

**NATIONAL**

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**1993-1995**

**INTERPRETATIONS**



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**Fifth Interim Collection  
1993-1995 NESC® Interpretations**

*National Electrical Safety Code Committee, ASC C2*

**Fifth Interim Collection  
of the  
National Electrical Safety Code®  
Interpretations**

**1993 1995**

**Abstract:** This edition includes official interpretations of the National Electrical Safety Code as made by the Interpretations Subcommittee of the National Electrical Safety Code Committee, ASC C2.

**Keywords:** electric supply stations, overhead electric supply and communication lines, underground electric supply and communication lines, clearances to electric supply and communication lines, strength requirements for electric supply and communication structures

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## Foreword

The IEEE C2 Secretariat regularly publishes Interpretation Requests received and Interpretations made by the National Electrical Safety Code® (NESC)® Subcommittee on Interpretations. The original requests have been lightly edited to remove extraneous matter and focus on the C2 problem presented. Some illustrations have been redrawn for publication. With these exceptions, requests are in the form received.

The First Interim Collection 1991–1993 provided interpretations for IR 442 and IR 443, which were still under consideration at press time of the previous volume, and incorporated interpretations for IR 444 through IR 447. The Second Interim Collection 1991–1993 provided interpretations for IR 448 through IR 453.

The Third Interim Collection 1991–1993 incorporated an interpretation for IR 454 and provided interpretations for IR 455 through IR 462. IR 463 through IR 467 were included, although the interpretations were under consideration.

The Fourth Interim Collection 1991–1993 provided interpretations for IR 463 through IR 467, and incorporated interpretations for IR 468 through IR 470. IR 471 through IR 474 were included although interpretations have not yet been provided for them.

This volume, the Fifth Interim Collection 1993–1995 provides interpretations for IR 471 through IR 474 and incorporates IR 475 through IR 489. Interpretations are under consideration for IR 490 through IR 493.

The Secretariat hopes that the publication of all interpretations will prove helpful to those concerned with the NESC.

# IEEE

## Procedure for Requesting an Interpretation

Requests for interpretation should be addressed to:

Secretary for Interpretations  
National Electrical Safety Code Committee, ANSI C2  
IEEE Standards Office  
445 Hoes Lane  
P.O. Box 1331  
Piscataway, NJ 08855-1331

Requests for interpretations should include:

1. The rule number in question.
2. The applicable conditions for the case in question

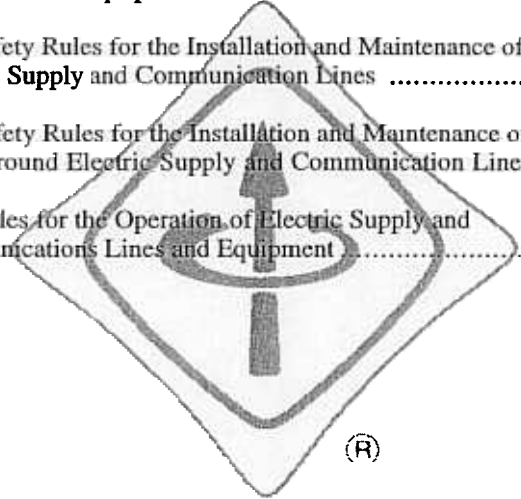
Line drawings should be black ink or excellent black pencil originals. Photos should be black-and-white glossy prints. These illustrations must be reproduced for committee circulation and eventually will be used to supplement the text of our next edition. Clear diagrams and pictures will make the work of interpretation easier and more valuable to C2 users.

Requests, including all supplementary material, must be in a form that is easily reproduced. If suitable for Subcommittee consideration, requests will be sent to the Interpretations Subcommittee. After consideration by the Subcommittee, which may involve many exchanges of correspondence, the inquirer will be notified of the Subcommittee's decision. Decisions will be published from time to time in cumulative form and may be ordered from IEEE.

Interpretations are issued to explain and clarify the intent of specific rules and are not intended to supply consulting information on the application of the code. The Interpretations Subcommittee does not make new rules to fit situations not yet covered.

## Contents

Section 2. Definitions of Special Terms.....	7
Section 9. Grounding Methods for Electric Supply and Communication Facilities .....	11
Part 1. Rules for the Installation and Maintenance of Electric Supply Stations and Equipment.....	16
Part 2. Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communication Lines .....	21
Part 3. Safety Rules for the Installation and Maintenance of Underground Electric Supply and Communication Lines.....	40
Part 4. Rules for the Operation of Electric Supply and Communications Lines and Equipment .....	46



**IEEE**

## Section 2. Definitions of Special Terms

### *Definition of a communication line or communication class conductor*

REQUEST (March 29, 1994)

IR 485

Section 2 of the NESC, Definitions of Special Terms, defines cable television plant as a "communication line," or "communication class conductor." The definition section goes on to state that "communication lines" may operate at potentials of up to "400 V to ground, or 750 V between any two circuit points "

Operation at a nominal voltage of greater than 90 V is acceptable as long as transferred power within the network is less than 150 W. This section then goes on to say that under specified conditions, the preceding limitations may be exceeded where such circuits are used to power (internal) communications equipment solely.

At the request of the major telecommunication firm I represent, clarification is needed regarding the definitions section as it applies to the broad band cable television network.

The industry has been traditionally powered with low-voltage ac (quasi-square wave), which has ranged from an initial 24 Vac of the 1940s to the present supply voltage of 60 Vac. The low source voltage employed, along with an ever increasing electronics loading, presents substantial problems for any effective powering of the network.

My firm has been retained by a major US multiple system operator who wishes to consider the use of higher ac supply voltages that would more effectively power their networks, thus significantly increasing overall network reliability and consumer satisfaction. Source voltages ranging from 90 Vac to 400 Vac (to near-dc) have been considered in our initial analysis, with the higher voltages in particular offering significant advantages as compared to the present 60 Vac.

Specific clarification requests are as follows:

1. What is the maximum voltage that a cable television network may employ while still meeting the general intent of this section (or any other) of the NESC?

Definitions

Definitions

2. Under what “specified conditions” (as referred to in the code) may a cable television network exceed the general limitations, and what new limitations then apply?

INTERPRETATION (July 25, 1994)

As you state, the term “communication lines” is defined in the Definitions section of the NESC, and cable television (CATV) systems are included in this definition. The general intent is to limit communication line voltages to 400 V to ground or 750 V between any two points of the circuit and transmitted power to 150 W. However, no limit is placed on transmitted power when a communication line is operated at a nominal voltage of less than 90 V.

Communication lines, including CATV networks, must meet *all* applicable NESC requirements. Some rules specify conditions under which communication cables may include special circuits where they are used *to supply power solely to communication equipment*. In this context, please refer to the following rules:

1. **Rule 222, Joint Use of Structures**  
The NESC does not mandate joint use of structures to support overhead plants. Mutual agreement of all parties involved in joint use is required, and the character of circuits is one item listed to be considered. Other parties to a potential joint use agreement may or may not accept CATV cables operating at higher than normal voltages. Consequently, development of a high-voltage CATV cable does not ensure general acceptance in overhead joint-use construction.
2. **Rule 224B, Supply Circuits Used Exclusively in the Operation of Communication Circuits**  
This rule specifies conditions for utilizing special circuits operating at over 400 V to ground. Note that:
  - a. This rule covers overhead lines, and
  - b. The special circuits must be used to supply power solely to communication equipment, and
  - c. All other conditions in the rule must be met (Rule 224B2a through Rule 224B2e inclusive).
3. **Rule 344, Communication Cables Containing Special Supply Circuits**

Definitions

Definitions

This rule is similar to Rule 224B, specifying conditions for utilizing special circuits operating at over 400 V to ground in underground structures. See comments in item 2 above.

4. Rule 350E

This rule states that direct-buried cables containing special circuits must also meet Rule 344A1 through Rule 344A5 inclusive.

5. Rule 354, Random Separation—Additional Requirements

The NESC does not mandate random separation of buried cables. Mutual agreement of all parties is required (Rule 354D). See comments in item 1 above.

In summary, voltage and transmitted power limitations for communication lines are:

1. In general: 400 V to ground or 750 V between any two points in the circuit with transmitted power of up to 150 W, or less than 90 V with no transmitted power limit.
2. Special circuits: over 400 V with no transmitted power limit providing that the specified conditions for special circuits are met.

Circuits not meeting these requirements are classified as electric supply lines and must meet all requirements for supply lines. As such, they must be installed in supply space and be worked on by qualified electric supply workers.

While not part of your request for interpretation, it should be noted that Rule 013A2 allows limited field trials of experimental installations under controlled conditions. Information obtained from such installations may be used to support formal change proposals; see Procedure for Revising the National Electrical Safety Code (p. 255, 1993 Edition). However, Rule 013A2 cannot be used to support general use of installations which do not meet NESC requirements.

See also IR 480 for further comments concerning special supply circuits in underground structures.

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Definitions

Definitions

REQUEST (Nov. 8, 1994)

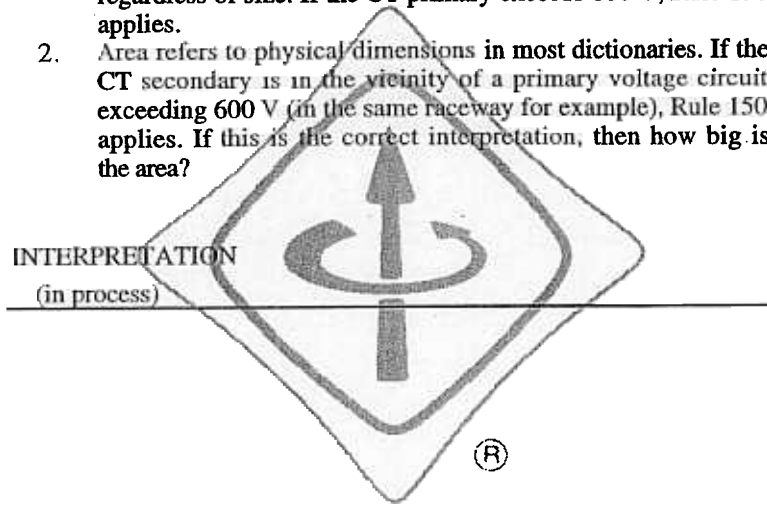
IR 493

Definition of *primary voltage area*

This interpretation request is in regard to the lack of a definition for "primary voltage area." I have found no definition either in the Code, or in the IEEE Standard Dictionary of Electrical and Electronics Terms. I can see the following two possible interpretations:

1. Primary voltage area refers to the whole secondary circuit, regardless of size. If the CT primary exceeds 600 V, Rule 150 applies.
2. Area refers to physical dimensions in most dictionaries. If the CT secondary is in the vicinity of a primary voltage circuit exceeding 600 V (in the same raceway for example), Rule 150 applies. If this is the correct interpretation, then how big is the area?

INTERPRETATION  
(in process)



**IEEE**

## Section 9. Grounding Methods for Electric Supply and Communications Facilities

### Rule 92D2

#### Separation of primary and secondary neutrals on a multiple-grounded system

REQUEST (Feb. 23, 1994)

IR 489

Please consider the following application of Rule 92D2, which allows the separation of primary and secondary neutrals on a multiple-grounded system. I refer to IR 466 (September 23, 1992). The concern behind this request is the belief that primary downgrounds near farm buildings may drop off significant system neutral currents and the hypothesis that those currents may result in livestock problems even if the primary and secondary neutrals are isolated.

I request an interpretation as to whether or not it is acceptable to install an insulated and buried primary grounding conductor running some distance (e.g., 200 ft) away from the transformer pole and away from the farm buildings to the ground electrode. The relocated ground electrode would be the only primary downground. The secondary neutral shall be isolated and connected through an arrester to the primary neutral and tank bond and the primary arrester's ground connection shall be connected to the system neutral and primary grounding conductor at the transformer pole.

Is the arrangement acceptable under Rule 92D2 as a means to limit objectionable grounding conductor current?

INTERPRETATION (Oct. 7, 1994)

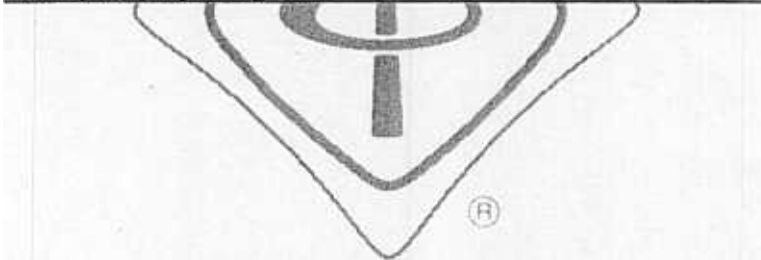
The arrangement that you propose to utilize, to limit objectionable grounding conductor current, does not comply with applicable NESC rules. NESC grounding requirements are intended to limit the adverse effects on the secondary system that could result from lightning on the primary line conductors or failure of the high-voltage transformer winding insulation. Such protection requires the transformer grounding electrode to be as near as practical to the transformer. Note

92D2

92D2

that Rule 92D prohibits removal of the source transformer ground. Rule 96C requires that the multi-grounded (common) neutral be connected to an electrode at each transformer location, and Rule 93A requires surge arrester grounding conductors to be as short, straight, and free as practical from sharp bends (rule references are to the 1993 Edition). While your proposed primary neutral connections are correct, locating the grounding electrode approximately 200 ft from the transformer pole cannot be considered to be “at the transformer location.”

As you state in your letter, your proposal is essentially the same electrically as the one presented in IR 466. The answer to IR 466 was based on electrical connection and grounding considerations, not on the premise of exposure of the grounding conductor to disconnection. The same considerations apply in your case, and your proposal does not comply with code requirements for the same reasons as given in IR 466. For your information, burying the grounding conductor (as opposed to an aerial run) does not necessarily reduce the degree of exposure to disconnection, and may even increase such exposure due to the possibility of dig-ins.



**IEEE**

**Rule 96C****Multi-grounded systems**

REQUEST (Sept. 26, 1993)

IR 476

As noted in the response to IR 445, “‘multi-grounded system’ and ‘multiple-grounded system’ are not defined in the NESC.” However, the response also states that “The requirements for a multiple-grounded system are included in Rules 96A3, 97C, and 97D2.” (Note there is no Rule 96A3.) The NESC has requirements without guidance on the application of the requirements.

This is a request for an interpretation of Rule 96C, Multi-grounded Systems.

The rule appears to be directed at three-phase four-wire distribution systems. Does it also apply to transmission systems? The majority of transmission systems in the US are effectively grounded at multiple sources through connection of auto transformer neutrals in the substations. Are these transmission systems multi-grounded systems?

Transmission lines do not have a “neutral conductor” in the usual sense of the word. A static wire, or wires, are often installed for lightning shielding, and the static wires must be grounded at each transmission line structure to achieve the lightning shielding objective. The static wires are also connected to the substation ground grids, and thereby connected to the transmission system neutral. However, the static wires are *not* intended to perform as a neutral conductor. Static wires are not used in areas of low lightning activity, or where the soil conditions can create a backflash problem that is more severe than the lightning problem. In addition, there is a growing reliance on arresters, rather than lightning shielding. Another practice is installation of static wires for some distance (several thousand feet) from the substation, but beyond that only the phase conductors are installed.

Typical transmission systems have several connections to ground, and do not have a neutral conductor in the transmission line. If “multi-grounded” means more than one connection of the electric system to ground, then Rule 96C requires a neutral with four grounds per mile, and most of the US transmission systems do not conform to the Code.

## INTERPRETATION (Jan. 25, 1994)

The reference to Rule 96A3 in IR 445 was based on the 1990 Edition of the NESC. This rule was renumbered to Rule 96C in the 1993 Edition.

As you state, the term "multi-grounded systems" (Rule 96C in the 1993 Edition) is not defined in the NESC. The term is defined in IEEE Std 100-1992 (IEEE Dictionary) as the following:

"A *distribution system* (emphasis added) of the four-wire type where all transformer neutrals are grounded, and neutral conductors are directly grounded at frequent points along the circuit."

Further, the neutral of a multi-grounded system must be continuous and carried throughout the entire line.

In answer to your questions, Rule 96C is more directed to distribution systems using common or interconnected neutrals (Rules 97C and 97D2) than it is to transmission systems. Transmission systems as described in your request for interpretation do not have neutral conductors meeting the requirements of Rule 96C. Rule 91 states that Section 9 rules do not cover lightning protection wires that are normally independent of supply or communication wires or equipment. These wires are not connected to the electric system along the line and do not perform as a neutral conductor, unless intentionally designed to serve a dual function. Consequently, Rule 96C does not apply to the systems you describe; such systems are not multi-grounded.

Regarding your comment that "...most of the US transmission systems do not conform to the Code," the NESC does *not* require that such systems be multi-grounded.



99C

99C

**Rule 99C**

**Grounding methods for telephone and other communication apparatus on circuits exposed to supply lines or lightning**

REQUEST (Feb. 7, 1994)

IR 483

I work as a cable television construction inspector and have recently encountered Rule 99C of the 1993 NESC for which I need clarification.

The rule states, "A bond not smaller than AWG No. 6 (0.162 in) copper or equivalent shall be placed between the communications grounding electrode and the supply system neutral grounding electrode where separate electrodes are used in or on the same building or structure."

My question is the following. Does this rule apply to pole line construction as well as service wire installations to the home?

INTERPRETATION (June 20, 1994)

In answer to your specific question, Rule 99C applies to the building or structure served, not to pole line construction. The intent of the rule is to limit potential differences between grounded conductors and parts. Communication service drop grounding is not always continuous, nor is it always routed back to a joint use pole line. While this Subcommittee cannot interpret the National Electrical Code (NEC), note that NEC article 800-40(d) has a similar requirement.

This should not be construed to mean that required bonding on pole structures is not equally important. Rule 215 covers grounding requirements and Rule 92C covers grounding methods for both communication and supply messengers and guys, and for supply neutrals. Rule 215 lists conductors and parts that are to be effectively grounded; Rule 215C3 requires bonding of multiple communication messengers on the same supporting structure to assure that they are at the same potential. Rule 92C provides methods for grounding messengers and guys; note Rule 92C3, which covers common grounding of both communication and supply messengers and guys on the same supporting structure. Compliance with these rules will provide the required common grounding and bonding between supply neutrals, communication messengers, and guys on joint use pole lines.

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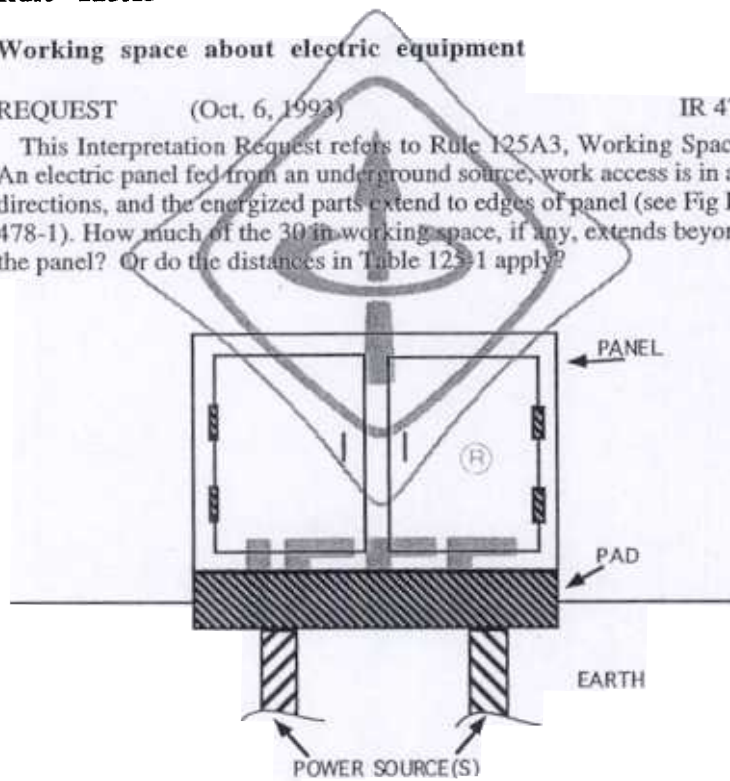
**Part 1.**  
**Rules for the Installation and Maintenance**  
**of Electric Supply Stations and**  
**Equipment**

**Rule 125A3**

**Working space about electric equipment**

REQUEST (Oct. 6, 1993) IR 478

This Interpretation Request refers to Rule 125A3, Working Space. An electric panel fed from an underground source, work access is in all directions, and the energized parts extend to edges of panel (see Fig IR 478-1). How much of the 30 in working space, if any, extends beyond the panel? Or do the distances in Table 125-1 apply?



**Fig IR 478-1**

## INTERPRETATION (Jan. 19, 1994)

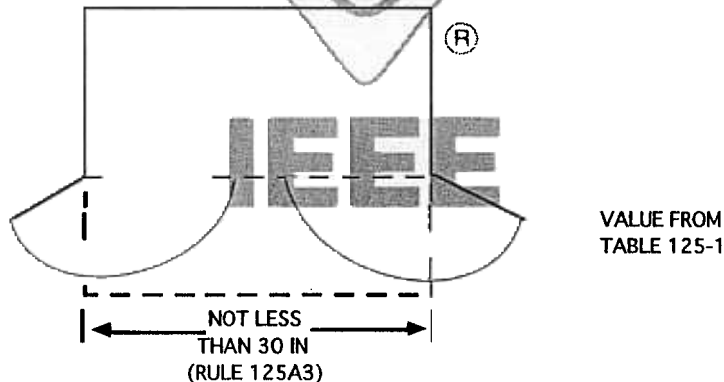
Your request for interpretation involves an electrical panel supplied by an underground source. Neither your description nor your sketch indicates that the installation is within an electric supply station. Part 1 covers electric supply conductors and equipment located in electric supply stations—see Rule 101 and the definition of electric supply station. Thus, Rule 125A3 is limited to equipment located within an electric supply station. Rule 381G covers access to pad-mounted equipment located outside of a supply station, and Rule 312 covers accessibility to parts.

Rule 125A3 covers working space around electrical equipment, located within electric supply stations, and containing parts operating at 600 V or less that require examination, adjustment, service, or maintenance while energized. It states two requirements, as follows:

1. A working space in the direction of access as indicated in Table 125-1, and
2. A working space not less than 30 in wide in front of the electrical equipment.

The 30 in width should be provided in front of the electrical equipment or panel. If the panel is less than 30 in wide, the working space must extend beyond the panel.

These requirements are diagrammed in the following Fig IR 478-2. If access is from all directions as you state (to all sides), working space must be provided from each side that access is utilized.



**Fig IR 478-2**



171/173A

171/173A

**Rule 171 and Rule 173A**

**Circuit breakers, reclosers, switches, and fuses**

REQUEST (Jan. 31, 1994)

IR 482

My company requests an interpretation of the 1993 National Electric Safety Code. The rules in question are Rule 171, Circuit Breakers, Reclosers, and Fuses: Application, and Rule 173A, Switches and Disconnect Devices: Capacity.

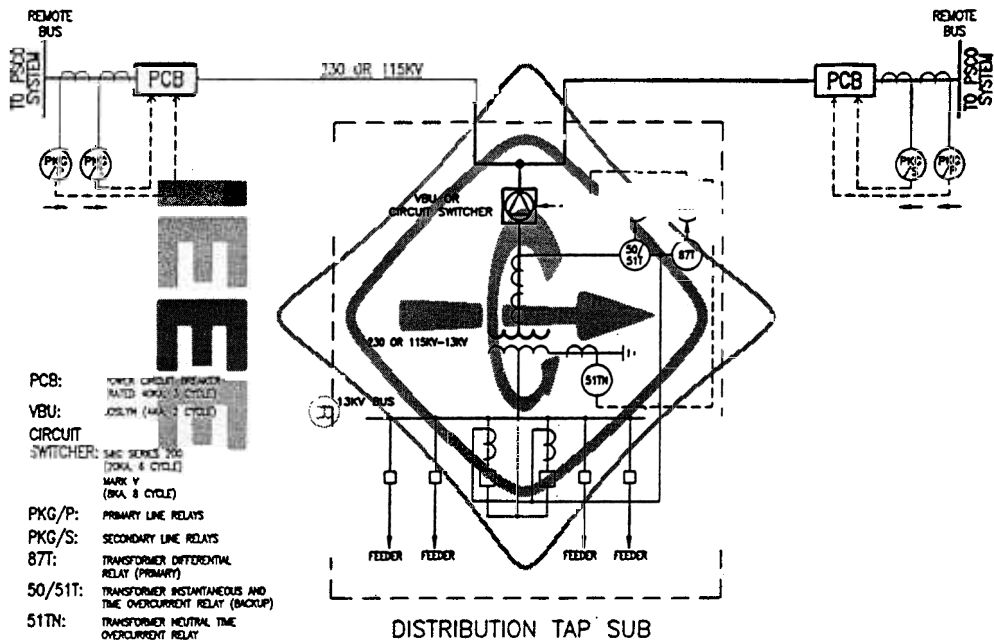
The question involves the application of 115 kV and 230 kV fault interrupters, specifically Joslyn's VBUs and S&C's circuit switchers. Currently, we are in the process of replacing failed VBUs with S&C's C2000s. At a few of the locations under consideration, the maximum available three-phase symmetrical fault is higher than the 20 KA rating on the C2000.

Please find attached the one-line diagram (see Fig IR 482), which shows the application of fault interrupters in a transmission line tapped distribution substation. The transformer's low-side VBU/circuit switcher interrupts low-side faults such as 13 kV bus faults, or internal transformer faults. The transformer's impedance typically limits these faults. The transmission line protective relays located at the remote breaker stations will interrupt the high magnitude 115/230 kV tapped substation faults by tripping the line breakers at both ends of the transmission line.

It has been our understanding that the application of these fault interrupters, in this manner, is not out of line with how other utilities apply them. Is it the intent of the NESC for high voltage fault interrupters to fall under the breaker rule? This would require the interrupters to be fully rated for the available short circuit current. Or do they belong under switches, which only require listing the short circuit capacity on the nameplate? Does the application of the circuit switcher in the relay scheme affect the decision?

My company requests a detailed explanation of your interpretation for 115 kV applications and higher.

Fig IR 482



171/173A

171/173A

## INTERPRETATION (July 25, 1994)

Your request for interpretation contains the following two basic questions regarding a specific type of fault-current-interrupting equipment, commonly known as circuit switchers:

1. Must circuit switchers meet the rules for circuit breakers or for switches?
2. Must circuit switchers be capable of interrupting the available short-circuit current?

In your scheme, it appears that the circuit switchers will have a dual function—to operate as both switching devices and as fault-current-interrupting devices. Rule 171 explicitly requires that circuit breakers, reclosers, and fuses be capable of safely interrupting the maximum available short-circuit current when performing a fault-current-interrupting function. Circuit switchers operate essentially as circuit breakers when performing their fault-current-interrupting function (see NESC definition) and Rule 171 applies.

You state the circuit switchers will interrupt low-side and internal transformer faults, typically limited by transformer impedance. “Typically limited” is disturbing; Rule 171 requires that circuit switchers be capable of safely interrupting fault-current at the point of application. The point of application is determined by the relay scheme; the circuit switchers must be able to interrupt the maximum fault-current available within the relay protective zone. For example, if the relays will cause a circuit switcher to open due to a fault at the circuit switcher terminals (such as high-side transformer bushing failure), the circuit switcher must be capable of interrupting the maximum short-circuit current available from the system due to a fault at that point on the system. Fault current in this instance will not be limited by transformer impedance. Conversely, if the relay scheme limits circuit switcher fault clearing operation to faults on the low-side of the transformer (such as the distribution bus), the circuit switcher must only be capable of interrupting the maximum short-circuit current available at that point on the system.

The Interpretations Subcommittee cannot review specific relay applications as shown on your one-line diagram; this would constitute consulting advice, which the Subcommittee does not provide.

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**Part 2.**  
**Safety Rules for the Installation  
 and Maintenance of Overhead Electric  
 Supply and Communication Lines**

**Rule 220B2e/Table 235-5, Footnote 1**

**Relative levels: Supply and communication conductors,  
 special construction for supply circuits**

REQUEST Nov. 3, 1994

IR 492

This interpretation request is for clarification of an apparent conflict between Footnote 1 of Table 235-5 and Rule 220B2e in the NESC 1993 Edition. Footnote 1 clearly states that a supply cable meeting Rule 230C1 construction, and not exceeding stated voltage and power limitations in the footnote, may be located 16 in below a communications cable. Criteria listed in Rule 220B must also be met.

Rule 220B2e states that a cable meeting the requirements of Rule 230C1 may be installed below communications attachments and must have a minimum vertical separation of 2 ft. This conflicts with Footnote 1 of Table 235-5.

We have researched this subject by means of earlier editions and it is our belief that the conflict came about when information in Table 11, Rule 238A in the 1973 Sixth Edition was transferred into the 1977 Edition in the newly created Table 235-5. (Note that although Table 11 (1973) dealt with cross arm construction, Rule 238D directed one to apply the same clearance to line conductors not carried on cross arms.) Up until this time, 1973 Edition's Table 11 and its Footnote 1 and Rule 220B3 were consistent with a 2 ft clearance requirement.

When the new table and its new footnote were created, Rule 220B2e should likewise have been changed to require 16 in, to be consistent with the new footnote.

220B2e/Table 235-5

Table 232-1

We are preparing to build a new system in which a communications cable will be placed above a Rule 230C1 supply cable that meets all the criteria in both Footnote 1 and Rule 220B2 except for the inconsistency in Rule 220B2e. For the reasons stated above, we will use a vertical clearance of 16 in per Footnote 1 as this appears to reflect the most recent intent of the Code.

Do you agree that we will comply with the 1993 Edition?

### INTERPRETATION

(in process)

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Table 232-1, Items 7 and 8

Vertical clearance of wires, conductors, and cables above ground, roadway, rail or water surfaces

REQUEST (June 5, 1994) IR 488

Clarification is needed in regard to the use and interpretation of Table 232-1, Items 7 and 8. The following questions will help you to determine where doubts are:

1. Is the area in consideration the portion of water or the portion of land and water in cases where public or private land and water areas are posted for rigging or launching sailboats? In other words, how is the area calculated in this particular case where land and water are included?
2. If it is the case where the land is also considered to determine the area, how far away from the shore over land must the clearance be kept as stated in Table 232-1, in particular to where sailboats are launched?

IEEE

Table 232-1

Table 232-1

INTERPRETATION (Nov. 17, 1994)

Item 7 of Table 232-1 specifies clearances over water areas suitable for sailboating. The clearance varies with the size of the water area. Only the unobstructed water surface area is considered in calculating the acreage to be used in Item 7. Footnotes 17 and 18 provide methods for determining the appropriate water surface area for controlled impoundments and other areas. Water areas posted for rigging or launching sailboats are included in the calculation of water areas for Item 7; land areas are not.

Item 8 covers both land and water areas posted for rigging or launching sailboats. The form of posting is not specified; it may be by signs, launching ramps, other special facilities or improvements, or use that indicates that the area is intended for rigging or launching sailboats. Clearance over ground must be 5 ft more than that required in Item 7 for the water area served by the launching site. The size of the water area is calculated as in Item 7; the size of the posted land area is not included in determining the size of the water area. The distance of the land from the shore for rigging or launching purposes is not specified; Item 8 applies only to posted land and water areas. Other areas are not included in Item 8, even though rigging or launching may be possible.

While not part of the official interpretation, the following is offered for your information. The NESC Handbook, 1993 Edition, pages 191-199, discusses the development and application of clearances over both water areas suitable for sailboating and rigging/launching areas. While the Handbook is not an official Code document, you may find this discussion to be helpful.

**IEEE**

**Rule 234F2a, EXCEPTION 3****Grain bins loaded by portable augers, conveyors, or elevators**

REQUEST (Aug. 16, 1994) IR 491

This rule states that the clearance of wires, conductors, and cables from grain bins that are expected to be loaded by use of a portable auger, conveyor, or elevator shall not be less than the values illustrated in Fig 234-3. This figure shows that all electrical wires, cables, etc., shall be at least 15 ft from any part that is considered as a loading side.

Rule 234F2a EXCEPTION 3 has an exception for supply cable of 0 V to 750 V if they are on the non-loading side of the grain bins. However, some grain bins do not have an area that could be classified as "non-loading." In this situation is it the intent of the Code to ban overhead service to such grain bins?

## INTERPRETATION

(in process)

**Rule 235****Clearance of wires, conductors, or cables carried on the same supporting structure** (R)

REQUEST (June 1, 1994) IR 487

The request for interpretation is in regard to Rule 235 and its applicability to a 115 kV transmission line on armless single pole structures. The structures are a combination of metal and wood. A static wire is attached to the top of the structures. The three-phase conductors are attached vertically to the structures beneath the static wire on alternate sides of the structure with standoffs and suspension insulators.

I am an inspection engineer for a state commission. The following interpretation disagreements arose with a utility regarding interpretation of the NESC as applied to the transmission line. The transmission line had experienced an outage at the end of a heavy ice storm as the ice was falling from the lines when two phase wires contacted each

other initially and the static wire subsequently. The two phase wires and the static wire burned apart and fell to the ground.

#### REQUEST NO. 1

There is a disagreement between Commission Staff and the affected utility company regarding the use of NESC Rule 235C for lines over 50 kV. The utility company interprets the following statements for Rule 234C1, Rule 235C2a(4), and Rule 235B to mean that the NESC has no specified minimum vertical clearances for conductors over 50 kV:

Rule 234C1 states, "No value is specified for clearances between conductors of the same circuit exceeding 50 kV."

Rule 235C2a(4) states, "No value is specified for clearances between conductors of the same circuit."

No equivalent statement is made in Rule 235B.

I interpret Rule 235C1 where it states, "No value is specified for clearances between conductors of the same circuit exceeding 50 kV," and Rule 235C2a(4) to mean that vertical clearances for lines over 50 kV are not specified in Table 235-5, but have to be calculated per the examples provided in Table 235-5, Footnotes 8 and 9.

#### REQUEST NO. 2

Is the static wire for a transmission line a conductor or a piece of surge protection equipment as defined by the NESC?

The NESC defines a conductor as "A material, usually in the form of a wire, cable, or bus bar, suitable for carrying an electric current." I interpret the static wire for transmission lines to be a conductor because it conducts surge current caused by lightning; it is a wire as defined by the industry, it is blown around in the wind like a conductor, it sags under temperature and ice loading like a conductor. I accept that a static wire is not a neutral as defined by NESC Rule 230E. It is an effectively grounded conductor as defined by the NESC and should be subject to the same clearances required for other bare, grounded wires such as guy wires, neutrals, grounding conductor, etc.

The utility company interprets the static wire as being a lightning shield similar to a lightning rod. It is not a supply conductor or a neutral conductor as defined by Rule 234E; it must of consequence not be a conductor. The utility company interpretation is that the NESC conductor clearance requirements do not apply to the static wire.



## REQUEST NO. 3

There is a difference of interpretation regarding the potential difference to be used for phase-to-static wire for voltages above 50 kV in determining required minimum separations.

My interpretation is that the phasor relationship between a delta-connected transmission line and the static wire is not known. NESC Rule 235A3a(1) requires the use of a phasor relationship of 180 degrees where the actual phasor relationship is unknown. NESC Rule 235C2a(3) requires the use of the maximum operating voltage instead of the nominal operating voltage. For the 115 kV line in question, I would use 121 kV for the applicable phase-to-static wire voltage in determining the required minimum conductor separations.

The utility company maintains that the maximum phasor relationship for determining phase-to-static wire voltage is known and would be  $0.707 \times 115 \text{ kV} + 20\%$ , or 97.5 kV. The utility company states the delta-connected transmission line is tied to ground at the substations through wye-to-delta transformers which limits the maximum phasor voltage to the above value.

## REQUEST NO. 4

There is a difference in interpretation on what a circuit is.

The NESC defines a circuit as "A conductor or system of conductors through which an electric current is intended to flow." I interpret this definition to mean a parallel system of conductors, each of which carry an equal portion of the total current, at the same voltage and phase. My interpretation is based on the use of the singular "an electric current." Thus, a multi-grounded three-phase distribution line would generally have six circuits, three phase-to-phase, and three phase-to-neutral. A transmission line would have four circuits, the three phase-to-phase circuits, and the static wire-to-ground surge current circuit. I would apply NESC Rule 235C2a to phase-to-phase and phase-to-static wire for the 115 kV line in question.

The utility company interpretation is that a circuit consists of all three phases and "neutral" conductor. Their interpretation is based on the expression "system of conductors." In the case of the 115 kV line, the utility company maintains that Rule 235C2a does not apply to phase-to-phase because the phases are the same system of conductors or circuit. Rule 235C1 says "No value is specified for clearances between conductors of the same circuit exceeding 50 kV," and Rule

235C2a(4) that states "No value is specified for clearances between conductors of the same circuit."

#### REQUEST NO. 5

There is a difference in interpretation as to when conductors have the same sag.

It is my contention that conductors must be of the identical type, size, and length, and be strung to the same tension in order to have the same sag. The same sag occurs only at initial sagging. It is common to see identical phase conductors with different sags. Identical conductors do not maintain equal tension for a number of reasons. It is impossible for conductors installed vertically on wood poles to maintain equal tensions because of the difference in pole movement between the top of the pole and lower parts of the pole from bending or raking. Suspension insulators do not swing the same distance in the wind. Crossarms twist and bend. Equal sag is practically impossible to maintain. Therefore, I believe that NESC Rule 235C2b should be applied to all conductors, especially when they are transmission lines running through urban and suburban residential areas.

The company maintains that conductors of the same type and length, installed at about the same tension, have the same sag as meant by the NESC. Therefore, Rule 235C2b does not apply to transmission line phase conductors.

#### REQUEST NO. 6

There is a difference in interpretation for the loading conditions to be used in conjunction with Rule 235C2b. The NESC does not specify loading conditions in this section. I interpret the intent of the NESC to be the use of the most severe loading conditions applicable. It is my experience that heavy icing in Wyoming occurs at temperatures with snowfall near 32 °F and strong wind. I interpret the NESC requiring the use of 0.5 in of ice at 32 °F, and a 6 lb/sq ft wind in heavy loading districts. If the reference to Rule 250B were applicable, I would interpret that Table 250-1 required 0.5 in of ice, 4 lbs/sq ft of ice at 0 °F for a heavy loading district.

The utility company interprets the reference to Rule 250B in Rule 235C2b to mean the use of 0.5 in of ice at 0 °F with no wind.

## INTERPRETATION (Nov. 15, 1994)

We understand that your request for interpretation involves a single-circuit, three-phase, 115 kV overhead transmission line in essentially vertical (staggered) configuration, with a static wire attached to the top of the supporting structures. The answers to your six specific requests are as follows:

## RESPONSE NO. 1

Rule 235C covers vertical clearance between line conductors. Rule 235C1 states that the basic clearances between conductors at supports is specified in Table 235-5 for voltages of 0 to 50 kV, but that no value is specified for clearances between conductors of the *same* circuit when the voltage exceeds 50 kV. In this latter case, since the NESC does not specify clearances, determination of an appropriate clearance value is the responsibility of the design engineer.

Rule 235C2a specifies additional clearances between conductors of *different* circuits for voltages exceeding 50 kV. Consistent with Rule 235C1, Rule 235C2a(4) states that no value is specified for clearances between conductors of the *same* circuit (for voltages exceeding 50 kV). For your information, Footnotes 8 and 9 (in Table 235-5) give examples for calculating clearances between conductors of different circuits—see Rule 235A3.

Consequently, Rule 235C does not specify vertical clearance between conductors in the instant case (same circuit, over 50 kV).

(R)

## RESPONSE NO. 2

The static wire is a surge-protection wire. The NESC definition of a line conductor does not include static wires. A line conductor conducts current under relatively steady-state conditions while a static wire conducts transient (lightning) surges on an infrequent basis.

For clearance purposes only in Rule 235C, a static wire is not a conductor unless it also meets the requirements for a neutral conductor as given in Rule 230E and is connected to carry the residual current of the transmission circuit. Note that clearances for surge-protection wires are specified in Tables 232-1, 233-1, 234-1 and 234-3; such clearances are not explicitly listed in Table 235-5. This appears to have resulted from format and table changes within Rule 235 that were

made at some earlier time and not coordinated with the other listed tables.

#### RESPONSE NO. 3

As you state, Rule 235C2a(3) requires use of maximum operating voltage for voltages exceeding 50 kV. Assuming a 5% overvoltage (as in ANSI C84.1), the maximum operating voltage would be 121 kV phase-to-phase.

However, most "delta" transmission lines are electrically connected to ground by means of wye-connected transformers at the source location(s)—with delta/wye transformer connections at the distribution substations. This limits the voltage between any phase conductor and the surge-protection wire to the transmission line phase-to-ground value: 66.4 kV nominal or 69.9 kV at 5% over-voltage (divide by the square root of 3).

The Interpretations Subcommittee cannot determine the phasor relationship or voltage values in this case based on your quotation of the utility company position. Your paragraph shows division by the square root of 2, implies a 20% over-voltage condition, and indicates wye/delta transformer connections at the "substations."

Nevertheless, the question regarding vertical clearance between the surge-protection wire and the transmission line conductors appears moot. Clearances for surge-protection wires are not provided in Table 235-5 (see response 2 above). Even if clearances for neutral conductors or zero-voltage open supply conductors were to be used for guidance, clearances for such conductors over open conductors energized at more than 8.7 kV are not given in Table 235-5.

#### RESPONSE NO. 4

For the transmission line you describe, the three (3) phase conductors constitute a single circuit with respect to Rule 235C, they are conductors of the same circuit (see response 2). However, if a neutral conductor was present and electrically connected to the transmission line transformers, it would also be part of the single circuit (this is more common in distribution circuits).

#### RESPONSE NO. 5

See IR 474.

While not part of the official interpretation, the following is offered for your information. NESC Subcommittee 4 has recommended that an exception to Rule 235C2b be included in the next Edition of the Code. This would exempt conductors belonging to the same utility when the conductors are of the same size and type and installed at the same sag and tension. This Subcommittee recommendation was included in the Preprint 1997 Proposals for public review and comment (CP 2009, page 148).

#### RESPONSE NO. 6

Rule 235C2b(1) specifies loadings to be used to determine vertical clearances between conductors of different sags. It states that the upper conductor shall be either of the following two conditions, whichever produces the greater sag:

1. Final unloaded sag at maximum conductor design temperature, or
2. Final sag with ice as specified in Rule 250B for the loading district concerned. Note that this requires consideration of ice loading only; neither wind nor temperature conditions are given.

The lower conductor shall be at final unloaded sag (no ice or wind) under the same ambient conditions as applicable in the worst sag case above and without electrical loading.

Assuming that icing of the upper conductor results in more sag than high-temperature operation, the utility company position appears essentially correct for a heavy loading district although the utility may find it appropriate to examine ambient temperatures between 32 °F and 0 °F to determine the closest proximity between conductors.

Again, vertical clearance between phase conductors of the transmission line appears to be moot (see response 1).

235C2b

235C2b

**Rule 235C2b**

**Conductors of different sags on same support**

REQUEST (April 26, 1993)

IR 474

Our question involves vertical clearance between the phase wire and the neutral wire of a 12.47/7.2 kV distribution circuit. The voltage between conductors is nominally 7.2 kV. We understand the basic clearance requirement to be 16 in per Rule 235C1, Table 235-5.

Rule 235C2b(1)(a) applies to conductors of different sags on the same support. We are using conductors of the same size and sag when installed. However, when one conductor has ice and the other does not, the two conductors no longer have the same sag. Is it the intent to apply Rule 235C2b(1)(a) to this condition when the two conductors involved are of the identical size and type, and are installed at the same tension and sag?

In our situation, on a typical distribution vertical single-phase structure, the phase-to-neutral vertical spacing is about 4 ft. Application of Rule 235C2b(1)(a) to this type of structure severely limits its span capacity.

INTERPRETATION (Sept. 13, 1993)

The answer to your request is yes, Rule 235C2b(1) applies to conductors of different sags on the same supporting structure *under the same ambient conditions*.

As you state, the basic clearance requirement between a phase wire and the neutral wire of a 12.47/7.2 kV effectively grounded distribution circuit is 16 in (Rule 235C1, Table 235-5). For conductors of different sags, the clearance may be reduced to 75% of the basic requirement, or 12 in, Rule 235C2b(1)(a). Rule 235C2b(1) specifies that the upper conductor be either thermally or ice loaded, whichever produces the greatest sag, while the lower conductor is at final unloaded sag, under the same ambient conditions, and without electrical loading.

Under icing conditions, sag of the lower conductor must be determined without ice or wind loading (final unloaded sag), at the same ambient temperature that produces the icing condition, and without electrical loading.

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**Rule 239G****Requirements for vertical supply conductors passing through communication space on jointly used line structures**

REQUEST (March 10, 1994)

IR 484

I am writing for an interpretation of Rule 239G. This rule states that supply cables passing through climbing space be protected with a suitable nonmetallic covering.

My question is, regarding this rule, does the jacket of a 15 kV jacketed concentric neutral URD cable constitute suitable nonmetallic covering if attached to the pole? Additionally, if cables are stood off approximately 6 in from the pole on cable hangers, would the jacket meet this rule?

INTERPRETATION (Aug. 1, 1994)

The answer to both of your questions is "no." A cable jacket such as you describe does not meet the intent of Rule 239G.

Where the rule specifies that supply cables be protected, a *separate physical covering* (such as a conduit or U-guard) is **required**. The purpose is to prevent a line person both from inadvertently gaffing the **supply cable and** from contacting a supply cable that may be at a potential different from the communication facilities on the structure.

In addition, please refer to Rules 236H and 239B. Rule 236H states that vertical runs that are protected and securely attached to the surface of the supporting structure without spacers do not obstruct the climbing space. Again, the intent is to require a separate conduit or covering. Rule 239B states that vertical conductors shall be located so that they do not obstruct the climbing space. Consequently, **vertical cables supported by stand-off brackets cannot be located in the climbing space, even if protected.**

261A2b(1)(a)

261A2b(1)(a)

**Rule 261A2b(1)(a)**

### **Strength requirements of wood structures**

REQUEST (Nov. 1, 1993)

IR 479

I would like an interpretation of Rule 261A2b(1)(a) as it is stated in the 1993 NESC. I am particularly interested in Footnote 2 in Table 261-3B.

Rule 261A2b states that "Wood structures shall be of such material and dimensions as to meet the following requirements." Then Rule 261A2b(1)(a) states that the permitted stress level of wood poles shall be determined by multiplying the designated fiber stress in ANSI O5.1-1987 by the strength factors in Table 261-3A. This rule is relating the stress level of a wood pole to the actual wood fiber material that makes up a particular species.

Then Rule 261A2b(2) states that wood structures shall be designed to withstand the loads in Rule 252, multiplied by the appropriate overload capacity factor in Table 261-3B, without exceeding the permitted stress level. This rule describes the loads that wood poles have to withstand without exceeding the permitted stress level, which relates to the wood fiber material that makes up a particular species.

Both of the rules above refer to Table 261-3B. Footnote 2 of this table states that "During the life of the structure, the capacity shall not be permitted to deteriorate to less than two-thirds of the capacity required by Rule 250B when installed." Rule 250B shows what districts apply to what areas of the country. It seems to me that there are two ways to interpret Footnote 2 of Table 261-3B.

One way to interpret this footnote is that it refers to the structure capacity, in other words the capacity of the wood fiber material in the structure. With this interpretation it does not matter what the loading is on the structure. The structure must be replaced when it has two-thirds of its original material capacity or has lost one-third of its original material capacity due to deterioration or physical removal. The wood pole is in a state of deterioration or is at a point where it has lost enough section modulus that it is deemed unsafe for the structure to stay in service for the welfare of the public.



261A2b(1)(a)

280A1b

Another way to interpret this Footnote is that it refers to the structure's loading capacity. A structure can stay in service as long as there is enough section modulus left in the structure to withstand any loading on the structure. So even if 90% of the section modulus has been lost to deterioration, as long as the remaining 10% of the section modulus can carry the loads imposed on the structure, the structure can stay in service.

Should a wood pole structure be replaced when it has lost one-third of its section modulus or should a wood pole structure be allowed to stay in service as long as any amount of remaining section modulus can carry the loads that are imposed on the structure?

INTERPRETATION (May 12, 1994)

Footnote 2 of Table 261-3B refers to the ability of a wood pole structure to carry the required loading, rather than the original capacity of the structure to carry load. If the installation (structure or supported facilities) has not been modified, the structure must be replaced when its capacity deteriorates to less than two-thirds of the capacity required by Rule 250B for a wood pole at installation. Note that this is not necessarily the same as two-thirds of the original pole capacity of a particular pole in question. If facilities have been added or removed since the time of the original installation, such loading change is considered to change the "when installed" loading, and capacity required by Rule 250B is to be based on the new loading. See also IR 336 for further explanation for the treatment of additional loading that may be placed on a pole after the initial installation.

Section 28 (NESC, 1984 ed.) Rule 280A1b

**Climbing Requirements for Structures for Overhead Lines**



REQUEST (April 8, 1993)

IR 472

This request involves Rule 280A1b in the 1984 NESC edition.

The structure in question is shown in Fig IR 472-1. This structure was constructed in 1894 to provide area lighting. Additionally, over the past thirty years, it has been utilized as a supporting structure for a three-phase 15 kV distribution line in a residential area. This was accomplished by bolting a spool insulator for the neutral conductor

280A1b

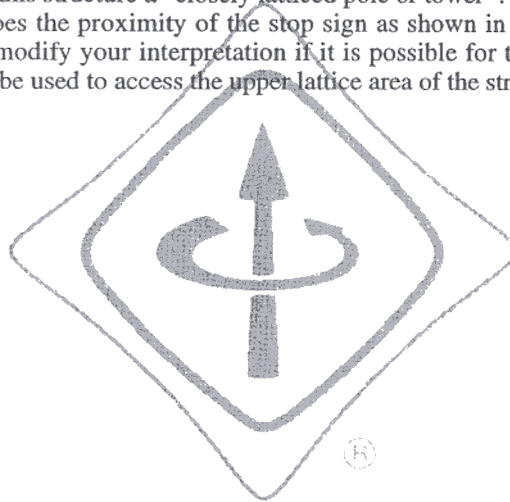
280A1b

and a cross arm for the three primary conductors to two of the vertical members of the lattice structure.

In Fig IR 472-2, the lattice-type structure supported by a single tubular steel support is shown. The tubular support is approximately 24 1/4 inches in diameter. The distances from ground level to the bottom of the support arms and additional distance to the first horizontal cross member are noted.

Please provide your response to the following questions:

1. Does this structure meet the definition of a "readily climbable" structure?
2. Is this structure a "closely latticed pole or tower"?
3. Does the proximity of the stop sign as shown in Fig IR 472-3 modify your interpretation if it is possible for the stop sign to be used to access the upper lattice area of the structure?



**IEEE**

280A1b

280A1b

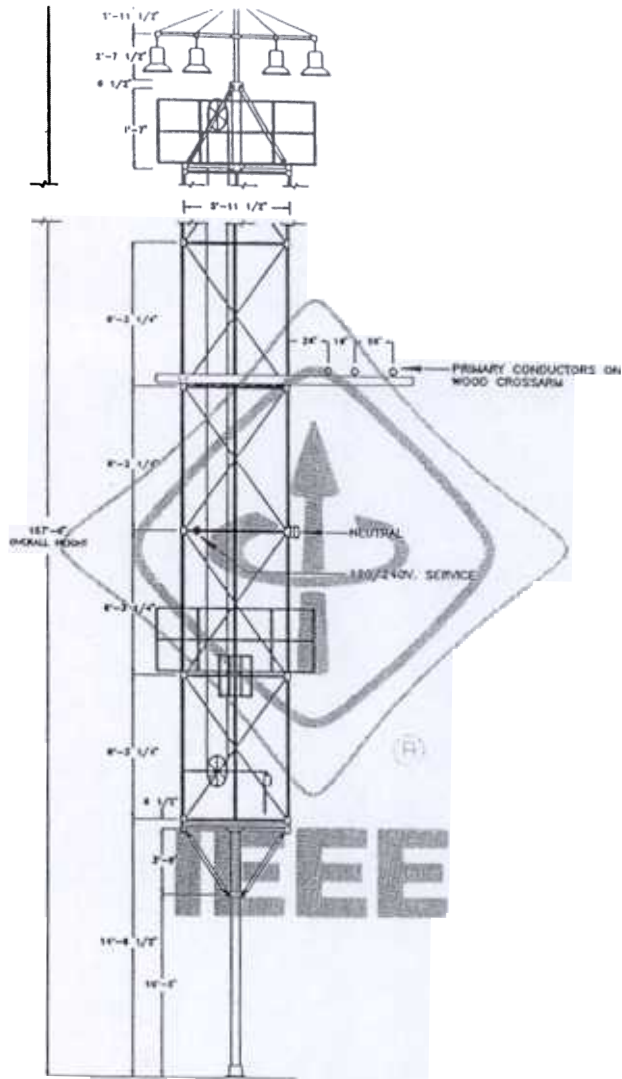
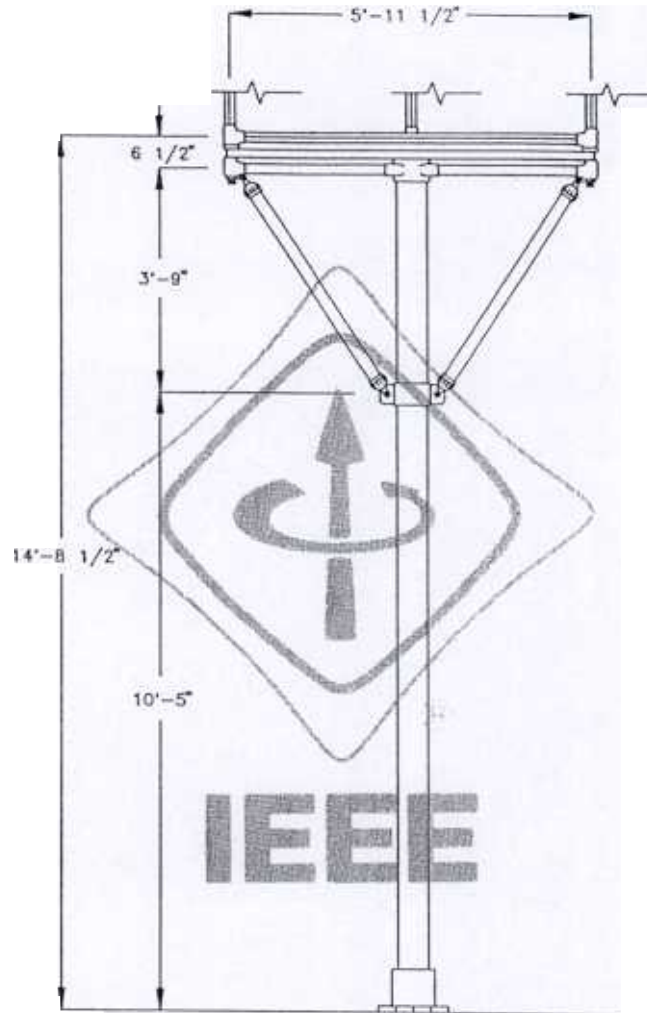


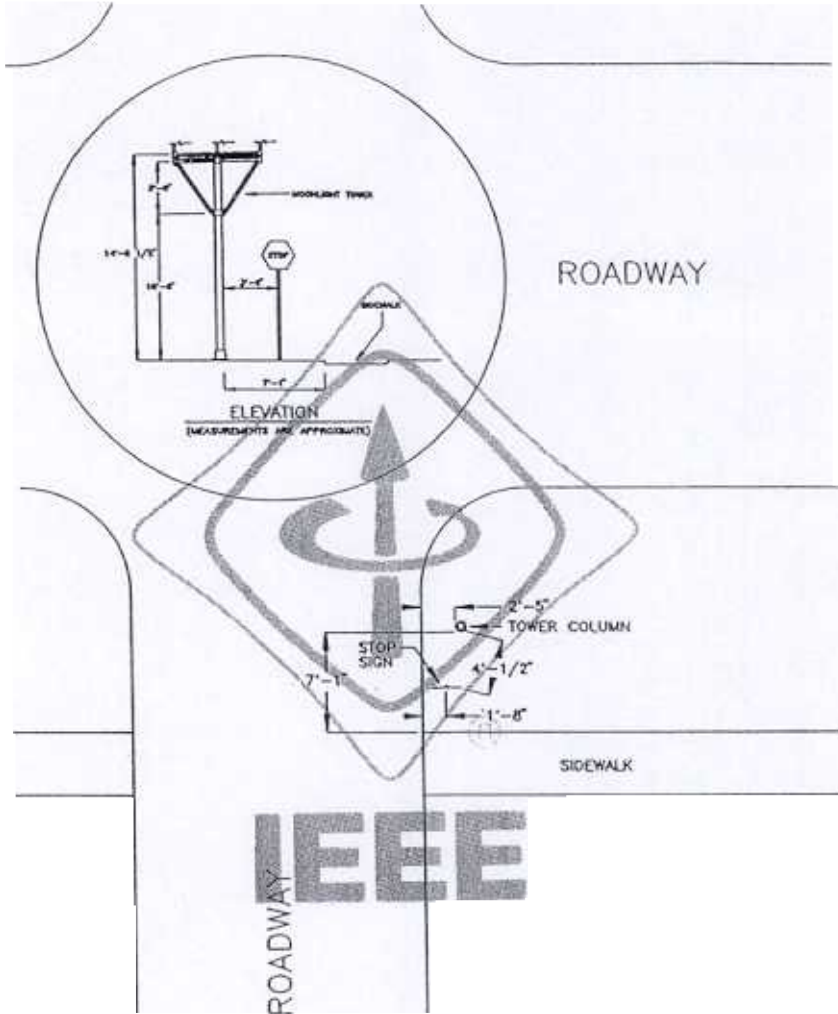
Fig IR 472-1  
Moonlight Tower

280A1b

280A1b



**Fig IR 472-2**  
**Column Base Elevation**



**Fig IR 472-3  
Plan View of Location**

280A1b

280A1b

INTERPRETATION (July 27, 1993)

The structure described in your request for interpretation does not appear to be a readily climbable structure. The drawings do not show either handholds or footholds in the 10 ft section above grade. Consequently, this portion of the structure is essentially a large-diameter pole. Answers to your specific questions are the following:

1. No, this structure does not meet the definition of a "readily climbable" structure. See also IR 357.
2. No, it is not a closely latticed pole or tower in the lowest 10 ft section. While the structure is a lattice structure above 10 ft, it does not appear to be so closely latticed as to be readily climbable. See also IR 357.
3. No. In the position shown, the stop sign does not appear to provide a sufficient platform or readily accessible surface to the lattice portion of the structure.

FOLLOW-UP REQUEST (Sept. 15, 1993)

IR 472A

Again, I request an interpretation of Rule 280A1b of the 1984 edition of the NESC.

Fig IR 472-2 shows the lattice type structure supported by a single tubular steel support. The tubular support is approximately 24 1/4 inches in circumference (approximately 8 inches in diameter), and the distances from ground level to the bottom of the support arms and additional distance to the first horizontal cross member are shown on the attached Figs.

FOLLOW-UP INTERPRETATION (Dec. 8, 1993)

The fact that the lower tubular support for the structure is approximately 8 inches in diameter rather than 24 1/4 inches in diameter does not change the original response to your request for interpretation.

**Part 3.**  
**Safety Rules for the Installation and  
Maintenance of Underground Electric  
Supply and Communication Lines**

**Rule 344A1**

**Communication cables containing special supply  
circuits**

**REQUEST** (Jan. 14, 1994) **IR 480**

I would like an interpretation of Rule 344A1 from the 1993 NESC. We are looking into the design of an armored loose tube optical fiber cable with a power supply circuit. Is the typical armored sheath in an optical fiber cable an adequate ground, or is it required that the power supply wire have its own ground? Please clarify.

**INTERPRETATION** (June 20, 1994)

Rule 344A outlines conditions under which special supply circuits, used for supplying power solely to communication equipment, may be included in communication cables. Only power supply circuits operating in excess of 400 V to ground are covered by this rule. For information concerning power supply circuits of lesser voltages, see the definition of communication lines.

Regarding special supply circuits, Rule 344A1 is specific; it requires that (a) the combination communication/supply cable have an effectively grounded, conductive sheath or shield, and (b) the conductors of each supply circuit be individually enclosed within a separate, effectively grounded shield. Grounding methods are covered in Section 9; see the definition for effectively grounded.

344A1

350F

Rule 344A1 does not cover requirements for grounding the supply circuit(s). However, if the supply circuit is to be grounded, the shield cannot be used as the grounded conductor. In this case, a separate current-carrying grounded conductor must be provided within the cable assembly.

Note that the remaining requirements of Rule 344A must also be met (Rules 344A2 through Rule 344A6 inclusive). Finally, the Interpretations Subcommittee cannot determine if a typical armored sheath is an adequate ground; this would constitute consulting advice, which the Subcommittee does not provide.

**Rule 350F**

**Direct-buried cable, general**

REQUEST (July 6, 1994)

IR 490

Rule 350F states "Bonding should be provided between all above ground metallic power and communications apparatus (pedestals, terminals, apparatus cases, transformer cases, etc.) that are separated by a distance of 6 ft (1.80 m) or less."

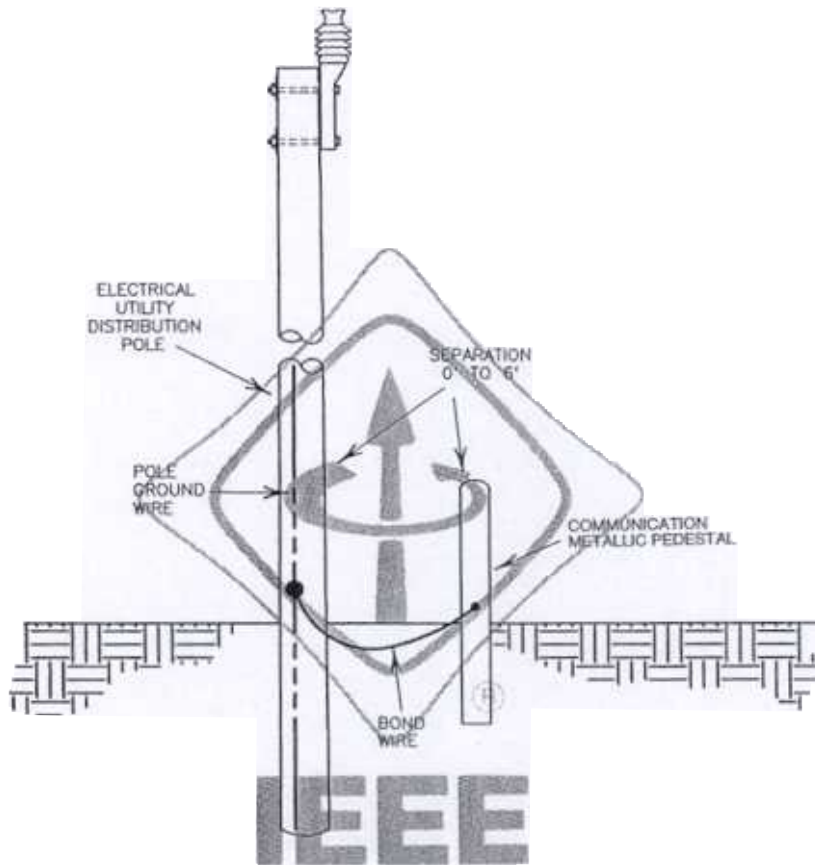
The attached Fig IR 490 shows an above ground communications apparatus (pedestal) within 6 ft of a power utility pole with a metallic ground wire. Does this ground wire constitute a metallic power apparatus and as such, would bonding between the two be required under this Rule 350F?

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350F

350F



**Fig IR 490**

**INTERPRETATION**  
**(in process)**

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**Rule 350G****Markings on direct-buried cable****REQUEST**

(Feb. 26, 1993)

IR 471

Rule 350G states that “all direct-buried jacketed supply cable meeting Rule 350B and all direct-buried communication cables shall be legibly marked...”

Clarification is requested as to whether the marking defined in Rule 350G applies to communication service drops. The buried service drop is a wire typically 0.275 inches to 0.350 inches in diameter that connects a communication cable to users of services on that cable from a pedestal or terminal interface to that cable. Does Rule 350G apply to the communication service drops?

**INTERPRETATION** (July 26, 1993)

Your request for interpretation asks if the marking defined in Rule 350G applies to buried communication service drops. In NESC language, a “service drop” consists of overhead conductors between the communication line and the building or structure being served (see Definitions). However, the communication industry sometimes refers to service conductors as “drop wire,” whether overhead or underground. This interpretation is limited to buried communication service cables using NESC terminology.

Rule 350G was adopted in the 1993 Edition in response to the need for uniform and positive identification of buried cable facilities (both supply and communication), particularly in joint trench with random separation. Jacket indentation or embossing was selected to satisfy the prime requisite—permanency of identification over the life of the cable.

However, it was not intended to include small sized communication service cables in this rule if it is not feasible to indent or emboss such cables. Consequently, the answer to your question is no, marking is not required for the communication service cables described in your request because they cannot be marked; see Exception 1. On the other hand, larger buried communication cables capable of being marked must be marked as required, whether used in line or service runs.

354D1f

354D1f

**Rule 354D1f**

**Random separation of supply and communication cables**

REQUEST (Aug. 24, 1993)

IR 475

This letter is in reference to Rule 354D1f of the 1993 NESC with respect to the random separation of supply and communication cables. The following two positions of thought have been taken:

1. This rule implies that the communication cable must contain a shield, thus the bonding occurs as stated.
2. This rule is stating that if a shield does exist within the communication cable, the bonding must occur as stated.

The obvious difference is whether the NESC is requiring the communication cable to contain a shield.

I am requesting that an official interpretation be provided on this rule.

INTERPRETATION (Feb. 24, 1994)

Your basic question is: Does the NESC require that metallic conductor communication cable used in random separation with supply contain a shield? While Rule 354D may imply that shielding is required, the wording of the rule does not specifically require this. Rule 354D1f merely requires that communication cable shields or sheaths, if present, be bonded to an effectively grounded supply conductor (in random separation).

However, rules regarding random separation were introduced when all buried communication cable was of shielded metallic conductor construction. Neither unshielded metallic conductor cable nor fiber optic cable was available at that time. Joint communication—supply tests and trial installations (early 1960s) were, in all cases, conducted with shielded cable bonded to the supply neutral. Acceptance of random lay as a safe construction practice was based on these tests and trial installations. There is no basis to allow extrapolation of the test and trial results to unshielded communication cable. Further, under fault conditions, the shield acts as a voltage divider to prevent full voltage from being impressed on communication equipment in the event that the supply neutral is badly corroded or open. This condition could occur with a supply cross on unshielded communication cable downstream of the communication pedestal, even though the pedestal

354D1f

354D1f

is properly fused. See also NEC Rule 800-30, Protective Devices, for additional protection requirements on customers' premises.

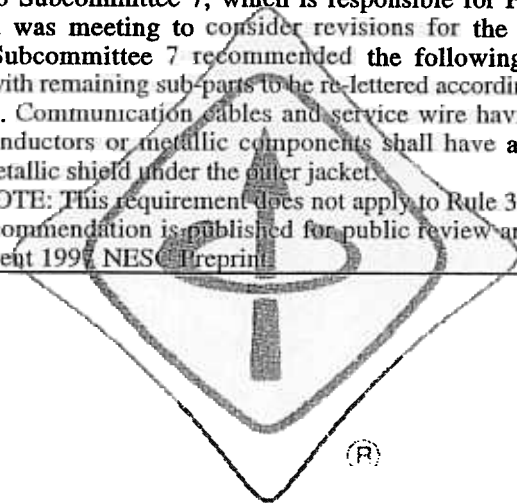
In other words, the present Code does not require use of a shield on communication cable in random lay. If there is no shield, Rule 012C may apply: "For all particulars not specified in these rules, construction and maintenance should be done in accordance with accepted good practice for the given local conditions." It is, therefore, the responsibility of the communication utility to determine if a shield is appropriate.

For your information, your request for interpretation was also referred to Subcommittee 7, which is responsible for Part 3 of the Code and was meeting to consider revisions for the next NESC edition. Subcommittee 7 recommended the following new Rule 354D1e, with remaining sub-parts to be re-lettered accordingly:

"e. Communication cables and service wire having metallic conductors or metallic components shall have a continuous metallic shield under the outer jacket.

NOTE: This requirement does not apply to Rule 354C."

This recommendation is published for public review and comment in the current 1997 NESC Preprint.



**IEEE**

**Part 4.**  
**Rules for the Operation of**  
**Electric Supply and Communications**  
**Lines and Equipment**

**Rule 441**

**Voltages of energized conductors or parts**

**REQUEST** (April 8, 1993)

**IR 473**

The voltage references in Table 441-1 are phase-to-phase voltages. The voltage references in the text, particularly in Rule 441A1, do not specify whether the voltage is phase-to-phase or phase-to-ground. **By definition, voltage, unless indicated otherwise, is phase-to-ground; however, the text also refers to Table 441-1, which clearly contains phase-to-phase voltages.**

I am requesting that an interpretation be rendered that would clarify the identification of voltage references in the text of Rule 441

**INTERPRETATION** (July 27, 1993)

Your assumption is correct. The intent of Rule 441 is to apply the voltage ranges as listed and specified in Table 441-1. Consequently, phase-to-phase voltages are to be used (except for the 50 V to 300 V range where phase-to-ground voltage may be used for single-phase systems only).

Under the voltage definitions, the voltage of an effectively grounded circuit is phase-to-ground, *unless otherwise noted*. Table 441-1 specifies that phase-to-phase voltages are to be used (except as noted in the 50 V to 300 V range).

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441A2

441A2

**Rule 441A2**

**Approach distance to live parts**

REQUEST (April 29, 1994)

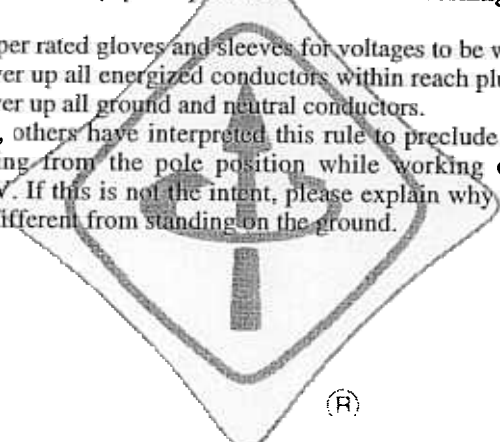
IR 486

Could you please clarify the intentions of Rule 441A2 in the 1993 NESC where it discusses the relevance to working voltages above 300 V and below 13 kV. This rule was discussed at a recent training association conference. Individual interpretations varied to the degree that we could not agree on the intent of this rule.

Some are interpreting this rule to be identical to the following I&I (Insulate & Isolate) principles we teach for working energized conductors:

1. Proper rated gloves and sleeves for voltages to be worked
2. Cover up all energized conductors within reach plus 2 ft.
3. Cover up all ground and neutral conductors.

However, others have interpreted this rule to preclude line people from working from the pole position while working on voltages above 300 V. If this is not the intent, please explain why standing on the pole is different from standing on the ground.



(R)

**IEEE**

## INTERPRETATION (October 19, 1994)

Rule 441A2 covers the requirements for working on conductors or parts energized from 300 V to 72.5 kV *when the rubber glove work method is used*, which follows your insulate and isolate principles.

Rule 441A2a states that exposed, grounded lines, conductors, or parts in the work area shall be guarded or insulated, i.e., protected from contact by the employee. At the present time, the wording does *not* include the pole or other supporting means that a worker may use. However, please see a later comment regarding a proposed change.

Whether or not the worker is gaffed into a pole, it is important that conductive items in the work area be guarded or insulated so that uninsulated parts of the worker do not contact ground. A worker is not usually at ground potential even when gaffed into a pole due to secondary insulation from the wood and/or the worker's footwear. Insulated pole platforms and aerial lifts provide further insulation from ground. This protection would be short-circuited if the worker's body were to contact a grounded part.

Rule 441A2b requires employees to wear appropriate rubber gloves when in the vicinity of energized conductors or parts. "In the vicinity" means within reach of the employee with arms in the extended position. In addition, the employee must wear rubber sleeves, *or* all exposed energized conductors or parts must be covered with insulating protective equipment, except conductors or parts temporarily exposed for work and maintained under positive control (not left free to move). The protective equipment must extend beyond the employee's maximum reach in the anticipated work position.

In essence, Rule 441A2b requires gloves to be worn at all times when in the vicinity of energized conductors or parts. In addition, sleeves must be worn until conductors or parts are covered with protective equipment, unless protective equipment can be installed (or removed) without violating minimum approach distances. Sleeves are not required while protective equipment is in place, provided that energized lines or parts temporarily exposed to perform work are maintained under positive control. Conversely, the rules do not prohibit wearing sleeves while protective equipment is in place.

In summary, your insulate and isolate principles appear to follow Rule 441A2 requirements for the rubber glove work method (300 V to 72.5 kV). Your condensed summary does not indicate where gloves and sleeves are to be worn; see the preceding two paragraphs. Also,

441A2

441A2b(1)

you require that energized conductors be covered “within reach plus 2 ft.” Rule 441A2 requires covering beyond the employee’s extended reach but does not specify a distance. Finally, the 1993 Edition of the NESC neither requires that the pole be covered nor prohibits employees from working while gaffed into the pole.

While not part of the official interpretation, the following comments are offered for your information:

1. Many supply utilities prohibit working directly off a pole at voltages over 5 kV (while using the rubber glove work method). These utilities require use of an insulated aerial lift or pole platform. NESC Subcommittee 8 considers this to be a good work practice and has recommended that a requirement for supplemental insulation (aerial lift, etc.) be part of the next Edition of the Code. The Subcommittee recommendation is included in the Preprint 1997 Proposals for public review and comment (CP 1990, page 204).
2. Your concerns have been discussed in the latest NESC Handbook, 1993 Edition, pages 375-376. While the Handbook is not an official Code document, you may find this discussion to be helpful.

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**Rule 441A2b(1)**

**Requirement for rubber insulating sleeves for working with live parts**

REQUEST (Sept. 15, 1993)

IR 477

This Interpretation Request is in regard to Rule 441A2b(1), which states, “The employee shall wear rubber insulating sleeves, insulated for the voltage involved, in addition to the rubber insulating gloves.”

The requirement for rubber insulating sleeves to supplement rubber insulating gloves in all work situations (300 V to 72.5 kV) is excessive and may actually incumber dexterity when all the work is in front of the employee, as in working with 480 V metering where the reach doesn’t extend beyond the glove cuff. Is it the intent of the NESC to require supplemental sleeves when working 480 V metering?



441A2b(1)

442E

INTERPRETATION (Jan. 25, 1994)

Rule 441A2b requires, for voltages from 300 V to 72.5 kV where the rubber glove work method is employed, that rubber gloves be worn *and* that one of the following supplementary methods be employed:

1. rubber sleeves, or
2. insulating protective equipment

In answer to your specific question, Rule 441A2b(1), as presently written, requires *both* rubber gloves and supplementary sleeves when working on 480 V metering equipment.

For your information, your request for interpretation was also referred to Subcommittee 8, which is responsible for Part 4 of the Code and was meeting to consider revisions for the next NESC edition. Subcommittee 8 recommended the following exception to Rule 441A2b(1):

"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."

This recommendation is currently published for public review and comment in the 1997 NESC Preprint.

#### Rule 442E

#### Tagging electric supply circuits associated with work activities

(R)

REQUEST (Jan. 26, 1994)

IR 481

Our district is in the process of installing a complete SCADA system for substation and field-operated protective devices. In this process, we plan to incorporate the use of remote relay tagging devices such as the 31 TR three position switches manufactured by the Electroswitch Company.

In reviewing the changes in the 1993 NESC publication, Rule 442E2 indicates that tags that can be activated from SCADA Systems are acceptable to serve as a physical tag at field locations. Our intent is to use these devices for physically tagging devices when we deactivate them for hot line work. These devices are not to be used to

442E

442E

circumvent visible opening requirements when de-energizing a line for clearance purposes. Are we interpreting this rule change correctly?

**INTERPRETATION (May 12, 1994)**

Please see prior Interpretation Requests 463 (July 1, 1992) and 464 (July 10, 1992). These requests and the response cover the same subject area as your request. Also, please note that the Interpretations Subcommittee cannot advise as to the acceptability of a particular product with respect to meeting NESC requirements.

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