

Pumps, fans and compressors

Application Note

Applications for thermal imagers

Pumps, fans, compressors and other motor-driven rotating equipment are essential to manufacturing, commercial and institutional enterprise, from fluid handling systems in petrochemical plants to large air comfort systems in shopping malls.



Many facilities monitor this type of equipment on a regular basis, because often a simple problem like lubrication can be spotted and fixed inexpensively, before the entire unit burns out. Such strategies fall under the general heading of predictive maintenance (PdM).

Thermal imaging is especially useful for monitoring rotating equipment, since many impending failures are accompanied by overheating. This predictive technique uses a handheld thermal imager to capture two-dimensional images representing the apparent* surface temperatures of equipment. Thermography can also be used together with other predictive technologies such as oil analysis, vibration monitoring and ultrasound.

What to check?

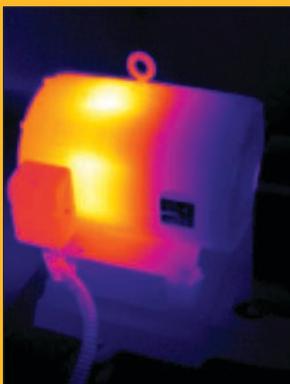
While it is in operation and under load, monitor rotating equipment that is critical to your operations, i.e., equipment whose failure would threaten people, property or production. Be sure to scan the equipment's drives—electric motors and gearboxes (if any)—also, on pumps and fans, get thermal profiles of the housings—scans that are likely to reveal any problems with bearings or seals—as well as scans of shaft couplings or drive belts and sheaves. For a compressor, use several images, if necessary, to get a thermal profile of the entire unit.

*Apparent temperature can differ significantly from actual temperature, due to the emissivity of a material's surface.

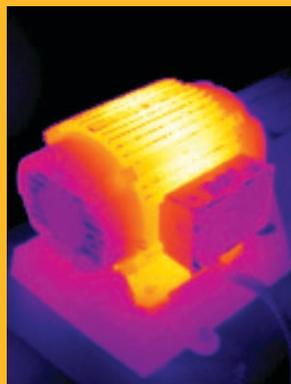
What to look for?

In general, look for hot spots and pay special attention to differences in temperature between similar units operating under similar conditions. For example, if a bearing in one fan in a bank of similar fans is running hotter than rest, the hotter one may be trending toward premature failure.

On a pump, a difference in temperature along a seal or gasket is the "signature" of a failure. A hot spot on the housing adjacent to a bearing may signal an impending bearing failure, although the



Ironbow Motor with hot bearings.



Ironbow motor-pump-valves.

root cause probably will not be ascertainable from a thermal image alone. Perhaps there's a lubrication problem or maybe misalignment in the drive. An overheating bearing on a fan also signals a problem but a thermal image of it alone is non-definitive. Again, the root cause could be lack of lubrication, the wrong lubrication, drive misalignment or unbalance in the fan itself. Further investigation is required.

Many industrial and most building-system fans are belt-driven, as are some pumps. According to one source¹, a belt-and-sheave drive that is designed and installed correctly generates very little heat, and the belt moving through the air tends to cool it to near ambient temperature. Overheating, detected by thermography, reflects a problem with the drive's design or installation, perhaps mismatched belt and sheaves or misalignment. Vibration analysis and/or an alignment check will confirm the latter condition.

Since a compressor is a "heat machine", a thermal imager can quite literally "see" a compressor work as compression produces heat while expansion cools². To check the efficiency of compressors, look for belt slippage on cooler fans, shaft misalignment, bearing problems, and blocked or leaking valves.

A good approach is to create inspection routes that include all critical assets using Fluke Connect™ EquipmentLog™ history. Using the EquipmentLog™ history feature you can create a folder for each critical equipment asset with a description of the asset and the location in the Fluke Cloud™ storage. Each time you inspect a piece of equipment you or any other team member who has been given access, saves a thermal image or measurement data to that equipment folder, allowing you and your team to track and monitor the equipment condition over time and getting instant access to historical data—all from one location. Now maintenance technicians can easily do a side-by-side comparison from previous inspections to help determine whether a hot spot or cool spot is unusual and if any planned maintenance is required. This keeps your equipment running longer, saving you time and money and reduces the risk of unplanned downtime.

Fluke thermal imagers include IR-Fusion^{®*}, technology that combines a visual, or visible light image with an infrared image for better identification, analysis and image management.

What represents a "red alert?"

Equipment conditions that pose a safety risk should take the highest repair priority. However, the imminent failure of any critical pump, fan or compressor represents a red alert. Consider using key safety, maintenance and operations personnel to quantify "warning" and "alarm" levels for these assets. Then, you can set alarm levels for specific equipment on your Fluke thermal imager⁴.

What's the potential cost of failure?

Because pumps, fans and compressors are key to productivity in so many industries, it is difficult to speak generally about the cost to a company from the failure of a critical unit. However, a failed pump at one automotive facility cost more than US \$15,000 to repair while lost labor costs totaled US \$600 per minute and lost production opportunities amounted to US \$30,000 per minute³. Try developing similar figures for a critical equipment failure in your operations. It may help you justify thermal imaging to your managers.

*Not available on all camera models. This feature is available for all models in the included SmartView[®] software.

An imaging tip:

Winds (or air currents inside) in excess of even a few miles per hour will reduce the surface temperatures you are seeing, causing real problems to seem less significant or even making them invisible. Inside plants air currents are often 10-15MPH! Buy a good quality wind meter and record the wind speed when you record the apparent temperature. When you must inspect in high convection situations, note all problems for a follow-up inspection. Even those with small temperature increases may become critically hot when the airflow is reduced.

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Fluke Corporation
PO Box 9090, Everett, WA 98206 U.S.A.

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:
In the U.S.A. (800) 443-5853 or
Fax (425) 446-5116
In Europe/M-East/Africa +31 (0) 40 2675 200 or
Fax +31 (0) 40 2675 222
In Canada (800)-36-FLUKE or
Fax (905) 890-6866
From other countries +1 (425) 446-5500 or
Fax +1 (425) 446-5116
Web access: <http://www.fluke.com>

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Follow-up actions

Whenever you use a thermal imager and find a problem, use the associated software to document your findings in a report that includes a digital photograph as well as a thermal image. That's the best way to communicate the problems you find and to suggest repairs. If a catastrophic failure appears imminent, the equipment must either be removed from service or repaired immediately.

¹From the web site of John Snell & Associates www.snellinfrared.com/tt/TT5_05_Web_Version.pdf

²Go to www.gmrc.org/gmrc/2004finalpapers/Optimized_Compressor_Efficiency_through_Thermography.pdf

³Source: the web site of the Academy of Infrared Thermography, specifically at www.infraredmechanical.com/mechanical_5.html

⁴Model depending