Product Service Bulletin

Vol. 1, October 2002

US MOTORS

Ask the experts

Q: If we suspect that a motor failed as a result of water damage, what installation advice can we give our customers to help them protect the motor from future water damage?

A: If they are going to use the motor outdoors, it is going to be subjected to humidity and moist environments. They can take appropriate precautions by using space heaters or trickle voltage heating schemes to keep the winding above the dew point and prevent moisture from collecting and causing problems.

Have a question for the experts? Contact us at jim.bryan@emotors.com

Under Warranty?

Tips to Identifying and Preventing Overloads and Environmental Contamination

Through detailed analysis of the motors returned under Emerson Motor Technologies' NEMA Winding Failure Return Program, we identified that contributors to some motor failures are application related. Our intent is to help identify application errors so we can prevent the customer from experiencing repeat failures. Improper installation and use of a motor can invite water damage, overloads, inadequate ventilation and other conditions that can severely damage a motor. These are not defects in workmanship or material covered by our warranty.

When tearing down a motor, the mechanic should be aware of signs that indicate whether the failure is attributed to the application. The customers can provide information to confirm your diagnosis. With this information you can offer tips to the user to help prevent this type of unwarranted damage from occurring in the future.

Environmental Contamination

One common cause of motor failure is water damage within a motor (see image). This can often be identified by the presence of rust, telltale water lines and green specs

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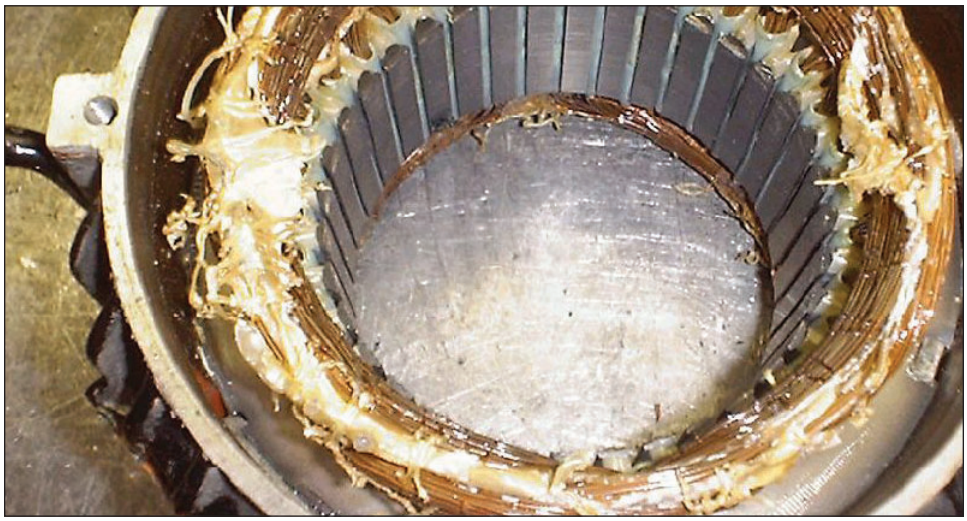

Popped strings and melted phase paper indicate overload.

Room For Improvement

Emerson Implements Motor Upgrades Based on Program Results

Industry leader Emerson Motor Technologies is committed to continual improvement of our products. We are grateful for sharing the opportunity for improvement with our EASA members in our recent NEMA Winding Failure Return Program. With the completion of this

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EMERSON™ Motor Technologies

Generally discolored winding of an overloaded motor.

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(copper oxides) on the winding. A low megger reading can also indicate water contamination.

Emerson motors are constructed for both indoor and outdoor use. If the motors are going to be used outdoors, they may be subject to humidity and moist environments. Some basic precautions are recommended when installing an Emerson motor outdoors that will help prevent moisture damage, such as using a space heater or trickle voltage heating. Heaters will keep the winding above the dew point and prevent moisture from collecting on the winding and other internal parts. Enclosed motors, by the nature of their construction, help prevent these contaminants from entering the motor. Large open motors may utilize an available filter accessory to control the ingress of contaminants.

Informing customers of these installation recommendations will help prevent future motor failures. Be sure to consult available installation literature for more information.

Overloads

Another common cause of motor failure is overloading. When investigating a potentially overloaded motor, the following questions will yield important clues: What are the three-phase full load amps and voltages? Has the application on the motor changed since its original installation? Was the motor sized properly?

An overloaded motor will have a general burnt appearance in the winding (see photo). A winding failure resulting from a defect in the motor, which is warrantable, will be more localized in nature.

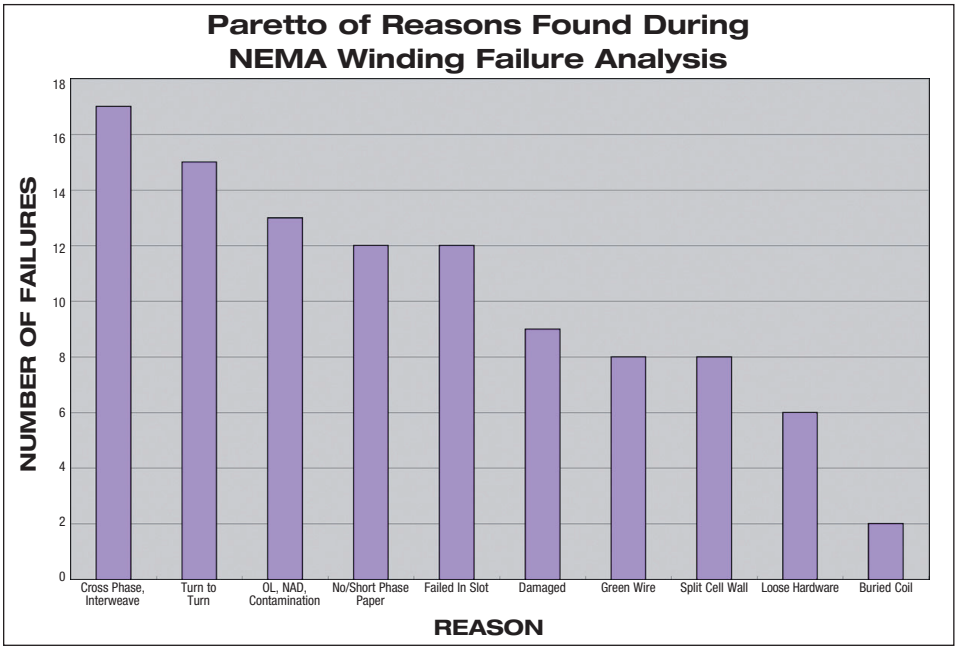
Overload can occur when the driven load is larger than the motor is capable of handling or if insufficient voltage is applied at the motor terminals. A motor that does not have proper ventilation and overheats is a form of overload. It is difficult to distinguish between the causes for a "roasted" winding, i.e., overload, low voltage, or ventilation, since the results are similar. Emerson requires that the ambient air temperature used for cooling the motor not exceed the rated ambient on the nameplate, typically 40 C (104 F). If the motor is operated in an enclosed or restricted area, a sufficient quantity of cooling air must be supplied as determined by Emerson with a maximum temperature of 40 C (104 F).

Test Your Testing Equipment

Properly functioning and calibrated test equipment is one way to be sure that your diagnosis of a motor is as accurate as it can be. Periodic calibration and proper training on test equipment is always recommended.

During its detailed analysis of the returned motors, Emerson identified several instances where motors had no apparent defects. Malfunctioning testing equipment, problems with a motor's power supply, bad control or circuit breakers and other malfunctioning equipment feeding the motor can give the appearance that the motor is not working properly, when in fact it is. On motors exhibiting an intermittent trip, the motor may have been tripped off-line on the application, which may create the appearance that the motor has failed. In fact, a malfunctioning feeder cable, control, or circuit breaker could be to blame for the trip, and not the motor. Remember to test all of the motor's wiring before making your final diagnosis.

If you are unsure of your diagnosis, please call Emerson Motor Technologies' Product Service Department for assistance. Contact information can be found on our website, www.emersonmotors.com or www.usmotors.com.



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program, we would like to share our findings so we all can benefit.

This unique program has been a success on many levels. The program, which generated outstanding participation from EASA repair facilities, allowed Emerson the opportunity to examine 130 of its own motors, field-tested in real industrial environments, to determine the causes of their failures.

As a result of the program, we identified key areas in our processes where performance improvements and warranty reductions are possible. With some of the returned motors, we attributed failures to circumstances not covered under warranty such as application error, overloads and contamination. In some cases, we could find no apparent defects in the motors.

Emerson identified the top 10 causes for the failures and has implemented an internal plan for researching and resolving those issues that pertain to the physical components of its motors:

1. Crossed phase wires, interwoven wires in the end turn
2. Turn to turn shorts
3. Overloads, no apparent defects and contamination (not covered under warranty)
4. Absence of or short phase paper
5. Failed in slot
6. Damaged wire
7. Green wire (caused by moisture contamination)
8. Split cell wall liner
9. Loose hardware (bolts, balance washers, etc.)
10. Buried coil

The improvements, outlined below, are in various stages of development. Some of the changes have already been implemented, some are in the implementation process and others are being analyzed further.

Cause of failure: Cross phase/interweave, 17 motors returned
Improvement: Put in place new instructions to have the lead wire sleeving on the leads go all the way to the stator core. Currently reviewing the machine winders and the blocking process.
Benefit: Eliminates interweaving and crossed phases.

Cause of failure: Loose hardware, 6 motors returned
Improvement: Create a pokeyoke system for attaching the balance washers.
Benefit: Prevents the balance washers from being installed incorrectly, which could result in the washers flying off into the windings and damaging the motor.

Cause of failure: Absence of or short phase paper, 12 motors returned
Improvement: Develop new instructions and geometry of trimming the phase paper.
Benefit: Prevents the phase paper from being trimmed too short or not being included, which can cause phase-to-phase shorts.

Cause of failure: Split cell wall, 8 motors returned
Improvement: Reinforcing the cell wall liners with taping and cuffing.
Benefit: Prevents cell wall splitting.

Cause of failure: Buried coils, 2 motors returned
Improvement: Made repairs to coil making machine that was not making the coils all the same length.
Benefit: Elimination of buried coils.

For more information about the program results or Emerson's motor improvements, please contact Jim Bryan at jim.bryan@emotors.com.

Rust from moisture contamination

EMERSON™
Motor Technologies

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Look inside for your inaugural copy of the Emerson Product Service Bulletin!

Product Service Bulletin

Open your copy of the inaugural issue and read about:

- What to do if a motor fails due to water damage — Ask the Experts!
- Tips to identifying and preventing overloads and environmentalcontamination
- NEMA Winding failure return program results in motor upgrade implementation
- ...and More!

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