Picture perfect

With so much publicity surrounding infrared cameras as very effective plant condition monitoring tools, Steed Webzell looks at the substance behind the hype

Below: Fluke's Ti32 thermal imager

Plant technicians tend to eulogise over the virtues of infrared cameras. Gone are the days, they say, of listening to screwdrivers resting on bearing housings, wondering whether the pitch sounds different to yesterday. No, modern thermographic instruments will capture images at the squeeze of a trigger, instantly revealing potentially troublesome hotspots on a digital colour display.

No wonder thermal imaging is revolutionising predictive maintenance and diagnostics in mechanical, process and electrical operations throughout industry. Quite simply, the surface temperature at specific points of critical plant assets is a consistent indication of its operating condition.

And it's so easy. In addition to highlighting temperature variations and hotspots in real time on LCD displays, many thermal imagers now even show a visible light picture superimposed on the infrared image to assist with identification, analysis and image management. Look at Fluke's IR-Fusion, for example.

So much for the sales messages: the reality is somewhat different. Precisely because thermal imagers only measure surface temperatures, the interpreter of the images must be conversant with what is happening beneath, if he or she is to make anything like accurate judgments. Thermal imaging may have been developed to be exceptionally easy to use, but this doesn't mean that, when armed with an IR camera, the user instantly becomes an expert in electro-mechanical fault detection.

For instance, when it comes to detecting electrical faults, there is no substitute for the 17th edition Wiring Regulations electrician qualification. Without knowledge, the user won't know if the thermal values on the image indicate normal operating temperatures or potential faults. Is the image simply showing a high operating temperature where that is, in fact, an expected norm?

Art or science

Then there are the nuances of thermography itself. Emissivity (the ratio of a surface's emissive power at a given temperature to that of a black body at the same temperature and same surroundings) is one of the key parameters. Values range from 1.0 for lamp-black, down to 0.02 for polished silver. In most cases, the infrared camera readings need to be adjusted to take emissivity into account before meaningful temperature data can be calculated.

"Basic thermal imaging training is an absolute must for anyone planning to use the technology," states Dave Blain, managing director of Thermascan, which undertakes thermographic surveys, hires out and sells Flir thermal imaging cameras and trains would-be thermographers. "When we sell a camera, we always provide a day's foundation course and, almost without exception, the customer admits they

Cementing plant improvements

Hanson Cement's Ketton Works in Rutland is reporting benefits from a Centurion TK50 thermal imaging scanner, from Thermoteknix. Discussions between Hanson's electrical engineer Jim Harvey and Thermoteknix's UK sales manager Peter Harvey led to its installation, following successful field trials at the firm's Ketton Plant.

The scanner was installed adjacent to the burning zone of Kiln 8 to minimise shadows from the support structure. Harvey says it allowed plant engineers to gain a more sophisticated and detailed temperature profile of the entire kiln. Indeed, shortly after the trial started, it alerted plant engineers to a very small, but intense, hot spot in the kiln, due to a single refractory brick failure.

Using the TK50 and its WinCem temperature alarms, the site was able to monitor and manage the hotspot by moving fans to the failed bricking so that no further damage occurred. Doing so allowed the kiln to continue production for another three months, until a planned shutdown enabled the damaged refractory to be replaced. Harvey says that this one incident meant the thermal imager paid for itself within the first 90 days.

were previously unaware of what's involved. I would also say that, in more than 70% of cases, the customer then opts to follow this basic grounding with training for a Level One qualification, accredited by the British Institute of Non-Destructive Testing."

That said, once the theory and practice is properly understood, there is little reason why infrared cameras cannot be used for plant condition monitoring as part of an holistic preventive maintenance strategy. As Phil Burge, communication manager at SKF, says: "In recent years, we have witnessed a number of advances in thermographic condition monitoring technology, providing a powerful driving force behind important developments in maintenance."

So much so that, for him, thermal imaging devices have become "one of the most useful tools an engineer can have when performing predictive maintenance". Correctly used, he insists, they can deliver considerable benefits by cutting downtime, extending equipment service life and, ultimately, even protecting profit margins.

That sounds fairly wide ranging – and it is. For example, the latest thermal cameras enable robust and sophisticated methods for detecting heat and energy losses, helping engineers to identify the early onset of wear in moving parts – and so allowing remedial work well ahead of significant problems.

SKF's TKTI 10 thermal camera, for instance, offers both thermal and 2 Megapixel visual imaging, and can identify hotspots ranging from -10 to 350°C. Two spot temperatures can be displayed on the screen and these can be moved independently to select an area of interest. For experienced thermographers, the camera also offers advanced features, including auto temperature ranging, selectable emissivity, reflected temperature compensation, hot and cold spot finding, temperature area measurement, and automatic and user-selectable level and span.

"This new generation of thermal imaging condition monitoring technologies is helping plant engineers take a fresh look at maintenance as part of an holistic strategy," comments Burge. Everything from system reliability to risk assessment can come into the picture – a far cry from the old days of reactive servicing programmes.

And condition monitoring can even be close to real time. The new Flir T620 and T640 models, for example, are equipped with a Wi-Fi interface, enabling images to be sent to a PC, iPad or iPhone. In this way, the thermographer can seek a swift, second opinion on a decision such as whether to shut down.

What's more, it's not just about hand-held devices. "Patrol monitoring a process plant, using relatively expensive handheld thermal imaging cameras, is not a viable option for many plant," states Chris Jones, managing director of Micro-Epsilon UK. "However, a device such as our new ThermoImager TIM160 can be installed in a fixed location, next to a critical component or part of a production line, to constantly monitor a target."

Powered and operated via a USB 2.0 interface, this device is an inline radiometric thermal imaging camera, with software that enables the user to configure all device parameters and capture images in real time (at 100Hz full frame rate), while also storing stills and video for analysis.

Clearly, the arguments for infrared cameras are compelling, providing that additional education is included. You can expect: an increase in workplace safety, due to timely detection of possible hazards; and condition monitoring, without hindering normal machine or plant operations. You can also look forward to reduced plant downtime, and a realistic prospect of worthwhile trend analysis for plant and machine evaluation. PE

Centre left: Flir Photon 160 in action
Below: Flir T640 infrared camera

Free thermography

Fluke is offering a free, 72-page book entitled 'Introduction to Thermography Principles', designed to familiarise users with thermal imager procedures by providing an overview for safe, efficient and practical operation. Potential users of thermal imagers can request a free demonstration via www.fluke.co.uk/ti and then request a free copy of the book (normally priced at £22).

The book includes chapters on troubleshooting, training and safety, applied theory, thermography applications and inspection methodologies, as well as analysis, reporting and documentation.