FLUKE®

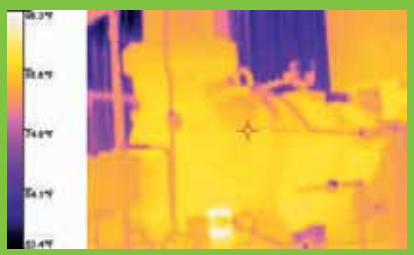
Petroleum and petrochemical processing

Application Note

Today's escalating gasoline and fuel oil prices underscore how important it is for petroleum and petrochemical companies to maintain their production capacities. They must optimize crude oil production and transportation, refining and processing, and the delivery of products to market. And while no amount of human precaution can avert natural disasters, there are day-to-day measures that under normal circumstances will help keep oil platforms, refineries, processing plants, pipelines and pumping stations operating at or near capacity.

Specifically, plant operations and maintenance personnel can maximize the reliability of production assets using predictive maintenance (PdM) techniques that monitor the condition of production assets while they operate. The goal is to detect impending failures of assets and correct those developing problems in order to avoid unplanned shutdowns.

On a commonality between many petrochemical production equipment failures, whether lubrication, valve failure, tank settling or electrical-related, is temperature. An abnormally hot or cold spot on process equipment often indicates an emerging problem. That makes handheld thermal imagers, which capture two-dimensional images of the apparent surface temperatures[1] of objects, a useful tool for regular predictive petrochemical maintenance.



This nitrogen pump had a persistently leaky seal and had to be changed out regularly. Thermal imaging revealed a restriction preventing the seal from receiving enough cool airflow. As a result, the seal was overheating and melting.

[1]Apparent temperature is often significantly different from actual temperature; the difference attributable generally to the emissivity of a material's surface. An understanding of emissivity and the thermal characteristics of materials is crucial in understanding the apparent temperatures displayed by infrared images.

FLUKE®

What to check?

In refineries and petrochemical plants that already use thermography, the lion's share of thermal imaging is devoted to electrical inspections. Such monitoring pinpoints potential problems with loose and corroded connections, electrical imbalance, failing transformers and switchgear and faults in motor control centers. However, there are many other kinds of equipment that you can profitably monitor using thermography. Refractory-lined equipment, heaters, boilers, furnaces, heat exchangers, steam lines and traps, process and safety valves, steam turbines, process lines and mechanical rotating equipment are only some of those items. In particular, thermography can also reveal the levels of product and/or contamination (sludge, water, etc.) in tanks and vessels.

To prioritize what you scan, begin with critical assets—those whose failure would threaten people, property or product. After determining which assets are critical, determine what conditions put added stress on them, and monitor those assets more frequently. For example, the presence of sludge and particulates found in many processes put extra stress on motors—affecting bearings, windings and insulation. That stress can show up as heat detectable by a thermal imager. Such motors should be scanned more frequently than others. Also consider taking thermography into the field to monitor similar equipment involved in extraction, pumping and transport sections.

What to look for?

In general, use your handheld thermal imager to look for hot spots, cool spots and other anomalies. Be especially aware of similar kinds of equipment operating under similar conditions but at different apparent temperatures. Such conditions usually signal problems.

A thermal imager is also a useful supplemental tool for use on equipment monitored by thermocouples. A thermal scan is more reliable for refractory monitoring and can be used to verify the functionality of thermocouples, which often fail before the equipment they monitor fails.

A good approach is to create inspection routes that include all critical assets. Each time you inspect a piece of equipment, save a thermal image of it and the associated data on the computer and track its condition over time. That way, you'll have a baseline for comparisons that will help you determine whether a hot spot (or cool spot) is unusual. You'll also be able to verify when repairs are successful.

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:** temperature alarm levels for specific equipment can be set on some Fluke handheld thermal imagers.)

What's the potential cost of failure?

It's difficult to determine exact downtime costs in the petroleum refining and petrochemical sectors. In 2000, one source placed the cost of downtime for a chemical facility in excess of US $700,000 an hour.* Of course, that figure does not take into account the recent sharp increases in the price of crude oil, the resulting cost of producing petroleum-based products and the increased gross revenues from the sale of those products.

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 of the equipment. That's the best way to communicate the problems you find and to suggest repairs. In general, if a catastrophic failure appears imminent, the equipment must either be removed from service or repaired immediately.

*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. This figure is tied to loss of IT performance but is presented as the general cost of downtime for the chemical industry.

Fluke. *Keeping your world up and running.*

An imaging tip:

After you have some thermographic experience, visit a sister plant or other facility in your area to see what they are doing with thermography. Take along some of your results to exchange. All parties will come away with their "batteries charged" and ready to do better work.