

TechTopics No. 64

NFPA 70E - Changes in the 2012 edition

This issue of TechTopics discusses changes to NFPA 70E® Electrical Safety in the Workplace® in the 2009 and 2012 editions. Changes discussed are those relative to personal protective equipment (PPE) for arc-resistant and for non-arc-resistant medium-voltage switchgear.

First, here's a bit of background regarding NFPA 70E. The Williams-Steiger Occupational Safety and Health Act was enacted in 1970, creating the U.S. Occupational Safety and Health Administration (OSHA). OSHA was charged with enforcement activities to foster safety in the workplace. OSHA initially used the National Electrical Code® (NEC®, or more formally, NFPA 70®) requirements in its enforcement activities, but soon realized that the NEC is an installation document and does not really address safety in any significant manner. OSHA also recognized that the federal regulatory process is slow, and therefore requested that a new consensus standard on safety in the workplace be created.

As a result, NFPA formed a new committee in early 1976 to create the document NFPA 70E. NFPA 70E was a logical adjunct to the NFPA 70 committee responsible for the NEC. The first edition of NFPA 70E was issued in 1979. The sixth edition of the document was issued in 2004, the eighth edition in 2009, and the 2012 issue is the ninth edition.

NFPA 70E was created at the request of OSHA, and OSHA uses NFPA 70E in enforcement activities. OSHA does not technically enforce NFPA 70E, but OSHA looks favorably on safety programs that comply with NFPA 70E. Programs that do not conform to NFPA 70E face a burden of demonstrating that they have a valid basis for a safety program. This is a burden that most firms prefer not to bear.

Enough background – what about the changes?

The 2004 edition of NFPA 70E did not explicitly recognize the existence of arc-resistant switchgear, and the hazard risk category (HRC) tables in the 2004 edition made no allowance for a lower HRC with arc-resistant switchgear. The 2009 edition recognized arc-resistant switchgear.

The HRC tables in NFPA 70E are only one method of determining the hazard risk category for various activities, and actually are not the preferred method. The preferred method is to determine the incident energy at the working distance for various activities.

Article 130.7(C)(15) states that "...for tasks not listed, or for power systems with greater than the assumed maximum short-circuit current capacity or with longer than the assumed maximum fault clearing times, an incident energy analysis shall be required..." Up to the 2012 edition, it was difficult to understand this statement because the Hazard/Risk Category (HRC) table only provided short-circuit current levels and fault-clearing times for low-voltage equipment, not for medium-voltage equipment. This difficulty was resolved in the 2012 edition, as table 130.7 (C)(15)(a) now lists maximum short circuit values and fault clearing times for all equipment categories.

Incident energy calculations are best performed in accordance with IEEE Std 1584. The calculation methods in IEEE Std 1584 will most often (but not always) yield a lower HRC than the task tables in NFPA 70E. However, many users simply rely on the tables in the standard, as they have not performed the calculations of incident energy. It is for this reason that the changes to the HRC tables are highly significant.

Article 100 in the 2012 edition includes the following definition:

Switchgear, Arc-Resistant: Equipment designed to withstand the effects of an internal arcing fault and that directs the internally released energy away from the employee.

The HRC table refers to IEEE C37.20.7 in connection with some medium-voltage equipment, but not for low-voltage equipment. Also, it does not consistently relate “arc resistant” to IEEE C37.20.7. The original issue of IEEE C37.20.7 was issued in 2001, and was titled “Guide for Testing Medium-Voltage Metal-Enclosed Switchgear for Internal Arcing Faults.” The 2007 edition of C37.20.7 was published in early 2008, further refining the test methodology of the 2001 document. It also extended the document to cover not only medium-voltage equipment, but also low-voltage equipment. Because of the extension to cover low-voltage equipment, the title changed to “Guide for Testing Metal-Enclosed Switchgear Rated Up To 38 kV for Internal Arcing Faults.”

While not shown in the table above, the revisions also recognize a reduction in HRC for medium-voltage NEMA E2 motor starters that have been tested in accordance with IEEE C37.20.7. For insertion or removal (racking) of starters of non-arc-resistant construction, the HRC is 4. For starters of arc-resistant construction with the doors closed, the HRC is 0.

The following table provides a comparison of the hazard risk category in the 2012 table.

Excerpt from Table 130.7(C)(15)(a), Hazard/Risk Category Classification for arc-resistant and non-arc-resistant switchgear

"Item"	Hazard risk category	
	Non-arc-resistant	Arc-resistant ¹
Metal-clad switchgear 1 kV to 38 kV		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	3	0 ² (doors closed)
CB operation with enclosure doors closed	2	0
Insertion or removal (racking) of CB		
■ Doors open	4	4
■ Dors closed	4	0
Opening VT or CPT compartments	4	4
Insertion or removal (racking) of VTs, doors closed	4	0

Footnotes:

¹ Arc-resistant switchgear, type 1 or 2 (for clearing times of < 0.5 s with a perspective fault current not to exceed the arc-resistant rating of the switchgear.

² Infrared thermography not addressed in NFPA 70E-2012, but HRC 0 inferred as circuit breaker operations with door closed are HRC category=0 for arc-resistant equipment.

As can be read from the table, the 2009 and 2012 revisions recognize a significantly reduced requirement for personal protective equipment for certain operations involving arc-resistant switchgear, as compared to the same operations with non-arc-resistant switchgear.

It must be recognized that arc-resistant switchgear is only arc-resistant when all doors and covers are closed and correctly secured. Whenever doors are open on arc-resistant switchgear, it is no longer arc-resistant, and therefore the HRC is the same as for non-arc-resistant switchgear.

Siemens must caution that this is only a summary of the 2012 edition of NFPA 70E and the reader is strongly encouraged to read and follow NFPA 70E carefully.

System voltage	Upstream fault-clearing time	Maximum bolted-fault current for HRC 2	Maximum bolted-fault current for HRC 4
		(8 cal/cm ²) ¹	(40 cal/cm ²) ¹
15 kV	0.10	45 kA	63 kA
	0.35	13 kA	63 kA
	0.70	7 kA	32 kA
	1.00	5 kA	23 kA

Footnote:

¹ Assumed working distance.

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Siemens Industry, Inc.
7000 Siemens Road
Wendell, NC 27591

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For more information, contact: +1 (800) 347-6659

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