Heat Run, Noise and ODS Testing

Following rewinding of a hydro-generator and conversion of the core from segmented to non-segmented there may be an increase in the operating noise level.

Although the excitation for the machine has not changed, the continuous stacking allowed the core to act as a complete ring. The ring modes which were ill defined or non-existent in the segmented configuration can now become well defined in a continuous core. A ring mode can now be excited, causing excessive noise during operation.

When an increase in the operating noise level occurs a number of tests can be performed to identify the cause.

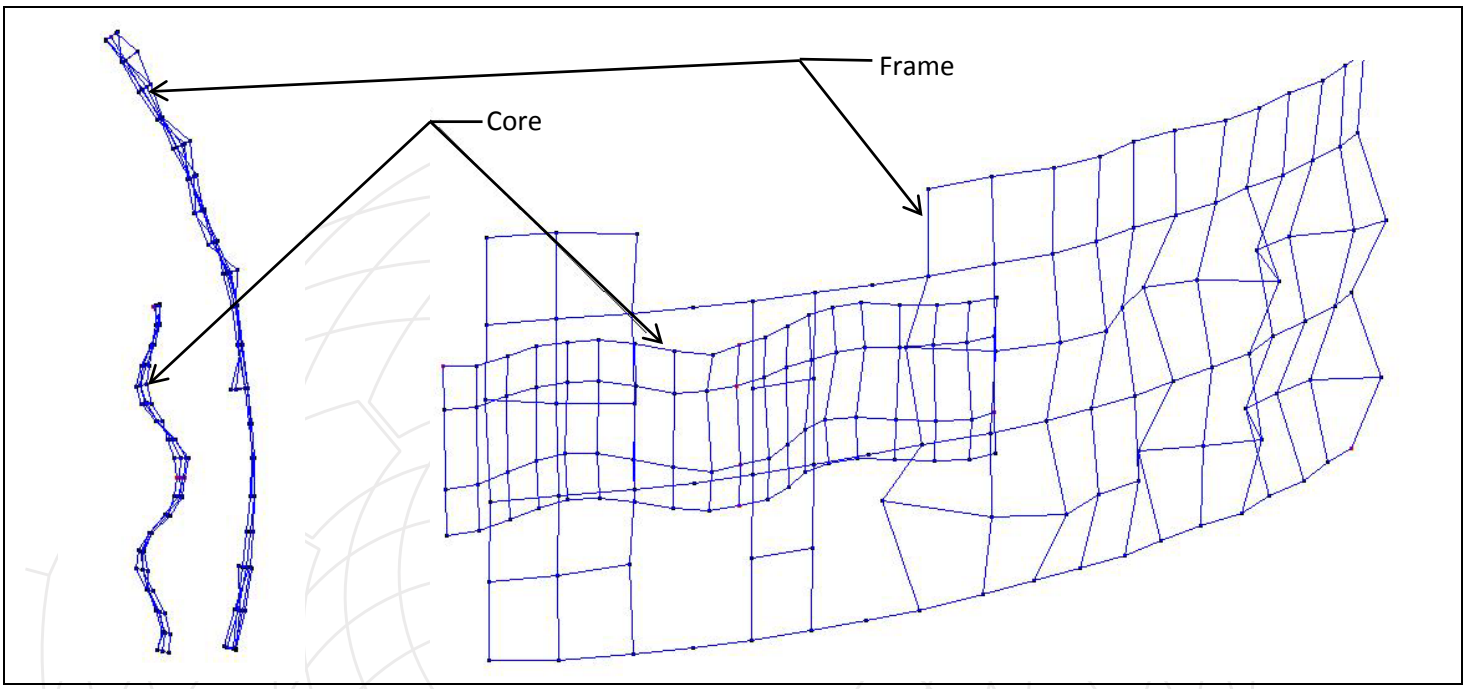
1. Heat run with noise mapping

   A heat run should be performed per IEEE specification 115 6.2.1. This will entail monitoring the stator RTD and inlet temperatures for three load points at rated voltage until a stable temperature is reached. Field current will be held constant for each load point. Temperatures will be recorded every 30 minutes until the change in temperature over the previous 3 readings is less than 1 °C. It is assumed that plant instrumentation can be used to collect the data and that a cold field resistance measurement is available to calibrate the measured field temperature rise. EME also anticipates using localized temperature instrumentation (provided by EME), such as thermocouples on the core back iron if needed.

   During the heat run, a noise map of the unit will be taken. This will involve noise samples at various points around the unit. An FFT will be performed on the noise samples which will determine the frequencies causing the severest noise. The frequency of the noise can lead to possible causes of it.

2. Operational Deflection Shape (ODS) testing

   The ODS testing should be performed at full load and should incorporate points on the generator core and frame. Typically, EME uses a very close distance between points on the core so that the wave of the core can be determined. Samples of data EME has taken on previous projects are shown in the figure below. Information from the operational data of the unit is also very helpful in determining the root cause of the vibration and noise.



1. Natural Frequency Testing of the generator core

   If the unit is being excited near a natural frequency, excessive noise and vibration can occur. It is possible that the restacked, continuous core now has ring modes that are being excited.

   In order to test for a generator core's natural frequency an Open Circuit test may be performed in which the excitation frequency is varied while monitoring vibration. Based on the vibration amplitudes and frequency, the natural frequency of the core can then be determined.