1984–1987

National Electrical Safety Code Interpretations

1984—1987 inclusive

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ANSI/IEEE C2
Interpretations 1984—1987

National Electrical Safety Code Committee, ANSI C2

National Electrical Safety Code Interpretations

1984—1987 inclusive

A companion volume to

National Electrical Safety Code Interpretations
1961—1977 inclusive

National Electrical Safety Code Interpretations
1978—1980 inclusive
with interpretations prior to the 6th Edition, 1961

National Electrical Safety Code Interpretations
1981—1984 inclusive

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, ANSI C2.

Key words: 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.

Contents

Foreword

In response to repeated public inquiries and requests from C2 Committee members, the IEEE C2 Secretariat arranged for publication of Interpretation Requests received and Interpretations made by the National Electrical Safety Code 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 interpretation IR 284 issued in 1981 and ended with IR 361 issued in 1984. It also contained requests IR 362 to IR 366, but did not include their interpretations, as the Interpretations Subcommittee still had them under consideration at press time. This new volume incorporates IR 362 to IR 366 with their interpretations, continues with IR 367, issued in 1984, and ends with IR 415, which was requested in 1987. Interpretations have not yet been provided for IR 407, IR 413, and IR 414, which are included in this volume.

The Secretariat hopes that the publication of all interpretations will prove helpful to those concerned with the National Electrical Safety Code.

National Electrical Safety Code Interpretations
Introduction

General: Interpretations are prepared by the National Electrical Safety Code Interpretations Subcommittee in response to formal requests received by the National Electrical Safety Code Secretariat.

This volume contains all interpretations issued on the National Electrical Safety Code 1984 through 1987 that have not been previously published.

Arrangement: This compilation includes a numerical index for all issued interpretations arranged in order of interpretation number, showing the rule number and topic covered. This will be convenient for location of the text if only the interpretation request number is available.

Interpretation requests and interpretations quoted in full are arranged according to the primary rule number. Applicable cross references are inserted appropriately if a request covers several rules. If illustrations were provided, they follow the Interpretation Request text. In the 1977 Edition some changes were made in the rule numbers. Exact correspondence of Rule numbers between other editions does not exist in some cases. Interpretations published in the 1977, 1981, 1984, and 1987 Editions are identified to show the Edition in which they were published.

The request data refers to the date on the original letter request. The Interpretation date is the date of the response letter.

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
345 East 47th Street
New York, NY 10017

Requests for interpretations should include:

A. The rule number in question.
B. 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.

Numerical Listing by Interpretation Request (IR) Numbers

(The volume in which the Interpretation appears is listed in italics below the IR number.)

Request Date	*IR Number*	*Subject*	*Rule*
(Dec 23, 43)	**11** *78/80*	Will use of Lamicoid marker on cross-arms of 550V power supply circuits comply with marking rule	220B3b
(Jan 18, 44)	**12** *78/80*	Avoiding fatigue failure in conductors under tension	233A, Table 3
(Aug 4, 44)	**13** *78/80*	Clearance over farmland	232A, Table 1
(Nov 16, 44)	**14** *78/80*	a) Transverse wind loading b) Definition of "grades" of construction	251
(Nov 13, 44)	**15** *78/80*	Climbing space minimum clearance	235A3, Table 9
(Nov 14, 44)	**16** *78/80*	Clearance of primary neutral conductor over communication conductor	233A, Table 3
(Nov 11, 44)	**17** *78/80*	Allowable stress in members of steel structure	261, Table 16
(Dec 18, 44)	**18** *78/80*	For special construction supply circuits is 550 the maximum allowable voltage or the nominal?	220B3
	19	*No record*	
(Feb 15, 45)	**20** *78/80*	Do words "containing steel" describe composite conductor or merely any wire of such a stranded conductor?	261F2
	21 *through* **23**	*No record*	
(May 26, 45)	**24** *78/80*	Change of districting from heavy to medium loading	250

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Oct 23, 45)	25 *78/80*	Increased clearances for excess span length	232B
(Dec 15, 45)	26 *78/80*	a) Vertical and transverse loadings;	261A4a
		b) Strength requirements for dead-end and transverse guys	261C5a
	27	*No record*	
(Apr 24, 46)	28 *78/80*	Insertion of choke coil in ground lead	Section 9, No Rule
	29 30	*No record*	
(Mar 28, 47)	31 *78/80*	Clearance over farm fields for voltages of 50kV	232, Table 1
	32 *through* 36	*No record*	
(June 8, 47)	37 *78/80*	High voltage transmission lines; excessive clearance requirements	235A, Table 9
	38 *through* 41	*No record*	
(June 30, 49)	42 *78/80*	Deflection data on tubular steel poles	260
(Aug 10, 49)	43 *78/80*	Clearance of transmission lines over navigable waters	232, Table 1
	44 45	*No record*	
(Oct 31, 49)	46 *78/80*	Thickness of metal used for metal poles	261A3e
(Dec 2, 49)	47 *78/80*	Clearances from building	234C4
	48	*No record*	
(May 10, 50)	49 *78/80*	Classification of jumper wires at poles	235A3, Table 9
(May 26, 50)	50 *78/80*	Guys attached to wood poles	283B4b

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Aug 25, 50)	51 *78/80*	Double crossarm over railroad tracks in suspension insulator type of construction	261D5
(Aug 30, 50)	52 *78/80*	Clearance for communications conductors used exclusively in the operation of supply lines	238B, 238E
	53	*No record*	
	54	*No record*	
(Jan 31, 51)	55 *78/80*	Ground resistance: a) limit, b) measurement requirement	96A,B
	56	*No record*	
(Aug 21, 51)	57 *78/80*	Horizontal or vertical clearances from buildings	234C4, Table 4
(Jan 25, 52)	58 *78/80*	Do clearances have to be maintained under all weather conditions?	232A, Table 1
(Mar 10, 52)	59 *78/80*	Clearance from buildings	234C4a(1) and (2)
(Mar 27, 52)	60 *78/80*	Clearance with suspension insulators	232A, Table 1; 232B1a(1); 232B3
(July 16, 52)	61 *78/80*	Grade B construction, conductor size; does Exception 2 apply to railroad crossings?	261F2
(Nov 27, 52)	62 *78/80*	Are clearance increases cumulative in 1, 2, and 3 as indicated in the text on page 52?	233A, B
(Apr 10, 53)	63 *78/80*	Vertical separation at supports	238A, Table 11
(June 15, 53)	64 *78/80*	a) Definition: Communication Lines	Definition 45
		b) Classification of CATV cable as a communication circuit	238
(June 4, 53)	65 *78/80*	Interpretation of footnote "c" appearing in Table 14, allowing Grade C construction	242; 243

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(May 14, 53)	66 *78/80*	Clearance to building or similar structure	234C4
(Aug 5, 53)	67 *78/80*	Clearances from buildings	234C4, Table 4
(Oct 1, 53)	68 *78/80*	Does the word "spliced" also refer to pole top extensions?	261A4g
(Dec 30, 53)	69 *78/80*	Clearance between conductors and supporting structures of another line	234B2
(Mar 2, 54)	70 *78/80*	Are galvanized steel ground rods regarded as approved equivalent of rods of nonferrous materials?	95D
	71	Interpretation was withdrawn	
(May 31, 55)	72 *78/80*	Minimum size of conductors in a crossing span of 215 feet over a railroad track	262I2b, Table 24
(July 29, 55)	73 *78/80*	Grounding of guys	283B4
(Aug 1, 55)	74 *78/80*	Horizontal and vertical clearances from a steel windmill tower	234C4a, Table 4
(Aug 29, 55)	75 *78/80*	Guy insulators; acceptability of fiberglass as insulating material	283A1a
(Sept 13, 55)	76 *78/80*	Clearance requirements for telephone lines which pass over driveways into farmer's fields in strictly rural areas	232A, Table 1
(Nov 15, 55)	77 *78/80*	Clearance requirements for conductors passing by or over buildings	234C4a
(Nov 16, 55)	78 *78/80*	Clearance requirements for conductors passing by or over buildings	234C4
(Jan 4, 55)	79 *78/80*	Clearance for cabled service drop, 150 V max to ground	232A Table 1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Aug 14, 56)	80 *78/80*	Clearance between 8.7-15 kV line and grounded neutral or secondary conductors	237B3
(Apr 18, 56) (Aug 24, 56)	81 *78/80*	Horizontal clearance of supply conductors (300V to 8.7 kV) from buildings	234C4 Table 4
(Sept 15, 56)	82 *78/80*	a) Clearances between conductors on adjacent crossarms	238B1
		b) Service brackets at end of crossarms	238D
		c) Clearance to buildings	234C3, 4
(Nov 1, 56)	83 *78/80*	a) Increase in clearance, V 50 kV	232B2, 233B2
		b) Clearance for basic and longer spans	234C4
		c) Clearance to building corner	
(Sept 20, 56) (Nov 7, 56)	84 *78/80*	a) Clearance between power and signal conductors on same crossarm	238A Table 11
		b) Clearance between signal conductors and multiple light system circuit	238E
		c) Clearance of vertical supply conductors from communication crossarm	239F
		d) Dead ending or guying of communication messenger	
		e) Spacing between crossarms	
(Feb 26, 57)	85 *78/80*	a) Classification of specific cable construction	230C
		b) Clearance requirements	234D

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(May 1, 57)	86 *78/80*	a) Requirements for a fence to prevent unauthorized entry	102
		b) What is practicable limit for reduction of hazards. Does rule apply to employee or public?	110
		c) Is exterior of porcelain arrester a live part?	114 Table 2,C
		d) Clearance to ground in substation; measured from earth or concrete supporting base for arresters	
		e) Clearance to live parts adjacent to fence separating station area from public	114 Table 2
		f) Does locked fence constitute guarding by isolation?	114C
(Jun 12, 57)	87 *78/80*	a) Clearance to building b) Is clearance (in a specific case) in accordance with the NESC?	234C4
(July 15, 57)	88 *78/80*	Can grounding conductor of primary spark gap be solidly interconnected with the secondary neutral on an otherwise ungrounded system?	97
(Apr 14, 58) (Apr 17, 58)	89 *78/80*	a) Should clearance of conductors passing by buildings include swing?	234C4a(2)
		b) Insulator swing considerations	235A2a(1) 235A2b
		c) Sag increase; span 150 ft or 350 ft?	234A 233 234C4a(1)
(Aug 12, 57)	89X *78/80*	a) Clearance for lines 70 kV	422C1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		b) Clearance for hot line work c) Clearance for climbing	
(Oct 24, 58)	90 *78/80*	Systematic inspection—time interval between inspections	213A2
	91	*No record*	
(May 19, 61)	92 *61/77*	Meaning of "supply cables having an effectively grounded continuous metal sheath, or insulated conductors supported on and cabled together with an effectively grounded messenger." Spacer cable	230C
(Apr 13, 62)	93 *61/77*	Clearance between multigrounded neutral and communication service drop	238D
(Mar 5, 62) (Mar 27, 62) (Aug 6, 62) (Aug 8, 62)	94 *61/77*	Plastic guy guards	282E
(Nov 14, 62)	95 *61/77*	Spliced and stub pole definitions; extension at top of pole	261A4(g)
(Dec 7, 62)	96 *61/77*	Clearance to parallel line	234B
(Feb 14, 63)	97 *61/77*	Guy grounding; upper end effectively grounded vs. anchor end ground	282H
(Feb 21, 63)	98 *61/77*	Clearance — horizontal and vertical — from buildings	234C4
(Mar 14, 63)	99 *61/77*	Definition of fixed supports	232A3
(Apr 22, 63)	100 *61/77*	Insulators in guys	283B2
(Sept 13, 63)	101 *61/77*	Clearance between line conductors and span or guy wires	235A, Table 9

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Oct 11 and 22, 63)	102 *61/77*	Clearance between line conductors and guy of EHV guyed tower	235A3, Table 9
(Nov 12, 63)	103 *61/77*	Constant to be added to storm loading for messenger supported cable	251
(Dec 31, 63)	104 *61/77*	Grounding point on 3-wire delta systems — corner or midpoint of one phase	92B
(June 15, 64)	105 *61/77*	Placement of communication cable above effectively grounded luminaires with drip loops.	238E4
(Jan 6, 64)	106 *61/77*	44 kV 3ϕ transformer bank fuse protection.	165
(Feb 24, 64)	107 *61/77*	Grounding of transformer tank with tank grounded arrester, via a sparkgap, etc.	97C 93A, B
(Apr 2, 64)	108 *61/77*	Longitudinal strength of towers — Grade B construction.	261A3(b)
(Apr 24, 64)	109 *61/77*	Joint use 7.2 kV/communications-cable joint use poles; insulated strand, self-supporting communications cable.	242
(May 14, 64)	110 *61/77*	Conductor vertical spacing with post insulators.	238A, Table 11
(May 26, 64)	111 *61/77*	Grade B crossing spans in a grade C supply line.	242, Table 15
(June 30, 64)	112 *61/77*	Final condition of a conductor — to determine vertical clearance — storm loading and long term creep.	234A1
(Nov 12, 64)	113 *61/77*	Clearance of conductor from building.	234C4(a)

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Aug 2, 65)	114 *61/77*	Clearance of HV conductors around circuit breakers.	114
(Aug 4, 64)	115 *61/77*	13.8 kV distribution clearance with horizontal post insulators without crossarms.	238 Table 11
(Aug 31, 65)	116 *61/77*	Guy guard — on guys to ground anchors — in areas where stock runs.	282E
(Sept 17, 65)	117 *61/77*	(a) Clearance between supply conductors and signs (b) Clearance between pad-mounted transformers and gas metering equipment	23
(Sept 8, 65)	118 *61/77*	Nine questions concerning grounding conductor	239C 97C1(b) and (c)
		(1) Mechanical protection for interconnected (arrester and neutral) grounding lead	
		(2) Required number of grounding connections	97C1(c)
		(3) Allowable omission of mechanical protection (4) Allowable omission of protective covering	239C and 97C1(b) and (c)
		(5) Method of grounding magnetic mechanical protection (6) Method of grounding nonmagnetic mechanical protection	93C1, 97A1 and 239C
		(7) Mechanical protection for interconnected (arrester and neutral) grounding lead	97C1(c) and 239C
		(8) Number of grounds	92B

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		(9) Allowable interconnection of grounding neutrals	97C
(Sept 2, 65)	119 *61/77*	Insulator electrical strength	272
(Dec 3, 65)	120 *61/77*	Clearance between highway lighting standards and transmission lines	243B
(Dec 13, 65)	121 *61/77*	(a) Sag — with or without creep	232A
		(b) Clearance over cultivated field	
(Feb 17, 66)	122 *61/77*	(a) Definition of "promptly deenergized"	242A, Table 15, note 3
		(b) Deflection, unbalanced pull: should dissimilar ice loadings be considered?	261A6b
		(c) Crossing of power and communications lines	261D5
(Mar 7, 66)	123 *61/77*	Minimum clearance for spacer cable on messenger under heavy loading conditions	232
(Feb 22, 67)	124 *61/77*	Substation conductor clearance to building	114A1 and 234C4(a)
(Dec 23, 66)	125 *61/77*	Distinction between urban and rural	232A
(Feb 1, 68)	126 *61/77*	(a) Grounded neutral clearance to ground	230D, 232A Table 1, 232B
		(b) Ground neutral clearance to building	230D 234C4
		(c) Spaces and ways accessible to pedestrians	232A, Table 1
(Feb 28, 68)	127 *61/77*	Clearance between supply conductors, communication and CATV cables	238
(Apr 15, 68)	128 *61/77*	Meaning of "closely latticed poles or towers"	280A2(b)
	129 *through* 150	Numbers not assigned	

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Nov 15, 73)	151 *61/77*	Crossarm; Definition and status of integrated conductor support assemblies	261D
	152	Number not assigned	
(Dec 17, 73)	153 *61/77*	Nonmetallic pipe protection for risers	239C
(Jan 29, 74)	154 *61/77*	Clearances from buildings; Meaning of voltage	234C, Table 4
(Feb 5, 74)	155 *61/77*	Cable burial depth	353D
(Oct 17, 73)	156 *61/77*	Clearances from buildings; Meaning of voltage	234C, Table 4
(Feb 25, 74)	157 *61/77*	Antenna conflicts	Def.
(Dec 18, 72)	158 *61/77*	Clearance for line	234
(Apr 11, 74)	159 *61/77*	Clearances applicable to building construction site	232A
(May 14, 74)	160 *61/77*	Clearances — Wires on different supports, voltages 50 kV; also above ground or rails	233B2 232B2
(May 15, 74)	161 *61/77*	Height of fence	110A
(May 17, 74)	162 *61/77*	Definition of "constant potential" in grades of construction	242, Table 15
(May 21, 74)	163 *61/77*	Grounding of guys	282H
(May 29, 74)	164 *61/77*	"Immediate vicinity of a fault" as applied to damage withstanding capability of underground cable	330D
(Aug 22, 74)	165 *61/77*	Basic clearance — Wires above ground; "Accessible to pedestrians only"	232A
(Nov 1, 74)	166 *61/77*	Grounded neutral; Definition of 4 grounds per mile	97C1(c)

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Oct 15, 74)	**167** *61/77*	Compact transmission lines, status with respect to NESC 1973 edition, especially when jacking for hot line maintenance is taken into account	235A, Table 6
(Dec 11, 74)	**168** *61/77*	Clearance of power lines above sprinkler heads over farm orchard	232A, Table 1
(Dec 12, 74)	**169** *61/77*	Clearance, CATV cable above vacant lot	232A
(Feb 25, 75)	**170** *61/77*	Direct buried cable near swimming pool	351C1
(Mar 19, 75)	**171** *61/77*	Communication cable burial depth	353D
(May 21, 75)	**172** *61/77*	Clearance to building	234C4
(May 29, 75)	**173** *61/77*	Clearance, line to adjacent steel structure; Voltage definition	234B1 234C, Table 4
(Sept 29, 75)	**174** *61/77*	Clearance to building and guarding	234C4
(Sept 30, 75)	**175** *61/77*	Clearance between conductors in substations	235A, Table 6
(Dec 15, 75)	**176** *61/77*	Climbing space	236
(Dec 18, 75)	**177** *61/77*	Fence height	110A
(Jan 22, 76)	**178** *61/77*	Clearance to ground at high conductor temperature	232
(Feb 5, 76)	**179** *61/77*	Guy guards; meaning of "traffic"	282E
(Feb 3, 76)	**180** *61/77*	Construction grade of line; Effect of additional loading	261A4
(Mar 8, 76)	**181** *61/77*	Application of K-factors	251 252
(June 1, 76)	**182** *61/77*	Guy guard; Placement on guy in field	282E
(May 17, 76)	**183** *61/77*	Fiberglass rod; Acceptability in lieu of steel	282B, 282D
(June 10, 76)	**184** *61/77*	Allowable pole loading	261A1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(June 29, 76)	185 *61/77*	Unfenced, pad-mounted equipment; Meaning of two procedures	381G
(Oct 21, 76)	186 *61/77*	Clearance to building	232A 234C4(a) 234C1(a)
(Mar 29, 77)	187 *61/77*	Clearance above ground in orchard	232A, Table 1
(June 24, 77)	188 *61/77*	Guy guards in relation to definition of "guarded"	282E
(Feb 18, 77)	189 *61/77*	Clearance of neutral to building	234C4a(1) Table 4
(May 23, 77)	190 *61/77*	(a) Requirements for disconnect switch (b) Energized switch blade	173C, 170, 171
(Mar 23, 77)	191 *61/77*	Foundation strength for steel pole structure	261B
(Mar 24, 77)	192 *61/77*	Clearance to energized parts in substation	124
(Apr 18, 77)	193 *61/77*	Outside substation (a) vertical clearance to live parts (b) definition of voltage	114A; 114C1
(May 9, 77)	194 *61/77*	Intent of term "proximate facilities"	212
(May 10, 77)	195 *61/77*	Clearance required for communication conductors over roads.	232A
(July 14, 77)	196 *61/77*	Neutral grounding for buried concentric neutral cable with semiconducting sheath	350F
(July 1, 77)	197 *61/77*	Clearance to roads; high temperature transmission lines	232B2d(2)
(July 12, 77)	198 *61/77*	Clearance to chimney; meaning of attachments	234C4(a)
(July 14, 77)	199 *61/77*	Meaning of "readily climbable"	280A1b
(July 8, 77)	200 *61/77*	Application of extreme wind loading	250C

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(July 27, 77)	201 *61/77*	(a) Implication of retro-fitting (b) Fence height	102B 110A
(Aug 23, 77)	202 *61/77*	Supply cable requirements, OR vs AND	230C
(Aug 25, 77)	203 *61/77*	Increased clearances for long span or sag — applicability to horizontal clearances	234F2c and d
(Sept 13, 77)	204 *61/77*	Grounding — pole butt plates	94B4b
(Sept 3, 77)	205 *61/77*	Electrostatic effects	234F1c
(Sept 15, 77)	206 *61/77*	CATV cable clearance	232A, Table 1
(Oct 3, 77)	207 *61/77*	Transmission line clearances Meaning of "maximum conductor temperature for which the line is designed to operate" with respect to designed for, but unplanned contingencies	232B2d
(Oct 31, 77)	208 *61/77*	Neutral clearance to bridge	234D1, Table 234-2
(Oct 31, 77)	209 *61/77*	Vertical clearance at supports	235C1, Table 235-5
(Oct 31, 77)	210 *61/77*	Clearance from line conductors at supports (a) Meaning of minimum clearance (b) Clarification of "voltages are between conductors" (c) Reason for additional clearances on joint poles	235E1, Table 235-6
(Nov 4, 77)	211 *61/77*	(a) Omission of fiber stress calculation point formerly stated in 6th Edition, 261A4a,b	261A2b,c

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		(b) Meaning of "other supported facilities"	260C
(Nov 11, 77)	212 *61/77*	Grounding of supporting structures	215C1
(Nov 26, 77)	213 *78/80*	Load on structure or foundation; application of overload capacity factors	260C
(Nov 28, 77)	214 *78/80*	Application of overload capacity factor unguyed and guyed angle factors	261A2d
(Dec 12, 77)	215 *78/80*	Meaning of "reconstructions"	202B1
(Dec 21, 77)	216 *78/80*	Load on foundation, application of overload capacity factors	261B
(Jan 3, 78)	217 *78/80*	Guy connection and placement of insulators	282C; 283B
(Jan 5, 78)	218 *78/80*	Conductor clearance from guy of parallel line structure	235E
(Jan 23, 78)	219 *78/80*	Reconstruction definition. Does line voltage change from 7.2/12.5 kV to 14.4/24.9 kV require compliance with 1977 Edition?	202B
(Jan 18, 78)	220 *78/80*	Reconstruction definition. Does line voltage change from 7.2/12.5 kV to 14.4/24.9 kV require compliance with 1977 Edition clearances?	202B
(Jan 25, 78)	221 *78/80*	Horizontal clearance under wind loading. One or both conductors under maximum swing angle?	233B1; 233B1b
(Jan 25, 78)	222 *78/80*	Horizontal clearance between line conductors	235B1

Request Date	*IR Number*	*Subject*	*Rule*
		2 circuits 115 kV and 230 kV on same support	
(Feb 7, 78)	223 *78/80*	Service drops — clearance to ground	232, Table 232-1
(Jan 26, 78)	224 *78/80*	Clearance over residential driveways	232, Table 232-1
(Feb 14, 78)	225 *78/80*	Clearance of primary riser termination from communication cable	Table 232-1 239F
(Feb 23, 78)	226 *78/80*	Clearance in pole to building spans between communication and electric supply service drops	235C2b
(Feb 23, 78)	227 *78/80*	(a) Magnitude limit of ground fault storage (b) Intent of "effectively grounded"	215C1
(Feb 28, 78)	228 *78/80*	(a) Centerline spacing for adequate clearance between parallel lines on separate structures (b) Use of switching surge factor in above case	233B1 235B2 235B3
(Mar 6, 78)	229 *78/80*	Clearance to bridle guy	235E
(Apr 5, 78)	230 *78/80*	Definition of reconstruction	202B
(Apr 6, 78)	231 *78/80*	Example requested	231B1a
(Apr 6, 78)	232 *78/80*	Horizontal and vertical clearances; effect of high temperature	234
(Apr 11, 78)	233 *78/80*	2: Does the exception apply to horizontal clearances or both 5: Vertical separation of conductors of same circuit	234B Table 235-5 Table 235-5
(July 21, 78)	234 *78/80*	Use of line conductor as grounding point in	92B1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		place of common point on wye-connected secondary	
(July 27, 78)	235 *78/80*	Use of double guy insulators in down guy	283B2b
(Sept 19, 78)	236 *78/80*	Insulator in down guy	283A3
(Sept 19, 78)	237 *78/80*	Rationale involved in calculating basic clearances shown in Table 234-3	234E1, Table 234-3
(Sept 25, 78)	238 *78/80*	Governing clearance to building — horizontal or vertical	234C4a
(Oct 31, 78)	239 *78/80*	Calculation of support load at angle in line	252B3
(May 24, 78)	240 *78/80*	Floor drains for transformer installations. Meaning of "outside the building"	153B1
(Nov 30, 78)	241 *78/80*	Definition of "large"; meaning of "segregated"	153A2
(Jan 2 & 11, 79)	242 *78/80*	Interpretation of clearance measurement; communication to power conductors	235C1; 238B Tables 235-5 and 238-1
(Jan 17, 79)	243 *78/80*	New installations, reconstruction extensions; status of existing installation if cable TV line is added	202B
(Jan 17, 79)	244 *78/80*	Definition of unsealed jars and tanks	141
(Feb 13, 79)	245 *78/80*	Overload capacity factors for composite components	261
(Feb 5, 79)	246 *78/80*	Frequency of inspection for service drops	214A2
(Mar 13, 79)	247 *78/80*	Service drop conductors (a) Minimum height in span	232, Table 232-1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		(b) Minimum height of point of attachment	
(Mar 15, 79)	248 *78/80*	Grain bin clearance (building vs tank) 115 kV line	234C, Table 234-1
(Mar 23, 79)	249 *78/80*	Spaces or ways accessible to pedestrians only; service drop clearance	232, Table 232-1
(Mar 27, 79)	250 *78/80*	Application of an overload capacity factor of 4.0 to the vertical load on an eccentric loaded column	261A2b
(June 1, 79)	251 *78/80*	Clearance requirements for building in transit	234
(June 25, 79)	252 *78/80*	Clearance of service drop	238D
(July 11, 79)	253 *78/80*	Grounding of rolling metal gate of a substation	92E
(Aug 29, 79)	254 *78/80*	(a) Distinction between rule, recommendation, Note exception	283B1
		(b) Requirements for guy insulator	
(Oct 15, 79)	255 *78/80*	Clearance for CATV amplifier power feed	220B2; 235E; 235G
(Nov 2, 79)	256 *78/80*	Effect of trees on minimum clearances	232, Table 232-1
(Nov 2, 79)	257 *78/80*	Disconnecting provision acceptability	173B
(Nov 6, 79)	258 *78/80*	Location of padmounted equipment	231B Section 38
(Nov 7, 79)	259 *78/80*	(a) Steel tower and footings — bonding requirements	94A3
		(b) Acceptability as ground electrode of 20 ft steel wire wrapped around rebar cage	94B6
		(c) Does 95A3 apply only to buildings or are steel supporting struc-	95A3

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		tures included also?	
(Nov 8, 79)	260 *78/80*	Determination of diagonal clearance	234 Fig 234-1; 234A3
(Oct 23, 79)	261 *78/80*	Conductor clearance for line near recreational water area	232, Table 232-1
(Nov 12, 79)	262 *78/80*	Conductor clearance to swimming pool slide	234E1 Table 234-3
(Jan 4, 80)	263 *78/80*	Acceptability of steel wire wrapped around reinforcing bar cage as grounding electrode	94A3
(Jan 21, 80)	264 *78/80*	Horizontal clearance between wires in a triangular configuration	235 Table 235-5
(Mar 3, 80)	265 *78/80*	Guarding requirement applicability Clearance to building	234C4b
(Mar 7, 80)	266 *78/80*	Ice loading computation on noncircular cross-section conductor	251A2
(Mar 20, 80)	267 *78/80*	(a) Voltage between conductors	235C
		(b) Ground required at distribution transformer	94B4a
(May 16, 80)	268 *78/80*	(a) Is base of epoxy extension arm noncurrent carrying?	238A, B Table 238-1
		(b) Spacing required between noncurrent carrying parts of adjacent supply and communication circuits	
(May 21, 80)	269 *78/80*	Communication cable clearance to ground	232A, Table 232-1
(June 25, 80)	270 *78/80*	Clearance over snow covered ground	232A
(June 13, 80) (July 16, 80)	271 *78/80*	Warning signs on tubular steel poles	280A1b
(July 14, 80)	272 *78/80*	Grade of construction for conductors/structure	242

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(July 24, 80)	273 *78/80*	Use of steel-clad copper wire as neutral conductor on direct buried, bare concentric neutral cable	332
(July 25, 80)	274 *78/80*	Clearance to conveyor structure	234C
(Aug 6, 80)	275 *78/80*	Clearance to ground for equipment on structures — not above a roadway	286E
(Aug 18, 80)	276 *78/80*	Meaning to be attached to "prevent" in connection with equipment enclosures	110A
(Aug 25, 80)	277 *78/80*	Ground clearance for service	232 Table 232-1
(Aug 25, 80)	278 *78/80*	Installation of submarine cable on islands in connection with aids to navigation	330
(Sept 4, 80)	279 *78/80*	Clearance for aerial secondary and service conductors with an insulated neutral	230C
(Sept 9, 80)	280 *78/80*	Neutral separation on distribution transformer poles to minimize dc flow	96A
(Oct 14, 80)	281 *78/80*	Clearances to noncurrent-carrying metal parts clearance for CATV	235
(Oct 17, 80)	282 *78/80*	Clearance for oversize haulage trucks	232A
(Dec 8, 80)	283 *78/80*	Clearance at crossing between transmission line and rigid bus structure	124A Table 2
(Jan 13, 81)	284 *81/84*	Clearance for sailboating	232A, Table 232-1
(Dec 19, 80)	285 *81/84*	Location of high longitudinal strength struc-	261A4a

Request Date	*IR Number*	*Subject*	*Rule*
		tures with respect to higher-grade section in line of lower-grade construction	
(Jan 19, 81)	**286** *81/84*	Spacing between communication cables of power and communication utilities when located below supply lines	235C1, Table 235-5
(Jan 19, 81)	**287** *81/84*	Objectionable voltages, neutral/ground	92D
(Jan 23, 81)	**288** *81/84*	Clearance from communication cable to tap & drip loop of supply cable	235C; 235D
(Jan 30, 81)	**289** *81/84*	Clarification of clearance at crossing	233A, Fig 233-1
(Jan 30, 81)	**290** *81/84*	Conductor clearance; applicability of catenary curve considerations	232A; 233A1; 234A
(Feb 2, 81)	**291** *81/84*	(a) Connection of fence grounding conductor to fence posts	93C
		(b) Extension of existing 6 ft fence	013; 110A; IR 177; 201b
(Mar 4, 81) (Mar 10, 81)	**292** *81/84*	Clearance required when second cable is added;	013B2
		Communication cable additional clearance; Reduced clearance to guys	232B, Table 232-1
(Apr 7, 81)	**293** *81/84*	Is tagging of remote *close/trip* control required if device is otherwise rendered inoperable	423C
(Mar 25, 81)	**294** *81/84*	4.8 kV ungrounded delta, change from grade C to B, believed inadvertent when footnote 7 changed	242, Table 242-1 Footnote 7 Table 15 (73 Ed.)
(May 6, 81)	**295**	Wye distribution system	92B2; 215B

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
	81/84	with neutral omitted in one feed	
(May 27, 81)	296 *81/84*	Replacement of structures strength and clearance required in completed work	013B
(Jan 12, 81)	297 *81/84*	AIEE Std 41, March 1930 (ASA C29a-1930) appears to have been superseded by ANSI C29.1-1976 Electric Power Insulator, Test	273
(June 1, 81)	298 *81/84*	Grounding of lamp posts	92D; 93; 215C1; 314B
(June 15, 81)	299 *81/84*	(a) Connection of two items to same grounding electrode	97A
		(b) Connection of arrester ground to grounded neutral	97C1b
		(c) Reasons for prohibiting solid interconnection of arrester grounding conductor and secondary grounding conductors	97
(June 25, 81)	300 *81/84*	(a) Guarding by fence enclosure	110A
		(b) Applicability of clearances: i) within fence enclosure; ii) within vault	124A, Table 2
(June 29, 81)	301 *81/84*	Depth of burial in rock and acceptable supplemental protection	353D2
(July 21, 81)	302 *81/84*	At crossing, Grade C Construction Definition of crossing	261A2, Table 261-3
(Aug 20, 81)	303 *81/84*	Protective covering requirements for power conductors passing through communications space	239A

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Aug 24, 81)	304 *81/84*	Minimum allowable clearance	232B2b; 232B2c(1)
(Oct 6, 81)	305 *81/84*	Clearance to tanks containing flammables	234C, Table 234-1
(Dec 8, 81)	306 *81/84*	Clearance for underbuild	233C1, Table 233-1
(Dec 10, 81)	307 *81/84*	Guard over ground lead	93D1
(Dec 16, 81)	308 *81/84*	Clearance over waterways	232A, Table 232-1
(Dec 21, 81)	309 *81/84*	Clearance to building	234C4 (73 Ed.)
(Nov 11, 81)	310 *81/84*	Vertical clearance between line and, at supports	235C, Table 235-5
(Nov 12, 81)	311 *81/84*	Clearance to street lighting brackets	238B, Table 238-1
(Jan 8, 82)	312 *81/84*	Clearance from supply equipment to CATV cable	239F1
(Feb 23, 82)	313 *81/84*	Clearance to flag pole with flag	234C2, Table 234-1
(Feb 23, 82)	314 *81/84*	(a) Thickness of pole butt plates	94B4b
		(b) Acceptability of #6 copper wire as a grounding electrode	97C
(Mar 11, 82)	315 *81/84*	Guarding of Supporting Structure — Potentially exposed to "abrasion by traffic"	280A2(A)
(Mar 18, 82)	316 *81/84*	Classification of below grade structure	323
(Mar 17, 82)	317 *81/84*	Overload capacity factor for guyed pole used as a column	261A2e, Table 261-3
(Mar 18, 82)	318 *81/84*	Door latch operation from inside requirement applicability to hinged-door cover on below grade structure	323F2
(Mar 26, 82)	319 *81/84*	Clearance to front of control board	125A3, Table 125-1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Apr 1, 82)	320 *81/84*	Adequacy of protection against mechanical damage	161
(Apr 5, 82)	321 *81/84*	Grade of construction for joint use with 7.2 kV open wire above communication circuits	242, Table 242-1
(Apr 29, 82)	322 *81/84*	Clearance from bottom of wave trap supporting insulator to ground	124A1, Table 124-1 Footnote 1
(May 18, 82)	323 *81/84*	Clearance to building	233A3; 234C3, Table 234-1 Figure 234-1
(June 4, 82)	324 *81/84*	Clearance of structure from roadway	231B1
(June 8, 82)	325 *81/84*	2nd Barrier requirements — pad mounted equipment	381G
(June 9, 82)	326 *81/84*	Clearance of neutrals and guys from other supporting structures	234B
(June 30, 82)	327 *81/84*	(a) Classification if adequate ventilation is provided (b) Is interlocking required	127A1
(Aug 6, 82)	328 *81/84*	Clearance from 34.5 kV supply conductor to street light bracket	238, Table 238-1
(Aug 20, 82)	329 *81/84*	Clearance between metal sheathed supply cable and communications	238, Table 238-1 Note 1
(Aug 19, 82)	330 *81/84*	Clearance between anchor guy and 8.7 kV (1977 Ed.)	235E1, Table 235-6
(Aug 25, 82)	331 *81/84*	(a) Effect of customer service entrance grounds on pole butt plate restrictions at transformer locations (b) Reasons for 2 pole butt plates to count	94B4a&b

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		as one made electrode, such as a driven rod	
(Aug 26, 82)	332 *81/84*	Tension (initial or final) during extreme wind loading calculations	250; 251
(Oct 1, 82)	333 *81/84*	Does transformer tank grounding qualify for reduced (30 inch) clearance	238B, Table 238-1
(Oct 21, 82)	334 *81/84*	Definition of "supplemental protection"	353D2c
(Oct 25, 82)	335 *81/84*	Overload factors: wire tension load vs. wind or weight load	261A, Table 261-1,2,3; 261B, Table 261-4; 261C, Table 261-5; 262A, Table 262-1; 262C, Table 262-3
(Jan 25, 83)	336 *81/84*	Application of "when installed" and "at replacement" values	261A, Table 261-3
(Feb 17, 83)	337 *81/84*	(a) Clearance to ground measured diagonally (b) Clearance, neutral to ground (c) Reason for 14 ft. minimum for neutrals	232; 230E1 & 2, Table 232-1 Item 10
(Mar 5, 83)	338 *81/84*	(a) Grounds at transformer locations (b) Adequacy of grounding	94B4 96A
	339 *81/84*	Number not used (Request withdrawn)	
(Apr 28, 83)	340 *81/84*	Effective grounding of guys; suitability of proposed configurations	215C; 92C2; 93D1 & D3
(May 2, 83)	341 *81/84*	Grounding of fully insulated, jacketed, concentric cable	96A3 97C
(June 16, 83)	342 *81/84*	Pole clearance for vertical jumper to recloser terminal	239D2, Table 239-2
(July 26, 83)	343 *81/84*	Cable supported by pipeline structure	230C; 232A; 234D1; 235E1

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(July 29, 83)	344 *81/84*	Original construction over farmland; clearance to ground for reconstructed spans	013B; 232
(July 23, 83)	345 *81/84*	Energized wire passing through trees, serving as a head guy	215C2; 281A
(July 29, 83)	346 *81/84*	Meaning of "crossings"	261H3a
(Aug 29, 83)	347 *81/84*	Guy Strand Insulation for corrosion reduction	283C
(Sept 27, 83)	348 *81/84*	Structure load stress vs. allowable stress basis (yield, proportionately, AISC allowable)	261A, Tables 261-1 & 2
(Oct 13, 83)	349 *81/84*	(a) Purpose of tree trimming (b) Spacing of oil-filled transformer from building	281; 152A2
(Nov 15, 83)	350 *81/84*	Guy marker requirements in case of 2 guys on one anchor	282E
(Nov 30, 83)	351 *81/84*	Service drop line conductor in aerial clamp saddle; clearance to pole	235E1, Table 235-6
(Dec 21, 83)	352 *81/84*	Clearance over cultivated land for 200° operating temperature	232B1a; 232B1d
(Dec 27, 83)	353 *81/84*	Clarification of line conductor clearance to guy	235E1 & 3, 233A3, 233C3
(Nov 3, 83)	354 *81/84*	Unlabeled, empty duct leading to live parts	370B, 373
(Jan 27, 84)	355 *81/84*	Pole mounted regulator bank with platform; clearance required for workmen on platform	124A1, 286C & D, 422B
(Feb 14, 84)	356 *81/84*	Bonding requirements for adjacent pad-mounted supply equip-	93C7

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
		ment and communication circuit pedestals in an underground system	
(Feb 10, 84)	357 *81/84*	Clarification of readily climbable with respect to a particular configuration	280A1b, 280A2
(Mar 13, 84)	358 *81/84*	Applicability of requirement for GF Indication System	354E2
(Mar 22, 84)	359 *81/84*	Minimum mid-span separation between a supply conductor < 750 V and a communication conductor — for spans over 150 ft.,	235C2b(3), 235C2b(1)a
(June 8, 84)	360 *81/84*	Additional clearance requirements	232B, 232B2c & d
(Aug 28, 84)	361 *81/84*	Clearance of conductors over a residential driveway	232A, Table 232-1
(Sept 10, 84)	362 *81/84*	Pole clearances for CATV system cable	235C1, Table 5
(Sept 14, 84)	363 *81/84*	(a) Which equipment is to be grounded? (b) What is well defined area? (c) What is adequate grounding?	238B, Table 1, Footnote 1
(Oct 11, 84)	364 *81/84*	Concentric neutral UG cable; Placement of separate grounding conductor (for cable corrosion protection).	92B3
(Oct 29, 84)	365 *81/84*	Clearance between line conductor and anchor guys	235E1, Table 6 235E3a, 235B3a, b
(Nov 1, 84)	366 *81/84*	Grounding of insulating jacketed cable neutral	92B2b(3)

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(Nov 14, 84)	**367** *84/87*	Clearance required for sailboats in an inlet that has an upstream restriction on height	232A, Table 232-1
(Dec 5, 84)	**368** *84/87*	Classification, for clearance purposes, of outdoor advertising signs (billboards) that have catwalks and that are with or without ladders	234C, Table 234-1
(Jan 15, 85)	**369** *84/87*	Relocation of line	013B1
(Mar 1, 85)	**370** *84/87*	Underbuilding on existing structures	013B
(Feb 27, 85)	**371** *84/87*	Reduced vertical clearance requirements	232A, Table 232-1
(Mar 14, 85)	**372** *84/85*	Calculating clearances	235C
(Mar 14, 85)	**373** *84/87*	Provision of adequate bonding	354E4
(Mar 25, 85)	**374** *84/87*	Application of 238 to service equipment and supply equipment	238
(Apr 3, 85)	**375** *84/87*	Reduction of horizontal clearance	234B
(Apr 4, 85)	**376** *84/87*	Crossarm length and longitudinal strength	261D, Table 261-6
(Apr 8, 85)	**377** *84/87*	Accessibility to pedestrians	234C3, Table 234-1
(Apr 18, 85)	**378** *84/87*	Vertical clearance between communication and supply lines	235C
(May 8, 85)	**379** *84/87*	Required strength of wood poles at replacement	261A2b, Table 261-3
(Aug 27, 85)	**380** *84/87*	Insulation of workers using buckets and aerial equipment	422B
(Dec 13, 85)	**381** *84/87*	Clearance above fences and walls	234C, Table 234-1
(Feb 10, 86)	**383** *84/87*	Clearance requirements in tunnels or on bridges	234C,D
(Feb 26, 86)	**384**	Submarine cable burial	353D

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
	84/87	depth and grounding requirements	
(Mar 7, 86)	**385** *84/87*	Definition of "limited access highway"	Table 242-1
(Mar 26, 86)	**386** *84/87*	Minimum cross-section dimensions of wood crossarms	261D, Table 261-1
(Apr 22, 86)	**387** *84/87*	Vertical clearance between supply conductor and communication cable attachment hardware	238B
(Apr 28, 86)	**388** *84/87*	Spacing required between noncurrent-carrying parts of adjacent supply and communication circuits	238A,B, Table 238-1
(May 1, 86)	**389** *84/87*	Crossarm bending stress, overload capacity factors, and vertical clearance	261, Table 261-2
(May 7, 86)	**390** *84/87*	Bonding of grounds and dimensions of grounding rods	99C
(July 18, 86)	**391** *84/87*	Grade of construction for colinear and at crossing conductors	Table 242-1
(July 11, 86)	**392** *84/87*	Drip loops and slack cables from an aerially-mounted transformer are parts of the span	235C2b(1)(a)
(Aug 18, 86)	**393** *84/86*	Vertical clearance between supply and communication lines	235C2b(1)(a)
(Sept 26, 86)	**394** *84/87*	Spacing of ground connections in circuits without a neutral	96A3
(Oct 26, 86)	**395** *84/87*	Working load of insulator must not exceed 50% of ultimate strength	277
(Oct 30, 86)	**396** *84/86*	Barriers for pad-mounted equipment	381G
(Nov 26, 86)	**397**	Climbability of guyed	280A1b

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
	84/87	dead end poles	
(Nov 26, 86)	**398** *84/87*	Guying of joint-use poles	261C2
(Jan 30, 87)	**399** *84/87*	Horizontal clearance to building or its attachments	234C4(a)
(Mar 13, 87)	**400** *84/87*	Surfaces used to determine horizontal clearance between line conductors	235B1
(Apr 7, 87)	**401** *84/87*	Meanings of "should" and "shall"	350E
(Apr 8, 87)	**402** *84/87*	Tagging energized circuits by SCADA systems	421G
(May 7, 87)	**403** *84/87*	Communication line requirements applied to fiber optic cable systems	Definitions
(Apr 28, 87)	**404** *84/87*	Application of Rules 011 and 012 and Parts 1 and 2 to a generation and transmission utility serving a distribution utility	011, 012
(Apr 28, 87)	**405** *84/87*	Application of Rules 011 and 012 and Part 4 to a generation and transmission utility notified of an accident on a served distribution utility system	011, 012
(Apr 28, 87)	**406** *84/87*	Application of Rules 011 and 012 and Part 4 to off-duty utility personnel	011, 012
(Apr 22, 87)	**407** *84/87*	Size of grounding conductor required for 795 kcmil aluminum neutral	93C2
(June 26, 87)	**408** *84/87*	Manual stopping devices	130B
(June 11, 87)	**409** *84/87*	Clearances on roofs	234C4

Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
(July 22, 87)	**410** *84/87*	Length of ground required to be in contact with earth	94B2c
(Aug 7, 87)	**411** *84/87*	Height of gap permitted between ground and bottom of fence	110A
(Aug 6, 87)	**412** *84/87*	Maximum permissible resistance to ground for two electrodes connected in parallel	96A2
(Aug 31, 87)	**413** *84/87*	Crossing structure as related to messenger and grounding conductors	92C3
(Oct 12, 87)	**414** *84/87*	Alternative to 8 ft driven ground rod	94B
(Oct 12, 87)	**415** *84/87*	Climbability of pipe risers	280A1b

Introduction to the National Electrical Safety Code

Introduction (Sections 1-9)

011, 012

Application of Rules 011 and 012 and Parts 1 and 2 to a generation and transmission utility serving a distribution utility

REQUEST (Apr 28, 87) IR 404

It has been alleged that the NESC requires a utility to be responsible for protection equipment and settings for facilities served by the utility. We are unable to find NESC rules that so require. Please consider the following.

If a generation and transmission utility only owns, maintains, or operates an incoming transmission line, high-side fuses and switches, power transformer, and metering in a substation; and if a distribution utility owns and operates the low-side bus, SCADA, circuit protection and outgoing feeders; and the G & T has no contractual responsibility for the low-side equipment design, placement, operation, settings, maintenance or any other similar function; does the NESC require the G & T to ascertain, design, review, approve, maintain, operate, or perform any other function for the following facilities owned and operated by the distribution utility:

(a) the low-side protection equipment?

(b) the low-side protection equipment settings?

(c) the outgoing distribution lines and equipment?

(d) protection equipment out on a distribution line several miles from the station?

(e) line step-down transformers in a distribution line several miles from the station?

INTERPRETATION (Feb 17, 88)

Rule 011, Scope, states that "These rules cover…lines, equipment and associated work practices employed by an electric supply…utility …in the exercise of its function as a utility." A "utility" is defined as an "organization responsible for the installation, operation or maintenance of electric supply…systems." This "responsibility" could only be the result of direct ownership or a contractual agreement for operation/

maintenance of a facilty. The NESC is silent on how this responsibility falls upon the utility.

In the particular case of IR 404, the transmission utility has no contractual responsibilities with respect to the installation, operation or maintenance of the facilities owned by the distribution utility. Therefore, there is no requirement in the NESC that assigns such "responsibilities" to the transmission utility. The answer is "no" to questions a through e.

* * * *

011, 012

Application of Rules 011 and 012, and Part 4 to a generation and transmission utility notified of an accident on a served distribution utility system

REQUEST (Apr 28, 87) IR 405

Please consider the following. A generation and transmission utility serves a distribution utility. The G & T maintains the high-side fuses, metering, and transformer in a substation but has no control (cr other function) over the low-side bus, protection equipment, switching equipment, or outgoing lines. The distribution utility has SCADA communication with the low-side facilities, but the G & T does not.

The distribution utility can remotely control individual outgoing feeders with its SCADA system, without affecting other feeders. The G & T does not have remote control over service to this substation; it can only interrupt the transmission circuit that feeds several substations. The G & T is notified by law enforcement authorities of an accident on a distribution line and informs the authorities that the distribution facilities are controlled by the distribution utility; the authorities then contact the distribution utility.

It has been alleged that the NESC applies to the G & T actions, but we are unable to find any applicable rule.

(1) Do NESC rules apply to the action of the G & T upon notification of an accident on a distribution utility line?

(2) Do NESC rules apply to the action of the distribution utility upon notification of an accident on one of its lines?

(3) Does the NESC require any action on the part of the G & T other than telling the authorities which organization controls the distribution circuit involved?

(4) If the answer to (1), (2), or (3) above is yes, please cite the applicable rules.

INTERPRETATION (Feb 17, 88)

The answer to questions (1) and (3) is "no." Regarding question (2), the rules of the NESC apply to the controlling utility regardless of whether an accident has occurred; there are no specific rules concerning actions in the event of an accident on the utility-controlled facilities.

* * * *

011, 012

Application of Rules 011 and 012, and Part 4 to off-duty utility personnel

REQUEST (Apr 28, 87) IR 406

It has been alleged that utility employees are on duty 24 hours a day and that the rules of the NESC apply to their actions throughout that time, regardless of whether they are on company business or are out with their families and friends during nonworking hours. We have been unable to find NESC rules to that effect. Please consider the following and help us if we have missed something.

We understand that the NESC Work Rules apply to the responsibilities of utilities and their employees when such employees are on duty and either personally engaged in the operation and maintenance of electric supply lines or near others performing those functions.

Our questions concern responsibilities, if any, that the NESC requires of either (a) a utility or (b) its employees when such employees are not on duty, in particular when such employees (a meter reader, a truck driver and a line worker) are with their families, in different cars, and by chance happen to ride by the site of an accidental electrical contact on a Sunday afternoon during the time that the victim is still on an aerial ladder and in contact with, or in the vicinity of, a 7200 V conductor.

(1) Are utility employees considered by the NESC to be on-duty 24 hours a day, 7 days a week?

(2) Does the NESC apply in any manner to

(a) an off-duty line worker?
(b) an off-duty meter reader?
(c) an off-duty truck driver?
(d) the utility by which (a), (b), or (c) is employed?

(3) Does it make any difference in the answer to either (1) or (2) above if the referenced workers are employed by a generation and transmission utility and the distribution facilities contacted by the

accident victim are owned, operated and maintained by a distribution utility that is served by the G & T?

(4) Does the NESC require one utility that serves several smaller utilities either directly or through an intermediary G & T organization to train or otherwise provide information to

(a) a meter reader,
(b) a truck driver, or
(c) a line worker

so that such an employee could identify the ownership of distribution facilities that he might pass, on his own time and in his private vehicle driving outside the territory directly served at distribution level by the employer company? Does Rule 410B1, Rule 411, or any other rule apply to the employer responsibility? Does Rule 420B1, 2, 3, or 4, 420C, 420D, 420E, or any other rule apply to employee action(s), or lack thereof, outside of working hours?

(5) If the answer to any of the above is "yes" please cite the rules that apply.

INTERPRETATION (Feb 17, 1988)

Questions 1, 2, and 3

The NESC covers employees working on a utility system performing functions assigned by their employers; it does not cover such persons in other activities.

Question 4

The NESC only requires employers to provide employees with appropriate means to identify facilities with which they are assigned to work.

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012 See 234C **IR 381**

012 See 350E **IR 401**

012 See 353D **IR 384**

013B

Underbuilding on existing structures

REQUEST (Mar 1, 85) IR 370

Section 1 of the Introduction to the NESC, paragraph 013B1 and 013B2, states the following:

1. Existing installations including maintenance replacements, which comply with prior editions of the code, need not be modified to comply with these rules except as may be required for safety reasons by the administrative authority.

2. Where conductors or equipment are added, altered, or replaced on an existing structure, the structure or the facilities on the structure need not be modified or replaced if the resulting installation will be in compliance with the rules that were in effect at the time of the original installation.

Through the years 1967 to 1976, a company constructed many miles of 33 kV transmission lines designed for either 10 or 30, 7.2/12.5 kV underbuild.

These lines were outside engineered and profiled, approved by REA, and constructed prior to the 1977 NESC change regarding increased ground clearance requirements.

Since the majority of these transmission lines were constructed on existing rights of ways (offset and parallel to existing distribution lines), it was expressly agreed upon with the affected landowners that the existing distribution lines would eventually be removed and replaced as underbuild circuits on the transmission poles.

Many of the transmission poles do not have enough additional height, even though the profiles allowed for a 1-ft safety factor, to obtain the underbuild clearances to ground for 750 V to 15 kV as required by the new NESC (Table 232-1), which in most cases would be lacking ±1 ft clearance to the phase wire only. The clearances would, however, exceed ±1 ft the clearances required at the time of construction.

Question #1. Can the company construct its underbuild facilities on these existing transmission poles as they were originally designed?

Question #2. Can the company reconductor existing lines constructed prior to the 1977 Code change without exceeding the ground clearances that were in effect at the time the line was originally constructed, if the original structures are utilized?

It is my understanding that if the structure is replaced, it must be replaced tall enough so that the conductors on the adjacent spans would meet the ground clearances required by the existing NESC.

INTERPRETATION (Nov 11, 85)

We do not understand what increased clearances are being referenced; the 1977 edition did not increase clearances over land for 7.2/12.47 kV circuits. The 1977 edition did add a new category called "other lands" to show specific values over farmland, etc. These clearances are, however, not an increase over what had been expected under Rule 200C of previous editions. See IR 13 and IR 31.

The response to IR 13 (Aug 4, 1944) stated "...the clearance values for 'Spaces and Ways Accessible to Pedestrians Only' do not apply inasmuch as fields may be traversed by various types of farm equipment." IR 13 continued with "However, it should not be difficult...to decide on clearances above tillable ground on the basis of the height of the farm equipment that normally is used in the region involved. To this can be added, if necessary, certain additional clearances for the safety of workmen on top of high loads, such as trucks or wagons loaded with hay or sheaves of wheat. Across farmlands that are not normally tilled or are only suitable for grazing, it would be reasonable to provide somewhat less clearance than over crop-producing lands."

The Interpretations Subcommittee again considered this matter in IR 31 (March 28, 1947): "When the code was revised no clearance from the ground over fields was set up because it did not seem practical to determine what vehicles could be expected to pass over such space. The 20 ft clearance specified in rural districts for wires along a right-of-way would seem logical but might be rather low for men on a load of hay or for certain farm machinery. Where there is no possibility of anything but a pedestrian traveling beneath the line, the reduced clearances of sub-note 10 might apply. The 22 ft clearance is over established roads only."

NOTE: The 20 and 22 ft clearances mentioned above refer to the clearance for conductors of 15 000 to 50 000 V between conductors required at that time along rural roads and urban roads, respectively; 22 ft was required over all roads. The 1981 and later editions no longer allow the reduction along rural roads except where it is unlikely that vehicles will be crossing underneath the line. The presumption is that lands accessible to highway vehicles should have vertical clearances that will allow vehicles of heights allowed on highways to traverse them in safety. Such lands do not meet the limitations of access required for the reduced clearances of the "spaces or ways accessible to pedestrians only" category to be applicable. The clearances required for "other lands" are based on a truck height of 14 ft—the maximum height currently allowed over US highways; see the reference heights of Table 232-3.

With respect to the question of adding underbuild, see IR 371. Note that, although either the present or a previous edition may apply, it is the current character of the line and the land and its use that determines the clearance category and resulting clearance requirements to be met within that edition.

When existing facilities receive additions or are otherwise altered, all code requirements must be met by the resulting installation. If a line is reconductored with larger or heavier conductors, the strength of the structures and supporting facilities must, after the change, be such that (a) the existing pole would have met the "at installation" requirements if it had carried the new facilities at the time of its original installation, and (b) the existing pole now meets and will meet during its remaining life the "at replacement" "strength requirements."

013B See 232A IR 371

013B1

Relocation of line

REQUEST (Jan 15, 85) IR 369

We have a single phase line that sets inside the County's 66 ft right-of-way line. But the County got a temporary 100 ft right-of-way easement to do road grading. We were then told to move our line out to the 100 ft easement point until the job was completed (60 days). Upon completion, we moved the line back to the original position (66 ft easement).

Does the line now need to comply with the 1984 edition of the NESC or does it still fall under Section 013B1 as an existing installation and need only comply with the prior edition of the NESC under which it was originally constructed? Specifically, must the basic clearance above ground now be 18 ft to the neutral as opposed to 15 ft to the neutral?

INTERPRETATION (May 6, 85)

It is not clear from the description whether (a) the facilities of the existing line were transferred from the existing poles to poles in a new location adjacent to and offset from the original line, or (b) short horizontal trenches were dug from the existing pole positions to the new positions and the pole butts were kicked over to the new position taking the existing facilities in place with them.

Case (a) is considered to be new construction. When a line is moved by transferring facilities to poles in a different location, whether a temporary or a permanent location, Rules 013A and 014 (last sentence) require the clearances to meet the present code requirements. Likewise, if such a line is subsequently similarly moved to a previous line location, it must meet the requirements in effect at the time of the move; that is, the present requirements.

However, if the existing poles with facilities attached are "butt-kicked" into the parallel line location, as in case (b) above, the edition of the NESC in effect at the time of the original line construction is still applicable. See Rule 013B. Note, however, that clearances may be required to change if the land-use category under the line changes with the move; the "old" code would still be applicable unless the line owner chooses to "upgrade" to the present code requirements, whether either is lesser or greater.

015 See 350E IR 401

Definitions

Communication line requirements applied to fiber optic cable systems

REQUEST (May 7, 87) IR 403

The National Electrical Safety Code (NESC) has provided definition of fiber optic cable—communication and fiber optic cable—supply, as stated on page 52 of the 1987 edition, as follows:

fiber optic cable—communication. A fiber optic cable under the exclusive control of a communication carrier and meeting the requirements for a communication line.

fiber optic cable—supply. A fiber optic cable not under the exclusive control of a communications carrier or not meeting the requirements for a communication line.

Please provide an interpretation of the intent regarding the above definitions as applied to a fiber optic cable system meeting the requirements of a "communications line" (as defined on page 53, 1987 NESC) but, not under the control of a telephone company. For example: Should a third-party attachment of a fiber optic cable to a pole line, jointly used by an electric and telephone company, be considered a supply facility and be required to meet the clearances of a fiber optic cable not under the exclusive control of a telephone company?

Such lines may typically be used by large corporations to provide communication services between building locations that are geographically separated by several miles or more.

This interpretation is being requested in order to assist in categorizing such systems as communications or supply.

INTERPRETATION (Feb 12, 88)

The definition of "communication lines" intentionally includes both public and private signal or communication service. A corporation serving only itself with service through a fiber optic system meeting the definition of fiber optic cable-communication is considered a private communication carrier. As such, it may, by mutual agreement(s), install and maintain such facilities in the communication space on structures owned by public carriers or utilities.

Alternatively, a communication carrier may contract with an electric supply utility for the construction and maintenance of a fiber optic cable in the supply space on overhead structures; the cable would then be considered a fiber optic cable-supply.

92B2b(3)

Grounding of insulating-jacketed cable neutral

REQUEST (Nov 1, 84) IR 366

Recently there has been a trend among electric utilities to install jacketed concentric neutral XLPE underground power cable. Our company has decided to install a non-conducting jacketed 15 kV cable in a PVC conduit system. Joints will be made up and contained in a manhole; thus, the cable system will not be in direct contact with the earth. We presently ground our system at the termination points.

Rule 92B2b3 on page 64 of the 1984 Code states that on cable systems above 750 V the cable shield or neutral system should be grounded at every joint exposed to personnel. However, the rule doesn't differentiate between an exposed neutral system and a non-exposed neutral system. We intend to ensure the integrity of the jacketed cable by inhibiting water penetration by way of installing a product that effectively rejackets over the splice and neutrals. Thus, the neutrals will not be directly exposed to personnel even though personnel, on rare occasions, could be working in proximity to this covered joint. Therefore, would you still recommend that the neutrals be grounded on this type of installation? We would prefer not to install the neutral grounds because it would not be compatible with the re-jacketing product we intend to use.

INTERPRETATION (Mar 25, 85)

Rule 92B2b(3) does not require grounding of splices in manholes if such splices are effectively insulated for the voltage that may appear on them.

92B3

Concentric neutral UG cable; placement of separate grounding conductor (for cable corrosion protection)

REQUEST (Oct 11, 84) IR 364

...have been experiencing severe corrosion of the exposed copper concentric neutral wires on underground cable. Some of this cable has been installed quite recently (3 to 4 years ago).

One method of correcting this problem has been to install a separate grounding conductor along the cable route. This cable has been direct buried in such a way so as to be installed as near as possible to the existing energized cable without coming in contact with it. This separate grounding conductor is then connected to the system neutral at transformer and/or sectionalizing cabinets along the cable route.

The rule in question is found in Section 9, Article 92B3 "Separate Grounding Conductor," found on page 65 of the 1984 edition of the National Electrical Safety Code. This rule states in part: "This grounding conductor shall be located in the same direct burial... as the circuit conductors."

The problem: Are the above mentioned construction practices in compliance with the current version of the National Electrical Safety Code?

INTERPRETATION (Nov 21, 84)

Your letter refers to severe corrosion of exposed copper concentric neutral wires on underground cable. You make the following statement, "One method of correcting this problem has been to install a separate grounding conductor along the cable route." It is not clear in this statement whether you intend "correcting" to mean (1) installing for use as a grounding measure after the concentric neutral wires are damaged, or (2) installing at the time of original cable installation for use as a means of additional supplementary grounding for the purpose of reducing corrosion. While the latter is acceptable under specified circumstances, the former does not meet the requirements of the NESC.

Rule 350B requires cables operating above 600 V to ground to have a continuous shield, sheath, or concentric neutral that is effectively grounded. The separate grounding conductor may be installed and used as an adjunct to the concentric neutral, but not as a substitute for it. It should be noted that Rule 92B3 requires separate grounding conductors to be connected at the source transformer.

92C3

Crossing structure as related to messenger and grounding conductor

REQUEST (Aug 31, 87) IR 413

I'm writing for an interpretation of the 1987 National Electrical Safety Code as it relates to Rule 92C3.

Please provide an interpretation of the meaning of "crossing structure" as related to the messenger and grounding conductor. Is a crossing structure where messengers cross each other, or is it where messengers cross the grounding conductors?

INTERPRETATION

(In process)

93C2

Size of grounding conductor required for 795 kcmil aluminum neutral

REQUEST (Apr 22, 87) IR 407

Your assistance is requested in interpreting the following rules for the circumstances given:

1. **Rule 93C2.** The largest primary conductor on our 12.47GrdY/7.2 and 34.5GrdY/19.9 kV distribution system is 795 kcmil all aluminum. The neutral commonly used along with this phase conductor size is 336.4 kcmil all aluminum, except where the neutral is carried on the same crossarm with the phase conductors. In this case the neutral is also sized at 795 kcmil all aluminum for mechanical reasons. The neutral is grounded at each pole to a made electrode, usually a wire wrap at the butt of the pole. Ground rods or metal plates are to be used at transformer locations. The grounding conductor used for all multi-grounded neutrals, including 795 kcmil aluminum, is #6 soft drawn copper.

Our concern is whether the NESC requires a grounding conductor larger than #6 soft drawn copper for connection to the 795 kcmil all aluminum neutral.

(a) Rule 93C2 refers to "continuous total ampacities." Is the grounding conductor required to have one-fifth the ampacity of the neutral conductor at the same conductor temperature? Or, can a higher conductor temperature be used for the grounding conductor since it is annealed already and not under tension?

(b) From the background information I have provided, do we need to increase our grounding conductor size for use with the 795 kcmil all aluminum conductor to comply with Rule 93C2? Please note that the 1987 NEC does not require anything larger than #6 copper as the grounding conductor for the electrode types we use or plan to use (Rule 250-94, Exception 1a. Also see the NEC 1987 Handbook, page 230, Figure 250-35).

2. Rule 93C8. Does the "ampacity" referred to in this rule mean "continuous ampacity," or does it refer to "short time ampacity" as defined at the beginning of Rule 93C?

3. Rule 94B4a. Rule 94B3c describes a metal plate that has not less than 2 ft^2 exposed surface area and that is buried not less than 5 ft deep as being more useful in areas of high soil resistivity than a driven rod. We are considering the use of a plate with a one-side surface area of 288 in^2 attached to the pole butt. We would like to use this large butt plate as the sole grounding electrode at transformer locations. Note that this plate is much larger than the minimum 0.5 ft^2 required by Rule 94B4b.

(a) May the large butt plate just described be used as the sole grounding electrode at transformer locations? Or does the location of the plate (attached to the pole butt) disqualify it?

(b) If attachment to the pole butt disqualifies the plate, would burial at a depth of, say, 6 in below the pole butt allow its use as the sole grounding electrode at transformer locations?

4. Rule 97D1. On our system we have a limited number of older 2400 V delta primary distribution circuits. At transformer installations, separate grounding conductors were used to connect to separate electrodes, but the separate grounding conductors were bonded together near the ground line, as shown in Fig IR 407. Rule 97B in the 1973 NESC edition states that "This does not prohibit the bonding together of these separate made electrodes or groups of electrodes near the ground level."

(a) Does this practice (bonding of the separate grounding conductors near ground level) meet the requirements of 1973 and prior editions of the NESC?

(b) Does the practice meet the current requirements of Rule 97D1?

(c) If bonding of the separate grounding conductors near ground level is not allowed, does interconnection through a spark gap or equivalent device constitute "connection of two electrodes in parallel" for application of Rule 96A2?

5. Rule 235A3. Does "phasor difference" in this rule imply the phase-to-phase voltage with the normal 120 degrees phase difference, or does it mean the phase-to-phase voltage with 180 degrees phase difference? The possibility of asynchronous operation for any situation on our system is only remotely possible.

6. Rule 235C, Table 235-5. An earlier interpretation (IR 267a, March 20, 1980) states that "In applying Rule 235C, the calculation of voltage should assume 180 degrees phase difference." Table 235-5 has been completely revised for the 1987 edition. Whereas the heading formerly stated "All voltages are between conductors involved..." the heading now states "Voltages are phase-to-ground...." Basic clearances in the table are now given as a number of inches plus "0.4 per kV over 8.7 kV."

We are not sure whether the earlier interpretation (IR 267a) applies for certain situations under the current edition. Asynchronous operation under any condition is only remotely possible on our system, but may be more probable in some situations, such as when two supply circuits on the same structure belong to different utilities. Also, we are confused as to the proper interpretation of the "per kV over 8.7 kV" in the table.

Please indicate which of the following interpretations is correct in calculating the vertical clearance "C" between line conductors on the same supporting structure for the stated conditions.

Case 1. A phase conductor of a 34.5GrdY/19.9 kV circuit over a different phase conductor of a different 34.5GrdY/19.9 kV circuit, same utility, same conductor sag, with 120 degrees phase difference normally between circuits.

Method 1. Asynchronous operation assumed and "per kV" interpreted to mean voltage between conductors involved.

$$C = 16 + 0.4 \times (19.9 + 19.9 - 8.7) = 28.4 \text{ in}$$

Method 2. 120 degrees phase difference assumed and "per kV" interpreted to mean voltage between conductors involved.

$$C = 16 + 0.4 \times (34.5 - 8.7) = 26.3 \text{ in}$$

Method 3. Voltage between conductors ignored and "per kV" interpreted to mean voltage to ground of the upper level circuit if over 8.7 kV.

$$C = 16 + 0.4 \times (19.9 - 8.7) = 20.5 \text{ in}$$

Method 4. Voltage between conductors ignored and "per kV" interpreted to mean voltage to ground of each conductor if over 8.7 kV.

$$C = 16 + 0.4 \times [(19.9 - 8.7) + (19.9 - 8.7)] = 25.0 \text{ in}$$

Case 2. Phase conductors of the same 34.5GrdY/19.9 kV circuit placed in a vertical configuration.

Method 1. C = 16 + 0.4 × (19.9 + 19.9 - 8.7) = 28.4 in

Method 2. C = 16 + 0.4 × (34.5 - 8.7) = 26.3 in

Method 3. C = 16 + 0.4 × (19.9 - 8.7) = 20.5 in

Method 4. C = 16 + 0.4 × [(19.9 - 8.7) + (19.9 - 8.7)] = 25.0 in

7. Rule 235E, Table 235-6. Footnote 12 states that "Phase-to-phase voltages shall be determined according to Rule 235A3." Should 180 degrees phase difference be assumed between phase conductors of different circuits, both for determining which column to enter, and ir applying the 0.4 multiplier "per kV over 8.7 or 50 kV"?

8. Rule 242, Table 242-1. In Table 242-1, the term "limited access highways" is used. Does this refer to one or both of the following highway types?

(a) Where full control of access is exercised (freeways, interstate highways with no at-grade crossings or driveway connections).

(b) Where partial control of access is exercised (state highways and some county roads where selected at-grade crossings and driveway connections are allowed).

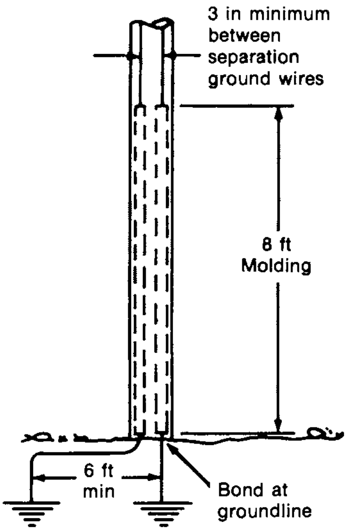


Fig IR 407

INTERPRETATION

The reply to this interpretation request has not yet been issued. It should be noted, however, that the answer to item 8 is contained in the reply to IR 385.

93C8 See 93C2 **IR 407**

94B

Alternative to 8 ft driven ground rod

REQUEST (Oct 12, 87) IR 414

Question 1. Rule 94B2c, Exception 1 states: "...or other types of electrode employed." Does this phrase mean:

(1) only those items listed in Rules 94B3, 94B4, 94B5, or 94B6 (ie, buried wire, strips, plates, pole butt plates, wire wraps, concentric neutral cable, and concrete-encased electrodes), or,

(2) other types, designs, or configurations of electrodes or grounding systems that, through a qualified engineering study, can be demonstrated to perform as well as or better than a driven rod?

Question 2. Rule 94B3a, Exception 2 states: "Other lengths or configurations may be used..." Does this exception apply strictly to wire, or can it be applied to the entire system of electrodes (ie, driven rods, plates, strips, etc)?

Background: Our line crews have asked if a multiple driven rod system where the rods are shorter than 8 ft can be used where rock bottom prohibits the use of an 8 ft rod. We conducted an engineering study (see "Installation of Ground Rods in Rock Areas—Final Report," by John L. Vrabel, P.E.) and concluded that two 0.5 in × 5.5 ft rods separated by a distance of 1.5 ft to 2 ft would be equivalent or better than one 8 ft driven rod. We believe that this grounding system meets the intent of Rule 94B, but are not sure if the language in Rule 94B2 or 94B3 allows this type of system.

Question 3. Does the multiple driven short rod system (in J. L. Vrabel's report) meet the intent of Rule 94B?

INTERPRETATION

(In process)

94B2a See 94B2c **IR 401**

94B2c

Length of ground rod required to be in contact with earth

REQUEST (July 22, 87) IR 410

Rule 94B2c of the NESC 1987 Edition requires "Driven depth [of ground rods] shall be not less than 8 ft."

Does this mean the lower end of the ground rod has to be 8 ft below the surface of the ground, or does this mean 8 ft of the rod has to be in contact with ground?

To better clarify my interpretation question, let me give you the following example:

An 8-ft ground rod is used in pad mounted equipment. This equipment has a 26 in ground sleeve in it. The ground rod is driven inside the ground sleeve unit, and the top of the rod is approximately level with the normal ground surface. Therefore the rod is driven 8 ft deep, but only about 6 ft of rod is in contact with ground. Does this comply with Rule 94B2c?

INTERPRETATION (Feb 22, 88)

Ground rods must be at least 8 ft long (94B2a) and totally driven into earth (94B2c), except in a pad mount enclosure where 6 in may be left not in contact with earth (94B2a, 94B2c Exception 2). If more than 6 in is desired not in contact with the earth under a pad mount installation, a longer rod is required.

94B4a See 93C2 **IR 407**

94B5 See 353D **IR 384**

96A2

Maximum permissible resistance to ground for two electrodes connected in parallel

REQUEST (Aug 6, 87) IR 412

During the last few years of working with contractors and design engineers, I have been exposed to several interpretations of the NESC. I would like to have an interpretation from the committee re Rule 96A2, Single Grounded Systems. I have always interpreted that paragraph to require a resistance to ground from an electrode to be 25 Ω or less. For example, if an electrode, or system of man-made electrodes, has a resistance to ground that exceeds 25 Ω, then additional electrodes, or systems of electrodes, are to be added until the resistance to ground is 25 Ω or less. I have had some people tell me that if one ground rod had a resistance that exceeded 25 Ω then all that was needed was to install one other ground rod, regardless of the resistance obtained.

INTERPRETATION (Feb 17, 88)

The first paragraph of Rule 96A is the key to your question. The grounding electrode system "shall have a resistance to ground low enough to minimize hazards to personnel and to permit prompt operation of circuit protective devices."

If a ground electrode system resistance of more than 25 Ω can accomplish the requirement of Rule 96A, no more than two electrodes (each meeting Rule 94) are required by Rule 96A2. However, if 25 Ω or less is required to meet Rule 96A, then either (1) a longer electrode(s), (2) a group of electrodes bonded together, or (3) a different kind of electrode system is required.

96A3

Spacing of ground connections in circuits without a neutral

REQUEST (Sept 26, 86) IR 394

We will be installing a three-phase, three-wire, 34.5 kV underground circuit approximately 1.75 mi long. This circuit is a radial-feed connected wye at the source and delta at the load. The cable is 250 MCM XLP with drain wires and an insulating jacket.

Rule 96A3 requires the neutral to have "not less than four grounds in each mile of line." Since our circuit does not have a neutral, is it correct to say this rule does not apply in this case?

If the rule does apply, what spacing is required for the grounds? We are planning to provide grounds at the splice locations (approximately every 2000 ft). Would one additional ground located between the splices meet the requirement of this rule?

INTERPRETATION (Feb 17, 88)

Terms not defined in the NESC are intended to carry the meaning found in IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms. If not found therein, normal dictionary definitions are to be used. IEEE Std 100 defines "system (electric power)" as follows:

> Designates a combination of lines, and associated apparatus connected therewith, all connected together without intervening transforming apparatus.

It is clear that once a distribution system is established at a substation transformation as a multigrounded wye system, the multigrounded neutral must be carried throughout the system, throughout all spans and all underground runs, and must meet the four-grounds-per-mile requirement of Rule 96A3. For purposes of this requirement, a line is a line, whether tap or main, and all lines between transformations are part of the intervening "system;" each part must meet Rule 96A3 and carry along a multigrounded neutral that has four ground electrodes within one mile of every point thereon. If your cable run is supplied from a multigrounded source, then Rule 96A3 applies.

The Grounding Subcommittee has reviewed this question and reports that the intent of Rule 96A3 is that, once a distribution system is established as a multigrounded system, the multigrounded neutral must be carried throughout the system, throughout all spans and all underground runs, and must meet the four-grounds-per-mile requirement of Rule 96A3.

96A3 See 353D **IR 384**

97D1 See 93C2 **IR 407**

99A2 Exception See 99C **IR 390**

99C

Bonding of grounds and dimensions of grounding rods

REQUEST (May 7, 86) IR 390

The 1984 National Electrical Safety Code, Rule 99C, Bonding of Electrodes, states that a bond is to 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.

When installing telephone service at many rural locations, we have found that the power company has permanently installed their service meters and grounding electrodes on service poles located 50 ft or more from the customer's house. There is no power ground available at the house itself where we are placing our protector and grounding electrode.

Our interpretation of Rule 99C is that the bond is only required if the electrodes are both located in or on the building or structure, but would not be required in the situation mentioned above. This would be a tremendous burden on the telephone company and would result in large expenses being incurred to provide this bond. Our first concern is always the safety of our customers and employees, but we do not want to go to the expense of trenching-in an unnecessary bond at all of these locations.

We would like an interpretation of Rule 99C as it applies to the above situation.

Rule 99A2, Exception, states that an iron or steel rod may have a minimum cross-sectional dimension of 1/2 in and a length of 5 ft.

What is the exception for copper-clad rods? Can they also be 5 ft in length, and is 1/2 in the minimum cross-sectional dimension as stated in 94B2? A 3/8 in by 5 ft copper-clad rod is commonly used by telephone companies for grounding station protectors where preferred grounds such as power grounds are not available.

INTERPRETATION (Aug 11, 86)

(a) The installations described are not considered to be in or on the same building or structure.

We are having difficulty in understanding the installation you describe. Where is the service ground required by the National Electrical Code in Articles 230-63, 250-5, and 250-23? That is the ground to which you should be bonding.

(b) The minimum size for copper-clad rods of Rule 94B2 is not reduced by Rule 99A, with the exception that the length may be reduced to 5 ft. The diameter remains at 1/2 in.

If you can show that a reduction in diameter is appropriate for copper-clad rods under Rule 99A, you may submit a change proposal, with documentation of tests and appropriate data, for the next code revision.

Rules for the Installation and Maintenance of Electrical Supply Stations and Equipment

Part 1 **(Sections 10-19)**

110A

Height of gap permitted between ground and bottom of fence

REQUEST (Aug 7, 87) IR 411

We have the responsibility in our area of ensuring that utilities comply with the National Electrical Safety Code (NESC). In our inspections of substations, we have observed several fences with gaps at ground level of 6 to 17 in, some large enough to be crawled under. However, we are not sure which, if any, of these are violations since the wording of Rule 110A of the NESC is not clear on the size of a gap under the fence that is permissible. In some cases, the gap under the fence was created by rain after the fence was constructed.

We request an interpretation of Rule 110A of the NESC that will specify the intent of the NESC Committee in regard to the height of the gap to be permitted for outside fence enclosures at ground level between the ground and the bottom of the fence enclosure.

INTERPRETATION (Feb 17, 88)

Rule 110A requires fences to "minimize the possibility of entrance of unauthorized persons..." Clearly 17 in of clearance does not meet this requirement; the maximum clearance will depend upon such factors as whether the fence fabric is anchored between posts, the tension of the fence fabric, and other variables controlling the ability of a person to nondestructively displace the fence for entry purposes.

130B

Manual stopping devices

REQUEST (June 26, 87) IR 408

In many industrial facilities, the operators are normally located within a central control room that is remote from the motor driven machinery or process. The motors are operated (started and stopped) from the control room or a nearby central electrical equipment room where the motor controllers are provided. This complies with the second paragraph of Rule 130B, which states, "Manual controls to be used in emergency for machinery and electrical equipment shall be located so as to provide protection to the operator during such emergency." In addition, these facilities are usually provided with in-plant communication systems. This allows the operators and maintenance personnel to communicate during normal and abnormal conditions.

If an operator or maintenance personnel are near the machinery during scheduled plant tours, they may or may not be within a location convenient to a stopping device. "Convenient" is not clearly defined in the NESC, NEC, or ANSI/IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms, is open to interpretation, and is ambiguous. Are arm's reach, 10 ft, 100 ft, 1000 ft, 1 mi, etc convenient? Is it the intent of Rule 130B to require a local stopping device, such as a switch or pushbutton for motors that are normally controlled from a remote location?

Also, it is my understanding that a prime mover is any device used to drive a machine. Typical prime movers are electric motors, turbines, combustion engines, etc. Why does the NESC differentiate between "... all prime movers and ... motors driving generating equipment?" Is a motor driving generating equipment not considered a prime mover?

In summary, please provide specific answers to the following:

(1) Where motors are controlled from central locations remote from the driven machinery, are local stopping devices such as a switch or pushbutton required? Note that the National Electrical Code does not require a local stopping device.

(2) Please define "convenient" in terms of an industrial environment with centralized control.

(3) Why does the NESC differentiate between prime movers and motors driving generating equipment?

INTERPRETATION (Feb 17, 88)

Rule 130B contains two requirements. The first is that prime movers and motors driving generating equipment shall be equipped with an appropriate stopping mechanism. The second is that the stopping mechanism controls must be so placed as to allow the operator to stop the equipment in a timely manner without endangerment to the operator.

Prime movers are considered to be rotating machines that utilize a primary energy source ("prime") to produce mechanical energy ("mover"), which is then either used directly or secondarily converted to electrical energy. Electric motors are secondary movers. The NEC does not apply to equipment used by a utility in production of electricity for a utility purpose.

Safety Rules for the Installation and Maintenance of Overhead Supply and Communication Lines

Part 2 **(Sections 20-28)**

232A, Table 232-1

Clearance required for sailboats in an inlet that has an upstream restriction on height

REQUEST (Nov 14, 84) IR 367

Please refer to the 1984 edition of the NESC, Table 232-1, "Minimum Vertical Clearance of Wires... Above... Water," number 7: "Water areas... suitable for sailboating."

What criteria should be used to determine if a water area underneath conductors is "suitable for sailboating?" Does this refer to boats under sail and sailboats moving under auxiliary power?

In Figs IR 367 1-3, which show a 23 kV line crossing the north end of a river blocked by a fixed, low railroad bridge, would that area be considered "suitable for sailboating?"

Our interpretation is that while the water under the conductors does not seem "suitable for sailboating," a sailboat under power—or out of control—could possibly contact the line; and since the river flows into another area greater than 2000 acres, the minimum conductor crossing height above the water should be 40 ft.

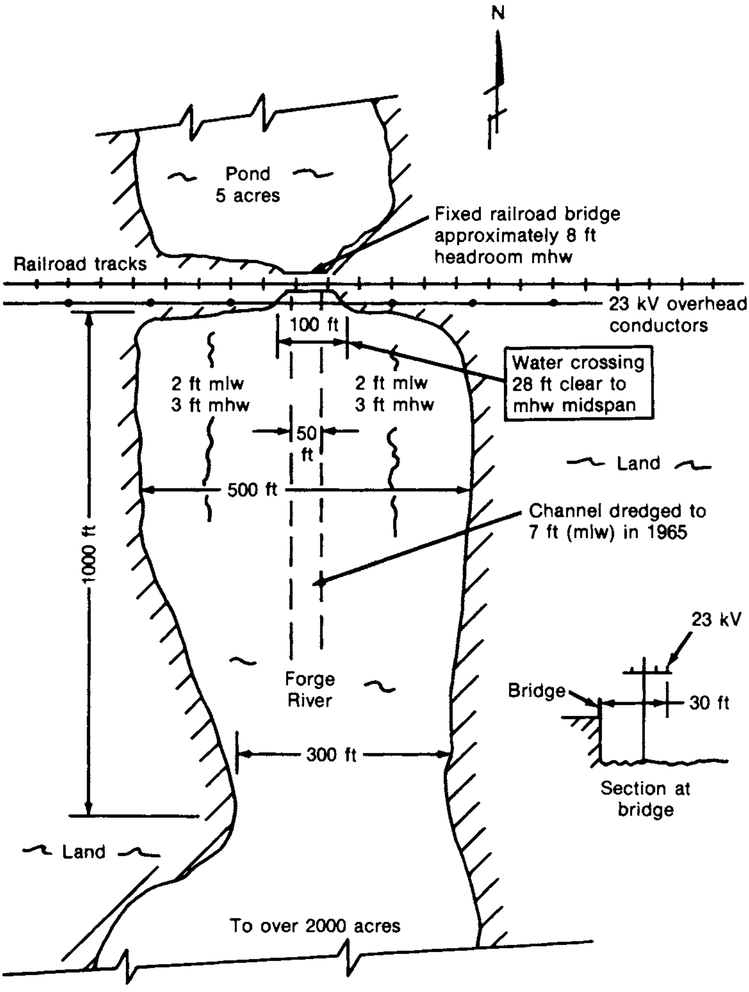

N
Pond
5 acres
Fixed railroad bridge
approximately 8 ft
headroom mhw
Railroad tracks
23 kV overhead
conductors
100 ft
Water crossing
28 ft clear to
mhw midspan
2 ft mlw
3 ft mhw
2 ft mlw
3 ft mhw
50
ft
Land
500 ft
Channel dredged to
7 ft (mlw) in 1965
1000 ft
23 kV
Bridge
30 ft
Forge
River
Section at
bridge
300 ft
Land
To over 2000 acres

Fig IR 367-1

Fig IR 367-2

Fig IR 367-3

INTERPRETATION (Dec 24, 84)

Although there is a bridge that restricts passage of sailboats into the small body of water, there is no restriction to the passage of shallow-drafted sailboats from the bay into the river area that includes the line crossing. The crossing is considered to be over water suitable for sailboating.

* * * *

232A, Table 232-1

Reduced vertical clearance requirements

REQUEST (Feb 27, 85) IR 371

The minimum vertical clearance requirements shown in Table 232-1 of the 1984 NESC are generally one foot less than the clearance requirements in Table 232-1 of the 1977/1981 NESC.

We request an interpretation as to whether this change in vertical clearance applies to transmission lines constructed prior to 1984. We desire to use the extra foot of clearance at existing lines to allow for heavier electrical loading.

INTERPRETATION (July 23, 85)

At the owner's option, existing facilities may be "upgraded" to meet new code requirements or may remain the same, regardless of whether the new requirements are lesser or greater than the former. In the case where a clearance requirement above grade is decreased, existing lines may be "upgraded" to the new code requirements and may take advantage of the reduced clearance requirement by increasing the thermal loading on the conductors, provided, however, that all requirements of the new code are met; requirements of different code editions cannot be mixed and matched.

Rule 013A requires all new installations and extensions constructed while a specific edition is in effect to meet the requirements of that edition. When a new edition of the NESC is promulgated, Rule 013B allows existing facilities to continue to remain "as is" if they continue to meet the requirements of the edition of the NESC that was in effect at the time of original construction of those facilities. When an existing installation or the use of the land underneath is altered, Rules 013B and 013A require that the existing installation fully meet either the present edition or the edition in effect at the time of original construction — no other edition may be used. If an existing line is "upgraded" to meet the requirements of a subsequent Code edition, that subsequent edition becomes the standard that the existing facilities must continue to meet.

Note that Rule 230H requires clearances to be maintained at the values and under the conditions specified; if either line use or land use changes enough to place the line in a new clearance category, the requirements of the new category must be met regardless of which edition is being used.

233B

Reduction of horizontal clearance

REQUEST (Apr 3, 85) IR 375

Rules 233B and 234B, clearances of wire, cables, etc, seem to pertain to safety while working on a support structure where energized wires pass close by.

In the case of CATV cables, or other cables that are at ground potential, does the exception to Rule 233B1 apply to the horizontal clearance required by Rule 234B — that is, may the horizontal clearance from a supporting structure, other than the structure that supports the CATV cable, be reduced to either 6 in (150 mm) or 2 ft (600 mm)?

I would appreciate your interpretation of the minimum horizontal spacing at support structures and cables at ground potential.

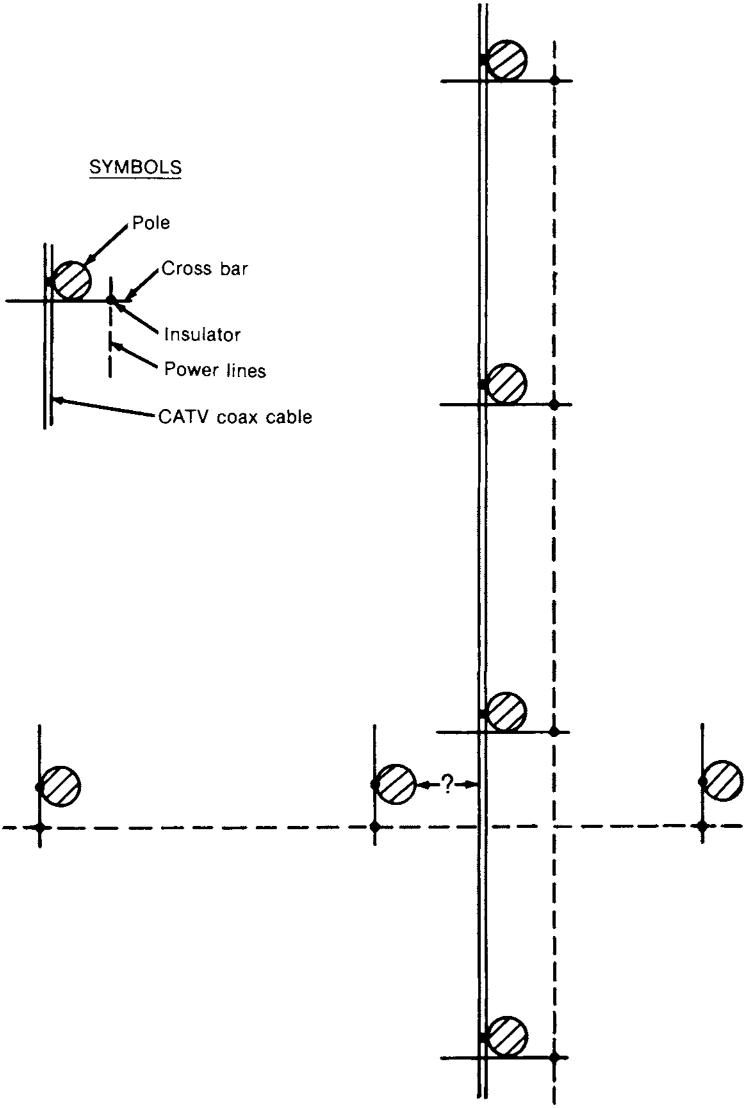

SYMBOLS
Pole
Cross bar
Insulator
Power lines
CATV coax cable
?

Fig IR 375

INTERPRETATION (June 21, 85)

Rule 233 concerns "clearances between wires, conductors, and cables" themselves when they are carried on different structures. Rule 233 is not applicable to clearance to a structure. Rules 234A1 and 234B1 require a minimum horizontal clearance of 5 ft without wind displacement for communication cables passing near supporting structures to which they are not attached.

233C2 See 235C **IR 372**

234A1 See 234B **IR 375**

234B See 233B **IR 375**

234C, Table 234-1

Classification, for clearance purposes, of outdoor advertising signs (billboards) that have catwalks and that are with or without ladders

REQUEST (Dec 5, 84) IR 368

Our client is extensively involved in outdoor advertising throughout the Southeastern United States, and has always been very concerned with the safety and welfare of the employees and independent contractors who maintain and paint its outdoor advertising signs. Recently, however, they embarked on a comprehensive safety program, which included review of the design, construction, and placement of its signs as well as a review of the tools, materials, and work practices of those who maintain and paint outdoor advertising signs. That safety review specifically included a study of safe clearances between overhead transmission and communication lines and outdoor advertising signs. We of course looked to the 1984 National Electrical Safety Code for guidance.

In that regard, we have a question of interpretation concerning the Safety Code. Are outdoor advertising signs classified as "Signs, Chimneys, Radio and Television Antennas, Tanks, and Other Installations Except Bridges," or as areas of buildings accessible to pedestrians under Rule 234C of the Safety Code? Put another way, are the clearances set forth in Rule 234C of the Safety Code for "Signs, Chimneys, Radio and Television Antennas, Tanks, and Other Installations Except

Bridges," applicable to outdoor advertising signs that have a catwalk and ladder permitting access to the sign for maintenance and painting?

Recent editions of the Safety Code have specifically included signs in Rule 234C. Figure 234-1, "Clearance Diagram for Building and Other Structures," however, depicts a neon-type motel sign. Therefore, some electrical engineers, when applying the clearances in Table 234-1, take the position that outdoor advertising signs come under the classification "Buildings, Vertical, Above or Below Balconies and Roofs Accessible to Pedestrians," instead of the classification "Signs, Chimneys, Radio and Television Antennas, Tanks, and Other Installations Except Bridges."

Which classification is applicable to outdoor advertising signs that have catwalks and ladders permitting access to the sign for maintenance and painting?

INTERPRETATION (July 22, 85)

Billboards are considered in the same category as other signs. If they have catwalks, access is assumed to be limited in a manner that they would not be considered to be accessible to pedestrians under Note 3 of Table 234-1. The required clearances are adequate for trained personnel using appropriate work methods and tools. If the catwalks are considered to be accessible to pedestrians, the vertical clearances of Table 232-1 for "spaces or ways accessible to pedestrians only" would be required, just as they are required by Table 234-1 above and below roofs and balconies accessible to pedestrians.

234C, Table 234-1

Clearance above fences and walls

REQUEST (Dec 13, 85) IR 381

I have an inquiry concerning the interpretation of Rule 234C. Does a 6 ft block wall fence fall within the class of "signs, chimneys, radio and television antennas, tanks, and other installations not classified as buildings or bridges?"

INTERPRETATION (Mar 26, 86)

There is not enough information given in the request upon which to base an opinion; no opinion will be issued. However, because of the type of question presented, and the practical guidance provided within the NESC for those with similar questions relating to appropriate actions in cases not directly addressed by the NESC, the following general guidance is given.

Since this installation is not specifically covered in the NESC, Rule 012 requires construction to be in accordance with accepted good practice for the given local conditions. Stated NESC requirements for clearances above specified areas and installations can be considered along with the types of activity expected in those areas to develop good practice for other conditions.

The answer to this question lies in a common-sense view of the wall with respect to its surroundings. First, the clearance immediately adjacent to the wall must be at least that required above grade for the type of area in which the wall resides, taking into account the grade change, if any, at the wall. Second, the nature of the fence or wall, including the width of the wall, the relative surety of its footing, and the access to the top of the wall, has a bearing upon the nature of the reasonably expected activity atop the wall; the expected activity is of value in determining the appropriate clearance above the wall. The resulting conductor elevation may be the same as or greater than that required above adjacent lands.

The vertical clearance above buildings required by Rule 234 depends upon the access to the roof or projection. If the roof or projection is not accessible to pedestrians (see Note 3 to Table 234-1; see also 234C3, IR 377), the activity reasonably expected and planned for in the rule is that of erect workers with small hand tools. Where the roof is accessible to pedestrians, additional clearance is provided for the public to use umbrellas in the rain, or unfold lawn chairs in the sun, etc, as in the "spaces or ways accessible to pedestrians only" category of Table 232-1. The clearances required above building surfaces are greater than those required above installations not classified as buildings, because of the lesser freedom of movement or necessity of movement expected about the latter category and the absence of a reasonable expectation of erect persons atop the latter installations.

Maintenance of a sign, chimney, antenna, or the like is not reasonably expected to require fully erect body extension above the installation, as would walking across a roof; such maintenance is usually performed from a side or face and from a ladder, bucket, or similar special access. Any such installations that require humans to walk erect atop them for maintenance or use purposes are considered as buildings for clearance purposes. The vertical clearances above signs and the like are thus generally appropriate above any structure above which humans are not expected to walk erect.

If the wall is wide enough to provide steady footing (and since it is less than 8 feet in height), the wall could be presumed to be accessible to pedestrians and require clearances appropriate thereto. Rules 232 and 234 have consistent, if slightly differently specified, clearances for areas with similar activity that would also be appropriate here.

If the wall does not provide steady footing, such as would be the case with a chain link fence, then humans might not reasonably be expected to be standing erect thereupon; while the conductor elevation at the fence must then be at least high enough to meet the required clearance above the adjacent grade, good practice consistent with the NESC would suggest that the conductor elevation should also be high enough to exceed the fence height by the clearance required above signs, etc (ie, by the amount considered appropriate for similar expected activity); depending upon the height of the fence, this might require increased conductor elevation to provide appropriate vertical clearances both over and adjacent to the fence.

234C3, Table 234-1

Accessibility to pedestrians

REQUEST (Apr 8, 85) IR 377

Law provides that the National Electrical Safety Code sets forth minimum electrical safety standards. We are involved in a case which calls for application of the clearance standards set forth in Table 234-1 of that Code. Specifically, the case calls for an interpretation of "accessible to pedestrians" as referred to in the vertical clearance portion of the Table and Footnote 4 thereto. Does the mere fact that a roof is made accessible by a permanently mounted ladder automatically mean the 15-ft standard applies, or must the accessibility be by "pedestrians" as well as by the specified means set forth in Footnote 4 before the standard applies? Assuming that the latter interpretation is correct, please define "pedestrians."

INTERPRETATION (Sept 9, 85)

To be applicable, the referenced note of Table 234-1 (Note 3 in the 1984 and 1987 editions, Note 4 in the 1981 edition) requires both accessibility to pedestrians and access through one of the stated means. A pedestrian is defined in dictionaries as "a person going on foot, a walker."

Elsewhere in the NESC, where a related matter of access is considered, Rule 280A2 requires that steps on utility structures accessible to pedestrians (ie, where access is not restricted by fences or other barriers meeting Rule 110A) shall not be closer than 8 ft from the ground or other accessible surface.

The clearances above roofs or projections not accessible to pedestrians shown in Table 234-1 provide adequate clearance for maintenance of the building roof by a worker with hand tools; they are not intended to provide clearances for activities expected in areas accessible to pedestrians.

It is consistent with applicable and related provisions of the NESC to consider that, if the bottom step of a stairway or permanently mounted ladder, etc, is less than 8 ft above the ground or other accessible surface, the area is considered accessible to pedestrians. The intention of the code is that access to the area may not be casual; it must require special effort on the part of the person involved, such as using portable ladders or other means of access or extraordinary physical exertion.

234C4

Clearances from roofs

REQUEST (June 11, 87) IR 409

In Rule 234C4 Exception 2, "any portion of the roof" and "overhanging portion of the roof" are both mentioned within the same sentence. Please clarify if "any portion of the roof" refers to the overhanging portion of the roof only.

Also, I have enclosed drawings (Figs IR 409-1 and IR 409-2) of a triplex service attachment using an insulated screw knob on the end of the house for point of attachment. Is the service wire between the screw knob and the weatherhead in violation of the NESC?

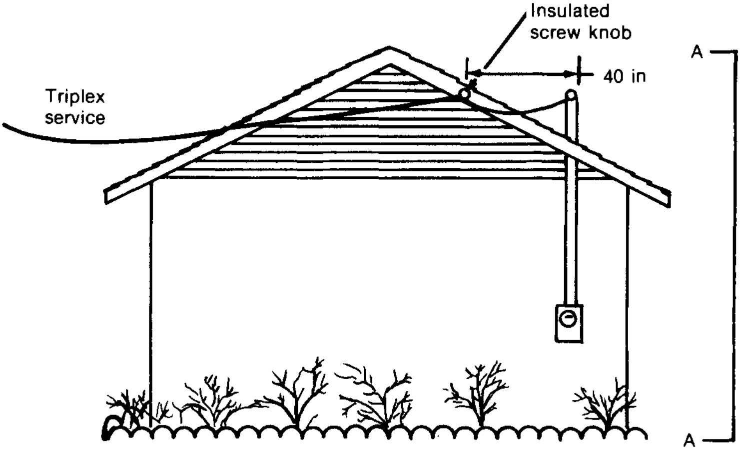


Fig IR 409-1

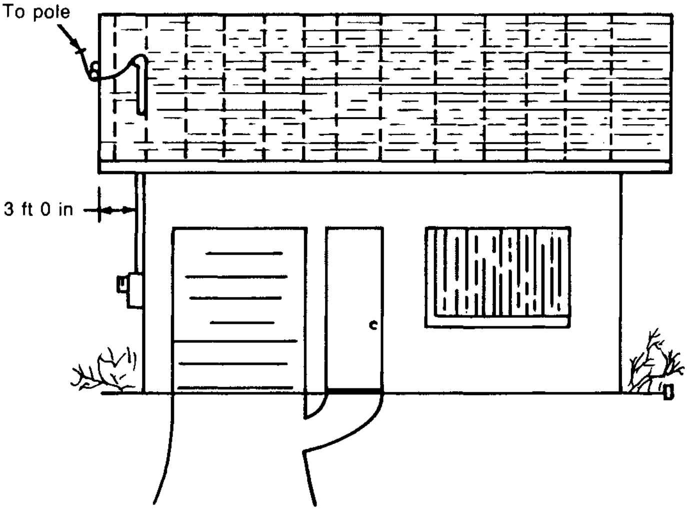


Fig IR 409-2
View A–A

INTERPRETATION (Feb 17, 88)

Roofs are treated differently from the building surface. Under Rule 234C4b, the clearances of Table 235-6 must be met for conductors of 300 V or less (see Rule 234C4a) attached directly to the building. However, Rule 234C4c requires 18 in of clearance for service drop conductors to allow for roof maintenance. Your installation appears to violate this requirement.

If the service drop crosses more than 4 ft of roof, then the clearance must be increased to 3 ft.

234C4(a)

Horizontal clearance to building or its attachments

REQUEST (Jan 30, 87) IR 399

We are requesting, on behalf of our client company, an official interpretation of the National Electrical Safety Code (NESC) with respect to the clearance of a 7200 V conductor from a building.

The distribution line in question was constructed between September of 1973 and January of 1974 alongside a building. In 1984 a workman on the roof of the building swung a piece of metallic closure material while he was upon that roof and caused that material to contact the distribution line while he was still holding onto said closure piece. As a result of the injury the workman received, he is suing our client.

Measurements taken the day after the accident indicate that the horizontal clearance between the edge of the roof (the closest part of the building to the line) and the conductor in question was 3 ft 0 in. Attached to the edge of the roof there was a gutter and the clearance between the rain gutter and the conductor was approximately 31 in.

Our reading of the 1973 Code indicates that a horizontal clerarance of 3 ft is required between the structure and the distribution line. Our question of interpretation involves whether or not one measures to the roof itself without regard to the attached gutter or whether the 3 ft of clearance would have to be measured between the line and the gutter.

INTERPRETATION (June 26, 87)

The horizontal clearance requirements of Rule 234 apply from the nearest conductor surface to the nearest surface of a building or its attachments. See 1R 198.

234C, D

Clearance requirements in tunnels or on bridges

REQUEST (Feb 10, 86) IR 383

The ... Department of Transportation has a 4,557 ft segmental box girder structure with a telephone conduit, cable television conduit, 24 in diameter watermain, and a 13.8 kV electrical distribution line installed within the void inside the superstructure. See Figs IR 383-1-7.

To comply with Federal and State statutes, the Department's bridge inspectors must periodically inspect every square inch of surface area inside the superstructure void. With temperatures inside the void ranging to the high 90s and with very little air exchange, the sweaty inspectors feel some concern for safety when crawling between the watermain and electrical distribution line. They also feel uncomfortable inspecting under and behind the electrical lines.

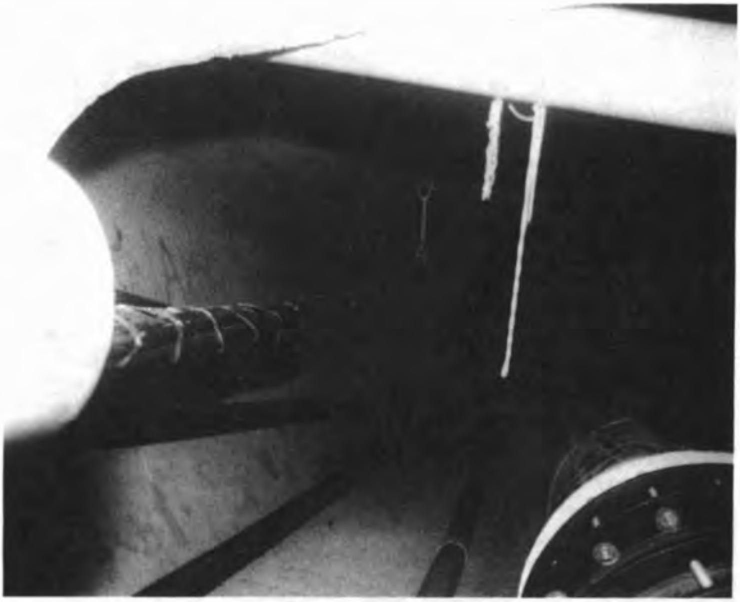
Maintenance personnel have expressed the same concerns while working on the watermain expansion joints. They feel that it is very unsafe to work on a steel waterline with steel tools when some of the tools may come in contact with the electrical distribution line.

Since neither the bridge inspectors nor the watermain maintenance personnel that must work in close proximity to this electric line are qualified electricians, the Department must determine if this electrical line is constructed in conformance with the National Electrical Safety Code, and if the installation contributes a safety hazard.

Several consultants have been engaged to resolve this issue, but each has a different opinion. The basic difference in their findings is in whether this structure should be considered a bridge or a tunnel.

Should this installation conform to the Code requirements for utility installations on a bridge, or in a tunnel?

Voltage Cable Connection at North Abutment
Fig IR 383-1

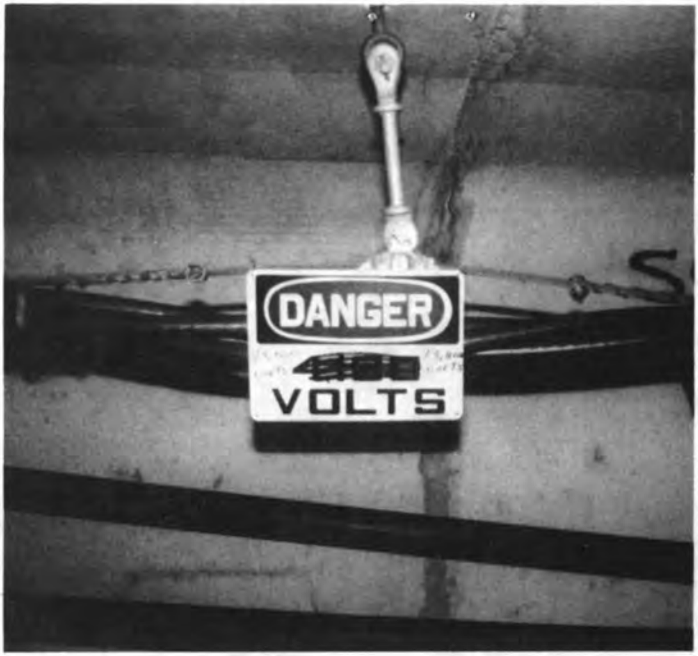


(North Abutment, Facing South)
Voltage Cable Secured to Interior Deck Transom
Fig IR 383-2

Span #38 (Right Side)
Hanging Anchor Supporting High Voltage Line
Fig IR 383-3

Span #38
Close-Up View of Voltage Line Support at Upper Transom
Fig IR 383-4

Span #37, Segment 7
View of Anchorage to Diaphragm
Fig IR 383-5



North Abutment
Posted Danger Sign Showing Voltage (13 800 V)
Fig IR 383-6

Elevation of Bridge
Fig IR 383-7

INTERPRETATION (Apr 16, 86)

For clearances and other NESC purposes, a completely enclosed thoroughfare, such as the interior of the hollow segmental box girder installation described, is considered to be a tunnel and must meet all of the rules applicable thereto. See Rule 301.

The clearances and relationships required between and among the independent utility installations within the hollow girder are dependent upon (1) the qualifications of the people with access to the area and (2) the type of conductor cable installation. Rule 390 requires electric and communication utility installations to meet the requirements of Part 2 of the NESC if the facilities are accessible to "other than qualified persons" or if the supply conductors do not meet the requirements of Part 3 for supply cable systems.

The definition of "qualified" is "having adequate knowledge of the installation, construction, or operation of apparatus and the hazards involved." It is not for the Interpretations Subcommittee to determine whether the persons with access to the area have adequate knowledge of the hazards involved; it is the responsibility of the installer to determine the level and extent of the potential hazard, if any, and to judge if the personnel with access to the area have the knowledge to allow them to safely perform their intended and likely functions under the expected conditions. If such persons are not expected to have the necessary knowledge, the applicable requirements of Part 2 must be met.

The requirements of Part 3 for supply cable systems include, among other things, Rule 314B, 323B, 340B and 391A3. Rules 314B and 340B require that the conductive surfaces of the cable installation and its mounting equipment be effectively grounded; the photographs supplied do not show evidence of bonding of these facilities, either together or to the communication facilities, nor is there any other evidence that the installation is, in fact and deed, effectively grounded. Rule 323B requires 3 ft wide by 6 ft high workroom; such dimensions do not appear to be available on the supply/telephone side of the space. Rule 391A3 requires the design to avoid unsafe conditions due to induced voltages; there is no evidence presented to indicate that the voltage potential difference between the surface of the supply cable installation and the other facilities would not be such as to be dangerous to persons bridging the gap between such facilities. If these rules are met in fact, then only the provisions of Part 3 apply. However, the appearance is that one or more of these rules is violated by the supply cable installation and, therefore, the applicable requirements of Part 2 must be met.

Because of the nature of this installation, there are two portions of Part 2 that must be immediately examined—the requirements for bridges in Rule 234D and the requirements for buildings in Rule 234C.

The clearances required by Rule 234D are contained within Table 234-2. There are two classifications for clearances within that table—those over bridges (which are not applicable in this case) and those "beside, under, or within bridge structure." The category of "within" a bridge structure was intended to apply to conductors and cables traversing the spaces between beams and columns in an open type of bridge structure design and does not apply; the clearances therein obviously do not allow room for a person to walk erect under them, and such action was not contemplated—such areas are considered as "traveled ways" for this purpose. See Footnote 1 to Table 234-2, which requires the clearances of Rule 232 (in this case, those for spaces or ways accessible to pedestrians only) to be met. However, Footnote 7 to the Table allows supply cables in rigid conduit to be attached directly to the bridge. Rule 234C (for buildings) is consistent with Rule 234D (for bridges) by requiring increased clearances or guarding of the conductors.

If the supply cables in the subject installation were in rigid conduit or otherwise guarded, the requirements of the NESC would be met, providing that any conductive guard material is effectively grounded.

Table 234-2 See 234C,D **IR 383**

235 See 238B **IR 387**

235A3 See 93C2 **IR 407**

235B1

Surfaces used to determine horizontal clearance between line conductors

REQUEST (Mar 13, 87) IR 400

This interpretation request is to clarify the surfaces to be used in determining the clearances required by this rule.

Our usual practice for installing distribution lines is to install the conductors on pin insulators. The conductors are attached to the insulators using metallic ties.

Rule 230B states that "for clearance measurement, live metallic hardware electrically connected to line conductors shall be considered a part of the line conductors." This would indicate that the clearances required by Rule 235B1 would be measured between the surfaces of the conductor ties and not between the surfaces of the conductors. This seems inconsistent with Rule 235B1b, where the clearance is dependent upon the conductor sag.

Please clarify which surfaces are to be used to determine if the clearances required by this rule are met.

INTERPRETATION (Sept 21, 87)

"Clearances" are the clear distances required between surfaces. As the conductor diameter increases, conductor spacing must increase in order to achieve the required clearance. Thus, Rule 235B1a requires the conductors (however large they are) to be spaced far enough apart at the structure that the surfaces of their ties and any other connected wiring will not be closer together than the clearances required in Table 235-1.

Where a greater clearance at the supports is required by Rule 235B1b, the basic problem is out in the span where the conductor sags create a situation where the conductors are likely to slap together under wind loading. Thus, the appropriate clearance at the structure between the surfaces of the conductors involved would be without ties when considering Rule 235B1b. However, if splices, weights or other attachments exist that would effectively increase the diameter of a conductor in midspan for clearance purposes, then such increase should be provided at the structure.

235C See 238B **IR 387**

235C, Table 235-5 See 93C2 **IR 407**

235C

Calculating clearances

REQUEST (Mar 14, 85) IR 372

This request for interpretation concerns the minimum vertical clearance required between a transmission circuit and an underbuilt distribution circuit of the same utility carried on the same supporting structure. The line is assumed to be at sea level and the maximum operating voltage is 5% above nominal voltage levels of 115 kV (phase-to-phase) for the transmission circuit and 12.47 kV (phase-to-phase) for the distribution circuit. The transmission conductors are built in a vertical configuration and have sag and tension characteristics that are different from those of the distribution conductors, which are arranged horizontally on a crossarm, except for the neutral wire, which is supported on the pole below the crossarm. The maximum operating temperature for the transmission conductors is 200 °F, but this condition can occur at any ambient temperature. The lowest ambient that may reasonably be expected to occur in our operating area is 10 °F. We have no known switching surge factors.

To calculate the required minimum vertical clearance between the lowest transmission conductor and the distribution conductors we interpret Rule 235C to require 40 in (from Table 235-5) plus any additional clearances required by 235C2. It is in calculating these additional clearances that interpretations are required.

Rule 235C2a refers to "Voltages Exceeding 50 Kilovolts." Part (1) of this rule states "... the clearance between conductors of different circuits shall be increased 0.4 in ... per kilovolt in excess of 50 kV." We interpret this to apply only to the transmission voltage; that is, in calculating the additional clearance we use the phase-to-ground value of the transmission conductor's maximum operating voltage. For example:

$$\left(\frac{1.05 \times 115\ \text{kV}}{\sqrt{3}} - 50\ \text{kV}\right)(0.4\ \text{in/kV}) = 7.89\ \text{in} \qquad \text{(Eq 1)}$$

It has been suggested that we should be using the vector difference of the transmission voltage and the distribution voltage (assuming a phase angle difference of 180°) rather than just the transmission voltage. This would cause the calculation to be performed thus:

$$\left(\frac{1.05 \times 115\ \text{kV}}{\sqrt{3}} + \frac{1.05 \times 12.47\ \text{kV}}{\sqrt{3}} - 50\ \text{kV}\right)(0.4\ \text{in/kV}) = 10.91\ \text{in} \qquad \text{(Eq 2)}$$

(1) Which method of calculating additional clearance on voltages exceeding 50 kV is correct?

Rule 235C2b(1) concerns adjusting vertical clearances at the supports based on a minimum vertical clearance between the conductors at any point in the span. To calculate this minimum clearance between conductors, we have been using only Rule 235C2b (1)(a) and 235C2b (1)(b). For example, in the above case we would perform the calculation as follows:

$$(75\% \times 40 \text{ in}) + 7.89 \text{ in} = 37.89 \text{ in} \qquad \text{(Eq 3)}$$

It has been suggested that because Rule 235C2 states that "The increases are cumulative where more than one is applicable," this value should be added to the previously calculated value of 47.89 in to yield a minimum clearance between conductors of 85.78 in.

(2) Which method of calculating additional clearances based on conductors of different sags on the same support is correct?

INTERPRETATION (July 23, 85)

The confusion appears to result from the differences in the way that clearances for high voltage conductors are calculated when the switching surge factor is known or is not known. Below 98 kV phase-to-ground, the methods are the same; a value is given in Table 235-5 to which 0.4 in must be added for each kV (if any) that each of the two conductors exceeds 50 kV. Between 98 kV and 470 kV, an alternate method is also available. The alternate method computes a stand-alone electrical clearance and requires the use of phasor differences.

Rule 235C1 and Table 235-5 require a conductor of 50 kV phase-to-ground to have a minimum of 40 in vertical clearance above a conductor (of 0 V to 50 kV) of a different circuit. If the switching surge factor is not known and the phase-to-ground voltage of either or both conductors is above 50 kV, Rule 235C2a requires an additional clearance of 0.4 in for each kV that one or both exceed 50 kV. For example, if both conductors exceed 50 kV, compute and sum the additional clearance required for each to get the total required additional clearance.

In the referenced case, only one conductor exceeds 50 kV and the additional required clearance is 7.89 in; the voltage of the less than 50 kV conductor is not considered. Rule 235C2 is consistent with the additional clearance requirements of Rule 233C2; the latter rule appears to be more clearly stated.

The clearance required at midspan is related to but not additive to that required at the structure; they are two separate requirements. Either requirement may be controlling. Equation 3 is correct; meeting that requirement may require greater clearances at the structure than the specified 40 in, depending upon relative sag characteristics of the two conductors or cables.

* * * *

235C

Vertical clearance between communication and supply lines

REQUEST (Apr 18, 85) IR 378

Rule 235C, Exception 3 states that supply service drops of 0-750 V running above and parallel to communication service drops may have a minimum spacing of 12 in at any point in the span and at the point of attachment to a building. This exception also states that there must be 40 in between facilities at the pole. Further research shows that this 40 in is established to minimize the possibility of accidental contact between conductors in the span, even under heavy loading conditions, and additionally provides clear working space between the two types of facilities.

My question, which relates to Figs IR 378-1 and -2 is, if the point of connection is at a pole, such as in Fig IR 378-2, and there are no additional aerial spans beyond this pole, then why would not 12 in between service drops suffice? This thrust of the 40 in requirement and its intent does not exist under the above situation.

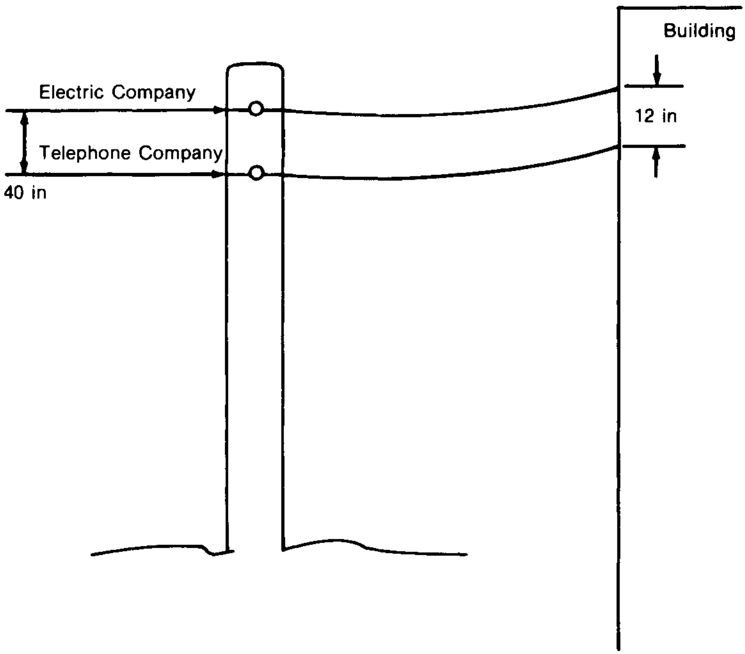


Fig IR 378-1
Normal Clearance at the Pole
(RULE 235C1)

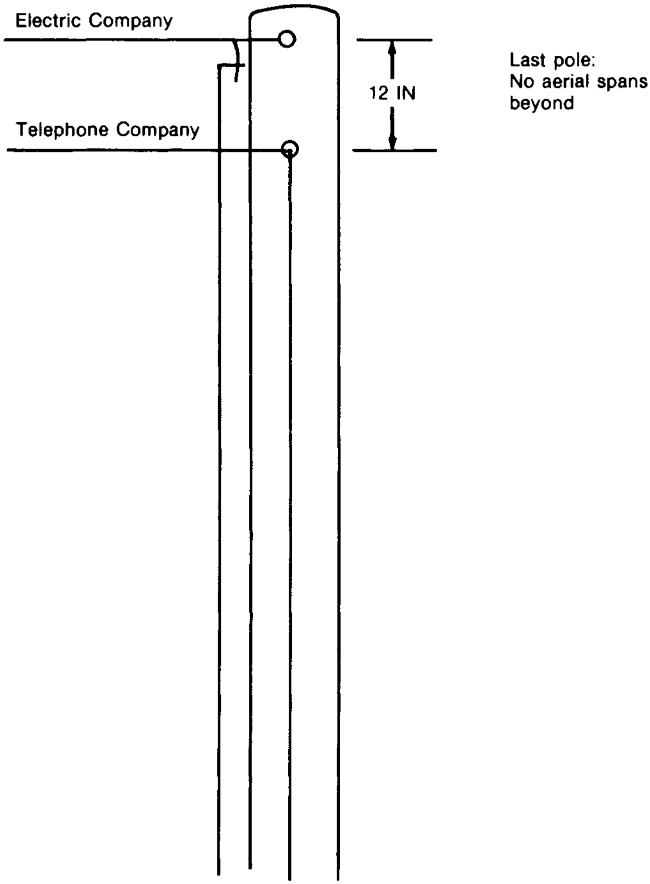

Electric Company
Telephone Company
12 IN
Last pole:
No aerial spans
beyond

Fig IR 378-2

INTERPRETATION (June 21, 85)

Rule 235C requires 40 in of vertical clearance between the communication and supply lines shown in both illustrations. This rule is intentionally consistent with Rule 238C, which requires 40 in clearance between the mounting hardware for the cables to allow headroom for communications workers and footroom for supply workers on the pole.

235C1, Table 235-5

CATV system; clearances on pole

REQUEST (Sept 10, 84) IR 362

... am in need of an interpretation of the National Electrical Safety Code (NESC) rules for Measurements of Clearances and Spacings.

These rules have been offered to us as the standard for the construction of a CATV system on the Utility Poles. Since we have to cohabitate these poles within the communications area ..., the enclosed becomes very important to us.

Table 235-5. States; Minimum Vertical clearance at supports between line conductions.

Rule 238 Vertical clearance between certain communication and supply facilities located on the same structure.

Rule 238B States; Vertical clearance.

Rule 238A Defines "equipment" as noncurrent carrying metal parts of equipment, including metal supports for cables on conductors.

Table 238-1 Vertical clearance between supply conductors and communication equipment etc.

Table 238-2 Vertical clearance of spare wire and brackets from Communication Lines

We believe that it was one of the intentions of the NESC to define clearances and spacings to protect communications personnel working on their facilities without risk of contacting supply facilities above.

We also believe that the history of physical plant has always been to measure clearances in a vertical plane of all cable, conductors, and equipment mounted on the same support structure in the same plane.

We therefore maintain that it is reasonable to consider measurements for clearances from surface to surface of noncurrent carrying metal parts, whether those parts or surfaces be in the same vertical plane or adjacent vertical planes as indicated in the attached enclosed examples, and still maintain a clearance equal to that necessary to protect communications personnel working on their facilities.

Request — for interpretation

Measurements of Clearances and Spacings

Rule 230B Unless otherwise stated, all clearances shall be measured from surface to surface and all spacings shall be measured center to center. For clearance measurements, live metallic hardware electrically connected to line conductors shall be considered a part of the line conductors. Metallic bases of potheads, surge arresters, and similar devices shall be considered a part of the supporting structure.

Rule 230C Supply Cables — For clearance purposes, supply cables, including splices and tapes, conforming to any of the following requirements are permitted lesser clearances than open conductors of the same voltage. Cables should be capable of withstanding tests applied in accordance with an applicable standard.

C1. Cables of any voltage having effectively grounded continuous metal sheath or shield or cables designed to operate on a multi-grounded system at 8.7 kV or less, having a semiconducting insulation shield in combination with suitable metallic drainage, all supported on and cabled together with an effectively grounded bare messenger-neutral.

(Description of Coaxial Cable used in CATV)

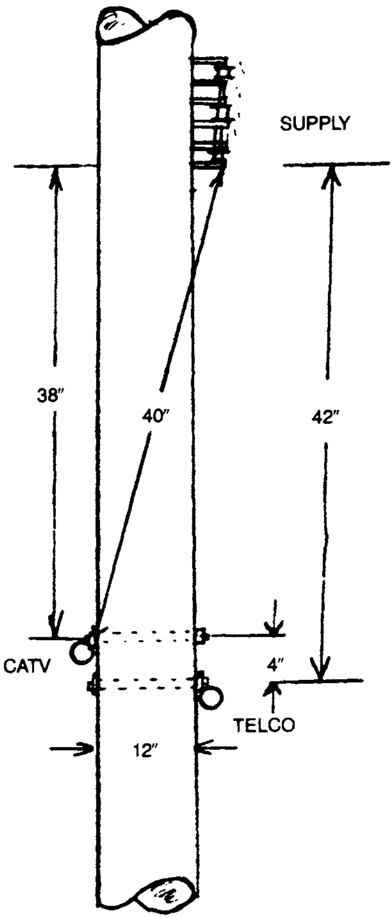


Fig IR 362-1

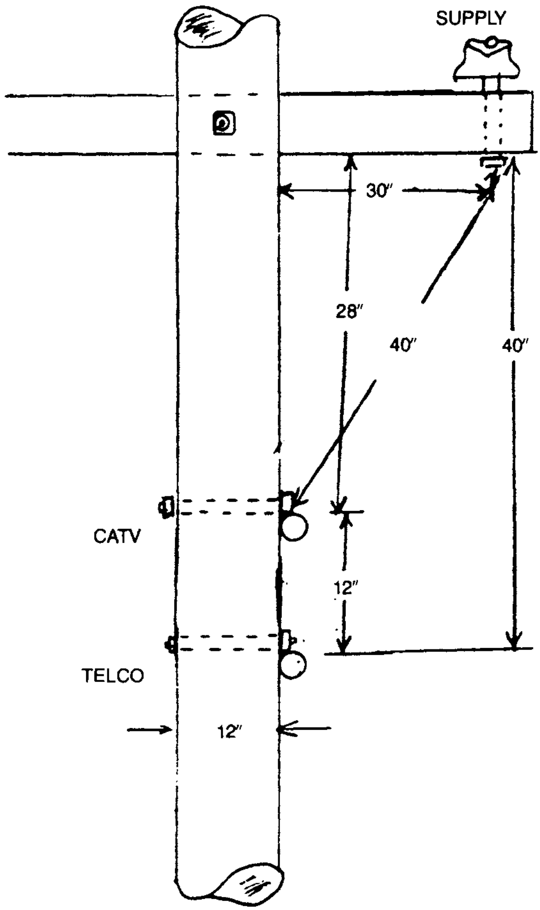


Fig IR 362-2

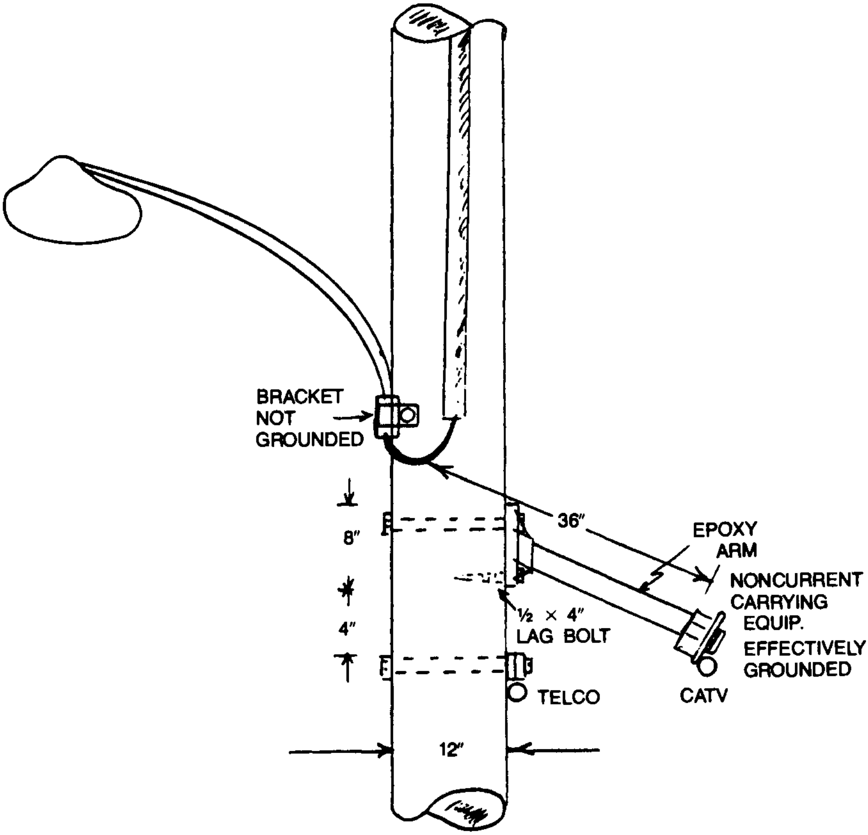

BRACKET
NOT
GROUNDED
8″
4″
36″
EPOXY
ARM
NONCURRENT
CARRYING
EQUIP.
EFFECTIVELY
GROUNDED
½ × 4″
LAG BOLT
TELCO
CATV
12″

Fig IR 362-3

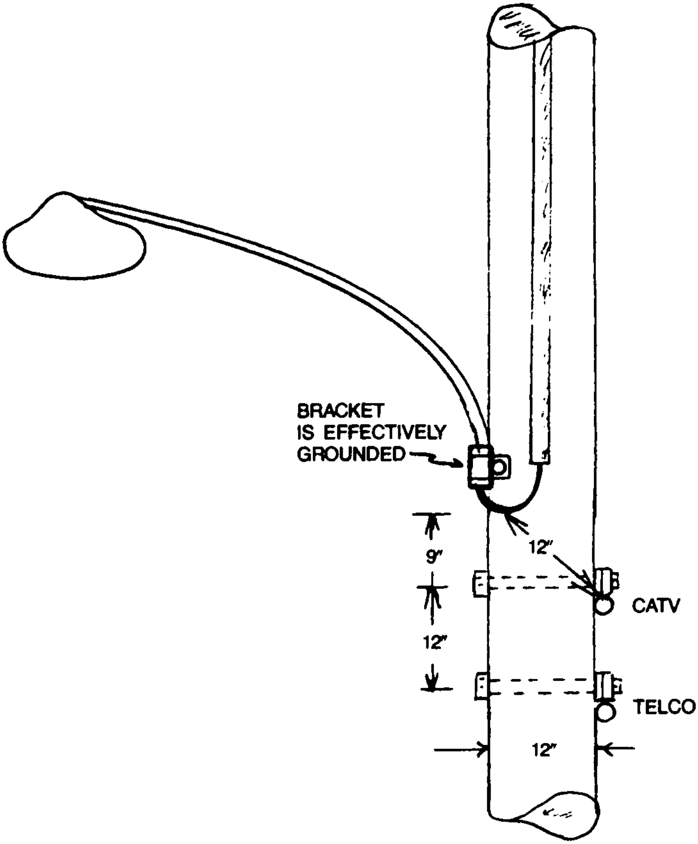


Fig IR 362-4

INTERPRETATION (Mar 20, 84)

The vertical clearances of Rules 235 and 238 are to be applied vertically, not diagonally. Rule 235D and Fig 235-1 make this quite clear. This requirement produces, among other things, a "box" that provides adequate headroom for communication employees under supply facilities that are or may become energized. This question was effectively answered in IR 268, was considered in subsequent Code revisions, and remains unchanged.

Figures IR 362-1 and IR 362-2 violate Rule 238.

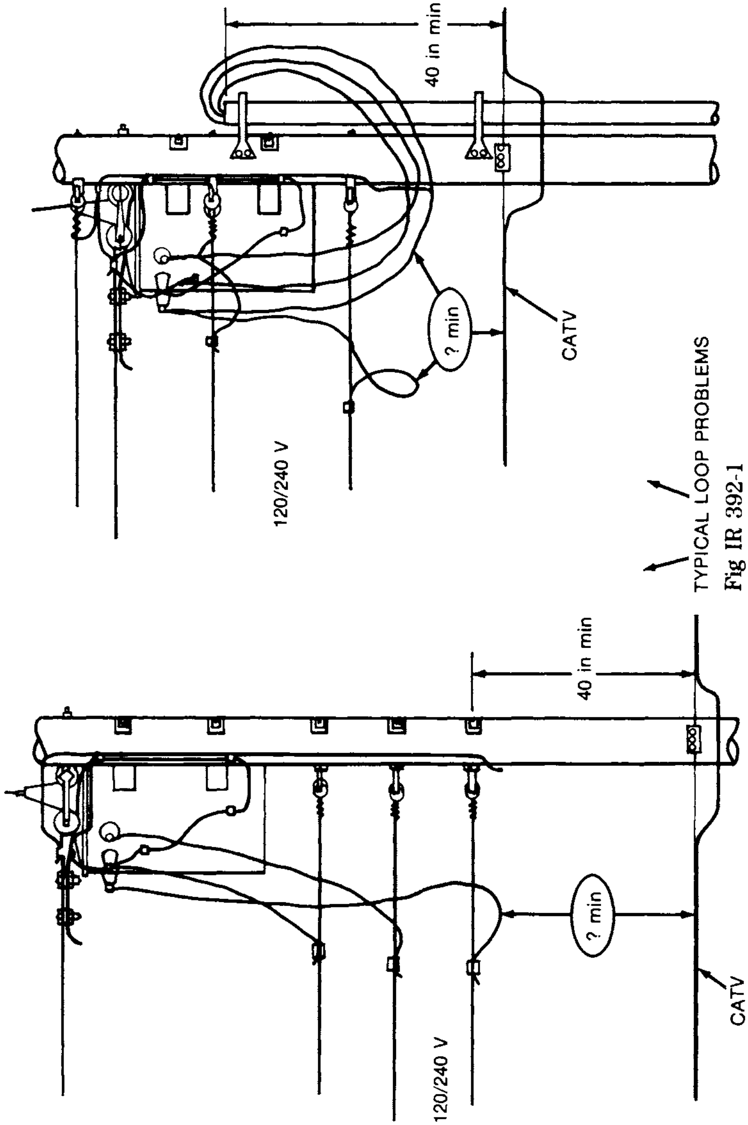
Since the epoxy arm of Fig IR 362-3 is not a metal arm, the metal base is not considered to be electrically connected to the cable and is, therefore, not considered as a "noncurrent-carrying metal part of equipment" for purposes of Rule 238A,B and Table 238-1. However, those rules are not controlling in the cases of Figs IR 362-3 and IR 362-4. Rule 238D requires communication throughbolts to be at least 12 in vertically below the level of exposed luminaire drip loops; this Rule provides room for the hands of communication workers when installing or removing such bolts, and 12 in is required regardless of whether or not the bracket attached is considered a noncurrent-carrying part. It appears from your illustration that the clearance under the drip loop in Fig IR 362-3 is less than the required 12 in. As a result, the construction of both Figs IR 362-3 and IR 362-4 violates the requirements of Rule 238D.

235C2b(1)(a)

Drip loops and slack cables from an aerially-mounted transformer are parts of the span

REQUEST (July 11, 86) IR 392

We request an interpretation regarding Rule 235C2b(1)(a), which deals with conductors of different sags on the same support. In particular, are the "drip loops" or "slack" cables from an aerially-mounted transformer a part of the span? A conflict of interpretation has arisen between an electric utility and the cable television company over the clearance between secondary cables (120/240 V) after they leave the point of pole attachment and connect to the transformer lugs. We understand the minimum vertical clearance to be 40 in between the cable television attachment and the secondary conductor attachment as reflected in Rule 235C, Table 235-5. Please comment on the status of the drip loops in question. Figures IR 392-1 and IR 392-2 are drawings of typical problems we have observed in this matter.



TYPICAL LOOP PROBLEMS
Fig IR 392-1

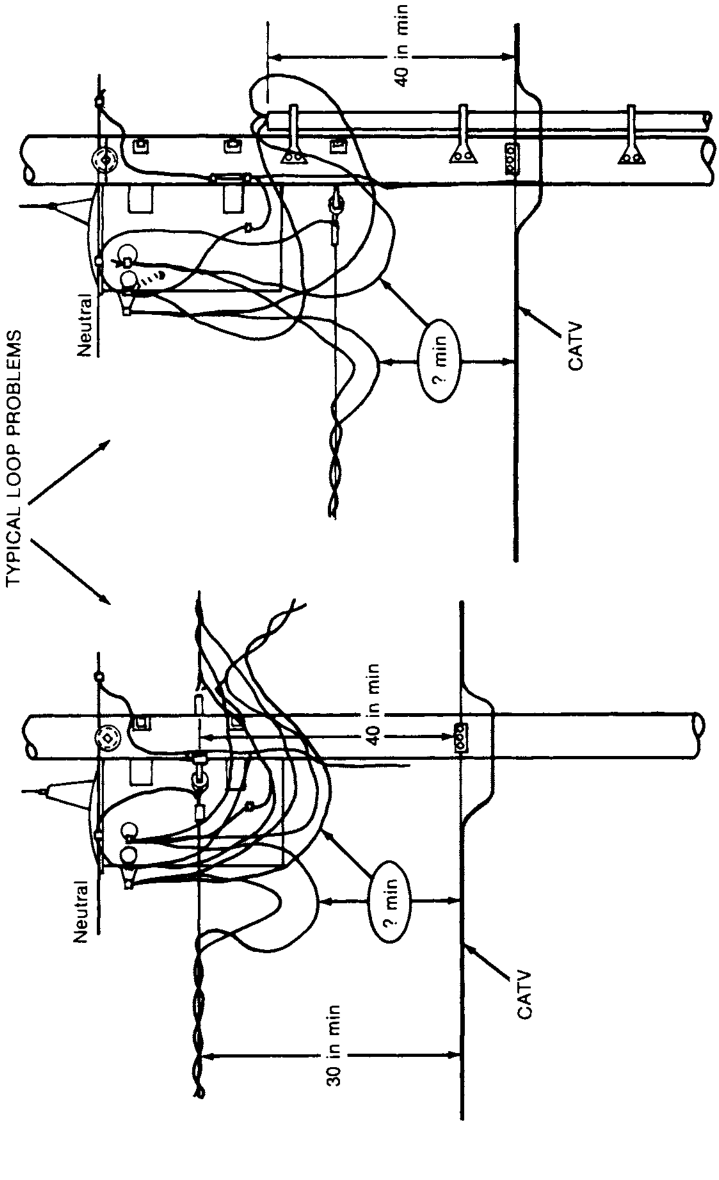


Fig IR 392-1 *(Continued)*

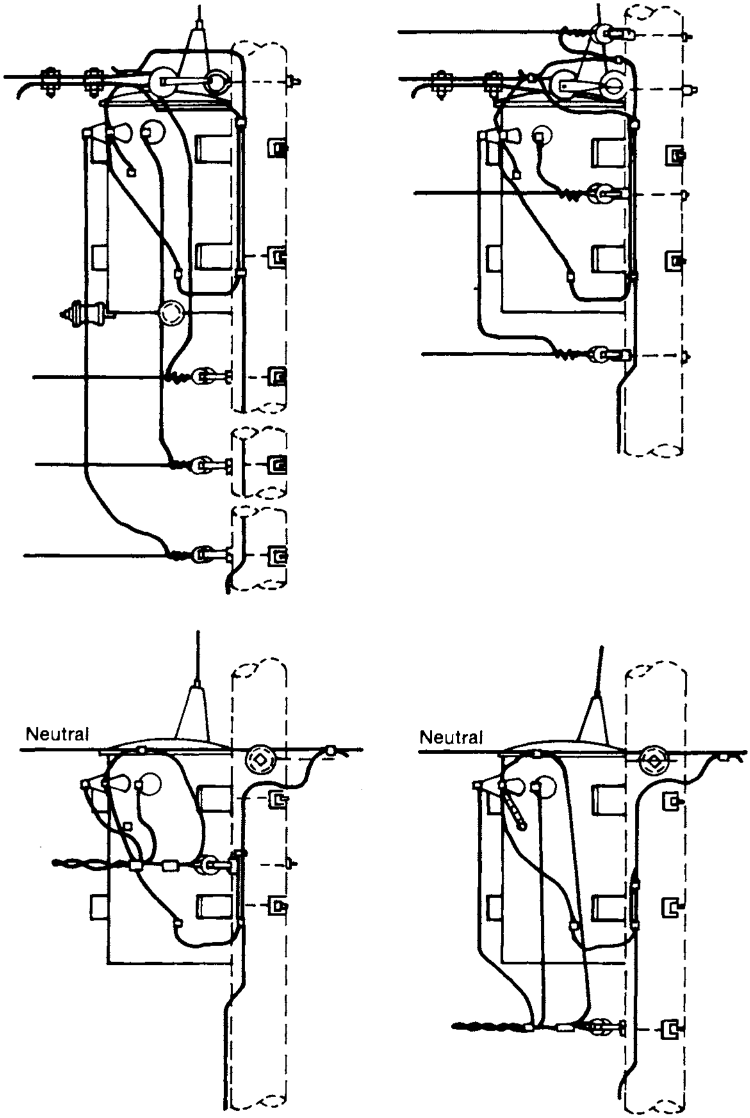


Fig IR 392-2

REA Specification Examples

INTERPRETATION (Nov 21, 86)

The answer to IR 388 applies to this question. See Rules 238A, B. Rule 238D does not apply in this case.

* * * *

235C2b(1)(a)

Vertical clearance between supply and communication lines

REQUEST (Aug 18, 86) IR 393

A secondary line of 0-750 V is strung between two poles and attached a minimum of 40 in above a communication circuit at the pole. There is a service line attached at midspan. The minimum clearance between the secondary line and the communication line is 30 in after the service is installed. Please provide interpretations of the following questions (see Fig 393-1):

(1) Is the radial clearance of 30 in the proper method and dimension to use for measuring the clearances from the communications line?

(2) If a communication service were installed directly below the electric service would the method or dimension change?

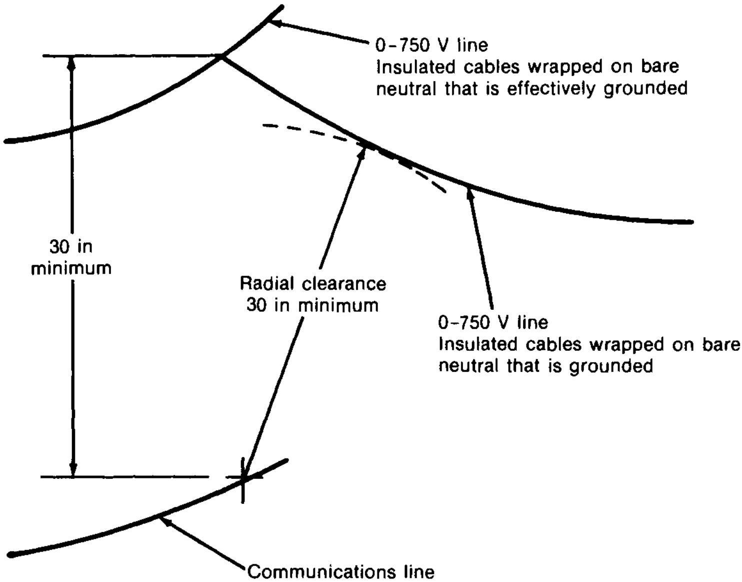


Fig IR 393-1

Conductor Clearance Midspan Tap

INTERPRETATION (Feb 19, 87)

Rule 235D requires vertical measurement of such clearances, not radial measurement. These clearances are required in the span above the level of communication cable to allow headroom for working on the communication cable. Once the supply service drop is outside the communication working space, its level is controlled by the vertical clearance above grade or above whatever it crosses.

235D See 235C2b(1)(a) IR 393

235D See 235C2b(1)(a) IR 393

235E, Table 235-6 See 93C2 IR 407

235E1, Table 235-6

Clearance between line conductors and anchor guys

REQUEST (Oct 29, 84) IR 365

The rule for which I request an interpretation is National Electrical Safety Code (NESC), 1984 Edition, Rule 235E, "Clearances in any Direction from Line Conductors to Supports and to Vertical or Lateral Conductors, Span or Guy Wires Attached to the Same Support."

The specific case in point is as follows:

1. Refer to Fig IR 353. It is desired to maintain the minimum NESC clearances between line conductors and anchor guys on this structure, which is to operate at 242 kV maximum phase-to-phase voltage.
2. Rule 235E1 and Table 235-6 require a minimum clearance of 64 in at 242 kV circuit, phase-to-phase voltage as shown calculated below.

$$\begin{aligned} D &= 16 + 0.25\ (242 - 50) \\ &= 64 \text{ in (Rule 235E1 and Table 235-6)} \end{aligned}$$

3. The exception to Rule 235E1 refers to Rule 235E3. The applicable part of Rule 235E3, which is 235E3a, states that alternate clearances shall not be less than the crossing clearances required by Rules 233B2 and 233C3.
   a. Rule 233B2 states that clearances shall not be less than those derived from computations in Rules 235B3a and 235B3b.
      1) Rule 235B3a, for a switching surge factor of 3.3 yields:

$$\begin{aligned} D &= 3.28 \left[\frac{V_{L\text{-}L} \cdot PU \cdot a}{500\ K} \right]^{1.667} b \\ &= 3.28 \left[\frac{242\ \sqrt{2}/\sqrt{3} \times 3.3 \times 1.15}{500 \times 1.4} \right]^{1.667} \times 1.03 \\ &= 3.8 \text{ ft} = 45.6 \text{ in} \end{aligned}$$

      2) Rule 235B3b states the value calculated above shall not be less than the basic clearances given in Table 235-1 computed for 169 kV AC:

      It does not appear that any of the "Class of Circuit" descriptions in Table 235-1 fit this case; the closest would be "supply conductors of the same circuit," but above 50 kV there is "no value specified."

If the "supply conductors of different circuits" is the correct "class circuit," then clearance required, in inches, is:

$$28.5 + .4\ (169 - 50) = 76.1 \text{ in},$$

but this is greater than the 64 in of the basic rule, so it would not seem to apply.

b. Rule 233C3 states "the clearances shall be not less than the values computed by adding the reference heights to the electrical component of clearance."
   1) The reference height for supply lines is 0.
   2) The electrical component of clearance for a switching surge factor of 3.3, per 233C3b is:

$$D = 3.28 \left[\frac{[242 \times \sqrt{2}/\sqrt{3} \times 3.3 + 0]\ 1.15}{500 \times 1.5} \right]^{1.667} \times 1.03 \times 1.2$$

$$= 4.55 \text{ ft} = 54.6 \text{ in}$$

   3) But Rule 233C3c says this value shall not be less than the clearance required by Rules 233C1 and 233C2 with the lower voltage circuit at ground potential, which yields the following:

$$48 \text{ in} + .4\ \left(\frac{242}{\sqrt{3}} - 50\right) = 84 \text{ in}$$

   Again, this is greater than that required by basic Rule 235E1 and Table 235-6.

Is it the intent, therefore, that the 64 in clearance required by Rule 235E1 and Table 235-6 be maintained?

INTERPRETATION (Dec 14, 84)

This request is basically the same as IR 353, so the Interpretation of IR 353 is applicable here. It should be pointed out that Rule 235E refers to clearances in any direction, whereas Rules 233B and 233C refer to horizontal and vertical clearances. The reductions allowed for high voltage circuits with known switching surge factors are limited in their applications; this is one of those applications. Although the requestor has incorrectly calculated the limit of Rule 235B3b (having used the full phase-to-phase voltage when the "voltage between conductors involved" is a phase-to-ground voltage)—its limit would be 47.5 in, not 76.1 in—the requestor has reached the correct conclusion. Rule 235D, in concert with the requirements of Rule 235E, would require that the reduced clearances of Rules 233B2 and 233C3 allowed by Rule 235E be applied as shown in Fig 235-1, and that the resulting "box" around the phase conductor not be violated by the anchor guy.

Table 235-1 See 235B1 **IR 400**

Table 235-5 See 235C2b(1)(a) **IR 392**

Table 235-6 See 234C4 Exception **IR 409**

236 See 238B **IR 387**

236D See 238 **IR 374**

237 See 238B **IR 387**

237C See 238 **IR 374**

238

Application of Rule 238 to service equipment and supply equipment

REQUEST (Mar 25, 85) IR 374

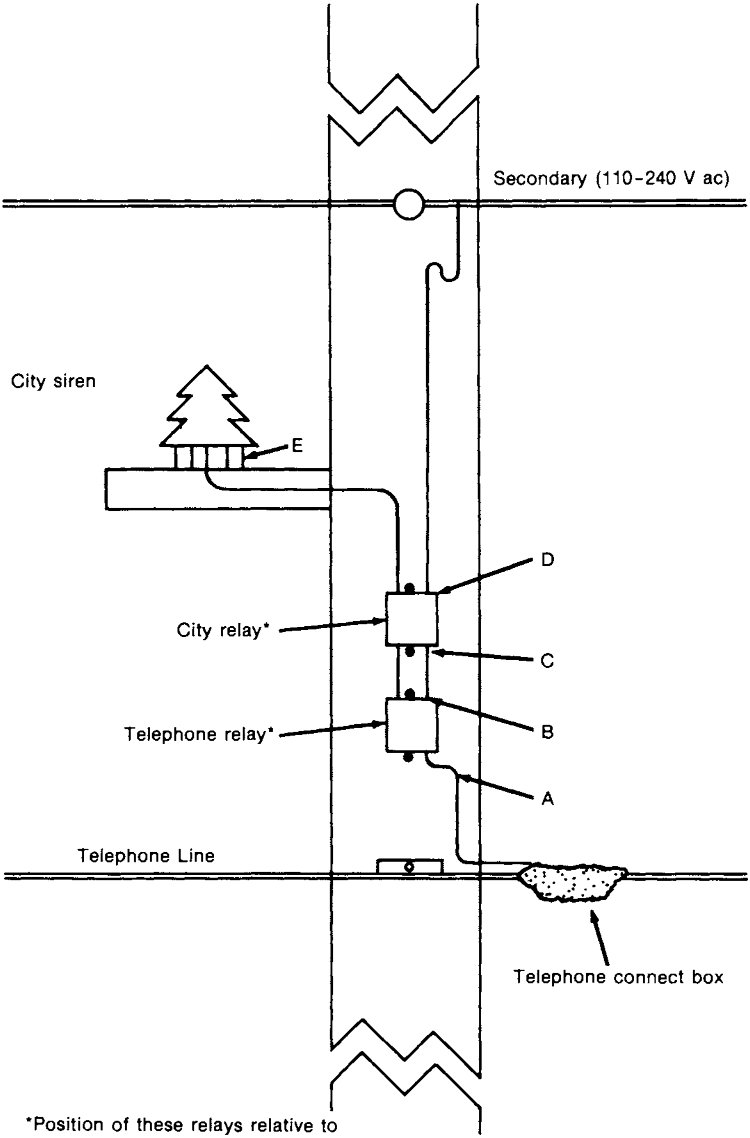
Figures IR 374-1-7 are depictions of two situations in diagrams, schematics, and photographs for your interpretation as to required vertical frame clearance from CATV plant.

Situation A, Figs IR 374-1-4, is a typical municipal siren and relay setup. The photographs illustrate the interchangeability of the position of the three component parts relative to each other on the pole. The schematic diagram indicates the presence of secondary voltage at both the city and telephone relays. The vertical clearances in question are those below point A, above B, below C, above D, and below E.

Situation B, Figs IR 374-5-7, is a photoreceptor that triggers services for a private concern (parking lot lights). The clearances in question are those above and below points A and B.

The difference in agreement prompting this inquiry lies in the distinction between "supply equipment" and "service equipment." Supply equipment, such as capacitor switches and meters on poles, is owned and operated by the power company. Service equipment, in this case sirens and photocells, is supplied electrically by the power company but owned and operated by municipal and private concerns. One party contends that Rule 238 applies to supply equipment only. The other denies this distinction applies.

Does Rule 238 apply to "service equipment" as described above, as well as to "supply equipment"? If it does not, does another Rule apply to "service equipment"?



*Position of these relays relative to each other is interchangeable.

Fig IR 374-1
Diagram A

Fig IR 374-2

Fig IR 374-3

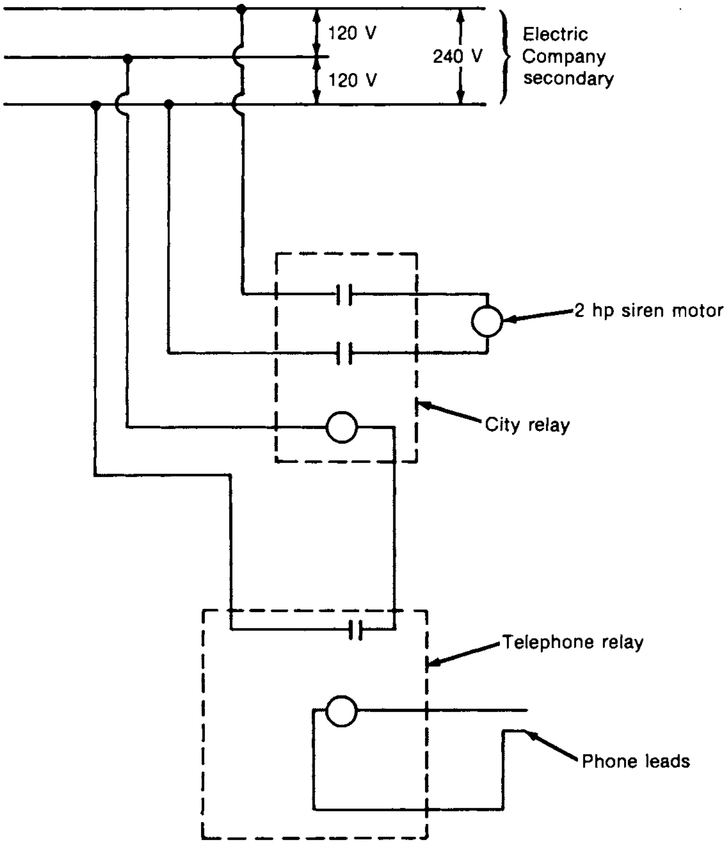


Fig IR 374-4
Schematic for Diagram A

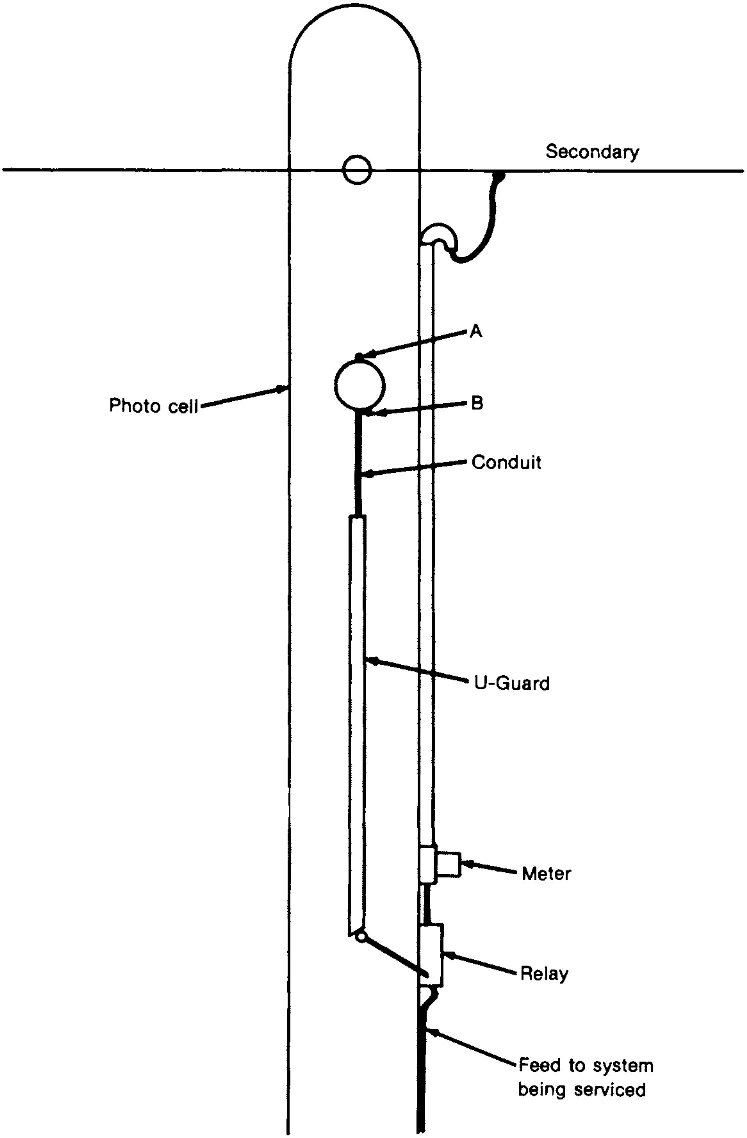


Fig IR 374-5

Diagram B

Fig IR 374-6

Fig IR 374-7

INTERPRETATION (Oct 18, 85)

The NESC limits communication equipment to "that which operates at potentials not exceeding 400 V to ground or 750 V between any two points of the circuit, and the transmitted power of which does not exceed 150 W," or that which operates at less than 150 V, regardless of the transmitted power. The telephone relay referenced in Situation A is considered as communication equipment. See the definition for communication lines.

If power flowing through the 240 V circuit of the city relay of Situation A exceeds the limitation of 150 W, as it would appear that it does, the city's siren control relay and siren are considered as supply equipment. Rule 238 requires 40 in clearance between supply equipment, such as the siren control relay and siren, and the communication relay, unless Note 1 to Table 238-1 applies. The vertical conductors between the two pieces of equipment must meet Rule 237C. If, however, the power to the siren is limited to less than 150 W or less than 150 V, the siren relay and siren can be considered as communication equipment, and no clearance to the communication relay is specified.

NOTE: If the siren and its control relay are considered as communication equipment, the clearance from either of them to supply facilities must be 40 in, as above.

In Situation B, both the photocell and the meter are considered as supply equipment and are required to meet clearances of Rule 238 from the communication attachment and Rule 236D from the climbing space. The vertical conductors must meet Rules 236D and 237C.

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238 See 235 **IR 362**

238A,B See 235C2b(1)(a) **IR 392**

238A,B, Table 238-1

Spacing required between noncurrent-carrying parts of adjacent supply and communication circuits

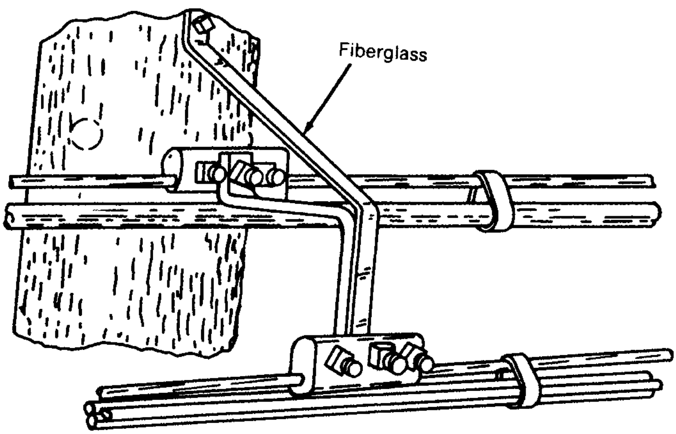
REQUEST (Apr 28, 86) IR 388

The subject of IR 268 is the tubular epoxy extension arm that is finding use as a means of providing additional pole space for CATV installations. My question concerns the last sentence in IR 268, which discourages installation by communications workers.

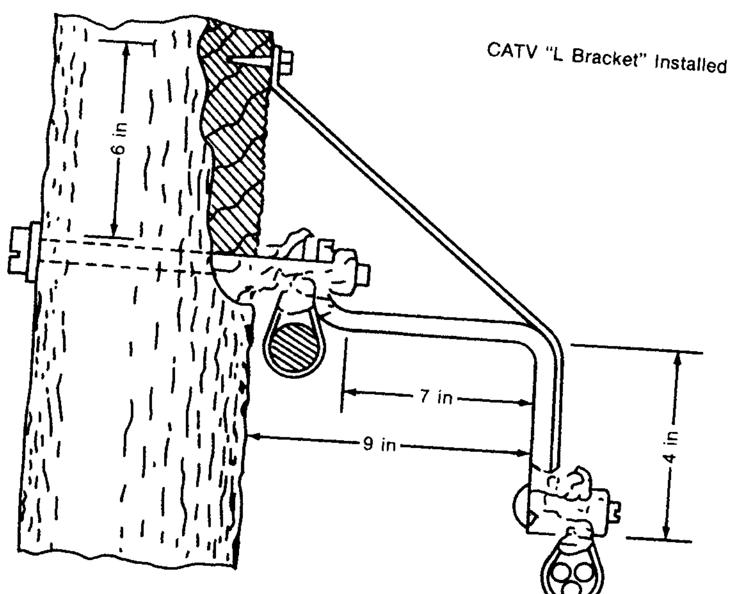
The tubular arm can be as long as 36 in and is often installed well into the clearance space. It also has metallic conductive end fittings; hence, I agree that communications workers should leave the installation to power utility workers or electricians, as suggested.

The CATV bracket with which I am concerned is shown in Fig IR 388. The reinforcing strap, which extends only 6 in into the clearance space, is fabricated of non-conductive fiberglass. Since it is affixed to the communication pole attachment, its depth of penetration into the clearance space is of necessity limited. The projected length of the strap is only about 12 in. Obviously this strap can be installed from the same position that the craftsman would be in to do his routine work on communications plant, and for this reason I believe it can be safely installed by a communications worker.

Am I correct in my opinion that communications workers can safely make the installation because of the significant differences between it and the tubular extension arm?



FRONT VIEW



SIDE VIEW

Fig IR 388-1

INTERPRETATION (Aug 11, 86)

It is intended that no communication equipment such as described in your interpretation request be installed closer than 40 in measured vertically to an ungrounded supply conductor or part. It is vital to the safety of communication line workers to provide adequate headroom for their work. Experience has shown that, just because such a bracket can be installed from a lower position, it does not follow that the bracket will always be installed from the lower position. In fact, it could be expected that a worker might go up each pole to preinstall the brackets before pulling the cable; in that case, the worker might be expected to go up as high as would make installing the bracket the most comfortable — ie, too high if the clearances required by Rule 238B are not met in full. Therefore, the full 40 in is needed vertically below the level of any ungrounded supply conductors to the level of any communication equipment, including the bracket that you described.

238B

Vertical clearance between supply conductor and communication cable attachment hardware

REQUEST (Apr 22, 86) IR 387

Please provide an interpretation of the applicability of NESC Rule 238B to the utility pole construction shown in Fig IR 387. The sketch shows typical construction, which would seem to satisfy NESC requirements on vertical separation of communication and power attachments as specified in Rule 235C, and also the requirements for climbing and working space specified in Sections 236 and 237.

The question arises whether Rule 238B, requiring 40 in of vertical space between power and communications conductors, would in fact apply in this case between the lowest power jumper off the arm end rack and the communications cable at the pole. Typically, in this area, the length of the jumpers below the end rack vary from 2 in to 18 in and are usually #4 to #1/0 solid aluminum or #6 solid copper that would not be prone to appreciable movement in the wind.

If Rule 238B does apply here, where the jumpers are 36 in horizontally off the pole, at what point (4 ft, 6 ft, 8 ft, 10 ft, etc), would the rule no longer apply?

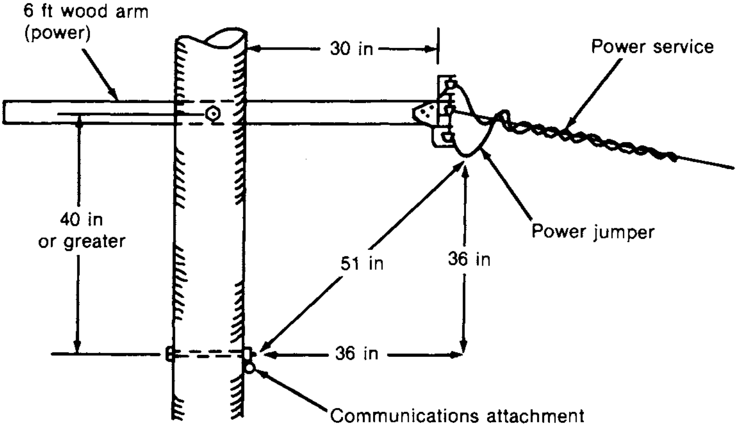


Fig IR 387

Typical Joint Use Pole
With 6 ft Arm

INTERPRETATION (July 9, 1986)

The vertical clearances of Rule 238 are to be measured vertically, not diagonally. They apply to facilities on the same structure regardless of the horizontal distance along the crossarm. The installation included in the request letter, therefore, violates the requirements of Rule 238 for the vertical clearance between the supply conductor and the communication cable attachment hardware.

Your letter referred to "power and communication conductors." Please note that Rule 238 applies when one or both of the facilities is "equipment" included within Rule 238A. Clearances between conductors on the same structure are found within Rule 235.

238B, Table 238-1, Footnote 1

(a) Which equipment is to be grounded?
(b) What is a well defined area?
(c) What is adequate grounding?

REQUEST (Sept 14, 84) IR 363

Request interpretation of "effectively grounded in a well defined area," as it relates to the clearance between a supply conductor, supply bracket and communication conductor/communication bracket.

(A) Which bracket must be grounded, supply or communication or both?

(B) What is a "well defined area?"

Definition of Grounded—Connected to or in contact with earth or connected to some extended conductive body that serves instead of the earth.

Definition of Effectively Grounded—Intentionally connected to earth through a grounded connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the build-up of voltage that may result in undue hazard to connecting equipment, or to persons.

By using the above definitions, the CATV company will ground the CATV system every fifth pole in its entire system.

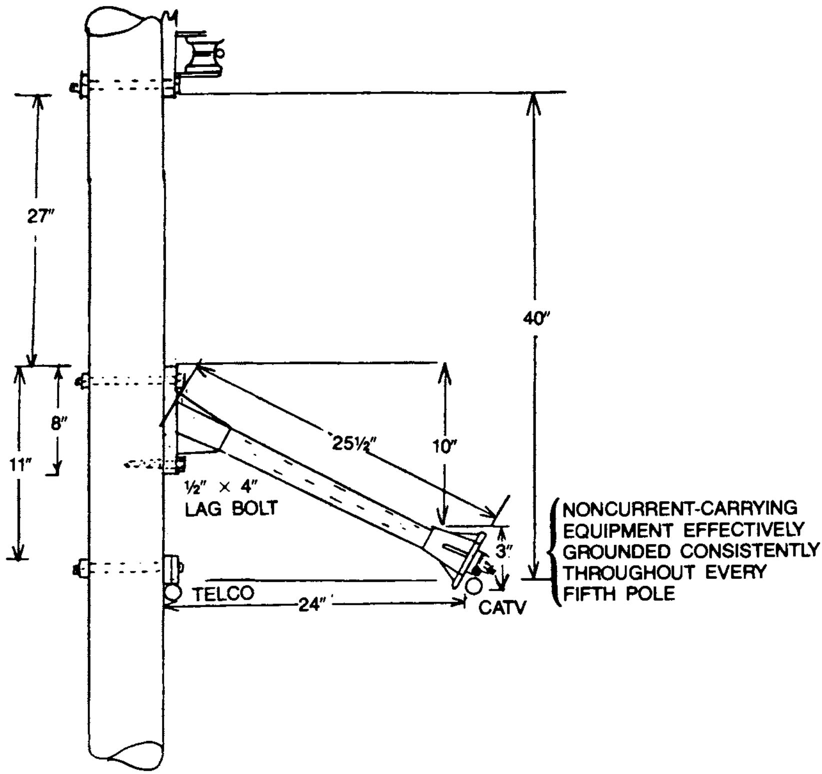

27″
40″
8″
11″
25½″
10″
½″ × 4″
LAG BOLT
3″
TELCO
24″
CATV
NONCURRENT-CARRYING
EQUIPMENT EFFECTIVELY
GROUNDED CONSISTENTLY
THROUGHOUT EVERY
FIFTH POLE

Fig IR 363-1

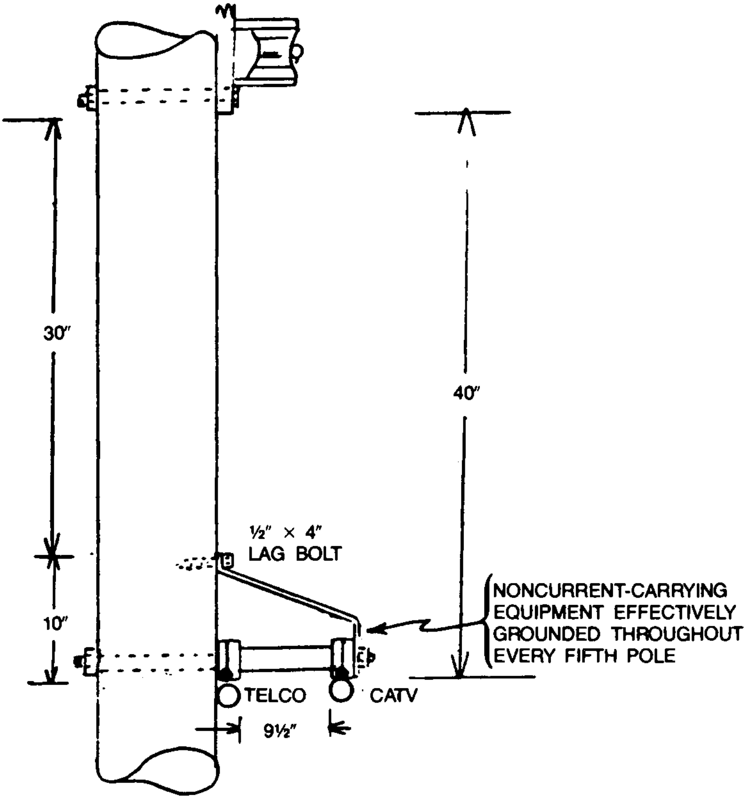

30″
40″
½″ × 4″
LAG BOLT
10″
NONCURRENT-CARRYING
EQUIPMENT EFFECTIVELY
GROUNDED THROUGHOUT
EVERY FIFTH POLE
TELCO
CATV
9½″

Fig IR 363-2

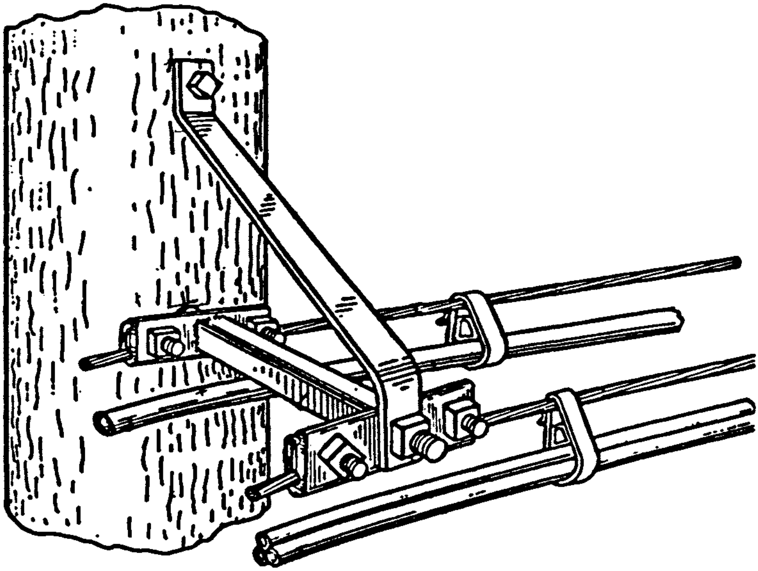


Fig IR 363-3

INTERPRETATION (Mar 20, 84)

We assume that the communication facilities in your illustrations are exposed to voltages above 300 V; if so, Rule 215C requires the communication messengers and their hangers to be effectively grounded. Table 238-1, Footnote 1 requires that noncurrent-carrying parts of supply equipment be effectively grounded consistently throughout well-defined areas to allow the reduced clearance. The reduced clearance allowed by Footnote 1 is not intended to apply between communications facilities and supply conductors; it is intended to apply between communications facilities and noncurrent-carrying parts of supply equipment where those parts also meet the effective grounding requirements of Footnote 1. It should be noted that Rule 235 contains requirements for clearances where conductors are involved—see Fig 235-1.

No specific definition of "well-defined area" is included within the Code; the answer depends upon the knowledge of the personnel of all parties concerned with the installations. The area could be a political subdivision, such as a town, township, county, or state, or a system boundary, terrain boundary, or any boundary known to all personnel involved with the installations therein. The key is that the grounding must be performed consistently throughout the area that the limits of the area must be known to all parties so that there is no uncertainty involved.

The constitution of effective grounding in actual fact depends upon site-specific conditions. The Code includes minimum requirements; it is the responsibility of the utility to install such additional facilities as required to achieve effective grounding.

241C See Table 242-1 **IR 391**

242, Table 242-1 See 93C2 **IR 407**

Table 242-1

Definition of "limited access highway"

REQUEST (Mar 7, 86) IR 385

Table 242-1 of the NESC 1984 Edition shows required "Grades of Construction for Supply Conductors Alone, at Crossings, or on the Same Structures with Other Conductors."

This table shows grade "B" construction as being required for crossing "Railroad Tracks and Limited Access Highways." Could you please clarify the definition of a "limited access highway?" In our State they identify their roads as "partially controlled access," "controlled access," and "fully controlled access" highways.

Which of these would fall into your classification of "Limited Access" highways?

INTERPRETATION (Aug 11, 86)

The term "limited access highway" was recommended to the Subcommittees by the Federal Department of Transportation at the time the rule was written during the revisions for the 1977 Edition. These highways generally carry such a volume of traffic, or traffic of such a critical nature, that access to the highway is controlled for purposes of improving traffic flow and safety. Both "fully controlled" and "partially controlled" highways are included. Fully controlled access highways have no grade crossings and have carefully-designed access connections. Partially controlled access highways are allowed to have same at-grade crossroad intersections and some carefully selected and predetermined land service connections (driveways), often using service roads to channel traffic.

* * * *

Table 242-1

Grade of construction for colinear and at crossing conductors

REQUEST (July 18, 86) IR 391

In attempting to ascertain the grade of construction required for supply conductors and a supporting structure in joint-use we find that Table 242-1 in the 1984 Edition of the NESC generally prescribes a higher grade where communication conductors are in place or to be placed as underbuild below the supply conductors. This may variously be called underbuild, colinear, or joint-use construction, and the presence of the communication conductors with strict interpretation of Table 242-1 would, in fact, be cause for upgrading of the supply line construction.

In contrast, a modification of Rule 241C, the addition of the first paragraph following "At Crossings," would appear to have been an attempt to exempt such "joint-use or colinear construction" from higher grade requirements as stated above.

The questions are:

(1) Does the presence of communication conductors at lower levels mandate the higher grade requirement regardless of their being "colinear" or "at crossing"?

(2) If "colinear" construction is exempt from said requirement, is the coincidental presence of lateral taps also exempt? (Services and two-wire taps are recognized to require lower grade via Footnote 6.)

INTERPRETATION (Nov 24, 86)

This question was discussed in IR 321.

Rule 243 requires the grade of construction of a structure to be the highest required of a supported conductor by Rule 242 and Table 242-1. When supply conductors are carried in the upper position on joint-use poles, both the supply conductors and the structures must meet Grade B, unless the conductors meet Footnote 8 requirements and Grade C is allowed. Grade N is not allowed.

The last sentence of the first paragraph in Rule 241C does not affect the required grade of construction but does affect the overload capacity factor required for such grade of construction under Section 26, where a distinction is made between "at crossings" and elsewhere.

261, Table 261-2

Crossarm bending stress, overload capacity factors, and vertical clearance

REQUEST (May 1, 86) IR 389

We would like your interpretation of the following situations per the 1984 Edition of the National Electrical Safety Code.

First, does Rule 261E require that the bending stress in steel crossarms used at dead ends when loaded to NESC heavy loading times the appropriate overload factors from Table 261-2 not exceed the: (A) yield or (B) ultimate.

Second, if the ultimate stress value above is allowed, does the vertical clearance above ground (Rule 232) have to take into account the increased sag due to deflection of the crossarm? If so, is the crossarm deflection determined using only the NESC heavy load or NESC heavy load times the overload factor from Table 261-2?

In other words: (a) Must stress in crossarms at dead ends not exceed yield or ultimate strength? (b) Must vertical clearance above ground include the effect of crossarm deflection? (c) Must crossarm deflection include an overload factor?

INTERPRETATION (July 9, 86)

(a) The answer given in IR 348 is applicable in this case as well.

(b) Rule 230H requires the clearances in Section 23 to be maintained.

(c) Overload capacity factors are not loads in themselves and are not intended to be used when determining structure flexure; OCFs are used solely for determining whether the required overload strength capacity remains in the structure after the specified loadings are applied. The specified loadings are intended to be used for both strength calculation purposes and determination of structure movement under load.

261A2b, Table 261-3

Required strength of wood poles at replacement

REQUEST (May 8, 85) IR 379

The term "at replacement" as it appears in the subject table could be interpreted by a designer in one of two ways. It could be interpreted to mean that when installing replacement wood poles, the appropriate design factors of safety would be those shown in the column headed "at replacement." These reduced factors of safety might allow, for example, a class 2 pole to be replaced with a class 3. Or, it could be interpreted as it is in REA Bulletin 62-1, 1980, "Design Manual for High Voltage Transmission Lines,"[1] where on page XI-5 a footnote states, "'At replacement' refers to the minimum strength at which deteriorating poles are to be replaced. The replacement poles are to meet 'new' ('when installed') construction requirements."

This indicates that if field inspection of a pole shows that decay has reduced the sound cross section, and thereby pole strength, to the point that the factors of safety are at or below those minimums shown for "at replacement," then the pole must be replaced. The replacement pole, however, is to be classed to provide the factors of safety required for "new" or "when installed."

As an example, if an existing class 3 pole in Grade B construction has decayed at the ground line so that the remaining sound cross section provides a factor of safety of only 2.50 under transverse wind loading, then the pole must be replaced. The replacement must be class 3 or larger to provide the 4.0 factor of safety required for "when installed."

Please advise which of the above interpretations is correct.

INTERPRETATION (June 21, 85)

Table 261-3 recognizes that the fibers, and thus the strength, of wood structures deteriorate under the influence of weather and other conditions. The "when installed" overload capacity factors of Table 261-3 are required when wood structures are initially installed for nontemporary service. When a wood structure deteriorates to the point that the "at replacement" overload capacity factors cannot be met, the structure must be replaced. The replacement structure is required to meet the "when installed" values.

SECRETARY'S NOTE: This interpretation request was reviewed by the members of NESC Subcommittee 5 at a meeting held on November 18 and 19, 1987, in order to determine if any change to the affected rule should be proposed. The members decided that no rule change is

[1] This document is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

necessary, but they requested that the following sentence be added to the reply: "This does not prohibit rehabilitations of a structure under Rule 261A2f."

261C2

Guying of joint-use poles

REQUEST (Nov 26, 86) IR 398

We are requesting an interpretation of NESC Rule 261C2 "Strength of Guys and Guy Anchors: Wood and Reinforced Concrete Poles and Structures" to assist us in determining the need for additional guying by second and third parties on joint use poles where one party is already guyed. This has become a major area of controversy in that we are presently surveying all CATV facilities within our operating area, which involves participation by the local telephone companies. There are differing opinions among the parties involved regarding the need for guying in certain situations. To explain further, first I will give you our interpretation of Rule 261C2 and then cite three situations found in the field that prompted our request for an interpretation of this Rule.

We interpret Rule 261C2 to mean that, assuming similar construction by all parties involved, once a guy is installed by either party on the pole, the pole becomes a strut or column only and is unable to support on its own any existing or additional unguyed load imposed in that direction. This is supported by Rule 261A2e, which states that "guyed poles shall be designed as columns, resisting the vertical component of the tension in the guy plus any other vertical load on such poles." In other words, if one party guys their load on a pole, then the other parties would also be required to guy their load acting in the same direction.

The three specific situations that prompted this interpretation request are listed below. The general questions under each situation were included to help us understand the intent of Rule 261C2 and they do not take into account the variables that could affect the need for additional guying by other parties (ie, offsetting angles, taplines, service drops pulling off back of pole, etc).

Situation 1. Poles involving very slight angles (less than four degrees), assuming similar construction by all parties.

Telephone normally does not require guying in these situations for single strand attachments as they rely on pole strength to hold their load. CATV will normally follow suit with telephone.

We have no minimum guying requirements as guys are installed for any angle as the tension dictates. On poles where we are guyed, we would require that telephone/CATV guy also, based on our interpretation. Therefore:

(a) If we are guyed on this pole and telephone/CATV attaches to the pole at a later date, is telephone/CATV required to guy because we are guyed?

(b) If telephone/CATV is attached to this pole and is not guyed, and we attach at a later date and guy our load on the pole, is telephone/CATV required to go back and guy their load because we are guyed?

Situation 2. Secondary non-slack span to a lift or drop pole.

Unless tension dictates otherwise, telephone normally does not require guying in this situation for secondary service drop conductors as they rely on pole strength to hold their load. Again, CATV will normally follow suit with telephone.

In most cases, we will guy all non-slack secondary conductors, space permitting, and would require that telephone/CATV also guy based on our interpretation. Therefore:

(a) If we are guyed on the lift pole and telephone/CATV attaches one or more service drop cables to the same pole at a later date, is telephone/CATV required to guy because we are guyed?

(b) If telephone/CATV is attached to the lift pole and is not guyed, and we attach to this pole at a later date and guy our strain on the pole, is telephone/CATV required to go back and guy their load because we are guyed?

Situation 3. Secondary slack span to a lift or drop pole.

All parties agree that slack span construction can be used in situations where guying is impractical or impossible. Slack spans are adequate provided pole strength has not been exceeded. Therefore:

(a) We have determined that pole strength is not exceeded and therefore, have not installed a guy on a lift pole. If telephone/CATV attaches to this lift pole at a later date, is telephone/CATV required to guy their load if pole strength has now been exceeded? Will we be required to go back and guy our load because telephone/CATV is now guyed?

Please advise if we are interpreting Rule 261C2 incorrectly. Assuming similar construction for all parties involved, we would answer "yes" to all of the questions above based on our interpretation.

INTERPRETATION (Sept 21, 87)

There are essentially two questions at issue in this request: (1) Must a wood pole be considered only as a strut if a guy is attached? (2) Is each load required to be guyed separately?

Question 1

It is intended that assumed forces be withstood by either (1) a structure acting alone, or (2) a structural system that employs suitable guying or bracing. Individual components of a structural system must be of such material and construction that their flexure under load will be limited below that which would cause either itself or another member to be overstressed.

It is recognized that wood and reinforced concrete poles will deflect considerably under heavy load. If guy strength were to be used in combination with the strength of such poles, the guys would be overstressed before the pole deflected enough to reach its full reaction capability. In addition, significant flexure of a pole exacerbates the bending moment caused by conductor weight and the vertical component of guy loading. Consequently, the NESC generally requires guying to take all assumed horizontal forces and the wood or reinforced-concrete pole to act only as a strut. Rule 261C2 excepts only those structures that "possess sufficient rigidity" not to overstress the guy from the general requirement. In the absence of knowledge of such rigidity, the general rule applies.

Question 2

The NESC requires that assumed loads be withstood by the structure and its supporting members with the required overload capacity factors. It neither requires nor prohibits withstanding each load on a guyed structure with a separate guy. It is the responsibility of every constructing party to assure that the loads it places on a structure are adequately withstood.

The NESC is not a design, construction, or administration manual; it is a safety document.

Nothing prohibits parties from agreeing to share structure space or structure guying capability. The questions of (a) who is responsible for guying which loads on a joint-use pole, (b) how many guys will be used, and (c) where they will be located are all matters for agreement by the parties, so long as the result is that all loads are withstood as required by the NESC rules.

261D, Table 261-1

Minimum cross-section dimensions of wood crossarms

REQUEST (Mar 26, 86) IR 386

We would like your interpretation of Rule 261D, Table 261-6, and Rule 261D4. The first sentence of Rule 261D4 states, "Wood crossarms of selected southern pine or Douglas fir shall have a cross section of not less than those shown in Table 261-6." For Grade C construction the minimum required dimensions of cross section for Douglas fir or southern yellow pine crossarms would be 2.75 in × 3.75 in. For Grade B construction the minimum required dimensions of cross section for Douglas fir or southern yellow pine crossarms would be 3 in × 4 in.

The last sentence of Rule 261D4 states, "Crossarms of other suitable timber or of other materials may be used provided they are of equivalent strength." Our interpretation of this part of the section is that all types of wood and nonwood crossarms should have strength equivalent to the minimum size Douglas fir or southern yellow pine crossarms for either Grade B or C construction. One commonly accepted method of equating crossarm strength is to compare crossarm static bending strength, which is dependent upon crossarm section modulus and modulus of rupture. Section modulus for minimum-size Douglas fir or southern yellow pine crossarms with two or four pins would be as follows:

I. Vertical
   A. Grade B Construction (3 in × 4 in Minimum Cross Section)

$$SB = \frac{3\ \text{in} \times (4\ \text{in})^2}{6} = 8.0\ \text{in}^3$$

   B. Grade C Construction (2.75 in × 3.75 in Minimum Cross Section)

$$SC = \frac{2.75\ \text{in} \times (3.75\ \text{in})^2}{6} = 6.45\ \text{in}^3$$

II. Longitudinal
   A. Grade B Construction (3 in × 4 in Minimum Cross Section)

$$SB' = \frac{(3\ \text{in})^2 \times (4\ \text{in} - 0.6875\ \text{in}^*)}{6} = 4.97\ \text{in}^3$$

   B. Grade C Construction (2.75 in × 3.75 in Minimum Cross Section)

$$SC' = \frac{(2.75\ \text{in})^2 \times (3.75\ \text{in} - 0.6875\ \text{in}^*)}{6} = 3.86\ \text{in}^3$$

*Allowance for 11/16 in mounting bolt hole.

The moduli of rupture for selected Douglas fir and southern yellow pine crossarms are as follows (based on small clear specimens at a moisture content of 12%):

Species	[MOR] Modulus of Rupture*
Douglas fir	12 400 psi
Southern yellow pine	14 500 psi

*Values from USDA Forest Product Laboratory, Agriculture Handbook No. 72.[2]

As a manufacturer of wood products for the utility industry, we are interested in the possibility of utilizing select apitong for certain crossarm applications. The modulus of rupture for apitong is 16 200 psi.

Based on all of the previous data, we would like to determine the minimum cross section dimensions for apitong crossarms, assuming that the crossarm width = 2.6875 in.

I. Vertical.

$$S = \frac{bd^2}{6}$$

where: b = crossarm width; d = crossarm depth.
Crossarm static bending strength = SX MOR.
Equating crossarm strength: apitong crossarm static bending strength = Douglas fir crossarm static bending strength; or

$$S[A] X \; MOR[A] = S[DF] X \; MOR[DF]$$

$$\frac{bd^2}{6} = \frac{S[DF] \times MOR[DF]}{MOR[A]}$$

$$d = \frac{[6[S[DF] \times MOR[DF]]]^{0.5}}{b \times MOR[A]}$$

A. Grade B Construction. Assuming b = 2.6875 in,

$$d = \frac{[6 \times 8.0 \text{ in}^3 \times 12\,400 \text{ psi}]^{0.5}}{2.6875 \text{ in} \times 16\,200 \text{ psi}}$$

minimum depth = 3.70 in

[2]United States Department of Agriculture, Forest Service, Forest Product Laboratory, Madison, Wisconsin. Agriculture Handbook No. 72, 1987. Wood Handbook: Wood as an Engineering Material. This document can be obtained from the Government Printing Office, 710 North Capital Street, NW, Washington, DC 20401.

B. Grade C Construction. Assuming b = 2.6875 in,

$$d = \frac{[6 \times 6.45 \text{ in}^3 \times 12\,400 \text{ psi}]^{0.5}}{2.6875 \text{ in} \times 16\,200 \text{ psi}}$$

minimum depth = 3.32 in

II. Longitudinal.

$$S = \frac{b^2 \times [d - 0.6875 \text{ in}]}{6}$$

A. Grade B Construction. Assuming b = 2.6875 in,

$$d = \frac{[6 \times 4.97 \text{ in}^3 \times 12\,400 \text{ psi}]}{[2.6875 \text{ in}]^2 \times 16\,200 \text{ psi}} + 0.6875 \text{ in},$$

minimum depth = 4.05 in.

B. Grade C Construction. Assuming d = 2.6875 in,

$$d = \frac{[6 \times 3.86 \text{ in}^3 \times 12\,400 \text{ psi}]}{[2.6875 \text{ in}]^2 \times 16\,200 \text{ psi}} + 0.6875 \text{ in},$$

minimum depth = 3.15 in.

Based on the preceding data, it is our opinion that an apitong crossarm with a 2.6875 in crossarm thickness requires a minimum crossarm depth of 4.05 in for Grade B construction and 3.32 in for Grade C construction.

INTERPRETATION (July 9, 86)

Rule 261D4 clearly allows the use of any crossarm material providing strength equivalent to the specified materials. The NESC does not specify methods for comparing strengths. Rule 012 requires the use of accepted good practice in all particulars not specified in the rules.

The Interpretations Subcommittee does not supply consulting information on specific application of the NESC, nor does it approve specific designs.

261D, Table 261-6

Crossarm length and longitudinal strength

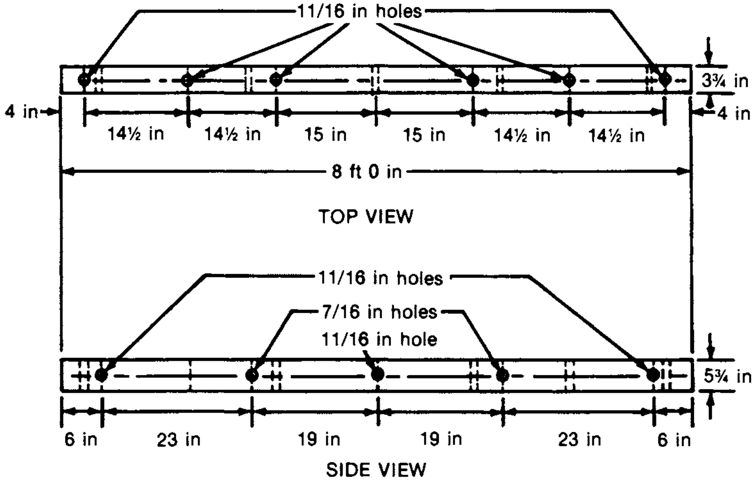
REQUEST (Apr 4, 85) IR 376

We would like your interpretation of two items in Rule 261 of the 1984 Edition of the National Electrical Safety Code.

First, in Table 261-6, "Minimum Dimensions of Crossarm Cross Section," we question what is meant by "Number of Pins." If we use an 8 ft crossarm that carries three conductors (or pins), in which category does our arm fall? Although we refer to this as a six-pin arm, no more than three pins (or conductors) are carried by the arm at one time (see Fig IR 376).

Second, in Rule 261D, "Crossarms," we question the safety factor, if any, that should be applied on crossarms for dead-ends. It is stated clearly that the vertical loads (Rule 261D1) shall not exceed 50% of the ultimate strength of the wood, yielding a safety factor of 2.0. However, when examining the longitudinal strength requirement (Rule 261D3), which we are presently interpreting to include dead-ends, a safety factor is not evident. If Rule 261D3b applies, would a crossarm section larger than that shown in Table 261-6 be able to carry a proportionally greater conductor tension (over 2000 lb)?

NOTE: Top edges to be rounded or chamfered.



Material: Douglas fir

Fig IR 376

INTERPRETATION (Nov 6, 85)

The "number of pins" is used to designate the length of the crossarm: 6 pin is 8 ft; 8 pin is 10 ft. An 8-ft arm requires use of the "6 or 8" category in Table 261-6 for supply conductors.

Stresses resulting from conductor tensions computed at 700 lb, as per Rule 261D3, provide small factors of safety that vary according to the grade of the crossarm, dimensions, and allowable fiber stress. Accordingly, the 700 lb loading or its equivalent results in a stress that approaches, but does not exceed, an overload capacity factor of unity. No overload capacity factor is stated as such when the expected loading is greater than 700 lb; Rule 261D3 implies a required overload capacity factor of unity where conductor tension is greater than 700 lb. This rule applies both to dead end and line poles; the code requires the designer to assure that the conductor loading on the crossarms will not exceed its designated fiber stress (or ultimate strength). Note that conductor tension resulting from all sources, including wind and ice loading, must be included. Rule 261D3a requires that, at a minimum, the crossarm be able to hold the forces capable of being withstood by good wood pins — 700 lb.

Rule 261D3b is provided as a convenience in assuring that appropriate safety considerations have been met for conductor tensions up to 2000 lb per conductor; the indicated construction requires double crossarms. Note that this particular construction is not required for conductor tensions above 700 lb; the designer may specify alternate construction that meets Rule 261D3a. For conductor tensions above 2000 lb, no particular construction is specified as being considered to meet the requirements of the rules; it is the designer's responsibility to assure compliance with the fiber stress limit.

Table 261-1 See 261D IR 386

277

Working load of insulator must not exceed 50% of ultimate strength

REQUEST (Oct 26, 86) IR 395

We plan to use a non-ceramic insulator for a dead end application. The working line tension under NESC light loading is 20 000 lbs. We, therefore, need an insulator with 40 000 lbs ultimate strength to meet the requirements of Rule 277.

A manufacturer sells an insulator rated at 20 000 lbs working load. The manufacturer's literature shows this insulator to have an ultimate strength of approximately 40 000 lbs for one day duration of load. However, this strength decreases for longer loading periods to an ultimate strength of approximately 20 000 lbs for 50-yr duration of load.

Since there is no discussion of time of load in Rule 277, I assume that the insulator must not exceed 50% of the ultimate strength for actual duration of the applied load. Since this ultimate strength is less than 40 000 lbs for the insulator in question, I conclude that I must use a stronger insulator for my application.

Is my conclusion correct? Please elaborate on how to treat non-ceramic insulators whose strength varies with duration of load.

INTERPRETATION (Dec 18, 86)

You have correctly interpreted the Rule.

280A1b

Climbability of guyed dead end poles

REQUEST (Nov 26, 86) IR 397

Please provide your interpretation of "readily climbable" as referenced in Rule 280A1b of the 1984 Edition of the National Electrical Safety Code.

In conjunction with the above interpretation, Fig IR 397 is a drawing showing our standard construction practice for a guyed dead end pole. Are these or similar structures considered to be "readily climbable" by unauthorized persons?

The definition of readily climbable as defined in the 1987 Edition of the NESC is "having sufficient handholds and footholds to permit an average person to climb easily without using a ladder or other special equipment." The deadend pole in question has neither handholds nor footholds. However, please reference the guy locations and interpret whether the guying for this structure is considered to be "readily climbable" by unauthorized personnel. The guy strand could be either 5/16 in or 7/16 in wire.

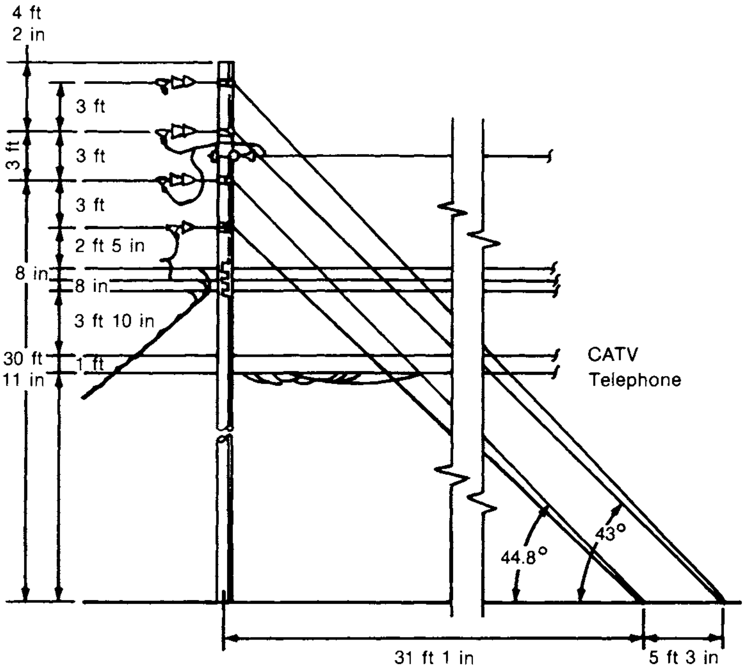


Fig IR 397

INTERPRETATION (Mar 23, 87)

We refer you to IR 357.

Anchor guys have neither footholds nor handholds and are, therefore, not easily climbed.

280A1b

Climbability of pipe risers

REQUEST (Oct 12, 87) IR 415

During some of our inspections, we have observed that a number of pipe risers are installed at a distance from the poles that will allow individuals to climb the riser pipes and gain access to the energized electrical conductors above. This type of installation contributed to a severe electrical accident that occurred on August 23, 1987 when a man climbed a pipe riser (see Fig IR 415) and contacted an overhead electrical conductor.

We request an interpretation of Rule 280A1b, page 294, of the 1987 NESC that will specify the intent of the NESC Committee in regard to whether riser pipes as described above should be treated as readily climbable structures.

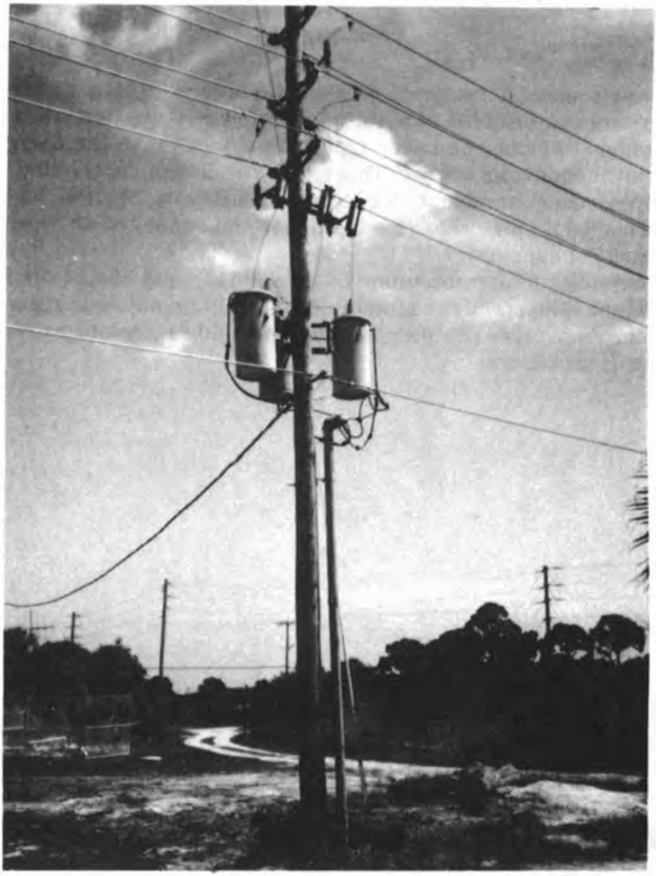


Fig IR 415

INTERPRETATION (Feb 17, 88)

The subject installation does not have sufficient handholds and footholds as to be easily climbed. See the definition of "readily climbable" and our answers to IR 357 and IR 397.

280A2 See 234C3 **IR 377**

Safety Rules for the Installation and Maintenance of Underground Electric-Supply and Communication Lines

Part 3 **(Sections 30-39)**

Section 39 See 234C,D **IR 383**

315B See 234C,D **IR 383**

323B See 234C,D **IR 383**

340B See 234C,D **IR 383**

350E

Meanings of "should" and "shall"

REQUEST (Apr 7, 87) IR 401

The 1987 Edition states that bonding should be provided between above-ground power and communications apparatus under specified conditions. It is our understanding of the Code that "should" means that under normal conditions something must be done unless a good reason, such as physical obstacles, prevents it from being done (see Rule 015).

We have a situation where a local power company has chosen not to observe this bonding requirement, based upon the fact that the mandatory "shall" was not used. In summary, we feel the use of "should" does not make the situation discretionary and that their interpretation is not in keeping with the intent of the Code.

May we have your interpretation?

INTERPRETATION (Sept 21, 87)

The NESC rules are carefully worded to indicate the intended level of desirability and appropriateness of specific action under particular and specified situations. Where it is intended that a specific action be taken in a particular situation, the word "shall" is used and the action is mandatory.

It is also recognized that a specific action may generally be appropriate in certain situations, but that occasionally some site-specific attribute will limit the practicality of performing the specified action and, thus, some other action will be appropriate for that particular situation. Where the NESC intends to allow the use of other methods to recognize site-specific problems, the word "should" is used. The use of the word "should" is not intended to relax the responsibility of the user for appropriately attending to the problem at hand. If there is no practical problem that limits the capability of the user to perform the specified action, then the specified action is required. If there is a practical problem, then Rule 012 becomes operable and requires "accepted good practice for given local conditions."

In summary, the word "shall" is used to require performance of the specified action. The word "should" is used to require performance of the specified action if it is practical to do so; if that action is impractical, some other action that recognizes particular conditions and accomplishes accepted good practice for those conditions shall be performed.

351C5 See 353D **IR 384**

353D

Submarine cable burial depth and grounding requirements

REQUEST (Feb 26, 86) IR 384

We are seeking your comments and interpretation of the NESC. Our questions are as follows:

Do the NESC requirements apply to the installation of URD cable laid on the bottom of a lake as it may relate to grounding requirements and depth of burial?

(A) Rule 96A3—Does this section of the Code apply to jacketed cable laid on the bottom of a lake where it is very unlikely that there will be human contact?

(B) Rule 353D1 states "the distance between the top of a cable and the surface under which it is installed shall be sufficient to protect the cable from injury or damage imposed by expected surface usage." What is meant by "surface?" The surface of the water level or the surface of the bottom of the lake?

(C) Rule 353D2 describes burial depths. Does this require the cable to be buried in soil under the water or, perhaps, would this not apply under lakes? If so, what is the definition of a lake?

Details of the proposed installation are as follows:

A client wants to install 6 mi of 3-phase underground distribution to serve a 750 kVA irrigation pump. There will be no loads served along the route. All of the cable will be 15 kV cable with bare copper concentric neutral except for a 7000 ft section in the middle of the project. It is 7000 ft across a lake and, on this portion, they would like to use cable with the concentric copper neutral covered with a polyethylene extruded semiconducting jacket.

The jacketed cable neutral will be well-grounded at each end of the 7000-ft crossing. The cable will be buried 42 in in the soil up to the shore and as far into the lake as practical. This design takes into account the minimum surface level of the lake as specified by the Army Corps of Engineers. What depth of water would be considered sufficient to protect the public? 42 in? 7 ft? 20 ft? 90 ft?

Providing ground electrodes at the bottom of a lake with depths up to 90 ft also appears to be impractical and is probably not necessary.

We are also concerned about cutting into the jacket to connect the copper concentric neutral to "made" electrodes. The primary reason for the jacket is to reduce the possibility of neutral corrosion. Cutting into the jacket could more likely be a cause of future neutral corrosion.

INTERPRETATION (July 9, 86)

As long as the concentric neutral and cable jacket meet the requirements of Rule 94B5, wherein the concentric neutral is considered to be a continuous electrode, the requirements of Rule 96A3 are met.

A fault in a cable that is (1) under water and (2) such a distance away from the location of humans or sensitive equipment that no appreciable voltage gradient exists around them will generally present no safety hazard. The intention of Rule 353 is to limit the opportunity for expected surface usage to damage the cable and present a hazard to the people or equipment involved. Generally, such requirements are applicable to burial in earth or rock areas, but they also apply in submarine areas to the extent that they may be applicable, considering the expected surface activity under the given local conditions. For submarine areas, Rule 351C5 is also applicable; this rule speaks to location and installation but does not contain specific depth requirements—as a result, Rule 012 is also applicable. The designer is thus required to consider accepted good practice for the given local conditions. The burial depths of Rule 353D2 are not mandatory. The appropriate burial depth at any point in the run of the submarine cable, if any, may be lesser or greater than that included in Rule 353D2 and should be determined by the nature of any expected activity at that point that offers the likelihood of breaching the cable.

354E4

Provision of adequate bonding

REQUEST (Mar 14, 85) IR 373

Rule 354E4 states that adequate bonding shall be provided between the effectively grounded supply conductor or conductors and the communications cable shield or sheath at intervals that shall not exceed 1000 ft (direct buried cable).

Both power and telecommunication cables are buried, not in a joint trench, but with above-ground conductive metal cases within three feet of each other. In order to satisfy 354E4 of the NESC and a safety practice that requires bonding of telco and power apparatus that are within ten feet of each other, ... placed a wire of the required size and requested that the power company complete the bond. In this case the ground is accessible only by the power company, as it is inside the transformer case.

The power company has refused to complete the bond connection and has also denied a telco request to make an exterior connection via the lifting bolt holes.

Which party shall provide the adequate bonding described in 354E4?

INTERPRETATION (July 23, 85)

Rule 354E4 applies only to random lay situations where supply and communication cables are in the same trench. The NESC requires that the supply apparatus and the communication apparatus referred to be each effectively grounded; however, there is no requirement in the NESC at the present time that such equipment be bonded together.

381G

Barriers for pad-mounted equipment

REQUEST (Oct 30, 86) IR 396

A question has arisen regarding the interpretation of what an adequate second barrier is as referred to in the NESC, 1984 Edition, Rule 381G, "The other shall be either the opening or the removal of a second secured door or barrier."

Electric utilities generally accept dead-front design as the second secured barrier. They point out that the high-voltage bushings are completely insulated and shielded, and the elbow connectors are also insulated.

My concern with accepting dead-front design as the second barrier is with the loadbreaking and disconnect procedure for the elbow connectors. The general public has neither the proper tools nor the knowledge to do this properly. Nor is the elbow secured in place.

For this reason, I question the adequacy of accepting dead-front design as the second secured barrier. I would appreciate your interpretation.

INTERPRETATION (Feb 25, 87)

Rule 381G1 of the 1987 Edition applies to all pad-mounted equipment not located in a protected area.

Rule 381G2 only applies where there are exposed live parts above 600 V. Dead-front elbows are not considered to be live parts within the meaning of this rule. Both the elbows and the connection points must be plugged to maintain the integrity of the insulating system.

391A3 See 234C,D IR 383

Rules for the Operation of Electric-Supply and Communication Lines and Equipment

Part 4 **(Sections 40-43)**

410B1 See 011, 012 **IR 406**

411 See 011, 012 **IR 406**

420B-E See 100, 012 **IR 406**

421G

Tagging energized circuits by SCADA systems

REQUEST (April 8, 87) IR 402

During the past decade, many electric utility systems in the United States have added supervisory control and data acquisitions systems (SCADA). Also during this time period, work methods utilizing bucket trucks and so forth have made work on transmission and distribution systems much safer. Rule 421G of the 1987 National Electrical Safety Code deals with tagging of electric supply circuits. This paragraph states that tags will be placed to identify deactivated control circuits when crews are working energized lines. Most SCADA systems have the capability of remotely deactivating the automatic recloser and the control switch for circuit breakers. The SCADA system also includes a tag in the form of an asterisk or other means at the control center and inhibits closing of a circuit remotely until this tag is removed.

I would like to have an interpretation as to whether tagging procedures by SCADA would meet requirements of Rule 421G.

I meet with most of the major electric utilities within my state semi-annually. A few of these utilities tag circuits remotely when performing energized work. We plan to include this as a topic in our September 1987 meeting. If possible, I would like to have a committee interpretation of tagging energized circuits by SCADA for the meeting. Does this meet the requirements of NESC 421G?

INTERPRETATION (Sept 21, 87)

The description of the SCADA system is not sufficient to answer the question specifically, but the following guidance may be used to do so.

The problem is essentially the same regardless of whether a line is (1) deenergized and being worked as "dead," or (2) energized and being worked hot with the reclosing circuits deenergized; inadvertent reenergizing of the line or reclosing control circuit may constitute a hazard to workers.

The intention of the rules is to limit, as far as is practical, the possibility of equipment or lines becoming accidentally energized or reenergized while workers are performing maintenance thereon. Rule 423 requires specific action to be taken in the required order. One of these actions is tagging controls with information concerning the time of disconnection, who made the disconnection, who requested the disconnection, and who authorized the disconnection (see Rule 423A,B,C, and E2). During the work, responsibility may change with permission of the designated person (Rule 423F2). After the work is completed and the designated person receives the request for reenergization, the circuit cannot be reenergized until the following actions are accomplished in order.

(1) The employee-in-charge removes protective grounds (if the line was worked as "dead"), ascertains that all dependent personnel are clear, and so reports to the designated person, requesting removal of tags (Rule 423F1).

(2) The designated person directs the removal of the tags (Rule 423G1).

(3) The person removing the tag adds the data required by Rule 423G1, assuring that the name of the reenergization requestor matches that of the deenergization requestor, unless responsibility has been transferred to the reenergization requestor.

(4) Under Rule 423G, the tag remover reports back to the designated person and verifies that the reenergization requestor matches the original deenergization requestor, unless responsibility was transferred under Rule 423F.

(5) Only after the above has been completed may the designated person direct reenergization (Rule 423H).

Both on-site controls and any remote switching must be tagged (Rule 423C). There are two major questions to be considered and both must be satisfied.

First, does the SCADA system deactivate the local control switch and any other remote control that would allow the equipment, line, or circuit to be accidentally energized? For example, does the SCADA deactivation then make SCADA system the only place from which reenergization or reinstatement of control functions can occur? If it does, then the other points would no longer be active and no longer require tagging. However, if reenergization or reinstatement of control functions could be accomplished at the site or from other remote apparatus, then such controls must be physically tagged.

Second, does the act of placing the computer "tag" symbol also place in effect a software requirement to first remove the "tag" before reenergization can be accomplished? To place this "tag," must all the information required in Rule 423C be input? To remove the "tag," must the information required in Rule 423G be matched with that previously provided under Rule 423C to assure that reenergization will not occur until all requestors are clear?

If the answer to these questions is positive, then the tagging requirements of Rule 423 would appear to be capable of being met by the SCADA system. Otherwise, all points of control are required to be physically tagged.

422A1 See 422B **IR 380**

422B

Insulation of workers using buckets and aerial equipment

REQUEST (Aug 27, 85) IR 380

Rule 422B concerning the third exception states: "No employee shall approach or take any conductive object without a suitable insulating handle within the distance of any exposed energized part listed in Table 422-1 unless the employee... is insulated from all conducting surfaces other than the one upon which the employee is working."

Please interpret this rule from the standpoint of a man doing barehand work on a 7200 V line from a bucket. Does the insulated bucket in itself constitute that the man is insulated from all conducting surfaces other than the one on which he is working?

INTERPRETATION (Nov 27, 85)

The intention of Section 42 of the Code is to ensure that the employee will avoid creating a situation in which an employee can simultaneously contact two or more conducting surfaces that are, or may be, energized at differing voltage potentials. Rule 422A1 and the other rules within Section 42 work together to that end.

Rule 422B specifies the clearances required between an energized part and the employee unless the employee is effectively insulated from conductive objects that could allow the employee's body to complete an electrical circuit. In other words, Rule 422B adds specifics to the general requirements of Rule 422A1.

This interpretation request deals with whether an insulated bucket is all that is required to insulate the employee "from all conducting surfaces other than the one upon which the employee is working." The answer is no; it is also required that either (1) all other conductive surfaces closer to the employee than the distance specified by Rule 422B be insulated from the employee, or (2) the employee be insulated from such surfaces, unless such surfaces are bonded together. Such surfaces include the upper controls and the upper boom, metal bucket supports and appurtenances, guys, conductors, etc. If the configuration and material of the bucket and associated aerial equipment act to effectively insulate or isolate the employee from conductive surfaces that are, or may become, energized at different potentials, then the bucket meets the requirements; otherwise, it does not, and other measures, such as the use of gloves mentioned in Rule 422B, are required.

It is stressed that all the Rules of Section 42 work together and all that are applicable must be met. For example, even if the bucket can meet the requirements of Rule 422B, the requirements of Rule 427 must also be met when the employee is performing bare-hand work. Rule 427 contains requirements for both testing of aerial devices and clearances of such devices from (1) all grounded objects and (2) all lines and equipment at different potentials than that to which the insulated aerial device is bonded.

Table 422-1 See 422B **IR 380**

423 See 421G **IR 402**

427 See 422B **IR 380**

Interpretation Requests

1943—1987

LISTING BY RULE NUMBER
with citation of applicable NESC edition

For each Rule in this list the applicable interpretations are arranged in IR serial number order.

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
RULES				
011,012	Application of Rules 011 and 012 and Parts 1 and 2 to a generation and transmission utility serving a distribution utility	404	Apr 28, 87	1987
011,012	Application of Rules 011 and 012 and Part 4 to a generation and transmission utility notified of an accident on a served distribution utility system	405	Apr 28, 87	1987
011,012	Application of Rules 011 and 012 and Part 4 to off-duty utility personnel	406	Apr 28, 87	1987
013	Interpretation of IR 177 and IR 201(b), Rule 13 vs. Rule 110A; extension of 6 ft fence	291	Feb 2, 81	77/81
013	See 93C	291		
013B	Replacement of structures, strength and clearance in completed work	296	May 27, 81	1981
013B	For 5th Edition original construction over farmland, must newly revised spans: (a) be based on "spaces and ways accessible to pedestrians only" or the new 1981 Edition category of "farmlands" (b) meet only 5th Edition or new 1981 rules for ground clearance	344	July 29, 83	5th and 1981
013B	Underbuilding on existing structures	370	Mar 1, 85	1984
013B1	Relocation of line	369	Jan 15, 85	1984
013B2	(1) Clearance required when second cable is added	292	Mar 3, 81	1981

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
	(2) Communication cable additional clearance (3) Reduced clearance to guys			
DEFINITIONS				
Part II	Antenna conflict. Def. 14	157	Feb 25, 74	6th
Part II	Communications lines (CATV circuits) See 238	64		
Definitions	Communication line requirements applied to fiber optic cable systems	403	May 7, 87	1987
SECTION 9				
No Rule	Insertion of choke coil in ground lead	28	Apr 24, 46	
92B	Grounding point on 3-wire delta systems—corner or mid-point of one phase	104	Dec 31, 63	6th
92B	Number of grounds	118	Sept 8, 65	6th
92B1	Use of line conductor as grounding point in place of common point on wye connected secondary	234	July 21, 78	1977
92B2	Wye distribution system with neutral omitted in one feed	295	May 6, 81	1981
92B2b(3)	Grounding of insulating—jacketed cable neutral	366	Nov 1, 84	1981
92B3	Concentric neutral UG cable; placement of separate grounding conductor (for cable corrosion protection)	364	Oct 11, 84	1981
92C2	Effective grounding of guys; suitability of proposed configuration	340	Apr 28, 83	1981

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
92C3	Crossing structure as related to messenger and grounding conductor	413	Aug 31, 87	1987
92D	Objectionable voltage: neutral/ground	287	Jan 19, 80	1981
92D	Grounding of lamp posts	298	June 1, 81	1981
92E	Grounding of rolling gate	253	July 11, 79	1977
93A, B	Grounding of transformer tank with tank grounded arrester, via a spark gap, etc.	107	Feb 24, 64	6th
93C	Connection of fence grounding conductor to fence posts	291	Feb 2, 81	1977/81
93C1	(1) Method of grounding magnetic mechanical protection (2) Method of grounding nonmagnetic mechanical protection	118	Sept 8, 65	6th
93C2	Size of grounding conductor required for 795 kcmil aluminum neutrals	407	Apr 22, 87	1987
93C7	Bonding requirements for adjacent pad-mounted supply equipment and communication circuit pedestals in an underground system	356	Feb 14, 81	1981
93D1	Guard over ground lead	307	Dec 10, 81	1981
93D1 and 3	See 93C2	340		
94A3	Steel tower and footings; bonding requirements	259a	Nov 15, 79	1977
94A3	Acceptability of steel wire wrapped around reinforcing bar cage, as grounding electrode	263	Jan 4, 80	1977
94B	Alternative to 8 ft driven ground rod	414	Oct 12, 87	1987

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
94B2c	Length of ground rod required to be in contact with earth	410	July 22, 87	1987
94B4	Grounds at transformer locations; adequacy of grounding	338	Mar 3, 83	1981
94B4a	Ground required at distribution transformer	267	Mar 20, 80	1977
94B4b	Grounding—pole butt plates	204	Sept 13, 77	1977
94B4a and b	(a) Effect of service entrance grounds on pole butt plate restrictions at transformer locations (b) Reasons for two butt plates to count as one made electrode, such as a driven ground	331	Aug 25, 82	1981
94B4b	(a) Thickness of butt plates (b) Acceptability of #6 copper wire wrap as grounding electrode	314 Revised Response (1)	Feb 23, 82	1981
94B6	Acceptability as a ground electrode of 20 ft of steel wire wrapped around rebar cage	259	Nov 15, 79	1977
95A3	Does 95A3 apply only to buildings or are steel supporting structures included also?	259	Nov 15, 79	1977
95D	Are galvanized steel group rods regarded as approved equivalent of rods of nonferrous materials?	70	Mar 2, 54	5th
96A	See 94B4			
96A2	Maximum permissible resistance to ground for two electrodes connected in parallel	412	Aug 6, 87	1987

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
96A3	Neutral grounding for buried concentric neutral cable with semiconducting sheath	196	July 14, 77	1977
96A3	Grounding of fully insulated jacketed concentric neutral cable	341	May 2, 83	1981
96A3	Spacing of ground connections in circuits without a neutral	394	Sept 26, 86	1984
96A and B	Ground resistance; (a) limit, (b) measurement	55	Jan 31, 51	5th
96C	Neutral separation on distribution transformer poles to minimize dc flow	280	Sept 9, 80	1977
97	Can grounding conductor of primary spark gap be solidly interconnected with the secondary neutral on an otherwise ungrounded system?	88	July 57	5th
97	See 91A	299		
97A	See 96A and B	55		
97A1	(1) Method of grounding magnetic mechanical protection (2) Method of grounding nonmagnetic mechanical protection	118	Sept 8, 65	6th
97A1	(a) Connection of two items to the same grounding electrode (b) Connection of arrester ground to grounded neutral (c) Reasons for prohibiting solid interconnection of arrester grounding conductor and secondary grounding conductors	299	June 15, 81	6th 1973 printing

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
97C	Grounding of transformer tank with tank grounded arrester, via a spark gap, etc.	107	Feb 24, 64	6th
97C	See 96A3	341		
97C	See 94B4b	314		
97C	(9) Allowable interconnection of grounds—primary arrester, primary neutral and secondary neutral	118	Sept 8, 65	6th
97C	See 96A3	196		
97C1b	See 97A	299		
97C1b and c	(1, 2, 3, 4, 7) Mechanical protection for interconnected (arrester and neutal) grounding lead; allowable omission of mechanical protection; required number of grounding connections	118	Sept 8, 65	6th
97C1c	Grounded neutral; definition of 4 grounds per mile	166	Nov 1, 74	6th
99C	Bonding of grounds and dimensions of grounding rods	390	May 7, 86	1984
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102	See 114, Table 2C	86		
102B	(a) Implication of retrofitting	201	July 27, 77	1977
110	See 114, Table 26	86		
110A	Height of fence	161	May 15, 74	6th
110A	Fence height	177	Dec 18, 75	6th
110A	(b) Fence height	201	July 27, 77	1977
110A	Meaning to be attached to "prevent" in connection with equipment enclosures	276	Aug 18, 80	1977

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
110A	Interpretation of IR 177 and IR 201(b), Rule 13 vs. Rule 110A; extension of existing 6 ft fence	291	Feb 2, 81	1977/81
110A	(a) Guarding by fence enclosure (b) Applicability of clearance (1) within fence enclosure (2) within vault	300	Oct 13, 81	1981
110A	See 93C	291		
110A	Height of gap permitted between ground and bottom of fence	411	Aug 7, 87	1987
114	Clearance of HV conductors around circuit breakers	114	Aug 2, 65	6th
114 Table 2C	(a) Requirements for a fence to prevent unauthorized entry (b) What is practicable limit for reduction of hazards? Does rule apply to employee or public? (c) Is exterior of porcelain arrester a live part? (d) Clearance to ground in substation; Measured from earth or concrete supporting base for arresters? (e) Clearance to live parts adjacent to fence separating station area from public? (f) Does locked fence constitute guarding by isolation?	86	May 1, 57	5th
114A	Outside substation— (a) vertical clearance to live parts (b) definition of voltage	193	Apr 18, 77	5th

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
114A1	Substation conductor clearance to building	124	Feb 22, 67	6th
114C1	See 114A	193		
124	Clearance to energized parts in substation	192	Mar 24, 77	6th
124 Table 124-2	See 110A	300		
124A Table 1	Clearance from bottom of wave trap supporting insulator to ground	322	Oct 25, 82	1981
124A Table 2	Clearance at crossing between transmission line and rigid bus structure	283	Dec 8, 80	1981
124A1 Table 1	Pole-mounted regulator bank with platform; Clearance required for workmen on platform	355	Jan 27, 84	1981
125A3 Table 1	Clearance to front of control board	319	Mar 26, 82	1981
127	(a) Classification if adequate ventilation is provided (b) Is interlocking required?	327	June 30, 82	1981
130B	Manual stopping devices	408	June 26, 87	
141	Definition of unsealed jars and tanks	244	Jan 17, 79	1977
152A2	See 281	349		
153A2	Definition of "large"; meaning of "segregated"	241	Nov 30, 79	1977
153B1	Floor drains for transformer installations. Meaning of "outside of building".	240	May 24, 79	1977
161	Adequacy of protection against mechanical damage	320	Apr 1, 82	1981
162	Clearance at crossing between transmission line and rigid bus structure	283	Dec 8, 80	1981

Rule	Subject	IR Number	Request Date	NESC Edition
165	44 kV 3ϕ transformer bank fuse protection	106	Jan 6, 64	6th
170	(a) Requirements for disconnect switch (b) Energized switch blade	190	May 23, 77	1977
171	See 170	190		
173B	Disconnecting provision acceptability	257	Nov 2, 79	1977
173C	See 170	190		

PART II

Rule	Subject	IR Number	Request Date	NESC Edition
200C	Clearance to buildings and lines	158	Dec 18, 72	6th
201A	Clearance required for communications conductors over roads	195	May 10, 77	6th
201B	See 93C	291		
202B	Reconstruction definition. Does line voltage change from 7.2/12.5 kV require compliance with 1977 Edition?	219	Dec 17, 77	1977
202B	Reconstruction definition. Does line voltage change from 7.2/12.5 kV to 14.4/24.9 kV require compliance with 1977 Edition clearances?	220	Jan 18, 78	1977
202B	Definition of reconstruction.	230	Apr 5, 78	1977
202B	New installations, reconstruction, extensions, status of existing installation if cable TV line is added.	243	Feb 7, 79	1977
202B1	Meaning of "Reconstruction".	215	Dec 12, 77	1977
212	Intent of term "proximate facilities".	194	May 9, 77	1977

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
213A2	Systematic inspection—time interval between inspections	90	Oct 24, 58	5th
214A2	Frequency of inspection for service drops.	246	Feb 5, 79	6th/ 1977
214A4	See 013B	344	5th	
215B	See 92B2	295		
215C	See 92C2	340		
215C1	Grounding of supporting structures	212	Nov 11, 77	1977
215C1	(a) Magnitude limit of ground fault voltage (b) Intent of "effectively grounded" as applied to structure.	277	Feb 23, 78	1977
215C1	See 92D	298		
215C1	See 93C7	356		
215C2	Insulator in down guy	236	Aug 31, 78	1977
215C2	Energized wire passing through trees, serving as a head guy	345	July 23, 83	1981
216B	Load on foundation, application of overload capacity factors	216	Dec 21, 77	1977
220B2	Clearance requirements for CATV amplifier power feed	255	Oct 15, 79	1977
220B3	For special construction supply circuits is 550 the maximum allowable voltage or the nominal?	18	Dec 18, 44	
Section 23	(a) Clearance between supply conductors and signs (b) Clearance between pad-mounted transformers and gas metering equipment	117	Sept 17, 65	6th
230C	(a) Classification of specific cable construction (b) Clearance requirements	85	Feb 26, 57	5th

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
230C	Meaning of "supply cables having an effectively grounded continuous metal sheath, or insulated conductors supported on and cabled together with an effectively grounded messenger." Spacer cable	92	May 19, 61	6th
230C	Supply cable requirements, OR vs AND	202	Aug 23, 77	1977
230C	Clearance for serial secondary and service conductors with an insulated neutral	279	Sept 4, 80	1977
230C	Classification of cables; clearance to ground; clearance to bridges; clearance to support cable supported by pipeline structure	343	July 26, 83	1981
230D	(a) Grounded neutral clearance to ground (b) Grounded neutral clearance to building	126	Feb 1, 68	6th
230E1 and 2	See 232	337		
231	Clearance of structure from roadway	324	June 4, 82	1981
231B	Location of pad-mounted equipment	258	Nov 6, 79	1977
231B1a	Example requested	231	Apr 6, 78 Apr 11, 78	1977
232	Minimum clearance for spacer cable on messenger under heavy loading conditions	123	Mar 7, 66	6th
232	Clearance to ground at high conductor temperature	178	Jan 22, 76	6th
232	See 013B	344		

Rule	Subject	IR Number	Request Date	NESC Edition
232 Table 1	Clearance over farm lands for voltages of 50 kV	31	Mar 28, 47	5th
232 Table 1	Clearances of transmission lines over navigable waters	43	Aug 10, 49	5th
232 Table 1	See 013B2	292		
232 Table 1	See 232	337		
232	(a) Clearance to ground measured diagonally (b) Clearance neutral to ground (c) Reason for 14 ft minimum for neutrals	337	Feb 17, 83	1981
232A	See 230C	343		
232A	Clearance for sailboating	284	Jan 13, 81	1981
232A Table 1	Clearance of conductors over a residential driveway	361	Aug 28, 81	1981
232A	(a) Sag—with or without creep (b) Clearance over cultivated field	121	Dec 13, 65	6th
232A	Distinction between urban and rural	125	Dec 23, 66	6th
232A	Clearances applicable to building construction site	159	Apr 11, 74	6th
232A	Basic clearance—wires above ground; "accessible to pedestrians only"	165	Aug 22, 74	6th
232A	Clearance, CATV cable above vacant lot	169	Dec 12, 74	6th
232A	Clearance to building	186	Oct 21, 76	6th
232A	Clearance required for communication conductors over roads	195	May 10, 77	6th
232A	Clearance over snow covered ground	270	June 25, 80	1977

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
232A	Clearance for oversize haulage trucks	282	Oct 17, 80	1977
232A	Conductor clearance; applicability of catenary curve considerations	290	Jan 30, 81 Feb 11, 81	1981
232A Table 1	Clearance requirements for telephone lines which pass over driveways into farmer's fields in strictly rural areas	76	Sept 13, 55	5th
232A Table 1	Clearance for cabled service drop, 150 V max to ground	79	Jan 4, 55	5th
232A Table 1	Clearance over farmland	13	Aug 4, 44	5th
232A Table 1	Do clearances have to be maintained under all weather conditions?	58	Jan 25, 52	5th
232A Table 1	(a) Grounded neutral clearance to ground (b) Spaces and ways accessible to pedestrians	126	Feb 1, 68	6th
232A Table 1	Clearance of power lines above sprinkler head over farm orchard	168	Dec 11, 64	6th
232A Table 1	Clearance above ground in orchard	187	Mar 27, 77	6th
232A Table 1	CATV cable clearance	206	Sept 15, 77	6th
232A Table 1	Service drops, clearance to ground	223	Feb 7, 78	1977
232A Table 1	Clearance over residential driveways	224	Jan 26, 78	1977
232A Table 1	Service drop conductors (a) Minimum height in span (b) Minimum height of point of attachment	247	Apr 3, 79	1977

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
232A Table 1	Spaces or ways accessible to pedestrians only, service drop clearance	249	Mar 23, 79	1977
232A Table 1	Effect of trees on minimum clearances	256	Nov 15, 79	1977
232A Table 1	Conductor clearance for line near recreational water area	261	Oct 23, 79	1977
232A Table 1	Communication cable clearance to ground	269	May 21, 80	1977
232A Table 1	Ground clearance for service	277	Aug 25, 80	1977
232A Table 1	Clearance over waterways	308	Jan 22, 81	1981
232A Table 232-1	Clearance required for sailboats in an inlet that has an upstream restriction on height	367	Nov 14, 84	1984
232A Table 232-1	Reduced vertical clearance requirements	371	Feb 27, 85	1984
232A3	Definition of fixed supports	99	Mar 14, 63	6th
232B	Increased clearances for excess span length	25	Oct 23, 45	
232B	Grounded neutral clearance to ground	126	Feb 1, 68	6th
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232B Exception 2	See 232B	292		
232B1	See 232B	25		
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232B1(a)(d) Table 1	Clearance over cultivated land for 200°F operating temperature	352	Dec 21, 83	1981
232B2	Clearances—wires on different supports, voltages 50 kV; also above ground or rails	160	May 14, 74	6th

Rule	Subject	IR Number	Request Date	NESC Edition
232B2	(a) Increase in clearance, V %50 kV (b) Clearance for basic and longer spans (c) Clearance to building corner	83	Nov 1, 56	5th
232B2 and C1	Minimum allowable clearance	304	Aug 24, 81	1981
232B2C	See 232B	360		
232B2d	Transmission line clearances—Meaning of "maximum conductor temperature for which the line is designed to operate" with respect to designed for but unplanned contingencies	207	Oct 3, 77	1977
232B2d	See 232B	360		
232B3	Clearance with suspension insulators	60	Mar 27, 52	5th
233	See 234B2	69		
233	See 234C4a(2)	89		
233A Table 3	Avoiding fatigue failure in conductors under tension	12	Jan 18, 44	5th
233A	Clearance of primary neutral conductor over communication conductor	16	Nov 14, 44	5th
233A Fig 233-1	Clarification of clearance at crossing	289	Jan 30, 81	1981
233A and B	Are clearance increases cumulative in 1, 2, and 3 as indicated in the text on page 52?	62	Nov 27, 52	5th
233A1	See 232A	290		
233A3	Clearance at crossing between transmission line and rigid bus structure	283	Dec 8, 80	1981
233A3	See 235E1	353		
233B	Conductor clearance from guy of parallel line structure	218	Jan 5, 78	1977

Rule	Subject	IR Number	Request Date	NESC Edition
233B1	Horizontal clearance under wind loading. One or both conductors at maximum swing angle?	221	Jan 25, 78	1977
233B1	(a) Centerline spacing for adequate clearance between parallel lines on separate structures (b) Use of switching surge factor in above case	228	Feb 28, 78	1977
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233B2	Clearances—Wires on different supports, voltages >50 kV; also above ground or rails	160	May 14, 74	6th
233B2, C3	See 235E1	365		
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233C3	See 235E1	353		
234	Clearance for line	158	Dec 18, 72	6th
234	Horizontal and vertical clearances, effect of high temperature	232	Apr 6, 78	1977
234	Clearance requirements for buildings in transit	251	July 5, 79	1977
234 Fig 234-1	Determination of diagonal clearance	260	Nov 8, 79	1977
234A	See 234C4a(2)	89		
234A	See 232A	290		
234A1	Final condition of a conductor—to determine vertical clearance—storm loading and long term creep	112	June 30, 64	6th
234A3	See 234, Fig 234-1	260		
234B	Clearance to parallel line	96	Dec 7, 62	6th

Rule	Subject	IR Number	Request Date	NESC Edition
234B	Does the exception apply to horizontal or vertical clearances or both?	233	May 10, 78	1977
234B	Clearance of neutral and guys from other supporting structures	326	June 9, 82	1981
234B	Reduction of horizontal clearance	375	Apr 3, 85	1984
234B1	Clearance, line to adjacent steel structure; Voltage definition	173	May 29, 75	6th
234B2	Clearance between conductors and supporting structures of another line	69	Dec 30, 53	5th
234C	Clearance to conveyor structure	274	July 25, 80	1977
234C Table 1	Grain bin clearance (building vs tank); 115 kV line	248	Mar 15, 79	1977
234C Table 1 Note 5	Clearance to flagpole with flag	313	Feb 23, 82	1981
234C Table 1	Clearance to tanks containing flammables	305	Oct 6, 81	1981
234C Table 1	Clearance to building	323	May 18, 82	1977
234C Table 234-1	Classification, for clearance purposes, of outdoor advertising signs (billboards) that have catwalks and that are with or without ladders	368	Dec 5, 84	1984
234C Table 234-1	Clearance above fences and walls	381	Dec 13, 85	1984
234C Table 4	Clearances from buildings; meaning of voltage	154	Jan 29, 74	6th
234C Table 4	Clearances from buildings; meaning of voltage	156	Oct 17, 73	6th
234C Table 4	See 234B1	173		

Rule	Subject	IR Number	Request Date	NESC Edition
234C1(a)	Clearance to building	186	Oct 21, 76	6th
234C3 Table 234-1	Accessibility to pedestrians	377	Apr 8, 85	1984
234C3 and 4	See 238B1	82		
234C4	(a) Clearance to building (b) Is clearance (in a specific case) in accordance with the NESC?	87	Aug 5, 57	5th
234C4	See 232B2	83		
234C4	Clearances from building	47	Dec 2, 49	5th
234C4	Clearances to building or similar structure	66	May 14, 53	5th
234C4	Clearance requirements for conductors passing by or over buildings	78	Nov 16, 55	5th
234C4	Clearance—horizontal and vertical—from buildings	98/98a	Feb 21, 63	6th
234C4	Grounded neutral clearance to building	126	Feb 1, 68	6th
234C4	Clearance applicable to building construction site	159	Apr 11, 74	6th
234C4	Clearance to building	172	May 21, 75	6th
234C4	Clearance to building and guarding	174	Sept 29, 75	6th
234C4	Clearances on roofs	409	June 11, 87	1987
234C4(a)	Horizontal clearance to building or its attachments	399	Jan 30, 87	1984
234C4 Table 4	Horizontal or vertical clearances from buildings	57	Aug 21, 51	
234C4 Table 4	Clearances from buildings	67	Aug 5, 53	
234C4 Table 4	Horizontal clearance of supply conductors	81	Apr 18 and Aug 24, 56	
234C4 Table 4	Clearance to building	309	Dec 17, 81	1973

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234C4a	Clearance requirements for conductors passing by or over buildings	77	Nov 15, 55	
234C4a	Clearance to building	113	Nov 12, 64	6th
234C4a	Substation conductor clearance to building	124	Feb 22, 67	6th
234C4a	Clearance to building	186	Oct 21, 76	6th
234C4a	Clearance to chimney; meaning of attachments	198	July 12, 77	6th
234C4a	Governing clearance to building — horizontal or vertical	238	Sept 25, 79	6th
234C4a	Clearance to building	265	Mar 3, 80	6th/77
234C4a	Horizontal and vertical clearances from a steel windmill tower	74	Aug 1, 55	
234C4a1 Table 4	Clearance of neutral to building	189	Feb 18, 77	6th
234C4a (1) and (2)	Clearance from buildings	59	Mar 10, 52	5th
234C4a (1) and (2)	(a) Should clearance of conductors passing by buildings include swing? (b) Insulator swing considerations (c) Sag increase; span 150 ft or 350 ft?	89	Apr 14 and 17, 58	5th
234C4a (2) and B	See 234C	47		
234C4b	Guarding requirement applicability	265	Mar 3, 80	6th/77
234C,D	Clearance requirements in tunnels or on bridges	383	Feb 10, 86	1984
234D	See 230C	85		
234D1	See 230C	343		
234D1 Table 2	Neutral clearance to bridge	208	Oct 31, 77	1977
234E	Conductor clearance to swimming pool slide	262	Nov 12, 79	1977

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234E1 Table 3	Rationale involved in calculating basic clearances shown in Table 3	237	Sept 19, 79	1977
234F1c	Electrostatic effects	205	Sept 3, 77	1977
234F2c and d	Increased clearances for long span or sag — applicability to horizontal clearances	203	Aug 25, 77	1977
235	Clearances to noncurrent carrying metal parts; clearance for CATV	281	Oct 14, 80	1977/81
235 Table 3	Horizontal clearance between wires in a triangular configuration	264	Jan 21, 80	1977
235A Table 6	Compact transmission lines, status with respect to NESC 1973 Edition, especially when jacking for hot line maintenance is taken into account	167	Oct 15, 74	6th
235A Table 6	Clearance between conductors in substations	175	Sept 30, 75	6th
235A Table 9	High voltage transmission lines; excessive clearance requirements	37	June 8, 48	5th
235A Table 9	Clearance between line conductors and span or guy wires	101	Sept 13, 63	6th
235A2a (1) and (2)	See 235A3, Table 9	15		
235A2a(1) and B	See 234C4a(2)	89		
235A3 Table 9	Climbing space minimum clearance	15	Nov 13, 44	5th
235A3 Table 9	Classification of jumper wires at poles	49	May 10, 50	5th
235A3 Table 9	Clearance between line conductors and guy of EHV guyed tower	102	Oct 11 and 22, 63	6th

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235B1	Horizontal clearance between line conductors. 2 circuits, 115 kV and 230 kV on same support	222	Jan 25, 78	1977
235B1	Surfaces used to determine horizontal clearance between line conductors	400	Mar 13, 87	1984
235B2	(a) Centerline spacing for adequate clearance between parallel lines on separate structures (b) Use of switching surge factor in above case	228	Feb 28, 78	1977
235B3a, b	See 235E1	365		
235C	Voltage between conductors	267	Mar 20, 80	1977
235C	Clearance from communication cable to tap and drip loop of supply cable	288	Jan 23, 81	1981
235C	Calculating clearances	372	Mar 14, 85	1984
235C	Vertical clearance between communication and supply lines	378	Apr 18, 85	1984
235C Table 5	Vertical separation of conductors of same circuit	233	May 10, 78	1977
235C Table 5	Clearance between metal sheathed supply cable and communications	329	Aug 20, 82	1981
235C Table 5	Vertical clearance between line conductors at supports	310	Nov 11, 81	1981
235C1 Table 5	Pole clearances for CATV system cable	362	Sept 10, 84	1981
235C1 Table 5	Vertical clearance at supports	209	Oct 31, 77	1977
235C1	Interpretation of clear-	242	Jan 2, 79	1977

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Table 5	ance measurement; Communication to power conductors	242a	Jan 11, 79	1977
235C1 Table 5	Spacing between communication cables of power and communication utilities, when located below supply lines	286	Jan 19, 81	1981
235C2b	Clearance in pole to building spans, between communication and electric supply service drops	226	Feb 23, 78	1977
235C2b(1)(a)	Drip loops and slack cables from an aerially-mounted transformer are parts of the span	392	July 11, 86	1984
235C2b(1)(a)	Vertical clearance between supply and communication lines	393	Aug 18, 86	1984
235C2b(3), C2b(1)a	Minimum mid-span separation between a supply conductor and a communication conductor—for spans over 150 ft	359	Mar 22, 84	1981
235E	Conductor clearance from guy of parallel line structure	218	Jan 5, 78	1977
235E	Clearance to bridle guy	229	Mar 6, 78	1977
235E	Clearance requirements for CATV amplifier power feed	255	Oct 15, 79	1977
235E1	See 230C	343		
235E1 Table 1	Clearance between line conductor and anchor guys	365	Oct 29, 84	1981
235E1 Table 6	Clearance from line conductors at supports (a) Meaning of minimum clearance (b) Clarification of "voltages are between conductors"	210	Oct 31, 77	1977

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	(c) Reason for additional clearance on joint poles			
235E1 Table 6	Clearance between an anchor guy and an 8.7 kV conductor	330	Aug 19, 82	1977
235E1 Table 6	Service drop line conductor in aerial cable clamp saddle; clearance to pole	351	Nov 30, 81	1981
235E1, E3 Table 6	Clarification of line conductor clearance to guy	353	Dec 27, 83	1981
235E3a	See 235E1	365		
235G	See 235E	255		
236	Climbing space	176	Dec 15, 75	6th
237B3	Clearance between 8.7—15 kV line and grounded neutral or secondary conductors	80	Aug 14, 56	5th
238 Definition 45	(a) Definition: communication lines (b) Clarification of CATV cable as a communication circuit	64	June 15, 53	5th
238	Clearance between supply conductors, communication and CATV cables	127	Feb 28, 68	6th
238	Clearance to noncurrent carrying metal parts. Clearance for CATV	281	Oct 14, 80	1977/81
238	Application of 238 to service equipment and supply equipment	374	Mar 25, 85	1984
238 Table 1	Clearance from a 34.5 kV supply conductor to a street light bracket	328	Aug 6, 82	1981
238 Table 1	See 235C	329		
238	13.8 kV distribution	115	Aug 4, 65	6th

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Table 1	clearance with horizontal post insulators without crossarms			
238A	(a) Clearance between power and signal H43 conductors on same crossarm (b) Clearance between signal conductors and multiple light systems circuit (c) Clearance of vertical supply conductors from communication crossarm (d) Dead ending or guying of communication messenger without insulators (e) Spacing between crossarms	84	Nov 7, 56	5th
238A Table 11	Vertical separation at supports	63	Apr 10, 53	5th
238A and B Table 1	(a) Is base of epoxy extension arm "noncurrent carrying"? (b) Spacing required between noncurrent carrying parts of adjacent supply and communication circuits	268	May 8, 80	1977
238A, B Table 238-1	Spacing required between noncurrent-carrying parts of adjacent supply and communication circuits	388	Apr 28, 86	1984
238A Table 11	Conductor vertical spacing with post insulators	110	May 14, 64	6th
238B	Vertical clearance between supply conductor and communication cable attachment hardware	387	Apr 22, 86	1984

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238B Table 1	Interpretation of clearance measurement; Communication to power conductors	242 242a	Jan 2, 79 Jan 11, 79	1977 1977
238B Table 1	Clearance to street lighting brackets	311	Nov 13, 81	1981
238B Table 1	Does grounding transformer tank to multigrounded neutral quality for rduced (30 in) clearance?	333	Oct 1, 82	1981
238B Table 1	Single bushing transformer status (current carrying or noncurrent carrying)	333a	Apr 27, 83	1981
238B Table 1	See 235C1, Table 5	362		
238B Table 1 Footnote 4	(a) Which equipment is to be grounded? (b) What is well defined area? (c) What is adequate grounding?	363	Sept 14, 84	1981
238B and E	Clearance for communications conductors used exclusively in the operation of supply lines. See also 238A, Table 11	52 63	Aug 30, 60	5th
238B1	(a) Clearance between conductors on adjacent crossarms (b) Service brackets at end of crossarms (c) Clearance to buildings	82	Sept 15, 56	5th
238B3a	See 234B2	69		
238C	See 235A3, Table 9	15		
238D	Clearance between multigrounded neutral and communication service drop	93	Apr 13, 62	6th
238D	Clearance of service drop	252	June 25, 79	1977

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238D	Clearance from communication cable to tap and drip loop of supply cable	288	Jan 23, 81	1981
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238D and E	See 238B	52		
238E	See 238A, Table 11	52		
238E4	Placement of communication cable above effectively grounded luminaires with drip loops	105	June 15, 64	6th
239A	Protective covering requirements for power conductors passing through communications space	303	Aug 20, 81	1981
239C	Nonmetallic pipe protection for risers	153	Dec 17, 73	6th
239C	(1, 3, 4, 5, 6) Mechanical protection for interconnected (arrester and neutral) grounding lead; allowable omission of mechanical protection; method of grounding either magnetic or nonmagnetic mechanical protection	118	Sept 8, 65	6th
239C	See 93D1	307		
239D2 Table 2	Pole clearance for vertical jumper to recloser terminal	342	June 16, 83	1981
239F	Clearance of primary riser termination from communication cable	225	Feb 14, 78	1977
239F, G2 and 3	See 220B3	18		
239F1	Clearance for supply equipment to CATV cable	312	Jan 8, 82	1981

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242	Joint use 7.2 kV/ communications-cable joint use poles; insulated strand, self supporting communications cable	109	Apr 24, 64	6th
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Table 242-1	Definition of "limited access highway"	385	Mar 7, 86	1984
Table 242-1	Grade of construction for colinear and at crossing conductors	391	July 18, 86	1984
242 Table 1	Grade of construction or joint use with 7.2 kV open wire above communication circuits	321	Apr 5, 82	1981
242 Tables 1 and 12	4.8 kV ungrounded delta, change from grade C to B believed inadvertent when Footnote 7 changed	294	Mar 25, 81	1977 and 1973
242 Table 14	Interpretation of Footnote "c" appearing in Table 14, allowing Grade C construction	65	June 14, 53	5th
242 Table 15	Grade B crossing spans in a Grade C supply line	111	May 26, 64	6th
242 Table 15	Definition of "constant potential" in grades of construction	162	May 17, 64	6th
242 Tables 1 and 15	See 242, Tables 1 and 12	294		
242A Table 15 Note 3	(a) Definition of "promptly deenergized" (b) Deflection, unbalanced pull: should dissimilar ice loadings be considered? (c) Crossing of power and communications lines	122	Feb 17, 66	6th

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243	Grade of construction for conductors	272	July 14, 80	1977
243B	Clearances between highway lighting standards and transmission lines	120	Dec 3, 65	6th
250	Change of districting from heavy to medium loading	24	May 26, 45	5th
250	Tension (initial or final) during extreme wind loading calculations	332	Aug 26, 82	1981
250C	Application of extreme wind loading	200	July 8, 77	1977
251	(a) Transverse wind loading (b) Definition of "grades" of construction	14	Nov 16, 44	5th
251	Constant to be added to storm loading for messenger supported cable	103	Nov 12, 63	6th
251	Application of K factors	181	Mar 8, 76	6th
251	See 250	332		
251A	Ice loading computation on noncircular cross-section conductor	266	Mar 7, 80	1977
252	See 251	181		
252B6	See 251	14		
252C1	Grade B crossings in Grade C supply lines	111	May 26, 64	6th
260	Deflection data on tubular steel poles	42	June 30, 49	
260C	(b) Meaning of "other supported facilities"	211	Nov 4, 77	1977
260C	Load on structure or foundation; application of overload capacity factors	213	Nov 26, 77	1977
261	Overload capacity factors for composite components	245	Feb 13, 79	1977

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261 Table 261-2	Crossarm bending stress, overload capacity factors, and vertical clearance	389	May 1, 86	1984
261 Table 6	Allowable stress in members of steel structure	17	Nov 11, 44	5th
261A Table 3	Application of "when installed" and "at replacement" values	336	Jan 25, 83	1981
261A1	Allowable pole loading	184	June 10, 76	6th
261A1 Tables 1 and 2	Structure load stress vs allowable stress basis (yield, proportionality, AISC allowable)	348	Sept 9, 83	1981
261A2 Table 3	At crossing, Grade C construction	302	July 21, 81	1981
261A2b	Calculation of support load at angle in line	239	Oct 13, 79	1977
261A2b	Application of an overload capacity factor of 4.0 to the vertical load on an eccentric loaded column	250	Mar 27, 79	1977
261A2b Table 261-3	Required strength of wood poles at replacement	379	May 8, 85	1984
261A2b, c	Omission of fiber stress calculation point formerly stated in 6th Edition, 261A4a, b	211	Nov 4, 77	6th
261A2d	Application of overload capacity factor, unguyed and guyed angle structures	214	Nov 28, 77	1977
261A3b	Longitudinal strength of towers—Grade B construction	108	Apr 2, 64	6th
261A3e	See 260	46		
261A4	Construction grade of line; effect of additional loading	180	Feb 3, 76	6th

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261A4a	See 261C5a	26b		
261A4e	(a) Vertical and transverse loadings	26a	Dec 15, 53	5th
261A4g	Does the word "spliced" also refer to pole top extensions?	68	Oct 1, 53	5th
261A4g	Spliced and stub pole definitions; extension at top of pole	95	Nov 14, 62	6th
261A6b	(b) Deflection, unbalanced pull: should dissimilar ice loadings be considered?	122	Feb 17, 66	6th
261A, B, C Tables 1 thru 5	Overload capacity factor: wire tension load vs wind or weight load	335	Oct 25, 82	1981
261B	Foundation strength for steel pole structure	191	Mar 23, 77	1977
261C2	Guying of joint-use poles	398	Nov 26, 86	1984
261C5a	(b) Strength requirements for dead-end and transverse guys	26b		
261C5a	See 261A4e	26a		
261D	Crossarm; definition and status of integrated conductor support assemblies	151	Nov 15, 73	6th
261D Table 261-1	Minimum cross-section dimensions of wood crossarms	386	Mar 26, 86	1984
261D Table 261-6	Crossarm length and longitudinal strength	376	Apr 4, 85	1984
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261D5	Double crossarm over railroad tracks in suspension insulator type of construction	51	Aug 25, 50	

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261F2	Do words "containing steel" describe composite conductor or merely any wire of such a stranded conductor?	20	Feb 15, 45	5th
261F4	(a) Sag—with or without creep	121	Dec 13, 65	6th
261F4	Final condition of a conductor—storm loading and long term creep	112	June 30, 64	6th
261H3a	Meaning of "crossings"	346	July 29, 83	1981
262A2e	Overload capacity factor for guyed pole used as a column	317	Mar 17, 82	1981
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262I2b Table 24	Minimum size of conductors in a crossing span of 215 ft over a railroad track	72	May 31, 55	5th
263D, E	See 261F	61		
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273	Insulator rating	297	June 12, 81	1981
277	Working load of insulator must not exceed 50% of ultimate strength	395	Oct 26, 86	1984
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280A1b	Climbability of guyed dead end poles	397	Nov 26, 86	1984
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280A2a	Guarding of supporting structure potentially exposed to "abrasion" by traffic	315	Mar 1, 82	1981
280A2b	Meaning of "closely latticed poles or towers"	128	Apr 15, 68	6th
281	(a) Purpose of tree trimming (b) Spacing of oil-filled transformer from building	349	Oct 3, 83	1981
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282B	Fiberglass rod; acceptability in lieu of steel	183	May 17, 76	6th
282C	Guy connection and placement of insulators	217	Dec 9, 78 Jan 3, 78	 1977
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282E	Plastic guy guards	94	Mar 5, 62 Mar 27, 62 Aug 6, 62 Aug 8, 62	6th
282E	Guy guards—on guys to ground anchors—in areas where stock runs	116		
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282E	Guy guards in relation to definition of "guarded"	188	June 24, 77	6th
282E	Guy marker requirements in case of two guys on one anchor	350	Nov 15, 83	1981
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282H	Guy grounding; upper end effectively grounded vs. anchor end ground	97	Feb 14, 63	6th

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282H	Grounding of guys	163	May 21, 74	6th
283A	Insulator in down guy	236	Aug 31, 76	1977
283A1a	Guy insulators; acceptability of fiberglass as insulating material	75	Aug 29, 55	5th
283B	Guy connection and placement of insulators	217	Dec 9, 78 Jan 3, 78	1977
283B1	Insulating vs. effectively grounding guy wires	254	Aug 29, 79	6th/77
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283B4	Grounding of guys	73	July 29, 55	5th
283B4b	Guys attached to wood poles	50	May 26, 50	5th
283C	Guy strand insulation for corrosion reduction	347	Sept 12, 83	1981
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286E	Clearance to ground for equipment on structures—not above a roadway	275	Aug 6, 80	1977
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311	See 300	258		
314B	Neutral grounding for buried concentric neutral cable with semi-conducting sheath	196	July 14, 77	1977
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330	Installation of submarine cable on islands in connection with aids to navigation	278	Aug 25, 80	1977
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332	Use of steel-clad copper wire as neutral conductor air direct buried, bare concentric neutral cable	273	July 24, 80	1977
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351C1	Direct buried cable near swimming pool	170	Feb 25, 75	6th
353	See 330	278		
353D	Cable burial depth	155	Feb 5, 74	6th
353D	Communication cable burial depth	171	Mar 19, 75	6th
353D	Submarine cable burial depth and grounding requirements	384	Feb 26, 86	1984
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354E4	Provision of adequate bonding	373	Mar 14, 85	1984
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381G	Second barrier requirements—pad-mounted equipment	325 325 a	June 8, 82 Nov 22, 82	1981 1981
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422C1	(a) Should clearance of conductors passing by buildings include swing? (b) Insulator swing considerations (c) Sag increase; span 150 ft or 350 ft	89X	Aug 12, 57	5th
423C	Is tagging of remote close/trip control required if device is otherwise rendered inoperable?	293	Apr 7, 81	1981