

APPLICATION NOTE

How to use the new arc-flash PPE tables in the 2018 edition of NFPA 70E

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Once again the NFPA 70E Committee has made significant revisions to the table method in the 2018 edition of NFPA 70E Standard for Electrical Safety in the Workplace. Since the 2000 edition of NFPA 70E the task tables have been both a boon and a bane. They were a boon, because in the absence of an incident energy analysis, the tables were often the only method available to choose arc-rated clothing and PPE. They were a bane, because they needed to be stated clearly in the table method.



Editor's note: We recommend obtaining the full NFPA 70E standard as a reference. It can be found at www.nfpa.org

High level summary of the guideline:

The table method is used only if an incident energy analysis has not been conducted. If an incident energy analysis has been performed the estimated incident energy exposure to the worker is calculated and an arc flash hazard warning label is applied to the equipment. Table 130.5(C) has been modified from the existing Table H.3(b) in Annex H and is intended to be used when an incident energy analysis has been performed and the equipment labeled. Since Table 130.5(C) is in the main standard text, it is now part of the standard, instead of the Annex it is not a mandatory table, though the 70E says its use is permitted. Incident energy exposures 1.2 cal/cm² and below were removed from the table, as the table only applies to arc-rated clothing, equipment and PPE.

Overview of the Table Method

The table method has been reduced to three tables: Table 130.7(C)(15)(a), Table 130.7(C)(15)(b) and Table 130.7(C)(15)(c). Table 130.7(C)(15)(a) is a revised and simplified version of Table 130.5(C). Table 130.5(C) can be used for both the table method and the incident energy analysis method to aid in determining the likelihood of the occurrence of an arc flash. This is an extension of the change made in the 2015 edition of NFPA 70E that looked to OSHA 29CFR1910.269 Annex E Table 1 and eliminate many of the shortcomings of the old table method, while allowing better safety for the engineering

1. The revised Table 130.5(C) to determine the likelihood of the occurrence of an arc flash. This table may not be applicable for all work conditions and circumstances and must be used with caution. Be safe. Do not do it if a competent person while using Table 130.5(C) to effect the elimination of the risk of an arc flash.

and the maximum clearing time of the overcurrent protective device. The minimum working distance is also given. If an overcurrent protective device is not within the limits of the table, the table method cannot be used to select arc-rated clothing and PPE. If the limits are within the table's elements, proceed to Table 130.7(C)(15)(c). Note that the electrical equipment is being examined and no arc flash warning label will be required.

a. A new Informational Note attached to Table 130.7(C)(15)(a) to provide some estimated maximum clearing time of common overcurrent protective devices. A minimum information change, the estimated maximum clearing time will be a factor for the condition of the work being performed. The elements must meet all the elements of 130.2(A)(4), Normal Clearing Condition. Some information, change

a. The condition of maintenance, maintenance, may not be known to the technician performing the work. If an arc flash condition cannot be met, all arc-rated clothing and PPE is always going to be required.

b. A fault current will be calculated using the maximum available fault current from the available ampere capacity of the transformer (terminal) feeding the circuit when using the table method. The 2018 edition of NFPA 70E listed the available fault current, meaning the circuit breaker, the point of fault. Available fault current is referred to the circuit breaker, and on the transformer secondary terminal in no impedance. Since an incident energy analysis has not been done, the fault current cannot be estimated, but the fault current can.

c. The available fault current will almost always be less than the calculated available fault current secondary terminal, due to circuit impedance. Using fault current will provide a conservative selection of arc-

Figure 1

Equipment	Arc flash PPE category	Arc-flash boundary
<p>Panelboard or switchgear, rated 240 volts and below</p> <p>Parameters: Maximum available fault current maximum clearing time; minimum working distance 455 mm (18 in.)</p>	1	485 mm (19 in.)
<p>Panelboard or switchgear, rated greater than 240 volts and up to 600 volts</p> <p>Parameters: Maximum available fault current maximum clearing time; minimum working distance 455 mm (18 in.)</p>	2	900 mm (3 ft)
<p>600-volt motor control center (MCC)</p> <p>Parameters: Maximum available fault current maximum clearing time; minimum working distance 455 mm (18 in.)</p>	2	1.5 m (5 ft)
<p>600-volt motor control center (MCC)</p> <p>Parameters: Maximum available fault current maximum clearing time; minimum working distance 455 mm (18 in.)</p>	4	4.3 m (14 ft)
<p>600-volt switchgear (high-voltage circuit breaker of fed-in type) and 600-volt</p>		

Informational Note to Table 130.7(C)(15)(a): The following are typical fault clearing times of overcurrent protective devices:

- (1) 0.5 cycle fault clearing time is typical for current limiting fuses when the fault current is within the current limiting range.
- (2) 1.0 cycle fault clearing time is typical for non-current limiting fuses and circuit breakers with an instantaneous integral trip.
- (3) 3.0 cycle fault clearing time is typical for insulated case circuit breakers rated less than 1000 volts with an instantaneous integral trip relay operated trip.
- (4) 5.0 cycle fault clearing time is typical for insulated case circuit breakers with a short time delay trip in the instantaneous range (i.e., "no intentional delay").
- (5) 10 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time delay trip in the instantaneous range.
- (6) 30 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay without instantaneous trip.

Informational Note No. 1: See Table 130.7(C)(15)(a) for the typical fault clearing times of overcurrent protective devices.

Additional information regarding the 2018 NFPA 70E reference to a specific PPE table in the 2018 Edition of NFPA 70E can be found in the 2018 NFPA 70E Handbook, Section 130.7(C)(15)(a). The handbook provides a hierarchy of risk control methods. More than one risk control method may need to be used to account for the risk involved in the task. If the level of PPE is indicated, Table 130.7(C)(15)(a) is then used. The first entry in Table 130.7(C)(15)(a) is to find the level of PPE indicated, then note the limit given in that column of the table.

In order to use Table 130.7(C)(15)(a) or 130.7(C)(15)(b), Section 130.7(C)(15) must be met. Section

Task	Equipment condition	Arc flash PPE category
Perform infrared on 1.3 (A)-23.6 0 0	1 183 602.06 cm0 T9.5 63 72.455 Tm09(c)-1o-f)10.3 (c)	12.2 (E)-5 (310.3 T 8.5 >>BD(310.26 0 0 1

3-Steps to use NFPA 70E Table Method

Step 1 – Determine the requirement for arc-rated clothing and PPE for a listed task

- If a task is not listed in Table 130.7(C)(15)(A)(a) the table method cannot be used
- If ALL conditions in the second column are met arc-rated clothing and PPE are not required by the table method
 - Even if arc-rated clothing and PPE are not required, it may be advisable to use
- If ANY of the conditions in the second column are not met arc-rated clothing and PPE are required
- If arc-rated clothing and PPE are required, proceed to Table 130.7(C)(15)(A)(b)

Step 2 – Determine arc-flash PPE category

- As an example, the task will be performed on a 480 V panelboard
- Estimate the available short-circuit current and clearing time of the OCPD, based on the device (OCPD)
 - Available short-circuit current and clearing time of the OCPD are being estimated. If unable to determine either of these, default the task and can be estimated in confidence

- See safety barrier, sign or attendant as needed (Section 130.7(E) A-130.7(E) (Technique))

- Proceed to Table 130.7(C)(16)

Step 3 – Choose arc-rated clothing and PPE and non-arc-rated PPE using Table 130.7(C)(16)

- In the example shown, PPE Category 2 (old HRC 2) is selected
- Wear all listed PPE listed in Table 130.7(C)(16)

PPE Category	PPE
1	<p>Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm² (see Note 1)</p> <p>Arc-Rated long-sleeve shirt and pants and arc-rated coveralls</p> <p>Arc-Rated face shield (see Note 2) or arc-rated hood</p> <p>Arc-Rated jacket, alka-safety earplugs or hearing protection (AN)</p> <p>Protective Equipment</p> <p>Hand gloves</p> <p>Safety glasses or safety goggles (SR)</p> <p>Hearing protection (ear canal insert)</p> <p>Headed leather gloves (see Note 3)</p> <p>Leather foot caps (AN)</p>
2	<p>Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm² (see Note 1)</p> <p>Arc-Rated long-sleeve shirt and pants and arc-rated coveralls</p> <p>Arc-Rated hood or arc-rated face shield (see Note 2) and arc-rated balaclava</p> <p>Arc-Rated jacket, alka-safety earplugs or hearing protection (AN)</p> <p>Protective Equipment</p> <p>Safety glasses BT8.56 (f)-3.7 (e)-4.7 (g)-38 (g)-11.2 (o)-14.5 (g)-</p>

Table 130.7(C)(16)

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