FIBER OPTIC COMMUNICATION 18

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1) GENERAL

Composite Optical Groundwire (OPGW) was developed to provide a large capacity telecommunications system utilizing overhead power transmission lines. Serving the additional purpose of an overhead ground wire, the OPGW is constructed of aluminum clad steel strands and aluminum alloy strands stranded with stainless steel tubes or surrounding a fiber unit (core) which contains optical fibers.

This specification covers installation of following single-mode fiber optic cable on Ameren structures:

- 48-ct OPGW:
  - 10,500-ft reel: Stk No: 27-59-086
  - 21,000-ft reel: Stk No: 27-59-080
- 72-ct OPGW:
  - 10,500-ft reel: Stk No: 27-59-087
  - 21,000-ft reel: Stk No: 27-59-088
- 48-ct OH ADSS: Stk No: 18-16-285
- 72-ct OH ADSS: Stk No: 27-59-084
- 72-ct UG Fiber Optic Cable: Stk No: 18-66-671

2) PRECAUTIONS

a) Care must be taken to avoid damaging the OPGW during handling and stringing operations. Avoid sharp bends to the cable and take precautions to prevent crushing the OPGW during placement. The transmission quality of the optical fibers can potentially be degraded if the OPGW is subjected to excessive pulling tensions or excessively small bend diameters.

b) Following values shall be considered to help prevent damage to the OPGW

i) Maximum Stringing Tensions listed in DCS **07-00-07-06**

ii) Minimum Bend Radius as follows:

During Installation (Dynamic): 20 x Diameter
After Installation (Static): 15 x Diameter

iii) Pulling Speed:

60 meters per minute, or
195 feet per minute, or
3.6 km per hour, or
2.2 miles per hour.

iv) Minimum distance from puller and tensioner to the stringing block:

3:1 Ratio

3) INSTALLATION

a) The contractor shall provide mechanical protection to the cable where it runs along the surface or edge of a structure or pulling devices.

b) At the locations where a splice is required, additional cable length must be provided to physically accommodate the splicing process.

i) The length of each cable end shall be not less than 115 feet from the base of the structure (ground level), or as otherwise noted on the Drawings, remembering that about 20 feet of cable shall be cut off to assure no damaged fiber is used.

ii) If additional length is required, due to limited access for splicing vehicles, it shall be included, as required, and with the approval of the Ameren Construction Services or Ameren Engineering.

c) The fiber shall be neatly coiled and securely attached to the structure on bracketing of the splice enclosure, as specified on the Drawings referenced in the Appendices. The diameter of the coil shall be a minimum of three feet or as required based on the minimum allowed bending radii.

d) The Contractor shall handle all fiber optic cable in strict accordance with the cable manufacturer's specifications and procedures.

e) If any Owner-provided materials appear to be damaged or defective, the Contractor shall immediately report the details to the Construction Manager, who shall provide written directions regarding the corrective actions, storage, or disposal of these materials.

f) If the cable must be temporarily stored overnight while in the process of splicing, the cable ends shall be sealed to prevent water migration and the cable coils stored out of the reach of vandals. It is unacceptable to temporarily store cable at the base of the pole, unless the structure is in a safe and secured location.

g) All cables splice boxes, and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

h) Fiber shall be segregated by tray, conduit, innerduct, or other innerduct methods for protection.

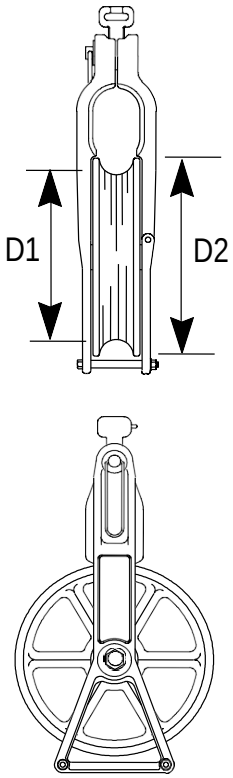
i) Where ADSS fiber is placed underground, it shall have its own conduit and be designated as such, or be segregated by using innerduct within the conduit or trench system.

ii) Innerduct will also be used in the main cable tray application within the control house.

iii) Within the confines of an enclosure, fiber jumpers should be segregated by a separate tray system, to ensure bend radii and cable weight concerns are mitigated.

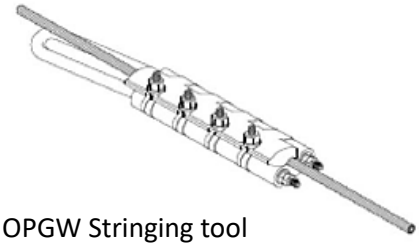
i) Contractor shall mark conduits leaving Ameren Property with approved marking methods that should be prescribed in project documentation.

j) Use properly sized and line Stringing Blocks (do NOT use Array-type Stringing Blocks):

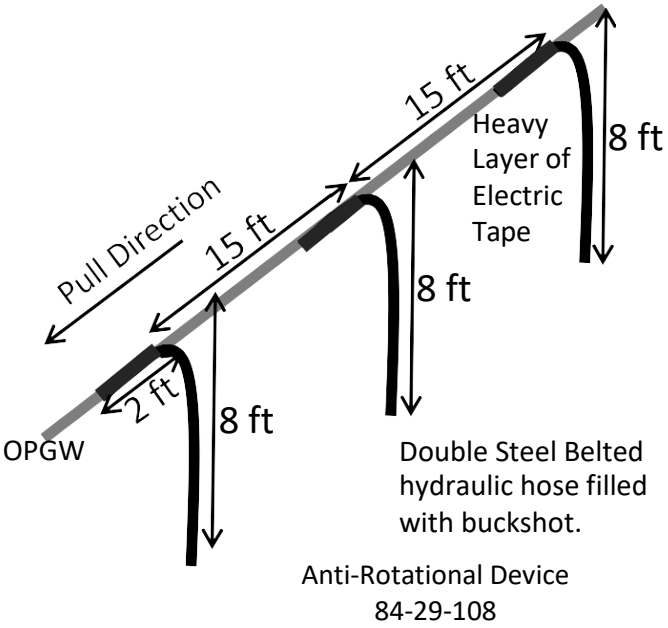


Structure Angle (θ)	Bottom Groove Diameter (D1)	Typical Stringing Block (minimum) (D2)
First and Last Structures	21”	28”
Tangent Structures $\theta < 20$	16”	20”
Tangent Structures $20 < \theta < 45$	21”	28”
Tangent Structures $45 < \theta < 60$	26”	35”
Tangent Structures $60 < \theta < 90$	31"	
Bull Wheel Diameter for 90°	36”	

k) Use Anti-Rotational Device (Stk No: 84-29-108) and OPGW stringing tool (Stk No: 85-21-130):

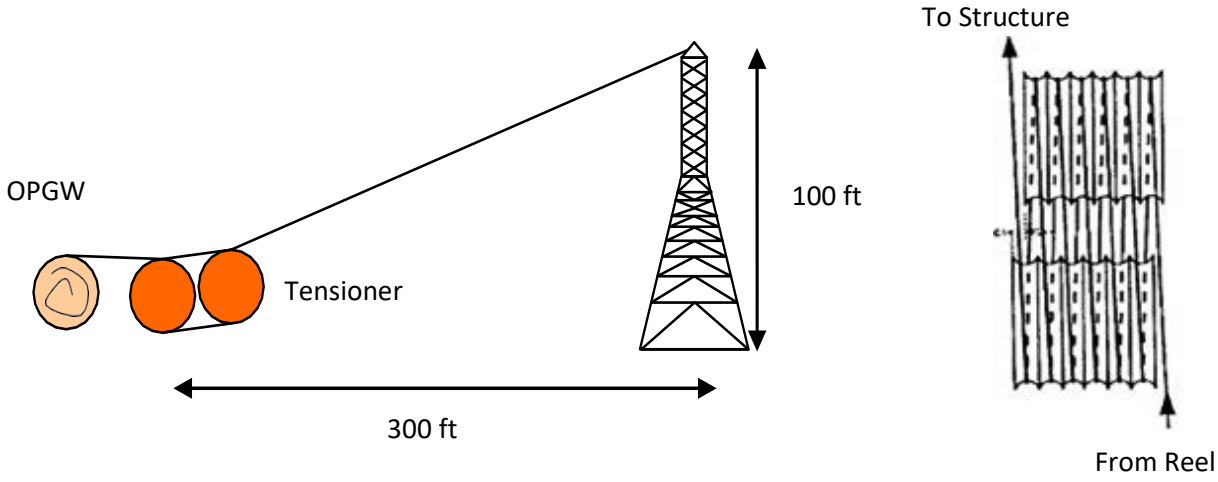


OPGW Stringing tool
85-21-130



Anti-Rotational Device
84-29-108

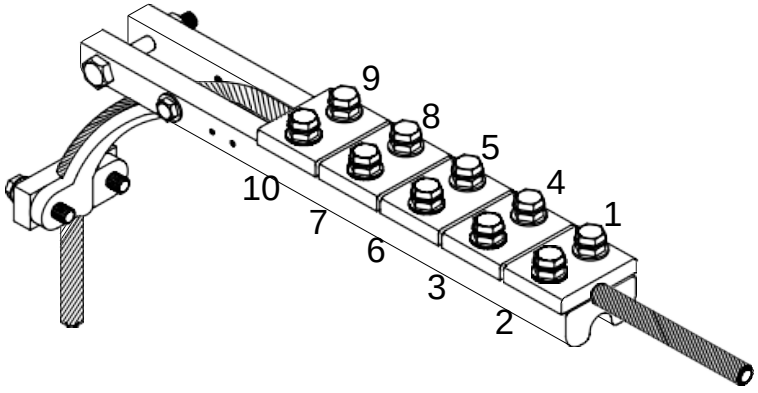
l) Tensioner shall be positioned 3x structure height from first structure and reeved Right-To-Left.



m) Prior to pulling, tighten bolts and loosen inner tail of OPGW Reel.

n) Pulling speed shall not exceed 200 ft/minute. Pulling tension shall not exceed 3,967 lbs (20% RBS). Do not exceed 48 hours in blocks prior to clipping in.

o) Deadend bolts shall be torqued to 40 ft-lbs and tightened in sequence at 5 ft-lbs increments.



1) GENERAL

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  - 21,000-ft reel: Stk No: 27-59-088
- 48-ct OH ADSS: Stk No: 18-16-285
- 72-ct OH ADSS: Stk No: 27-59-084
- 72-ct UG Fiber Optic Cable: Stk No: 18-66-671

2) SPLICING

a) Splicing shall be performed as per provided documentation and reference drawings.

b) Standard optical cable color codes and fiber types shall be observed when fusion splicing two fiber optic cables together unless otherwise directed by the Ameren Representative. For instance, when butt splicing OPGW fibers to All Dielectric Self Supporting (ADSS) fiber optic cable, G.652 standard single mode fibers shall be spliced to G.652 standard single mode fibers, and G.655 fibers shall be spliced to G.655 fibers in order based on the TIA/EIA-598 color code scheme. G.655 fibers shall be spliced as the last group in the fiber cable count.

c) OPGW and ADSS shall be prepared for splicing as per manufacturer's installation procedures. The installation procedures shall be read and fully understood prior to field installation. The manufacturer's recommended maximum bend radii and tensions shall be observed at all times so not to exceed these values.

d) All fiber optic splicing shall be fusion type. Splicing shall be performed in an environmentally protected enclosure to ensure high quality splice performance. Splicing shall be accomplished on the ground and not in an aerial bucket. The excess cable at splice points shall be properly secured and mounted in/on the appropriate location. Fusion Splicing shall use Single Mode Fiber Active Core Alignment and LID (Light Injection and Detection) splicing methods per Telcordia GR-765-CORE.

e) Splice equipment must meet or exceed minimum performance standards as described within Rural Development Utilities Program (RDUP, formerly RUS – Rural Utilities Service) Bulletin 1753F-401 RUS Standard for Splicing Copper and Fiber Optic Cables.

f) All spliced fibers shall be protected by a fiber optic heat shrink sleeve. Tyco/Raychem SMOUV heat shrink

or equivalent are acceptable products. A heat oven shall be the only method used to shrink the sleeves. The acrylic coating on the fiber shall not be removed beyond the areas that will be covered by the heat shrink sleeves.

g) Visual inspection of each splice shall be performed by Ameren personnel or Ameren approved Contractor. The visual inspection requires that the splicing technician inspect the splice for abnormalities such as a narrowing, thickening, or bubble at the splice point. If abnormalities exist, the splice shall be broken and re-spliced. After passing visual inspection and profile alignment qualifications, the splice shall be subject to a tension test to ensure the fiber splice and adjacent fiber are of proper quality.

h) Final acceptance of a splice will be determined by the Ameren or Ameren Representative, as per 'ACCEPTANCE' paragraph below, upon successful completion of the bi-directional OTDR testing phase.

i) Prior to any work being performed on Ameren structures, approval from Ameren Supervision shall be obtained.

3) TESTING

a) All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.

b) Fiber end-faces shall be inspected at 250x or 400x magnification. Magnification of 250x is suitable for inspecting multimode and single-mode fibers. Magnification of 400X magnification should be used for detailed examination of single-mode fibers.

c) Scratched, pitted or dirty connectors shall be diagnosed and corrected. If the problem cannot be completed by cleaning, it should be reported to Ameren or Ameren Representative.

d) It is recommended that the end-face images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.

e) Testing shall be performed on each cabling segment (connector to connector). An "end-to-end" test is required. For example, splice box A to splice box B, cable run structure 100 to 110, substation X to substation Y, etc. or per scope required by Project Engineer.

f) Single mode fiber tests at wavelengths of 1310 nm, 1383 nm, 1550 nm, and 1625 nm at a distance range up to 80km shall be completed using OLTS – Optical Loss Test Set per standards ANSI/TIA/EIA-526-7 Method A.1; and

g) Single mode fiber tests at wavelengths of 1310 nm, 1383 nm, 1550 nm, and 1625 nm at a distance range up to 80km shall be completed using OTDR – Optical Time Domain Reflectometer Test per standards IEC 60793-1-40 or IEC 61300-3-7 with broadband light sources and spectrum analyzer on the receiving end of the fiber.

h) Optical length shall be measured using an OLTS and OTDR. OLTS fiber calculated length measurements will be used as a reference for all the budget loss calculations.

i) Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with ANSI/TIA/EIA-568-C.1. The polarity of the paired duplex fibers shall be verified using an OLTS.

j) Each fiber segment of the fiber shall be tested at the wavelengths listed above, unless otherwise noted by Ameren Personnel.

k) A final end-to-end test shall be done (substation patch box to substation patch box) with a loss budget less than 5% over the calculated total loss under ideal conditions per manufacturer's published values for the frequencies listed above, after each section of splicing is completed.

i) Patch box, splice enclosure, patch panel, all refer to the same box that is installed into the fiber distribution panel.

4) ACCEPTANCE

a) Changes to the acceptance criteria can only be obtained with approval from Ameren Personnel or those he/she designates.

b) Cabled fiber loss shall be a maximum of:

0.35 dB/km at 1310 nm
0.35 dB/km at 1383 nm
0.20 dB/km at 1550 nm
0.23 dB/km at 1625 nm

c) Maximum fusion splice loss for any single splice shall be less than 0.10 dB.

d) A factory terminated connector (type LC) shall not exceed loss of 0.75 dB end to end.

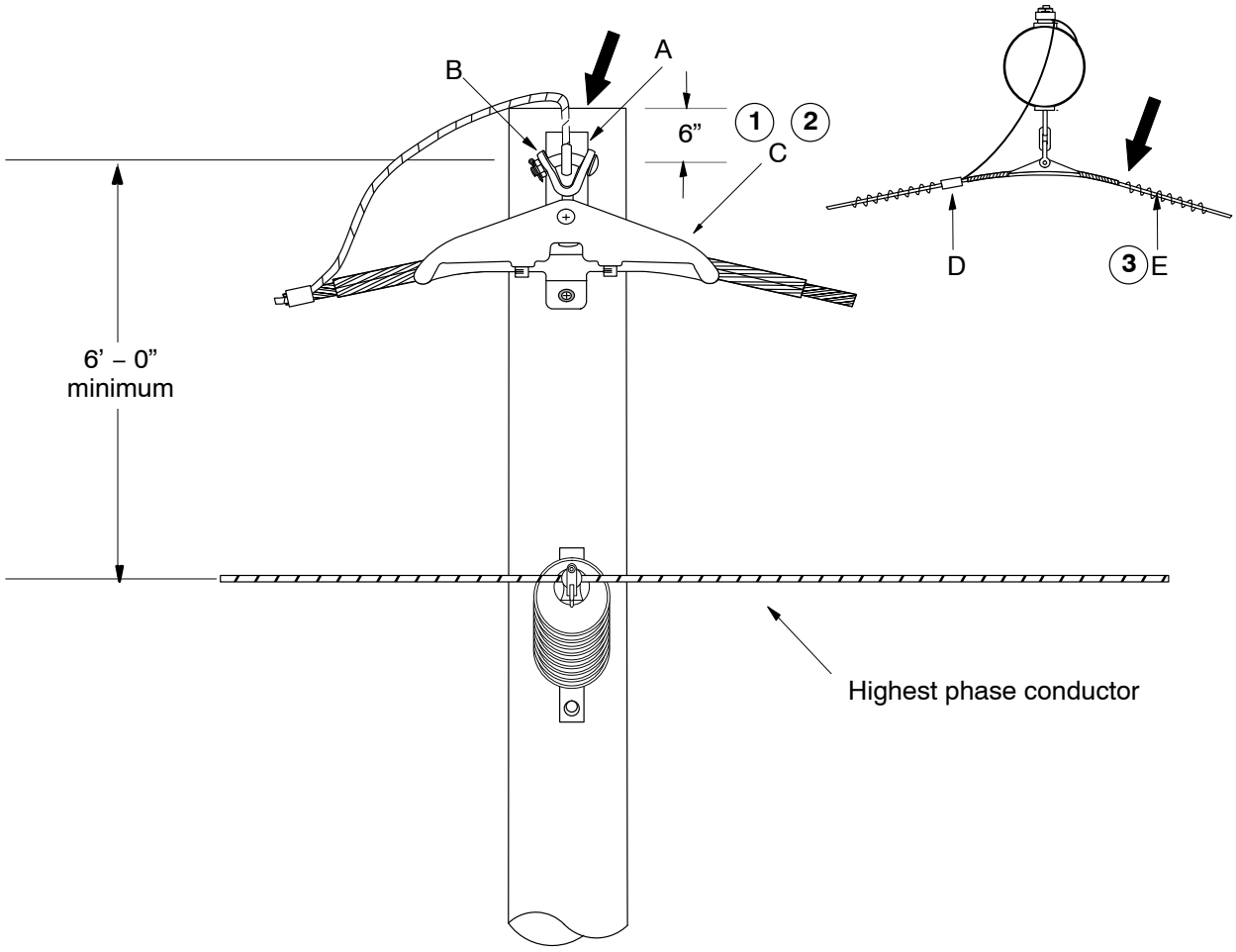
5) LABELING

a) Labeling shall conform to the requirements specified within ANSI/TIA/EIA-606-A or to the requirements specified by an Ameren Representative;

b) Shall meet the legibility, defacement, exposure and adhesion requirements of Marking and Labeling Systems - UL 969. Handwritten labels are not acceptable.

c) Labeling shall be done per Ameren guidance and standardization from the Ameren Fiber mapping system and conform to proper formats.

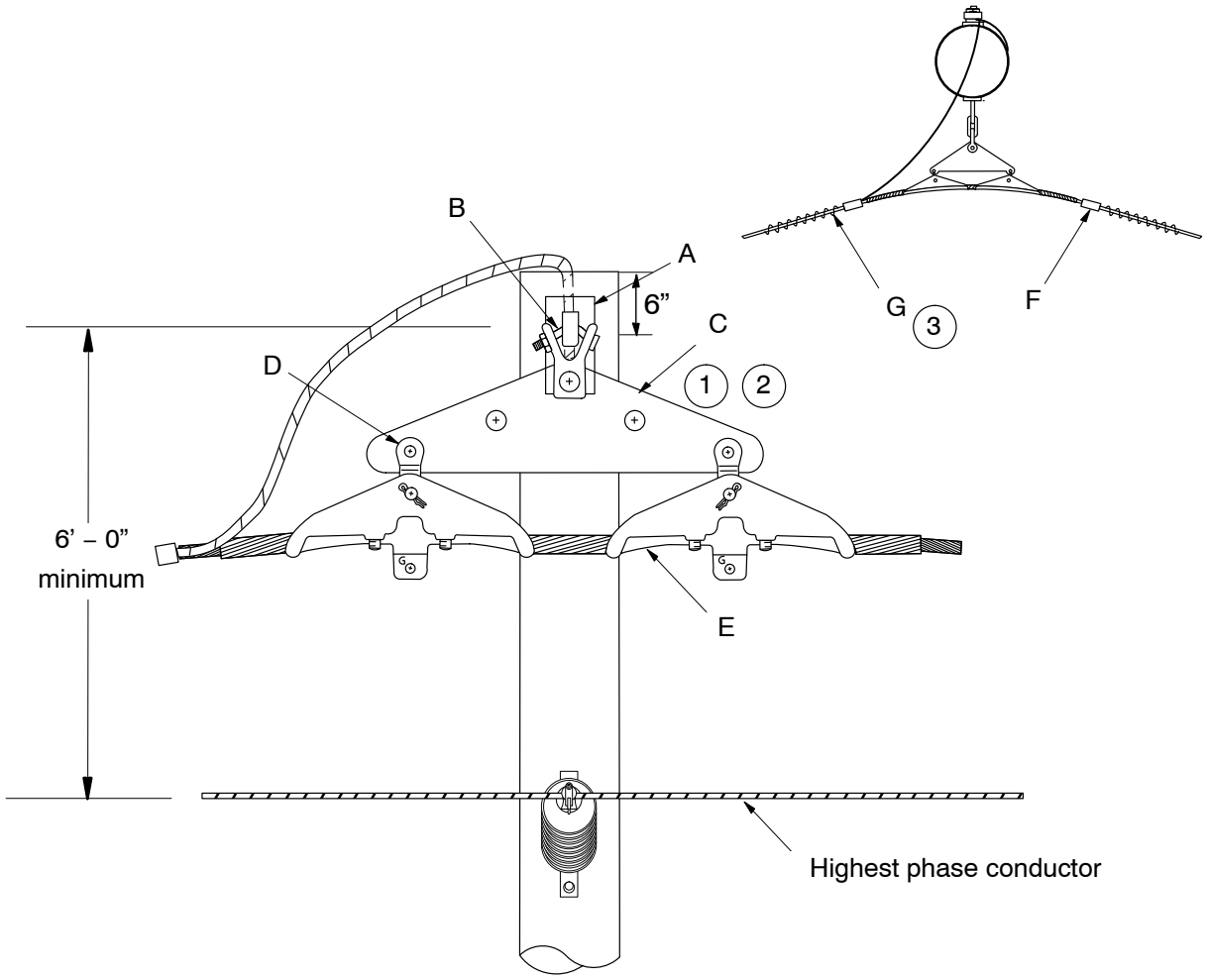
d) As-builts shall have properly labeled end points of both OPGW and ADSS.



NOTES:

1. Mark center of clamp location on OPGW cable with ink (not tape) when aligning armor rods and clamp body on OPGW cable.
2. Be sure to finger tighten bolts on clamp to ensure bolts are not compressed onto the OPGW cable, and alternate tightening. Tighten until break away bolt heads shear off.
3. Spiral Vibration Dampers are used on 350’ and above spans only.
4. For larger wood or composite poles 16” static support (23–68–459), 18” static support (23–68–460), or 20” static support (23–68–614) will be required.

		Std. / Stk. No	Description 18 05 10	01
	A	23 68 458	Static Support Bracket ¾” x 14”	1
	B	23 58 127	Clevis Eye	1
	C	23 67 502	OPGW Suspension Clamp w/Armor Rods	1
	D	17 52 217	Clamp for bonding OPGW Static to Pole Ground	1
3@	E	23 67 319	Spiral Vibration Damper	2
@	F	**12 00 10 ****	Grounding Unit	1



NOTES:

1. Mark Center of clamp location on OPGW with ink (not tape) when aligning armor rods and clamp body on OPGW cable.
2. Be sure to finger tighten bolts on clamp to ensure bolts are not compressed onto the OPGW cable, and alternate tightening. Tighten until break away bolt heads shear off.
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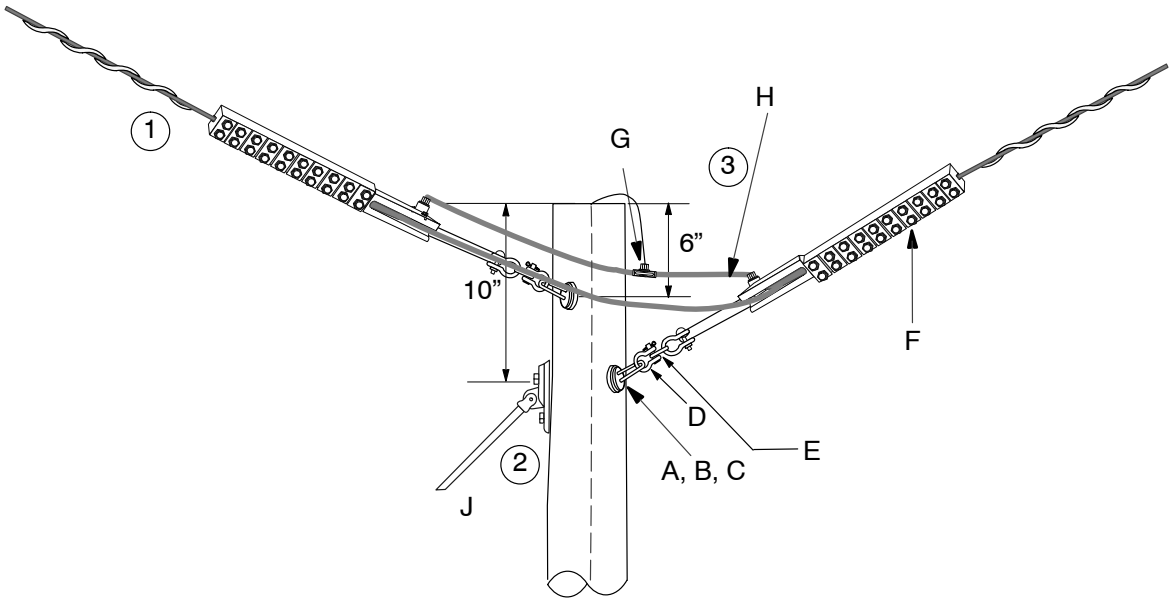
4. For larger wood poles or composite poles 16” static support (23–68–459), 18” static support (23–68–460), or 20” static support (23–68–614) will be required.

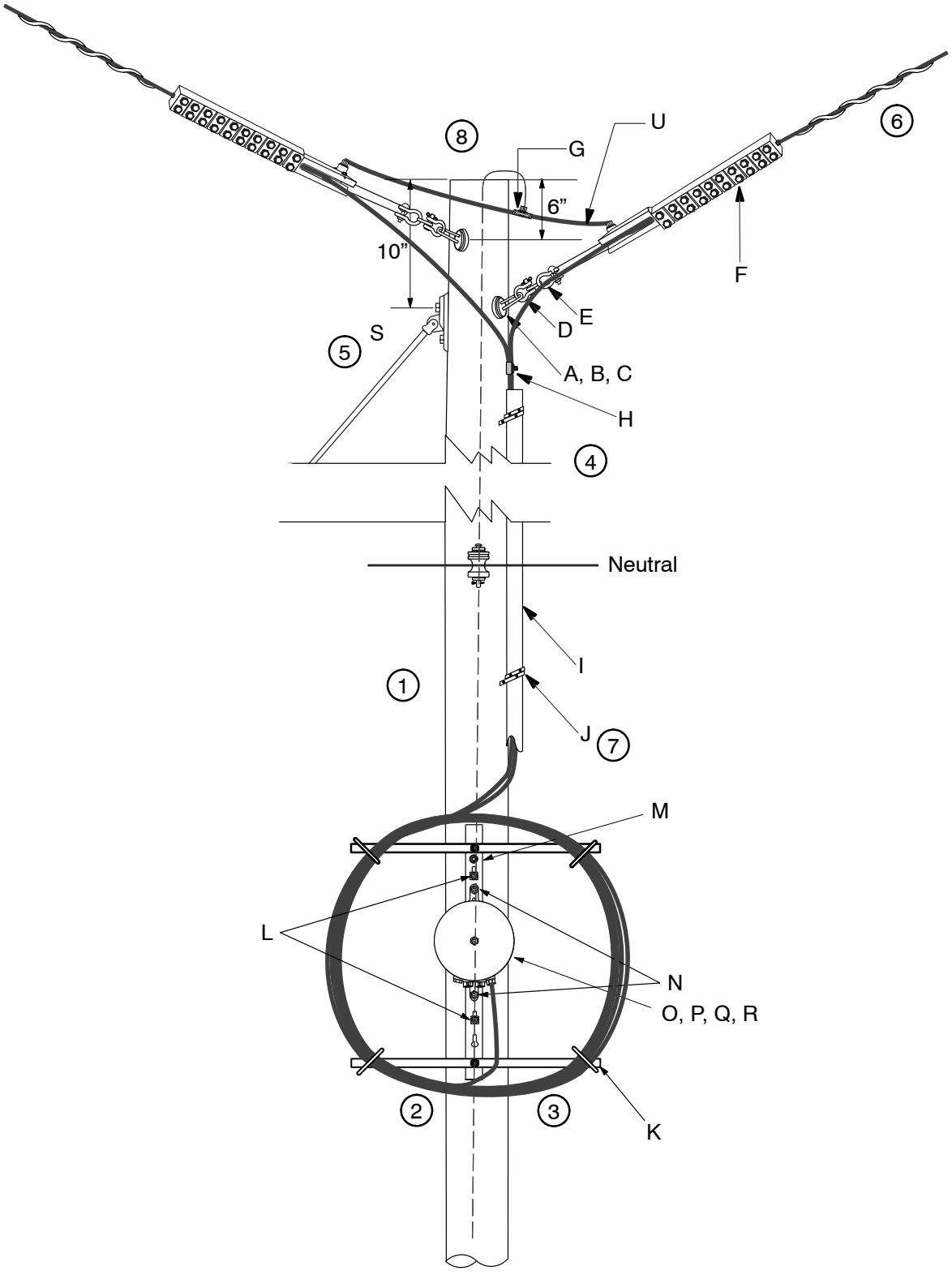
		Std. / Stk. No	Description 18 05 11	01
	A	23 68 458	Static Support Bracket ¾” x 14”	1
	B	23 68 368	Anchor shackle	1
	C	23 17 437	Yoke Plate	1
	D	23 58 127	Clevis Eye	2
	E	23 67 501	OPGW Suspension Clamp w/ Armor Rods	2
	F	17 52 217	Clamp For Bonding OPGW Static to Pole Ground	1
3@	G	23 67 319	Spiral Vibration Damper	2
@	H	**12 00 10 ****	Grounding Unit	1



NOTES:

1. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
2. See DCS **11 00 02 02** for typical guy insulator placement.
3. For larger wood poles or composite poles 16” static support (23–68–459),18” static support (23–68–460), or 20” static support (23–68–614) will be required.

		Std./Stk. No.	Description 18–05–12	01
	A	23 66 135	Washer, Lock, Double Coil ¾”	2
	B	23 66 031	Washer, Square for ¾” bolt	2
	C	23 52 254	Machine Bolt ¾” x 16”	2
	D	23 59 095	Eyelet, for ¾” bolt	2
	E	23 59 042	Extension Link 6”	2
	F	23 68 732	Bolted Deadend	2
	G	17 51 137	Clamp, Parallel Groove	1
	H	18 66 678	Bonding Wire , 60”	1
@	I	**12 00 10 ****	Grounding Unit	1
@2	J	**11 00 4* ****	Guying Unit (Down, Span, or Sidewalk)	2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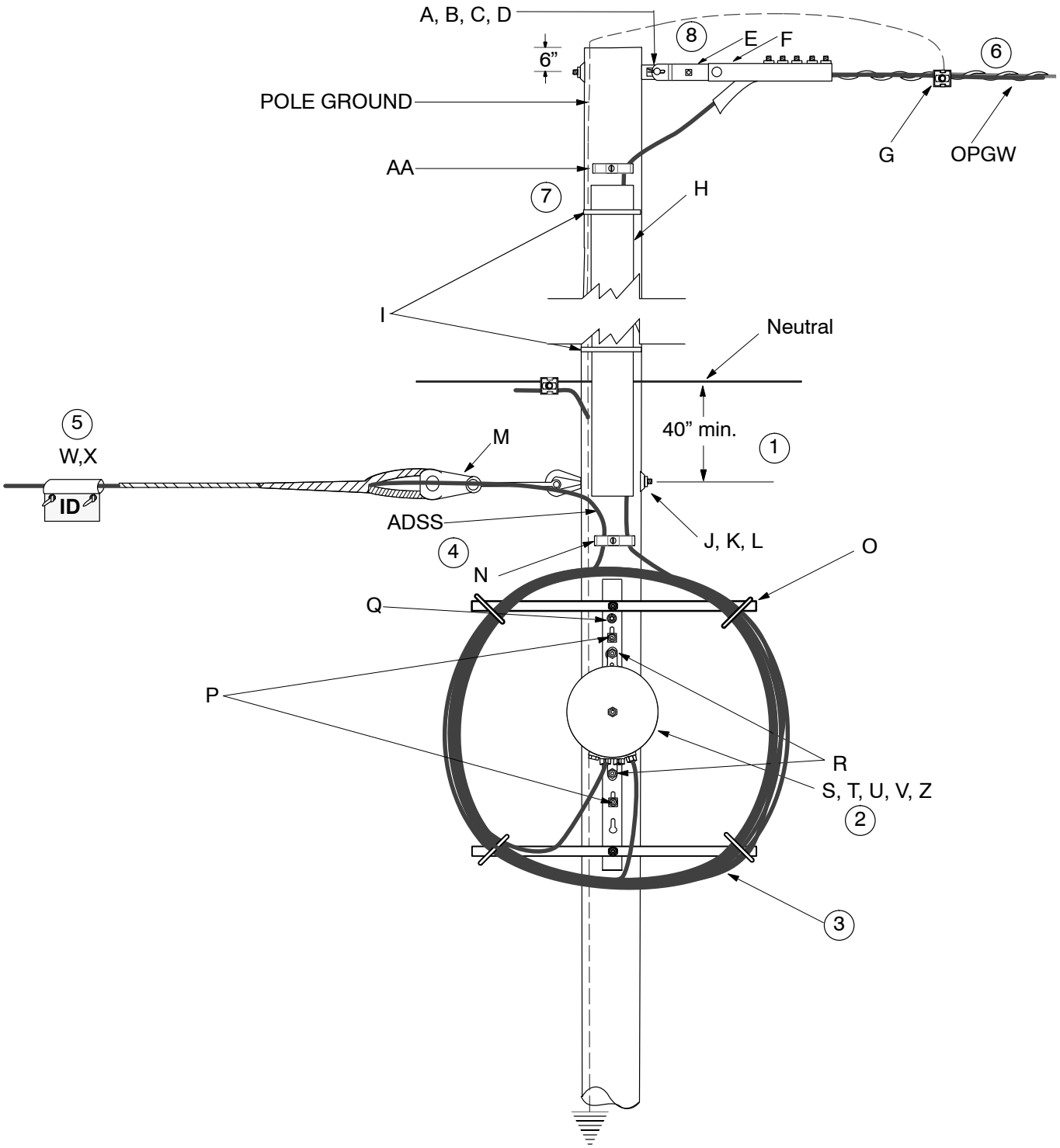
NOTES:

1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket.
3. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
4. Install downlead clamps every 10’.
5. See DCS **11 00 02 02** for typical guy insulator placement.
6. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
7. To attach Iron Hanger (27–60–035) around conduit on a Composite pole use #10 Self Tapping screws.
8. For larger wood poles or composite poles 16” static support (23–68–459), 18” static support (23–68–460), or 20” static support (23–68–614) will be required.

		Std./Stk. No.	Description 18–05–13	01
	A	23 66 135	Washer, Lock, Double Coil ¾”	1
	B	23 66 031	Washer, Square for ¾” bolt	1
	C	23 52 254	Machine Bolt ¾” x 16”	1
	D	23 59 095	Eyelet, for ¾” bolt	1
	E	23 59 042	Extension Link 6”	1
	F	23 68 732	Bolted Deadend	1
	G	17 51 137	Clamp, Parallel Groove	4
	H	17 52 220	Downlead Clamp, OPGW	1
	I	12 01 230	Conduit, 1½”	1
	J	27 60 035	Strap, Iron Hanger	2
	K	40 54 480	Coil Bracket	1
	L	23 60 011	Lag Screw, ⅝” x 5” galvanized	2
	M	40 59 318	Pipe grounding clamp	1
	N	23 52 031	Bolt ½” x 3” with Galv. Nut	2
	O	40 54 478	Splice Enclosure	1
	P	17 60 734	Splice Protector Sleeve	10
	Q	40 54 481	Connector Kit, OPGW	1
	R	40 54 479	Furcation Kit (for OPGW)	2
@5	S	**11 00 4* ****	Guying Unit (Down, Span, or Sidewalk)	2
@	T	**12 00 10 ****	Grounding Unit	1
	U	18 66 678	Bonding Wire, 60”	1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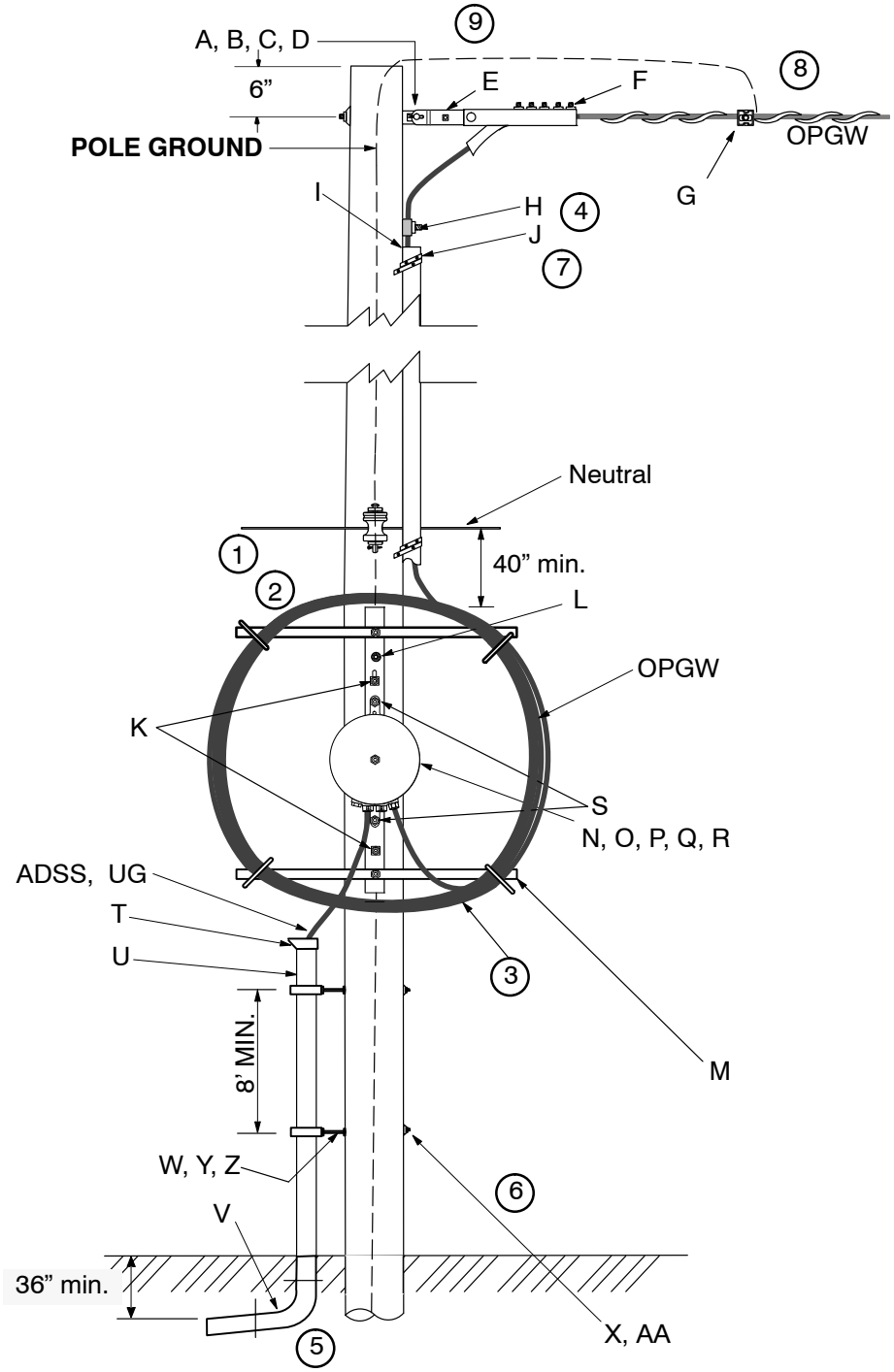
3

NOTES:

1. ADSS must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket.
3. Bottom loop of coiled fiber optic cable shall be located minimum of 15’ above ground.
4. Install downlead clamps every 10’.
5. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable within 10’ of the pole.
6. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
7. To attach Iron Hanger (27–60–035) around conduit on a Composite pole use #10 Self Tapping screws.
8. For larger wood poles or composite poles 16” static support (23–68–459), 18” static support (23–68–460), or 20” static support (23–68–614) will be required.

		Std. / Stk. No.	Description 18 05 14	01	02
	A	23 66 135	Washer, Lock, Double Coil ¾”	1	1
	B	23 66 031	Washer, Square for ¾” bolt	1	1
	C	23 52 254	Machine Bolt ¾” x 16”	1	1
	D	23 59 095	Eyelet, for ¾” bolt	1	1
	E	23 59 042	Extension Link 6”	1	1
	F	23 68 732	Bolted Deadend	1	1
	G	17 52 217	Clamp for bonding OPGW Static to Pole Ground	1	1
	H	12 01 230	Conduit, 1½”	1	1
	I	27 60 035	Strap, Iron Hanger	2	2
	J	23 66 134	Washer Lock, Double Coil ⅝”	1	1
	K	23 66 027	Washer, Square, for ⅝” machine bolt	2	2
	L	23 52 069	Machine Bolt ⅝” x 18’	1	1
	M	23 68 747	Formed Wire Deadend, 48–ct ADSS	1	
		23 68 778	Formed Wire Deadend, 72–ct ADSS		1
	N	17 02 177	Downlead Clamp, for 48–ct and 72ct ADSS	1	1
	O	40 54 480	Coil Bracket	1	1
	P	23 60 011	Lag Screw, ⅝” x 5” galvanized	2	2
	Q	40 59 318	Pipe grounding clamp	1	1
	R	23 52 031	Bolt ½” x 3” with Galv. Nut	2	2
	S	40 54 478	Splice Enclosure	1	1
	T	17 60 734	Splice Protector Sleeve	10	10
	U	17 62 293	Connector Kit, 48–ct ADSS	1	
		17 62 296	Connector Kit, 72–ct ADSS		1
	V	40 54 479	Furcation Kit (for OPGW)	2	2
	W	16 01 647	ID Tag, ADSS	1	1
	X	40 89 494	Nylon Zip Tie	2	2
@	Y	12 00 10 **	Grounding Unit	1	1
	Z	40 54 481	Connector Kit, OPGW	1	1
	AA	17 52 220	Downlead Clamp, for OPGW	1	1


A, B, C, D
6”
POLE GROUND
9
E
F
8
OPGW
G
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Neutral
40” min.
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OPGW
K
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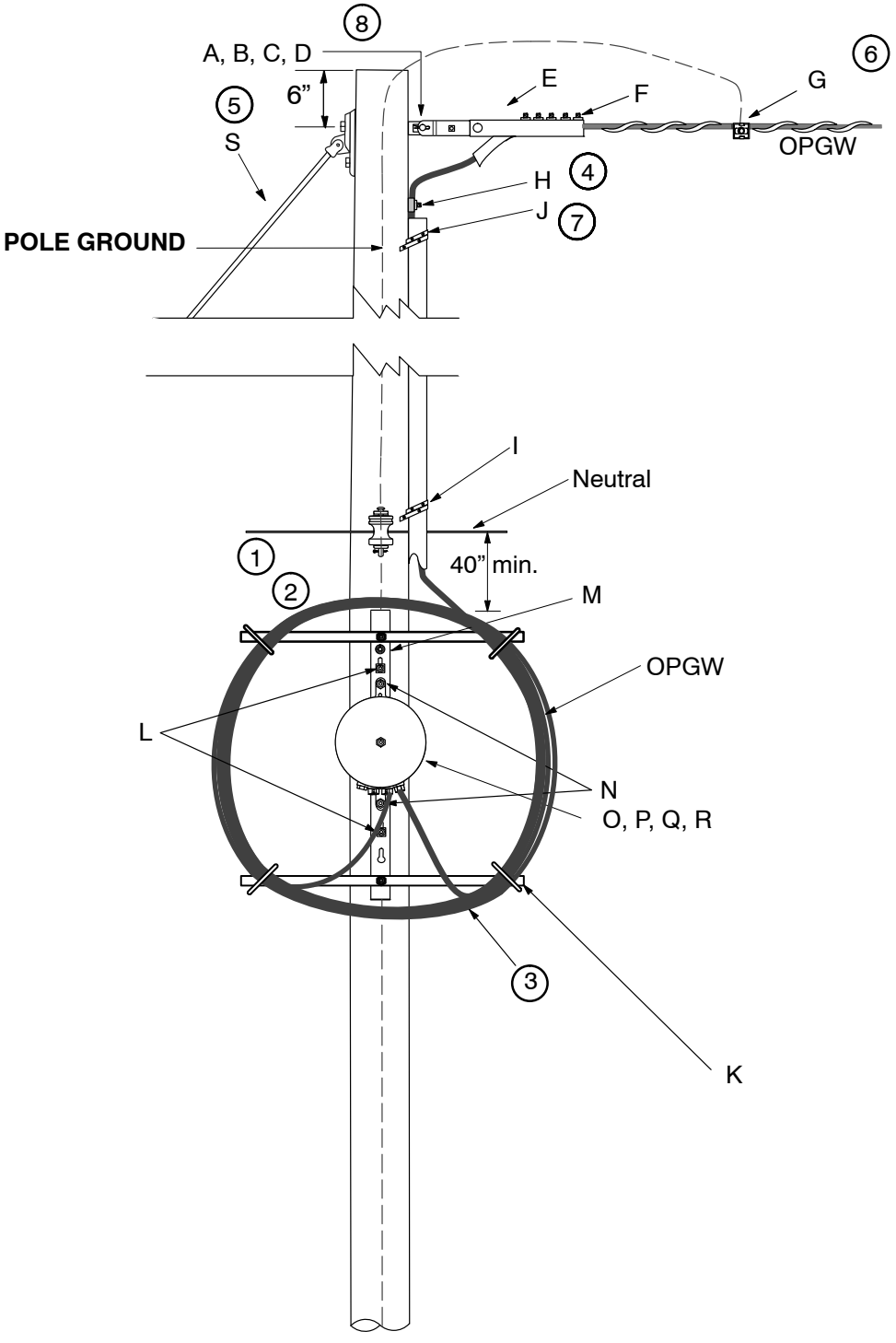
N, O, P, Q, R
ADSS, UG
T
U
3
8’ MIN.
M
W, Y, Z
6
V
36” min.
X, AA
5

NOTES:

1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket.
3. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
4. Install downlead clamps every 10’.
5. Bring 1¼” Conduit (12-01-338) up the riser.
6. Ground each standoff bracket with transformer ground connector and bond to pole ground with PG Clamp (17-51-032).
7. To attach Iron Hanger (27–60–035) around conduit on a Composite pole use #10 Self Tapping screws.
8. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
9. For larger wood poles or composite poles 16” static support (23–68–459), 18” static support (23–68–460), or 20” static support (23–68–614) will be required.
10. Apply two layers of tape to protect cable under the cable grips.
11. For alternate construction, call for split conduit – 3” (12–51–218), 4” (12–51–219), 5” (12–51–220).
12. Top of conduit may be sealed with polyurethane expanding foam, (31–53–082). Expanding foam must be used with dispensing gun, (85–20–073).

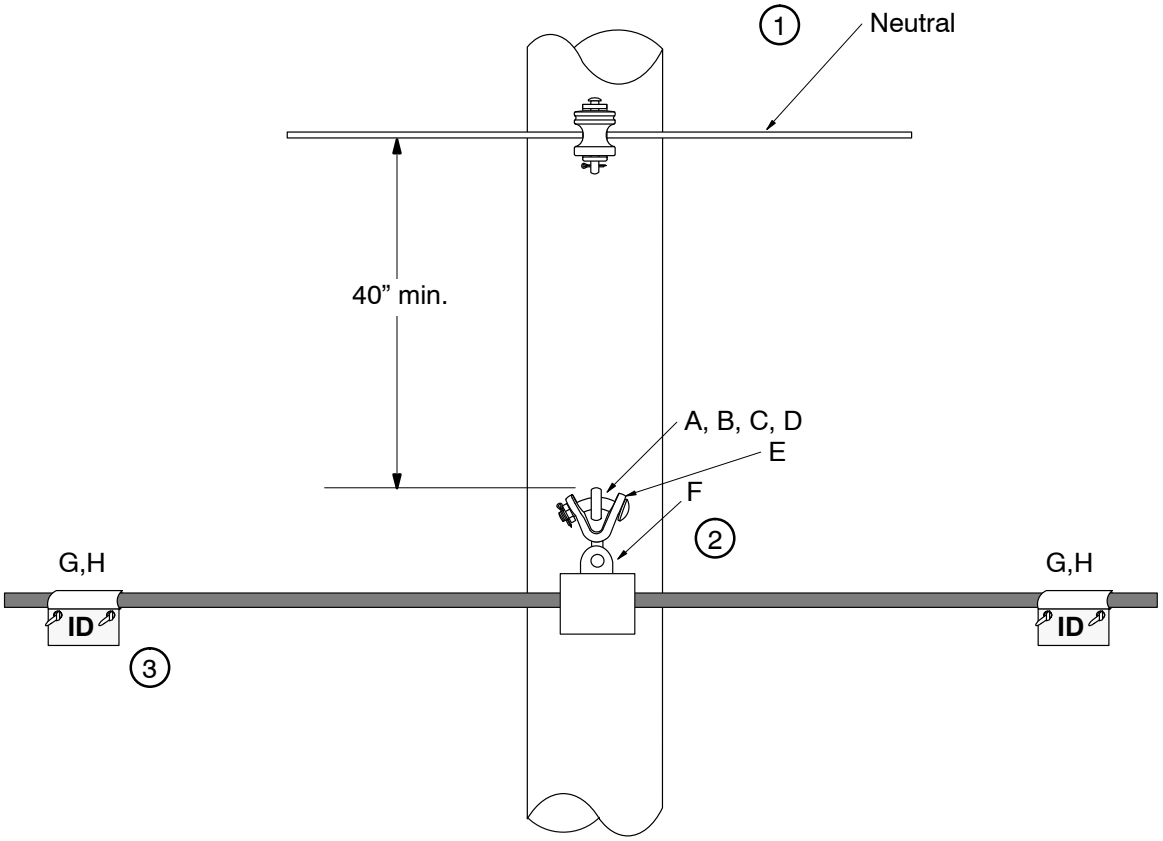
		Std./Stk. No.	Description 18 05 15	01
	A	23 66 135	Washer, Lock, Double Coil ¾"	1
	B	23 66 031	Washer, Square for ¾" bolt	1
	C	23 52 254	Machine Bolt ¾" x 16"	1
	D	23 59 095	Eyelet, for ¾" bolt	1
	E	23 59 042	Extension Link 6"	1
	F	23 68 732	Bolted Deadend, OPGW	1
	G	17 52 217	Clamp for bonding OPGW Static to Pole Ground	1
	H	17 52 220	Downlead Clamp, OPGW	1
	I	12 01 230	Conduit 1½" PVC Sch. 40, 10' LGH	1
	J	27 60 035	Strap, Iron Hanger	1
	K	23 60 011	Screw, Lag ⅝" x 5"	2
	L	40 59 318	Pipe grounding clamp	1
	M	40 54 480	Coil Bracket	1
	N	40 54 479	Furcation Kit OPGW	1
	O	17 04 247	Connector Kit, ADSS UG	1
	P	40 54 481	Connector Kit, OPGW	1
	Q	17 60 734	Splice Protector Sleeve	10
	R	40 54 478	Splice Enclosure	1
	S	23 52 031	Bolt, ½" x 3" with Galv. Nut	2
	T	12 51 254	Bell end fitting	1
	U	12 01 278	4" Sch. 80 PVC 10' LGH	1
	V	12 51 176	4" Sch. 40 Bend 36" Radius	1
	W	23 53 003	Bolt, double arming, ⅝" x 18" with 4 sq. nuts	2
	X	23 65 053	Nut, Jam, ⅝"	2
	Y	23 06 087	Bracket, Standoff, 12"	2
	Z	69 58 121	Transformer Ground Connector	3
	AA	23 66 027	Washer, square, for ⅝" lag screw	2
@	BB	**12 00 10 ****	Grounding Unit	1


8
A, B, C, D
6"
5
S
E
F
G
6
OPGW
4
H
J
7
POLE GROUND
I
Neutral
40" min.
1
2
M
OPGW
L
N
O, P, Q, R
3
K

NOTES:

1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket.
3. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
4. Install downlead clamps every 10’.
5. See DCS **11 00 02 02** for typical guy insulator placement.
6. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
7. To attach Iron Hanger (27–60–035) around conduit on a Composite pole use #10 Self Tapping screws.
8. For larger wood poles or composite poles 16” static support (23–68–459), 18” static support (23–68–460), or 20” static support (23–68–614) will be required.

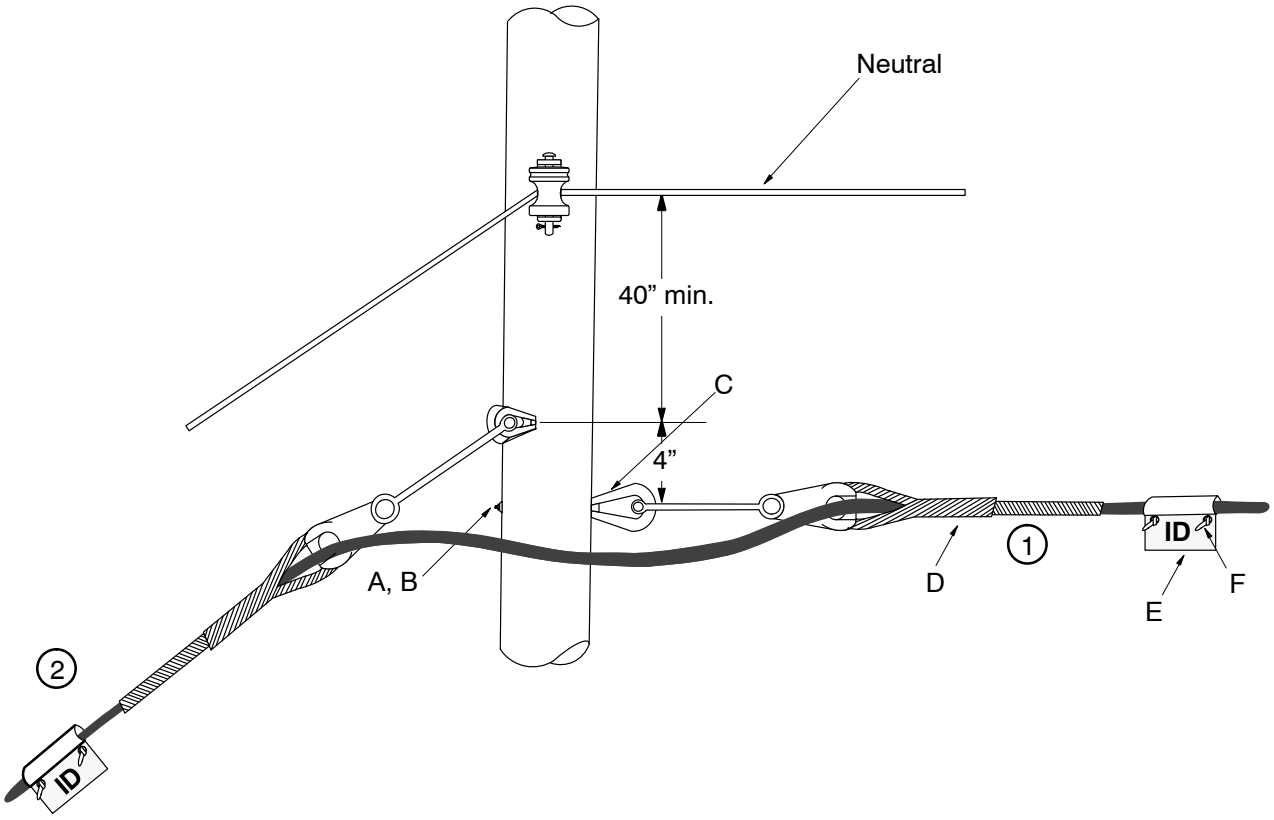
		Std. / Stk. No.	Description 18 05 16	01
	A	23 66 135	Washer, Lock, Double Coil ¾”	1
	B	23 66 031	Washer, Square for ¾” bolt	1
	C	23 52 254	Machine Bolt ¾” x 16”	1
	D	23 59 095	Eyelet, for ¾” bolt	1
	E	23 59 042	Extension Link 6”	1
	F	23 68 732	Bolted Deadend	1
	G	17 52 217	Clamp for bonding OPGW Static to Pole Ground	1
	H	17 52 220	Downlead Clamp, OPGW	1
	I	12 01 230	Conduit 1½”	1
	J	27 60 035	Strap, Iron Hanger	2
	K	40 54 480	Coil Bracket	1
	L	23 60 011	Lag Screw, ⅝” x 5” galvanized	2
	M	40 59 318	Pipe grounding clamp	1
	N	23 52 031	Bolt ½” x 3” with Galv. Nut	2
	O	40 54 478	Splice Enclosure	1
	P	17 60 734	Splice Protector Sleeve	10
	Q	40 54 481	Connector Kit, OPGW	1
	R	40 54 479	Furcation Kit, OPGW	2
@5	S	**11 00 4* ****	Guying Unit (Down, Span, or Sidewalk)	1
@	T	**12 00 10 ****	Grounding Unit	1



NOTES:

1. ADSS must be installed 40" or greater from Neutral or closest conductor.
2. For Spans > 600 feet use 23–68–750 for 48–ct ADSS and 23–68–779 for 72–ct ADSS for item F.
3. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable within 10' of pole.

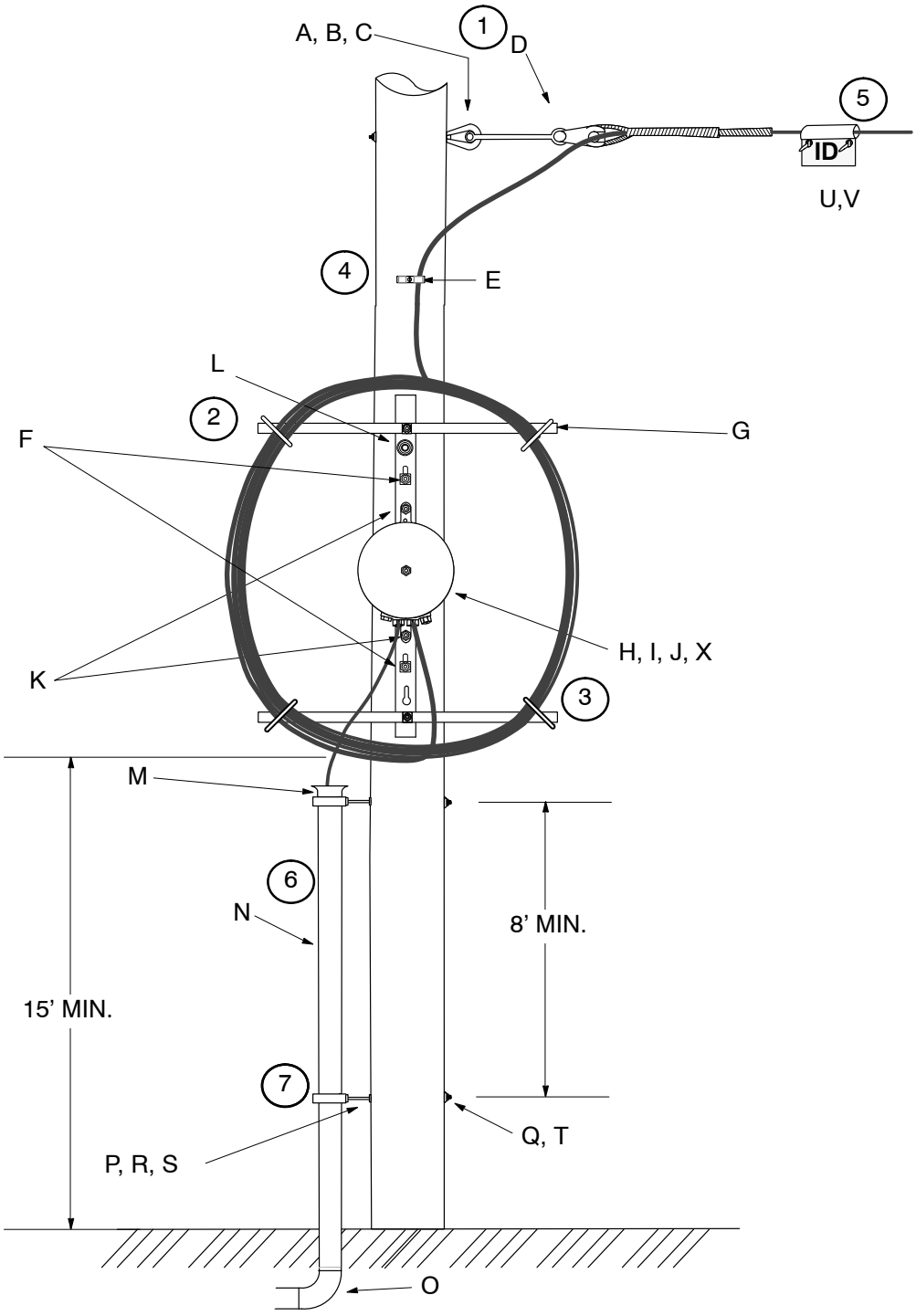
		Std. / Stk. No	Description	01
2	A	23 66 135	Washer, Lock, Double Coil ¾"	1
	B	23 66 031	Washer, Square for ¾" Bolt	1
	C	23 52 103	Machine Bolt ¾" X 18"	1
	D	23 65 018	Eyelet for ¾" bolt	1
	E	23 58 127	Clevis Eye	1
	F	17 01 119	Formed Wire Suspension, ADSS	1
	G	16 01 647	ID Tag, ADSS	2
	H	40 89 494	Nylon Zip Tie	4



NOTES:

1. Actual length of deadend is longer than shown.
2. ADSS Tags should be attached with zip ties on overhead ADDS fiber optic cable within 10' of the pole.

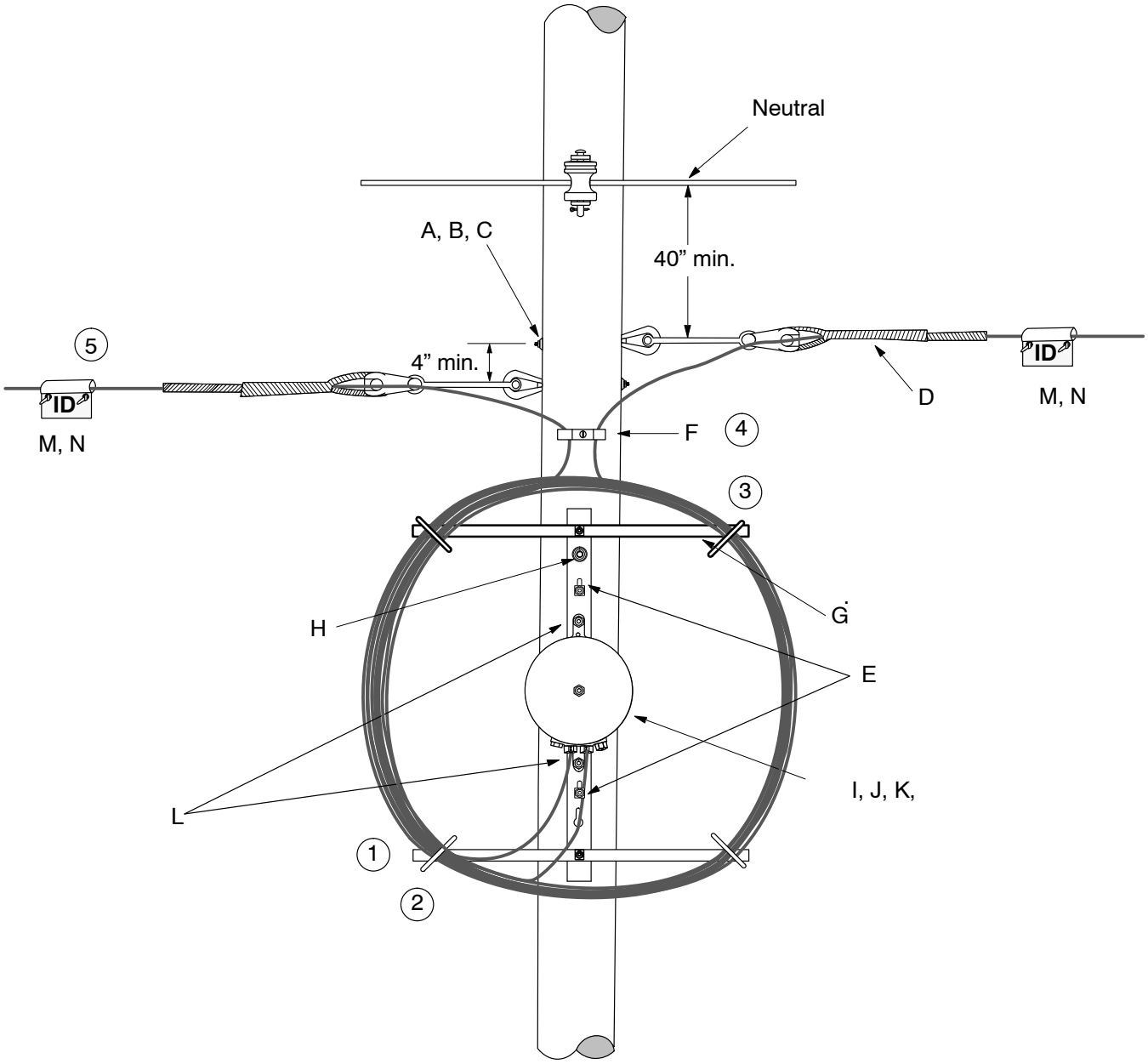
		Std. / Stk. No.	Description 18 10 02	01	02
	A	23 66 135	Washer, Lock, Double Coil ⅝"	2	2
	B	23 66 027	Washer, Square for ⅝" bolt	2	2
	C	23 52 069	Machine Bolt ⅝" x 18"	2	2
	D	23 68 747	Formed Wire Deadend, ADSS 48 ct. Fiber	2	
		23 68 778	Formed Wire Deadend, ADSS 72 ct. Fiber		2
	E	16 01 647	ADSS Identification Tag	2	2
2	F	40 89 494	Zip Tie	4	4


A, B, C
1
D
5
ID
U,V
4
E
L
2
F
G
K
H, I, J, X
3
M
6
N
8' MIN.
15' MIN.
7
Q, T
P, R, S
O

NOTES:

1. ADSS must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around splice rack.
3. Splice enclosure shall be located a minimum of 15’ above ground.
4. Install downlead clamps every 10’.
5. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable within 10’ of pole.
6. Bring 1¼” conduit (12–01–338) up the riser.
7. Ground each standoff bracket with transformer ground connector and bond to pole ground with PG clamp (17–51–032).
8. Apply two layers of tape to protect cable under the cable grips.
9. For alternate construction, call for split conduit – 3” (12 – 51 – 218), 4” (12 – 51 – 219), 5” (12 – 51 – 220).
10. Top of conduit may be sealed with polyurethane expanding foam, (31–53–082). Expanding foam must be used with dispensing gun, (85 – 20 – 073).

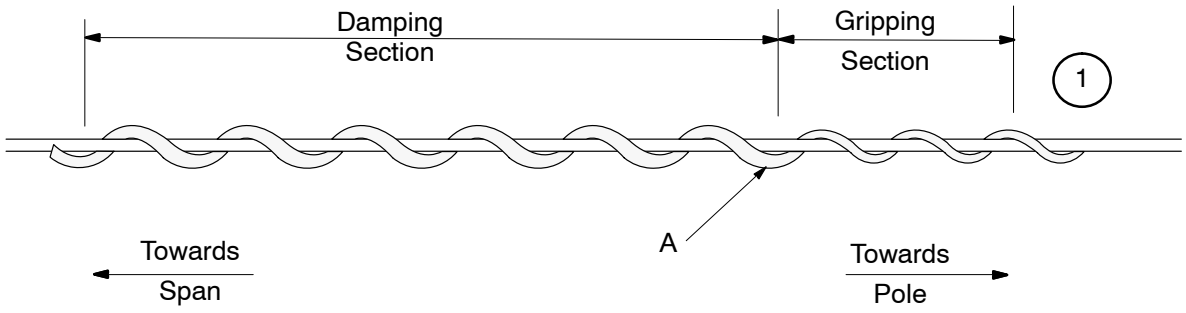
		Std. / Stk. No.	Description 18 10 03	01	02
	A	23 66 135	Washer, Lock, Double Coil ¾”	1	1
	B	23 66 031	Washer, Square for ¾” bolt	1	1
	C	23 52 069	Machine bolt ¾” x 18”	1	1
	D	23 68 747	Formed wire Deadend, 48–ct ADSS	1	
		23 68 778	Formed wire Deadend, 72–ct ADSS		1
	E	17 02 177	Downlead Clamp, 48–ct and 72–ct ADSS	1	1
	F	23 60 011	LAG Screw, ⅝” x 5” galvanized.	2	2
	G	40 54 480	Coil Bracket	1	1
	H	17 60 734	Splice Protector Sleeve	10	10
	I	40 54 478	Splice Enclosure	1	1
	J	17 62 293	Connector kit, 48–ct ADSS	1	
		17 62 296	Connector kit, 72-ct ADSS		1
	K	23 52 031	Bolt, ½” x 3” with Galv. Nut	2	2
	L	40 59 318	Pipe grounding clamp	1	1
	M	12 51 254	Bell end fitting	1	1
	N	12 01 278	4’’ Sch. 80 PVC 10’ LGH	1	1
	O	12 51 176	4’’ Sch. 40 Bend 36’’ Radius	1	1
	P	23 53 003	Bolt, double arming, ⅝” x 18” with 4 sq. nuts	2	2
	Q	23 65 053	Nut, Jam, ⅝”	2	2
	R	23 06 087	Bracket, Standoff 12”	2	2
	S	69 58 121	Transformer Ground Connector	3	3
	T	23 66 027	Washer, square, for ⅝” bolt	2	2
	U	16 01 647	ID Tag, ADSS	1	1
	V	40 89 494	Nylon Zip Tie	2	2
@	W	**11 00 4* ****	Guying Unit (Down, Span, or Sidewalk)	1	1
	X	17 04 247	Connector Kit, ADSS UG	1	1


Neutral
A, B, C
40" min.
4" min.
5
ID
M, N
ID
M, N
D
F
4
3
H
G
E
I, J, K,
L
1
2

NOTES:

1. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
2. Coil 100’ of extra fiber optic cable around coil bracket.
3. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
4. Install downlead clamps every 10’.
5. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable within 10’ of pole.

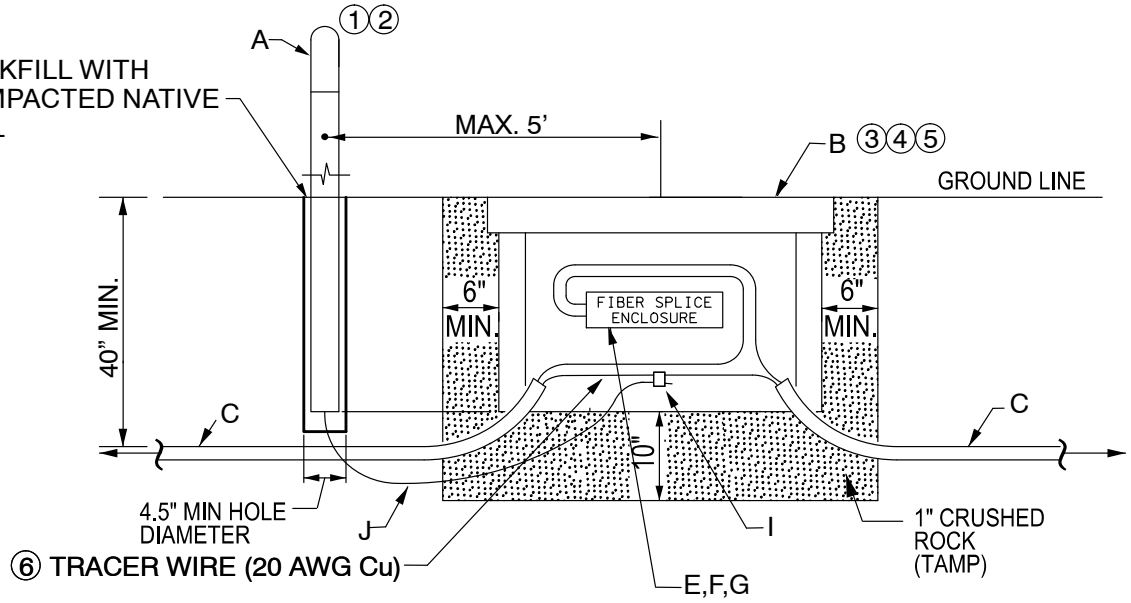
	Std. / Stk. No.	Description 18 10 04	01	02
A	23 66 135	Washer, Lock, Double Coil ¾”	2	2
B	23 66 031	Washer, Square for ¾” bolt	2	2
C	23 52 069	Machine Bolt ¾” x 18”	2	2
D	23 68 747	Formed Wire Deadend, ADSS 48–ct Fiber	2	
	23 68 778	Formed Wire Deadend, ADSS 72–ct Fiber		2
E	23 60 011	Screw, LAG ⅝” x 5”	2	2
F	17 02 177	Downlead Clamp, 48–ct and 72–ct ADSS	1	1
G	40 54 480	Coil Bracket	1	1
H	40 59 318	Pipe grounding clamp	1	1
I	17 60 734	Splice Protector Sleeve	10	10
J	40 54 478	Splice Enclosure	1	1
K	17 62 293	Connector Kit, 48–ct ADSS	1	
	17 62 296	Connector Kit, 72–ct ADSS		1
L	23 52 031	Bolt, ½” x 3” with Galv Nut	2	2
M	16 01 647	ID Tag, ADSS	1	1
N	40 89 494	Nylon Zip Tie	2	2



NOTES:

1. Gripping section features smaller helix than damping section.
2. Dampers shall be used when cable spans exceed 350’ and/or tension exceeds 15% of the rated cable breaking strength.

	Std. / Stk. No	Description 18 10 05	01
A	17 13 306	Vibration Damper – ADSS	1



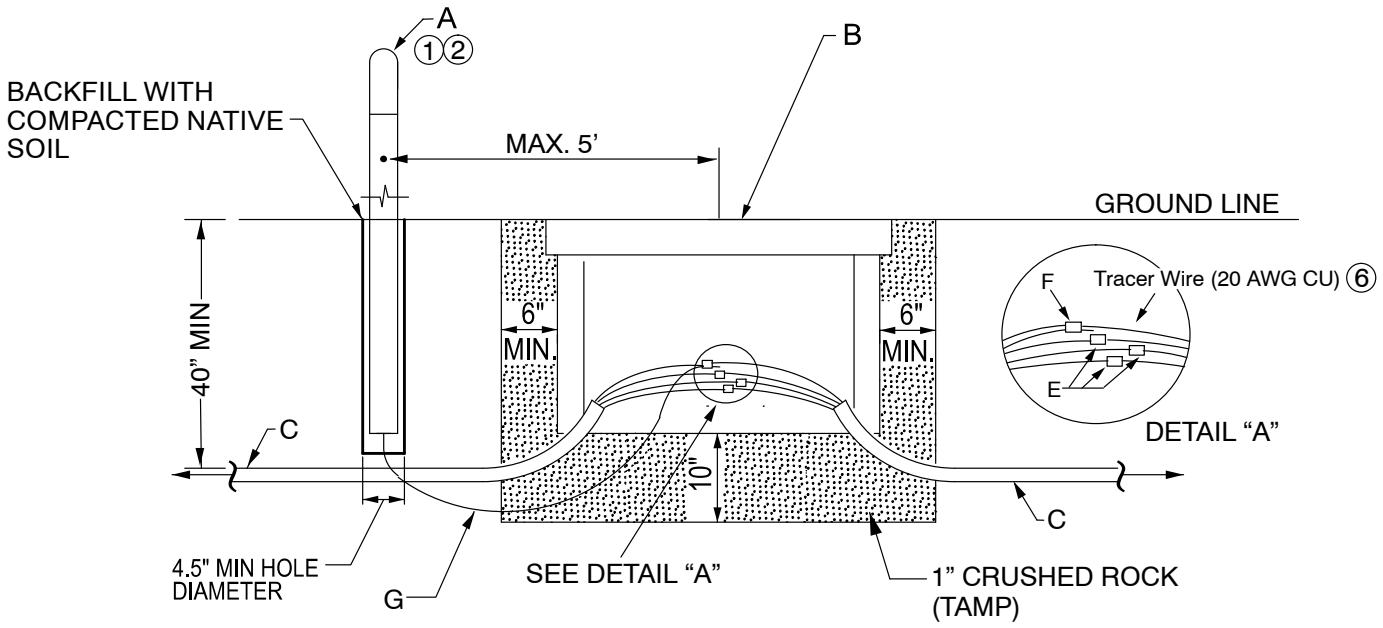
NOTES:

1. Install fiber markers with test paddle (16–16–283) max. 5' North of center of hand–hole and at beginning and end of each run.
2. Install buried fiber markers without test paddle (16–16–292) directly over buried fiber midway between hand–holes or no more than 1000' in rural areas.
3. Hand–holes shall be installed at grade at beginning and end points of farmable fields. In rural areas that exceed 4500' spacing (Note 7) install two (2) fiber markers with test paddles, one on each side of the hand–hole, for protection. Preferred method of installation is at each property corner location. UG fiber shall be installed min. 60" below grade in farmable fields.
4. Fiber runs $\leq$ 300' may be pushed or pulled (pulling tape 83–36–251). Fiber runs > 300' shall be installed using the blown fiber method when using 3–, 4–, or 7–way HDPE Microducts.
5. Coil 50' of fiber optic cable per run (100' total). Splice–thru remaining unused microducts using straight–thru connectors (12–01–342).
6. Ensure tracer wire is continuous by using the tracer wire connector (40–89–744).
7. Hand–holes shall be installed no further apart than 2500' in urban areas and 4500' in rural land. Hand–holes are required at each alignment angle for pulling locations (splice not required for pulling purposes).
8. Refer to installation guide for fiber optic cable stock numbers.
9. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4" HDPE conduit (12–01–334) may be used.
10. End caps (12–01–343) shall be installed on all unused microducts.
11. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.

		Std. / Stk. No.	Description 18 20 01 **	01
@1	A	16 16 283	Orange Fiber Cable Marker w/Test Paddle	Ea.
	B	12 56 129	Hand–Hole	1
@	C	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
@4	D	83 36 251	PullingTape	Ft.
	E	40 89 742	Splice Tray, 24 ct.	3
	F	40 54 494	Splice Box	1
	G	40 54 495	Splice Box Hand–Hole Stand	1
	H	12 01 342	Straight–thru connectors for microducts	3
	I	40 89 744	Connector, tracer wire	1
@6	J	18 66 689	#12 Orange Tracer Wire	Ft.

FIBER OPTIC COMMUNICATION
Underground Fiber without Splice

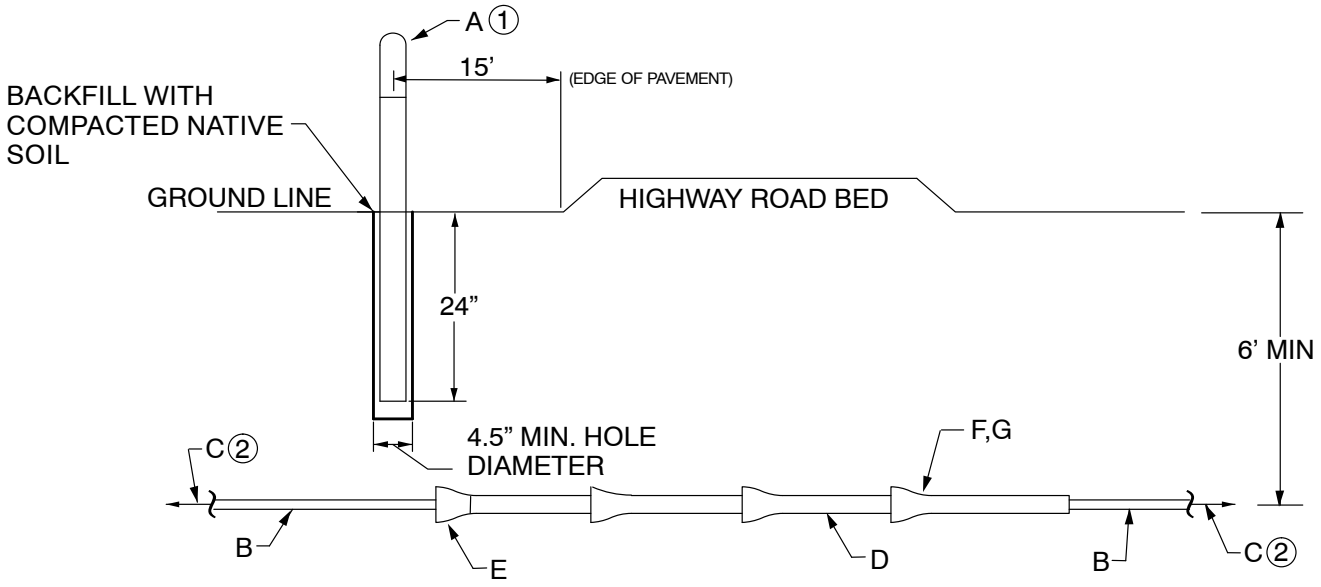
18 20 02 **
Sheet 1 of 1



NOTES:

1. Install fiber markers with test paddle (16–16–283) max. 5' North of center of hand–hole and at beginning and end of each run.
2. Install buried fiber markers without test paddle (16–16–292) directly over buried fiber midway between hand–holes or no more than 1000' in rural areas.
3. Hand–holes shall be installed at grade at beginning and end points of farmable fields. In rural areas that exceed 4500' spacing (Note 7) install two (2) fiber markers with test paddles, one on each side of the hand–hole, for protection. Preferred method of installation is at each property corner location. UG fiber shall be installed min. 60" below grade in farmable fields.
4. Fiber runs ≤ 300' may be pushed or pulled (pulling tape 83–36–251). Fiber runs > 300' shall be installed using the blown fiber method when using 3–, 4–, or 7–way HDPE Microducts.
5. Splice–thru each of the microducts using straight–thru connectors (12–01–342).
6. Ensure tracer wire is continuous by using the tracer wire connector (40–89–744).
7. Hand–holes shall be installed no further apart than 2500' in urban areas and 4500' in rural land. Hand–holes are required at each alignment angle for pulling locations (splice not required for pulling purposes).
8. Refer to installation guide for fiber optic cable stock numbers.
9. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4" HDPE conduit (12–01–334) may be used.
10. End caps (12–01–343) shall be installed on all unused microducts.

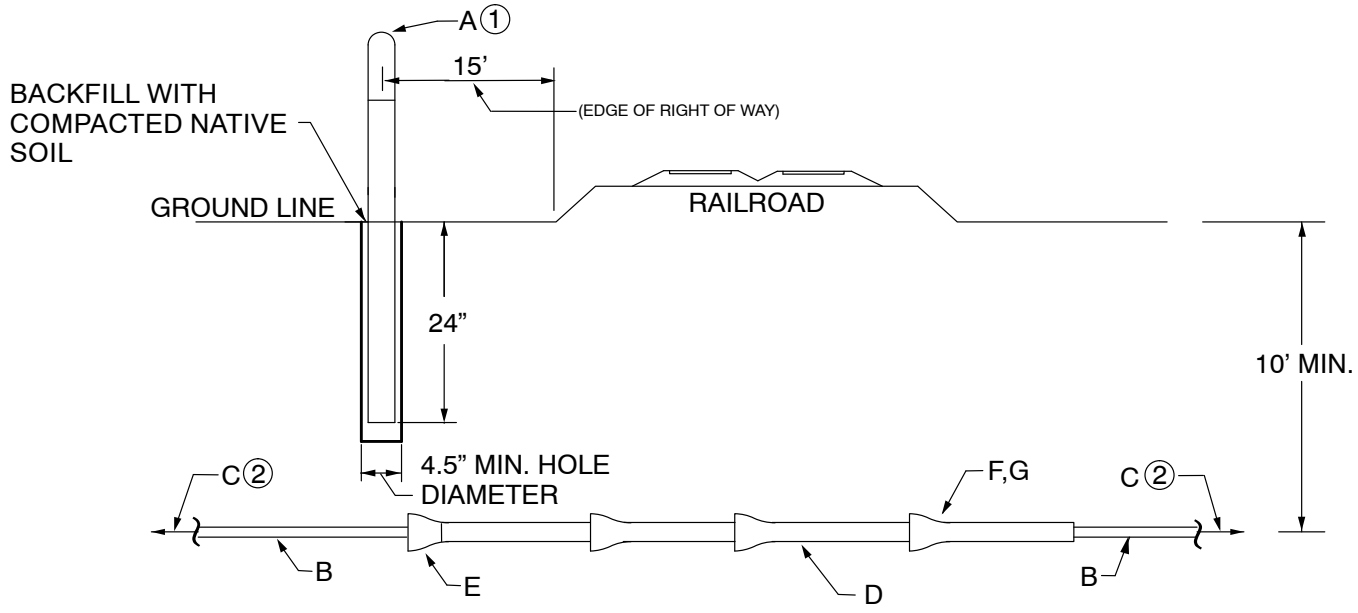
		Std. / Stk. No.	Description 18 20 02 **	01
@1	A	16 16 283	Orange Fiber Cable Marker w/Test Paddle	Ea.
	B	12 56 129	Hand–Hole	1
@	C	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
@4	D	83 36 251	Pulling Tape	Ft.
	E	12 01 342	Straight–thru connectors for microducts	4
	F	40 89 744	Connector, tracer wire	1
@6	G	18 66 689	#12 Orange Tracer Wire	Ft.



NOTES:

1. Install fiber marker without test paddle (16–16–292) 15’ from edge of pavement.
2. Fiber runs ≤ 300’ may be pushed or pulled (pulling tape 83–36–251). Fiber runs > 300’ shall be installed using the blown fiber method when using 3–, 4–, or 7–way HDPE Microducts.
3. Refer to installation guide for fiber optic cable stock numbers.
4. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4” HDPE conduit (12–01–334) may be used.
5. End caps (12–01–343) shall be installed on all unused microducts.
6. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.

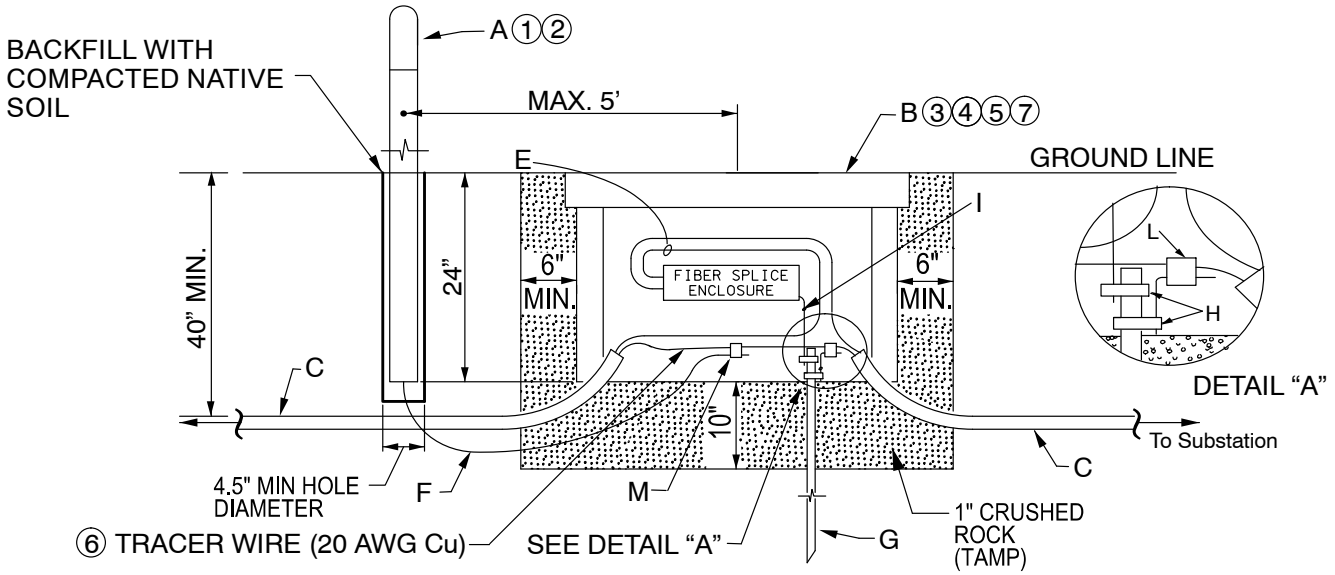
		Std. / Stk. No.	Description 18 20 03 **	01
@1	A	16 16 292	Orange Fiber Cable Marker without Test Paddle	Ea.
@	B	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
@2	C	83 36 251	Pulling Tape	Ft.
@	D	12 01 278	4” Sch. 80 PVC, 10’Length, w/ coupling	Ft.
	E	12 51 254	Bell end fitting	1
	F	30 58 068	PVC Primer, Purple, 10 Ounce Container	1
	G	12 56 100	PVC Solvent Cement, Yellow	1



NOTES:

1. Install fiber marker without test paddle (16–16–292) 15’ from edge of right–of–way.
2. Fiber runs ≤ 300’ may be pushed or pulled (pulling tape 83–36–251). Fiber runs > 300’ shall be installed using the blown fiber method when using 3–, 4–, or 7–way HDPE Microducts.
3. Refer to installation guide for fiber optic cable stock numbers.
4. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4” HDPE conduit (12–01–334) may be used.
5. End caps (12–01–343) shall be installed on all unused microducts.
6. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.
7. When using steel conduit use stock code (40–83–343) in place of PVC.

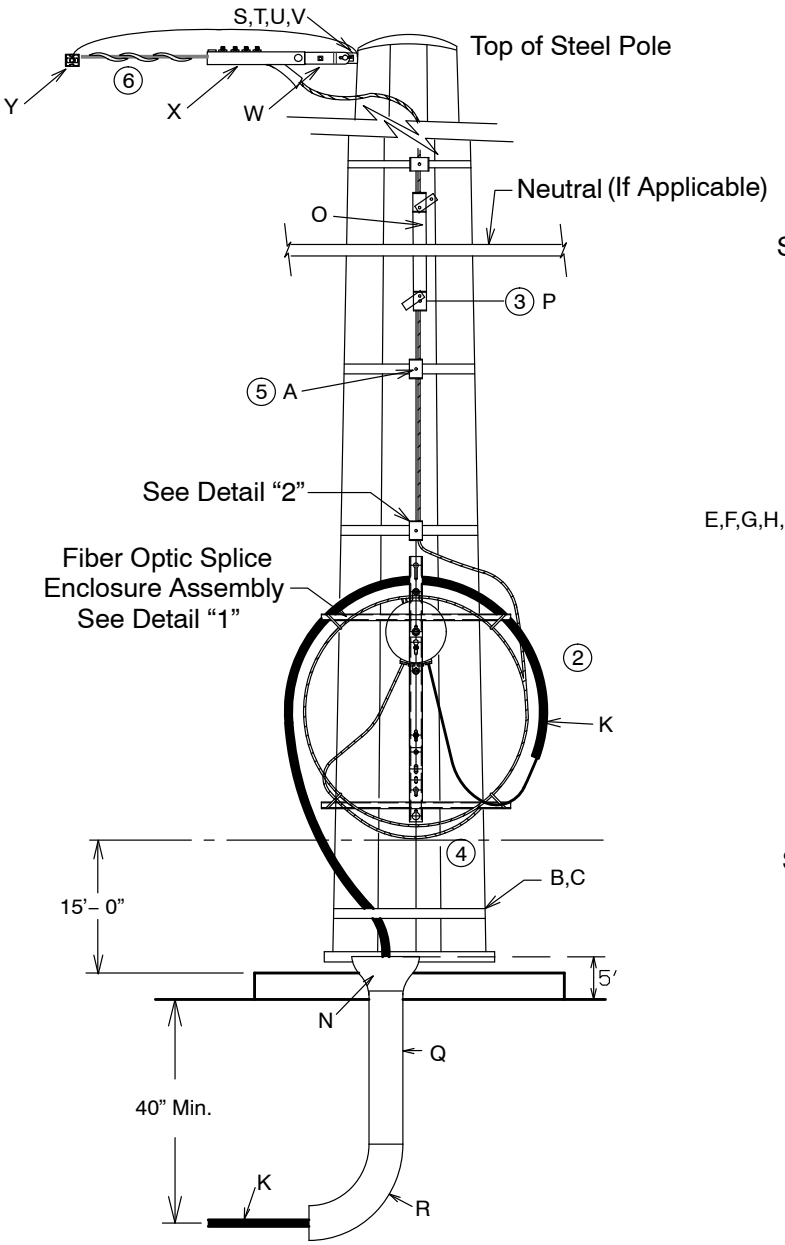
		Std. / Stk. No.	Description 18 20 04 **	01
@1	A	16 16 292	Orange Fiber Cable Marker without Test Paddle	Ea.
@	B	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
@2	C	83 36 251	Pulling Tape	Ft.
@	D	12 01 278	4” Sch. 80 PVC, 10’Length, w/ coupling	Ft.
	E	12 51 254	Bell end fitting	1
	F	30 58 068	PVC Primer, Purple, 10 Ounce Container	1
	G	12 56 100	PVC Solvent Cement, Yellow	1

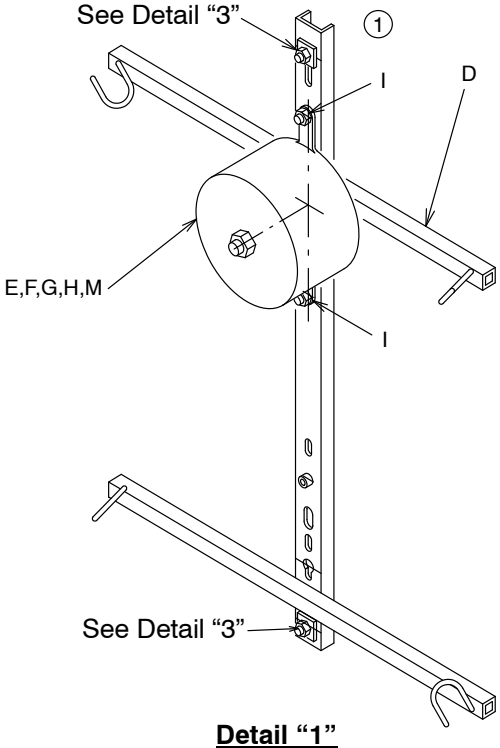


NOTES:

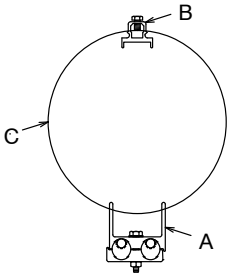
1. Install fiber markers with test paddle (16–16–283) max. 5' North of center of hand–hole and at beginning and end of each run.
2. Install buried fiber markers without test paddle (16–16–292) directly over buried fiber midway between hand–holes or no more than 1000' in rural areas.
3. Hand–holes shall be installed at grade at beginning and end points of farmable fields. In rural areas that exceed 4500' spacing (Note 7) install two (2) fiber markers with test paddles, one on each side of the hand–hole, for protection. Preferred method of installation is at each property corner location. UG fiber shall be installed min. 60" below grade in farmable fields.
4. Fiber runs $\leq$ 300' may be pushed or pulled (pulling tape 83–36–251). Fiber runs > 300' shall be installed using the blown fiber method when using 3–, 4–, or 7–way HDPE Microducts.
5. Coil 50' of fiber optic cable per run (100' total). Splice–thru remaining unused microducts using straight–thru connectors (12–01–342).
6. Ensure tracer wire is continuous by using the tracer wire connector (40–89–744).
7. Hand–holes shall be installed no further apart than 2500' in urban areas and 4500' in rural land. Hand–holes are required at each alignment angle for pulling locations (splice not required for pulling purposes).
8. Refer to installation guide for fiber optic cable stock numbers.
9. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4" HDPE conduit (12–01–334) may be used.
10. End caps (12–01–343) shall be installed on all unused microducts.
11. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.

		Std. / Stk. No.	Description 18 20 05 **	01
@1	A	16 16 283	Orange Fiber Cable Marker w/Test Paddle	Ea.
	B	12 56 129	Hand–Hole	1
@	C	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
@4	D	83 36 251	Pulling Tape	Ft.
	E	40 89 742	Splice Tray, 24ct.	3
@6	F	18 66 689	#12 Orange Tracer Wire	Ft.
	G	23 13 069	Ground Rod ⅝”x8’ Copperweld	1
	H	17 52 032	Grounding Clamp	2
@	I	18 52 025	#2 solid CU Ground Wire	Ft.
	J	40 54 494	Splice Box	1
	K	40 54 495	Splice Box Hand–Hole Stand	1
	L	12 01 342	Straight–thru connectors for microducts	3
	M	40 89 744	Connector, tracer wire	1

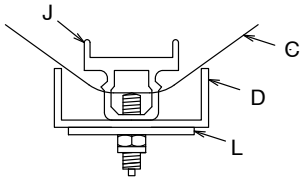




Detail "1"
Fiber Optic Splice Enclosure
Detail



Detail "2"
ADSS Downlead Clamp
Assembly

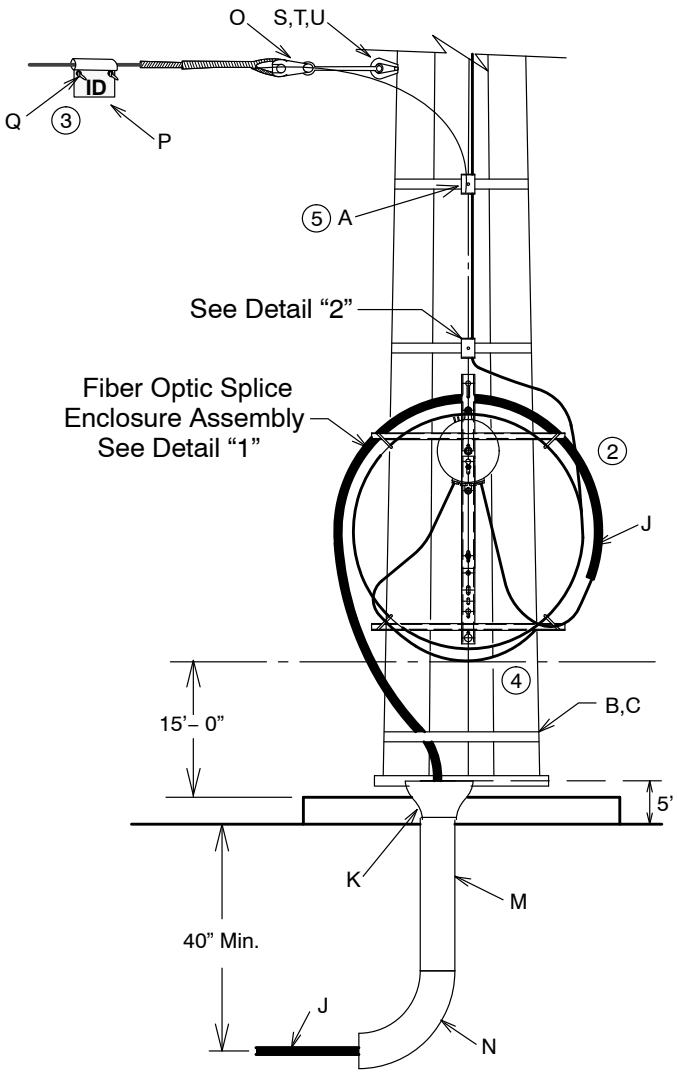


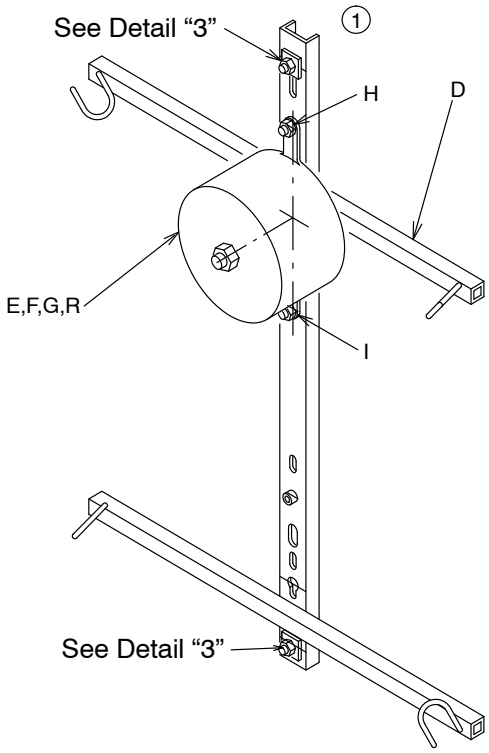
Detail "3"
Splice Enclosure Attachment
Without Bracket

NOTES:

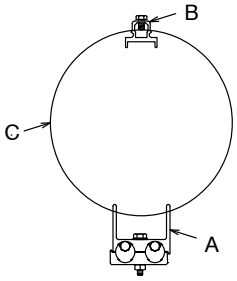
1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket. Wrap HDPE conduit 3/4 turn (opening points down) around coil bracket.
3. To attach iron hanger to pole use #10 self tapping screws.
4. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
5. Install downlead clamps every 10’.
6. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
7. Refer to installation guide for fiber optic cable stock numbers.
8. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4” HDPE conduit (12–01–334) may be used.
9. End caps (12–01–343) shall be installed on all unused microducts.
10. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.
11. Apply two layers of tape to protect cable under the cable grips.
12. For alternate construction, call for split conduit – 3” (12–51–218), 4” (12–51–219), 5” (12–51–220).
13. Top of conduit may be sealed with polyurethane expanding foam, (31–53–082). Expanding foam must be used with dispensing gun, (85–20–073).

		Std. / Stk. No.	Description 18 30 01 **	01
5	A	17 52 219	Downlead Clamp	10
	B	23 67 500	Banding Clamp, w/ ⅝” Bolt	10
@	C	22 12 084	Banding, Stainless Steel	Ft.
1	D	40 54 480	Coil Bracket	1
	E	17 60 734	Splice Protector Sleeve	10
	F	40 54 478	Splice Enclosure	1
	G	40 54 479	Furcation Kit (for OPGW)	1
	H	40 54 481	Connector Kit, OPGW	1
	I	23 52 024	Machine Bolt, Galv., ½” x 1 ¼”, w/Nut	2
	J	23 67 499	Banding Clamp, with ⅝” Stud and Nut	2
@	K	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
	L	23 66 027	Washer, Square, for ⅝” bolt	2
	M	17 04 247	Connector Kit , UG Fiber Optic Cable	1
	N	12 51 254	Bell end fitting	1
@	O	12 01 230	Conduit, 1 ½” PVC, Schedule 40, 10’	Ft.
3	P	27 60 035	Strap, Iron Hanger, 50’Coil	1
	Q	12 01 278	4” Sch. 80 PVC, 10’ Length	1
	R	12 51 176	4” Sch. 40 Bend, 36” Radius	1
	S	23 66 135	Washer, Lock, Double Coil, ¾”	1
	T	23 66 031	Washer, Square for ¾” bolt	1
	U	23 52 254	Mach. Bolt, Galv., ¾” x 16”	1
	V	23 59 095	Eyelet, for ¾” Bolt	1
	W	23 59 042	Extension Link,6”	1
	X	23 68 732	Bolted Deadend	1
	Y	17 52 217	Clamp for bonding OPGW Static to Pole Ground	1

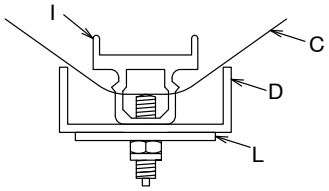




Detail "1"
Fiber Optic Splice Enclosure
Detail



Detail "2"
ADSS Downlead Clamp
Assembly

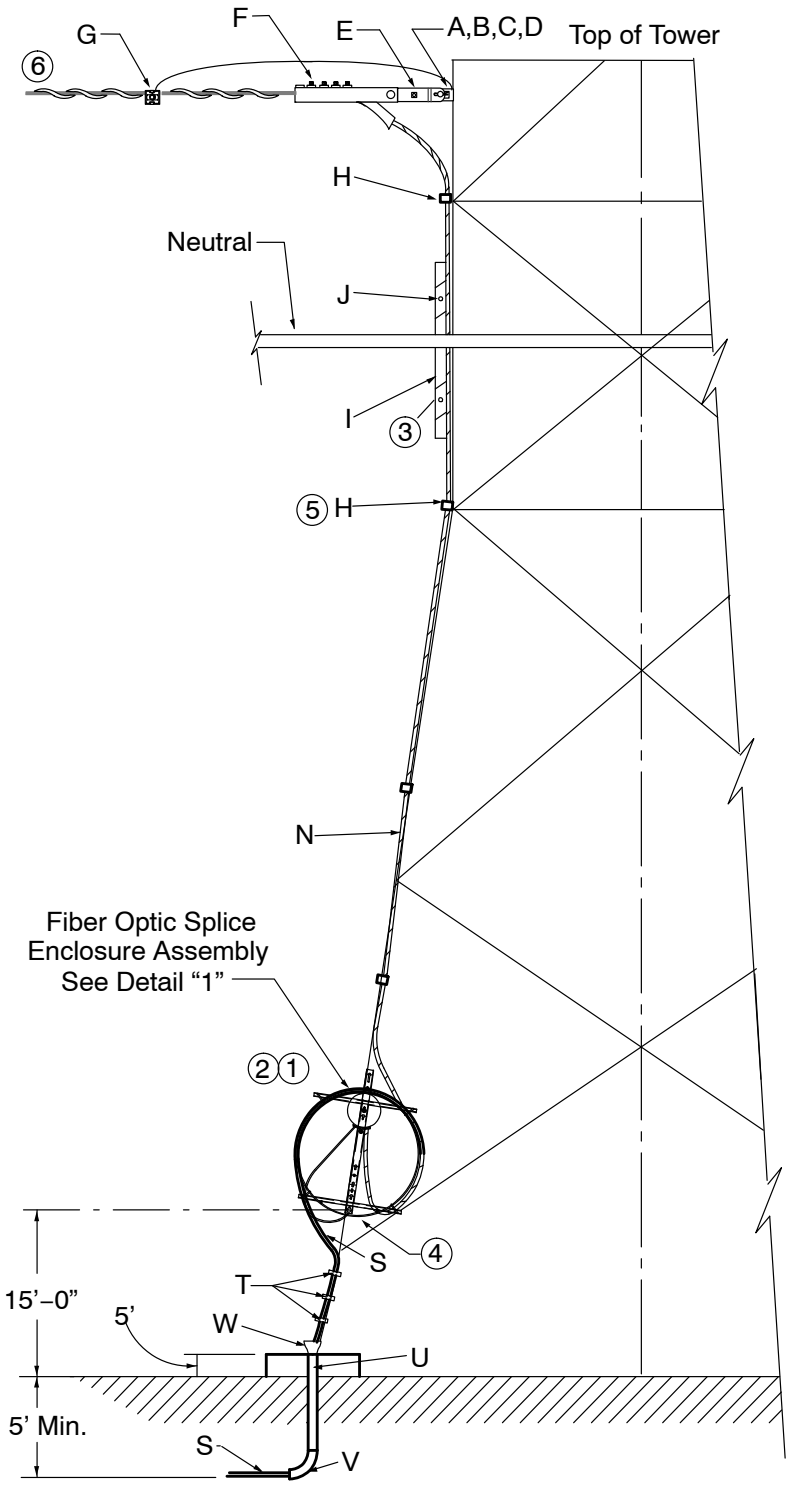


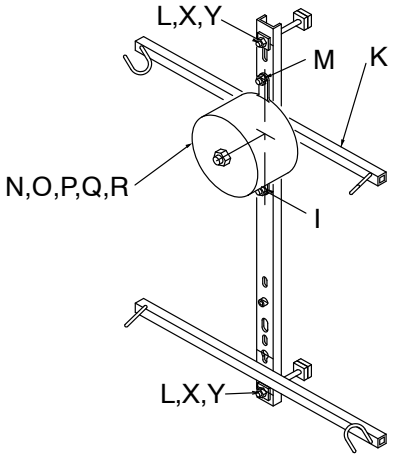
Detail "3"
Splice Enclosure Attachment
Without Bracket

NOTES:

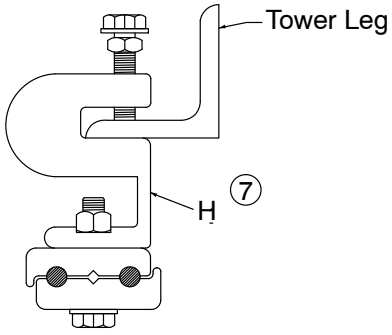
1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket. Wrap HDPE conduit 3/4 turn (opening points down) around coil bracket.
3. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable within 10’ of pole.
4. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
5. Install downlead clamps every 10’.
6. Refer to installation guide for fiber optic cable stock numbers.
7. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4” HDPE conduit (12–01–334) may be used.
8. End caps (12–01–343) shall be installed on all unused microducts.
9. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.
10. Apply two layers of tape to protect cable under the cable grips.
11. For alternate construction, call for split conduit – 3” (12–51–218), 4” (12–51–219), 5” (12–51–220).
12. Top of conduit may be sealed with polyurethane expanding foam, (31–53–082). Expanding foam must be used with dispensing gun, (85–20–073).

		Std. / Stk. No.	Description 18 30 02 **	01	02
4	A	17 52 219	Downlead Clamp	10	10
	B	23 67 500	Banding Clamp, with ⅝” Bolt	10	10
@	C	22 12 084	Banding, Stainless Steel	Ft.	Ft.
1	D	40 54 480	Coil Bracket	1	1
	E	17 60 734	Splice Protector Sleeve	10	10
	F	40 54 478	Splice Enclosure	1	1
	G	17 62 293	Connector Kit, 48–ct ADSS	1	
		17 62 296	Connector Kit, 72–ct ADSS		1
	H	23 52 024	Machine Bolt, Galv., ½” x 1 ¼”, w/Nut	2	2
	I	23 67 499	Banding Clamp, with ⅝” Stud and Nut	2	2
@	J	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.	Ft.
	K	12 51 254	Bell end fitting	1	1
	L	23 66 027	Washer, Square, for 5/8” bolt	2	2
	M	12 01 278	4” Sch. 80 PVC, 10’ Length	1	1
	N	12 51 176	4” Sch. 40 Bend, 36” Radius	1	1
	O	23 68 747	Formed Wire Deadend, 48–ct ADSS	1	
		23 68 778	Formed Wire Deadend, 72–ct ADSS		1
	P	16 01 647	ID Tag, ADSS	1	1
	Q	40 89 494	Nylon Zip Tie	2	2
	R	17 04 247	Connector Kit, UG Fiber Optic Cable	1	1
	S	23 66 135	Washer, Lock, Double Coil, ¾”	1	1
	T	23 66 031	Washer, Square for ¾” bolt	1	1
	U	23 52 069	Machine Bolt ¾” x 18”	1	1





Detail "1"
Fiber Optic Splice Enclosure Detail

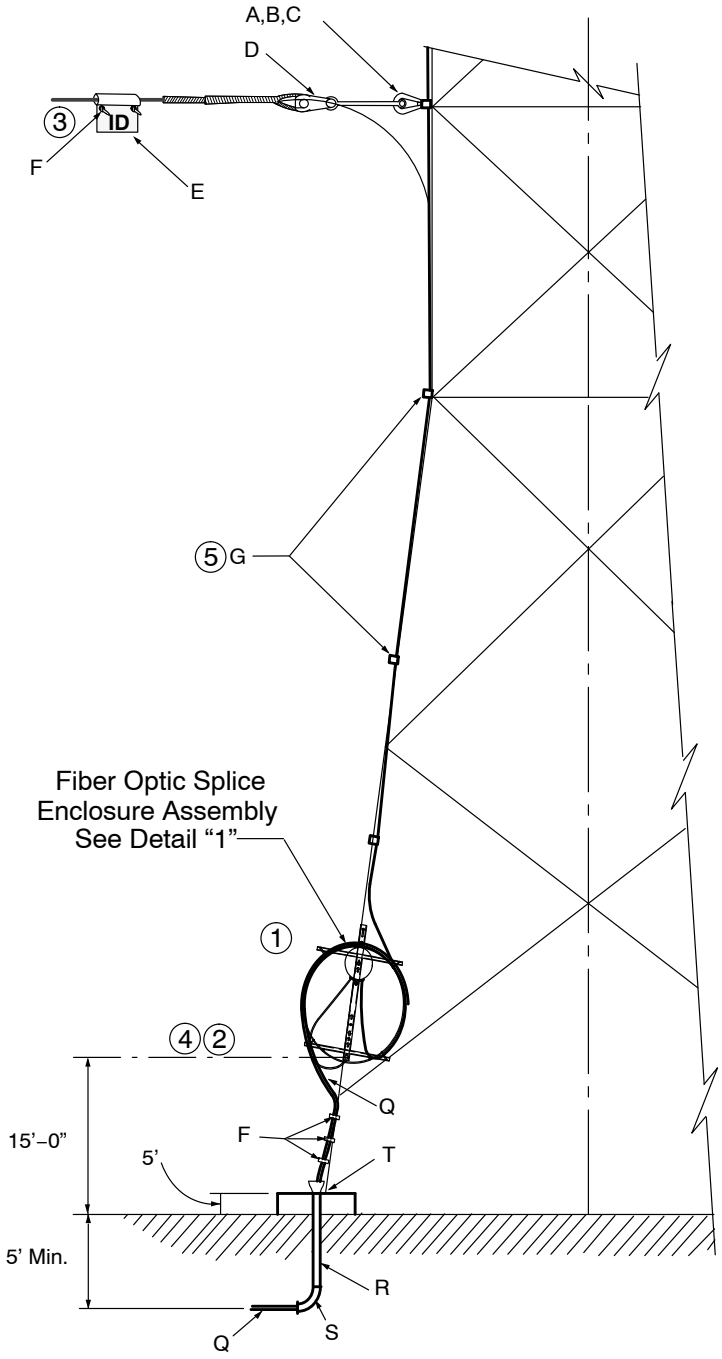


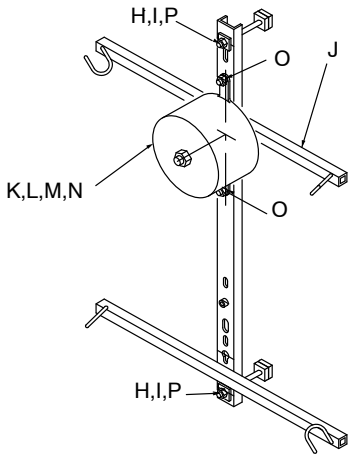
Detail "2"
OPGW Downlead Clamp Detail

NOTES:

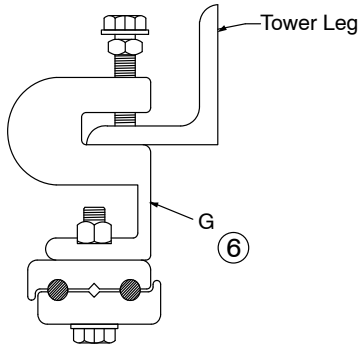
1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket. Wrap HDPE conduit 3/4 turn (opening points down) around coil bracket.
3. To attach iron hanger to pole use #10 self tapping screws.
4. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
5. Install downlead clamps every 10’.
6. Spiral vibration dampers (23–67–319) are used on 350’ and above spans only.
7. For lattice tower web thickness greater than 0.75” use stock code (17–52–228). For web thickness less than 0.75” use stock code (17–52–221).
8. Refer to installation guide for fiber optic cable stock numbers.
9. Where 3–, 4–, or 7–way HDPE Microducts are not feasible, 1 1/4” HDPE conduit (12–01–334) may be used.
10. End caps (12–01–343) shall be installed on all unused microducts.
11. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)–896–0662.
12. Apply two layers of tape to protect cable under the cable grips.
13. For alternate construction, call for split conduit – 3” (12–51–218), 4” (12–51–219), 5” (12–51–220).
14. Top of conduit may be sealed with polyurethane expanding foam, (31–53–082). Expanding foam must be used with dispensing gun, (85–20–073).

		Std./Stk No.	Description 18 40 01 **	01
	A	23 66 135	Washer, Lock, Double Coil, ¾”	1
	B	23 66 031	Washer, Square for ¾” bolt	1
	C	23 52 254	Mach. Bolt, Galv., ¾” x 16”	1
	D	23 59 095	Eyelet, for ¾” Bolt	1
	E	23 59 042	Extension Link, 6”	1
	F	23 68 732	Bolted Deadend	1
	G	17 52 217	Clamp for bonding OPGW Static to Pole Ground	1
@5,7	H	17 52 228	Downlead Clamp	10
		17 52 221	Downlead Clamp	10
	I	12 01 230	Conduit, 1 ½ ” PVC, Schedule 40, 10’	Ft.
	J	27 60 035	Strap, Iron Hanger	2
1	K	40 54 480	Coil Bracket	1
	L	23 52 200	Machine bolt, Galv., ⅝” x 4”, w/Nut	2
	M	23 52 031	Mach. Bolt, Galv., ½” x 3”, w/Nut	2
	N	40 54 478	Splice Enclosure	1
	O	17 60 734	Splice Protector Sleeve	10
	P	17 04 247	Connector Kit, Underground Fiber Optic	1
	Q	40 54 481	Connector Kit, OPGW	1
	R	40 54 479	Furcation Kit (for OPGW)	2
@	S	12 01 341	HDPE Microduct, 4–Way, w/ 20 AWG Cu Tracer Wire	Ft.
	T	40 89 494	Tie, Nylon, Self Locking, UV Protected	3
	U	12 01 278	4” Sch. 80 PVC 10’ Length	1
	V	12 51 176	4” Sch. 40 Bend, 36” Radius	1
	W	12 51 254	Bell end fitting	1
	X	23 66 027	Washer, Square for ⅝” bolt	2
	Y	23 65 043	Nut, Lock for ⅝” bolt, Galv.	2





Detail "1"
Fiber Optic Splice Enclosure Detail



Detail "2"
ADSS Downlead Clamp Detail

NOTES:

1. Top of coil bracket must be installed 40” or greater from Neutral or closest conductor.
2. Coil 100’ of extra fiber optic cable around coil bracket. Wrap HDPE conduit 3/4 turn (opening points down) around coil bracket.
3. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable within 10’ of pole.
4. Bottom loop of coiled fiber optic cable shall be located a minimum of 15’ above ground.
5. Install downlead clamps every 10’.
6. For lattice tower web thickness greater than 0.75” use stock code (17−52−228). For web thickness less than 0.75” use stock code (17−52−221).
7. Refer to installation guide for fiber optic cable stock numbers.
8. Where 3−, 4−, or 7−way HDPE Microducts are not feasible, 1 1/4” HDPE conduit (12−01−334) may be used.
9. End caps (12−01−343) shall be installed on all unused microducts.
10. For any splicing or network communication issues please contact the Network Operating Center (NOC) at (866)−896−0662.
11. Apply two layers of tape to protect cable under the cable grips.
12. For alternate construction, call for split conduit − 3” (12−51−218), 4” (12−51−219), 5” (12−51−220).
13. Top of conduit may be sealed with polyurethane expanding foam, (31−53−082). Expanding foam must be used with dispensing gun, (85−20−073).

		Std. / Stk. No.	Description 18 40 02 **	01	02
	A	23 66 135	Washer, Lock, Double Coil ¾ ”	1	1
	B	23 66 031	Washer, Square for ¾ ” bolt	1	1
	C	23 52 254	Mach. Bolt, Galv., ¾ ” x 16”	1	1
	D	23 68 747	Formed Wire Deadend, 48−ct ADSS	1	
		23 68 778	Formed Wire Deadend, 72−ct ADSS		1
	E	16 01 647	ID Tag, ADSS	1	1
	F	40 89 494	Nylon Zip Tie	5	5
@5,7	G	17 52 228	Downlead Clamp	10	10
		17 52 221	Downlead Clamp	10	10
	H	23 65 043	Nut, Lock, for ⅝ ” Bolt, Galv.	2	2
	I	23 66 027	Washer,Square, for ⅝” Bolt	2	2
1	J	40 54 480	Coil Bracket	1	1
	K	17 60 734	Splice Protector Sleeve	10	10
	L	40 54 478	Splice Enclosure	1	1
	M	17 62 293	Connector Kit, 48−ct ADSS	1	
		17 62 296	Connector Kit, 72−ct ADSS		1
	N	17 04 247	Connector Kit , UG Fiber Optic Cable	1	
	O	23 52 024	Machine Bolt, Galv., ½ ” x 1 ¼ ”, w/ Nut	2	2
	P	23 52 200	Machine Bolt, Galv., ⅝ ” x 4”, w/ Nut	2	2
@	Q	12 01 341	HDPE Microduct, 4−Way, w/ 20 AWG Cu Tracer Wire	Ft.	Ft.
	R	12 01 278	4” Sch. 80 PVC, 10’ Length	1	1
	S	12 51 176	4” Sch. 40 Bend, 36” Radius	1	1
	T	12 51 254	Bell end fitting	1	1