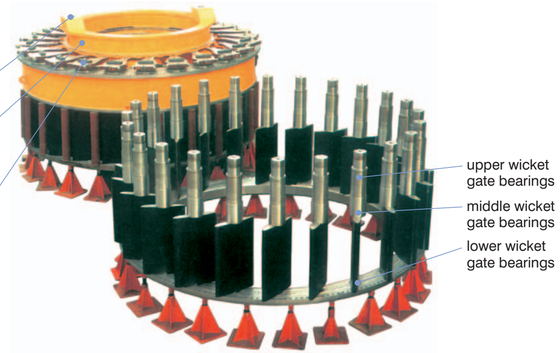
Francis turbine

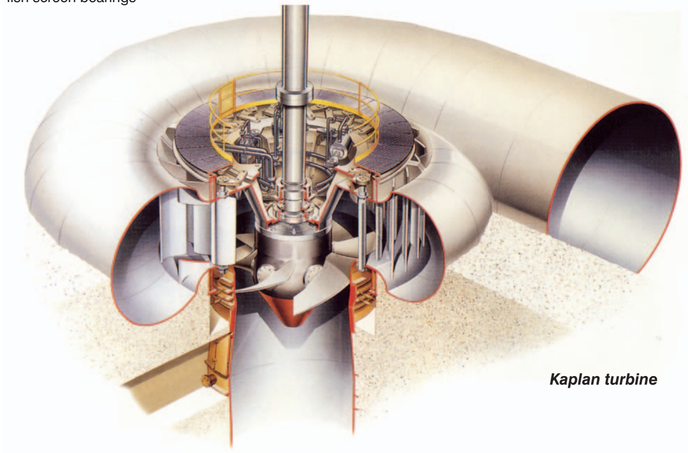


Gates
- intake gate sliding segments
- intake gate roller bearings
- spillway gate bearings
- lock gate bearings
- trash rake bearings
- fish screen bearings

Valves
- ball and butterfly valves trunion bearings

Pelton turbines
- injector bearings
- deflector bearings

Kaplan turbines
- servo-motor bearings
- linkage bearings
- trunion bearings
- blade bearings



Kaplan turbine

GGB
BEARING TECHNOLOGY

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GGB, an EnPro Industries company

IN213ENG05-07USA

Leading the Way in Hydropower Bearings

Technical Information

GGB
BEARING TECHNOLOGY

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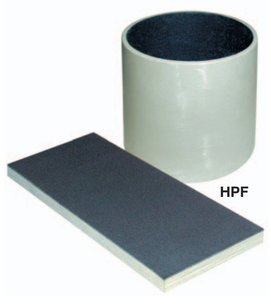
Introduction

GGB Bearing Technology is the world's largest manufacturer of polymer plain bearings for low maintenance and maintenance free applications. This includes an extensive product portfolio including metal-polymer bearings, thermoplastic materials, fibre-reinforced polymer composite materials and monometallic materials.

In addition to metal polymer plain bearings, GGB Bearing Technology also has specialist expertise in the manufacture of fibre reinforced polymer composite bearings and materials. With its own filament winding facility, together with the technical support and design services of its R&D Department, GGB Bearing Technology is ideally positioned to provide advanced and unique bearing solutions.

New GGB Hydropower products - HPF™, HPM™



HPF

GGB Bearing Technology is proud to announce the availability of two recently developed self-lubricating, fiber/resin composite bearing materials, HPF and HPM.

These materials have been specifically designed to meet the demands of a wide range of hydropower applications for high load capacity, low wear, low friction and a long service life.

Both HPF and HPM combine the excellent self-lubricating properties of PTFE (polytetrafluoroethylene) with the high strength and stability of a carefully orientated glass fibre filled epoxy resin backing.

Typical advantages offered by these materials include:

- Self-lubrication and maintenance free
- High load capabilities
- Excellent shock and edge loading capabilities
- Low coefficient of friction
- Superior wear rate and bearing life compared with conventional bearings
- Dimensional stability, very low water absorption, no swelling
- Excellent corrosion resistance
- Environmentally friendly
- Secure and easy installation

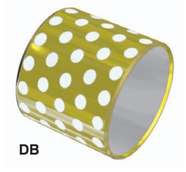
HPM

HPF self-lubricating materials are available in both flat and cylindrical bearing geometries and consist of a proprietary filled PTFE liner securely bonded to a fibreglass reinforced composite backing. The specially formulated liner has been developed to maximize bearing life without lubrication.

HPM is available as cylindrical bushing and consists of a bearing liner, composed of a PTFE and high strength fibre winding encapsulated in an epoxy resin, that has been further enhanced with self lubricating filler to minimise friction and maximize wear resistance.

DB™ and DU®B

Other well-known GGB Bearing Technology maintenance-free bearings recommended for Hydropower applications are DB and DUB.



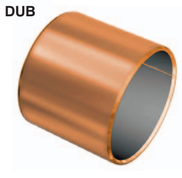
DB

DB is available as cylindrical bearings, flanged bearings, thrust washers, self-aligning bearings and sliding plates. DB consists of a high strength bronze with strategically placed solid lubricant inserts. A running-in film of solid lubricant is also applied to the sliding surface. The bronze alloy and lubricant inserts are selected according to the application conditions and operating environment. The lubrication inserts are arranged for optimal distribution over the sliding surface.

Typical advantages of DB are:

- Provides maintenance-free operation
- High load capacity
- Excellent performance under high load, intermittent operating conditions
- Negligible stick-slip effect
- Long service life, due to low wear rate
- Corrosion resistance

DUB



DUB is available as cylindrical bearings, flanged bearings, thrust washers, flanged washers and strip. DUB consists of thee bonded layers: a bronze backing and a porous bronze matrix, impregnated and overlaid with the PTFE/lead bearing material. The bronze backing provides a high corrosion resistance, anti-magnetic properties and a good thermal conductivity. DUB is anti-magnetic and performs well with a good wear and friction performance over a wide range of load, speed and temperature conditions.

Service and Support

As a world class supplier, GGB offers a professional service with unrivalled customer technical support via a team of Application Engineers including:

- application data analysis
- material specification
- bearing dimensions calculation
- design recommendations and drawings
- technical proposal and quotations
- machining recommendations
- bearing installation assistance

Other special support activities may be considered on request such as:

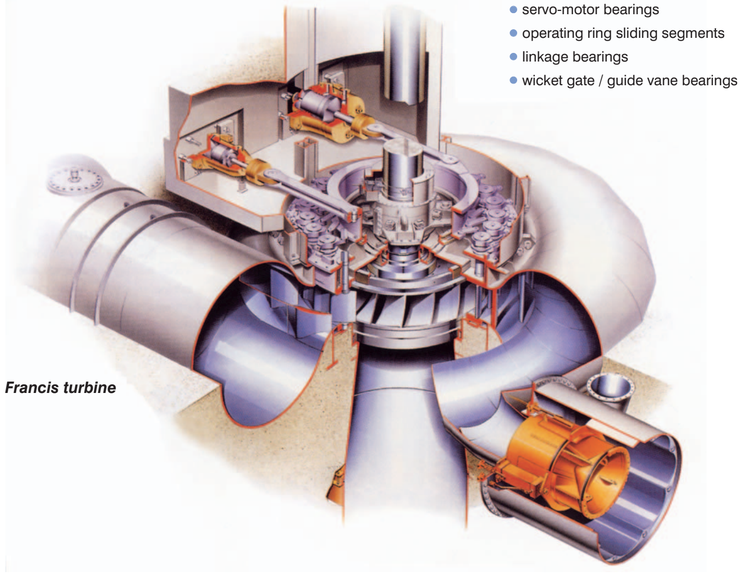
- references
- life-time estimation
- test rig evaluations
- third party approval
- certification / guarantee

Hydropower Applications

Potential applications for **HPF**, **HPM**, **DB** and **DUB** bearings include:

Francis turbines

- servo-motor bearings
- operating ring sliding segments
- linkage bearings
- wicket gate / guide vane bearings



Francis turbine