

CASE STUDY – 06

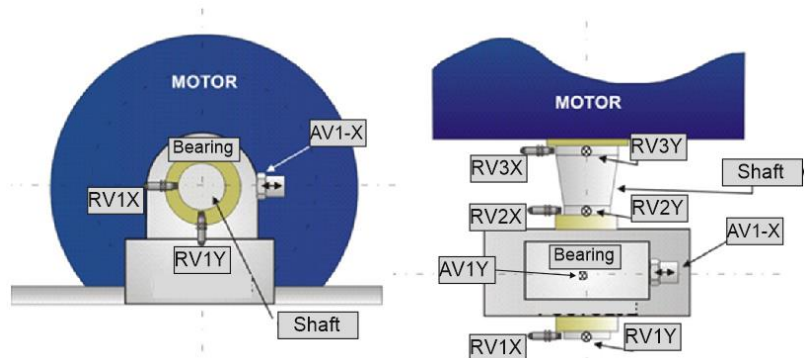
Shaft to bearing rub / Portable Diagnostic System

Machine data:

Horizontal high voltage motor-compressor (2600Bar)/ Power: 4.5 MW; 200 RPM

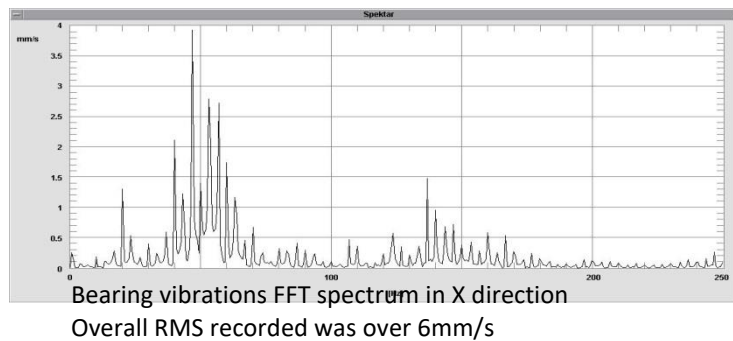
Measurement Configuration:

- 6 relative shaft vibrations
- 2 absolute bearing vibrations
- Shaft Trigger (RPM and Phase)



Problem: Vibration problems on motor free end bearing

Power plant staff noticed unusual vibration behaviour on one of the motor bearings after motor replacement which was a part of a refurbishment activity. Thorough measurements (relative shaft and absolute bearing vibrations) were performed to identify the root cause of the problem and high bearing vibrations (>6mm/s RMS) on the non-drive end of the motor.



Data analysis and problem identification

Using CoDiS-PDS (Computerized Diagnostic System – Portable Diagnostic System)¹, relevant vibration data was captured and analysed. The identification was pointed in detecting the actual shaft position inside the bearing during two staged operation (1000 and 2600 bar). The data was recorded continuously, tracking the shaft dynamic and static centerline during the load process as well as the bearing vibrations.

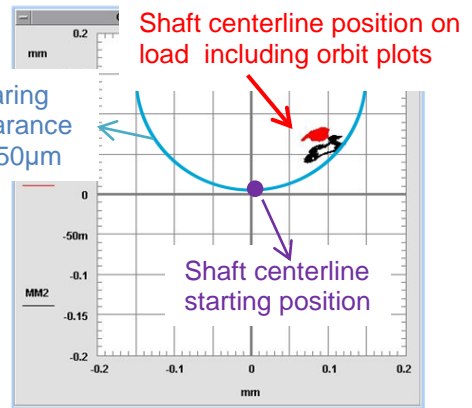
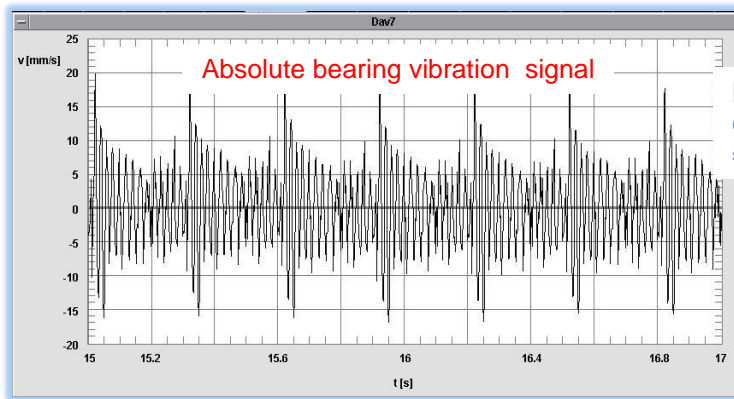
Relative and absolute vibrations analysis

Shaft static and dynamic centerline analysis revealed the position of shaft inside the bearing from standstill to full load. It was noticed that the shaft position did not change during loading, after the initial positioning caused by the hydraulic lift. The orbit plots, displayed with shaft static centerline position, showed that the shaft is orbiting around the edge of the bearing as the oil film thickness was inadequate (only 50 μm in the horizontal direction). This indicated that high absolute vibrations might be caused by contact between the bearing and the shaft on the inner side of the bearing – measurement position 2 (black orbit).

It was decided to analyze and display the raw data of the bearing vibrations in the time and frequency domains.

The waveform had a once per revolution impulse present in the signal which was a clear indication of rub repeating every turn. The bearing was constantly being “bumped” causing high vibrations. This is visible in both the raw data as well as in the FFT spectrum.

¹ Veski Ltd's product - a portable measurements system intended primarily for vibration measurements, but can be used for air gap, magnetic field, process parameters etc. analyses as well



Conclusion

- Machine vibrational state is unacceptable due to the high bearing vibrations, > 6mm/s RMS.
- Relatively small orbits were measured.
- The cause of the unacceptable vibrational state was shaft coupling. The shaft position inside the bearing was at the very edge at no load and couldn't move during loading because there was no space left.
- Bearing vibrations showed a once per revolution impulse present indicating shaft and bearing rub.
- The shaft was to be realigned and positioned in the bearing center reducing the load on the oil film.