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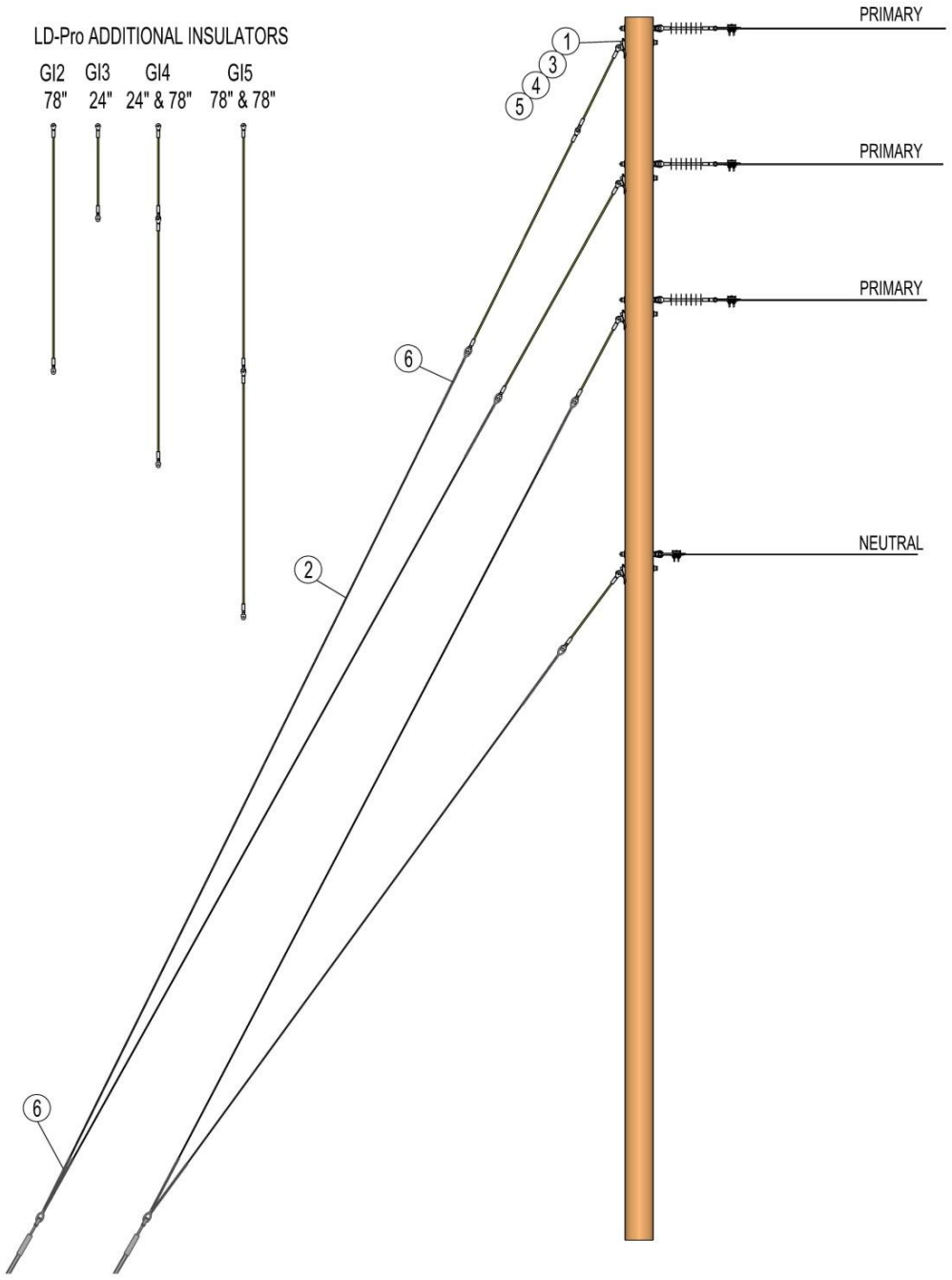
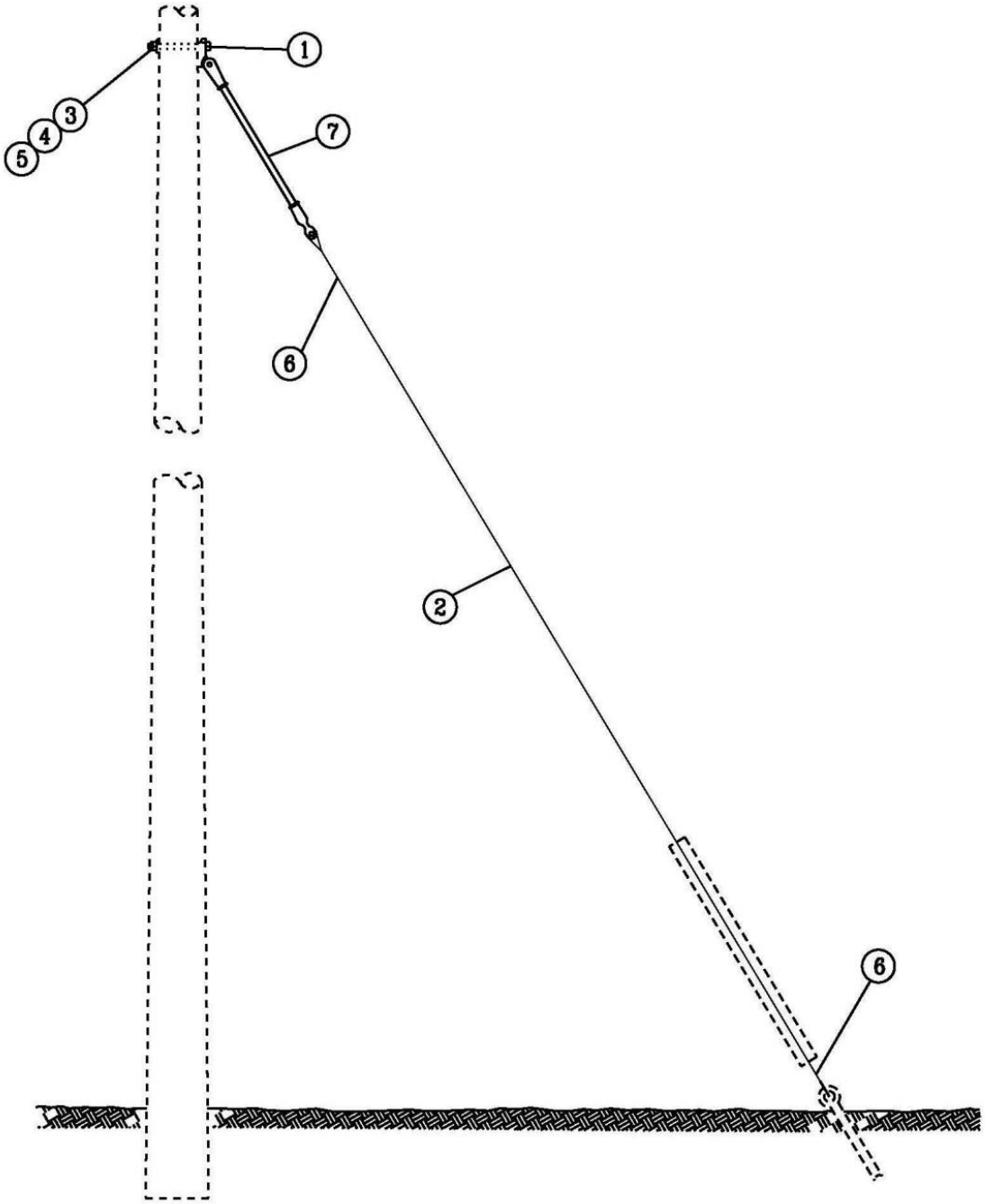


□ Notes:

1. See Std G80 for proper placement of strain insulator.
2. All materials to be rated for use with 3/8 inch Extra High Strength (EHS) guy wire.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: PRIMARY DOWN GUY		1		**ASSEMBLY: GI3**		**1**
1	ATTACHMENT, COMBINATION GUY	135-0060	1	8	GUY INSULATORS, 24”	134-5236	1
2	WIRE, GUY, EHS, 3/8”	133-2635	44 FT		**ASSEMBLY: GI4**		1
3	BOLT, MACHINE, 3/4”	MCH423X	1	9	GUY INSULATORS, 24”	134-5236	1
4	NUT, LOCK 3/4” DIA	143-6255	1	10	GUY INSULATORS, 78”	134-5242	1
5	WASHER, CURVED, 4” X 4”	143-9108	1		**ASSEMBLY: GI5**		**1**
6	GRIP, CABLE, PRE-FORMED	134-4532	2	11	GUY INSULATORS, 78”	134-5242	2
	ASSEMBLY: GI2		1				
7	GUY INSULATORS, 78”	134-5242	1				

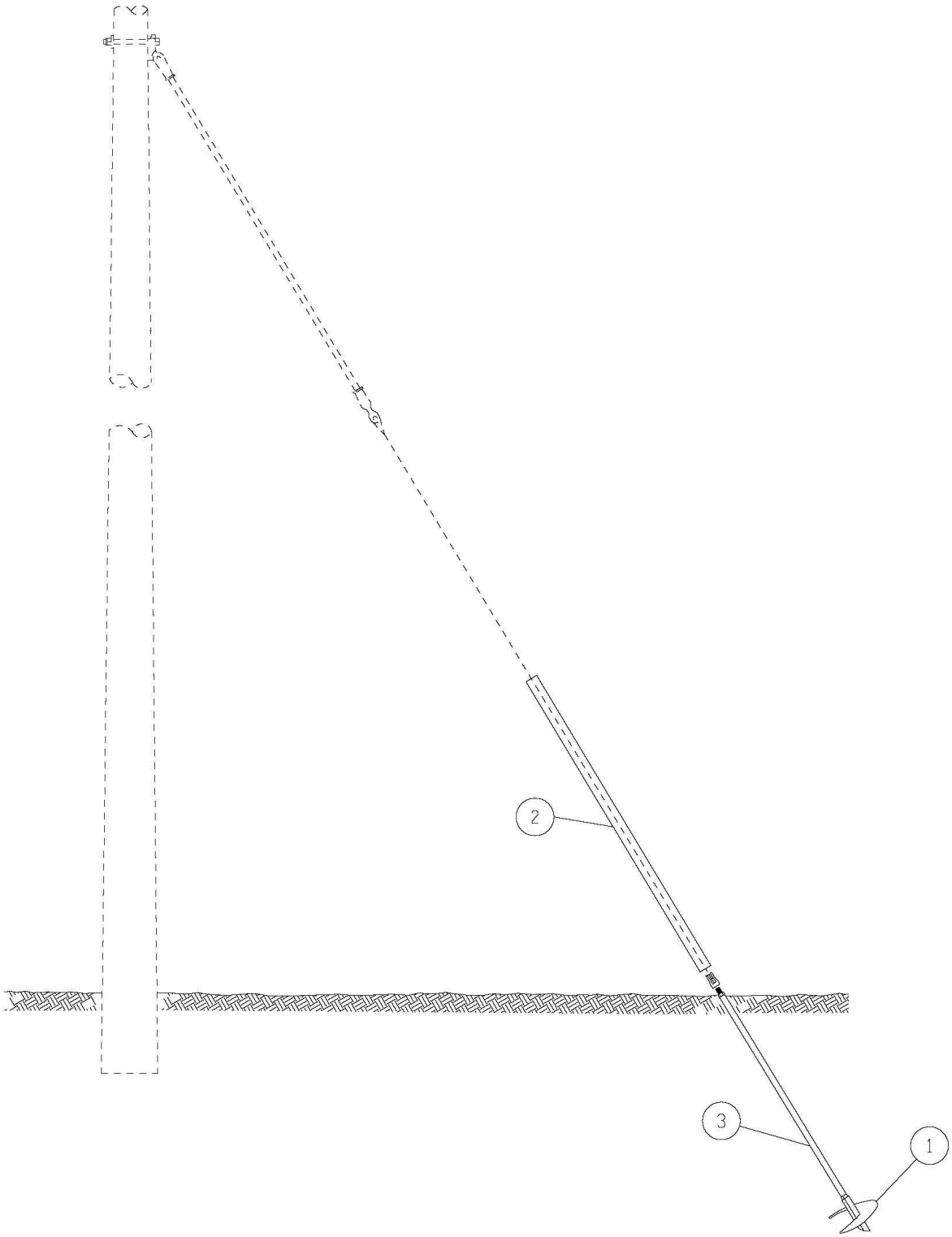


□ Notes:

1. See Std G80 for proper placement of strain insulator.
2. All materials to be rated for use with 3/8-inch Extra High Strength (EHS) guy wire.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: NEUTRAL/SECONDARY DOWN GUY		1	5	WASHER, CURVED, 4" X 4"	143-9108	1
1	ATTACHMENT, COMBINATION GUY	135-0060	1	6	GRIP, CABLE, PRE-FORMED	134-4532	2
2	WIRE, GUY, EHS, 3/8"	133-2635	44 FT		**ASSEMBLY: GI2**		1
3	BOLT, MACHINE, 3/4"	MCH423X	1	7	GUY INSULATORS, 24"	134-5236	1
4	NUT, LOCK 3/4" DIA	143-6255	1				

08/13/02	**G20**	**8” POWER SCREW ANCHOR, SINGLE**	Page 1 of 1

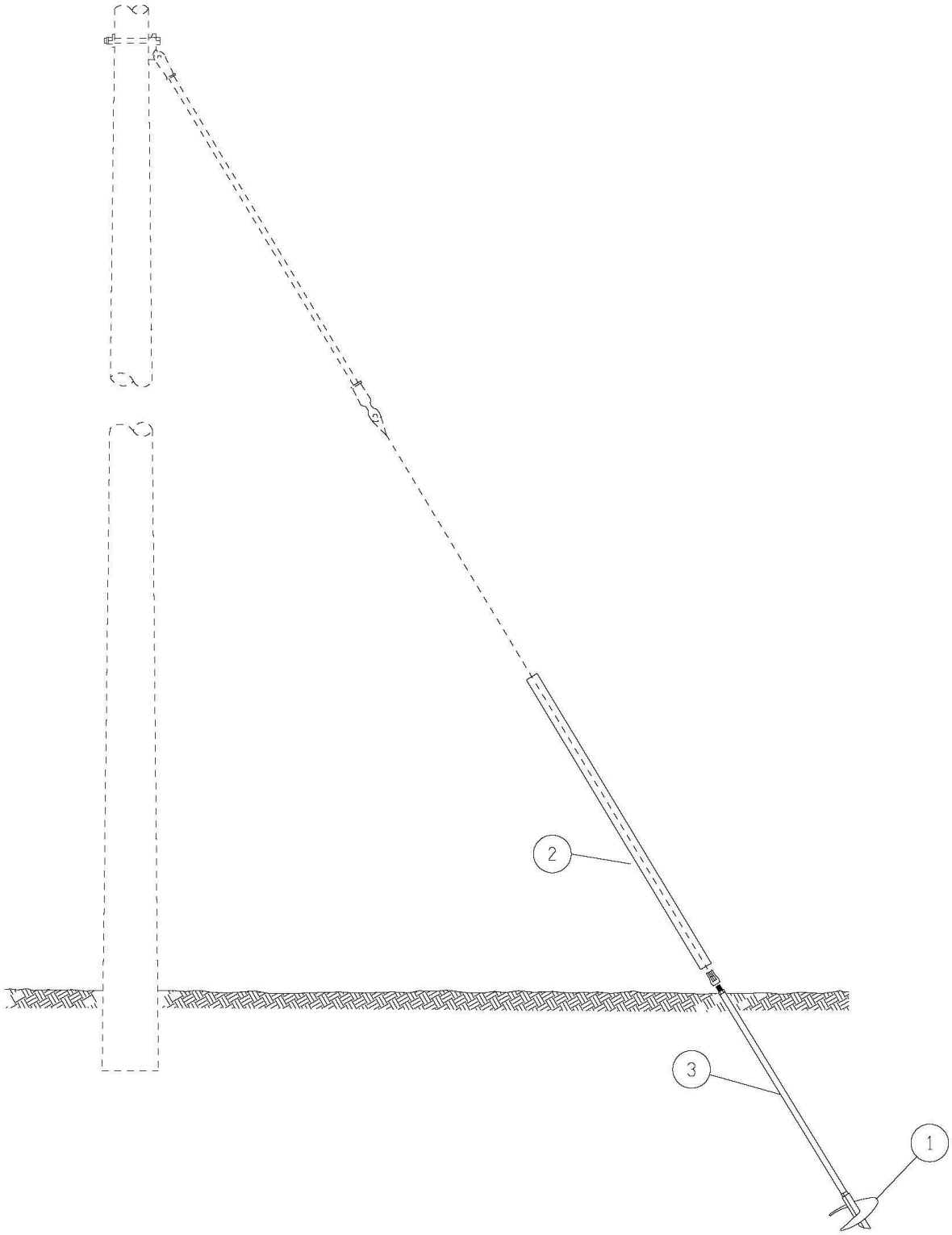


Note:

1. Reference installation methods on Line Work Method (LWM) 2006.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 8” PS ANCHOR, SINGLE		1	2	MARKER, GUY, YELLOW, 8’	134-6035	1
1	ANCHOR, POWER, SINGLE HELIX, 8”	134-0053	1	3	ROD, ANCHOR, TRIPLE EYE, 3/4” DIA	134-6508	1

08/13/02	G21	12" POWER SCREW ANCHOR, SINGLE	Page 1 of 1

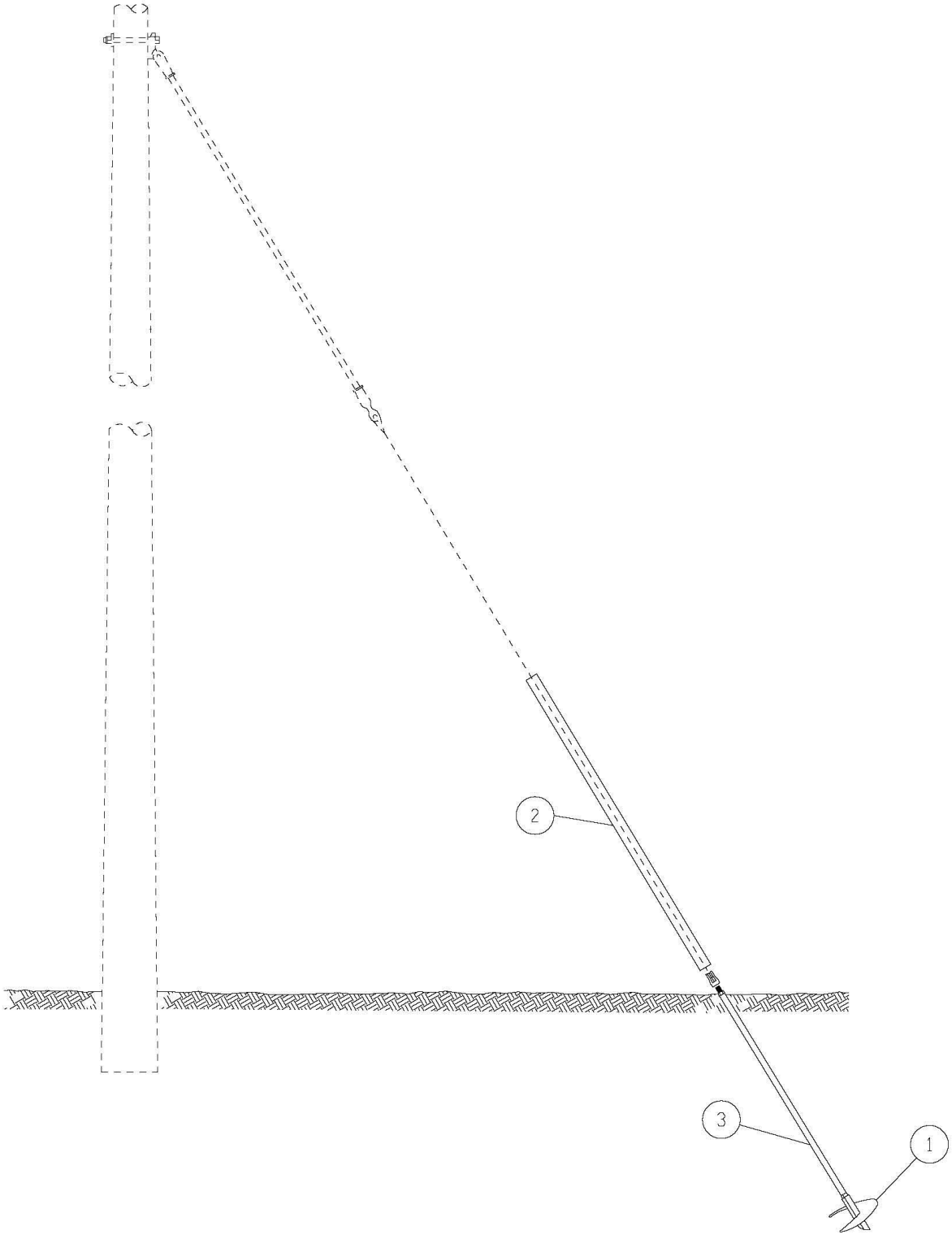


Note:

1. Reference installation methods on Line Work Method (LWM) 2006.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 12" PS ANCHOR, SINGLE		1	2	MARKER, GUY, YELLOW, 8'	134-6035	1
1	ANCHOR, POWER, SINGLE HELIX, 12"	134-0055	1	3	ROD, ANCHOR, TRIPLE EYE, 3/4" DIA	134-6508	1

01/01/13	G22	10" HEAVY DUTY POWER SCREW ANCHOR, SINGLE	Page 1 of 1

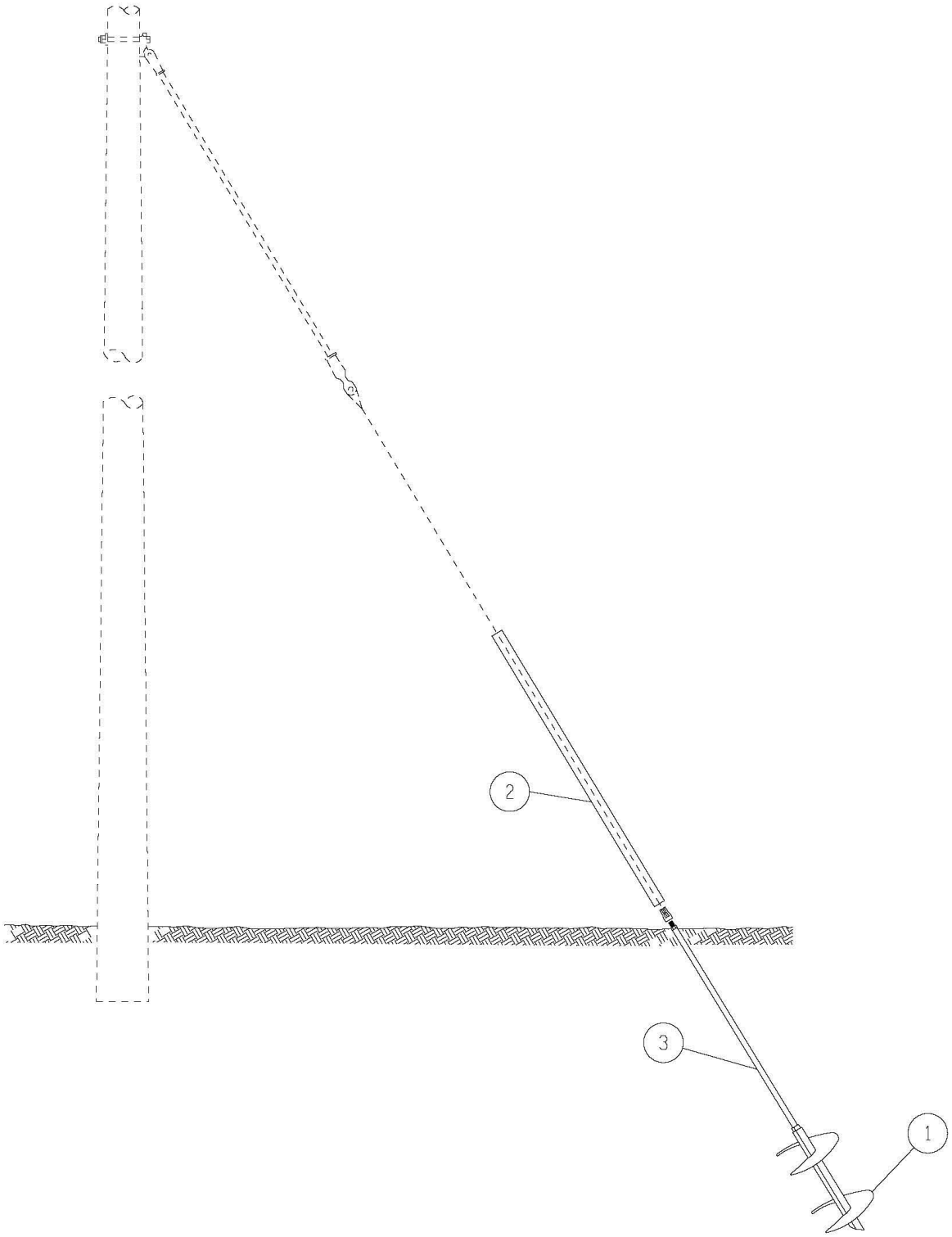


Note:

1. This anchor is a high-strength power installed screw anchor and should only be used in rocky soil conditions or high installation torque areas. A Dixie drive-end assembly tool, catalog number 030187, is needed to install this anchor. Contact the Operations Training – Training Coordinators for tooling. This anchor has a 1-1/2" hub tapped for 1" rod (134-6510 and 134-6512).

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 10" PS ANCHOR, SINGLE		1	2	MARKER, GUY, YELLOW, 8'	134-6035	1
1	ANCHOR, POWER, SINGLE HELIX, 10"	134-0058	1	3	ROD, ANCHOR, TRIPLE EYE, 1" DIA	134-6510	1

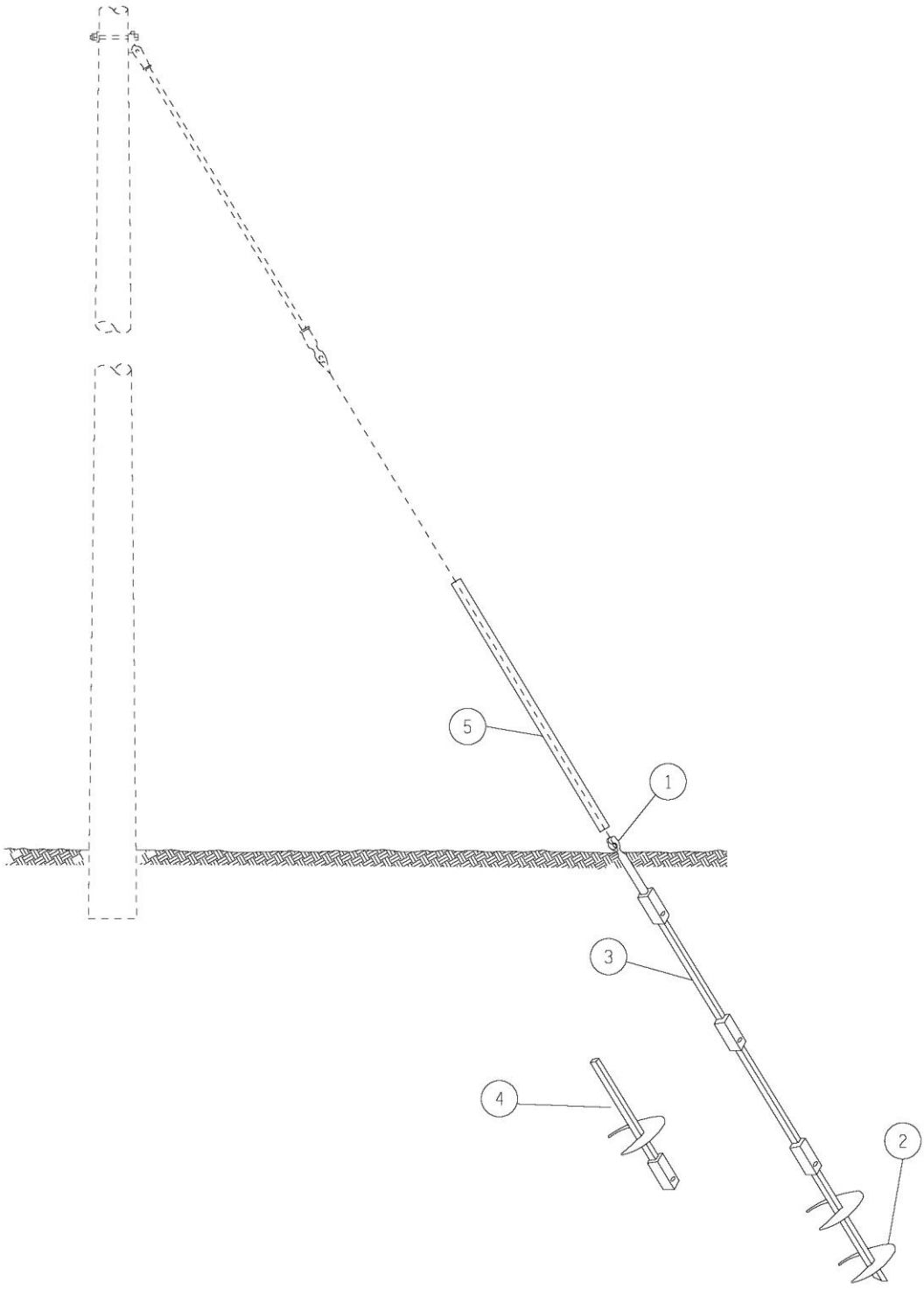
08/13/02	G23	10" POWER SCREW ANCHOR, TWIN	Page 1 of 1



Note:

1. Reference installation methods on Line Work Method (LWM) 2006.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 10" PS ANCHOR, TWIN		1	2	MARKER, GUY, YELLOW, 8'	134-6035	1
1	ANCHOR, POWER, TWIN HELIX, 10"	134-0056	1	3	ROD, ANCHOR, SCREW EXTENSION, 1" DIA	134-6510	1

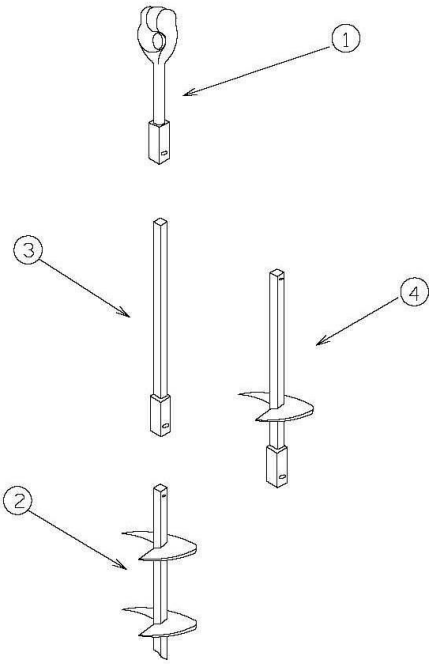


Note:

1. Reference installation methods in Line Work Method (LWM) 2006.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 8”-10” PS TRANSMISSION ANCHOR		1	3	ANCHOR, POWER, SCREW 3.5’ EXTENSION, SQUARE SHAFT	143-0066	2
1	ADAPTOR, ANCHOR, TRIPLE EYE GUY, SQUARE SHAFT	143-0045	1	4	ANCHOR, POWER, SCREW EXT W/ 12” HELIX, SQUARE SHAFT	143-0068	1
2	ANCHOR, POWER, TWIN HELIX, 8”-10”, SQUARE SHAFT	143-0064	1	5	MARKER, GUY, YELLOW, 8’	134-6035	1

Square-shaft (SS) multi-helix anchors are designed for heavy guy loading. Two helices are welded on a 1-1/2" square-steel shaft. Each helix acts essentially as a separate anchor for increased holding capacity. Extension shafts may be coupled to the helix section for installation to the depth required to put the helices into firm anchoring soil. The top helix must be buried to a depth of at least 5 helix diameters into the soil. SS screw anchors consist of three galvanized components as shown. The extensions and guy adapters include a high-strength nut and bolt.

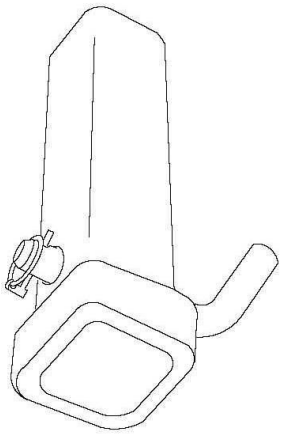


(1) 143-0040....TWIN EYE GUY ATTACHMENT
143-0045....TRIPLE EYE GUY ATTACHMENT

(2) 143-0064....TWO HELIX SCREW ANCHOR

(3) 143-0066....EXTENSION SHAFT

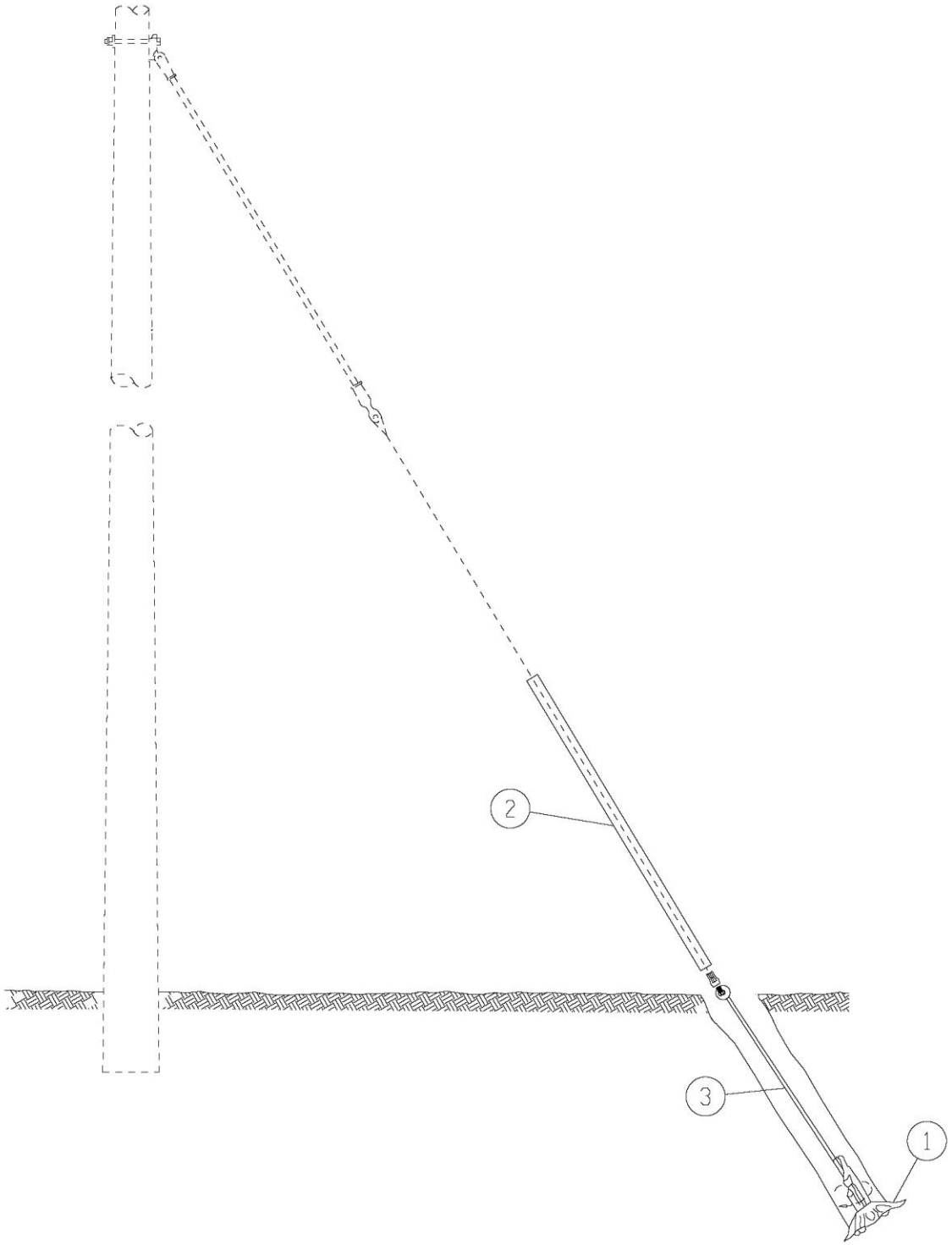
(4) 143-0068....EXTENSION SHAFT WITH HELIX FOR MULTI-HELIX ANCHOR



The SS anchor attaches to the 8" drive end assembly rather than the long drive used for the round anchor rods.

Do not use the long drive assembly as it will be twisted by the torque used in installation of the SS anchor.

The torque indicator (Line Work Method 5014) can be used to determine the holding power of the SS anchor assembly. As in all anchor installations, the holding power is relative to the type of soil in the area.

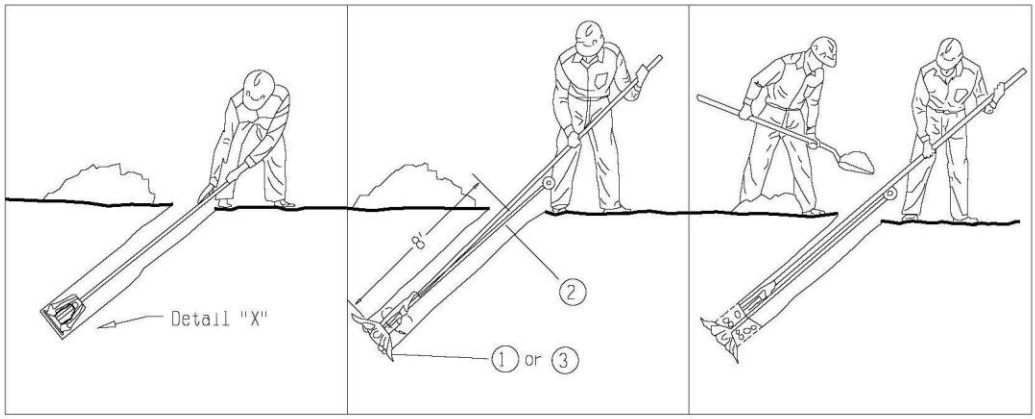


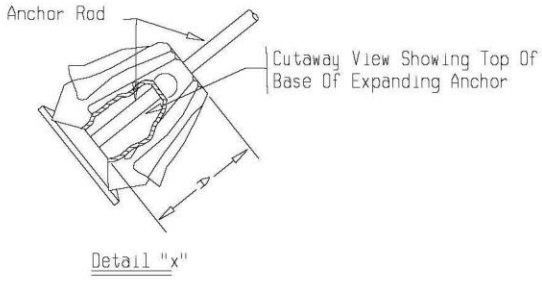
8” Expanding Anchor Materials

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 8” EXPANSION ANCHOR		1	2	MARKER, GUY, YELLOW, 8’	134-6035	1
1	ANCHOR, EXPANSION, 8”	134-0045	1	3	ROD, ANCHOR, TWINEYE, 3/4” DIA	134-6522	1

10” Expanding Anchor Materials

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 10” EXPANSION ANCHOR		1	2	MARKER, GUY, YELLOW, 8’	134-6035	1
1	ANCHOR, EXPANSION, 10”	134-0048	1	3	ROD, ANCHOR, TWINEYE, 3/4” DIA	134-6522	1





Detail "x"

APPLICATION

Expanding type anchors shall be used only in areas such as back lot lines, etc., where it would be impractical to get equipment in or install screw anchors by hand.

These anchors may be used for all guying requirements other than swamps, quicksand, or other continually wet soil, and solid rock. One 8” expanding anchor should be used for each 10,000 lbs of guy tension. One 10” expanding anchor should be used for each 19,000 lbs of guy tension. These ratings hold true only if expanding anchor is used in type of soil it has been designed for.

INSTALLATION

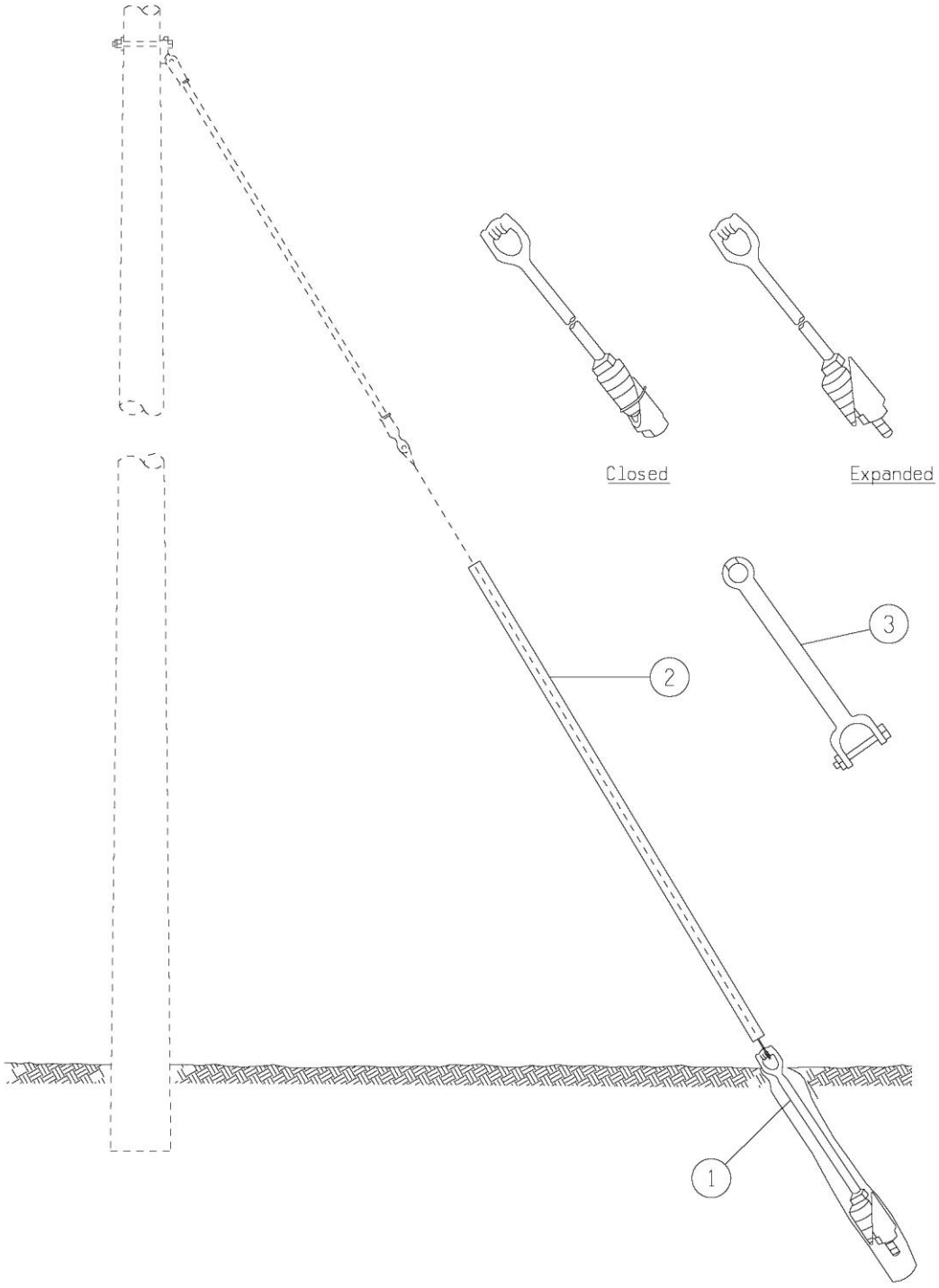
DIG HOLE TO PROPER DEPTH AND TAMP BOTTOM TO SQUARE IT OFF. 8” and 10” expanding anchors have approximately 8” and 10” diameters respectively. Hole diameter shall be no larger than 9” and 12” respectively; otherwise, anchor rating will not be achieved.

ATTACH ANCHOR ROD. (WIRES HOLDING MOVABLE EARS SHALL NOT BE CUT.) Before placing the assembly in the hole, the distance required for complete expansion (shown as A dimension above) should be measured and marked on the expanding and tamping bar with the reference being the anchor rod. In the past, these marks were made on the bar and assumed to be the same for all expanding anchors. This is not true as each size of anchor and manufacturer have a different “A” dimension and should be treated as such when being installed.

EXPAND THE ANCHOR WITH AN EXPANDING AND TAMPING BAR. Strike the anchor with the bar a sufficient number of times to obtain complete expansion. This is important because if complete expansion is not obtained, the anchor will not meet its rated holding strength.

BACKFILL AND TAMP IN APPROXIMATELY 6 TO 8 INCH INCREMENTS. No rock fill is necessary unless the ground is exceptionally wet at the time of installation.

ANCHOR ROD – TWINEYE	134-6522
ANCHOR ROD - TRIPLEYE	134-6525

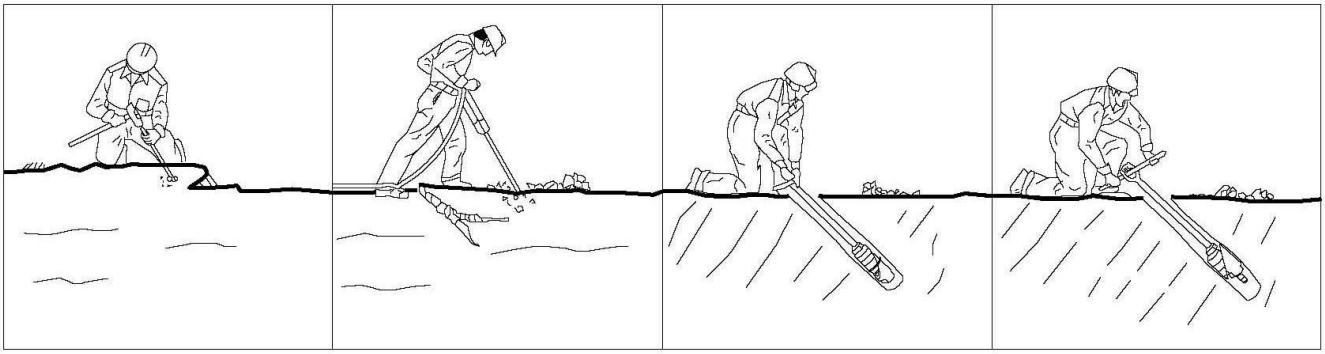


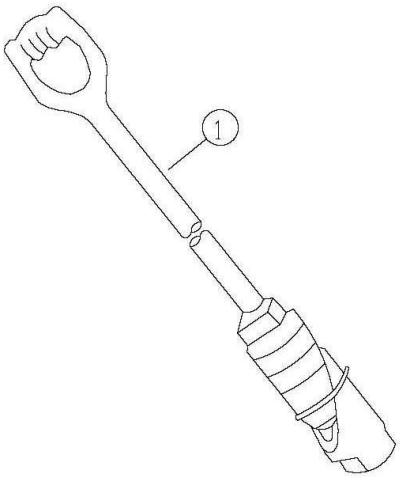
53” Expanding Rock Anchor

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: ROCK ANCHOR		1	2	MARKER, GUY, YELLOW, 8’	134-6035	1
1	ANCHOR, ROCK EXPANDING, 53”	134-0065	1	3	EXTN ROD, 1 1/4” X 72”	134-6506	AS REQ

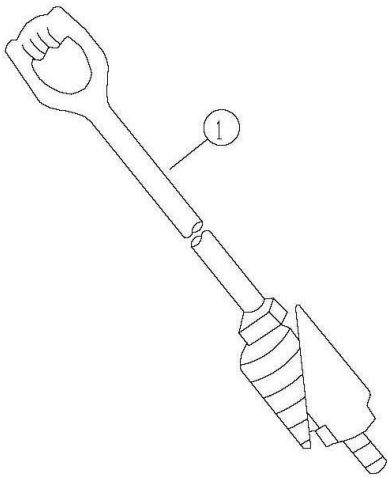
72” Expanding Rock Anchor

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: ROCK ANCHOR		1	2	MARKER, GUY, YELLOW, 8’	134-6035	1
1	ANCHOR, ROCK EXPANDING, 72”	134-0066	1	3	EXTN ROD, 1 1/4” X 72”	134-6506	AS REQ





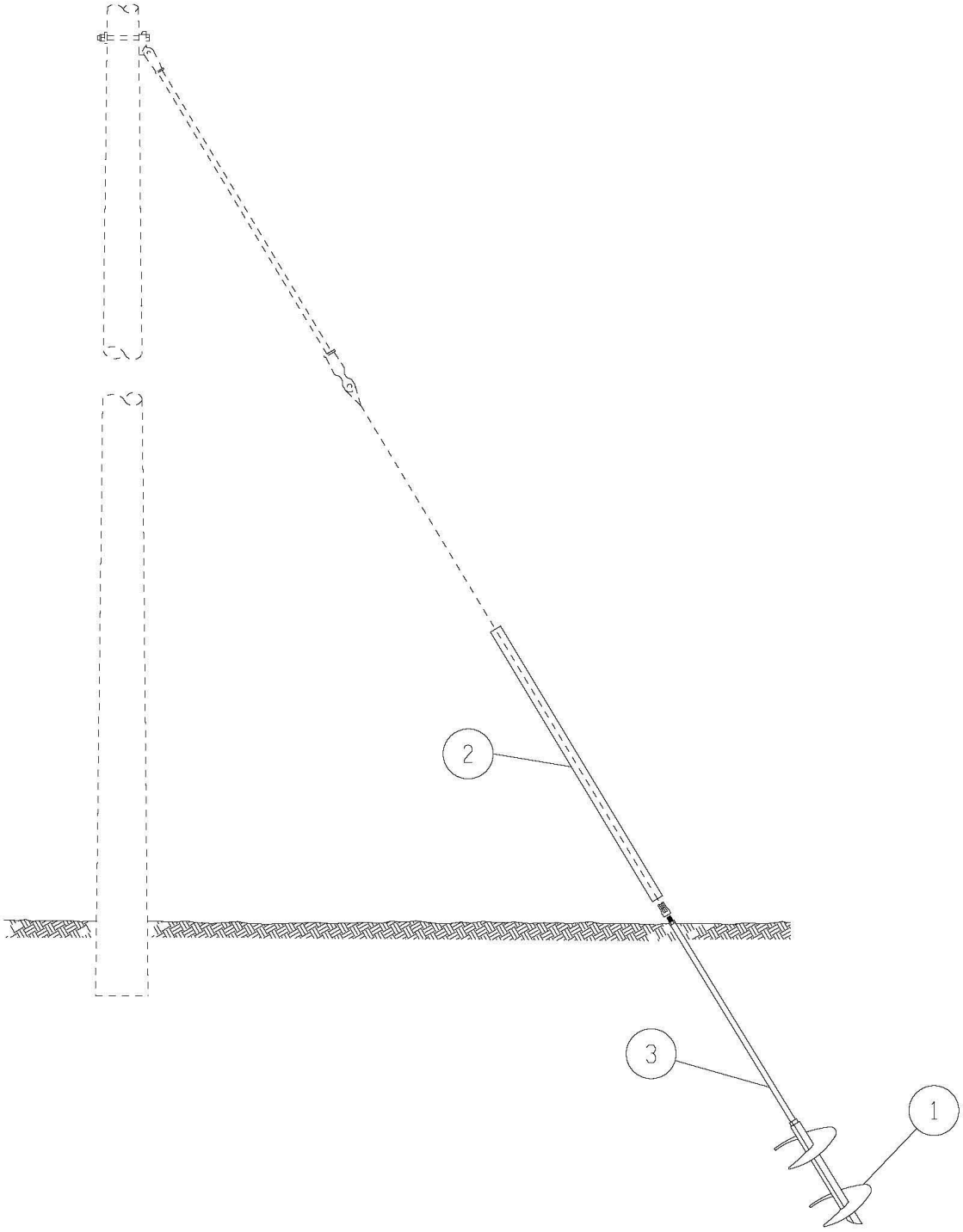
Closed



Expanded

□ Notes:

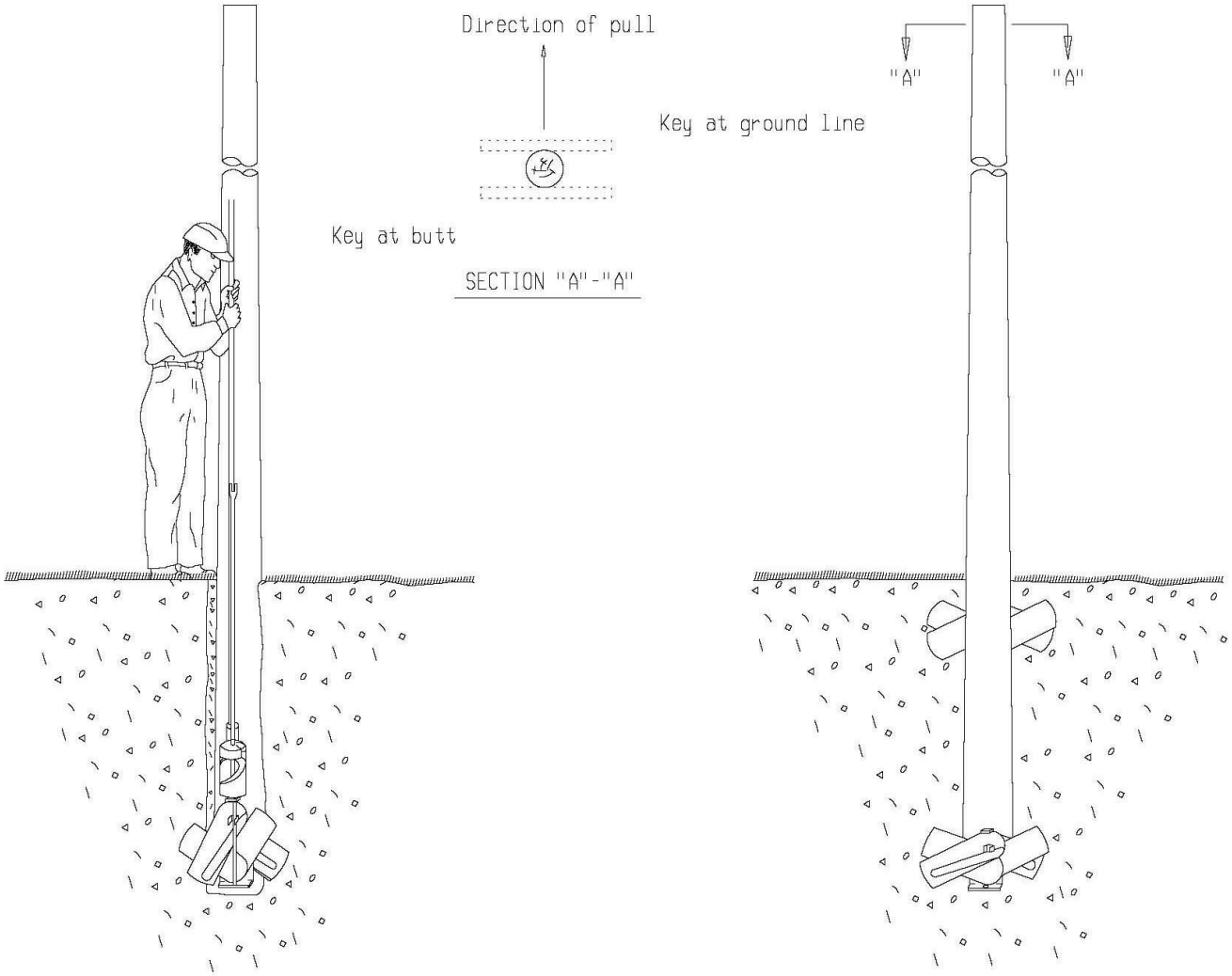
1. This anchor shall only be used in solid rock.
2. Bore with a hand or power drill a 2” diameter hole for 1-3/4” anchors.
3. Put a bar through the large eye of the anchor rod and turn until the anchor is firmly expanded against the sides of the hole.
4. See Std G100 for the holding strength of this anchor.
5. Where rock is about 2’ – 3’ below the surface, a swamp anchor extension (135-6505) can be used to get the rod to extend above the ground line.
6. The anchor extension rod, 134-6506, can be used in cases when the rock anchor is installed below grade and additional length is needed in order to attach the downguy. Note, however, that the extension shall be installed after the anchor has been installed, and no torque is intended to be applied to the extension. It is intended for straight pulling tension only.



Note:

1. Reference installation methods in Line Work Methods (LWM) 2006.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: 4" PS ANCHOR, TWIN		1	2	MARKER, GUY, YELLOW, 8'	134-6035	1
1	ANCHOR, POWER, SCREW TWIN HELIX	134-0054	1	3	ROD, ANCHOR, TRIPLE EYE, 3/4" DIA	134-6508	1



I. General

A. Pole keys shall be used in pairs to reinforce the soil around pole butts. A single pole key may be installed on an existing leaning pole as an aid to straightening it. Care shall be taken so that the pole keys are not used beyond their capabilities.

B. Pole keys may be used on poles supporting street light cables and fixtures in residential areas and on small angle poles where the use of a guy is not required, but the soil needs reinforcing.

II. Installation

A. Pole keys shall be installed so that they are perpendicular to the direction of the pull they are resisting.

B. Use only the existing hole augered for the pole. Do not enlarge the hole for pole key installation.

C. Screw a 3/4” anchor rod (134-6522) or 134-6525) into the key (134-5268). Then lower it into the hole. Use an expanding and tamping bar to expand the key into solid ground. Remove the rod when the key is expanded. The backfill shall be placed one shovel full at a time and thoroughly tamped.

III. Pole Key Calculations

A. Determine "Horizontal Force" (H) for each conductor.
   1. Tangent Pole: H=T; "Transverse Loading" from Std OHC15.
   2. Angle Pole: H=(QXG) + T; Q=from Table 1; G= "Maximum Guying Tension" from Sag tables; T= "Transverse Loading" from Std OHC15.
   3. Deadend Pole: H=G; G= "Maximum Guying Tension" from Sag tables.

B. Determine "Total Ground Line Moment" (MTOT)
   1. Determine "Ground Line Moment" (M) from the formula, M=HXD, where (D) is height of the conductor on the pole above ground.
   2. Add the values of M for each conductor and call the total, MTOT.

C. Determine "A" from Table 2.
   1. If MTOT is Less than "A," then no pole keys are needed.
   2. If MTOT is Greater than "A," then proceed to III.D.

D. Determine "A+B"
   1. Determine "B" from Table 3.
   2. If MTOT is Less than "A+B," then pole keys are sufficient.
   3. If MTOT is Greater than "A+B," then pole keys are not sufficient and guying is required.

Note: Contact your Field Application Engineer if the conductors are slack span.

IV. Soil Types

A. Poor Soil – wet clay, loose fine sand, fill and silt.

B. Average Soil – damp clay, coarse sand, sand-gravel mixtures, and clay loam.

Example: 3 0 line, 3 336.4 KCM ACSR 8.1 #1/0 ACSR, 250' span short span arm construction 35' pole, 1 angle, poor soil.

	336.4 KCM ACSR		#1/0 ACSR
1.	T= 140.3 lbs		T= 116.5 lbs
2.	G= 2,575 lbs		G= 1,460 lbs
3.	Q= .017 from Table 1		Q= .017 from Table 1
4.	H= (.017 x 2,575) + 140.3 H= 184.1 lbs		H= (.017 x 1,460) + 116.5 H= 141.3 lbs
5.	M= (1 x 184.1 lbs x 30.75') + (2 x 184.1 lbs x 29.5') M= 16,523 ft. lbs		M= 1 x 141.3 x 26.25 M= 3,709 ft. lbs
6.	MTOT - 16,523 + 3,709 = 20,232 ft. lbs		
7.	A= 13,800 ft. lbs from Table 2 MTOT>13,800 ft. lbs. Therefore, pole keys or guying are required		
8.	B= 20,000 from Table 3 A+B= 13,800 + 20,000 = 33,800 MTOT<33,800 ft. lbs. Therefore pole keys are sufficient and guying is not required.		

Table 1

Line Angle	"Q"
1	.017
2	.035
3	.052
4	.07
5	.087

Table 2

Pole	"A" (Ft. Lbs)	
Height	Poor Soil	Average Soil
30'	10,000	20,100
35'	13,800	27,600
40'	19,800	39,600
45'	27,500	55,000
50'	37,200	74,300

Table 3

"B" (Ft. Lbs)	
Poor Soil	Average Soil
20,000	33,000

I. Arm and Span Guys
- A. All new arm and span guys should be 3/8" EHS guy strand.
- B. Refer to Table 2, Std G100, for allowable tension limits for 3/8" (HS, EHS) guy strand.
- C. 3/12 copperweld can be used for arm guys and head guys where the total guying tension does not exceed 1500 lbs. 3/10 copperweld can be substituted for 3/12 when it is available.

II. Down Guys
- A. All new down guys shall be 3/8" EHS guy strand.
- B. Prior to 2002, the standard down guy wire was 3/8" HS guy strand. This can be determined visually by the size of porcelain strain insulator and guy attachment hardware.
- C. A down guy or head guy is not required if the difference in tension does not exceed 500 lbs and the difference in pole attachment heights is less than 12 inches. The difference in tension is the difference between the maximum guying tensions times the number of conductors on each side of the pole.
- D. Shorter anchor lead lengths result in more tension in the down guy and more vertical stress on the pole. Therefore, it is advisable to obtain as much of a lead length as practical.

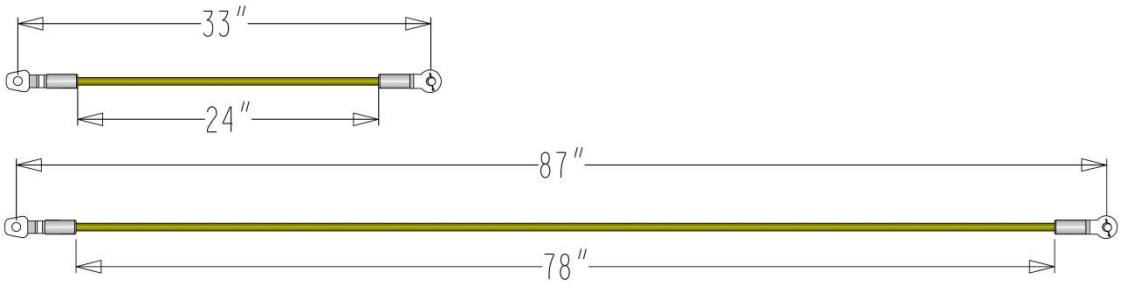
III. Guy Attachment
- A. 134-3200 auxiliary eye for use with 5/8" and 3/4" diameter anchor rods can be used.

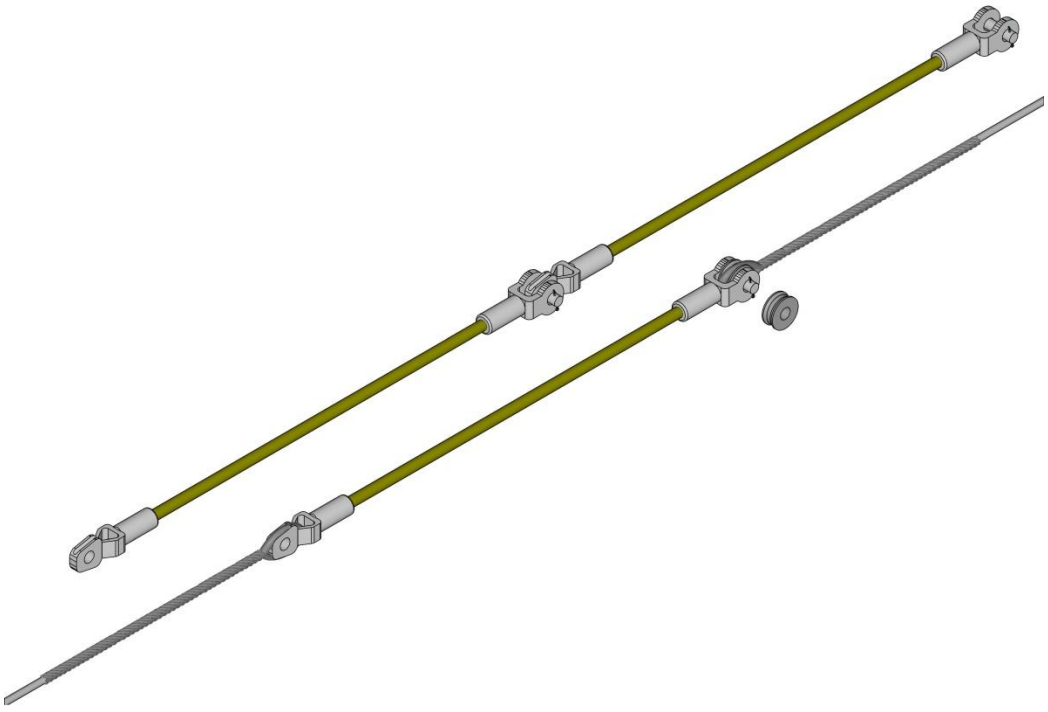
IV. Guy Grip Tools
- A. The Pengo #E-90 bracket can be attached below the anchor rod eye to provide enough offset for pulling the guy to permit the installation of a guy grip.

V. Guy Grips
- A. Guy grips shall not be used with strap-type attachments; replace strap-type attachments with guy hooks and replace guy grips previously used with strap-type attachments. Remove and replace strap-type attachment when work is performed as part of the maintenance program.
- B. Only preformed guy grips shall be used to attach guy strand.
- C. In order to prevent slack in guys made up with guy grips due to the loop in the grip changing shape as the load is increased, the guys should be "over-pulled" when they are installed. This will compensate for the collapsing of the loops. With a little practice, it will be possible to determine the amount of "over-pulling" needed to end up with the desired rake.
- D. Guy grips for 3/12 copperweld, 134-4534, have two red marks near the curved end. Guy grips for 5/16" guy strand, 134-4530, have two black marks near the curved end. Guy grips for 3/8" guy strand, 134-4532, have two orange marks near the curved end. These marks indicate two possible points for positioning the end of the guy strand. The mark that will give the smaller loop is the one that we will normally use. When installing the old larger strain insulator, the mark which will give the larger loop will be used for positioning the end of the guy strand.

VI. Guy Splices
- A. When guys need to be lengthened, 135-7955 shall be used for splicing 5/16" galvanized steel guys, and 135-7956 shall be used when splicing 3/8" galvanized steel guys. For transmission splices, see Std TR105.

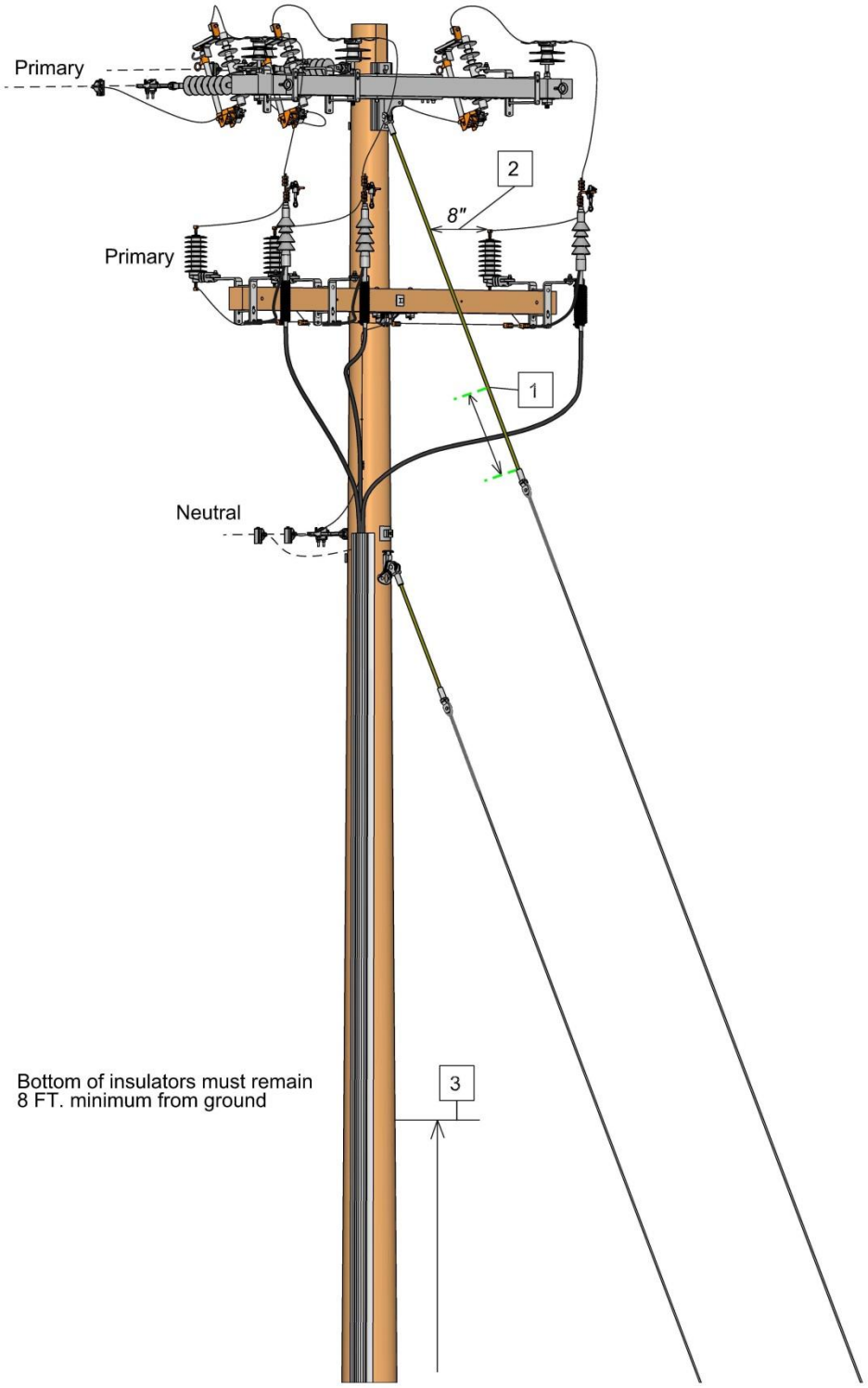
Guy insulators protect communications and public from primary and secondary voltages in the event the guy wire breaks or becomes slack. A minimum of 18 inches of insulation must extend below the lowest energized conductor, arrester, terminator, or cutout. The bottom of the insulator must remain 8 ft above ground in the broken guy wire position. There are two fiberglass guy strain insulators available (shown below.) The 78 inch (134-5242) and 24 inch (134-5236) insulators can be linked together in any combination needed. Use rollers (135-5010) with guy grips when insulators are connecting two segments of guy wire.



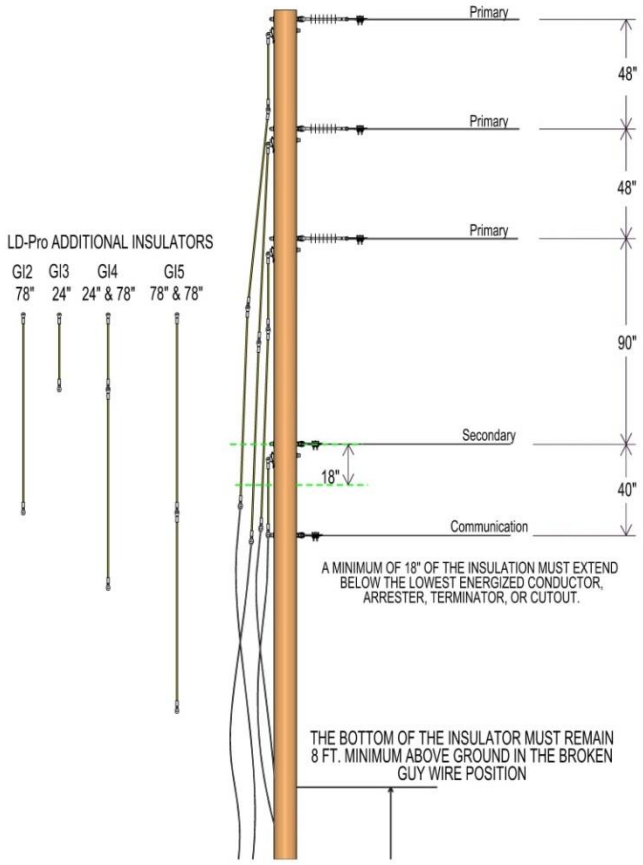


Guy strain insulator (134-5236) has 24 inches of insulation, and a total length of 33 inches.
Guy strain insulator (134-5242) has 78 inches of insulation, and a total length of 87 inches.

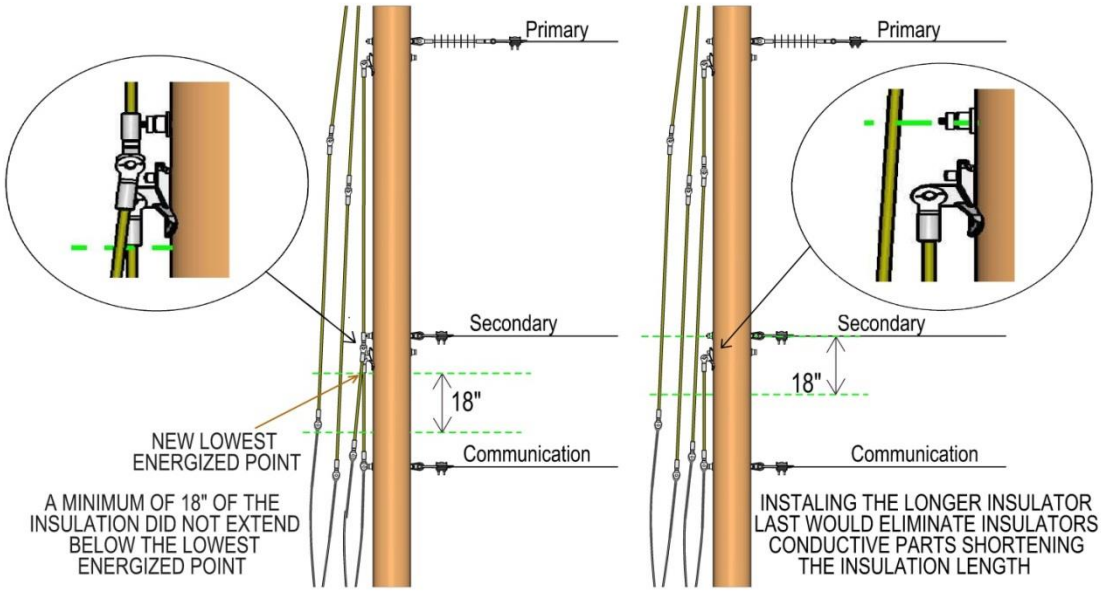
Total insulator length is very important to take into consideration when installing insulators in series arrangements.



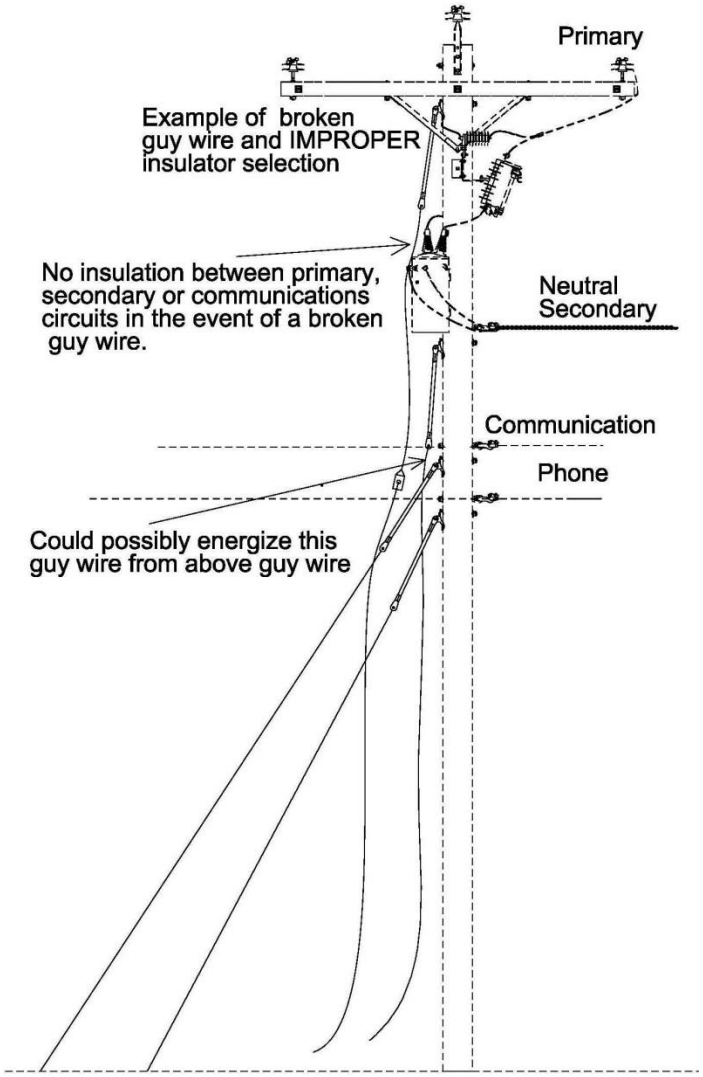
1. There must be a minimum of 18” of insulation past the lowest energized conductor or energized equipment in the event of a broken or slack guy wire. For arresters/insulators/bushings, this 18” starts at the bottom of the equipment.
2. 8 inches should be maintained between the guy strain insulator and an energized conductor/component that it passes by.
3. In case of a broken guy wire, the bottom of the insulator(s) must remain 8 ft. minimum above ground.

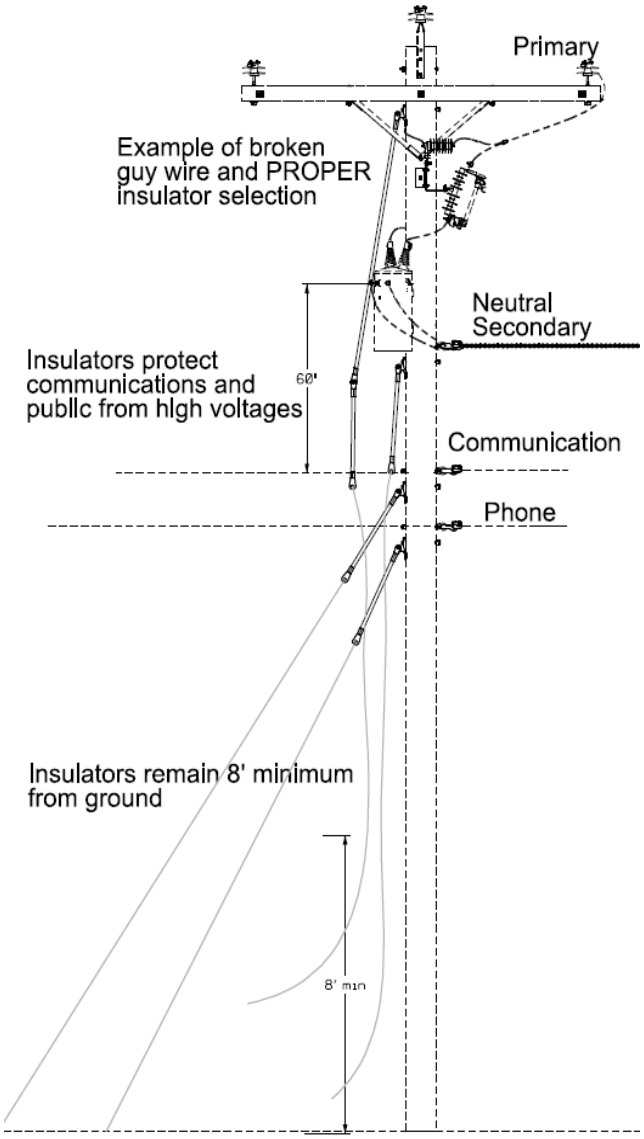


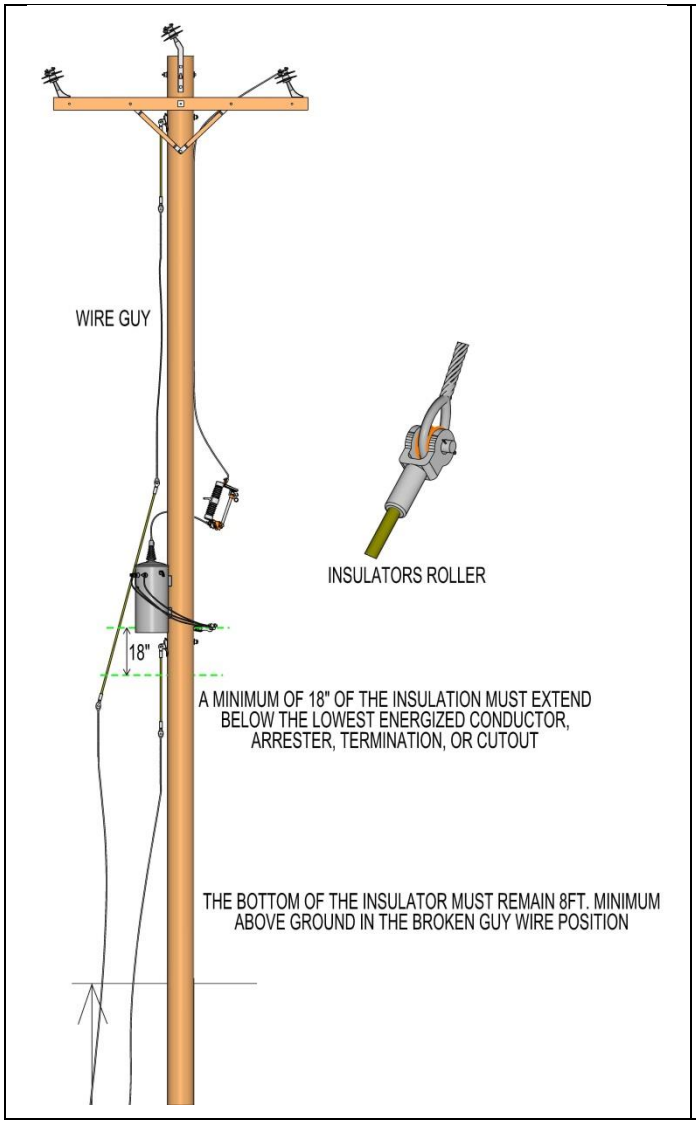
The above vertical three-phase deadend structure is a good example of properly selected and placed fiberglass guy strain insulators. In case of broken guy wires, insulation will pass energized conductors in excess of 18 inches.

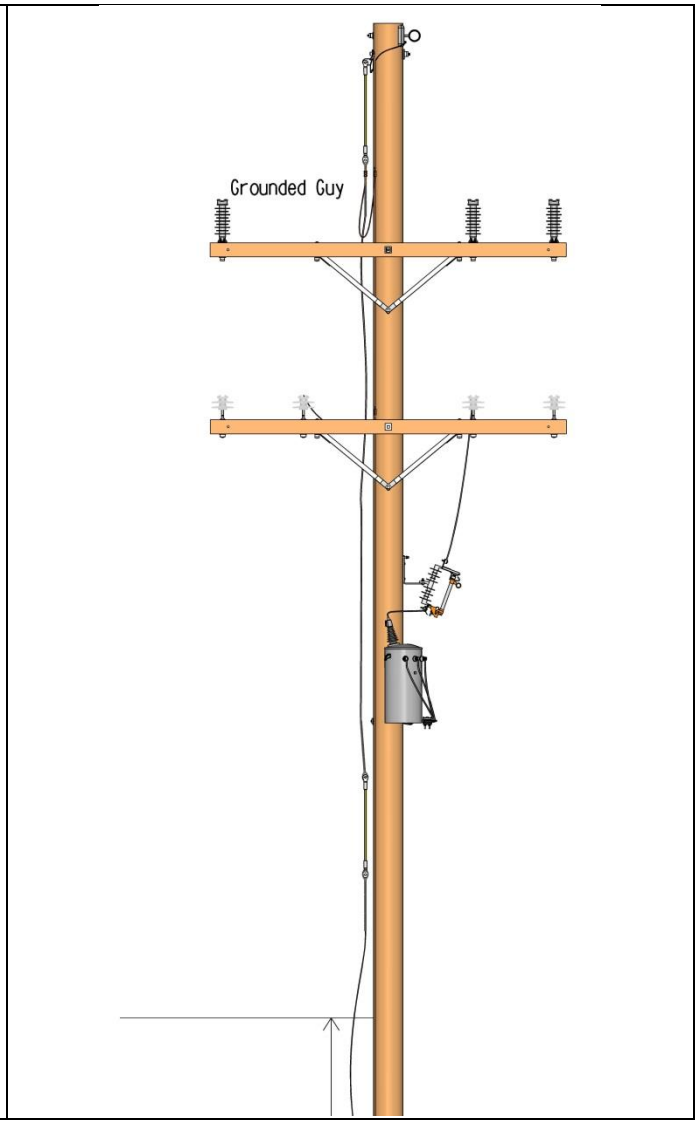


The above pictures demonstrate the importance of proper selection and placement of guy strain insulators. Both pictures use the same size and quantity of insulators for the lowest primary guy. The left picture does not meet the minimum 18” requirement as the metal end fittings of the insulators all touch each other and could become energized by the Secondary. By placing the shorter insulator at the top, the issue of end fittings contacting each other is eliminated and the 18” requirement is met

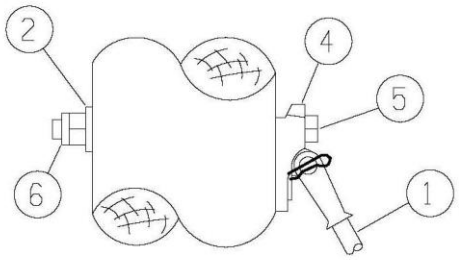

Primary
Example of broken guy wire and IMPROPER insulator selection
No insulation between primary, secondary or communications circuits in the event of a broken guy wire.
Neutral Secondary
Communication
Phone
Could possibly energize this guy wire from above guy wire


Primary
Example of broken guy wire and PROPER insulator selection
Neutral Secondary
Insulators protect communications and publlc from hlgh voltages
60'
Communication
Phone
Insulators remain 8' minimum from ground
8' min

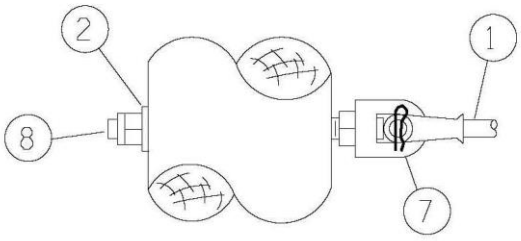




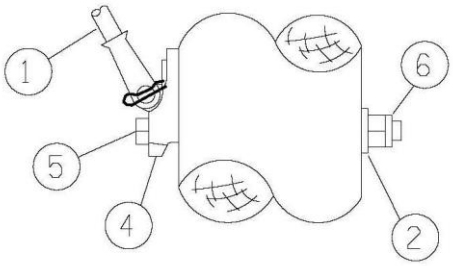
1. To save insulators, guy wire can be used between insulators for extremely tall distribution poles and for transmission grounded guys.
2. Bottom fiberglass guy strain insulators should be installed so that the point of possible contact between the guy and lowest energized point would have minimum 18” of the guy insulation past that point.
3. The guy roller must be used when attaching insulator between two guy wire segments.



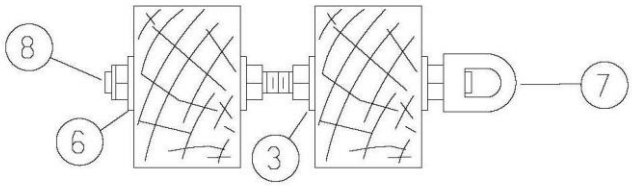
DOWN GUY



HORIZONTAL OVERHEAD GUY



UPWARD OVERHEAD GUY



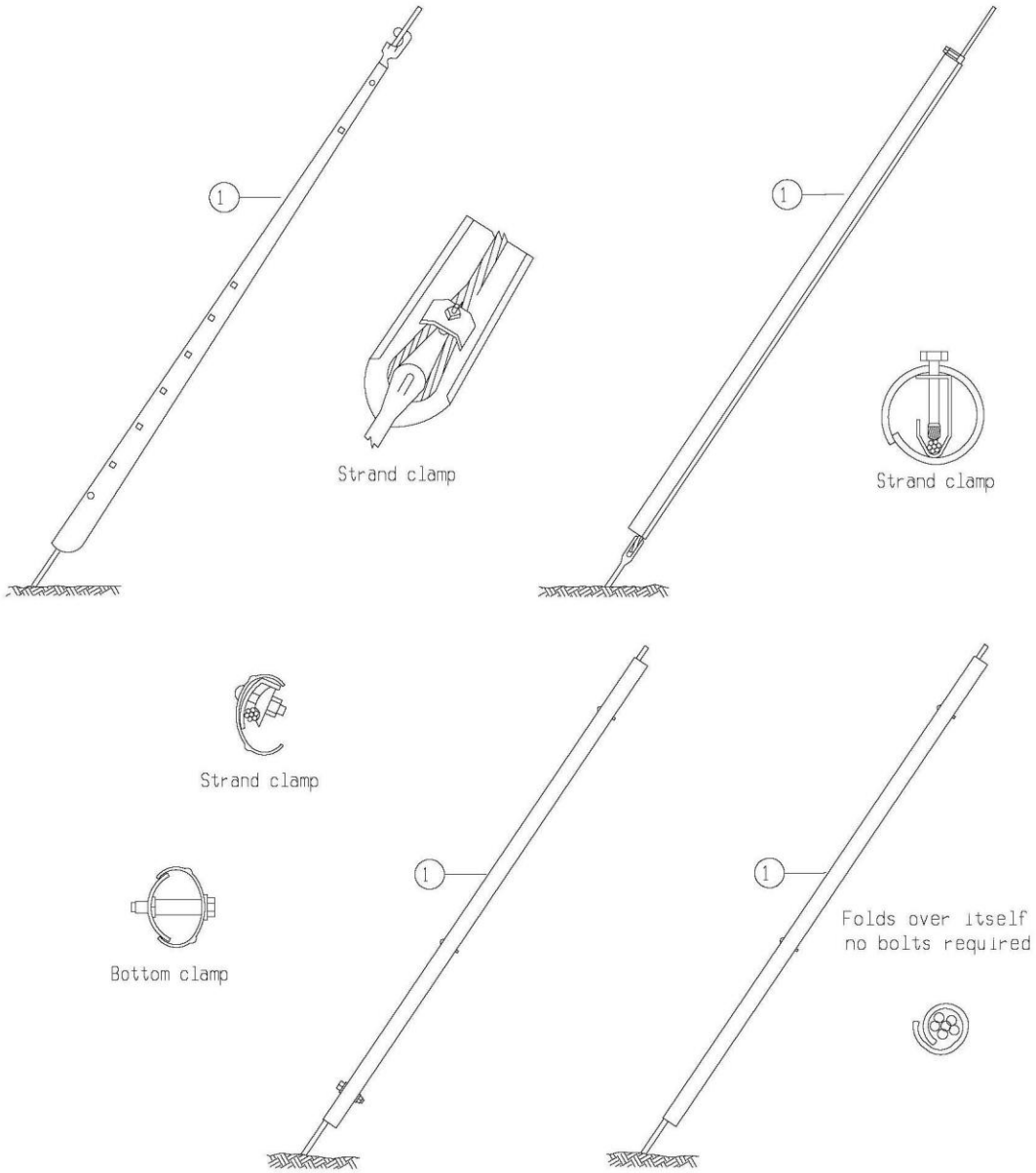
ARM GUY

□ Notes:

1. Contact the Materials & Standards group before making any attachments to transmission guy stubs or poles.
2. See Section TR Standards for distribution guy attachments on transmission poles where drilling is not permitted.
3. When two guys are to be attached to a stub, use twin eye nut (135-4445).

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
1	FIBERGLASS STRAIN INSULATOR	134-5236	1	5	5/8" X " MACHINE BOLT	135-03__	1
2	3"X3" CURVED WASHER	135-9500	1	6	5/8" LOCKNUT	135-4480	1
3	2-1/4" X 2-1/4" FLAT WASHER	135-9400	4	7	EYE NUT	135-4425	1
4	COMBINATION GUY ATTACHMENT	135-0060	1	8	5/8" X " D.A. BOLT	135-01__	1

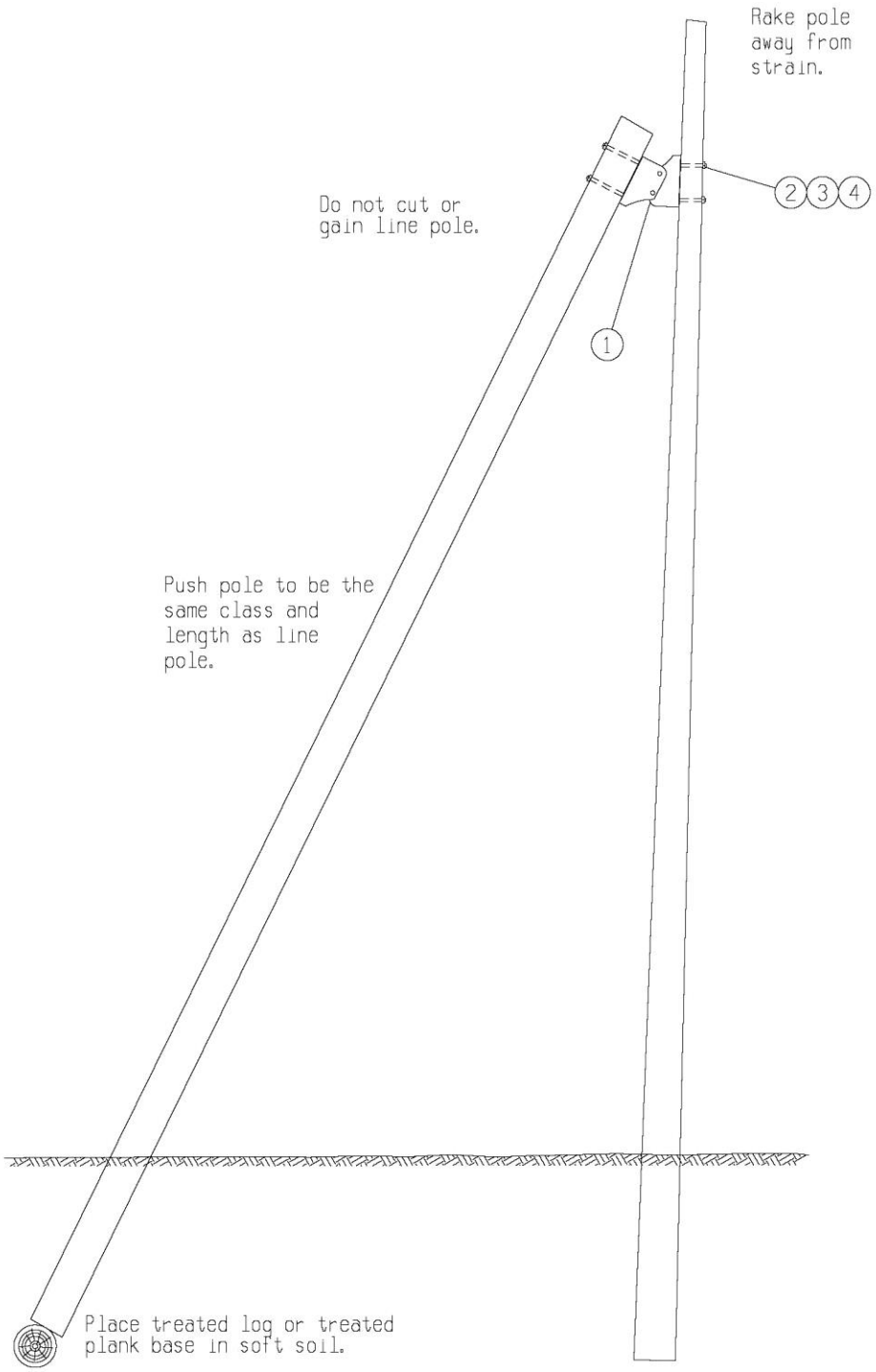
10/24/95	**G90**	**INSTALLATION OF GUY MARKERS**	Page 1 of 1



□ Notes:

1. Every rural and urban new single guy installation attached to an anchor shall have a marker attached. Where there are multiple guys attached to an anchor, only one guy marker shall be required. That marker shall be attached to the uppermost guy.
2. All existing wood spindle and other badly damaged guy markers shall be replaced when other work is performed on guyed pole.
3. Markers shall be added to unmarked guys when other work is done on pole or when high pedestrian, bicycle, snowmobile or vehicular traffic indicates it is necessary. Markers added to existing guys shall be charged to maintenance.
4. The various manufacturers' units purchased by our company differ in appearance and require different methods of installation.
5. When grey plastic or metal guy markers are removed, they shall be junked.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
1	GUY MARKER	134-6035	1				



□ Notes:

The use of push braces should be limited to small angles in the line or for deadend tensions not exceeding a total of 2800 pounds.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
1	POLE BRACE	134-1270	1	3	3/4" LOCKNUT	134-6255	4
2	3/4" X 8" MACHINE BOLT	143-0799	4	4	3/4" CURVED WASHER	143-9108	4

GENERAL INFORMATION

The following examples provide a procedure for calculating guying requirements for new or existing structures. For crossarm construction, the guying requirements for the primary conductor(s) should be calculated separately from the neutral conductor. The reason has to do with the relatively larger load applied in the primary position, compared to the neutral position and the pole's deflective properties. For vertical construction, the guying requirements for the primary and neutral conductors can be calculated together. Refer to the appropriate Section "C" Standards for attaching guys to a structure in the proper order on vertical construction.

DEAD-END STRUCTURE

Example Assumptions:
- Structure = Three-Phase Crossarm Dead End
- Conductors = 3-1/0 ACSR Primary, 1-1/0 ACSR Neutral, Long Span Tension
- Guy Attachment Height = 33'. Anchor Lead Length = 11'.
- Construction Safety Factor = Grade C
- Soil Type = Sandy Gravel

Primary Guying Calculation

1. Determine the conductor Total Tension, T, to be guyed by adding the Maximum Guying Tensions (see Section OSAG Standards) for the primary conductors.
   (Ex: T = 2,160 lbs x 3 = 6,480 lbs)

2. Determine the guying Lead Ratio by referring to Figure 1, page 3.
   (Ex: Lead Ratio = 33:11 = 3:1)

3. Determine the Guying Tension, TG, by finding the intersection of T with the Lead Ratio line on Table 4, page 4.
   (Ex: TG = 20,500 lbs)

4. Determine the type and number of guy wires required by using TG and the Number of Guys Chart on Table 4, page 4.
   (Ex: 2 EHS Guys Required at Grade C)

Neutral Guying Calculation

5. Determine the conductor Total Tension, T, to be guyed by finding the Maximum Guying Tension (see Section OSAG Standards) for the neutral conductor.
   (Ex: T = 2,160 lbs)

6. Repeat Steps 3 and 4 to determine the neutral guying requirements.
   (Ex: TG = 7,000 lbs, 1 EHS Guy Required at Grade C)

Anchoring Calculation

7. Determine the Soil Class by using Table 1, page 3.
   (Ex: Medium Soft)

8. Determine if a single anchor is sufficient to hold both the primary and neutral guys by summing the primary and neutral TG valued and using Table 5, page 5. If not, go to step 9.
   (Ex: 20,500 lbs + 7,000 lbs = 27,500 lbs, which exceeds any one anchor's holding power at Grade C in Medium Soft soil. Therefore, go to step 9.)

9. Determine the anchoring requirements for the primary and neutral guys separately by using the primary and neutral TG values and Table 5, page 5.
   (Ex: Primary TG = 20,500 lbs, 1-10" PS Single Helix Anchor Required at Grade C.
   Neutral TG = 7,000 lbs, 1-8" PS Single Helix Anchor Required at Grade C.)

ANGLE STRUCTURE

Example Assumptions:
- Structure = Three-Phase Crossarm Angle
- Conductors = 3-336 ACSR Primary, 1-1/0 ACSR Neutral, 300' Spans
- Pull Factor = 18
- Guy Attachment Height = 34' Primary, Anchor Lead Length = 17'
- Construction Safety Factor = Grade B
- Soil Type = Sandy Gravel

Primary Guying Calculation

1. Determine the conductor Total Tension, TM, by adding the Maximum Guying Tensions (see Section OSAG Standards) for the primary conductors.
   (Ex: T = 3,500 lbs x 3 = 10,500 lbs)

2. Determine the Line Angle on the structure by referring to Figure 2, page 3 and Line Work Method (LWM) 5020 if using a Pull Finder.
   (Ex: Line Angle = 18 x 1.2 = 21.6 degrees)

3. Determine the Angle Tension, TA, by multiplying TM by the Q-Factor. (See Table 3, page 3.)
   (Ex: Q-Factor = 0.39, TA = 10,500 lbs x 0.39 = 4,095 lbs)

4. Determine the Horizontal Tension, TH, by adding the Horizontal Transverse Wind Loads (see Std OHC15) for each primary conductor and multiplying by 2 (safety factor reasons).
   (Ex: TH = (168.4 x 3) x 2 = 1,010 lbs)

5. Determine the Total Tension, T, for guying by adding TA and TH.
   (Ex: T = TA + TH = 4,095 lbs + 1,010 lbs = 5,105 lbs)

6. Determine the guying Lead Ratio by referring to Figure 1, page 3.
   (Ex: Lead Ratio = 34:17 = 2:1)

7. Determine the Guying Tension, TG, by finding the intersection of T with the Lead Ratio line on Table 4, page 4.
   (Ex: TG = 11,500 lbs)

8. Determine the type and number of guy wires required by using TG and the Number of Guys Chart on Table 4, page 4.
   (Ex: 2 EHS Guys Required at Grade B)

Neutral Guying Calculation

9. Determine the conductor Total Tension, TM, by finding the Maximum Guying Tension (see Section OSAG Standards) for the neutral conductor.
   (Ex: T = 2,160 lbs)

10. Repeat Steps 3-8 to determine the neutral guying requirements.
    (Ex: TA = 2,160 lbs x 0.39 = 842 lbs
    TH = 139.8 lbs x 2 = 280 lbs
    T = 842 lbs + 280 lbs = 1,122 lbs
    TG = 2,500 lbs
    1 EHS Guy Required at Grade B)

Anchoring Calculation

11. Determine the Soil Class by using Table 1, page 3.
(Ex: Medium Soft)

12. Determine if a single anchor is sufficient to hold both the primary and neutral guys by summing the primary and neutral TG values and using Table 5, page 5. If not, go to step 13.
(Ex: 11,500 lbs + 2,500 lbs = 14,000 lbs, 1-10" PS Twin Helix Anchor Required at Grade B)

13. Determine the anchoring requirements for the primary and neutral guys separately by using the primary and neutral TG values and Table 5, page 5.
(Ex: N/A)

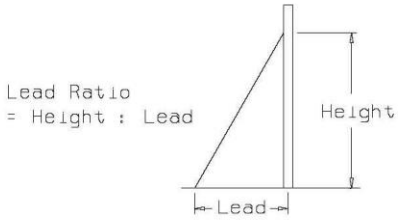


Figure 1

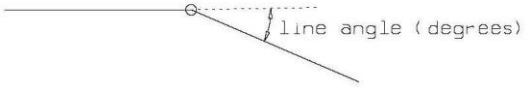


Figure 2

Table 1

Class	Common Soil Type Description
Hard	Sound hard rock, unweathered Very dense and/or cemented sands; coarse gravel and cobbles
Medium Hard	Dense find sand; very hard silts and clays (may be preloaded). Dense clays, sands and gravel; hard silts and clays
Medium Soft	Medium dense sandy gravel; very stiff to hard silts and clays Medium dense coarse sand and sandy gravels; stiff to very stiff silts and clays
Soft	Loose to medium dense fine to coarse sand; firm to stiff clays and silts Loose fine sand; Alluvium; loess; soft-firm clays; varied clays; fill

Table 2

Guy Strand	Grade of Construction	Allowable Tension per Guy Wire - Lbs
3/8" HS	B	5891
3/8" HS	C	8836
3/8" EHS	B	8182
3/8" EHS	C	12273

Table 3

Line Angle (degrees)	Q Factor	Line Angle (degrees)	Q Factor
0	0.0	30.0	0.518
2.5	0.044	32.5	0.560
5.0	0.087	35.0	0.601
7.5	0.131	37.5	0.643
10.0	0.174	40.0	0.684
12.5	0.218	42.5	0.725
15.0	0.261	45.0	0.765
17.5	0.304	47.5	0.805
20.0	0.347	50.0	0.845
22.5	0.390	52.5	0.885
25.0	0.433	55.0	0.923
27.5	0.475	*	

* For angles greater than 55 degrees, treat as deadend.

Table 4

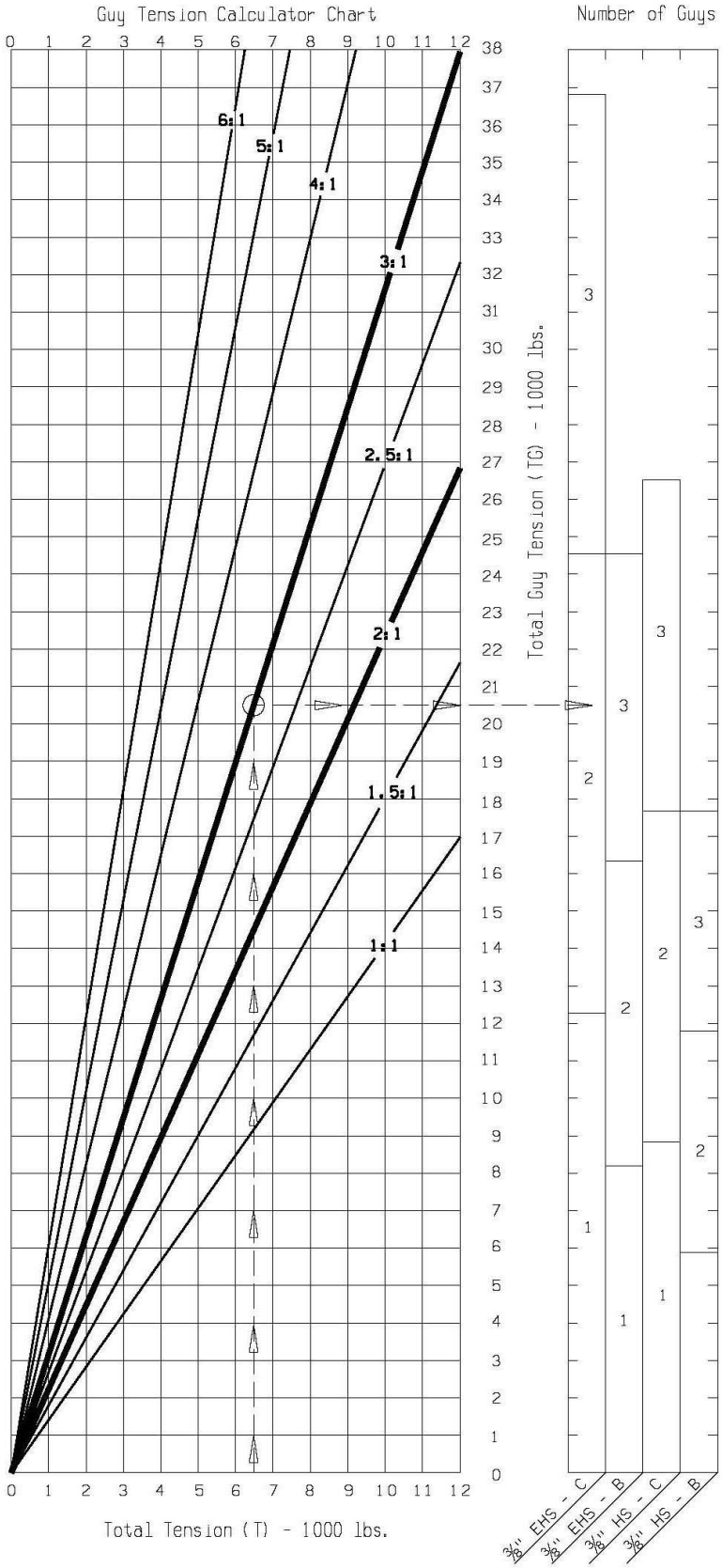

Guy Tension Calculator Chart
Number of Guys
6:1
5:1
4:1
3:1
2.5:1
2:1
1.5:1
1:1
Total Guy Tension (TG) - 1000 lbs.
Total Tension (T) - 1000 lbs.
3/8" EHS - C
3/8" EHS - B
3/8" HS - C
3/8" HS - B

Table 5

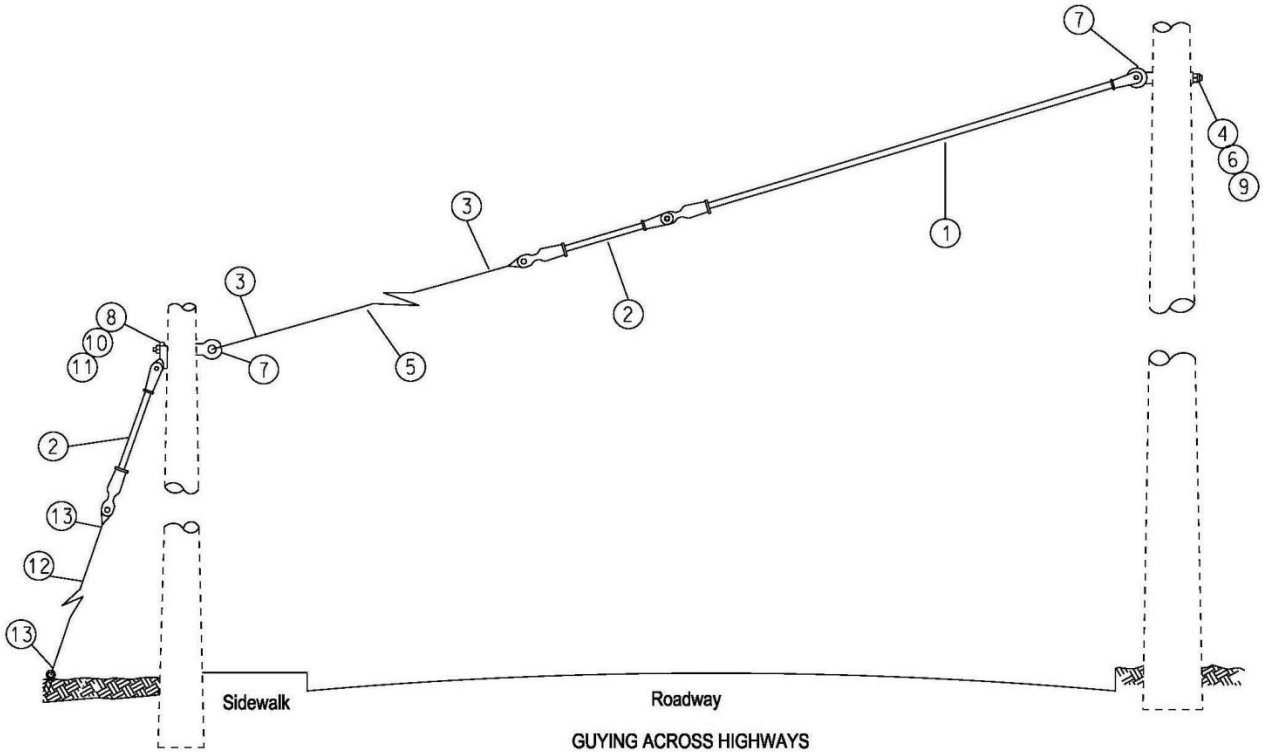
Allowable holding power per anchor. (lbs.)				Hard Soil			Medium Hard Soil			Medium Soft Soil			Soft Soil		
Type	Description	Code	Rod [2]	Grade B (lbs)	Grade C (lbs)	Install Torque ft. lbs [1]	Grade B (lbs)	Grade C (lbs)	Install Torque ft. lbs [1]	Grade B (lbs)	Grade C (lbs)	Install Torque ft. lbs [1]	Grade B (lbs)	Grade C (lbs)	Install Torque ft. lbs [1]
G20	8” Power Single Helix	134-0053	3/4”				12545	18818	4500	8864	13295	2300	4636	6955	825
G21	12” Power Single Helix	134-0055	3/4”				12545	18818	3500	11182	16773	2700	6545	9818	950
G22	10” Heavy Duty [3]	134-0058	1”				13500	20250	5000						
G23	10” Power Twin Helix	134-0056	1”							14318	21477	3600	9545	14318	1400
G25	8”-10” SS Twin Helix	143-0064	1-1/2”				21273	31909	3000	15955	23932	2000	11636	17454	1000
G30	8” Expansion	134-0045	3/4”							10909	16364		6818	10227	
G30	10” Expansion	134-0048	3/4”							12545	18818		7773	11659	
G40	53” Rock Expanding	134-0065	3/4”	12545	18818										
G40	72” Rock Expanding	134-0066	3/4”	12545	18818										
G41	4” PS Twin Helix	134-0054	3/4”	12545	18818	4500									

□ Notes:

1. The installation torque must be maintained over the last three feet of installation to obtain the listed holding power.

2. When using an extension, the extension and the rod diameters should match.

3. This anchor is a high-strength power installed screw anchor and should only be used in rocky soil conditions or high installation torque areas. A Dixie drive-end assembly tool, catalog number 030187, is needed to install this anchor. Contact the Operations Training – Training Coordinators for tooling. This anchor has a 1-1/2” hub tapped for 1” rod (134-6510 and 134-6512).

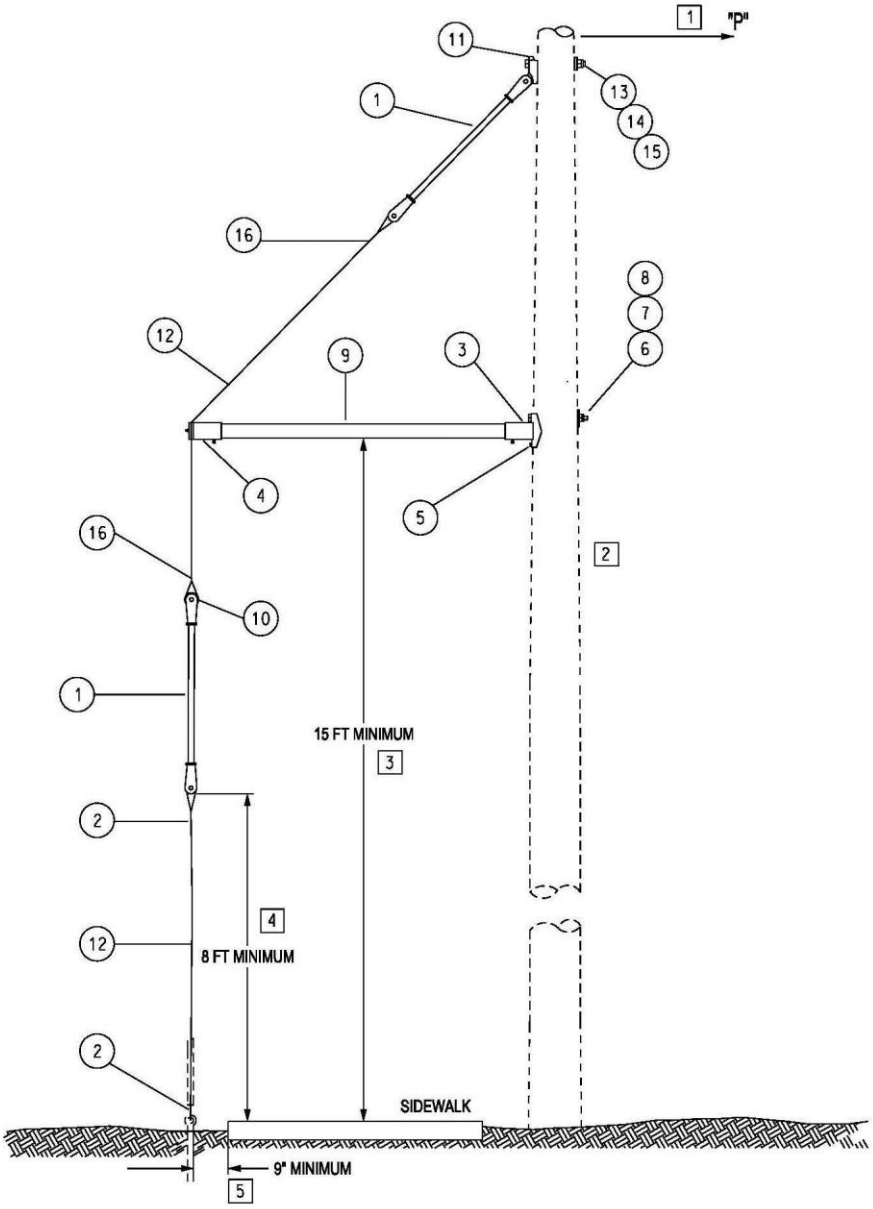


GUYING ACROSS HIGHWAYS

□ Notes:

1. Additional insulators may be required when transformers, cable risers, cutouts, or arresters are added below existing conductor.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: GI6-HEAD GUY		1		**ASSEMBLY: PRIMARY DOWN GUY**		1
1	INSULATOR,GUY STRAIN, FIBERGLASS, 78" LG	134-5242	1	8	ATTACHMENT, COMBINATION GUY	135-0060	1
2	INSULATOR,GUY STRAIN, FIBERGLASS, 24" LG	134-5236	2	9	WASHER, CURVED, 4" X 4"	143-9108	1
3	GRIP, CABLE, PRE-FORMED	134-4532	2	10	BOLT, MACHINE, 3/4"	MCH423X	1
4	BOLT, MACHINE, 3/4"	MCH423X	1	11	NUT, LOCK 3/4" DIA	143-6255	1
5	WIRE,GUY,3/8" DIA,7 STR,EHS,STEEL,15400LB	133-2635	22 FT	12	WIRE, GUY, EHS, 3/8"	133-2635	44 FT
6	NUT, LOCK, 3/4" DIA	143-6255	1	13	GRIP, CABLE, PRE-FORMED	134-4532	2
7	EYELET, 3/4"	135-3551	2				



□ Notes:

1. Contact Regional Engineer for allowed “P” force.
2. Install on Class 5 or better poles.
3. Install sidewalk guy arm minimum 15 feet above ground.
4. Bottom of insulator must remain 8 feet minimum from ground.
5. Install anchor minimum 9” from the sidewalk.

ITEM	MATERIAL		NO.REQ.	ITEM	MATERIAL		NO.REQ.
	ASSEMBLY: GI7 – SIDEWALK GUY		1	9	ARM, SIDEWALK GUY, 10 FT	134-0345	1
1	INSULATOR, STRAIN, FIBERGLASS, 24” LG	134-5236	2	10	INSULATOR, ROLLER	135-5010	1
2	GRIP, CABLE, PRE-FORMED	134-4532	2		**ASSEMBLY: PRIMARY DOWN GUY**		**1**
3	FITTING, SIDEWALK GUY, POLE-END, 2’	134-4045	1	11	ATTACHMENT, COMBINATION GUY	135-0060	1
4	FITTING, GUY WIRE CLAMP END, 2”	134-4046	1	12	WIRE, GUY, EHS, 3/8”	133-2635	44 FT
5	SCREW, LAG, 1/2” DIA, 4” LG	135-5300	2	13	BOLT, MACHINE, 3/4”	MCH423X	1
6	BOLT, MACHINE, 5/8” X VARIABLE LENGTH, GALVANIZED	MCH421X	1	14	NUT, LOCK 3/4” DIA	143-6255	1
7	WASHER, CURVED, 3/4” NOM, GALVANIZED, 3X3 SQUARE	135-9500	1	15	WASHER, CURVED, 4”X4”	143-9108	1
8	NUT, LOCK, 5/8” DIA, GALVANIZED	135-4480	1	16	GRIP, CABLE, PRE-FORMED	134-4532	2