MECHANICAL ANALYSIS OF A 25MW TURBINE

Case Study

Background

Ampcontrol was engaged to analyse machine vibration on a 25MW turbine at an alternative power generation facility in QLD.

Achievements

- Machine balancing
- Identification and rectification of an oil whip issue
- Quick implementation of a solution, minimising downtime

The Project

A 25MW turbine at the facility was experiencing high levels of vibration after being returned to service from overhaul.

Ampcontrol's mechanical team attended the site and balanced the turbine. After balancing, the turbine ran with a very low level of vibration, significantly less that before overhaul.

The vibration level of the turbine remained low until reaching half load, when the vibration spiked unexpectedly and the machine tripped.

Ampcontrol reviewed the overhaul work and data from the vibration spike and trip. The fault was identified as an oil whip caused by the bearing being unloaded by the partial arc steam admission to the turbine. Exacerbating factors included the bearing journals being machined during the overhaul to the minimum diameter allowable and a combination of the as left alignment of the machine and the very good balance condition.

Oil whip as a result of increasing machine load such as this is uncommon. Commonly oil whip is a condition seen during transient machine operation, as an oil whirl latches onto a shafts natural frequency.

Our analysis indicated that this oil whip was being caused by the bearing being unloaded due to partial arc steam admission. This is where, at lower loads, steam is supplied through multiple valves opened sequentially to minimise throttle losses.

The machine design consisted of two main steam valves opening one after the other providing steam to just under 50% of the inlet.

Analysis of the machine dynamic characteristics indicated that if the sequencing of the inlet valves was reversed the unloading that peaked at 50% load would be reversed and bearing stability would be increased.

Ampcontrol proposed a machine configuration change that would rectify the problem and the OEM of the machine carried out this modification with minimal downtime.

Once the solution was implemented the turbine ran to full load for the rest of the season without any further vibration issues.