

# Bearings reduce spiral vibration turbo-generators

**Ball and socket design provides superior stiffness, dynamic alignment capability, and eliminates pivot wear.**

**W**ith the industry trending toward improved efficiency, in both new and existing equipment, higher demands are placed on the equipment and the bearings.

When Alstom Power identified a phenomenon of spiral vibration close to the trip level on one of their 450MVA hydrogen-cooled generators, Waukesha Bearings' (WB) proprietary predictive tools and extensive industry experience on equipment of this size made them the clear choice to design and manufacture a drop-in bearing replacement. More than 13 generator sets have been commissioned since the initial phenomenon was detected in 2003. In total, the Maxalign bearings have seen 600,000 cumulative operating hours with these particular Alstom generators.

Spiral vibration, also known as the Newkirk effect, can be observed on various types of turbo-machinery and is caused by a vibration induced hot spot on the shaft surface generated by friction. The relative shaft vibration at the generator non-driven end bearing was measured to be close to trip level and therefore a root cause analysis was initiated by Alstom to solve the problem. Alstom sought WB's expertise to design and manufacture new bearings to resolve the spiral vibration and fit within an existing radial space to provide a drop-in replacement without modifications to the pedestal. In terms of performance, the new bearings were required to have maximized stiffness coefficients, in particular in the direct coupled horizontal plane. Within the space constraints of the original fixed geometry bearings, the new design would need to produce acceptable load support and oil inlet flow velocity, with double insulation to prevent grounding of shaft currents via the bearings.

WB's Maxalign journal bearing with a 400mm (15.75 in) inside diameter was engineered to solve the challenges on this turbo-generator. Using proprietary predictive tools coupled with 30 years of field experience, testing, and development, WB was able to confidently predict bearing performance. This included optimisation of pad geometry, lubrication method

and taking advantage of the superior stiffness qualities of WB's ball and socket pivot design. The installation successfully eliminated the vibration and shifted critical speeds to well above the rated speed, just as the performance testing predicted.



Maxalign offers many added features which yield additional benefits to OEMs and end users alike. The ball and socket pivot design is highly adaptable to shaft misalignment caused by mechanical loading or thermal effects in large rotating equipment. The ball and socket pivot design eliminates pivot wear commonly associated with traditional pivot designs, thus providing a zero maintenance bearing. Utilising WB's 'directed lubrication' method reduces the amount of oil needed, power loss, and keeps operating temperatures within the acceptance range.

Hydrostatic jacking grooves in the lower pads not only reduce friction during start up but increase safety margins and machine reliability. The bearing also includes a provision for instrumentation to match original equipment fittings as well as the ability to directly measure electric resistance of each insulating layer when assembled.

Overall, the benefits all point to an increase in availability and reliability in the field. ●

For more information, visit  
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Fig. 1. Maxalign offers many added features which yield additional benefits to OEMs and end users alike.