

## Infrared inspection

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### Introduction

Infrared electrical inspection should be an integral part of any electrical preventive maintenance (EPM) program. This type of inspection can help save money by verifying equipment is operating at peak efficiency and reducing costly downtime in the event of electrical system failure. It also can help save the costs associated with the damage that a fire may cause if an electrical system overheats or fails catastrophically. This inexpensive inspection program has evolved into a valuable preventive maintenance tool. The following information discusses the benefits of infrared inspection and explains how the inspections are conducted.

### What is infrared radiation?

In the early 1800s, Sir William Hershel discovered that when sunlight was directed through a prism, the resulting colors could aid him in an experiment. When moving a blackened thermometer across the spectrum of colors, he found that the heating effect increased toward the red. As he moved the thermometer to the dark portion beyond the red end of the color spectrum, the heating effect continued to increase. He found that the maximum heating effect lies considerably beyond the red end of the spectrum. The heating effect continued to increase past the red, in a region that is now called infrared (“below red”). He measured radiation effects from fires, candles and stoves and deduced the similarity of light and heat. Today, devices can be designed to detect, amplify and display radiation from the visible or infrared portions of the spectrum.

### Using infrared thermography for electrical preventive maintenance

Using infrared technology as part of an electrical preventive maintenance program works on the principle that electrical equipment normally gives off heat, but malfunctioning or overloaded electrical equipment will give off excessive heat due to increased electrical resistance. This heat can be detected with the use of infrared imaging equipment. Using an infrared camera or video recorder, the heat can be converted to an image that can be seen and recorded for analysis. The infrared camera can display various temperatures that are being recorded and the temperature differential between “normal” and malfunctioning equipment. The images can be used to identify exactly what equipment is affected and how serious of a problem exists based on temperatures and temperature differentials. The images can be inserted into a report to help explain the problem and any suggested repairs or improvements.

Thermographic inspection should be scheduled prior to a major scheduled shutdown. This allows the greatest flexibility in resolving problems found during the inspection. Infrared inspections are a non-destruction test that should be completed during normal business operations while equipment is running at or near capacity. Equipment should run for at least one hour before scanning. There is no need for downtime or special teardown of the equipment to perform the inspection. However, equipment covers must be removed to ensure effective scanning. Because busway conductors are so close to enclosures, the covers may not need to be removed.

### Benefits of infrared inspections

Detecting electrical hot spots allows for repair or replacement of the affected equipment before failure occurs. Repair or replacement of malfunctioning equipment prior to failure can help save the much greater costs associated with manufacturing downtime, production losses, power outages, fires and other catastrophic losses that can occur if equipment is allowed to operate until failure. Not all failures can be detected using infrared thermography because sometimes the process of heating and failure occurs too rapidly to be detected. But a regularly scheduled infrared thermographic survey can help to prevent many electrical failures. Some of the benefits of conducting an infrared inspection include the following:

- Reduce the potential for personal injury and damage to buildings and equipment by making sure the electrical equipment is repaired or replaced prior to failure.
- Minimize charges on monthly electric utility bills by making sure equipment is performing at peak efficiency.

## Infrared inspection

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- Lower the cost of ongoing equipment repair and replacement by performing regular maintenance. If you wait for equipment to malfunction it can cause damage to other electrical equipment both up and down stream of the failure. The resulting loss can be more widespread than you realize.
- Avoid the disastrous effects of electrical outages on plant production schedules and customer commitments.
- Avoid the costs of temporary repairs to get production operating until full repairs can be completed.

### Equipment to be inspected

Depending on a company's operations and type of electrical usage, a variety of equipment can be tested. The type and scope of inspection should be discussed with a licensed, bonded, electrical contractor that provides infrared inspection. Typically infrared inspections can be completed on a variety of equipment, such as electrical distribution equipment, main switchgear equipment, motor control centers, transformers, electrical motors, high value electronics, circuit breakers, fuses, bus ducts and various other electrical equipment. Infrared inspection also can be used to detect problems associated with overheating on bearings, conveyors, hydraulic equipment and other moving mechanical equipment.

Interestingly enough, infrared cameras or video equipment can be used for production process monitoring, roofing system inspections (indicates moisture soaked areas), steam line leaks and blockages, building heating and cooling equipment, building structural deterioration, termite infestation and various types of surveillance.

### Frequency of infrared inspection

The frequency at which infrared inspections should be conducted depends on the type of operations, environmental conditions, importance of the equipment, electrical current load and the age of the electrical equipment. In general, an infrared inspection should be conducted on electrical equipment on an annual basis. Companies that have high value equipment or processes, higher electrical current load requirements, change out equipment regularly, change processes frequently, or have older wiring and electrical equipment should consider a more frequent inspection regimen. The frequency and scope of inspection for each individual facility should be discussed with a licensed, bonded, electrical contractor.

### Infrared inspection costs

The cost of the inspection will vary by contractor, type of equipment used, and the depth of the inspection. This type of inspection has become more common and the price has become more affordable in recent years. To obtain a bid for your facility contact a local contractor that specializes in this type of work. Most electricians can either perform the work or refer you to someone who can. Only fully trained competent personnel should perform infrared inspections. Companies that specialize in providing this service can be found in the local yellow pages (under "Infrared Inspection") or you can contact your Travelers Risk Control consultant for assistance.

### Who should do the inspection?

All work should be conducted by licensed electricians that are well versed in working around live electrical equipment. A good infrared contractor will only use licensed electricians that are at least Level 2 certified infrared thermographers using NETA (International Electrical Testing Association, Inc.) or ANSI (American National Standards Institute) training standards. They should also be using modern equipment that produces a full radiometric image for complete analysis of any trouble spots that are detected. NETA is a standards-developing organization for ANSI. NETA promotes the independent electrical testing industry by establishing testing standards and specifications, training and certifying testing technicians, marketing the professional services of its members, and collecting and disseminating information and data of value to the electrical testing industry.

A discussion with one or more licensed electrical contractors should assist you in determining the needs for your organization. Do not hesitate to ask them about their previous clients, training of camera operators and length of experience in performing this type of testing.

Contractors performing an infrared inspection may require the assistance of facility maintenance staff familiar with the building, equipment and who can provide access to all areas in a facility. A contractor should first meet with facility people to discuss the production process, review electrical diagrams, identify key pieces of equipment, discuss safety issues and develop a planned route through the facility. The survey should be performed while electrical equipment remains

## Infrared inspection

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energized at normal operating load. Equipment should run for at least one hour before scanning. Great care regarding safety must be taken when working around energized electrical equipment. Only licensed electricians should open energized electrical panels. All personnel not properly trained on working around energized electrical equipment should be restricted from any area where energized electrical equipment is exposed

### Documentation

Following the thermographic survey, a thorough report should include:

- Overview of the facility, environment and power systems
- Specifications of scanning equipment and techniques
- General summary of survey results
- Detailed list of equipment scanned, results and recommendations
- Survey sheet for each item scanned, containing: thermogram, correlated photo, item identification, problem description, problem cause, recommended action and pertinent data so that future surveys can be compared

### Conclusion

By using infrared technology to perform inspections for an electrical preventive maintenance program, companies can reduce downtime, repair costs and fire hazards. At the same time, they can increase safety, equipment life and productivity. Infrared inspection is non-destructive and can be completed at any time during normal business operations.

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