

NFPA 70E

# **Personal Protective Equipment (PPE) SELECTOR**



## **An NFPA 70E – 2009 Perspective**

### **PPE Selector – – Objectives**

#### ***Objectives***

- Explain why electrical contractors should follow precautions set forth in NFPA 70E
- List at least three hazards which demonstrate why a flash hazard analysis is needed.
- Describe the restrictions associated with the boundaries defined in NFPA 70E.
- Identify two methods for determining the appropriate PPE for a given task
- Given the Hazard Risk Category of a task select appropriate PPE.

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## **PPE Selector – Summary of NFPA 70E Standard**

### **NFPA 70E - 2009**

Chapter 1 - Safety- Related Work Practices

Chapter 2 - Safety-Related Maintenance Requirements

Chapter 3 - Safety Requirements for Special Equipment.



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## **Summary of NFPA 70E Standard for Electrical Safety in Workplace**

### **PPE Compliance/Advice**

- OSHA
  - 1910 General Industry Subpart S
  - 1926 Construction Subpart K

- NFPA 70E

- OSH Act: General Duty Clause 5a(1)

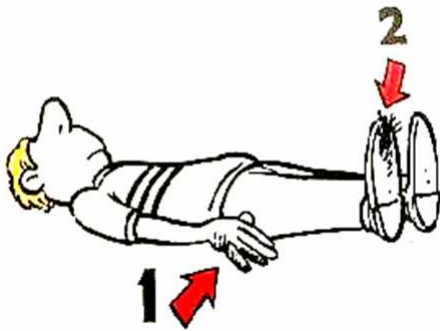
- Other



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## PPE Selector – Assessment

### The Body as Conductor



Current (mA*)	Reaction
1	Faint tingle
5	Slight shock
6 – 30	Can't let go
50 – 150	Death possible
1,000 – 4,300	Heart ceases

\* mA = 0.001 amp

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## PPE Selector – Assessment

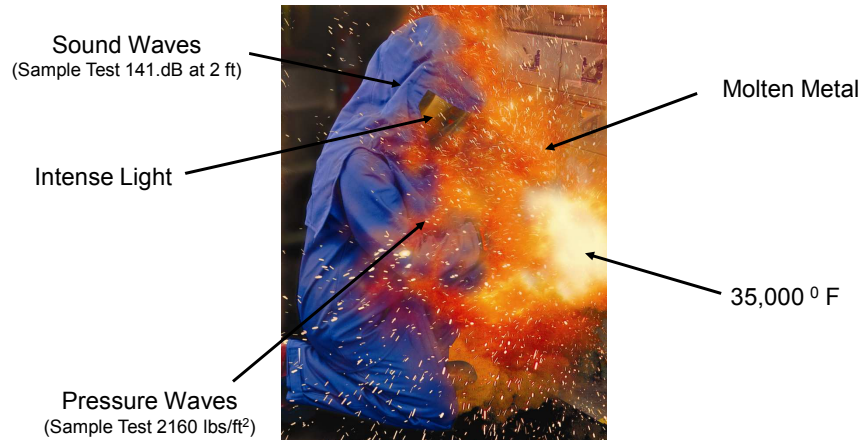
### Protect Employees

- Working on or Near Live Parts
  - Justification
  - Safe Practices for Working Hot
- Personal Protective Equipment



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## PPE Selector – Assessment

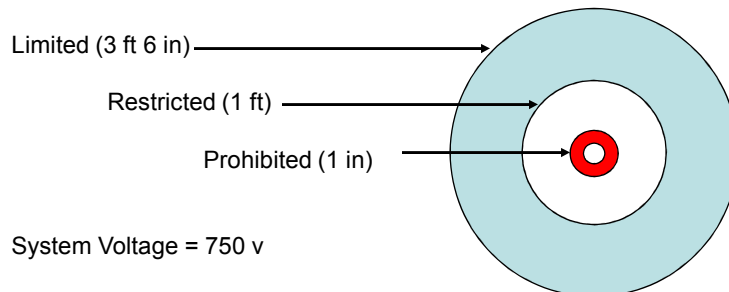


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## PPE Selector – Assessment

### Assess Hazards - Electrical Hazard Analysis

- Shock Hazard Analysis - Table 130.2 (C)



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## PPE Selector – Assessment

### Assess Hazards - Electrical Hazard Analysis

- Flash Hazard Analysis

#### Flash Boundary =

$$D_c = [2.65 \times MVA_{bf} \times t]^{1/2}$$

or

$$D_c = [53 \times MVA \times t]^{1/2}$$

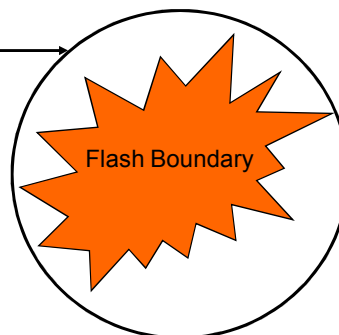
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## PPE Selector – Assessment

### Assess Hazards - Electrical Hazard Analysis

- Flash Hazard Analysis

4 feet  
(Default Boundary  
at 600 volts or less)



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## PPE Selector – Assessment

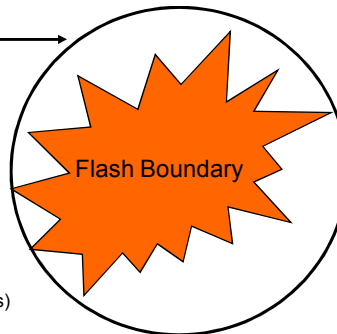
### Assess Hazards - Electrical Hazard Analysis

- Flash Hazard Analysis

Greater than 600 volts =  
Distance at which  
Incident Energy  
Equals 1.2 cal/cm<sup>2</sup>\*

SEE Table D.2

\*(Fault clearing time slower than 0.1. seconds)



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## PPE Selector – Assessment

### Incident Energy Levels

Levels of Exposure		
Calculated Incident Energy	Hazard Risk Category	Minimum ATPV Rating
Up to 1.2 Cal/cm <sup>2</sup>	Category 0	(N/A)
1.2 to 4 Cal/cm <sup>2</sup>	Category 1	4
4.1 to 8 Cal/cm <sup>2</sup>	Category 2	8
8.1 to 25 Cal/cm <sup>2</sup>	Category 3	25
25.1 to 40 Cal/cm <sup>2</sup>	Category 4	40
Over 40 Cal/cm <sup>2</sup>	No Category – Not Permitted	

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## **PPE Selector - Selection**

### **Calculation Method**

- Calculate Incident Energy Level (cal/cm<sup>2</sup>)
- Select the Hazard / Risk Category using Table 130.7(C)(11)  
(Match PPE Arc Thermal Protective Value (ATPV) to incident energy calculation)
- Select clothing and PPE for task from Table 130.7(C)(10)
- Determine the need for V-rated gloves and tools

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## **PPE Selector - Selection**

### **Table Method**

- Identify Hazard / Risk Category Classification  
in Table 130.7(C)(9)
- Select clothing and PPE from Table 130.7(C)(10) and the need  
for V- rated gloves and tools

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## PPE Selector - Selection

**HAZARD/RISK  
CATEGORY 0**

**0NN**



### Personal Protective Equipment and Clothing

Protective Clothing	FR Protective Equipment
Shirt (long sleeve) (NM) Pants (long) (NM)	Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (AN) (Note 2)

### NOTES

NM = Protective Clothing, Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber

SR = Selection Required

AN = As Needed (optional)

2 If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfy the flash protection requirement.

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## PPE Selector - Selection

**HAZARD/RISK  
CATEGORY 0**

**0YY**



Rubber Insulating Gloves are gloves rated for the maximum line-to-line voltage upon which work will be done.

Insulated and Insulating Hand Tools are tools rated and tested for the maximum line-to-line voltage upon which work will be done. Insulated and Insulating Hand Tools are tools that are manufactured and tested in accordance with the ASTM F 1505 standard.

### Personal Protective Equipment and Clothing

Protective Clothing	FR Protective Equipment
Shirt (long sleeve) (NM) Pants (long) (NM)	Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Rubber insulating gloves Insulated and insulating hand tools

### NOTES

NM = Protective Clothing, Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber

SR = Selection Required

2 If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfy the flash protection requirement.

**Warning:** A leather protective glove should always be worn over rubber insulating gloves to provide the needed mechanical protection against cuts, abrasions, and punctures.

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## PPE Selector - Selection

### HAZARD/RISK CATEGORY 1

Minimum Arc Rating of PPE 16.74 J/cm<sup>2</sup> (4 cal/cm<sup>2</sup>) (Note 1)

1NN



#### Personal Protective Equipment and Clothing

FR Clothing	FR Protective Equipment
Arc-rated long-sleeve shirt (Note 3)	Hard hat
Arc-rated pants (Note 3)	Safety glasses or safety goggles (SR)
Arc-rated coverall (Note 4)	Hearing protection (ear canal inserts)
Arc-rated face shield or flash suit hood (Note 7)	Leather gloves (Note 2)
Arc-rated jacket, parka or rainwear (AN)	Leather work shoes (AN)

#### NOTES

- SR = Selection Required      AN = As Needed (optional)
- See Table 130.7(C)(11). Arc rating for a garment or system of garments is expressed in cal/cm<sup>2</sup>.
  - If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.
  - The FR shirt and pants used for Hazard/ Risk Category 1 shall have a minimum arc rating of 4.
  - Alternate is to use FR coveralls (minimum arc rating of 4) instead of FR shirt and FR pants.
  - A face shield with a minimum arc rating of 4 for Hazard/Risk Category 1 or a minimum arc rating of 8 for Hazard/Risk Category 2, with 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.

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## PPE Selector - Selection

### HAZARD/RISK CATEGORY 2

Minimum Arc Rating of PPE 33.47 J/cm<sup>2</sup> (8 cal/cm<sup>2</sup>) (Note 1)

2NN



#### Personal Protective Equipment and Clothing

FR Clothing	FR Protective Equipment
Arc-rated long-sleeve shirt (Note 5)	Hard hat
Arc-rated pants (Note 5)	Safety glasses or safety goggles (SR)
Arc-rated coverall (Note 6)	Hearing protection (ear canal inserts)
Arc-rated face shield or flash suit hood (Note 7)	Leather gloves (Note 2)
Arc-rated jacket, parka or rainwear (AN)	Leather work shoes

#### NOTES

- SR = Selection Required      AN = As Needed (optional)
- See Table 130.7(C)(11). Arc rating for a garment or system of garments is expressed in cal/cm<sup>2</sup>.
  - If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.
  - FR shirt and FR pants used for Hazard/ Risk Category 2 shall have a minimum arc rating of 8.
  - Alternate is to use FR coveralls (minimum arc rating of 8) instead of FR shirt and FR pants.
  - A face shield with a minimum arc rating of 4 for Hazard/Risk Category 1 or a minimum arc rating of 8 for Hazard/Risk Category 2, with 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.

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## PPE Selector - Selection

### HAZARD/RISK CATEGORY 3

Minimum Arc Rating of PPE 104.6 J/cm<sup>2</sup> (25 cal/cm<sup>2</sup>) (Note 1)

**3NN**



#### Personal Protective Equipment and Clothing

FR Clothing	FR Protective Equipment
Arc-rated long-sleeve shirt (AR) (Note 8)	Hard hat
Arc-rated pants (AR) (Note 8)	FR hard hat liner (AR)
Arc-rated coverall (AR) (Note 8)	Safety glasses or safety goggles (SR)
Arc-rated flash suit jacket (AR) (Note 8)	Hearing protection (ear canal inserts)
Arc-rated flash suit pants (AR) (Note 8)	Arc-rated gloves (Note 2)
Arc-rated flash suit hood (Note 8)	Leather work shoes
Arc-rated jacket, parka or rainwear (AN)	

#### NOTES

- SR = Selection Required AR = As Required AN = As Needed (optional)
- See Table 130.7(C)(11). Arc rating for a garment or system of garments is expressed in cal/cm<sup>2</sup>.
  - If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfy the flash protection requirement.
  - An alternate is to use a total FR clothing system and hood, which shall have a minimum arc rating of 25 for Hazard/Risk Category 3.

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## PPE Selector - Selection

### HAZARD/RISK CATEGORY 4

Minimum Arc Rating of PPE 167.36 J/cm<sup>2</sup> (40 cal/cm<sup>2</sup>) (Note 1)

**4NN**



#### Personal Protective Equipment and Clothing

FR Clothing	FR Protective Equipment
Arc-rated long-sleeve shirt (AR) (Note 9)	Hard hat
Arc-rated pants (AR) (Note 9)	FR hard hat liner (AR)
Arc-rated coverall (AR) (Note 9)	Safety glasses or safety goggles (SR)
Arc-rated flash suit jacket (AR) (Note 9)	Hearing protection (ear canal inserts)
Arc-rated flash suit pants (AR) (Note 9)	Arc-rated gloves (Note 2)
Arc-rated flash suit hood (Note 9)	Leather work shoes
Arc-rated jacket, parka or rainwear (AN)	

#### NOTES

- SR = Selection Required  
AN = As Needed (optional)
- See Table 130.7(C)(11). Arc rating for a garment or system of garments is expressed in cal/cm<sup>2</sup>.
  - If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfy the flash protection requirement.
  - The total clothing system consisting of FR shirt and pants and/or FR coveralls and/or arc flash coat and pants and hood shall have a minimum arc rating of 40 for Hazard/Risk Category 4.

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## PPE Selector - Selection

### Basic Rules of PPE

- Layering
- Coverage
- Fit
- Maintenance



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## PPE Selector – Tools and Equipment

### Supplemental Protective Equipment

- Tools
- Temporary grounds
- Rubber insulating equipment
- Barriers
- Inspection and maintenance

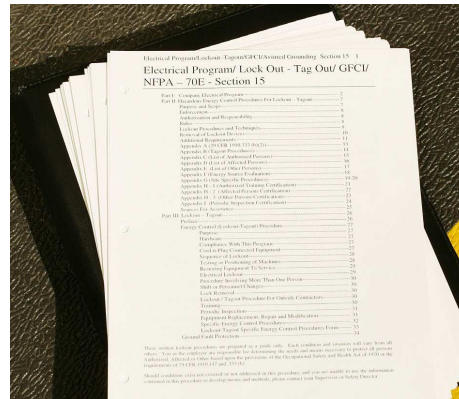


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## PPE Selector – Summary

### NFPA 70E Requirements

- Complete Energized Electrical Work Permit
- Perform Hazard/Risk Analysis
- Select PPE



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## PPE Selector – Summary

### Exceptions to Work Permit by Qualified Person

- Testing
- Troubleshooting
- Voltage Measuring



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## **PPE Selector - Summary**

### **PPE**

- Required within the Flash Protection Boundary
- Based on Flash Hazard Analysis as well as other hazards
- Includes head to toe protection



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## **PPE Selector - Summary**

### **Supplemental Protective Equipment**

- Tools
- Temporary grounds
- Rubber insulating equipment
- Barriers
- Inspection and maintenance



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### **PPE Selector – Review Questions**

1. A prudent course of action for electrical contractors is to observe the PPE requirements in NFPA 70E because:
  - a. NFPA 70E is the equivalent of an OSHA standard
  - b. NFPA 70E serves as an industry guideline for safe practices and may be referenced by OSHA
  - c. NFPA 70E should not be used

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### **PPE Selector – Review Questions**

2. List at least three hazards which demonstrate why a flash hazard analysis is needed

**Electric Shock Hazard**

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**Extreme Temperatures**

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**Molten Metal Debris**

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**Intense Light**

**Sound waves**

**Pressure**

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### **PPE Selector – – Review Questions**

3. A distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists is:
- a. Arc Flash Protection Boundary
  - b. Limited Protection Boundary
  - c. Prohibited Boundary

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### **PPE Selector – – Review Questions**

4. The only method for determining the appropriate PPE is to perform a Flash Hazard Analysis and Incident Energy Level calculation using appropriate formulas.
- True
- False

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## **PPE Selector – – Review Questions**

5. Which of the following would you not expect to be need for a Hazard Risk Category 0?
- a. Arc-rated face shield or flash suit hood
  - b. Hearing
  - c. Rubber Gloves

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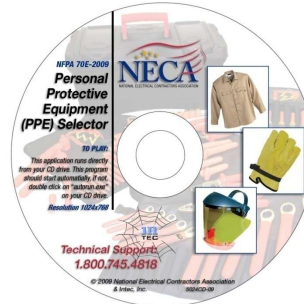
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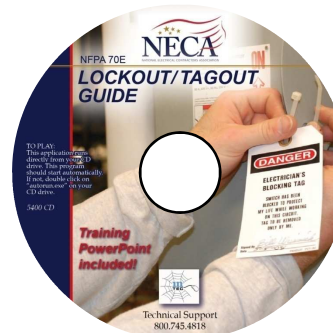
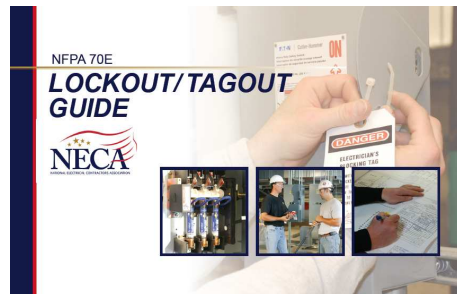


## PPE Selector – Resources



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## PPE Selector – Resources



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## PPE Selector – Resources

The screenshot shows a web browser window displaying the NECA eSafetyLine website. The browser's address bar shows the URL <http://www.esafetyline.net/neca/index.asp?>. The browser's toolbar includes Norton, Phishing Protection, Identity Safe, Log-ins, Google, and various utility buttons like Bookmarks, Popups, Check, AutoLink, and AutoFill. The website header features the NECA logo and the text "NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION". A left sidebar contains a list of navigation links: Home, Access Records, Accident Reporting, Back Injury Prevention, Basic Safety Program, Bloodborne Pathogens, Chemical Safety, Confined Space, Electrical Safety, Ergonomics, Fall Protection, Fire Prevention, and NFPA 70E. The main content area is titled "Welcome to eSafetyLine" and includes a welcome message, a list of links (Email Customer Service, License, Copyright, Disclaimer, and Confidentiality), a section on "Using The Website" explaining the grey buttons, a "Compliance Guides" section, and a "Print Binders" section with links to Compliance Binder and Training Binder. A "Latest Updates" section is also visible. The footer of the website states "© 2009 National Electrical Contractors Association and Intec, Inc."

## End of Session For Help Contact

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