

Electrical Safety

IN THE WORKPLACE

ARC FLASH SAFETY TRAINING

Smart Operators Know You're Never Done *page 16*

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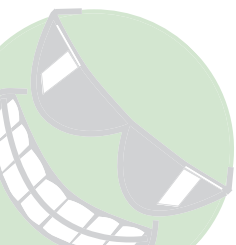
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PUBLISHER'S NOTE

I wear a lot of hats, and I mean a lot, more than I ever did when I was an employee of a publishing company. When people call me and ask, "can you tell me who I can speak to in your organization that handles (fill in the blank)," I tell them that is not a person, that is a hat I wear, how can I help you. Part of my job involves gathering articles that will appear in *Electrical Safety in the Workplace* magazine. It's an interesting and sometimes challenging process, because I'm asking busy subject matter experts to take time out of their workday and write a thought leadership piece for us. The goal: to deliver high-quality, specialized, and timely information to our readers, in order to help them do their jobs better, make their operations more efficient, and safeguard their employees from injury or worse. But what's in it for the companies or individuals who are on the receiving end of my editorial solicitations?

By contributing educational articles to this publication, companies and people gain exposure among the various industries and decision-makers who are their potential customers. They establish themselves as credible sources of information and even experts on the topic they are writing about. An article also gives a contributor the opportunity to educate would-be product users in a way that a visit to a website might not – unless you know all of the right links to click. The articles we run are relatively short, because we are aware that our readers are busier than ever and need information delivered quickly and concisely. The subjects the thought leadership pieces address may include legacy topics or current issues our readers face, plus, there are always new people responsible for electrical safety in their facility that need to educate themselves on arc flash or NFPA 70E.

With our hybrid editorial focus on electrical safety, we cover a tremendous range of topics, including Best Practices for an Electrical Safety Program, Lockout/Tagout, Arc-Rated PPE, Proper Grounding of Equipment, Standards & Codes, Fire Protection, Signs & Labels, and let's not forget about NFPA 70E, which is pretty much a staple in every issue.

I really enjoy working with contributors, they are the blood line of the publication. Some work for companies that manufacture or distribute the kinds of products, services or training widely used in the industries we serve. Others are individuals with experience or specialized knowledge they are happy to share with their colleagues. If you are interested in contributing a feature article to *Electrical Safety in the Workplace* – one which will appear in our print and digital editions, as well as an easily "shared" stand-alone on our website – feel free to contact me. I'm open to topic ideas, because I know the experts I'm dealing with are attuned to issues and developments in their respective fields. I can also help fine tune a topic, so that it's a good fit for our readers. I learn something new from each and every article I receive from a contributor. If you've already written for us, thanks for helping us communicate important information to subscribers. This is the last issue of 2021 so if you're considering writing for us in 2022 and have questions, drop me an email, connect with me on LinkedIn, or give me a call.

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Electrical Safety
IN THE WORKPLACE

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Congress Urges OSHA To Act on Arc Flash PPE

By Scott Margolin, Co-Chairman, The Partnership for Electrical Safety

The Partnership for Electrical Safety (PES) has admirable goals, dedicated members, and bad timing. PES was founded in early 2020, with its first meeting scheduled for late March... one week after the NBA and NHL shut down along with the rest of the country. That inaugural meeting, and all following ones, have been held on Zoom. However, very significant progress has been made despite the headwinds of the pandemic and the presidential election cycle with its subsequent change of administration, policies, and focus.

If you're not familiar with PES or its work, here's a brief primer.

The Partnership for Electrical Safety firmly believes that every American working on or near energized electrical equipment deserves equal protection from arc flash, including the appropriate arc rated clothing and associated PPE (personal protective equipment). We believe that the PPE requirements of NFPA 70E: Standard for Electrical Safety in the Workplace provide the appropriate best practices to ensure industrial electrical worker and operator safety, and should be broadly adopted for substantially all live or potentially live industrial electrical work in the United States. We seek to educate those at risk and to make plain to relevant oversight entities the need for use of PPE when doing industrial electrical work, and the extreme human and financial costs of non-compliance.

Transmission and distribution utilities have provided arc flash PPE since 1994, which has dramatically reduced injuries and virtually eliminated arc flash fatalities among line workers. Despite that success, and despite the NFPA 70E standard, which has included the arc flash hazard and relevant PPE for over twenty years, at least half a million industrial electrical workers STILL are not provided arc rated clothing and other PPE they need to do the job safely. The fix for this long-standing unsafe, unequal situation is simple: OSHA must act to give industrial electrical workers the same protection their utility counterparts have long enjoyed.

OSHA action has long been a primary driver

of major American workplace safety advances, including several directly relevant to this issue. OSHA was heavily involved in the Electric Utility segment move to arc flash PPE in the mid-1990s, initial industrial electrical adoptions of NFPA 70E in the early 2000s, the Oil & Gas segment move to flash fire PPE both in the late 1980s, and again with the publishing of NFPA 2112 in the early 2000s. The most recent example is also an almost perfect match and template for the current lack of industrial electrical PPE.

OSHA published a document in March of 2010 (often called the "Drilling Letter") which essentially noted that A) the drilling industry has the same flash fire hazard as the rest of the Oil & Gas Industry; B) that there are consensus standards which clearly address both the hazard and feasible means of abatement, including PPE; C) that despite these standards existing for a decade at that time, the significant majority of the drilling segment did not provide the flash fire PPE; and D) as a result, OSHA was directing the drilling industry to act. An almost identical scenario exists today, except that NFPA 70E has included arc flash for twice as long - twenty years, not ten, and the number of unprotected industrial electrical workers is substantially larger - making this situation even more urgent.

PES PROGRESS

Since the pandemic hit, it has been essentially impossible to take the traditional approach and meet with relevant people in person to make the case. But because the situation affects so many people and the PPE/no PPE divide is so stark (an arc flash without PPE will usually result in catastrophic injury or death, whereas with the PPE there is very minor or no injury), we found many people at OSHA and within Congress were very willing to engage on the matter.

OSHA LETTER

PES began by vetting our concerns and our intended approach with a gentleman recently

retired from OSHA; during his 40-year tenure he was the primary author of most of OSHA's electrical standards. He also served on the NFPA 70E committee, ASTM F-18, and a myriad of other electrical safety efforts. He quickly agreed that there is a serious issue here which demands resolution and worked closely with us to draft a letter to OSHA. Despite submission of that letter during an administration which was resistant to regulatory processes, OSHA did respond positively in late 2020, concurring with the PES position: "OSHA agrees with [PES] that the hazards associated with arc-flashes are serious" but noting they were not prepared to act immediately, likely due to both the pandemic and the impending presidential election.

CONGRESSIONAL ENGAGEMENT

PES identified key members of Congress who have oversight for the Department of Labor and OSHA as a result of committee assignments and other legislative business. Our association has held a series of meetings over several months with more than a dozen of these Congressmen and women and their staffs, emerging with unanimous agreement that the issue is consequential, and must be rectified. We have spoken with both Republicans and Democrats, in the House and Senate, including Sen. Cindy Hyde-Smith (R-MS), Sen. Lindsey Graham (R-SC), Rep. Tom Cole (R-OK, 4th District), Rep. John Moolenaar (R-MI, 4th District), Rep. Alma Adams (D-NC, 12th District), Sen. Susan Collins (R-ME), Sen. Bob Casey (D-PA), Rep. Brian Fitzpatrick (R-PA, 1st District) and Rep. Donald Norcross (D-NJ, 1st District). Everyone was willing to help, and many have offered to take proactive steps. Rep. Norcross is the only electrician serving in Congress and has been very generous with his time and assistance; he has first-hand experience with the frequency and severity of electrical injuries in general and arc flash in particular.

CONGRESS URGES OSHA TO ACT ON ARC FLASH PPE

Both the House and the Senate have sent bipartisan letters to OSHA. On May 14, 2021, the Chairman of the Senate Health, Education, Labor and Pensions Subcommittee on Employment and Workplace

Safety Senator John Hickenlooper (D-CO) and Ranking Member Senator Mike Braun sent a letter to the OSHA Principal Deputy Assistant Secretary James Frederick urging OSHA to take a renewed approach to this standard. The House of Representatives sent a companion letter on May 17, 2021, led by Representative Donald Norcross (D-NJ) and Representative Brian Fitzpatrick (R-PA) with support from Representatives Mark Pocan (D-WI), Linda Sanchez (D-CA), and Haley Stevens (D-MI).

OSHA SECRETARY DOUG PARKER

During confirmation hearings for incoming OSHA Secretary Parker on May 27th 2021, he was asked about his awareness of and disposition toward the arc flash PPE issue by Senator Mike Braun:

"Senator Hickenlooper and I, as the Chair and Ranking Member of the Subcommittee on Employment and Workforce Safety, have already begun to work with OSHA regarding industry safety standards. This has included clarifying personal protective equipment for industrial electricians. Can you commit today to working with my office in order to shore up these standards?"

Mr. Parker responded, "If confirmed I would be happy to provide technical assistance with respect to this or other legislation. Similarly, I am willing to work with your office on improving health and safety standards, including on personal protective equipment for industrial electricians and a standard to protect workers in the tree care industry."

The three things are almost always necessary to fix a problem are now in place: knowledge among the relevant people that the issue exists, understanding of the scope, consequences and urgency, and agreement on a path to resolution. The Partnership for Electrical Safety is delighted that the United States Senate, House of Representatives, and incoming Department of Labor leadership understand the gravity of the hazard and the urgency of action to remedy the protection gap which exists today. At least 500,000 American electrical workers will continue to go to work every day without lifesaving PPE until OSHA acts. **ESW**

For more information or to participate in the effort, visit www.partnershipforelectricalsafety.org.

Common Electrical Hazards and How to Avoid Them

Contributed by Synergy Electric

Although we rely on electricity to keep our facilities up and running, certain electrical conveniences can be hazardous to you and your employees' safety. While it's important to be conscious of these dangers, being informed and proactive can help you keep your facility safe.

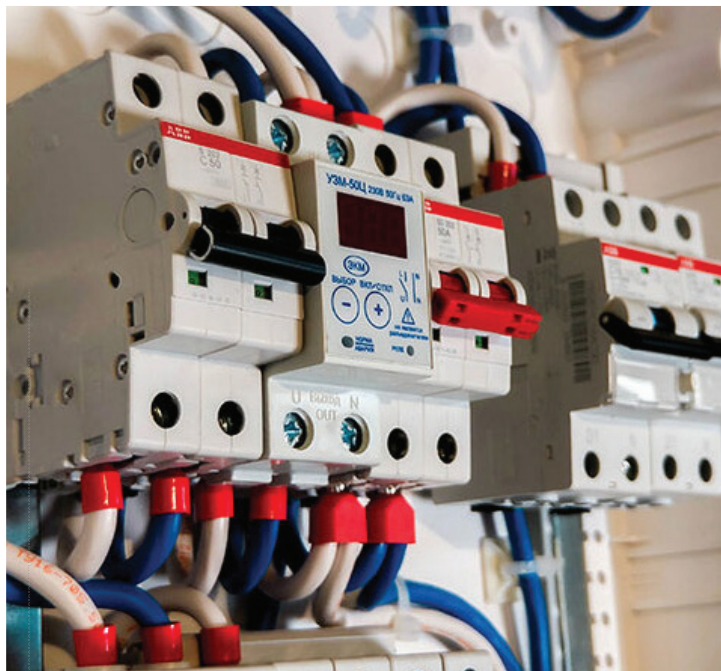
HOW TO AVOID ELECTRICAL HAZARDS IN YOUR FACILITY

Check your facility's wiring: One of the most common electrical hazards is old, defective, or low-quality electric wires. This threat seems straightforward, but with electrical wiring being out of sight, it can be easy to neglect cables' conditions. It is imperative to have a trained electrical contractor check the safety of your facility's wires regularly. This means checking for old, damaged, and corroded wiring. If there is any concern over a wire's safety, have a professional replace them with new wiring that adheres to safety standards.

Keep wires uncovered: Although wires covered by materials or objects are a less commonly known hazard than old or faulty wiring, it is still essential to be cautious. Ensure any cords or wires are free and clear of furniture, clothing, or any other items that could catch fire due to hot wires.

Be careful with extension cords: Extension cords and power strips are a necessity in many facilities. However, these cords can be dangerous if not fixed in place or if they do not have covers over unused sockets. Long cords, such as those found on extension cords, present more opportunities for being pulled, worn, or damaged, which would pose a potential danger. Uncovered sockets in extension cords or power strips can also be dangerous, so it is crucial to use plastic socket covers on any outlet that is not in use.

Be mindful of lightbulbs: Although lightbulbs do not present much of a threat on their own, they can get extremely hot. If you have lightbulbs that are too close to furniture, fabrics, clothing, or any other flammable material, it could be hazardous to your facility and employees. Make sure when lightbulbs are turned on and in use that they are not close to any material that could cause a fire. It is a good habit to turn off all lights when you leave a room or if you are otherwise unable to monitor them to avoid any potential danger.



One of the most common electrical hazards is old, defective, or low-quality electric wires.

KEEP ELECTRICAL OUTLETS AND APPLIANCES AWAY FROM WATER

All electrical outlets must be installed at a safe distance from any water source, and all plugged-in electrical appliances must remain far away from water while in use. Water is a conductor of electricity, which poses the threat of electrical shock. Do not use or handle any electrical appliances while wet. It is also critical that, in the event of an electrical fire, you do not attempt to put out the fire using water. Doing so can make the fire much worse and far more dangerous.

Although there is always an inherent risk when taking advantage of electricity's conveniences, there are steps you can take to make sure your facility and your employees are safe from potential electrical hazards. **ESW**

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Ensuring Worker Safety and a Safe Electrical System Through the Proper Grounding of Electrical Equipment

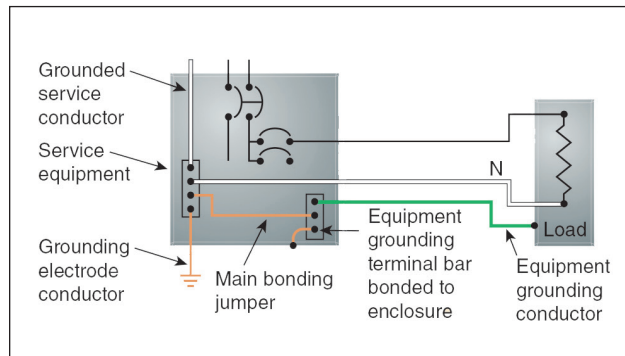
By Dean Austin, Contributor

Grounding, grounded, bonding, and bonded are all terms an electrician, electrical engineer, or facility manager is familiar with and use frequently, but what does it mean to properly ground electrical equipment? The initial thought is, it's just connecting the branch circuit equipment grounding conductor to the electrical equipment grounding terminal. In simple terms that is correct, but it is more than that. First, we must understand what grounding is so the electrical equipment can have proper grounding.

For grounded systems, the grounding of electrical equipment is referred to in the 2020 National Electrical Code (NEC), NFPA 70®, Section 250.4(A)(2) as: Normally non-current-carrying conductive materials enclosing electrical conductors or equipment, or forming part of such equipment, shall be connected to the earth so as to limit the voltage to ground on these materials. So, the thought is, just stick a wire in the earth and call it good, right? Well not exactly, it goes much deeper; there must be an effective ground-fault current path created to ensure a safe electrical system. Basically, it is the creation of a low-impedance circuit that facilitates the operation of the overcurrent protective device (breaker or fuse). This path must be capable of safely carrying the maximum ground-fault current likely to be imposed on it from any point on the wiring system where a ground fault may occur to the electrical supply. The earth itself is not considered an effective ground-fault current path, so sticking the wire in the ground is not enough.

PROPER GROUNDING

Proper grounding of electrical equipment starts at the foundation of a building or structure. According to 250.20(B) of the 2020 NEC alternating-current (AC) systems of 50 volts to 1000 volts must be grounded which means referenced to earth. This is accomplished through the grounding electrode system installed in accordance with the NEC. Having a strong



grounding electrode system stabilizes voltage and helps to clear ground faults. The 2020 NEC, Section 250.50 gives the outline of a grounding electrode system and section 250.52 lists the approved grounding electrodes. A few of the more efficient grounding electrodes for buildings and structures are:

- Metal Underground Water Pipe
- Metal In-ground Support Structures
- Concrete-Encased Electrode, also known as: footer or Ufer ground
- Ground Ring

A grounding electrode system is the connection to earth, through the code required grounding electrodes. The grounding electrodes then get connected back to the buildings electrical service via a grounding electrode conductor (GEC). The GEC is terminated on the neutral bar in the building or structure's electrical service equipment alongside the grounded (neutral) conductor. The neutral bar is bonded (connected) to the service equipment enclosure through a main bonding jumper, which creates an effective ground-fault current path for the electrical system.

An effective ground-fault current path has been established to the earth, now what? How is the electrical equipment going to be properly connected to the earth? Through the equipment grounding conductor (EGC). EGCs come in various

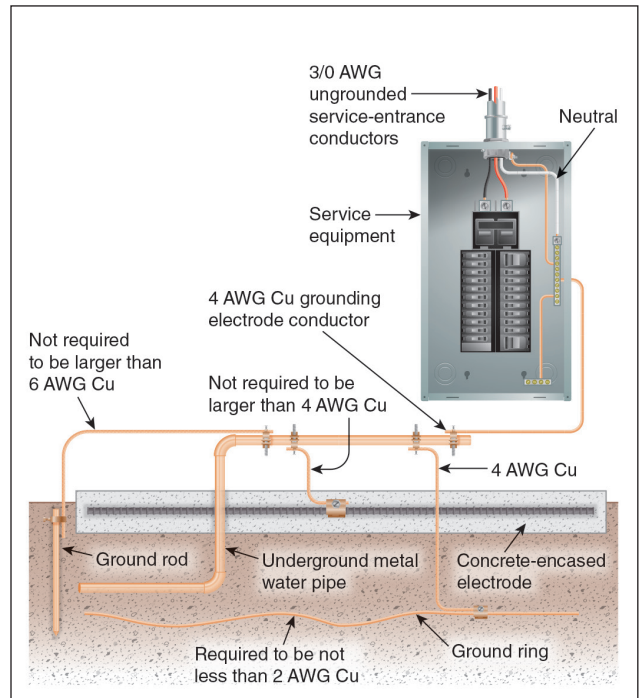
PROPER GROUNDING OF ELECTRICAL EQUIPMENT

sizes, types, and materials as found in the 2020 NEC, Section 250.118. Some of those are:

- Copper, aluminum, or copper-clad aluminum conductors
- Rigid metal conduit (RMC)
- Intermediate metal conduit (IMC)
- Electrical metallic tubing (EMT)

Frequently, EGCs are the raceway system, RMC, IMC, or EMT. These types of EGCs are bonded together and to the equipment enclosure through a series of listed set screw or compression couplings and connectors. Most connectors utilize lock nuts or bond bushings for the connection to the electrical equipment or enclosures. Where bond bushings are used, they require an additional conductor to connect to the electrical equipment grounding terminal, neutral bar, or EGC bar to complete the effective ground-fault current path. With this type of EGC, the electrical equipment grounding is more prone to human error or mechanical failure, therefore the effective ground-fault current path may not be as sound. While EGCs that are an electrical conductor such as copper, aluminum, or copper-clad aluminum conductors, these tend to be more effective due to the direct connection to the electrical equipment, enclosure, neutral bar, or EGC bar. There is less opportunity for failure with this type of EGC because of reduced number of connection points. In general, when installing an EGC, the approved EGC shall be contained within the same raceway, trench, cable, or cord from the electrical service or sub-panel as the feeder or branch circuit conductors that provide power to the electrical equipment. From an electrical safety standpoint and looking at NFPA 70E®, Section 120.5(8), where there is a possibility of induced voltages all circuit conductors and circuit parts should be grounded before touching them. This is one of the potential steps for establishing an electrically safe work condition (ESWC), so a weak or non-functioning EGC would make it difficult or impossible to create an ESWC when the need for replacing or maintaining the electrical equipment arises.

Study and dissect Article 250 of the 2020 NEC to discover more about grounding and creating an effective ground-fault current path.



Properly grounding of electrical equipment sounds simple but is more important than is often realized. Failure to properly ground electrical equipment may prevent the overcurrent protective device from working properly and therefore not effectively clearing a ground-fault, which could result in a shock, electrocution, or arc flash incident. There is much more that goes into proper grounding of electrical equipment than most people think. Always double check the work, terminations, and the effectiveness of the equipment grounding conductor to ensure a safe equipment grounding system. **ESW**

Dean Austin is Senior Electrical Content Specialist at the National Fire Protection Association (NFPA). 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. NFPA 70 the National Electrical Code® (NEC®) and NFPA 70E are now available in NFPA LiNK™, the association's information delivery platform with NFPA codes and standards, supplementary content, and visual aids for building, electrical, and life safety professionals and practitioners. Learn more at [nfpa.org/LiNK](https://www.nfpa.org/LiNK).



Arc Flash Safety Training: Smart Operators Know You're Never Done

By Justin Gaull, Contributor

Smart companies know safety training is never complete. Ongoing training and testing are vital to safe, injury-free operations. Proper training (and re-training) on electrical safety equipment and procedures prevents injuries, protects electrical apparatus from damage, and promotes operational efficiencies. Ongoing training is also a requirement to meet code. NFPA 70E, (the standard for electrical safety in the workplace) Article 110, Section 6 (3), states that "additional training and retraining in safety-related work practices shall be performed at intervals not to exceed 3 years."¹ The standard also states that training shall be more frequent for certain conditions, including the use of new technology and equipment, procedures performed less than once per year or work practices that are not a normal part of an employee's regular job duties.

SAFETY SAVES LIVES

Electrical safety is no less important than EMT training for saving lives. Imagine if an Emergency Medical Technician didn't correctly perform CPR or improperly used their AED (Automated Electrical Defibrillator). What if their chest compressions were positioned incorrectly or if AED pads were applied to the wrong locations? Bad news for that patient. But it doesn't happen because EMTs continuously train – CPR recertification is required every two years for medical practitioners and first responders. Likewise, what if remote racking or remote switching equipment is applied to a breaker incorrectly? Or if a worker doesn't read the arc flash warning label and adhere to the appropriate PPE category? If there's an arc flash incident, that's bad news for everyone in the area. Exposed energized conductors and arc faults can

have mortal consequences for workers who don't follow proper procedures.

With the industry adoption of NFPA 70E, "there has been an annual decrease of 76% in electrical contact fatalities since 1982." That's just a few years after the first edition of NFPA 70E.² The use of electrical-safety procedures, energy-reducing technologies and engineered controls, such as remote switching and racking, reduces electrical injuries from shocks and burns.

SCHEDULE TRAINING LIKE YOU SCHEDULE MAINTENANCE

Training works, but it doesn't happen on its own. You need to create and document a safety training schedule for each employee and for your organization as a whole. Then you can execute to the training and retraining schedule just as you would execute to an equipment maintenance schedule. The training becomes part of your standard operating procedures, your employee reviews/evaluations and your culture.

In addition to ongoing retraining, you need to be prepared with a quick-deploy training program for when employees leave your company or move on to new opportunities. Otherwise, you're left with a dangerous knowledge gap for safe processes and procedures. As a manufacturer of remote switching and remote racking equipment, it's not uncommon for our team to encounter scenarios where trained personnel leave and there's inadequate timely training for the new person or team. With that training gap comes an increase in job safety hazards.

SAFETY EQUIPMENT ONLY PROTECTS WHEN PROPERLY USED

Remote switching or racking equipment can save lives, stave off injury, and prevent an accident from becoming a tragedy – but only when applied and set-up correctly. That's why training is vital. Workers need to understand and precisely adhere to safe-distance and PPE requirements. They must know how to read arc flash labels and how that information applies to their personal and team safety. They need to understand the correct procedures and sequence to attach and operate



Training and retraining every three years is vital to safe operation. It's a best practice that's also required by the National Electrical Code.

safety devices, like remote switching and racking equipment. For example, when using remote racking equipment (in certain applications) on circuit breakers, it's possible to over-torque a breaker's racking mechanism during the racking sequence – a risk that can be mitigated with the proper training and equipment application.

TAP INTO YOUR SUPPLIERS' KNOWLEDGE BASE

A best practice for spot-on training and safe equipment use is to have new employees receive equipment and task training by the OEMs (Original Equipment Manufacturer) of your electrical safety devices. Most manufacturers offer it. We conduct several for our customers each week. Nobody knows the equipment better than the team that designed and built it. Plus, OEMs have

ARC FLASH SAFETY TRAINING

already created and fine-tuned training programs that cover all the features and incorporate what they've learned through years of conducting trainings. It's what they do every day. **ESW**

EFFECTIVE TRAINING IS A LIFELONG PROCESS

Just like EMTs who continually train to save lives, electrical workers need ongoing periodic safety training to prevent potentially life-changing events. Fortunately, it's not difficult to make sure electrical safety knowledge and procedures are refreshed on a regular basis and in accordance with NFPA 70E standards. Create your schedules, conduct the trainings, call in OEMs to help when appropriate – it will become part of your company's standard procedures and your culture. EMTs save lives after a tragic event. A robust training and retraining program saves lives by preventing tragic events. Train and be a lifesaver.

SOURCES:

1. National Fire Prevention Agency. NFPA 70E Handbook for Electrical Safety in the Workplace 2021. NFPA. 2020
2. Coache, C. Website. (2019, December 04) A Better Understanding of NFPA 70E) NFPA. org. <https://www.nfpa.org/news-and-research/publications-and-media/blogs-landing-page/nfpa-today/blog-posts/2019/12/04/a-better-understanding-of-nfpa-70e-electrical-contact-fatalities>



Justin Gaull is VP of Business Development at CBS ArcSafe. He is a former firefighter/EMT, trained in NFPA 70E, and holds a master's in technology entrepreneurship from the University of Maryland's Clark School of Engineering. Learn more at www.groupcbs.com.

Don't Wear Fuel.



Partnership for Electrical Safety

Congress Urges OSHA
to Address Arc Flash PPE:

OSHA MUST ACT.

500,000+ Industrial
Electricians Still Without
Arc Flash PPE



Arc Rated Clothing



Non-Arc Rated Clothing

For more information or to get involved please visit our website, PartnershipForElectricalSafety.org



Arc Flash Relays: A Critical Component of Your Mitigation Strategy

By Ralph DeLisio, Contributor

Every day it is estimated between 5-10 arc flash incidents occur in the U.S., according to the U.S. Bureau of Labor Statistics. That is approximately 1,800 to 3,600 each year. Most occur when something is moving. Opening a door, removing a cover, and operating a disconnecting means or a closing contactor are frequent actions triggering an arc flash. A worker's movement (even a rodent's movement) might result in an arcing fault.

The intensity of the energy generated in an arc flash depends on the capacity of the circuit to maintain the arc, the duration of the arc, and the distance between the worker and the arc. Arc flashes can range in current from a few amps up to thousands of amps and are highly variable in strength and duration. An arc flash and ignition of flammable clothing are the cause of up to 80% of all electrical injuries and fatalities among qualified

electrical workers, according to OSHA. Clothing can be ignited from ten feet away, and clothed areas can be burned more severely than exposed skin.

NEED FOR RAPID DETECTION

Even if personnel injuries are avoided, an arc flash can damage or destroy equipment, resulting in costly replacement and prolonged and expensive downtime. To prevent serious injuries, fatalities, and property damage, it's important to have arc flash protection. The best way to minimize the impact of an arc flash event is to reduce the detection and circuit breaker tripping times. Conventional protection may need several cycles to detect the resulting overcurrent fault and trip the breaker. In some cases, there may not be sufficient current to detect an overcurrent fault. Tripping may be delayed hundreds of milliseconds for sensitivity and selectivity reasons in some applications.

ARC FLASH RELAYS

Arc flash detection-based (AFD) protection can act on the circuit breaker in a few milliseconds (2-5 ms). This fast response can limit the arc flash energy, preventing injury to personnel and limiting or eliminating equipment damage. The arc flash protection option in one arc flash relay currently on the market adds four-channel fiber-optic AFD inputs and protection elements. Each channel has a fiber-optic receiver and an LED-sourced fiber-optic transmitter that continuously self-tests and monitors the optical circuit to detect and alarm for any malfunction.

Don't overlook the importance of pre-work. Finishing the installation and getting the system back up while still having time to troubleshoot if necessary is key.

Because the relay is always active and monitoring the system for an arc flash, a facility does not have to rely on someone activating the system before doing work, which removes the potential for human error. Studies indicate up to two-thirds of electrical injuries are caused by human error.

In the 2018 edition of NFPA 70E, a guideline was added stating that human error must now be considered as part of the risk assessment procedure and the risk assessment must address the potential for human error and its negative consequences on people, processes, the work environment, and equipment.

Error precursors can involve excessive task demands, the work environment, individual capabilities that are not equal to task demands, and the natural limitations of human performance that cause workers to err under unfavorable conditions.

The propensity for human error is why the NFPA 70E 2018 edition emphasizes engineering out electrical risks. Wearing personal protective equipment (PPE) is the last line of defense. The focus is on how you mitigate the hazard. An arc flash relay is an important part of your mitigation strategy.

SELECTION FACTORS

Many arc flash relays are available in the market, making it challenging to select and install the right option. What features should you consider?

Reaction time: The relay's trip speed is an important feature. Reaction times are principally a function of the arc flash relay's light sensor input sampling scheme and the design of its trip output circuit. Because light is the earliest detectable indication that an arc flash is occurring, arc flash relays use optical light sensors to detect the arc that is forming. One arc flash relay on the market is configured based on monitoring system current, as well as light via fiber optic cables installed in the equipment. This arc flash relay design is capable of also monitoring voltage and data logs and provides other system protection such as undervoltage and ground fault. Ground fault detection allows you security in knowing your systems are ground correctly and you won't get faults - triggers that will come up.

Trip reliability: Reliable tripping is important because reliability ensures mitigation of an arcing fault.

Installation: Here are key issues to consider regarding installation: Where are you going to locate the relay? How are you going to wire it into your system? You want to have enough flexibility in your installation plans so the closer you can get the relay to your incoming load the less wire runs you have to put out. It is a significant time-saver when you're not running conduit and you're not going through ceilings.

You're always under a time constraint with a shutdown. You want to do your prep work and do a pre-check before you shut down. If you're running conduit lines, you want to run those wires and conduit long before you shut down. Don't overlook the importance of pre-work. Finishing the installation and getting the system back up while still having time to troubleshoot if necessary is key. Installing a prefabricated enclosure that is easier to wire to, and getting it as close to the switchgear as possible are two other installation considerations.

WHAT YOU NEED TO KNOW

Arc flash relays are complicated devices. How much

knowledge should a facility safety manager have of an arc flash relay?

You need to know the features and the advantages of these devices. Not every safety manager is an electrical engineer or an electrician. But you need to understand the function the arc flash relay plays, and what it is protecting: these are fundamentals. Work with your electricians or a company that you believe has the right expertise and select a service provider that meets your needs. The right company will understand your requirements, do the pre-work, and install protection correctly.

WHAT SHOULD FACILITY MANAGERS LOOK FOR IN A SERVICE PROVIDER?

Emphasize experience. How many arc flash relays has the service installed? In what type of locations? How many relays do you need in a single location? How many crews can a service provider run at once? In a large facility, one service did an installation in a day and evening with nine incoming feeds. There were 42 people on site. Services need to have the ability to manage a large facility, or on the other hand, be able to quickly handle one incoming feed in a short shutdown window.


Work with your electricians or a company that you believe has the right expertise and select a service provider that meets your needs. The right company will understand your requirements.

The pre-work is an important part of all this. And take advantage of other installation options. While you're installing a relay, it's a good time to install infrared windows because you have the line side open. When you are infrared testing, you no longer have to open the panel, you can still look at your incoming.

An arc flash relay is critical to prevent serious injuries, fatalities, and equipment damage and downtime. But your service provider should know what other problems your system may have and

correct them proactively and routinely to extend the lifecycle of your assets and improve your operational and safety performance in the long-term. Before your facility enquires about arc flash relay installations, work with a service provider to conduct an arc flash hazard assessment. An assessment can uncover issues in an electrical distribution system that may be hidden and make recommendations for reducing incident energy. If there are issues with your equipment, a service provider will partner with your facility to correct and repair them. One important defense is to install arc flash relays. **ESW**

Ralph DeLisio is Executive VP at SEAM Group (www.seamgroup.com). He is responsible for creating and maintaining a unified sales strategy across all business units on a global basis. He has more than 25 years of domestic and international business management and sales experience in manufacturing and service development.




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

Visit atplearning.com for more information.



A Mission-Driven CEO Leveraging Scale to Drive Competency

It's no surprise that John Welch, founder, and CEO of the Atlanta-based company Bowtie Engineering, has a strong vision about how to solve the electrical safety puzzle. Welch says "we are going to implement eight new things every month or else we fail the problem." The problem is big. We continue to see electrical violations hit OSHA's top ten list of injuries every year. We continue to see customers who decide not to invest in training, PPE and processes for implementation. Welch says, "With the right person, the right tools and the right process, we can work anywhere on the electrical system safely!"

Generally speaking, customers are not informed on the value of these process/maintenance tools, and electrical engineering studies. One can argue that there is no ROI on performing an Incident Energy Study. An Environment, Health & Safety (EHS) person can counter this argument and show the value; avoiding the risk of injury from a shock or a burn injury. But it is still hard to inform a non-technical decision maker of its value.

What Welch has done to address this disconnect, is to develop a solution that is so



simple to get around this complexity, that there is no reason not to sign up with Bowtie. Welch says "the qualified electricians continue to complain of the difficulties to understand the electrical risk, PPE requirements and condition of maintenance". These things are supposed to be supplied by the electrical equipment owners. The person doing the work and exposing his/her face and chest to energized electrical equipment rarely asks or has the data necessary to support safe work practices. Add the fact that he/she is most likely being pressured to hurry up and fix the electrical issue. All of these are trigger points to short cuts and mistakes, in Welch's view. An employee will introduce a threat to the system (human error); will drop load; cause enormous equipment damage and potential injury or loss of life from an electrocution or arc flash.

The solution is Bowtie Engineering Service model, coupled with Bowtie's Patented BowVue® Portal.

The Service model implements and controls the qualified worker and associates it with the risk/task. The BowVue® Portal manages it for the customer so with three mouse clicks a worker can be looking at any asset with the appropriate PPE requirement, the condition of maintenance, and the qualified person required for risk and job planning. It's simple, it's fast, it can be customized, and it continuously improves.

ABOUT US

Bowtie Engineering is a solutions-based systems engineering/integrated consulting firm that specializes in: Electrical Power studies (arc flash), Electrical Testing (NETA, IR), HVAC Management, UPS Management Generator Management. We deliver Safe reliable solutions for the most critical complex systems in the USA and Canada. We take a systems approach to facility management with uncompromising focus on safety & process that's supported by a leading team of engineers and technicians. All of whom are trained and certified in the regulation standards.

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Bowtie Engineering

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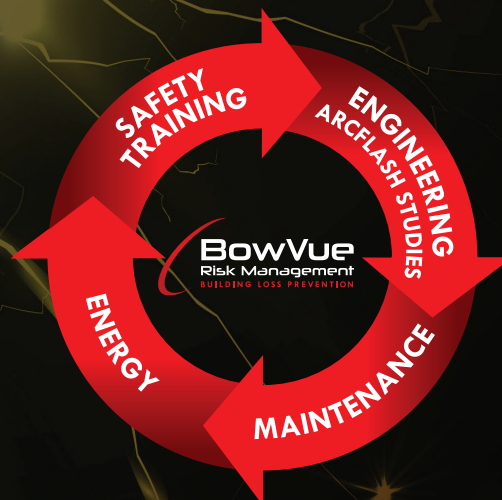
We are systems engineers who build roadmaps to greatness by implementing and building your top-notch employees.



What We Do

Technology-Enabled Solutions Tailored to Meet Customers Unique Needs:

- ⚡ Customized SOW for each critical power modality (UPS/Gen/HVAC/FSS/DC)
- ⚡ PM Maintenance & Full-Service Programs
- ⚡ Time Flexibility (Annual, Bi-Annual, Quarterly, or Monthly)
- ⚡ Ability to initiate, integrate, and maintain current vendor partnerships
- ⚡ Automated service reports uploaded to the BowVue Portal
- ⚡ 24x7 monitoring & NOC capabilities
- ⚡ Centralized scheduling platform for all critical power maintenance
- ⚡ National Electrical Arc Flash Studies | National Electrical NETA Testing
- ⚡ Electrical Safety Training NFPA 70E



Call today to learn more: 866.730.6620
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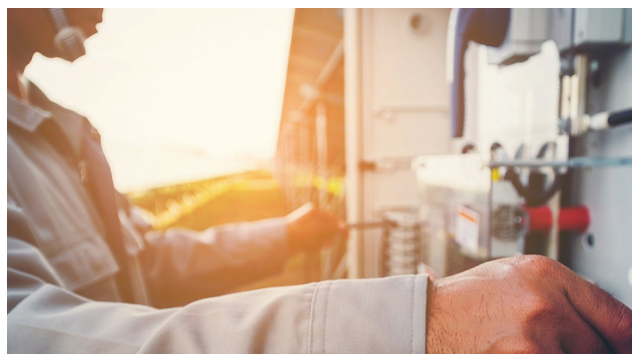
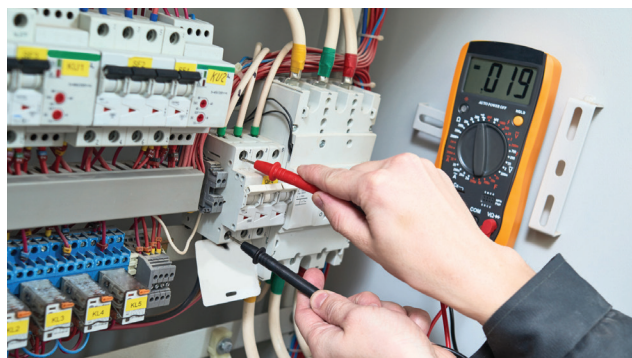
Inherently committed to electrical safety, I-Gard is providing its customers with Ground Fault and Arc Flash protection systems.

Every company wants the same from its electrical system: continuity and no safety issues. Electrical hazards such as ground faults, arc flashes, electrical shock impact industry on a daily basis from interrupting processes, damaging equipment and posing a safety risk to personnel but we have the a solution to each.

For process facilities concerned about process interruptions, equipment damage, the risk of arc flash that solution is High Resistance Grounding which is recognized by NFPA 70E, CSA ZA462 and the National Electrical Code as a technology that reduces the probability of an arc flash hazard. At I-Gard, we take safety one-step further by adding optical arc flash mitigation to our HRG systems to reduce probability and impact of an arc flash.

For users who cannot convert to HRG technology, we offer ground fault and arc flash protection relays to minimize the impact of an arc flash.

For facilities concerned about electric shock we have available, both our shock protection panels as well as our newest Absence of Voltage Tester (i-AVT)



Our history started as a power resistor company and we continue to offer a full range of resistor based solutions including Neutral Grounding Resistors (NGRs), dynamic braking resistors, and motor control resistors, all manufactured under the CSA SMTc program. With over 35 years of both domestic and international experience, I-Gard provides world class power protection.

Our focus on safety extends to education and awareness and is demonstrated through our partnerships with media companies at providing education editorials, application white papers and our active participation on industry safety and standards committees.

When you need electrical safety products, whether protecting your personnel, your key processes or your electrical equipment such as transformers, switchgear and generators, you can trust that I-Gard will offer you unparalleled protection.



ABOUT US

With over thirty-five years of both domestic and international experience, I-Gard's full line of neutral grounding resistors, ground fault protection systems and power-resistor based solutions provides world class power protection. Working to improve the future of power protection, I-Gard invests extensive resources on research and product development, with the goal of proactively eliminating ground faults, improving reliability in the workplace and reducing the risk posed by electrical hazards.

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- **Reducing the risk of electrical shock:** Positive indication of absence of voltage (Green LED lights) indicating the voltage is less than 3VAC or 3VDC.
- **Indication prior opening the panel:** Indication of hazardous voltage is present (Red LED lights), establishing a safer working condition for personnel.
- **Certified safe:** Tested to CSA 22.2 #160, UL 1436 and SIL 3 rated.

Contact I-Gard's sales team at: support@i-gard.com

Download the i-AVT technical information, visit: www.i-gard.com

The IRISS Ecosystem: Protect Your Workers, Assets, and Operations

Electrical incidents happen daily, putting lives and operational continuity at risk. However, there are ways companies can reduce the occurrence of these incidents and protect everyone concerned from the physical, operational, and financial consequences. Those who are implementing the IRISS Ecosystem of products and services are reaping significant benefits in terms of efficiency gains, cost control, and incident prevention.

WHAT IS THE IRISS ECOSYSTEM?

Originally a manufacturer of patented Infrared Inspection Windows, IRISS has continued to develop technologies that combine to form a full-scope approach to reliability. Each component plays a vital role, contributing to a safer, more educated workforce, and more efficient operations.

Online monitoring systems attach directly to electrical enclosures. Asset surveillance is a crucial part of maintaining electrical equipment and helps identify issues early to avoid system damage and downtime by monitoring power quality and partial discharge with permanently installed equipment and software. The data is wirelessly transmitted for analysis and to establish trends, putting equipment temperature changes in historical context to ease problem identification.

Infrared windows from IRISS are patented, polymer-based, effectively reducing downtime and risk while offering access to the points inside equipment parts require inspection and maintenance. Windows placed at targeted inspection points such as cable terminations or critical current-carrying components enable viewing in the visual, Ultraviolet, shortwave, mid-wave, and longwave IR spectrums - providing full access to connections without the significant risks



associated with panel removal.

Ultrasonic ports are used to detect arcing and tracking problems in electrical distribution systems and switchgear. They provide a standard and systematic approach to collecting data essential to establishing repeatable CBM by providing a ventilated, standardized measurement point. Alternately, low cost ultrasonic sensors can be permanently mounted to electrical equipment allowing simple plug-in measurements with a handheld ultrasound detector. IRISS has innovated our Infrared Inspection Windows to include them as well. Now, visual, thermographic, and ultrasound inspections can be accomplished all at once.

Intelligent asset tags link maintenance instructions and equipment diagrams to simplify the inspection/maintenance process by providing technicians with the information they need when and where they need it. This invariably leads to safer working conditions and faster maintenance as the technician does not have to search around for documentations, or worse, perform service ad hoc. Asset tracking and equipment maintenance history trend analysis help a business better understand how and why systems are operating or failing.

VALUE OF ELECTRICAL MAINTENANCE SAFETY DEVICES

The main benefits of using IRISS products as an ecosystem is that they remove risk of incidents threatening the safety of workers and provide for a more efficient pathway to asset reliability. Because there is no panel removal required, inspections can be accomplished with less manpower, time, and lower Personal Protection Equipment (PPE) levels.

ABOUT US

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Electrical Safety Through Superior Technology

IRISS is the global leader in engineering and manufacturing technology that makes the electrical world a safer place to work. Our asset monitoring, inspection, and management solutions work as a full scope to keep workers safe and improve operational reliability. In the dangerous world of electrical work, shouldn't you be adopting the best safeguards?



Wireless Temperature Monitoring Systems

The Delta-T wireless temperature monitoring system provides around the clock watch on asset performance and temperature. Easily-installed sensors transmit data for analysis and trending, and provides alerts to operators of possible issues before costly damage and downtime can occur.



Infrared Inspection Windows

Our patented IR Inspection windows are environmentally sealed and feature a reinforced polymer that allows closed-panel inspection of energized electrical assets with any thermographic camera. These fully-customizable designs allow for safer, more efficient, and more frequent inspections to promote operational continuity.



Ultrasound Inspection Technologies

Ideally suited to work with any plant maintenance program, Ultrasound detection can be utilized to detect early warning signs of equipment failure. Quickly and Safely perform closed-panel, airborne Ultrasound inspections of electrical equipment through built-in ports in the Infrared Inspection Windows.



Intelligent Asset Management

The E Sentry Connect™ is our next generation intuitive asset information tagging system, utilizing Near Field Communication and contactless Smart Card technology to easily access critical data for the equipment. Customize reports, inspection routes, and data caching with any smart phone device.



www.iriss.com



Oberon

Oberon is the market leader in high incident energy Arc Flash Personal Protective Equipment (PPE). Oberon, founded in 1978, is an engineering and manufacturing company that produces innovative electrical safety solutions.

Oberon's mission is to protect the welfare of the individual, while adding value to a customer's overall safety program. To ensure the worker's safety, Oberon has delivered innovations like these:

TRUE COLOR SHIELD FOR CLEAR VISIBILITY

Oberon invented the world's first ever clear grey lens technology, the True Color Grey (TCG™) Arc Flash Face Shields, allowing for true visibility with unmatched clarity.

COMFORT THROUGH LIGHTWEIGHT FABRIC

Oberon developed its own proprietary lightweight fabric systems that provides unsurpassed comfort for the wearer, without compromising safety.

THE RIGHT PROTECTION FOR EACH RISK SITUATION

With the widest range of protection in the market from 8 cal/cm² up to 140 cal/cm², Oberon offers the right solution for your risk level.

TESTED IN REAL WORLD CONDITIONS FOR HIGHEST SAFETY

Over the years Oberon has developed and implemented real world tests with simulated arc flash incidents to measure product response.

COMPLIANCE WITH SAFETY NORMS

The entire Arc Flash PPE product line meets



ANSI/ISEA 125 Conformity Level 2. In addition, excellent Quality Control with ISO 9001 accredited manufacturing facility in Dartmouth, MA, USA ensures top performance.

STANDARDS DEVELOPMENT

Oberon participates on many national standards committees like ANSI, ASTM, and CSA related to safety in the workplace.

EVERY SUIT IS TRACKED INDIVIDUALLY FOR ACCOUNTABILITY

Every Coat, Bib, Hood, Coverall, and Face Shield has their own individual unique serial number and bar code. If a customer has any questions about that products history and manufacturing, we can search our system using the serial number to determine production history.

OVERALL PROTECTION THROUGH FULL LINE SUPPORT

Oberon innovates, develops, and produces in house the complete Suits, Face Shields and Hard Hats. This integrated competence ensures that your PPE is working as one high performing unit, eliminating hazardous gaps by incompatible equipment.

LEAD TIME ADVANTAGE

Oberon products are manufactured in the USA and are available with short lead times. Order today on Oberon's webstore at www.oberoncompany.com.

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How Do You Know Your PPE Will Perform If You're Hit With 35,000°F in an Arc Flash?

Because we have done the rigorous testing for your safety.



- You deserve protection you can depend on - when you need it most.
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- Proven performance and comfort to meet your needs, because your safety is our business.
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National Safety Apparel



National Safety Apparel's family business is to protect workers in the toughest industries: getting them home safely, day after day.

We've contributed to the fabric of America since our modest beginnings in the midst of the Great Depression. In 1935, Walter "Wally" Grossman began developing and manufacturing heat and thermal protective apparel for foundry workers, steel pipe manufacturers and welders in his father's basement in Cleveland, Ohio.

Today we are a fourth generation, family-owned business that is proud to manufacture in the USA and serve hard-working members of the workforce

and our armed forces with FR clothing, safety clothing and military gear.

Our acquisitions help shape who we are. We continue to grow so we can offer our customers the largest selection of safety products in the industry.

Adding to our high-visibility and FR clothing lines has allowed us to provide hi-visibility, flash fire and arc flash hazard protection to workers that face these hazards. Our cutting-edge manufacturing capabilities has allowed us to grow these lines on a larger scale.

We've also expanded our offerings through acquisition to allow us to serve a wider range



of users and hazards, including women, special operations, unique and harsh environments and comprehensive head to toe protection.

We're proud to manufacture safety apparel for workers in hazardous industries and environments and proud to protect our heroes on the battlefield with high-performance FR combat and field gear.

Throughout our acquisitions our values of family, knowledge and customer focus remain constant, as well as our commitment to our workforce, armed forces, and their families.

Innovation isn't just our tagline: it's how we define ourselves.

National Safety Apparel's diverse house of FR clothing and safety brands are all dedicated to one critical mission: Protecting America's utility, manufacturing, and steel workers in the field and our armed forces on the battlefield. Our brands include:



DRIFIRE® FR - hi-vis, arc flash and flash fire industrial workwear and FR military clothing (found at DRIFIRE.com)



TECGEN® FR - stylish and lightweight flame-resistant clothing that includes head to toe options for arc flash and flash fire protection



HYDROLite FR™ - hi-vis flame resistant rainwear made from GORE® PYRAD® technology



VIZABLE® FR - hi-vis FR clothing



Union Line™ FR - USA, union-made FR clothing (found at UnionMadeClothing.com)



HauteWork® - FR Clothing made for women by women



Wild Things® - Wild Things is a premium cold weather military clothing brand that perfectly complements our existing DRIFIRE® brand of high-performance flame-resistant base layers, combat uniforms, and flight suits.



ArcGuard® - arc flash PPE, featuring our newest ArcGuard® Performance 40 cal arc flash suit



CARBON ARMOUR™ - thermal, welding and molten metal protection



cutGUARD™ - mechanical and cut protection



Kunz Glove® - quality leather gloves in the power utility industry



AG Safety™ - our newest line of electrical safety tools, blankets and accessories



ABOUT US

National Safety Apparel's family business is to protect your family working in the toughest industries, helping them get the job done safely and getting home to you, day after day. Our acquisitions help shape who we are. We continue to grow so we can offer our customers the largest selection of safety products in the industry.

National Safety Apparel
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Practicing Safety While Working on or Near Electrical Equipment

By Brianne Deerwester, Contributor

Electricity drives our everyday lives as demand and connectivity increase in this rapidly changing digital world. As our phones, homes, and workplaces get even smarter, a greater focus should be placed on utilizing electricity safely, especially on the worksite. Workplace electrical injuries and fatalities continue to disrupt the lives of workers and families yearly. These preventable injuries and fatalities can be avoided by providing proper training for electrical and non-electrical occupations and educating workers about the activities and hazards causing accidents in the workplace.

Every year, the Electrical Safety Foundation International compiles data on electrical injuries and fatalities using the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Injuries (SOII). This data provides insight to better promote electrical safety in the workplace. The data in ESFI's reports covers U.S. occupational electrical accidents, including the total number of electrical injuries and fatalities, the industries and occupations in which they occurred, and the rates of injury for selected industries. ESFI compiles the data to track electrical injury trends and to identify occupations and industries where electrical training, provided by the NIOSH and OSHA, can be applied to reduce the number of occupational electrical injuries.

The BLS found that between 2011 and 2019, there was a total of 19,055 workplace injuries caused by contact with or exposure to electric current; 17,680 of these were nonfatal injuries, while 1,375 were fatal. This accounts for an average of 2,177 injuries a year, or 5.9 injuries a day. In looking at the most recent data, 2019 recorded the highest number of fatal electrical injuries since 2011. There was a 3.75% increase in fatal injuries over 2018. Contact with or exposure to electric current accounted for 3% of all fatalities, maintaining the same percentage as in 2018. Electrical fatality rates were 0.11 fatalities per 100,000 workers, while the rate for all fatalities was 3.6 per 100,000 workers. In 2019, 8% of all electrical injuries were fatal.

There were 1,900 nonfatal electrical injuries

Temporary Power Safety

The Occupational Health and Safety Administration (OSHA) states that **contact with electricity** is one of the leading causes of **construction workplace fatalities**. However, temporary power is essential to construction workites and poses a great risk to workers. Follow these steps to **ensure proper safety procedures are met** when working with or around temporary power.

Setup

- Temporary wiring should be designed and installed according to OSHA, NEC, and NFPA 70E requirements.
- Temporary power must be installed by a **qualified electrician**.
- Temporary power equipment should be located on a worksite **protected from vehicle traffic**, accessible only to **authorized persons**, and suitable for the **environmental conditions** that may be present.
- Calculate the electrical load demand** to ensure the temporary power has the capacity to supply all connected loads.
- Ensure all unused openings are covered or closed** to afford protection substantially equivalent to the wall of the equipment.

Use

- Inspect cords and wiring** to ensure there is no **damage or alterations**.
- Temporary wiring must be maintained in a **safe code-compliant manner**.
- Ensure all equipment, receptacles, and flexible cords and cables are properly grounded.**
- Unused panelboard, disconnect, and breaker openings must be effectively closed** to prevent any foreign objects from getting inside.
- Establish a timeframe** of when temporary power will be removed or switched over to permanent power.
- Use equipment rated for the environment** (indoor or outdoor) where supplied by temporary power.
- GFCI protection is required for all 120-volt, 15- and 20-ampere receptacle outlets, listed cord sets or devices incorporating listed GFCI protection for portable use is permitted. Other receptacle outlets shall be GFCI protected or be included in an approved equipment grounding conductor program.**
- Test GFCIs monthly.**
- Keep a test and maintenance log** of the equipment and cord sets being used.
- Always disconnect power and lockout/tagout** when maintaining, repairing, extending, or re-routing temporary power.

Removal

- Temporary power **must be removed** when the project is completed. Temporary wiring is only allowed for:
 - Construction, remodeling, maintenance, repair, or demolition of buildings, structures, or equipment — or similar activities.
 - Emergencies, tests, experiments, and developmental work.
- Temporary wiring must be removed immediately upon completion of construction or the purpose for which it was installed.
- Maintain circuit directories** to ensure worker safety.

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involving days away from work in 2019, which was a 22% increase over 2018. In 2019, 0.21% of all nonfatal injuries resulting in days away from work could be attributed to electricity, compared to 2018, when 0.17% could be attributed to electricity. The industries with the leading number of nonfatal electrical injuries were construction at 20% of the total, manufacturing at 16%, leisure and hospitality at 13%, education and health services at 11%, and accommodation and food services at 10%. Electrical shocks accounted for 1,340 of the nonfatal electrical injuries, while burns accounted for 470.

The construction industry had the highest rate of fatal electrical injuries, 0.7 fatalities per 100,000 workers, followed by the utility industry, 0.4 fatalities per 100,000 workers. All industries had 0.1 fatalities per 100,000 workers. The number of electrical fatalities varied between age groups. Eleven percent occurred in workers aged 20 to 24, 30% occurred in workers aged 25 to 34, 27% occurred in workers aged 34 to 44, 17% occurred in workers aged 45 to 54, and 13% of electrical fatalities occurred in workers aged 55 to 64.

COMBATTING INJURY

An infographic highlighting Temporary Power Safety was created to help combat preventable electrical injuries in the construction industry. OSHA states that contact with electricity is one of the leading causes of construction workplace fatalities. However, temporary power is essential to worksites but poses a great risk to workers. The proper steps must be followed to ensure proper safety procedures are met when working with or around temporary power. Temporary power must be removed when a project is completed. Temporary wiring must be removed immediately upon completion of construction or the purpose for which it was installed and is only allowed for: construction, remodeling, maintenance, repair or demolition of buildings, structures, or equipment, or similar activities, emergencies, tests, experiments, and developmental work.


Temporary wiring should be designed and installed according to OSHA, NEC, and NFPA 70E requirements and must be installed by a qualified electrician. Temporary power equipment should be located on a worksite protected from vehicle traffic, accessible only to authorized persons, and suitable for the environmental conditions that may be present. Always calculate the electrical load demand to ensure the temporary power can supply all connected loads. Ensure all unused openings are covered and closed to afford protection substantially equivalent to the wall of the equipment. Unused panelboard disconnect and breaker openings must be effectively closed to prevent any foreign objects from getting inside. Establish a timeframe of when temporary power will be removed or switched over to permanent power.

Before using temporary power, always inspect cords and wiring to ensure there is no damage or alterations. Temporary wiring must be maintained in a safe, code-compliant manner. Ensure all equipment, receptacles, and flexible cords and cables are properly grounded. Use equipment rated for the environment where supplied by temporary power. GFCI protection is required for all 125-volt, 15-, 20-, and 30-ampere receptacle outlets. Listed cord sets or devices incorporating listed GFCI protection for portable use are permitted. Other receptacle outlets shall be GFCI protected or be included in an assured equipment grounding conductor program. Be sure to test GFCIs monthly. Keep a test and maintenance

log of the equipment and cord sets being used. Always disconnect power and lockout/tagout when maintaining, repairing, extending, or re-routing temporary power. Maintain circuit directories to ensure worker safety.

Contact with overhead power lines continues to be one of the major worksite hazards and causes of electrical injuries and fatalities. Overhead power lines cause 40% of all electrically related fatalities in the workplace, and a majority of these accidents occur with workers that have little to no electrical safety training. Before conducting any work on a worksite, it's important to always look up to survey the area for any overhead power lines. Always carry equipment horizontally, such as ladders, to avoid bumping into any overhead lines. Ensure you are at least 10 feet away from any overhead lines and 35 feet away, or about two dump truck lengths, from any downed power lines. If weather conditions are wet, you may need to move even further.

If you contact a power line and you're in a vehicle, stay inside and warn others to stay away, then call 911. Do not exit unless you see smoke or fire. If you must exit the vehicle, do not touch the ground and the vehicle at the same time. You must jump from the vehicle and land with your feet together. Then avoid lifting your feet as you slowly shuffle away from the vehicle and downed line. Remember, if you see a downed power line, stay away and call 911. But to avoid major accidents in the first place, be sure to always look up.

As the world becomes more electrified and the U.S. construction sectors continue to grow, the average worker has a greater risk of unintentionally encountering hazardous electrical current. This is why all workers, whether they are working on and near electrical equipment directly or not, need to be trained on the importance of working safely with electricity. No matter if the work takes place in an office, industrial facility, or construction site, all workers should be aware of the hazards of their worksite and how to avoid electrical injuries and fatalities. For free-to-share materials you can use throughout your workplace to prevent these avoidable injuries, visit esfi.org. 

Brianne Deerwester is the Communications Coordinator at Electrical Safety Foundation International (www.ESFI.org).

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Setting The Record Straight: Equipment Safety in Hazardous Areas

By Robert Potter & Richard Holub, Contributors

When it comes to using equipment in hazardous location classified areas that's manufactured in other countries, what are the rules? What certifications are necessary? And how do you tell if equipment is safe for your application?

Hazardous location classified areas contain flammable gas, liquids or vapors, combustible dusts, or easily ignitable fiber and flyings. When one of these are combined with an oxidizer and ignition source, the result may be an explosion or fire.

In North America, equipment meeting relevant hazardous area location certifications first must meet ordinary location requirements. These "ordinary" standards include but are not limited to:

- UL 94-VO standard for flammability
- UL 489 for molded case circuit breakers
- UL 50 and NEMA 250 standards for electrical enclosures, and
- UL 1581 standard for electrical wires, cables and flexible cords.

In our view, there is a common shortfall with hazardous areas solutions from overseas; they may not be tested to the general ordinary location American standards for suitability. In contrast, North American products applied in hazardous locations classified areas must first meet the requirements of ordinary locations before approval for hazardous areas may be achieved.

When organizations decide to use technology from outside of North America, there are the National Electrical Code (NEC) and Occupational Safety and Health Administration (OSHA) exceptions to consider. It's essential to understand there is tremendous liability to use those technologies if equipment is not certified to North American standards.

PRIMER ON ZONE EQUIPMENT CERTIFICATION

The Zone method has become a worldwide accepted practice for classifying hazardous location classified areas. The International Electrotechnical Commission System for certification to standards relating to equipment for use in explosive atmospheres (IECEx System) lists 62 countries that are full members and an additional 26 as associate members. Many countries have their own directives and certification requirements for equipment

approvals within their borders.

The Zone method dates back to 1996 and was first introduced by the NEC, National Fire Protection Association (NFPA) with Article 505. It allows for parallel classification in the traditional NEC Article 500 Division system.

In this division system, Zone terminology was used as the international system for classification of hazardous locations containing flammable gasses, liquids or vapors, combustible dust, or ignitable flyings, which divided classified areas into three segments: Zone 0, Zone 1, or Zone 2 for gases/ vapors, and Zone 20, Zone 21, Zone 22, for combustible dust and ignitable flyings.

Today, Zone-rated equipment still requires certification of ordinary location requirements in the U.S. The AEx marking, developed by the American National Standards Institute (ANSI) and International Society of Automation (ISA), ensures that Zone equipment conforms with hazardous location requirements and the general ordinary location American safety standards. As such, the AEx symbol is a critical marking requirement within the Zone material nomenclature.

The AEx marking per NEC article 505.9 and Article 506.9 certifies the equipment has been produced to American standards—conforming with both general standards for ordinary locations and hazardous area requirements.

The Authority Having Jurisdiction (AHJ) and qualified testing labs have an essential role. The AHJ can approve equipment when there is sufficient safety data. Further, if equipment is listed by a qualified lab, then the internals of the equipment do not need to be inspected, except to look for problems, changes, or damage. *Note: The 2020 Edition of the National Electrical Code allows for the Class I marketing to be optional.*

What if an AEx-Zone or Division certified technology isn't available?

The NEC Article 500.8(A) addresses this possibility and indicates that the suitability of equipment is determined by one of the following:

- Equipment listing
- Evidence of equipment evaluation from a qualified testing lab or AHJ, or

EQUIPMENT SAFETY IN HAZARDOUS AREAS

- Evidence acceptable to the AHJ like a manufacturer's self-evaluation or owner's engineering judgement.

In our view, a manufacturer's self-certification and owner's engineering judgement must be carefully reviewed and only be considered when the decision maker is fully confident that ordinary safety standards have been achieved. This evidence must also be accepted by the AHJ.

Further, OSHA provides additional guidance and requirements for product allowance. OSHA 29 CFR 1910.399 defines equipment acceptable for hazardous environments if it is:

1. Determined safe by a nationally recognized testing lab
2. Inspected by another federal agency, or by a state, municipal or other local authority responsible for enforcing occupational safety provisions of the NEC and found in compliance with the NEC
3. Determined to be safe (for its intended use) by the manufacturer, based on test data, that the employer keeps and can provide for inspection purposes.

ZONE METHOD RATED EQUIPMENT: MARKED WITH AEX, LISTED BY A NATIONALLY RECOGNIZED TESTING LAB

The OSHA and NEC allowances permit for a product to be approved for installation without third-party testing by a nationally recognized testing lab (NRTL); OSHA lists 19 NRTLs on their website, including UL, CSA, ETL-Intertek, and FM.

However and importantly, both the OSHA and NEC language indicate the general rule is that equipment should be tested and listed by a NRTL—unless these avenues have been exhausted.

When thinking about electrical equipment without testing by a NRTL, it's important to consider:

- Does the state or municipality where equipment is being installed have requirements only allowing for the installation of third-party evaluated equipment?
- Does the customer facility have requirements only allowing for installation of third-party NRTL evaluated equipment?
- Who is shouldering the liability for the owner's engineering judgement or self-

evaluated equipment for suitability of ordinary and hazardous-area locations?

Facilities using the NEC Articles 505 and 506 Zone classification of hazardous location classified areas are governed by the approval requirements outlined in the NEC articles for the wiring methods and equipment certification.

When zone method-rated equipment includes the AEx marking, it means the equipment is certified to the American standards per NEC Article 505.9 (C) and Article 506.9 (C). That AEx marking ensures the Zone equipment conforms with both hazardous location requirements and general safety American standards for ordinary locations. These certifications give customers confidence and trust in the equipment they're applying. **ESW**



Robert Potter is a Field Application Specialist at Eaton (www.eaton.com) & Richard Holub is an Electrical Engineering Consultant at DuPont (www.dupont.com).

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Using Technology to Enhance Electrical Safety

By Steven J Abbott, REALTIME-SAFETY.com

There is a growing overemphasis in the job planning process to simply use the information on an applied arc flash warning sticker. This all too often creates an unconscious disregard or forgetfulness to review other critical sources of information that are important to the electrical safety planning process and creates an incomplete picture of the hazard and associated risk. We will take a look at how this can increase the risk of an arc flash or shock-related injury.

First let's be clear: there is a lot of important and useful information on the arc flash warning label (based on the 2021 NFPA 70E 130.5(H) Equipment Labeling). The immediate concern is how quickly that new arc flash label no longer accurately represents the hazards that exist at the present time. Changes occur very quickly and very often in some work environments, which make it easy to have incorrect information being used for safety.

Here is a breakdown some of the additional information that you typically will not find on an arc flash warning label that should at least be reviewed in the job planning process:

- **Current system details:** One-line diagrams, detailed arc flash analysis reports (which may include specific analysis assumptions, more specific system switching configurations that may need to be determined before proceeding), as well as any equipment specifications, cut sheets, or manufacturers' documentation.
- **Equipment historical data:** Inspection data, logs/reports of preventive maintenance actions, and any repairs to fix problems that may have occurred (or, just as important are the repairs that have been identified but not yet fixed).
- **Other concerns:** At some point most workers will realize that the arc flash analysis information (labels, drawings, etc.) is no longer accurately providing the information needed to plan and prepare for the task at hand. When that point is reached, far too many qualified and knowledgeable individuals will no longer rely on the warning label and try to come up with their own best on-the-spot assessment



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.

to do the job as safely with the incomplete information at their disposal.

A quick remedy to this practice can simply be to quickly communicate the changes that have occurred or the problems that have been addressed by using available technology to document or "alert" anybody and everybody who would potentially have access to that equipment to ensure that they are made aware. With most workers having a smartphone, quick alerts using text or email can really keep the changes in the forefront for everyone to notice of and prevent an accident for failure of being aware.

Considering that in 2021 much of the workforce would rather use a touchscreen than a pencil and paper, it creates a much more inviting situation for workers to be able to participate and use information in a readily available format, and it makes it simpler if all records and information for a specific device is compiled in one easy-to-access source. This cuts out countless hours of not only compiling and sharing documents, but also clearing out outdated information. What this does is create for industry that our social culture has become accustomed to, which is getting information as close to when it happens as

USING TECHNOLOGY TO ENHANCE ELECTRICAL SAFETY




Using only the warning label applied to a piece of equipment is only providing you limited information and potentially outdated information.

possible or having it in “realtime”. The alternative could be gaps in time when new information has been shared, which adds a layer of risk to the job planning process.

Imagine being able to access the current one-line diagrams via your mobile device and quickly get the newest versions as soon as they are available or having pictures instantly shared (or even videos) to illustrate and explain things that are found to have changed from previous installations / conditions.

Imagine being able to access schematics or manufactured cut sheets and quickly view any prior preventative maintenance efforts or even documented inspection findings to quickly be able to evaluate the current equipment as to if any of those findings still exist or if they have been abated.

Using only the warning label applied to a piece of equipment is only providing you limited information and potentially outdated information unless you pursue and review other related sources of information that can confirm its accuracy or to determine if a more up-to-date accurate piece of information is available. Using technology to keep your information readily available to the workers who need it can make their jobs: **QUICKER, SIMPLER, SAFER.** 

Steven J Abbott is owner of Stark Safety Consultants and REALTIME-SAFETY.com, an online cloud-based system that offers a quicker, simpler and safer solution to data collection, device document and system change tracking, and preventative maintenance and more (www.realtime-safety.com).



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