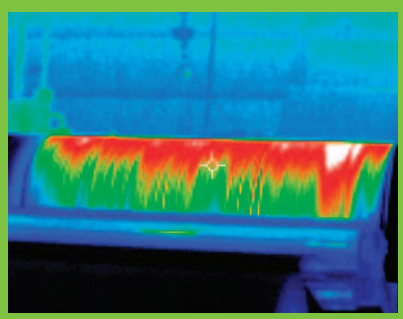
FLUKE®

Thermal process monitoring

Application Note

In process manufacturing, uniformity is essential. Technicians rely on monitoring of all kinds, from fixed mount sensors to handheld thermal imagers to track the condition of product and critical equipment. That's because temperature measurement and control is one of the single most significant variables for uniformity across process industries.



This thermal image highlights uneven cooling on a cooled paper roller.

Temperature monitoring can detect overheating delivery system components, help solve irregularities in electrical power supplies, predict operational machinery failure, detect blockages in supply pipes, and identify product inconsistencies.

Given the number of process industries and associated equipment variations, the possibilities for thermal monitoring are endless. One approach is to monitor critical assets the most often, followed by equipment in harsh environments. For example, the sludge, solvents and particulates found in many processes puts extra stress on motors, affecting bearings, windings and insulation. That stress shows up as heat detectable by a thermal imager.

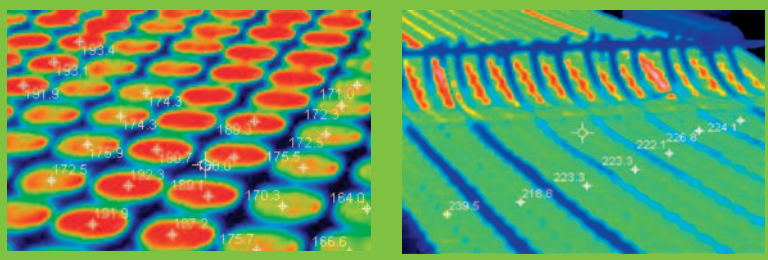
What to check?

Power distribution systems. Consistent, high quality power is essential for process manufacturing. Thermal imagery can identify bad electrical connections, imbalances, overloads, harmonics, and other impending electrical equipment failures and prevent both uneven or inadequate power supply as well as downtime.

Motors, fans, pumps, conveyors. Thermal inspections of the bearings, shafts, casings, belts, gearboxes and other components that emit heat before failure can prevent unexpected equipment breakdowns on moving equipment.

Heat processes. Paper, glass, steel and food product production all require the uniform application of heat. These processes often utilize thermocouples or infrared temperature sensors for thermal control. Frequently, spot measurements are not adequate due to process variations. Line scanners provide continuous thermal profiling in these cases, while portable thermal cameras can troubleshoot problems and determine the optimum spot to install the thermocouple or infrared sensor.

Pipes. In processes, fluids need to be delivered to the right place at the right time and in the right amounts. If a pipe is obstructed it can cause a chain reaction that throws an entire process loop out of tune, creating oscillation. This will cause motors to cycle on and off too frequently, which in turn causes more frequent current surges that stress the electrical system and



By canning product at different points in production as with these cookie and cracker production lines, thermal imaging can help spot check quality and troubleshoot irregularities.

add harmonics that lower system efficiency and ultimately lead to equipment failure. Thermography can often pinpoint an obstruction, allowing corrective action before the whole loop goes down, and the loop can be recalibrated by a multi-tasking tech using loop calibrators and digital multimeters.

Valves. Process control valves are also critical to delivering fluids to processes at the right time. A thermal imager can monitor for leakage, stiction (sticking) or excess friction. Also, a valve's excitation coil may overheat from working too hard, pointing to a problem such as current leakage or valve size mismatch. When thermography indicates a problem, technicians can follow up by calibrating the valve or the valve's positioner.

What to look for?

In specific processes, use your thermal imager to look at product uniformity. For example, if you have a paper process, you probably process the paper running it through an oven to cure it. The coatings applied often require a combination of time and temperature to achieve the right cure point and final moisture level. Use your handheld thermal imager to examine the thermal uniformity of the product as it comes out of the oven. Thermal variations are often attributable to other process variables such as non-uniformity in moisture or cure.

In general, use your handheld thermal imager to look for hotspots, cool spots and other anomalies. Here are some suggestions about critical equipment to monitor and what thermography might detect: motors (hot bearings and windings), motor control centers and switchgear (imbalance, overloads), steam systems (failed traps, obstructed piping), cooling systems (fouled cooling towers, blocked heat exchangers), furnaces and boilers (damaged refractory, leaking ports), pumps (hot bearings, leaking seals), process piping (ineffective insulation, reduced flow), tanks and vessels (product or sludge levels, leaks), valves (leakage, stiction) and conveyors (hot bearings and drives).

Each time you inspect a piece of equipment, save a thermal image of it on the computer and track its condition over time. That way, you'll have baseline data for comparisons that will help you to determine whether a hotspot (or cool spot) is unusual or increasing over time and also to verify when repairs are successful.

Follow-up actions

Whenever a thermal image detects a problem, use the associated software to document your findings in a report that includes a digital, photograph as well as a thermal image of the equipment. It's the best way to communicate the problems you found and to suggest repairs. In general, if a catastrophic failure appears imminent, the equipment must either be removed from service or, if possible, repaired while operating.

What represents a "red alert?"

Equipment conditions that pose a safety risk should take the highest repair priority. However, the imminent failure of any piece of critical equipment constitutes a red alert. The same key operations, maintenance and safety personnel who determine which production assets are critical should play important roles in quantifying "warning" and "alarm" levels for those assets. (Note: alarm levels for specific equipment can be set on Fluke handheld thermal imagers.)

What's the potential cost of failure?

Here are representative hourly downtime costs for some selected process industries: Energy, US $2.8 million; Pharmaceuticals, US $1 million; Food and Beverage, US $800,000; Chemicals, US $700,000; Metals, US $550,000. These figures are tied to loss of IT performance, but are cast in terms of general downtime.*

*Source: IT Performance Engineering and Measurement Strategies: Quantifying Performance and Loss, Meta Group, Oct. 2000; Fibre Channel Industry Association as found on the Web site of the Association of Contingency Planners, Washington State Chapter – www.acp-wa-state.org.

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