Bellcore

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Clearances for Multiple Drop Wire

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Clearances for Multiple Drop Wire

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1. GENERAL INFORMATION

1.01 This Practice contains the recommended clearances for multiple pair, 22 gauge aerial service wire constructed with an .083-inch galvanized steel independent support messenger. The wire is furnished in 3 sizes: 2-pair (.065 lbs/ft), 5-pair (.086 lbs/ft), and 6-pair (.092 lbs/ft). For purposes of computing sag, 5- and 6-pair sizes are treated identically and 2-pair is considered separately.

1.02 This Practice is issued to

- Include the drop wire clearances of the 1990 edition of the National Electrical Safety Code (NESC), and
- Increase those drop wire clearances that were insufficient under ice loading.

1.03 Drop wire tends to elongate as the temperature rises and to contract as the temperature falls. Wire placed during cold weather will have a greater sag in warm weather, even if no permanent stretch is involved.

1.04 To avoid excessive sags over roads, alleys, or driveways, poles should be placed within 50 feet of the edge of these obstacles. A pole located within 50 feet of the road, alley or driveway (distance A in Figure 1-1) will permit the overhead clearance to conform to reduced crossing clearances.

> **Example:** A 200-foot lead crosses a highway that has one pole located within 50 feet of the far edge of the boundary. The loading area is categorized as *medium* and the minimum sag is specified.
>
> From Table 3-2 a 200-foot section has a maximum sag of 80 inches, and from Table 3-3, 15 feet 6 inches is required for the road crossing. From Table 1-1 associated with Figure 1-1, a 200-foot span may be reduced to 80% of its normal sag. Therefore, the attachment height is (15 feet 6 inches) + (5 feet 4 inches) = (20 feet 10 inches).

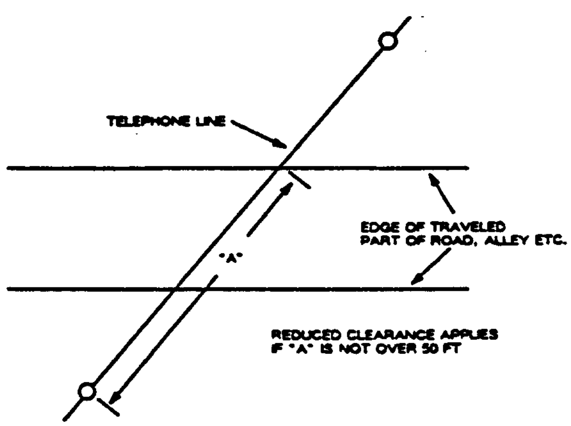


Figure 1-1. A Wire Spanning a Public Road — Poles Located at the Edges of the Road

Table 1-1. The Percentage of Midspan Sag of a Drop Wire for a Certain Span

Span (feet)	Percent of Midspan Sag "X" = 50 feet
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

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

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

1.07 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, aerial drop wire crossings over swimming pools should be avoided.

2. TERMINOLOGY

2.01 The following is a brief description of conditions applicable to multiple drop wire clearance requirements.

(a) **Storm Loading Areas:** Figure 2-1 identifies the three storm loading areas based upon studies made from records of wire-using companies and data from the United States Weather Bureau. The frequency, severity, and effects of ice and windstorms in various sections of the country were the elements considered in establishing the loading area zones. Because of the weather differences, allowances must be made for the stretching of conductors in their respective loading zones when placing a drop wire.

(b) **Multiple Drop Wire Sag:** The sag in multiple drop wire is measured by comparing the line of sight established by the drop wire attachments and the lowest point in the span. Stringing sags recommended for multiple drop wire are shown in predivesture Bell System Practice 462-500-011.

1. **Normal Drop Wire Sag:** Drop wires are to be strung with normal sags when adequate clearances can be attained. Technicians may or may not be able to obtain these sags with normal hand pulling. For calculation purposes, the initial tension is taken as 65 pounds. Clearance values for 5- or 6-pair drop wire placed with normal sag are given in Table 3-1.

2. **Minimum Drop Wire Sag:** A minimum sag in a drop wire can be strung where clearance is limitied and normal sags cannot be attained. These smaller sags result in higher stringing tensions in the wire; therefore, the technician needs pulling tools to pull the wire up to tension. For calculation purposes, the initial tension is taken as 85 pounds. Clearance values for 5- or 6-pair drop wire placed with a minimum sag are given in Table 3-2.

3. Tables 3-1 and 3-2 may be used when placing 2/22 F multiple drop wire in the following manner:

   - Install with an initial tension of 45 lbs and sags in Table 3-1.
   - Install with an initial tension of 60 lbs and sags shown in Table 3-2.

(c) **Placing Clearances:** Placing value of clearance is the height the drop wire will clear when placed or replaced. It is also called construction clearance. (See Paragraph 3.01a.)

(d) **Placing Clearances on Jointly Used Poles:** Placing clearances on jointly used poles are the clearances required between drop wires or drop wire attachments and foreign equipment and foreign equipment attachment apparatus.

(e) **Maintenance Clearances:** Maintenance clearance is the clearance that should exist after wire has been exposed to one or more cycles of storm loading and the temperature returns to 60°F. Placing clearances are more conservative and, if there is doubt as to sag characteristics, it is advisable to use placing clearances.

(f) **Multiple Drop Wire Crossing Above Railroad Tracks and Limited Access Highways:** Railroad crossing and limited access highways (such as interstate highways) require special considerations to minimize sag under loaded conditions. The following limitations on span lengths must be observed when applying the clearances given in Table 3-3.

1. **Light Storm Loading Area:** Limit span length to 150 feet. Longer spans require 10M strand.
2. **Medium Storm Loading Area:** Support on 6M or 6.6M strand for spans greater than 100 feet.
3. **Heavy Storm Loading Area:** Support on 10M strand for spans greater than 150 feet.

(g) **Drop Wire Crossing Above Public Roads, Public Alleys, or Residential Drives:** Public roads and streets are considered thoroughfares that are routinely subject to truck traffic. Trucks are defined in the NESC as exceeding a height of 8 feet. The following limits for road crossings must be observed:

1. **Light Storm Loading Area:** Limit span length to 350 feet if installed with minimum sag; 300 feet if installed with normal sag.
2. **Medium Storm Loading Area:** Limit span to 350 feet if installed with minimum sag; 275 feet when installed with normal sag.
3. **Heavy Storm Loading Area:** Limit span to 300 feet if installed with minimum sag; 250 feet when installed with normal sag.

(h) **No Overhang — Back of Obstruction:** A pole line located in back of a fence, ditch, embankment, etc., so that the ground beneath the line can ordinarily be traveled by pedestrians only, has clearances shown in Figure 2-2.

(i) **No Overhang — Not Back of Obstruction:** This category is a pole line not back of a fence, ditch, embankment, etc., and does not overhang the normal traveled road. This category is meant to include ground not ordinarily traveled in both rural (Figure 2-3) and nonrural (Figure 2-4) areas that can be reached by vehicles. The clearance in Figure 2-4 may be reduced to 15 feet if a curb or other vehicular deterrent is present. If farm machinery is likely to pass under the line, sufficient clearance must be provided so that the drop wire when under maximum sag condition will be 1-1/2 feet above the highest part of the machinery or the loads it will carry.

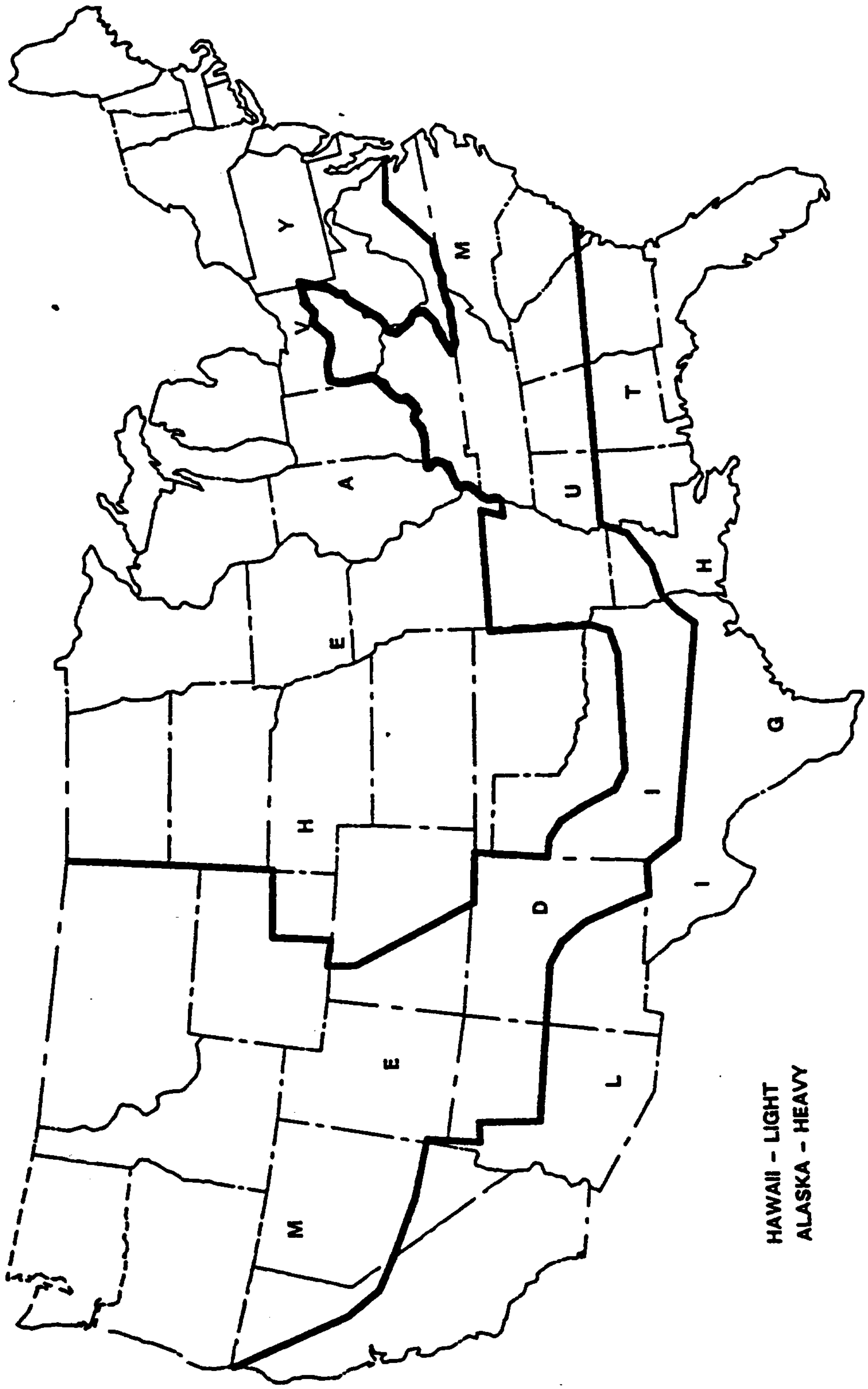


Figure 2-1. Storm Loading Areas

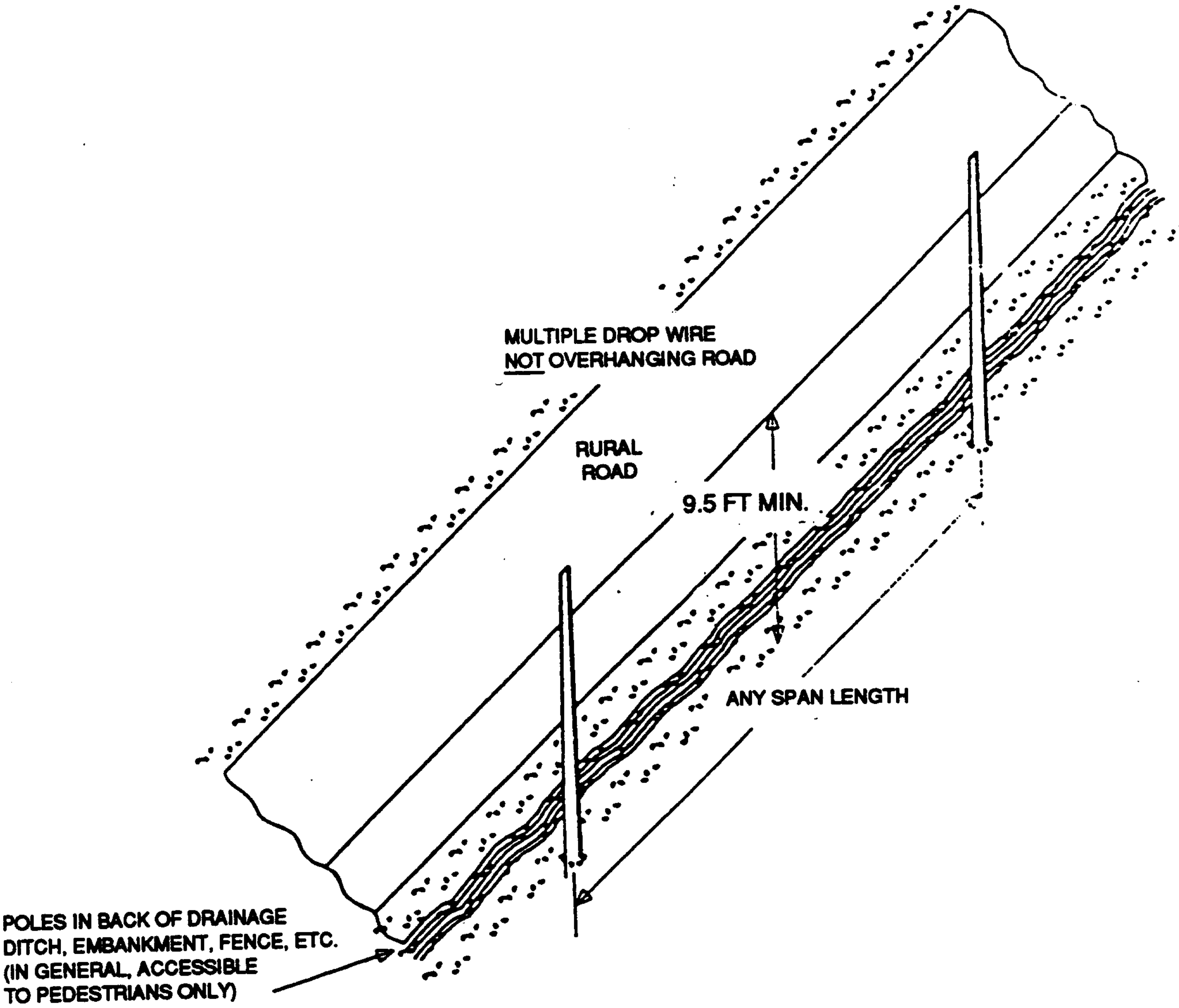


Figure 2-2. Wire Running Along Rural Roads (Back of Obstructions)

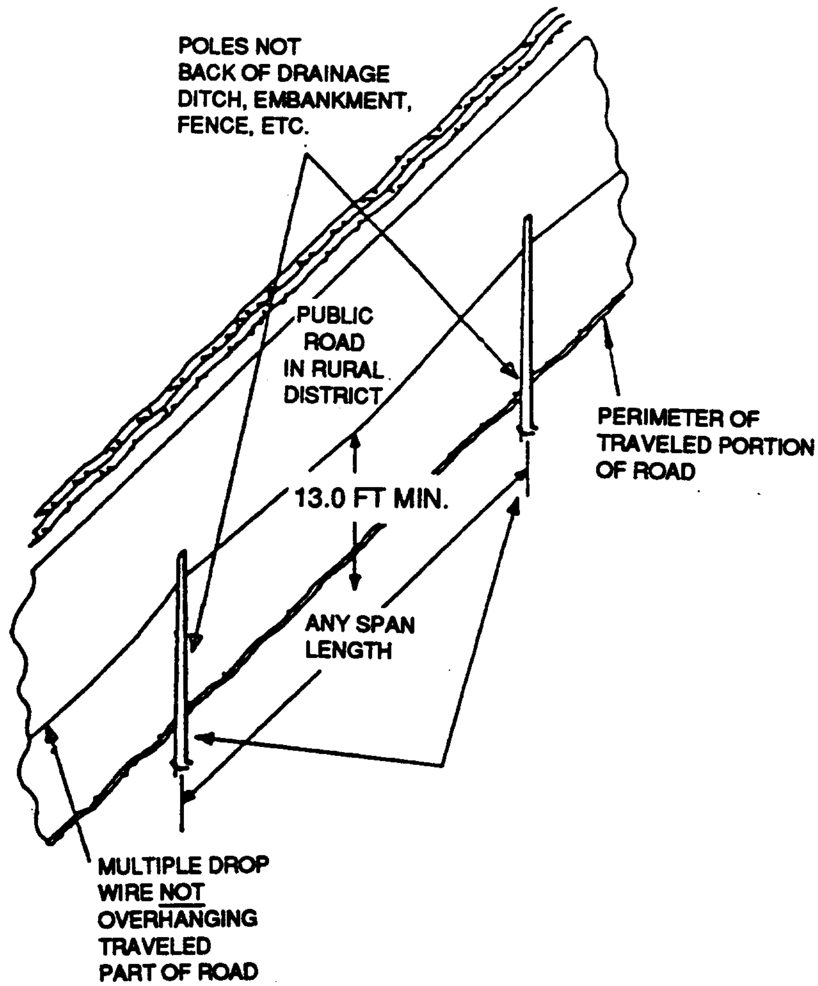
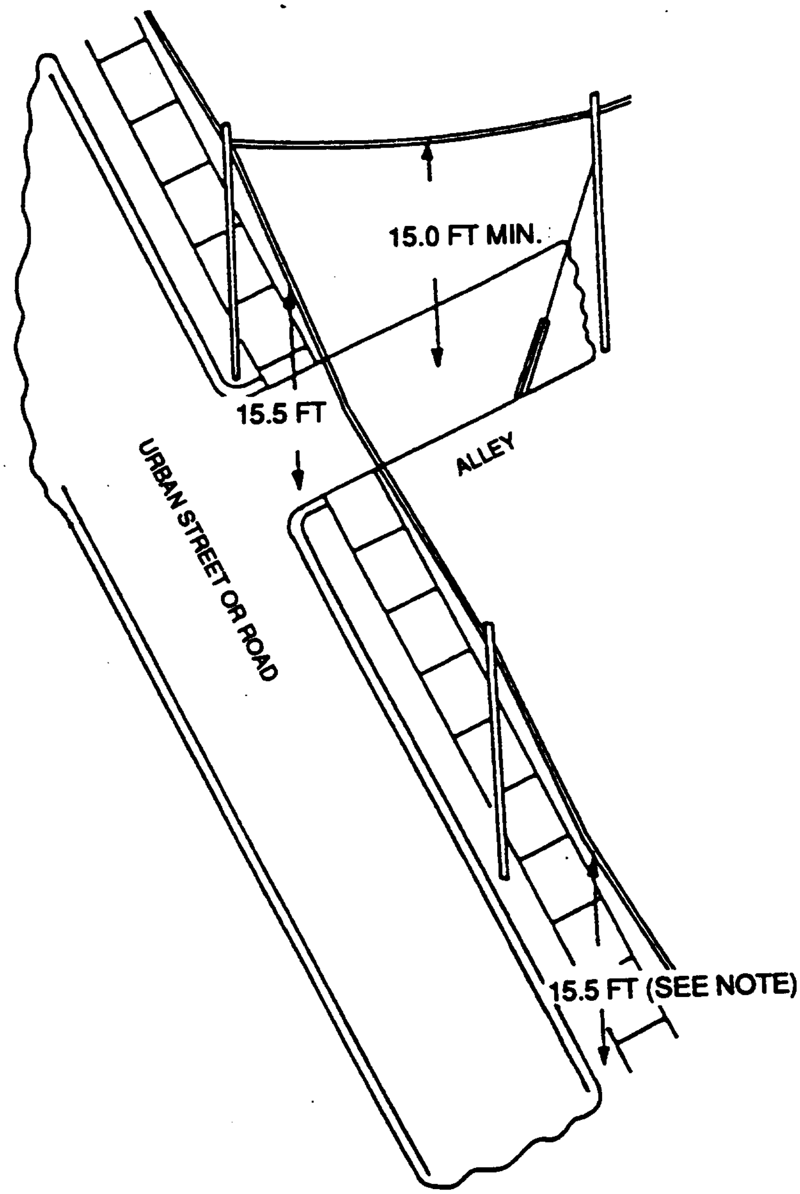


Figure 2-3. Wire Running Along, but Not Overhanging, Rural Roads (Not Back of Obstruction)



NOTE: IF BACK OF CURB, 15 FEET

Figure 2-4. Wire Running Along, but Not Overhanging, Non-Rural Roads (Not Back of Obstruction) and Crossing an Alley

3. MULTIPLE DROP WIRE CLEARANCES

3.01 The following factors must be considered when determining the proper wire clearances.

(a) **Placing or Maintenance Clearances:** The clearances for drop wires to be placed or replaced are identified as placing clearances. The clearances for existing drop wires, in place, are identified as maintenance clearances after they have been subjected to one full storm-loading cycle.

(b) **The Storm Loading Area:** Determine the storm-loading area applicable to the locality where the drop wire exists or is to be placed. Storm-loading areas are shown in Figure 2-1.

(c) **Drop Wire Sag:** Drop wires are placed in-service with a normal or minimum sag. Two values for sag are given: 65 lbs initial tension, referred to as normal, and 85 lbs initial tension, referred to as minimum sag. Generally, above 50 lbs requires mechanical assistance. See Paragraph 3.06 for information concerning placing sags for 2/22 multiple drop.

(d) **Specific Condition Encountered:** The specific condition encountered, such as placing the drop wire above or along roadways, rails, and buildings, or above or below power facilities, foreign equipment, and signs, will determine the initial tension placed on the drop wire.

3.02 **Multiple Drop Wire Clearances Above Ground and Other Objects:** As discussed in Paragraph 1.06, the method of calculating these clearances was changed in the 1990 edition of the NESC.

NOTE: Under no condition should values from past editions of the NESC be used with the clearances given in this Practice.

3.03 The following figures and table provide the approximate clearance for multiple pair, 22-gauge drop wire above ground and other objects when installed at 60°F. This clearance will assure that under "maximum" sag conditions code requirements will be met.

3.04 Tables 3-1 and 3-2 are provided to account for "Normal" and "Minimum" placing sags for both 5/22-F and 6/22-F multiple drop wire. The maximum sag given is based upon 1/2-inch ice, 1/4-inch ice and 120°F for Heavy, Medium, and Light loading areas, respectively. This clearance is then added to the appropriate clearance from Table 3-3.

3.05 See Paragraphs 2.01b and 3.01c for selection of proper initial stringing sags.

3.06 Tables 3-1 and 3-2 may also be applied to 2/22-F wire at 60°F in the following manner:

(a) When using Table 3-1 for <u>normal stringing sags,</u> install the wire with an initial stringing sag of 45 lbs and all sags shown in the table will apply.

(b) When using Table 3-2 for <u>minimum stringing sags,</u> install the wire with an initial stringing sag of 60 lbs and all sags shown in the table will apply.

3.07 The following examples will illustrate the use of the tables.

Example 1: What clearance (Table 3-1) is required at 60°F in a *medium storm loading* area for a 250-foot, 5/22 service drop crossing a pedestrian walkway? The drop was installed several years earlier.

Required clearance from Table 3-3 is 9.5 feet.
*Required clearance from Table 3-1 is 11.0 inches.
Required clearance at 60°F is 9.5 ft plus 11 inches = 10 ft 5 inches.
Required attachment height is 9.5 ft plus 144 inches = 21 feet 6 inches.

*Normal sag may be used since the span length is less than 275 feet.

Example 2: A 2/22 multiple drop wire is to be installed in a *medium loading area.* The span length will be 280 feet crossing through grazing pastures. What is the required clearance?

Required clearance from Table 3-3 is 15 ft 6 inches.
*Required clearance from Table 3-2 is approximately 24 inches. Required clearance at 60°F is 15 ft 6 inches plus 24 inches = 17 feet 6 inches.

*Minimum sag required because the span is greater than 275 feet. Install with initial stringing tension of 60 pounds.

Table 3-1. Clearance Factors at 60°F – Normal Sag

INITIAL STRINGING SAG 65 LBS – NORMAL SAG"									
	Heavy Storm Loading Area			Medium Storm Loading Area			Light Storm Loading Area		
Span	60°F Sag	Maint Clrnce	Const Clrnce	60°F Sag	Maint Clrnce	Const Clrnce	60°F Sag	Maint Clrnce	Const Clrnce
Feet	Max Sag	Inches		Max Sag	Inches		Max Sag	Inches	
50	5 13	8	10	5 9	4	4	5 8	3	3
75	12 23	11	13	12 17	5	5	12 15	3	3
100	21 36	15	18	21 28	7	8	21 25	4	4
125	33 51	18	24	33 41	8	10	33 37	4	4
150	48 69	21	27	48 57	9	11	48 52	4	4
175	65 88	23	30	65 75	10	13	65 69	4	4
200	85 110	25	32	85 95	10	13	85 89	4	4
225	107 134	27	35	107 118	11	15	107 112	4	4
250	133 161	28	37	133 144	11	15	133 137	4	4
275				161 172	11	17	161 165	4	4

NOTE: The above sag information may be applied to 2/22-F wire when placed with an initial stringing sag of 45 pounds.

Table 3-2. Clearance Factors at 60°F – Minimum Sag

INITIAL STRINGING SAG 85 LBS – MINIMUM SAG									
	Heavy Storm Loading Area			Medium Storm Loading Area			Light Storm Loading Area		
Span	60°F Sag	Maint Clrnce	Const Clrnce	60°F Sag	Maint Clrnce	Const Clrnce	60°F Sag	Maint Clrnce	Const Clrnce
Feet	Max Sag	Inches		Max Sag	Inches		Max Sag	Inches	
50	4 12	8	13	4 8	4	6	4 6	2	2
75	9 22	13	20	9 15	6	9	9 12	3	3
100	16 34	22	29	16 25	9	13	16 20	4	4
125	25 47	22	30	25 36	11	15	25 30	4	4
150	37 62	25	33	37 49	12	16	37 41	4	4
175	50 79	29	38	50 64	14	19	50 55	5	5
200	65 98	33	43	65 80	15	20	65 70	5	5
225	82 118	36	47	82 98	16	21	82 88	6	6
250	102 140	38	51	102 119	17	23	102 107	6	6
275	123 160	41	56	123 141	18	24	123 129	6	6
300	146 190	44	59	146 165	19	25	146 152	6	6
350							199 205	6	6

NOTE: The above sag information may be applied to 2/22-F wire when placed with an initial stringing sag of 60 pounds.

Table 3-3. Minimum Clearance Requirements Under **Maximum Sag Conditions**

Crossing Above:	**Clearance (feet)**	**Remarks**
Railroad tracks	23.5	See span limitations, Paragraph 2.01f
Public roads	15.5	See span limitations, Paragraph 2.01g
Public alleys, non-residential driveways, parking lots	15.0	
Residential driveways: • General • Other	 15.0 11.5	Where building height does not permit 15 feet, 11.5 feet is permissible.
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 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 non-rural areas • Rural (light traffic) roads unlikely to have vehicles passing under the line (NOTE) – Back of obstruction – Not back of obstruction • Public alleys	 15.5 9.5 13.0 15.0	 May be reduced per Figure 2-4 See Figure 2-2 See Figure 2-3

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

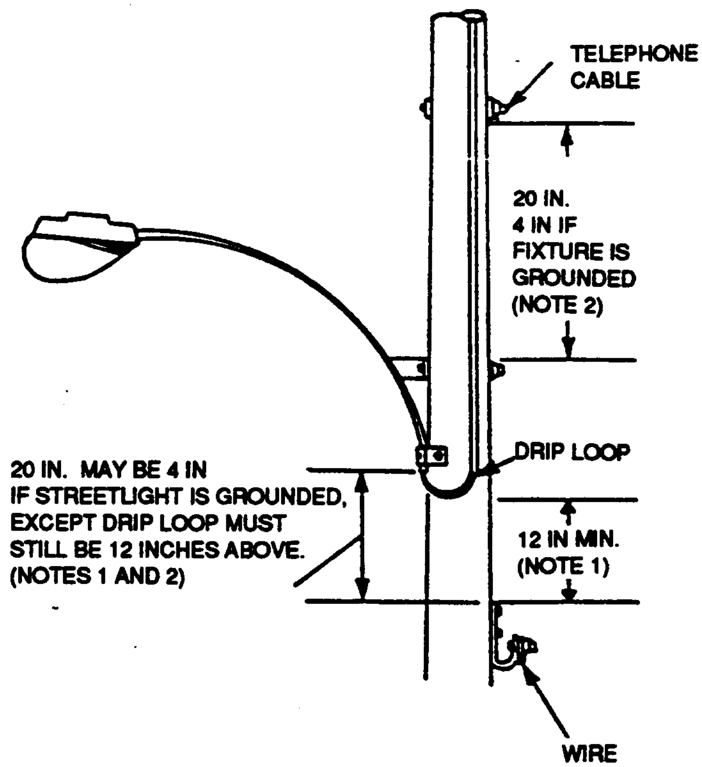
3.08 **Clearances on Jointly Used Poles:** These are clearances to be maintained between telephone facilities and power company or licensee attachments, as shown in Table 3-4 and Figures 3-1 through 3-6.

Table 3-4. Multiple Drop Wire Clearances on Jointly Used Poles

Minimum Clearance To	Grounded (inches)	Not Grounded (inches)
Street fixtures, span wires (Figure 3-1 through 3-4)	4	20
Streetlight drip loops (Figure 3-1)	12[1]	12[1]
Drive hooks, bridlewire rings, brackets, etc. (Figure 3-2)	4	16
Guys	3	6
Licensee attachments (Figure 3-5)	12	12[2]
Grounded neutral on common crossing poles (Figure 3-6)	4	NOTE 3

NOTES

1. The clearance is 3 inches if the drip loop is covered. See Figure 3-2.
2. These facilities are always grounded on joint poles.
3. The clearance is the same as the associated phase conductor.



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 Cable

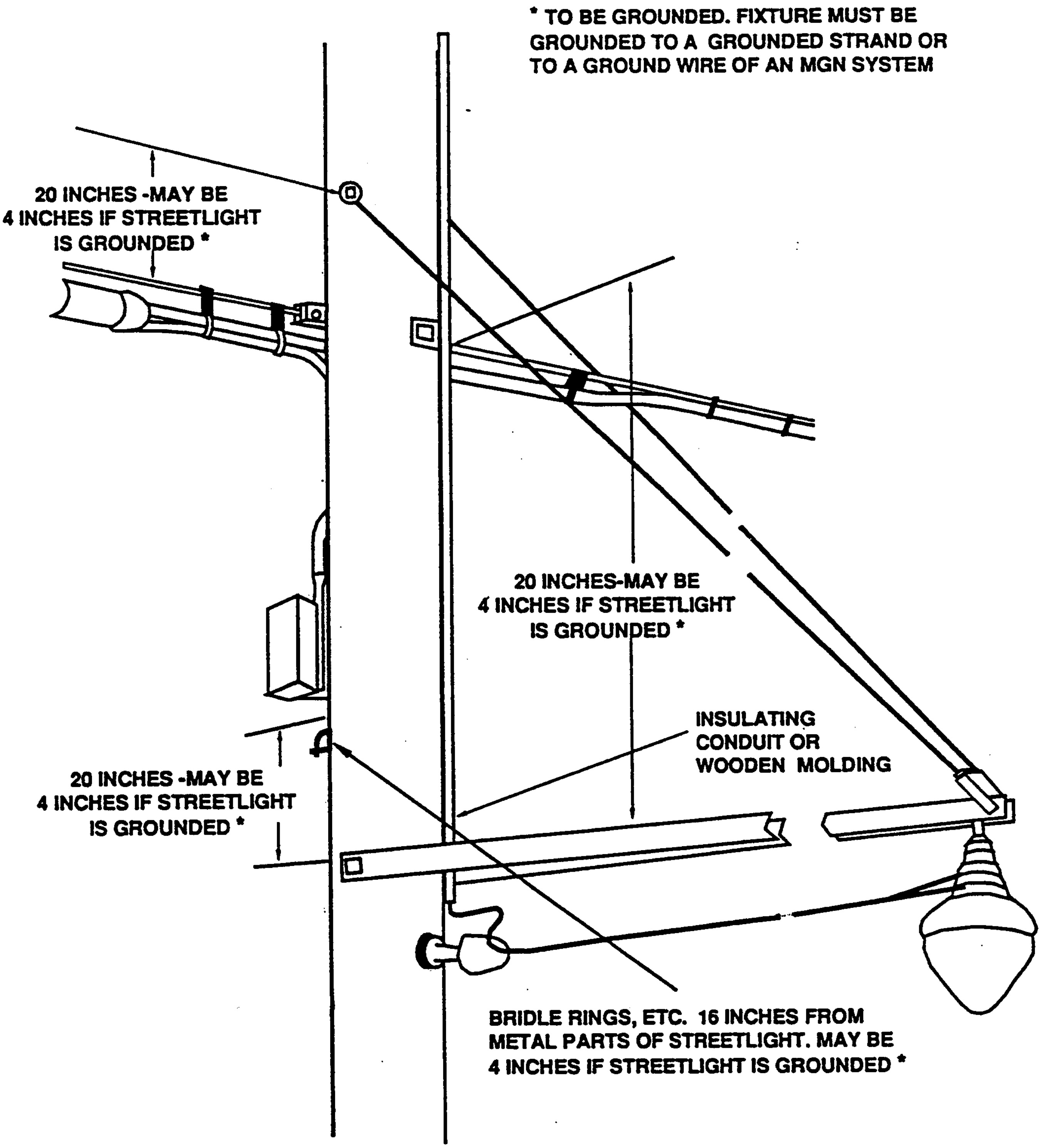
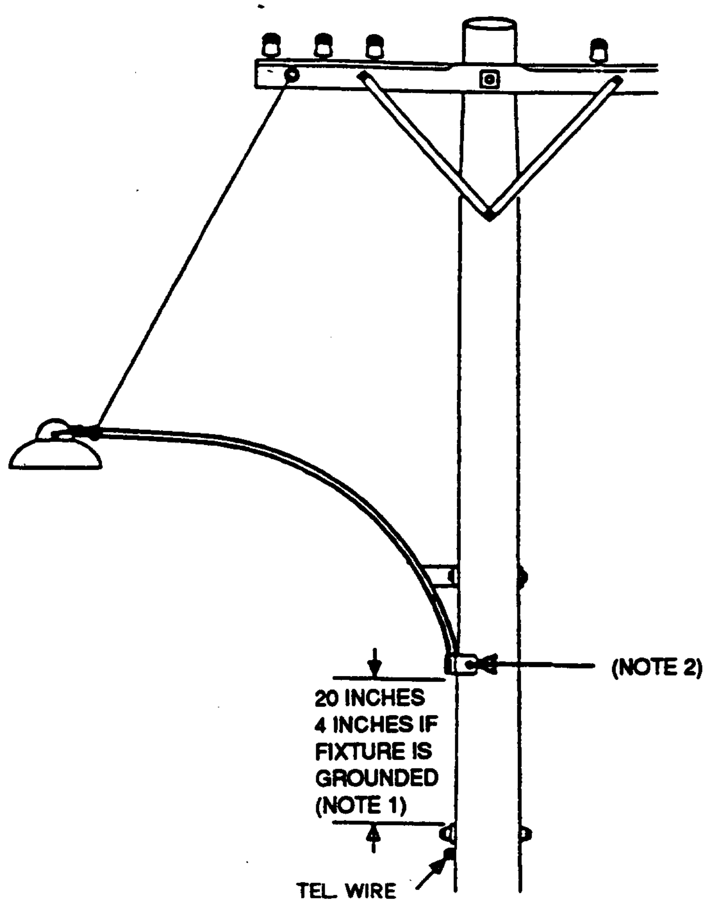


Figure 3-2. Clearance of Drivehooks, Bridlewire Rings, or Brackets from Streetlight Fixture



NOTES:

1. To be grounded, a fixture must be bonded to a grounded strand or to a ground wire of an MGN system.
2. The same clearances apply to span wire brackets carrying traffic signals.

Figure 3-3. Clearance of Cable from Streetlight Fixture Mounted Above Drop Wire

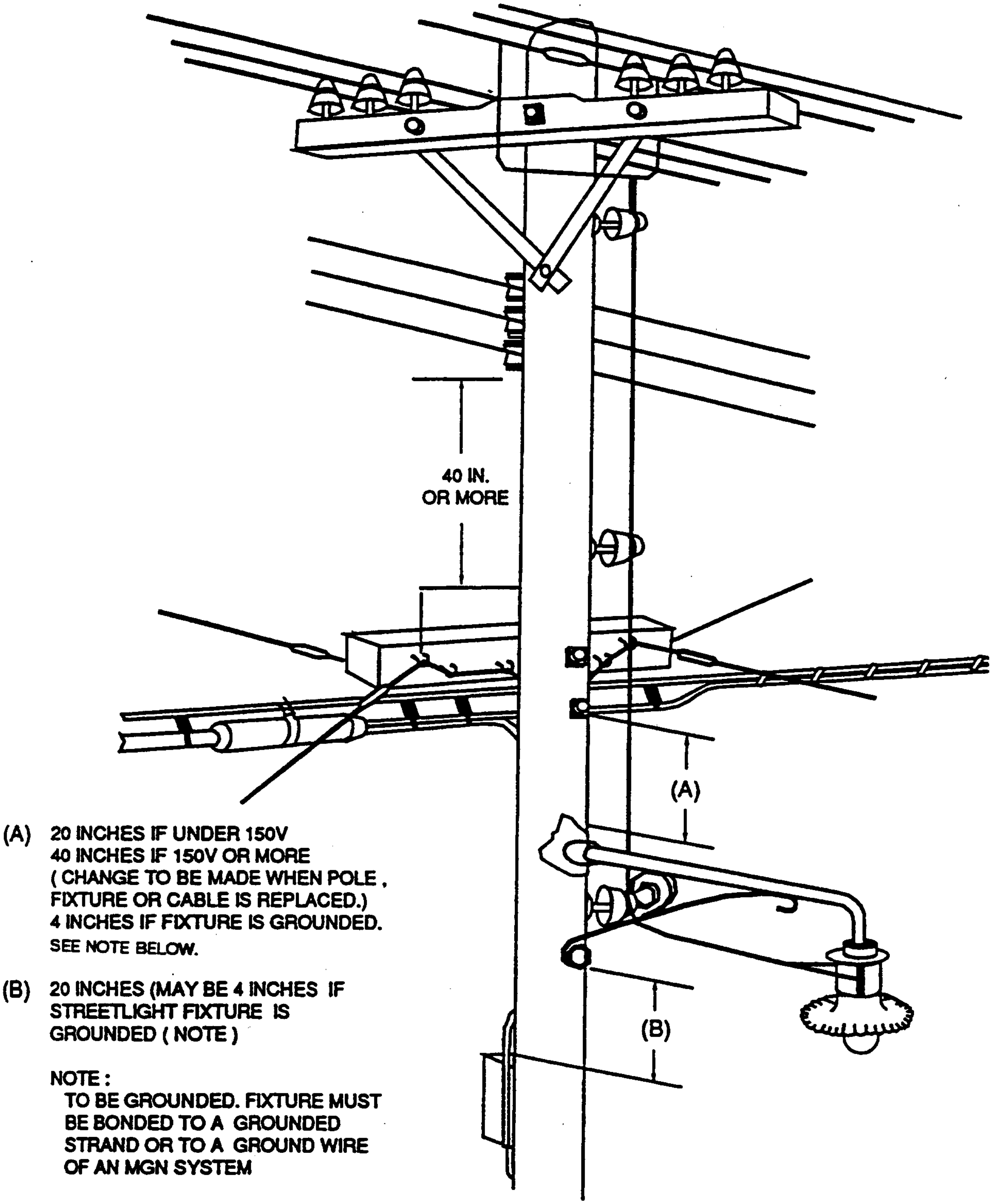
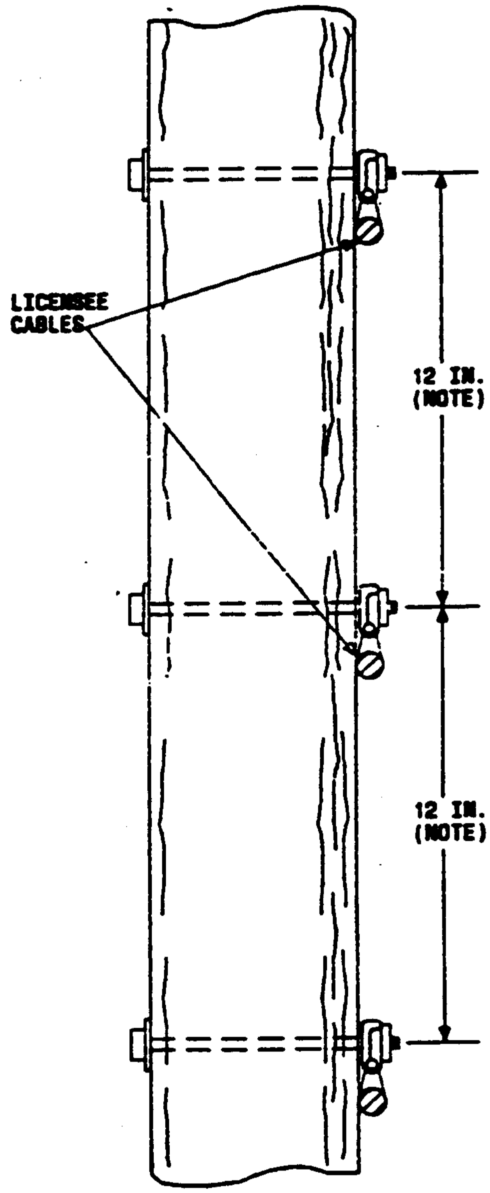
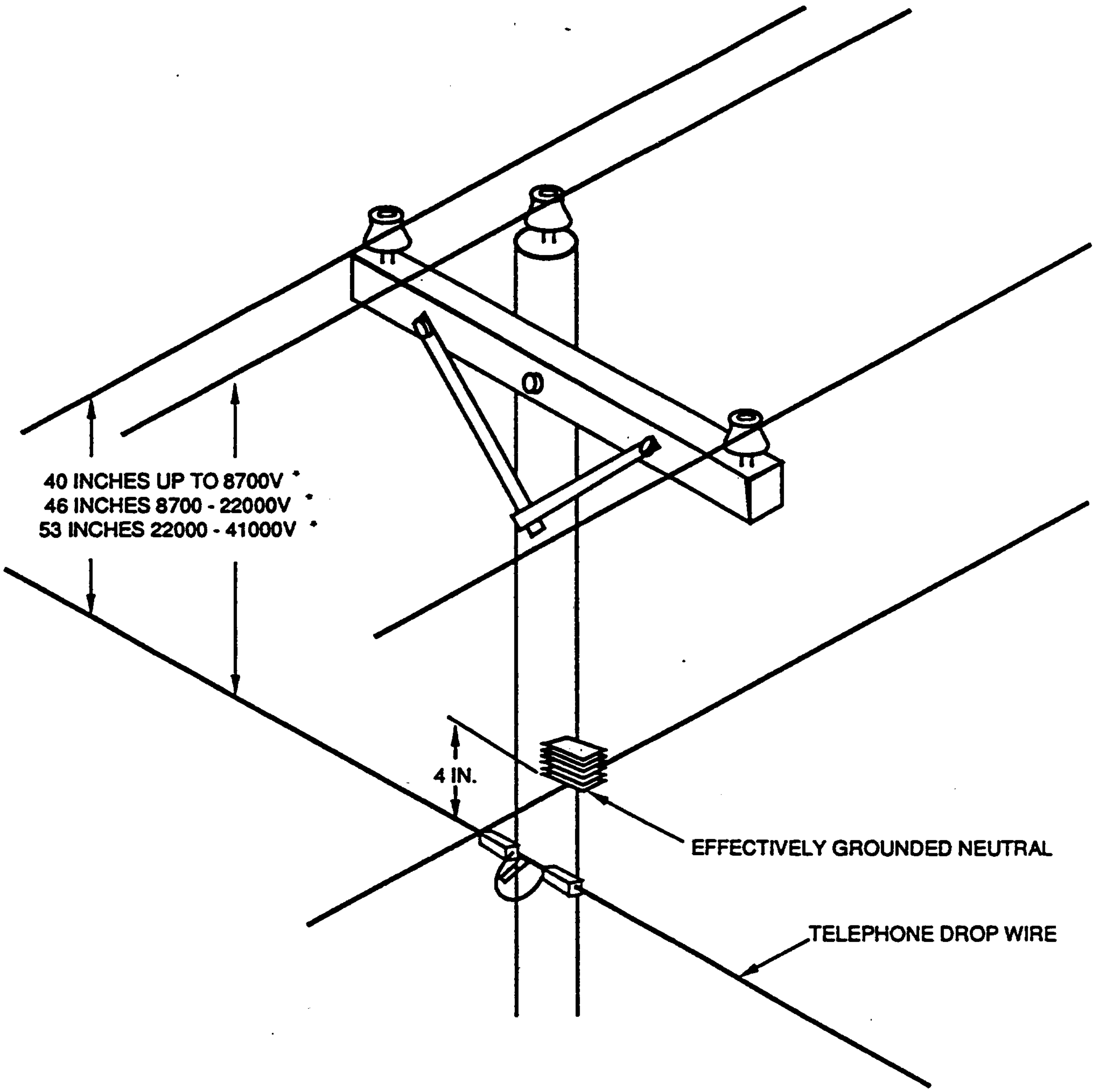


Figure 3-4. Clearance of Cable and Pole-Mounted Terminal from Streetlight Fixture Mounted Below Cable



NOTE:
MAY BE REDUCED BY MUTUAL AGREEMENT
(NOT AN NESC REQUIREMENT)

Figure 3-5. Vertical Clearance Between Telephone and Licensee Cables



* Voltages are phase to ground

Figure 3-6. Multiple Drop Wire Clearance on Common Crossing Pole

3.09 Clearances for various job conditions and span lengths not included in Tables 3-3 and 3-4 may be determined using Figures 3-7 through 3-12. Figures 3-7, 3-8, and 3-9 show construction and maintenance clearances for multiple drop wire passing ABOVE, BELOW, and ALONGSIDE miscellaneous facilities for the various loading areas. Figures 3-10, 3-11, and 3-12 show construction clearances for multiple drop wire BELOW various power conductors for the various loading areas. Where power conductors cross within six (6) feet of the pole to which the drop is attached, a common crossing pole should be used, if possible. When a common pole cannot be used, power conductors to drop pole clearances must be as shown in BR 620-210-012, *Clearance for Telephone Poles and Stubs.*

(a) In the tabular part of the figure, identify the reference letter associated with the job condition.

(b) On the graph part of the figure, locate the straight line associated with the letter reference.

(c) Locate the vertical line associated with the span length encountered.

(d) The intersection of the straight line and vertical lines identifies the clearance (ft - inches) required.

Multiple Drop Wire		
ABOVE	**Clearance*** (feet - inches)	**Max. Span Length†** (feet)
Power Service Drops or Power Line Wires 750 Volts or Less	2 - 0	300
Trolley Contact Wires 750 Volts or Less (Place Wire Guard at Point of Crossing)	4 - 0	250
BELOW		
Foreign Guys, Communication Cables	2 - 0	300
Signs	3 - 0	300
ALONGSIDE		
Signs	3 - 0	300

* Placing or Maintenance Clearance

† Normal or Minimum Drop Wire Sag.

Figure 3-7. Multiple Drop Wire Placing Clearances - **Light Loading Area** - Above, Below, or Alongside Electrical Facilities - with Normal and Minimum Sag.

MULTIPLE DROP WIRE	Placing Wire		Maintaining Wire	
	Normal Sag	Minimum Sag	Normal Sag	Minimum Sag
ABOVE				
Power Service Drops or Power Line Wires 750 Volts or Less	A	B	A	A
Trolley Contact Wires 750 Volts or Less*	D	D	C	C
BELOW				
Foreign Guys, Communication Cables†	A	A	A	A
Signs	E	E	E	E
ALONGSIDE				
Signs	E	E	E	E

* Place Wire Guard at Point of Crossing.

† Span Length of Foreign Cable Not Over 250 Feet.

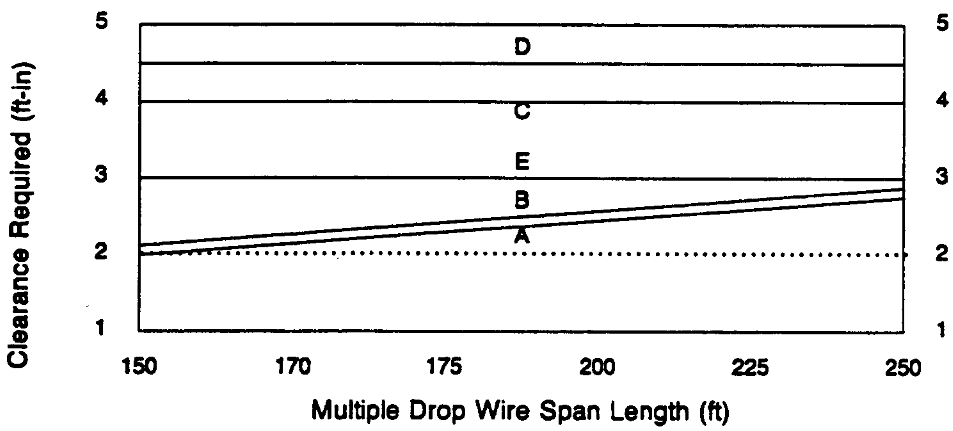


Figure 3-8. Multiple Drop Wire Placing Clearances - **Medium Loading Area** - Above, Below, or Alongside Electrical Facilities - with Normal and Minimum Sag.

MULTIPLE DROP WIRE	Placing Wire		Maintaining Wire	
	Normal Sag	Minimum Sag	Normal Sag	Minimum Sag
ABOVE				
Power Service Drops or Power Line Wires 300 Volts or Less	A	B	C	C
Trolley Contact Wires 750 Volts or Less*	D	E	F	F
BELOW				
Foreign Guys, Communication Cables†	H	H	H	H
Signs	G	G	G	G
ALONGSIDE				
Signs	G	G	G	G

* Place Wire Guard at Point of Crossing.

† Span Length of Foreign Cable Not Over 175 Feet.

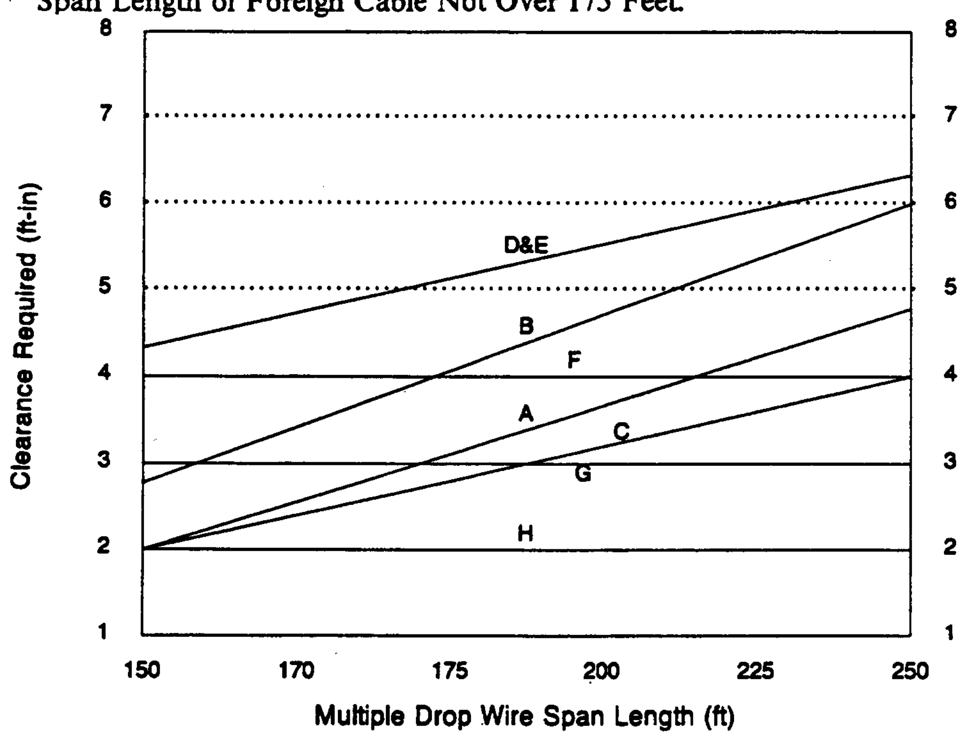
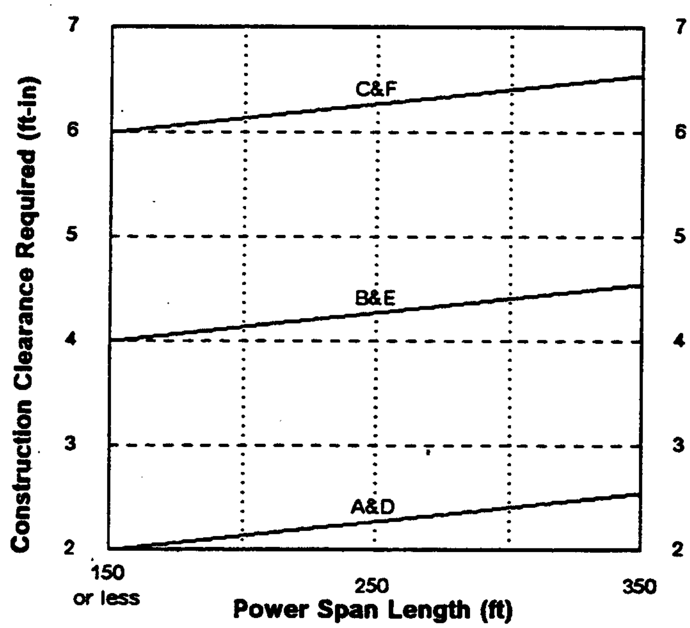


Figure 3-9. Multiple Drop Wire Placing Clearances - **Heavy Loading Area** - Above, Below, or Alongside Electrical Facilities - with Normal and Minimum Sag.

Construction Clearances Crossing Below Power Wires and Cables

Multiple Drop Wire Below	Ref
0 - 750 volts service wire or cable. If running parallel and attached to same pole with service drop — 12 inches	A
Open power conductors 0 - 750 volts. If supply service drop use A as above.	B
751v - 22 Kv phase wires generally. If within 6 feet of a pole use C. (Use curve B up to only 8.7 Kv.)	B C
Foreign communication cable — less if by mutual consent.	D
Grounded neutrals — up to 22 Kv to ground.	A
Grounded neutrals — systems over 22 Kv and other neutrals — see associated phase clearances.	
Grounded metal sheath cable.	D
Insulated cable on bare messenger, triplex and quadraplex.	A
Spacer cables — Illustrated in BSP-627-070-015. 750v or less — generally.	E
Spacer cables 751v to 22 Kv, generally. If within 6 feet of pole use F. (Use Curve E up to only 8.7 Kv.)	E F

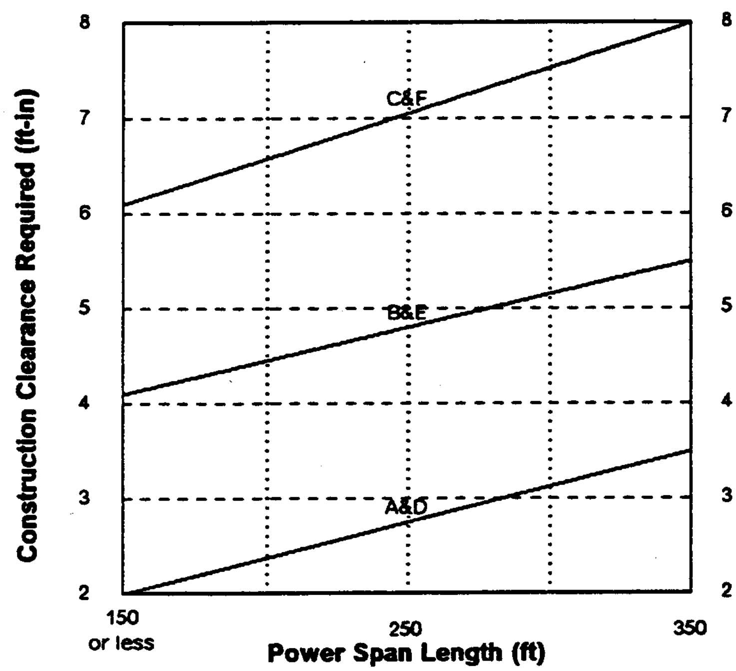


NOTE: Maintenance clearances for span lenghts up to 350 feet are to be the same as that specified in placing the drop wire for span lengths of 150 feet or less.

Figure 3-10. Multiple Drop Wire Placing Clearances — **Light Loading Area** — Normal or Minimum Sag.

Construction Clearances Crossing Below Power Wires and Cables

Multiple Drop Wire Below	Ref
0 - 750 volts service wire or cable. If running parallel and attached to same pole with service drop — 12 inches	A
Open power conductors 0 - 750 volts. If supply service drop use A as above.	B
751v - 22 Kv phase wires generally. If within 6 feet of a pole use C. (Use curve B up to only 8.7 Kv.)	B C
Foreign communication cable — less if by mutual consent.	D
Grounded neutrals — up to 22 Kv to ground.	A
Grounded neutrals — systems over 22 Kv and other neutrals — see associated phase clearances.	
Grounded metal sheath cable.	D
Insulated cable on bare messenger, triplex and quadraplex.	A
Spacer cables — Illustrated in BSP-627-070-015. 750v or less — generally.	E
Spacer cables 751v to 22 Kv, generally. If within 6 feet of pole use F. (Use Curve E up to only 8.7 Kv.)	E F

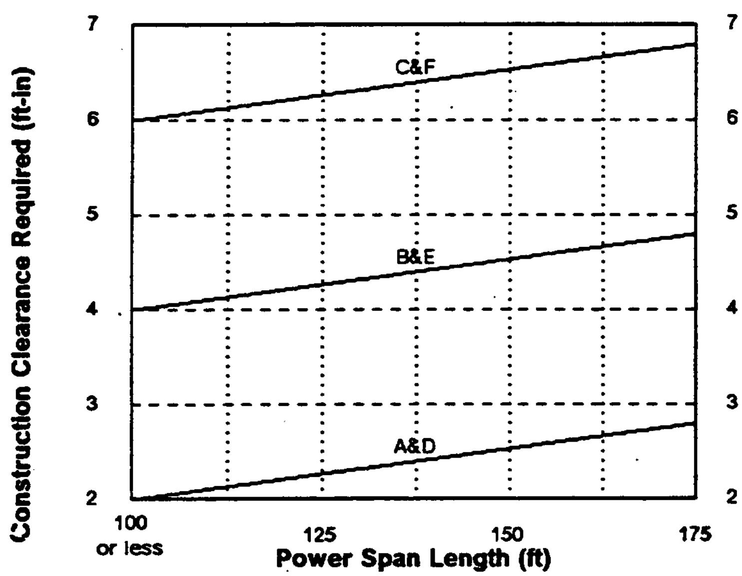


NOTE: Maintenance clearances for span lenghts up to 250 feet are to be the same as that specified in placing the drop wire for span lengths of 150 feet or less.

Figure 3-11. Multiple Drop Wire Placing Clearances — **Medium Loading Area** — Normal or Minimum Sag.

Construction Clearances Crossing Below Power Wires and Cables

Multiple Drop Wire Below	Ref
0 - 750 volts service wire or cable. If running parallel and attached to same pole with service drop — 12 inches	A
Open power conductors 0 - 750 volts. If supply service drop use A as above.	B
751v - 22 Kv phase wires generally. If within 6 feet of a pole use C. (Use curve B up to only 8.7 Kv.)	B C
Foreign communication cable — less if by mutual consent.	D
Grounded neutrals — up to 22 Kv to ground.	A
Grounded neutrals — systems over 22 Kv and other neutrals — see associated phase clearances.	
Grounded metal sheath cable.	D
Insulated cable on bare messenger, triplex and quadraplex.	A
Spacer cables — Illustrated in BSP-627-070-015. 750v or less — generally.	E
Spacer cables 751v to 22 Kv, generally. If within 6 feet of pole use F. (Use Curve E up to only 8.7 Kv.)	E F



NOTE: **Maintenance clearances for span lenghts of 101 to 175 feet are to be the same as that specified in placing the drop wire for span lengths of 100 feet or less.**

Figure 3-12. Multiple Drop Wire Placing Clearances — **Heavy Loading Area** — Normal or Minimum Sag.