National Electrical Safety Code Committee, ASC C2

Third Interim Collection of the National Electrical Safety Code Interpretations

1991–1993

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 volume, INTERPRETATIONS 1961–1977, published in 1978, included the first interpretation request received for the 6th Edition of Part 2 (IR 92, May 1961) and ended with the last interpretation issued in 1977 (IR 212). The second volume, INTERPRETATIONS 1978–1980, continued with IR 213 issued in 1978 and ended with the last interpretation issued in 1980 (IR 283). It also includes all interpretations found in the archives and applying to the 5th and prior editions of the Code (IR 11 through IR 90). Where no copy of an interpretation request or an interpretation could be found in the archives, this fact is noted. The third volume, INTERPRETATIONS 1981–1984, continued with IR 284 issued in 1981 and ended with IR 361 issued in 1984. It also contains requests IR 362 to IR 366, but did not include their interpretations, as the Interpretations Subcommittee still had them under consideration at press time. INTERPRETATIONS 1984–1987 incorporated IR 362 to IR 366 with their interpretations, continued with IR 367, issued in 1984, and ended with IR 415, which was requested in 1987. The next volume, INTERPRETATIONS 1988–1990, incorporated interpretations for IR 407, IR 413, and IR 414, which were not included in the previous volume, and included interpretation requests to IR 443.

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.

This volume, the Third Interim Collection 1991–1993, incorporates an interpretation for IR 454 and provides interpretations for IR 455 through IR 462. IR 463 through IR 467 are included, although interpretations have not yet been provided for them.

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.

Contents

Section 2.
Definitions of Special Terms

Definitions of *voltage* and *voltage of an effectively grounded circuit*, as applied to Rule 279A1b, Electrical Strength (of Guy Insulators)

REQUEST (Mar. 31, 1992) IR 459

Section 2. Definitions of Special Terms, page 61 of the 1990 NESC, gives the definition of "voltage" as:

> 1. The effective (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values unless otherwise indicated. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of a system may vary above or below this value.

On page 62, the following definition is given:

> 4. **voltage of an effectively grounded circuit.** The highest nominal voltage available between any conductor of the circuit and ground unless otherwise indicated.

On page 324, Rule 279A1b, the following is given:

> The guy insulator shall have a rated dry flashover voltage at least double the nominal line voltage and a rated wet flashover voltage at least as high as the nominal line voltage between conductors of the guyed circuit.

For an effectively grounded circuit, is the nominal line voltage referred to in Rule 279A1b line-to-line voltage or line-to-ground voltage?

INTERPRETATION (June 22, 1992)

The "nominal line voltage" in Rule 279A1b is the voltage between conductors (line to line) for both dry flashover and wet flashover.

The voltage of an effectively grounded circuit is defined as: "The...voltage...between any conductor of the circuit and ground *unless otherwise indicated.*" Rule 279A1b states that voltage between conductors of the guyed circuit is to be used to determine the required rated voltage of guy insulators. See also Rule 275B for insulators on single-phase circuits directly connected to three-phase circuits.

Section 9.
Grounding Methods for Electric Supply and Communications Facilities

Rule 97D

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

REQUEST (Sept. 23, 1992) IR 466

In recent months some farmers have expressed concern that the separation of primary and secondary neutrals on a multiple-grounded system as outlined in Rule 97D2 is inadequate. These farmers assert that earth currents are accessing their dairy cattle via the primary multiple-grounded system and specifically the grounding conductor and electrode at the transformer.

I have been requested to obtain an interpretation from the National Electrical Safety Code Committee relative to installing a grounding conductor and electrode at the transformer locations only for the primary arrestor and tank grounding. The primary neutral would then be grounded one span (approximately 300 ft) from the transformer. The primary and secondary neutrals would be separated by a spark gap or device with a breakdown voltage not

exceeding 3 kV and the secondary neutral will have a separate grounding electrode as outlined in Rule 97D2.

1. Is the above arrangement allowable as outlined in Rule 97D2 and to reduce objectionable current flow in the grounding conductor as outlined in Rule 92D?
2. Does the above arrangement still meet the requirements of an effectively grounded neutral as indicated in the Definitions and a multiple-grounded system as in Rule 96A3 if the utilities continue to install a minimum of four grounds per mile?
3. Since the last span may be considered a single-grounded system, should the grounding connection on the secondary neutral be located at least 20 ft from the surge arrestor grounding electrode as in Rule 97D1?

INTERPRETATION

(In process)

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

Rule 127L, Table 127-5

(a) Natural gas (methane) areas with inadequate ventilation
(b) Definition of adequate ventilation

REQUEST (Mar. 19, 1992) IR 457

Table 127-5, "Electrical Equipment Classified Areas—Natural Gas (Methane) Areas" of the NESC (1990 Edition) states that the non-fired areas containing gas pipeline connections, valves, or gages, indoors with adequate ventilation, are Division 2. Does this mean that these areas are Division 1 if they are not adequately ventilated?

In a 15 ft × 40 ft gas metering building located on a gas-fired steam turbine power generation site, with multiple, small diameter (3/8 inch) gas lines with pressures ranging from 45 to 600 psig being brought into the building, how is "adequate" ventilation determined?

INTERPRETATION (June 12, 1992)

Your IR concerns classification of natural gas (methane) areas, which is covered by NESC Rule 127L. As you state in your letter, Table 127-5 places non-fired areas containing gas pipeline connections, valves, or gauges, located indoors with adequate ventilation, in Division 2. The answer to your first question is yes, these areas are Division 1 if they are not adequately ventilated.

In response to your second question, adequate ventilation is not defined in the NESC. Rule 127L references ANSI/NFPA 70-1987 (32), Article 500. While the Interpretations Subcommittee is not empowered to interpret NFPA 70 (NEC) requirements, we note that under NEC Article 500 a Class 1, Division 2 location is one "in which ignitible concentrations of gasses or vapors are normally prevented by positive mechanical ventilation." Further consideration of how adequate ventilation for the gas metering building described in your letter would be determined constitutes consulting information, which this Subcommittee cannot provide.

Hazardous area ratings for natural gas

REQUEST (Oct. 5, 1992) IR 467

Review of Rule 127L of the NESC concerning hazardous area ratings for natural gas indicates that there are several industry practices that do not appear to be in strict compliance with the requirements of this rule. Your response to the following questions is requested.

1. Based on industry practice, the use of low-pressure natural gas for building heating (5 psig or less) does not seem to require the building to be rated as a hazardous area. Table 127-5 does not put any limitation on the gas pressure. According to this table, the building would have to be rated Class I, Division 2, Group D, because the gas piping contains screwed

connections and valves. Can buildings using natural gas at 5 psig or less for heating, and containing natural gas heaters and piping with screwed or flanged connections, not be rated as hazardous (Class I, Division 2, Group D) solely because of the natural gas pipe and heating equipment?

2. A generation building of approximately 1 000 000 ft^3 contains a natural gas pipeline operating at 550 psig or less. The natural gas pipeline passes through the building. The building has power roof ventilators, louvers, supply fans, and roll-up metal doors that are used for ventilation; however, the amount of ventilation provided will depend upon the outdoor ambient temperature and the amount of heat being generated within the building. The pipeline is all welded construction except for one ANSI Class 300 raised face flange. The flange is required at the point where the gas pipeline exits the ground in order to provide electrical separation between the below and above grade pipe for cathodic protection purposes. Does the presence of this one flange in this building require the entire building plus any connected buildings that share a non-gas tight wall with this building, and 15 ft beyond any wall or roof ventilation louver on this building or the connected building, to be rated Class I, Division 2, Group D?
3. Question no. 3 is identical to question no. 2, except the flange on the pipeline is contained within a small enclosure that has weather boots at each pipe penetration into the enclosure and the enclosure has a 2-inch vent pipe connected to the top of the enclosure and extended outside the building.
4. A generation building as described in question no. 2 contains a combustion turbine that burns natural gas. The combustion turbine is contained within a separate enclosure inside the building. Natural gas piping, valves, fitting, and connections to the combustors are contained within the combustion turbine enclosure. The combustion turbine enclosure has natural gas detectors that alarm and then shut off the gas turbine and the gas supply at levels below the ignitible level of natural gas. The combustion turbine has a positive pressure ventilation system. All penetrations into the enclosure are sealed sufficiently to hold in the CO_2 discharge in the event of a fire. The discharge of ventilation

air is through a louver into the generation building. Is the combustion turbine enclosure a Class I, Division 2, Group D area, or a nonhazardous area? Is the entire larger generation building a Class I, Division 2, Group D area?

5. This question is identical to question no. 4, except the ventilation air discharged from the combustion turbine enclosure is ducted outside the larger generation building.

INTERPRETATION

(In process)

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

Rule 215C1

Metal frames, cases, and hangers of equipment

REQUEST (Apr. 2, 1992) IR 461

Please clarify the intent of 1993 Rule 215C1, specifically the words "metal frames, cases, and hangers of equipment."

Situation: There is a wide variation of metal signs attached with nails or lag screws to wooded electric utility poles. They are normally attached at a height between 4 and 8 ft. These signs could consist of a 10 × 14-inch sheet of aluminum or a wooded 20 × 28-inch frame with a tin covering. These metal signs are on utility poles with (7200 V) open supply conductors running overhead and attached to the pole.

Are metal signs as described above intended to be considered in the passage of "metal frames, cases, and hangers of equipment" from Rule 215C1?

INTERPRETATION (June 22, 1992)

Metal signs such as you describe are not intended to be included in the Rule 215C1 phrase "metal frames, cases, and hangers of equipment."

Frames, cases, and hangers all refer to equipment, which is defined as items "used as part of or in connection with an electric supply or communications system." Further, each item listed in Rule 215C1 either routes, contains, or houses live parts that, in the event of insulation failure, can energize the non-current-carrying part.

In your letter, you imply that attachment of metal signs to utility poles is a common occurrence. Please refer to Rule 217A4, which prohibits signs on utility poles without the concurrence of the owner.

Rule 225B

Nominal voltages of high-voltage contact conductors

REQUEST (Apr. 1, 1992) IR 460

We design overhead contact systems for electrified railways. Please verify that the term "energized at more than 750 V" refers to nominal voltage. Our present design involves a 750 V dc system with a single trolley wire suspended at 100–140 ft intervals. The 750 V is nominal and depends on system load. The system voltage can vary from 795 V dc down to 525 V dc. We are attempting to determine if such a system falls within the scope of Rule 225B.

INTERPRETATION (June 22, 1992)

Rule 225B applies to trolley-contact conductors energized at a *nominal* voltage of more than 750 V. The definition for *voltage* states: "Voltages are expressed in nominal values unless otherwise indicated" and "The operating voltage of the system may vary above or below this value."

Demarcation points between voltage classes are normally selected so that there are no recognized industry system voltages at or near the demarcation point. This interpretation makes no determination as to the designation of 750 V as the nominal voltage

for your system; such a determination would constitute consulting advice, which is beyond the scope of the Interpretations Subcommittee.

Rule 230C3

Clearances from the side of a mobile home

REQUEST (Mar. 9, 1992) IR 458

I have enclosed a drawing of an electrical supply and the requirements as my electrical co-op has interpreted the requirements of the NESC to be.

The co-op supplies the wire to the top of a customer-supplied power pole. It also supplies only the wire and any conduit needed to service the disconnect and meter base for a totally underground system.

Figure IR 458-1(a) shows an overhead service. The co-op line comes only to the top of the pole and ties to the customer-supplied service cable that runs to the meter base and disconnect.

Figure IR 458-1(b) shows an underground service. The co-op supplies the electric line and any necessary conduit into the bottom of the meter base and disconnect, which is customer-supplied.

The customer must install the power pole and meter base with disconnect and make all connections past where the co-op connects at the top of the pole for overhead service, and must install the meter base and disconnect and support for underground service. The customer makes all connections from the service disconnect to the mobile home.

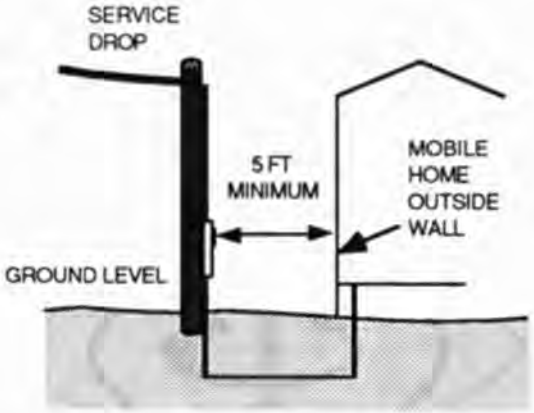
The co-op engineers have determined that the NESC requires the meter and service disconnect to be placed 5 ft from the mobile home. They have quoted 230C3 and Table 234-1, 1a(1) as requiring the 5 ft spacing.

I have studied the NESC and cannot seem to get the same interpretation, but co-op engineers are adamant about the 5 ft requirement and will not budge, insisting that the NESC requires the 5 ft.

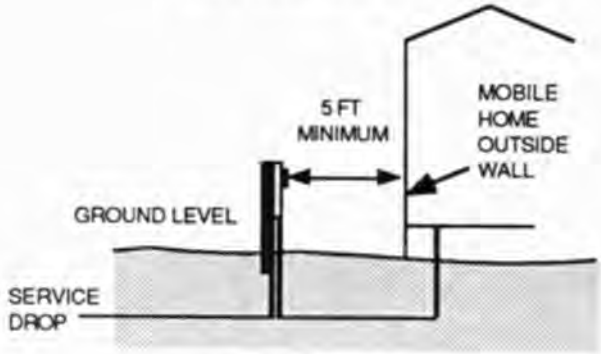
I have found that any time you place a pole, whether it be for power, telephone, clothesline or any other use, children will play around it, attach basketball hoops to it, etc. These poles are

invariably run into with lawn mowers, weed eaters, brush hooks, and occasionally by vehicles, farm tractors, and the like, making for a real safety hazard.

Is there a 5 ft requirement between a customer-supplied service disconnect and meter base as described above and the side of a mobile home?



(a) Overhead Service



(b) Underground Service

Fig IR 458

INTERPRETATION (June 22, 1992)

The NESC does not cover clearance from the side of a mobile home to a

- Service pole (overhead service) or pedestal (underground service)
- Meter base/service disconnect mounted on a service pole or pedestal
- Service cable mounted on a service pole (overhead service) or underground cable to a meter/disconnect on a pedestal (underground service)
- Service cable from the meter/disconnect to the mobile home.

The NESC does specify clearance from an overhead service drop, including the drip loop, and the side or roof of a mobile home. The service drop is the overhead cable from a utility pole to the top of the customer-installed service pole; the service drop does not include the vertical run of customer-supplied service cable on the service pole.

Assuming that the service drop in this case is the typical 120/240 V Rule 230C3 cable, Table 234-1 requires a horizontal clearance of 5 ft to buildings. However, this horizontal clearance applies only if required vertical or transitional clearance is not met. In other words, the horizontal clearance does not apply if the service pole is tall enough to provide required vertical clearance above the roof of the mobile home.

While the Interpretations Subcommittee is not empowered to interpret National Electrical Code (NEC) requirements, we refer you to NEC Article 550-23 for your information. This Article states that mobile home service equipment must be located adjacent to the mobile home, not mounted in or on the mobile home, and be in sight of but not more than 30 ft from the exterior wall of the mobile home.

Electric supply utilities may establish rules that exceed NESC requirements. However, the NESC does not require 5 ft clearance from a customer-supplied service disconnect and meter base to the side of a mobile home.

Rule 232A, Table 1

Definition of residence garage

REQUEST (Oct. 3, 1991) IR 455

The NESC 1973 Edition, Rule 232A, *Basic Clearances,* Table 1, Column 1, "Where Wires Cross Over," contains one category entitled "Driveways to residence garages" and states the basic clearance shown for these conditions is 10 ft, with no footnotes.

Nowhere in this code is there a definition of a "driveway." The code implies that this "driveway" must terminate at a residence garage.

The definition of a garage is "a building or a wing of a building in which to park a car or cars" (*American Heritage Dictionary*).

In some sections of the country, weather conditions are mild and "garages" are not used or required. In other situations, an owner may elect not to build a garage for a variety of reasons, but will still have a driveway.

Is it the intent that "residence garages" is literally a structure, or is it a location adjacent to a residence where the owner regularly parks a car or pickup truck for overnight or other storage periods?

In rural areas, vehicles (cars and pickup trucks) are parked near residences, barns, and other farm-related structures.

Considering Rules 200C and 210, is it reasonable to conclude that 10 ft ground clearance is adequate for communication conductors over a "private driveway" to a location adjacent to a residence? This private driveway has a gate that can be closed and locked at any given time.

Your review of this concern for adequate, safe clearance and an interpretation shall be appreciated.

INTERPRETATION (Jan. 14, 1992)

The item "Driveways to residence garages" in Rule 232, Table 1 of the 1973 Edition does not require an enclosed garage structure in order to be applicable. The intent was to designate a driveway location near or adjacent to a residence where the owner or occupant would routinely park or store automobile-size vehicles, such as family cars or pickup trucks.

This item was not intended to cover driveways to barns or other farm-related structures normally used by larger trucks or equipment, of such height as to conflict with the 10-ft clearance for communication conductors shown in Table 1.

Table 234-1 *See Rule 230C3* *IR 458*

Rule 234C, Table 234-1

Horizontal clearance from structure that leans from the vertical

REQUEST (July 29, 91) IR 454

Our Association is faced with the need to establish the clearance requirement of the National Electrical Safety Code for power lines in the phase to ground voltage range of 750 V to 8.7 kV that pass near water tanks of heights which make vertical clearance impractical.

The tanks are constructed similar to Figs IR 454-1 and 454-2 (see pp. 20–21) with four metal legs supporting the tanks. The horizontal distance between legs is greater at the ground than at the tank. In any of our tank locations (as represented in the figures) the horizontal distance clearance requirement and the diagonal distance from the conductor to the nearest point on the structure is greater than the vertical clearance requirement of Table 234-1. Also, the conductors are higher above ground than the code requirement by Table 232-1.

Our understanding of the clearance envelope is indicated on the attached drawing; however, the code is not clear in Section 234C as to how the horizontal requirement should be applied to a side of the water tank support leg that has a slight lean such as is the case on our attached drawing. Also, the Clearance Diagrams for Building and Other Structures in Figure 234-1 do not address our specific concern. In each of these clearance diagrams the horizontal measurement is from a vertical surface. Should the horizontal measurement be made horizontally from the conductor to the

leaning support leg or perpendicular to the support leg out to the conductor?

INTERPRETATION (Nov. 8, 1991)

Rule 234C specifies vertical and horizontal clearances to buildings and similar installations. These vertical and horizontal clearances are to be applied in the appropriate vertical or horizontal plane, *not* perpendicular to a sloping surface.

Application of vertical clearances required by Rule 234C to sloping surfaces is illustrated in Fig 234-1. Horizontal clearances to sloping surfaces are applied in the same manner, horizontally to the surface.

Note 4 in your request for interpretation states that the conductors shown in the side view are in the maximum displ .ed position toward the tank. Horizontal clearances shown in Table 234-1 are for conductors at rest (no wind displacement) under the conditions specified in Rule 234A1; see Rule 234C1a. Certain supply conductors must also meet the clearances shown in Rule 234C1b when displaced by wind. Open wire supply conductors in the voltage range you specified in the first paragraph of your request must meet *both* conditions.

234C, Table 234-1

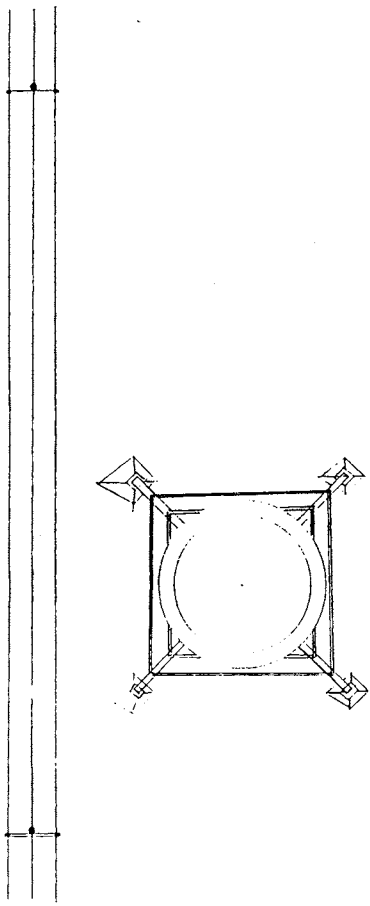


Fig IR 454-1
Top View

234C, Table 234-1

NOTES:

(1) A permanent ladder is attached for access to the top of the tank.
(2) Tank is supported by four steel legs.
(3) Tank is cylindrical with rounded top and bottom.
(4) The position of the conductors relative to the tank are in the maximum displaced position toward the tank according to Rule 234 for conductor temperature, loading, and wind displacement.
(5) This request is in the Medium Loading District with span length less than 250 ft between the supporting power pole on each side of the water tank.

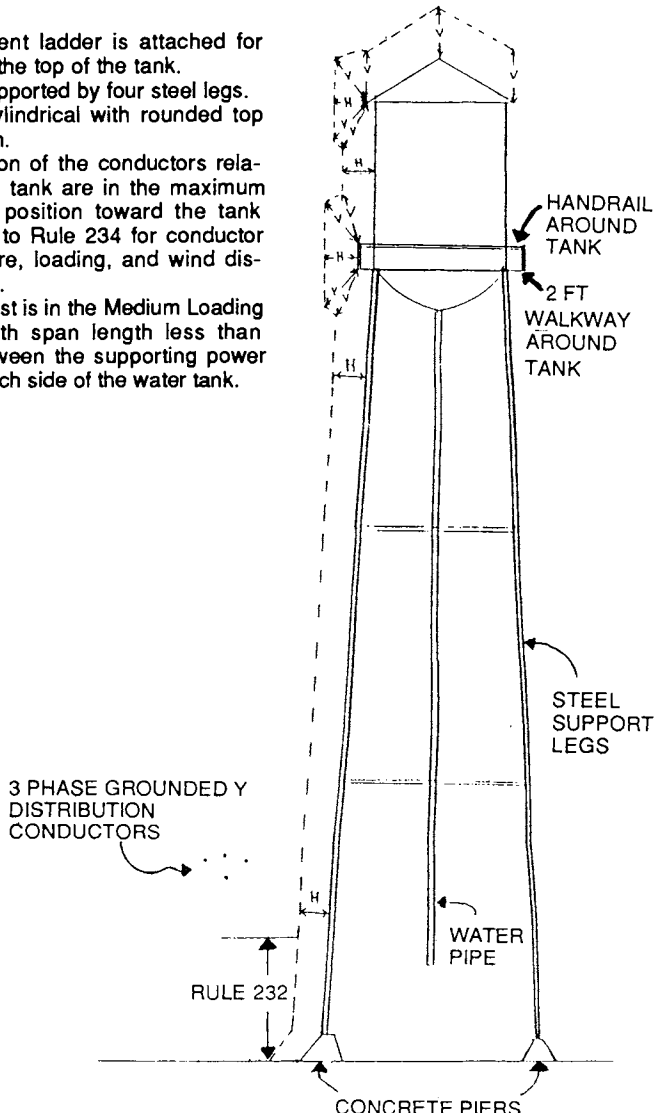


Fig IR 454-2
Side View

Rule 234F2(b)

Designation of non-loading side of a grain bin

REQUEST (June 1, 1992) IR 462

I work for a service organization to 47 rural distribution cooperatives and seven generation and transmission cooperatives. As Director of Loss Control Services, my primary responsibility is to assist our members in reducing and eliminating situations that may result in accidents to employees and the public. One of these situations is clearances around grain bins.

Rule 234F2(b) states: "Any side of a grain bin is considered to be a non-loading side if it is so designated." This begs the following questions:

1. Who is responsible for designating the non-loading side?
2. If the utility designates, must the farmer accept, or could the farmer so designate and the utility then must accept?
3. Must the designated non-loading side be marked accordingly?
4. If marking is required, what type of sign should be installed, where should it be installed, and who is responsible for maintenance of the sign?
5. What, specifically, should the sign say, how large should it be, and what colors would be appropriate?
6. If bins are relocated either on the same farm or sold and moved to another farm, who is responsible for removing signs or ensuring safe operation at the new location?
7. If the farm is purchased by a new owner and the new owner decides to designate a different non-loading area, must the utility comply? If changes in line construction were necessary, which party would bear the cost of these changes?

INTERPRETATION (Sept. 29, 1992)

In general, the grain bin owner or operator is primarily responsible for determining the type of loading operation to be used. When a portion of a grain bin is designated as a non-loading side through mutual agreement with the electric supply company, the concerned parties should be cognizant that documentation of any

such agreement is desirable. The NESC does not require either documentation of agreements or marking of non-loading sides, nor does it cover responsibility for the cost of an installation or subsequent rearrangements. Rule 012 states that construction, operation, and maintenance should be done in accordance with good practice for the given local conditions when particulars are not specified in the rules.

Answers to your numbered questions are:

1, 2. The grain bin owner or operator is primarily responsible for designating loading and non-loading sides. If an existing electric supply line is nearby, a prudent owner or operator should contact the supply company prior to erection of a new grain bin to mutually resolve site specific concerns and to ensure that the clearances to the grain bin(s) will meet NESC requirements. On the other hand, the supply company should contact the owner or operator of an existing grain bin before installing new facilities in close proximity to the bin(s).

3. The NESC does not require marking of non-loading sides; see Rule 012.

4, 5. See #3.

6. Relocation of an existing grain bin to a new location is essentially the same as installing a new bin; see #1 & 2.

7. This specific situation is not covered by the NESC. However, as a matter of practice, a utility company is not normally obligated to modify its facilities when an existing installation complies with the applicable NESC edition. If the customer insists that utility facilities be rearranged or relocated, such work is normally done at the customer's expense. Local law or regulation may require different treatment.

Rule 235A3

Minimum horizontal clearance required between two transmission circuits

REQUEST (May 17, 1992) IR 456

This request for interpretation refers to the minimum horizontal clearance required between two transmission circuits, carried on the same supporting structure. The line is at sea level and the maximum operating voltage is 230 kV plus 10% (phase to phase) for both circuits. The transmission conductors are built in a vertical configuration and have the same sag and tension characteristic. Switching surge factors are not known.

To calculate the required minimum horizontal clearance between transmission conductors, we interpret Rule 235B1a to require 725 mm (from Table 235-1) plus the additional clearance required by Rule 235B. However, Table 235-1 refers to Rule 235A3, *Line Conductors of Different Circuits*, and under Part (a) of this rule states that

> Unless otherwise stated, the voltage between line conductors of different circuits shall be the greater of the following:
> 1. The phasor difference between the conductors involved...
> 2. The phase-to-ground voltage of the higher voltage circuits.

We interpret condition 1 to apply only to *the different phases of different circuits,*

$$\text{requiring a clearance} = \left(\frac{1.10 \times 230\ \text{kV}}{\sqrt{3}} + \frac{1.10 \times 230\ \text{kV}}{\sqrt{3}} - 50\right) \times (10\ \text{mm/kV}) = 2420\ \text{mm}.$$

But assuming *the same phases of different circuits* and considering condition 2 using phase-to-ground voltage of the higher-voltage circuit,

$$\text{requiring a clearance} = \left(\frac{1.10 \times 230\ \text{kV}}{\sqrt{3}} - 50\ \text{kV}\right)(10\ \text{mm/kV})$$

$$= 960\ \text{mm}.$$

Please advise which of the two methods of calculating additional clearances based on Rule 235A3a shall be applied?

Additionally, please refer to Table 235-1, "Supply conductors of different circuits: Over 50 kV to 814 kV. "The required clearance in English units is 28.5 plus 0.4 per kV over 50 kV. But the required clearance in metric units is 725 plus 10 per kV over 8.7 kV. We believe this is an error that requires correction.

INTERPRETATION (Sept. 29, 1992)

Your basic question involves determination of the voltage to be used to calculate minimum horizontal clearance between conductors of two transmission circuits on the same supporting structure, both circuits having the same maximum operating voltage. This determination is covered by Rule 235A3, and must be made before horizontal clearance can be calculated by Rule 235B.

In the normal two-circuit vertical configuration, the phase relationship for each pair of conductors should be known to fully apply Rule 235A3. This rule states that the voltage is the *greater* of either:

1. The phasor difference between the (two) conductors involved, or
2. The phase-to-ground voltage of the higher-voltage circuit.

If the opposite conductors are of the same phase, the phasor difference is essentially zero. If they are of different phases, the phasor difference is normally line-to-line voltage (more or less depending on phase shift). If the actual phasor relationship is unknown, the NOTE states that a phasor relationship of 180 degrees (twice line-to-ground voltage) is appropriate. However, the voltage cannot be less than phase-to-ground (of the higher-voltage circuit).

Rule 235B1 states that horizontal clearance for line conductors on fixed supports shall be the greater of that given in Table 235-1 (Rule 235B1a) or clearance according to sags (Rule 235B1b). Table 235-1 requires a basic clearance of 725 mm *plus* an additional clearance

(adder) for voltages over 50 kV. In your request, you show two calculations for the adder (to the 725 mm basic clearance). The first (2420 mm) is the correct *adder* for a 180-degree phasor relationship. Total horizontal clearance would be 725 mm + 2420 mm = 3145 mm. This is the worst-case condition, appropriate when phase relationships are unknown or when phase shifts of opposite phases may occur. The second (960 mm) is the correct *adder* for phase-to-ground voltage, appropriate when the line conductors are the same phase. Total horizontal clearance would be 725 mm + 960 mm = 1685 mm. Thus selection of the clearance to be used depends on the phase relationship for each pair of conductors involved.

In your request, you also point out a difference between English and metric units in Table 235-1. The English units are correct; there is an error in the metric units. The metric portion of the table should read "725 plus 10 per kV over *50* kV."

235B *See 235A3* *IR 456*

235B1 *See 235A3* *IR 456*

Table 235-1 *See 235A3* *IR 456*

Rule 239E *See 239G2* *IR 465*

Rule 239G *See 239G2* *IR 465*

Rule 239G

Electrical conductors in climbing space on joint-use utility poles

REQUEST (Sept. 15, 1992) IR 465

I have been requested to seek advice and interpretation of current NESC rules regarding electrical conductors in climbing space on joint-use utility poles. There has been much concern among telephone and CATV employees that the current practice of installing temporary electrical drops in climbing space presents excessive hazards to those climbing the poles. Therefore, I am requesting your assistance in providing a ruling on this issue.

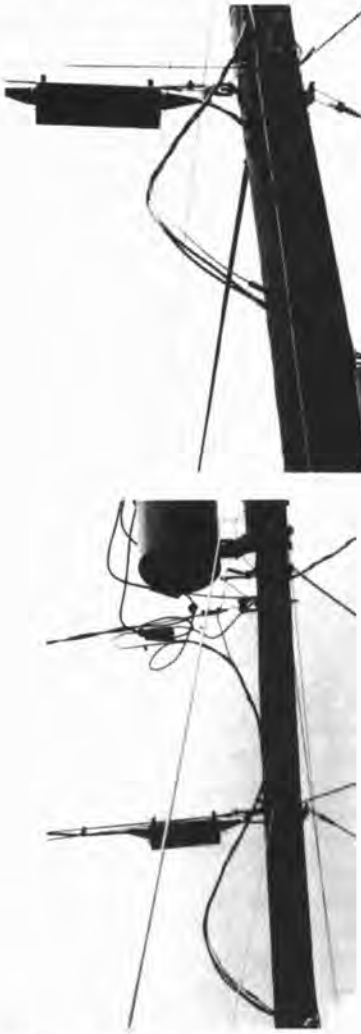
The enclosed photographs (Figs IR 465-1–465-6) depict typical temporary power installations throughout the area concerned consisting of triplex conductors suspended freely from the transformer secondary splice to the weatherhead placed toward the bottom of the pole. As you can see, the conductors are somewhat loose in the climbing space and, according to some, create a considerable exposure hazard to those climbing with "hooks." One photo (Fig IR 465-3) exhibits an attempt by a communications worker to tie back the triplex so that it would not be adjacent to his working area on the pole.

The position of the local electric utility is that these installations are in accordance with the NESC rules in that the multiconductors are jacketed and require no extra protection as specified in Rule 239G2. The communication companies in the area believe that if in fact this service drop requires no extra protection, it still would require being fastened taut on the pole as specified in Rule 239G4b. It also appears that Rule 239E2c addresses the issue of attaching the secondary conductors to the surface of the pole. The local electric utility does not agree with this.

Please provide your recommendations on these issues:

1. Does Triplex constitute a jacketed multiconductor cable requiring no extra physical protection in vertical installations as referred to in the NESC Rule 239G2?
2. Is Triplex exempted in any way from being securely fastened through climbing spaces as specified in NESC Rules 239E and 239G?

3. Are the construction methods depicted in Figs IR 465-1–465-6 in accordance with NESC rules and regulations?



Figs IR 465-1 and IR 465-2

239G

Figs IR 465-3 – IR 465-6

INTERPRETATION
(In process)

Rule 279A1b *see Section 2* *IR 459*

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

Rule 442E

Tagging of Supervisory Control and Data Acquisition Systems (SCADA)

REQUEST (July 10, 1992) IR 464

Regarding 1990 NESC Rule 442E, *Tagging Electric Supply Circuits* (paragraph 1, second sentence), "Controls that are to be de-activated during the course of work on energized or de-energized equipment or circuits shall also be tagged. The tags shall be placed to identify plainly the equipment or circuits on which work is being performed." Paragraph 2 follows with: "Tagging of Supervisory Control and Data Acquisition Systems (SCADA) in itself shall not be considered sufficient."

As a result of paragraph 2, a portion of the benefit realized from the installation of a SCADA system is diminished, namely, the time and cost factor of sending a switchman to the location to install tags on switches previously operated by the system. Case in point: when performing any energized work on transmission or distribution circuits, safety procedures require the reclosing devices to be turned off during this work. Prior to Rule 442E, our SCADA system was utilized for this purpose, including the tagging of the device in SCADA. Our switching and tagging procedures do not allow

operation of switches or equipment without authorization from the appropriate operator; therefore, the practice worked very well.

In an effort to regain some of the cost incentive features, we would propose the following comments for consideration by the Committee.

Point: If the circuit that normally provides the reclosing voltage to the closing circuit of breakers were rendered inoperative, a person could not close a breaker from any manually operated control switch located at the substation control room or the breaker itself without first turning control voltage onto the closing circuit for that breaker via SCADA. Would the device, rendered inoperative, and the electronic tag placed in SCADA become sufficiently safe as the present Rule 442E provision provides?

We understand that all companies must apply this rule to the operation of their electrical system, and the effect is relative to procedure and degree of automation in place. We believe this modification does produce a positive desirable result for the safety of electric utility workers, and will help to minimize the increases in operating costs.

We are committed to safety and system reliability in the electrical power industry and realize the tremendous impact that advanced technology has made. We are confident that an automated solution is possible, one in which total safety and economics are provided for.

In regards to our telephone conversation on July 23, 1992, concerning the 1990 edition of the NESC Rule 442E, please find the enclosed schematic drawing #JW-S-105 showing the installation of a remotely operated contact that provides interruption of the closing circuit's power supply. This feature does not allow any closing of the device from the panel or the breaker. However, the intent of the rule to provide a warning to anyone at the substation is not achieved even though an operation to close would have no effect. In addition to the power cutoff contact, new developments in electronic tags for remote operation are available.

We are actively pursuing this approach in order to maintain the full benefit of our SCADA equipment.

INTERPRETATION

(In process)

Requirement for local tagging during hot line holds

REQUEST (July 1, 1992) IR 463

Rule 442E of the 1993 edition has been changed in part to read:

> "2. Controls that are to be de-activated during the course of work on energized or de-energized equipment or circuits shall also be tagged. Tagging of Supervisory Control and Data Acquisition Systems (SCADA) in itself shall not be considered sufficient. A physical tag is required to be located at every switch, breaker, or like device from which operation via SCADA of equipment is possible."

Previously interpretation request numbers IR 433 and 434 were issued on this matter, which indicated that the intent was to require tagging on all controls, both local and remote, from which re-energization of a line or piece of equipment was possible. The intent of the revised rule seems confusing once again.

The condition in question is when qualified personnel are working on or near energized lines or equipment and the feature of automatic reclosing on fault-protecting breakers/reclosers is disabled; we term this a hot line hold: in the event of a tripout, the switching authority obtains a release from the crew prior to directing re-energization.
At one time we had relied on our operating rules that require all personnel to obtain authorization from the switching authority prior to operating any controls or switches; i.e. we were tagging only the SCADA controls, and this worked without incident for many years. A couple of years ago, we added permanently installed hot line hold tags on all SCADA-controlled breakers in an attempt to meet code by providing local warning not to operate without authorization. These permanent tags read: "Caution. Hot Line Hold Order may be in effect on this circuit. Do not place in local position unless requested by Operator." Based on the previously referenced interpretations, we were considering the modification of local breaker controls such that local closing capability was disabled during a hot line hold (at the same time automatic reclosing was disabled). As a result we felt that tagging during our hot line holds would be done on the only controls from which re-energization could occur, i.e., only on SCADA. This approach was to have been done using the same

latching relay now used to disable automatic reclosing, such that loss of power or loss of SCADA communications would not change the status of local closing control or of automatic reclosing. Now we are unsure of the intent of the revised rule requiring local tagging. If SCADA controls are the only point of closing control remaining in effect, how do local tags provide for worker safety?

I agree that such local tagging is prudent and necessary for de-energized work, when not only breakers but also disconnect switches are open and motor operators are also uncoupled. It seems the revised language applies most when working on de-energized lines (as detailed fully in NESC Rule 444C) rather than to energized work; perhaps rules for work on energized and de-energized facilities should be kept separate and distinct from one another.

The requirement for local tagging during hot line holds may in fact result in some adverse safety effects. The NESC does not require that automatic reclosing be disabled when workers perform energized work, so rather than wait for the time necessary to place local tags, the fear is that some may choose to work with automatic reclosing enabled.

If our breakers had no automatic reclosing feature, then no controls would be de-activated during energized work, and no tagging (local or SCADA) would be required, and yet the local breaker controls could conceivable be operated to re-energize. This seems to be an inconsistent requirement.

If as in our organization, the disabling of reclosing and the operation of breakers will be done predominantly via SCADA, the local tags during a hot line hold provide no warning to the control center operator; only the SCADA tag provides that. Our operating restriction requiring authorization prior to switching covers the local possibility of breaker closing.

In our effort to meet the intent of the revised code, we are considering several options:

1. Continue to count on permanently installed tags on each breaker's local control panel, warning to obtain authorization prior to operating any equipment, without adding any other tags each time a hot line hold is issued, i.e., tagging only SCADA controls since that is the control we normally use.
2. Change control wiring schemes, using the latching relay to deactivate all local breaker closing controls at the same time

that the reclosing feature is disabled via SCADA and tag only the SCADA controls during hot line holds.

3. Remove all reclosing relays from service such that no tagging (either local or SCADA) is required during energized work since no controls will be de-activated.
4. Replace our local/remote control switches on breaker panels with a new type that includes a tagging flag feature to provide a warning locally when a hot line hold is implemented via SCADA.
5. Add a warning lamp to breaker panels that would serve as the local warning tag, i.e., turned on when the reclosing feature is de-activated via SCADA command.

I am unsure which of these options would meet the intent of the revised rule as presently written and would appreciate some clarification to help guide us in this matter.

INTERPRETATION

(In process)

Rule 444C *see Rule 442E* *IR 463*