APPLICATION NOTE

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

by Jim White, Shermco Industries

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 it needs to be stated clearly that 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

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(G) 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(G) is in the main standard text, it is now part of the standard, instead of the Annex. It is not a mandatory table, though and 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)(a) was revised and parts of it now Table 130.5(C). Table 130.5(C) can be used for both the table method and the incident energy analysis method to assist in determining the likelihood of the occurrence of an arc flash. This is an extension of the changes made in the 2015 edition of NFPA 70E that looked to OSHA 29CFR1910.269 Annex E Table 1 and eliminated many of the shortcomings of the old table method, while also providing better safety for those using it.

High level summary of the guidelines:

1. It is first used to determine the likelihood of the occurrence of an arc flash. This table may not be suitable for all work conditions and circumstances and must be used with caution. Best safe work practice would require a complete risk assessment while using Table 130.5(C) to verify or supplement the results of the risk assessment.
2.

current and the maximum operating time of the overcurrent protective device. The minimum working distance is also given. If any of these conditions are not within the limits of the tables, the table method cannot be used to select arc-rated clothing and PPE. If the limits are within the table requirements, proceed to Table 130.7(C)(15)(c). Note that these values are being estimated and no arc flash warning label will be present.

a. A new Informational Note attached to Table 130.7(C)(15)(a) provides some estimated maximum operating times of common overcurrent protective devices. As with all information such as this, those estimates may or may not be appropriate for the conditions of the task being performed. The equipment must meet all the requirements of 130.2(A)(4), Normal Operating Conditions. Some information, such

a the condition of maintenance, ma not be kno n to the technician performing the ta k. If an of the condition cannot be met f ll , arc-rated clothing and PPE i al a going to be e ired.

b. A a matter of afet , i i be to calc late the ma im m a ailable hort-circ it c rrent a ailable at the econdar of the tran – former terminal( ) feeding the cir it hen ing the table method. The 2018 edition of NFPA 70E itched to the hi he a ailable fa lt c rrent, meaning the c rrent een at the oint of fa lt A ailable hort-cir it c r- rent refer to the c rrent that o ld a ear on the tran former econdar terminal ith no im edance. Since an incident energy anal i ha not been done, the fa lt c rrent cannot be e timated, b the hort-cir it c rrent can.

c. The a ailable fa lt c rrent ill almo t al a be lo er than the c rrent calc lated at the tran former econdar terminal , d e to cir it im edance. U ing hort-cir it c rrent ill pro ide a con er ati e election of arc-

Figure 1

Equipment	Arc flash PPE category	Arc-flash boundary
Panelboard or other equipment rated 240 volts and below Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycle) fault clearing time; minimum working distance 455 mm (18 in)	1	485 mm (19 in.)
Panelboard or other equipment rated greater than 240 volts and up to 600 volts Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycle) fault clearing time; minimum working distance 455 mm (18 in)	2	900 mm (3 ft)
600-volt class motor control centers (MCC) Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycle) fault clearing time; minimum working distance 455 mm (18 in)	2	1.5 m (5 ft)
600-volt class motor control centers (MCC) Parameters: Maximum of 42 kA available fault current; maximum of 0.33 sec (20 cycle) fault clearing time; minimum working distance 455 mm (18in.)	4	4.3 m (14 ft)
600-volt class switchgear (with power circuit breakers or fused switches) and 600-volt class		

Informati[illegible] Note to Table [illegible](C)(15)(a): The follow[illegible] 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) [illegible] is typical for molded case circuit breakers rated less than 1[illegible] volts with an instantaneous integral [illegible]

(3) 3.0 cycle fault clearing time is typical for insulated case circuit breakers [illegible] less than 1000 volts with an instantaneous integral trip or relay operated trip.

(4) 5.0 cycle fault clearing time [illegible] instantaneous range (i.e., "no intentional delay").

[illegible] cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers w[illegible] motor [illegible]

(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 1 of IEEE 1584TM, *Guide for Performing Arc Flash Hazard Calculations*, for further information regarding Notes [illegible] through d.

Assuming the worker is performing a task that requires what the 2018 NFPA 70E refers to as additional protective measures, they would go through the 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 use of PPE is indicated, Table 130.7(C)(15)(a) is then used. The first step in using Table 130.7(C)(15)(a) is to find the type of equipment listed, then note the limits given in that portion 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

FLUKE®

Arc-Flash PPE Category	PPE
1	**Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm² (16.75J/cm²)[a]** Arc-rated long-sleeve shirt and pants or arc-rated coverall Arc-rated face shield[b] or arc flash hood Arc-rated jacket, parka, rain gear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts)[c] Heavy duty leather gloves Leather footwear (AN)
2	**Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm² (33.5J/cm²)[a]** Arc-rated long-sleeve shirt and pants or arc-rated coverall Arc-rated face shield[b] or arc flash hood Arc-rated jacket, parka, rain gear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts)[c] Heavy duty leather gloves Leather footwear (AN)

Task	Equipment condition	Arc flash PPE category
Perform infrared th1.3 (r)-23.6 0 0	1 183 602.i96 cm0 T9.5 63 72.455 Tm(o9(c)-1o-f)10.3 (c	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 operating time of the overcurrent protective device (OCPD)
  - Available short circuit current and operating time of the OCPD are being estimated. If unable to determine either of these, defer the work until these can be estimated with confidence

- Se safe barriers, sign or attendant as needed (Section 130.7(E) Alerting Techni e)
- 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 e am le ho n, PPE Category 2 (old HRC 2) i e ired
- Wear all li ted PPE li ted in Table 130.7(C)(16)

PPE Category	PPE
1	**Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm²** (ee note 1) Arc-rated long- lee e hirt and ant or arc-rated co erall Arc-rated face hield (ee Note 2) or arc fla h hood Arc-rated jacket, arka, rain ear, or hard hat liner (AN) **Protective Equipment** Hard hat Safe gla e or afe goggle (SR) Hearing rotection (ear canal in er) Hea -d leather glo e (ee Note 3) Leather foot ear (AN)
2	**Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm²** (ee note 1) Arc-rated long- lee e hirt and ant or arc-rated co erall Arc-rated fla h hood or arc-rated face hield (ee Note 2) and arc-rated balacla a Arc-rated jacket, arka- d ear l 7 2 l der (AN) **Protecti Equipment** Sfe gla e BT8.56 (f)–3.7 (e)–4.7 ( )–38 (g)–11.2 (o)–14.5 (g)–

Table 130.7(C)(16)

Aou 8htm White

Fluke. *Keeping your world up and running.®*

Fluke Corporation
PO Bo 9090, E e WA 98206 U.S.A.

Fluke Europe B.V.
PO Bo 1186, 5602 BD
Eindho en, The Ne herland

For more information call:
In the U.S.A. (800) 443-5853 or
Fa (425) 446-5116
In E e/M-Ea /Africa +31 (0) 40 2675 200 or
Fa +31 (0) 40 2675 222
In Canada (800)-36-FLUKE or
Fa (905) 890-6866
From other co ntrie +1 (425) 446-5500 or
Fa +1 (425) 446-5116
Web acce : ht :// .fl ke.com