

EFCOG Best Practice #264

Title: Adoption of NFPA 70E® 2024 in place of NFPA 70E® 2021

Facility: DOE Complex

Points of Contact:

Mark Muir Electrical Authority Having Jurisdiction (AHJ), Savannah River Nuclear Solutions, LLC., mark.muir@srs.gov, 803-557-9002; Jennifer L Martin AHJ, Past Chair EFCOG Electrical Safety Community of Practice (ESCoP), Pacific Northwest National Laboratory, Jennifer.l.martin@pnnl.gov, (509) 371-8805

Brief Description of Best Practice: NFPA 70E® – 2024 is recommended for adoption across the DOE Complex as an upgrade to NFPA 70E® – 2021 in 10 CFR 851 Worker Safety and Health Plans (WSHP). Previously, EFCOG Best Practice #239 determined that the use of the 2021 edition of NFPA 70E® is at least as protective as the 2015 edition, and even more protective in some areas, such that the new edition should be considered for DOE Complex wide acceptance.

Why the Best Practice was used: 10 CFR 851 lists safety and health consensus standards with which the contractor must comply when applicable with site hazards (851.23). Only the versions of consensus standards that were in effect on February 9, 2006 and subsequent technical amendments were promulgated pursuant to rulemaking therefore only those specifically cited versions are required by the Rule. Contractors may include successor versions of the consensus standards that provide equal or greater worker protection if included in their DOE-approved worker safety and health program.

What are the benefits of the Best Practice: The use of the 2024 edition of NFPA 70E® is at least as protective as the 2021 edition, and even more protective in some areas, such that the new edition should be considered for adoption within the DOE Complex. NFPA 70E® – 2024 is recommended for implementation across the DOE Complex as an upgrade to NFPA 70E® – 2021.

What problems/issues were associated with the Best Practice: No problems were noted with the Best Practice. Adoption of the 2024 edition of NFPA 70E® by a contractor provides a level of protection “As Safe or Safer” than the 2021 Edition.

How the success of the Best Practice was measured:

A detailed gap analysis of NFPA 70E® version 2024 (Attachment 1) against the 2021 version was performed. Success will be measured by use of this Best Practice into each site’s implementation of this NFPA standard.

Description of process experience using the Best Practice: This Best Practice can be used by a contractor at a DOE site as justification for adopting the 2024 revision of the NFPA 70E® standard for implementation.

EFCOG Working Group Members Participating on Best Practice Review Team:

Jennifer Martin Past Chair ESCoP, NFPA 790/791 Committee Member Alternate, PNNL
Heath Garrison, Past Chair ESCoP and NFPA 70E® Committee Member, NREL
Andrew Drutel, ESCoP Member, PE Engineering Standards Board SRNS
Mark Muir, ESCoP Member Electrical AHJ, SRNS

Date: April 24, 2024

Code/Standard Title: *NFPA 70E® – Standard for Electrical Safety in the Workplace®*

CODE/STANDARD EVALUATION

TITLE: Technical Evaluation of the Changes in *NFPA 70E* between 2021 and 2024 Editions

Note:

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1. DESCRIPTION

10 CFR 851 - “DOE Worker Health and Safety Program” requires that the 2015 edition of *NFPA 70E* - “*Standard for Electrical Safety in the Workplace*” be utilized.

The purpose of this evaluation is to document the acceptability of the changes introduced in the 2024 edition of *NFPA 70E* as compared to the 2021 edition and to identify and evaluate the impact of the changes to the safety and health of workers. The sections of this code that deal strictly with electrolytic cells or systems are not included in this evaluation. Furthermore, a majority of editorial changes, clarifications, additions of or relocations of definitions, rearrangement of sections and related cross-reference revisions, global changes such as addition of *electric* where the term *shock hazard* is used, or changes related to bringing the code in alignment with the *NFPA Style Manual* are not considered to have an impact on safety and, therefore, are in most cases not included in this evaluation. The Informational Notes and Informative Annexes were not evaluated since they are not part of the Code text and have no enforceable meaning.

2. TECHNICAL JUSTIFICATION

The attached comparison was prepared by Andrew Drutel and Mark Muir (SRNS, LLC).

Attachment #2 to this CSE provides a comparison of changes that were made to the 2021 edition of *NFPA 70E*. Each line item listed in the “Comparison Table” has been reviewed and rated for the impact to worker safety. A rating of “No negative impact” (editorial or technical improvement) or “Potential safety consequence” has been assigned for each item under Impact to Worker Safety. Examples of the ratings are provided below.

1. No Negative Impact – An Editorial Change or a technical improvement such as an addition, enhancement or change in methodology or acceptance criteria that does not degrade worker safety when compared to previous edition. Editorial changes are so noted in the comparison table as “editorial change”.

Example of editorial change: Relocating a requirement from one section to another or revising a definition to correlate with definition in NEC.

Example of technical improvement: Adding a requirement for a documented meeting between host employer and contract employee.

2. Potential Safety Consequence – Changes or revisions that potentially make the electrical safety practices less robust and could affect personnel safety. This rating requires additional justification or further action.

Example: Change in PPE requirements which could result in reduced margin of safety.

The changes are depicted as follows:

- Text shown highlighted in Attachment 2 represents the portion of the text revised in 2024 Edition of the document.

As demonstrated in Attachment 2, there have been no changes made to the *NFPA 70E, Standard for Electrical Safety in the Workplace* in the 2024 Edition that could present adverse impact to worker health or safety (rated “Potential Safety Consequence”, as described above). Some of the changes which result in reduction of requirements (e.g., change to Table 130.7(C)(15)(b)), are based on expanded tests, resulting in altering criteria without adversely impacting worker’s safety.

Furthermore, the provisions of the 2024 edition are at least as protective as the edition specified in 10 CFR 851 (*NFPA 70E-2015*), *NFPA 70E-2018*, and *NFPA 70E-2021*.

3. GENERAL NOTES

1. This document shall be considered when adopting the 2024 edition of the *Standard for Electrical Safety in the Workplace* for use.
2. The Comparison Table (Attachment #2) does not represent all changes potentially having impact on working practices relative to the hazards arising from the use of electricity. Refer to the *NFPA70E - 2024* for the full extent of the changes introduced in this new edition of the code.

4. REFERENCES

1. 10 CFR 851, Worker Safety and Health Program
2. *NFPA 70E, 2021, Standard for Electrical Safety in the Workplace*
3. *NFPA 70E, 2024, Standard for Electrical Safety in the Workplace*

5. ATTACHMENTS

1. Permission Letter from NFPA “Requests for NFPA® Materials”, Kristin Bigda to Andrew Drutel, February 05, 2024
2. Comparison Table - NFPA 70E-2024 Impact Analysis



NATIONAL FIRE PROTECTION ASSOCIATION

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SENT VIA EMAIL

andrew.drutel@srs.gov

February 5, 2024

Andrew M. Drutel, P.E.
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Re: Requests for NFPA® Material – Updated Permission Letter

Dear Mr. Drutel:

We are writing in response to your request on behalf of Savannah River Nuclear Solutions (“SRNS”) to use certain material which is the intellectual property of the National Fire Protection Association® (“NFPA®”). Specifically, SNRS has requested NFPA’s permission to use excerpts from the NFPA 70E® 2021 and 2024 editions of the Standard for Electrical Safety in the Workplace® (the “Standard”) (collectively, the “NFPA Material”) in SNRS’ role as the contractor for the Department of Energy (“DOE”) to compare the two editions, evaluate the changes and determine the impact to safety and cost to each site that is part of the DOE complex, with the ultimate goal of incorporating by reference NFPA 70E, 2024 edition, at each site.

It is our understanding that SRNS’ proposed comparison and evaluation document would consist of technical changes only from the 2021 and 2024 editions of the Standard and a commentary regarding acceptability of the individual changes for use at SRS. For changes selected for evaluation, the exact text from the 2021 and 2024 editions will be reflected to help readers understand the nature and the impact of the specific change. We also understand SNRS will quote changes which are applicable to industrial uses or settings, and will exclude other changes, such as editorial changes, rearrangement of articles, changes to articles which are not applicable to the work at SRS, and changes to certain parts of the Standard, such as informational notes. Furthermore, new articles will not be quoted but will be listed by title only.

NFPA is willing to grant SNRS’ request for permission to use the NFPA Material with the following terms and conditions:

1. SNRS may set forth the NFPA Material referenced in its evaluation and comparison document only this one time for the goals stated above and at no other time and for no other purpose. SNRS may copy and paste such NFPA Material. Except as set forth herein, SNRS may not reproduce, distribute, share or sell the NFPA Material and may not use the NFPA Material in any other manner, form or format, except as noted herein.
2. Pursuant to this agreement, SRNS is authorized to share the evaluation and comparison document with the following:
 - a. Department of Energy, SRS Field Office
 - b. Members of the Energy Facility Contractors Group (EFCOG)
3. SRNS agrees to include the following credit statement where the NFPA Material appears:

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4. Upon creation and prior to publication, SNRS shall send to NFPA a copy of SNRS’ comparison and evaluation document, including the attribution statement described herein.
5. SNRS acknowledges and agrees that, as between SNRS and NFPA, NFPA owns and has all right, title and interest to the NFPA Material, including all intellectual property rights therein, and SNRS shall not take any steps that would violate such rights.
6. All rights in the NFPA Material not expressly granted pursuant to the terms of this letter agreement are expressly reserved in their entirety to NFPA.
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Sincerely,

A handwritten signature in black ink, appearing to read 'Kristin Bigda'.

Kristin Bigda, P.E.
Director of Publication Strategy

Attachment 2 Comparison Table
 Technical Evaluation - NFPA 70E, 2021 vs. 2024
NFPA 70E 2024 Impact Analysis

2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
Introduction		
Article 90 – Introduction		
90.4(C) Explanatory Material. Explanatory material, such as references to other standards, references to related sections of this standard, or information related to a rule in this standard, is included in this standard in the form of informational notes. Such notes are informational only and are not enforceable as requirements of this standard. Brackets containing section references to another NFPA document are for informational purposes only and are provided as a guide to indicate the source of the extracted text. These bracketed references immediately follow the extracted text.	90.5(C) Explanatory Material. Explanatory material, such as references to other standards, references to related sections of this standard, or information related to a rule in this standard, is included in this standard in the form of informational notes or informative annexes . Such notes and annexes are informational only and are not enforceable as requirements of this standard. Unless the standard reference includes a date, the reference is to be considered as the latest edition of the standard. Brackets containing section references to another NFPA document are for informational purposes only and are provided as a guide to indicate the source of the extracted text. These bracketed references immediately follow the extracted text.	Provided clarification regarding enforceability of informative annexes and edition of referenced standards. Safety Impact: No negative impact.
Chapter 1 – Safety-Related Work Practices		
Article 100 - Definitions		
<i>This content was not in the previous edition.</i>	Protector. A glove or mitten designed to be worn over rubber insulating gloves.	Created new definition to accommodate materials other than leather that provide protection for rubber insulating gloves. [FR-62, SR-11] Safety Impact: No negative impact.
Article 110 – General Requirements for Electrical Safety-Related Work Practices		
110.1 Priority. Hazard elimination shall be the first priority in the implementation of safety-related work practices.	110.2 Electrically Safe Work Condition. (A) Policy. An employer shall establish, document, and implement an electrically safe work condition policy that does both of the following: (1) Requires hazard elimination to be the first priority in the implementation of safety-related work practices (2) Complies with 110.2(B)	Replaced “Priority” with “Policy” using content from former 110.1 and 110.5(K). Safety Impact: No negative impact.
<i>This content was not in the previous edition.</i>	110.2(B) When Required. 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.	Created new section titled “When Required” using content from former 110.3 and 110.4. Added Informational Revised former subsections of 110.4 and rephrased them as exceptions for clarity. [FR-52, SCR-5]

Attachment 2 Comparison Table
 Technical Evaluation - NFPA 70E, 2021 vs. 2024

2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
	<p>(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</p> <p><i>Exception No. 1:</i> 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:</p> <ol style="list-style-type: none"> (1) The equipment is properly installed. (2) The equipment is properly maintained. (3) The equipment is rated for the available fault current. (4) The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions. (5) The equipment doors are closed and secured. (6) All equipment covers are in place and secured. (7) There is no evidence of impending failure. <p><i>Exception No. 2:</i> An energized disconnecting means or isolating element shall be permitted to be operated to achieve an electrically safe work condition or to return equipment to service that has been placed in an electrically safe work condition. The equipment supplying the disconnecting means or isolating element shall not be required to be placed in an electrically safe work condition provided a risk assessment is performed and there is no unacceptable risk identified.</p> <p><i>Exception No. 3:</i> 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.</p> <p><i>Exception No. 4:</i> Energized work shall be permitted where the employer can demonstrate that de-energizing introduces additional hazards or increased risk.</p> <p><i>Exception No. 5:</i> 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.</p>	<p>Revised Exception No. 1 from content in 110.4(D) and added list item (3) for equipment to be rated for the available fault current. [FR-52]</p> <p>Added Exception to address operation of a disconnecting means to establish an electrically safe work condition in situations where not all of the "normal operating condition" requirements exist. [FR-52]</p> <p>Safety Impact: No negative impact.</p>

Attachment 2 Comparison Table
 Technical Evaluation - NFPA 70E, 2021 vs. 2024

2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
<p>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.</p>	<p>110.2(C) Requirements Until Established. Electrical conductors and circuit parts shall not be considered to be in an electrically safe work condition until all of the applicable requirements of 120.2 through 120.6 have been met. Safe work practices applicable to the circuit voltage and energy level shall be used until such time that electrical conductors and circuit parts are in an electrically safe work condition.</p>	<p>Added section titled "Requirements Until Established" from content in former 110.2 and revised for clarity. [FR-52]</p> <p>Safety Impact: No negative impact.</p>
<p>110.5(l)(1) Job Safety Planning and Job Briefing. The job safety plan shall be in accordance with the following:</p> <ol style="list-style-type: none"> (1) Be completed by a qualified person (2) Be documented (3) Include the following information: <ol style="list-style-type: none"> 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 	<p>110.5(l)(1) Job Safety Planning and Job Briefing. The job safety plan shall be in accordance with the following:</p> <ol style="list-style-type: none"> (1) Be completed by a qualified person (2) Be documented (3) Include the following information: <ol style="list-style-type: none"> a. A description of the job and the individual tasks b. Identification of the electrical hazards associated with each task c. An electric shock risk assessment in accordance with 130.4 for tasks involving an electric 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 f. An emergency response plan 	<p>Added item (3)(f) to list identifying an emergency response plan as part of the job safety planning. [FR-30]</p> <p>Safety Impact: No negative impact.</p>
<p>110.6(A)(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.</p> <ol style="list-style-type: none"> (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: 	<p>110.4(A)(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.</p> <ol style="list-style-type: none"> (a) Such persons shall also be familiar with the proper use of applicable precautionary techniques, electrical policies, procedures, PPE, insulating materials, shielding materials, and insulated tools and test equipment. (b) A person shall be qualified for certain equipment and tasks to be performed. (c) Such persons permitted to work within the limited approach boundary shall, at a minimum, be additionally trained in all of the following: <ol style="list-style-type: none"> (1) Skills and techniques necessary to distinguish exposed energized electrical 	<p>Revised to clarify that qualified persons be qualified for certain equipment and tasks to be performed and to change "can" to "shall" for mandatory language. [FR-33, SR-32]</p> <p>Safety Impact: No negative impact.</p>

Attachment 2 Comparison Table
 Technical Evaluation - NFPA 70E, 2021 vs. 2024

2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
<p>(1) Skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment</p> <p>(2) Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts</p> <p>(3) Approach distances specified in Table 130.4(E)(a) and Table 130.4(E)(b) and the corresponding voltages to which the qualified person will be exposed</p> <p>(4) Decision-making process necessary to be able to do the following:</p> <ul style="list-style-type: none"> 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 110.3(H)(3), including PPE <p>(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.</p> <p>(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.</p> <p>(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.</p>	<p>conductors and circuit parts from other parts of electrical equipment</p> <p>(2) Skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts</p> <p>(3) Approach distances specified in Table 130.4(E)(a) and Table 130.4(E)(b) and the corresponding voltages to which the qualified person will be exposed</p> <p>(4) Decision-making process necessary to be able to do the following:</p> <ul style="list-style-type: none"> 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 110.3(H)(3), including PPE <p>(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.</p> <p>(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.</p> <p>(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.</p>	
<p>110.10(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.</p>	<p>110.8(A) General. Employees shall be provided with listed ground-fault circuit-interrupter (GFCI) protective devices 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.</p>	<p>Revised to clarify the requirements for GFCI protection and that they be listed. [FR-39]</p> <p>Safety Impact: No negative impact.</p>

Attachment 2 Comparison Table
 Technical Evaluation - NFPA 70E, 2021 vs. 2024

2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
<p>110.10(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.</p>	<p>110.8(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 120-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 120-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.</p>	<p>Revised voltage to align with the nominal circuit voltage.</p> <p>Safety Impact: No negative impact.</p>
<p>110.10(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.</p>	<p>110.8(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 120-volt, 15-, 20-, or 30-ampere circuits. Where employees working outdoors operate or use equipment supplied by greater than 120-volt, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.</p>	<p>Revised voltage to align with the nominal circuit voltage found in NFPA 70 (NEC).</p> <p>Safety Impact: No negative impact.</p>
<p>Article 120 Establishing an Electrically Safe Work Condition</p>		
<p>120.3(D) Tagout Device. The tagout device shall meet the following requirements:</p> <ol style="list-style-type: none"> (1) A tagout device shall include a tag together with an attachment means. (2) The tagout device shall be readily identifiable as a tagout device and suitable for the environment and duration of the tagout. (3) A tagout device attachment means shall be capable of withstanding at least 224.4 N (50 lb) of force exerted at a right angle to the disconnecting means surface. The tag attachment means shall be nonreusable, attachable by hand, self-locking, nonreleasable, and equal to an all-environmental tolerant nylon cable tie. 	<p>120.4(D) Tagout Device. The tagout device shall meet the following requirements:</p> <ol style="list-style-type: none"> (1) A tagout device shall include a tag together with an attachment means. (2) The tagout device shall be readily identifiable as a tagout device and suitable for the environment and duration of the tagout. (3) A tagout device attachment means shall be capable of withstanding at least 222.4 N (50 lb) of force exerted at a right angle to the disconnecting means surface. The tag attachment means shall be nonreusable, attachable by hand, self-locking, nonreleasable, and equal to an all-environmental tolerant nylon cable tie. 	<p>Updated conversion from <i>lbs</i> to <i>N</i>.</p> <p>Safety Impact: No negative impact.</p>
<p>120.4(B)(2) Stored Energy. The procedure shall include requirements for releasing stored electric or mechanical energy that might endanger personnel. All capacitors shall be discharged, and high-capacitance elements shall also be short-circuited and grounded before the associated equipment is touched or worked on. Springs shall be released or physical restraint shall be applied when necessary to immobilize mechanical equipment and pneumatic and hydraulic pressure reservoirs. Other sources of stored energy shall be blocked or otherwise relieved.</p>	<p>120.5(B)(2) Stored Energy. The procedure shall include requirements for releasing stored electric or mechanical energy that might endanger personnel. All capacitors shall be discharged, and high-capacitance elements shall also be short-circuited and grounded before the associated equipment is touched or worked on. Springs shall be released or physical restraint shall be applied when necessary to immobilize mechanical equipment and pneumatic and hydraulic pressure reservoirs. Other sources of stored energy shall be blocked or otherwise relieved.</p>	<p>Revised to add clarity around mechanical energy. [FR-49]</p> <p>Safety Impact: No negative impact.</p>

Attachment 2 Comparison Table
 Technical Evaluation - NFPA 70E, 2021 vs. 2024

2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
	otherwise relieved to the extent that the circuit cannot be unintentionally energized.	
<p>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:</p> <p>(7) Use an adequately rated portable test instrument to test each phase conductor or circuit part to test for the absence of voltage. 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.</p>	<p>120.6 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:</p> <p>(7) Use an adequately rated portable test instrument to test each phase conductor or circuit part at each point of work to test for the absence of voltage. 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.</p>	<p>Revised item (7) to clarify absence of voltage measurements must be taken at each point of work. [FR-50]</p> <p>Safety Impact: No negative impact.</p>
Article 130 Work Involving Electrical Hazards		
<p>Table 130.4(E)(a)</p> <p>^b See definition in Article 100 and text in 130.4(D)(2) and Informative Annex C for elaboration.</p> <p><i>Note ^d did not appear in 2021 edition.</i></p> <p>Table 130.4(E)(b)</p> <p><i>Note ^b did not appear in 2021 edition.</i></p>	<p>Table 130.4(E)(a) Notes: ^b See definition in Article 100 and text in 130.4(F)(3) and Informative Annex C for elaboration. ^d The restricted approach boundary in Column 4 is based on an elevation not exceeding 900 m (3000 ft). For higher elevations, adjustment of the restricted approach boundary shall be considered.</p> <p>Table 130.4(E)(b) Notes: ^b The restricted approach boundary in Column 4 is based on an elevation not exceeding 900 m (3000 ft). For higher elevations, adjustment of the restricted approach boundary shall be considered.</p>	<p>Revised Table 130.4(E)(a) and Table 130.4(E)(b) to correct conflicts and to correlate with OSHA requirements. Corrected metrification discrepancies. [FR-183, SR-61]</p> <p>Safety Impact: No negative impact.</p>
<p>130.4(F) Limited Approach Boundary (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 alerting methods in 130.8(O) 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.</p>	<p>130.4(F) Limited Approach Boundary (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 alerting methods in 130.8(O) shall be applied to warn the unqualified person(s) of the electrical hazard and to stay outside of the limited approach boundary.</p>	<p>Revised to address changes in other sections of Article 130 as well as for clarity and consistency. [FR-57]</p> <p>Safety Impact: No negative impact.</p>
<p>130.5(H) Equipment Labeling</p>	<p>130.5(H) Equipment Labeling</p>	<p>Added text to specify durability of label. [FR-60]</p>

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2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
<i>Added text did not appear in 2021 edition.</i>	The label shall be of sufficient durability to withstand the environment involved.	Safety Impact: No negative impact.
130.7 Personal and Other Protective Equipment. (C) Personal Protective Equipment (PPE) (5) Hearing Protection. Employees shall wear hearing protection whenever working within the arc flash boundary.	130.7 Personal and Other Protective Equipment. (C) Personal Protective Equipment (PPE) (5) Hearing Protection. Employees inside the arc flash boundary shall wear hearing protection.	Revised text to require hearing protection within the arc flash boundary. [FR-64] Safety Impact: No negative impact.
130.7 Personal and Other Protective Equipment. (C) Personal Protective Equipment (PPE) (7) Hand and Arm Protection Hand and arm protection shall be provided in accordance with 130.7(C)(7)(a), (C)(7)(b), and (C)(7)(c). (a) <i>Shock Protection.</i> 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:	130.7 Personal and Other Protective Equipment. (C) Personal Protective Equipment (PPE) (7) Hand and Arm Protection Hand and arm protection shall be provided in accordance with 130.7(C)(7)(a), (C)(7)(b), and (C)(7)(c). (a) <i>Electric Shock Protection.</i> Employees shall wear rubber insulating gloves with 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 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 protectors, under the following conditions:	Removed the requirement for the glove protectors to be made of leather. Safety Impact: No negative impact.
Table 130.7(C)(7)(a) Distances Between Gauntlet and Cuff, minimum	Table 130.7(C)(7)(a) Distances Between Protector Cuff and Rubber Insulating Glove Cuff, minimum	Revised to remove “gauntlet” from Table 130.7(C)(7)(a) as gloves and protectors have cuffs. [FR-65] Safety Impact: No negative impact.
130.7 Personal and Other Protective Equipment. (C) Personal Protective Equipment (PPE) (10) Arc Flash Protective Equipment. (d) <i>Hand Protection.</i> (2) Where insulating rubber gloves are used for shock protection, leather protectors shall be worn over the rubber gloves.	130.7 Personal and Other Protective Equipment. (C) Personal Protective Equipment (PPE) (10) Arc Flash Protective Equipment. (d) <i>Hand Protection.</i> (2) Where insulating rubber gloves are used for electric shock protection, protectors shall be worn over the rubber gloves.	Removed the requirement for the glove protectors to be made of leather. Safety Impact: No negative impact.
Table 130.7(C)(15)(b) Arc Flash Categories for dc Systems	Table 130.7(C)(15)(b) Arc Flash Categories for dc Systems <i>Consolidated the defined arc flash PPE categories for the 150 – 600 Volts DC range (arc flash PPE category method), effectively eliminating 100 – less than 150 Volts DC range. Refer to the table for details of these changes.</i>	Revised Table 130.7(C)(15)(b). Recent test data indicates that the probability of sustaining an arc for 125-volt dc nominal systems is minimal for available fault currents less than 17,000 amps. Technical references support this change include, Kinectrics report

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		referenced in Informative Annex D.5.2 and those listed in new informational Note No.3. [FR-108, FR-142, SR-65] Safety Impact: No negative impact.
Table 130.7(C)(15)(c) Personal Protective Equipment (PPE) ... or rubber insulating gloves with leather protectors (SR) ^d <i>(multiple places)</i>	Table 130.7(C)(15)(c) Personal Protective Equipment (PPE) ... or rubber insulating gloves with protectors (SR) ^d <i>(multiple places)</i>	Removed the requirement for the glove protectors to be made of leather. Safety Impact: No negative impact.
130.8 Other Precautions for Personnel Activities. (M) Reclosing Circuits After Protective Device Operation. After a circuit is de-energized by the automatic operation of a circuit protective device, the circuit shall not be manually re-energized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or re-energizing circuits through replaced fuses shall be prohibited. When it is determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment shall not be required before the circuit is re-energized.	130.8 Other Precautions for Personnel Activities. (M) Reclosing Circuits After Protective Device Operation. After a circuit is de-energized by the automatic operation of a circuit protective device, the circuit shall not be manually re-energized until a qualified person or persons determines the equipment and circuit can be safely energized. Manually reclosing circuit breakers or re-energizing circuits through replaced fuses shall be prohibited until the fault has been cleared. Exception: When it is determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment shall not be required before the circuit is re-energized.	Removed the term “repetitive,” which could be misinterpreted as permission to reset a breaker or replace a fuse without having a qualified person determine the cause. Relocated former text allowing for re-energizing for conditions caused by overload as an exception to the requirement. [FR-75] Safety Impact: No negative impact.
130.11 Cutting or Drilling. Before cutting or drilling into equipment, floors, walls, or structural elements where a likelihood of contacting energized electrical lines or parts exists, the employer shall perform a risk assessment to: <ol style="list-style-type: none"> (1) Identify and mark the location of conductors, cables, raceways, or equipment (2) Create an electrically safe work condition (3) Identify safe work practices and PPE to be used 	130.11 Cutting or Drilling. Before cutting or drilling into equipment, floors, walls, or structural elements where a likelihood of contacting energized electrical lines or parts exists, the employer shall perform a risk assessment to do the following: <ol style="list-style-type: none"> (1) Identify and mark the location of conductors, cables, raceways, or equipment (2) Establish and verify an electrically safe work condition (3) Identify safe work practices, risk control methods, additional protective measures, and any required electric shock or arc flash PPE 	Revised text to be consistent with 120.5. [FR-76] Safety Impact: No negative impact.
130.12 Cutting, Removing, or Rerouting of Conductors. Where conductors are de-energized in order to cut, remove, or reroute them and the conductor terminations are not within sight from the point of work, such as where the conductors are remote from the source of supply 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.	130.12 Cutting, Removing, or Rerouting of Electrical Conductors and Circuit Parts. Where electrical conductors and circuit parts are de-energized in order to cut, remove, reroute, or otherwise work on them and the conductor terminations or circuit parts are not within sight from the point of work, such as where the electrical conductors or circuit parts are remote from the source of supply in a junction or pull	Revised for clarity and to include any work that occurs outside of an electrically safe working condition. Added Informational Note 2 to provide critical distinction that the term <i>de-energized</i> as used in 130.12 is only one

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	box, additional steps to verify absence of voltage or identify the electrical conductors and circuit parts shall be taken prior to cutting, removing, rerouting, or otherwise work on the conductors and circuit parts.	part of establishing an electrically safe work condition. [FR-77] Safety Impact: No negative impact.
Chapter 2 – Safety-Related Maintenance Requirements		
Article 205 – General		
<i>This content was not in the previous edition.</i>	205.1 Scope. This article covers general maintenance requirements for electrical equipment.	Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.
Article 210 – Substations, Switchgear Assemblies, Switchboards, Panelboards, Motor Control Centers, and Disconnect Switches		
<i>This content was not in the previous edition.</i>	210.1 Scope. This article covers maintenance requirements for substations, switchgear assemblies, switchboards, panelboards, motor control centers, and disconnect switches.	Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.
Article 205 – Premises Wiring		
<i>This content was not in the previous edition.</i>	215.1 Scope. This article covers maintenance requirements for premises wiring.	Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.
Article 220 – Controller Equipment		
220.1 Scope. This article shall apply to controllers, including electrical equipment that governs the starting, stopping, direction of motion, acceleration, speed, and protection of rotating equipment and other power utilization apparatus in the workplace.	220.1 Scope. This article covers maintenance requirements for controllers, which includes electrical equipment that governs the starting, stopping, direction of motion, acceleration, speed, and protection of rotating equipment and other power utilization apparatus in the workplace.	Revised scope statement to include the requirement of maintenance. [FR-95, SR-36] Safety Impact: No negative impact.
Article 225 – Fuses and Circuit Breakers		
<i>This content was not in the previous edition.</i>	225.1 Scope. This article covers maintenance requirements for fuses and circuit breakers.	Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.
Article 230 – Rotating Equipment		
<i>This content was not in the previous edition.</i>	230.1 Scope. This article covers maintenance requirements for rotating equipment.	Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.
Article 235 – Hazardous (Classified) Locations		

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2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
<p>235.1 Maintenance Requirements for Hazardous (Classified) Locations. Equipment and installations in these locations shall be maintained such that the following criteria are met: (1) No energized parts are exposed. <i>Exception to (1):</i> <i>Intrinsically safe and nonincendive circuits.</i></p>	<p>235.2 Maintenance Requirements for Hazardous (Classified) Locations. Equipment and installations in these locations shall be maintained such that the following criteria are met: (1) No energized parts are exposed. <i>Exception to (1):</i> <i>Intrinsically safe and nonincendive circuits shall be permitted to be exposed.</i></p>	<p>Clarified the intent of the Exception. Safety Impact: No negative impact.</p>
<p>Article 240 – Batteries and Battery Rooms</p>		
<p><i>This content was not in the previous edition.</i></p>	<p>240.1 Scope. This article covers maintenance requirements for batteries and battery rooms.</p>	<p>Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.</p>
<p>Article 245 – Portable Electric Tools and Equipment</p>		
<p><i>This content was not in the previous edition.</i></p>	<p>245.1 Scope. This article covers maintenance requirements for portable electrical tools and equipment.</p>	<p>Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.</p>
<p>Article 250 – Personal Safety and Protective Equipment</p>		
<p><i>This content was not in the previous edition.</i></p>	<p>250.1 Scope. This article covers maintenance requirements for personal safety and protective equipment.</p>	<p>Added Scope section to clarify applicability of the article. Safety Impact: No negative impact.</p>
<p>250.1 Maintenance Requirements for Personal Safety and Protective Equipment. Personal safety and protective equipment such as the following shall be maintained in a safe working condition: (1) Grounding equipment (2) Hot sticks</p>	<p>250.2 Maintenance Requirements for Personal Safety and Protective Equipment. Personal safety and protective equipment such as the following shall be maintained in a safe working condition: (1) Grounding equipment (2) Hot sticks (live line tools)</p>	<p>Clarification of the wording. Safety Impact: No negative impact.</p>
<p>250.3 Safety Grounding Equipment.</p>	<p>250.3 Grounding Equipment.</p>	<p>Clarification of the wording. Safety Impact: No negative impact.</p>
<p>Chapter 3 – Safety Requirements for Special Equipment</p>		
<p>Article 320 – Safety Requirements Related to Batteries and Battery Rooms.</p>		
<p>320.1 Scope. This article covers electrical safety requirements for the practical safeguarding of employees while working with exposed stationary storage batteries that exceed 50 volts, nominal.</p>	<p>320.1 Scope. This article covers electrical safety requirements for the practical safeguarding of employees while working with exposed stationary storage batteries that exceed 100 volts, nominal, or exceed a short-circuit power of 1000 watts.</p>	<p>Added watt level for short-circuit power to address heating concerns and revised voltage for correlation with other sections. [FR-101] Safety Impact: No negative impact.</p>
<p>320.3 Safety Procedures. (A) General Safety Hazards.</p>	<p>320.3 Safety Procedures. (A) General Safety Hazards.</p>	<p>Revised title for accuracy. Added “40 milliamperes” as a part of the dc</p>

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2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
<p>(1) Energy Thresholds. Energy exposure levels shall not exceed those identified in the following list unless appropriate controls are implemented:</p> <ol style="list-style-type: none"> (1) AC: 50 volts and 5 milliamperes (2) DC: 100 volts <p>(2) Battery Risk Assessment. Prior to any work on a battery system, a risk assessment shall be performed to identify the chemical, thermal, electrical shock, and arc flash hazards and assess the risks associated with the</p>	<p>(1) Electrical Hazard Thresholds. Exposure levels shall not exceed those identified in the following list unless appropriate controls are implemented:</p> <ol style="list-style-type: none"> (1) AC: 50 volts and 5 milliamperes (2) DC: 100 volts and 40 milliamperes (3) Thermal: 1000 watts short-circuit power <p>(2) Battery Risk Assessment. Prior to any work on a battery system, a risk assessment shall be performed to identify the chemical, thermal, electrical shock, and arc flash hazards and assess the risks associated with the type of tasks to be performed.</p>	<p>threshold to be consistent with other Chapter 3 articles. Added the threshold for exposure to a thermal hazard to instruct that controls are required to prevent injury. Added an Informational Note for guidance to apply the thermal threshold. [FR-102, SR-47]</p> <p>Revised to add “thermal” to the list of hazards associated with batteries and battery rooms for completeness. [FR-102, SR-48]</p> <p>Safety Impact: No negative impact</p>
<p>Article 330 – Safety-Related Work Practices: Lasers</p>		
<p>330.3 Hazardous Energy (A) Voltage and Current. For the purpose of this section, hazardous voltage and current for ac systems is considered greater than or equal to 50 volts ac and 5 mA. For dc systems, hazardous voltage or current is considered greater than or equal to 100 volts dc and 40 mA. (B) Stored Energy. For the purpose of this article, hazardous stored energy is considered greater than or equal to 0.25 joules at 400 volts or greater, or 1 joule at greater than 100 volts up to 400 volts.</p>	<p>330.3 Electrical Hazard Thresholds. Exposure levels shall not exceed those identified in the following list unless appropriate controls are implemented:</p> <ol style="list-style-type: none"> (1) AC: 50 volts and 5 milliamperes (2) DC: 100 volts and 40 milliamperes (3) Capacitor stored energy: <ol style="list-style-type: none"> a. Less than 100 volts and greater than 100 joules of stored energy b. Greater than or equal to 100 volts and greater than 1.0 joule of stored energy c. Greater than or equal to 400 volts and greater than 0.25 joule of stored energy 	<p>Revised title for accuracy. Reformatted text into a list format to be consistent with other Chapter 3 articles. Added two Informational Notes to provide the basis for the hazard thresholds. [FR-127]</p> <p>Safety Impact: No negative impact</p>
<p>330.4 Electrical Safety Training. (B) Electrical Safety Training for Work on or with Lasers. Training in electrical safe work practices shall include, but is not limited to, the following:</p> <ol style="list-style-type: none"> (1) Chapter 1 electrical safe work practices (2) Electrical hazards associated with laser equipment (3) Stored energy hazards, including capacitor bank explosion potential (4) Ionizing radiation (5) X-ray hazards from high-voltage equipment (>5 kV) (6) Assessing the listing status of electrical equipment and the need for field evaluation of nonlisted equipment 	<p>330.4 Electrical Safety Training. (B) Electrical Safety Training for Work on or with Lasers. Training in electrical safe work practices shall include, but is not limited to, the following:</p> <ol style="list-style-type: none"> (1) Chapter 1 electrical safe work practices (2) Electrical hazards associated with laser equipment (3) Stored energy hazards, including capacitors and capacitor banks (4) Ionizing radiation, including X-rays at voltages greater than 10 kV in a vacuum (5) Assessing the listing status of electrical equipment and the need for field evaluation of nonlisted equipment 	<p>Revised text to accurately reflect changes in terms used throughout the standard and to remove redundancies. [FR-146, SR-53]</p> <p>Safety Impact: No negative impact</p>
<p>330.4 Safeguarding of Persons from Electrical Hazards Associated with Lasers and Laser Systems. (E) Listing.</p>	<p>330.4 Safeguarding of Persons from Electrical Hazards Associated with Lasers and Laser Systems. (E) Listing.</p>	<p>Revised text to clarify the requirement only applies to systems with the potential to expose workers to electrical</p>

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2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
Laser system electrical equipment shall be listed or field evaluated prior to use.	Laser system electrical equipment with the potential to expose workers to electrical hazards shall be listed or field evaluated prior to use.	hazards, which would not apply to laser pointers. [FR-129, SR-60] Safety Impact: No negative impact
Article 340 – Safety-Related Work Practices: Power Electronic Equipment		
<p>340.1 Scope. This article shall apply to safety-related work practices around power electronic equipment, including the following:</p> <ol style="list-style-type: none"> (1) Electric arc welding equipment (2) High-power radio, radar, and television transmitting towers and antennas (3) Industrial dielectric and radio frequency (RF) induction heaters (4) Shortwave or RF diathermy devices (5) Process equipment that includes rectifiers and inverters such as the following: <ol style="list-style-type: none"> a. Motor drives b. Uninterruptible power supply systems c. Lighting controllers 	<p>340.1 Scope. This article covers safety-related work practices around power electronic equipment, including the following:</p> <ol style="list-style-type: none"> (1) Electric arc welding equipment (2) High-power radio, radar, and television transmitting towers and antennas (3) Industrial dielectric and radio frequency (RF) induction heaters (4) Shortwave or RF diathermy devices (5) Equipment that includes rectifiers and inverters such as the following: <ol style="list-style-type: none"> a. Motor drives b. Uninterruptible power supply systems c. Lighting controllers (6) Generators producing sub RF (1 kHz to 3 kHz) and RF (3 kHz to 100 MHz) fields (7) Ionizing radiation field generators including X-rays, magnetrons, klystrons, thyratrons, vacuum tubes, and similar high-voltage vacuum devices (8) Nonionizing radiation field generating equipment, including: <ol style="list-style-type: none"> a. Antennas and RF transmission lines b. Radar equipment c. Industrial scientific and medical equipment d. RF induction and dielectric heaters e. Industrial microwave heaters and diathermy radiators f. Magnetic resonance imagers (MRIs) g. Large electromagnets 	<p>Revised to expand the list of equipment to include advances in technology. Removed “process” from list item (5) because the scope of Article 340 is not limited to process equipment. Revised Informational Note to add a reference applying to nonionizing radiation fields in the United States. [FR-136, SR-54]</p> <p>Safety Impact: No negative impact</p>
<i>This content was not in the previous edition.</i>	<p>340.4 Electrical Hazard Thresholds. Exposure levels shall not exceed those identified in the following list unless appropriate controls are implemented:</p> <ol style="list-style-type: none"> (1) DC (0 Hz to 1 Hz): 100 volts and 40 milliamperes (2) 60/50 Hz power: 50 volts and 5 milliamperes (3) AC (1 Hz to 3 kHz): 50 volts and 3 milliamperes (4) AC (3 kHz to 100 kHz): 1 x f mA, f in kHz (5) AC (100 kHz to 3 MHz): 100 mA 	<p>Added new section for electrical hazard thresholds to be consistent with other Chapter 3 articles. The electrical hazard thresholds are from IEEE C95.1. [FR-131, FR-167, SR-55]</p> <p>Safety Impact: No negative impact</p>

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2021 Edition Text	2024 Edition Text (Text changed or added is highlighted)	Change Description/ Impact to Worker Safety
	(6) AC (3 MHz to 30 MHz):100 (f/3)*0.3, f in MHz (7) AC (30 MHz to 110 MHz): 200 mA	
Article 350 Safety-Related Work Requirements: Research and Development Laboratories		
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 and 5 milliamperes (2) DC: 100 volts and 40 milliamperes	350.9 Electrical Hazard Thresholds. 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 and 5 milliamperes (2) DC: 100 volts and 40 milliamperes	Revised to replace “energy thresholds” with “electrical hazard thresholds” to correlate with other Chapter 3 articles. [FR-132, SR-56] Safety Impact: No negative impact
360.5 Establishing an Electrically Safe Work Condition for a Capacitor(s). (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 shall apply the following process for establishing and verifying an electrically safe work condition: (6) Verify that the capacitors are discharged. For capacitors less than 1000 joules, verification shall be permitted to be done either by testing or by grounding. For capacitors between 1000 joules and less than 100 kJ, verification shall be done using testing or soft grounding, then hard grounding. Above 100 kJ, an engineered and redundant system shall be used for remote testing and grounding. An adequately rated portable test instrument shall be used to test between each capacitor terminal and from each terminal to ground to assure that the capacitor is de-energized. (7) Before and after each verification, determine that the test instrument is operating satisfactorily through verification on a known dc voltage source. If voltage remains, determine and correct the cause, and repeat step (5) to discharge the capacitors. Where recharging can occur due to dielectric absorption or induced voltages, all the capacitor terminals shall be connected together and grounded with a bare or transparent-insulated wire.	360.5 Establishing an Electrically Safe Work Condition for a Capacitor(s). (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 shall apply the following process for establishing and verifying an electrically safe work condition: (6) Verify that the capacitors are discharged. For capacitors less than 1000 joules, verification shall be permitted to be done either by testing or by grounding. For capacitors between 1000 joules and less than 100 kJ, verification shall be done using testing or soft grounding, then hard grounding. Above 100 kJ, an engineered and redundant system shall be used for remote testing and grounding. An adequately rated grounding device (ground stick) or portable test instrument shall be used to test between each capacitor terminal and from each terminal to ground to assure that the capacitor is de-energized. (7) When test instruments are used for testing the absence of voltage, the operation of the test instrument shall be verified on a known dc voltage source before and after each absence of voltage procedure is performed. If voltage remains, determine and correct the cause, and repeat step (5) to discharge the capacitors. Where recharging can occur due to dielectric absorption or induced voltages, all the capacitor terminals shall be connected together and grounded with a bare or transparent-insulated wire.	Revised list item (6) to include ground sticks as an appropriate method to test for absence of voltage of capacitors. Revised list item (7) to correlate with language used elsewhere in the standard and clarify that the operability test is performed at the beginning and end of the sequence of absence of voltage tests, rather than after each terminal is checked. [FR-133] Safety Impact: No negative impact