

**Seventh Interim Collection
1996–1997 NESC® Interpretations**

National Electrical Safety Code Committee, ASC C2

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

1996–1997

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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345 East 47th Street, New York, NY 10017-2394, USA

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ISBN 1-55937-928-6

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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.

The Fifth Interim Collection 1993–1995 provided interpretations for IR 471 through IR 474 and incorporated IR 475 through IR 489.

The Sixth Interim Collection 1994–1996 provides interpretations for IR 490 through IR 499 inclusive.

The Seventh Interim Collection 1996–1997 provides interpretations for IR 500 through 508 inclusive.

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

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.

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Section 2. Definitions of Special Terms

Definition of *effectively grounded*

REQUEST (5 June 1996)

IR 503

An interpretation of the meaning of *effectively grounded* is desired. We are unclear as to the qualification made in the definition in question through the use of the preceding term, *effectively*.

Effectively grounded is defined as:

Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current carrying capacity to prevent the buildup of voltages that may result in undue hazard to connected equipment or to persons.

In our view, we could interpret this term in either of one of two ways with respect to how we might standardize our grounding procedures. Our first interpretation is that *effectively grounded* only permits a permanent conductor (of sufficient current-carrying capacity and sufficiently low impedance) to be in the path between the equipment and the earth. Our second interpretation is that the path between the equipment to be grounded and earth may consist of any devices that meet the requirements of the definition: 1) adequate current-carrying capacity; 2) sufficiently low impedance; and 3) prevent the buildup of hazardous voltages. This device, according to our second interpretation of the definition in question, could be a protective device, such as a gas tube/solid-state protector that conducts hazardous electrical current to ground, or a filter that does likewise. (The reason we may desire to use these devices is to permit the transmission of radio signals on the cable sheath for location purposes, yet still provide a path to ground for harmful electric currents.)

Essentially, the term *effectively grounded*, through inclusion of the word *effectively*, is ambiguous. On one hand, it may be interpreted to permit any device(s) that meets the requirement of the definition to be

placed between the equipment and earth. On the other hand, *effective* may only permit conductors to lie within this path.

INTERPRETATION (19 November 1996)

The term *effectively grounded* as used in the NESC, including Rule 314B, requires use of a permanent conductor. As you noted, the definition of *effectively grounded* provides performance requirements but does not specify the methods to be used. These methods are given in Section 9, as stated in Rule 314A. (See also Rule 215 for overhead.)

Rule 93 covers grounding conductors and means of connection. Rule 93A requires that the grounding conductor be either copper or other suitable metal that will not corrode excessively over the expected service life of the installation. Note that devices other than a suitable grounding conductor are not included in Rule 93. Filters, in particular, do not function well when subjected to steep wave fronts. Filters, gas tubes, or solid state devices inserted in the grounding conductor path are not acceptable under NESC rules.

Section 9. Grounding Methods for Electric Supply and Communications Facilities

Rule 93D1 & 2

Guarding Methods for Grounding Conductors

REQUEST (6 May 1996) IR 502

Regarding two applications of guarding methods for grounding conductors,

Application 1) Is the use of copper wire with a covering of 95 mils of polyethylene commensurate with the guarding requirements of paragraph 93D1 & 2 of the 1993 Edition of the NESC?

Application 2) Is the use of copper wire with a covering of 60 mils of polyethylene commensurate with the guarding requirements of paragraph 93D1 & 2 of the 1993 Edition of the NESC?

To summarize: Does the use of polyethylene covered wire on a grounding conductor meet the guarded requirements of the NESC?

INTERPRETATION (22 July 1996)

The use of polyethylene covered wire as a grounding conductor does *not* meet the guarding requirements of Rules 93D1 & 2. The definition of guarded indicates that some form of adequate mechanical protection is to be provided where guarding is required. Further, the NOTE under the definition states that wires which are insulated, but not otherwise protected, are not considered to be guarded unless there are specific exemptions in the applicable rules. Rule 93D does not contain any exemptions which would allow use of a covered conductor as the only means of protection where guarding is required.

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

Rule 110B2**Storage in Electric Supply Stations****REQUEST (17 October 1996) IR 507**

It has been suggested to our company that the temporary storage of a concrete vault within a substation fence is in violation of Rule 110B2, since this is not a minor maintenance part. This vault is part of a substation expansion project. The vault represents only the first shipment; more material will be delivered. All stored material will be well away from the energized area. Is the intent of Rule 110B2 to prohibit the temporary storage of substation construction materials and equipment within an existing substation?

This interpretation of 110B2 would prohibit any substation expansion, since any equipment not immediately put in service is being stored by definition.

INTERPRETATION (31 January 1997)

The intent of Rule 110B2 is to prohibit storage of construction within a substation fence, even if such material is stored well away from energized conductors or equipment. Rule 110A1 states the requirements for enclosures at electric supply stations: all rooms (indoor stations) and spaces (outdoor stations) in which electric supply conductors or equipment are *installed* shall be enclosed with fences, screens, partitions, or walls. The purpose is to keep unauthorized persons out of areas containing energized conductors or equipment. Rule 110B2 states that rooms or spaces in which electric supply equipment is installed shall not be used for storage (except for minor parts essential to the maintenance of the installed equipment).

Note that the rules do not cover storage of material in electric supply station rooms or spaces *where electric supply equipment is not installed*. Accordingly, where space permits, an interior fence or other barrier installed in accordance with the rules can be used to partition off or separate electric supply equipment space and storage space. Also, the rules are not intended to prohibit substation expansion, provided that work within enclosed rooms or spaces containing energized conductors or equipment is done by qualified personnel and that all clearance requirements are met while work is being performed.

Table 124-1**Basic Impulse Insulation Level (BIL) Values for Electric Distribution Structures****REQUEST (11 November 1996) IR 508**

Regarding Table 124-1, we would be interested in your interpretation of whether the Basic Impulse Insulation Level (BIL) values indicated would apply to distribution lines outside an electrical substation. If so, how should Table 124-1 be properly used to determine the required Basic Impulse Insulation Level for electric distribution structures?

Regarding Table 273-1, we would appreciate your interpretation of how the indicated values for Rated Dry Flashover Voltage of Insulators relate to the required Basic Impulse Insulation Level for electric distribution structures.

From discussions with many utilities across the United States, it is apparent that some uncertainty exists regarding the BIL required for electric distribution structures. Also, the Rural Utilities Service (RUS) advocates a minimum withstand strength of 300 kV for distribution pole top assemblies in order to minimize flashovers. We have tried to rationalize how this 300 kV BIL level relates to NESC guidelines.

INTERPRETATION (26 February 1997)

The answer to your first question is no; the BIL values in Table 124-1 do not apply to distribution lines outside an electric supply substation. All of the rules in Part 1, which includes Rules 124A1 and Table 124-1, apply only to electric supply stations, as stated in Rule 101-Scope (for Part 1).

Likewise the rated dry flashover values of insulators in Table 273-1 apply only to overhead lines. All of the rules in Part 2, which includes Rule 273 and Table 273-1, apply only to overhead lines, generally outside of electric supply stations, as stated in Rule 201—Scope (for Part 2). In Rule 201, the reference to Rule 110D should be to Rule 162.

There is no correlation between Tables 124-1 and 273-1; they apply to different situations. Selection of an appropriate BIL for electric distribution structures is a design consideration; it is not covered in the NESC because the NESC is a performance standard, not a design manual. BIL is only one of many overhead line design criteria which has an impact on lightning performance of shield wire lines. On the other hand, having a BIL considerably less than 300 kV, say 110 kV BIL, results in excellent lightning performance when surge arresters are installed on the line at frequent intervals. Therefore, line BIL need not be a set minimum level, such as 300 kV, to minimize flashovers.

See also IR 355, dated January 27, 1984, which reads in part: Part 1 of the NESC applies where the requirements of Rule 110A are met; otherwise, the installation must meet the requirements of Part 2 of the Code.

Rule 125B**Working space requirements****REQUEST (19 July 1996)****IR505**

Rule 125B states that “Working space shall be in accordance with Table 124-1 clearances for guarding.” It is not clear what the terms *in accordance with* and *clearances for guarding* mean. There are two very different interpretations that can easily be inferred from this language. Which, if either, of the following is correct?

1) Since the rule uses the term clearances for guarding, one interpretation is to take whatever clearance is required under Rule 125A and table 125-1 for 600 V (given the condition that is applicable of the surface at the worker’s back) and add to that the guard zone clearance of Table 124-1 that is appropriate for the high voltage. If this is the correct interpretation, is it also correct to add two guard zones if the surface at the back of the worker is also above 600 V?

2) This could also be interpreted to intentionally *not specify* a working space in front of equipment containing parts above 600 V by requiring that the designer provide enough space to maintain the horizontal clearances of Table 124-1 from the place where the person would be expected to stand while doing the expected work whatever that might be.

Clearly, the nature of the surface is required to be taken into account when the parts are 600 V or less. If 1) is correct, it would also be taken into account by the methodology when the voltage exceeds 600 V. However, if 2) is correct, is the nature of the surface behind the worker supposed to be taken into account? If so, how?

INTERPRETATION (26 February 1997)

Rule 125B covers working space for electrical equipment energized at more than 600 volts in electric supply stations. The working space for energized parts is defined by the dimensions given in Table 124-1 for the BIL for which the parts have been designed (1997 Edition). If access is necessary for examination, adjustment, servicing or maintenance while the equipment is energized, workers may be closer to the energized parts than the clearances required by Rule 124, but the space must be large enough to allow uninsulated portions of the

worker's body to meet the approach distances to live parts required by Part 4. Working space is not required if access to the equipment is not necessary while the equipment is energized.

Rule 125B does not address the nature of the surface behind the worker.

Table 273-1 See Table 124-1

IR 508

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

Rule 234C3b

Three-phase feeder cable passing over a residence

REQUEST (26 March 1996) IR 500

Rule 234C3b refers to the permanent attachment of supply conductors to a building for an entrance. Am I correct in my interpretation that a three-phase feeder cable (23 kV phase-to-phase) that will pass over a residence can be attached to the side and/or roof of the residence provided that the feeder cable is guarded or made inaccessible to pedestrians? This feeder cable will not enter the residence; it will only pass over it.

INTERPRETATION (9 July 1996)

The NESC does not anticipate attachment of a 23 kV, three-phase, feeder cable to the side and/or roof of a residential building. Rule 234C3 applies to the attachment of supply conductors to buildings only where such an attachment is necessary for an entrance, or, in other words, where supply conductors or cables are attached to a building in order to supply electric service to that building. In your case, the residential building will not be supplied from the 23 kV feeder cable. Consequently, neither Rule 234C3 nor Rule 234C3b applies.

Rule 234C1 (Table 234-1) specifies clearances for conductors from buildings where the conductors are not attached to the buildings. Rule 234C2 offers guidance where Table 234-1 clearances cannot be obtained. However, the guarding specified in this rule is not intended to allow the conductors (or cable) to be attached to the building.

Rule 235C1, Exception 1**Closer Spacings Between Bare Neutral Conductors and 600 V Multiplex Cable****REQUEST (17 July 1997)****IR 506**

A 16 in vertical clearance between conductors at supports is required by NESC Rule 235C1 and Table 235-5 for a neutral conductor (upper level) meeting rule 230E1 and a supply conductor (lower level) 0—750V, meeting Rule 230C3. Regarding Exception 1 of Rule 235C1 and the subsequent reference to Rule 235G, is it permissible by code to use the 8 in vertical clearance for 200—250ft spans as indicated in the table under Rule 235G for the following application?

Application: The primary neutral and multiplex messenger, installed vertically on one side of the structure on separate brackets, are bonded at every transformer pole (but not at every common structure), resulting in little voltage difference between them, satisfying Condition 1 of Rule 235G under normal operating conditions. The multiplex cable will sag more than the bare neutral for various circuit loading, ambient temperatures, and ice loading conditions, satisfying Condition 2 of Rule 235G. No intermediate spacers are used, so the exception to 235G would not apply.

Discussion: These conductors are all located in the supply space and installed and maintained by the same electrical supply employees. It seems that the installation does not result in any unsafe working situation or hazardous operating condition. Originally, the exception referenced in NESC 235G seems to have applied to a common (primary & secondary) neutral with open wire secondary cables installed in vertical racks. Modern construction practice employing a separate, continuous bare neutral conductor and 600 V multiplex cable with the closer spacings listed should prove to be as safe and reliable for the given conditions.

INTERPRETATION (14 October 1996)

1. The neutral conductor must meet Rule 230E1 (which you state it does in your request for interpretation). Otherwise, Rule 230E2 applies.
 2. Bonding the Rule 230E1 neutral and the Rule 230C3 cable messenger at every transformer pole *does not meet* the Rule 235G1 requirement (see Rule 92C for messenger grounding and bonding requirements). Rule 235G1 is a voltage limitation, which is met in your application.
 3. In your application, the neutral and cable messenger will be of different materials, presumably with different sag-tension characteristics. Rule 235G2 requires that the specified clearance be maintained under all service conditions.
-

Table 235-5**Clearances for communication conductors located in supply space****REQUEST (12 July 1997)****IR****504**

Table 235-5 appears to allow communication conductors and cables to be installed in close proximity to supply conductors and cables in Category 1b as compared with Category 1a. However, there does not appear to be any stipulation as to when, and under what condition, that is allowed. Rule 238 has the requirements for clearances between communication facilities and supply facilities and has greater clearance requirements than in Table 235-5, Category 1b. This seems to be ambiguous and incomplete, with a need for clarification. It appears that if we install communication cables in the supply space in accordance with Table 235-5, Category 1b, we will then be in violation of Rule 238.

We interpret the rules as one of the two, as follows:

1. Category 1b of Table 235-5 can only be used for communication cables installed in the supply space if

installed, operated, and maintained by qualified persons as required by Rule 224A1.

The clearances in Rule 238 are for communication facilities installed in the communication space, with an appropriate safety zone between the communication space and the supply space. The dimension of the safety zone is determined by the requirements of Rules 235 and 238.

Facilities in the communication space are intended to be worked upon by persons other than those qualified to be in the supply space; thus, the clearances of Rule 238 correspond closely with those in Table 235-5, Category 1a only.

2. The clearance requirements in Rule 238 preclude the clearances in Table 235-5, Category 1b from being utilized, even if the cables are installed, operated, and maintained by persons qualified to be in the supply space.

We think our interpretation number 1 is the correct one. However, please note that our confusion is exacerbated by reading Rule 224A2a, since it refers the reader to Rules 235 and 238 for further information on communication circuits located in the supply space. It is not clear, but we think that reference is only to the required clearances of 230E1 neutrals, since the communication cables on conductors in Rule 224A2a are to be treated as neutrals for clearance purposes. This also needs clarification.

INTERPRETATION (26 November 1996)

There is no conflict between Table 235-5, Item 1b and Rule 238 clearance requirements for communication cables installed in the supply space. In response to your request for interpretation, the following areas are clarified:

First, communication circuits located in the supply space must meet all of the Rule 224A requirements. Such circuits must be installed and maintained by personnel authorized and qualified to work in the supply space, as stated in Rule 224A1. Rule 224A2 covers clearance requirements; Rule 224A3 covers location/protection requirements.

Second, clearance requirements *for insulated communication cables supported by an effectively grounded messenger* are stated in Rule 224A2a. This type of communication cable, when it is located in the supply space, may have the same clearances as neutrals meeting Rule 230E1 from other communication circuits located in the communication space and from supply conductors or cables located in the same supply space. Such cables are referred to as communication cables meeting Rule 224A2 and are treated as neutral conductors meeting Rule 230E1 for clearance purposes.

Pole clearances for a typical joint-use installation are shown in the enclosed figure IR 504-1. Note that the clearances specified for "B" in Table 235-5 are the same, whether "B" is a Rule 230E1 neutral or a Rule 224A2 communication cable (installed in the supply space). Also, note that Table 235-5 specifies clearances both to the supply cable above and to the communication cable below.

Third, Rule 238, including Table 238-1, does not specifically mention Rule 224A2 communication cables. However, such cables are treated as Rule 230E1 neutrals *for clearance purposes*. In the typical installation shown in Fig IR 504-1, the applicable clearance would be from the supply conductor (Rule 230E1 neutral or equivalent) to the communication through-bolt or bracket below (defined as equipment in Rule 238A for measuring clearance under this rule).

Finally, you commented that supply, communication and safety zone spaces are not defined in the code. This is correct. Both "communication lines" and "electric supply lines" are defined (see pages 7 and 8, 1993 Edition). These definitions include the associated conductors, cables and supporting or containing structures. While it should be intuitively obvious that communication lines are generally associated with communication space and supply lines with supply space, particularly with respect to longitudinal spans of conductors and cables, there are exceptions that preclude simple definitions. A generalized space allocation for the typical installation is also shown in Fig IR 504-1.

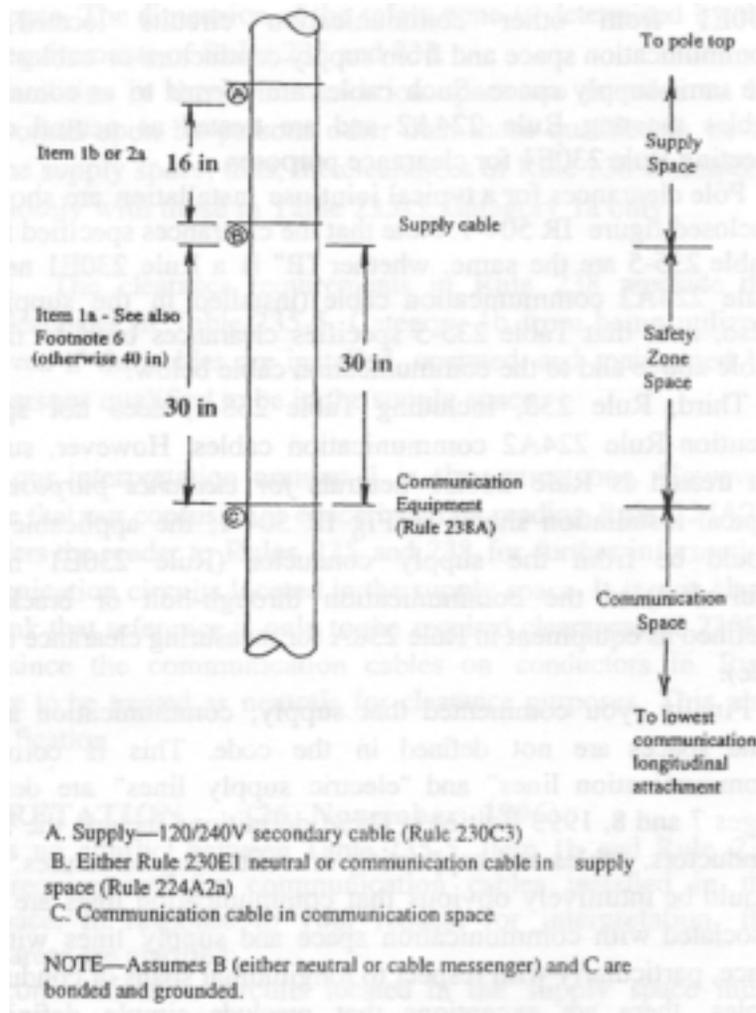


Figure IR 504-1

Table 235-5, Footnote 6**Vertical Clearance Between Conductors At Supports****REQUEST (10 April 1996) IR 501**

The NESC Table 235-5 (col.1, row 1) requires 40 in clearance between neutral conductors meeting Rule 230E1 and communication conductors and cables located in the communication space. Footnote 6 allows this to be reduced to 30 in where the supply neutral or messenger is bonded to the communication messenger.

Can the reduced clearance of 30 in allowed by Footnote 6 be applied to an entirely dielectric fiber-optic-supply cable and messenger since, as stated in Rule 230F1b, such a cable shall have the same clearance from communication facilities as required for a neutral conductor meeting Rule 230E1?

Is bonding to the communication messenger necessary since, being non-metallic, such a bond would be ineffective and purposeless? Or does Footnote 6 apply to entirely dielectric fiber-optic-supply cables such that bonding is not needed?

INTERPRETATION (12 August 1996)

An entirely dielectric fiber-optic supply cable and messenger can be installed 30 in above communication cables located in the communication space. Bonding of the entirely dielectric messenger is not required.

A fiber-optic supply cable and messenger assembly that is entirely dielectric may have the same clearances from communication facilities as required for a neutral conductor meeting Rule 230E1 (see Rule 230F1b). Footnote 6 of Table 235-5 allows a reduced vertical clearance of 30 in at the supporting structure between Rule 230E1 neutrals and communication cables located in the communication space, provided that the Rule 230E1 neutral is bonded to the communication messenger. However, bonding of an entirely dielectric fiber-optic supply messenger cannot be implemented because there are no conductive parts to bond (see definition of bonding).

This interpretation is limited to installation of entirely dielectric fiber-optic supply cables in the neutral space of a joint use pole line at locations where a Rule 230E1 neutral could be installed without violating clearance requirements to energized supply or communication conductors or cables.

235G	See 235C1, Exception 1	IR 506
238	See Table 235-5	IR 504
