Bently Nevada
a Baker Hughes business

Case study

Restoring and optimizing aluminum plant operation with Bently Nevada condition monitoring system

Bently Nevada, a Baker Hughes business, successfully restored full operation to a steam turbine generator (STG) powering an aluminum smelter process plant. The turbine function is essential to profitable and reliable operations. STG downtime could cause production interruptions and would require power import from the grid, an expensive—and untenable—option for continuous plant operations.

Challenges

An aluminum smelter process plant depends on its steam turbine generator (STG) for power. To maintain proper operation, the STG underwent a major overhaul, including replacement of the last stage blades in the low pressure (LP) rotor section of the turbine. These specific blades are a key element of the turbine's operation as they can generate up to 50% of the turbine's total power.

Under initial operation following the overhaul, the STG was unable to reach running speed due to high overall vibrations at LP stage 4 and 5 bearings. The bearings were crossing trip limits and, as such, prevented the machine from reaching its operational speed.

Solution

To find the root cause of the high vibrations, transient data was collected using a Bently Nevada ADRE 408 condition monitoring system. The data indicated that high vibrations were due to residual unbalance of forces on the rotor. An in-depth data analysis suggested that there were two types of unbalance forces, thus a couple balancing was conducted for both LP rotors.

A couple balance occurs when a rotating mass has two equal unbalance forces that are situated 180 degrees opposite each other. It is a more frequent issue in elongated cylindrical rotors. For this customer, there were unique challenges stemming from multiple rotors on a single machine that were exhibiting couple unbalance forces.

ADRE Sxp software has a novel feature that calculates the static and couple unbalance forces using the vibration data collected. This feature helped the team determine which type of balancing activity to use and pinpointed its locations.

After completing the in-situ balancing activity, the machine was able to reach its full speed and operate at full load, up to 500 MW capacity.

Benefits

Condition monitoring data collection, along with the careful analysis of reliable and accurate condition data, enabled informed, timely decisions. Thus, in-situ couple balancing was able to resolve the complex unbalance issues on the rotor.

As a result, the STG was kept in service at full load within the targeted time frame, enabling the customer to supply power for the aluminum smelter plant without interruption. The aluminum smelter plant avoided using power from the national grid at a much higher cost than the STG-generated power, preserving operational efficiency and protecting profits.

1X polar plots before balancing vs after balancing