ALL-TEST Pro: Media Kit 2018

ALL-TEST Pro delivers on the promise of true motor maintenance and troubleshooting, with innovative diagnostic tools, software, and support that enable you to keep your business running.

We ensure the reliability of motors in the field and help to maximize the productivity of maintenance teams everywhere, backing every ALL-TEST Pro product with unmatched motor testing expertise.

About Us

Since 1985, ALL-TEST Pro, LLC has provided the industry with the most advanced predictive maintenance testing and troubleshooting tools for AC and DC motors, coils, windings, transformers, generators and more to a wide range of industries worldwide. With a full line of testing instruments, software, accessories and training programs, ALL-TEST Pro has the tools you need to perform advanced non-destructive motor testing and analysis for both de-energized motor circuit analysis and energized electrical signature and power analysis.

The extensive capabilities of the instruments, coupled with dependable post-sale training and technical support, ensure improved productivity, reduced downtime and a rapid return on investment.

Several of our easy-to-use models include intuitive integrated software, enabling users to perform testing and report on equipment trending and analysis with a single hand-held instrument. Models for de-energized motors provide early detection of internal winding faults for predictive maintenance, quality control and troubleshooting. Energized motor testing models provide immediate information about incoming power and mechanical and electrical health, as well as analysis of the driven load. Built-in memory allows for storage of test data for reference.

Industries Served

We serve all industries that utilize electric motors, generators and transformers including, water pumps, automobile, food, hotels, resorts & casinos, shipbuilding, HVAC motor service, technology research & development, public utilities, textiles, military, cement, chemical processing, pharmaceutical, printing/publishing, general manufacturing, wind energy, oil & natural gas, steel, aerospace, mining, nuclear energy, hydro energy, electrical distribution, elevators, paper, agriculture, power generation and building maintenance.

Product Line

ALL-TEST PRO 5™	ALL-EST PRO On-Line II™
ALL-TEST PRO 33 IND™	ALL-SAFE PRO®
ALL-TEST PRO 31™	ALL-TEST PRO MD III™
MOTOR GENIE®	ALL-TEST PRO Professional System 5™

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ALL-TEST PRO 5™

- Detects early faults in AC / DC motors, transformers & generators
- Complete stator & rotor analysis
- Immediate health analysis
- Route-based testing and trending, ideal for predictive maintenance
- Hand-held, portable testing instrument

ALL-TEST PRO 33 IND™

- The perfect tool for troubleshooting and inspection of incoming or stored motors before installation
- The AT33 IND™ quickly shows the complete condition of the stator windings, the rotor, contamination, ground fault & connections
- Simple step-by-step instructions on the easy to read screen
- Quick test comparison between first and last test in only minutes

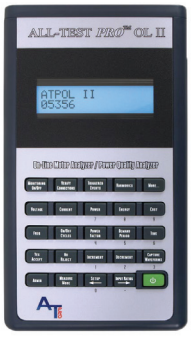
ALL-TEST PRO 31™

- Locates winding faults such as turn to turn and coil to coil, along with grounded windings
- Rotor test helps detect problems such as broken rotor bars and eccentricity
- Measures impedance (Z), phase angle (Fi), current/frequency response (I/F), & insulation to ground resistance (500V or 1000V and measure to 500 meg-ohm)
- Performs a quick pass/fail rotor test

MOTOR GENIE®

- Locates winding faults such as turn to turn and coil to coil, along with grounded windings
- Measures impedance (Z), phase angle (Fi), current/frequency response (I/F), and insulation to ground resistance (500V or 1000V and measure to 500 meg-ohm)
- MOTOR GENIE® App available

ALL-TEST PRO On-Line II™



- 1000V CAT III rating-directly connect to electrical motors & generators with an operating voltage up to 1000V
- Multiple motor tests can be performed automatically - User can set a delay between each test.
- Compatible with SD cards to 32GB
- New Arm Processor - Improved Bluetooth communication between instrument & computer. Faster communication between instrument & SD card.

ALL-SAFE PRO®

- Permanently installed accessory which offers significant advantages over conventional methods for the temporary monitoring and measuring of power systems
- Determine a motors condition with minimal risk, error, and trouble
- Certified by CSA and complies with the EC requirements for a rated input of 1000V
- For motors or generators over 1000Vrms it can be connected via potential transformers and current transformers

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ALL-TEST PRO MD III™

- The MD III™ Assembly includes all you need for complete Energized and De-Energized Testing of Motors, Generators & Transformers. Combine the power of Motor Circuit Analysis (MCA™) and Electrical Signature Analysis (ESA) to evaluate and trend your entire motor system.

ALL-TEST PRO Professional System 5™

- The ALL-TEST PRO Professional System 5™ combines the analytical and trending power of the hand-held ALL-TEST PRO 5™ and ALL-TEST PRO 31™ tools with the advanced analysis and motor management capabilities of the MCA PRO™ enterprise soft ware.
- This comprehensive package will greatly improve plant productivity and reduce operating costs, with a low investment for a rapid ROI.

Continuing Education and Training in the Field of Motor Diagnostics and Predictive Maintenance

Public Courses: We offer intense, five-day training workshops on the latest and most advanced techniques in both de-energized and energized motor testing. These two, back-to-back courses are independently certified by IACET and SAIEE and can be taken individually or together. The combined course provides the knowledge necessary to detect developing winding faults before they occur; troubleshoot motor faults; identify and correct 100% of mechanical & electrical motor faults; and estimate time until failure on low voltage motors (<600V). Attendees will also learn how to implement comprehensive, reliable predictive maintenance and “Electrical Precision Maintenance” Programs.

On-Site Course: Hold training at customers facility. Courses are geared towards the plant’s equipment & objectives. Efficiently train various levels of personnel at once while minimizing downtime and travel expenses.

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Proactive Motor Testing Protects Ethanol Plant

ALL-TEST Pro 33 IND™ allows motor testing prior to installation

By Mike Schneider, ALL-TEST Pro LLC.

Ethanol has been a clean-burning fuel used in the United States since the 1850s. Ford's Model T automobile was designed to run on ethanol, and while ethanol was banned during the Prohibition era, it gained traction in the 1970s at a time of high gas prices and concern around oil imports. Ethanol made a major come-back when the Renewable Fuel Standard was initiated by Congress in 2005 to set some minimum requirements for using renewable fuels, and now, about 14 billion gallons of ethanol are added per year to gasoline consumed nationwide.

CARDINAL ETHANOL NEEDS RELIABLE POWER

One of the companies dedicated to contributing to America's sources of renewable energy is Cardinal Ethanol. In 2008, Cardinal Ethanol commissioned a natural gas fired ethanol producing plant in the heart of the Corn Belt. Located in Indiana, this ethanol plant produces approximately 100 million gallons of ethanol per year, in addition to 340,000 tons of dried distillers grains with solubles that are distributed to companies who produce food for livestock and poultry.

In order to produce 100 million gallons of ethanol per year, the plant has to ensure their equipment operates reliably 24 hours a day, 7 days a week. The in-house maintenance team at the ethanol plant schedules "planned shutdowns" twice each year, once in the spring and once in the fall, to perform maintenance on the equipment and machinery operating in the plant. During the fall 2015 shutdown, four new motors were installed to drive the conveyor belts that fed the corn in through to the ethanol processing plant.

The Cardinal Ethanol Plant near Union City, Indiana, processes approximately 36 Million bushels of corn each year into ethanol.

ABOUT CARDINAL ETHANOL

Originally founded by twelve members from Randolph County, Indiana, the Cardinal Ethanol project was officially organized in February 2005 with the intention of planning, constructing and operating a 100-million-gallon dry mill corn-processing plant to benefit investors, farmers and the community. For more information, visit www.cardinalethanol.com.

In December 2015, the maintenance team noticed the grain flow was being interrupted. Mark Durr, maintenance project manager at the ethanol plant, swiftly investigated the grain delivery system and determined that the interruptions in grain flow were being caused by intermittent shutoff of the conveyors. Mark then instructed

his in-house maintenance team to perform several tests on all four motors that drive the corn conveyors.

MOTOR TESTING TO PREVENT UNPLANNED SHUTDOWN

"I instructed my technicians to test all four motors, which ranged from 40- to 60-horsepower, and our meg-ohm meter showed the coils were fine, no short turns and nothing going to ground," explains Mark. "When we used the ALL-TEST Pro 33 IND™, that motor testing instrument showed us the rotors were bad."

A CLOSER LOOK: ALL-TEST PRO 33 IND™

The AT33 IND™ instrument is an excellent tool for troubleshooting, inspection of incoming or stored motors before installation or repair and shows the complete condition of the stator windings, the rotor, contamination, ground fault, and connections.

This instrument presents an exciting break-through in de-energized testing. Within minutes the operator can get a complete picture of the condition of the motor without having to stress-test the windings or use other more expensive or elaborate instruments, which can be difficult to operate and analyze captured data with.

Providing, two tests in one, the instrument can be used in two modes: Static and Dynamic. Both quickly collect data in the auto mode and there is no need to operate a lot of difficult to understand buttons.

Mark immediately contacted the general contractor who had installed the motors to inform him of his discovery. The contractor was curious about Mark's conclusion that there was a problem with the rotors. The motors were brand new, and the contractor could not

believe that all four motors would have rotor problems. When asked how he came to this conclusion about the rotors being the root cause of the problem, Mark explained to the contractor that he had an AT33™, which is a de-energized motor testing instrument that shows the complete condition of the both the stator windings and the rotor.

"I had purchased the AT33™ motor testing instrument a little over a year ago, shortly after I began working at this plant. We are focused on preventive maintenance to keep this plant up and running, and that means having the right tools to prevent plant shutdowns," states Mark. "When you have a problem with a motor, a meg-ohm meter, multi-meter, and LCR meter (L-inductance, C-capacitance, R-resistance) are not going to tell you if there is a problem with a rotor, but an AT33™ will."

After the motor testing results were shared with the contractor, the contractor made arrangements to replace the motors, which had been under warranty. The motors that had been tested with the AT33™ were sent to the contractor's service center to be disassembled and inspected. The service center technicians confirmed that the rotors had in fact been the root cause of the motors' inability to perform as intended.

"The report from the service center, confirming the rotors were bad, was not a surprise to me," shares Mark. "We have used the AT33™ quite successfully on several motors, because we know that more common testers don't have the capability to show rotor health. This is one of the main reasons I bought the AT33™, because of its ability to test the rotor. In this case, it really came in handy."

	Ground Faults	Internal Windings Faults	Open Connection	Rotor Faults	Contamination
ATT33 IND	YES	YES	YES	YES	YES
Meg-Ohm-Meter	YES	NO	NO	NO	YES
Volt/Ohm Meter	NO	NO	YES	NO	NO

"When you have a problem with a motor, a meg-ohm meter, multi-meter, and LCR meter (L-inductance, C-capacitance, R-resistance) are not going to tell you if there is a problem with a rotor, but an AT33™ will."

—Mark S. Durr,
Maintenance Project Manager
Cardinal Ethanol LLC.

LESSONS LEARNED

It is critical to inspect new motors and stored motors before they are installed into a system. Spending a few minutes to test a motor before installing it can save thousands of dollars in maintenance, and in some cases, shutdown costs.

The AT33™ de-energized motor testing instrument, which performs both Static and Dynamic tests, is a proven asset for revealing the complete condition of the motor rotor and stator windings and also helps the maintenance technician or operator understand if there are any issues with contamination, connections, and ground faults. ◆

Since 1985, ALL-TEST Pro, LLC has provided industry with the most advanced predictive maintenance testing and troubleshooting tools for AC and DC motors, coils, windings, transformers, generators, and more to a wide range of industries worldwide. With a full line of testing instruments, software, accessories and training programs, ALL-TEST Pro has the tools you need to perform advanced non-destructive motor testing and analysis for both de-energized motor circuit analysis and energized electrical signature and power analysis. The extensive capabilities of the instruments, coupled with dependable post-sale training and technical support, ensure improved productivity, reduced downtime, and a rapid return on investment. For more information, visit **www.alltestpro.com.**

Municipal Utility District Reduces Energy Demand Penalties & Implements Condition-Based Monitoring Program

Instrumentation led these users to more informed decisions.

By **Mike Bjorkman,** ALL-TEST Pro, LLC
& Stephen Hogue, Less Watts Inc.

Unlike residential consumers, industrial and commercial companies pay for the reactive kilovolt-amps (kVA) demand power they use along with the active kilowatt (kW) energy they consume.

Each electrical power provider supplies reactive kVA that produces the magnetic field in the motor that turns the rotor. The rotor converts electrical energy into mechanical energy that drives connected rotating equipment. The kVA electrical power is not consumed like the active kW energy.

Utility providers use a demand meter to determine how efficiently a customer is using the supplied kVA energy. The efficiency is measured as percentage below 1.0 or unity.

Power factor (PF) below 95 percent has a penalty charge applied to each billing cycle. The monthly electric demand charges can be the major electrical cost for larger motors operating with low PFs.

Companies who have optimized PF and avoid PF penalties often achieve a return on investment (ROI) within two years.

Case Study

In 2008, a municipal utility district (MUD) in Texas began working with a company that specializes in motor reliability and power quality testing for the water/wastewater industry. At a MUD board of directors meeting, Stephen Hogue, president of the motor reliability and power quality testing company, discussed potential opportunities to improve rotating equipment operating efficiency and lower electrical costs. In 2009, capacitors were installed on eight of the larger district motors. Power quality monitoring for one lift station during 2009 showed major reductions. By the end of 2009, the kVA billed was reduced by 50 percent, and kW was reduced by 25 percent.

The 400-horsepower (HP) well motor with four 60-HP booster pumps did not indicate any energy cost reductions even though the PF had been increased to 98 percent efficiency. Hogue then contracted a third-party motor testing company to perform energized and de-energized testing at the well

Image 1. Deep well vertical pump and 400-HP motor at the well pumping facility (*Images courtesy of ALL-TEST Pro*)

facility. The testing revealed that two of the six underground motor cables that connected the well to the motor control center had been close to grounding out.

Immediate action was taken to re-trench and replace the 100-foot lead cables that ran underground from the pump motor to the motor control center. At that point, Hogue knew it would be essential to collect and trend data on all the motors so he could better understand the health of the motors and show the MUD how the condition of their motors and other rotating equipment affected the MUD's ability to achieve energy savings.

After extensive research of motor testing equipment, the motor reliability and power quality testing company purchased both a handheld energized testing instrument and a handheld troubleshooting instrument. Both are ideal for condition-based monitoring and trending. The company chose these user-friendly motor-testing instruments for the following reasons:

- The handheld energized testing instrument is used in energized conditions for both electric signature analysis (ESA) and power quality (PQ) analysis. In ESA mode, the instrument evaluates the condition of incoming power, the control circuit, the motor and the driven load. When in PQ mode, it can be used for energy data logging for an array of data points that include harmonic analysis, voltage and current charting, viewing waveforms, waveform capture of sags and swells, and transient event capture.
- The troubleshooting instrument, which is used for de-energized testing, is specifically designed for troubleshooting motors and commissioning new and rebuilt motors before installation. This instrument enables the operator to identify motor conditions that include winding contamination, stator and rotor unbalance, changes in rotor and stator condition, resistance in windings, contamination and insulation to ground. This de-energized motor testing instrument reveals actual motor conditions and enables the scheduling of remedial work to prevent serious damage and even avoid catastrophic failure.

The instrument manufacturer provided extensive training and support for the motor reliability company. Hogue quickly learned how to use the motor testing instruments and immediately began trending data for the MUD motors. The troubleshooting instrument proved to be instrumental in 2012 when the district's 400-HP well pump motor was sent to a motor repair shop to be reconditioned.

"It is important to commission new and reconditioned motors. Without motor commissioning, there is no confirmation that the motor is going to operate as designed," Hogue said. "By commissioning the motor, the chance that a motor will have operational issues that appear after installation can be reduced. The owner is better off having a motor commissioned before paying for delivery and installation, then finding out there is a problem. Finding issues after motor installation often leads to the owner having to fight for warranty satisfaction."

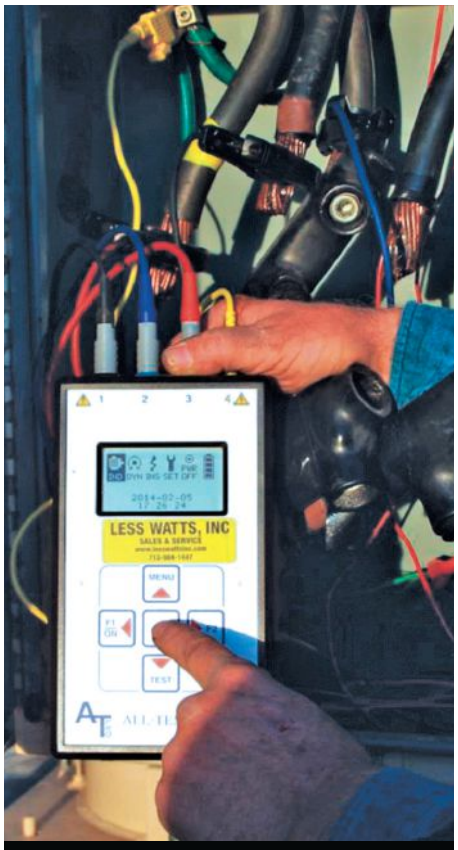


Image 2. Well pump motor tested with the troubleshooting instrument

Commissioning Issues

When Hogue went to the motor repair shop to commission the reconditioned motor, the energized testing instrument tests indicated poor insulation-to-ground results, showing a reading of 6.01 megaohms (Mohm). A healthy reading for a reconditioned motor should have been between 500 and 999 Mohm. The motor repair shop agreed to correct the issue.

Hogue returned three days later to repeat the commissioning tests. Using the troubleshooting instrument, the test results indicated an insulation-to-ground reading of 551 Mohm. Hogue issued his approval for the pump motor to be shipped back to the lift station. Once the rebuilt vertical pump and reconditioned motor were installed, Hogue returned to the lift station to perform motor tests with the instruments. This time, all tests yielded positive results, completing Hogue's commissioning process. Today, the MUD's well pump motor is operating efficiently, with an insulation-to-ground reading at 999 Mohm and a PF of 98 percent efficiency.

This MUD's approach to motor reliability demonstrates that a change is occurring in the industry.

Equipment owners and operating service companies are improving their reactive maintenance strategies and are now embracing more condition-based monitoring programs. This growing proactive change is increasing the benefits related to reduced downtime, energy savings and extended equipment life cycles, which are becoming more important for daily operations.

While providing dedicated personnel to monitor and trend collected electric motor data is difficult for many businesses, third-party professionals support the industry with condition-based technologies and services.

These instruments give end users the data they need to understand the health of their equipment and to make informed decisions. ■

Mike Bjorkman is vice president of BJM Corp. and has more than 30 years of industry experience. He is director of marketing and IT for BJM Pumps LLC and ALL-TEST Pro LLC, both subsidiaries of BJM Corp. Bjorkman may be reached at 860-399-5937. ALL-TEST Pro provides instruments for troubleshooting, quality control and predictive maintenance of electric motors, transformers and generators.

Stephen Hogue is president and founder of Less Watts Inc. since 2007. Hogue may be reached at stephen@lesswattsinc.com or 832-428-6890. Less Watts Inc. provides dynamic electric motor reliability and power quality testing services in Texas.

Go Beyond Vibration Analysis in Diagnosing Rotating Equipment Problems

Electrical signature analysis identified a breakdown in one pump station.

BY **WILLIAM KRUGER**
ALL-TEST PRO

In Henderson, Nevada, P-19A is one of the most critical potable pump stations operated by the city. It supplies drinking water to the second largest city in Nevada. The station was put in service in 1999 with three vertical turbine pumps. Each pump was driven by a six-pole 700-horsepower (HP) vertical induction motor. Two additional vertical pumps, also driven by six-pole 700-HP vertical induction motors, were installed in 2006.

Routine machinery vibration surveys taken at the station in November 2014 identified possible early stages of bearing failure, but no additional mechanical or electrical issues were detected. The vibration summary concluded that all pumps were operating within acceptable limits and no maintenance was necessary.

Overheating Motors

In January 2015 the motors for pumps 1 and 5 exhibited overheating as well as current and speed fluctuations. A variety of de-energized and energized diagnostic tests were conducted—including a rotor inductance test (RIT), vibration testing, a manual rotor test and a 10-second current trace. De-energized tests showed all measurements were balanced, which meant there were no indications of winding issues. Machinery vibration data again indicated early bearing degradation, but no additional electrical or mechanical issues.

Both the manual rotor test and RIT exhibited some anomalies. The motor current had a phase unbalance of about five percent and was modulating approximately 15 amps. The rotor speed appeared to be fluctuating and was running about 12 rpm below nameplate. These symptoms suggested rotor bar issues on the affected motors.

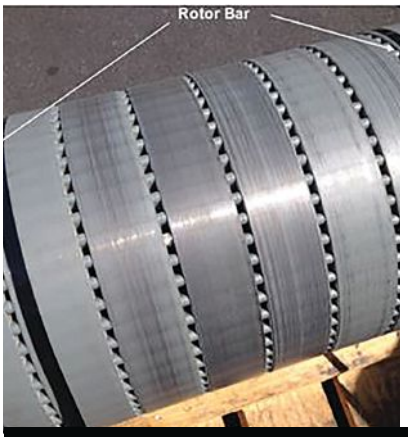


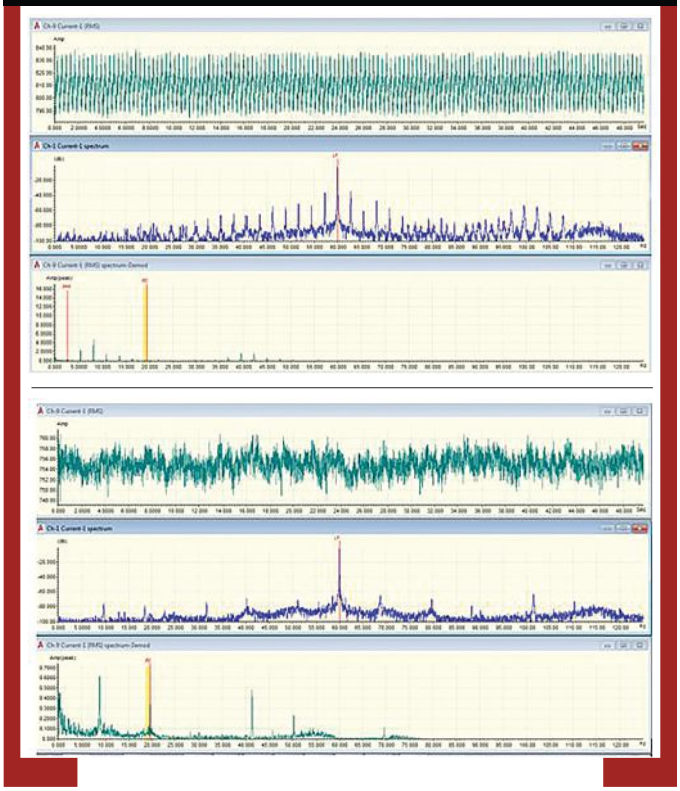
Image 1. Unit #5 damaged rotor Image 2. Rotor showing damaged rotor bar areas *(Images and graphics courtesy of City of Henderson)*

However, since vibration tests failed to indicate rotor issues, management wanted additional confirmation or indication of rotor problems before expending limited resources on pulling and inspecting the motors. Based on these concerns, the staff had electrical signature analysis (ESA) performed on all the pumps.

Electrical Signature Analysis

ESA is a diagnostic technology that uses the motor supply voltage and operating current to identify existing and developing faults throughout the motor system. ESA performs simultaneous data acquisition of all three phases of voltage and current to create a three-phase power-quality table. Additionally, it digitizes and stores

Figure 1. Software display of the low frequency data before repair.
Figure 2. May 5, 2015 – ESA after repairs. Pole pass frequency side bands were gone and current draw was 754 amps with 2 amps modulation.



the voltage and current waveforms for additional processing and analysis using fast Fourier transforms (FFT).

During the motor tests, ESA data was taken at different times: first shortly after start-up, then again after the pump had been running for about 30 minutes. The most significant finding was the large change in rotor speed with a very small change in motor load. The rotor was running considerably below nameplate. After running 30 minutes, the rotor speed was 1,171 rpm. This was confirmed by a handheld tachometer used by the vibration analyst while taking the vibration data.

Rotor Bars

Rotor bars are copper or aluminum bars that run the length of the rotor in alternating current (AC) squirrel cage induction motor rotors. These parallel bars are connected to rings—called end rings or shorting rings—on either end of the rotor providing a path for current flow through the rotor. Current flowing through the bars creates an electromagnet. Since these bars create parallel paths, the voltage across each path is the same and current flow through each path will vary depending on the resistance of each path. If the rotor bars develop cracks, separate from the end ring or have other imperfections, the resistance of the bars will increase and the current flow through the affected bar will decrease.

Induction motors rely on the rules of mutual inductance to get power onto the rotor of a squirrel cage rotor. These rules (Faradays first law of electromagnetic inductance) require:

- a magnetic field
- a path for current flow
- relative motion between magnetic field & conductor

In three-phase induction motors, a rotating magnetic field is created by applying a three-phase voltage to the three-phase stator windings. The rotor bars act as the conductor to create the path for current flow. The relative motion is established by the difference in the rotational speeds between the rotational speed of the magnetic field (synchronous speed) and the speed of the rotor (rotor speed). The difference between them is the slip speed.

When rotor bar imperfections cause unbalanced current flow through individual rotor bars, it affects the total rotor current flow. The frequency of the current through the rotor is the difference between the rotor speed and the speed of the rotating magnetic field, which is the slip speed.

Symptoms of Rotor Bar Issues

When the rotor has unbalanced current flow through the rotor bars, it causes the rotor current to vary as the affected bars pass under the magnetic fields on the stator. Due to the difference of the rotational speeds between the rotor and the rotating magnetic field, each rotor bar will pass under each of the magnetic field poles each revolution of slip. For example, in a six-pole motor induction motor, there will be three north poles and three south poles.

Therefore, when squirrel cage induction motors have rotor bar issues, the motor's current modulates at a frequency equal to the number on poles on the motor times the frequency of the current flow through the rotor. This frequency is commonly referred to as Pole Pass Frequency (PPF), which is equal to the number of poles in the motor times slip speed.

ESA FFT Results & Analysis

The results of the FFTs on pump motors 1 and 5 provided clear indication of rotor bar damage. The ESA automatic analysis software applies a proprietary algorithm that uses five criteria of the ESA analysis to identify rotor bar issues and to determine the severity of the problems. The software provides the charts, tables and graphs of the motor data, as well as detailed analysis report with actual recommendations.

1. Amplitude of PPF sidebands in current spectrum
2. Motor load
3. PPF amplitude in demodulated spectrum
4. PPF harmonics in demodulated spectrum
5. PPF sidebands around running speed spectral peaks

Based on the ESA data taken and applying the above criteria, pump 5 was given a severity level of seven out of seven, and pump 1 was rated six out of seven. Though the results of the vibration analysis did not show any indications of rotor problems, the reduced speed of the rotor and the analyzed ESA data showed several rotor bars were broken. When the maintenance team pulled motor 5, it found 30 percent of the rotor bars broken.

Rebuilding the Rotor with Different Metallurgy

After discussing the issues with the motor manufacturer and a third party motor repair company, the maintenance team chose to have both motor 1 and motor 5 rotors rebuilt with copper rotor bars. Pumps 2, 3 and 4 had copper rotor bars and did not have the same issues as pumps 1 and 5. The original rotor bars in pumps 1 and 5 had been made of aluminum. This was believed to be the root cause of the problem.

Gone uncorrected, the elevated operating temperature of the motor could have caused shorted stator winding and would have required a rewind or scrapping the motor as well as the repair or replacement of the rotor. Having the motors rebuilt with copper rotor bars enabled the team to avoid catastrophic failure of their vertical turbine pump motors.

Motor 5 was rebuilt and installed in May. Another round of MVA and ESA testing was performed immediately after installation to ensure proper operation. The electrical signatures reported excellent rotor condition (see Figure 2). It also showed that rotor speed increased, while overall current dropped. The newly rebuilt motor 1 was installed in a few months later and a third round of testing was performed.

Lessons Learned

Although machinery vibration analysis has been used for many years, it is limited in its ability to detect and evaluate problems in electric motors. Therefore, diagnostic tools available to determine the condition of rotating equipment are invaluable when trying to identify faults in electrical equipment. ■

William Kruger is technical and training manager at ALL-TEST PRO. He can be reached at 860-399-4222 or wkruger@alltestpro.com. For more information, visit alltestpro.com.

Municipal Utility District Prevents Failure by Testing Motors Before Installation

Early inspection revealed a winding fault.

BY **AARON SCHNELLE**
ALL-TEST PRO LLC

Since 2008, a municipal utility district (MUD) in Texas has worked with Less Watts Inc., a company that specializes in motor reliability and power quality testing for the water and wastewater industry. Less Watts Inc. supports MUDs by providing motor acceptance testing, commissioning and condition monitoring services. When one of the booster stations managed by the Harris County MUD was upgrading its pumps and motors, Stephen Hogue from Less Watts Inc. was asked to perform acceptance testing.

This MUD's main booster station pumps water into static tanks that are then pressurized to push drinking water throughout the municipal water district. The MUD had scheduled an upgrade to their Well-1 booster station in 2017 and ordered four booster pumps with 75-horsepower motors.

Each pump system (pump, motor and drive) had been mounted on individual skids. Hogue brought a hand-held testing device to the pump suppliers' warehouse to check the condition of the new motors before they could be officially accepted by the MUD. The device, which is used for de-energized Motor Circuit Analysis (MCA), is specifically designed for troubleshooting motors and commissioning new and rebuilt motors before installation. The testing device enables the operator to identify motor conditions that include winding contamination, stator and rotor unbalance, changes in rotor and stator condition, resistance in windings, contamination and insulation to ground issues.

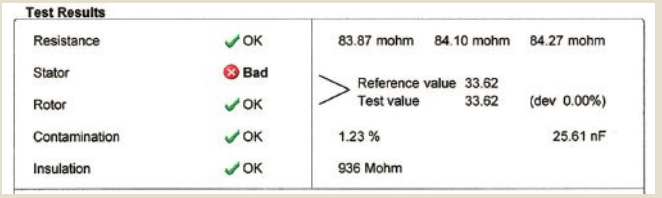
Hogue connected the testing device to the motor box leads and performed static and dynamic tests. He generated reports for each of the motors, with one report showing test results consistent with a developing winding fault in Phase 3-2.

Image 1. MUD freshwater distribution pump room *(Images courtesy of ALL-TEST Pro LLC)*

Hogue discussed the test results with the MUD, explaining why his acceptance report showed one motor should not be accepted or approved for installation. Even though the motor was brand new, the testing device showed a defect and provided an alert to the potential of a motor failure. The MUD requested that the questionable motor be returned to the vendor and replaced with another unit. A new motor was delivered a week later, and Hogue returned to the pump supplier's warehouse with his hand-held testing instrument to test the replacement motor. This time, the new motor passed the acceptance test.

In August 2017, the fully assembled skids were installed at the main booster station. Hogue tested the installed motors prior to startup to make sure all motors were operating as designed. The commissioning went smoothly and the motors have been operating well since startup. Hogue continues to collect operating data on a monthly basis.

"It is important to perform acceptance testing for new and repaired motors," Hogue said. "Testing your motors before installing them gives you confirmation that the equipment will operate as designed.



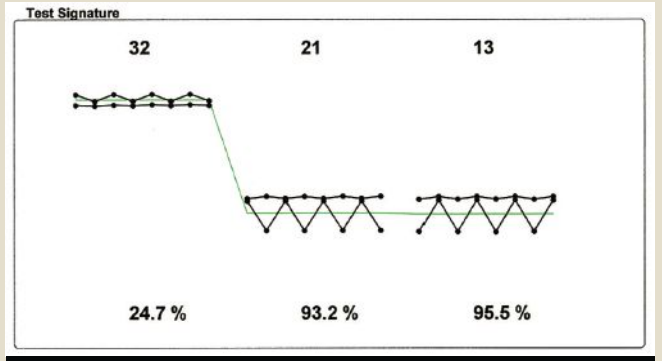


Image 2. Result report page

"When you install a new or repaired motor, it is better to have the equipment commissioned prior to paying for delivery and installation. Finding out there is a problem with a motor after startup or even after a short period of run time can result in additional maintenance costs, system downtime, and possible challenges in obtaining warranty satisfaction."

Lessons Learned

1 Do not accept a motor if there is proof that it is not operating as intended. The proactive testing initiated by this MUD prior to delivery and installation of the motors helped them avoid additional project costs.

2 Equipment owners can avoid unscheduled downtime, and even failure, by testing their equipment prior to receipt and installation. Even though motors may be brand new, they should be tested prior to acceptance and installation. If the motor had failed within the first year of operation, the standard parts and labor would likely be under warranty, while the vendor would have been responsible for the materials and replacement. However, if this motor had passed the warranty period, the owner would have had to cover the entire expense.

3 Mistakes in the manufacturing or repair process can be detected with sophisticated testing instruments. ■

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