Automatic Offline Testing Saves Money

Rick Zelm, Meg-Alert, Inc. | *Electrical Construction and Maintenance* *Feb 1, 2002*

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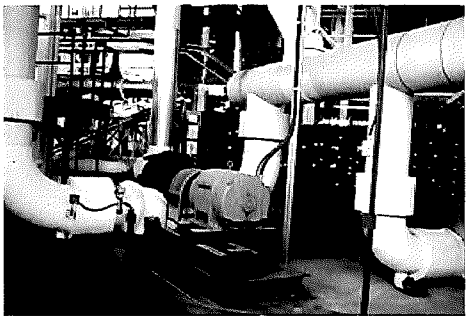

Windings are the key indicators of degradation and potential failure in a typical motor. The cause might be phase imbalance, undervoltage, or something else, but the effects will show up in the windings. If you have a properly mounted, balanced, grounded, and lubricated motor, you can probably rule out bearing failure, leaving the windings as the weak link. Thus, insulation resistance (IR) testing gives you predictive power.

There's no doubt portable IR testers are valuable, but using them for motor protection can be difficult. Consider what you must do every time you conduct a manual IR test on a motor. After shutting down and locking out the motor — at a time convenient to the operators — you can hook up the tester, but this often means working around live electrical systems or breaking leads apart at the weatherhead.

When you're done, it's necessary to repeat the whole process in reverse to return the motor to service. And the operators might not give you more than a 15-min window in which to do it. When you're done, you'll only have a snapshot of the motor condition —

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the information won't be in real-time, so it might be outdated by the time you go to start the motor. It's not difficult to see why few maintenance departments conduct this critical testing and why only those with an automated system do it with any consistency or true trending.

What is automatic offline IR testing?

Automatic offline IR testing and monitoring should be conducted when the motor is de-energized. It provides a real-time view of motor winding condition up to start-up, which is the most rigorous part of motor operation (see **Why Start-ups Are So Rough** on page 15), and the point when a motor is statistically most likely to fail. Your goal should be to predict motor failure before start-up and to take action to prevent a catastrophic failure. This can mean performing minor on-site repairs to the motor to prevent motor loss or replacing the motor to prevent process interruption. Either way, you can realize huge cost-savings.

Most maintenance workers should be familiar with manual insulation resistance testing for cables: A portable test device sends a test voltage signal through the cable to measure any current leakage to ground over time. An automatic IR system uses this same technology to test critical motor winding insulation.

Automatic offline IR testing is a more consistent and less expensive hands-free method of conducting this testing. Installing this type of system at the motor controller allows you to continuously test the motor windings during downtime and up to the point of every start-up. This ensures the motor is safe to start and operate — before start-up. This approach allows you to predict and prevent equipment failures and unexpected downtime. A properly designed system uses a current-limited DC test voltage comparable to the rated operating voltage of the motor, which means it won't damage the insulation. This provides a true dielectric test (see **Why Use Rated Voltage?** above) of the winding insulation while protecting the motor and maintenance people from harm.

When the motor stops operating, such a system automatically applies a test voltage signal to the windings and measures any leakage current to ground. The system should have a meg-ohm indicator and a condition alarm to alert you when the insulation resistance drops below an acceptable level. You could use lockout contacts to disable the motor starter, thus preventing the motor from starting and causing a failure. After you correct the winding insulation problems, you can reset the system and return the motor to normal operation.

When the motor starts, the system automatically stops testing and disconnects itself from the motor circuit. This type of protection prevents a catastrophic failure, which often means you can service the motor in place to correct the insulation problem. For example, in a paper mill, you might blow the windings clean with compressed air before starting, rather than replace the motor after starting. Such a system won't always prevent you from having to pull a motor, but in those instances it often keeps damage to a minimum — the repair shop may have to re-insulate the motor, but a complete rewind won't be necessary. This results in a 40% to 50% savings on average.

Complete motor protection

In today's world of maintenance cutbacks and downsizing, this type of automated protection is becoming a necessity. An automatic insulation resistance monitor provides you with the ability to extend your maintenance capabilities beyond your limited manpower. These offline testing and monitoring systems, coupled with existing online protection, can ensure reliable equipment operation and maintain maximum plant production.

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