NATIONAL ELECTRIC SAFETY CODE (ANSI C2 / NESC)

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NESC

NESC CODE CYCLE
(5 YEARS)

- CPs submitted
- Subcommittee takes action on each CP
- Preprint distributed for public comments
- Public comments submitted for subcommittee review
- Subcommittee, Main Committee, and ANSI ballot

NESC 2012

IMPORTANT DATES

SEPTEMBER 1, 2009 - Preprint published

MAY 1, 2010 - The final date to submit comments on the Preprint

NESC 2012

- **Subcommittees will meet in 2010 to consider all submitted comments**
- **Final ballot distributed to Main Committee and ANSI in 2011**
- **Executive Subcommittee reviews ballot results**
- **2012 Edition published on**

  August 1, 2011
- **Effective January 1, 2012**

NESC

- **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

- ❖ Chairman and Vice Chairman
- ❖ Main Committee
- ❖ Executive Committee
- ❖ Interpretations Subcommittee

- 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

NESC & 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.

NESC - NEC

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

“…or by other agreements…”

NESC - NEC

Change 90.2(B)(5) to read as follows:

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

c. Are located in legally established easements or rights-of-way, or

d. Are located by other written agreements either designated by or recognized by public service commissions, utility commissions, or other regulatory agencies having jurisdiction for such installations. These written agreements shall be limited to installations for the purpose of communications, metering, generation, control, transformation, transmission, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained. These installations shall be limited to Federal Lands, Native American Reservations through the U.S. Department of the Interior Bureau of Indian Affairs, Military bases, lands controlled by port authorities and State agencies and departments, and lands owned by railroads.

NESC - NEC

These installations shall be limited to Federal Lands, Native American Reservations through the U.S. Department of the Interior Bureau of Indian Affairs, Military bases, lands controlled by port authorities and State agencies and departments, and lands owned by railroads.

NESC 2012

2 SIGNIFICANT ISSUES

1) ARC HAZARD

2) MINIMUM APPROACH DISTANCES (MAD)

NESC 2012

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 (IR)

asking these questions

NESC 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.

NESC 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.

NESC 2012

Low voltage arc exposure <1000 Volts

PROPOSED TO:

- Clarify interpretation issues
- Specifically include <1000 volt exposures
- Provide Table similar to existing Tables

NESC 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)

	Nominal Voltage Range and Calories/Cm²		
Equipment Type	***50 – 250 V***	***251 – 500 V***	***501 – 1000 V***
Self-contained meters / Pad-mounted transformers / Panels and Cabinets	**4**[2]	**20**[4]	**30**[8]
CT meters and control wiring	**4**[2]	**4**[5]	**6**[8]
Metal-clad Switchgear / Motor Control Centers	**8**[3]	**40**[6]	**60**[8]
Subsurface / Pedestal-mounted equipment	**4**[2]	**8**[7]	**12**[8]
Open Air (includes lines)	**4**[2]	**4**[2]	**6**[8]

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.) (Xd = 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 cal/s/cm2 * 1.42 sec = 37 cal/cm2

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

NESC 2012

Several Change Proposals (CPs) for the NESC were submitted

Subcommittee 8 rejected all CPs

IEEE 516 was not finalized

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 Std 516–2009	1994 1910.269	2002 NESC	2007 NESC	IEEE Std 516–2009
0 to 0.050		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	1-1	Avoid contact	1–0	1-0	1-1
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	3-0	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
121.1 to 145	3.0	3-7	3–7	3-10	3-10	4-11	4–11	5-4	5-4
145.1 to 169	3.0	4-0	4–0	4-3	4-3	5-8	5–8	6-0	6-3
169.1 to 242	3.0	5-3	5–3	5-8	5-8	7-6	7–6	8-2	9-2
242.1 to 362	3.0	8-6	8–6	9-2	9-1	12-6	12–6	13-6	14-3
362.1 to 550	2.4	11-3	11–3	11-10	11-11	18-1	18–1	19-2	19-9
551 to 800	2.0	14-11	14–11	15-11	15-10	26-0	26–0	27-10	29-2

NESC 2012

OSHA reopened record for Subpart V & 1910.269 rulemaking

- Only on the MAD issue
- Did not propose new distances
- Asked several questions regarding IEEE 516
- If and how the new 516 distances should be used

IEEE 516 MAD TABLE

121.1 to 145 kV

T p.u.)	Line-to-ground work					Line-to-line work		
	MAID (ft)	MTID (ft)	MAD (ft)	MAD for Tools (ft)	MHID (ft)	MAID (ft)	MAD (ft)	MHID (ft)
1.5	1.26	1.39	2.26	2.39	2.49	2.22	3.22	3.54
1.6	1.34	1.48	2.34	2.48	2.58	2.35	3.35	3.68
1.7	1.43	1.57	2.43	2.57	2.67	2.48	3.48	3.83
1.8	1.51	1.66	2.51	2.66	2.76	2.61	3.61	3.97
1.9	1.60	1.75	2.60	2.75	2.85	2.75	3.75	4.12
2.0	1.68	1.85	2.68	2.85	2.95	2.88	3.88	4.27
2.1	1.76	1.94	2.76	2.94	3.04	3.02	4.02	4.42
2.2	1.85	2.03	2.85	3.03	3.13	3.16	4.16	4.58
2.3	1.93	2.12	2.93	3.12	3.22	3.30	4.30	4.73
2.4	2.01	2.22	3.01	3.22	3.32	3.44	4.44	4.89
2.5	2.10	2.31	3.10	3.31	3.41	3.59	4.59	5.04
2.6	2.18	2.40	3.18	3.40	3.50	3.73	4.73	5.20
2.7	2.27	2.49	3.27	3.49	3.59	3.88	4.88	5.36
2.8	2.35	2.58	3.35	3.58	3.68	4.02	5.02	5.52
2.9	2.43	2.68	3.43	3.68	3.78	4.17	5.17	5.69
3.0	2.52	2.77	3.52	3.77	3.87	4.32	5.32	5.85
3.1	2.60	2.86	3.60	3.86	3.96	4.47	5.47	6.02
3.2	2.68	2.95	3.68	3.95	4.05	4.63	5.63	6.19
3.3	2.77	3.04	3.77	4.04	4.14	4.78	5.78	6.36
3.4	2.85	3.14	3.85	4.14	4.24	4.94	5.94	6.53
3.5	2.94	3.23	3.94	4.23	4.33	5.09	6.09	6.70

IEEE 516 MAD TABLES

Phase-to-ground

- MAID – Minimum air insulation distance
- MTID – Minimum tool insulation distance
- MAD – Minimum approach distance
- MAD for tools – MAD with tool in air gap
- MHAD – Minimum helicopter approach distance

NESC & OSHA

- Should OSHA publish distances different from what was proposed in 2005?
- If THEY SHOULD - Is new IEEE 516 calculation method OK?
- If NOT – what method should be used?
- Should MAD for Tools be used as MAD?
- Should OSHA include higher p.u. overvoltage factors?

QUESTIONS

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