NFPA 70E and Risk Management – The Decision-Making Process for Performing Thermography Inspections

Craig Nelson, CESW, CESCP

JM Test Systems, Inc.
2001 Bates Drive, Suite 320
Waxahachie, TX 75167

Ph: 225-925-2029 x3122
Web: www.jmtest.com
Email: craignelson@jmtest.com

Abstract

The 2018 edition of the NFPA 70E Standard for Electrical Safety in the Workplace emphasizes performing a risk assessment to determine if a task involving electrical maintenance and, by extension, a thermographic inspection, is an acceptable risk and if so, ensuring that the risk is minimized as much as possible. By the same token, it is also imperative that a thorough risk assessment is performed to evaluate all recognized hazards, utilize the hierarchy of controls to minimize risk to an acceptable level, and if the risk is determined to be unacceptable, either take steps to lower that risk to an acceptable level or make the informed decision not to perform the inspection at all. This presentation will focus on the importance of performing risk assessments to minimize electrically-related hazards in performing thermographic inspections.

Risk Assessment

The first step in performing any task is a risk assessment; in this case, addressing exposure to electrical hazards. This includes:

1. Identify the hazards
2. Assess the risks
3. Follow the hierarchy of risk control methods, implement risk controls

The Hierarchy of Risk Control Methods is as follows:

1. Elimination
2. Substitution
3. Engineering controls
4. Awareness
5. Administrative controls
6. PPE

The first three are designed into the system and are not under the control of the worker, but the last three are.

- Awareness: situational awareness of surroundings and assessing the work area
- Administrative Controls: adhering to rules, standards and procedures
- PPE: properly wearing the appropriate PPE whenever applicable

Failure to properly and conscientiously apply all of these controls, especially the last three, can lead to severe injury or death.

The two primary electrical hazards are electrical shock, and arc flash and blast. They are independent of each other and have distinctly different characteristics. Therefore, a different set of rules, procedures and safety precautions apply to each.

Shock Hazard

The most commonly encountered is Shock Hazard. There are hundreds of electrical shocks every day. Most are not fatal, but too many are. A person is usually shocked by touching an energized circuit, but if the voltage is high enough, close proximity is sufficient for the voltage to flash over to the individual. Fortunately, thermography work can be done at a sufficient distance that electric shock is relatively easy to avoid, but to be certain of it, proper precautions and safe distance are paramount.

There are two safety boundaries that apply to exposed, energized electrical circuits or to components or conductors that have the potential to become energized. In order to avoid the latter, proper lockout and tagout procedure will eliminate it. However, most thermography surveys are best performed with equipment energized and operating normally. Therefore, we will usually have to deal with exposed, energized circuits. Two electrical safety boundaries apply to shock hazards; the Limited Approach Boundary (LAB) and the Restricted Approach Boundary (RAB). These boundaries are determined by voltage magnitude; the higher the voltage, the greater the distance.

The Limited Approach Boundary cannot be crossed by unqualified personnel. In order for them to do so, they must be made fully aware of the hazards and be escorted within the limited approach boundary by a qualified electrical worker, who stays with them at all times. The other one is the restricted approach boundary which can only be crossed by qualified electrical workers wearing proper electrical PPE. While a thermographer could, with appropriate training, cross both boundaries, the most practical, timely and safest approach is using equipment that can perform a proper survey without crossing either one. The boundaries are determined by voltage magnitude so the higher the voltage, the further away a person must be. For example, the LAB from 50 to 750 volts AC is 42 inches, and from 751 to 15,000 volts is 60 inches.

We have to justify performing work on energized circuits. For thermographic surveys, this is pretty easy because to perform an effective survey, equipment has to be in its normal operating condition, which is energized.

Arc Flash Hazard

The other hazard is arc flash and arc blast which are a function of the discharge of incident energy from an electrical fault. There is no table established for determining arc flash boundaries. The arc flash boundary is based on several variables specific to each circuit or piece of equipment and must be calculated. The magnitude of the arc flash is measured in calories per square centimeter (cal/cm^2) and the boundary within which applicable PPE must be worn is contained on an arc flash label affixed to the equipment. The label will also contain other required and optional safety-related information.

Sooo… is thermography considered energized work? Not in the sense that you're coming into physical contact with it, but you could get too close to it. An Energized Electrical Work Permit (EEWP) is required only when you will be working within the RAB or if you interact with equipment that might present an increased likelihood of an arc flash event. Some employers and customers may require an EEWP to open cabinets, remove covers, etc. or work in the vicinity of energized equipment as a safety precaution. This could be very cumbersome in performing a survey in a wide variety of locations. The good news is, there are exceptions!

According to NFPA 70E, 130.2(B)(3), an EEWP is not required if a qualified person uses appropriate safe work practices and PPE in accordance with Chapter 1 to perform certain tasks as long as the *restricted approach boundary* is not crossed and one of those tasks is *thermography* (my emphasis). Three key elements are "safe work practices", "qualified" and "PPE." While no electrical protection is required outside of the RAB, it is very likely that the arc flash boundary may be crossed. In addition to general PPE required on the job, it may be necessary to wear arc flash protection if it is not possible to perform the survey from beyond the arc flash boundary or it is not possible to be beyond it (i.e., no clear space behind it).

We know from the requirements of the NFPA 70E standard that if we want to perform work inside the LAB, we must meet the definition of a qualified electrical worker which is a person "who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk." This is strictly safety-related and does not require a person to also be a qualified electrical craftsman. To eliminate this requirement, you must work outside the LAB, but that means a qualified person must be present to open enclosure doors, etc. for the thermographer to perform the survey.

If the thermographer is going to work inside the arc flash boundary, they must be able to choose and properly wear the applicable PPE and also be able to determine when the arc flash hazard exceeds the ability of PPE to protect them; in other words, when it is an unacceptable risk.

Lastly, if the site has a poor safety record, the maintenance program is inadequate, equipment is in poor condition, or the equipment is exhibiting symptoms of impending failure, these elements may determine a task to be an unacceptable risk as well.

Conclusion

We must have a risk management program that consists of a risk assessment procedure with all the components necessary to determine if a task can be performed safely and to clearly determine when it cannot so that the likelihood of injury is kept to an absolute minimum while at the same time, getting the job done safely, efficiently and in a timely manner.