Motor repair shops, whether in the plant or commercial facilities outside the plant, should be able to furnish vibration data on repaired motors for use in condition monitoring or predictive maintenance programs. A requirement for such data is being included in motor repair specifications by an increasing number of maintenance and reliability professionals.

Customers can witness motor qualification on monitor where spectra can be called up on demand or examined live with time waveforms.

Gary Herr, vibration analyst at Demaria Electric, uses a Microlog CMVA55 balancing wizard to determine motor unbalance.

Demaria Electric Motor Services Inc., Wilmington, CA, uses on-line monitoring to augment hand held data collectors in its motor repair operations. Its electric motor test stands now use multi-parameter vibration data collection technology tied to a local area network (LAN) to assure industry standard quality control. The technology, typically used to monitor critical industrial machinery, is easily adapted to the motor test cell environment.

When faulty motors arrive at the repair facility, they are tested to confirm mechanical or electrical problems. Spectral signatures are analyzed to determine incoming bearing condition, balance tolerance, and rotor bar condition. After motors are repaired, quality is confirmed at a test stand.

Multi-parameter monitoring allows all aspects of the motor frequency spectrum to be analyzed for quality assurance. Before and after repair reports contain a percent of change column to justify repairs and give credence to the customer's predictive maintenance program. Test data are archived for historical reference, giving proof to the motor's condition of operation upon shipment.

Demaria Electric incorporated the on-line monitoring system to augment its use of hand held data collectors for motor qualification. The system consists of an SKF Condition Monitoring CMMA320 local monitoring unit (LMU), a 32-channel NEMA enclosed vibration monitor with a front panel switch assembly with BNC connectors to access buffered signals and tachometer speed pulses.

The data acquisition device (DAD) is mounted on the wall next to the motor supply test panel which can power motors up to 3500 hp and up to 4160 V. A hinged 90 deg bend of conduit was fabricated and mounted on the motor test panel to allow the transducers to swing freely over the motor under test with 20 ft of lead length. A BNC connector at the end of the conduit gland fitting provides for optical phase reference input.

Six SKF Condition Monitoring integral lead accelerometers equipped with magnets are used for sensor inputs. System software allows for motor point configuration on a personal computer to be downloaded to the DAD which collects the data and communicates directly to the host computer over the LAN.

Accelerometers are placed in horizontal, vertical, and axial planes on both inboard and outboard bearings. Sixteen vibration points are collected on each motor. A complete set of data measurement points typically takes 6 min. Spectral signatures are collected at 1600 lines of resolution and two averages to allow for detailed frequency analysis.

Horizontal parameters include peak velocity at 10 times running speed of the motor under test, peak acceleration at 100 times running speed, acceleration enveloping, and high frequency detection (HFD).

Vertical and axial measurements include velocity and acceleration parameters.

Velocity measurement allows observation of running speed balance condition, 2 times line frequency electrical condition, lower order bearing condition, seal installation, and rotor rub condition.

Acceleration measurement gives an indication of higher order bearing frequencies and rotor bar frequencies. Envelope demodulation will confirm a bearing problem as repetitive frequencies are accentuated.

HFD provides a reliable indication of bearing installation quality, lubrication, and metal-to-metal contact, as it offers a higher frequency overall measurement from sensor resonance which acceleration spectra might not detect. SKF Spectral Emitted Energy (SEE) technology is used to confirm lubrication problems.

Motor test vibration data are sent directly to the analysis computer, running PRISM software. Spectra are updated continuously as the motor under test is exercised. Customers who elect to witness motor qualification can observe the real time aspects of the motor operation indicated on a monitor. Spectra may be called up on demand or examined live with time waveforms. Rolling element bearing condition may be monitored using the software frequency analysis module. BPFO, BPFI, BSF, and FTF frequency overlays on the spectrum point out any bearing fault frequencies.

Rolling element bearing motors are typically run for 30 min to 1 hr to allow for trend development to judge the integrity of the repair.

Large journal bearing motors are run from 1 to 2 hr to allow for proper stabilization of bearing temperatures and to understand how heat influences the rotor balance condition. This condition

will determine whether the rotor will be balanced in place at running speed. If this is the case, the motor may be balanced with the company's SKF Microlog CMVA55 hand held data collector-analyzer at the motor. The motor may also be balanced using the DAD's buffered outputs.

Motors also may be monitored using existing eddy current probes in large sleeve bearing motors which can be connected to the system. The eddy current probe outputs also may be used for balancing. Polar vector plots make it easy to track phase angle changes over time for confirming unbalance.

System software is easily accessible to everyone in the shop. Motor parameters are derived according to running speed. Templates for a motor under test are easily created and downloaded to the DAD according to the job number. The software has been customized for a wide variety of motor applications. The operator enters a four-digit job number and motor RPM to create the machinery point parameters.

The database hierarchy is based on customer name with the motor shop reference job number residing within its respective set. Each motor point identification includes the motor job number. The software also allows for adding customer machine number, plant name, purchase order, and other helpful information. Notes may also be taken and saved to the particular motor data set.

Large motors (1000 hp and higher) typically are followed out to the field for installation. Only one attribute of the DAD points needs to be changed to allow for downloading shop data motor points to the data collector for on site data collection and baseline comparison.

Motors are run on the base uncoupled to prove sound operation. After alignment, another set of data is collected for on site baseline reference as well as the driven equipment. Data are often collected on a weekly basis (primarily for sleeve bearing motors) to insure proper working condition.

The on-line system has proved to be a valuable resource for the shop and its customers. If a vibration problem exists in the field, shop baseline data may be easily checked. The reporting capabilities of the software prove motor shop compliance with customer motor vibration

specifications. Expert system PRISM4 Pro software can be used in conjunction with the system to provide before-and-after motor repair reports with analysis of incoming and outgoing condition. **MT**

Information furnished by SKF Condition Monitoring, 4141 Ruffin Rd., San Diego, CA 92123-1841; (619) 496-3400; Internet [*http://www.skfcm.com*](http://www.skfcm.com) *.*