

STATOR ENDWINDING HARMONIC VIBRATION IN AIR COOLED GENERATOR REVEALED BY IMPACT TESTING

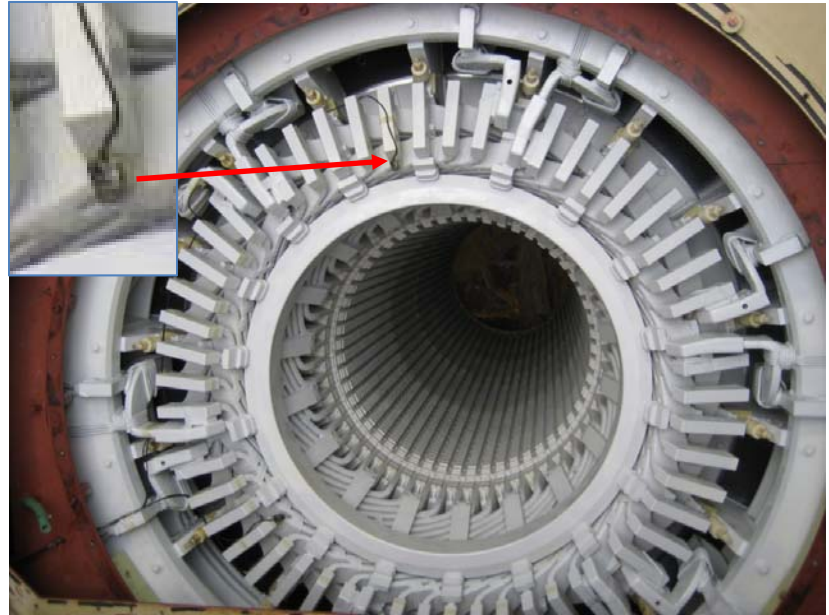


Figure 1 – Stator Endwinding and EVA Sensor

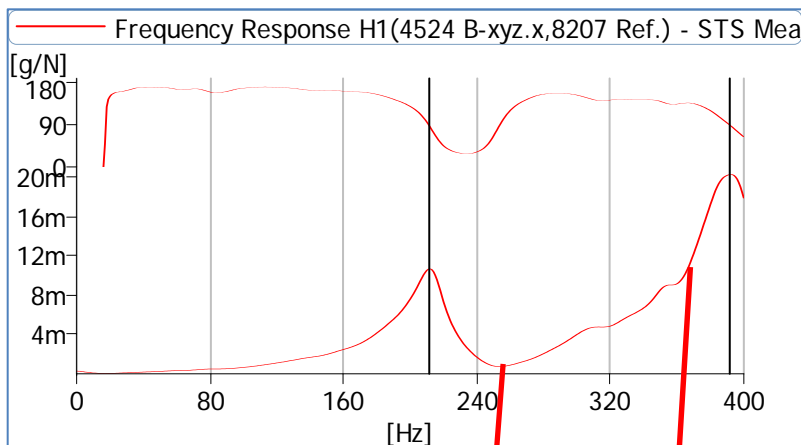


Figure 2 – Offline Impact Data 11:30 Top Winding Bar

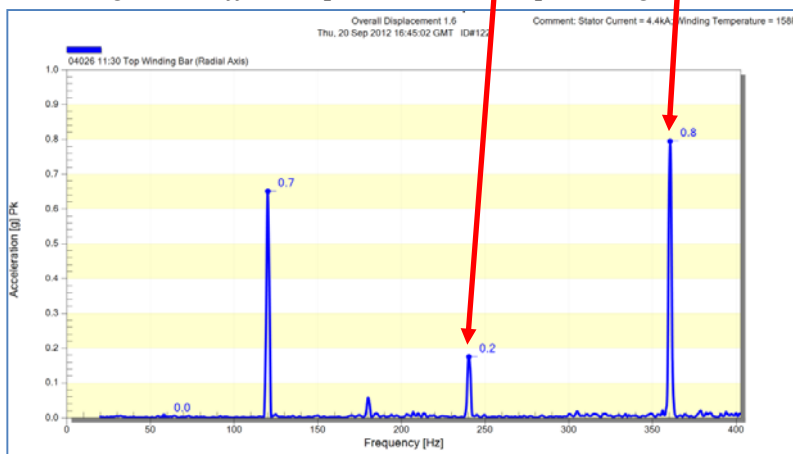


Figure 3 – Online Vibration Data 11:30 Top Winding Bar

Company:

Central Canada Utility

Ratings:

287.66 MVA, 21kV, 2-pole, Air-cooled Generator

Details:

- offline impact test data identified natural frequencies near 211Hz and 392Hz (see Figure 2)
- natural frequencies are expected to shift downward at operating temperatures
- online acceleration data showed dominant peaks at 120Hz from electro-magnetic force with multiples at 240Hz and 360Hz (see Figure 3)
- harmonics are generally expected to decay linearly if not influenced by resonance
- online acceleration response can be directly correlated to offline sensitivity, i.e. at 360Hz there is 8x more response than expected due to sensitivity identified at 392Hz

Copper fatigue rates are influenced by amplitude and frequency. Faults like mechanical looseness usually generate a series of frequencies (harmonics) due to non-linear response and often excite 1 or more resonances. This indicates the importance of monitoring endwinding vibration to at least 400Hz, ideally 1000Hz.