IEEE Std 45.5®-2014

IEEE Recommended Practice for Electrical Installations on Shipboard – Safety Considerations

Presented by

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Introduction

- IEEE Std 45®-2002 Recommended Practice for Electrical Installations on Shipboard
  - Resource for engineering and management
- Original publication in 1998

Introduction

- IEEE Std 45®-2002 is being reorganized and revised into nine individual “dot” standards
  - *45.0 Base Document*
  - *45.1 Design*
  - ***45.2-2011 Controls and Automation – published***
  - ***45.3 Systems Engineering – in ballot***
  - *45.4 Marine Sectors and Mission Systems*
  - ***45.5-2014 Safety Considerations – published***
  - *45.6 Electrical Testing*
  - ***45.7-2012 AC Switchboards – published***
  - *45.8 Cable Systems*

IEEE STANDARDS ASSOCIATION IEEE

IEEE Recommended Practice for Electrical Installations on Shipboard—Safety Considerations

IEEE Industry Applications Society

Sponsored by the
Petroleum & Chemical Industry Committee

IEEE
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New York, NY 10016-5997
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IEEE Std 45.5™-2014

IEEE Std 45.5-2014

- IEEE Recommended Practice for Electrical Installations on Shipboard – Safety Considerations
  - Resources used to develop 45.5:
    - IEEE Std 3007.3 IEEE Recommended Practice for Electrical Safety in Industrial and Commercial Power Systems
    - NFPA 70E *Standard for Electrical Safety in the Workplace*
    - OSHA 29 CFR 1915 *Shipyard Employment* which includes portions of 1910 *General Industry Standards*
    - USCG - Marine electrical regulations in 46 CFR Subchapter J

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- IEEE Recommended Practice for Electrical Installations on Shipboard – Safety Considerations
  - Value to the electrical power-oriented engineers with limited experience in electrical installations
  - Aid to all engineers responsible for the operation and maintenance of electrical installations
  - Vital importance for electrical safety when working with all electrical installations

IEEE Std 45.5-2014

- Organized into nine sections:
  - Section 1: Overview
  - Section 2: Normative References
  - Section 3: Definitions
  - Section 4: Introduction to electrical safety
  - Section 5: Establishing an electrical safety program
  - Section 6: Providing and maintaining electrically safe systems and equipment
  - Section 7: Safe electrical work practices
  - Section 8: Protective equipment, tools, and methods
  - Section 9: Safety of use of electrical equipment

Section 3: Definitions

- Definition – electrical hazard
  - “A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.”
- Definition – electrical safety
  - “Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.”

Section 3: Definitions

- Definition – qualified person
  - “One who has received training in and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations and in the hazards involved.”

Section 4: Introduction to electrical safety

- Understand the nature and consequences of electrical hazards and the need for electrical safety
  - Injuries
  - Deaths
  - Near-misses

Section 4: Introduction to electrical safety

- Main phases of protection
  - Unless deenergizing is infeasible
    - Nature of the task
    - Creates a more hazardous situation
  - Place in an electrically safe work condition
    - Deenergized
    - Tried
    - Tested
    - Locked/tagged
    - Grounded or isolated
  - Work within the Limited Approach Boundary
    - Safe work practices and procedures must be used

Section 4: Introduction to electrical safety

- Electrical installations should be designed and constructed to be safe
  - Integrity of electrical equipment must be maintained
  - The following must be understood and used
    - Safe work practices
    - Personal protective equipment (PPE)
    - Insulated tools
    - Test equipment

Section 5: Establishing an Electrical Safety Program

- Familiarize workers with each procedure
- Familiarize workers with rites and responsibilities
- Demonstrate the employer’s intention
- Document general requirements and guidelines
- Direct the activities of workers
- Enable each employee to take responsibility

Section 5: Establishing an Electrical Safety Program

- Electrical safety program should be:
  - Formal
  - Written
  - Published
  - Available to all workers
  - Indication that the employer intends to comply

Section 6: Providing and maintaining electrically safe facilities

- Electrical
  - Designed
  - Installed
  - Maintained
- Will not be the cause of an electrical shock, arc flash burn, or blast
- Proper maintenance to reestablish safe condition

Section 7: Safe electrical work practices

- Careless actions of personnel results in injuries or death
- Safe practices necessary in all workplaces
- Enable employees to:
  - Recognize electrical hazards
  - Minimize exposure to hazards

Section 7: Safe electrical work practices

- Safe work practices are most important to concentrate on
- Not the intent of this section to repeat information from:
  - Nationally recognized regulations (OSHA)
  - Standards (NFPA 70E)
- Provides an overview of information for safe electrical work practices

Section 8: Protective equipment, tools, and methods

- Serves to eliminate or reduce hazard severity
- Reduce the likelihood of an accident
- Reduce the severity of an injury
  - OSHA and NFPA specific requirements to protect personnel
  - Selection of PPE determined by hazard analysis

Section 8: Protective equipment, tools, and methods

- All body parts exposed must be protected
- Last line of defense from personal injury
- ANSI and ASTM for selection, care, and use of clothing, tools, and equipment

Section 9: Safety of use of electrical equipment

- Helpful tips provided for operation and use of common equipment
  - Portable electric tools
  - Temporary extension cords
  - Testing instruments
- Safety of use depends on:
  - User knowledge of equipment
  - Integrity of system grounding
  - Protective systems, including GFCI
  - Inspection and maintenance of equipment

Section 9: Safety of use of electrical equipment

- Operation of distribution, utilization, and control equipment
  - Often performed by people without in-depth knowledge
  - Personnel should be knowledgeable of the equipment hazards

Electrical Safety Update
IEEE Std 45.5®-2014

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Electrical Safety Update

NFPA 70E®-2015 Revisions

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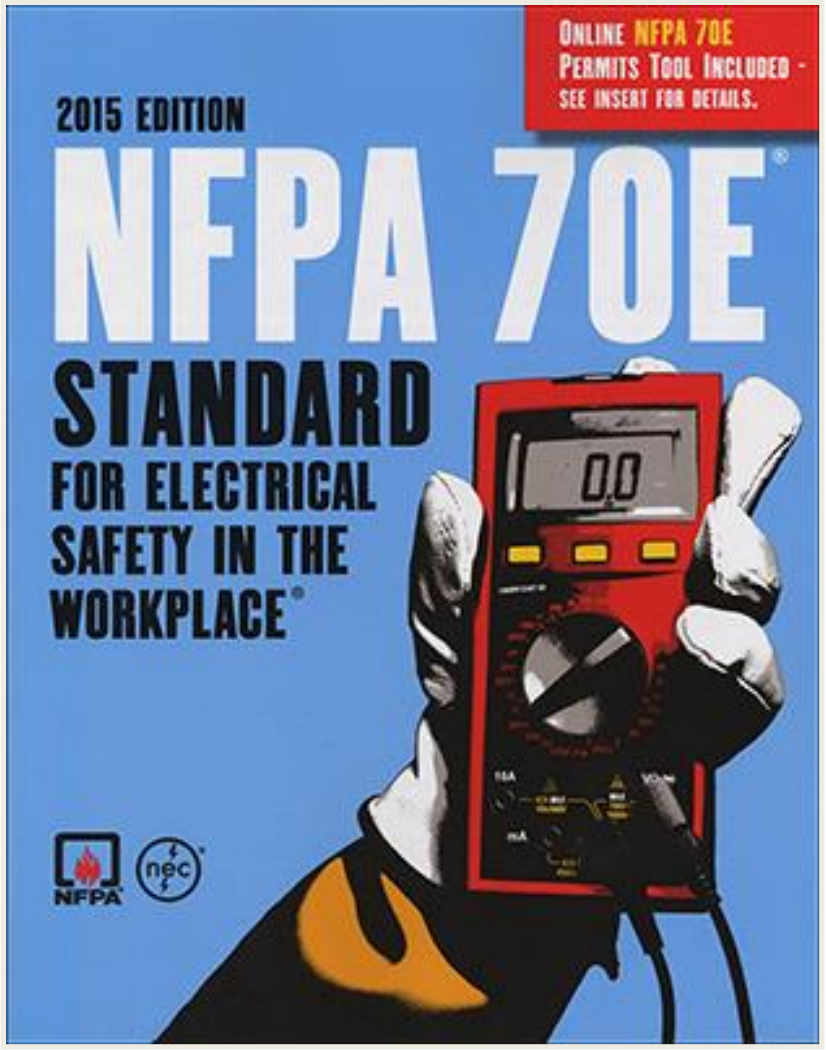
NFPA 70E® - 2015



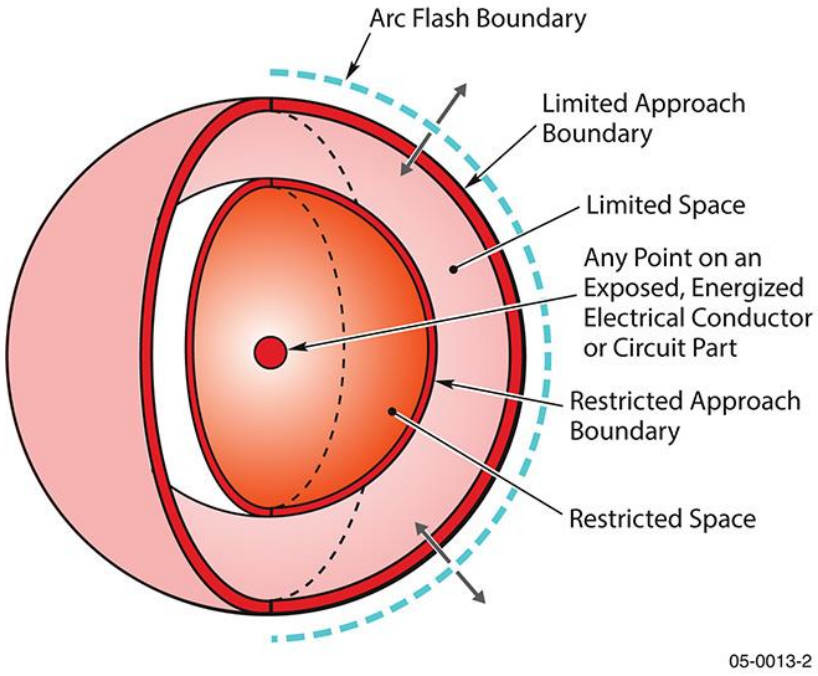
NFPA 70E-2015 Revisions

- Global revisions

NFPA 70E®-2012 Terms	NFPA 70E®-2015 Terms
electrical hazard analysis	electrical risk assessment
shock hazard analysis	shock risk assessment
arc flash hazard analysis	arc flash risk assessment
hazard/risk category	arc flash PPE category
hazard identification and risk assessment	risk assessment
probability	likelihood
harm	injury or damage to health
work shoes	footwear

NFPA 70E-2015 Revisions

- Prohibited Approach Boundary
  - Deleted
    - Did not require additional qualification requirements



NFPA 70E-2015 Revisions

- New and revised definitions
  - Risk
    - “A combination of 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
    - “A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard.”

NFPA 70E-2015 Revisions

- Section 90.2(A) Covered: added the words "**safety-related maintenance requirements, and other administrative controls**"
- A new paragraph **(B) Maintenance** was added to Section 110.1 *Electrical Safety Program*

NFPA 70E-2015 Revisions

- 130.2 – Risk assessment identifies need to establish an Electrically Safe Work Condition
- Section 130.2(A)(4) Normal Operation:
  1. Equipment is properly installed
  2. Equipment is properly maintained
  3. All doors are closed and secure
  4. All covers are in place and secure
  5. No evidence of impending failure

NFPA 70E-2015 Revisions

- Section 130.2(A)(4) Normal Operation:
  1. Equipment is properly installed
  2. Equipment is properly maintained
  3. All doors are closed and secure
  4. All covers are in place and secure
  5. No evidence of impending failure

NFPA 70E-2015 Revisions

- Section 130.5(3) requires the condition of **maintenance** as part of the arc flash risk assessment
- Section 205.3 requires electrical equipment to be **maintained** per the manufacturer's instructions or industry consensus standards to reduce the risk associated with failure of the equipment

NFPA 70E-2015 Revisions

- Section 205.4 requires overcurrent protective devices to be maintained and requires the **maintenance** to be documented

Note: The risk of an arc flash occurring, or equipment having exposed energized conductors or circuit parts, can be reduced through proper **maintenance** of electrical equipment

NFPA 70E-2015 Revisions

- New Table 130.7(C)(15)(A)(a) *Arc Flash Hazard Identification* has three columns;
  - Task
  - Equipment Condition
    - 5 conditions mentioned earlier
  - Arc Flash PPE Required – Yes or No

NFPA 70E-2015 Revisions

- NFPA 70E-2012 HRC tables were replaced with:
  - Table 130.7(C)(15)(A)(b) *Arc Flash Hazard PPE Categories for Alternating Current (ac) Systems*
  - Table 130.7(C)(15)(B) *Arc Flash Hazard PPE Categories for Direct Current (dc) Systems*
- Categories 0 and 2* have been deleted

NFPA 70E-2015 Revisions

- A new Section 130.10 addresses the requirement for performing a risk assessment prior to cutting or drilling into electrical equipment or through floors, walls or other structural elements where there is a likelihood of contacting energized parts
- Revised Informative Annex F Risk Assessment Procedure

OSHA Electrical Safety Revisions

- OSHA 20 CFR 1910.269 *Electric Power Generation, Transmission, and Distribution*
- OSHA 1910.137 *Electrical Protective Equipment*
- OSHA 1926 Subpart V *Electric Power Transmission and Distribution*
- OSHA 1926.97 *Electrical Protective Equipment*

OSHA Electrical Safety Revisions

- OSHA 20 CFR 1910.269 revisions include:
  - Information Transfer
  - Job Briefings
  - Fall Protection
  - Minimum Approach Distances (MAD)
  - Protection from Flames and Electric Arcs
  - Deenergizing Lines and Equipment for Employee Protection
- OSHA 1910.137 revisions include:
  - Addition of the Class 00, 500 volt, rubber insulating gloves

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