framatome

EMPATH™

Challenge

Electric motors and mechanical systems are subject to deterioration and damage that can suspend operations, leading to expensive repair and downtime.

Solution

Framatome offers the Electric Motor Performance Analysis & Trending Hardware (EMPATH™) system to conveniently measure and analyze electric motor current and voltage to obtain information on critical processes and equipment. EMPATH helps owners detect potential motor problems early, enabling timely repairs and avoiding serious damage.

The key to EMPATH's successful track record is its utilization of Motor Current Signature Analysis (MCSA) technology.

The Theory of MCSA

When an electric motor drives a mechanical system, it experiences variations in load caused by gears, pulleys, friction, bearings, and other conditions that may change over the life of the motor. The variations in load caused by each of these factors in turn cause a variation in the current supplied to the motor. These variations modulate the carrier frequency.

EMPATH utilizes a unique process to demodulate the signal from the carrier and present an unambiguous spectral display. Using normal and demodulated data permits analysis of not only the motor but also the load and the supplied power.

The EMPATH System

The EMPATH system consists of a laptop computer with our exclusive signal conditioning board. Analysis software stores data and gives a readout of the time and frequency signatures. The signal conditioning board collects data on all three phases of voltage & current and provides MCSA-filtered signals. Also, two general-purpose input channels give the customer the option of collecting additional data simultaneously (such as vibrations, temperature, pressure, etc.).

Customer benefits

- EMPATH hardware is CE qualified.
- EMPATH provides unique algorithms that can reliably detect the early stages of rotor bar failures in induction motors.
- EMPATH saves time and precludes plant walkdowns by monitoring plant motors and driven machinery from a central motor control center.
- Auxiliary channels allow acquisition and analysis of data from a variety of other sources such as accelerometers (vibration data collection), proximity probes or process measurements. This information, properly analyzed, can greatly enhance a predictive maintenance program.
- The EMPATH System permits data acquisition and analysis of not only AC induction motors but also DC motors, synchronous motors, generators and transformers. Efficient energy utilization is also indicated by the EMPATH analysis routines.

Technical Design

The EMPATH software provides spectral analysis of all inputs.

Inputs
- Three Phases of Current (A,B,C)
- Three Phases of Voltage (A,B,C)
- Two Auxiliary Inputs (± 5V)

Outputs
- Three Conditioned Currents (A,B,C)
- Three Conditioned Voltages (A,B,C)
- Phase A RMS Current Level
- Phase A RMS Demodulated MCSA Signal
- Two Isolated Auxiliary Signals

Software
- Automatically marks traces
- Automatically tunes acquisition hardware for the incoming signals
- Adjusts sampling frequency and length of input sample
- Displays time and frequency data with cursors to read actual values
- Retrieves past data and compares with present data via plot overlays
- Comes with built-in
  - Tracking and trending database
  - Motor and bearing database
  - Motor enclosure and efficiency database
- Fully compatible with the existing data
- Fully compatible with Windows-XP, VISTA, Windows-7 and Windows-10 OS
- Fully compatible with Framatome's Continuous Motor Monitoring System (CMMS)
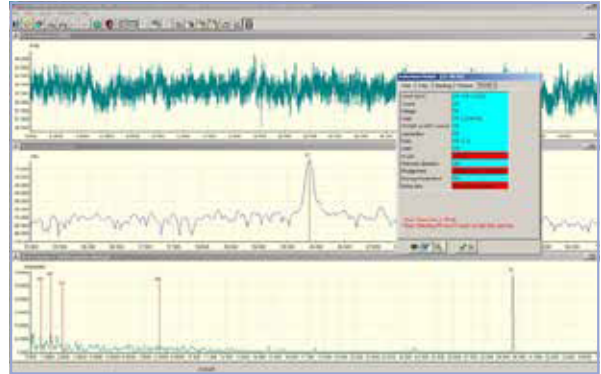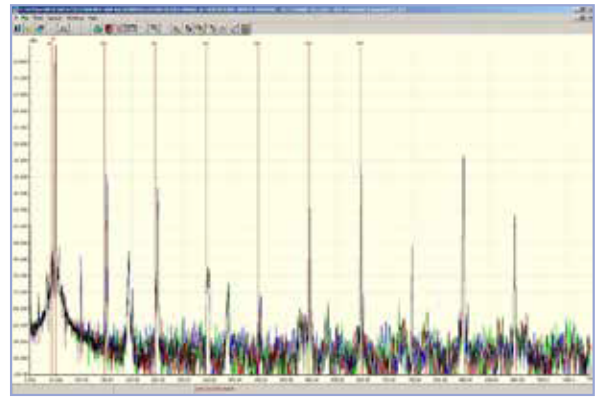
In the "High Frequency" data, EMPATH provides three phases of current and voltage and their associated spectra. An automatic on-screen assessment of the motor health is performed immediately after the data acquisition.

EMPATH indicates:

- Rotor bar deterioration
- Rotor eccentricity
- Stator phase imbalance
- Motor speed and slip
- Gear and belt imperfections
- Average running current, an indicator of motor torque
- Numerical and graphical display of Torsional vibration and dynamic loading
- Bearing degradation