



CURRENT SPECTRUM ANALYSIS

IDENTIFIABLE FAILURE MODES

- Broken / cracked rotor bars.
- Cracked endrings on fabricated rotors
- Porosity in aluminium die cast rotors.

DESCRIPTION

Broken rotor bars can cause mechanical and electrical damage due to centrifugal forces on the bars, elevated operating temperatures that can result in advanced thermal aging of insulation systems, and a loss of torque that results in trips on start or under load.

High and low resolution current spectrum analysis is used for rotor bar analysis and speed acquisition.

Current Spectrum analysis is carried out utilising specific current clamps and a FFT signal conditioner (high resolution frequency spectrum analyser). Software programs enable easy calculation of slip frequency and identification of applicable sideband frequencies and their amplitude for analysis and trending.

For low voltage motors the current signal is captured utilising current clamps directly on the motor phase cables (up to 5000 Aac). For high voltage motors the signal acquisition is by utilising the motors current or protection transformers.

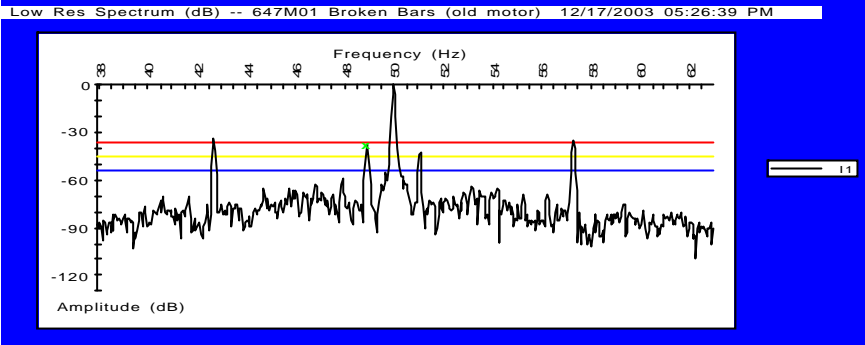
ANALYSIS APPLICATION

Rotor bar defects are identified in 2 areas of the current spectrum. The first is the Fp sidebands around the fundamental frequency (50 Hz). If the amplitude of these sidebands reaches a predefined value, then rotor bar damage is likely. The sideband activity is created by modulation of the fundamental frequency. The second area of indication in the current spectrum is the 5th harmonic of the fundamental frequency (250 Hz) and its relevant sideband activity. Actual broken rotor bars will cause a phase shift in the air gap flux of the rotor and sidebands will be present. As the problem becomes more severe as more bars break the amount and amplitude of the sidebands increases.

APPLICABLE STANDARD / ACCEPTANCE CRITERIA

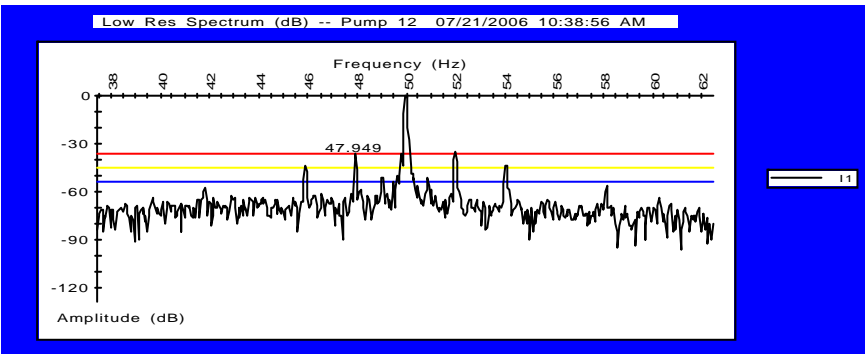
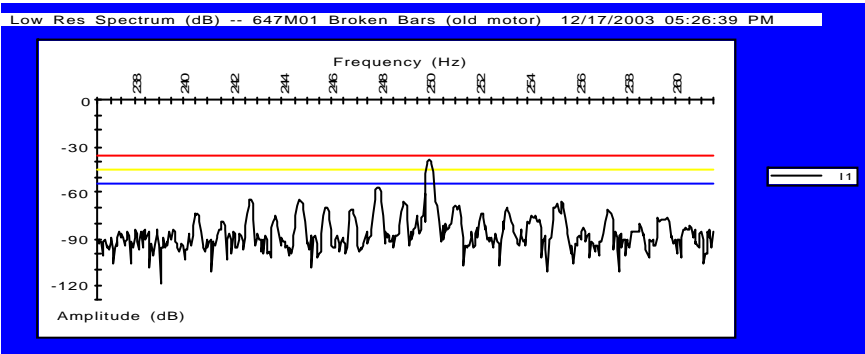
There is no applicable standard for this test.

The amplitude of the Fp frequency determines the severity of the problem, a Fp amplitude of 48 to 60dB is considered satisfactory. A Fp frequency of 36 to 48 dB should have further investigations carried out to confirm the severity of the problem. A Fp frequency of < 36 dB should be investigated as a matter of urgency.



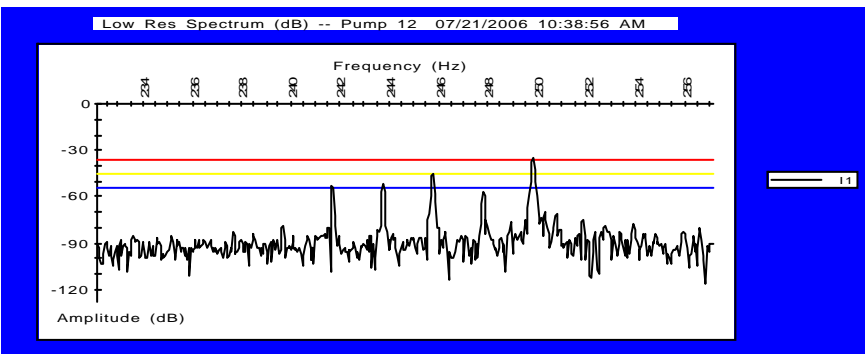
A higher than expected F_p amplitude for the load on the motor prompted a check of the 5th harmonic spectrum.

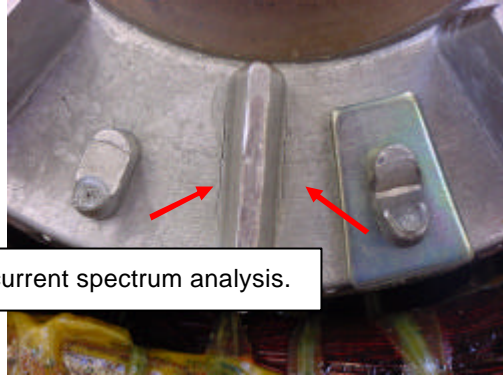
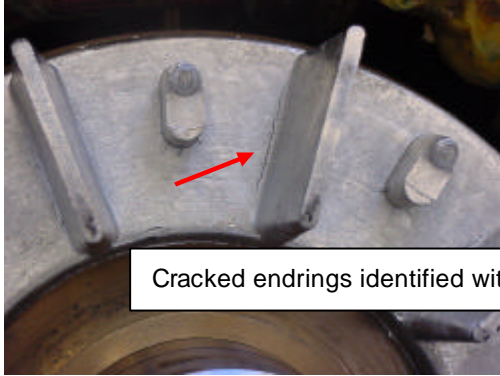
This motor was running hotter than other identical motors on site and had occasionally tripped on starting. The motor was removed from service during a maintenance day and numerous broken rotor bars were identified with a visual inspection.



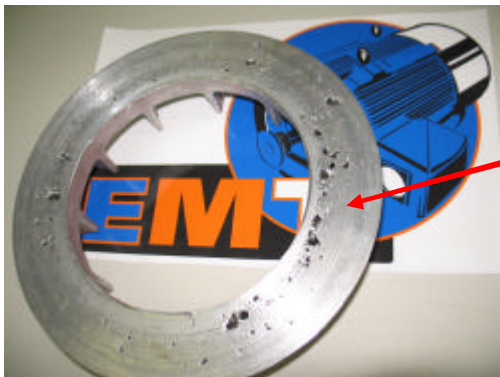
Current spectrum performed on motor due to nuisance trips on start and after a request by VA technicians for further investigation to electrical frequencies identified during routine vibration analysis.

This motor was removed from service and disassembled with 4 broken rotor bars being identified. 2 of the broken rotor bars had started to damage the rotor laminations due to centrifugal forces during running.

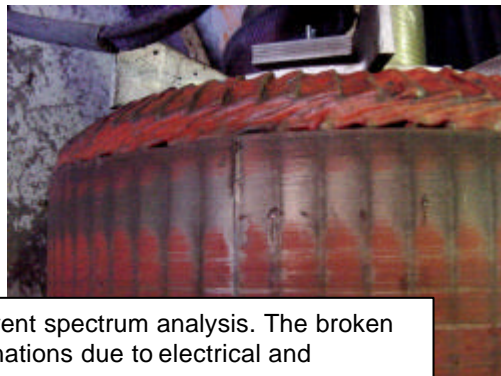
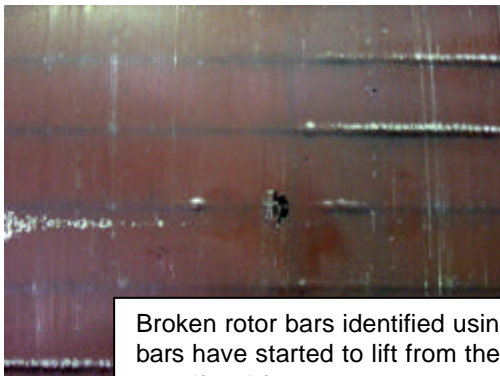




Cracked endrings identified with current spectrum analysis.



Porosity in die cast aluminum rotor identified using current spectrum analysis. This motor was new and would not start under loaded conditions.



Broken rotor bars identified using current spectrum analysis. The broken bars have started to lift from the laminations due to electrical and centrifugal forces.