



CASE STUDY—VFD

EMAX identifies misfiring transistor in a VFD

Industry:	Utility	Fault Zone:	Power Quality
Motor Type:	AC Induction	Voltage:	460
HP:	450	Speed:	890

Problem

A utility has four identical motors all driven by VFD's. One motor runs well at lower frequencies, but develops a vibration when it reaches a high frequency level. The drive manufacturer suggested checking for motor insulation degradation.

Action Taken

The MCE standard and PI test were run. With a PI of 4 and the standard test results well within specifications, insulation degradation was ruled out (Figure 1).

An identical good motor was selected for testing to compare with the test results from the problem motor. The two motors were run at lower frequencies and slowly brought up to the problem level. Testing was done at each frequency change.

Test results on the problem motor show high voltage, current, and impedance imbalances (Figure 2). Both voltage and current sinewaves showed a severe misfire in the positive direction, when normal firing should be in the negative direction (Figure 3 and 4). This misfire changed the magnetic flux in the motor, causing the magnetic field to work against itself. The resulting vibration could be felt in the floor fifty feet from the motor. No voltage spikes or imbalances were shown in the good motor. All indications pointed to the drive.

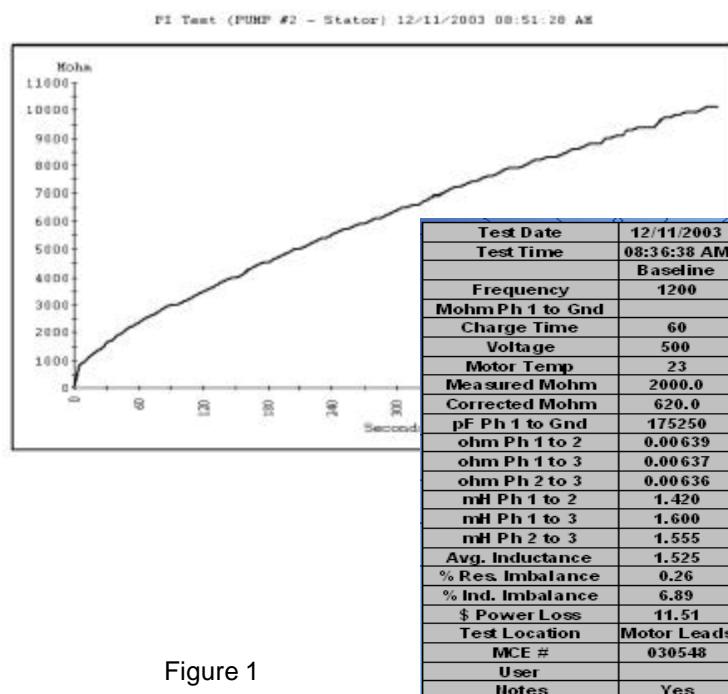


Figure 1

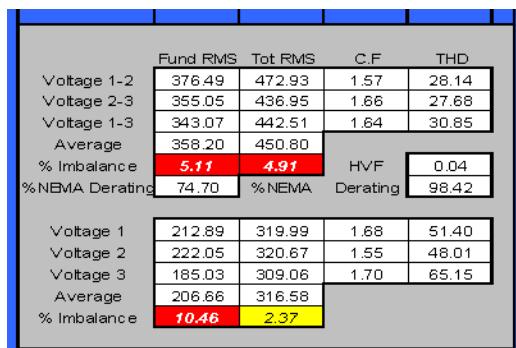


Figure 2

Voltage and Current Time Domain -- PUMP #2 12/11/2003 10:47:48 AM

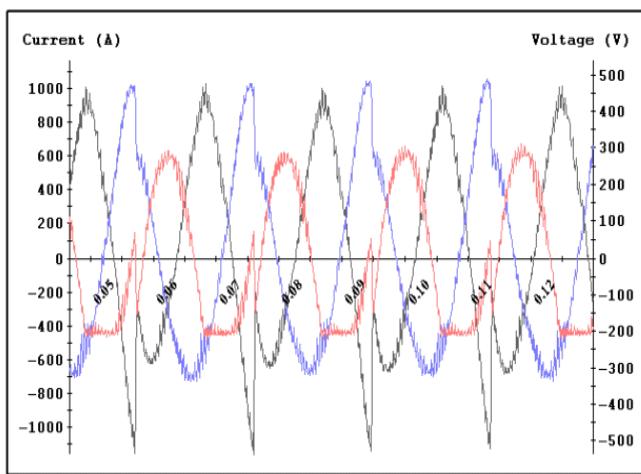


Figure 3

Voltage and Current Time Domain -- PUMP #2 12/11/2003 10:47:48 AM

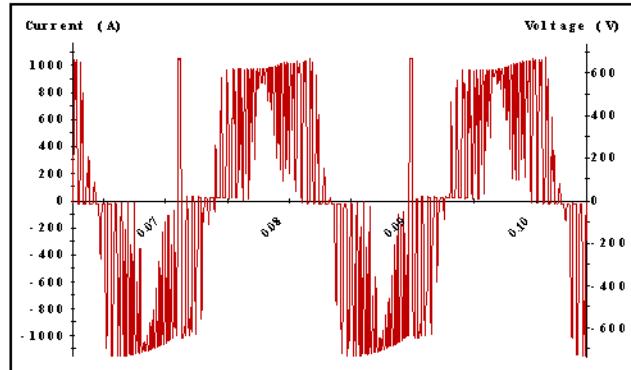


Figure 4

Root Cause

After presenting evidence indicating a defective drive, the drive manufacturer provided a technician for troubleshooting and a bad firing package was found in the drive. The bad firing package was causing the misfire seen in the sine-wave (Figure 3 and 4). The firing package was changed and the motor retested. The test results showed healthy levels for power, sinewaves, and harmonics and the vibration problem ceased.

Savings

The utility has four motors; three motor are needed to run the facility, therefore total failure of the problem motor would not have caused the facility to shut down. By ruling out an insulation breakdown and determining the problem was in the drive, repair costs were eliminated because the drive was still in warranty. However, if the problem had not been correctly diagnosed and the motor failed, the cost to replace the motor was \$32,000.

The technician called in to diagnose the problem made this observation, “VFD’s are simple units that can be a nightmare to troubleshoot. The PdMA MCEMAX allows us to take some of the trouble out of troubleshooting.”