Brüel & Kjær Vibro

Success Story

DETECTING BEARING CREEP TO AVOID REPLACING GEARBOX

Bearing creep, or also called rotational looseness, refers to rolling-element bearing inner race looseness on the shaft (this case study) or outer race looseness on the bearing housing. Inner race looseness most often occurs on the helical gear stage bearings of the multi-stage wind turbine gearboxes. A loose inner race can result in wear on the shaft that could require replacing the entire gearbox stage. It can also result in improper gear meshing, leading to broken gear teeth and thus requiring to replace the entire gearbox and lubrication oil cooling system.

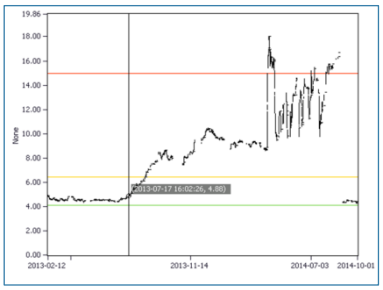

Figure 1. HFCF trend – 18 months

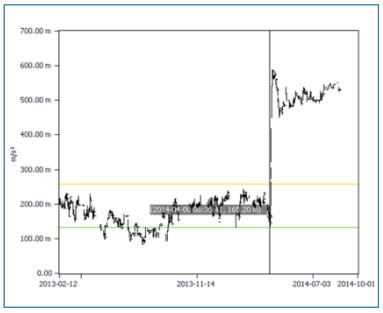

Figure 2. TMF sideband energy trend – 18 months

MACHINE/INDUSTRY/PROCESS

Machine	Bearings on intermediate speed and high speed helical gearbox stages of a wind turbine multi-stage gearbox
Company/Process	Several wind turbine operators
Monitoring System	Brüel & Kjær Vibro Wind Turbine Monitoring System: Bearing inner race is monitored by an accelerometer
Monitoring Strategy	Detection of inner race bearing fault: High frequency crest factor (HFCF). Detection of bearing creep: Tooth meshing frequency (TMF) sideband energy

OBSERVATION/DIAGNOSIS

The HFCF measurement detects inner race faults, such as pitting, spalling and hairline cracks with typically an 8 month lead-time. Not all inner race faults lead to rotational looseness, but it is speculated some faults such as cracks are the beginning stage of this condition. Once the inner race becomes loose enough to rotate on the shaft, it can be detected with the TMF sideband energy measurement. Once detected, this condition is immediately considered at the highest severity and action has to be taken quickly to avoid wear on the shaft and damage to the gear teeth.

BENEFITS

If bearing creep is allowed to progress unchecked to the point of breaking gear teeth, the entire gearbox may have to be replaced including the lubrication oil cooling system (because of metal pieces present in the system). This costs approximately US$216,000 for a 5 day shutdown or US$276,000 for 1 month shutdown (this includes equipment, downtime, labor and crane, but the actual costs depend on a number of factors). By comparison, if the inner bearing race fault was detected and the bearing replaced before a catastrophic failure occurs, this would cost only US$12,000 for a 2-day shutdown.

CONTACT

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