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Thermography and motor-condition monitoring at a paper mill

Application Note

Testing Functions
Case Study

Measuring tools: Fluke Ti30 Thermal Imager

Operator: Bill Gray, paper mill plant maintenance reliability specialist

Equipment inspected: Motors, pumps, heat exchangers, gear boxes, bearings, MCCs

Until three years ago, the only thermography performed at the specialty paper mill featured in this case study was done by a consulting firm that inspected the switchgear once a year. The inspectors usually found hotspots that needed to be eliminated, but after plant technicians performed a fix, it would have been cost prohibitive to call the consultants back to verify that each repair was successful. That was a problem.

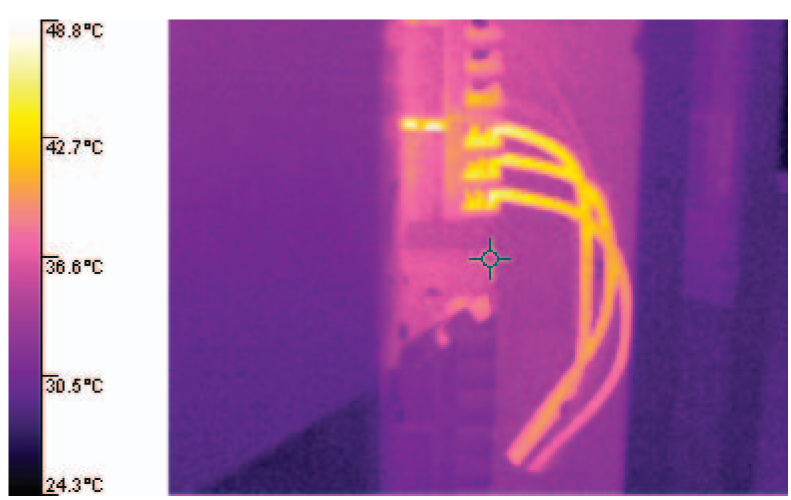
The mill runs 24x7, and they can't afford unscheduled shutdowns. In particular, they wanted to be able to inspect switchgear more than once a year, to monitor other equipment before and after repairs, and establish baselines on new equipment. Then, the facility purchased a Fluke Ti30 Thermal Imager.

Bill Gray, the plant's maintenance reliability specialist, trained in its use and became a Level I Thermographer. Gray began conducting thermal inspections of equipment as needed. Now, having used the thermal imager for two years, he's using the experience he's gained to develop a formal motor-condition monitoring reliability maintenance program.

Post-repair and other applications

The paper mill still contracts with outside thermographers to monitor the switchgear once a year, because of the time it takes to do a complete survey. The contractor surveys about 5,000 pieces of equipment over a week.

However, when Gray started taking thermal images of the repairs performed as a result of those outside thermographers' findings, he discovered that about 30 percent of the repairs were either unsuccessful or had made things worse. There had been a significant disconnect between the outside thermographers and the facility's interpretation of what repairs were



Hot connections.

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needed. Now Gray and his crew can work on the problem until the repair is satisfactory.

Since infrared imagers can monitor undesirable thermal buildup in an array of critical process systems, Gray also uses the Ti30 to detect dysfunctional pumps, under-performing heat exchangers, and a host of other equipment including gearboxes, bearings and motors.

Motor monitoring

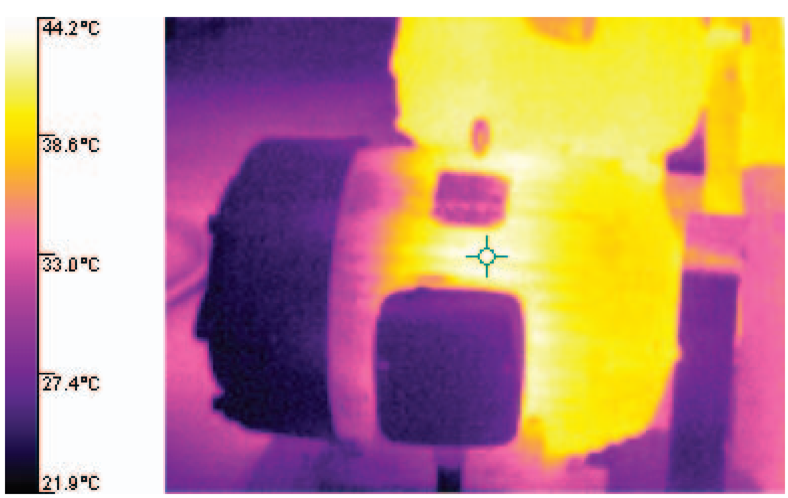
The mill is still in the process of developing its own thermal inspection routes. So, they started out by using thermal images on an "exceptional occurrence" basis.

In other words, if someone walks past a motor and notices it's hot, then Gray take a thermal image to find out where and why the motor is hot. If vibration data indicates a bad bearing or imbalance, he can confirm those findings with the camera by finding out if the motor is hot and where it's hot. A motor's heat signature tells them a lot about its quality and condition. In particular, every increase of 10 °C on a motor's windings above its design operating temperature cuts the life of its windings' insulation by 50 percent, even if the overheating is only temporary.

The mill has approximately 3,000 motors ranging from fractional horsepower units on pumps that supply coating and additives to 1,000-horsepower units powering large operations. If even that little pump motor fails, a whole batch of paper can be ruined or the machine shut down.

So far, Gray keeps thermographic records of motors that have needed repair. That way, he can go back and check them later to make sure the corrective action was successful. In one case, he had a big motor that was running warm. It was on a fan pump on the paper machine that supplied the stock to the head box. Nobody knew exactly how warm the motor was running, but everyone knew that if that pump went down the machine would be dead in the water.

Gray took thermal images of the motor. At the hottest spot on the housing, the image showed



Hot casing on a motor for the cream separator.

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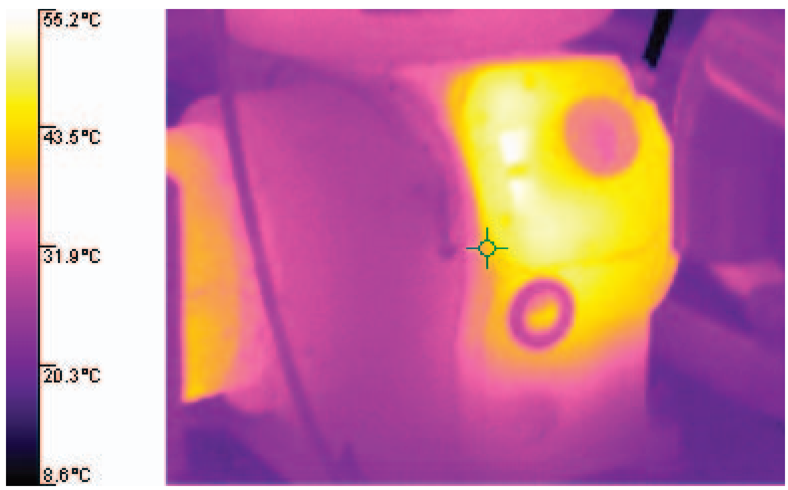
284 °F. The image also showed that the heat was coming from the windings.

He filed a report and then monitored the motor closely for about a week until it the maintenance team could install a new motor and send the other one out for repairs. The replacement was deemed so necessary that they shut the machine down for the transfer, rather than waiting for a scheduled shutdown and risking a failure with no replacement.

Hot connections on the Motor Control Center.



The gearbox of the separator motor, showing extreme (white) hotspots.

Moving toward a formal motor-monitoring program

As part of the formal motor-monitoring, Gray will concentrate on shafts, couplings, gearboxes and other mechanical components. Once the inspection routes and schedules are finalized, he hopes to get the maximum life out of his expensive, high-horsepower motors.

He'll be combining data from visual inspections, infrared spot thermometer checks, vibration analysis, thermography and current-phase analysis into a new condition-based monitoring and asset management system. The system ties the collected data to the specific piece of equipment and flags anything that is not within predetermined parameters.

In the future, when Gray uses thermography on a motor, he'll be able to tie the images or a report to the overall system data for that piece of equipment, and to a work order for use by technicians making the repairs.

By putting all the analysis data together into one picture, he'll be able to deal most effectively with problem motors and prolong the lives of critical ones.

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