

# Use of Thermographic Cameras – General Considerations

Thermographic cameras are relatively inexpensive and can be used by organisations and businesses in support of their risk management programmes.

They can help identify issues such as overheating components or equipment; maintenance related issues; unexpected ‘hot or cold’ spots; water leaks/damp, as well as measuring thermal outputs for efficiency and sustainability strategies.

This Tops Tips document provides useful guidance on using thermographic cameras to help improve equipment and plant availability, reliability and reduce the risks of loss or damage.

# Use of Thermographic Cameras – General Considerations

## Introduction

Many equipment failures or breakdowns, fire or water/fluid related loss events could be avoided via early identification of the initial causation. The use of low-cost thermographic cameras, as part of regular or routine self-inspection and maintenance programmes, can help detect such issues, potentially before they manifest into loss incidents and damage.



Aviva Loss Prevention Standard, **Thermographic Surveys**, provides an overview of the technology, the benefits and main applications, along with guidance on establishing thermographic survey programmes carried out by competent and qualified persons, or other maintenance arrangements.

This Loss Prevention Standard provides useful guidance for the use of handheld thermographic cameras as part of daily/weekly checks etc., within formal risk management programmes, but not as a replacement for more formal thermographic inspections/surveys.

**Note:** This document is focussed on property loss prevention in relation to the use of thermographic camera technology. It is not intended to address liability exposures. The presumption is that all regulatory requirements, Fire Risk Assessments, and compliance with requirements placed by the local authority having jurisdiction which would include licencing, building permissions, regulations, codes, or standards, have or will be met.

## Understanding the Risks

### Fire

Fire ignition hazards include, but are not limited to:

- **Electrical Systems.** Performance issues and maintenance related failures; general aging; incorrect installation; damage to components; overloaded circuits; misuse or inappropriate use. Can be used for both charging and portable equipment.
- **Hot Work Operations.** Poorly planned or managed hot work activities can lead to ignition of combustible materials in proximity, and subsequent fire spread. An excellent addition to the hot work fire watch tool kit.
- **Trade Activities.** Those using or generating highly flammable liquids or dusts; cooking or use of oven equipment; charging operations e.g., lift trucks; power tools; use of volatile chemicals or other agents; recycling processes; processes that generate heat; moving or rotating components which can wear and overheat.

- **Housekeeping.** Poorly organised storage, e.g., storage in proximity to lighting or heaters; charging equipment etc.; inappropriate smoking arrangements; waste bins; external skips and waste arrangements; self-heating.
- **Heating and Refrigeration Equipment.** Including failure of over-temperature devices; failure of insulation materials; radiated heat warming items or materials in proximity; lack of air flow and cooling etc.
- **Solar Photovoltaic (PV) Equipment.** Components and cables, panels or modules can become damaged or shaded by overhanging branches and fouling which can lead to hot spots and panel damage. Inverters and other control equipment can be damaged or become defective and over-heat.

Upon ignition, fire can spread to other combustible materials in proximity, including construction materials, potentially leading to a significant or catastrophic loss event.

### Escape of Water and Other Fluids

Water and fluid leaks can cause significant damage to property, leading to costly repairs. In addition, any property with one leak/incident is statistically more likely to have future similar events from similar failure modes.

Common causation includes:

- **Leaking Pipes.** Potable water and sprinkler pipework can develop leaks due to faults; damage; corrosion; over-pressurisation; freezing.
- **Fittings.** Different fittings, their use and application have different exposures: compression, push, welded, soldered etc. These can fail for a number of reasons.
- **Faulty Fixtures and Appliances.** Washroom equipment, e.g., showers, basins/sinks, toilets and cisterns can be damaged or develop faults, and appliances such as washing machines and dishwashers can leak due to poor installation or excessive movement loosening connectors.
- **Water Ingress.** Roofing systems, blocked or faulty guttering systems; property damage; pointing failure etc., can all lead to water ingress, which can potentially cause structural damage, ruin stock and cause electrical fires.
- **Heating and Cooling systems.** Boiler equipment; filtration plant; water tanks; air conditioning systems etc., can all cause water damage if not properly maintained, or as a result of faults.
- **Predictive Maintenance.** Using thermographic cameras as part of predictive maintenance regimes can help reduce the frequency of servicing/parts replacement in some equipment, whilst helping identify equipment requiring more frequent attention, improving efficiency and helping to reduce costs.

### General

Whilst this document focuses on property risk exposures, businesses and organisations are exposed to contingencies which may impact Environmental, Sustainability and Governance (ESG) objectives, or lead to increased costs/reduced profits.

- **Insulation Materials.** Heat emissions can negatively impact ESG ratings and attract negative publicity.
- **Storage.** Rising temperatures of some stocks may affect product quality, usability and sales prices.
- **Ventilation.** Heat could be escaping the building, leading to increased heating costs.
- **Air Movement.** Air movement and ventilation systems within a building not performing as expected, increasing cooling or heating load and associated costs.

- **Efficiency.** Equipment running at higher temperatures may be indicative of inefficient programming or speeds, potentially leading to increased costs.
- **Solar PV Panels.** Compromised panels can lead to energy production losses.

## What to Inspect

A risk assessment of all processes, machinery, plant, services and infrastructure at the premises should be undertaken to identify potential vulnerabilities, including but not limited to:

### Fire.

Equipment that generates thermal emissions and/or is vulnerable or susceptible to over-heating, self-heating etc., and ignition. Common examples include:

- Electrical systems/components, transformers, generators and switchgear.
- Welding bays and areas where hot works may be undertaken.
- Cooking equipment such as ovens, frying ranges etc.
- Mechanical systems, e.g., pumps, motors, conveyors etc.
- Manufacturing or processing equipment.
- Charging equipment and equipment under charge including leads and cables.
- Heating including boilers and trace heating.
- Lighting including emergency escape signage.
- Mobile plant.
- Battery powered equipment, Uninterrupted power supplies (UPS) and battery energy storage systems.
- Solar PV panels and components, e.g., inverters, isolators, connectors etc.
- Lighting systems.
- Air handling and cooling equipment including refrigerators, fans, condensers etc.
- Tablets, cameras, radios.
- Scanning equipment.

### Escape of Water and Other Fluids.

Equipment that holds or is vulnerable to water or fluid ingress/egress, including:

- Tanks or vessels, washing machines, dishwashers.
- Sanitary fittings e.g. toilets, sinks, basins, showers etc.
- Pipework.
- Valves.
- Regulators.
- Seals and joints.
- Internal areas behind external soffits, gutters, flat and/or aged roofing etc.
- Surfaces under and in proximity to such fittings.
- Areas of staining or damp.
- Hydraulic systems.

### General

Includes:

- Insulated stores.
- External wall and roofing.
- Guttering.
- Ventilation systems.
- Operating machinery.

- Refrigeration and chiller equipment.
- Heating equipment and room temperature – may indicate heating inefficiency.

**Note:** A sample checklist is provided in Aviva Loss Prevention Standard **Use of Thermographic Cameras - Checklist**.

Following this risk assessment, the following should be considered:

1. The potential for loss events, e.g., ignition/fire or damage to equipment or other assets through over-temperature, leaks etc.
2. The importance, or business impact, should the equipment be lost or incur downtime.
3. The financial value, or reinstatement cost of the equipment or damaged assets.
4. The potential for wider damage, e.g., fire growth spread attributed to combustible materials or construction in proximity, susceptibility of wall and floor surfaces, stock and machinery to water or fluid damage.
5. Previous losses or downtime.

This will help identify and grade the critical or exposed equipment, infrastructure, services and processes to the organisation and their vulnerability to ‘fail’ and loss events.

Refer to Aviva Loss Prevention Standard **Material Damage Risk Assessment** for further guidance.

## Frequency of Checks

The frequency of thermographic checks will vary between organisations based on the findings of the risk assessment, and considering factors such as:

- Nature of the equipment.
- Its vulnerability to a loss event and the anticipated damage that might occur.
- Operating times.
- Other trade hazards or exposures that might impact the severity of a loss event.
- The criticality of the equipment or the process.

Daily or weekly informal camera checks may be appropriate in some cases, particularly for high-risk activities, those carried out/based in higher risk areas, or where a breakdown/stoppage could lead to significant production impacts.

At least monthly formal checks are recommended as part of formal self-inspection and maintenance programmes; however, this frequency should be increased where recommended within the risk assessment.

Refer to Aviva Loss Prevention Standards **Self-Inspections** and **Maintenance Regimes** for further guidance.

## Camera Equipment

A range of handheld cameras are available, and the most appropriate type depends on the intended application. Whilst the thermal detection technology is similar in all handheld cameras, some will incorporate features that are relevant or useful for specific usage. For instance, cameras used for monitoring electrical equipment are likely to have a higher temperature range and faster response time to help identify the rapid heat changes common in some components/equipment, features that may not be of use for monitoring liquid-related issues.

Some cameras can physically attach to mobile telephones/tablets whilst others can connect to telephones remotely to enable instant messaging and file sharing.

**Note:** These camera types may not be suitable where the camera is required to be used for long periods or repeatedly due to battery power limitations of mobile devices.

Whatever the intended application, always seek professional guidance on the most appropriate camera for the intended usage based on the application.

Aviva Specialist Partner [PASS](#) offers a range of thermographic camera equipment to Aviva customers at discounted cost, and can advise on the most appropriate camera for your application.

## Image Quality

To improve the quality of imaging:

1. **Operating Equipment.** Always use the camera whilst equipment is powered/running under normal to maximum load.
2. **Temperature Range.** Ensure the correct temperature range setting for the equipment being inspected. If the temperature range is too low, the image may be oversaturated and too high a range may result in underexposure. Parameters may need to be increased for hot processes or equipment.
3. **Resolution.** Ensure appropriate resolution for the image. Higher resolution settings increase the number of pixels, and therefore the quality of the readings.
4. **Proximity.** The camera's field of view may need to be changed depending on your proximity to the equipment being inspected. Too far away and a wider field of view will result in a poor quality reading. A distance of between 150mm and 5 metres from the item being inspected, and a minimum of at least 5x5 pixels on the image area is generally recommended.
5. **Target Setting.** Use the target setting on the camera to point directly at the item being inspected. Being slightly 'off' target can affect the temperature reading.
6. **Focus.** Use of the manual focus setting may result in high quality imaging, however, will take more time to set. Autofocus is the most practical setting for general thermographic image inspections. Avoid fixed focus cameras unless the images are used for basic heat checks.
7. **Colour Palette.** Chose the correct colour palette.
  - The **iron palette** which captures warm images in yellow and whites and cold images in blues and purples, allows quick identification of temperature variance in an image and is generally used for 'up close' work such as electrical control panels, items of machinery.
  - The **rainbow palette** allows for identification of small temperatures changes, and is useful when inspecting large objects, such as buildings and when identifying water related issues such as leaks.
8. **Avoid Reflections.** Do not stand in front of reflective surfaces (like glass, polished metal) as they can reflect body heat or other heat sources. If unavoidable, angle the camera slightly to reduce reflections.
9. **Clear Line of Sight.** Remove any obstructions between you and the target. Avoid imaging through glass or plastic unless your camera is designed for it. Metals generally have low emissivity and can give false readings.
10. **Calibration.** Calibrate your thermal camera regularly. Calibration compensates for factors that can affect your readings.

## Assessing Images

Having identified the items to be checked/inspected using thermographic cameras in the risk assessment, you should:

- Document the normal operating temperature parameters for the item or location. The Original Equipment Manufacturer (OEM) may be able to assist with this, if the information is not already held. Factor in any adjustment for ambient temperatures changes, e.g. equipment situated outdoors, etc., and any peak operational hours where machinery or equipment may be working harder and producing increased heat output.
- Identify any areas where those parameters have been exceeded or not achieved.

## Reporting

Ensure any areas of concern are reported and actioned appropriately.

It may be prudent to produce 'risk banding' to ensure deviations from normal temperature readings are reported within defined timescales. Clear deviations from 'normal conditions' on higher risk/high criticality equipment, or in higher risk areas, may need to result in urgent reporting with corrective maintenance/remedial work completed as soon as possible, whereas issues involving low risk/low criticality equipment or areas may be suitable for allocation into normal maintenance scheduling.

The value of the thermographic checks/inspections should be shared with senior management. This may support ongoing use of thermography, or any planned expansion into other divisions or risk areas. Creating a database of faults, damage, issues that have been identified and remedied following thermographic camera inspections may prove invaluable, however these should be quantified in terms of the loss avoided e.g.:

- Cost of repair – maintenance and parts charges, downtime etc.
- Cost of no repair – avoided loss event type, anticipated scale of damage, estimate cost of repair/reinstatement, downtime, consequences, e.g., injury, business interruption losses, ESG damage etc.

## Training

Operatives should be adequately trained to use the equipment. Professional thermographers are trained and certified in accordance with local or national standards, regulations or codes. In the United Kingdom this would be **PCN/ITC Levels 2 or 3**, in accordance with **ISO 18436-1: Condition monitoring and diagnostics of machine systems – Requirements for certification of personnel**. In addition, professional thermographers may require formal electrical competence/qualifications for work in higher risk environments.

For general use of thermographic cameras in support of risk management self-inspections, monitoring and maintenance, the PCN/ITC Level 1 certification could be considered. Alternatively, many local educational establishments, camera retailers and other organisations provide introductory training to personnel to familiarise them with the principles of thermography, the full range of camera features, etc., and start them on the journey to eventual certification.

Aviva Specialist Partner [PASS](#) provides both ITC Level 1 and introductory courses to Aviva customers at a discounted cost.

## Ongoing Care

Maintenance and ongoing care can enhance the performance and longevity of the camera equipment.

- Clean the lens regularly using a soft cloth or lens cleaning wipes. Avoid using water and abrasive materials.
- Check calibration readings regularly to ensure the camera is functioning normally.
- Ensure firmware updates are carried out as soon as possible.
- Avoid extreme temperatures. Cameras can be damaged by exposure to freezing environments or temperatures in excess of 50° C.
- Do not point at direct sunlight.
- Avoid dropping cameras. Use of protective cases are recommended when transporting to and from work areas.
- Always use straps to avoid dropping cameras, taking into account any safety risks in the work area.
- Store in a cool dry place and in a protective case to help prevent damage by dust and other contaminants.

## Review

The thermographic camera processes and procedures should be audited routinely to ensure:

- The risk assessment remains adequate and reflective of the current processes, equipment, services etc.
  - ✓ The risk assessment should be updated upon changes to layout, services, infrastructure, machinery etc., or at least annually.
- The formal procedures are being correctly followed, corrective actions completed, and that the risk banding for reporting faults etc., remain appropriate.

Refresher training should be undertaken regularly to ensure manufacturer guidelines are being followed, and to identify/avoid any poor practice.

- ✓ Check whether your supplier has produced and uploaded any new training courses or learning material on their website.

## Key Actions

1. **Assess.** Assess the processes, equipment, services etc., at the premises to identify areas where the camera can be used.
2. **Checklist.** Create a checklist and decide on the frequency of checks based on risk levels, criticality and likely costs of breakdown, stoppage etc.
3. **Camera Choice.** Choose the most appropriate camera for your needs and train users appropriately. Aviva Specialist Partner [PASS](#) can assist with camera choices and training at a discounted cost to Aviva customers.
4. **Action Issues.** Ensure any issues identified are actioned appropriately.
5. **Record Issues.** Record the issues and costs avoided. Share with leadership teams.
6. **Camera Care.** Ensure camera equipment is fitted with straps and is cleaned, calibrated and stored appropriately.
7. **Review.** Regularly review the assessment to ensure all new or replaced equipment and processes have been included in the checklist.

## Specialist Partner Solutions

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners.

Thermal Imaging Cameras and Training - [PASS](#)

For more information please visit: [Aviva Risk Management Solutions - Specialist Partners](#)

## Sources and Useful Links

- [ISO 18436-1: Condition monitoring and diagnostics of machine systems — Requirements for certification of personnel Part 1: Sector specific requirements for certification bodies and the certification process](#)

**Note:** Whilst UK standards and legislation are referenced in this document, other international standards and legislation should be referenced where applicable.

## Additional Information

Relevant Aviva Loss Prevention Standards include:

- **Use of Thermographic Cameras - Checklist**
- **Thermographic Surveys**
- **Hot Work Operations**
- **Maintenance Regimes**
- **Material Damage Risk Assessment**
- **Self-Inspections**

To find out more, please visit [Aviva Risk Management Solutions](#) or speak to one of our advisors.

Email us at [riskadvice@aviva.com](mailto:riskadvice@aviva.com) or call 0345 366 6666.\*

\*The cost of calls to 03 prefixed numbers are charged at national call rates (charges may vary dependent on your network provider) and are usually included in inclusive minute plans from landlines and mobiles. For our joint protection telephone calls may be recorded and/or monitored.

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