



Self-lubricating Bearings for
Marine and Offshore Applications

deva.metal® is a family of high performance, self-lubricating bearing materials. The **deva.metal** system is based on four main groups – bronze, iron, nickel and stainless steel – each containing dry solid lubricant, most commonly graphite, uniformly dispersed within the metal matrix.

Important selection criteria are the sliding speed, specific load, temperature and other application-specific influences.

deva.metal

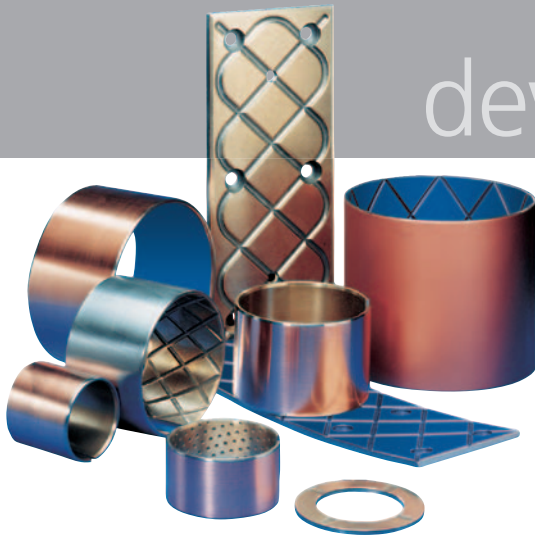
- normally requires no lubrication.
- provides maintenance free operation.
- has high static and dynamic load capacity.
- has good frictional properties with negligible stick-slip.
- can be used in dusty environments.
- can be used in a temperature range of -200°C to +800°C, depending on alloy.
- grades may be selected to tolerate corrosive applications.
- has no water absorption and is therefore dimensionally stable, suitable for use in sea water and many commercial liquids.
- alloys are available for use in radioactive environments.
- is electrically conductive. No signs of electrostatic charging occur.

- is suitable for translatory, rotational and oscillating movements with cylindrical guide or also for direct surface use. These movements can occur individually or in combination.
- is used where conventional lubrication is not possible.
- offers advantages for low-cost lubrication in comparison to conventional bearing materials.
- can be used as back-up bearing for hydrodynamic lubrication.
- can be used with hydrodynamic water lubrication.



deva.metal®

deva.bm® · deva.bm®/9P



deva.bm® is a self-lubricating composite bearing material, comprising a seawater resistant stainless steel backing with a sliding layer of **deva.metal®**.

deva.bm is produced using a special sintering process to get the following advantages.

deva.bm

- normally requires no lubrication.
- allows maintenance-free operation.
- possesses a high static and dynamic load-bearing capacity.
- has a low coefficient of friction.
- is stick-slip-free.

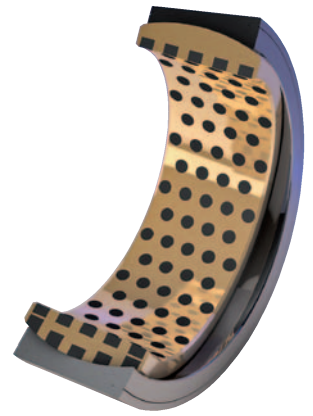
- offers a high margin of safety against mating material damage.
- is utilisable in dusty environments.
- is utilisable at temperatures ranging from -190 °C to +280 °C.
- is utilisable in corrosive environments.
- does not absorb water and ensures maximum dimensional accuracy.
- is utilisable in seawater.
- is utilisable in radioactive environments.
- is electrically conductive. No electrostatic charging effects occur.
- is suitable for rotational, oscillating and linear movements.
- is suitable for micro movements.
- is suitable even for applications involving high edge pressures.

deva.glide® materials consist of highly wear-resistant copper cast alloys showing sliding surfaces with evenly provided solid lubricant plugs according to the so-called "macro distribution" principle. These plugs are arranged according to the movement requirements. The high density of the bronze ensures high stability under load along with good dirt particle embedding properties into the lubricant plugs. Under dry running conditions, **deva.glide** is supplied with a 10 - 15 µm thick running-in film which enables the solid lubricant to be transferred to the mating material at the first contact between the sliding partners.

deva.glide

- allows maintenance-free operation due to the solid lubricant content of the sliding material.
- can accommodate high static and dynamic loads.
- has a consistently low coefficient of friction without stick-slip effects.
- is resistant to dirt, corrosion, impact stress and edge loads.

- is provided with a vibration absorbing base material.
- can be used over a large temperature range.
- can be used in salt water.
- does not absorb water and ensures maximum dimensional accuracy.
- is electrically conductive. No electrostatic charging effects occur.
- tolerates a high level of misalignment.
- can also be used in applications involving additional, conventional lubrication.



deva.glide®



deva.tex®



deva.tex® is a self-lubricating, glass-fibre reinforced composite bearing material which is produced using a special winding technology. The base material ensures high strength, while the sliding layer contains special non-abrasive fibres and solid lubricants which ensure excellent tribological properties even in damp environments or in the event of edge loads. The solid lubricants were developed to give extremely low coefficients of friction and wear rates in both wet and dry-running conditions.

deva.tex

- is available as a precision cylindrical or spherical bushing with inner diameter tolerances H8/D8/E8, or as a standard bushing with inner diameter tolerance D11. The required grade of precision depends on the application.
- is available as spherical bearings.
- is available as plates made of a sliding layer with or without glassfibre backing.
- is available as radial segments produced with the required radius.
- can be machined to the required inner or outer diameter.
- requires no additional lubrication.
- can be equipped with cleaning grooves.
- allows for maintenance-free operation.
- can accommodate high static and dynamic loads.
- shows no swelling in liquids.
- is suitable for rotating, oscillating and linear movements.
- withstands temperatures up to 160 °C (cylindrical bearings).
- can be used in seawater (certification for rudder bearings DNV and GL).
- can be used in corrosive environments.
- is non-sensitive to impact loads and shock loads.
- is non-sensitive to vibrations.
- is suitable for micro-movements.
- can be used in a vacuum.

DEVA self-lubricating bearings in Marine and Offshore Applications

Design, Research & Development

Investment in innovation

Offshore and Marine applications constantly require new bearing developments. The Federal-Mogul DEVA application engineers support these development processes from their initial inquiry over application specific calculations up to the final design and installation. Based on this a suitable bearing material is chosen from hundreds of options of the unique DEVA bearing material system. Additionally the DEVA R&D engineers are able to test and prove bearing materials. Beside applying different movements, loads and speeds the Deva bearings can be tested under special conditions like extreme heat, different oils or sliding pastes, sea water and sand, sub-zero temperatures and hydrodynamic lubrication, just to name a few.

The very close collaboration with our customers is completed by a substantial service portfolio:

- Support in selecting sliding material and counter material
- Design support (tolerances, fixation etc.)
- Service life estimation
- FEM analyses
- Assembly assistance / inspection assistance on-site by DEVA service technicians
- Implementation of specific customer- / application tests
- Chemical analyses if required

DEVA test rig

DEVA service technician during noise measurement on a spherical bearing of a FPSO mooring system





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Applicat

Mooring- & Turret system

- Fairleads / Chain stoppers
- Winches / Windlasses
- Universal joints

Jacking & fixation system

- Oil rigs
- Wind-turbine installation

Off-loading terminals in

- Loading arms
- Loading couplings

Pipe-laying equipment in

- Stinger handling system
- Stinger / tower- / hinge
- Pipe handling equipment
- Pipe couplings

Riser applications incl.

- Hang off's
- Connectors
- Tensioner systems
- Riser pull in systems

Crane applications

Dredging applications

Drilling equipment & ma

- Top drive systems
- Tube handlings
- Wellhead systems
- Drilling tools

Subsea applications

- AUV's & ROV'S
- Subsea tools
- Production & Auxiliary e

Marine applications

- CPP-pitch regulation be
- Trim tabs / Rudder bear
- Submarine application
- RO-RO applications



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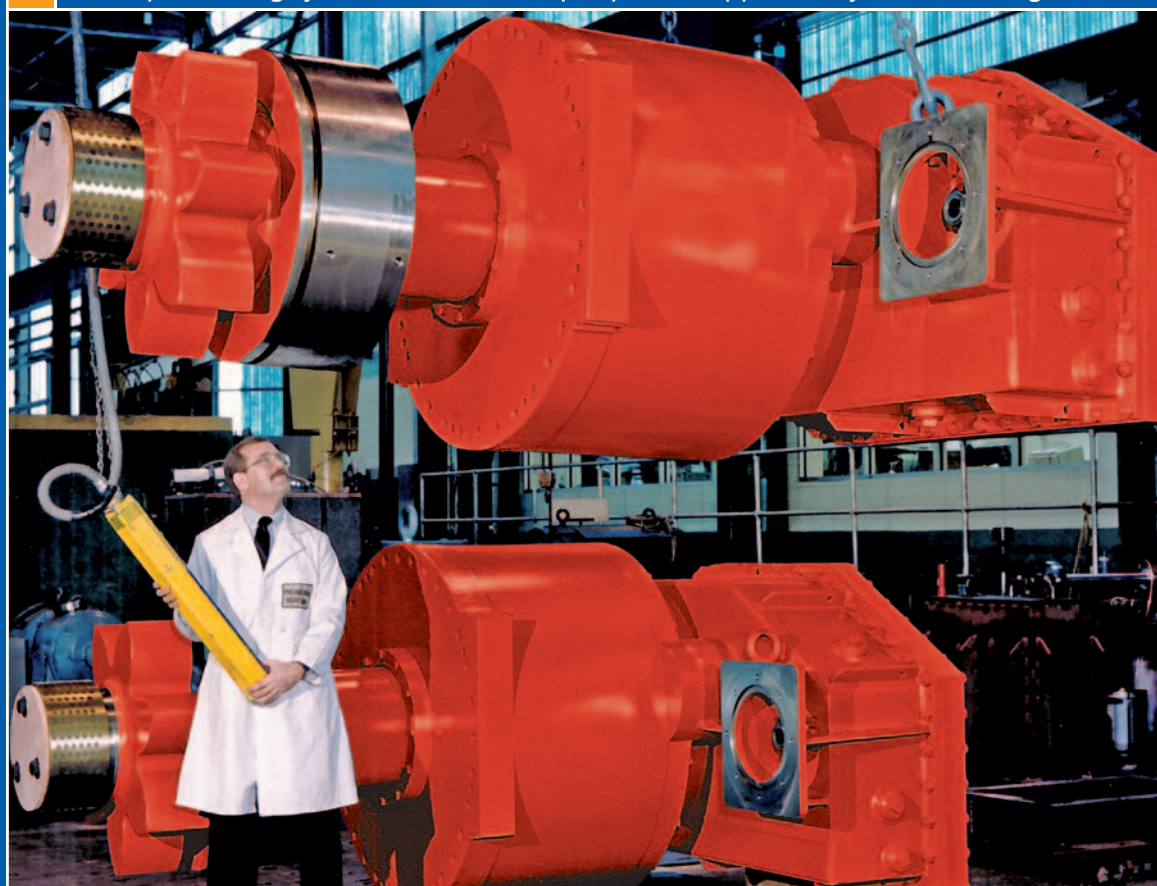
Maintenance-free bearing technology at a glance

The market for self-lubricating and maintenance-free bearings is growing rapidly within the Marine and Offshore Industries. Increasing maintenance cost, the pressure of competition and the need to be environmentally friendly is leading companies to change the way bearings have been used for decades: Grease is substituted with solid lubricants which form a film with low friction between the bearing and the mating part, thus separating them from each other. This allows a low and controlled wear combined with low friction.

Extreme operating conditions and challenges like high loads, stick-slip, chemicals, edge load, dirt, corrosion, small angular movements, extreme temperatures, difficult or impossible lubrication among others are everyday challenges for Federal-Mogul DEVA. A high-end self-lubricating bearing can be used as a solution for all these demands.

DEVA has a broad range of different maintenance-free materials, enabling a custom-made bearing solution for each application, regardless of if submerged, above surface or in the splash zone.

Jack up elevating system – Gearbox output pinion supported by DEVA bearings





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