

New maintenance-free bearings assure smooth, safe operation and long service in spillway gates



When it is commissioned in 2010 and becomes fully operational in 2011, the \$1 billion, 660 MW Porce III hydroelectric power plant will be the eighth such facility in the Porce River's watershed and the largest in the municipally owned, multi-utility system of Empresas Publicas de Medellin (EPM).

The project involved impounding the river by constructing a 150m high concrete face rockfill dam with a crest length of 426 m. In the left abutment, an open-channel spillway with a discharge capacity of 10,850 m³/s is controlled by four radial gates, measuring 11m by 14m and a flip bucket for energy dissipation. When it awarded the contract for these gates to ATB Riva Calzoni SpA, Roncadelle, Italy,

EPM indicated it wanted to minimize maintenance and service interruptions by using materials that would last for decades.

ATB Riva Calzoni turned to GGB, formerly Glacier Garlock Bearings, for a technical analysis to assure that the bearings supporting the gates would provide the required performance and longevity. Significantly the main contributors to bearing failure in hydropower gates, which do move infrequently, are dirt and corrosion.

"ATB was looking for a material that could deliver guaranteed superior performance in terms of wear rate, load capacity and sliding properties," said Gianni Borio, country manager for GGB Italy. "After evaluating the situation, we recommended our DB spherical bearings as a solution."

GGB supplied eight of these bearing, two per gate, which will be subjected to radial loads of 9,000 to 12,000 kN, axial loads of 900 to 1,200 kN and sliding speeds of 0.0003 m/s. When the gates open and close, the bearings will rotate 70° in 90 minutes at angles of +/- 2° and operating temperatures of 0°C to +40°C. They have a yield strength of 300 Mpa and can accommodate a maximum static load of 150 Mpa, maximum dynamic load of 80 Mpa, maximum sliding speed of 0.50 m/s and working temperature of -50o C to +350o C. Friction coefficient is 0.05-0.18 dry and 0.10 wet.

Special hydropower bearings

Developed specifically for hydropower applications, the self-lubricating bearings provide maintenance-free operation, excellent performance under intermittent operating conditions, high-load capacity, and corrosion resistance for long service life, up to 100 years under ideal conditions. The self-aligning spherical bearings feature a stainless steel inner ring and an axially-split aluminum-bronze alloy outer ring embedded with high-quality, graphite-free solid lubricant for easy installation.

Running-in film over the sliding surface assures instant full-load capacity to minimize stick-slip effect.

This structure provides an ultra-low coefficient of friction, maximum wear resistance, long service life and absolute corrosion resistance, even in wet, dirty environments and exposure to sea water. Embedded with solid PTFE, the environmentally friendly bearings require no additional lubrication, unlike non-corrosion-resistant bearings which are especially vulnerable to dirt and moisture and require regular lubrication which can contaminate the river.

In addition to its new DB spherical bearings, GGB recently developed two new self-lubricating, filament-wound materials, HPFTM and HPMTM for bearings for Francis, Kaplan and Pelton turbines, as well as gates and valves. These materials are specifically designed to meet the demands of a wide range of hydropower applications for high load capacity, low friction and wear rate and long service life.

