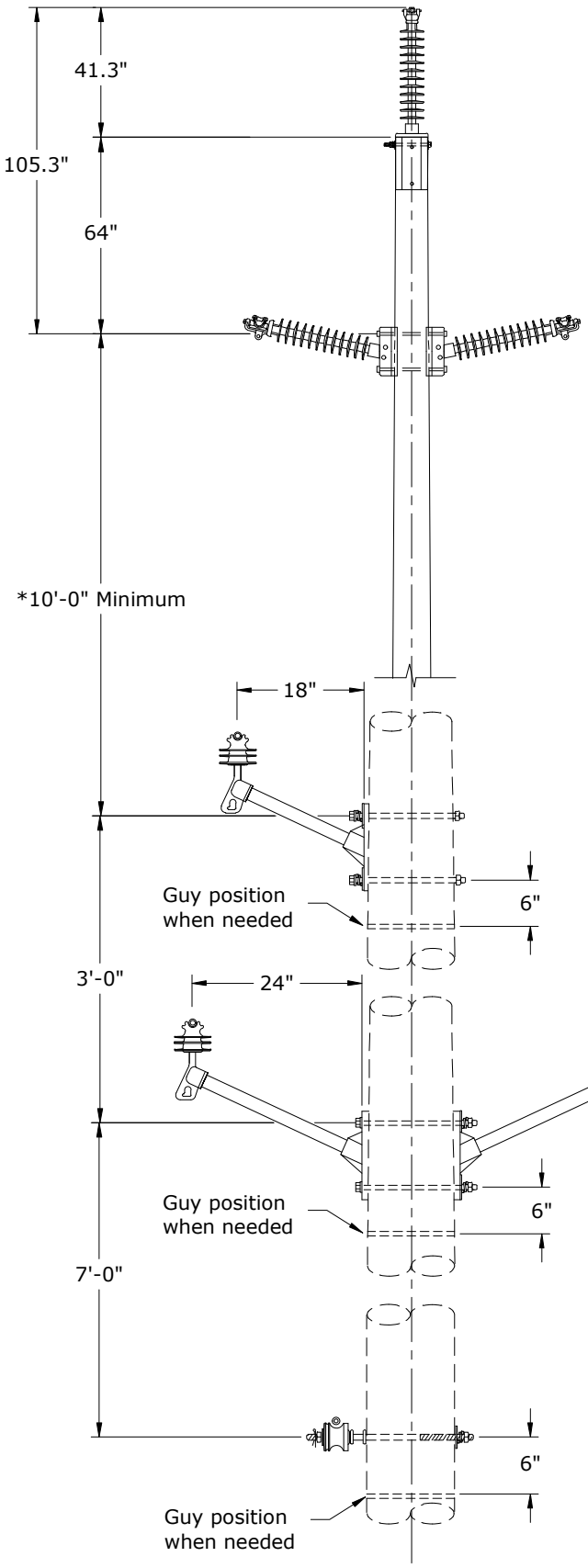

* For tall poles, make sure the distribution can be reached by a service/line truck.

CONSTRUCTION STANDARDS

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TRANSMISSION UNDERBUILD

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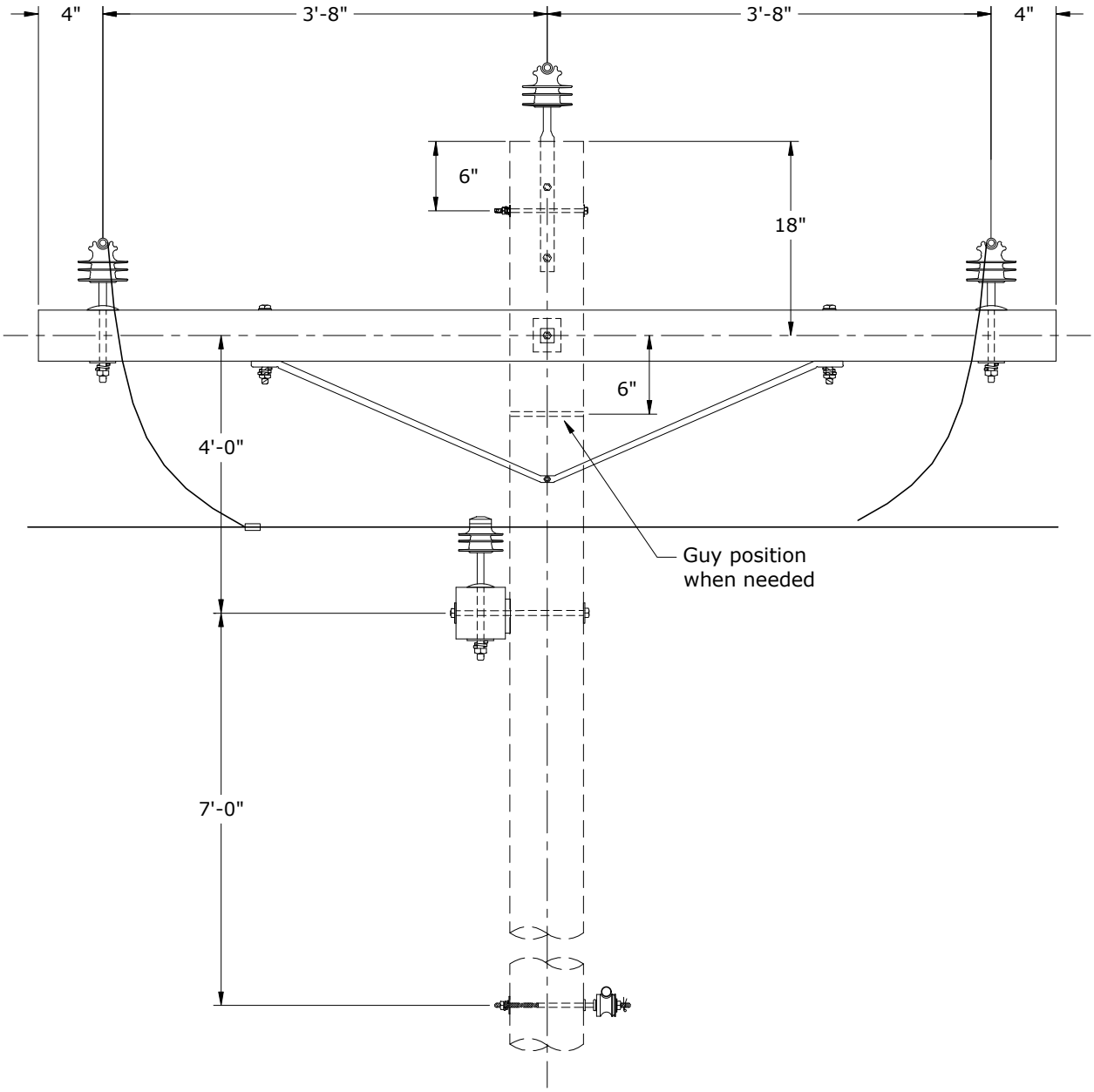

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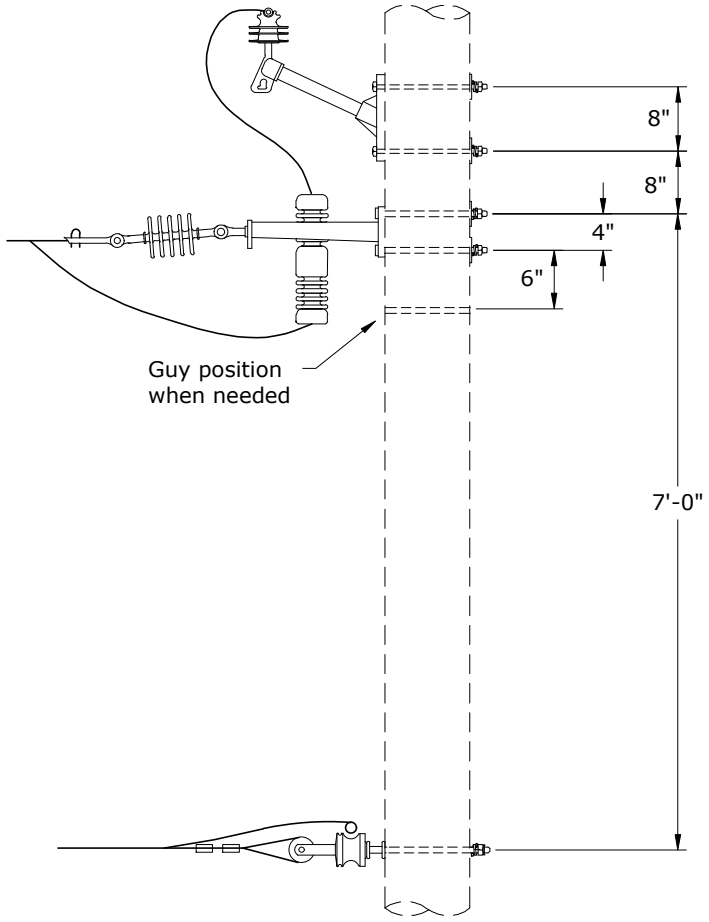

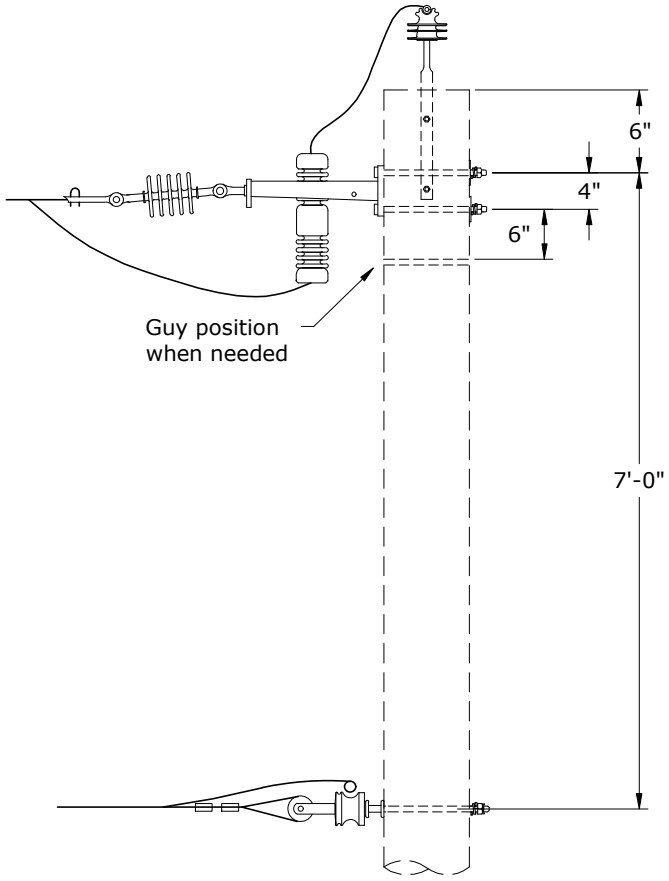

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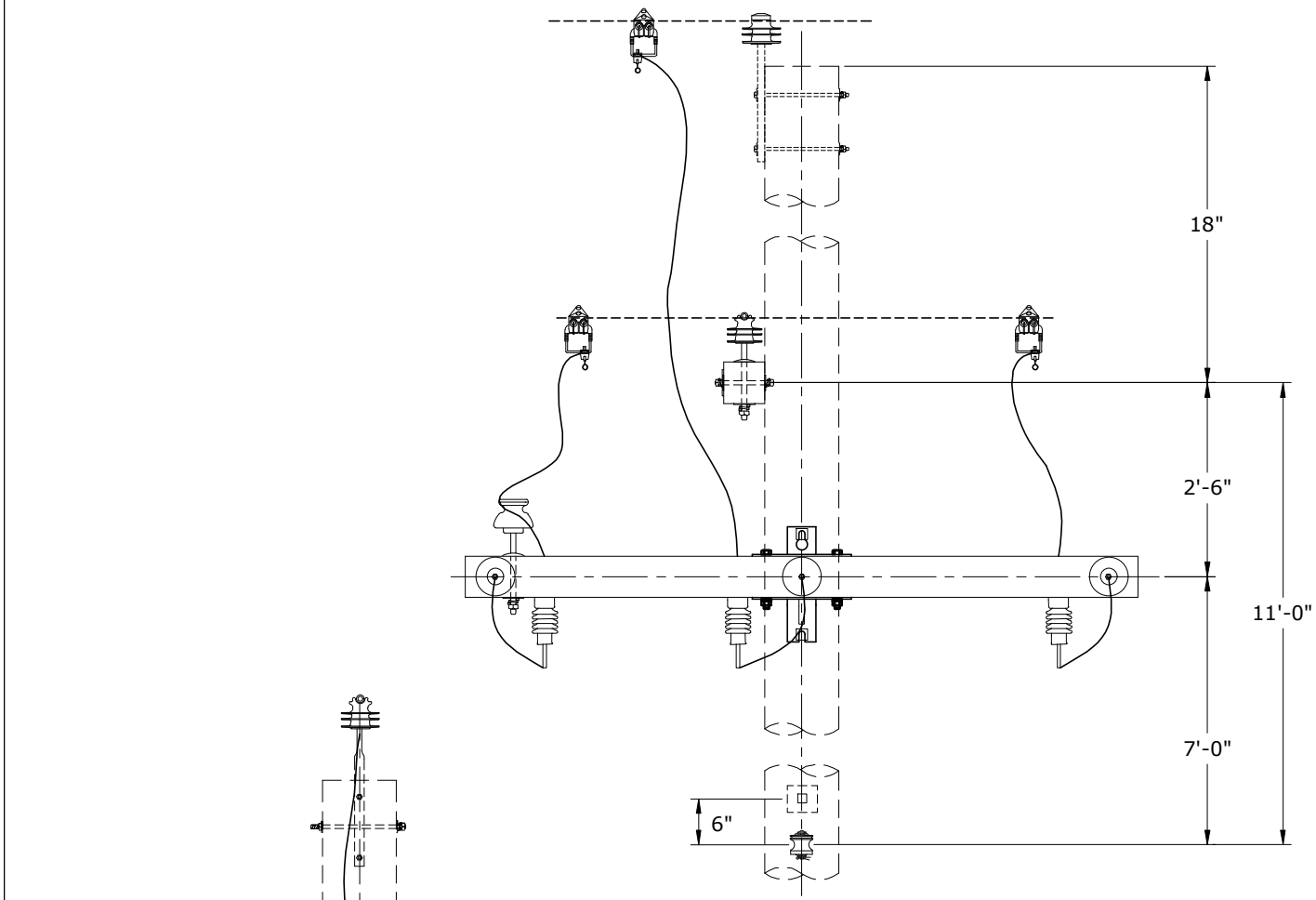

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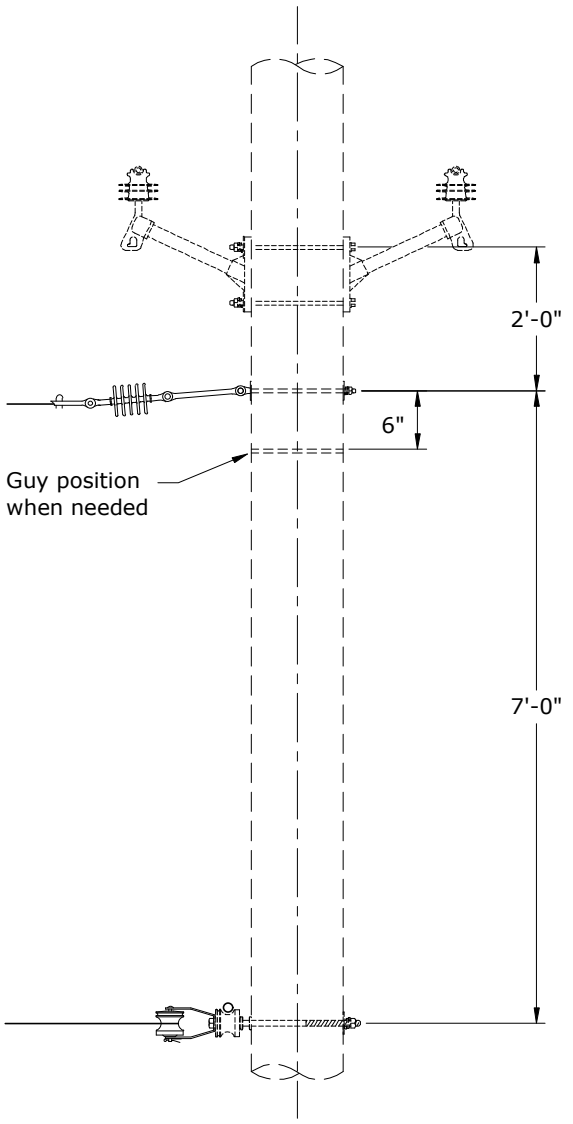

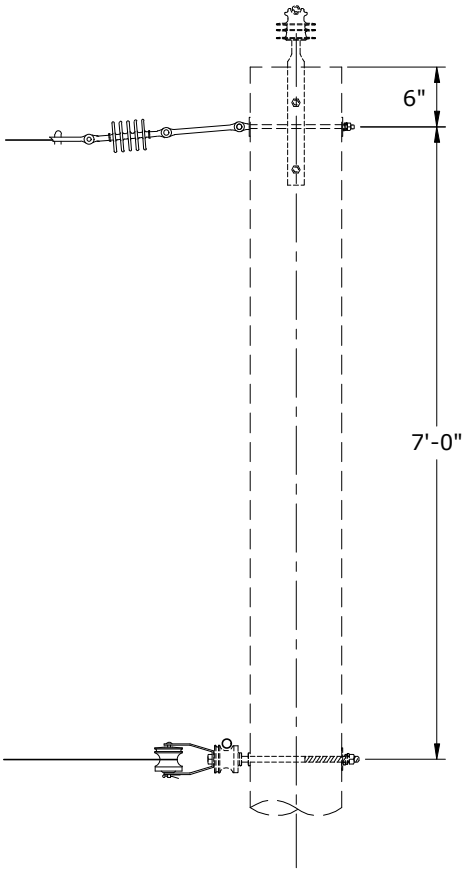

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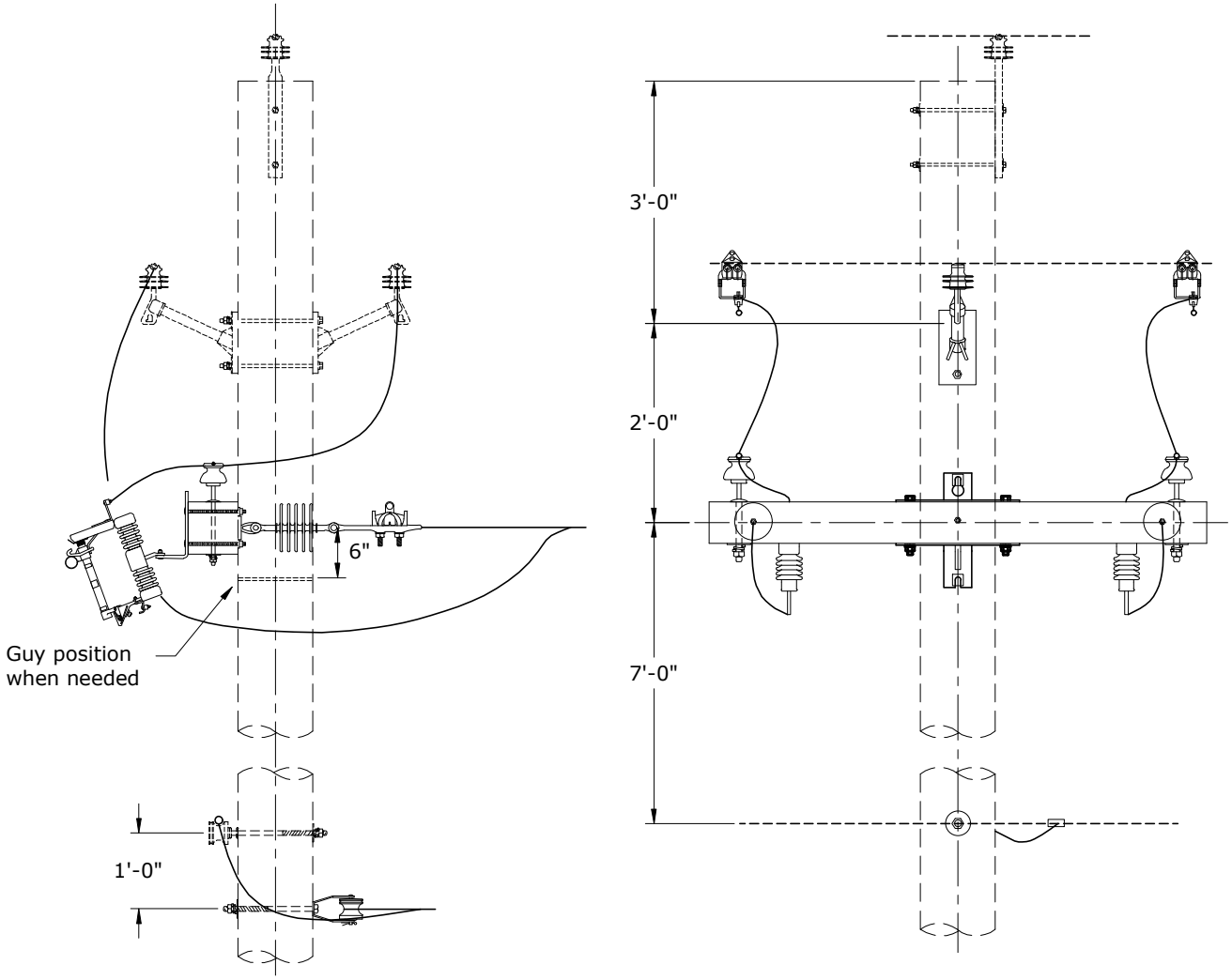
OVERHEAD VERTICAL WIRE CLEARANCES OVER GROUND
lowest point on the conductor during worst case sag condition

Nature of surface underneath wires, conductors, or cables	Ins. Comm. Cable, multi-grounded neutrals, grounded guys & triplex serv. Cable	Noninsulated comm. wire; insulated supply cables 0-750V;ungrounded guys exposed to 750V	Supply conductors over 750V to 15KV; ungrounded guys exposed to 750-15,000V	
1. Track rails of railroads (except electrified railroads using overhead trolley conductors	23.5	24	24.5	NESC
	25.5	*26*	26.5	*RUS*
	27	**27.5**	***28.5***	**PUD1**
2. Public roads, streets, alleys and other areas subject to truck traffic.	15.5	16	18.5	NESC
	17.5	*18*	*20.5*	*RUS*
	19	**19**	**20.5**	**PUD1**
3. Private roads and other land traversed by vehicles (cultivated, grazing, forest, etc.)	15.5	16	18.5	NESC
	17.5	*18*	*20.5*	*RUS*
	17.5	**18**	**20.5**	**PUD1**
4. Spaces and ways for pedestrians only (cannot ride horses). Spaces created by fences/gates do not qualify *	9.5	12	14.5	NESC
	11.5	*14*	*16.5*	*RUS*
	11.5	**14**	**16.5**	**PUD1**
5. INTERSTATES & STATE HIGHWAYS (crossings) **	24	24	30	WSDOT
	24* **	**24**	**30**	**PUD1**
Where wires, conductors, or cables run along and within the limits of highways or other road rights-of-way but do not overhang the roadway				
6. Public roads, streets or alleys	15.5	16	18.5	NESC
	17.5	*18*	*20.5*	*RUS*
	17.5	**18**	**20.5**	**PUD1**
7. INTERSTATES & STATE HIGHWAYS (longitudinal)	20	24	27	WSDOT
	20	**24**	**27**	**PUD1**

* These spaces must be the result of a physical terrain feature (a steep bank) where vehicles or horses cannot traverse or a man made feature not easily modified for vehicles (a cat walk)

** Refer to WAC 468-34-290 for more information

*** Communication joint use with electrical may be 20' per WAC 468-34-290



CONSTRUCTION STANDARDS

CONSTRUCTION FRAMING GUIDE
TWIGGY TO TAP ON CROSSARM

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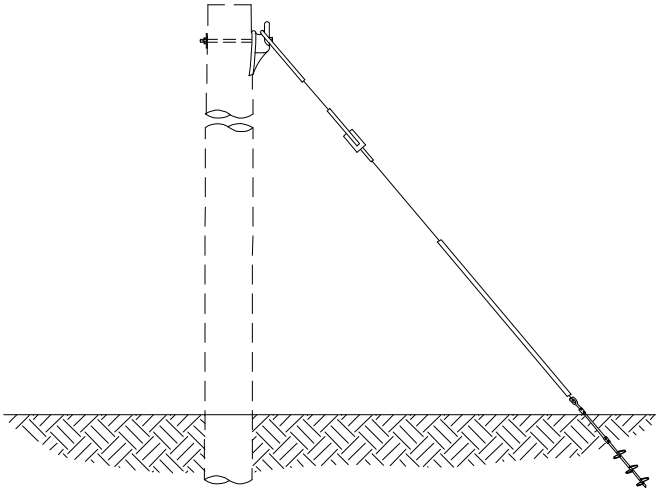
SCOPE

This section covers selection of down guys, span guys, sidewalk guys, push braces and anchors. The selections are based upon wood strengths, guy component strengths, anchor strengths and soil holding power of anchors.

DEFINITIONS (Taken from The Lineman's and Cableman's Handbook, Seventh Edition)

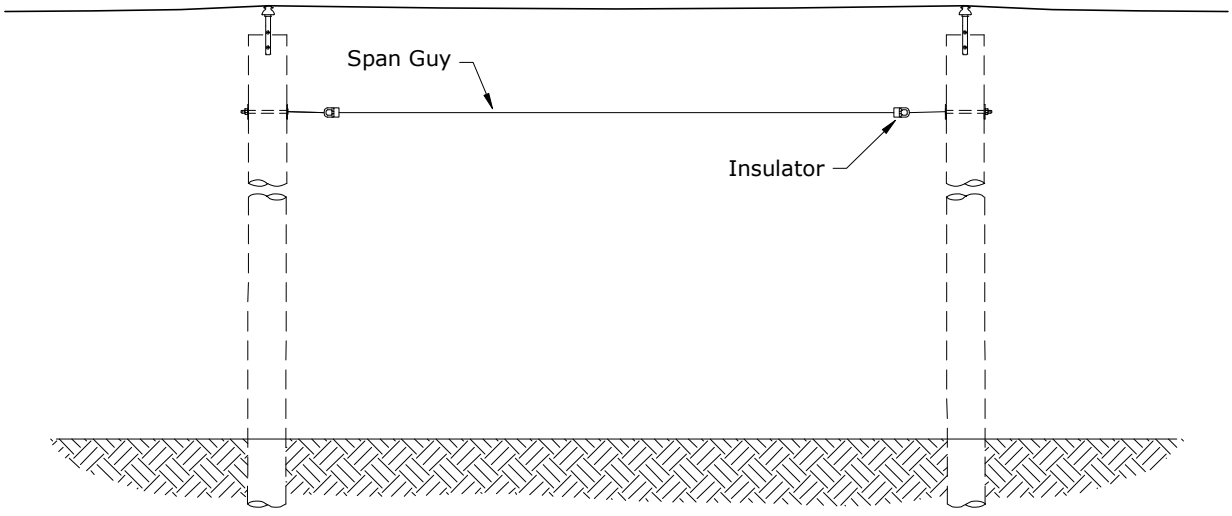
1. Down Guy-

Consists of a wire running from the attachment near the top of the pole to a rod and anchor installed in the ground.



2. Span Guy-

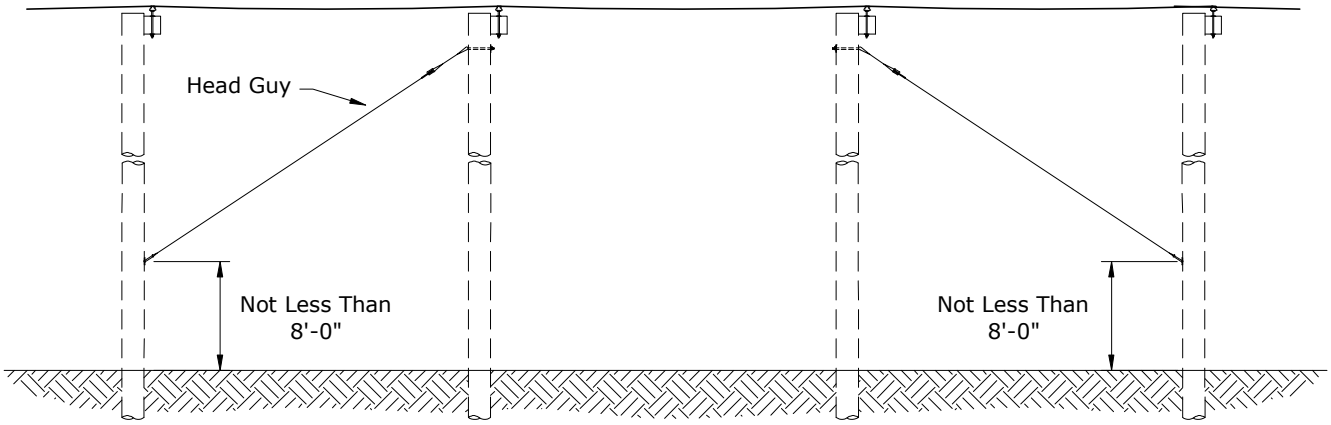
Consists of a guy wire installed from the top of a pole to the top of an adjacent pole to remove the strain from the line conductors.



Rev 2: Added definitions and updated to 2007 NESC.

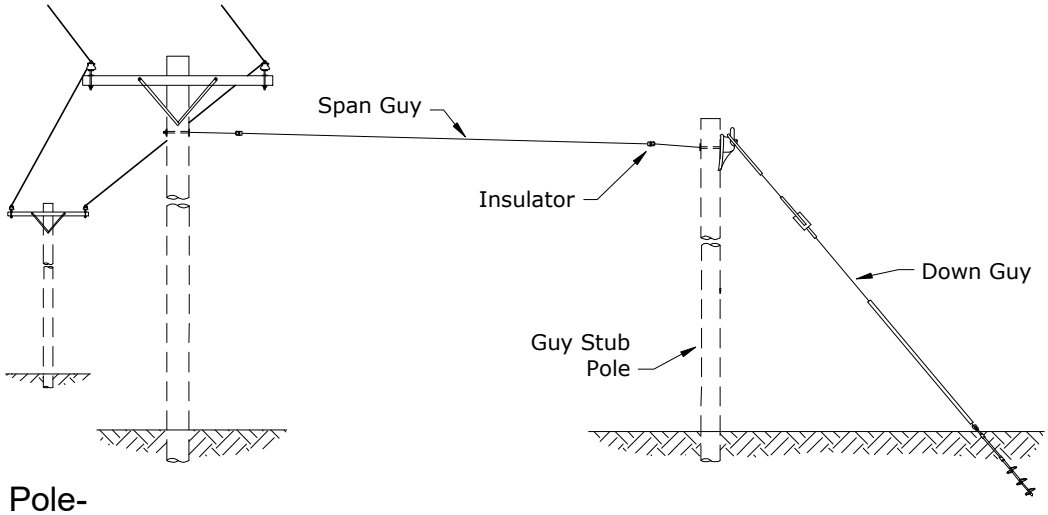
3. Head Guy-

A guy wire running from the top of a pole to a point below the top of the adjacent pole.



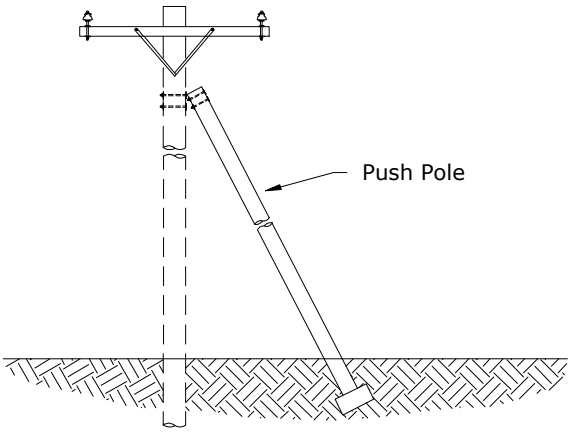
4. Guy Stub-

A guy wire installed between a line pole and a stub pole. The span guy, guy stub pole, and the down guy make up the guy stub.



5. Push Pole-

A pole used as a brace to a line pole.



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GENERAL

1. Guying

a) Guying assemblies include down, span and sidewalk types. A push brace consisting of a pole and attachment fittings may be used in place of tensioned wire guying only where tension guying is impossible by reason of location or rights-of-way.

b) Guying requirements can often be advantageously combined on a deadend pole, a span or more away by extending the circuit or by use of span guys in order to provide a reduced combined guying load on the same pole. A sidewalk guy is an expensive method of guying and provides limited support, particularly on taller poles, due to the comparatively short guy lead. DO NOT use a sidewalk guy if a down or span guy is possible.

c) Guy assemblies are designed for the maximum allowable load which may be supported by the pole and the related hardware. Heavy duty guying will normally require the use of multiple guying attachments.

d) A guy marker shall be used on all down guy and sidewalk guy locations. A minimum of one marker per anchor is required. It should be noted that guy markers DO NOT PROTECT OR "GUARD" a down/sidewalk guy, but rather warn the public of its presence.

2. Sidewalk Guy Insulation

Sidewalk guys shall have guy insulators installed in the guy strand above the horizontal guy strut. The breakers should be at a point that will allow at least 6" clearance between the breaker and the strut attachment to the pole, should the guy wire become broken.

3. Grounded Guys

Grounded guys shall not be used. All guys on transmission and distribution circuits shall have insulation sections (Johnny balls or fiberglass rods) installed on all new and rebuilt circuits. Grounded guys are to be replaced by insulated guys when work is done on that pole.

4. Application of Guy Insulators

It is impractical to show every NESC requirement for applying guy strain insulators. A clear understanding of the rules will provide for the correct applications. These guidelines will help in understanding the requirements.

Guideline 1 (see figure #1) - All down guys shall have a minimum of one guy insulator. (NESC 215C2)

Guideline 2 - All span guys will have a minimum of two guy insulators. (NESC 215C5)

Guideline 3 (see figure #2) - On jointly used poles, down guys that pass within 12 inches of supply conductors, and also pass within 12 inches of communication cables, shall be insulated with a guy insulator at a point below the lowest supply conductor and above the highest communication cable. (NESC 235I)

Guideline 4 (see figure #1) - All guy insulators shall be located at least 8 feet above the ground including when the guy would sag or break. (NESC 215C5a)

Guideline 5 (see figure #1) - Guy insulators shall be placed so that in case any guy wire contacts, or is contacted by an energized conductor or part, the voltage will not be transferred to other facilities on the structure. (NESC 215C5b)

Guideline 6 (see figure #3) - Guys may sag or break, bringing them into contact with energized conductors, jumpers, or bushings to create a hazard to the public. Guy insulators shall be placed so that when any guy sags down or falls upon another facility, the insulators will remain effective. (NESC 215C5c)

Figure 1: Guidelines 1, 4, 5, and 6

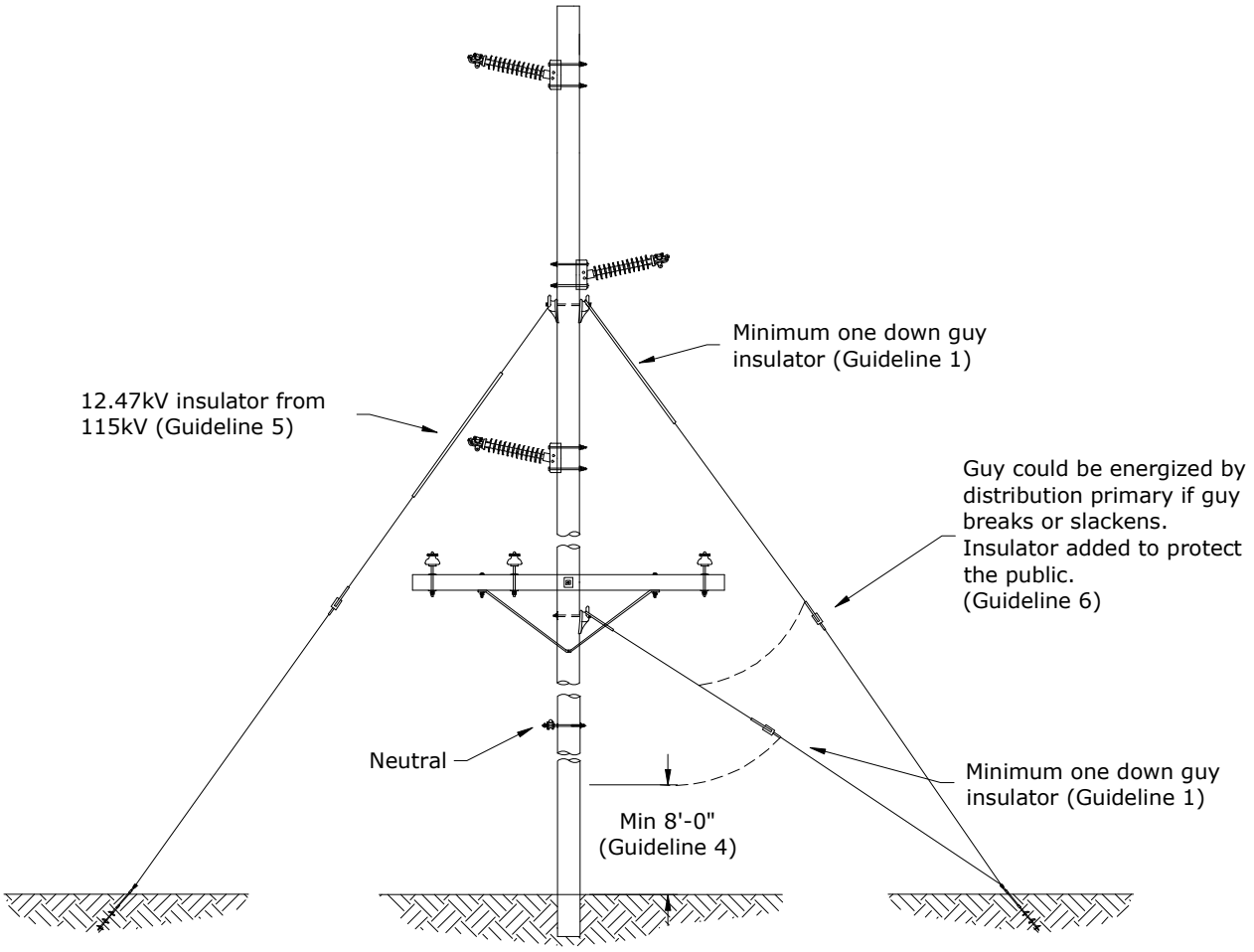


Figure 2: Guying near communication cable (Guideline 3)

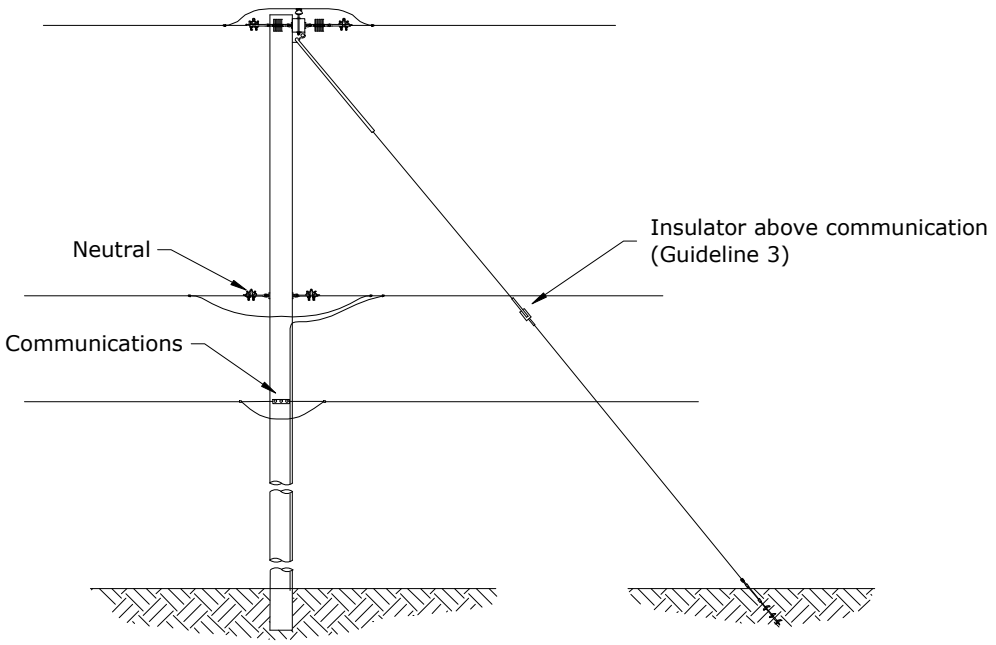
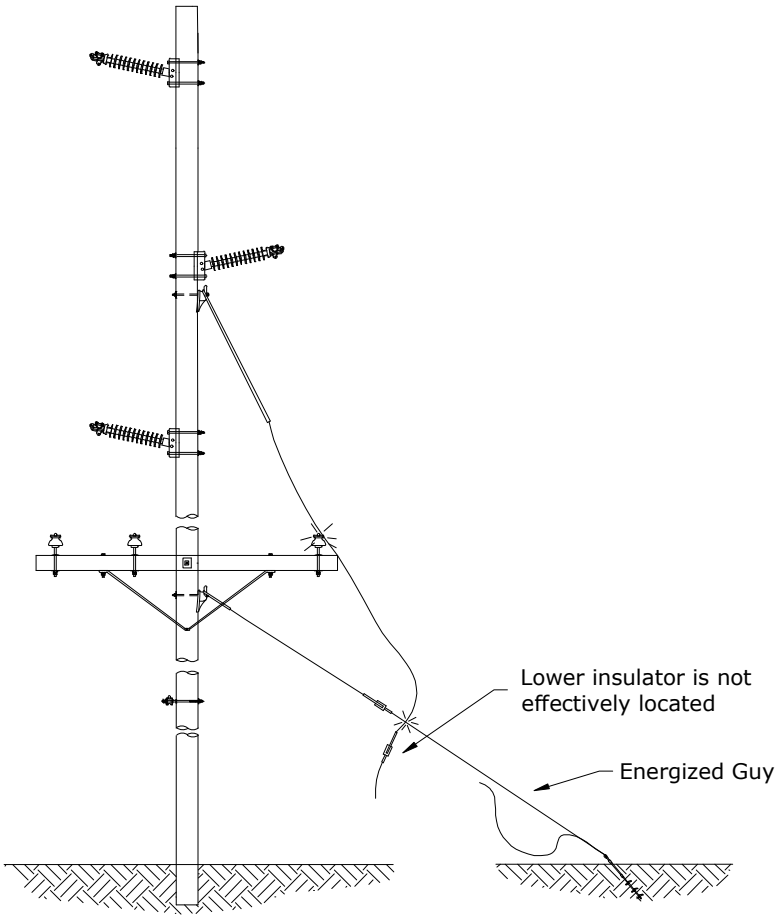


Figure 3: Allow for guys to sag or break (Guideline 6)



5. Anchors

Anchors shall be located so as to provide as large a lead over height ratio with as little interference to the public as possible.

ANCHOR SELECTION

1. Anchor Selection in General

a. Anchor selection is based upon guy tension, type of soil, available installation equipment and location.
b. Power installed screw anchors are the best choice if soil and location permit their use.
c. A plate anchor may be used if a hole can be dug either by machine or blasting or hand dug at inaccessible locations.
d. If solid rock is encountered, specify one of the rock anchors.
e. Some swamp areas cannot be covered by these anchors and must have special design consideration.

2. Soil Classification

The table of soil classification data which follows is for general use in specifying anchors.

SOIL CLASSIFICATION DATA

CLASS	PROBE VALUE	COMMON SOIL-TYPE DESCRIPTION	GEOLOGICAL SOIL CLASSIFICATION
0		Sound hard rock, unweathered	Granite, Basalt, Massive Limestone
1	750-1600 in-lbs	Very dense and/or cemented sands; coarse gravel and cobbles	Caliche, (nitrate-bearing gravel/rock)
2	600-750 in-lbs	Dense fine sand; very hard silts and clays (may be preloaded)	Basal Till; Boulder Clay; Caliche; Weathered Laminated Rock
3	500-600 in-lbs	Dense sands and gravel; hard silts and clays	Glacial Till; Weathered Shales, Schist, Gneiss and Siltstone
4	400-500 in-lbs	Medium dense sand and gravel; very stiff to hard silts and clays	Glacial Till, Hardpan and Marls
5	300-400 in-lbs	Medium dense coarse sands and sandy gravels; stiff to very stiff silts and clays	Saprolites, Residual Soils
6	200-300 in-lbs	Loose to medium dense fine to coarse sands to stiff clays and silts	Dense Hydraulic Fill; Compacted Fill; Residual Soils
7	100-200 in-lbs	Loose fine sand; alluvium; loess; medium-stiff and varied clays; fill	Flood Plain Soils; Lake Clays; Adobe; Gumbo, Fill
8	< 100 in-lbs	Peat, organic silts; inundated silts, fly ash, very loose sands, very soft to soft clays	Miscellaneous Fill, Swamp Marsh

CONVERTING HYDRAULIC PRESSURE TO TORQUE

If a shear pin torque indicator is not going to be used, the operator can make a conversion chart so that pounds per square inch of system hydraulic pressure can be converted to torque at the anchor. This chart can be made by temporarily using a shear pin torque indicator and recording maximum hydraulic pressure readings when various numbers of pins shear. Each pin is equal to 500 ft-lb of torque. After the conversion chart is completed, it is not necessary to use the shear pin torque indicator. Any changes in the hydraulic motor system will require a new conversion chart. Check the accuracy of the chart annually, after any hydraulic system repairs, or before critical anchor installation such as mainline, distribution lines, or transmission lines.

TRUCK # _____ CHART DATE _____ OPERATOR _____

SYSTEM HYDRAULIC PRESSURE LBS./SQ. IN.	TORQUE IN FT. LBS	NUMBER OF SHEARED PINS	NOTES
	500	1	
	1000	2	
	1500	3	
	2000	4	
	2500	5	
	3000	6	
	3500	7	
	4000	8	
	4500	9	
	5000	10	
	5500	11	
	6000	12	
	6500	13	
	7000	14	

Grounding Installations - Distribution Circuits

The minimum requirements for grounding assemblies are specified in the National Electrical Safety Code (IEEE C2-2017).

Rule #93-A: Copper-clad steel ground without joint or splice, if possible, free from sharp bends and as short as possible.

Rule #93-C-2: Ground for AC distribution shall have not less than 1/5 of the line conductance. (#4 Cu-equivalent copper-clad steel).

Rule #94-B: Driven electrodes, if practicable, shall be below permanent moisture level, minimum size 5/8" x 8', driven eight (8) feet deep. When rod cannot be driven eight (8) feet deep, install second rod on opposite side of pole and interconnect ground wire. The top of the ground rod shall be flush with or below the ground level unless suitably protected.

Rule #97-A: Ground conductors shall be run separately to ground for:

- Surge Arresters over 750v and frames of any equipment operating over 750v (see exceptions below).
- Lighting and power circuits under 750v.
- Shield wires of power circuits

Rule #97-B: An interconnection of primary surge arrester ground and primary and secondary neutral is permitted on a multi-grounded system. This solid interconnection shall be made since surge current is routed through several parallel ground impedances and the danger of insulation damage no longer exists even under conditions of high surge current and high ground impedance.

Rule #215-C: Non-current-carrying parts shall be grounded unless they are 8 feet or more above readily accessible surfaces or they are otherwise isolated or guarded.

OVERHEAD TRANSFORMER

FUSE LOOK-UP TABLE

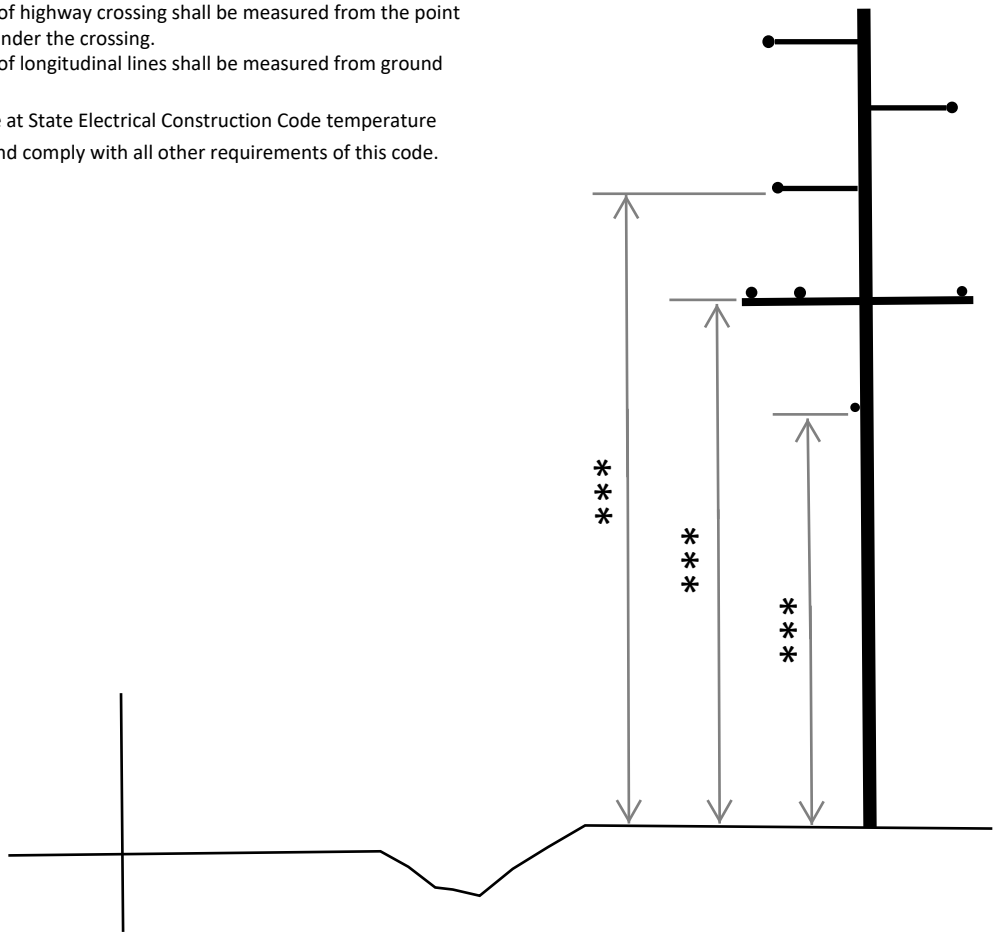
OH XFMR	K-LINK
15	6K
25	6K
37.5	8K
50	10K
75	15K
100	20K

*** HOA to provide the WAC required minimum vertical clearance.

468-34-290 Vertical clearance.
The vertical clearance for overhead power and communication lines above the highway and the lateral and vertical clearance from bridges shall conform with the National Electrical Safety Code and/or with the clearances as shown below,whichever is greater.

TYPE OF UTILITY LINE LINES	CROSSING ROADWAYS	LONGITUDINAL
Communications and Cable Television	24'	20'
Communications and/or Cable Television joint usage with electrical	20'	20'
ELECTRICAL		
0 - 750 volts	24'	24'
751 - 15,000 volts	30'	27'
15,001 - 50,000 volts	32'	32'
50,001 volts and over	34'	32'

(1) The minimum height of highway crossing shall be measured from the point of the roadway directly under the crossing.
(2) The minimum height of longitudinal lines shall be measured from ground line.
(3) All clearances shall be at State Electrical Construction Code temperature and loading standards, and comply with all other requirements of this code.



Minimum Vertical Clearance Requirements

STANDOFF BRACKET PLACEMENT

1) Basic Rule: On poles without anchors or existing clean poles, 1Ø primary and secondary riser brackets should be installed on the "belly button" side of the pole. Typically, a transformer would also be installed on the "belly button" side above the 1Ø primary or secondary riser.

2) On poles with an existing transformer or transformer bank, the bracket should be installed under the transformer or center transformer on a bank with the alternative position being 45°-90° away from street side. If the existing transformer is located on the opposite side of the "belly button," place the bracket under the transformer.

3) Standoffs are typically not installed under guy wires no matter where the "belly button" is located.

4) Standoffs and risers should be placed to avoid conflict with overhead communication wires and guy wires.

5) For poles with an existing riser, use the brackets that are installed to maintain climbing space.

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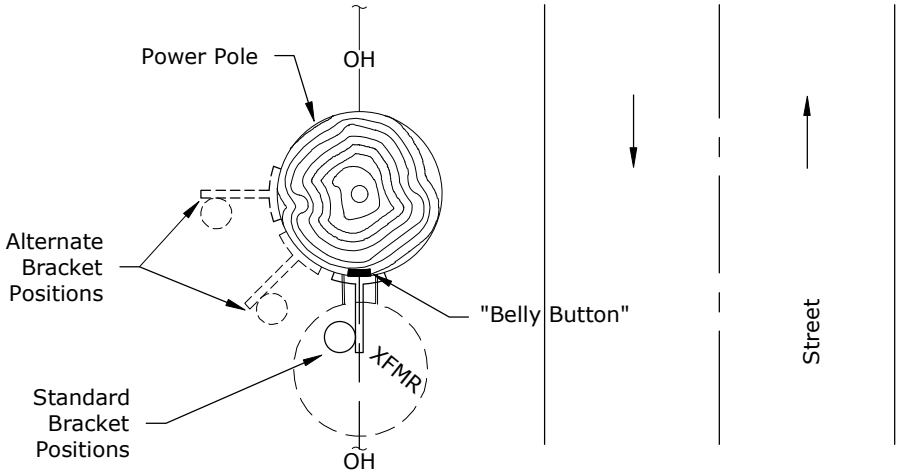

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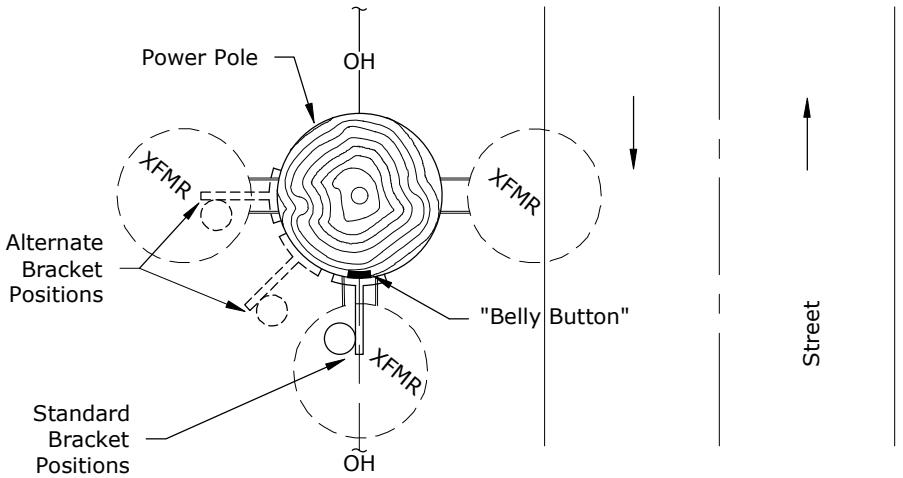

	CONSTRUCTION STANDARDS 1Ø PRIMARY (U1) & SECONDARY (U8) RISER GUIDELINES			REVISIONS	
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