

## Attachment 1

The NFPA 70E requires a shock hazard analysis and an arc flash hazard analysis to be conducted under article 130.2(A) and Article 130.3 respectively for work being performed on energized circuits of 50 volts or more. The approach boundaries given in Table 130.4(D)(a) define the limits of approach for AC shock hazards for both qualified and unqualified employees. (Note: Use Table 130.4(D)(b) for DC limits of approach). For qualified employees, the shock hazard may be mitigated by the proper selection and use of insulating PPE or materials and tools. On the other hand, performing an arc flash hazard analysis is much more complicated and involves calculations of incident energy at each location in the system where an arc flash event may occur. However, in lieu of an arc-flash analysis the NFPA 70E standard permits the employer to use Table 130.7(C)(15)(A) to assess the arc flash hazard identification for under a set of limited working conditions particularly related to condition and maintenance. And then determine the arc flash hazard PPE category on table 130.7(C)(15)(B) along with the associated arc-flash boundary.<sup>1</sup> The conditions that lie within the scope of this electrical safety program are given in Table II. Table I specifies the PPE requirement for those tasks identified in Table II. Work to be performed that lies outside of the tasks identified in Table II require an arc flash analysis and the proper selection of PPE before it may be performed safely.

<sup>1</sup> Note: To use the tables, the fault current and clearing time must be less than the parameters outlined in table I

**Personal Protective Equipment Selection Matrix  
for work on Energized Electrical Components or Systems**

**(Tables are based on the NFPA 70E-2015)**

**Table I**

<b>Arc Flash Hazard PPE Category</b>	<b>Protective Clothing and PPE Required</b>	<b>Required Minimum Arc Rating of PPE (cal/cm<sup>2</sup>)</b>
1	<p><b>Clothing</b> AR long sleeve shirt and long pants or AR coveralls over cotton shirt and pants.</p> <p><b>Protective Equipment</b> Hard hat (ANSI Z89.1) Safety glasses (ANSI Z87.2) Face protection (arc-rated face shield complying with ANSI Z87.2) Rubber gloves* (ASTM D120, Type 1) Leather protectors (ASTM F686-02) Ear protection (ear canal inserts) Insulated tools (ASTM F1505) Leather work shoes</p>	4.0

\* For circuit voltage up to 500V, use class 00 rated rubber gloves, for circuit voltage between 501 volts and 750 volts AC (1000 volts DC), use class 0 rated rubber gloves.

**Table I (Cont)**

<b>Arc Flash Hazard PPE Category</b>	<b>Protective Clothing and PPE Required</b>	<b>Required Minimum Arc Rating of PPE (cal/cm<sup>2</sup>)</b>
2	<p><b>Clothing</b>            Cotton undergarments, AR long sleeve shirt and long pants             An alternate is to use AR coveralls (minimum arc rating of 8 cal/cm<sup>2</sup> over non-melting or untreated natural fiber pants and T-shirt.</p> <p><b>Protective Equipment</b>            Hard hat (ANSI Z89.1)            Safety glasses (ANSI Z87.1)            Face protection (arc-rated face shield or double-layer switch hood with shield Complying with ANSI Z87.2)            Balaclava hood min. 8 cal/cm<sup>2</sup>            Ear protection (ear canal inserts)            Rubber gloves* (ASTM D120, Type 1)            Leather protectors (ASTM F696-02)            Insulated tools (ASTM F1505)            Leather work shoes</p>	8.0

\* For circuit voltage up to 500V, use class 00 rated rubber gloves, for circuit voltage between 501 volts and 750 volts AC (1000 volts DC), use class 0 rated rubber gloves.

**Table I (Cont)**

<b>Arc Flash Hazard PPE Category</b>	<b>Protective Clothing and PPE Required</b>	<b>Required Minimum Arc Rating of PPE (cal/cm<sup>2</sup>)</b>
3	<p><b>Clothing</b> Cotton underwear, long sleeve shirt and long pants plus AR suit</p> <p><b>Protective Equipment</b> Hard hat (ANSI Z89.1) Safety glasses (ANSI Z87.1) Face protection (rated flash suit hood with shield complying with ANSI Z87.2) Ear protection (ear canal inserts) Rubber gloves* (ASTM D120, Type 1) Leather protectors (ASTM F696-02) Insulated tools (ASTM F1505) Leather work shoes</p>	25.0
4	<p><b>Clothing</b> Cotton underwear shirt and pants plus multilayer flash suit</p> <p><b>Protective Equipment</b> Hard hat (ANSI Z89.1) Safety glasses (ANSI Z87.1) Face protection (rated flash suit hood with shield complying with ANSI Z87.2) Ear protection (ear canal inserts) Rubber gloves* (ASTM D120, Type 1) Leather protectors (ASTM F696-02) Insulated tools (ASTM F1505) Leather work shoes</p>	40

\* For circuit voltage up to 500V, use class 00 rated rubber gloves, for circuit voltage between 501 volts and 750 volts AC (1000 volts DC), use class 0 rated rubber gloves. Class 1 rated gloves for work on 4160 volt equipment and class 2 rated gloves for voltages over 5 kV but less than 15 kV.

**Table II**

This arc flash PPE table is based on NFPA 70E tables in a condensed format. It is based on equipment in good condition, secured, and regularly maintained as per manufacturer or NFPA 70B recommendations. If parameters are met, this table may be used for PPE category and arc flash boundary.

Note: For arc flash boundary, see Arc Flash label on equipment or use Table II

TASK	PARAMETERS Fault Current Clearing Time	ARC FLASH PPE CATEGORY	ARC FLASH BOUNDARY and WORK DISTANCE
Electrical work on systems rated 240 volts or less including: operate single phase circuit breakers if maintained, or fused switches and disconnects with doors closed, cable trough or tray cover removal, work on control circuits 50 volts or less, meggar testing or similar diagnostics, and 12 VDC battery maintenance (less than 1 kA).	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
Working on electrical systems rated at 240 volts or less including: opening hinged covers on control circuit enclosures and voltage testing, work on DC systems up to 250 volts with less than 4 kA.	≤25 kA & Max 2 cycles	1	19 in. Work 18 in.
Working on or near exposed energized parts rated at 600 volts or less where exposed to electrical parts, but no physical work is performed that may cause a serious arc flash and that is not listed in PPE 3 category. Work on DC Systems up to 250 VDC with 4-7 kA.	≤65 kA & Max 2 cycles  or ≤42 kA & Max 30 cycles	2	5 ft. Work 18 in.
Working on or near exposed energized parts rated at 600 volts or less including removing bolted covers on exposed 480 volt cabinets with generator running, open cover to exposed parts of an ATS or UPS enclosure, racking in or out 480 volt breakers on an energized bus or working on a 480 volt MCC, Work on DC Systems up to 250 VDC with 7-15 kA	≤35 kA & Max 30 cycles	3	AC - 20 ft. DC – 6 ft. Work 18 in.
Exposing energized parts rated at <u>greater than 600</u> volts nominal including main switchgear, racking in/out breakers, and opening doors to check phasing or other energized work, or testing and grounding with a hot stick.	≤35 kA & Max 15 cycles	4	40 ft. Work 36 in.

**Table III**

**Approach Boundaries to Live Parts for Shock Protection**  
**(All dimensions are distance from live part to employee measured in feet)**

(1)	(2)	(3)	(4)
	<b>LIMITED APPROACH BOUNDARY</b>		<b>RESTRICTED APPROACH BOUNDARY</b>
<b>Nominal System Voltage Range Phase to Phase</b>	<b>Exposed Movable Conductor</b>	<b>Exposed Fixed Circuit Part</b>	
50 to 150	(10 ft. 0 in.)	(3 ft. 6 in.)	Avoid Contact
150 to 600	(10 ft. 0 in.)	(3 ft. 0 in.)	(1 ft. 0 in.)
601 to 15,000	(10 ft. 0 in.)	(5 ft. 0 in.)	(2 ft. 2 in.)