Practical guide
Thermography in preventive maintenance.

Optimise processes, reduce costs and ensure system availability.

Introduction.

This Practical guide is intended for plant managers and maintenance engineers in manufacturing companies, who are looking to optimise their maintenance processes and system availability.

Condensed onto 16 pages, it outlines how thermal imagers and the latest thermography technologies help to guarantee increased system availability and, at the same time, reduce costs.

Contents.

Good reasons to use thermography.

For years now, the use of thermography has been on the increase in the field of preventive maintenance. Nowadays it is common knowledge that thermal images provide valuable assistance in the visual inspection of electrically and mechanically stressed components. This non-contact measurement methodology helps identify anomalies – so-called hotspots (see Fig. 1) – quickly and reliably. These are generally regarded as a reliable indication of defective or worn-out components in systems and machinery.

The use of thermography is also recommended in a wide range of standards and guidelines.

Some insurance companies even require their customers to carry out regular thermographic inspections on insured facilities and installations.

Therefore in the event of personal injury or damage to property, companies run considerable financial and legal risks if thermography has not been used.

Nonetheless, many of those responsible for maintenance still hesitate when it comes to using thermal imagers. However, in addition to the actual investments in the necessary hardware and employee training, this is mainly because they are simply unaware that thermography can enable those employees entrusted with maintenance to be deployed much more efficiently than they previously were.

Once they are made aware of this, however, they no longer query whether thermography should be used, but rather how this technology can be implemented as efficiently as possible and integrated into the existing processes.

For those who get things done and those who make decisions.

Maintenance in industrial companies is largely characterised by the different areas of responsibility of plant managers and maintenance engineers.

The head of department (the one who makes decisions) is constantly striving to strike the right balance between system availability and cost pressure. He must ensure that the systems maintained by him do not break down, while also making sure to keep costs down.
At the same time, the head of department is also responsible for introducing safer and more efficient processes and cost optimisation measures.

The maintenance technician (the one who gets things done), on the other hand, is responsible for spotting potential breakdown risks in good time and, where necessary, using the insights gained to determine the correct measures to take. Typical tours of maintenance also need to be documented and relayed.

Thermography makes it possible to achieve system availability at minimal cost. This technology also assists both those who get things done and those who make decisions in their day-to-day work. Thus, companies who opt to use thermal imagers as part of their maintenance program benefit in many ways.

Key benefits of using thermography

- Test procedures and routine inspections can be carried out faster.
- The imaging process of thermal imagers enables errors and anomalies to be detected sooner and more clearly than they would be via spot measurements using infrared thermometers.
- The thermal imager analysis software also makes it easy to create reports. This reduces the time and effort required to create documentation.
- Thermal imagers are easy to operate and are useful when you have specialist staff with no experience of thermography.

Typical challenges
when it comes to maintenance.

In a medium-sized manufacturing company, the number of measuring points with electrically or mechanically stressed components is normally well within the triple figures. Depending on the size of the particular measurement object, up to three infrared images are required to evaluate them. This means that several hundred infrared images are generated during one single tour of inspection.

This inevitably creates the following challenges:

- How to assign the infrared images to the relevant measurement objects?
- How time-consuming were the individual measurements? Do notes need to be created and evaluated where necessary?
- How expensive and time-consuming are the evaluation and reporting processes?
- Is it possible to identify the temperature development of a component over the course of time, and derive any necessary measures based on this?

Since infrared images of electrical components are very similar, efficient manual assignment is virtually impossible. Who could possibly know after just one tour of inspection that infrared image no. 130 belongs to switching cabinet no. 48-3b, for example?

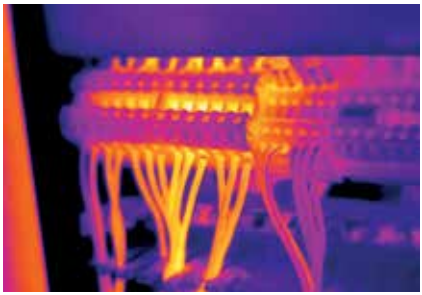

Fig. 1: Overheated connections in a switching cabinet.

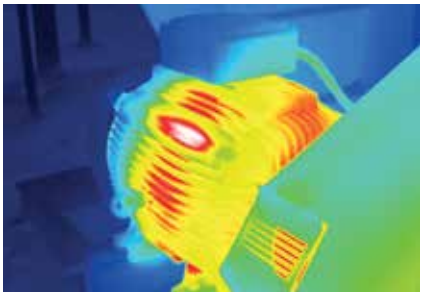

Fig. 2: Temperature distribution on an engine.

Admittedly, there is a possibility of taking written notes on site or recording voice commentaries using the thermal imager. However, considerable effort is required for this. Moreover, this method is extremely prone to error with regard to the later assignment of real image to thermal image.

However, it's the subsequent evaluation of the infrared images that involves the most effort. To this end, firstly all the thermal images recorded need to be sorted and then assigned to the correct system. It is then essential to summarise all this information in a comprehensible report.

With countless hours already having been wasted up to this point, the real problem becomes apparent: let's assume that a tour of inspection is carried out every six months and those in charge wish to evaluate the temperature development of the examined components or systems in order to be able to ascertain whether this is still within an acceptable range or whether any measures need to be taken. For all previous methods of managing and documenting thermal images, this would mean searching for and opening all the old images for each measuring location in order to be able to compare them with the matching new images. No easy task when we're talking about several hundred thermal images. Also, considering the ever-present cost and time pressures, you can no doubt think of other, more useful activities that you could be doing instead.

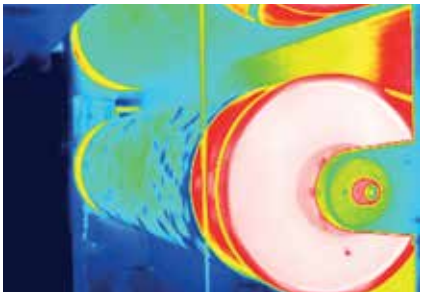

Fig. 3: Infrared image of a system in plastics production.

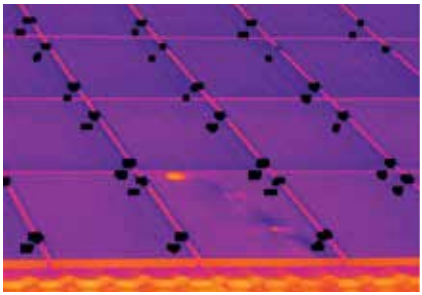

Fig. 4: Defective cells of a solar module.

Automatic site recognition with testo SiteRecognition.

The large number of infrared images and the search for and manual assignment of thermal images to the appropriate measurement object make error analysis and reporting extremely time-consuming and also prone to error. However, one of the greatest benefits of using thermography in maintenance applications lies in the analysis itself.

There is a solution to this problem, in the form of the new testo SiteRecognition technology. You can use this to create a measurement site archive in the testo IRSoft analysis software, and this serves as a database for your thermal images. For every measuring location stored in the archive, you can create markers (small symbols similar to QR codes) and attach them on site.

During the subsequent inspection you simply record this marker using the camera's testo SiteRecognition assistant, and the measuring location, along with its corresponding information, is then automatically stored with the thermal imager itself. When you transfer these thermal images to the testo IRSoft software after the measurement, they are then filed in the measurement site archive, completely automatically. This takes away the need for any time-consuming administration or manual archiving. You can then conveniently open the images from the archive, and analyse or process them in reports. Testo SiteRecognition also makes it possible to locate images quickly and easily on the basis of the description of a meas-

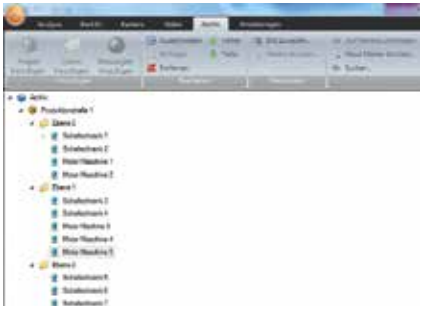

Fig. 5: Example of a measurement location structure (database), created one time only, in the testo IRSoft software.

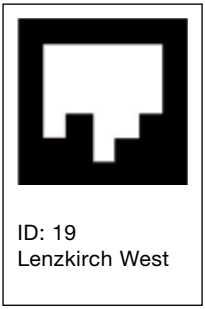

Fig. 6: ID code of an affixed marker.

urement object, a date or a particular temperature. This makes it possible, for example, to simply and directly call up comparative images from previous periods. In practice, with testo SiteRecognition the work process consists specifically of the following three steps, with the first step needing to be carried out one time only.

testo SiteRecognition in three steps

1 Firstly the measurement objects need to be set up, one time only (e.g. switching cabinet no. 1) and assigned to the measuring locations (e.g. level 0, production hall 1). The database created during this process (see Fig. 5) is transferred once only via USB interface to the thermal imager, and stored there for further tours of inspection. During this step, a marker is also created for each measurement object (see Fig. 6), printed onto standard self-adhesive labels and stuck onto the measurement object (e.g. on the switching cabinet door or on the engine housing).

2 Subsequently, during the tour of inspection the marker is scanned using the digital camera. The measuring location is therefore activated and all infrared images stored thereafter are automatically assigned to this measuring location (see Fig. 7).

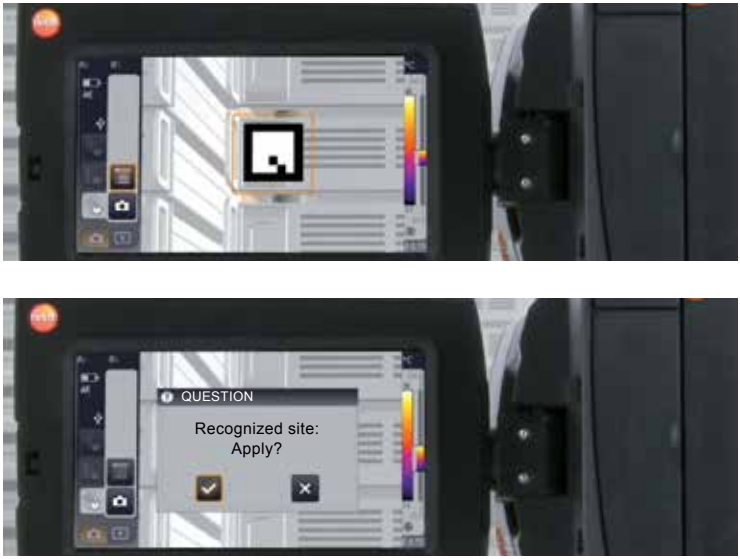

Fig. 7: Top: Scanning the marker. Bottom: The measuring location is automatically detected.

3 On completion of the tour of inspection, the thermal imager is connected via USB (or via SD card) to a PC on which the testo IRSoft software is installed. With the aid of the software's import assistant, the infrared images are automatically assigned to the measuring locations and stored. If you have more than one hundred images, you will save several hours simply as a result of this automated process.

After the automatic importing process, the respective infrared image can be opened and analysed, or compared with a reference image in order to detect increases in temperature for instance (see Fig. 8).
Notably, the quick comparison with reference images, ideally created during the commissioning or review of a machine, is optimised thanks to automatic management of the infrared images. Increases in temperature are detected promptly, enabling suitable measures to be initiated quickly.

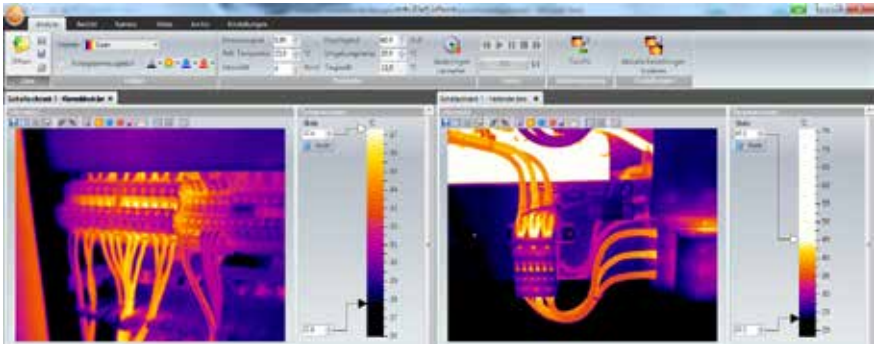

Fig. 8: Parallel assessment of relevant components in switching cabinet 1.

Conclusion: Thermography saves both time and money.

The use of thermal imagers in preventive maintenance is not just about detecting thermal anomalies (hot spots). Rather, the main concern should be to design an efficient, fault-free and resource-friendly process.

The automatic site recognition and thermal image management of the testo SiteRecognition technology helps both the plant manager in charge and the assigned engineer to establish these processes and to utilise thermography even more efficiently as part of the day-to-day working procedures.

Moreover, testo SiteRecognition makes it significantly easier to integrate thermography into existing or new standard procedures. Valuable working time can therefore be spent on other maintenance tasks, rather than sorting thermal images.

A thermal imager will also very quickly pay for itself – loss of production caused by an undetected overheated connection is considerably costlier.

Thermography also minimises the risk of fire, which can often result in significant financial repercussions or even personal injury, especially in manufacturing companies.

Therefore a thermal imager featuring testo SiteRecognition technology provides increased efficiency and safety when tackling preventive maintenance in industrial environments.

The ideal thermal imager for preventive maintenance.

The testo SiteRecognition technology is available for the testo 885 thermal imager, your ideal maintenance partner. This will enable you to identify and analyse thermal anomalies in a way that is non-contact and cost-saving, both in electrical and in mechanical maintenance. Ideal for monitoring low, medium and high-voltage systems, mechanical components or the fill level of sealed fluid tanks.

Place your trust in the test winner.
Trade journals Photon and Photon International tested 14 thermal imagers and discovered that when it comes to professional thermography, the testo 885 is the instrument of choice.

640 x 480 pixel detector
Displays objects in excellent image quality.

testo SuperResolution
Improves the resolution of the thermal images by a factor of 1.6.

30° wide-angle lens
For large image sections; included in delivery. The optional **11° telephoto lens** enables small details to be measured accurately, even from a great distance away.

Thermal sensitivity < 30 mK
Makes even the smallest temperature differences visible.

High temperature option
For extending the measuring range to 1200 °C.

testo SiteRecognition
For the automatic detection and management of measuring locations.

Process analysis package
Thanks to image sequence capturing in the instrument and fully radiometric video measurement, thermal processes can be streamed to a PC, where they can be analysed.

Display of surface moisture distribution
For each measuring point, the value of the relative surface moisture is displayed according to the traffic light principle.

Panorama image assistant
In the case of large measurement objects, a composite image is automatically stitched together from multiple individual images.

Laser marker
A laser dot is indicated on the measurement object for orientation purposes and displayed parallax-free in the infrared image.

Auto-focus
Automatic thermal image focusing.

Minimum focus distance of 10 cm
This means that even very small measurement objects can be inspected at close range.

Further information.

Video about testo SiteRecognition
Watch a short video showing exactly how the testo SiteRecognition technol-ogy works at www.youtube.com/testouk

testo SuperResolution
The patent-pending technology testo SuperResolution uses the natural movement of the hand, and records multiple, slightly offset images in quick succession. Using an algorithm, these are then compiled into an image. This contains four times as many readings and a geometric resolution that is improved by a factor of 1.6, making the quality of the infrared images a cut above the rest. The end result is a sharper, more detailed image – thus, thermal images can be taken of even the smallest structures. The famous Frauenhofer Institute has confirmed this in an extensive study.

Image sequence capturing
The image sequence capturing func-tion enables you to record infrared image sequences in the thermal imager itself. This means that thermal images of a measurement object can be recorded over a longer period of time (e.g. thermally-relevant machine start-up cycles).

Notes.

We measure it.

Subject to change, including technical changes, without notice.

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