Camera call

Infrared cameras are getting a lot of air time, as being among the most valuable tools for technicians concerned with plant and process condition monitoring. Brian Tinham reviews developments and issues

Thermal imaging cameras have come a very long way since their introduction to the professional thermography market around 20 years ago. Prices have collapsed, just as sophistication and functionality have mushroomed, in line with developments throughout electronics. Ease of use, too, and simplicity of everything from maintenance scheduling to focusing, taking pictures and reporting, have also improved almost beyond recognition. And, as a result, the latest generations of devices are seeing rapidly increasing adoption by plant engineers and technicians for a growing range of equipment condition monitoring – both mechanical and electrical, static and rotating.

So it's no surprise that developers of thermal cameras, despite devices flying off the shelves, are now looking to the mass market for further growth by emphasising the value of 'seeing' temperature, and the simplicity of doing so. But while no one doubts the power of remote thermal monitoring in anything from facilities management to utilities and process control, the issue is: how easy are they to use? Just as important, how realistic and reliable are readings dressed up in apparently professional reports?

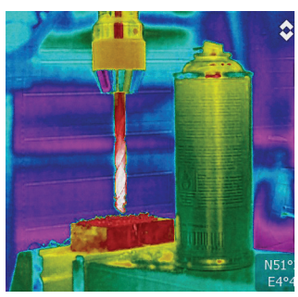
Thermographic pitfalls

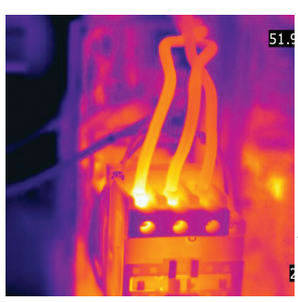
Plant Engineer has reported before on the thermographic pitfalls that lie in wait for the unwary (May/June 2011, page 10) and, according to Duncan Webb, condition monitoring manager for MRO (maintenance, repair and overhaul) specialist Eriks, they remain just as perilous today. And he should know: Webb has been involved with predictive maintenance – typically using vibration and thermal imaging techniques – since the early 1990s, when he got his hands on one of the original Agema 440s (now long since obsolete).

First, however, he waxes lyrical about their power. "We used to carry them for remote checking of distribution boards at substations, to check for overheating buses and contacts," he recalls. "Then, because the output was so visual, we extended their application to looking at motors, gearboxes, pumps and the like, for detecting early signs of mechanical wear, fatigue and stress. They have become exceptional predictive maintenance tools."

Webb's contention: thermal cameras really do make it easy to check all sorts of equipment that wouldn't normally get regular oversight. "They're ideal instruments for helping to prevent machines of all sorts going into catastrophic failure – or, in the worst case, even fire," says Webb. And he adds that Eriks, among others, also now uses thermal cameras for auditing steam networks, at one end of the temperature spectrum, and chilled water systems at the other – looking for signs of poor insulation and mechanical problems, which invariably mean wasted money.

All well and good, but Webb confirms that accurate, repeatable and reliable results can only be guaranteed from the right hands. "One of the mistakes I've seen so many technicians make is to be fooled by the auto-scaling most cameras do for everything in the viewfinder. The point is that images can then look quite alarming. In a control





Above and centre: thermal imaging in action

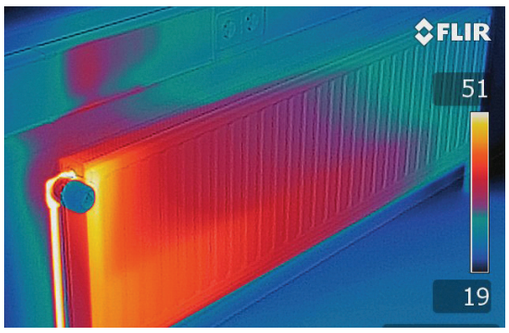
The power and the glory

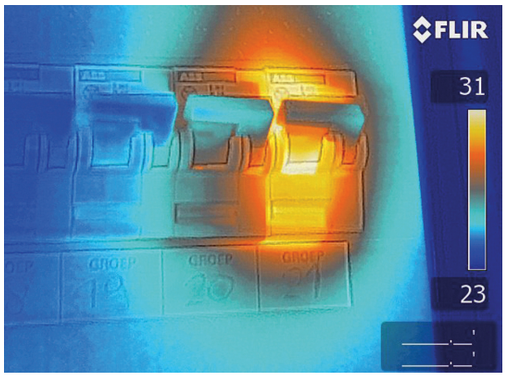
Thermal cameras are changing the methods, costs, speed and even the value proposition of maintenance engineering. By way of illustration, Eriks condition monitoring manager Duncan Webb recalls a recent project with "a leading UK motor manufacturer" that wanted a review of its plant condition monitoring route.

"We took the thermal camera out and immediately noticed one electric motor that was still running, but with an external temperature exceeding 100ºC. Looking more closely, we found that it had been knocked, probably by a forklift truck, such that the fan, which must have been rubbing against its cowl, had burnt out. So, with no cooling, it was just sitting there cooking."

Clearly, a health and safety issue had gone undetected. Moreover, so had a production and indeed a fire risk been overlooked – with an entirely avoidable catastrophic failure only a matter of time away. As Jeremy Salisbury, head of marketing at maintenance specialist Brammer UK, puts it: "Running hot is usually a tell-tale sign that a component is about to fail. Thermal imaging technology is really easy to use. You can see the results in real time, with the parts in situ. There's no need to stop the manufacturing process.

"We'd recommend that all customers include thermal imaging in their routine maintenance. You soon build up a picture of what things look like in normal operating conditions and spot when a component is generating excessive heat."





panel, for example, the terminals may be at 35°C and balanced, but the camera may make them look like they're on fire. I've lost count of the number of times I've seen reports where the technician thought something serious was going on, when everything was fine."

Skill and experience

In short, operating thermal cameras does require skill and, as ever, there is no substitute for training and experience. And to emphasise that truism, Webb also refers to the Achilles' heel of thermography, 'emissivity' – the relative ability of a surface to radiate energy, which differs from material to material. "I've seen situations in which images have been taken of plant where the surface concerned had a low emissivity, yet decisions were taken that took no account of that fact."

The solution: applying PVC tape (which has an emissivity of 0.95), where possible. It may sound simple, but experience shows it works. Appropriate equipment for this treatment ranges from copper conductors to control cabinets. Incidentally, where perspex shields have been installed on cabinets, the camera can't see through them, so you'll need to open the door or use thermal imaging windows, such as those available from Flir Systems.

But it's not just about emissivity: there can be similar issues with reflections. "I'm thinking, for example, of a stainless steel silo that one technician thought was haemorrhaging heat, because of the camera picture," recalls Webb. "The plant owner invested in insulation – and it made no difference at all. The camera had done what it was supposed to do, but the person holding it was mistaken. He had failed to take account of infrared contamination from foreign temperature sources."

Bear in mind that cameras can read -40C for a surface that's actually at ambient temperature, for no other reason than it's getting a reflection of clear sky.

That said, Webb reiterates that thermal cameras are superb tools. "Thermography allows engineers to cover more ground, more quickly, and, in some cases, more accurately than with, say, vibration or ultrasonic inspection equipment. Also, some faults that are plainly visible with thermal cameras just wouldn't be seen by the other tools. Vibration, for example, won't necessarily tell you that the windings on a motor are fatigued or that the drive end seal on a shaft is worn.

"But thermal imaging will not only tell you all that. It will also help you see impending bearing condition problems – and that there's a blockage in the motor fan cowl, preventing cooling."

All good points – and the speed is important, too. Given that thermal cameras can operate close up and personal, or three-plus metres away from a target, it's easy to sweep, say, a long production line packed with gearbox motors in just a few minutes, looking for raised temperatures. With modern report filtering, potential problems can then be instantly prioritised for closer inspection.

The bottom line: a picture really can paint 1,000 words, but if you want to get the right message, beware the pitfalls for the unsuspecting. PE

Eriks' Duncan Webb takes aim

Technology update

Flir's latest T400 thermal cameras now include patent-pending MSX (multi-spectral dynamic imaging) technology on its range-topping T440. Described as real-time thermal video, enhanced with visible spectrum definition, it's claimed to take the guesswork out of image analysis.

The new range, which includes the entry-level T420, also provides up to 8x digital zoom, auto focus, resizable and moveable 'picture-in-picture' Thermal Fusion and digital camera video recording. Additionally, users get instant reporting, with voice, text and sketch annotations applied via the 3.5in touch screen. And there are exchangeable lenses for a range of applications – with the 25° standard, plus 6°, 15°, 45° and 90° optics.

Beyond all that, these devices also come with Wi-Fi for wireless transfer of images, or remote control of the camera via smart phone or tablet PC. The Bluetooth-based Meterlink function also allows readings to be transmitted from electrical test meters to the thermal image, while the company's Flir Tools software enables images to be exported to a PC for reporting and analysis.