

DTS10[®]
METAL-POLYMER BEARING SOLUTIONS
FOR LUBRICATED APPLICATIONS

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 120 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 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 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 ISO 45001, allowing 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:

<https://www.ggbearings.com/en/certificates>



RESPECT

Our teams work together with mutual respect regardless of background, nationality, or function, embracing the diversity of people and learning from one another - after all, with respect comes both individual and group growth.



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The GGB Advantage



LOWER SYSTEM COST

GGB bearings reduce shaft costs by eliminating the need for hardening and machining grease paths. Their compact, one-piece construction provides space and weight savings and simplifies assembly.



LOW-FRICTION, HIGH WEAR RESISTANCE

Low coefficients of friction eliminate the need for lubrication, while providing smooth operation, reducing wear and extending service life. Low-friction also eliminates the effects of stick-slip or “stiction” during start up.



MAINTENANCE-FREE

GGB bearings are self-lubricating, making them ideal for applications requiring long bearing life without continuous maintenance, as well as operating conditions with inadequate or no lubrication.



ENVIRONMENTAL

Greaseless, lead-free GGB bearings comply with increasingly stringent environmental regulations such as the EU RoHS directive restricting the use of hazardous substances in certain types of electrical and electronic equipment.



CUSTOMER SUPPORT

GGB’s flexible production platform and extensive supply network assure quick turnaround and timely deliveries. In addition, we offer local applications engineering and technical support.



GLOBAL FOOTPRINT

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.

1 Introduction

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)

2 Structure and Composition

The DTS10® metal-polymer bearing contains three layers. The sliding layer is a thick (0,1 mm) 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.

2.1 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 8 mm up to 300 mm. All formats are considered made to order items.

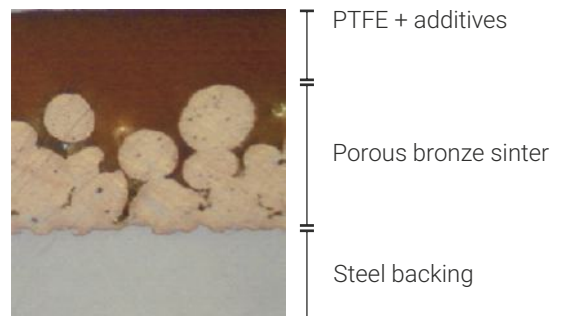
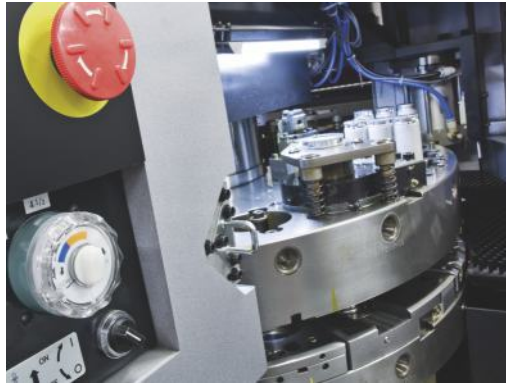


Figure 1: DTS10® microsection



Figure 2: DTS10® available forms

3 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
- Oil pumps
- Hydraulic cylinders
- Scroll compressors
- Powertrain and industrial gearboxes
- Small engines
- Radial piston motors
- Semi-hermetic and hermetic reciprocating compressors

4 Properties

4.1 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

Table 1: Lubricated bearing properties

*Depending on hydro-dynamic conditions

5 Bearing Performance

5.1 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.

TEST CONDITIONS	
Bearing Diameter	20 mm
Bearing Length	15 mm
Mean Diametral Clearance	0.07 mm
Speed	0.11 m/s
Lubricant	ISO VG 46 hydraulic oil
Temperature	ambient

Table 2: Test conditions - Relative lubricated wear resistance

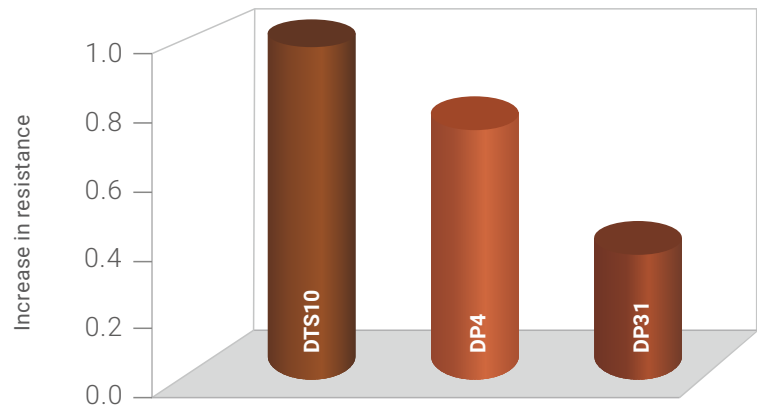


Figure 3: Relative lubricated wear resistance

5.2 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.

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

Table 3: Test conditions - Relative cavitation resistance

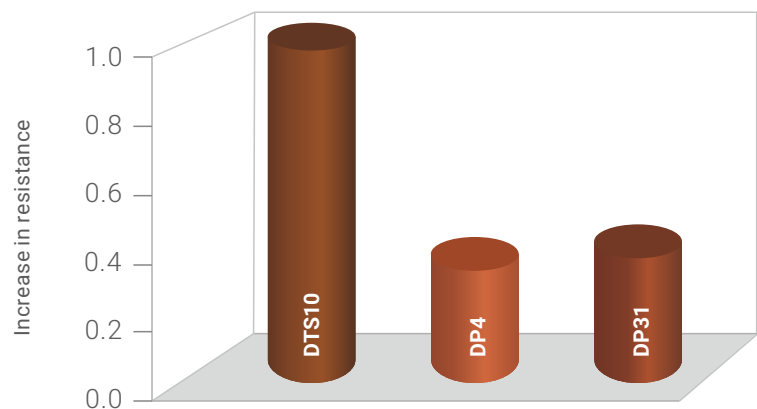


Figure 4: Relative cavitation resistance

5.3 RELATIVE HYDROFATIGUE RESISTANCE

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

TEST CONDITIONS	
Load	18 N/mm ²
Speed	1.05 m/s
Lubricant	oil ISO 680
Temperature	+ 120°C

Table 4: Test conditions - Relative cavitation resistance

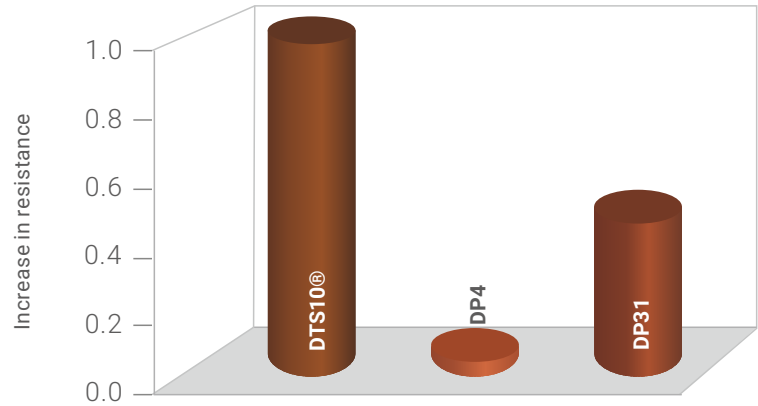
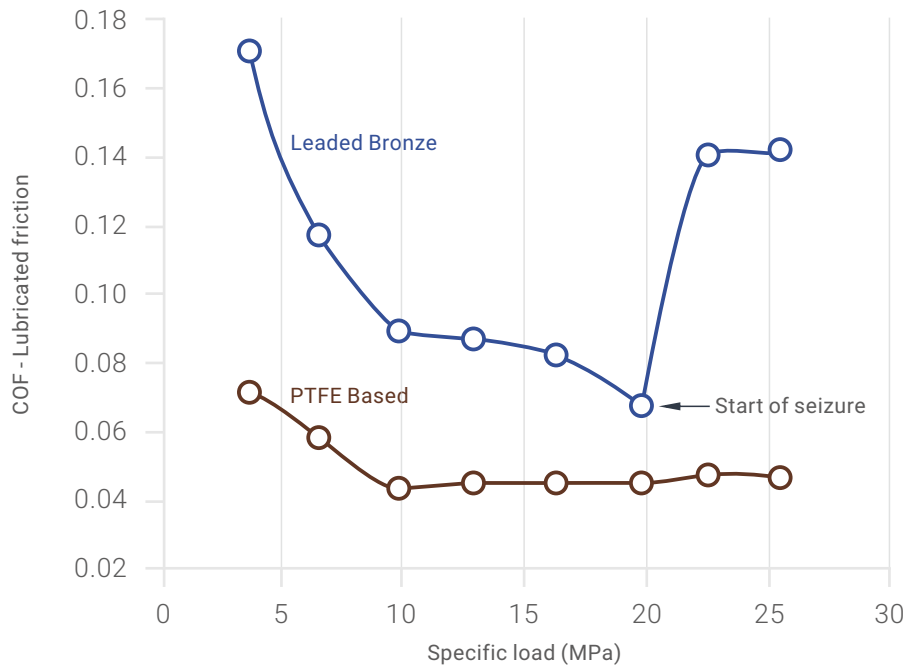


Figure 5: Relative cavitation resistance

5.4 RELATIVE HYDROFATIGUE 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.



6 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.



Ø RANGE	TOLERANCE	TOLERANCE CLASS
> 6,0 ≤ 10,0	+ 0,015	H7
	0	
> 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]

6.1 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 0,05 mm 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.

6.2 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.

BORING CONDITIONS

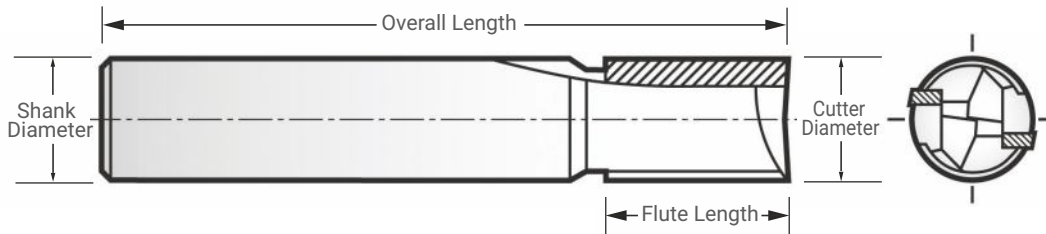
Clearance Angle	5 - 10°
Rake Angle	0 - 15°
Nose Angle	356 - 55°
Nose Radius (ISO types DC and VC) R =	0.20 - 0.40 mm
Speed	200 - 500 m/min
Feed Rate	0.05 - 0.50 mm/rev

6.3 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.

MILLING CONDITIONS

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

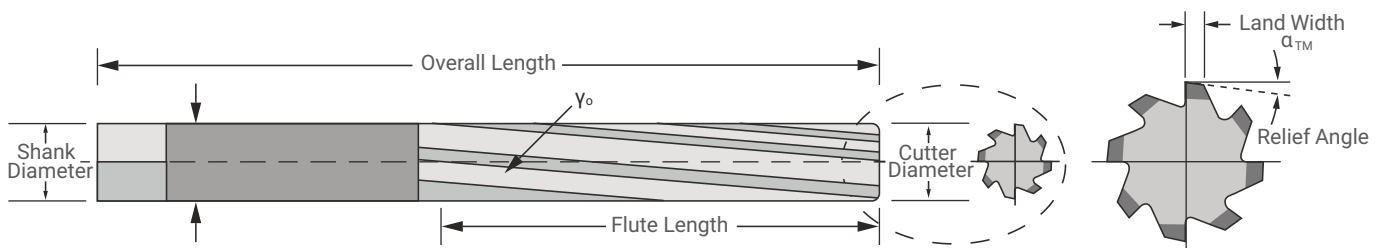


6.4 REAMING

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.

REAMING CONDITIONS

Clearance / Relief Angle	10°
Rake Angle	0°
Helix Angle	10°
Speed	200 - 500 m/min
Feed Rate	0.05 - 0.1 mm/tooth



7 Product Information

GGB assures 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 material suitability for intended use. They have been developed from our own investigations as well as 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 for 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 technical data without prior announcement. Edition 2023 (this edition replaces earlier editions which hereby lose their validity).

STATEMENT REGARDING LEAD CONTENT IN GGB PRODUCTS & EU DIRECTIVE COMPLIANCE

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

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

Each of our global locations has management systems in place that adhere to IATF 16949, ISO 9001, ISO 14001, ISO 45001, and AS9100D/EN9100 quality regulations.

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



GGB®, DU®, DP4, DX®, DP31 and DTS10® are registered trademarks or trademarks, as the case may be, of GGB and its affiliates.

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8 Bearing Application Data Sheet

Not sure which GGB part fits your application requirements?

Please 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

Steady load Rotating load Rotational movement Oscillating movement Linear movement

DIMENSIONS [MM]

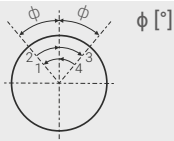
Inside diameter	D_i
Outside diameter	D_o
Length	B
Flange Diameter	D_{fl}
Flange thickness	B_{fl}
Wall thickness	S_T
Length of slideplate	L
Width of slideplate	W
Thickness of slideplate	S_s

LOAD

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

MOVEMENT

Rotational speed	N [1/min]
Speed	U [m/s]
Length of stroke	L_s [mm]
Frequency of stroke	[1/min]
Oscillating cycle	ϕ [°]
Osc. frequency	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} [°]
Bearing housing material	
<input type="checkbox"/> Housing with good heating transfer properties	
<input type="checkbox"/> Light pressing or insulated housing with poor heat transfer properties	
<input type="checkbox"/> Non metal housing with poor heat transfer properties	
<input type="checkbox"/> Alternate operation in water and dry	

LUBRICATION

<input type="checkbox"/> Dry	
<input type="checkbox"/> Continuous lubrication	
<input type="checkbox"/> Process fluid lubrication	
<input type="checkbox"/> Initial lubrication only	
<input type="checkbox"/> Hydrodynamic conditions	
Process fluid	
Lubricant	
Dynamic viscosity	η [mPas]

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

Cylindrical bush

Flanged bush

Thrust washer

Slideplate

Special parts (sketch)

CUSTOMER INFORMATION

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

PUSHING BOUNDARIES TO CO-CREATE A HIGHER QUALITY OF LIFE



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