Sample Facility

Main Gas Turbine Generator

DATA COLLECTED: 3/6/14
Subject: Vibration Analysis And Balance of Main Gas Turbine Generator

Following reports of an increase in shaft vibration on the Main Gas Turbine Generator at the Sample Client facility, Condition Monitoring Services was contacted to evaluate the vibration characteristics on March 6th, 2014.

History
The unit had undergone a rotor inspection late last year, at which time several of the recommendations from earlier analyses were carried out. Significantly, the rotor out-of-level condition was corrected, and a soft-foot shim condition on the drive end pedestal was eliminated. However, on return to service, the axial hunting and pedestal movement appeared to be unchanged. More recently, the plant had removed both SKF backplane analysis computer and local patch panel connections from the circuit. This is when the step increase in indicated shaft vibration occurred. This system has a known grounding issue, and it is likely the removal of the attached panels resulted in the readings rising to their actual levels.

Procedure
An ADRE instrument was connected directly to the proximiters, seismic probes were mounted to the pedestals, and a laser tachometer was set up for speed and phase reference. Initial startup to minimum load revealed both high shaft and pedestal seismic levels at speed and loads (see Figure 1, showing a listing of the initial filtered data for each point, and Figures 3&5, showing the trend of both the initial shaft and pedestal data). The frequency content of the vibration showed similar data to previous surveys; with sideband peaks around the 1X component indicating strong impacts of the shaft on the thrust pads (see Figure 9 showing the initial Waterfall spectrum plots).
However, one significant difference from past data was that the bearing-to-bearing phase relationship was now primarily out-of-phase, indicating a strong couple (dynamic) force acting on the rotor (see initial data polar plot, Figure 7). This condition made it conducive to an in-situ trim balance.

A couple pair balance shots of 14.7 ounces placed 180° opposite each other on both ends resulted in reduced vibration levels on both the shaft and pedestal measurements (see final data listing, Figure 2, and final shaft and pedestal trend plots, Figure 4&6). More importantly, by eliminating the large couple component on the rotor, the axial hunting of the shaft and the resultant impact at the pedestals was also eliminated (see Figure 8, showing the final Polar plot, and Figure 10, showing the final Waterfall spectrum plots). It is believed this occurred as a result of the reduction in the “crank” effect on the unit. It is also felt that the correction of both the unit level and the drive end pedestal soft foot was beneficial in lining up the imbalance as a large couple, allowing the field trim balance to succeed with minimal weight changes.

The remaining concerns are with the NDE seal leakage and the lack of a buffered patch panel for readings. Feel free to contact me if there are any questions.

Sincerely,

Certified Level III Vibration Analyst
Condition Monitoring Services, Inc.
www.conditionmonitoringservices.com
Graphical Data:

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### Figure 1 - Initial Run Direct and Filtered Data, showing high levels on most positions

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<tr>
<th>Channel Name</th>
<th>Sample...</th>
<th>Sample...</th>
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<th>Speed(P)</th>
<th>Speed(S)</th>
<th>Direct</th>
<th>Avg Gap</th>
<th>Inst Gap</th>
<th>1X Ampl...</th>
<th>1X Phase</th>
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Figure 2 - Final Run Direct and Filtered Data following the balance, showing improved levels

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<th>Avg Gap</th>
<th>Inst Gap</th>
<th>1X Ampl...</th>
<th>1X Phase</th>
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Figure 3 - DE Pedestal Direct and Filtered Vibration Trend for Initial Run

Note the initial direct levels are much higher than the 1X filtered levels, showing the influence of the impact vibration.
Figure 4- DE Pedestal Direct and Filtered Vibration Trend for Final Run

Note the final direct levels are essentially all comprised of the 1X filtered component, indicating the elimination of the impact influence.
Figure 5 - NDE Shaft Relative Direct and Filtered Vibration Trend for Initial Run
Figure 6 - NDE Shaft Relative Direct and Filtered Vibration Trend for Final Run
Figure 7 - Pedestal Filtered Vibration Polar Plots for Initial Run

Note the initial 1X phase between ends at full speed is showing a primarily couple relationship.

Figure 8 - Pedestal Filtered Vibration Polar Plots for Final Run
Figure 9 - Pedestal Waterfall Plot for Initial Run

Note the initial data shows the pronounced sideband impact peaks.
Figure 10 - Pedestal Waterfall Plot for Final Run

Note the final data shows the impact peaks have been eliminated.