Power Separation and Working in the Vicinity of Power Conductors

General Safety Precautions and Guidelines

This section covers the general safety precautions to be observed when working on poles, cables, guys, wire, strand, joint-use poles.

This section is intended to be a reference guide for the safe performance of work operations and supplements the associated clearance section and the sections on specific work operations.

All personnel must conform with the federal, state, and local laws requiring personnel protection equipment to be worn when performing particular work operations. Examples of personnel protection equipment are hard hats, safety glasses or goggles, insulating gloves, proper foot wear, work gloves, etc.

Working in the Vicinity of Power Conductors

While working in the vicinity of power conductors, know what voltages are involved. Do not assume the voltage in any power source and beware of the lower secondary voltages. They may be dangerous and lethal. Take the necessary steps to do the work operation safely.

Detailed plans, work orders, or drawings that involve joint-use plant or non-joint power crossing plant must show the voltage involved, clearances required, and any known hazardous condition that may be encountered during the work operation. If the specified clearances on the work order or the minimum clearances as shown in the clearance section cannot be met, notify your supervisor or the appropriate engineer.

The prevention of contacts between telephone plant and power conductors, and maintaining the required clearances are the responsibility of each employee. It is the prime concern of both the supervisors and employees when working on joint-use poles, on power crossings, or in the vicinity of power conductors.

Prior to the start of work operations, each employee should be informed of the hazards involved and a job plan should be formulated to include the necessary steps to complete the work operation safely.

In case of emergency work, storm damage, broken poles, wire down, etc., do not start work operations until the utility company has cleared away, restored, or made safe all power conditions on the pole and in the vicinity. This must be confirmed by a responsible employee of the utility company.

Insulating gloves and protectors must be worn by all persons handling poles, cable, wire, strand, guys, and associated equipment during placing, removing, tensioning, tying, grounding, etc., in the vicinity of power conductors. In addition, avoid all contact of exposed unprotected parts of the body with any reel, wire, pole motor vehicle, etc., during periods when there is a possibility of power contact.

Under no condition is it permissible to get closer than the minimum approach distance to energized exposed power conductors with any part of the body or with any non-insulated tool, pole, basket platform, etc., as listed in Table 2-1 unless the conductors have been deenergized and grounded or the employee or equipment is insulated from the conductor.

Table 2-1. Minimum Approach Distances

Voltage Phase to Phase	Voltage Phase to Ground	Approach Distances (ft-in)	(m)
300 V and less	173 V and less	Avoid Contact	Avoid Contact
300 V to 750 V	173 V to 434 V	1-0	0.31
750 V to 15 kV	434 V to 8700 V	2-2	0.65
15 kV to 36 kV	8700 V to 20,880 V	3-0	0.91
36 kV to 46 kV	20,800 V to 26,680 V	3-6	1.06
46 kV to 131 kV	26,680 V to 70,180 V	4-0	1.21
121 kV to 140 kV	70,180 V to 81,200 V	4-6	1.38

Never use any pull lines, control lines, etc., other than rope that is dry and free of metallic strand, or its equivalent, of sufficient size and strength for the particular work operation in the vicinity of power conductors.

Ground telephone wire, cable strand, etc., during placing, rearranging, removal, and tensioning operations. To be effective, the ground should be made to a low resistance ground such as the vertical ground conductor of a common neutral power system or inplace cable and strand, etc. This additional protection in no way modifies or makes unnecessary the safety precautions outlined in this section or sections on specific work operations.

Never make the ground connection in the space above telephone attachments. Test vertical power guy or ground wire of a multi-grounded neutral as outlined in Section 10 before connections are made.

It is essential for the safety of telephone employees, the general public, and communication plant that the required clearances be maintained as outline in Section 3 of this document.

Identifying Power

In most cases clearance, approach distances, and safety protection from power conductors are determined by the voltage involved and the type of construction used by the power company.
Conductors of the same size and construction may be carrying completely different voltages and require different clearances and safety measures appropriate to the situation. The voltage on the conductors varies depending on the particular system of connections and grounding used by the power company.

The type of construction must be considered for clearance purposes. Open insulated conductors always require maximum clearance for voltage involved. Clearance from spacer cable and sheathless cable is determined by the voltage; whereas, with sheathed cable, voltage is not a factor. Figure 2-1 shows various types of power conductors.

Figure 2-1. Various Types of Power Conductors

The voltage involved in joint-use and power-crossing poles is difficult to determine accurately in the field.

> **Note:** Power construction and equipment vary between areas and utilities. If you do not know or cannot accurately determine the voltages, contact your supervisor, the engineering forces, or the local utility company before proceeding with the work operation.

Clearance Between Power and Communication Facilities

The required vertical clearances at the poles between power facilities and the metal parts of a communication facility that do not carry a current are given in Table 3-1. Figures 3-3 through 3-5 are referenced in Table 3-1. The clearances are based on Rule 238 of the NESC.

An optimal method of providing required clearance is to use standoff assemblies to support cable owned by an authorized licensee in situations where there is inadequate space on the pole for placement of an additional cable. Cable extension arms or standoff assemblies may be used to support cable, when necessary, to accomplish the following:

- Clear obstructions in the span
- Improve cable alignment
- Provide space for an additional cable where that space cannot be provided without replacing the pole.

IMPORTANT NOTE: When extension arms or standoff assemblies are being considered, obtain permission from the telephone company for its use, type, location, and method of installation.

Table 3-1. Minimum Vertical Clearances Between Power Facilities and Noncurrent-Carrying Parts of Communication Facilities on Poles

Facility	Clearance
Power Circuits, 0-8700 volts (Figure 3-3)	40 in (1 m)
Transformer case or capacitor case (nongrounded) 0-8700 volts (Figure 3-4)	40 in (1 m)
Transformer case or capacitor case (effectively grounded as uniform practice over a well-defined area) (Figure 3-4)	30 in (0.75m)
Transformer case or capacitor case (nongrounded) over 8700 volts (Figure 3-4)	[1]
Power circuits, 8701-50,000 volts	[1]
Streetlight and traffic-signal bracket (nongrounded) (Figure 3-5)	20 in (500 mm)
Streetlight and traffic-signal bracked (effectively grounded) (Figure 3-5)	4 in (100 mm)
Drip loop of a streetlight bracket (Figure 3-5)	12 in (300 mm)
Licensee strandoff assemblies	40 in (1 m)

Note:

[1] The clearance is 40 inches (1 m) plus 0.4 inch (10 mm) per kV over 8.7 kV.

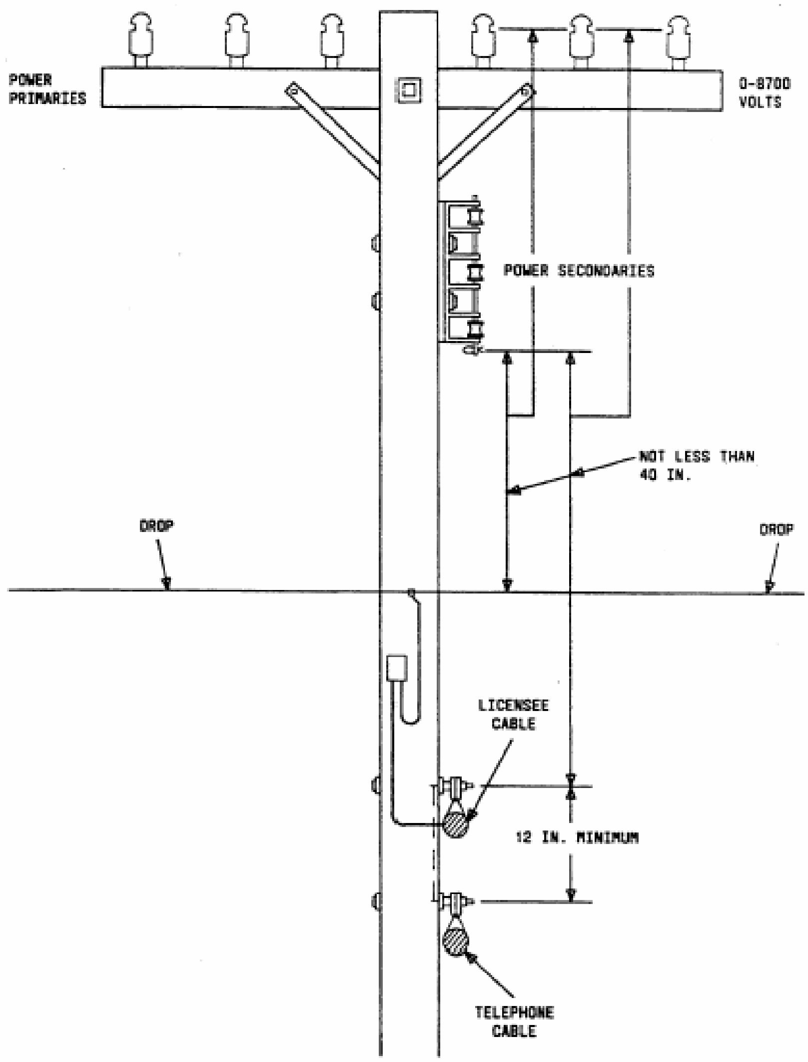

Figure 3-3. Clearances on Joint-Use Poles

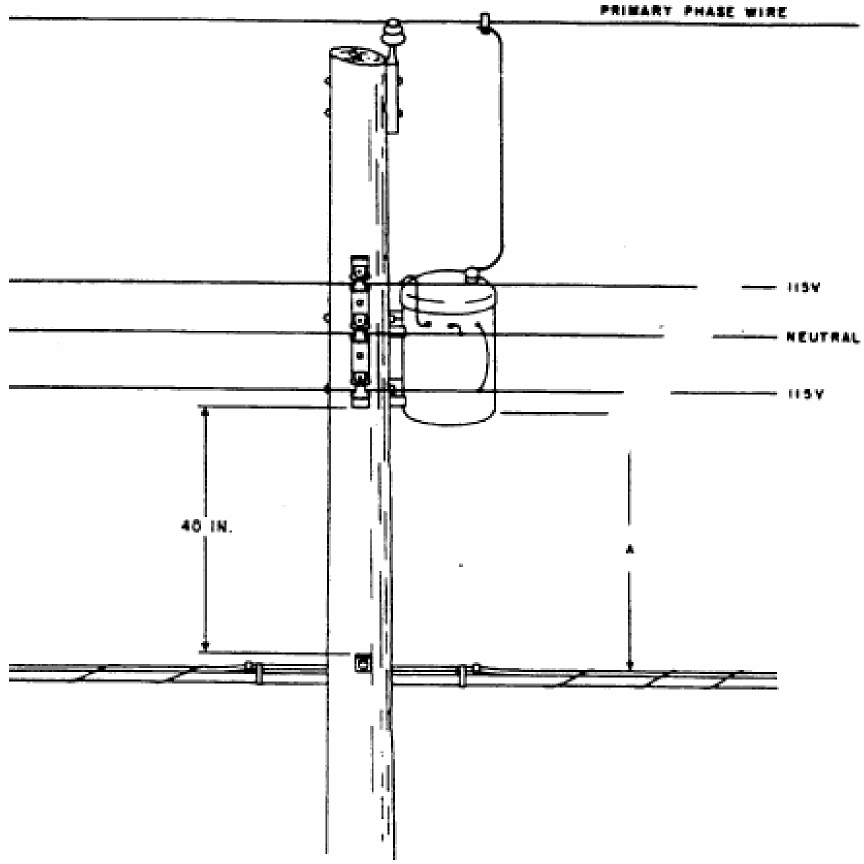

Figure 3-4. Clearances Between Power Transformer Voltage Regulator or Capacitor and Communication Wire or Cable

Note: A = 30 inches (0.75 m) if transformer is effectively grounded as uniform practice over well-defined area. Otherwise, 40 inches (1 m) for 8.7 kV or less and 40 inches (1 m) + 0.4 inches (10 mm) for each kV over 8.7 kV.

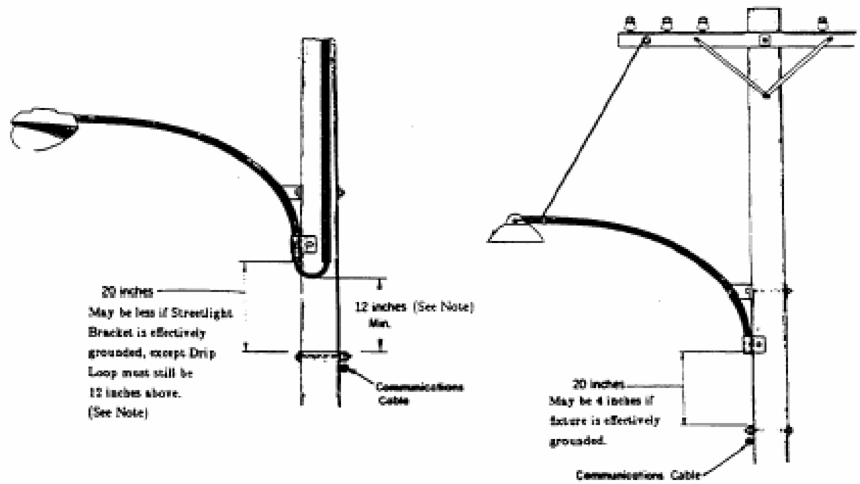

Figure 3-5. Clearance Between Streetlight Bracket and Communication Cable

NOTE: The 12 inch (300 mm) clearance may be reduced to 3 inches (75 mm) if the loop is covered by a suitable non-metallic covering that extends at least 2 inches (50 mm) beyond the loop.

Minimum clearances at crossings of communication wires or cables and power conductors, neutrals, guys, and other communication cables carried on different structures based on Section 23, Rule 233C and associated Table 233-1 of the 1997 Edition of NESC, are shown in Table 3-2. The clearances in Table 3-2 are based on the maximum sag for the power conductors. This will occur at either the maximum operating temperature of the conductor or with the radial thickness of ice for the loading district involved. In almost all cases, it will be necessary to contact the local power company for sag data on its conductors. The clearances apply when the power facility is above the communications facility.

Table 3-2. Vertical Clearance at Span Crossing Upper Conductor at Maximum Sag —Communication Conductor at Ambient

Between Communication Facility and	Vertical Clearance For		Remarks
	Wire & Cable	Guy	
Supply cables 750V or less	2 ft (0.6 m)	2 ft (0.6 m)	
Neutrals associated with systems of 22,000V or less to ground, if effectively grounded	2 ft (0.6 m)	2 ft (0.6 m)	If within 3 ft (900 mm) of pole, wire-to-pole clearance also applies
Open conductors 0-750V	4 ft (1.2 m)	4 ft (1.2 m)	2 ft. (600 mm) for drop wires
Open conductors and service drops 750V - 22kV	5 ft (1.5 m) [1]	5 ft (1.5 m)	May be 4 ft (1.2 m) if crossing more than 6 ft (1.8 m) horizontal from pole
Open conductors over 22kV	[2]	[2]	
Neutrals of systems above 22kV to ground, and any neutral not effectively grounded		Same clearance as phase wire	
Power cables having effectively grounded continuous metallic sheaths	2 ft (0.6 m)	2 ft (0. 6 m)	If within 3 ft (900 mm) of pole, wire-to-pole clearance also applies
Other power cables, including			Same clearance as for spacer cables open power wires of the same voltage
Service drops 750V or less	2 ft (0.6 m)	2 ft (0.6 m)	4 ft (1.2 m) required for cable crossing above open service drops. Should be avoided.
Guys, span wires, lightning protection wires	2 ft (0.6 m)	2 ft (0.6 m)	
Foreign communication cables, wires, and guys	2 ft (0.6 m)	2 ft (0.6 m)	

Notes:

[1] May be reduced to 4 feet (1.2 m) where supply conductors of 750V to 8.7kV cross a communication line more than 6 feet (1.8 m) horizontally from a communication structure (i.e., telephone pole).

[2] The vertical clearance should be 5 ft + 0.4 in/kV over 22kV (1.5 m + 10 mm/kV) over 22 kV.

Clearance Between Power and Communication Conductors in the Span

Generally, communication conductors at midspan must be no closer to power conductors of 50kV, phase-to-phase, than 75% of the clearance required at the supporting structure. This is a closest point of approach since the power conductor is assumed to be at final sag with radial thickness of ice as specified for the loading district or at maximum operating temperature, whichever produces the maximum sag.

The exception to the requirements in this section is that effectively grounded neutral conductors and power cables having an effectively grounded continuous metallic sheath or shield may have a minimum span clearance of 12 inches (300 mm) from communication conductors if a 30-inch (750-mm) clearance is maintained at the supports.

Power service drops may have a clearance of 12 inches (300 mm) from communication service drops at any point in the span and at the attachment to the building if the required clearance is maintained at the supporting structure.

The required minimum midspan clearances between power supply conductors and communication conductors are shown in Figure 3-8 and Table 3-3. These clearances are based on Section 23 of the NESC 1997 edition.

Table 3-3. Minimum Mid-Span and Vertical Clearances[1]

Power Conductor	Maximum Voltage (Phase to Ground)	Minimum Dimensions (See Figure 3-8)		Minimum Clearance at Pole [2]
		A	B[3]	
Open Conductors, Spacer Cable and Triplex and Quadraplex Cable (Figures 3-6 and 3-7)	0 to 8.7 kV	30 in (750 mm)	Does Not Apply	40 in (1 m)
	8.7 to 50 kV [5]	[5]	> or = 0	40 in + .4 in (l m + 10 mm) per kV over 8.7 kV
Other Cables With Grounded Sheath or inches Strand	> 50 kV	12 in (30 mm)	Does Not Apply	30 in (750 mm)
Effectively Grounded Neutrals	> 50 kV	12 in (30 mm)	Does Not Apply	30 in 0(750 mm)

Notes:

[1] Clearances are measured at the maximum sag condition of the power conductor and, for the communication conductor, at the final unloaded sag under the same ambient as the power conductor.

[2] The minimum clearance at poles may have to be greater to meet mid-span requirements.

[3] For spans longer than 150 feet (45 m).

[4] Includes neutral, if not effectively grounded.

[5] Seventy-five percent of pole clearance (last column).

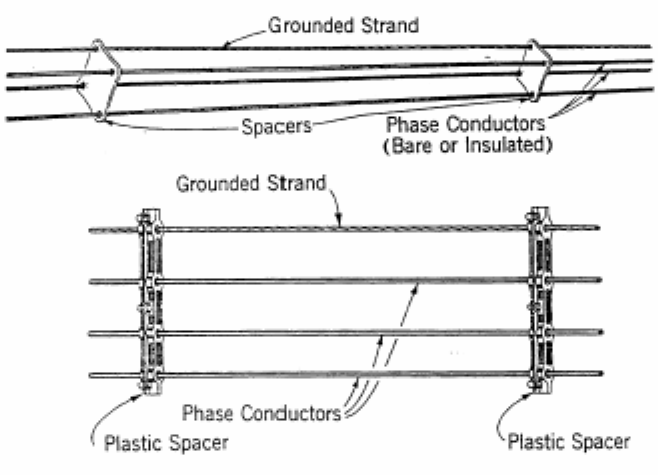

Figure 3-6. Spacer Cables

Figure 3-7. Triplex Power Cable

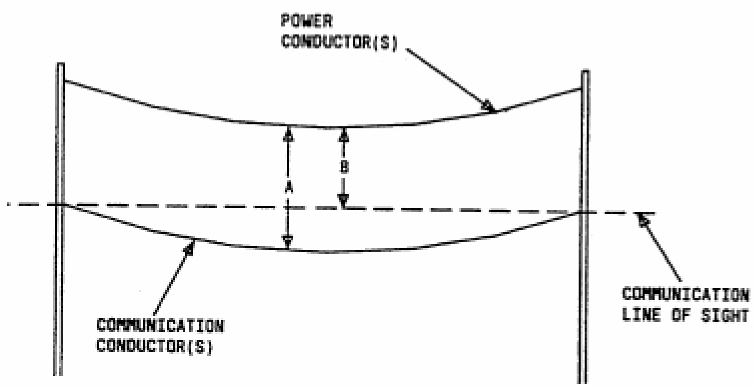

Figure 3-8. Midspan Clearance

Clearances Above Roads, Rails, and Other Structures

Clearances for all sizes of strand and all weights of cable are shown in Table 3-4.

The clearances shown in Table 3-4 represent communication conductor or cable sag at **"worst case"** condition, i.e., maximum temperature or with radial thickness of ice for the loading district involved. Although the clearance numbers appear radically different from earlier code editions because of the different form in which they are expressed, attachment heights are essentially unchanged in the heavy loading districts. The clearances shown in Table 3-4 must not be applied at 60°F (15°C), but are intended to be applied under maximum sag conditions.

Table 3-4. Clearances for All Sizes of Strand and Weights of Cable

Situation	Typical Clearances All Loading Areas [1]	Remarks
Crossing Above		
• Railroad Tracks	23.5 ft (7 m) [2]	For special railways using cars less than 22 ft (6.7 m) high, see Table 232-1 of the NESC
• Public Roads	15.5 ft (4.8 m)	
• Public Alleys	15.0 ft (4.6 m)	
• Nonresidential Driveways	15.0 ft (4.6 m)	Includes parking lots
• Residential Driveways	15.0 ft (4.6 m)	Communication Service Drops - 11.5 ft (3.5 m)
• Walks & Lanes	95 ft (2.9 m)	
• Flat Roof Buildings	10.5 ft (3.2 m)	Vertical
• Peak Roof Buildings	3.0 ft (900 mm)	Vertical
• Billboards	3.0 ft (900 mm)	Horizontal and Vertical
• Signs	3.0 ft (900 mm)	Horizontal and Vertical
• Waterways		See Table 232-1 of the NESC or the proper administrative authority
Paralleling Public Roads		
• Urban	15.5 ft (4.8 m)	15 feet (4.6 m) if in back of vehicular deterrents such as curbs
• Rural (Light Traffic)		
—Back of Obstacle	9.5 ft (2.9 m)	Unlikely to have vehicles passing under the line. Obstacles include ditches, fences, embankments
—Not Back of Obstacle	13.0 ft (4 m)	
• Public Alleys	15.0 ft (4.6 m)	

Notes:

[1] Represents clearances that are usually applicable but are often modified by specific conditions covered by Table 232-1 of the NESC.

[2] The minimum size strand required for crossing is 6M strand.

Climbing Space

In addition to the clearances covered in Sections 3.2 through 3.5, proper climbing space must be maintained. Climbing space is an unobstructed vertical space along the side of a pole. In general, it consists of an imaginary box 30 inches (750 mm) square, extending at least 40 inches (1 m) above the highest communication cable or other facility and 40 inches (1 m) below the lowest communication cable or other facility. Figure 3-9 illustrates how the 30-inch (750-mm) climbing space can be maintained where drop wires are involved. Note that in Figure 3-9 (g) and (h) this is accomplished by using span clamps attached to the strand supporting the cable.

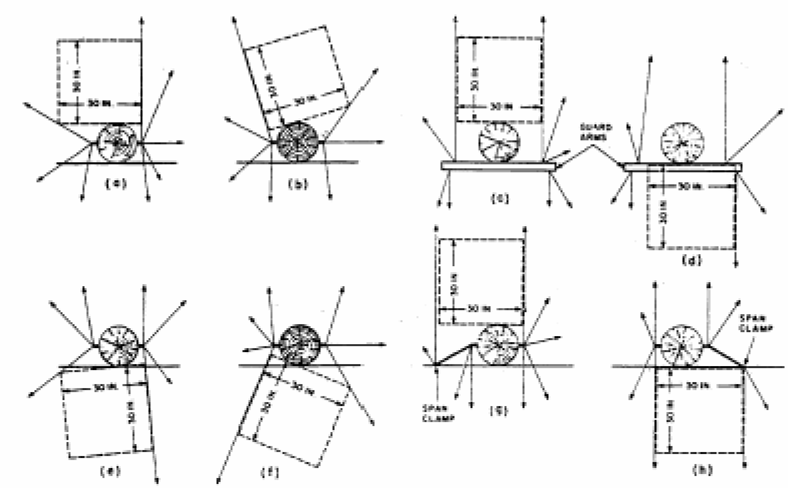

Figure 3-9. Climbing Space Where Drop Wires Are Involved

The minimum vertical clearance (the closest distance from the ground to the span) in Figure 3-10 is 17 feet (5.2 mm). This does not include the sag due to storm loading. To calculate total vertical height over a surface, storm loading must be added.

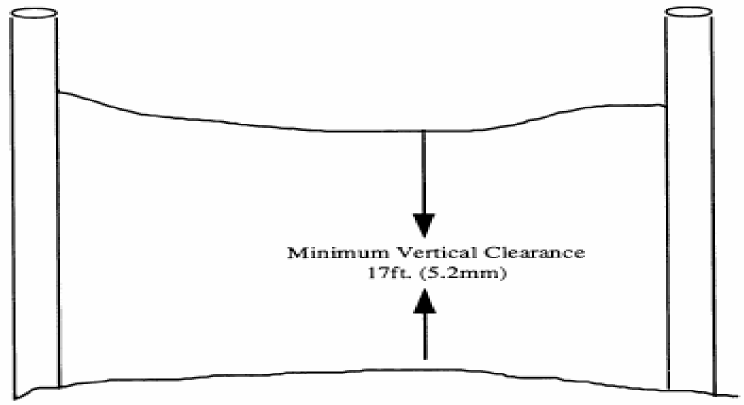

Figure 3-10. Minimum Vertical Clearance

Calculations

The height at which a cable is to hang above a surface such as a street, pedestrian path, navigable waterway, etc., is determined as follows:

Minimum Vertical Clearance
\+ Sag Due to Storm Loading
= Total Vertical Height Over Surface

It is necessary to assume the wind and ice loads that may occur on a line. Three general degrees of loading due to weather conditions are recognized and are designated as heavy, medium, and light loading. Figure 250-1 of the NESC shows the districts where these loadings apply. Table 3-5 shows the radial thickness of ice and the wind pressures to be used in calculating loads. Ice is assumed to weigh 57 lb/ft^3 (913 kg/m^3).

Table 3-5. Ice, Wind, and Temperature

	Loading Districts (For With For Use With Rule 250B)			Extreme Wind Loading (For Use With Rule 250C)
	Heavy	Medium	Light	
Radial Thickness of Ice	0.50 in (12.5 mm)	0.25 in (6.5 mm)	0 in (0 mm)	0
Horizontal Wind Pressure	4 psf (190 Pa)	4 psf (190 Pa)	9 psf (430 Pa)	Refer to Figure 250-2 of the NESC
Temperature	0°F (-20°C)	15°F (-10°C)	30°F (-1°C)	+60°F (+15°C)