Product Range
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.

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 + PTFE + 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®</td>
<td>Steel + Porous Bronze Sinter + POM with Lubrication indents</td>
<td>low-maintenance, machinable</td>
<td>17</td>
</tr>
<tr>
<td>HL-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>
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</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®</td>
<td>POM + Solid Lubricant</td>
<td>self-lubricating</td>
<td>22</td>
</tr>
<tr>
<td>EP®</td>
<td>POM + Solid Lubricant</td>
<td>self-lubricating</td>
<td>23</td>
</tr>
<tr>
<td>EP®</td>
<td>PBT + Solid Lubricant</td>
<td>self-lubricating</td>
<td>24</td>
</tr>
<tr>
<td>EP®</td>
<td>PA 6.6 + AF + Solid Lubricant</td>
<td>self-lubricating</td>
<td>25</td>
</tr>
<tr>
<td>EP®</td>
<td>PPS + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>26</td>
</tr>
<tr>
<td>EP®</td>
<td>PPS + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>27</td>
</tr>
<tr>
<td>EP®</td>
<td>PEEK + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>28</td>
</tr>
<tr>
<td>EP®</td>
<td>PEEK + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>29</td>
</tr>
<tr>
<td>EP®</td>
<td>PAI + Solid Lubricant + Fillers</td>
<td>self-lubricating</td>
<td>30</td>
</tr>
<tr>
<td>EP®</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>
<tr>
<td>PRODUCT NAME</td>
<td>FIBER REINFORCED COMPOSITE BEARINGS</td>
<td>WORKING CONDITIONS</td>
<td>PAGE</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------</td>
<td>--------------------</td>
<td>------</td>
</tr>
<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>HPMB®</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>MultiFil</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>

<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>
Overview of Bearing Materials & Accessory Products

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

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<th>PAGE</th>
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<tbody>
<tr>
<td>Technical Data Sheet</td>
</tr>
<tr>
<td>Product Information / Fabrication</td>
</tr>
</tbody>
</table>
**Parameters**

**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>
</tr>
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</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>2,5</td>
</tr>
<tr>
<td>Coefficient of friction, $f$</td>
<td></td>
<td>0.04 - 0.25*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>OIL LUBRICATED</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>5,0</td>
</tr>
<tr>
<td>Coefficient of friction, $f$</td>
<td></td>
<td>0.02 - 0.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>RECOMMENDATIONS</strong></th>
<th><strong>UNITS</strong></th>
<th><strong>VALUE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, $R_a$</td>
<td>μm</td>
<td>0.3 - 0.5</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.
DP4-B Bearing Material

METAL-POLYMER BRONZE BACKED PTFE PLAIN BEARINGS

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

AVAILABILITY
Bearing forms available in standard dimensions:
- Cylindrical bushes
- Flanged bushes
- Sliding plates

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

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

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

Microsection
- Sliding layer PTFE + Fillers
- Porous Bronze Sinter
- Bronze Backing

Operating Performance
<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Good</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>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
Water lubricated DP4-B

Bearing Properties

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>UNITS</th>
<th>VALUE</th>
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<tbody>
<tr>
<td><strong>GENERAL</strong></td>
<td></td>
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</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 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>0,02 - 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

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra Dry/Lubricated</td>
<td></td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</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
- 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.

**AVAILABILITY**
- Bearing forms available in standard dimensions:
  - Cylindrical bushes
  - Flanged bushes
  - Flanged washers
  - Sliding plates
  - Thrust washers
- **Bearing forms made-to-order:** Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, customized bearing designs

**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 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</td>
<td>10⁻⁶/K</td>
</tr>
<tr>
<td></td>
<td>Normal to the surface</td>
<td>10⁻⁶/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>1,8</td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0,02 - 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>5,0</td>
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<tr>
<td>Coefficient of friction, ( f )</td>
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<td>0,02 - 0,12</td>
</tr>
<tr>
<td><strong>FOR SUPERIOR / LEAD-FREE PERFORMANCE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>DP4 / DP11</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>DP4 / DP31</td>
<td></td>
</tr>
<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>
<tr>
<td><strong>SHOULD BE ELECTROPLATED WITH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, ( R_a )</td>
<td>Dry Lubricated</td>
<td>μm</td>
</tr>
<tr>
<td></td>
<td>Unhardened</td>
<td>μm</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></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
- 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>OPERATING PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td></td>
<td>Very good</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td></td>
<td>Fair</td>
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<tr>
<td>Water lubricated</td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td></td>
<td>Fair</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>FOR SUPERIOR / LEAD-FREE PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td></td>
<td>DP4-B</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td></td>
<td>DP4-B</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td></td>
<td>DP4-B</td>
</tr>
<tr>
<td>Water lubricated</td>
<td></td>
<td>DP4-B</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
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<td>DP4-B</td>
</tr>
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<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 Dynamic N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min Max °C</td>
<td>-200 280</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Normal to the surface 10⁻⁶/K</td>
<td>18</td>
</tr>
<tr>
<td>DRY</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>1,8</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,02 - 0,25*</td>
</tr>
<tr>
<td>OIL LUBRICATED</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>5,0</td>
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<tr>
<td>Coefficient of friction, f</td>
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<td>0,02 - 0,12</td>
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<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>UNITS</th>
<th>VALUE</th>
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<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>Dry Lubricated</td>
<td>µm</td>
</tr>
<tr>
<td></td>
<td>Unhardened acceptable, improved bearing life</td>
<td>HB</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td></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>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>250</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>-200</td>
</tr>
<tr>
<td>Min</td>
<td>10³/K</td>
<td>11</td>
</tr>
<tr>
<td>Max</td>
<td>10³/K</td>
<td>30</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>Dry</td>
<td>2,5</td>
</tr>
<tr>
<td></td>
<td>Lubricated</td>
<td>5,0</td>
</tr>
<tr>
<td></td>
<td>Oil lubricated</td>
<td>1,0</td>
</tr>
<tr>
<td></td>
<td>Process fluid lubricated</td>
<td>0,03 - 0,25*</td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,3 - 0,5</td>
</tr>
<tr>
<td>Lubricated</td>
<td>μm</td>
<td>≤ 0,05 - 0,4*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

* Depending on operating conditions

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

AVAILABILITY
- Bearing forms available in standard dimensions:
  - Cylindrical bushes
  - Flanged bushes
  - Sliding plates
  - Thrust washers
- Bearing forms made-to-order: Standard forms in special dimensions, half-bearings, special shapes obtained by stamping or deep drawing, bearings with local notches, lubricant holes and machined/stamped grooves, customized bearing designs

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

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
DP11 Bearing Material

METAL-POLYMER ANTI-FRICTION
PLAIN BEARINGS

CHARACTERISTICS

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

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>CHARACTERISTIC</th>
<th>UNITS</th>
<th>VALUE</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>10⁶/K</td>
<td>11</td>
</tr>
<tr>
<td>Dry</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 μU 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>Oil lubricated</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 μU 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>
<tr>
<td>Grease lubricated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,3 - 0,5</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 200</td>
</tr>
<tr>
<td>Unhardened acceptable, improved bearing life</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Depending on operating conditions

AVAILABILITY

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

RECOMMENDATIONS

- Shaft surface roughness: Dry lubricated μm 0,3 - 0,5
- Shaft surface hardness: Unhardened acceptable, improved bearing life HB > 200
- Process fluid lubricated DP4 / DP31
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.

**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

**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></td>
<td>N/mm²</td>
<td>140</td>
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<tr>
<td>Operating temperature</td>
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<td></td>
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<tr>
<td>Min</td>
<td></td>
<td>-200</td>
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<tr>
<td>Max</td>
<td></td>
<td>280</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Parallel to the surface</td>
<td>10⁶/K</td>
<td></td>
</tr>
<tr>
<td>Normal to the surface</td>
<td>10⁶/K</td>
<td>30</td>
</tr>
<tr>
<td><strong>OIL LUBRICATION</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>10,0</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,01 - 0,05</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
<td>≤ 0,05 - 0,4*</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Unhardened acceptable, improved bearing life</td>
<td>HB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

* Depending on operating conditions
DX® Bearing Material

METAL-POLYMER PLAIN BEARINGS
GREASE LUBRICATED

CHARACTERISTICS

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

AVAILABILITY

Bearing forms available in standard dimensions:
- Cylindrical bushes
- Thrust washers
- Sliding plates

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

APPLICATIONS

Automotive: Steering gear, power steering, pedal bushes, seat slides, king-pin bushes, tailgate pivots, brake caliper bushes, etc.
Industrial: Mechanical handling and lifting equipment, machine slides, hydraulic cylinders, hydraulic motors, ski-lifts, equipment, agricultural medical equipment, textile machinery, 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>140</td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>Min</td>
</tr>
<tr>
<td>Maximum</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Parallel to the surface</td>
<td>10⁻⁶/K</td>
<td>11</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>Normal to the surface</td>
<td>29</td>
</tr>
</tbody>
</table>

OIL LUBRICATED

| Maximum sliding speed, U | m/s | 2,5 |
| Maximum pU factor | N/mm² x m/s | 2,8 |

Coefficient of friction, f

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

* Depending on operating conditions

MOBCROSECTION

- Sliding layer
- POM with/without lubricant
- Indents for machining
- Porous Bronze Sinter
- Steel Backing

OPERATING PERFORMANCE

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

FOR SUPERIOR PERFORMANCE

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

TRIBOLOGICAL BEARINGS - Metal-Polymer Bearings
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>Static Dynamic</td>
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<tr>
<td>Dynamic</td>
<td></td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
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<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>
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<td>m/s</td>
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<td>N/mm² x m/s</td>
<td>2,8</td>
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<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,01 - 0,06</td>
</tr>
</tbody>
</table>

FOR SUPERIOR PERFORMANCE

Dry Oil lubricated Grease lubricated Water lubricated Process fluid lubricated
- GAR-MAX / HBG / GAR-FIL / MLG
- Very good
- Fair
- Poor
- Fair

RECOMMENDATIONS

|                  |       |         |
| Shaft surface roughness, Ra | μm | ≤ 0,4 |
| Shaft surface hardness | Normal / For longer service life | HB / HB | > 200 / > 350 |
HI-EX® Bearing Material

METAL-POLYMER HYDRONAMIC COMPOSITE BEARINGS

CHARACTERISTICS
- Marginally lubricated bearing material with good wear resistance under thin film conditions
- Standard bearings supplied with indents for optimum retention and distribution of the lubricant over the sliding layer
- Available with non-indent 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

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

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>140</td>
</tr>
<tr>
<td>Dynamic</td>
<td>N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>250</td>
</tr>
<tr>
<td>Min</td>
<td>-150</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parallel to the surface</td>
<td>10⁻⁴/K</td>
<td>11</td>
</tr>
<tr>
<td>Normal to the surface</td>
<td>10⁻⁴/K</td>
<td>29</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>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>

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>VALUE</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>HB</td>
<td>&gt; 200</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 350</td>
</tr>
</tbody>
</table>

* Depending on operating conditions
DTS10® Bearing Material

METAL-POLYMER HYDRONAMIC COMPOSITE BEARINGS

CHARACTERISTICS

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

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

OPERATING PERFORMANCE

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

FOR SUPERIOR PERFORMANCE

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

AVAILABILITY

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

MICROSECTION

Steel Backing
PTFE + Fillers
Porous Bronze Sinter

RoHS compliant

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
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>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 Max</td>
<td>°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th></th>
<th></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>
<td>1.4</td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td>0.15 - 0.3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GREASE LUBRICATED</th>
<th></th>
<th></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>0.05 - 0.1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OIL LUBRICATED</th>
<th></th>
<th></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>0.03 - 0.08</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOR SUPERIOR PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lubricated HPM / HPF / DP4-B</td>
</tr>
<tr>
<td>Process fluid lubricated DP4 / GAR-FIL / Hi-EX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, ( Ra )</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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

RoHS compliant
EP® Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

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

AVAILABILITY

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

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

APPLICATIONS

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

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 Dynamic</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>N/mm² Static</td>
<td>40</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C Min</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>°C Max</td>
<td>140</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>22</td>
</tr>
</tbody>
</table>

DRY

<table>
<thead>
<tr>
<th>Operating Performance</th>
<th>Static</th>
<th>1,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td>N/mm² x m/s</td>
<td>0,06</td>
</tr>
<tr>
<td></td>
<td>N/mm² x m/s</td>
<td>0,24</td>
</tr>
<tr>
<td></td>
<td>N/mm² x m/s</td>
<td>1,00</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>μm</td>
<td>0,15 - 0,3</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>FOR SUPERIOR PERFORMANCE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Water lubricated</td>
<td>EP22</td>
</tr>
</tbody>
</table>

MICROSECTION

PA 6.6T + Solid Lubricant + Fillers

OPERATING PERFORMANCE

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

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>GENERAL</th>
<th>UNITS</th>
<th>VALUE</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</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>120</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>0,04</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></td>
<td>0,09</td>
</tr>
<tr>
<td>for A_u/A_c = 20</td>
<td></td>
<td>0,18</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,18 - 0,3</td>
</tr>
</tbody>
</table>

BEARING PROPERTIES

<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>
<td>0,1 - 0,5</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>

MICROSECTION

EP®12 Bearing Material

TRIBOLOGICAL BEARINGS - Engineered Plastic Bearings
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

APPLICATIONS
EP®15 Bearing forms made-to-order: Cylindrical bushings, flanged bushings, thrust washers, sliding plates, half-bushings, customized bearing designs
Solar Power Equipment, Outdoor Applications, Recreational Applications

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></td>
<td>- 40 / - 40</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>°C / °F</td>
<td></td>
<td>125 / 260</td>
</tr>
<tr>
<td>Maximum extended temperature limit</td>
<td>°C / °F</td>
<td></td>
<td>125 / 260</td>
</tr>
<tr>
<td>Density</td>
<td>DIN EN ISO 1183-1:2013-04, DIN EN ISO 1183-2:2004-10</td>
<td>g/cm³</td>
<td>1,50</td>
</tr>
<tr>
<td>Maximum static load</td>
<td>N/mm² / psi</td>
<td></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>
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>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
<td>50</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-50 → 170</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁴/K</td>
<td>90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</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>Good</td>
<td>Good</td>
<td>Very good</td>
<td>Good after resistance testing</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>1,0</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>0,05</td>
</tr>
<tr>
<td></td>
<td>for Aₚ/Aₜ = 5</td>
<td>N/mm² x m/s</td>
</tr>
<tr>
<td></td>
<td>for Aₚ/Aₜ = 10</td>
<td>N/mm² x m/s</td>
</tr>
<tr>
<td></td>
<td>for Aₚ/Aₜ = 20</td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,22 - 0,37</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>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®30 Bearing Material**

**SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS**

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

**AVAILABILITY**

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

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

**APPLICATIONS**

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

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

---

**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>65</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-50</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</td>
</tr>
<tr>
<td>for Aᵣ/Aᵣ = 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for Aᵣ/Aᵣ = 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>for Aᵣ/Aᵣ = 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>0,08 - 0,16</td>
<td></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>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, ( p )</td>
<td>N/mm²</td>
<td>83</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>°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>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>0,22</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></td>
<td></td>
</tr>
<tr>
<td>for ( A_u/A_c = 20 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0,11 - 0,2</td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, ( Ra )</td>
<td>( \mu m )</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

AVAILABILITY

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

APPLICATIONS

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

BEARING PROPERTIES

| GENERAL |
|-----------------|------------|--------|
| Maximum load, p | Static     | N/mm²  |
| Operating temperature | Min | °C |
|                 | Max | °C |
| Coefficient of linear thermal expansion | | 10⁻¹/K |

<table>
<thead>
<tr>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>BEARING PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
</tr>
<tr>
<td>Maximum pU factor for A_u/A_c = 5</td>
</tr>
<tr>
<td>for A_u/A_c = 10</td>
</tr>
<tr>
<td>for A_u/A_c = 20</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
</tr>
<tr>
<td>Shaft surface roughness, Ra</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
EP®63 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

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

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

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

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

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>90</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-100</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th></th>
<th></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></td>
<td></td>
</tr>
<tr>
<td>for A_w/A_c = 5</td>
<td>N/mm² x m/s</td>
<td>0,16</td>
</tr>
<tr>
<td>for A_w/A_c = 10</td>
<td>N/mm² x m/s</td>
<td>0,66</td>
</tr>
<tr>
<td>for A_w/A_c = 20</td>
<td>N/mm² x m/s</td>
<td>2,63</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,12 - 0,21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<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®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>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>125</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-100</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td>290</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>( 10^{5}/K )</td>
<td>14</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></td>
</tr>
<tr>
<td>for ( A_u/A_c = 5 )</td>
<td></td>
<td>0,09</td>
</tr>
<tr>
<td>for ( A_u/A_c = 10 )</td>
<td></td>
<td>0,35</td>
</tr>
<tr>
<td>for ( A_u/A_c = 20 )</td>
<td></td>
<td>1,40</td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0,3 - 0,5</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, ( Ra )</td>
<td>( \mu ) m</td>
<td>0,1 - 0,5</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HV</td>
<td>&gt; 450</td>
</tr>
</tbody>
</table>

MICROSECTION

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>LUBRICATION</th>
<th>PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Good</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very 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 after resistance testing</td>
</tr>
</tbody>
</table>

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
EP®73 Bearing Material

SELF-LUBRICATING ENGINEERED PLASTIC BEARINGS

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

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

APPLICATIONS
General: Generally applicable within the limits of the material properties
Automotive: Automatic gears, pumps, sealing in turbo compressors, piston rings, valve seats, sealings
Industrial: Continuous furnaces, drying furnaces for coating, textile machines and many more
Aerospace: Weight saving by replacement of aluminum or metal alloys, while providing superior stability and viscosity. Applicable in extreme high and low temperatures e.g. turbojet engine compressor blade

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>105</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
<td>25</td>
</tr>
<tr>
<td>DRY</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></td>
</tr>
<tr>
<td>for A_p/A_c = 5</td>
<td></td>
<td>0,10</td>
</tr>
<tr>
<td>for A_p/A_c = 10</td>
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<td>0,39</td>
</tr>
<tr>
<td>for A_p/A_c = 20</td>
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<td>1,57</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,19 - 0,31</td>
</tr>
<tr>
<td>LUBRICATED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>5,0</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; 200</td>
</tr>
</tbody>
</table>

MICROSECTION
PAI + Solid Lubricant + Fillers

OPERATING PERFORMANCE

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

FOR SUPERIOR PERFORMANCE
Water lubricated EP64
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
  - Min °C
  - Max °C
- Coefficient of linear thermal expansion $10^6$/K

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Lubrication</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Fair</td>
</tr>
<tr>
<td>Process fluid</td>
<td>Good after</td>
</tr>
<tr>
<td>lubricated</td>
<td>resistance testing</td>
</tr>
</tbody>
</table>

FOR SUPERIOR PERFORMANCE

<table>
<thead>
<tr>
<th>Lubrication</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>EP73</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>EP64</td>
</tr>
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</table>

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>Property</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>
<td>-200 - 260</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>$10^6$/K</td>
<td>9</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>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,005 - 0,1</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; 500</td>
</tr>
</tbody>
</table>

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

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

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>20</td>
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<tr>
<td>Dynamic</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Static</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-40</td>
</tr>
<tr>
<td>Min</td>
<td>°C</td>
<td>40</td>
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<tr>
<td>Max</td>
<td>°C</td>
<td>80</td>
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<tr>
<td><strong>GREASED</strong></td>
<td></td>
<td></td>
</tr>
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<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>1.5</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td></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>EP22</td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0.08 - 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>≤ 0.4</td>
</tr>
<tr>
<td>Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>EP22</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>EP22</td>
<td></td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 350</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

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

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>60</td>
</tr>
<tr>
<td>Static Dynamic</td>
<td>N/mm²</td>
<td>30</td>
</tr>
<tr>
<td>Min °C</td>
<td>-40</td>
<td></td>
</tr>
<tr>
<td>Max °C</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Momentary °C</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁴/K</td>
<td>101</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>1,5</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>0,1 - 0,2</td>
<td></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>Normal HB</td>
<td>&gt; 200</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 350</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

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>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></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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th>m/s</th>
<th>0,13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum sliding speed, U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
</tr>
<tr>
<td></td>
<td>0,15 - 0,4</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>HB</td>
</tr>
<tr>
<td>For longer service life</td>
<td>&gt; 350</td>
</tr>
<tr>
<td>Water lubricated HPF / HPM</td>
<td></td>
</tr>
</tbody>
</table>

FOR SUPERIOR PERFORMANCE

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

* Depending on operating conditions
GAR-FIL Bearing Material

FIBER REINFORCED COMPOSITE BEARINGS WITH PTFE TAPE LINER

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

APPLICATIONS
- Industrial: Valves, scissor lifts, pulleys, toggle linkages, 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>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>140</td>
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<tr>
<td>Minimum</td>
<td>-195°C</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>205°C</td>
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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>Coefficient of friction, f</td>
<td>N/mm² x m/s</td>
<td>1,23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0,02 - 0,12*</td>
</tr>
</tbody>
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RECOMMENDATIONS

<table>
<thead>
<tr>
<th>FOR SUPERIOR PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</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>
</tbody>
</table>

* Depending on operating conditions

AVAILABLE

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
HIGH-LOAD FIBER REINFORCED COMPOSITE PTFE BEARINGS

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

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

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

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

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>415</td>
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<tr>
<td>Dynamic</td>
<td>N/mm²</td>
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<tr>
<td>Operating temp.</td>
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<td>Min: -195, Max: 160</td>
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<table>
<thead>
<tr>
<th>Operating Performance</th>
<th>Units</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Dry</td>
<td>m/s</td>
<td>0,13</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>N/mm² x m/s</td>
<td>1,05</td>
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<tr>
<td>Grease lubricated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td></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>μm</td>
<td>0,15 - 0,4</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 350</td>
</tr>
<tr>
<td>Normal</td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
</tbody>
</table>

* Depending on operating conditions
MLG Bearing Material

SELF-LUBRICATING FIBER REINFORCED COMPOSITE BEARINGS

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

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

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

MICROSECTION

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>PROPERTY</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>210</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-195</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>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,05</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,05 - 0,3*</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>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 350</td>
</tr>
</tbody>
</table>

* Depending on operating conditions

FOR SUPERIOR PERFORMANCE

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

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
**HPM Bearing Material**

**FIBER REINFORCED COMPOSITE HYDRO BEARINGS**

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

**APPLICATIONS**

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

**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>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>210</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-195</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>160</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><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></td>
<td></td>
</tr>
<tr>
<td></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

**FOR SUPERIOR PERFORMANCE**

<table>
<thead>
<tr>
<th>Lubrication Type</th>
<th>推薦潤滑油/潤滑脂類型</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil lubricated</td>
<td>GAR-FIL / HPF</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>DX / DX10</td>
</tr>
<tr>
<td>Water lubricated</td>
<td>GAR-FIL / HPF</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>GAR-FIL / HPF</td>
</tr>
</tbody>
</table>

**MICROSECTION**

- Sliding Layer
- Backing

**OPERATING PERFORMANCE**

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

**AVAILABILITY**

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

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

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

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>210</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>196</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁹/K</td>
<td>12,6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOR SUPERIOR PERFORMANCE</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<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

### MICROSECTION
- Sliding Layer
- Backing

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

### 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>
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</tr>
<tr>
<td>Dynamic</td>
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<tr>
<td>Operating temperature</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-195</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td>140</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>Coefficient of friction, ( f )</td>
<td></td>
<td>0,02 - 0,1*</td>
</tr>
<tr>
<td>Minimum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,23</td>
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<tr>
<td><strong>GREASE LUBRICATED</strong></td>
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<td></td>
</tr>
<tr>
<td>Coefficient of friction, ( f )</td>
<td></td>
<td>0,02 - 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>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>HB</td>
<td></td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 180</td>
</tr>
<tr>
<td>For longer service life</td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
</tbody>
</table>

* Depending on operating conditions
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

APPLICATIONS
Bearing forms available in standard dimensions:
- Plain thrust washers

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

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>OPERATING PERFORMANCE</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>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-195</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>175</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,5</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>0,02 - 0,12*</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</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></td>
<td></td>
</tr>
</tbody>
</table>

* Depending on operating conditions

SHAFT SURFACE HARDNESS

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil lubricated</td>
<td>HPF</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>DX</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>HPF</td>
<td></td>
</tr>
</tbody>
</table>
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>GENERAL</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>Static Dynamic N/mm²</td>
<td>70</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>
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</table>

<table>
<thead>
<tr>
<th>DRY</th>
<th>UNIT</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>0,32</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GREASE / OIL LUBRICATED</th>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum pU factor</td>
<td>N/mm² x m/s</td>
<td>1,25</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0,05</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS</th>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>μm</td>
<td>0,2 - 0,4</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>
SBC with GAR-MAX® Bearing Material

SEAL 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></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>210</td>
</tr>
<tr>
<td></td>
<td>N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>°C</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>HB</td>
<td>&gt; 350</td>
</tr>
<tr>
<td></td>
<td>HB</td>
<td>&gt; 480</td>
</tr>
</tbody>
</table>

AVAILABILITY

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

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>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></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>
</tbody>
</table>

DRY
| Maximum sliding speed, U | m/s | 0,13 |
| Maximum pU factor        | N/mm² x m/s | 1,05 |

RECOMMENDATIONS
| Shaft surface roughness, Ra | μm | 0,15 - 0,4 |
| Shaft surface hardness     |     |
|                           | Normal | HB | > 350  |
|                           | For longer service life | HB | > 480  |
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

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.

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum load, p</td>
<td>MPa</td>
<td>200</td>
</tr>
<tr>
<td>Static (at 20°C/68°F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic (at 550°C/1022°F)</td>
<td>MPa</td>
<td>10</td>
</tr>
<tr>
<td>Dynamic (at 750°C/1382°F)</td>
<td>MPa</td>
<td>2</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C / °F</td>
<td>800 / 1472</td>
</tr>
<tr>
<td>Min</td>
<td></td>
<td>-50 / -60</td>
</tr>
<tr>
<td>Max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10^-6/K</td>
<td>16 - 18</td>
</tr>
<tr>
<td>DRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0.1</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>MPa x m/s</td>
<td>0.6</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td></td>
<td>0.20 - 0.45</td>
</tr>
<tr>
<td>MATING MATERIAL</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; 200</td>
</tr>
</tbody>
</table>

Actual values can vary depending on conditions of specific applications.

Microsection
- Corrosion Resistant Metallic Matrix
- High Temperature Solid Lubricant

Operating Performance
- Designed and intended for dry running applications operating at elevated temperatures

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
**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></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>100 - 260</td>
</tr>
<tr>
<td></td>
<td>N/mm²</td>
<td>55 - 130</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
<td>-200</td>
</tr>
<tr>
<td></td>
<td>°C</td>
<td>600</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁶/K</td>
<td>13 - 18</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>0,2 - 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><strong>WATER LUBRICATED</strong></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: 0,2 - 0,8 μm
- 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>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static</td>
<td>Dynamic</td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
</tr>
<tr>
<td></td>
<td>Max °C</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion</td>
<td>10⁻⁶/K</td>
</tr>
</tbody>
</table>

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>LUBRICATION</th>
<th>PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>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>Good</td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Depending on fluid</td>
</tr>
</tbody>
</table>

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<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>Coefficient of friction, f</td>
<td>0.10 - 0.2</td>
</tr>
<tr>
<td>WATER LUBRICATION</td>
<td>Coefficient of friction, f</td>
</tr>
</tbody>
</table>

RECOMMENDATIONS

<table>
<thead>
<tr>
<th>UNIT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft surface roughness, Ra</td>
<td>µm</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>HB</td>
</tr>
</tbody>
</table>

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

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

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>20</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C Min</td>
<td>-180</td>
</tr>
<tr>
<td></td>
<td>°C Max</td>
<td>90</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>OPERATING PERFORMANCE</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>0.05 - 0.25*</td>
<td></td>
</tr>
<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

METAFRAM OIL IMPREGNATED SINTERED IRON BEARINGS

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

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

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>OPERATING PERFORMANCE</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></td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td></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>45</td>
</tr>
<tr>
<td>Static</td>
<td></td>
<td>8,0 - 22,5</td>
</tr>
<tr>
<td>Dynamic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td></td>
<td>-180 / -5*</td>
</tr>
<tr>
<td>Min °C</td>
<td></td>
<td>90 / 300*</td>
</tr>
<tr>
<td>Max °C</td>
<td></td>
<td></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>
</tbody>
</table>
| Bearing properties depending on oil or solid lubricants

MICROSECTION
- Cu: 1 - 4%
- C: < 0,25%
- Other: < 2%
- Rest Fe: Impregnation group 1 (up to 80°C)

RECOMMENDATIONS
- Shaft surface roughness, Ra: ≤ 0,2 - ≤ 0,3*
- Shaft surface hardness: HB > 240 - > 355*

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
GGB-SO16 Bearing Material

METAFRAM OIL IMPREGNATED SINTERED IRON BEARINGS

CHARACTERISTICS

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

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

OIL IMPREGNATED

<table>
<thead>
<tr>
<th>Operating performance</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good (Oil impregnated)</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Process fluid</td>
<td>Not recommended</td>
<td></td>
</tr>
</tbody>
</table>

MICROSECTION

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

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Operating performance</th>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil lubricated</td>
<td>Good (Oil impregnated)</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Process fluid</td>
<td>Not recommended</td>
<td></td>
</tr>
</tbody>
</table>

PRACTICAL APPLICATIONS

- Maintenance-free bearing for general engineering applications
- Superior performance compared to GGB-FP20 under high loads and low speeds

RECOMMENDATIONS

- Shaft surface roughness, Ra μm ≤ 0.2*
- Shaft surface hardness HB > 355

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

CASE HARDENED STEEL BEARINGS

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

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>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>150</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>N/mm²</td>
<td>550</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GREASE LUBRicated</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

RECOMMENDATIONS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<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>

Bearing properties depending on oil or solid lubricants

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

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Condition</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Very good</td>
<td></td>
</tr>
<tr>
<td>Water lubricated</td>
<td>Not recommended</td>
<td></td>
</tr>
<tr>
<td>Process fluid lubricated</td>
<td>Depending on fluid</td>
<td></td>
</tr>
</tbody>
</table>

BEARING MATERIAL

Bearing properties depending on oil or solid lubricants

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
**BIMETAL LEAD-FREE PLAIN BEARINGS**

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

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

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

**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 N/mm²</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Dynamic N/mm²</td>
<td>140</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>Max greased °C</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Max oil lubricated °C</td>
<td>250</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>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>Greased Oil</td>
<td>0.05 - 0.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.04 - 0.12</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaft surface roughness, (Ra)</td>
<td>Normal µm</td>
<td>≤ 0.8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal For longer service life</td>
<td>&gt; 200 HB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 350 HB</td>
</tr>
</tbody>
</table>

**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, off-highway equipment, and many more.

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

SY Bearing Material

Bearing properties depending on oil or solid lubricants

BEARING PROPERTIES

<table>
<thead>
<tr>
<th>UNITS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>VALUE</td>
</tr>
<tr>
<td>GENERAL</td>
<td></td>
</tr>
<tr>
<td>Maximum load, p</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C</td>
</tr>
<tr>
<td>OIL IMPREGNATED</td>
<td>m/s</td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Maximum pU factor</td>
<td>0,05 - 0,12</td>
</tr>
<tr>
<td>Coefficient of friction, f</td>
<td>Greased Oil lubricated</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 For longer service life</td>
</tr>
</tbody>
</table>

APPLICATIONS
Industrial: Mechanical handling and lifting equipment, hydraulic cylinders, agricultural equipment, off highway equipment etc.
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>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>120</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min</td>
<td>°C</td>
</tr>
<tr>
<td>Max greased</td>
<td>°C</td>
<td>150</td>
</tr>
<tr>
<td>Max oil lubricated</td>
<td>°C</td>
<td>250</td>
</tr>
</tbody>
</table>

GREASED / OIL LUBRICATED

| Maximum sliding speed, U | m/s | 2,5 |
| Maximum pU factor | N/mm² x m/s | 2,8 |
| Coefficient of friction, f | Greased | 0,05 - 0,12 |
| Oil lubricated | 0,04 - 0,12 |

RECOMMENDATIONS

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

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>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>120</td>
</tr>
<tr>
<td></td>
<td>Dynamic N/mm²</td>
<td>40</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>Max grease</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Max oil</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>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 HB</td>
<td>&gt; 200</td>
</tr>
<tr>
<td></td>
<td>For longer service life HB</td>
<td>&gt; 350</td>
</tr>
</tbody>
</table>

**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-Rest

**OPERATING PERFORMANCE**

<table>
<thead>
<tr>
<th>Lubrication Method</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>Good</td>
</tr>
<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

**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>
</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>

**METAL & BIMETAL BEARINGS**
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 Dynamic</td>
<td>N/mm²</td>
</tr>
<tr>
<td></td>
<td>Static 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>
</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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not recommended</td>
</tr>
<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>

THE TRIBOLOGICAL SOLUTION PROVIDER FOR INDUSTRIAL PROGRESS, REGARDLESS OF SHAPE OR MATERIAL
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
- 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>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 Static Dynamic</td>
<td>200 100</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>°C Min Max greased</td>
<td>-50 350</td>
</tr>
<tr>
<td>DRY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum sliding speed, U</td>
<td>m/s</td>
<td>0,5</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>0,05 - 0,18</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>Normal HB</td>
<td>&gt; 200</td>
</tr>
</tbody>
</table>
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></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>200</td>
</tr>
<tr>
<td></td>
<td>Dynamic N/mm²</td>
<td>100</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Min °C</td>
<td>-40</td>
</tr>
<tr>
<td></td>
<td>Max greased °C</td>
<td>140</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>0,09 - 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>
<td>0,2 - 0,8</td>
</tr>
<tr>
<td>Shaft surface hardness</td>
<td>Normal HB</td>
<td>&gt; 350</td>
</tr>
</tbody>
</table>
SICAL®3 / SICAL®3D 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
- Good fatigue and wear resistance
- High mechanical strength
- Good friction
- Excellent machinability

MICROSECTION

- Aluminium Alloy

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Lubrication</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Not recommended</td>
</tr>
<tr>
<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

APPLICATIONS

Industrial & Automotive: Hydraulic external gear pumps and motors

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

OPERATING PERFORMANCE

<table>
<thead>
<tr>
<th>Lubrication</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>Not recommended</td>
</tr>
<tr>
<td>Oil lubricated</td>
<td>Very good</td>
</tr>
<tr>
<td>Grease lubricated</td>
<td>Not recommended</td>
</tr>
<tr>
<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

APPLICATIONS

Industrial & Automotive: Hydraulic external gear pumps and motors

MICROSECTION

Aluminium Alloy

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
Made-to-order

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

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.
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

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>

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

### DATA FOR BEARING DESIGN CALCULATION

<table>
<thead>
<tr>
<th>Application:</th>
<th>Quantity:</th>
<th>New Design</th>
<th>Existing Design</th>
</tr>
</thead>
</table>

- **Steady load**
- **Rotating load**
- **Rotational movement**
- **Oscillating movement**
- **Linear movement**

### DIMENSIONS [MM]

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside diameter</td>
<td>( D_i )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Outside diameter</td>
<td>( D_o )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Length</td>
<td>( L )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Flange Diameter</td>
<td>( D_f )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Flange thickness</td>
<td>( B_f )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Wall thickness</td>
<td>( S_t )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Length of slideplate</td>
<td>( L )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Width of slideplate</td>
<td>( W )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Thickness of slideplate</td>
<td>( S_S )</td>
<td>( 	ext{mm} )</td>
</tr>
</tbody>
</table>

### FITS & TOLERANCES

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft</td>
<td>( D_j )</td>
<td>( 	ext{mm} )</td>
</tr>
<tr>
<td>Bearing housing</td>
<td>( D_h )</td>
<td>( 	ext{mm} )</td>
</tr>
</tbody>
</table>

### OPERATING ENVIRONMENT

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>( T_{amb} )</td>
<td>( ^\circ \text{C} )</td>
</tr>
<tr>
<td>Bearing housing material</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### LUBRICATION

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process fluid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lubricant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic viscosity</td>
<td>( \eta )</td>
<td>( \text{mPas} )</td>
</tr>
</tbody>
</table>

### LOAD

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial load</td>
<td>( F )</td>
<td>( \text{N} )</td>
</tr>
<tr>
<td>Radial load</td>
<td>( F )</td>
<td>( \text{N} )</td>
</tr>
</tbody>
</table>

### MOVEMENT

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotational speed</td>
<td>( N )</td>
<td>( \text{1/min} )</td>
</tr>
<tr>
<td>Speed</td>
<td>( U )</td>
<td>( \text{m/s} )</td>
</tr>
<tr>
<td>Length of stroke</td>
<td>( L_s )</td>
<td>( \text{mm} )</td>
</tr>
<tr>
<td>Frequency of stroke</td>
<td>( f )</td>
<td>( \text{1/min} )</td>
</tr>
<tr>
<td>Oscillating cycle</td>
<td>( \phi )</td>
<td>( ^\circ )</td>
</tr>
<tr>
<td>Osc. frecuence</td>
<td>( N_{osc} )</td>
<td>( \text{1/min} )</td>
</tr>
</tbody>
</table>

### MATING SURFACE

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardness</td>
<td>( HB/HRC )</td>
<td></td>
</tr>
<tr>
<td>Surface finish</td>
<td>( Ra )</td>
<td>( \mu \text{m} )</td>
</tr>
</tbody>
</table>

### CUSTOMER INFORMATION

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

### SERVICE HOURS PER DAY

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

### SERVICE LIFE

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required service life</td>
<td>( L )</td>
<td>( \text{h} )</td>
</tr>
</tbody>
</table>

### BEARING TYPE

- Cylindrical bush
- Flanged bush
- Thrust washer
- Slideplate
- Special parts (sketch)

www.ggbearings.com
Product Information

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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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