

NATIONAL ELECTRIC SAFETY CODE (ANSI C2 / NESC)



2012 EDITION

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Committee Conference*

NEESC 2012

IMPORTANT DATES

SEPTEMBER 1, 2009 - Preprint published

MAY 1, 2010 - The final date to submit comments on the submitted change proposals and the subcommittee recommendations.

NESC 2012

Preprint for 2012 NESC

- All submitted CPs recorded**
- Subcommittee action on each CP**
- Preprint distributed for public comments**
- Public comments submitted to IEEE for review**

NEESC 2012

- **Subcommittees will meet in 2010 to consider all submitted comments**
- **Final ballot distributed to Main Committee and ANSI in 2011**
- **2012 Edition published on August 1, 2011**
- **Effective January 1, 2012**

NESC

FOUR PARTS

- **Part 1 – Rules for the Installation of Electric Supply Stations and Equipment**
- **Part 2 – Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communication Lines**
- **Part 3 – Safety Rules for the Installation and Maintenance of Underground Electric Supply and Communication Lines**
- **Part 4 – Rules for the Operation of Electric Supply and Communications Lines and Equipment**

NESC

COMMITTEE STRUCTURE

- ❖ **Main Committee**
- ❖ **Executive Committee**
 - **Subcommittee 1 – Purpose, Scope, Application, Definitions, and Reference**
 - **Subcommittee 2 – Grounding Methods**
 - **Subcommittee 3 – Electric Supply Stations**
 - **Subcommittee 4 – Overhead Lines – Clearances**
 - **Subcommittee 5 – Overhead Lines – Strength and Loading**
 - **Subcommittee 7 – Underground Lines**
 - **Subcommittee 8 – Work Rules**
- ❖ **Interpretations Subcommittee**

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NESC Part 4

Rules for the Operation of Electric Supply and Communications Lines and Equipment

(Subcommittee 8)

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2 SIGNIFICANT ISSUES

1) ARC HAZARD

**2) MINIMUM APPROACH DISTANCES
(MAD)**

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Arc Exposure (2007 NESC)

Effective as of January 1, 2009, the employer shall ensure that an assessment is performed to determine potential exposure to an electric arc for employees who work on or near energized parts or equipment. If the assessment determines a potential employee exposure greater than 2 cal/cm² exists (see Neal, Bingham, and Doughty [B59]), the employer shall require employees to wear clothing or a clothing system that has an effective arc rating not less than the anticipated level of arc energy.

NESC 2012

Low voltage arc exposure <1000 Volts (2007 NESC)

The effective arc rating of clothing or a clothing system to be worn at voltages 1000 V and above shall be determined using Tables 410-1 and 410-2 or performing an arc hazard analysis.

EXCEPTION 2: For secondary systems below 1000 V, applicable work rules required by this part and engineering controls shall be utilized to limit exposure. In lieu of performing an arc hazard analysis, clothing or a clothing system with a minimum effective arc rating of 4 cal/cm² shall be required to limit the likelihood of ignition.

NESC 2012 – Rule 410.A.3

***WHAT DOES RULE MEAN
AND
WHEN DOES IT APPLY?***

Interpretation requests asking this question

NEESC 2012 – Rule 410.A.3

(IR – 557)

Does this rule apply to insulated conductors in an underground manhole location. If an employee is working on a de-energized conductor in a manhole, does he need arc flash protection for the other energized, but insulated conductors, that are located in the same manhole.

While it is theoretically possible for an arc to occur whenever parts or equipment are energized, the likelihood – in part – is typically dependent upon the work being performed on energized facilities.

NEESC 2012 – Rule 410.A.3

(IR – 558)

Does the term “potential exposure” mean “any possible exposure” or does it mean “an exposure with a strong possibility of occurring?”

“Potential exposure” can be interpreted as “any exposure existing in possibility” or it can be interpreted as “an exposure with a strong possibility” of actually occurring. After 1 January 2009, these differences in interpretation almost certainly will result in differences in application of the Rule.

See I.R. 557 - Rule 410A3 requires an assessment of the potential for an electric arc and the wearing of protective clothing as appropriate. The employer is responsible for determining potential employee exposure, based on what activities will occur and to what extent such activities may potentially initiate an arc.

NEESC 2012

Low voltage arc exposure <1000 Volts

PROPOSED TO:

- **Specifically include**
- **Provide Table similar to existing Tables**
- **Clarify issues**

NEESC 2012 – Rule 410.A.3

EXCEPTION 2: For secondary systems below 1000 V, applicable work rules required by this part and engineering controls shall be utilized to limit exposure. In lieu of performing an arc hazard analysis, clothing or a clothing system with a minimum effective arc rating of 4 cal/cm² shall be required to limit the likelihood of ignition.

NOTE 1: Assessments performed to determine potential exposure to an electric arc consider the affected employee's assigned tasks and/or work activities.

Table 410-1: Clothing and Clothing Systems (per cm²) for voltages 50 to 1000 V (AC)¹ (See Rule 410A3)

	<u>Nominal Voltage Range and Calories/Cm²</u>		
<u>Equipment Type</u>	<u>50 – 250 V</u>	<u>251 – 500 V</u>	<u>501 – 1000 V</u>
<u>Self-contained meters / Pad-mounted transformers / Panels and Cabinets</u>	<u>4²</u>	<u>20⁴</u>	<u>30⁸</u>
<u>CT meters and control wiring</u>	<u>4²</u>	<u>4⁵</u>	<u>6⁸</u>
<u>Metal-clad Switchgear / Motor Control Centers</u>	<u>8³</u>	<u>40⁶</u>	<u>60⁸</u>
<u>Subsurface / Pedestal-mounted equipment</u>	<u>4²</u>	<u>8⁷</u>	<u>12⁸</u>
<u>Open Air (includes lines)</u>	<u>4²</u>	<u>4²</u>	<u>6⁸</u>

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

1. This table is based on maximum fault current of 51kA.

Calculations are based on an 18-in separation distance from the arc to the employee. See IEEE 1584-2002.

Other methods are available to estimate arc exposure values and may yield slightly different but equally acceptable results.

The use of the table in the selection of clothing is intended to reduce the amount or degree of injury but may not prevent all burns.

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

2. Industry testing by two separate major utilities has demonstrated that voltages 50 - 240V will not sustain arcs for more than 0.5 cycles thereby limiting exposure to less than 4 calories/cm².

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

3. Value based on industry test results and IEEE Std. 1584-2002 formula for Motor Control Centers. (Gap = 1 in.) ($X_d = 1.641$) (18 in. distance) 51kA (Based on a 208V, 1000kVA, 5.3% Z, served from a 500mVA system) Maximum duration (from tests) is 10 cycles: 46.5 cal/s/cm²
* 0.167 sec = 7.8 cal/cm²

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

4. Industry testing on 480V equipment indicates exposures for self-contained meters do not exceed 20 calories/cm².

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

5. Industry testing on 480V equipment indicates exposures for CT meters and control wiring does not exceed 4 calories/cm².

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

6. Value based on industry test results and IEEE Std. 1584-2002 formula for Motor Control Centers. (Gap = 1" and Xd = 1.641, 18 inch distance) 12.7kA at 480 V (worst case energy value from testing). Maximum duration from tests is 85 cycles: $26.2 \text{ cal/s/cm}^2 * 1.42 \text{ sec} = 37 \text{ cal/cm}^2$

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

7. Incident analysis on this equipment indicates exposures do not exceed 8 calories/cm².

PROPOSED RULE

LOW VOLTAGE ARC EXPOSURE

(Footnotes)

8. Incident analysis and industry testing indicates that applying a 150% multiplier to the 480V exposure values provides a conservative value for equipment and open air lines operating at 501 – 1000V.

NESC 2012

MINIMUM APPROACH DISTANCES (MAD)

IEEE 516 is the historic source of MAD

***Guide for Maintenance Methods on
Energized Power Lines***

IEEE 516 is changing

Errors found in calculation method

Voltage in kilovolts phase to phase	T – p.u.	Distance to employee - MAD							
		Phase to ground				Phase to phase			
		(ft–in)				(ft–in)			
		1994 1910.269	2002 NESC	2007 NESC	IEEE 516 Draft #13	1994 1910.269	2002 NESC	2007 NESC	IEEE 516 Draft #13
0 to 0.0501		not specified				not specified			
0.051 to 0.300		avoid contact				avoid contact			
0.301 to 0.750	3.0	Avoid contact	1–0	1-0	1-0	Avoid contact	1–0	1-0	1-0
0.751 to 15	3.0	2-1	2–2	2-2	2-2	2-2	2–3	2-3	2-3
15.1 to 36.0	3.0	2-4	2–7	2-7	2-5	2-7	2–10	2-10	2-10
36.1 to 46.0	3.0	2-7	2–9	2-9	2-7	2-10	3–2	3-2	3-1
46.1 to 72.5	3.0	3-0	3–3	3-3	2-11	3-6	3–11	3-11	3-9
72.6 to 121	3.0	3-2	3–2	3-4	3-4	4-3	4–3	4-7	4-7
138 to 145	3.0	3-7	3–7	3-10	3-10	4-11	4–11	5-4	5-4
161 to 169	3.0	4-0	4–0	4-3	4-3	5-8	5–8	6-0	6-3
230 to 242	3.0	5-3	5–3	5-8	5-8	7-6	7–6	8-2	9-2
345 to 362	3.0	8-6	8–6	9-2	9-1	12-6	12–6	13-6	14-3
500 to 550	2.4	11-3	11–3	11-10	11-11	18-1	18–1	19-2	19-9
765 to 800	2.0	14-11	14–11	15-11	15-10	26-0	26–0	27-10	29-2

NESC 2012

NESC – NEC

**Controversy over scope conflicts
very much alive**

***WHERE SHOULD THE LINE OF
DEMARCATIION BE BETWEEN THE
TWO CODES?***

NEESC & NFPA

Section 90.2(B)(5):

(5) Installations under the exclusive control of an electric utility where such installations

a. Consist of service drops or service laterals, and associated metering, or

b. Are located in legally established easements, rights-of-way, **or by other agreements** either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations, or

c. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, or distribution of electric energy.

NEESC - NEC

**2008 NEC changed scope that limits
the utility exclusion by removing
the words:**

“...or by other agreements...”

NEESC 2012

- **Joint NFPA/NEESC Task group**
 - **Have discussed what can be done to put an end to the scope debate**
 - **Possible TIA for the NEC**
 - **Possible CP for the NEESC**

NEESC 2012

- **Joint NFPA/NEESC Task group**
 - **Change proposals submitted for both codes**
 - **NEESC – accepted for Preprint**
 - **NEC- rejected by committee for ROP**

NESC 2012

- **Joint NFPA/NESC Task group**
 - **Next meeting scheduled in May**
 - **Don't see much progress being made**