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Infrared Thermography Guide

Electrical failures are a leading cause of equipment damage, potentially catastrophic fires, and costly downtime in commercial and industrial facilities. While many of these failures develop slowly and silently, their consequences can be both sudden and severe.

Infrared thermography has become a key tool in identifying these hidden risks before they escalate into major problems. When incorporated into an electrical preventative maintenance (EPM) program, infrared thermography can significantly reduce the likelihood of system failures and subsequent losses.

What is Infrared Thermography?

Infrared thermography is a non-invasive technique that uses thermal imaging cameras to detect excess heat in electrical systems. As equipment operates, it naturally produces some heat; however, when components begin to fail, they may generate more heat than normal. These abnormal heat patterns, invisible to the naked eye, are captured as “hot spots” on a thermal imaging camera.

During a scan, a trained technician uses a thermal imaging camera to inspect energized electrical systems while they operate under normal load conditions. The camera highlights surface temperature differences, helping identify early warning signs of electrical issues. Infrared scans can uncover a wide range of hidden issues, such as:

- Loose or corroded connections
- Defective breakers or fuses
- Overloaded circuits
- Deteriorated insulation
- Damaged switchgear
- Oxidized terminals
- Contaminants or foreign material buildup
- Component fatigue

This technology offers several practical advantages when incorporated into a facility’s EPM program, including:

- **Early problem detection:** Identifies abnormal heating before visible damage occurs, allowing proactive maintenance and avoiding costly surprises.
- **Reduced fire and equipment risk:** Helps prevent electrical fires and equipment failures by revealing hidden faults such as loose terminations, phase imbalances, or overloading.
- **No downtime is required:** Scans are performed on energized equipment under normal load conditions, eliminating the need to shut down operations.
- **Cost efficiency:** Prevents emergency repairs, reduces unplanned downtime, and extends equipment life, contributing to long-term savings.
- **Improved maintenance planning:** Scan results help prioritize repairs and schedule maintenance based on actual conditions rather than guesswork.

What Equipment Should Undergo an Infrared Thermography Scan?

Infrared thermography should focus on electrical components that carry high loads, serve critical functions, or are prone to wear. Key targets include, but are not limited to, the following, where applicable:

- Main distribution panels
- Panelboards and sub-panels
- Circuit breakers and disconnects
- Transformers
- Bus ducts and bus bars
- Motor control centres
- Variable frequency drives
- Automatic transfer switches
- High-load endpoints

How Often Should Equipment Undergo an Infrared Thermography Scan?

According to National Fire Protection Association (NFPA) 70B – Standard for Electrical Equipment Maintenance, electrical systems should undergo infrared inspections on an annual basis. However, more frequent scanning (i.e., quarterly, semi-annually) may be necessary based on the following considerations:

- **Equipment criticality:** Systems essential to operations, safety, or backup power may require semi-annual or quarterly scans.
- **Environmental exposures:** Facilities exposed to vibration, dust, moisture, or corrosive conditions are at higher risk of equipment degradation.
- **Operational changes:** Load increases, equipment upgrades, or process changes warrant follow-up scans to verify system integrity.
- **Past infrared findings:** Components previously flagged with anomalies should be re-scanned after repairs or on a shorter cycle.
- **History of failures or near misses:** Frequent or unexplained electrical issues indicate a need for increased monitoring.

Who Can Perform Infrared Thermography Scans?

To ensure reliable results, infrared inspections and reporting must be conducted by properly trained and certified personnel. There are three levels of infrared thermography certification, all of which are defined under International Organization for Standardization (ISO) 18436-7 – *Requirements for Qualification and Assessment of Personnel – Part 7: Thermography.*

At a minimum, on-site technicians must hold a Level I certification from a recognized training provider, and the associated report must be prepared by an individual holding a Level II certification. In addition, all technicians must understand how electrical components operate and interact, especially under load. Furthermore, they must comply with all relevant electrical safety standards, including those referenced in Canadian Standards Association (CSA) Z462 – *Workplace Electrical Safety* and NFPA 70E – *Standard for Electrical Safety in the Workplace*.

What Should be Included in an Infrared Thermography Report?

A complete infrared thermography report provides documentation for maintenance planning, compliance, and risk mitigation. This report should include the following, at minimum:

- **Basic inspection information**, including date, facility name, equipment scanned, and load conditions during the inspection.
- **Thermographer credentials**, including name, certification level, and training body.
- **Imagery**, including side-by-side thermal and visual images clearly showing each anomaly with hotspot locations identified.

- **Temperature data**, including recorded hotspot temperature, reference temperature, and calculated differential.
- **Findings and interpretation**, including a description of the observed issue, suspected cause (e.g., loose connection), and urgency level.
- **Corrective actions**, including recommended steps for repair or follow-up, including timelines if appropriate.

Infrared thermography is a proven and practical method for uncovering hidden electrical issues before they escalate into costly failures or safety hazards. By scanning energized equipment under normal load conditions, businesses can detect problems such as loose connections, overloaded circuits, and deteriorating components early when intervention is most effective and least disruptive. Integrating thermal imaging into a proactive maintenance program strengthens system reliability, supports risk reduction efforts, and helps avoid unplanned downtime.

References

Canadian Standards Association (CSA) Z462 – Workplace Electrical Safety and NFPA 70E – *Standard for Electrical Safety in the Workplace*

Infrared Training Center
www.infraredtraining.com/en-CA/

NFPA 70B – *Standard for Electrical Equipment Maintenance*

NFPA 70E – *Standard for Electrical Safety in the Workplace*

Organization for Standardization (ISO) 18436-7 – *Requirements for Qualification and Assessment of Personnel – Part 7: Thermography*