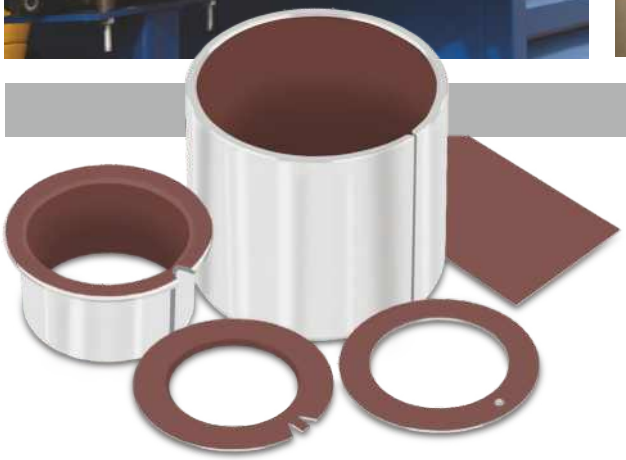
GGB DP31

Metal-Polymer Bearing Solutions for Lubricated Applications



The Global Leader
in High Performance Bearing Solutions

GGB
BEARING TECHNOLOGY

an EnPro Industries company

Quality

All the products described in this brochure are manufactured under ISO/TS 16949 and ISO 14001 approved quality management systems.

Brazil

China

Germany

France

Slovakia

USA

These certificates are also available for download on our website **https://www.ggbearings.com/certificates**

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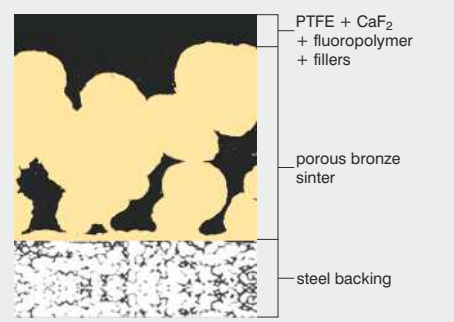
1 Introduction

This brochure describes GGB DP31 PTFE based metal-polymer plain bearing material which has been developed to provide enhanced performance under lubricated conditions in industrial and automotive applications such as hydraulic pumps and motors, fuel injection pumps, power steering pumps, compressors, hydraulic cylinders, shock absorbers and McPherson struts.

DP31 complies with the EU directives 2002/96/EG (End of Life directive on electric and electronic devices), 2002/95/EG (Constraint of certain hazardous materials in electric and electronic devices) and End of Life Vehicles directive (2000/53/EC) on the elimination of hazardous materials in the construction of passenger cars and light trucks.

2 Structure and Composition

DP31 is a composite material consisting of steel backing to which is sintered a porous bronze interlayer impregnated and overlaid with a bearing layer of PTFE with fluoropolymer and other fillers. The PTFE bearing layer uses a proprietary formulation and process method specifically developed to provide enhanced bearing performance under lubricated conditions. The steel backing provides mechanical strength and the bronze sinter layer provides a strong mechanical bond for the filled PTFE bearing layer.

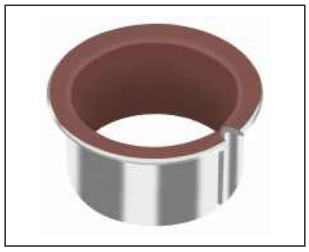


2.1 Basic Forms

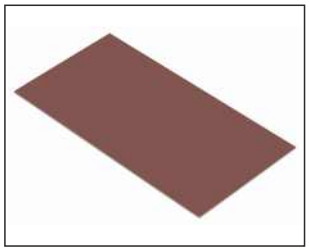
Standard Components

These products are manufactured to international, national or GGB standards.

Cylindrical bushes



Flanged bushes

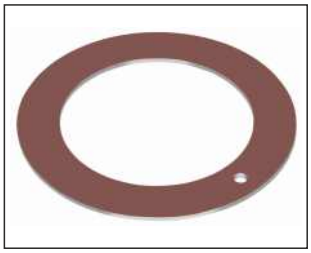


Strips

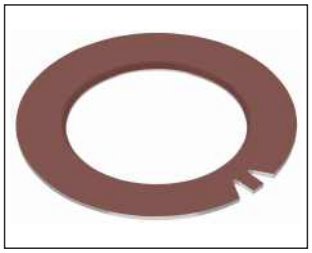
Non-Standard Components

These products are manufactured to customer's requirements and include:

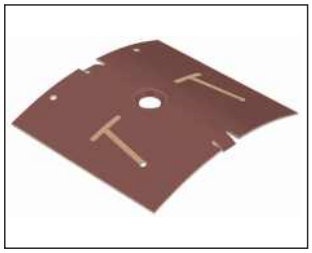
- Modified standard components
- Thrust washers
- Flanged bushes
- Half bearings
- Flat components
- Deep drawn parts
- Pressings
- Stampings



Thrust washers



Flanged washers



Special part

3 Properties

3.1 Physical and Mechanical Properties

Bearing Properties		Units	Value
General			
Maximum load, p	Static Dynamic	N/mm² N/mm²	250 140
Operating temperature	Min Max	°C °C	- 200 280
Coefficient of linear thermal expansion	Parallel to the surface Normal to the surface	10^{-6}/K 10^{-6}/K	11 30
Oil Lubricated			
Maximum sliding speed, U		m/s	10,0
Maximum pU factor		N/mm² x m/s	10,0
Coefficient of friction			0,01 - 0,05
Recommendations			
Shaft surface roughness, Ra	Lubricated	µm	≤ 0,05 - 0,4*
Shaft surface hardness	Unhardened acceptable, improved bearing life	HB	> 200

Table 1: Physical and Mechanical Properties

* Depending on operating conditions

3.2 Lubricated Friction

A low and constant static and dynamic friction is generally desirable in most applications. However, actual friction values depend on the many design and operating factors that influence the lubrication conditions.

Friction is lowest under full hydrodynamic conditions and increases as the generated lubricant films decrease through the mixed film to boundary conditions. DP31 does not show any stick-slip effects.

3.3 Chemical Properties

The following provides an indication of the chemical resistance of DP31 to various common lubricant media.

It is recommended that the chemical resistance is confirmed by testing if possible.

Medium	°C	Rating
Paraffin	20	+
Gasoline	20	+
Kerosene	20	+
Diesel fuel	20	+
Mineral oil	70	+
HFA-ISO46 high water fluid	70	+
HFC-water glycol	70	+
HFD-phosphate ester	70	+
Water	20	o
Sea water	20	-

Table 2 Chemical Resistance of DP31

+ **Satisfactory**
  Corrosion damage is unlikely to occur
o **Acceptable**
  Some corrosion damage may occur but this will not be sufficient to impair the structural integrity for the tribilogical performance of the material
- **Unsatisfactory**
  Corrosion damage will occur and is likely to affect either the structural integrity or the tribological performance of the material

4 Bearing Performance

Each application places particular demands on the bearing material properties required for satisfactory performance, depending on the equipment design, usage, lubrication and operating conditions.

The following describes the major performance factors required for satisfactory operation in lubricated applications and indicates the relative performance of DP31 compared with GGB DU® and DP4® for each of the factors.

4.1 Boundary Lubricated Wear Resistance

For a long service life, a low wear rate is necessary, particularly under severe mixed film or boundary lubricated conditions where the generated lubricant films are of the same order or less than the surface roughness of the mating surface.

The wear resistance under steady load oil immersed boundary lubrication conditions has been evaluated using the test rig shown in Fig. 1. The test conditions are given in Table 3.

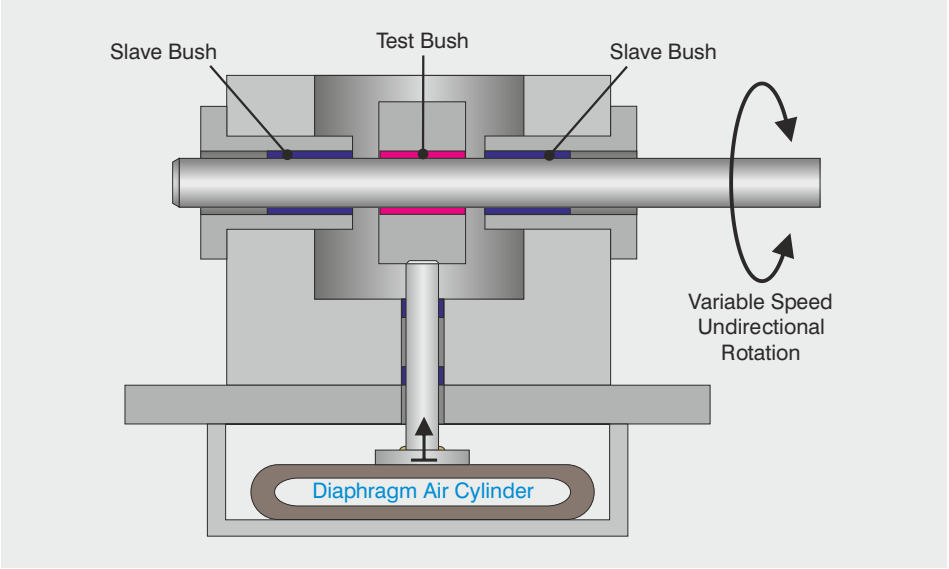


Figure 1: GGB Jupiter test rig

Bearing Diameter	20 mm
Bearing Length	15 mm
Mean Diametral Clearance	0,10 mm
Speed	0,11 m/s
pU (N/mm² x m/s)	2,8 4,2 5,6
Lubricant	ISO VG 46 hydraulic oil

Table 3: Test conditions - steady load

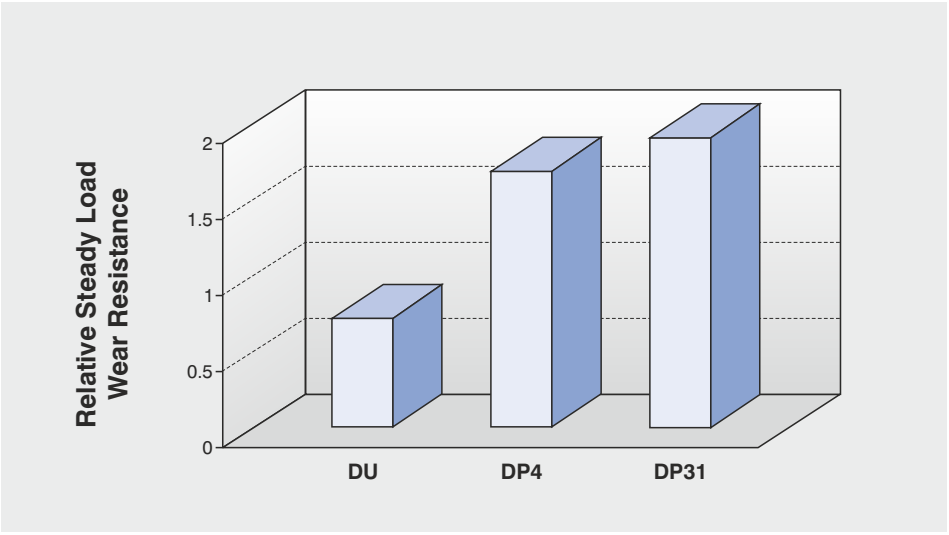


Figure 2: Relative steady load wear resistance

4.2 Fatigue Strength

Under dynamically loaded lubricated conditions the resulting cyclic pressure fluctuations generated in the lubricant film can result in fatigue damage of the PTFE bearing lining leading to a reduced service life.

Wear resistance and fatigue strength have been evaluated on bushings under rotating load conditions using the test rig shown in Figure 3. The test conditions are given in Table 4.

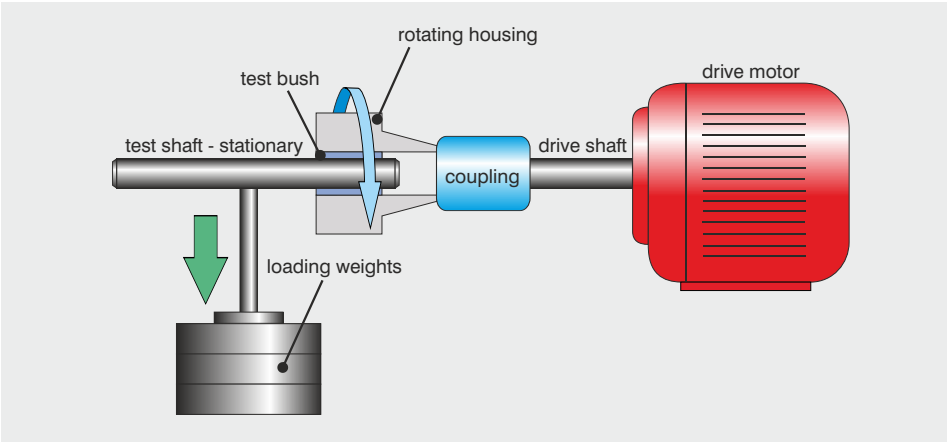


Figure 3: Bush wear / fatigue test rig

Bearing Diameter	20 mm
Bearing Length	15 mm
Mean Diametral Clearance	0,10 mm
Load	13,8 N/mm²
pU	11 N/mm² x m/s

Table 4: Test conditions
rotating bush - stationary shaft

Wear resistance and fatigue strength have also been evaluated on thrust washers under cyclic load conditions using the test rig shown in Fig. 4. The test conditions are given in Table 5.

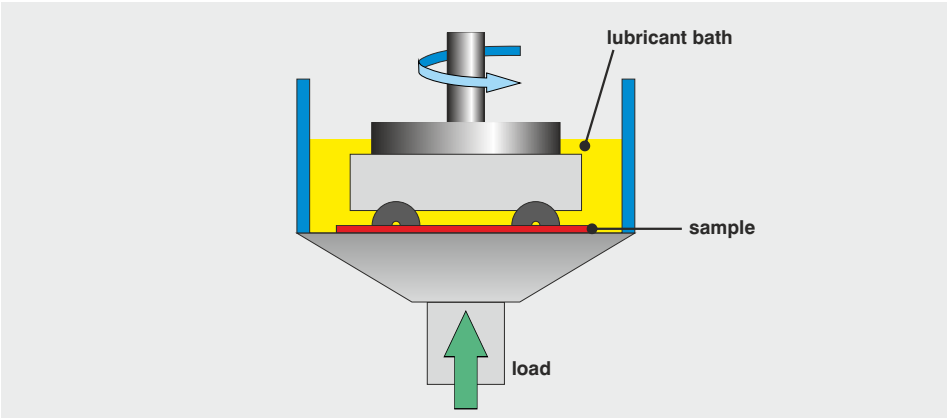


Figure 4: Falex thrust washer wear / fatigue test

pU	10,8 N/mm² x m/s
Temperature	100 C
Duration	6 hours

Table 5: Test conditions

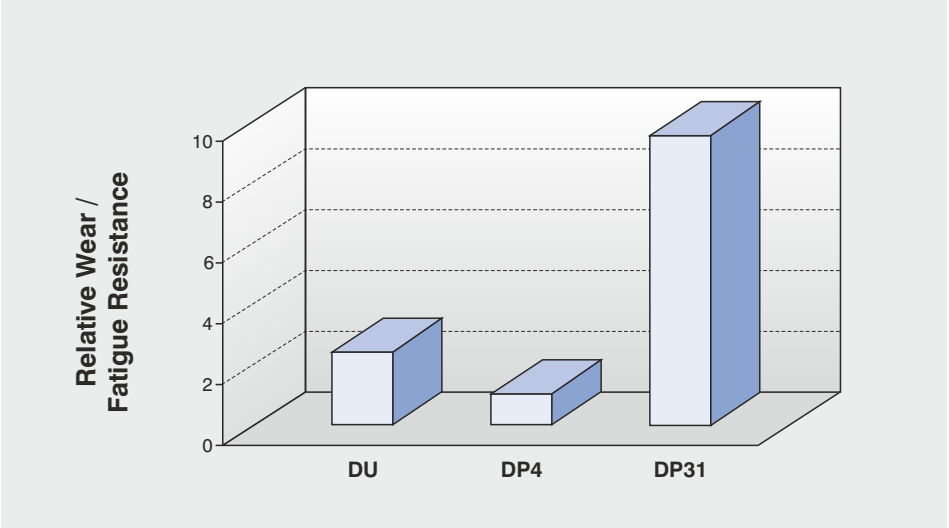


Figure 5: Relative wear / fatigue resistance

4.3 Cavitation Erosion Resistance

Under dynamically loaded lubricated conditions vapour cavities can be generated within the lubricant film, which subsequently collapse, causing damage to the PTFE bearing lining. This damage takes the form of localised removal of the PTFE and fillers across the bearing surface, leading to a reduced service life.

The test rig shown in Fig. 6 is designed to reproduce the cavitation erosion damage to the bearing lining of the test specimen.

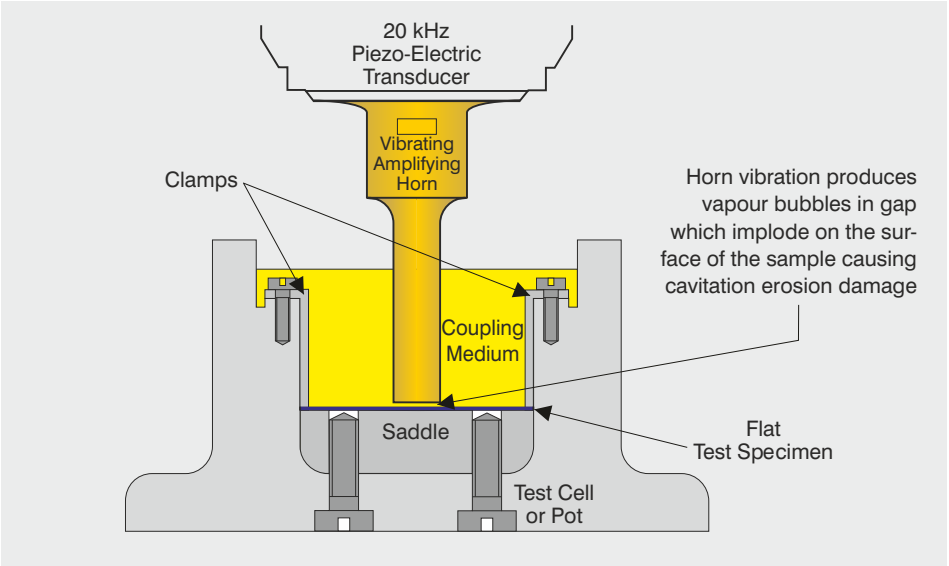


Figure 6: Cavitation erosion test rig

Amplitude	0,015 mm
Frequency	20 kHz
Test Duration	30 minutes
Coupling Medium	Water
Temperature	Ambient

Table 6: Cavitation erosion test conditions

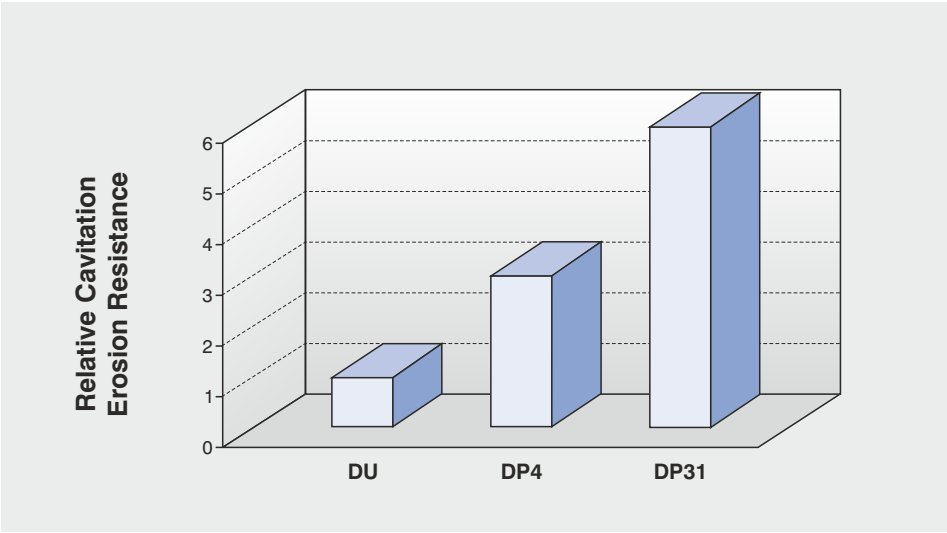
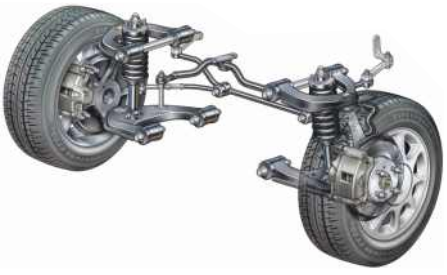


Figure 7: Relative cavitation erosion resistance

5 Applications

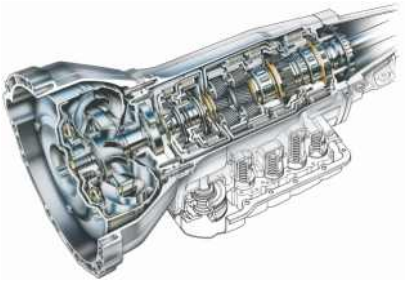
DP31 has been developed to provide enhanced performance under the most demanding marginally lubricated operating conditions.

Typical applications include:



- McPherson struts and shock absorbers
- Hydraulic cylinders

- Hydraulic pumps and motors
- Fuel injection pumps
- Power steering pumps
- Compressors
- Engine valve-train bearings



- Transmission bearings

Product Information

GGB gives an assurance that the products described in this document have no manufacturing errors or material deficiencies. The details set out in this document are registered to assist in assessing the material's suitability for the intended use. They have been developed from our own investigations as well as from generally accessible publications. They do not represent any assurance for the properties themselves.

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

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

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

Edition 2017 (This edition replaces earlier editions which hereby lose their validity).

Declaration on lead contents of GGB products/compliance with EU law

Since July 1, 2006 it has been prohibited under Directive 2002/95/EC (restriction of the use of certain hazardous substances in electrical and electronic equipment; ROHS Directive) to put products on the market that contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). Certain applications listed in the annex to the ROHS Directive are exempted. A maximum concentration value of 0.01% by weight and per homogeneous material, for cadmium and of 0.1% by weight and per homogeneous material, for lead, mercury, hexavalent chromium, PBB and PBDE shall be tolerated.

According to Directive 2000/53/EC on end-of life vehicles, since July 1, 2003 it has been prohibited to put on the market materials and components that contain lead, mercury, cadmium or hexavalent chromium. Due to an exceptional provision, lead-containing bearing shells and bushes could still be put on the market up until July 1, 2008. This general exception expired on July 1, 2008. A maximum concentration value of up to 0.1% by weight and per homogeneous material, for lead, hexavalent chromium and mercury shall be tolerated.

All products of GGB in this brochure, with the exception of DU and DUB, satisfy these requirements of Directives 2002/95/EC (ROHS Directive) and 2000/53/EC (End-of-life Vehicle Directive).

All products manufactured by GGB are also compliant with REACH Regulation (EC) No. 1 907/2006 of December 18, 2006.

Health Hazard - Warning

Fabrication

At temperatures up to 250 °C the polytetrafluroethylene (PTFE) present in the lining material is completely inert so that even on the rare occasions in which DP31 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 DP31 is being machined.

DU®, DP4® and DP31 are trademarks of GGB

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BEARING TECHNOLOGY

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