The Global Leader
in High Performance Bearing Solutions

GGB
BEARING TECHNOLOGY
an EnPro Industries company

GGB Provides Unique Custom Solutions for Global Hydropower Projects

GGB Bearing Technology is on the forefront of developing highly customized solutions to specific friction challenges, to help the hydropower industry realize its maximum potential.

GGB's fiber reinforced composite bearings, including HPMB™, HPM and HPF,are specifically developed for hydropower applications. Their reinforced composite structure has a high load capacity, excellent shock and edge loading capacity, excellent corros ion resistance and is dimensionally stable. The bearings will not deform, crack or delaminate under severe conditions often found in hydroelectric installations. Further, they will not swell to the point that the bearings could stick to the shafts and prev ent them from moving.

The high load carrying capacity of GGB bearings provides substantial benefits to the customer, including a significant cost savings. With low friction and significantly less wear, GGB bearings offer reduced energy consumption that lowers operating costs and provides e xtended service life. These fiber reinforced composite bearings are available as bushes, plates, bearing segments and special forms, depending on the particular material type.

GGB has excellent bearing materials well suited for the hydropower industry. But the real advantage to working with GGB is their ability to collaborate with clients to solve very specific problems, as illustrated in the following projects.

Brazil's Belo Monte Hydroelectric Power Plant

The design team of the third largest hydro plant in the world, Brazil's Belo Monte dam, selected GGB to supply HPM bearings and HPF bearing segments for wicket gate service. These bearing materials were an ideal choice because they provide reliable water and debris resistance and are able to withstand harsh 24-hour

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operating conditions at the dam, while still providing a minimum service life of 20 years.

Testing performed by Powertech Labs, in accordance with the United States Corps of Engineers (USACE), imposed severe operation conditions extended to simulate 30 years of operation instead of the typical eight years, with 10 load rejections per day versus one load rejection per day. The testing demonstrated that the coefficient of friction and wear rate decreased as running time increased, allowing the project engineers to design the turbines with smaller servomotors. Engineers now use the data provided from the test when specifying self-lubricating bearings in hydropower turbines to achieve longer service life and maintenance-free operation.

Panama Canal

Another good example of GGB's ability to collaborate with a client to meet a specific need is the development of GGB-DB™ cast bronze hemispherical bearings, a new type of pintle bearing for refurbishment and expansion of the miter gates in the Panama Canal's lock system.

Among the requirements specified for the new hydro bearings were 25-year service life, abrasion-resistance, underwater operability, and ease of assembly and operation. In addition, the USACE stipulated the use of self-lubricating bearings rather than greased bronze bearings to eliminate water contamination.

GGB-DB™ cast bronze hemispherical bearings are lined with engineered polymer in the form of embedded, solid lubricant plugs protruding above and covering 70 percent of the surface area. This configuration not only allowed for efficient flushing of the bearing via integral cleaning grooves, but also enhanced its structural integrity.

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Following the initial product development and installation, GGB was recently awarded a second contract to supply four additional pintle bearings for underwater miter gates. To date, GGB has provided a total of 10 pintle bearings, enough to refurbish five m iter gates.

China's Xiangjiaba Hydropower Plant

GGB's HPM and HPF bearings can also be found in the turbine wicket gates, as well as in servomotors and linkages, for the first of four Francis turbines that drive China's Xiangijaba hydropower plant.

GGB's HPM and HPF bearings allowed smart design of servomotors. Due to the low coefficient of friction provided by these materials, less force is required to adjust the position of the wicket gates during the operation. Also, the reduced wear observed in these materials will permit reliable operation for more than 20 years, without significant increase in the clearance between the bearings and the mating materials.

The new plant's first turbine began generating power in 2012 and, at the time, the four 800 MW turbines were the most powerful in the world, each producing an estimated power output that can serve the annual electricity needs of about five million people. When fully operational, it will be China's third-largest hydropower plant after the Three Gorges and Xiluodu dams.

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China's JiXi Pumped Storage Power Station
The JiXi Pumped Storage Power Station, currently under construction, will operate by using two reservoirs to generate power, an upper and a lower reservoir. During periods of high energy demand, water from the upper reservoir will release to the power station to generate electricity. When demand for energy is low, water will be pumped to the upper reservoir where it is stored for future demand.

Six Francis pump turbines, manufactured by Dongfang Electric Machinery Company (DEC), provide power to the station. Based on the location of wicket gates, the operating regime of bearings in the operating ring is much more demanding, due to the increased level of vibrations and loads.

To service this demanding application, GGB supplied HPMB™ composite bearings based on the machinability of the liner, precision requirements and superior dithering operating performance. More than 70 percent of all of the bearings are being machined to the final dimensions by DEC. The remaining 30 percent of HPMB™ bearings were machined to the final dimensions by GGB.

Validation tests of the HPMB™ material were performed by Powertech Labs in British Columbia, Canada, per USACE test protocol. Tests demonstrated dry coefficient of friction 0.068 and minimal stick slip effect, contributing to a smooth operation of the adjusting mechanism. Further, HPMB™ material exhibits water swell rate four times lower than some other composite bearings, allowing tighter operating clearance and resulting in pumped turbine operation with reduced vibration.

As these success stories all indicate, GGB engineers specialize in collaborating with clients early in the design phase of projects, to offer customized solutions to the world's most challenging motion design problems. With extensive expertise and locations around the globe, GGB Bearing Technology has the ability to respond promptly to your design needs wherever you do business.

For more information, please contact hydro@ggbearings.com or visit www.ggbearings.com.

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