1981–1984

National Electrical Safety Code Interpretations

1981—1984 inclusive

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Interpretations 1981-1984

National Electrical Safety Code Committee, ANSI C2

National Electrical Safety Code Interpretations

1981—1984 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

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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 lines.

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. This new volume, INTERPRETATIONS, 1981 - 1984, continues with interpretation IR 284 issued in 1981 and ends with IR 366 issued in 1984.

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 1981 through 1984 and not 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 and 1984 Editions are identified to show the Edition in which they were published.

1981 Editions Interpretations are so appropriately identified.

The request date 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*
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(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

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(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

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(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 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
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(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

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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
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(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	234C4
		b) Is clearance (in a specific case) in accordance with the NESC?	
(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

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Request Date	*IR Number*	*Subject*	*Rule*
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(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)

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(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	23
		(b) Clearance between pad-mounted transformers and gas metering equipment	
(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
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		(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*
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(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
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(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
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(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
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Numerical Listing by Interpretation Request (IR) Numbers

Request Date	*IR Number*	*Subject*	*Rule*
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(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	350B
(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

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		(b) Meaning of "other supported facilities"	260C
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(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

Numerical Listing by Interpretation Request (IR) Numbers

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		2 circuits 115 kV and 230 kV on same support	
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(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	233B1 235B2
		(b) Use of switching surge factor in above case	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	234B Table 235-5
		5: Vertical separation of conductors of same circuit	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; Communication cable additional clearance; Reduced clearance to guys	013B2 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)

013B

Replacement of structures, strength and clearance in completed work

REQUEST (May 27, 81) IR 296

... [Our company] is currently doing maintenance work on 34.5 kV and above transmission lines. These transmission lines may be single pole or H-frame. The design criteria in most cases for these transmission lines has changed from its initial design, due to material specifications and National Electrical Safety Code (NESC) changes.

The questions we would like answered are:

(1) What edition NESC should we use when replacing a small percentage (25 percent due to decay in the wood) of poles or structures?
   (a) The code in effect at the time of original construction
   (b) The New 1981 Code
   (c) Some other specified code
(2) The transmission line having structures replaced must meet some ground clearance requirement. That clearance is derived from:
   (a) The NESC in effect at the time of original
   (b) The New 1981 Code
   (c) Some other specified code

INTERPRETATION (July 10, 81)

Rule 013A1 states that these rules apply to all new installations and extensions ... Maintenance replacement of structures are not considered new installations.

Note, however, that rule 202 requires that when structures are replaced, the arrangement of equipment shall conform to the current edition of rule 238C. If the equipment mentioned in rule 238C is not present, the code only requires that the replacing structure comply with the rules in effect at the time the line was built. It should be recognized, however, that conditions may have changed since the line was built. For example, an area originally considered rural may have become urban. Although the code rules in effect at the time the line was built would apply to replacing structures the specific requirements would be for urban rather than rural areas.

* * * *

013B, 1981 Edition

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 category of "farm lands"
(b) meet only 5th Edition or new 1981 Edition rules for ground clearance.

REQUEST (July 29, 83) IR 344

... request an interpretation regarding the application of related rules. They are Rule 013B, Rule 214A 4 and 5, and Rule 232. The subject is ground clearance on transmission lines built under older editions of the National Electrical Safety Code (NESC).

The hypothetical situation is this: As recommended by Rule 214 ... investigating a line built under the Fifth Edition of the NESC.... find several spans that do not meet ground clearance requirements of the Fifth Edition, Rule 232.... plan to improve the clearance in those spans by either modifying existing structures or adding mid-span structures.

... ask for the following interpretation of Rule 013B and Rule 232:

(1) Must the improved ground clearance meet only Fifth Edition criteria or must I design to the 1981 edition standards?

(2) Under the Fifth Edition, there was no category covering agricultural lands, and the associated ground clearance. Practice at the time was to use spaces or ways accessible to pedestrians only as the criteria over farm lands. Now the NESC covers this application in the 1977 and 1981 editions. If your response to question 1. is that I can redesign to the Fifth Edition, can I continue to use the criteria given under spaces and ways accessible to pedestrians only or must I improve conditions based on some other section of the NESC?

INTERPRETATION (May 21, 84)

Early Discussions and Interpretations of the Code clearly state that clearances for "spaces and ways accessible to pedestrians only" were never intended to apply to farmland that is cultivated or otherwise traversed by vehicles. Such lands do not meet the requirements for that category. Early editions of the Code intentionally did not specify clearances over farmland because of the great variation in the height of farm equipment. Rules 200C of the 5th Edition applied to such construction.

Clearances over farmland and similar lands were specified for the first time in the 1977 Edition. Table 232-1 include Note 17 which clearly indicated that the specified clearances were for equipment not exceeding 14 ft in height. This value continues to be shown as a reference height in Table 232-3.

Rule 013A requires that all new installations and extensions meet the requirements of the current edition of the Code. New structures that are added within an existing line are considered to be new installations and are required to meet the requirements of the current edition.

Rule 013B2 allows conductors or equipment to be added, altered or replaced on an existing structure without having to modify or replace existing structure or the facilities on the structure so long as the resulting installation will meet the requirements of the edition in effect at the time of original construction. The existing conductors or equipment may also be rearranged on an existing structure, or an existing structure may be replaced in kind, without having to meet current code requirements so long as the result meets the requirements in effect at the time of the original construction.

In the specific case that you mention, the conductors may be rearranged on existing structures so long as they meet the requirements of the 5th Edition, including Rules 200C and 210. Added structures and installations thereon must meet the current requirements, including Rules 232 and 012. If existing structures cannot be rearranged to meet the requirements of the 5th Edition and must be replaced with taller structures, they are not considered to be maintenance replacements but are considered to be new installations; the current rules apply to such structures and their supported facilities.

013B2

(1) Clearance required when second cable is added
(2) Communication cable additional clearance
(3) Reduced clearance to guys

REQUEST (Mar 3, 81) IR 292

(1) When an additional telephone cable is lashed to an existing telephone cable and strand and the resulting ground clearance meets clearance requirements at the time of the original installation, but not at the time of the additional installation, do the poles have to be changed out for the sole purpose of providing additional clearance? (Note: The original strand was installed with the intended purpose of being available for future additional lashings.)

(2) When an additional telephone cable and strand are installed immediately (12 in) under an existing telephone cable and strand and the resulting ground clearance meets the clearance requirements at the time of the original installation, but not at the time of the new installation, do the poles have to be changed out for the sole purpose of providing additional ground clearance?

(3) Same as question 2 above, except the new installation is 12 in above the existing installation. (Note: The existing and lower installation would not have been moved or modified in any way.)

(4) Does this rule say that additional clearances are not required for any communication cable supported on a messenger or only for those run along and within the limits of public highways or other public rights-of-way of traffic?

[The following pertains to Rule 232, Table 232-1]

(5) With reference to National Electrical Safety Code (NESC) Table 232-1, Footnotes 12, 13, and 23, does this reduced clearance also apply to communication guys?

INTERPRETATION (May 12, 81)

With respect to questions 1, 2, and 3, Rules 013B2 specifically says that conductors or equipment may be added, altered, or replaced and the structure need not be replaced if the resulting installation complies with the rules in effect at the time of the original installation. It says nothing about the added conductors being higher, lower or at the same level as existing conductors. Regarding footnotes 12, 13, and 23 associated with table 232-1, there is no mention of communication guys. While any hazard entailed by contacting a low hanging communications guy is little different from that of a low hanging communication cable or conductor, and the writers of the code may have meant to include such guys in these footnotes, the fact is that they did not do so. The Interpretations Committee is not at liberty to change the rules.

With respect to the last question, the intent of the exception was to apply to cable anywhere. This originally appeared in the Fifth Edition without the clause covering conductors running along the public right-of-way. The reason for the original exception was that cable had a lesser sag increase than wires in common use at the time.

The advent of lighter weight cables in recent years, however, makes possible greater span lengths which incur greater sag increase than was contemplated when the original exception was written. Some discretion would be advisable in the application of the exception to longer spans of light weight cables.

Definition: readily climbable **See 280 A1b** **IR 357**

Grounding Methods for Electric Supply and Communication Facilities

Section 9

92B2

Wye distribution system with neutral omitted in one feed

REQUEST (May 6, 81) IR 295

... State Electric and Gas Corporation operates radial 34.5 kV multi-grounded wye distribution systems in its service area. Load serving distribution transformers and other equipment are connected to a multi-grounded neutral conductor that is continuous from the load area to the normal (preferred) system positive and zero sequence source. Overall positive and zero sequence system impedances in the load area are such that voltages on unfaulted phases are limited to a level that will not result in undue hazard to connected equipment or persons. Furthermore, adequate ground fault current is available for protective relaying.

In some cases, where a back-up or contingency source exists and is occasionally used, the neutral conductor, while completely continuous in the area where distribution equipment is connected, may not be continuous to the contingency source, that is, there may be a section of circuit between the load area and the contingency source that lacks the neutral conductor. However, the overall system grounding in the load area as measured with the contingency source in operation is still such as to limit voltages on unfaulted phases to acceptable values, and adequate ground fault current is available for proper protective relaying. The enclosed drawing illustrates a potential situation.

We do not believe that the lack of the continuous neutral conductor as described above violates any requirements of the National Electrical Safety Code (NESC), particularly Section 9, Paragraph 92 and Section 21, Paragraph 215. May we have your concurrence on our interpretation.

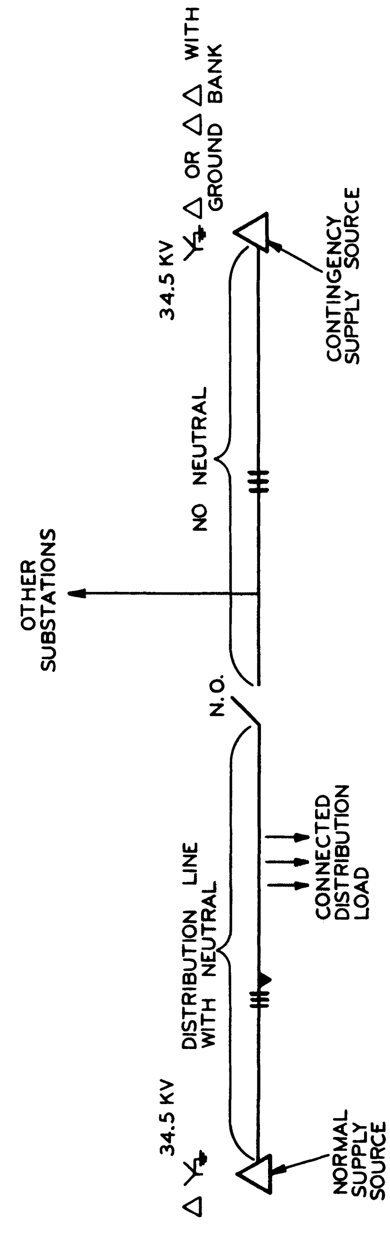

34.5 KV
Y⏚ Δ OR Δ Δ WITH GROUND BANK
CONTINGENCY SUPPLY SOURCE
NO NEUTRAL
OTHER SUBSTATIONS
N.O.
CONNECTED DISTRIBUTION LOAD
DISTRIBUTION LINE WITH NEUTRAL
34.5 KV
Δ Y⏚
NORMAL SUPPLY SOURCE

Fig IR 295

INTERPRETATION (June 24, 81)

First, the code does not require electric supply systems to have a neutral *per se*, although the absence of a neutral in the arrangement you have shown appears to violate several rules.

Your arrangement shows using the earth to return unbalanced current to the source, which is in violation of Rule 215B4. Also, where a primary neutral is common with the secondary neutral, Rule 97C requires four ground connections in each mile of line exclusive of ground connections at customer's equipment. The section of line without a neutral has no ground connections, thus violating Rule 97C.

Further, Rule 96A3 requires that the neutral of multiple grounded systems be grounded at each transformer location plus four grounds in each mile of line, not including grounds at individual services. Lack of a neutral in part of the system results in violation of this rule also.

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

(In process)

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 92 B3 "Separate Grounding Conductor," found on page 65 of the 1984 edition of the National Electric 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 Electric Safety Code?

INTERPRETATION

(In process)

92C2

Effective grounding of guys; suitability of proposed configuration

REQUEST (Apr 28, 83) IR 340

In an attempt to eliminate the primary downguy strand grounding conductor from the surface of the structure above the system neutral (see Fig IR 340-1), the grounding configurations shown in Figs IR 340-1,2 were proposed by our operations personnel.

Our request is for interpretations of these proposed configurations shown if Figs IR 340-2,3 with respect to the following National Electrical Safety Code (NESC) Rules:

(1) NESC Rule 215C2 requires that downguy strands without insulators, attached to supporting structures carrying conductors of more than 300 volts shall be effectively grounded. Will the proposed configurations satisfy this requirement?

(2) Will the point of connection of the grounding conductor of the proposed configuration shown in Figs IR 340-2,3, satisfy the requirements of NESC Rule 92C2?

(3) By NESC definition the secondary downguy strands, shown in Figs IR 340-2,3, will be the grounding conductor for the primary downguy strands. Will the requirements of NESC Rule 93D1 or 93D3 negate the proposed configurations shown in Figs IR 340-2,3, as an alternative for grounding the primary downguy strand?

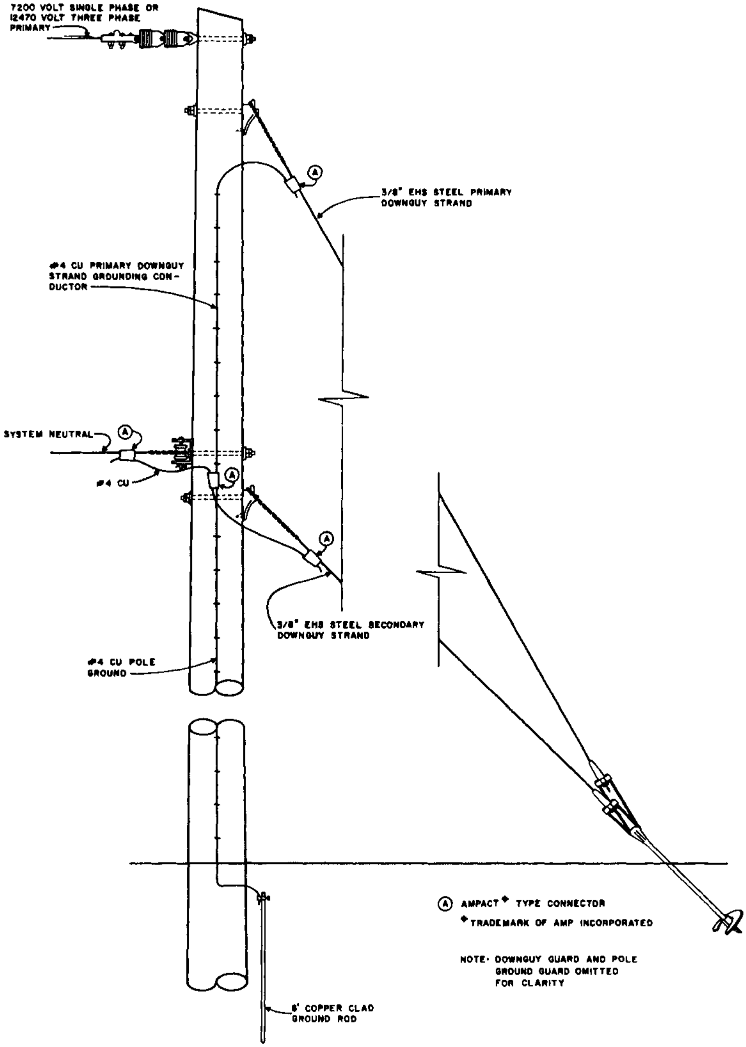

7200 VOLT SINGLE PHASE OR
12470 VOLT THREE PHASE
PRIMARY
3/8" EHS STEEL PRIMARY
DOWNGUY STRAND
#4 CU PRIMARY DOWNGUY
STRAND GROUNDING CON-
DUCTOR
SYSTEM NEUTRAL
#4 CU
3/8" EHS STEEL SECONDARY
DOWNGUY STRAND
#4 CU POLE
GROUND
A AMPACT* TYPE CONNECTOR
*TRADEMARK OF AMP INCORPORATED
NOTE: DOWNGUY GUARD AND POLE
GROUND GUARD OMITTED
FOR CLARITY
8' COPPER CLAD
GROUND ROD

Fig IR 340-1

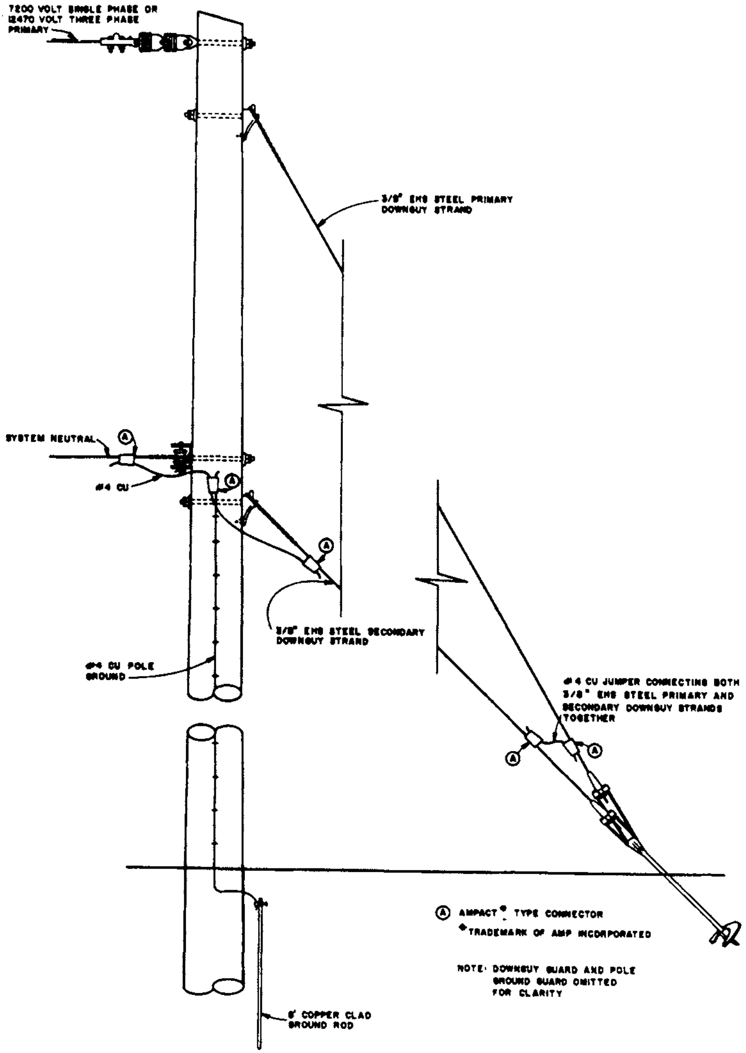

7200 VOLT SINGLE PHASE OR
12470 VOLT THREE PHASE
PRIMARY
3/8" EHS STEEL PRIMARY
DOWNGUY STRAND
SYSTEM NEUTRAL
A
#4 CU
A
A
3/8" EHS STEEL SECONDARY
DOWNGUY STRAND
#4 CU POLE
GROUND
#4 CU JUMPER CONNECTING BOTH
3/8" EHS STEEL PRIMARY AND
SECONDARY DOWNGUY STRANDS
TOGETHER
A
A
A AMPACT* TYPE CONNECTOR
*TRADEMARK OF AMP INCORPORATED
NOTE: DOWNGUY GUARD AND POLE
GROUND GUARD OMITTED
FOR CLARITY
8' COPPER CLAD
GROUND ROD

Fig IR 340-2

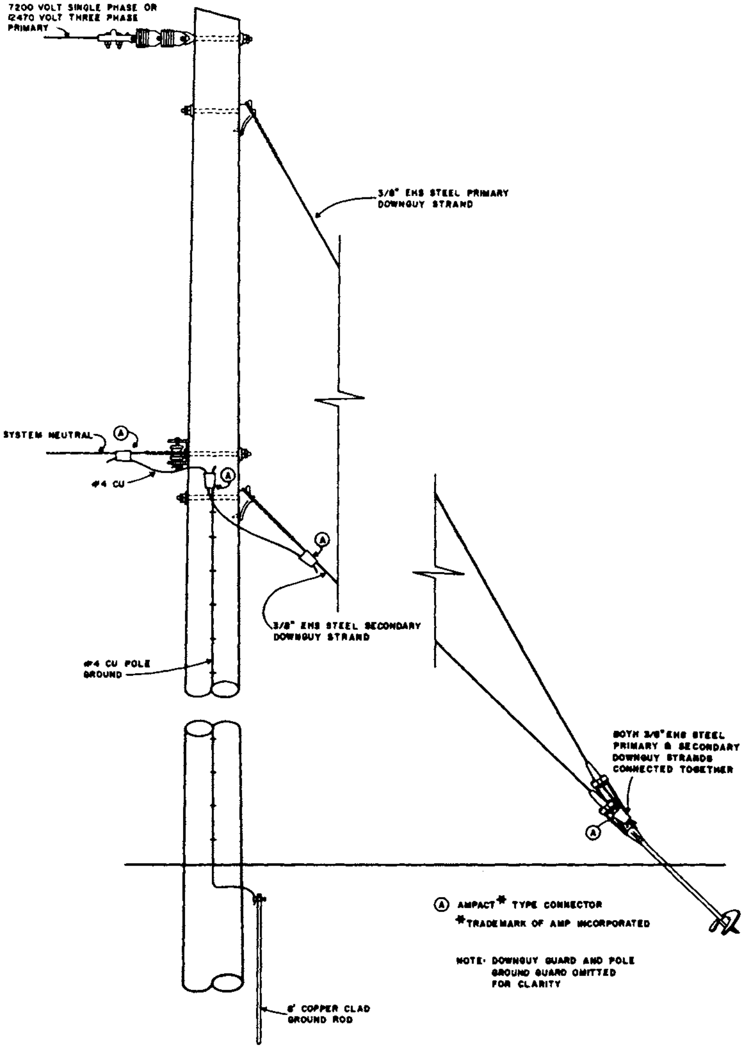

7200 VOLT SINGLE PHASE OR
12470 VOLT THREE PHASE
PRIMARY
3/8" EHS STEEL PRIMARY
DOWNGUY STRAND
SYSTEM NEUTRAL
A
#4 CU
A
A
3/8" EHS STEEL SECONDARY
DOWNGUY STRAND
#4 CU POLE
GROUND
BOTH 3/8" EHS STEEL
PRIMARY & SECONDARY
DOWNGUY STRANDS
CONNECTED TOGETHER
A
A AMPACT* TYPE CONNECTOR
*TRADEMARK OF AMP INCORPORATED
NOTE: DOWNGUY GUARD AND POLE
GROUND GUARD OMITTED
FOR CLARITY
8' COPPER CLAD
GROUND ROD

Fig IR 340-3

INTERPRETATION (Aug 15, 83)

The configurations of all three of your figures meet the requirements of the code.

92D

Grounding of lamp posts

REQUEST (June 1, 81) IR 298

Please inform me of the acceptable minimum for grounding steel lamp posts. Section 215C Noncurrent Carrying Parts, states that lamp posts shall be "effectively grounded".

Section 314 B Conductive Parts to be Grounded, also states that lamp posts shall be "effectively grounded".

"Effectively grounded" means intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current carrying capacity to prevent buildup of voltages.

Our present practice is to tie the lamp and post to the system neutral which is well grounded (more than four grounds per mile). This wire, number 14 copper, from the lamp and post carries the lamp current.

My question is, should we run separate grounds to the post such as a bare counterpoise, ground rods, or some other acceptable means, and is the wire we use large enough?

INTERPRETATION (Nov 11, 81)

Your questions ask 'should we run' separate grounding conductors to the post rather than 'does the code require' you to do so. Our answer is given with respect to code requirement only. You will have to answer the 'should' question.

We are enclosing copies of early code Rules and the Discussions thereof which bear upon this subject. These documents are useful in determining the development of the code provisions. The initial codes required separate grounding conductors for frames of utilization equipment and secondaries. One of the several reasons for that requirement was that failure of the common grounding conductor through mechanical injury or loose connection could place an electric potential above ground on the frame 'creating a grave hazard of shock to persons.' The Discussion of the Fifth Edition began to speak of the practice of using 'a common grounding conductor of substantial cross section . . .' and the Fifth Edition rules allowed frames of utilization equipment to be connected to multigrounded secondary neutrals. The Sixth Edition dropped frames of utilization equipment operating at less than 750 V from the separate grounding conductor requirement.

Rules 215C and 314B require that lamp posts be effectively grounded. If a multigrounded neutral is effectively grounded as defined in the National Electrical Safety Code (NESC) and sized in accordance with Rule 93F, it may be used as part of the grounding circuit for equipment such as lamp posts. Otherwise, the lamp post must be separately effectively grounded by one of the methods that you describe.

If there is no overcurrent or fault protection provided, Rule 93C5 requires a minimum of No. 8 AWG copper for the ground wire. If the lamp supply conductor is larger than No. 14 copper, Rule 93C8 requires a correspondingly larger grounding conductor.

However, the operative rule in this case may be Rule 93D—Guarding and Protection. The NESC distinguishes between (1) one of the grounding conductors which connect a multigrounded neutral to one of its grounding electrodes and (2) a grounding conductor which is the single connector of utilization equipment or its circuit to a grounding electrode or a multigrounded neutral. If the first type of grounding conductor is severed or develops a loose connection, both ends of the conductor should remain at ground potential because of the grounding electrode on one end and the multigrounded neutral on the other. In the second case, an electric potential between the ground and one side of the conductor could be expected to result.

Even though the single grounding conductor to which you refer may be connected at some point to a multigrounded neutral, that one conductor is the single ground for the utilization system which it serves. Since the lamp circuit is a single grounded system, its grounding conductor is required by Rule 93D1 to be guarded. Rule 93D2 then becomes operative and the post, which is a part of the grounding conductor, must be guarded for not less than 8 ft above ground if it is readily accessible to the public. If a separate grounding conductor is run for the post and is not connected to the circuit grounding conductor except at a grounding electrode or through a multigrounded bus, then guarding of the lamp post is not required.

* * * *

Objectional voltage: neutral/ground

REQUEST (Jan 19, 80) IR 287

Experience in the last ten years has indicated that an interpretation of a word and concept expressed in the National Electrical Safety Code (NESC) or the National Electrical Code (NEC) electrical codes is needed.

Code Reference — NESC

Section 9 — Grounding Methods for Electric Supply and Communication facilities.
Sub-section 92 — Point of Connection of Grounding Conductor
Part D — Current in Grounding Conductor.
Word needing interpretation: "objectionable".
Concept needing clarification.

Concept as quoted from Rule 92D

"Ground connection points shall be so arranged that under normal circumstances there will be no objectionable flow of current over the grounding conductor. If an objectionable flow of current occurs over a grounding conductor due to the use of multiple grounds, one or more of the following should be used:

(1) Abandon one or more grounds
(2) Change location of grounds
(3) Interrupt the continuity of the conductor between ground connections.
(4) Subject to the approval of the administrative authority take other effective means to limit the current.

The system ground of the source transformer shall not be removed.

The temporary currents set up under abnormal conditions while the grounding conductors are performing their intended protection functions are not considered objectionable. The conductor shall have the capability of conducting anticipated fault current without thermal overloading or excessive voltage buildup — Refer to Rule 93C."

Discussion of Concept and Word

The title of Section 9 includes both Electric Supply and Communication facilities. Part D refers to methods to reduce the objectionable flow of current in multiple grounded systems. The multigrounded power distribution system in which the primary distribution neutral is grounded and the consumer's secondary neutral is grounded and both neutrals are interconnected by a solid bonding conductor is becoming prevalent. The flow of current through the neutral impedance results in a voltage. Some of the normal neutral load current passes to earth through the grounding conductors and grounding resistances. The net result is a voltage between the grounding conductor and earth.

This voltage (and the subsequent current flow through an undesired path) understandably can be objectionable to a communication facility that is grounded to, or is grounded adjacent to the power line grounds. This requires correction.

Questions — NESC

(1) The larger question is whether this same concept (reduction of objectionable flow of current associated with power system grounding conductors) extends to other facilities also usually connected to the power distribution system grounding conductors, and whether the methods outlined in this section can also be used at these facilities?

(2) A key question is what constitutes "objectionable", for what circumstances has the "objectionable" level been legally defined, and who makes the decision for particular cases?

Interaction — NESC and National Fire Protection Agency (NFPA) — NEC codes

Power utilities have been going more to the multigrounded neutral for their primary distribution system and many require that the customer's secondary neutral and grounding system be directly bonded to their primary neutral and ground system. It appears that the NESC does not require that primary and secondary neutrals and grounds "shall" be solidly connected together.

I understand the Power utilities use the NESC (ANSI-C2) (as accepted and amended by State and local codes) for their operations while the NEC (NFPA No. 70- [*year to be specified*], ANSI C-1) [*year *to be specified*] (as also amended) covers essentially buildings and other structures. The NEC (article 250) generally requires grounding of the secondary circuit but allows for a separately derived system where the primary and secondary neutrals at the distribution transformer are not solidly connected together (NEC — Art. 250-5, 250-23, 250-24, 250-26). The same reduction in objectionable current flow over grounding conductors and with the same methods as specified in the NESC is allowed in NEC 250-21.

Question — NESC and NEC

I understand a number of utilities consider that the solid interconnection of primary and secondary grounded neutrals is code required. Is this interconnection of grounded neutrals required by either or both of these codes?

Background

As power distribution has been extended to outlying areas and loads recently have been increasing, the neutral to earth voltage on the grounding conductors has been increasing. This voltage, due to normal load currents flowing in neutral and grounding resistances can be quite variable with time and with location. Abnormal conditions in either the secondary or primary circuit also can cause these neutral to earth voltages, but these usually can be found and corrected. Voltages to earth considered to be part of normal operation of the power distribution system but which are proving objectionable to others are the concern.

An acceptable magnitude of the neutral/grounded conductor to earth has not been defined to my knowledge. Some power utilities appear to consider that voltages in the tens of volts are reasonable and that 5 to 10 volts should be acceptable. This may arise from the concept of a known safety voltage level of about 15 V ac (NEC Art. 680-20(a)(1)). In most cases these voltage levels will not be noticed by humans insulated from the earth by footware.

Our experience with this problem has come from effects on animals, particularly dairy farms, where the animals have a much lower resistance, and low voltage can cause significant currents to flow. The animals are sensitive to these currents and it affects their productivity. Tests have demonstrated that disconnecting the normally operating primary neutral/ground system from the properly operating secondary neutral/ground system at the distribution transformer has reduced the neutral/ground voltage to earth considerably. Owners of mobile homes, persons using shower facilities with concrete laying on the earth and other similar areas where neutral/ground to earth voltages can exist have complained of "tingles" or "shocks".

Question — NESC/NEC

The crux of the problem is—can the secondary system of the normal distribution transformer be isolated from the primary as a Separately Derived Alternating Current System within both codes?

References

I have included several items that will indicate the interest in the problem.

Craine, Lloyd B. *Discussion of Electrical Neutral to Earth Voltage Problems, the "Disconnect", and Possible Solutions for Dairymen.* Washington State University, Electrical Research, College of Engineering. September, 1976. (Some 1976 statements concerning codes requiring primary to secondary neutral interconnection may be in error).

Craine, Lloyd B. *Nationwide Occurrences of Electrical Neutral-to-Earth Voltage on Dairy Farms.* Paper Number 80-3502, for presentation at the 1980 Winter Meeting of the American Society of Agricultural Engineers.

Gustafson, R. J. and Lloyd B. Craine. *Bibliography of Neutral-to-Earth Voltages in Livestock Facilities.* University of Minnesota and Washington State University. November, 1980.

INTERPRETATION (Apr 30, 81)

In answer to your first question, the NESC does not require interconnection of primary and secondary grounds".

The phrase objectionable flow of current has not been defined by the code *per se.* We are, however, attaching [immediately below] a discourse on this which was published in a Discussion Handbook prepared for the Fourth (1928) edition of the Code."

RULE 92 — POINT OF ATTACHMENT

(c) Current in grounding conductor. — Where multiple grounds are used there is a possibility of circulating currents between the different ground connections, arising from unbalanced loads, improper connection of grounding wires, and for other reasons. It is advisable to ascertain the amount of this current flow when the grounds are made in order to make certain that it is not great enough to be objectionable. A fraction of an ampere, or even several amperes on circuits of large capacity, may not be a serious matter, but cases can easily arise where the flow would be sufficient to be disturbing to the service.

The advantages in permanency and reliability which result from the use of a number of grounds on a given circuit feeding a considerable area will generally warrant the use of multiple grounds on alternating-current secondaries, notwithstanding the possible existence of slight interchange of alternating current over these connections due to moderate unbalancing of the circuit, or to other causes, since heating or electrolysis from such small currents will be entirely negligible. A value of interchange current which would not be harmful with alternating current might, however, be sufficient to cause damage if on a direct-current system.

If the protective ground connection normally carries current, it is part of a closed circuit, and this may be an undersirable type of ground by reason of introducing other hazards. Direct current, in particular, may cause electrolytic damage, if not confined wholly to the metallic circuit and the utilization devices designed for use with the direct current. Multiple grounds from a neutral wire of a direct-current three-wire circuit may, if the direct-current circuit is unbalanced, cause earth currents and produce electrolytic damage by reason of such earth currents. Even alternating current, in large amounts or long continued, may unnecessarily deteriorate the ground connection, but such a current could only result from a fault or from excessive unbalancing of three-wire alternating-current circuits with multiple ground connections, and such unbalancing would soon be detected and corrected. With artifical grounds, the drying out of surrounding soil under such conditions might be serious, and with direct-current neutrals might result in destruction of the grounding wire by corrosion, the protection afforded by the artificial ground thus being lost.

An objectionable flow of current over a grounding conductor may be due to any one of several reasons, including the location of electric railway returns in close proximity to water pipes or other grounds, which carry part of the railway current through the supply conductors themselves from one ground connection to another. This might result in the deterioration and ultimate failure of such ground connections from electrolysis or drying out of the ground.

In this connection it might be well to consider cases in which the high-tension side of a distribution or station transformer is grounded. Where transformer banks consisting of three single transformers connected in star on the high-tension side have the neutral point grounded, a certain amount of current will flow in this ground connection because of the third-harmonic voltage present. This current may be of considerable value unless proper methods are employed to control it. Station transformer banks may also have their secondary windings connected in star and the neutral point grounded. In some cases the neutral wire may not be carried out of the station as the fourth wire of a three-phase system, as when the load supplied is almost exclusively a power load. In such systems, where lighting is supplied, a single-phase transformer is sometimes installed so that one side of its primary winding is connected to one of the phase wires and the other side to the ground. This results in a continual flow of current at all times, varying from the small excitation current under no-load conditions to a maximum at full load. If an artifical ground is used, this flow of current may result in a drying out of the soil so that in dry sections of the country the soil immediately adjacent to the artificial ground may become nonconducting. As a result the potential of the ground connection may be raised much above ground and even approach that of the line. It is evident that a very serious condition of hazard may be produced because the high voltage is brought down to the ground line. Should a rain occur at such time there is danger of the pole burning off because of current flow across the surface of the pole. This practice should, therefore, be avoided and supply lines limited to metallic circuits, as required in urban districts by rule 215C. Such a flow of current would be considered objectionable, but since this is not a protective ground, this case was not contemplated as coming within the application of this rule.

In answer to your third question, a secondary system may be operated isolated from the primary.

93C

Connection of fence grounding conductor to fence posts Extension of existing 6 ft fence

REQUEST (Feb 2, 81) IR 291

In reviewing the ANSI C2 1981 Edition of the National Electric Safety Code (NESC) with our Substation Design Engineers, several questions were asked. Could you please send us your interpretations on the following areas of concern.

93C. Ampacity and Strength (Grounding Conductor and Means of Connection)

6. Fences
   The grounding conductor for fences required to be grounded by other parts of this code shall be any of those meeting the requirements of Rule 95C5 or shall be steel wire not smaller than No. 5 Steel Wire Gage. It shall be connected to the fence posts with connecting means suitable for the material when the posts are of conducting material. If the posts are of nonconducting material, suitable bonding connections shall be made to the fence mesh strands and the barbed wire strands at each grounding conductor point.

Our question relates to, "It shall be connected to the fence posts with connecting means suitable for the material when the posts are of conducting material."

... Power & Light's substation Grounding Standard ... states: "All metallic fencing shall be securely tied to the main ground system at each gate post, and fence corners and at intermediate intervals of 30 to 50 feet as detailed on sheet ... of these standards." A copy ... [Fig IR 291] is attached. As can be seen, other than the gate and corner posts, the posts are not directly connected to the ground system. We do feel that we meet the code requirement in that there are two connections of the mesh to the #4 copper or aluminum ground wire. The #9 galvanized steel mesh wire forms a network of parallel connections from those two ground connections to the intermediate posts in the 30 to 50 ft sections where it is tied to the posts with #9 aluminum tie wires every 15 in up the posts. Also in parallel with the mesh network are the three barbed two strand #12½ galvanized steel wires connecting to the posts, each barbed wire is connected to the #4 ground wire. All these connections to the posts exceed the ampacity of the code minimum #5 steel wire and keeps the touch and step potentials at the fence under the requirement of Rule 96. In your opinion, does our standard meet the code?

Rule 013 states:

013. Application

A. New Installations and Extensions

1. These rules shall apply to all new installations and extensions, except that they may be waived or modified by the administrative authority. When so waived or modified, equivalent or greater safety shall be provided in other ways, including special working methods.

B. Existing Installations

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 which were in effect at the time of the original installation.

Our question involves how Rules 13A1 and B1&2 apply to extensions of existing fences which are a combination of six ft of mesh plus one-ft barbed wire, which meet the requirement of Rule 110A of the 1977 code, but by interpretations do not meet the 1981 code [as quoted below.]

"INTERPRETATION (Feb. 4, 76) IR 177

The intent of Rule 110A is to require seven ft of fence mesh. Barbed wire extensions are not permitted in some localities. Where barbed wire extensions are permitted by local laws or regulations, any one of the three methods shown in Fig. 177.1 may be used on top of a seven-ft fence mesh. Use of barbed wire is recommended in the note associated with the rule but is not mandatory. A combination of six ft of fence mesh plus a one-ft barbed wire extension in any of the three positions shown does not meet the intent of Rule 110A.

"REQUEST (July 27, 77) IR 201(b)

(b) 110. General Requirements

A.

Enclosure of Equipment

Is it the intent of the indented section and the note to allow the use of six ft of fence fabric plus one ft of barbed wire extension to meet the minimum of seven ft in height listed in the indented section?

Comment:

If the barbed wire is not part of the permissible fence height, the note should stop after "... vertical extension ..."

"INTERPRETATION (Oct 19, 77)

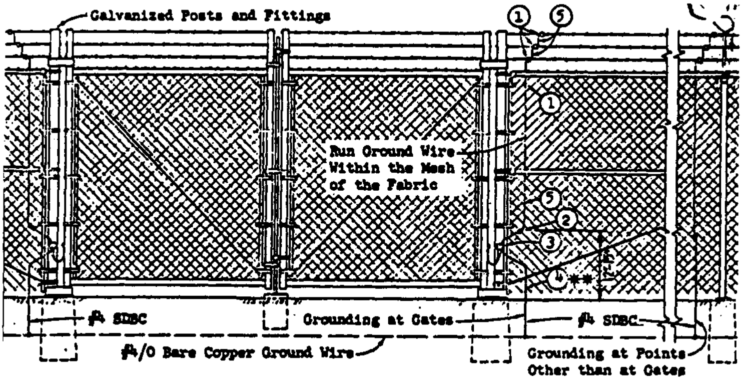
The intent of Rule 110A is to require seven ft of mesh whether a barbed wire extension is or is not used.

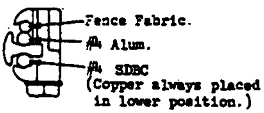
We feel no increase in safety is achieved by making seven ft mesh and one foot barbed wire extensions to existing 6 ft mesh and one foot barbed wire fences, most of these extensions are relatively short. Do you agree, if so, do we need a waiver?

Rule 110A Note states:

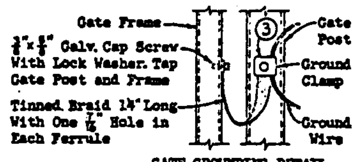
NOTE: It is recommended that, where permissible, a one ft extension, carrying three strands of barbed wire, be used above the fence fabric, either as an outside or inside the fence overhang, or as a vertical extension of the fence to obtain the desired overall height.

We would recommend in the next revision that the last phrase be changed to: '... or as a vertical extension of the fence and is to be in addition to the required seven ft minimum height.'"

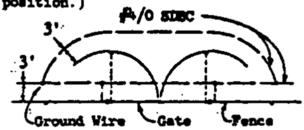




DETAIL ITEM 2
Fargo Connector
GC-8002P



GATE GROUNDING DETAIL



ADDITIONAL GROUND WIRE AROUND GATES WHICH SWING OUT FROM SUBSTATIONS

BARBED WIRE AND FENCE FABRIC	CONNECTORS*			GROUNDING WIRE	
	Item 1	Item 2	Item 3	Item 4	Item 5
Galvanized Steel or Aluminum, Barbed Wire and Fence Fabric.	Fargo GC-5004P	Fargo GC-8002P	PDU OPA 7-198	#4 SDBC	#4 Alum.

*Similar connectors, of equal quality, may be substituted for those listed.

**The copper ground wire must not contact Aluminum fabric.

NOTE: Refer to Standard 10.1, sheet 3, paragraphs specifying fence grounding. General Fence Specifications PA-24600 Sh 1-2 & 3.

Fig IR 291

INTERPRETATION (Apr 24, 81)

With respect to the first question, it appears the described method of grounding fences does comply with the code.

With respect to the second question, since rule 110A has been interpreted as requiring seven feet of mesh, and the wording of this rule is the same in the 1977 and 1981 codes, it seems clear that the original installation did not meet the intent of rule 110A. Extension of the same size fencing would also be counter to the intent of rule 110A. Rule 013B has no bearing on this situation.

Rule 013A provides that these rules may be modified or waived by the administrative authority provided equivalent or greater safety is provided.

93C7

Bonding requirements for adjacent pad-mounted supply equipment and communication circuit pedestals in an underground system

REQUEST (Feb 14, 84) IR 356

... Telephone Company primarily serves the rural areas ... with some exchanges servicing the suburban areas of major cities and towns. We, as well as the local power companies, have begun placing more and more of our distribution facilities underground (direct buried), but not in a common trench. This is very often the case in subdivisions and developed tracts, and due to property lines and common utility easements, our cable housings (service drop points) and the power company's pad mounted transformers and even the CATV's service pedestals are located in close proximity to one another. It is my interpretation of the aforementioned Rule that these above ground metallic enclosures must be bonded together to insure the safety of our employees and the general public. Due to design, there is no external connection available on either of the parties' enclosures, thus requiring extraordinary coordination and installation.

INTERPRETATION (May 21, 84)

Rule 93C7 does not require bonding together of metal pad-mounted enclosures of different utilities; this rule contains the requirements for performance if bonding is required by some other rule. However, Rules 215C1, 314B, 374A, and 384A require the metallic enclosures of the supply apparatus and the communication apparatus to be effectively grounded. When such enclosures are in close proximity, bonding is often used to enhance the effectiveness of the grounding system.

Rule 99 contains the requirements for grounding outside communication apparatus if such grounding is required by another rule. Rule 99A allows connection of a communication apparatus grounding conductor to a separate electrode or to supply apparatus if the requirements of Rules 94A1 or 99A1 are met.

The bonding requirements of Rule 354E4 are not applicable, since the buried cables are not in the same trench and are more than 12 inches from each other. The bonding requirements of Rule 99A2 are also not required, since the location that you describe is not at the service entrance to the customer's facilities. Rule 374 allows, but does not require bonding.

In summary, the National Electrical Safety Code (NESC) allows, but does not require, bonding of enclosures under the conditions stated in this interpretation request. If bonding is performed, the NESC does contain the performance requirements.

93D1

Guard over ground lead

REQUEST (Dec 10, 81) IR 307

I wish to have a clarification of Rule 93D1 — Guarding and Protection, particularly in reference to paragraph 1 of that rule.

... Public Service Corporation is an electrical utility company which owns and maintains an overhead distribution system operating in the 5 kV, 15 kV, and 35 kV voltage classes. This system is a four-wire, multigrounded neutral system. Company standards require a minimum of four driven grounds per mile, and driven grounds are installed at all transformer locations.

The ground lead conductor that connects driven grounds to the neutral conductor is #6 solid bare copper wire and is firmly stapled to the pole from the base to a height of approximately 25 ft. Present operating procedure is to cover this #6 bare copper ground lead with a plastic half round guard.

It is the practice of installing this ground lead guard that is being reviewed. Those who criticize the guard point out that the installation and maintenance costs outweigh whatever mechanical protection the guard is intended to provide. In fact, the guard provides minimal mechanical protection.

It is our obligation and intention to comply with the National Electrical Safety Code (NESC). In reference to Rule 93D1, I frankly am uncertain as to whether a ground lead accessible to the public, yet part of a multigrounded system, must be guarded. I would appreciate your assistance in clarifying this rule as it applies to my situation.

INTERPRETATION (Mar 9, 82)

Rule 239C and its five exceptions govern the requirements for mechanical protection of all vertical conductors, cables, and grounding wires within 8 ft of the ground. Rule 93D provides requirements for guarding and protection for rounding conductors only. Rule 239C determines which of the requirements of Rule 93D is applicable.

Rule 239C, Exception 4, exempts the grounding conductors of multigrounded systems from the requirement of that rule for mechanical protection. Rules 93D1 and 93D3 then apply.

93D1&3 See 92C2

IR 340

94B4

(a) Grounds at transformer locations; Adequacy of grounding

REQUEST (Mar 3, 83) IR 338

We are a utility that operates a three phase-four wire 7200/12,470 wye V multigrounded neutral distribution system with approximately 50,000 customers. Our customers are residential, commercial, and industrial and part of the system is in a coastal area. We use primarily wood pole structures and average in excess of 25 structures per mi. Most of our services are from overhead transformers, but we have many underground services from pad mounted transformers as well.

Our present grounding practices consist of installing a wire wrap ground as described in Rule 94B4c (using #4 bare solid copper wire) on every pole. Primary and secondary neutrals, surge arresters, equipment frames, equipment mounting brackets, and concentric neutrals of underground primary cables are all connected to this one (1) common pole ground.

At pad mounted transformer locations, a 10 ft x 1/2 in copperweld ground rod is driven and utilized as a grounding electrode to which all neutrals, frames, and equipment as described above are connected. However, at overhead transformer locations no other ground electrode is utilized except for the wire wrap as described previously. We believe that this grounding system is adequate in that:

(1) Circuit protective devices operate properly during fault conditions.
(2) We do not have a problem with equipment damage due to lightning in non-coastal or in coastal areas where lightning activity is high.
(3) We have not experienced any hazardous conditions of touch or step potential.

However, we are concerned about the intent of rules 94B4a and 96. Our specific questions are:

(1) We interpret the portion of Rule 94B4a which reads "... two such electrodes may be counted as one made electrode and ground for application of Rules 92C1a, 92C2b, 97C, and 96A3 ..." to require eight (8) wire wrap grounds per mi on a system where wire wraps are employed. Is this a correct interpretation?

(2) Rule 94B4a continues to state "... however, these types shall not be the sole grounding electrode at transformer locations."
   (a) What is the intent of this part of this rule? (Please discuss both overhead and pad mounted transformers.)
   (b) Could the fact that we use a wire wrap ground on every pole (over 25 per mi) satisfy this rule for overhead transformers?

(3) Rule 96A3 states "The neutral ... shall be connected to made electrodes at each transformer location and at a sufficient number of additional points to total not less than four (4) grounds in each mi of line. . . ."
   (a) What is the intent of this rule?
   (b) Does this mean that the total number of grounds, transformer and additional grounds must be no less than four (4) per mi or that the total number of additional grounds exclusive of transformer grounds must be no less than four (4) per mi?
   (c) Can a wire wrap constitute a "made electrode" as referred to in this rule?

INTERPRETATION (Sept 2, 83)

(1) Your interpretation is correct.
(2) These rules do not distinguish between overhead and pad-mounted transformers. A large number of wire-wrapped pole butt grounds or butt-plate grounds, if they meet the size requirements of the rules, have been shown to be a dependable grounding mechanism for a line under the specified conditions. However, experience has shown that one such ground is not a dependable ground for a transformer and that an additional grounding electrode is required at a transformer location; the ground at the individual service does not satisfy the requirement of Rule 94B4a.
(3) If the neutral is properly bonded to the made electrode at a transformer location, that electrode does count as one of the required grounds per mile of line. One wire wrap ground does not qualify as a made electrode.

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

REQUEST (Aug 25, 82) IR 331

We have had discussions, and would like a committee opinion, on the interpretation of the above two rules as they regard grounding at transformer locations.

Specifically:

(1) Since each pole mounted transformer will have at least one and often several customers associated with it, and each of these customers can be expected to have a driven ground rod at his point of service, can these driven grounds be included for purposes of satisfying that portion of Rule 94G4a referring to pole butt plates which reads "however these types shall not be the sole grounding electrode at transformer locations"?

(2) What are the reasons behind specifying in Rule 94B4a that two electrodes such as pole butt plates may be counted as one made electrode such as a driven rod?

INTERPRETATION (Oct 25, 27, 82)

(1) Customer-owned grounds are not under the control of the utility and are not AT the transformer location; they do not qualify for the requirement of Rule 94B4a of grounding other than that provided by a pole butt ground. Rules 92C1b, 92C2b, 96A3, and 97C clearly specify that grounds at services are not included.

(2) This is not a request for an interpretation.

We advise, for your information, that a driven ground has approximately twice the exposed surface area as a butt ground and is considered to be a more consistent ground since it is not as affected by actions of the pole, such as movement or drying of the ground through wicking action.

* * * *

(a) Thickness of butt plates
(b) Acceptability of #6 copper wire wrap as grounding electrode

REQUEST (Feb 23, 82) IR 314

We utilize a multigrounded distribution system at 2400/4160, 7200/12470 and 19420/34500 V. Our standard construction has been to use a butt plate with a #6 copper lead to the neutral conductor on every other pole (ten to twelve plates per mi). All transformers have two ground connections, one to the neutral conductor and one to the grounded down leads. We felt our grounding system met or exceeded the requirements of the National Electrical Safety Code (NESC) and our operating record has been excellent as far as grounding problems are concerned. Recently we discovered the thickness of our non-ferrous butt plates are only .03 in. Because of this condition we have the following questions:

(1) What was the criteria that determined the thickness of nonferrous metal butt plates should be .06 in?
(2) Would eight nonferrous pole butt plates per mi .03 in thick meet the requirements of Rules 97C and 94B4b.
(3) Would nonferrous pole butt plates .03 in thick on every other pole (ten to twelve per mi) meet the requirements of Rules 97C and 94B4b.
(4) Would nonferrous pole butt plates .03 in thick on every pole (twenty to twenty-four per mi) meet the requirements of Rules 97C and 94B4b.
(5) Would twelve or more ft of #6 copper wire wrapped on eight poles per mi meet the requirements of Rules 97C and 94B4b.
(6) Would twelve or more ft of #6 copper wire wrapped on every other pole (ten to twelve per mi) meet the requirements of Rules 97C and 94B4b.
(7) Would twelve or more ft of #6 copper wire wrapped on every pole (twenty to twenty-four per mi) meet the requirements of Rules 97C and 94B4b.

INTERPRETATION (June 24, 82)

(1) This is not a request for interpretation.

(2-7) Rule 97C requires a common neutral to have at least four ground connections in each mile of line exclusive of the ground connections at customers equipment. Rule 96 includes the requirements for the resistance of grounding electrodes. Rule 94 includes the requirements for grounding electrodes themselves; part B of that rule covers made electrodes.

It is clear from the language of Rule 94B4a that pole butt plates and wire wraps are not normally considered to provide effective grounding electrode functions except in SOME areas of very low soil resistivity. In those limited cases, as determined by Rule 96, Rule 94B4a allows TWO such assemblies meeting Rule 94B4b or Rule 94B4c to count as one made electrode for certain requirements NOT including transformer grounding electrodes (transformer locations require a grounding electrode of more substance).

Nonferrous plates of less than .06 in thickness or less than 0.5 square ft in surface area on one side do not meet the requirements of Rule 94B46.

For your information, note that the NESC Committee considered reducing the required thickness for nonferrous butt plates from .06 inches to .025 in for the 1981 Edition of the Code. After review of National Bureau of Standards Circular No. 579 and other data which indicated that such thin plates cannot be depended upon because of corrosion problems, and because the required square ft of plate area had been reduced, the NESC Committee rejected the change proposal.

96A See 94B4 IR 338

96A3

Grounding of fully insulated jacketed concentric neutral cable

REQUEST (May 2, 83) IR 341

A number of rural electric cooperatives in our area, including ourselves, plan to install the standard URD cable with a fully insulated jacket over the concentric neutral. This type of cable is being installed to prevent the copper concentric neutral wires from corroding.

Rural Electrification Administration has permitted the installation of fully insulated jacketed cable on a trial basis, with the stipulation that four (4) made electrodes be installed per mi of line. This is done to comply with Rules 96A3 and 97C.

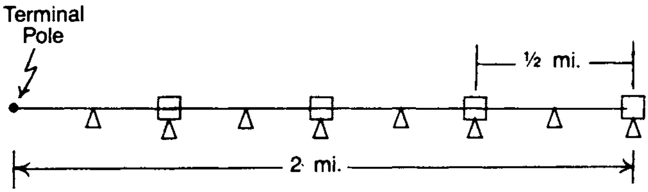
In our case, we plan to install two miles of insulated jacketed cable. Sectionalizing enclosures are to be placed one-half mile apart and a 3/4 in × 8 ft ground rod installed. Also, halfway between each enclosure another ground rod needs to be added by stripping back the jacket and making a suitable connection to the concentric neutral. This area needs to be sealed again to prevent moisture from entering. (Please see Fig IR 341-1.)

If this two-mi piece of line is electrically isolated at each end, a neutral-to-earth resistance can be calculated based on the 2000 ohm-centimeter soil in the area. (Please see Fig IR 341-2.) This is the base line case.

If the grounding electrode at each sectionalizing enclosure is improved (that is a small grid installed) and the ground rod between each enclosure is removed, it can be shown the neutral-to-earth resistance can be made equal to or better than the base line case. (Please see Figs IR 341-3 and 4.) It also can be shown the loss of a ground and the potential build up on the cable is similar to or less than in the base line case.

The two improved electrodes per mi is a different method to get to the same end-product as produced by the four ground rods per mi. Is it enough to comply with the intended results of a Rule 96A3, that is installing two grounds per mi with the overall neutral-to-earth resistance the same or better than four (4) grounds per mi, or does the fully insulated jacketed cable need to be grounded in the same manner as an overhead line?

Cable: 3-4/0 Aluminum with 11 - #14 Cu concentric neutral wires with fully insulated jacket.



☐ Sectionalizing enclosure.

△ Denotes ground rod (3/4 in × 8 ft) — calculated resistance of 7 ohms in 2000 ohm-centimeter soil.

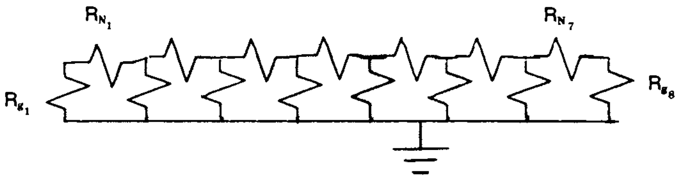
Fig IR 341-1

Resistance of the concentric neutral on one cable is .3544 ohm/1320 ft.

For 3Ø cable installation, have three (3) neutrals in parallel between common connections, therefore resistance between ground rods is .1181 ohm/1320 ft.

R_{N_1}, R_{N_2}, ... R_{N_7} = .1181 ohm, resistance of neutral.

R_{g_1}, R_{g_2}, ... R_{g_8} = 7 ohm, resistance of each ground rod.



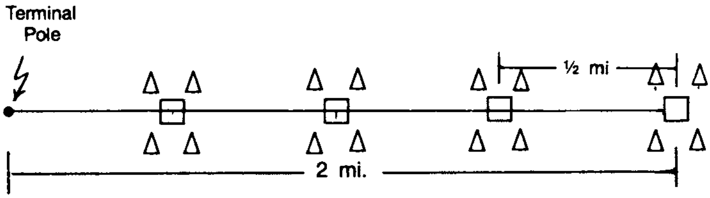
The total neutral-to-earth resistance looking across R_{g_8} is 1.11 ohms.

If R_{g_6} is infinity, that is the ground connection is bad, the total resistance across R_{g_8} is 1.26 ohms.

Halfway between R_{g_4} and R_{g_5} the resistance to earth from the midpoint on one of the 3Ø cables is 1.01 ohms.

Fig IR 341-2

Cable: 3-4/0 Aluminum with 11 - #14 Cu concentric neutral wires with fully insulated jacket.



 Denotes 20′ × 20′ ground grid around each enclosure, calculated resistance of each grid 2 ohms or less in 2000 ohm-centimeter soil.

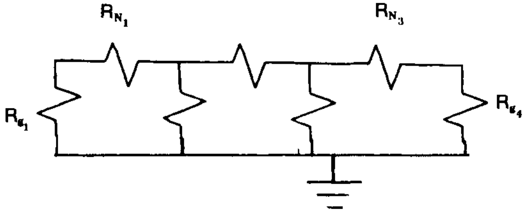
Fig IR 341-3

Resistance of the concentric neutral on one cable is .7088 ohm/2640 ft.

For 3Ø cable installation, have three (3) neutrals in parallel between common connections, therefore resistance between ground grids is .2362 ohm/2460 ft.

R_{N_1}, R_{N_2}, R_{N_3} = .2362 ohm, resistance of neutral.

R_{g_1}, R_{g_2}, R_{g_3}, R_{g_4} = 2 ohm, resistance of each ground grid.



The total neutral-to-earth resistance looking across R_{g_4} is .68 ohms.

If R_{g_3} is infinity, that is the ground connection is bad, the total resistance to earth across R_{g_4} is .87 ohms.

Halfway between R_{g_2} and R_{g_3} the resistance to earth from the midpoint on one of the 3Ø cables is .71 ohms.

Fig IR 341-4

INTERPRETATION (Aug 15, 83)

The requirement is that there be at least four ground connections to made electrodes in each mile of line if either

(1) primary and secondary circuits utilize one concentric neutral as a common neutral (Rule 97C) or

(2) the system is multigrounded (Rule 96A3).

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97 (1973) See 97A1 (1973) IR 299

97A1 (1973)

(a) Connection of two items to the same grounding electrode
(b) Rule 97C1b (1973) Connection of arrester ground to grounded neutral
(c) Rule 97 (1973) Reasons for prohibiting solid interconnection of arrester grounding conductor and secondary grounding conductors

REQUEST (June 15, 81) IR 299

This interpretations request concerns clarification of Rule 97, 1973 Edition and a request for background data on eliminating a Rule 97 option between the 1973 and 1977 Editions:
(1) Clarification of Rule 97A, 1973 Edition:

97. SEPARATE GROUNDING CONDUCTORS AND GROUNDING ELECTRODES.

A. Grounding Conductors.

Grounding conductors from equipment and circuits of each of the following classes, if required by these rules, shall be run separately to the grounding electrode or to a sufficiently heavy grounding bus or system ground cable which is well connected to ground at more than one place, except as provided in paragraph C and in Rule 285C.

1. Primary lightning arresters, except as is provided in Rule 97C.
2. Secondaries connected to low-voltage lighting or power circuits, except that if a secondary distribution system has multiple grounds, utilization equipment and wire enclosures may use the same grounding conductor.
3. Frames of direct-current railway equipment and of equipment operating in excess of 750 volts.
4. Lightning rods.

Condition: 4800 V, 3 wire, ungrounded delta primary without a primary and secondary common neutral where an interconnection between the arrester grounding conductor and secondary grounded conductor is *not* permitted.

Does the intent of Rule 97A permit the connection of the arrester grounding conductor and secondary grounded conductor to the same grounding electrode?

(2) Clarification of Rule 97C1(b), 1973 Edition:

C. Interconnection of Primary Arrester and Secondary Neutral.

1. SOLID INTERCONNECTION.

The grounding conductor of a lightning arrester protecting a transformer which supplies a secondary distribution system may be interconnected with the grounded conductor of such secondary distribution system provided that either:

(b) The secondary has elsewhere a grounding connection to a continuous metallic underground water-piping system, in addition to the direct earth grounding connection of the arrester, or

(c) ...

Condition: 4800 V, 3 wire, ungrounded delta primary without a primary and secondary common neutral, where the secondary neutral is grounded at the transformer pole through a grounding electrode and, in addition, the secondary neutral has a grounding connection at a customer service location to a continuous metallic underground water-piping system.

Does the intent of Rule 97C1(b) permit the arrester grounding conductor to be interconnected to the grounded neutral? What if the customer service location substituted a metal well casing of considerable extent as a piping system alternate via Rule 94B?

(3) Rule 97 changes between 1973 and 1977 Editions

(1973) C. Interconnection of Primary Arrester and Secondary Neutral.

1. SOLID INTERCONNECTION.

The grounding conductor of a lightning arrester protecting a transformer which supplies a secondary distribution system may be interconnected with the grounded conductor of such secondary distribution system provided that *either*:

(1977) D. Where the secondary neutral is not interconnected with the primary neutral as in Rule 97B, interconnection of the neutral may be made through a spark gap. The gap shall have a 60 hertz breakdown voltage of at least twice the primary circuit voltage but not necessarily more than 10 kilovolts. At least one other ground connection on the secondary neutral shall be provided, at a distance of not less than 20 feet from the surge arrester grounding electrode.

Conditions: 4800 V, 3 wire, ungrounded delta primary without a primary and secondary common neutral.

The 1973 Edition of the National Electrical Safety Code (NESC) permitted a solid interconnection of the arrester grounding conductor to the secondary grounded conductor for a specified set of conditions. The 1977 Edition does not permit this solid interconnection. What were the reasons for and intent of this change?

INTERPRETATION (Nov 12, 81)

Question (1)

The answer to this question under the stated conditions is NO.

We have enclosed copies of Rule 97 as it has existed in each adopted Edition of the NESC prior to and including the 1973 Edition to which you refer. Also shown are the official Discussion paragraphs which relate thereto. Throughout the history of the code, the NESC has distinguished between arrester grounds and all other grounds. All types of grounding conductors except those of arresters may be connected at a grounding electrode. However, because of the resistance of a single grounding electrode, a voltage potential may be impressed on other circuits during discharge of a surge arrester if they are connected to the arrester grounding conductor at a single grounding electrode. At the start of the NESC, separate grounds were specifically required for lightning arresters. The Fifth Edition of the code began to allow interconnection of the arrester grounding conductor with the secondary conductor if there was direct grounding at the arrester site AND other specific multiple grounding provisions were met. The Sixth Edition continued this allowance under slightly different restrictions which still required multiple grounds.

Connecting an arrester grounding conductor and the secondary grounding conductor to the same grounding electrode is considered to constitute interconnection of the two conductors. Such connection is only allowed by Rule 97A (1973) if Rule 97C (1973) is met. Your question indicates that such is not the case, so separate grounding conductors and electrodes are required.

Question (2)

Rule 97C1(b) (1973) allows direct interconnection of an arrester grounding conductor to the grounded neutral of the secondary circuit where both of the following are met:

(A) The secondary grounding conductor is elsewhere connected to a continuous metallic underground water piping system.

(B) The arrester is also connected to a direct earth grounding electrode at the arrester site.

Rule 96A (1973) states the requirements that the grounding electrode at the pole and the water system piping or well casing must each meet in order for Rule 97C1(b) (1973) to be operable.

Question (3)

This question is not a request for an interpretation. However, we provide the following for information:

The change to which you refer was formally publicly noticed in the August 15, 1973 Draft of what was to become the 1977 Edition of the NESC. We have no record of comments which may have been received on the change as proposed in that draft. The proposed change continued in the March 1, 1975 Draft. There were eleven comments made to the Subcommittee about the 1975 Draft of Rule 97; one of these dealt partially with the problem that you mention. That comment was considered and the number of items included under Rule 97A was reduced. It is not clear whether the exact change to which you refer was specifically questioned and considered at that date. No response relating to the Rule 97 change that you have questioned was received to the subsequent April 1, 1976 Draft; the April 1, 1976 wording was adopted as the final wording of Rule 97 in the 1977 Edition. No requests for change or comments on this requirement were received or acted upon for the 1981 Edition.

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

Part I **(Sections 10-19)**
110A

110A See 93C IR 291

110A

(a) Guarding by fence enclosure
(b) 124 Table 2 Applicability of clearance
(i) within fence enclosure
(ii) within vault

REQUEST (Oct 13, 81) IR 300

(1) Does a fence enclosure described in paragraph 110-A satisfy the guarding requirements of large pole type transformers sitting on a concrete pad at ground level described in paragraph 153-A-1 or do the minimum clearances given in paragraph 124, table 2, apply within the fenced area?

(2) If the minimum clearances still apply, would they apply within a transformer vault inside a building?

INTERPRETATION (Oct 13, 81)

This interpretation request evidently refers to the 1977 Edition, but the answer applies to the 1981 Edition as well. The wording of the 1981 Edition more effectively expresses the requirements intended by the code.

There are two separate sources of potential safety problems when transformers or regulators are installed at ground level, authorized persons and unauthorized persons. Rule 153A1 (1977) and Rule 110A are intended to minimize conflict with unauthorized persons by limiting their access to the installation. Rule 152A1 (1981) and rules 124 and 125 are intended to minimize conflict with persons having authorized access to the installation, whether within a vault or within an outdoor fenced enclosure, by providing guarding or adequate working clearances. The requirements of all of these applicable rules must be met.

It appears that your conclusion may result from the earlier wording providing for the use of 'pad-mount' tranformer installations.

The 1981 Edition more clearly states the requirement in Rule 152A1:

Either (The ground level transformer must be installed such that all energized parts are enclosed or guarded.)

Or (The energized parts shall be isolated in accordance with (Rule 124. (See Table 124-1.))

In both alternatives, Rule 152A1 (1981) requires that the transformer case be grounded in accordance with Rule 123. This is a change from Rule 153A1 (1977) in which case grounding was only required in the first alternative. The requirements of Rule 110A apply in both alternatives. A typical underground system pad-mount transformer meets these requirements by having an outer-grounded case which, in effect, forms a small vault enclosure. Within the enclosure, the live parts are guarded.

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124 Table 2 See 110A IR 300

124A, Table 124-1 (Footnote 1)

Clearance from bottom of wave trap supporting insulator to ground

REQUEST (Oct 25, 82) IR 322

I would like to request an interpretation to the following rule of the 1981 National Electrical Safety Code:

Rule number 124A1, Footnote 1 of Table 124-1.

We have designed a wave trap support structure per the attached diagram. See Fig IR 322

The problem for which clarification is requested is as follows:

Does rule 124A in any way state that a minimum distance must be maintained between the bottom of porcelain and ground level (dimension "X" in sketch)? The last sentence of Footnote 1 of Table 124-1 is in essence saying that a minimum distance of 8 ft 6 in must be maintained between bottom of porcelain and ground level on surge protective devices, but no mention is made of other devices such as wave traps, bus support insulators, etcetera.

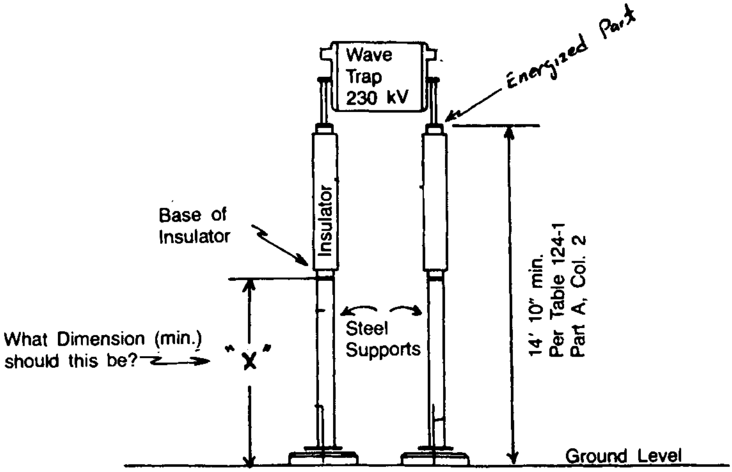

Energized Part
Wave
Trap
230 kV
Insulator
Base of
Insulator
Steel
Supports
14' 10" min.
Per Table 124-1
Part A, Col. 2
What Dimension (min.)
should this be?
"X"
Ground Level

Fig. IR 322

INTERPRETATION (Oct 25, 82)

Rule 124A does not clearly specify the vertical clearance above ground of a grounded base of an insulator.

Our review of past interpretations by this subcommittee on this subject indicates that IR 86 of May 1, 1957, asked specifically 'Is the entire porcelain portion of a lightning arrester considered a "live part" in the measurement of distance in the Rule and in Table 2?' (underline added). The Interpretation provided by the subcommittee at that time was based on the Fifth Edition of the National Electrical Safety Code (NESC) and was: 'The point of measurement is from the actual "live part" rather than from some part of the porcelain body of the arrester.' While this interpretation is correct for that edition of the code and also applies to later editions, we believe that it is not a complete explanation of current code requirements and offer further comment herein.

It is appropriate to consider the definitions of the terms involved as well as applicable rules other than Rule 124A1 cited by the requestor. The definition of 'energized', which is also the definition of 'live' and 'alive', is: 'Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of earth in the vicinity.' That definition from the 1981 Edition is the same as previous editions with one exception: while it includes 'current-carrying parts', it is no longer synonymous with that term.

Rule 124A1 requires guarding of all 'live' parts operating above 150 V to ground which do not have an adequate insulating covering or do not meet the clearances given in Table 124-1. Rule 124A3 requires that parts of indeterminate potential, such as ungrounded parts of arresters, shall be guarded on the basis of the maximum voltage which may be present.

It is clear from the wording of the Code and the past interpretation and code promulgation history that it is not intended that the entire porcelain portion of an insulator be required to meet the same clearance as the live end which faces the full voltage potential. It is also clear that parts of indeterminate potential are required to be guarded or located appropriately for the voltage potential which may be present at such point.

The point on an insulator at which the voltage potential reached 150 V to ground is required by Rules 124A1 and 124A3 to be guarded or located so as to have a combination of horizontal and vertical clearances to minimize the possibility of human contact. Although the Code does not specify the clearance appropriate for the point at which a voltage potential of 150 V to ground may be reached, the minimum clearances required for points reaching various voltage potentials above 301 V to ground are specified in Table 124-1. For example, the point on an insulator at which the voltage potential may reach 23,000 V to ground must have a vertical clearance above grade of 9 ft 3 in. The last sentence of Note 1 to Table 124-1 allows reduction of these values to not less than 8 ft 6 in plus the electrical clearance between energized parts and ground if limited by surge protective devices.

The Code does not specify the point on an insulator at which various levels of voltage potential may be present; that would depend on the gradient characteristics of the insulator material and construction and the level of exterior contaminants.

The matter at issue in this interpretation request is the required clearance above grade of the grounded base of an insulator; that clearance is not specified in the Code. Neither is the clearance required for the portion of the insulator material up to the point at which the voltage potential to ground begins to be covered at 301 V in Table 124-1. However, we advise that, though not specified, a minimum height of a grounded insulator base of 8 ft 6 in above grade would be consistent with the requirements of Rule 124A.

124A1, Table 124-1

Pole-mounted regulator bank with platform; clearance required for workmen on platform

REQUEST (Jan 27, 84) IR 355

Our interpretation request concerns the use of a supported walkway or platform on a pole mounted regulator bank installation.

If the walkway or platform is installed with the guard rail, as shown on Fig IR 355, is it considered to be a "permanent supporting surface for workmen" as shown in Part 1, Rule 124A1 of the 1981 Edition consequently requiring clearances from "live parts" as shown in Table 124-1?

If the installation is not in the category of Part 1 of the National Electrical Safety Code (NESC), then does it fall in the category covered by Rule 286D, "Equipment on Supporting Structures" and require only the clearances to "live parts" required by rule 422B?

SKETCH #1

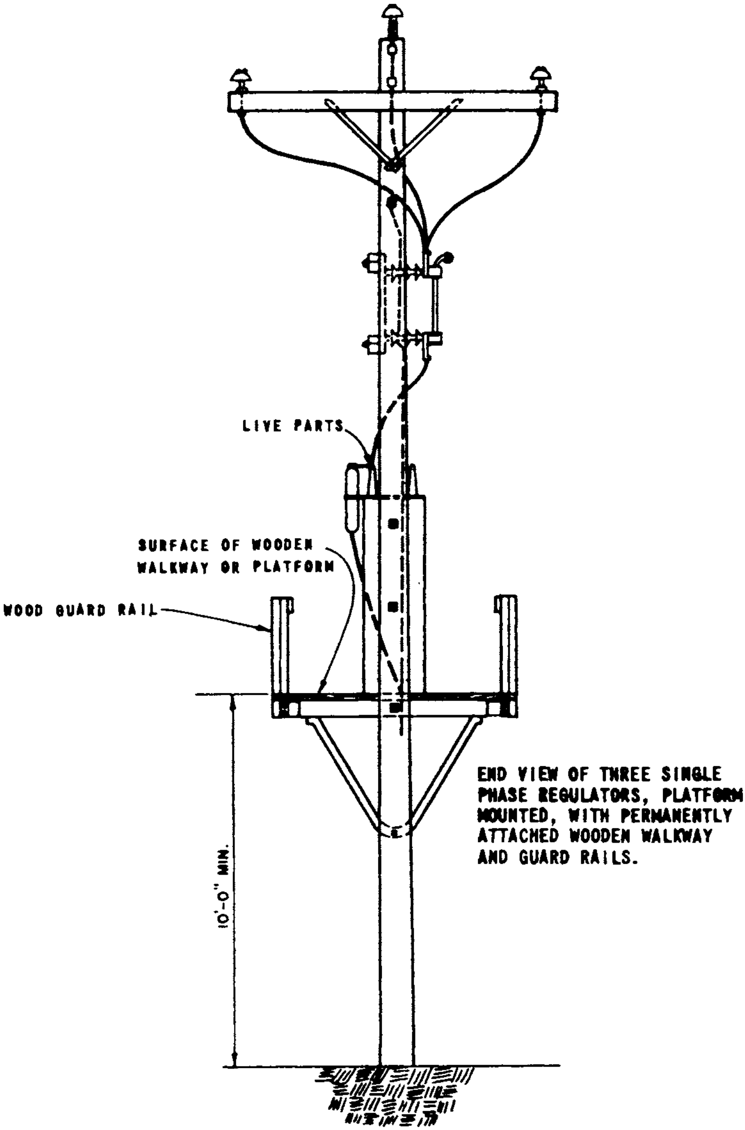


Fig. IR 355

INTERPRETATION (May 21, 84)

Part 1 of the NESC only applies where the requirements of Rule 110A are met; otherwise, the installation must meet the requirements of Part 2 of the Code. From the description supplied, the enclosure requirements of Rule 110A do not appear to be met.

Rule 286D applies if Rule 110A is not met; Rule 286D further requires Rule 422B or 427C to be met. Part 2 does not require the railing.

If the requirements of Rule 110A are met, Rule 124A1 applies; such a platform is considered a "permanent supporting surface" for the purpose of Rule 124A1. Rule 112C requires the railing.

125A3, Table 125-1

Clearance to front of control board

REQUEST (Mar 26, 82) IR 319

We respectfully request an interpretation regarding the applicability of Part A of Article 125 of Section 12 of the National Electric Safety Code (NESC), 1981 edition, to electrical clearances inside an auxiliary control board which has been installed in the ... Power Plant ....

Article 125 is titled "Working Space About Electric Equipment". Part A of Article 125 applies to working space for voltages of 600 V or less. Table 125-1 shows minimum clear distances for working space for equipment voltages up to 600 V.

The ... auxiliary control board is a completely enclosed dead front board with various operating controls and indicating devices on the top half of the front panel. The board is approximately 6 ft wide by 2 ft deep by 7 ft high. There is a full height access door on each end and a pair of access doors on the lower half of the front panel. The board is installed with its back against a masonry wall. The control board is a non-walk-in type with the bottom half consisting of a separate compartment extending essentially from front to back except for a space for wire routing at the rear of the compartment. The doors in the front panel provide access into this lower compartment. All electrical circuits enter the control board through the bottom. The maximum voltage present in the board is 480 V.

Part A of Article 125 lists 4 conditions regarding access to and working space about electrical equipment. The control board is installed in a typical enclosed control room with other control boards and electrical equipment. None of the four conditions described appears to be in violation, as indicated hereinafter.

(1) Clear Space
The space in front of [the control board] and at both ends is unrestricted for more than 5 ft in each direction. No equipment or materials will be stored in the area immediately surrounding the board.

(2) Access and Entrance
Access to the control room in which the board is installed is through one large double doorway.

(3) Working Space
The working space in the direction of access (in front of and at each end) exceeds the minimum distances listed in Table

125-1 by a considerable amount. All operating functions are performed from the front of the board. There are no operational examinations or adjustments required inside the board. Entry into the board will be required for trouble shooting in case of a malfunction and for replacement of parts when required. All circuit breakers and fuses are located in the lower compartment of the board and are accessible through the front panel doors. All circuits can be de-energized for maintenance work when required.

(4) Headroom Working Space
Headroom of the space about the board exceeds 7 ft.

We note that the requirements of Article 125 of Section 12 of the NESC are essentially the same as those specified in Article 110-16 of the National Electric Code (NEC) (1981 edition). In the commentary contained in the NEC Handbook (Second Edition), the minimum working space clearances are shown in Fig IR 319-1 and Fig IR 319-2 as being measured about the electrical equipment on the outside of the equipment.

We request an interpretation of Article 125 as to whether the minimum clearances listed in Table 125-1 must be maintained in front of energized components inside of non-walk-in type control boards such as described above, in order to comply with Article 125.

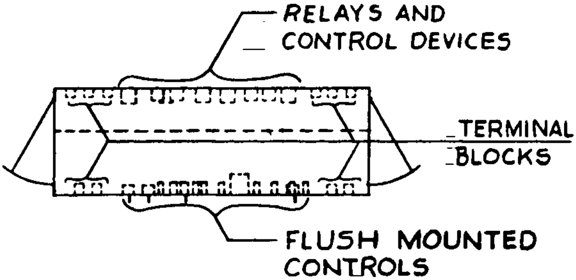

RELAYS AND
CONTROL DEVICES
TERMINAL
BLOCKS
FLUSH MOUNTED
CONTROLS

Fig. IR 319-1

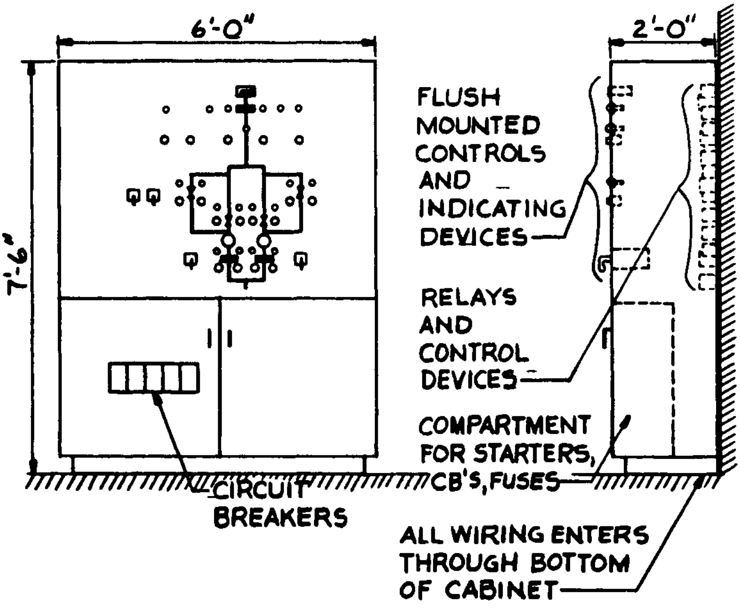

6'-0"
2'-0"
7'-6"
FLUSH MOUNTED CONTROLS AND INDICATING DEVICES
RELAYS AND CONTROL DEVICES
COMPARTMENT FOR STARTERS, CB'S, FUSES
CIRCUIT BREAKERS
ALL WIRING ENTERS THROUGH BOTTOM OF CABINET
GREEN LAKE
AUXILIARY CONTROL BOARD

Fig. IR 319-2

INTERPRETATION (Aug 24, 82)

If the conductors or equipment that are exposed are energized, the clearances of Table 125-1 apply. If the conductors or equipment are deenergized before exposure for maintenance, Rule 125A3 does not specify required working clearances.

127

(a) Classification if adequate ventilation is provided
(b) Is interlocking required?

REQUEST (June 30, 82) IR 327

Rule 127A1 specifies specific areas to be classified Class I, Division 1, Group D in addition to Class II, Division 1, Group F and makes no allowances for ventilation to reduce or eliminate that classification. Rule 127A3 states that "electrical equipment in other locations . . . shall be in accordance with Article 501 of the National Electrical Code (NEC) or be adequately ventilated" which implies that, if ventilation is provided, an area normally classified Class I, Division 1 may be reclassified as nonhazardous. The National Electrical Safety Code (NESC) makes no provision for a Division 2 classification similar to that specified by the National Electrical Code in Article 500-4(b), nor is there any requirement specified for safety interlocks except in Rule 127A4, which applies strictly to pressurized areas or enclosures *within* Class I areas.

Is it the intent of Rule 127A1, that if adequate ventilation is provided to eliminate the methane hazard, the areas specified need only be classified Class II, Division 1, Group F? Is a Class I, Division 2 classification required if the hazard is prevented by positive mechanical ventilation, as required by the NEC? Is any safety interlocking required to de-energize equipment in the event of ventilation failure?

We have reviewed the proposed rewording for Rule 127A1 in the "Preprint—Proposals for Revision of the 1981 Edition," and find that it only acknowledges ventilated tunnels and implies that they would not require a Class I, Division 1 or Division 2 classification.

INTERPRETATION (Oct 25, 82)

Rule 127A1 classifies certain areas to be BOTH Class I, Division 1, Group D and Class II, Division 1, Group F locations. Rule 127A4 details the conditions under which Class I locations may be reduced in classification. Rule 127A7 details similar requirements for Class II locations.

As required by Rule 127, electrical installations in hazardous locations must meet the requirements of articles 500 through 503 and 511 through 517 of NFPA-78, the National Electrical Code. The exceptions and reductions allowed under the conditions specified in those articles are allowed by the NESC if the specific requirements of NESC rules are not violated.

If a classification is reduced pursuant to Rule 127A4, interlocking is required.

152A2

(b) Spacing of oil-filled transformer from building

REQUEST (Oct 7, 83) IR 349

The next section that needs information or explanation is Section 152, addressing the arrangement and location of power transformers and regulators. Section 152A2 specifically addresses one or more of the following methods to minimize fire hazard. The question which arose and prompted this letter is: if a transformer contains 40-50 gal of oil, what distance would be considered proper for space separation in order to minimize fire hazards. Also, I presume that the exterior walls and roof of the nearby building would have to be taken into consideration during the decision regarding space separation. The specific building in question in this case was of wooden frame members with wooden exterior walls and a galvanized steel roof.

... two sketches are included ... Also, some additional information which is needed by you is included. The three transformers were 100 kVA each and contained approximately 42 gal of oil each. The transformers wre mounted on a support between two wooden poles. The bottommost section of the support was approximately 15 ft above ground level. The junction of the building's wall and roof line was approximately 16 ft above ground level. The building was constructed of wood with a galvanized metal roof over it. Located on the pole structure above the transformers were the three incoming overhead conductors, three surge arresters, and three high voltage fuses.

The particular question involves the National Electrical Safety Code (NESC), section 152A2. The primary question in my inquiry is since oil filled transformers shall be located and protected to minimize fire hazards, was the space consideration in this installation sufficient? As can be seen in one of the sketches, the approximate center line of the nearest transformer was approximately 4 ft from the building. Again, the basic question is, was space separations sufficient in this particular case.

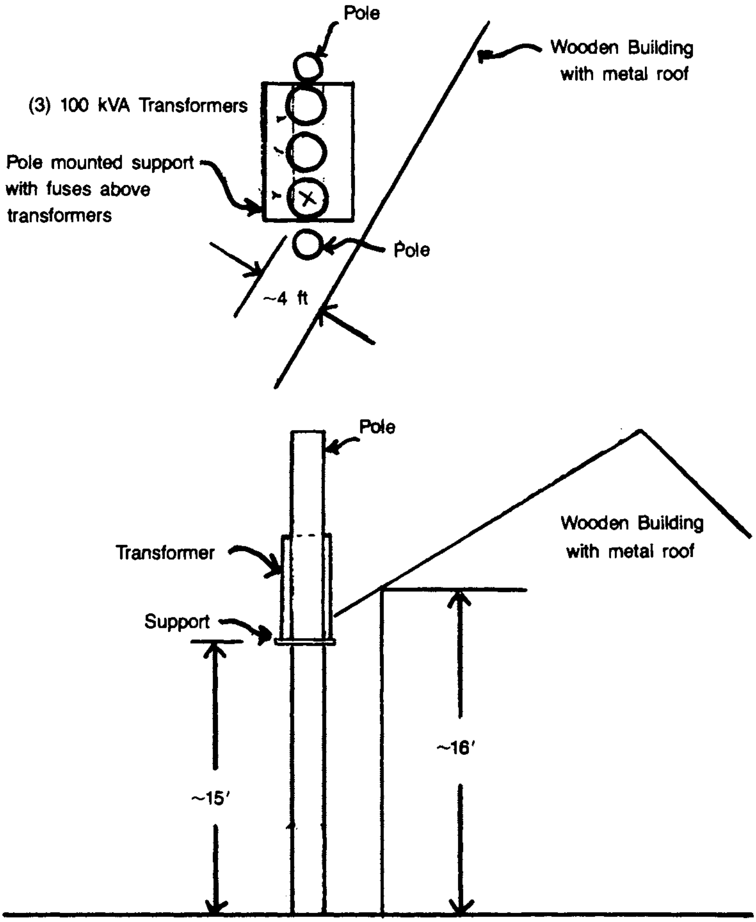

Pole
Wooden Building
with metal roof
(3) 100 kVA Transformers
Pole mounted support
with fuses above
transformers
Pole
~4 ft
Pole
Wooden Building
with metal roof
Transformer
Support
~16'
~15'

Fig IR 349

INTERPRETATION (Jan 17, 84)

Rule 152A2 is only applicable where the provisions of Rule 110A are met and Part 1 applies. If the area is accessible to unauthorized persons, Part 2 applies. Neither Part of the NESC specifies the required clearances from buildings based upon the oil content of a transformer.

161

Adequacy of protection against mechanical damage

REQUEST (Apr 1, 82) IR 320

We have an installation of three (3) 34.5 kV cables coming up from underground entry into an electrical substation. The cables are encased in concrete and PVC conduits as shown on the attached drawings. The cables are exposed from the 5 ft elevation to the bottom of the tower 14 ft above the ground where they are terminated.

The 1981 edition of the National Electrical Safety Code (NESC) Part 1. Section 16. paragraph 161. page 120 second paragraph states:

> "Where exposed to mechanical damage, casing armor, or other means shall be employed to prevent damage or disturbance to conductors, their insulation, or supports."

Recognizing the physical protection provided by the concrete and PVC conduit to the 5 ft 0 in elevation is it the interpretation of the committee that this construction complies with the NESC requirements?

Top & Front View of 34.5KV Cable entering Midland Forge Substation.
Scale 1/2" = 1'0"

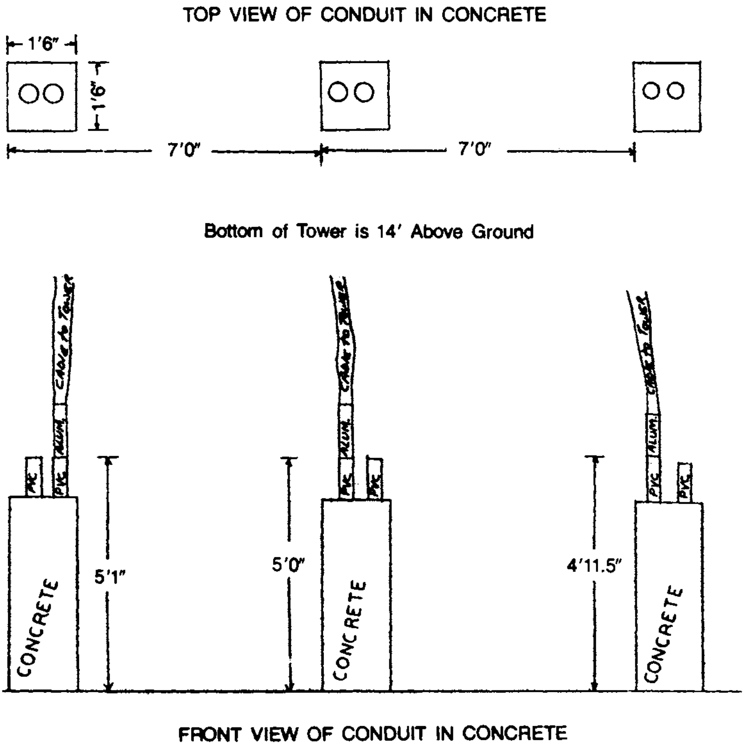


Fig IR 320-1

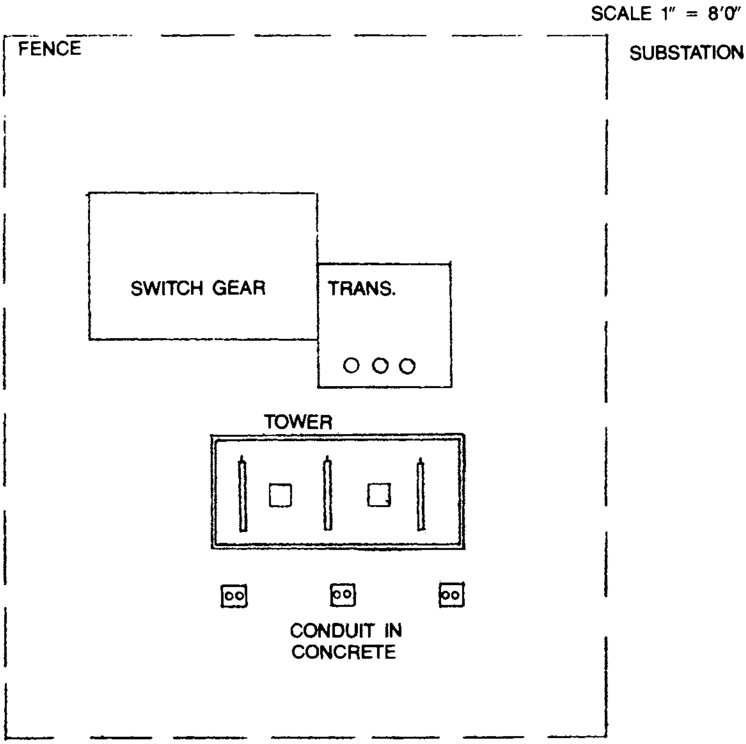

SCALE 1" = 8'0"
FENCE
SUBSTATION
SWITCH GEAR
TRANS.
TOWER
CONDUIT IN
CONCRETE

Fig IR 320-2

INTERPRETATION (Jul 22, 82)

Whether the installation described meets the requirements of Rule 161 depends upon the activities expected in the area. Will trucks be in the area? Are workmen likely to be in the area carrying ladders? It is the responsibility of the designer to assure that the protection is appropriate for the expected activity. Depending upon the type of cable above the PVC conduit, the described installation may not meet the requirements of Rule 162.

201B See 93C **IR 291**

214A4 See 013B **IR 344**

215B See 92B2 **IR 295**

215C See 92C2 **IR 340**

215C1 See 92D **IR 298**

215C1 See 93C7 **IR 356**

215C2

Energized wire passing through trees, serving as a head guy

REQUEST (July 23, 83) IR 345

A 7200 V single-phase distribution line supplies a residential area. (Fig IR 345 depicts the area of interest.) The single-phase line is fed from a three-phase line that runs along Q Street. . . . The single-phase line runs northward from pole A to pole G via poles B, C and D. It also runs east-west on poles D, E and F (and on other poles), to supply the homes on the south side of S Street and on the north side of R Street. Homes on the north side of S street are fed from another three-phase circuit that lies several blocks to the north of S Street.

The span between poles D and G carries a telephone cable, a CATV cable, a neutral wire and the 7200 V phase wire. All wires and cables lie close to, are touching, and/or are embedded in the trunk of a pine tree. The 7200 V phase wire is bare. The tree is approximately 35 ft tall and is readily climbable. At the tree the phase wire is approximately 24 ft above ground, the neutral wire is approximately 18 ft above ground and the CATV and telephone cables are at lower elevations. There is no tap to the 7200 V phase wire within the span between poles D and G. Nor does this circuit continue beyond pole G. This energized phase wire in the span between poles D and G serves only as a head guy for pole D. Pole G carries a street lighting circuit that is fed from the north and is supported by a head guy to pole H.

The power company states that the installation meets all Code requirements. Prior to 1981 the span between poles D and G would have been in clear violation of Rule 211. Does the 1981 Edition of the Code permit energized wires, serving no purpose other than mechanical support for a pole, to run within three inches of the trunk of a readily climbable tree? If not, what rule prohibits such an installation?

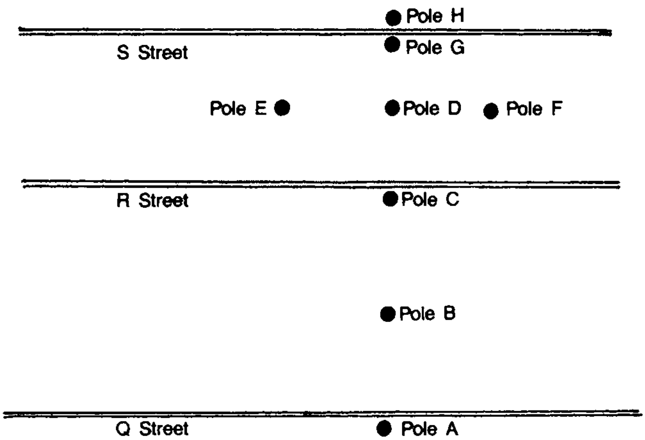


Fig IR 345

INTERPRETATION (December 6, 83)

The National Electrical Safety Code (NESC) does not prohibit the use of energized wires to continue the longitudinal forces applied on a structure to such a location as is convenient to offset those forces, so long as those wires meet the clearances required for the voltage classification which they meet. If energized, they would not meet the classification for guys. Continuations of primary circuits beyond the point of last transformation are commonly installed for a variety of reasons including, but not limited to, providing for future service or taps, providing additional lightning surge protection to transformer or underground cable terminations, and carrying longitudinal line forces to a convenient point of termination.

Rule 281 covers practical requirements for tree trimming. The requirements of that rule are not specific as to distances. Trees do not generally fulfill the requirements of the definition of 'readily climbable' because they are generally not easy to climb. Rule 012 applies to this situation.

230C

Classification of cables
Clearance to ground (232A)
Clearance to bridges (234D1)
Clearance to support (235E1)
Following is general topic; applies to all 3 preceding.
Cable supported by pipeline structure

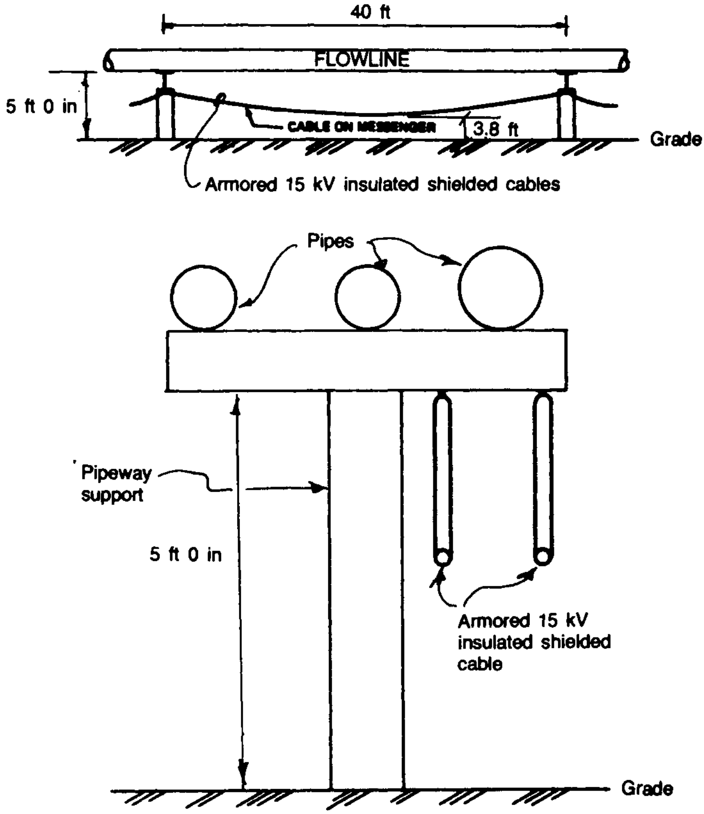
REQUEST (July 26, 83) IR 343

(1) Do 15 kV 3 conductor shielded armored cables fall under the definitions stated in Sections 230C1 and 230C2?

(2) Can 15 kV armored cables as described above be treated like cables in conduits hence no need to comply with the clearances and spacings specified in the code for supply cables? (There is a prevailing view from our supposed experts that this is the case. . . .)

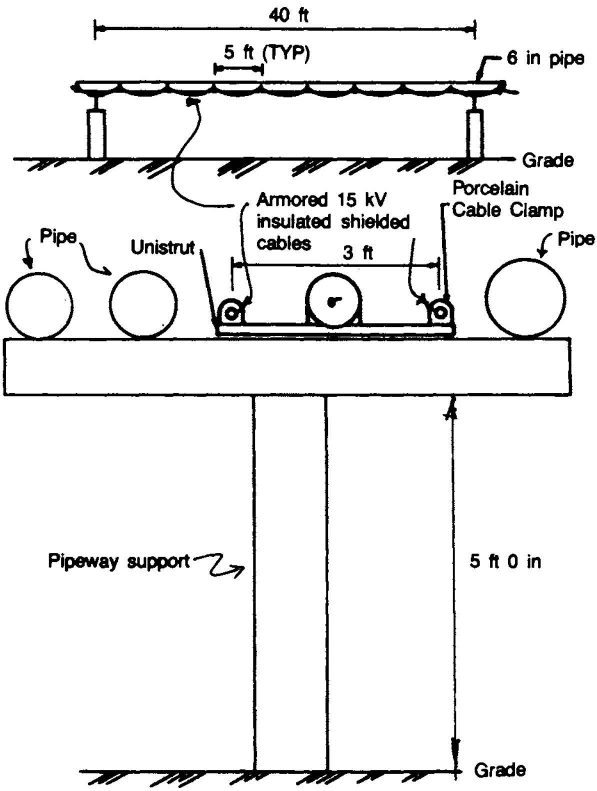
(3) Can we attach to a pipeway where people come and go to maintain the pipes 15 kV armored cables described above by messengers or just placing the cables alongside the pipes as shown by the enclosed attachments? If so, under what section and what should the spacings and clearances be?

. . . have always felt that the above-described cables are supply cables as defined under Sections 230C1 and 230C2 for safety reasons even if the cables will be installed in remote and frigid Alaska which is incidentally so.



MESSENGER SUPPORTED CABLE ON FLOWLINE

Fig IR 343-1



PIPE SUPPORTED CABLE ON FLOWLINE

Fig IR 343-2

INTERPRETATION (December 6, 83)

The 15kV 3-conductor shielded cable meets the requirements of Rule 230C if it is supported on and cabled together with an effectively grounded bare messenger-neutral. Since armored cable exceeds the requirements of Rule 230C, it would be consistent with the Code to treat it as such. However, since armored cable is not specifically covered by the rules for overhead construction, Rule 012 applies.

The particular installation with armored cable to which you refer is not covered in the Code. Cables meeting Rule 230C are generally treated as a mechanical impediment for ground clearance purposes. For *spaces or ways accessible to pedestrians only,* which the pipeline itself would cause the area to be if the ground clearances are 5 ft 0 in as indicated in your sketch, the ground clearance allowed by the Code is 10 ft. This is based upon a reference height of 9 ft. No further reductions are allowed by the Code for cables meeting Rule 230C.

In this case, the pipeline itself serves as a controlling obstruction. There are at least two similar extraordinary constraint situations specifically treated by the Code in which further reduced overhead clearances are allowed: (1) where there is a controlling obstruction alongside a railroad track, the required horizontal clearance from the track to utility structures may be reduced to the value of the controlling obstruction; (2) where bridges obstruct passage of sailboats, the vertical clearances over water may be reduced. Since the cable referred to in this request is armored and presents only a mechanical impediment, it would certainly appear to be consistent with the above specifically treated conditions, with past interpretations relating to armored cables, and with Rules 010, 012 and 200, for the clearance above ground of such armored cables to be no less than that of the pipeline itself. It would be consistent with Rule 352A to provide an appropriate clearance from other facilities to allow each to be maintained without damage to the other. Since this situation is not directly covered by the requirements stated in the rules, Rule 012 requires the use of accepted good practice for the given local conditions.

230E1 and 2 See 232 IR 337

231

Clearance of structure from roadway

REQUEST (June 4, 82) IR 324

This letter is written for the purpose of obtaining an interpretation of 231B2 dealing with supporting structures which are located on streets, roads and highways that have no curbs.

It is stated therein that ". . . supporting structures should be at or near as practical to the street, road . . . right-of-way line."

My question, for which an interpretation is requested, is as follows:

Where there are no curbs and there is a 40 ft right of way within which there is a 34 ft section of pavement and approximately 3 ft of unpaved area on each side, but within the right of way, at what point should a utility pole be located, that is just behind the 40 ft right of way or just behind the paved portion of the road, but within the 40 ft right of way?

INTERPRETATION (Aug 24, 82)

The National Electrical Safety Code (NESC) does not specify whether a supporting structure should be within or without a highway right-of-way. If within, and if there are no curbs, Rule 231B2 requires that supporting structures be placed at or near the right-of-way line insofar as it is practical to do so.

REQUEST (Sept 1, 82) IR 324A

... I am taking the liberty of enclosing photostatic copy of a road survey covering a road intersection which involves a certain supporting structure depicted as NYT46. . . . You will note that [on both the street and the road] there is a 40 ft right of way and my question to you is whether under Rule 231B2, the Code recommends that the involved supporting structure be placed at or near the right of way line, which translated on this chart means at the outer limit of the 40 ft right of way, provided of course there was no obstruction to prevent same?

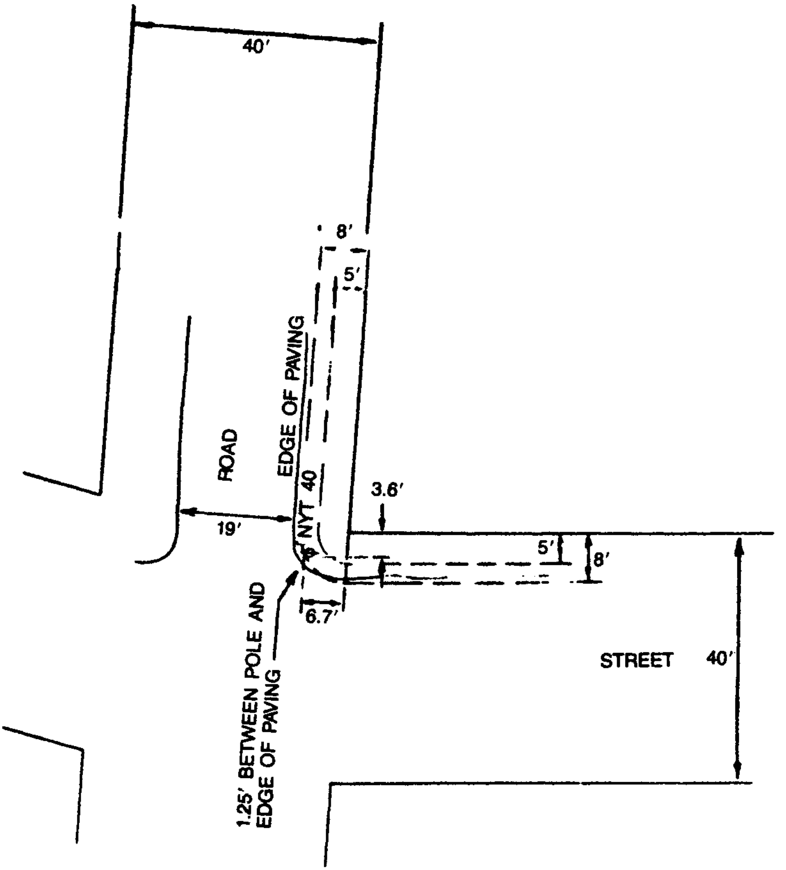

40′
8′
5′
EDGE OF PAVING
ROAD
NYT 40
3.6′
19′
5′
8′
6.7′
1.25′ BETWEEN POLE AND EDGE OF PAVING
STREET
40′

Fig IR 324

INTERPRETATION (Sept 2, 82)

Your September 1 letter with location sketch does not provide sufficient information for a definitive answer as to an acceptable location for the supporting structure. Note particularly in the National Electrical Safety Code (NESC) 1981 Edition, Rule 231B2: "Where there are no curbs, supporting structures should be at or as near as practical to the . . . right of way line." (Underlines are ours.) Note also Rule 015.

A review of the Interpretation Subcommittee members' comments on IR324 discloses a consensus that the NESC Rule is clear concerning its applicability to your case.

232

(a) Clearance to ground measured diagonally
(b) Clearance neutral to ground, 230E1, 2
(c) Reason for 14 ft minimum for neutrals

REQUEST (Feb 17, 83) IR 337

In Section 23, Rule 232 of the 1981 National Electrical Safety Code (NESC), I can find no information on diagonal clearances from an overhead conductor to ground. When building electrical lines I often encounter areas where severe backslopes parallel to the centerline of the electrical line, and the distance from a given point on the backslope to the phase conductor will be less than the vertical distance from ground to the phase wire (see Fig IR 337). My question is, since the Code Book makes reference to only vertical clearance from ground, should the diagonal distance be considered as the minimum in these cases?

Also, I have two questions for which I hope you can provide me more details:

(1) Could you explain why in Section 23, Rule 230E1 and 2 neutrals associated with circuits above 22 kV are required to have the same clearance as the phase conductors, and

(2) Section 23, Rule 232, Table 232-1 No. 10, why was 14 ft established as the minimum for neutral conductors in this case?

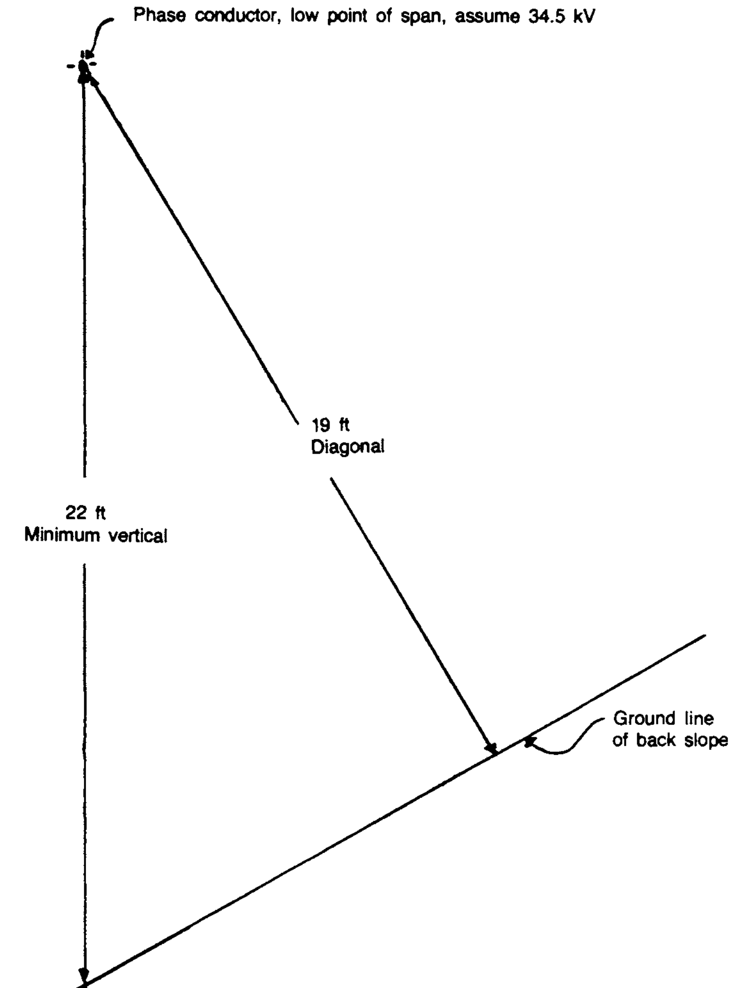

Phase conductor, low point of span, assume 34.5 kV
19 ft
Diagonal
22 ft
Minimum vertical
Ground line
of back slope

Fig IR 337

INTERPRETATION (Sept 2, 83)

(a) The NESC does not contain specific requirements for horizontal or diagonal clearances from conductors to hillsides; Rule 012 applies under these circumstances. The site-specific conditions will control the probability and location of vehicular and pedestrian traffic over sloping terrain adjacent to a line. The clearances required by other rules, where the limits of vehicular or pedestrian traffic are assumed, are useful in the determination of appropriate clearances for special situations not specifically covered by the code language.

The remainder of the questions, (b) and (c), are not requests for interpretation and no official response will be given.

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232 See 013B, 1981 Edition **IR 344**

232, Table 232-1, Item 10 See 232

232, Table 232-1 See 013B2 **IR 292**

(3) Reduced clearance to guys

232A

Conductor clearance; applicability of catenary curve considerations

REQUEST (Feb 11, 81) IR 290

. . . In order to clarify Rules Numbers 232A, 232A1 and 234A2, we seek an interpretation from your committee. The basic clearances of these rules consider the Conductor at 60°F and stressed to provide a final sag for determining Vertical clearances. Rules Numbers 233A1 and 234A1 also considers the Conductor displaced from rest by a 6 (or 4) lb per sq ft wind including the deflection of suspension insulators and flexible structure at the same temperature and sag. It assumed that required clearances will vary from the maximum at the midpoint of the span to a minimum at the supporting structures as the sag affects the basic clearances. Yet there is some doubt that the maximum required clearance would apply for the entire span. This is predicate on the sag increase required in Rules Numbers 232B2c, and 232B2d, 233A1b(3), 233A1b(4), 234F2c and 234F2d are specifically modified by the factors of a catenary curve in Rules Numbers 232B2e, 233A1b(5) and 234F2e respectively. In other words, can these same factors of a catenary curve be used to modify basic clearances in Rules Numbers 232A, 233A1 and 234A?

INTERPRETATION (Apr 24, 81)

Although we agree there is a certain logic to reduce basic clearances by application of catenary curve factors, the rules do not presently allow such reduction.

232A See 230C

IR 343

232A Table 232-1 Item 3 vs Item 9

Clearance of conductors over a residential driveway

REQUEST (Aug 28, 84) IR 361

In reviewing Table 232-1, Minimum Vertical Clearance of Wires, Conductors and Cables Above Ground, Rails or Water of the National Electrical Safety Code (NESC), there appears to be conflicting information concerning the height of cables over residential driveways. Item 3 in the code specifically addresses residential driveways and states that the cable clearance shall be twelve (12) ft and even allows an exception to a clearance of only ten (10) ft, as described in Footnote number 24.

Since almost all residential driveways are perpendicular to a road, street or alley, Item 9 of the same code could apply. Item 9 states the minimum clearance for Telephone Company cable to be eighteen (18) ft, with exceptions that would allow the clearance to be reduced to fifteen (15) ft.

We have researched this problem in detail and have found what we believe to be the answer. In the book, National Electrical Safety Code Interpretations 1978 - 1980, a request on page 76 deals with clearances over residential driveways. We interpret the ruling to provide that Item 3 would have the jurisdictional privilege over Item 9 should the cable in question cross over a residential driveway.

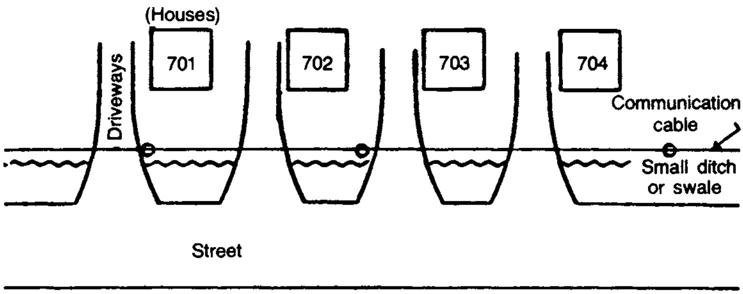


Fig IR 361-1

What should the minimum height of the cable be?

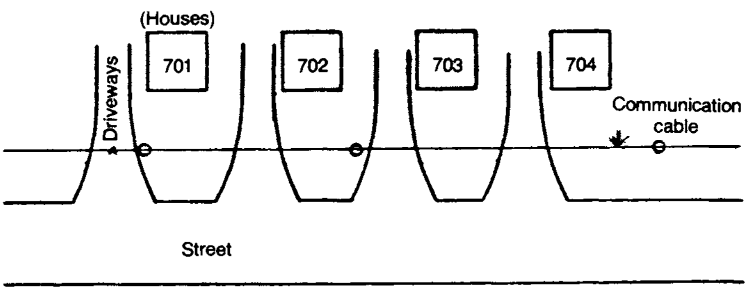


Fig IR 361-2

What should the minimum height of the cable be?

INTERPRETATION

Item 9 applies over access to a residential driveway within highway and road rights-of-way; Item 3 applies over residential driveways outside of the rights-of-way.

232A Table 232-1, Item 7

Clearance for sailboating

REQUEST (Jan 13, 81) IR 284

This is a request for interpretation of the National Electrical Safety Code (NESC), Rule 232, Table 232-1, item 7, as it applies to vertical clearance of wires, conductors and cables above water suitable for sailboating.

In our specific situation, a pole line was built in 1939 on private right-of-way adjacent to state highway right-of-way. It paralleled both the highway and a river's edge. The river's edge was approximately 90 ft away. Vertical clearances of the line over land met the requirements of the code in effect at the time of construction (4th edition, 1928) and meets the latest code revision (1981 edition) requirements. However, over the years erosion has changed the contour of the river's edge so that for 50± ft the water extends 10± ft back under the line to where a retaining bulkhead has been constructed to control the advance of erosion.

The river is 1000± ft wide and flows into a large tidal bay area which in turn empties into the Intracoastal Waterway and finally into the Atlantic Ocean. There are no overhead obstructions between the area of the pole line overhang and the Atlantic Ocean. The water depth in the river is typically 15-30 ft deep and the bay area at Mean High Water is 8-10 ft which allows access to the river by rather large engine powered pleasure craft and sailboats.

There is a 26-foot wide boat launching ramp approximately 200 ft from the overhanging line area and a wood dock with 12 ft × 24 ft boat slips extends out into the river approximately 75 ft in the immediate vicinity of the line. There is also a marina approximately 1400 ft away but the line does not restrict vessel height (except over land at the boat launching ramp) nor restrict normal waterway travel.

In summary:

(1) The line met code requirements at the time of installation.

(2) The line overhang does not obstruct normal water travel nor restrict vessel height.

(3) The line overhang would be a possible hazard only for a large water craft that may be out of control and drifts into the line.

Following are some specific questions we would like answered.

(1) Does the code require a review of the line clearances since the line met code requirements at the time of construction?

(2) Are the clearances as specified in Table 232-1, item 7, intended to apply to an "overhanging line" situation as described above?

(3) If Table 232-1, item 7, does apply would 7(d) be the required clearances since the river does provide access to the Atlantic Ocean? (Ref: Last sentence of Footnote 17.) If not 7(d), what acreage would apply?

(4) In reference to the statements in Table 232-1, Footnote 17, that begin with "The clearance over . . ." etcetera, is the word "over" intended to imply a line crossing that goes from one side to the other side of a river, stream or canal in a way that it may restrict vessel height and normal water travel or is it intended to imply simply wherever there is water under the line and that water is any portion of a body of water suitable for sailboating?

We would also appreciate any comments you may have that would be helpful in interpreting this portion of the code in relation to our coastal, tidal water areas with their vast complex of various size creeks, bays, channels, etc., most of which can "provide access for sailboats to a larger body of water"—the Atlantic Ocean—but may not "normally" be used as an access. (Ref: Footnote 17).

. . . Our sketch . . . is . . . enclosed giving additional detail of the location.

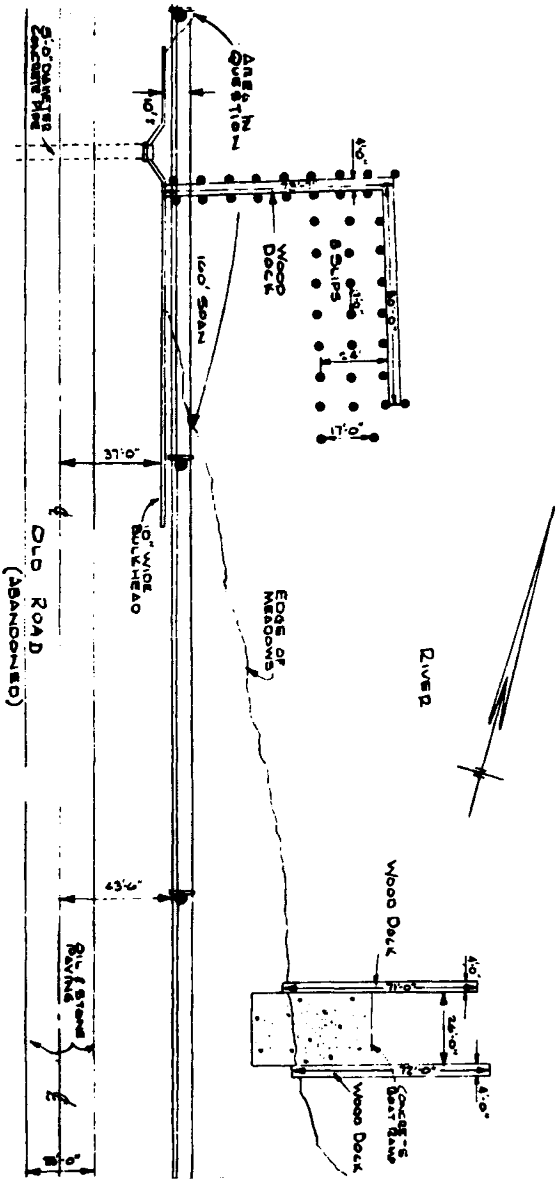

AREA IN QUESTION
5'-0" DIAMETER CONCRETE PIPE
WOOD DOCK
8 SLIPS
160' SPAN
17'-0"
37'-0"
10" WIDE BULKHEAD
OLD ROAD (ABANDONED)
EDGE OF MEADOWS
RIVER
43'-0"
WOOD DOCK
OIL & STONE PAVING
CONCRETE BOAT RAMP
18'-0"

Fig IR 284-1

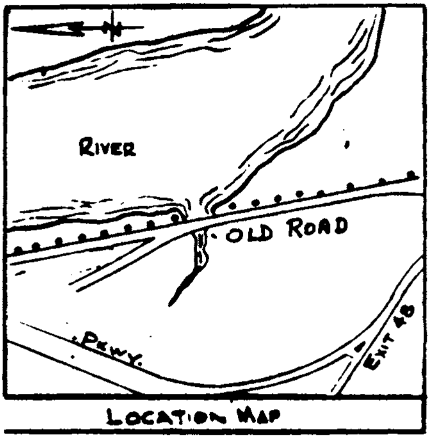


Fig IR 284-2

INTERPRETATION (Apr 16, 81)

The Code does not require a review of clearances after construction for changes in conditions per se. At the same time, the Code does not sanction building lines and then forgetting them. Rule 200 points out the purpose of the rules is the 'practical safeguarding of persons during the installation, operation or maintenance of overhead supply . . . lines.'

The clearances specified in Table 232-1 are intended to apply to an overhanging line situation as well as crossings.

As to question 3, Table 232-1 item 7 does apply (specifically the clearances of 7-d)

Regarding question 4, the clearance required would be as shown for item 7. The area adjacent to the boat ramp would come under item 8.

* * * *

Clearance over waterways

REQUEST (Dec 16, 81) IR 308

. . . Company . . . is in the process of designing a 69 kV transmission line which will cross a small river. In our attempts to design the crossing for proper clearances the following questions arose:

(1) What criteria should be used to determine if a body of water is suitable for sailboating?

(2) For water areas not suitable for sailboating, what water elevation should be used when determining clearances (Table 232-1, Item 6, Page 143, National Electrical Safety Code (NESC) 1981 Edition)?

It is obvious that if the Code is to be applied properly, one must be able to discern whether or not a body of water is suitable for sailboating. Please provide us with any recommendations which you may have with regards as to how this determination should be made. Secondly, Footnote 17 for Table 232-1 Page 146 of the NESC 1981 Edition, clearly describes what water levels are to be used when determining clearances suitable for sailboating. A description similar to this or possibly the same description would also seem necessary for waters not suitable for sailboating. Please describe what water elevations should be used when the body of water in question is not suitable for sailboating.

INTERPRETATION (Mar 9, 82)

The NESC does not include criteria for determination of whether a water area is suitable for sailboating or for determination of the appropriate water height from which to measure the clearance. Areas which are not suitable for sailboating are so diverse in nature that these determinations are left to the judgment and experience of the designer with respect to the conditions encountered.

Many of these areas are so tortuous, narrow, or rocky, or have such swift currents that they are unsuitable for maneuvering a sailboat. However, even though sailboats may not reasonably be anticipated in these areas, these areas may still be entirely suitable for a canoe, raft, or small boat during periods of appropriate water flow. While the use of some nonsailboating water areas may increase for canoeing, etcetera, during periods of high water, the use of others may be reduced because currents become too swift or turbulent. The appropriate level for measuring clearances will depend on the local conditions at the site.

* * * *

232B Exception 2, See 013B2 IR 292

Communication cable additional clearance

232B1 (a) and (d), Table 232-1

232B

Additional clearance requirements

REQUEST (June 8, 84) IR 360

We have been using Rule 232B to determine the required additional clearance for power wire, conductors and cables. The question that has arisen deals with the added clearance required for long span lengths (232B2c) and for conductor temperatures in excess of 120°F (232B2d) are they cumulative where both conditions apply?

Rule 232B notes that increases are cumulative where more than one apply. Rule 232B2d states in part "... regardless of span length ...". These two statements appear to be in conflict.

INTERPRETATION

The rule is correctly written. Increases are cumulative where more than one apply. Subrules 232B2c and 232B2d are mutually exclusive. Rule 232B2c applies only when conductor temperatures are 120 degrees F or less; Rule 232B2d applies whenever the conductor temperature exceeds 120 degrees F.

* * * *

Clearance over cultivated land for 200°F operating temperature

REQUEST (Dec 21, 83) IR 352

We would like a clarification of Rule 232, 1981, National Electrical Safety Code (NESC). Assume that we have a 161 kV line crossing over cultivated land and our maximum operating temperature is 200°F. From Table 232-1, for open supply line conductors, the minimum clearance above ground is 22 ft for phase to ground voltages between 15 and 50 kV. Additional clearances are as noted below:

Rule 232Bla: 161 kV phase to phase =

$$\frac{161}{\sqrt{3}} \text{ kV phase to ground} =$$

92.95 phase to ground

$$92.95 - 50 = 42.95$$

$$\frac{0.4 \text{ in}}{\text{kV}} \times 42.95 \text{ kV} = 17.18 \text{ in} = 1.43 \text{ ft}$$

Rule 232B2d: Let us assume the final sag at 200°F with no horizontal displacement is greater than the final sag at 32°F, no wind, with radial thickness of ice. Therefore, we subtract the final sag at 60°F with no horizontal displacement from the final sag at 200°F with no horizontal displacement to obtain the additional clearance due to operating temperatures above 120°F. Let us assume the additional clearance in this example is equal to 7.07 ft. Am I correct in saying the following:

(1) If we were to use a sag template plotted for 60°F Final to designate the amount of sag in a particular span, the required ground clearance at midspan would be equal to: the minimum ground clearance from Table 232-1 plus the voltage adder plus the design operating temperature adder. In this example, the required ground clearance at midspan would be equal to: 22 + 1.43 + 7.07 = 30.05 ft. The required ground clearance at any other location in the span can be calculated using Rule 232B2e.

(2) If we were to use a sag template plotted for 200°F Final to designate the amount of sag in a particular span, the required ground clearance at any location in the span would be equal to: the minimum ground clearance from Table 232-1 plus the voltage adder. In this example, the required ground clearance would be equal to: 22 + 1.43 = 23.43 ft.

INTERPRETATION (May 14, 84)

The additional clearances specified in Rules 232B2c and 232B2d for midspan crossings may be reduced at other locations in the span by multiplying by the factors shown in the table in Rule 232B2e; these factors are based on catenary curve sags at various points. As a result, such additional clearances for 200°F would approximate the difference between a 60°F curve and a 200°F curve. However, Rule 232 requires conductor clearances over land to be met when measured at 60°F and final sag. The Code does not specify methods by which lines are to be designed to meet its requirements. It is the responsibility of the designer to choose appropriate design tools and methods to achieve the required clearances.

232B2b, 232B2c(1)

Minimum allowable clearance

REQUEST (Aug 24, 81) IR 304

From Rule 232A1 on Page 141 under Basic Clearances for Wires, Conductors, and Cables, we see that the basic clearances in Table 232-1 on Pages 142 and 143, for the basic spans under Rules 232A2, apply under a conductor temperature of 60°F, no wind, with final unloaded sag. Since there are no provisions for increased clearance under loaded conditions at the basic span we assume that the reduced clearance at loaded condition under the basic span is negligible.

For instance let's say that we have a span of wire that is equal to the basic span length. For the particular situation that we encounter we look at the table and find that we need 18 ft of clearance to meet code clearance at 60°. From our sag charts we find that the difference between final unloaded sag at 60° and sag at 120° is 0.93 ft. From this we assume that the minimum code clearance for this loaded situation is 18 ft − 0.93 ft = 17.07 ft.

From this we assume that at any span length with the same conductor, if we maintain 17.07 ft clearance under the most extreme sag conditions, that code clearance will be met, and that this is exactly what Rule 232B2C1 on Pages 147 and 148 assures us of when used to design a line or checking for code clearance on an existing line.

INTERPRETATION (Feb 18, 82)

The basic clearances in Table 232-1 for the basic span lengths of Rule 232A apply only under the stated conditions. They are specifically stated in terms of 60°F. and final sag conditions to aid in measurement. The values shown are large enough to allow for increased sag beyond the measurement conditions due to ice loading or 120°F. conductor temperature operation. Whether the ice loading condition or the 120°F. conductor temperature loading condition determines the maximum sag will depend upon the individual case. Where spans are longer than the basic lengths or maximum conductor operating temperature is higher than 120°F., other rules require additions to the basic clearances measured at the 60°F., final sag condition.

The Code has been developed through years of practical experience and the values and requirements included therein recognize the practicalities of that experience. The method of determining clearances that you propose does not meet the requirements of the Code as presently stated.

233A, Fig 233-1

Clarification of clearance at crossing

REQUEST (Jan 30, 81) IR 289

. . . Confusion exists in the requirement that Rule 233A states "The Conductor Movement Envelopes shall be determined for each Conductor involved in accordance with Rule 233A1." Since the 1977 edition of the code and four out of five proposals in the 1980 preprint recognize the movement of both (or all) the Conductors with the Wind Displacement of up to six pounds per square foot, it is assumed the 1981 edition has the same consideration when the wording used in the new code is ". . . a Clearance Envelope applied at points on the relevant segments of the Conductor Movement Envelopes at the location where the two Conductors would be the closest together, as shown in Fig 233-1 [in C2-1981]." Fig 233-1 does not show any Conductors. Of course the position of the Conductor of Circuit No. 1 is at the point where the Clearance Envelope is shown. The closest the two Conductors would be when the Conductor of Circuit No. 2 would have a temperature of 60°F with initial sag if it is new (along line AB) or final sag if it had been fully stressed and/or had been installed for sufficient time (along line CD). The Conductor Movement Envelope is a help in visualizing the closest Conductor to Conductor Clearance. But, Fig 233-1 is an incomplete example to determine the clearance between crossing or adjacent wires, Conductors or Cables are required in Rule 233B1 or Rule 233C1. Could your Committee please clarify?

INTERPRETATION (May 27, 81)

In order to ascertain whether a particular installation meets the clearance requirements of the National Electrical Safety Code (NESC), it is necessary to do two things:

(1) Determine the clearance which must be met. This will depend upon the possible voltage potential between the items in potential conflict and upon the safety factors to be used, among other things.

(2) Determine the conditions under which the point of maximum potential conflict between the items exists. This will depend upon the ability of the items to change location, such as with wind, ice or thermal loading, as well as their positions when at rest.

The determination of the point of maximum potential for conflict is generally easy when one of the items in potential conflict does not move, such as when measuring the clearance from a conductor to a building. In that case, any adders for extra movement of the conductor due to loading or due to voltages greater than those in the basic clearance to make one easily measured and calculated "total clearance" requirement.

However, the problem is complicated somewhat when both of the potentially conflicting items have the potential to move. To aid in the determination of whether a conductor meets the clearance required from another conductor, the required clearance is calculated separately and is not mixed in with adders resulting from conductor movement from rest due to loading. It makes no difference whether the required clearance is calculated first or the locations of the potentially conflicting conductors are calculated first.

It must be recognized that conductors of different lines can have different thermal or ice loadings but that they must have the same wind loading. If one conductor is under a wind loading, then the other conductor is assumed to be under the same loading in the same direction. The amount of displacement under the load would, of course, depend upon the conductor characteristics. However, one line can have a very light thermal loading while the other has a heavy thermal loading. Likewise, one conductor can have ice loading while the other, due to its thermal loading being great enough to prevent ice, can essentially be at its 60°F location.

It is important to note that the position of maximum potential conflict may not be when the conductors are under some wind loading but that conductors with thermal or ice loading but without wind displacement could be at their closest proximate position. It is at this closest proximate position that the distance between the conductors must be at least that of the required clearance.

The method of determining whether the clearance requirement is met, then, is to (1) determine the Conductor Movement Envelopes for each conductor and their relationship with each other at the point in the line where the conductors will be closest together and (2) "slide" a Clearance Envelope along the locus of the most extreme positions of one conductor, that is, its Conductor Movement Envelope, and check to see if the Clearance Envelope touches a position on or within the Conductor Movement Envelope of the second conductor which is experiencing the same ambient air conditions as the first conductor. If it does not, then the clearance requirement is met.

233A1 See 232A **IR 290**

233A3 See 235E1 **IR 353**
See 124 Table 2 **IR 283**

233C1, Table 233-1

Clearance for underbuild

REQUEST (Dec 8, 81) IR 306

When intermediate poles are installed in 7.2 kV multiground distribution line for telephone communication facilities and these poles are not joint use poles, can these poles be considered the same as a crossing where power line is less than 6 ft from communication structure Table 233-1 Footnote 5? See Fig IR 306.

Is this the right interpretation?

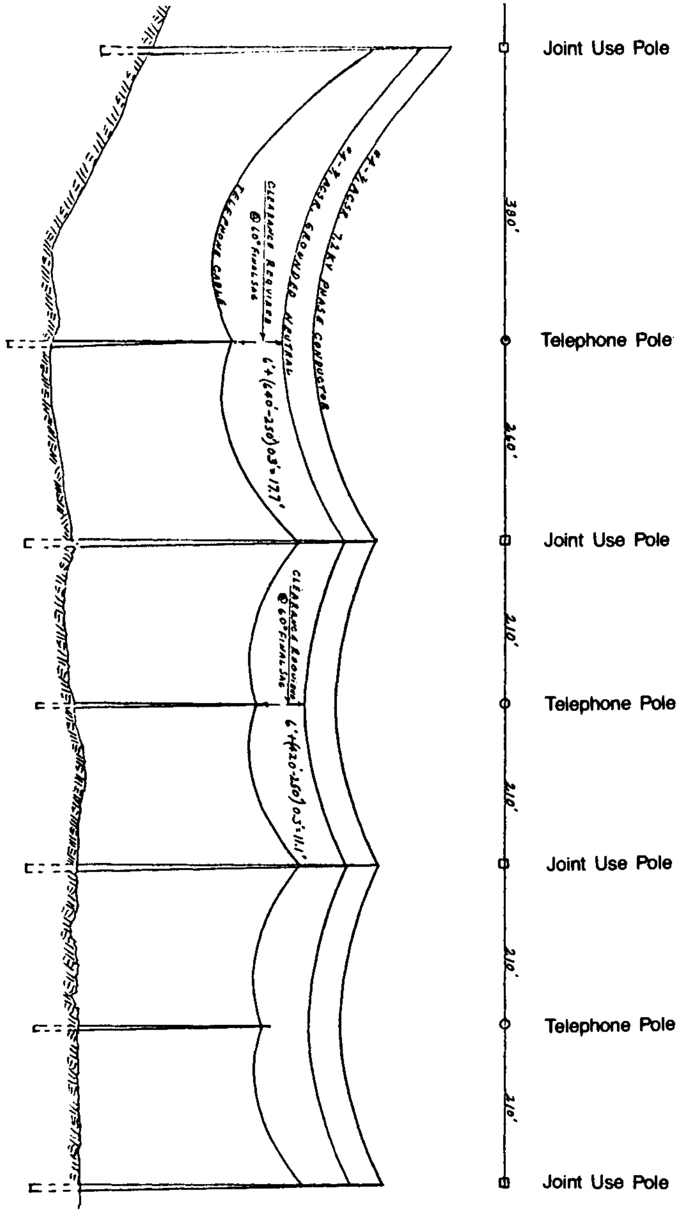

Joint Use Pole
380'
Telephone Pole
260'
Joint Use Pole
210'
Telephone Pole
210'
Joint Use Pole
210'
Telephone Pole
210'
Joint Use Pole

Fig IR 306

INTERPRETATION (Mar 9, 82)

Footnote 5 of Table 233-1 applies to a condition in which one conductor passes over another conductor. Rule 234B contains the requirements for clearances between a conductor of one line and a supporting structure of other lines to which it is not attached.

233C3 See 235E1 **IR 353**

234A See 232A **IR 290**

234B

Clearance of neutrals and guys from other supporting structures

REQUEST (June 9, 1982) IR 326

Rule 234B specifies horizontal and vertical clearances for voltages up to 50 kV. However, clearances for neutrals and guys are not shown. Would you please indicate what these clearances should be?

INTERPRETATION (Oct 25, 82)

Rule 230E determines whether a neutral conductor must meet the full clearance requirements of Rule 234B. If the neutral conductor meets the requirements of Rule 230E1, it is considered to be equivalent to a messenger-neutral meeting the requirements of Rule 230C and Exception 1 of Rule 234B applies. If the neutral conductor meets the requirements of Rule 230E2, the full clearance is required as specified in Rule 234B.

It should be noted that Exception 2 of Rule 234B applies only to the vertical clearance requirement and may only be used in lieu of Exception 1—THE CLEARANCE REDUCTIONS OF THE TWO EXCEPTIONS ARE NOT CUMULATIVE.

234C, Table 234-1, Footnote 5 (1977 Edition)

Clearance to building

REQUEST (May 18, 82) IR 323

Section 234C of the 1977 edition of the National Electrical Safety Code (NESC) contains requirements for "Clearance of Wires, Conductors, and Cables from Buildings; Signs, Chimneys, Radio and Television Antennas, Tanks Containing Nonflammables, and Other Installations Except Bridges." More specificially, Section 234C3 provides that:

> Unguarded or accessible supply wires, conductors, and cables may be run either beside or over buildings or other installations and any projections therefrom. Minimum basic vertical and horizontal clearances are given in Table 234-1.

Table 234-1 sets forth a horizontal clearance of open supply line conductors between 750 V to 8,700 V (phase to ground) to balconies and areas accessible to pedestrians, as defined in footnote 4 of that table, of five ft. The same table also prescribes a vertical clearance for open supply line conductors of the same voltage "above or below balconies and roofs accessible to pedestrians" of 15 ft. Section 234A3, entitled "Diagonal Clearance," provides:

> The horizontal clearance governs above the roof level or top of an installation to the point where the diagonal equals the vertical clearance requirement. Similarly, the horizontal clearance governs above or below projections from buildings, signs, or other installations to the point where the diagonal equals the vertical clearance requirement. The 15 ft for roofs accessible to pedestrians agrees with Table 232-1 for spaces and ways accessible to pedestrians only. From this point the diagonal clearance shall equal the vertical clearance as shown in Fig IR 234. This rule should not be interpreted as restricting the installation of a trolley-contact conductor over the approximate center line of the track it serves.

As of October 1980, the utility maintained an overhead three phase distribution line, each phase energized at 7,620 V to ground, in front of a three story building. Each of the three primary conductors, as they passed in front of the building, were suspended and supported by pole mounted pin type insulators, one above the other in regular vertical construction. The uppermost primary conductor was 35 ft 4 in above ground when it passed the front of this building. The wall of the building extended straight up from the inner edge of the sidewalk, with no balconies, extensions or other projections to the top of a parapet surrounding the roof on the top of the building. The top of the parapet was 39 ft 3 in above the sidewalk or ground level and 1 ft 7 in above the roof itself of the building which it surrounded. The uppermost primary conductor was 7 ft 6 in horizontally from the front face of the building wall and 3 ft 11 in lower than the top of the parapet wall. The roof of the building was accessible to pedestrians by one of the means set forth in footnote 4 of Table 234-1. It is the utility's interpretation of Section 234C and specifically Table 234-1 that the clearance requirement of the uppermost primary conductor from the building required by Section 234C and Table 234-1 of the 1977 edition of the National Electrical Safety Code was the prescribed basic horizontal clearance from the front face of the building wall of five feet and, thus, this conductor not only met, but exceeded clearance requirements prescribed for such conductor by Section 234C and Table 234-1 of the 1977 edition of the National Electrical Safety Code. More specifically, it is the utility's position and interpretation of Section 234C and Table 234-1 that the uppermost primary conductor was not subject to a diagonal clearance requirement from the building roof top or parapet wall top and, more specifically, that the closest straight line distance from the top of the parapet wall or roof to the uppermost primary conductor was not required to be equal to or comply with the vertical clearance requirement for open supply line conductors "above or below balconies and roofs accessible to pedestrians" set forth in Table 234-1. A sketch depicting the heights of the uppermost distribution conductor and building above ground and the clearance between them is attached for your information.

Questions:

(1) Does the electrical distribution conductor, as shown on the attached sketch, comply with the clearance requirements prescribed by Section 234C and Table 234-1 of the 1977 edition of the National Electrical Safety Code?

(2) Is the electrical distribution conductor, as shown on the attached sketch, complying with the five ft minimum basic horizontal requirement of Section 234C and Table 234-1 of the 1977 edition of the National Electrical Safety Code, also required to be at least 15 ft measured diagonally or on a straight line distance from the top of the parapet wall?

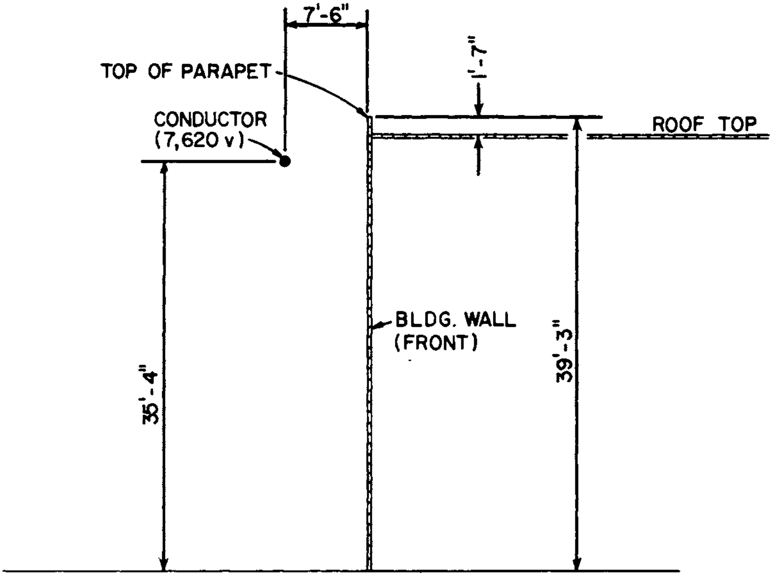

7'-6"
TOP OF PARAPET
CONDUCTOR
(7,620 v)
1'-7"
ROOF TOP
BLDG. WALL
(FRONT)
35'-4"
39'-3"

Fig IR 323

INTERPRETATION (Aug 24, 82)

The diagonal clearance requirement is not at issue when the horizontal clearance requirement or the vertical clearance requirement is met. In the case that you cite, it is impossible to determine if the installation met the requirements of the 1977 Edition of the NESC without knowing the horizontal movement of the conductor under the basic conditions specified in Rule 234A1. If that movement is less than 2 ft 6 in, the installation would meet the horizontal clearance requirements since the total of the 5 ft 0 in clearance value plus blowout of the conductor would be less than the 7 ft 6 in clearance of the conductor from the building.

* * * *

Clearance to flagpole with flag

REQUEST (Feb 23, 82) IR 313

The second sentence in Note 5 of Table 234-1, 1977 Edition, ANSI C2 states as follows:

The required clearances shall be increased to allow for the movement of motorized signs and any installation covered by rule 234C.

We have a situation in which the horizontal clearance between a flag pole and a 4800 V conductor is approximately 6½ ft. However, on certain occasions a flag which is alleged to be 5 ft long is flown on the flag pole.

We would like to know if it was the intent of the Committee that a flag be considered as an attachment to the flag pole, requiring that the horizontal clearances specified in Table 234-1 as modified by paragraph 234A1 be increased by the length of the flag.

INTERPRETATION (June 24, 82)

Rule 234 includes required clearances to both the pole and the flag and requires the effect of wind to be taken into account. Rule 234A1 requires that the clearances be applied with the conductor displaced in the direction of the pole by a 6 lb per sq ft wind at final sag at 60°F. In other words, the total required distance between the POLE and the CONDUCTOR AT REST is the required CLEARANCE PLUS the BLOWOUT of the conductor at that point under a 6 lb wind. If the pole does not have to be maintained, Note 1 of Table 234-1 allows a reduction of the clearance portion of that distance to 3 ft.

Note 5 of Table 234-1 requires that the blowout of the flag be taken into account by increasing the required clearance to the pole enough to allow 3 ft of clearance between the extended flag and the conductors (assuming that the flag would be lowered to be maintained and that Note 1 would apply). In this case, the extension of the flag is dependent upon the strength of the wind. When the wind blows in a pole-to-line direction, both the flag and conductors would respond to some extent to the wind forces. The amount of additional clearance that is required depends upon the relative response of the flag and the conductor to the wind force; if the flag can extend fully on a gust of wind that would not be powerful or sustained enough to displace the conductor, the total required clearance between the pole and the conductor at rest would be the flag length plus 3 ft.

* * * *

Clearance to tanks containing flammables

REQUEST (Oct 6, 81) IR 305

We request clarification of horizontal and vertical clearances for tanks containing flammables. Rule 234C and Table 234-1 provide information on clearances for tanks containing nonflammables only.

... mainly serves a rural and suburban area and frequently encounters situations where it has been necessary for conductors to pass by or over tanks containing flammables.

Are we correct in interpreting that the clearances applied to tanks containing nonflammables in Rule 234C and Table 234-1 apply to tanks containing flammables as well?

INTERPRETATION (Feb 18, 82)

The 1981 Edition of the National Electrical Safety Code (NESC) does not specify minimum clearances to tanks containing flammables. Rule 012 applies to these situations.

For your information, note that a proposal has been made for the 1984 edition of the National Electrical Safety Code to change Rule 234C to delete the nonflammable restriction on tank clearances. You may wish to comment on that Change Proposal when the Preprint becomes available in a few weeks. NFPA Handbook 30, Flammable and Combustible Liquids Code, may be of help to you in this matter.

234C4, Table 4, (1973 Edition)

Clearance to building

REQUEST (Dec 17, 81) IR 309

A question has arisen concerning the interpretation of the 1973 National Electrical Safety Code (NESC) in regard to the clearances between buildings and power lines. The accompanying sketch shows a feed-bin outline relative to a 7620 V primary feed line. Our questions are:

(1) Is this line in violation of the 1973 NESC as you would interpret the Code, section 234C?

(2) How does one interpret the NESC section 234C in applying the code to this case?

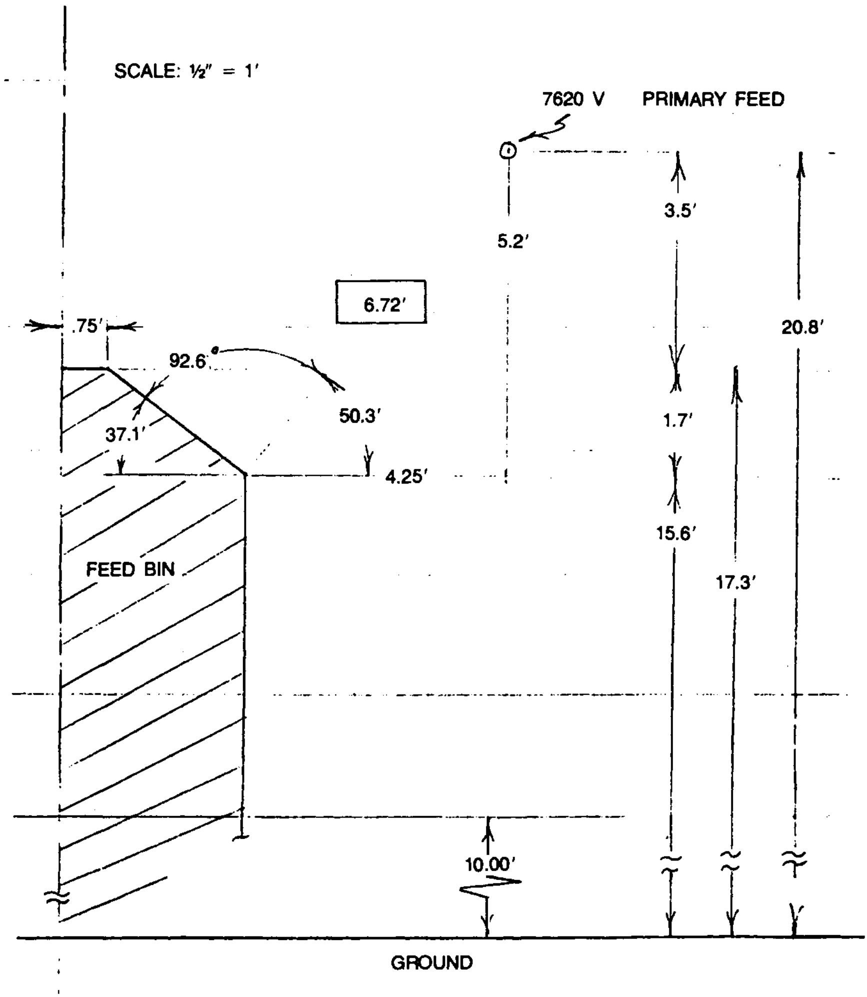

SCALE: ½" = 1'
7620 V PRIMARY FEED
3.5'
5.2'
6.72'
.75'
20.8'
92.6°
50.3'
37.1'
1.7'
4.25'
15.6'
FEED BIN
17.3'
10.00'
GROUND

Fig IR 309

INTERPRETATION (Mar 12, 82)

(1) The line is not in violation of Rule 234C4 of the 1973 Edition of the NESC. It should be noted that the requirements changed in subsequent editions of the Code and that structures built in this manner after the effective date of subsequent editions would not meet the changed requirements.

(2) Fig 234-1 of the 1981 edition of the NESC adequately portrays the spatial relationships of horizontal and vertical clearance requirements to buildings that has existed throughout the history of the code.

234D1 See 230C IR 343

235C

Clearance from communication cable to tap and drip loop of supply cable

REQUEST (Jan 23, 81) IR 288

An interpretation of Rules 235C (Vertical Clearance between Line Conductors) and 238D (Clearance from Drip Loops of Luminaire Brackets) is requested concerning the following application....

The attached sketch illustrates the conflict. The situation arises at joint poles where, at the time of attachment, there are no power service drops. The power conductors have been tightly coiled together at the pole, thus placing the telephone cable 40 in below the power attachment. When a service drop is attached (see Fig IR 288), a section of their mainline is dropped down forming a drip loop allowing enough slack to splice in the service drop. These splice points have been found hanging as much as 18 in below the power attachment.

The power company feels this is the same as Rule 238D which would allow the drip loop to come within 12 in of our cable. We maintain that this violates Rule 235C which requires a minimum of 40 in clearance between the two cables.

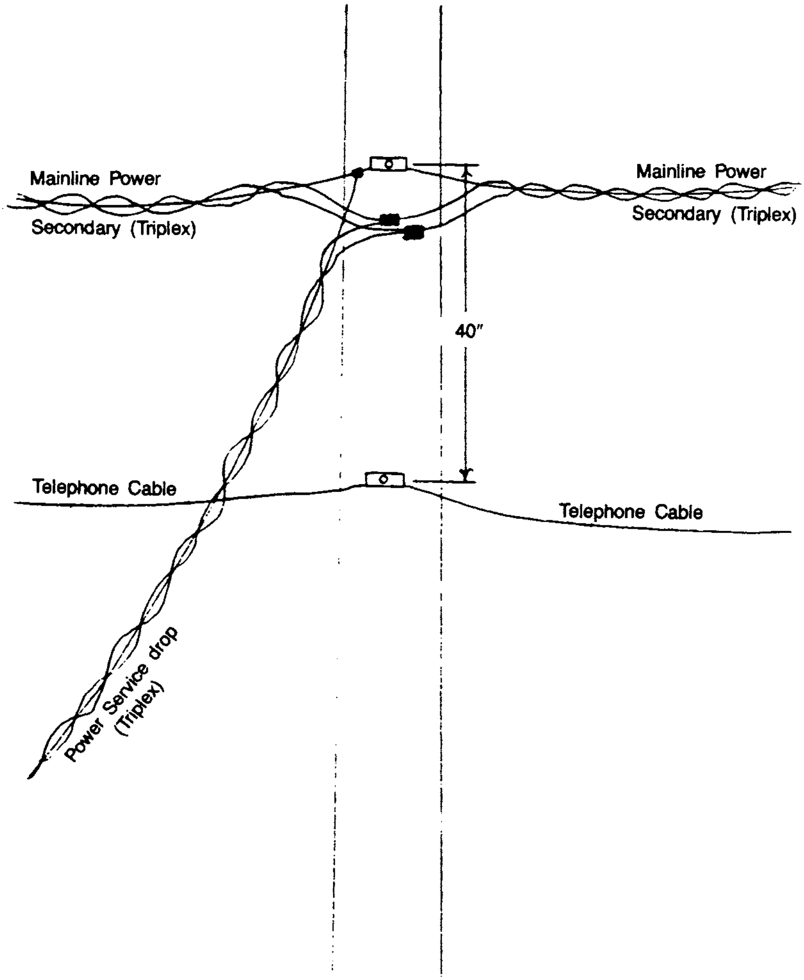

Mainline Power
Secondary (Triplex)
Mainline Power
Secondary (Triplex)
40″
Telephone Cable
Telephone Cable
Power Service drop
(Triplex)

Fig IR 288

INTERPRETATION (Apr 24, 81)

Rule 238D was written specifically to establish separation between drip loops from luminaires and communication cables because there are restrictions on the permissible height of the lamp fixture. These are caused by lighting spread and requirements for some given lighting intensity. Rule 238D does not apply to supply line conductors or supply service drops.

* * * *

Clearance between metal sheathed supply cable and communications

REQUEST (Aug 20, 82) IR 329

We are requesting an interpretation of Table 238-1 Note 1 so we may be allowed to use the 30 in clearance requirement between our Metal Sheathed Aerial Cable on messenger and communication circuits.

The Metal Sheathed Aerial cable's messenger is grounded with #2 cu. or equivalent at all locations where apparatus is supplied by the Aerial Cable and there are no surge arresters. At surge arrester locations, the aerial cable sheath, the messenger, the equipment case and the primary neutral are solidly interconnected with an adequate ground. Furthermore, the cable's messenger on 4 kV and the sheath of the Aerial cable at 13, 27 and 33 kV has at least one adequate ground of #2 cu. or equivalent every four normal pole spans of cable. Where this grounding is impractical, the cable sheath is grounded at every cable joint.

The following are considered adequate grounds on our overhead system:

(1) A connection to a bonding tree in a cable manhole.

(2) A connection to an overhead secondary neutral or to a common primary and secondary neutral conductor provided that any one of the conditions that follow below exist:

(a) At least two continuous metallic water pipe grounds exist on services within one span from the pole where the ground is required, or

(b) At least four continuous metallic water pipe grounds exist on services within two spans, or

(c) The overhead neutral conductor is connected to an underground secondary neutral at the pole on which the connection is required, and there are at least two continuous metallic water pipe grounds on services supplied from the underground secondary mains. The lead sheath of riser cables which are bonded to the secondary neutral at the first manhold shall be considered an adequate connection to an underground secondary neutral.

(3) A driven ground, at the grounding location, supplemented, if possible, by one water pipe ground.

(4) A connection to a buried loop of bare copper cable. Cable should be at least #2/0 copper and buried a minimum of 12 in deep. The perimeter of the cable loop shall be a minimum of 20 ft. As a special application for URD developments the outer, bare, copper, concentric neutral on the URD primary cable may be interpreted to be a buried loop.

(5) A connection to a metallic water main, water service pipe or sewer pipe with a #2 copper conductor or equivalent. This connection is to be made with the approval of the owner and in accordance with local ordinances.

Presently, the... Telephone Company bonds their multi-conductor cables to these same grounds. Since both companies bond to the same vertical ground at the pole we therefore would like this Metal Sheathed Aerial Cable to be considered an effectively grounded non-energized conductor and therefore the clearance between communication circuits and this cable be 30 in.

INTERPRETATION (Oct 25, 82)

Rule 238 and Table 238-1 are not applicable to the situation described. The applicable requirements may be found in Rule 235C and Table 235-5. The required clearance is 40 in.

235C, Table 235-5

Vertical clearance between line conductors at supports

REQUEST (Nov 11, 81) IR 310

This is a request for an interpretation of Table 235-5 titled, "Minimum Vertical Clearance at Supports Between Line Conductors", from the 1981 edition. A question has arisen on how the voltage levels of the upper and lower conductors should be determined. Three interpretations have been profered. For clarity, each will be explained using the same situation; a 12.47 kV (phase to phase system voltage; 7.2 kV phase to ground voltage) three phase line strung with an effectively grounded neutral beneath. What is the required clearance between the lowest phase conductor of the 12 kV circuit and the neutral?

One idea is that it is the difference in voltage between the 12 kV circuit and the neutral that is the important parameter, per the description under the title heading "(All voltages are between conductors involved . . .)". Therefore the section "Conductors usually at upper levels" is entered at "750 V to 8.7 kV" because a 12 kV phase to phase circuit's voltage is 7.2 kV with respect to the neutral. The table is entered at "Conductors usually at lower levels" at "Neutral conductors meeting Rule 230E1". These values yield a required clearance of 16 in.

Using the same example, the table has also been interpreted by using all voltages with respect to ground. In this case a 12 kV phase to phase circuit's voltage is 7.2 kV phase to ground voltage and the section "Conductors usually at upper levels" is entered at "750 V to 8.7 kV". "Conductors at lower levels" is entered at "Neutral conductors meeting Rule 230E1" and a clearance of 16 in is again obtained.

Finally, all voltages can be considered at their phase to phase system voltage level. In this case, "Conductors usually at upper levels" is entered at "8.7 kV to 15 kV". The neutral wire comes under "Neutral Conductors meeting Rule 230E1" and in this case the required clearance is 40 in.

We would like to know which (if any) of the above interpretations is correct. Leading to the confusion is the sentence, "(All voltages are between conductors involved except railway feeders, which are to ground.)"; and the lack of subheadings specifically stating voltage references (-to phase, -to ground, -to other conductor) to be used.

If in the above example the three phase 12 kV (phase to phase) circuit was replaced with a single phase line of the same circuit voltage but with 7.2 kV potential with respect to ground; will this affect the required clearance between conductor and neutral?

INTERPRETATION (Apr 30, 82)

The voltage between a phase wire of a wye circuit and its associated multigrounded neutral is the line-to-ground voltage. Rule 235C1 and Table 235-5 require the basic vertical clearance between a phase conductor and the multigrounded neutral of a 7.2/12.45 kV wye circuit to be 16 in. Rule 235C2 may require additional clearance.

* * * *

235C1, Table 235-5

Spacing between communication cables of power and communications utilities, when located below supply lines

REQUEST (Jan 19, 81) IR 286

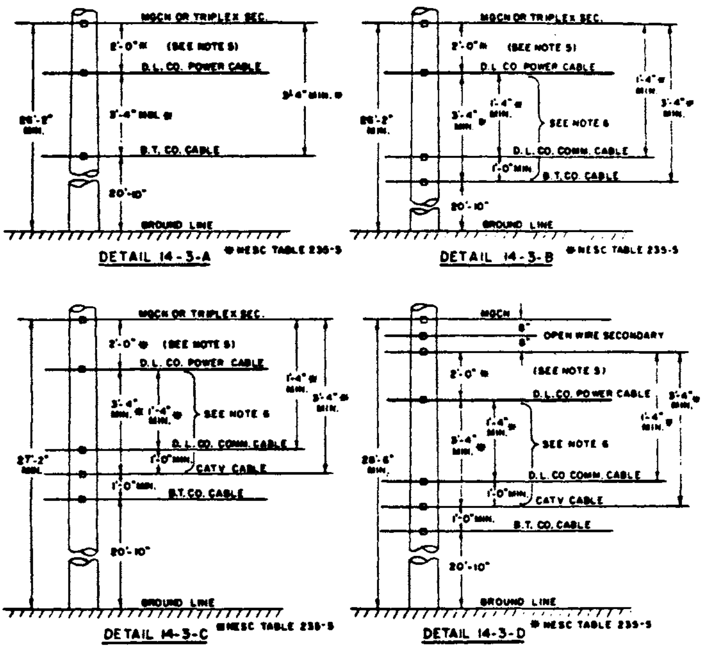
We are requesting an interpretation of Table 235-5 (Minimum Vertical Clearance at Supports Between Line Conductors), Page 192-193, National Electrical Safety Code (NECS), 1981 Edition (ANSI C2-1981).

... Light Company owns and operates its own communication system (used in the operation of supply lines) throughout its service area. Our interpretation of Table 235-5 is that company-owned communications cable systems may be installed a minimum of 16 in below a supply cable of 23,000 V meeting Rule 230C1 or C2; a supply cable of 240 V, meeting Rule 230C3; or covered conductors (max cct V: 240 V) meeting Rule 230D or 230E, all defined on Pages 138 and 139, NESC, 1981 Edition.

Further, our interpretation of Table 235-5 is that communications cables owned and operated by other utilities on jointly used wood poles must be located a minimum of 40 in below the power cables and covered conductors defined above. We interpret this to mean that a communications cable owned by another utility company may be placed an additional 24 in below a ... Light Company communications cable which is located 16 in below a power cable or covered conductor described above. The total of 16 in plus the additional 24 in provides the required 40 in vertical separation for the communications utility company. ... Light Company drawing ... detailing this condition is attached for your information.

Please advise if we are interpreting Table 235-5 correctly in both of the instances described above.

AERIAL CABLE



NOTES:

1. CLEARANCES SHOWN MEET MINIMUM REQUIREMENTS OF LATEST NESC CODE. THIS IS ONLY A GUIDELINE; FIELD CONDITIONS, T.&D. CONSTRUCTION PROCEDURES OR OPERATING PROCEDURES MAY REQUIRE INCREASING THESE DIMENSIONS.
2. IF FUTURE ATTACHMENT OF D. L. CO. COMMUNICATIONS AND/OR CATV IS ANTICIPATED, ALLOW CLEARANCES FOR THESE CABLES.
3. ATTACHMENT CLEARANCES BETWEEN MULTIPLE D. L. CO. POWER CABLES SHOULD BE 2'-0".
4. WHERE CABLES SHOWN HAVE UNEQUAL SAGS, ATTACHMENT POINTS MUST BE ADJUSTED, IF NECESSARY, SO THAT MIDSPAN CLEARANCE BETWEEN CABLES AT 60°F UNLOADED SAG IS THE LARGER OF THE FOLLOWING: a) 75% OF THE ATTACHMENT CLEARANCE, OR b) 12" [NESC 235 C2b(1)c]
5. THE 2'-CLEARANCE INDICATED IN NOTE 3 AND SHOWN ON THE DETAILS ABOVE MAY BE REDUCED TO 1'-0" MIN. ON EXISTING POLES WHERE POLE REPLACEMENT CAN BE AVOIDED, AND THE CABLE WILL BE INSTALLED PRE-LASHED. MIDSPAN CLEARANCE MUST STILL MEET REQUIREMENTS OF NOTE 4. [NESC 235C2b(1)c]
6. THE TOTAL OF THESE TWO MINIMUM DISTANCES MUST BE AT LEAST 3'-4".

STANDARD CLEARANCES FOR AERIAL CABLE ATTACHMENTS

INTERPRETATION (Apr 30, 81)

The clearance required between communications circuits used in the operation of a power line and communications circuits of a communications facility depends upon whether the communications circuits of the electric utility meet the requirements of rule 288A3 or 288A4. If built in conformance with rule 288A3, there is no requirement for any particular clearance between the two facilities. If built under the provisions of rule 288A4, the required clearance to the other communications cable would be 40 in. Communications circuits operated by an electric utility are designated as supply circuits when designed under the provisions of rule 288A4.

* * * *

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 K V 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)

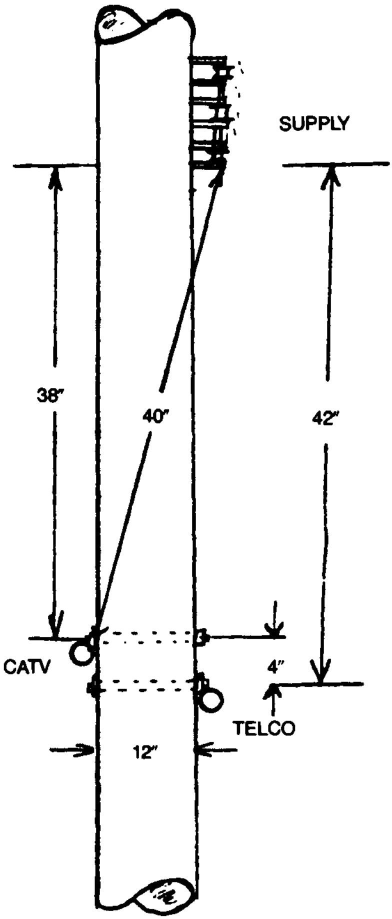


Fig IR 362-1

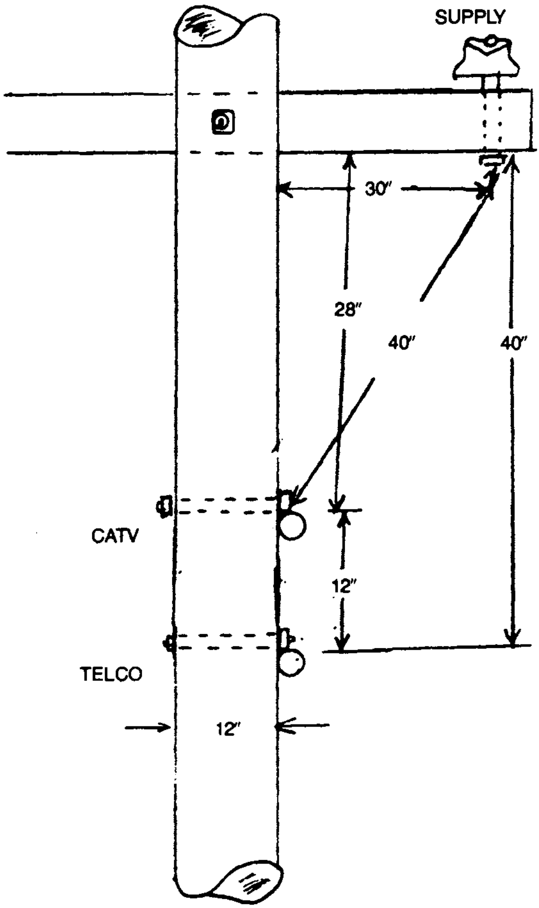


Fig IR 362-2

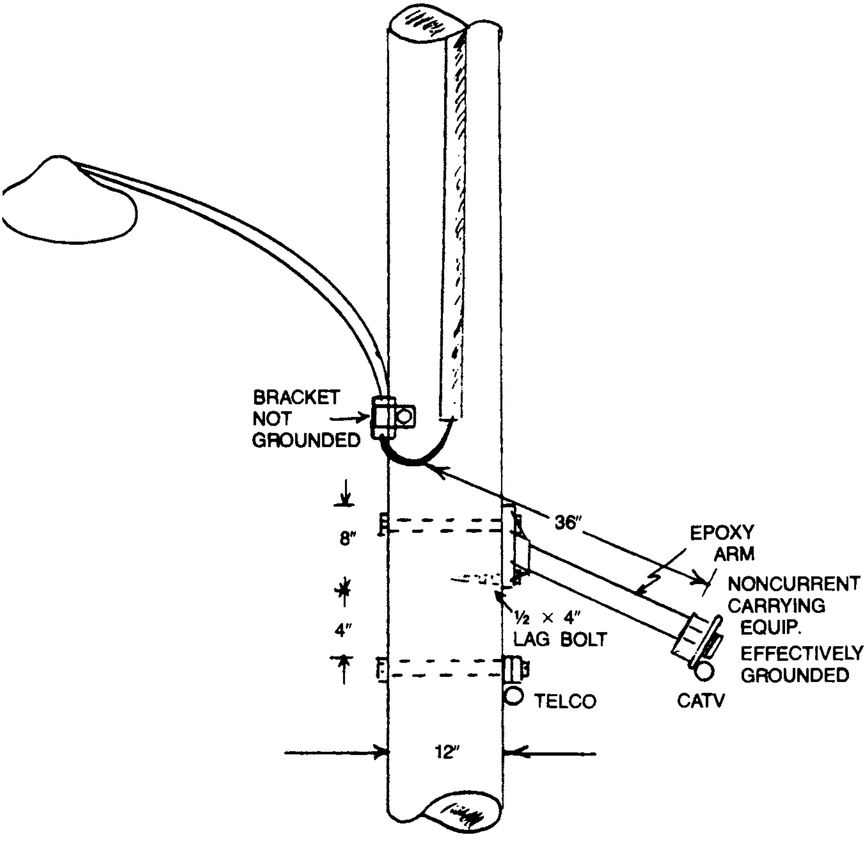

BRACKET
NOT
GROUNDED
8"
4"
36"
EPOXY
ARM
NONCURRENT
CARRYING
EQUIP.
EFFECTIVELY
GROUNDED
½ × 4"
LAG BOLT
TELCO
CATV
12"

Fig IR 362-3

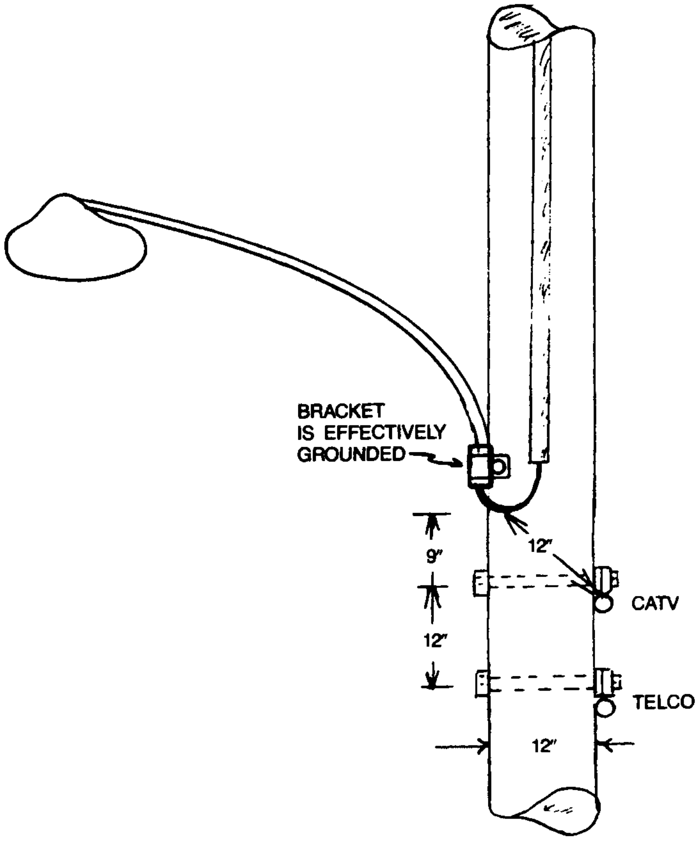


Fig IR 362-4

INTERPRETATION

(In process)

235C2b(3), C2b(1)a

Minimum mid-span separation between a supply conductor <750V and a communication conductor—for spans over 150 feet

REQUEST (Mar 22, 84) IR 359

We request an interpretation of Rule 235C2b(3) [of the National Electrical Safety Code (NESC)] for spans greater than 150 ft.

QUESTION: What is the minimum mid-span separation between a supply conductor operating at 750 V or less and a communication cable or conductor?

Rule 235C2b(3) states that a supply conductor of 750 V or less cannot sag below the line of sight of the communication cable/conductor supports. However, no minimum mid-span separation is given in that rule. Communication conductors, cables, or messengers sag differently than supply conductors. It is possible to have several in of separation mid-span and still comply with the requirements of Rule 235C2b(3).

If the minimum separation is the same as that given in Rule 235C2b(1) (a), then a reference to that rule should be included in the wording of Rule 235C2b(3). Rule 235C2b(3) is ambiguous as written since a minimum 30 in mid-span separation is required for spans less than 150 ft but for spans greater than 150 ft the mid-span separation could be less!

INTERPRETATION (May 21, 84)

Rule 235C2—Additional Clearances reads as follows:

> "Greater clearances than given in Table 235-5 (Rule 235C1) shall be provided under the following conditions. The increases are cumulative where more than one is applicable."

Each of the subrules under Rule 235C2 contains requirements that are applicable under stated circumstances. For each circumstance, all applicable requirements must be met. Rule 235C2b concerns conductors of different sags and carried on the same support. Within that section of the NESC, Rule 235C2b(1) applies regardless of span length and Rule 235C2b(3) applies only to span lengths in excess of 150 ft. The controlling rule depends upon the relative difference in sags between the affected conductors.

---

235 E1 See 230C

IR 343

235E1, Table 235-6

Clearance between an anchor guy and an 8.7 kV conductor

REQUEST (Aug 19, 82) IR 330

The National Electrical Safety Code (NESC), 1977 Edition, states in Table 235-6 clearance between an 8.7 kV phase and an anchor guy is 6 in. If a fiberglass strain insulator is used as shown on the attached drawing and the clearance is less than 6 in will it comply with the codes?

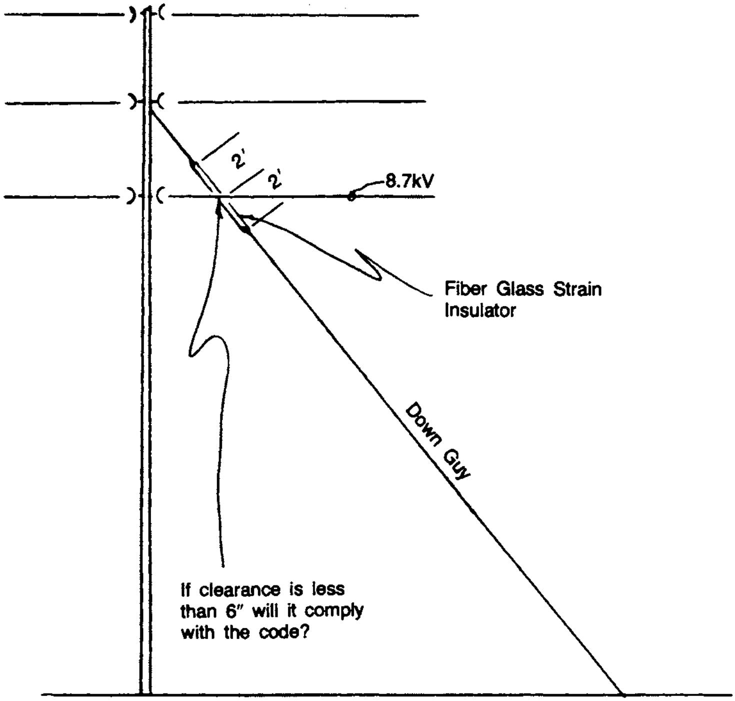


Table 235-6 1977 Code
Clearance to Anchor Guys

Fig IR 330

INTERPRETATION (Mar 23, 83)

Rule 235E1 and Table 235-6 give requirements for clearances between an anchor guy and a conductor which it passes. This section of the Code is unclear as to the required clearance between an energized conductor and an insulator which is in a passing guy. A note has been proposed to clarify this matter for the next Edition of the Code. The note is essentially the same as Note 7 to Table 233-1. We believe that an installation meeting the allowances of Note 7 of Table 233-1 applied to the clearance required by Rule 235E1 and Table 235-6 would meet the intent of the Code requirements.

* * * *

Service drop line conductor in aerial cable clamp saddle; Clearance to pole

REQUEST (Nov 30, 83) IR 351

In a recent conversation ... the interpretation and intent of Rule 235 was discussed. Particularly on page 196-197, Table 235-236 of the 1981 Edition of the National Electrical Safety Code (NESC), footnotes 3 and 8 suggest a 1 in clearance from secondary conductors to the pole surface.

We ... have offered a line of secondary clamps shown in the [figures below.] It was suggested that under the Code, our PA332 and PA333 series could be in violation when the insulated conductors of the triplex were supported in the crotch as shown in the 2nd installation photo. With 4/0 conductor, the series could be less than 1 in from the pole surface.

From this, two questions developed:

(1) With no insulated protection in the conductor support area, are we in fact violating the intent of the Code?

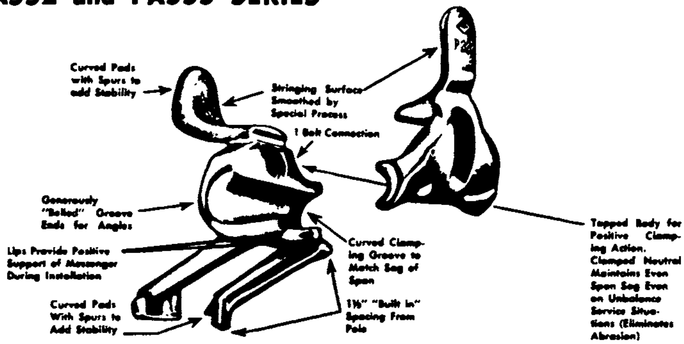
(2) If so, do we relieve the violation by insulating that surface with a nylon coating that provides 900 V per mil of thickness protection with an average thickness of 12 mils. See Fig IR 351-2.

It is my feeling that the code or intent of the Code is not violated as the approach described plus support of triplex by upset bolts has been used for many years by the majority of power customers nationally without conflict.

AERIAL CABLE CLAMPS—MEDIUM DUTY

Malleable Iron — Hot Dip Galvanized

PA332 and PA333 SERIES

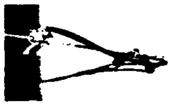


ADVANTAGES

1. Curved clamping groove to conform to sag of span.
2. Generously belled groove ends for angles.
3. Built-in 1 1/2" clearance form pole face.
4. Tapped body for positive clamping action.
5. Firm clamping action of neutral eliminates slippage of neutral due to unbalanced span load such as service take-off from one side of pole only.
6. Teeth on feet resists bending of bolt and vertical movement of clamp.

INSTALLATION

Specially smoothed area for stringing.



Typical installation with services attached to PA342 span clamp.

Belled clamp groove for tangent and angle construction up to 60° on bisect.

PA342

ACCESSORY – as shown on Installation Photo (middle illustration above)

Catalog Number	Messenger Range	Mounting Bolt Dia.	Clearance Pole to Neutral	Shipping Weight Per 100 Pieces
PA332	.22"-.50"	5/8"	1 1/2"	232 lbs.
PA333	.43"-.75"	5/8"	1 1/2"	232 lbs.
*PA333C	.43"-.75"	5/8"	1 1/2"	235 lbs.
PA342	1/0 -4/0	mid span service clamp		74 lbs.

*With Nylon Coated Stringing Surface

Fig IR 351-1

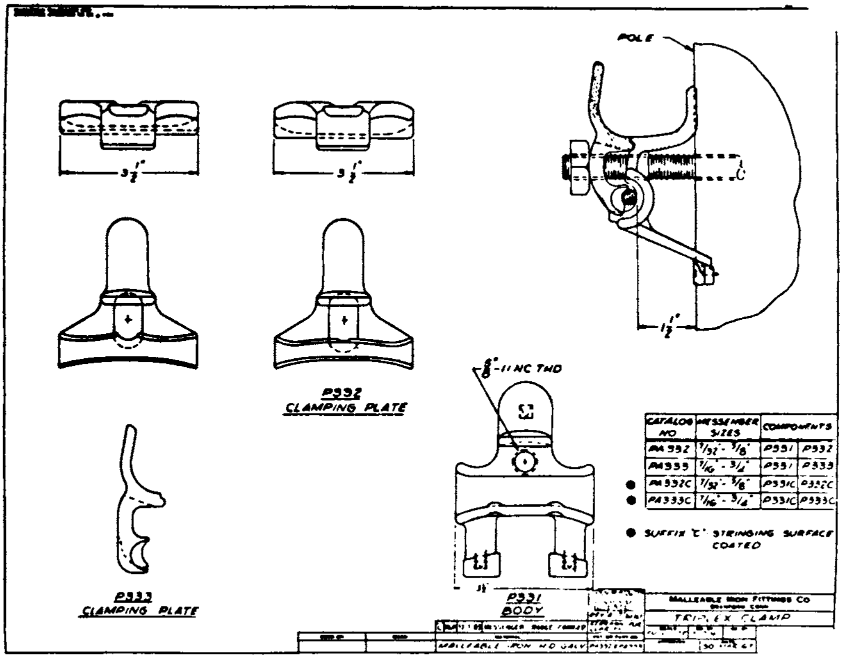

POLE
3 1/2"
3 1/2"
1 1/2"
P332
CLAMPING PLATE
5/8"-11 NC THD
CATALOG NO
MESSENGER SIZES
COMPONENTS
PA 332
7/32" - 5/8"
P331
P332
PA333
7/16" - 3/4"
P331
P333
PA332C
7/32" - 5/8"
P331C
P332C
PA333C
7/16" - 3/4"
P331C
P333C
SUFFIX "C" STRINGING SURFACE COATED
P333
CLAMPING PLATE
P331
BODY
MALLEABLE IRON FITTINGS CO
TRIPLEX CLAMP

Fig IR 351-2

INTERPRETATION (May 14, 84)

(1) If the insulated conductors remain in the stringing saddle in such a manner as to be less than one inch from the support surface, the installation is in violation of the rule as the rule is presently written.

(2) While there is no prohibition against placing a nylon coating on the surface, such a coating does not relieve the installation from meeting the one-inch clearance requirement.

235E1, E3, Table 235-6, 1981 Edition

Clarification of line conductor clearance to guy

REQUEST (Dec 27, 83) IR 353

The rule for which I request an interpretation is 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".

Rule 235EI states "Clearances shall be not less than given in Table 235-6". The exception to Rule 235E1 allows clearances less than those required by Table 235-6 and refers to Rule 235E3.

Rule 233E3a refers to Rule 233A3 which, I believe, should correctly be a reference to 233C3.

Rule 233C3 contains a tabulation of reference heights, a formula for calculating the electrical component of clearance and a limit on the minimum allowable clearance.

My request for interpretation concerns whether the limit of Rule 233C3 is intended to be applied to the calculated clearance from a line conductor to an anchor guy.

The specific case in point is as follows:

(1) Refer to Fig IR 352 attached. It is desired to maintain the minimum National Electrical Safety Code (NESC) clearances between line conductors and anchor guys on this structure.

(2) Rule 235E1 and Table 235-6 requires a minimum clearance of 64 in at 242 kV circuit, phase-to-phase voltage as shown calculated below.

$$\begin{aligned} D &= 16 + .25\,(242 - 50) \\ &= 64 \text{ in (Rule 235E1 and Table 235-6)} \end{aligned}$$

(3) The exception to Rule 235E1 refers to Rule 235E3 which refers to Rule 233C3 (?) yields a calculated total clearance of 55 in as shown below.

$$\begin{aligned} D &= 0 + 3.28\left[\frac{242\,\sqrt{2}/\sqrt{3} \times 3.3 \times 1.15}{500 \times 1.4}\right]^{1.667} \times 1.03 \times 1.2 \\ &= 4.55 \text{ ft} \\ &= 55 \text{ in (Rule 235E1-Exception, Rule 235E3a and Rule 233C3a \& b)} \end{aligned}$$

(4) If it is required, the limit of Rule 233C3c which refers to the clearance required by Rules 233C1 and 233C2 with the lower voltage circuit at ground potential, the clearance required as shown calculated below is 84 in.

$D = 48 + .4\ (242/\sqrt{3} - 50)$
$= 84$ in (Rule 235E1-Exception, Rule 235E3a and Rule 233C3a & b, but limited by Rule 233C3c)

It is my opinion that the limit of Rule 233C3 was not intended to apply when Rule 233C3 is being applied under the exception provision of Rule 235E1.

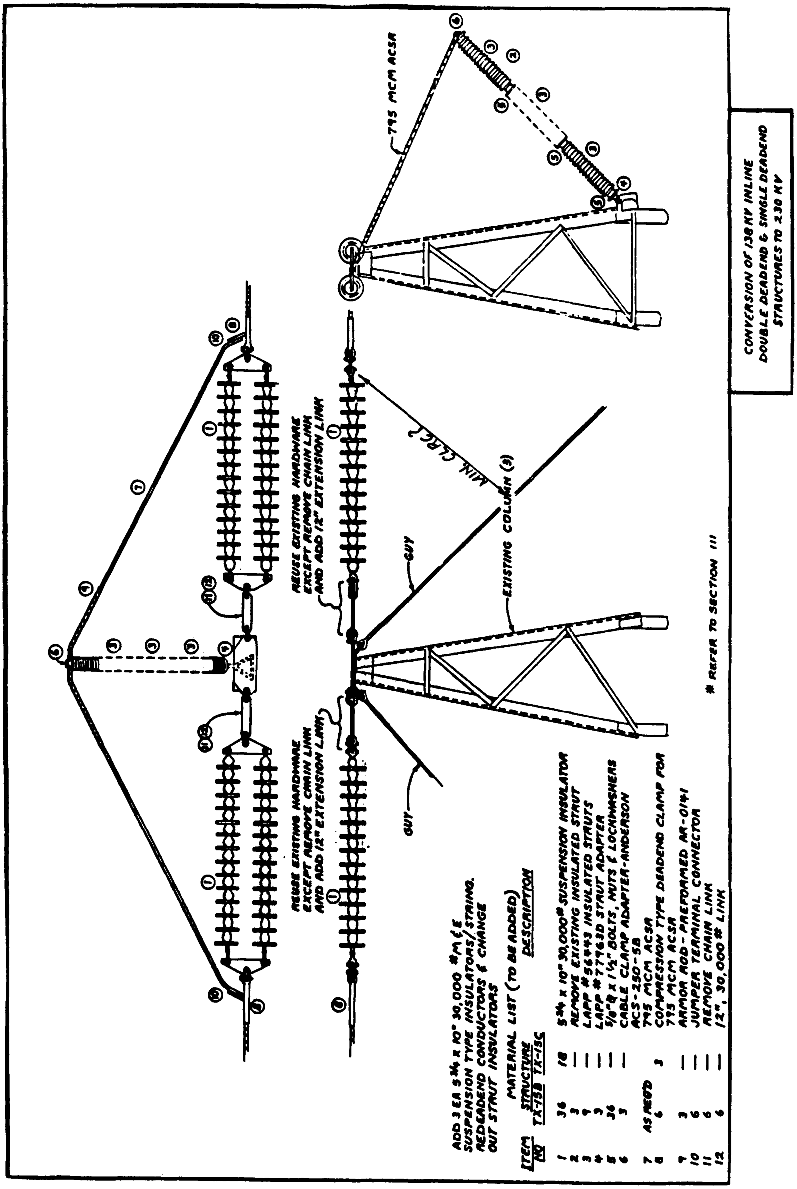

REUSE EXISTING HARDWARE
EXCEPT REMOVE CHAIN LINK
AND ADD 12" EXTENSION LINK
REUSE EXISTING HARDWARE
EXCEPT REMOVE CHAIN LINK
AND ADD 12" EXTENSION LINK
GUY
GUY
MIN. CLRC?
EXISTING COLUMN (9)
795 MCM ACSR
ADD 3 EA 5¾ x 10" 30,000 #M & E
SUSPENSION TYPE INSULATORS/STRING.
REDEADEND CONDUCTORS & CHANGE
OUT STRUT INSULATORS
MATERIAL LIST (TO BE ADDED)
ITEM NO | STRUCTURE TX-15B | TX-15C | DESCRIPTION
1 36 18 5¾ x 10" 30,000# SUSPENSION INSULATOR
2 3 — REMOVE EXISTING INSULATED STRUT
3 9 — LAPP #56443 INSULATED STRUTS
4 3 — LAPP #77963D STRUT ADAPTER
5 36 — 5/8"Ø x 1½" BOLTS, NUTS & LOCKWASHERS
6 3 — CABLE CLAMP ADAPTER-ANDERSON ACS-250-5B
7 AS REQ'D 795 MCM ACSR
8 6 3 COMPRESSION TYPE DEADEND CLAMP FOR 795 MCM ACSR
9 3 — ARMOR ROD-PREFORMED AR-0141
10 6 — JUMPER TERMINAL CONNECTOR
11 6 — REMOVE CHAIN LINK
12 6 — 12", 30,000# LINK
* REFER TO SECTION III
CONVERSION OF 138 KV INLINE
DOUBLE DEADEND & SINGLE DEADEND
STRUCTURES TO 230 KV

Fig IR 353

INTERPRETATION (May 14, 84)

The reference in Rule 233E3a is indeed to Rule 233*C*3, and not 233*A*3. That typographical error was changed in the 1984 Edition.

The limit included in Rule 233C3c *does* apply in this case as the Code is currently written. When applied in this case, the result is to limit allowed reductions to higher voltages and switching surge factors. Table 233-2 shows that such limits are normally the case when applying this rule. The applicability of the limits to the case that you mention is now being considered by a special working group of the Clearances Subcommittee for the 1987 Edition revisions.

* * * *

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, above attached. 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 requires a minimum clearance of 64″ at 242 kV circuit, phase-to-phase voltage as shown calculated below.
   D = 16 + .25 (242 − 50)
   = 64 inches (Rule 235E1 and Table 235-6)
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:

$$D = 3.28\left[\frac{VL\text{-}L \cdot PU \cdot a}{500K}\right]^{1.667} b$$

$$= 3.28\left[\frac{242\sqrt{2}/\sqrt{3} \times 3.3 \times 1.15}{500 \times 1.4}\right]^{1.667} \times 1.03$$

$$= 3.8 \text{ ft.} = 45.6''$$

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:

$$28.5 + .4\,(169 - 50) = 76.1'',$$

but this is greater than the 64″ 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:

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

$$= 4.55 \text{ ft.} = 54.6''$$

   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:

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

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

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

INTERPRETATION

(In process)

238, Table 238-1 See 235C, Table 235-5 IR 329

238, Table 238-1

Clearance from 34.5 kV supply conductor to street light bracket

REQUEST (Aug 6, 82) IR 328

We have been using Rule 238 Table 238-1 to determine the required clearance between a phase wire of a 34.5 kV three phase four wire circuit and a grounded street light luminaire bracket located below the phase conductor. Communication is located below the grounded street light bracket. We interpret the table to say that 30 in is required between the phase conductor and the grounded street light bracket. Is this the appropriate rule and is 30 inches the proper clearance governing this situation?

This question is being raised because of the proposed 1982 revision, CP 1037, which changes the title of Table 238-1 in such a way that when both the supply conductor and the equipment, namely street light bracket, are owned by the same utility the required clearance is no longer governed by Table 238-1.

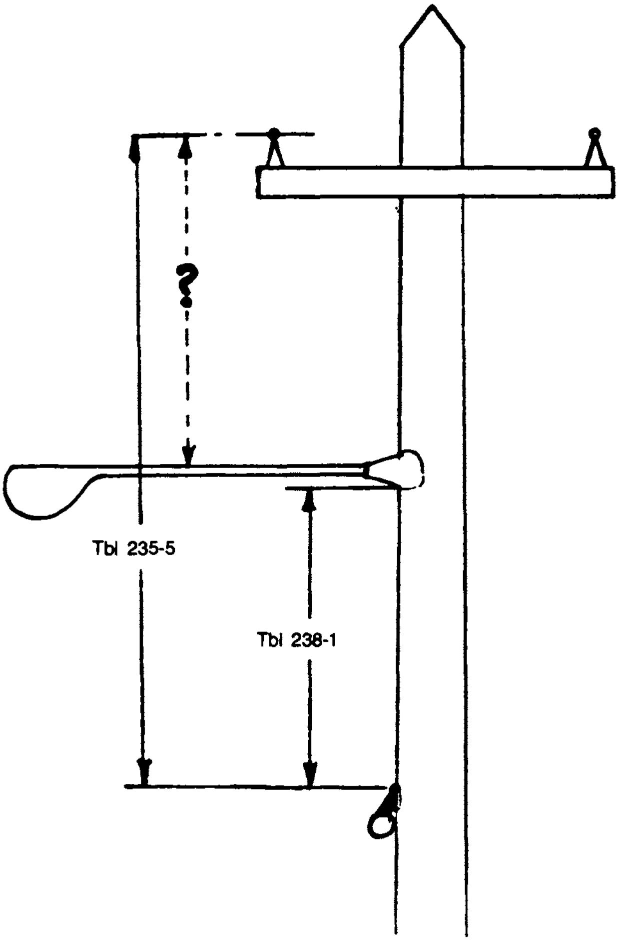


Fig IR 328

INTERPRETATION (Oct 25, 82)

The Interpretation given to IR 311 also applies to this request. See Rule 238B, Table 238-1.

238B, Table 238-1

Clearance to street lighting brackets

REQUEST (Nov 13, 81) IR 311

The National Electrical Safety Code (NESC), 1981 Edition, states in Table 238-1 "Vertical clearance between conductors and noncurrent carrying metal parts of equipment" that the minimum clearance from phase wires to noncurrent carrying equipment such as street light brackets is 40 in or 60 in depending on voltage to ground. This may be reduced to 30 in if the equipment is effectively grounded.

No acceptable horizontal clearance is given any place that I can find, so I need an interpretation of the intent of paragraph 238.

(1) If a phase wire (7.2 kV to ground) is located on one side of a pole, does it effect the location of a street light bracket on the other side of the pole?

(2) If a street light bracket sweeps upward, do we measure clearance from the highest point on the light, do we measure to the point directly under the phase wire, or do we measure the closest diagonal distance?

INTERPRETATION (Apr 30, 82)

The NESC does not specify a minimum clearance between supply conductors and supply equipment under the conditions that you describe. The installation is, however, required to meet the requirements of Rules 236 and 237.

Please note that we have received a Change Proposal 1036, 1037 for revision of the title of Rule 238 and Table 238-1 to clearly state that the included clearances are between supply and communications facilities only. The approval of this change proposal is some time in the future—if it is found acceptable.

* * * *

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 which 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 which 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.

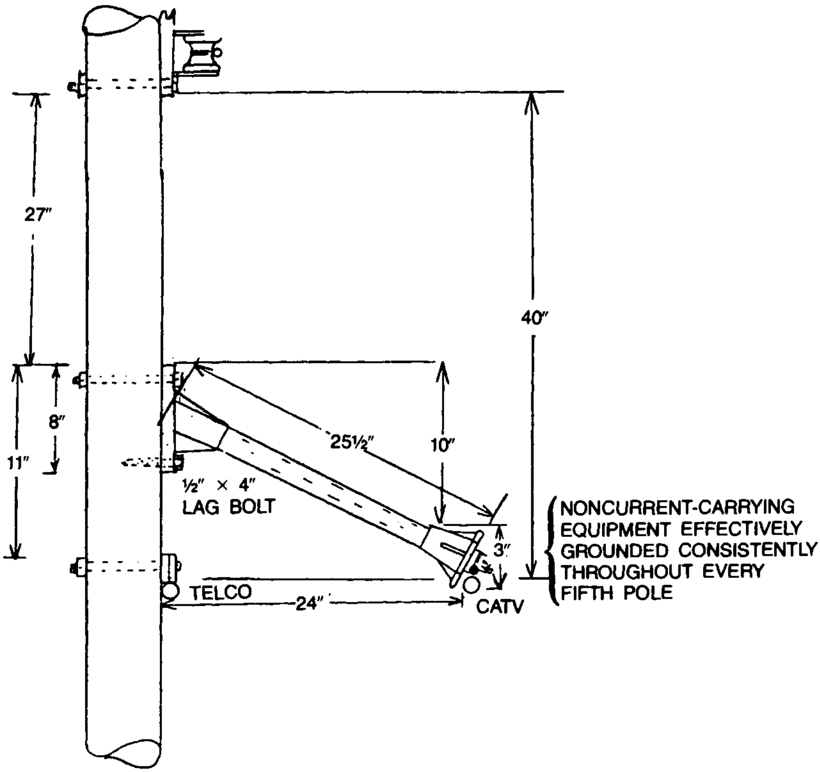

27″
40″
8″
11″
25½″
10″
½″ × 4″
LAG BOLT
3″
TELCO
24″
CATV
NONCURRENT-CARRYING
EQUIPMENT EFFECTIVELY
GROUNDED CONSISTENTLY
THROUGHOUT EVERY
FIFTH POLE

Fig IR 363-1

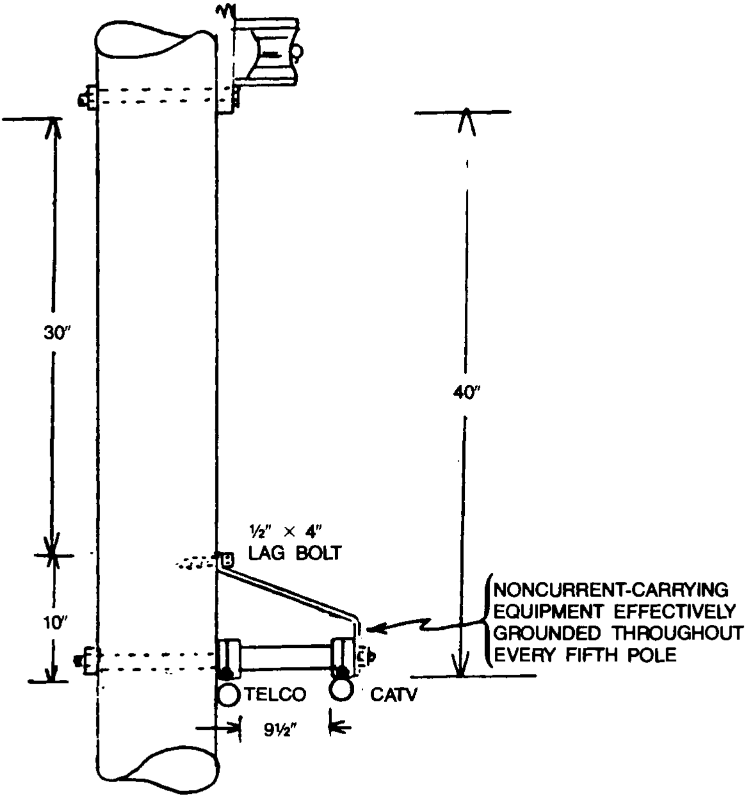

30″
40″
½″ × 4″
LAG BOLT
10″
NONCURRENT-CARRYING
EQUIPMENT EFFECTIVELY
GROUNDED THROUGHOUT
EVERY FIFTH POLE
TELCO
CATV
9½″

Fig IR 363-2

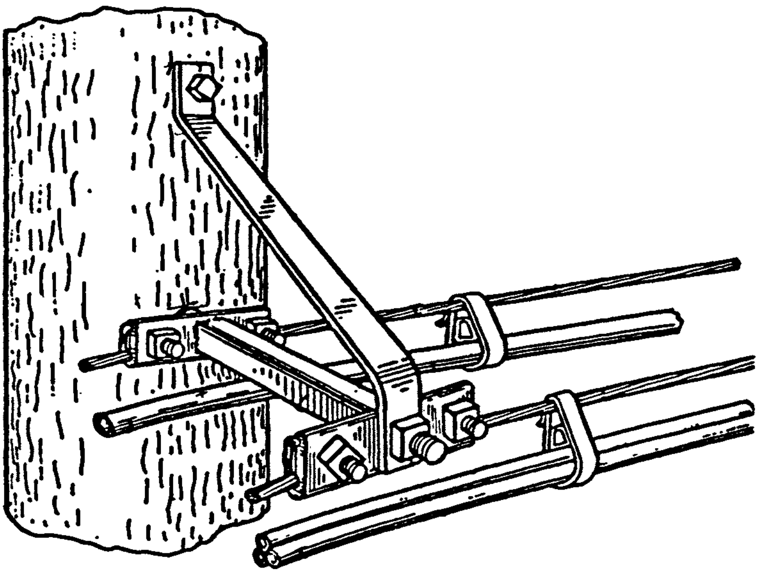


Fig IR 363-3

INTERPRETATION

(In process)

238D See 235C IR 288

Does grounding transformer tank to multigrounded neutral qualify for reduced (30 in) clearance?

REQUEST (Oct 1, 82) IR 333

The question has been raised as to whether or not the tank of a single bushing protected transformer connected to the neutral of a multigrounded neutral line on a system where multigrounded neutral lines are consistently used meets the requirements of Footnote 1 following Table 238-1 of ANSI C2-1981 for reduction of clearance to 30 in.

INTERPRETATION (Mar 22, 83)

The answer to your question lies in Rule 96A3 and in Note 1 to Table 238-1. Rule 96A3 requires, *inter alia,* that multigrounded neutrals be connected to made electrodes at each transformer location. If your intention was to connect the transformer only to a neutral and not to a made electrode at the transformer location, that would violate the requirements of Rule 96A3 and preclude the use of Note 1 to Table 238-1.

It is unclear from your wording whether the requirements of Note 1 to Table 238-1 are fully met. You indicate that multigrounded neutrals are "consistently used." That does not answer the question of whether noncurrent-carrying parts are effectively grounded consistently throughout well-defined areas. If ALL noncurrent-carrying parts of equipment, not just transformer tanks, are not consistently effectively grounded (notice that there is more to effectively grounding than just attaching to a neutral with four grounds per mile—that is only the minimum amount of grounds required) and the area in which this is done is not well-defined (i.e., if the limits of this consistency are not readily apparent to both the power and communication workers), the area does not meet the requirements of Note 1 to Table 238-1 and the reduced clearance is not allowed.

* * * *

Single-bushing transformer status (current-carrying or noncurrent-carrying)

REQUEST (Apr 27, 83) IR 333A

Our concern is whether or not the tank of a single bushing transformer is a noncurrent-carrying part, since the tank is used as one terminal of the high voltage winding. I apologize for not putting the emphasis in the right place in the original question. We do install grounds at all transformer and equipment locations and additionally as required to provide grounds every quarter mile on our distribution lines.

Please advise if it is the intent of the definition of "current-carrying part" in Section 2 to exclude grounded transformer tanks even when they are used as part of the circuit.

INTERPRETATION (July 8, 83)

The definitions of "current-carrying part" and "noncurrent-carrying part" clearly indicate that the tank of a single bushing transformer, where "effectively grounded consistently through well-defined areas . . ." are not "intended to be connected . . . to a source of voltage" but are, in face, effectively grounded and qualify as noncurrent-carrying parts meeting the requirements of Note 1 to Table 238-1.

239A

Protective covering requirements for power conductors passing through communications space

REQUEST (Aug 20, 81) IR 303

Your assistance is respectfully requested in reference to Rule 239A "Vertical and Lateral Conductors on Support" and Rule 239F. "Requirements for Vertical Supply Conductors Passing through Communication Space on jointly used Line Structures" by the ... Telephone Company, Construction Segment, ... The following data and assumptions are offered to ensure continuity of understanding by both parties.

As indicated above, the request for interpretations involves communication construction safety practices and standards in area of power conductors passing through the Communication space of a jointly used pole structure. See Fig IR 303.

Situation: Rule 239F (1981 Edition) is being interpreted by the area power utilities to state that power supply conductors not exceeding 300 volts may pass through the communication space of a jointly used pole without mechanical protection except as specified in Rule 239C.

Concern: "Safety of our technicians that climb these poles and utilize construction equipment during their daily work operations".

The ... Telephone Company views safety as number one, it is difficult to explain to our craftspeople that they must wear hard hats, glasses etcetera, but in the same breath state that is permissible not to protect a power lead that extends down a pole which could result in death if spurred by a climbing gaff.

F. Requirements for Vertical Supply Conductors Passing Through Communication Space on Jointly Used Line Structures

1. Grounded Metal-Sheathed Cables

   Grounded metal-sheathed calbes may be fastened directly to the surface of the line structure. Such cables shall be protected with suitable nonmetallic covering when the line structure also carries trolley attachments or when an ungrounded luminaire is attached below the communication cable. The grounded metal-sheathed cable shall be protected with a nonmetallic covering for a distance of 40 in above the highest communication wire and 6 ft below the lowest trolley attachment or ungrounded luminaire fixture.

2. Jacketed Multiple-Conductor Cables
Jacketed multiple-conductor cables operating at voltages not exceeding 300 volts to ground may be attached directly to the surface of the line structure. Each conductor shall be insulated for a potential of at least 600 volts. Where used as aerial services, the point where such cables leave the structure shall be at least 40 inches above the highest or 40 inches below the lowest communication attachment. All splices and connections in the cable shall be insulated. No additional protection is required.
3. Grounded Metal Covering
Conductors of all voltages may be run in effectively grounded metal covering. Such metal covering shall be protected with a nonmetallic covering under the same conditions and to the same extent as required for grounded metal-sheather cables in Rule 239F1.
4. Suspended from Supply Support Arm
Lamp Leads of lighting circuits may be run from supply support arms directly to a bracket or luminaire under the following conditions:
   a. The vertical run shall consist of paired wires or multiple-conductor cable securely attached at both ends to suitable brackets and insulators.

Jacketed Multiple-Conductor Cable
Cable Jacket: A protective covering over the insulation, core, or sheath of a cable (Section 2 PG 51)
Question: What type of protection is implied? Protection against the elements or a mechanical type protection.

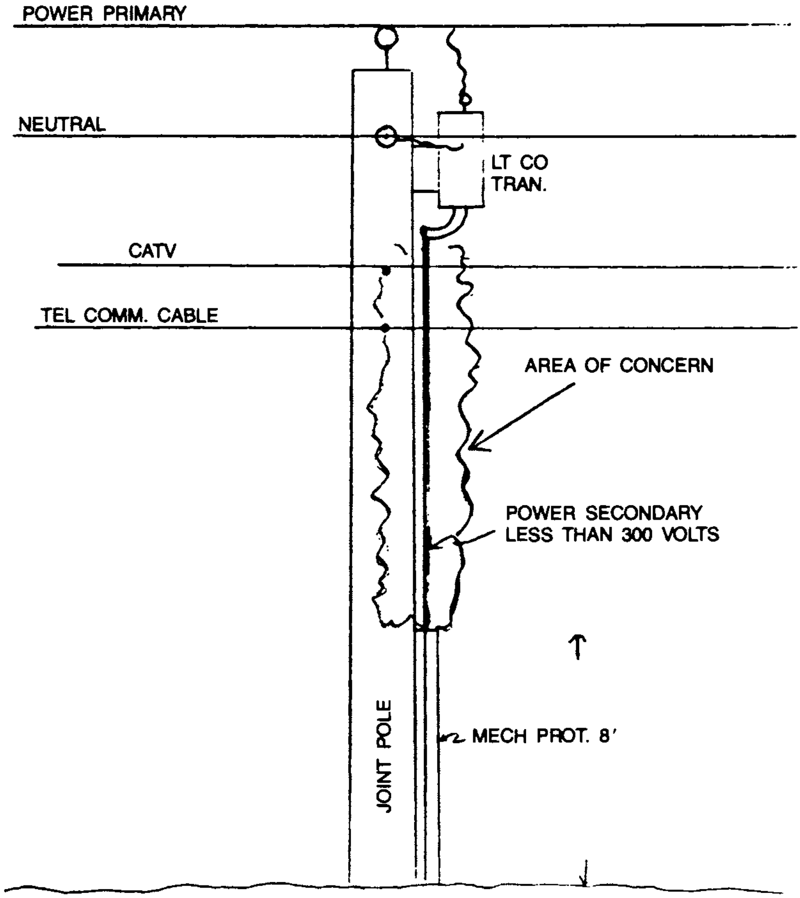

POWER PRIMARY
NEUTRAL
LT CO
TRAN.
CATV
TEL COMM. CABLE
AREA OF CONCERN
POWER SECONDARY
LESS THAN 300 VOLTS
JOINT POLE
MECH PROT. 8'

Fig IR 303

INTERPRETATION (Feb 17, 82)

You have correctly interpreted Rule 239F2 to allow jacketed multiple-conductor cables not exceeding 300 V to ground, which are passing through the communications space on jointly used line structures, to be directly attached to the surface of a line structure without further protection. Rule 239A requires such conductors to be located so that they do not obstruct climbing spaces, etcetera.

The 'protection' required of a jacket is the same as that required of other coverings in Rule 239F, that is, a nonmetallic covering which would limit possible problems of contact with the cable cover which is grounded or which has been accidentally energized.

239C See 93D1 IR 307

239D2, Table 239-2

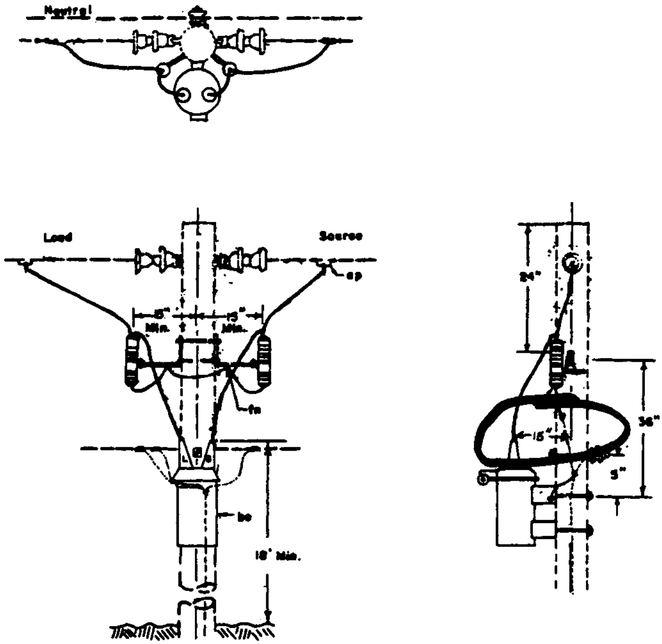
Pole clearance for vertical jumper to recloser terminal

REQUEST (June 16, 83) IR 342

... [require] interpretation of the National Electrical Safety Code (NESC) Table 239-2, page 212, 1981 edition. I specifically would like clarification on when the 15 in separation between a vertical conductor and the pole center at 0-8.7 kV is applicable.

... Association operates a 7.2/12.47 kV grounded Wye system. The attached drawings, Figs IR 342-1, 2, and 3 show [our] typical and Rural Electrification Administration style installations. Unless the pole diameter is quite large, we cannot obtain the required 15 in separation between the pole center and the bushings of small transformers and oil circuit reclosers (OCR). This equipment comes with mounting brackets factory welded directly to the tank. In Fig IR 342-1 you can see that we even turned the OCR head so the bushings are parallel to the overhead line in an attempt to obtain the maximum possible separation. Yet in the smaller OCRs, we still cannot meet the 15 in requirement.

Since the equipment is manufactured with the intent of directly mounting on the pole surface using the provided bracket, we are confused as to whether or not the clearance Table 239-2 apply to the top of the equipment bushings where vertical jumpers are attached. We would greatly appreciate your help in clarifying this NESC table for us.



ITEM	NO	MATERIAL
c	3	Bolt machine 5/8" x required length
d	3	Washer, square 2 1/4" square
p		Connectors, (as required)
j		Screw, lag (as required)
ep	2	Clamp, hot line copper
dq		Jumpers, as required
be	1	Recloser, oil circuit
fn	2	Bracket, extension
	2	Lightning arrester (dist class)
	2	Line stirrup
	2	Squirrel guard

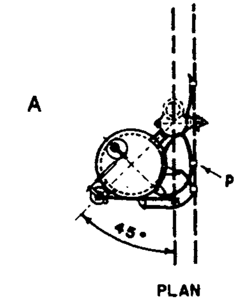
NOTES

1. EACH RECLOSURE TANK SHALL HAVE TWO CONNECTIONS TO GROUND.

7.2/12.5 KV
1Ø OIL CIRCUIT RECLOSURE

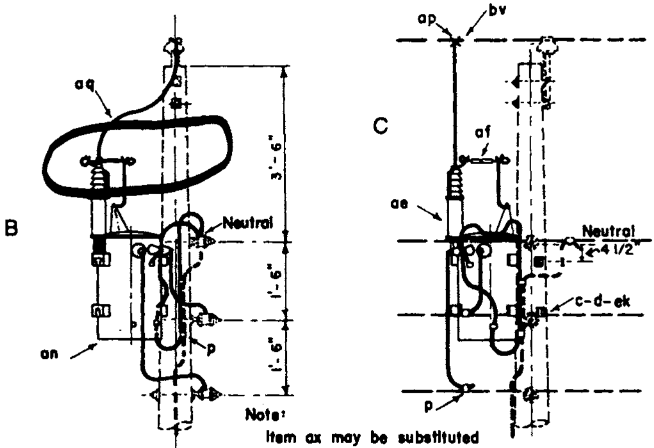
APPROVED Sept 21, 82 | DWG MARCH 80 | M3-10X

Fig IR 342-1



Notes:

1. Designate A for conventional transformer with tank mounted cutout and arrester, B for transformer with double gap and internal fuse, C for self protected transformer.
2. See guide drawings for details of transformer secondary and service connections.



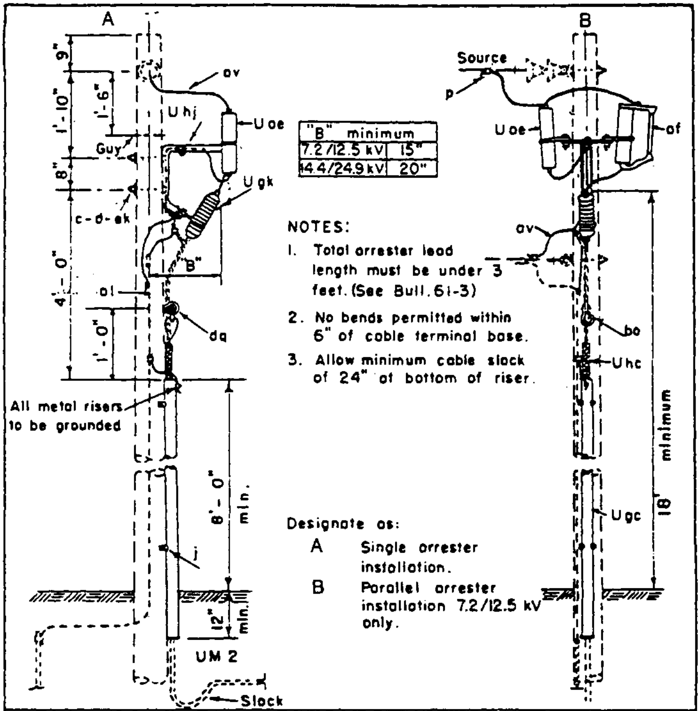
Note:
Item ax may be substituted for items ae and af.

ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
c	2	Bolt, machine, 5/8" x req'd. length	an	1	Transformer
d	2	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole	ap	1	Clamp, hot line, top assembly
p		Connectors, as required	aq		Jumpers, stranded, as required *
ae		Lightning arrester (G9 only)	bv	1	Rods, armor
af		Cutout, fuse, open link (G9 only)	ek		Locknuts

7.2/12.5 KV.
SINGLE PHASE TRANSFORMER
AT 1-PHASE TANGENT

Jan 1, 1962

G9-,G65-,G105-



ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
c	2	Bolt, machine, 5/8" x required length	bo	1	Shackle, anchor
d	2	Washer, square, 2 1/4"	ek		Locknuts, as required
j		Screw, lag, 1/2" x 4", as required	Uhj	1	Bracket, cutout, arrester & pothead ext.
dq	1	Eye screw, elliptical	Ugc	1	Cable riser shield, length as required
p		Connectors, as required	Ugk	1	Cable termination
Uoe	1	Lightning arrester, dist. class, (UM2)	Uoe	2	Lightning arrester, dist. class, (UM2A)
of	1	Cutout, load break type	Uhc	1	Cable support
ov		Jumpers, as required	ol		Staples, as required

SINGLE-PHASE CABLE TERMINAL POLE WITH DISTRIBUTION VALVE ARRESTER OVERHEAD SOURCE

REV. OCT. 1981

Dec. 1974

UM2, UM2A

Fig IR 342-3

INTERPRETATION (December 6, 83)

The 15-in clearance to which you refer is required when workmen ascend the pole in this area when these vertical conductors are alive. If workmen do not ascend these areas of the pole when these conductors are alive, the clearances of Table 239-1 and rule 235 are required.

239F1

Clearance from supply equipment to CATV cable

REQUEST (Jan 8, 82) IR 312

Enclosed please find a drawing [Fig IR 312] of a distribution line showing a pole with a ... Power and Light three phase primary riser.

Rule 239F1 apparently states requirements for this situation. Please interpret when minimum clearance for clearance marked A and clearance marked B, with no trolley attachments present should be.

Please include clearance for a 13 kV system and if different for a 23 kV system.

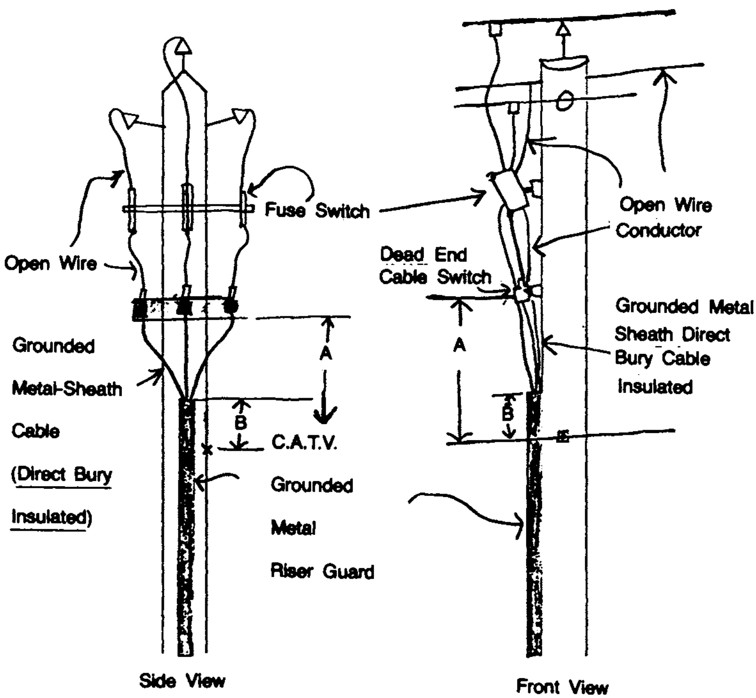

Open Wire
Fuse Switch
Grounded
Metal-Sheath
Cable
(Direct Bury
Insulated)
A
B
C.A.T.V.
Grounded
Metal
Riser Guard
Side View
Open Wire
Conductor
Dead End
Cable Switch
Grounded Metal
Sheath Direct
Bury Cable
Insulated
Front View

FIG IR 312

INTERPRETATION (Apr 30, 82)

Rule 239F1 allows grounded metal-sheathed cables to be fastened directly to the surface of a line structure. Rule 239F3 allows the cables to be protected by an effectively grounded metal covering, no additional nonmetallic protection is required as long as trolley conductors or ungrounded luminaires are not within the communications space. No clearance requirement is specified under these conditions for your clearance "B". Rules 235 and 238, which affect your clearance "A", appear from the information that you provided to be the controlling rules in this case.

The illustration which you supplied shows no neutral conductor; we assume you refer to a delta system. Rule 238B requires 60 in of clearance between communications conductors and noncurrent-carrying parts of supply equipment. If such parts are effectively grounded, the clearance may be reduced to 30 in. In either case, Rule 235C requires the clearance between the communications conductors and the live parts of the supply cable/switch to be 60 in.

If the system which you intended to represent actually is a wye system of less than 8.7 kV line-to-ground and includes a multigrounded neutral, the CATV cable is required by Rule 235C to be located at least 40 inches below the live parts of the cables/switches and at least 40 in below the multigrounded neutral support.

241, 242 See 261H3 (1981) IR 346

242, Table 242-1

Grade of construction or joint use with 7.2 kV open wire above communication circuits

REQUEST (Apr 5, 82) IR 321

With the use of larger conductors and higher voltage circuits, the classes of wood poles necessary to support these lines are reaching and sometimes exceeding practical limits. Although we are located in the "Medium Loading District" our lines are constructed using the guidelines for "National Electrical Safety Code (NESC) Heavy Loading" and this is a practice we wish to continue.

My question addresses Rule 242, "Grades of Construction for Conductors", as it applies to jointly used lines of open supply conductors above telephone and/or cable TV conductors. Table 242-1 specifies that for open supply conductors exceeding 8.7 kV above communications conductors, Grade B construction be used, unless both requirements of Footnote 8 are fulfilled.

I am confident that we satisfy the requirements of part (1) of Footnote 8. This is accomplished by station relaying, line reclosures and coordinated fusing. It is the intent and requirements of part (2) of Footnote 8 that I am in doubt about.

Discussions I have had with engineers associated with local telephone and cable TV companies indicate that the only protective devices utilized in their communication plants are small surge type arresters. These devices are normally located at their switching or distribution stations and/or along various points of their distribution systems. They are quick to point out, however, that these devices are not intended to protect their systems from the kinds of power surges that can be inflicted by contact with our open supply conductors.

The telephone company attempts to size their conductors to either trip our breaker devices or to fuse open in case of contact with open supply conductors.

If these are indeed the communication protective devices referred to in part (2) of Footnote 8, I feel that we are then obligated to use Grade B construction for all joint use poles of our 7.2 kV and above open supply lines. If they are not, what type of protective devices are being referred to and would Grade C construction be allowed for the situation described above?

INTERPRETATION (July 29, 82)

Footnote 8(2) of Table 242-1 should be read in conjunction with Rule 287. If the communications utilities meet the requirements of Rule 287, then the requirements of Footnote 8(2) of Table 242-1 would be met. Typically such measures as those listed in Rule 287 are used in conjunction with bonding of the communications cable messenger(s) to the neutral of the electric supply system in order to limit the voltage which can be impressed on the communications facilities to a level at which those measures can protect customer's premises.

242, Table 242-1, 1977 Edition and Table 15, 1973 Edition

4.8 kV ungrounded delta, change from grade C to B believed inadvertent when Footnote 7 changed

REQUEST (Mar 25, 81) IR 294

Applicable conditions concern constant potential supply conductors, open construction, at 4800 V line-to-line supplied by ungrounded delta transformation. These supply conductors are above communication conductors on the same structure.

Clarification is needed as to the required construction grade and associated footnotes.

The 1973 Edition Table 15 dealt with line-to-line voltages and permitted Grade C construction via footnote 7.

TABLE 15.—*Grades of construction for supply conductors alone, at crossings, at conflicts, or on same poles with other conductors*

[All voltages are between wires except as indicated. Corresponding voltages to grounded neutral of grounded circuits are shown in parentheses. In applying the table to two-wire grounded circuits use the "to neutral" voltage. The grade of construction for any particular supply conductors, as indicated across the top of the table according to type, location and voltage, should meet the requirements for *all applicable situations at lower levels* as to other conductors, tracks and rights-of-way as indicated in the left-hand column]

Supply Conductors at Higher Levels[1] / Conductors, trucks and rights of way at lower levels	Constant-potential supply conductors other than direct current railway feeders			
	750 to 8700 Volts. (750 to 5000 Volts to Neutral)			
	Urban		Rural	
	Open	Cable	Open	Cable
Communication conductors—Urban or Rural, Open or Cable[6]	B[7,8]	C	B[7,8]	C

[7]Grade C construction may be used, if the voltage between wires does not exceed 5,000 volts (2900 volts to neutral).

[8]The supply conductors need only meet the requirements of grade C construction if both of the following conditions are fulfilled:

(1) The supply and communication circuits are so constructed, operated and maintained that the supply voltage will be promptly removed from the communication plant by deenergization or other means, both initially and following subsequent breaker operations in the event of a contact with the communication plant.

(2) The voltage and current impressed on the communication plant in the event of a contact with the supply conductors are not in excess of the safe operating limit of the communication protective devices.

However, the 1977 Edition, Table 242-1 indicates the voltage values in the table refer to line-to-ground values except for ungrounded systems which require a line-to-line voltage application to the values listed. Footnote 7 was subsequently simplified and no longer permits Grade C construction for the identical previously defined conditions.

Table 242-1. Grades of Construction for Supply Conductors Alone, at Crossing, or on the Same Structures With Other Conductors

(The voltages listed in this table are line to ground values for: effective grounded ac circuits, two wire grounded circuits, or center grounded dc circuits; otherwise line to line values shall be used. The grade of construction for supply conductors, as indicated across the top of the table, must also meet the requirements for any lines at lower levels except when otherwise noted.)

Supply conductors at higher levels [1] / Conductors, tracks and rights of way at lower levels	Constant-potential supply conductors			
	0.75—8.7 kV			
	Urban		Rural	
	Open	Cable	Open	Cable
Communication conductor: Urban or rural, open or cable(6)	(7) (8)B	C	(7) (8)B	C

(7)Grade C construction may be used if the voltage does not exceed 2.9 kV.

(8)The supply conductors need only meet the requirements of grade C construction if both of the following conditions are fulfilled:

(1) The supply voltage will be promptly removed from the communication plant by de-energization or other means, both initially and following subsequent circuit breaker operations in the event of a contact with the communication plant.

(2) The voltage and current impressed on the communication plant in the event of a contact with the supply conductors are not in excess of the safe operating limit of the communication protective devices.

I believe this change to be unintentional and resulted when simplifying the tables and footnotes. Please clarify.

INTERPRETATION (June 5, 81)

A review of available documentation plus inquiry of key committee personnel fails to indicate whether the change calling for Grade B construction when 4800 V delta is above communication facilities was or was not inadvertent. The change was not challenged when it was proposed. The revised rule was not challenged during preparation of the 1981 Code. Accordingly, Footnote 7 to Table 242-1 must be regarded as having the same validity as other parts of the Code. However, Grade C construction may be used where the requirements of Footnote 8 are met.

250

Tension (initial or final) during extreme wind loading calculations

REQUEST (Aug 26, 82) IR 332

Rules 250A, 250B, 250C, 251A and 251B refer to various loading conditions, but do not state whether an initial or a final condition should be used. ... request ... to ask whether an initial or final wire tension should be used in applying the Extreme Wind Condition referred to in Rule 250C, and in applying the loading components in Rule 251B. In other words, for Florida, Rules 250 and 251 require a wind of 9 PSF at 30°F, with a constant of 0.05. Is this an initial or final tension? Since your interpretation will greatly affect our wood pole design loading criteria, I would appreciate an early answer to the above request.

INTERPRETATION (Mar 23, 83)

The Code requirements are to be met during the life of the installations to which they apply, including both at the time of initial installation and after final loading has occurred.

251 See 250 IR332

261A Table 261-3

Application of "when installed" and "at replacement" values

REQUEST (Jan 25, 83) IR 336

Regarding the terms "when installed" and "at replacement" used in Rule 261A, Table 261-3, which of the following statements is applicable:

(1) Use "when installed" values for computations of all initial loads applied at the time of construction or when considering the maximum load addition permissible on an existing pole line.

Use "at replacement" values when determining whether an existing pole shall be changed due to deterioration.

(2) Use "when installed" values for computation of all initial loads applied at the time of construction.

Use "at replacement" values when determining whether an existing pole shall be changed due to deterioration or when determining the maximum load addition permissible on an existing pole line.

INTERPRETATION (Sept 2, 83)

Your "Statement (1)" is correct unless the addition qualifies as a temporary installation under Note 1 to Table 261-3, in which case your "Statement (2)" applies.

261A1, Tables 261-1 and 261-2, 1981 Edition

Structure load stress vs allowable stress basis (yield, proportionality, AISC allowable)

REQUEST (Sept 9, 83) IR 348

Rule 261A1 reads:

"... The structures shall be designed to withstand the loads in Rule 252 multiplied by the appropriate overload capacity factors given in Tables 161.1 or 161.2 ..." (The underlining is mine).

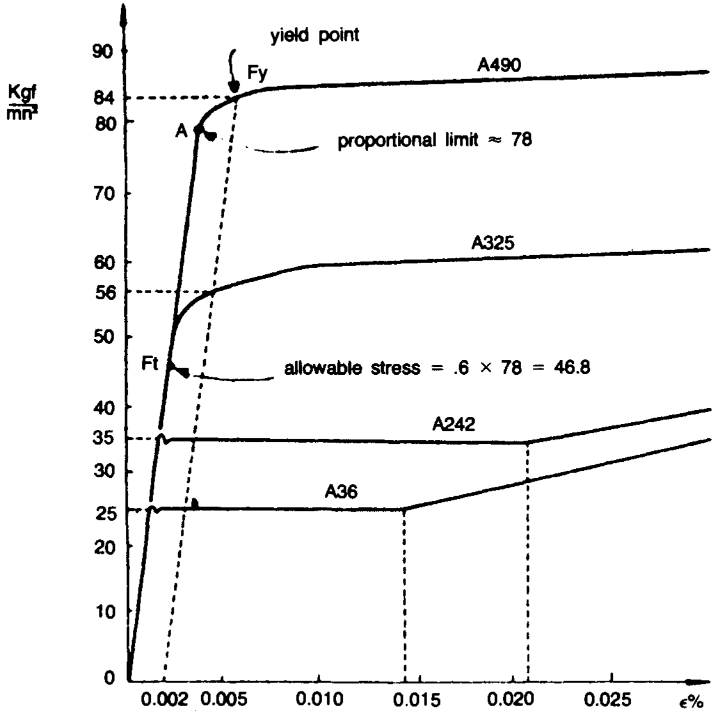
No indication is given to which reference the stress after the application of the overload capacity factor must be compared. For instance, the following points could be used for structural steel ASTM 490 (See attached Fig IR 348):

Fy: 80 kgf/mm^2 – the yield point
A : 78 kgf/mm^2 – the proportionality limit
Ft: 46.9 kgf/mm^2 – the allowable stress; calculated at 60 percent yield as per AISC specifications.

Note that the subject National Electrical Safety Code (NESC) tables give values as low as 1.0-1.1 for Grades B and C. If NESC recommends yield, those values are extremely low in comparison with metal users and several international standards. For instance, the adoption of the AISC of stresses up to 60 percent yield is equivalent to an overload capacity factor of 1.67 (1/.6).

INTERPRETATION (Jan 17, 84)

Rule 261A1 requires covered facilities to withstand the loads plus overload capacity factors required. The NESC no longer specifies the type of stress to be considered; 'withstand' is not specially defined. The usual dictionary definition is applicable. Rule 010 plainly states that the Code is not intended to be a design manual. Please note that Section 23 requires flexure of structures to be considered when determining clearance requirements.



Stress-strain diagram of selected ASTM structural steels

261A, B, C

Overload capacity factors: Wire tension load vs wind or weight load

REQUEST (Oct 25, 82) IR 335

A recent question has been asked concerning overload factors indicated in Section 26, Strength Requirements, of the 1981 National Electrical Safety Code (NESC). Regardless of the grade of construction or the condition being checked, the following question was asked, "Why is the overload factor for wire tension always less than that required for wind or weight calculations."

INTERPRETATION (Mar 22, 83)

This is not a request for an interpretation but is a request for information; accordingly, no official response of the Interpretations Subcommittee will be given.

SECRETARIAT NOTE:

The NESC reflects the practical experience of the codifying engineers throughout this century. The differences in Overload Capacity Factors to which you refer result from the experienced and expected differences in controllability and consistency among the different types of loads.

261A2, Table 261-3

At crossing, Grade C construction

REQUEST (July 21, 81) IR 302

Will you please provide a clarification on the definition of "crossing" as applied to a supply or communications line with regard to the requirements of Section 24—Grades of Construction and Section 26—Strength Requirements, in particular Table 261-3 in the 1981 edition of the National Electrical Safety Code (NESC). The question arises as to when Grade C "at crossing" is required as opposed to Grade C construction when a supply line is built over another supply line or communication line. In particular the following three cases are involved in the situation with which we are concerned:

Case A—Crossing in span.
This is the case where a supply line span crosses over another supply or communication line. (See Fig IR 302-1).
There appears to be no question that this is considered a crossing and that the upper supply line must be constructed to meet the safety factors required for Grade C at crossing as listed in Table 261-3.

Case B—Nonparallel lines attached to same pole.
This is the case where a supply line is located above another supply or communication line running in a different direction and both are attached to the same joint use pole. (See Fig IR 302-2)
The Code is unclear as to whether this situation simply constitutes a joint use attachment or is considered a crossing for the purposes of determining the grade of construction in Table 261-3.

Case C—Parallel lines—joint use construction.
This is the case where a supply line is located above another supply or communication line utilizing common poles for joint use construction. (See Fig IR 302-3)
The Code indicates that this type of construction is not considered to constitute a crossing and the upper supply line may be constructed to the safety factors required for Grade C construction as listed in Table 261-3.

Would you please comment on these three cases and our interpretation of the meaning of the term crossing. Note that crossing is not defined in the Definitions section of the code.

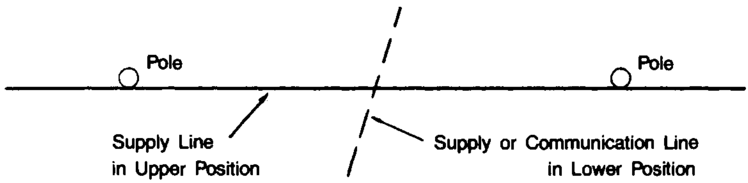


Fig IR 302-1

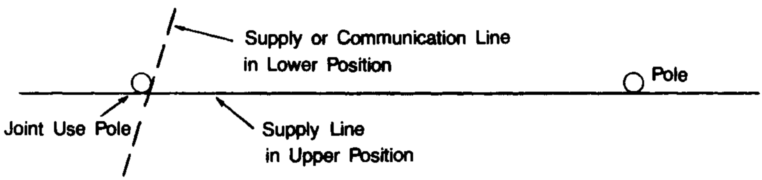


Fig IR 302-2

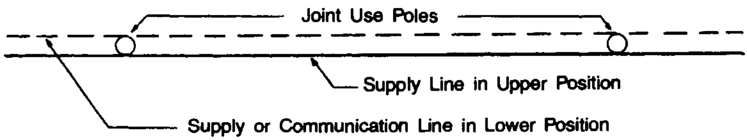


Fig IR 302-3

INTERPRETATION (Feb 17, 82)

It is clear from the titles of Tables 242-1 and 242-2 that all three illustrations that you have used require Grade C constructions. However, only Case A and Case B are at crossing. Colinear, joint-use construction is not considered to be at crossing.

For your information, we have enclosed a copy of excerpts from the official Discussion of the 5th Edition of the NESC. From the language included therein concerning both Section 24 and Section 26, it is apparent that the intention has always been for the grade of construction to be upgraded when one line is above another, whether or not attached to the same pole(s). Although the Code establishes the required grade of construction without distinguishing between a crossing and colinear, joint-use construction, it does distinguish between a crossing and colinear, joint-use construction for determination of some overload capacity factors.

261A2e

Overload capacity factor for guyed pole used as a column

REQUEST (Mar 17, 82) IR 317

We would like an interpretation of Rule 261A2e of the 1981 edition of the National Electrical Safety Code (NESC). We would like to know which Overload Capacity Factor for Grade B construction, from Table 261-3, to use when designing a guyed pole as a column.

INTERPRETATION (July 22, 82)

Rule 261A2d and Table 261-3 must be considered when fulfilling the requirements of Rule 261A2e. The column must be designed to take (a) the vertical component of the wind loading times the OCF of 4 plus (b) the vertical component of the wire tension loading times the OCF of 2.

261A4a, second paragraph

Location of high longitudinal strength structures with respect to higher grade section in line of lower grade construction

REQUEST (Dec 19, 80) IR 285

We require a clarification of 1981 National Electrical Safety Code (NESC) Rule 261A4a, "Longitudinal Strength Requirements for Sections of Higher Grade in Lines of a Lower Grade Construction, Methods of Providing Longitudinal Strength, Grade B".

Our particular application involves a two-pole, H-Frame transmission line which includes a Grade B crossing. If the line is tangent, longitudinal strength requirements can be met if the crossing structures meet transverse requirements without guying (or cross-bracing) per Rule 261A2c, Exception 1. It is assumed that, if cross-bracing is added to reduce stresses on the crossarm bracing (where the poles already meet transverse strength requirements), the application of Exception 1 is still valid.

We find no rule which prohibits extension of Grade B construction beyond the crossing span. It is occasionally convenient and economical to extend Grade B construction and charge the grade of construction at dead-end structures remote from the Grade B crossing. Additionally, where an angle structure is required at a Grade B crossing, Grade B construction is extended to a tangent structure farther from the crossing and the change of grade is accomplished on an unguyed (unbraced) tangent structure using the reasoning of Rule 261A2c, Exception 1. For a transmission line with a ruling span exceeding 500 ft utilizing large diameter, high strength conductors, it is difficult to follow the logic of the span limitations included in the second paragraph of Rule 261A4a.

We would appreciate an explanation of the application of this second paragraph.

INTERPRETATION (Apr 16, 81)

First, there is no rule prohibiting extension of Grade B construction beyond the crossing span.

Second, Rule 261A4a represents an attempt to use the conductors themselves as guys, but recognizes this becomes ineffective with longer spans because of their greater sag.

261A, B, C, Tables 261-1 through 5

Overload capacity factor: wire tension load vs wind or weight load

REQUEST (Oct 25, 82) IR 335

A recent question has been asked concerning overload factors indicated in Section 26, Strength Requirements, of the 1981 National Electrical Safety Code (NESC). Regardless of the grade of construction or the condition being checked, the following question was asked, "Why is the overload factor for wire tension always less than that required for wind or weight calculation."

INTERPRETATION (May 22, 83)

This is not a request for an interpretation but is a request for information; accordingly, no official response of the Interpretations Subcommittee will be given.

SECRETARIAT NOTE:

The NESC reflects the practical experience of the codifying engineers throughout this century. The differences in Overload Capacity Factors to which you refer result from the experienced and expected differences in controllability and consistency among the different types of loads.

261H3a

Meaning of "crossings"

REQUEST (July 29, 83) IR 346

Paragraph 261H3a states "Splices should be avoided at crossings . . ." We would appreciate obtaining a definition of crossings as used in this paragraph, that is, what type of crossings (lines, roads, railroads, etc.) are included. Also, please let us know if this definition is applicable for other parts of the National Electrical Safety Code (NESC) where this term appears.

INTERPRETATION (Dec 6, 83)

The term crossing is defined as a general term in the Code because it may apply to different items in different parts of the Code.

The requestor is referred to Rule 015-Intent for the difference between the requirement of 'shall' and 'should'.

Rule 261H3 applies only to Grades B and C construction and is applicable wherever such construction is required by Rules 241, 242 and Table 242-1. Rule 241C of the 1984 Edition added a definition of 'At Crossings' which is applicable in this case.

262A2e

Overload capacity factor for guyed pole used as a column

REQUEST (Mar 17, 22) IR 317

We would like an interpretation of rule 261A2e of the 1981 edition of the National Electrical Safety Code (NESC). We would like to know which Overload Capacity Factor for Grade B construction, from Table 261-3, to use when designing a guyed pole as a column.

INTERPRETATION (July 22, 82)

Rule 261A2d and Table 261-3 must be considered when fulfilling the requirements of Rule 261A2e. The column must be designed to take (a) the vertical component of the wind loading times the OCF of 4 plus (b) the vertical component of the wire tension loading times the OCF of 2.

262A,C, Tables 262-1 and 3 See 261A,B,C, Tables 261-1 through 5 **IR 335**

262A Table 262-1 See 261A Tables 261, 2, 3 IR 335

262C Table 262-3 See 261A Tables 261-1, 2, 3 IR 335

273

Insulator rating

REQUEST (June 12, 81) IR 297

[Require] ... interpretative information on Section 273 (Table 273a-1) of the National Electrical Safety Code (NESC), 1981 Edition.

The quoted section provides that 12 kV nominal circuits require insulators with dry flashover rating of not less than 51.9 kV and that 21 kV nominal circuits require insulators with dry flashover rating of 70.9 kV.

A similar standard, based on the Standards of the American Institute of Electrical Engineers for Insulator Tests, Standard Number 41 dated March 1930, prescribes 52 kV and 73 kV, respectively.

Both codes specify that the dry flashover voltage shall be not less than these values.

A [state] utility has applied to this Commission for a deviation from the above requirement. It proposes to raise the nominal voltage of a number of 12 kV circuits on which insulators with a dry flashover voltage of 65 kV are installed to 21 kV which would require a 70.9 kV dry flashover insulator rating according to NESC and a 72.7 kV rating according to the applicable [state] order.

The interpretation ... [required] is whether the requested deviation from these standards would be deemed reasonable to your committee. I am particularly concerned with the possibility that the increased voltage would increase the leakage current through the wooden crossarms on which the insulators are mounted and thereby igniting the wood. Are there published standards for acceptable values of leakage currents and, if so, what are these values?

INTERPRETATION (Aug 21, 81)

Rule 013 requires that all new installations and extensions shall meet the requirements of the current edition of the NESC unless such requirements are waived or modified by the administrative authority. Where rules are so waived or modified, Rule 013 requires that equivalent or greater safety be provided in other ways.

Table 273-1 is a list of minimum insulation requirements. Rule 273 requires that the rated dry flashover voltage of an insulator or insulators shall not be less than the values shown in Table 273-1 and further requires that higher insulation levels or other effective means shall be used where unfavorable conditions exist. Rule 273 clearly requires that lesser ratings shall not be used unless a qualified engineering study of the operating conditions indicates that such insulation levels are not required.

The values in Table 273-1 and AIEE Standard No. 41 correspond to the bottom end of the 60 Hz test voltage ranges for insulators in common use at the voltages indicated and are essentially the same as those required since the Third Edition of the NESC in 1920.

Rule 273 may not be the controlling rule in the voltage conversion case that you have cited. Rule 235E, Table 235-6 and Rule 239D, Table 239-1 are examples of other rules which may be controlling.

Rule 013 allows types of construction and methods of installation other than those specified in the rules to be used experimentally to gain information."

280A1b, A2

Clarification of readily climbable with respect to a particular configuration

REQUEST (Feb 10, 84) IR 357

... are having difficulty in the interpretation of the terms "readily climbable" and "closely latticed" in the specific application of a tower built in 1911. We enclose two copies of prints of the tower, Fig IR 357-1 and Fig IR 357-2.

We note from Section 2 (Definitions of Special Terms) that "readily climbable" means:

> Having sufficient handholds and footholds to permit an average person to climb easily without using a ladder or other special equipment.

Does the tower in question have sufficient handholds and footholds to permit an average person to climb easily without using a ladder or other special equipment? Would your answer be different if there were no series of intended footholds starting at the location indicated on the drawing? How should we identify the "average person"? Does that term mean average height, average weight, average strength, average agility, average between children and adults, average between men and women, or something else? Does the word "easily" mean something less than the strength and agility required to do a chinup?

Would the tower be considered "closely latticed"?

Related references are 1984 National Electrical Safety Code (NESC), paragraph 280A2; IR 199 (29 Sep. 1977); IR 128 (19 Dec. 1969); IR 271 (30 Sep. 1980).

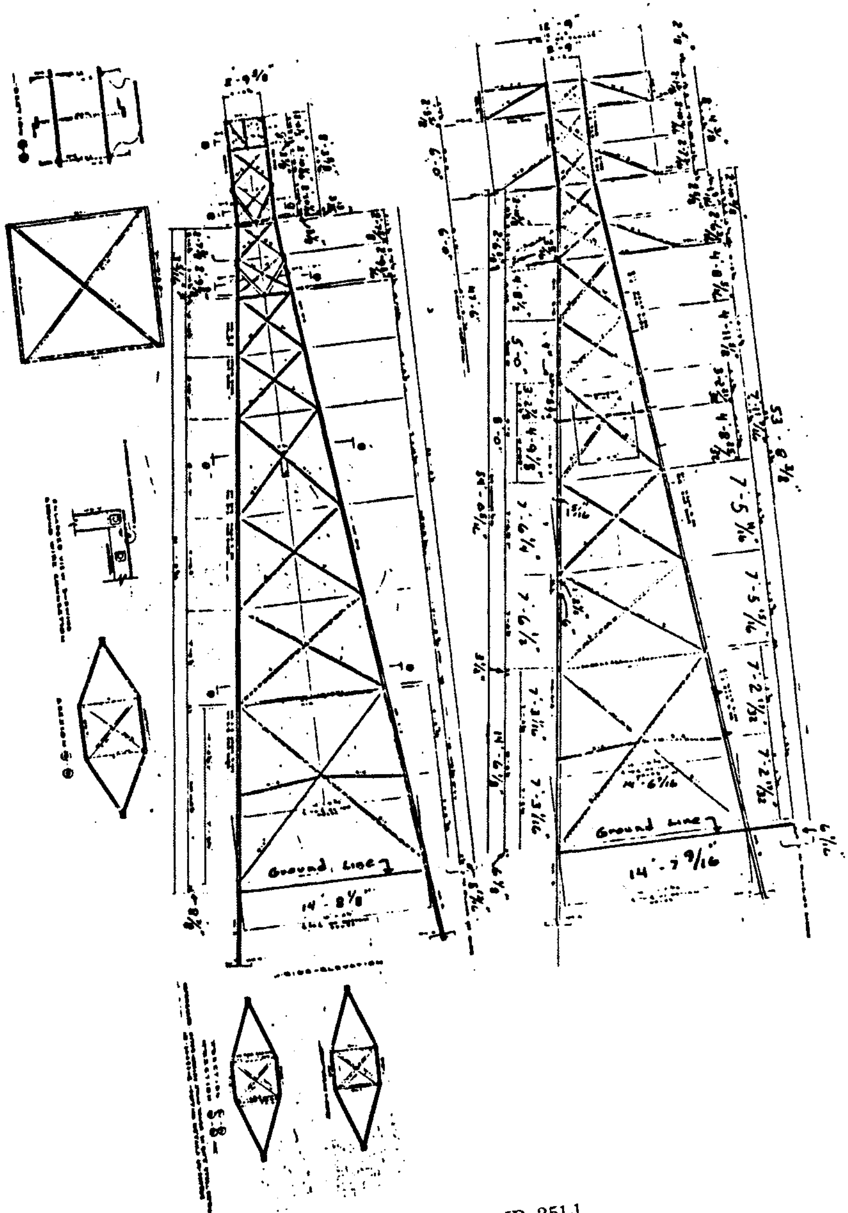


Fig IR 351-1

280Alb, A2

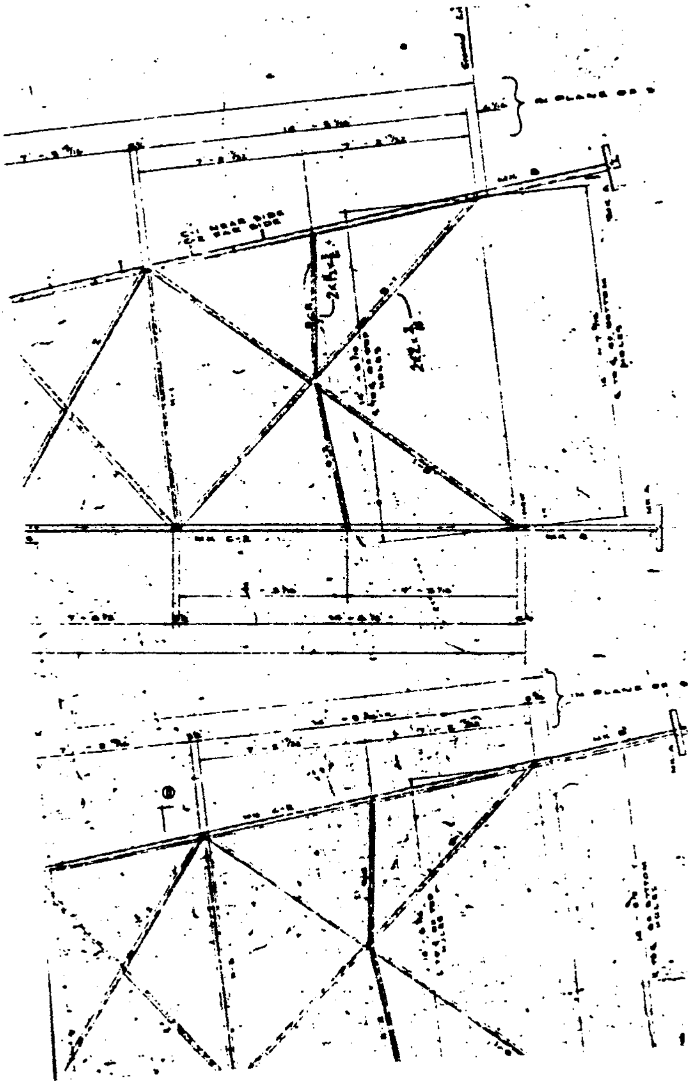


Fig IR 352-2

INTERPRETATION (Nov 10, 84)

The definition of 'readily climbable' includes the terms 'average person' and 'climb easily.' Standard dictionary definitions are intended to apply to all terms which are not specifically defined in the NESC or in IEEE Std 100-1977 *IEEE Standard Dictionary of Electrical and Electronics Terms.*

"The 'average person' can be considered as one of skill, training and motivation which may be commonly found; in this case, it is a person who is neither especially trained or motivated to climb nor especially strong. To 'climb easily' is to do so without special effort; in this case, it may be considered that to 'climb easily' is to do so without requiring strength, physical coordination or skills significantly different from that required to 'climb' a normal household ladder when such as ladder is in the vertical position.

"Towers and latticed structures which do not have handholds and horizontal step-like members within 8 feet of ground level that are so closely spaced as to resemble a normal household ladder are not considered to be readily climbable. Where cross members are widely spaced so as to require significant pulling or hanging with the arms, balancing on sloped members or like actions, the structure is not considered to be readily climbable. The structure to which you refer is not considered to be inconsistent with the requirements of the NESC.

280A See Section 2 Definitions: Readily Climbable IR 357

280A2a

Guarding of supporting structure potentially exposed to "abrasion" by traffic

REQUEST (Mar 1, 82) IR 315

... involved in a lawsuit regarding the location of an electric utility pole ... A driver drove his car off the exit ramp ... and into a wooden electric supply pole, causing the pole to crack and break. The pole did not fall immediately to the ground, however. The Plaintiff was driving in the area, saw the lights in the area go out, and a fire start in the grass around the pole. He went to assist the driver of the car, and while assisting him, the pole broke and the wires fell on the Plaintiff, entangling him and causing severe electrical shock. There were two three-phase electrical systems on the pole, each phase consisting of 7200 V. The wires were uninsulated. Apparently, a circuit breaker on one set of wires was activated and stopped the flow of electricity in the bottom set of wires, but the electricity in the top set of wires continued to flow until the wires fell on the Plaintiff.

... [Require] an interpretation of the National Electrical Safety Code (NESC) 280A2a, [1961 Edition]:

> "Where poles and towers are exposed to abrasion by traffic or to other damage which would materially affect their strength, they shall be protected by guards."

... interested in when a pole is considered to be subject to abrasion by traffic and the meaning of the term abrasion by traffic. I am also interested in when a pole is considered to be exposed to other danger that would materially affect its strength. In short, I am very interested in an interpretation of this section that would tell me when a pole is subject to the terms of this section so that guards are required.

INTERPRETATION (June 24, 82)

Rule 280A2a recognizes that there are some locations, such as street corners with lines running down both streets or in constricted alleys or parking areas, at which it is impractical because of building locations or other requirements to locate structures far enough away from the travelled way to prevent occasional rubbing against the structures by vehicles, such as by longchassis trucks or trailers turning corners in constricted areas or by tall trucks riding on severely-crowned roadways. In these cases, Rule 280A2a requires that the structure be protected from repeated abrasion which would affect the ability of the structure to meet the strength requirements of the Code. This guarding is often accomplished by placing a curved metal plate over the area most likely to be abraded so that the vehicle body would slide along the pole and not reduce its diameter by abrasion. Rule 280A2a does not require protection to prevent collision of a vehicle with the structure.

281

(a) Purpose of tree trimming

REQUEST (Oct 7, 83) IR 349

... need information regarding two sections of the National Electrical Safety Code (NESC). The first section which requires some interpretation is Section 281 of the 1981 edition of the Code. Section 281 addresses tree trimming. The interpretation or information needed is: was this section included for public safety or was its primary intent to prevent abrasion and damage to the overhead conductors?

INTERPRETATION (Jan 17, 84)

Rule 010—Purpose states the purpose of these rules; the safety of both utility employees and members of the public are considered.

281A See 215C2 IR 345

282E

Guy marker requirements in case of two guys on one anchor

REQUEST (Nov 15, 83) IR 350

This request is for interpretation of the configurations shown in the attached Fig IR 350-1 and Fig IR 350-2 with respect to Rule 282E of the National Electrical Safety Code (NESC).

Fig IR 350-1 represents ... Company['s] ... standard deadend construction where both the primary and neutral downguy strands are attached to the same anchor rod and anchor. NESC Rule 282E states that, "The ground end of anchor guys, exposed to pedestrian traffic, shall be provided with a substantial and conspicuous marker not less than 8 ft long". Will the configuration in Fig IR 350-1, with a single guy guard meet the requirements of Rule 282E, or will individual guards be required for both the primary and neutral downguy strands as shown in Fig IR 350-2?

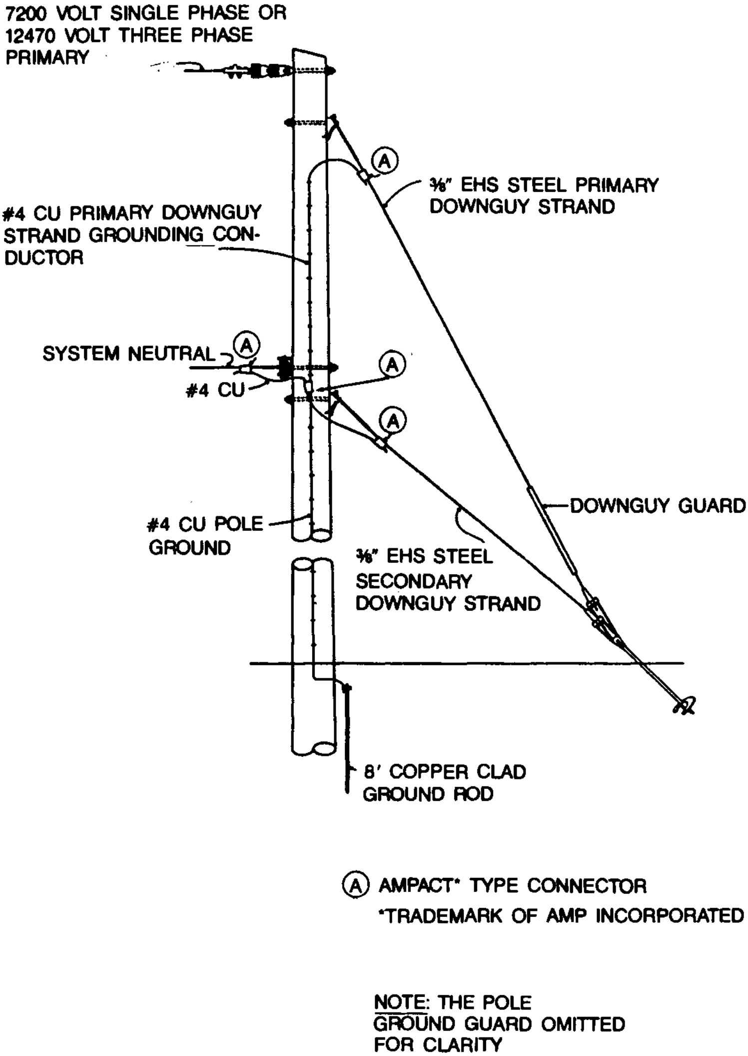

7200 VOLT SINGLE PHASE OR
12470 VOLT THREE PHASE
PRIMARY
#4 CU PRIMARY DOWNGUY
STRAND GROUNDING CON-
DUCTOR
SYSTEM NEUTRAL
#4 CU
#4 CU POLE
GROUND
A
⅜" EHS STEEL PRIMARY
DOWNGUY STRAND
DOWNGUY GUARD
⅜" EHS STEEL
SECONDARY
DOWNGUY STRAND
8′ COPPER CLAD
GROUND ROD
A AMPACT* TYPE CONNECTOR
*TRADEMARK OF AMP INCORPORATED
NOTE: THE POLE
GROUND GUARD OMITTED
FOR CLARITY

Fig IR 350-1

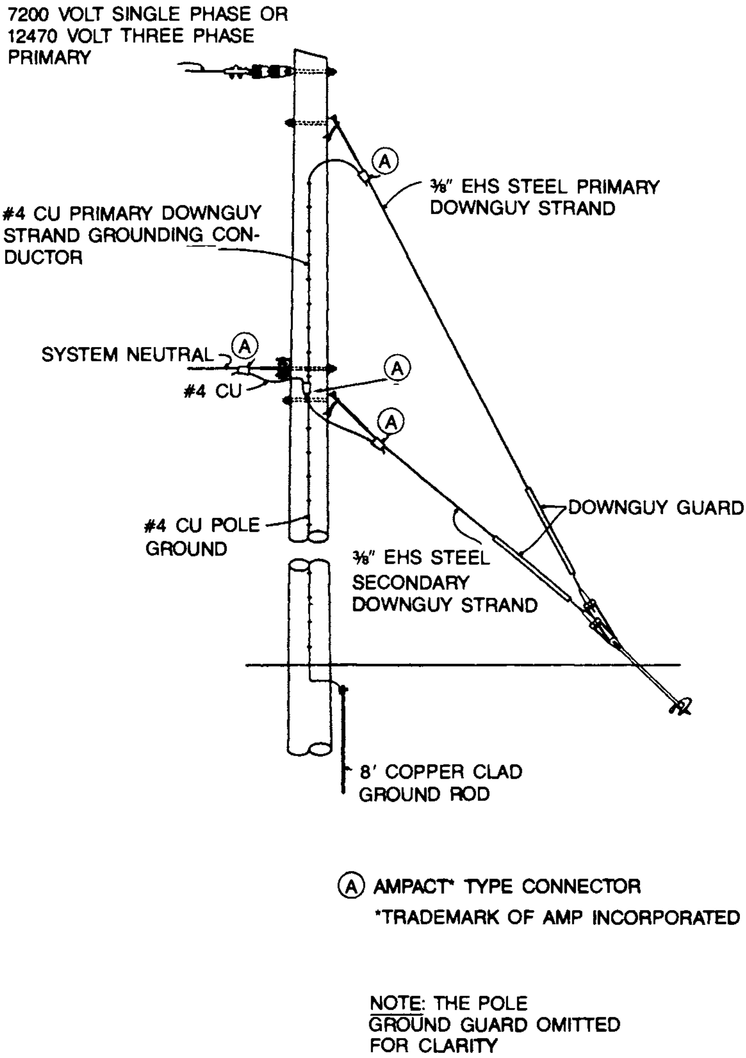
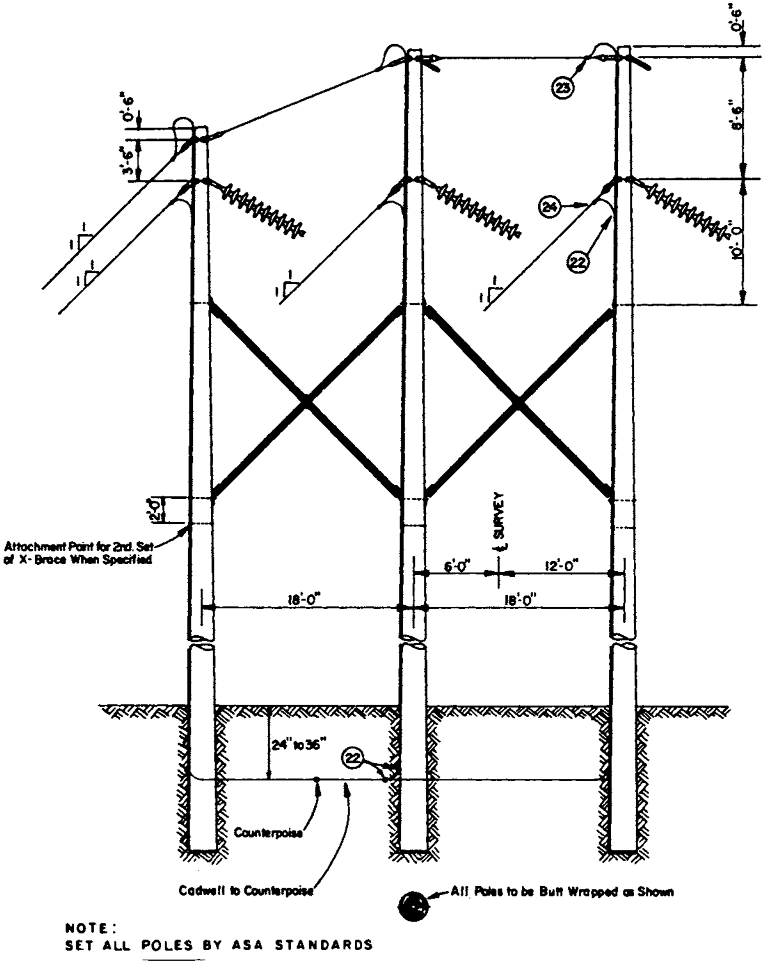

7200 VOLT SINGLE PHASE OR
12470 VOLT THREE PHASE
PRIMARY
#4 CU PRIMARY DOWNGUY
STRAND GROUNDING CON-
DUCTOR
⅜" EHS STEEL PRIMARY
DOWNGUY STRAND
SYSTEM NEUTRAL
A
#4 CU
A
A
A
DOWNGUY GUARD
#4 CU POLE
GROUND
⅜" EHS STEEL
SECONDARY
DOWNGUY STRAND
8' COPPER CLAD
GROUND ROD
A AMPACT* TYPE CONNECTOR
*TRADEMARK OF AMP INCORPORATED
NOTE: THE POLE
GROUND GUARD OMITTED
FOR CLARITY

Fig IR 350-2

INTERPRETATION (Feb 28, 84)

Rule 282E requires anchor guys which are exposed to pedestrian traffic to be made conspicuous by the addition of a marker on the ground end of the guy. The rule requires a marker at the ground of such guys. Where more than one guy attaches to the same anchor, a marker may be placed on each, but only one is required for the assembly by the rule. The required marker should be placed on the guy which is most exposed to pedestrian traffic so that it fulfills the function of conspicuous visibility to approaching pedestrians. The NESC does not specify the guy upon which the marker should be placed.



115KV TRANSMISSION LINE STANDARD
SSPO-L1 ANGLE (17° TO 35°) STR.

283C

Guy strand insulation for corrosion reduction

REQUEST (Sept 12, 83) IR 347

... request ... your interpretation of the National Electrical Safety Code (NESC) Rule 283C regarding corrosion protection of guy anchors. Our present standard on wood pole construction is to ground the overhead shield wire to a copperweld ground wire on each pole. The ground wire is wrapped around the butt of the pole and is also bonded to the counterpoise system. In addition, each pole of the two- or three-pole structure is bonded to each other to form a structure grounding system. The guy wires are then bonded to the structure grounding system at their respective points of attachment, as shown on the attached drawing Fig IR 347.

With this structure grounding system, the guy anchors have been experiencing rapid deterioration due to galvanic reaction between the anchor and grounding materials. We have considered several possible solutions to this problem and request your interpretation as to what will satisfy the intent of Rule 283C.

One solution being considered is the installation of a guy strain insulator, commonly called a "Johnny Ball", mid-way up the guy wire, to isolate the guy anchor electrically.

(1) My primary concern is whether additional grounding would be required at the anchor for the lower guy to be in conformance with Rule 283C of the Code, even though the upper guy lead is bonded to the structure grounding system.
(2) Does the Code allow for reduced flashover on the insulator in this situation?

Another solution being considered would involve the coating of either the anchor itself or the guy wire grip hardware attached to the anchor with an insulating material. This would isolate the anchor from the grounding circuit, while still bonding the guy wire to the structure grounding system at the upper attachment location.

(3) Would additional grounding at the anchor be required to be in Code compliance?
(4) What would be the flashover requirements of this insulating material to be in compliance with the Code?

INTERPRETATION (Dec 6, 83)

If the upper portion of the guy meets the requirements of Rule 215C2, the answer to Questions 1 and 3 is NO.

Rule 283 does not contain flashover requirements for insulators placed in guy strands solely for the purpose off elimination of corrosion.

286C,D See 124A1 **IR 355**

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

Part 3

(Sections 30-39).

314B See 92D **IR 298**

314B See 93C7 **IR 356**

323

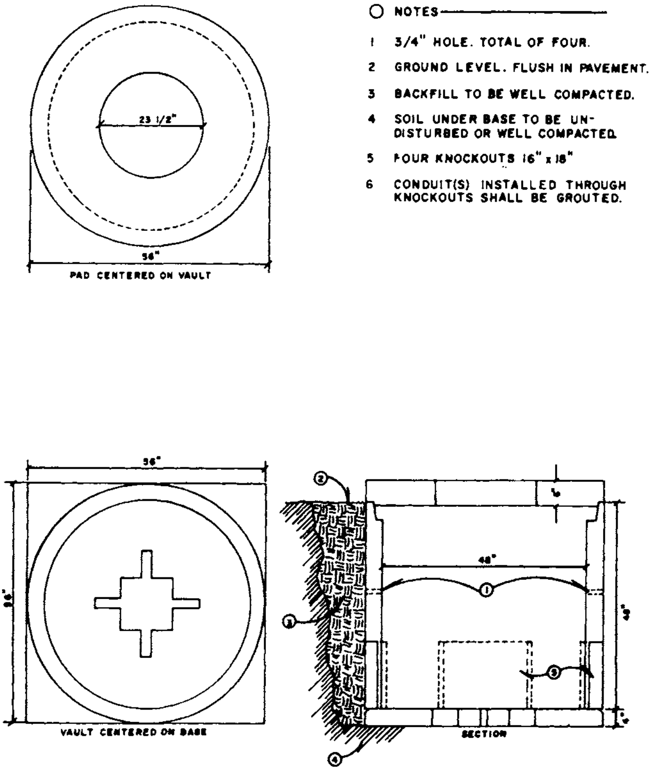
Classification of below grade structure

REQUEST (Mar 18, 82) IR 316

Enclosed is a drawing of below grade structures that ... [our] Electric Company uses in construction of underground primary power systems. The structure consists of a 48 in ID concrete cylinder that is 48 in high. The flat top is traffic rated and has an access opening 23½ inches in diameter.

The structures are used for cable splices at junctions in conduit runs. No submersible equipment is located within these structures. On occasions, the entire concrete top cannot be removed and splicing must be done by a man entering the structure through the 23½ in access opening.

Are these structures classified as manholes or as vaults for the purpose of applying Section 323 of the National Electrical Safety Code (NESC)?



	APPROX. WT.		H.C. MAT. #
PAD	= 1100	LBS.	40400
BASE	= 1100	LBS.	40150
VAULT	= 2500	LBS.	40750

SPLICE VAULT

SCALE 1/2" = 1' | MAR 1981

Fig IR 316

INTERPRETATION (July 22, 82)

The drawing provided (Fig IR 316) shows a manhole which does NOT meet the requirements of Rules 323B or 323C1. If the opening was 26 in or larger in diameter, both rules would be met.

323F2

Door latch operation from inside requirements; applicability to hinged-door cover on below grade structure

REQUEST (Mar 18, 82) IR 318

Attached is a description of a situation involving the interpretation of Rule 323F2 concerning the design of access door locks used on underground manholes....

Rule 323F2 requires access doors to be designed so that a person on the inside may exit when the door is locked from the outside.

We have interpreted Rule 323F2 to apply to walk-in type doors on utility tunnels and vaults such as those mentioned in Rule 323F1.

We have not interpreted Rule 323F2 to apply to hinged-door, rectangular access openings located on top of below-grade manholes. It is our contention that steel doors which cover rectangular access openings on the top of manholes are not true access doors as covered by Rules 323F1 and 323F2.

We feel our steel doors are only hinged covers for manhole access openings as covered by Rule 323C1. Therefore, we have not included internal unlocking features on our manhole doors.

Some pertinent facts to support our decision not to include internal operators (Rule 323F2) on our manhole door locks are as follows:

(1) The manholes are below-grade and must be entered from above through rectangular access openings in the top of the manhole. These rectangular openings are covered by hinged steel doors.
(2) The steel doors are locked with integral, flush fitting locks (not a padlock-latch system). The locks must be manually turned to the lock position and cannot be accidentally locked by inadvertent door closings.
(3) The rectangular access openings' steel doors feature slide bars to hold the doors in the open position. These slide bars prevent accidental door closings.
(4) The manholes are not equipped with permanent ladders. Portable ladders which extend up through the rectangular opening are used to enter the manholes.
(5) Company safety procedures prohibit the steel doors to be closed when employees are inside the manhole.
(6) Company safety procedures require another employee to be available outside the manhole when an employee is inside.
(7) Company safety procedures require the manhole doors to be locked when not continuously attended by an employee.

We have not had any reported cases of an employee or anyone else being locked in one of our manholes. We feel our interpretation of Rule 323F2 is supported by our manhole design and company safety procedures which provide safe access to our manholes without internal operators on the steel door locks.

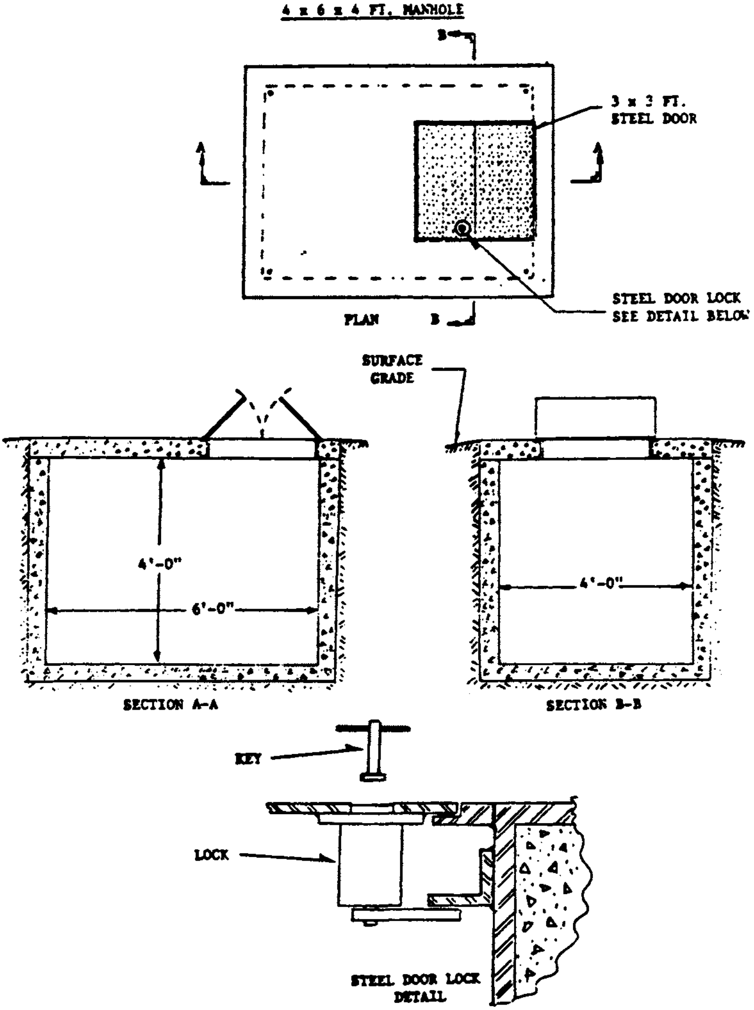


Fig IR 318-1

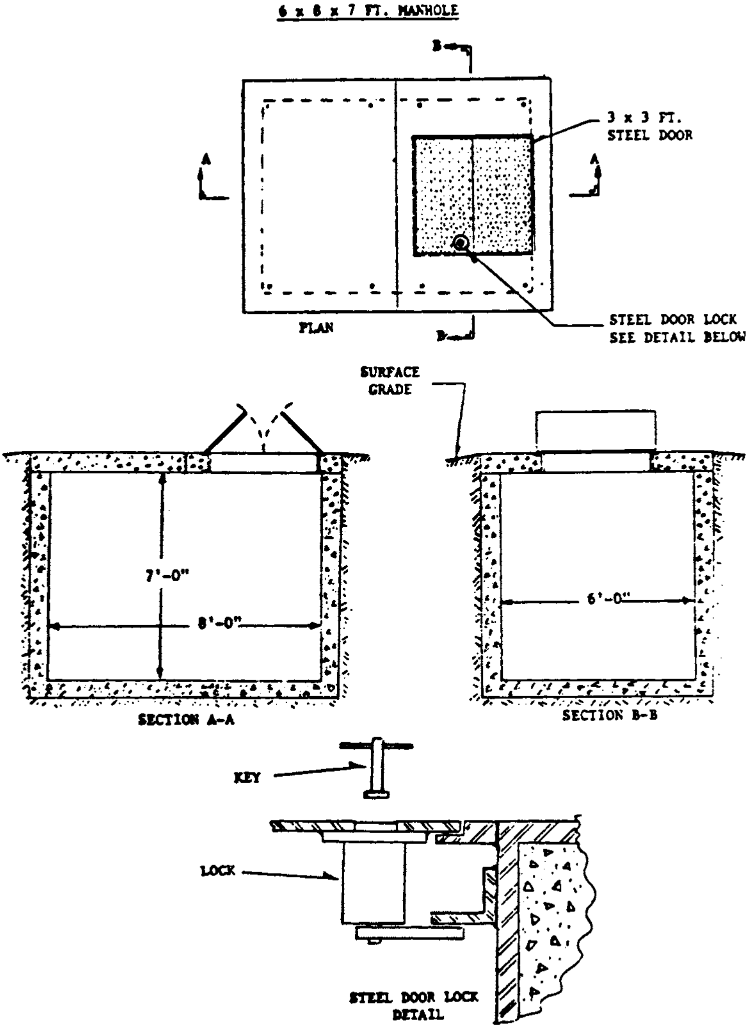


Fig IR 318-2

INTERPRETATION (July 22, 82)

Rule 323F2 does not apply to hinged manhole covers of the type described.

353D2

Depth of burial in rock and acceptable supplemental protection

REQUEST (June 29, 81) IR 301

Concerning rule 353D2c we are at times unable to obtain the depth specified in 353D2a for voltages at 600 and below or 601 to 22,000 due to rock and need to know if and at what depth the following would be necessary and adequate for supplemental protection:

(1) Schedule 40 PVC
(2) Steel IMC
(3) PVC encased in concrete

INTERPRETATION (Sept 3, 81)

Rule 353D1 indicates the requirement which must be met if Rule 353D2c is used. The supplementary protection must be sufficient to protect the cable from injury or damage imposed by expected surface usage.

The extent of the supplementary protection required depends upon the depth which can be achieved and upon the surface usage. It is the responsibility of the design engineer to consider these factors in the analysis used to select the supplementary protection.

In any such installation, the requirements of Rules 94B5, 94B6 and 354C2 continue in force.

Transitions from the required burial depths of Rule 353D2a to the lesser depths of Rule 353D2c must also be supplementally protected. The possibility of electrolytic reactions between the concentric neutral and the supplemental protection are a design consideration.

353D2c

Definition of "supplemental protection"

REQUEST (Oct 21, 82) IR 334

I would like an interpretation of 353D2c, "Lesser depths than indicated above may be used where supplemental protection is provided". In this section, what is meant by "supplemental protection"? This is to be used in a URD cable burial depth standard for our company.

INTERPRETATION (Mar 22, 83)

This question was answered in IR 301. The Interpretations Subcommittee response to IR 301 is valid generally and is specifically valid here, as well.

354E2

Applicability of requirement for GF indication system

REQUEST (Mar 13, 84) IR 358

... please provide ... an interpretation for Rule 354E2 in the 1984 Edition of the National Electrical Safety Code (NESC) by answering the following question: Does this rule apply in the case of a single direct buried 480 V ungrounded delta supply circuit installed by itself where the facility consists of three separate conductors or single-conductor cables installed with random separation? (I presume that if this facility consisted of a bundled triplex type of facility or a multiple conductor cable 354E2 would not apply because closely fixed rather than random separation would exist. A dig-in would be expected to cause a phase-to-phase fault instead of phase to ground. If this assumption is incorrect, please let me know.)

... question hinges on the determination of whether individual conductors or cables of a single supply circuit installed randomly by itself in a trench are covered by Rule 354. The definition of random separation and the first sentence of Rule 354 seem to indicate that the referenced ungrounded 480 V delta installation may be covered by Rule 354 including 354E2. On the other hand it can be argued that 354E (Protection) was intended to apply only to the specific types of installations covered by Rule 354, namely, more than one supply circuit (354A), more than one communication circuit (354B), supply and communication facilities buried together (354C) and more than one cable system (354D); and further, that since none of these prior sections of Rule 354 specifically apply to individual conductors or single-conductor cables of the same (single) supply circuit buried together, it was not intended that 354E2 should be so applied.

Discussion

So far as I can determine most utilities are not installing ground fault indication systems for direct buried ungrounded 480 V delta supply circuits with random placement of the three individual conductor or cables as a single-circuit installation. I don't know whether ground fault indication systems are being used for over 300 V ungrounded supply circuits installed with another supply or communication facility, but 354E2 would clearly seem to require this whether the ungrounded supply circuit was a facility consisting of individual conductors/cables randomly placed or a bundled or cable facility.

The random separation requirement initially appeared in the March 1968 code as Rule 294D of Supplement 2 of NBS (National Bureau of Standards) Handbook 81.

REVISION OF SUBSECTION 294—PART 2 OF THE NATIONAL ELECTRICAL SAFETY CODE

294. PROTECTION AND SEPARATION OF CONDUCTORS BURIED IN EARTH

D. Random Separation Between Supply and Communication Conductors

Communication and supply conductors or cable may be buried together at the same depth with no deliberate separation between facilities, provided the following conditions and requirements are met:

1. Voltage
   (a) Grounded wye supply systems shall be operated at voltages not in excess of 22,000 volts to ground.
   (b) Delta supply systems shall be operated at voltages not in excess of 5,300 volts phase to phase.
2. Bare Grounded Conductor
   (a) A supply facility operating above 300 volts to ground must include a bare grounded conductor in continuous contact with the earth. This conductor, adequate for the magnitude and duration of the fault current imposed, shall be one of the following:
      (1) a sheath or shield
      (2) multiple concentric conductors closely spaced circumferentially
      (3) a separate bare conductor in contact with the earth and in close proximity to the cable when such cable(s) have a grounded sheath or shield, which shall also be adequate for the magnitude and duration of the fault currents imposed, but not necessarily in contact with earth.

      Note: This is applicable when "cable in nonmetallic duct" is considered as a direct buried cable installation and random separation is desired.

      Exception: Where a buried system passes through a short section of conduit, such as under a roadway, the contact with earth of the grounded conductor can be omitted, provided the ground conductor is continuous through the conduit.
   (b) The bare conductor(s) in contact with the earth shall be of suitable corrosion resistant material.
3. Delta Supply Cables
   Delta supply cables operating above 300 volts to ground shall be of a duplex or triplex concentric shield construction or single conductor concentric cables maintained in close proximity to each other.
4. Protection

(a) Supply circuits operating above 300 volts to ground shall be so constructed, operated and maintained that, when faulted, they will be promptly deenergized initially or following subsequent protective device operations. (Phase-to-ground faults for wye circuits, phase-to-phase faults for delta circuits.)

(b) Communication protective devices shall be adequate for the voltages and currents impressed on them in event of contact with the supply conductors.

(c) An adequate bond shall be provided between the grounded supply conductor(s) and the communications cable shield or sheath. (Preferable intervals not to exceed 1000 feet.)

(d) Ungrounded delta supply circuits operating above 300 volts to ground shall be equipped with a ground indication system.

... and was applicable to only communication and supply conductors buried together. Section 294D4d required a "ground indication system" for ungrounded delta supply circuits operating above 300 V to ground, which would not include 480 V delta circuits.

The random separation requirements in essentially their present form appeared in the 1973 Edition of the NESC with relatively minor changes in the 1981 and 1984 editions. For the first time the rule covered supply-supply (354A), communication-communication (354B) and multiple cable systems (354D) in addition to the supply-communication systems (354C). The 354E Protection requirements were also revised for the 1973 edition and these included the present requirement of 354E2 for a "ground fault indication system" for ungrounded supply circuits operating above 300V (instead of above 300 V to ground as provided for in 1968). Also, the first sentence of 354 was added below the title of Rule 354. This states that the random separation rule applies to "cables or conductors" with spacing less than 12 inches and contains no reference to circuits or systems.

.... From the earliest (1971) draft ... the present language of 354E2 appeared and remained in its present form.

The substance of the sentence of Rule 354, below the title, first appeared in a different form and location in a draft sent on June 25, 1971 to members of the subcommittee. It then appeared as a note in 354C (obviously misplaced) and read as follows:

"Note: These rules apply to supply and communication facilities when the radial separation between them will be less than 12 in."

A copy of that portion of the draft which also contains ... notes [See immediately below].

B. Communication Conductors or Cables

Note: These rules apply to supply and communication conductors or cables when the radial separation between them will be less than twelve (12) inches.

The conductors or cables of a communication circuit and those of another communication circuit may be buried together and at the same depth with no deliberate separation between facilities provided all parties involved are in agreement.

... The revised sentence appeared in its present language in the September 1971 draft of Part 3 as a note located immediately under the title of 354. (See below).

354 Random Separation—Additional Requirements

Note: These rules apply to conductors or cables when the radial separation between them will be less than twelve (12) inches.

... The word "note" was stricken in the March 1972 draft of Part 3 and the sentence and location have not been changed since.

One might reasonably ask what would be accomplished from a public or employee safety standpoint by installing a ground fault indication system for these conductors/cables of a single ungrounded 480 V circuit installed alone with random separation. The principal reason for excavating to such conductors would be to repair a known failure of some kind. The fact that a failure existed would of itself be evidence of a hazard if the circuit were in fact still energized. The need for a ground fault indication system is more obvious where another supply or communications facility occupies the same trench with random separation. Here there could be a possibility for employees working on the telephone or another supply facility to be exposed to a hazard created by the defective ungrounded circuit.

A greater reason for the ground fault indication system would seem to be that of protecting persons otherwise having access to the energized conductors or equipment. A ground fault on one of the conductors of a direct buried 480 V ungrounded 3-wire delta service would change the phase to ground voltage at the meter socket, service equipment and beyond. For the grounded phase this voltage could equal or approach zero instead of 277 V but for the other two phases this could equal or approach 480 V instead of 277 V. It should also be noted that while the phase to ground fault may occur because of a dig-in or other failure of a buried phase conductor the fault could also occur elsewhere including on the customer's internal wiring or equipment and may possibly be present only when specific utilization equipment is energized.

REQUEST ADDENDUM A (Mar 16, 84)

My letter pointed out the obvious fact that a phase to ground fault, whether in one of the buried conductors/cables or in the customer's equipment, would increase the voltage to ground at the service and utilization equipment and customer wiring to zero for the grounded phase and to 480 V for the other two phases. If this were really a concern for customer safety it would seem that installation of a ground fault indication system by the customer would be the logical solution since the system would give an indication of a ground fault in all circumstances regardless of the location of the fault and whether the service were underground or overhead. The working group would have been aware of this.

REQUEST ADDENDUM B (Mar 22, 84)

Will you please consider our comments in your investigation of IR 358 (... request for Interpretation-Rule 354E2, dated March 13, 1984).

We have interpreted rule 354E2 as applying only when more than one circuit is in random lay in the same trench. We have concluded this because the drafters of this rule used the word circuits, indicating that they intended it to apply when an underground supply circuit was in random lay in the same trench with another circuit as referred to in rules 354A, 354B, 354C and 354D. If the drafters of rule 354E2 had intended it to apply to a single ungrounded circuit in a trench by itself, we believe they would have written the rule as: "An ungrounded supply circuit operating etcetera".

We are not aware of any electric utility that installs ground fault indication systems on 480 V 3-wire ungrounded delta services. Therefore, we assume that they are interpreting rule 354E2 the same way that we are.

Rule 350C also indicates that rule 354E2 does not apply to one circuit. Rule 350C requires random separation of the cables in a direct buried 480 V circuit, but does not require ground fault indication or refer to rule 354E2.

INTERPRETATION (May 14, 84)

Rule 354E and its subrules are not intended to apply to installations, such as the single circuit that you mention, which do not involve multiple contiguous circuits covered by Rules 345A, B or C.

354E4 See 93C7 IR 356

370B

Unlabeled empty duct leading to live parts

REQUEST (Nov 3, 83) IR 354

... a cable TV installer, was seriously injured when he ran a "snake" through a conduit he believed had been provided for cable TV. The conduit was a "spare lateral" which led from a pole to a live switchgear mounted on a pad outside a newly constructed building. Neither the outside nor the inside of the spare conduit was capped. No warning was posted at the pole to indicate the conduit led to a live switchgear. The conduit was made of PVC material at its ends, however, the portion of the conduit that ran under the ground, was made of metal.

Questions posed are:

- Should this conduit have been capped or plugged at either or both ends?
- Should a warning have been posted?

Picture A depicts the inside of the covered switchgear with three lines energizing the system exiting from a conduit. The spare conduit is immediately to the left of that conduit. Picture B shows the same from another angle. Pictures C and D show the conduits at the utility pole. All pictures indicate that there was no cap at either end of the conduit.

A — Showing three (3) conductors coming out of conduit energizing switchgear. Uncapped dark cylinder, left and rear, spare lateral. Note proximity of openings to switchgear.

B — Same as A but from a different angle, front view, uncapped spare to right. Three (3) conductors on the left.

C — Showing spare conduit right foreground-uncapped. Half round metal conduit covering live conductors rear of spare.

D — (same as C)

INTERPRETATION (May 14, 84)

The National Electrical Safety Code (NESC) does not require the ends of unused conduits to be capped, nor does it require posting of any special sign of recognition on such facilities.

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373 See 370B IR 354

374 See 93C7 IR 356

381G

Second barrier requirements—pad mounted equipment

REQUEST (June 8, 82) IR 325

As a manufacturer of Pad-Mounted equipment designed for outdoor applications, we need clarification of intent for Part 3 Section 28-381G.

(1) Is this rule intended to protect the utility operator, the general public, children or all three?
(2) In the event live fuse mountings are contained in an enclosure with lockable outer doors and a removable insulating barrier is the second access procedure:
  (A) Should the barrier completely close the door opening until intentionally removed?
  (B) If the barrier does not have to completely close the door opening should it:
    (1) Prevent a child from contacting the live parts with any part of the body?
    (2) Prevent a child from contacting live parts with items like a table knife, spoon, toy or coat hanger?
    (3) Prevent an operator from reaching around or past the barrier to contact live parts?
    (4) Prevent an operator from contacting live parts if he slips and falls against the barrier or tries to stop his fall with his hand against the barrier?
    (5) Merely provide a warning of high voltage?
(3) In the event separable insulated connectors are contained in an enclosure with lockable outer doors would the cables and separable connectors be considered live parts?

Answers to these questions will be very helpful in our evaluation of present and future designs of our pad mounted 5 kV thru 35 kV equipment.

INTERPRETATION (Oct 25, 82)

Rule 010 states that the purpose of the Code is practical safeguarding of 'persons ... necessary for the safety of employees and the public.' The Code does not distinguish between operators, children and other members of the public.

Rule 381G requires two separate procedures to be performed before gaining access to exposed live parts. The Code does not distinguish between methods of potential contact with the exposed live parts but requires that one procedure be accomplished and then a sequential procedure be accomplished before such access to the live parts is gained. The Code does not specify the types of procedures which must be performed. If the second procedure is the removal of a barrier, the barrier is not required to fully cover the opening. However, the combination of the barrier, its location, and its configuration with respect to that of the enclosure must together meet the mandate of requiring a second procedure to be accomplished before access to the live parts is gained.

Separable connectors, if they meet other requirements of the Code such as insulation and shielding, are not considered as live parts within the context of Rule 381G.

* * * *

REQUEST (Nov 22, 82) IR 325A

Thank you for the interpretation of Rule 381G in your October 25, 1982 letter.

I understand that "the National Electrical Safety Code (NESC) does not distinguish between operators, children and other members of the public" and the purpose is the practical safeguarding of all three.

I understand separable connectors which are insulated and shielded are not considered live parts.

I understand "that one procedure be accomplished and then a sequential procedure be accomplished before access to the live parts is gained". What I need interpreted is what "access to live parts" means in the practical safeguarding of persons.

If the first procedure is the opening of the enclosure doors and this has been accomplished by a trained utility operator but the second procedure has not been accomplished, has the intent of Rule 381G been met if the trained operator:

(1) Can put his hand through some opening and contact live parts (even though there may be signs to warn of Danger-High Voltage)?
(2) Can put a screwdriver or other tool through some opening and contact live parts (even though there may be signs to warn of Danger-High Voltage)?

If the first procedure is the opening of the enclosure doors and this has been accomplished by a vandal or by a trained utility operator having accidentally failed to lock the doors but the second procedure has not been accomplished, has the intent of Rule 381G been met if a child or other member of the public:

(1) Can put a hand or other part of the body through some opening and contact live parts?

(2) Can put a screwdriver, tire tool or other common tool through some opening and contact live parts?

(3) Can put a coat hanger, metal tape measure or carpenter's square through some opening and contact live parts?

(4) Can put a piano wire or a #14 wire from a concentric neutral through some opening and contact live parts?

INTERPRETATION (July 8, 83)

Rule 010 states that the purpose of the Code is the practical safeguarding of "persons ... necessary for the safety of employees and the public." The Code makes no distinction between operators, children and other members of the public except where it specifically refers to authorized personnel; no reference to authorized personnel is made in Rule 381G.

Rule 381G requires two separate procedures to be performed before gaining access to exposed live parts. The Code does not distinguish between methods of possible contact with the exposed live parts but requires that one procedure be accomplished and then a sequential procedure be accomplished before such access to the live parts is gained. The Code specifies that the first procedure must be the opening of a locked or otherwise secured door or barrier. The second procedure is not specified except for the requirement that it be performed after the first procedure is completed and the door or barrier has been opened. If the second procedure is the removal of a barrier, there is no specific requirement as to the amount of the opening to be covered by the barrier. However, the combination of the barrier, its location, and its configuration with respect to that of the enclosure must together meet the mandate of requiring a second procedure to be accomplished before access to the live parts is gained.

The requirements of this Rule were added to the Code as a result of accidents involving authorized personnel and unauthorized personnel. These requirements are intended to serve two purposes: protection of the authorized person working on the unit by assuring that access to the live parts is deliberate; and practical protection of children and other unauthorized persons during curious observation or exploration of the interior if the outer door has been forceably opened by vandals. The key to this requirement is the practicality of the protection. Accidents have occured when children reached into such enclosures after damage by vandals, explored the interior with sticks or wires, and came in contact with live parts. To the extent that it is practical to do so, protection from casual exploration should be provided; it is recognized, however, that it is impractical, if not impossible, to prevent the determined person, regardless of age or knowledge, that has enough time and a suitable instrument from penetrating the interior defenses of the enclosure.

Separable connectors, if they meet other requirements of the Code such as insulation and shielding, are not considered as live parts within the context of Rule 381G."

384A See 93C7 IR 356

422B See 124A1 IR 355

423C

Is tagging of remote close/trip control required if device is otherwise rendered inoperable?

REQUEST (Apr 7, 81) IR 293

... request an interpretation and explanation of intent relating to Section 42, Article 423C, on Page 324 of the 1981 Edition of ANSI C2 of the following sentence:

> "All automatically and remotely controlled switches shall also be tagged at the point of control and should be rendered inoperable where practical".

(1) Was this intended to mean the remote close/trip control for a motor-operated disconnect that has been opened, blocked, and drive motor fuses pulled at the disconnect location?

(2) In the case where an oil circuit breaker is out for maintenance and disconnects are opened preventing a source of potential to the breaker bushings, does the remote control have to be tagged?

INTERPRETATION (June 4, 81)

In answer to your first question, yes, automatic equipment, should be rendered inoperable and tagged at the point of control.

In answer to your second question, yes, a tag should be placed on the remote control. Rendering the device inoperable does not relieve the primary task of opening and tagging.

Interpretation Requests

1981—1984

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*
DEFINITIONS				
Part II	Antenna conflict. Def. 14	157	Feb 25, 74	6th
Part II	Communications lines (CATV circuits) See 238	64		
RULES				
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
013B2	(1) Clearance required when second cable is added (2) Communication cable additional clearance (3) Reduced clearance to guys	292	Mar 3, 81	1981
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	234	July 21, 78	1977

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
	as grounding point in place of common point on wye connected secondary			
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
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
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		

Rule	Subject	IR Number	Request Date	NESC Edition
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
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			

Rule	Subject	IR Number	Request Date	NESC Edition
96A3	Neutral grounding for buried concentric neutral cable with semi-conducting sheath	196	July 14, 77	1977
96A3	Grounding of fully insulated jacketed concentric neutral cable	341	May 2, 83	1981
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
97C	Grounding of transformer tank with tank grounded arrester, via a spark gap, etc.	107	Feb 24, 64	6th

Rule	Subject	IR Number	Request Date	NESC Edition
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

PART I

Rule	Subject	IR Number	Request Date	NESC Edition
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
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	300	Oct 13, 81	1981

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
	clearance (1) within fence enclosure (2) within vault			
110A	See 93C	291		
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
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	283	Dec 8, 80	1981

Rule	Subject	IR Number	Request Date	NESC Edition
	line and rigid bus structure			
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
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
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				
200C	Clearance to buildings and lines	158	Dec 18, 72	6th

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
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
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

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
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
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

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
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		
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	121	Dec 13, 65	6th

Rule	Subject	IR Number	Request Date	NESC Edition
	(b) Clearance over cultivated field			
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
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	168	Dec 11, 64	6th

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
	head over farm orchard			
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
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
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
232B	Additional clearance requirements	360	June 8, 84	1981
232B Exception 2	See 232B	292		
232B1	See 232B	25		
232B1a (1)(2)(3)	See 232B	25		

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
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
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	283	Dec 8, 80	1981

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
	line and rigid bus structure			
233A3	See 235E1	353		
233B	Conductor clearance from guy of parallel line structure	218	Jan 5, 78	1977
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
233B1b	See 233B1	221		
233B2	See 233B2	83		
233B2	Clearances—Wires on different supports, voltages >50 kV; also above ground or rails	160	May 14, 74	6th
233B2, C3	See 235E1	365		
233C1 Table 1	Clearance for underbuild	306	Dec 8, 81	1981
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

Rule	Subject	IR Number	Request Date	NESC Edition
234A3	See 234, Fig 234-1	260		
234B	Clearance to parallel line	96	Dec 7, 62	6th
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
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 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 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		
234C Table 1	Grain bin clearance (building vs tank); 115 kV line	248	Mar 15, 79	1977
234C1(a)	Clearance to building	186	Oct 21, 76	6th
234C3 and 4	See 238B1	82		
234C4	(a) Clearance to building (b) Is clearance (in a specific case) in ac-	87	Aug 5, 57	5th

Rule	*Subject*	*IR Number*	*Request Date*	*NESC Edition*
	cordance with the NESC?			
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 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
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

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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
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
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	167	Oct 15, 74	6th

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	Edition, especially when jacking for hot line maintenance is taken into account			
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
235B1	Horizontal clearance between line conductors. 2 circuits, 115 kV and 230 kV on same support	222	Jan 25, 78	1977
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	Clearance from communication cable to tap and drip loop of supply cable	288	Jan 23, 81	1981
235C Table 5	Vertical separation of conductors of same circuit	233	May 10, 78	1977

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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
235C	Voltage between conductors	267	Mar 20, 80	1977
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 Table 5	Interpretation of clearance measurement; Communication to power conductors	242 242a	Jan 2, 79 Jan 11, 79	1977 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(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

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235E1 Table 6	Clearance from line conductors at supports (a) Meaning of minimum clearance (b) Clarification of "voltages are between conductors" (c) Reason for additional clearance on joint poles	210	Oct 31, 77	1977
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 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		

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238 Table 1	13.8 kV distribution clearance with horizontal post insulators without crossarms	115	Aug 4, 65	6th
238A Table 11	Vertical separation at supports	63	Apr 10, 53	5th
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 and B Table 1	(a) Is base of epoxy extension arm "non-current carrying"? (b) Spacing required between noncurrent carrying parts of adjacent supply and communication circuits	268	May 8, 80	1977
238A Table 11	Conductor vertical spacing with post insulators	110	May 14, 64	6th
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 multi-grounded neutral quality for rduced (30 in) clearance?	333	Oct 1, 82	1981

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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
238D	Clearance from communication cable to tap and drip loop of supply cable	288	Jan 23, 81	1981
238D	See 235C	288		
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

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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
242	Joint use 7.2 kV/ communications-cable joint use poles; insulated strand, self supporting communications cable	109	Apr 24, 64	6th
242	Grade of construction for conductors	272	July 14, 80	1977
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

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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 I 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
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

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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
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, c	Omission of fiber stress calculation point for-	211	Nov 4, 77	6th

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	merly stated in 6th Edition, 261A4a, b			
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
261A4a	Location of high longitudinal strength structures with respect to higher grade section in line of lower grade construction	285	Dec 19, 80	1981
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
261C5a	(b) Strength requirements for dead-end and transverse guys	26b		
261C5a	See 261A4e	26a		
261D	Crossarm; definition and status of integrated	151	Nov 15, 73	6th

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	conductor support assemblies			
261D3b, d	Grade B crossing in Grade C supply lines	111	May 26, 64	6th
261D5	Double crossarm over railroad tracks in suspension insulator type of construction	51	Aug 25, 50	
261D5	(c) Crossing of power	122	Feb 17, 66	6th
261E3	See 261D3b, d	111		
261F2	Grade B construction, conductor size; does Exception 2 apply to railroad crossings?	61	July 16, 52	5th
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
262A, C Tables 1 and 3	See 261A, B, C, Tables 1 thru 5	335		
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		
272	Insulator electrical strength	119	Sept 2, 65	6th
273	Insulator rating	297	June 12, 81	1981
280A1b	Meaning of "readily climbable"	199	July 4, 77	1977

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280A1b	Warning signs on tubular steel poles	271	June 13, 80	1977
280A1b, A2	Clarification of readily climbable with respect to a particular configuration	357	Feb 10, 84	1981
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
281A	See 215C2	345		
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
282D	See 282B	183		
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		
282E	Guy guards; meaning of "traffic"	179	Feb 5, 76	6th
282E	Guy guards; placement on guy in field	182	June 1, 76	6th
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
282F	See 283B4b	50		
282H	Guy grounding; upper end effectively	97	Feb 14, 63	6th

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	grounded vs. anchor end ground			
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
283B2	Insulators in guys	100	Apr 22, 63	6th
283B2b	Use of double guy insulators in down guy; also, validity of discussions of 4th and 5th Editions of NESC	235	July 27, 78	1977
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
286C, D	See 124A1	355		
286E	Clearance to ground for equipment on structures—not above a roadway	275	Aug 6, 80	1977
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300	Location of pad-mounted equipment	258	Nov 6, 79	1977
310	See 300	258		
311	See 300	258		
314B	Neutral grounding for buried concentric neutral cable with semi-conducting sheath	196	July 14, 77	1977
314B	See 92D	298		
314B	See 93C7	356		
323	Classification of below grade structure	316	Mar 18, 82	1981

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323F2	Door latch operation from inside requirements; applicability to hinged-door cover on below grade structure	318	Mar 18, 82	1981
330	Installation of submarine cable on islands in connection with aids to navigation	278	Aug 25, 80	1977
330D	"Immediate vicinity of a fault" as applied to damage withstanding capability of underground cable	164	May 29, 74	6th
332	Use of steel-clad copper wire as neutral conductor air direct buried, bare concentric neutral cable	273	July 24, 80	1977
350B	Neutral grounding for buried concentric neutral cable with semiconducting sheath	196	July 14, 77	1977
351	See 330	278		
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
Section 38	Location of pad-mounted equipment	258	Nov 6, 79	1977
353D2	Depth of burial in rock and acceptable supplemental protection	301	June 29, 81	1981
353D2c	Definition of "supplemental protection"	334	Oct 21, 82	1981
354E2	Applicability of requirement for GF indication system	358	Mar 13, 84	1981
354E4	See 93C7	356		
370B	Unlabeled empty duct leading to live parts	354	Nov 3, 83	1981
373	See 370B	354		

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374	See 93C7	365		
381G	Unfenced pad-mounted equipment; meaning of two procedures	185	June 29, 76	6th
381G	Second barrier requirements—pad-mounted equipment	325 325 a	June 8, 82 Nov 22, 82	1981 1981
384A	See 93C7	356		
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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