Product Range

OTHER MARKETS
The Tribological Solution Provider for Industrial Progress, Regardless of Shape or Material

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

GGB is an EnPro Industries company (NYSE: NPO).

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

- Aerospace
- Agricultural
- Automotive
- Railway
- Industrial
- Primary Metals
- Recreation
- Construction
- Oil & Gas
- Energy
- Fluid Power
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.

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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, ISO14001 and OHSAS 18001. 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)
WHY IS TRIBOLOGY IMPORTANT

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
FOR MORE THAN 115 YEARS, GGB HAS IMPROVED SURFACE ENGINEERING TO MOVE THE WORLD FORWARD.

GGB began in 1899 as Glacier Antifriction Metal Company, producing plain bearings and introducing many successful new products to the market, including internationally recognized polymer materials. Over the past 115 years, our company has continued forming strategic partnerships, continuously expanding into a global network of manufacturing facilities, increasing production capabilities and resources to become who we are today: world leaders in tribological innovation.

Today, our products can be found everywhere – from scientific vessels at the bottom of the ocean to race cars speeding down the tarmac to jumbo jets slicing through the sky to the Curiosity rover exploring the surface of Mars.

Throughout our history, safety, excellence and respect have formed the foundational values for the entire GGB family. They are of paramount importance as we seek to maximize personal possibility, achieve excellence and establish open, creative work environments with the highest safety standards in the industry.

SAFETY

GGB’s deep-rooted culture of safety places a relentless focus on creating a secure, healthy work environment for all. A core value of GGB, safety is critical at all levels of business in order to achieve our goal of having the safest employees in the industry.

EXCELLENCE

A world-class organization is built by fostering excellence throughout the company, across all roles. Our world-class manufacturing plants are certified in quality and excellence in the industry according to ISO 9001, IATF 16949, ISO 14001 and OHSAS 18001, allowing us to access the industry’s best practices while aligning our quality management system with global standards.

RESPECT

We believe that respect is consistent with the growth of individuals and groups. Our teams work together with mutual respect regardless of background, nationality or function, embracing the diversity of people and learning from one another.
# Overview of Bearing Materials & Accessory Products

## TRIBOLOGICAL BEARINGS

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>METAL-POLYMER BEARINGS</th>
<th>WORKING CONDITIONS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP4®</td>
<td>Steel + Porous Bronze Sinter + PTFE + Fillers</td>
<td>self-lubricating, low-maintenance</td>
<td>9</td>
</tr>
<tr>
<td>DP4-B</td>
<td>Bronze + Porous Bronze Sinter + PTFE + Fillers</td>
<td>self-lubricating, corrosion-resistant</td>
<td>10</td>
</tr>
<tr>
<td>DU®</td>
<td>Steel + Porous Bronze Sinter + PTFE + Pb</td>
<td>self-lubricating</td>
<td>11</td>
</tr>
<tr>
<td>DU-B</td>
<td>Bronze + Porous Bronze Sinter + PTFE + Pb</td>
<td>self-lubricating, corrosion-resistant</td>
<td>12</td>
</tr>
<tr>
<td>DP10</td>
<td>Steel + Porous Bronze Sinter + PTFE + Solid Lubricants</td>
<td>self-lubricating, low-maintenance</td>
<td>13</td>
</tr>
<tr>
<td>DP11</td>
<td>Steel + Porous Bronze Sinter + PTFE + Solid Lubricants + Fillers</td>
<td>self-lubricating, low-maintenance</td>
<td>14</td>
</tr>
<tr>
<td>DP31</td>
<td>Steel + Porous Bronze Sinter + Fluoropolymer + Fillers</td>
<td>low-maintenance</td>
<td>15</td>
</tr>
<tr>
<td>DX®</td>
<td>Steel + Porous Bronze Sinter + POM with Lubrication indents</td>
<td>low-maintenance, machinable</td>
<td>16</td>
</tr>
<tr>
<td>DX-10</td>
<td>Steel + Porous Bronze Sinter + High Tech Polymer with Lubrication indents</td>
<td>low-maintenance, machinable</td>
<td>17</td>
</tr>
<tr>
<td>HI-EX®</td>
<td>Steel + Porous Bronze Sinter + PEEK + PTFE + Fillers</td>
<td>low-maintenance, machinable</td>
<td>18</td>
</tr>
<tr>
<td>DTS10®</td>
<td>Steel + Porous Bronze Sinter + PTFE + Fillers</td>
<td>low-maintenance, machinable</td>
<td>19</td>
</tr>
<tr>
<td>DS</td>
<td>Steel + Porous Bronze Sinter + POM Modified</td>
<td>self-lubricating, low-maintenance</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>ENGINEERED PLASTIC BEARINGS</th>
<th>WORKING CONDITIONS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP®</td>
<td>PA6.6T + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>21</td>
</tr>
<tr>
<td>EP=12</td>
<td>POM + Solid Lubricant</td>
<td>self-lubricating</td>
<td>22</td>
</tr>
<tr>
<td>EP=15</td>
<td>POM + Solid Lubricant</td>
<td>self-lubricating</td>
<td>23</td>
</tr>
<tr>
<td>EP=22</td>
<td>PBT + Solid Lubricant</td>
<td>self-lubricating</td>
<td>24</td>
</tr>
<tr>
<td>EP=30</td>
<td>PA 6.6 + AF + Solid Lubricant</td>
<td>self-lubricating</td>
<td>25</td>
</tr>
<tr>
<td>EP=43</td>
<td>PPS + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>26</td>
</tr>
<tr>
<td>EP=44</td>
<td>PPS + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>27</td>
</tr>
<tr>
<td>EP=63</td>
<td>PEEK + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>28</td>
</tr>
<tr>
<td>EP=64</td>
<td>PEEK + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>29</td>
</tr>
<tr>
<td>EP=73</td>
<td>PAI + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>30</td>
</tr>
<tr>
<td>EP=79</td>
<td>PAI + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>31</td>
</tr>
<tr>
<td>KA Glacetal</td>
<td>POM</td>
<td>self-lubricating, low-maintenance</td>
<td>32</td>
</tr>
<tr>
<td>Multilube</td>
<td>POM + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>33</td>
</tr>
</tbody>
</table>
## Fiber Reinforced Composite Bearings

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>FIBER REINFORCED COMPOSITE BEARINGS</th>
<th>WORKING CONDITIONS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAR-MAX®</td>
<td>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</td>
<td>self-lubricating</td>
<td>34</td>
</tr>
<tr>
<td>GAR-FIL</td>
<td>Proprietary filled PTFE tape liner + continuous wound fiberglass encapsulated in a high temperature epoxy resin</td>
<td>self-lubricating</td>
<td>35</td>
</tr>
<tr>
<td>HSG</td>
<td>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</td>
<td>self-lubricating</td>
<td>36</td>
</tr>
<tr>
<td>MLG</td>
<td>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</td>
<td>self-lubricating</td>
<td>37</td>
</tr>
<tr>
<td>HPM</td>
<td>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</td>
<td>self-lubricating</td>
<td>38</td>
</tr>
<tr>
<td>HPM®</td>
<td>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</td>
<td>self-lubricating</td>
<td>39</td>
</tr>
<tr>
<td>HPF</td>
<td>Proprietary filled PTFE tape liner + continuous woven cloth laminate impregnated and cured with epoxy resin</td>
<td>self-lubricating</td>
<td>40</td>
</tr>
<tr>
<td>GGB-MEGALIFE® XT</td>
<td>Proprietary filled PTFE tape liner on both sides + continuously woven layer of filament glass fiber encapsulated in a high temperature epoxy resin</td>
<td>self-lubricating</td>
<td>41</td>
</tr>
<tr>
<td>MultiFl</td>
<td>PTFE + proprietary filler system</td>
<td>self-lubricating</td>
<td>42</td>
</tr>
<tr>
<td>SBC with GAR-MAX®</td>
<td>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.</td>
<td>self-lubricating, low-maintenance</td>
<td>43</td>
</tr>
<tr>
<td>SBC with HSG</td>
<td>Composite material with sealing SBC bearings are available with HSG are sealed to exclude containments. SBC are optionally available with a steel outer shell.</td>
<td>self-lubricating, low-maintenance</td>
<td>44</td>
</tr>
</tbody>
</table>

## Metal & Bimetal Bearings

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>METAL &amp; BIMETAL BEARINGS</th>
<th>WORKING CONDITIONS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PyroSlide™1100</td>
<td>Powder metallurgical monometallic bearing material consisting of a solid lubricant homogeneously distributed in a metallic matrix</td>
<td>self-lubricating</td>
<td>45</td>
</tr>
<tr>
<td>GGB-CSM®</td>
<td>Powder metallurgical monometallic bearing material (bronze, nickel or iron-based) + solid graphite lubricant, MoS₂</td>
<td>self-lubricating</td>
<td>46</td>
</tr>
<tr>
<td>GGB-CBM®</td>
<td>Thin walled powder metallurgical bimetal bearing material stainless steel, carbon steel or bronze with bronze + based backing): + solid graphite lubricant</td>
<td>self-lubricating</td>
<td>47</td>
</tr>
<tr>
<td>GGB-BP25</td>
<td>Sintered bronze impregnated with oil, similar to SINT A 50, impregnation group 1</td>
<td>self-lubricating</td>
<td>48</td>
</tr>
<tr>
<td>GGB-FP20</td>
<td>Steel alloy sinter impregnated with oil, similar to SINT A 10, impregnation group 1</td>
<td>self-lubricating</td>
<td>49</td>
</tr>
<tr>
<td>GGB-SO16</td>
<td>Sintered steel alloy impregnated with oil</td>
<td>self-lubricating</td>
<td>50</td>
</tr>
<tr>
<td>GGB-SHR®</td>
<td>Case hardened steel bearings for lubricated applications</td>
<td>conventional lubrication</td>
<td>51</td>
</tr>
<tr>
<td>AuGlide™</td>
<td>Steel backing and lead-free bronze overlay</td>
<td>low-maintenance</td>
<td>52</td>
</tr>
<tr>
<td>SY</td>
<td>Steel backing and leaded bronze overlay + CuPb10Sn10</td>
<td>low-maintenance</td>
<td>53</td>
</tr>
<tr>
<td>SP</td>
<td>Steel backing and leaded bronze overlay + CuPb26Sn2</td>
<td>low-maintenance</td>
<td>54</td>
</tr>
<tr>
<td>MBZ-B09</td>
<td>Monometallic material CuSn8</td>
<td>self-lubricating</td>
<td>55</td>
</tr>
<tr>
<td>LD®</td>
<td>Monometallic material CuSn8</td>
<td>self-lubricating</td>
<td>56</td>
</tr>
<tr>
<td>LDD®</td>
<td>Monometallic material CuSn8</td>
<td>self-lubricating</td>
<td>57</td>
</tr>
<tr>
<td>GGB-DB®</td>
<td>Dry bearing material: cast bronze + solid lubricant inserts</td>
<td>self-lubricating</td>
<td>58</td>
</tr>
<tr>
<td>Solid Bronze</td>
<td>Solid bronze alloy bearings</td>
<td>conventional lubrication</td>
<td>59</td>
</tr>
</tbody>
</table>
### ACCESSORY PRODUCTS

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>BUSHING BLOCKS &amp; THRUST PLATES</th>
<th>WORKING CONDITIONS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SICAL 3 / SICAL 3D</td>
<td>Aluminum alloys, for use with different GGB cylindrical bushes</td>
<td>depends on bearing material</td>
<td>60</td>
</tr>
<tr>
<td>PICAL 2 / PICAL 3</td>
<td>Aluminum alloys, for use with different GGB cylindrical bushes</td>
<td>depends on bearing material</td>
<td>61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>BEARING ASSEMBLIES</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNI</td>
<td>Self-aligning bearing housings</td>
<td>62</td>
</tr>
<tr>
<td>MINI</td>
<td>Self-aligning bearing housings</td>
<td>63</td>
</tr>
<tr>
<td>EXALIGN®</td>
<td>Self-aligning bearing housings</td>
<td>64</td>
</tr>
</tbody>
</table>

### ADDITIONAL INFORMATION

- Technical Data Sheet | 65
- Product Information / Fabrication | 66
**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.

**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.

**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.

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th><strong>GENERAL</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>250</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-200</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
<td>11</td>
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<table>
<thead>
<tr>
<th><strong>DRY</strong></th>
<th><strong>VALUES</strong></th>
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</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
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</table>

<table>
<thead>
<tr>
<th><strong>OIL LUBRICATED</strong></th>
<th><strong>VALUES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>RECOMMENDATIONS</strong></th>
<th><strong>VALUES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td></td>
</tr>
</tbody>
</table>

* 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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>VALUE</th>
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<tbody>
<tr>
<td><strong>GENERAL</strong></td>
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<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min Max</td>
<td>°C</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Parallel to the surface Normal to the surface</td>
<td>10⁶/K</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
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<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
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<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,04 - 0,25*</td>
</tr>
<tr>
<td><strong>OIL LUBRICATED</strong></td>
<td></td>
<td></td>
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<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>5,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,02 - 0,08*</td>
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<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>Dry Lubricated</td>
<td>μm</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</td>
<td>HB</td>
</tr>
</tbody>
</table>

* Depending on operating conditions
DU® Bearing Material

METAL-POLYMER ANTI-FRICTION PLAIN BEARINGS

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

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.

BEARING MATERIAL
CHARACTERISTICS
- Metal-polymer anti-friction plain bearings

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic N/mm²</td>
<td>250</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
<td>-200</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Parallel to the surface 10⁴/K</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Normal to the surface 10⁴/K</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2.5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1.8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>0.02 - 0.25*</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OIL LUBRICATED</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>5.0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>5.0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>0.02 - 0.12</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>Dry Lubricated µm</td>
<td>0.3 - 0.5</td>
</tr>
<tr>
<td></td>
<td>Lubricated µm</td>
<td>≤ 0.05 - 0.4*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</td>
<td>HB</td>
</tr>
</tbody>
</table>

* 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

APPLICATIONS

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic</td>
<td>N/mm² N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min Max</td>
<td>°C °C</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Parallel to the surface Normal to the surface</td>
<td>10⁻⁶/K 10⁻⁶/K</td>
</tr>
</tbody>
</table>

DRY

<table>
<thead>
<tr>
<th>Dry</th>
<th>Oil lubricated</th>
<th>Grease lubricated</th>
<th>Water lubricated</th>
<th>Process fluid lubricated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>Fair</td>
</tr>
</tbody>
</table>

FOR SUPERIOR / LEAD-FREE PERFORMANCE

<table>
<thead>
<tr>
<th>Dry</th>
<th>Oil lubricated</th>
<th>Grease lubricated</th>
<th>Water lubricated</th>
<th>Process fluid lubricated</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP4-B</td>
<td>DP4-B</td>
<td>DP4-B</td>
<td>DP4-B</td>
<td>DP4-B</td>
</tr>
</tbody>
</table>

ORY LUBRICATED

<table>
<thead>
<tr>
<th>Dry</th>
<th>Oil lubricated</th>
<th>Grease lubricated</th>
<th>Water lubricated</th>
<th>Process fluid lubricated</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP4-B</td>
<td>DP4-B</td>
<td>DP4-B</td>
<td>DP4-B</td>
<td>DP4-B</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Shaft surface roughness, Ra</th>
<th>Dry Lubricated</th>
<th>μm</th>
<th>μm</th>
<th>0,3 - 0,5</th>
<th>≤ 0,05 - 0,4*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</td>
<td>HB</td>
<td></td>
<td>&gt; 200</td>
<td></td>
</tr>
</tbody>
</table>

* 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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>°C</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Parallel to the surface</td>
<td>10⁶/K</td>
</tr>
<tr>
<td></td>
<td>Normal to the surface</td>
<td>10⁶/K</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,03 - 0,25*</td>
</tr>
<tr>
<td><strong>OIL LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>5,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,02 - 0,08</td>
</tr>
</tbody>
</table>

FOR SUPERIOR PERFORMANCE

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

RECOMMENDATIONS

Shaft surface roughness, Ra

<table>
<thead>
<tr>
<th>Shaft surface roughness, Ra</th>
<th>Dry</th>
<th>Lubricated</th>
<th>μm</th>
<th>μm</th>
<th>≤ 0,05 - 0,4*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</td>
<td>HB</td>
<td>&gt; 200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Depending on operating conditions
**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

**APPLICATIONS**
- **Automotive:** Belt tensioners, clutches, dual mass fly-wheels, pulley dampers, etc.
- **Industrial:** Applications with high frequency and low amplitude oscillating movements

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic N/mm²</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>°C</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Parallel to the surface 10²/K</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Normal to the surface 10²/K</td>
<td>30</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,04 - 0,25*</td>
</tr>
<tr>
<td><strong>OIL LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>5,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,02 - 0,08</td>
</tr>
</tbody>
</table>

| **RECOMMENDATIONS**   |       |       |
| Shaft surface roughness, Ra | Dry/Lubricated µm | 0,3 - 0,5 |
|                       | µm    | ≤ 0,05 - 0,4* |
| Shaft surface hardness | Unhardened acceptable, improved bearing life | HB | > 200 |

* Depending on operating conditions

---

**OPERATING PERFORMANCE**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Fair</td>
<td></td>
</tr>
</tbody>
</table>

---

**FOR SUPERIOR PERFORMANCE**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease lubricated</td>
<td>DP4 / DX</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>DP4-B</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>DP4 / DP31</td>
<td></td>
</tr>
</tbody>
</table>
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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td>Max</td>
<td>°C</td>
<td>280</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Parallel to the surface</td>
<td>10⁶/K</td>
</tr>
<tr>
<td></td>
<td>Normal to the surface</td>
<td>10⁶/K</td>
</tr>
</tbody>
</table>

OIL LUBRICATED

| Maximum sliding speed, U       | m/s   | 10,0 |
| Maximum pU factor              | N/mm² x m/s | 10,0 |
| Coefficient of friction, f     |       | 0,01 - 0,05 |

RECOMMENDATIONS

| Shaft surface roughness, Ra    | Lubricated | µm   | ≤ 0,05 - 0,4* |
| Shaft surface hardness         | Unhardened acceptable, improved bearing life | HB   | > 200 |

* Depending on operating conditions

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

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

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

MICROSECTION
- Sliding layer
  - PTFE + Solid Lubricant + Fillers
- Pores: Bronze Sinter
- Steel Backing

FOR SUPERIOR PERFORMANCE
- Steel Backing: Sliding layer
  - PTFE + Solid Lubricant + Fillers
- Porous Bronze: Sinter

UNITS
- VALUE
  - > 200
  - HB
**DX® Bearing Material**

**METAL-POLYMER PLAIN BEARINGS**

**GREASE LUBRICATION**

**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

**APPLICATIONS**

**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

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th>General</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-40</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10²/K</td>
<td>11</td>
</tr>
</tbody>
</table>

**OIL LUBRICATION**

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>μm</td>
<td>0,06 - 0,12</td>
</tr>
</tbody>
</table>

**RECOMMENDATIONS**

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>≤ 0,4</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

"Depending on operating conditions"
DX®10 Bearing Material

METAL-POLYMER PLAIN BEARINGS
GREASE LUBRICATED

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>250</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>175</td>
</tr>
<tr>
<td><strong>GREASE LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,01 - 0,10</td>
</tr>
<tr>
<td><strong>OIL LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,01 - 0,06</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS
- Shaft surface roughness, Ra: Normal: μm, ≤ 0,4
- Shaft surface hardness: For longer service life: HB, > 200
- For longer service life: HB, > 350

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

FOR SUPERIOR PERFORMANCE
- Dry: GAR-MAX / HBG / GAR-FIL / MLG
- Water lubricated: HPM / HPF / DP4-B
- Process fluid lubricated: DP4 / Hi-EX / GAR-FIL

MICROSECTION
- Sliding layer
- High-Tech Polymer
- Porous Bronze Sinter
- Steel Backing

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
HI-EX® Bearing Material

**METAL-POLYMER HYDRONAMIC COMPOSITE BEARINGS**

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

**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

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th><strong>BEARING PROPERTIES</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>°C</td>
</tr>
<tr>
<td>Coefficient of linear</td>
<td>Parallel to the surface</td>
<td>10⁶/K</td>
</tr>
<tr>
<td>thermal expansion</td>
<td>Normal to the surface</td>
<td>10⁶/K</td>
</tr>
</tbody>
</table>

**GREASE LUBRICATED**

<table>
<thead>
<tr>
<th><strong>BEARING PROPERTIES</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,08 - 0,12</td>
</tr>
</tbody>
</table>

**OIL LUBRICATED**

<table>
<thead>
<tr>
<th><strong>BEARING PROPERTIES</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,03 - 0,08</td>
</tr>
</tbody>
</table>

**RECOMMENDATIONS**

<table>
<thead>
<tr>
<th><strong>BEARING PROPERTIES</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>≤ 0,05 - 0,4*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>

* Depending on operating conditions

**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

**OPERATING PERFORMANCE**

<table>
<thead>
<tr>
<th><strong>OPERATING PERFORMANCE</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Fair</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Good</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Good</td>
</tr>
</tbody>
</table>

**FOR SUPERIOR PERFORMANCE**

<table>
<thead>
<tr>
<th><strong>FOR SUPERIOR PERFORMANCE</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>GAR-MAX / HBG / GAR-FIL / MLG</td>
</tr>
</tbody>
</table>
DTS10® Bearing Material

METAL-POLYMER HYDRONAMIC COMPOSITE BEARINGS

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

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

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td>Max °C</td>
<td>280</td>
</tr>
<tr>
<td><strong>FLUID LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>100*</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,01 - 0,08</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,05 - 0,2*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

* Depending on operating conditions

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

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

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
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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>110</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-60</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Dry lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>HPM / HPF / DP4-B</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>DP4 / GAR-FIL / Hi-EX</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
<td></td>
</tr>
</tbody>
</table>

RECOMMENDATIONS
- Shaft surface roughness, Ra | μm | ≤ 0.4 |
- Shaft surface hardness | Normal HB | > 200 |
- For longer service life | HB | > 350 |

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

MICROSECTION
- Sliding layer
- POM + Fillers
- Porous Bronze Sinter
- Steel Backing

FOR SUPERIOR PERFORMANCE
- Water lubricated | HPM / HPF / DP4-B |
- Process fluid lubricated | DP4 / GAR-FIL / Hi-EX |
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

APPLICATIONS
General: Generally applicable within the limits of the material properties
Industrial: Medical equipment, awnings and blinds, scientific equipment, gaming equipment, office equipment, etc.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>80</td>
</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>40</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-40</td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td>140</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>22</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>for A_u/A_c = 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for A_u/A_c = 10</td>
<td>N/mm² x m/s</td>
<td>0,06</td>
</tr>
<tr>
<td>for A_u/A_c = 20</td>
<td>N/mm² x m/s</td>
<td>0,24</td>
</tr>
<tr>
<td>for A_u/A_c = 20</td>
<td>N/mm² x m/s</td>
<td>1,00</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,15 - 0,3</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>
**EP®12 Bearing Material**

---

**SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS**

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

**AVAILABILITY**

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

**APPLICATIONS**

**General:** Generally applicable within the limits of the material properties
**Industrial:** Domestic appliances, furniture, office equipment, sports equipment and many more

---

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th><strong>GENERAL</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, ( p )</td>
<td>N/mm²</td>
<td>65</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-40 to 125</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>( 10^6/K )</td>
<td>120</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DRY</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, ( U )</td>
<td>m/s</td>
<td>1.0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td></td>
</tr>
<tr>
<td>for ( A_u/A_c = 5 )</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>for ( A_u/A_c = 10 )</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>for ( A_u/A_c = 20 )</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0.18 - 0.3</td>
</tr>
</tbody>
</table>

**RECOMMENDATIONS**

<table>
<thead>
<tr>
<th><strong>FOR SUPERIOR PERFORMANCE</strong></th>
<th><strong>VALUES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lubricated</td>
<td>EP22</td>
</tr>
<tr>
<td>Shaft surface roughness, ( Ra )</td>
<td>( \mu m )</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
</tr>
</tbody>
</table>
EP®15 Bearing Material

UV-RESISTANT BEARINGS FOR SUN & OUTDOOR APPLICATIONS

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

MICROSECTION

POM + PTFE + UV Stabilizer

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Lubrication</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Very good</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Good</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Good after resistance testing</td>
</tr>
</tbody>
</table>

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>STANDARD</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charpy unnotched impact strength</td>
<td>ISO 179/1eU</td>
<td>kJ/m²</td>
<td>45</td>
</tr>
<tr>
<td>Charpy notched impact strength</td>
<td>ISO 179/1eA</td>
<td>kJ/m²</td>
<td>4,5</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>ISO 11359-2:1999-10</td>
<td>x10⁻⁶</td>
<td>120</td>
</tr>
<tr>
<td>Minimum temperature</td>
<td>°C / °F</td>
<td>-40 / -40</td>
<td></td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>°C / °F</td>
<td>125 / 260</td>
<td></td>
</tr>
<tr>
<td>Maximum extended temperature limit</td>
<td>°C / °F</td>
<td>125 / 260</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>DIN EN ISO 1183-1:2013-04</td>
<td>g/cm³</td>
<td>1,5</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>DIN EN ISO 527-1:2012-06</td>
<td>N/mm² / psi</td>
<td>50 / 7252</td>
</tr>
<tr>
<td>Elastic modulus in tension</td>
<td>DIN EN ISO 527-2:2012-06</td>
<td>N/mm² / psi</td>
<td>2750 / 398854</td>
</tr>
<tr>
<td>Maximum static load</td>
<td>DIN EN ISO 527-3:2003-07</td>
<td>N/mm² / psi</td>
<td>65 / 9500</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td></td>
<td>0.09 - 0.15</td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td></td>
<td>Blue</td>
</tr>
</tbody>
</table>

AVAILABLE

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

APPLICATIONS

Solar Power Equipment, Outdoor Applications, Recreational Applications

THIS TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL

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EP®22 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

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

AVAILABILITY
Bearing forms available in standard dimensions:
- Plain cylindrical bushes
- Plain flanged bushes
Bearing forms made-to-order: Standard forms in special dimensions, thrust washers, half-bearings, sliding plates, customized bearing designs

APPLICATIONS
General: Generally applicable within the limits of the material properties
Industrial: Domestic appliances, chemical equipment, office equipment, sports equipment and many more

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>50</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>-50</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁴/K</td>
<td>90</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,05</td>
</tr>
<tr>
<td>for A₀/A₀ = 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for A₀/A₀ = 10</td>
<td>N/mm² x m/s</td>
<td>0,10</td>
</tr>
<tr>
<td>for A₀/A₀ = 20</td>
<td>N/mm² x m/s</td>
<td>0,20</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,22 - 0,37</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,1 - 0,5</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>50</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>-50</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁴/K</td>
<td>90</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,05</td>
</tr>
<tr>
<td>for A₀/A₀ = 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for A₀/A₀ = 10</td>
<td>N/mm² x m/s</td>
<td>0,10</td>
</tr>
<tr>
<td>for A₀/A₀ = 20</td>
<td>N/mm² x m/s</td>
<td>0,20</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,22 - 0,37</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,1 - 0,5</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

TRIBOLOGICAL BEARINGS - Engineered Plastic Bearings
SELF-LUBRICATION 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

AVAILABLE
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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>65</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>Min: -50, Max: 200</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>40</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,05, 0,10, 0,20</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,08 - 0,16</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,1 - 0,5</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>
**EP® 43 Bearing Material**

**SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS**

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

**AVAILABILITY**
Bearing forms available in standard dimensions:  
- Plain cylindrical bushes  
- Plain flanged bushes

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

**APPLICATIONS**
**General:** Generally applicable within the limits of the material properties
**Industrial:** Domestic appliances, materials handling equipment, apparatus engineering, slot machines and cash boxes and many more

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static, N/mm²</td>
<td>83</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min, °C</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>Max, °C</td>
<td>240</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
<td>45</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
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</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>for A₂/A₁ = 5, N/mm² x m/s</td>
<td>0,22</td>
</tr>
<tr>
<td></td>
<td>for A₂/A₁ = 10, N/mm² x m/s</td>
<td>0,90</td>
</tr>
<tr>
<td></td>
<td>for A₂/A₁ = 20, N/mm² x m/s</td>
<td>3,59</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,11 - 0,2</td>
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<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>
EP® 44 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

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

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

GENERAL
- Generally applicable within the limits of the material properties
- Industrial: Domestic appliances, valve technology, electronics assembly, apparatus engineering and many more

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
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<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>95</td>
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<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td>240</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻¹/K</td>
<td>27</td>
</tr>
<tr>
<td>DRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td></td>
</tr>
<tr>
<td>for Aₔ/Aₐ = 5</td>
<td></td>
<td>0,11</td>
</tr>
<tr>
<td>for Aₔ/Aₐ = 10</td>
<td></td>
<td>0,42</td>
</tr>
<tr>
<td>for Aₔ/Aₐ = 20</td>
<td></td>
<td>1,69</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,16 - 0,26</td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 450</td>
</tr>
</tbody>
</table>

MICROSECTION

OPERATING PERFORMANCE

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

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
EP®63 Bearing Material

**SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS**

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

**APPLICATIONS**
- **General:** Generally applicable within the limits of the material properties
- **Industrial:** Domestic appliances, valve technology, electronics assembly, agricultural machinery and many more

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th><strong>GENERAL</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>90</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-100 - 290</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
<td>50</td>
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</tbody>
</table>

**DRIY**

<table>
<thead>
<tr>
<th><strong>OPERATING PERFORMANCE</strong></th>
<th><strong>MAXIMUM SLIDING SPEED, U</strong></th>
<th><strong>m/s</strong></th>
<th>1,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MAXIMUM pU FACTOR</strong></th>
<th><strong>N/mm² x m/s</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>for A₁ / A₂ = 5</td>
<td></td>
<td>0,16</td>
</tr>
<tr>
<td>for A₁ / A₂ = 10</td>
<td></td>
<td>0,66</td>
</tr>
<tr>
<td>for A₁ / A₂ = 20</td>
<td></td>
<td>2,63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>COEFFICIENT OF FRICTION, f</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,12 - 0,21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>FOR SUPERIOR PERFORMANCE</strong></th>
<th><strong>SHAFT SURFACE ROUGHNESS, Ra</strong></th>
<th><strong>µm</strong></th>
<th>0,1 - 0,5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lubricated</td>
<td>EP64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RECOMMENDATIONS**

- Shaft surface hardness: HV > 200
EP®64 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

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

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

APPLICATIONS
General: Generally applicable within the limits of the material properties
Industrial: Domestic appliances, transportation equipment, apparatus engineering, conveyor equipment and many more

BEARING PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATING PERFORMANCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Process fluid</td>
<td>Good after resistance testing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>125</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>100 - 290</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>14</td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,09, 0,35, 1,40</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,3 - 0,5</td>
</tr>
</tbody>
</table>

MICROSECTION

PEEK + Solid Lubricant + Fillers

RECOMMENDATIONS
Shaft surface roughness, Ra | μm | 0,1 - 0,5 |
Shaft surface hardness      | HV  | > 450   |

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR 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

APPLICATIONS

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>105</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-200</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td>260</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>25</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>for A⁺/A⁻ = 5</td>
<td></td>
<td>0,10</td>
</tr>
<tr>
<td>for A⁺/A⁻ = 10</td>
<td></td>
<td>0,39</td>
</tr>
<tr>
<td>for A⁺/A⁻ = 20</td>
<td></td>
<td>1,57</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,19 - 0,31</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LUBRICATED</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>5,0</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

| Shaft surface roughness, Ra | µm    | 0,2 - 0,8 |
| Shaft surface hardness     | HV    | > 200    |
EP®79 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

CHARACTERISTICS

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

APPLICATIONS

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

GENERAL

Operating temperature

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>-200</td>
<td>260</td>
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Coefficient of linear thermal expansion

<table>
<thead>
<tr>
<th></th>
<th>10⁶/K</th>
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<td></td>
<td>9</td>
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RECOMMENDATIONS

Shaft surface roughness, Ra

<table>
<thead>
<tr>
<th></th>
<th>μm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,2 - 0,8</td>
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</table>

Shaft surface hardness

<table>
<thead>
<tr>
<th></th>
<th>HV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt; 500</td>
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BEARING PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>130</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
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</tr>
<tr>
<td></td>
<td>Min</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>260</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,005 - 0,1</td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>10,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>10,0</td>
</tr>
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</table>

MICROSECTION

PAI+ Solid Lubricant + Fillers

FOR SUPERIOR PERFORMANCE

Dry

<table>
<thead>
<tr>
<th></th>
<th>EP73</th>
</tr>
</thead>
</table>

Water lubricated

<table>
<thead>
<tr>
<th></th>
<th>EP64</th>
</tr>
</thead>
</table>
KA Glacetal Bearing Material

ENGINEERED PLASTIC THRUST WASHERS

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

APPLICATIONS

AVAILABILITY
Bearing forms available in standard dimensions:
- Plain thrust washers
Non standard parts made-to-order

BEARING PROPERTIES

OPERATING PERFORMANCE
<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Fair</td>
<td></td>
</tr>
</tbody>
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FOR SUPERIOR PERFORMANCE

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>EP22</td>
<td></td>
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<tr>
<td>Water lubricated</td>
<td>EP22</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>EP22</td>
<td></td>
</tr>
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</table>

BEARING PROPERTIES

GENERAL

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
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<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>10</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td>°C</td>
<td>-40</td>
</tr>
<tr>
<td>Max</td>
<td>°C</td>
<td>80</td>
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GREASED

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
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</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,08 - 0,12</td>
</tr>
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RECOMMENDATIONS

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,4</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>
**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

---

**APPLICATIONS**

**Industrial:** Linkages, seat suspensions

---

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
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<tr>
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<td>N/mm²</td>
<td>60</td>
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<td>°C</td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>°C</td>
<td>80</td>
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<tr>
<td>Momentary</td>
<td>°C</td>
<td>120</td>
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<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
<td>101</td>
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<tr>
<td><strong>DRY</strong></td>
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<td></td>
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<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,6</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,1 - 0,2</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
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<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,2 - 0,8</td>
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<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>

---

**FOR SUPERIOR PERFORMANCE**

Water lubricated: EP22
Process fluid lubricated: EP22
GAR-MAX® Bearing Material

SELF-LUBRICATING FIBERGLASS REINFORCED PLAIN BEARINGS

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

APPLICATIONS
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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
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</table>

FOR SUPERIOR PERFORMANCE

<table>
<thead>
<tr>
<th>LUBRICATION METHOD</th>
<th>RECOMMENDATIONS</th>
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<tbody>
<tr>
<td>Oil lubricated</td>
<td>GAR-FIL</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>DX / DX10</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>HPF / HPM</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>GAR-FIL</td>
</tr>
</tbody>
</table>
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

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
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</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
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<td></td>
<td>N/mm²</td>
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<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>Min: -195</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>Max: 205</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Very good</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th>UNITS</th>
<th>VALUE</th>
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</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,23</td>
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<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,02 - 0,12*</td>
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<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
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<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

* 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
Bearings 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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
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<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
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</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>140</td>
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<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-195</td>
</tr>
<tr>
<td>Min</td>
<td>°C</td>
<td>160</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,13</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>N/mm² x m/s</td>
<td>1,05</td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,15 - 0,4</td>
</tr>
<tr>
<td>Bearing surface hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>HB</td>
<td>&gt; 350</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
</tbody>
</table>

* Depending on operating conditions.

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

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic</td>
<td>N/mm²</td>
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<tr>
<td>Operating temperature</td>
<td>Min Max</td>
<td>°C</td>
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<table>
<thead>
<tr>
<th>DRY</th>
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<th></th>
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</thead>
<tbody>
<tr>
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<td>m/s</td>
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<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
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<tr>
<td>Coefficient of friction, f</td>
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<td>0,05 - 0,3*</td>
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FOR SUPERIOR PERFORMANCE

<table>
<thead>
<tr>
<th>FOR SUPERIOR PERFORMANCE</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease lubricated</td>
<td>DX / DX10</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>HPF / HPM</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>GAR-FIL</td>
<td></td>
</tr>
</tbody>
</table>

MICROSECTION

OPERATING PERFORMANCE

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

* Depending on operating conditions

RECOMMENDATIONS

Shaft surface roughness, Ra | μm | 0,15 - 0,4 |
Shaft surface hardness | HB | > 350 |
**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

**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.

**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

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
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<tr>
<td><strong>GENERAL</strong></td>
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<td></td>
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<tr>
<td>Operating temperature</td>
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<tr>
<td>Dynamic</td>
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<td>140</td>
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<tr>
<td>Min</td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,13</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,03 - 0,12*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOR SUPERIOR PERFORMANCE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>GAR-FIL / HPF</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>DX / DX10</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>GAR-FIL / HPF</td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal HB</td>
<td>&gt; 180</td>
</tr>
<tr>
<td></td>
<td>For longer service life HB</td>
<td>&gt; 480</td>
</tr>
</tbody>
</table>

* Depending on operating conditions
HPMB® Bearing Material

HIGH PRECISION FIBER REINFORCED COMPOSITE BEARINGS

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

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
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</tr>
<tr>
<td>Static</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Dynamic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-196</td>
</tr>
<tr>
<td>Min</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
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<td>12,6</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,13</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,23</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,03 - 0,12*</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
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<td></td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 180</td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td></td>
<td></td>
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<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>GAR-FIL / HPF</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>DX / DX10</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>GAR-FIL / HPF</td>
<td></td>
</tr>
</tbody>
</table>

* Depending on operating conditions
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

APPLICATIONS
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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td>Max</td>
<td>°C</td>
<td>140</td>
</tr>
</tbody>
</table>

| DRY | | |
| Maximum sliding speed, U | m/s | 2,5 |
| Maximum pU factor | N/mm² x m/s | 1,23 |
| Coefficient of friction, f | | 0,02 - 0,1* |

| GREASE LUBRICATED | | |
| Coefficient of friction, f | | 0,02 - 0,08* |

| RECOMMENDATIONS | | |
| Shaft surface roughness, Ra | μm | 0,2 - 0,8 |
| Shaft surface hardness | Normal | HB | > 180 |
| For longer service life | HB | > 480 |

* Depending on operating conditions
GGB-MEGALIFE® XT

FIBER REINFORCED COMPOSITE PTFE THRUST WASHERS

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

AVAILABILITY

Bearing forms available in standard dimensions:
- Plain thrust washers

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

APPLICATIONS

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
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</tr>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic</td>
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<tr>
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<td>Min</td>
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<tr>
<td></td>
<td>Max</td>
</tr>
<tr>
<td>Operating temperature</td>
<td></td>
</tr>
<tr>
<td>DRY</td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
</tr>
</tbody>
</table>

* 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, gibbs and other sliding applications

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>MAXIMUM LOAD, p</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static</td>
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</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>35</td>
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<tr>
<td>Operating temp.</td>
<td>Min</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>280</td>
</tr>
<tr>
<td>MAXIMUM SLIDING SPEED, U</td>
<td>m/s</td>
<td>2.5</td>
</tr>
<tr>
<td>MAXIMUM pU FACTOR</td>
<td>N/mm² x m/s</td>
<td>0.32</td>
</tr>
<tr>
<td>COEFFICIENT OF FRICTION, f</td>
<td></td>
<td>0.07</td>
</tr>
</tbody>
</table>

GREASE / OIL LUBRICATED

| MAXIMUM pU FACTOR | N/mm² x m/s | 1.25 |
| COEFFICIENT OF FRICTION, f |   | 0.05 |

RECOMMENDATIONS

| SHAFT SURFACE ROUGHNESS, Ra | µm | 0.2 - 0.4 |
| SHAFT SURFACE HARDNESS  | HB | > 200   |

TRIBOLOGICAL BEARINGS - Fiber Reinforced Composite Bearings
SBC with GAR-MAX® Bearing Material

SEALED FIBER REINFORCED COMPOSITE BEARINGS

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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static N/mm²</td>
</tr>
<tr>
<td>Dynamic N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
</tr>
<tr>
<td>Max °C</td>
<td>104</td>
</tr>
<tr>
<td>DRY</td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
</tr>
<tr>
<td>OPERATING PERFORMANCE</td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>Very good</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal HB</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

AVAILABLE

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

**SEaled Fiber Reinforced Composite Bearings**

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

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

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

**Microsection**

**Operating Performance**

<table>
<thead>
<tr>
<th>Lubrication Form</th>
<th>Dry</th>
<th>Oil lubricated</th>
<th>Grease lubricated</th>
<th>Water lubricated</th>
<th>Process fluid lubricated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very good</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
</tr>
</tbody>
</table>

**Bearing Properties**

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>415</td>
</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>140</td>
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<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>93</td>
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<tr>
<td>Min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td>104</td>
</tr>
<tr>
<td><strong>Dry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,13</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,05</td>
</tr>
<tr>
<td><strong>Recommendations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,15 - 0,4</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>HB</td>
<td>&gt; 350</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
</tbody>
</table>
PyroSlide™1100 Bearing Material

HIGH TEMPERATURE POWDER METAL BEARINGS

CHARACTERISTICS
- Powder metallurgical bearing material consisting of a solid lubricant homogeneously distributed in a metallic matrix
- Self-lubricating and maintenance-free by forming a solid lubricant film during the relative motion
- Excellent high-temperature resistance
- High wear resistance
- Low-friction properties
- Resistant to corrosive environments
- High load capacity
- High dimensional precision

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPa</td>
<td>200</td>
</tr>
<tr>
<td>MPa</td>
<td>10</td>
</tr>
<tr>
<td>MPa</td>
<td>2</td>
</tr>
<tr>
<td>°C / °F</td>
<td>-50 / -60</td>
</tr>
<tr>
<td>°C / °F</td>
<td>800 / 1472</td>
</tr>
<tr>
<td>10⁻⁶/K</td>
<td>16 - 18</td>
</tr>
<tr>
<td>m/s</td>
<td>0,1</td>
</tr>
<tr>
<td>MPa x m/s</td>
<td>0,6</td>
</tr>
<tr>
<td>MPa x m/s</td>
<td>0,20 - 0,45</td>
</tr>
<tr>
<td>µm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>HB</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

APPLICATIONS

Automotive: EGR valves, exhaust heat recovery systems (EHRS), exhaust throttle valves, exhaust brakes, turbocharger wastegate valves
Industrial: Industrial & domestic ovens and furnaces, natural gas/petrochemical valves, exhaust or smoke flaps, high temperature valves, heavy-duty engines, applications with elevated temperatures & corrosion risk, industrial processing plant applications, gas and steam turbines
Aerospace: Engine turbo fans, engine guide vanes, engine pneumatic-bleed valves

- No requirement to operate against high cost special counter surface materials with specific hardness requirements, a standard stainless steel counter surface is appropriate

AVAILABILITY

Bearing forms made-to-order: According to customer design/drawing. Regardless of shape size or material, we can customize your shape. High volume production is feasible.

MICROSECTION

Corrosion Resistant Metallic Matrix
High Temperature Solid Lubricant

OPERATING PERFORMANCE

Designed and intended for dry running applications operating at elevated temperatures

Actual values can vary depending on conditions of specific applications.
GGB-CSM® Bearing Material

THICK WALLED MONOMENTAL BEARINGS

CHARACTERISTICS
- Self-lubricating metal bearings produced by metallurgic powder
- Maintenance-free bearings with homogeneously distributed solid lubricant (graphite, MoS₂) 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

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

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>100 - 260</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-200 - 600</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>13 - 18</td>
</tr>
<tr>
<td>DRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0.2 - 0.5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0.8 - 1.5</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0.11 - 0.5</td>
</tr>
<tr>
<td>WATER LUBRICATED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0.08 - 0.18</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS
- Shaft surface roughness, Ra: μm 0.2 - 0.8
- Shaft surface hardness: HB > 180, HRC > 45

Bearing properties and recommendations depending on GGB-CSM material grade
GGB-CBM® Bearing Material

THIN WALLED BIMETAL BEARINGS MADE BY METALLURGIC POWDER

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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>260 - 280</td>
</tr>
<tr>
<td></td>
<td>N/mm²</td>
<td>80 - 150</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-150</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>280</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10^-6/K</td>
<td>12 - 16</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,3 - 0,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,5 - 1,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,10 - 0,2</td>
</tr>
<tr>
<td><strong>WATER LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,10 - 0,15</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 180 - &gt; 250</td>
</tr>
</tbody>
</table>

Bearing properties and recommendations depending on GGB-CBM material grade.
GGB-BP25
Bearing Material

METAFRING 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

APPLICATIONS
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

Industrial: FHP motor bearings, domestic appliances and hand tools

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>°C</td>
</tr>
<tr>
<td>Minimum density</td>
<td>g/cm³</td>
<td>6,2</td>
</tr>
<tr>
<td>Minimum apparent porosity</td>
<td>%</td>
<td>23</td>
</tr>
</tbody>
</table>

OIL IMPREGNATED

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,1 - 6,0*</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,1 - 1,8*</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>N/mm² x m/s</td>
<td>0,05 - 0,25*</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>≤ 0,3 - 0,6*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 240 - &gt; 355*</td>
</tr>
</tbody>
</table>

Bearing properties depending on oil or solid lubricants
GGB-FP20 Bearing Material

METAFRAME 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

APPLICATIONS
Non-standard parts made-to-order: plain cylindrical bushes, plain flanged bushes, non standard parts
Industrial: FHP motor bearings, domestic appliances and hand tools

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>8,0 - 22,5</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-180 / -5°</td>
</tr>
<tr>
<td>Minimum density</td>
<td>g/cm³</td>
<td>5,6</td>
</tr>
<tr>
<td>Minimum apparent porosity</td>
<td>%</td>
<td>20</td>
</tr>
<tr>
<td>OIL IMPREGNATED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,1 - 4,0°</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,1 - 1,8°</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,05 - 0,25°</td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,2 - ≤ 0,3°</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 240 - &gt; 355°</td>
</tr>
</tbody>
</table>

OPERATING PERFORMANCE
- Dry Good (PTFE / MoS₂)
- Oil lubricated Good (Oil impregnated)
- Grease lubricated Not recommended
- Water lubricated Not recommended
- Process fluid lubricated Not recommended

Bearings properties depending on oil or solid lubricants
**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

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

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>120</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>0</td>
</tr>
<tr>
<td>Minimum density</td>
<td>g/cm³</td>
<td>6</td>
</tr>
<tr>
<td>Minimum apparent porosity</td>
<td>%</td>
<td>16</td>
</tr>
<tr>
<td><strong>OIL IMPREGNATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,3</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,9</td>
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<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,05 - 0,15*</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,2*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 355</td>
</tr>
</tbody>
</table>

Bearing properties depending on oil or solid lubricants
GGB-SHB® Bearing Material

CASE HARDENED STEEL BEARINGS

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

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

AVAILABILITY
Bearing forms available in standard dimensions:
- Plain cylindrical bushes

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>N/mm²</td>
<td>550</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
<td>150</td>
</tr>
<tr>
<td>Density</td>
<td></td>
<td>7,8</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>%</td>
<td>12</td>
</tr>
<tr>
<td><strong>GREASE LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,1</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,5</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,2</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HRC</td>
<td>58 - 62</td>
</tr>
</tbody>
</table>

Bearings properties depending on oil or solid lubricants

MICROSECTION
Steel E410, 1470 (CDMn56, 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

UNITS
ΗRC

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
AuGlide™ Bearing Material

BIMETAL LEAD-FREE PLAIN BEARINGS

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

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

APPLICATIONS
Automotive: Transmissions, king pin, truck brake caliper
Industrial: Agricultural machinery, earth-movers, textile machinery, pneumatic equipment, mechanical handling and lifting equipment, hydraulic cylinders, offhighway equipment, and many more.

MICROSECTION
- Sliding Layer: CuSn8.5Bi7Zn2
- Steel Backing

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Lubrication Type</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Poor</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Poor</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
</tr>
</tbody>
</table>

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, ( p )</td>
<td>N/mm²</td>
<td>300</td>
</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-40</td>
</tr>
<tr>
<td>Min</td>
<td>°C</td>
<td>150</td>
</tr>
<tr>
<td>Max greased</td>
<td>°C</td>
<td>250</td>
</tr>
<tr>
<td>Max oil lubricated</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td><strong>OIL LUBRICATED</strong></td>
<td>N/mm² x m/s</td>
<td>2.5</td>
</tr>
<tr>
<td>Maximum sliding speed, ( U )</td>
<td>m/s</td>
<td></td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>Greased Oil</td>
<td>0.05 - 0.12</td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0.04 - 0.12</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td>μm</td>
<td>≤ 0.8</td>
</tr>
<tr>
<td>Shaft surface roughness, ( Ra )</td>
<td>Normal</td>
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</tr>
<tr>
<td>Shaft surface hardness for longer service life</td>
<td>&gt; 200 HB</td>
<td></td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>&gt; 350 HB</td>
<td></td>
</tr>
</tbody>
</table>
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.
SP Bearing Material

BIMETAL PLAIN BEARINGS TO STANDARD SAE 792

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
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</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
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<tr>
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<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-40</td>
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<tr>
<td>Max grease</td>
<td>°C</td>
<td>150</td>
</tr>
<tr>
<td>Max oil lubricated</td>
<td>°C</td>
<td>250</td>
</tr>
<tr>
<td><strong>GREASED / OIL LUBRICATED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greased</td>
<td>Greased Oil lubricated</td>
<td>0,05 - 0,12</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td></td>
<td>0,04 - 0,12</td>
</tr>
<tr>
<td><strong>OPERATING PERFORMANCE</strong></td>
<td></td>
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</tr>
<tr>
<td>Dry</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
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<td></td>
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<tr>
<td>Grease lubricated</td>
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<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
<td></td>
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<tr>
<td><strong>MICROSECTION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sliding Layer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CuPb26Sn2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>consists of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu 72 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pb 26 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sn 2 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronze</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPERATING PERFORMANCE:
- Good: Suitable for lubricated applications with plain sliding layer
- Poor: Not recommended for lubricated applications

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
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<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
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<tr>
<td></td>
<td>Dynamic</td>
<td>N/mm²</td>
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<td></td>
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<tr>
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<td>m/s</td>
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</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,06 - 0,15</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>≤ 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>

AVAILABILITY
Bearing forms available in standard dimensions:
- Cylindrical bushes

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

MICROSECTION

CuSn8 with Composition
Sn 8 %
P < 0,05 %
Cu/Rust

OPERATING PERFORMANCE

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Poor</td>
</tr>
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<td>Good</td>
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<tr>
<td>Water lubricated</td>
<td>Poor</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
</tr>
</tbody>
</table>
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

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, ( p )</td>
<td>N/mm²</td>
<td></td>
</tr>
<tr>
<td>Static</td>
<td></td>
<td>120</td>
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<tr>
<td>Dynamic</td>
<td></td>
<td>40</td>
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<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-40</td>
</tr>
<tr>
<td>Max greased</td>
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<td>150</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GREASED / OIL LUBRICATED</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, ( U )</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0,06 - 0,15</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, ( Ra )</td>
<td>( \mu m )</td>
<td>( \leq 0,8 )</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>

MICROSECTION
CuSn8 with Composition
Sn 8 %
P < 0,05 %
Cu Rest

OPERATING PERFORMANCE
<table>
<thead>
<tr>
<th>Lubricant</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
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<tr>
<td>Oil lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Good</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Poor</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
</tr>
</tbody>
</table>
**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.

**BEARING PROPERTIES**

<table>
<thead>
<tr>
<th></th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max greased</td>
<td>°C</td>
</tr>
<tr>
<td><strong>GREASED / OIL LUBRicated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,06 - 0,15</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,8</td>
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<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td>For longer service life</td>
<td>HB</td>
</tr>
</tbody>
</table>

**MICROSECTION**

CuSn8 composition:
- Sn 8 %
- P < 0,05 %
- Cu Rest

**OPERATING PERFORMANCE**

<table>
<thead>
<tr>
<th>Lubrication Method</th>
<th>Rating</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Poor</td>
<td></td>
</tr>
</tbody>
</table>
GGB-DB®
Bearing Material

CAST BRONZE BEARINGS WITH SOLID LUBRICANT INSERTS

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

APPLICATIONS
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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max greased</td>
<td>°C</td>
</tr>
<tr>
<td><strong>DRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,5</td>
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<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
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<td>Coefficient of friction, f</td>
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<td>0,05 - 0,18</td>
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<td><strong>RECOMMENDATIONS</strong></td>
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<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>0,2 - 0,8</td>
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<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
</tbody>
</table>
Solid Bronze Bearing Material

SOLID BRONZE ALLOY BEARINGS ACCORDING TO ISO 4379

CHARACTERISTICS
- Conventional bearing material for lubricated applications in general engineering applications
- Suitable for oil and grease lubrication

APPLICATIONS
Industrial: Mechanical handling and lifting equipment, general and special engineering, agricultural equipment, textile machinery, automotive engineering, etc.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>Static</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
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<td>°C</td>
</tr>
<tr>
<td></td>
<td>Max greased</td>
<td>°C</td>
</tr>
<tr>
<td><strong>GREASE LUBRICATED</strong></td>
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<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>2,5</td>
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<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>2,8</td>
</tr>
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<td>Coefficient of friction, f</td>
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<td>0,09 - 0,15</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
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<td>Normal</td>
<td>HB</td>
</tr>
</tbody>
</table>
SICAL®3 / SICAL®3D Bearing Material

**CHARACTERISTICS**

- Aluminium bearing alloy widely used in external gear pumps and motors
- High strength aluminium alloy with anti-friction and wear resistance properties
- Suitable for use with oil lubrication
- High load capacity
- Good fatigue and wear resistance
- High mechanical strength
- Good friction
- Excellent machinability

**APPLICATIONS**

**Industrial & Automotive:** Hydraulic external gear pumps and motors

**OPERATING PERFORMANCE**

<table>
<thead>
<tr>
<th>Lubrication Type</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Oil lubricated</td>
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<td>Water lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Not recommended</td>
</tr>
</tbody>
</table>

**AVAILABILITY**

Bearing forms made-to-order: High performance engineered solutions and designs with or without assembled bearings according to customers’ requirements.

**MICROSECTION**

Aluminium Alloy widely used in external gear pumps and motors. High strength aluminium alloy with anti-friction and wear resistance properties.

**RoHS compliant**

**ACCESSORY PRODUCTS - Bushing Blocks & Thrust Plates**
PICAL®2 / PICAL®3 Bearing Material

PUMP BEARINGS AND BUSHING BLOCKS

CHARACTERISTICS
- Aluminium bearing alloy widely used in external gear pumps and motors
- High strength aluminium alloy with anti-friction and wear resistance properties
- Suitable for use with oil lubrication
- High load capacity
- High mechanical strength
- Good friction
- Excellent machinability

MICROSECTION

Aluminium Alloy

OPERATING PERFORMANCE

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</table>

AVAILABILITY

Bearing forms made-to-order: High performance engineered solutions and designs with or without assembled bearings according to customers’ requirements

APPLICATIONS

Industrial & Automotive: Hydraulic external gear pumps and motors

Aluminium bearing alloy widely used in external gear pumps and motors
- High strength aluminium alloy with anti-friction and wear resistance properties
- Suitable for use with oil lubrication
- High load capacity
- High mechanical strength
- Good friction
- Excellent machinability
UNI Self-Aligning Bearing Housing

SELF-ALIGNING PILLOW BLOCK BEARING HOUSING

CHARACTERISTICS

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

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

AVAILABILITY

Made-to-order

APPLICATIONS

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

LOAD LIMIT VALUES FOR RADIAL FORCES

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

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

SELF-ALIGNING PILLOW BLOCK BEARING HOUSING

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

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

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

AVAILABILITY
Made-to-order

LOAD LIMIT VALUES FOR RADIAL FORCES

<table>
<thead>
<tr>
<th>SIZE</th>
<th>BUSH ID</th>
<th>MAX RADIAL LOAD [N] (HOUSING)</th>
<th>MAX RADIAL LOAD [N] (BOLT)</th>
<th>MAX SHEAR OFF LOAD [N] (BOLT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8 - 15</td>
<td>10 000</td>
<td>5 000</td>
<td>500</td>
</tr>
</tbody>
</table>

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

SELF-ALIGNING PEDESTAL AND FLANGE BEARING HOUSING

CHARACTERISTICS

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

APPLICATIONS

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

AVAILABILITY

- Made-to-order

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

LOAD LIMIT VALUES FOR RADIAL FORCES

<table>
<thead>
<tr>
<th>SIZE</th>
<th>BUSH ID</th>
<th>MAX RADIAL LOAD [N]</th>
<th>MAX RADIAL LOAD [N]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 - 15</td>
<td>4 250</td>
<td>3 750</td>
</tr>
<tr>
<td>2</td>
<td>20 - 25</td>
<td>7 700</td>
<td>5 900</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>9 500</td>
<td>8 000</td>
</tr>
<tr>
<td>4</td>
<td>35 - 40</td>
<td>17 000</td>
<td>11 000</td>
</tr>
<tr>
<td>5</td>
<td>45</td>
<td>23 000</td>
<td>12 000</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>25 000</td>
<td>14 500</td>
</tr>
<tr>
<td>7</td>
<td>55 - 60</td>
<td>30 000</td>
<td>16 000</td>
</tr>
<tr>
<td>8</td>
<td>70 - 75</td>
<td>38 000</td>
<td>17 000</td>
</tr>
<tr>
<td>9</td>
<td>80 - 85</td>
<td>45 500</td>
<td>27 000</td>
</tr>
<tr>
<td>10</td>
<td>90 - 100</td>
<td>74 500</td>
<td>30 500</td>
</tr>
</tbody>
</table>

TYPE PB 2-HOLE PEDESTAL BEARING

TYPE FL/DF 4-HOLE / 2-HOLE FLANGE BEARING
Bearing Application Data Sheet

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

DATA FOR BEARING DESIGN CALCULATION

<table>
<thead>
<tr>
<th>Application:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Project/No.:</td>
<td>Quantity:</td>
</tr>
<tr>
<td>Steady load</td>
<td>Rotating load</td>
</tr>
</tbody>
</table>

DIMENSIONS [MM]

<table>
<thead>
<tr>
<th>Inside diameter</th>
<th>Outside diameter</th>
<th>Length</th>
<th>Flange Diameter</th>
<th>Flange thickness</th>
<th>Wall thickness</th>
<th>Length of slideplate</th>
<th>Width of slideplate</th>
<th>Thickness of slideplate</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_1</td>
<td>D_2</td>
<td>B</td>
<td>D_3</td>
<td>B_3</td>
<td>S_r</td>
<td>L</td>
<td>W</td>
<td>S_5</td>
</tr>
</tbody>
</table>

FITS & TOLERANCES

<table>
<thead>
<tr>
<th>Shaft</th>
<th>Bearing housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_j</td>
<td>D_h</td>
</tr>
</tbody>
</table>

LOAD

<table>
<thead>
<tr>
<th>Static load</th>
<th>Dynamic load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial load F</td>
<td>[N]</td>
</tr>
<tr>
<td>Radial load F</td>
<td>[N]</td>
</tr>
</tbody>
</table>

MOVEMENT

<table>
<thead>
<tr>
<th>Rotational speed</th>
<th>Speed</th>
<th>Length of stroke</th>
<th>Frequency of stroke</th>
<th>Oscillating cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>N [1/min]</td>
<td>U [m/s]</td>
<td>L_s [mm]</td>
<td>[1/min]</td>
<td></td>
</tr>
<tr>
<td>Osc. frequ.</td>
<td>N_osz [1/min]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MATING SURFACE

<table>
<thead>
<tr>
<th>Material</th>
<th>Hardness</th>
<th>Surface finish</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HB/HRC</td>
<td>Ra [µm]</td>
</tr>
</tbody>
</table>

FITTING & TOLERANCES

<table>
<thead>
<tr>
<th>Shaft</th>
<th>Bearing housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_j</td>
<td>D_h</td>
</tr>
</tbody>
</table>

BEARING TYPE

<table>
<thead>
<tr>
<th>Cylindrical bush</th>
<th>Flanged bush</th>
<th>Thrust washer</th>
<th>Slideplate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPERATING ENVIRONMENT

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Bearing housing material</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_amb [°]</td>
<td></td>
</tr>
<tr>
<td>Housing with good heating transfer properties</td>
<td>Light pressing or insulated housing with poor heat transfer properties</td>
</tr>
<tr>
<td>Non metal housing with poor heat transfer properties</td>
<td>Alternate operation in water and dry</td>
</tr>
</tbody>
</table>

LUBRICATION

<table>
<thead>
<tr>
<th>Dry</th>
<th>Continuous lubrication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Process fluid lubrication</td>
</tr>
<tr>
<td></td>
<td>Initial lubrication only</td>
</tr>
<tr>
<td></td>
<td>Hydrodynamic conditions</td>
</tr>
<tr>
<td>Process fluid</td>
<td>Lubricant</td>
</tr>
<tr>
<td>Dynamic viscosity</td>
<td>n[mPas]</td>
</tr>
</tbody>
</table>

SERVICE HOURS PER DAY

<table>
<thead>
<tr>
<th>Continuous operation</th>
<th>Intermittent operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating time</td>
<td>Days per year</td>
</tr>
</tbody>
</table>

SERVICE LIFE

<table>
<thead>
<tr>
<th>Required service life</th>
<th>L_s [h]</th>
</tr>
</thead>
</table>

CUSTOMER INFORMATION

<table>
<thead>
<tr>
<th>Company</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Street</td>
<td></td>
</tr>
<tr>
<td>City / State / Province / Post Code</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>Fax</td>
</tr>
<tr>
<td>Name</td>
<td></td>
</tr>
<tr>
<td>Email Address</td>
<td>Date</td>
</tr>
</tbody>
</table>

www.ggbearings.com
Product Information

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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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Edition 2019 (This edition replaces earlier editions which hereby lose their validity).

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For shipments to or within the EU: All products with this part number contain lead (CAS no: 7439-92-1) at a concentration greater than 0.1% (w/w). There are no necessary actions at this time, as these products are not expected to be of concern under normal safe usage providing customary workplace safety and hygiene practices are followed, including but not limited to wearing protective gloves to avoid skin contact and always washing your hands after handling these products, especially before eating, drinking, or smoking. When cutting, machining, or thermal operations (e.g. laser cutting, thermal processing, etc.) are performed on this material or components, additional precautions and safety practices must be followed. These additional precautions include but are not limited to: utilization of proper respiratory protection, avoidance of ingestion and inhalation, prolonged skin and eye contact, and proper handling, storage, and disposal of the products. In case you have further questions, please do not hesitate to contact us. Always follow local legal requirements.
FABRICATION

At temperatures up to 250°C the 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.


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