

**FINAL MEETING MINUTES
NESC SUBCOMMITTEE 8
Work Rules**

**September 28, 29, 1998
IEEE
Piscataway, NJ**

**Part 4
Rules for the Operation of Electric Supply
And Communication Lines and Equipment
Sections 40 through 44**

<u>Name</u>	<u>Organization</u>	<u>9/28</u>	<u>9/29</u>
Bob Baird (alt)	IEC		
John Dahmer	EEI	X	X
Henry Dennis	ATIS	*	*
Fred Doering	Self	X	X
Charlie Grose	Emeritus		
Stephen Hadley (alt)	SEEX		
Stephen Keys	IEC		
Hank Kientz,Chair	Emeritus	X	X
David Mitchell	IEEE	X	X
Dick Mooney	AEIC	X	X
Joseph Pipkin	OSHA		
Thomas Ryder	EIA	X	X
Larry Schweitzer (alt)	IEEE	X	X
Les Shankland	APPA	X	X
Steven Theis	NUCA		
Bob Thiede	EEI	X	X
Jim Tomaseski, Secretary	IBEW	X	X
Gene Tootle	SEEX	X	X
James Tuggle (alt)	IEC		
Tom Verdecchio (alt)	IEEE	X	X
David Wallis	OSHA	X	X

*Trevor Bowmer attended for Dennis Henry

1. The meeting was called to order at 10:00. Members and guests introduced themselves.
2. Chairman discussed meeting schedule and projected hours to complete tasks.
3. Status of principals, alternates, and guests discussed.

4. □ Voting process was reviewed, and roll call was made of voting members.
5. Report given regarding recent code action by the NFPA 70E Committee, including proposed changes the code and possible effects on Part 4 of the NESC and other effects on utility workers.

6. □ Reports from Working Groups

WG 8.05-Clearance of supporting structures from other objects.

A motion was made and seconded to disband this WG. The motion was approved.

WG 8.06-Maximum Use Voltage.

A motion was made and seconded to disband this WG. The motion was approved.

WG 8.08 – Terminology and Work Rules

A motion was made and seconded to disband this WG. The motion was approved.

WG 8.09 – Broken Insulators

A motion was made and seconded to disband this WG. The motion was approved.

7. Agreed that all Change Proposals regarding clothing requirements would be discussed last.
8. Reminded those present to review Interpretation Requests (IRs) for final resolution prior to conclusion of meeting.
9. □ Preliminary discussions regarding CP 2205, on differences in calculating clearances in different parts of the Code.

10. □ Discussion regarding Working Group 4.8 on Aerial Facilities Clearances and participation from Subcommittee 8 members. The next meeting of the Working Group will be held on December 8, 1998 at the Edison Electric Institute in Washington, D.C. Those interested in participating on the Working Group should contact Sue Vogel for information.

11. □ Resolution of CPs.

12. □ Reviewed balloting process of final report from secretary. Subcommittee members will receive copy of minutes and letter ballot on CPs.

13. □ New Business

Discussions were held on the following issues:

- □ Fiber Optic Installations, all dielectric self-supporting, and problems with induced voltages reaching hazardous limits

- Research and development regarding 138kV hard cover-up equipment
- Communications equipment (cellular) installed on utility structures, non - electrical workers within MAD, and electrical workers on structures near or climbing past cellular equipment while “hot”
- IEEE Power Meeting information can be found at <http://www.ieee.org/power/>

14. Discussion regarding status of Subcommittee work prior to publication of Preprint and schedule of next Code cycle presented

15. Old Business

None

16. Next meeting of Subcommittee will be in October, 2000. Current Working Groups have the opportunity to submit Subcommittee CP prior to the publication of the Preprint. CPs and final action by the Subcommittee must be submitted to the IEEE Standards Department by May 15, 1999.

RESOLUTIONS OF CPs

Section 2. - Definitions

CP 2162

Replace the present definition of *qualified* with the following new definition based upon OSHA definitions:

qualified; qualified employee; qualified person; Having An employee or person who has been trained in and has demonstrated adequate knowledge of the installation, construction, or operation of apparatus and the hazards involved, including identification of and exposure to electric supply apparatus in or near the workplace. NOTE: An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training, and who is under the direct supervision of a qualified person, is considered to be a qualified person for the performance of those duties.

qualified communication line worker; A qualified employee or person who has been trained in and demonstrated particular knowledge of the installation, construction, or operation of communication apparatus and the hazards involved, including identification of and exposure to electric supply apparatus used in the operation of, or located in the vicinity of, communication apparatus.

qualified electric supply line worker; A qualified employee or person who has been trained in and demonstrated particular knowledge of the installation, construction, or operation of electric supply apparatus and the hazards involved, including identification of and exposure to communication apparatus used in the operation of, or located in the vicinity of, electric supply apparatus.

Revise Rule 430 to read as follows:

General

Communications employees shall observe the following rules in addition to the rules contained in Section 42. Employees working on energized communication apparatus, in equipment containing electric supply circuits, or in elevated positions near electric supply lines and equipment shall be qualified communication workers.

Submitter:

Allen L. Clapp

Supporting Comment:

The existing use of *qualified* is essentially the same as that originally adopted by OSHA. This proposal updates the NESC use of *qualified* more in line with recent changes in OSHA and further emphasizes the need for communication workers to know how to identify and work around electric supply facilities.

Communication workers need to know how to identify and appropriately treat supply lines and equipment. Many recent accidents, particularly involving CATV workers on poles contacting energized, open power conductors, were an obvious result of a lack of training in identification of, and how to work around, power apparatus. This change in the definitions and requirements will reinforce appropriate training requirements.

By the same token, with all the changes in the industries involved, it is more and more apparent that supply workers need to know how to identify communication equipment, if for no other reason than to be able to promptly notify the appropriate people when there is a problem and promote getting the problem fixed in a timely manner.

Subcommittee Recommendation: Accept in Principle.

Revise the definition of “qualified” to read as follows:

qualified; Having been trained in and has demonstrated adequate knowledge of the installation, construction, or operation of ~~apparatus~~ lines and equipment and the hazards involved, including identification of and exposure to electric supply and communication apparatus in or near the workplace. NOTE: An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of

training, and who is under the direct supervision of a qualified person, is considered to be a qualified person for the performance of those duties.

Subcommittee Comment: The Subcommittee accepts the definition of qualified as amended. SC8 rejects definitions of “qualified communication line worker” and “qualified electric supply line worker.” SC8 also rejects changes to Rule 430 and 440.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Schweitzer, Tootle, Doering, Bowmer

Negative: Mitchell

Abstention: Wallis

Explanation of Vote:

Mitchell: The definition is too narrow

Wallis: Agency policy requires me to abstain from all votes on technical issues.

See also Subcommittee action on CP 2356.

Section 2. - Definitions

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Submitter:

Allen L. Clapp

Supporting Comment:

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Communication workers need to know how to identify and appropriately treat supply lines and equipment. Many recent accidents, particularly involving CATV workers on poles contacting energized, open power conductors, were an obvious result of a lack of training in identification of, and how to work around, power apparatus. This change in the definitions and requirements will reinforce appropriate training requirements.

By the same token, with all the changes in the industries involved, it is more and more apparent that supply workers need to know how to identify communication equipment, if for no other reason than to be able to promptly notify the appropriate people when there is a problem and promote getting the problem fixed in a timely manner.

Subcommittee Recommendation: Reject

Rejected because the accepted definition for “qualified” covers the proposed communication line worker and electric supply worker. To add these would be redundant.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Schweitzer, Tootle, Doering, Bowmer

Negative: Mitchell

Abstention: Wallis

See also Subcommittee action on CP 2356.

Explanation of Vote:

Mitchell: The definition is too narrow.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 410.A

CP 2357

Add new Rule 410.A.3 as follows:

410.A.3 The employer shall train each employee that may be exposed to electric arcs on the different types, combinations, and materials of wearing apparel. The training shall include information on exposure levels associated with different voltages and work practices required by the employer, and methods of preventing of clothing and thermal burns.

3.4.

4.5.

Submitter:

James R. Tomaseski

Supporting Comment:

The completion of the work at ASTM, Committee F18, for clothing and rainwear will now allow development of rules for Part 4. NFPA 70E Committee and the IEEE/ESMOL Committee are independently developing standards that could affect the requirements for electrical workers covered by Part 4. Subcommittee 8 should develop rules within Part 4 to provide instruction to workers exposed to electric arcs.

Subcommittee Recommendation: Reject.

4 CPs submitted regarding worker clothing– Subcommittee recommends formation of new Working Group 8.10 to review OSHA 1910.269, IEEE/ESMOL papers, NFPA 70E recent actions, etc., in an effort to establish appropriate requirements in Part 4 of the Code. See CP's 2343, 2358 and 2122.

Hank Kientz, Fred Doering, Tom Verdecchio, Dave Mitchell, Dick Mooney, Steve Theis, Jim Tomaseski are working group members.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 410.A.2

CP 2343

Revise Rule 410.A.2 to read as follows:

...and materials of wearing apparel. The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that when exposed to electric arcs could increase the extent of injury that would be sustained by the employee.

Submitter:

Stephen Hadley

Supporting Comment:

Provides additional guidance for wearing apparel for employees to the hazards of flames or electric arcs.

Subcommittee Recommendation: Reject.

4 CPs submitted regarding worker clothing– Subcommittee will recommend formation of new Working Group 8.10 to review OSHA 1910.269, IEEE/ESMOL papers, NFPA 70E recent actions, etc., in an effort to establish appropriate requirements in Part 4 of the Code. See CP’s 2357, 2358 and 2122.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 410.A.2

CP 2356

Revise Rule 410.A.2 to read as follows:

The employer shall provide training and certification to all employees who work in the vicinity of exposed energized facilities. The training shall include applicable work rules required by this Part and other mandatory referenced standards or rules. The employer will provide certification that each employee has received training and demonstrated proficiency in required tasks. The employer shall provide retraining for any employee who, as a result of routine employer observance of work practices, is not following work rules established by this Part and other mandatory referenced standards or rules. ~~The training shall include information on the advantages and limitations of various types, combinations and materials of wearing apparel.~~

Submitter:

James R. Tomaseski

Supporting Comment:

The employer training requirements in Section 41, Rule 410 do not establish specific subjects for training. Section 42, General Rules for Employees, establishes the requirement that employees may only perform tasks in which they are trained, equipped, authorized, and so directed. Section 41, Rules for Employers, needs to establish specific requirements that guarantee employees the proper training necessary to:

1. perform required tasks in a safe manner
2. be in compliance with Section 42
3. provide the mechanism for retraining when necessary

The last sentence regarding wearing apparel belongs in a separate wearing apparel section.

NOTE: With the advent of deregulation on our backs, employers should realize that a trained and certified worker is a vital part to the electrical systems providing service to our customers. Federal and state regulators should also realize that in establishing criteria must include training and certification of all workers that could affect the safety and reliability of the systems.

Subcommittee Recommendation: Accept in Principle.

Revise Rule 410A2 to read as follows:

The employer shall provide training to all employees who work in the vicinity of exposed energized facilities. The training shall include applicable work rules required by this Part and other mandatory referenced standards or rules. The employer will ensure that each employee has demonstrated proficiency in required tasks. The employer shall provide retraining for any

~~employee who, as a result of routine observance of work practices, is not following work rules. The training shall include information on the advantages and limitations of various types, combinations and materials of wearing apparel.~~

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 411.D

CP 2344

Revise Rule 411.D to read as follows:

~~All warning—Temporary safety~~ signs and tags required by Part 4 shall comply with the provisions of ANSI Z 535.5 – 1991 inclusive. ~~Permanent warning signs shall be displayed in conspicuous places at all entrances to electric supply stations, substations, and other enclosed walk in areas containing exposed current carrying parts.~~

Submitter:

Stephen Hadley

Supporting Comment:

411.D requires all warning signs in Part 4 to comply with ANSI Z.535. The requirement to comply with appropriate signage is already covered in 110.A of the Safety Code. The definition of tag is contained in Section 2 – definitions. The purpose of Part 4 clearly states that the scope of this part is to provide work rules for employee and public safety.

Subcommittee Recommendation: Accept in principle.

Revise Rule 411.D to read as follows:

Safety signs and tags required by Part 4 shall comply with the provisions of ANSI Z 535.1 – 1991 through ANSI Z 535.5 – 1991 inclusive. Permanent warning signs shall be displayed in conspicuous places at all entrances to electric supply stations, substations, and other enclosed walk in areas containing exposed current carrying parts.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Bowmer

Negative: Doering

Abstention: Wallis

Explanation of Vote:

Doering: The subcommittee approved the following wording for 411.D:

Safety signs and tags required by Part 4 shall comply with the provisions of ANSI Z 535.1 - 1991 through ANSI Z 535.4 - 1991 inclusive.

I have a number of tags used by various electric utilities, each different in many ways. The primary differences are tied to the tagout procedure of that particular company. With respect to the information written on the tag, they vary from none (simply a unique number that has been recorded in the elaborate dispatchers records of dates, times, personnel involved, etc.), to a long tag with each step written on the tag, some of which may run over to the back of the tag, as well as dates, times, personnel involved, etc. The color varies, but most clearances that permit grounding are red, if only removing reclosing possibly yellow, and if information they are general white. The key wording will contain words normally used by the employees of that company, such as; blocking tag, worker's blocking tag, permissive tag, caution tag, do not operate tag, danger tag, information tag, clearance tag, hold-off tag, notify dispatcher before operating tag, etc.

Tags are supplemented by locks when the operating points are accessible to unauthorized employees or the general public. Depending upon their training, contractors employees may be authorized to participate in the tagout system, but generally they are under the wing of an authorized company employee. Foreign company line crews are much like contractor employees, and generally tagging considerations are handled by a "bird dog".

I would agree to the extent possible the tags should follow the requirements of the Z 535 standards, but the greater need is that tags for energy control be singularly identified, be the only device used for controlling hazardous energy, and be durable. The restrictions on the use of these tags (for hazardous energy control only) are required to insure that the sight of a distinctive tag will provide a constant message of the use to which the tag is being put and the restrictions which this tag is intended to convey. The need for uniqueness become evident when you review a suppliers catalogue and see hundreds of danger, warning or caution tags with various messages, but are similar in general appearance.

In summary, there needs to be flexibility when specifying the appearance of tags to be used with formal hazardous energy control procedures.

J. F. Doering Recommendations:

I would suggest following wording for 411.D:

Safety signs and tags required by Part 4 shall comply with the provisions of ANSI Z 535.1 - 1991 through ANSI Z 535.4 - 1991 inclusive. Hazardous energy control tags required by 442E may deviate from the ANSI Z 535 standards as necessary to be compatible with the employer's energy control procedures and for the tag to be singularly identified as the only device used for controlling hazardous energy, be durable, and be standardized within a company.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.C.1

CP 2345

Revise Rule 420.C.1 to read as follows:

Employees shall heed ~~warning~~ safety signs and signals and warn others who are in danger or in the vicinity of energized equipment.

Submitter:

Stephen Hadley

Supporting Comment:

411.D requires all warning signs in Part 4 to comply with ANSI Z.535. The requirement to comply with appropriate signage is already covered in 110.A of the Safety Code. The definition of tag is contained in Section 2 – definitions. The purpose of Part 4 clearly states that the scope of this part is to provide work rules for employee and public safety.

Subcommittee Recommendation: Accept.

See Subcommittee Recommendation on CP 2344.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.D

CP 2161

Revise Rule 420.D to read as follows:

Energized or Unknown Conditions

Employees shall consider electric supply equipment and lines to be energized, unless they are positively known to be de-energized.

1. Before starting work, employees shall perform preliminary inspections or tests to determine existing conditions. Operating voltages of equipment and lines should be known before working on or in the vicinity of energized parts.

2. When repairing storm damage to electric supply lines, or to communication lines that are joint use with electric supply lines at that or another point, employees shall (a) assure that the supply lines involved are de-energized and grounded in accordance with Section 44 or (b) treat all such supply and communication lines as energized to the highest voltage to which they are exposed.

Submitter:

Allen L. Clapp

Supporting Comment:

There have been numerous instances of communication workers jumping the gun and working on their storm-damaged facilities before the associated power lines were grounded. As a result, communication line workers have been injured when the communication lines were tangled with power lines and power was either still on or came back on while the communication worker was handling the facilities.

Communication utilities need to have procedures in place to assure that their workers only begin work after the power has been de-energized and grounded.

Subcommittee Recommendation: Accept in Principle.

Revise Rule 431 to read as follows:

Approach to Energized or Parts

No employee shall approach, or take any conductive object, within the distances to any exposed energized part as listed in Table 431-1.

When repairing storm damage to communication lines that are joint use with electric supply lines at that or another point, employees shall:

(a) treat all such supply and communication lines as energized to the highest voltage to which they are exposed, or

(b) assure that the supply lines involved are de-energized and grounded in accordance with Section 44.

Subcommittee Comment: Existing language in part 4 provides sufficient work rules when repairing storm damage to electric supply lines.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.D

CP 2217

Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 44A3 – 444B – 444C – 444E1 – 444E2 – 445B

Note: Some Rules have multiple usage of the term.

Revise definition of de-energized to read as follows:

de-energized: ~~Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of earth:~~

~~NOTE: The term is used only with reference to current carrying parts that are sometimes alive (energized).~~ **Synonym: dead.** Removed from all sources of electrical supply by opening switches, disconnectors, jumpers, taps, or other means of electrical supply.

NOTE: The circuit could be electrically charged through induction from energized circuits in proximity to it, particularly if the circuits are parallel.

Submitter:

H. J. Kientz

Supporting Comment:

This change would require that all references to **de-energized** be left as is where grounding of the circuit is not required and that, where grounding is required, the text would be changed to read “**de-energized and grounded.**”

This proposed language is consistent with OSHA 1919.269(m)(3)(ii).

There is a conflict between the definition of de-energized (grounded – dead) and some of the uses in the text. For instance Rule 443F, Making Connections, reads: “In connecting **de-energized** equipment or lines to an **energized** circuit by means of a conducting wire or device, ...” According to the existing definition of de-energized, this requires connecting a grounded component to an energized circuit.

The existing rules separated into their application of definitions is as follows

DEFINITELY COMPLY WITH EXISTING DEFINITION BUT NOT PROPOSED DEFINITION

Rule: Section 2, definitions – 443I – 444E1 – 444E2 – 445B.

PROBABLY COMPLY WITH PROPOSED DEFINITION BUT NOT EXISTING DEFINITION

Rule: Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – **443F** – 444A3 – 444B – 444C

Note: Rule 443F is definitely the new definition or you are placing a ground on a live circuit.

NOT SURE BUT COULD BE EITHER

Rule: 127A3c – 354A2 – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 444A3 – 444B – 444C – 444E1 – 444E2 – 445B – Appendix B[15]

Note: Some Rules have multiple usage of the term.

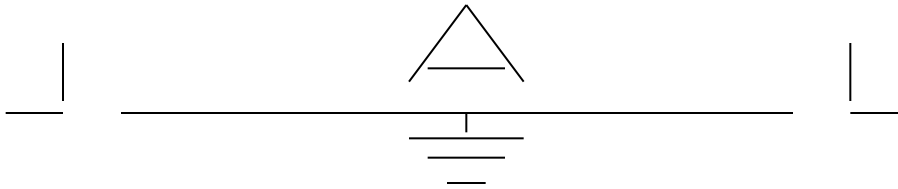
Consider the three circuits

CIRCUIT # 1 – ENERGIZED

This circuit has to be worked with live (energized) maintenance procedures.



**CIRCUIT # 2 – ISOLATED FROM ALL SOURCES OF PRIMARY SYSTEM SUPPLY –
ENERGIZED BY INDUCTION – NO GROUNDS – NOT DEAD**



CIRCUIT # 3 – POINT A – DE-ENERGIZED – GROUNDED – (DEAD???)

NOTE: Only point A is at ground potential, therefore, the circuit is not really dead. An additional set of grounding cables would be required at each additional worksite on the same circuit.

CIRCUIT 1.

Circuit one is definitely energized in everyone’s mind and requires live working methods.

CIRCUIT 2.

The largest majority of utility engineers, operators, dispatchers, and workers consider this to be de-energized as proposed in this Change Proposal. It does not meet the criteria of the existing definition as it is not grounded – dead. Because of the wide use of this philosophy, it is not possible to reeducate people to accept the existing definition. It is more practical to make the definition fit the common usage.

CIRCUIT 3.

According to the existing definition, this circuit is grounded (i.e. dead). This is not entirely true. It is dead at point A only. In fact the end points on long lines paralleling heavily loaded high voltage transmission lines may have very high-induced voltages.

To address this circuit in the common language of the trade and the conditions of this change proposal, Circuit 3 should be referred to as **“de-energized and grounded”**.

This issue was discussed at the International Electrotechnical Commission – Technical Committee 78 meeting in Birmingham, UK in October 1997. The issue was resolved by removing the term “de-energized” from international standards.

IEEE ESMOL adopted the proposed change into their drafts of Std 1048, Guide for Protective Grounding for Power Lines and Std 516, Maintenance Methods on Energized Power-Lines at the IEEE Winter Meeting in February 1998. The chairmen of the construction and substation grounding standards were also consulted and are in agreement.

Subcommittee Recommendation: Accept in principle.

Revise the definition of de-energized to read as follows:

de-energized: ~~Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of earth:~~

~~NOTE: The term is used only with reference to current carrying parts that are sometimes alive (energized). **Synonym: dead.** Removed from all sources of electrical supply by opening switches, disconnectors, jumpers, taps, or other means of electrical supply.~~

NOTE: The conductor could be electrically charged through unknown sources or induction from energized circuits in proximity to it, particularly if the circuits are parallel.

Subcommittee Comment: Subcommittee 8 accepts this definition provided that other subcommittees agree and that each reference within the Code be researched and either entered as “de-energized” or “de-energized and grounded” as the application applies.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Shankland: *affirmative comment:* I would further add: Removed from all “known” sources... to clarify for overhead distribution lines that radial transformers may be left connected although portable generator backfeed remains as a possible “unknown” source of supply requiring the use of protective grounds if hot work methods are not used.

Doering: *affirmative comment:* We are now dealing with three definitions, the existing or traditional definition, the Kientz’s definition, and now the SC1/SC3 definition. The existing definition is generically correct, but not specific to NESC facilities. Kientz’s definition is specific to NESC facilities, but has rough spots. SC1/SC3’s definition is grammatically smoother. Both Kientz and SC1/SC3 lack the point that the definition only covers current carrying parts that are sometimes energized.

I would prefer:

De-energized: Disconnected from all sources of electric supply by opening switches, disconnectors, jumpers, taps, or other means.

NOTE 1: A de-energized conductor could be electrically charged through various means, such as inductive or capacitive coupling from energized circuits.

NOTE 2: The term is used only with reference to current carrying parts that are sometimes energized.

The more important point, and possibly the real problem, is when is it safe for an employee to contact current carrying parts that are sometimes energized? NFPA 70E uses the current NESC definition for “de-energized”, and came up with the second expression “electrically safe work condition” to describe the state in which the conductor or circuit part to be worked on or near has

been disconnected from the energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary. SC8 has not seen fit to adopt such an expression, therefore we must use two expressions, “de-energized”, or “de-energized and grounded”. I don’t like the latter expression, because it implies a live part must always be grounded to be safe. Both the NESC and OSHA recognize there are times when grounding is not necessary, and times when it creates a hazard to ground.

The first expression “de-energized” is used to describe the electrical condition of live parts.

The second expression “de-energized and grounded per §444D”, is used to describe the electrical condition of live parts as it pertains to employee safety.

Use of De-Energized:

Reviewing the report on the use of de-energized in the NECS, I would have the following comments:

127.A.3.c	“De-energized” okay as employee contact is not involved.
234.B.2 Exception 2.	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 234-2 Heading	“De-energizing” is okay.
Table 234-2	Should read “de-energized and grounded per §444D, as possible employee contact is involved.
Table 235-5 Heading	“De-energizing” is okay.
Table 235-5 2.c(1) & (2)	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 235.5 Footnote 5	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
236.E	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 242-1	“De-energized” is okay.
354.A.2	“De-energized” is okay.
420.D	“De-energized” is okay.
420.L	“De-energized” is okay.
441.A.1.a	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
442.B	“De-energized” is okay.
442.B Exception 2	“De-energized” is okay.
442.D	“De-energized” is okay.
442.E.1	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.A.4.a	“De-energized” is okay.
443.F	“De-energized” is okay.
443.G	Unless other editorial changes are made, this should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.H	“De-energized” is okay.
443.I	“De-energized” is okay.

- 444.A.1 “De-energized” is okay.
444.A.3 “De-energized” is okay.
444.B “De-energized” is okay.
444.C “De-energized” is okay.
444.E.1&2 “De-energized” is okay, though I would like “per §444D” added after grounding.
445.B “De-energized” is okay.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.I

CP 2122

Revise Rule 420.I to read as follows:

Employees shall wear clothing suitable for the assigned task and the work environment. See Rule 410.A.2. The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.

Submitter:

Stephen A. Olinick

Supporting Comment:

This proposed language provides additional guidance for wearing apparel for employees who may be exposed to the hazards of flames or electric arcs.

Subcommittee Recommendation: Reject.

4 CPs submitted regarding worker clothing – Subcommittee will recommend formation of new Working Group 8.10 to review OSHA 1910.269, IEEE/ESMOL papers, NFPA 70E recent actions, etc., in an effort to establish appropriate requirements in Part 4 of the Code. See CP’s 2357, 2358 and 2343.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.I

CP 2358

Revise Rule 420.I to read as follows:

Employees shall wear suitable clothing for the assigned task and the work environment, that will not ignite under the conditions present at the worksite. The clothing shall also provide protection against thermal burns in the event of an electric arc.

Submitter:

James R. Tomaseski

Supporting Comment:

See Supporting Comments for Rule 410.A.

Subcommittee Recommendation: Reject.

4 CPs submitted regarding worker clothing– Subcommittee will recommend formation of new Working Group 8.10 to review OSHA 1910.269, IEEE/ESMOL papers, NFPA 70E recent actions, etc., in an effort to establish appropriate requirements in Part 4 of the Code. See CP's 2357, 2343 and 2122.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.J

CP 2359

Add new Rule 420.J as follows:

420.J Employees shall wear UV eye protection of appropriate grade for electric arc exposure whenever they can be exposed to an electric arc during the course of their work.

J.K.
K.L.
L.M.
M.N.
N.O.
O.P.
P.Q.

Submitter:

James R. Tomaseski

Supporting Comment:

During the last revision cycle of the Code, there was a similar proposal that Subcommittee 8 recognized as fulfilling the intent of prior CP's to develop requirements for eye protection. Subcommittee 8 determined that assistance from the ANSI Z87.1 Committee was necessary to complete the task, which was never completed. Therefore, prior to finalizing CP's for the Preprint, Subcommittee 8 should attempt to, with the help of ANSI Z87.1 Committee, develop these requirements.

Subcommittee Recommendation: Reject.

Subcommittee Comment: This subcommittee does not have sufficient technical data to define required levels to assure filtration of hazardous UV/IR radiation.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering
Abstention: Bowmer, Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.L

CP 2217

Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 44A3 – 444B – 444C – 444E1 – 444E2 – 445B

Note: Some Rules have multiple usage of the term.

Revise definition of de-energized to read as follows:

de-energized: ~~Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of earth:~~

~~NOTE: The term is used only with reference to current carrying parts that are sometimes alive (energized).~~ **Synonym: dead.** Removed from all sources of electrical supply by opening switches, disconnectors, jumpers, taps, or other means of electrical supply.

NOTE: The circuit could be electrically charged through induction from energized circuits in proximity to it, particularly if the circuits are parallel.

Submitter:

H. J. Kientz

Supporting Comment:

This change would require that all references to **de-energized** be left as is where grounding of the circuit is not required and that, where grounding is required, the text would be changed to read “**de-energized and grounded.**”

This proposed language is consistent with OSHA 1919.269(m)(3)(ii).

There is a conflict between the definition of de-energized (grounded – dead) and some of the uses in the text. For instance Rule 443F, Making Connections, reads: “In connecting **de-energized** equipment or lines to an **energized** circuit by means of a conducting wire or device, ...” According to the existing definition of de-energized, this requires connecting a grounded component to an energized circuit.

The existing rules separated into their application of definitions is as follows

DEFINITELY COMPLY WITH EXISTING DEFINITION BUT NOT PROPOSED DEFINITION

Rule: Section 2, definitions – 443I – 444E1 – 444E2 – 445B.

PROBABLY COMPLY WITH PROPOSED DEFINITION BUT NOT EXISTING DEFINITION

Rule: Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – **443F** – 444A3 – 444B – 444C

Note: Rule 443F is definitely the new definition or you are placing a ground on a live circuit.

NOT SURE BUT COULD BE EITHER

Rule: 127A3c – 354A2 – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 444A3 – 444B – 444C – 444E1 – 444E2 – 445B – Appendix B[15]

Note: Some Rules have multiple usage of the term.

Consider the three circuits

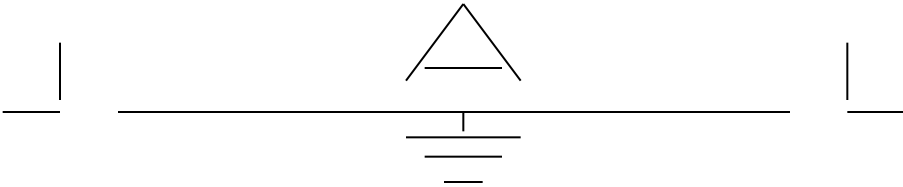


CIRCUIT # 1 – ENERGIZED

This circuit has to be worked with live (energized) maintenance procedures.



CIRCUIT # 2 – ISOLATED FROM ALL SOURCES OF PRIMARY SYSTEM SUPPLY – ENERGIZED BY INDUCTION – NO GROUNDS – NOT DEAD



CIRCUIT # 3 – POINT A – DE-ENERGIZED – GROUNDED – (DEAD???)

NOTE: Only point A is at ground potential, therefore, the circuit is not really dead. An additional set of grounding cables would be required at each additional worksite on the same circuit.

CIRCUIT 1.

Circuit one is definitely energized in everyone’s mind and requires live working methods.

CIRCUIT 2.

The largest majority of utility engineers, operators, dispatchers, and workers consider this to be de-energized as proposed in this Change Proposal. It does not meet the criteria of the existing definition as it is not grounded – dead. Because of the wide use of this philosophy, it is not possible to reeducate people to accept the existing definition. It is more practical to make the definition fit the common usage.

CIRCUIT 3.

According to the existing definition, this circuit is grounded (i.e. dead). This is not entirely true. It is dead at point A only. In fact the end points on long lines paralleling heavily loaded high voltage transmission lines may have very high induced voltages.

To address this circuit in the common language of the trade and the conditions of this change proposal, Circuit 3 should be referred to as **“de-energized and grounded”**.

This issue was discussed at the International Electrotechnical Commission – Technical Committee 78 meeting in Birmingham, UK in October 1997. The issue was resolved by removing the term “de-energized” from international standards.

IEEE ESMOL adopted the proposed change into their drafts of Std 1048, Guide for Protective Grounding for Power Lines and Std 516, Maintenance Methods on Energized Power-Lines at the IEEE Winter Meeting in February 1998. The chairmen of the construction and substation grounding standards were also consulted and are in agreement.

Subcommittee Recommendation: Accept in principle. See action taken on Rule 420D, CP 2217.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Doering: *affirmative comment:* We are now dealing with three definitions, the existing or traditional definition, the Kientz’s definition, and now the SC1/SC3 definition. The existing definition is generically correct, but not specific to NESC facilities. Kientz’s definition is specific to NESC facilities, but has rough spots. SC1/SC3’s definition is grammatically smoother. Both Kientz and SC1/SC3 lack the point that the definition only covers current carrying parts that are sometimes energized.

I would prefer:

De-energized: Disconnected from all sources of electric supply by opening switches, disconnectors, jumpers, taps, or other means.

NOTE 1: A de-energized conductor could be electrically charged through various means, such as inductive or capacitive coupling from energized circuits.

NOTE 2: The term is used only with reference to current carrying parts that are sometimes energized.

The more important point, and possibly the real problem, is when is it safe for an employee to contact current carrying parts that are sometimes energized? NFPA 70E uses the current NESC definition for “de-energized”, and came up with the second expression “electrically safe work

condition” to describe the state in which the conductor or circuit part to be worked on or near has been disconnected from the energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary. SC8 has not seen fit to adopt such an expression, therefore we must use two expressions, “de-energized”, or “de-energized and grounded”. I don’t like the latter expression, because it implies a live part must always be grounded to be safe. Both the NESC and OSHA recognize there are times when grounding is not necessary, and times when it creates a hazard to ground.

The first expression “de-energized” is used to describe the electrical condition of live parts.

The second expression “de-energized and grounded per §444D”, is used to describe the electrical condition of live parts as it pertains to employee safety.

Use of De-Energized:

Reviewing the report on the use of de-energized in the NECS, I would have the following comments:

127.A.3.c	“De-energized” okay as employee contact is not involved.
234.B.2 Exception 2.	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 234-2 Heading	“De-energizing” is okay.
Table 234-2	Should read “de-energized and grounded per §444D, as possible employee contact is involved.
Table 235-5 Heading	“De-energizing” is okay.
Table 235-5 2.c(1) & (2)	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 235.5 Footnote 5	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
236.E	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 242-1	“De-energized” is okay.
354.A.2	“De-energized” is okay.
420.D	“De-energized” is okay.
420.L	“De-energized” is okay.
441.A.1.a	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
442.B	“De-energized” is okay.
442.B Exception 2	“De-energized” is okay.
442.D	“De-energized” is okay.
442.E.1	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.A.4.a	“De-energized” is okay.
443.F	“De-energized” is okay.
443.G	Unless other editorial changes are made, this should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.H	“De-energized” is okay.

- 443.I “De-energized” is okay.
- 444.A.1 “De-energized” is okay.
- 444.A.3 “De-energized” is okay.
- 444.B “De-energized” is okay.
- 444.C “De-energized” is okay.
- 444.E.1&2 “De-energized” is okay, though I would like “per §444D” added after grounding.
- 445.B “De-energized” is okay.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 420.Q

CP 2191

Add new Rule 420.Q as follows:

420.Q Climbing Above Apparatus at the Base of a Structure

1. Free climbing of a structure is not permitted if there is hazardous apparatus (such as fire hydrants, communication pedestals, padmounted equipment, or other surface obstructions hazardous to falling climbers) within 3 m (10 ft) of the base of the structure on the side of the structure being climbed.
2. Belt climbing of a structure is not permitted if there is hazardous apparatus located within 1.20 m (4 ft) of the base of the structure on the side of the structure being climbed.
3. If fall restraint devices are used to limit falling, climbing above is permitted.
4. Free climbing is permitted above pedestals attached to the pole if either (a) a permanent sloping personnel deflector is installed above the pedestal or (b) it is the unvarying rule to install a portable slanted personnel deflector above the pedestal before climbing.

Submitter:

Allen L. Clapp

Supporting Comment:

Line workers who climb wooden poles with gaffs will, on occasion, have their climbing gaffs cut out of the pole due to wood chipping out. From time to time, pole steps fail to carry the load of a line worker. If the line worker falls to the ground, and the area beneath is clear, the result is often only embarrassment and a few scratches or splinters. If communication pedestals, fire hydrants, and similar installations are underneath when the climbing gaffs cut out of the pole, there is a high likelihood of the worker receiving a broken arm or leg; all too often, the result is

paraplegia or quadriplegia, due to spinal or cranial damage when the body hits the pedestal or hydrant.

Rule 236 requires a clear climbing space to the ground. However, Rule 236, Rule 237, and the work rules allow line workers to shift from one side or corner of the pole as they climb or perform their assigned duties. In such circumstances, a communication pedestal, fire hydrant, or similar installation poses a severe hazard to the line worker above.

This proposal is deliberately worded to (a) require specific work rules to be used if these installations are within 10 feet of a pole and (b) to suggest that, if 10 feet are not available, get the most that is practical to get under the circumstances.

Subcommittee Recommendation: Reject.

Subcommittee Comment: Subcommittee 8 believes the present requirements in 420K are adequate.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Bowmer

Negative: Doering

Abstention: Wallis

Explanation of Vote:

Doering: Allen Clapp had submitted a similar proposal for the 1997 Edition of the NESC. It appeared as CP 1943 on page 107 of the Preprint 1997 Proposals. It was proposed to replace Rule 231 A in the design section. Subcommittee 4 recommended rejection, though Ozzello supported the concept. Subcommittee 8 recommended accepting in principle. SC8 recommended that SC 4 consider the concept and consider incorporating it in the design section. SC8 also requested approval to form WG 8.05 to address the issue.

While voting with SC8, Doering submitted a stand alone rule to be put under Rule 420, or combined with the proposed fall protection rules. Proposal CP 1943 was not adopted for inclusion in the 1997 NESC.

This new proposal by Allen Clapp is essentially the recommended rule Doering had proposed for Rule 420 in the 1997 Preprint mentioned above. I would be a bit hypocritical if I didn't support Allen's proposal.

J. F. Doering's Recommendations:

I believe Allen left some words out of his third sentence. It should read as follows:

- 3.□ If fall restraint devices are used to limit falling, climbing above hazardous apparatus at the base of the structure is permitted.

I believe SC8 should again consider the proposal. With the adoption of 420 K Fall Protection in the 1997 NESC, we should consider adding the above proposal, with possibly a caveat or two for flexibility, to reduce the probability of a serious accident.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 421.B.1.a

CP 2346

Revise Rule 421.B.1.a to read as follows:

Before engaging in work that may endanger the public, ~~warning~~ safety signs or traffic control devices, or both, shall be placed conspicuously to alert approaching traffic. Where further protection...

Submitter:

Stephen Hadley

Supporting Comment:

411.D requires all warning signs in Part 4 to comply with ANSI Z.535. The requirement to comply with appropriate signage is already covered in 110.A of the Safety Code. The definition of tag is contained in section 2 – definitions. The purpose of Part 4 clearly states that the scope of this part is to provide work rules for employee and public safety.

Subcommittee Recommendation: Accept.

See Subcommittee recommendation on CP 2344.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 421.B.2.a

CP 2347

Revise Rule 421.B.2.a to read as follows:

If the work exposes energized or moving parts that are normally protected, ~~danger~~ safety signs shall be displayed. Suitable barricades shall be erected to restrict other personnel from entering the area.

Submitter:

Stephen Hadley

Supporting Comment:

411.D requires all warning signs in Part 4 to comply with ANSI Z.535. The requirement to comply with appropriate signage is already covered in 110.A of the Safety Code. The definition of tag is contained in section 2 – definitions. The purpose of Part 4 clearly states that the scope of this part is to provide work rules for employee and public safety.

Subcommittee Recommendation: Accept.

See Subcommittee recommendation on CP 2344.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 423.C.4

CP 2120

Add new Rule 423.C.4 as follows:

423.C.4 When a torch or open flame is used (as in heat shrink splicing) in proximity to a visibly exposed plastic natural gas pipe, adequate air space or a barrier shall be provided to preclude the transmission of heat to the plastic pipe.

Submitter:

Stephen A. Olinick

Supporting Comment:

More utility facilities are being installed underground today than ever before, therefore, exposing and working around gas pipes and other buried facilities occurs more frequently. Electric supply cables are regularly installed near other buried facilities. A work activity that may be performed in an excavation is heat shrink covering and splicing of cables. The heat from this process can weaken plastic gas pipe with no visible warning. It is not commonly known outside of the gas industry that pressurized plastic pipe heated to about 250 degrees Fahrenheit can catastrophically fail and release its flammable gas. If this heating is done with a gas fueled torch, as in heat shrink splicing, the results can be devastating.

Subcommittee Recommendation: Accept in principle.

Refer to action taken on CP 2348.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 423.C.4

CP 2348

Add new Rule 423.C.4 as follows:

423.C.4 When a torch or open flame is used (as in heat shrink splicing) in proximity to a visibly exposed gas or fuel line, adequate air space or a barrier shall be provided to protect the gas or fuel line from the heat source.

Submitter:

Stephen Hadley

Supporting Comment:

More utility facilities are being installed underground today than ever before, therefore, exposing and working around fuel lines and other buried facilities occurs more frequently.

Electric supply cables are regularly installed near other buried facilities. A work activity that may be performed in an excavation is the process of utilizing heat shrink terminations and heat shrink jackets during the splicing of cables. The heat from this process can weaken fuel lines (for example, plastic gas pipe) with no visible warning. It is not commonly known outside of the gas industry that pressurized plastic pipe heated to about 250 degrees Fahrenheit can catastrophically fail and release its flammable gas.

Subcommittee Recommendation: Accept in principle.

Add new Rule 423.C.4 as follows:

423.C.4 When a torch or open flame is used (as in heat shrink splicing) in proximity to a visibly exposed gas or other fuel line(s), adequate air space or a barrier shall be provided to protect the gas or fuel line(s) from the heat source.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 423.D.5

CP 2349

Add new Rule 423.D.5 as follows:

423.D.5 When a worker is required to perform tasks in trenches or excavations in excess of 1.5 meters (5 feet) in depth, there shall be adequate measures taken to provide protection from cave-in.

Submitter:

Stephen Hadley

Supporting Comment:

With the addition of this new rule, the code becomes consistent with the requirement of OSHA regulation 1910.269, which became effective in 1995. In addition, shoring is an important safety consideration, and is appropriate for inclusion in the code.

This will provide guidance to employees while working in excavations.

Subcommittee Recommendation: Accept in Principle

Add new Rule 423.D.5 to read as follows:

When a worker is required to perform tasks in trenches or excavations where a cave-in hazard exists, or the trench or excavation is in excess of 1.5 meters (5 feet) in depth, then shoring, sloping or benching methods shall be used to provide employee protection.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 430

CP 2162

Replace the present definition of *qualified* with the following new definition based upon OSHA definitions:

qualified; qualified employee; qualified person; Having An employee or person who has been trained in and has demonstrated adequate knowledge of the installation, construction, or operation of apparatus and the hazards involved, including identification of and exposure to electric supply apparatus in or near the workplace. NOTE: An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training, and who is under the direct supervision of a qualified person, is considered to be a qualified person for the performance of those duties.

qualified communication line worker; A qualified employee or person who has been trained in and demonstrated particular knowledge of the installation, construction, or operation of communication apparatus and the hazards involved, including identification of and exposure to electric supply apparatus used in the operation of, or located in the vicinity of, communication apparatus.

qualified electric supply line worker; A qualified employee or person who has been trained in and demonstrated particular knowledge of the installation, construction, or operation of electric supply apparatus and the hazards involved, including identification of and exposure to

communication apparatus used in the operation of, or located in the vicinity of, electric supply apparatus.

Revise Rule 430 to read as follows:

General

Communications employees shall observe the following rules in addition to the rules contained in Section 42. Employees working on energized communication apparatus, in equipment containing electric supply circuits, or in elevated positions near electric supply lines and equipment shall be qualified communication workers.

Submitter:

Allen L. Clapp

Supporting Comment:

The existing use of *qualified* is essentially the same as that originally adopted by OSHA. This proposal updates the NESC use of *qualified* more in line with recent changes in OSHA and further emphasizes the need for communication workers to know how to identify and work around electric supply facilities.

Communication workers need to know how to identify and appropriately treat supply lines and equipment. Many recent accidents, particularly involving CATV workers on poles contacting energized, open power conductors, were an obvious result of a lack of training in identification of, and how to work around, power apparatus. This change in the definitions and requirements will reinforce appropriate training requirements.

By the same token, with all the changes in the industries involved, it is more and more apparent that supply workers need to know how to identify communication equipment, if for no other reason than to be able to promptly notify the appropriate people when there is a problem and promote getting the problem fixed in a timely manner.

Subcommittee Recommendation: Reject

Proposed Rule 430 rejected because the proposed changes are covered by Rule 420B.

See also Subcommittee action on CP 2356.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE Table 431-1

CP 2121

Change the column heading in Table 431-1 from “Approach distance” to:

“Distance to employee (Phase to ground)”.
Do **not** change any values in Table 431-1.

Submitter:

Stephen A. Olinick

Supporting Comment:

Review and check the approach distances in Table 431-1 against the approach distances in Table 441-1. The approach distances for communication employees in Table 431-1 should be equal to or greater than those in Table 441-1 for supply employees. For example, in the 750 to 15 kV row of Table 431-1 and at the 120 kV and 140 kV levels of Table 431-1 the communication worker approach distance is less than what is required of the supply worker. The approach distances for communication employees in Table 431-1 should be equal to or greater than those in Table 441-1 for supply employees.

Subcommittee Recommendation: Accept in Part.

Revise Rule 431 to read as follows:

431. Approach to Energized Conductors or Parts

A. No employee shall approach, or take any conductive object, within the distances to any exposed energized part as listed in Table 431-1.

B. Altitude Correction

The distances in Tables 431-1 shall be used at elevations below 900 m (3000 ft). Altitude correction factors as indicated in Table 441-5 shall be applied above that altitude. Altitude correction factors shall be applied only to the electrical component of the minimum approach distance.

Revise Table 431-1 to read as follows:

Table 431-1
Overhead Supply Lines and Equipment Approach Distances to Exposed Energized Parts
 (See Rule 431 in its entirety)

Voltage range (phase-to-phase, rms)²	Approach Distance Distance to Employee	
	<u>Phase-to ground</u> (m)	<u>Phase-to-ground</u> (ft-in)
0 V to 50 V ¹	not specified	Not specified
51 V to 300 V ¹	avoid contact	Avoid contact
301 V to 750 V ¹	0.31	1-0
751 V to 15.0 kV	0.65	2-2
15.1 kV to 36.0 kV	0.91	3-0
36.1 kV to 46.0 kV	1.06	3-6
46.1 kV to 121.0 kV	1.21	4-0
121.1 kV to 140 kV	1.38	4-6

¹ For single-phase systems, use the highest voltage available.

² For single-phase lines off three-phase systems, use the phase-to-phase voltage of that system

Secretary’s Comment: Editorial corrections made to clarify specific sections as “A” and “B”.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Mitchell, Schweitzer, Doering, Bowmer, Theis
 Negative: Tootle, Tomaseski
 Abstention: Wallis

Explanation of Vote:

Tootle: The fact that this CP was submitted underscores the confusion between Minimum Approach Distance, Table 441-1, for Supply Employees and Minimum Approach Distance, Table 431-1, for Communications Employees. The Communication Worker should have a minimum distance equal to or greater than those listed in Table 441-1 for phase to ground exposure. Therefore, changing the column title to “phase to ground” will go a long way in clarifying these issues. However, “distance to employee” is a vital element in this process for enhancing the field application of this table and reducing a comparison to Table 441-1. I believe that “distance to employee” is a phrase that is self-explanatory and promotes the intent of Table 431-1. Concern for extended reach is clearly defined in 431 with a reference to Table 431-1. In summary, I support CP 2121 but feel that “distance to employee” should not be excluded.

Tomaseski: The rule developed in 431, Approach to Energized Conductors or Parts, carries the same intent and purpose of Rule 441.A. The title of both of these rules are similar:

- 431.** *Approach to Energized Conductors or Parts*
- 441.A.** *Approach Distance to Live Parts*

The language in these two rules is also very similar, e.g., “No employee shall approach...” & “Employees shall not approach...” These rules are explicit in their directive, prohibiting an employee to approach, or take any conductive object within the distances listed in the two tables. Changing the wording to “*distance to employee*” could give the user of the rule the sense that the only distance of concern is the distance to the body of the worker. This is, obviously, not true. It is very clear in the present rules, 431 & 441, that conductive objects the worker is in contact with, such as tools or equipment, may, also, not violate the distance listed in the tables. Therefore, “*distance to employee*” would only weaken the language of the rules and should not be used. I would also suggest the column heading in Table 441-1 should be changed from “Distance to Employee” to “Approach Distance” to clarify the intent of the rule.

This CP incorrectly describes the differences in the approach distances contained in Table 431-1 and Table 441-1. To illustrate this, the following chart contains the phase-to-ground approach distances from both tables:

Voltage Range (phase-to-phase, rms)	APPROACH DISTANCE			
	TABLE 431-1		TABLE 441-1	
	(m)	(ft-in)	(m)	(ft-in)
0 V to 50 V	Not specified	Not specified	Not specified	Not Specified
51 V to 300 V	Avoid contact	Avoid contact	Avoid contact	Avoid contact
301 V to 750 V	0.31	1-0	0.31	1-0
751 V to 15.0 kV	0.65	2-2	0.65	2-2
15.1 kV to 36.0 kV	0.91	3-0	0.77	2-7
36.1 kV to 46.0 kV	1.06	3-6	0.84	2-9
46.1 kV to 121.0 kV	1.21	4-0	0.95-1.00*	(3-2)-(3-3)
121.1 kV to 140 kV	1.38	4-6	1.09	3-7

* Table 441-1 footnote explains the difference in approach distances at the changeover for distribution voltages to transmission systems because of work practices and the difference in the inadvertent movement factor.

This table clearly shows that the distance for phase-to-ground approach distances within Table 431-1, for communication workers, is at least if not greater than those in Table 441-1, for supply workers. Therefore, no changes are necessary based on the discussion offered in the supporting comments for this CP.

I agree with the change in adding references to altitude correction factors, but this CP should be rejected and the altitude correction factors addressed in a separate CP.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

Doering: *Affirmative comment:* I believe the parenthetical statement covers the fact that the distance also applies to conductive objects held by the employee. Consider adding a third footnote:

³For delta systems multiply the phase-to-phase voltage by $\sqrt{3}$ before entering the table. See CP 2131 for justification.

RULE Table 431-1

CP 2131

Change Table 431-1 to use the style of footnotes as used in other parts of the Code. In Table 431-1, make the single * to be Footnote 1 and create a new Footnote 2 to be identical to Footnote 2 of Table 441-1, as shown below:

**Table 431-1
Overhead Supply Lines and Equipment Approach Distances to Exposed Energized Parts**

Voltage range (phase-to-phase, rms) ²	Approach distance	
	(m)	(ft-in)
0 V to 50 V* ¹	not specified	not specified
Over 50 V, not over 300 V* ¹	avoid contact	avoid contact
Over 300 V, not over 750 V* ¹	0.31	1-0
Over 750 V, not over 15 kV	0.65	2-2
Over 15.1 kV, not over 36 kV	0.91	3-0
Over 36.1 kV, not over 46.0 kV	1.06	3-6
Over 46.1 kV, not over 121 kV	1.21	4-0
Over 121 kV, not over 140 kV	1.38	4-6

*¹ For single phase systems, use the highest voltage available

² For single-phase lines off three-phase systems, use the phase-to-phase voltage of that system

Submitter:

David Komassa

Supporting Comment:

These changes use the style for footnotes used in other Parts of the Code. Breaking the single * of Table 441-1 into two footnotes better indicates where they apply. FN 1 is applicable for secondary systems and FN 2 is more applicable to primary systems. Adding FN 2 to Table 431-1 improves consistence and clarity between Table 431-1 and Table 441-1.

Subcommittee Recommendation: Accept in principle.

See action taken on CP 2121.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
 Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 431.1

CP 2350

Change data in table to reflect the same phase-to-phase distances as in Table 441-1:

**Table 431-1
 Overhead Supply Lines and Equipment Approach Distances to Exposed Energized Parts**

Voltage range (phase-to-phase, rms)	Approach distance	
	(m)	(ft-in)
0 V to 50 V*	not specified	Not specified
Over 50 V, not over 300 V*	avoid contact	Avoid contact
Over 300 V, not over 750 V*	0.31	1-0
Over 750 V, not over 15 kV	<u>0.67</u> 0.65	<u>2-3</u> 2-2
Over 15.1 kV, not over 36 kV	<u>0.86</u> 0.91	<u>2-10</u> 3-0
Over 36.1 kV, not over 46.0 kV	<u>0.96</u> 1.06	<u>3-2</u> 3-6
Over 46.1 kV, not over 121 kV	<u>1.29</u> 1.21	<u>4-3</u> 4-0
Over 121 kV, not over 140 kV	<u>1.50</u> 1.38	<u>4-11</u> 4-6

* For single phase systems, use the highest voltage available

Submitter:

Stephen Hadley

Supporting Comment:

Table 441 and Table 431 address two distinctly different applications: 441 is designed to provide safe working distances for qualified employees engaged in Live-Line work, whereas 431 is designed to provide safe working distances from exposed energized parts for communication workers.

2. The clearances for communication workers is phase-to-ground and not phase-to-phase, therefore, the data in the tables has been updated to reflect the correct distances to which the worker must be minimally protected from exposed energized equipment.

Subcommittee Recommendation: Reject.

Subcommittee Comment: Supply and communications tables should not be the same. The submitter supplied no basis for the change.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 440

CP 2162

Replace the present definition of *qualified* with the following new definition based upon OSHA definitions:

qualified; qualified employee; qualified person; ~~Having~~ An employee or person who has been trained in and has demonstrated adequate knowledge of the installation, construction, or operation of apparatus and the hazards involved, including identification of and exposure to electric supply apparatus in or near the workplace. NOTE: An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training, and who is under the direct supervision of a qualified person, is considered to be a qualified person for the performance of those duties.

qualified communication line worker; A qualified employee or person who has been trained in and demonstrated particular knowledge of the installation, construction, or operation of communication apparatus and the hazards involved, including identification of and exposure to electric supply apparatus used in the operation of, or located in the vicinity of, communication apparatus.

qualified electric supply line worker; A qualified employee or person who has been trained in and demonstrated particular knowledge of the installation, construction, or operation of electric supply apparatus and the hazards involved, including identification of and exposure to communication apparatus used in the operation of, or located in the vicinity of, electric supply apparatus.

Revise Rule 440 to read as follows:

440. General

Supply employees shall observe the following rules in addition to the rules contained in Section 42. Employees working on energized supply apparatus, in equipment containing

electric supply circuits, or in elevated positions near electric supply lines and equipment shall be qualified electric supply line workers.

Submitter:

Allen L. Clapp

Supporting Comment:

The existing use of *qualified* is essentially the same as that originally adopted by OSHA. This proposal updates the NESC use of *qualified* more in line with recent changes in OSHA and further emphasizes the need for communication workers to know how to identify and work around electric supply facilities.

Communication workers need to know how to identify and appropriately treat supply lines and equipment. Many recent accidents, particularly involving CATV workers on poles contacting energized, open power conductors, were an obvious result of a lack of training in identification of, and how to work around, power apparatus. This change in the definitions and requirements will reinforce appropriate training requirements.

By the same token, with all the changes in the industries involved, it is more and more apparent that supply workers need to know how to identify communication equipment, if for no other reason than to be able to promptly notify the appropriate people when there is a problem and promote getting the problem fixed in a timely manner.

Subcommittee Recommendation: Reject.

Proposed Rule 440 rejected because the proposed changes are covered by Rule 420B.

See also Subcommittee action on CP 2356.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441

CP 2123

Add new Note to Table 441-1:

NOTE 1: For 121 kV to 362 kV single break per pole switching devices with 3 phase reclosing into trapped charges the maximum per-unit values given in the table (3 per unit for 121 to 362 kV) may increase significantly. Minimum approach distances for these devices shall be determined by a transient overvoltage study.

Submitter:

H. J. Kientz

Supporting Comment:

Transient overvoltage studies and testing on single break 3 phase reclosing on trapped charges has confirmed the higher than table values.

IEEE Standard 516, which is the supporting document for the NESC minimum approach distances, is being revised to include the higher transient overvoltages; however, that revision will not be available until the year 2000.

Subcommittee Recommendation: Accept in principle.

Revise Rule 441.A.4 to read:

4. ~~Transient Overvoltages Control~~ Above 72.5 kV

A. For 121 kV to 362 kV single break per pole switching devices with 3 phase reclosing into trapped charges the maximum per-unit values given in the table (3 per unit for 121 to 362 kV) may increase significantly. Minimum approach distances for these devices shall be determined by a transient overvoltage study.

Note: These overvoltages will not exceed the values of Table 441-1 if reclosing is blocked.

- B. For voltages above 72.5 kV, the approach distance may be reduced if the maximum anticipated transient overvoltage is known for the work site. Engineering analysis is required when transient overvoltage control techniques are employed. When preinsertion resistors are employed, they shall be operational. The approach distances derived from Tables 441-2, 441-3, and 441-4 may be used. When a reduced clearance distance from Tables 441-2, 441-3, and 441-4 is used for a specific per-unit transient overvoltage, the maximum transient overvoltage shall be controlled at the work site by one of the following methods:
- a. The operation of a circuit breaker or other switching device shall be modified, including blocking reclosing.

- b. The overvoltage itself shall be forcibly held to an acceptable level by the installation of temporary transient voltage protective devices, such as surge arresters or temporary protective gaps.
- c. The operation of the system shall be changed to restrict potential overvoltages resulting from the effect of activity on the system (e.g., capacitor switching, tap changing, cable de-energization, etc.).

Vote on Subcommittee Recommendation: Accept in principle.

Subcommittee Comment: The Subcommittee agrees with the principle of the CP, but believes this is more appropriately contained in a rule than as a footnote to the table.

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441

CP 2131

Change Table 441-1 and Table 431-1 to use the style of footnotes as used in other parts of the Code. In Table 441-1, make the first sentence of the single * to be Footnote 1, make the second sentence of the single * to be Footnote 2 and make the double ** to be Footnote 3, as shown below:

Table 441-1
AC Live Work Minimum Approach Distance
(See Rule 441 in its entirety)

Voltage in kilovolts phase to phase * ²	Distance to employee			
	Phase to ground		Phase to phase	
	(m)	(ft-in)	(m)	(ft-in)
0 to 0.050 ¹	not specified		not specified	
0.051 to 0.300 ¹	Avoid contact		avoid contact	
0.301 to 0.750 ¹	0.31	1-0	0.31	1-0
0.751 to 15	0.65	2-2	0.67	2-3
15.1 to 36.0	0.77	2-7	0.86	2-10
36.1 to 46.0	0.84	2-9	0.96	3-2
46.1 to 72.5	1.00** ³	3-3** ³	1.20	3-11
72.6 to 121	0.95** ³	3-2** ³	1.29	4-3
138 to 145	1.09	3-7	1.50	4-11
161 to 169	1.22	4-0	1.71	5-8
230 to 242	1.59	5-3	2.27	7-6
345 to 362	2.59	8-6	3.80	12-6
500 to 550	3.42	11-3	5.50	18-1
765 to 800	4.53	14-11	7.91	26-0

*¹ For single-phase systems use the highest voltage available.

² For single-phase lines off three phase systems, use phase-to-phase voltage of the system.

**³ The 46.1 to 72.5 kV phase-to-ground 3-3 distance contains a 1-3 electrical component and a 2-0 inadvertent movement component while the 72.6 to 121 kV phase-to-ground 3-2 distance contains a 2-0 electrical component and a 1-0 inadvertent movement component

Submitter:

David Komassa

Supporting Comment:

These changes use the style for footnotes used in other Parts of the Code. Breaking the single * of Table 441-1 into two footnotes better indicates where they apply. FN 1 is applicable for secondary systems and FN 2 is more applicable to primary systems. Adding FN 2 to Table 431-1 improves consistence and clarity between Table 431-1 and Table 441-1.

Subcommittee Recommendation: Accept in principle.

Revise Table 441-1 to read as follows:

Table 441-1
AC Live Work Minimum Approach Distance
 (See Rule 441 in its entirety)

Voltage in kilovolts phase to phase ^{1,2}	Distance to employee			
	Phase to ground		Phase to phase	
	(m)	(ft-in)	(m)	(ft-in)
0 to 0.050	not specified		not specified	
0.051 to 0.300	avoid contact		avoid contact	
0.301 to 0.750	0.31	1-0	0.31	1-0
0.751 to 15	0.65	2-2	0.67	2-3
15.1 to 36.0	0.77	2-7	0.86	2-10
36.1 to 46.0	0.84	2-9	0.96	3-2
46.1 to 72.5	1.00 ³	3-3 ³	1.20	3-11
72.6 to 121	0.95 ³	3-2 ³	1.29	4-3
138 to 145	1.09	3-7	1.50	4-11
161 to 169	1.22	4-0	1.71	5-8
230 to 242	1.59	5-3	2.27	7-6
345 to 362	2.59	8-6	3.80	12-6
500 to 550	3.42	11-3	5.50	18-1
765 to 800	4.53	14-11	7.91	26-0

¹ For single-phase systems use the highest voltage available.

² For single-phase lines off three phase systems, use phase-to-phase voltage of the system.

³ The 46.1 to 72.5 kV phase-to-ground 3-3 (ft-in) distance contains a 1-3 (ft-in) electrical component and a 2-0 (ft-in) inadvertent movement component while the 72.6 to 121 kV phase-to-ground 3-2 (ft-in) distance contains a 2-0 (ft-in) electrical component and a 1-0 (ft-in) inadvertent movement component

Vote on Subcommittee Recommendation: Accept in principle.

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Bowmer, Theis

Negative: Doering

Abstention: Wallis

Explanation of Vote:

Doering: First, consider the following technical comments:

1. □ The phase to ground minimum approach distances in the Table 431-1 and the Tables 441-1, 2, 3 are based on grounded wye systems. While entering the table using a phase-to-phase voltage, actually the maximum line-to-ground voltage is processed to give the electrical component of the gap withstand distance, after which the inadvertent movement distance is added to give the minimum approach distance.

- 2.□ The phase-to-phase distances are determined by multiplying the phase-to-ground gap withstand distance by a second factor that varies from 1.8 to 1.275 (generally around 1.732), after which the inadvertent movement distance is added to give the minimum approach distance.
- 3.□ As we start to adapt the table to systems other than grounded wye systems, it is necessary to understand the basis of the tables as stated in (1) and (2) above. Therefore, for other than three-phase grounded wye systems, we need to enter the table using an equivalent or pseudo phase-to-phase voltage as directed in the footnotes.
- a.□ To determine the correct approach distance for ungrounded delta systems, use the phase-to-phase minimum approach distance available in the 441 tables. This gives a distance that would protect the employee when one phase is accidentally grounded, resulting in the grounded employee being exposed to the phase-to-phase voltage.
- b.□ To determine the correct approach distance for ungrounded delta systems using Table 431-1, it is necessary to enter the table at a voltage equal to the phase-to-phase voltage multiplied by 3. This gives a distance that would protect the employee when one phase is accidentally grounded, resulting in the grounded employee being exposed to the phase-to-phase voltage.

Consider the following modifications to the footnotes;

- 1□ For single-phase systems use the highest voltage available and the phase-to-phase distance to employee.
- 4 For delta systems use the phase-to-phase distance to employee.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441

CP 2235

Add new Note to Table 441-1:

NOTE 1: For 121 kV to 362 kV single break per pole switching devices with 3 phase reclosing into trapped charges the maximum per-unit values given in the table (3 per unit for 121 to 362 kV) may increase significantly. Minimum approach distances for these devices shall be determined by a transient overvoltage study.

Submitter:

H. J. Kientz

Supporting Comment:

Transient overvoltage studies and testing on single break 3 phase reclosing on trapped charges has confirmed the higher than table values.

IEEE Standard 516, which is the supporting document for the NESC minimum approach distances, is being revised to include the higher transient overvoltages; however, that revision will not be available until the year 2000.

Subcommittee Recommendation: See CP 2123. (This was a duplicate CP).

RULE 441.A.1.a

CP 2217

Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 44A3 – 444B – 444C – 444E1 – 444E2 – 445B

Note: Some Rules have multiple usage of the term.

Revise definition of de-energized to read as follows:

de-energized: ~~Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of earth:~~

~~NOTE: The term is used only with reference to current carrying parts that are sometimes alive (energized).~~ **Synonym: dead.** Removed from all sources of electrical supply by opening switches, disconnectors, jumpers, taps, or other means of electrical supply.

NOTE: The circuit could be electrically charged through induction from energized circuits in proximity to it, particularly if the circuits are parallel.

Submitter:

H. J. Kientz

Supporting Comment:

This change would require that all references to **de-energized** be left as is where grounding of the circuit is not required and that, where grounding is required, the text would be changed to read “**de-energized and grounded.**”

This proposed language is consistent with OSHA 1919.269(m)(3)(ii).

There is a conflict between the definition of de-energized (grounded – dead) and some of the uses in the text. For instance Rule 443F, Making Connections, reads: “In connecting **de-energized** equipment or lines to an **energized** circuit by means of a conducting wire or device, ...” According to the existing definition of de-energized, this requires connecting a grounded component to an energized circuit.

The existing rules separated into their application of definitions is as follows

DEFINITELY COMPLY WITH EXISTING DEFINITION BUT NOT PROPOSED DEFINITION

Rule: Section 2, definitions – 443I – 444E1 – 444E2 – 445B.

PROBABLY COMPLY WITH PROPOSED DEFINITION BUT NOT EXISTING DEFINITION

Rule: Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – **443F** – 444A3 – 444B – 444C

Note: Rule 443F is definitely the new definition or you are placing a ground on a live circuit.

NOT SURE BUT COULD BE EITHER

Rule: 127A3c – 354A2 – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 444A3 – 444B – 444C – 444E1 – 444E2 – 445B – Appendix B[15]

Note: Some Rules have multiple usage of the term.

Consider the three circuits

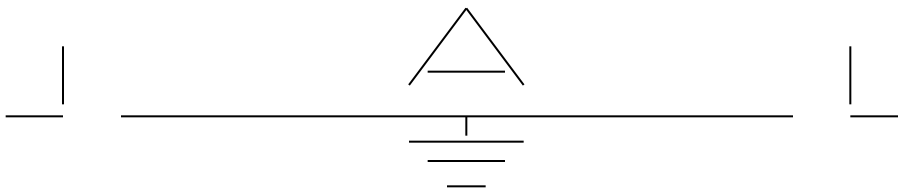


CIRCUIT # 1 – ENERGIZED

This circuit has to be worked with live (energized) maintenance procedures.



CIRCUIT # 2 – ISOLATED FROM ALL SOURCES OF PRIMARY SYSTEM SUPPLY – ENERGIZED BY INDUCTION – NO GROUNDS – NOT DEAD



CIRCUIT # 3 – POINT A – DE-ENERGIZED – GROUNDED – (DEAD???)

NOTE: Only point A is at ground potential, therefore, the circuit is not really dead. An additional set of grounding cables would be required at each additional worksite on the same circuit.

CIRCUIT 1.

Circuit one is definitely energized in everyone's mind and requires live working methods.

CIRCUIT 2.

The largest majority of utility engineers, operators, dispatchers, and workers consider this to be de-energized as proposed in this Change Proposal. It does not meet the criteria of the existing definition as it is not grounded – dead. Because of the wide use of this philosophy, it is not possible to reeducate people to accept the existing definition. It is more practical to make the definition fit the common usage.

CIRCUIT 3.

According to the existing definition, this circuit is grounded (i.e. dead). This is not entirely true. It is dead at point A only. In fact the end points on long lines paralleling heavily loaded high voltage transmission lines may have very high induced voltages. To address this circuit in the common language of the trade and the conditions of this change proposal, Circuit 3 should be referred to as “**de-energized and grounded**”.

This issue was discussed at the International Electrotechnical Commission – Technical Committee 78 meeting in Birmingham, UK in October 1997. The issue was resolved by removing the term “de-energized” from international standards.

IEEE ESMOL adopted the proposed change into their drafts of Std 1048, Guide for Protective Grounding for Power Lines and Std 516, Maintenance Methods on Energized Power-Lines at the IEEE Winter Meeting in February 1998. The chairmen of the construction and substation grounding standards were also consulted and are in agreement.

Subcommittee Recommendation: Accept in principle. See action taken on Rule 420D, CP 2217.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis

Abstention: Wallis

Explanation of Vote:

Doering: *affirmative comment:* We are now dealing with three definitions, the existing or traditional definition, the Kientz's definition, and now the SC1/SC3 definition. The existing definition is generically correct, but not specific to NESC facilities. Kientz's definition is specific to NESC facilities, but has rough spots. SC1/SC3's definition is grammatically

smoother. Both Kientz and SC1/SC3 lack the point that the definition only covers current carrying parts that are sometimes energized.

I would prefer:

De-energized: Disconnected from all sources of electric supply by opening switches, disconnectors, jumpers, taps, or other means.

NOTE 1: A de-energized conductor could be electrically charged through various means, such as inductive or capacitive coupling from energized circuits.

NOTE 2: The term is used only with reference to current carrying parts that are sometimes energized.

The more important point, and possibly the real problem, is when is it safe for an employee to contact current carrying parts that are sometimes energized? NFPA 70E uses the current NESC definition for “de-energized”, and came up with the second expression “electrically safe work condition” to describe the state in which the conductor or circuit part to be worked on or near has been disconnected from the energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary. SC8 has not seen fit to adopt such an expression, therefore we must use two expressions, “de-energized”, or “de-energized and grounded”. I don’t like the latter expression, because it implies a live part must always be grounded to be safe. Both the NESC and OSHA recognize there are times when grounding is not necessary, and times when it creates a hazard to ground.

The first expression “de-energized” is used to describe the electrical condition of live parts.

The second expression “de-energized and grounded per §444D”, is used to describe the electrical condition of live parts as it pertains to employee safety.

Use of De-Energized:

Reviewing the report on the use of de-energized in the NECS, I would have the following comments:

127.A.3.c	“De-energized” okay as employee contact is not involved.
234.B.2 Exception 2.	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 234-2 Heading	“De-energizing” is okay.
Table 234-2	Should read “de-energized and grounded per §444D, as possible employee contact is involved.
Table 235-5 Heading	“De-energizing” is okay.
Table 235-5 2.c(1) & (2)	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 235.5 Footnote 5	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
236.E	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 242-1	“De-energized” is okay.
354.A.2	“De-energized” is okay.
420.D	“De-energized” is okay.

420.L	“De-energized” is okay.
441.A.1.a	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
442.B	“De-energized” is okay.
442.B Exception 2	“De-energized” is okay.
442.D	“De-energized” is okay.
442.E.1	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.A.4.a	“De-energized” is okay.
443.F	“De-energized” is okay.
443.G	Unless other editorial changes are made, this should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.H	“De-energized” is okay.
443.I	“De-energized” is okay.
444.A.1	“De-energized” is okay.
444.A.3	“De-energized” is okay.
444.B	“De-energized” is okay.
444.C	“De-energized” is okay.
444.E.1&2	“De-energized” is okay, though I would like “per §444D” added after grounding.
445.B	“De-energized” is okay.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441.A.3.b

CP 2354

Revise Rule 441.A.3.b to read as follows:

b. When the Rubber Glove Work Method is employed, rubber insulating gloves, ~~insulated for the voltage involved,~~ insulated for the maximum voltage exposure at the worksite, shall be worn whenever employees are in the vicinity of energized conductors or parts, supplemented by one of the following two protective methods:

Submitter:

James R. Tomaseski

Supporting Comment:

The language in the existing rule is not clear as to what voltage the rubber insulating gloves shall insulate for. Voltage exposure levels at the worksite may exceed phase-to-ground voltage, depending on the implementation of overvoltage control procedures, circuit configuration, etc.

ASTM Standards include a definition of maximum use voltage that refers to work practices that are not described in the ASTM Standards, nor does Part 4 of the NESC describe those work rules regarding the class of rubber insulating glove to be used. ASTM definition states:

voltage, maximum use – the a-c voltage, (rms), rating of the protective equipment that designate the maximum nominal voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits.

If there is no multiphase exposure in a system area and the voltage exposure is limited to the phase (polarity on d-c systems) to ground potential, the phase (polarity on d-c systems) to ground potential shall be considered to be the nominal design voltage.

If electrical equipment and devices are insulated, or isolated, or both, such that the multiphase exposure on a grounded wye circuit is removed, then the nominal design voltage may be considered as the phase-to-ground voltage on that circuit.

NOTE: ASTM definition of nominal design voltage

voltage, nominal design – a nominal value consistent with the latest revision of ANSI C84.1, assigned to the circuit or system for the purpose of conveniently designating its voltage class.

Subcommittee Recommendation: Reject.

Subcommittee Comment: See Subcommittee action on CP 2385.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Bowmer, Theis

Negative: Doering :

Abstention: Wallis

Explanation of Vote:

Doering: As I understand the history of the ASTM F-18 Insulating Protective Equipment (IPE), the Maximum Use Voltage (D120-§3.1.13) was based on the phase-to-phase voltage exposure. More realistically the highest voltage to stress the IPE is the phase-to-ground voltage during a transient condition. The probability of a phase-to-phase contact during a transient overvoltage is extremely low, because work practices are universally based on working on one phase at a time.

Exception 1 (D120-§3.1.13.1) and Exception 2 (D120-§3.1.13.2) were added to the ASTM Standards, and are now used by many to select the Class of IPE. I believe Exceptions 1 and 2 should be replaced with application formulas patterned after the method use to calculate the Minimum Approach Distances (MAD) in Tables 441-1 through 441-3.

The application of Exception 1 would be rare, as the probability of such a system existing throughout a utility system is not realistic. In any event, as will be shown below, the IPE could still be over stressed.

The problem with Exception 2 is the difficulty in removing the multi phase exposure, by insulation or isolation or both, without violating the standards for clearances and for the protective equipment. For example, when approaching one phase conductor and the second phase conductor is within the phase-to-phase MAD, this would be a violation of the standard. In any event, as will be shown below, the IPE could still be over stressed.

The maximum voltage stress on rubber IPE is due to transient overvoltages (TOV). In general, this stress is assumed to be 3 p.u. of the maximum line to ground voltage. In order to provide protection to workers, all IPE must withstand this electrical stress.

For example, Class 4 IPE is rated for a maximum use voltage of 36 kV rms line-to-line or 21 kV rms line-to-ground. The maximum anticipated TOV on this 36 kV line would be (21 kV rms) x (√2) x (3 p.u.) or 89 kV peak. For this set of conditions, the Class 4 IPE should be rated to the TOV withstand 89 kV peak, or an equivalent 60 Hz (AC rms) voltage. It has been demonstrated [1] that for test purposes the ratio of the transient overvoltage (TOV) to the 60 Hz (AC rms) is a conservative 1.3.

Note: Test equipment to generate the maximum TOV is normally not available for most users and suppliers. However, equivalent 60 Hz (AC rms) voltage could be used in place of the TOV.

Following is an example of applying the above requirements:

Transient Overvoltage (TOV)peakwithstand = (kV rms L-G) (√2) (p.u.) = (21) (√2) (3) = 89 kV peak

ACwithstand = TOVwithstand ÷ TOV/AC ratio

For TOV/AC ratio of 1:1; ACrmswithstand = 89 ÷ √2(1) = 63 kVrms

For TOV/AC ratio of 1:1.3; ACrmswithstand = 63 ÷ 1.3 = 48 kVrms

Class 4 IPE AC minimum withstand [2] is 50 kVrms, therefore the Class 4 IPE is appropriate for working on the 21/36 kV line.

The following table list the equivalent maximum rms over-voltage data for a range of distribution systems.

System Voltage	Maximum Line-To-Ground Voltage ANSI C84.1	P. U. Transient Overvoltage	Transient Over voltage Withstand rms	Transient Over voltage Withstand Peak	Equivalent 60 Hz Withstand rms
4160Y/2400	2,520	3	7,600	10,700	5,800
8320Y/4800	5,040	3	15,100	21,400	11,600
12470Y/7200	7,560	3	22,700	32,100	17,400
13200Y/7620	8,000	3	24,000	33,900	18,500
22860Y/13200	13,860	3	41,600	58,800	32,000
24940Y/14400	15,120	3	45,400	64,100	34,900
34500Y/19920	20,920	3	62,800	88,700	48,300

The equivalent 60 Hz Withstand rms voltage in the above table must be less than the minimum breakdown voltage rms of the IPE, see below.

Class of IPE	D120[2] Minimum Breakdown Voltage rms	Test Results Mean Breakdown Voltage rms	Test Results Mean Breakdown Voltage peak
1	20,000	37,840[4]	74,800[4]
2	30,000	42,600[3]	80,900[3]
3	40,000	54,600[3]	92,600[3]
4	50,000	60,200[3]	100,900[3]

In a series of TOV function breakdown tests[4] on class 1 gloves, the mean value for bare gloves was 74.8 kV with a standard deviation of 6.8 kV.

In a series of 60 Hz breakdown tests[4] on Class 1 gloves, the mean value for bare gloves was 37.84 kV with a standard deviation of 3.18 kV.

The breakdown voltage of rubber gloves depends on the thickness of the rubber material. For low class gloves (class 0, 1), the material thickness is governed primarily by the need for mechanical strength, rather than the withstand voltage. For that reason, lower class gloves are

thicker than needed from an electrical viewpoint. In higher classes, the voltage requirements predominate and the observed withstand levels, in general are closer to those required by the standards.

[1] Task Force 15.07.03.02 Analytical Considerations Working Group, ESMOL Subcommittee of T & D, "Correlation of AC, Switching Surge and DC Breakdown Tests Results for Insulating Blankets and Line Hoses", *IEEE Transactions on Power Delivery*, Vol. 7, No. 3, July 1992.

[2] ASTM Standards, D120-95 Specification for Rubber Insulating Gloves.

[3] M. Balpinarli, J.J. Dai, and G. Gela, "AC and DC Breakdown Versus Thickness Characteristics for Rubber Gloves", *IEEE Transactions on Power Delivery*, Vol. 3, No. 1, January 1988.

[4] Hamman, Shawky, Yoshimura, Brockway, Adams, Fine, and Nowack, "Puncture Breakdown Characteristics Of Protected Rubber Insulating Gloves, IEEE Transactions on Power Delivery, Vol. 5, No. 2, April 1990.

J. F. Doering Recommendation:

Revise Rule 441.A.3 to read as follows:

441.A.3

b. When the Rubber Glove Work Method is employed, rubber insulating gloves, insulated for the maximum use voltage ~~involved~~, as listed in Table 441-6, shall be worn whenever employees are in the vicinity of energized conductors or parts, supplemented by one of the following two protective methods:

(1) The employee shall wear rubber insulating sleeves, insulated for the maximum use voltage ~~involved~~ as listed in Table 441-6, in addition to the rubber insulating gloves.

EXCEPTION: When work is performed on electric supply equipment energized at 750 V or less, rubber sleeves are not required if only the live parts being worked on are exposed.

(2) All exposed energized lines or parts, other than those temporarily exposed to perform work and maintained under positive control, located within maximum reach of the employee's work position, shall be covered with insulating protective equipment.

EXCEPTION: When work is being performed on parts energized between 300 V and 750 V within enclosed spaces, (e.g., control panels and relay cabinets), insulated or guarding of all exposed grounded lines, conductors, or parts in the work area is not required provided that employees use insulated tools and/or gloves and that exposed grounded lines, conductors, or parts are covered to the extent feasible.

- c. Cover-up rated for the voltage involved, when used, shall be applied to the exposed facilities as the employee first approaches the facilities from any direction, be that from the structure or from an aerial device, and shall be removed in the reverse order. This protective cover-up shall extend beyond the reach of the employee's anticipated work position or extended reach distance.

Table 441-6
Maximum Use Voltage for Rubber Insulated Equipment

Class of Equipment	Maximum Use Voltage ¹
00	500
0	1000
1	7500
2	17000
3	26500
4	36000

¹ The maximum use voltage is the a-c voltage (rms) rating of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuit.

EXCEPTION: The selection of a lesser Class of rubber insulating equipment may be possible if the transient overvoltage is known at the work site, and following an engineering analysis. The following table lists the equivalent maximum rms overvoltages data for a range of distribution systems for a P.U. equal to 3.0.

System Voltage	Maximum Line-To-Ground Voltage ANSI C84.1	P. U. Transient Over voltage	Transient Over voltage Withstand rms	Transient Over voltage Withstand Peak	Equivalent 60 Hz Withstand rms
4160Y/2400	2,520	3	7,600	10,700	5,800
8320Y/4800	5,040	3	15,100	21,400	11,600
12470Y/7200	7,560	3	22,700	32,100	17,400
13200Y/7620	8,000	3	24,000	33,900	18,500
22860Y/13200	13,860	3	41,600	58,800	32,000
24940Y/14400	15,120	3	45,400	64,100	34,900
34500Y/19920	20,920	3	62,800	88,700	48,300

The equivalent 60 Hz Withstand rms voltage in the above table must be less than the minimum breakdown voltage rms of the IPE, see below.

Class of IPE	Minimum Breakdown Voltage rms (ASTM D120)
1	20,000
2	30,000
3	40,000
4	50,000

For other conditions, such as controlling the transient over voltage, use the formulas in the following examples:

For p.u. = 3.0

Transient Overvoltage (TOV) peak withstand = (kV rms L-G) $(\sqrt{2})$ (p.u.) = (21) $(\sqrt{2})$ (3) = 89 kV peak

AC rms = (TOV) withstand $\div \sqrt{2}$ = 89 kV $\div \sqrt{2}$ = 63 kV rms

AC withstand = AC rms \times TOV/AC ratio = 63 kV \times 1.3 = 48 kV rms

Class 4 IPE minimum breakdown is 50 kV rms, therefore the Class 4 IPE is appropriate for the 21/36 kV line.

For controlled p.u. = 2.0 (Generally not a realistic value if capacitors are being switched.)

Transient Overvoltage (TOV) withstand = (kV rms L-G) \times (p.u.) = (21) \times (2) = 59.4 kV peak

AC rms = (TOV) withstand \div $\sqrt{2}$ = 59.4 kV \div $\sqrt{2}$ = 42 kV rms

AC withstand = AC rms \times TOV/AC ratio = 42 kV \times 1.3 = 32.3 kV rms

Class 3 IPE minimum breakdown is 40 kV rms, therefore the Class 3 IPE is appropriate for the 21/36 kV line.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441.A.3.b

CP 2385

Submitter:

Subcommittee 8

Revise Rule 441.A.3.b to read as follows:

441.A.3

b. When the Rubber Glove Work Method is employed, rubber insulating gloves, insulated for the maximum use voltage involved as listed in Table 441-6, shall be worn whenever employees are in the vicinity of energized conductors or parts, supplemented by one of the following two protective methods:

The employee shall wear rubber insulating sleeves, insulated for the maximum use voltage involved as listed in Table 441-6, in addition to the rubber insulating gloves.

EXCEPTION: When work is performed on electric supply equipment energized at 750V or less, rubber sleeves are not required if only the live parts being worked are exposed.

2) (REMAINS UNCHANGED)

(NEW TABLE 441-6)

Table 441-6
Maximum Use Voltage for Rubber Insulating Equipment

Class of Equipment	Maximum Use Voltage¹
00	500
0	1000
1	7500
2	17000
3	26500
4	36000

¹ The maximum use voltage is the a-c voltage (rms) rating of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to the phase-to-phase voltage on multiphase circuits.

EXCEPTION 1: If there is no multiphase exposure in a system area and the voltage exposure is limited to the phase (polarity on d-c systems) to ground potential, the phase (polarity on d-c systems) to ground potential shall be considered to be the nominal design voltage.

EXCEPTION 2: If electric equipment and devices are insulated, isolated, or both, such that the multiphase exposure on a grounded wye circuit is removed and if supplemental insulation (e.g., insulated aerial device or structure-mounted insulating work platform) is used to insulate the employee from ground, then the nominal design voltage may be considered as the phase-to-ground voltage on that circuit.

Vote on Subcommittee Recommendation: Accept.

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Bowmer, Theis

Negative: Doering

Abstention: Wallis

Explanation of Vote:

Doering: See explanation of negative vote on CP 2354.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441.A.3.b

CP 2355

Add a new paragraph (c) to read as follows:

c. When the Rubber Glove Work Method is employed at voltages above 10kV, supplementary insulation, tested for the maximum voltage exposure at the worksite, shall be used to support the worker.

Submitter:

James R. Tomaseski

Supporting Comment:

Although this practice is followed by knowledgeable employers, there is no requirement in current directives. IEEE Standard 516 acknowledges that "...additional insulation is usually employed."

Subcommittee Recommendation: Accept in principle.

Add to rule Rule 441.A.3.b as new paragraph (c) as follows:

(c) When the Rubber Glove Work Method is employed at voltages above 15 kV phase to phase, supplementary insulation, (e.g., insulated aerial device or structure-mounted insulating work platform), tested for the voltage involved, shall be used to support the worker.

re-letter the existing (c) to (d), and reword as follows:

Cover-up ~~rated~~ insulated for the voltage involved.....

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Bowmer, Theis

Negative: Doering

Abstention: Wallis

Explanation of Vote:

Doering: Some utilities require an insulating or insulated support for the workers when the Rubber Glove Work Method is used. Insulating or insulated supports would include: climber guards with insulated overshoes, portable insulated pole platforms, or insulated aerial lift truck.

Several reasons are given for using the insulating support during gloving:

1. To provide additional insulation in case the glove should fail, or if the workers should overreached the protection of the rubber gloves or sleeves or other insulating protective equipment, or if an energized conductor would "get away" from the worker.
2. To provide an insulating or insulated support for the workers when gloving to control the level of glove leakage current as felt by the worker. This assumes the gloves are properly rated for the voltage involved.
3. To provide the required level of insulation when working on distribution systems whose maximum switching overvoltage exceeds the capability of the rubber glove or other insulating protective equipment being used by the worker. This may be due to using the multiphase exposure exception to the basic ASTM Maximum Use Voltage. (See my discussion on CP 2354, rule 441.A.3.b.)

Support for these three reasons varies:

1. Since gloves are periodically tested and examined prior to their use, and cover-up rules provide good protection, there is no strong urgency or need to justify insulating supports. This is a belt and suspenders approach.
2. This reason is supported by the hazard to the worker of leakage currents that have a steady state threshold of perception [1] shown in Table 1.

TABLE 1

Probability Of Perception	Men	Women
2 %	550 μ A	350 μ A
50%	750 μ A	1,086 μ A
98%	1,650 μ A	1,100 μ A

3. To depend on two insulation systems in series to provide basic protection may be misleading. It is difficult enough to fully evaluate one insulating system, but when two are in series it is more than doubly difficult. As the conditions effecting the two systems change, such as the level of dampness, the voltage division across the two systems may change and one system may fail in such a manner that the worker is unaware of the damage done to the equipment. Due to this difficulty, both insulating systems must be adequate for the full possible electrical stress. The proper approach is to either have

rubber insulating gloves rated for the full electrical stress, or to use the barehand work method and depend totally on the insulated support.

Leakage current data[2] for a lineman on a pole is given in Table 2. This was a one time test for a particular worker under wet conditions. Wetting down the lineman and pole would increase the resistive leakage current, but would not effect the capacitive leakage current. The net effect of the two quadrature currents is the recorded leakage current given in the Table 2. The "bare conductor" column is the "no support" data, and the "hose on the conductor" would be similar to contacting the bare conductor, but on an "insulated support".

TABLE 1
Lineman On Spurred To Pole, Gloves and Sleeves*, Water Spray On Involved Equipment

Leakage Current – Milliamperes		
Applied Potential, kV	Bare Conductor	Hose On Conductor
2.5	0.60	0.33
4.0	0.99	0.58
6.5	1.56 (1)	0.78
7.5	1.90	0.88
12.0	3.20 (2)	1.14
13.5	3.63 (3)	1.27
15.0	4.18 (4)	1.36 (5)
(1) Slight arc when glove leaves conductor. (2) Feels slight sensation in hand. (3) Feels slight sensation in arm. (4) Definite buzz occurs when hand is on conductor. (5) No sensation during entire test. * 15 kV (Class II) rubber gloves and standard-weight sleeves. Old standard ratings.		

From another source[3] we have leakage current test data for Class 4 insulating gloves with a protector, shown in Table 3. The current is the value through the employee, under various conditions. As the capacitive reactance varies inversely with the thickness of the glove, I would expect the leakage current to increase with a lower class gloves for the same voltage.

TABLE 3

Line-to-Grnd Voltage, Volts	Lineman Grounded, ⚡ A	Lineman in Aerial Lift, ⚡ A
4800	950	110
7200	1,150	160
9600	2,350	220
14400	3,700	340
16200	4,650	460
24000		560
34000		820

The above indicates that some type of insulated support is required at 7200Y/12470 volts and higher. It would appear that on 21/36 kV system the leakage currents would approach the safe let-go current without an insulating support.

[1] Charles F. Dalziel, "The Threshold of Perception Currents, *AIEE Power Apparatus and Systems*, August 1954.

[2] G. A. Ewald, Public Service Electric & Gas, "Utility Develops New Work Practices, Hardware and Tools for Higher Distribution Voltages", *Electric Light and power*, December 1964.

[3] Nestor Kolcio, "Field Measurements Of Leakage Current In Insulated Gloves", *IEEE Transactions on Power Apparatus and Systems*, Vol. PAS-104, No. 9, September 1985.

J. F. Doering recommendation:

Add a new paragraph (d) to read as follows:

- d. When the Rubber Glove Work Method is employed, supplemental insulation, testing in accordance with the appropriate standards, shall be used to isolate the worker from ground; when conditions are such that the capacitive leakage current across the rubber gloves is expected to exceed the steady state threshold of perception. An engineering analysis is required for applications over 5,000 volts line-to-ground.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441.A.5

CP 2163

Revise Rule 441.A.5 to read as follows:

5. Altitude Correction

The distances in Tables 441-1, 441-2, 441-3, and 441-4 shall be used at elevations below 900 m (3000 ft). Above that altitude, the minimum approach distance shall be increased by (a) multiplying the electrical component of the minimum approach distance by the applicable altitude correction factors as indicated in of Table 441-5 and (b) adding the result to the values for inadvertent movement required by Rule 441.A.6.a.(3). ~~shall be applied above that altitude. Altitude correction factors shall be applied only to the electrical component of the minimum approach distance.~~

NOTE: The electrical component of clearance included in the values of Tables 441-1,2,3&4 is the table value less the value for inadvertent movement for that voltage shown in Rule 441.A.6.a.(3).

Submitter:

Allen L. Clapp

Supporting Comment:

Some people have apparently been confused as to whether “apply” means that the factor is a distance that should be added or a factor to be multiplied. The rule needs clarification to show the latter.

Would it be better to create a new appendix similar to Appendix A (or modify Tables 441-1, 441-2, 441-3, and 441-4) to show the electrical component and inadvertent movement component included in each table value, so that altitude correction would be easier for users to perform?

Subcommittee Recommendation: Accept.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis
Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441.B.4.a

CP 2386

Revise Rule 441.B.4.a as follows:

4. Special Rules for Working on Insulator Assemblies Operating Above 72.5 kV
 - a. When work is to be performed at the ground end of an insulator assembly, the approach distance to the nearest energized part may equal the straight-line distance measured along the insulators. ~~from step and touch potentials.~~

Submitter:

Subcommittee 8

Supporting Comment:

This was an error in the 1997 NESC.

Subcommittee Recommendation: Accept

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Theis

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 441.B.4.b & c

CP 2124

Add the following note to both paragraphs:

EXCEPTION: For voltages at 230 kV and above where hardware (i.e., gradient rings) creates a mechanical problem for tool attachment, up to three insulator units may be temporarily shorted out as part of the work procedure, **provided** that transient overvoltage control (i.e., blocked reclosing, portable protective gaps) suitable to meet the minimum approach distance requirements of Table 441-2 is provided.

Submitter:

H. J. Kientz

Supporting Comment:

It is not practical and it would create greater hazards to attempt to follow the existing rules with many hardware designs. The work procedure proposed in this CP has been in use for many years without incident. The existing rule does not take into account the number of insulator units in an insulator string. The hardware problems associated with maintenance also apply to electrical operating design which in turn results in insulator units being added to the insulator string. The requirement for reduced transient overvoltages ensures safe work practices.

Subcommittee Recommendation: Accept in principle.

Add the following note to both paragraphs:

EXCEPTION: For voltages at 230 kV and above, up to three insulator units may be temporarily shorted out as part of the work procedure, **provided** that the minimum approach distance requirements of Rule 441 are met.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Theis

Negative: Doering

Abstention: Wallis

Explanation of Vote:

Doering: The provisions of 441B Additional Approach Requirements first appeared in the 1993 Edition of the NESC. The provisions resulted from a number of Change Proposals, two of which were proposals that, either under certain conditions or for a very limited time frame, would permit approaching a conductor (or in the case of bare-hand work approaching ground) closer than the MAD value. In the case of working on a switch, it was proposed to reduce the inadvertent movement by one-half if special precautions were taken to ensure good footing and work position; in the case of shorting out insulators, the inadvertent portion of the MAD would only occur briefly and the probability of a surge would be remote.

In my opinion, when the provisions were completed, it was an excellent example of a committee designing a horse that ended up looking like a camel. There had never been any provision prohibiting shorting out insulators if the MAD was preserved, but we ended up saying we could short out one unit, but not if it would result in a distance less than the MAD. While the original intent was to permit a limited reduction in the MAD, it never happened, but new provision permitted shorting out one insulator, but such shorting out had never been prohibited.

The result has been a confusing requirement, in fact we suddenly had a requirement prohibiting shorting out more than one insulator. We lost ground for no good reason. Now we have a this CP2124 to permit shorting out up to three insulators as long as we maintain the MAD value.

441.B.2 has an impossible requirement, that is to have the distribution insulators as long as the MAD value. Distribution insulators are sized by the electrical need which is considerably less than the MAD.

The 44.1.B provisions have been changed by the 2-28-97 Errata, and now we have CP 2124, and CP 2386 to make further changes. While very likely beyond the changes permitted by the NESC rules, I believe we should clean-up 441B as shown below.

441.B.4 has been revised to call for an Engineering analysis when the MAD can't be met, or when there are broken insulators.

B. Additional Approach Requirements **Existing Requirements**

1. The clear insulation distance associated with insulators shall be the shortest straight-line air-gap distance from the nearest energized part to the nearest grounded part.
2. When working on insulators under live work procedures employing rubber gloves or live-line tools (hot sticks), the clear insulation distance shall be not less than the straight-line distance in air required by Tables 441-1, 441-2, 441-3, and 441-4.
3. Work may be performed at the grounded end of an open switch if all of the following conditions are met:
 - a. The air-gap distance of the switch shall not be reduced in any manner. The distance shall be not less than the electrical basis for approach distances determined by rule 441A6a(4) for the maximum anticipated transient overvoltage. The inadvertent movement values of Rule 441A6a(3) are not required in this distance.
 - b. The minimum approach distance to the energized part of the switch shall be not less than that required by rule 441A.
4. Special Rules for Working on Insulator Assemblies Operating Above 72.5 kV
 - a. When work is to be performed at the grounded end of an insulator assembly, the approach distance to the nearest energized part may equal the straight-line distance measured along the insulators ~~from step and touch potentials~~.
 - b. For suspension insulator assembly installations (see ANSI C29.2-1992) operating above 72.5 kV, the first insulator at the grounded end may be temporarily shorted out as part of the work procedure.
 - c. When performing live work employing the bare-hand technique on installations operating above 72.5 kV, the first insulator at the energized (hot) end of a suspension insulator assembly (see ANSI C29.2-1992) may be shorted out during the work.
 - (1) The approach distance to the grounded end of the insulator assembly may equal to the straight-line distance from the nearest energized part. to the closest grounded past across the insulators.
 - (2) The straight-line insulation distance shall be not less than the values required by Tables 441-1, 441-2, 441-3, and 441-4.

B. Additional Approach Requirements **Proposed Requirements**

1. The clear insulation distance associated with insulators shall be the shortest straight-line air-gap distance from the nearest energized part to the nearest grounded part.
2. Work may be performed at the grounded end of an open switch if all of the following conditions are met:
 - a. The air-gap distance of the switch shall be not less than the electrical basis for approach distances determined by rule 441A6a(4) for the maximum anticipated transient overvoltage. The inadvertent movement values of Rule 441A6a(3) are not required in this distance. The distance across the air gap shall always be 10% greater than the distance from a live part to ground.
 - b. The minimum approach distance to the energized part of the switch shall be not less than that required by rule 441A.
3. Special Rules for Working on Insulator Assemblies Operating Above 72.5 kV
 - a. When working on insulators under live work procedures employing the bare-hand procedure or live-line tools (hot sticks), the clear insulation distance across the insulators shall not be less than the straight-line distance in air required by Tables 441-1, 441-2, 441-3, and 441-4.
 - b. When the work method calls for shorting out insulators at either end of the insulator assembly, an Engineering analysis is required if :
 - (1) If the clear insulator distance across the insulators will be less than the values required by Tables 441-1, 441-2, 441-3, and 441-4, or
 - (2) If there are insulators with reduced electrical strength due to damage.

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

RULE 442.B

CP 2217

Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 44A3 – 444B – 444C – 444E1 – 444E2 – 445B

Note: Some Rules have multiple usage of the term.

Revise definition of de-energized to read as follows:

de-energized: ~~Free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of earth:~~

~~NOTE: The term is used only with reference to current carrying parts that are sometimes alive (energized). **Synonym: dead.** Removed from all sources of electrical supply by opening switches, disconnectors, jumpers, taps, or other means of electrical supply.~~

NOTE: The circuit could be electrically charged through induction from energized circuits in proximity to it, particularly if the circuits are parallel.

Submitter:

H. J. Kientz

Supporting Comment:

This change would require that all references to **de-energized** be left as is where grounding of the circuit is not required and that, where grounding is required, the text would be changed to read **“de-energized and grounded.”**

This proposed language is consistent with OSHA 1919.269(m)(3)(ii).

There is a conflict between the definition of de-energized (grounded – dead) and some of the uses in the text. For instance Rule 443F, Making Connections, reads: “In connecting **de-energized** equipment or lines to an **energized** circuit by means of a conducting wire or device,” According to the existing definition of de-energized, this requires connecting a grounded component to an energized circuit.

The existing rules separated into their application of definitions is as follows

DEFINITELY COMPLY WITH EXISTING DEFINITION BUT NOT PROPOSED DEFINITION

Rule: Section 2, definitions – 443I – 444E1 – 444E2 – 445B.

PROBABLY COMPLY WITH PROPOSED DEFINITION BUT NOT EXISTING DEFINITION

Rule: Section 2, definitions – 127A3c – 234B2b(1) – Table 235-5, 2c(1), and Footnote 5 – Table 235-5, 2c(2) – 236E, Exception 1 – Table 242-1, Footnote 3 – 354A2 – 420D – 420L – 441A1(a) – 442B – 442D – 442E(1) – **443F** – 444A3 – 444B – 444C

Note: Rule 443F is definitely the new definition or you are placing a ground on a live circuit.

NOT SURE BUT COULD BE EITHER

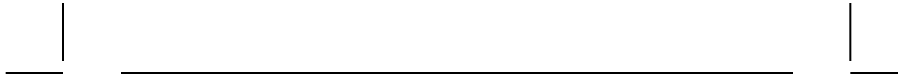
Rule: 127A3c – 354A2 – 420L – 441A1(a) – 442B – 442D – 442E(1) – 443A4 – 443F – 443G – 443H – 443I – 444A3 – 444B – 444C – 444E1 – 444E2 – 445B – Appendix B[15]

Note: Some Rules have multiple usage of the term.

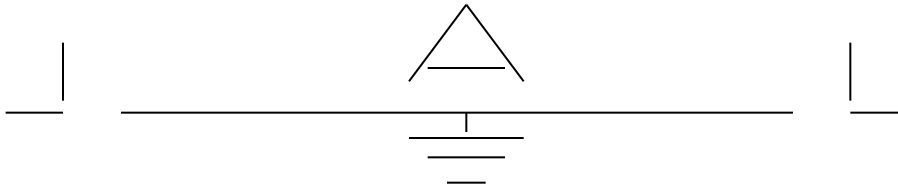
Consider the three circuits

CIRCUIT # 1 – ENERGIZED

This circuit has to be worked with live (energized) maintenance procedures.



CIRCUIT # 2 – ISOLATED FROM ALL SOURCES OF PRIMARY SYSTEM SUPPLY – ENERGIZED BY INDUCTION – NO GROUNDS – NOT DEAD



CIRCUIT # 3 – POINT A – DE-ENERGIZED – GROUNDED – (DEAD???)

NOTE: Only point A is at ground potential, therefore, the circuit is not really dead. An additional set of grounding cables would be required at each additional worksite on the same circuit.

CIRCUIT 1.

Circuit one is definitely energized in everyone's mind and requires live working methods.

CIRCUIT 2.

The largest majority of utility engineers, operators, dispatchers, and workers consider this to be de-energized as proposed in this Change Proposal. It does not meet the criteria of the existing definition as it is not grounded – dead. Because of the wide use of this philosophy, it is not possible to reeducate people to accept the existing definition. It is more practical to make the definition fit the common usage.

CIRCUIT 3.

According to the existing definition, this circuit is grounded (i.e. dead). This is not entirely true. It is dead at point A only. In fact the end points on long paralleling heavily loaded high voltage transmission lines may have very high induced voltages.

To address this circuit in the common language of the trade and the conditions of this change proposal, Circuit 3 should be referred to as **“de-energized and grounded”**.

This issue was discussed at the International Electrotechnical Commission – Technical Committee 78 meeting in Birmingham, UK in October 1997. The issue was resolved by removing the term “de-energized” from international standards.

IEEE ESMOL adopted the proposed change into their drafts of Std 1048, Guide for Protective Grounding for Power Lines and Std 516, Maintenance Methods on Energized Power-Lines at the IEEE Winter Meeting in February 1998. The chairmen of the construction and substation grounding standards were also consulted and are in agreement.

Subcommittee Recommendation: Accept in principle. See action taken on Rule 420D, CP 2217.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Bowmer, Theis

Abstention: Wallis

Explanation of Vote:

Doering: *affirmative comment:* We are now dealing with three definitions, the existing or traditional definition, the Kientz’s definition, and now the SC1/SC3 definition. The existing definition is generically correct, but not specific to NESC facilities. Kientz’s definition is specific to NESC facilities, but has rough spots. SC1/SC3’s definition is grammatically smoother. Both Kientz and SC1/SC3 lack the point that the definition only covers current carrying parts that are sometimes energized.

I would prefer:

De-energized: Disconnected from all sources of electric supply by opening switches, disconnectors, jumpers, taps, or other means.

NOTE 1: A de-energized conductor could be electrically charged through various means, such as inductive or capacitive coupling from energized circuits.

NOTE 2: The term is used only with reference to current carrying parts that are sometimes energized.

The more important point, and possibly the real problem, is when is it safe for an employee to contact current carrying parts that are sometimes energized? NFPA 70E uses the current NESC definition for “de-energized”, and came up with the second expression “electrically safe work condition” to describe the state in which the conductor or circuit part to be worked on or near has been disconnected from the energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary. SC8 has not seen fit to adopt such an expression, therefore we must use two expressions, “de-energized”, or “de-energized and grounded”. I don’t like the latter expression, because it implies a live part must always be grounded to be safe. Both the NESC and OSHA recognize there are times when grounding is not necessary, and times when it creates a hazard to ground.

The first expression “de-energized” is used to describe the electrical condition of live parts.

The second expression “de-energized and grounded per §444D”, is used to describe the electrical condition of live parts as it pertains to employee safety.

Use of De-Energized:

Reviewing the report on the use of de-energized in the NECS, I would have the following comments:

127.A.3.c	“De-energized” okay as employee contact is not involved.
234.B.2 Exception 2.	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 234-2 Heading	“De-energizing” is okay.
Table 234-2	Should read “de-energized and grounded per §444D, as possible employee contact is involved.
Table 235-5 Heading	“De-energizing” is okay.
Table 235-5 2.c(1) & (2)	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 235.5 Footnote 5	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
236.E	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
Table 242-1	“De-energized” is okay.
354.A.2	“De-energized” is okay.
420.D	“De-energized” is okay.
420.L	“De-energized” is okay.
441.A.1.a	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
442.B	“De-energized” is okay.
442.B Exception 2	“De-energized” is okay.
442.D	“De-energized” is okay.
442.E.1	Should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.A.4.a	“De-energized” is okay.
443.F	“De-energized” is okay.
443.G	Unless other editorial changes are made, this should read “de-energized and grounded per §444D”, as possible employee contact is involved.
443.H	“De-energized” is okay.
443.I	“De-energized” is okay.
444.A.1	“De-energized” is okay.
444.A.3	“De-energized” is okay.
444.B	“De-energized” is okay.
444.C	“De-energized” is okay.
444.E.1&2	“De-energized” is okay, though I would like “per §444D” added after grounding.
445.B	“De-energized” is okay.

Wallis: Agency policy requires me to abstain from all votes on technical issues.

NESC Parts 1, 2, & 4

CP 2205

Initiate a Working Group (WG) to establish a relationship for the recommended safe clearances of Parts 1,2 and 4 of the NESC. The scope of the new WG will be to define a common basis or source for clearances recommended in Part 1, Electric Supply Station (clearances guard to live parts); Part 2, Overhead Lines (electrical components of clearance); and Part 4, Rules of Operation (minimum approach distance).

Submitter:

D. Jack Christofersen

Supporting Comment:

The present NESC guidelines for safe clearances within Parts 1, 2 and 4 are inconsistent. There should be a direct relationship between Clearance Guard to Live Parts, Electrical Component of Clearance and Minimum Approach Distance. The present inconsistency may be illustrated by comparing 800 kV application as follows:

**NESC Minimum Recommended Clearance
800kV With 2.0 Maximum Switching Surge
1306 kV Crest**

Part	Application	Meters
1. Electric Supply Stations	Clearance Guard to Live Parts	6.80
2. Overhead Lines	Electrical Component of Clearance	
	Vertical	6.10
	Horizontal	5.10
3. Rules for Operation	Minimum Approach Distance	4.53

Refer to WG13 and 15.05.10 Report, “National Electric Safety Code (NESC) Inconsistencies In Clearance Recommendations and High Voltage Direct Current (HVDC) Clearances.”

Subcommittee Recommendation: Accept.

Subcommittee will agree to the formation of the Working Group with the intent to protect the concept of the minimum approach distance being acceptable for qualified workers only.

Fred Doering, Hank Kientz, Larry Schweitzer, David Mitchell and Jim Tomaseski will represent SC8 on the proposed working group. The chair will communicate results of the activities to the SC8 members.

Vote on Subcommittee Recommendation:

Affirmative: Mooney, Shankland, Thiede, Dahmer, Tomaseski, Mitchell, Schweitzer, Tootle, Doering, Theis

Abstention: Wallis

Explanation of Vote:

Wallis: Agency policy requires me to abstain from all votes on technical issues.

Interpretation Requests

IR 477, Rule 441.A.2.b(1)

This was resolved in the 1997 edition of the NESC.

IR 481, Rule 442.E

This was resolved by the interpretation and the 1997 edition of the NESC.

IR 486, Rule 441.A.2

SC8 believes that Rule 441.A.2.b does not require the use of rubber insulating sleeves to apply cover up in most situations. Actions taken by SC8 for the 2002 Code and the interpretation dated October 18, 1994 have resolved this issue. No further action by SC8 is required.