

DTS10™

Metal-Polymer Bearing Solutions for Lubricated Applications



The Global Leader
in High Performance Bearing Solutions

 **GGB**
BEARING TECHNOLOGY

an EnPro Industries company

GGB Bearing Technology

GGB's history as the global leader in plain bearing technologies dates back more than 115 years, beginning with the founding of Glacier Antifriction Metal Company in 1899. GGB introduced the industry-leading DU® bearing in 1956 and the DX® bearing in 1965. Since that time, GGB has continued to create innovative technologies and solutions that improve safety, performance and profitability in a wide range of markets. Today, our products can be found everywhere – from scientific vessels at the bottom of the ocean to racecars 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 critically essential 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 in all positions and functional areas. Our world-class manufacturing plants are certified in quality and excellence in the industry according to ISO 9001, TS 16949, ISO 14001, ISO 50001 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.

The GGB Advantage

With a global manufacturing footprint, including cutting edge R&D facilities, flexible production platforms and extensive customer support networks, GGB offers unmatched technical expertise combined with razor sharp responsiveness and customized solutions.

Our global presence and local logistics networks ensure our customers receive only the highest quality bearing solutions, in a timely manner and with extensive engineering support. **We don't just make products, we build partnerships. That's the GGB Advantage.**

Quality/Certification

Our world-class manufacturing plants in the United States, Brazil, China, Germany, France and Slovakia and are **CERTIFIED IN QUALITY AND EXCELLENCE IN THE INDUSTRY** according to ISO 9001, TS 16949, ISO 14001, ISO 50001 and OHSAS 18001. This allows us to access the industry's best practices while aligning our quality management system with global standards.

For a complete listing of our certifications, please visit our website:

<http://www.ggbearings.com/en/company/certificates>.



DTS10™ Metal-Polymer Bearings for Lubricated Applications

Customers with high expectations turn to GGB for innovative and application-specific plain bearing technology and solutions. The recent development of DTS10™ metal-polymer bearings illustrates GGB's commitment to advancing the technology of metal-polymer PTFE bearings for hydro-dynamic lubricated applications. DTS10™ bearings deliver superior friction and wear properties, providing customers with advanced solutions that precisely meet their unique needs.

Featuring a uniquely engineered PTFE overlay, the DTS10™ bearing is the first polymer-lined material for lubricated conditions to not allow for metal exposure after machining. Providing low friction and excellent wear and fatigue resistance, DTS10™ improves the overall energy efficiency and increases the service life of high precision assemblies. DTS10™ provides the precision of a bi-metallic bearing and the high performance of an engineered metal-polymer bearing. **Here are some of the benefits of the DTS10™ bearing:**

- Excellent fatigue resistance
- High resistance against cavitation & flow erosion
- Excellent chemical resistance
- Good wear resistance
- Low friction
- High load capacity
- Promotes elastohydrodynamic performance benefits
- Good temperature range
- Machinable to obtain almost perfect bearing form
- RoHS compliant (lead-free)

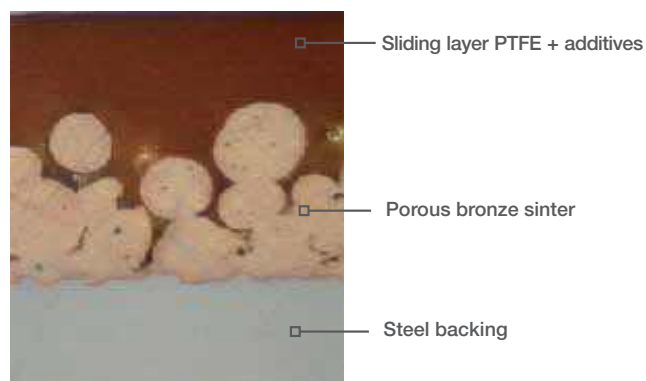


Fig. 1: DTS10™ Microsection before machining

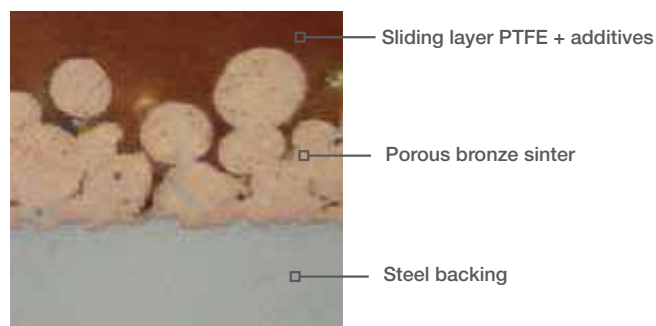


Fig. 2: DTS10™ Microsection after machining



Applications

The DTS10™ is a PTFE-based metal-polymer bearing that is excellent for mixed-film and hydrodynamic lubricated applications. It is the first such bearing designed to be machined for tight tolerance control. Featuring excellent wear resistance and low friction as well as strong chemical, cavitation and flow erosion resistance, the DTS10™ is well suited for demanding applications. With all its great attributes, the DTS10™ bearing provides additional user benefits such as **greater tolerance toward foreign particulates** and **reduces noise and vibration**.

Below are a few of the applications for which the DTS10™ was designed.

- External gear pump and motors
- Scroll compressors
- Radial piston motors
- Oil Pumps
- Powertrain and industrial gearboxes
- Semi-hermetic and hermetic reciprocating compressors
- Hydraulic Cylinders
- Small Engines



Available Forms

Available as cylindrical bushes, thrust washers, flanged washers, slide plates, half bearings and special shapes.

Cylindrical bushes are available in sizes ranging from 8mm - 300mm. All formats are considered made to order items.

Material Structure

The DTS10™ metal-polymer bearing contains three layers. The sliding layer is a thick (0.1mm) PTFE and filler overlay, which is impregnated into a porous bronze inner structure. The bronze center layer is sintered to a steel backing for mechanical strength.

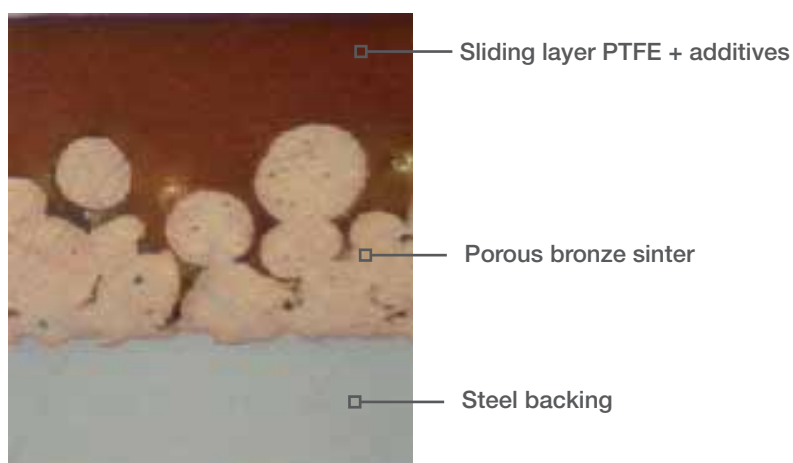


Fig. 3: DTS10™ Microsection

Lubricated Bearing Properties

Bearing Properties		Imperial Units	Imperial Value	Metric Units	Metric Value
General					
Maximum load, p	Static	psi	20 000	N/mm ²	140
Operating temperature	Min	°F	-328	°C	-200
	Max	°F	536	°C	280
Fluid Lubricated					
Maximum sliding speed, U		fpm	2 000*	m/s	10*
Maximum pU factor		psi x fpm	2 860 000*	N/mm ² x m/s	100*
Coefficient of friction			0.01 - 0.08		0.01 - 0.08
Recommendations					
Shaft surface roughness, Ra		μin	< 2 - 8*	μm	< 0.05 - 0.2*
Shaft surface hardness		HB	> 200	HB	> 200

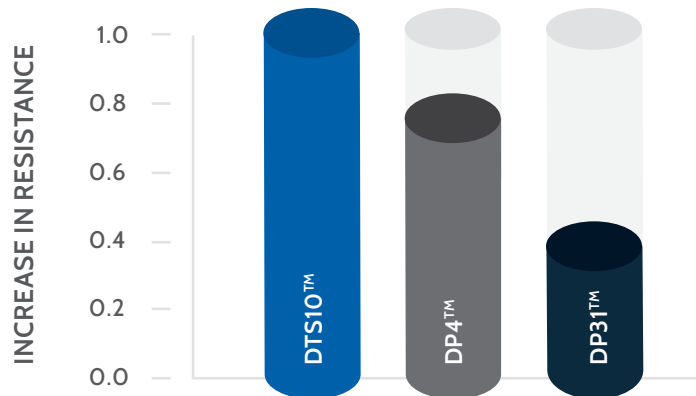
*Depending on Hydro-Dynamic Conditions

Bearing Performance

Relative Lubricated Wear Resistance

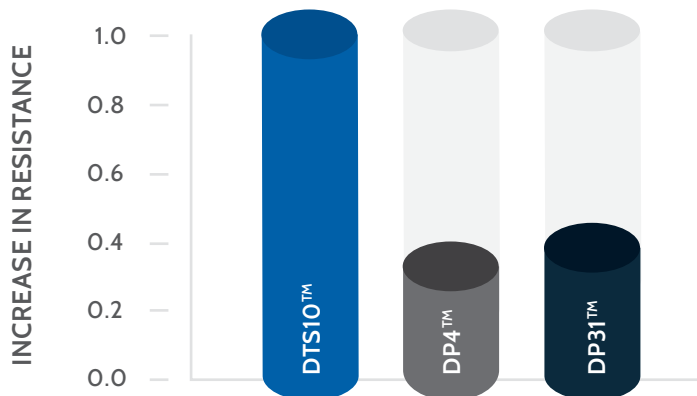
Composed of a unique combination of PTFE and fillers, the unique sliding layer composition of **DTS10™** enhances its wear resistance over a wide range of operating conditions. The chart below summarizes the relative lubricated wear resistance of **DTS10™** in comparison with GGB's **DP4™** and **DP31™** products.

Bearing diameter..... 20 mm
Bearing length..... 15 mm
Mean diametral clearance..0.07 mm
Speed.....0.11 m/s
Lubricant.....ISO VG46 hydraulic oil
Temperature.....ambient



Relative Cavitation Resistance

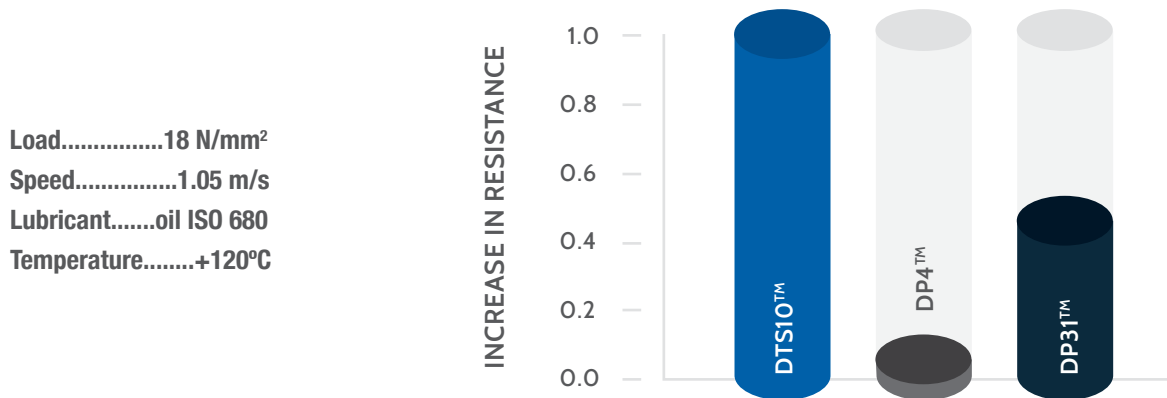
As a result of its proprietary manufacturing process, the **DTS10™** sliding layer far exceeds industry standards of cavitation resistance, making it an excellent choice for fluid power applications such as high-power pumps and motors.



Amplitude.....0.047 mm
Frequency.....20 kHz
Test duration.....6 minutes
Coupling medium.....water
Temperature.....ambient

Relative Hydrofatigue Resistance

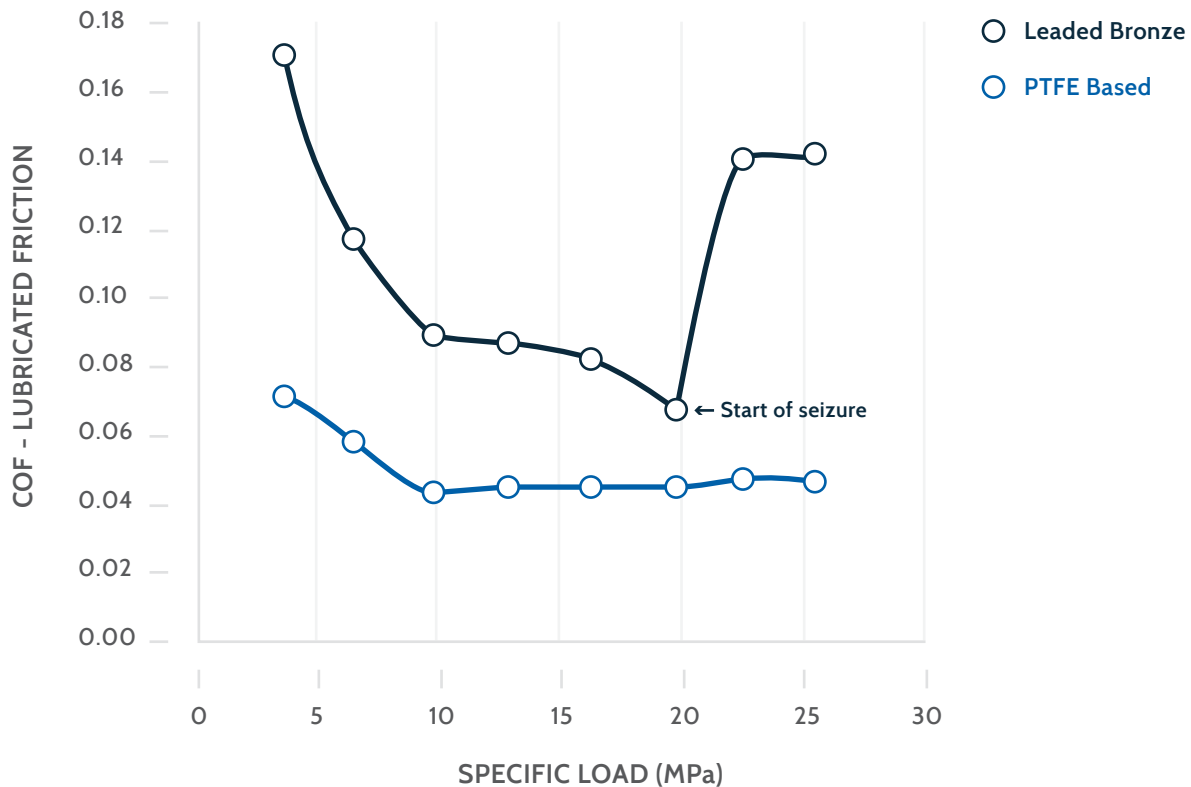
The excellent hydrofatigue resistance of DTS10™ products makes them an ideal choice for applications with cyclic or rotating loads.



Relative Friction and Seizure Resistance

As demonstrated in a friction and load test, DTS10™ bearings offer an excellent alternative to bimetallic bearings. The chart below compares the performance of PTFE based metal-polymer materials against leaded bronze, commonly used as the sliding layer in bimetal bearings.

In this incremental test, the load is increased with time and the friction and wear are recorded. As seen below, PTFE-based metal-polymer materials produce significantly lower friction over the entire range of loads, exhibiting excellent seizure resistance well past the point at which the leaded bronze product seized.





Machining

The PTFE copolymer lining of DTS10™ has excellent machinability characteristics, making it an ideal material for high precision applications. The benefit of machining the DTS10™ liner is that a controlled or precisely designed oil clearance can be achieved producing an almost perfect bearing form, which reduces inner diameter tolerances, initial bearing wear and noise. Dimensionally, the machined bore meets tolerance class 7 specifications with a surface finish in the range of 1.6 μm Ra max, with geometric roundness below 10 μm .

Class 7 Chart

Ø RANGE	TOLERANCE	TOLERANCE CLASS
> 6.0 ≤ 10.0	+ 0.015 0	H7
> 10.0 ≤ 18.0	+ 0.018 0	
> 18.0 ≤ 30.0	+ 0.021 0	
> 30.0 ≤ 50.0	+ 0.025 0	
> 50.0 ≤ 80.0	+ 0.030 0	
> 80.0 ≤ 120.0	+ 0.035 0	

Units (mm)

Machining Guidelines

The DTS10™ liner can be machined using three recommended methods: boring, milling and reaming. When machining DTS10™, it is recommended that no more than 0.05mm is removed from the lining thickness in order to ensure an ideal overlay anti-friction layer. Precise machine set-up and careful tool alignment are essential in obtaining good assembled roundness and cylindricity after machining.

- To avoid overheating and excessive wear on the tooling, lubrication is essential.
- Use a system to ensure that burrs/swarf will be removed (e.g. brush, air).
- Use polycrystalline diamond (PCD) or coated carbide (K20) tool material.

Please contact the GGB Application Engineering department should you have a specific need.

Boring

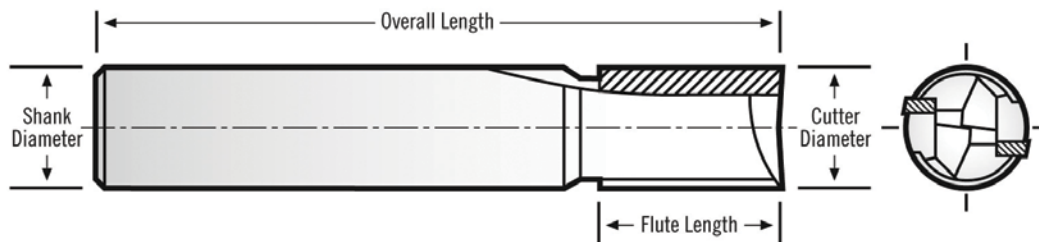
It is recommended to use inserts with wiper technology. The essential characteristics required in the single point turning tool is a nose radius of 0.2 mm – 0.4 mm, combined with a rake angle no greater than 15 degrees. Optimal cutting speeds are between 200 – 500 m/min. The feed rate should be in the range of 0.05 – 0.5 mm/rev. Satisfactory finishes can be obtained using PCD or coated carbide tool materials.

Clearance angle	5 - 10°
Rake angle	0 - 15°
Nose angle	35 - 55°
Nose radius (ISO types DC and VC)	R = 0.20 - 0.40 mm
Speed	200 - 500 m/min
Feed Rate	0.05 - 0.50 mm/rev

Milling

For milling, it is recommended to use two edge millers. The characteristic required in the milling tool is a clearance angle of 5 -10 degrees. The rake angle should be no greater than 15 degrees. Optimal cutting speeds are between 200 – 500 m/min. The feed rate should be in the range of 0.05 – 0.1 mm/tooth.

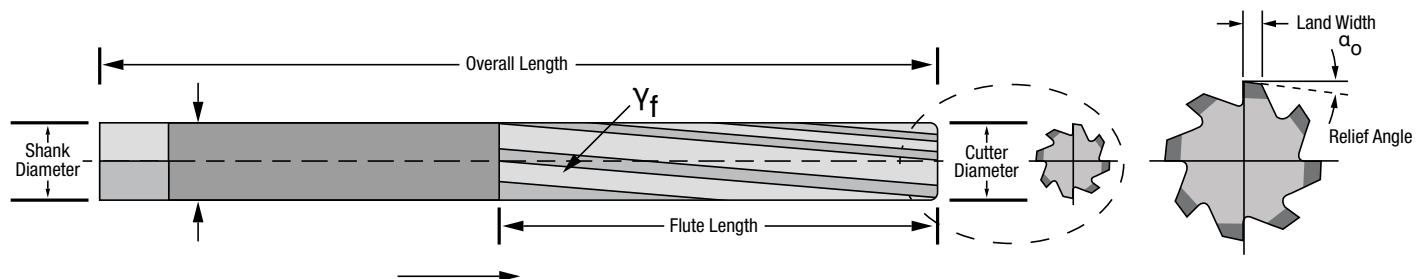
Clearance angle	5 - 10°
Rake angle	0 - 15°
Speed	200 - 500 m/min
Feed Rate	0.05 - 0.1 mm/tooth



Reaming

The reaming process utilizes multiple cutting edges and is an ideal method for enlarging or sizing the inner diameter of DTS10™ bushings. The essential characteristics required in the reaming tool are a 10-degree clearance or relief angle, and a tooling groove angle of 10 degrees. The benefits of reaming produces hole geometry and finish as close to perfection as theoretically possible.

Clearance / relief angle	10°
Rake angle	0°
Helix angle	10°
Speed	200-500 m/min
Feed Rate	0.05 - 0.10 mm/tooth



Product Information

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

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

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

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

Edition 2015 (This edition replaces earlier editions, which hereby lose their validity.)

RoHS - Restriction of Hazardous Substances

Declaration on lead contents of GGB products/compliance with EU law: It has been prohibited under Directive 2011/65/EU (restriction of the use of certain hazardous substances in electrical and electronic equipment; ROHS II 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 II Directive are exempted. According to Directive 2011/65/EU 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.

All products of GGB, with the exception of DU®, DU-B™, DB™, PICAL™2, SY™, GGB-CSM™115, GGB-CSM™118, GGB-CSM™124, GGB-CSM™125, GGB-CBM™311, GGB-CBM™312, GGB-CBM™321, GGB-CBM™322, GGB-CBM™341, GGB-CBM™342 und SP satisfy these requirements of 2011/65/EU from 08.06.2011 (ROHS II Directive). All products manufactured by GGB are also compliant with REACH Regulation (EC) No. 1 907/2006 of December 18, 2006."

Fabrication

At temperatures up to 250°C, the polytetrafluoroethylene (PTFE) present in the lining material is completely inert so that even on the rare occasions in which DP4™, DP4B™, 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.

Bearing Application Data Sheet

Not sure which GGB part fits your application requirements? Go to ggbpartfinder.com to complete a Bearing Application Data Sheet online, and one of our GGB bearing specialists will reach out to you with recommended options that meet your application requirements. You can also complete the form below and share it with your GGB sales person or distributor representative.

DATA FOR BEARING DESIGN CALCULATION

Application:

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

DIMENSIONS (mm)

Inside diameter	D_i	
Outside diameter	D_o	
Length	B	
Flange diameter	S_{fi}	
Flange thickness	B_{fi}	
Wall thickness	S_T	
Length of slideplate	L	
Width of slideplate	W	
Thickness of slideplate	S_s	

LOAD

Radial load static [N]	F	dynamic [N]	
Axial load static [N]	F	dynamic [N]	
Specific load radial [MPa]	p	axial [MPa]	

MOVEMENT

Rotational speed	N [1/min]	
Speed	U [ms]	
Length of stroke	L_s [mm]	
Frequency of stroke	[1/min]	
Oscillating cycle	ϕ [°]	
Oscillating freq.	N_{osz} [1/min]	

MATING SURFACE

Material	
Hardness	HB/HRC
Surface finish	Ra [μm]

FITS & TOLERANCES

Shaft	D_j	
Bearing housing	D_H	

OPERATING ENVIRONMENT

Ambient temperature	T_{amb} [°]	
<input type="checkbox"/>	Housing with good heating transfer properties	
<input type="checkbox"/>	Light pressing or insulated housing with poor heat transfer properties	
<input type="checkbox"/>	Non metal housing with poor heat transfer properties	
<input type="checkbox"/>	Alternate operation in water and dry	

LUBRICATION

<input type="checkbox"/>	Dry
<input type="checkbox"/>	Continuous lubrication
<input type="checkbox"/>	Process fluid lubrication
<input type="checkbox"/>	Initial lubrication only
<input type="checkbox"/>	Hydrodynamic conditions

Process fluid	
Lubricant	
Dynamic viscosity	η

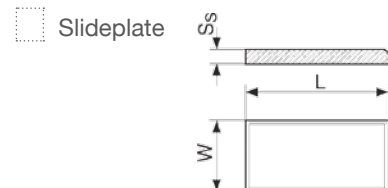
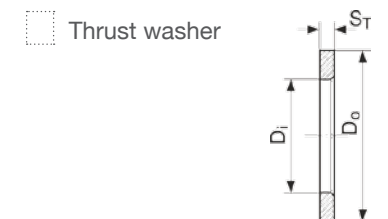
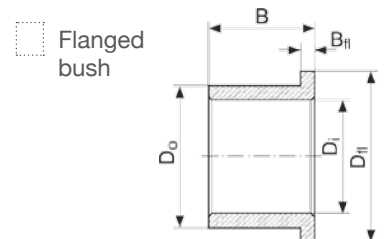
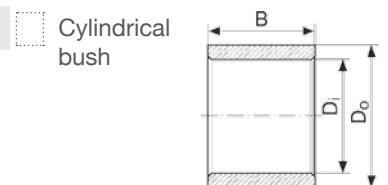
SERVICE HOURS PER DAY

Continuous operation	
Intermittent operation	
Operating time	
Days per year	

SERVICE LIFE

Required service life	L_H [h]
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BEARING TYPE:



- ☐ Special parts (sketch)
- ☐ Rotational movement
- ☐ Steady load
- ☐ Rotating load
- ☐ Oscillating movement
- ☐ Linear movement

CUSTOMER INFORMATION

Company

Street

City / State / Province / Post Code

Telephone Fax

Name

Email Address Date



an EnPro Industries company

The Global Leader in High Performance Bearing Solutions

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