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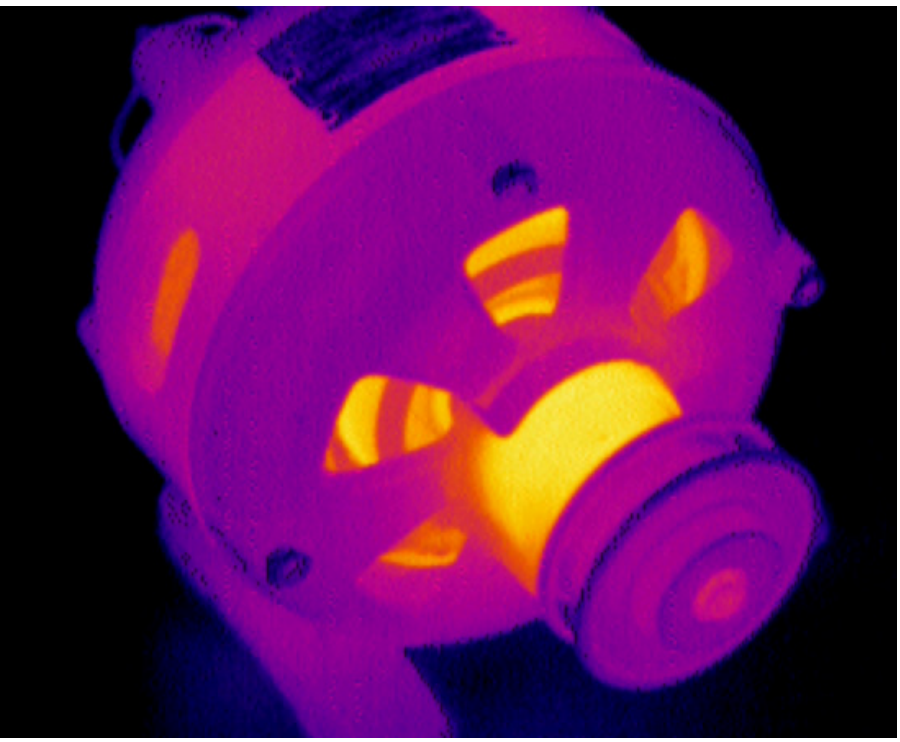
Using thermal imaging to troubleshoot motors and drives

By Sat Sandhu



Infrared cameras, also called thermal imagers, are useful for troubleshooting motor problems as well as for monitoring motor condition for preventative maintenance in power generation, manufacturing and commercial plants. Thermal images of motors reveal their operating condition as indicated by surface temperature. Such condition monitoring is important as a way to avert many unexpected motor malfunctions in systems that are critical to manufacturing. The onset of motor failures can often be detected by a variety of techniques, including vibration, ultrasound and thermal imaging.

Why thermal imaging?

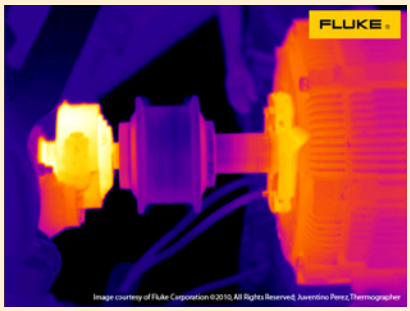
Thermal imaging is an effective way to assess equipment condition. Thermal imaging enables you to:

- Inspect while the equipment is running
- Verify repairs have been done properly
- Inspect faster and from a safer distance
- Improve repair efficiency and reduce costs

What to scan?

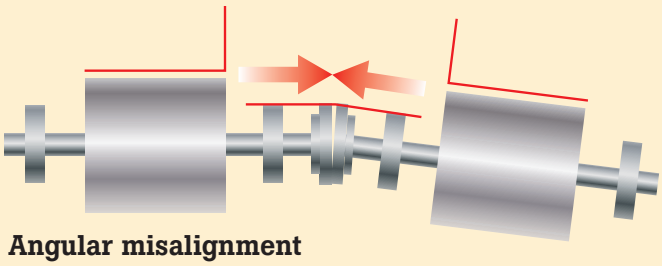
To get started in building heat profiles of your motors, it is a best practice to capture good quality infrared images when the motors are running under normal operating conditions. That gives you baseline measurements of the temperature of components. An infrared camera can capture temperatures of all the critical components: motor, shaft coupling, motor and shaft bearings, and the gearbox.

When you are working with low electrical loads, the indications of a problem may be subtle. Thus a minimum of 40 % of design load is recommended (National Fire Protection Association NFPA 70B), and the higher the load, the better. When inspecting in low load situations, be sure to note all possible problems, even if they reflect only a small temperature difference. As a load increases, the temperature will increase too and if a problem exists, expect greater temperature differences at higher loads.

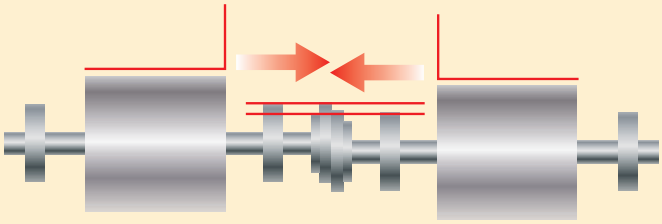


Coupling: This image shows an alignment issue on a motor coupling.

Combo: This heat pattern indicates an operational motor.



Angular misalignment
The centerline of the two shafts intersect are not parallel.



Parallel misalignment
The centerline of the two shafts are parallel but not concentric.

What to look for?

All motors should list the normal operating temperature on the nameplate. Abnormal temperatures, which will show up on a thermal imaging inspection, can be an indication of:

Inadequate cooling because of insufficient air flow. Clearing this issue may only require minor cleaning on the air intake grills.

Power quality issues such as unbalanced voltage or overload or harmonics. All of these will cause excessive heat dissipation.

Impending bearing failure. An overheating bearing is an indication of an impending bearing failure. Bearing condition degrade for a number of reasons:

- Heavier than anticipated loading
- Inadequate or incorrect lubrication
- Ineffective sealing
- Shaft misalignment
- Incorrect fit

Insulation failure. With failing insulation of the motor windings the overall motor temperature increases this overheating causes failures and reduces insulation time.

Shaft misalignment. Most misalignment cases are a combination of parallel and angular misalignment. (please see image above)

Creating regular inspection routes that include thermal images of all critical motor/drive combinations and tracking to those baseline images will help you determine whether a hotspot is unusual or not, and help you verify if the repairs were successful.

Sandhu is a Thermography Services Manager for Fluke, covering Europe, the Middle East and Africa (EMEA) and Asia Pacific. Sandhu has worked in electronics design and thermal imaging for over 36 years.

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