To The Point
Infrared Thermography

Flawed electrical systems are a leading cause of fires and downtime. The impact of a fire often goes beyond the repair and replacement costs of damaged equipment. Smoke and water damage from firefighting efforts, and spoilage affect the surrounding area. Time and extra expenses are associated with the recovery, restoration, and cleanup efforts until power and operations are restored.

Understanding Infrared Thermography

Nearly everything that uses or transmits power gets hot before it fails. The higher the object's temperature, the greater the energy that is emitted and the more imminent the potential failure. Thermal energy is part of the electromagnetic spectrum of light and is not visible to the human eye. Using infrared thermography to scan for abnormal operating temperatures in electrical and mechanical systems is a proven method for preventing catastrophic equipment failures and electrical fires that can result in costly and unscheduled shutdowns. That is why routine infrared scans at least annually are now a requirement of NFPA 70B.

This inspection technique is conducted on energized equipment and electrical distribution systems under load to obtain accurate results. With the infrared camera, conditions can be assessed in real-time to identify hot spots. Early detection of problems provides the opportunity to address hazards with corrective action that can prevent equipment failure, fire, and business interruption.

The following equipment and systems can be incorporated into an infrared testing program:

- Rotating machinery such as motors, generators, pumps, and chillers
- Motor controls
- Lighting systems
- Electrical systems, including switchgears, transformers, and circuit breakers
- Photovoltaic (PV) solar systems such as solar arrays, combiner boxes, inverters, panels, and switches
- Emergency systems such as UPS, transfer switches, and generators

Benefits

The Federal Energy Management Program claims a properly functioning predictive maintenance program saves 30-40% more than reactive maintenance. Integrating infrared testing into predictive maintenance programs helps reduce reactive maintenance fees and the probability of unscheduled downtime. Among the advantages of infrared thermography are:

- Analysis is conducted without disrupting electrical service or business operations.
- Results are accurate, reliable, and immediate.
- Loss-producing conditions can be identified and mitigating solutions implemented before major problems occur.
- Peak performance and extended lifespan of machines and equipment.
- Trends in performance can be detected.
- Repairs and maintenance activities can be prioritized, allowing shutdowns to be planned around operating schedules.
- Potentially reduced energy costs.

Case In Point

During a routine scan of a main electrical service, the main transformer's cooling fins exhibited a very unusual infrared signature. The fins are used to cool the oil in the transformer, much like a car's radiator cools the engine. Transformers carry an enormous amount of electrical energy, so when a transformer overheats, the event can result in a massive discharge of energy that is passed on to the facility's electrical system and machinery. This transformer happened to feed an emergency call center. If the transformer overheated and failed while the center was in operation, emergency call may have been interrupted. Performing this infrared inspection saved the company unplanned downtime and severe electrical damage. The transformer was shut down and replaced on a planned date and time with minimal impact on the call center operations.

Conducting an Infrared Scan

Roles & Responsibilities

Infrared inspections require a team of individuals with significant experience and technical competency.

- An infrared scan cannot be conducted without a facilities representative who is familiar with the building systems, operations, equipment, and site-specific hazards and procedures.
- The certified thermographer operates the infrared camera. This individual is highly trained and experienced in infrared technology and electrical safety.
- It is important to have a licensed electrician on hand to open the energized equipment and assist with the electrical inspection.

Facility Tour

The infrared inspection begins with a tour of the areas to be scanned to verify that the target areas and electrical equipment are sufficiently accessible for the scan. It is necessary to understand how the systems interact and to identify critical components. While an inexpensive fuse or breaker may not seem very significant, damage to the equipment it protects could be devastating. Keeping these system dependencies in mind is useful when assessing an unusual infrared indication.

Safety Precautions

The electrical system evaluation work requires that cabinet doors be opened and panel covers removed on the equipment to be inspected. This is necessary to facilitate an unobstructed view of the energized components and the proper identification of any problem conditions.

There is no room for complacency when working in areas where electrical panels are open and energized surfaces are exposed. The potential for personal injury includes arc flash, electrocution, shock hazards, and lacerations. The National Fire Protection Association (NFPA) requires recognition and communication of the hazards and employment of safe work practices while working on or near energized equipment by all parties involved in the infrared scan. For example, due to the possible exposure to an arc flash, NFPA requires that individuals wear flame-resistant protective clothing that meets the requirements of ASTM F1506. Specific requirements for personal protective equipment and other precautions are detailed in the NFPA 70E Standard for Electrical Safety in the Workplace.

It is critical that the scanning areas remain secure during the inspection:

- All nonqualified or unprotected personnel should be prevented from entering scanning areas.
- No repairs or work may be conducted during the scan.

Results

A detailed report of an infrared analysis includes thermal and digital images of equipment where hot spots or indications were found. Each indication should be accompanied by comments and recommendations to correct the discrepancy.

Resources

ASTM International, https://www.astm.org/

- ASTM F1506: Standard Performance Specification for Flame Resistant Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards

National Fire Protection Association (NFPA), http://www.nfpa.org/

- NFPA 70: National Electrical Code
- NFPA 70B: Standard for Electrical Systems Maintenance
- NFPA 70E: Standard for Electrical Safety in the Workplace

Occupational Safety and Health Administration (OSHA), https://www.osha.gov/laws-regs

- 29 CFR 1910.269: Electrical Power Generation, Transmission, and Distribution

Learn More & Connect

For more information on protecting your business, contact your local risk engineer, visit the Chubb Risk Consulting Library, or check out www.chubb.com/riskconsulting.

Form 09-10-0519 (Ed. 02/25)