Thermal Sensing & Imaging Diagnostics.

Think Thermally-Seeing Heat, Then The Light! Infrared Thermography: Its Place In Your P/PM Programme.

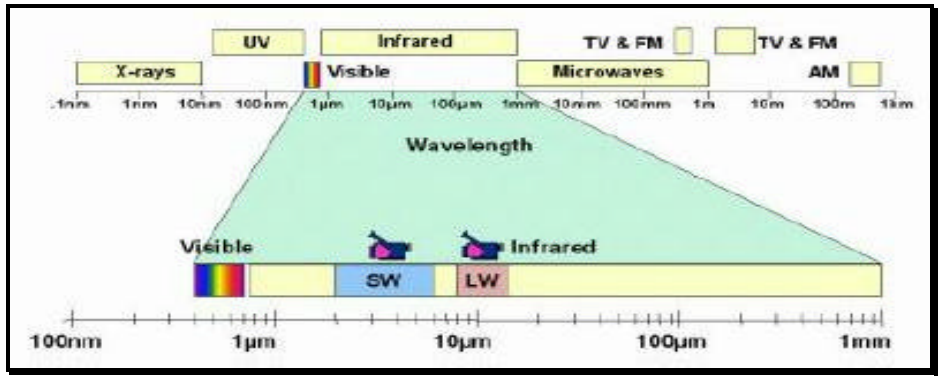
Infrared Thermography.

Temperature changes are often the precursor to many significant problems that occur within industry, but are often unnoticeable to the human eye. Infrared thermography negates this problem by producing a visible image of invisible (to our eyes) infrared light emitted by objects due to their thermal condition.

The visible portion of the electromagnetic spectrum sensed by the human eye is extremely small (between 0.4 - 0.7μm) with our visual sensitivity to temperature change becoming only apparent with temperature rise with a subsequent and mutual decrease in wavelength causing the object to glow as it enters into the visible portion of the electromagnetic spectrum. At this time however, component failure or, a chain of associated events may well take place exacerbating the severity of the initial problem. Using infrared thermography one can detect this invisible form of energy by means of a TV like thermal image or thermogram preventing failure from occurring.

Seeing this 'unseen' heat energy within the 3-5 and 7-14μm of the electromagnetic spectrum allows for a multitude of uses in optimising

and evaluating the operating condition of electrical, mechanical, and process equipment for early signs of imminent failure. Such are the vast attributes of infrared thermography that qualified thermographers are beginning to hone their services to infrared inspection programmes within the demanding environments of the UK industrial sectors.



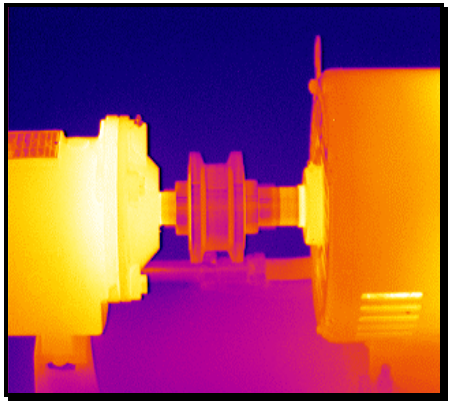
Shorter Wavelength Longer

The Electromagnetic Spectrum

All objects emit infrared radiation. The amount of radiation emitted is proportional to the temperature of the object. Infrared cameras operate in one of two transmission windows in the atmosphere. These transmission windows 3-5μm and 7-14μm are bands that are not absorbed or blocked by the affects atmosphere.

Moreover, as more UK management become conducive to the benefits of a proactive approach to predictive and preventative maintenance (P/PM) programmes rather than to reactive ones, their awareness and acceptance of establishing new monitoring techniques become amplified, particularly when they permit continuation of production,

implement higher energy efficiencies and cost returns within an existing (and or new) P/PM programme, most significantly that the new monitoring techniques are deemed safe and non-hazardous to the environment and employees. To which infrared inspections are.



Heat generated from shaft misalignment on the front bearing on the left electrical motor. It is an established fact that a 10°C rise in the normal operating temperature at which the electrical motor functions, the life of the motor is reduced by one half. This damage is irreversible, and can amount to thousands of pounds a year in lost profits.

Measuring Temperature

The development and introduction of infrared focal plane array (FPA) imagers in recent years has made the above all-possible, revolutionising infrared imaging from cumbersome systems needing pressurised cryogenic cooling to hand held systems resembling a video camera that fit in the palm of the users' hand. The FRA detector elements allow photons of energy within the instantaneous field of view to be recorded by each detector element, resulting in improved radiometric resolution. This ability to resolve small temperature differentials as low as 0.5 degrees C at ambient temperatures, provide

an accurate means for recording and observing dynamic hot and cold temperatures.

The conversion to voltage variations across the array produces a visible heat image or thermogram 30 times per second on the cameras viewfinder or monitor, providing real-time instantaneous temperature sensing of the subject matter. Images can be either monochrome or multicoloured where the shades of grey or colour represent the temperature patterns across the surface of the object. The warmer the object, the brighter we see it. In 'raw' infrared white is hotter, black is colder. Such is the sensitivity of the imager combined with the fact that all objects warmer than absolute zero (0 Kelvin or –275.15°C) emit energy allowing for considerable diversity for infrared imaging and detection within industry, (depending on the sensitivity range of the thermal camera)

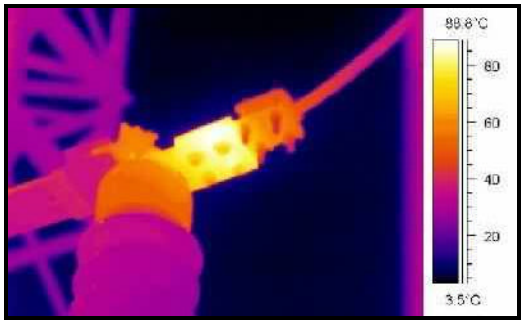
Safe handling

The beauty of utilising infrared thermography within a P/PM programme lies with the knowledge that the detection of heat patterns will provide meaningful data about a process, system, or structure, non-evasively and non-destructively. This means it is safe to view energised electrical system or moving parts without physically touching or dismantling them. It also means the actual temperature measuring process will not change the thermal characteristics of the material or process the thermographer is looking at. This provision of real time

monitoring in addition sensing large tracts of land, plant and material in relatively short periods of time, will culminate in the expediency of essential management information and report production for maintenance and production problems.

Data Collection and Reporting.

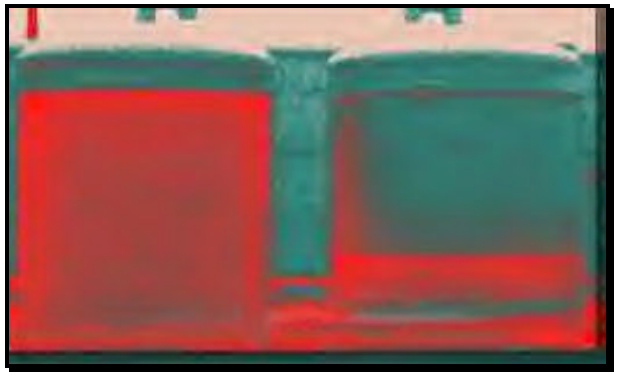
The reporting and documenting findings is an important part of the health facility of the item and plant under inspection. Thermal images that exhibit evidence for further or immediate action can be saved and printed, with appropriate rectifying measures taken up by the in-house maintenance technicians on the very same day.



Apart from the costly inefficiency of wasted power, this electrical connection would eventually have resulted in failure once melting point is reached. The cause, a combination of material quality and fixings.

Thermograms are the starting point in the data gathering process, by initiating a tri or bi annual thermograhic P/PM programme (or incorporating it in to an existing P/PM programme) one can immediately start to collect temperature data, and other information such as load, criticality, previous history, anticipated usage, ambient changes to name just a few important factors (most of which are more important than 'how hot is it') and over time compare the data to normal operating temperatures. Affirmation of baseline values from manufacturer's specifications and from previous infrared inspections can, when problems arise help in trouble shooting and diagnostics by providing a record of previous operating conditions (both normal and out of tolerance).

The report and spreadsheet analysis are geared to the particular requirements of the requestor often in a simple, clear and concise format, but offering consistency in methodology and repeatability from inspection to inspection and thermographer to thermographer. The use of Laptop computers permit direct input of information at the time of inspection, minimising transference error from hand written datasheets while providing the most cost-effective solution with instant report turnaround at the end of the inspection.



The differences in heat capacity of liquids, solids and air permit the level in these tanks to show up clearly when the tank is pushed through a temperature range. In a typical diurnal temperature cycle, the level will be readily visible except for a brief time in the morning and again in the evening. This method verifies levels to level indicators, while eliminating the need to physically open and inspect the tanks, preventing risks to workers associated with gaining access and exposure to stored materials.

A Positive Investment.

The results from the report assist in tracking problems and categorising them by their temperature rise (and or other supplementary information) to reveal trends in the facilities' health over time. This strategy on key equipment leads to the ability to analyse what factors play an important role in their failure, and give an insight into the correct preventive maintenance measures to be taken so future problems will be minimised.

The report can also provide vital information when producing a cost breakeven report generated from materials, labour and unscheduled downtime vs. using an infrared inspection programme. Savings from unplanned shutdowns or when infrared inspections are implemented before and after scheduled shutdowns can be substantive, (thermography may infuse better work ethics within contractual and maintenance staff). Furthermore, because of reduced losses and increased productivity, which in turn increase revenue, the return on investment from implementation of an infrared P/PM programme can be as much as or even higher than 1:20-1:30, depending on the industry. In many cases where no previous thermography inspections have taken place, it is not unusual to be able to find enough avoided savings on the first inspection to pay for further consultancy, inventory and infrared inspections for several years. Moreover, when your company looks for solutions or information, they will begin to 'think thermally and see the heat……then the light!