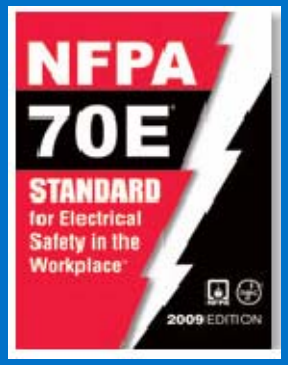
NFPA 70E
Standard for Electrical Safety in the Workplace

EEI Safety and Health Meeting

October 2008



NFPA Structure

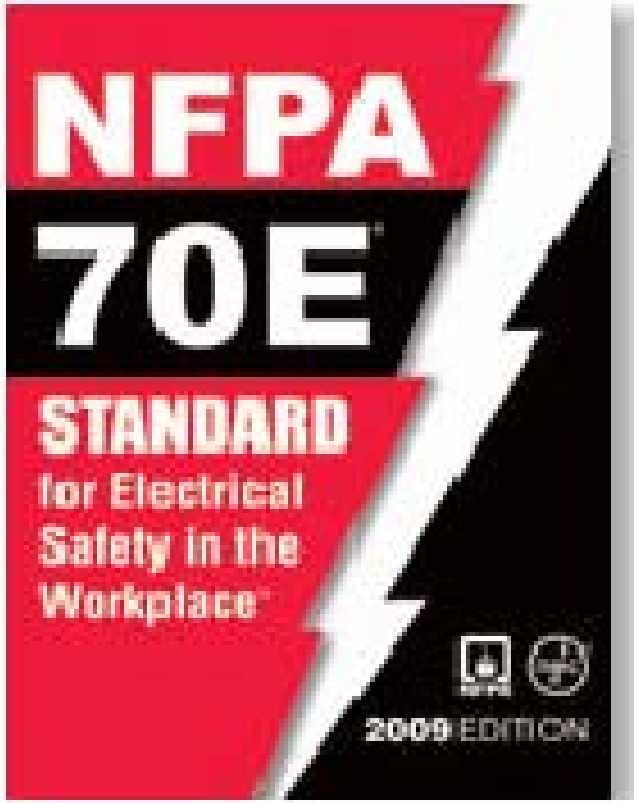
- NFPA 70E Technical Committee reports to:
  - NEC Technical Correlating Committee reports to:
    - NFPA Standards Council
- Standards Council has final say.

NFPA 70E Representatives

- EEI Representatives to the TC:
  - Kathleen Wilmer, Duke Energy (Principal)
  - John Boothroyd, Entergy (Alternate)
- EEI Representatives to the NEC TCC:
  - Neil LaBrake, Jr., National Grid (Principal)
  - Tom Adams, ComEd Retired (Alternate)
- EEI Staff Liaison
  - Chuck Kelly

2009 NFPA 70E

- Revision cycle started September 2006.
- Great EEI participation in comment phase.
- 2009 version finalized.
- Available now from NFPA.



Major 2009 NFPA 70E Issues of Utility Interest

- **Scope Issue:**

  Standard Scope – 90.1(B) Not Covered:

  (3) railways……

  (4) communication utilities……

  (5) electric utilities……

- **Multiple proposals were received to delete these sections.**
- **Scope section was not revised – utilities continue to be excluded……for now..**

Next Steps on Scope

- **IEEE (NESC) and NFPA representatives meeting September 30 on Scope of NESC and NEC.**

- **NFPA Technical Correlating Committee meeting October 1 to discuss future Scope of 70E. Neil LaBrake represented EEI.**

Arc Flash Standards Overlap

- **2007 NESC Rule 410A3**
  - Applies to TD&G at utilities and similar industrial complexes.
  - “Implement arc flash protection” by 1/1/09.
  - Adopted by most (not all) utility commissions.
- **Proposed OSHA Revisions 1910.269 and 1926 Subpart V**
  - Similar language to NESC rule.
  - No date for being finalized.
- **NFPA 70E**
  - Does not apply to TD&G under exclusive control of electric utilities.
  - Provides “how” to do arc flash in generating plants.
  - Does not help with Transmission and Distribution implementation.
  - Being effectively enforced in non-utility industries through general duty clause.
  - Not incorporated by current OSHA regulations.

Changes in 70E-2009

- New Section 130.3(C)
  - **(C) Equipment Labeling.** Equipment shall be field marked with a label containing the available incident energy or required level of PPE.

More Changes

- **Chapter 4, Installations, Removed**
  - OSHA just revised Subpart S, Part 1. Did not need 70E Installation chapter.
  - 70E now just a work practice standard.

Changes

- **130.3 Arc Flash Hazard Analysis.** An arc flash hazard analysis shall determine the Arc Flash Protection Boundary and the personal protective equipment that people within the Arc Flash Protection Boundary shall use. **The arc flash hazard analysis shall be updated when a major modification or renovation takes place. It shall be reviewed periodically, not to exceed five years**, to account for changes in the electrical distribution system that could affect the results of the arc flash hazard analysis.

Changes

- **130.7 (C) Personal Protective Equipment.**
  - (1) General. When an employee is working within the Arc Flash Protection Boundary he or she shall wear protective clothing and other personal protective equipment in accordance with 130.3**. All parts of the body inside the Arc Flash Protection Boundary shall be protected**.

110.5 Relationships with Contractors

- **(A) Host Employer Responsibilities.**
  - **(1) The host employer shall inform contract employers of:**
    - a. **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
    - b. **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**.**

Relationships with Contractors……

- **(B) Contract Employer Responsibilities.**
  - (1) The contract employer shall ensure that each of his or her employees is instructed in the hazards communicated to the contract employer by the host employer. This instruction is in addition to the basic training required by this standard.
  - (2) The contract employer shall ensure that each of his or her employees follows the work practices required by this standard and safety-related work rules required by the host employer.
  - (3) The contract employer shall advise the host employer of:
    - (1) Any unique hazards presented by the contract employer's work,
    - (2) Any unanticipated hazards found during the contract employer's work that the host employer did not mention, and
    - (3) The measures the contractor took to correct any violations reported by the host employer ….. and to prevent such violation from recurring in the future.

Auditing

- **(H) Electrical Safety Auditing.** An electrical safety program shall be audited to help ensure that the principles and procedures of the electrical safety program are being followed. The **frequency of audit shall be determined by the employer**, based on the complexity of the procedures and the type of work being covered.

Table 130.7(C) (9) Changes

Added tasks, changed ratings on tasks

Table 130.7(C)(9) *Continued*

Tasks Performed on Energized Equipment	Hazard/Risk Category	Rubber Insulating Gloves	Insulated and Insulating Hand Tools
CB or fused switch operation with covers off	1	Y	N
Work on energized electrical conductors and circuit parts, including voltage testing	2*	Y	Y
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard or switchboard	2*	Y	Y
600 V Class Motor Control Centers (MCCs) — Note 2 (except as indicated)			
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	1	N	N
CB or fused switch or starter operation with enclosure doors closed	0	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	1	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	2*	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	0	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	2*	Y	Y
Insertion or removal of individual starter "buckets" from MCC — Note 3	4	Y	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts) — Note 3	4	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts) — Note 3	1	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the motor control center	2*	Y	Y

Added Arc Resistant Switchgear to the Table

compartments			
Arc-Resistant Switchgear Type 1 or 2 (for clearing times of <0.5 sec with a perspective fault current not to exceed the arc resistant rating of the equipment)			
CB operation with enclosure door closed	0	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	0	N	N
Insertion or removal of CBs from cubicles with door open	4	N	N
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	2	Y	Y
Insertion or removal (racking) of ground and test device with door closed	0	N	N
Insertion or removal (racking) of voltage transformers on or off the bus door closed	0	N	N

Reformatted Table C(10) and C(11).

- Simplified.
- HRC 1 must be FR.
- Can't layer FR over cotton to get higher rating if you are a Table user.

Table 130.7(C)(11) Protective Clothing Characteristics

Hazard/Risk Category	Clothing Description	Required Minimum Arc Rating of PPE [J/cm^2(cal/cm^2)]
0	Nonmelting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd^2	N/A
1	Arc-rated FR shirt and FR pants or FR coverall	16.74 (4)
2	Arc-rated FR shirt and FR pants or FR coverall	33.47 (8)
3	Arc-rated FR shirt and pants or FR coverall, and arc flash suit selected so that the system arc rating meets the required minimum	104.6 (25)
4	Arc-rated FR shirt and pants or FR coverall, and arc flash suit selected so that the system arc rating meets the required minimum	167.36 (40)

Table 130.7(C)(10) Protective Clothing and Personal Protective Equipment (PPE)

Hazard/Risk Category	Protective Clothing and PPE
Hazard/Risk Category 0	
Protective Clothing, Nonmelting (according to ASTM F 1506-00) or Untreated Natural Fiber	Shirt (long sleeve) Pants (long)
FR Protective Equipment	Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (AN) (Note 2)
Hazard/Risk Category 1	
FR Clothing, Minimum Arc Rating of 4 (Note 1)	Arc-rated long-sleeve shirt (Note 3) Arc-rated pants (Note 3) Arc-rated coverall (Note 4) Arc-rated face shield or arc flash suit hood (Note 7) Arc-rated jacket, parka, or rainwear (AN)
FR Protective Equipment	Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes (AN)
Hazard/Risk Category 2	
FR Clothing, Minimum Arc Rating of 8 (Note 1)	Arc-rated long-sleeve shirt (Note 5) Arc-rated pants (Note 5) Arc-rated coverall (Note 6) Arc-rated face shield or arc flash suit hood (Note 7) Arc rated jacket, parka, or rainwear (AN)
FR Protective Equipment	Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (Note 2) Leather work shoes
Hazard/Risk Category 2*	
FR Clothing, Minimum Arc Rating of 8 (Note 1)	Arc-rated long-sleeve shirt (Note 5) Arc-rated pants (Note 5)

More changes

- (d) Foot Protection. Heavy-duty leather work shoes provide some arc flash protection to the feet and shall be used in all tasks in Hazard/Risk Category 2 and higher and **in all exposures greater than 4 cal/cm2.**

Relief for Nuclear

- *Exception No. 2: Where the work to be performed inside the Arc Flash Protection Boundary exposes the worker to multiple hazards, such as airborne contaminants, under special permission by the authority having jurisdiction and where it can be shown that the level of protection is adequate to address the arc flash hazard,* ***non-FR Personnel Protective Equipment shall be permitted****.*

Changes

- **(4) Look-Alike Equipment.** Where work performed on equipment that is deenergized and placed in an electrically safe condition exists in a work area with other energized equipment that is similar in size, shape, and construction, one of the methods in 130.7(E)(1), (2), or (3) shall be employed to prevent the employee from entering lookalike equipment.
    - **(signs, barricades, or attendants)….**

Other Changes

- Added Article 350 provides first-time requirements for the protection of electrical personnel in R&D labs.
- A new exception verifies that 240 V and less power systems fed by a single transformer less than 125 kvs no longer require an arc flash hazard analysis.

Training

- **CPR training …….** shall be certified by the employer annually.
- **Training Documentation.** The employer shall document that each employee has received the training ……. This documentation shall be made when the employee **demonstrates proficiency** in the work practices involved…….

Annex D – New table listing calculation methods and limitations of each.

Table D.1 Limitation of Calculation Methods

Section	Source	Limitations/Parameters
D.2, D.3, D.4	Ralph Lee paper	Calculates Arc Flash Protection Boundary for arc in open air; conservative over 600 V and becomes more conservative as voltage increases
D.5	Doughty/Neal paper	Calculates incident energy for 3-phase arc on systems rated 600 V and below; applies to short-circuit currents between 16 kA and 50 kA
D.6	Ralph Lee paper	Calculates incident energy for 3-phase arc in open air on systems rated above 600 V; becomes more conservative as voltage increases
D.7	IEEE Std. 1584	Calculates incident energy and Arc Flash Protection Boundary for: 208 V to 15 kV; 3-phase; 50 Hz to 60 Hz; 700 A to 106,000 A short-circuit current; and 13 mm to 152 mm conductor gaps
D.8	ANSI/IEEE C2 NESC-Section 410 Tables 410-1 and Table 410-2	Calculates incident energy for open air phase-to-ground arcs 1 kV to 500 kV for live-line work

Annex D – New tables estimating energy for overhead power lines.

D.8 Estimated Incident Energy Exposures for Live Line Work on Overhead Open Air Systems 1 kV to 800 kV. Table D.8(1) and Table D.8(2) list the heat flux rate in cal/cm^2/sec derived from the ANSI/IEEE C2 Tables 410-1 and 410-2. To estimate the incident energy, multiply the heat flux rate in the tables by the maximum clearing time (in seconds).

Table D.8(1)

Max Fault Current (kA)	Phase-to-Phase Voltage (kV)			
	1 to 15	15.1 to 25	25.1 to 36	36.1 to 46
	Heat Flux Rate (cal/cm^2/sec)			
5	4.9	8.7	11.6	14.8
10	12.5	20.8	27.1	34.5
15	22.2	35.6	45.4	56.2
20	34	52.8	66.4	78.7

Next Actions

- Published now.
- TCC meeting October 1 on Scope.
- Next cycle starts 2010 for the 2012 edition.
  - **Scope issue should be decided by the Standards Council before the revision cycle opens.**