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TESTO INDUSTRY REPORT

How Thermal Imaging Can Help Domestic Heating Engineers Reduce Costs and Sell More

www.testo.co.uk/thermal
01420 544433

Introduction

Thermal imaging has for several years been regarded as an invaluable tool in the detection of faults and anomalies in the industrial marketplace. Technological developments and the increased affordability of thermal imaging cameras now make this exciting technology a reality for Domestic Heating Engineers.

Testo Thermal Imaging Cameras can be used as a highly valuable diagnostic tool for Engineers working in the domestic heating market. This report looks at some of the key applications and demonstrates how they can be used on a daily basis to help save time and therefore reduce costs and generate/sell additional lucrative services to help expand your business.

Contents:

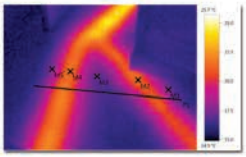
Tracing Heating System Pipework and Leaks

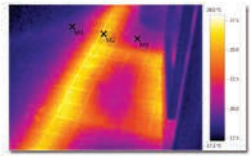
Heating Engineers are often asked to identify and fix leaking hot water pipes. When these potential leaks are below tiled or concrete flooring it results in the extremely time consuming and laborious task of trying to identify the location of the leak, including digging out large sections of the floor to uncover the problem. Using a thermal imaging camera makes the identification of problem areas almost instant, without the additional issue of extensive, unnecessary damage to the customer's property.

Example 1

The first part of trying to thermally locate a leak in the heating system pipework is to trace the pipework in order to ascertain where the pipes run. This is the first requirement because it will also help reduce the time to locate the leak as it dramatically reduces the area for inspection, enabling concentration on just the relevant areas. Testo Thermal Imaging Cameras can easily be used to trace the runs of pipework.

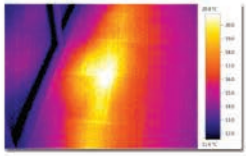
The images below show how the thermal imaging camera is used to trace the pipework by clearly highlighting the thermal trace.

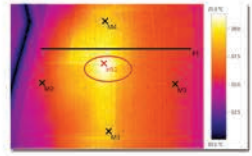





Example 2

Once the pipework runs have been established with the thermal imaging camera, then efforts can be focused on locating the leak. The images below show the thermal survey of a glazed walkway between a lounge and kitchen extension. The homeowner is complaining of a possible water leak under the tiled floor. The thermal image shows the heat pattern effect from the heating pipes under the floor, travelling the length of the walkway where a hot spot can be clearly seen. This is an indication of an anomaly, i.e. a possible leak from the central heating system and leaks are usually identifiable by an irregular shaped hot spot. These thermal images identified the possible location of the leak on the heating system pipework and further investigation revealed a leak was in existence at this point.





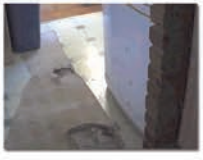
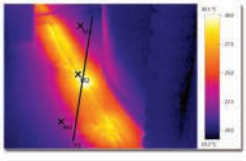
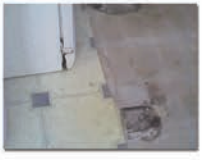
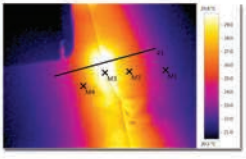
Example 3

The images below are taken from a thermal survey conducted in conjunction with an ongoing investigation, regarding a suspected water leak at the property.



They show a kitchen floor that has been dug up in an attempt to trace the heating system pipework and locate a leak. In this instance it was totally unsuccessful. It took over 3 days of digging and chasing out the pipework to conclude that it was not going to be found in this way. The costs mounted up; labour costs for over three days, plus labour and materials for the time it would take to repair the floor once the leak had been found and fixed. The question is, what other methods can be used that are not so time consuming and don't cause damage?

The thermal imaging camera is a completely non-destructive tool making it the ideal investigative tool to locate damage, blockages or leaks. In this instance, Testo were asked to demonstrate the ability of a thermal imaging camera to try to trace leaks where more conventional methods had so far dramatically failed. With the Testo 875-2 Thermal Imaging Camera it was possible to trace the heating system pipework beyond the areas where the pipework had been exposed. Frustratingly for the engineers involved a hot spot was quickly detected with the camera and after waiting for a short period of time the hot spot began to expand, which was a good indication of a possible leak.

Having located the leak, the Engineer was able to expose this small section of the pipework and, with reference to the adjacent image, the leaking section of pipework was found.

The leak had quickly and non-intrusively been successfully detected and in comparison to other methods that had been conducted, with minimal disruption and considerably less

cost. This should be a lesson learnt that investing in technology such as a thermal imaging camera will in the long run make a job easier, saving time, money and preserving your professionalism. Keeping up to date with new technology will give you an edge over someone using tired, old methods.

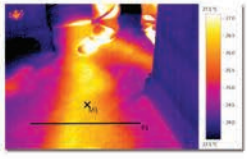
The camera used was a Testo 875-2, with 160 x 120 pixel configuration and <80mK temperature resolution. Affordably priced the range of Testo Thermal Imaging Cameras are highly suited to the HVAC sector.

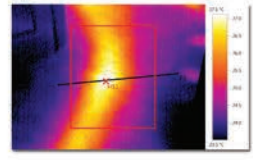
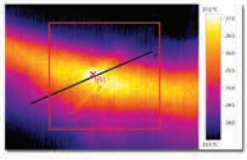
Example 4

The Testo 875 series Thermal Imaging Camera has established itself as a *Must Have Diagnostic Tool* within the HVAC industry by being able to *Thermally Visualise* the trace of the heating system pipework to check for leaks.

A recent application involves a family firm of Heating Engineers, who have been providing quality maintenance and servicing of domestic gas boilers in their area for over 40 years.

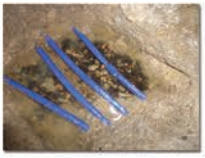
One of their customers was constantly having to top up the water level on their heating system, which was an indication there was probably a leak somewhere in the system. The heating was switched on and after a short period of time the Testo 875 Thermal Imaging Camera was used to trace the heating system pipework and check the various pipework runs for any leaks. Very quickly a Hot Spot was identified in the doorway between the hall and the lounge, which was a good indication of a leak.



The hot spot was identified with masking tape for future reference when the carpets would be lifted and an inspection hole dug to check this section of the floor. The marked location

for the leak proved to be correct and the hot spot had identified the leak on a Microbore Heating System where the pipes were running approximately 70-90mm under concrete screed and beneath a substantial carpet/rubberised underlay.


Using the Testo 875 Thermal Imaging Camera provided this heating company with the technical capability to quickly and easily trace the heating system pipework and identify the leak. This provided considerable savings in respect of time and cost to locate the leak and was beneficial to the customer by providing major savings in terms of cost and disruption.

This also demonstrates the capability of the Testo 160 x 120 pixel configuration in respect of the image quality/resolution produced with this level of thermal imaging camera which also translates to superior standard reports being produced with the Testo IR software.

In terms of technical overview, the light and smart camera features a 3.5 inch display with the capability to have interchangeable wide angle and telephoto lens and the means to save up to approximately 2000 images on an SD card. One of the main features of the camera is the 160 x 120 pixel configuration detector and the thermal sensitivity of <0.08°C. These are essential criteria, which specifically relate to this type of application where a thermal imager with a good thermal sensitivity is required to highlight the small temperature differences encountered and to provide high quality thermal images.

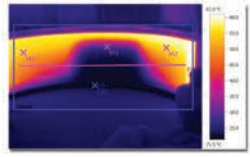
Notable aspects of the set-up in the camera for this particular project were the capability to control the temperature scale and also the Auto Hot/Cold Spot indicators. In the images produced in the software a temperature profile line graph was utilised to indicate the temperature variation across the subject along with spot markers to indicate the temperature. The captured images are automatically time and date stamped for verification purposes.

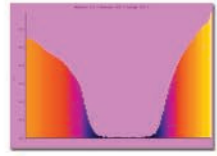
Assessing Radiator Performance

The power flushing of radiators is just one part of the many services offered by a Heating Engineer. Due to rising costs saving energy is a necessity and offering a service that can show and verify that power flushing saves time and money is of major interest to all potential customers. The question is, how can you verify the need for the service and demonstrate the improvements in performance?

Thermal imaging cameras provide the answer. This case study shows how Heating Engineers can quickly check a radiator's condition/performance to easily identify and diagnose problems or anomalies. With the highly professional software a report can be easily produced providing images so the customer can see the problems in turn verifying the need for improvements. Alternative methods of detection used by some engineers include simply touching a radiator to feel for cold areas or using infrared thermometers with a single or two spot laser sighting, which can only pick up small areas of the radiator not revealing the whole picture. These methods are no longer good enough and don't offer the reassurance the customer often seeks. Without a piece of equipment like a thermal imaging camera detailed analysis is not possible.

To set the scene, the thermal imaging camera was used by a local Heating Engineer on a job where a domestic dwelling had a problem with their radiators. On arrival, the boiler was switched on and left to heat up. The thermal imaging camera was used to take thermal and digital images of each of the radiators throughout the house to quickly ascertain their condition. The engineer could see in the thermal image the temperature variation at various points of the radiator. With its simple-to-use buttons and clear options, the images were taken and saved within minutes. The report took only another few minutes on a laptop using the Testo IR software, supplied with the camera.



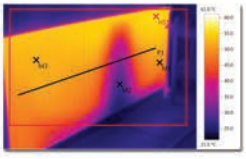


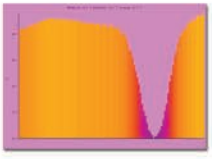
Measurement Objects	Temp °C	Emiss.	Refl. Temp °C
Measure point 1	54.1	0.95	20.00
Measure point 2	55.7	0.95	20.00
Measure point 3	29.1	0.95	20.00
Cold spot 1	22.0	0.95	20.00

It was quite shocking to see how poorly the radiators were performing. The first images show the radiators displaying a significant amount of cold area (as highlighted by the blue coloured areas) indicating substantial contaminant and sludge within the system. The temperature on the coldest part of one radiator was only 22°C compared to the average temperature in other areas of approximately 55°C, which is below optimum temperature.

The images show how inefficiently the radiators were performing, thereby wasting a lot of the heat produced by the boiler. The temperature profile line graph produced with the Testo IR software dramatically verifies the temperature variation across the radiator.

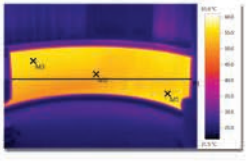
The customer was presented with this information and the real benefit of the thermal images were that they allowed the customer to see and understand the problem, and more importantly agree that power flushing was required to get the system performing back to full capability, in turn improving efficiency and saving money.



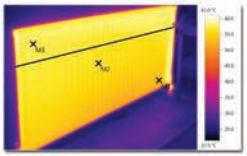


Measurement Objects	Temp °C	Emiss.	Refl. Temp °C
Measure point 1	52.3	0.95	20.00
Measure point 2	28.5	0.95	20.00
Measure point 3	50.1	0.95	20.00
Hot spot 1	55.6	0.95	20.00

During the course of the power flushing the engineer used the thermal imaging camera to view each radiator to verify the process was achieving its objectives. Once the process was complete the thermal imaging camera was used to assess whether all the contaminant and sludge had been removed and check the systems performance. The images show that the cold spots had been removed with the process of power flushing and the temperature was now consistent across the radiator. This verifies that the process of power flushing does improve a radiators' performance so it runs efficiently, without waste.



Measurement Objects	Temp °C	Emiss.	Refl. Temp °C
Measure point 1	55.5	0.95	20.00
Measure point 2	52.2	0.95	20.00
Measure point 3	54.3	0.95	20.00

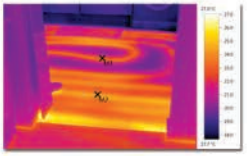


Measurement Objects	Temp °C	Emiss.	Refl. Temp °C
Measure point 1	57.6	0.95	20.00
Measure point 2	55.7	0.95	20.00
Measure point 3	53.6	0.95	20.00

It is clear from the results that using a thermal imaging camera gives Heating Engineers the edge and the customer added value. A thermal imaging camera will show the condition of radiators before, during and after the power flushing process and verify the improvements that the process produces. This level of analysis and extra reassurance to the customer demonstrates a high level of professionalism.

Underfloor Heating

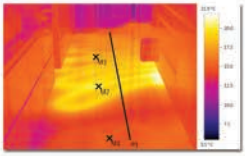
These days more customers are choosing underfloor heating as the ideal solution for providing reliable, consistent heat without the need for radiators. But how can you ascertain if an existing underfloor heating system is operating correctly or prove the correct installation of a new system?

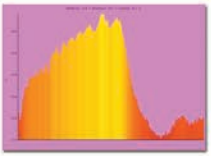


Picture markings:

Measurement Objects	Temp.°C
Measure point 1	24.2
Measure point 2	23.2

If we cannot see something with our own eyes we are unsure as ***seeing is believing.*** Using a thermal imaging camera provides a clear, visual presentation of the condition of the underfloor heating system in an instant. A thermal imaging camera also gives an indication of the surface temperature of the floor which is also indicative of performance of the system.

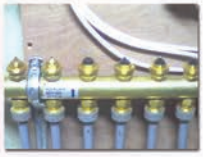


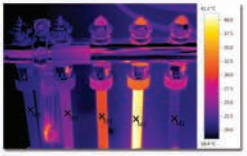


Picture markings:

Measurement Objects	Temp.°C
Measure point 1	17.5
Measure point 2	20.0
Measure point 3	15.1

In the images above, we see the poor operation of the underfloor heating system. It can clearly be seen where it is working and where it is not working. The thermal image verifies this visually with the indicated temperatures and the temperature profile line graph. The thermal report can be used to indicate temperatures across the heating coils and highlight any temperature variaton across the floor with a temperature profile graph.





Picture markings:

Measurement Objects	Temp.°C
Measure point 1	20.7
Measure point 2	24.2
Measure point 3	30.5
Measure point 4	40.1
Measure point 5	21.7

We can also use a thermal imaging camera to give a visual indication of what is happening at the Supply and Return Manifold, with large variations on the return temperatures, a possible indication that there is a problem with the system.

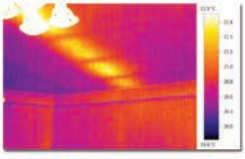
Tracing Concealed Boiler Flues

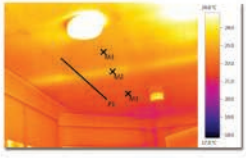
Where boilers are located away from external walls, flues are more likely to run through ceiling or wall voids. In such cases when the gas appliance is serviced or maintained it can be difficult, or impossible to determine whether the flue has been installed correctly or whether it is still in good condition.

In response to this, the Health & Safety Executive has issued technical guidance that requires inspection hatches to be fitted in properties where the flue is concealed within voids. The homeowner (or landlord etc.) has until 31st December 2012 to arrange for inspection hatches to be installed and any Gas Engineer working on affected systems after 1st January 2013 will advise the homeowner that the system is "at risk" (AR) in accordance with the GIUSP and, with the owner's permission, will turn off the gas supply to the boiler so it cannot be used.

The question is, how do you ascertain where the concealed boiler flue is and where does it run in the void?

See it clearly with a Testo Thermal Imaging Camera.





Here the location of the concealed flue can clearly be seen in the thermal image running in the void above the ceiling in an apartment. Having established where the concealed flue runs the positions of inspection hatches can be marked and subsequently cut and installed.

Without a thermal imaging camera it would not have been possible to visually locate the exact position of the concealed flue.

Thermal Imaging Camera Specification

When choosing a thermal imaging camera suitable for a variety of HVAC applications you will need to consider a number of criteria:

- Detector resolution / number of pixels
- Thermal sensitivity
- Field of view
- Camera functions: control of scale, manual span and level setting, focusing
- Software
- Ease of use
- Product support

All of the above parameters are very important. Quite often with HVAC applications such as tracing heating system pipework and leaks, temperature differences can be quite small so it is essential to select a thermal imaging camera that is suitable and will deliver results.

Detector Resolution / Number of Pixels

The detector resolution / number of pixels, determines the image quality, the main consideration being that the thermal image should be of sufficient resolution/quality to ensure the required detail can be clearly seen. The higher the resolution of the detector, the better it will resolve small details. The minimum detector size that should be considered for these applications is 160 x 120 pixels, (19,200 pixels).

Thermal Sensitivity

Good thermal sensitivity is an essential requirement on a thermal imaging camera for HVAC applications because quite often you are trying to detect small temperature differences, such as when trying to trace heating system pipework and leaks. Thermal sensitivity describes how small a temperature difference the camera can detect. The better the thermal sensitivity the smaller the minimum temperature difference the thermal imaging camera can detect and visualise. Usually the thermal sensitivity is described in ^{0}C or mK. Thermal imaging cameras for HVAC applications, particularly for tracing pipework and leaks under floors, should have a thermal sensitivity of 0.08^{0}C /80mK or better.

Field of View

In HVAC applications a wide field of view is a key requirement. Quite often you are viewing/ inspecting large floor areas when tracing heating pipework or inspecting underfloor heating systems. A wide view is also required to get the full view of radiators or sections of ceilings. In order to see a large section of these subjects it is necessary to have a wide angle lens with a wide field of view. In many instances there is insufficient room to step further back so a wide field of view is necessary in order to see large sections of the subject.

The Testo 875 series Thermal Imaging Cameras are equipped with a 32^0 wide angle lens as standard and provide a large sectional view. The smaller the field of view, the further away from the subject you will have to position yourself and the further away you are then the less detail you will see.

Camera Functions: Control of Scale, Manual Span and Level Setting

An essential feature of a thermal imaging camera is the ability to manually control the scale. This is achieved by manually setting the span and level of the scale to provide the optimum contrast on the thermal image in order to highlight small temperature differences. Just using the camera in Auto Mode can mean areas of small temperature differences are missed or not displayed in sufficient contrast to make them visible. When tracing heating system pipework and leaks, highlighting underfloor heating, or tracing concealed flues, there is often the need to minimise the scale. This will allow detection of small temperature differences associated with these types of application.

Focus

The prerequisite for any thermography measurement is a properly focused subject. A blurred image cannot be corrected and is not presentable. The focus arrangement has to provide easy focusing as the subject must be focused correctly.

Software

The software is important from the aspect of being able to optimise and analyse the images and to also ensure they clearly convey/report the findings. The software has to be easy and intuitive to use with a clear structure and high user friendliness. It should have the capability for report generation assistance to enable reports to be generated quickly.

Ease of Use

The camera has to be easy and comfortable to use safely, with intuitive operation, user friendly handling and provide flexibility/suitability for a variety of applications.

Product Support

When purchasing a thermal imaging camera you need to ensure you select a thermal imaging camera that best fits your needs and requirements. Therefore you need a reliable supplier that has the technical capability and knowledge to provide the support required to assist your selection.

Testo 875 Thermal Imaging Camera

The Testo 875 Series Thermal Imaging Cameras are an ideal investigative tool for HVAC applications:

- Large 3.5" display with high resolution image
- Exchangeable wide angle (32°) & telephoto lens (optional)
- Thermal sensitivity < 0.08°C, (80mK)
- Integrated digital camera, (Testo 875-2)
- Minimum focus distance - 10cm
- Manual control of scale, to set span and level
- Auto Hot / Cold Spot Recognition
- Save up to 1,500 images to the SD memory card
- Powerful software with full reporting features
- Two year warranty

Easy to use and capable of producing professional results, the Testo 875 is the perfect solution for the Heating Engineer who is looking to utilise thermal imaging. The Testo 875 Thermal Imaging Camera costs from as little as £1,895.

Achieving a Return on Investment

Although purchasing a thermal imaging camera is clearly a significant investment, there are many reasons and justifications to prove this cost will easily be recovered when factors such as the following are taken into consideration:

- Thermal imaging will significantly reduce the time taken to locate a leak or find a fault on an underfloor heating installation or heating system pipework.
- Once located, both you and your customers will benefit from less cost and disruption by a considerable reduction in the need for unnecessary excavation work.
- In utilising thermal imaging technology to increase efficiency you will be able to accommodate additional customer visits.
- Extra income can be generated through the selling of additional services such as power flushing. Now it is possible to visually see problems the customer has the reassurance that the service is necessary.
- Promotion of your business using professional reports to generate more income.
- Using thermal images on your website and promotional material to gain new business.
- The opportunity to generate business from other HVAC Engineers and Builders etc.

"The impact on our business has been dramatic in terms of optimising how long we need to spend with a customer and the work involved, which is allowing us to conduct more visits in any given period. We have built up a loyal base of some 2,500 domestic customers and there is no doubt that being seen with the Testo camera reassures them in their perception of our company as a well equipped progressive company who can be trusted to give value for money. It also inspires confidence with the likes of insurance companies, plumbers and builders. All in all the Testo thermal imaging camera is an invaluable asset in our portfolio to the extent that it will feature within our promotional material and website.

Rolfe's Heating Limited

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