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Reliability

The Essentials of Eliminating Downtime of your Electric Motor

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Reliability:

The Essentials for Eliminating Downtime of Your Electric Motor

Lola L. Williams

Downtime is the nemesis of any reliability manager. Every hour of your shutdown due to motor failure affects not only your internal operations, but your customers, your employees and potentially the community at large. Keeping the motor running safely and efficiently in your operation should be a primary goal. Jim Williams, a nationally recognized motor reliability expert and president of Bradleys, points out that, "Preventative maintenance and regular analysis of your motor's load test performance are essential keys to a reliable motor."

Figure 1: Bradleys ships a recently repaired and tested ultra large motor.

A critical success factor in the operation of your electric motor is to ensure the new or remanufactured motor is designed for the application or load. When a motor is put into an application that it was NOT designed to do, it will cause many kinds of repetitive repair issues that even the best preventative maintenance practices will not correct.

Proper evaluation of environmental conditions under which the motor will be operating reduces operating and capital expenditures on future planned and unplanned repairs. The more hostile the environment, such as the corrosive nature of the geographic region itself (e.g., the highly alkaline Gulf Coast region), the ambient air temperature and the actual corrosive or high particulate nature of the industry and actual plant conditions, greatly impact your motor's long-term reliability. Motors, like you and me, prefer moderate temperatures to operate, such as clean air and a relatively dry climate.

Figure 2: ALCOA windings covered in particulate

Motors breathe and require air free of particulates to reduce the opportunity for clogged inlets. Your motors will run cooler and last longer when they breathe clean air. In high particulate environments, such as mining, recycling and aggregate industries, filtration systems with several filters that step-down from large to small micron pores and have pressure differential gauges to monitor the filter occlusion are highly recommended. "Like a molecular sieve, the filtration systems effectively trap the various sizes of particulate without overwhelming the maintenance department," explains Williams. He suggests you have a particulate sample analyzed for micron size to optimize the efficiency and lifespan of each filter. Root cause failure analysis (RCFA) often finds that motor coil damage is caused by high operating temperatures over extended periods of time. As Williams advises, "An ounce of prevention is worth a pound of cure."

Keeping your critical spare motor in a climate-controlled facility specifically designed for storage of motors and equipment at 50 percent humidity at ambient temperature will assist you in resuming operations quickly.

Motors operating in highly corrosive environments, such as pump motors around cooling towers, require a few preventative measures to extend operating downtime intervals. Two part epoxy coatings on all exposed metal surfaces is recommended to protect the exterior from the highly alkaline and wet environment. Additionally, bearing isolators installed in the bearing housing will protect the bearings. Motor life span is generally five to 10 years with these preventative measures. Without preventative maintenance, they may survive six to 12 months.

Full or partial load testing of a critical motor prior to installation or storage is another preventative measure to verify motor

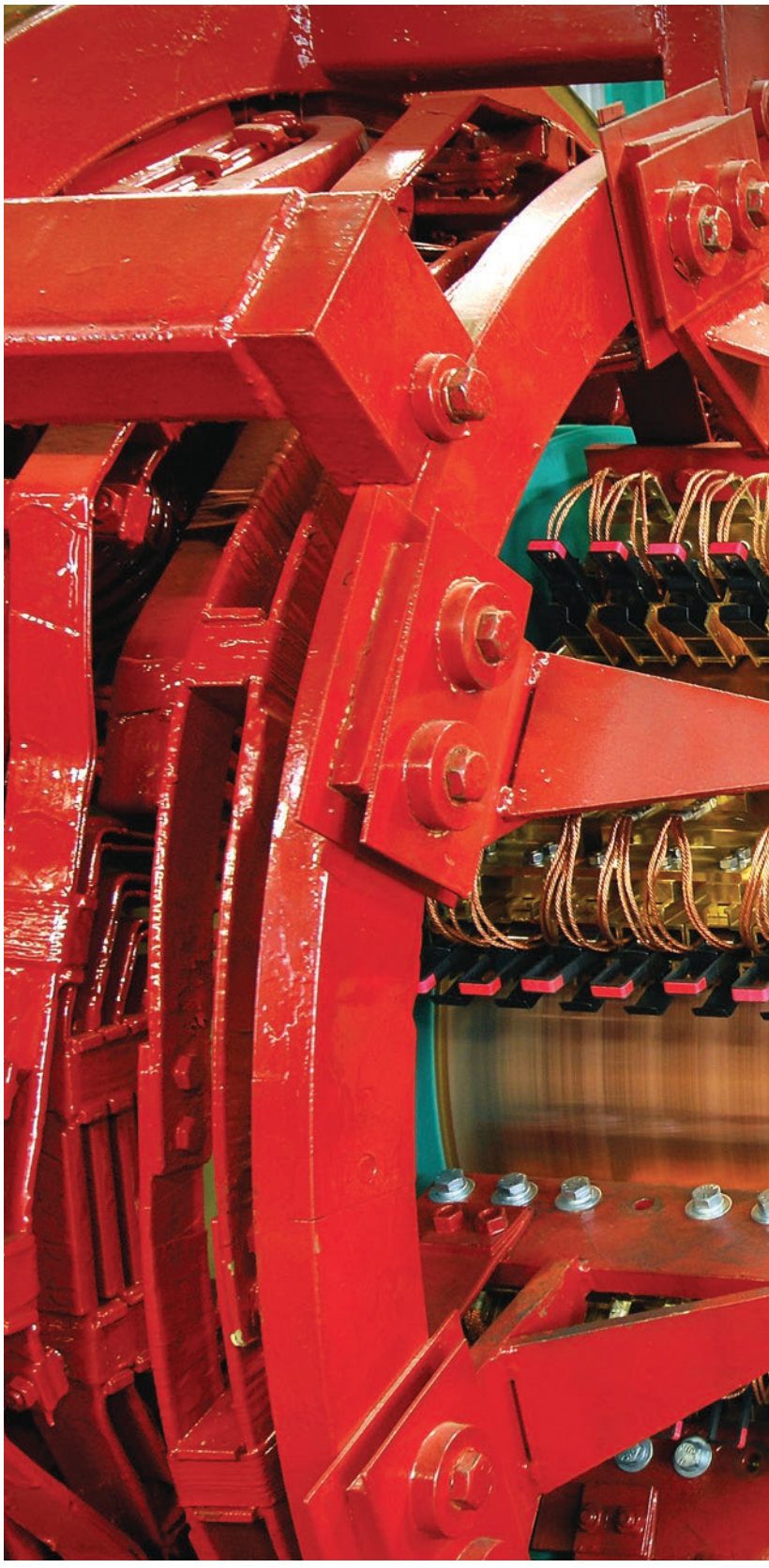

Figure 3a: Load test stand with VFDS

Figure 3b: Load testing monitors in Bradleys' control room

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reliability. Motors with a history of excessive operating temperatures, high vibration, or an unexplained noise are common driving factors for considering a load test. They can be run from four to 24 hours, depending on the customer's specifications. Motors generally stabilize within the first four hours of run time, however, several operating functions of your motor can be analyzed over a 24-hour period. For example, performing a full load test for the motor and drive system up to 7000 HP at 720 RPM provides analysis related to the system's harmonic signature, as well as the impact studies of the motor system on a given distribution system.

A problem-free motor system starts with a good installation. Regardless of whether the motor drives a fan, pump, or compressor, a few basics are necessary to ensure a proper installation. The motor base must be cleaned and inspected for cracks. Oftentimes, motors are returned to the shop by a customer for load and vibration testing when the vibration is caused by a compromised motor base.

The shop's motor removal checklist verifies if the existing motor base is inadequate for the reinstall.

Once the motor is set on the base, the soft foot is adjusted to the industrial standard of 0.002 inches. The motor is then test run to verify rotation and the baseline vibration data is collected. The laser alignment is completed and the motor system is rerun to verify the loaded vibration. The final loaded motor system vibration test can be run from 30 minutes to several hours based on vibration history. Improper alignment causes vibration and short bearing life of both the motor and the driven equipment. Most problems originate with inadequate attention to shims and soft foot. The motor foot and base mounting surface must be clean.

The condition and the number of shims are critical. The rule of thumb is to use no more than five shims to reduce the sponginess of the shim stack. Be aware that between the base and the motor foot, toe and heel problems may exist, requiring partial shims or possible re-machining of the base and/or motor feet. Improper soft procedures can cause distortion of the motor frame, resulting in bearing misalignment and vibration.

A good monthly preventative maintenance program is the vital component to a healthy and happy motor. Based on the motor size and environmental conditions around the motor, the monthly program can change, but the three essentials are lubrication, vibration testing and changing filters. Five to 10 year preventative maintenance programs can include on-site services, such as dry ice blasting to remove heavy particulate loading of the intake vents and other components.

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The largest cause of failures of a motor in the right application is lubrication, which results in bearing failures. Several studies over the last 50 years have all revealed that a high percentage of motor failures are in the bearings due to lubrication issues. Bearings that never get lubricated account for most failures. Some of the subsequent issues are improper lubrication, incompatible lubrication and contamination of the lubrication. One of the highest returns for your maintenance dollars is to implement a comprehensive lubrication program for ALL of your rotating equipment, especially your motors.

Lola Williams is the Special Projects/Marketing Manager for Bradleys, Inc., a large electric motor repair, rewinding, load testing and field service maintenance company. Bradley's Inc. has served the nation's petroleum, petrochemical, manufacturing and mining industry giants for over 80 years. Her career has spanned two decades in industrial sales and marketing. She lives in Portland, Texas.