

NFPA 70E DO'S and DON'TS

AVOID COSTLY MISTAKES

By John Klingler, P.E.
Klingler Electrical Safety, LLC

Companies across the U.S. and Canada are pursuing compliance with NFPA 70E – the Standard for Electrical Safety in the Workplace. Some of these companies will make costly mistakes; here are some Do's and Don'ts to avoid doing the same.

DON'T

- **Don't wait for an accident or for NFPA 70E to become a legal requirement before implementing its requirements.**

NFPA 70E addresses electrical hazards including shock and arc-flash. If you implement the requirements of NFPA 70E, you will avoid that electrically related accident that causes grief, suffering, financial settlements, investigations, and citations.

NFPA 70E is the most comprehensive electrical safety standard available today. There are other excellent electrical safety standards including the National Electrical Code, but NFPA 70E is the only one that addresses electrically safe work practices, electrical maintenance safety, special electrical equipment safety and electrical installation safety in one document. Serious consideration should be given to NFPA 70E not because it virtually assures compliance with OSHA's electrical requirements, which it does, but because it addresses protection from electrical hazards for your employees and others who work in your facility.

- **Don't purchase flame-resistant (FR) clothing needlessly.**

Yes, FR clothing is probably needed for several tasks in your facility, but there are several ratings of FR clothing varying from light-weight to very heavy switching suits, none of which are what one would call inexpensive. So how do you know which of these ratings you need? You don't want to buy clothing that is too light-weight exposing your employees to a hazardous injury and you don't want to burden them with wearing too much clothing that may cause heat stress or even compromise their safety by hindering visibility and movement.

Furthermore, arc-flash hazards can often be reduced or in some cases even eliminated by making changes in fuses or circuit breakers, possibly avoiding the need for heavier PPE. If you have employees that need to be protected against potential arc-flash hazards, it is always better to complete an arc-flash hazard analysis, reduce or eliminate as many hazards as possible, and then decide on a reasonable PPE policy to address the remaining hazards.

A few years ago, a survey determined that 75% of the equipment qualified personnel work on or near had an NFPA 70E Hazard / Risk of Category 1 or

less. The most important point here is: know which equipment is not in the 75% and therefore requires the additional FR clothing and personal protective equipment.

Keep in mind you do not need separate FR clothing for each Hazard / Risk Category. NFPA 70E suggests a clothing system in Annex H of the standard that may significantly simplify FR clothing requirements.

- **Don't purchase insulated tools that are too bulky for the tasks your employees perform.**

NFPA 70E requires employees to use insulated tools when working inside the Limited Approach Boundary of exposed, energized parts where tools might make accidental contact with the energized parts.

Insulated tools are easy to find, but many tool sets are designed for big equipment that linemen work on and are not well suited for industrial control panels and drives. Make sure the tools you select are not too big and bulky to be used on the equipment in your plant. If you are buying multiple sets, suppliers/manufacturers may allow you to customize your tool sets by picking and choosing tools that are practical for your facility, in some cases even allowing mixing of brands to come up with just the right set of tools for your facility.

When you buy insulated tools, invest in a separate tool pouch for the insulated tools so the insulated tools are not banging around against the non-insulated tools resulting in damage to the insulation. A worker's life may depend on the condition of that insulated tool; take good care of the tools.

- **Don't implement an "Energized Electrical Work Permit" without some serious thought.**

An Energized Electrical Work Permit as required by NFPA 70E is an excellent means of discouraging energized work/maintenance/repair unless absolutely necessary, and if it is necessary, complying with the permit assures every possible measure has been taken to keep the worker safe while performing the task.

However, before implementing an Energized Electrical Work Permit Policy, give serious thought to how permits will be handled in the middle of the night, weekends and holidays. Will the appropriate personnel be available to sign the permits when needed? Will work be delayed until the appropriate signatures are collected? Is it acceptable to fill out and sign a permit after the fact? And what about those tasks that everyone already knows must be completed without de-energizing the equipment, are you going to delay the task each time until the permit is filled out and appropriate signatures are obtained?

The Energized Electrical Work Permit can be an effective tool, but you must anticipate the scenarios of how it will be applied before implementing the policy. Don't implement an Energized Electrical Work Permit Policy just because NFPA 70E requires it, do it to reduce exposure of employees to

electrical hazards and to make sure when they are exposed, they are protected and prepared to perform the work safely.

- **Don't implement policies you are not willing to enforce.**

It is a waste of time, money, and effort to develop policies that are not going to be enforced. Regulatory agencies will not be impressed by well-written policies; they are looking for results – a safe work place with no accidents.

Facilities that have great policies, but have workers who respond, “Most of the time”, when asked if they always comply with the policies, are not achieving the level of safety needed. The facilities with the best safety results are those that have good safety policies with zero tolerance for non-compliance.

When developing a safety policy, make sure it is written such that you are willing to enforce the policy. Decide what your disciplinary policy will be for non-compliance, document the safety policy and the disciplinary policy, and communicate these policies to employees, contractors, vendors, and suppliers. When disciplinary action is taken, make sure you document the action every time. This documentation is not only important to prove consistency and credibility with the workforce, but it may be extremely important in proving your regulatory compliance with the Regulators following an accident.

- **Don't forget about shock hazards.**

Today arc-flash hazards and FR clothing are getting much attention. This is because knowledge of flash hazards is relatively new (most of the research has been completed since the mid 1980s), OSHA has become more outspoken in their support of NFPA 70E and its arc-flash requirements, and because manufacturers and suppliers have been aggressive in their advertising of products and services to protect against arc-flash hazards.

However, fatality statistics still show that more workers die from electrocutions than from arc-flash. It may be that more people go to the hospital with arc-flash injuries than shock injuries, but shock is still the greater threat.

So when purchasing PPE for electrical hazards, writing your electrical safety policies, and training your workers, don't forget about shock hazards. NFPA 70E does an excellent job of addressing shock hazards.

Do's

- **Do develop a training schedule.**

Proof of attendance at a one-day training session on NFPA 70E is not adequate to *qualify* your employees to perform electrical work. Although NFPA 70E training is definitely recommended, if not required, it should only be a single component of a much broader-based training program.

Start by preparing a list of the tasks *qualified* person(s) or electrician(s) are to perform on or near exposed energized parts; this can be accomplished more formally in a job/task analysis (JTA).

Next, complete a hazard analysis for each task, formally known as a job hazard analysis (JHA), and prepare a description of the skills and knowledge required to perform the job safely. This should include OSHA and NFPA 70E training requirements.

Now compare these requirements to the knowledge, skills, and training of the person expected to perform the task(s). This comparison should identify the areas of weakness and be a guide to develop a training schedule to *qualify* your employee(s).

Training budgets are limited, so concentrate on the major safety deficiencies first. Try to develop a 3 year plan, which will coincide with updates to the regulations and standards. Schedule a minimum of 2 to 5 days of training annually for each *qualified* employee.

- **Do complete an arc-flash hazard analysis.**

Facilities having employees, contractors, or service personnel that perform tasks exposing them to energized components are generally better off completing an arc-flash hazard analysis as opposed to just using NFPA 70E's four-foot arc-flash boundary for equipment less than 600V and the PPE prescribed by the NFPA 70E tables. The NFPA 70E tables serve a vital need, providing arc-flash boundaries and PPE requirements, for equipment that a hazard analysis has not been completed. However, if the table footnotes are not properly observed, the required PPE may be inadequate to protect the worker, or in the more likely case, the PPE requirements will exceed what is actually necessary, potentially causing heat stress, hindered visibility, and restricted movement.

It is the author's experience that a substantial percentage of the equipment operating at 480 volts and less will have an arc-flash boundary of less than 12 inches, negating the requirement for FR clothing to protect the face and torso. However, experience has also shown that it is not uncommon for industrial and large commercial facilities to have a small percentage of equipment where even the 4 foot default boundary is not adequate to avoid permanent injury in the event of an arc-flash. Consequently NFPA 70E and IEEE std. 1584 provide formulas to be used under engineering supervision to determine where FR clothing is needed and where it is not.

- **Do ask the engineers completing the arc-flash hazard analysis for recommendations on how to reduce or eliminate the hazard.**

An arc-flash analysis by a qualified engineer should provide more than just the results of the analysis. The engineer should review each location having a Hazard / Risk Category 1 or greater to determine if any changes can be made to reduce or eliminate the severity of potential flash hazards. The engineer should evaluate what affect changing fuse types or breaker settings will have on the Hazard / Risk Category of the equipment. In most cases the engineer can make recommendations that if accepted will reduce flash hazards, resulting in a safer workplace and lower PPE cost - truly a win-win.

- **Do keep a copy of the arc-flash analysis data files.**

If you use an engineering/consulting company to conduct an arc-flash hazard analysis, require that they provide an electronic copy of all the data files used in the analysis.

Within weeks or months, if not days, following the completion of the analysis, changes will be made to the facility's electrical system which may require recalculating part or all of the analysis. If you have the data files, your options for updating the analysis are much greater than if your consultant owns the files. Having the data files will generally result in a lower cost to update the flash hazard analysis. If you have the necessary resources you may even consider purchasing the analysis software and updating the analysis yourself.

- **Do decide on how appropriate PPE will be made available to employees before labeling equipment with PPE requirements and before training employees on the PPE requirements.**

Please do not misunderstand what I am saying, I am not suggesting that you delay informing your employees of potential electrical hazards they may be exposed to. I'm just suggesting that you don't get the cart before the horse, potentially creating a situation you cannot tolerate.

The natural progression of completing hazard analyses and providing appropriate PPE should go something like this; complete the analyses, eliminate or reduce as many hazards as possible, identify where the remaining hazards are, determine the level of PPE needed, procure the PPE, label the equipment and then train your employees. The training should include:

- how to recognize and avoid the hazards
- PPE Policy
- Energized Electrical Work Permit Policy
- Lockout/Tagout Procedures
- Requirements for an Electrical Safe Work Condition

Some facilities do the right things, in the wrong order, resulting in frustration, resistance and even bitterness toward management, assuming management is only doing this to meet legal requirements, not because they are truly concerned about the safety of the employee. It is very difficult to explain why an employee should work in a cabinet that has an arc-flash warning label on the door, without providing the employee the appropriate PPE required by the label. Excuses of - the PPE is back-ordered or the PPE has not been decided on yet or the new PPE requirement has not received funding approvals yet, does not build an atmosphere of trust and commitment to safety.

Consider procuring a minimum amount of PPE immediately, enough to use until your analyses are complete and the appropriate levels and quantities of PPE can be procured, and then proceed with labeling and training.

- **Do label equipment with enough detail to inform the worker of the potential hazard and PPE requirements.**

Labeling of equipment is an extremely important component of the Flash Hazard Analysis. Determining the arc-flash boundary and the appropriate PPE is pointless if that information is not communicated to the individuals working on or near the equipment with the hazard. The label should be placed in a conspicuous location that will be easily seen by workers before opening the equipment. The label should provide the worker with enough information to know at what distance PPE is required and what level/category of PPE is required when crossing the approach/flash boundaries.

Since 2002 the National Electrical Code[®] (NEC[®]) has required labeling of panelboards and similar electrical equipment to warn of potential flash hazards. Although the current NEC[®] language does not specify what information must be provided on the warning label, it is likely that future editions will add some requirements. This author recommends that at a minimum the following information should be included on the label:

Maximum Voltage in the Equipment
Arc-Flash Boundary
Required PPE (Hazard/Risk Category or cal/cm²)

- **Do give consideration to contractors, vendors, and service personnel that enter your facility and are exposed to electrical hazards.**

For their safety and your protection, contractors, vendors, and service personnel should be required to comply with NFPA 70E when working in your facility. Many companies send letters to all their contractors, vendors, and service companies requiring NFPA 70E compliance when working in their facilities.

The facility must make sure their equipment has been properly labeled with enough information for these non-employees to understand the potential hazards and to select appropriate PPE.

- **Do make sure your equipment has been properly identified.**

Label each disconnect (circuit breakers and switches) as to its purpose - a requirement of the National Electrical Code "Section 110.22". Furthermore proper identification is required to complete lockout/tagout procedures, but can lockout/tagout procedures be completed if the appropriate disconnecting devices cannot be found?

Identification is also a prerequisite of any arc-flash hazard analysis study. Regardless if you are conducting your own arc-flash hazard analysis or hiring it done, the required electrical data cannot be accurately collected without knowing the purpose of each disconnecting device.

Unfortunately, many facilities do not have all disconnects labeled, and surprisingly in some plants no one knows what some disconnects are used for. Leaving it to the analysis data collectors to trace out a circuit generally requires additional time, money, and potentially even disruption of equipment operation. It is much more effective to label your disconnects before the analysis at times convenient to the facility.

If you really want to enhance safety and maintenance, consider also labeling the utilization equipment (the load) with information as to the location of the respective disconnect. Proper labeling generally encourages lockout/tagout procedures and may save valuable time in the event of an emergency.

As an example, following an electrocution of an electrician, his co-worker was interviewed to determine why the two of them had been replacing lighting ballasts while the circuit was energized. The co-worker replied that the circuit breakers were not labeled, and it took too long to determine the proper breaker to de-energize, so they always perform the work “hot”. **Label disconnects; it's the law!**