2018 Electrical Safety NFPA 70E

Arc Flash is More Than Just a PPE Label!
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Our History With NFPA 70E:

- Employee owned specialty Engineering and Design Co. with over 2,000 electricians in the field for over 45 years now in the industry on a National level.
- Our first exposure with 70E came in 2000 with a flight for life in Kansas City and since that time we have dedicated a complete division within Faith to help internally and externally with customer care on program development.
2017 Top Ten OSHA Citations List:

OSHA’s top 10 violations are:

#1  Fall Protection in construction  (29 CFR 1926.501)  6,072 violations
#2  Hazard Communication  (29 CFR 1910.1200)  4,176 violations
#3  Scaffolding  (29 CFR 1926.451)  3,288 violations
#4  Respiratory Protection  (29 CFR 1910.134)  3,097 violations
#5  Lockout/Tagout  (29 CFR 1910.147)  2,877 violations
#6  Ladders in construction  (29 CFR 1926.1053)  2,241 violations
#7  Powered Industrial Trucks  (29 CFR 1910.178)  2,162 violations
#8  Machine Guarding  (29 CFR 1910.212)  1,933 violations
#9  Fall Protection—training requirements  (29 CFR 1926.503)  1,523 violations
#10  Electrical—wiring methods  (29 CFR 1910.305)  1,405 violations
Typical Control Panel Incident Video Example:
Defining Our Perspectives on NFPA 70E:

“Arc flash”
It’s More Than Just a PPE Label

Our goal today is to not only help review the current 2018 code but to also challenge “what we think we know”.

From general experience over 18 years of helping companies nationally we have witnessed some common themes or trends nationally to share with companies.

Today we will cut to the core essential needs and build a perception foundation. From there everyone can then review arc flash as “one component” of the overall ESWP program.
Defining “Compliance”:

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of the NFPA standards. Nor does the NFPA list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.
NFPA 70E Employer Options:

**Code Book Methodology:**
The NFPA 70E Code has methods available for employers to pick PPE levels to the best of your ability should you chose this method for picking PPE. OSHA cannot force employers to do formal engineered audits to determine exact exposure levels however if we chose PPE incorrectly the employer is accountable.

**Formal Engineered Risk Methodology:**
Although the code book is an option, the one true method in determining exposures is to have systems formally engineered. This method presents better support but still has potentials for gaps in the process used to enter in exact field information etc.
How to Dissect Written Scope Content:

“Data Collection” Definitions

“Field Technicians will visit your facility to collect the necessary electrical data to perform an Arc Flash Hazard Analysis. Electrical information will be gathered and the systems analyzed form the utility connection point to the equipment.”

“Your facility should be properly labeled per the NEC prior to arrival. If there are unlabeled or mislabeled over-current protection devices, it is the responsibility of the facility to rectify these if they are to be included in the analysis.”

-ABC Company

•Since roughly 2006, Faith recognized the national trends in arc flash where vendors were collecting “as is” equipment data therefore making site time less costly but potentially increasing risk by running with raw data collection efforts.
2018 NFPA 70E Summary of Expectations:

- From the first several slides hopefully we have a different perspective on what NFPA 70E represents and how we should reference it but not use it as ultimate compliance?

- Hopefully we can help others as we move forward in keeping our vision on building overall program depth vs getting engaged in just the “arc flash” or engineering end of the safety topic.

- Again, “Arc Flash is More Than Just a Label” ......
We “Don’t Know What We Don’t Know”........

• Employee used wasp spray on an exterior bus. Wasps died along with major injuries to the employee when the bus faulted as the nest fell onto live bus.
What Employee Group Should We Watch?........

• In safety we all can relate to one common theme. That general theme is as human beings, we all have some tendencies and at times common traits.

• Which age group of employees has shown they present a higher risk in not following along with safety expectations or policies?

1. 18 – 25
2. 25 – 40
3. 40 - Retirement
What Employee Group Should We Support?........

• If most of you picked #3 in the options you aren’t alone and commonly many people think that section of our workforce is where we should focus our attention.

• The answer is 25-40 and the statistics prove this to be true from OSHA. When new programs get released this group tends to not follow them as fast and can feel their productivity and past value to the company outweighs safety expectations etc.....

25 – 40
OSHA Has Some Fairly Common Citation Themes:


OSHA Regional News Release

May 3, 2016

Mansfield employer exposes workers to machine, electrical hazards

Employer Name: Edge Plastics Inc., 449 Newman St., Mansfield, Ohio

Citations issued: April 25, 2016

Investigation findings: The U.S. Department of Labor’s Occupational Safety and Health Administration issued eight serious and one other-than-serious safety violation to Edge Plastics Inc. Inspectors from the Toledo office found the plastic storage bin maker exposed workers to amputation, falls and electrical hazards at its Mansfield plant.

During its investigation, the agency found the employer:

- Did not de-energize machines prior to maintenance.
- Exposed workers in plastic injection molding operations as guard rails and ladders were inadequate.
- Failed to implement lockout/tag out procedures to prevent unintentional machine starts during service and maintenance such as clearing jams, and adjusting operating parts.
- Violated electrical safe work practices, including not providing personal protective equipment.
- Not training workers adequately in electrical safety related work practices.

Quote: "Common sense safety procedures like powering down equipment and preventing unintentional movement can protect maintenance workers from amputation and other serious injuries," said Kim Nelson, OSHA’s area director in Toledo. "Employers like Edge Plastics must review their safety and health procedures and make immediate improvements to protect workers on the job."

Proposed Penalties: $43,200

View Citations here*.

To ask questions, obtain compliance assistance, file a complaint, or report amputations, eye loss, workplace hospitalizations, fatalities or situations posing imminent danger to workers, the public should call OSHA's toll-free hotline at 800-321-OSHA (6742) or the agency's Toledo Area Office at 419-259-7542.

# # #
Article 110 (Chapter 1)

General Requirements for Electrical Safety-Related Work Practices:

• Article 110 in summary discusses the application of documentation and expectations that employers set up for qualified employees to follow for example starting out with:

  – Article 110.1 Electrical Safety Program starts out this article section

  – Much of this entire article was created to help us document expectations of our programs and for qualified employees regarding training, risk assessment and job planning etc.

  – Not a simple task as we all can relate to challenges with documenting just about anything we do right?
110.3 Host and Contract Employers’ Responsibilities

(A) **Host Employer Responsibilities.**

(1) The host employer shall inform contract employers of the following:

(1) Known hazards that are covered by this standard, that are related to the contract employer’s work, and that might not be recognized by the contract employer or its employees.

(2) Information about the employer’s installation that the contract employer needs to make the assessments required by Chapter 1.

(2) The host employer shall report observed contract employer–related violations of this standard to the contract employer.

**Informational Note:** Examples of a host employer can include owner or their designee, construction manager, general contractor, or employer.

**Bottom Line:** Don’t assume contractors are all thinking the same or proper with safety.
Article 110.1 – Safety Related Work Practices:

110.1 in Safety Related Work Practices essentially says; How Do We Manage & how Do We Document?

New Additions to the 2018 NFPA 70E Include:

A. Inspection of Newly Installed Equipment
B. Condition of maintenance
C. Risk Assessment procedure
D. Human Error
E. Hierarchy of Risk Controls
F. Job Safety Planning and Job Briefing
G. Job Safety Planning
H. Job Briefing
I. Change in Scope
J. Incident Investigations
K. Lockout/Tagout Program and Procedure Audit
Article 110.1 – Safety Related Work Practices:

Review:
Key 2018 code additions here are changes with Risk Assessment Procedures and Job Safety Planning.

• What the code is saying in simple terms is we assume too much at times on what our staff is doing and if they are truly qualified to assess their hazards and avoid them.

• Both of these additions in the above two mentioned are key indicators that NFPA is telling us we need to be better structured in how we communicate and plan internally on a daily or job specific basis etc.
“Risk Assessments” essentially rely on one primary goal and that is the employee is able to recognize or “Identify Hazards”...

**Δ (H) Risk Assessment Procedure.** The electrical safety program shall include a risk assessment procedure and shall comply with 110.1(H)(1) through 110.1(H)(3).

**(1) Elements of a Risk Assessment Procedure.** The risk assessment procedure shall address employee exposure to electrical hazards and shall identify the process to be used by the employee before work is started to carry out the following:

1. Identify hazards
2. Assess risks
3. Implement risk control according to the hierarchy of risk control methods
110.1 Risk Assessment Procedure Outline:

Thoughts:

- Not to be confused with “Energized Work Permits”

- This assessment form is simply a way for qualified employees to dive deeper into “evaluating” certain activities.

- Example might be: Documenting some risks for de-energizing a high arc flash risk item like main switchgear?
110.1 Risk Assessment Procedure Outline:
(Recent Incident Case Study Example)

• Qualified worker was asked to troubleshoot a breaker disconnect after a forklift had bumped the cabinet because the lights had gone out.
• In the process of turning off the breaker, the internal components failed and the fault came out the handle.
• Could a Risk Assessment possibly have helped the employee recognize the need for minimally leather gloves to help with potential burn protection when he already knew something wasn’t right on the inside of that cabinet?
Pre-Planning Activities is Crucial. How Can we Implement More Communication? Can this fit Article 110 Needs?

- Don’t Rush Into Tasks:
  - Human tendencies are to rush in and get something fixed. We have to guard against this!

The 2018 NFPA code is requesting us to do **Job Planning and Job Briefings**...
110 (I) Job Planning and Job Briefing:

(I) **Job Safety Planning and Job Briefing.** Before starting each job that involves exposure to electrical hazards, the employee in charge shall complete a job safety plan and conduct a job briefing with the employees involved.

(1) **Job Safety Planning.** The job safety plan shall be in accordance with the following:

1. Be completed by a qualified person
2. Be documented
3. Include the following information:
   a. A description of the job and the individual tasks
   b. Identification of the electrical hazards associated with each task
   c. A shock risk assessment in accordance with 130.4 for tasks involving a shock hazard
   d. An arc flash risk assessment in accordance with 130.5 for tasks involving an arc flash hazard
   e. Work procedures involved, special precautions, and energy source controls
At the main focus of what OSHA expects getting equipment to a safe working condition is #1. For several code cycles now this process hasn’t been well written. Added info in red.

1. Determine all sources of electrical supply or energy to the equipment. Check up to date drawings as required
2. Open the upstream disconnecting sources for each source of power.
3. Release stored electrical energy if present
4. Release or block stored mechanical energy
5. Apply Lockout/Tagout devices in accordance with established procedures
6. Determine expected PPE needs for the piece of equipment you intend to power down. Obtain correct arc flash and shock hazard protection including the appropriate voltage meter for upcoming steps.
7. Use an adequately rated portable test instrument to test all aspects of the power supply to verify upstream power has been eliminated. **Meter shall be tested on a known 120V power supply before and after LOTO verification steps to ensure the meter works properly**.
Exception No. 1: An adequately rated permanently mounted test device shall be permitted to be used to verify the absence of voltage of the conductors or circuit parts at the work location, provided it meets the all following requirements: (1) It is permanently mounted and installed in accordance with the manufacturer’s instructions and tests the conductors and circuit parts at the point of work; (2) It is listed and labeled for the purpose of verifying the absence of voltage; (3) It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground; (4) The test device is verified as operating satisfactorily on any known voltage source before and after verifying the absence of voltage.

There are many potential issues associated with this introduction within the code. Installing these meters will not act as a substitute to the proper steps we take to ensure power is absent inside equipment etc!
In past years we’ve seen LED indicators as quote “round one” from manufactures to sell employers as a feel safe application. OSHA teaches “Point on Point” contact testing with a qualified test instrument and qualified employee with “live dead live” formats to ensure accuracy.

New designs have now incorporated both the visual and “Point on Point” contact testing means to help make improvements.

To rely on devices like these, we carry risks also so.. Who installs them, are the installed correctly, why do we need them and who verifies they work correctly?
2018 NFPA 70 Code Insert on Devices:

This video from Panduit we watched shows they installed the device on the “LOAD” side of the control panel disconnect.

One main concern with insertions of codes like these is that the general public will install these devices and feel they have created a “safe work environment” but the reality is “ALL ENERGY” must be removed from the enclosure so installing people are going to not be truly compliant.
2018 NFPA 70E Training Requirements (Qualified)

Training Requirements Under Article 110.2

- Training requirements continue to expand in the 2018 code
- Type of training and Documentation have been clarified more

(4) Type of Training. The training required by 110.2(A) shall be classroom, on-the-job, or a combination of the two. The type and extent of the training provided shall be determined by the risk to the employee.

(5) Electrical Safety Training Documentation. The employer shall document that each employee has received the training required by 110.2(A). This documentation shall be in accordance with the following:

1. Be made when the employee demonstrates proficiency in the work practices involved
2. Be retained for the duration of the employee’s employment
3. Contain the content of the training, each employee’s name, and dates of training
Training for qualified employee status is largely based on the concepts of “show me”.

In summary, we can have great safety policies and good equipment labeling in place BUT if employees do not demonstrate effective practice of our safety needs, this represents a problem with compliance.
Article 130 (Chapter 1)

Work Involving Electrical Hazards:

- Article 130 in summary discusses how we determine risks and which methods we have used to know our exact hazard levels. It also is the largest article in Chapter 1 and includes multiple tables associated with arc flash and shock hazard tables along with explaining the four hazard categories.

- Article 130 starts out this article section with establishing what is “Safe Working Condition” and article 130.2 is a key code reference we can use as a basis for internal conversations surrounding activities such as troubleshooting vs. repair related work etc.

- Article 130.5 is an article we reference on PPE Labeling
Article 130.2 Normal Operations (Maintenance):

**Maintenance:**
Define “Normal Operation”? What is clear, is the code is expressing the need to address Maintenance of equipment. There are direct ties to our arc flash outcomes based on how breakers react when called upon to trip etc.

\[\text{(4) Normal Operating Condition. Normal operation of electric equipment shall be permitted where a normal operating condition exists. A normal operating condition exists when all of the following conditions are satisfied:}\]

1. The equipment is properly installed.
2. The equipment is properly maintained.
3. The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer’s instructions.
4. The equipment doors are closed and secured.
5. All equipment covers are in place and secured.
6. There is no evidence of impending failure.

Informational Note: The phrase *properly installed* means that the equipment is installed in accordance with applicable industry codes and standards and the manufacturer’s recommendations. The phrase *properly maintained* means that the equipment has been maintained in accordance with the manufacturer’s recommendations and applicable industry codes and standards. The phrase *evidence of impending failure* means that there is evidence such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration.
This Article Will Inevitably Bring Up the Age Old Question of “Closed Door Switching PPE Needs” and is a key topic when the code committee decides what the “likelihood” of an exposure might be etc.

Here is what has commonly been used to define closed door risk management and PPE needs.

- For known (calculated) HRC Levels of 0, 1 or 2
- Recommended HRC Level 0 PPE for switching procedures
- For known (calculated) HRC Levels of 3, 4 or Dangerous
- Recommended HRC Level 2 PPE for switching procedures

Remember the maintenance component discussed earlier and work with employees to understand the importance of shedding load on a system before we re-engage breaker disconnects.
Labeling Goals for Arc Flash and Shock (LOTO) Programs

- Equipment Labeling should include **three** key components which are:
  - 130.5 does not view PPE labeling from the ESWP process for LOTO goals however our views on LOTO align with OSHA expectations for “Safe Work Practice”. Summary, One PPE Label, all Inclusive for goals on ESWP!!

1. **Complete Arc flash hazard ratings and PPE needs**
2. **Shock hazard ratings and glove needs**
3. **What is my equipment name? & Where do I turn off power?**
Connecting OSHA & NFPA 70E – PPE Labeling

Citation and Notification of Penalty

Company Name:  
Inspection Site:  

The alleged violations below have been grouped because they involve similar or related hazards that may increase the potential for injury or illness.

Citation 1 Item 4 a Type of Violation: Serious

Markings were not provided on electrical equipment giving voltage, current, wattage, and other ratings as necessary:

(a) Drill bank; Two electrical panels were not marked with applicable ratings.

Date by which Violation must be Abated: /2012

Proposed Penalty: $4400.00
Part #1: Complete Arc flash hazard ratings and PPE needs so employees can perform their activities without questioning what is exactly required. Many PPE labels we see often are ok with this component of the 70E topic. Some however may refer you to the code book for PPE selection based on the vendor you chose?

29" Flash Hazard Boundary
2.6 cal/cm² Flash Hazard at an 18" Working Distance
PPE Level, AR Shirt, AR Pants, Hard Hat, 4 cal/cm² Face Shield, Safety Glasses, Hearing Protection
Labeling Goals for Arc Flash and Shock (LOTO) Programs

**Part #2:** Shock hazards and PPE needs associated with the voltage employees may be exposed to.

Generally vendors rely too much on software systems to create PPE labeling so shortcuts are common.

![Labeling Example](image)

**480 VAC** Shock Hazard when Cover is **Open/Removed**

**42''** Limited Approach

**12''** Restricted Approach - **Class 00 500Volt Gloves**

**WARNING**

Arc Flash and Shock Hazard
Appropriate PPE Required

0.13 cal/cm² @ 18''

5 in  Arc Flash Boundary

480 VAC  Nominal System Voltage

42 inches  Limited Approach Boundary

12 inches  Restricted Approach Boundary

Bus: PNL HA  Prot: MSB-1 FS 1-2

**Missing glove ratings**
Part #3: NFPA 70E does not comment on the core value PPE labels can bring or how they could tie into the overall ESWP process.

Generally equipment labeling and upstream Lock Out sources are either not present or questionable for true value. This part of the PPE label starts creates safety value and direction for your program!
Overview of Informative 2018 PPE Label Format:

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

29" Flash Hazard Boundary
2.6 cal/cm² Flash Hazard at an 18" Working Distance
PPE Level, AR Shirt, AR Pants, Hard Hat, 4 cal/cm²
  Face Shield, Safety Glasses, Hearing Protection

480 VAC Shock Hazard when Cover is Open/Removed
42" Limited Approach
12" Restricted Approach - Class 00 500 Volt Gloves


Fault Current: 25 kA  Date: 08-23-17  Faith Technologies 800-274-2345

Date Optional for 70E

Shows Fault Current Levels to Aid in Breaker Applications

Complete Statements in PPE listings

Shows When Gloves are needed. Prohibited Approach Boundary was eliminated for 2015

Supports Electrical LOTO Needs
Obtaining a De-Energized State Correctly is our Primary Goal with ESWP and OSHA:

- This example shows a standard disconnect with ideal labeling in place which in turn supports the fundamental goal for any safety program.

- If an employee was asked this question, how would they be able to respond?

- **OSHA Question:** If you had to change a fuse in this disconnect, explain to me how you would do that???
Can this PPE Label Support That Prime Directive???

This PPE label may satisfy some minimal need to say what the arc flash rating is but what else does it help with???
Arc Flash Categories as Referenced in the Code:

The levels of PPE in concept when we talk about “categories” has remained consistent from the 2015 Code. Using category names applies to code book methods on PPE selection only.

<table>
<thead>
<tr>
<th>PPE CATEGORY 1</th>
<th>PPE CATEGORY 2</th>
<th>PPE CATEGORY 3</th>
<th>PPE CATEGORY 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Arc Rating of 4 cal/cm²</td>
<td>Minimum Arc Rating of 8 cal/cm²</td>
<td>Minimum Arc Rating of 25 cal/cm²</td>
<td>Minimum Arc Rating of 40 cal/cm²</td>
</tr>
<tr>
<td>Arc Rated Clothing:</td>
<td>Arc Rated Clothing:</td>
<td>Arc Rated Clothing:</td>
<td>Arc Rated Clothing:</td>
</tr>
<tr>
<td>• AR long-sleeve shirt and pants, or AR coverall</td>
<td>• AR long-sleeve shirt and pants, or AR coverall</td>
<td>• As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants</td>
<td>• As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants</td>
</tr>
<tr>
<td>• AR face shield, or AR flash suit hood</td>
<td>• AR flash suit hood, or AR face shield and AR balaclava</td>
<td>• AR flash suit hood</td>
<td>• AR flash suit hood</td>
</tr>
<tr>
<td>• AR jacket, parka, rainwear, or hard hat liner (as needed)</td>
<td>• AR jacket, parka, rainwear, or hard hat liner (as needed)</td>
<td>• AR gloves</td>
<td>• AR gloves</td>
</tr>
<tr>
<td>Protective Equipment:</td>
<td>Protective Equipment:</td>
<td>Protective Equipment:</td>
<td>Protective Equipment:</td>
</tr>
<tr>
<td>• Hard hat</td>
<td>• Hard hat</td>
<td>• Hard hat</td>
<td>• Hard hat</td>
</tr>
<tr>
<td>• Safety glasses or safety goggles</td>
<td>• Safety glasses or safety goggles</td>
<td>• Safety glasses or safety goggles</td>
<td>• Safety glasses or safety goggles</td>
</tr>
<tr>
<td>• Hearing protection (with inserts)</td>
<td>• Hearing protection (with inserts)</td>
<td>• Hearing protection (with inserts)</td>
<td>• Hearing protection (with inserts)</td>
</tr>
<tr>
<td>• Heavy-duty leather gloves</td>
<td>• Heavy-duty leather gloves</td>
<td>• Leather footwear</td>
<td>• Leather footwear</td>
</tr>
<tr>
<td>• Leather footwear</td>
<td>• Leather footwear</td>
<td>• Leather footwear</td>
<td>• Leather footwear</td>
</tr>
</tbody>
</table>

FAITH TECHNOLOGIES
2018 Article 130.5 “Picking a Path on Arc Flash Methods”

- The code book gives us two methods to select PPE and assess risk levels.
- The code book PPE category Method or doing Incident Energy Analysis or Engineering to determine exact risk levels.
- You can only pick one path. Cannot use both.

Δ (F) Arc Flash PPE. One of the following methods shall be used for the selection of arc flash PPE:

(1) The incident energy analysis method in accordance with 130.5(G)
(2) The arc flash PPE category method in accordance with 130.7(C)(15)

Either, but not both, methods shall be permitted to be used on the same piece of equipment. The results of an incident energy analysis to specify an arc flash PPE category in Table 130.7(C)(15)(c) shall not be permitted.
### NFPA 70E Task Based Support Table:

Table 130.7(C)(15)(A)(a) Arc Flash Hazard Identification for Alternating Current (ac) and Direct Current (dc) Systems

<table>
<thead>
<tr>
<th>Task</th>
<th>Equipment Condition*</th>
<th>Arc Flash PPE Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading a panel meter while operating a meter switch</td>
<td>Any</td>
<td>No</td>
</tr>
<tr>
<td>Normal operation of a circuit breaker (CB), switch, contactor or starter</td>
<td>All of the following: The equipment is properly installed The equipment is properly maintained All equipment doors are closed and secured All equipment covers are in place and secured There is no evidence of impending failure</td>
<td>No</td>
</tr>
<tr>
<td>Remember the task tables are for those employers who have not formally determined risk levels through actual 70E audits and they are forced to assume PPE needs based on the code book recommendations!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For ac systems: Work on energized electrical conductors and circuit parts, including voltage testing</td>
<td>Any</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 130.7(C)(15)(A)(b) Arc-Flash Hazard PPE Categories for Alternating Current (ac) Systems

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Arc Flash PPE Category</th>
<th>Arc Flash Boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panelboards or other equipment rated 240V and below</td>
<td>1</td>
<td>485 mm</td>
</tr>
<tr>
<td>Parameters: Maximum of 25 kA short-circuit current available; maximum</td>
<td></td>
<td>(19 in.)</td>
</tr>
<tr>
<td>of 0.03 sec (2 cycles) fault clearing time; working distance 455 mm (18 in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panelboards or other equipment rated &gt;240V and up to 600V</td>
<td>2</td>
<td>900 mm</td>
</tr>
<tr>
<td>Parameters: Maximum of 25 kA short-circuit current available; maximum</td>
<td></td>
<td>(3 ft.)</td>
</tr>
<tr>
<td>0.03 sec (2 cycles) fault clearing time; working distance 455 mm (18 in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600-V class motor control centers (MCCs)</td>
<td>1.5 m</td>
<td></td>
</tr>
<tr>
<td>Parameters: Maximum of 65 kA short-circuit current available; maximum</td>
<td>2</td>
<td>(5 ft)</td>
</tr>
<tr>
<td>of 0.03 sec (2 cycles) fault clearing time; working distance 455 (18 in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600-V class motor control centers (MCCs)</td>
<td></td>
<td>4.3 m</td>
</tr>
<tr>
<td>Parameters: Maximum of 42 kA short-circuit current available; maximum</td>
<td>4</td>
<td>(14 ft)</td>
</tr>
<tr>
<td>of 0.33 sec (20 cycles) fault clearing time; working distance 455 mm (18 in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600-V class switchgear (with power circuit breakers or fused switches)</td>
<td></td>
<td>6 m</td>
</tr>
<tr>
<td>and 600 V class switchboards</td>
<td></td>
<td>(20 ft)</td>
</tr>
<tr>
<td>Parameters: Maximum of 35 kA short-circuit current available; maximum</td>
<td>4</td>
<td>(1.5 m)</td>
</tr>
<tr>
<td>of up to 0.5 sec (30 cycles) fault clearing time; working distance 455 mm (18 in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600-V class (277V through 600 V, inclusive) equipment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When does the “Work Permit” discussion come into play?

There are two categories of what we consider “Working On” and it is assumed your employees are wearing/using appropriate PPE!!

**Diagnostic (testing)** is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment.

**Repair** is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc).

Only “Repair” related tasks require permits. This does not mean we don’t evaluate risks before we open doors and troubleshoot equipment but if we aren’t fixing or repairing equipment under energized load, then we don’t need a written permit.
What Constitutes Valid Reasons to Work on Energized Equipment?

1. **Additional hazards or Increased risk:** Employer must demonstrate that de-energizing introduces additional hazards or increased risks to the employee.

2. **Infeasibility:** Employer must demonstrate that the task to be performed is infeasible in a de-energized state due to the equipment design or operational limitations. *(Be very cautious of discussing costs or money in any way if you chose to use this)*

3. **Less than 50 volts:** Self explanatory...
WORK PERMIT EXAMPLE:

- It is more important to learn how to fill these out and what they mean so you can help others and also manage expectations with staff on being complete in documentation!
From the beginning the term “One-Line Diagram” has been widely interpreted in structure or value.

Engineering software systems all create a drawing which can convert to a DWG format but these impedance diagrams can lack depth and value.

Knowing LOTO and process are key topics for OSHA so we can have qualified people get equipment free of hazard, shouldn’t we look to create an easy to use and functional drawing?
Engineering Program One-Line Diagram are Common But Ineffective:

- Common to see Engineering Software based drawings that look similar but can lack detail.
- Breaker ID for LOTO Missing?
- Breaker MFG? or Cat #?

- What is PP-20-002?
- How many loads does it serve?
Orderly Shut Down Processes Rely Heavily on Functional Prints: Review of Internal One-Lines....:

<table>
<thead>
<tr>
<th>Item #</th>
<th>Location (Sheet #)</th>
<th>Protective Device</th>
<th>Initial Setting or Device</th>
<th>Present Cal/cm²</th>
<th>Hazard Class</th>
<th>Recommended Change</th>
<th>New Cal/cm²</th>
<th>Hazard Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TURB-SWGR (E-002)</td>
<td>GEN-1, GEN-2 &amp; RESER-SWGR-CAB-1B</td>
<td>CO-6 Relay set at: 1200A, Tap=5.0, Time=4.0, GEN-1 and GEN-2</td>
<td>49</td>
<td>Dangerous!</td>
<td>Remove utility feed at RESERVIOR-SWGR-CAB-1B</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CP-44-PKR-B (E-101)</td>
<td>CP-44-PKR</td>
<td>Shawmut type AJT 250 amp fuses</td>
<td>1.7</td>
<td>1</td>
<td>Replace CP-44PKR fuses with Bussmann type LPS-RK 250 amp fuses</td>
<td>0.44</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>CP-45A-1 (E-109)</td>
<td>MCC-Z45C-6E</td>
<td>Sq-D 60 amp breaker</td>
<td>3.3</td>
<td>1</td>
<td>Install a fused disconnect before CP-45A-1 using Bussmann type LPS-RK 60 amp fuses</td>
<td>0.05</td>
<td>0</td>
</tr>
</tbody>
</table>
Within Your Programs, Inventory and Publish Your Safety Equipment for Staff”:

ELECTRICAL SAFE WORK PRACTICE-SAFETY EQUIPMENT

BE PREPARED, FROM FIRST AID KITS FOR EMERGENCIES TO FALL PROTECTION WHEN WORKING ATOP ELECTRICAL GEAR.

LIVE WORK / HIGH VOLTAGE

12 Calorie Hot Work Kit:

Kit consists of a hard hat/face shield, jacket, bib over pants, danger tape, HV glove tester & dust, washing instructions, and a copy of Faith’s Safety policy re: Energized work in a duffel bag.

Note: Individual replacement pieces are available.

45/51 Calorie Hot Work Kit:

Kit consists of a hard hat, hood, jacket, bib overalls, danger tape, HV glove tester & dust, washing instructions, and a copy of Faith’s Safety policy re: Energized work in a duffel bag.

Note: Individual replacement pieces are available.

HV Gloves:

Classes & sizes available from shop are:
Class 00, 0, 2, & 4 in Sizes 9, 10 & 11
Ties NFPA 70E has with Maintenance & NFPA 70B:

NFPA 70E Defines Maintenance in chapter 2:

Chapter 2 Safety-Related Maintenance Requirements

ARTICLE 200
Introduction

200.1 Scope. Chapter 2 addresses the requirements that follow.

(1) Chapter 2 covers practical safety-related maintenance requirements for electrical equipment and installations in workplaces as included in 90.2. These requirements identify only that maintenance directly associated with employee safety.

(2) Chapter 2 does not prescribe specific maintenance methods or testing procedures. It is left to the employer to choose from the various maintenance methods available to satisfy the requirements of Chapter 2.

(3) For the purpose of Chapter 2, maintenance shall be defined as preserving or restoring the condition of electrical equipment and installations, or parts of either, for

facturers’ instructions or industry consensus standards to reduce the risk associated with failure. The equipment owner or the owner’s designated representative shall be responsible for maintenance of the electrical equipment and documentation.

Informational Note: Common industry practice is to apply test or calibration decals to equipment to indicate the test or calibration date and overall condition of equipment that has been tested and maintained in the field. These decals provide the employee immediate indication of last maintenance date and if the tested device or system was found acceptable on the date of test. This local information can assist the employee in the assessment of overall electrical equipment maintenance status.

205.4 Overcurrent Protective Devices. Overcurrent protective devices shall be maintained in accordance with the manufacturers’ instructions or industry consensus standards. Maintenance, tests, and inspections shall be documented.
205.3 General Maintenance Requirements:
Electrical equipment shall be maintained in accordance with manufacturers’ instructions or industry consensus standards to reduce the risk associated with failure. The equipment owner or the owner’s designated representative shall be responsible for the maintenance of the electrical equipment and documentation.
Identifying the often forgotten risk factors on electrical systems is something that OSHA has covered already!!!!

Maintenance and working condition of key electrical systems is one of those topics that any accident investigation will seek for supporting documentation!
Summary:
As employers we have one primary goal and that is to help qualified employees perform their tasks safely! We can make NFPA 70E complex or keep our foundation simple in LOTO goals, sound labeling and good print formats that help all of us manage plants for years to come. OSHA has some simple questions they ask to determine if our program is focused on the right topics.

Questions?