STATOR ENDWINDING GLOBAL RESONANCE IDENTIFIED BY ODS

Company: Scandinavian utility
Type of Machine: 2-Pole Turbogenerator
Ratings: 72.25 MW, 10.5 kV

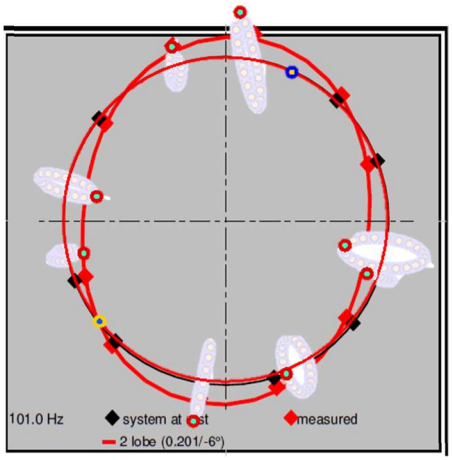

Figure 1 – Endwinding Modal and ODS Illustrations

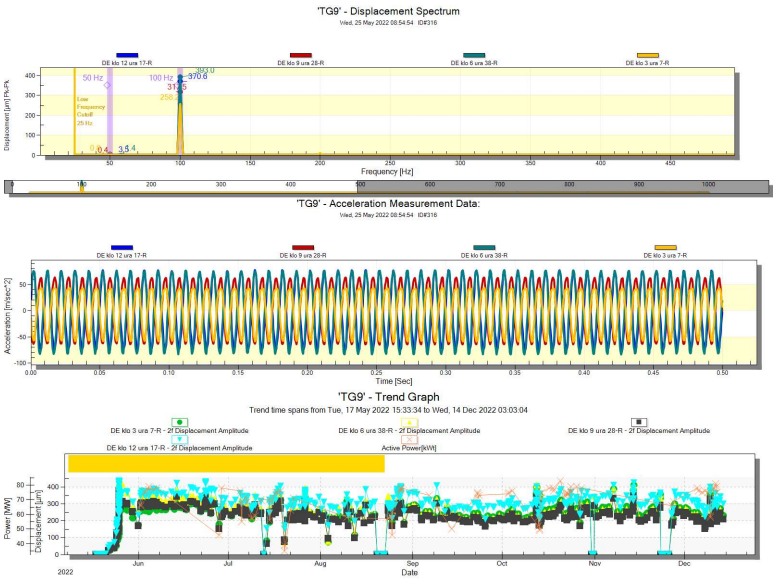

Figure 2 –DE Endwinding – 2xLF Vibration Data Plots

Figure 3 –DE Endwinding – Indication of Dusting

Details:

- New replacement stator for 30-year old GVPI ABB design
- IRIS Power EVAII monitoring installed
- 3rd party modal analysis identified elliptical mode shape of concern near twice line frequency (2xLF=100 Hz), see Figure 1

May-2022

- Unit returned to service, high endwinding vibration levels identified, upwards of 350 um p-p at 2xLF, see Figure 2
- Operating Deflection Shape (ODS) analysis identifies excitation of global endwinding basket resonance, supporting modal analysis findings
- Levels fluctuate with load, but remained generally stable for ~1.5 years

Nov-2023

- Warranty inspection confirms elevated endwinding vibration with indications of dusting on the two surge rings at the twelve support brackets on both ends of the unit, see Figure 3

In a two-pole AC generator of particular concern is the n=2 (elliptical shape) mode. This can readily be excited by the rotating magnetic field at twice line frequency (100 or 120 Hz for a 50 or 60 Hz machine respectively) potentially resulting in unacceptable endwinding vibration. When a once per revolution reference signal is supplied to the monitoring system, both amplitude and phase measurements can be combined to llustrate the motion as an ODS animation. At resonance, the ODS will closely resemble the excited mode shape.