

CASE STUDY – 07

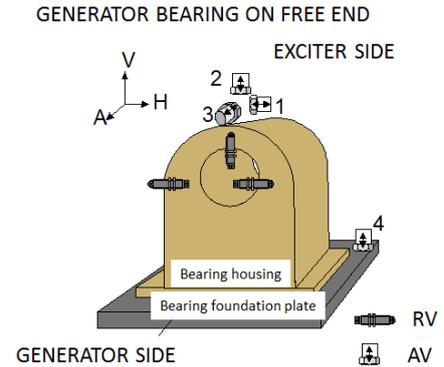
Loose bearing to foundation support / Portable Diagnostic System

Machine data:

Steam turbine generator / Power: 35 MW; 3000 RPM

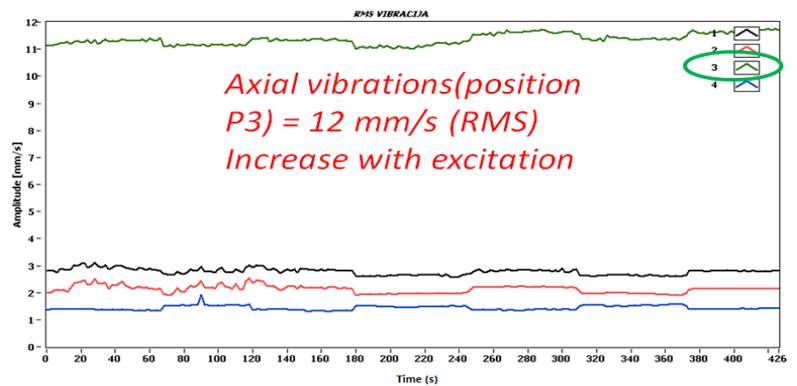
Measurement Configuration:

- 4 relative shaft vibrations (two on each generator bearing)
- 6 absolute bearing vibrations (three on each generator bearing)
- Shaft Trigger (RPM and Phase)
- Absolute vibrations of bearing foundation plate



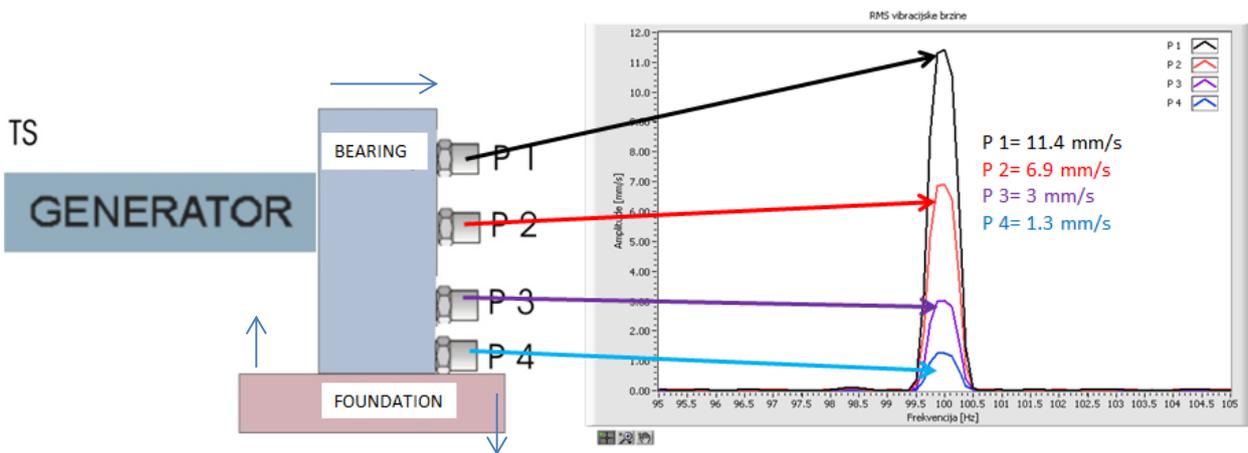
Problem: High vibration on generator bearing in axial direction

Vibration measurements were conducted before a scheduled overhaul on the generator and turbine bearings. Vibration amplitudes were in tolerance in the radial direction but the absolute vibration was considered very high in the axial direction on one of the generator bearing housings. The high vibration amplitudes occurred with excitation and increased with load.



Data analysis and problem identification

Using CoDiS-PDS¹, relevant vibration data was captured and analysed. Since high axial vibrations occurred with excitation, resonance was suspected near the 100 Hz frequency causing the bearing vibration levels to amplify as a result of exciting a critical frequency.



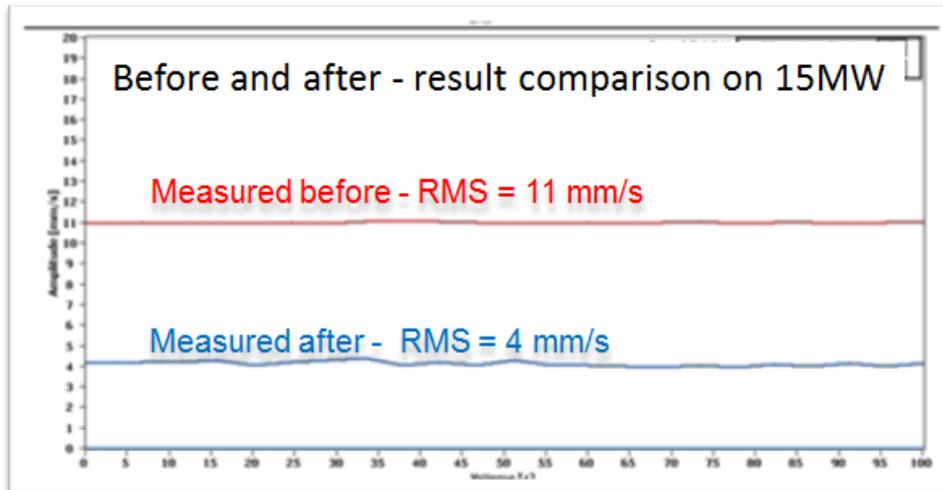
Additional measurements were conducted on the bearing housing at multiple positions in axial direction in order to detect the actual vibration pattern. Four positions were chosen from the top to bottom of the bearing housing and the FFT spectrum was conducted simultaneously on all positions. The dominant

¹ Computerized Diagnostic System – Portable Diagnostic System, Veski Ltd's product, a portable measurements system intended primarily for vibration measurements, but can be used for air gap (on hydro generators), magnetic field as well as other dynamic measurements which can then be correlated with process parameters for condition based analysis.

frequency was 100 Hz and the largest amplitude was at the top of the bearing and the lowest at the bottom. The bearing vibrated around the center of the bearing in axial direction and all 4 accelerometers signals were in phase.

During the repair works conducted on the generator the overhaul contractor disassembled the bearing and found cracks in the connection of the bearing plate to the concrete foundation which resulted in decreased bearing stiffness and shifted the bearing housing critical frequency towards the 100 Hz zone.

The plant had no time to perform permanent repairs of the bearing foundations so it was decided to drill additional holes in the concrete and temporarily fix the bearing in six more positions, which should reduce the vibrations to acceptable levels so the machine can remain in operation without any restrictions.



Conclusion

- Machine vibrational state was unacceptable due to the high axial bearing vibrations, > 11mm/s RMS
- The cause of the unacceptable vibrational state was inadequate bearing stiffness due to cracks in the bearing to foundation support
- Additional measurements were conducted, using 4 accelerometers placed on the bearing housing from the top to the bottom in order to obtain the full vibration pattern
- Temporary repair actions were taken during the overhaul to ensure the bearing vibration levels were acceptable for operation until permanent repairs scheduled for the next overhaul can be conducted