

Electrical Safety IN THE WORKPLACE



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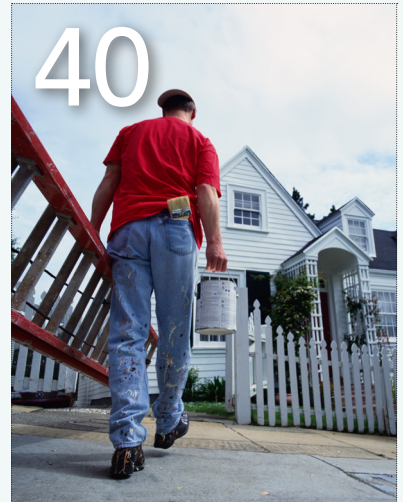
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PUBLISHER'S NOTE

National Electrical Safety Month is HERE!

May is an important month for our industry – it's National Electrical Safety Month. Lots of organizations put energy and resources behind this month, but we should be thinking about electrical safety all year long. Many of you will see almost daily newsletters this month about electrical safety, so when you have some time, take a few minutes to read them. There are some great resources in them, website links, and industry knowledge to keep you and your workers safe when working around electricity. Looking at this month's issue, make sure you check out a couple of these must-read stories:

- OSHA Arc Flash Update and the Myth of De-Energized Work. Read an update from OSHA regarding arc flash... and do you know the myth surrounding the idea of de-energized work?
- Electrical Safety Statistics: Why Workers Are Still Dying on the Job: A look at how to reduce electrical fatalities and injuries in the workplace.
- A Q&A with Bret Bevis, Managing Director of SEAM Group Asia on "The Ins and Outs of an Infrared Inspection Service."

Putting some focus on this month, according to the Electrical Safety Foundation International (ESFI)*, there were 126 electrical fatalities in 2020 - a 24% decrease over 2019. However, there was a 10% drop in total hours worked in the U.S. in 2020. Contact with / exposure to electric current accounted for 2.6% of all fatalities in 2020. In 2020, 5.3% of all electrical incidents were fatal. Hispanic or Latino workers accounted for 40% of electrical fatalities - a 24% increase over 2019. Constructing, repairing, and cleaning accounted for the leading worker activity for electrical fatalities at 64%. *esfi.org. Workplace Injury & Fatality Statistics - Electrical Safety Foundation International (esfi.org)

Electrical-related incidents are a serious risk to people and productivity. The National Fire Protection Association offers a wide range of solutions dedicated to enhancing electrical safety in the workplace. These include self-paced online training, or live training (virtually or at your facility) All training is done by industry experts who helped develop the codes. Expert certifications, best practices, up-to-date information about standards and compliance support are also available. Visit www.nfpa.com for more details.

Here is a story from our archives (electricalsafetypub.com) that you might want to check out as well: Using Technology to Enhance Electrical Safety - While there is a lot of important and useful information on the arc flash warning label, the concern is how quickly that new arc flash label no longer accurately represents the hazards that exist at the present time.

Enjoy this issue, work safe, and take advantage of the National Electrical Safety Month resources that are available to you.

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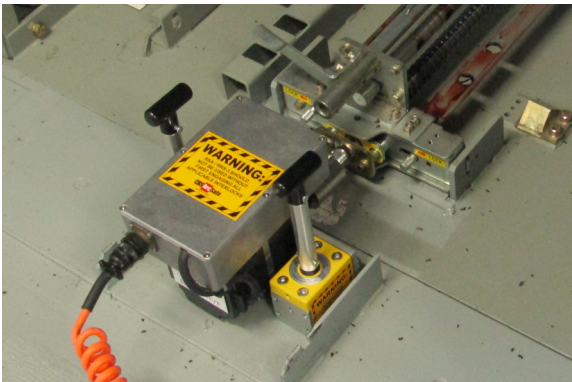
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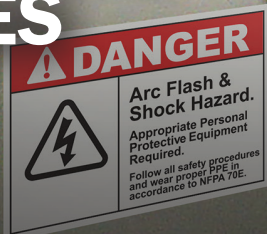
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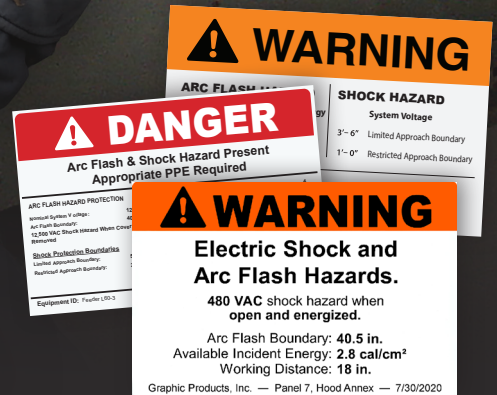
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Understanding The Arc Flash Danger: How Bad Could It Be?

By Derek Vigstol, Contributor

It's no secret that arc flash and arc blast are real hazards that present themselves when working with and around electrical equipment. And with regulations, such as OSHA, mandating that workplaces be free from known and recognized hazards, we all have a responsibility to do everything we can to mitigate the risk of injury to employees from arc flash/blast. However, if we are going to protect individuals from the hazards, we might want to have an accurate idea of just what those hazards entail. This means having a rock-solid understanding of the arc flash risk assessment process to determine which strategy is needed to protect the worker.

Let's start by looking at what the risk assessment process is supposed to provide. During the risk assessment procedure, our main goals are to determine if the employee is exposed to a hazard during the course of the task at hand, determine what risk level the employee is exposed to, and then determine what they are going to do about it to stay safe. With risk being defined as the combination of how likely an injury is to occur and the possible severity of said injury should it occur; we see the structure of the risk assessment process start to take shape. Basically, we must ask ourselves, "Is what we are about to go do likely to cause an arc flash and, if so, how bad is it going to be?"

Industry seems to have a pretty good handle on estimating how likely an arc flash is to occur; however, when it comes to estimating the severity, there seems to be a bit of an issue as to what needs to be done. NFPA 70E®: Standard for Electrical Safety in the Workplace® points us to two

options for estimating the severity of an arc flash: Incident Energy Analysis (IEA) and The PPE Category Method. Either of these methods can be used to provide the needed information for the selection of PPE employees must wear to protect themselves when the risk has not been lowered to a satisfactory level by other means within the hierarchy of risk control methods, such as hazard elimination or engineering controls. However, if you are like this author and a stickler for the details, there is one clear winner when it comes to accuracy in estimating the severity of an arc flash, and that is the incident energy analysis.

THE INCIDENT ENERGY ANALYSIS

IEA involves a full-on study of the equipment in the system, the available energy during fault conditions, and calculates the amount of thermal energy released based on the estimate of what the arcing current might be at that point in the system and how long the arcing fault will be allowed to persist based on the clearing time of the upstream overcurrent protective device. This study will also estimate where the arc flash boundary needs to be established, which is the distance at which the incident energy equals 1.2 calories per square centimeter. However, the downside to this method is that if it has not been performed prior to the work being performed, it isn't very realistic to quickly whip out an incident energy analysis as the employee is standing in front of the equipment ready to go to work. That is where the PPE Category Method becomes important.

The importance of the risk assessment method used takes a back seat to the reality that a labeled work environment is a safer environment with respect to arc flash because it removes the pressure to accurately assess the arc flash risk on the fly.

THE PPE CATEGORY METHOD

Performing an arc flash study or incident energy analysis also often leads to the equipment being labeled with the results of the study. This is a huge benefit to those exposed to the arc flash hazard because the results of the risk assessment are pre-populated at the point of work or close by. This isn't to say that a label can't be made using the PPE Category Method, because it absolutely can be used for the label information, but it is the experience of this author that facilities with an IEA performed tend to have a higher probability of having these labels installed. This is optimal for employees who must wear PPE to mitigate the risk as they simply need to select arc-rated PPE that exceeds the value on the label for any body part that will cross the arc flash boundary. There is also a table in NFPA 70E® that gives guidance as to what articles of PPE this entails based on the severity of the hazard, Table 130.5(G).

Understanding exactly how to apply the PPE Category Method becomes a bit more confusing than when an IEA has been performed. However, it has served as a useful tool for employees without the benefit of access to the results of an IEA. Simply put,

the PPE Category Method is an attempt to categorize equipment by equipment type, amount of available fault current, and the type of upstream overcurrent protective device that will be interrupting the fault should one occur. It is more of a situational response or a sort of, "If you have a panelboard connected to a system capable of supplying no more than this many amps for this amount of time, then this level of PPE should reduce the severity of injury to a survivable level" kind of approach. Not super accurate on understanding the exact risk, but it is better than not doing anything at all. Let's face it, people rarely are injured or killed because they aren't wearing enough arc-rated PPE; they are injured or killed when they aren't wearing any PPE at all.

Whichever method is utilized, it becomes more important that we stress how beneficial it can be for the protection of employees to have this information provided beforehand. The importance of the method used takes a back seat to the reality that a labeled work environment is a safer environment with respect to arc flash because it removes the pressure to accurately assess the arc flash risk on the fly. Employees that must make heads or tails of this process are doing so while also juggling pressure from several other influences. Providing a labeled environment simplifies the process for those affected and reduces the potential impact of human error. Failing to take this crucial step is failing to provide employees with a workplace where every effort has been made to protect them from the hazard of arc flash. **ESW**

Derek Vigstol is an electrical safety consultant for E-Hazard and co-host of E-Hazard's electrical safety podcast, "Plugged Into Safety." E-Hazard is the industry leading provider of electrical safety consulting & training services (www.e-hazard.com).



Risk Management in Electrical Utilities

How to boost operational resilience and respond to emergencies.

By Roger Guerrero, Contributor

Electric utility companies face threats every day, whether natural disasters or emergencies caused by people. Historic cold streaks have battered power systems in the South and glitches have shut down three times more power than expected during rolling blackouts in Louisiana. Devastating wildfires have downed, and been caused by, electric utilities in the West. Whether preparing for a hurricane, life-threatening tornado, or a severe winter storm, utility companies must incorporate strong risk management to stand resilient in the face of adversity. Disruptions such as operational and system failures can bring long-lasting damage to both communities and electric utility providers, and leaders must make changes to increase operational

resilience and situational awareness.

Electrical utilities can strengthen their organization's operational resilience by focusing on clear communication between public and private sectors to make the right decisions. This starts by reviewing the latest state and federal standards on preparedness, helping utilities avoid costly fines and legal exposure due to a failure to act proactively or react to adverse conditions. A lack of regulatory compliance can also lead to reputational damage for your organization – a potential threat to business continuity. Incident management technology will empower electric utility organizations to adapt to regulatory changes, avoid litigation, and improve operational resilience.

Here are some ways that utility provid-

ers can improve risk management and boost operational resilience.

ASSESS EMERGENCY PREPAREDNESS

The first step in improving operational resilience is to assess the level of preparedness for emergencies and the range of capabilities accessible for a strong response. By routinely assessing emergency preparedness, the chances of property, facilities, and equipment suffering severe damage will decrease. Emergency preparedness also ensures that utility companies meet regulatory standards and avoid costly downtime. During this assessment, identify points of failure that require a shore up. The key to emergency preparedness is collaborating with stakeholders to share real-time data across existing networks and infrastructure.

BUILD A COMMUNICATION PLAN

Utility providers must create executive communication plans that serve both their internal and external partners. To work together to achieve true operational resilience, efficient data exchanges across internal and external teams and processes through the use of technology is critical. Technologies that enable reliable communication between essential parties and support an active response and recovery lead to faster communications and better incident responses. They enhance utility providers' situational awareness, a key component in the grand scheme of resilience. Automation, for example, makes incident management more effective and allows local and state agencies to stay connected during emergencies for optimal awareness and coordination of response and recovery. Proper communication also supports the social well-being of local communities.

MAP RESPONSES TO POTENTIAL THREATS

Provide access to detailed maps to aid in both initial response efforts and later repair and



Detailed mapping is invaluable for first responders as they prepare for and respond to potential threats. *Photo courtesy of Juvare.*

restoration work. Detailed mapping is invaluable for first responders as they prepare for and respond to potential threats. They will need to remain aware of utilities' infrastructure and activities in the field, a critical component for utility crews and first responders to remain aware of evacuation status and right to return orders. More detailed maps that show emergency locations, area conditions, and whether electricity is still active in certain areas will also

RISK MANAGEMENT IN ELECTRICAL UTILITIES

ensure everybody is on the same page. In addition, mapping lets you track dispatched personnel and ensure they are connected to the resources they need to respond to the emergency. After the threat is mitigated, detailed maps can support a coordinated and efficient restoration effort by showing priority issues, tracking which areas have been brought back online, and enabling better communication between incident commanders and crews in the field.

PARTICIPATE IN REGULAR DRILLS AND TABLETOP EXERCISES

In 2022, utility crews maintain situational awareness during a natural and human-caused disaster by using software to maintain daily logs and share data with third-party response teams. Software tools keep utility providers ready through drills and tabletop exercises that prepare teams for all sorts of disasters. Keep emergency readiness apps accessible on digital devices and conduct routine trainings and drills to ensure everyone understands how to use the technology. Utility providers should deploy both surprise drills and scheduled drills that occur at least once every quarter.

COMPLETE THE PLANNING LOOP

The final step in building operational resilience for utility providers involves completing the loop and planning and practicing for a successful recovery. Following a disaster, you will return to operations through a process that requires planning and reviewing the recovery. Re-evaluate goals and learn from past mistakes to prepare for subsequent recoveries. Emergency management systems and processes, in combination with a work culture that always looks a few steps ahead, keeps emerging threats in view and helps ensure the response to future disasters will be even more successful.

OPERATIONAL RESILIENCE FOR THE FUTURE

Being prepared for emergencies through maintaining an effective risk management strategy comes down to maintaining reliable communication channels between all integral parties, including power plants, first responders, EMTs, and government officials – a single source of truth for all stakeholders. Using helpful software tools with integrated emergency management can automate processes and maintain visibility across where your organization should manage risk and bolster defenses. Whether it is a wildfire out West or a hurricane in the East, the right level of operational resilience will keep utility providers prepared with a quick response plan for the next time disaster strikes.

Roger Guerrero is Director of Business Development, Juvare (www.juvare.com).

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Five Ways to Protect Workers During Plant Turn-Around or Shutdowns

By Brian Earl, Contributor

When creating a project plan for plant shutdowns, there is one aspect you can't compromise on: employee safety. Although each facility is different, there are several common denominators when it comes to safety concerns. Below are 5 ways you can protect your workers on the job site:

WET LOCATION PROTECTION

Anywhere indoors, outdoors, or underground that is vulnerable to moisture is considered a wet location. Protecting enclosures and connections from hose down cleaning or other forms of exposure significantly decreases the possibility of electrical shock.

Per the National Electrical Manufacturers Association (NEMA), equipment should have a rating of 3R or 6P. 3R products protect against water intrusion and have covers over any connector locations. 6P is the more robust of the two ratings and enables the connection to safely operate temporarily while submerged in water. Be sure to utilize equipment that has the proper NEMA rating for your application.

Measures should be taken to prevent the space from energizing and shocking the worker. This is easily achieved by utilizing either GFCI protection or a low-voltage power supply.



HAZARDOUS LOCATION PROTECTION

The National Electric Code (NEC) quantifies hazardous location based on the environment's type, condition, and nature. The most common rating for refineries is Class 1, which pertains to gases, liquids hazards, and vapors. The Condition establishes whether the exposure is normally present (Division 1) or may accidentally exist (Division 2). Finally, the Nature specifies the ignition temperature of the substance, the explosion pressure, and other flammable characteristics.

In order for equipment to withstand these areas, each piece will be required to have these characteristics:

- Explosion proof: Strength, durability, and the capability to withstand the internal strain of an explosion
- Well-Established Flame Path: Controlled escape path for exploding gases, where gases are able to cool while flames are extinguished. Several types exist, such as threaded and grounded surface.
- Special Fittings and Seals: Prohibits hot gases from traveling through the conduit

FIVE WAYS TO PROTECT WORKERS

system, blocks flammable dusts from entering dust-ignition-proof enclosures, and prohibits ignition in other areas of the closed system.

CONFINED SPACE PROTECTION (NON-PERMIT)

A confined space (non-permit) is an area that can handle temporary occupancy, but has limited access to the entry or exit, such as manholes, tanks, and vessels. Measures should be taken to prevent the space from energizing and shocking the worker. This is easily achieved by utilizing either GFCI protection or a low-voltage power supply.

This part of the project is also an excellent time to review your in-house safety procedures. Although OSHA currently allows companies to use either of the two solutions previously noted, some businesses require low voltage lighting regardless of the project scope.

AUTOMATIC POWER SOURCE & LINE QUALITY MONITORING

When there's a ground fault, wiring error, loose wire, or other failure mode, a best-case scenario is the equipment can be damaged. However, there are more serious consequences at stake - workers can be exposed to electrical shock and seriously injured.

To combat this risk, take advantage of a power source and line quality monitoring device. These products quickly alert operators of any problems via indicator lights in both the plug and connector ends of the cord set. One color signifies the wiring is correct and safe while the second color indicates a dangerous situation exists (loss or discontinuity of wiring conductors). When a red color indication is present on either end of the cordset, a dangerous situation exists and this receptacle or cordset should not be used until the situation is corrected.



CABLE PROTECTION

It is especially important in a heavy industrial environment to take precautions to protect your equipment. A cable failure can lead to downtime for your machinery, while cables with weakened outer insulation can expose workers to shock hazards.

Because heavy vehicular traffic is often present, cables must be properly protected from damage. The most popular and convenient means are nonmetallic portable cable ramps. These units are comprised of two elements: a ramp on either side of the cable, as well as a central section that conceals the cable with a lid.

When selecting a cable protector, double check that the weight load rating is appropriate for your application. For some added insurance, you can opt for a slightly higher rating than you anticipate you'll need.

Plant shutdowns are a complex, time-consuming endeavor. Selecting the proper equipment can streamline the project and help it stay within budget, but more importantly, workers will be protected in all areas of the job site. **ESW**

Brian Earl is VP Marketing & Sales, Ericson Manufacturing. Learn more about Ericson product solution for demanding jobsite environments by visiting www.ericson.com

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Avoid Arc Flash Occurrences with Preventive Measures

Adhering to NFPA standards and safety best practices are the best deterrents.

By John Foged, Contributor

Today's dependence on electrical energy has led to a lower tolerance for any outage. To meet these expectations, electrical workers are being pressed to perform maintenance work on energized electrical equipment. In addition to the electrical shock hazard that results from direct contact of live conductors with the body, workers are exposed to the risk of injury due to the accidental initiation of electric arcs. Arc flash injuries can occur without any direct contact with energized parts.

An electric arc, or an arcing fault, is the flow of electric current through the air from one conductor to another or ground. When an arc fault occurs, there's an immense electrical explosion. Both arc flash and arc blast are separate byproducts of that electrical explosion. The arc flash is the light and heat from the explosion, while the arc blast is a pressure wave that follows. Electrical hazards, specifically arc flash and arc blast, can potentially result in severe injury or even death of electrical workers. Exposure and risk to arc flash hazards have increased due to higher voltages and available fault currents in electrical systems.

Temperatures of an arc flash can reach as high as 2,800 to 19,000 °C (5,000 to 35,000 °F). For perspective, the temperature of the sun's surface is estimated at 5,500 °C (9,932 °F). Temperatures that high can ignite the clothing and burn the skin of anyone within a few feet. Air expands dramatically when heated to these temperatures, and arcing can instantly vaporize metals like copper or steel. The ensuing shock waves result from the rapid expansion of air and metal vapors like those produced in an explosion and can pulverize concrete walls. Too often, employees who are not wearing personal protective equipment (PPE) are seriously



Optimal PPE plans need to fully protect employees while addressing all relevant OSHA standards to ensure compliance.

injured or killed if an electrical arc occurs when they are working on it.

It's estimated that between five and 10 arc fault incidents occur every day in the United States, based on the Bureau of Labor Statistics findings. The result is more than 30,000 injuries and 400 deaths annually, with approximately 80% of the fatalities due to burns, not shocks. Avoiding such instances takes diligence and results in a safer workplace.

START WITH AN ARC FLASH STUDY

Every arc flash safety program should begin with an arc flash study to calculate how much energy an arc flash could release at various points along the power chain. Accuracy is essential with such measurements, so plant managers who lack direct and extensive experience with arc flash incident energy assessment should always seek assistance from a qualified power systems engineer. A detailed study should include the following steps:

1. Identify all locations and equipment for arc flash hazard assessment.
2. Collect data:
 - a) Equipment data for short circuit study: voltage, size (MVA/kVA), impedance, X/R ratio, etc.
 - b) Equipment data for protective device characteristics: type of device, existing settings for relays, breakers, and trip units, rating amps, time-current curves, and total clearing time.
 - c) Equipment data for arc flash study: type of equipment, type of enclosure (open-air, box, etc.), the gap between conductors, grounding type, number of phases, and approximate working distance for the equipment.
 - d) All power system equipment, their existing connections, and possible alternative connections.
3. Prepare a one-line diagram of the system.
4. Perform a short circuit study:
 - a) Calculate bolted (available) 3-phase fault current for each piece of equipment.
 - b) Calculate current for every contributing branch and load.
5. Determine expected arc current:
 - a) Calculate arc current.
 - b) Calculate branch currents contributing to the arc current from every branch.

6. Estimate arcing time from the protective device characteristics and the contributing arc current passing through this device for every branch that significantly contributes to the arc fault.
7. Estimate the incident energy for the equipment at the given working distances.
8. Determine the arc flash boundary for the equipment.
9. Document the assessment in reports, one-line diagrams, and appropriate labels on the equipment.

An arc flash study is not a “one-and-done” type of study. The NFPA requires the analysis to be updated every time significant changes occur in the electrical system or at intervals not to exceed five years. In addition, there are mandatory audit procedures imposed by NFPA 70E: An electrical safety program should be updated at least once every three years. Fieldwork should have time intervals not to exceed one year. Your Lockout/Tagout (LOTO) program and procedure will require updating once a year.

Lack of compliance may expose workers to unknown hazards and severe financial penalties.

In addition to the arc flash study, make sure your electrical reliability services partner provides a complete solution, including the following tasks and activities:

- Site review/compliance assessment
- Protective scheme design review
- Electrical safety program review/development
- Training and performance evaluation
- PPE plan
- Preventive maintenance
- Annual recertification

PROTECTION THROUGH ELECTRICAL SAFETY TRAINING

The NFPA 70E: Standard for Electrical

AVOID ARC FLASH OCCURRENCES

Safety in the Workplace states that “Hazard elimination shall be the first priority in implementing safety-related work practices.” The proper use of safety equipment, knowledge of electrical hazards, and proper response in an electrical disaster are essential for all electrical personnel or those working on or around electrical equipment.

An electrical safety program should be designed to provide personnel involved with operating and maintaining a power distribution system with the knowledge, skills, and abilities to meet the NFPA 70E training requirements to be considered a “qualified” electrical worker by NFPA standards. The electrical safety program is a requirement imposed by the NFPA 70E standard and must be implemented as part of your overall occupational health and safety management system. An optimal training program should always be tailored to your specific needs and may include, but not be limited to, the following:

- Procedures to be used before employees exposed to electrical hazards start working
- Risk assessment procedures that need to address the potential for human error and its negative consequences
- Proper major electrical component operation/maintenance with manufacturer instructions
- Applicable testing and maintenance recommendations from ANSI/NETA, MTS, or NFPA 70B: Recommended Practices for Electrical Equipment Maintenance
- Site and equipment-specific safety hazards and mitigation techniques
- Lectures, presentations, and hands-on demonstrations to provide maximum possible exposure to power distribution system safety, operations, and maintenance requirements

- Emergency response and safe release methods
- A method for investigating electrical incidents (NFPA 70E requirement for incident investigations)

PREVENTIVE MAINTENANCE MAINTAINS COMPLIANCE AND SAFETY

NFPA 70E requires maintenance on electrical equipment following manufacturers’ instructions or industry consensus standards. Your partner of choice for electrical reliability services should assist you in developing a preventive maintenance program to address arc flash hazards specifically. An optimal program needs to evaluate equipment conditions and determine the most cost-effective and manageable solution to ensure your protective devices operate correctly, safely, and reliably. Proper maintenance will ensure that you comply with the NFPA 70E requirements permitting regular operation of equipment, reducing hazards, thus often allowing tasks to be accomplished safely and without extensive PPE.

Optimal PPE plans need to fully protect employees while addressing all relevant OSHA standards to ensure compliance. Ideally, before work is performed on or around electrical equipment, it must be de-energized, if possible. Otherwise, recommendations for the minimum protective equipment workers must wear when they are near exposed energized equipment should be based on the arc flash risk assessment findings and calculated incident energy (IE) values. The plan also should cover how PPE should be worn, maintained, and disposed of at the end of the equipment’s life.

DO YOU MEET COMPLIANCE STANDARDS?

If you answer “No” to any of the following questions, then the chances are you may not be compliant.

- Is your arc flash hazard plan documented?
- Does your documentation include the results of the previous arc flash risk assessment and arc flash training?
- Have the single-line diagrams been updated following any changes in your electrical infrastructure?
- Do you have current signs and labels on equipment and at hazardous areas?
- Do all labels include the type, name/ID, incident energy at working distances, flash protection boundary, arc flash PPE category, shock protection information, date of analysis, and the certifying person per OSHA 29 CFR 1910.132 (d)(2)?

PLANNING FOR THE FUTURE

Arc flash hazards are very serious, and it takes more than a label to ensure the safety and well-being of your employees while making sure that your critical assets are also protected.

Consider the financial and safety impact of ignoring these types of recurrent and mandatory studies. Then, wisely prioritize budgets to ensure funding is available for current study needs, future updates, and ongoing training requirements. **ESW**

John Foged, CSM, REM, is the Environmental, Safety & Health Manager at High Voltage Maintenance (hvmcorp.com) and has been a safety, environmental, health professional with over 30 years of experience working in the electrical safety and environmental field.

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The Ins and Outs of an Infrared Inspection Service

A Q&A with Bret Bevis, Managing Director of SEAM Group Asia.

WHAT IS INFRARED TECHNOLOGY AND HOW DOES IT WORK?

Infrared thermal technology detects abnormal thermal patterns that can indicate a defect exists. We use infrared devices and cameras with sensors that give us a radiographic image that plots temperature. Most operating equipment has a thermal signature. If the image found by an infrared device doesn't look right or if the temperature is warmer than it should be, you know there's a problem.

HOW DOES INFRARED TECHNOLOGY MINIMIZE THE RISK OF ELECTRICAL FAILURE AND FIRE?

By using infrared technology in electrical

inspections, you're able to increase the safety and reliability of your equipment, while also reducing the risk of fire or downtime. Infrared technology helps you determine problems and criticality before a serious issue occurs. And given the fact that poor electrical connections are overwhelmingly the main factor in fires and other dangerous situations, this is critical to minimizing risk.

WHAT'S INCLUDED WITH AN INFRARED INSPECTION SERVICE?

Infrared inspections should be carried out by certified thermographers. They use their qualified training to execute all phases of the inspection. This includes making sure

THE INS AND OUTS OF AN INFRARED INSPECTION SERVICE

equipment covers are removed so there is a direct line of sight to electrical connections during the inspection. An infrared device is used, along with a digital camera, to properly document any issues with the equipment. Then, the criticality of each issue is determined, and the recommended repair noted.

WHY IS IT IMPORTANT TO IDENTIFY POTENTIAL RISKS AND THREATS IN MY COMPANY'S ASSETS, FACILITIES, PROCESSES, AND DOCUMENTATION?

Safety. Infrared inspections improve the safety of your people and the reliability of your energized assets. Electrical failures can occur over time. The key to avoiding the risk of fire, injuries, costly remediation, unavoidable downtime, and even insurance cost spikes, is regular predictive maintenance that utilizes infrared technology.

HOW DO I KNOW IF I NEED INSPECTION SERVICES?

A good question to ask yourself is, "Do I use electricity?" If the answer is yes – which it probably is – then you need inspection services. The National Fire Protection Association recommends infrared inspections at least once per year, and many insurance companies may actually require these types of services. Another good question is, "Do I want to save money?" By staying on top of your maintenance with inspection services, you'll enjoy inherent energy and cost savings.

WHAT ARE THE BENEFITS OF WORKING WITH AN ASSET MANAGEMENT AND OPTIMIZATION COMPANY?

These types of companies should offer certified, qualified professionals to help manage and optimize your energized assets. They will also likely provide additional, complementary services like lockout / tagout programs and arc flash hazards assessments

that can help ensure a comprehensive approach to safety, reliability, and maintenance. **ESW**

Bret Bevis is a Managing Director at SEAM Group LLC, a global leader in energized asset performance-focused on delivering safety, reliability, and maintenance solutions to some of the world's largest companies. Inspecting more than one million assets per year, SEAM Group offers a proven platform that combines strategic advisory and consulting services, custom training, advanced technology, and actionable data management to position customers for success (www.seamgroup.com).

Knowledge That Saves Lives



This practical guide provides an overview of electrical safety in the workplace. Both OSHA regulations and the NFPA 70E® 2021 standards are covered to provide an overview of proper electrical safety procedures. This resource, when used with NFPA 70E, is a valuable aid in preparing for the CESW and CSCP certification programs.

Key topics include:

- Methods for choosing and inspecting PPE
- Performing a risk assessment
- Training qualified and non-qualified workers

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Lockout/Tagout Compliance

Implementing a world-class management system.

By Ricky Rodriguez, Contributor

Implementing a Lockout/Tagout (LOTO) is often mistaken as just developing procedures and training. This article will help explain what encompasses an effective Lockout/Tagout management system and best practices.

Lockout/Tagout compliance prevents 120 fatalities and 50,000 injuries a year, with injuries that can vary from amputations to electrocution. LOTO applies to both affected employees and authorized employees. The OSHA regulation reference for lockout-tagout is 29 CFR 1910.147.

The two most significant root causes of cases I have investigated throughout my years of experience are lack of training and complacency. When drilling into the root causes of accidents involving LOTO, the leading causes of accidents are:

- Lack of machine-specific procedures
- Failure to identify machine energy sources correctly
- No training for new hires
- No training for affected employees (only authorized)
- No lockout/tagout safety orientation for contractors and visitors
- Lack of communication between affected and authorized employees
- Failure to stop equipment
- Failure to apply locks and tags
- Lack of compliance enforcement (supervision)

When it comes to implementing a Lockout/Tagout system, writing procedures and training employees are only part of the program. A LOTO management system consists of various elements:

- Written lockout/tagout policy (describes

what your machine lockout program requires)

- Inventory of equipment that requires lockout/tagout
- Inventory of padlocks and isolation devices
- Machine-specific procedures available for all work shifts
- Training (affected and authorized employees)
- Safety orientation for contractors and visitors
- Annual procedure audits
- Annual "authorized employee" procedure performance audits
- Procedure for abandoned lockout removal
- Periodic lockout program assessment

Lockout/Tagout applies to machines with multiple energy sources or when the energy source is not under the employee's immediate control. Employers must provide training to authorized and affected employees.

Written procedures must be machine or equipment specific to guide employees through the proper steps for isolating energy sources. Writing machine-specific lockout procedures requires knowledge of the machine energy sources and means for isolation. Identifying energy sources correctly in the lockout procedure is very important. Examples of energy sources and isolation methods are:

- **Electrical:** Physical Interruption (e.g., breakers, switches)
- **Hydraulic/Pneumatic:** Physical Isolation (e.g., Ball Valves)
- **Chemicals:** Physical Isolation (e.g., Ball or Gate Valves)

LOCKOUT/TAGOUT COMPLIANCE

- **Dangerous Gases:** Removal or line disconnect with end caps or blind flanges.
- **Heat:** Time to cool down to a safe temperature
- **Kinetic:** Time to come to a complete stop
- **Gravity:** Install jacks, safety bars, etc.

Labeling machines clearly in the lockout procedure is essential to guide the employee through the isolation steps. Applying these labels to the energy point is an excellent way to help the employee find the isolation points.









When writing machine-specific lockout procedures, avoid using generic steps. A straightforward lockout procedure identifies every isolation point and details what isolation device to use and how to apply it. Lockout devices (e.g., ball valve, switch, or breakers lockout devices, etc) can be confusing. I often see devices installed incorrectly, and it all comes down to a lack of training.

The order of lockout steps may impact the machine-specific lockout procedure. These steps must be clear to avoid human error or confusion. Consider writing detailed steps for bringing the machine back to normal operations.

Machine-specific lockout procedures need to be available to employees for all working shifts. Lockout procedures can be either affixed to the machine or in a binder near the equipment operations.

Testing for machine isolation is one of the most crucial steps in the LOTO process after the machine is locked out. Employers must train employees to test the devices for energy isolation before performing work. Testing is how employees can verify that:

- The lockout procedure is the correct one
- Isolation points are labeled correctly

 P-1 PNEUMATIC AIR 130 PSI	1 Lock 1 Tag 1 Ball Valve Device 	1. Yellow ball valve located behind the feeder. 2. Close P-1 and install a ball valve lockout device. 3. Apply lock and tag.
 P-2 PNEUMATIC AIR 130 PSI	1 Lock 1 Tag 1 Ball Valve Device 	4. Yellow ball valve located behind the feeder above P-1. 5. Close P-2 and install a ball valve lockout device. 6. Apply lock and tag.
 P-3 PNEUMATIC AIR 130 PSI	1 Lock 1 Tag 1 Ball Valve Device 	7. Yellow ball valve located left side of the feeder to the wall (middle valve). 8. Close P-3 and install a ball valve lockout device. 9. Apply lock and tag.

LOCKOUT/TAGOUT COMPLIANCE

- Machine isolation points have not changed
- No damage to the isolation points or lockout devices

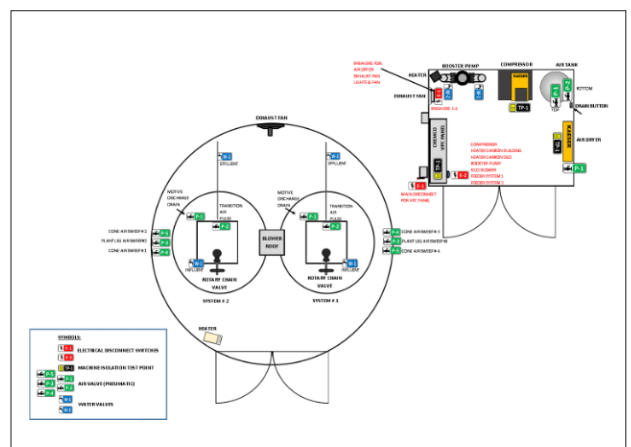
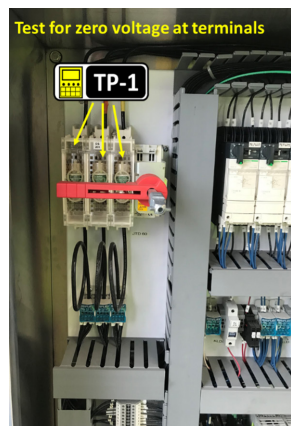
Machine testing techniques will depend on the machine's capabilities. The most efficient method to ensure the device is safe for maintenance is testing for the absence of voltage with a calibrated meter. However, arc flash hazards need to be considered in this case. Therefore, training/qualifying employees in arc flash hazards and proper arc flash PPE is crucial when testing machines for zero voltage. Machine lockout procedures should identify test points and provide clear instructions on testing machine operation.

Machine signage, labeling of energy sources, and lockout/tagout maps are best practices that improve the machine lockout performance. Labeling machine isolation points is also a best practice to improve the identification of energy sources and testing points.

Mapping machine isolation points is another good practice for implementing a world-class LOTO program. Maps significantly reduce confusion and human error by identifying energy sources for isolating machines. It is also an excellent tool for training employees on the production line and providing safety orientation for contractors working in the facility.

A sustainable lockout/tagout program requires audits by employees knowledgeable about the operations. There are three types of audits for the implementation of a compliant lockout management system:

- Lockout/tagout program audit
- Machine specific procedure audit
- Authorized Employee audit



ISOLATION POINTS	Process Area:	Packing Area	
9	Machine Description:	Packer #2	
NEXT AUDIT DUE SEP 2020	NEXT AUDIT DUE SEP 2021	NEXT AUDIT DUE SEPT 2022	NEXT AUDIT DUE SEPT 2023
PURPOSE: To remove all energy sources from the equipment to allow maintenance service to be performed safely.			



Using E-Stop buttons or any device intended for machine guarding is not acceptable for machine interruption during minor servicing operations (e.g., blocking light curtains, E-stop buttons, etc.).

Audits are required at least annually to certify that written procedures are accurate. It is essential to document the revision by updating revision dates or placing initials physically on the "Next Audit Due," as illustrated below in a section of a lockout procedure.

Minor servicing is one exception to the lockout tagout process. However, you need to consider alternative measures to ensure a safe method. A minor servicing operation is the need to pause production for services such as

cleaning, adjusting, or maintenance activities that are considered routine, repetitive, and integral to normal operations.

Minor servicing can also include unjamming tasks. However, it is crucial to ensure that energy cannot release during the unjamming process (e.g., overhead, gravity, spring-loaded, etc.)

Examples of alternative measures employees can implement for minor servicing are:

- Keyed control switches
- Interlocked barrier guards
- Local disconnects
- Remote devices

Using E-Stop buttons or any device intended for machine guarding is not acceptable for machine interruption during minor servicing operations (e.g., blocking light curtains, E-stop buttons, etc.). These devices are not effective methods for isolating machine energy.

Implementing a world-class lockout/tagout program can be an easy process when you understand the elements involved. Proper training, developing procedures, annual program audits, and good signage are vital elements for preventing accidents and improving compliance. **ESW**

Ricky Rodriguez is with Electrical Safety Specialists, LLC, Louisburg, KS. For more information about Lockout/Tagout and management system implementation, please contact Ricky Rodriguez (816) 925-0443, ricky_rod_asn@hotmail.com).



Electrical Safety Statistics: Why Are Workers Still Dying on the Job

By Lee Marchessault, CUSA, CUSP, Contributor

Since the beginning of the American Industrial Revolution, workers have died on the job. In the latter part of the 1800s several states adopted different variations of state job safety and health legislation to protect workers, but there was limited enforcement. The introduction of electricity to the workplace provided a more efficient means to manufacture goods but created serious hazardous conditions for workers and frequently caused fires. To address this phenomenon, five different accredited standards from various organizations, such as the insurance industry were developed.¹ The principals of each standard met and formed a committee to determine a means to consolidate the standards. The committee settled on a single standard and the National Code under the directorate trade organization

National Fire Protection Association was born.

The Code, later renamed the National Electric Code (NEC) 1897², was a pivotal action creating a consistent guide for all electrical installations and greatly reducing electrical-related fires. But even with this new standard, electrical fatalities increased as demand for electricity expanded. To address safety concerns, the additional safety standards were promulgated under the Walsh-Healey Act of June 30, 1936.³ And, in the generation, transmission, and distribution of electricity along with communications systems, work began on another standard in 1913. The new National Electric Safety Code (NESC) addressed areas that would not be covered by the NEC. In 1915 the National Safety Council was created to help squelch high levels of fatalities and injuries spawned

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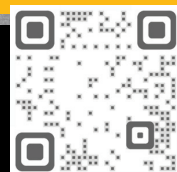
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ELECTRICAL SAFETY STATISTICS

by the steel industry. At the time, the electric industry realized that the primary safety issues were clearance of energized parts, strength of supporting structures, wiring methods, and electrical work methods.⁴

Standards helped address the safety concerns of electrical workers but were only enforceable to a point and did little to hold employers accountable for the safety of their workers. In 1970, OSHA was signed into law by President Richard Nixon. The first electrical safety regulations were promulgated by OSHA. During the 1980s OSHA would develop multiple standards in General Industry, Construction, and Maritime. In addition, the Mine Safety and Health (MSHA) developed their own regulations.

With all the standards and enforceable regulations in place and protective equipment, the United States continues to have an unacceptable level of electrical fatalities. According to the Bureau of Labor Statistics (BLS), electrocution is the fifth leading cause of workplace fatalities in the U.S. with more than 2,000 fatal and more than 24,000 non-fatal electrical injuries reported in the last 10 years. Note: The BLS counts arc flash injuries as burns rather than electrical injuries, so they are in addition to the numbers stated above.

WHERE ARE FATALITIES OCCURRING?

According to a recent research paper, at least half of all occupational electrocutions occur as a result of contact with power lines, and about a quarter as a result of electrical machines or tools. There are more than 30,000 non-fatal shock incidences each year that accounts for approximately 5% of burn unit admissions.⁵ Standards for electrical-rated rubber gloves, sleeves, and blankets have been in existence for over 75 years.⁶ Despite ample rules and regulations, electrocutions and serious burns are still happening.

WHY ARE ELECTROCUTIONS STILL PREVALENT IN THE WORKPLACE?

I have been observing electrical workers in all areas of electrical exposure, from bare handling 450,000 VDC power lines to electricians working on 480-volt panels, and PHD Engineers working on Ultra High Voltage Test Areas, to Telecommunication workers stringing fiber under energized power lines and have investigated fatalities resulting from contact with high voltage and low voltage exposed electrical parts. Based on these observations, I can conclude two facts: we don't have enough education for non-qualified workers who operate or install equipment around power lines, and second, qualified electrical workers don't treat single phase or 208-volt 3-phase seriously, meaning they don't wear rubber gloves as they should, especially working on residential electrical systems.

There are essentially two sources of fatalities and injuries for electrical workers. First, direct or indirect electrical shock, which essentially requires contact with an energized conductive part. And second, an arc flash incident that causes burns resulting from high incident energy created by a ground fault or short circuit (where two metal objects of different potentials or voltages contact each other).

Let's start with shock hazards. One disparity causing confusion is the difference between the OSHA regulations and the NFPA 70E standards. The OSHA regulations require that we avoid contact from 50 to 300 volts. It has been long accepted that we can use insulated tools and simply avoid touching the exposed energized parts. In reality, if parts rated higher than 50 volts are exposed within arm's reach, you are not avoiding contact so rubber gloves should be worn to do so. The NFPA 70E mirrored OSHA language until the 2015 version. The 2015 NFPA's Restricted Approach Boundary no longer matched with OSHA's Minimum Approach Distance.

So, if the company's written electrical safety program follows NFPA 70E, qualified workers would have to be protected if any part of their body can go within 12 inches to an exposed part over 150 volts, which now included 240-volt single phase and 208-volt 3 phase. For trainers this worked well because now, when opening doors or removing covers to energized parts (or de-energized and locked out until verified off by testing), rubber gloves are always required. Because a significant number of electrical fatalities are related to low voltage contact, adhering to this simple standard would likely prevent nearly half of the electrocutions we face in this country in construction, general industry, or in mines.

The other half of the serious injuries and fatalities are the result of direct or indirect contact with powerlines. Indirect is where a metal case of an electrical supplied device, tool, panel, etc. is energized - typically because it is not properly grounded. This is an extremely important connection for many reasons and includes the ground pin on extension cords and tool cords. GFCI protection can protect from indirect contact. OSHA now requires GFCI protection for all cord and plug activity related to construction and maintenance). This one work practice will save many lives for both qualified and non-qualified workers.

QUALIFIED WORKERS

A qualified worker is one who has demonstrated understanding of construction and operation of equipment including the hazards involved and means to control the hazards. They must:

- Know what is live and what is not (i.e. metal parts that or insulated/isolated from grounded parts)
- Know the nominal voltage of the live parts (classification of voltage i.e. 480V, 12,470V, 115,000V)



A qualified worker is one who has demonstrated understanding of construction and operation of equipment including the hazards involved and means to control the hazards.

- Know minimum approach distances to the live parts (i.e. arm's reach plus 2 ft. 2 in. for distribution 13,800 volt distribution powerlines and further as voltage increases). To go any closer requires rubber gloves, or other rubber/plastic protection rated for the voltage.
- Understand special precautions (listed in applicable OSHA regulations)
- Understand energy source controls (de-energizing lines and equipment) methods
- Have a full understanding of ratings, inspection, and use of personal protective equipment

UNQUALIFIED WORKERS

Unqualified workers who do not have sufficient electrical safety knowledge and are therefore required to stay away from exposed parts. How far away varies with the exposed nominal voltage. For low voltage (50-750

ELECTRICAL SAFETY STATISTICS

volts) this is 42 inches (based on NFPA 70E standard's limited approach boundary). For medium voltage (751 volts to 15kV) this is 5 ft. and it increases as the voltage increases. Non-qualified workers are never allowed to encroach these distances. The challenge for non-qualified workers comes from performing a risk assessment when working with electrical parts. Because a high percentage of electrical contacts comes from low voltage, the risk assessment may start with inspecting and testing extension cords and hand tools. Or it may be examining service entrance equipment before setting up a scaffold. For equipment use in construction, follow the 10-ft. rule or 20-

ft. rule for cranes, and always use a spotter if encroaching that distance.

ARC FLASH INJURIES AND FATALITIES

An arc flash is intense heat and pressure that occurs from a short circuit or ground fault (two wires of different voltages touching). The severity is based on the fault current available and is directly proportional to the clearing time it takes a breaker to open, or a fuse to blow. This has a direct correlation to our electrical infrastructure. If breakers and electrical equipment is not maintained, the likelihood and severity increase dramatically. When I started my electrical career in 1978, the electrical panels and other equipment may have been 20 years old, but now that same equipment still in service is 65 years old. Risk is much greater than it was. Special emphasis should be put on additional precautions and risk assessment in these cases. OSHA requires that we do a coordination study and short circuit analysis (29 CFR 1910.303(b) (4) and (5)), but unfortunately regulations do not specify a timeline for updates. NFPA 70E requires that and arc flash analysis should be updated every five years. Since this engineering analysis includes the OSHA required studies, this works.

Based on statistical data on electrical fatalities and injuries, we still have over 150 fatal contacts and over 1,500 injuries related to shock each year. We can lower this statistic by:

- Proper training of qualified and non-qualified workers on applicable standards
- Shut off power (lock and tag) feeding electrical parts before removing covers. For qualified, test before touch to verify. Non-qualified must be informed that parts are de-energized from testing.
- Maintain minimum approach distance (qualified), or limited approach boundary (non-qualified) from exposed live parts.



Standards for electrical-rated rubber gloves, sleeves, and blankets have been in existence for over 75 years.

- Conduct a job briefing on-site, including a thorough inspection of all electrical parts for breaches in insulation or missing ground path and develop a safe work plan.
- Inspect and use proper PPE if encroaching the safe approach boundary.
- Properly maintain the electrical infrastructure using manufacturer recommendations or NFPA 70B standards.

If these basic steps are followed, we can significantly reduce electrical fatalities and injuries in the workplace. **ESW**

SOURCES

1. The History of Electrical Safety, CESNews 2021
2. History of NFPA; by Casey Cavanaugh Grant, P.E. Executive Director of the Fire Protection Research Foundation
3. Legal Information Institute <https://www.law.cornell.edu/uscode/text/29/653>
4. Judson MacLaury, U.S. Department of Labor, Monthly Labor Review, 1981
5. Electrical Injuries; Aug 2021 Michael R. Zemaitis; Lisa A. Foris; Richard A. Lopez; Martin R. Huecker StatPearls Publishing LLC
6. Industrial Standardization Magazine October 1945

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Protecting People, Property, and Production with Proper Electrical Grounding

By Dave Hernandez, Contributor

Grounding plays a critical role in any electrical power system. The grounding system is a network that connects all components of an electrical power system to a line that is buried in the earth. The line carries excess fault current or unwanted electrical charge away from equipment, structures, and personnel through a path of least resistance, so that the current safely dissipates below ground. Proper grounding systems provide a reference point of zero volts in earth, and reduce damage, outages, accidents, injuries, and casualties.

Grounding systems provide many benefits for any type of facility using electrical power systems. They allow for a common reference point in the power system, which makes it easy to detect ground fault locations, identify short circuits, and measure data or unexpected incidents in the power system. Grounding systems form a defense against transient over-voltages caused by certain types of equipment, and help protect equipment via ground fault interrupters, lightning protection, and surge protection. Grounding systems improve safety for workers and lower the odds of high energy electrostatic hazards that can pose extreme dangers to people.

There are several types of grounding systems, each with a different function. The following takes a brief overview of the systems that are frequently deployed.

THE VARIOUS TYPES OF GROUNDING SYSTEMS

System grounding is the most common. It is used in most three-phase power systems.

Every piece of equipment in the power system is run into a grounding grid, with grounding rods that are buried in earth at least 10 feet deep under the facility. Equipment grounding connects all non-current carrying metal parts to earth. This includes frames, enclosures, transformers, motors, conduit, junction boxes, cables, poles, and towers. Bonding is commonly used to merge electrically continuous materials. It utilizes infrastructure such as structural steel, plumbing, and other equipment to connect, lead, and feed unwanted electrical current into the grounding grid. These systems utilize green cables or solid, non-stranded uninsulated cables. All of the equipment is interconnected and electrically continuous to produce stability and proper grounding.

Neutral grounding systems are deployed for high energy equipment that generates electromagnetic fields. Parts such as transformers, generators, and motors create transient disturbances and electrostatic hazards. Static often builds up in insulating materials and can become a fire hazard or cause the air to become flammable. Neutral grounding systems provide the means to control and mitigate those disturbances by dissipating high energy charges or electrical faults that could damage gear or cause injuries to workers.

Lightning protection uses a conductor network to prevent incidents in towers, buildings, and other tall structures. Lightning strikes cause thermal effects that can spark fire hazards and harm or kill people. Conductor networks re-direct lightning strikes to ground, diverting harmful current away from buildings,

Ground fault protection is the most important safety mechanism to decrease shock hazards and prevent loss of life for workers or unqualified individuals who may inadvertently come into contact with equipment, frames, and enclosures.

equipment, and individuals.

Surge protection provides transient overvoltage protection caused by drives and motors.

Using drives to change motor speeds creates harmonic electrical instability and overvoltage conditions. If those overvoltages go undetected, they can cause equipment blowouts or arc flash events that cause injuries to people. Grounding re-stabilizes current levels when motors change speeds, helping to protect equipment and maintain production. Surge protection also mitigates the dangers of tall structures which produce transient overvoltages as part of regular electrical power system function.

Ground fault protection removes excess energy that accumulates in structural hardware and takes it to ground. Most large frames and enclosures are constructed of conductive material and can absorb voltages from energized parts. This creates a dangerous return path for fault current unless the current flow is diverted through a path of least resistance to ground. Damp, wet, or dusty environments require special attention to design and maintenance of ground fault protection. Water is highly conductive, and moisture or particle debris can accelerate the breakdown of equipment. Ground fault protection is the most important safety mechanism to decrease shock hazards and prevent loss of life for workers or unqualified individuals

who may inadvertently come into contact with equipment, frames, and enclosures. This vital protection is the only way to remove a ground fault from the system. It prevents a person from becoming part of the circuit and suffering electrical shock.

More detailed information about any of the codes and standards related to electrical grounding can be found in National Electrical Code Article 250. It provides guidance on system grounding, equipment grounding and bonding, and conductive material bonding to create an effective ground fault current path to divert unwanted electrical hazards away from equipment that should not be energized. Tables 250.66, 250.102(C) (1), 250.122 provide helpful references for grounding, bonding, and sizing.

Consulting the NFPA 70E is the best way to ensure your system follows proper grounding procedures that will offer protections to your facility, equipment, and personnel. **ESW**



Dave Hernandez, PE, CEM, GBE, CESCO is a distinguished Professional Engineer licensed in 52 U.S. jurisdictions and serves as the Chief Executive Officer at Electrical Power & Safety Co (<https://epsco.co>), a world leader in electrical safety. He has held responsible charge of over 20,000 electrical projects, sits on various industry committees, and has authored several publications.

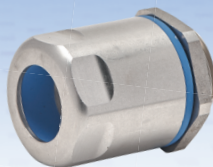
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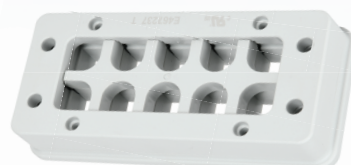


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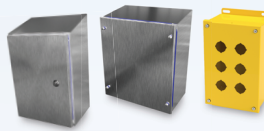
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One Electrician's Life Lesson:

The Case for Electrical Safety Training for Both Electricians and Non-Electricians

By Corey Hannahs, Contributor

The sirens were deafening, even to my 13-year-old ears. My good friend, Heath, and I were playing an intense game of summer basketball in my driveway. The fact that I was losing and, as always, determined to win, should have been reason enough for my focus to be on the game and the game alone. But it was impossible not to hear the sirens of the emergency vehicles rushing down our road and begin wondering – “What’s going on? What happened? Where are they going?”. Heath’s house was across the street, about 10 houses down. From our slightly distant perspective, it appeared that his house was right where the emergency vehicles stopped.

Throwing down the basketball in my yard, I took off sprinting in the direction of Heath’s house, right after my friend who already had a two-house lead on me. We both likely set world records based on how fast our teenage legs enabled our arrival to Heath’s yard. The paramedics had already begun to tend to Heath’s brother, Josh, who was lying motionless in their driveway. Their mother was outside and crying hysterically. Heath was a “surprise” baby for his parents and Josh was almost 10 years older than us. Josh worked as a painter for a local contractor. Work was slow that summer, so Josh had offered to repaint the exterior of his parents’ house. Scanning the area to try and make sense of it all, I noticed a couple of paint cans and an aluminum extension ladder on the driveway near Josh. Transitioning my eyes upward, it all began making sense. At this point, life experience was not my specialty, but even my teenage mind could put the pieces together: Josh plus conductive aluminum ladder plus overhead power lines is equal to why Josh is lying in the driveway. Josh had received an electrical shock. That day provided a life-lesson to me that I have carried with me



every day of my nearly 30 years in the electrical industry, and I always will – electricity does not discriminate.

NOT JUST FOR ELECTRICIANS

Electrical safety training is not just for electricians. Proper and adequate training is essential to the prevention of electrical related injuries to all personnel that are at risk. Is the plumber that is plugging his extension cord into a defective ground-fault circuit-interrupter (GFCI) at risk? What about the carpenter using a saw with a broken ground prong on the cord end? How about the painter using an aluminum ladder near overhead electrical lines? Non-electrical workers are exposed to many potential electrical hazards, every day. Not only is electrical safety training for non-electricians a necessity, but it’s also required.

Occupational Safety and Health Administration (OSHA) Standard Number 1910.332(a) mandates electrical training for employees who face risk of electrical shock. 1910.332(a) Note states that training is required for all occupations listed in Table S-4 and the second sentence goes on to state that employees not listed in Table S-4, but that are reasonably expected to face the same risk due

to electric shock or other electrical hazards, must also be trained. On a jobsite, or within a facility, a case could certainly be made that many workers not listed within Table S-4 are just as susceptible to the same risks that electrical workers could potentially face.

According to data provided by Electrical Safety Foundation International (ESFi), between 2011 and 2020, 44% of fatal electrical injuries occurred in the construction industry (Source: www.esfi.org/workplace-fatalities-and-injuries-2003-2020/). That means that 56% of all electrical fatalities were outside of the construction industry or trades. This statistic alone speaks to the need for mitigating risk of exposure to electrical hazards through further training. NFPA 70E®, Standard for Electrical Safety in the Workplace® is a great resource for defining enforceable responsibilities for both employers and employees to protect against electrical hazards that employees might be exposed to. OSHA itself is a large part of why NFPA 70E even exists. NFPA 70E provides the electrical safety prescriptive-based how methods of achieving the performance-based requirements of what OSHA demands of all occupational industries. Developing and implementing an Electrical Safety Program (ESP) aligned with the responsibilities and training defined within NFPA 70E is a vital component in reducing the risk associated with electrical hazards, for all workers. Employers and employees following the ESP, and holding one another accountable for doing so, is the other crucial piece in the electrical safety equation.

There was no ESP in place, or training that had been done. Josh was a white male, brown hair, blue eyes, football fan, avid golfer, practical joker, painter, brother, son, father-to-be...so much more, and still - electricity did not discriminate. The previous sentence was written in the past tense because the summer of 1989, along with a conductive ladder near electricity, resulted in the preventable loss of

Josh's life. All that he was, and all that he would be, died with him that day. A life cut way too short, that brought his family so much heartache and pain. I know that Josh's family isn't the only one. It's extremely unfortunate that there are tens of thousands of others out there who know the story of Josh all too well and have been impacted by loss of their own. They may have been male or female, white or black, young or old, electrical workers or non-electrical workers, etc. The differentiations in the victims are endless but one similarity rests with all of them - electricity did not discriminate. Loss of life is immeasurable, which in turn makes prevention priceless. Only through proper and adequate electrical training can we prevent the victims list from growing and, in some small way, honor those that have been lost. **ESW**

Important Notice: Any opinion expressed in this column (article) is the personal opinion of the author and does not necessarily represent the official position of NFPA or its Technical Committees. In addition, this piece is neither intended, nor should it be relied upon, to provide professional consultation or services.



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In his current role, he serves as an electrical subject matter expert in the development of products and services that support NFPA documents and stakeholders. Hannahs is a third-generation electrician, holding licenses as a master electrician, contractor, inspector, and plan reviewer in the state of Michigan, was twice appointed to the State of Michigan's Electrical Administrative Board by former Governor Rick Snyder, and he received United States Special Congressional Recognition for founding the B.O.P. (Building Opportunities for People) Program, which teaches construction skills to homeless and underprivileged individuals.

Arc Flash Labels: What You Need to Know

By Brandon Smoak, Contributor

OSHA requires employers to ensure that each employee exposed to hazards from electric arcs wears personal protective equipment (PPE) with an arc rating greater than or equal to the estimated heat energy that could be released.^[3] Taken at face value, this OSHA requirement seems straightforward; however, accomplishing this outcome requires successful implementation of a series of events linked together like a chain that all build on one another to achieve the desired safety outcome. If any link in the chain is broken, it is possible that an injury will occur; arc flash hazard labels are a crucial link in this chain. This article discusses fundamentals of arc flash labels, what type of information is presented on these labels, and how electrical workers should respond to this information when it's encountered on the job.

WHAT ARE ARC FLASH LABELS AND WHY ARE THEY NEEDED?

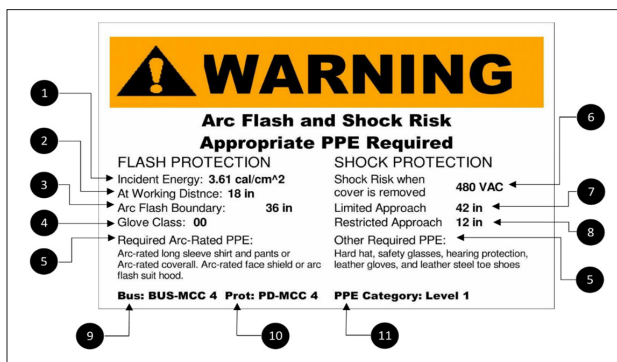
Arc flash labels are an important tool in the safe-work process that communicate pertinent information about the risks associated with a particular piece of electrical equipment. They give electrical workers the information needed to protect themselves with appropriate PPE prior to beginning an electrical task. Additionally, labels help employers comply with OSHA 29CFR Paragraph (g)(2) of § 1926.960, which requires that the employer make a reasonable estimate of the heat energy to which an employee would be exposed if an arc were to occur. Labels can take numerous shapes and forms depending on the situation.

WHAT TYPE OF INFORMATION IS PRESENTED ON LABELS?

According to NFPA 70, article 130.5(H), the following (minimum) information shall be on the label:

1. Nominal system voltage
2. Arc flash boundary
3. At least one of the following:
 - a. Available incident energy and the corresponding working distance, or the arc flash PPE category level
 - b. Minimum arc rating of clothing
 - c. Site-specific level of PPE

See the figure below for an example label and a description of each area of the label:



1. **Incident Energy:** the amount of energy on a surface at a specific distance from a flash; communicated in calories per sq. cm.
2. **Working Distance:** the distance between the arc source and the worker's face or chest.
3. **Arc flash boundary:** the distance from exposed live parts within which a person could receive a 2nd degree burn.
4. **Insulating Glove Class:** the class of rubber insulating gloves the employee shall wear.
5. **Arc-Rated and 'Other' PPE Requirements:** indicates the personal protective equipment (PPE) required to prevent an incurable burn at the working distance specified during an arcing fault for the calculated amount of incident energy.
6. **Shock Hazard:** bus voltage at the fault location
7. **Limited Approach Boundary:** the only

boundary that may be crossed by an unqualified person, when accompanied by a qualified person.

- 8. Restricted Approach Boundary:** the boundary that may only be crossed by a qualified person using adequate safety equipment and work techniques.
- 9. Bus Name:** fault location for bus report.
- 10. Protective Device Name:** the protective device that clears the arcing fault or portion of the total arc fault current.
- 11. PPE Category:** The minimum incident energy category rating of required PPE, in accordance with NFPA 70E – Table 130.7(C)(15)(C). The minimum rating of each category shall be above the calculated incident energy of the equipment in question. Note: Site specific requirements can require additional PPE protection levels than what is required in this table.

WHERE ARE THEY INSTALLED?

Arc flash labels should be installed in readily accessible locations on all equipment in an electrical system on which an electrical worker might need to perform “energized” work. Examples of such equipment include, but are not necessarily limited to, “switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling units.” [1]

WHAT ACTION SHOULD BE TAKEN IN RESPONSE TO THESE LABELS?

Worker interaction with arc flash hazard labels involves training (pre-encounter), understanding (encounter), and response (post-encounter prior to the commencement of work). Before a label is encountered, the employee “should be capable of reading and interpreting the information included on an arc flash hazard label.” [1] This capability is accomplished through sufficient employee-sponsored training and preparation.

Additionally, before a label is encountered, an employer should have already provided the employee with sufficient PPE to be prepared for whatever maximum allowable exposure level he or she may encounter on the job. [3] Finally, with proper training (prior to the work) and knowledge of the associated risks (as communicated on the label), the employee must put on and use the appropriate PPE to mitigate the risks associated with the task at hand. [4]

In closing, arc flash hazard labels are an integral part of the electrical safety process. Considerable activity occurs prior to the creation of the labels in preparation to provide timely and accurate information to electrical workers when the need to safely perform energized electrical work arises. If inaccurate labels are provided or labels are misunderstood and the information presented is not applied properly, a serious electrical injury could result. It is therefore necessary for all participants in the electrical industry to continually reassess and improve their current understanding of this important link in the safety process to ensure a safe workplace for all involved. **ESW**

SOURCES

1. National Fire Protection Association, NFPA 70E Handbook for Electrical Safety in the Workplace 2021
2. OSHA 1926.960(g)(2) Estimate of available heat energy
3. OSHA 1926.960(g)(5) Arc rating
4. OSHA 1910.335(a)(1)(i) Provision and use of PPE

Brandon Smoak is a consulting electrical and fire protection engineer with Total Arc Flash Safety, LLC, (TotalArcFlashSafety.com), an engineering firm focused on improving workplace safety and increasing the resiliency of complex electrical systems.

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OSHA Arc Flash Update and the Myth of De-Energized Work

By Scott Margolin, Contributor

The Partnership for Electrical Safety (PES) has been working with OSHA to understand NFPA 70E compliance rates and the resultant frequency and consequences of arc flash among commercial and industrial electricians in the United States. We've written in this space about the bipartisan letters from the House and Senate urging OSHA action on arc flash, as well as direct (albeit virtual) engagement with OSHA. I am delighted to report that PES was recently joined by senior safety leadership of the IBEW and Electrical Training Alliance for a meeting with OSHA, during which we received very positive feedback.

We are in alignment on the basic facts:

- Half or more of all commercial and industrial electrical workers in the U.S. (500,000 or more) still do not have arc flash PPE despite a standard (70E) that has addressed arc flash for over twenty years.
- The consequences of this lack of compliance are dozens of catastrophic injuries and fatalities every year.
- These injuries would be eliminated or dramatically reduced by arc rated clothing and other PPE.
- Action is justified and required to reduce injuries and save lives.

We applaud OSHA for recognizing the huge gap in protection and engaging with the industry to resolve it, and we're optimistic that updated guidance will be forthcoming in 2022. We expect this guidance to address the myth and close the loophole that has been largely responsible for the lack of protection for hundreds of thousands of commercial and industrial electrical workers: "we don't work energized."

THE DE-ENERGIZED MYTH

When the subject of arc flash PPE arises at seminars, training, trade shows, safety caucuses, or other venues, the primary reason cited for failure to provide arc rated clothing and other PPE is, as noted above, "we don't work energized." Sadly, many arc flash injuries occur as a direct result of a conviction that the work is de-energized, and the resultant lack of PPE. Obviously, if there was an arc the circuit was NOT de-energized. Arc rated clothing and other PPE such as hard hats, face shields, rubber insulating gloves and leather keepers can and do protect the wearer from burns...but flammable clothing is literally fuel for the fire. The logic is simple: don't wear fuel. Here's why.

The vast majority of fatal and catastrophic injuries in arc flash are not caused by the arc itself, but by the arc igniting flammable clothing. Arcs are extraordinarily hot, but also very, very brief and highly directional. This means that in most cases, less (and often much less) than half of the body is exposed to the arc energy. But if your clothing ignites, the hazard now lasts 5-10 seconds or more, rather than 1/10th of a second, and covers far more of your body (clothing covers about 88% of your skin). And since heat rises, once your clothing ignites you are very likely to inhale fire and superheated gasses, as well as suffer facial burns. The result of wearing fuel is thus much greater TBSA (Total Body Surface Area) of burn injury as well as greater severity (2nd and 3rd degree burns), in addition to the potential for respiratory issues. TBSA over 20% runs a high risk of shock, which can be fatal in and of itself. TBSA over 50% runs a much higher risk of fatality due to infection, as well as less desirable quality of life for those who do survive.

There are three key safety measures:

- Don't work energized if you don't have to.
- If you do work energized, recognize the hazard and don't wear fuel.
- Ensure that your arc rated clothing and other PPE is rated to protect against the level of incident energy projected for that equipment.

We applaud OSHA for recognizing the huge gap in protection and engaging with the industry to resolve it, and we're optimistic that updated guidance will be forthcoming in 2022.

IS IT REALLY DE-ENERGIZED?

Even those who strive to only work de-energized rarely achieve that goal; very little of what is called de-energized work actually is, from either a standards or a practical/PPE perspective. There are two primary reasons. A misunderstanding of what "de-energized" means, and that some of the most common energized work is infeasible to perform de-energized such as "...testing of electric circuits that can only be performed with the circuit energized."

Unless you're pulling wire in new construction that is not connected to the grid and has no temporary power, chances are very high that the work is energized. NFPA 70E requires energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts shall be put into an electrically safe work condition (ESWC) before an employee performs work. Think about the process for establishing ESWC: "electrical conductor or circuit part has been disconnected from energized parts (de-

energized), locked/tagged in accordance with established standards, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personnel protection." Disconnection is energized work, and so is testing for absence of voltage. When the task is completed and it's time to reverse the process, both reconnecting and testing for presence of voltage are energized work as well. So at least four major steps in almost every ESWC process ARE energized work. Workers need to routinely be protected from electric shock and arc flash as these energized tasks are performed.

It's clear to PES and to OSHA that some significant portions of most electrical tasks qualify as energized work. It's also clear that far too many people either misunderstand both the standards and the hazards, or have chosen to ignore them, resulting in a serious injury/fatality rate of about one person each week in the United States. These tragedies are compounded by how easily they are avoided. Establish an electrically safe work condition whenever possible, and wear arc rated clothing as daily wear. If the energized work truly is infrequent (less than once a week or so, including de-energizing tasks) another option is to obtain and enforce 100% donning of arc rated coveralls and other PPE over standard cotton clothing. This task-based option was common 5-10 years ago but has become significantly less popular recently. The two primary drivers of this migration from task to daily wear are the liability and accident rate with task based (when it is not worn) and the evolution of arc rated daily wear, which is now much lighter, more comfortable, and more stylish. **ESW**

Scott Margolin is Co-Chairman, The Partnership for Electrical Safety. For more information or to participate in the effort, visit www.partnershipforelectricalsafety.org.

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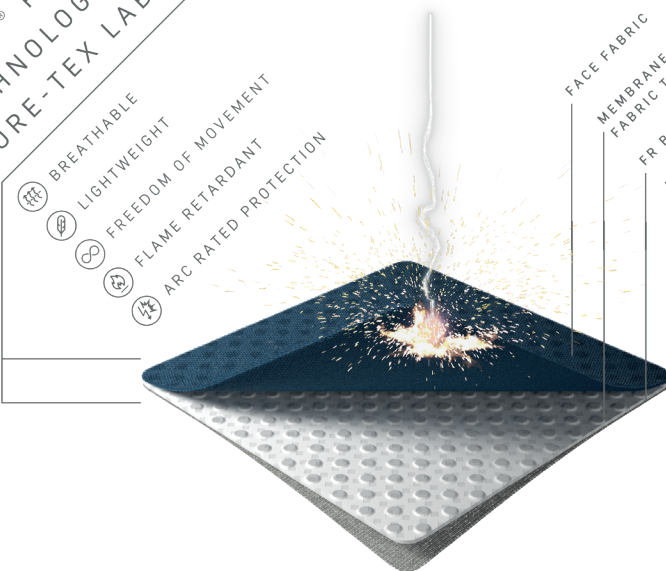
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