



Success Story

OPTIMIZING BEARING CLEARANCE

Too tight, power is wasted and bearings wear faster. Too loose, increased vibrations overload components and run the risk of a Kaplan blade rub. These were the considerations for the eight cascade power station hydro units that have recently been subjected to increased bearing wear due to peaking operation. Brüel & Kjær Vibro's Compass 6000™ played a critical role in monitoring the clearance and facilitating maintenance planning.

MACHINE/INDUSTRY/PROCESS

Machine	22 hydroelectric generating units with Kaplan turbines
Company/Process	DEM (Dravske Elektrarne Maribor) hydropower, Slovenia
Monitoring System	Brüel & Kjær Vibro Compass 6000™
Monitoring Strategy	Protection and comprehensive condition monitoring with specialized generator monitoring for some units (air gap and magnetic flux).

OBSERVATION/DIAGNOSIS

Since peaking operation has been implemented on the hydro units, the S_{max} trend value was observed to be increasing over time; up to 130 μm at maximum load on the guide bearings of several units. Although this is still considered satisfactory according to ISO 7919-5, the bearings were disassembled anyway to determine the radial bearing clearance. This was measured to be 0.20 mm. Above 0.20 mm, S_{max} increases significantly during starting and stopping of the unit, while below 0.15 mm, S_{max} decreased to 60 μm (at full load), but the bearing temperature increases significantly

BENEFITS

By monitoring S_{max} to the limits 90-100 μm , It is possible to identify the initiation of excessive clearance during the summer months, which then gives sufficient lead time to stop the machine and adjust the bearings during the winter months. This would save 3 days lost production per unit if the re-adjustment had to be done during the production months.

Since Compass 6000™ was commissioned on all the hydro units in the cascade power stations, a major contribution was made to converting maintenance work that was interval based to predictive based. This has significantly reduced the maintenance expenses and increased uptime. Moreover, the interval between inspection shutdowns for the hydrogenerating units has also increased from 25,000 to 30,000 hours for the Zlatoličje hydropower plant. Plans are already underway to implement this turnaround time for the other power stations.



Figure 1. Tilt pad bearings.

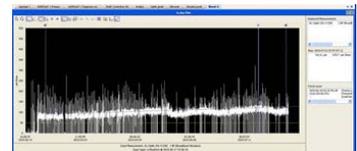


Figure 2. S_{max} trend.

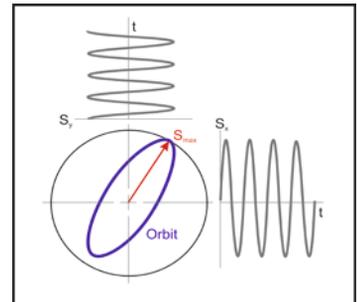


Figure 3. S_{max} definition.

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