



Training Solutions, Delivered!

**SAFE ELECTRICAL  
WORK PRACTICES  
& THE 2018 NFPA 70E®  
(Concise)**

**Leader's Guide, Fact Sheet  
& Quiz**

**Item Number: 4892**  
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***This easy-to-use Leader's Guide is provided to assist in conducting a successful presentation.***

## **PREPARING FOR THE MEETING**

Here are a few suggestions for using this program:

- a) Review the contents of the Fact Sheet that immediately follows this page to familiarize yourself with the program topic and the training points discussed in the program. The Fact Sheet also includes a list of Program Objectives that details the information that participants should learn from watching the program.
- b) If required by your organization, make an attendance record to be signed by each participant to document the training to be conducted.
- c) Prepare the area and equipment to be used for the training. Make sure the watching environment is comfortable and free from outside distractions. Also, ensure that participants can see and hear the TV screen or computer monitor without obstructions.
- d) Make copies of the Review Quiz included at the end of this Leader's Guide to be completed by participants at the conclusion of the presentation. Be aware that the page containing the answers to the quiz comes before the quiz itself, which is on the final page.

## **CONDUCTING THE PRESENTATION**

- a) Begin the meeting by welcoming the participants. Introduce yourself and give each person an opportunity to become acquainted if there are new people joining the training session.
- b) Introduce the program by its title and explain to participants what they are expected to learn as stated in the Program Objectives of the Fact Sheet.
- c) Play the program without interruption. Upon completion, lead discussions about your organization's specific policies regarding the subject matter. Make sure to note any unique hazards associated with the program's topic that participants may encounter while performing their job duties at your facility.
- d) Hand out copies of the review quiz to all of the participants and make sure each one completes it before concluding the training session.

# 4892 SAFE ELECTRICAL WORK PRACTICES & THE 2018 NFPA 70E® (Concise) FACT SHEET

**LENGTH: 13 MINUTES**

## **PROGRAM SYNOPSIS:**

This video explains the important changes and updates contained in the 2018 NFPA 70E and discusses how electrical workers can be protected from both the shock hazard and arc-flash hazard presented by exposed energized parts. After viewing, electrical workers will have an understanding the details of the updated regulation and be convinced that always following electrical safe work practices and procedures is the only way to stay safe.

Topics include skills of a qualified person, approach boundaries, the arc-flash boundary, arc-flash hazard PPE categories, field labels, establishing and verifying an electrically safe work condition and energized work and the energized work permit.

## **PROGRAM OBJECTIVES:**

After watching the program, the participant should be able to explain the following:

- How an electrically safe working condition is established and verified;
- What the two approach boundaries for shock protection are;
- How the Arc-flash Boundary is determined;
- What clothing and protective equipment is required by each of the four arc-flash hazard PPE categories;
- When energized work is allowed and when an energized work permit is required.

## **PROGRAM OUTLINE**

### **BACKGROUND**

- One of the leading authorities on electrical safety is the National Fire Protection Association, the NFPA. Their document number "70E" is recognized by OSHA and other regulatory authorities as the "best practices" for electrical safety.
- The 2018 NFPA 70E focuses on protecting workers from the two main hazards of electricity: the shock hazard and the arc-flash hazard.
- In order to protect workers from the dual hazards of electricity, a job briefing must be conducted with all involved employees prior to beginning any job. The job briefing must include all elements of the job safety plan as well as the information contained on an energized electrical work permit if one is required.

### **THE QUALIFIED PERSON**

- One important safety principle contained in the NFPA 70E is that an electrical worker must be "qualified" for the work to be performed. A qualified person is defined as follows: "A qualified person is one who has demonstrated skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risks."
- Some skills that a qualified electrical worker should be able to demonstrate include:
  - Distinguish exposed energized conductors and circuit parts from other parts of the equipment;
  - Determine the nominal voltage of exposed energized conductors and circuit parts;
  - Determine the Approach Boundary distances.

### **APPROACH BOUNDARIES**

- There are two approach boundaries for shock protection: the Limited Approach Boundary and the Restricted Approach Boundary.
- The Limited Approach Boundary is the shock protection boundary farthest away from exposed energized electrical conductors or circuit parts and is established to keep unqualified persons a safe distance from exposed energized parts.
- Unqualified workers may not cross the Limited Approach Boundary unless briefed on the hazards and continuously escorted by a qualified person.
- The Restricted Approach Boundary is the shock protection boundary closest to the exposed energized parts and may only be crossed by qualified electrical workers following safe electrical work-practices which include wearing appropriate shock protection PPE and using insulated tools.

- Shock protection PPE must include voltage rated gloves anytime the nominal voltage is greater than 50 volts.
- The distance from an energized part or conductor to each of these shock protection boundaries increases as the nominal voltage increases. One of the required skills of a qualified electrical worker is determining the nominal voltage of the equipment on which they intend to work.
- Once this information is known, the shock protection approach boundaries may be looked up in Table 130.4(D)(a) for alternating current or “AC” systems and in table 130.4(D)(b) for direct current or “DC” systems.

### **THE ARC-FLASH BOUNDARY**

- A qualified electrical worker must also be able to determine the Arc-flash Boundary and the required Arc-flash PPE for the job task they intend to perform.
- First, use Task Table 130.5(C) to determine the likelihood of an arc-flash occurrence. If an arc-flash occurrence is likely then, Table 130.7(C)(15)(a) may be used for common AC systems and Table 130.7(C)(15)(b) may be used for common for DC systems.
- Before using these tables, you must ensure that the circuit and equipment on which you intend to work match the available fault current and fault clearing times noted in the table.
- The arc-flash boundary is typically the outermost of all approach boundaries and must be marked with barricading and hazard signage.
- One method used to meet this requirement is using red "Danger High Voltage" barricade tape, which serves the dual purpose of being both a barricade and a danger sign.
- Workers may not cross the Arc-flash Boundary unless they are briefed on the hazards and are wearing appropriate arc-rated clothing and protective equipment.

### **ARC-RATED CLOTHING**

- Arc-rated clothing is designed to withstand both the intense heat and force of an arc blast without breaking open or bursting into flames.
- When unprotected workers cross the arc-flash protection boundary without arc-rated clothing and protective equipment, they place themselves at risk of serious burn injury. These burns are often made much worse by the ignition of flammable clothing.
- Because the survival rate of serious burn injury is largely dependent on the percentage of body burned, preventing your clothing from igniting during an arc-flash incident is often the difference between life and death.

### **ARC-FLASH HAZARD PPE CATEGORIES**

- The Arc-flash Hazard PPE tables in the 2018 70E standard list the required arc-flash protection as being in one of four arc-flash PPE categories.
- Each arc-flash PPE Category requires a specific level of arc rated protection, measured in calories per square centimeter or joules per square centimeter.
- Category One requires arc-rated clothing of at least four calories per square centimeter or 16.75 joules per square centimeter. This must include arc-rated long sleeves and long pants or arc-rated coveralls. Also required is an arc-rated face shield or an arc-rated flash suit hood.
- Category Two requires arc-rated clothing of at least eight calories per square centimeter or 33.5 joules per square centimeter. This must include arc-rated long sleeves and long pants or arc-rated coveralls. Also required is an arc-rated face shield combined with an arc-rated balaclava or an arc-rated flash suit hood.
- Category Three requires a system of arc-rated clothing that provides a minimum of 25 calories per square centimeter or 104.7 joules per square centimeter.
- This system of arc-rated clothing may consist of any combination of the following provided that the chosen combination has been tested and verified to provide the required level of arc-flash protection: arc-rated long sleeves, arc-rated long pants, arc-rated coveralls, arc-rated flash suit pants and arc-rated flash suit jacket. Also required is an arc-rated flash suit hood.
- Category Four requires a system of arc-rated clothing that provides a minimum of 40 calories per square centimeter or 167.5 joules per square centimeter. Also required is an arc-rated flash suit hood.
- Each of the four arc-flash PPE categories also requires the following protective equipment: voltage-rated hardhat, safety glasses or safety goggles, ear canal insert-type hearing protection, leather footwear and leather gloves or voltage-rated gloves with leather protectors.
- Category three and four require that gloves be arc-rated.

### **FIELD LABELS**

- The 2018 NFPA 70E requires that the owner of electrical equipment install field-labels on equipment. These labels must display the nominal system voltage, the arc-flash boundary and at least one of the following two items: the arc-flash hazard

PPE category and/or the minimum arc rating of clothing and PPE.

- If an incident energy calculation was used to determine the appropriate arc-flash hazard PPE, then the incident energy level and corresponding working distance may be substituted on the label for the arc-flash PPE category.
- Having this critical information readily available on the equipment label makes the selection of proper arc-rated clothing and PPE much easier for electrical workers.

#### **ESTABLISHING AND VERIFYING AN ELECTRICALLY SAFE WORK CONDITION**

- Until you have verified the existence of an electrically safe work condition, all safe work practices applicable to the circuit voltage and energy level must be used.
- To create an electrically safe working condition, first determine all possible sources of electrical supply to the equipment.
- Next, disconnect any active loads.
- Then open the disconnecting device for each source of electrical supply.
- Visually verify if possible, that all blades of disconnecting devices are fully open and that draw-out type circuit breakers are withdrawn to the fully disconnected position.
- Next, release any stored electrical energy such as that found in capacitors and release or block any stored mechanical energy such as springs under tension or items that could be impacted by gravity.
- Then apply company approved locks and tags to the open disconnecting devices in accordance with your facility's lockout tagout procedures.
- Finally, no electrical lockout is complete without testing for the absence of voltage and applying grounds when necessary.
- The test instrument must be verified to be working properly by measuring a known voltage source immediately prior to voltage testing.
- When testing to confirm an absence of voltage, test each phase conductor or circuit part both phase to ground and to phase, for all phases.
- Once voltage testing is complete, immediately verify the test instrument again on a known voltage source.
- Once the electrical conductors and circuit parts are verified to be in an electrically safe work condition, then no electrical hazards exist.
- This means that shock and arc-flash protection are no longer necessary and may be removed.

#### **ENERGIZED WORK AND THE ENERGIZED WORK PERMIT**

- The 2018 NFPA 70E requires an Energized Electrical Work Permit anytime work is performed within the Restricted Approach Boundary and/or anytime a worker interacts with equipment when an increased likelihood of injury or damage to health from an exposure to an arc-flash hazard exists.
- An Energized Electrical Work Permit is not required under the following conditions: testing, troubleshooting and voltage measuring, thermography, ultrasound or visual inspections if the restricted approach boundary is not crossed.
- An Energized Electrical Work Permit is not required for general housekeeping and non-electrical tasks provided that the restricted approach boundary is not crossed.

## **ANSWERS TO THE REVIEW QUIZ**

1. a

2. b

3. c

4. a

5. b

6. a

7. a

8. c

9. b

*The following questions are provided to determine how well you understand the information presented in this program.*

Name \_\_\_\_\_ Date \_\_\_\_\_

A qualified worker must be able to determine Approach Boundary distances.

- a. True
- b. False

2. What is the first step in creating an electrically safe working condition?

- a. Disconnecting any active loads
- b. Determining all possible sources of electrical supply to the equipment
- c. Opening the disconnecting device for each source of electrical supply

3. When should a voltage test instrument be verified to be working properly?

- a. Immediately prior to testing
- b. Immediately after testing
- c. Both immediately prior to testing and immediately after testing

4. Which approach boundary is the closest to the exposed energized parts?

- a. The Restricted Approach Boundary
- b. The Limited Approach Boundary

5. Shock protection PPE that includes voltage rated gloves is not required unless the nominal voltage is greater than 120 volts.

- a. True
- b. False

6. If your equipment does not match the available fault current and fault clearing times noted in the 2018 NFPA 70E tables, you may NOT use these tables to determine the Arc-Flash Boundary distance or the appropriate arc-flash hazard PPE.

- a. True
- b. False

7. The arc-flash boundary is typically the outermost of all approach boundaries and must be marked with barricading and hazard signage.

- a. True
- b. False

8. Arc-flash PPE \_\_\_\_\_ requires a system of arc-rated clothing that provides a minimum of 25 calories per square centimeter or 104.7 joules per square centimeter.

- a. Category 1
- b. Category 2
- c. Category 3
- d. Category 4

9. The installation of field labels on electrical equipment is NOT required by the 2018 NFPA 70E.

- a. True
- b. False