



A DIVISION OF WESCO DISTRIBUTION, INC.

## Electrical Arc Flash Protection Ready Reference

Updated 10/2018

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### 1. The Law

#### A. NFPA 70E 2018

- This standard addresses electrical safety work practices and procedures for employees who work on or near exposed, energized electrical equipment.
- This standard requires employees to wear Arc Rated (AR) clothing that meets the requirements of ASTM F1959 whenever there is a possibility of an arc flash and the employee is within the restricted approach or arc flash boundaries.
- Prior to the performance of live work, employees must perform a risk assessment to determine the likelihood and severity of an arc flash to develop based on their work.

Colors and numbers above correspond to the arc flash PPE categories below

Arc Flash PPE Category	Minimum Arc Rating (cal/cm <sup>2</sup> )	Non-melting Clothing (Base layer)	<u>Arc Rated</u> Clothing (outer layer)	Additional, Required PPE
1	4	T-shirt & Long pants	Long sleeve shirt and pants or coveralls. Face shield or flash suit hood.	Hard hat, safety glasses or goggles, hearing protection, leather footwear, voltage rated rubber gloves w/ leather protectors
2	8	T-shirt & Long pants	Long sleeve shirt and pants or coveralls. Flash suit hood or face shield and balaclava.	Hard hat, safety glasses or goggles, hearing protection, leather footwear, voltage rated rubber gloves w/ leather protectors
3	25	T-shirt & Long pants	Long sleeve shirt and pants or coveralls. Or flash suit jacket and pants. Flash suit hood.	Hard hat, safety glasses or goggles, hearing protection, leather footwear, voltage rated rubber gloves w/ leather protectors
4	40	T-Shirt & Long pants	Long sleeve shirt and pants or coveralls. Or flash suit jacket and pants. Flash suit hood.	Hard hat, safety glasses or goggles, hearing protection, leather footwear, voltage rated rubber gloves w/ leather protectors

## B. OSHA Requirements

- While OSHA has not formally adopted this standard, they have several comparable regulations to cite employers.
- General Duty Clause (OSHA Act 1970 5(a)(1)) and make reference to NFPA 70E
- 1926.97(c)(2)(viii)
  - Electrical protective equipment shall be subjected to periodic electrical tests. Test voltages and the maximum intervals between tests shall be in accordance with Table E-4 and Table E-5
  
- 29 CFR 1910.132 (d)(1): Requires employers to perform a personal protective equipment (PPE) hazard assessment to determine necessary PPE;
- 29 CFR 1910.269 (l)(6)(iii): Requires that employers ensure each employee working at electric power generation, transmission, and distribution facilities who is exposed to the hazards of flames or electric arcs does not wear clothing that could increase the extent of injury when exposed to such a hazard;
- 29 CFR 1910.335 (a)(1)(i): Employees working in areas where there are potential electrical hazards shall use electrical protective equipment appropriate for the specific parts of the body for the work being performed;
- 29 CFR 1910.335 (a)(1)(iv): Requires employees to wear nonconductive head protection whenever exposed to electric shock or burns due to contact with exposed energized parts;
- 29 CFR 1910.335 (a)(1)(v): Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from an electrical explosion;
- 29 CFR 1926.28 (a): Employer shall require employees to wear appropriate personal protective equipment (PPE) during construction work.
  
- OSHA has confirmed that garments which meet the requirements of ASTM F1506 are in compliance with OSHA 29 CFR 1910.269 Electrical Power Generation, Transmission, and Distribution, with regard to garments not contributing to burn severity
- To address the industry's request to utilize non-flame resistant clothing based on an analysis of their exposure level, ASTM developed F1958, whereby non-flame resistant garments, which do not meet the requirements of ASTM F1506, are tested on a manikin to determine the probability of ignition. The major problem associated with applying this test is that accidents typically do not follow a prescribed set of rules, so actual burn injuries could greatly vary from the results of the test.
- By utilizing flame resistant garments, compliance to OSHA requirements can be assured and potentially more serious burn injuries from garment ignition may be avoided
- OSHA only allows work on live electrical parts under two special circumstances – when continuity of service is required and when de-energizing equipment would create additional hazards. In all other cases, lockout/tagout is the law.

## **2. The Essentials**

### **A. What Happens to Clothing During Electrical Arc Flash?**

- Electrical arcs can reach temperatures in excess of 35,000 degrees which instantly melts and then vaporizes electrical conductors into combustible plasma gas. This gas rapidly expands due to the superheating of air which produces a concussive blast that propels molten shrapnel at speeds that exceed the speed of sound; NFPA refers to this condition as arc blast. A byproduct of arc blast is blast overpressure which is produced when the blast shock wave reaches the sound barrier. Blast overpressure is fatal even down to 2 pounds per square inch where it crushes hollow organ systems such as the respiratory and gastrointestinal systems. For these reasons, 40cal/cm<sup>2</sup> is the largest arc flash exposure that PPE can protect against.

### **B. What if My Job Task is Not Listed in Table 130.7(C)(15)(a) of NFPA 70E?**

- A flash hazard analysis must be done. The Duke Power Flux Calculator is needed.

### **C. Is Compliance with NFPA 70E Mandatory?**

- No. NFPA 70E is a national consensus safety standard published by NFPA primarily to assist OSHA in preparing electrical safety standards. Federal OSHA has not incorporated it into the Code of Federal Regulations.

### **D. Can I Be Cited for Not Complying with NFPA 70E?**

- No. The employer must assess the workplace for electrical hazards and the need for PPE under 29CFR 1910.335(a)(1)(i). Details on how to comply with this standard are up to the employer. The

employer is expected to use the best means available to comply with this requirement, and that is done through consensus standard NFPA 70E. Compliance with 70E will assure compliance with this OSHA requirement. In the event of an injury or death due to an electrical accident, if OSHA determines that compliance with 70E would have prevented or lessened the injury, OSHA may cite the employer under the general duty clause.

### **E. What Are the Regulations for Labeling Electrical Equipment?**

- Employers are responsible for complying with the NEC labeling requirements
- This standard requires all switchboards, panel boards, industrial control panels, and motor control centers to be marked

### **F. How Often Should Electrical Gloves be Tested?**

- A minimum of every 6 months for most applications (exception is telecom). [PowerPoint from Salisbury](#).

### **G. Why Are Leather Glove Protectors so Expensive?**

- These gloves are specifically made to fit over the electrical gloves, offering the best dexterity possible. If customers use standard leather gloves, they will not be afforded nearly as good of dexterity. If low-voltage electrical gloves are used without a leather protector, regulation specifies that these gloves be electrically retested to ensure no pinholes have developed.

### **H. Glove Sizing ([Glove Sizing](#))**

- When choosing electrical gloves, you measure your hand as you would other gloves (circumference of the widest part of the hand). While we only stock size large (9), x-large (10), and xx-large (11), we can special order electrical gloves down to a size medium (8). For half sizes, it is usually best to go up to the next size.
- If you add a glove liner, you might want to have the customer consider going up one size.
- For leather protectors, choose the exact same size as electrical glove they go over.

## I. Electrical Glove Classes

### Class – Max. Voltage

00	-	500 Volts
0	-	1,000 Volts
1	-	7,500 Volts
2	-	17,000 Volts
3	-	26,500 Volts
4	-	36,000 Volts

## 3. Product Reference

- A. Low or High Voltage Gloves and Leather Protector
- B. Glove Inflator Kit
- C. Canvas Glove Bag
- D. Insulated Tools
- E. Switchboard/Insulated Matting
- F. Arc Flash Hazard Warning Labels
- G. Dielectric Overshoes
- H. Insulated Rescue Hook
- I. Carbtex Heat Resistant Gloves – Designed for use in arc flash environments

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