Bellcore

Bell Communications Research

Bellcore Practice
BR 462-525-017
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C Rural Wire Clearances All Loading Areas

This practice replaces AT&T Section 462-525-017, Issue 1, June 1982.

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Prepared for the Network Technology Applications Division
by the Information Management Services Division, September 1991.

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1. GENERAL INFORMATION

This section covers the recommended clearances for C rural wire in all loading areas. The values specified meet, and in some cases exceed, the requirements of the National Electrical Safety Code (NESC), 1990 Edition, ANSI C2. They apply under conditions of maximum wire sag.

Construction clearances for span lengths over 150 feet contain allowance for extra sag that will be introduced as a result of permanent stretching of the wire under storm-loaded conditions. In some cases the **Construction** sag must be computed by adding an increment (shown in tables in this document) to the **maintenance** sag. It should not be necessary to resag C rural wire unless actual storm loading is quite severe.

Maintenance clearances should exist after the wire has been through one or more cycles of the storm loading and the temperature returns to 60°F. Wire should be resagged only if clearances at 60°F are less than the maintenance values shown in Section 2. Clearances above ground or fixed objects will, however, decrease as the temperature rises above 60°F since the sag increases. The amount by which clearances should be adjusted for temperature may be determined by comparing the sags shown for the actual temperature with the sags shown for 60°F. Clearances at time of installation are Construction; all others are maintenance.

The methods of calculating ground clearances described in this document assume that the point of maximum sag increase (midspan) occurs somewhere above the traveled part of the highway or above a railroad track, etc. When the point of maximum sag increase occurs elsewhere, some reduction in clearance may be possible. To evaluate this factor, it is necessary to locate the ''point of crossing'' in the crossing span as a percentage of span length. The point of crossing in the case of roads, streets, alleys, and driveways is defined as the edge of the traveled way that is farthest from the nearer support. In the case of a railroad crossing, it is the track rail that is farthest from the nearer support of the crossing span.

Where poles can be located within 50 feet of the far edge to comply with Figure 1-1, the height of attachment will not always have to be based on 100 percent of the midspan sag. The approximate percentage of midspan sag that should be used in locating pole attachments when Figure 1-1 applies is shown in the table below. This procedure should be ignored for spans shorter than 180 feet.

Span (feet)	Percent of Midspan Sag "X"= 50 ft
180 through 200	80
201 through 225	75
226 through 250	70
251 through 275	65
276 through 305	60
306 through 340	55
341 through 385	50
386 through 440	45
441 through 500	40

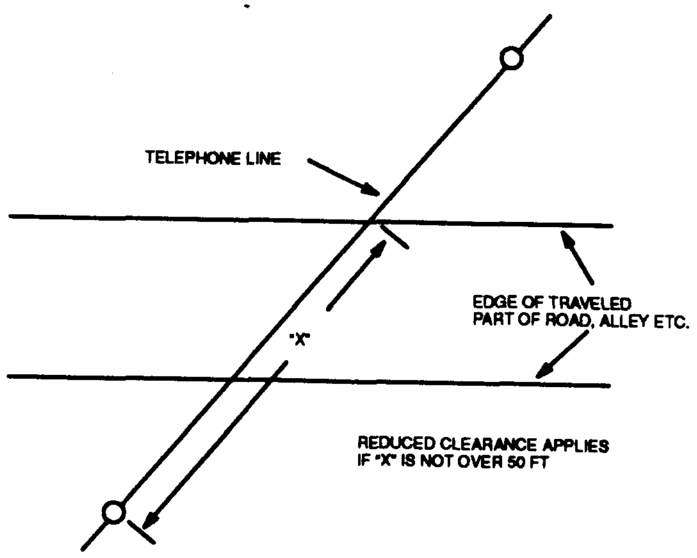


Figure 1-1. Midspan Sag Diagram

Example:

A pole lead of a 200-foot span crossing a driveway has one of the poles located within 50 feet of the far edge of the driveway boundary. The ground in which the pole is located is 2 feet lower than the driveway. The loading area is medium.

The sag for a 200-foot span in a medium loading area (¼-inch ice) is 3 feet 2 inches (see Table A), and from Table H the required clearance is 15 feet. The sag 50 feet from the pole according to the table is 80 percent of midspan, or 30 inches. Therefore, the minimum attachment height is 15 feet + 2.5 feet + 2 feet = 19.5 feet.

To determine the clearances required from power wires, it is necessary to know the voltage of the power wires and also whether they are part of a grounded system. Clearances for grounded power systems are based on their voltage to ground; for other systems, clearances depend on the voltage between wires. Most grounded power systems include a grounded wire that has many connections to ground. Such wires are called *multigrounded neutrals* and are generally considered to be effectively grounded.

Power companies occasionally attach the neutral above the phase wire, as shown in Figure 1-2. Therefore, it is important to identify the neutral wire before determining separation requirements. The neutral can usually be identified by observing the presence of the following:

- The neutral is usually bonded to a vertical ground wire at least every 1300 feet, and more often when transformers are present.
- The neutral is normally bonded to power guys that do not contain insulators.
- Neutrals are sometimes carried on insulators that are smaller than those carrying phase wires.
- The neutral is sometimes carried on an insulator that is lighter in color than the phase wire.
- On transformer poles, the bushing for the neutral is usually smaller than the bushing for the phase connection. The neutral bushing is often located near the secondary bushing (Figure 1-3).
- Where secondaries are dead ended, if the phase wire is carried through, the neutral will also be carried through.

NOTE: If, after considering these factors, you have not definitely identified the neutral wire, consult your supervisor or the electric utility company. However, if the neutral is attached above the phase wire, provide the clearance specified for phase wires of appropriate voltage.

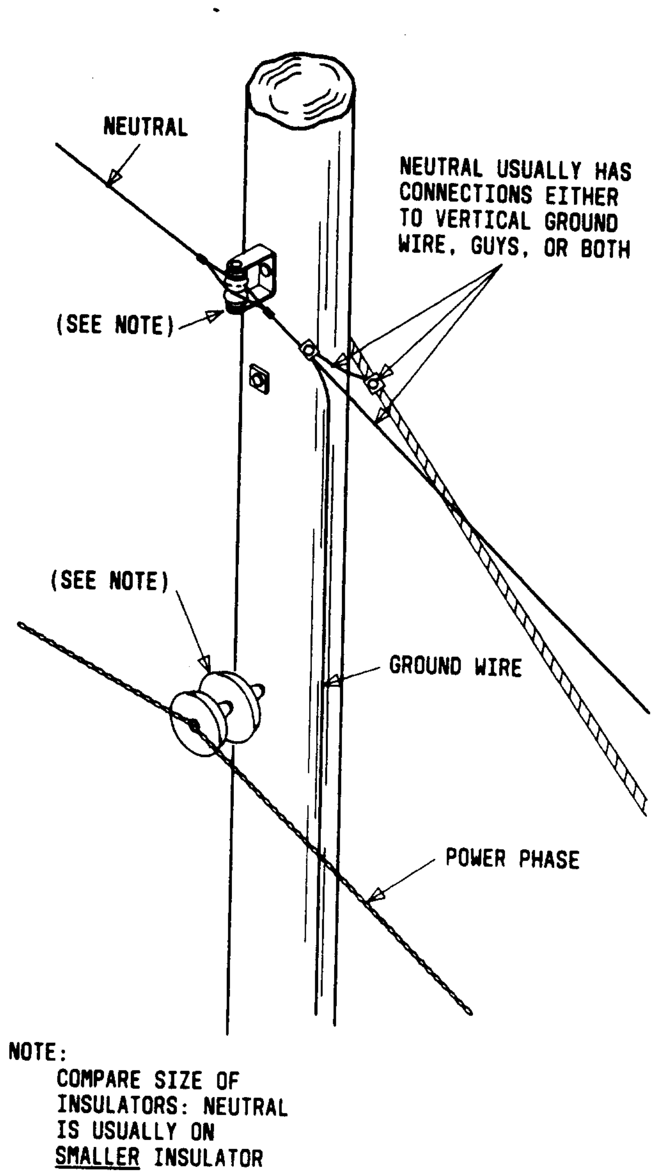
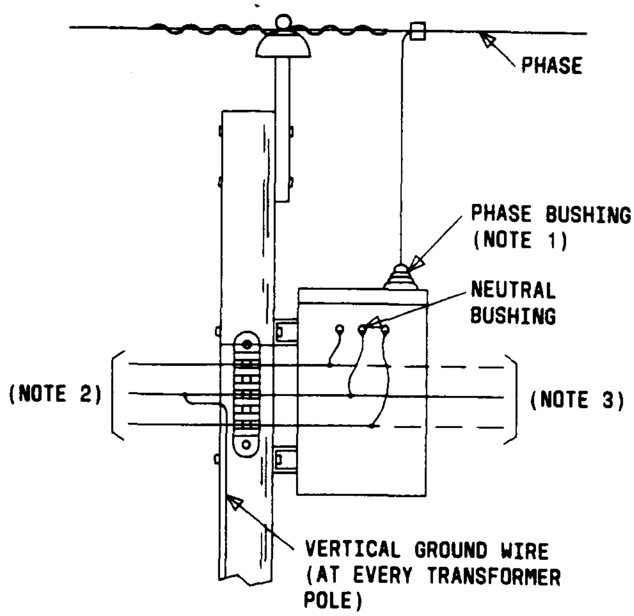


Figure 1-2. Inverted Power Construction



NOTES:
1. PHASE BUSHING IS USUALLY LARGER THAN NEUTRAL BUSHING.
2. NEUTRAL CAN BE ANY ONE OF THESE. POSITION DEPENDS ON WIRING AT TRANSFORMER.
3. NEUTRAL ALWAYS CARRIES THROUGH WHEN PHASE CARRIES THROUGH. SECONDARIES ARE DEAD ENDED IN SOME CASES.

Figure 1-3. Identification of Neutral at Transformer Location

The clearances from streetlights show one value for grounded fixtures and a larger value for nongrounded fixtures. Streetlight fixtures bonded to cable suspension strand that is connected to a low-impedance ground or a ground wire of a multigrounded neutral (MGN) power system are considered to be sufficiently grounded to use the smaller clearance. Fixtures that are merely grounded to a ground rod are not considered sufficiently grounded to use the smaller clearance.

The clearances from grounded transformers, capacitors, etc., are smaller than for nongrounded transformers. Since it is generally not possible to determine by sight whether power equipment is grounded, local instructions will designate areas where transformer and/or capacitor cases are grounded.

Clearances shown in this document should be used unless the detail plans show other values. Clearances shown on the plans may call for different values where engineering forces have recognized factors not allowed for in this document. Clearances for other span lengths, voltages, and conditions not shown in this document are an engineering responsibility and will be shown on the work order or detail plans, etc.

NOTE: Work prints may sometimes show greater clearances, since the values recommended are based on a maximum vehicle or equipment height of 14 feet. Where greater equipment height might be expected, the engineer may elect to show greater clearances.

2. CLEARANCES ABOVE GROUND, RAILS, WATER

The clearance values specified in this document are in accord with the requirements of the 1990 edition of the NESC and, in general, should be used only if state governmental agencies have adopted this edition. These clearances should be used unless the work order or local requirements call for other values, as may occur when engineering forces recognize factors not allowed for in this document or because of local requirements. Clearances for span lengths, voltages, and conditions not covered in this document are an engineering responsibility and will be shown on the work order or detailed plans. Rural wire placed under previous editions of the code need not be changed to meet newer editions until rearrangements are made.

Calculations of the attachment heights controlled by the clearances have changed from earlier code editions although the end-point attachment heights have changed only modestly in some cases (compared to earlier editions). This situation exists because in previous editions all clearances were based on a 60°F temperature of the wires while the 1990 edition assumes wires to be at the maximum sag condition they will experience, whether due to temperature change or ice buildup. Therefore, for attachment height to remain unchanged, the clearances (over terrain) will have smaller values.

NOTE: Never use values for clearances from this practice with values taken from earlier editions.

Clearances over public and private swimming pools are covered by the 1990 edition of the NESC, Rule 234E1. For reasons of safety, sanitation, and appearance, rural wire crossings over swimming pools should be avoided.

Whereas clearances are specified under maximum sag conditions, obviously they are not installed under those conditions, and equivalent sags at 60°F and other temperatures must be known in order to place the wire. Tables A through G and AA through GG used in conjunction with Table H provide the midspan clearance for "C" Rural wire (or its equivalent) under various temperatures that will equate to a sag under maximum sag conditions for the given loading area. Tables A through G are keyed to Tables A through G of Bell System Practice 462-525-115, which provides the recommended C Rural Sags from 0° through 120°F. Tables A through G in this Bellcore Practice provide the additional sag values under light, medium, and heavy storm loading, information that is necessary in order to meet 1990 code requirements for clearance under *maximum* sag conditions.

When Tables A through G and AA through GG are used, note that in some cases the *same* span length in the *same* loading area have *different* recommended sags and adders. This is not inconsistent; it simply reflects the difference between initial stringing tensions applied in Tables A through G in Bell System Practice 462-525-115. The choice of the initial stringing sag is based upon the importance of avoiding excessive sag. Such a choice is also recognized in the practices that relate to placing service drop wire. (See Figure 2-1 for storm loading areas.)

Example 1:

What clearance is required for a 250-foot span crossing a residential driveway in a heavy loading area if the wire has experienced at least one cycle of storm loading? The temperature is 15°F at the time of measurement.

Required clearance from Table H = 15.0 feet
Sag under ice load from Table B = 79 inches
Sag at 15°F from Table B = 11 inches

Sag difference is 79 minus 11 = 68 inches = 5 feet 8 inches
15 feet + 5 feet 8 inches = 20 feet 8 inches required clearance at 15°F.

Since most wire installations are made at about 60°F, the calculations can be further simplified by the use of Tables AA through GG, which are keyed to Tables A through G. The former tables simply tabulate the subtraction of sag at 60°F and the maximum sag value for the appropriate storm loading area; hence, they give the difference between the two sag values. These tables also provide the "adders" for determining construction clearances. In general, the adder may be applied at all temperatures, since differences at other temperatures are negligible.

Example 2:

Compute the clearance height at 60°F for a wire of 200-foot span crossing a public road in a medium loading area.

Required clearance from Table H = 15 feet 5 inches
Table AA difference in sag (medium) = 2 feet 2 inches

15 feet 5 inches + 2 feet 2 inches = 17 feet 7 inches + 0 feet 4 inches = 17 feet 11 inches at installation.

Each loading area has a maximum allowable span length that is based on the strength of the wire when subjected to the appropriate storm loading. In some cases where crossings of critical thoroughfares are involved, the maximum allowable spans are reduced to lesser lengths in order to provide an appropriate factor of safety. Table I establishes span limits that are based on these considerations.

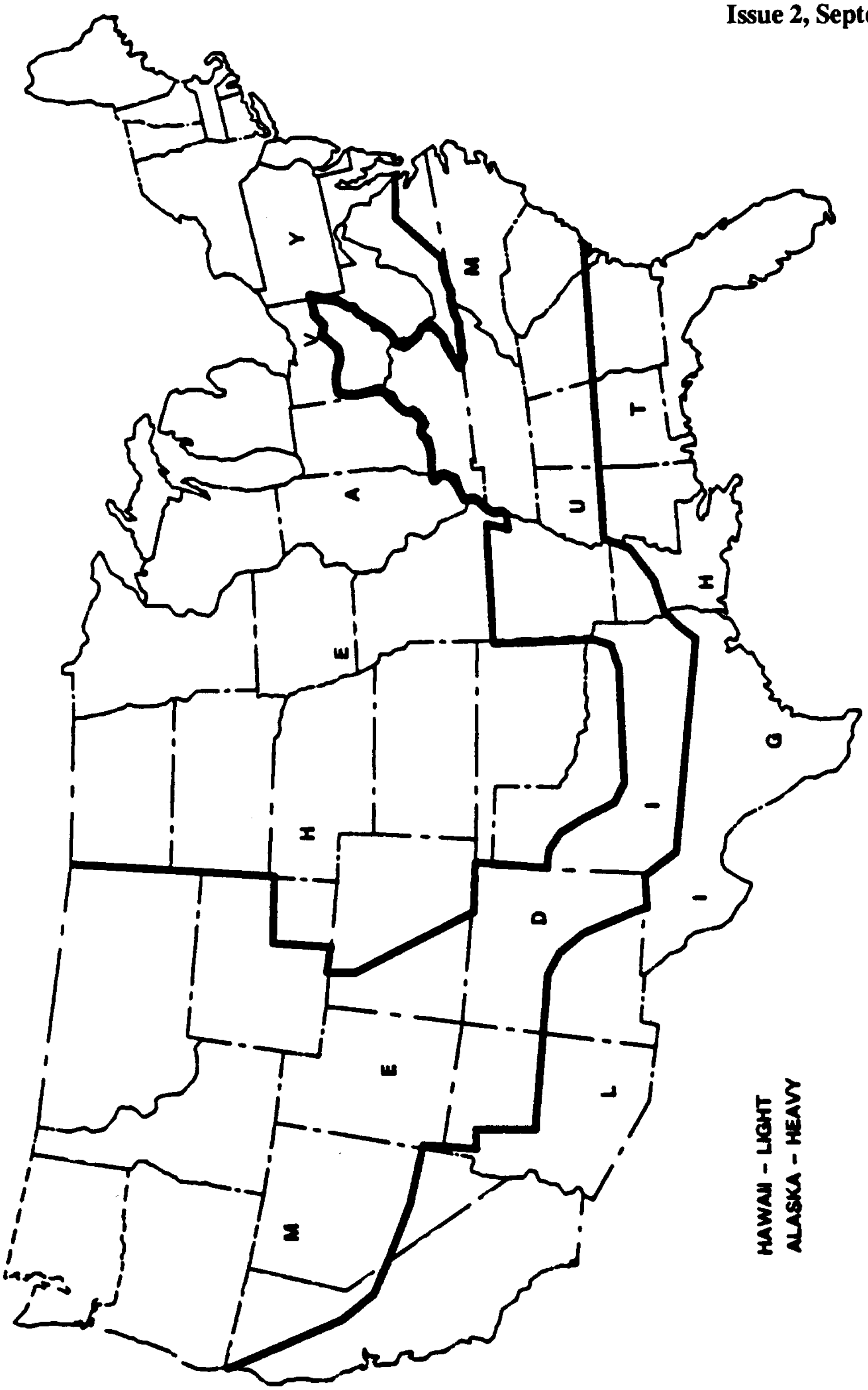


Figure 2-1. Storm Loading Areas

Table A. All Storm Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
100	2	2	3	3	3	4	5	12	22
125	4	4	4	5	5	6	7	17	31
150	5	6	6	7	8	8	10	24	40
175	7	7	8	9	10	11	14	30	51
200	9	10	11	12	13	15	18	38	62
225	12	12	13	16	17	18	22	46	74
250	14	15	17	19	21	23	27	54	86

Table B. Heavy Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
250	10	11	11	13	13	14			79
275	12	13	14	15	16	17			91
300	15	15	16	18	19	20			104
325	17	18	19	21	22	24			117
350	20	21	22	25	26	28			131

Table C. Medium and Light Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
250	13	14	15	17	18	20	23	52	
275	16	17	19	21	22	24	28	60	
300	19	20	21	24	26	29	33	70	
325	22	24	25	29	31	33	39	79	
350	26	27	29	33	35	38	44	88	

Table D. Medium Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
350	20	21	22	24	26	27		79	
375	23	24	25	28	29	31		89	
400	25	27	28	32	33	35		99	
425	29	31	32	36	38	40		109	
450	33	34	36	40	42	45		119	

Table E. Medium Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
450	27	28	29	31	33	34		108	
475	30	31	32	35	36	38		118	
500	33	34	36	39	40	42		128	
525	36	38	39	43	45	47		139	
550	40	41	43	47	49	51		150	

Table F. Light Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
350	21	22	24	27	28	30	34		
375	24	26	27	30	32	34	39		
400	28	29	31	35	37	39	44		
425	32	33	35	39	41	44	49		
450	36	37	39	44	46	49	55		

Table G. Light Loading Areas

Span In Feet	Temperature °F						Loading Area		
	0	15	30	60	75	90	Light	Medium	Heavy
	Sag Measured in Inches								
450	30	32	33	36	38	40	45		
475	34	35	37	41	43	45	50		
500	38	39	41	45	47	50	55		
525	42	43	45	50	52	55	61		
550	46	48	50	54	57	60	66		
575	50	52	54	60	62	66	72		
600	54	57	59	65	68	71	78		

Table AA. Maintenance Clearance at 60°F, Add to Maximum Sag Clearance

Span in Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
100	0-2	0-9	1-7	0-0
125	0-2	1-0	2-2	0-0
150	0-3	1-5	2-9	0-0
175	0-5	1-9	3-6	0-2
200	0-6	2-2	4-2	0-4
225	0-7	2-6	4-10	0-5
250	0-8	3-0	5-7	0-7

Table BB. Maintenance Clearance at 60°F, Add to Maximum Sag Clearance

Span in Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
250			5-6	0-6
275			6-4	0-9
300			7-2	1-3
325			8-0	1-8
350			8-10	2-1

Table CC. Maintenance Clearance at 60°F; Add to Maximum Sag Clearance

Span in Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
250	0-6	2-11		0-2
275	0-7	3-4		0-3
300	0-9	3-10		0-3
325	0-10	4-2		0-4
350	1-1	4-7		0-5

Table DD. Maintenance Clearance at 60°F; Add to Maximum Sag Clearance

Span in Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
350		4-7		0-5
375		5-1		0-8
400		5-7		0-8
425		6-1		0-10
450		6-7		0-10

Table EE. Maintenance Clearance at 60°F; Add to Maximum Sag Clearance

Span in Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
450		6-5		0-10
475		6-11		0-10
500		7-5		1-3
525		8-0		1-6
550		8-0		1-8

Table FF. Maintenance Clearance at 60°F; Add to Maximum Sag Clearance

Span In Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
350	0-7			0-0
375	0-9			0-0
400	0-9			0-0
425	0-10			0-0
450	0-11			0-1

Table GG. Maintenance Clearance at 60°F; Add to Maximum Sag Clearance

Span In Feet	Loading Area			Additional for Construction Clearance
	Light	Medium	Heavy	
	Feet-Inches			
450	0-10			0-0
475	0-10			0-1
500	0-10			0-2
525	0-11			0-3
550	1-0			0-3
575	1-0			0-3
600	1-1			0-3

Table H. Minimum Clearance Requirements Under Maximum Sag Conditions

Crossing Above	Clearance (Feet)	Remarks
Railroad tracks	23.5	See span limitations, page 2-2
Public roads	15.5	See span limitations, page 2-2
Public alleys, non-residential driveways, parking lots	15.0	
Residential driveways	15.0	
Walks and lanes (pedestrian)	9.5	Vehicles not anticipated
Other lands	15.5	Includes grazing, orchards, forest, cultivated land
Waterways	Must be shown on plans – consult with the engineer	In some cases, under the jurisdiction of the US Army Corps of Engineers
Flat-roof buildings	10.5	Accessible to pedestrians
Peaked-roof buildings	3.0	
Signs, chimneys, antennas, tanks	3.0	
Running along:		
• Public roads in nonrural areas	15.5	May be reduced per Figure 2-3
• Rural (light traffic) roads unlikely to have vehicles passing under the line (See Note below)		
— Back of obstruction	9.5	See Figure 2-4
— Not back of obstruction	13.0	See Figure 2-2
• Public Alleys	15.0	

NOTE: Lightly traveled country lanes only. If well traveled, consider this as urban even if in a rural area.

Table I. Maximum Allowable Span Lengths in Feet

Crossing	Loading Area		
	Light	Medium	Heavy
In General	600	550	350
Crossing Railroads	150 ④	125 ③	100 ①
Crossing Waterways	②	②	②
Crossing Public Roads	600	300 ②	250 ②

① For spans of 100 through 225 feet, supported on 6M messenger.
② Consult work print.
③ For spans of 125 through 250 feet, supported on 6M messenger.
④ For spans of 150 through 450 feet, supported on messenger.

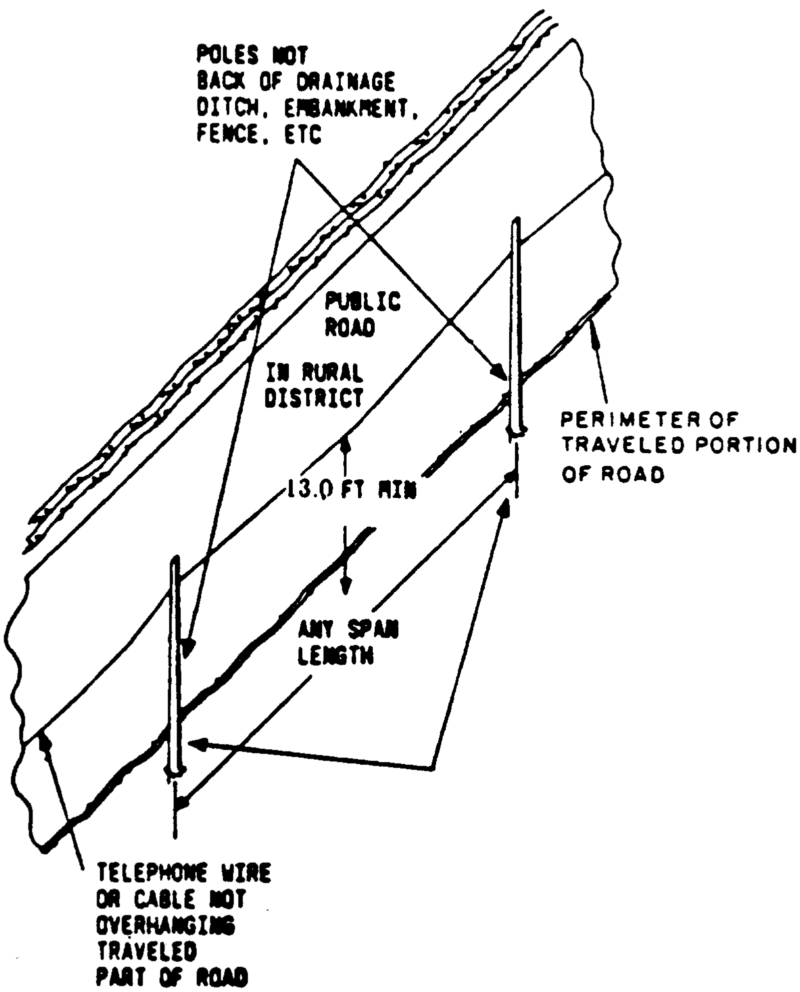


Figure 2-2. Wire Running Along, but Not Overhanging, Rural Roads (Not Back of Obstruction)

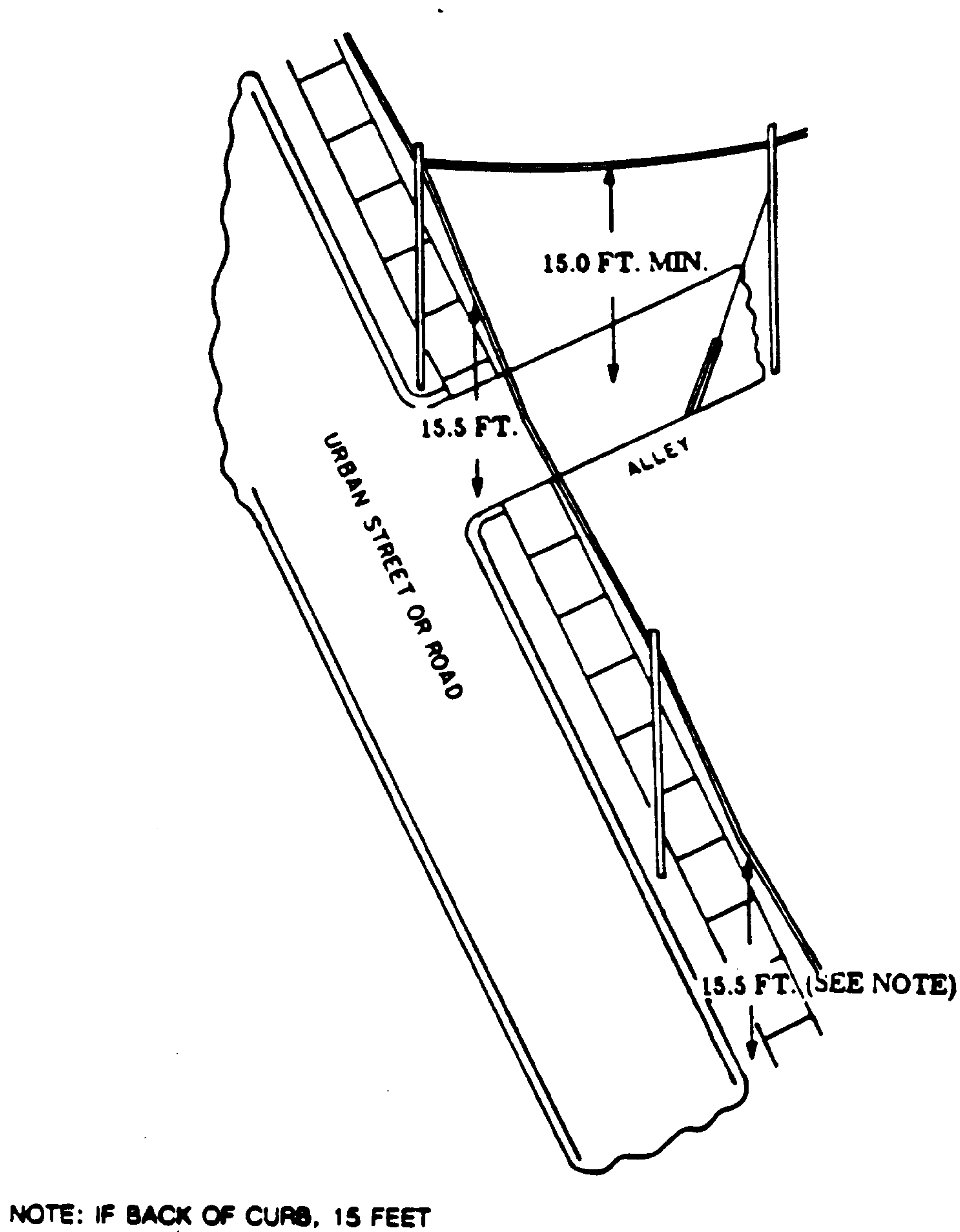


Figure 2-3. Wire Running Along, but Not Overhanging, Non-rural Roads (Not Back of Obstruction)

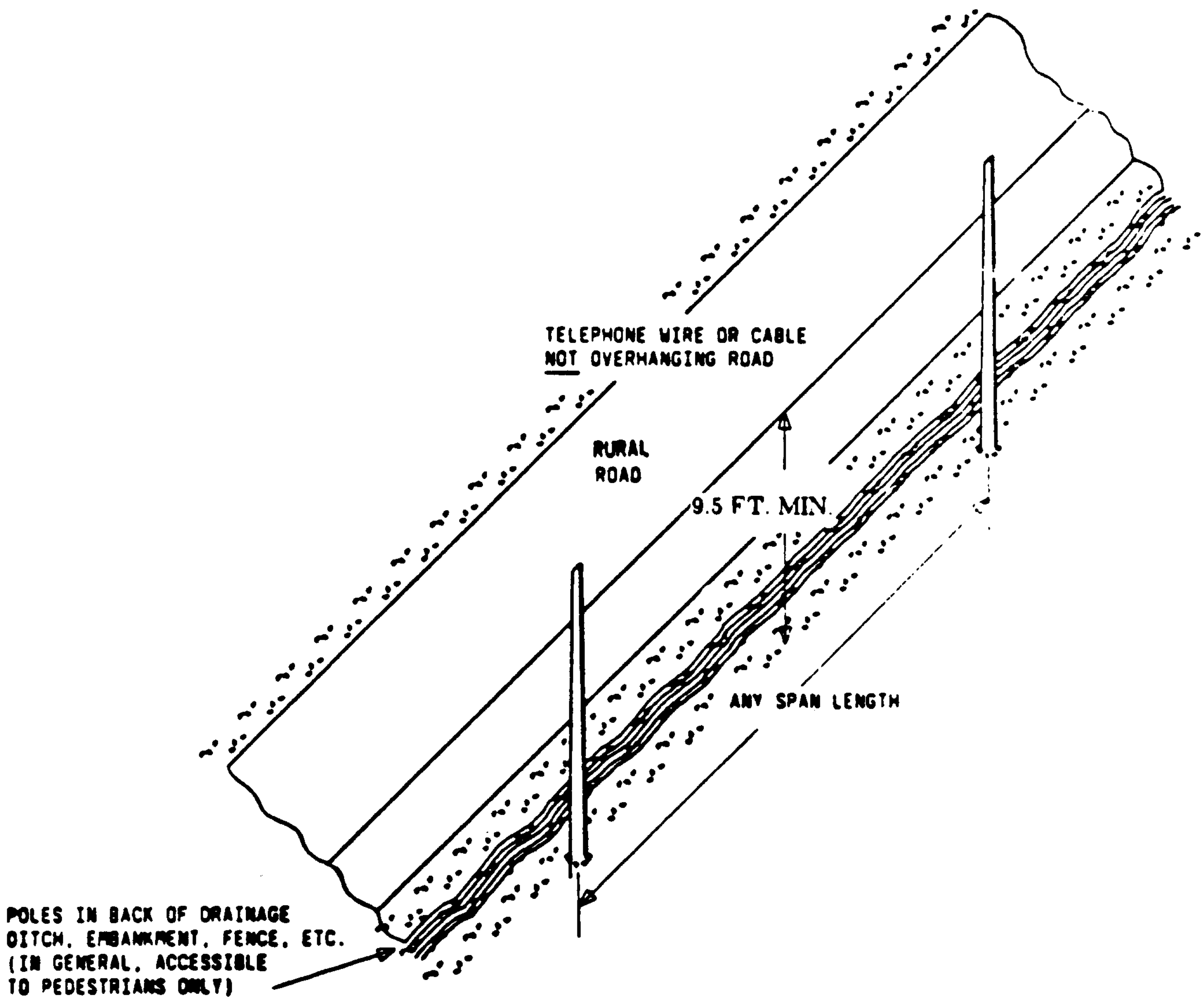


Figure 2-4. Wire Running Along Rural Roads (Back of Obstruction)

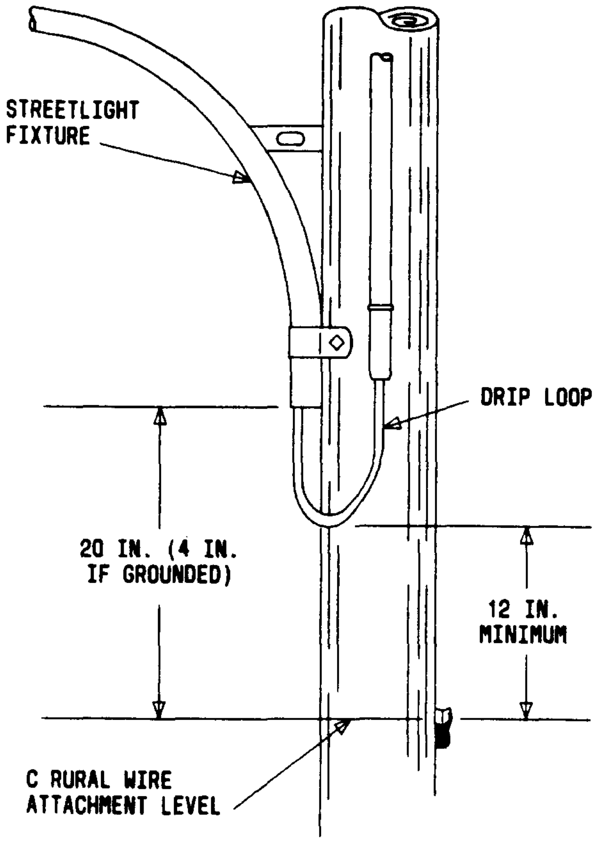
3. CLEARANCES ON JOINT-USE POLES

Clearances from power equipment and pole attachments on joint-use poles are shown in Tables J through L and Figures 3-1 through 3-7.

Table J. Clearances on Joint-Use Poles

Facility	Clearance in Inches	
	Grounded	Not Grounded
Streetlight Fixtures and Associated Wiring (Figures 15 and 16)		
Streetlight fixtures and span wires above or below telephone wire*	4	20
Drip loop entering fixture from surface of pole	12	
Vertical feed on pins and insulators	6	
Vertical feed on surface of pole	2 inches minimum; 1/8 pole circumference generally	
Vertical feed from crossarm to fixture 40 inches from pole	20	
Traffic Light Fixtures and Associated Wiring		
Traffic light fixtures and span wires	4	20
Vertical runs for traffic light fixtures and controls	Same clearances as power vertical runs	
Trolley Span Wires and Brackets		
Span wires and brackets	4	4

* Applies if voltage is ≤ 150 V to ground when luminaire is below messenger. If voltage is > 150 V and luminaire is below, 20 inches is required.



NOTES:

1. The 12-inch drip-loop clearance may be reduced to 3 inches if the loop is covered by a suitable nonmetallic covering that extends at least 2 inches beyond the loop.
2. To be grounded, a fixture must be bonded to a grounded strand or to a ground wire of a multigrounded neutral (MGN) system.

Figure 3-1. Clearance from Streetlight Fixture Drip Loop Above C Rural Wire

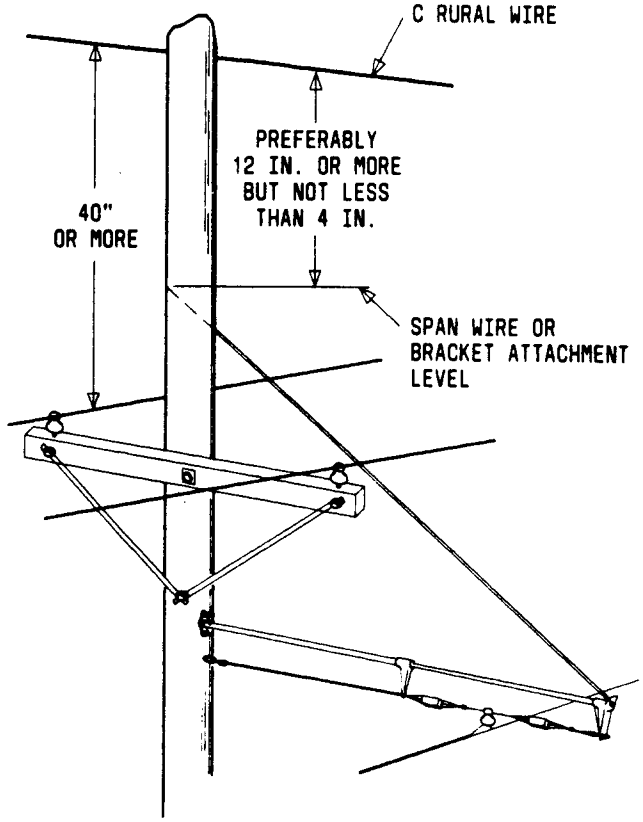


Figure 3-2. Clearance between C Rural Wire and Trolley Wire and Attachments

Table K. Clearances from Pole Attachments and Equipment

Power Facility	See Table	Figure
Power transformers, capacitors, regulators	L	3-3
Secondary racks	L	3-4
Steel pins	L	3-4
Metal crossarm braces: • Attached to metal crossarms within 1 inch of nongrounded transformer, capacitor cases, or their supports	L	3-3
• Attached to wood crossarms less than 1 inch below top of arm	L	3-3

Table L. Clearances for Power Circuits

For Grounded Power Circuits		
Voltage to Ground	Voltage between Lines	Clearance (Inches)
8,700 V or Less	15,000 V or Less	40*
8,701 V through 22,000 V	15,001 V through 38,000 V	46*
22,001 V through 41,000 V	38,001 V through 70,000 V	53*
For Other Power Circuits		
—	5,000 V or Less	40

* May be 30 inches if case is effectively grounded as a uniform procedure over a well-defined area.

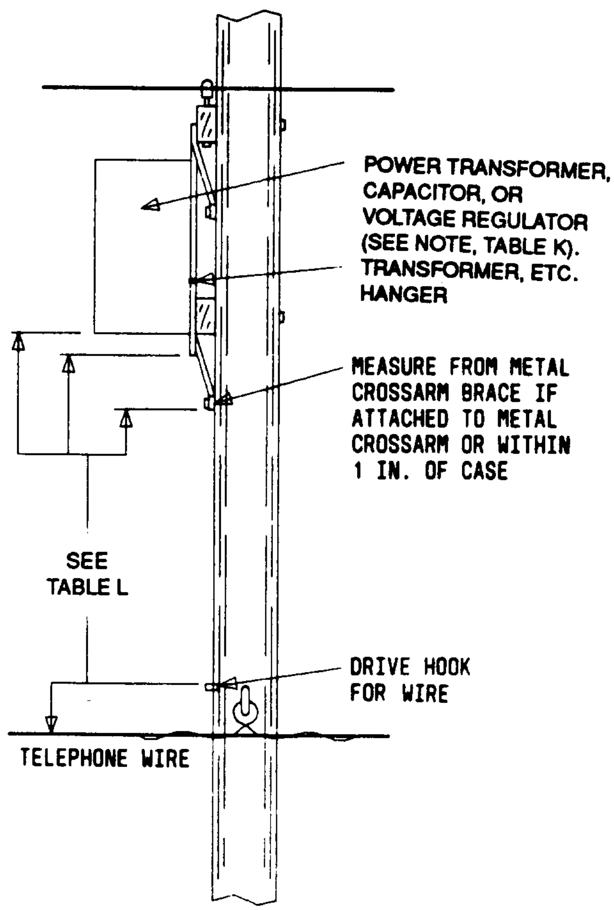
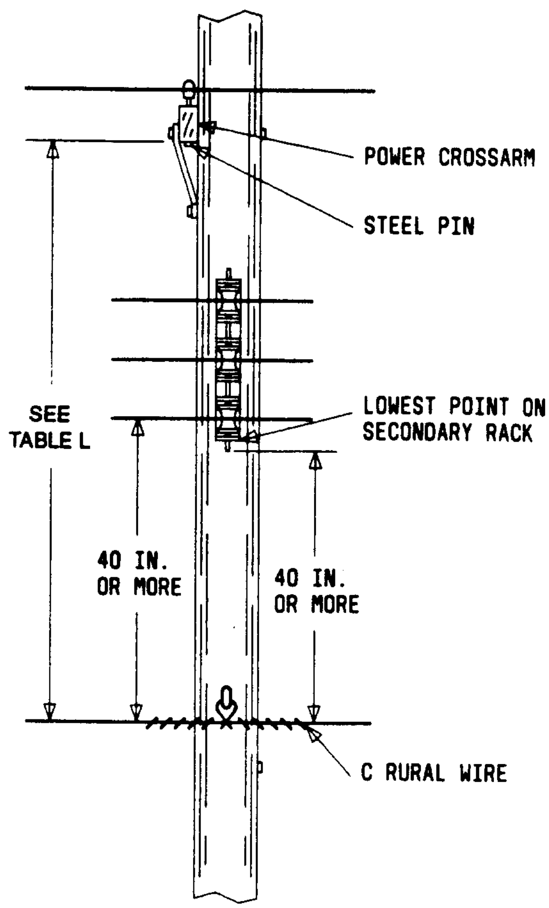


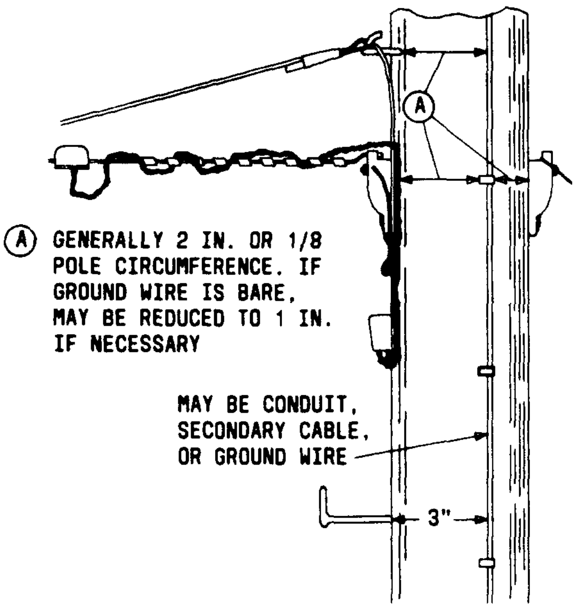
Figure 3-3. Vertical Clearance from Power Transformers, Crossarm Braces, Etc.



NOTE: For grounded circuits 8,700 V or less, need 40 inches; for 8,701 V to 22,000 V, need 46 inches; for 22,001 V to 41,000 V, need 53 inches. Voltages stated are phase to ground.

Figure 3-4. Vertical Clearance from Secondary Racks, Steel Pins, and Crossarms

Clearance from vertical runs of power is shown in Figure 3-5.



Vertical Runs	
Kind of Vertical Run	**Clearance in Inches**
Power service under 750 volts on pins and insulators	3
Power service on surface of pole from telephone hardware	2 inches minimum; 1/8 pole circumference generally
Bare grounding wires from telephone hardware	1

Figure 3-5. Clearance from Power Vertical Runs on Pole Surface

The clearances from C Rural Wire and licensee attachments and licensee attachments to power are shown in Figure 3-6.

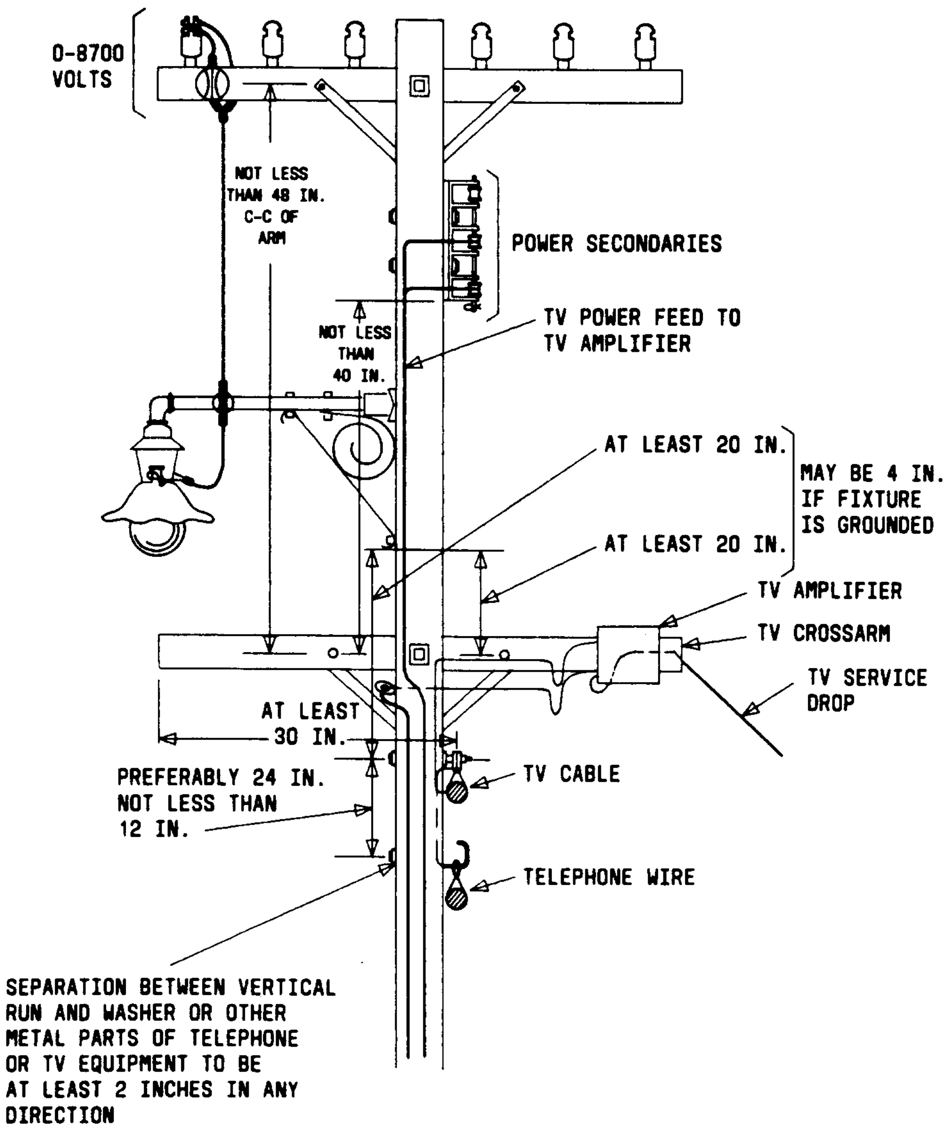


Figure 3-6. Clearances of C Rural Wire From Licensee Attachments

Specific rules cover clearances between guys (both power and telephone) and C Rural wire. In some cases the guys are effectively grounded to operate protective relays in the event of a power cross, while other guys are fitted with strain insulators to isolate portions of the guy that could become energized. Telephone guys must have a minimum clearance of at least 3 inches from C Rural wire. Requirements for longitudinal power guys are shown in Figure 3-7.

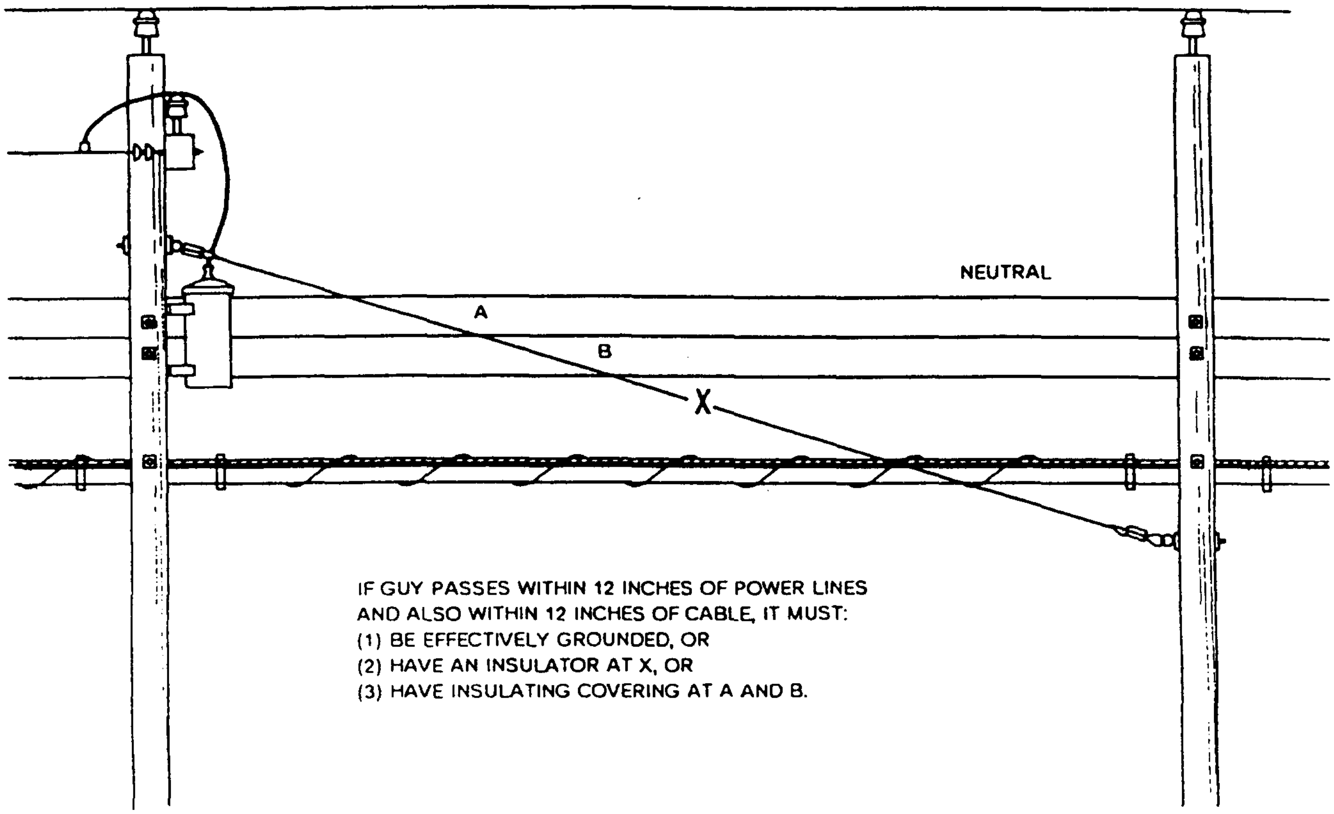


Figure 3-7. Requirements for Longitudinal Guys

4. JOINT-USE SEPARATION FROM POWER WIRES IN THE SPAN AND ON THE POLE

Power wires that attach to the same structure and run parallel with each other must meet two clearance requirements:

1. Midspan clearances
2. Attachment clearances.

The following attachment clearances must be maintained between communications and open power wires:

- Less than 8.7 kV — 40 inches
  8.7 kV through 50 kV — 40 inches plus 0.4 inch per kV over 8.7 kV
  over 50 kV — 40 inches plus 0.4 inch per kV over 8.7 kV.

To simplify application of the 0.4 inch per kV adder for voltages over 8.7 kV, the following voltages are suggested. (These ranges are based on commonly used distribution ranges.)

Range Phase-to-Ground (kV)	Range Phase-to-Phase (kV)	Clearance (Inches)
0 through 8.7	0 through 15	40
8.7 through 22	15 through 38	46
22 through 41	38 through 70	53

Often the midspan clearances will overrule the attachment clearances, and the attachment separation distances will then need to be increased by an amount that exceeds code requirements.

Charts, which are part of the figures in this section, show values for "maintenance" and "construction." The maintenance values must be maintained throughout the life of the plant. Construction values are those that are suggested for placing new plant; they account for creep and the permanent sag that will occur following a cycle of storm loading.

One of the major changes in the 1990 Edition of the NESC is the partial elimination of the "line of sight" rule. This rule required that, for spans exceeding 150 feet, open power wires of primary voltages be a minimum of 30 inches above the telephone attachment "line of sight," and secondary wires be no lower than the "line of sight," in center span. The 1990 Edition of the NESC simply requires that primary wires of the same span length do not sag below the "line of sight." There is no longer a restriction on secondaries, except that they meet the center span requirements shown in the following figures.

Separation requirements between telephone cable and open power wires of 750 volts or less are shown in Figure 4-1. The examples that follow show how to determine the appropriate midspan separation for light, medium, and heavy loading areas. These examples apply to Figure 4-1, but the method demonstrates the use of Figures 4-1 through 4-9.

Example 1: Light Loading Area

- Span length is 200 feet
- Power secondaries have a 30-inch sag
- Telephone cable has a 28-inch sag.

The required construction clearance at midspan is 36 inches or telephone sag + 6 inches, if greater. However, telephone sag is only 34 inches (i.e., 28 + 6). Therefore, the 36-inch separation, which is greater, is the appropriate separation length. Standard 40-inch spacing at the pole will provide a midspan separation of 38 inches (40 - 30 + 28), which is adequate.

Example 2: Medium Loading Area

- Span length is 250 feet
- Power secondaries have a 30-inch sag
- Telephone wire has a 42-inch sag.

The required construction clearance at midspan is 48 inches or sag of telephone wire + 48 inches, if greater. Since 18 + 42 is 60 inches, which is greater than the 48 inches, the required midspan separation is 60 inches. The standard 40-inch spacing at the pole will provide 52 inches (40 - 30 + 42), which is 8 inches short. Separation at the pole must be 48 inches (40 + 8).

Example 3: Heavy Loading Area

- Span length is 140 feet
- Power secondaries have a 35-inch sag
- Telephone cable has a 15-inch sag.

The required construction clearance at midspan is 36 inches. Standard 40-inch separation at the pole will provide only 20 inches (40 - 35 + 15). Therefore, the separation at the pole must be increased by the amount of the shortage, which is 16 inches (36 - 20). Separation at the pole is 56 inches (40 + 16).

Open Supply Wires of 750 Volts or Less: Includes Neutrals, Other than Multigrounded, Associated with Wires of 750 Volts or Less			
Span Length (S) in Feet	Midspan Clearance (A) in Inches (See Note 1)		Minimum Clearance at the Pole in Inches (See Note 1)
	Construction	Maintenance	
Light Loading Area			
150 or less	34	30	40
150 through 350	36, or sag of tel plus 6, if greater	30, or sag of tel, if greater	40
Medium Loading Area			
150 or less	36	30	40
150 through 200	40, or sag of tel plus 10, if greater	30, or sag of tel, if greater	40
200 through 250	48, or sag of tel plus 18, if greater	30, or sag of tel, if greater	40
Heavy Loading Area			
150 or less	36	30	40
150 through 200	42, or sag of tel plus 12, if greater	30, or sag of tel, if greater	40
200 through 250	48, or sag of tel plus 18, if greater	30, or sag of tel, if greater	40

NOTE 1: May have to be greater than 40 inches to meet midspan requirements.
NOTE 2: The term "tel" in the table above means "telephone wire."

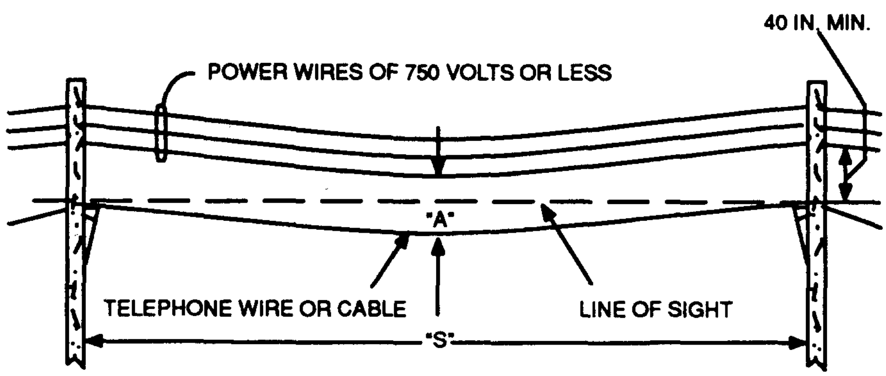
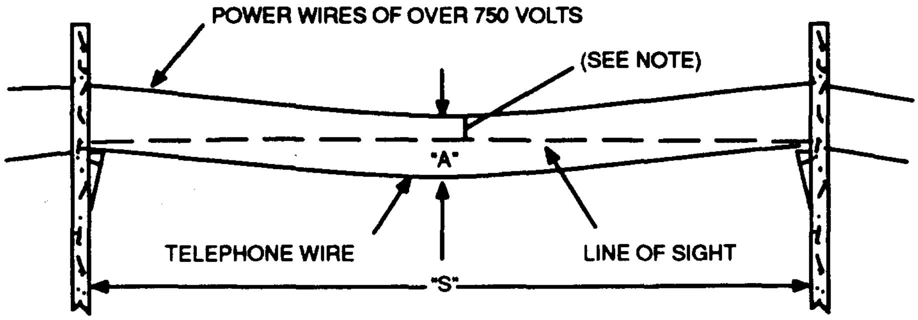


Figure 4-1. Clearance of Power Wires of 750 Volts or Less, All Loading Areas

Span Length (S) in Feet	Midspan Clearance (A) in Inches		Minimum Clearance at the Pole in Inches (See Note 1)
	Construction	Maintenance	
Grounded Power Systems of Up to 15 kV between Wires (8.7 kV to Ground) and Other Systems of Up to 8.7 kV between Wires			
150 or less	34	30	40
150 through 350	36 plus sag of tel	30 plus sag of tel	40
Grounded Power Systems of Voltages > 15 kV < 38 kV between Wires (8.7 kV through 22 kV to Ground) and Other Systems of 8.7 kV through 22 kV between Wires			
150 or less	36	35	46
150 through 250	37, or tel sag plus 32, if greater	35, or tel sag plus 30, if greater	46
250 through 350	40, or tel sag plus 35, if greater	35, or tel sag plus 30, if greater	46
Grounded Power Systems of Voltages > 38 kV < 78 kV between Wires (22 kV through 41 kV to Ground) and Other Systems of 22 kV through 41 kV between Wires			
150 or less	42	40	53
150 through 250	44, or tel sag plus 33, if greater	40, or tel sag plus 30, if greater	53
250 through 350	45, or tel sag plus 35, if greater	40, or tel sag plus 30, if greater	53

NOTE 1: Clearance at the pole is minimum; may need greater clearance to meet midspan requirements.
NOTE 2: The term "tel" in the table above means "telephone wire."

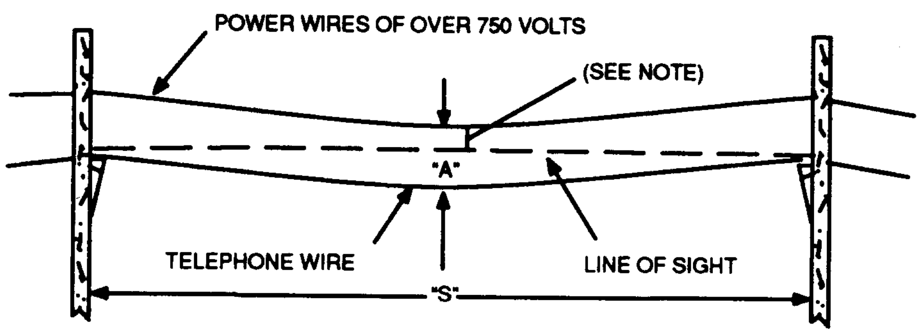


NOTE: Power wires with voltages exceeding 750 volts must be no lower than the line of sight if "S" exceeds 150 feet.

Figure 4-2. Clearance of Power Wires Over 750 Volts, Light Loading Area

Span Length (S) in Feet	Midspan Clearance (A) in Inches		Minimum Clearance at the Pole in Inches (See Note 1)
	Construction	Maintenance	
Grounded Power Systems of Up to 15 kV between Wires (8.7 kV to Ground) and Other Systems of Up to 8.7 kV between Wires			
150 or less	36	30	40
150 through 200	38 plus sag of tel	30 plus sag of tel	40
200 through 250	46 plus sag of tel	30 plus sag of tel	40
Grounded Power Systems of Voltages > 15 kV < 38 kV between Wires (8.7 kV through 22 kV to Ground) and Other Systems of 8.7 kV through 22 kV between Wires			
150 or less	40	35	46
150 through 200	44, or tel sag plus 38, if greater	38, or tel sag plus 30, if greater	46
200 through 250	50, or tel sag plus 45, if greater	35, or tel sag plus 30, if greater	46
Grounded Power Systems of Voltages > 38 kV < 70 kV between Wires (22 kV through 41 kV to Ground) and Other Systems of 22 kV through 41 kV between Wires			
150 or less	46	40	53
150 through 200	50, or tel sag plus 38, if greater	40, or tel sag plus 30, if greater	53
200 through 250	56, or tel sag plus 45, if greater	40, or tel sag plus 30, if greater	53

NOTE 1: Clearance at the pole is minimum; may need greater clearance to meet midspan requirements.
NOTE 2: The term "tel" in the table above means "telephone wire."

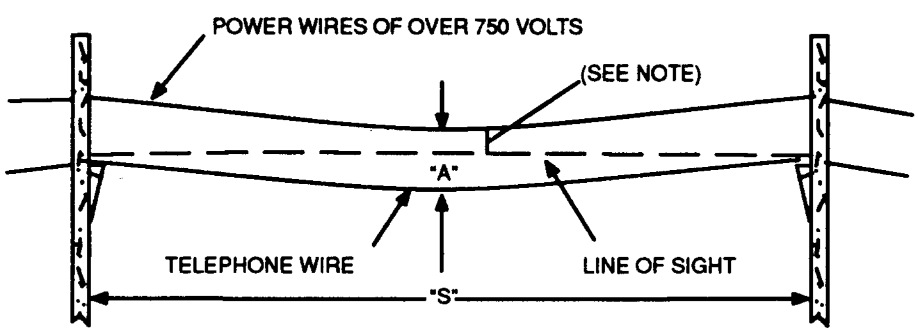


NOTE: Power wires with voltages exceeding 750 volts must be no lower than the line of sight if "S" exceeds 150 feet.

Figure 4-3. Clearance of Power Wires Over 750 Volts, Medium Loading Area

Span Length (S) in Feet	Midspan Clearance (A) in Inches		Minimum Clearance at the Pole in Inches (See Note 1)
	Construction	Maintenance	
Grounded Power Systems of Up to 15 kV between Wires (8.7 kV to Ground) and Other Systems of Up to 8.7 kV between Wires			
150 or less	36	30	40
150 through 200	42 plus sag of tel	30 plus sag of tel	40
200 through 250	46 plus sag of tel	30 plus sag of tel	40
Grounded Power Systems of Voltages > 15 kV < 38 kV between Wires (8.7 kV through 22 kV to Ground) and Other Systems of 8.7 kV through 22 kV between Wires			
150 or less	40	35	46
150 through 200	45, or tel sag plus 40, if greater	35, or tel sag plus 30, if greater	46
200 through 250	50, or tel sag plus 43, if greater	38, or tel sag plus 30, if greater	46
Grounded Power Systems of Voltages > 38 kV < 70 kV between Wires (22 kV through 41 kV to Ground) and Other Systems of 22 kV through 41 kV between Wires			
150 or less	46	40	53
150 through 200	50, or tel sag plus 40, if greater	40, or tel sag plus 30, if greater	53
200 through 250	55, or tel sag plus 46, if greater	42, or tel sag plus 30, if greater	53

NOTE 1: Clearance at the pole is minimum; may need greater clearance to meet midspan requirements.
NOTE 2: The term "tel" in the table above means "telephone wire."



NOTE: Power wires with voltages exceeding 750 volts must be no lower than the line of sight if "S" exceeds 150 feet.

Figure 4-4. Clearance of Power Wires Over 750 Volts, Heavy Loading Area

Span Length (S) in Feet	Midspan Clearance (A) in Inches		Minimum Clearance at the Pole in Inches (See Note)
	Construction	Maintenance	
Systems of 22 kV or Less to Ground (38 kV or Less between Wires)			
150 or less	14	12	30
151 through 350	17	12	30
Systems of 22 kV through 41 kV to Ground (38 kV through 70 kV between Wires)			
150 or less	42	40	53
150 through 350	45	40	53

NOTE: Clearance at the pole is minimum; may need greater clearances to meet midspan requirements.

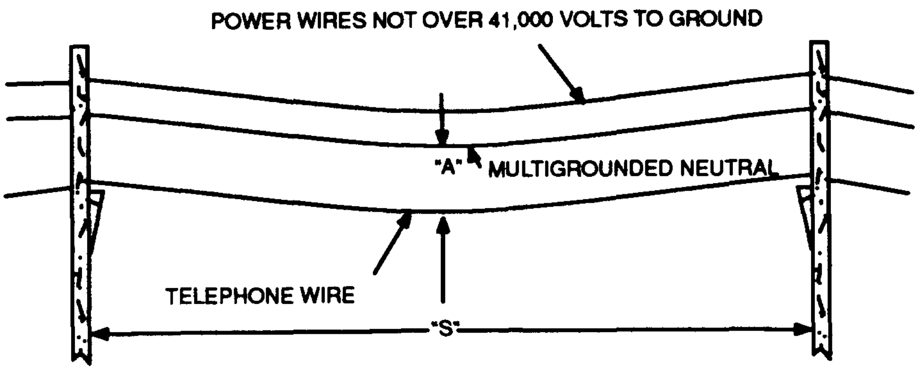


Figure 4-5. Clearance of Multigrounded Neutrals in a Light Loading Area

Span Length (S) in Feet	Midspan Clearance (A) in Inches		Minimum Clearance at the Pole in Inches (See Note)
	Construction	Maintenance	
Systems of 22 kV or Less to Ground (38 kV or Less between Wires)			
150 or less	16	12	30
150 through 200	20	12	30
200 through 250	24	12	30
Systems of 22 kV through 41 kV to Ground (38 kV through 70 kV between Wires)			
150 or less	45	40	53
150 through 200	47	40	53
200 through 250	50	40	53

NOTE: Clearance at the pole is minimum; may need greater clearances to meet midspan requirements.

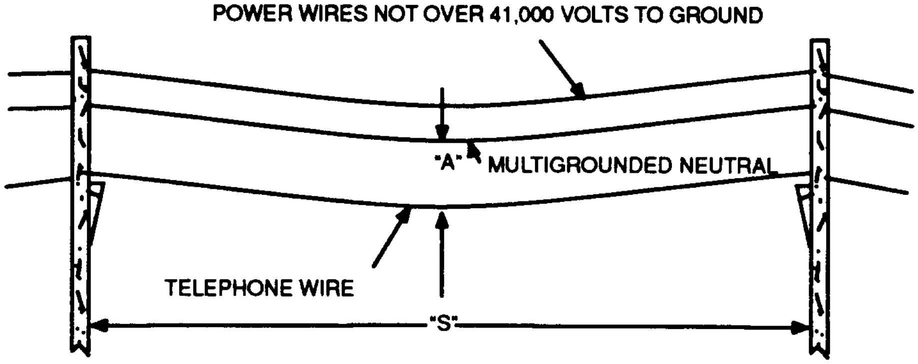


Figure 4-6. Clearance of Multigrounded Neutrals in a Medium Loading Area

Span Length (S) in Feet	Midspan Clearance (A) in Inches		Minimum Clearance at the Pole in Inches (See Note)
	Construction	Maintenance	
Systems of 22 kV or Less to Ground (38 kV or Less between Wires)			
150 or less	18	12	30
150 through 200	22	12	30
200 through 250	25	12	30
Systems of 22 kV through 41 kV to Ground (38 kV through 70 kV between Wires)			
150 or less	46	40	53
150 through 200	50	40	53
200 through 250	53	40	53

NOTE: Clearance at the pole is minimum; may need greater clearances to meet midspan requirements.

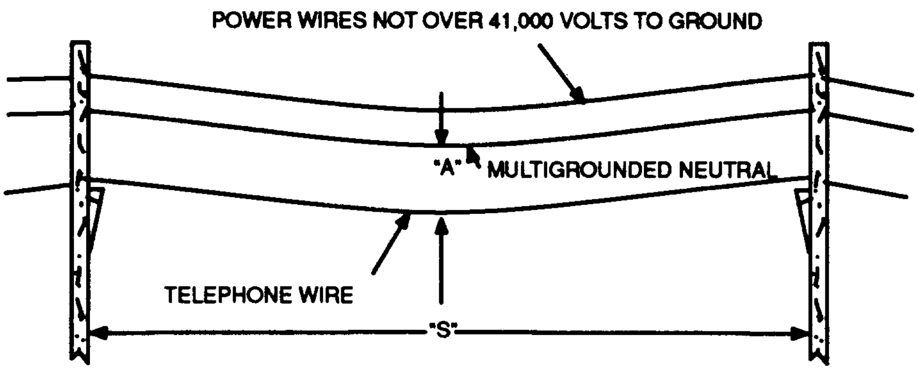


Figure 4-7. Clearance of Multigrounded Neutrals in a Heavy Loading Area

Clearance requirements between cable and power cables (except spacer-type cables) are shown in Figure 4-8.

Span Length (S) in Feet	Midspan Clearance (A) in Inches — Construction and Maintenance	Minimum Clearance at the Pole in Inches (See Note 1)
Grounded Power Cable as Covered by Rule 230C1 NESC 1990, All Voltages		
any	12	30
Grounded Power Cable as Covered by Rules 230C2 and 230C3 NESC 1990		
any	30	40
Nongrounded Power Cables (See Note 2), **8.7 kV or Less** (See Note 3)		
any	30	40
Nongrounded Power Cables (See Note 2), **8.7 kV through 22 kV or Less** (See Note 3)		
any	35	46
Nongrounded Power Cables (See Note 2), **22 kV through 41 kV** (See Note 3)		
any	40	53

NOTES:

1. Clearance at the pole is minimum; may need greater clearances to meet midspan requirements.
2. Generally excludes spacer cable, since the supporting messenger is usually grounded.
3. Voltage between wires.

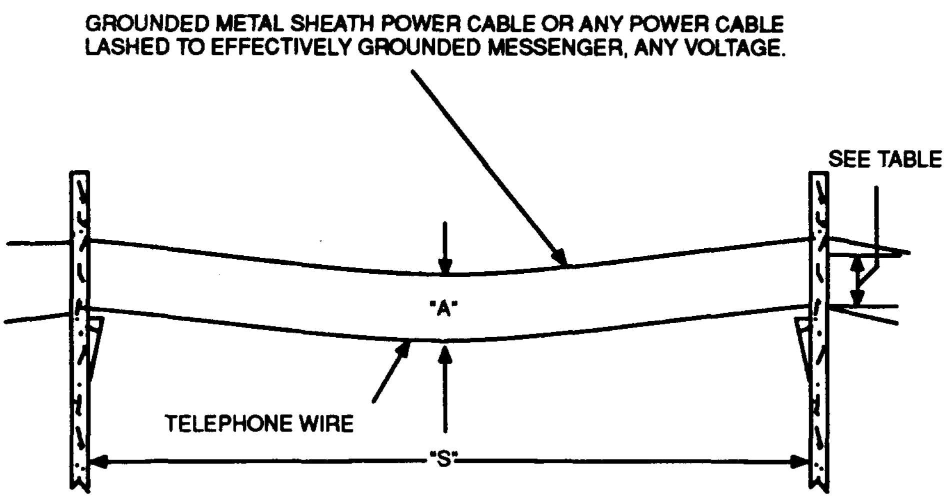
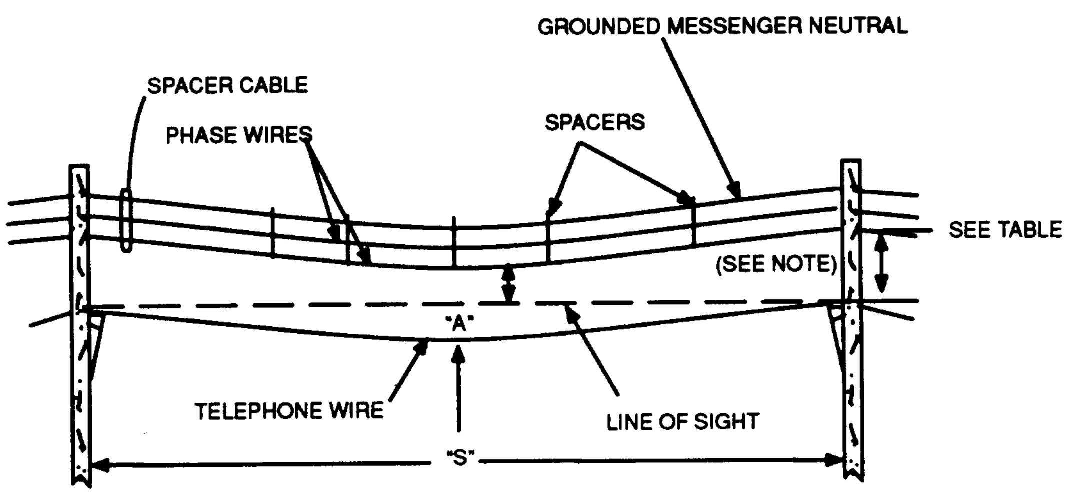


Figure 4-8. Clearance of Power Cables (Except Spacer Cables)

Span Length (S) in Feet	Midspan Clearance (A) in Inches Construction and Maintenance	Minimum Clearance at the Pole in Inches (See Note)
Systems of 8.7 kV or Less to Ground (15 kV or Less between Wires)		
150 or Less	30	40
151 or More	30 plus sag of telephone wire	40
8.7 kV through 22 kV to Ground (15 kV through 38 kV between Wires)		
150 or Less	35	46
151 or More	35 plus telephone-wire sag	46
20 kV through 41 kV to Ground (35 kV through 70 kV between Wires)		
150 or Less	40	53
151 or More	40, or 30 plus telephone-wire sag, if larger	53

NOTE: Clearance at the pole is minimum; may need greater clearances to meet midspan requirements.



NOTE: Power wires with voltages exceeding 750 volts must be no lower than the line of sight if "S" exceeds 150 feet.

Figure 4-9. Clearance of Spacer-Type Cables

5. CLEARANCES FROM POWER WIRES ATTACHED TO DIFFERENT STRUCTURES

Wire crossings below power wires that are attached to different structures are shown in Table M. Values apply to all loading areas.

Table M. Clearances from Power Wires Attached to Different Structures

Power Facility All Voltages to Ground; If Ungrounded between Phase Wires	Span Length in Feet			
	Construction			Maintenance
	150 or Less	151 thru 200	201 thru 250	250 or Less
	Clearance in Feet-Inches			
Nonmetallic sheath on a grounded messenger over 750 V	4-0	4-0	4-0	4-0
750 through 22,000 V phase wires	6-0	6-6	7-0	6-0
Grounded neutrals 22,000 V or less to ground	2-0	2-6	3-0	2-0
Over 22,000 V to ground, other neutrals	Same as associated phase wires			
Any metal-clad cable lashed to grounded strand, any voltage	2-0	2-0	2-0	2-0
750 V and less (triplex)	2-0	2-0	2-0	2-0
751 through 8,700 V Within 6 feet of telephone pole*	4-0 6-0	4-0 6-0	4-0 6-0	4-0 6-0
750 V and less (open supply)	4	4	4	4
Grounded metal-clad service drops	2-0	2-0	2-0	2-0
Messenger supported and cables nonmetallic sheath line wires	4-0	4-0	4-0	4-0
Messenger-supported nonmetallic sheath service drops	2-0	2-0	2-0	2-0
Open wires—service drops	2-0	2-6	3-0	2-0

* Every effort should be made to avoid these situations and establish a common crossing pole instead.

6. MISCELLANEOUS CLEARANCES

Miscellaneous clearances for C Rural wire in the Heavy Loading area are shown in Table N.

Table N. Miscellaneous Clearances, C Rural Wire, Heavy Loading Area

Facility	Span Length in Feet	Clearance in Feet-Inches	
		Construction	Maintenance
C Rural Wire Above			
Power service drops or power wires, 300 volts or less. Foreign guys communication cables, and surge protection wires	175 or Less 176 through 208 209 through 241 242 through 275 276 through 308	2-0 3-4 4-7 5-9 7-6	2-0 3-0 4-0 5-0 6-0
Trolley contact wires 750 volts or less	150 or Less 151 through 175	4-0* 5-0*	4-0 4-10
Trolley contact wires 751 volts and greater	150 or Less 151 through 175	6-0 7-0	6-0 6-10
C Rural Wire Below			
Foreign communication guys or cables	Any span length	2-0	2-0
Signs, tanks, chimneys	Any span length	3-0	3-0
C Rural Wire Alongside			
Signs, tanks, chimneys	Any span length	3-0	3-0

* Place wire guard at point of crossings.

Miscellaneous clearances for C Rural wire in the Medium Loading area are shown in Table O.

Table O. Miscellaneous Clearances, C Rural Wire, Medium Loading Area

Facility	Span Length in Feet	Clearance in Feet-Inches	
		Construction	Maintenance
C Rural Wire Above			
Power service drops or power wires 300 volts or less. Foreign guys communication cables, and surge protection wires	200 or Less 201 through 250 251 through 283 284 through 316 317 through 350	2-0 2-2 3-3 4-4 5-7	2-0 2-0 3-0 4-0 5-0
Trolley contact wires 750 volts or less	200 or Less	4-0*	4-0
Trolley contact wires 751 volts and greater	200 or Less 261 through 300	6-0 6-6	6-0 6-3
C Rural Wire Below			
Foreign communication guys or cables	Any span length	2-0	2-0
Signs, tanks, chimneys		3-0	3-0
C Rural Wire Alongside			
Signs, tanks, chimneys	Any span length	3-0	3-0

* Place wire guard at point of crossings.

Miscellaneous clearance for C Rural wire in the Light Loading area are shown in Table P.

Table P. Miscellaneous Clearances, C Rural Wire, Light Loading Area

Facility	Span Length in Feet	Clearance in Feet-Inches: Construction and Maintenance
C Rural Wire Above		
Power service drops or power wires 300 volts or less. Foreign guys communication cables, and surge protection wires	350 or Less 351 through 383 384 through 417 418 through 450	2-0 2-6 3-0 4-6
Trolley contact wires 750 volts or less	250 or Less	4.0*
C Rural Wire Below		
Foreign communication guys or cables	Any span length	2-0
Signs, tanks, chimneys	Any span length	3-0
C Rural Wire Alongside		
Signs, tanks, chimneys	Any span length	3-0

* Place wire guard at point of crossings. Clearance should be 6 feet if over 751 volts.