



**GGB**  
BY TIMKEN



# Product Range

USA / Australia





# PUSHING BOUNDARIES TO CO-CREATE A HIGHER QUALITY OF LIFE

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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](http://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](#)
- [Construction](#)
- [Fluid Power](#)
- [Mining](#)
- [Railway](#)
- [Agricultural](#)
- [E-Mobility](#)
- [Industrial](#)
- [Oil & Gas](#)
- [Recreation](#)
- [Automotive](#)
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# 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.



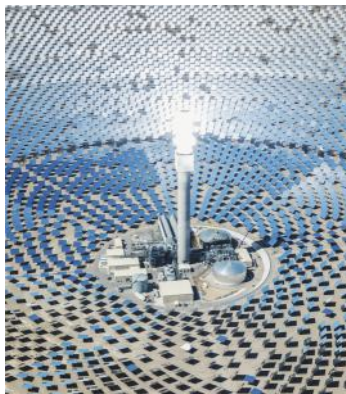
## ENVIRONMENTAL

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

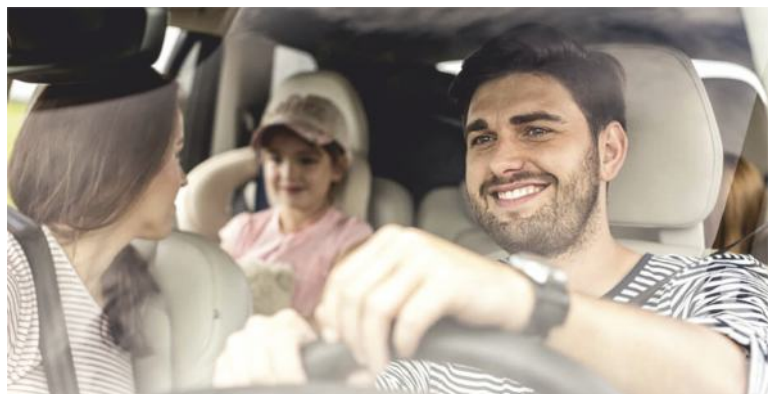
Our world-class manufacturing plants in the United States, Brazil, China, Germany, France and Slovakia are certified in quality and excellence according to ISO 9001, IATF 16949, ISO 14001 and ISO 45001. This allows us to access the industry’s best practices while aligning our management system with global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

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



## 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 Bearing Materials & Accessory Products

## TRIBOLOGICAL COATINGS

| PRODUCT NAME                      | POLYMER COATINGS   | WORKING CONDITIONS                        | PAGE |
|-----------------------------------|--|---|------|
| <a href="#">TriboShield®TS161</a> | TriboShield coatings are applied directly to the customer's part | low-friction, low-loads                   | 9    |
| <a href="#">TriboShield®TS225</a> | TriboShield coatings are applied directly to the customer's part | low-friction, low to medium loads         | 10   |
| <a href="#">TriboShield®TS421</a> | TriboShield coatings are applied directly to the customer's part | low-friction, low-loads                   | 11   |
| <a href="#">TriboShield®TS651</a> | TriboShield coatings are applied directly to the customer's part | low-friction, up to moderately high loads | 12   |
| <a href="#">TriboShield®TS741</a> | 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 |
|------------------------|---|---------------------------------------|------|
| <a href="#">DP4</a>    | Steel + Porous Bronze Sinter + PTFE + Fillers                             | self-lubricating, low-maintenance     | 14   |
| <a href="#">DP4-B</a>  | Bronze + Porous Bronze Sinter + PTFE + Fillers                            | self-lubricating, corrosion-resistant | 15   |
| <a href="#">DU®</a>    | Steel + Porous Bronze Sinter + PTFE + Pb                                  | self-lubricating                      | 16   |
| <a href="#">DU-B</a>   | Bronze + Porous Bronze Sinter + PTFE + Pb                                 | self-lubricating, corrosion-resistant | 17   |
| <a href="#">DP10</a>   | Steel + Porous Bronze Sinter + PTFE + Solid Lubricants                    | self-lubricating, low-maintenance     | 18   |
| <a href="#">DP11</a>   | Steel + Porous Bronze Sinter + PTFE + Solid Lubricants + Fillers          | self-lubricating, low-maintenance     | 19   |
| <a href="#">DP31</a>   | Steel + Porous Bronze Sinter + PTFE + Fluoropolymer + Fillers             | low-maintenance                       | 20   |
| <a href="#">DX®</a>    | Steel + Porous Bronze Sinter + POM with Lubrication indents               | low-maintenance, machinable           | 21   |
| <a href="#">DX®10</a>  | Steel + Porous Bronze Sinter + High Tech Polymer with Lubrication indents | low-maintenance, machinable           | 22   |
| <a href="#">HI-EX®</a> | Steel + Porous Bronze Sinter + PEEK + PTFE + Fillers                      | low-maintenance, machinable           | 23   |
| <a href="#">DTS10®</a> | Steel + Porous Bronze Sinter + PTFE + Fillers                             | low-maintenance, machinable           | 24   |
| <a href="#">DS</a>     | Steel + Porous Bronze Sinter + POM Modified                               | self-lubricating, low-maintenance     | 25   |

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

| PRODUCT NAME             | FIBER REINFORCED COMPOSITE BEARINGS  | WORKING CONDITIONS                | PAGE |
|--------------------------|--|-----------------------------------|------|
| <b>GAR-MAX®</b>          | 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   |
| <b>GAR-FIL®</b>          | Proprietary filled PTFE tape liner + continuous wound fiberglass encapsulated in a high temperature epoxy resin  | self-lubricating                  | 40   |
| <b>HSG</b>               | 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   |
| <b>MLG</b>               | 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   |
| <b>HPM</b>               | 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   |
| <b>HPMB®</b>             | 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   |
| <b>HPE®</b>              | Proprietary filled PTFE tape liner + continuous woven cloth laminate impregnated and cured with epoxy resin  | self-lubricating                  | 45   |
| <b>GGB-MEGALIFE® XT</b>  | 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   |
| <b>Multifil</b>          | PTFE + proprietary filler system   | self-lubricating                  | 47   |
| <b>SBC with GAR-MAX®</b> | 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   |
| <b>SBC with HSG</b>      | 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 Bearing Materials & Accessory Products

| PRODUCT NAME    | METAL & BIMETAL BEARINGS   | WORKING CONDITIONS       | PAGE |
|-----------------|--|--------------------------|------|
| <b>GGB-CSM®</b> | Powder metallurgical monometallic bearing material (bronze, nickel or iron-based) + solid graphite lubricant, MoS <sub>2</sub>                             | self-lubricating         | 50   |
| <b>GGB-CBM®</b> | Thin walled powder metallurgical bimetal bearing material stainless steel, carbon steel or bronze with bronze + based backing): + solid graphite lubricant | self-lubricating         | 51   |
| <b>GGB-BP25</b> | Sintered bronze impregnated with oil, similar to SINT A 50, impregnation group 1   | self-lubricating         | 52   |
| <b>GGB-FP20</b> | Steel alloy sinter impregnated with oil, similar to SINT A 10, impregnation group 1  | self-lubricating         | 53   |
| <b>GGB-SO16</b> | Sintered steel alloy impregnated with oil  | self-lubricating         | 54   |
| <b>GGB-SHB</b>  | Case hardened steel bearings for lubricated applications   | conventional lubrication | 55   |
| <b>AuGlide™</b> | Steel backing and lead-free bronze overlay   | low-maintenance          | 56   |
| <b>SY</b>       | Steel backing and leaded bronze overlay + CuPb10Sn10   | low-maintenance          | 57   |
| <b>SP</b>       | Steel backing and leaded bronze overlay + CuPb26Sn2  | low-maintenance          | 58   |
| <b>MBZ-B09</b>  | Monometallic material CuSn8  | self-lubricating         | 59   |
| <b>LD</b>       | Monometallic material CuSn8  | self-lubricating         | 60   |
| <b>LDD</b>      | Monometallic material CuSn8  | self-lubricating         | 61   |
| <b>GGB-DB®</b>  | Dry bearing material: cast bronze + solid lubricant inserts  | self-lubricating         | 62   |

## ACCESSORY PRODUCTS

| PRODUCT NAME    | BEARING ASSEMBLIES             | PAGE |
|-----------------|--------------------------------|------|
| <b>UNI</b>      | Self-aligning bearing housings | 63   |
| <b>MINI</b>     | Self-aligning bearing housings | 64   |
| <b>EXALIGN™</b> | Self-aligning bearing housings | 65   |

## ADDITIONAL INFORMATION

|                                   | PAGE |
|-----------------------------------|------|
| Technical Data Sheet              | 66   |
| Product Information / Fabrication | 67   |



# 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       |
|--------------------------------------|---------|-------------|
| <b>GENERAL</b>                       |         |             |
| 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

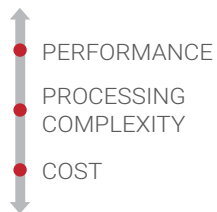
### TYPICAL APPLICATIONS

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

### TRIBOMATE® UPGRADE AVAILABLE

No

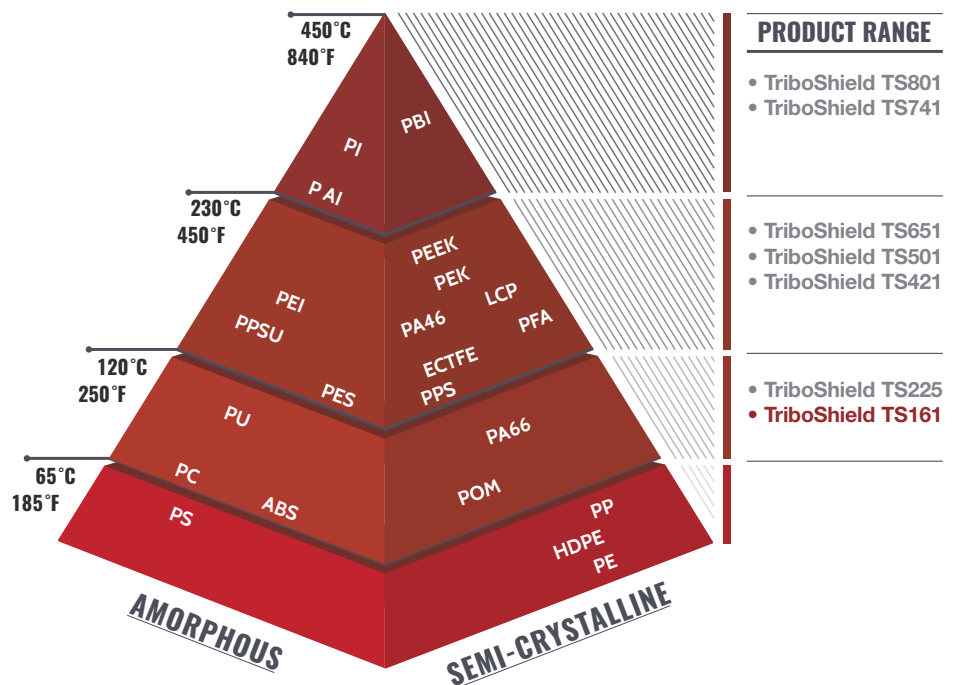
### STANDARD COATINGS RANGE



### 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

### 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 DIY tools

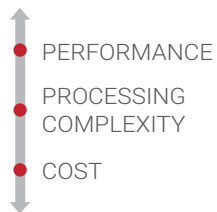
### TRIBOMATE® UPGRADE AVAILABLE

Yes

| BEARING PROPERTIES                   | UNITS   | VALUE       |
|--------------------------------------|---------|-------------|
| <b>GENERAL</b>                       |         |             |
| 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.  
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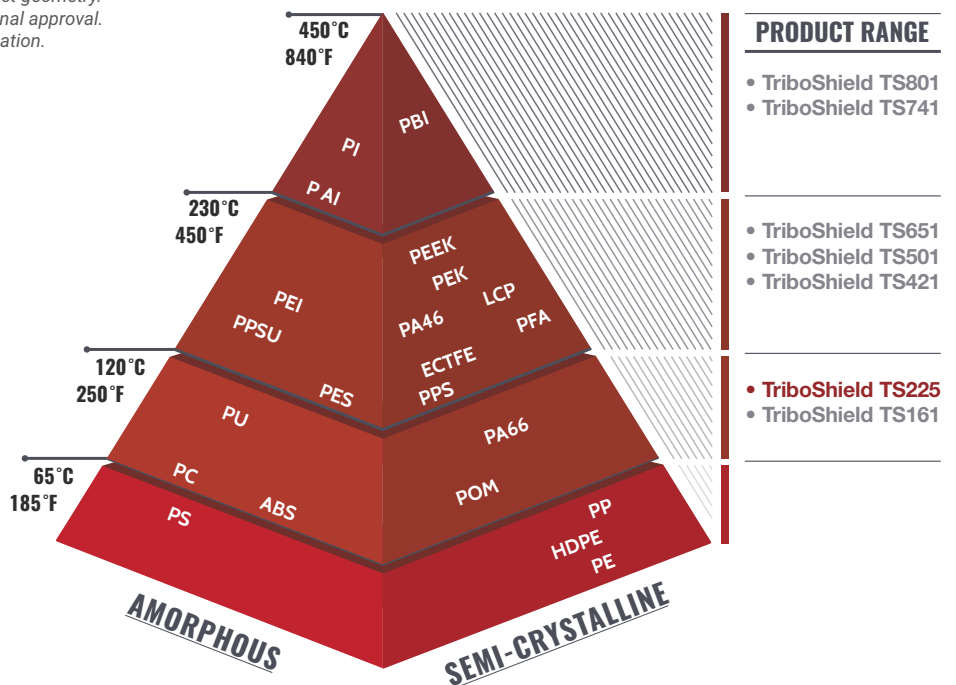
### STANDARD COATINGS RANGE



### COATING ADVANTAGES

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

## 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

### 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

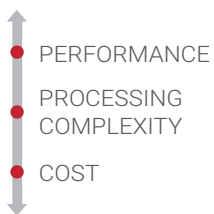
### TRIBOMATE® UPGRADE AVAILABLE

Yes

| BEARING PROPERTIES                   | UNITS   | VALUE              |
|--------------------------------------|---------|--------------------|
| <b>GENERAL</b>                       |         |                    |
| 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.  
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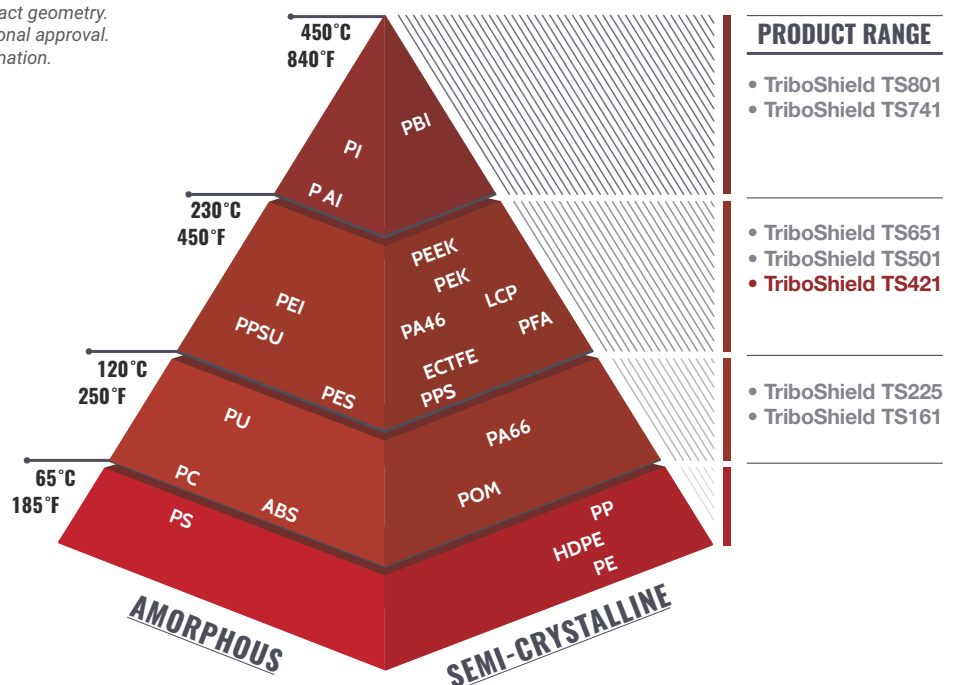
### STANDARD COATINGS RANGE



### COATING ADVANTAGES

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

## 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

### 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

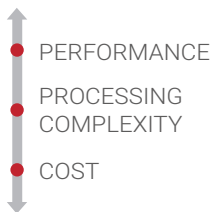
### TRIBOMATE® UPGRADE AVAILABLE

Yes

| BEARING PROPERTIES                   | UNITS   | VALUE       |
|--------------------------------------|---------|-------------|
| <b>GENERAL</b>                       |         |             |
| 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.

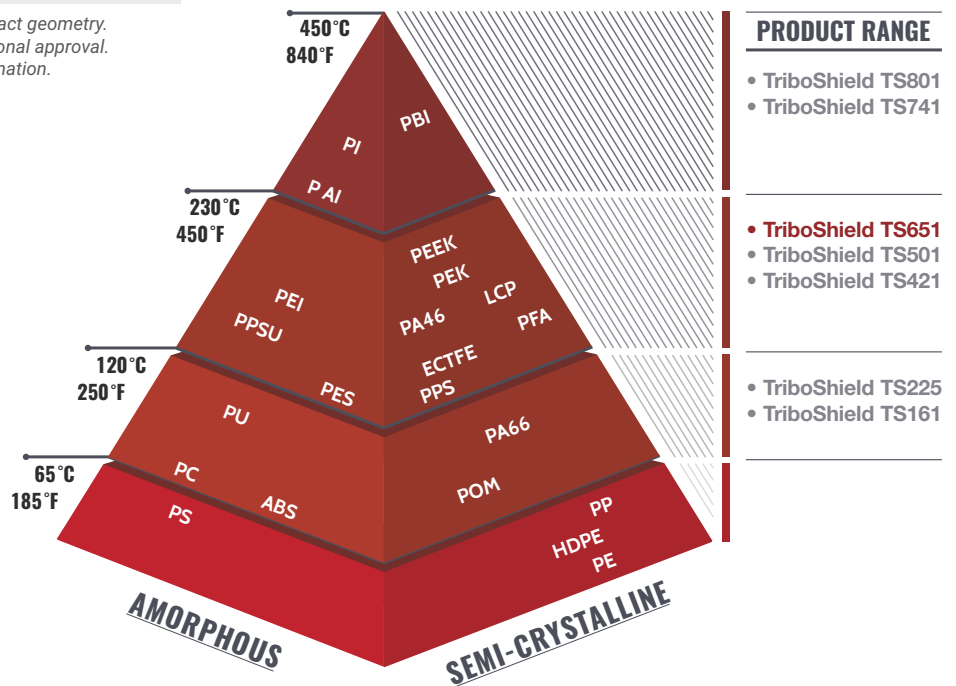
### STANDARD COATINGS RANGE



### COATING ADVANTAGES

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

## 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.

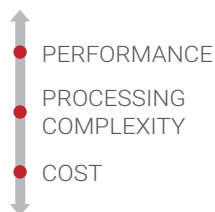
### UNIQUE CHARACTERISTICS

- 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       |
|--------------------------------------|---------|-------------|
| <b>GENERAL</b>                       |         |             |
| 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



### 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.

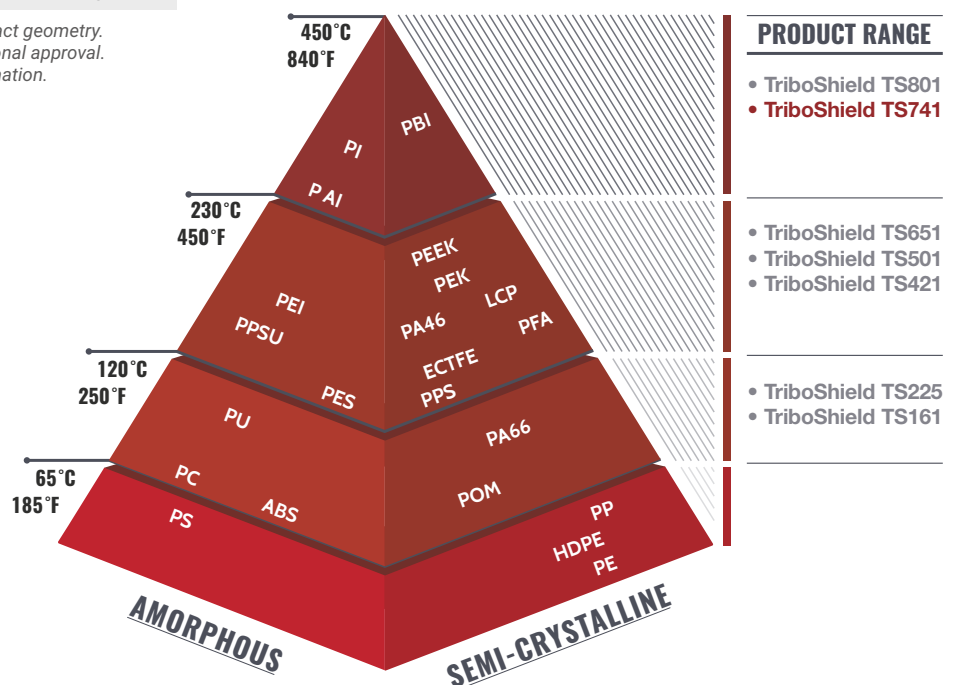
### TYPICAL APPLICATIONS

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

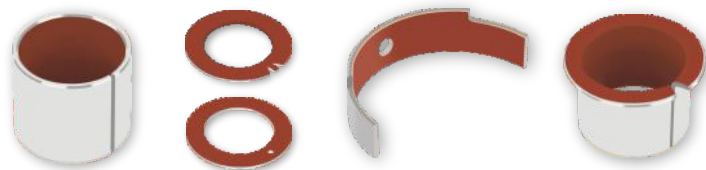
### TRIBOMATE® UPGRADE AVAILABLE

Yes

## TriboShield® Standard Product Range



## DP4 Bearing Material

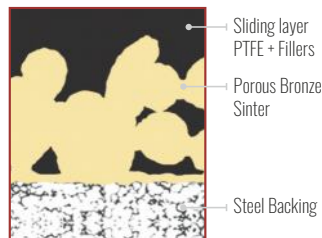


### METAL-POLYMER ANTI-FRICTION PLAIN BEARINGS

#### 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.

#### MICROSECTION



#### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Good      |
| Oil lubricated           | Very good |
| Grease lubricated        | Good      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Good      |

#### FOR SUPERIOR PERFORMANCE

|                  |       |
|------------------|-------|
| Water lubricated | DP4-B |
|------------------|-------|

#### 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, 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.

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 36 000         | N/mm <sup>2</sup>       | 250           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 6              | 10 <sup>-6</sup> /K     | 11            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 17             | 10 <sup>-6</sup> /K     | 30            |
| <b>DRY</b>                              |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 500            | m/s                     | 2.5           |
| Maximum pU factor                       |  | psi x fpm           | 29 000         | N/mm <sup>2</sup> x m/s | 1.0           |
| Coefficient of friction, f              |  |                     | 0.04 - 0.25*   |                         | 0.04 - 0.25*  |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 1 000          | m/s                     | 5.0           |
| Maximum pU factor                       |  | psi x fpm           | 286 000        | N/mm <sup>2</sup> x m/s | 10.0          |
| Coefficient of friction, f              |  |                     | 0.02 - 0.08    |                         | 0.02 - 0.08   |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Dry  | µin                 | 12 - 20        | µm                      | 0.3 - 0.5     |
|   | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     | > 200 HB       |                         |               |

\* 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

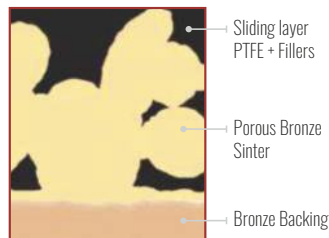
**Bearing forms made-to-order:** Standard forms in special dimensions, thrust washers, flanged-thrust washers, halfbearings, special shapes obtained by stamping or deep drawing, bearings with locating notches, lubricant holes and machined / stamped grooves

### 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      |

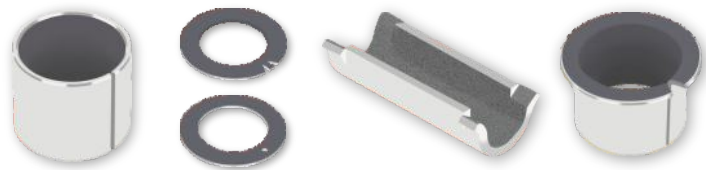
### FOR SUPERIOR PERFORMANCE

|                  |       |
|------------------|-------|
| Water lubricated | DP4-B |
|------------------|-------|

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 10             | 10 <sup>-6</sup> /K     | 18            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 20             | 10 <sup>-6</sup> /K     | 36            |
| <b>DRY</b>                              |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 500            | m/s                     | 2.5           |
| Maximum pU factor                       |  | psi x fpm           | 29 000         | N/mm <sup>2</sup> x m/s | 1.0           |
| Coefficient of friction, f              |  |                     | 0.04 - 0.25*   |                         | 0.04 - 0.25*  |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 1 000          | m/s                     | 5.0           |
| Maximum pU factor                       |  | psi x fpm           | 286 000        | N/mm <sup>2</sup> x m/s | 10.0          |
| Coefficient of friction, f              |  |                     | 0.02 - 0.08*   |                         | 0.02 - 0.08*  |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Dry  | µin                 | 12 - 20        | µm                      | 0.3 - 0.5     |
|   | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     | > 200 HB       |                         |               |

\* Depending on operating conditions

## DU<sup>®</sup> 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:

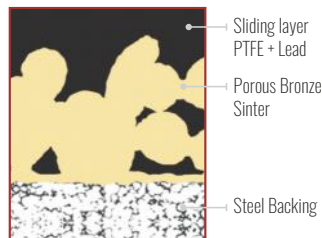
- Cylindrical bushes
- Flanged bushes
- Flanged washers
- Sliding plates
- Thrust washers

**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 PERFORMANCE

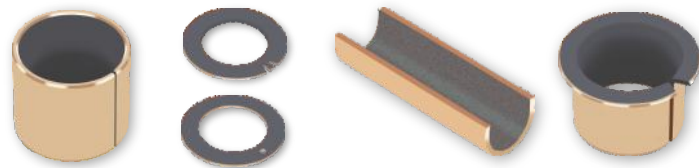
|                          |            |
|--------------------------|------------|
| Dry                      | DP4 / DP11 |
| Oil lubricated           | DP4 / DP31 |
| Grease lubricated        | DP4 / DX   |
| Water lubricated         | DP4-B      |
| Process fluid lubricated | DP4 / DP31 |

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 36 000         | N/mm <sup>2</sup>       | 250           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 6              | 10 <sup>-6</sup> /K     | 11            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 17             | 10 <sup>-6</sup> /K     | 30            |
| <b>DRY</b>                              |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 500            | m/s                     | 2.5           |
| Maximum pU factor                       |  | psi x fpm           | 50 000         | N/mm <sup>2</sup> x m/s | 1.8           |
| Coefficient of friction, f              |  |                     | 0.02 - 0.25*   |                         | 0.02 - 0.25*  |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 1 000          | m/s                     | 5.0           |
| Maximum pU factor                       |  | psi x fpm           | 143 000        | N/mm <sup>2</sup> x m/s | 5.0           |
| Coefficient of friction, f              |  |                     | 0.02 - 0.12    |                         | 0.02 - 0.12   |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Dry  | µin                 | 12 - 20        | µm                      | 0.3 - 0.5     |
|   | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     |                |                         | > 200 HB      |

\* 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

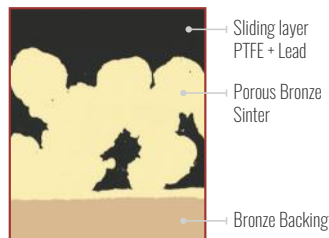
**Bearing forms made-to-order:** Standard forms in special dimensions, thrust washers, flanged-thrust washers, half-bearings, special shapes obtained by stamping or deep drawing, customized bearing designs

### 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 PERFORMANCE

|                          |       |
|--------------------------|-------|
| Dry                      | DP4-B |
| Oil lubricated           | DP4-B |
| Grease lubricated        | DP4-B |
| Water lubricated         | DP4-B |
| Process fluid lubricated | DP4-B |

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 10             | 10 <sup>-6</sup> /K     | 18            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 20             | 10 <sup>-6</sup> /K     | 36            |
| <b>DRY</b>                              |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 500            | m/s                     | 2.5           |
| Maximum pU factor                       |  | psi x fpm           | 50 000         | N/mm <sup>2</sup> x m/s | 1.8           |
| Coefficient of friction, f              |  |                     | 0.02 - 0.25*   |                         | 0.02 - 0.25*  |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 1 000          | m/s                     | 5.0           |
| Maximum pU factor                       |  | psi x fpm           | 143 000        | N/mm <sup>2</sup> x m/s | 5.0           |
| Coefficient of friction, f              |  |                     | 0.02 - 0.12    |                         | 0.02 - 0.12   |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Dry  | µin                 | 12 - 20        | µm                      | 0.3 - 0.5     |
|   | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     |                |                         | > 200 HB      |

\* 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

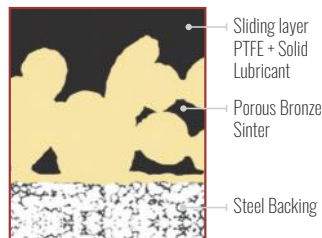
**Bearing forms made-to-order:** Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, bearings with local notches, lubricant holes and machined/stamped grooves, customized bearing designs

#### 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 PERFORMANCE

|                          |            |
|--------------------------|------------|
| Grease lubricated        | DP4 / DX   |
| Water lubricated         | DP4-B      |
| Process fluid lubricated | DP4 / DP31 |

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 36 000         | N/mm <sup>2</sup>       | 250           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 6              | 10 <sup>-6</sup> /K     | 11            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 17             | 10 <sup>-6</sup> /K     | 30            |
| <b>DRY</b>                              |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 500            | m/s                     | 2.5           |
| Maximum pU factor                       |  | psi x fpm           | 29 000         | N/mm <sup>2</sup> x m/s | 1.0           |
| Coefficient of friction, f              |  |                     | 0.03 - 0.25*   |                         | 0.03 - 0.25*  |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 1 000          | m/s                     | 5.0           |
| Maximum pU factor                       |  | psi x fpm           | 286 000        | N/mm <sup>2</sup> x m/s | 10.0          |
| Coefficient of friction, f              |  |                     | 0.02 - 0.08    |                         | 0.02 - 0.08   |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Dry  | µin                 | 12 - 20        | µm                      | 0.3 - 0.5     |
|   | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     | > 200 HB       |                         |               |

\* 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            |

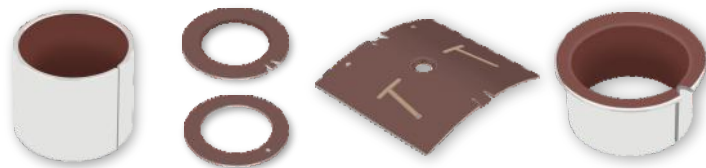
### FOR SUPERIOR PERFORMANCE

|                          |            |
|--------------------------|------------|
| Grease lubricated        | DP4 / DX   |
| Water lubricated         | DP4-B      |
| Process fluid lubricated | DP4 / DP31 |

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 36 000         | N/mm <sup>2</sup>       | 250           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 6              | 10 <sup>-6</sup> /K     | 11            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 17             | 10 <sup>-6</sup> /K     | 30            |
| <b>DRY</b>                              |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 500            | m/s                     | 2.5           |
| Maximum pU factor                       |  | psi x fpm           | 29 000         | N/mm <sup>2</sup> x m/s | 1.0           |
| Coefficient of friction, f              |  |                     | 0.04 - 0.25*   |                         | 0.04 - 0.25*  |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 1 000          | m/s                     | 5.0           |
| Maximum pU factor                       |  | psi x fpm           | 286 000        | N/mm <sup>2</sup> x m/s | 10.0          |
| Coefficient of friction, f              |  |                     | 0.02 - 0.08    |                         | 0.02 - 0.08   |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Dry  | µin                 | 12 - 20        | µm                      | 0.3 - 0.5     |
|   | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     | > 200 HB       |                         |               |

\* 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



Sliding layer  
PTFE + Solid  
Lubricant +  
Fluoropolymer  
+ Fillers  
Porous Bronze  
Sinter  
Steel Backing

#### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Fair      |
| Oil lubricated           | Very good |
| Grease lubricated        | Fair      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Good      |

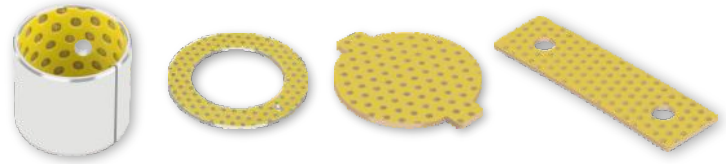
#### FOR SUPERIOR PERFORMANCE

|                   |            |
|-------------------|------------|
| Dry               | DP4 / DP11 |
| Grease lubricated | DP4 / DX   |
| Water lubricated  | DP4-B      |

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|---|--|---------------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>                          |  |                     |                |                         |               |
| Maximum load, p                         | Static                                       | psi                 | 36 000         | N/mm <sup>2</sup>       | 250           |
|   | Dynamic                                      | psi                 | 20 000         | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min  | °F                  | -328           | °C                      | -200          |
|   | Max  | °F                  | 536            | °C                      | 280           |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 6              | 10 <sup>-6</sup> /K     | 11            |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 17             | 10 <sup>-6</sup> /K     | 30            |
| <b>OIL LUBRICATED</b>                   |  |                     |                |                         |               |
| Maximum sliding speed, U                |  | fpm                 | 2 000          | m/s                     | 10.0          |
| Maximum pU factor                       |  | psi x fpm           | 286 000        | N/mm <sup>2</sup> x m/s | 10.0          |
| Coefficient of friction, f              |  |                     | 0.01 - 0.05    |                         | 0.01 - 0.05   |
| <b>RECOMMENDATIONS</b>                  |  |                     |                |                         |               |
| Shaft surface roughness, Ra             | Lubricated                                   | µin                 | ≤ 2 - 16*      | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     | > 200 HB       |                         |               |

\* Depending on operating conditions

# DX<sup>®</sup> 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

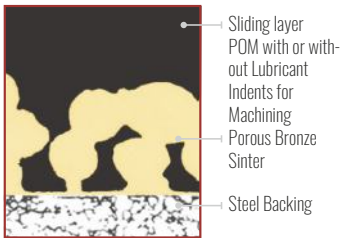
**Bearing forms made-to-order:** Standard forms in special dimensions, half-bearings, special shapes obtained by stamping, bearings with locating notches, lubricant holes and machined grooves, customized bearing designs

### 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 PERFORMANCE

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

| BEARING PROPERTIES                      |  | IMPERIAL UNITS      | IMPERIAL VALUE       | METRIC UNITS            | METRIC VALUE |
|---|--|---------------------|----------------------|-------------------------|--------------|
| <b>GENERAL</b>                          |  |                     |                      |                         |              |
| Maximum load, p                         | Static                                       | psi                 | 20 000               | N/mm <sup>2</sup>       | 140          |
|   | Dynamic                                      | psi                 | 20 000               | N/mm <sup>2</sup>       | 140          |
| Operating temperature                   | Min  | °F                  | -40                  | °C                      | -40          |
|   | Max  | °F                  | 265                  | °C                      | 130          |
| Coefficient of linear thermal expansion | Parallel to the surface                      | 10 <sup>-6</sup> /F | 6                    | 10 <sup>-6</sup> /K     | 11           |
|   | Normal to the surface                        | 10 <sup>-6</sup> /F | 17                   | 10 <sup>-6</sup> /K     | 29           |
| <b>OIL LUBRICATED</b>                   |  |                     |                      |                         |              |
| Maximum sliding speed, U                |  | fpm                 | 500                  | m/s                     | 2.5          |
| Maximum pU factor                       |  | psi x fpm           | 80 000               | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f              |  |                     | 0.06 - 0.12          |                         | 0.06 - 0.12  |
| <b>RECOMMENDATIONS</b>                  |  |                     |                      |                         |              |
| Shaft surface roughness, Ra             |  | µin                 | ≤ 16                 | µm                      | ≤ 0.4        |
| Shaft surface hardness                  | Unhardened acceptable, improved bearing life |                     | > 200 HB<br>> 350 HB |                         |              |

\* Depending on operating conditions

## DX<sup>®</sup>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 PERFORMANCE

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

| BEARING PROPERTIES          |                                   | IMPERIAL UNITS | IMPERIAL VALUE       | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-----------------------------------|----------------|----------------------|-------------------------|--------------|
| <b>GENERAL</b>              |                                   |                |                      |                         |              |
| Maximum load, p             | Static                            | psi            | 36 000               | N/mm <sup>2</sup>       | 250          |
|                             | Dynamic                           | psi            | 20 000               | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                               | °F             | -40                  | °C                      | -40          |
|                             | Max                               | °F             | 350                  | °C                      | 175          |
| <b>GREASE LUBRICATED</b>    |                                   |                |                      |                         |              |
| Maximum sliding speed, U    |                                   | fpm            | 500                  | m/s                     | 2.5          |
| Maximum pU factor           |                                   | psi x fpm      | 80 000               | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f  |                                   |                | 0.01 - 0.10          |                         | 0.01 - 0.10  |
| <b>OIL LUBRICATED</b>       |                                   |                |                      |                         |              |
| Maximum sliding speed, U    |                                   | fpm            | 2 000                | m/s                     | 10.0         |
| Maximum pU factor           |                                   | psi x fpm      | 80 000               | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f  |                                   |                | 0.01 - 0.06          |                         | 0.01 - 0.06  |
| <b>RECOMMENDATIONS</b>      |                                   |                |                      |                         |              |
| Shaft surface roughness, Ra |                                   | µin            | ≤ 16                 | µm                      | ≤ 0.4        |
| Shaft surface hardness      | Normal<br>For longer service life |                | > 200 HB<br>> 350 HB |                         |              |

# HI-EX<sup>®</sup> 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 PERFORMANCE

|     |                               |
|-----|-------------------------------|
| Dry | GAR-MAX / HSG / GAR-FIL / MLG |
|-----|-------------------------------|

### BEARING PROPERTIES

|   |                                   | IMPERIAL UNITS      | IMPERIAL VALUE       | METRIC UNITS            | METRIC VALUE  |
|---|-----------------------------------|---------------------|----------------------|-------------------------|---------------|
| <b>GENERAL</b>                          |                                   |                     |                      |                         |               |
| Maximum load, p                         | Static                            | psi                 | 20 000               | N/mm <sup>2</sup>       | 140           |
|   | Dynamic                           | psi                 | 20 000               | N/mm <sup>2</sup>       | 140           |
| Operating temperature                   | Min                               | °F                  | -240                 | °C                      | -150          |
|   | Max                               | °F                  | 480                  | °C                      | 250           |
| Coefficient of linear thermal expansion | Parallel to the surface           | 10 <sup>-6</sup> /F | 6                    | 10 <sup>-6</sup> /K     | 11            |
|   | Normal to the surface             | 10 <sup>-6</sup> /F | 17                   | 10 <sup>-6</sup> /K     | 29            |
| <b>GREASE LUBRICATED</b>                |                                   |                     |                      |                         |               |
| Maximum sliding speed, U                |                                   | fpm                 | 500                  | m/s                     | 2.5           |
| Maximum pU factor                       |                                   | psi x fpm           | 80 000               | N/mm <sup>2</sup> x m/s | 2.8           |
| Coefficient of friction, f              |                                   |                     | 0.08 - 0.12          |                         | 0.08 - 0.12   |
| <b>OIL LUBRICATED</b>                   |                                   |                     |                      |                         |               |
| Maximum sliding speed, U                |                                   | fpm                 | 2 000                | m/s                     | 10.0          |
| Maximum pU factor                       |                                   | psi x fpm           | 286 000              | N/mm <sup>2</sup> x m/s | 10.0          |
| Coefficient of friction, f              |                                   |                     | 0.03 - 0.08          |                         | 0.03 - 0.08   |
| <b>RECOMMENDATIONS</b>                  |                                   |                     |                      |                         |               |
| Shaft surface roughness, Ra             |                                   | µin                 | ≤ 2 - 16*            | µm                      | ≤ 0.05 - 0.4* |
| Shaft surface hardness                  | Normal<br>For longer service life |                     | > 200 HB<br>> 350 HB |                         |               |

\* Depending on operating conditions

## DTS10<sup>®</sup> Bearing Material

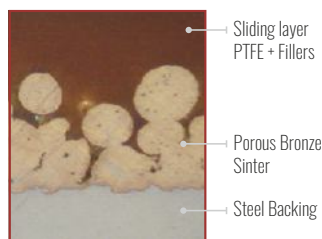


### METAL-POLYMER HYDRODYNAMIC COMPOSITE BEARINGS

#### 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

#### MICROSECTION



Sliding layer  
PTFE + Fillers

Porous Bronze  
Sinter

Steel Backing

#### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Fair      |
| Oil lubricated           | Excellent |
| Grease lubricated        | Fair      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Good      |

#### FOR SUPERIOR PERFORMANCE

|                   |                                  |
|-------------------|----------------------------------|
| Dry               | GAR-MAX / HSG /<br>GAR-FIL / MLG |
| Grease lubricated | DX / DX10                        |
| Water lubricated  | HPM / HPF / DP4-B                |

#### 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

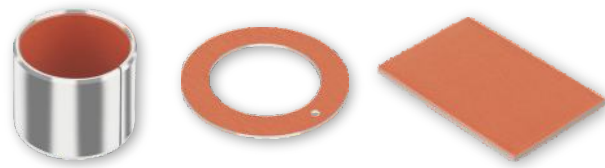
**Industrial:** Compressors: scroll and reciprocating, external and internal motors, external and internal pumps, vane pumps, axial and radial piston pumps, gerotor pumps, hydraulic cylinders

| BEARING PROPERTIES          |        | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE  |
|-----------------------------|--------|----------------|----------------|-------------------------|---------------|
| <b>GENERAL</b>              |        |                |                |                         |               |
| Maximum load, p             | Static | psi            | 20 000         | N/mm <sup>2</sup>       | 140           |
|                             |        |                |                |                         |               |
| Operating temperature       | Min    | °F             | -328           | °C                      | -200          |
|                             | Max    | °F             | 536            | °C                      | 280           |
| <b>FLUID LUBRICATED</b>     |        |                |                |                         |               |
| Maximum sliding speed, U    |        | fpm            | 2 000          | m/s                     | 10.0          |
| Maximum pU factor           |        | psi x fpm      | 2 860 000      | N/mm <sup>2</sup> x m/s | 100*          |
| Coefficient of friction, f  |        |                | 0.01 - 0.08    |                         | 0.01 - 0.08   |
| <b>RECOMMENDATIONS</b>      |        |                |                |                         |               |
| Shaft surface roughness, Ra |        | µin            | ≤ 2 - 8*       | µm                      | ≤ 0.05 - 0.2* |
| Shaft surface hardness      |        |                | > 200 HB       |                         |               |

\* 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 PERFORMANCE

|                          |                       |
|--------------------------|-----------------------|
| Water lubricated         | HPM / HPF / DP4-B     |
| Process fluid lubricated | DP4 / GAR-FIL / HI-EX |

| BEARING PROPERTIES          |                                   | IMPERIAL UNITS | IMPERIAL VALUE       | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-----------------------------------|----------------|----------------------|-------------------------|--------------|
| <b>GENERAL</b>              |                                   |                |                      |                         |              |
| Maximum load, p             | Static                            | psi            | 16 000               | N/mm <sup>2</sup>       | 110          |
|                             | Dynamic                           | psi            | 6 500                | N/mm <sup>2</sup>       | 45           |
| Operating temperature       | Min                               | °F             | -80                  | °C                      | -60          |
|                             | Max                               | °F             | 270                  | °C                      | 130          |
| <b>DRY</b>                  |                                   |                |                      |                         |              |
| Maximum sliding speed, U    |                                   | fpm            | 300                  | m/s                     | 1.5          |
| Maximum pU factor           |                                   | psi x fpm      | 40 000               | N/mm <sup>2</sup> x m/s | 1.4          |
| Coefficient of friction, f  |                                   |                | 0.15 - 0.3           |                         | 0.15 - 0.3   |
| <b>GREASE LUBRICATED</b>    |                                   |                |                      |                         |              |
| Maximum sliding speed, U    |                                   | fpm            | 500                  | m/s                     | 2.5          |
| Maximum pU factor           |                                   | psi x fpm      | 80 000               | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f  |                                   |                | 0.05 - 0.1           |                         | 0.05 - 0.1   |
| <b>OIL LUBRICATED</b>       |                                   |                |                      |                         |              |
| Maximum sliding speed, U    |                                   | fpm            | 2 000                | m/s                     | 10.0         |
| Maximum pU factor           |                                   | psi x fpm      | 286 000              | N/mm <sup>2</sup> x m/s | 10.0         |
| Coefficient of friction, f  |                                   |                | 0.03 - 0.08          |                         | 0.03 - 0.08  |
| <b>RECOMMENDATIONS</b>      |                                   |                |                      |                         |              |
| Shaft surface roughness, Ra |                                   | µin            | ≤ 16                 | µm                      | ≤ 0.4        |
| Shaft surface hardness      | Normal<br>For longer service life |                | > 200 HB<br>> 350 HB |                         |              |

## EP<sup>®</sup> 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

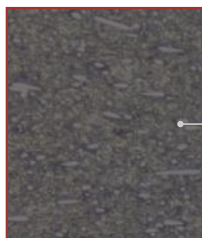
**Bearing forms made-to-order:** Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

#### 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



PA 6.6T+  
Solid Lubricant  
+ Fillers

#### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Good                          |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Fair                          |
| Process fluid lubricated | Good after resistance testing |

#### FOR SUPERIOR PERFORMANCE

|                  |      |
|------------------|------|
| Water lubricated | EP22 |
|------------------|------|

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 12 000         | N/mm <sup>2</sup>       | 80           |
|   | Dynamic                                 | psi                 | 6 000          | N/mm <sup>2</sup>       | 40           |
| Operating temperature                   | Min                                     | °F                  | -40            | °C                      | -40          |
|   | Max                                     | °F                  | 284            | °C                      | 140          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 12             | 10 <sup>-6</sup> /K     | 22           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 1 700          | N/mm <sup>2</sup> x m/s | 0.06         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 6 800          | N/mm <sup>2</sup> x m/s | 0.24         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 28 600         | N/mm <sup>2</sup> x m/s | 1.00         |
| Coefficient of friction, f              |   |                     | 0.15 - 0.3     |                         | 0.15 - 0.3   |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

# EP<sup>®</sup>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



POM + Solid Lubricant

### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Very good                     |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Fair                          |
| Process fluid lubricated | Good after resistance testing |

### FOR SUPERIOR PERFORMANCE

|                  |      |
|------------------|------|
| Water lubricated | EP22 |
|------------------|------|

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 9 500          | N/mm <sup>2</sup>       | 65           |
| Operating temperature                   | Min                                     | °F                  | -40            | °C                      | -40          |
|   | Max                                     | °F                  | 257            | °C                      | 125          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 67             | 10 <sup>-6</sup> /K     | 120          |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 1 100          | N/mm <sup>2</sup> x m/s | 0.04         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 2 500          | N/mm <sup>2</sup> x m/s | 0.09         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 5 100          | N/mm <sup>2</sup> x m/s | 0.18         |
| Coefficient of friction, f              |   |                     | 0.18 - 0.3     |                         | 0.18 - 0.3   |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 4 - 20         | µm                      | 0.1 - 0.5    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

## EP<sup>®</sup>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

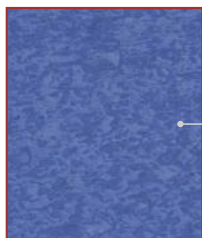
**EP<sup>®</sup>15 Bearing forms made-to-order:** Cylindrical bushings, flanged bushings, thrust washers, sliding plates, half-bushings, customized bearing designs

#### APPLICATIONS

Solar Power Equipment, Outdoor Applications, Recreational Applications



#### MICROSECTION



POM + PTFE + UV Stabilizer

#### 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         |
|---|---|-------------------------|---------------|
| <b>CHARACTERISTICS</b>                  |   |                         |               |
| Charpy unnotched impact strength        | ISO 179/1eU   | kJ/m <sup>2</sup>       | 45            |
| Charpy notched impact strength          | ISO 179/1eA   | kJ/m <sup>2</sup>       | 4.5           |
| Coefficient of linear thermal expansion | ISO 11359-2:1999-10   | x10 <sup>-6</sup>       | 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<br>DIN EN ISO 1183-2 :2004-10                            | g/cm <sup>3</sup>       | 1.50          |
| Tensile strength                        | DIN EN ISO 527-1 :2012-06<br>DIN EN ISO 527-2 :2012-06<br>DIN EN ISO 527-3 :2003-07 | N/mm <sup>2</sup> / psi | 50 / 7252     |
| Elastic modulus in tension              | DIN EN ISO 178:2013-09<br>DIN EN ISO 527-1:2012-06<br>DIN EN ISO 604:2003-12        | N/mm <sup>2</sup> / psi | 2750 / 398854 |
| Maximum static load                     |   | N/mm <sup>2</sup> / psi | 65 / 9500     |
| Coefficient of friction, f              |   |                         | 0.09 - 0.15   |
| Color                                   |   |                         | Blue          |

# EP<sup>®</sup>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



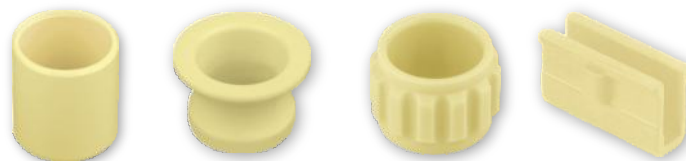
PBT +  
Solid Lubricant

### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Very good                     |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Very good                     |
| Process fluid lubricated | Good after resistance testing |

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 7 000          | N/mm <sup>2</sup>       | 50           |
| Operating temperature                   | Min                                     | °F                  | -60            | °C                      | -50          |
|   | Max                                     | °F                  | 340            | °C                      | 170          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 50             | 10 <sup>-6</sup> /K     | 90           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 1 400          | N/mm <sup>2</sup> x m/s | 0.05         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 2 800          | N/mm <sup>2</sup> x m/s | 0.10         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 5 700          | N/mm <sup>2</sup> x m/s | 0.20         |
| Coefficient of friction, f              |   |                     | 0.22 - 0.37    |                         | 0.22 - 0.37  |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 4 - 20         | µm                      | 0.1 - 0.5    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

## EP<sup>®</sup>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

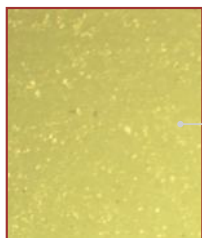
**Bearing forms made-to-order:** Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

#### APPLICATIONS

**General:** Generally applicable within the limits of the material properties

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

#### MICROSECTION



PA 6.6 + AF  
Solid Lubricant

#### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Very good                     |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Very good                     |
| Process fluid lubricated | Good after resistance testing |

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 9 500          | N/mm <sup>2</sup>       | 65           |
| Operating temperature                   | Min                                     | °F                  | -60            | °C                      | -50          |
|   | Max                                     | °F                  | 392            | °C                      | 200          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 22             | 10 <sup>-6</sup> /K     | 40           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 1 400          | N/mm <sup>2</sup> x m/s | 0.05         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 2 800          | N/mm <sup>2</sup> x m/s | 0.10         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 5 700          | N/mm <sup>2</sup> x m/s | 0.20         |
| Coefficient of friction, f              |   |                     | 0.08 - 0.16    |                         | 0.08 - 0.16  |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 4 - 20         | µm                      | 0.1 - 0.5    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

# EP<sup>®</sup>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

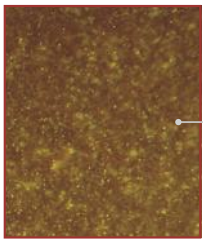
**Bearing forms made-to-order:** Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

### 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



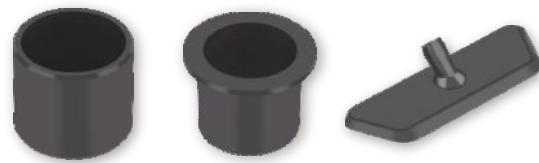
PPS +  
Solid Lubricant  
+ Fillers

### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Very good                     |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Very good                     |
| Process fluid lubricated | Good after resistance testing |

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 12 000         | N/mm <sup>2</sup>       | 83           |
| Operating temperature                   | Min                                     | °F                  | -40            | °C                      | -40          |
|   | Max                                     | °F                  | 460            | °C                      | 240          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 25             | 10 <sup>-6</sup> /K     | 45           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 2 600          | N/mm <sup>2</sup> x m/s | 0.22         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 25 700         | N/mm <sup>2</sup> x m/s | 0.90         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 102 000        | N/mm <sup>2</sup> x m/s | 3.59         |
| Coefficient of friction, f              |   |                     | 0.11 - 0.2     |                         | 0.11 - 0.2   |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

## EP<sup>®</sup>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

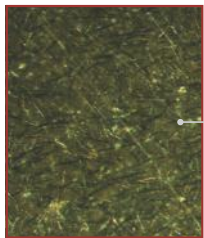
**Bearing forms made-to-order:** Cylindrical bushings, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

#### APPLICATIONS

**General:** Generally applicable within the limits of the material properties

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

#### MICROSECTION



PPS + Solid Lubricant + Fillers

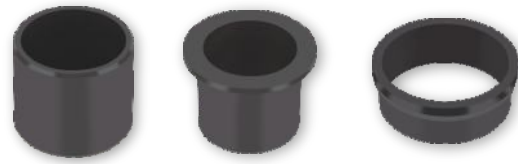
#### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Good                          |
| Oil lubricated           | Very good                     |
| Grease lubricated        | Very good                     |
| Water lubricated         | Very good                     |
| Process fluid lubricated | Good after resistance testing |

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 14 000         | N/mm <sup>2</sup>       | 95           |
| Operating temperature                   | Min                                     | °F                  | -40            | °C                      | -40          |
|   | Max                                     | °F                  | 460            | °C                      | 240          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 15             | 10 <sup>-6</sup> /K     | 27           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 3 100          | N/mm <sup>2</sup> x m/s | 0.11         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 12 000         | N/mm <sup>2</sup> x m/s | 0.42         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 48 300         | N/mm <sup>2</sup> x m/s | 1.69         |
| Coefficient of friction, f              |   |                     | 0.16 - 0.26    |                         | 0.16 - 0.26  |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |   |                     | > 450 HV       |                         |              |



# EP<sup>®</sup>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

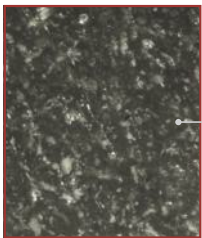
**Bearing forms made-to-order:** Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

### APPLICATIONS

**General:** Generally applicable within the limits of the material properties

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

### MICROSECTION



PEEK + Solid Lubricant + Fillers

### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Good                          |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Fair                          |
| Process fluid lubricated | Good after resistance testing |

### FOR SUPERIOR PERFORMANCE

|                  |      |
|------------------|------|
| Water lubricated | EP64 |
|------------------|------|

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 13 000         | N/mm <sup>2</sup>       | 90           |
|   |   |                     |                |                         |              |
| Operating temperature                   | Min                                     | °F                  | -150           | °C                      | -100         |
|   | Max                                     | °F                  | 550            | °C                      | 290          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 28             | 10 <sup>-6</sup> /K     | 50           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 4 500          | N/mm <sup>2</sup> x m/s | 0.16         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 18 800         | N/mm <sup>2</sup> x m/s | 0.66         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 75 200         | N/mm <sup>2</sup> x m/s | 2.63         |
| Coefficient of friction, f              |   |                     | 0.12 - 0.21    |                         | 0.12 - 0.21  |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 4 - 20         | µm                      | 0.1 - 0.5    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

## EP<sup>®</sup>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

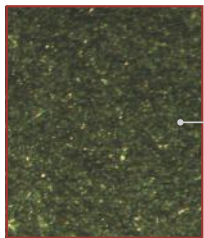
**Bearing forms made-to-order:** Cylindrical bushes, flanged bearings, thrust washers, sliding plates, half-bearings, customized bearing designs

#### APPLICATIONS

**General:** Generally applicable within the limits of the material properties

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

#### MICROSECTION



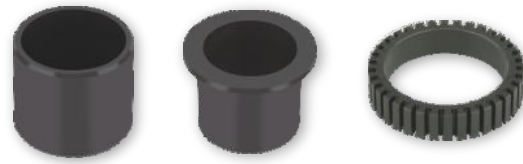
PEEK + Solid Lubricant + Fillers

#### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Good                          |
| Oil lubricated           | Very good                     |
| Grease lubricated        | Very good                     |
| Water lubricated         | Good                          |
| Process fluid lubricated | Good after resistance testing |

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 18 000         | N/mm <sup>2</sup>       | 125          |
| Operating temperature                   | Min                                     | °F                  | -150           | °C                      | -100         |
|   | Max                                     | °F                  | 550            | °C                      | 290          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 8              | 10 <sup>-6</sup> /K     | 14           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 200            | m/s                     | 1.0          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 2 500          | N/mm <sup>2</sup> x m/s | 0.09         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 10 000         | N/mm <sup>2</sup> x m/s | 0.35         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 40 000         | N/mm <sup>2</sup> x m/s | 1.40         |
| Coefficient of friction, f              |   |                     | 0.3 - 0.5      |                         | 0.3 - 0.5    |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 4 - 20         | µm                      | 0.1 - 0.5    |
| Shaft surface hardness                  |   |                     | > 450 HV       |                         |              |

# EP<sup>®</sup>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

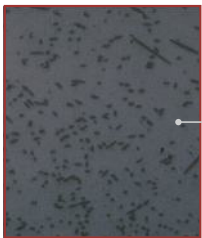
**General:** Generally applicable within the limits of the material properties

**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



PAI +  
Solid Lubricant  
+ Fillers

### OPERATING PERFORMANCE

|                          |                               |
|--------------------------|-------------------------------|
| Dry                      | Good                          |
| Oil lubricated           | Good                          |
| Grease lubricated        | Good                          |
| Water lubricated         | Fair                          |
| Process fluid lubricated | Good after resistance testing |

### FOR SUPERIOR PERFORMANCE

|                  |      |
|------------------|------|
| Water lubricated | EP64 |
|------------------|------|

| BEARING PROPERTIES                      |   | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |   |                     |                |                         |              |
| Maximum load, p                         | Static                                  | psi                 | 15 000         | N/mm <sup>2</sup>       | 105          |
|   |   |                     |                |                         |              |
| Operating temperature                   | Min                                     | °F                  | -330           | °C                      | -200         |
|   | Max                                     | °F                  | 500            | °C                      | 260          |
| Coefficient of linear thermal expansion |   | 10 <sup>-6</sup> /F | 14             | 10 <sup>-6</sup> /K     | 25           |
| <b>DRY</b>                              |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 500            | m/s                     | 2.5          |
| Maximum pU factor                       | for A <sub>H</sub> /A <sub>C</sub> = 5  | psi x fpm           | 2 800          | N/mm <sup>2</sup> x m/s | 0.10         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 10 | psi x fpm           | 11 100         | N/mm <sup>2</sup> x m/s | 0.39         |
|   | for A <sub>H</sub> /A <sub>C</sub> = 20 | psi x fpm           | 44 900         | N/mm <sup>2</sup> x m/s | 1.57         |
| Coefficient of friction, f              |   |                     | 0.19 - 0.31    |                         | 0.19 - 0.31  |
| <b>LUBRICATED</b>                       |   |                     |                |                         |              |
| Maximum sliding speed, U                |   | fpm                 | 1 000          | m/s                     | 5.0          |
| <b>RECOMMENDATIONS</b>                  |   |                     |                |                         |              |
| Shaft surface roughness, Ra             |   | µin                 | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |   |                     | > 200 HV       |                         |              |

## EP<sup>®</sup>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

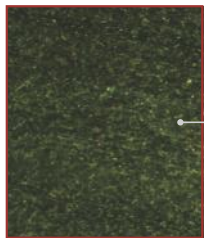
#### APPLICATIONS

**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



PAI+  
Solid Lubricant  
+ Fillers

#### 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 PERFORMANCE

|                  |      |
|------------------|------|
| Dry              | EP73 |
| Water lubricated | EP64 |

| BEARING PROPERTIES                      |        | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|--------|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |        |                     |                |                         |              |
| Maximum load, p                         | Static | psi                 | 19 000         | N/mm <sup>2</sup>       | 130          |
|   |        |                     |                |                         |              |
| Operating temperature                   | Min    | °F                  | -330           | °C                      | -200         |
|   | Max    | °F                  | 500            | °C                      | 260          |
| Coefficient of linear thermal expansion |        | 10 <sup>-6</sup> /F | 5              | 10 <sup>-6</sup> /K     | 9            |
| <b>DRY</b>                              |        |                     |                |                         |              |
| Maximum sliding speed, U                |        | fpm                 | 2 000          | m/s                     | 10.0         |
| Maximum pU factor                       |        | psi x fpm           | 286 000        | N/mm <sup>2</sup> x m/s | 10.0         |
| Coefficient of friction, f              |        |                     | 0.005 - 0.1    |                         | 0.005 - 0.1  |
| <b>RECOMMENDATIONS</b>                  |        |                     |                |                         |              |
| Shaft surface roughness, Ra             |        | µin                 | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |        |                     | > 500 HV       |                         |              |

# KA Glacetal Bearing Material



## 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

## 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

### MICROSECTION



#### OPERATING PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | Fair |
| Oil lubricated           | Good |
| Grease lubricated        | Good |
| Water lubricated         | Fair |
| Process fluid lubricated | Fair |

#### FOR SUPERIOR PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | EP22 |
| Water lubricated         | EP22 |
| Process fluid lubricated | EP22 |

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 3 000          | N/mm <sup>2</sup>       | 20           |
|                             | Dynamic                 | psi            | 1 500          | N/mm <sup>2</sup>       | 10           |
| Operating temperature       | Min                     | °F             | -40            | °C                      | -40          |
|                             | Max                     | °F             | 180            | °C                      | 80           |
| <b>GREASED</b>              |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 300            | m/s                     | 1.5          |
| Maximum pU factor           |                         | psi x fpm      | 10 000         | N/mm <sup>2</sup> x m/s | 0.35         |
| Coefficient of friction, f  |                         |                | 0.08 - 0.12    |                         | 0.08 - 0.12  |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | ≤ 16           | µm                      | ≤ 0.4        |
| Shaft surface hardness      | Normal                  |                | > 200 HB       |                         |              |
|                             | For longer service life |                | > 350 HB       |                         |              |

## 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



POM + Solid Lubricant + Fillers

#### OPERATING PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | Good |
| Oil lubricated           | Good |
| Grease lubricated        | Good |
| Water lubricated         | Fair |
| Process fluid lubricated | Fair |

#### FOR SUPERIOR PERFORMANCE

|                          |      |
|--------------------------|------|
| Water lubricated         | EP22 |
| Process fluid lubricated | EP22 |

| BEARING PROPERTIES                      |                                   | IMPERIAL UNITS      | IMPERIAL VALUE       | METRIC UNITS            | METRIC VALUE |
|---|-----------------------------------|---------------------|----------------------|-------------------------|--------------|
| <b>GENERAL</b>                          |                                   |                     |                      |                         |              |
| Maximum load, p                         | Static                            | psi                 | 9 000                | N/mm <sup>2</sup>       | 60           |
|   | Dynamic                           | psi                 | 4 500                | N/mm <sup>2</sup>       | 30           |
| Operating temperature                   | Min                               | °F                  | -40                  | °C                      | -40          |
|   | Max                               | °F                  | 180                  | °C                      | 80           |
|   | Momentary                         | °F                  | 250                  | °C                      | 120          |
| Coefficient of linear thermal expansion |                                   | 10 <sup>-6</sup> /F | 56                   | 10 <sup>-6</sup> /K     | 101          |
| <b>DRY</b>                              |                                   |                     |                      |                         |              |
| Maximum sliding speed, U                |                                   | fpm                 | 300                  | m/s                     | 1.5          |
| Maximum pU factor                       |                                   | psi x fpm           | 17 000               | N/mm <sup>2</sup> x m/s | 0.6          |
| Coefficient of friction, f              |                                   |                     | 0.1 - 0.2            |                         | 0.1 - 0.2    |
| <b>RECOMMENDATIONS</b>                  |                                   |                     |                      |                         |              |
| Shaft surface roughness, Ra             |                                   | µin                 | 8 - 32               | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  | Normal<br>For longer service life |                     | > 200 HB<br>> 350 HB |                         |              |

## GAR-MAX<sup>®</sup> 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<sup>®</sup> bearing sizes available according to DIN ISO 4379 for the replacement of traditional greased bronze bearings

#### AVAILABILITY

Bearing forms available in standard dimensions:

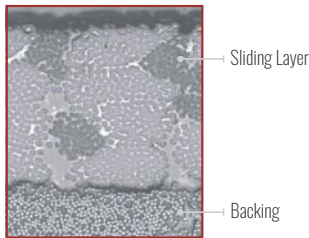
- Plain cylindrical bushes

**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



Sliding Layer

Backing

#### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Very good |
| Oil lubricated           | Fair      |
| Grease lubricated        | Fair      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Poor      |

#### FOR SUPERIOR PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Oil lubricated           | GAR-FIL   |
| Grease lubricated        | DX / DX10 |
| Water lubricated         | HPF / HPM |
| Process fluid lubricated | GAR-FIL   |

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 30 000         | N/mm <sup>2</sup>       | 210          |
|                             | Dynamic                 | psi            | 20 500         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | -320           | °C                      | -195         |
|                             | Max                     | °F             | 320            | °C                      | 160          |
| <b>DRY</b>                  |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 25             | m/s                     | 0.13         |
| Maximum pU factor           |                         | psi x fpm      | 30 000         | N/mm <sup>2</sup> x m/s | 1.05         |
| Coefficient of friction, f  |                         |                | 0.05 - 0.3*    |                         | 0.05 - 0.3*  |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | 6 - 16         | µm                      | 0.15 - 0.4   |
| Shaft surface hardness      | Normal                  |                | > 350 HB       |                         |              |
|                             | For longer service life |                | > 480 HB       |                         |              |

\* 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:**

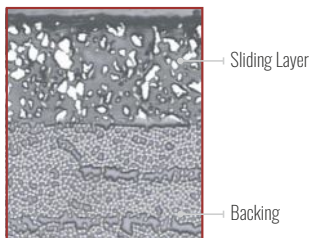
- Plain cylindrical bushes

**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



Sliding Layer

Backing

#### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Very good |
| Oil lubricated           | Very good |
| Grease lubricated        | Fair      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Very good |

#### FOR SUPERIOR PERFORMANCE

|                   |           |
|-------------------|-----------|
| Grease lubricated | DX / DX10 |
| Water lubricated  | HPF / HPM |

| BEARING PROPERTIES          |         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|---------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |         |                |                |                         |              |
| Maximum load, p             | Static  | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
|                             | Dynamic | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min     | °F             | -320           | °C                      | -195         |
|                             | Max     | °F             | 400            | °C                      | 205          |
| <b>DRY</b>                  |         |                |                |                         |              |
| Maximum sliding speed, U    |         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor           |         | psi x fpm      | 35 000         | N/mm <sup>2</sup> x m/s | 1.23         |
| Coefficient of friction, f  |         |                | 0.02 - 0.12*   |                         | 0.02 - 0.12* |
| <b>RECOMMENDATIONS</b>      |         |                |                |                         |              |
| Shaft surface roughness, Ra |         | µin            | ≤ 16           | µm                      | ≤ 0.4        |
| Shaft surface hardness      | Normal  |                | > 200 HB       |                         |              |

\* 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:

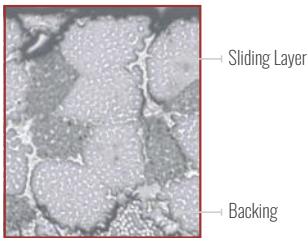
- Plain cylindrical bushes

**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



Sliding Layer

Backing

### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Very good |
| Oil lubricated           | Fair      |
| Grease lubricated        | Fair      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Fair      |

### FOR SUPERIOR PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Oil lubricated           | GAR-FIL   |
| Grease lubricated        | DX / DX10 |
| Water lubricated         | HPF / HPM |
| Process fluid lubricated | GAR-FIL   |

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 60 000         | N/mm <sup>2</sup>       | 415          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | -320           | °C                      | -195         |
|                             | Max                     | °F             | 320            | °C                      | 160          |
| <b>DRY</b>                  |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 25             | m/s                     | 0.13         |
| Maximum pU factor           |                         | psi x fpm      | 30 000         | N/mm <sup>2</sup> x m/s | 1.05         |
| Coefficient of friction, f  |                         |                | 0.05 - 0.3*    |                         | 0.05 - 0.3*  |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | 6 - 16         | µm                      | 0.15 - 0.4   |
| Shaft surface hardness      | Normal                  |                | > 350 HB       |                         |              |
|                             | For longer service life |                | > 480 HB       |                         |              |

\* 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 misalignment resistance
- Excellent shock resistance
- Good friction and wear properties
- Good chemical resistance

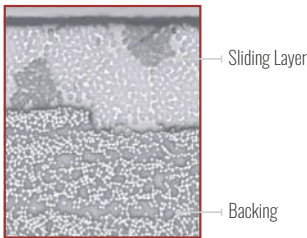
### AVAILABILITY

**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      |

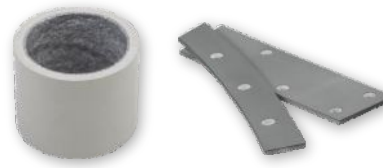
### FOR SUPERIOR PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Grease lubricated        | DX / DX10 |
| Water lubricated         | HPF / HPM |
| Process fluid lubricated | GAR-FIL   |

| BEARING PROPERTIES          |         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|---------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |         |                |                |                         |              |
| Maximum load, p             | Static  | psi            | 30 000         | N/mm <sup>2</sup>       | 210          |
|                             | Dynamic | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min     | °F             | -320           | °C                      | -195         |
|                             | Max     | °F             | 320            | °C                      | 160          |
| <b>DRY</b>                  |         |                |                |                         |              |
| Maximum sliding speed, U    |         | fpm            | 25             | m/s                     | 0.13         |
| Maximum pU factor           |         | psi x fpm      | 30 000         | N/mm <sup>2</sup> x m/s | 1.05         |
| Coefficient of friction, f  |         |                | 0.05 - 0.3*    |                         | 0.05 - 0.3*  |
| <b>RECOMMENDATIONS</b>      |         |                |                |                         |              |
| Shaft surface roughness, Ra |         | µin            | 6 - 16         | µm                      | 0.15 - 0.4   |
| Shaft surface hardness      |         |                | > 350 HB       |                         |              |

\* 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:

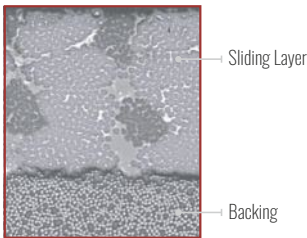
- Plain cylindrical bushes

**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      |

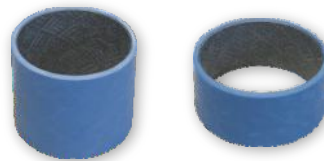
### FOR SUPERIOR PERFORMANCE

|                          |               |
|--------------------------|---------------|
| Oil lubricated           | GAR-FIL / HPF |
| Grease lubricated        | DX / DX10     |
| Process fluid lubricated | GAR-FIL / HPF |

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 30 000         | N/mm <sup>2</sup>       | 210          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | -320           | °C                      | -195         |
|                             | Max                     | °F             | 320            | °C                      | 160          |
| <b>DRY</b>                  |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 25             | m/s                     | 0.13         |
| Maximum pU factor           |                         | psi x fpm      | 35 000         | N/mm <sup>2</sup> x m/s | 1.23         |
| Coefficient of friction, f  |                         |                | 0.03 - 0.12*   |                         | 0.03 - 0.12* |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness      | Normal                  |                | > 180 HB       |                         |              |
|                             | For longer service life |                | > 480 HB       |                         |              |

\* Depending on operating conditions

# HPMB<sup>®</sup> 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

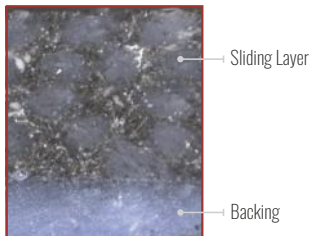
**Bearing forms made-to-order:** Finished cylindrical bushings, pre-machined cylindrical bushings, flanged cylindrical bushings (subject to design review)

### 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



Sliding Layer

Backing

### 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 PERFORMANCE

|                          |               |
|--------------------------|---------------|
| Oil lubricated           | GAR-FIL / HPF |
| Grease lubricated        | DX / DX10     |
| Process fluid lubricated | GAR-FIL / HPF |

| BEARING PROPERTIES                      |                         | IMPERIAL UNITS      | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|-------------------------|---------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |                         |                     |                |                         |              |
| Maximum load, p                         | Static                  | psi                 | 30 000         | N/mm <sup>2</sup>       | 210          |
|   | Dynamic                 | psi                 | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature                   | Min                     | °F                  | -320           | °C                      | -196         |
|   | Max                     | °F                  | 325            | °C                      | 163          |
| Coefficient of linear thermal expansion |                         | 10 <sup>-6</sup> /F | 7              | 10 <sup>-6</sup> /K     | 12.6         |
| <b>DRY</b>                              |                         |                     |                |                         |              |
| Maximum sliding speed, U                |                         | fpm                 | 25             | m/s                     | 0.13         |
| Maximum pU factor                       |                         | psi x fpm           | 35 000         | N/mm <sup>2</sup> x m/s | 1.23         |
| Coefficient of friction, f              |                         |                     | 0.03 - 0.12*   |                         | 0.03 - 0.12* |
| <b>RECOMMENDATIONS</b>                  |                         |                     |                |                         |              |
| Shaft surface roughness, Ra             |                         | µin                 | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  | Normal                  |                     | > 180 HB       |                         |              |
|   | For longer service life |                     | > 480 HB       |                         |              |

\* Depending on operating conditions

# HPF<sup>®</sup> 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:

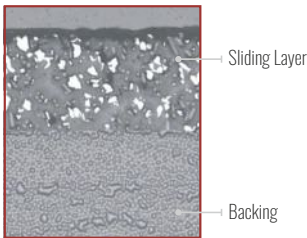
- Plain cylindrical bushes
- Sliding plates

**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 PERFORMANCE

|                   |           |
|-------------------|-----------|
| Grease lubricated | DX / DX10 |
|-------------------|-----------|

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | -320           | °C                      | -195         |
|                             | Max                     | °F             | 285            | °C                      | 140          |
| <b>DRY</b>                  |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor           |                         | psi x fpm      | 35 000         | N/mm <sup>2</sup> x m/s | 1.23         |
| Coefficient of friction, f  |                         |                | 0.02 - 0.1*    |                         | 0.02 - 0.1*  |
| <b>GREASE LUBRICATED</b>    |                         |                |                |                         |              |
| Coefficient of friction, f  |                         |                | 0.02 - 0.08*   |                         | 0.02 - 0.08* |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness      | Normal                  |                | > 180 HB       |                         |              |
|                             | For longer service life |                | > 480 HB       |                         |              |

\* 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:**

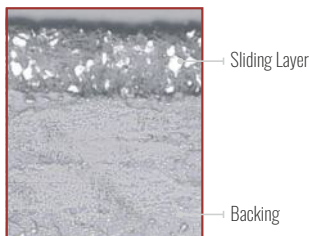
- Plain thrust washers

**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 PERFORMANCE

|                          |     |
|--------------------------|-----|
| Oil lubricated           | HPF |
| Grease lubricated        | DX  |
| Process fluid lubricated | HPF |

| BEARING PROPERTIES          |         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|---------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |         |                |                |                         |              |
| Maximum load, p             | Static  | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
|                             | Dynamic | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min     | °F             | -320           | °C                      | -195         |
|                             | Max     | °F             | 350            | °C                      | 175          |
| <b>DRY</b>                  |         |                |                |                         |              |
| Maximum sliding speed, U    |         | fpm            | 100            | m/s                     | 0.5          |
| Maximum pU factor           |         | psi x fpm      | 35 000         | N/mm <sup>2</sup> x m/s | 1.23         |
| Coefficient of friction, f  |         |                | 0.02 - 0.12*   |                         | 0.02 - 0.12* |
| <b>RECOMMENDATIONS</b>      |         |                |                |                         |              |
| Shaft surface roughness, Ra |         | µin            | ≤ 16           | µm                      | ≤ 0.4        |
| Shaft surface hardness      | Normal  |                | > 200 HB       |                         |              |

\* 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:

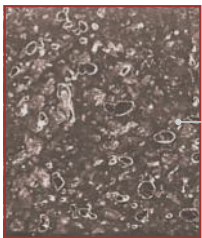
- Bearing tape

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



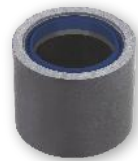
Structure PTFE tape with proprietary fillers

### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Very good |
| Oil lubricated           | Very good |
| Grease lubricated        | Very good |
| Water lubricated         | Good      |
| Process fluid lubricated | Good      |

| BEARING PROPERTIES             |         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|--------------------------------|---------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                 |         |                |                |                         |              |
| Maximum load, p                | Static  | psi            | 10 000         | N/mm <sup>2</sup>       | 70           |
|                                | Dynamic | psi            | 5 000          | N/mm <sup>2</sup>       | 35           |
| Operating temperature          | Min     | °F             | -330           | °C                      | -200         |
|                                | Max     | °F             | 540            | °C                      | 280          |
| <b>DRY</b>                     |         |                |                |                         |              |
| Maximum sliding speed, U       |         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor              |         | psi x fpm      | 9 000          | N/mm <sup>2</sup> x m/s | 0.32         |
| Coefficient of friction, f     |         |                | 0.07           |                         | 0.07         |
| <b>GREASE / OIL LUBRICATED</b> |         |                |                |                         |              |
| Maximum pU factor              |         | psi x fpm      | 36 000         | N/mm <sup>2</sup> x m/s | 1.25         |
| Coefficient of friction, f     |         |                | 0.05           |                         | 0.05         |
| <b>RECOMMENDATIONS</b>         |         |                |                |                         |              |
| Shaft surface roughness, Ra    |         | µin            | 8 - 16         | µm                      | 0.2 - 0.4    |
| Shaft surface hardness         |         |                | > 200 HB       |                         |              |

# SBC with GAR-MAX<sup>®</sup> 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 contaminants to offer extended service life
- Environmentally friendly and eliminates need for automated grease system and grease

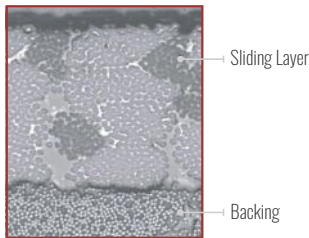
### AVAILABILITY

**Bearing forms made-to-order:** GGB SBC with GAR-MAX<sup>®</sup> 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          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 30 000         | N/mm <sup>2</sup>       | 210          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | 200            | °C                      | 93           |
|                             | Max                     | °F             | 220            | °C                      | 104          |
| <b>DRY</b>                  |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 25             | m/s                     | 0.13         |
| Maximum pU factor           |                         | psi x fpm      | 30 000         | N/mm <sup>2</sup> x m/s | 1.05         |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | 6 - 16         | µm                      | 0.15 - 0.4   |
| Shaft surface hardness      | Normal                  |                |                |                         | > 350 HB     |
|                             | For longer service life |                |                |                         | > 480 HB     |



# 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 contaminants to offer extended service life
- Environmentally friendly and eliminates need for automated grease system and grease

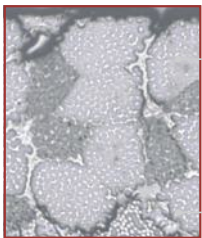
### AVAILABILITY

**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



Sliding Layer

Backing

### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Very good |
| Oil lubricated           | Fair      |
| Grease lubricated        | Fair      |
| Water lubricated         | Fair      |
| Process fluid lubricated | Fair      |

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 60 000         | N/mm <sup>2</sup>       | 415          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | 200            | °C                      | 93           |
|                             | Max                     | °F             | 220            | °C                      | 104          |
| <b>DRY</b>                  |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 25             | m/s                     | 0.13         |
| Maximum pU factor           |                         | psi x fpm      | 30 000         | N/mm <sup>2</sup> x m/s | 1.05         |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | 6 - 16         | µm                      | 0.15 - 0.4   |
| Shaft surface hardness      | Normal                  |                |                |                         | > 350 HB     |
|                             | For longer service life |                |                |                         | > 480 HB     |

## GGB-CSM<sup>®</sup> Bearing Material



### THICK WALLED MONOMENTAL BEARINGS

#### CHARACTERISTICS

- Self-lubricating metal bearings produced by metallurgic powder
- Maintenance-free bearings with homogeneously distributed solid lubricant (graphite, MoS<sub>2</sub>) 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

#### MICROSECTION

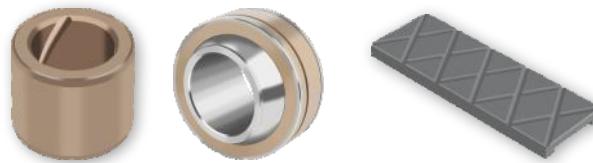


Solid Lubricant:  
Graphite, MoS<sub>2</sub>

Metallic Matrix:  
Bronze, Nickel,  
or Iron-based

#### OPERATING PERFORMANCE

|                          |                             |
|--------------------------|-----------------------------|
| Dry                      | Good                        |
| Oil lubricated           | Good                        |
| Grease lubricated        | Good                        |
| Water lubricated         | Depending on alloy          |
| Process fluid lubricated | Depending on fluid or alloy |



#### 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

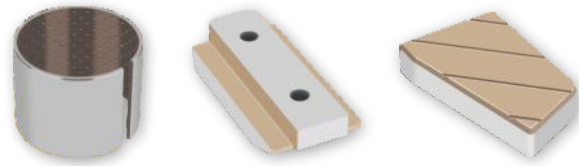
#### APPLICATIONS

**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.

| BEARING PROPERTIES                      |         | IMPERIAL UNITS      | IMPERIAL VALUE       | METRIC UNITS            | METRIC VALUE |
|---|---------|---------------------|----------------------|-------------------------|--------------|
| <b>GENERAL</b>                          |         |                     |                      |                         |              |
| Maximum load, p                         | Static  | psi                 | 15 000 - 38 000      | N/mm <sup>2</sup>       | 100 - 260    |
|   | Dynamic | psi                 | 8 000 - 19 000       | N/mm <sup>2</sup>       | 55 - 130     |
| Operating temperature                   | Min     | °F                  | -330                 | °C                      | -200         |
|   | Max     | °F                  | 1 100                | °C                      | 600          |
| Coefficient of linear thermal expansion |         | 10 <sup>-6</sup> /F | 7 - 10               | 10 <sup>-6</sup> /K     | 13 - 18      |
| <b>DRY</b>                              |         |                     |                      |                         |              |
| Maximum sliding speed, U                |         | fpm                 | 40 - 100             | m/s                     | 0.2 - 0.5    |
| Maximum pU factor                       |         | psi x fpm           | 23 000 - 40 000      | N/mm <sup>2</sup> x m/s | 0.8 - 1.5    |
| Coefficient of friction, f              |         |                     | 0.11 - 0.5           |                         | 0.11 - 0.5   |
| <b>WATER LUBRICATED</b>                 |         |                     |                      |                         |              |
| Coefficient of friction, f              |         |                     | 0.08 - 0.18          |                         | 0.08 - 0.18  |
| <b>RECOMMENDATIONS</b>                  |         |                     |                      |                         |              |
| Shaft surface roughness, Ra             |         | µin                 | 8 - 32               | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |         |                     | > 180 HB<br>> 45 HRC |                         |              |

*Bearing properties and recommendations depending on GGB-CSM material grade*

# GGB-CBM<sup>®</sup> 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

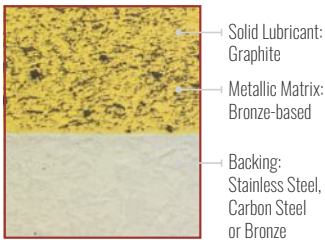
### AVAILABILITY

**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                      |         | IMPERIAL UNITS      | IMPERIAL VALUE   | METRIC UNITS            | METRIC VALUE |
|---|---------|---------------------|------------------|-------------------------|--------------|
| <b>GENERAL</b>                          |         |                     |                  |                         |              |
| Maximum load, p                         | Static  | psi                 | 38 000 - 41 000  | N/mm <sup>2</sup>       | 260 - 280    |
|   | Dynamic | psi                 | 12 000 - 22 000  | N/mm <sup>2</sup>       | 80 - 150     |
| Operating temperature                   | Min     | °F                  | -240             | °C                      | -150         |
|   | Max     | °F                  | 540              | °C                      | 280          |
| Coefficient of linear thermal expansion |         | 10 <sup>-6</sup> /F | 7 - 9            | 10 <sup>-6</sup> /K     | 12 - 16      |
| <b>DRY</b>                              |         |                     |                  |                         |              |
| Maximum sliding speed, U                |         | fpm                 | 60 - 100         | m/s                     | 0.3 - 0.5    |
| Maximum pU factor                       |         | psi x fpm           | 14 000 - 29 000  | N/mm <sup>2</sup> x m/s | 0.5 - 1.0    |
| Coefficient of friction, f              |         |                     | 0.10 - 0.2       |                         | 0.10 - 0.2   |
| <b>WATER LUBRICATED</b>                 |         |                     |                  |                         |              |
| Coefficient of friction, f              |         |                     | 0.10 - 0.15      |                         | 0.10 - 0.15  |
| <b>RECOMMENDATIONS</b>                  |         |                     |                  |                         |              |
| Shaft surface roughness, Ra             |         | µin                 | 8 - 32           | µm                      | 0.2 - 0.8    |
| Shaft surface hardness                  |         |                     | > 180 - > 250 HB |                         |              |

*Bearing properties and recommendations depending on GGB-CBM material grade*

## GGB-BP25 Bearing Material

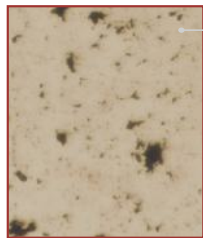


### METAFRAM OIL IMPREGNATED SINTERED BRONZE BEARINGS

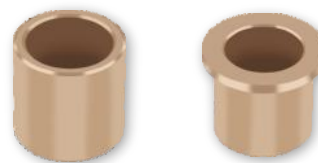
#### CHARACTERISTICS

- 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

#### MICROSECTION



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



#### 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

#### OPERATING PERFORMANCE

|                          |                                 |
|--------------------------|---------------------------------|
| Dry                      | Good (PTFE / MoS <sub>2</sub> ) |
| Oil lubricated           | Good                            |
| Grease lubricated        | Fair                            |
| Water lubricated         | Not recommended                 |
| Process fluid lubricated | Not recommended                 |

| BEARING PROPERTIES          |         | IMPERIAL UNITS     | IMPERIAL VALUE  | METRIC UNITS            | METRIC VALUE   |
|-----------------------------|---------|--------------------|-----------------|-------------------------|----------------|
| <b>GENERAL</b>              |         |                    |                 |                         |                |
| Maximum load, p             | Static  | psi                | 2 900           | N/mm <sup>2</sup>       | 20             |
|                             | Dynamic | psi                | 1 400           | N/mm <sup>2</sup>       | 10             |
| Operating temperature       | Min     | °F                 | -290 / 30*      | °C                      | -180 / 0*      |
|                             | Max     | °F                 | 190 / 570*      | °C                      | 90 / 300*      |
| Minimum density             |         | lb/in <sup>3</sup> | 0.22            | g/cm <sup>3</sup>       | 6.2            |
| Minimum apparent porosity   |         | %                  | 23              | %                       | 23             |
| <b>OIL IMPREGNATED</b>      |         |                    |                 |                         |                |
| Maximum sliding speed, U    |         | fpm                | 20 - 1 100      | m/s                     | 0.1 - 6.0*     |
| Maximum pU factor           |         | psi x fpm          | 2 800 - 51 400  | N/mm <sup>2</sup> x m/s | 0.1 - 1.8*     |
| Coefficient of friction, f  |         |                    | 0.05 - 0.25*    |                         | 0.05 - 0.25*   |
| <b>RECOMMENDATIONS</b>      |         |                    |                 |                         |                |
| Shaft surface roughness, Ra |         | µin                | ≤ 16 - ≤ 24*    | µm                      | ≤ 0.3 - ≤ 0.6* |
| Shaft surface hardness      |         |                    | > 240 HB > 355* |                         |                |

Bearing properties depending on oil or solid lubricants

# GGB-FP20 Bearing Material



## AVAILABILITY

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

## APPLICATIONS

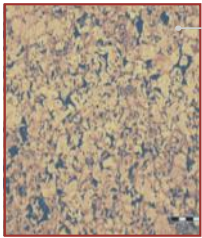
**Industrial:** FHP motor bearings, domestic appliances and hand tools

## 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

### MICROSECTION



Cu 1 - 4 %  
C < 0.25 %  
Other < 2 %  
Rest Fe  
Impregnation group 1 (up to 80°C)

### OPERATING PERFORMANCE

|                          |                                 |
|--------------------------|---------------------------------|
| Dry                      | Good (PTFE / MoS <sub>2</sub> ) |
| Oil lubricated           | Good (Oil impregnated)          |
| Grease lubricated        | Not recommended                 |
| Water lubricated         | Not recommended                 |
| Process fluid lubricated | Not recommended                 |

| BEARING PROPERTIES          | IMPERIAL UNITS | IMPERIAL VALUE     | METRIC UNITS    | METRIC VALUE            |                |
|-----------------------------|----------------|--------------------|-----------------|-------------------------|----------------|
| <b>GENERAL</b>              |                |                    |                 |                         |                |
| Maximum load, p             | Static         | psi                | 6 500           | N/mm <sup>2</sup>       | 45             |
|                             | Dynamic        | psi                | 1 100 - 3 200*  | N/mm <sup>2</sup>       | 8.0 - 22.5     |
| Operating temperature       | Min            | °F                 | -290 / 25*      | °C                      | -180 / -5*     |
|                             | Max            | °F                 | 190 / 570*      | °C                      | 90 / 300*      |
| Minimum density             |                | lb/in <sup>3</sup> | 0.20            | g/cm <sup>3</sup>       | 5.6            |
| Minimum apparent porosity   |                | %                  | 20              | %                       | 20             |
| <b>OIL IMPREGNATED</b>      |                |                    |                 |                         |                |
| Maximum sliding speed, U    |                | fpm                | 20 - 780*       | m/s                     | 0.1 - 4.0*     |
| Maximum pU factor           |                | psi x fpm          | 2 800 - 51 400  | N/mm <sup>2</sup> x m/s | 0.1 - 1.8*     |
| Coefficient of friction, f  |                |                    | 0.05 - 0.25*    |                         | 0.05 - 0.25*   |
| <b>RECOMMENDATIONS</b>      |                |                    |                 |                         |                |
| Shaft surface roughness, Ra |                | µin                | ≤ 8 - ≤ 12*     | µm                      | ≤ 0.2 - ≤ 0.3* |
| Shaft surface hardness      |                |                    | > 240 HB > 355* |                         |                |

Bearing properties depending on oil or solid lubricants

# GGB-S016 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



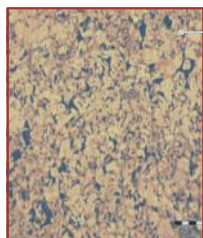
### AVAILABILITY

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



Cu 20 %  
C 0.3 - 0.6 %  
Other < 2%  
Rest Fe

### OPERATING PERFORMANCE

|                          |                           |
|--------------------------|---------------------------|
| Dry                      | Not applicable            |
| Oil lubricated           | Good<br>(Oil impregnated) |
| Grease lubricated        | Not recommended           |
| Water lubricated         | Not recommended           |
| Process fluid lubricated | Not recommended           |

| BEARING PROPERTIES          |         | IMPERIAL UNITS     | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|---------|--------------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |         |                    |                |                         |              |
| Maximum load, p             | Static  | psi                | 17 400         | N/mm <sup>2</sup>       | 120          |
|                             | Dynamic | psi                | 8 700          | N/mm <sup>2</sup>       | 60           |
| Operating temperature       | Min     | °F                 | 32             | °C                      | 0            |
|                             | Max     | °F                 | 220            | °C                      | 105          |
| Minimum density             |         | lb/in <sup>3</sup> | 0.22           | g/cm <sup>3</sup>       | 6            |
| Minimum apparent porosity   |         | %                  | 16             | %                       | 16           |
| <b>OIL IMPREGNATED</b>      |         |                    |                |                         |              |
| Maximum sliding speed, U    |         | fpm                | 59             | m/s                     | 0.3          |
| Maximum pU factor           |         | psi x fpm          | 25 700         | N/mm <sup>2</sup> x m/s | 0.9          |
| Coefficient of friction, f  |         |                    | 0.05 - 0.15*   |                         | 0.05 - 0.15* |
| <b>RECOMMENDATIONS</b>      |         |                    |                |                         |              |
| Shaft surface roughness, Ra |         | µin                | ≤ 8*           | µm                      | ≤ 0.2*       |
| Shaft surface hardness      |         |                    | > 355 HB       |                         |              |

Bearing properties depending on oil or solid lubricants

# GGB-SHB Bearing Material



## 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

## 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

### 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                      |         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---|---------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                          |         |                |                |                         |              |
| Maximum load, p                         | Static  | psi            | 43 500         | N/mm <sup>2</sup>       | 300          |
|   | Dynamic | psi            | 21 500         | N/mm <sup>2</sup>       | 150          |
| Tensile strength                        |         | psi            | 79 750         | N/mm <sup>2</sup>       | 550          |
| Operating temperature                   | Min     | °F             | 302            | °C                      | 150          |
| Density                                 |         |                | 0.282          |                         | 7.8          |
| Coefficient of linear thermal expansion |         | %              | 6.76           | %                       | 12           |
| <b>GREASE LUBRICATED</b>                |         |                |                |                         |              |
| Maximum sliding speed, U                |         | fpm            | 19.7           | m/s                     | 0.1          |
| Maximum pU factor                       |         | psi x fpm      | 42 000         | N/mm <sup>2</sup> x m/s | 1.5          |
| Coefficient of friction, f              |         |                | 0.2            |                         | 0.2          |
| <b>RECOMMENDATIONS</b>                  |         |                |                |                         |              |
| Shaft surface roughness, Ra             |         | µin            | ≤ 31.5         | µm                      | ≤ 0.8        |
| Shaft surface hardness                  |         |                | 58 - 62 HRC    |                         |              |

*Bearing properties depending on oil or solid lubricants*

## AuGlide™ Bearing Material

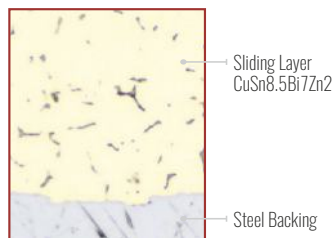


### BIMETAL LEAD-FREE PLAIN BEARINGS

#### 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

#### MICROSECTION



#### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Poor      |
| Oil lubricated           | Good      |
| Grease lubricated        | Very good |
| Water lubricated         | Poor      |
| Process fluid lubricated | Poor      |



#### 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

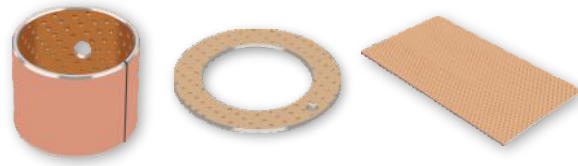
**Industrial:** Agricultural machinery, earth-movers, textile machinery, pneumatic equipment, mechanical handling and lifting equipment, hydraulic cylinders, offhighway equipment, and many more.

- 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

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 44 000         | N/mm <sup>2</sup>       | 300          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | - 40           | °C                      | - 40         |
|                             | Max greased             | °F             | 300            | °C                      | 150          |
|                             | Max oil lubricated      | °F             | 480            | °C                      | 250          |
| <b>OIL LUBRICATED</b>       |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor           |                         | psi x fpm      | 80 000         | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f  | Greased                 |                | 0.05 - 0.12    |                         | 0.05 - 0.12  |
|                             | Oil                     |                | 0.04 - 0.12    |                         | 0.04 - 0.12  |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra | Normal                  | µin            | ≤ 32           | µm                      | ≤ 0.8        |
| Shaft surface hardness      | Normal                  |                | > 200 HB       |                         |              |
|                             | For longer service life |                | > 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



Sliding Layer with Lubrication Indents  
CuPb10Sn10 consists of Approx.  
Cu 80 %  
Pb 10 %  
Sn 10 %  
Steel Backing

### OPERATING PERFORMANCE

|                          |           |
|--------------------------|-----------|
| Dry                      | Poor      |
| Oil lubricated           | Good      |
| Grease lubricated        | Very good |
| Water lubricated         | Poor      |
| Process fluid lubricated | Poor      |

| BEARING PROPERTIES          |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |                         |                |                |                         |              |
| Maximum load, p             | Static                  | psi            | 44 000         | N/mm <sup>2</sup>       | 300          |
|                             | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 140          |
| Operating temperature       | Min                     | °F             | - 40           | °C                      | -40          |
|                             | Max greased             | °F             | 300            | °C                      | 150          |
|                             | Max oil lubricated      | °F             | 480            | °C                      | 250          |
| <b>OIL IMPREGNATED</b>      |                         |                |                |                         |              |
| Maximum sliding speed, U    |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor           |                         | psi x fpm      | 80 000         | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f  | Greased                 |                | 0.05 - 0.12    |                         | 0.05 - 0.12  |
|                             | Oil lubricated          |                | 0.04 - 0.12    |                         | 0.04 - 0.12  |
| <b>RECOMMENDATIONS</b>      |                         |                |                |                         |              |
| Shaft surface roughness, Ra |                         | µin            | ≤ 32           | µm                      | ≤ 0.8        |
| Shaft surface hardness      | Normal                  |                | > 200 HB       |                         |              |
|                             | For longer service life |                | > 350 HB       |                         |              |

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

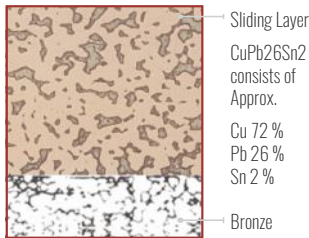
### AVAILABILITY

**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



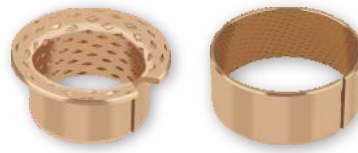
### OPERATING PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | Poor |
| Oil lubricated           | Good |
| Grease lubricated        | Good |
| Water lubricated         | Poor |
| Process fluid lubricated | Poor |

| BEARING PROPERTIES              |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---------------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                  |                         |                |                |                         |              |
| Maximum load, p                 | Static                  | psi            | 44 000         | N/mm <sup>2</sup>       | 250          |
|                                 | Dynamic                 | psi            | 20 000         | N/mm <sup>2</sup>       | 120          |
| Operating temperature           | Min                     | °F             | - 40           | °C                      | -40          |
|                                 | Max greased             | °F             | 300            | °C                      | 150          |
|                                 | Max oil lubricated      | °F             | 480            | °C                      | 250          |
| <b>GREASED / OIL LUBRICATED</b> |                         |                |                |                         |              |
| Maximum sliding speed, U        |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor               |                         | psi x fpm      | 80 000         | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f      | Greased                 |                | 0.05 - 0.12    |                         | 0.05 - 0.12  |
|                                 | Oil lubricated          |                | 0.04 - 0.12    |                         | 0.04 - 0.12  |
| <b>RECOMMENDATIONS</b>          |                         |                |                |                         |              |
| Shaft surface roughness, Ra     |                         | µin            | ≤ 16           | µm                      | ≤ 0.4        |
| Shaft surface hardness          | Normal                  |                | > 200 HB       |                         |              |
|                                 | For longer service life |                | > 350 HB       |                         |              |

*Bearing properties depending on oil or solid lubricants*

# MBZ-B09 Bearing Material



## BRONZE BEARINGS MADE OF CuSn8 WITH LUBRICATION INDENTS

### CHARACTERISTICS

- Bearing material made of solid bronze strip with indents for lubrication
- Good wear resistance, suitable for rough conditions
- Optimum performance under relatively high loads and low speeds

### AVAILABILITY

**Bearing forms available in standard dimensions:**

- Cylindrical bushes

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

### APPLICATIONS

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

### MICROSECTION



CuSn8 with  
Composition  
Sn 8 %  
P < 0.05 %  
Cu Rest

### OPERATING PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | Poor |
| Oil lubricated           | Good |
| Grease lubricated        | Good |
| Water lubricated         | Poor |
| Process fluid lubricated | Poor |

| BEARING PROPERTIES              |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---------------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                  |                         |                |                |                         |              |
| Maximum load, p                 | Static                  | psi            | 17 000         | N/mm <sup>2</sup>       | 120          |
|                                 | Dynamic                 | psi            | 6 000          | N/mm <sup>2</sup>       | 40           |
| Operating temperature           | Min                     | °F             | - 40           | °C                      | -40          |
|                                 | Max greased             | °F             | 300            | °C                      | 150          |
|                                 | Max oil lubricated      | °F             | 480            | °C                      | 250          |
| <b>GREASED / OIL LUBRICATED</b> |                         |                |                |                         |              |
| Maximum sliding speed, U        |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor               |                         | psi x fpm      | 80 000         | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f      |                         |                | 0.06 - 0.15    |                         | 0.06 - 0.15  |
| <b>RECOMMENDATIONS</b>          |                         |                |                |                         |              |
| Shaft surface roughness, Ra     |                         | µin            | ≤ 32           | µm                      | ≤ 0.8        |
| Shaft surface hardness          | Normal                  |                | > 200 HB       |                         |              |
|                                 | For longer service life |                | > 350 HB       |                         |              |

# LD Bearing Material



## BRONZE BEARINGS MADE OF CuSn8 WITH GREASE RESERVOIRS

### CHARACTERISTICS

- Wear resistant bearing made of solid bronze strip with perforation for lubricated applications
- Improved performance compared with MBZ-B09: larger grease reservoirs increase maintenance intervals, dirt and debris swept into perforations, thereby reducing wear
- Optimum performance under relatively high loads and low speeds

### AVAILABILITY

**Bearing forms made-to-order:** Cylindrical bushes with non-standard dimensions, customized bearing designs

### APPLICATIONS

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

### MICROSECTION



CuSn8 with Composition  
Sn 8 %  
P < 0.05 %  
Cu Rest

### OPERATING PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | Poor |
| Oil lubricated           | Fair |
| Grease lubricated        | Good |
| Water lubricated         | Poor |
| Process fluid lubricated | Poor |

| BEARING PROPERTIES              |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---------------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                  |                         |                |                |                         |              |
| Maximum load, p                 | Static                  | psi            | 17 000         | N/mm <sup>2</sup>       | 120          |
|                                 | Dynamic                 | psi            | 6 000          | N/mm <sup>2</sup>       | 40           |
| Operating temperature           | Min                     | °F             | - 40           | °C                      | -40          |
|                                 | Max greased             | °F             | 300            | °C                      | 150          |
| <b>GREASED / OIL LUBRICATED</b> |                         |                |                |                         |              |
| Maximum sliding speed, U        |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor               |                         | psi x fpm      | 80 000         | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f      |                         |                | 0.06 - 0.15    |                         | 0.06 - 0.15  |
| <b>RECOMMENDATIONS</b>          |                         |                |                |                         |              |
| Shaft surface roughness, Ra     |                         | µin            | ≤ 32           | µm                      | ≤ 0.8        |
| Shaft surface hardness          | Normal                  |                | > 200 HB       |                         |              |
|                                 | For longer service life |                | > 350 HB       |                         |              |

# LDD Bearing Material



## BRONZE BEARINGS MADE OF CuSn8 WITH GREASE RESERVOIRS

### CHARACTERISTICS

- Wear resistant, perforated bronze bearing material with integrated seals for lubricated applications
- Integrated lip seals reduce installation space, protect the bearing from contamination and prolong service life after greasing
- Suitable for use with all standard greases
- Optimum performance under relatively high loads and low speeds

### AVAILABILITY

**Bearing forms made-to-order:** Cylindrical bushes with non-standard dimensions, customized bearing designs

### APPLICATIONS

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

### MICROSECTION



CuSn8 with Composition  
Sn 8 %  
P < 0.05 %  
Cu Rest

### OPERATING PERFORMANCE

|                          |                 |
|--------------------------|-----------------|
| Dry                      | Not recommended |
| Oil lubricated           | Fair            |
| Grease lubricated        | Good            |
| Water lubricated         | Poor            |
| Process fluid lubricated | Poor            |

| BEARING PROPERTIES              |                         | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|---------------------------------|-------------------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>                  |                         |                |                |                         |              |
| Maximum load, p                 | Static                  | psi            | 17 000         | N/mm <sup>2</sup>       | 120          |
|                                 | Dynamic                 | psi            | 6 000          | N/mm <sup>2</sup>       | 40           |
| Operating temperature           | Min                     | °F             | - 40           | °C                      | -40          |
|                                 | Max greased             | °F             | 300            | °C                      | 150          |
| <b>GREASED / OIL LUBRICATED</b> |                         |                |                |                         |              |
| Maximum sliding speed, U        |                         | fpm            | 500            | m/s                     | 2.5          |
| Maximum pU factor               |                         | psi x fpm      | 80 000         | N/mm <sup>2</sup> x m/s | 2.8          |
| Coefficient of friction, f      |                         |                | 0.06 - 0.15    |                         | 0.06 - 0.15  |
| <b>RECOMMENDATIONS</b>          |                         |                |                |                         |              |
| Shaft surface roughness, Ra     |                         | µin            | ≤ 32           | µm                      | ≤ 0.8        |
| Shaft surface hardness          | Normal                  |                | > 200 HB       |                         |              |
|                                 | For longer service life |                | > 350 HB       |                         |              |

## GGB-DB<sup>®</sup> Bearing Material



### 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

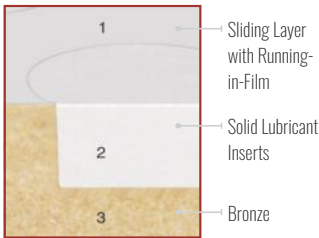
**Industrial:** Offshore industry, underwater equipment, bridges and civil engineering, iron and steel industry equipment, cranes and conveyors, deep and open cast mining equipment, construction and earthmoving equipment, etc.

### 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

#### MICROSECTION



#### OPERATING PERFORMANCE

|                          |      |
|--------------------------|------|
| Dry                      | Good |
| Oil lubricated           | Good |
| Grease lubricated        | Good |
| Water lubricated         | Good |
| Process fluid lubricated | Fair |

| BEARING PROPERTIES          |             | IMPERIAL UNITS | IMPERIAL VALUE | METRIC UNITS            | METRIC VALUE |
|-----------------------------|-------------|----------------|----------------|-------------------------|--------------|
| <b>GENERAL</b>              |             |                |                |                         |              |
| Maximum load, p             | Static      | psi            | 29 000         | N/mm <sup>2</sup>       | 200          |
|                             | Dynamic     | psi            | 15 000         | N/mm <sup>2</sup>       | 100          |
| Operating temperature       | Min         | °F             | - 60           | °C                      | -50          |
|                             | Max greased | °F             | 660            | °C                      | 350          |
| <b>DRY</b>                  |             |                |                |                         |              |
| Maximum sliding speed, U    |             | fpm            | 100            | m/s                     | 0.5          |
| Maximum pU factor           |             | psi x fpm      | 43 000         | N/mm <sup>2</sup> x m/s | 1.5          |
| Coefficient of friction, f  |             |                | 0.05 - 0.18    |                         | 0.05 - 0.18  |
| <b>RECOMMENDATIONS</b>      |             |                |                |                         |              |
| Shaft surface roughness, Ra |             | µin            | 8 - 32         | µm                      | 0.2 - 0.8    |
| Shaft surface hardness      | Normal      |                | > 200 HB       |                         |              |

# UNI Self-Aligning Bearing Housing



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

## 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  $\pm 5^\circ$
- 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

### LOAD LIMIT VALUES FOR RADIAL FORCES

| SIZE | BUSH ID  | MAX RADIAL LOAD [N]<br>(HOUSING) | MAX RADIAL LOAD [N]<br>(BOLT) | MAX SHEAR OFF LOAD [N]<br>(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                            |

### LOAD LIMIT VALUES FOR RADIAL FORCES

| SIZE | BUSH ID  | MAX RADIAL LOAD [lb]<br>(HOUSING) | MAX RADIAL LOAD [lb]<br>(BOLT) | MAX SHEAR OFF LOAD [lb]<br>(BOLT) |
|------|----------|-----------------------------------|--------------------------------|-----------------------------------|
| 1    | 10 - 25  | 4 400                             | 2 200                          | 220                               |
| 2    | 28 - 40  | 6 700                             | 3 300                          | 330                               |
| 3    | 45 - 60  | 11 200                            | 5 600                          | 560                               |
| 4    | 65 - 80  | 20 100                            | 10 000                         | 1 000                             |
| 5    | 85 - 100 | 28 000                            | 14 000                         | 1 300                             |

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**

## 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

## 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  $\pm 5^\circ$
- 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

### LOAD LIMIT VALUES FOR RADIAL FORCES

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

### LOAD LIMIT VALUES FOR RADIAL FORCES

| SIZE | BUSH ID | MAX RADIAL LOAD [lb]<br>(HOUSING) | MAX RADIAL LOAD [lb]<br>(BOLT) | MAX SHEAR OFF LOAD [lb]<br>(BOLT) |
|------|---------|-----------------------------------|--------------------------------|-----------------------------------|
| 0    | 8 - 15  | 2 200                             | 1 100                          | 110                               |

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  $\pm 5^\circ$
- 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 | TYPE PB 2-HOLE PEDESTAL BEARING | TYPE FL/DF 4-HOLE / 2-HOLE FLANGE BEARING |
|-------------------------------------|----------|---------------------------------|---|---------------------------------|---|
| SIZE                                | BUSH ID  | MAX RADIAL LOAD [lb]            | MAX RADIAL LOAD [lb]                      | MAX RADIAL LOAD [N]             | MAX RADIAL LOAD [N]                       |
| 1                                   | 10 - 15  | 20 000                          | 950                                       | 4 250                           | 3 750                                     |
| 2                                   | 20 - 25  | 30 000                          | 1 700                                     | 7 700                           | 5 900                                     |
| 3                                   | 30       | 50 000                          | 2 100                                     | 9 500                           | 8 000                                     |
| 4                                   | 35 - 40  | 90 000                          | 3 800                                     | 17 000                          | 11 000                                    |
| 5                                   | 45       | 125 000                         | 5 100                                     | 23 000                          | 12 000                                    |
| 6                                   | 50       | 20 000                          | 5 600                                     | 25 000                          | 14 500                                    |
| 7                                   | 55 - 60  | 20 000                          | 6 700                                     | 30 000                          | 16 000                                    |
| 8                                   | 70 - 75  | 30 000                          | 8 500                                     | 38 000                          | 17 000                                    |
| 9                                   | 80 - 85  | 50 000                          | 10 200                                    | 45 500                          | 27 000                                    |
| 10                                  | 90 - 100 | 90 000                          | 16 700                                    | 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: [usa@ggbearings.com](mailto:usa@ggbearings.com)

## DATA FOR BEARING DESIGN CALCULATION

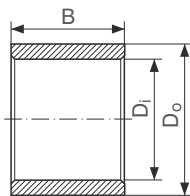
Application: \_\_\_\_\_

Project/No.: \_\_\_\_\_ Quantity: \_\_\_\_\_  New Design  Existing Design

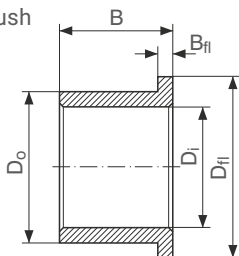
Steady load  Rotating load  Rotational movement  Oscillating movement  Linear movement

### BEARING TYPE

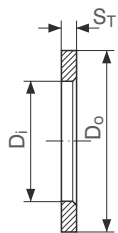
Cylindrical bush



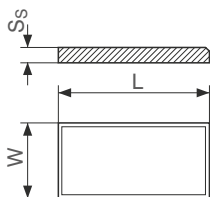
Flanged bush



Thrust washer



Slideplate



Special parts (sketch)

### DIMENSIONS [MM]

|                         |     |
|-------------------------|-----|
| Inside diameter         | Di  |
| Outside diameter        | Do  |
| Length                  | B   |
| Flange Diameter         | Dfl |
| Flange thickness        | Bfl |
| Wall thickness          | ST  |
| Length of slideplate    | L   |
| Width of slideplate     | W   |
| Thickness of slideplate | Ss  |

### LOAD

|                                       |
|---------------------------------------|
| <input type="checkbox"/> Static load  |
| <input type="checkbox"/> Dynamic load |
| Axial load F [N]                      |
| Radial load F [N]                     |

### MOVEMENT

|                     |              |
|---------------------|--------------|
| Rotational speed    | N [1/min]    |
| Speed               | U [m/s]      |
| Length of stroke    | Ls [mm]      |
| Frequency of stroke | [1/min]      |
| Oscillating cycle   | $\phi$ [°]   |
| Osc. frequency      | Nosz [1/min] |

### MATING SURFACE

|                |         |
|----------------|---------|
| Material       |         |
| Hardness       | HB/HRC  |
| Surface finish | Ra [µm] |

### CUSTOMER INFORMATION

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

### FITS & TOLERANCES

|                 |    |
|-----------------|----|
| Shaft           | Dj |
| Bearing housing | Dh |

### OPERATING ENVIRONMENT

|   |          |
|---|----------|
| Ambient temperature   | Tamb [°] |
| Bearing housing material  |          |
| <input type="checkbox"/> Housing with good heating transfer properties                          |          |
| <input type="checkbox"/> Light pressing or insulated housing with poor heat transfer properties |          |
| <input type="checkbox"/> Non metal housing with poor heat transfer properties                   |          |
| <input type="checkbox"/> Alternate operation in water and dry                                   |          |

### LUBRICATION

|  |               |
|--|---------------|
| <input type="checkbox"/> Dry                       |               |
| <input type="checkbox"/> Continuous lubrication    |               |
| <input type="checkbox"/> Process fluid lubrication |               |
| <input type="checkbox"/> Initial lubrication only  |               |
| <input type="checkbox"/> Hydrodynamic conditions   |               |
| Process fluid                                      |               |
| Lubricant  |               |
| Dynamic viscosity                                  | $\eta$ [mPas] |

### SERVICE HOURS PER DAY

|                        |
|------------------------|
| Continuous operation   |
| Intermittent operation |
| Operating time         |
| Days per year          |

### SERVICE LIFE

|                       |        |
|-----------------------|--------|
| Required service life | Lh [h] |
|-----------------------|--------|

# Product Information

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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.

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GGB is committed to adhering to all U.S., European and international standards and regulations with regard to lead content. We have established internal processes that monitor any changes to existing standards and regulations, and we work collaboratively with customers and distributors to ensure that all requirements are strictly followed. This includes RoHS and REACH guidelines.

GGB makes it a top priority to operate in an environmentally conscious and safe manner. We follow numerous industry best practices, and are committed to meeting or exceeding a variety of internationally recognized standards for emissions control and workplace safety.

Each of our global locations has management systems in place that adhere to IATF 16949, ISO 9001, ISO 14001 and ISO 45001 quality regulations.

All of our certificates can be found here: <https://www.ggbearings.com/en/company/certificates>. A detailed explanation of our commitment to REACH and RoHS directives can be found at <https://www.ggbearings.com/en/company/quality-and-environment>.

## FABRICATION

At temperatures up to 250°C the polytetrafluoroethylene (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.

GGB®, DP4, DP4-B, DU®, DU-B, DP10, DP11, DP31, DX®, DX®10, HI-EX®, DTS10®, DS, EP®, EP®12, EP®15, EP®22, EP®30, EP®43, EP®44, EP®63, EP®64, EP®73, EP®79, FLASH-CLICK®, KA Glacetal, Multilube, GAR-MAX®, GAR-FIL®, HSG, MLG, HPM, HPMB®, HPF®, GGB-MEGALIFE® XT, Multifil, SBC with GAR-MAX®, SBC with HSG, GGB-CSM®, GGB-CBM®, GGB-BP25, GGB-FP20, GGB-SHB, GGB-SO16, AuGlide™, SY, SP, GGB-DB®, UNI, MINI and EXALIGN™ are registered trademarks or trademarks, as the case may be, of GGB and its affiliates.

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# PUSHING BOUNDARIES TO CO-CREATE A HIGHER QUALITY OF LIFE



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