

# CASE STUDY: CSMETER FINDS BROKEN ROTOR BARS IN CONDENSATE PUMP MOTOR

## BACKGROUND

A large utility in the US northeast suspected a broken rotor bar problem in one of their condensate pump motors located in a fossil power generation plant. The motor was a 3000hp, 6.6kV design with rated speed of 1785rpm. Their suspicion arose from a constant hum during motor operation and abnormal vibration levels during start-up and running. The plant vibration monitoring system did not have the ability to zoom into the 60Hz region of the spectrum so they could review and confirm their suspicions. Iris Power Engineering was called in to perform a test with CSMeter in January 2004.

## TEST RESULTS

The motor name-plate data such as the rated hp, rated current, rated speed and also the main CT ratio was uploaded to the CSMeter in approximately 2 minutes. The test was taken by clamping a 5A/1V current probe around the secondary side of a main phase CT.

CSMeter gave an instant diagnosis of "Very High Risk" and displayed a frequency spectrum showing broken rotor bar sidebands on the LCD screen after acquiring and processing the data for approximately 3 minutes.

The data was later downloaded to a PC and the graph from the analysis software is displayed in Figure 1. The CSMeter had showed the running speed to be 1789.88 rpm and the load current at 137A (60% full load current) that is also reflected in Figure 1.

Note that the sidebands due to broken rotor bars have been marked "BB" (short for broken bars) in red. The frequency positions of the two symmetrical sidebands due to broken rotor bars are indicated at 59.34Hz and 60.69Hz. Also note the skirting effect at the base of the supply frequency spike due to load fluctuations and the presence of harmonics of the sidebands at 58.67Hz and 61.36Hz.

The dB difference between the fundamental frequency and each sideband is marked at 28.78dB and 28.91dB. The diagnosis of "Very High Risk" (see Figure 1, BBE or the Broken Bar Estimator) is based the average dB values of the two sidebands since, for this motor, the number of rotor slots/bars was not known. Had the latter been known the CSMeter would have provided an estimate (BBF, or the Broken Bar Factor) of the number of bars broken.

The customer was informed of a very severe case of broken rotor bars and was advised to take the motor off-line to avert an in-service failure.

## CORROBORATION

The motor was taken out of service and sent for repairs in March 2004. 7 bars were found to be broken (see photographs). The original rotor cage was fabricated aluminum type and bars were broken in the mid-section of the rotor cage winding. The cage was re-constructed from copper alloy material and the motor put back in service in May 2004.

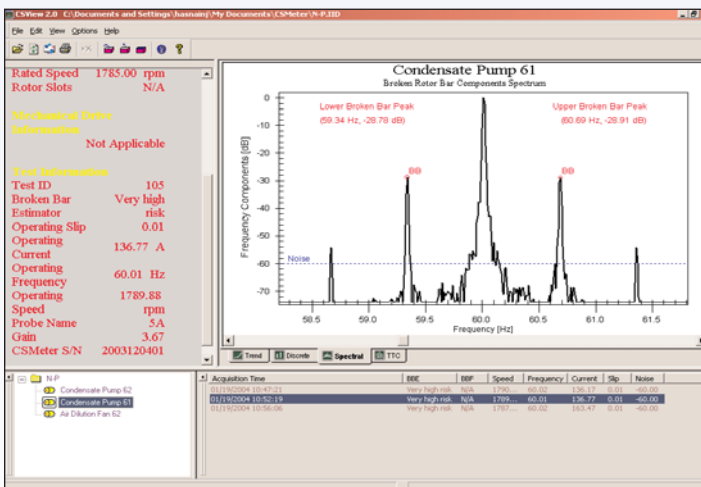


Figure 1: Screen capture from CSView analysis software showing test data, test list, spectrum and organization tree



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