National Electrical Code® Correlating Committee
NFPA 70E, 73, 790 and 791 First Draft Meeting Agenda
December 18, 2018
Telephone/Web Conference

Item No.	Subject
18-12-1	Call to order and introduction of members and guests
18-12-2	Staff presentation
18-12-3	Approval of the May 7 – 12, 2018 meeting minutes (Attachment A)
18-12-4	Review of NFPA 70E First Draft and task group recommendations (Attachment B)
18-12-5	Review of NFPA 73 First Draft and task group recommendations (Attachment C)
18-12-6	Review of NFPA 790/791 First Draft and task group recommendations (Attachment D)
18-12-7	Acting Chair for NFPA 79
18-12-8	Future Meetings February 19 – 22, 2019 – NEC® Correlating Committee Second Draft meeting, St. Petersburg, FL
18-12-9	New Business
18-12-10	Adjournment

Attachment A: Previous Meeting Minutes

National Electrical Code® Correlating Committee
NEC® First Draft and NFPA 70B Second Draft Meeting Minutes
May 7 – 12, 2018
Northbrook, IL

Item No. **Subject**

18-5-1 Call to Order

Chairman Michael Johnston called the meeting to order at 1:35PM and welcomed the Committee and guests. Mark Earley presented the NFPA staff presentation. A Standards Council update was provided by the Chair. The following members were in attendance:

Principal Members in Attendance

Michael Johnston, *Chair*, National Electrical Contractors Association	Mark Earley, *Secretary*, NFPA
Sarah Caldwell, *Acting Recording Secretary,* NFPA	James Brunssen, rep. Alliance for Telecommunications Industry Solutions
Palmer Hickman, rep. IBEW	David Hittinger, rep. Independent Electrical Contractors, Inc.
Richard Holub, rep. American Chemistry Council	John Kovacik, UL LLC
Alan Manche, Schneider Electric	Roger McDaniel, rep. Electric Light and Power Group/EEI
James Pierce, Intertek Testing Services	Vincent Saporita, rep. National Electrical Manufacturers Association
David Williams, rep. IAEI	

Alternate Members in Attendance

Lawrence Ayer, rep. Independent Electrical Contractors, Inc.	Roland Deike, rep. Electric Light & Power Group/EEI
James Dollard, Jr., rep. IBEW	Ernest Gallo, rep. Alliance for Telecommunications Industry Solutions
Robert McCullough, rep. IAEI	Robert Osborne, UL LLC
Christine Porter, Intertek Testing Services	George Straniero, rep. National Electrical Manufacturers

Non-Voting Members in Attendance

Timothy Pope, rep. CSA/Canadian Electrical Code Committee	

Guests and NFPA Staff in Attendance

Patrick Foley, NFPA	Erik Hohengasser, NFPA
Tim Porter, City of Seattle	George Zimmerman, CME Consulting, Inc.

Chad Jones, Cisco Systems	Paul Dobrowsky, Innovative Technology Service
Keith Lofland, IAEI	Christel Hunter, Cerrowire
Casey Grant, NFPA	

18-5-2 Approval of the April 3rd, 2018 meeting minutes

The minutes of the April 2018 meeting were approved as written.

18-5-3 Membership – Executive Session

a) Correlating Committee Roster
b) The Process of Application Review & Recommendations
c) NEC Committee Member Classification
d) NFPA 70E Membership

18-5-4 NEC® Global Correlating Recommendations

a) Listed & Labeled
The work of the Task Group assigned to review the series of Public Inputs and Comments related to this issue is still ongoing.

b) Definitions & CMP Responsibility
A discussion was had on the Global Use of Definitions in the NEC®. The Correlating Committee created Correlating Notes to direct the panels to reconsider First Revisions and Public Inputs to provide correlation throughout the code with respect to the application of definitions in the XXX.2 sections.

c) Informational Note Placement – First Correlating Revisions
The Correlating Committee created a Global First Correlating Revision to move Informational Notes to the end of the Article scope.

d) "The provisions of" issues
The Correlating Committee is creating a Task Group to review the use of "the provisions of" throughout the NEC®. A report containing the instances of "the provisions of" has been created by the NFPA Editorial team for use by the Task Group.

18-5-5 Task Groups

Correlating Committee Task Groups

UTG – NEC® Style Manual
The Correlating Committee discussed the use of referenced dates, relevancy and placement of Informational Notes.

Appointments to Fill Vacancies of Correlating Committee TGs

Task Group Chairs can reach out to Chair Michael Johnston for assistance in filling vacancies.

NFPA 110/111 Harmonization with the NEC® and other standards and codes
A new Task Group will be established to review issues from a correlating prospective to develop language between the NEC® and NFPA 110 and 111, the chair is Alan Manche and co-chair is Robert Osborne.

Panel Task Groups

Guests/Guest Speakers
NFPA will be meeting internally to develop guidelines for Task Group meetings with a focus on participation by Task Group members and guests at the meetings..

18-5-6 External Communication to Correlating Committee Members

Correlating Committee members should direct all questions from outside parties to the NFPA *Regs*. and process for further information.

18-5-7 NFPA 70B Second Draft Review

The Correlating Committee created two Second Correlating Revisions on NFPA 70B.

18-5-8 Review of NEC® First Draft and Task Group Recommendations

The Correlating Committee created 260 Correlating Notes and 5 First Correlating Revisions upon completion of the Task Group reports.

FR 8036/CCN 1 – The Correlating Committee directs a Task Group be created between CMP 6 and 14 to correlate uses permitted, as done in other cable assembly articles, for Type P Cable in Chapter 5 locations. Task Group Chair is Jim Dollard.

FR 8030/CCN 2 – The Correlating Committee directs a Task Group be created between CMP 6 and the Correlating Committee to review text in Article 311 for compliance with the NEC® Style Manual. Task Group Chair is Richard Holub, co-chair is George Straniero.

FR 8789/CCN 42 – The Correlating Committee directs CMP 17 to create a Task Group to re-write the First Revision to comply with the NEC® Style Manual and to correlate with 210.8 and other GFCI requirements with this article.

FR 8907/CCN 45 – The Correlating Committee directs CMP 17 to create a Task Group to provide clarity on 680.35 and 680.45 with respect to inconsistent use of terms permanent and storable/portable immersion pools.

FR 8463/CCN 64 – The Correlating Committee directs a Task Group be created between CMP 9, 10 and the Correlating Committee. Task Group Chair is David Williams.

FR 8623/CCN 65 - The Correlating Committee directs a Task Group be created between CMP 1, 10 and 14 to determine proper terminology used in FR 8462 for correlation. Task Group Chair is Larry Ayer. Members of the task group include David Hittinger and Alan Manche.

FR 8169 – The Correlating Committee directs CMP-2 to create a Task Group to correlate with 210.8 and other GFCI requirements with this article.

PI 2935 – The Correlating Committee created a Task Group to review the use of refurbished equipment throughout the NEC®. Task Group Chair is James Dollard, co-chair is Robert Osborne. Members of the task group include Jim Pierce and David Williams.
FRs 8790/7892/8117/CCNs 139/145 – The Correlating Committee directs a Task Group be created between CMP 3 and 16 to correlate “rated” vs. “nominal”. Task Group Chair is Ernie Gallo.

PI 3232/3330 – The Correlating Committee supports the recommendation of the CMP 3 Chair to create a Task Group within CMP 3 and other applicable panels.

PI 2442/FR 8597/CCN 191 – The Correlating Committee directs a Task Group be created between CMP 1 and 12 to address scope changes. Task Group Chair is John Kovacik. Members of the task group include Palmer Hickman and David Hittinger.

The Correlating Committee created a Task Group to discuss “fire rated’ code wide and determine standard language on how it will be addressed. Recommended to include CMP 1 and 13 members. Task Group Chair is Robert Osborne. Members of the task group include John Kovacik and David Hittinger.

18-5-9 Future Meetings

The Second Draft Code-Making Panel Meetings will be held in San Diego, CA from October 22 – November 3, 2018.

The Second Draft Correlating Committee Meetings will be held in St. Petersburg, FL from February 19 – 22, 2019.

Meeting notices have been posted on the NFPA Document Information Page at www.nfpa.org/70next for both meetings.

18-5-10 New Business

A webinar will be held (date TBD) to address the NEC® Style Manual with the CMP Chairs and Task Group Chairs.

18-5-11 Adjournment

Meeting was adjourned on May 11, 2018 at 5:00PM.

Attachment B: Review of NFPA 70E First Draft

NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

M E M O R A N D U M

TO: Technical Committee on Electrical Safety in the Workplace

FROM: Sarah Caldwell, *Project Administrator*

DATE: November 28, 2018

SUBJECT: NFPA 70E First Draft Technical Committee FINAL Ballot Results (A20)

According to the final ballot results, all ballot items received the necessary affirmative votes to pass ballot.

27 Members Eligible to Vote
2 Members Not Returned (*Dyson, Hayes*)

The attached report shows the number of affirmative, negative, and abstaining votes as well as the explanation of the vote for **each** revision**.**

To pass ballot, **each** revision requires: (1) a simple majority of those eligible to vote and (2) an affirmative vote of $^{2}/_{3}$ of ballots returned. See Sections 3.3.4.3.(c) and 4.3.10.1 of the ***Regulations Governing the Development of NFPA Standards***.

First Revision No. 68-NFPA 70E-2018 [Global Input]

Move existing entire (included revised subsections) of 130.6 after 130.7. DO NOT RENUMBER 130.7. There will be a gap in section numbers which is permitted by NEC Style Manual.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 13:03:37 EDT 2018

Committee Statement

Committee Statement: Relocating 130.6 to follow 130.7 will enhance the logical flow of requirements.

Response Message: FR-68-NFPA 70E-2018

Public Input No. 46-NFPA 70E-2018 [Sections 130.6, 130.7]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 88-NFPA 70E-2018 [Global Input]

See attached for new Article 360.

Supplemental Information

File Name	Description	Approved
attachment_for_FR88_New_Article_360.docx	attachment for FR 88 new Article 360--for staff use	
70E_Global_FR-88_Article_360.docx	For ballot	

Submitter Information Verification

Committee:
Submittal Date: Thu Aug 16 17:50:11 EDT 2018

Committee Statement

Committee Statement: New Article 360 provides safe work practices for working with hazardous capacitors.
Response Message: FR-88-NFPA 70E-2018

Public Input No. 311-NFPA 70E-2018 [New Section after 350.10]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
23 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: There is an inconsistency between 350.9(3), Energy Thresholds [FR 77], and 360.3, Stored Energy Hazard Threshold [FR 88]. Both these sections address stored energy and hence, should be consistent and correlated.

Negative with Comment

Barnhart, Paul D.

The new proposed Article 360 duplicates much of what is already in NFPA 70E, and also introduces requirements that appear to conflict with requirements found elsewhere in NFPA 70E. Additionally, it introduces new requirements for hearing protection and lung protection boundaries which are not required for other equipment that does not contain capacitors. If these are an issue with capacitors, they should also be addressed for other products.

Article 360 Safety-Related Requirements for Capacitors

360.1 Scope.

This article applies to the electrical safety-related requirements for the practical safeguarding of employees while working with capacitors that exceed 100 volts.

> Informational Note: For more information on working safely with capacitors, see Informative Annex R, Working with Capacitors.

360.2 Definitions.

Arc Blast Hazard.

A source of possible injury or damage to health from the energy deposited into acoustical shock-wave and high-velocity shrapnel.

Bleed Resistor.

A resistor network connected in parallel with a capacitor's terminals that drains the charge after power has been disconnected.

Charge Transfer.

Improper discharging of capacitor networks that results in transferring charge instead of fully discharging the stored energy.

Dielectric Absorption.

The property of certain capacitors to recharge after being discharged. A voltage recharge of up to 10 percent may occur a few minutes after the grounding or shorting device has been removed.

Discharge Time.

The time required to discharge a capacitor to a safe level.

Ground Stick.

A device that is used to ensure that the capacitor is discharged by applying it to all terminals of the capacitor element.

> Informational Note: This is also called a ground hook and could incorporate power-rated discharge resistors for high-energy applications.

Hard Grounding (Low Z).

The practice of discharging a capacitor through a low impedance, also called Low Z (impedance) grounding.

Hearing Protection Boundary.

Worker distance at which a 1 percent probability of ear damage exists from a 3.0 psi shock wave.

Lung Protection Boundary.

Worker distance at which a 1 percent probability of lung damage exists from a 10 psi shock wave.

Soft Grounding (Hi-Z).

The practice of connecting a capacitor to ground through a power resistor to avoid the hazards related with hard grounding. This is also called High Z (impedance) grounding.

Time Constant.

The time it takes for voltage to drop by ~63 percent (1/e) during discharge.

360.3 Stored Energy Hazard Thresholds.

Appropriate controls shall be applied where the following hazard threshold conditions exist:

(1) Less than 100 volts and greater than 100 joules of stored energy

(2) Greater than or equal to 100 volts and greater than 1.0 joule of stored energy

(3) Greater than or equal to 400 volts and greater than 0.25 joules of stored energy

360.4 Specific Measures for Personnel Safety.

(A) Qualification and Training.

The following qualifications and training shall be required for personnel safety:

(1) Employees who perform work on electrical equipment with capacitors that exceed the energy thresholds in 360.3 shall be qualified and shall be trained in, and familiar with, the specific hazards and controls required for safe work.

(2) Unqualified persons who perform work on electrical equipment with capacitors shall be trained in, and familiar with, any electrical safety-related work practices necessary for their safety.

(B) Performing a Risk Assessment for Capacitors.

The risk assessment process for capacitors shall follow the overall risk assessment procedures per Chapter 1. If additional protective measures are required, they shall be selected and implemented according to the hierarchy of risk control identified in 110.5(H). When the additional protective measures include the use of PPE, the following shall be determined:

(1) Capacitor voltage and stored energy for the worker exposure. An exposure exists when a conductor or circuit part that could potentially remain energized with hazardous stored energy is exposed.

(2) Thermal hazard. The appropriate thermal PPE shall be selected and used if the stored energy of the exposed part is greater 100 joules.

(3) Shock hazard. The appropriate shock PPE per 130.7 shall be selected and used if the voltage is greater than or equal to 100 volts.

(4) Arc flash and arc blast hazard at the appropriate working distance. Select the appropriate protection for the arc flash and arc blast hazard, as follows:

(a) Arc flash PPE per 130.7 shall be selected and used if stored energy is greater than 10 kJ.

(b) Hearing protection shall be required where the stored energy exceeds 100 joules.

(c) The lung protection boundary shall be determined if stored energy is above 122 kJ. Employees shall not enter the lung protection boundary.

(d) Alerting techniques per 130.7(E) shall be used to warn employees of the hazards.

(5) Required test and grounding method. Soft grounding shall be used for stored energy greater than 1000 joules. If capacitors are equipped with bleed resistors, or if using a soft grounding system, determine the required discharge wait time, where applicable.

(6) Develop a written procedure that captures all of the required steps to place the equipment in an electrically safe work condition. Include information about the amount of stored energy available, how long to wait after de-energization before opening the enclosure, how to test for absence of voltage, and what to do if there is still stored energy present.

Informational Note No. 1: For more information on calculating capacitor stored energy, arc flash, and arc blast boundaries, see Annex R, Working Safely with Capacitors.
Informational Note No. 2: Heavy duty leather with a minimum thickness of 0.03 in. (0.7 mm) provides protection from thermal hazards.

360.5 Establishing an Electrically Safe Work Condition for the Capacitor Element.
(A) Written Procedure.

Where a conductor or circuit part is operating above the thresholds per 360.3, a written procedure shall be used to document the necessary steps and sequence to place the equipment into an electrically safe work condition. The written procedure shall incorporate the results of the risk assessment performed in 360.5(B) and specify the following at a minimum:

(B) Safe Work Practices.

In order to place the capacitor(s) into an electrically safe work condition, a qualified person shall use the appropriate safe work practices and PPE and perform the following steps:

(1) If bleed resistors or automatic discharge systems are applicable, wait the prescribed time for the capacitors to discharge to less than the thresholds in 360.3.

(2) For capacitors less than or equal to 1000 volts and less than or equal to 10 kJ of stored energy, use an adequately rated portable test instrument to test between each capacitor terminal and from each terminal to ground to assure that the capacitor is de-energized.

(3) Before and after each verification, determine that the test instrument is operating satisfactorily through verification on a known dc voltage source. If voltage remains, proceed to 360.5(B)(4).

(4) For capacitors greater than 1000 volts and less than or equal to 10 kJ of stored energy capacitors and those less than 1000 volts with remaining energy, an adequately rated grounding device (e.g., ground stick) shall be used to ground the capacitor terminals.

(5) To ensure that recharging does not occur, all of the capacitor terminals shall be shorted together and to ground with a noninsulated wire of sufficient gauge to withstand handling.

(6) For series capacitors these shorting wires shall be attached across each individual capacitor, and to case.

For single capacitors or for a parallel capacitor bank, the grounding device shall be permitted to be left hanging on the capacitor terminal during the work (e.g., a ground stick/hook). For capacitors greater than 10 kJ of stored energy, energy removal shall be performed remotely.

360.6 Grounding Sticks.

Grounding sticks shall be provided for qualified persons to safely discharge any residual stored energy contained in capacitors. The grounding sticks shall be designed, constructed, installed, and periodically inspected so that the full energy and voltage of the capacitors can be safely discharged.

(A) Visual Inspection.

The ground stick shall be visually inspected for defects before each use. Resistors shall be visually inspected for cracks or other defects and electrically tested for proper resistance. The following shall occur if defects or contamination are found:

(1) If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the ground stick is present, the tool shall be removed from service. All mechanical connections shall be examined for loose connections. Ground sticks shall have a hand guard that reduces the risk of shock.

(2) If the defect or contamination exists on the grounding stick, then it shall be replaced or repaired and tested before returning to service.

(3) If the defect or contamination exists on the cable, then it shall be replaced or repaired and tested before returning to service.

(B) Electrical Testing.

All ground sticks shall be electrically tested as follows:

(1) The ground stick cable shall be tested to verify that impedance is less than 0.1 Ω to ground every 2 years.

(2) The testing shall be documented.

Exception: The test shall be performed annually if the ground stick is utilized outdoors or in other adverse conditions.

(3) Soft grounding (Hi-Z) ground sticks with resistors shall be measured and compared to the specified value before each use.

(C) Storage and Disposal.

Any residual charge from capacitors shall be removed by discharging before servicing or removal.

(1) All uninstalled capacitors capable of storing 10 joules or greater at their rated voltage shall be short-circuited with a conductor of appropriate size.

(2) When an uninstalled capacitor is discovered without the shorting conductor attached to the terminals, it shall be treated as energized and charged to its full rated voltage until determined safe by a qualified person.

Informational Note: A capacitor that develops an internal open circuit could retain substantial charge internally even though the terminals are short-circuited. Such a capacitor can be hazardous to transport, because the damaged internal wiring could reconnect and discharge the capacitor through the short-circuiting conductor. Any capacitor that shows a significant change in capacitance after a fault could have this problem. Action should be taken to minimize this hazard when it is discovered.

First Revision No. 89-NFPA 70E-2018 [Global Input]

See attached file for new Annex R.

Supplemental Information

File Name	Description	Approved
attachment_for_FR_89_New_Annex_R.docx	attachment for FR 89 Annex R--for staff use	
70E_Global_FR-89_Annex_R.docx	For ballot	

Submitter Information Verification

Committee:
Submittal Date: Thu Aug 16 17:56:05 EDT 2018

Committee Statement

Committee Statement: Annex R is added to correlate with the new Article 360.
Response Message: FR-89-NFPA 70E-2018

Public Input No. 229-NFPA 70E-2018 [New Section after Q.8.4]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

This is good information. I'm not certain that all of it is necessary as Annex material for NFPA 70E, in particular since new Article 360 is also added.

Informative Annex R Working with Hazardous Capacitors

R.1 Introduction.

Capacitors have the ability to store energy after source power has been disconnected. While most systems with capacitors are built with bleed resistors that automatically discharge the stored energy within a set time, these systems can sometimes fail, leaving a shock, arc flash, or arc blast hazard. This informative annex provides detailed guidance on how to properly assess the risk in working with capacitors and implement suitable controls.

R.2 Qualification and Training.

R.2.1

Employees who perform work on electrical equipment with capacitors that exceed 10 J and 50 volts should be qualified persons as required in Chapter 1 and should be trained in, and familiar with, the specific hazards and controls required for safe work.

R.2.2

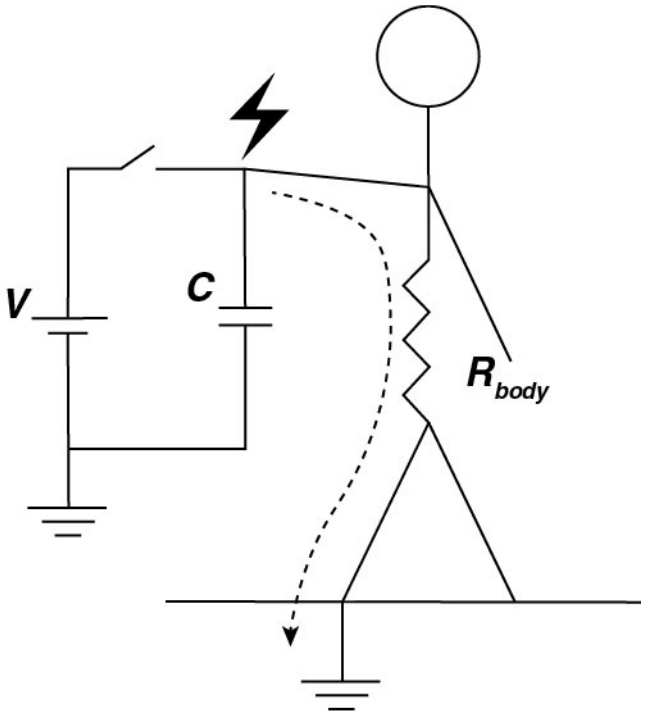
Unqualified persons who perform work on electrical equipment with capacitors that exceed 1 joule (50–400 volts), or 0.25 joules (greater than 400 volts) should be trained in, and familiar with, any electrical safety-related practices necessary for their safety.

R.3 Shock Hazard.

R.3.1 General.

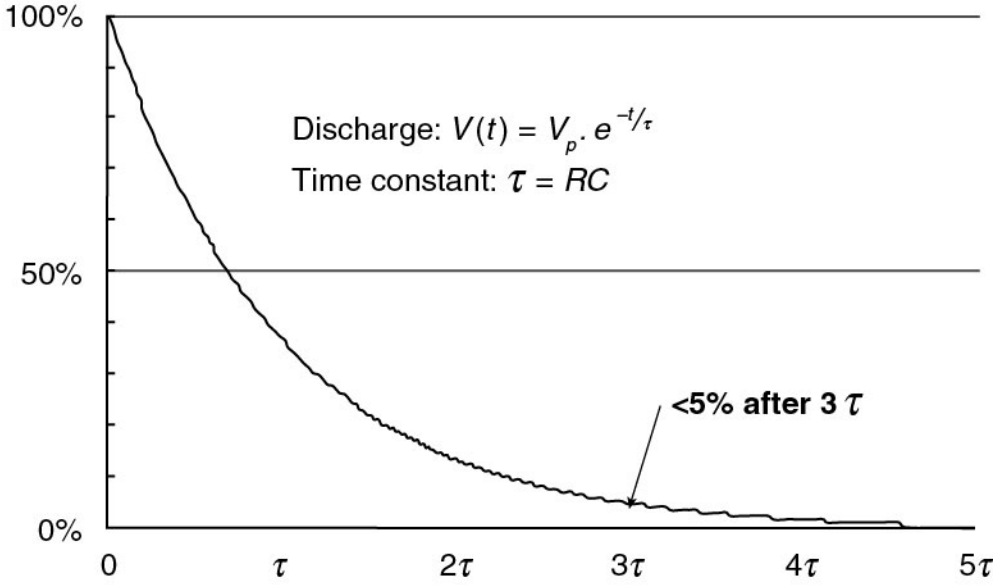
The capacitor shock hazard to a person is an impulse shock with an exponential decay curve. The severity of the shock is related to the amount of energy (joules) delivered within a set time period. Heart fibrillation is the primary shock hazard and can be fatal. Heart fibrillation can happen when the voltage exceeds 50 volts and the stored energy delivered exceeds 10 joules under certain circumstances. However, even without fibrillation, a high-voltage, high-energy shock can cause serious injuries, either directly or through reflex action, down to as low as 0.25 joules. Instances of temporary paralysis, loss of consciousness, hearing damage, temporary loss of eyesight, burns, and dislocated joints have been reported. [See Figure R.3.1(a) for a capacitive shock circuit and Figure R.3.1(b) for a capacitive discharge curve.]

Figure R.3.1(a) Capacitor Shock Circuit.



where:
V = voltage
C = capacitance
R = resistance

Figure R.3.1(b) Typical Exponential Discharge Characteristic of a Capacitor Through a Resistor.



where:
V = voltage
t = time
Vp = peak voltage
τ = time constant
R = resistance
C = capacitance

R.3.2 Capacitive Discharge

The duration of a capacitive discharge shock is independent of voltage and is generally assumed to be three times the time constant of the shock circuit. After three time constants, the voltage is reduced by 95 percent, and the energy has been reduced by 99.25 percent. The time constant, τ, is equal to body shock pathway resistance times capacitance, as follows:

$$\tau = RC \quad \textbf{[R.3.2]}$$

R.3.3 Current.

The current delivered by the shock is independent of capacitance and is proportional to the initial peak voltage and inversely proportional to shock pathway resistance. Assuming that all of the stored energy is delivered in 3τ, the rms equivalent current can be expressed as follows

$$I_{rms} = \frac{V_p}{R\sqrt{6}} \quad \textbf{[R.3.3]}$$

where:

I_{rms} = rms current

V_p = peak voltage

R = pathway resistance

:

R.3.4 Pathway Resistance.

The shock pathway resistance, which can vary depending on skin resistance, entry and exit locations, and many other factors, has a relatively minor effect on the severity of a capacitor discharge shock. A capacitor disconnected from a live voltage source has only a finite amount of energy and can deliver that energy either quickly or slowly. As shock pathway resistance increases, the current lowers but the time to discharge also takes longer, and vice versa. Overall, a higher shock pathway resistance will likely reduce the severity of the shock.

R.3.5 Stored Energy.

For a given stored energy, there is a difference in response to whether it is a high-voltage, low-capacitance shock, or a low-voltage, high-capacitance shock. At high voltage and low capacitance, a hazardous shock will fully discharge nearly instantaneously (in microseconds) and could miss the vulnerable part of the heart cycle. However, the full energy is delivered to the person. At low voltage and high capacitance, the total discharge time can extend several seconds (multiple heart beats), behaving more like a dc shock. However, a person's reflex action could interrupt the shock before all of the energy is delivered. Both scenarios remain highly hazardous as fibrillation could still occur.

Informational Note: For more information on impulse shock hazards, see IEC TS 60479-2, *Effects of Current on Humans and Livestock, Part 2, Special Aspects*.

R.3.6 Reflex Hazard.

Even when fibrillation does not occur, there remains the potential for serious bodily injury, especially at higher voltages. The reflex action to an impulse shock can be severe, causing persons to fall off of elevated platforms or ladders, knock a body part into nearby objects, or in some cases cause severe muscle clenching, temporary paralysis, or dislocated joints. This reflex hazard extends to lower energies even where fibrillation is unlikely.

R.3.7 Shock Hazard Thresholds.

Capacitors connected to conductors or circuit parts operating at voltages equal to or greater than 50 Vdc and containing a stored energy equal to or greater than 10 J present a significant risk of shock and fibrillation. Below 10 J, a significant risk of reflex action leading to injury could exist in the following situations:

(1) 50–400 volts: if the stored energy is 1–10 joules

(2) >400 volts: if the stored energy is 0.25–10 joules

R.4 Short-Circuit Hazard.

Capacitors have the unique ability to discharge very rapidly in a shorted condition. AC power system faults typically occur on the order of milliseconds and are limited by transformer impedances. Battery faults take seconds or minutes to discharge. In contrast, capacitors have very little internal impedance and can fully discharge in microseconds, with very high discharge current. This current can cause thermal burn hazards, arc flash hazards, and arc blast hazards when the stored energy is high enough.

R.4.1 Thermal Hazard.

At around 100 joules, a short through a ring or tool can cause rapid heating and burns to the skin. Above 1 kJ, there can be substantial heating of metal, arcing, and magnetic forces causing mechanical deformation. Above 10 kJ, there is massive conductor melting, massive magnetic/mechanical motion, and an explosion hazard.

R.4.2 Arc Flash Hazard.

Above around 44 kJ (in a box) or 131 kJ (in open air), there exists sufficient stored energy to create an arc flash hazard (greater than 1.2 cal/cm^2 at a working distance of 18 in.). This is a conservative lower bound that assumes all of the stored energy has been converted to radiant heat. Note that capacitor banks can have an arc flash hazard much greater due to the ac contribution to incident energy.

R.4.3 Arc Blast Hazard.

Capacitors can have a significant arc blast hazard due to the very high short-circuit current involved. The concussive effects of the acoustic shock wave can rupture eardrums and collapse lungs. While hearing protection should be used above 100 joules to mitigate against hearing damage, there is no PPE for protection against lung collapse, which becomes a hazard above 112 kJ.

R.5 Other Hazards.

R.5.1

An additional hazard exists when a capacitor is subjected to high currents that can cause heating and explosion.

R.5.2

When capacitors are used to store large amounts of energy, internal failure of one capacitor in a bank frequently results in explosion when all other capacitors in the bank discharge into the fault.

R.5.3

Fuses are generally used to preclude the discharge of energy from a capacitor bank into a faulted individual capacitor. Improperly sized fuses for this application can explode.

R.5.4

Internal faults can rupture capacitor containers. Rupture of a capacitor can create a fire hazard. Dielectric fluids can release toxic gases when decomposed by fire or the heat of an electric arc.

R.6 Performing a Risk Assessment for Hazardous Capacitors.

R.6.1

The risk assessment process for hazardous capacitors can follow the overall risk management process found in Annex F. This risk assessment should be coordinated with the shock risk assessment of 130.4 and the arc flash risk assessment of 130.5.

R.6.2

Whether there is an exposure to capacitor stored energy hazard should be determined. An exposure would exist when a conductor or circuit part that could potentially remain energized with hazardous stored energy is not properly guarded, enclosed, or insulated. All circuit parts that are electrically connected to a capacitor bank could present this hazard. For example, a power factor correction bank could be in a completely separate enclosure; however, should the bank remained charged for some reason, the switchgear to which it is connected could also deliver the stored energy hazard.

R.6.3

The shock hazard should be determined (see R.7). Use the shock risk assessment process of 130.4 and the dc shock approach boundaries and PPE ratings.

R.6.4

The total capacitor stored energy (see R.8) of the system should be determined.

R.6.5

The arc flash hazard (see R.9) should be determined. If stored energy is greater than 40 kJ (in a box) or 120 kJ (open air), the arc flash incident energy and the arc flash boundary should be determined at the appropriate working distance. Appropriate arc flash PPE should be selected accordingly but should remain out of the lung protection boundary.

R.6.6

The arc blast hazard (see R.10) should be determined. Hearing protection should be required where the stored energy exceeds 100 J. Where the stored energy exceeds 10 kJ, the hearing protection boundary should be calculated. If stored energy is above 112 kJ, determine the arc blast boundary for lung hazards. A lung collapse hazard could exist above 112 kJ. DO NOT ENTER THE LUNG PROTECTION BOUNDARY. There is no PPE for lung protection.

R.6.7

The required test and grounding method (see R.11) should be determined. Because of the loudness of hard grounding, which can be uncomfortable or hazardous to nearby personnel, soft grounding should be used for stored energy greater than 1000 joules. For systems less than 1000 volts and less than 10 kJ, with a bleed system, this can be simply performed using an approved voltage tester in accordance with 110.8. As long as the capacitors have discharged, then the equipment is safe. However, should the bleed system malfunction, there needs to be a prescribed and safe method to discharge the capacitors. This would include whether hard or soft grounding is preferred, if a specific sequence is necessary, and whether shorting straps would remain applied to account for the possibility of dielectric absorption.

R.6.8

If capacitors are equipped with bleed resistors, or if using a soft grounding system, the required discharge wait time should be determined where applicable (see R.12).

R.6.9

A written lockout/tagout procedure should be developed that captures all of the required steps to place the equipment in an electrically safe work condition. Information about the amount of stored energy available, how long to wait after de-energization before opening the enclosure, how to test for absence of voltage, and what to do if there is still stored energy present should be included.

R.6.10

Labeling the equipment with a hazard warning label (see R.15) should be considered so that qualified persons are made aware of the potential for stored energy and the need for a written lockout/tagout procedure.

R.7 Determining the Shock Hazard.

R.7.1

A shock risk assessment should be performed in accordance with 130.4. Shock approach boundaries are based on the peak voltage and the dc shock approach boundaries of Table 130.4(E)(b). Appropriately rated shock protection PPE, such as voltage-rated gloves and insulating sheeting, should be selected. The dc ratings for rubber insulated products should be used. (See ASTM D120, *Standard Specification for Rubber Insulating Gloves*, for dc ratings.)

R.7.2

Shock protection PPE is required for all parts of the body that enter the restricted approach boundary. [See Table 130.4(E)(b).]

R.8 Determining Capacitor Stored Energy.

R.8.1

Determining capacitor stored energy could require detailed examination of drawings or manufacturer's information to properly determine both the peak voltage that will be applied to the capacitors and the total system capacitance.

R.8.2

The stored energy in a capacitor is calculated as follows:

$$E = \frac{1}{2} C V^2 \quad \textbf{[R.8.2]}$$

where:

E = capacitive stored energy in joules

C = total capacitance in farads

V = peak voltage in volts

R.8.3

The total capacitance of capacitor banks is calculated as follows:

(1) For capacitors in parallel, add the capacitance as follows:

$$C_{total} = C_1 + C_2 + C_3 + \cdots$$ **[R.8.3a]**

(2) For capacitors in series, use the following:

$$\frac{1}{C_{total}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots$$ **[R.8.3b]**

(3) Capacitor banks used for power factor correction are often labeled with a kVAr value (kilovolt-amperes reactive) to facilitate power engineering calculations. Calculate the capacitance as follows:

$$C = \frac{Q}{2\pi f V^2}$$ **[R.8.3c]**

where:

C = total capacitance in farads

Q = reactive power in VAr (volt-amperes reactive)

f = frequency in hertz

V = phase-to-phase voltage in volts rms

(4) Long high-voltage coaxial cables can have significant capacitance, normally on the order of 15–35 pF/ft (1 picofarad = 1×10^{-12} F). Manufacturer's specifications on capacitance per foot should be consulted.

R.8.4

For peak voltage, the voltage applied across the capacitors that would cause the maximum charge should be used. For disconnected capacitors in storage or for disposal, the capacitor rated voltage should be used.

R.8.4.1

For dc systems use the maximum available pole-to-pole voltage that could be applied to the capacitor by the system.

R.8.4.2

For ac systems nominal system voltage is normally expressed in volts rms. For capacitor stored energy calculations, use the peak amplitude of the voltage, V_p, as follows:

$$V_{rms} = \frac{1}{\sqrt{2}} V_p = 0.707 V_p$$ **[R.8.4.2a]**

(1) For single-phase ac systems, use peak ac voltage, as follows:

$$V_p = V_{rms} \cdot \sqrt{2}$$ **[R.8.4.2b]**

(2) For 3-phase wye-connected systems, use the peak phase-to-neutral ac voltage, as follows:

$$V_p = V_{\phi-N} \cdot \sqrt{2}$$ **[R.8.4.2c]**

(3) For 3-phase delta-connected systems, use the peak phase-to-phase ac voltage, as follows:

$$V_{cap} = V_{\phi-\phi} \cdot \sqrt{2}$$ **[R.8.4.2d]**

Informational Note: For the same capacitance, a delta-connected system will have a total energy three times higher than a wye-connected system. Always check the configuration as design requirements vary.

R.9 Determining the Arc Flash Hazard.

R.9.1

The maximum theoretical possible arc flash incident energy can be calculated by assuming that all of the stored energy is dissipated as radiant energy in a spherical expansion in open air. While this is unlikely, it helps set a lower bound of stored energy below which an arc flash hazard is unlikely.

$$IE_{open\ air} = \frac{Energy}{Area} = \frac{\frac{1}{2}CV^2}{4\pi r^2} = \frac{CV^2}{8\pi r^2} J/cm^2 \quad \textbf{[R.9.1a]}$$

Converting to cal/cm2 (1 cal = 4.184 joules) we obtain the following:

$$IE_{open\ air} = \frac{CV^2}{105.1r^2} = \frac{E}{52.6r^2} cal/cm^2 \quad \textbf{[R.9.1b]}$$

where:

IE = incident energy

E = energy

C = capacitance

V = voltage

r = radius

R.9.2

The arc flash boundary, where IE = 1.2 cal/cm^2, is then as follows:

$$AFB_{open\ air} = 0.126\sqrt{E(cm)} = 0.05\sqrt{E(in.)} \quad \textbf{[R.9.2a]}$$

In a box, we apply a three times factor over the open-air incident energy calculation, as follows:

$$IE_{box} = 3 \times IE_{open\ air} \textbf{[R.9.2b]}$$

$$AFB_{box} = \sqrt{3} \times AFB_{open\ air} \quad \textbf{[R.9.2c]}$$

where:

AFB = arc flash boundary

IE = incident energy

Thus, the minimum stored energy (lower bound) required to obtain 1.2 cal/cm^2 at a working distance of 18 in. is roughly 44 kJ in a box or 131 kJ in open air. Extreme caution should be used with the open air calculation, as the arc flash boundary can fall inside the lung protection boundary for arc blast. A better practice is to always use the box arc flash boundary as a minimum approach distance.

R.10 Determining the Arc Blast Hazard.

R.10.1

The arc blast hazard is directly related to the instantaneous (initial) short circuit current. Since capacitors can discharge so rapidly, the shockwave generated by a capacitor discharge can cause barotrauma (overpressure injury) to persons in the area. The most sensitive organs are the ears and lungs. When a differential pressure across the eardrums exceeds around 20–35 kilopascals (3–5 psi), the eardrum can rupture. At 200 kilopascals (29 psi), lung damage can occur. The following formulas are used to estimate safe boundaries based on total stored energy, where "safe" is less than a 1 percent probability of eardrum rupture or lung injury:

$$R_{ear} = 49.29\sqrt[3]{\frac{E}{1000}} - 5.09 \quad \textbf{[R.10.1a]}$$

$$R_{lung} = 31.22\sqrt[3]{\frac{E}{1000}} - 155.45 \quad \textbf{[R.10.1b]}$$

where:

R_{ear} = eardrum rupture boundary (1 percent probability) in cm

R_{lung} = lung collapse boundary (1 percent probability) in cm

E = capacitor stored energy in joules

Informational Note: For more information about the derivation of these formulas, see Charles R. Hummer, Richard J. Pearson, and Donald H. Porschet, "*Safe Distances From a High-Energy Capacitor Bank for Ear and Lung Protection*," Army Research Laboratory Report, ANL-TN-608, July 2014.

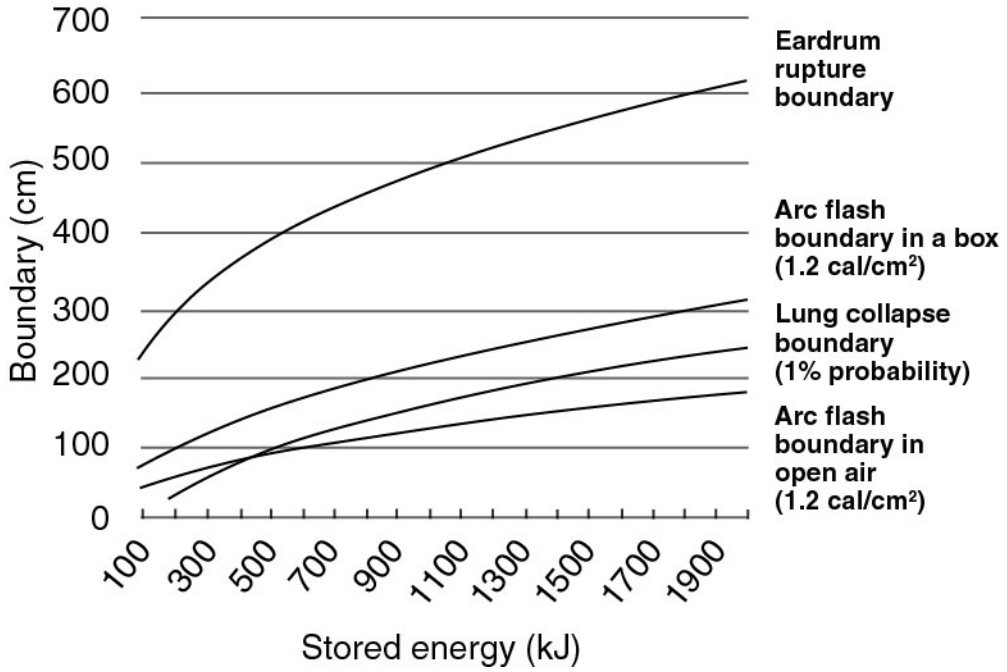
R.10.2

Above 112 kJ a lung collapse hazard can exist. It is not sufficient to wear arc flash PPE, as this will not protect against lung injury. Remain outside of the lung collapse boundary.

R.10.3

Above 448 kJ, the lung protection boundary will be greater than the arc flash boundary in open air calculated in R.9. A better practice is to always use the box arc flash boundary as a minimum approach distance. (See Figure R.10.3.)

Figure R.10.3 Plot of Arc Flash and Blast Protection Boundaries.



R.11 Selecting the Appropriate Grounding Method: Hard Grounding vs. Soft Grounding.

R.11.1

Hard grounding is the practice of shorting a capacitor directly to ground. Since the resistance is typically <0.1 ohm, the discharge time is very rapid. A loud spark and bang can happen at higher voltage and energies. Above 100 joules there is a hearing damage hazard.

R.11.2

Soft grounding is the practice of connecting a capacitor to ground through a power resistor. The resistor raises the time constant ($\tau = RC$) and reduces the peak discharge current ($I = V/R$) to safer levels. Soft grounding is required above 1000 joules.

R.11.3

At the conclusion of the specified discharge time, there is still voltage on the capacitors. A properly matched resistor and capacitor will reduce the voltage to less than 50 volts and the energy to less than 5 joules. At this point hard grounding is applied to fully short the capacitors to ground.

R.11.4

Sometimes the grounding resistor is attached directly to the grounding stick. Other times, there are two separate grounding points built into the equipment itself. The grounding point labeled "Hi-Z" is the soft grounding point, where "Hi-Z" stands for high impedance. In this case the same ground stick is applied, first to the Hi-Z point, then to the ground point.

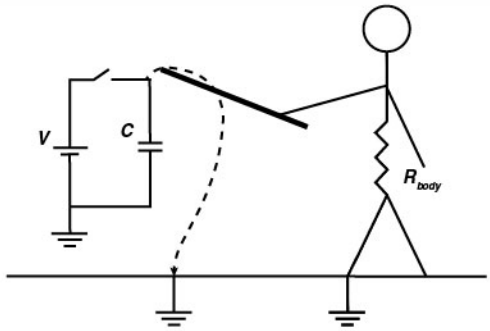
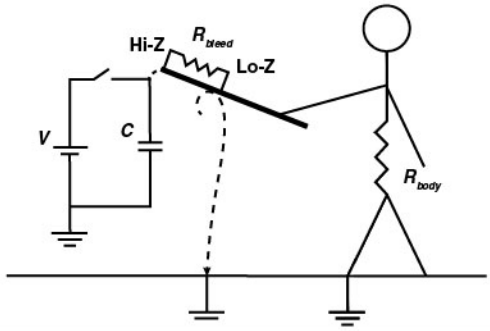
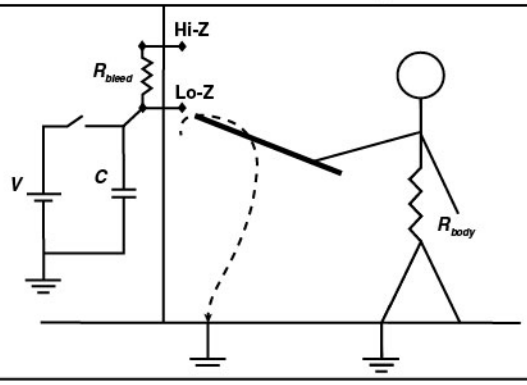
R.11.5

The grounding method should keep all personnel clear of the lung protection boundary. For this reason, above 100 kJ, remote soft grounding and testing may be required.

R.11.6

All ground sticks should meet the requirements of R.16. (See Figure R.11.6 for illustrating of grounding techniques.)

Figure R.11.6 Illustration of Hard and Soft Grounding Examples.

	**Hard grounding:** An insulating stick with a grounding tip is used to discharge the capacitor to ground.
	**Soft grounding 1:** An insulating stick with a mounted resistor is used to perform a controlled bleed-off of the capacitor charge using the Hi-Z tip first. Then, after the prescribed wait time, hard grounding is applied with the second (Lo-Z) tip that bypasses the resistor.
	**Soft grounding 2:** An insulating stick with a grounding tip is first applied to the Hi-Z point to perform a controlled bleed-off of the capacitor charge. Then, after the prescribed wait time, the grounding tip is applied to the Lo-Z point to bypass the resistor and hard-ground the capacitor.

R.11.7

Other considerations are as follows:

(1) Charge transfer: Grounding capacitors in series may transfer rather than discharge the stored energy. Special precaution should be taken in selecting the tools and sequence necessary to discharge capacitors connected in series. Improper grounding can result in moving charge around and not fully discharging to ground. Capacitor cases are not always grounded and should be considered charged unless otherwise determined.

(2) Dielectric absorption: Not all the charge in an electrolytic capacitor is dissipated when it is short-circuited for a short time. A voltage rebound of up to 10 percent can occur a few minutes after the grounding or shorting device has been removed.

(3) High-voltage capacitors can build a charge in the presence of high electric fields.

(4) A momentary hazardous voltage can exist at the moment of contact across the impedance of a few feet of grounding cable at the moment of contact with a charged capacitor.

R.12 Determining the Capacitor Discharge Time.

R.12.1

The discharge time, T_d, of a capacitor is the time it takes to reduce to less than 50 volts. It is related to the time constant, τ. The discharge resistance can be permanently installed on the capacitors, automatically switched in after power shutoff, or applied through a soft grounding stick.

R.12.2

For voltages up to 1000 volts, it is sufficient to wait three times the time constant, or one minute, whichever is greater. That is because after 3τ, the residual voltage is less than 5 percent of the initial voltage.

R.12.3

For voltages above 1000 volts, the discharge time will need to be longer than 3τ and should be calculated. Use the following formula to determine the minimum wait time:

$$\tau = RC \quad \textbf{[R.12.3a]}$$

$$T_d = -\ln\left(\frac{50}{V_p}\right)\tau \quad \textbf{[R.12.3b]}$$

where:

τ = time constant

R = discharge path resistance

C = total capacitance

T_d = discharge time (wait time)

V_p = peak voltage

R.13 Establishing an Electrically Safe Work Condition.

R.13.1

Where a conductor circuit part is operating at 50 volts or greater and the stored capacitive energy is 10 joules or greater, a written lockout/tagout procedure should be used to document the necessary steps to place the equipment in an electrically safe work condition. The written lockout/tagout procedure should incorporate the results of the risk assessment performed in R.6 and specify the following at a minimum:

(1) Energy in joules

(2) Specific steps to safely discharge the capacitor or verify that it is discharged

(3) Specific tool to ground the capacitors, if required

R.13.2

In order to place the equipment with stored hazardous energy in an electrically safe work condition, a qualified person should follow the steps in 120.5 as well as the specific sequence outlined in the written lockout/tagout procedure. These would then be as follows:

(1) Review the scope of work and the written lockout/tagout procedure. Determine all required safe approach boundaries and necessary PPE and tools for the task.

(2) Perform a job briefing with the personnel involved and notify affected persons that the equipment will be de-energized.

(3) After properly interrupting the load current, open the disconnecting device(s) for each source.

(4) Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.

(5) Apply lockout/tagout devices in accordance with a documented and established policy.

(6) If applicable, wait the prescribed time for the capacitors to fully discharge to less than 50 volts through the bleed resistors.

(7) Use an adequately rated test instrument to test each phase conductor or circuit part to verify it is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the test instrument is operating satisfactorily through verification on a known voltage source. If voltage remains, proceed to step 8. For high energy capacitors, where no safe test equipment is available, this step can be omitted, provided that step 8 is fully implemented.

(8) Using a properly rated grounding device, ground the phase conductors or circuit parts before touching them. To ensure that all charge is properly dissipated and that charge transfer did not occur, ensure that that all of the poles are shorted together and to ground. Follow the specific sequence prescribed in the written lockout/tagout procedure.

(9) Where dielectric absorption could cause a hazardous voltage rebound, apply suitably rated shorting straps as necessary to dissipate any remaining stored energy. The grounding devices of step 8 should remain in place while the shorting straps are applied.

R.14 Storage and Disposal.
R.14.1

Any residual charge from capacitors should be removed by grounding the terminals before servicing or removal.

R.14.2

All uninstalled capacitors capable of storing 10 joules or greater at their rated voltage should be short-circuited with a conductor of appropriate size (typically 14 AWG bare copper wire or equivalent). The conductor should be able to withstand damage related to transportation activities.

R.14.3

When an uninstalled capacitor is discovered without a shorting wire attached to the terminals, it should be treated as energized and charged to its full rated voltage until determined otherwise. A qualified person should be contacted to determine the appropriate steps to safely discharge the capacitor.

R.14.4

A capacitor that develops an internal open circuit can retain a substantial charge internally even though the terminals are short-circuited. Such a capacitor can be hazardous to transport because the damaged internal wiring can reconnect and discharge the capacitor through the short-circuiting wires. Any capacitor that shows a significant change in capacitance after a fault can have this problem. Action should be taken to minimize this hazard when it is discovered.

R.15 Capacitor Hazard Labeling.
R.15.1

Electrical equipment operating at 50 volts and greater and containing capacitive stored energy of 10 joules or greater should be field marked with a label containing all the following information:

(1) A warning about the potential for capacitive stored energy, with the word "WARNING" on an orange colored background

(2) Stored energy in joules

(3) Wait time before opening enclosure (usually 1 minute or 5 minutes per NFPA 70, *National Electrical Code*, and Underwriters Laboratories requirements)

(4) Date of the stored energy hazard analysis

(5) An instruction that a qualified person is required and that they should use a written lockout/tagout procedure

R.15.2

Labeling should conform to the requirements of ANSI Z535.4, *Product Safety Signs and Labels*.

R.16 Grounding Hooks.
R.16.1

Grounding hooks should be provided for qualified persons to safely discharge any residual stored energy contained in capacitor banks. The grounding hooks should be designed, constructed, installed, and periodically inspected so that the full energy of a capacitor bank can be safely discharged.

R.16.2

Design and construction is as follows:

(1) Ground hook stick: When built of fiber reinforced plastic (FRP), the rod in the ground hook assembly should meet ASTM F711, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools*, specifications. Other insulating materials can be used provided they are of acceptable insulation and durability for the application. The stick should be long enough to be handled effectively and also to keep a person's hands out of the restricted approach boundary.

(2) Ground hook tip: The ground hook connection to discharge points can be chain links, bare conductor, or solid copper bar in various geometries. The selection of the grounding tip should match the requirements of the intended application and ensure that all necessary circuit parts are fully discharged and grounded at the same time in order to avoid charge transfer. The grounding tips can be designed to remain applied in order to safely prevent voltage rebound from dielectric absorption. Alternatively, shorting straps can be applied while the grounding hooks are applied. Discharge points should be clearly marked and caution should be used to prevent transferring charges to other capacitors or reversing the charge on affected capacitors.

(3) Ground hook resistor. Soft grounding should be provided where stored energy exceeds 1000 joules. The resistor used to soft ground a capacitor bank should be fully rated to handle power, voltage, and current. A proper engineering safety margin would be to calculate peak power, voltage and current, and double the resistor rating for each parameter. The resistor should be able to discharge the capacitor bank to less than 50 volts and less than 5 joules in less than 1 minute (<1000 volts) or less than 5 minutes (greater than 1000 volts) to match NFPA 70, *National Electrical Code*, requirements. Note that soft grounding is always followed by hard grounding to complete the discharge.

(4) Ground hook cable: The cable should be grounding or welding cable, flexible rope lay, soft drawn copper. The individual strands should not be larger than #30 AWG. Grounding cables have flexible elastomer or thermoplastic jackets primarily for mechanical protection of the conductor it covers. Connections should be crimped according to manufacturer instructions. The lugs should be rated for the cables to be clamped. In permanent equipment installations the cable conductor size should be at least #2 AWG or larger. For temporary or benchtop situations, the conductor should be capable of safely carrying any potential current. Ground hooks should never be fused.

R.16.3

Installation is as follows:

(1) Connection to building ground: Ground hooks should be connected to the building grounding electrode system. A qualified engineer should evaluate the connection point to ensure the integrity of the ground hook system. This connection should be in a location accessible to and visible to the operator of the ground hook. Ground hooks should be connected such that impedance is less than 0.1 ohms to ground. Hi-Z ground hooks should be connected such that impedance is less than 0.1 between the resistor and the ground connection.

(2) Operator access: The ground hooks should be permanently grounded and stored in the immediate area of the equipment in a manner that ensures they are used. The approach path to the equipment being grounded should be perpendicular to the equipment and clear of debris or obstructions. The ground hook operator will then always be facing the potential hazard and have the grounded conductor between them and the potentially energized equipment.

R.16.4

The visual inspection is as follows:

(1) The ground hook should be visually inspected for defects before use each day. Excessive dirt should be wiped off the ground stick.

(2) If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the ground hook is present, the tool should be removed from service and examined and tested. Special attention should be paid to the ground cable, as any fraying or damage could impair the integrity of the ground on the end of the ground hook.

(3) If the defect or contamination exists on the grounding stick, then it should be replaced.

(4) If the defect or contamination exists on the cable, then it should be repaired or replaced and tested before return to service.

R.16.5 Biennial Testing (every 2 years).

A ground hook system places a grounded conductor at the end of the rod between the operator and the electrical hazard. The low impedance (Lo-Z) ground hook system is not a live line tool, and there will not be a voltage potential at the end of the ground hook rod. High-impedance (Hi-Z) ground hooks can have a voltage potential at the end of the rod and should be treated as live line tools.

(1) For all ground hooks: The ground hook system should be tested to verify that impedance is less than 0.1 Ω to ground. This test should be performed annually when it is located outside or under any other adverse conditions.

(2) All Hi-Z ground hook insulating rods should be removed from service to be recertified to the ASTM F711, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools*, standard or equivalent.

(3) Hi-Z ground hooks with resistors: The resistor on the Hi-Z ground hook should be measured and compared to the specified value.

R.17 References.

Dalziel, Charles F., "A Study of the Hazards of Impulse Currents," *Transactions of the American Institute of Electrical Engineers. Part III: Power Apparatus and Systems*, Volume 72, Issue 2, 1953, DOI: 10.1109/AIEEPAS.1953.4498738.

DOE-HDBK-1092-2013, *DOE Handbook for Electrical Safety*, U.S. Department of Energy, Washington, DC

Gordon, Lloyd B. and Cartelli, Laura, "A complete electrical hazard classification system and its application," *Electrical Safety Workshop 2009*, IEEE IAS, pp. 1–12, 2009.

Hummer, Charles R., Pearson, Richard J., and Porschet, Donald H., "Safe Distances From a High-Energy Capacitor Bank for Ear and Lung Protection," Army Research Laboratory Report, ANL-TN-608, July 2014.

IEC TS 60479-1, 4th Edition (2005), *Effects of Current on Human Beings and Livestock, Part 1, General Aspects*, Geneva, Switzerland.

IEC TS 60479-2, 3rd Edition (2007), *Effects of Current on Human Beings and Livestock, Part 2, Special Aspects*, Geneva, Switzerland.

Richmond, D.R., Yelverton, J.T., Fletcher, E.R., and Phillips, YY, "Physical Correlates of Eardrum Rupture," *Annals of Otology Rhinology and Laryngology*, Vol 109 (May 1989): 35-41.

Scott, Mark, "Working Safely with Hazardous Capacitors," Paper No. ESW2018-20.

First Revision No. 90-NFPA 70E-2018 [Global Input]

Reorganize Article 110 as in the attached document.

Supplemental Information

File Name	Description	Approved
70E_new_110_reorg.docx		

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 28 12:49:21 EDT 2018

Committee Statement

Committee Statement: The requirements found in 120.2 Lockout/Tagout Principles (A) General are relocated to Article 110 as these requirements are general in nature and are more appropriate for this section of the document. The relocated text is placed at 110.2 so as create a logical progression of requirements.

Locating the requirement to de-energize in Article 110 prioritizes and emphasizes the requirement: the requirement to de-energize is a requirement of an Electrical Safety Program; the requirement to de-energize should be located before lockout requirements; and Article 130 can be focused on requirements related to work involving an electrical hazard.

Response Message: FR-90-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

REORG—Global FR-90

Article 110— General Requirements for Electrical Safety-Related Work Practices

105.4 Priority. [move to 110.1]
Hazard elimination shall be the first priority in the implementation of safety-related work practices.
Informational Note: Elimination is the risk control method listed first in the hierarchy of risk control identified in 110.1(H).

Commented [BS1]: Technical changes in FR-16

120.2(A) General. [move to 110.2]
Electrical conductors and circuit parts shall not be considered to be in an electrically safe work condition until all of the requirements of Article 120 have been met.
Safe work practices applicable to the circuit voltage and energy level shall be used in accordance with Article 130 until such time that electrical conductors and circuit parts are in an electrically safe work condition.
Informational Note: See 120.5 for the steps to establish and verify an electrically safe work condition.

Commented [BS2]: Technical changes in FR-17

130.2 Electrically Safe Work Conditions. [move to 110.3]
Energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts shall be put into an electrically safe work condition before an employee performs work if any of the following conditions exist:

1. The employee is within the limited approach boundary.
2. The employee interacts with equipment where conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.

Commented [BS3]: Technical changes in FR-28

(A) Energized Work. [move to 110.3(A)]

(1) Additional Hazards or Increased Risk.
Energized work shall be permitted where the employer can demonstrate that de-energizing introduces additional hazards or increased risk.
Informational Note: Examples of additional hazards or increased risk include, but are not limited to, interruption of life-support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment.

(2) Infeasibility.
Energized work shall be permitted where the employer can demonstrate that the task to be performed is infeasible in a de-energized state due to equipment design or operational limitations.
Informational Note: Examples of work that might be performed within the limited approach boundary of exposed energized electrical conductors or circuit parts because of infeasibility due to equipment design or operational limitations include performing diagnostics and testing (for example, start-up or troubleshooting) of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that

would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

(3) Equipment Operating at Less Than 50 Volts.
Energized electrical conductors and circuit parts that operate at less than 50 volts shall not be required to be de-energized where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.

(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.

110.~~1~~ 4 Electrical Safety Program.

(A) General.
The employer shall implement and document an overall electrical safety program that directs activity appropriate to the risk associated with electrical hazards. The electrical safety program shall be implemented as part of the employer's overall occupational health and safety management system, when one exists.
Informational Note No. 1: Safety-related work practices such as verification of proper maintenance and installation, alerting techniques, auditing requirements, and training requirements provided in this standard are administrative controls and part of an overall electrical safety program.
Informational Note No. 2: ANSI/AIHA Z10, *American National Standard for Occupational Health and Safety Management Systems*, provides a framework for establishing a comprehensive electrical safety program as a component of an employer's occupational safety and health program.
Informational Note No. 3: IEEE 3007.1, *Recommended Practice for the Operation and Management of Industrial and Commercial Power Systems*, provides additional guidance for the implementation of the electrical safety program.
Informational Note No. 4: IEEE 3007.3, *Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems*, provides additional guidance for electrical safety in the workplace.

(B) Inspection.
The electrical safety program shall include elements to verify that newly installed or modified electrical equipment or systems have been inspected to comply with applicable installation codes and standards prior to being placed into service.

(C) Condition of Maintenance.
The electrical safety program shall include elements that consider condition of maintenance of electrical equipment and systems.

(D) Awareness and Self-Discipline.

Commented [BS4]: Renumber existing sections from Article 110

The electrical safety program shall be designed to provide an awareness of the potential electrical hazards to employees who work in an environment with the presence of electrical hazards. The program shall be developed to provide the required self-discipline for all employees who must perform work that may involve electrical hazards. The program shall instill safety principles and controls.

(E) Electrical Safety Program Principles.

The electrical safety program shall identify the principles upon which it is based.

Informational Note: For examples of typical electrical safety program principles, see Informative Annex E.

(F) Electrical Safety Program Controls.

An electrical safety program shall identify the controls by which it is measured and monitored.

Informational Note: For examples of typical electrical safety program controls, see Informative Annex E.

(G) Electrical Safety Program Procedures.

An electrical safety program shall identify the procedures to be utilized before work is started by employees exposed to an electrical hazard.

Informational Note: For an example of a typical electrical safety program procedure, see Informative Annex E.

(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

(2) Human Error.

The risk assessment procedure shall address the potential for human error and its negative consequences on people, processes, the work environment, and equipment.

Informational Note: The potential for human error varies with factors such as tasks and the work environment. See Informative Annex Q.

(3) Hierarchy of Risk Control Methods.

The risk assessment procedure shall require that preventive and protective risk control methods be implemented in accordance with the following hierarchy:

(1) Elimination

(2) Substitution

(3) Engineering controls

(4) Awareness

(5) Administrative controls

(6) PPE

Informational Note No. 1: Elimination, substitution, and engineering controls are the most effective methods to reduce risk as they are usually applied at the source of possible injury or damage to health and they are less likely to be affected by human error. Awareness, administrative controls, and PPE are the least effective methods to reduce risk as they are not applied at the source and they are more likely to be affected by human error.

Informational Note No. 2: See ANSI/AIHA Z10, *American National Standard for Occupational Health and Safety Management Systems*, for more information regarding the hierarchy of risk control methods.

Informational Note No. 3: The risk assessment procedure could include identifying when a second person could be required and the training and equipment that person should have.

Informational Note No. 4: For an example of a risk assessment procedure, see Informative Annex F.

(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

(2) Job Briefing.
The job briefing shall cover the job safety plan and the information on the energized electrical work permit, if a permit is required.
(3) Change in Scope.
Additional job safety planning and job briefings shall be held if changes occur during the course of the work that might affect the safety of employees.
Informational Note: For an example of a job briefing form and planning checklist, see Informative Annex I, Figure I.1.
(J) Incident Investigations.
The electrical safety program shall include elements to investigate electrical incidents.
Informational Note: Electrical incidents include events or occurrences that result in, or could have resulted in, a fatality, an injury, or damage to health. Incidents that do not result in fatality, injury, or damage to health are commonly referred to as a "close call" or "near miss."
(K) Auditing.
(1) Electrical Safety Program Audit.
The electrical safety program shall be audited to verify that the principles and procedures of the electrical safety program are in compliance with this standard. Audits shall be performed at intervals not to exceed 3 years.
(2) Field Work Audit.
Field work shall be audited to verify that the requirements contained in the procedures of the electrical safety program are being followed. When the auditing determines that the principles and procedures of the electrical safety program are not being followed, the appropriate revisions to the training program or revisions to the procedures shall be made. Audits shall be performed at intervals not to exceed 1 year.
(3) Lockout/Tagout Program and Procedure Audit.
The lockout/tagout program and procedures required by Article 120 shall be audited by a qualified person at intervals not to exceed 1 year. The audit shall cover at least one lockout/tagout in progress. The audit shall be designed to identify and correct deficiencies in the following:

(1) The lockout/tagout program and procedures

(2) The lockout/tagout training

(3) Worker execution of the lockout/tagout procedure

(4) Documentation.
The audits required by 110.1(K) shall be documented.
110.~~2~~5 Training Requirements.
(A) Electrical Safety Training.
The training requirements contained in 110.2(A) shall apply to employees exposed to an electrical hazard when the risk associated with that hazard is not reduced to a safe level by the applicable electrical installation requirements. Such employees shall be trained to understand the specific hazards associated with electrical energy. They shall be trained in safety-related work practices and procedural requirements, as necessary, to provide protection from the electrical hazards associated with their respective job or task assignments. Employees shall be trained to identify and understand the relationship between electrical hazards and possible injury.
Informational Note: For further information concerning installation requirements, see *NFPA 70*, *National Electrical Code*.
(1) Qualified Person.
A qualified person shall be trained and knowledgeable in the construction and operation of equipment or a specific work method and be trained to identify and avoid the electrical hazards that might be present with respect to that equipment or work method.

(a) Such persons shall also be familiar with the proper use of the special precautionary techniques, applicable electrical policies and procedures, PPE, insulating and shielding materials, and insulated tools and test equipment.

(b) A person can be considered qualified with respect to certain equipment and tasks but still be unqualified for others.

(c) Such persons permitted to work within the limited approach boundary shall, at a minimum, be additionally trained in all of the following:

(1) Skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment

(2) Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts

(3) Approach distances specified in Table 130.4(D)(a) and Table 130.4(D)(b) and the corresponding voltages to which the qualified person will be exposed

(4) Decision-making process necessary to be able to do the following:

a. Perform the job safety planning

b. Identify electrical hazards

c. Assess the associated risk

d. Select the appropriate risk control methods from the hierarchy of controls identified in 110.1(G), including personal protective equipment

(d) An employee who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person, and who in the course of such training demonstrates an ability to perform specific duties safely at his or her level of training, and who is under the direct supervision of a qualified person shall be considered to be a qualified person for the performance of those specific duties.

(e) Employees shall be trained to select an appropriate test instrument and shall demonstrate how to use a device to verify the absence of voltage, including interpreting indications provided by the device. The training shall include information that enables the employee to understand all limitations of each test instrument that might be used.

(f) The employer shall determine through regular supervision or through inspections conducted on at least an annual basis that each employee is complying with the safety-related work practices required by this standard.

(2) Unqualified Persons.

Unqualified persons shall be trained in, and be familiar with, any electrical safety-related practices necessary for their safety.

(3) Retraining.

Retraining in safety-related work practices and applicable changes in this standard shall be performed at intervals not to exceed 3 years. An employee shall receive additional training (or retraining) if any of the following conditions exists:

(1) The supervision or annual inspections indicate the employee is not complying with the safety-related work practices.

(2) New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices different from those that the employee would normally use.

(3) The employee needs to review tasks that are performed less often than once per year.

(4) The employee needs to review safety-related work practices not normally used by the employee during regular job duties.

(5) The employee's job duties change.

(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

Informational Note No. 1: Content of the training could include one or more of the following: course syllabus, course curriculum, outline, table of contents, or training objectives.

Informational Note No. 2: Employment records that indicate that an employee has received the required training are an acceptable means of meeting this requirement.

(B) Lockout/Tagout Procedure Training.

(1) Initial Training.

Employees involved in or affected by the lockout/tagout procedures required by 120.2 shall be trained in the following:

(1) The lockout/tagout procedures

(2) Their responsibility in the execution of the procedures

(2) Retraining.

Retraining in the lockout/tagout procedures shall be performed as follows:

(1) When the procedures are revised

(2) At intervals not to exceed 3 years

(3) When supervision or annual inspections indicate that the employee is not complying with the lockout/tagout procedures

(3) Lockout/Tagout Training Documentation.

(a) The employer shall document that each employee has received the training required by 110.2(B).

(b) The documentation shall be made when the employee demonstrates proficiency in the work practices involved.

(c) The documentation shall contain the content of the training, each employee's name, and the dates of the training.

Informational Note: Content of the training could include one or more of the following: course syllabus, course curriculum, outline, table of contents, or training objectives.

(C) Emergency Response Training.

(1) Contact Release.

Employees exposed to shock hazards and those responsible for the safe release of victims from contact with energized electrical conductors or circuit parts shall be trained in methods of safe release. Refresher training shall occur annually.

(2) First Aid, Emergency Response, and Resuscitation.

(a) Employees responsible for responding to medical emergencies shall be trained in first aid and emergency procedures.

(b) Employees responsible for responding to medical emergencies shall be trained in cardiopulmonary resuscitation (CPR).

(c) Employees responsible for responding to medical emergencies shall be trained in the use of an automated external defibrilator (AED) if an employer's emergency response plan includes the use of this device.

(d) Training shall occur at a frequency that satisfies the requirements of the certifying body.

Informational Note: Employees responsible for responding to medical emergencies might not be first responders or medical professionals. Such employees could be a second person, a safety watch, or a craftsperson.

(3) Training Verification.
Employers shall verify at least annually that employee training required by 110.2(C) is current.
(4) Documentation.
The employer shall document that the training required by 110.2(C) has occurred.
110.~~3~~ 6 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.
(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 shall be 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 the following:

(1) Any unique hazards presented by the contract employer's work

(2) Hazards identified during the course of work by the contract employer that were not communicated by the host employer

(3) The measures the contractor took to correct any violations reported by the host employer under 110.3(A)(2) and to prevent such violation from recurring in the future

(C) Documentation.
Where the host employer has knowledge of hazards covered by this standard that are related to the contract employer's work, there shall be a documented meeting between the host employer and the contract employer.
110.~~4~~ 7 Test Instruments and Equipment.
(A) Testing.
Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring on electrical equipment operating at voltages equal to or greater than 50 volts.
(B) Rating.
Test instruments, equipment, and their accessories shall be as follows:

(1) Rated for circuits and equipment where they are utilized

(2) Approved for the purpose

(3) Used in accordance with any instructions provided by the manufacturer

Informational Note: See UL 61010-1, *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements*, for rating and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 volts and below and UL 61010-2-033, *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use — Part 2-033: Particular Requirements for Hand-Held Multimeters and Other Meters, for Domestic and Professional use, Capable of Measuring Mains Voltage*.
(C) Design.
Test instruments, equipment, and their accessories shall be designed for the environment to which they will be exposed and for the manner in which they will be utilized.
(D) Visual Inspection and Repair.

Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before each use. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service. No employee shall use it until a person(s) qualified to perform the repairs and tests that are necessary to render the equipment safe has done so.

(E) Operation Verification.

When test instruments are used for testing the absence of voltage on conductors or circuit parts operating at voltages equal to or greater than 50 volts, the operation of the test instrument shall be verified on any known voltage source before and after an absence of voltage test is performed.

110.~~5~~—8 Portable Cord- and-Plug-Connected Electric Equipment.

This section applies to the use of cord- and plug-connected equipment, including cord sets (extension cords).

(A) Handling and Storage.

Portable equipment shall be handled and stored in a manner that will not cause damage. Flexible electric cords connected to equipment shall not be used for raising or lowering the equipment. Flexible cords shall not be fastened with staples or hung in such a fashion as could damage the outer jacket or insulation.

(B) Grounding-Type Equipment.

(a) A flexible cord used with grounding-type utilization equipment shall contain an equipment grounding conductor.

(b) Attachment plugs and receptacles shall not be connected or altered in a manner that would interrupt continuity of the equipment grounding conductor. Additionally, these devices shall not be altered in order to allow use in a manner that was not intended by the manufacturer.

(c) Adapters that interrupt the continuity of the equipment grounding conductor shall not be used.

(C) Visual Inspection and Repair of Portable Cord- and Plug-Connected Equipment and Flexible Cord Sets.

(a) *Frequency of Inspection.* Before each use, portable cord- and plug-connected equipment shall be visually inspected for external defects (such as loose parts or deformed and missing pins) and for evidence of possible internal damage (such as a pinched or crushed outer jacket).

Exception: Stationary cord- and plug-connected equipment and flexible cord sets (extension cords) that remain connected once they are put in place and are installed such that the cord and plug are not subject to physical damage during normal use shall not be required to be visually inspected until they are relocated or repaired.

(b) *Defective Equipment.* If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service. No employee shall use it until a person(s) qualified to perform the repairs and tests necessary to render the equipment safe has done so.

(c) *Proper Mating.* When an attachment plug is to be connected to a receptacle, the relationship of the plug and receptacle contacts shall first be checked to ensure that they are of mating configurations.

(D) Conductive Work Locations.

Portable electric equipment used in highly conductive work locations (such as those inundated with water or other conductive liquids) shall be approved for those locations. In job locations where employees are likely to contact or be drenched with water or conductive liquids, ground-fault circuit-interrupter protection for personnel shall also be used.

Informational Note: The risk assessment procedure can also include identifying when the use of portable tools and equipment powered by sources other than 120 volts ac, such as batteries, air, and hydraulics, should be used to minimize the potential for injury from electrical hazards for tasks performed in conductive or wet locations.

(E) Connecting Attachment Plugs.

(a) Employees' hands shall not be wet when plugging and unplugging flexible cords and cord- and plug-connected equipment if energized equipment is involved.

(b) Energized plug and receptacle connections shall be handled only with insulating protective equipment if the condition of the connection could provide a conductive path to the employee's hand (e.g, if a cord connector is wet from being immersed in water).

(c) Locking-type connectors shall be secured after connection.

(F) Manufacturer's Instructions.

Portable equipment shall be used in accordance with the manufacturer's instructions and safety warnings.

110.~~6~~ 9 Ground-Fault Circuit-Interrupter (GFCI) Protection.

(A) General.

Employees shall be provided with ground-fault circuit-interrupter (GFCI) protection where required by applicable state, federal, or local codes and standards. Listed cord sets or devices incorporating listed GFCI protection for personnel identified for portable use shall be permitted.

(B) Maintenance and Construction.

GFCI protection shall be provided where an employee is operating or using cord sets (extension cords) or cord- and plug-connected tools related to maintenance and construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

Informational Note: Where an assured equipment grounding conductor program is used, a special purpose ground-fault circuit interrupter may provide additional protection. See Informative Annex O.

(C) Outdoors.

GFCI protection shall be provided when an employee is outdoors and operating or using cord sets (extension cords) or cord- and plug-connected equipment supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees working outdoors operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

Informational Note: Where an assured equipment grounding conductor program is used, a special purpose ground-fault circuit interrupter may provide additional protection. See Informative Annex O.

(D) Testing Ground-Fault Circuit-Interrupter Protection Devices.

GFCI protection devices shall be tested in accordance with the manufacturer's instructions.

110.~~7~~ 10 Overcurrent Protection Modification.

Overcurrent protection of circuits and conductors shall not be modified, even on a temporary basis, beyond what is permitted by applicable portions of electrical codes and standards dealing with overcurrent protection.

Informational Note: For further information concerning electrical codes and standards dealing with overcurrent protection, refer to Article 240 of *NFPA 70*, *National Electrical Code*.

First Revision No. 55-NFPA 70E-2018 [Detail]

see attached table

Supplemental Information

File Name	Description	Approved
attachement_for_FR55_Table_130.7_C_15_c_.docx	attachment for FR 55 modified Table 130.7(C)(15)(c)	

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 10:09:46 EDT 2018

Committee Statement

Committee Statement: Editorially revised the Arc Flash PPE Category 4 arc-rated glove note reference from “c” to “d.”

A new table foot note includes footwear that has been tested to demonstrate no ignition, melting or dripping at the minimum arc rating in each PPE category to be used in lieu of leather or dielectric footwear.

High-visibility apparel added to list of other arc-rated apparel in all Arc Flash PPE Categories.

Table 130.7(C)(15)(c) glove requirements and Table Note (d) are revised to correlate with Table 130.5(G).

FR-55 is ballotable detail is a ballotable detail for Table 130.7(C)(15)(c) with FR-54 being main FR.

Response Message: FR-55-NFPA 70E-2018

Public Input No. 325-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 15-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 295-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 76-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 273-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

Table 130.7(C)(15)(c) Personal Protective Equipment (PPE)

Arc Flash PPE Category	PPE
1	**Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm^2 (16.75 J/cm^2)** [a] Arc-rated long-sleeve shirt and pants or arc-rated coverall Arc-rated face shield [b] or arc flash suit hood Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)0 **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) [c] Heavy duty leather gloves, arc rated gloves, or rubber insulating gloves with leather protectors (SR) [d] Leather footwear [e] (AN)
2	**Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm^2 (33.5 J/cm^2)** [a] Arc-rated long-sleeve shirt and pants or arc-rated coverall Arc-rated flash suit hood or arc-rated face shield [b] and arc-rated balaclava Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) [c] Heavy duty leather gloves, arc rated gloves, or rubber insulating gloves with leather protectors (SR) [d] Leather footwear [e]
3	**Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 25 cal/cm^2 (104.7 J/cm^2)** [a] Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves or rubber insulating gloves with leather protectors (SR) [d] Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) [c] Leather footwear [e]
4	**Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm^2 (167.5 J/cm^2)** [a] Arc-rated long-sleeve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves or rubber insulating gloves with leather protectors (SR) [e][d]

	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) [c] Leather footwear[e]

AN: As needed (optional). AR: As required. SR: Selection required.

[a] *Arc rating* is defined in Article 100.

[b] Face shields are to have wrap-around guarding to protect not only the face but also the forehead, ears, and neck, or, alternatively, an arc-rated arc flash suit hood is required to be worn.

[c] Other types of hearing protection are permitted to be used in lieu of or in addition to ear canal inserts provided they are worn under an arc-rated arc flash suit hood.

[d] ~~If rubber insulating gloves with leather protectors are used, additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.~~ Rubber insulating gloves with leather protectors provide arc flash protection in addition to shock protection. Higher class rubber insulating gloves with leather protectors, due to their increased material thickness, provide increased arc flash protection.

[e] Footwear other than leather or dielectric shall be permitted to be used provided it has been tested to demonstrate no ignition, melting or dripping at the minimum arc rating for the respective Arc Flash PPE Category.

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First Revision No. 91-NFPA 70E-2018 [Detail]

I.2 **Job Safety Planning Checklist.**

Figure I.2 illustrates considerations for a job safety planning checklist.

Figure I.2 Sample Job Safety Planning Checklist.

Job Safety Planning Checklist				
Equipment:				
Task:				
Location:				
Qualified submitter:		**Date:**		
Section A, General				
Mark "Y" or "N" as appropriate				
No.	**Item**	**Yes**	**No**	**Instructions**
1.	Is there justification for the energized work? a. Equipment operating at less than 50 volts b. Additional hazard or increased risk c. Infeasible to de-energize d. Normal operating condition			*If **No**, the equipment must be placed in an electrically safe working condition.* *If **Yes**, complete 1a, 1b, and 1c, and shock and arc flash risk assessments are required to determine the appropriate hazard controls.* *Proceed to Line 2.*
2.	Will the worker be exposed to energized parts?			*If **No**, a shock risk assessment is discretionary and completing Sections B and C is optional.* *Proceed to Line 3.*
3.	Is there an arc flash hazard?			*If **No**, arc flash risk assessment is discretionary and completing Sections D or E and F is optional.* *Proceed to Line 4.*
4.	Were any of the answers to Questions 3 or 4 yes?			*If **No**, further risk assessment is discretionary.* *If **Yes**, proceed to Line 5.*
5.	Did the arc flash risk assessment determine that additional protective measures are required?			*If **No**, completing Parts D or E and F is discretionary.* *If **Yes**, Part D or E is required to be completed.* *Proceed to Line 6.*
6.	Is the required working distance available?			*If **Yes**, proceed to Line 7.* *If **No**, additional risk assessment is required before completing Section D or E or performing any work.* *Proceed to Line 7.*
Section B, Shock Hazard Information *Use Table 130.4(D)(a) for ac system boundaries or Table 130.4(D)(b) for dc system boundaries*				
7.	Voltage between phases: Limited approach boundary: Restricted approach boundary:			*Establish the shock boundaries.* *Proceed to Line 8.*
Section C, Shock Control Information				
Mark "Y" or "N" as appropriate				
8.	Will the task require the worker to cross the restricted approach boundary?			*If **No**, shock protection controls are discretionary.* *Proceed to Section D or E as appropriate.* *If **Yes**, shock protection controls are required.* *Proceed to Line 9.*
9.	Will rubber insulating gloves and leather protectors be used for the task?			*If **Yes**, proceed to Line 10.* *If **No**, proceed to Line 11.*
10.	Minimum glove class required for insulating gloves			*Establish minimum glove class.* *Proceed to Line 11.*
11.	Will insulating blankets be used for the task?			*If **Yes**, proceed to Line 12.* *If **No**, proceed to Line 13.*
12.	Minimum voltage rating for insulating blankets			*Establish minimum voltage rating.* *Proceed to Line 13.*

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	Mark "Y" or "N" as appropriate			
13.	Are insulated or insulating hand tools required for the task?			*If **Yes**, proceed to Line 14.* *If **No**, proceed to Section D or E as applicable.*
14.				*Identify the hand tools, including the minimum voltage rating required.* *Proceed to Section D or E as applicable.*
	Section D, Arc Flash Control Information — Incident Energy Analysis Method *Use information from incident energy study*			
15.	Incident energy: Working distance: Level of PPE: Minimum arc rating of clothing: Arc flash boundary:			***Include:** the arc flash boundary **and** at least one of the following: the incident energy and the working distance **or** the level of PPE **or** the minimum arc-rating of clothing.* *Proceed to Section F.*
	Section E, Arc Flash Hazard Control Information — Arc Flash PPE Category Method *Use Table 130.5(C)(15)(a) for ac systems or Table 130.7(C)(15)(b) for dc systems*			
16.	Determine the estimated available fault current and clearing times for the task.			
	Available short circuit current:		Overcurrent device clearing time:	
	Mark "Y" or "N" as appropriate			
17.	Do the estimated available fault current and clearing times for the task exceed the maximum allowed by Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b)?			*If **Yes**, an incident energy analysis is required.* *If **No**, proceed to Line 18.*
18.	Arc flash boundary:			*Proceed to Line 19.*
19.	Arc flash PPE category: Working distance:			*Proceed to Line 20 and 21, Section F.*
	Section F, Arc-Rated Clothing and Other Arc Flash Protection Equipment Information			
20.	Minimum arc rating in cal/cm^2 for protective clothing and other PPE			*Establish the required arc-rated clothing and other PPE.*
21.				*List the required arc-rated clothing and other arc flash PPE.* ***PPE Category Method:** Use 130.7(C)(15)(c) and Table 130.7(C)(15)(c).* ***Incident Energy Analysis Method:** Use 130.5(G) and Table 130.5(G).*

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Supplemental Information

File Name	Description	Approved
attachment_for_FR_91_New_Figure_I.2.pdf	new table for ballotable detail FR-91-for staff use	
70E_Detail_FR-91_Figure_I.2.docx	For staff use	

Submitter Information Verification

Committee:
Submittal Date: Tue Aug 28 14:24:55 EDT 2018

Committee Statement

Committee Statement: Annex I is modified to add a job safety planning checklist.
Response Message: FR-91-NFPA 70E-2018

Public Input No. 327-NFPA 70E-2018 [New Section after I.1]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
23 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Affirmative with Comment

White, James R.

Section E, Line 16 states "Short circuit current, which should be fault current

Wolf, Jason

The addition of a sample Job Safety Plan will help provide employers an example to follow. However, the sample does not include all elements required by 110.1(I)(3)(e), such as, work procedures, special precautions and energy source controls.

First Revision No. 93-NFPA 70E-2018 [Detail]

Move 130.2 as new 110.3

~~130.2~~110.3 Electrically Safe Work Conditions .
Energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts shall be put into an electrically safe work condition before an employee performs work if any of the following conditions exist:

(1) The employee is within the limited approach boundary.

(2) The employee interacts with equipment where conductors or circuit parts are not exposed but an increased likelihood of injury from an exposure to an arc flash hazard exists.

Submitter Information Verification

Committee:
Submittal Date: Wed Oct 31 17:41:29 EDT 2018

Committee Statement

Committee Statement: Relocating the requirement to create an electrically safe work condition from 130.2 and 130.2(A) to 110.3 is for the following reasons:

Locating the requirement to de-energize in Article 110 prioritizes and emphasizes the requirement: the requirement to de-energize is a requirement of an Electrical Safety Program; the requirement to de-energize should be located before lockout requirements; and Article 130 can be focused on requirements related to work involving an electrical hazard. The voltage threshold of 50-volts is used to be consistent with previous actions taken during the last revision cycle.

Response Message: FR-93-NFPA 70E-2018

Public Input No. 44-NFPA 70E-2018 [New Section after 110.1(F)]

Public Input No. 190-NFPA 70E-2018 [New Section after 110.7]

Public Input No. 45-NFPA 70E-2018 [Sections 130.1, 130.2, 130.3]

Public Input No. 217-NFPA 70E-2018 [Section No. 130.2(A)(3)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: NFPA 70E should recognize the difference in human physiological response to ac vs. dc voltages. The human body is able to tolerate greater levels of dc voltage as opposed to ac voltage. This has been demonstrated by decades of research on the subject. Perhaps NFPA could work with OSHA to obtain such recognition in the OSHA requirements.

Negative with Comment

Mohla, Daleep C.

The electrical safety program (110.5) should be 110.1. All the requirements in 110.1 through 110.4 need to be part of the ESP so those sections should appear after that requirement. Sections 110.8, 110.9, and 110.10 should be moved to Article 130 because they are similar to other portions of that Article such as 130.8, 130.9, 130.10, 130.11, and 130.12. All of the requirements in Chapter 1 are important but Article 110 should be focused on major concepts to be included in an employer's electrical safety program

First Revision No. 8-NFPA 70E-2018 [Definition: Conductor, Covered.]

Conductor, Covered.

A conductor encased within material of composition or thickness that is not recognized by ~~this Code~~ *NFPA 70* , *National Electrical Code* , as electrical insulation. [**70:**100]

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 11:32:00 EDT 2018

Committee Statement

Committee Statement: The definition is necessary to distinguish between a conductor that is covered versus a conductor that is insulated.

Response Message: FR-8-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 7-NFPA 70E-2018 [Definition: Conductor, Insulated.]

Conductor, Insulated.

A conductor encased within material of composition and thickness that is recognized by ~~this~~ ~~*Code*~~ *NFPA 70* , *National Electrical Code* , as electrical insulation. [**70:**100]

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 11:28:41 EDT 2018

Committee Statement

Committee Statement: The definition is necessary to distinguish between a conductor that is covered versus a conductor that is insulated.

Response Message: FR-7-NFPA 70E-2018

Public Input No. 154-NFPA 70E-2018 [Definition: Conductor, Insulated.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 1-NFPA 70E-2018 [Definition: Accessible (as applied to wiring methods).]

~~**Accessible (as applied to wiring methods).**~~

~~Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.~~ [~~**70:** 100~~]

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 09:57:05 EDT 2018

Committee Statement

Committee Statement: The definition is not necessary as the term is not used within the body of NFPA 70E.

Response Message: FR-1-NFPA 70E-2018

Public Input No. 150-NFPA 70E-2018 [Definition: Accessible (as applied to wiring methods).]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 2-NFPA 70E-2018 [Definition: Accessible, Readily (Readily Accessible).]

~~**Accessible, Readily (Readily Accessible).**~~

~~Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. [**70:** 100]~~

~~Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided in *NFPA 70 , National Electrical Code* .~~

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 09:58:55 EDT 2018

Committee Statement

Committee Statement: The definition is not necessary as the term is not used within the body of NFPA 70E.

Response Message: FR-2-NFPA 70E-2018

Public Input No. 151-NFPA 70E-2018 [Definition: Accessible, Readily (Readily Accessible).]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 3-NFPA 70E-2018 [Definition: Arc Flash Hazard.]

Arc Flash Hazard.

A source of possible injury or damage to health associated with the release of energy caused by an electric arc.

Informational Note No. 1: The likelihood of occurrence of an arc flash incident increases when energized electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, provided a person is interacting with the equipment in such a manner that could cause an electric arc. An arc flash incident is not likely to occur under normal operating conditions when enclosed energized equipment has been properly installed and maintained. See 110.4(D) for further information.

Informational Note No. 2: See Table 130.5(C) for examples of tasks that increase the likelihood of an arc flash incident occurring.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 10:09:50 EDT 2018

Committee Statement

Committee Statement: This clarifies the informational note by adding a reference to 130.2(A)(4) for normal operating conditions.

Response Message: FR-3-NFPA 70E-2018

Public Input No. 162-NFPA 70E-2018 [Definition: Arc Flash Hazard.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

Note the reference in the committee statement does not reflect the relocation of this material to 110.4(D). Need to verify correct numbering in first draft report.

Hickman, Palmer L.

Note that the Committee Statement section reference does not match the final section reference in the reorganized standard.

First Revision No. 4-NFPA 70E-2018 [Definition: Arc Rating.]

Arc Rating.

The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (E_{BT}) (should a material system exhibit a breakopen response below the ATPV value). Arc rating is reported as either ATPV or E_{BT}, whichever is the lower value.

Informational Note No. 1: Arc-rated clothing or equipment indicates that it has been tested for exposure to an electric arc. Flame-resistant clothing without an arc rating has not been tested for exposure to an electric arc. All arc-rated clothing is also flame resistant.

~~Informational Note No. 2: *Breakopen* is a material response evidenced by the formation of one or more holes in the innermost layer of arc-rated material that would allow flame to pass through the material.~~

Informational Note No. 2: ATPV is defined in ASTM F1959/F1959M, *Standard Test Method for Determining the Arc Rating of Materials for Clothing*, as the incident energy (cal/cm^2) on a material or a multilayer system of materials that results in a 50 percent probability that sufficient heat transfer through the tested specimen is predicted to cause the onset of a second degree skin burn injury based on the Stoll curve.

Informational Note No. 3: E_{BT} is defined in ASTM F1959/F1959M, *Standard Test Method for Determining the Arc Rating of Materials for Clothing*, as the incident energy (cal/cm^2) on a material or a material system that results in a 50 percent probability of breakopen. Breakopen is ~~defined as a hole with~~ a material response evidenced by the formation of one or more holes of a defined size [an area of 1.6 cm^2 (0.5 in.^{2}) or an opening of 2.5 cm (1.0 in.) in any dimension] in the innermost layer of arc-rated material that would allow thermal energy to pass through the material .

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 10:15:49 EDT 2018

Committee Statement

Committee Statement: This FR clarifies the term “breakopen” by replacing the word “flame” with “thermal energy” to be consistent with the ASTM definition. The informational notes related to breakopen are combined into one new informational note for clarity.

Response Message: FR-4-NFPA 70E-2018

Public Input No. 161-NFPA 70E-2018 [Definition: Arc Rating.]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 5-NFPA 70E-2018 [Definition: Balaclava (Sock Hood).]

Balaclava ~~(Sock Hood)~~ .

An arc-rated ~~hood~~ head-protective fabric that protects the neck and head except for a small portion of the facial area ~~of the eyes and nose~~ .

Informational Note: Some balaclava designs protect the neck and head area except for the eyes while others leave the eyes and nose area unprotected.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 10:42:17 EDT 2018

Committee Statement

Committee Statement: This clarifies the definition of the term balaclava by removing the requirement to leave the nose exposed and eliminating the potentially confusing word “hood” from the definition. The added informational note provides clarity.

Response Message: FR-5-NFPA 70E-2018

Public Input No. 251-NFPA 70E-2018 [Definition: Balaclava (Sock Hood).]

Public Input No. 252-NFPA 70E-2018 [New Definition after Definition: Balaclava (Sock Hood).]

Public Input No. 91-NFPA 70E-2018 [Definition: Balaclava (Sock Hood).]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 6-NFPA 70E-2018 [Definition: Branch Circuit.]

~~**Branch Circuit.**~~

~~The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).~~
[~~**70:** 100~~]

Submitter Information Verification

Committee:
Submittal Date: Mon Aug 13 10:55:46 EDT 2018

Committee Statement

Committee Statement: The definition is not necessary as the term is not used within the body of NFPA 70E.
Response Message: FR-6-NFPA 70E-2018

Public Input No. 152-NFPA 70E-2018 [Definition: Branch Circuit.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Dyson, Thomas B.
Hayes, James B.

Affirmative All
Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 9-NFPA 70E-2018 [Definition: Electrically Safe Work Condition.]

Electrically Safe Work Condition.

A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personnel protection.

Informational Note: An electrically safe work condition is not a procedure, it is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are maintained in a zero-energy state for the purpose of eliminating electrical hazards.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 11:43:23 EDT 2018

Committee Statement

Committee Statement: The added informational note provides clarity to the definition.

Response Message: FR-9-NFPA 70E-2018

Public Input No. 171-NFPA 70E-2018 [Definition: Electrically Safe Work Condition.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
21 Affirmative All
4 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: This informational note and the note added in 110.1 explain that where an Electrically Safe Work Condition is implemented in accordance with 70E, it is a form of elimination. This informational note is necessary due to misapplication of the hierarchy of control. The NEC Correlating Committee should review this issue.

Hickman, Palmer L.

This new informational note is necessary to provide clarity for the user of this document with respect to the implementation of an electrically safe work condition to eliminate hazards. This first revision and the associated public input are intended to address potential misconception that the implementation of an electrically safe work condition as required in NFPA 70E does not eliminate electrical hazards. This possible misconception is evident from the fact that some see the need to introduce safety management system requirements and related concepts into the 70E standard. Incorporating the misconception that an electrically safe work condition does not eliminate electrical hazards could create confusion and potential liability for design engineers and manufacturers, owners, installers, and maintainers of electrical equipment. This lack of clarity has apparently led to the misconception and misapplication of the 70E standard with a belief that a properly implemented electrically safe work condition does not eliminate an electrical hazard. If the NFPA 70E Technical Committee were to buy into this concept, NFPA 70E would no longer be relevant as it would not provide a method to eliminate hazards in electrical distribution and other electrical equipment which is in stark contrast to why and how this standard was created. See the Foreword to NFPA 70E. The NFPA 70E committee "was formed to assist OSHA in preparing an electrical safety standard that would serve OSHA's needs and that could be expeditiously promulgated" into OSHA regulations. The revisions to OSHA 1910 subpart S are an excellent example of how this standard assists OSHA in the promulgation of practical and feasible regulations. In summary, NFPA 70E is not an overall safety program, it is not a safety management system, and it is not a design or an installation standard. Therefore, all references to ANSI Z10 and any other safety management system should be deleted from this standard. This affirmative comment reaffirms the need for this informational note and the clarity it provides. This affirmative comment clearly puts this in the public record for interested parties and the general public so that any and all comments submitted to delete all references to safety management systems in the 2018 edition of NFPA 70E shall not be considered new material.

Mohla, Daleep C.

Even though establishing an electrically safe work condition eliminates the hazard from the electrical and mechanical energy sources directly connected to the equipment and circuit parts, the electrical sources in the vicinity of the equipment being worked on needs to be addressed. The external sources for testing, temporary power (e.g. space heater energization) and diagnostics may also be of a concern .It requires that only qualified persons perform the testing and diagnostic. They should be aware of capacitive and inductive effects of external sources being introduced in electrical equipment such as transformers etc. Each case is unique and qualified person(s) are required to evaluate each case each task even with new equipment on pallets prepared for shipment to determine if additional protective measures required to remove possible external hazards

White, James R.

A much-needed IN considering the problems with Z10 last cycle. This is not Z10.

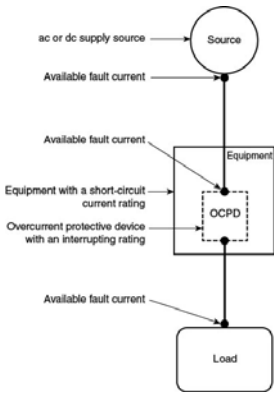
First Revision No. 10-NFPA 70E-2018 [Definition: Fault Current, Available.]

Fault Current, Available.

The largest amount of current capable of being delivered at a point on the system during a short-circuit condition.

Informational Note No. 1: A short circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Figure 100.0.

Figure 100.0 Available Fault Current.



Informational Note No. 2: If the dc supply is a battery system, the term *available fault current* refers to the prospective short-circuit current.

Informational Note No. 3: The available fault current varies at different locations within the system due to the location of sources and system impedances.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 12:06:09 EDT 2018

Committee Statement

Committee Statement: This new informational note clarifies that the available fault current may be different at different locations within an electrical system.

Response Message: FR-10-NFPA 70E-2018

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 11-NFPA 70E-2018 [Definition: Ground Fault.]

Ground Fault.

An unintentional, electrically ~~conducting~~ conductive connection between an ungrounded conductor of an electrical circuit and the normally non–current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth. [**70:** 100]

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 12:11:13 EDT 2018

Committee Statement

Committee Statement: The revision to the definition is made to be consistent with the defined term in Article 100 of the National Electrical Code.

Response Message: FR-11-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 12-NFPA 70E-2018 [Definition: Receptacle.]

Receptacle.

A ~~receptacle is a~~ contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device . A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke. [**70:**100]

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 13:48:08 EDT 2018

Committee Statement

Committee Statement: This first revision correlates the definition with the revised definition in the 2017 National Electrical Code, NFPA 70.

Response Message: FR-12-NFPA 70E-2018

Public Input No. 63-NFPA 70E-2018 [Definition: Receptacle.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 13-NFPA 70E-2018 [Definition: Shock Hazard.]

Shock Hazard.

A source of possible injury or damage to health associated with current through the body caused by contact or approach to exposed energized electrical conductors or circuit parts.

Informational Note: Injury and damage to health resulting from shock is dependent on the magnitude of the electrical current, the power source frequency (e.g., 60 Hz, 50 Hz, dc), and the path and time duration of current through the body. The physiological reaction ranges from perception, muscular contractions, inability to let go, ventricular fibrillation, tissue burns, and death.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 13:52:45 EDT 2018

Committee Statement

Committee Statement: This first revision clarifies and correlates the definition of shock hazard with the Article 100 definition of exposed as applied to energized electrical conductors and circuit parts.

Response Message: FR-13-NFPA 70E-2018

Public Input No. 81-NFPA 70E-2018 [Definition: Shock Hazard.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 14-NFPA 70E-2018 [Definition: Switchgear, Arc-Resistant.]

~~Switchgear~~ Equipment , Arc-Resistant.

Equipment designed to withstand the effects of an internal arcing fault and that directs the internally released energy away from the employee.

Informational Note No. 1: An example of a standard that provides information for arc-resistant equipment is IEEE C37.20.7, *Guide for Testing Switchgear Rated Up to 52 kV for Internal Arcing Faults* .

Informational Note No. 2: See O.2.4 (9) for information on arc-resistant equipment.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 13:59:58 EDT 2018

Committee Statement

Committee Statement: Other arc-resistant products beyond just switchgear are available. Informational Note No. 1 directs the user to the applicable IEEE standard. Informational Note No. 2 directs the user to informative Annex O for additional information.

Response Message: FR-14-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 15-NFPA 70E-2018 [Definition: Voltage, Nominal.]

Voltage, Nominal.

A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). [**70:**100]

Informational Note No. 1: The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

Informational Note No. 2: See ANSI C84.1, *Electric Power Systems and Equipment — Voltage Ratings (60 Hz)*.

Informational Note No. 3: Certain battery units are rated at nominal 48 volts dc but have a charging float voltage up to 58 volts. In dc applications, 60 volts is used to cover the entire range of float voltages.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 14:14:59 EDT 2018

Committee Statement

Committee Statement: New Informational Note No. 3 maintains correlation with NFPA 70, the National Electrical Code.

Response Message: FR-15-NFPA 70E-2018

Public Input No. 94-NFPA 70E-2018 [Definition: Voltage, Nominal.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 16-NFPA 70E-2018 [Section No. 105.4]

110.1 Priority.

Hazard elimination shall be the first priority in the implementation of safety-related work practices.

Informational Note No. 1: Elimination is the risk control method listed first in the hierarchy of risk control identified in 110.5(H) ~~110.5(I)110.1(H)~~ (3) . See Annex F for examples of hazard elimination.

Informational Note No. 2: An electrically safe work condition is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are placed and maintained in a zero-energy state, eliminating electrical hazards. See Article 120 for requirements to establish an electrically safe work condition. See Informative Annex F for information regarding the hierarchy of risk control and hazard elimination.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 14:32:36 EDT 2018

Committee Statement

Committee Statement: A reference to Informative Annex F was added to Informational Note 1. The revision to the reference to the hierarchy of risk control is editorially corrected.

A new informational note clarifies that an electrically safe work condition is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are placed and maintained in a zero-energy state, eliminating electrical hazards.

Response Message: FR-16-NFPA 70E-2018

Public Input No. 236-NFPA 70E-2018 [Section No. 105.4]

Public Input No. 321-NFPA 70E-2018 [Section No. 110.1(H)(3)]

Public Input No. 186-NFPA 70E-2018 [Section No. 105.4]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
22 Affirmative All
2 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Hickman, Palmer L.

This new informational note is necessary to provide clarity for the user of this document with respect to the implementation of an electrically safe work condition to eliminate hazards. This first revision and the associated public input are intended to address potential misconception that the implementation of an electrically safe work condition as required in NFPA 70E does not eliminate electrical hazards. This possible misconception is evident from the fact that some see the need to introduce safety management system requirements and related concepts into the 70E standard. Incorporating the misconception that an electrically safe work condition does not eliminate electrical hazards could create confusion and potential liability for design engineers and manufacturers, owners, installers, and maintainers of electrical equipment. This lack of clarity has apparently led to the misconception and misapplication of the 70E standard with a belief that a properly implemented electrically safe work condition does not eliminate an electrical hazard. If the NFPA 70E Technical Committee were to buy into this concept, NFPA 70E would no longer be relevant as it would not provide a method to eliminate hazards in electrical distribution and other electrical equipment which is in stark contrast to why and how this standard was created. See the Foreword to NFPA 70E. The NFPA 70E committee "was formed to assist OSHA in preparing an electrical safety standard that would serve OSHA's needs and that could be expeditiously promulgated" into OSHA regulations. The revisions to OSHA 1910 subpart S are an excellent example of how this standard assists OSHA in the promulgation of practical and feasible regulations. In summary, NFPA 70E is not an overall safety program, it is not a safety management system, and it is not a design or an installation standard. Therefore, all references to ANSI Z10 and any other safety management system should be deleted from this standard. This affirmative comment reaffirms the need for this informational note and the clarity it provides. This affirmative comment clearly puts this in the public record for interested parties and the general public so that any and all comments submitted to delete all references to safety management systems in the 2018 edition of NFPA 70E shall not be considered new material.

Mohla, Daleep C.

Even though establishing an electrically safe work condition eliminates the hazard from the electrical and mechanical energy sources directly connected to the equipment and circuit parts, the electrical sources in the vicinity of the equipment being worked on needs to be addressed. The external sources for testing, temporary power (e.g. space heater energization) and diagnostics may also be of a concern .It requires that only qualified persons perform the testing and diagnostic. They should be aware of capacitive and inductive effects of external

sources being introduced in electrical equipment such as transformers etc. Each case is unique and qualified person(s) are required to evaluate each case each task even with new equipment on pallets prepared for shipment to determine if additional protective measures required to remove possible external hazards

Negative with Comment

Gallo, Ernest J.

Comments: The first sentence of Informational Note No. 1 is redundant. The reference to 110.5(H)(3) may be included in the main text per the NEC Style Manual, Section 3.1.3. The first sentence of Informational Note No. 2 is redundant as it is a definition that is already contained in Article 100 and may be deleted here. Suggest combining Informational Notes Nos. 1 and 2 into a single note as follows: "Informational Note: See Informative Annex F for information regarding the hierarchy of risk control and examples of hazard elimination."

First Revision No. 30-NFPA 70E-2018 [New Section after 110.1(G)]

(K) Electrically Safe Work Condition Policy.

An electrical safety program shall include an electrically safe work condition policy that complies with 110.3 .

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 10:03:08 EDT 2018

Committee Statement

Committee Statement: The new subsection requires that employers electrically safe work program include a policy on establishing an electrically safe work condition. This correlates with the requirement in Article 120 and provides clarity by ensuring it becomes part of the employer's electrically safe program.

Response Message: FR-30-NFPA 70E-2018

Public Input No. 189-NFPA 70E-2018 [New Section after 110.1(K)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 20-NFPA 70E-2018 [Section No. 110.1(H)(1)]

(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

Informational Note No. 1: The risk assessment procedure could include identifying when a second person could be required and the training and equipment that person should have.

Informational Note No. 2: For more information regarding risk assessment and the hierarchy of risk control, see Informative Annex F.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 15:56:32 EDT 2018

Committee Statement

Committee Statement: Section 110.1(H)(3) Informational Notes No. 3 & 4 are relocated to 110.1(H)(1) as the information that is contained in the notes pertains to 110.1(H)(1).

This requirement is about risk assessment procedure and the process to be used before work is started. There is no need to reference “the employee.”

Response Message: FR-20-NFPA 70E-2018

Public Input No. 141-NFPA 70E-2018 [Section No. 110.1(H)(1)]

Public Input No. 213-NFPA 70E-2018 [Section No. 110.1(H)(1)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Negative with Comment

Gallo, Ernest J.

Comments: Delete Informational Note No. 1 and incorporate the text into the requirement per the NEC Style Manual, Section 3.1.3, "If an Informational Note is needed to explain the text of the Code, consideration should be given to rewriting the text of the Code to make the rule clear." Renumber Informational Note No. 2 as Informational Note No. 1.

First Revision No. 22-NFPA 70E-2018 [Section No. 110.1(H)(2)]

(2) Human Error.

The risk assessment procedure shall address the potential for human error and its negative consequences on people, processes, the work environment, and equipment relative to the electrical hazards in the workplace .

Informational Note: The potential for human error varies with factors such as tasks and the work environment. See Informative Annex Q.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 16:49:36 EDT 2018

Committee Statement

Committee Statement: The risk assessment procedure is relative to the electrical hazards in the workplace and is consistent with the Section 90.2 Scope. The reference to consequences on processes, the work environment, and equipment is kept as they all relate to worker safety. This language is consistent with language in Annex Q.1

Response Message: FR-22-NFPA 70E-2018

Public Input No. 312-NFPA 70E-2018 [Section No. 110.1(H)(2)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 21-NFPA 70E-2018 [Section No. 110.1(H)(3)]

(3) Hierarchy of Risk Control Methods.

The risk assessment procedure shall require that preventive and protective risk control methods be implemented in accordance with the following hierarchy:

(1) Elimination

(2) Substitution

(3) Engineering controls

(4) Awareness

(5) Administrative controls

(6) PPE

Informational Note No. 1: Elimination, substitution, and engineering controls are the most effective methods to reduce risk as they are usually applied at the source of possible injury or damage to health and they are less likely to be affected by human error. Awareness, administrative controls, and PPE are the least effective methods to reduce risk as they are not applied at the source and they are more likely to be affected by human error.

Informational Note No. 2: See Informative Annex F and ANSI/AIHA Z10, *American National Standard for Occupational Health and Safety Management Systems*, for more information regarding the hierarchy of risk control methods and examples of those methods .

~~Informational Note No. 3: The risk assessment procedure could include identifying when a second person could be required and the training and equipment that person should have.~~

~~Informational Note No. 4: For an example of a risk assessment procedure, see Informative Annex F.~~

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 16:41:18 EDT 2018

Committee Statement

Committee Statement: Section 110.1(H)(3) Informational Notes No. 3 & 4 are relocated to 110.1(H)(1) as the information that is contained in the notes pertains to 110.1(H)(1).

Response Message: FR-21-NFPA 70E-2018

Public Input No. 140-NFPA 70E-2018 [Section No. 110.1(H)(3)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters

2 Not Returned

25 Affirmative All

0 Affirmative with Comments

0 Negative with Comments

0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 23-NFPA 70E-2018 [Section No. 110.1(I)(1)]

(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

Informational Note: For an example of a job safety planning checklist see Figure I.2 .

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 17:02:52 EDT 2018

Committee Statement

Committee Statement: An informational note was added to align with new Figure I.2 in Informative Annex I.

Response Message: FR-23-NFPA 70E-2018

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 79-NFPA 70E-2018 [Section No. 110.1(I)(3)]

(3) Change in Scope.

Additional job safety planning and job briefings shall be held if changes occur during the course of the work that might affect the safety of employees.

Informational Note: For an example of a job briefing form ~~and planning~~ checklist, see ~~Informative Annex I,~~ Figure I.1.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:04:13 EDT 2018

Committee Statement

Committee Statement: The word "planning" is deleted to correlate with changes in Informative Annex I.

Response Message: FR-79-NFPA 70E-2018

Public Input No. 333-NFPA 70E-2018 [Section No. 110.1(I)(3)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

A "job briefing form checklist" is redundant. The modified phrase should be "job briefing checklist" to match the Annex.

First Revision No. 24-NFPA 70E-2018 [New Section after 110.1(J)]

(L) Lockout/Tagout Program.

The electrical safety program shall include the information required by 120.1(A) .

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 17:15:09 EDT 2018

Committee Statement

Committee Statement: Inclusion of this new first level subdivision clarifies that the lockout/tagout program must be part of the electrical safety program.

Response Message: FR-24-NFPA 70E-2018

Public Input No. 187-NFPA 70E-2018 [New Section after 110.1(K)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

The committee may have oversimplified the original public input. Suggest the following to remove the awkwardness of the proposed language. "An electrical safety program shall include a written lockout/tagout program as required in 120.1(A)."

First Revision No. 25-NFPA 70E-2018 [Section No. 110.2(A)(1)]

(1) Qualified Person.

A qualified person shall be trained and knowledgeable in the construction and operation of equipment or a specific work method and be trained to identify and avoid the electrical hazards that might be present with respect to that equipment or work method.

(a) Such persons shall also be familiar with the proper use of the special precautionary techniques, applicable electrical policies and procedures, PPE, insulating and shielding materials, and insulated tools and test equipment.

(b) A person can be considered qualified with respect to certain equipment and tasks but still be unqualified for others.

(c) Such persons permitted to work within the limited approach boundary shall, at a minimum, be additionally trained in all of the following:

(1) Skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment

(2) Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts

(3) Approach distances specified in ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) and ~~Table 130.4(D)(b)~~ Table 130.4(E)(b) and the corresponding voltages to which the qualified person will be exposed

(4) Decision-making process necessary to be able to do the following:

a. Perform the job safety planning

b. Identify electrical hazards

c. Assess the associated risk

d. Select the appropriate risk control methods from the hierarchy of controls identified in 110.5(G), including ~~personal protective equipment~~ PPE

(d) An employee who is undergoing on-the-job training for the purpose of obtaining the skills and knowledge necessary to be considered a qualified person, and who in the course of such training demonstrates an ability to perform specific duties safely at his or her level of training, and who is under the direct supervision of a qualified person shall be considered to be a qualified person for the performance of those specific duties.

(e) Employees shall be trained to select an appropriate test instrument and shall demonstrate how to use a device to verify the absence of voltage, including interpreting indications provided by the device. The training shall include information that enables the employee to understand all limitations of each test instrument that might be used.

~~(e) The employer shall determine through regular supervision or through inspections conducted on at least an annual basis that each employee is complying with the safety-related work practices required by this standard.~~

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 17:36:42 EDT 2018

Committee Statement

Committee Statement: Item (d) - Correct reference from 110.1(G) to 110.1(H)(3) which addresses the hierarchy or risk control methods.

Item (f) - The requirement to verify that employees are complying with safety related work practices is identified in 110.1(K)(2).

Response Message: FR-25-NFPA 70E-2018

Public Input No. 296-NFPA 70E-2018 [Section No. 110.2(A)(1)]

Public Input No. 54-NFPA 70E-2018 [Section No. 110.2(A)(1)]

Public Input No. 165-NFPA 70E-2018 [Section No. 110.2(A)(1)]

Public Input No. 238-NFPA 70E-2018 [Section No. 110.2(A)(1)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Mohla, Daleep C.

The committee statement for the deletion of 110.6(A)(1)(f) is: “Item (f) - The requirement to verify that employees are complying with safety related work practices is identified in 110.1(K)(2).” There is no rule numbered 110.1(K), and I could not find the deleted text anywhere in Article 110

First Revision No. 26-NFPA 70E-2018 [Section No. 110.2(A)(3)]

(3) Additional Training and Retraining.

~~Retraining~~ Additional training and retraining in safety-related work practices and applicable changes in this standard shall be performed at intervals not to exceed 3 years. An employee shall receive additional training ~~(~~ or retraining~~)~~ if any of the following conditions exists:

(1) The supervision or annual inspections indicate the employee is not complying with the safety-related work practices.

(2) New technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices different from those that the employee would normally use.

(3) The employee needs to review tasks that are performed less often than once per year.

(4) The employee needs to review safety-related work practices not normally used by the employee during regular job duties.

(5) The employee's job duties change.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 17:48:09 EDT 2018

Committee Statement

Committee Statement: Adding "additional training" to the title correlates the section title with the content of the requirement since the section addresses both. The parenthesis is removed from "or retraining" as additional training and retraining are different and both are mentioned in the requirement.

Response Message: FR-26-NFPA 70E-2018

Public Input No. 174-NFPA 70E-2018 [Section No. 110.2(A)(3)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 27-NFPA 70E-2018 [Section No. 110.2(A)(4)]

(4) Type of Training.

The training required by 110.6(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.

Informational Note: Classroom training can include interactive electronic or interactive web-based training components.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 18:22:22 EDT 2018

Committee Statement

Committee Statement: The new informational note recognizes that electronic training is widely used.

Response Message: FR-27-NFPA 70E-2018

Public Input No. 307-NFPA 70E-2018 [New Section after 110.2(A)(4)]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
23 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Harris, William R.

Hickman, Palmer L.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Hilbert, Mark R.

I support the addition of the informational note and agree that classroom training is often accomplished though interactive electronic or web-based applications. However, the Committee statement should note that it may not be appropriate in all cases. There are times when face to face communication with a knowledgeable instructor is required in the classroom.

Negative with Comment

Gray, Bobby J.

There are applications where self-paced training is appropriate such as retraining or optional training. But, specific training elements intended to qualify a person to perform hazardous electrical tasks, must be completed under the direction of a knowledgeable instructor that can respond to questions and evaluate whether key concepts are understood.

First Revision No. 31-NFPA 70E-2018 [Section No. 110.2(B)(1)]

(1) Initial Training.

Employees involved in ~~or affected by~~ the lockout/tagout procedures required by 120.2(B) shall be trained in the following:

(1) The lockout/tagout procedures

(2) Their responsibility in the execution of the procedures

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 10:47:33 EDT 2018

Committee Statement

Committee Statement: The 120.2 reference is editorially corrected to 120.2(C).

The phrase “or affected by” is deleted. While all employees must understand the purpose of a lockout, the requirement to train employees that are involved in the lockout is consistent with the requirement in 120.2(B) Employee Involvement: “Each person who could be exposed directly or indirectly to a source of electrical energy shall be involved in the lockout/tagout process.”

Response Message: FR-31-NFPA 70E-2018

Public Input No. 239-NFPA 70E-2018 [Section No. 110.2(B)(1)]

Public Input No. 305-NFPA 70E-2018 [Section No. 110.2(B)(1)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 32-NFPA 70E-2018 [Section No. 110.3(C)]

(C) Documentation.

Where the host employer has knowledge of hazards covered by this standard that are related to the contract employer's work, there shall be a documented meeting between the host employer and the contract employer.

Informational Note: On multi-employer work sites (in all industry sectors), more than one employer can be responsible for identifying hazardous conditions and creating safe work practices.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 11:49:24 EDT 2018

Committee Statement

Committee Statement: The new informational note provides information that more than one employer can be responsible for identifying hazardous conditions and creating safe work practices.

Response Message: FR-32-NFPA 70E-2018

Public Input No. 11-NFPA 70E-2018 [Section No. 110.3]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 33-NFPA 70E-2018 [Section No. 110.4(A)]

(A) Testing.

Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring on electrical equipment ~~operating at voltages equal to or greater than 50 volts~~ where an electrical hazard exists .

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 12:03:55 EDT 2018

Committee Statement

Committee Statement: The requirement was revised to apply to all electrical hazards, as testing and troubleshooting that involves any electrical hazard, not just a shock hazard, should be performed by a qualified person.

Response Message: FR-33-NFPA 70E-2018

Public Input No. 175-NFPA 70E-2018 [Section No. 110.4(A)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Wolf, Jason

Affirmative with Comment

White, James R.

Using "where electrical hazards exists" emphasizes that shock may not be the only hazard.

Negative with Comment

Gray, Bobby J.

The proposed requirement is too broad and unnecessary. Taking voltage readings at locations where electrical hazards exist already requires a qualified person. This additional language now would prevent a worker from doing non-contact evaluations such as thermographic or ultrasonic readings unless they have had all the training required by 110.2(A)(1), including demonstrated skills with a test instrument. Working inside the arc flash boundary should not be limited to qualified persons.

First Revision No. 34-NFPA 70E-2018 [Section No. 110.5(C)]

(C) Visual Inspection and Repair of Portable Cord- and Plug-Connected Equipment and Flexible Cord Sets.

(a) *Frequency of Inspection.* Before each use, portable cord- and plug-connected equipment shall be visually inspected for external defects (such as loose parts or deformed and missing pins) and for evidence of possible internal damage (such as a pinched or crushed outer jacket).

Exception: Stationary cord- and plug-connected equipment ~~and flexible cord sets (extension cords)~~ that remain connected once they are put in place and are installed such that the cord and plug are not subject to physical damage during normal use shall not be required to be visually inspected until they are relocated or repaired.

(b) *Defective Equipment.* If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service. No employee shall use it until a person(s) qualified to perform the repairs and tests necessary to render the equipment safe has done so.

(c) *Proper Mating.* When an attachment plug is to be connected to a receptacle, the relationship of the plug and receptacle contacts shall first be checked to ensure that they are of mating configurations.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 12:18:00 EDT 2018

Committee Statement

Committee Statement: The exception to 110.5(C) is revised to apply only to cord and plug connected equipment that remains at a designated location and that can be controlled to ensure no damage occurs to the power cord. Extension cord sets are intended for temporary use and not permitted to substitute for permanent wiring methods as mandated by Article 400 of the NEC.

Response Message: FR-34-NFPA 70E-2018

Public Input No. 64-NFPA 70E-2018 [Section No. 110.5(C)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 35-NFPA 70E-2018 [Section No. 110.5(D)]

(D) Conductive or Wet Work Locations.

Portable cord- and-plug-connected electric equipment used in ~~highly~~ conductive or wet work locations ~~(such as those inundated with water or other conductive liquids)~~ shall be approved for use in those locations. In ~~job~~ work locations where employees are likely to contact or be drenched with water or conductive liquids, ground-fault circuit-interrupter protection for personnel shall ~~also~~ be used.

Informational Note: The risk assessment procedure can also include identifying when the use of portable tools and equipment powered by sources other than 120 volts ac, such as batteries, air, and hydraulics, should be used to minimize the potential for injury from electrical hazards for tasks performed in conductive or wet locations.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 12:22:30 EDT 2018

Committee Statement

Committee Statement: Section 110.5(D) is revised to clarify that the requirement for GFCI protection also applies to wet locations. Other editorial revisions are made for consistency.

Response Message: FR-35-NFPA 70E-2018

Public Input No. 176-NFPA 70E-2018 [Section No. 110.5(D)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 36-NFPA 70E-2018 [Section No. 110.5 [Excluding any Sub-Sections]]

This section applies to the use of cord- and plug-connected equipment, including cord- and plug-connected test instruments and cord sets (extension cords).

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 12:26:54 EDT 2018

Committee Statement

Committee Statement: Section 110.5 is edited to include cord and plug connected test equipment as they can present the same shock hazard when used in wet or damp locations, therefore, the same level of personnel GFCI protection should be extended to this equipment.

Response Message: FR-36-NFPA 70E-2018

Public Input No. 19-NFPA 70E-2018 [Section No. 110.5 [Excluding any Sub-Sections]]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Hickman, Palmer L.

The intent of this sentence may be unclear due to where "cord- and plug-connected test instruments" was added to the existing sentence. A clearer sentence structure may be as follows: ...including cord sets (extension cords) and cord- and plug-connected test instruments.

First Revision No. 37-NFPA 70E-2018 [New Section after 110.7]

110.12 Equipment Use.

Equipment shall be used in accordance with the manufacturer's instructions.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 13:44:33 EDT 2018

Committee Statement

Committee Statement: All equipment needs to be used in accordance with instructions provided by the manufacturers. Presently NFPA 70E requires instructions to be followed only for some specific applications. Installation requirements were not included because they are within the NEC scope. The term "equipment" is used as it is defined in Article 100.

Response Message: FR-37-NFPA 70E-2018

Public Input No. 349-NFPA 70E-2018 [New Section after 110.7]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
22 Affirmative All
1 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Harris, William R.

Hickman, Palmer L.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Mohla, Daleep C.

110.12 Equipment Use. Adding this general requirement is important. Delete other sections or portions of sections that duplicate this requirement.

Negative with Comment

Gray, Bobby J.

The TC has done a good job of purging philosophical, unenforceable requirements from the Standard. This would be a step backwards and place an unreasonable burden on the enforcing authority. What is the criteria for compliance? Will all equipment users be required to provide the instructions? Will the enforcing authority be expected to interpret and enforce all equipment instructions? Although a worthy goal, this expectation should be managed by the local procedures not a universal standard that must be able to be enforced by a governmental body through a legal process.

Hilbert, Mark R.

As noted in the substantiation for the proposed change, NFPA 70E already includes requirements for using equipment in accordance with the manufacturer's instructions for specific applications. These specific applications are directly related electrical safety such as when determining if a normal operating condition exists. Expanding the requirement beyond applications directly related to electrically safe work practices is outside the scope of NFPA 70E. Having such a broad requirement will also create significant challenges for those having to enforce the Standard (e.g. installation instructions are not always available, determining if the instructions are part of the equipment's listing, will those enforcing the requirements have to observe operation of all electrical equipment).

First Revision No. 38-NFPA 70E-2018 [Section No. 120.1(B)]

(B) Employer Responsibilities.

The employer shall be responsible for the following:

(1) Providing the equipment necessary to execute lockout/tagout procedures

(2) Providing lockout/tagout training to workers in accordance with 110.6(B)

(3) Auditing the lockout/tagout program in accordance with ~~110.5~~ 110.5(M)(3)

(4) Auditing execution of the lockout/tagout procedures in accordance with ~~110.5~~ 110.5(M)(3)

Informational Note: For an example of a lockout/tagout program, see Informative Annex G.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 14:24:09 EDT 2018

Committee Statement

Committee Statement: Editorial corrections to section references.

Response Message: FR-38-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 17-NFPA 70E-2018 [Section No. 120.2(A)]

110.2 General.

Electrical conductors and circuit parts shall not be considered to be in an electrically safe work condition until all of the requirements of Article 120 have been met.

Safe work practices applicable to the circuit voltage and energy level shall be used in accordance with Article 110 and Article 130 until such time that electrical conductors and circuit parts are in an electrically safe work condition.

Electrical conductors and circuit parts shall not be considered to be in an electrically safe work condition until all of the requirements of Article 120 have been met.

Informational Note: See 120.5 for the steps to establish and verify an electrically safe work condition.

Submitter Information Verification

Committee:

Submittal Date: Mon Aug 13 14:43:09 EDT 2018

Committee Statement

Committee Statement: The requirements found in 120.2 Lockout/Tagout Principles (A) General are relocated to Article 110 as these requirements are general in nature and are more appropriate for this section of the document. The relocated text is placed at 110.2 so as create a logical progression of requirements.

A title is added to address safe work practices and establishment of an electrically safe work condition.

Response Message: FR-17-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gray, Bobby J.

I agree with addressing the ESWC in Article 110 since that was the intent of the 1993 TC, when it originally introduced the concept into the Standard. I object to requiring all requirements in Article 120 to be met before a work location can be considered into an electrically safe work condition. Much of Article 120 applies when service and maintenance is being performed. An ESWC can be established to eliminate the arc flash hazard for a work location even if no service or maintenance is being performed on equipment.

Negative with Comment

Gallo, Ernest J.

Comments: The added text is redundant and should be removed.

First Revision No. 39-NFPA 70E-2018 [Section No. 120.3(C)]

(C) Lockout Device.

The lockout device shall meet the following requirements:

(1) A lockout device shall include a lock — either keyed or combination.

(2) The lockout device shall include a method of identifying the individual who installed the lockout device.

(3) A lockout device shall be permitted to be only a lock, if the lock is readily identifiable as a lockout device, in addition to having a means of identifying the person who installed the lock, provided that all of the following conditions exist:

(a) Only one circuit or piece of equipment is de-energized.

(b) The lockout period does not extend beyond the work shift.

(c) Employees exposed to the hazards associated with re-energizing the circuit or equipment are familiar with this procedure.

(4) Lockout devices shall be attached to prevent operation of the disconnecting means without resorting to undue force or the use of tools.

(5) Where a tag is used in conjunction with a lockout device, the tag shall contain a statement prohibiting unauthorized operation of the disconnecting means or unauthorized removal of the device.

(6) Lockout devices shall be suitable for the environment and for the duration of the lockout.

(7) Whether keyed or combination locks are used, the key or combination shall remain in the possession of the individual installing the lock or the person in charge, when provided by the established procedure.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 14:34:50 EDT 2018

Committee Statement

Committee Statement: This change brings this section in alignment with OSHA 1910.333(b)(2)(iii)(E).

Response Message: FR-39-NFPA 70E-2018

Public Input No. 227-NFPA 70E-2018 [Section No. 120.3(C)]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 40-NFPA 70E-2018 [Section No. 120.5]

120.5 Process for Establishing and Verifying an Electrically Safe Work Condition.

Establishing and verifying an electrically safe work condition shall include all of the following steps, which shall be performed in the order presented, if feasible:

(1) Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.

(2) After properly interrupting the load current, open the disconnecting device(s) for each source.

(3) Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the test or fully disconnected position.

(4) Release stored electrical energy.

(5) Release or block stored mechanical energy. Block or relieve stored non-electrical energy in devices that could re-energize electric circuit parts to the extent that the circuit parts could not be accidentally energized by the device.

(6) Apply lockout/tagout devices in accordance with a documented and established procedure.

(7) Use an adequately rated portable test instrument to test each phase conductor or circuit part to verify it is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the test instrument is operating satisfactorily through verification on any known voltage source.

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.

Exception No. 2: On electrical systems over 1000 volts, noncontact test instruments shall be permitted to be used to test each phase conductor.

Informational Note No. 1: See UL 61010-1, *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements*, for rating, overvoltage category, and design requirements for voltage measurement and test instruments intended for use on electrical systems 1000 volts and below.

Informational No. 2: For additional information on rating and design requirements for absence of voltage testers, refer to UL 1436, *Outlet Circuit Testers and Other Similar Indicating Devices* .

Informational Note No. 3: For additional information on rating and design requirements for voltage detectors, refer to IEC 61243-1, *Live Working — Voltage Detectors — Part 1: Capacitive type to be used for voltages exceeding 1kV a.c.*, or IEC 61243-2, *Live Working — Voltage Detectors — Part 2: Resistive type to be used for voltages of 1kV to 36 kV a.c.*, or IEC 61243-3, *Live Working — Voltage Detectors — Part 3: Two-pole low voltage type*.

(8) Where the possibility of induced voltages or stored electrical energy exists, ground ~~the phase~~ all circuit conductors ~~or~~ and circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply temporary protective grounding equipment in accordance with the following:

a. *Placement.* Temporary protective grounding equipment shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to a shock hazard (i.e., hazardous differences in electrical potential). The location, sizing, and application of temporary protective grounding equipment shall be identified as part of the employer's job planning.

b. *Capacity.* Temporary protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault.

Informational Note: ASTM F855, *Standard Specification for Temporary Protective Grounds to be Used on De-energized Electric Power Lines and Equipment*, is an example of a standard that contains information on capacity of temporary protective grounding equipment.

c. *Impedance.* Temporary protective grounding equipment and connections shall have an impedance low enough to cause immediate operation of protective devices in case of unintentional energizing of the electric conductors or circuit parts.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 14 16:21:42 EDT 2018

Committee Statement

Committee Statement: Item (3) – Modified to permit racking to the test position to enable the enclosure doors to be shut for disconnection and isolation.

Item (5) – Revised to correlate the requirements of this section with OSHA 1910.333(b)(2).

Item (7) - Added informational note reference to the applicable product standard identified in the requirements of Exception No. 1 to Item (7).

Item (8) - Modified the existing text to require grounding of all circuit conductors and circuit parts before touching them where the possibility of induced voltages or stored electrical energy exists.

Response Message: FR-40-NFPA 70E-2018

Public Input No. 350-NFPA 70E-2018 [Section No. 120.5]

Public Input No. 310-NFPA 70E-2018 [Section No. 120.5]

Public Input No. 193-NFPA 70E-2018 [Section No. 120.5]

Public Input No. 318-NFPA 70E-2018 [Section No. 120.5]

Public Input No. 285-NFPA 70E-2018 [Section No. 120.5]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

The changes to 120.5(5) appeared to have resulted in redundant text. Did the committee intend to replace the first sentence with the second? Suggested deleting the first sentence "Release or block stored mechanical energy."

First Revision No. 41-NFPA 70E-2018 [Section No. 130.1]

130.1 General.

Article 130 covers requirements for work involving electrical hazards such as the electrical safety-related work practices, assessments, precautions, and procedures when an electrically safe work condition cannot be established~~the following:~~ .

(0) ~~When an electrically safe work condition must be established~~

(0) ~~Requirements for work involving electrical hazards such as the electrical safety-related work practices, assessments, precautions, and procedures when an electrically safe work condition cannot be established~~

Safety-related work practices shall be used to safeguard employees from injury while they are exposed to electrical hazards from electrical conductors or circuit parts that are or can become energized.

When energized electrical conductors and circuit parts operating at voltages equal to or greater than 50 volts are not put into an electrically safe work condition, and work is performed as permitted in accordance with 110.6 , all of the following requirements shall apply:

(1) Only qualified persons shall be permitted to work on electrical conductors or circuit parts that have not been put into an electrically safe work condition.

(2) An energized electrical work permit shall be completed as required by 110.3 .

(3) A shock risk assessment shall be performed as required by 130.4 .

(4) An arc flash risk assessment shall be performed as required by 130.5 .

All requirements of ~~this article~~ Article 130 shall apply whether an incident energy analysis is completed or if Table 130.7(C)(15)(a), Table 130.7(C)(15)(b), and Table 130.7(C)(15)(c) are used in lieu of an incident energy analysis.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 11:53:57 EDT 2018

Committee Statement

Committee Statement: Sections 130.1-130.3 are rewritten to accommodate the relocation of information from the present 130.2(A) to 110.3. This revision provides additional clarity and usability by grouping together into Article 110 the requirements for de-energizing.

Relocated the concepts from the present 130.3 into a re-worded introduction in 130.1, General.

Response Message: FR-41-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: NFPA 70E should recognize the difference in human physiological response to ac vs. dc voltages. The human body is able to tolerate greater levels of dc voltage as opposed to ac voltage. This has been demonstrated by decades of research on the subject. Perhaps NFPA could work with OSHA to obtain such recognition in the OSHA requirements.

Mohla, Daleep C.

Article 130 covers requirements for work involving electrical hazards such as the electrical safety-related work practices, assessments, precautions, and procedures when an electrically safe work condition cannot be established the following: Add the following to the end of the sentence in 130.1 as revised in the first draft. "and during the process of establishing an electrically safe work condition". The requirements in Article 130 also apply while an electrically safe work condition is being established until that state is achieved.

First Revision No. 42-NFPA 70E-2018 [Section No. 130.2(B)(2)]

(B) Elements of Work Permit.

The work permit shall include, but not be limited to, the following items:

(1) Description of the circuit and equipment to be worked on and their location

(2) Description of the work to be performed

(3) Justification for why the work must be performed in an energized condition *[see 110.4]*

(4) Description of the safe work practices to be employed *(see 130.1 ~~130.3~~)*

(5) Results of the shock risk assessment *[see 130.4(A)]*

a. Voltage to which personnel will be exposed

b. Limited approach boundary *[see ~~130.4(E)~~ 130.4(F) , ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) , and ~~Table 130.4(D)(b)~~ Table 130.4(E)(b)]*

c. Restricted approach boundary *[see ~~130.4(F)~~ 130.4(G) , ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) , and ~~Table 130.4(D)(b)~~ Table 130.4(E)(b)]*

d. Personal and other protective equipment required by this standard to safely perform the assigned task and to protect against the shock hazard *[see ~~130.4(E)~~ 130.4(F) , 130.7(C)(1) through (C)(16), and 130.7(D)]*

(6) Results of the arc flash risk assessment *[see 130.5]*

a. Available incident energy at the working distance or arc flash PPE category *(see 130.5)*

b. Personal and other protective equipment required by this standard to protect against the arc flash hazard *[see 130.5(F), 130.7(C)(1) through (C)(16), Table 130.7(C)(15)(c), and 130.7(D)]*

c. Arc flash boundary *[see 130.5(E)]*

(7) Means employed to restrict the access of unqualified persons from the work area *[see ~~130.3~~ 130.7(E)]*

(8) Evidence of completion of a job briefing, including a discussion of any job-specific hazards *[see 110.5(I) ~~110.1(I)~~]*

(9) Energized work approval (authorizing or responsible management, safety officer, or owner, etc.) signature(s)

Informational Note: For an example of an acceptable energized work permit, see Figure J.1.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 11:59:44 EDT 2018

Committee Statement

Committee Statement: Editorially correct the reference in 130.2(B)(7) from 130.3 to 130.7(E).

Response Message: FR-42-NFPA 70E-2018

Public Input No. 71-NFPA 70E-2018 [Section No. 130.2(B)(2)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters

2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 43-NFPA 70E-2018 [Section No. 130.3]

~~**130.3** Working While Exposed to Electrical Hazards.~~

~~Safety-related work practices shall be used to safeguard employees from injury while they are exposed to electrical hazards from electrical conductors or circuit parts that are or can become energized. The specific safety-related work practices shall be consistent with the electrical hazards and the associated risk. Appropriate safety-related work practices shall be determined before any person is exposed to the electrical hazards involved by using both shock risk assessment and arc flash risk assessment. Only qualified persons shall be permitted to work on electrical conductors or circuit parts that have not been put into an electrically safe work condition.~~

Submitter Information Verification

Committee:
Submittal Date: Wed Aug 15 12:08:51 EDT 2018

Committee Statement

Committee Statement: This requirement is editorial relocated to 130.1. See FR-41.
Response Message: FR-43-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Dyson, Thomas B.
Hayes, James B.

Affirmative All
Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.

Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 44-NFPA 70E-2018 [Section No. 130.4]

130.4 Shock Risk Assessment.

(A) General.

A shock risk assessment shall be performed:

(1) To identify shock hazards

(2) To estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health

(3) To determine if additional protective measures are required, including the use of PPE

(B) Estimate of Likelihood and Severity.

The estimate of likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health shall take into consideration all of the following:

(1) The design of the electrical equipment

(2) The electrical equipment operating condition and the condition of maintenance

(C) Additional Protective Measures.

If additional protective measures are required, they shall be selected and implemented according to the hierarchy of risk control identified in 110.5(H) ~~110.1(H)~~ (3) . When the additional protective measures include the use of PPE, the following shall be determined:

(1) The voltage to which personnel will be exposed

(2) The boundary requirements

(3) The personal and other protective equipment required by this standard to protect against the shock hazard

(D) Documentation.

The results of the shock risk assessment shall be documented.

(E) Shock Protection Boundaries.

The shock protection boundaries identified as limited approach boundary and restricted approach boundary shall be applicable where personnel are approaching exposed energized electrical conductors or circuit parts. ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) shall be used for the distances associated with various ac system voltages. ~~Table 130.4(D)(b)~~ Table 130.4(E)(b) shall be used for the distances associated with various dc system voltages.

Informational Note: In certain instances, the arc flash boundary might be a greater distance from the energized electrical conductors or circuit parts than the limited approach boundary. The shock protection boundaries and the arc flash boundary are independent of each other.

Table 130.4(E)(a) Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Alternating-Current Systems

(1)	(2)	(3)	(4)
	Limited Approach Boundary[b]		
Nominal System Voltage Range, Phase to Phase[a]	Exposed Movable Conductor[c]	Exposed Fixed Circuit Part	Restricted Approach Boundary[b]; Includes Inadvertent Movement Adder
Less than 50 V	Not specified	Not specified	Not specified
50 V–150 V[d]	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
151 V–750 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
751 V–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–36 kV	3.0 m (10 ft 0 in.)	1.8 m (6 ft 0 in.)	0.8 m (2 ft 9 in.)
36.1 kV–46 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
46.1 kV–72.5 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
72.6 kV–121 kV	3.3 m (10 ft 8 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
138 kV–145 kV	3.4 m (11 ft 0 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
161 kV–169 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.3 m (4 ft 3 in.)
230 kV–242 kV	4.0 m (13 ft 0 in.)	4.0 m (13 ft 0 in.)	1.7 m (5 ft 8 in.)
345 kV–362 kV	4.7 m (15 ft 4 in.)	4.7 m (15 ft 4 in.)	2.8 m (9 ft 2 in.)
500 kV–550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	3.6 m (11 ft 8 in.)
765 kV–800 kV	7.2 m (23 ft 9 in.)	7.2 m (23 ft 9 in.)	4.9 m (15 ft 11 in.)

Notes:

(1) For arc flash boundary, see 130.5~~(A)~~ (E) .

(2) All dimensions are distance from exposed energized electrical conductors or circuit part to employee.

[a]For single-phase systems above 250 volts, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.

[b]See definition in Article 100 and text in 130.4(D)(2) and Informative Annex C for elaboration.

[c]*Exposed movable conductors* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

[d]This includes circuits where the exposure does not exceed 120 volts nominal.

Table 130.4(E)(b) Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Direct-Current Voltage Systems

(1)	(2)	(3)	(4)
	Limited Approach Boundary		
Nominal Potential Difference	Exposed Movable Conductor*	Exposed Fixed Circuit Part	Restricted Approach Boundary; Includes Inadvertent Movement Adder

(1)	(2)	(3)	(4)
Nominal Potential Difference	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder
	Exposed Movable Conductor*	Exposed Fixed Circuit Part	
Less than 50 V	Not specified	Not specified	Not specified
50 V–300 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
301 V–1 kV	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
1.1 kV–5 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.5 m (1 ft 5 in.)
5 kV–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–45 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
45.1 kV– 75 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
75.1 kV–150 kV	3.3 m (10 ft 8 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
150.1 kV–250 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.6 m (5 ft 3 in.)
250.1 kV–500 kV	6.0 m (20 ft 0 in.)	6.0 m (20 ft 0 in.)	3.5 m (11 ft 6 in.)
500.1 kV–800 kV	8.0 m (26 ft 0 in.)	8.0 m (26 ft 0 in.)	5.0 m (16 ft 5 in.)

Note: All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.

**Exposed movable conductor* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

(F) Limited Approach Boundary.

(1) Approach by Unqualified Persons.

Unless permitted by ~~130.4(E)(3)~~ 130.4(F)(3) , no unqualified person shall be permitted to approach nearer than the limited approach boundary of energized conductors and circuit parts.

(2) Working at or Close to the Limited Approach Boundary.

Where one or more unqualified persons are working at or close to the limited approach boundary, the ~~designated person in charge of the work space where the electrical hazard exists shall~~ alerting methods in 130.7(E) shall be applied to advise the unqualified person(s) of the electrical hazard and warn him or her to stay outside of the limited approach boundary.

(3) Entering the Limited Approach Boundary.

Where there is a need for an unqualified person(s) to cross the limited approach boundary, a qualified person shall advise the unqualified person(s) of the possible hazards and continuously escort the unqualified person(s) while inside the limited approach boundary. The qualified person escorting the unqualified person(s) shall have no unrelated duties. Under no circumstance shall unqualified person(s) be permitted to cross the restricted approach boundary.

(G) Restricted Approach Boundary.

No qualified person shall approach or take any conductive object closer to exposed energized electrical conductors or circuit parts than the restricted approach boundary set forth in ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) and ~~Table 130.4(D)(b)~~ Table 130.4(E)(b) , unless one of the following conditions applies:

(1) The qualified person is insulated or guarded from energized electrical conductors or circuit parts operating at 50 volts or more. Insulating gloves and sleeves are considered insulation only with regard to the energized parts upon which work is performed.

(2) The energized electrical conductors or circuit parts are insulated from the qualified person and from any other conductive object at a different potential.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 12:38:11 EDT 2018

Committee Statement

Committee Insert “Estimate of Likelihood and Severity” information to provide clarity and usability by aligning

Statement: with 130.5. Also editorially renumber the subsequent sections (existing C, D, E and F becomes D, E, F and G).

Editorially correct the reference in 130.4(B) from 110.1(H) to 110.1(H)(3).

Editorially correct the reference in Table 130.4(D)(a) Note (1) from 130.5(A) to 130.5(E).

The requirements for alerting the unqualified worker of the impending hazard and warning them to stay out is adequately covered in 130.7(E) and the reference is replacing existing text. The alerting techniques do not require a person in charge, but simply an attendant if necessary to warn unqualified persons. Consistent application of the rules will minimize confusion.

The revision in (E)(2) increases safety by requiring no unrelated duties for the qualified person escorting unqualified persons.

Response Message: FR-44-NFPA 70E-2018

Public Input No. 70-NFPA 70E-2018 [Section No. 130.4(E)(2)]

Public Input No. 103-NFPA 70E-2018 [Section No. 130.4(D)]

Public Input No. 102-NFPA 70E-2018 [Section No. 130.4(B)]

Public Input No. 355-NFPA 70E-2018 [Section No. 130.4(E)(3)]

Public Input No. 104-NFPA 70E-2018 [New Section after 130.4(B)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
21 Affirmative All
3 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

The proposed new text in In 130.4(F)(3), "The qualified person escorting the unqualified person(s) shall have no unrelated duties" is vague and may introduce confusion related to the term "unrelated duties".

Bowman, William Bruce

103.4(B)(2) should read: "....electrical equipment's operating...." to be grammatically correct.

Gallo, Ernest J.

Comments: NFPA 70E, in 130.4(G)(1), should recognize the difference in human physiological response to ac vs. dc voltages. The human body is able to tolerate greater levels of dc voltage as opposed to ac voltage. This has been demonstrated by decades of research on the subject. Perhaps NFPA could work with OSHA to obtain such recognition in the OSHA requirements.

Negative with Comment

Mohla, Daleep C.

The boundaries in Table 130.4(E)(a) are insufficient for voltages of 72.6 kV and more. The distances in the table were based on “industry-accepted values” for maximum transient overvoltages that OSHA determined were insufficient in some cases. OSHA raised the default per-unit transient overvoltages from 2.0 to 3.0 to 2.5 to 3.5 pu depending on voltage. (See Table R-9 in 29 CFR 1910.269.) The new default minimum approach distances for voltages from 72.6 to 800 kV are listed in Table R-7 in 29 CFR 1910.269, and the boundaries in Table 130.4(E)(a) should be adjusted accordingly. (Note that the PI did not address the table.)

First Revision No. 45-NFPA 70E-2018 [Section No. 130.5(C)]

(C) Additional Protective Measures.

If additional protective measures are required they shall be selected and implemented according to the hierarchy of risk control identified in 110.5(H) ~~110.1(H)~~ (3) . When the additional protective measures include the use of PPE, the following shall be determined:

(1) Appropriate safety-related work practices

(2) The arc flash boundary

(3) The PPE to be used within the arc flash boundary

Table 130.5(C) shall be permitted to be used to estimate the likelihood of occurrence of an arc flash event to determine if additional protective measures are required.

Table 130.5(C) Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems

Task	Equipment Condition	Likelihood of Occurrence*
Reading a panel meter while operating a meter switch.	Any	No
Performing infrared thermography and other non-contact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers.		
Working on control circuits with exposed energized electrical conductors and circuit parts, nominal 125 volts ac or dc, or below without any other exposed energized equipment over nominal 125 volts ac or dc, including opening of hinged covers to gain access.		
Examination of insulated cable with no manipulation of cable.		
~~For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an open rack.~~		
For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack.		
For ac systems, work on energized electrical conductors and circuit parts, including ~~voltage~~ electrical testing.	Any	Yes
Operation of a CB or switch the first time after installation or completion of maintenance in the equipment.		
For dc systems, working on energized electrical conductors and circuit parts of series-connected battery cells, including ~~voltage~~ electrical testing.		
Removal or installation of CBs or switches.		
Opening hinged door(s) or cover(s) or removal of bolted covers (to expose bare, energized electrical conductors and circuit parts). For dc systems, this includes bolted covers, such as battery terminal covers.		
Application of temporary protective grounding equipment, after voltage test.		
Working on control circuits with exposed energized electrical conductors and circuit parts, greater than 120 volts.		
Insertion or removal of individual starter buckets from motor control center (MCC).		
Insertion or removal (racking) of circuit breakers (CBs) or starters from cubicles, doors open or closed.		
Insertion or removal of plug-in devices into or from busways.		
Examination of insulated cable with manipulation of cable.		
Working on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or motor control center.		
Insertion or removal of revenue meters (kW-hour, at primary voltage and current).		
~~Removal~~ Insertion or removal of covers for battery ~~conductive~~ intercell connector(s) ~~covers~~ .		
For dc systems, working on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source.		
Opening voltage transformer or control power transformer compartments.		

Task	Equipment Condition	Likelihood of Occurrence*
Operation of outdoor disconnect switch (hookstick operated) at 1 kV through 15 kV.		
Operation of outdoor disconnect switch (gang-operated, from grade) at 1 kV through 15 kV.		
Operation of a CB, switch, contactor, or starter.	Normal	No
Voltage testing on individual battery cells or individual multi-cell units.	Abnormal	Yes
Removal or installation of covers for equipment such as wireways, junction boxes, and cable trays that does not expose bare, energized electrical conductors and circuit parts.		
Opening a panelboard hinged door or cover to access dead front overcurrent devices.		
Removal of battery nonconductive intercell connector covers.		
Maintenance and testing on individual battery cells or individual multi-cell units in an open rack		
Insertion or removal of individual cells or multi-cell units of a battery system in an open rack.		
Arc-resistant ~~switchgear Type 1 or 2 (for clearing times of less than 0.5 sec with a prospective fault current not to exceed the arc-resistant rating of the equipment) and metal enclosed interrupter switchgear, fused or unfused of arc resistant type construction, 1 kV through 15 kV~~ equipment with the DOORS CLOSED and SECURED, and where the available fault current and fault clearing time does not exceed that of the arc-resistant rating of the equipment .		
Insertion or removal of individual starter buckets.		
Insertion or removal (racking) of CBs from cubicles;		
Insertion or removal (racking) of ground and test device; or		
Insertion or removal (racking) of voltage transformers on or off the bus.		
Equipment ~~condition~~ is considered to be in a "normal operating condition" if all of the conditions in 130.2(A)(4) are satisfied. ~~following circumstances apply:~~		
(0) ~~The equipment is properly installed in accordance with the manufacturer's recommendations and applicable industry codes and standards.~~		
(0) ~~The equipment is properly maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards.~~		
(0) ~~The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.~~		
(0) ~~Equipment doors are closed and secured.~~		
(0) ~~Equipment covers are in place and secured.~~		
(0) ~~There is no evidence of impending failure such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration.~~		

*As defined in this standard, the two components of risk are the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard. Risk assessment is an overall process that involves estimating both the likelihood of occurrence and severity to determine if additional protective measures are required. The estimate of the likelihood of occurrence contained in this table does not cover every possible condition or situation, nor does it address severity of injury or damage to health. Where this table identifies "No" as an estimate of likelihood of occurrence, it means that an arc flash incident is not likely to occur. Where this table identifies "Yes" as an estimate of likelihood of occurrence, it means an arc flash incident should be considered likely to occur. The likelihood of occurrence must be combined with the potential severity of the arcing incident to determine if ~~that~~ additional protective measures are required to be selected and implemented according to the

hierarchy of risk control identified in 110.1(H)(3) .

An example of a standard that provides information for arc-resistant ~~switchgear~~ equipment referred to in Table 130.5(C) is IEEE C37.20.7, *Guide for Testing ~~Metal-Enclosed~~ Switchgear Rated Up to ~~38~~ 52 kV for Internal Arcing Faults*.

Improper or inadequate maintenance can result in increased fault clearing time of the overcurrent protective device, thus increasing the incident energy. Where equipment is not properly installed or maintained, PPE selection based on incident energy analysis or the PPE category method might not provide adequate protection from arc flash hazards.

Both larger and smaller available fault currents could result in higher incident energy. If the available fault current increases without a decrease in the fault clearing time of the overcurrent protective device, the incident energy will increase. If the available fault current decreases, resulting in a longer fault clearing time for the overcurrent protective device, incident energy could also increase.

The occurrence of an arcing fault inside an enclosure produces a variety of physical phenomena very different from a bolted fault. For example, the arc energy resulting from an arc developed in the air will cause a sudden pressure increase and localized overheating. Equipment and design practices are available to minimize the energy levels and the number of procedures that could expose an employee to high levels of incident energy. Proven designs such as arc-resistant switchgear, remote racking (insertion or removal), remote opening and closing of switching devices, high-resistance grounding of low-voltage and 5000-volt (nominal) systems, current limitation, and specification of covered bus or covered conductors within equipment are available to reduce the risk associated with an arc flash incident. See Informative Annex O for safety-related design requirements.

For additional direction for performing maintenance on overcurrent protective devices, see Chapter 2, Safety-Related Maintenance Requirements.

See IEEE 1584, *Guide for Performing Arc Flash Hazard Calculations*, for more information regarding incident energy and the arc flash boundary for three-phase systems.

Supplemental Information

File Name	Description	Approved
Attachement_for_FR45_Table_130.5_C_.docx	for fr-45. For staff use	

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 14:57:21 EDT 2018

Committee Statement

Committee Statement: The table correctly indicates that an arc flash incident is not likely to occur under normal operating conditions when operating a circuit breaker or switch. However, there is a higher likelihood of occurrence for an arc flash event the first-time equipment is energized following the initial installation. This is also true immediately after completion of maintenance activities within equipment. The standard now provides guidance for these situations.

The conditions of normal (normal equipment condition) are exactly the same as the requirement in 130.2(A)(4). The redundancy is deleted and a reference to 130.2(A)(4) is added.

Editorially change 110.1(H) to 110.1(H)(3) for clarity.

Arc-resistant MCCs are available on the market and are evaluated against IEEE Std C37.20.7 - revision 2017 - "IEEE Guide for Testing Switchgear Rated Up to 52 kV for Internal Arcing Faults" providing protection to contain internal arcing. The arc resistant task is expanded to cover all arc resistant equipment provided the DOORS are CLOSED and SECURED, and where the available fault current and fault clearing time does not exceed that of the arc-resistant rating of the equipment. This correlates with revisions in 130.7(C)(15)(a). The revision to address all arc resistant equipment necessitated the addition of a new task to address, “Insertion or removal of individual starter buckets.”

Voltage testing is changed to electrical testing. There are many individual cell/unit readings performed on batteries during normal maintenance. The same revision was made for ac testing. This

revision provides necessary clarity.

The table note is modified to clarify that the “likelihood of occurrence must be combined with the potential severity of an arcing incident to determine if” additional protective measures are required.

The title of IEEE C37.20.7 is modified to update the standard title and scope.

The task for intercell battery covers is revised to delete “conductive” as they do not exist. The task is modified for clarity to include insertion.

The task for insertion and removal is deleted in the “Any/No” category as it is already listed in the “Normal/Abnormal” Category

Response Message: FR-45-NFPA 70E-2018

Public Input No. 211-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 133-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 334-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 120-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 195-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 346-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 344-NFPA 70E-2018 [Section No. 130.5(C)]

Public Input No. 6-NFPA 70E-2018 [Section No. 130.5(C)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

White, James R.

Wolf, Jason

Affirmative with Comment

Mohla, Daleep C.

In the last row of Table 130.5(C), there is a reference to 130.2(A)(4). That reference is incorrect. The Committee moved that provision to Article 110.

West, Rodney J.

Affirmative comment: Perhaps due to software limitations, the layout of Table 130.5(C) is unclear and may be confusing. The final table format should separate or otherwise highlight the normal operating condition language at the end of the table from the other task based entries. In addition, the four “insertion or removal” tasks listed under arc resistant equipment should be indented or otherwise formatted to show that they are associated only with arc resistant equipment and not electrical equipment in general.

First Revision No. 46-NFPA 70E-2018 [Section No. 130.5(G)]

(G) Incident Energy Analysis Method.

The incident energy exposure level shall be based on the working distance of the employee's face and chest areas from a prospective arc source for the specific task to be performed. Arc-rated clothing and other PPE shall be used by the employee based on the incident energy exposure associated with the specific task. Recognizing that incident energy increases as the distance from the arc flash decreases, additional PPE shall be used for any parts of the body that are closer than the working distance at which the incident energy was determined.

The incident energy analysis shall take into consideration the characteristics of the overcurrent protective device and its fault clearing time, including its condition of maintenance.

The incident energy analysis shall be updated when changes occur in the electrical distribution system that could affect the results of the analysis. The incident energy analysis shall also be reviewed for accuracy at intervals not to exceed 5 years.

Table 130.5(G) identifies the arc-rated clothing and other PPE requirements of Article 130 and shall be permitted to be used with the incident energy analysis method of selecting arc flash PPE.

Informational Note: For information on estimating the incident energy, see Informative Annex D. For information on selection of arc-rated clothing and other PPE, see Informative Annex H.

Table 130.5(G) Selection of Arc-Rated Clothing and Other PPE When the Incident Energy Analysis Method Is Used

Incident energy exposures equal to 1.2 cal/cm^2 up to and including 12 cal/cm^2
Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy[a]
~~Long~~ Arc-rated long -sleeve shirt and pants or arc-rated coverall or arc flash suit (SR)
Arc-rated face shield and arc-rated balaclava or arc flash suit hood (SR)[b]
Arc-rated outerwear (e.g., jacket, parka, rainwear, hard hat liner, high-visibility safety apparel) (AN)
Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR)[c]
Hard hat
Safety glasses or safety goggles (SR)
Hearing protection
Leather footwear[d]
Incident energy exposures greater than 12 cal/cm^2
Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy[a]
~~Long~~ Arc-rated long -sleeve shirt and pants or arc-rated coverall or arc flash suit (SR)
Arc-rated arc flash suit hood
Arc-rated outerwear (e.g., jacket, parka, rainwear, hard hat liner, high-visibility safety apparel) (AN)
Arc-rated gloves or rubber insulating gloves with leather protectors (SR)[c]
Hard hat
Safety glasses or safety goggles (SR)
Hearing protection
Leather footwear[d]

SR: Selection of one in group is required.

AN: As needed.

[a]Arc ratings can be for a single layer, such as an arc-rated shirt and pants or a coverall, or for an arc flash suit or a multi-layer system if tested as a combination consisting of an arc-rated shirt and pants, coverall, and arc flash suit.

[b]Face shields with a wrap-around guarding to protect the face, chin, forehead, ears, and neck area are required by 130.7(C)(10)(c). Where the back of the head is inside the arc flash boundary, a balaclava or an arc flash hood shall be required for full head and neck protection.

[c]Rubber insulating gloves with leather protectors provide arc flash protection in addition to shock protection. Higher class rubber insulating gloves with leather protectors, due to their increased material thickness, provide increased arc flash protection.

[d] Footwear other than leather or dielectric shall be permitted to be used provided it has been tested to demonstrate no ignition, melting, or dripping at the estimated incident energy exposure.

Supplemental Information

File Name	Description	Approved
attachment_for_FR_46_Table_130.5_G_.docx	attachment for fr46. For staff use	

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 16:15:04 EDT 2018

Committee Statement

Committee Statement: A new table foot note is added to include footwear that has been tested to demonstrate no ignition, melting or dripping at the estimated incident energy exposure to be used in lieu of leather or dielectric footwear.

The term “arc-rated” is added for long-sleeve shirts and coveralls. The use of high visibility safety apparel could be a requirement for personnel exposed to arc flash hazards and is added to the list of outer garments.

The addition of “and including” is editorial and clarifies that this range includes 12 calories.

Response Message: FR-46-NFPA 70E-2018

Public Input No. 284-NFPA 70E-2018 [Section No. 130.5(G)]

Public Input No. 55-NFPA 70E-2018 [Section No. 130.5(G)]

Public Input No. 271-NFPA 70E-2018 [Section No. 130.5(G)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Mohla, Daleep C.

Add a new Note c to Table 130.5(G) as follows: The outerwear arc rating shall not be required to be rated for the estimated incident energy if it is not used as part of a system arc rating. Re-identify existing note c as d, and note d as e. Add the letter c after Arc-rated outerwear in two places in Table 130.5(G).

First Revision No. 60-NFPA 70E-2018 [Section No. 130.6(A)]

(A) Alertness.

(1) ~~When~~ Where Electrical Hazards Might Exist.

Employees shall be instructed to be alert at all times ~~when they are working within the limited approach boundary of energized electrical conductors or circuit parts operating at voltages equal to or greater than 50 volts and in work situations when~~ where electrical hazards might exist.

(2) When Impaired.

Employees shall not be permitted to work ~~within the limited approach boundary of energized electrical conductors or circuit parts operating at voltages equal to or greater than 50 volts, or~~ where ~~other~~ electrical hazards exist while their alertness is recognizably impaired due to illness, fatigue, or other reasons.

(3) Changes in Scope.

Employees shall be instructed to be alert for changes in the job or task that could lead the person outside of the electrically safe work condition or expose the person to additional hazards that were not part of the original plan.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 11:42:36 EDT 2018

Committee Statement

Committee Statement: This first revision simplifies the requirement by using only “electrical hazard” which is a defined term. Editorially corrected the term "when" to "where".

Response Message: FR-60-NFPA 70E-2018

Public Input No. 194-NFPA 70E-2018 [Section No. 130.6(A)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 61-NFPA 70E-2018 [Section No. 130.6(C)(2)]

(2) Obstructed View of Work Area.

Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform any task ~~within the limited approach boundary of energized electrical conductors or circuit parts operating at voltages equal to or greater than 50 volts or~~ where an electrical hazard exists.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 11:50:44 EDT 2018

Committee Statement

Committee Statement: This first revision simplifies the requirement by using only “electrical hazard” which is a defined term.

Response Message: FR-61-NFPA 70E-2018

Public Input No. 197-NFPA 70E-2018 [Section No. 130.6(C)(2)]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
Wolf, Jason

Affirmative with Comment

White, James R.

Revision simplifies the language making it easier to understand.

First Revision No. 62-NFPA 70E-2018 [Section No. 130.6(E)(2)]

(2) Approach to Energized Electrical Conductors and Circuit Parts.

Means shall be employed to ensure that conductive materials approach exposed energized electrical conductors or circuit parts no closer than that permitted by ~~130.2~~ 130.4(F) .

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 12:06:14 EDT 2018

Committee Statement

Committee Statement: This section has been revised editorially to provide the correct applicable reference.

Response Message: FR-62-NFPA 70E-2018

Public Input No. 75-NFPA 70E-2018 [Section No. 130.6(E)(2)]

Public Input No. 142-NFPA 70E-2018 [Section No. 130.6(E)(2)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 63-NFPA 70E-2018 [Section No. 130.6(F)]

(F) Confined or Enclosed Work Spaces.

When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized electrical conductors or circuit parts ~~operating at voltages equal to or greater than 50 volts or~~ where an electrical hazard exists, the employer shall provide, and the employee shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts and the effects of the electrical hazards.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 12:09:15 EDT 2018

Committee Statement

Committee Statement: This first revision simplifies the requirement by using only “electrical hazard” which is a defined term.

Response Message: FR-63-NFPA 70E-2018

Public Input No. 198-NFPA 70E-2018 [Section No. 130.6(F)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

In multiple locations of 70E, the committee has proposed to remove the phrase "operating at voltages equal to or greater than 50 volts" and retain the phrase "where an electrical hazard exists" to reflect that the requirement does not only apply to shock hazards. In this case, the result is an awkward requirement that retains the phrase "exposed energized electrical conductors and circuit parts". This phrasing should probably be cleaned up during the public comment stage.

White, James R.

Revision simplifies the language making it easier to understand.

First Revision No. 64-NFPA 70E-2018 [Section No. 130.6(G)]

(G) Doors and Hinged Panels.

Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized electrical conductors or circuit parts ~~operating at voltages equal to or greater than 50 volts or~~ where an electrical hazard exists if movement of the door, hinged panel, and the like is likely to create a hazard.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 12:12:15 EDT 2018

Committee Statement

Committee Statement: This first revision simplifies the requirement by using only “electrical hazard” which is a defined term.

Response Message: FR-64-NFPA 70E-2018

Public Input No. 199-NFPA 70E-2018 [Section No. 130.6(G)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
Wolf, Jason

Affirmative with Comment

White, James R.

Revision simplifies the language making it easier to understand.

First Revision No. 65-NFPA 70E-2018 [Section No. 130.6(N)]

(N) Safety Interlocks.

Only qualified persons following the requirements for working inside the restricted approach boundary as covered by 130.4(F) ~~130.4(D)~~ shall be permitted to defeat or bypass an electrical safety interlock over which the person has sole control, and then only temporarily while the qualified person is working on the equipment. The safety interlock system shall be returned to its operable condition when the work is completed.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 12:14:47 EDT 2018

Committee Statement

Committee Statement: This section has been revised editorially to provide the correct applicable reference.

Response Message: FR-65-NFPA 70E-2018

Public Input No. 129-NFPA 70E-2018 [Section No. 130.6(N)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 47-NFPA 70E-2018 [Section No. 130.7(C)(1)]

(1) General.

When an employee is working within the restricted approach boundary, the worker shall wear PPE in accordance with 130.4. When an employee is working within the arc flash boundary, he or she shall wear protective clothing and other PPE in accordance with 130.5. All parts of the body inside the arc flash boundary shall be protected.

Informational Note: Although PPE is required for all parts of the body within the arc flash boundary, similar PPE can be used for parts of the body outside the arc flash boundary to reduce the likelihood of injury due to sound or the expulsion of burning particles or other projectiles.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 17:41:38 EDT 2018

Committee Statement

Committee Statement: An informational note is added to provide non-mandatory guidance regarding protection of body parts outside the arc flash boundary.

Response Message: FR-47-NFPA 70E-2018

Public Input No. 329-NFPA 70E-2018 [Section No. 130.7(C)(1)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
23 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Affirmative with Comment

Wolf, Jason

The informational note could lead the user to interpret similar PPE as optional. Hardhats and safety glasses are already required for protection against expulsion of burning particles or other projectiles.

Negative with Comment

Barrios, Louis A.

The addition of the informational note to suggest the use of similar PPE when outside the arc flash boundary is unnecessary and has the potential of blurring the shock and arc flash boundaries.

First Revision No. 48-NFPA 70E-2018 [Section No. 130.7(C)(3)]

(3) Head, Face, Neck, and Chin (Head Area) Protection.

Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with energized electrical conductors or circuit parts or from flying objects resulting from electrical explosion. Employees shall wear nonconductive protective equipment for the face, neck, and chin whenever there is a danger of injury from exposure to electric arcs or flashes or from flying objects resulting from electrical explosion. If employees use hairnets or beard nets, or both, these items ~~must~~ shall be arc rated.

Informational Note: See 130.7(C)(10)(b) and ~~(c)~~ (C)(10(c) for arc flash protective requirements.

Submitter Information Verification

Committee:
Submittal Date: Wed Aug 15 17:44:33 EDT 2018

Committee Statement

Committee Statement: This revision corrects editorial errors with respect to mandatory text.
Response Message: FR-48-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.

Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 49-NFPA 70E-2018 [Section No. 130.7(C)(7)]

(7) Hand and Arm Protection.

Hand and arm protection shall be provided in accordance with 130.7(C)(7)(a), ~~(b)~~ (C)(7)(b) , and ~~(c)~~ (C)(7)(c) .

(a) *Shock Protection.* Employees shall wear rubber insulating gloves with leather protectors where there is a danger of hand injury from electric shock due to contact with exposed energized electrical conductors or circuit parts. Employees shall wear rubber insulating gloves with leather protectors and rubber insulating sleeves where there is a danger of hand and arm injury from electric shock due to contact with exposed energized electrical conductors or circuit parts. Rubber insulating gloves shall be rated for the voltage for which the gloves will be exposed. Rubber insulating gloves shall be permitted to be used without leather protectors, under the following conditions:

(1) There shall be no activity performed that risks cutting or damaging the glove.

(2) The rubber insulating gloves shall be electrically retested before reuse.

(3) The voltage rating of the rubber insulating gloves shall be reduced by 50 percent for class 00 and by one whole class for classes 0 through 4.

(b) *Arc Flash Protection.* Hand and arm protection shall be worn where there is possible exposure to arc flash burn. The apparel described in 130.7(C)(10)(d) shall be required for protection of hands from burns. Arm protection shall be accomplished by the apparel described in 130.7(C)(6).

(c) *Maintenance and Use.* Electrical protective equipment shall be maintained in a safe, reliable condition. Insulating equipment shall be inspected for damage before each day's use and immediately following any incident that can reasonably be suspected of having caused damage. Insulating gloves shall be given an air test, along with the inspection. Maximum use voltages for rubber insulating gloves shall not exceed that specified in 130.7(C)(7)(a) . The top of the cuff of the protector glove shall be shorter than the rolled top of the cuff of the insulating glove by at least the distance specified in 130.7(C)(7)(a) .

(d) ~~Electrical protective~~ *Periodic Electrical Tests* . Rubber insulating equipment shall be subjected to periodic electrical tests. Test voltages shall be in accordance with applicable state, federal, or local codes and standards. The maximum intervals between tests shall not exceed that specified in Table 130.7(C)(7)(b).

Informational Note: See OSHA 29 CFR 1910.137; ASTM F478, *Standard Specification for In-Service Care of Insulating Line Hose and Covers*; ASTM F479, *Standard Specification for In-Service Care of Insulating Blankets*; and ASTM F496, *Standard Specification for In-Service Care of Insulating Gloves and Sleeves*, which contain information related to in-service and testing requirements for rubber insulating equipment.

Table 130.7(C)(7)(a) Maximum Use Voltage for Rubber Insulating Gloves

Class Designation of Glove or Sleeve	Maximum ac Use Voltage rms, volts	Maximum dc Use Voltage avg, volts	Distances Between Gauntlet and Cuff, minimum
00	500	750	13 mm (0.5 in.)
0	1,000	1,500	13 mm (0.5 in.)
1	7,500	11,250	25 mm (1 in.)
2	17,000	25,500	51 mm (2 in.)
3	26,500	39,750	76 mm (3 in.)
4	36,000	54,000	102 mm (4 in.)

Table 130.7(C)(7)(b) Rubber Insulating Equipment, Maximum Test Intervals

Rubber Insulating Equipment	When to Test
Blankets	Before first issue; every 12 months thereafter*
Covers	If insulating value is suspect
Gloves	Before first issue; every 6 months thereafter*
Line hose	If insulating value is suspect
Sleeves	Before first issue; every 12 months thereafter*

*New insulating equipment is not permitted to be placed into service unless it has been electrically tested within the previous 12 months. Insulating equipment that has been issued for service is not new and is required to be retested in accordance with the intervals in this table.

Supplemental Information

File Name	Description	Approved
attachement_for_fr49_new_table_130.7_C_a_.docx	attachment for FR 49 new table 130.7(C)(a). For staff use	

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 17:49:24 EDT 2018

Committee Statement

Committee Statement: A new Table 130.7(C)(7)(a) iprovides maximum use voltages for rubber insulating gloves. This new table is necessary to provide ready access to users of this standard and for proper application of 130.7(C)(7)(a). Editorially, existing Table 130.7(C)(7) is retitled as 130.7(C)(7)(b). Editorial revisions were made in this section as necessary.

Response Message: FR-49-NFPA 70E-2018

Public Input No. 290-NFPA 70E-2018 [Section No. 130.7(C)(7)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Wolf, Jason

Affirmative with Comment

White, James R.

Many workers don't understand the concept of voltage creep and don't maintain that minimum space.

First Revision No. 50-NFPA 70E-2018 [Section No. 130.7(C)(9)]

(9) Factors in Selection of Protective Clothing.

Clothing and equipment that provide worker protection from shock and arc flash hazards shall be used. If arc-rated clothing is required, it shall cover associated parts of the body as well as all flammable apparel while allowing movement and visibility.

Clothing and equipment required for the degree of exposure shall be permitted to be worn alone or integrated with flammable, nonmelting apparel. Garments that are not arc rated shall not be permitted to be used to increase the arc rating of a garment or of a clothing system.

Informational Note: Protective clothing includes shirts, pants, coveralls, jackets, and parkas worn routinely by workers who, under normal working conditions, are exposed to momentary electric arc and related thermal hazards. Arc-rated rainwear worn in inclement weather is included in this category of clothing.

(a) *Layering.* Nonmelting, flammable fiber garments shall be permitted to be used as underlayers in conjunction with arc-rated garments in a layered system. If nonmelting, flammable fiber garments are used as underlayers, the system arc rating shall be sufficient to prevent breakopen of the innermost arc-rated layer at the expected arc exposure incident energy level to prevent ignition of flammable underlayers. Garments that are not arc rated shall not be permitted to be used to increase the arc rating of a garment or of a clothing system.

Informational Note: A typical layering system might include cotton underwear, a cotton shirt and trouser, and an arc-rated coverall. Specific tasks might call for additional arc-rated layers to achieve the required protection level.

(b) *Outer Layers.* Garments worn as outer layers over arc-rated clothing, such as jackets, high-visibility safety apparel, or rainwear, shall also be made from arc-rated material.

(c) *Underlayers.* Meltable fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric underlayers.

Exception: An incidental amount of elastic used on nonmelting fabric underwear or socks shall be permitted.

Informational Note No. 1: Arc-rated garments (e.g., shirts, trousers, and coveralls) worn as underlayers that neither ignite nor melt and drip in the course of an exposure to electric arc and related thermal hazards generally provide a higher system arc rating than nonmelting, flammable fiber underlayers.

Informational Note No. 2: Arc-rated underwear or undergarments used as underlayers generally provide a higher system arc rating than nonmelting, flammable fiber underwear or undergarments used as underlayers.

(d) *Coverage.* Clothing shall cover potentially exposed areas as completely as possible. Shirt and coverall sleeves shall be fastened at the wrists, shirts shall be tucked into pants, and shirts, coveralls, and jackets shall be closed at the neck.

(e) *Fit.* Tight-fitting clothing shall be avoided. Loose-fitting clothing provides additional thermal insulation because of air spaces. Arc-rated apparel shall fit properly such that it does not interfere with the work task.

(f) *Interference.* The garment selected shall result in the least interference with the task but still provide the necessary protection. The work method, location, and task could influence the protective equipment selected.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 17:59:01 EDT 2018

Committee Statement

Committee Statement: The use of high visibility safety apparel could also be required for personnel exposed to arc flash hazards and is added to the list of outer garments.

Response Message: FR-50-NFPA 70E-2018

Public Input No. 281-NFPA 70E-2018 [Section No. 130.7(C)(9)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 51-NFPA 70E-2018 [Section No. 130.7(C)(10)]

(10) Arc Flash Protective Equipment.

(a) *Arc Flash Suits.* Arc flash suit design shall permit easy and rapid removal by the wearer. The entire arc flash suit, including the hood's face shield, shall have an arc rating that is suitable for the arc flash exposure. When exterior air is supplied into the hood, the air hoses and pump housing shall be either covered by arc-rated materials or constructed of nonmelting and nonflammable materials.

(b) *Head Protection.*

(1) An arc-rated hood or an arc-rated balaclava with an arc-rated face shield shall be used when the back of the head is within the arc flash boundary.

(2) An arc-rated hood shall be used when the anticipated incident energy exposure exceeds 12 cal/cm^2 (50.2 J/cm^2).

(c) *Face Protection.* Face shields shall have an arc rating suitable for the arc flash exposure. Face shields with a wrap-around guarding to protect the face, chin, forehead, ears, and neck area shall be used. Face shields without an arc rating shall not be used. Eye protection (safety glasses or goggles) shall always be worn under face shields or hoods.

Informational Note: Face shields made with energy-absorbing formulations that can provide higher levels of protection from the radiant energy of an arc flash are available, but these shields are tinted and can reduce visual acuity and color perception. Additional illumination of the task area might be necessary when these types of arc-protective face shields are used.

(d) *Hand Protection.*

(1) Heavy-duty leather gloves or arc-rated gloves shall be worn where required for arc flash protection.

Informational Note: Heavy-duty leather gloves are made entirely of leather with minimum thickness of 0.03 in. (0.7 mm) and are unlined or lined with nonflammable, nonmelting fabrics. Heavy-duty leather gloves meeting this requirement have been shown to have ATPV values in excess of 10 cal/cm^2 (41.9 J/cm^2).

(2) Where insulating rubber gloves are used for shock protection, leather protectors shall be worn over the rubber gloves.

Informational Note: The leather protectors worn over rubber insulating gloves provide additional arc flash protection for the hands for arc flash protection exposure.

(e) *Foot Protection.* ~~Heavy-duty leather~~ Leather footwear or dielectric footwear or both provide some arc flash protection to the feet and shall be used in all exposures greater than 4 cal/cm^2 (16.75 J/cm^2). Footwear other than leather or dielectric shall be permitted to be used provided it has been tested to demonstrate no ignition, melting, or dripping at the estimated incident energy exposure or the minimum arc rating for the respective arc flash PPE category.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 18:05:25 EDT 2018

Committee Statement

Committee Statement: The phrase "heavy duty leather" is revised to "leather" as there is no specification as what is meant by "heavy duty."

A last sentence is added to include footwear that has been tested to demonstrate no ignition, melting or dripping at the estimated incident energy exposure or the minimum arc rating for the

respective for the arc-flash PPE category to be used in lieu of leather footwear or dielectric footwear.

Response Message: FR-51-NFPA 70E-2018

Public Input No. 270-NFPA 70E-2018 [Section No. 130.7(C)(10)]

Public Input No. 324-NFPA 70E-2018 [Section No. 130.7(C)(10)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 52-NFPA 70E-2018 [Section No. 130.7(C)(13)]

(13) Care and Maintenance of Arc-Rated Clothing and Arc-Rated Arc Flash Suits.

(a) *Inspection.* Arc-rated apparel shall be inspected before each use. Work clothing or arc flash suits that are contaminated or damaged to the extent that their protective qualities are impaired shall not be used. Protective items that become contaminated with grease, oil, or flammable liquids or combustible materials shall not be used.

(b) *Manufacturer's Instructions.* The garment manufacturer's instructions for care and maintenance of arc-rated apparel shall be followed.

(c) *Storage.* Arc-rated apparel shall be stored in a manner that prevents physical damage; damage from moisture, dust, or other deteriorating agents; or contamination from flammable or combustible materials.

(d) *Cleaning, Repairing, and Affixing Items.* When arc-rated clothing is cleaned, manufacturer's instructions shall be followed ~~to avoid loss of protection~~ . When arc-rated clothing is repaired, the same arc-rated materials used to manufacture the arc-rated clothing shall be used to provide repairs.

Informational Note No. 1: The purpose of following manufacturer's instructions is to avoid the loss of protection and to remove contaminants such as hydrocarbons and metallic and disease-causing contaminants that could compromise safety.

Informational Note No. 2: Additional guidance is provided in ASTM F1506, *Standard Performance Specification for Flame Resistant and Electric Arc Rated ~~Textile Materials for Wearing Apparel for Use by Electrical~~ Protective Clothing Worn by Workers Exposed to ~~Momentary Electric Arc and Related Thermal Hazards~~ Flames and Electric Arcs* , when trim, name tags, logos, or any combination thereof are affixed to arc-rated clothing.

Informational Note No. 3: Additional guidance is provided in ASTM F1449, *Standard Guide for Industrial Laundering of Flame, Thermal, and Arc Resistant Clothing*, and ASTM F2757, *Standard Guide for Home Laundering Care and Maintenance of Flame, Thermal, and Arc Resistant Clothing*.

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 18:12:49 EDT 2018

Committee Statement

Committee Statement: The new informational note provides useful information regarding the purpose of following manufacturer's cleaning instructions. The first sentence of the requirement was revised to remove "avoid loss of protection" as it is addressed in the new informational note.

Response Message: FR-52-NFPA 70E-2018

Public Input No. 253-NFPA 70E-2018 [Section No. 130.7(C)(13)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments

0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 53-NFPA 70E-2018 [Section No. 130.7(C)(14)]

(14) Standards for ~~Personal Protective Equipment (PPE)~~ PPE .

(a) *General.* PPE shall conform to applicable state, federal, or local codes and standards.

Informational Note No. 1: The standards listed in Table 130.7(C)(14), which is part of this Informational Note, are examples of standards that contain information on the care, inspection, testing, and manufacturing of PPE.

Informational Note No. 2: Non-arc-rated or flammable fabrics are not covered by any of the standards in Table 130.7(C)(14), Informational Note. See 130.7(C)(11) and 130.7(C)(12).

(b) *Conformity Assessment.* All suppliers or manufacturers of PPE shall demonstrate conformity with an appropriate product standard by one of the following methods:

(1) Self-declaration with a Supplier's Declaration of Conformity

(2) Self-declaration under a registered quality management system and product testing by an accredited laboratory and a Supplier's Declaration of Conformity

(3) Certification by an accredited independent third-party certification organization

Informational Note No. 1: Examples of a process for conformity assessment to an appropriate product standard can be found in ANSI/ISEA 125, *American National Standard for Conformity Assessment of Safety and Personal Protective Equipment*. See ~~Informative Annex~~ H.4

Informational Note No. 2: An example of a process to accredit independent third-party certification organizations is ISO 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services* .

(c) *Marking.* All suppliers or manufacturers of PPE shall provide the following information on the ~~personal protective equipment~~ PPE , on the smallest unit container, or contained within the manufacturer's instructions:

(1) Name of manufacturer

(2) Product performance standards to which the product conforms

(3) Arc rating where appropriate for the equipment

(4) One or more identifiers such as model, serial number, lot number, or traceability code

(5) Care instructions

Table 130.7(C)(14) Informational Note: Standards ~~For~~ for ~~Personal Protective Equipment~~ PPE

Subject	Document Title	Document Number
~~Apparel~~ Clothing — Arc Rated	Standard Performance Specification for Flame Resistant and Electric Arc Rated ~~Textile Materials for Wearing Apparel for Use by Electrical~~ Protective Clothing Worn by Workers Exposed to ~~Momentary~~ Flames and Electric Arc ~~and Related Thermal Hazards~~	ASTM F1506
	Standard Guide for Industrial Laundering of Flame, Thermal, and Arc Resistant Clothing	ASTM F1449
	Standard Guide for Home Laundering Care and Maintenance of Flame, Thermal and Arc Resistant Clothing	ASTM F2757
Aprons — Insulating	Standard Specification for Electrically Insulating Aprons	ASTM F2677
Eye and Face Protection — General	~~Eye and Face Protection — General~~ American National Standard for Occupational and Educational Professional Eye and Face Protection ~~Devices~~	ANSI/ISEA Z87.1

Subject	Document Title	Document Number
Face — Arc Rated	Standard Test Method for Determining the Arc Rating and Standard Specification for Personal Eye or Face Protective Products	ASTM F2178
Fall Protection	Standard Specification for Personal Climbing Equipment	ASTM F887
Footwear — Dielectric Specification	Standard Specification for Dielectric Footwear	ASTM F1117
Footwear — Dielectric Test Method	Standard Test Method for Determining Dielectric Strength of Dielectric Footwear	ASTM F1116
Footwear — Standard Performance Specification	Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear	ASTM F2413
Footwear — Standard Test Method	Standard Test Methods for Foot Protections	ASTM F2412
Gloves — Arc Rated	Standard Test Method for Determining Arc Ratings of Hand Protective Products Developed and Used for Electrical Arc Flash Protection	ASTM F2675/F2675M
Gloves — Leather Protectors	Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens	ASTM F696
Gloves — Rubber Insulating	Standard Specification for Rubber Insulating Gloves	ASTM D120
Gloves and Sleeves — In-Service Care	Standard Specification for In-Service Care of Insulating Gloves and Sleeves	ASTM F496
Head Protection — Hard Hats	~~Industrial~~ American National Standard for Head Protection	ANSI/ISEA Z89.1
Rainwear — Arc Rated	Standard Specification for Arc and Flame Resistant Rainwear	ASTM F1891
Rubber Protective Products — Visual Inspection	Standard Guide for Visual Inspection of Electrical Protective Rubber Products	ASTM F1236
Sleeves — Insulating	Standard Specification for Rubber Insulating Sleeves	ASTM D1051

Supplemental Information

File Name	Description	Approved
attachment_for_FR-53_Table_130.7_C_14_.docx	attachment for FR-53. For staff use.	

Submitter Information Verification

Committee:

Submittal Date: Wed Aug 15 18:26:24 EDT 2018

Committee Statement

Committee Statement:	An informational note is added to 130.7(C)(14)(b)(3) to provide users of the document with information regarding the certification process for suppliers and manufacturers. The title of the ASTM 1506, ANSI/ISEA Z87.1 and ANSI/ISEA Z89.1 document is updated in Table 130.7(C)(14)
Response Message:	FR-53-NFPA 70E-2018

Public Input No. 256-NFPA 70E-2018 [Section No. 130.7(C)(14)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 54-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Detail FR-55

(15) Arc Flash PPE Category Method.

The requirements of 130.7(C)(15) shall apply when the arc flash PPE category method is used for the selection of arc flash PPE.

(a) *Alternating Current (ac) Equipment.* When the arc flash risk assessment performed in accordance with 130.5 indicates that arc flash PPE is required and the arc flash PPE category method is used for the selection of PPE for ac systems in lieu of the incident energy analysis of 130.5(G), Table 130.7(C)(15)(a) shall be used to determine the arc flash PPE category. The estimated maximum available fault current, maximum fault-clearing times, and minimum working distances for various ac equipment types or classifications are listed in Table 130.7(C)(15)(a). An incident energy analysis shall be required in accordance with ~~130.5~~ 130.5(G) for the following:

(1) Power systems with greater than the estimated maximum available fault current

(2) Power systems with longer than the maximum fault clearing times

(3) Less than the minimum working distance

(b) *Direct Current (dc) Equipment.* When the arc flash risk assessment performed in accordance with ~~130.5~~ 130.5(G) indicates that arc flash PPE is required and the arc flash PPE category method is used for the selection of PPE for dc systems in lieu of the incident energy analysis of 130.5(G), Table 130.7(C)(15)(b) shall be used to determine the arc flash PPE category. The estimated maximum available fault current, maximum arc duration, and working distances for dc equipment are listed in 130.7(C)(15)(b). An incident energy analysis shall be required in accordance with ~~130.5~~ 130.5(G) for the following:

(1) Power systems with greater than the estimated maximum available fault current

(2) Power systems with longer than the maximum arc duration

(3) Less than the minimum working distance

Informational Note No.1: The arc flash PPE category of the protective clothing and equipment is generally based on determination of the estimated exposure level.

Informational Note No.2: In most cases, closed doors do not provide enough protection to eliminate the need for PPE in situations in which the state of the equipment is known to readily change (e.g., doors open or closed, rack in or rack out).

(c) *Protective Clothing and Personal Protective Equipment (PPE).* Once the arc flash PPE category has been identified from Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b), Table 130.7(C)(15)(c) shall be used to determine the required PPE ~~for the task~~ . Table 130.7(C)(15)(c) lists the requirements for PPE based on arc flash PPE categories 1 through 4. This clothing and equipment shall be used when working within the arc flash boundary. The use of PPE other than or in addition to that listed shall be permitted provided it meets 130.7(C)(7) .

Informational Note No. 1: See Informative Annex H for a suggested simplified approach to ensure adequate PPE for electrical workers within facilities with large and diverse electrical systems.

Informational Note No. 2: The PPE requirements of this section are intended to protect a person from arc flash hazards. While some situations could result in burns to the skin even with the protection described in Table 130.7(C)(15)(c), burn injury should be reduced and survivable. Due to the explosive effect of some arc events, physical trauma injuries could occur. The PPE requirements of this section do not address protection against physical trauma other than exposure to the thermal effects of an arc flash.

Informational Note No. 3: The arc rating for a particular clothing system can be obtained from the arc-rated clothing manufacturer.

Table 130.7(C)(15)(a) Arc Flash PPE Categories for Alternating Current (ac) Systems

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Panelboards or other equipment rated 240 volts and below Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	1	485 mm (19 in.)
Panelboards or other equipment rated greater than 240 volts and up to 600 volts	2	900 mm

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(3 ft)
600-volt class motor control centers (MCCs)	2	1.5 m
Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(5 ft)
600-volt class ~~motor control centers (~~ MCCs~~)~~	4	4.3 m
Parameters: Maximum of 42 kA available fault current; maximum of 0.33 sec (20 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(14 ft)
600-volt class switchgear (with power circuit breakers or fused switches) and 600-volt class switchboards	4	6 m
Parameters: Maximum of 35 kA available fault current; maximum of up to 0.5 sec (30 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(20 ft)
Other 600-volt class (277 volts through 600 volts, nominal) equipment	2	1.5 m
Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(5 ft)
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV	4	12 m
Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)		(40 ft)
Metal-clad switchgear, 1 kV through 15 kV	4	12 m
Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)		(40 ft)
~~Arc-resistant switchgear 1 kV through 15 kV [for clearing times of less than 0.5 sec (30 cycles) with an available fault current not to exceed the arc-resistant rating of the equipment], and metal-enclosed interrupter switchgear, fused or unfused of arc-resistant-type construction, 1 kV through 15 kV~~	~~N/A (doors closed)~~	~~N/A (doors closed)~~
~~Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)~~	~~4 (doors open)~~	~~12 m (40 ft)~~
Metal enclosed interrupter switchgear, fused or unfused type construction, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Other equipment 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Arc-resistant equipment up to 600-volt class Parameters: DOORS CLOSED and SECURED; with an available fault current and a fault clearing time that does not exceed the arc-resistant rating of the equipment*	N/A	N/A
Arc-resistant equipment 1 kV through 15 kV Parameters: DOORS CLOSED and SECURED; with an available fault current and a fault clearing time that does not exceed the arc-resistant rating of the equipment*	N/A	N/A

N/A: Not applicable

Note:

For equipment rated 600 volts and below and protected by upstream current-limiting fuses or current-limiting molded case circuit breakers sized at 200 amperes or less, the arc flash PPE category can be reduced by one number but not below arc flash PPE category 1.

*For DOORS OPEN refer to the corresponding non-arc-resistant equipment section of this table.

Informational Note No. 1 to Table 130.7(C)(15)(a): The following are typical fault clearing times of overcurrent protective devices:

(1) 0.5 cycle fault clearing time is typical for current-limiting fuses and current-limiting molded case circuit breakers when the fault current is within the current limiting range.

(2) 1.5 cycle fault clearing time is typical for molded case circuit breakers rated less than 1000 volts with an instantaneous integral trip.

(3) 3.0 cycle fault clearing time is typical for insulated case circuit breakers rated less than 1000 volts with an instantaneous integral trip or relay operated trip.

(4) 5.0 cycle fault clearing time is typical for relay operated circuit breakers rated 1 kV to 35 kV when the relay operates in the instantaneous range (i.e., “no intentional delay”).

(5) 20 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay for motor inrush.

(6) 30 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay without instantaneous trip.

Informational Note No. 2 to Table 130.7(C)(15)(a): See Table 1 of IEEE 1584™ , *Guide for Performing Arc Flash Hazard Calculations*, for further information regarding Notes b list items (2) through d (4) in Informational Note No. 1 .

Informational Note No. 3 to Table 130.7(C)(15)(a): An example of a standard that provides information for arc-resistant switchgear equipment referred to in Table 130.7(C)(15)(a) is IEEE C37.20.7, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 52 kV for Internal Arcing Faults*.

Informational Note No. 4 to Table 130.7(C)(15)(a): See O.2.4(9) for information on arc-resistant equipment.

Table 130.7(C)(15)(b) Arc Flash PPE Categories for Direct Current (dc) Systems

Equipment	Arc Flash PPE Category	Arc Flash Boundary
Storage batteries, dc switchboards, and other dc supply sources		
Parameters: Greater than or equal to 100 V volts and less than or equal to 250 V volts		
Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 4 kA	2	900 mm
		(3 ft)
Available fault current greater than or equal to 4 kA and less than 7 kA	2	1.2 m
		(4 ft)
Available fault current greater than or equal to 7 kA and less than 15 kA	3	1.8 m
		(6 ft)
Storage batteries, dc switchboards, and other dc supply sources		
Parameters: Greater than 250 V volts and less than or equal to 600 V volts		
Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 1.5 kA	2	900 mm

Equipment	Arc Flash PPE Category	Arc Flash Boundary
		(3 ft)
Available fault current greater than or equal to 1.5 kA and less than 3 kA	2	1.2 m
		(4 ft)
Available fault current greater than or equal to 3 kA and less than 7 kA	3	1.8 m
		(6 ft.)
Available fault current greater than or equal to 7 kA and less than 10 kA	4	2.5 m
		(8 ft)

Notes:

(1) Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:

(a) Be evaluated for electrolyte protection

Informational Note: ASTM F1296, *Standard Guide for Evaluating Chemical Protective Clothing*, contains information on evaluating apparel for protection from electrolyte.

(b) Be arc rated

Informational Note: ASTM F1891, *Standard Specification for Arc and Flame Resistant Rainwear*, contains information on evaluating arc-rated apparel.

(2) A two-second arc duration is assumed if there is no overcurrent protective device (OCPD) or if the fault clearing time is not known. If the fault clearing time is known and is less than 2 seconds, an incident energy analysis could provide a more representative result.

Informational Note No. 1: When determining available fault current, the effects of cables and any other impedances in the circuit should be included. Power system modeling is the best method to determine the available short-circuit current at the point of the arc. Battery cell short-circuit current can be obtained from the battery manufacturer. See ~~Informative Annex~~ D.5 for the basis for table values and alternative methods to determine dc incident energy. Methods should be used with good engineering judgment.

Informational Note No. 2: The methods for estimating the dc arc flash incident energy that were used to determine the categories for this table are based on open-air incident energy calculations. Open-air calculations were used because many battery systems and other dc process systems are in open areas or rooms. If the specific task is within an enclosure, it would be prudent to consider additional PPE protection beyond the value shown in this table. ~~Research with ac arc flash has shown a multiplier of as much as 3× for arc-in-a-box [508 mm (20 in.) cube] versus open air. Engineering judgment is necessary when reviewing the specific conditions of the equipment and task to be performed, including the dimensions of the enclosure and the working distance involved.~~

Table 130.7(C)(15)(c) Personal Protective Equipment (PPE)

Arc-Flash PPE Category	PPE
1	**Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm^2 (16.75 J/cm^2)**[a]
	Arc-rated long-sleeve shirt and pants or arc-rated coverall
	Arc-rated face shield[b] or arc flash suit hood
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR)[d]
	Leather footwear[e] (AN)

Arc-Flash PPE Category	PPE
2	**Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm^2 (33.5 J/cm^2)[a]**
	Arc-rated long-sleeve shirt and pants or arc-rated coverall
	Arc-rated flash suit hood or arc-rated face shield[b] and arc-rated balaclava
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR)[d]
	Leather footwear[e]
3	**Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 25 cal/cm^2 (104.7 J/cm^2)[a]**
	Arc-rated long-sleeve shirt (AR)
	Arc-rated pants (AR)
	Arc-rated coverall (AR)
	Arc-rated arc flash suit jacket (AR)
	Arc-rated arc flash suit pants (AR)
	Arc-rated arc flash suit hood
	Arc-rated gloves or rubber insulating gloves with leather protectors (SR)[d]
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Leather footwear[e]
4	**Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm^2 (167.5 J/cm^2)[a]**
	Arc-rated long-sleeve shirt (AR)
	Arc-rated pants (AR)
	Arc-rated coverall (AR)
	Arc-rated arc flash suit jacket (AR)
	Arc-rated arc flash suit pants (AR)
	Arc-rated arc flash suit hood
	Arc-rated gloves or rubber insulating gloves with leather protectors (SR)[cd]
	Arc-rated jacket, parka, high-visibility apparel, rainwear, or hard hat liner (AN)
	Protective Equipment
	Hard hat
	Safety glasses or safety goggles (SR)
	Hearing protection (ear canal inserts)[c]
	Leather footwear[e]

AN: As needed (optional). AR: As required. SR: Selection required.

[a] *Arc rating* is defined in Article 100.

[b]Face shields are to have wrap-around guarding to protect not only the face but also the forehead, ears, and neck, or, alternatively, an arc-rated arc flash suit hood is required to be worn.

[c]Other types of hearing protection are permitted to be used in lieu of or in addition to ear canal inserts provided they are worn under an arc-rated arc flash suit hood.

[d]~~If rubber insulating gloves with leather protectors are used, additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.~~ Rubber insulating gloves with leather protectors provide arc flash protection in addition to shock protection. Higher class rubber insulating gloves with leather protectors, due to their increased material thickness, provide increased arc flash protection.

[e] Footwear other than leather or dielectric shall be permitted to be used provided it has been tested to demonstrate no ignition, melting or dripping at the minimum arc rating for the respective arc flash PPE category.

Supplemental Information

File Name	Description	Approved
attachment_for_FR54_Table_130.7_C_15_a_.docx	attachment for FR 54 Table 130.7(C)(15)(a)--For staff use	
attachement_for_FR55_Table_130.7_C_15_c_.docx	Ballotable detail table for FR-55. For staff use.	

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 09:13:45 EDT 2018

Committee Statement

Committee Statement: The reference to 130.5 was amended to 130.5(G) for accuracy.

The phrase “for the task” was removed from 130.7(C)(15)(c) as the Arc Flash PPE Category Method is no longer a task based method.

A statement permitting the use of other or additional PPE was added 130.7(C)(15)(c) provided such PPE meets the requirements of 130.7(C).

This is main FR with a ballotable detail (FR-55) for Table 130.7(C)(15)(c).

The following sections are added to Table 130.7(C)(15)(a) to update the applicability of Arc Flash PPE Category Method with changing technology:

The existing “arc resistant switchgear” reference is revised to create two general “arc resistant equipment” categories.

The phrase “DOORS CLOSED and SECURED” is added to the parameters of each of the arc resistant sections to clarify that each of these sections applies only when the equipment doors are closed. A note is added below the table to clarify how to apply a “door open” situation for these sections.

A new Table Note is added to clarify that N/A means “Not Applicable”

“Current limiting molded case circuit breaker” equipment type is added to Informational Table Note list item (1) to clarify that the identified typical fault clearing time is also applicable to that equipment. The words "molded case" were added to the table note for clarity.

Existing Informational Note No. 1 is relocated to be part of the Informational Note to the Table, and the reference to the list in the note is editorially corrected from “Notes b through d” to “Items (2) through (4).” Existing Informational Note No. 2 is modified to address the title of IEEE C37.20.7. The informational notes are renumbered as Informational Note No. 1, 2 and 3 for clarity.

A new Informational Note No. 3 is added to reference Informative Annex O, O.2.4(9) to provide clarity for the user with respect to arc resistant equipment.

Table 130.7(C)(15)(b) - The change to Informational Note No. 2 aligns with the action taken in 2018 version in Annex D.5.1. The informational note continues to suggest the consideration for additional PPE where tasks are performed within an enclosure.

Response Message: FR-54-NFPA 70E-2018

Public Input No. 206-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 316-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 200-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 56-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 221-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 58-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 196-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 49-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 212-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 57-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Public Input No. 319-NFPA 70E-2018 [Section No. 130.7(C)(15)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Mohla, Daleep C.

Table 130.7(C)(15)(c) Personal Protective Equipment (PPE) Add a new Note c to Table 130.7(C)(15)(c) as follows: The outerwear arc rating shall not be required to be rated for the estimated incident energy if it is not used as part of a system arc rating. Re-identify existing note c as d, note d as e, and e as f. Add the letter c after Arc-rated jacket, parka... in four places in Table 130.7(C)(15)(c).

First Revision No. 67-NFPA 70E-2018 [Section No. 130.7(D)(1)]

(1) Insulated Tools and Equipment.

~~Employees shall use insulated tools or handling equipment, or both, when working inside~~ Tools and handling equipment used within the restricted approach boundary ~~of exposed energized electrical conductors or circuit parts where tools or handling equipment might make unintentional contact~~ shall be insulated . Insulated tools shall be protected from damage to the insulating material.

Informational Note: See ~~130.4(D)~~ 130.4(E) , Shock Protection Boundaries.

(a) *Requirements for Insulated Tools.* The following requirements shall apply to insulated tools:

(1) Insulated tools shall be rated for the voltages on which they are used.

(2) Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.

(3) Insulated tools and equipment shall be inspected prior to each use. The inspection shall look for damage to the insulation or damage that can limit the tool from performing its intended function or could increase the potential for an incident (e.g., damaged tip on a screwdriver).

(b) *Fuse or Fuseholder Handling Equipment.* Fuse or fuseholder handling equipment, insulated for the circuit voltage, shall be used to remove or install a fuse if the fuse terminals are energized.

(c) *Ropes and Handlines.* Ropes and handlines used within the limited approach boundary shall be nonconductive.

(d) *Fiberglass-Reinforced Plastic Rods.* Fiberglass-reinforced plastic rod and tube used for live-line tools shall meet the requirements of applicable portions of electrical codes and standards dealing with electrical installation requirements.

Informational Note: For further information concerning electrical codes and standards dealing with installation requirements, refer to ASTM F711, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools.*

(e) *Portable Ladders.* Portable ladders shall have nonconductive side rails when used within the limited approach boundary or where the employee or ladder could contact exposed energized electrical conductors or circuit parts. Nonconductive ladders shall meet the requirements of applicable state, federal, or local codes and standards.

Informational Note: The standards listed in Table 130.7(G), Informational Note are examples of standards that contain information on portable ladders.

(f) ~~*Protective Shields.* Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries~~ *Barriers* . Exposed energized electrical conductors or circuit parts operating at 50 volts or more shall be guarded by a barrier in accordance with 130.7(D)(1)(g) through 130.7(D)(1)(i) while an employee is working within the ~~limited~~ restricted approach boundary of ~~energized~~ those conductors or circuit parts ~~that might be unintentionally contacted or where dangerous electric heating or arcing might occur. When normally enclosed energized conductors or circuit parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with the energized conductors or circuit parts~~ . Barriers shall be supported to remain in place and shall prevent contact by a person, tool, or equipment.

(g) *Rubber Insulating Equipment.* Rubber insulating equipment used for protection from unintentional contact with energized conductors or circuit parts shall be rated for the voltage and shall meet the requirements of applicable state, federal, or local codes and standards.

Informational Note: The standards listed in Table 130.7(G), Informational Note are examples of standards that contain information on rubber insulating equipment.

(h) *Voltage-Rated Plastic Guard Equipment.* Plastic guard equipment for protection of employees from unintentional contact with energized conductors or circuit parts, or for protection of employees or energized equipment or material from contact with ground, shall be rated for the voltage and shall meet the requirements of applicable state, federal, or local codes and standards.

Informational Note: The standards listed in Table 130.7(G), Informational Note are examples of standards that contain information on voltage-rated plastic guard equipment.

(i) *Physical or Mechanical Barriers.* Physical or mechanical (field-fabricated) barriers shall be installed no closer than the ~~limited~~ restricted approach boundary distance given in ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) and ~~Table 130.4(D)(b)~~ Table 130.4(E)(b) . While the barrier is being installed, the ~~limited~~ restricted approach boundary distance specified in ~~Table 130.4(D)(a)~~ Table 130.4(E)(a) and ~~Table 130.4(D)(b)~~ Table 130.4(E)(b) shall be maintained, or the energized conductors or circuit parts shall be placed in an electrically safe work condition.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 12:54:15 EDT 2018

Committee Statement

Committee Statement: The language in 130.7(D)(1) regarding the requirement to use insulated tools and equipment is simplified.

130.7(D)(1)(f) is retitled “Barriers” and the language regarding the use of barriers is simplified and the applicable boundary is changed from the limited approach boundary to the restricted approach boundary to clarify the difference between the use of barriers per 130.7(D) and barricades per 130.7(E). 130.7(D)(1)(g) and 130.7(D)(1)(h) are revised to require the rubber insulating equipment and the plastic guard equipment to be rated for the voltage.

The approach boundary in 130.7(D)(1)(i) is changed from limited to restricted to clarify the difference between the use of barriers per 130.7(D) and barricades per 130.7(E).

Response Message: FR-67-NFPA 70E-2018

Public Input No. 77-NFPA 70E-2018 [Section No. 130.7(D)(1)]

Public Input No. 139-NFPA 70E-2018 [Section No. 130.7(D)(1)]

Public Input No. 78-NFPA 70E-2018 [Section No. 130.7(D)(1)]

Public Input No. 260-NFPA 70E-2018 [Section No. 130.7(D)(1)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
21 Affirmative All
3 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Affirmative with Comment

Gallo, Ernest J.

Comments: NFPA 70E, in 130.7(D)(1)(f), should recognize the difference in human physiological response to ac vs. dc voltages. The human body is able to tolerate greater levels of dc voltage as opposed to ac voltage. This has been demonstrated by decades of research on the subject. Perhaps NFPA could work with OSHA to obtain such recognition in the OSHA requirements.

Gray, Bobby J.

I support the changes to 130.7(D)(1), but the proposed wording to (f) needs some work. The language applies to work inside the RAB after a barrier has been placed over exposed energized parts. But, energized parts that are suitably guarded with a barrier is no longer exposed and no RAB exists. I will submit a PC to address my concern.

White, James R.

All good changes and should make this easier to use in the field.

Negative with Comment

Wolf, Jason

I support the revisions to insulated tools 130.7(D)(1) and the revisions to insulating equipment and guarding, 130.7(D)(1)(g), (h) & (i). However, 130.7(D)(1)(f) barriers, does not read correctly. The text relating to unintentional contact has been removed, requiring all exposed energized electrical conductors to be guarded by a barrier. This is not feasible for all activities, such as troubleshooting, where the employee is in the restricted approach boundary and would need to expose the circuit parts. I don’t think this was our intent.

First Revision No. 57-NFPA 70E-2018 [Section No. 130.7(E)(4)]

130.12 Cutting, Removing, or Rerouting of Conductors.

Where conductors are de-energized in order to cut, remove, or reroute them and conductor terminations are not within sight, such as where they are in a junction or pull box, additional steps to verify absence of voltage or identify the conductors shall be taken prior to cutting, removing, or rerouting the conductors.

Informational Note: Additional steps to be taken include, but are not limited to, remotely spiking the conductors ~~and~~ , pulling the conductors to visually verify movement, remotely cutting the conductors, or other approved methods . Nonshielded conductors could be additionally verified with a noncontact test instrument, and shielded conductors could be verified with devices to that identify the conductors.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 10:49:06 EDT 2018

Committee Statement

Committee Statement: Section 130.7(E)(4) is relocated to a NEW 130.11 as the requirements are not related to alerting techniques.

Other examples of additional steps to identify conductors were added to the informational note.

Response Message: FR-57-NFPA 70E-2018 Current examples were not deleted or modified as these methods are examples only, and each has an appropriate use.

Public Input No. 389-NFPA 70E-2018 [New Section after 130.10]

Public Input No. 136-NFPA 70E-2018 [Section No. 130.7(E)(4)]

Public Input No. 388-NFPA 70E-2018 [Section No. 130.7(E)(4)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Negative with Comment

Wolf, Jason

The negative vote is related to revising (improving) the Informational Note to clarify that movement of “deenergized conductors” is one method of practical and acceptable means to identify conductors at both ends. Movement or pulling of energized conductors is not implied here. Adjusting the Informational Note to include the word “deenergized” would be helpful as follows: Informational Note: Additional steps to be taken include, but are not limited to, remotely spiking the conductors and, pulling the deenergized conductors to visually verify movement, remotely cutting the conductors, or other approved methods. Non-shielded conductors could be additionally verified with a noncontact test instrument, and shielded conductors could be verified with devices to that identify the conductors. Qualified persons should be aware of multiple methods that can be used to identify conductors that are not simultaneously visible at both ends, including pulling on them in some instances, definitely not all instances. NECA will develop a comment that helps clarify the intent of this well justified informational note.

First Revision No. 58-NFPA 70E-2018 [Section No. 130.7(G)]

(G) Standards for Other Protective Equipment.

Other protective equipment required in 130.7(D) shall conform to the applicable state, federal, or local codes and standards.

Informational Note: The standards listed in Table 130.7(G), which is part of this Informational Note, are examples of standards that contain information on other protective equipment.

Table 130.7(G) Informational Note: Standards on Other Protective Equipment

Subject	Document	Document Number
Arc Protective Blankets	Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards	ASTM F2676
Blankets	Standard Specification for Rubber Insulating Blankets	ASTM D1048
Blankets — In-service Care	Standard Specification for In-Service Care of Insulating Blankets	ASTM F479
Blankets — Selection, Care, and Use	Standard Guide for Selection, Care, and Use of Arc Protective Blankets	ASTM F3272
Covers	Standard Specification for Rubber Insulating Covers	ASTM D1049
Fiberglass Rods — Live Line Tools	Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools	ASTM F711
Insulated Hand Tools	Standard Specification for Insulated and Insulating Hand Tools	ASTM F1505
Ladders	American National Standard for Ladders — Wood — Safety Requirements	ANSI/ ASC A14.1
	American National Standard for Ladders — Fixed — Safety Requirements	ANSI /ASC A14.3
	American National Standard Safety Requirements for Job Made Wooden Ladders	ANSI ASC A14.4
	American National Standard for Ladders-— - Portable Reinforced Plastic — Safety Requirements	ANSI ASC A14.5
Line Hose	Standard Specification for Rubber Insulating Line Hoses	ASTM D1050
Line Hose and Covers — In-service Care	Standard Specification for In-Service Care of Insulating Line Hose and Covers	ASTM F478
Plastic Guard	Standard Test Methods and Specifications for Electrically Insulating Plastic Guard Equipment for Protection of Workers	ASTM F712
Sheeting	Standard Specification for PVC Insulating Sheeting	ASTM F1742
	Standard Specification for Rubber Insulating Sheeting	ASTM F2320
Safety Signs and Tags	Series of Standards for Safety Signs and Tags	ANSI Z535
Shield Performance on Live Line Tool	Standard Test Method for Determining the Protective Performance of a Shield Attached on Live Line Tools or on Racking Rods for Electric Arc Hazards	ASTM F2522
Temporary Protective Grounds — In-service Testing	Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-energized Electric Power Lines and Equipment	ASTM F2249
Temporary Protective Grounds — Test Specification	Standard Specification for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment	ASTM F855

Supplemental Information

File Name	Description	Approved
attachment_for_FR58_Table_130.7_G_.docx	attachment for FR58. For staff use.	

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 10:57:56 EDT 2018

Committee Statement

Committee Statement: ASTM F3272, a recently approved standard for Selection, Care, and Use of Arc Protective Blankets is added to Table 130.7(G).

Response Message: FR-58-NFPA 70E-2018

Public Input No. 261-NFPA 70E-2018 [Section No. 130.7(G)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 66-NFPA 70E-2018 [Section No. 130.8(F)(3)]

(3) Equipment Grounding.

If any vehicle or mechanical equipment is capable of having parts of its structure elevated ~~near~~ within the limited approach boundary of exposed movable conductors of energized overhead lines and is intentionally grounded, employees working on the ground near the point of grounding shall not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades, dielectric overshoe footwear, or insulation, shall be taken to protect employees from hazardous ground potentials (step and touch potential).

Informational Note: Upon contact of the elevated structure with the energized lines, hazardous ground potentials can develop within a few feet or more outward from the grounded point.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 12:21:42 EDT 2018

Committee Statement

Committee Statement: This First Revision provides additional clarity related to any vehicle or mechanical equipment capable of having parts of its structure elevated in the vicinity of energized overhead lines that are intentionally grounded.

Response Message: FR-66-NFPA 70E-2018

Public Input No. 24-NFPA 70E-2018 [Section No. 130.8(F)(3)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gray, Bobby J.

It seems there should be "to" inserted before "within."

First Revision No. 69-NFPA 70E-2018 [Section No. 250.3]

250.3 Safety Grounding Equipment.

(A) ~~Visual~~ Inspection .

Personal protective ground cable sets shall be inspected for cuts in the protective sheath and damage to the conductors. Clamps and connector strain relief devices shall be checked for tightness. These inspections shall be made at intervals thereafter as service conditions require, but in no case shall the interval exceed 1 year.

(B) Testing.

Prior to being returned to service, temporary protective grounding equipment that has been repaired or modified shall be tested. Temporary protective grounding equipment shall be tested as service conditions require, but in no case shall the interval exceed 3 years.

Informational Note: Guidance for inspecting and testing safety grounds is provided in ASTM F2249, *Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-~~Energized~~ energized Electric Power Lines and Equipment*.

(C) Grounding and Testing Devices.

Grounding and testing devices shall be stored in a clean and dry area. Grounding and testing devices shall be properly inspected and tested before each use.

Informational Note: Guidance for testing of grounding and testing devices is provided in Section 9.5 of IEEE C37.20.6, *Standard for 4.76 kV to 38 kV Rated Ground and Test Devices Used in Enclosures*.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 13:52:34 EDT 2018

Committee Statement

Committee Statement: 250.3 (A) “Visual” changed to “Inspection” for clarity. The term aligns with language in ASTM F2249, and more closely describes the inspections contained within 250.3 (A), which contains both visual and mechanical inspections.

250.3 (B) added 3-year maximum interval as proposed by submitter. The term “medium voltage equipment” was removed so that all classes of equipment (low-, medium-, and high-voltage) are included.

Response Message: FR-69-NFPA 70E-2018

Public Input No. 137-NFPA 70E-2018 [Section No. 250.3(B)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
22 Affirmative All
1 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

Wolf, Jason

Affirmative with Comment

White, James R.

Since OSHA does not provide a real test interval, it falls on this committee.

Negative with Comment

Barrios, Louis A.

Neither the committee, nor the submitter as indicated by the committee statement, provided any substantiation for the 3 year maximum interval for testing temporary protective grounding equipment.

Pace, David A.

The change to 250.3(B) requiring testing every 3 years has no technical substantiation, and conflicts with ASTM F2249-03 (reaffirmed 2015)which states in section 4.5, "The test procedures in this specification should be performed at a time interval established by the user to ensure that defective grounding jumper assemblies are detected and removed from service in a timely manner." Requiring testing every three years is not necessary in many cases, and is not consistent with the ASTM standard governing this testing. The test frequency should be established by the employer as the ASTM standard states.

First Revision No. 70-NFPA 70E-2018 [Section No. 310.1]

310.1 Scope.

The requirements of this article shall apply to the electrical safety-related work practices used in the types of electrolytic cell areas.

Informational Note No. 1: See Informative Annex L for a typical application of safeguards in the cell line working zone.

Informational Note No. 2: For further information about electrolytic cells, see *NFPA 70*, *National Electrical Code*, Article 668.

Note: IEEE 463, *Electrical Safety Practices in Electrolytic Cell Line Working Zones* , is an example of a standard that contains additional information related to electrical safety-related work practices.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:02:13 EDT 2018

Committee Statement

Committee Statement: IEEE Std 463 is a resource document related to electrolytic cell line safety.

Response Message: FR-70-NFPA 70E-2018

Public Input No. 202-NFPA 70E-2018 [Section No. 310.1]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: Identify "Note" as "Informational Note No. 3:" in keeping with the NEC Style Manual.

First Revision No. 71-NFPA 70E-2018 [Section No. 310.5(C) [Excluding any Sub-Sections]]

The requirements of 130.5, Arc Flash Risk Assessment, shall not ~~apply to~~ be required for electrolytic cell line ~~work~~ working zones.

Submitter Information Verification

Committee:
Submittal Date: Thu Aug 16 14:04:48 EDT 2018

Committee Statement

Committee Statement: This revision editorially modifies arc flash risk assessment requirements for clarity.
Response Message: FR-71-NFPA 70E-2018

Public Input No. 382-NFPA 70E-2018 [Section No. 310.5(C) [Excluding any Sub-Sections]]

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Dyson, Thomas B.
Hayes, James B.

Affirmative All
Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.

McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 73-NFPA 70E-2018 [Section No. 320.3(A)(2)]

(2) Battery Risk Assessment.

Prior to any work on a battery system, a risk assessment shall be performed to identify the chemical, electrical shock, and arc flash hazards and assess the risks associated with the type of tasks to be performed.

Informational Note: For an example of a risk assessment method for work on batteries, see F.7 and Figure F.7 .

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:23:53 EDT 2018

Committee Statement

Committee Statement: The standard does not provide guidance to users on how to select PPE when a risk assessment is performed on tasks involving multiple hazards. This addition to Annex F provides one method for determining appropriate PPE.

Response Message: FR-73-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: Editorial revise the Informational Note as follows for clarity and completeness: "Informational Note: For an example of a risk assessment method for work on batteries, see Informative Annex F.7 and Figure F.7."

First Revision No. 74-NFPA 70E-2018 [Section No. 320.3(B)(2)]

(2) Activities That Do Not Include Handling of Electrolyte.

Employees performing any activity not involving the handling of electrolyte shall wear safety glasses.

Informational Note: Battery maintenance activities usually do not involve handling electrolyte. Batteries ~~with solid electrolyte~~ that are hermetically sealed (such as most lithium batteries) or immobilized electrolyte (such as valve-regulated lead acid batteries) present little or no electrolyte hazard. Most modern density meters expose a worker to a quantity of electrolyte too minute to be considered hazardous, if at all. Such work would not be considered handling electrolyte. However, if specific gravity readings are taken using a bulb hydrometer, the risk of exposure is higher — this could be considered to be handling electrolyte, and the requirements of 320.3(B)(1) would apply.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:27:32 EDT 2018

Committee Statement

Committee Statement: Most Lithium batteries have a liquid electrolyte, but the cells are hermetically sealed and there is not an exposure hazard. The change is to correct an inaccurate statement.

Response Message: FR-74-NFPA 70E-2018

Public Input No. 338-NFPA 70E-2018 [Section No. 320.3(B)(2)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 75-NFPA 70E-2018 [Section No. 320.3(C)]

(C) ~~Testing, Maintenance, and Operation.~~ Tools and Equipment.

(1) Handles.

Tools and equipment for work on batteries shall be equipped with handles listed as insulated for the maximum working voltage.

(2) Contact.

Battery terminals and all electrical conductors shall be kept clear of unintended contact with tools, test equipment, liquid containers, and other foreign objects.

(3) Nonsparking Tools.

Nonsparking tools shall be required when the risk assessment required by 110.5(H) ~~110.1(H)~~ justifies their use.

~~**(1)** Direct-Current Ground-Fault Detection.~~

~~Ground-fault detection shall be based on the type of dc grounding systems utilized.~~

~~Informational Note: Not all battery systems have dc ground-fault detection systems. For personnel safety reasons, it is important to understand the grounding methodology being used and to determine the appropriate manner of detecting ground faults. If an unintended ground develops within the system (e.g., dirt and acid touching the battery rack), it can create a short circuit that could cause a fire. Commonly used dc grounding systems include, but are not limited to, the following:~~

(0) ~~Type 1. An ungrounded dc system, in which neither pole of the battery is connected to ground. If an unintentional ground occurs at any place in the battery, an increased potential would exist, allowing fault current to flow between the opposite end of the battery and the ground. An ungrounded dc system is typically equipped with an alarm to indicate the presence of a ground fault.~~

(0) ~~Type 2. A solidly grounded dc system, in which either the most positive or most negative pole of the battery is connected directly to ground. If an unintentional ground occurs, it introduces a path through which fault current can flow. A ground detection system is not typically used on this type of grounded system.~~

(0) ~~Type 3. A resistance grounded dc system, which is a variation of a Type 1 system, in which the battery is connected to ground through a resistance. Detection of a change in the resistance typically enables activation of a ground-fault alarm. Introducing an unintentional ground at one point of the battery could be detected and alarmed. A second unintentional ground at a different point in the battery would create a path for short-circuit current to flow.~~

(0) ~~Type 4. A solidly grounded dc system, either at the center point or at another point to suit the load system. If an unintentional ground occurs on either polarity, it introduces a path through which short circuit current can flow. A ground detection system is not typically used on this type of grounded system.~~

~~**(1)** Tools and Equipment.~~

(0) ~~Tools and equipment for work on batteries shall be equipped with handles listed as insulated for the maximum working voltage.~~

(0) ~~Battery terminals and all electrical conductors shall be kept clear of unintended contact with tools, test equipment, liquid containers, and other foreign objects.~~

(0) ~~Nonsparking tools shall be required when the risk assessment required by 110.1(H) justifies their use.~~

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:30:04 EDT 2018

Committee Statement

Committee Statement: The existing information is addressing design and installation considerations. NFPA 70E is a work practice standard.

Response Message: FR-75-NFPA 70E-2018

Public Input No. 339-NFPA 70E-2018 [Section No. 320.3(C)(1)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 76-NFPA 70E-2018 [Definition: Field Evaluated.]

Field Evaluated.

A thorough evaluation of nonlisted or modified equipment in the field that is performed by persons or parties acceptable to the authority having jurisdiction. The evaluation approval ensures that the equipment meets appropriate codes and standards, or is similarly found suitable for a specified purpose.

Informational Note: For additional information on recommended practices and procedures for the field evaluation of nonlisted equipment, see NFPA 791 , *Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation* . For help in evaluating whether third-party entities are acceptable to an authority having jurisdiction, see NFPA 790 , *Standard for Competency of Third-Party, Field Evaluation Bodies* .

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:33:21 EDT 2018

Committee Statement

Committee Statement: An informational note is added to reference NFPA 790 and 791 for information on field evaluations.

Response Message: FR-76-NFPA 70E-2018

Public Input No. 232-NFPA 70E-2018 [Definition: Field Evaluated.]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 77-NFPA 70E-2018 [Section No. 350.9]

350.9 Energy Thresholds.

Energy exposure levels shall not exceed those identified in the following list unless appropriate controls are implemented as approved by the ESA:

(1) AC: 50-~~Volts~~ volts and 5 milliamperes

(2) DC: 100-~~Volts~~ volts and 40 milliamperes

(3) Capacitive systems:

a. 100-~~Volts~~ volts and ~~100 Joules~~ 1 joule of stored energy

b. 400-~~Volts~~ volts and ~~1.0 Joule~~ 25 joules of stored energy

c. ~~0.25 Joules~~ Less than 100 volts and 100 joules of stored energy

Informational Note: This information is extracted from the Department of Energy, ~~(~~*DOE*~~)~~ *Electrical Safety Handbook*, DOE-HDBK-1092.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:42:03 EDT 2018

Committee Statement

Committee Statement: This change corrects an error from the 2018 edition. The change accurately reflects the information in the resource document.

Response Message: FR-77-NFPA 70E-2018

Public Input No. 231-NFPA 70E-2018 [Section No. 350.9]

Public Input No. 297-NFPA 70E-2018 [Section No. 350.9]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
22 Affirmative All
2 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Barrios, Louis A.

The way this information is presented is not clear. Possibly a graph, or the values expressed as ranges instead of absolutes would be more explanatory.

Gallo, Ernest J.

Comments: There is an inconsistency between 350.9(3), Energy Thresholds, and 360.3, Stored Energy Hazard Threshold. Specifically, 350.9(3)(b) should be 0.25 joules. The two requirements should be correlated. Interestingly, this section makes a distinction between ac and dc voltages, items (1) and (20, respectively. This is not the case in Sections 130.1, 130.4 and 130.7(D)(1), but these sections should also distinguish between the physiological effects of ac versus dc voltages.

Negative with Comment

Niemira, James K.

The text does NOT correctly quote the values from DOE-HDBK-1092-2013 which ARE correctly cited in new section 360.3; section 350.9 needs to be reconciled with DOE-HDBK-1092 and new section 360.3. The energy threshold at more than 400 volts is 0.25 joules, not 25 joules. The "more than" and "less than" indications should also be included as in the DOE-HDBK-1092. See Table D-1 on p. D-4 and Table D-3 on p. D-6 of DOE-HDBK-1092-2013. Correct values should read: a. more than 100 volts volts and more than 1.0 joules of stored energy b. more than 400 volts volts and more than 0.25 joules of stored energy c. Less than 100 volts and more than 100 joules of stored energy

First Revision No. 81-NFPA 70E-2018 [Section No. A.3.1]

A.3.1 ANSI Publications.

American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI/ASC A14.1, *American National Standard for Ladders — Wood — Safety Requirements,* 2007.

ANSI/ASC A14.3, *American National Standard for Ladders — Fixed — Safety Requirements,* 2008.

ANSI/ASC A14.4, *American National Standard Safety Requirements for Job Made Wooden Ladders,* 2009.

ANSI/ASC A14.5, *American National Standard for Ladders — Portable Reinforced Plastic — Safety Requirements,* 2007.

~~ANSI Z87.1, *American National Standard for Occupational and Educational Eye and Face Protection,* 2015.~~

~~ANSI Z89.1, *American National Standard for Head Protection,* 2014.~~

ANSI C84.1, *Electric Power Systems and Equipment — Voltage Ratings (60 Hz)*, 2011.

ANSI/AIHA Z10, *American National Standard for Occupational Health and Safety Management Systems*, 2012.

ANSI Z136.1, *Standard for Safe Use of Lasers* , 2014.

ANSI/ASSE Z244.1, *Control of Hazardous Energy — Lockout/Tagout and Alternative Methods*, 2003 (R 2008).

ANSI Z535, *Series of Standards for Safety Signs and Tags,* 2011.

ANSI Z535.4, *Product Safety Signs and Tags Labels* , 2011.

~~ANSI/ISO 14001, *Environmental Management Systems — Requirements with Guidance for Use,* 2004/Corrigendum 1, 2009.~~

ANSI/NETA MTS, *Standard for Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*, 2011.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:16:11 EDT 2018

Committee Statement

Committee Statement: The reference to ANSI/ISEA 125 is added to correlate with the reference to this standard throughout NFPA 70E

Response Message: FR-81-NFPA 70E-2018

Public Input No. 277-NFPA 70E-2018 [Section No. A.3.1]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments

0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

Comments: The Committee Statement does not address the deletion of ANSI Z87.1, ANSI Z89.1 and ANSNI/ISO 14001. The "Regulations Governing The Development of NFPA Standards" requires that a Committee Statement be provided for all changes in requirements.

First Revision No. 82-NFPA 70E-2018 [Section No. A.3.2]

A.3.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O Box C700, West Conshohocken, PA 19428-2959.

ASTM D120, *Standard Specification for Rubber Insulating Gloves*, 2014a.

ASTM D1048, *Standard Specification for Rubber Insulating Blankets,*2014.

ASTM D1049, *Standard Specification for Rubber Insulating Covers,* 1998 (R ~~2010~~ 2017).

ASTM D1050, *Standard Specification for Rubber Insulating Line Hoses,* 2005 (R ~~2011~~ 2017).

ASTM D1051, *Standard Specification for Rubber Insulating Sleeves*, 2014a.

ASTM F478, *Standard Specification for In-Service Care of Insulating Line Hose and Covers*, 2014a.

ASTM F479, *Standard Specification for In-Service Care of Insulating Blankets,* 2006 (R ~~2011~~ 2017).

ASTM F496, *Standard Specification for In-Service Care of Insulating Gloves and Sleeves*, 2014a.

ASTM F696, *Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens,* 2006 (R 2011).

ASTM F711, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live Line Tools,*~~2002 (R 2013)~~ 2017 .

ASTM F712, *Standard Test Methods and Specifications for Electrically Insulating Plastic Guard Equipment for Protection of Workers,* 2006 (R 2011).

ASTM F855, *Standard Specification for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment*, ~~2015~~ 2017 .

ASTM F887, *Standard Specification for Personal Climbing Equipment*, ~~2013~~ 2016 .

ASTM F1116, *Standard Test Method for Determining Dielectric Strength of Dielectric Footwear*, 2014a.

ASTM F1117, *Standard Specification for Dielectric Footwear*, 2003 (R 2013).

ASTM F1236, *Standard Guide for Visual Inspection of Electrical Protective Rubber Products,*~~2015~~ 2016 .

ASTM F1296, *Standard Guide for Evaluating Chemical Protective Clothing*, 2015.

ASTM F1449, *Standard Guide for Industrial Laundering of Flame, Thermal, and Arc Resistant Clothing*, 2015.

ASTM F1505, *Standard Specification for Insulated and Insulating Hand Tools,*~~2015~~ 2016 .

ASTM F1506, *Standard Performance Specification for Flame Resistant and Electric Arc Rated ~~Textile Materials for Wearing Apparel for Use by Electrical~~ Protective Clothing Worn by Workers Exposed to ~~Momentary~~ Flames and Electric Arcs ~~and Related Thermal Hazards~~* , ~~2015~~ 2018 .

ASTM F1742, *Standard Specification for PVC Insulating Sheeting*, 2003 (R 2011).

ASTM F1891, *Standard Specification for Arc and Flame Resistant Rainwear,* 2012.

ASTM F1959/F1959M, *Standard Test Method for Determining the Arc Rating of Materials for Clothing,* 2014.

ASTM F2178, *Standard Test Method for Determining the Arc Rating and Standard Specification for Eye or Face Protective Products*, ~~2012~~ 2017b .

ASTM F2249, *Standard Specification for In-Service Test Methods for Temporary Grounding Jumper Assemblies Used on De-~~Energized~~ energized Electric Power Lines and Equipment*, 2003 (R 2015).

ASTM ~~F2412/~~ F2320, *Standard Specification for Rubber Insulating Sheeting*, 2011.

ASTM F2412, *Standard Test Methods for Foot Protections*, ~~2011~~ 2018 .

ASTM F2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*, ~~2011~~ 2017 .

ASTM F2522, *Standard Test Method for Determining the Protective Performance of a Shield Attached on Live Line Tools or on Racking Rods for Electric Arc Hazards*, ~~2012~~ 2017 .

ASTM F2675/F2675M, *Standard Test Method for Determining Arc Ratings of Hand Protective Products Developed and Used for Electrical Arc Flash Protection*, 2013.

ASTM F2676, *Standard Test Method for Determining the Protective Performance of an Arc Protective Blanket for Electric Arc Hazards*, ~~2009~~ 2016 .

ASTM F2677, *Standard Specification for Electrically Insulating Aprons*, (R 2013).

ASTM F2757, *Standard Guide for Home Laundering Care and Maintenance of Flame, Thermal, and Arc Resistant Clothing*, 2016.

ASTM F3272, *Standard Guide for Selection, Care, and Use of Arc Protective Blankets* , 2018.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:19:29 EDT 2018

Committee Statement

Committee Statement: The revision dates and titles in A.3.2 are updated to reflect the most recent ASTM standards.

ASTM F3272 is added to section A.3.2 to correlate with the new language in 130.7(G).

Response Message: FR-82-NFPA 70E-2018

Public Input No. 257-NFPA 70E-2018 [Section No. A.3.2]

Public Input No. 263-NFPA 70E-2018 [Section No. A.3.2]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 92-NFPA 70E-2018 [Section No. A.3.9]

A.3.8 ISEA Publications.

International Safety Equipment Association, 1901 North Moore Street, Arlington, VA 22209-1762.

ANSI/ISEA 125, *American National Standard for Conformity Assessment of Safety and Personal Protective Equipment* , 2014.

ANSI/ISEA Z87.1, *American National Standard for Occupational and Educational Eye and Face Protection* , 2015.

ANSI/ISEA Z89.1, *American National Standard for Head Protection* , 2014.

ANSI/ISEA Z358.1, *American National Standard for Emergency Eye Wash and Shower Equipment*, 2009.

Submitter Information Verification

Committee:

Submittal Date: Wed Sep 19 14:19:24 EDT 2018

Committee Statement

Committee Statement: Standard included in annex is added to reference documents.

Response Message: FR-92-NFPA 70E-2018

Ballot Results

This item has passed ballot

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

Affirmative with Comment

Gallo, Ernest J.

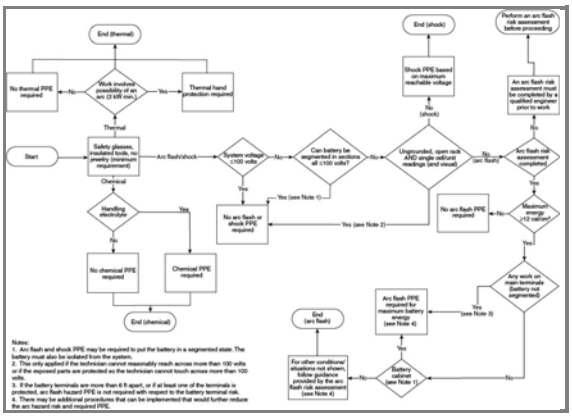
Comments: The Committee Statement is less than informative and grammatically incorrect as there are a multiplicity of documents/standards added by FR 92.

First Revision No. 72-NFPA 70E-2018 [New Section after F.6]

F.7 Battery Risk Assessment.

Multiple hazards may be encountered when working on batteries (shock, arc flash, chemical, thermal). PPE selection should take into account all of the hazards depending on the task. The flow chart displayed in Figure F.7 will assist users to assess all hazards associated with work on batteries.

Figure F.7 Assessing Hazards Associated with Work on Batteries.



Supplemental Information

File Name	Description	Approved
attachment_for_FR_72_Next_F.7.docx	attachment for FR72. For staff use.	

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 14:19:35 EDT 2018

Committee Statement

Committee Statement: The new annex material provides guidance to users on how to select PPE using a battery risk assessment process when multiple hazards are or may be present.

Response Message: FR-72-NFPA 70E-2018

Public Input No. 343-NFPA 70E-2018 [New Section after 320.3(D)]

Public Input No. 214-NFPA 70E-2018 [Section No. 320.3(B)]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 83-NFPA 70E-2018 [Section No. H.2]

H.2 Simplified Two-Category Clothing Approach for Use with Table 130.7(C)(15)(a), Table 130.7(C)(15)(b), and Table 130.7(C)(15)(c).

The use of Table H.2 is a simplified approach to provide minimum PPE for electrical workers within facilities with large and diverse electrical systems. The clothing listed in Table H.2 fulfills the minimum arc-rated clothing requirements of Table 130.7(C)(15)(a), Table 130.7(C)(15)(b), and Table 130.7(C)(15)(c). The clothing systems listed in this table should be used with the other PPE appropriate for the arc flash PPE category *[see Table 130.7(C)(15)(c)].* The notes to Table 130.7(C)(15)(a), Table 130.7(C)(15)(b), and Table 130.7(C)(15)(c) must apply as shown in those tables.

Table H.2 Simplified Two-Category, Arc-Rated Clothing System

Clothing[a]	Applicable Situations
Everyday Work Clothing Arc-rated long-sleeve shirt with arc-rated pants (minimum arc rating of 8) *or* Arc-rated coveralls (minimum arc rating of 8)	Situations where a risk assessment indicates that PPE is required and where Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) specify arc flash PPE category 1 or 2[b]
Arc Flash Suit A total clothing system consisting of arc-rated shirt and pants and/or arc-rated coveralls and/or arc flash coat and pants (clothing system minimum arc rating of 40)	Situations where a risk assessment indicates that PPE is required and where Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) specify arc flash PPE category 3 or 4[b]

[a]Note that other PPE listed in Table 130.7(C)(15)(c), which include arc-rated face shields or arc flash suit hoods, arc-rated hard hat liners, safety glasses or safety goggles, hard hats, hearing protection, heavy-duty leather gloves, rubber insulating gloves, and leather protectors, could be required. The arc rating for a garment is expressed in cal/cm^2.

[b]The estimated available fault current capacities and fault clearing times or arcing durations are listed in the text of Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b). For power systems with greater than the estimated available fault current capacity or with longer than the assumed fault clearing times, Table H.2 cannot be used and arc flash PPE must be determined and selected by means of an incident energy analysis in accordance with 130.5(G).

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:39:07 EDT 2018

Committee Statement

Committee Statement: This First Revision is created to accept TIA 18-a that was issued by Standards Council on August 17, 2017. Annex H.2 and Table H.2 are updated to reflect the revisions to the Arc Flash PPE Category Method during the last NFPA 70E cycle.

Response Message: FR-83-NFPA 70E-2018

Public Input No. 215-NFPA 70E-2018 [Section No. H.2]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 80-NFPA 70E-2018 [Annex I]

Informative Annex I Job Briefing and Job Safety Planning Checklist

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

I.1 Job Briefing ~~and Planning~~ Checklist.

Figure I.1 illustrates considerations for a job briefing ~~and planning~~ checklist.

Figure I.1 Sample Job Briefing ~~and Planning~~ Checklist.

Identify

- ❑ Hazards
- ❑ Voltage levels involved
- ❑ Skills required
- ❑ Any "foreign" (secondary source) voltage source
- ❑ Any unusual work conditions
- ❑ Number of people needed to do the job
- ❑ Shock protection boundaries
- ❑ Available incident energy
- ❑ Potential for arc flash (Conduct an arc flash risk assessment.)
- ❑ Arc flash boundary
- ❑ Any evidence of impending failure?

Ask

- ❑ Can the equipment be de-energized?
- ❑ Are backfeeds of the circuits to be worked on possible?
- ❑ Is an energized electrical work permit required?
- ❑ Is a standby person required?
- ❑ Is the equipment properly installed and maintained?

Check

- ❑ Job plans
- ❑ Single-line diagrams and vendor prints
- ❑ Status board
- ❑ Information on plant and vendor resources is up to date
- ❑ Safety procedures
- ❑ Vendor information
- ❑ Individuals are familiar with the facility

Know

- ❑ What the job is
- ❑ Who else needs to know — Communicate!
- ❑ Who is in charge

Think

- ❑ About the unexpected event . . . What if?
- ❑ Lock — Tag — Test — Try
- ❑ Test for voltage — FIRST
- ❑ Use the right tools and equipment, including PPE
- ❑ Install and remove temporary protective grounding equipment
- ❑ Install barriers and barricades
- ❑ What else . . . ?

Prepare for an emergency

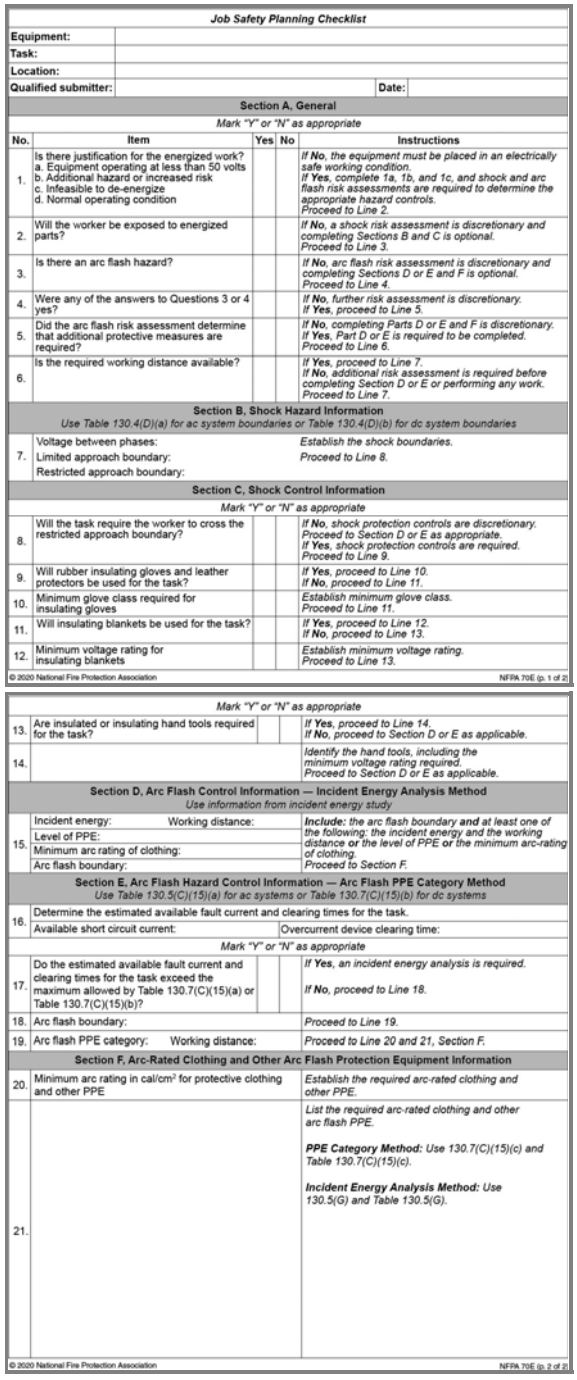
- ❑ Is the standby person CPR/AED trained?
- ❑ Is the required emergency equipment available? Where is it?
- ❑ Where is the nearest telephone?
- ❑ Where is the fire alarm?
- ❑ Is confined space rescue available?
- ❑ What is the exact work location?
- ❑ How is the equipment shut off in an emergency?
- ❑ Are the emergency telephone numbers known?
- ❑ Where is the fire extinguisher?
- ❑ Are radio communications available?
- ❑ Is an AED available?

Detail FR-91

I.2 Job Safety Planning Checklist.

Figure I.2 illustrates considerations for a job safety planning checklist.

Figure I.2 Sample Job Safety Planning Checklist.



Job Safety Planning Checklist

Equipment:			
Task:			
Location:			
Qualified submitter:		**Date:**	

Section A, General

Mark "Y" or "N" as appropriate

No.	Item	Yes	No	Instructions
1.	Is there justification for the energized work? a. Equipment operating at less than 50 volts b. Additional hazard or increased risk c. Infeasible to de-energize d. Normal operating condition			*If **No**, the equipment must be placed in an electrically safe working condition.* *If **Yes**, complete 1a, 1b, and 1c, and shock and arc flash risk assessments are required to determine the appropriate hazard controls.* *Proceed to Line 2.*
2.	Will the worker be exposed to energized parts?			*If **No**, a shock risk assessment is discretionary and completing Sections B and C is optional.* *Proceed to Line 3.*
3.	Is there an arc flash hazard?			*If **No**, arc flash risk assessment is discretionary and completing Sections D or E and F is optional.* *Proceed to Line 4.*
4.	Were any of the answers to Questions 3 or 4 yes?			*If **No**, further risk assessment is discretionary.* *If **Yes**, proceed to Line 5.*
5.	Did the arc flash risk assessment determine that additional protective measures are required?			*If **No**, completing Parts D or E and F is discretionary.* *If **Yes**, Part D or E is required to be completed.* *Proceed to Line 6.*
6.	Is the required working distance available?			*If **Yes**, proceed to Line 7.* *If **No**, additional risk assessment is required before completing Section D or E or performing any work.* *Proceed to Line 7.*

Section B, Shock Hazard Information

Use Table 130.4(D)(a) for ac system boundaries or Table 130.4(D)(b) for dc system boundaries

7.	Voltage between phases: Limited approach boundary: Restricted approach boundary:	*Establish the shock boundaries.* *Proceed to Line 8.*

Section C, Shock Control Information

Mark "Y" or "N" as appropriate

8.	Will the task require the worker to cross the restricted approach boundary?			*If **No**, shock protection controls are discretionary.* *Proceed to Section D or E as appropriate.* *If **Yes**, shock protection controls are required.* *Proceed to Line 9.*
9.	Will rubber insulating gloves and leather protectors be used for the task?			*If **Yes**, proceed to Line 10.* *If **No**, proceed to Line 11.*
10.	Minimum glove class required for insulating gloves			*Establish minimum glove class.* *Proceed to Line 11.*
11.	Will insulating blankets be used for the task?			*If **Yes**, proceed to Line 12.* *If **No**, proceed to Line 13.*
12.	Minimum voltage rating for insulating blankets			*Establish minimum voltage rating.* *Proceed to Line 13.*

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Mark "Y" or "N" as appropriate

13.	Are insulated or insulating hand tools required for the task?			*If **Yes**, proceed to Line 14.* *If **No**, proceed to Section D or E as applicable.*
14.				*Identify the hand tools, including the minimum voltage rating required.* *Proceed to Section D or E as applicable.*

Section D, Arc Flash Control Information — Incident Energy Analysis Method

Use information from incident energy study

15.	Incident energy: Working distance: Level of PPE: Minimum arc rating of clothing: Arc flash boundary:	***Include:** the arc flash boundary **and** at least one of the following: the incident energy and the working distance **or** the level of PPE **or** the minimum arc-rating of clothing.* *Proceed to Section F.*

Section E, Arc Flash Hazard Control Information — Arc Flash PPE Category Method

Use Table 130.5(C)(15)(a) for ac systems or Table 130.7(C)(15)(b) for dc systems

16.	Determine the estimated available fault current and clearing times for the task.	
	Available short circuit current:	Overcurrent device clearing time:

Mark "Y" or "N" as appropriate

17.	Do the estimated available fault current and clearing times for the task exceed the maximum allowed by Table 130.7(C)(15)(a) or Table 130.7(C)(15)(b)?			*If **Yes**, an incident energy analysis is required.* *If **No**, proceed to Line 18.*
18.	Arc flash boundary:			*Proceed to Line 19.*
19.	Arc flash PPE category: Working distance:			*Proceed to Line 20 and 21, Section F.*

Section F, Arc-Rated Clothing and Other Arc Flash Protection Equipment Information

20.	Minimum arc rating in cal/cm² for protective clothing and other PPE	*Establish the required arc-rated clothing and other PPE.*
21.		*List the required arc-rated clothing and other arc flash PPE.* ***PPE Category Method:** Use 130.7(C)(15)(c) and Table 130.7(C)(15)(c).* ***Incident Energy Analysis Method:** Use 130.5(G) and Table 130.5(G).*

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Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:10:27 EDT 2018

Committee Statement

Committee Statement: The title of Annex I is modified to address the addition of I.2. Section I.1 is revised to address job briefing checklist.

Response Message: FR-80-NFPA 70E-2018

Public Input No. 330-NFPA 70E-2018 [Annex I]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
24 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Affirmative with Comment

Wolf, Jason

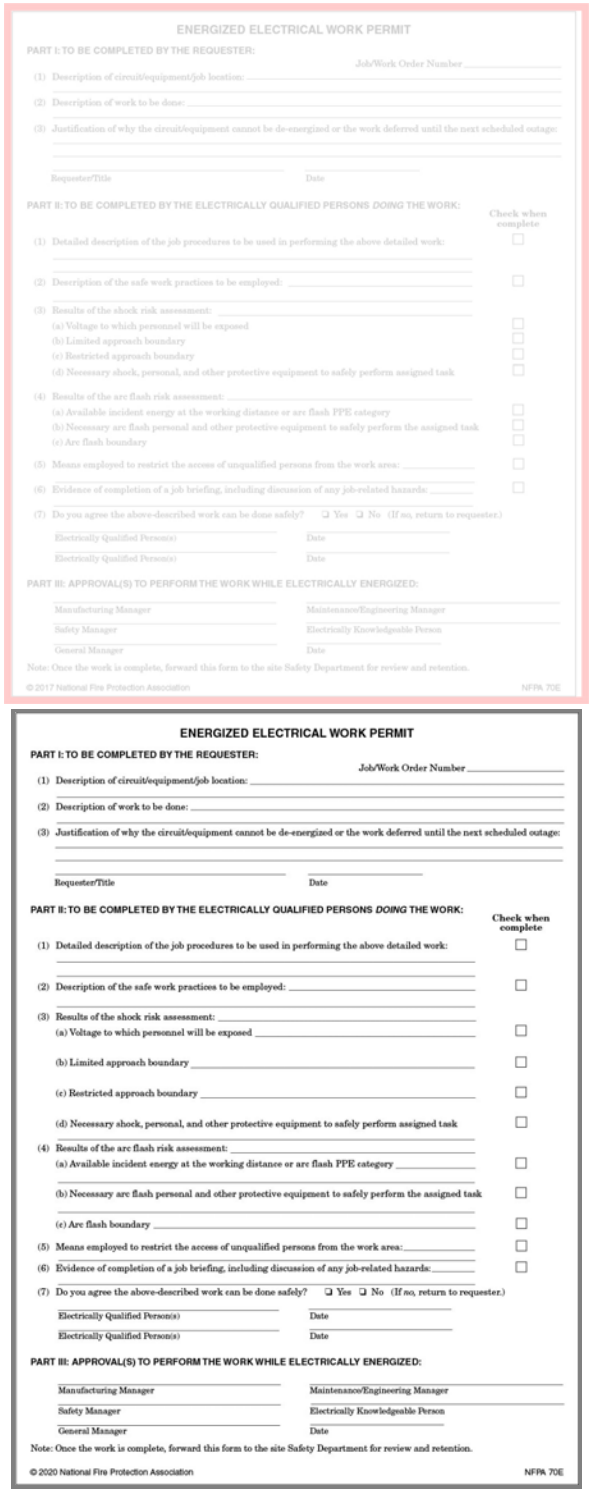
The addition of a sample Job Safety Plan will help provide employers an example to follow. However, the sample does not include all elements required by 110.1(I)(3)(e), such as, work procedures, special precautions and energy source controls.

First Revision No. 87-NFPA 70E-2018 [Section No. J.1]

J.1 Energized Electrical Work Permit Sample.

Figure J.1 illustrates considerations for an energized electrical work permit.

Figure J.1 Sample Permit for Energized Electrical Work.



ENERGIZED ELECTRICAL WORK PERMIT

PART I: TO BE COMPLETED BY THE REQUESTER:

Job/Work Order Number _____

(1) Description of circuit/equipment/job location: _____

(2) Description of work to be done: _____

(3) Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage: _____

Requester/Title _____ Date _____

PART II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS *DOING* THE WORK:

Check when complete

(1) Detailed description of the job procedures to be used in performing the above detailed work: _____ ☐

(2) Description of the safe work practices to be employed: _____ ☐

(3) Results of the shock risk assessment: _____

(a) Voltage to which personnel will be exposed ☐

(b) Limited approach boundary ☐

(c) Restricted approach boundary ☐

(d) Necessary shock, personal, and other protective equipment to safely perform assigned task ☐

(4) Results of the arc flash risk assessment: _____

(a) Available incident energy at the working distance or arc flash PPE category ☐

(b) Necessary arc flash personal and other protective equipment to safely perform the assigned task ☐

(c) Arc flash boundary ☐

(5) Means employed to restrict the access of unqualified persons from the work area: _____ ☐

(6) Evidence of completion of a job briefing, including discussion of any job-related hazards: _____ ☐

(7) Do you agree the above-described work can be done safely? ❑ Yes ❑ No (If no, return to requester.)

Electrically Qualified Person(s) _____ Date _____

Electrically Qualified Person(s) _____ Date _____

PART III: APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:

Manufacturing Manager _____ Maintenance/Engineering Manager _____

Safety Manager _____ Electrically Knowledgeable Person _____

General Manager _____ Date _____

Note: Once the work is complete, forward this form to the site Safety Department for review and retention.

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ENERGIZED ELECTRICAL WORK PERMIT

PART I: TO BE COMPLETED BY THE REQUESTER:

Job/Work Order Number _____

(1) Description of circuit/equipment/job location: _____

(2) Description of work to be done: _____

(3) Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage: _____

Requester/Title _____ Date _____

PART II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS *DOING* THE WORK:

Check when complete

(1) Detailed description of the job procedures to be used in performing the above detailed work: _____ ☐

(2) Description of the safe work practices to be employed: _____ ☐

(3) Results of the shock risk assessment: _____

(a) Voltage to which personnel will be exposed ☐

(b) Limited approach boundary ☐

(c) Restricted approach boundary ☐

(d) Necessary shock, personal, and other protective equipment to safely perform assigned task ☐

(4) Results of the arc flash risk assessment: _____

(a) Available incident energy at the working distance or arc flash PPE category ☐

(b) Necessary arc flash personal and other protective equipment to safely perform the assigned task ☐

(c) Arc flash boundary ☐

(5) Means employed to restrict the access of unqualified persons from the work area: _____ ☐

(6) Evidence of completion of a job briefing, including discussion of any job-related hazards: _____ ☐

(7) Do you agree the above-described work can be done safely? ❑ Yes ❑ No (If no, return to requester.)

Electrically Qualified Person(s) _____ Date _____

Electrically Qualified Person(s) _____ Date _____

PART III: APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:

Manufacturing Manager _____ Maintenance/Engineering Manager _____

Safety Manager _____ Electrically Knowledgeable Person _____

General Manager _____ Date _____

Note: Once the work is complete, forward this form to the site Safety Department for review and retention.

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Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 17:26:06 EDT 2018

Committee Statement

Committee Statement: Sections in Part II of the Energized Electrical Work Permit (Figure J.1) is reformatted to allow the results of the shock and arc flash risk assessment to be entered.

Response Message: FR-87-NFPA 70E-2018

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.

Harris, William R.

Hickman, Palmer L.

Hilbert, Mark R.

Lippert, Kevin J.

McKinch, Terrance L.

McNellis, Mark

Miller, Charles R.

Mohla, Daleep C.

Niemira, James K.

Norwood, Thomas D.

Pace, David A.

Stallcup, James G.

Stonerock, Samuel B.

Thurmond III, Charlie R.

Tobias, John M.

West, Rodney J.

White, James R.

Wolf, Jason

First Revision No. 84-NFPA 70E-2018 [Section No. M.1.1]

M.1.1

Layering of arc-rated clothing is an effective approach to achieving the required arc rating. The use of all arc-rated clothing layers will result in achieving the required arc rating when the layers have been tested together to determine the combined rating. The use of all arc-rated clothing layers will result in achieving the required arc rating with the lowest number of layers and lowest clothing system weight. Garments that are not arc rated should not be used to increase the arc rating of a garment or of a clothing system.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:49:08 EDT 2018

Committee Statement

Committee Statement: M.1.1 has been revised to provide clarity that arc-rated clothing used in layers must be tested together to determine an overall clothing rating.

Response Message: FR-84-NFPA 70E-2018

Public Input No. 246-NFPA 70E-2018 [Section No. M.1.1]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.

Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 85-NFPA 70E-2018 [Section No. M.1.2]

M.1.2

~~The~~ A total system of protective clothing can be ~~selected~~ determined to take credit for the protection provided by all the layers of clothing that are worn if tested as a combination . For example, to achieve an arc rating of 40 cal/cm^2 (167.5 J/cm^2), an arc flash suit with an arc rating of 40 cal/cm^2 (167.5 J/cm^2) could be worn over a cotton shirt and cotton pants. Alternatively, an arc flash suit with a 25 cal/cm^2 (104.7 J/cm^2) arc rating could be worn over an arc-rated shirt and arc-rated pants with an arc rating of 8 cal/cm^2 (33.5 J/cm^2) to achieve a total system arc rating of 40 cal/cm^2 (167.5 J/cm^2). This latter approach provides the required arc rating at a lower weight and with fewer total layers of fabric and, consequently, would provide the required protection with a higher level of worker comfort.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 16:57:28 EDT 2018

Committee Statement

Committee Statement: M.1.2 has been revised to provide clarity that arc-rated clothing used in layers must be tested together to determine an overall clothing rating.

Response Message: FR-85-NFPA 70E-2018

Public Input No. 248-NFPA 70E-2018 [Section No. M.1.2]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.

Hayes, James B.

Affirmative All

Barnhart, Paul D.

Barrios, Louis A.

Bowman, William Bruce

Chybowski, Steven C.

Crow, Daryld Ray

Gallo, Ernest J.

Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

First Revision No. 86-NFPA 70E-2018 [Section No. O.2.3]

O.2.3 Incident Energy Reduction Methods.

The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. This is a method that allows two or more circuit breakers to communicate with each other so that a short circuit or ground fault will be cleared by the breaker closest to the fault with no intentional delay. Clearing the fault in the shortest time aids in reducing the incident energy.

(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.

(3) Energy-reducing maintenance switching with a local status indicator. An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to operate faster while the worker is working within an arc flash boundary, as defined in *NFPA 70E*, and then to set the circuit breaker back to a normal setting after the work is complete.

(4) Energy-reducing active arc flash mitigation system. This system can reduce the arcing duration by creating a low impedance current path, located within a controlled compartment, to cause the arcing fault to transfer to the new current path, while the upstream breaker clears the circuit. The system works without compromising existing selective coordination in the electrical distribution system.

(5) Energy-reducing line side isolation. This is equipment that encloses the line side conductors and circuit parts and has been listed to provide both shock and arc flash protection from events on the line side of a circuit breaker or switch.

(6) Arc flash relay. An arc flash relay typically uses light sensors to detect the light produced by an arc flash event. Once a certain level of light is detected, the relay will issue a trip signal to an upstream overcurrent device.

(7) High-resistance grounding. A great majority of electrical faults are of the phase-to-ground type. High-resistance grounding will insert an impedance in the ground return path and will typically limit the fault current to 10 amperes and below (at 5 kV nominal or below), leaving insufficient fault energy and thereby helping reduce the arc flash hazard level. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

(8) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc source. The energy reduction becomes effective for current above the current-limiting threshold of the current-limiting fuse or current limiting circuit breaker.

(9) Shunt-trip. Adding a shunt-trip that is signaled to open from an open-fuse relay to switches 800 amperes and greater reduces incident energy by opening the switch immediately when the first fuse opens. The reduced clearing time reduces incident energy. This is especially helpful for arcing currents that are not within the current-limiting threshold of the three current-limiting fuses.

Submitter Information Verification

Committee:

Submittal Date: Thu Aug 16 17:04:07 EDT 2018

Committee Statement

Committee Statement: Energy Reducing Line Side Isolation is an acceptable method to reduce incident energy and is added in O.2.3.

Response Message: FR-86-NFPA 70E-2018

Public Input No. 124-NFPA 70E-2018 [Section No. O.2.3]

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
2 Not Returned
25 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Dyson, Thomas B.
Hayes, James B.

Affirmative All

Barnhart, Paul D.
Barrios, Louis A.
Bowman, William Bruce
Chybowski, Steven C.
Crow, Daryld Ray
Gallo, Ernest J.
Gray, Bobby J.
Harris, William R.
Hickman, Palmer L.
Hilbert, Mark R.
Lippert, Kevin J.
McKinch, Terrance L.
McNellis, Mark
Miller, Charles R.
Mohla, Daleep C.
Niemira, James K.
Norwood, Thomas D.
Pace, David A.
Stallcup, James G.
Stonerock, Samuel B.
Thurmond III, Charlie R.
Tobias, John M.
West, Rodney J.
White, James R.
Wolf, Jason

Attachment C: Review of NFPA 73 First Draft

NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

M E M O R A N D U M

TO: Technical Committee on Electrical Systems Maintenance

FROM: Kelly Carey, *Project Administrator*

DATE: October 19, 2018

SUBJECT: NFPA 73 First Draft Technical Committee FINAL Ballot Results (A2020)

According to the final ballot results, all ballot items received the necessary affirmative votes to pass ballot.

12 Members Eligible to Vote
4 Members Not Returned (*Charkey, Mercier, Van Den Huevel, Worsham*)

The attached report shows the number of affirmative, negative, and abstaining votes as well as the explanation of the vote for **each** revision**.**

To pass ballot, **each** revision requires: (1) a simple majority of those eligible to vote and (2) an affirmative vote of $^{2}/_{3}$ of ballots returned. See Sections 3.3.4.3.(c) and 4.3.10.1 of the ***Regulations Governing the Development of NFPA Standards***.

First Revision No. 1-NFPA 73-2018 [Section No. 2.2]

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, National Electrical Code®, ~~2014~~ 2017 edition.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 10:48:56 EDT 2018

Committee Statement

Committee Statement: Updated reference to current edition of the NEC.

Response Message: FR-1-NFPA 73-2018

Public Input No. 6-NFPA 73-2018 [Section No. 2.2]

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 2-NFPA 73-2018 [Section No. 2.4]

2.4 References for Extracts in Mandatory Sections.

NFPA 70®, National Electrical Code®, ~~2014~~ 2017 edition.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 10:50:03 EDT 2018

Committee Statement

Committee Statement: Updated reference to current edition of the NEC.

Response Message: FR-2-NFPA 73-2018

Public Input No. 7-NFPA 73-2018 [Section No. 2.4]

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.
No Comment
Parkin, David B.

No Comment

First Revision No. 8-NFPA 73-2018 [Section No. 3.3.1.3]

3.3.1.3 Readily Accessible.

Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys) , to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. [**70:**100]

Submitter Information Verification

Committee:
Submittal Date: Tue Aug 07 11:41:49 EDT 2018

Committee Statement

Committee Statement: Updated definition to the current edition of the NEC.
Response Message: FR-8-NFPA 73-2018

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All
Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment
Katen, James S.
No Comment

Parkin, David B.

No Comment

First Revision No. 12-NFPA 73-2018 [Section No. 3.3.9]

3.3.9 Exposed (as applied to live parts).

Capable of being inadvertently touched or approached nearer than a safe distance by a person. ~~It is applied to parts that are not suitably guarded, isolated, or insulated.~~ [**70:**100]

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 13:47:42 EDT 2018

Committee Statement

Committee Statement: Updated extract to the 2017 Edition of the NEC.

Response Message: FR-12-NFPA 73-2018

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.

Mercier, Charles David

Van Den Heuvel, James

Worsham, John A.

Affirmative All

Kerkhoff, Todd

Ludecke, Robert C.

Manche, Alan

McDaniel, Roger D.

Miller, Charles R.

Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 3-NFPA 73-2018 [Section No. 3.3.16]

3.3.16 Manufactured Home.

A structure, transportable in one or more sections, ~~that~~ which , in the traveling mode~~,~~ is 2.4 m (8 ~~body-~~ ft) or more in width or 12.2 m (40 ~~body-~~ ft) or more in length, or~~,~~ when erected on site~~,~~ is 29.77 m^2 (320 ft^2) or more ~~and that~~ is built on a permanent chassis and is designed to be used as a dwelling~~,~~ with or without a permanent foundation, ~~when connected~~ whether or not connected to the utilities, and includes plumbing, heating, air conditioning, and electrical systems contained therein. The term *manufactured home* includes any structure that meets all the ~~provisions~~ requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency~~, and except that such term does not include any self-propelled recreational vehicle~~ . Calculations used to determine the number of square meters (square feet) in a structure are based on the ~~structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions~~ structure's exterior dimensions and include all expandable rooms, cabinets, and other projections containing interior space~~,~~ but do not include bay windows. [**70:**550.2]

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 10:50:51 EDT 2018

Committee Statement

Committee Statement: Updated extract to the 2017 Edition of the NEC.

Response Message: FR-3-NFPA 73-2018

Public Input No. 8-NFPA 73-2018 [Section No. 3.3.16]

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan

McDaniel, Roger D.

Miller, Charles R.

Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 13-NFPA 73-2018 [Section No. 3.3.21]

3.3.21 Raceway.

An enclosed channel ~~of metal or nonmetallic materials~~ designed expressly for holding wires, cables, or busbars, with additional functions as permitted in ~~*NFPA 70*~~ ~~. Raceways include, but are not limited to, rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible conduit, flexible metallic tubing, flexible metal conduit, electrical nonmetallic tubing, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways~~ *NFPA 70 (NEC)* . [**70:**100]

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 14:05:08 EDT 2018

Committee Statement

Committee Statement: Updated extract to the 2017 Edition of the NEC.

Response Message: FR-13-NFPA 73-2018

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 4-NFPA 73-2018 [Section No. 3.3.22]

3.3.22 Receptacle.

A ~~receptacle is a~~ contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device . A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke. [**70:**100]

Submitter Information Verification

Committee:
Submittal Date: Tue Aug 07 10:57:27 EDT 2018

Committee Statement

Committee Statement: Updated extract to the 2017 Edition of the NEC.
Response Message: FR-4-NFPA 73-2018

Public Input No. 5-NFPA 73-2018 [Section No. 3.3.22]

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All
Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment
Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 9-NFPA 73-2018 [Section No. 4.4.5]

4.4.5

Where evidence of overfusing of or tampering with Edison-~~based~~ base -type fuses exists, Type S nontamperable adapters and fuses shall be installed.

Submitter Information Verification

Committee:
Submittal Date: Tue Aug 07 12:12:54 EDT 2018

Committee Statement

Committee Statement: Correct the term to state "edison-base-type".
Response Message: FR-9-NFPA 73-2018

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All
Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment
Katen, James S.
No Comment
Parkin, David B.

No Comment

First Revision No. 10-NFPA 73-2018 [Section No. 4.5.2.2]

4.5.2.2

~~Except for older~~ Single conductors shall not be installed unless they are part of a recognized wiring method such as knob-and-tube ~~wiring, single conductors that are not part of an approved cable~~ or ~~cable assembly shall be installed with an approved wiring method~~ approved raceway.

Submitter Information Verification

Committee:
Submittal Date: Tue Aug 07 12:16:13 EDT 2018

Committee Statement

Committee Statement: The revision clarifies the use of single conductors.
Response Message: FR-10-NFPA 73-2018

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All
Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment
Katen, James S.
No Comment

Parkin, David B.

No Comment

First Revision No. 5-NFPA 73-2018 [Section No. 4.6.1]

4.6.1

Flexible cords and cables shall not be used as follows:

(1) As a substitute for the fixed wiring of a structure

(2) Where run through holes in walls, ceilings, or floors

(3) Where run through doorways or windows, under carpets, and so forth

(4) Where attached to building surfaces

(5) To hang or support any type of electrical utilization equipment unless listed to be applied in that manner

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 10:58:51 EDT 2018

Committee Statement

Committee Statement: Extension cords are often misused to hang appliances or lights from the ceiling. This requirement clarifies the acceptable use of flexible cords and cables.

Response Message: FR-5-NFPA 73-2018

Public Input No. 1-NFPA 73-2016 [Section No. 4.6.1]

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.

Mercier, Charles David

Van Den Heuvel, James

Worsham, John A.

Affirmative All

Kerkhoff, Todd

Ludecke, Robert C.

Manche, Alan

McDaniel, Roger D.

Miller, Charles R.

Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 7-NFPA 73-2018 [New Section after 5.1.2]

5.1.3

Receptacles located in areas required to be ground-fault circuit-interrupter protected shall not have been replaced with non-ground-fault circuit-interrupter-protected receptacles.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 11:38:34 EDT 2018

Committee Statement

Committee Statement: This requirement addresses replacement receptacles where GFCI protection should have been provided in accordance with the NEC. This new language provides a mechanism for inspection of existing dwellings to identify those receptacles that have been replaced incorrectly with non-GFCI protection.

Response Message: FR-7-NFPA 73-2018

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

The overall notion of this proposed section is fine, but if an inspector does not know the age of the installation, how is he to determine whether or not GFCI protection would have been required or if it was once present? It seems like this proposed section requires one to see back into the past. Inspectors who are required to comply with this standard might be put into a no-win situation here.

Parkin, David B.

No Comment

First Revision No. 11-NFPA 73-2018 [Section No. 5.3.1]

5.3.1

~~Appliances and utilization equipment shall have a~~ A disconnecting means to disconnect all ungrounded conductors shall be provided for appliances and utilization equipment .

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 12:44:47 EDT 2018

Committee Statement

Committee Statement: The revision clarifies that the disconnecting means does not have to be part of the appliance or equipment.

Response Message: FR-11-NFPA 73-2018

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.
No Comment

Parkin, David B.

No Comment

First Revision No. 16-NFPA 73-2018 [Section No. A.4.10.7]

A.4.10.7

Additional protection can be provided for non-grounding-type receptacles by replacing the devices with a ground-fault circuit-interrupter-type receptacle or a grounding-type receptacle in accordance with 406.3 4 (D)(3 2)(b) or (c) of *NFPA 70*.

Submitter Information Verification

Committee: EFM-AAA
Submittal Date: Mon Aug 27 12:57:00 EDT 2018

Committee Statement

Committee Statement: Revised NEC section references to 2017 Edition.
Response Message: FR-16-NFPA 73-2018

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Parkin, David B.
No Comment

Negative with Comment

Katen, James S.

This is a peculiar section that's out of place in this standard. As far as I can see, it's the only part of this standard that advises what to do *after* the inspection has taken place. The existing 4.10.7 already covers this topic in the context of an inspection. The proposed section would be more appropriate in a guide for those who make repairs.

First Revision No. 14-NFPA 73-2018 [Section No. D.1.1]

D.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70®, *National Electrical Code®*, ~~2014~~ 2017 edition.

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 14:16:03 EDT 2018

Committee Statement

Committee Statement: Updated reference to the 2017 Edition of the NEC.

Response Message: FR-14-NFPA 73-2018

Ballot Results

✔ **This item has passed ballot**

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.
No Comment
Parkin, David B.

No Comment

First Revision No. 6-NFPA 73-2018 [Section No. D.1.2.1]

D.1.2.1 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

~~ANSI/~~ UL 943, ~~*Standard for*~~ *Ground-Fault Circuit-Interrupters*, ~~2006, revised 2008~~ 2016 .

Submitter Information Verification

Committee:

Submittal Date: Tue Aug 07 11:18:27 EDT 2018

Committee Statement

Committee Statement: Updated the publishing date for the UL standard listed to reflect the most up to date edition.

Response Message: FR-6-NFPA 73-2018

Public Input No. 4-NFPA 73-2018 [Section No. D.1.2.1]

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All

Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment

Katen, James S.

No Comment

Parkin, David B.

No Comment

First Revision No. 15-NFPA 73-2018 [Section No. D.3]

D.3 References for Extracts in Informational Sections.

NFPA 70®, National Electrical Code®, ~~2014~~ 2017 edition.

Submitter Information Verification

Committee:
Submittal Date: Tue Aug 07 14:16:44 EDT 2018

Committee Statement

Committee Statement: Updated reference to the 2017 Edition of the NEC.
Response Message: FR-15-NFPA 73-2018

Ballot Results

This item has passed ballot

12 Eligible Voters
4 Not Returned
6 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Charkey, Edward S.
Mercier, Charles David
Van Den Heuvel, James
Worsham, John A.

Affirmative All
Kerkhoff, Todd
Ludecke, Robert C.
Manche, Alan
McDaniel, Roger D.
Miller, Charles R.
Offerdahl, Donald R.

Affirmative with Comment
Katen, James S.
No Comment
Parkin, David B.
No Comment

Attachment D: Review of NFPA 790 and 791 First Draft

NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

M E M O R A N D U M

TO: Technical Committee on Electrical Equipment Evaluation

FROM: Sarah Caldwell, *Technical Committee Administrator*

DATE: November 13, 2018

SUBJECT: NFPA 790 First Draft Technical Committee FINAL Ballot Results (A2020 Cycle)

According to the final ballot results, all ballot items received the necessary affirmative votes to pass ballot.

15 Members Eligible to Vote
2 Members Not Returned (*Gillerman, McGee*)

The attached report shows the number of affirmative, negative, and abstaining votes as well as the explanation of the vote for **each** revision**.**

To pass ballot, **each** revision requires: (1) a simple majority of those eligible to vote and (2) an affirmative vote of $^{2}/_{3}$ of ballots returned. See Sections 3.3.4.3.(c) and 4.3.10.1 of the ***Regulations Governing the Development of NFPA Standards***.

First Revision No. 2-NFPA 790-2018 [Section No. 1.1.1.2]

1.1.1.2

These requirements are based on ISO/IEC ~~Guide 65~~ 17065 and ISO/IEC 17020 with adaptation for the unique characteristics of field evaluations.

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Tue Oct 09 13:36:01 EDT 2018

Committee Statement

Committee Statement: Update to current edition of ISO/IEC documents
Response Message: FR-2-NFPA 790-2018

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.

Widup, Ron

First Revision No. 1-NFPA 790-2018 [Section No. 3.3.1]

3.3.1* Electrical Equipment.

Any device, appliance, or machine that generates, stores, conducts, or utilizes electrical energy.

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 11:09:25 EDT 2018

Committee Statement

Committee Statement: Energy storage equipment has been added to the definition to be recognized as equipment that can be field evaluated.

Response Message: FR-1-NFPA 790-2018

Public Input No. 3-NFPA 790-2018 [Section No. 3.3.1]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

Ritchie, Scott J.

Szende, Andras

Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 3-NFPA 790-2018 [Section No. 6.1.3.2]

6.1.3.2*

The technical manager(s) shall be competent for the functions performed, including making required technical judgements, framing policies, and implementing ~~them~~ required technical changes and said policies .

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 11 11:26:56 EDT 2018

Committee Statement

Committee Statement: This first revision clarifies that the technical managers are required to implement the technical changes and policies previously referred to in the requirement.
Response Message: FR-3-NFPA 790-2018

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 4-NFPA 790-2018 [Section No. D.2]

D.2 Informational References.

The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*, 2004.

~~ISO/IEC Guide 65, *General requirements for bodies operating product certification systems,* 1996.~~

~~ISO/IEC 17020, *Conformity assessment — Requirements for the operation of various types of bodies performing inspection* , 2012.~~

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Mon Oct 15 15:07:10 EDT 2018

Committee Statement

Committee Statement: Delete Guide 65 and 17020 reference
Response Message: FR-4-NFPA 790-2018

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
12 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Widup, Ron

Affirmative with Comment

Whipple, John J.

Needs correlated with FR-1. IEC 17065 is added in 1.1.1.2 but has not been added in D.2. IEC 17020 has been deleted from D.2 but still remains in 1.1.2.

NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

M E M O R A N D U M

TO: Technical Committee on Electrical Equipment Evaluation

FROM: Sarah Caldwell, *Technical Committee Administrator*

DATE: November 13, 2018

SUBJECT: NFPA 791 First Draft Technical Committee FINAL Ballot Results (A2020 Cycle)

According to the final ballot results, all ballot items received the necessary affirmative votes to pass ballot.

15 Members Eligible to Vote
2 Members Not Returned (*Gillerman, McGee*)

The attached report shows the number of affirmative, negative, and abstaining votes as well as the explanation of the vote for **each** revision**.**

To pass ballot, **each** revision requires: (1) a simple majority of those eligible to vote and (2) an affirmative vote of $^{2}/_{3}$ of ballots returned. See Sections 3.3.4.3.(c) and 4.3.10.1 of the ***Regulations Governing the Development of NFPA Standards***.

First Revision No. 1-NFPA 791-2018 [Section No. 1.1.1]

1.1.1

This document covers recommended procedures for evaluating unlabeled electrical equipment in conjunction with ~~the applicable nationally~~ nationally recognized standard(s) applicable to the subject equipment and any requirements of the authority having jurisdiction (AHJ).

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 11:22:05 EDT 2018

Committee Statement

Committee Statement: This First Revision clarifies that the nationally recognized standards are those specific to the subject equipment being evaluated.

Response Message: FR-1-NFPA 791-2018

Public Input No. 1-NFPA 791-2018 [Section No. 1.1.1]

Ballot Results

This item has passed ballot

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

Ritchie, Scott J.

Szende, Andras

Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 2-NFPA 791-2018 [Section No. 1.1.2]

1.1.2

This document does not cover procedures ~~for evaluations relating to product certification systems~~ for the evaluation of third-party certification programs that result in listed and labeled ~~products~~ equipment .

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 11:28:46 EDT 2018

Committee Statement

Committee Statement: Third party certification efforts are more commonly called programs. The word system may describe the steps associated with such certification effort but it is the program of the third party that results in listing and labeling. The term equipment is a defined term in NFPA 791 and includes a number of other terms (e.g. product, fitting, device, appliance, etc.). To minimize confusion when applying NFPA 791 the term equipment was added to be consistent throughout the document.

Response Message: FR-2-NFPA 791-2018

Public Input No. 2-NFPA 791-2018 [Section No. 1.1.2]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

Ritchie, Scott J.

Szende, Andras

Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 3-NFPA 791-2018 [Section No. 1.2.3]

1.2.3

The purpose ~~of the evaluation~~ of an evaluation conducted in accordance with this standard is to assist regulating authorities who ~~make product and related installation approval decisions~~ make approval decisions related to equipment and their installation .

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 11:32:39 EDT 2018

Committee Statement

Committee Statement: The term product was changed to "equipment" for consistency throughout the standard. The statement was reworded to clarify that the purpose is to assist the AHJ with making approval decisions.

Response Message: FR-3-NFPA 791-2018

Public Input No. 3-NFPA 791-2018 [Section No. 1.2.3]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 4-NFPA 791-2018 [Section No. 1.2.4]

1.2.4

It is not the purpose of this document to be used as the sole reference to complete the field evaluation ~~of products~~ of equipment and to be referenced as the standard applied in the field evaluation report.

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 11:41:46 EDT 2018

Committee Statement

Committee Statement: The term "product" was changed to "equipment" for consistency throughout the standard.

Response Message: FR-4-NFPA 791-2018

Public Input No. 4-NFPA 791-2018 [Section No. 1.2.4]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 5-NFPA 791-2018 [Section No. 1.3.2]

1.3.2

~~Products undergoing this~~ Equipment undergoing evaluation process ~~do~~ does not acquire product certification or listing, nor should evaluation of any equipment imply a ~~product imply a~~ determination of conformance of similar existing or any subsequently produced or ~~altered product(s) or system(s)~~ altered equipment .

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 11:43:42 EDT 2018

Committee Statement

Committee Statement: The term "product" was changed to "equipment" for consistency throughout the standard.
Response Message: FR-5-NFPA 791-2018

Public Input No. 5-NFPA 791-2018 [Section No. 1.3.2]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All
Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 6-NFPA 791-2018 [Section No. 1.3.3]

1.3.3

~~Only units or assemblies undergoing~~ Only the specific equipment undergoing this process should be considered eligible to bear the FEB label and have an FEB statement of conformity. *(Refer to Annex B for the procedures for multiple units of the same ~~product~~ equipment .)*

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 11:46:50 EDT 2018

Committee Statement

Committee Statement: The phrase "units or assemblies" was changed to "equipment" for consistency throughout the standard.
Response Message: FR-6-NFPA 791-2018

Public Input No. 6-NFPA 791-2018 [Section No. 1.3.3]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 7-NFPA 791-2018 [Section No. 3.3.3]

3.3.3* Critical Component(s).

Electrical components or assemblies used in a power control or safety circuit whose proper operation is essential to the safe performance of the equipment or an electrical system or circuit.

A.3.3.3 Critical Component(s).

Electrical components or assemblies include, but are not limited to, the following:

(1) All electrical components acting as a protective device to interrupt current in an abnormal condition, such as circuit breakers, circuit protectors, fuses, and overload or thermal relays, or to control the equipment, electrical system, or circuit in such a way as to eliminate an abnormal condition

(2) All components and wiring for the emergency stop system, including power supply, emergency stop contactor, or interrupting device and pushbuttons

(3) All hardware or firmware components and wiring for safety interlock circuits

(4) All devices ~~that are~~ in an area that is classified as a Hazardous Location with the appropriate rating for the area, such as Class I, Division 1 or Class I, Division 2, unless listed as intrinsically safe

(5) Those components that upon evaluation present a risk of fire or shock in their use or application

Note that it is possible and understood that like components can exist on equipment where one is required to be approved (listed) since it is used in a safety circuit or other device as described in the preceding list, and the other is not used in such a circuit. In these cases, like components are treated differently.

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 11:52:20 EDT 2018

Committee Statement

Committee Statement: Electrical components or assemblies that are 'critical components' would also be used in control circuits. Safe performance is not only desired in a system or circuit but also the equipment itself.

Response Message: FR-7-NFPA 791-2018

Public Input No. 29-NFPA 791-2018 [Section No. A.3.3.3]

Public Input No. 7-NFPA 791-2018 [Section No. 3.3.3]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

Ritchie, Scott J.

Szende, Andras

Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 8-NFPA 791-2018 [Section No. 3.3.4]

3.3.4* Electrical Equipment.

Any device, appliance, or machine that generates, conducts, stores, or utilizes electrical energy.

A.3.3.4 Electrical Equipment.

The term *electrical equipment* is used in this document to clearly indicate that the coverage for a field evaluation is inclusive of ~~products~~ equipment that ~~generate~~ generates , ~~transmit~~ stores , ~~distribute~~ distributes , ~~control,~~ or ~~utilize~~ utilizes electrical energy.

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 12:00:24 EDT 2018

Committee Statement

Committee Statement: Energy storage equipment has been added to the definition to be recognized as equipment that can be field evaluated.

Response Message: FR-8-NFPA 791-2018

Public Input No. 8-NFPA 791-2018 [Section No. 3.3.4]

Public Input No. 30-NFPA 791-2018 [Section No. A.3.3.4]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

Ritchie, Scott J.

Szende, Andras

Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 9-NFPA 791-2018 [Section No. 3.3.7]

3.3.7* Field Evaluation.

The process used to determine conformance with requirements for one-of-a-kind, limited production, used, or modified ~~products~~ equipment that ~~are~~ is not listed or field labeled under a certification program.

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 12:12:07 EDT 2018

Committee Statement

Committee Statement: The term "product" was changed to "equipment" for consistency throughout the standard.
Response Message: FR-9-NFPA 791-2018

Public Input No. 10-NFPA 791-2018 [Section No. 3.3.7]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.

Widup, Ron

First Revision No. 10-NFPA 791-2018 [Section No. 4.1.1]

4.1.1 General.

The following information should be provided for all evaluations:

(1) Layout drawings showing ~~components~~ all equipment with designators that match the schematic and actual marks on, or adjacent to, the ~~components~~ equipment

(2) Electrical schematic drawings for all power, control, and safety circuits

(3) A bill of material that includes certification details for all critical components

(4) Limitations or conditions of acceptability for critical components

(5) Installation, operation, and maintenance manuals for the equipment to be installed

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 12:15:00 EDT 2018

Committee Statement

Committee Statement: The term "product" was changed to "equipment" for consistency throughout the standard.

The proposed list item (5) is already included in item (2).

Proposed list item (6) Failure Modes and Effects Analysis evaluations do not need to be considered in every installation.

New item (5) was added to address the need for installation, maintenance, and operation manuals at the time of evaluation.

Response Message: FR-10-NFPA 791-2018

Public Input No. 11-NFPA 791-2018 [Section No. 4.1.1]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.
Widup, Ron

First Revision No. 11-NFPA 791-2018 [Section No. 4.1.2]

4.1.2

The information in Section 4.1.1 should be requested by the ~~evaluator~~ FEB prior to or upon arrival on site.

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 12:42:38 EDT 2018

Committee Statement

Committee Statement: The term "evaluator" is not as specific as the defined term Field Evaluation Body(FEB).
Response Message: FR-11-NFPA 791-2018

Public Input No. 12-NFPA 791-2018 [Section No. 4.1.2]

Ballot Results

This item has passed ballot

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.
Widup, Ron

First Revision No. 12-NFPA 791-2018 [Section No. 4.2.1]

4.2.1

Before the evaluation, a review of service history and construction changes should be performed to ~~resolve common noncompliant items~~ determine their impact on the compliance of the equipment .

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 12:59:53 EDT 2018

Committee Statement

Committee Statement: A review of service history and construction changes to used equipment will help in evaluating used equipment.

Response Message: FR-12-NFPA 791-2018

Public Input No. 14-NFPA 791-2018 [Section No. 4.2.1]

Ballot Results

This item has passed ballot

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

Ritchie, Scott J.

Szende, Andras

Todd, Lawrence E.

Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 13-NFPA 791-2018 [Section No. 4.2.2]

4.2.2

Common issues that should be considered can include the following :

(1) *Damaged Components*. Inspection of mechanical components, such as enclosures, conduit, and fittings, and electrical devices should be completed to identify any visible damage or deformity that could render ~~a product~~ equipment noncompliant or require replacement. Those items known to be damaged should be reviewed with the ~~evaluating body~~ FEB in advance when possible.

(2) *Suitability for Use*. An assessment of the environment surrounding equipment should be completed to observe changes that have occurred over time. Changes to building construction, moving the equipment, and installing other equipment close by should be reviewed for any effect on compliance in the changed environment. Enclosure ratings, devices that penetrate enclosures, and the environment surrounding the equipment should be reviewed in advance when possible.

(3) *Availability of Drawings*. Availability of technical drawings or schematics should be ensured in advance when possible. Because a lack of technical drawings or schematics can increase the complexity of or hinder an evaluation, accurate drawings should be produced.

(4)* *Availability of Manufacturer or Technical Support*. Availability of the manufacturer's technical information or technical support should be ensured in advance where possible.

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 13:16:31 EDT 2018

Committee Statement

Committee Statement: The term "product" was changed to "equipment" for consistency throughout the standard.

The term "evaluating body" is not as specific as the defined term Field Evaluation Body(FEB).

Response Message: FR-13-NFPA 791-2018

Ballot Results

This item has passed ballot

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.
Widup, Ron

First Revision No. 14-NFPA 791-2018 [Section No. 4.3 [Excluding any Sub-Sections]]

The FEB should ~~select appropriate standards~~ select nationally recognized standards applicable to the subject equipment under evaluation based on the equipment's design and application ~~of the equipment under evaluation~~ .

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 13:21:51 EDT 2018

Committee Statement

Committee Statement: The first revision clarifies what standards are to be use during an evaluation.
Response Message: FR-14-NFPA 791-2018

Public Input No. 16-NFPA 791-2018 [Section No. 4.3 [Excluding any Sub-Sections]]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned
Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All
Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.

Widup, Ron

First Revision No. 15-NFPA 791-2018 [Section No. 4.3.2]

4.3.2* Primary Standard.

The primary standard to be used should be a nationally recognized ~~product~~ safety standard written and maintained by a standards development organization that issues ~~product~~ safety standards~~, such as Underwriters Laboratories or Factory Mutual Research Corporation~~ .

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 13:31:30 EDT 2018

Committee Statement

Committee Statement: The term product was removed for consistency. All applicable safety standards should be applied to field evaluations.

Response Message: FR-15-NFPA 791-2018

Public Input No. 17-NFPA 791-2018 [Section No. 4.3.2]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
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Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 16-NFPA 791-2018 [Section No. 4.4]

4.4 Jurisdictional Notification.

The FEB should notify the electrical AHJ ~~in writing~~ when an evaluation is initiated and about to commence.

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 13:55:17 EDT 2018

Committee Statement

Committee Statement: Communication in writing is not always practical or necessary.
Response Message: FR-16-NFPA 791-2018

Public Input No. 32-NFPA 791-2018 [Section No. 4.4]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
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Walker, Christopher G.
Whipple, John J.

Widup, Ron

First Revision No. 17-NFPA 791-2018 [Section No. 5.7]

5.7 Components.

~~Component inspections~~ The verification of equipment components should include, but not be limited to, the following:

(1) Accuracy of and correlation between component identification in drawings, the bill of material, and marking within equipment

(2) Critical components listed or recognized and labeled by a nationally recognized testing laboratory (NRTL)

(3) Critical components used in accordance with their listing or the “conditions of acceptability” defined by an NRTL

(4) Suitability of mounting methods

(5) Suitability of components to perform as intended considering the critical/safety function of the device, mechanical and electrical loads, and other factors affecting the immediate environment or performance of the component

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 14:07:53 EDT 2018

Committee Statement

Committee Statement: The first sentence was restructured to clarify the requirement to component suitability only.

Response Message: FR-17-NFPA 791-2018

Public Input No. 20-NFPA 791-2018 [Section No. 5.7]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.

Farrell III, Michael J.

Lewandowski, Mark L.

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Szende, Andras

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Walker, Christopher G.

Whipple, John J.

Widup, Ron

First Revision No. 18-NFPA 791-2018 [Section No. 7.7]

7.7 Equipment Identification and Nameplate.

The equipment nameplate information should be documented for each ~~manufactured unit that~~ manufactured piece of equipment that was evaluated, as follows:

~~Product name~~

(1) ~~Product manufacturer's name~~ Type

(2) Manufacturer

(3) Model identification

(4) Serial number ~~for each unit evaluated~~

(5) Electrical ratings

(6) Mechanical ratings as applicable

(7) FEB label serial number

Submitter Information Verification

Committee: EEE-AAA

Submittal Date: Thu Oct 04 14:59:56 EDT 2018

Committee Statement

Committee Statement: This first revision removes redundant text in the list items and clarifies the requirement.

Response Message: FR-18-NFPA 791-2018

Public Input No. 28-NFPA 791-2018 [Section No. 7.7]

Ballot Results

This item has passed ballot

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon

McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.

Burns, Julian R.

Carpenter, David R.

Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.
Walker, Christopher G.
Whipple, John J.
Widup, Ron

First Revision No. 19-NFPA 791-2018 [Section No. A.4.3.2]

A.4.3.2

The primary standards are generally adopted by the American National Standards Institute. ~~Supplementary standards can include ones from manufacturing organizations such as the National Electrical Manufacturers Association or general safety bodies such as the National Fire Protection Association.~~

Submitter Information Verification

Committee: EEE-AAA
Submittal Date: Thu Oct 04 15:17:27 EDT 2018

Committee Statement

Committee Statement: All applicable safety standards should be applied to field evaluations.

Response Message: FR-19-NFPA 791-2018

Public Input No. 31-NFPA 791-2018 [Section No. A.4.3.2]

Ballot Results

✔ **This item has passed ballot**

15 Eligible Voters
2 Not Returned
13 Affirmative All
0 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Gillerman, Gordon
McGee, Charles ?Scott?

Affirmative All

Burgess, Bruce H.
Burns, Julian R.
Carpenter, David R.
Chilton, Nancy W.
Farrell III, Michael J.
Lewandowski, Mark L.
Ritchie, Scott J.
Szende, Andras
Todd, Lawrence E.
Trainor, Richard S.

Walker, Christopher G.

Whipple, John J.

Widup, Ron