Methods for Determining Motor/System Baselines

Changes in motor/system vibration readings provide the best early warning of developing problems in the motor or a system component. Other parameters to monitor may include the operating temperature of critical components, mechanical tolerances, and overall system performance.

Motor-specific baselines include records of electrical, mechanical and vibration tests performed when motors are placed in operation or before they are put in storage. Ideally, baselines would be obtained for all new, repaired and in situ motors.

Baselines for motors often include some or all of the following:

Load current, speed and terminal voltage. These changes usually indicate that a vital system component is damaged or about to fail. Other electrical tests may include insulation resistance, lead-to-lead resistance at a known temperature, no-load current, no-load voltage, and starting characteristics.

TIP: Some changes in the current and speed may be normal depending on the type of load.

Motor current signature analysis (MCSA). This test diagnoses squirrel cage rotor problems (e.g., broken bars or an uneven air gap). It's more accurate if a baseline is established early in the motor's life.

Mechanical tests. These normally consist of measuring shaft runout (TIR) and checking for a soft foot.

Vibration. Although overall vibration readings can be used as baseline data, Fast Fourier Transform (FFT) spectra in all three planes at each bearing housing are preferred.

Infrared thermography. This tool can detect changes in the operating temperature of critical motor components, especially bearings.

New motor baselines. Comparing factory terminal winding resistance and no-load amps with data taken under load can be useful when monitoring the condition of a new motor or troubleshooting system problems. Factory baselines are often available from the manufacturer or its website. The accuracy of factory data depends on how it was obtained, but it's usually sufficient for field use.

Baseline data for a newly installed motor could reveal an error and prevent a premature motor failure. Rather than simply "bumping" a motor for rotation before coupling it to the load, operate it long enough to measure the line current for all three phases, as well as the voltage and vibration levels.

TIP: Comparing the baselines of a failed motor and its replacement could reveal application- or process-related weaknesses in the system.

Repaired motor baselines. Service centers usually provide no-load and/or full-load test data for repaired motors, including voltage, current and vibration spectra. Comparing these results with historical baselines and those obtained on site when the motor is returned to service may confirm the quality of the repair or possibly reveal underlying system problems. For newly repaired motors that have been in operation many years, baseline comparisons are invaluable for root cause failure analysis and may even expose consequential damage from certain kinds of failures (e.g., a broken shaft). To correctly identify cause and effect and prevent a recurrence, always investigate equipment failure at the system level.

Learn More

For more considerations regarding the installation process, see EASA's materials on:

- Preventive, predictive and reliability-based maintenance
- Motor current signature analysis
- Vibration analysis
- Motor/system baseline data
- How to use motor/system baselines
- Total motor management

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