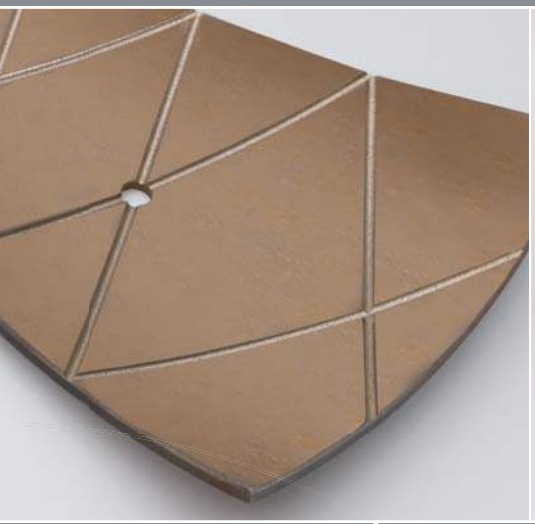
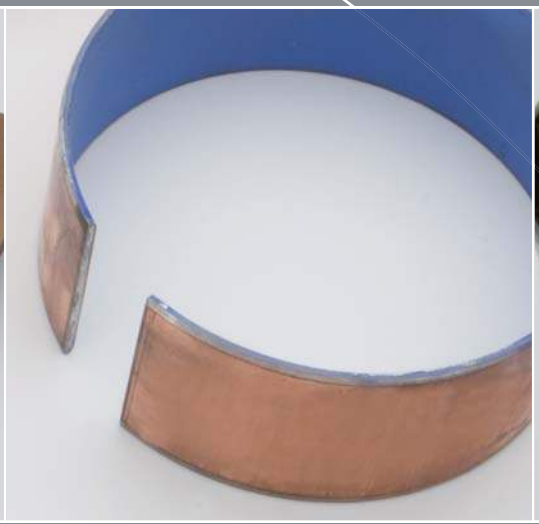
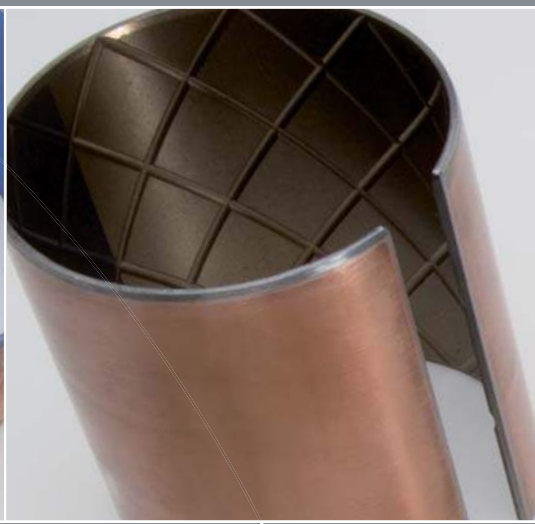
FEDERAL-MOGUL POWERTRAIN

DEVA

World Class Bearing Technology







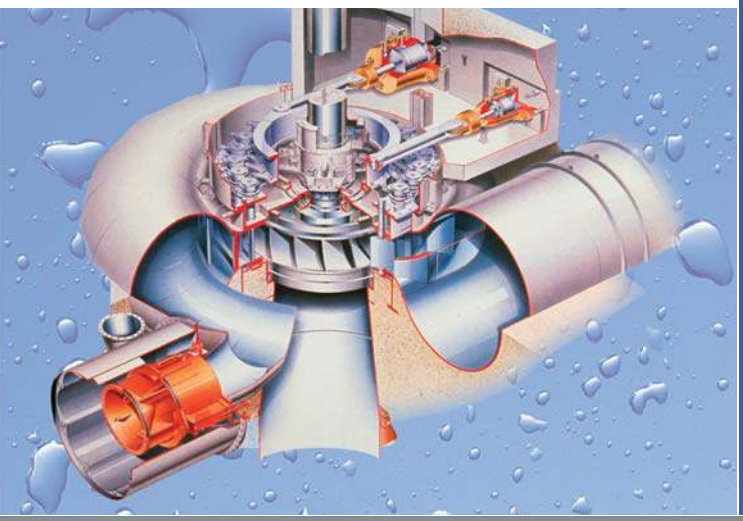
deva.bm® sliding bearings
Maintenance-free, self-lubricating

FEDERAL-MOGUL
POWERTRAIN

deva.bm®

Self-lubricating composite bearing material

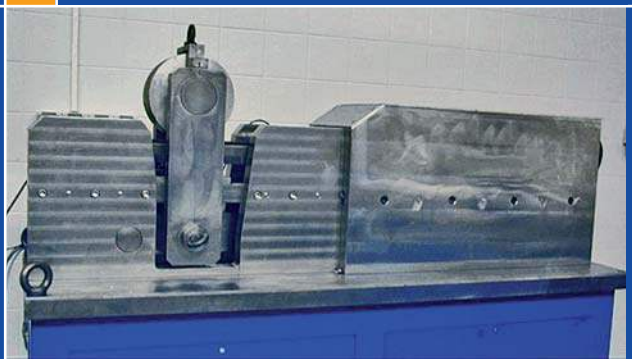
Contemporary designs represent an enormous challenge to modern-day bearing materials because, frequently, zero maintenance is expected under severe to extreme conditions as well as under maximum loads.
The constant pressure on costs additionally calls for increasing uptime of machinery and equipment and uncompromising standards of operational reliability.
The maintenance-free, permanently self-lubricating heavy-duty bearing materials from the DEVA® product range offer bearing solutions guaranteed to operate reliably and safely over a long term.



Our bearing service

- Profit from more than 60 years of experience in self-lubricating sliding bearings.
- Make use of our extensive material and application expertise spanning a very wide range of industries.
- Let our application engineering team assist you in the:
  - selection of the bearing materials,
  - design, purpose-built to your requirements,
  - assembly and installation,
  - calculation of estimated life time.
- Benefit from the latest material developments, tested using state of the art facilities.
- Ask for a simulation of your bearing application on our test rigs.
- Expect the highest quality standards, certified to DIN ISO 9001:2008, ISO/TS 16949:2009 and DIN EN ISO 14001:2004.

One of eight of our test benches



Content

1

Material properties

deva.bm® is a self-lubricating composite bearing material, comprising a steel backing with a sliding layer of **deva.metal®**. **deva.bm** is produced using a special sintering process to get the following advantages:

deva.bm

- normally requires no lubrication.
- allows maintenance-free operation.
- possesses a high static and dynamic load-bearing capacity.
- has a low coefficient of friction.
- is stick-slip-free.
- offers a high margin of safety against mating material damage.
- is utilisable in dusty environments.
- is utilisable at temperatures ranging from -190 °C to +280 °C.
- is utilisable in corrosive environments.
- does not absorb water and guarantees maximum dimensional accuracy.
- is utilisable in seawater.
- is utilisable in radioactive environments.
- is electrically conductive. No electrostatic charging effects occur.
- is suitable for rotational, oscillating and linear movements.
- is suitable for micro movements.
- is suitable even for applications involving high edge pressures.

2

Material structure

Solid lubricants used

It is additionally possible to apply an initial surface film to support running-in phases in which the running conditions are purely dry. The thickness of the running-in-film is not considered in any bushings bore tolerance because it will be consumed during the running-in-period.

Where used with conventional lubricants, the graphite-containing **deva.bm** sliding layer can be impregnated with oil.

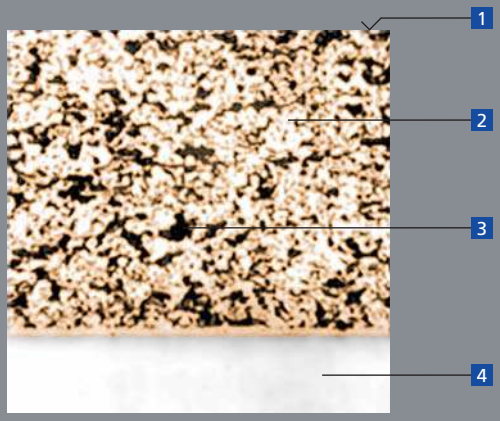
Solid lubricants properties — Table 2.1

Properties	Graphite	PTFE
Crystal structure	hexagonal	none
Specific gravity	2.25	2.15 - 2.20
Coefficient of friction in air	0.1 - 0.18	0.01 to 0.30
Chemical resistance	very good	very good
Corrosive resistance	good	very good
Nuclear radiation resistance	very good	not suitable
Performance in air	very good	very good
Performance in water	very good	good
Performance in vacuum	not suitable	very good

Layer structure and microstructure of deva.bm

The distinguishing features of **deva.bm** are its highly durable steel backing and the bronze matrix with homogeneous solid lubricant indentations that ensure low friction coefficients. The latter is either graphite of varying particle form and size, or PTFE.

Microstructure of deva.bm — Figure 2.1



1 Sliding surface, optionally with initial, running-in film

2 Sliding layer (bronze)

3 Solid lubricant
deva.bm : graphite
deva.bm/9P : PTFE

4 Steel backing

3

Materials

3.1 Material properties

Properties of steel backing and physical properties of deva.bm® [1)] — Table 3.1.A

	Materials	Properties of steel backing				Physical properties		Mechanical properties
		Alloys[5)]	0.2 % Yield min.	Tensile strength	Linear coefficient of thermal expansion 20 - 100 °C	Density	Hardness	Compressive strength
Symbol			R_{p02}	R_m	α_1	ρ		σ_{dB}
Unit			MPa	MPa	10^{-6}/K	g/cm³	HBmin	MPa
Bronze alloys								
	deva.bm 302	stainless[4)]	210	500 - 700	16.0	6.5	40	320
	deva.bm 372	stainless[4)]	210	500 - 700	16.0	6.3	40	320
	deva.bm 382	unalloyed[3)]	140	270 - 350	12.0	6.0	40	300
	deva.bm 388[2)]	unalloyed[3)]	140	270 - 350	12.0	6.6	40	300
	deva.bm 392	stainless[4)]	210	500 - 700	16.0	6.0	40	300
	deva.bm 362/9P	stainless[4)]	210	500 - 700	16.0	6.5	35	320

[1)] Current properties and values are listed in the DEVA® material sheets. These are provided on request.

[2)] deva.bm 388 has lubrication indentations in the sliding layer.

[3)] 1.0338

[4)] Standard 1.4301 or 1.4571 on demand

[5)] Other backing materials (e.g. sea water resistant steel) on request.

Bearing properties of deva.bm — Table 3.1.B

	Alloys	Bearing properties								
		Max. permissible load [static][1)]	Max. permissible load [dynamic][1)]	Max. sliding velocity [dry]	Max. $\bar{p}U$ value [dry]	Temperature range [max]	Temperature range [min]	Coef. of friction[2) 3)] [dep. on op. cond.]	Min. shaft hardness	Shaft surface finish [optimum]
Symbol		$\bar{p}_{stat/max}$	$\bar{p}_{dyn/max}$	U_{max}	$\bar{p}U_{max}$	T_{max}	T_{min}	f		R_a
Unit		MPa	MPa	m/s	MPa × m/s	°C	°C		HB/HRC	µm
Bronze alloys										
	deva.bm 302	280	150[5)]	0.10	0.4	280	-150	0.13 - 0.22	180HB	0.2 - 0.8
	deva.bm 372	280	80	0.25	0.8	280	-150	0.11 - 0.18	180HB	0.2 - 0.8
	deva.bm 382	250	80	0.50	1.0	280	-150	0.10 - 0.16	180HB	0.2 - 0.8
	deva.bm 388[4)]	250	120	1.00	1.5	280	-150	0.10 - 0.16	180HB	0.2 - 0.8
	deva.bm 392	280	100	0.50	1.0	280	-150	0.10 - 0.16	180HB	0.2 - 0.8
	deva.bm 362/9P	280	120	1.00	2.0	250	-190	0.05 - 0.13	180HB	0.2 - 0.8

[1)] Under optimum operating conditions.

[2)] The stated sliding friction coefficients are not guaranteed properties. They have been determined on our test rigs using field-proven parameters that do not necessarily reflect the actual application of our products and their service environment. We offer customer-specific friction and wear tests on request.

[3)] Axial bearings tend to higher friction coefficients than radial bearings.

[4)] $\bar{p}U$ = 1.5 if dimples and grease lubrication are used

[5)] In case of higher loads (>50 MPa) superposed by an (expected) high number of sliding cycles, the use of deva.bm 309 (same alloy+lubrication dimples) with an additional lubricant is recommended.

3.2 Chemical resistance

The following decision chart provides guidance on the selection of the appropriate **deva.bm** alloy according to the environmental conditions of the application.

Definitions

- ✓ Resistant
- O Resistant depending on construction, oxygen content, temperature, etc.
- × Not recommended
- – No data available

Chemical resistance of deva.bm — Table 3.2.1

Medium / chemical substance	Concentration in %	Temperature in °C	Alloys deva.bm 302 / 372 / 392 / 362/9P	Alloys deva.bm 382 / 388
Strong acids	5	20		
Hydrochloric acid	5	20	×	×
Hydroflouric acid	5	20	O	×
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				
Ammonium hydroxide	10	20	×	×
Potassium hydroxide	5	20	✓	×
Sodium hydroxide	5	20	✓	×
Solvents				
Acetone		20	✓	×
Carbon tetrachloride		20	✓	×
Ethanol		20	✓	×
Ethyl acetate		20	✓	×
Ethyl chloride		20	✓	×
Glycerin		20	✓	O
Salts				
Ammonuim nitrate			×	×
Calcium chloride			✓	×
Magnesium chloride			✓	×
Magnesium sulphate			✓	×
Sodium chloride			✓	×
Sodium nitrate			✓	×
Zinc chloride			×	×
Zinc sulfate			✓	×
Gases				
Ammonia			O	×
Chlorine			×	×
Carbon dioxide			✓	×
Fluorine			×	×
Sulphur dioxide			✓	×
Hydrogen sulphide			O	×
Nitrogen			✓	×
Hydrogen			✓	×
Fuels and lubricants				
Paraffin		20	✓	✓
Gasolene		20	✓	✓
Kerosene		20	✓	✓
Diesel fuel		20	✓	✓
Mineral oil		70	✓	✓
HFA - ISO46 water-in-oil		70	✓	✓
HFC - water-glycol		70	✓	✓
HFD - phosphate ester		70	✓	✓
Others				
Water		20	✓	×
Seawater		20	✓	×
Resin			✓	✓
Hydrocarbon			✓	×

4

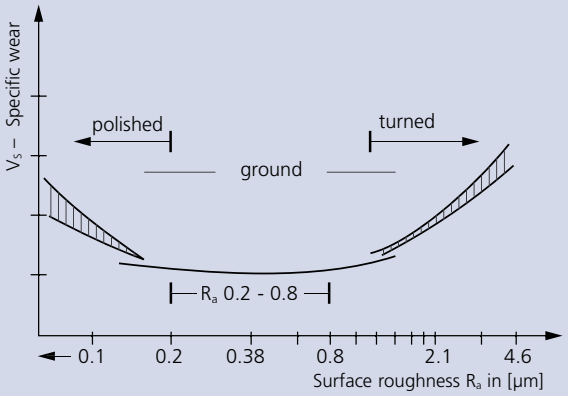
Mating material

The **deva.bm®** bearing materials can be used only with mating materials demonstrating a hardness of at least 180 HB. Where lubricant is additionally introduced into the sliding contact, hardness values of >130HB are also permissible. In abrasive environments, a surface hardened to 35 HRC/45 HRC should be used. The ideal mating surface roughness for **deva.bm** is R_a = 0.2 to 0.8 µm, produced by grinding. Rougher surfaces are also acceptable, depending on the operating conditions. To obtain the right surface roughness, it is equally possible to use bushings of a suitable hardness. Hard-faced or galvanized protective layers (normally coated, hard-chrome, nickel-plated) can also be used to a limited extent.

The corrosion criteria for the mating materials have to be determined on the basis of the operating conditions in each case. The adjacent table provides an overview of several possible mating materials.

Surface roughness — Figure 4.1

Influence of mating material surface roughness on the microwear of composite (Model representation, based on various tests and studies)



Mating materials for standard applications — Table 4.1.A

Material number	DIN designation	Comparable standards		
		USA – ANSI	GB – B.S. 9 70	F – AFNOR
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 corrosive environments — Table 4.1.B

Material number	DIN designation	Comparable standards		
		USA – ANSI	GB – B.S. 9 70	F – AFNOR
1.4021	X20Cr13	420	420S37	Z20C13
1.4057	X17CrNi-16-2	431	432S29	Z15CN16.02
1.4112	X90CrMoV18	440B	–	(Z70CV17)
1.4122	X35CrMo17-1	–	–	–

Mating materials for seawater applications — Table 4.1.C

Material number	DIN designation	Comparable standards		
		USA – ANSI	GB – B.S. 9 70	F – AFNOR
1.4460	X3CrNiMoN27-5-3	329	–	–
1.4462	X2CrNiMoN22-5-3	UNS531803	318513	Z3CND24-08
2.4856	Inconel 625	–	–	–

5

Fits

- **deva.bm** is pressed into the housing with an interference fit (using a screw press, hydraulic press or press-fit mandrel). Tapping or driving into place is not permissible.
- The standard housing bore is **H7**.
- Mean roughness of housing: R_a = 3.2 µm
- The housing has a chamfer of 20° - 40° for easier mounting.
- To achieve minimum clearances after mounting (**IT7** or higher), finishing should take place in the mounted state. For this purpose, **deva.bm** can be provided with a machining allowance, in which case the running-in film has to be applied after finishing.

Permissible fit and tolerance ranges — Table 5.1

Inner diameter D_1	D_1 tolerance excl. running-in film	Shaft	
mm	in installed state	Standard application	Precision applications
< 20	H9	d7	e7
> 20	H8	d7	e7
> 45	H8/H9 (standard)	d7	e7
> 180	H8/H9	d7	e7

6

Design

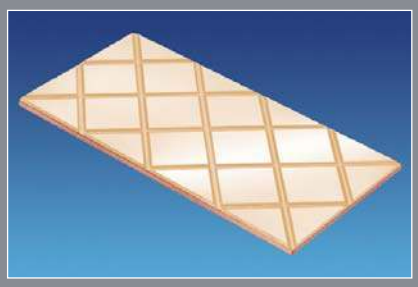
6.1 Sliding surface design

Sliding surfaces

Plain sliding surface

For applications without any special dry running criteria, **deva.bm** can be used with a plain sliding surface and a running-in film.

Cleaning grooves



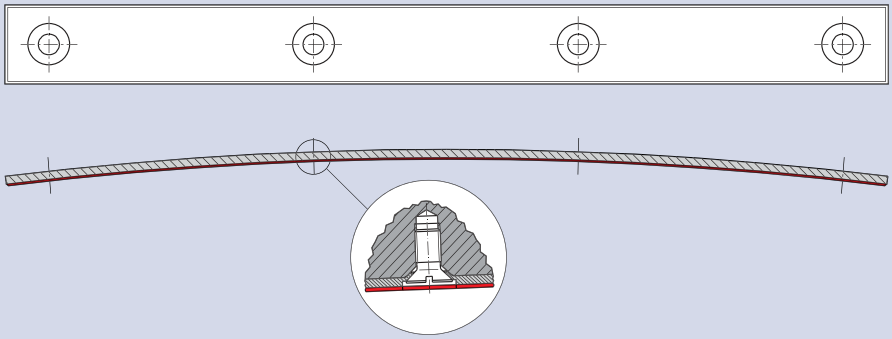
For difficult, non-lubricated applications in abrasive and vibrating environments, etc., **deva.bm** can also be provided with cleaning grooves in the sliding layer as a means of prolonging the service life.

Lubrication indentations

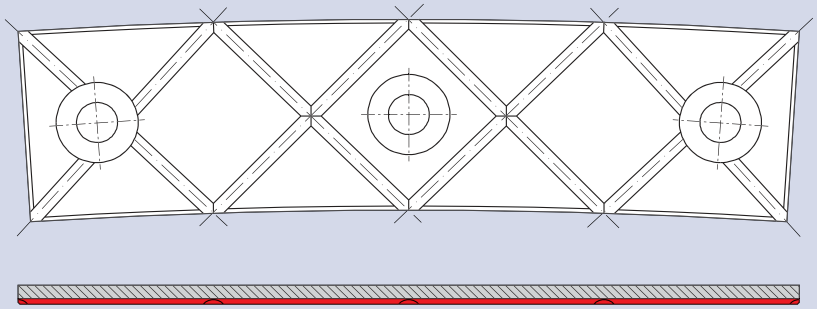
For grease-lubricated applications, the **deva.bm** sliding layer can be provided with regularly spaced lubrication indentations, which act as a lubricant ‚reservoir' to prolong the service life.

6.2 Special design solutions

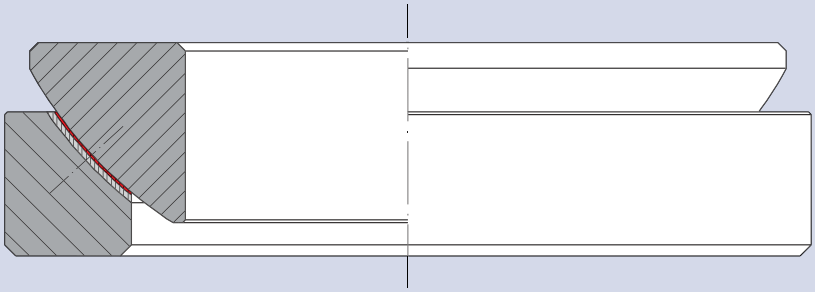
deva.bm® radial segment including mounting and screw joint — Figure 6.2.1



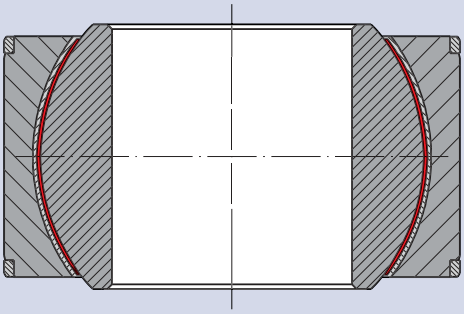
deva.bm axial segment with cleaning grooves — Figure 6.2.2



deva.bm spherical sliding bearing — Figure 6.2.3



deva.bm spherical sliding bearing — Figure 6.2.4



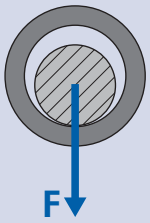
6.3 Description what values to be considered for design

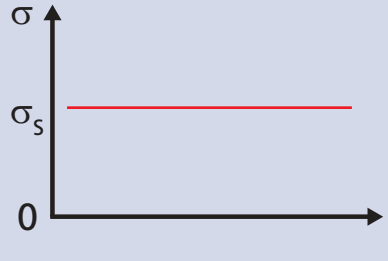
DEVA® differentiates load cases (0 to 3) regarding the character of load stressing a bearing. This is to consider fatigue influences in case of dynamic pressure. The percentage values are refering to the limit values described in the material data sheet or technical handbooks.

This worksheet is related to DEVA work instruction A 616 (see also "Qualitäts-, Umwelt- und Arbeitsschutz-Management Handbuch, Verfahrensanweisungen + Arbeitsanweisung").

Load cases 0-3 — Figure 6.3.1

Load case 0

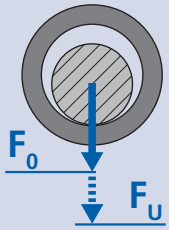


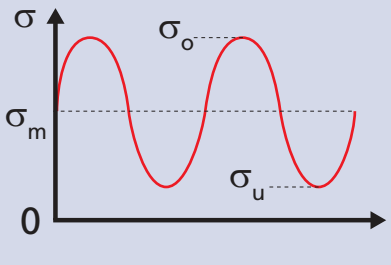


100 % of static load limit

0

Load case 1

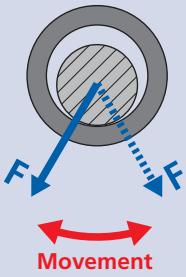




80 % of static load limit

1

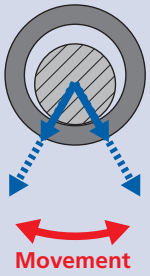
Load case 2

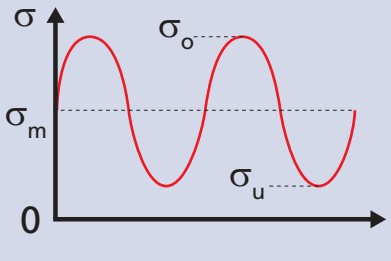


50 % of static or
100 % of dynamic load limit
(the higher is value valid)

2

Load case 3





100 % of dynamic load limit

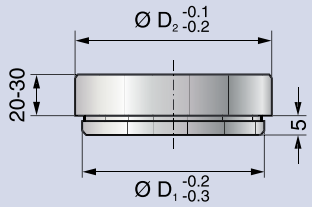
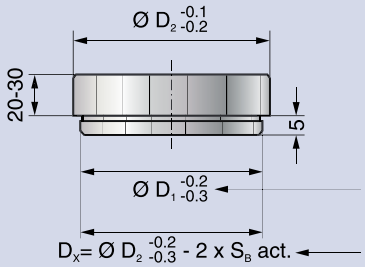
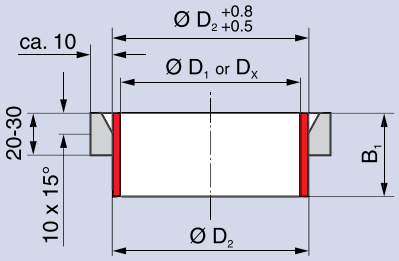
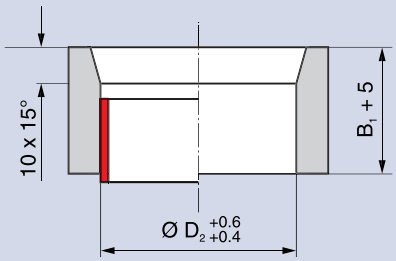
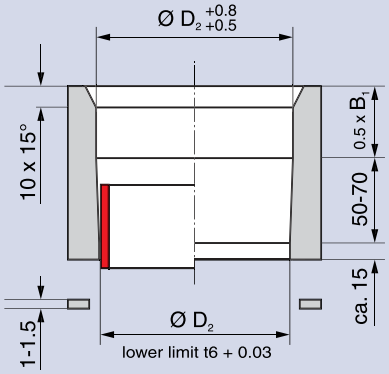
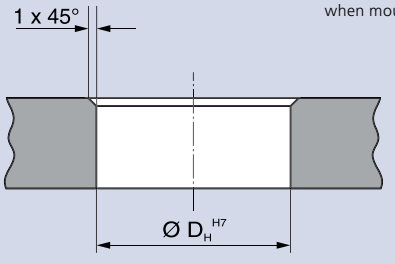
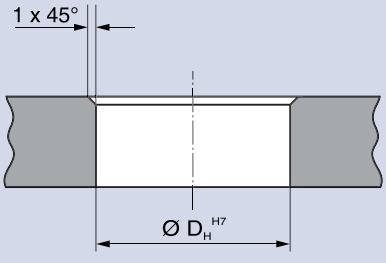
3

7

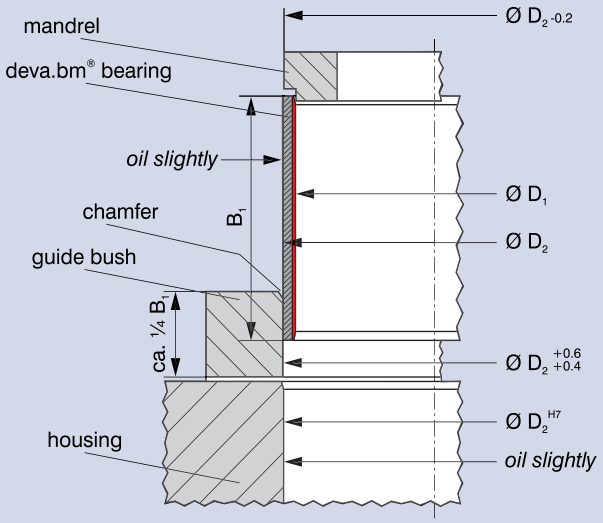
Installation

7.1 Installation of deva.bm cylindrical bearings

Installation of deva.bm cylindrical bearings with $D_1 \leq 550$ mm by press-fitting — Figure 7.1.1

Installation of precision bearings (H8)	**Installation of a) Standard bearing** (H9) **b) Precision bearing with $D_1 \geq 180$ mm** **c) Bearing with machining allowance**
Press-fit mandrel  A1	**Press-fit mandrel**  for standard H9 and precision bearing with $D_1 \geq 180$ mm for bearings with machining allowance B1
Symbols D_X = Inner diameter with machining allowance D_1 = Inner diameter D_2 = Outer diameter B_1 = Bearing width $SB_{act.}$ = measured wall thickness D_H = Housing bore diameter	**Auxiliary bush**  for long bearings only (B_1/ D_2 > 2) B2
Guide bush  A2	**Guide bush**  Material: grey cast iron, use hardened steel for large quantities Spacer ring for centring in housing B3
Housing Slight oiling is permissible when mounting  A3	**Housing** Slight oiling is permissible when mounting  B4

Installation of large deva.bm cylindrical bearings with D_1 > 550 mm by press-fitting — Figure 7.1.2



Notes

- Guide bush ensures correct circularity Ø = $D_2^{+0.6}_{+0.4}$
- Oil slightly during press-fitting

7.2 Installation of deva.bm sliding bearings by supercooling

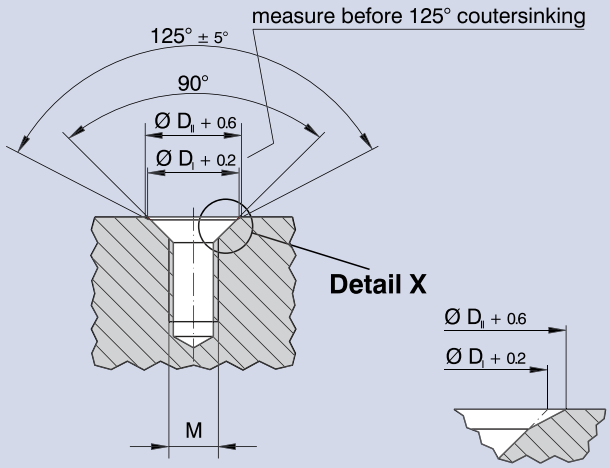
deva.bm bearings with > 130 mm can be installed by supercooling with dry ice or liquid nitrogen. Both substances are classified as hazardous.
We expressly draw attention to dealing with hazardous substances. Safety data sheets are available on request.
To achieve a uniform supercooling, the dry ice should be crushed to about the size of a walnut. The sliding bearings should be completely immersed when using liquid nitrogen. The time required for complete supercooling of the bearings is between 15 minutes to 1 hour depending on the volumes of the parts to be cooled.

7.3 Fastening of deva.bm sliding plates with countersunk flat head screws

Installation of 2, 2.5, 3 and 5 mm thick deva.bm sliding plates with countersunk flat head screws according to DIN EN ISO 7046-1 or DIN EN ISO 2009

Figure 7.3.1

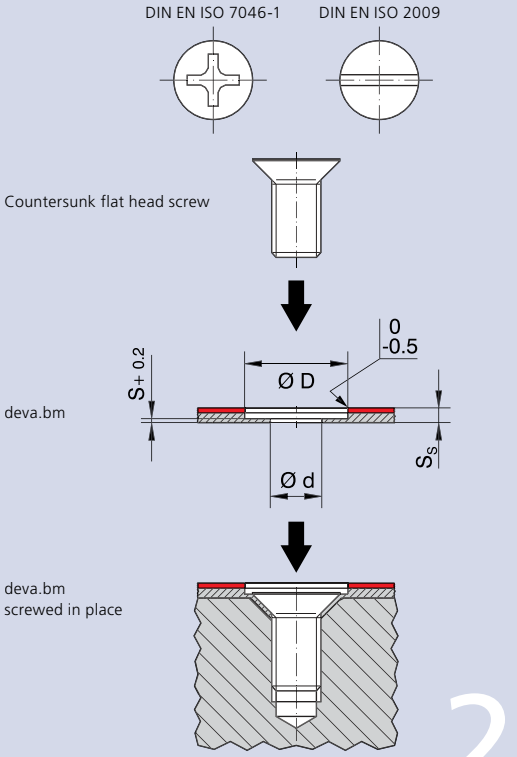
Preparation



Installation

During mounting, secure the screws with metal adhesive "Loctite 243" for intermediate strength or „Loctite 278" for high-strength bolting. Observe manufacturer's instructions on temperature limits and use.

1



2

Installation dimensions (see drawing step 1 above)

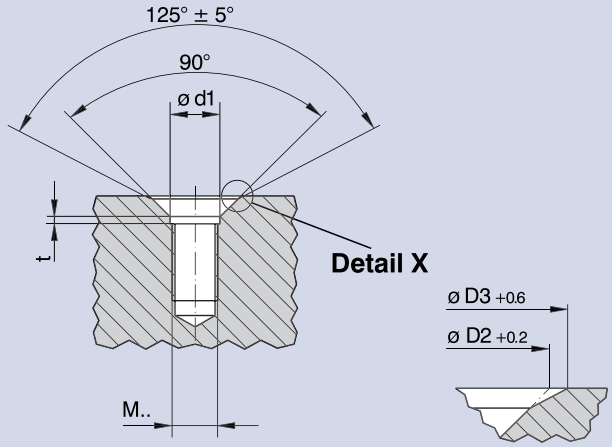
Table 7.3.1

Thread to DIN 13	d	D	D$_I$	D$_{II}$	S$_S$	S		Hole spacing tolerance supporting element and deva.bm
						unalloyed	stainless steel	
	mm	mm	mm	mm	mm	mm	mm	
M5	5.3	11	9.5	10.5	2	0.8	0.8	± 0.10
M6	6.4	13	11.5	12.5	2/2.5	0.8	0.8	± 0.10
M8	8.4	17	15.0	16.0	2.5/3	1.0	0.8	± 0.10
M10	10.5	21	18.5	19.5	3/5	1.0	0.8	± 0.15
M12	13.0	25	22.5	23.5	5	1.0	0.8	± 0.15

Installation of 2, 2.5, 3 and 5 mm thick deva.bm sliding plates with hexagon socket countersunk head screws to EN ISO 10642 [1)]

Figure 7.3.2

Preparation

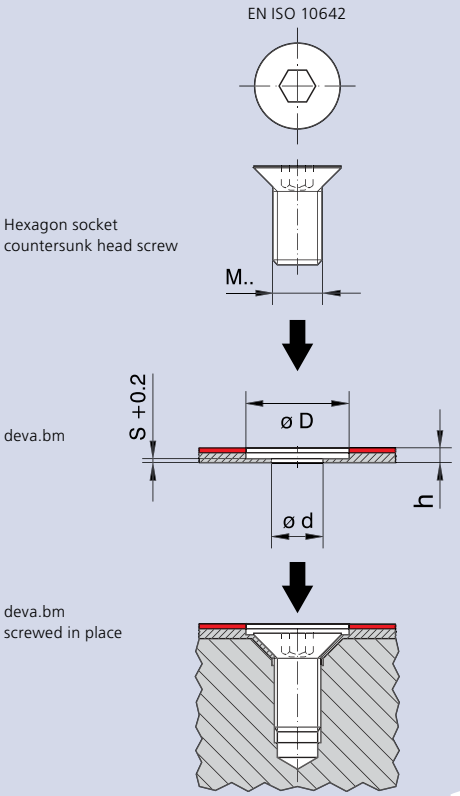


Installation

During mounting, secure the screws with metal adhesive "Loctite 243" for intermediate strength or „Loctite 278" for high-strength bolting. Observe manufacturer's instructions on temperature limits and use.

1

Installation



2

[1)] Countersinking is also suitable for screws to DIN EN ISO 7045-1 and DIN EN ISO 2009.

Installation dimensions (see drawings above)

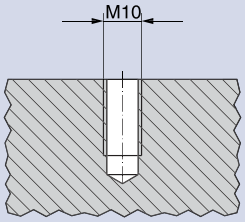
Table 7.3.2

Thread to DIN 13	d	D	D2	D3	d1	t	h	S		Hole spacing tolerance supporting element and deva.bm
	mm	mm	mm	mm	mm	mm	mm	unalloyed mm	stainless steel mm	
M5	5.3	13.5	11.5	12.5	6	1.0	2	0.8	0.8	± 0.10
M6	6.4	16.0	14.0	15.0	7	1.5	2/2.5	0.8	0.8	± 0.10
M8	8.4	20.0	18.0	19.0	9	2.0	2.5/3	1.0	0.8	± 0.10
M10	10.5	25.0	22.0	23.0	11	2.5	3/5	1.0	0.8	± 0.15
M12	13.0	29.0	26.5	27.5	13	3.0	5	1.0	0.8	± 0.15

Installation of 10 mm thick deva.bm® sliding plates with M10 hexagon socket countersunk head screws to EN ISO 10642

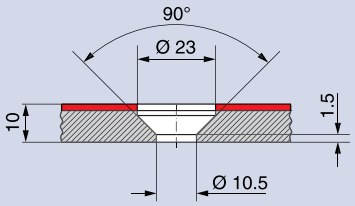
Figure 7.3.3

Preparation



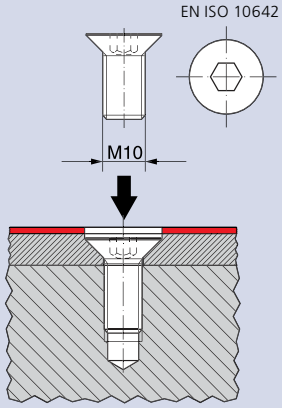
1

Preparation of deva.bm



2

Installation



3

deva.bm sliding plates – Hole spacing and installation

Figure 7.3.4

Notes

The number and size of the screws depends on the occurring stresses and the shearing forces to be withstood as a result. We recommend as guide values:

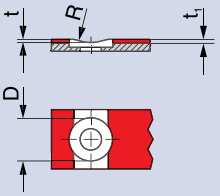
b_1 = 10 - 30 mm – if b_1 < 4 mm, should nicks be made as shown in the drawing below, in order to avoid chipped sliding layer edges.

l_1 = 60 - 150 mm

b ≈ (1 - 1.5) D

Maximum machining depth for deva.bm

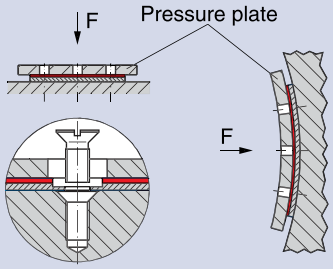
$t_1 = t^{-0.1}_{-0.2}$



A

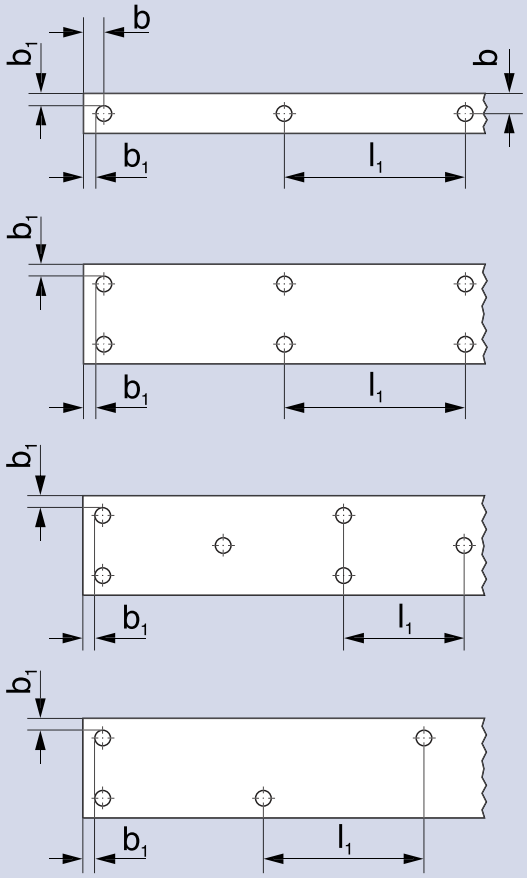
Notes

When screwing into place, secure deva.bm with a pressure plate. Tighten alternately on the left and right sides, in relation to the centre.



B

Configuration examples



C

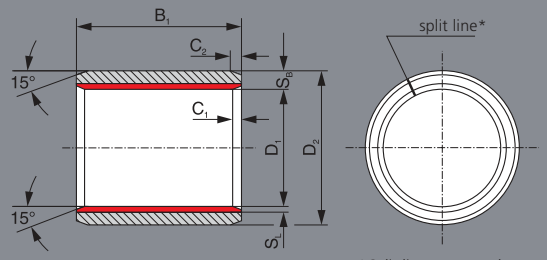
Dimensions

8.1 Recommended dimensions deva.bm cylindrical bearings

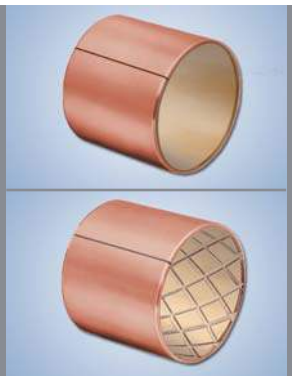
deva.bm bearings are made to DIN ISO 3547 standard. Other sizes and tolerances for special applications are also possible.

The sizes given in the following table can be manufactured as standard in all the alloys listed in this manual.

Cylindrical bearings



* Split line must not be located in load direction.



Dimensions deva.bm cylindrical bearings — Table 8.1.1

Bore tolerance (after mounting)

	Nominal dimensions						Bearing width B_1 ±0.25 mm															
	D_1	D_2	S_B	S_L	C_1	C_2	10	15	20	25	30	40	50	60	70	80	100	120	140	150	160	180	200
	mm	mm	mm	mm	mm	mm	mm																
H9	10	12	1.0	≥ 0.40	0.7	0.5																	
	12	14																					
	14	16																					
	15	17																					
	16	18																					
	18	20																					
H8	20	23	1.5	≥ 0.50	1.0	0.6																	
	22	25																					
	24	27																					
	25	28																					
	28	32	2.0	≥ 0.75	1.5	0.8																	
	30	34																					
	32	36																					
	35	39																					
	36	40																					
	38	42																					
	40	44																					
	42	46																					
H8 (precision) / H9 (standard)	45	50	2.5	≥ 0.70	1.8	1.0																	
	50	55																					
	55	60																					
	60	65																					
	65	70																					
	70	75																					
	75	81	3.0	≥ 1.00	2.5	1.5																	
	80	86																					
	85	91																					
	90	96																					
	95	101																					
	100	106																					
	105	111																					
	110	116																					
	115	121																					
	120	126																					
	125	131																					
	130	136																					
	135	141																					
	140	146																					
	145	151																					
	150	156																					
	160	166																					
	180	186																					
	200	206																					
	220	226																					
	240	246																					
	250	260	5.0	≥ 1.50	3.0	2.0																	
	all dimensions	$D_1 + 2 \times S_B$																					
	800	810																					

deva.bm bearings, D_1 > 550 mm, laser-welded, additionally locking recommended.

Very large deva.bm bearings are manufactured in segments.

deva.bm 388 and deva.bm 362/9P are available in diameters from D_1 > 28 mm. deva.bm 362/9P is available in width B_1 < 190 mm only.

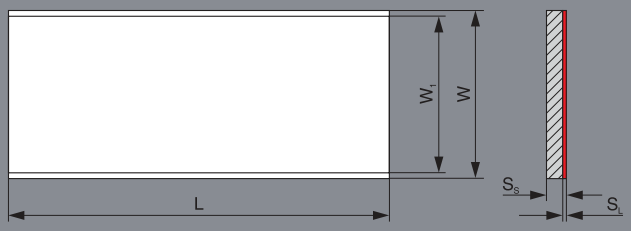
Cross cleaning grooves are available in diameters from D_1 >20 mm.

= recommended dimensions
Further dimensions on request.

8.2 Dimensions deva.bm sliding plates

deva.bm sliding plates are deliverable as standard in the following materials: **deva.bm** 302, **deva.bm** 372, **deva.bm** 392 and **deva.bm** 362/9P. Other materials and thicknesses are deliverable on request.

Sliding plates



Dimensions deva.bm sliding plates — Table 8.2.1

Wall thickness S_s	Wall thickness tolerance	Sliding layer thickn. S_L	Useful width W_1 [2]	Length L
mm	mm	min mm	tolerance +1 mm mm	tolerance +3 mm mm
2.5	± 0.05 [1]	0.75	200	1750
3.0	± 0.05 [1]	1.05	200	1750
5.0	± 0.05 [1]	1.55	200	1750
10.0	± 0.05 [1]	2.00	200	1000

[1] Different tolerances possible

[2] For deva.bm 362/9P W_1 = 190 mm

8.3 Dimensions deva.bm sliding plates

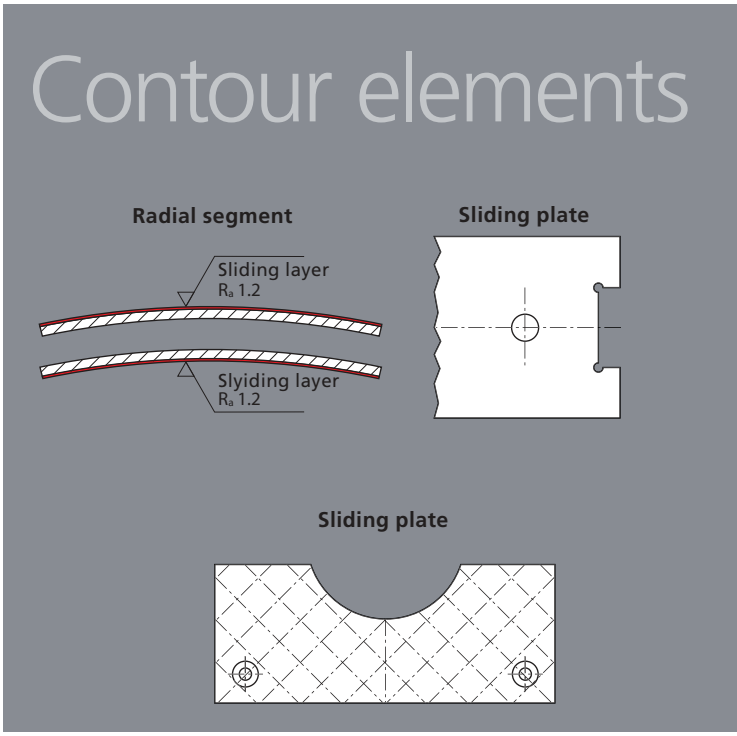
The minimum bending radius for **deva.bm** depends on the total thickness of the steel backing and sliding layer.

Manufacturing restrictions for deva.bm radial segments — Table 8.3.1

Segment thickness [1]	Minimum bending diameter for deva.bm sliding plates with sliding layer at the ...	
	Inner diameter	Outer diameter
mm	mm	mm
1.0	10	– [2]
1.5	20	– [2]
2.0	28	– [2]
2.5	45	– [2]
3.0	75	600
5.0	250	800

[1] Other thicknesses on request

[2] On request



Data relevant to the design of DEVA® bearings

Questionaire 9.1.A

Description of application

☐ Steel Industry ☐ Steam and Gas Turbines ☐ Railway

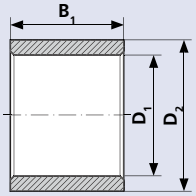
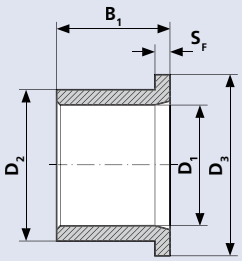
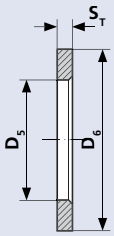
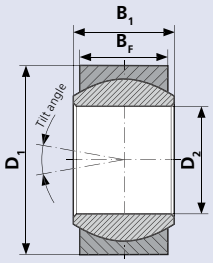
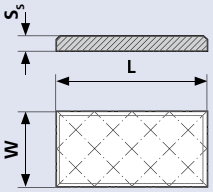
☐ Wind Energy ☐ Offshore and Marine ☐ Hydro Power

☐ Rubber and Plastic Industry ☐ Heavy-duty Vehicles ☐ Others

☐ New design

☐ Existing design

Project No.

☐ Plain bearing	☐ Flanged bearing	☐ Thrust washer	☐ Spherical bearing	☐ Sliding plate
			☐ Floating bearing ☐ Fixed bearing 	

☐ Shaft rotates ☐ Bearing rotates ☐ Angular motion ☐ Axial motion

		Item 1	Item 2	Item 3
Quantity				
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 diameter	D_3			
Flange thickness	S_F			
Wall thickness	S_T			
Plate length	L			
Plate width	W			
Plate thickness	S_S			
Loading		Item 1	Item 2	Item 3
Static		☐	☐	☐
Dynamic		☐	☐	☐
Alternating		☐	☐	☐
Impact		☐	☐	☐
Radial load [kN]				
Axial load [kN]				
Surface pressure				
Radial [MPa]				
Axial [MPa]				
Mating material		Item 1	Item 2	Item 3
Material no./type				
Hardness [HB/HRC]				
Roughness R_a [µm]				
Housing material		Item 1	Item 2	Item 3
Material no./type				
Lubrication		Item 1	Item 2	Item 3
Dry running		☐	☐	☐
Permanent lubrication		☐	☐	☐
Medium lubrication		☐	☐	☐
Medium				
Lubricant				
Initial lubrication		☐	☐	☐
Hydrodyn. lubrication		☐	☐	☐
Dynamic viscosity				

Motion	Item 1	Item 2	Item 3
Speed [rpm]			
Sliding speed [m/s]			
Stroke length [mm]			
Double strokes [/min]			
Rotating angle [°]			
Frequency [n/min]			
Tilt angle (spherical bearing) [°]			
Operating time	Item 1	Item 2	Item 3
Continuous operation			
Intermittent operation			
Duty operation [%/h]			
Days/year			
Frictional distance [km]			
Fits/tolerances	Item 1	Item 2	Item 3
Shaft			
Bearing housing			
Environmental conditions	Item 1	Item 2	Item 3
Temperature at bearing			
Contact medium			
Other influences			
Lifetime	Item 1	Item 2	Item 3
Desired operating time [h]			
Permissible wear [mm]			

Company	
Company name	
Address	
Contact person	
Phone	
Fax	
Cell-phone	
E-mail	

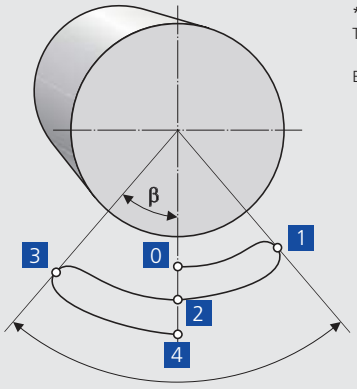
02.13

Questionaire 9.1.B

Remarks

	yes	no
Certificate required (e.g. 3.1)	☐	☐
Acceptance procedure (e.g. 3.2)	☐	☐

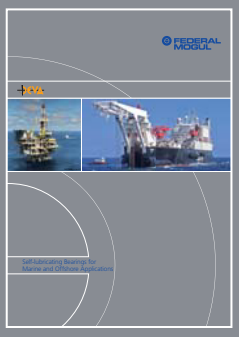
Explaination



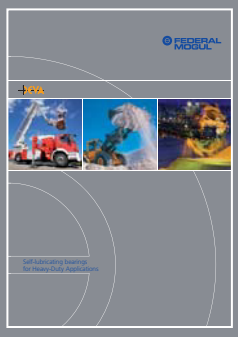
* angle: According to DEVA® definition, one cycle is four times the angle β.
This is the basis to calculate the expected sliding distance.

Example: Bushing D_1 = 50 mm and agle β = 5° → 1 cycle shows a sliding distance of 8.73 mm

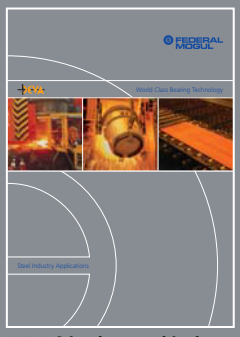
Portfolio



DEVA® in marine/offshore

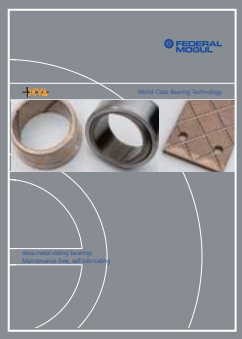


DEVA® in heavy-duty



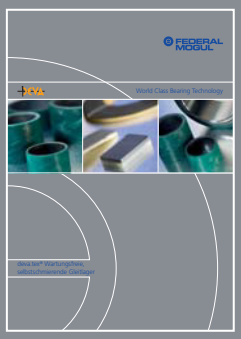
DEVA® in the steel industry

Industry solutions

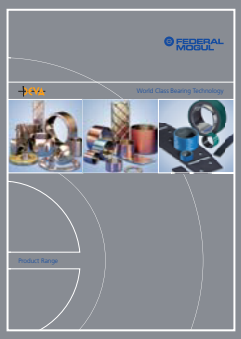


deva.metal®

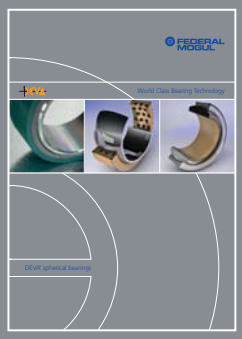
deva.glide®



deva.tex®



Product range



Spherical bearings

Product information

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 on request. Our products are subject to a constant process of development. DEVA®

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POWERTRAIN

DEVA

Federal-Mogul DEVA GmbH
Schulstraße 20

BM-EN/10/2012/Rev. 2/2000