

from the nearer support of the crossing span. In other situations it is the location under the conductors of any topographical feature which is the determinant of the clearance.

1. Where point of crossing occurs at point of maximum total sag of the conductor.

a. General. For spans exceeding the limits specified in section E 123.03(1), the clearance specified in table 1 shall be increased by 0.1 foot for each 10 feet of the excess span length over such limits. (See c. below.)

b. Railroad crossings. For spans exceeding the limits specified in section E 123.03(1), the clearance specified in table 1 shall be increased by the following amounts for each 10 feet by which the crossing span lengths exceed such limits. (See c. below.)

*Amount of Increase per 10 Feet*

For conductors equal to or smaller than the following-----0.30 foot

Solid copper 0.160 inches in diameter

Stranded copper 0.250 inches in diameter

Other than all copper (solid) 0.250 inches in diameter

Other than all copper (stranded) 0.275 inches in diameter

For conductors larger than the above-----0.15 foot

c. Limits for a and b above. The maximum additional clearance need not exceed 75% of the "maximum sag increase" for the conductor concerned. The "maximum sag increase" is the arithmetic difference between final unloaded sag with a temperature of 60° F., no wind, and the maximum total sag under the entire conductor loading of section E 125.02, or with a temperature of 120° F., no wind, whichever sag is greater, computed for the span length for which such difference is greatest.

d. Temperature. For conductors to be normally operated at temperatures in excess of 120° F., the clearance specified in table 1 and c above shall be increased by the difference between final unloaded sag at 120° F., no wind, and the final unloaded sag at the maximum temperature at which the conductor will operate.

2. Where point of crossing is not at point of maximum total sag of the conductor. Under these conditions the required clearance may be obtained by multiplying the clearance determined by subsections

Distance from Nearer Support of Crossing Span to Point of Crossing in Percentage of Crossing Span Length	Factors
5.....	0.85
10.....	.88
15.....	.91
20.....	.94
25.....	.96
30.....	.98
35.....	.99
40 to 50.....	1.00

Interpolate for intermediate values.

**TABLE 1**  
**MINIMUM VERTICAL CLEARANCE OF WIRES (IN FEET) ABOVE GROUND**  
**OR RAILS (SUPPLY WIRES INCLUDE TROLLEY FEEDERS)**

Location of Wires and Cables	Guys, Communication Cables; Messengers and Wires, Grounded Supply Cables; Messengers and Lightning Protection Wires (a) (b) (e)	Open Supply Line Wires, Arc Wires, and Service Drops (c) (c)			Trolley Contact Conductors and Associated Span or Messenger Wires (d)	
		0 to 750 Volts	750 to 15,000 Volts	15,000 to 50,000 Volts	0 to 750 Volts to Ground	Exceeding 750 Volts to Ground
Over track rails of railroads (e)-----	27 (f) (q)	27 (f) (q)	28	30	22	22
Over streets, alleys or roads (g)-----	18 (r)	18	20	22	18	20
Along streets or alleys in urban districts (g)-----	18 (h) (r)	18 (h)	20	22	18	20
Along roads in rural districts (g)-----	14 (h) (t)	15 (h)	18	20	18	20
Over areas used for agricultural purposes-----	15	15	18	20	18	20
Over fenced or otherwise guarded rights of way in which only authorized persons are permitted (i)-----	15 (j)	15 (x)	15	17	16 (n)	18 (n)
Over normal high water of lakes, streams or ponds-----	18	18	18	20	-----	-----
See (y)-----	18	18	18	20	-----	-----
Over commercial areas such as parking lots and drive-in establishments not subject to truck traffic-----	12	15	18	20	-----	-----
Over driveways to residence garages-----	12	15 (s)	20	22	18	20
Over commercial and industrial areas, parking lots and other areas subject to truck traffic-----	15	15	20	22	18	20
Over agricultural areas subject to truck traffic-----	15	15	20	22	18	20
Over footwalks and spaces accessible to pedestrians only-----	15 (w)	15 (x)	18	20	16 (n)	18 (n)
Over spaces or ways not covered above:-----						
In rural districts (p)-----	10 (j)	15 (x)	18 (m)	20 (m)	18	20
In urban districts (p)-----	10 (j)	18 (x)	20	22	18	20

(a) Including supply line guys where effectively grounded or insulated against the highest voltage to which they are exposed. Note: No clearance from ground is required for anchor guys not crossing streets, driveways, roads or pathways nor for anchor guys provided with traffic guards and paralleling sidewalk curbs.

(b) This relates to a supply cable of any voltage having effectively grounded continuous metal sheath supported by continuous grounded messenger and to insulated conductors lashed to or twisted with an effectively grounded continuous metallic messenger or neutral. This does not include a so-called cable where a messenger supports separate conductors with an insulating yoke.

(c) A conductor which is effectively grounded throughout its length and is associated with a supply circuit of 0 to 22,000 volts may have the clearance specified for conductors 0-750 volts.

(d) Where subways, tunnels or bridges require it, less clearances above ground or rails than required by Table 1 may be used locally. The trolley contact conductor should be graded very gradually from the regular construction down to the reduced elevation.

(e) In the case of electrified railroads served by overhead trolley conductors, these clearances do not apply if other orders require greater clearances.

(f) This clearance may be reduced to 25 feet where paralleled by trolley contact conductor on the same street or highway.

(g) These requirements apply only to wires within the limits of public highways or other public rights of way for traffic.

(h) Where a pole line along a road is located relative to fences, ditches, embankments, etc., so that the grounds under the line will never be traveled except by pedestrians, this clearance may be reduced to the following values:

- (1) Communication conductors limited to 160 volts to ground and communication cables----- 8 Feet
- (2) Conductors of other communication circuits----- 10 Feet
- (3) Supply conductors----- 12 Feet
- (4) Guys----- 8 Feet

(i) These clearance requirements do not apply in transformer or substation areas which are so fenced or guarded that they are never accessible to other than authorized persons. (See section E112.05)

(j) This clearance may be reduced to 8 feet for guys, cables, messengers and communication wires limited to 160 volts where the ground underneath the wires or cables is accessible to pedestrians only.

(m) This clearance may be reduced by 3 feet for distribution circuits in rural districts not along or across the yard or space near to the buildings of a farmstead, residence or school, if the wires are located relative to embankments, marshes, woods, etc., so that the ground underneath is not likely to be traveled by high loaded vehicles.

(n) Trolley contact conductors for industrial railways when not along or crossing roadways may be placed at a less height if suitably guarded.

(o) A diagonal clearance the same as the vertical clearance, shall be maintained to uneven or sloping terrain within a horizontal distance of  $\frac{3}{4}$  of the vertical clearance. All distances to be measured from the conductors in their deflected position.

(p) See section E128.07(5) for street lamps and drops.

(q) This value may be reduced to 25 feet for guys, for cables having effectively grounded continuous metal sheaths, and for insulated conductors lashed to or twisted with an effectively grounded messenger or neutral,

and for conductors effectively grounded throughout their length and associated with supply circuits of 0 to 22,000 volts only if such conductors are stranded, are of corrosion resistant material, and conform to the strength and tension requirements for messengers given in section E126.02(7).

(r) Where communication wires or communication cables cross over or run along alleys, this clearance may be reduced to 15 feet.

(s) Service drop operating at less than 600 volts may have the clearance reduced to 12 feet.

(t) This clearance may be reduced to 13 feet for communication conductors where no part of the line overhangs any part of the highway which is ordinarily traveled, and where it is unlikely that loaded vehicles will be crossing under the line into a field.

(w) This clearance may be reduced to the following values:

- (1) For communication conductors of circuits limited to 160 volts to ground, and communication cables 8 Feet
- (2) For conductors of other communication circuits 10 Feet
- (3) For guys 8 Feet
- (4) For supply cables having effectively grounded continuous metal sheath, and or insulated conductors lashed to or twisted with an effectively grounded messenger or neutral, all voltages 10 Feet

(x) This clearance may be reduced to the following values:

- (1) Supply wires (except trolley contact wires) limited to 300 volts to ground 12 Feet
- (2) Supply wires (except trolley contact wires) limited to 150 volts to ground and located at entrances to buildings 10 Feet
- (3) Where supply circuits of 550 volts or less, with transmitted power of 3,200 watts or less, are run along fenced (or otherwise guarded) private rights of way in accordance with the provisions specified in section E122.01(2)(c) 10 Feet

(y) Lines shall not obstruct, or endanger navigation or activities associated therewith. Application of section 30.15, Wis. Statutes may require greater clearances than shown and clearances specified by the Army Engineers over waters considered navigable by the United States may be greater. The largest requirement shall be complied with.

E 123.03(1) and E 123.03(2) (a)1. by the following factors, but in no case shall the clearance be less than required by table 1.

(b) *Voltages exceeding 50,000 volts.* For these voltages the clearances given in table 1, section E 123.03 (1), shall be increased at the rate of 0.4 inch for each 1,000 volts of the excess.

(c) *Conductors supported by suspension-type insulators at crossings over track rails.* The clearance shall be increased by such an amount that the values specified in table 1, section E 123.03(1), will be maintained in case of a broken conductor in either adjoining span if the conductor is supported as follows.

1. At one support by suspension-type insulators in a suspended position, and at the other support by insulators which are not free to swing (including semistrain-type insulators).

2. At one support by strain insulators, and at the other support by semistrain-type insulators.

(d) *Methods of avoiding this increase of clearance.* Any of the following construction methods will avoid the necessity for the increase in clearance required by section E 123.03 (2) (c).

1. Suspension-type insulators in a suspended position at both supports.

2. Semistrain-type insulators at both supports.

3. Arrangement of insulators so that they are restrained from displacement toward the crossing.

(3) **SUPPLY POLE WIRING AT UNDERGROUND RISERS.** Unguarded supply wires connecting to underground systems shall not be run open closer to the ground than is indicated in table 2.

**TABLE 2**  
**CLEARANCE ABOVE GROUND FOR OPEN UNGUARDED**  
**SUPPLY WIRING**

Voltage				
0 to 150 Volts	150 to 300 Volts	300 to 750 Volts	750 to 15,000 Volts	More Than 15,000 Volts
Feet	Feet	Feet	Feet	Feet
10	12	14	16	18

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68; am. table 1, (left-hand column), Register, April, 1972, No. 196, eff. 5-1-72.

Electrical Code, Volume 1  
Register, April, 1972, No. 196

**E 123.04 Crossing clearances of wires carried on different supports.** The clearance between any 2 wires crossing each other and carried on different supports shall not be less than the following:

**Note:** Recommendation: Crossings shall be made on a common crossing pole or structure where practicable.

(1) **BASIC CLEARANCES.** The clearances given in table 3 below apply under the following conditions:

(a) Temperature of 60° F., no wind, with the upper conductor or wire at its final unloaded sag and the lower conductor or wire at its initial unloaded sag.

(b) Span lengths not greater than the following for the upper conductor or wire:

1. 0-150 feet for 3-strand conductors, each wire of which is 0.09 inch or less in diameter.

2. 0-175 feet for other types of wire.

(c) Fixed supports for the upper conductor or wire.

(d) For other conditions, see section E 123.04 (2).

**TABLE 3  
MINIMUM CLEARANCES OF CROSSINGS OF WIRES CARRIED  
ON DIFFERENT SUPPORTS**

(The insertion of a given clearance in parentheses indicates that in general the lines operating at the voltage named above this clearance should not cross over the lines at the voltage to the left of the clearance in parentheses)

Nature of Wires Crossed Over	Communication Wires Including Cables and Messengers	Open supply wires 0-750 volts; supply cable having effectively grounded continuous metal sheath, or insulated conductors lashed to or twisted with an effectively grounded messenger or neutral, all voltages; messengers associated with such cable		Open supply wires and service drops (a)		Guys, Span Lightning Protection Wires
		Line Wires	Service Drops	750 to 8,700 Volts	8,700 to 50,000 Volts	
Communication, including cables and messengers.....	Feet (b)2	Feet (c) (j) (i)4	Feet (i)2	Feet (f)4	Feet 6	Feet (b)2
Supply cable having effectively grounded continuous metal sheath or insulated conductors lashed to or twisted with an effectively grounded messenger or neutral, all voltages; messengers associated with such cable...	(j)4	2	2	2	4	2
Open supply wires 0 to 750 volts.....	(4)	2	2	2	4	2
750 to 8,700 volts.....	(4)	(2)	(4)	2	4	4
8,700 to 50,000 volts.....	(6)	(4)	(6)	(4)	4	4
Trolley contact conductors..	(d)4	(d)(e)4	(d)4	6	6	(d)4
Guys, span wires, lightning protection wires, service drops 0 to 750 volts.....	(b)(g)2	2	2	4	4	(b)(h)2

**Footnotes for table 3**

(a) A conductor which is effectively grounded throughout its length in accordance with subsection E 103.02(2)(e) and is associated with a cir-

Electrical Code, Volume 1  
Register, April, 1972, No. 196

the largest value required by (a), (b), or (c) below at 60° F., and no wind.

(a) 4 feet.

(b) The values required by sections E 123.06(1)(b)1., a. or b. for separation between conductors on the same support.

(c) The apparent sag of the conductor having the greater sag, plus 0.2 inch per kilovolt of the highest voltage concerned.

1. Exception: In situations where supply-line conductors only are involved, the clearance required by (c) above need not be greater than the value required by sections E 123.04(1) and (2) for a center-span crossing, assuming the conductor having the larger sag swinging through an arc of 45° from the vertical.

(2) CLEARANCES FROM SUPPORTING STRUCTURES OF ANOTHER LINE. Conductors of any line passing near a pole or similar supporting structure of a second line without being attached thereto, shall have clearances from any part of such structure not less than the larger value required by either (a) or (b) below at 60° F., and no wind.

(a) Three feet if practicable.

(b) The values required by sections E 123.06(1)(b)1., a. and b. for separation between similar conductors on the same support, increased by 1 inch for each 2 feet of the distance from the supporting structure of the second line to the nearest supporting structure of the first line.

The climbing space on the structure of the second line shall in no case be reduced by a conductor of the first line.

(3) CLEARANCES FROM BUILDINGS. (a) *General*. Conductors shall be arranged and maintained so as to hamper and endanger firemen as little as possible in the performance of their duties.

(b) *Ladder space*. Where buildings exceed three stories (or 50 feet) in height, overhead lines should be arranged where practicable so that a clear space or zone at least 6 feet wide will be left, either adjacent to the building or beginning not over 8 feet from the building to facilitate the raising of ladders where necessary for fire fighting.

1. Exception: This requirement does not apply where it is the unvarying rule of the local fire departments to exclude the use of ladders in alleys or other restricted places which are generally occupied by supply lines.

(c) *Open supply conductors attached to buildings*. Where the permanent attachment of open supply conductors of any class to buildings is necessary for an entrance, such conductors shall meet the following requirements:

1. Conductors of more than 300 volts shall not be carried along or near the surface of the building unless they are guarded or made inaccessible.

2. Clearance of wires from building surface shall be not less than those required in table 9, section E 123.06(1)(c)1., for clearance of conductors from pole surfaces.

3. Service head and service drop attachments and communication cables or conductors attached to or carried along the surface of a building shall be so located that no part of the drip-loops or service drop conductors within 3 feet of the service head and service drop attachments shall be less than 12 inches from communication cables or conductors.

(d) *Conductor passing by or over buildings.* 1. Crossing roofs. Supply conductors exceeding 8,700 volts should not be carried over buildings not concerned in the operation of the utility owning them, if this can be avoided. When it is necessary to attach wires to the roofs of buildings, the supporting structure shall be of substantial construction. Wherever feasible, wires crossing over buildings shall be supported on structures which are independent of the buildings crossed over.

2. Minimum clearances. Unguarded or accessible supply conductors carrying voltages in excess of 300 volts may be run either beside or over buildings. The vertical or horizontal clearance to any building or its attachments (balconies, platforms, etc.) shall be as listed below. The horizontal clearance governs above the roof level to the point where the diagonal equals the vertical clearance requirement. From this point the diagonal clearance shall be equal to the vertical clearance requirement. 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.

a. Spans 0 to 150 feet. For spans 0 to 150 feet, the clearances shall be as given in table 4.

TABLE 4  
CLEARANCES OF SUPPLY CONDUCTORS FROM BUILDINGS

Voltage of Supply Conductors	Horizontal Clearance	Vertical Clearance
	Feet	Feet
0 to 300.....	3	(a) 8
300 to 8,700.....	3	8
8,700 to 15,000.....	8	8
15,000 to 50,000.....	10	10
Exceeding 50,000.....	10 plus 0.4 inch per Kv. in excess	10 plus 0.4 inch per Kv. in excess

*Note:* Conductors shall have a clearance of not less than 8 feet from the highest point of roofs over which they pass, except that where the voltage between conductors does not exceed 300 and the roof has a slope of not less than 4 inches in 12 inches the clearance may be not less than 3 feet. Service-drop conductors of 300 volts or less which do not pass over other than a maximum of 4 feet of the overhang portion of the roof for the purpose of terminating at a (through-the-roof) service raceway or approved support may be maintained at a minimum of 18 inches from any portion of the roof over which they pass.

b. Spans exceeding 150 feet. Where span lengths exceed 150 feet, the increased clearance required by section E 123.03 (2) (a) shall be provided.

1. Exception: These increased clearances are not required where the voltage of the supply conductors is from 300 to 8,700 volts.

3. Guarding of supply conductors. Supply conductors of 300 volts or more shall be properly guarded by grounded conduit, barriers, or otherwise, under the following conditions:

a. Where the clearances set forth in table 4, section E 123.05 (3) (d) 2. a., cannot be obtained.

b. Where such supply conductors are placed near enough to windows, verandas, fire escapes, or other ordinarily accessible places, to be exposed to contact by persons.

*Note:* Supply conductors in grounded metal-sheathed cable are considered to be guarded within the meaning of this section.

(e) For clearance of conductors from scaffolding and buildings under construction see Wis. Adm. Code chapter Ind 35

(4) CLEARANCES FROM BRIDGES. (a) *Clearances of conductors from bridges.* Supply conductors which pass under, over or near a bridge shall have clearances therefrom not less than given in table 5.

**TABLE 5**  
**CLEARANCES FROM BRIDGES**

Voltages	Readily Accessible Portions (Other Than Traveled Ways) (a) of Any Bridge, Including Wing Walls or Bridge Attachments		From Ordinarily Inaccessible Portions (b) of Bridges (Other Than Brick, Concrete or Masonry) and From Abutments	
	For Conductors Attached to Bridge	For Conductors Not Attached to Bridge	For Conductors Attached to Bridge(c)	For Conductors Not Attached to Bridge(c)
	Feet	Feet	Feet	Feet
0 to 2,500-----	3.0	3.0	0.5	3.0
Over 2,500 to 5,000----	3.0	3.0	1.0	3.0
Over 5,000 to 8,700----	3.0	3.0	3.0	3.0
Over 8,700 to 15,000----	5.0	5.0	5.0	5.0
Over 15,000 to 25,000----	7.5	7.5	7.5	7.5
Over 25,000 to 35,000----	7.5	9.0	7.5	9.0
Over 35,000 to 50,000----	7.5	12.0	7.5	12.0
Exceeding 50,000-----	7.5 plus 0.4 inch per Kv in excess	12.0 plus 0.4 inch per Kv in excess	7.5 plus 0.4 inch per Kv in excess	12.0 plus 0.4 inch per Kv in excess

(a) Where over traveled ways on or near bridges the clearances of section E 123.03 apply.  
(b) Bridge seats of steel bridges carried on masonry, brick, or concrete abutments which require frequent access for inspection shall be considered as readily accessible portions.

(c) Where conductors passing under bridges are adequately guarded against contact by unauthorized persons and can be deenergized for maintenance of the bridge, clearances of the conductors from the bridge, at any point, may have the clearances specified in table 9 for clearance from surfaces of crossarms plus one-half the final unloaded sag of the conductor at that point.

1. Exception: Grounding conductors, effectively grounded neutrals, conductors installed in grounded conduit, metal sheathed cables and cables supported on effectively grounded messengers.

(b) *Guarding trolley contact conductors located under bridges.*

1. Where guarding is required. Guarding is required where the trolley contact conductor is located so that a trolley pole leaving the conductor can make simultaneous contact between it and the bridge structure.

2. Nature of guarding. Guarding shall consist of a substantial inverted trough of non-conducting material located above the contact conductor, or of other suitable means of preventing contact between the trolley pole and the bridge structure.

(5) CLEARANCE FROM SIGNS. The clearance of lines from buildings shall govern the clearance of lines from signs. Where signs are animated, contain lamps, or where the sign is periodically renewed, replaced or changed the minimum horizontal clearance shall not be less than 10 feet. This does not apply to the conductors supplying the sign.

(6) CLEARANCE FROM LIGHT STANDARDS. Conductors not used to supply light standards shall have clearances equal to the clearance from buildings between such conductors and independent lighting supports.

(a) *Exception 1:* Conductors properly attached to the lighting standards are permitted. Such conductors shall not interfere with the safe servicing of the lighting fixtures and shall have the clearance required for conductors on poles.

(b) *Exception 2:* A vertical clearance of 5 feet is permitted for lines 300 to 8,700 volts.

(7) **LINES IN TREES.** Supply wires shall not be run through fruit trees that must be climbed to gather the fruit.

(a) *Exception:* Insulated supply lines and associated neutral conductors operating at less than 300 volts to ground are exempt.

(8) **NEAR STORED MATERIAL.** Lines should not be run over areas where material is regularly stored and handled by cranes or other types of high machinery unless the clearance of such lines is adequate to permit full use of the equipment.

(9) **NEAR STORAGE TANKS.** A horizontal clearance of at least 15 feet shall be maintained between above ground flammable liquids storage tanks and open conductors operating at more than 300 volts to ground. When voltages are 300 volts or below, a horizontal clearance of not less than 8 feet shall be maintained.

*Note:* This requirement does not apply to LPG tanks with capacity of 1,000 gallons or less.

(10) **NEAR WELLS.** A horizontal distance of at least  $\frac{3}{4}$  of the required vertical clearance of the conductors to ground shall be maintained between open conductors and wells.

(11) E 123.03 Table 1, note c, requires a diagonal clearance the same as the vertical clearance be maintained to uneven or sloping terrain within a horizontal distance of  $\frac{3}{4}$  of the vertical clearance. Distances are to be measured from the conductors in their deflected position.

(12) **NEAR SWIMMING POOLS.** A horizontal clearance of at least 10 feet shall be maintained between service drops or other open overhead wiring, and swimming pools, diving structures, observation stands, towers or platform. (See NEC-1971 section 680-8.)

**History:** Cr. Register, January, 1968, No. 145, eff. 2-1-68; am. (3) (d) 2. a. Table 4 Note (a) and (12), Register, April, 1972, No. 196, eff. 5-1-72.

#### **E 123.06 Minimum line-conductor clearances and separations at supports.**

##### **(1) SEPARATION BETWEEN CONDUCTORS ON POLE LINES.**

(a) *Application of rule. 1.* Multiconductor wires or cables. Cables and duplex, triple or paired conductors supported on insulators or messengers, whether single or grouped, are for the purpose of this rule considered single conductors even though they may contain individual conductors not of the same phase or polarity.

2. Conductors supported by messengers or span wires. Clearances between individual wires or cables supported by the same messenger, or between any group and its supporting messenger, or between a trolley feeder, supply conductor, or communication conductor, and their respective supporting span wires, are not subject to the provisions of this rule. This paragraph also refers to spacer installations where the distance between conductors is maintained by spacers placed at intervals which are much less than the length of a span.