

**NFPA 70E Proposals
for the ROP Meeting
January 16-20, 2007**

**Proposals 70E- 313
through
Proposal 70E-426**

Part 3 of 5

70E-313 Log #10 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: David Hatton, D.R. Hatton Electric

Recommendation: Revise as follows:

Other 600 V Class (277V through 600V, nominal) Equipment: ~~Application of safety grounds, after voltage testing 2*~~ Y
N

Substantiation: Duplication of task identifications within this section. 4th task - in this section of table is listed again, as the last (9th task) in this section. All the requirements for hazard/risk category, v-rated gloves, v-rated tools matches in both the 4th and the 9th tasks.

70E-314 Log #12 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: David Hatton, D.R. Hatton Electric

Recommendation: Revise as follows:

Other 600 V Class (277 through 600V, nominal) Equipment: ~~“Work on energized parts, including voltage testing 2” Y~~
~~Y.”~~

Substantiation: Duplication of text contained within the same section of this table. Third item matches the eight item word for word.

70E-315 Log #13
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Carl Marcinkowski, Applied Standards LLC

Recommendation: New text to read as follows:

inspection of energized parts with covers off, including photography, infrared thermography or other noncontact method.

Substantiation: These inspection methods as well as visual inspection are not listed in the table, thus the selection of PPE is determined by arc flash analysis. The task is relatively safe as a qualified person(s) will open or remove the covers and the inspector does not enter the plane of the enclosure door. I'd propose reducing the hazard/risk category in line with the task of "opening hinged covers..."

70E-316 Log #16
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Conrad St. Pierre, Electric Power consultants, LLC

Recommendation: Revise Table as follows:
(sample using NEMA E2 motor starter)

Task	Hazard/Risk Category
Work on energized parts, including voltage testing	3 4
Removal of bolted covers (to expose bare, energized parts)	4

****Insert Table here 130.7(C)(9)(a) Here****

Substantiation: There are a number of places in Table 130.7(C)(9)(a) where the risk class for " Work on energized parts, including voltage testing" is lower than some other tasks for the same equipment. To me this does not appear logical. I would expect that working on the energized bare bus would be the highest PPE or equal to the highest PPE of any of the other tasks. In the case of NEMA E2 motor starter it is hard for me to believe that "Removal of bolted covers (to expose bare, energized parts)" would carry a higher PPE than " Work on energized parts, including voltage testing". The same lower " Work on energized parts, including voltage testing" risk class PPE occurs under "600V Class MCC's", and "600V Switchgear".

1. Table would better serve the user if it had both instantaneous and time delay trips.
2. Including the three main equipment rating in the table prevent the overlooking of the footnotes at the end of the table.
3. Use equipment rating rather than fault level. If the user is using this table he/she does not know the fault level in the first place. They should however be able to obtain the equipment rating. Assuming the fault level is not over the equipment rating, equipment rating may be a better guide.
4. Providing values for several equipment ranges should allow the NFPA table look up to be closer to the IEEE-1584 PPE selection when Table 130.7(C) (10) is used.

Sample Modification (PPE values may need to be modified)
 Modification would also apply to other equipment types

Table 130.7(C)(9)(a) *Continued*

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category			V-rated Gloves	V-rated Tool
	<25 kA	25-65kA	>65 kA		
Feeder Breaker Rating					
600 V Class Switchgear (with power circuit breakers with instantaneous trip or fused switches)					
CB or fused switch operation with enclosure doors closed	0	0	0	N	N
Reading a panel meter while operating a meter switch	0	0	0	N	N
CB or fused switch operation with enclosure doors open	0	0	1	N	N
Work on energized pans, including voltage testing	0	1	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	0	0	Y	Y
Work on control circuits with energized parts >120 V exposed	0	1	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	1	2	3	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	0	1	2	N	N
Application of safety grounds, after voltage test	0	1	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	1	2	3	N	N
Opening hinged covers (to expose bare, energized parts)	0	1	2	N	N

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category			V-rated Gloves	V-rated Tool
	<25 kA	25-65kA	>65 kA		
Feeder Breaker Rating					
600 V Class Switchgear (with power circuit breakers with time delay trip)					
CB or fused switch operation with enclosure doors closed	0	1	2	N	N
Reading a panel meter while operating a meter switch	0	1	2	N	N
CB or fused switch operation with enclosure doors open	1	2	3	N	N
Work on energized pans, including voltage testing	2*	3	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	0	0	Y	Y
Work on control circuits with energized parts >120 V exposed	2*	3	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	3	X	X	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	3	4	N	N
Application of safety grounds, after voltage test	2*	3	4	Y	N
Removal of bolted covers (to expose bare, energized parts)	3	X	X	N	N
Opening hinged covers (to expose bare, energized parts)	2	3	4	N	N

X = PPE requirement greater than 4. Fault pressure wave may be controlling. Do not work on exposed energized parts.

70E-317 Log #24
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Conrad St. Pierre, Electric Power consultants, LLC

Recommendation: Modify Table as follows:

INSERT 70E_L24_Tb_130.7(C)(9)(a)_R.doc

- Substantiation:**
1. Table would better serve the user if it had both instantaneous and time delay trips.
 2. Including the three main equipment rating in the table prevent the overlooking of the footnotes at the end of the table.
 3. Use equipment rating rather than fault level. If the user is using this table he/she does not know the fault level in the first place. They should however be able to obtain the equipment rating. Assuming the fault level is not over the equipment rating, equipment rating may be a better guide.
 4. Providing values for several equipment ranges should allow the NFPA table look up to be closer to the IEEE-1584 PPE selection when Table 130.7(C) (10) is used.

Sample Modification (PPE values may need to be modified)
 Modification would also apply to other equipment types

Table 130.7(C)(9)(a) *Continued*

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category			V-rated Gloves	V-rated Tool
	<25 kA	25-65kA	>65 kA		
Feeder Breaker Rating					
600 V Class Switchgear (with power circuit breakers with instantaneous trip or fused switches)					
CB or fused switch operation with enclosure doors closed	0	0	0	N	N
Reading a panel meter while operating a meter switch	0	0	0	N	N
CB or fused switch operation with enclosure doors open	0	0	1	N	N
Work on energized pans, including voltage testing	0	1	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	0	0	Y	Y
Work on control circuits with energized parts >120 V exposed	0	1	2*	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	1	2	3	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	0	1	2	N	N
Application of safety grounds, after voltage test	0	1	2*	Y	N
Removal of bolted covers (to expose bare, energized parts)	1	2	3	N	N
Opening hinged covers (to expose bare, energized parts)	0	1	2	N	N

Task (Assumes Equipment Is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/ Risk Category			V-rated Gloves	V-rated Tool
	<25 kA	25-65kA	>65 kA		
Feeder Breaker Rating					
600 V Class Switchgear (with power circuit breakers with time delay trip)					
CB or fused switch operation with enclosure doors closed	0	1	2	N	N
Reading a panel meter while operating a meter switch	0	1	2	N	N
CB or fused switch operation with enclosure doors open	1	2	3	N	N
Work on energized pans, including voltage testing	2*	3	4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	0	0	0	Y	Y
Work on control circuits with energized parts >120 V exposed	2*	3	4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	3	X	X	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	2	3	4	N	N
Application of safety grounds, after voltage test	2*	3	4	Y	N
Removal of bolted covers (to expose bare, energized parts)	3	X	X	N	N
Opening hinged covers (to expose bare, energized parts)	2	3	4	N	N

X = PPE requirement greater than 4. Fault pressure wave may be controlling. Do not work on exposed energized parts.

70E-318 Log #128 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Hugh Hoagland, ArcWear.com

Recommendation: Create thermography as a separate task in this table.

Substantiation: Have suited electrician open the switchgear/MCC and then thermographer can step in and read with HRC1 clothing sans face shield since no work is going on and the equipment has been opened safely. Then electrician closes gear after thermographer does readings and exits the flash boundary. This makes the thermography much more doable without all the flash suit being worn. Alternatively you could recommend the thermographer stay back and wear HRC2.

Suggest the use of viewing ports on equipment when possible.

Thermography is not inherently unsafe after the covers are removed and this will prevent overdressing the thermographer and allow use of the equipment without unnecessary impedance. Requiring FR will prevent fatalities from electric arc ignition of clothing and offer additional protection.

70E-319 Log #130 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Hugh Hoagland, ArcWear.com

Recommendation: Revise text to read:

Other Equipment 1 kV and Above

Outdoor disconnect switch operation (gang-operated, from grade)

Recommend using Voltage rated gloves

Could give option of diElectric Shoes or mats (depending on substation design) to prevent shock in a failure.

Substantiation: VR gloves are used in almost all utilities for racking gang operated HV breakers due to potential lightening damage of parts causing shock hazard. Depending on substation design, some utilities use conductive mats or dielectric mats to prevent shock.

70E-320 Log #134 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: John Snell, Snell Infrared

Recommendation: Add a new line item to read:

A category will be created for the task of "non-intrusive inspection," and will include, among others, infrared, airborne ultrasound, corona detection, or visual inspections. The inspector will have 1) a specified limit of approach for the distance at which the inspection is conducted, and 2) will wear PPE appropriate to that limited approach and 3) will be accompanied by a qualified safety person (or work with a restraining barrier) that ensures the inspector does not come closer than that specified limit of approach. When access to conduct such inspections of energized equipment is through special windows or ports, rather than by opening the enclosure door, the limit of approach will be the same as if the enclosure door were not opened.

Substantiation: Thermographers and others who are presently conducting non-intrusive inspections of energized electrical equipment have little guidance as to how NFPA 70E applies to them.

The risk of exposure to an arc flash is low because they should be cognizant of the risks associated with such an inspection; they are typically not the person who open the enclosure; they stand back out of the arc-flash zone while equipment is being accessed; they spend only a brief time in front of the exposed, energized equipment; they do not touch the energized equipment for any reason; they do not need to break the plane of the enclosure door; and they are able to stand back from the equipment at least three feet (when space allows). Similar needs and circumstances exist for corona detection and airborne ultrasound inspections as well as, to some extent, visual inspections. Unfortunately, the most effective way to conduct an inspection using these technologies is to have a direct view of the energized equipment.

Thermography inspections, in particular, may represent a higher risk than some other activities because it is important that they occur as quickly after an enclosure is opened as is safe. The physical act of opening, and thus disturbing, the enclosure may increase the risk for any number of reasons versus the enclosure being left unopened.

We suggest that the risk associated with these normal inspection activities is low and that a special category should be created as a result.

In some circumstances, it may be possible to install infrared-transparent windows or small viewing ports to facilitate an inspection. These can enable an effective inspection to be made without having to open the entire enclosure. The window or port is affixed with a solid cover that is secured in place when not being used for an inspection. At the time of an inspection the cover slides out of the way, exposing the window or opening. The infrared camera is placed up the window or over the opening to view the energized equipment inside the enclosure. When the inspection is completed, the cover is again secured in place.

In such circumstances, thermographers using a window or port are working at a very close physical distance to the energized equipment but the enclosure door is not open. We suggest that the risk of exposure to arc flash is very low and that a special category should be created for the activity.

70E-321 Log #158 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Palmer L. Hickman, NJATC

Recommendation: Recommendation: Delete the (a) from the heading of Table 130.7(C)(9)(a)

Legislative format: Table 130.7(C)(9) (~~a~~) Hazard/Risk Category Classifications

Substantiation: The proposed deleted text is intended as an editorial correction to comply with the NEC Style Manual. There is no apparent need to have an (a) if there is no (b).

This is not original material; its reference/source is as follows:

My recommendations modify existing NFPA 70E text developed previously by the NFPA 70E Technical Committee.

70E-322 Log #183 EEW-AAA
(Table 130.7(C)(9)(a))

Final Action:

Submitter: Daniel Doan, DuPont Engineering

Recommendation: Note: This proposal is based on and includes the changes in Tentative Interim Amendment TIA 04-1.

1. Revise existing Notes and add Notes for Part II, Table 130.7(C)(9)(a), as follows:

(a) Maximum of 25 kA short circuit current available, and up to 0.03 second (2 cycle) fault clearing time.

(b) Maximum of 65 kA short circuit current available, and up to 0.03 second (2 cycle) fault clearing time.

(c) For < 10 kA short circuit current available, and up to 0.03 second (2 cycle) fault clearing time, the hazard/risk category required may be reduced by one number.

(d) Maximum of 65 ~~42~~ kA short circuit current available, and up to 0.33 second (20 cycle) fault clearing time.

(e) Maximum of 65 ~~35~~ kA short circuit current available, and up to ~~1.0~~ 0.5 second (~~60~~ 30 cycle) fault clearing time.

(f) For < 25 kA short circuit current available, and up to 0.5 second (20 cycle) fault clearing time, the hazard/risk category required may be reduced by one number.

(g) For equipment protected by upstream current limiting fuses with arcing fault current in their current limiting range (1/2 cycle fault clearing time or less), the hazard/risk category required may be reduced by one number.

2. Add references to Notes and make changes at the following locations (highlighted) within the table:

INSERT 70E_L183_Tb_R.doc

Substantiation: TIA04-1 added the words "Maximum of..." to Notes 1, 2, 4, and 5, and changed the short circuit current values and fault clearing times of some of the notes. Notes 3 and 6 also show a maximum short circuit current, but do not mention the allowable fault clearing time for those notes. The proposed changes to Notes 3 and 6 add the limitation of fault clearing time. Also, the proposed words "and up to..." clarify the meaning of the fault clearing time in a similar way.

Note 7 is proposed to show that current limiting fuses, in their current limiting range of arcing current, will be very quick to open, and will significantly reduce the arc flash hazard. This table should give the user the advantage of this reduced energy.

The proposed changes to the Hazard/Risk Category entries in the Table are based on the values of arcing current and fault clearing time in the Notes, using the IEEE 1584-2004 spreadsheet. This provides a published and accepted estimate, based on research and testing. The IEEE/NFPA Research and Testing Planning Committee has determined that more testing is needed to provide a more complete and accurate estimate of arc flash hazards. As of 2006, the existing IEEE 1584 spreadsheet is an accepted and available estimate of the arc flash energy. Numerous studies have been completed and documented using this methodology, and the results have proven to be useful for application to electrical equipment. Here is a summary of the results for low voltage equipment:

INSERT 70E_L183_Tb_S.doc

In several sections of the table there is an item named "Work on control circuits with energized parts 120 V or below, exposed". Normally these exposures could be assigned Category 0, but when a worker is making changes in a control circuit, there is an increased chance of having the breaker open on high-energy equipment. For this reason it is prudent to require the worker to wear a single layer of flash protection clothing, to keep the worker's clothes from catching fire in an incident. Also, working distance from the possible fault location would normally be higher if the person is working in a separate section of the equipment. For these reasons, Category 1 clothing is recommended for MCCs and Switchgear.

Task (Assumes Equipment is Energized, and Work Is Done Within the Flash Protection Boundary)	Hazard/Risk Category	V-rated Gloves	V-rated Tools
Panelboards rated 240 V and below – Notes 1 and 3			
Circuit breaker (CB) or fused switch operation with covers on	0	N	N
CB or fused switch operation with covers off	0	N	N
Work on energized parts, including voltage testing	<u>1</u> 0	Y	Y
Remove/install CBs or fused switches	<u>1</u> 0	Y	Y
Removal of bolted covers (to expose bare, energized parts)	<u>1</u> 0	N	N
Opening hinged covers (to expose bare, energized parts)	0	N	N
Panelboards or Switchboards rated >240 V and up to 600 V (with molded case or insulated case circuit breakers) - Notes 1, and 3 and 7			
CB or fused switch operation with covers on	<u>0</u> 1	N	N
CB or fused switch operation with covers off	1	N	N
Work on energized parts, including voltage testing	<u>2</u> * 1	Y	Y
600 V Class Motor Control Centers (MCCs) - Notes 2 (except as indicated), and 3 and 7			
CB or fused switch or starter operation with enclosure doors closed	<u>0</u> 2*	N	N
Reading a panel meter while operating a meter switch	0	N	N
CB or fused switch or starter operation with enclosure doors open	<u>1</u> 2*	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	<u>0</u> 1	Y	Y
Work on control circuits with energized parts >120 V, exposed	2*	Y	Y
Insertion or removal of individual starter “buckets” from MCC – Note 4	<u>3</u> 4	Y	N
Application of safety grounds, after voltage test	2*	Y	N
Removal of bolted covers (to expose bare, energized parts) – Note 4	<u>2</u> * 4	N	N
Opening hinged covers (to expose bare, energized parts)	<u>1</u> 2*	N	N
600 V Class Switchgear (with power circuit breakers or fused switches) - Notes 5 and 6			
CB or fused switch operation with enclosure doors closed	<u>0</u> 4	N	N
Reading a panel meter while operating a meter switch	<u>0</u> 4	N	N
CB or fused switch operation with enclosure doors open	<u>1</u> 4	N	N
Work on energized parts, including voltage testing	<u>2</u> * 4	Y	Y
Work on control circuits with energized parts 120 V or below, exposed	<u>0</u> 1	Y	Y
Work on control circuits with energized parts >120 V, exposed	<u>2</u> * 4	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open	<u>3</u> 4	N	N
Insertion or removal (racking) of CBs from cubicles doors closed	<u>2</u> 4	N	N
Application of safety grounds, after voltage test	<u>2</u> * 4	Y	N
Removal of bolted covers (to expose bare, energized parts)	<u>3</u> 4	N	N
Opening hinged covers (to expose bare, energized parts)	<u>2</u> 4	N	N
Other 600 V (277 V through 600 V, Nominal) Equipment – Notes 2 (except as indicated) and 3			
Lighting or small power transformers (600 V, maximum)	—	—	—
Removal of bolted covers (to expose bare, energized parts)	2*	N	N
Opening hinged covers (to expose bare, energized parts)	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N
Revenue meters (kW-hour, at primary voltage and current)	—	—	—
Insertion or removal	2*	Y	N
Cable trough or tray cover removal or installation	1	N	N
Miscellaneous equipment cover removal or installation	1	N	N
Work on energized parts, including voltage testing	2*	Y	Y
Application of safety grounds, after voltage test	2*	Y	N

Section of Table	Volts	kA	Fault clearing time	Working distance inches	Energy cal/sqcm	PPE Category
Panelboards <240 V Note 1	240	25	0.03	18	0.9	0
Panelboards <240 V Note 3	240	10	0.03	18	0.4	0
Panelboards <240 V Note 7	240	25	0.008	18	0.2	0
Panelboards <240 V Note 1	600	25	0.03	18	1.9	1
Panelboards <600 V Note 3	600	10	0.03	18	0.8	0
Panelboards <600 V Note 7	600	25	0.008	18	0.5	0
MCCs Note 2	600	65	0.03	18	5.0	2
MCCs Note 3	600	10	0.03	18	0.8	0
MCCs Note 4	600	42	0.33	18	35.3	4
MCCs Note 7	600	65	0.008	18	1.3	1
Switchgear Note 5	600	35	0.5	24	26.3	4
Switchgear Note 6	600	25	0.5	24	19.0	3
600 V eqpt Note 2	600	65	0.03	18	5.0	2
600 V eqpt Note 3	600	10	0.03	18	0.8	0

