GGB
BY TIMKEN

Product Range

BENELUX

PUSHING BOUNDARIES TO CO-CREATE A HIGHER QUALITY OF LIFE

GGB helps create a world of motion with minimal frictional loss through plain bearing and surface engineering technologies. With R&D, testing and production facilities in the United States, Germany, France, Brazil, Slovakia and China, GGB partners with customers worldwide on customized tribological design solutions that are efficient and environmentally sustainable. GGB's engineers bring their expertise and passion for tribology to a wide range of industries, including automotive, aerospace and industrial manufacturing. To learn more about tribology for surface engineering from GGB, visit www.ggbearings.com.

Our products are used in tens of thousands of critical applications every day on our planet. It is always our goal to provide superior, high-quality solutions for our customers' needs, no matter where those demands take our products. From space vehicles to golf carts and virtually everything in between; we offer the industry's most extensive range of high performance, maintenance-free bearing solutions for a multitude of applications:

- Aerospace
- Agricultural
- Automotive
- Construction
- E-Mobility
- Energy
- Fluid Power
- Industrial
- Medical
- Mining
- Oil & Gas
- Primary Metals
- Railway
- Recreation

The GGB Advantage

LOWER SYSTEM COST

GGB bearings reduce shaft costs by eliminating the need for hardening and machining grease paths. Their compact, one-piece construction provides space and weight savings and simplifies assembly.

LOW-FRICTION, HIGH WEAR RESISTANCE

Low coefficients of friction eliminate the need for lubrication, while providing smooth operation, reducing wear and extending service life. Low-friction also eliminates the effects of stick-slip or "stiction" during start up.

MAINTENANCE-FREE

GGB bearings are self-lubricating, making them ideal for applications requiring long bearing life without continuous maintenance, as well as operating conditions with inadequate or no lubrication.

ENVIRONMENTAL

Greaseless, lead-free GGB bearings comply with increasingly stringent environmental regulations such as the EU RoHS directive restricting the use of hazardous substances in certain types of electrical and electronic equipment.

CUSTOMER SUPPORT

GGB's flexible production platform and extensive supply network assure quick turnaround and timely deliveries. In addition, we offer local applications engineering and technical support.

The Highest Standards in Quality

Our world-class manufacturing plants in the United States, Brazil, China, Germany, France and Slovakia are certified in quality and excellence according to ISO 9001, IATF 16949, ISO 14001 and ISO 45001. This allows us to access the industry's best practices while aligning our management system with global standards.

For a complete listing of our certifications, please visit our website: **www.ggbearings.com/en/company/certificates**

Tribology at GGB

BY MAKING ADVANCEMENTS IN THE FIELD OF TRIBOLOGY, WE CAN:

- Reduce/control friction, decrease wear, increase lifetime and durability - **Lower overall operating cost**
- Reduce energy losses - **Make our world a little greener**
- Reduce/control stick-slip, improve precision and reduce noise - **Keep people safe, improve comfort and quality of life**








Who we Are

TIMKEN AND GGB: EXPONENTIAL EXPERTISE AND INNOVATION

Timken has completed 24 acquisitions since 2010 to advance its engineered bearings and industrial motion expertise. The latest, GGB, provides additional technical solutions that strengthen Timken's position in key strategic markets.

At GGB, engineers apply specialized knowledge in material science and tribology to innovate polymer coatings and plain bearing solutions for industrial applications, including pumps and compressors, HVAC, off-highway, energy, material handling and aerospace. With its acquisition of GGB, Timken diversifies its technical expertise and global leadership in highly engineered bearings — giving customers access to more custom bearing solutions across more markets.

Exponential innovation for shifting design trends

Andreas Roellgen, executive vice president and president of the Engineered Bearings group, said the GGB acquisition builds on Timken's "advanced coating technologies and customized solutions for customers' specific needs in fragmented markets". While every acquisition is about adding value for customers, the more synergies there are, the greater the potential.

"Timken has very strong capabilities in material science, surface engineering and tribology — specific to steel-made bearings with rolling elements," said Roellgen. "GGB builds on strengthening knowledge beyond steel-bearing competencies in all three areas that help address emerging technical trends for our customers."

Two such trends are light-weighting and downsizing in applications like electric vehicles and wind energy. GGB plain bearing solutions help with this by using a wide range of materials like polymer coatings, engineered plastics, fiber-reinforced composites and bimetals.

In many cases, the two companies engineer adjacent, ultra-high-performance solutions for the same customers and equipment.

For example, the Curiosity rover has been operating on Mars for 10+ years and depends on GGB self-lubricating metal-polymer bushings to help drill for rock samples. Also onboard are two ¼ inch (6.35 mm) Timken bearings that run a vacuum pump in support of the rover's analytical equipment. Essentially, GGB helps gather the samples, and Timken makes it possible to learn about them. Both are crucial to mission success.

Shared legacy, complementary products

GGB was founded in 1899, the same year Timken began producing its first patented tapered roller bearing. Also similar to Timken, GGB demonstrated early leadership in key markets, inventing the first self-lubricated metal-polymer bearing, and they are recognized for their excellence in application engineering.

Chris Small, president, GGB, added that this is what sets GGB apart in the global plain bearings market.

"It's extremely competitive, but we're able to win customers because our strong application engineering capabilities and our legacy of material science innovations," he said. "Collaborating with customers, designing into their applications and solving their most critical problems brings so much loyalty."

And like Timken, GGB has a global manufacturing footprint committed to safety, quality and efficiency, in support of an ever-evolving product line.

"GGB will have a noteworthy impact due to its size and scope, Roellgen said. They have capabilities and products new to our customers. We have the channel access to get them into new market spaces. From a customer value creation standpoint, it's quite exciting."

Overview of Coatings, Bearing Materials & Accessory Products

TRIBOLOGICAL COATINGS

PRODUCT NAME	POLYMER COATINGS	WORKING CONDITIONS	PAGE
TriboShield®TS161	TriboShield coatings are applied directly to the customer's part	low-friction, low-loads	9
TriboShield®TS225	TriboShield coatings are applied directly to the customer's part	low-friction, low to medium loads	10
TriboShield®TS421	TriboShield coatings are applied directly to the customer's part	low-friction, low-loads	11
TriboShield®TS651	TriboShield coatings are applied directly to the customer's part	low-friction, up to moderately high loads	12
TriboShield®TS741	TriboShield coatings are applied directly to the customer's part	low-friction, moderate up to high loads	13

TRIBOLOGICAL BEARINGS

PRODUCT NAME	METAL-POLYMER BEARINGS	WORKING CONDITIONS	PAGE
DP4®	Steel + Porous Bronze Sinter + PTFE + Fillers	self-lubricating, low-maintenance	14
DP4-B	Bronze + Porous Bronze Sinter + PTFE + Fillers	self-lubricating, corrosion-resistant	15
DU®	Steel + Porous Bronze Sinter + PTFE + Pb	self-lubricating	16
DU-B	Bronze + Porous Bronze Sinter + PTFE + Pb	self-lubricating, corrosion-resistant	17
DP10	Steel + Porous Bronze Sinter + PTFE + Solid Lubricants	self-lubricating, low-maintenance	18
DP11	Steel + Porous Bronze Sinter + PTFE + Solid Lubricants + Fillers	self-lubricating, low-maintenance	19
DP31	Steel + Porous Bronze Sinter + PTFE + Fluoropolymer + Fillers	low-maintenance	20
DX®	Steel + Porous Bronze Sinter + POM with Lubrication indents	low-maintenance, machinable	21
DX®10	Steel + Porous Bronze Sinter + High Tech Polymer with Lubrication indents	low-maintenance, machinable	22
HI-EX®	Steel + Porous Bronze Sinter + PEEK + PTFE + Fillers	low-maintenance, machinable	23
DTS10®	Steel + Porous Bronze Sinter + PTFE + Fillers	low-maintenance, machinable	24
DS	Steel + Porous Bronze Sinter + POM Modified	self-lubricating, low-maintenance	25

PRODUCT NAME	ENGINEERED PLASTIC BEARINGS	WORKING CONDITIONS	PAGE
EP®	PA6.6T + Solid Lubricant + Fillers	self-lubricating	26
EP®12	POM + Solid Lubricant	self-lubricating	27
EP®15	POM + Solid Lubricant	self-lubricating	28
EP®22	PBT + Solid Lubricant	self-lubricating	29
EP®30	PA 6.6 + AF + Solid Lubricant	self-lubricating	30
EP®43	PPS + Solid Lubricant + Fillers	self-lubricating	31
EP®44	PPS + Solid Lubricant + Fillers	self-lubricating	32
EP®63	PEEK + Solid Lubricant + Fillers	self-lubricating	33
EP®64	PEEK + Solid Lubricant + Fillers	self-lubricating	34
EP®73	PAI + Solid Lubricant + Fillers	self-lubricating	35
EP®79	PAI + Solid Lubricant + Fillers	self-lubricating	36
KA Glacetal	POM	self-lubricating, low-maintenance	37
Multilube	POM + Solid Lubricant + Fillers	self-lubricating	38

PRODUCT NAME	FIBER REINFORCED COMPOSITE BEARINGS	WORKING CONDITIONS	PAGE
GAR-MAX®	Continuous wound PTFE and high-strength fibers encapsulated in an internally lubricated, high temperature filled epoxy resin sliding layer + continuous wound fiberglass encapsulated in a high temperature epoxy resin	self-lubricating	39
GAR-FIL	Proprietary filled PTFE tape liner + continuous wound fiberglass encapsulated in a high temperature epoxy resin	self-lubricating	40
HSG	Continuous wound PTFE and high-strength fibers encapsulated in an internally lubricated, high temperature filled epoxy resin sliding layer + continuous wound fiberglass encapsulated in a high temperature epoxy resin	self-lubricating	41
MLG	Continuous wound PTFE and high-strength fibers encapsulated in an internally lubricated, high temperature filled epoxy resin sliding layer + continuous wound fiberglass encapsulated in a high temperature epoxy resin	self-lubricating	42
HPM	Continuous wound PTFE and high-strength fibers encapsulated in an internally lubricated, high temperature filled epoxy resin sliding layer + continuous wound fiberglass encapsulated in a high temperature epoxy resin	self-lubricating	43
HPMB®	Machinable continuous wound PTFE and high-strength fibers encapsulated in an internally lubricated, high temperature filled epoxy resin sliding layer + continuous wound fiberglass encapsulated in a high temperature epoxy resin	self-lubricating	44
HPF	Proprietary filled PTFE tape liner + continuous woven cloth laminate impregnated and cured with epoxy resin	self-lubricating	45
GGB-MEGALIFE®XT	Proprietary filled PTFE tape liner on both sides + continuously woven layer of filament glass fiber encapsulated in a high temperature epoxy resin	self-lubricating	46
Multifil	PTFE + proprietary filler system	self-lubricating	47
SBC with GAR-MAX®	Composite material with sealing SBC bearings are available with GAR-MAX are sealed to exclude containments. SBC are optionally available with a steel outer shell.	self-lubricating, low-maintenance	48
SBC with HSG	Composite material with sealing SBC bearings are available with HSG are sealed to exclude containments. SBC are optionally available with a steel outer shell.	self-lubricating, low-maintenance	49

Overview of Coatings, Bearing Materials & Accessory Products

PRODUCT NAME	METAL & BIMETAL BEARINGS	WORKING CONDITIONS	PAGE
GGB-CSM®	Powder metallurgical monometallic bearing material (bronze, nickel or iron-based) + solid graphite lubricant, MoS_2	self-lubricating	50
GGB-CBM®	Thin walled powder metallurgical bimetal bearing material stainless steel, carbon steel or bronze with bronze + based backing): + solid graphite lubricant	self-lubricating	51
GGB-BP25	Sintered bronze impregnated with oil, similar to SINT A 50, impregnation group 1	self-lubricating	52
GGB-FP20	Steel alloy sinter impregnated with oil, similar to SINT A 10, impregnation group 1	self-lubricating	53
GGB-SO16	Sintered steel alloy impregnated with oil	self-lubricating	54
GGB-SHB®	Case hardened steel bearings for lubricated applications	conventional lubrication	55
AuGlide®	Steel backing and lead-free bronze overlay	low-maintenance	56
SY	Steel backing and leaded bronze overlay + CuPb10Sn10	low-maintenace	57
SP	Steel backing and leaded bronze overlay + CuPb26Sn2	low-maintenance	58
GGB-DB®	Dry bearing material: cast bronze + solid lubricant inserts	self-lubricating	59

ACCESSORY PRODUCTS

PRODUCT NAME	BEARING ASSEMBLIES	PAGE
UNI	Self-aligning bearing housings	60
MINI	Self-aligning bearing housings	61
EXALIGN®	Self-aligning bearing housings	62

ADDITIONAL INFORMATION	PAGE
Technical Data Sheet	63
Product Information	64
Fabrication	65

TriboShield®TS161 Polymer Coating

SELF-LUBRICATING COMPOSITE COATING FOR LOW LOADS

TS161 is an engineering thermoplastic based composite coating composed of a primer and a top coat. Specifically designed for low-friction at low loading conditions, it presents excellent wear resistance as one of its standout features. TS161 is part of the standard TriboShield® product range.

UNIQUE CHARACTERISTICS

- Low-friction in low loading conditions
- Excellent wear resistance under low loads

BEARING PROPERTIES	UNITS	VALUE
GENERAL		
Color		Black
Max. continuous service temperature	°C / °F	60 / 140
Max. short-term peak temperature	°C / °F	80 / 176
Friction coefficient, typical range*		0.04 - 0.25
Food contact compliant**		No

** Dependent on contact pressure, sliding speed and contact geometry.*
*** Your specific food contact condition may require additional approval. Please contact your GGB representative for more information.*

AVAILABILITY

TriboShield coatings are applied directly to the customer's part. Suitable for complex geometries and a wide range of substrates eg steel, stainless steel, Al, Ti, Mg etc. Can be used for both interacting surfaces that are in relative motion

TYPICAL APPLICATIONS

- Conveyor deflectors
- Rod guides
- Automotive seat belt sliders
- Sliding guides for packaging lines

TRIBOMATE® UPGRADE AVAILABLE

No

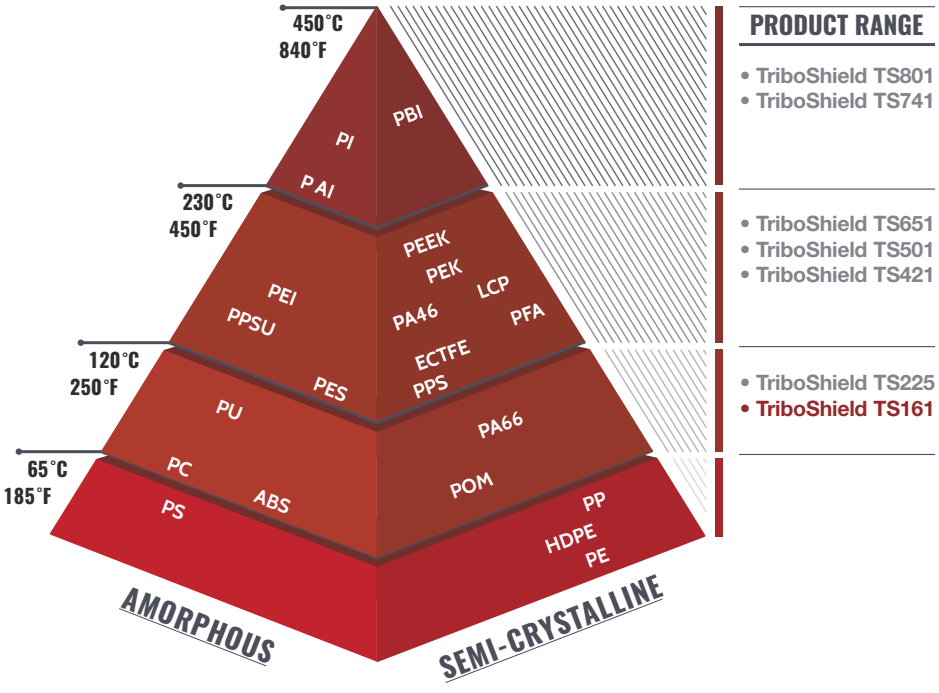
STANDARD COATINGS RANGE

- PERFORMANCE
- PROCESSING COMPLEXITY
- COST

COATING ADVANTAGES

- More compact design
- Less complex system assembly
- Reduced weight
- Increased surface durability

TriboShield® Standard Product Range



TriboShield®TS225 Polymer Coating

NANOSTRUCTURED COATING FOR LOW TO MEDIUM LOADS

TS225 is based on a nanostructured thermoset polymer designed for low-friction and high wear resistance at low to medium loads in dry or lubricated conditions. TS225 is part of the standard TriboShield® product range.

UNIQUE CHARACTERISTICS

- Excellent friction at high sliding speeds
- Very good friction in lubricated conditions
- Applicable to heat-sensitive substrates
- High surface hardness

BEARING PROPERTIES	UNITS	VALUE
GENERAL		
Color		Black
Max. continuous service temperature	°C / °F	120 / 248
Max. short-term peak temperature	°C / °F	130 / 266
Friction coefficient, typical range*		0.04 - 0.25
Food contact compliant**		No

** Dependent on contact pressure, sliding speed and contact geometry.*
*** Your specific food contact condition may require additional approval. Please contact your GGB representative for more information.*

STANDARD COATINGS RANGE

- PERFORMANCE
- PROCESSING COMPLEXITY
- COST

COATING ADVANTAGES

- More compact design
- Less complex system assembly
- Reduced weight
- Increased surface durability

AVAILABILITY

TriboShield coatings are applied directly to the customer's part and are suitable for complex geometries as well as various substrates e.g. steel, stainless steel, Al, Ti, Mg, etc. They can be used for both interacting surfaces that are in relative motion

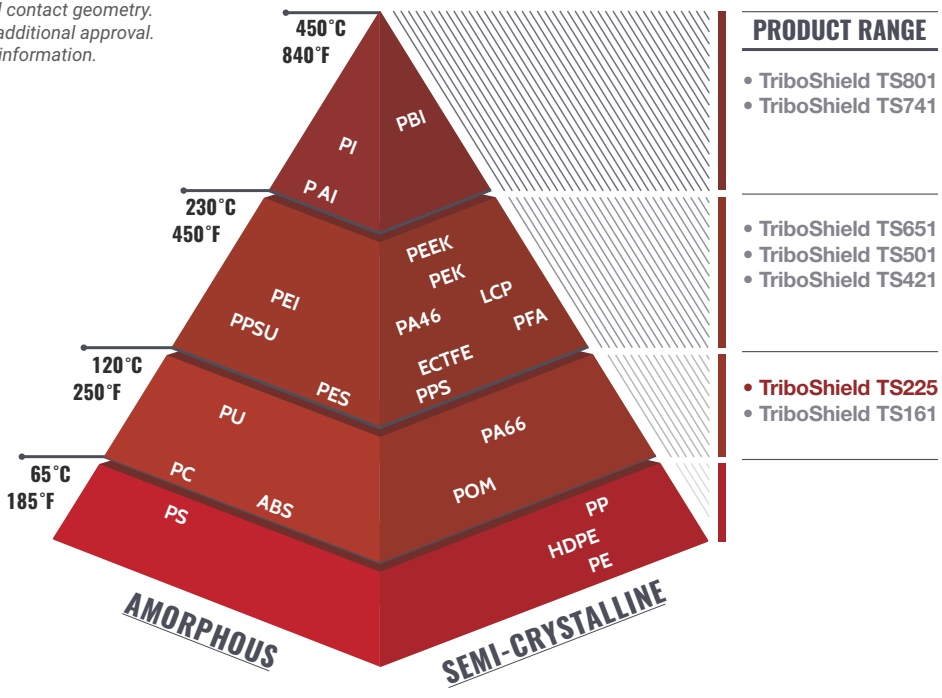
TYPICAL APPLICATIONS

- Piston skirts for internal combustion engines
- Garden and DYI tools

TRIBOMATE® UPGRADE AVAILABLE

Yes

TriboShield® Standard Product Range



TriboShield®TS421 Polymer Coating

LOW-FRICTION COATING FOR LUBRICATED CONDITIONS

TS421 is based on engineering thermoplastics, specifically designed for extremely low-friction in lubricated conditions under low loads but presenting good characteristics in dry low load conditions as well. This system comprises a primer layer and an active hybrid top-coat. TS421 is part of the standard TriboShield® product range.

UNIQUE CHARACTERISTICS

- Extremely low-friction in lubricated condition
- Very low-friction in dry conditions at low loads
- Excellent chemical resistance

BEARING PROPERTIES	UNITS	VALUE
GENERAL		
Color		Black, Green, Blue
Max. continuous service temperature	°C / °F	250 / 482
Max. short-term peak temperature	°C / °F	280 / 536
Friction coefficient, typical range*		0.04 - 0.30
Food contact compliant**		Yes

** Dependent on contact pressure, sliding speed and contact geometry.*
*** Your specific food contact condition may require additional approval. Please contact your GGB representative for more information.*

STANDARD COATINGS RANGE

- PERFORMANCE
- PROCESSING COMPLEXITY
- COST

COATING ADVANTAGES

- More compact design
- Less complex system assembly
- Reduced weight
- Increased surface durability

AVAILABILITY

TriboShield coatings are applied directly to the customer's part and are suitable for complex geometries as well as various substrates e.g. steel, stainless steel, Al, Ti, Mg, etc. They can be used for both interacting surfaces that are in relative motion.

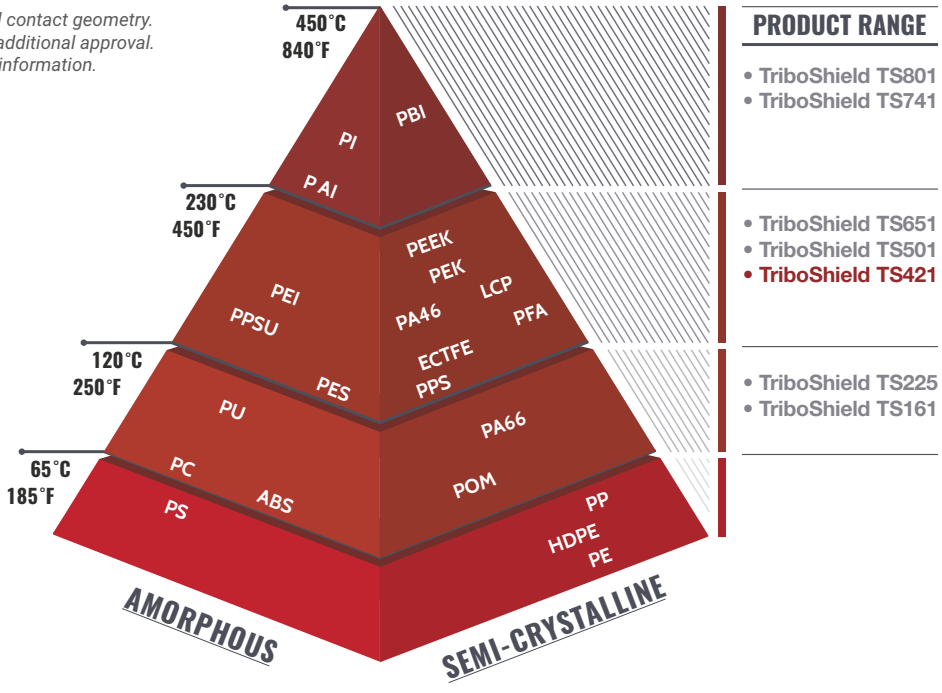
TYPICAL APPLICATIONS

- Pumps
- Hydraulic motors
- Precision linear guides

TRIBOMATE® UPGRADE AVAILABLE

Yes

TriboShield® Standard Product Range



TriboShield®TS651 Polymer Coating

HIGH PERFORMANCE LOW-FRICTION COATING

TS651 is based on high-performance thermoplastics specifically designed for constant low-friction from low to moderately high loads in dry or lubricated conditions. Highly suitable for high-frequency/ low amplitude (HFLA) applications, particularly in dry conditions. TS651 is part of the standard TriboShield® product range.

UNIQUE CHARACTERISTICS

- Excellent performance in dry
- Good performance in lubricated condition
- Very low stick-slip characteristic
- Excellent wear resistance up to moderately high loads

BEARING PROPERTIES	UNITS	VALUE
GENERAL		
Color		Dark Brown
Max. continuous service temperature	°C / °F	260 / 500
Max. short-term peak temperature	°C / °F	280 / 536
Friction coefficient, typical range*		0.06 - 0.30
Food contact compliant**		Yes

** Dependent on contact pressure, sliding speed and contact geometry.*
*** Your specific food contact condition may require additional approval. Please contact your GGB representative for more information.*

STANDARD COATINGS RANGE

- PERFORMANCE
- PROCESSING COMPLEXITY
- COST

COATING ADVANTAGES

- More compact design
- Less complex system assembly
- Reduced weight
- Increased surface durability

AVAILABILITY

TriboShield coatings are applied directly to the customer's part and are suitable for complex geometries as well as various substrates e.g. steel, stainless steel, Al, Ti, Mg, etc. They can be used for both interacting surfaces that are in relative motion.

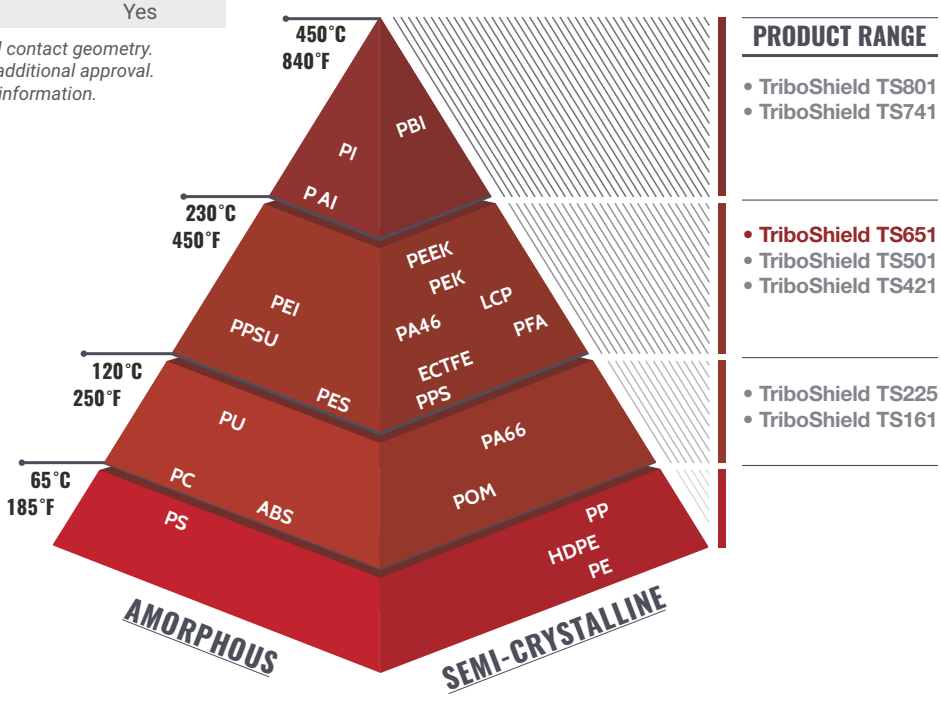
TYPICAL APPLICATIONS

- Solenoid armatures
- Seat mechanisms, struts and shock absorbers...
- Compressors and radial piston pumps
- Hydraulic pumps and motors

TRIBOMATE® UPGRADE AVAILABLE

Yes

TriboShield® Standard Product Range



TriboShield®TS741 Polymer Coating

LOW-FRICTION COATING FOR HIGH LOADS APPLICATIONS

TS741 is based on high-performance thermoplastics specifically developed for demanding and heavy duty applications. Very high load bearing capacity and low-friction at moderate to high loads are some of its standout features. TS741 is part of the standard TriboShield® product range.

UNIQUE CHARACTERISTICS

- Very high load bearing capacity
- Excellent wear resistance and sliding properties
- Very low-friction in medium to high load conditions
- Very good non-stick properties

BEARING PROPERTIES	UNITS	VALUE
GENERAL		
Color		Black
Max. continuous service temperature	°C / °F	260 / 500
Max. short-term peak temperature	°C / °F	270 / 518
Friction coefficient, typical range*		0.04 - 0.25
Food contact compliant**		No

** Dependent on contact pressure, sliding speed and contact geometry.*
*** Your specific food contact condition may require additional approval. Please contact your GGB representative for more information.*

STANDARD COATINGS RANGE

- PERFORMANCE
- PROCESSING COMPLEXITY
- COST

COATING ADVANTAGES

- More compact design
- Less complex system assembly
- Reduced weight
- Increased surface durability

AVAILABILITY

TriboShield coatings are applied directly to the customer's part and are suitable for complex geometries as well as various substrates e.g. steel, stainless steel, Al, Ti, Mg, etc. They can be used for both interacting surfaces that are in relative motion.

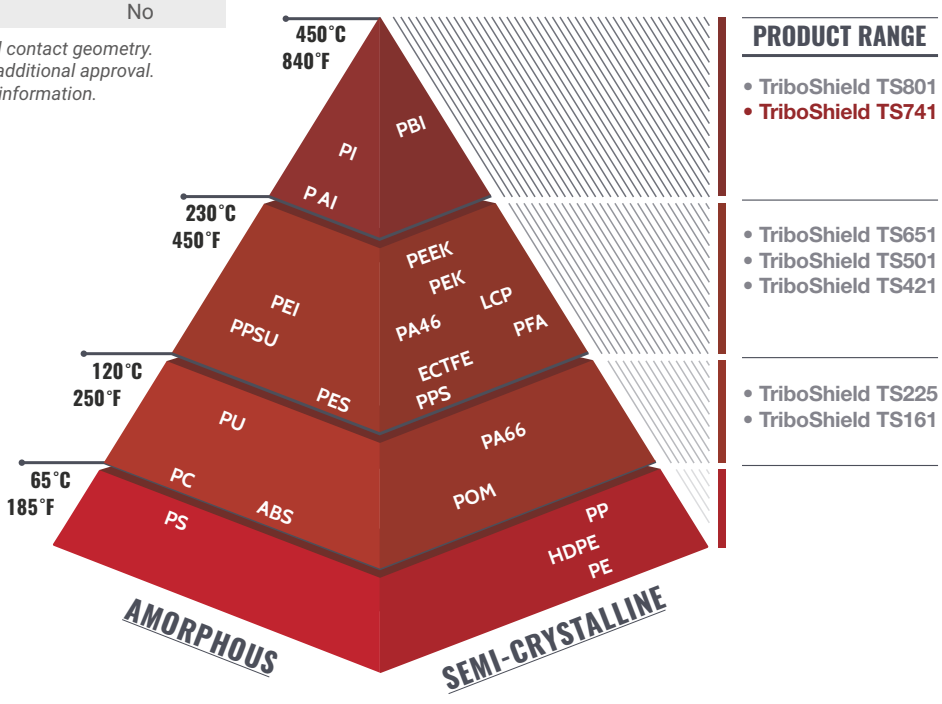
TYPICAL APPLICATIONS

- Highly loaded mechanisms
- Mechanisms requiring lifetime lubrication in dry conditions
- Submerged parts requiring corrosion protection
- Harsh chemical environments
- Braking systems, cutting blades...

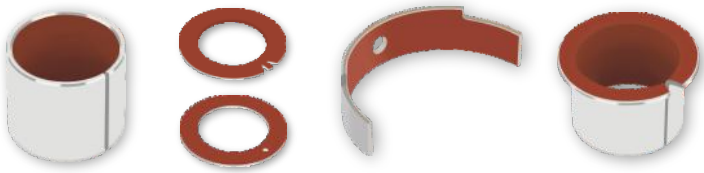
TRIBOMATE® UPGRADE AVAILABLE

Yes

TriboShield® Standard Product Range



DP4® Bearing Material



METAL-POLYMER ANTI-FRICTION PLAIN BEARINGS

CHARACTERISTICS

- DP4 anti-friction bushings offer good wear and low-friction performance over a wide range of loads, speeds and temperatures in dry running conditions
- Very good performance in lubricated applications
- Good performance in greased applications
- Suitable for linear, oscillating and rotating movements
- Lead-free material compliant to ELV, WEEE, and RoHS specifications
- Approved to standard DIN EN 1797: 2002-02 and ISO 21010: 2004-04 (Cryogenic Vessels – Gas/Material Compatibility) for piping, valves, fittings and other components in both gaseous and liquid oxygen for up to maximum temperature of 60°C and oxygen pressure of 25 bars. Contact GGB for further details.

AVAILABILITY

Bearing forms available in standard dimensions:

- Cylindrical bushes
- Flanged bushes
- Flanged washers
- Sliding plates
- Thrust washers

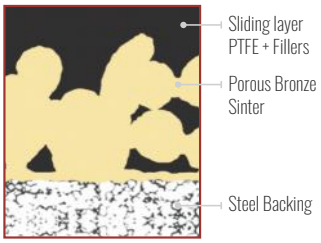
Bearing forms made-to-order: Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, bearings with locating notches, lubricant holes and machined/stamped grooves, customized bearing designs

APPLICATIONS

Automotive: Braking systems, clutches, gearbox and transmissions, hinges: door, bonnet, boot, cabriolet roof tops, pedals; pumps: axial piston, radial piston, gear and vane; seat mechanisms, steering systems, struts and shock absorbers, wiper systems, etc.

Industrial: Aerospace, agricultural equipment, construction equipment, food and beverage, material handling equipment, formingmachines: metal, plastic and rubber; office equipment, medical and scientific equipment, packaging equipment, pneumatic and hydraulic cylinders, pumps and motors, railroad and tramways, textile machinery, valves, etc.

MICROSECTION



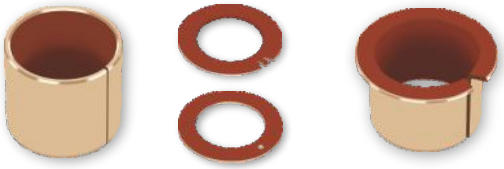
OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Very good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Good

FOR SUPERIOR PEFORMANCE	
Water lubricated	DP4-B

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 30
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.0
Coefficient of friction, f			0.04 - 0.25*
OIL LUBRICATED			
Maximum sliding speed, U		m/s	5.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.02 - 0.08
RECOMMENDATIONS			
Shaft surface roughness, Ra	Dry Lubricated	µm µm	0.3 - 0.5 ≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DP4-B Bearing Material



METAL-POLYMER BRONZE BACKED PTFE PLAIN BEARINGS

CHARACTERISTICS

- Good wear and low-friction performance over a wide range of loads, speeds and temperatures in dry running conditions
- Very good performance in lubricated applications
- Good performance in greased applications
- Suitable for linear, oscillating and rotating movements
- Bronze back offers improved corrosion-resistance in humid/saline environments
- Lead-free material

AVAILABILITY

Bearing forms available in standard dimensions:

- Cylindrical bushes
- Flanged bushes
- Sliding plates

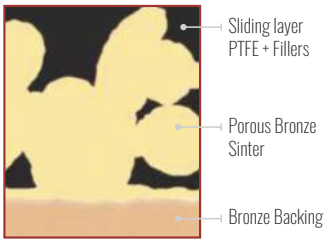
Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, flanged-thrust washers, halfbearings, special shapes obtained by stamping or deep drawing, bearings with locating notches, lubricant holes and machined / stamped grooves

APPLICATIONS

Industrial: Aerospace, agricultural equipment, construction equipment, material handling equipment, forming machines - metal, plastic and rubber; office equipment, medical and scientific equipment, packaging equipment, pneumatic and hydraulic cylinders, pumps and motors, railroad and tramways, textile machinery, valves, etc.

Others: Civil engineering, marine and offshore equipment, other applications in water or in outdoor environments, etc.

MICROSECTION



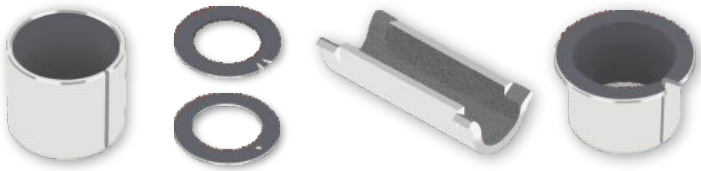
OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Very good
Grease lubricated	Good
Water lubricated	Good
Process fluid lubricated	Good

FOR SUPERIOR PEFORMANCE	
Water lubricated	DP4-B

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	18 36
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.0
Coefficient of friction, f			0.04 - 0.25*
OIL LUBRICATED			
Maximum sliding speed, U		m/s	5.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.02 - 0.08*
RECOMMENDATIONS			
Shaft surface roughness, Ra	Dry Lubricated	µm µm	0.3 - 0.5 ≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DU® Bearing Material



METAL-POLYMER ANTI-FRICTION PLAIN BEARINGS

CHARACTERISTICS

- Very good wear and low-friction performance over a wide range of loads, speeds and temperatures in dry running conditions
- Suitable for lubricated applications
- Suitable for linear, oscillating and rotating movements

AVAILABILITY

Bearing forms available in standard dimensions:

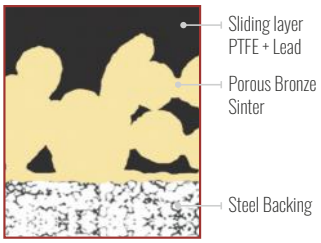
- Cylindrical bushes
- Flanged bushes
- Flanged washers
- Sliding plates
- Thrust washers

Bearing forms made-to-order: Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, customized bearing designs

APPLICATIONS

Industrial: Aerospace, agricultural equipment, construction equipment, food and beverage, material handling equipment, forming machines: metal, plastic and rubber; office equipment, medical and scientific equipment, packaging equipment, pneumatic and hydraulic cylinders, pumps and motors, railroad and tramways, textile machinery, valves, etc.

MICROSECTION



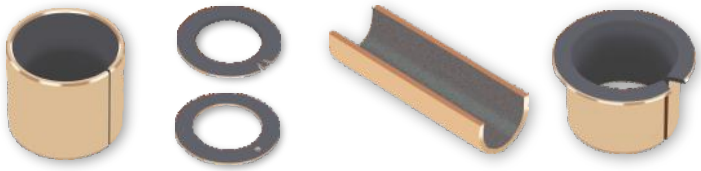
OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Fair

FOR SUPERIOR / LEAD-FREE PEFORMANCE	
Dry	DP4 / DP11
Oil lubricated	DP4 / DP31
Grease lubricated	DP4 / DX
Water lubricated	DP4-B
Process fluid lubricated	DP4 /DP31

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 30
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.8
Coefficient of friction, f			0.02 - 0.25*
OIL LUBRICATED			
Maximum sliding speed, U		m/s	5.0
Maximum pU factor		N/mm^2 x m/s	5.0
Coefficient of friction, f			0.02 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra	Dry Lubricated	µm µm	0.3 - 0.5 ≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DU-B Bearing Material



METAL-POLYMER BRONZE BACKED PTFE PLAIN BEARINGS

CHARACTERISTICS

- Very good wear and low-friction performance over a wide range of loads, speeds and temperatures in dry running conditions
- Suitable for lubricated applications
- Suitable for linear, oscillating and rotating movements
- Bronze back offers improved corrosion-resistance in humid/saline environments
- Approved to standard EN1337-2 for structural bearings for civil engineering

AVAILABILITY

Bearing forms available in standard dimensions:

- Cylindrical bushes
- Flanged bushes
- Sliding plates

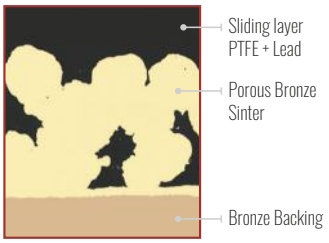
Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, flanged-thrust washers, half-bearings, special shapes obtained by stamping or deep drawing, customized bearing designs

APPLICATIONS

Industrial: Aerospace, agricultural equipment, construction equipment, material handling equipment, forming machines -metal, plastic and rubber; office equipment, medical and scientific equipment, packaging equipment, pneumatic and hydraulic cylinders, pumps and motors, railroad and tramways, textile machinery, valves, etc.

Others: Marine and offshore equipment, other applications in water or in outdoor environments

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Fair
Water lubricated	Good
Process fluid lubricated	Fair

FOR SUPERIOR / LEAD-FREE PEFORMANCE	
Dry	DP4-B
Oil lubricated	DP4-B
Grease lubricated	DP4-B
Water lubricated	DP4-B
Process fluid lubricated	DP4-B

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	18 36
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.8
Coefficient of friction, f			0.02 - 0.25*
OIL LUBRICATED			
Maximum sliding speed, U		m/s	5.0
Maximum pU factor		N/mm^2 x m/s	5.0
Coefficient of friction, f			0.02 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra	Dry Lubricated	µm µm	0.3 - 0.5 ≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DP10 Bearing Material

METAL-POLYMER ANTI-FRICTION PLAIN BEARINGS

CHARACTERISTICS

- Good wear and low-friction performance over a wide range of loads, speeds and temperatures in dry running conditions
- Very good performance in lubricated applications particularly in marginally lubricated applications
- Suitable for linear, oscillating and rotating movements
- Lead-free material compliant to ELV, WEEE, and RoHS specifications

AVAILABILITY

Bearing forms available in standard dimensions:

- Cylindrical bushes
- Flanged bushes
- Sliding plates
- Thrust washers

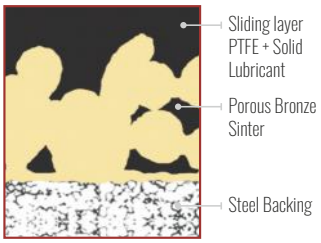
Bearing forms made-to-order: Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, bearings with local notches, lubricant holes and machined/stamped grooves, customized bearing designs

APPLICATIONS

Automotive: Braking systems, clutches, hinges – door, bonnet, boot, cabriolet roof tops, pedals, pumps – axial, piston, gear, vane, seat mechanisms, steering systems, struts and shock absorbers, wiper systems, etc.

Industrial: Agricultural equipment, compressors – scroll and reciprocating, construction equipment, food and beverage, material handling equipment, forming machines – metal, plastic and rubber, office equipment, medical and scientific equipment, packaging equipment, pneumatic and hydraulic cylinders, pumps and motors, railroad and tramways, textile machinery, valves, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Fair
Water lubricated	Not recommended
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Grease lubricated	DP4 / DX
Water lubricated	DP4-B
Process fluid lubricated	DP4 / DP31

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 30
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.0
Coefficient of friction, f			0.03 - 0.25*
OIL LUBRICATED			
Maximum sliding speed, U		m/s	5.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.02 - 0.08
RECOMMENDATIONS			
Shaft surface roughness, Ra	Dry Lubricated	µm µm	0.3 - 0.5 ≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DP11 Bearing Material

METAL-POLYMER ANTI-FRICTION PLAIN BEARINGS

CHARACTERISTICS

- Very good wear and low-friction performance over a wide range of loads, speeds and temperatures in dry running conditions
- Particularly suited to dry applications with high frequency and low amplitude oscillating movements
- Suitable for linear, oscillating and rotating movements
- Lead-free material compliant to ELV, WEEE, and RoHS specifications
- Approved to standard FMVSS 302 - Federal Motor Vehicle Safety Standard concerning the flammability of materials used in the occupant compartments of motor vehicles

AVAILABILITY

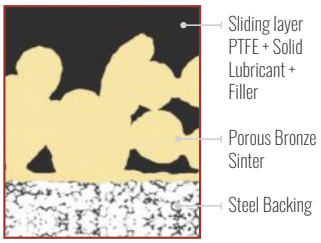
Bearing forms made-to-order: Cylindrical bushes, flanged bushes, thrust washers, flanged-thrust washers, sliding plates, half-bearings, special shapes obtained by stamping or deep drawing, customized bearing designs

APPLICATIONS

Automotive: Belt tensioners, clutches, dual mass fly-wheels, pulley dampers, etc.

Industrial: Applications with high frequency and low amplitude oscillating movements

MICROSECTION



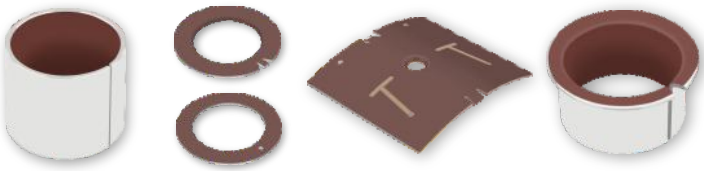
OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Fair
Water lubricated	Not recommended
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Grease lubricated	DP4 / DX
Water lubricated	DP4-B
Process fluid lubricated	DP4 / DP31

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 30
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.0
Coefficient of friction, f			0.04 - 0.25*
OIL LUBRICATED			
Maximum sliding speed, U		m/s	5.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.02 - 0.08
RECOMMENDATIONS			
Shaft surface roughness, Ra	Dry Lubricated	µm µm	0.3 - 0.5 ≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DP31 Bearing Material



METAL-POLYMER HYDRODYNAMIC COMPOSITE BEARINGS

CHARACTERISTICS

- Excellent low-friction and wear resistance performance in lubricated applications
- Excellent flow erosion and cavitation resistance
- Very good fatigue strength
- Lead-free material compliant to ELV, WEEE, and RoHS specifications

AVAILABILITY

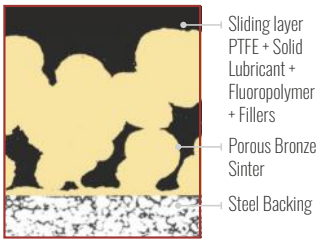
Bearing forms made-to-order: Cylindrical bushes, flanged bushes, thrust washers, flanged-thrust washers, sliding plates, half-bearings, bearings with locating notches, lubricant holes and machined/ stamped grooves, customized bearing designs

APPLICATIONS

Automotive: Air conditioning compressors, gearbox and transmissions, heavy duty struts and shock absorbers, high performance pumps: axial piston, radial piston, gear, vane, etc.

Industrial: Compressors: scroll and reciprocating; pneumatic and hydraulic cylinders, high performance pumps axial piston, radial piston, gear, vane, etc.

MICROSECTION



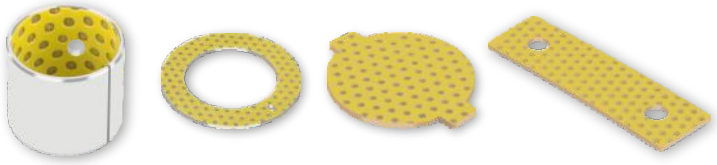
OPERATING PERFORMANCE	
Dry	Fair
Oil lubricated	Very good
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Good

FOR SUPERIOR PEFORMANCE	
Dry	DP4 / DP11
Grease lubricated	DP4 / DX
Water lubricated	DP4-B

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 140
Operating temperature	Min Max	°C °C	-200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 30
OIL LUBRICATED			
Maximum sliding speed, U		m/s	10.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.01 - 0.05
RECOMMENDATIONS			
Shaft surface roughness, Ra	Lubricated	µm	≤ 0.05 - 0.4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

** Depending on operating conditions*

DX® Bearing Material



METAL-POLYMER PLAIN BEARINGS GREASE LUBRICATED

CHARACTERISTICS

- Marginally lubricated bearing material for grease or oil lubricated applications
- Standard parts contain grease indents in the sliding layer; plain sliding layer available by request
- Optimum performance under relatively high loads and low speeds
- Suitable for linear, oscillating and rotating movements
- Wide range of parts available from stock

AVAILABILITY

Bearing forms available in standard dimensions:

- Cylindrical bushes
- Thrust washers
- Sliding plates

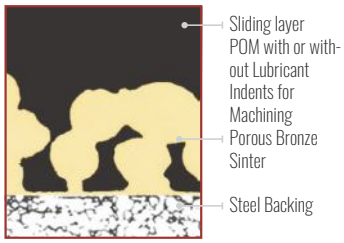
Bearing forms made-to-order: Standard forms in special dimensions, half-bearings, special shapes obtained by stamping, bearings with locating notches, lubricant holes and machined grooves, customized bearing designs

APPLICATIONS

Automotive: Steering gear, power steering, pedal bushes, seat slides, king-pin bushes, tailgate pivots, brake caliper bushes, etc.

Industrial: Mechanical handling and lifting equipment, machine slides, hydraulic cylinders, hydraulic motors, ski-lifts, pneumatic equipment, medical equipment, textile machinery, agricultural equipment, scientific equipment, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Poor
Oil lubricated	Good
Grease lubricated	Very good
Water lubricated	Poor
Process fluid lubricated	Poor

FOR SUPERIOR PEFORMANCE	
Dry	GAR-MAX / HSG / GAR-FIL / MLG
Water lubricated	HPM / HPF / DP4-B
Process fluid lubricated	DP4 / HI-EX / GAR-FIL

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-40 130
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 29
OIL LUBRICATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f			0.06 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB HB	> 200 > 350

** Depending on operating conditions*

DX®10 Bearing Material

METAL-POLYMER PLAIN BEARINGS GREASE LUBRICATED

CHARACTERISTICS

- Perfect for heavy duty and harsh environments
- Excellent chemical resistance
- Excellent erosion resistance
- Good fatigue strength
- Good wear performance
- Can be broached for tighter tolerance
- Lead-free material compliant to ELV, RoHS and WEEE specifications

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, thrust washers, sliding plates, half-bearings, special shapes obtained by stamping, bearings with locating notches, lubricant holes and machined grooves, customized bearing designs

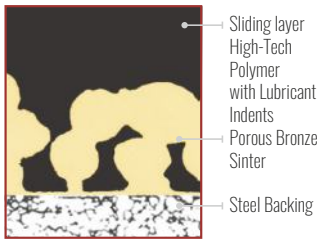
APPLICATIONS

General: Greased or oiled applications with high load, high temperature, and contamination; ideal for replacing bi-metal or bronze bushings to achieve improved wear performance

Automotive: King pins, oil pumps

Industrial: Piston pumps, agriculture equipment, construction, lift and cranes, small reciprocating bushing

MICROSECTION



OPERATING PERFORMANCE	
Dry	Fair
Oil lubricated	Very good
Grease lubricated	Very good
Water lubricated	Poor
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Dry	GAR-MAX / HSG / GAR-FIL / MLG
Water lubricated	HPM / HPF / DP4-B
Process fluid lubricated	DP4 / HI-EX / GAR-FIL

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 140
Operating temperature	Min Max	°C °C	-40 175
GREASE LUBRICATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f			0.01 - 0.10
OIL LUBRICATED			
Maximum sliding speed, U		m/s	10.0
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f			0.01 - 0.06
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

HI-EX® Bearing Material

METAL-POLYMER HYDRONAMIC COMPOSITE BEARINGS

CHARACTERISTICS

- Marginally lubricated bearing material with good wear resistance under thin film conditions
- Standard bearings supplied with indents for optimum retention and distribution of the lubricant over the sliding layer
- Available with non-indented overlay for hydrodynamic applications
- Rated for high temperature use up to 250°C / 480°F
- Suitable for use with low viscosity fluids
- Good chemical resistance
- Lead-free material compliant to ELV, RoHS and WEEE specifications

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, thrust washers, sliding plates, half-bearings, special shapes obtained by stamping, bearings with locating notches, lubricant holes and machined grooves, customized bearing designs

APPLICATIONS

Automotive: Diesel fuel pumps, heavy duty brakes, heavy duty axles

Industrial: Hydraulic motors, axial and radial piston pumps, agricultural equipment, wind energy equipment, yaw and teeter bearings

MICROSECTION

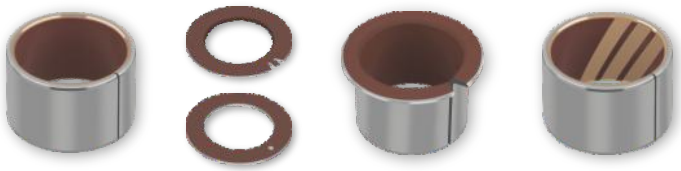
OPERATING PERFORMANCE	
Dry	Fair
Oil lubricated	Good
Grease lubricated	Very good
Water lubricated	Good
Process fluid lubricated	Good

FOR SUPERIOR PEFORMANCE	
Dry	GAR-MAX / HSG / GAR-FIL / MLG

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-150 250
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	$10^{-6}/K$ $10^{-6}/K$	11 29
GREASE LUBRICATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f			0.08 - 0.12
OIL LUBRICATED			
Maximum sliding speed, U		m/s	10.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.03 - 0.08
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.05 - 0.4*
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

** Depending on operating conditions*

DTS10® Bearing Material



METAL-POLYMER HYDRONAMIC COMPOSITE BEARINGS

CHARACTERISTICS

- The first polymer-lined bearing for lubricated conditions offering low-friction and high wear resistance that is designed to be machined on-site for tight tolerances
- Excellent wear resistance and low-friction in lubricated hydraulic applications
- Excellent chemical resistance, fatigue strength, cavitation and flow erosion resistance, and good behavior in dry start-up conditions
- A minimum overlay thickness of 0.1 mm permits, under carefully controlled conditions, machining of the assembled bore for improved dimensional tolerance and reduced geometric defects, while retaining a thin layer of PTFE sliding surface
- Compatible with most standard machining processes including turning, broaching, reaming, and milling
- Lead-free material compliant to ELV, RoHS and WEEE specifications

AVAILABILITY

Bearing forms made-to-order: Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, bearings with locating notches, lubricant holes and machined/stamped grooves, customized bearing designs

APPLICATIONS

Industrial: Compressors: scroll and reciprocating, external and internal motors, external and internal pumps, vane pumps, axial and radial piston pumps, gerotor pumps, hydraulic cylinders

MICROSECTION

OPERATING PERFORMANCE	
Dry	Fair
Oil lubricated	Excellent
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Good

FOR SUPERIOR PEFORMANCE	
Dry	GAR-MAX / HSG / GAR-FIL / MLG
Grease lubricated	DX / DX10
Water lubricated	HPM / HPF / DP4-B

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	140
Operating temperature	Min Max	°C °C	-200 280
FLUID LUBRICATED			
Maximum sliding speed, U		m/s	10.0
Maximum pU factor		N/mm^2 x m/s	100*
Coefficient of friction, f			0.01 - 0.08
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.05 - 0.2*
Shaft surface hardness		HB	> 200

** Depending on operating conditions*

DS Bearing Material

METAL-POLYMER SELF-LUBRICATING BEARINGS

CHARACTERISTICS

- Self-lubricating bearing material for operation in mixed film lubrication conditions
- Sliding layer is machinable (ca. 0.4 mm above bronze sinter layer)
- Resistant to fretting corrosion damage to the shaft under low amplitude oscillating movements
- Similar in performance to DX® but with lower friction

AVAILABILITY

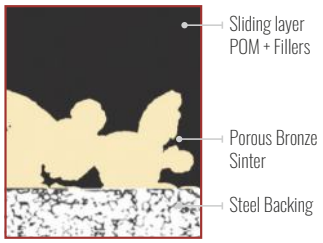
Bearing forms made-to-order: Cylindrical bushes, thrust washers, sliding plates, half-bearings, special shapes obtained by stamping, customized bearing designs

APPLICATIONS

Automotive: Steering gear, power steering, pedal bushes, seat slides, king-pin bushes, tailgate pivots, brake caliper bushes, etc.

Industrial: Mechanical handling and lifting equipment, machine slides, hydraulic cylinders, hydraulic motors, ski lifts, pneumatic equipment, medical equipment, textile machinery, agricultural equipment, scientific equipment, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Very good
Grease lubricated	Very good
Water lubricated	Poor
Process fluid lubricated	Poor

FOR SUPERIOR PEFORMANCE	
Water lubricated	HPM / HPF / DP4-B
Process fluid lubricated	DP4 / GAR-FIL / HI-EX

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	110 45
Operating temperature	Min Max	°C °C	-60 130
DRY			
Maximum sliding speed, U		m/s	1.5
Maximum pU factor		N/mm^2 x m/s	1.4
Coefficient of friction, f			0.15 - 0.3
GREASE LUBRICATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f			0.05 - 0.1
OIL LUBRICATED			
Maximum sliding speed, U		m/s	10.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.03 - 0.08
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

EP® Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain cylindrical bushes
- Plain flanged bushes

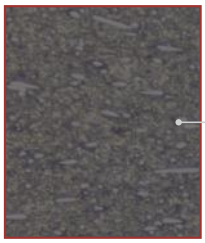
Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Medical equipment, awnings and blinds, scientific equipment, gaming equipment, office equipment, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Good after resistance testing

FOR SUPERIOR PEFORMANCE	
Water lubricated	EP22

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	80 40
Operating temperature	Min Max	°C °C	-40 140
Coefficient of linear thermal expansion		$10^{-6}/K$	22
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.06 0.24 1.00
Coefficient of friction, f			0.15 - 0.3
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HV	> 200

EP®12 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

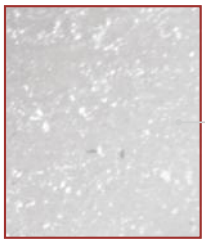
Bearing forms made-to-order: Cylindrical bushes, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Domestic appliances, furniture, office equipment, sports equipment and many more

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Good after resistance testing

FOR SUPERIOR PEFORMANCE	
Water lubricated	EP22

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	65
Operating temperature	Min Max	°C °C	-40 125
Coefficient of linear thermal expansion		$10^{-6}/K$	120
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.04 0.09 0.18
Coefficient of friction, f			0.18 - 0.3
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.1 - 0.5
Shaft surface hardness		HV	> 200

EP®15 Bearing Material

UV-RESISTANT BEARINGS FOR SUN & OUTDOOR APPLICATIONS

CHARACTERISTICS

- UV-resistant bearings
- Abrasion-resistant
- Lightweight
- Low coefficient of friction
- Very good bushing performance in dry working conditions
- Good bushing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/ saline environments
- Very good price performance ratio
- Very good weight performance ratio
- Within injection molding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

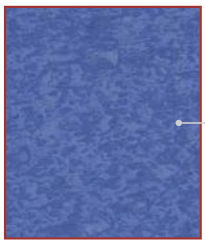
EP®15 Bearing forms made-to-order: Cylindrical bushings, flanged bushings, thrust washers, sliding plates, half-bushings, customized bearing designs

APPLICATIONS

Solar Power Equipment, Outdoor Applications, Recreational Applications

EP®15
ENGINEERED FOR SUN

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Good after resistance testing

BEARING PROPERTIES	STANDARD	UNITS	VALUE
CHARACTERISTICS			
Charpy unnotched impact strength	ISO 179/1eU	kJ/m^2	45
Charpy notched impact strength	ISO 179/1eA	kJ/m^2	4.5
Coefficient of linear thermal expansion	ISO 11359-2:1999-10	$x10^{-6}$	120
Minimum temperature		°C / °F	- 40 / - 40
Maximum temperature		°C / °F	125 / 260
Maximum extended temperature limit		°C / °F	125 / 260
Density	DIN EN ISO 1183-1 :2013-04 DIN EN ISO 1183-2 :2004-10	g/cm^3	1.50
Tensile strength	DIN EN ISO 527-1 :2012-06 DIN EN ISO 527-2 :2012-06 DIN EN ISO 527-3 :2003-07	N/mm^2 / psi	50 / 7252
Elastic modulus in tension	DIN EN ISO 178:2013-09 DIN EN ISO 527-1:2012-06 DIN EN ISO 604:2003-12	N/mm^2 / psi	2750 / 398854
Maximum static load		N/mm^2 / psi	65 / 9500
Coefficient of friction, f			0.09 - 0.15
Color			Blue

EP®22 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Very good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain cylindrical bushes
- Plain flanged bushes

Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

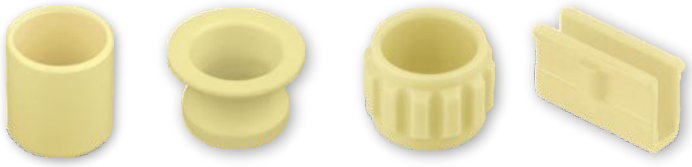
Industrial: Domestic appliances, chemical equipment, office equipment, sports equipment and many more

MICROSECTION

OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Very good
Process fluid lubricated	Good after resistance testing

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	50
Operating temperature	Min Max	°C °C	-50 170
Coefficient of linear thermal expansion		$10^{-6}/K$	90
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.05 0.10 0.20
Coefficient of friction, f			0.22 - 0.37
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.1 - 0.5
Shaft surface hardness		HV	> 200

EP®30 Bearing Material



SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Very good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio
- Very good weight performance ratio
- Very good in elasto hydrodynamic applications
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain cylindrical bushes
- Plain flanged bushes

Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Domestic appliances, chemical equipment, office equipment, sports equipment and many more

MICROSECTION

OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Very good
Process fluid lubricated	Good after resistance testing

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	65
Operating temperature	Min Max	°C °C	-50 200
Coefficient of linear thermal expansion		$10^{-6}/K$	40
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.05 0.10 0.20
Coefficient of friction, f			0.08 - 0.16
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.1 - 0.5
Shaft surface hardness		HV	> 200

EP®43 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio for high temperature applications
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain cylindrical bushes
- Plain flanged bushes

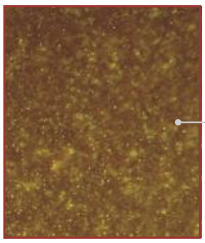
Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Domestic appliances, materials handling equipment, apparatus engineering, slot machines and cash boxes and many more

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Very good
Process fluid lubricated	Good after resistance testing

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	83
Operating temperature	Min Max	°C °C	-40 240
Coefficient of linear thermal expansion		$10^{-6}/K$	45
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.22 0.90 3.59
Coefficient of friction, f			0.11 - 0.2
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HV	> 200

EP®44 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio for high temperature applications
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

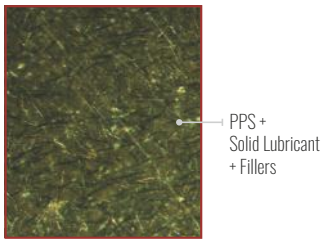
Bearing forms made-to-order: Cylindrical bushings, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Domestic appliances, valve technology, electronics assembly, apparatus engineering and many more

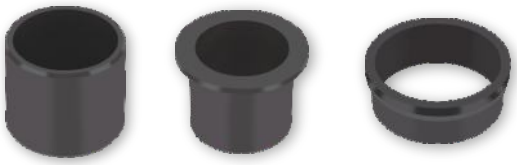
MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Very Good
Grease lubricated	Very Good
Water lubricated	Very Good
Process fluid lubricated	Good after resistance testing

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	95
Operating temperature	Min Max	°C °C	-40 240
Coefficient of linear thermal expansion		$10^{-6}/K$	27
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.11 0.42 1.69
Coefficient of friction, f			0.16 - 0.26
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HV	> 450

EP®63 Bearing Material



SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Suitable for very high temperature applications
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain cylindrical bushes
- Plain flanged bushes

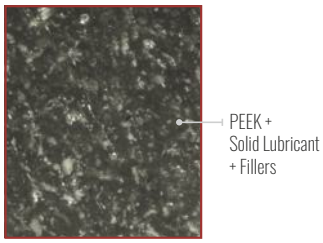
Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Domestic appliances, valve technology, electronics assembly, agricultural machinery and many more

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Good after resistance testing

FOR SUPERIOR PEFORMANCE	
Water lubricated	EP64

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	90
Operating temperature	Min Max	°C °C	-100 290
Coefficient of linear thermal expansion		$10^{-6}/K$	50
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.16 0.66 2.63
Coefficient of friction, f			0.12 - 0.21
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.1 - 0.5
Shaft surface hardness		HV	> 200

EP®64 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in lubricated or marginally lubricated applications
- Excellent flow erosion and cavitation resistance
- Corrosion-resistant in humid/saline environments
- Suitable for very high temperature applications
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

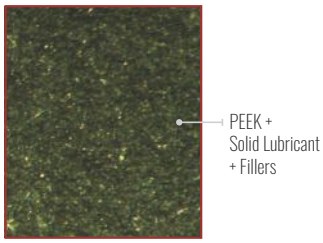
Bearing forms made-to-order: Cylindrical bushes, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Industrial: Domestic appliances, transportation equipment, apparatus engineering, conveyor equipment and many more

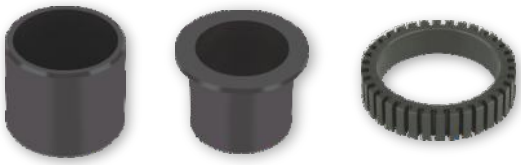
MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Very good
Grease lubricated	Very good
Water lubricated	Good
Process fluid lubricated	Good after resistance testing

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	125
Operating temperature	Min Max	°C °C	-100 290
Coefficient of linear thermal expansion		$10^{-6}/K$	14
DRY			
Maximum sliding speed, U		m/s	1.0
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.09 0.35 1.40
Coefficient of friction, f			0.3 - 0.5
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.1 - 0.5
Shaft surface hardness		HV	> 450

EP®73 Bearing Material



SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good bearing performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good dimensional stability
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Automotive: Automatic gears, pumps, sealing in turbo compressors, piston rings, valve seats, sealings

Industrial: Continuous furnaces, drying furnaces for coating, textile machines and many more

Aerospace: Weight saving by replacement of aluminum or metal alloys, while providing superior stability and viscosity. Applicable in extreme high and low temperatures e.g. turbojet engine compressor blade

MICROSECTION

OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Good after resistance testing

FOR SUPERIOR PEFORMANCE	
Water lubricated	EP64

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	105
Operating temperature	Min Max	°C °C	-200 260
Coefficient of linear thermal expansion		$10^{-6}/K$	25
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor	for A_H/A_C = 5 for A_H/A_C = 10 for A_H/A_C = 20	N/mm^2 x m/s N/mm^2 x m/s N/mm^2 x m/s	0.10 0.39 1.57
Coefficient of friction, f			0.19 - 0.31
LUBRICATED			
Maximum sliding speed, U		m/s	5.0
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HV	> 200

EP®79 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

- Excellent flow erosion and cavitation resistance
- Excellent performance in fully lubricated applications
- Corrosion-resistant in humid/saline environments
- Excellent dimensional stability
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features
- Compliant to ELV, WEEE and RoHS specifications

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

APPLICATIONS

General: Generally applicable within the limits of the material properties

Automotive: Automatic gears

Industrial: Domestic appliances, control valves, fittings, textile machines and many more

MICROSECTION

OPERATING PERFORMANCE	
Dry	Not recommended
Oil lubricated	Very good
Grease lubricated	Very good
Water lubricated	Fair
Process fluid lubricated	Good after resistance testing

FOR SUPERIOR PEFORMANCE	
Dry	EP73
Water lubricated	EP64

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static	N/mm^2	130
Operating temperature	Min Max	°C °C	-200 260
Coefficient of linear thermal expansion		$10^{-6}/K$	9
DRY			
Maximum sliding speed, U		m/s	10.0
Maximum pU factor		N/mm^2 x m/s	10.0
Coefficient of friction, f			0.005 - 0.1
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HV	> 500

KA Glacetal Bearing Material

ENGINEERED PLASTIC THRUST WASHERS

CHARACTERISTICS

- Good bearing performance in light duty working conditions
- Good performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Very good price performance ratio
- Very good weight performance ratio

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain thrust washers

Non standard parts made-to-order

APPLICATIONS

Industrial: Thrust washers are used as axial bearings in conjunction with all cylindrical bushes according to ISO 3547 to prevent metal-to-metal contact and fretting damage

MICROSECTION

OPERATING PERFORMANCE	
Dry	Fair
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Dry	EP22
Water lubricated	EP22
Process fluid lubricated	EP22

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	20 10
Operating temperature	Min Max	°C °C	-40 80
GREASED			
Maximum sliding speed, U		m/s	1.5
Maximum pU factor		N/mm^2 x m/s	0.35
Coefficient of friction, f			0.08 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

Multilube Bearing Material

THERMOPLASTIC PLAIN BEARINGS

CHARACTERISTICS

- Good bearing performance in dry working conditions
- Good performance in lubricated or marginally lubricated applications
- Corrosion-resistant in humid/saline environments
- Good price performance ratio
- Very good weight performance ratio
- Within injection moulding tool feasibility unlimited dimensions and design features

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

APPLICATIONS

Industrial: Linkages, seat suspensions

MICROSECTION

OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Fair
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Water lubricated	EP22
Process fluid lubricated	EP22

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	60 30
Operating temperature	Min Max Momentary	°C °C °C	-40 80 120
Coefficient of linear thermal expansion		$10^{-6}/K$	101
DRY			
Maximum sliding speed, U		m/s	1.5
Maximum pU factor		N/mm^2 x m/s	0.6
Coefficient of friction, f			0.1 - 0.2
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

GAR-MAX® Bearing Material

SELF-LUBRICATING FIBERGLASS REINFORCED PLAIN BEARINGS

CHARACTERISTICS

- High load capacity
- Excellent shock and misalignment resistance
- Excellent contamination resistance
- Very good friction and wear properties
- Good chemical resistance
- Very good dry wear performance
- GAR-MAX® bearing sizes available according to DIN ISO 4379 for the replacement of traditional greased bronze bearings

AVAILABILITY

Bearing forms available in standard dimensions:

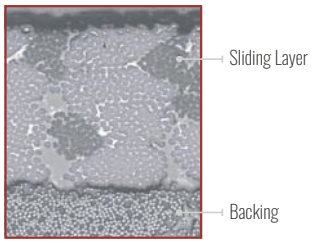
- Plain cylindrical bushes

Non-standard parts made-to-order: Cylindrical bushes with non-standard lengths and wall thickness, customized bushing designs

APPLICATIONS

Industrial: Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates, backhoes, trenchers, skid steer loaders, front end loaders, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Poor

FOR SUPERIOR PEFORMANCE	
Oil lubricated	GAR-FIL
Grease lubricated	DX / DX10
Water lubricated	HPF / HPM
Process fluid lubricated	GAR-FIL

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	210 140
Operating temperature	Min Max	°C °C	-195 160
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.05
Coefficient of friction, f			0.05 - 0.3*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.15 - 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 350 > 480

** Depending on operating conditions*

GAR-FIL Bearing Material

FIBER REINFORCED COMPOSITE BEARINGS WITH PTFE TAPE LINER

CHARACTERISTICS

- Proprietary filled PTFE tape liner
- High load capacity
- Good chemical resistance
- Machinable bearing surface
- High rotational speed capacity
- Very good friction and wear properties
- Excellent contamination resistance

AVAILABILITY

Bearing forms available in standard dimensions:

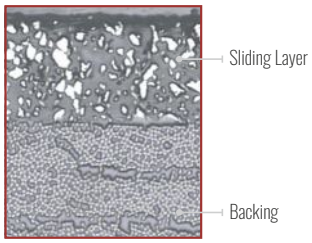
- Plain cylindrical bushes

Non-standard parts made-to-order: Cylindrical bushes with non-standard lengths and wall thickness, flanged bearings, hexagonal and square bores, liner on outer diameter, customized bearing designs

APPLICATIONS

Industrial: Valves, scissor lifts, pulleys, toggle linkages, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Very good
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Very good

FOR SUPERIOR PEFORMANCE	
Grease lubricated	DX / DX10
Water lubricated	HPF / HPM

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-195 205
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.23
Coefficient of friction, f			0.02 - 0.12*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Normal	HB	> 200

** Depending on operating conditions*

HSG Bearing Material

HIGH-LOAD FIBER REINFORCED COMPOSITE PTFE BEARINGS

CHARACTERISTICS

- Self-lubricating plain bearing material
- High load capacity (twice as much as standard GAR-MAX® bearings)
- Excellent shock and misalignment resistance
- Excellent contamination resistance
- Very good friction and wear properties
- Good chemical resistance

AVAILABILITY

Bearing forms available in standard dimensions:

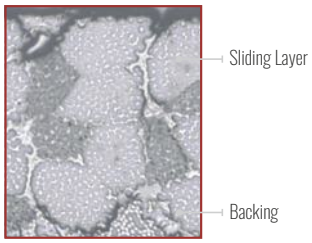
- Plain cylindrical bushes

Non-standard parts made-to-order: Cylindrical bushes with non-standard lengths and wall thickness, flanged bearings, hexagonal and square bores, liner on outer diameter, customized bearing designs

APPLICATIONS

Industrial: Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates, backhoes, trenchers, skid steer loaders, front end loaders, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Oil lubricated	GAR-FIL
Grease lubricated	DX / DX10
Water lubricated	HPF / HPM
Process fluid lubricated	GAR-FIL

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	415 140
Operating temperature	Min Max	°C °C	-195 160
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.05
Coefficient of friction, f			0.05 - 0.3*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.15 - 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 350 > 480

** Depending on operating conditions*

MLG Bearing Material

SELF-LUBRICATING FIBER REINFORCED COMPOSITE BEARINGS

CHARACTERISTICS

- Value engineered filament-wound bearing for lighter duty applications
- High load capacity
- Good misaligment resistance
- Excellent shock resistance
- Good friction and wear properties
- Good chemical resistance

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes with non-standard lengths and wall thickness, flanged bearings, hexagonal and square bores, liner on outer diameter, customized bearing designs

APPLICATIONS

Industrial: Construction and earth moving equipment, conveyors, cranes, hoists, hydraulic cylinder pivots, etc.

MICROSECTION

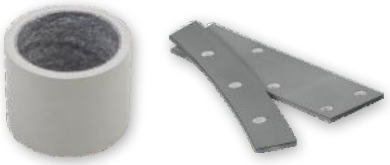
OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Good
Grease lubricated	Poor
Water lubricated	Fair
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Grease lubricated	DX / DX10
Water lubricated	HPF / HPM
Process fluid lubricated	GAR-FIL

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	210 140
Operating temperature	Min Max	°C °C	-195 160
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.05
Coefficient of friction, f			0.05 - 0.3*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.15 - 0.4
Shaft surface hardness		HB	> 350

** Depending on operating conditions*

HPM Bearing Material



FIBER REINFORCED COMPOSITE HYDRO BEARINGS

CHARACTERISTICS

- Designed for hydropower applications
- High load capacity
- Excellent shock and edge loading capacity
- Low-friction, superior wear rate and bearing life
- Excellent corrosion-resistance
- Dimensionally stable - very low water absorption, low swelling
- Environmentally friendly

AVAILABILITY

Bearing forms available in standard dimensions:

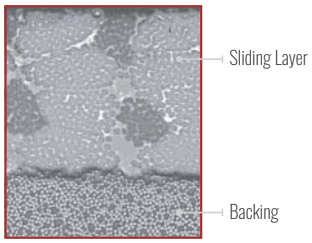
- Plain cylindrical bushes

Non-standard parts made-to-order: Cylindrical bushes with non-standard dimensions, customized bearing designs

APPLICATIONS

Industrial: Servo-motor bearings, operating ring sliding segments, linkage bearings, wicket gate bearings, guide vane bearings, intake gate sliding segments, intake gate roller bearings, spillway gate bearings, trash rate bearings, fish screen bearings, trunnion bearings, blade bearings, injector bearings, deflector bearings, ball and butterfly trunnion bearings, etc.

MICROSECTION



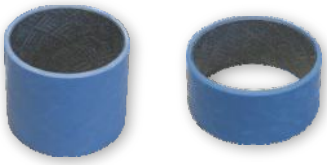
OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Poor
Water lubricated	Very good
Process fluid lubricated	Poor

FOR SUPERIOR PEFORMANCE	
Oil lubricated	GAR-FIL / HPF
Grease lubricated	DX / DX10
Process fluid lubricated	GAR-FIL / HPF

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	210 140
Operating temperature	Min Max	°C °C	-195 160
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.23
Coefficient of friction, f			0.03 - 0.12*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness	Normal For longer service life	HB HB	> 180 > 480

** Depending on operating conditions*

HPMB® Bearing Material



HIGH PRECISION FIBER REINFORCED COMPOSITE BEARINGS

CHARACTERISTICS

- Machinable inner and outer diameters for superior application precision, circularity and cylindricity tolerances
- Pre-machined high precision HPMB bearings available for immediate installation
- High precision through easy single point machining of the bearing liner, on-site prior to installation
- Superior precision achieved with post-installation (inner diameter tolerance IT7 attainable) single point machining of the bearing liner
- High load capacity
- Excellent shock and edge loading capacity
- Low-friction with negligible stick-slip
- Low wear rate for extended bearing life

AVAILABILITY

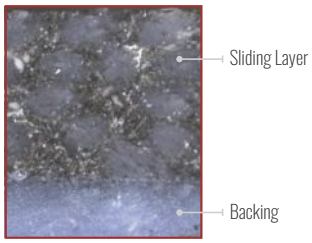
Bearing forms made-to-order: Finished cylindrical bushings, pre-machined cylindrical bushings, flanged cylindrical bushings (subject to design review)

APPLICATIONS

Industrial: Railroad stabilization system, railroad brake linkages, injection molding machines – guide bushings, hydraulic cylinder pivots, water turbines – wicket gates, servomotors, links, water gates, valves

- Excellent corrosion-resistance
- Dimensionally stable - very low water absorption, low swelling
- Environmentally friendly grease-free operation

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Not recommended
Water lubricated	Very good
Process fluid lubricated	To be tested by final user

FOR SUPERIOR PEFORMANCE	
Oil lubricated	GAR-FIL / HPF
Grease lubricated	DX / DX10
Process fluid lubricated	GAR-FIL / HPF

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	210 140
Operating temperature	Min Max	°C °C	-196 163
Coefficient of linear thermal expansion		$10^{-6}/K$	12.6
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.23
Coefficient of friction, f			0.03 - 0.12*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness	Normal For longer service life	HB HB	> 180 > 480

** Depending on operating conditions*

HPF Bearing Material

FIBER REINFORCED COMPOSITE BEARINGS WITH PTFE TAPE LINER

CHARACTERISTICS

- Proprietary filled PTFE tape machinable liner
- Designed for hydropower applications
- Machinable bearing surface
- High load capacity
- Excellent shock and edge loading capacity
- Low-friction, superior wear rate and bearing life
- Excellent corrosion-resistance
- Dimensionally stable - very low water absorption, low swelling
- Environmentally friendly

AVAILABILITY

Bearing forms available in standard dimensions:

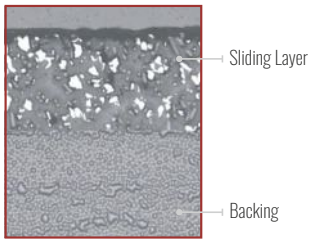
- Plain cylindrical bushes
- Sliding plates

Non-standard parts made-to-order: Cylindrical bushes with non-standard dimensions, customized bearing designs

APPLICATIONS

Industrial: Servo-motor bearings, operating ring sliding segments, linkage bearings, wicket gate bearings, guide vane bearings, intake gate sliding segments, intake gate roller bearings, spillway gate bearings, trash rate bearings, fish screen bearings, trunnion bearings, blade bearings, injector bearings, deflector bearings, ball and butterfly trunnion bearings, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Very good
Grease lubricated	Poor
Water lubricated	Very good
Process fluid lubricated	Good

FOR SUPERIOR PEFORMANCE	
Grease lubricated	DX / DX10

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-195 140
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	1.23
Coefficient of friction, f			0.02 - 0.1*
GREASE LUBRICATED			
Coefficient of friction, f			0.02 - 0.08*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness	Normal For longer service life	HB HB	> 180 > 480

** Depending on operating conditions*

GGB-MEGALIFE® XT

FIBER REINFORCED COMPOSITE PTFE THRUST WASHERS

CHARACTERISTICS

- Proprietary filled PTFE tape liner on both surfaces
- Excellent shock resistance
- High load capacity
- Excellent misalignment resistance
- Excellent contamination resistance
- Good surface speed capability
- Very good friction and wear properties
- Good chemical resistance

AVAILABILITY

Bearing forms available in standard dimensions:

- Plain thrust washers

Bearing forms made-to-order: Thrust washers with non-standard dimensions

APPLICATIONS

Industrial: Pulley spacers, gear spacers, aerial lifts, fork lift masts, king pins, steering links, lift gates, cranes, backhoes, valve actuator linkages, etc.

MICROSECTION

OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Poor
Water lubricated	Very good
Process fluid lubricated	Fair

FOR SUPERIOR PEFORMANCE	
Oil lubricated	HPF
Grease lubricated	DX
Process fluid lubricated	HPF

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	140 140
Operating temperature	Min Max	°C °C	-195 175
DRY			
Maximum sliding speed, U		m/s	0.5
Maximum pU factor		N/mm^2 x m/s	1.23
Coefficient of friction, f			0.02 - 0.12*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Normal	HB	> 200

** Depending on operating conditions*

Multifil Bearing Material

PROPRIETARY FILLED PTFE SLIDING BEARING TAPE

CHARACTERISTICS

- Superior sliding bearing material which can be easily bonded to any clean, rigid substrate
- Reduces vibration

AVAILABILITY

Bearing forms available in standard dimensions:

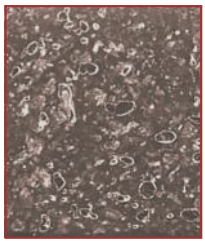
- Bearing tape

Tape with 0.015" to 0.125" (0.38 to 3.2 mm) thickness and 12" (305 mm) width or 24" (610 mm) width

APPLICATIONS

Industrial: Machine tool ways, gibs and other sliding applications

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Very good
Grease lubricated	Very good
Water lubricated	Good
Process fluid lubricated	Good

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	70 35
Operating temperature	Min Max	°C °C	-200 280
DRY			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	0.32
Coefficient of friction, f			0.07
GREASE / OIL LUBRICATED			
Maximum pU factor		N/mm^2 x m/s	1.25
Coefficient of friction, f			0.05
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.4
Shaft surface hardness		HB	> 200

SBC with GAR-MAX® Bearing Material

SEALED FIBER REINFORCED COMPOSITE BEARINGS

CHARACTERISTICS

- Self-lubricating bearings
- High static load capacity
- Excellent resistance to shock loading and misalignment
- Very good friction and wear properties
- Good chemical resistance
- Sealed to exclude contaminates to offer extended service life
- Environmentally friendly and eliminates need for automated grease system and grease

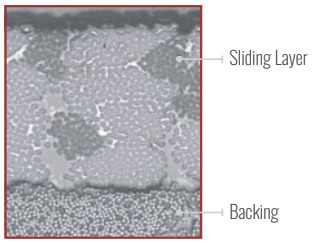
AVAILABILITY

Bearing forms made-to-order: GGB SBC with GAR-MAX® sealed assemblies with or without steel outer shell, customized bearing designs

APPLICATIONS

Industrial: Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates, backhoes, trenchers, skid steer loaders, front end loaders, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Fair

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	210 140
Operating temperature	Min Max	°C °C	93 104
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.05
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.15 - 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 350 > 480

SBC with HSG Bearing Material

SEALED FIBER REINFORCED COMPOSITE BEARINGS

CHARACTERISTICS

- Self-lubricating bearings
- High static load capacity
- Excellent resistance to shock loading and misalignment
- Very good friction and wear properties
- Good chemical resistance
- Sealed to exclude contaminates to offer extended service life
- Environmentally friendly and eliminates need for automated grease system and grease

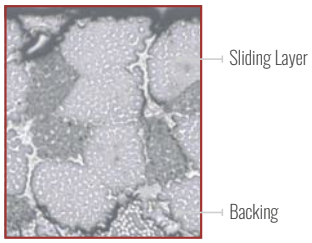
AVAILABILITY

Bearing forms made-to-order: GGB SBC with HSG sealed assemblies with or without steel outer shell, customized bearing designs

APPLICATIONS

Industrial: Steering linkages, hydraulic cylinder pivots, king pin bearings, boom lifts, scissor lifts, cranes, hoists, lift gates,backhoes, trenchers, skid steer loaders, front end loaders, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Very good
Oil lubricated	Fair
Grease lubricated	Fair
Water lubricated	Fair
Process fluid lubricated	Fair

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	415 140
Operating temperature	Min Max	°C °C	93 104
DRY			
Maximum sliding speed, U		m/s	0.13
Maximum pU factor		N/mm^2 x m/s	1.05
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.15 - 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 350 > 480

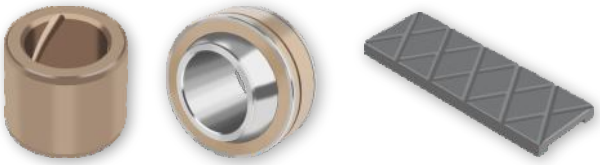
GGB-CSM® Bearing Material

compliant RoHS

THICK WALLED MONOMENTAL BEARINGS

CHARACTERISTICS

- Self-lubricating metal bearings produced by metallurgic powder
- Maintenance-free bearings with homogeneously distributed solid lubricant (graphite, MoS_2) in the metallic matrix
- High load capacity and temperature ranges up to 600°C possible depending on the alloy
- Corrosion-resistant alloys are available
- Lead-free alloys are available



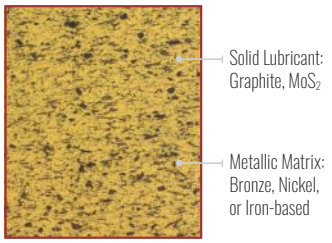
AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, flanged bushes, thrust washers, sliding plates, half-bearings, axial and radial segment rings, self-aligning spherical bearings, special shapes, customized bearing designs

APPLICATIONS

Industrial: General mechanical engineering, applications with elevated temperatures and corrosion risk, exhaust or smoke flaps, valves, turbines, iron foundry, steel and aluminum industry, furnaces, blower, steel works and civil engineering, turbines (water, steam and gas), pumps and compressors, sewage purification plants, thermal treatment furnaces, hot rolling mills, food and beverage industry, packaging equipment, agriculture and construction machines, handling equipment, tire molds, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Depending on alloy
Process fluid lubricated	Depending on fluid or alloy

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	100 - 260 55 - 130
Operating temperature	Min Max	°C °C	-200 600
Coefficient of linear thermal expansion		$10^{-6}/K$	13 - 18
DRY			
Maximum sliding speed, U		m/s	0.2 - 0.5
Maximum pU factor		N/mm^2 x m/s	0.8 - 1.5
Coefficient of friction, f			0.11 - 0.5
WATER LUBRICATED			
Coefficient of friction, f			0.08 - 0.18
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HB HRC	> 180 > 45

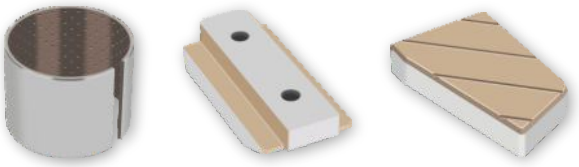
Bearing properties and recommendations dapending on GGB-CSM material grade

GGB-CBM®
Bearing Material

THIN WALLED BIMETAL BEARINGS MADE BY METALLURGIC POWDER

CHARACTERISTICS

- Self-lubricating and maintenance-free with homogeneously distributed solid lubricant (graphite) in the sliding layer
- High load capacity and suited to temperatures from -150°C up to 280°C
- Different metallic backings are available: stainless steel, carbon steel or bronze
- Lead-free alloys are available



AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, flanged bushes, thrust washers, axial washers, sliding plates, half shells, axial and radial segment rings, spherical bushings, customized bearing designs

APPLICATIONS

Industrial: General mechanical engineering, applications at high loads, iron foundry, steel and aluminum industry, furnaces, blower, steel works, food and beverage industry, packaging equipment, agriculture and construction machines, handling equipment, tire molds, etc.

MICROSECTION

OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Good
Process fluid lubricated	Depending on fluid

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	260 - 280 80 - 150
Operating temperature	Min Max	°C °C	-150 280
Coefficient of linear thermal expansion		$10^{-6}/K$	12 - 16
DRY			
Maximum sliding speed, U		m/s	0.3 - 0.5
Maximum pU factor		N/mm^2 x m/s	0.5 - 1.0
Coefficient of friction, f			0.10 - 0.2
WATER LUBRICATED			
Coefficient of friction, f			0.10 - 0.15
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0.2 - 0.8
Shaft surface hardness		HB	> 180 - > 250

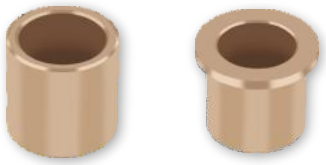
Bearing properties and recommendations dapending on GGB-CBM material grade

GGB-BP25 Bearing Material

METAFRAM OIL IMPREGNATED SINTERED BRONZE BEARINGS

CHARACTERISTICS

- Similar to SINT A 50, impregnation group 1
- Maintenance-free bearing for general engineering applications
- Optimum performance under relatively light loads and high speeds
- Produced by powder metallurgy process and therefore suitable for complex shapes



AVAILABILITY

Bearing forms available in standard dimensions:

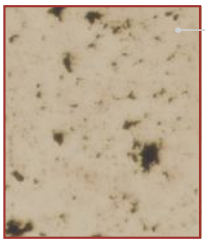
- Plain cylindrical bushes
- Plain flanged bushes

Non-standard parts made-to-order: Cylindrical bushes and flanged bushes with non-standard dimensions, spherical bearings, tubes and rod blanks, customized bearing designs

APPLICATIONS

Industrial: FHP motor bearings, domestic appliances and hand tools

MICROSECTION



BP25 with composition
Sn 8 - 10.5 %
Other < 2 %
Cu Rest
Impregnation group 1 (up to 80°C)

OPERATING PERFORMANCE	
Dry	Good (PTFE / MoS_2)
Oil lubricated	Good
Grease lubricated	Fair
Water lubricated	Not recommended
Process fluid lubricated	Not recommended

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	20 10
Operating temperature	Min Max	°C °C	-180 / 0* 90 / 300*
Minimum density		g/cm^3	6.2
Minimum apparent porosity		%	23
OIL IMPREGNATED			
Maximum sliding speed, U		m/s	0.1 - 6.0*
Maximum pU factor		N/mm^2 x m/s	0.1 - 1.8*
Coefficient of friction, f			0.05 - 0.25*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.3 - ≤ 0.6*
Shaft surface hardness		HB	> 240 - > 355*

Bearing properties depending on oil or solid lubricants

GGB-FP20 Bearing Material

METAFRAM OIL IMPREGNATED SINTERED IRON BEARINGS

CHARACTERISTICS

- Similar to SINT A 50, impregnation group 1
- Maintenance-free bearing for general engineering applications
- Optimum performance under relatively light loads and high speeds
- Produced by powder metallurgy process and therefore suitable for complex shapes

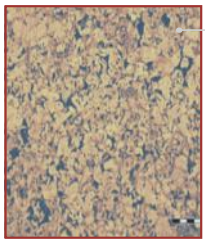
AVAILABILITY

Non-standard parts made-to-order: plain cylindrical bushes, plain flanged bushes, non standard parts

APPLICATIONS

Industrial: FHP motor bearings, domestic appliances and hand tools

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good (PTFE / MoS_2)
Oil lubricated	Good (Oil impregnated)
Grease lubricated	Not recommended
Water lubricated	Not recommended
Process fluid lubricated	Not recommended

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	45 8.0 - 22.5
Operating temperature	Min Max	°C °C	-180 / -5* 90 / 300*
Minimum density		g/cm^3	5.6
Minimum apparent porosity		%	20
OIL IMPREGNATED			
Maximum sliding speed, U		m/s	0.1 - 4.0*
Maximum pU factor		N/mm^2 x m/s	0.1 - 1.8*
Coefficient of friction, f			0.05 - 0.25*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.2 - ≤ 0.3*
Shaft surface hardness		HB	> 240 - > 355*

Bearing properties depending on oil or solid lubricants

GGB-SO16 Bearing Material

METAFRAM OIL IMPREGNATED SINTERED IRON BEARINGS

CHARACTERISTICS

- Maintenance-free bearing for general engineering applications
- Superior performance compared to GGB-FP20 under high loads and low speeds
- Produced by powder metallurgy process and therefore suitable for complex shapes

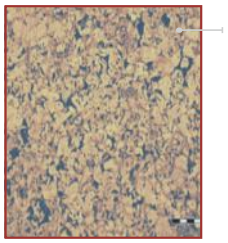
AVAILABILITY

Blanks are made-to-order

APPLICATIONS

Industrial: FHP motor bearings, domestic appliances and hand tools, heavy duty applications: construction equipment, railway equipment, military equipment

MICROSECTION



OPERATING PERFORMANCE	
Dry	Not applicable
Oil lubricated	Good (Oil impregnated)
Grease lubricated	Not recommended
Water lubricated	Not recommended
Process fluid lubricated	Not recommended

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	120 60
Operating temperature	Min Max	°C °C	0 105
Minimum density		g/cm^3	6
Minimum apparent porosity		%	16
OIL IMPREGNATED			
Maximum sliding speed, U		m/s	0.3
Maximum pU factor		N/mm^2 x m/s	0.9
Coefficient of friction, f			0.05 - 0.15*
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.2*
Shaft surface hardness		HB	> 355

Bearing properties depending on oil or solid lubricants

GGB-SHB®
Bearing Material

CASE HARDENED STEEL BEARINGS

CHARACTERISTICS

- For lubricated applications
- With plain or grooved sliding layer
- Suitable for grease lubrication
- Low rotation speed with high specific pressure

AVAILABILITY

Bearing forms available in standard dimensions:

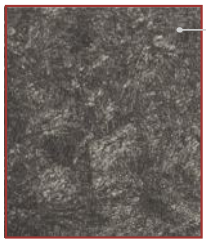
- Plain cylindrical bushes

Non-standard parts made-to-order: bearings with various lubrication grooves, non-standard parts

APPLICATIONS

Industrial: Earth moving machinery, excavators and loaders, farming machinery, power harrows, ploughs and harvesters, grabs, buckets and grippers, hydraulic cylinders for the protection against wear of bottoms and eyelets, industrial washing machines, sliding guides for industrial presses, suction pumps, sliding seats, machine tools

MICROSECTION



Steel E410, E470 (20MnV6, AISI A381) acc. to EN 10305

OPERATING PERFORMANCE	
Dry	Poor
Oil lubricated	Good
Grease lubricated	Very good
Water lubricated	Not recommended
Process fluid lubricated	Depending on fluid

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	300 150
Tensile strength		N/mm^2	550
Operating temperature	Min	°C	150
Density			7.8
Coefficient of linear thermal expansion		%	12
GREASE LUBRICATED			
Maximum sliding speed, U		m/s	0.1
Maximum pU factor		N/mm^2 x m/s	1.5
Coefficient of friction, f			0.2
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.8
Shaft surface hardness		HRC	58 - 62

Bearing properties depending on oil or solid lubricants

AuGlide® Bearing Material

BIMETAL LEAD-FREE PLAIN BEARINGS

CHARACTERISTICS

- Lead-free
- Machinable
- Design freedom – customizable to meet specific indentation and shape needs
- Capable of supporting high specific loads and high temperatures
- Excellent fatigue strength under dynamic and shock load conditions
- Excellent wear resistance
- Suitable for hydrodynamic operation
- Suitable for oil and grease lubrication

AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes and sliding plates with non-standard dimensions, RoHS customized bearing designs

APPLICATIONS

Automotive: Transmissions, king pin, truck brake caliper

Industrial: Agricultural machinery, earth-movers, textile machinery, pneumatic equipment, mechanical handling and lifting equipment, hydraulic cylinders, offhighway equipment, and many more.

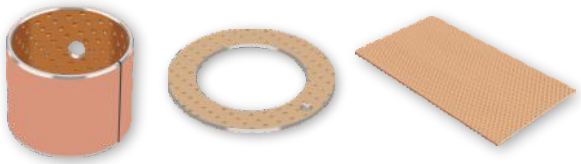
- Superior performance under oscillating movement
- Thin-wall construction permits compact bearing assembly
- Indents in the bearing surface provide a reservoir for grease and thus allow extended re-greasing

MICROSECTION

OPERATING PERFORMANCE	
Dry	Poor
Oil lubricated	Good
Grease lubricated	Very good
Water lubricated	Poor
Process fluid lubricated	Poor

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	300 140
Operating temperature	Min Max greased Max oil lubricated	°C °C °C	- 40 150 250
OIL LUBRICATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f	Greased Oil		0.05 - 0.12 0.04 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra	Normal	µm	≤ 0.8
Shaft surface hardness	Normal For longer service life		> 200 HB > 350 HB

SY Bearing Material



BIMETAL PLAIN BEARINGS TO STANDARD SAE 792

CHARACTERISTICS

- Bimetal bearing with steel backing and bronze overlay
- Particularly suitable for high specific loads with oscillating motion and low frequency
- Applicable in rough operation conditions
- High load capacity, very good resistance to fatigue strength at higher temperatures

AVAILABILITY

Bearing forms available in standard dimensions:

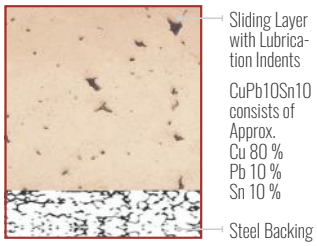
- Cylindrical bushes
- Thrust washers

Bearing forms made-to-order: Cylindrical bushes and thrust washers with non-standard dimensions, sliding plates, customized bearing designs

APPLICATIONS

Industrial: Mechanical handling and lifting equipment, hydraulic cylinders, agricultural equipment, off highway equipment etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Poor
Oil lubricated	Good
Grease lubricated	Very good
Water lubricated	Poor
Process fluid lubricated	Poor

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	300 140
Operating temperature	Min Max greased Max oil lubricated	°C °C °C	-40 150 250
OIL IMPREGNATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f	Greased Oil lubricated		0.05 - 0.12 0.04 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.8
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

Bearing properties depending on oil or solid lubricants

SP Bearing Material

BIMETAL PLAIN BEARINGS TO STANDARD SAE 794

CHARACTERISTICS

- Bimetal bearing with steel backing and leaded bronze overlay
- For lubricated applications with plain sliding layer
- Suitable for oil and grease lubrication

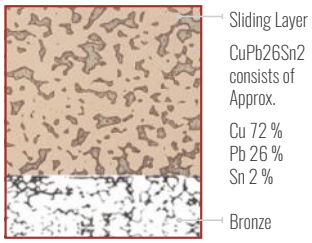
AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, thrust washers, sliding plates, customized bearing designs

APPLICATIONS

Industrial: Mechanical handling and lifting equipment, machine slides, hydraulic cylinders, hydraulic motors, pneumatic equipment, medical equipment, textile machinery, agricultural equipment, etc.

MICROSECTION

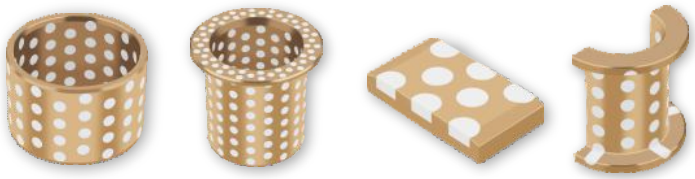


OPERATING PERFORMANCE	
Dry	Poor
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Poor
Process fluid lubricated	Poor

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	250 120
Operating temperature	Min Max greased Max oil lubricated	°C °C °C	-40 150 250
GREASED / OIL LUBRICATED			
Maximum sliding speed, U		m/s	2.5
Maximum pU factor		N/mm^2 x m/s	2.8
Coefficient of friction, f	Greased Oil lubricated		0.05 - 0.12 0.04 - 0.12
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	≤ 0.4
Shaft surface hardness	Normal For longer service life	HB HB	> 200 > 350

Bearing properties depending on oil or solid lubricants

GGB-DB®
Bearing Material



CAST BRONZE BEARINGS WITH SOLID LUBRICANT INSERTS

CHARACTERISTICS

- Maintenance-free bearing material for heavy duty applications
- Excellent performance under high loads and intermittent operation
- Also available with graphite inserts for temperatures above 250°C

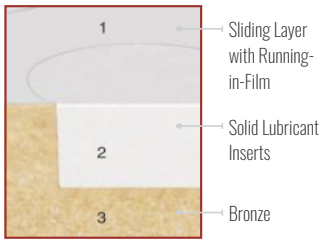
AVAILABILITY

Bearing forms made-to-order: Cylindrical bushes, flanged bushes, thrust washers, sliding plates, pintle bearings, half-bearings, axial and radial segment rings, self-aligning spherical bearings, customized bearing designs

APPLICATIONS

Industrial: Offshore industry, underwater equipment, bridges and civil engineering, iron and steel industry equipment, cranes and conveyors, deep and open cast mining equipment, construction and earthmoving equipment, etc.

MICROSECTION



OPERATING PERFORMANCE	
Dry	Good
Oil lubricated	Good
Grease lubricated	Good
Water lubricated	Good
Process fluid lubricated	Fair

BEARING PROPERTIES		UNITS	VALUE
GENERAL			
Maximum load, p	Static Dynamic	N/mm^2 N/mm^2	200 100
Operating temperature	Min Max greased	°C °C	-50 350
DRY			
Maximum sliding speed, U		m/s	0,5
Maximum pU factor		N/mm^2 x m/s	1,5
Coefficient of friction, f			0,05 - 0,18
RECOMMENDATIONS			
Shaft surface roughness, Ra		µm	0,2 - 0,8
Shaft surface hardness	Normal	HB	> 200

UNI Self-Aligning Bearing Housing

SELF-ALIGNING PILLOW BLOCK BEARING HOUSING

CHARACTERISTICS

- Adjusting bearing for misalignment equalisation
- All-purpose as flange or pedestal bearing, suitable for high loads
- Self-aligning spheric avoids edge load to the bearing
- Adjustable up to ± 5°
- Spheric is secured against distortion
- Depending on choice of housing, spherics and bearings, simple to most demanding bearing solutions are possible
- For optimum design solutions, various bearings from the GGB product program are applicable

Housing Material: **GGG40**
Spherical Material: **16MnCr5**
Corrosion-resistant material possible

AVAILABILITY

Made-to-order

APPLICATIONS

Industrial: Wind energy plants, car washes, cleaning machines, drum systems, bevelling equipment, handling systems, conveyor belts (pulleys), printing machines, heating and ventilation equipment, hoists, cranes, textile machinery, special machine engineering, bakery equipment, marine equipment

LOAD LIMIT VALUES FOR RADIAL FORCES

SIZE	BUSH ID	MAX RADIAL LOAD [N] (HOUSING)	MAX RADIAL LOAD [N] (BOLT)	MAX SHEAR OFF LOAD [N] (BOLT)
1	10 - 25	20 000	10 000	1 000
2	28 - 40	30 000	15 000	1 500
3	45 - 60	50 000	25 000	2 500
4	65 - 80	90 000	45 000	4 500
5	85 - 100	125 000	62 500	6 000

The given data for UNI bearing housings are valid for 12.9 screws (DIN EN 20898, part 1), since the housing stability exceeds the permissible load of the fixing screws.

MINI Self-Aligning Bearing Housing

Housing Material: **AlMgSi12**
Spherical Material: **9SMn28K**
Stainless steel and other materials available

SELF-ALIGNING PILLOW BLOCK BEARING HOUSING

CHARACTERISTICS

- Adjusting bearing for misalignment equalisation
- All-purpose as flange or pedestal bearing, suitable for high loads
- Self-aligning spheric avoids edge load to the bearing
- Adjustable up to ± 5°
- Spheric is secured against distortion
- Depending on choice of housing, spherics and bearings, simple to most demanding bearing solutions are possible
- For optimum design solutions, various bearings from the GGB product program are applicable

AVAILABILITY

Made-to-order

APPLICATIONS

Industrial: Wind energy plants, car washes, cleaning machines, drum systems, bevelling equipment, handling systems, conveyor belts (pulleys), printing machines, heating and ventilation equipment, hoists, cranes, textile machinery, special machine engineering, bakery equipment, marine equipment

LOAD LIMIT VALUES FOR RADIAL FORCES

SIZE	BUSH ID	MAX RADIAL LOAD [N] (HOUSING)	MAX RADIAL LOAD [N] (BOLT)	MAX SHEAR OFF LOAD [N] (BOLT)
0	8 - 15	10 000	5 000	500

The permissible loads for MINI bearings housings are defined by the housing stability or the strength of the fixing screws (6mm diameter), depending on the load direction.

EXALIGN® Self-Aligning Bearing Housing

Housing Material: **Cast Iron**
Spherical Material: **Cast Iron**
Corrosion-free and corrosion-resistant models possible

SELF-ALIGNING PEDESTAL AND FLANGE BEARING HOUSING

CHARACTERISTICS

- Adjusting bearing for misalignment equalisation
- All-purpose as flange (EXALIGN® DF and FL) or pedestal bearing (EXALIGN® PB), suitable for high loads
- Self-aligning spheric avoids edge load to the bearing
- Adjustable up to ± 5°
- Spheric is secured against distortion
- Depending on choice of housing, spherics and bearings, simple to most demanding bearing solutions are possible
- For optimum design solutions, various bearings from the GGB product program are applicable

AVAILABILITY

Made-to-order

APPLICATIONS

Industrial: Wind energy plants, car washes, cleaning machines, drum systems, bevelling equipment, handling systems, conveyor belts (pulleys), printing machines, heating and ventilation equipment, hoists, cranes, textile machinery, special machine engineering, bakery equipment, marine equipment

LOAD LIMIT VALUES FOR RADIAL FORCES		TYPE PB 2-HOLE PEDESTAL BEARING	TYPE FL/DF 4-HOLE / 2-HOLE FLANGE BEARING
SIZE	BUSH ID	MAX RADIAL LOAD [N]	MAX RADIAL LOAD [N]
1	10 - 15	4 250	3 750
2	20 - 25	7 700	5 900
3	30	9 500	8 000
4	35 - 40	17 000	11 000
5	45	23 000	12 000
6	50	25 000	14 500
7	55 - 60	30 000	16 000
8	70 - 75	38 000	17 000
9	80 - 85	45 500	27 000
10	90 - 100	74 500	30 500

Bearing Application Data Sheet

Please complete the form below and share it with your GGB sales engineer or send it to:
benelux@ggbearings.com

DATA FOR BEARING DESIGN CALCULATION

Application: _____

_____

Project/No.: _____ Quantity: _____ ☐ New Design ☐ Existing Design

☐ Steady load ☐ Rotating load ☐ Rotational movement ☐ Oscillating movement ☐ Linear movement

DIMENSIONS [MM]

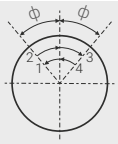
Inside diameter	D_i	
Outside diameter	D_o	
Length	B	
Flange Diameter	D_{fl}	
Flange thickness	B_{fl}	
Wall thickness	S_T	
Length of slideplate	L	
Width of slideplate	W	
Thickness of slideplate	S_S	

LOAD

☐ Static load
☐ Dynamic load

Axial load F	[N]	
Radial load F	[N]	

MOVEMENT

Rotational speed	N [1/min]	
Speed	U [m/s]	
Length of stroke	L_S [mm]	
Frequency of stroke	[1/min]	
Oscillating cycle 	ϕ [°]	
Osc. frequence	N_{osz} [1/min]	

MATING SURFACE

Material		
Hardness	HB/HRC	
Surface finish	Ra [µm]	

FITS & TOLERANCES

Shaft	D_J	
Bearing housing	D_H	

OPERATING ENVIRONMENT

Ambient temperature	T_{amb}[°]	
Bearing housing material		

☐ Housing with good heating transfer properties
☐ Light pressing or insulated housing with poor heat transfer properties
☐ Non metal housing with poor heat transfer properties
☐ Alternate operation in water and dry

LUBRICATION

☐ Dry
☐ Continuous lubrication
☐ Process fluid lubrication
☐ Initial lubrication only
☐ Hydrodynamic conditions

Process fluid		
Lubricant		
Dynamic viscosity	η[mPas]	

SERVICE HOURS PER DAY

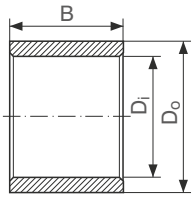
Continuous operation		
Intermittent operation		
Operating time		
Days per year		

SERVICE LIFE

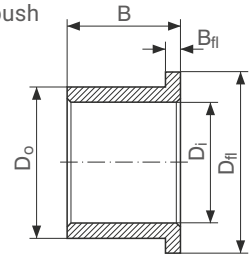
Required service life	L_H [h]	

BEARING TYPE

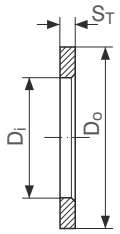
☐ Cylindrical bush



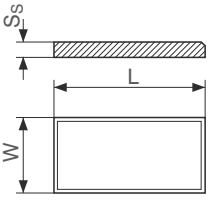
☐ Flanged bush



☐ Thrust washer



☐ Slideplate



☐ Special parts (sketch)

CUSTOMER INFORMATION

Company _____
Street _____
City / State / Province / Post Code _____
Telephone _____ Fax _____
Name _____
Email Address _____ Date _____

Product Information

GGB gives an assurance that the products described in this document have no manufacturing errors or material deficiencies.

The details set out in this document are registered to assist in assessing the material's suitability for the intended use. They have been developed from our own investigations as well as from generally accessible publications. They do not represent any assurance for the properties themselves.

Unless expressly declared in writing, GGB gives no warranty that the products described are suited to any particular purpose or specific operating circumstances. GGB accepts no liability for any losses, damages or costs however they may arise through direct or indirect use of these products.

GGB's sales and delivery terms and conditions, included as an integral part of quotations, stock and price lists, apply absolutely to all business conducted by GGB. Copies can be made available on request.

Products are subject to continual development. GGB retains the right to make specification amendments or improvements to the technical data without prior announcement.

Edition 2023 (This edition replaces earlier editions which hereby lose their validity).

STATEMENT REGARDING LEAD CONTENT IN GGB PRODUCTS & EU DIRECTIVE COMPLIANCE

For shipments to or within the EU: All products with this part number contain lead (CAS no: 7439-92-1) at a concentration greater than 0,1% (w/w). There are no necessary actions at this time, as these products are not expected to be of concern under normal safe usage providing customary workplace safety and hygiene practices are followed, including but not limited to wearing protective gloves to avoid skin contact and always washing your hands after handling these products, especially before eating, drinking, or smoking. When cutting, machining, or thermal operations (e.g. laser cutting, thermal processing, etc.) are performed on this material or components, additional precautions and safety practices must be followed. These additional precautions include but are not limited to: utilization of proper respiratory protection, avoidance of ingestion and inhalation, prolonged skin and eye contact, and proper handling, storage, and disposal of the products. In case you have further questions, please do not hesitate to contact us. Always follow local legal requirements.

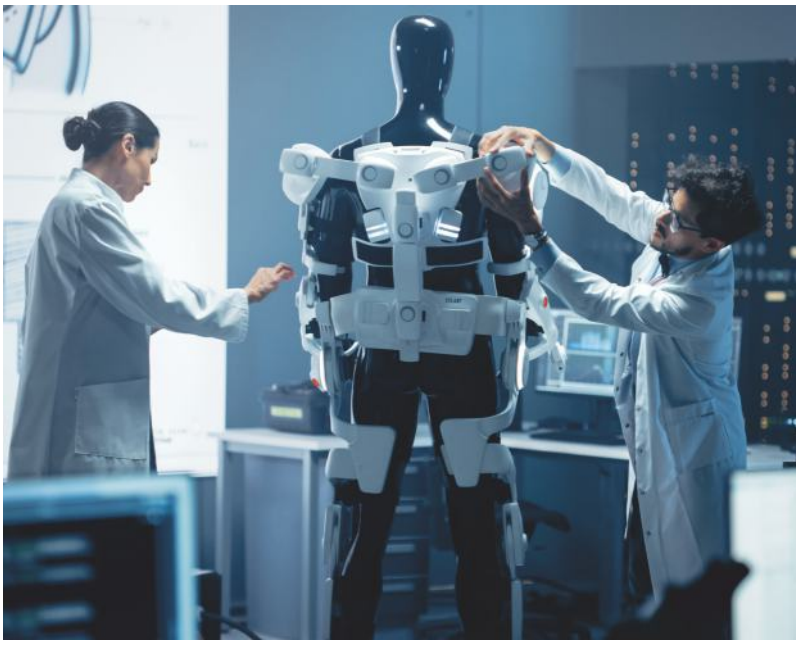
FABRICATION

At temperatures up to 250°C the polytetrafluroethylene (PTFE) present in the lining material is completely inert so that even on the rare occasions in which DP4, DP4-B, DP10 or DP11 bushes are drilled or sized after assembly there is no danger in boring or burnishing.

At higher temperatures however, small quantities of toxic fumes can be produced and the direct inhalation of these can cause an influenza type of illness which may not appear for some hours but which subsides without after-effects in 24-48 hours.

Such fumes can arise from PTFE particles picked up on the end of a cigarette. Therefore smoking should be prohibited where DP4, DP4-B, DP10 or DP11 are being machined.

PUSHING BOUNDARIES TO CO-CREATE A HIGHER QUALITY OF LIFE



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