Industrial Motor Maintenance

Motors are complex. Maintaining them requires skill in several disciplines, including mechanical, electrical, and controls. How can you get a handle on all of this?

BY MARK LAMENDOLA

Before we get into the basics of motor maintenance, there are two key points on which industrial maintenance people need to be clear:

- Motor maintenance is *not* motor repair.
- The goal of motor maintenance is *not* to fix broken motors.

What's the idea, then? We need to prevent failures by correcting deficiencies that cause failures. Those deficiencies are often *outside the motor.*

Errors You Can Prevent That You Didn't Make

Errors made before the motor goes into service can render maintenance pointless. Two examples:

1. The motor's designer "saves money" by going cheap on the motor pedestal and base. The resulting movement of the motor during operation costs more in energy dollars each month than the money you "saved" (on materials) in the initial purchase price.
2. A tech overtightens a motor foot. This distorts the motor case, causing "inexplicable" alignment and vibration problems.

What's that you say—a maintenance program can't prevent such errors? *Correct!* But baseline testing, a core part of effective maintenance, typically leads to detection and correction.

Baseline Motor Testing: Measurement Now

The main reason for baseline testing, however, isn't error detection. You need to do baseline testing so that you have a reference. That will help you to make sense out of data collected during Preventive Maintenance (PM) and Predictive Maintenance work.

Use monitoring, but not to eliminate manual tests. Monitoring & manual tests complement each other.

Think about it: There's not much of an alternative! With nothing to compare the data to, measurements may not mean much.

Many managers deliberately eliminate baseline testing to "save money." They consider testing to be unnecessary, "because it's new so we know it works." This is bad practice based on a false assumption.

What's more, that false assumption is also irrelevant. Baseline testing amounts to simple data collection, *not* acceptance testing.

At a minimum, baseline motor testing includes:

- Alignment and vibration data.
- Insulation resistance tests.
- Hi-potential tests.

Avoid Wasted Time Via Pre-Installation Testing

For critical motors, get a complete workup from a motor shop prior to installation. That includes new motors (can you say, "warranty claim?").

Which tests matter? The motor shop will know. For example, they'll recommend balancing critical motors. You can't do balancing in the field or create "as installed" forensic data after operational failure.

Do the same for motors that are difficult to install. There are motors on which one can spend 37 man-hours in the installation process. After this time has been invested, you do not want to discover—to your chagrin—that the motor must now be replaced for an easily discovered reason (for example, due to a bent shaft you should have detected before starting the work).

Best To Test For The Rest—Drives & Environment

Conduct baseline testing of the motor environment:

- Power quality data before energization.
- Power quality data after energization.
- Insulation resistance testing of the supply (branch and/or feeder) conductors.
- Testing of the controls.

Conduct baseline testing of motor drives:

- A motor drive may be a Variable-Frequency Drive (VFD) on the input or a gearbox on the output.
- For VFDs, log the settings and any reasons for changes made from the factory defaults.

Once you're running the motor, you're into operational motor maintenance. Let's hit some highlights.

Operational Maintenance: 70+ Electrical Tests

There are more than 70 different electrical tests you can perform on an industrial motor. *The number of mechanical tests is also large.*

You don't have the resources to conduct all of these tests, so which ones should you do? The answer depends on several factors. It's your mission to determine which out of this universe of potential tests that—

- . . .motor and drive manufacturers recommend *for your application.* Industry standards alone may not suffice.
- . . .your downtime history indicates a need for.
- . . .you can allocate resources to, based on prioritization.

Once you have your list of tests for each motor, determine which of these you have the time and expertise to perform; you'll outsource the others *(see box on outsourcing).*

Preventive maintenance standard operations should include visual inspections of your bonding system. If you're grounding your motors, review Article 100 definitions of grounding (connected to earth) and bonding (connected to metal). Bring things into conformance with Article 250, Part V.

Maintenance Monitoring: What You Might Automate

Improve uptime and lower costs with automated monitoring:

Power quality. Ensure your power monitor looks at the supply of each critical motor.

Vibration monitoring. Detect alignment and wear problems early.

Thermal monitoring. Install a temperature sensor on the windings and thrust bearing of each motor.

Insulation resistance testing. Install an automated system wherever possible.

Voltage and current. Monitor each phase; set up alarms for imbalance greater than 2%.

Don't use monitoring simply as a means of eliminating manual testing. Use monitoring and manual tests to complement each other. The more you integrate the two via a well-thought-out strategy, the higher your reliability will be.

In some cases, it'll make sense to do both and in other cases it won't.

Your Motors 'Live' In The Environment!

The motor interacts with both its load and its supply, so maintain both in relation to the motor. For example, do you have a formal program of gearbox maintenance?

"Supply" goes beyond the electrical to include airflow. Motors need cooling air. A vented motor may have an air filter that needs regular maintenance. A totally enclosed fan cooled (TEFC) motor needs a certain amount of airflow around it.

Keep motors clean. Contaminants on the case can migrate to the windings, or simply cause the motor to overheat.

Mini case study: A paper mill kept losing a 50-hp TEFC motor... until someone realized that pulp buildup was insulating the case and causing the motor to overheat. Simply brushing off the motor case once per shift ended the frequent failures!

Reliability Is The Goal

This article is presented in the hope of giving the reader a basic overview of motor maintenance. Work out the details for each motor, and you'll have the reliable performance on which your plant depends on.

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LUBRICATION

To borrow from Rodney Dangerfield, motor lubrication "don't get no respect" in the typical plant. This is exactly why motor repair shops find grease in the windings of shorted motors.

Lubricating motors isn't "a job for the grunts." It's an important maintenance task that requires attention to detail (actually, to many details!).

Bottom line: Formal training in lubrication is never a bad idea.

OUTSOURCE MOTOR MAINTENANCE?

In the nearby article, mention is made about outsourcing some of your motor maintenance testing.

You might well be skeptical. *Won't the corporate bean counters squawk about outsourcing motor tests when the company owns expensive test equipment?*

Sure they will. But you have a ready response.

Show them which process lines will lose X dollars of revenue if you don't spend Y dollars on testing by qualified personnel.

Obviously, all these tests (and the preventive maintenance) are necessary. Let the bean counters choose between beefing up your staff, outsourcing... or (ultimately) losing the revenue.

— M. Lamendola