

STANDARD DRAWINGS: PART 3

TRANSMISSION LINES WOOD POLE STRUCTURES



WAPA 6000 Series Drawings for Wood Structures - September 2026

NO.	WAPA Drawing No.		Rev.	Date	Format	Comments	Drawing Title
1	41	6000	D	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6107 (3A-1) (note 7) (note 16)	TYPE 3A 69 AND 115KV MEDIUM ANGLE STRUCTURE
2	41	6001	D	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6108 (3AB-1) (note 7) (note 16)	TYPE 3AB 69 AND 115KV MEDIUM ANGLE STRUCTURE
3	41	6002	D	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6127 (3AC-1) (note 16)	TYPE 3AC 69 AND 115KV SUSPENSION STRUCTURE
4	41	6003	D	08/24/2026	CAE	Historical Reference (note 16)	TYPE 3AD 69 AND 115KV SUSPENSION STRUCTURE
5	41	6004	C	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6126 (3DE-1) (note 16)	TYPE 3DE 69 AND 115KV 3-POLE SPECIAL DEAD-END STRUCTURE
6	41	6005	B	03/02/2011	CAE		4SWT 115KV DISCONNECTING SWITCH STRUCTURE
7	41	6006	C	09/01/2026	CAE	Historical Reference – New Design Standard Drawings 41 6159 and 41 6169 (HS-1) (note 16)	TYPE HS 138 AND 161KV SUSPENSION STRUCTURE
8	41	6007	C	09/01/2026	CAE	Historical Reference – New Design Standard Drawings 41 6159 and 41 6129 (HSB-1) (note 16)	TYPE HSB 138 AND 161KV SUSPENSION STRUCTURE
9	41	6008	D	08/24/2026	CAE	Historical Reference (note 16)	TYPE 3AC 138 AND 161KV SUSPENSION STRUCTURE
10	41	6009	C	08/24/2026	CAE	Historical Reference (note 16)	TYPE 3AD 138 AND 161KV SUSPENSION STRUCTURE
11	41	6010	E	08/24/2026	CAE	Historical Reference – New Design Std Dwgs 41 6117 (69KV HS-1) & 41 6122 (115KV HS-1) (note 16)	TYPE HS 69 AND 115KV SUSPENSION STRUCTURE
12	41	6011	E	08/26/2026	CAE	Historical Reference – New Design Standard Drawings 41 6123 (69 and 115KV HSB-1) (note 16)	TYPE HSB 69 AND 115KV SUSPENSION STRUCTURE
13	41	6012	E	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6128 (HSB-1) (Note 2) (note 16)	TYPE HSB 230KV SUSPENSION STRUCTURE
14	41	6013	F	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6103 (3A-1) (note 7) (note 16)	TYPE 3A 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE
15	41	6014	F	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6104 (3AB-1) (note 7) (note 16)	TYPE 3AB 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE
16	41	6015	E	08/25/2026	CAE	Historical Reference – New Design Standard Drawings 41 6131-1 and 41 6131-2 (3AC-1) (note 16)	TYPE 3AC, 230KV SUSPENSION STRUCTURE
17	41	6016	D	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6119 (HA-GL) (GLULAM) (note 16)	TYPE 3AD 230KV SUSPENSION STRUCTURE
18	41	6017	C	08/24/2026	CAE	Historical Reference (note 16)	TYPE 3T 138 AND 161KV 3-POLE TENSION STRUCTURE
19	41	6018	G	08/25/2026	CAE	Historical Reference – New Design Std. Dwgs 41 6118, 41 6130-1, 41 6130-2, 41 6134, 41 6158 (3TA-1) (note 16)	TYPE 3TA, 69, 115, 138, 161 AND 230KV 3-POLE TENSION STRUCTURE
20	41	6019	D	08/24/2026	CAE	Historical Reference (note 16)	SELECTION AND INSTALLATION DETAIL FOR CROSSARMS GRADED UNDER WCLA GRADING RULES
21	41	6020	C	08/25/2026	CAE	Historical Reference (note 16)	138, 161 & 230KV SELECTION AND INSTALLATION DETAIL FOR CROSSARMS GRADED UNDER WWPA GRADING RULES
22	41	6021	D	08/25/2026	CAE	Historical Reference (note 16)	69 AND 115KV, 2 AND 3 POLE STRUCTURE DRILLING AND GAINING DETAILS WITH OGW-30 DEGREE PROTECTIVE ANGLE
23	41	6022	C	08/24/2026	CAE	Historical Reference (note 16)	DRILLING AND GAINING DETAILS 69KV AND 115KV, 3AD STRUCTURE
24	41	6023	C	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6114 (note 16)	CROSSARM DRILLING DETAILS 69 AND 115KV, HS AND HSB STRUCTURES
25	41	6024	D	08/24/2026	CAE	Historical Reference (note 16)	138, 161, & 230 KV 2 & 3-POLE STRUCTURES DRILLING AND GAINING DETAILS WITH OVERHEAD GROUND WIRE
26	41	6025	C	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6114 (note 16)	CROSSARM DRILLING DETAILS 138 AND 161KV HS AND HSB STRUCTURES
27	41	6026	C	08/24/2026	CAE	Historical Reference (note 16)	CROSSARM DRILLING DETAILS 138 AND 161KV 3AC AND 3AD STRUCTURES
28	41	6027	D	08/24/2026	CAE	Historical Reference – New Design Standard Drawing 41 6114 (note 16)	CROSSARM DRILLING DETAILS 230KV HS AND HSB STRUCTURES
29	41	6028	D	08/24/2026	CAE	Historical Reference (note 16)	CROSSARM DRILLING DETAILS 230KV 3AC & 3AD STRUCTURES
30	41	6029	D	08/20/2026	CAE	Historical Reference (note 16)	X-BRACE DETAILS
31	41	6030	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE A FOUR-WAY STRAIN BAND
32	41	6031	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE B FOUR-WAY STRAIN BAND
33	41	6032	C	08/20/2026	CAE	Historical Reference (note 16)	POLE TO BAND-PLAIN
34	41	6033	C	08/20/2026	CAE	Historical Reference (note 16)	POLE TOP BANDS FOR OVERHEAD GROUND WIRES
35	41	6034	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE A POLE TOP BAND FOR OVERHEAD GROUND WIRE
36	41	6035	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE B POLE TOP BAND FOR OVERHEAD GROUND WIRE
37	41	6036	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE C POLE TOP BAND FOR OVERHEAD GROUND WIRE

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NO.	WAPA Drawing No.		Rev.	Date	Format	Comments	Drawing Title
38	41	6037	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE D POLE TOP BAND FOR OVERHEAD GROUND WIRE
39	41	6038-1	A	08/20/2026	CAE	Historical Reference – Split 41 6038 into 2 new drawings (note 16)	69 AND 115KV H-FRAME POLE HARDWARE DETAILS (SHEET 1 OF 2)
40	41	6038-2	A	08/20/2026	CAE	Historical Reference – Split 41 6038 into 2 new drawings (note 16)	69 AND 115KV H-FRAME POLE HARDWARE DETAILS (SHEET 2 OF 2)
41	41	6039-1	B	08/20/2026	CAE	Historical Reference – Split 41 6039 into 2 new drawings (note 16)	138 AND 161KV H FRAME POLE HARDWARE DETAILS (SHEET 1 OF 2)
42	41	6039-2	B	08/20/2026	CAE	Historical Reference – Split 41 6039 into 2 new drawings (note 16)	138 AND 161KV H FRAME POLE HARDWARE DETAILS (SHEET 2 OF 2)
43	41	6040	D	08/20/2026	CAE	Historical Reference (note 16)	230KV H-FRAME POLE HARDWARE DETAILS
44	41	6041	D	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6133 (note 16)	69, 115, 138, 161, & 230KV H-FRAME ANGLE IRON DETAILS
45	41	6042	E	08/24/2026	CAE	Historical Reference (note 16)	WOOD-POLE DEAD END DETAILS FOR OVERHEAD GROUND WIRE
46	41	6043	D	08/20/2026	CAE	Historical Reference (note 16)	DETAILS OF POLE ANCHOR
47	41	6044	C	08/20/2026	CAE	Historical Reference (note 16)	ANGLE BRACKET
48	41	6045	C	08/24/2026	CAE	Historical Reference (note 16)	SWINGING ANGLE BRACKET
49	41	6046	C	08/20/2026	CAE	Historical Reference (note 16)	SWINGING ANGLE BRACKET FOR TYPE 3AC AND 3AD 230KV STRUCTURES
50	41	6047	F	01/06/2005	CAE		GUY ASSEMBLY AND DETAILS
51	41	6048	C	08/25/2026	CAE	Historical Reference (note 16)	TRANSMISSION LINES GUY ARRANGEMENT AND DETAILS WITHOUT OVERHEAD GROUND WIRE 161KV.
52	41	6049	D	07/15/2003	CAE		CONCRETE ANCHORS
53	41	6050	D	07/15/2003	CAE		ANCHOR ROD GROUTING DETAILS
54	41	6051	C	05/28/2014	CAE		GUY ARRANGEMENT 2-POLE TANGENT STRUCTURES
55	41	6052	C	04/05/2001	CAE		GUY ARRANGEMENT 2-POLE ANGLE STRUCTURES
56	41	6053	H	06/27/2025	CAE		GUY ARRANGEMENT FOR TYPE 3A AND 3AB STRUCTURES WITH OVERHEAD GROUND WIRES
57	41	6054	D	03/24/2021	CAE		GUY ARRANGEMENT FOR TYPE 3T, 3TX, 3AC AND 3AD STRUCTURES WITH OVERHEAD GROUND WIRES
58	41	6055	E	05/28/2014	CAE		GUY ARRANGEMENT FOR TYPE 3TA STRUCTURES
59	41	6056	B	05/28/2014	CAE		GUY ARRANGEMENT FOR TYPE 4SWT 115KV DISCONNECTING SWITCH STRUCTURE
60	41	6057	B	05/28/2014	CAE		TYPES SS, SSA, & SAB 2.4 & 34.5KV TANGENT, SMALL ANGLES, & LARGE ANGLE STRUCTURES
61	41	6058	B	05/28/2014	CAE		TYPES SD AND ST 2.4 & 34.5KV DEADEND, TANGENT & ANGLE TENSION STRUCTURES
62	41	6059	B	05/28/2014	CAE		GUYING REQUIREMENTS FOR LINE POST CONSTRUCTION
63	41	6060	B	08/24/2026	CAE	Historical Reference (note 16)	EXTENSION BRACKET SAB STRUCTURES
64	41	6061	D	08/24/2026	CAE	Historical Reference (note 16)	TYPE HS - 161KV SUSPENSION STRUCTURE
65	41	6062	B	08/20/2026	CAE	Historical Reference (note 16)	TYPE HST - 161KV SUSPENSION-GROUND WIRE TENSION-STRUCTURE
66	41	6063	B	09/01/2026	CAE	Historical Reference – New Design Standard Drawing 41 6171 (3A-2) (note 16)	TYPE 3A - 161KV MEDIUM ANGLE STRUCTURE
67	41	6064	B	08/25/2026	CAE	Historical Reference (note 16)	TYPE 3T - 161KV 3-POLE DEAD END STRUCTURE
68	41	6065	C	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6133 (note 16)	161KV H-FRAME ANGLE IRON DETAILS
69	41	6066	C	08/20/2026	CAE	Historical Reference (note 16)	69 & 115KV 2 & 3 POLE STRUCTURES DRILLING & GAINING DETAILS WITHOUT OGW.
70	41	6067	B	5/28/2014	CAE		GUY ARRANGEMENT AND DETAILS WITH OVERHEAD GROUND WIRE 161KV
71	41	6068	C	08/20/2026	CAE	Historical Reference (note 16)	115KV H-FRAME STRUCTURES DRILLING AND GAINING DETAILS WITH OGW - 39 DEGREE PROTECTIVE ANGLE
72	41	6069	B	05/28/2014	CAE		TYPE HSWT - WOOD FRAME - 69KV AIR BREAK SWITCH STRUCTURE
73	41	6070	C	08/24/2026	CAE	Historical Reference (note 16) no OGW	GUY ARRANGEMENT - ASSEMBLY 3-POLE STRUCTURES-HEAVY GUYING
74	41	6071	A	05/28/2014	CAE		GUYING REQUIREMENTS FOR SINGLE POLE CONSTRUCTION WITH OVERHEAD GROUND WIRE
75	41	6072-1	A	08/24/2026	CAE	Historical Reference (note 16)	69KV AND 115KV TWO- AND THREE-POLE STRUCTURES OVERHEAD GROUND WIRE DETAILS (SHEET 1 OF 2)
76	41	6072-2	A	08/19/2026	CAE	Historical Reference (note 16)	69KV AND 115KV TWO- AND THREE-POLE STRUCTURES OVERHEAD GROUND WIRE DETAILS (SHEET 2 OF 2)
77	41	6073	C	08/24/2026	CAE	Historical Reference (note 16)	GUY ARRANGEMENT-ASSEMBLY 3-POLE STRUCTURES LIGHT GUYING
78	41	6074	C	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6118 (3TA-1) (note 16)	TYPE 3AT-69 AND 115KV LARGE ANGLE STRUCTURE
79	41	6075-1	A	08/24/2026	CAE	Historical Reference (note 16) Split 41 6075 into 2 new drawings	TYPE 3T 69 AND 115KV 3-POLE TENSION STRUCTURE (SHEET 1 OF 2)
80	41	6075-2	A	08/18/2026	CAE	Historical Reference (note 16) Split 41 6075 into 2 new drawings	TYPE 3T 69 AND 115KV 3-POLE TENSION STRUCTURE (SHEET 2 OF 2)
81	41	6076	D	08/24/2026	CAE	Historical Reference (note 16)	CROSS ARM DRILLING DETAILS 69 & 115KV 3T & 3TX STRUCTURES

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82	41	6077	B	05/28/2014	CAE		LONG SPAN STRUCTURE TYPE HT-33 -44KV
83	41	6078	C	08/20/2026	CAE	Historical Reference (note 16)	DRILLING & GAINING DETAILS 161KV H-FRAME POLES
84	41	6079-1	A	08/24/2026	CAE	Historical Reference (note 16) Split 41 6079 into 2 new drawings	GROUNDING AND COUNTERPOSE DETAILS WITH OVERHEAD GROUND WIRE - 161KV (SHEET 1 OF 2)
85	41	6079-2	A	08/24/2026	CAE	Historical Reference (note 16) Split 41 6079 into 2 new drawings	GROUNDING AND COUNTERPOSE DETAILS WITH OVERHEAD GROUND WIRE - 161KV (SHEET 1 OF 2)
86	41	6080	B	08/25/2026	CAE	Historical Reference – New Design Std. Drawings 41 6115 (SS-1), 41 6120 (SSA-1 and SLA-1) (note 16)	TYPE SS, SSA, AND SLA 69 AND 115KV TANGENT, SMALL ANGLE AND LARGE ANGLE STRUCTURES
87	41	6081	B	08/25/2026	CAE	Historical Reference - New Design Std. Drawings 41 6116 (ST-1), 41 6121 (SD-1) (note 16)	TYPE SD AND ST 69 AND 115KV DEADEND, TANGENT AND ANGLE TENSION STRUCTURES
88	41	6082	C	08/24/2026	CAE	Historical Reference (note 16) no OGW	GUY ARRANGEMENT-ASSEMBLY SINGLE POLE ANGLE STRUCTURES
89	41	6083	C	08/24/2026	CAE	Historical Reference (note 16) no OGW	GUY ARRANGEMENT-ASSEMBLY SINGLE POLE ANGLE STRUCTURES
90	41	6084	B	05/28/2014	CAE		44KV SINGLE POLE STRUCTURES OVERHEAD GROUND WIRE DETAILS
91	41	6086	B	05/28/2014	CAE		GUY ARRANGEMENT 115KV GUY ARRANGEMENT FOR TYPE HA STRUCTURE WITH GUY STUB AND OVERHEAD GROUND WIRE
92	41	6087	D	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6173 (HTR-1) (Note 16)	69 AND 115KV TYPE HTR TRANSPOSITION STRUCTURE
93	41	6088	C	08/25/2026	CAE	Historical Reference – New Design Standard Drawing 41 6124 (HA-1) (Note 16)	TYPE HA 69 and 115KV Small Angle Suspension Structure
94	41	6089	B	09/24/2012	CAE		TYPE HSWT - WOOD FRAME 69KV STEEL DETAILS
95	41	6090	C	08/20/2026	CAE	Historical Reference (note 16)	CROSSARM DRILLING DETAILS 69KV & 115KV, HA AND HAB STRUCTURES
96	41	6091	C	08/20/2026	CAE	Historical Reference (note 16)	SWINGING ANGLE BRACKET
97	41	6092	C	05/28/2014	CAE		DISCONNECTING SWITCH STRUCTURE 115KV STEEL DETAILS
98	41	6093	C	08/24/2026	CAE	Historical Reference (note 16)	69 AND 115KV 3TX 3-POLE LONG SPAN STRUCTURE
99	41	6094	B	05/28/2014	CAE		CONDUCTOR ARRANGEMENT H-FRAME TRANSPOSITION
100	41	6095	B	05/28/2014	CAE		GUY ARRANGEMENT FOR TYPE 3DE AND 3BT/4BT STRUCTURES WITH OVERHEAD GROUND WIRES
101	41	6096	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE HAB 69 AND 115KV SMALL ANGLE SUSPENSION STRUCTURE
102	41	6097	C	08/20/2026	CAE	Historical Reference (note 16)	CROSSARM DRILLING DETAILS 138KV & 161KV, 3T AND 3TX STRUCTURES
103	41	6098	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE SD - 13.2KV LONG SPAN CONSTRUCTION
104	41	6099	D	06/22/2022	CAE		TYPE 3AT STRUCTURES WITH OVERHEAD GROUND WIRES
105	41	6100	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE SS - 33KV FLAT TOP CONSTRUCTION
106	41	6101	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE SD - 33KV FLAT TOP CONSTRUCTION
107	41	6102	C	08/20/2026	CAE	Historical Reference (note 16)	TYPE HSWT - 33 AND 44KV AIR BREAK SWITCH STRUCTURE
108	41	6103	B	12/28/2005	CAE	(note 7)	TYPE 3A-1 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE
109	41	6104	C	12/28/2005	CAE	(note 7)	TYPE 3AB-1 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE
110	41	6105	B	03/02/2011	CAE		TYPE 4S AND 4S-1 69 AND 115KV SUSPENSION STRUCTURE
111	41	6106	B	07/15/2003	CAE		DOUGLAS FIR POLES, DRILLING DETAILS
112	41	6107	B	01/06/2005	CAE	(notes 7,8,9,10,11)	TYPE 3A-1, 69 AND 115KV MEDIUM ANGLE STRUCTURE
113	41	6108	C	08/24/2006	CAE	(notes 7,8,9,10,11)	TYPE 3AB-1, 69 AND 115KV MEDIUM ANGLE STRUCTURE
114	41	6109	B	03/02/2011	CAE		TYPE 3BT/4BT 69 AND 115KV BRANCH LINE STRUCTURE
115	41	6110	B	06/09/2011	CAE		ELECTRICAL DISTRIBUTION SYSTEMS STANDARD CONSTRUCTION DETAILS 2300 VOLTS
116	41	6111	B	05/28/2014	CAE		ELECTRICAL DISTRIBUTION SYSTEMS STANDARD CONSTRUCTION DETAILS 2300 VOLTS
117	41	6112	B	05/28/2014	CAE		ELECTRICAL DISTRIBUTION SYSTEMS STANDARD CONSTRUCTION DETAILS
118	41	6113		08/30/1996	CAE		CROSSARM DRILLING DETAILS HS-1 AND HSB-1 STRUCTURES W/ ADJUSTABLE SPACER FITTINGS
119	41	6114	B	01/03/2022	CAE		CROSSARM DRILLING DETAILS HS and HSB STRUCTURES W/ FIXED SPACER FITTINGS
120	41	6115	B	04/14/2011	CAE	Added shield wire support bracket	TYPE SS-1 69 AND 115KV TANGENT SUSPENSION STRUCTURE
121	41	6116	B	10/17/2005	CAE		TYPE ST-1 AND LST-1 69KV AND 115KV TANGENT AND ANGLE TENSION STRUCTURES
122	41	6117	A	04/14/2005	CAE	(notes 1,2,3,4,5,6,8,10,11,13)	TYPE HS-1 69KV SUSPENSION STRUCTURE
123	41	6118	B	05/08/2006	CAE	(notes 8,9,10,11)	TYPE 3TA-1 69 AND 115KV 3-POLE TENSION STRUCTURE

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NO.	WAPA Drawing No.		Rev.	Date	Format	Comments	Drawing Title
124	41	6119	B	04/20/2023	CAE	Glulam, replaces 230KV 3AD (41 6016)	TYPE HA-GL 230KV ANGLE SUSPENSION STRUCTURE
125	41	6120		10/18/2005	CAE	(note 17)	TYPE SSA-1, LSSA-1, SLA-1 & LSLA-1 69 AND 115KV SMALL & LARGE ANGLE SUSPENSION STRUCTURES
126	41	6122	F	09/23/2025	CAE	(notes 1,2,3,4,5,6,8,10,11,13)	TYPE HS-1 115KV SUSPENSION STRUCTURE
127	41	6123	C	11/18/2025	CAE	(notes 1,2,3,4,5,8,10,11,13)	TYPE HSB-1 69 AND 115KV SUSPENSION STRUCTURE
128	41	6124	C	07/22/2022	CAE	(notes 8,9,10,13)	TYPE HA-1 69- AND 115KV SMALL ANGLE SUSPENSION STRUCTURE
129	41	6125	A	03/02/2005	CAE		TYPE 3TA-1 STRUCTURES, STANDARD GUY ARRANGEMENT
130	41	6126		02/07/1997	CAE	All voltages	TYPE 3DE-1 3-POLE SPECIAL DEAD END STRUCTURE
131	41	6127	D	03/10/2026	CAE	(notes 8,9,10,11)	TYPE 3AC-1 115KV SUSPENSION STRUCTURE
132	41	6128	E	5/3/2019	CAE	(notes 2,3,4,5,8,10,11)	TYPE HSB-1 230KV SUSPENSION STRUCTURE
133	41	6129	C	03/23/21	CAE	(notes 2,3,4,5,8,10,11)	TYPE HSB-1 161KV SUSPENSION STRUCTURE
134	41	6130_1		12/31/1999	CAE	Split 41 6130 into 2 new drawings	TYPE 3TA-1 230KV 3-POLE TENSION STRUCTURE SHEET 1
135	41	6130_2		12/31/1999	CAE	Split 41 6130 into 2 new drawings	TYPE 3TA-1 230KV 3-POLE TENSION STRUCTURE SHEET 2
136	41	6131_1	B	03/20/2017	CAE	Split 41 6131 into 2 new drawings	TYPE 3AC-1 230KV SUSPENSION STRUCTURE
137	41	6131_2		02/29/2000	CAE	Split 41 6131 into 2 new drawings	TYPE 3AC-1 230KV SUSPENSION STRUCTURE
138	41	6132	A	04/05/2000	CAE		TYPE HS-1A 115KV SUSPENSION STRUCTURE - NO OGW
139	41	6133	G	11/02/2022	CAE		STEEL ANGLE DETAILS FOR WOOD POLE STRUCTURES
140	41	6134	A	07/26/2006	CAE		TYPE 3TA-1 NO OGW 3-POLE TENSION STRUCTURE
141	41	6135		06/10/2002	CAE		TYPE HS-1A SUSPENSION STRUCTURE - NO OGW
142	41	6136		01/20/2005	CAE		CROSSARM DRILLING DETAILS 115KV 3AC-1 STRUCTURE W/ ADJUSTABLE PHASE FITTINGS
143	41	6137		10/07/2004	CAE		TYPE SS-CAP 34.5KV TANGENT CAPACITOR STRUCTURE
144	41	6138	B	06/09/2010	CAE	Added double tee option	TYPICAL DETAILS FOR DEAD END TEES
145	41	6139	A	12/21/2005	CAE		CROSSARM DRILLING DETAILS 69 AND 115KV HA-1 STRUCTURE W/ ADJUSTABLE PHASE FITTINGS
146	41	6140		07/15/2005	CAE	Designed for Wilton temporary tap	TYPE 4SWT 230KV DISCONNECTING SWITCH STRUCTURE - NO OGW
147	41	6141	B	04/20/2023	CAE	Designed for Wilton temporary tap	DISCONNECTING SWITCH STRUCTURE 230-KV STEEL DETAILS
148	41	6142		10/13/2005	CAE	Designed for DCI	TYPE LSS-1 69KV TANGENT SUSPENSION STRUCTURE-LIGHT LOADING
149	41	6143	A	07/22/2010	CAE	Designed for DCI	TYPE LSSA-GL AND LSLA-GL 69KV SMALL & LARGE ANGLE SUSPENSION GLUED LAMINATED WOOD STRUCTURES-LIGHT LOADING
150	41	6144		11/02/2005	CAE	Designed for DCI	TYPE LSD 69KV FLAT TOP SUSPENSION STRUCTURE - LIGHT LOADING
151	41	6145	A	07/22/2010	CAE	Designed for DCI	TYPE LST-GL 69KV TANGENT AND ANGLE TENSION GLUED LAMINATED WOOD STRUCTURE-LIGHT LOADING
152	41	6146		11/17/2005	CAE	Designed for DCI	TYPE LSWT-GL 69KV SWITCH STRUCTURE-GLUED LAMINATED LIGHT LOADING
153	41	6147		11/18/2005	CAE	Designed for DCI	TYPE SBT-1 AND LSBT-1 69KV BRANCH LINE STRUCTURE
154	41	6148		11/17/2005	CAE	Designed for DCI	TYPE LCOT-GL 69KV CUT-OUT STUCTURE LIGHT LOADING-GLUED LAMINATED-
155	41	6149		12/21/2005	CAE		TYPE HA-1 230KV SMALL ANGLE SUSPENSION STRUCTURE
156	41	6150		12/21/2005	CAE		CROSSARM DRILLING DETAILS 230KV HA-1 STRUCTURE WITH ADJUSTABLE PHASE FITTINGS
157	41	6151		12/21/2005	CAE		CROSSARM DRILLING DETAILS 230KV 3AC-1 STRUCTURE WITH ADJUSTABLE PHASE FITTINGS
158	41	6152		2/15/2006	CAE	Tension Dead End Structure used for Cascade Protection (0-10 deg) short pole top, needs guy strain insulators, use 3TD-1 or 3TD-2 for clearance without strain insulators	TYPE 3TD 230KV 3-POLE TENSION DEAD END STRUCTURE
159	41	6153	A	02/28/2006	CAE		TYPICAL DETAILS OF OPTICAL GROUND WIRE SPLICE STRUCTURES
160	41	6154_1	A	03/14/2007	CAE	Tension Angle Dead End Structure (10-90 deg) (note 14)	TYPE 3TAD 230KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 1 of 2
161	41	6154_2	A	03/14/2007	CAE	Tension Angle Dead End Structure (10-90 deg)	TYPE 3TAD 230KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 2 of 2
162	41	6155		04/03/2006	CAE	Tension Angle Dead End Structure (10-90 deg) (note 14)	TYPE 3TAD STRUCTURES STANDARD GUYING ARRANGEMENT
163	41	6156_1	A	03/14/2007	CAE	Tension Angle Dead End Structure (10-90 deg)	TYPE 3TAD 69 AND 115KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 1 of 2
164	41	6156_2	A	03/14/2007	CAE	Tension Angle Dead End Structure (10-90 deg)	TYPE 3TAD 69 AND 115KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 2 of 2
165	41	6157	A	03/10/2026	CAE	Tension Dead End Structure used for Cascade Protection (0-10 deg)	TYPE 3TD 115KV 3-POLE TENSION DEAD END STRUCTURE
166	41	6158		10/26/2006	CAE		TYPE 3TA-1 138KV AND 161KV 3-POLE TENSION STRUCTURE

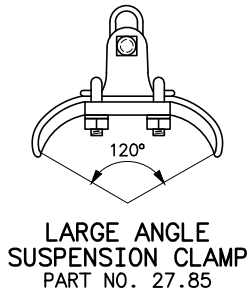
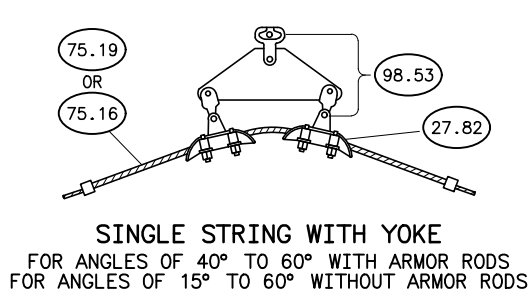
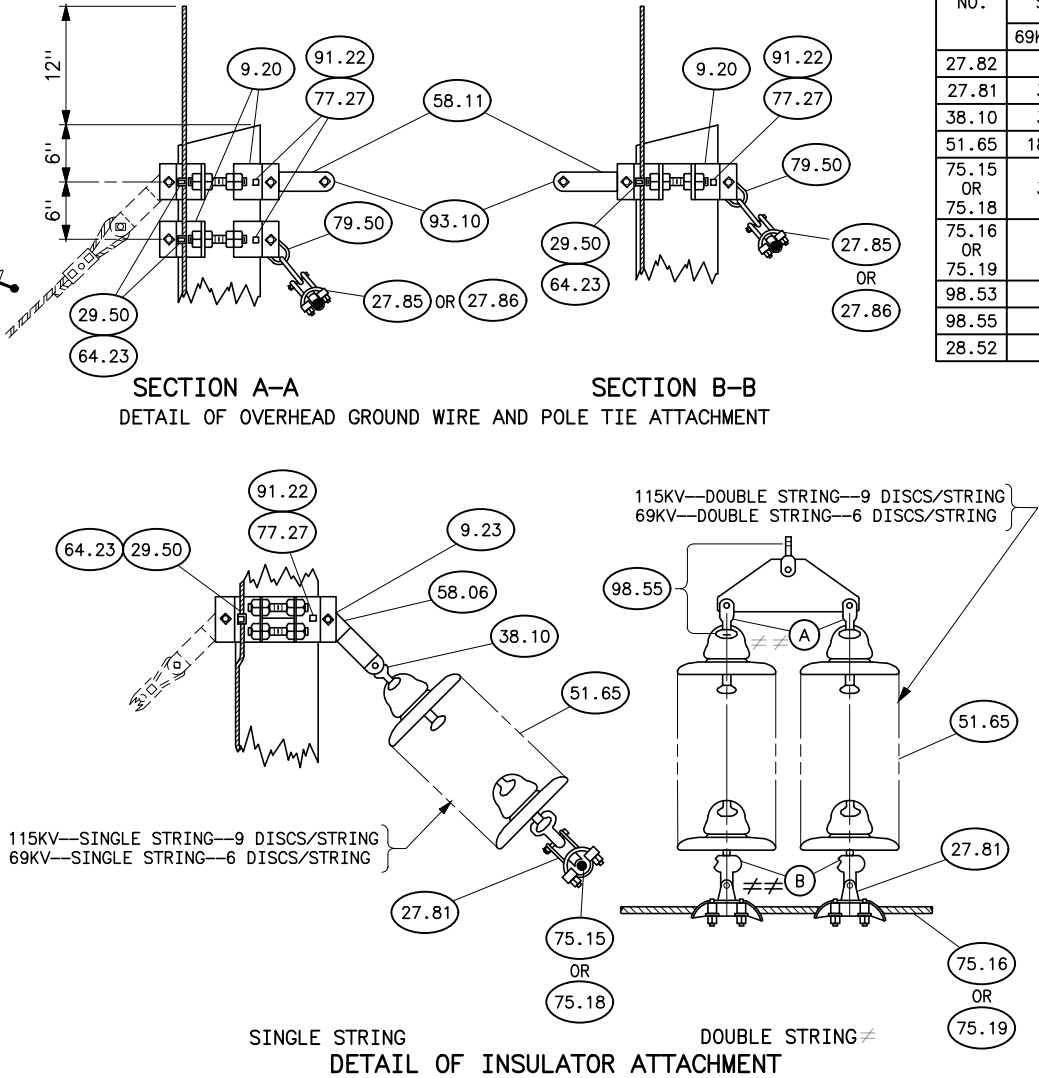
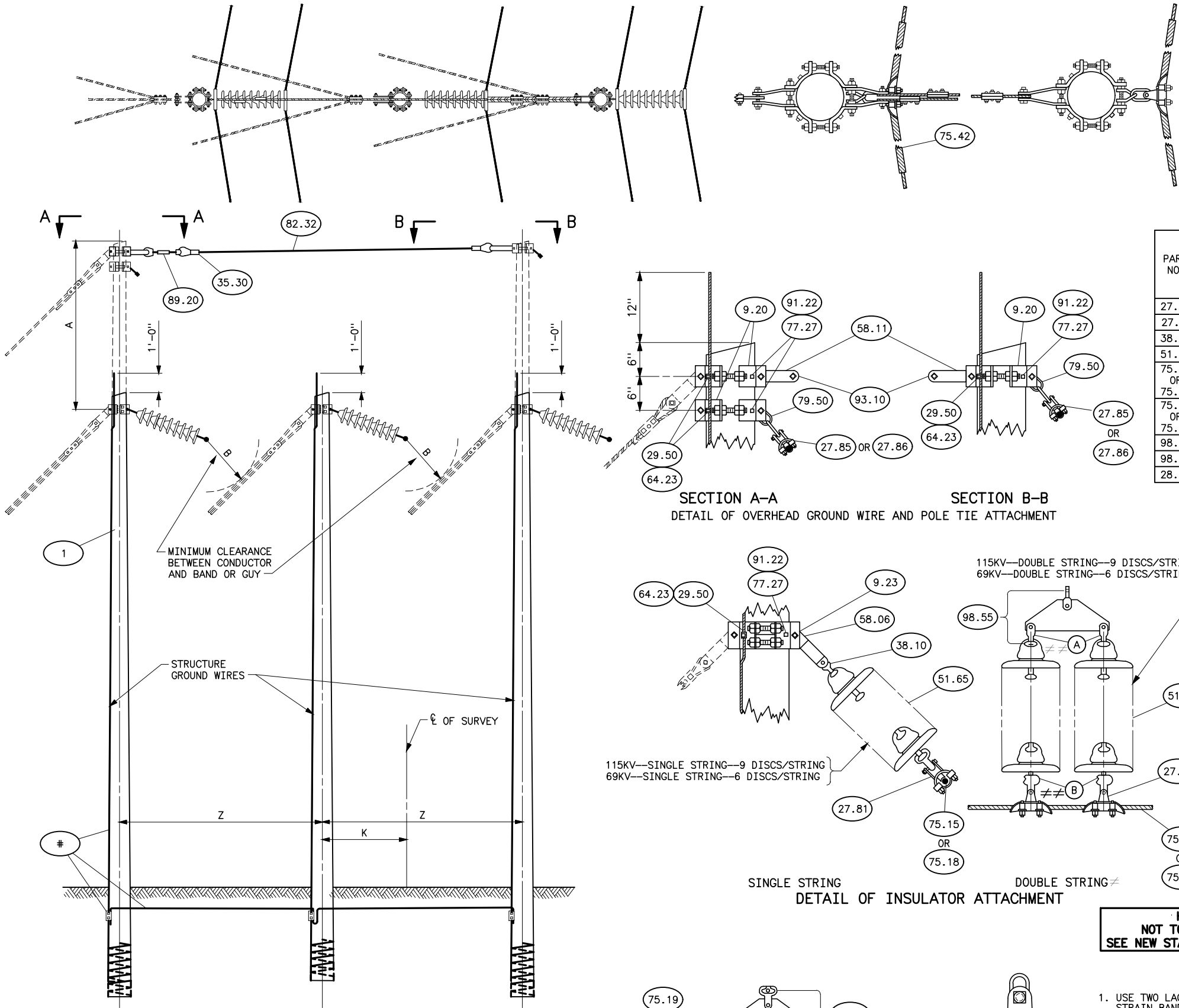
WAPA 6000 Series Drawings for Wood Structures - September 2026

NO.	WAPA Drawing No.		Rev.	Date	Format	Comments	Drawing Title
167	41	6159	B	05/09/2019	CAE	Replaces 41 6006 and 41 6007 for new construction	TYPE HS-1 AND HSB-1 138KV SUSPENSION STRUCTURE
168	41	6160		06/21/2022	CAE	Void	
169	41	6161		02/23/2007	CAE		GUY ARRANGEMENT FOR TYPE HA-1 230KV ANGLE STRUCTURES
170	41	6162		06/21/2022	CAE	Tension Dead End Structure used for Cascade Protection (0-10 deg) with pole bands (note 15)	TYPE 3TD-1 230KV 3-POLE TENSION DEAD END STRUCTURE
171	41	6163		01/27/2011	CAE	Tension Dead End Structure used for Cascade Protection (0-10 deg) with dead end tees (note 15)	TYPE 3TD-2 230KV 3-POLE TENSION DEAD END STRUCTURE
172	41	6164		03/5/2010	CAE		TYPE 3TD-GL 230KV 3-POLE TENSION DEAD-END STRUCTURE
173	41	6165		06/21/2022	CAE		TYPE LSTF-GL 69-KV FLAT TOP TENSION STRUCTURE LIGHT LOADING-GLUED LAMINATED
174	41	6166	A	1/27/2014	CAE	For Vernal-Hayden with shield wire support bracket	TYPE HA-GL 115KV ANGLE SUSPENSION STRUCTURE
175	41	6167		03/20/2011	CAE		TYPE SS-1 1385KV TANGENT ANGLE SUSPENSION STRUCTURE
176	41	6168			Manual	Old Bureau Switch Structure	TYPE 3SWT AND TWO POLES FOR OGW
177	41	6169	A	5/3/2019	CAE	Replace 41 6006 for new construction	TYPE HS-1 161KV SUSPENSION STRUCTURE
178	41	6170		1/9/2018	CAE	3-poles same length, designed for DSWR	Type 3TA-3 161KV 3-POLE TENSION STRUCTURE
179	41	6171	A	06/21/2022	CAE	3-poles same length, designed for DSWR	TYPE 3A-2 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE
180	41	6172		5/3/2019	CAE		TYPE HP2X 115KV DOUBLE CIRCUIT SUSPENSION STRUCTURE
181	41	6173		3/18/2019	CAE	Replaces 41 6087 for new construction	TYPE HTR-1 115KV TRANSPOSITION STRUCTURE
182	41	6174		12/11/2019	CAE	All poles the same height	TYPE 3A-2 69 AND 115KV MEDIUM ANGLE STRUCTURE
183	41	6175		12/11/2019	CAE	All poles the same height	TYPE 3AB-2 69 AND 115KV MEDIUM ANGLE STRUCTURE
184	41	6176	A	07/25/2023	CAE		TYPE HTR-1 230KV TRANSPOSITION STRUCTURE
185	41	6177	B	10/15/2024	CAE		TYPE HLA-GL 230KV LARGE ANGLE SUSPENSION STRUCTURE
186	41	6178		05/11/2021	CAE		TYPE HA-1 138KV SMALL ANGLE SUSPENSION STRUCTURE
187	41	6179		01/03/2022	CAE		TYPE HS-2 230KV LOW TOP SUSPENSION STRUCTURE
188	41	6180	A	02/12/2026	CAE	All poles the same height	TYPE 3AB-2 138, 161 AND 230KV MEDIUM ANGLE STRUCTURE
189	41	6181		07/13/2023	CAE		TYPE HSWT-1 69KV SWITCH STRUCTURE
190	41	6182		05/03/2023	CAE		TYPE HSWT-1 69KV SWITCH BEAM PLAN AND ELEVATION VIEWS
191	41	6183		05/03/2023	CAE		TYPE HSWT-1 69KV SWITCH BEAM STEEL SECTIONS AND DETAILS
192	41	6184		05/03/2023	CAE		TYPE HSWT-1 69KV SWITCH BEAM STEEL SECTIONS AND DETAILS
193	41	6185		04/20/2023	CAE		TYPE SS-2 115KV TANGENT SUSPENSION STRUCTURE
194	41	6186		6/7/2023	CAE	Design to show structures on Tracy-Contra Costa 69kv line	TYPE SS-DELTA 69KV TANGENT SUSPENSION STRUCTURE - NO OPGW
195	41	6187		7/13/2023	CAE	Uses dead-end tees as opposed to pole bands and has equal pole length	TYPE 3TA-3 115KV 3-POLE TENSION STRUCTURE
196	41	6188		7/10/2026	CAE	Single Pole for overhead ground wire only	TYPE SS-OGW TANGENT SUSPENSION STRUCTURE – OGW SUPPORT
		*Notes					
		(1) Added a steel angle for a pole-to-pole tie and OGW attachment (Bed Rail)					
		(2) Lowered x-brace for safer maintenance					
		(3) Changed phase fittings from fixed to adjustable on new construction					
		(4) Changed from solid sawn crossarm to glued laminated crossarm					
		(5) Added pole bottom plate for grounding					
		(6) Added outside knee braces					
		(7) Moved short pole to outside. Used for new T/L structures built after 1985.					
		(8) Added Star lock to drawing					
		(9) Added Dead End Tee option					
		(10) Added Optical Ground Wire reference drawing					
		(11) Added new reference drawings for insulator assemblies					

WAPA 6000 Series Drawings for Wood Structures - September 2026

		(12) Took off a 5 degree offset on middle pole. Was a request by RMR for visual but will work structurally.	
		(13) Increased spacing from crossarm to x-brace to 8 ft on HS-1, 8.5 ft on HA-1 for safer maintenance	
		(14) Added Dead End Tee Details	
		(15) Increased outside pole lengths 10 ft. for more guy to insulator clearance, eliminating need for more guy strain insulators.	
		(16) Several older Bureau Drawings were drafted in AutoCad (CAE) and have newer dates. These are Historical References. New updated standards should be used when available. Standard drawings were updated and revised in the	
		Late 1980's. New WAPA standard wood structure drawings are noted with a "-1" or sometimes "-2" and "-3".	

Plotted By: court Aug 25, 2026- 12:41pm
Images: S:\Projects\Misc\StandardDrawings\Drawings\Karrens Drawings To Revise\Done\41_6000d.dwg Last Saved By: Court, Donita (CONTR) on 8/24/2026 6:25 AM



HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6107(3A-1)

- NOTES**
1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
 2. *FOR LINE ANGLES UP TO AND INCLUDING 30°, USE SUSPENSION CLAMP PART NO. 27.86.
 3. *FOR LINE ANGLES GREATER THAN 30°, USE LARGE ANGLE SUSPENSION CLAMP PART.
 4. ≠ USE ONLY WHEN SPECIFIED.
 5. POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN.
 6. ≠≠ USE ITEM 28.52 AT (A) AND ITEM 38.10 AT (B) WHEN INSULATOR CAPS ARE SPECIFIED TO BE AWAY FROM STRUCTURE.

STRUCTURE MATERIAL

PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRES		W/OUT OVERHEAD GROUND WIRES			
	69KV	115KV	69KV	115KV		
1	3	3	3	3	POLE	
9.23	3	3	3	3	BAND, FOUR-WAY STRAIN, TYPE B	6031
29.50	3	3	3	3	CLIP, GROUND	6030
58.06	3	3	3	3	LINK, CONNECTING, PR.	6031
64.23	3	3	3	3	LOCKNUT FOR 3/4" BOLT	
77.27	6	6	6	6	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.22	6	6	6	6	WASHER, ROUND FLAT, 1 3/8" O.D. 9/16" HOLE	
#	GROUNDING MATERIAL PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

INSULATOR MATERIAL

PART NO.	QUANTITY						DESCRIPTION	DWG NO. 41
	SINGLE STRING		SINGLE STRING WITH YOKE		DOUBLE STRING ≠			
	69KV	115KV	69KV	115KV	69KV	115KV		
27.82			6	6			CLAMP, SUSPENSION WITHOUT CONNECTOR	
27.81	3	3			6	6	CLAMP, SUSPENSION WITH SOCKET FITTING	1000
38.10	3	3	3	3	3	3	CONNECTOR, BALL-EYE	1003
51.65	18	27	18	27	36	54	INSULATORS, SUSPENSION TYPE, 10" DIA, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3					ROD, ARMOR, TAPERED, SINGLE SUPPORT (ACSR), SET	1000
							ROD, ARMOR, PREFORMED, SINGLE SUPPORT (ACSR), SET	
75.16 OR 75.19			3	3	3	3	ROD, ARMOR, TAPERED, DOUBLE SUPPORT (ACSR), SET	
							ROD, ARMOR, PREFORMED, DOUBLE SUPPORT (ACSR), SET	
98.53			3	3			YOKE, COMPLETE WITH FITTINGS	1004
98.55					3	3	YOKE, COMPLETE WITH FITTINGS	1004
28.52					6	6	CLEVIS, SOCKET 4 1/2" LONG	1004

OVERHEAD GROUND WIRE MATERIAL

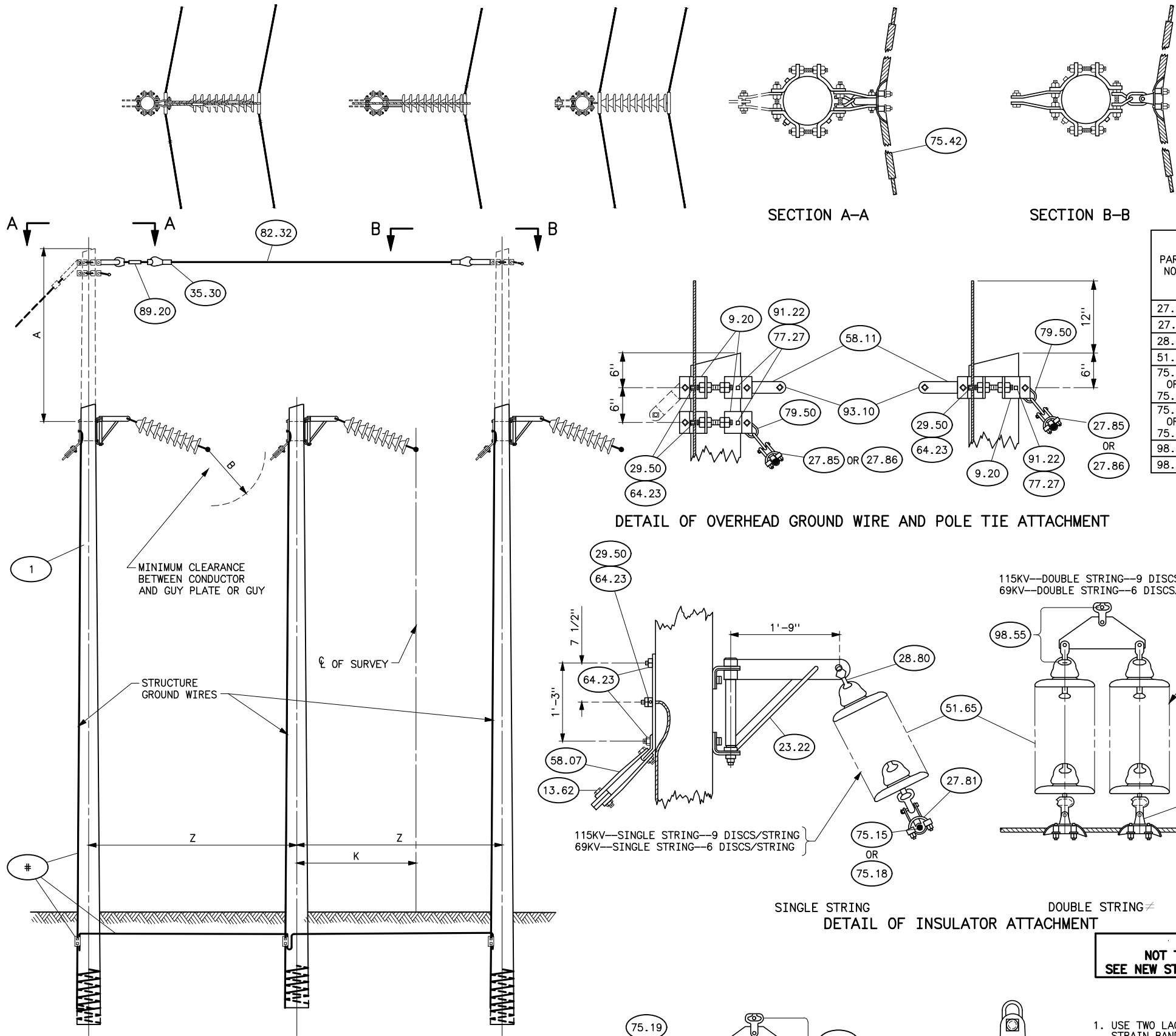
PART NO.	QUANTITY	DESCRIPTION	DWG NO. 41
9.20	3	BAND, FOUR-WAY STRAIN	6030
35.30	2	DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL	
89.20	1	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	BT-3155
29.50	3	CLIP, GROUND	6030
58.11	2	LINK, CONNECTING, PAIR	6030
64.23	3	LOCKNUT FOR 3/4" BOLT	
77.27	6	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	SHACKLE, TWISTED	6038
82.32		STEEL STRAND, 7 WIRE, 7/16" HIGH STRENGTH	
91.22	6	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	2	SHEAVE WHEEL, FOR 7/16 HIGH STRENGTH STRAND	6030
75.42	2 SETS	ROD, ARMOR, PREFORMED	
27.85 OR 27.86	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK FOR OGW	

REFERENCE DRAWINGS

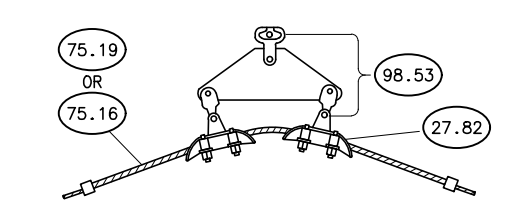
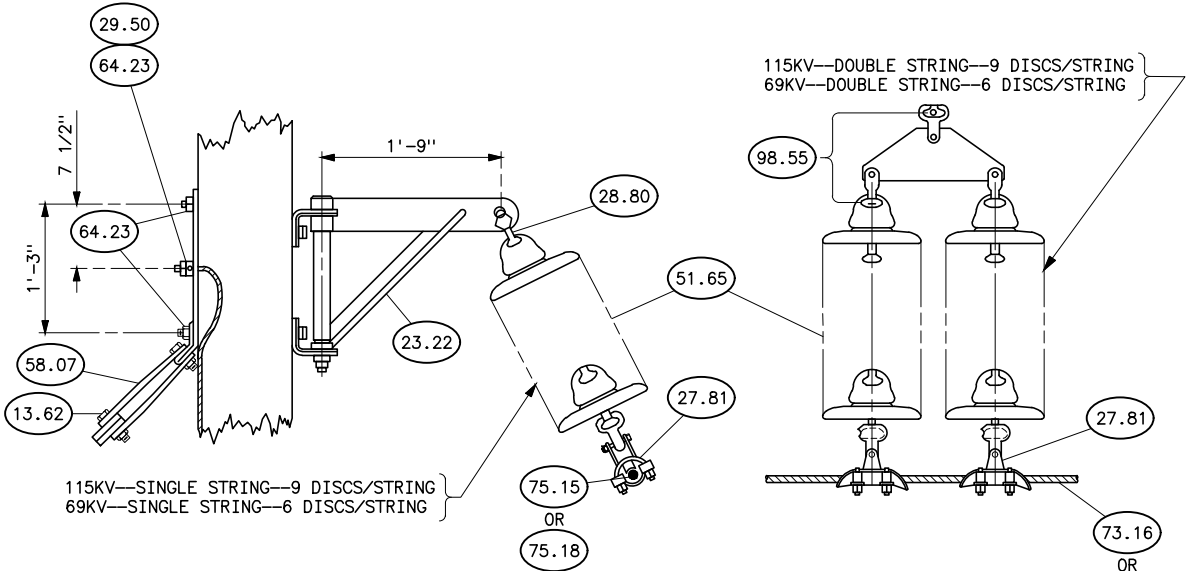
GROUNDING DETAILS	41 1012
GUY ARRANGEMENT, FOR TYPE 3A & 3AB STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053
GUY ARRANGEMENT, 3 POLE STRUCTURE	
HEAVY GUYING	41 6070
GUY ARRANGEMENT, 3 POLE STRUCTURE	
LIGHT GUYING	41 6073

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	12-9-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-3656 & 40-D-4809		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3A, 69 AND 115KV MEDIUM ANGLE STRUCTURE		
DESIGNED BUREC	APPROVED BUREC	
A	AUGUST 6, 1979	41 6000

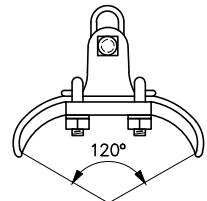
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VOLTAGE	A			K	Z	B
	WITH OGW		WITHOUT OGW			
	30° PROTECTIVE ANGLE	39° PROTECTIVE ANGLE				
69KV	10'-0"	5'-6"	1'-6"	4'-6"	14'-6"	30"
115KV	10'-0"	5'-6"	1'-6"	6'-0"	17'-0"	48"



SINGLE STRING WITH YOKE
FOR ANGLES OF 40° TO 60° WITH ARMOR RODS
FOR ANGLES OF 15° TO 60° WITHOUT ARMOR RODS



LARGE ANGLE SUSPENSION CLAMP
PART NO. 27.85

STRUCTURE MATERIAL						
PART NO.	QUANTITY				DESCRIPTION	DWG. NO. 41
	WITH OVERHEAD GROUND WIRES		W/OUT OVERHEAD GROUND WIRES			
	69KV	115KV	69KV	115KV		
1	3	3	3	3	POLE	
23.22	3	3	3	3	BRACKET EXTENSION 1'-9", COMPLETE WITH 3/4" ATTACHMENT BOLTS HUGHES BROS #282	6045
29.50	3	3	3	3	CLIP, GROUND	6030
64.23	9	9	9	9	LOCKNUT FOR 3/4" BOLT	
58.07	3	3	3	3	CONNECTING LINKS, 3/4"x3 1/2"	6031
13.62	3	3	3	3	MACHINE BOLT, WITH BRASS COTTER, 3/4"x3 1/2"	6031
#	GROUNDING MATERIAL PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

PART NO.	QUANTITY						DESCRIPTION	DWG NO. 41
	SINGLE STRING		SINGLE STRING WITH YOKE ≠		DOUBLE STRING ≠			
	69KV	115KV	69KV	115KV	69KV	115KV		
27.82	—		6	6			CLAMP, SUSPENSION, WITHOUT CONNECTOR	
27.81	3	3			6	6	CLAMP, SUSPENSION, WITH SOCKET FITTING	1000
28.80	3	3	3	3	3	3	CLEVIS, Y-BALL	1003
51.65	18	27	18	27	36	54	INSULATORS, SUSPENSION TYPE, 10" DIA, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3	—	—	—	—	ROD, ARMOR, TAPERED, SINGLE SUPPORT (ACSR) SET	1000
75.16 OR 75.19	—	—	3	3	3	3	ROD, ARMOR, TAPERED, DOUBLE SUPPORT (ACSR) SET	
98.53	—	—	3	3	—	—	YOKE, COMPLETE WITH FITTINGS	1004
98.55	—	—	—	—	3	3	YOKE, COMPLETE WITH FITTINGS	1004

OVERHEAD GROUND WIRE MATERIAL				DESCRIPTION	DWG NO. 41
PART NO.	QUANTITY				
9.20	3			BAND, FOUR-WAY STRAIN	6030
35.30	2			DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL	
27.85 OR 27.86	2*			CLAMP, SUSPENSION, WITH 2 1/4" LINK FOR OGW	
29.50	3			CLIP, GROUND	6030
58.11	2			LINK, CONNECTING, PAIR	6030
64.23	3			LOCKNUT FOR 3/4" BOLT	
77.27	6			LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2			SHACKLE, TWISTED	6038
82.32	AS REQD			STEEL STRAND, 7 WIRE, 7/16" HIGH STRENGTH	
91.22	6			WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	3			SHEAVE WHEEL, FOR	6030
75.42	2 SETS			ROD, ARMOR, PREFORMED	
89.20	1			TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	

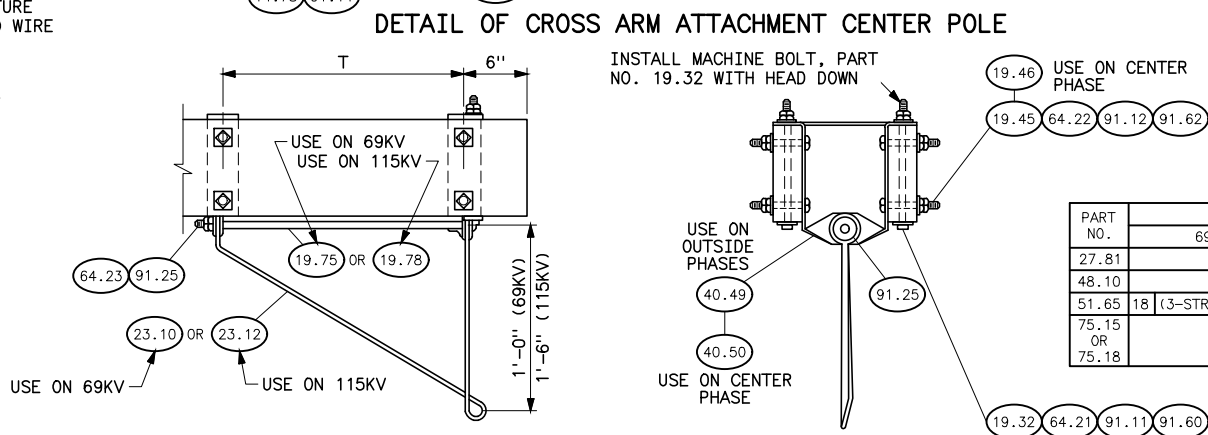
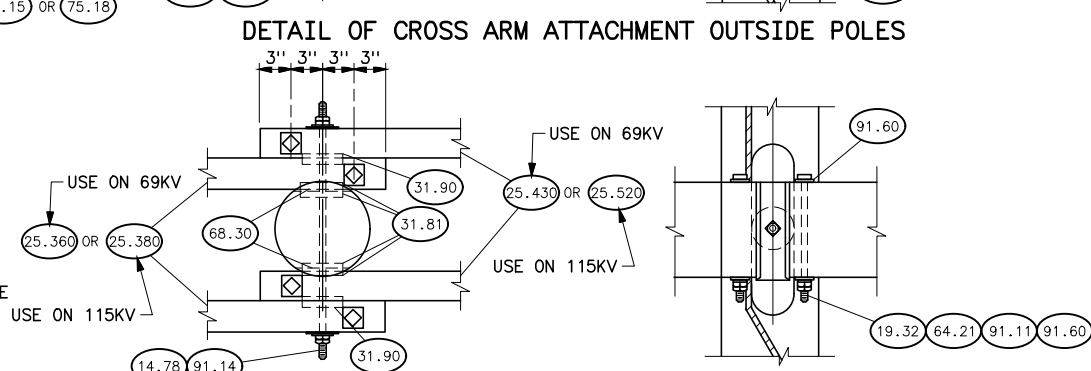
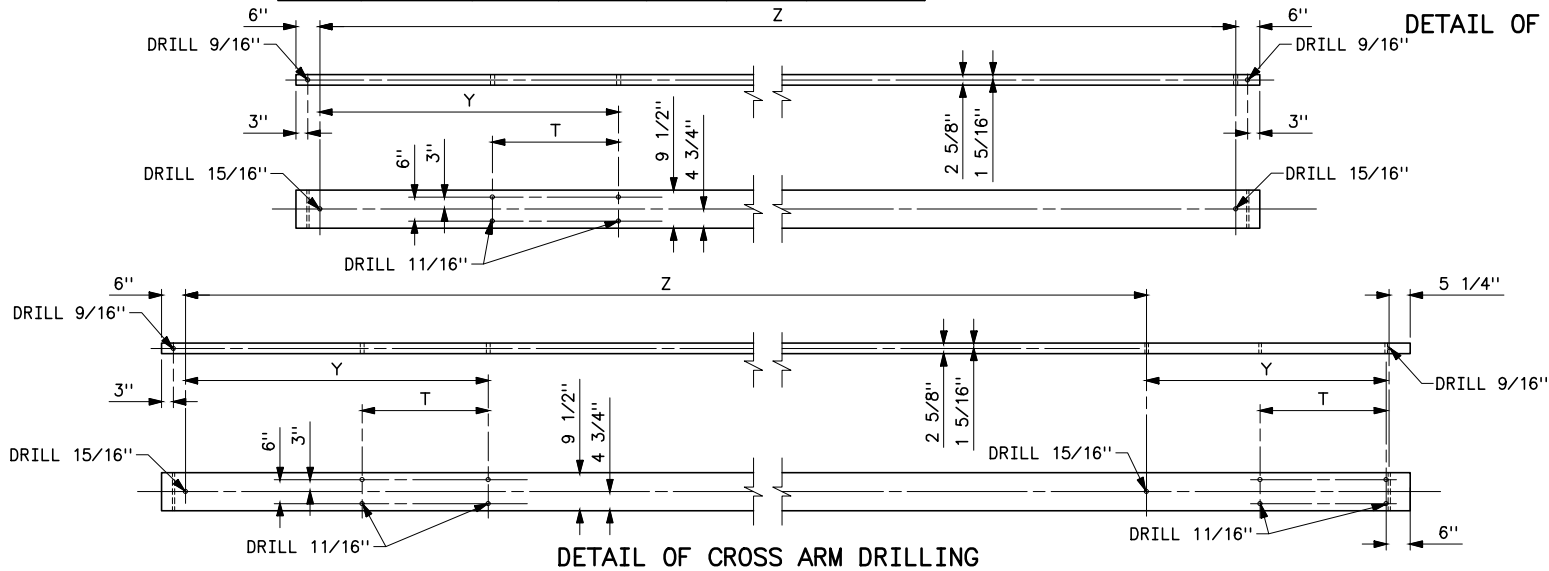
REFERENCE DRAWINGS		
GROUNDING DETAILS	41 1012	
GUY ARRANGEMENT, FOR TYPE 3A & 3AB STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053	
GUY ARRANGEMENT, 3 POLE STRUCTURE		
HEAVY GUYING	41 6070	
GUY ARRANGEMENT, 3 POLE STRUCTURE	41 6073	
LIGHT GUYING		

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6108(3AB-1)

NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. *FOR LINE ANGLES UP TO AND INCLUDING 30°, USE SUSPENSION CLAMP PART NO. 27.86.
3. *FOR LINE ANGLES GREATER THAN 30°, USE LARGE ANGLE SUSPENSION CLAMP PART 27.85.
4. ≠ USE ONLY WHEN SPECIFIED.
5. POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN.

D	8/24/26 A7-KR	HISTORICAL REFERENCE.
C	12-9-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-3657 & 40-D-4945		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AB, 69 AND 115KV MEDIUM ANGLE STRUCTURE		
DESIGNED	BUREC	APPROVED BUREC
A	AUGUST 6, 1979	41 6001



1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. ADJUST NUTS ON ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
3. ≠ USE ONLY WHEN SPECIFIED.
4. Ø GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

GROUNDING DETAILS-----	41	1012
DRILLING AND GAINING DETAILS-		
30° PROTECTIVE ANGLE-----	41	6021
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW-----	41	6054
DRILLING AND GAINING DETAILS		
(WITHOUT OGW)-----	41	6066

PART NO.	QUANTITY		DESCRIPTION	DWG NO.
	69KV	115KV		
27.8.1	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)	1000
48.10	3	3	HOOK, SUSPENSION	1003
51.65	18 (3-STRINGS OF 6)	27 (3-STRINGS OF 9)	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3	ROD, ARMOR, TAPERED, SINGLE SUPPORT (FOR ACSR ONLY)	1000
			ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	1000

PART NO.	SUSPENSION	DESCRIPTION	DWG NO. 41
9.20	1	BAND, FOUR-WAY STRAIN	6030
27.86	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	1	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
64.23	1	LOCKOUT FOR 3/4" BOLT	
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	SHACKLE, TWISTED	6038
91.22	2	WASHER, ROUND FLAT, 1 3/8" O.D. 9/16" HOLE	
75.42	2 SETS	ROD, ARMOR, PREFORMED	

D	8/24/26 A7-KR	HISTORICAL REFERENCE.
C	12-9-11 A7-DDD	REDRAWN.

SUPERSEDES DWG NO. 40-D-4361

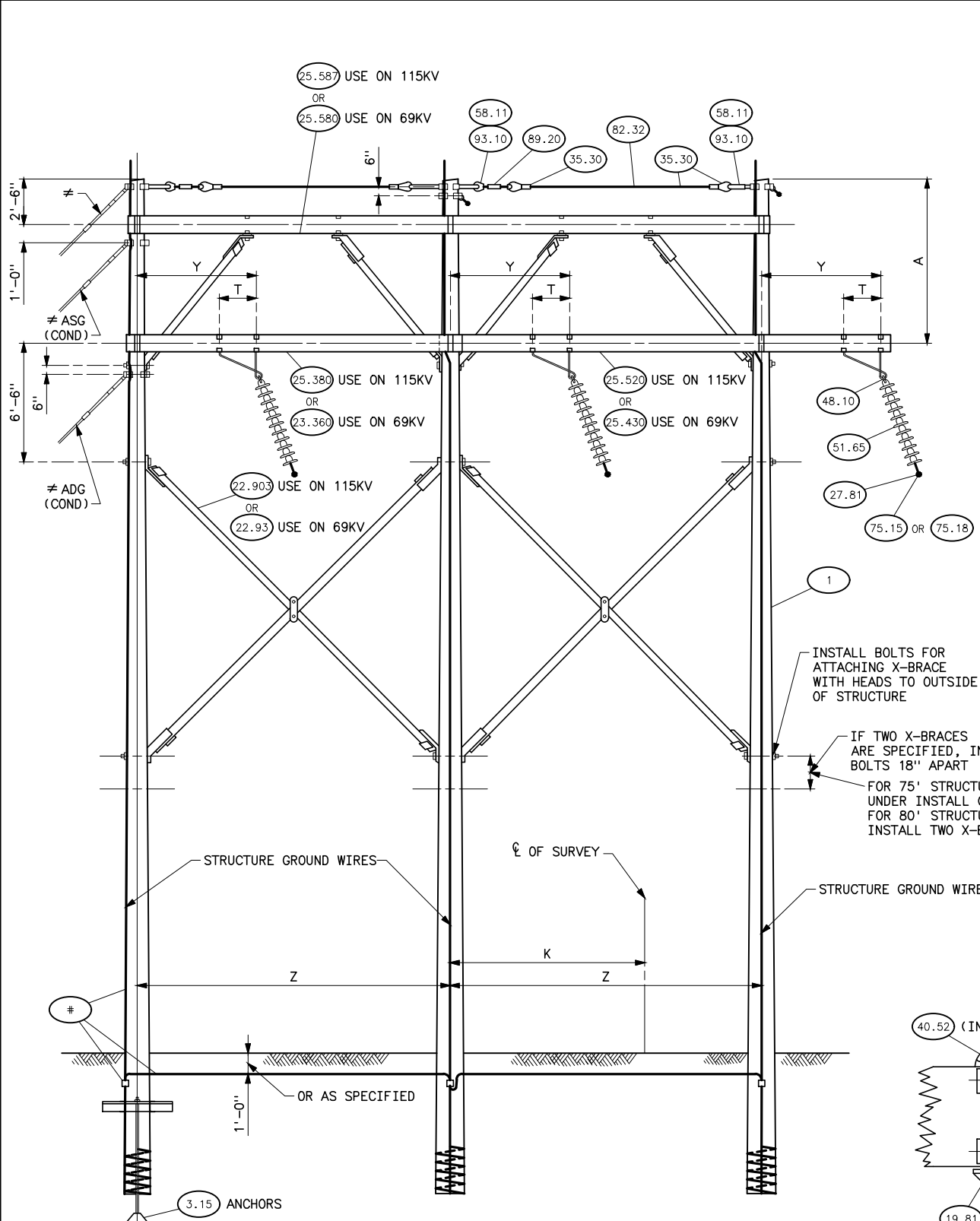
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS TRANSMISSION LINES TYPE 3AC, 69 AND 115KV SUSPENSION STRUCTURE

DESIGNED BUREC _____ APPROVED BUREC _____

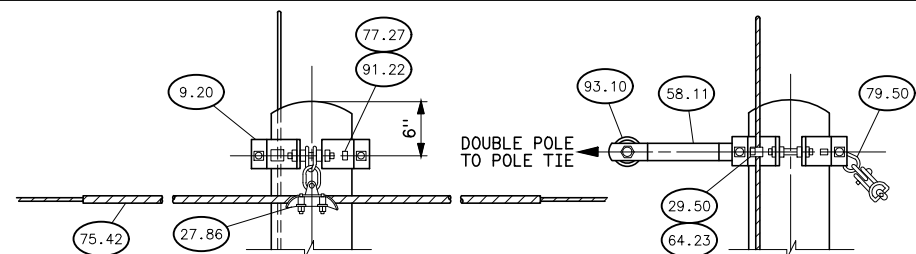
CAE	AUGUST 6, 1979	41	6002
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Plotted By: court Aug 25, 2026- 12:42pm
Images: S:\Projects\Wisc\StandardDrawings\Drawings\Korens Drawings To Revise\Done\41-6003d.dwg Last Saved By: Court, Donita (CONTR) on 8/24/2026 6:24 AM



VOLTAGE	A	Z	K	Y	T
69KV	6'-6"	12'-0"	7'-0"	4'-6"	2'-0"
115KV	6'-6"	14'-0"	9'-0"	5'-0"	2'-0"

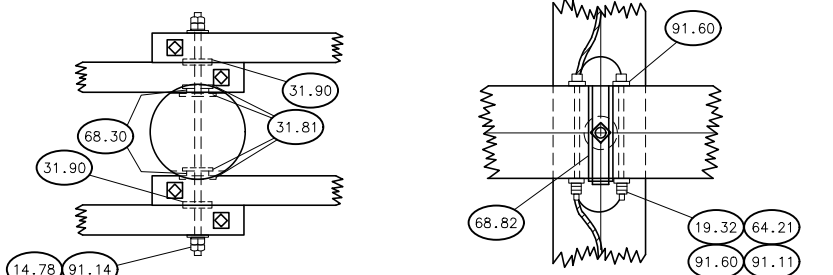
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	69KV	115KV		
27.81	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING	1000
48.10	3	3	HOOK, SUSPENSION	1003
51.65	18 (3-STRINGS OF 6)	27 (3-STRINGS OF 9)	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3	ROD, ARMOR, TAPERED, SINGLE SUPPORT FOR ACSR, SET ROD, ARMOR, PREFORMED, SINGLE SUPPORT FOR ACSR, SET	1000



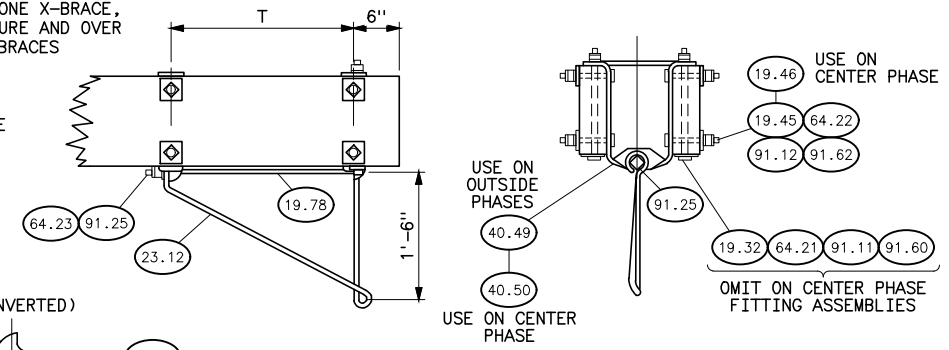
DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



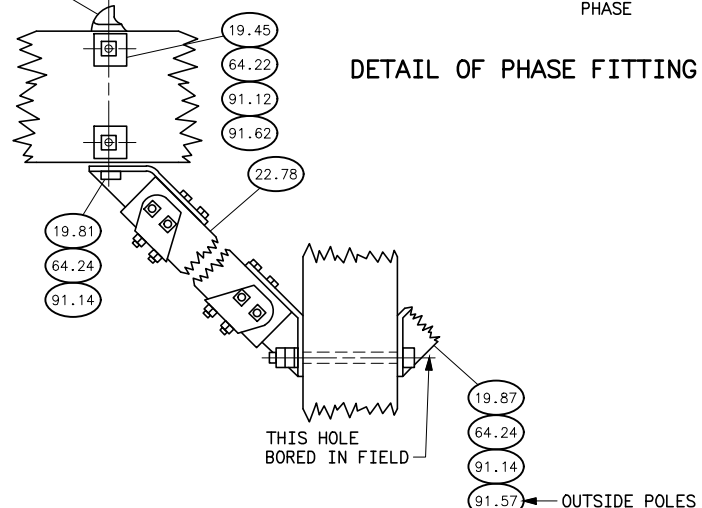
DETAIL OF CROSS ARM ATTACHMENT- UPPER CROSSARMS AND FOR OUTSIDE POLES - LOWER CROSSARMS



DETAIL OF CROSS ARM ATTACHMENT CENTER POLE - LOWER CROSSARMS



DETAIL OF PHASE FITTING ASSEMBLY



DETAIL OF BRACE ATTACHMENT

STRUCTURE MATERIAL

PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	69KV	115KV		
1	3	3	POLE, SEE STRUCTURE LIST FOR HEIGHT	
3.15	2	2	ANCHOR, EXPANDING TYPE	
9.20	3	3	BAND, FOUR-WAY STRAIN	6030
14.75	5	5	BOLT, DOUBLE ARMING, 7/8"x20", USE EXTRA NUTS AS LOCKNUTS	
14.78	1	1	BOLT, DOUBLE ARMING, 7/8"x28", USE EXTRA NUTS AS LOCKNUTS	
19.32	12	12	BOLT, MACHINE, 1/2"x12"	
19.45	32	32	BOLT, MACHINE, 5/8"x5"	
19.46	8	8	BOLT, MACHINE, 5/8"x6"	
25.360	2	-	CROSSARM, WOOD, 2 5/8"x9 1/2"x13'-0"	
19.78	3	3	BOLT, MACHINE, 3/4"x28"	
19.81	4	4	BOLT, MACHINE, 7/8"x2 1/2"	
19.87	3	3	BOLT, MACHINE, 7/8"x14"	
22.78	4	4	BRACE, KNEE, SPACING 5'-0", DROP 5'-0", 3 3/8"x4 3/8" SECTION	
25.430	2	-	CROSSARM, WOOD, 2 5/8"x9 1/2"x17'-6"	
23.12	3	3	BRACKET, ANGLE	6044
25.380	-	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x15'-0"	6022
25.520	-	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x20'-0"	6022
25.587	-	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x29'-0"	6022
35.30	4	4	DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL	
29.50	3	3	CLIP, GROUND, WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
31.81	24	24	CONNECTOR, 4" SHEAR PLATE, FOR 7/8" BOLT	
31.90	2	2	CONNECTOR, 4" SPLIT RING	
40.49	4	4	FITTING, PHASE	6038
40.50	-	2	FITTING, PHASE	6038
40.52	4	4	FITTING, PHASE	6038
58.11	4	4	LINK, CONNECTING PAIR	6030
89.20	2	2	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	BT-3155
64.21	12	12	LOCKNUT FOR 1/2" BOLT	
64.22	40	40	LOCKNUT FOR 5/8" BOLT	
64.23	6	6	LOCKNUT FOR 3/4" BOLT	
64.24	7	7	LOCKNUT FOR 7/8" BOLT	
68.30	12	12	PLATE, FLAT GAIN	6038
68.82	12	12	PLATE, RIBBED TIE	6038
77.27	6	6	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
82.32	AS REQUIRED		STEEL STRAND, 7-WIRE, 7/16" HIGH STRENGTH	
91.11	12	12	LOCK WASHER FOR 1/2" BOLT	
91.12	40	40	LOCK WASHER FOR 5/8" BOLT	
91.14	19	19	LOCK WASHER FOR 7/8" BOLT	
91.22	6	6	WASHER, ROUND FLAT, 1 3/8" O.D., 9/16" HOLE	
91.25	6	6	WASHER, ROUND FLAT, FOR 3/4"-BOLT	
91.57	2	2	WASHER, SQUARE CURVED, 4"x4"x1/4", 15/16"-INCH HOLE	
91.60	24	24	WASHER, SQUARE, FLAT, 2"x2"x1/8", 9/16" HOLE	
91.62	40	40	WASHER, SQUARE, FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
93.10	4	4	SHEAVE WHEEL	6030
A	1	1	POLE ANCHOR ASSEMBLY	6043
25.580	2	-	CROSSARM, WOOD, 2 5/8"x9 1/2"x25'-0"	
22.903	2 OR 4	2 OR 4	X-BRACE, COMPLETE WITH FITTINGS (3 5/8"x4 3/8") 14' SPACING	6029
22.93	2 OR 4	2 OR 4	X-BRACE, COMPLETE WITH FITTINGS (3 5/8"x4 3/8") 12' SPACING	
#			GROUNDING MATERIAL, PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012	

OVERHEAD GROUND WIRE MATERIAL

PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	69KV	115KV		
9.20	1	1	BAND, FOUR-WAY STRAIN	6037
27.86	2	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	1	1	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6037
64.23	1	1	LOCKNUT FOR 3/4" BOLT	
75.42	2 SETS	2 SETS	ROD, ARMOR, PREFORMED, FOR OGW, SET	
77.27	2	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	2	SHACKLE, TWISTED	6037
91.22	2	2	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	12-9-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-6017		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AD - 69 AND 115KV SUSPENSION STRUCTURE		
DESIGNED	BUREC	APPROVED BUREC
A	AUGUST 6, 1979	41 6003

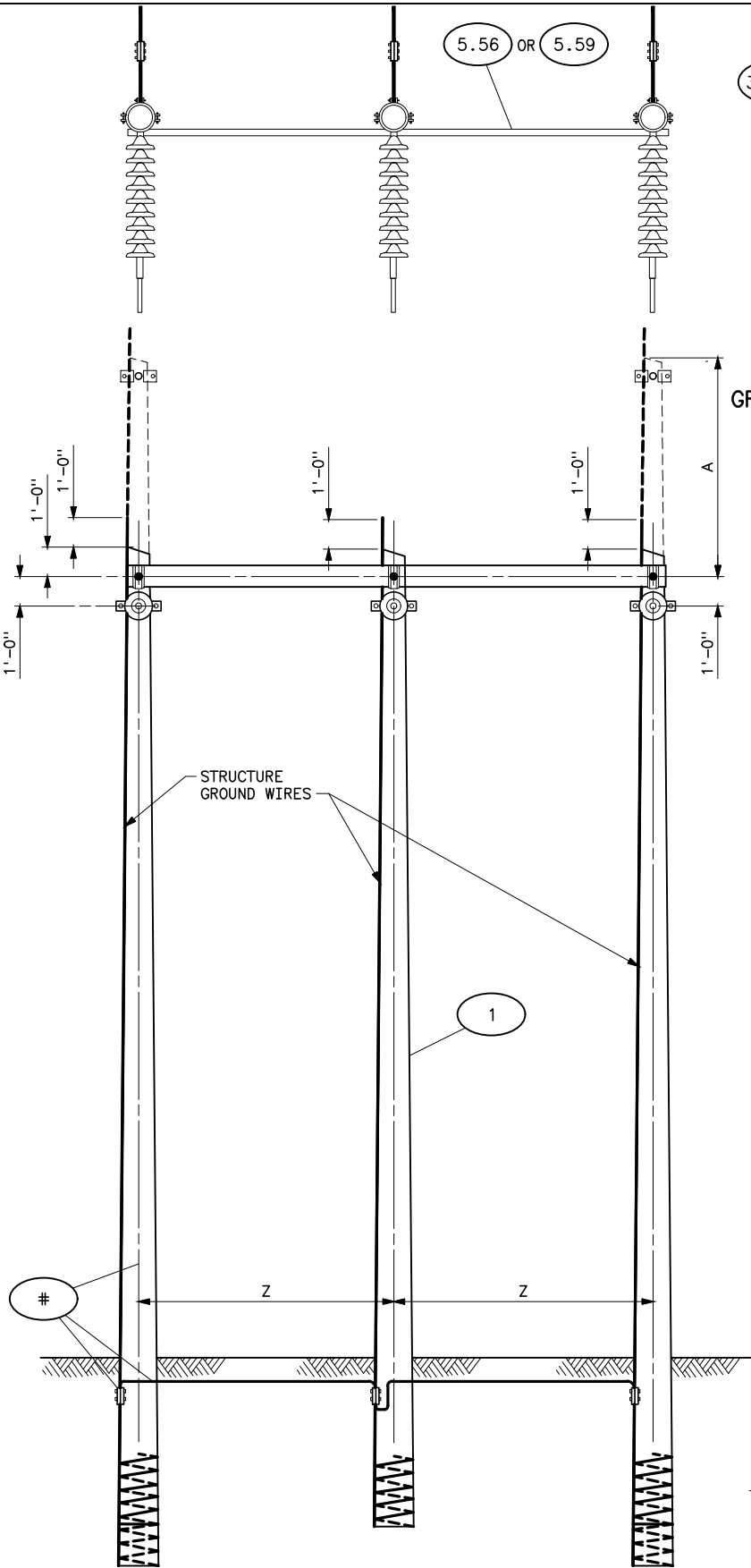
NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. ADJUST NUTS ON ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
3. ≠ USE ONLY WHEN SPECIFIED.
4. Ø GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

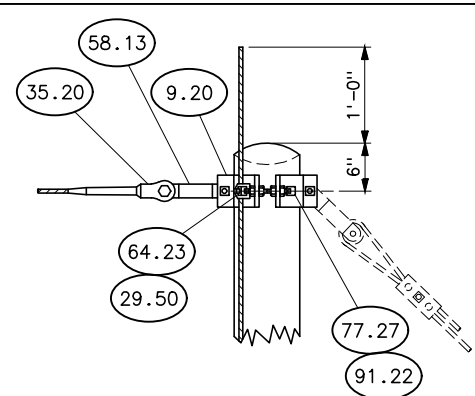
REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
DRILLING AND GAINING DETAILS	41 6022
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW	41 6054

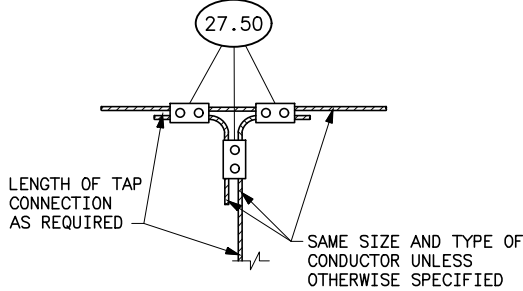
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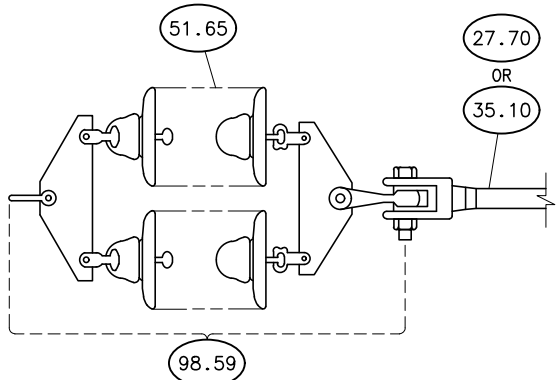
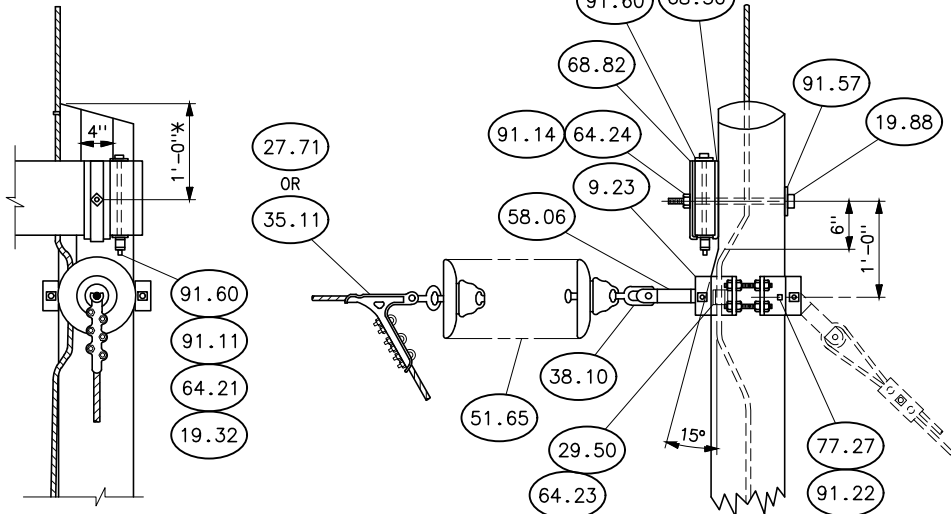
VOLTAGE	A			Z	L
	WITH OGW		WITHOUT OGW		
	30° PROTECTIVE ANGLE	39° PROTECTIVE ANGLE			
69KV	10'-0"	6'-0"	1'-0"	10'-0"	21'-0"
115KV	10'-0"	6'-0"	1'-0"	12'-0"	25'-0"



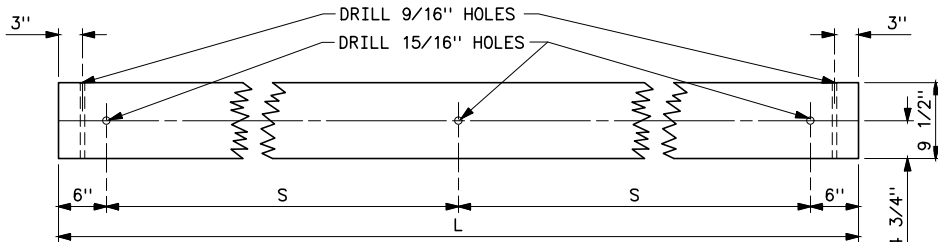
DETAIL OF OVERHEAD
GROUND WIRE DEAD END ATTACHMENT



DETAIL OF TAP CONNECTION
(TOP AND BOTTOM CONNECTION SIMILAR)



DOUBLE INSULATOR STRING
ASSEMBLY ≠



CROSSARM DRILLING DETAIL

STRUCTURE MATERIAL

PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRES		W/OUT OVERHEAD GROUND WIRES			
	69KV	115KV	69KV	115KV		
1	3	3	3	3	POLE	
5.56	1	—	1	—	CROSSARM, WOOD, 2 5/8"x9 1/2"x21'-0" 69KV CUT AND DRILL AS PER DETAIL SHOWN BELOW	
5.59	—	1	—	1	CROSSARM, WOOD, 2 5/8"x9 1/2"x25'-0" 115KV CUT AND DRILL AS PER DETAIL SHOWN BELOW	
9.23	3	3	3	3	BAND, FOUR-WAY STRAIN, TYPE B	6031
19.88	3	3	3	3	BOLT, MACHINE 7/8"x16"	
29.50	3	3	3	3	CLIP, GROUND	6030
58.06	3	3	3	3	LINK, CONNECTING, PAIR	6031
64.23	3	3	3	3	LOCKNUT, FOR 3/4" BOLT	
64.24	3	3	3	3	LOCKNUT, FOR 7/8" BOLT	
68.30	3	3	3	3	PLATE, FLAT GAIN	6038
68.82	3	3	3	3	PLATE, RIBBED TIE	6038
77.27	6	6	6	6	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.14	3	3	3	3	LOCKWASHER, SPRING, FOR 7/8" BOLT	
91.22	6	6	6	6	WASHER, ROUND, FLAT, 1 3/8" O.D., 9/16" HOLE	
91.57	3	3	3	3	WASHER, SQUARE, CURVED, 4"x4"x1/4", 15/16" HOLE	
19.32	2	2	2	2	BOLT, MACHINE, 1/2"x12"	
27.50	18	18	18	18	CLAMP, PARALLEL GROOVE, 2-BOLT FOR CONDUCTOR	
64.21	2	2	2	2	LOCKNUT FOR 1/2" BOLT	
91.11	2	2	2	2	LOCKWASHER, SPRING, FOR 1/2" BOLT	
91.60	4	4	4	4	WASHER, SQUARE FLAT, 2"x2"x1/8", 9/16" HOLE	
#	GROUNDING MATERIAL, PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

OVERHEAD GROUND WIRE MATERIAL

PART NO.	DEAD END	DESCRIPTION	DWG NO. 41
9.20	2	BAND, FOUR-WAY STRAIN	6030
29.50	2	CLIP, GROUND	6030
35.20	2	DEAD END, COMPRESSION TYPE, FOR OVERHEAD GROUND WIRE	
58.13	2	LINK, CONNECTING, PAIR	6030
64.23	2	LOCKNUT, FOR 3/4" BOLT	
77.27	4	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.22	4	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	

INSULATOR ASSEMBLY

PART NO.	QUANTITY				DESCRIPTION		DWG NO. 41
	SINGLE STRING		DOUBLE STRING ≠				
	69KV	115KV	69KV	115KV			
27.70 OR 35.10	—	—	3	3	CLAMP, STRAIN, WITH CLEVIS FITTING, FOR CONDUCTOR		
					DEAD END, COMPRESSION TYPE, FOR CONDUCTOR		
27.71 OR 35.11	3	3	—	—	CLAMP, STRAIN, WITH SOCKET FITTING, FOR CONDUCTOR		1002
					DEAD END, COMPRESSION TYPE, WITH SOCKET FITTING, FOR CONDUCTOR		1002
38.10	3	3			CONNECTOR, BALL-EYE		1003
51.65	18 (3 STRINGS OF 6)	27 (3 STRINGS OF 9)	36 (6 STRINGS OF 6)	54 (6 STRINGS OF 9)	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	SINGLE STRING, DEAD END	1002
						DOUBLE STRING, DEAD END ≠	
98.59	—	—	3	3	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS		1004

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6126(3DE-1)

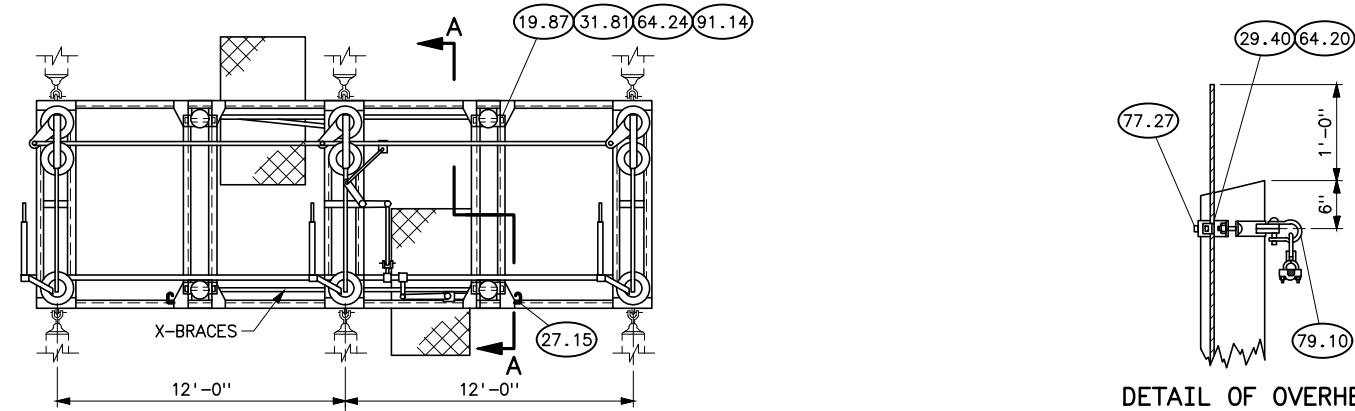
REFERENCE DRAWINGS

GROUNDING DETAILS ----- 41 1012
GUY ARRANGEMENT ----- 41 6095

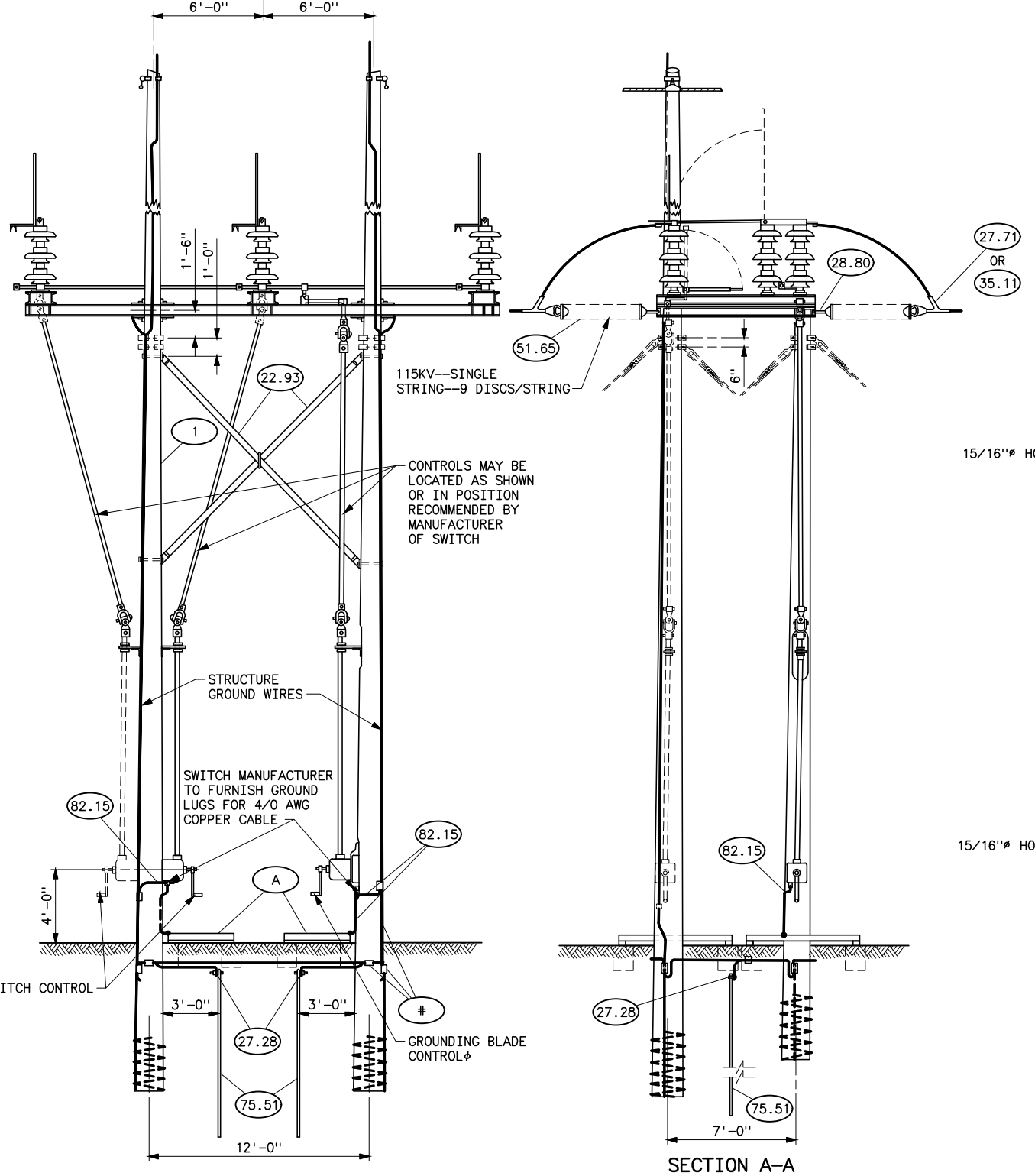
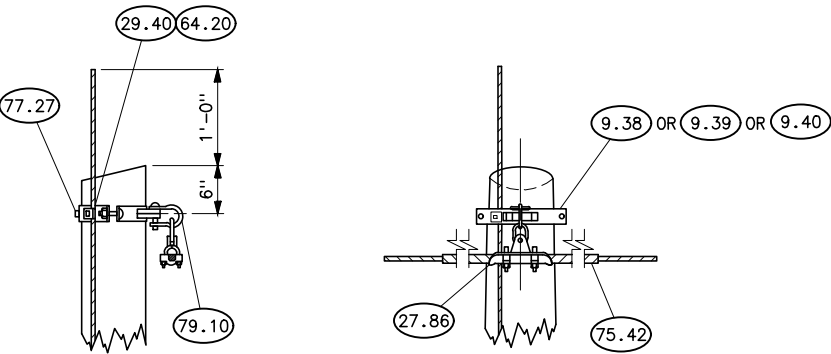
NOTES

- ≠ USE ONLY WHEN SPECIFIED.
- *DIMENSION DOES NOT APPLY ON OUTSIDE POLES WHEN STRUCTURE IS USED WITH OVERHEAD GROUND WIRE.
- ON STRUCTURES WITH OVERHEAD GROUND WIRE GAIN OUTSIDE POLES 6" ABOVE AND BELOW CENTER LINE OF BOLT HOLE.
- USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.

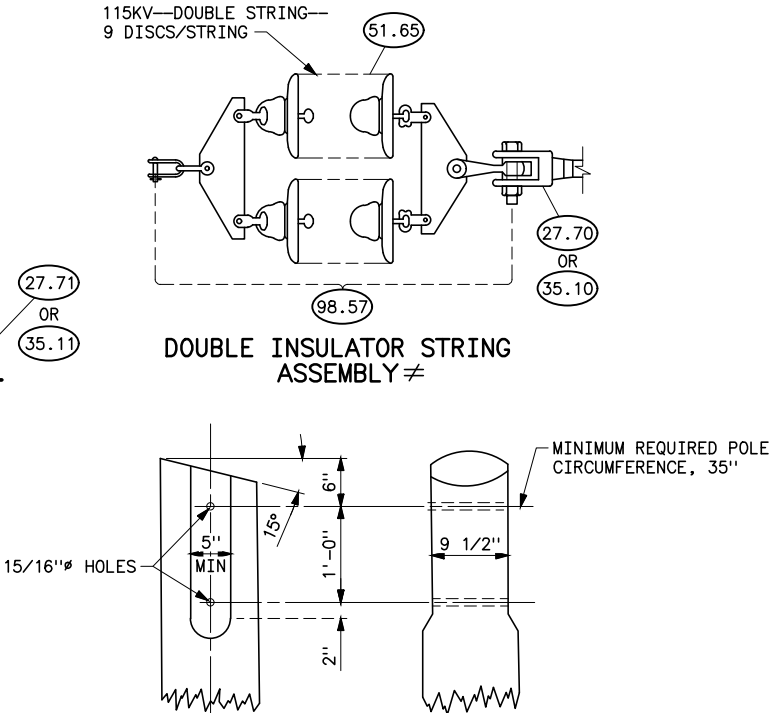
C	8/24/26 A7-KR	HISTORICAL REFERENCE.
B	12-9-11 A7-DDD	REDRAWN AND REVISED TITLE BLOCK TO BE CONSISTENT WITH TRANSMISSION LINE STD DWGS.
SUPERSEDES DWG NO. 40-D-4813		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3DE - 69 AND 115KV 3-POLE SPECIAL DEAD END STRUCTURE		
DESIGNED BUREC ----- APPROVED BUREC -----		
A	JUNE 25, 1981	41 6004



DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT

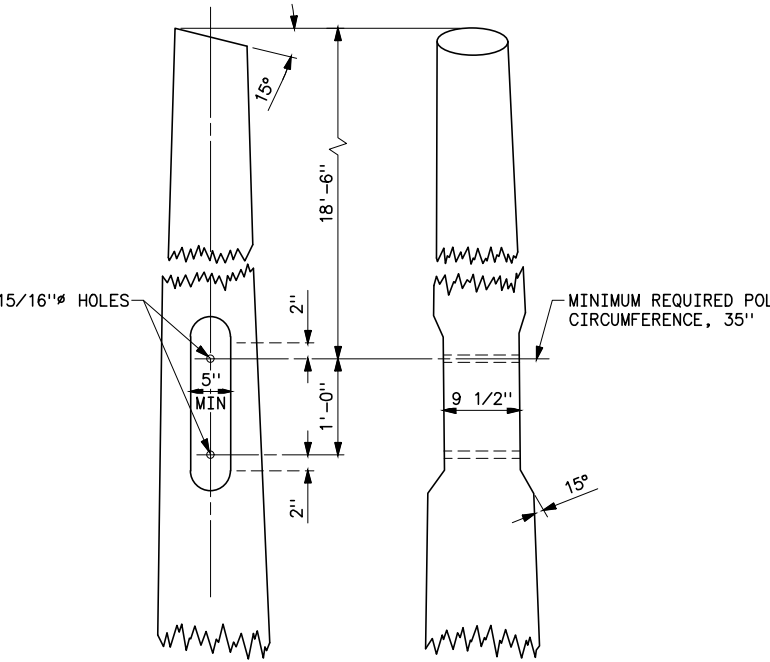


SECTION A-A



DOUBLE INSULATOR STRING ASSEMBLY ≠

DETAIL OF SHORT POLE



DETAIL OF LONG POLE

STRUCTURE MATERIAL				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	WITH OGW	W/O OGW		
1	4	4	POLE	
19.87	8	8	BOLT, MACHINE 7/8"x14"	
22.93	2	2	X-BRACES, COMPLETE WITH FITTINGS, (3 1/8"x 4 3/8")	6029
27.15	2	2	CLAMP, BELCHER, 15/16" HOLE SPACING, 1/2" J-BOLT	
27.28	2	2	CLAMP, COPPER ALLOY FOR GROUND ROD	
31.81	16	16	CONNECTOR, SHEAR PLATE, 4" DIAMETER FOR 7/8" BOLT (WOOD TO METAL)	
64.24	8	8	LOCKNUT, FOR 7/8" BOLT	
75.51	2	2	GROUND ROD, COPPERWELD 3/4"x10'	
82.15	40 FT.	40 FT.	4/0 AWG 19 STRAND COPPER CABLE	
84.10	1	1	AIR-BREAK SWITCH, COMPLETE WITH MOUNTING BOLTS	
84.15	1	1	BASE, SWITCH	6092
91.14	8	8	LOCK WASHER, SPRING, FOR 7/8" BOLT	
A	2	2	SWITCH OPERATING PLATFORM, DETAIL "A"	31 1075
#	GROUNDING MATERIAL, PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012			

INSULATOR MATERIAL				
PART NO.	SINGLE STRING	DOUBLE ≠ STRING	DESCRIPTION	DWG NO. 41
27.70 OR 35.10		6	CLAMP, STRAIN WITH CLEVIS FITTING FOR CONDUCTOR DEAD END, COMPRESSION TYPE	
27.71 OR 35.11	6		CLAMP, STRAIN WITH SOCKET FITTING FOR CONDUCTOR DEAD END, COMPRESSION TYPE WITH SOCKET FITTING	1002
28.80	6		CLEVIS, Y-BALL	1003
51.65	6	54-DISCS 108-DISCS	INSULATOR, ASSEMBLY SINGLE STRING, DEAD END 5 3/4" SPACING ≠ DOUBLE STRING, DEAD END	1002
98.57		6	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS	1004

OVERHEAD GROUND WIRE MATERIAL				
PART NO.	QUANTITY	DESCRIPTION		DWG NO. 41
9.38-9.39 OR 9.40	2Δ	BAND, POLE TOP		6035, 6036, 6037
27.86	2Δ	CLAMP, SUSPENSION WITH 2 1/4" LINK FOR OVERHEAD GROUND WIRE		
29.40	2	CLIP, GROUND, WITH 3/8"x1 1/2" CARRIAGE BOLT AND M.F. LOCKNUT		6035, 6036, 6037
64.20	2	LOCKNUT FOR 3/8" BOLT		
75.42	2 SETS	ROD, ARMOR, PREFORMED, FOR 3/8" STEEL STRAND		
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD		
79.10	2	SHACKLE FOR POLE TOP BAND		6036, 6037

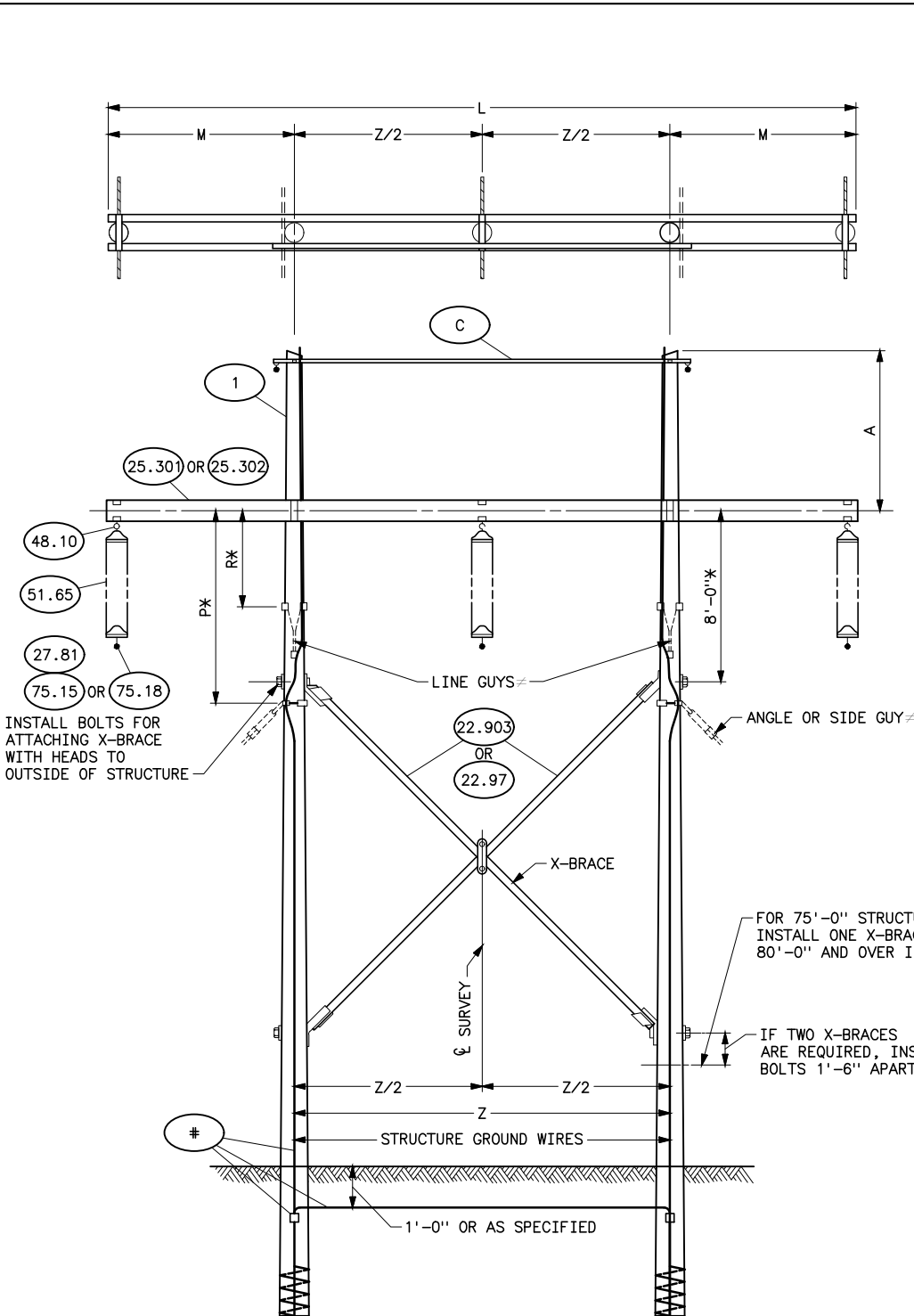
REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
GUYING DETAILS	41 6056
STEEL DETAILS	41 6092

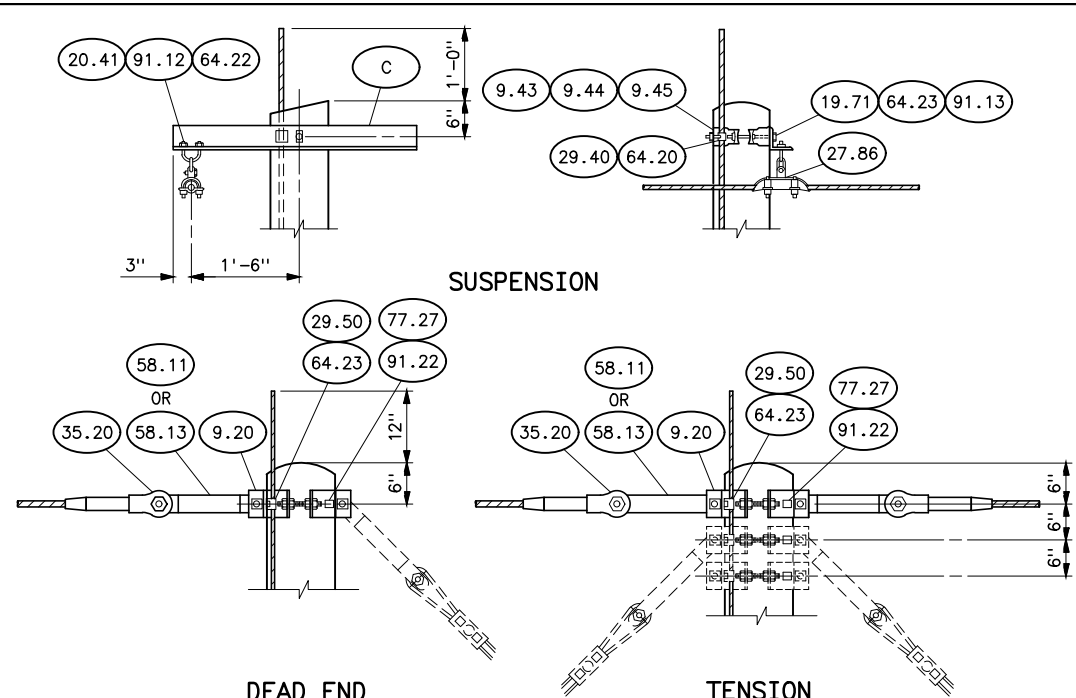
NOTES

- USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
- Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO 41 6035 IS USED.
- ≠ USE ONLY WHEN SPECIFIED.
- φ FOR SWITCH WITH HANDLE OPERATED MECHANISM SEE DETAIL E, DWG. 31 1075 FOR GROUNDING.

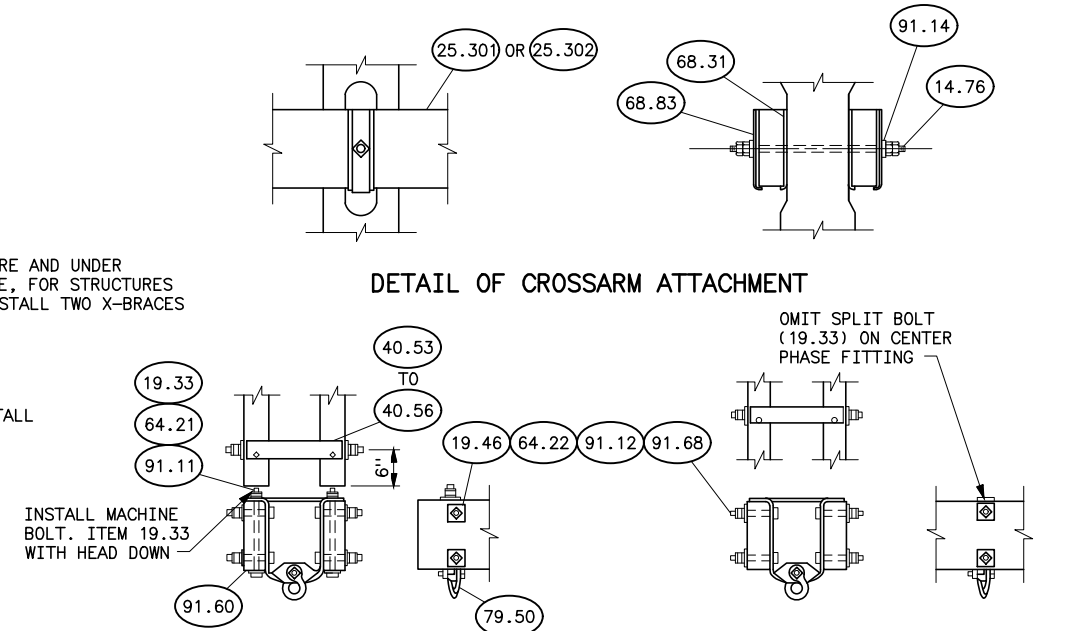
B	3-2-11 A7-DDD	REDRAWN AND REVISED TITLE BLOCK TO BE CONSISTENT WITH TRANSMISSION LINE STD DWGS.
SUPERSEDES DWG NO. 40-D-5189		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 4SWT 115KV DISCONNECTING SWITCH STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	SEPTEMBER 29, 1980	41 6005



VOLTAGE	A	L	Z	Z/2	M	P	R
138KV	7'-0"	29'-0"	14'-0"	7'-0"	7'-6"	9'-0"	4'-0"
161KV	8'-0"	35'-0"	17'-0"	8'-6"	9'-0"	9'-0"	4'-6"



SUSPENSION
 DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



DETAIL OF CROSSARM ATTACHMENT

DETAIL OF PHASE FITTING ASSEMBLY

NOTES

- USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
- ≠ USE ONLY WHEN SPECIFIED.
- * WHEN AN ADDITIONAL DISC IS USED ON ANGLE STRUCTURES, AT RAILROAD OR MAIN HIGHWAY CROSSINGS DIMENSION SHALL BE INCREASED ONE FOOT.
- Ø GREATER THAN 22-INCH LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

REFERENCE DRAWINGS

GROUNDING DETAILS	41	1012
DRILLING AND GAINING DETAILS WITH OGW	41	6024
X-BRACE DETAILS	41	6029
H-FRAME ANGLE IRON DETAILS	41	6041
GUY ARRANGEMENT-ASSEMBLY-H-FRAME	41	6051 AND 41 6052

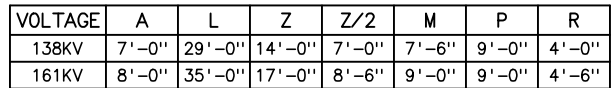
STRUCTURE MATERIAL					
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41	
	138KV	161KV			
1	2	2	POLE, SEE STRUCTURE LIST FOR HEIGHT		
14.76	2	2	BOLT, DOUBLE ARMING, 7/8"x22" WITH 4 NUTS USE EXTRA NUTS AS LOCKNUTS		
19.33	4	4	BOLT, MACHINE, 1/2"x14"		
19.46	12	12	BOLT, MACHINE, 5/8"x6"		
25.301	2	—	CROSSARM, WOOD, 3 5/8"x11 1/2"x29'-0"	6025	
25.302	—	2	CROSSARM, WOOD, 3 5/8"x11 1/2"x35'-0"	6025	
40.53 TO 40.58	3	3	FITTING, PHASE	6039	
			SELECT PHASE FITTING WITH DIMENSION "B" TO MATCH POLE GAIN		
64.21	4	4	LOCKNUT FOR 1/2" BOLT		
64.22	12	12	LOCKNUT FOR 5/8" BOLT		
68.31	4	4	PLATE, FLAT GAIN	6039	
68.83	4	4	PLATE, RIBBED TIE	6039	
79.50	3	3	SHACKLE, TWISTED	6039	
91.11	4	4	LOCK WASHER, SPRING, FOR 1/2" BOLT		
91.12	12	12	LOCK WASHER, SPRING, FOR 5/8" BOLT		
91.14	4	4	LOCK WASHER, SPRING, FOR 7/8" BOLT		
91.60	4	4	WASHER, SQUARE FLAT, 2"x2"x1/8", 9/16" HOLE		
91.62	12	12	WASHER, SQUARE FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE		
22.903	1 OR 2	—	X-BRACE COMPLETE WITH FITTINGS (3 3/8"x4 3/8")	6029	
22.97	—	1 OR 2	X-BRACE COMPLETE WITH FITTINGS (3 3/8"x5 3/8")	6029	
#	GROUNDING MATERIAL PART NUMBERS AND DESCRIPTION, SHOWN ON 41 1012				

INSULATOR MATERIAL						
PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	138KV		161KV			
27.81	3		3		CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)	1000
48.10	3		3		HOOK, SUSPENSION	1003
51.65	24	3 STRINGS OF 8	30	3 STRINGS OF 10	INSULATOR, SUSPENSION TYPE, 10" DIA. 5 3/4" SPACING	1000
7515 OR 75.18	3		3		ROD, ARMOR, TAPERED SINGLE SUPPORT, SET	1000
					ROD, ARMOR,PREFORMED, SINGLE SUPPORT, SET	1000

OVERHEAD GROUND WIRE MATERIAL						
PART NO.	QUANTITY			DESCRIPTION	DWG NO. 41	
	SUSPENSION	DEAD END	TENSION			
9.20	—	2	2	BAND, FOUR-WAY STRAIN		6030
9.43, 9.44 OR 9.45	2	—	—	BAND, POLE TOP		6033
27.86	2Δ	—	—	CLAMP, SUSPENSION, WITH 2 1/4" LINK		
29.40	2	—	—	CLIP, GROUND, WITH 3/8"×1 1/2" CARRIAGE BOLT		6035, 6036, 6037
29.50	—	2	2	CLIP, GROUND, WITH 3/4"×2 1/2" CONE HEAD BOLT		6030
35.20	—	2	4	DEAD END, COMPRESSION TYPE O.G.W.		
58.11 OR 58.13	—	2	4	LINK, CONNECTING, PR.	FOR EYE-TYPE DEAD END, USE 58.11 FOR CLEVIS-TYPE DEAD END, USE 58.13	6030
64.20	2	—	—	LOCKNUT FOR 3/8" BOLT		
64.23	2	2	2	LOCKNUT FOR 3/4" BOLT		
77.27	2	4	4	LAG SCREW, 1/2"×4", FETTER DRIVE THREAD		
91.12	4	—	—	LOCK WASHER, SPRING FOR 5/8" BOLT		
91.22	—	4	4	WASHER, ROUND FLAT, 1 3/8" O.D., 9/16" HOLE		
91.13	2	—	—	LOCK WASHER, SPRING FOR 3/4" BOLT		
19.71	2	—	—	BOLT MACHINE, 3/4"×12"		
64.22	4	—	—	LOCKNUT FOR 5/8" BOLT WITH HEX NUTS		
20.41	2	—	—	BOLT, U, 5/8"×3" LONG, WITH 4 HEX NUTS		6033
C	1	—	—	ANGLE IRON		6041

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6159 AND 41 6169 (HS-1)

C	9/1/26 A7-KR	HISTORICAL REFERENCE.	
B	1-27-14 A7-DDD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-5428			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS TYPE HS 138KV AND 161KV SUSPENSION STRUCTURE			
DESIGNED BUREC _____ APPROVED BUREC _____			
C	JULY 1, 1981	41	6006

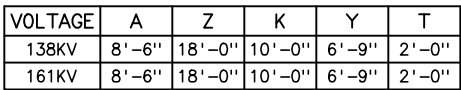


1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. $\neq$ USE ONLY WHEN SPECIFIED.
3. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO. 41 6035, IS USED.
4. * WHEN AN ADDITIONAL DISC IS USED ON ANGLE STRUCTURES, AT RAILROAD OR MAIN HIGHWAY CROSSINGS DIMENSION SHALL BE INCREASED ONE FOOT.
5. $\emptyset$ GREATER THAN 22-INCH LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

GROUNDING DETAILS_____	41	1012
DRILLING AND GAINING DETAILS WITH OGW_____	41	6024
X-BRACE DETAIL_____	41	6029
H-FRAME ANGLE IRON DETAILS_____	41	6041
GUY ARRANGEMENT-ASSEMBLY-H-FRAME____41	6051	AND 41 6052

INSULATOR MATERIAL							
PART NO.	QUANTITY				DESCRIPTION	DWG NO. 4	
	138KV		161KV				
27.81	3		3		CLAMP, SUSPENSION WITH SOCKET FITTING (FOR CONDUCTOR)	1000	
48.10	3		3		HOOK, SUSPENSION	1003	
51.65	24	3 STRINGS OF 8	30	3 STRINGS OF 10	INSULATOR, SUSPENSION TYPE, 10" DIA. 5 3/4" SPACING	1000	

C	9/1/26 A7-KR	HISTORICAL REFERENCE.
B	1-27-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5683		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE HSB 138KV AND 161KV SUSPENSION STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
DATE	JUNE 30, 1981	41 6007



INSULATOR MATERIAL						
PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	138KV		161KV			
27.81	3		3		CLAMP, SUSPENSION WITH SOCKET FITTING	1000
48.10	3		3		HOOK, SUSPENSION	1000
51.65	30	3 STRINGS OF 10	33	3 STRINGS OF 11	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3		3		ROD, ARMOR, TAPERED, SINGLE SUPPORT FOR ACSR, SET ROD, ARMOR, PREFORMED, SINGLE SUPPORT FOR ACSR, SET	1000

OVERHEAD GROUND WIRE MATERIAL				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	138KV	161KV		
9.20	2	2	BAND, FOUR-WAY STRAIN	
27.86	2	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	2	2	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
64.23	2	2	LOCKNUT FOR 3/4" BOLT	
75.42	2	2	ROD, ARMOR, PREFORMED	
77.27	4	4	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	2	SHACKLE, TWISTED	6039
91.22	4	4	WASHER, ROUND FLAT, 1 3/8" O.D., 9/16" HOLE	

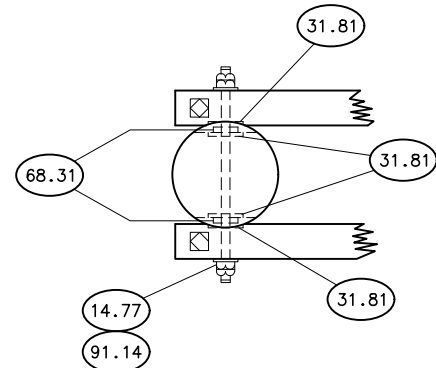


Diagram illustrating the components of a center phase fitting assembly:

- 19.47 USE ON CENTER PHASE
- 19.46 64.22 91.12 91.62
- 91.25
- 40.53 TO 40.56
- 19.33 64.21 91.11 91.60
- OMIT ON CENTER PHASE FITTING ASSEMBLIES

NOTES

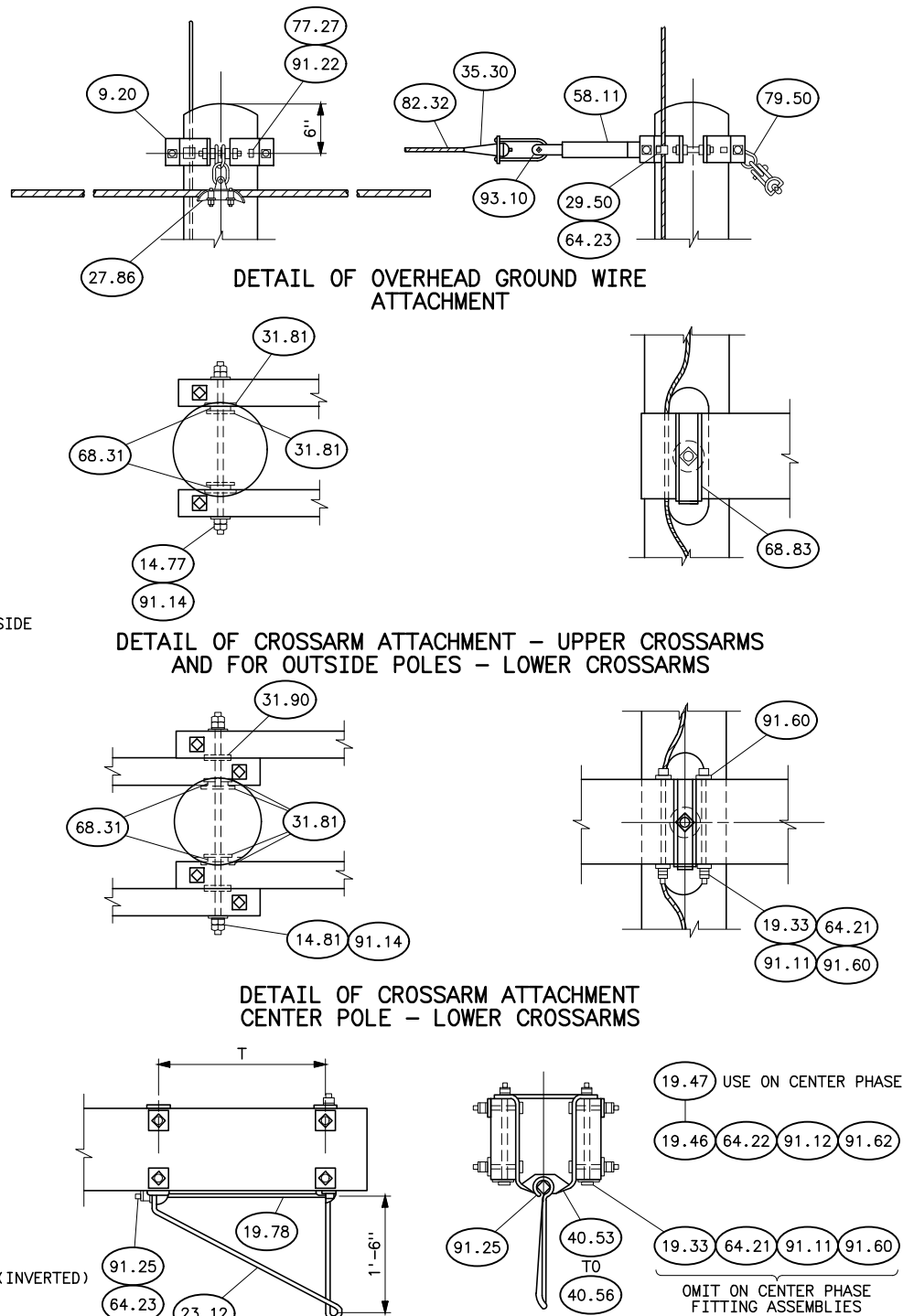
1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. ADJUST NUTS AND ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
3. ≠ USE ONLY WHEN SPECIFIED.
4. Ø GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

REFERENCE DRAWINGS

GROUNDING DETAILS	41	1012
DRILLING AND GAINING DETAILS	41	6024
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW	41	6054

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	1-27-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5688		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE 3AC 138KV AND 161KV SUSPENSION STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A F	AUGUST 9, 1979	41 6008



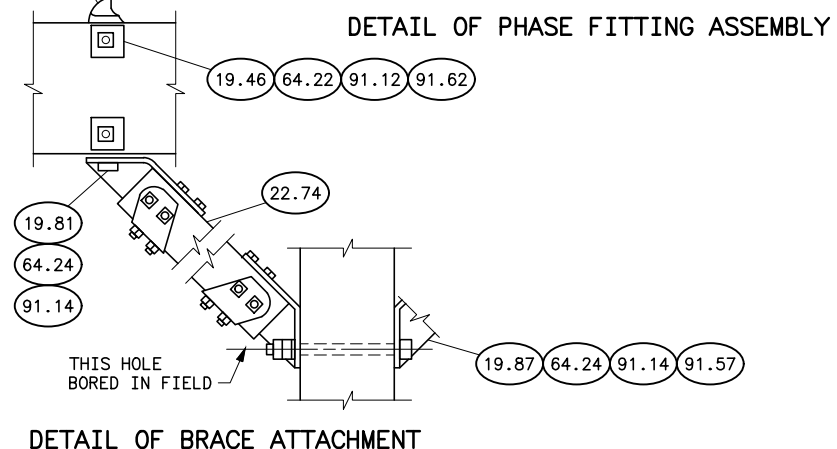
OVERHEAD GROUND WIRE MATERIAL				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	138KV	161KV		
9.20	1	1	BAND, FOUR-WAY STRAIN	
27.86	2	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	1	1	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
64.23	1	1	LOCKNUT FOR 3/4" BOLT	
77.27	2	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	2	SHACKLE, TWISTED	6039
91.22	2	2	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

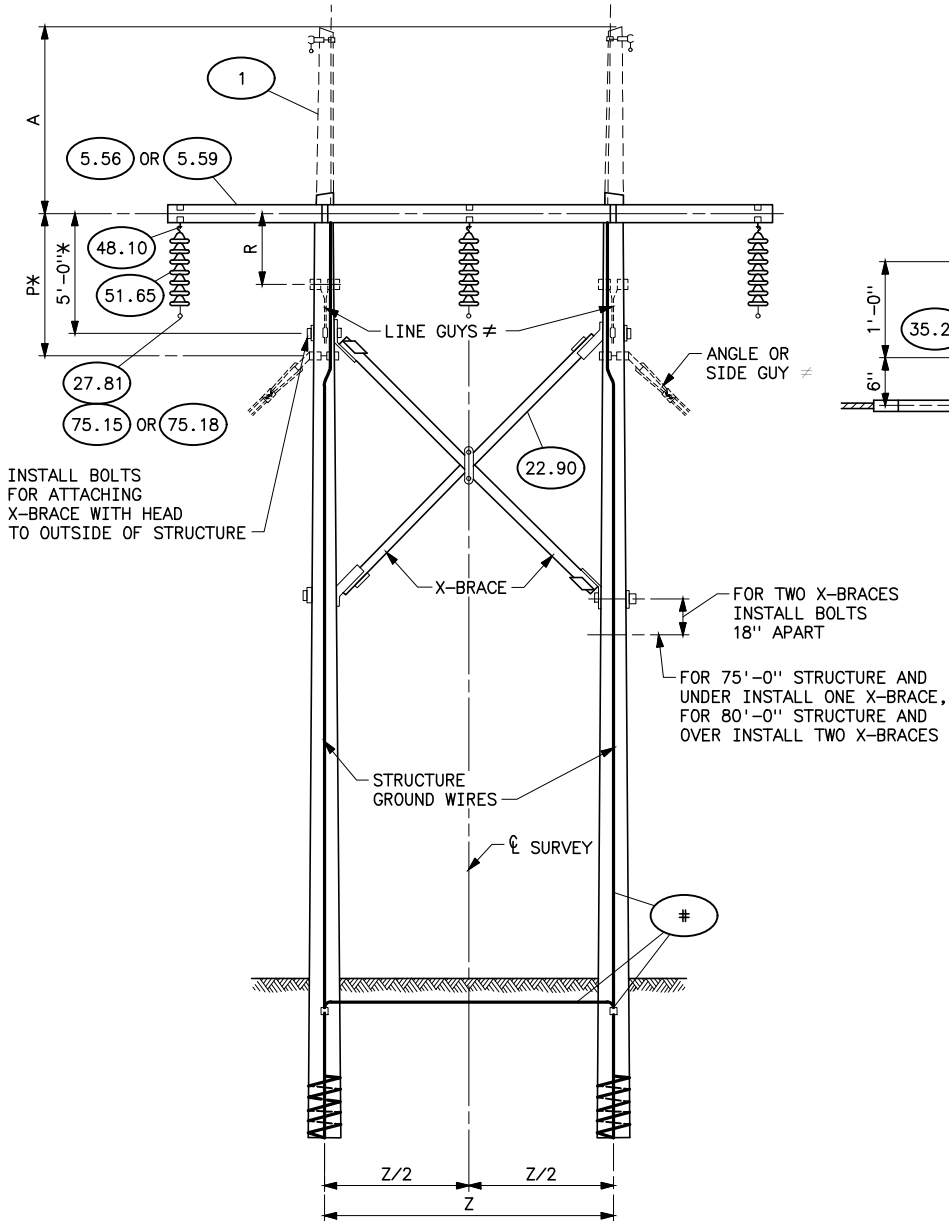
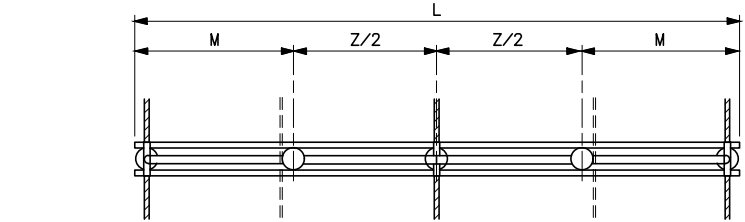
C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN
SUPERSEDES DWG NO. 40-D-5689		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE 3AD 138KV AND 161KV SUSPENSION STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
DATE	APRIL 21, 1981	61
		6009

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. ADJUST NUTS AND ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
3. * USE ONLY WHEN SPECIFIED.
4. Ø GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

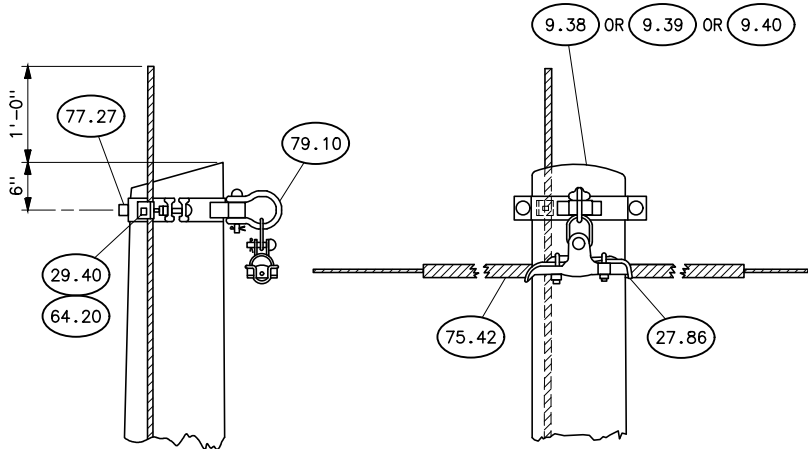
GROUNDING DETAILS	41	1012
DRILLING AND GAINING DETAILS	41	6024
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW	41	6054



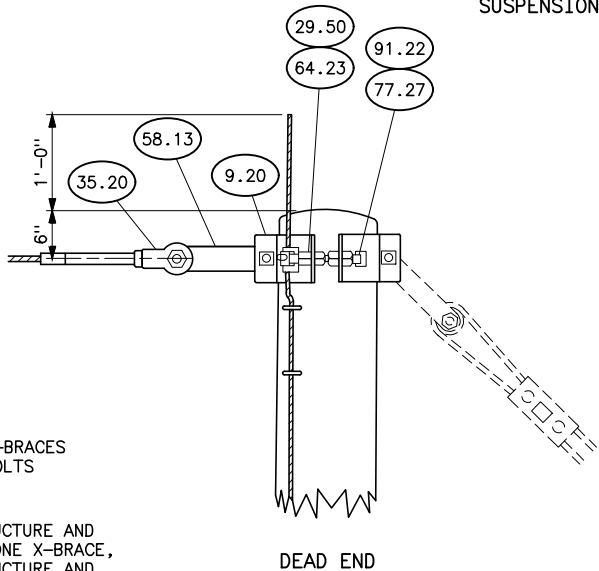
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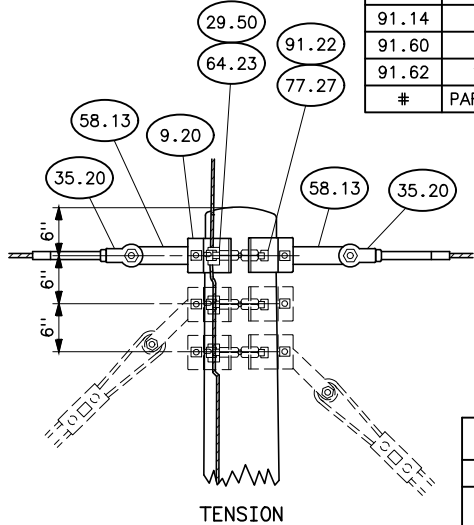
VOLTAGE	A			L	Z	Z/2	M	PK	R
	WITH OGW		WITHOUT OGW						
	30° PROTECTIVE ANGLE	39° PROTECTIVE ANGLE							
69KV	6'-6"	3'-0"	1'-0"	21'-0"	10'-0"	5'-0"	5'-6"	4'-0"	2'-0"
115KV	6'-6"	3'-0"	1'-0"	25'-0"	12'-0"	6'-0"	6'-6"	6'-0"	3'-0"



SUSPENSION

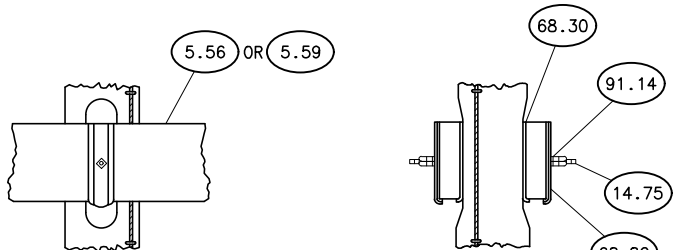


DEAD END

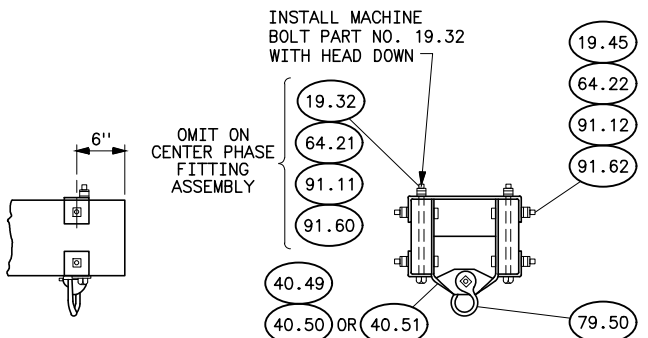


TENSION

DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



DETAIL OF CROSSARM ATTACHMENT



DETAIL OF PHASE FITTING ASSEMBLY

STRUCTURE MATERIAL

PART NO.	QUANTITY				DESCRIPTION	DWG NO 41
	WITH OVERHEAD GROUND WIRES		W/OUT OVERHEAD GROUND WIRES			
	69KV	115KV	69KV	115KV		
1	2	2	2	2	POLE	
5.56	2	—	2	—	CROSSARM, WOOD, 2 5/8"x9 1/2"x21'—0"	6023
5.59	—	2	—	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x25'—0"	6023
14.75	2	2	2	2	BOLT, DOUBLE ARMING, 7/8"x20" W/4 NUTS, USE EXTRA NUTS AS LOCKING NUTS	
19.32	4	4	4	4	BOLT, MACHINE, 1/2"x12"	
19.45	12	12	12	12	BOLT, MACHINE, 5/8"x5"	
22.90	1 OR 2	1 OR 2	1 OR 2	1 OR 2	X—BRACE, COMPLETE WITH FITTINGS, 3 3/8"x4 3/8"	6029
40.49 40.50 OR 40.51	3	3	3	3	FITTING, PHASE SELECT PHASE FITTING WITH DIMENSION 'B', NEAREST TO GAINING DIMENSION 'B', DRAWING NUMBERS 41 6066 & 41 6021	6038
64.21	4	4	4	4	LOCKNUT FOR 1/2" BOLT	6038
64.22	12	12	12	12	LOCKNUT FOR 5/8" BOLT	
68.30	4	4	4	4	PLATE, FLAT GAIN	6038
68.82	4	4	4	4	PLATE, RIBBED TIE	6038
79.50	3	3	3	3	SHACKLE, TWISTED	6038
91.11	4	4	4	4	LOCK WASHER, SPRING, FOR 1/2" BOLT	
91.12	12	12	12	12	LOCK WASHER, SPRING, FOR 5/8" BOLT	
91.14	4	4	4	4	LOCK WASHER, SPRING, FOR 7/8" BOLT	
91.60	4	4	4	4	WASHER, SQUARE FLAT, 2"x2"x1/8", 9/16" HOLE	
91.62	12	12	12	12	WASHER, SQUARE FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
#	PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

INSULATOR MATERIAL

PART NO.	69KV	115KV	DESCRIPTION	DWG NO. 41
27.81	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)	1000
48.10	3	3	HOOK, SUSPENSION	1003
51.65	12	3 STRINGS OF 4	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15	3	3	ROD, ARMOR, TAPERED, SINGLE SUPPORT (FOR ACSR ONLY)	1000
75.18	3	3	ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	

OVERHEAD GROUND WIRE MATERIAL

PART NO.	SUSPENSION	DEADEND	TENSION	DESCRIPTION	DWG NO. 41
9.20	-	2	2	BAND, FOUR-WAY STRAIN	6030
9.38, 9.39 OR 9.40	2	-	-	BAND, POLE TOP	6035, 6036, 6037
29.40	2	-	-	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	
27.86	2 Δ	-	-	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	-	2	2	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
35.20	-	2	4	DEAD END, COMPRESSION TYPE, FOR OVERHEAD GROUND WIRE	
58.13	-	2	4	LINK, CONNECTING, PAIR	6030
64.23	-	2	2	LOCKNUT FOR 3/4" BOLT	
77.27	2	4	4	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2 Δ	-	-	SHACKLE, ANCHOR TYPE	6036, 6037
91.22	-	4	4	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
64.20	2	-	-	LOCKNUT FOR 3/8" BOLT	
75.42	2 SETS	-	-	ROD, ARMOR, PREFORMED	

REFERENCE DRAWINGS

GROUNDING DETAILS----- 41 1012
DRILLING AND GAINING DETAILS WITH OGW -
30° PROTECTIVE ANGLE----- 41 6021
GUY ARRANGEMENT-ASSEMBLY-
H-FRAME----- 41 6051 AND 41 6052
DRILLING AND GAINING DETAILS (WITHOUT OGW)----- 41 6066
DRILLING AND GAINING DETAILS WITH OGW -
39° PROTECTIVE ANGLE----- 41 6068
GUY ARRANGEMENT-WITH GUY STUB AND
OVERHEAD GROUND WIRE----- 41 6086

NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. Δ USE ONLY WHEN SPECIFIED.
3. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE 'B' POLE TOP BAND, DWG NO. 41 6035 IS USED.
4. * WHEN AN ADDITIONAL DISC IS USED ON ANGLE STRUCTURES, AT RAILROAD OR MAIN HIGHWAY CROSSINGS, DIMENSIONS SHALL BE INCREASED ONE FOOT.
5. Ø GREATER THAN 20 INCH LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING
41 6117(69KV HS-1) & 41 6122(115KV HS-1)

E	8/24/26 A7-KR	HISTORICAL REFERENCE.
D	1-6-12 A7-DDD	REDRAWN.

SUPERSEDES DWG NO. E40-D-4804

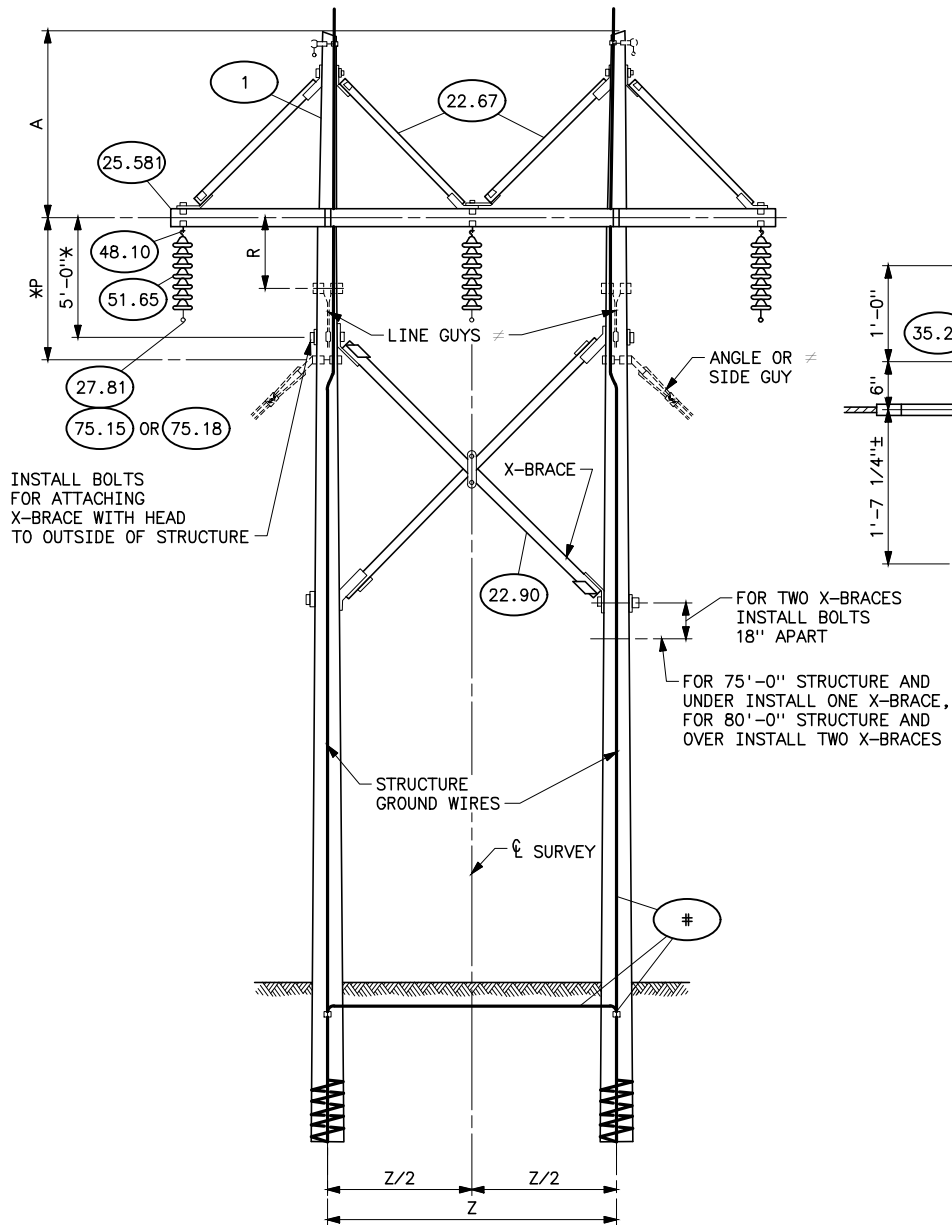
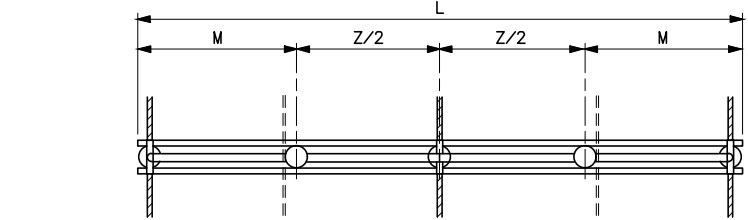
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE HS 69 AND 115KV
SUSPENSION STRUCTURE

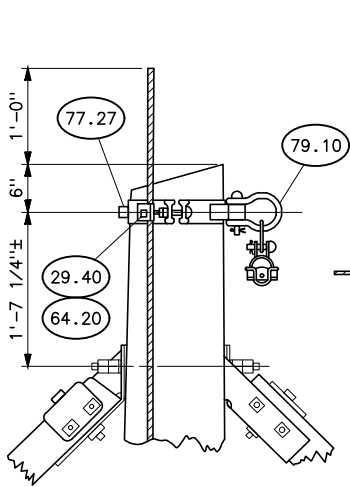
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A	AUGUST 6, 1979	41	6010
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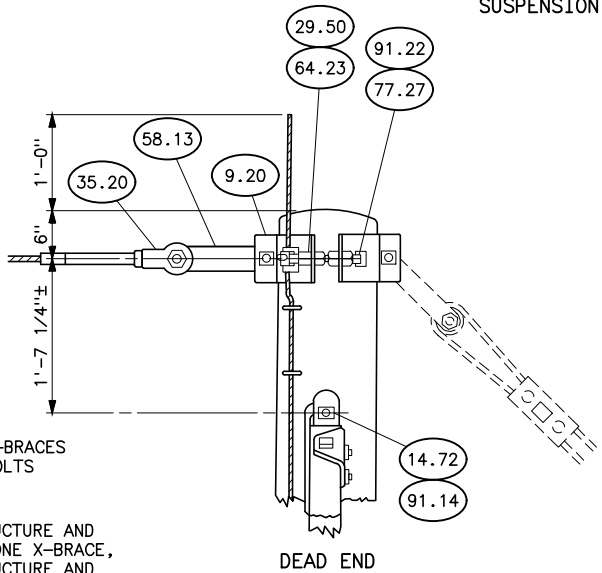
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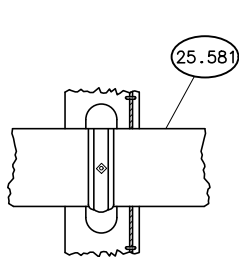
VOLTAGE	A		L	Z	Z/2	M	PX	R
	WITH OGW	WITHOUT OGW						
	FOR LINES WITH 30° OR 39° PROTECTIVE ANGLES							
69 & 115KV	8'-2"	8'-2"	25'-0"	12'-0"	6'-0"	6'-6"	6'-0"	3'-0"



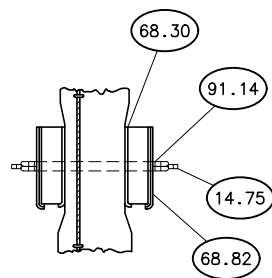
SUSPENSION



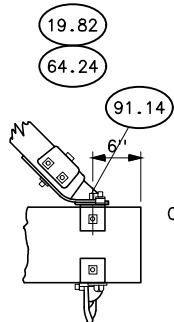
DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



DETAIL OF CROSSARM ATTACHMENT



INSTALL MACHINE BOLT PART NO. 19.32, WITH HEAD DOWN



DETAIL OF PHASE FITTING ASSEMBLY

STRUCTURE MATERIAL

PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRES		W/OUT OVERHEAD GROUND WIRES			
	69KV	115KV	69KV	115KV		
1	2	2	2	2	POLE	
25.581	2	2	2	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x25'-0"	6023
14.72	2	2	2	2	BOLT, DOUBLE ARMING, 7/8"x14" WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS	
14.75	2	2	2	2	BOLT, DOUBLE ARMING, 7/8"x20" WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS	
19.32	4	4	4	4	BOLT, MACHINE, 1/2"x12"	
19.45	12	12	12	12	BOLT, MACHINE, 5/8"x5"	
19.82	3	3	3	3	BOLT, MACHINE, 7/8"x3"	
22.67	4	4	4	4	BRACE, KNEE, SPACING 5'-8", DROP 5'-8", 3 3/8"x4 3/8" SECTION	
40.52	3	3	3	3	FITTING, PHASE	6038
64.21	4	4	4	4	LOCKNUT FOR 1/2" BOLT	
64.22	12	12	12	12	LOCKNUT FOR 5/8" BOLT	
64.24	3	3	3	3	LOCKNUT FOR 7/8" BOLT	
68.30	4	4	4	4	PLATE, FLAT GAIN	6038
68.82	4	4	4	4	PLATE, RIBBED TIE	6038
79.50	3	3	3	3	SHACKLE, TWISTED	6038
91.11	4	4	4	4	LOCK WASHER, SPRING, FOR 1/2" BOLT	
91.12	12	12	12	12	LOCK WASHER, SPRING, FOR 5/8" BOLT	
91.14	11	11	11	11	LOCK WASHER, SPRING, FOR 7/8" BOLT	
91.60	4	4	4	4	WASHER, SQUARE FLAT 2"x2"x1/8", 9/16" HOLE	
91.62	12	12	12	12	WASHER, SQUARE FLAT 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
22.90	1 OR 2	1 OR 2	1 OR 2	1 OR 2	X-BRACE, COMPLETE WITH FITTINGS, (3 3/8"x4 3/8")	6029
#	PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

INSULATOR MATERIAL

PART NO.	69KV	115KV	DESCRIPTION	DWG NO. 41
27.81	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)	1000
48.10	3	3	HOOK, SUSPENSION	1003
51.65	12	3-STRINGS OF 4	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3	ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	1000
			ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	

OVERHEAD GROUND WIRE MATERIAL

PART NO.	SUSPENSION	DEADEND	TENSION	DESCRIPTION	DWG NO. 41
9.20	-	2	2	BAND, FOUR-WAY STRAIN	6030
9.38, 9.39 OR 9.40	2	-	-	BAND, POLE TOP	6035, 6036, 6037
29.40	2	-	-	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	
27.86	2	-	-	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	-	2	2	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
35.20	-	2	4	DEAD END, COMPRESSION TYPE, FOR OVERHEAD GROUND WIRE	
58.13	-	2	4	LINK, CONNECTING, PAIR	6030
64.23	-	2	2	LOCKNUT FOR 3/4" BOLT	
77.27	2	4	4	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2	-	-	SHACKLE, ANCHOR TYPE	6036, 6037
91.22	-	4	4	WASHER, ROUND FLAT, 1-3/8" OD, 9/16" HOLE	
64.20	2	-	-	LOCKNUT FOR 3/8" BOLT	
75.42	2 SETS	-	-	ROD, ARMOR, PREFORMED	

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING
41 6123(69 AND 115KV HSB-1)

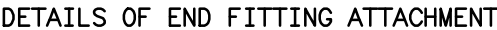
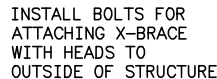
REFERENCE DRAWINGS

GROUNDING DETAILS ----- 41 1012
DRILLING AND GAINING DETAILS WITH OGW - 30° PROTECTIVE ANGLE ----- 41 6021
GUY ARRANGEMENT-ASSEMBLY-----
H-FRAME ----- 41 6051 AND 41 6052
DRILLING AND GAINING DETAILS (WITHOUT OGW)----- 41 6066
DRILLING AND GAINING DETAILS WITH OGW - 39° PROTECTIVE ANGLE ----- 41 6068
GUY ARRANGEMENT-WITH GUY STUB AND OVERHEAD GROUND WIRE ----- 41 6086

NOTES

- USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
- USE ONLY WHEN SPECIFIED.
- ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO. 41 6035 IS USED.
- WHEN AN ADDITIONAL INSULATOR DISC IS USED ON ANGLE STRUCTURES, AT RAILROAD OR MAIN HIGHWAY CROSSINGS, THIS DIMENSION SHALL BE INCREASED ONE FOOT.
- GREATER THAN 20-INCH LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

E	8/26/26 A7-KR	HISTORICAL REFERENCE.
D	1-30-12 A7-KRR	CORRECTED A TYPO IN THE NOTES AND ADDED A MISSING PART NO.
C	6-14-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. E40-D-4805 & 40-D-3802		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HSB 69 AND 115KV SUSPENSION STRUCTURE		
DESIGNED BUREC	APPROVED BUREC	
AUGUST 6, 1979	41	6011

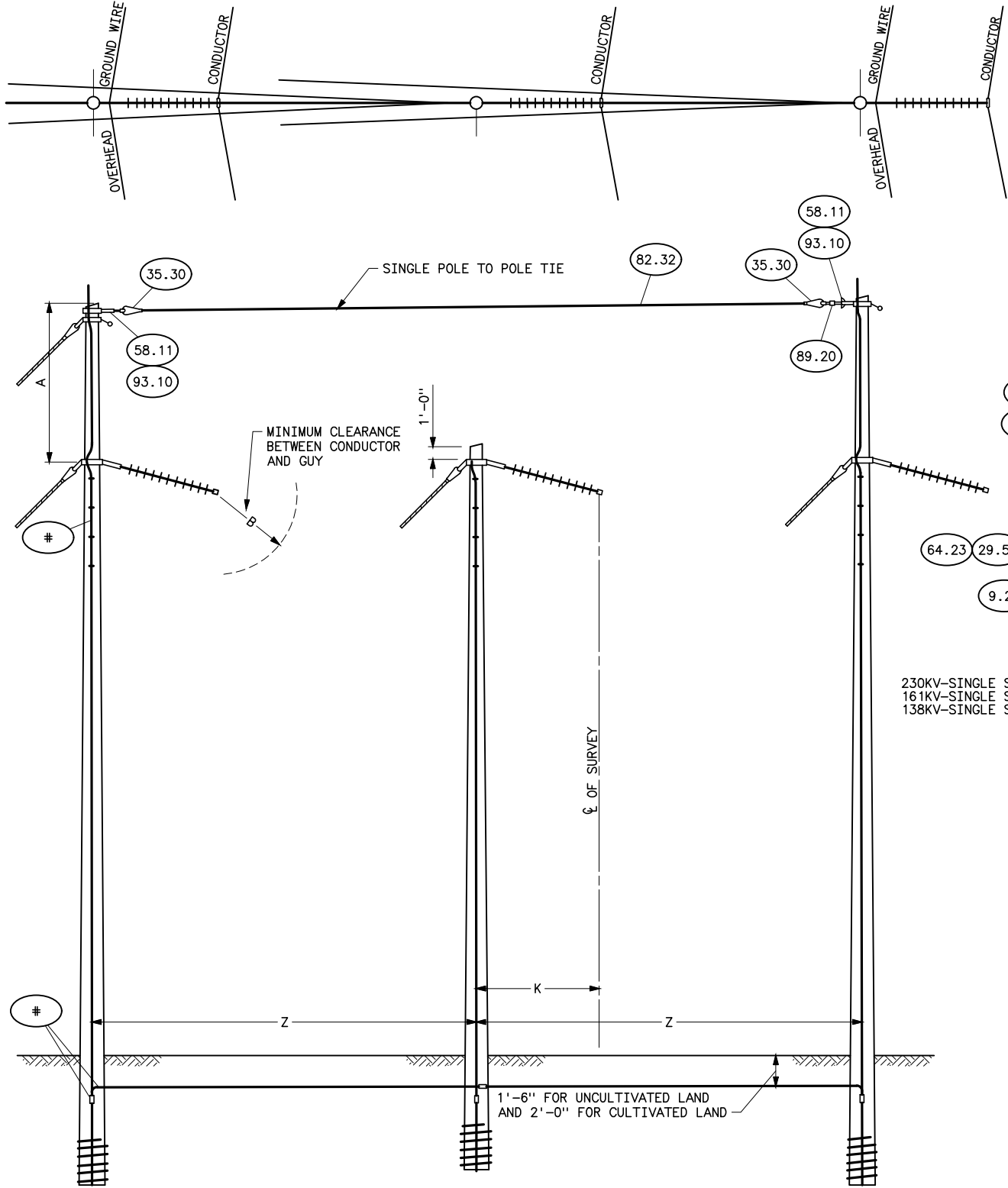


HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6128(HSB-1)

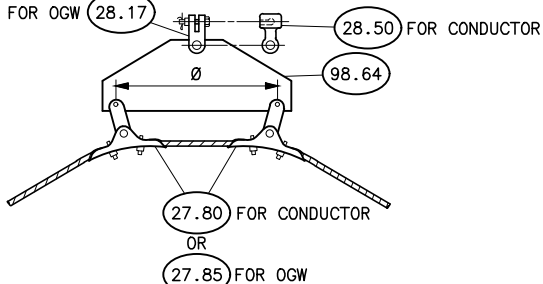
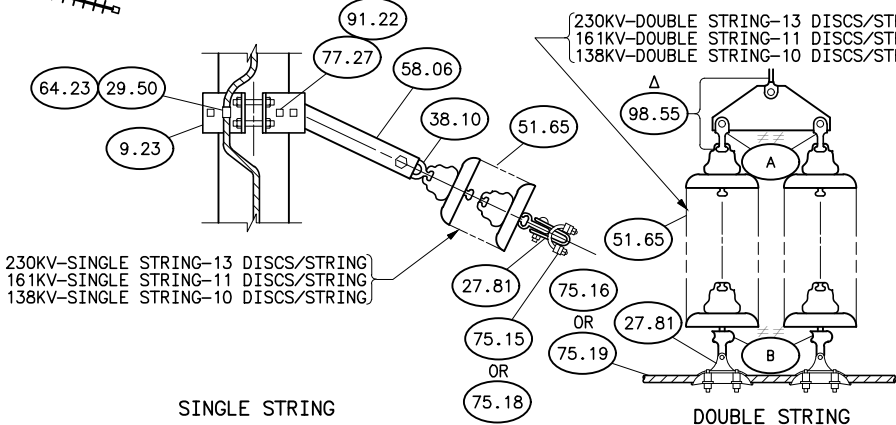
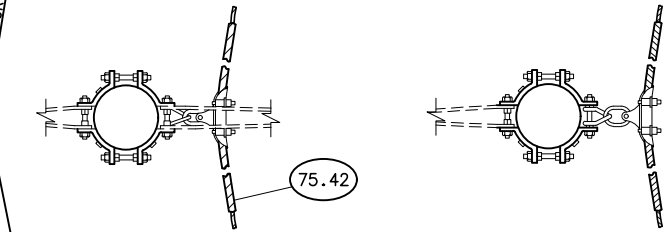
OVERHEAD GROUND WIRE MATERIAL					
PART NO.	QUANTITY			DESCRIPTION	DWG NO.
	SUSP	DEAD END	TENSION		
9.20	-	2	2	BAND, FOUR-WAY STRAIN	41 6030
9.43, 9.44, 9.45	2	-	-	BAND, POLE TOP	41 6033
19.71	2	-	-	BOLT, MACHINE, 3/4"x12"	
20.41	2	-	-	BOLT, "U", 5/8"x3" LONG, WITH 4 HEX. NUTS	41 6033
27.86	2	-	-	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.40	2	-	-	CLIP, GROUND, WITH 3/8"x1 1/2" CARRIAGE BOLT	41 6033
29.50	-	2	4	CLIP, GROUND, WITH 3/4"x2 1/2" CONE HEAD BOLT	41 6030
35.20	-	2	4	DEAD END, COMPRESSION TYPE FOR OGW	
35.30	-	2	2	DEAD END, AUTOMATIC VISE TYPE FOR GUY STAND, SHORT BAIL	
58.11	-	6	6	LINK, 17" LONG, 13/16" HOLE, 3/4"x2 1/2" BOLT	41 6030
64.20	2	-	-	LOCKNUT FOR 3/8" BOLT	
64.22	4	-	-	LOCKNUT FOR 5/8" BOLT WITH HEX NUTS	
64.23	2	2	4	LOCKNUT FOR 3/4" BOLT	
75.42	2	-	-	RODS, ARMOR, PREFORMED, SET	
77.27	-	4	8	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
82.32	AS REQD			STRAND, STEEL, 7/16", HIGH STRENGTH STEEL	
89.20	-	1	1	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	B.T.-3155
91.12	4	-	-	LOCK WASHER, SPRING, FOR 5/8" BOLT	
91.13	2	-	-	LOCK WASHER, SPRING, FOR 3/4" BOLT	
91.22	-	4	4	WASHER, ROUND, FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	-	4	6	WHEEL, SHEAVE, FOR 7/16", HIGH STRENGTH STEEL	41 6030
A	-	-	2	BAND, POLE WITH HOLE FOR CLIP	HB-3108
C	1	-	-	ANGLE IRON, 3"x3"x3/8"x25"-6"	41 6041
58.13a	-	-	4	LINK, 17" LONG, 15/16" HOLE, 3/4"x2 1/2" BOLT	41 6030

E	8/25/26 A7-KR	HISTORICAL REFERENCE.	
D	1-6-12 A7-DDD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-5990			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS TYPE HSB 230KV SUSPENSION STRUCTURE			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
C A	JULY 26, 1979	41	6012

Plotted By: court Aug 25, 2026- 12:41pm
S:\Projects\Wisc\Standard Drawings\Drawings\Korens Drawings To Revise\going Up In Revision\highlighted drawings\41_6013f.dwg Last Saved By: Court, Donita (CONTR) on 8/25/2026 7:45 AM
IMAGES:



VOLTAGE	A	K	Z	B
138KV	10'-0"	6'-0"	23'-0"	5'-0"
161KV	10'-0"	6'-6"	24'-0"	5'-6"
230KV	10'-0"	7'-6"	25'-0"	6'-5"



HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6103 (3A-1)

STRUCTURE MATERIAL				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	W/OVERHEAD	GROUND WIRES		
1	3		POLE, SEE STRUCTURE LIST FOR HEIGHT	
9.20	2		BAND, FOUR-WAY STRAIN, TYPE A (WHEN SPECIFIED)	6030
9.23	3		BAND, FOUR-WAY STRAIN, TYPE B	6031
29.50	5		CLIP, GROUND	6031
58.06	3		LINK, CONNECTING PR	6031
58.11	2		LINK, CONNECTING PR (USE WITH 9.20)	6030
64.23	5		LOCKNUT FOR 3/4" BOLT	
77.27	10		LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.22	10		WASHER, ROUND FLAT, 1 3/8" OD 9/16" HOLE	
93.10	2		SHEAVE WHEEL, FOR 7/16" HIGH STRENGTH STEEL STRAND	6030
35.30	2		DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL	
82.32	AS REQUIRED		STEEL STRAND, 7 WIRE, 7/16" HIGH STRENGTH	
89.20	1		TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	BT-3155
#	GROUNDING MATERIAL PART NO'S AND DESCRIPTION SHOWN ON 41 1013			

INSULATOR MATERIAL									
PART NO.	QUANTITY								
	SINGLE STRING			SINGLE STRING WITH YOKE			DOUBLE STRING		
	138	161	230	138	161	230	138	161	230
# 27.80	-	-	-	6	6	6	-	-	-
27.81	3	3	3	-	-	-	6	6	6
28.52	-	-	-	-	-	-	2≠≠	2≠≠	2≠≠
38.10	3	3	3	3	3	3	3	3	3
51.65	30	33	39	30	33	39	60	66	78
75.15 OR 75.18	3	3	3	-	-	-	-	-	-
75.16 OR 75.19	-	-	-	3	3	3	3	3	3
Δ 98.55	-	-	-	-	-	-	3	3	3
# 98.64	-	-	-	3	3	3	-	-	-
# 28.50	-	-	-	3	3	3	-	-	-

OVERHEAD GROUND WIRE MATERIAL				
PART NO.	QUANTITY	DESCRIPTION		DWG NO. 41
9.20	1	BAND, FOUR-WAY STRAIN		6030
# 28.17	2	CLEVIS, - CLEVIS 90° CONNECTOR		
27.85 OR 27.86	2*,#	CLAMP, SUSPENSION, WITH 2 1/4" LINK FOR OGW		
29.50	1	CLIP, GROUND		6030
64.23	1	LOCKNUT FOR 3/4" BOLT		
75.42	2	ROD, ARMOR, PREFORMED, SET		
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD		
79.50	2	SHACKLE, TWISTED		6039
91.22	2	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE		

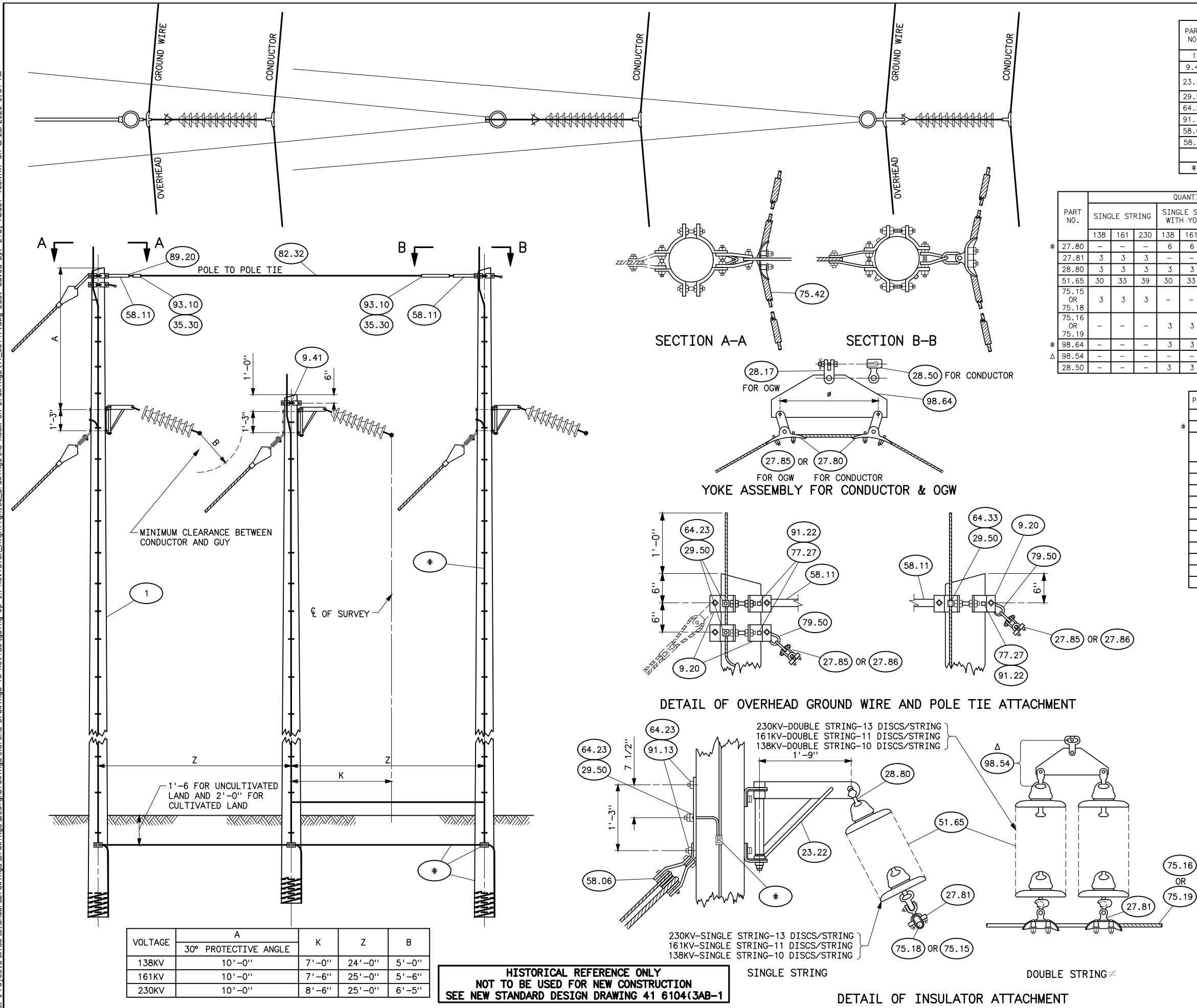
REFERENCE DRAWINGS

GROUNDING DETAILS _____ 41 1013
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB _____
STRUCTURES WITH OVERHEAD GROUND WIRES _____ 41 6053

NOTES

- USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
- * FOR LINE ANGLES UP TO AND INCLUDING 30° USE SUSPENSION CLAMP. PART NO. 27.86.
- * FOR LINE ANGLES GREATER THAN 30° USE LARGE ANGLE SUSPENSION CLAMP PART NO. 27.85.
- ≠USE ONLY WHEN SPECIFIED.
- POLES SHALL BE GIVEN RAKE OF 1/4-INCH FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ≠≠USE ITEM 28.52 AT (A) AND ITEM 38.10 AT (B) WHEN INSULATOR CAPS ARE SPECIFIED TO BE AWAY FROM STRUCTURE.
- Δ WHEN SIZED SUSPENSION CLAMPS ARE SPECIFIED THE LENGTH OF THE YOKE SHALL BE EQUAL TO THE LENGTH OF THE SUSPENSION CLAMP PLUS AT LEAST 10 INCHES.
- # YOKE ASSEMBLY SHALL BE USED FOR CONDUCTOR ASSEMBLIES AT LINE ANGLES OF 20° TO 60°, FOR OVERHEAD GROUND WIRE ASSEMBLIES AT LINE ANGLES OF 30° TO 60°.
- Ø LENGTH OF SUSPENSION CLAMP PLUS 3 INCHES.

F	8/25/2026 A7-KR	HISTORICAL REFERENCE
SUPERSEDES DWG NO. 40-D-5686		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3A 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE		
DESIGNED BUREC _____	APPROVED BUREC _____	
DATE AUGUST 6, 1979	41	6013



STRUCTURE MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRES		
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT	
9.41	1	BAND, POLE TOP	6032
23.22	3	BRACKET, EXTENSION, 21", COMPLETE WITH 3/4" ATTACHMENT BOLTS. HUGHES BROS #2822.8	6045
29.50	3	CLIP, GROUND	6030
64.23	9	LOCKNUT FOR 3/4" BOLT	
91.13	6	LOCK WASHER, SPRING FOR 3/4" BOLT	
58.06	3	LINK, CONNECTING PAIR	6031
58.11	3	LINK, CONNECTING PAIR	6030
#	GROUNDING MATERIAL PART NUMBERS AND DESCRIPTION SHOWN ON 41 1013		

PART NO.	QUANTITY									DESCRIPTION	DWG NO. 41
	SINGLE STRING			SINGLE STRING WITH YOKE $\neq$			DOUBLE STRING $\neq$				
	138	161	230	138	161	230	138	161	230		
27.80	—	—	—	6	6	6	—	—	—	CLAMP, SUSPENSION, WITH CLEVIS-EYE CONNECTOR	
27.81	3	3	3	—	—	—	6	6	6	CLAMP, SUSPENSION, WITH SOCKET FITTING	1000
28.80	3	3	3	3	3	3	3	3	3	Y-BALL CLEVIS	1003
51.65	30	33	39	30	33	39	60	66	78	INSULATOR, SUSPENSION TYPE, 10" DIA, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3	3	—	—	—	—	—	—	ROD, ARMOR, TAPERED, SINGLE SUPPORT (ACSR) SET	1000
75.16 OR 75.19	—	—	—	3	3	3	3	3	3	ROD, ARMOR, PREFORMED, SINGLE SUPPORT (ACSR) SET	
98.64	—	—	—	3	3	3	—	—	—	ROD, ARMOR, TAPERED, DOUBLE SUPPORT (ACSR) SET	1004
98.54	—	—	—	—	—	—	3	3	3	ROD, ARMOR, PREFORMED, DOUBLE SUPPORT (ACSR) SET	
28.50	—	—	—	3	3	3	—	—	—	YOKE	1004
	—	—	—	—	—	—	3	3	3	YOKE, COMPLETE WITH FITTINGS	1004
	—	—	—	3	3	3	—	—	—	CLEVIS, SOCKET CONNECTOR	

OVERHEAD GROUND WIRE MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO.
9.20	3	BAND, FOUR-WAY STRAIN	
28.17	2	CLEVIS - CLEVIS 90° CONNECTOR	
27.85 OR 27.86	2#, #	CLAMP, SUSPENSION, WITH 2 1/4" LINK FOR OGW	
29.50	3	CLIP, GROUND	6030
58.11	3	LINK, CONNECTING, PAIR	6030
64.23	3	LOOKNUT FOR 3/4" BOLT	
75.42	2	ROD, ARMOR, PREFORMED, SET	
77.27	6	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	SHACKLE, TWISTED	6038
82.32	AS REQD	STEEL STRAINING, 7 WIRE, 7/16" HIGH STRENGTH	
91.22	6	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	3	SHEAVE WHEEL, FOR 7/16" HIGH STRENGTH STRAND	6030
35.30	2	DEAD END, AUTOMATIC WIRE TYPE FOR GUY STRAND, SHORT BAIL	
89.20	2	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	BT-3155

NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. *FOR LINE ANGLES UP TO AND INCLUDING 30°, USE SUSPENSION CLAMP PART NO. 27.86.
3. *FOR LINE ANGLES GREATER THAN 30°, USE LARGE ANGLE SUSPENSION CLAMP PART 27.85.
4. ≠ USE ONLY WHEN SPECIFIED
5. POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN.
6. ΔWHEN SIZED SUSPENSION CLAMPS ARE SPECIFIED THE LENGTH OF THE YOKE SHALL BE EQUAL TO THE LENGTH OF THE SUSPENSION CLAMP PLUS AT LEAST 10 INCHES.
7. *YOKE ASSEMBLY SHALL BE USED FOR CONDUCTOR ASSEMBLIES AT LINE ANGLES OF 20° TO 60° FOR OVERHEAD GROUND WIRE ASSEMBLIES, AT LINE ANGLES OF 30° TO 60°.
8. Ø LENGTH OF SUSPENSION CLAMP PLUS 2 INCHES.

REFERENCE DRAWING

GUY ARRANGEMENT, FOR TYPE 3A & 3AB STRUCTURES
WITH OVERHEAD GROUND WIRES_____41 6053

F	8/25/2026 A7-KR	HISTORICAL REFERENCE
D	1-6-12 A7-DDD	REDRAWN.

SUPERSEDES DWG NO. 40-D-5687

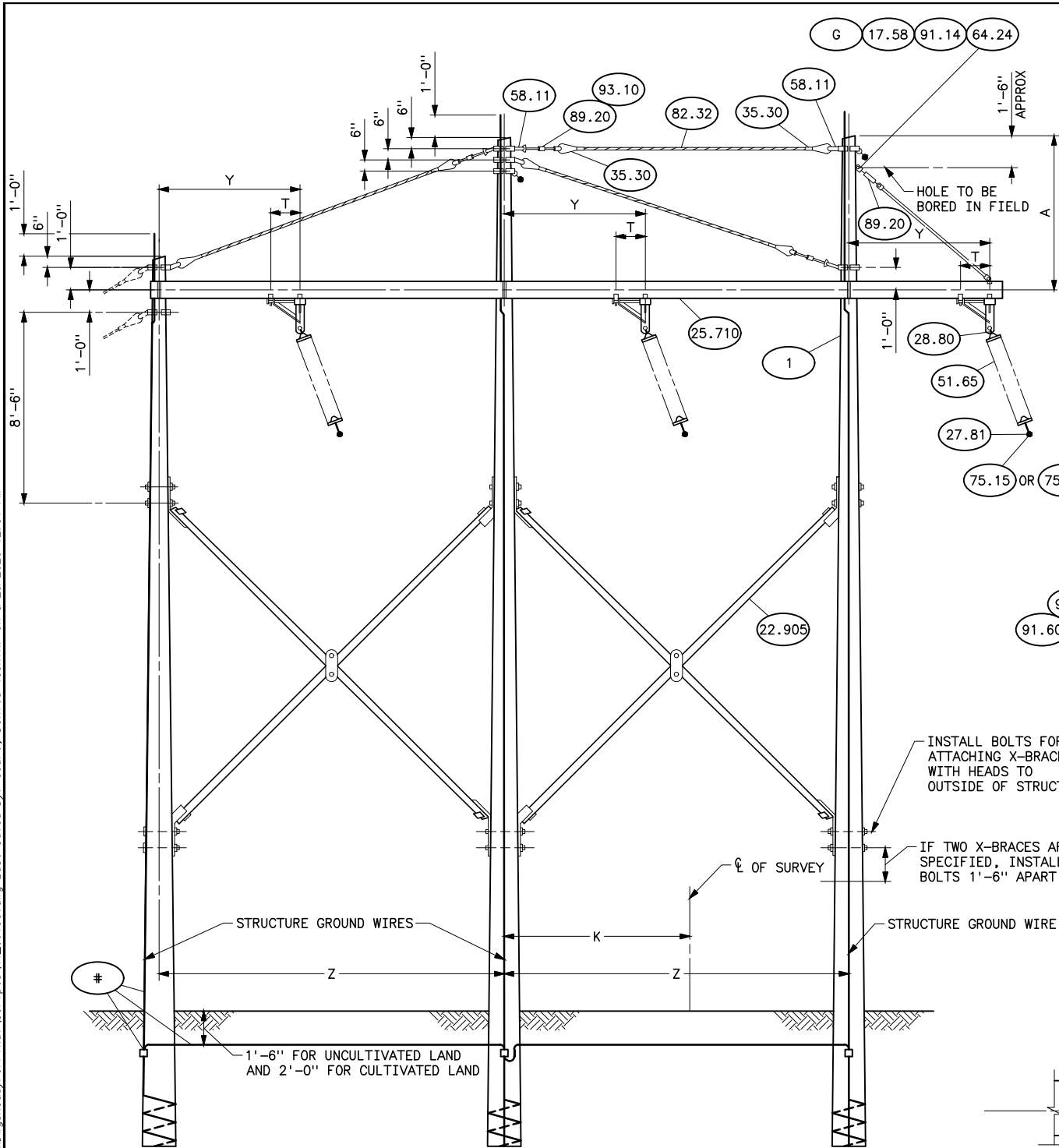
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS TRANSMISSION LINES TYPE 3AB, 138, 161, AND 230KV MEDIUM ANGLE STRUCTURE

DESIGNED BUREC _____ APPROVED BUREC _____

C _A F	AUGUST 6, 1979	41	6014
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Plotted By: Zita Sep 01, 2026- 10:34am
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IMAGES:



VOLTAGE	A	Z	K	Y	T
230KV	10'-6"	24'-0"	11'-0"	7'-8"	1'-6"

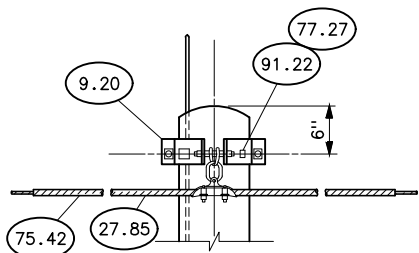
REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
DRILLING AND GAINING DETAILS - 30° PROTECTIVE ANGLE	41 6024
CROSSARM DRILLING DETAILS	41 6028
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW	41 6054

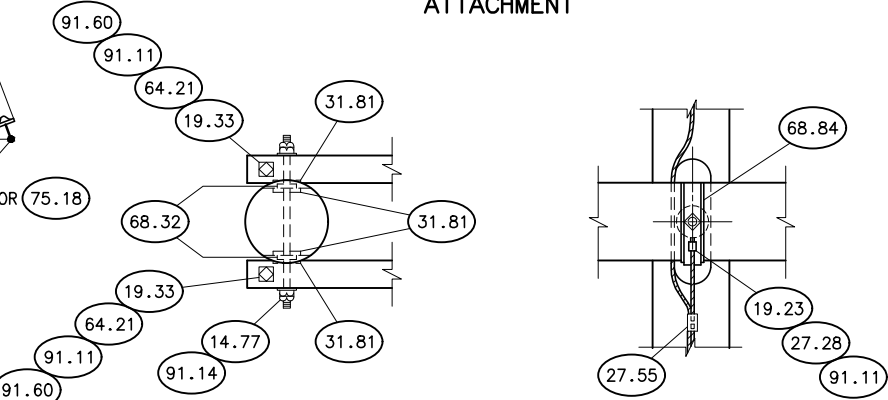
NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH 4-WAY STRAIN BAND.
2. ADJUST NUTS ON ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
3. ≠ USE ONLY WHEN SPECIFIED.
4. Ø GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGER POLES.

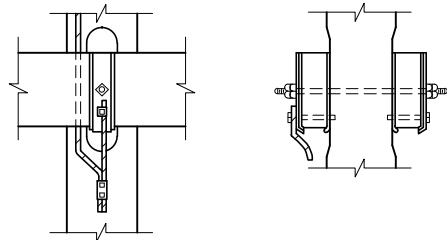
OVERHEAD GROUND WIRE MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO. 41
27.85	2	CLAMP, SUSPENSION WITH 2 1/4" LINK	
75.42	2	ROD, ARMOR, PREFORMED, FOR OVERHEAD GROUND WIRE	
79.50	2	SHACKLE, TWISTED	6040



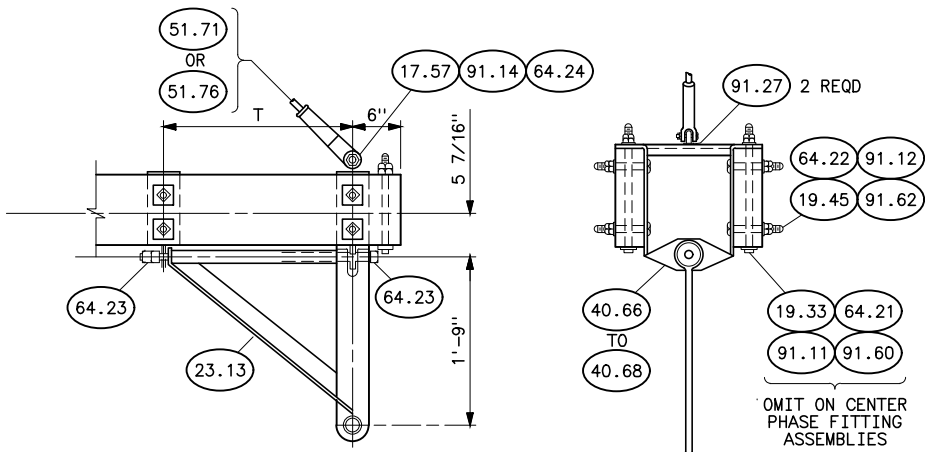
DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



DETAIL OF CROSS ARM ATTACHMENT



DETAIL OF CROSS ARM ATTACHMENT



DETAIL OF PHASE FITTING ASSEMBLY

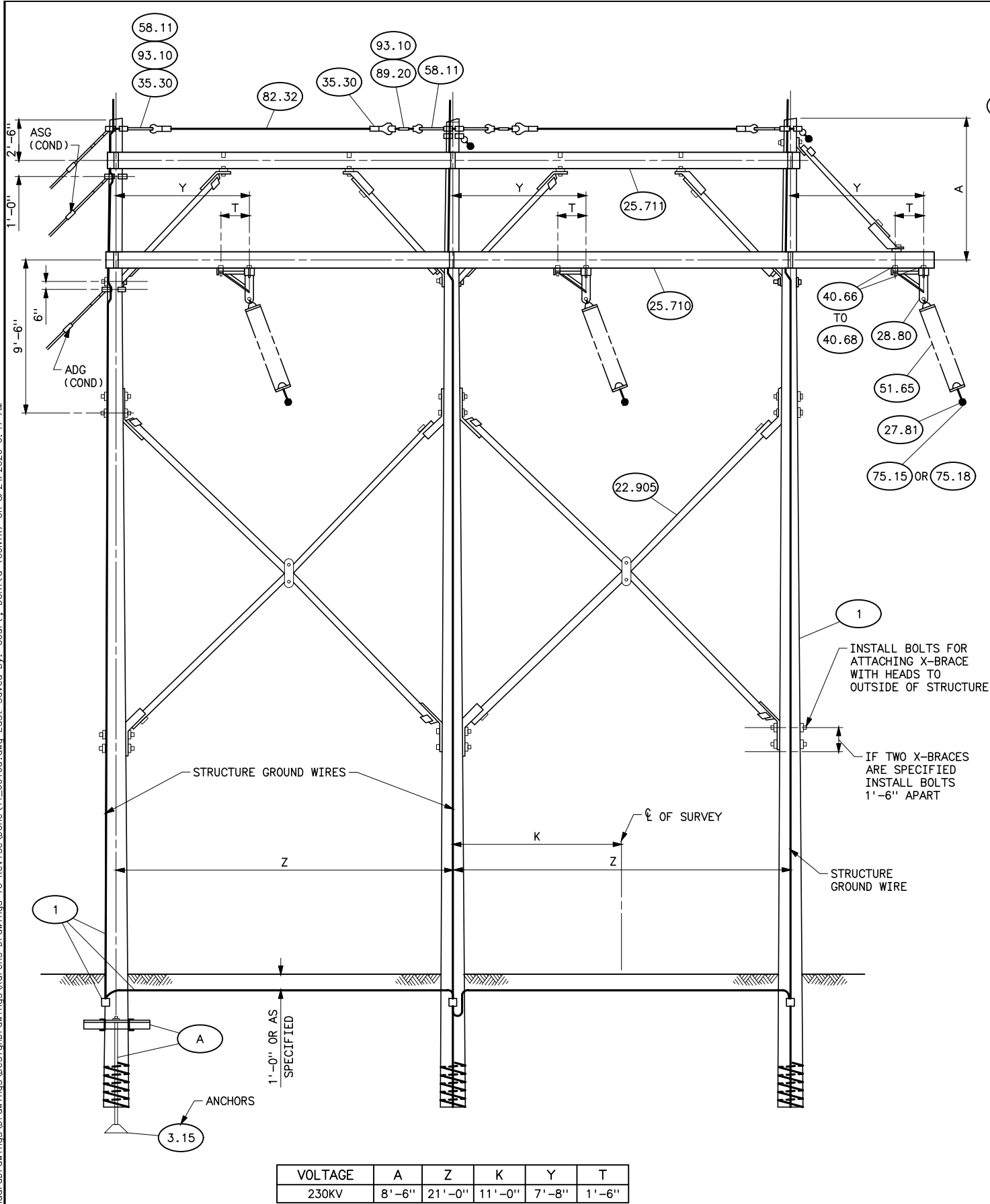
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING
41 6131-1 AND 41 6131-2 (3AC-1)

STRUCTURE MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO. 41
1	3	POLE	
9.20	6	BAND, FOUR-WAY STRAIN	6030
14.77	3	BOLT, DOUBLE ARMING 7/8"x21" WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS	
19.23	6	BOLT, MACHINE, WITH HEXAGONAL HEAD, 1/2"x5 1/2" NO NUT	
19.33	4	BOLT, MACHINE, 1/2"x14"	
17.57	1	BOLT, SHOULDER EYE, WITH PUNCHED EYE, 7/8"x2 1/2", 1 7/8" MIN THREAD LENGTH	
19.45	24	BOLT, MACHINE 5/8"x5"	
22.905	2 OR 4	X-BRACE COMPLETE W/FITTINGS, WASHERS, NUT AND BOLTS	
23.13	3	BRACKET, SWINGING, ANGLE, 18"x21"	6046
25.710	2	CROSSARM, LAMINATED WOOD, 3 1/8"x9"x56'-8"	
27.28	3	2 PC COPPER ALLOY GROUND CONNECTOR FOR 1/2" BOLT 2# BURNDY G.B.	
27.55	3	CLAMP, PARALLEL GROOVE, 2-BOLT, COPPER ALLOY	1012
17.58	1	BOLT, SHOULDER EYE, WITH PUNCHED EYE, 7/8"x14"	
29.50	6	CLIP, GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	6030
31.81	24	CONNECTOR, 4" SHEAR PLATE, FOR 7/8" BOLT	
35.30	6	DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL	
40.66 TO 40.68	6	PHASE FITTING SELECT PHASE FITTING WITH DIMENSION "B" WHICH MAKES BEST FIT BETWEEN CROSSARMS	6040
58.11	6	LINK, CONNECTING PAIR	6030
64.21	4	LOCKNUT FOR 1/2" BOLT	
64.22	24	LOCKNUT FOR 5/8" BOLT	
64.23	15	LOCKNUT FOR 3/4" BOLT	
68.32	6	PLATE, FLAT GAIN	
64.24	2	LOCKNUT FOR 7/8" BOLT	
68.84	6	PLATE, RIBBED TIE	
77.27	12	LAG SCREW, 1/2"x4" FETTER DRIVE THREAD	
82.32	AS REQD	STEEL STRAND, 7-WIRE, 7/16" HIGH STRENGTH	
89.20	4	TURNBUCKLE, CLEVIS - EYE 7/8"x12"	BT 3155
91.11	10	LOCKWASHER, SPRING FOR 1/2" BOLT	
91.27	2	WASHER, ROUND 3"x1/4" WITH 15/16" HOLE	
91.12	24	LOCKWASHER FOR 5/8" BOLT	
91.22	12	WASHER, ROUND FLAT, 1 3/8" OD 9/16" HOLE	
91.60	8	WASHER, SQUARE, FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
91.62	24	WASHER, SQUARE	
91.14	8	LOCKWASHER, FOR 7/8" BOLT	
93.10	6	SHEAVE WHEEL, FOR 7/16" HIGH STRENGTH STEEL STRAND	
51.71 OR 51.76	1	INSULATOR, WOOD GUY STRAIN, CLEVIS-CLEVIS. MIN ULTIMATE STRENGTH OF 25,000# 9'-6" LONG. INSULATOR, FIBERGLASS OR EPOXYGLASS GUY STRAIN, CLEVIS-CLEVIS. MIN ULTIMATE STRENGTH OF 25,000# 9'-6" LONG.	
G	1	GRID GRAIN	
# GROUNDING MATERIAL PART NO.'S. AND DESCRIPTION SHOWN ON 41 1012			

INSULATOR MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO. 41
27.81	3	CLAMP SUSPENSION, WITH SOCKET FITTING	1000
28.80	3	CLEVIS, Y-BALL	1003
51.65	39	3-STRINGS OF 13 INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING.	1002
75.15 OR 78.18	3	ROD, ARMOR TAPERED, SINGLE SUPPORT FOR ACSR, SET. ROD, ARMOR PREFORMED, SINGLE SUPPORT FOR ACSR, SET.	1002

E	8/25/26 A7-KR	HISTORICAL REFERENCE.
D	5-28-14 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE 3 AC 230KV SUSPENSION STRUCTURE		
DESIGNED FRED COOK APPROVED C.A. CABRAL DIRECTOR, DIVISION OF ELECTRICAL DESIGN		
SEPTEMBER 20, 1979	41	6015

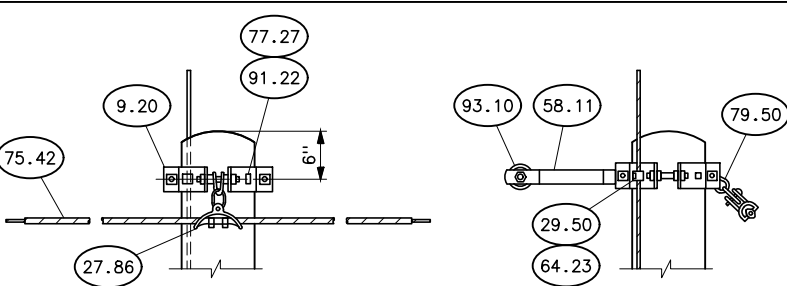
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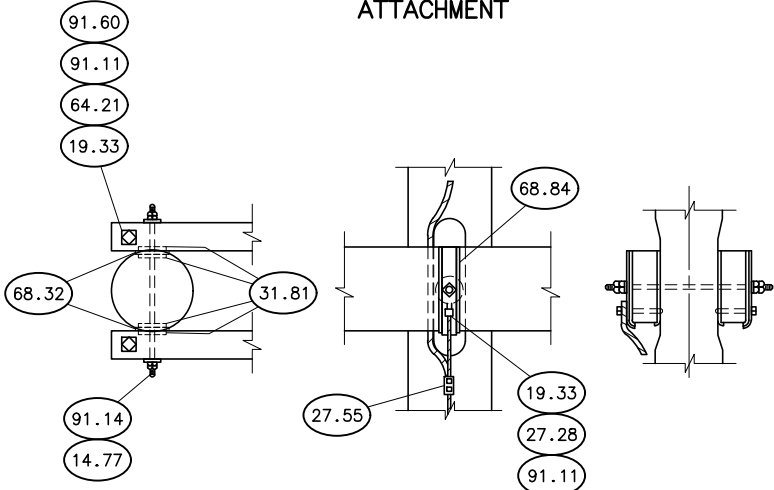
VOLTAGE	A	Z	K	Y	T
230KV	8'-6"	21'-0"	11'-0"	7'-8"	1'-6"

NOTES

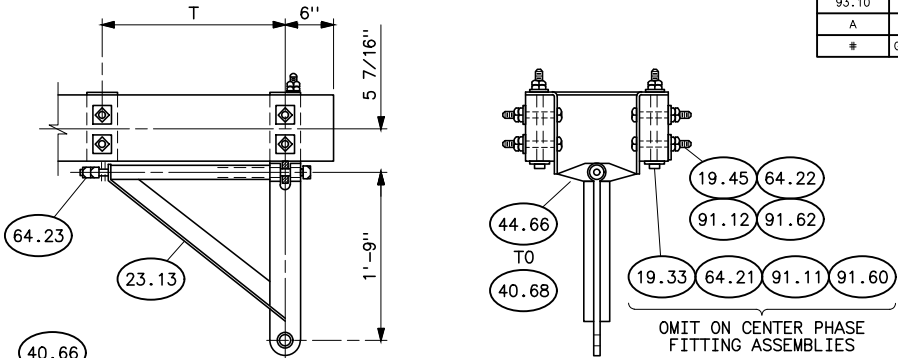
- USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
- ADJUST NUTS AND ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
- ≠ USE ONLY WHEN SPECIFIED.
- # GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.



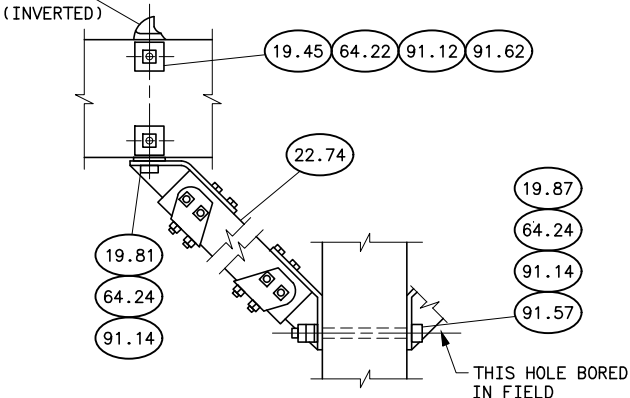
DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



DETAIL OF CROSSARM ATTACHMENT



DETAIL OF PHASE FITTING ASSEMBLY



DETAIL OF BRACE ATTACHMENT

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6119(HA-GL)

STRUCTURE MATERIAL			
PART NO.	QTY	DESCRIPTION	DWG NO.
1	3	POLE	41
3.15	2	ANCHOR, EXPANDING TYPE	
9.20	3	BAND, FOUR-WAY STRAIN	6030
14.77	6	BOLT, DOUBLE ARMING, 7/8"x21", USE EXTRA NUTS AS LOCKNUTS	
19.23	6	BOLT, MACHINE, WITH HEXAGONAL HEAD, 1/2"x5 1/2", NO NUT	
19.33	8	BOLT, MACHINE, 1/2"x14"	
19.45	40	BOLT, MACHINE, 5/8"x5"	
19.81	5	BOLT, MACHINE, 7/8"x2 1/2"	
19.87	4	BOLT, MACHINE, 7/8"x14"	
22.74	5	BRACE, KNEE, SPACING 6'-2", DROP 6'-9", 3 3/8"x4 3/8" SECTION	
22.905	2 OR 4	X-BRACE COMPLETE WITH FITTINGS, WASHERS, NUTS AND BOLTS	
23.13	3	BRACKET, SWINGING ANGLE, 18"x21"	6048
25.710	2	CROSSARM, LAMINATED WOOD, 3 1/8"x10 1/2"x50'-8"	
25.711	2	CROSSARM, LAMINATED WOOD, 3 1/8"x10 1/2"x43'-0"	
27.28	6	GROUND CONNECTOR, 2 PC COPPER ALLOY, FOR 1/2" BOLT AND NO. 2 COPPERWELD	BURNDY-G, B
27.55	6	CLAMP, PARALLEL GROOVE, 2-BOLT, COPPER ALLOY	1013
29.50	3	CLIP, GROUND, WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
31.81	24	CONNECTOR, 4" SHEAR PLATE, FOR 7/8" BOLT	
35.30	4	DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL.	
40.66 TO 40.68	10	FITTING, PHASE	SELECT PHASE FITTING WITH DIMENSION "B" WHICH MAKES BEST FIT BETWEEN CROSSARMS
58.11	4	LINK, CONNECTING, PAIR	6030
64.21	8	LOCKNUT FOR 1/2" BOLT	
64.22	40	LOCKNUT FOR 5/8" BOLT	
64.23	3	LOCKNUT FOR 3/4" BOLT	
64.24	9	LOCKNUT FOR 7/8" BOLT	
68.32	12	PLATE, FLAT GAIN	6040
68.84	12	PLATE, RIBBED TIE	6040
77.27	6	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
82.32	AS REQD	STEEL STRAND, 7-WIRE, 7/16" HIGH STRENGTH	
89.20	2	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	BT-3155
91.11	14	LOCK WASHER, FOR 1/2" BOLT	
91.12	40	LOCK WASHER, FOR 5/8" BOLT	
91.14	15	LOCK WASHER, FOR 7/8" BOLT	
91.22	6	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
91.57	3	WASHER, SQUARE, CURVED, 4"x4"x1/4", 15/16" HOLE	
91.60	8	WASHER, SQUARE FLAT, 2"x2"x1/8", 9/16" HOLE	
91.62	40	WASHER, SQUARE FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
93.10	4	SHEAVE WHEEL	6030
A	1	POLE ANCHOR ASSEMBLY	6043
#	GROUNDING MATERIAL PART NUMBERS AND DESCRIPTION SHOWN ON 41 1013		

INSULATOR MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO.
27.81	3	CLAMP, SUSPENSION, WITH SOCKET FITTING	1000
28.80	3	CLEVIS, Y-BALL	1003
51.65	39	3-STRINGS OF 13 INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3	ROD, ARMOR, TAPERED, SINGLE SUPPORT FOR ACSR, SET ROD, ARMOR, PREFORMED, SINGLE SUPPORT FOR ACSR, SET	1000

OVERHEAD GROUND WIRE MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	DWG NO.
9.20	1	BAND, FOUR-WAY STRAIN	6030
27.86	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.50	4	CLIP, GROUND, WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
64.23	4	LOCKNUT FOR 3/4" BOLT	
75.42	2	ROD, ARMOR, PREFORMED, FOR OVERHEAD GROUND WIRE, SET	
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	SHACKLE, TWISTED	6040
91.22	2	WASHER, ROUND FLAT, 1 3/8" OD 9/16" HOLE	

REFERENCE DRAWINGS

GROUNDING DETAILS	41 1013
DRILLING AND GAINING DETAILS	41 6024
CROSSARM DRILLING DETAILS	41 6028
GUY ARRANGEMENT FOR TYPE 3AD WITH OGW	41 6054

D	8/24/26 A7-KR	HISTORICAL REFERENCE.
C	1-6-12 A7-DDD	REDRAWN.

SUPERSEDES DWG NO. 40-D-6190

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO
TRANSMISSION LINE STANDARDS
TYPE 3AD 230KV
SUSPENSION STRUCTURE

DESIGNED BUREC	APPROVED BUREC		
A	AUGUST 6, 1979	41	6016

LIST OF DIMENSIONS							
STRUCTURE TYPE	Z	A	B	C	C-PART NO.	D	D-PART NO.
TYPE 3T	17'-0"	34'-0"	9'-0"	27'-0"	25.304	19'-0"	25.303
TYPE 3T-1	20'-0"	40'-0"	12'-0"	30'-0"	25.306	22'-0"	25.305
TYPE 3T-2	25'-0"	50'-0"	17'-0"	35'-0"	25.308	27'-0"	25.307

OGW ATTACHMENT TANGENT, SUSPENSION

OGW ATTACHMENT ANGLE, SUSPENSION

OGW ATTACHMENT TANGENT, TENSION

TENSION INSULATOR ASSEMBLY ATTACHMENT

POLE ATTACHMENT ASSEMBLY CENTER POLE

POLE ATTACHMENT ASSEMBLY OUTSIDE POLES

SUSPENSION INSULATOR SUPPORT ASSEMBLY

NOTES:

- Δ ANCHOR TYPE SHACKLE AND WHEN TYPE B POLE TOP BAND.
- * USE ITEM 27.86 FOR LINE INCLUDING 30°, USE ITEM CLAMP FOR LINE ANGLES MO.
- ≠USE ONLY WHEN SPECIFIED
- USE TWO LAG SCREWS AND W STRAIN BAND.

REFERENCE

GROUNDING DETAILS

INSULATOR MATERIAL						
	SINGLE STRING		DOUBLE STRING-			
	138KV	161KV	138KV	161KV		
27.70 OR 35.10	-	-	6	6	CLAMP, STRAIN, WITH CLEVIS FITTING, FOR CONDUCTOR DEAD END, COMPRESSION TYPE, FOR CONDUCTOR	
27.71 OR 35.11	6	6	-	-	CLAMP, STRAIN, WITH SOCKET FITTING, FOR CONDUCTOR DEAD END, COMPRESSION TYPE, WITH SOCKET FITTING	1002
27.51 OR 31.20	3	3	3	3	CLAMP, PARALLEL GROOVE, 3-BOLT, FOR CONDUCTOR COMPRESSION JUMPER CONNECTOR FOR CONDUCTOR	1002
27.81	3	3	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING	1000
38.10	6	6	-	-	CONNECTOR, BALL EYE	1003
48.10	3	3	3	3	HOOK, SUSPENSION	1003
51.65	84	96	144	162	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	
98.57	-	-	6	6	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS	1004

OVERHEAD GROUND WIRE MATERIAL							
	TANGENT		ANGLE				
	SUSPENSION	TENSION	SUSPENSION	TENSION			
9.20	2	4	3	6	BAND, FOUR-WAY STRAIN	6030	
9.38, 9.39 OR 9.40	2	—	—	—	BAND, POLE TOP	6036, 6036 OR 6037	
27.85 OR 27.86	2	—	2	—	CLAMP, SUSPENSION, WITH 2 1/4" LINK Δ *		
29.40	2	—	—	—	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	6035, 6036 OR 6037	
29.50	2	4	2	6	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030	
35.20	—	4	—	4	DEAD END, COMPRESSION TYPE FOR OGW		
58.11	2	2	2	2	LINK, CONNECTING, PAIR	6030	
35.30	2	2	2	2	DEAD-END,AUTOMATIC VISE TYPE FOR GUY STRAND,SHORT BAIL	6030	
58.11 OR 58.13	—	4	—	4	LINK, CONNECTING, PAIR	FOR EYE-TYPE DEADEND,USE 58.11 FOR CLEVIS-TYPE DEADEND, USE 58.13	
64.20	2	—	—	—	LOCKNUT FOR 3/8" BOLT		
64.23	2	4	3	6	LOCKNUT FOR 3/4" BOLT		
77.27	6	8	6	12	LAC SCREW, 1/2"x4", FETTER DRIVE THREAD		
79.10	2	—	—	—	SHACKLE, ANCHOR TYPE Δ	6036 OR 6037	
79.50	—	—	2	—	SHACKLE, TWISTED	6039	
82.32	AS REQUIRED				STEEL STRAND, 7/16"—7-WIRE, HIGH STRENGTH		
91.22	4	8	6	12	WASHER, ROUND FLAT, 1 3/8" O.D., 9/16" HOLE		
93.10	3	3	3	3	SHEAVE WHEEL FOR 7/16" STRAND	6030	
89.20	1	1	1	1	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"		

SUSPENSION INSULATOR SUPPORT ASSEMBLY	HISTORICAL REFERENCE ONLY NOT TO BE USED FOR NEW CONSTRUCTION
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1. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO. 41 6035 IS USED.
2. * USE ITEM 27.86 FOR LINE ANGLES UP TO AND INCLUDING 30°, USE ITEM 27.85 LARGE ANGLE SUSPENSION CLAMP FOR LINE ANGLES MORE THAN 30°.
3. =USE ONLY WHEN SPECIFIED.
4. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.

GROUNDING DETAILS_____	41	1012
DRILLING AND GAINING DETAILS_____	41	6024
GUY ARRANGEMENT_____	41 6047, 41	6054

Plotted By: Zia, Sep 01, 2026- 10:39am
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IMAGES:

14'-0" (18'-6" AT 230KV): WITHOUT POST INSULATOR
16'-0" (20'-6" AT 230KV): WITH POST INSULATOR

OMIT LINE POST FROM 60° TO 90°

MINIMUM CLEARANCE BETWEEN CONDUCTOR
AND BAND OR GUYS: 69KV-38"
115KV-55"
138KV-60"
161KV-66"
230KV-77"

USE ONLY
WHEN
SPECIFIED

STRUCTURE
GROUND WIRES

Z

Z

#

TABLE 3

OVERHEAD GROUND WIRE IN SUSPENSION		
VOLTAGE	Z	
	ANGLE TURNED IN DEGREES	
	0°-60°	60°-90°
69KV	12-0	USE OGW IN TENSION
115KV	14-0	
138KV	17-0	
161KV	20-0	
230KV	26-0	

TABLE 4

OVERHEAD GROUND WIRE IN TENSION				
VOLTAGE	Z			
	ANGLE TURNED IN DEGREES			
	0°-30°	30°-45°	45°-60°	60°-90°
69KV	14-0	19-0	25-0	33-0
115KV	15-0	21-0	27-0	35-0
138KV	16-0	22-0	28-0	36-0
161KV	18-0	23-0	29-0	38-0
230KV	23-0	28-0	35-0	48-0

LOCATION OF
ANGLE GUYS

OGW ATTACHMENT, TANGENT SUSPENSION

OGW ATTACHMENT, ANGLE SUSPENSION

OGW ATTACHMENT, TANGENT TENSION

OGW ATTACHMENT, ANGLE TENSION

FOR LINE ANGLES 45°
TO 90° USE CONDUCTOR
BANDS FOR LINE GUYS

LOCATION OF
ANGLE GUYS

INSULATORS NORMAL

INSULATORS INVERTED

LOCATION OF LINE GUYS FOR
LINE ANGLES LESS THAN 45°

DETAIL OF INSULATOR ATTACHMENT, SINGLE STRING

POST INSULATOR ASSEMBLY

161 & 230KV
69,115 & 138KV

TABLE 1		
HORIZONTAL LINE POST		
PART NUMBER	VOLTAGE (KILOVOLT)	MINIMUM POSITIVE IMPULSE FLASHOVER (KILOVOLT)
51.80	69	525
51.81	115	695
51.82	138	780
51.83	161	945
51.84	230	1105

TABLE 2			
INSULATORS PER TENSION STRING			
PART NUMBER	VOLTAGE KILOVOLT	INSULATORS PER STRING	TOTAL
51.65	69	6	36
51.65	115	9	54
51.65	138	10	60
51.65	161	11	66
51.65	230	13	78

SECTION A-A

NOTES

1. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED. MATERIAL BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
2. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE "B" POLE TOP BAND IS USED, SEE DWG NO. 41 6035.
3. * FOR LINE ANGLES UP TO AND INCLUDING 30°, USE SUSPENSION CLAMP PART NO. 27.86.
4. * FOR LINE ANGLES GREATER THAN 30° USE LARGE ANGLE SUSPENSION CLAMP PART NO. 27.85.
5. ** USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.

REFERENCE DRAWINGS

GROUNDING DETAILS _____ 41 1012
STANDARD GUYING ARRANGEMENT FOR
TYPE 3TA STRUCTURES _____ 41 6055

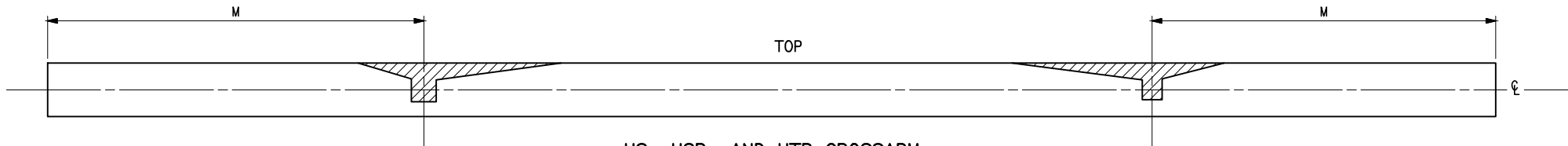
STRUCTURE MATERIALS				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	TANGENT	ANGLE		
1	3	3	POLE	
9.23	3	6	BAND, FOUR WAY, STRAIN, TYPE B	6031
29.50	3	6	CLIP, GROUND 3/4"x2 1/2" CONEHEAD BOLT	6031
58.06	3	6	LINK, CONNECTING, PAIR	6031
64.23	3	6	LOCKNUT FOR 3/4" BOLT	
77.27	6	12	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.22	6	12	WASHER, ROUND, 1 3/8" O.D., 9/16" HOLE	
#	GROUNDING MATERIAL, PART NO.'S AND DESCRIPTION SHOWN ON DRAWING NO. 41 1012			

INSULATOR MATERIALS				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	NORMAL INSTALLATION WITH STRAIN CLAMP	INSULATORS INVERTED WITH COMP. CLAMP		
27.70	6	6	STRAIN CLAMP WITH CLEVIS FITTING	
28.11		6	BALL-CLEVIS, HOT LINE TYPE	
28.53	6		SOCKET-CLEVIS, HOT LINE TYPE	
35.10	6	6	COMPRESSION DEAD-END	
38.12	6	6	BALL-OVAL EYE, HOT-LINE TYPE	
38.63		6	SOCKET-EYE, HOT LINE TYPE, FOR 3/4" BOLT	
38.66	6		SOCKET-EYE, HOT LINE TYPE, FOR 5/8" BOLT	
51.65	SEE TABLE 2		INSULATOR, SUSPENSION TYPE, 10" DIA, 5 3/4" SPACING	
	69,115,138KV		161, 230KV	
19.73	2		BOLT, MACHINE 3/4"x14"	
19.87		2	BOLT, MACHINE 7/8"x14"	
27.21	1		GROUNDING CLAMP FOR 3/4" BOLT TO NO. 2 AWG CWD	1012
27.22		1	GROUNDING CLAMP FOR 7/8" BOLT TO NO. AWG CWD	1012
27.89	3	3	CLAMP FOR LINE POST INSULATOR	
51.80	3	3	HORIZONTAL LINE POST INSULATOR, SEE TABLE 1	
64.23	6		LOCKNUT FOR 3/4" BOLT	
64.24		6	LOCKNUT FOR 7/8" BOLT	
91.13	6		LOCKWASHER FOR 3/4" BOLT	
91.14		6	LOCKWASHER FOR 7/8" BOLT	
91.57	6	6	WASHER, SQUARE, CURVED 15/16" HOLE, 4"x4"x1/4"	

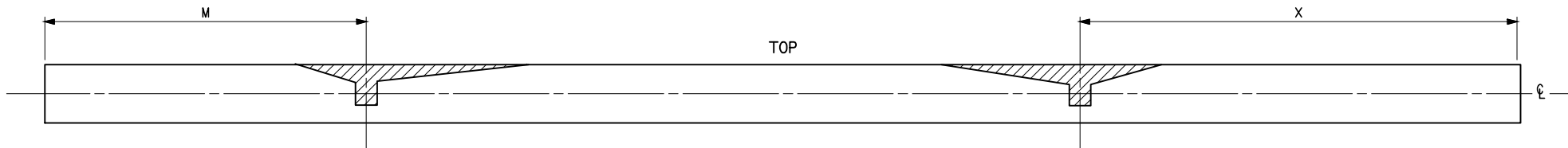
OVERHEAD GROUND WIRE MATERIALS						
PART NO.	TANGENT		ANGLE		DESCRIPTION	DWG NO. 41
	SUSPENSION	TENSION	SUSPENSION	TENSION		
9.20	2	4	3	6	BAND, FOUR WAY STRAIN, TYPE A	6030
9.38, 9.39, 9.40	2				BAND, POLE TOP	6035, 6036, 6037
27.85 OR 27.86	2		2		CLAMP, SUSPENSION WITH 2 1/4" LINK	
29.40	2				CLIP, GROUND, 3/8"x1 1/2" ORG. BOLT	6035, 6036, 6037
29.50	2	4	3	6	CLIP, GROUND, 3/4"x2 1/2" CONEHEAD BOLT	6030
35.20		4		4	DEAD END COMPRESSION TYPE FOR O.G.W.	
35.30	2	2	2	2	DEAD END, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL	
58.11	2	6	2	6	LINK, CONNECTING, PAIR	6030
64.20	2				LOCKNUT FOR 3/8" BOLT	
64.23	2	4	3	6	LOCKNUT FOR 3/4" BOLT	
75.42	2		2		ROD, ARMOR, PREFORMED, FOR 3/8" ST. STRAND	
77.27	6	8	6	12	LAG SCREW, 1/2"x14" FETTER DRIVE THREAD	
79.10	2				SHACKLE, ANCHOR TYPE	6036, 6037
82.32	AS REQUIRED				STEEL STRAND 7/16", 7-WIRE, HIGH STRENGTH	
89.20	1	1	1	1	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"	BT-3155
91.22	4	8	6	12	WASHER, ROUND FLAT, 1 3/8" OD 9/16" HOLE	
93.10	2	2	2	2	SHEAVE WHEEL FOR 7/16" STRAND	6030
79.50			2		SHACKLE, TWISTED	6038

G	8/25/2026 A7-KR	HISTORICAL REFERENCE						
	SUPERSEDES DWG NO. 40-D-6311							
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO								
TRANSMISSION LINE STANDARDS TYPE 3TA 69,115,138,161 AND 230KV 3-POLE TENSION STRUCTURE								
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____								
A _E	AUGUST 6, 1979	41	6018					

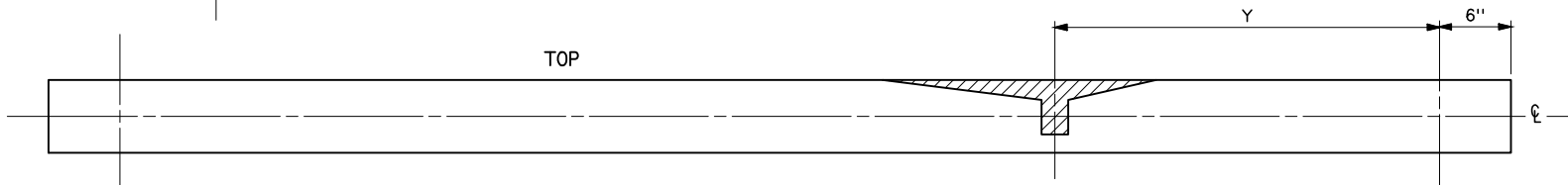
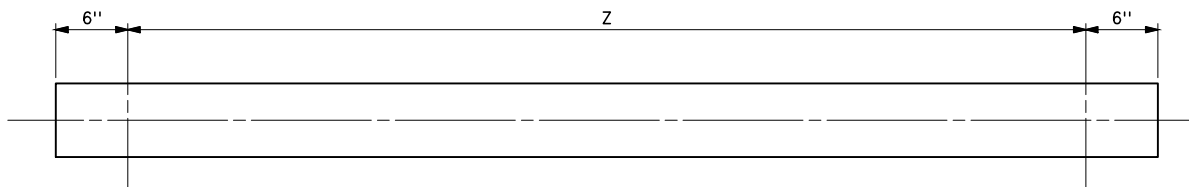
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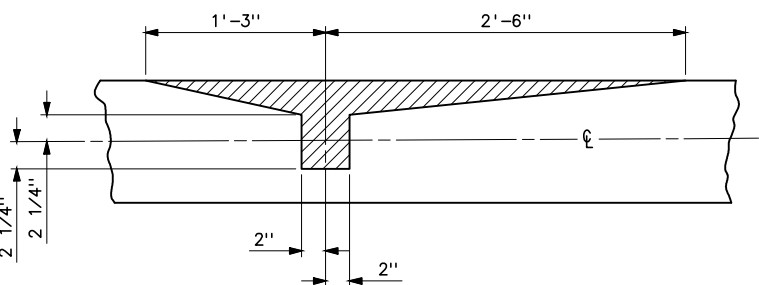
HS, HSB, AND HTR CROSSARM
SEE DRAWINGS 41 6010, 41 6011,
41 6023, AND 41 6087



HA AND HAB CROSSARM
SEE DRAWINGS 41 6088, 41 6090,
AND 41 6096



3AC CROSSARMS
SEE DRAWING 41 6002



DETAIL OF KNOT RESTRICTED AREA

NOTES

1. ALL CROSSARMS FOR HS, HSB, HTR, HA, HAB, AND 3AC STRUCTURES WHICH ARE GRADED UNDER WCLA GRADING RULES SHALL BE SELECTED SO AS TO BE FREE OF KNOTS OVER 1/2" IN DIAMETER IN THE SHADED AREAS SHOWN ON THIS DRAWING.
2. CROSSARMS FOR 3T, 3TX, 4S, AND 3DE STRUCTURES WHICH ARE GRADED UNDER WCLA GRADING RULES MAY BE SELECTED WITHOUT REFERENCE TO THE SPECIAL KNOT RESTRICTIONS SHOWN ON THIS DRAWING.
3. CROSSARMS SHOULD BE INSTALLED SO THAT THE AREAS SHOWN SHADED ON THIS DRAWING ARE IN THE TOP SECTION OF THE CROSSARM.

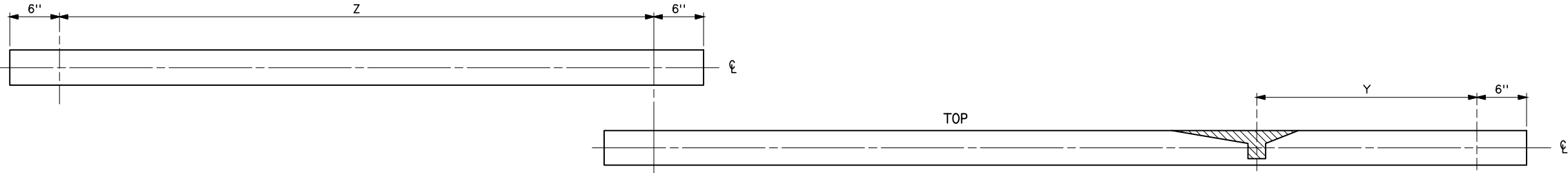
FOR DOUGLAS FIR CROSSARMS ON
69KV AND 115KV TRANSMISSION
LINES ONLY

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

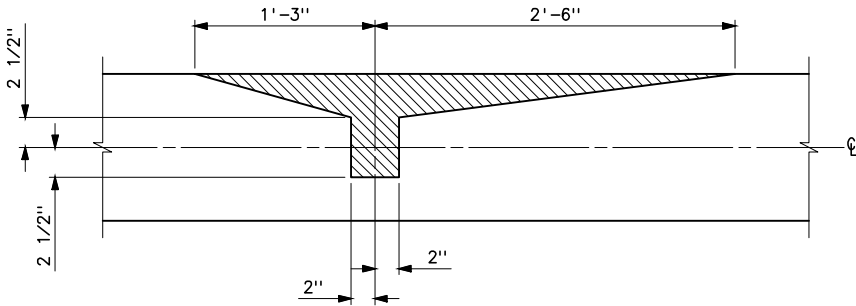
D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	12-9-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5145		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES SELECTION AND INSTALLATION DETAIL FOR CROSSARMS GRADED UNDER WCLA GRADING RULES		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A	E AUGUST 6, 1979	41 6019



HS AND HSB CROSSARMS
SEE DRAWINGS 41 6006, 6007, AND 6012



3AC CROSSARMS
LOWER 3AD CROSSARMS



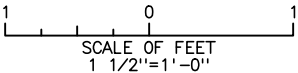
DETAIL OF KNOT RESTRICTED AREA
SEE DRAWINGS 41 6008, 6009, AND 6016

NOTES

- 1. ALL CROSSARMS FOR HS, HSB, 3AC, AND 3AD STRUCTURES WHICH ARE GRADED UNDER WMPA GRADING RULES SHALL BE SELECTED SO AS TO BE FREE OF KNOTS OVER 1/2" IN DIAMETER IN THE SHADED AREAS SHOWN ON THIS DRAWING.
- 2. CROSSARMS FOR 3T AND 3TX STRUCTURES AND UPPER CROSSARMS FOR 3AD STRUCTURES WHICH ARE GRADED UNDER WMPA GRADING RULES MAY BE SELECTED WITHOUT REFERENCE TO THE SPECIAL KNOT RESTRICTIONS SHOWN ON THIS DRAWING.
- 3. CROSSARMS SHOULD BE INSTALLED SO THAT THE AREAS SHOWN SHADED ON THIS DRAWING ARE IN THE TOP SECTION OF THE CROSSARM.
- 4. FOR DOUGLAS FIR CROSSARMS ON 138KV, 161KV, AND 230KV TRANSMISSION LINES ONLY.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

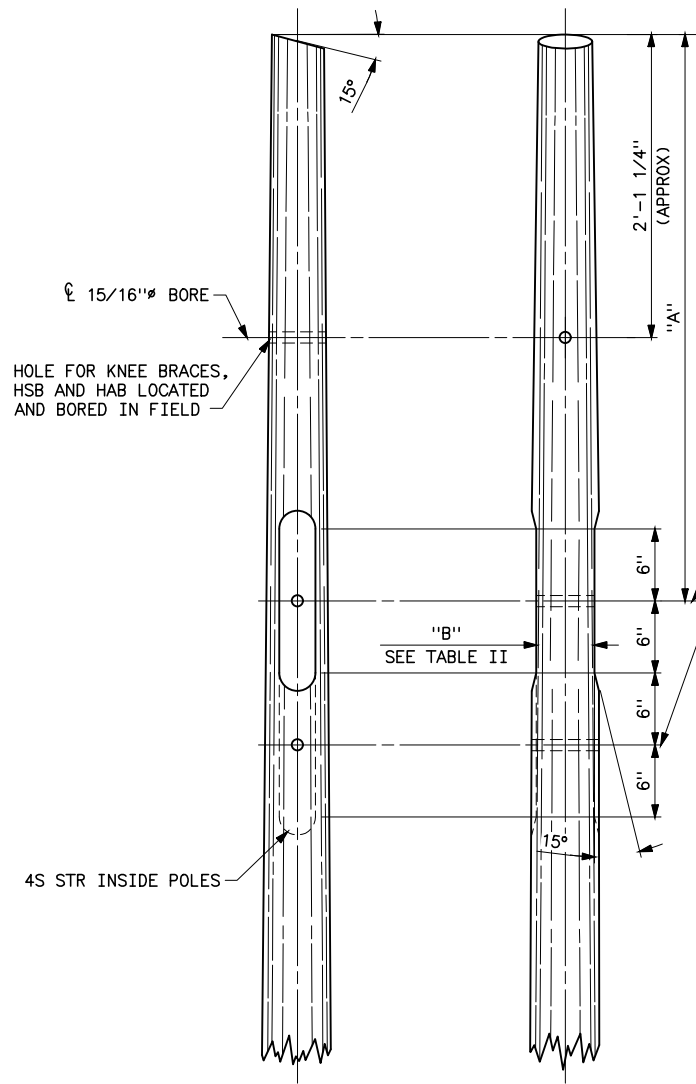
C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5697		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 138, 161 & 230KV SELECTION AND INSTALLATION DETAIL FOR CROSSARMS GRADED UNDER WMPA GRADING RULES		
DESIGNED BUREC _____ APPROVED BUREC _____		
C A	APRIL 6, 1981	41 6020



Plotted By: court Aug 25, 2026- 12:47pm
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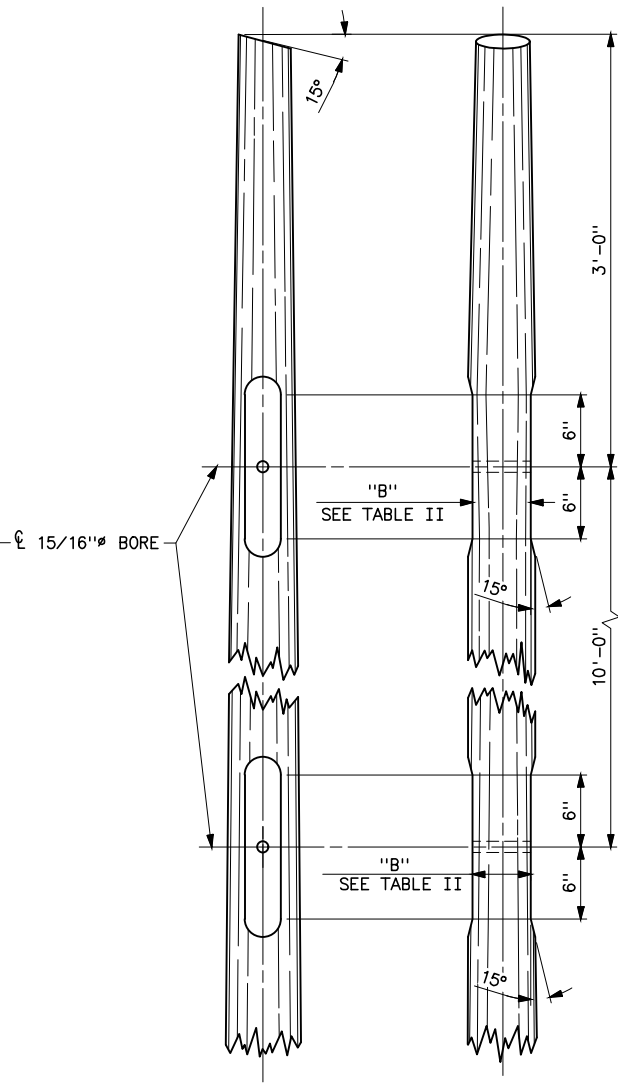
XREF(S):

Plotted By: court Aug 25, 2026- 12:47pm
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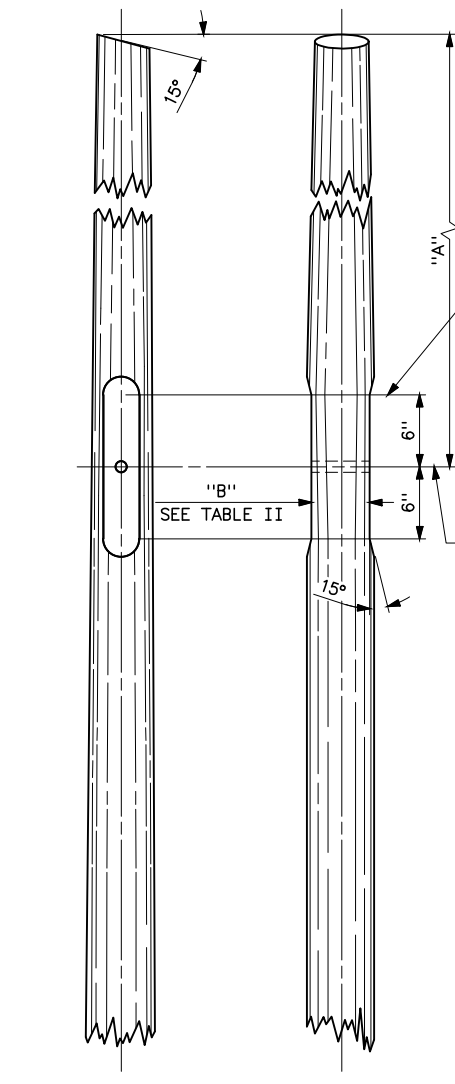
HS, HSB, 3AC, AND 4S
STRUCTURES
(SEE TABLE I FOR DIMENSION "A")

TABLE I	
TYPE OF STRUCTURE	DIMENSION "A"
HS	6'-6"
HSB	8'-2"
3AC	SEE DWG 41 6002
3DE, 3T	10'-0"
3TX	14'-6"
4S	9'-0"



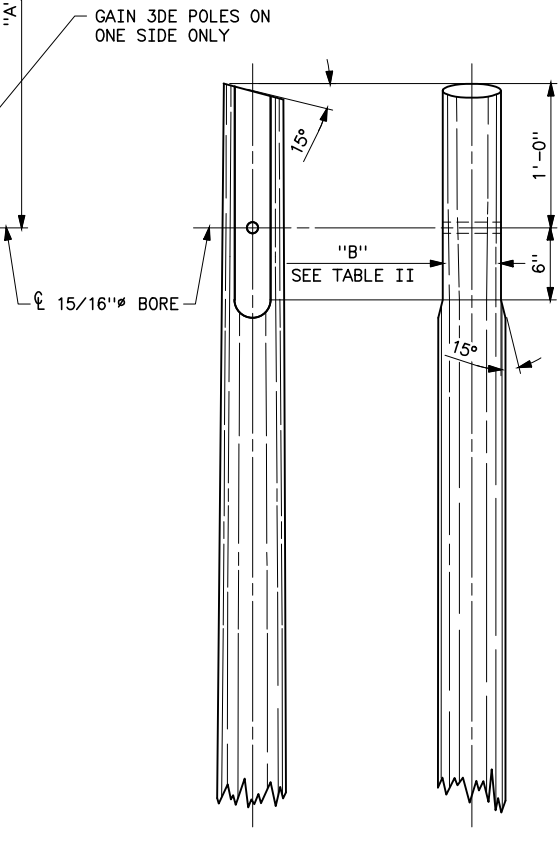
HTR STRUCTURES

TABLE II	
CIRCUMFERENCE OF POLE AT POINT OF GAIN	DIMENSION "B"
UNDER 25"	GAIN 1/4" DEEP
25" TO 27"	7 1/2"
27" TO 30"	8"
30" TO 35"	9"
35" TO 45"	10 1/2"
45" AND OVER	GAIN 2" DEEP MAX



OUTSIDE POLES-3DE, 3T, AND 3TX

3DE, 3T, 4S, AND 3TX STRUCTURES
(SEE TABLE I FOR DIMENSION "A")



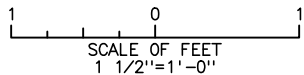
OUTSIDE POLES-4S
INSIDE POLE-3DE, 3T, AND 3TX

NOTE

1. OPPOSITE FACES TO BE GAINED TO SOME WIDTH AND SHALL BE PARALLEL.

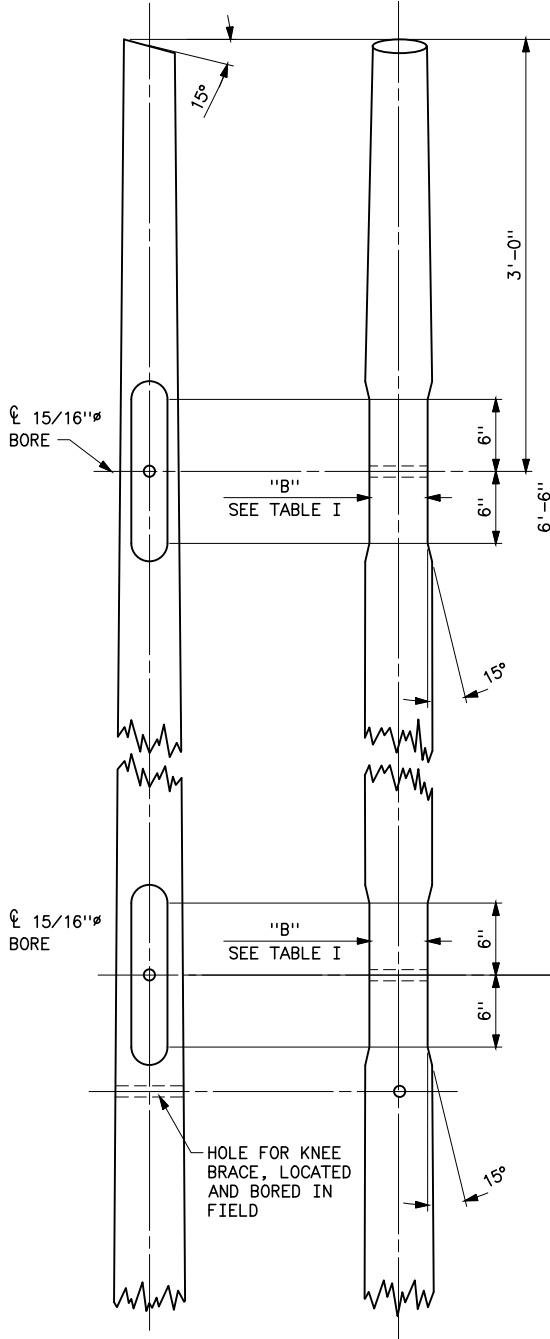
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

D	8/24/26 A7-KR	HISTORICAL REFERENCE	
C	9-24-12 A7-DD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-4351			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE-LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES 69KV & 115KV, 2 AND 3 POLE STRUCTURE DRILLING AND GAINING DETAILS WITH OGW-30° PROTECTIVE ANGLE			
DESIGNED <u>BUREC</u> _____		APPROVED <u>BUREC</u> _____	
A	AUGUST 6, 1979	41	6021



XREF(S):

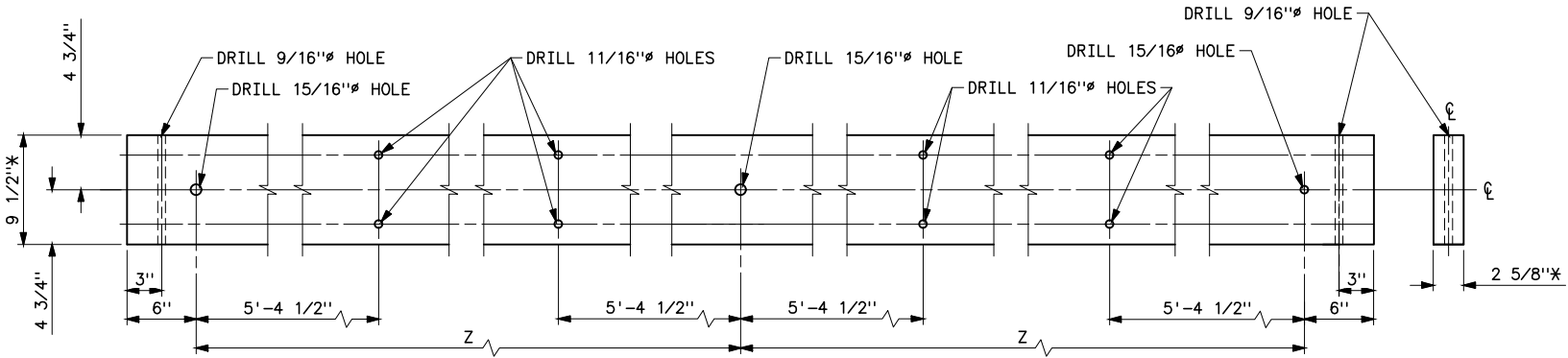
Plotted By: court Aug 25, 2026- 12:47pm
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I:\AGES:



3AD STRUCTURE

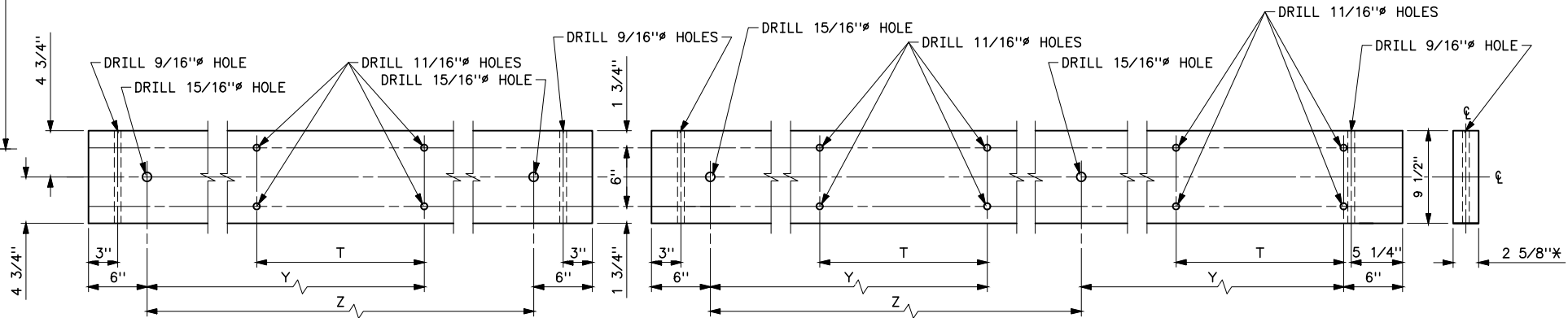
TABLE I

CIRCUMFERENCE OF POLE AT POINT OF GAIN	DIMENSION "B"
UNDER 25"	GAIN 1/4" DEEP
25" TO 27"	7 1/2"
27" TO 30"	8"
30" TO 35"	9"
35" TO 45"	10 1/2"
45" AND OVER	GAIN 2" DEEP MAX



DETAIL 1

UPPER CROSSARM DETAILS FOR 3AD STRUCTURE



DETAIL 2

DETAIL 3

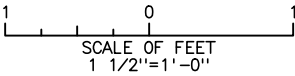
LOWER CROSSARM DETAILS FOR 3AD STRUCTURE

TWO CROSSARMS PER DETAIL 1, TWO CROSSARMS PER DETAIL 2, AND TWO CROSSARMS PER DETAIL 3, REQUIRED PER STRUCTURE.

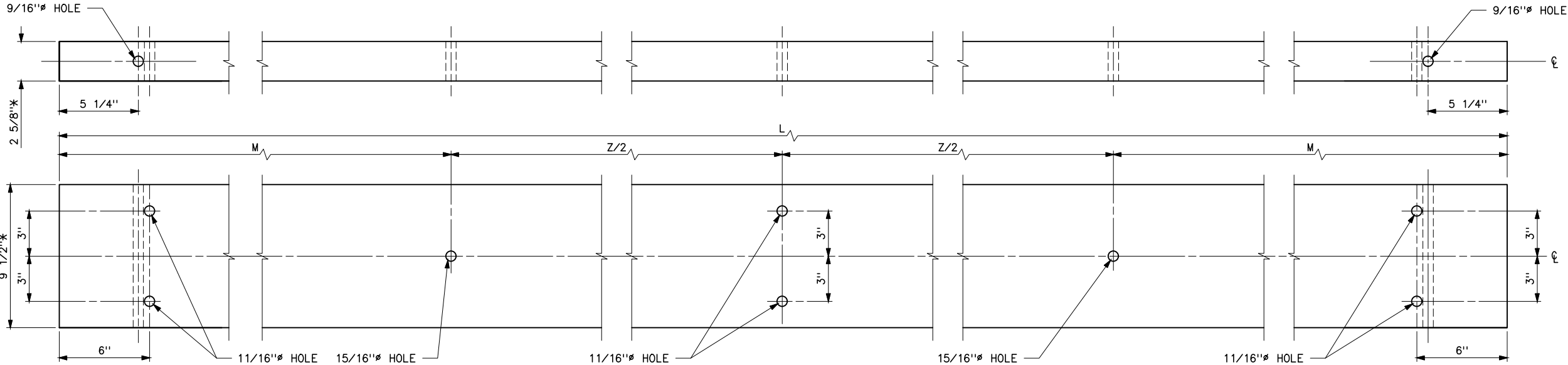
CROSSARM DRILLING REFERENCES			
VOLTAGE	Z	T	Y
69KV	12'-0"	2'-0"	4'-6"
115KV	14'-0"	2'-0"	5'-0"

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DD	REDRAWN.
SUPERSEDES DWG NO. 40-D-6018		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES DRILLING AND GAINING DETAILS 69KV AND 115KV, 3AD STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6022



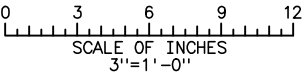
Plotted By: court Aug 25, 2026- 12:48pm
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IMAGES:



DIMENSIONS FOR CROSSARMS			
PART NO.	L	Z/2	M
5.56	21'-0"	5'-0"	5'-6"
5.59	25'-0"	6'-0"	6'-6"

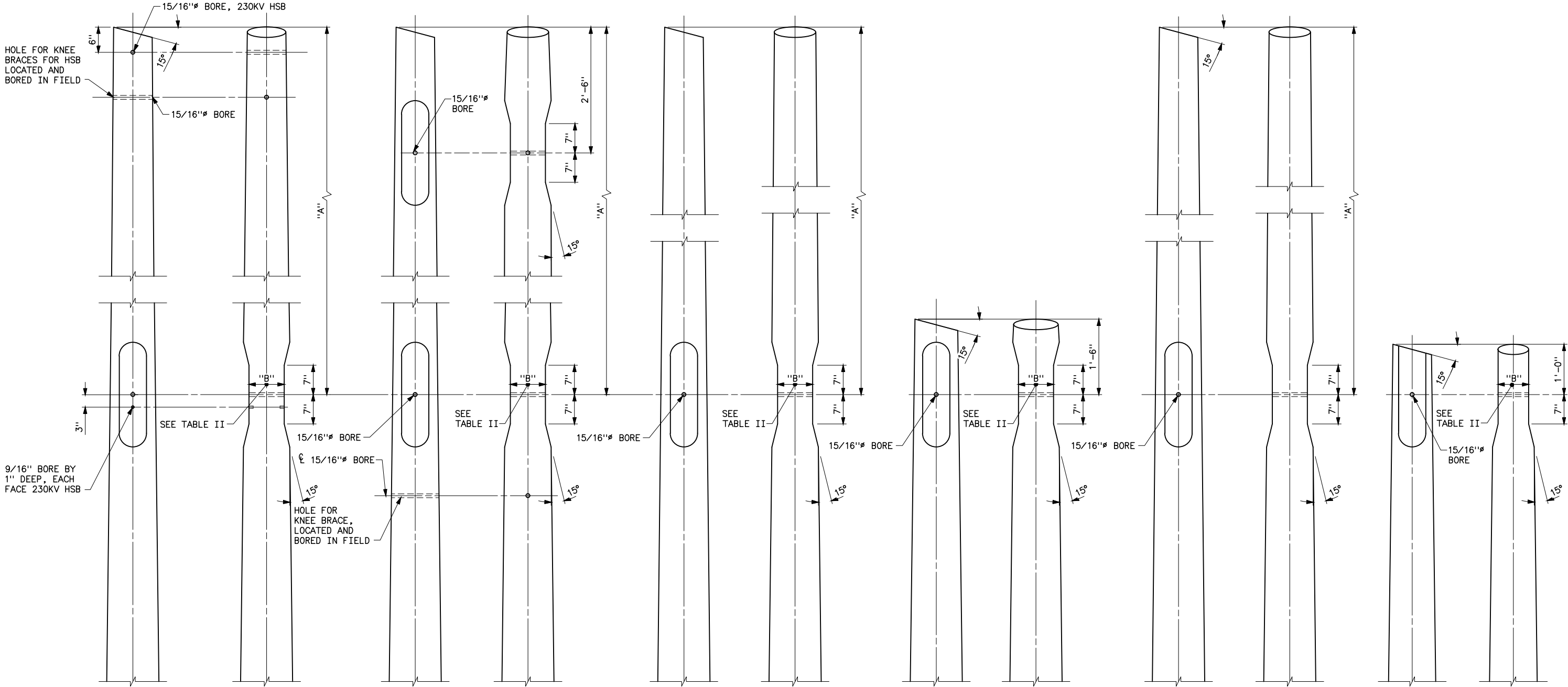
NOTE
1. *MINIMUM DIMENSIONS AFTER SEASONING AND SURFACING.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6114



C	8/24/26 A7-KR	HISTORICAL REFERENCE.
B	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4325		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES CROSSARM DRILLING DETAILS 69 AND 115KV, HS AND HSB STRUCTURES		
DESIGNED BUREC _____ APPROVED BUREC _____		
C/A	AUGUST 6, 1979	41 6023

Plotted By: court Aug 25, 2026 - 12:48pm
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HS AND HSB STRUCTURES
(SEE TABLE I FOR DIMENSION "A")

3AD STRUCTURES
(SEE TABLE I FOR DIMENSION "A")

CENTER AND INSIDE POLES

3AC STRUCTURES
(SEE TABLE I FOR DIMENSION "A")

OUTSIDE POLES

OUTSIDE POLES

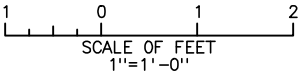
3T AND 3TX STRUCTURES
(SEE TABLE I FOR DIMENSION "A")

CENTER POLE

TYPE OF STRUCTURE	TABLE I DIMENSION "A"		
	138KV	161KV	230KV
HS	7'-0"	8'-0"	-
HSB	7'-0"	8'-0"	10'-0"
3AC	8'-6"	41 6008	8'-6"
3AD	8'-6"	8'-6"	8'-6"
3T	10' OGW SUSP	41 6017	
	14'-6" OGW TNSN	41 6017	
3TX	14'-6"	14'-6"	-

TABLE II	
CIRCUMFERENCE OF POLE AT POINT OF GAIN	DIMENSION "B"
UNDER, 25"	GAIN 1/4" DEEP
25" TO 27"	7 1/2"
27" to 30"	8"
30" to 35"	9"
35" to 40"	10 1/2"
40" TO 45"	12"
45" AND OVER	GAIN 2" DEEP, MAX

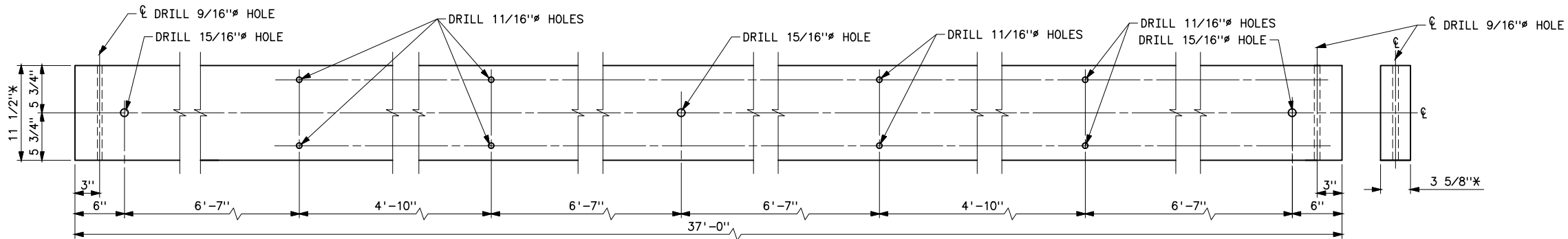
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION



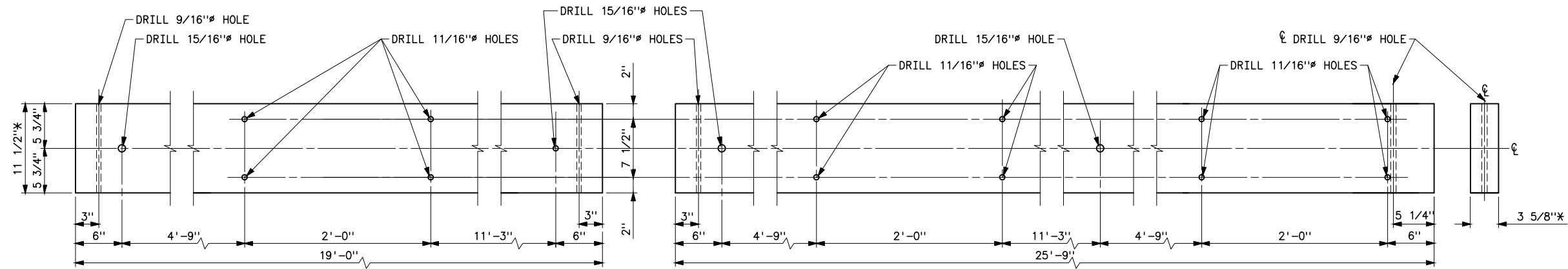
NOTE
1. OPPOSITE FACES TO BE GAINED TO SAME WIDTH AND SHALL BE PARALLEL.

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	9-24-12 A7-DD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5693		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 138,161, & 230KV 2 & 3 POLE STRUCTURES DRILLING AND GAINING DETAILS WITH OVERHEAD GROUND WIRE		
DESIGNED BUREC _____ APPROVED BUREC _____		
41	AUGUST 6, 1979	6024

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IMAGES:



DETAIL 1, 3 5/8"x11 1/2"x37'-0"
UPPER CROSSARM DETAILS FOR 3AD STRUCTURES



DETAIL 2, 3 5/8"x11 1/2"x19'-0"

DETAIL 3, 3 5/8"x11 1/2"x25'-9"

CROSSARM DETAILS FOR 3AC STRUCTURES
LOWER CROSSARM DETAILS FOR 3AD STRUCTURES

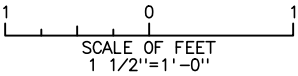
TWO CROSSARMS PER DETAIL 2, AND TWO CROSSARMS PER
DETAIL 3, REQUIRED PER TYPE 3AC STRUCTURE

TWO CROSSARMS PER DETAIL 1, AND TWO CROSSARMS PER
DETAIL 2, AND TWO CROSSARMS PER DETAIL 3,
REQUIRED PER TYPE 3AD STRUCTURE

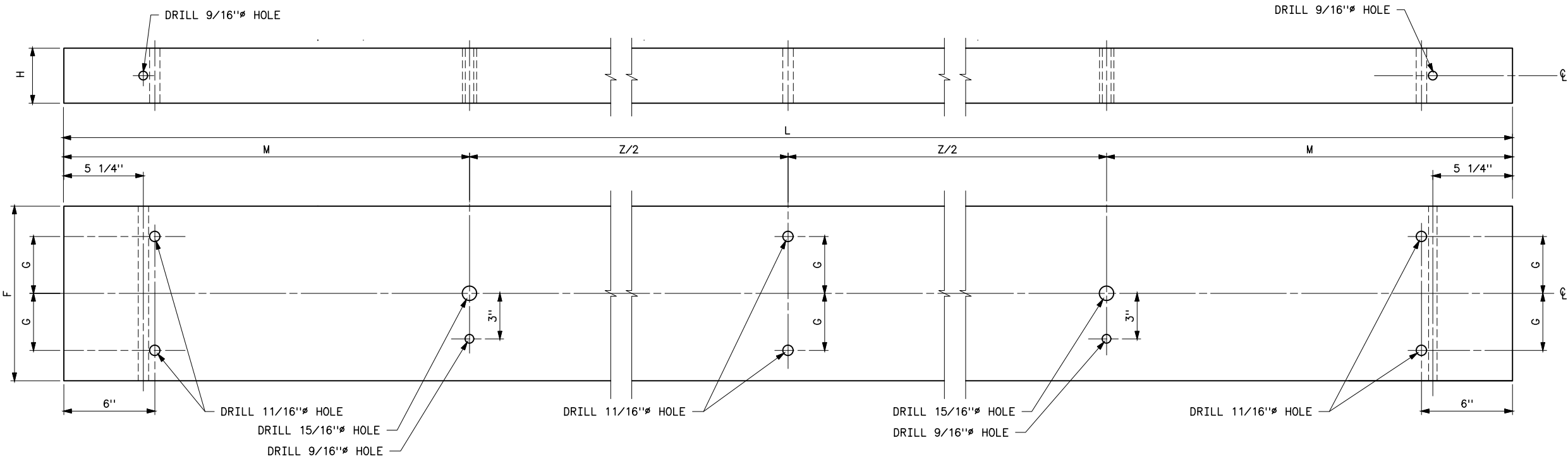
* MINIMUM DIMENSIONS AFTER SEASONING AND SURFACING.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/24/26 A7-KR	HISTORICAL REFERENCE
	9-24-12 A7-DD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5695		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES CROSSARM AND DRILLING DETAILS 138 & 161KV 3AC AND 3AD STRUCTURES		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1981	41 6026



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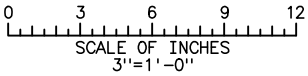


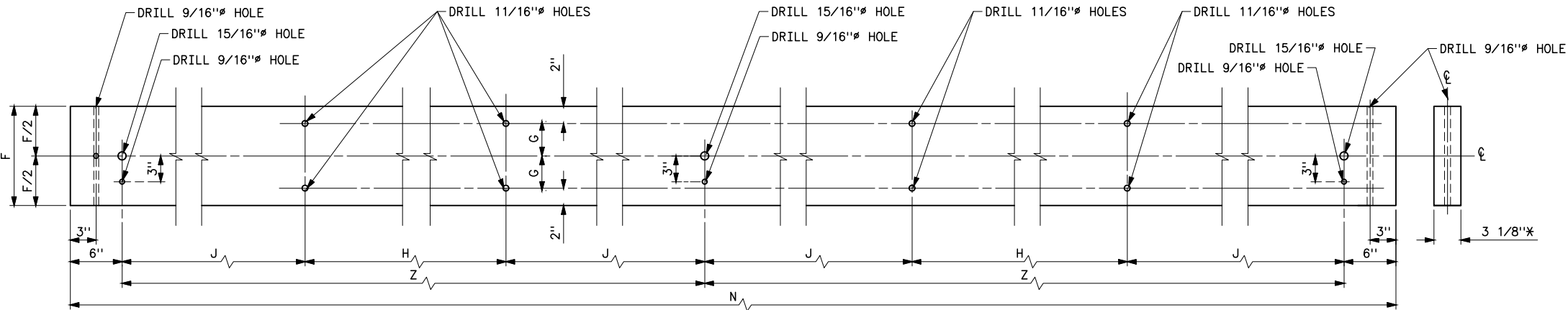
NOTE
1. * = MINIMUM DIMENSIONS AFTER LAMINATING AND SURFACING.

DIMENSIONS FOR CROSSARMS					
F*	G	H*	L	Z/2	M
9"	2 1/2"	3 1/8"	45'-0"	11'-0"	11'-6"
10 1/2"	3 3/16"	3 1/8"	45'-0"	11'-0"	11'-6"
11 1/2"	3 3/4"	3 5/8"	41'-0"	10'-0"	10'-6"

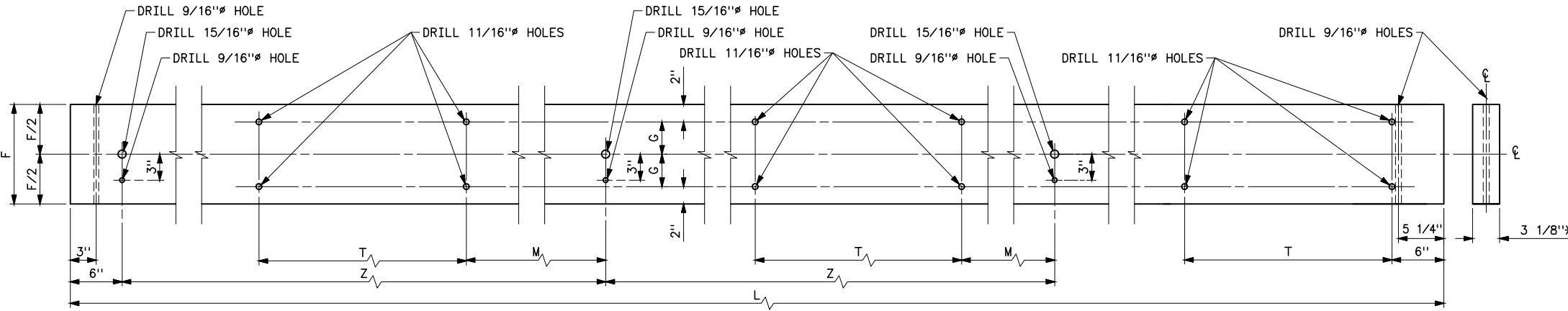
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6114

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5992		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES CROSSARM DRILLING DETAILS 230KV HS AND HSB STRUCTURES		
DESIGNED BUREC _____ APPROVED BUREC _____		
C/A	AUGUST 6, 1979	41 6027





DETAIL 1
UPPER CROSSARM DETAILS FOR 3AD STRUCTURES



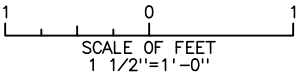
DETAIL 2
CROSSARM DETAILS FOR 3AC & 3AD STRUCTURES

TWO CROSSARMS PER DETAIL 1, AND TWO CROSSARMS PER
DETAIL 2, REQUIRED PER TYPE 3AD STRUCTURE.

TWO CROSSARMS PER DETAIL 2, REQUIRED PER TYPE 3AC
STRUCTURE.

* - MINIMUM DIMENSIONS AFTER LAMINATING AND SURFACING.

DIMENSIONS FOR CROSSARMS								
F *	G	H	L	M	N	Z	J	T
9"	2 1/2"	10'-4"	56'-8"	16'-4"	49'-0"	24'-0"	6'-10"	1'-6"
10 1/2"	3 3/16"	7'-10"	51'-2"	12'-10"	43'-0"	21'-0"	6'-7"	2'-0"

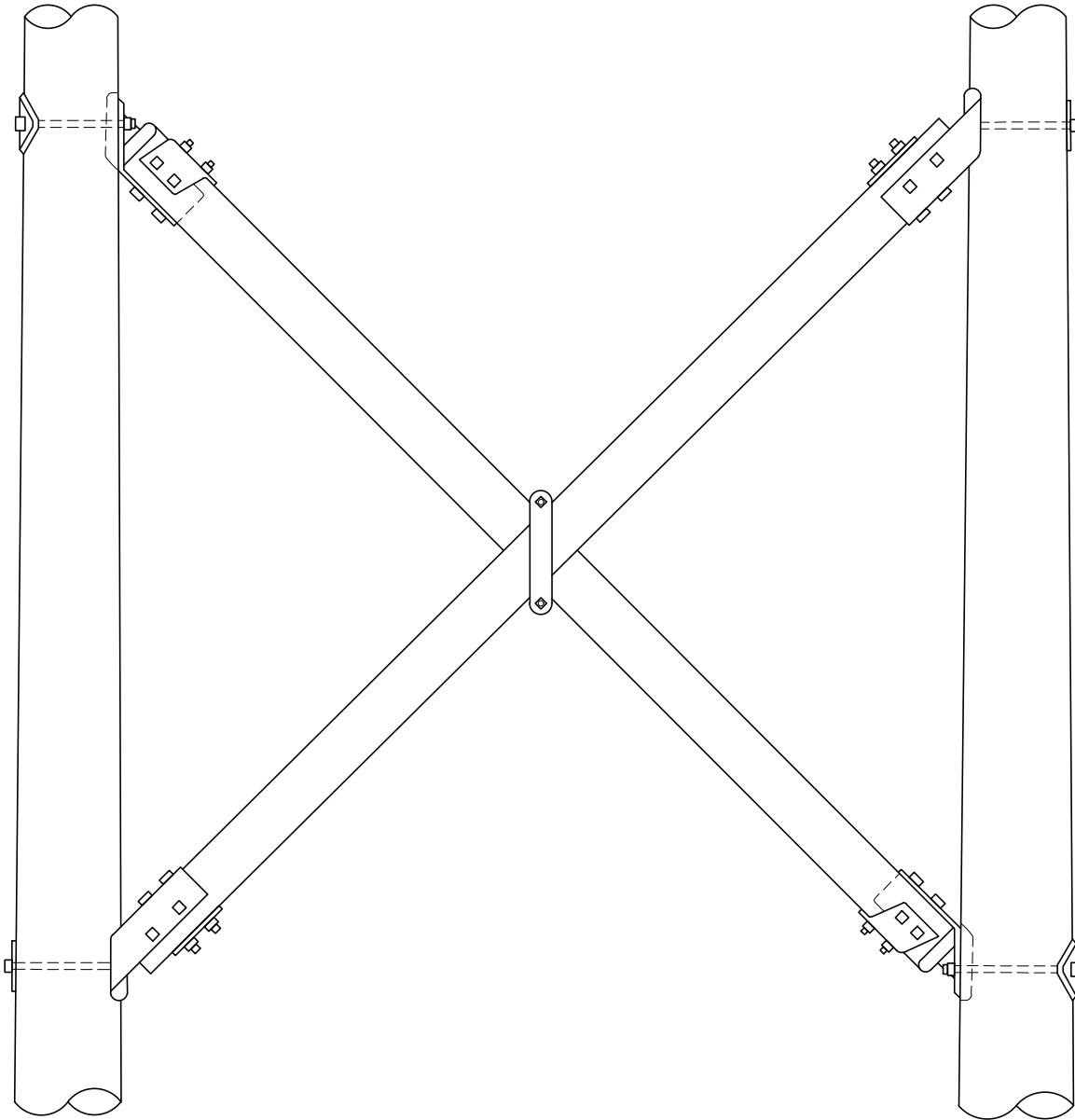
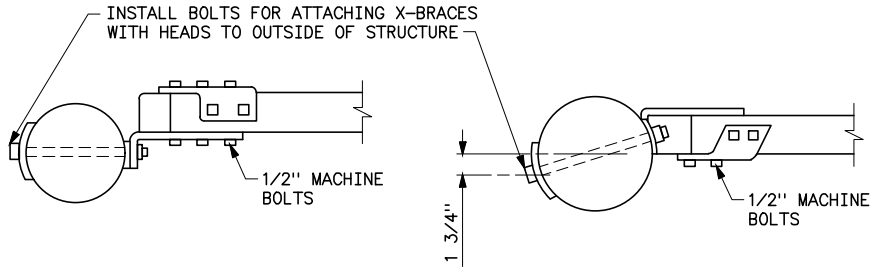
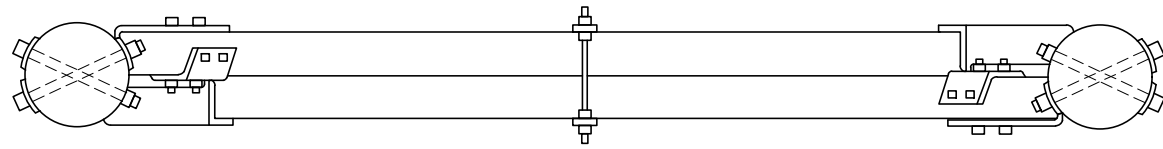


HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

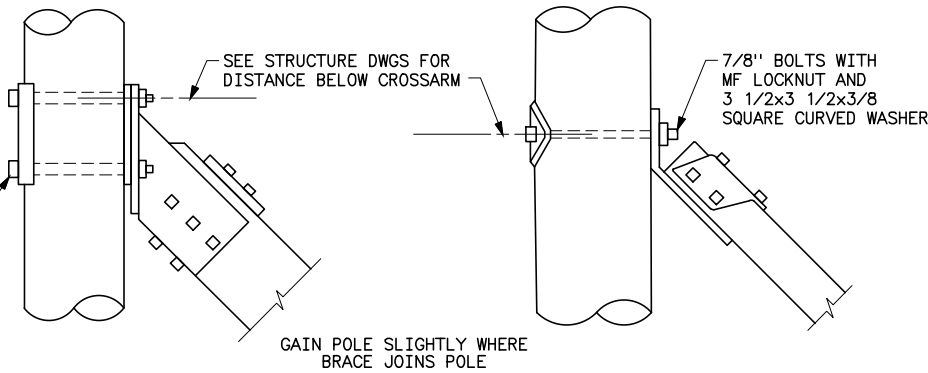
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C	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-6191		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES CROSSARM DRILLING DETAILS 230KV 3AC & 3AD STRUCTURES		
DESIGNED BUREC _____ APPROVED BUREC _____		
AUGUST 6, 1979	41	6028

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IMAGES:

XREF(S):



7/8" BOLTS WITH MF LOCKNUTS AND 4 3/4x9 1/4 CURVED POLE WASHER WITH 15/16" UPPER HOLE AND LOWER SLOT OF 15/16x1 1/2



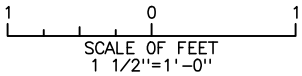
FOR 3TX (69 AND 115KV)
FOR 3T-1, 3T-2, 3TX (138 AND 161KV)
FOR 2 AND 3-POLE STRUCTURES (230KV)
FOR 3TA (ALL KV)

FOR 3AD (69 AND 115KV)
FOR 3T, 3T-1, 3T-2, 4S, 4S-1 (69 AND 115KV)
FOR 3T, 3AC, 3AD (138 AND 161KV)
FOR 2-POLE STRUCTURES (69, 115, 138 AND 161KV)

NOTE
1. END FITTINGS AND CENTER CLAMP SHALL BE MADE FROM 1/4" MINIMUM STEEL PLATE.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

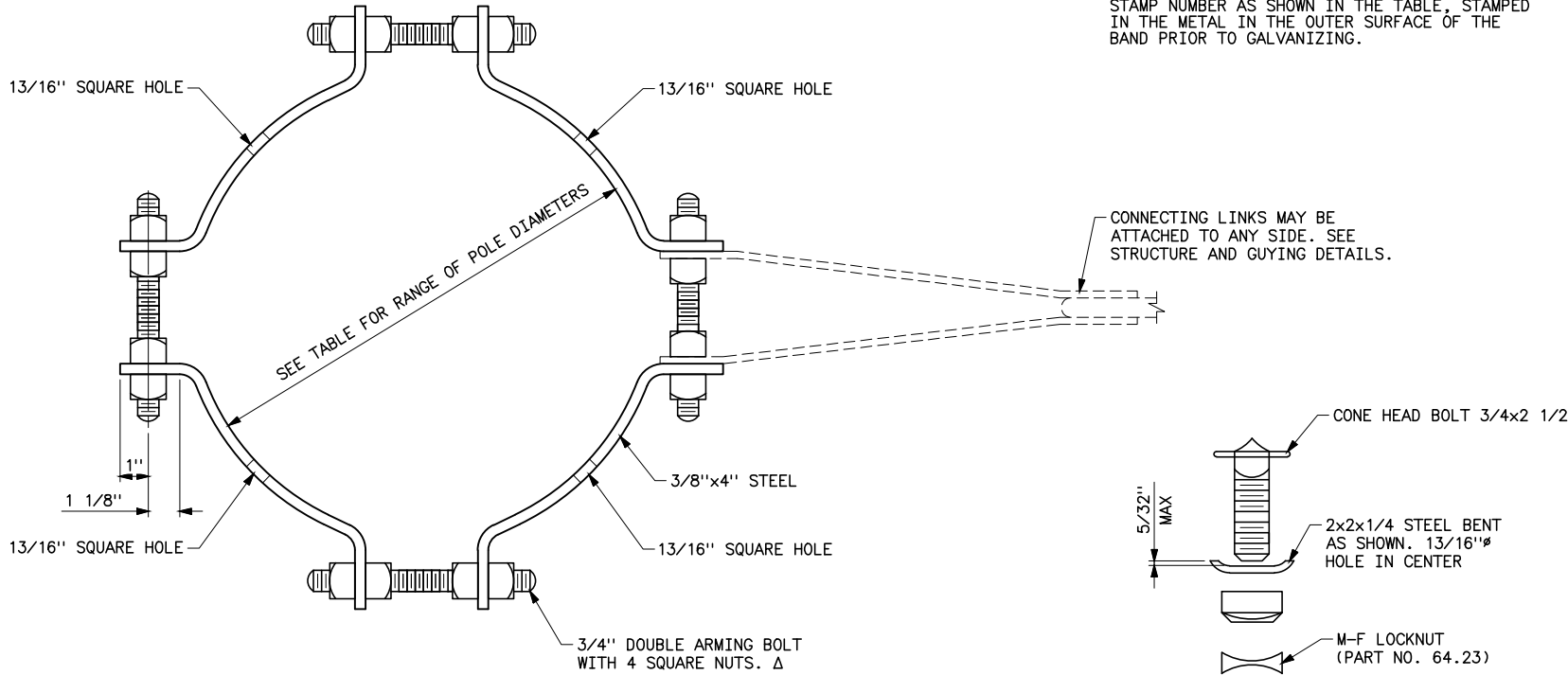
D	8/20/26 A7-KR	HISTORICAL REFERENCE	
C	1-6-12 A7-DDD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-5923			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES X-BRACE DETAILS			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____ ELECTRICAL ENGINEERING MANAGER			
C A F	AUGUST 6, 1979	41	6029



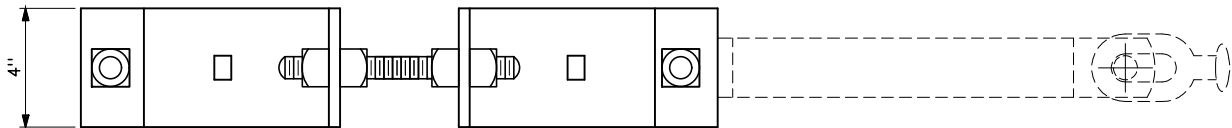
Plotted By: court Aug 25, 2026- 1:06pm
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IMAGES:

PART NO.	STAMP NO.***	RANGE OF POLE DIAMETER
9.20	1	7" TO 10"
	2	9" TO 12"
	3	11" TO 14"
	4	13" TO 16"

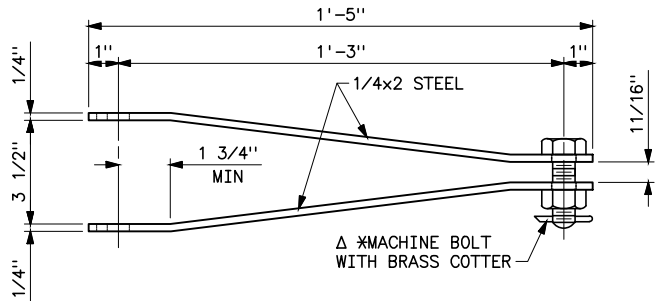
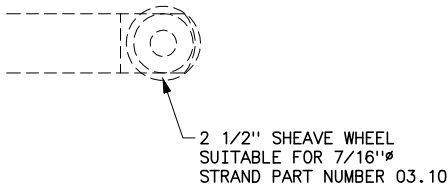
*** ALL BAND SEGMENTS SHALL HAVE THE PROPER STAMP NUMBER AS SHOWN IN THE TABLE, STAMPED IN THE METAL IN THE OUTER SURFACE OF THE BAND PRIOR TO GALVANIZING.



GROUND CLIP
PART NO. 29.50



FOUR-WAY STRAIN BAND
PART NO. 9.20



CONNECTING LINKS

PART NUMBERS 58.11, 58.12, 58.13 AND 58.13a

PART NO.	"D" INCHES	MACHINE BOLT
58.11	13/16"	3/4"x2 1/2"
58.12	13/16"	3/4"x3 1/2"
*** 58.13	13/16"	NONE
58.13a	15/16"	3/4"x2 1/2"

NOTES

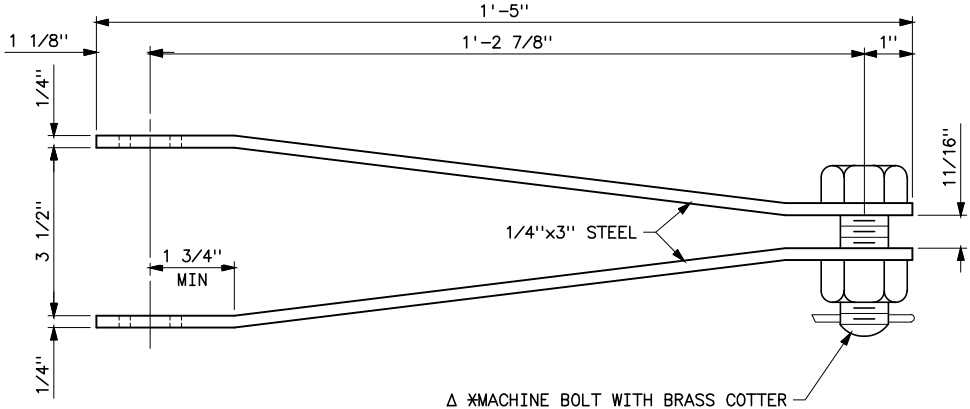
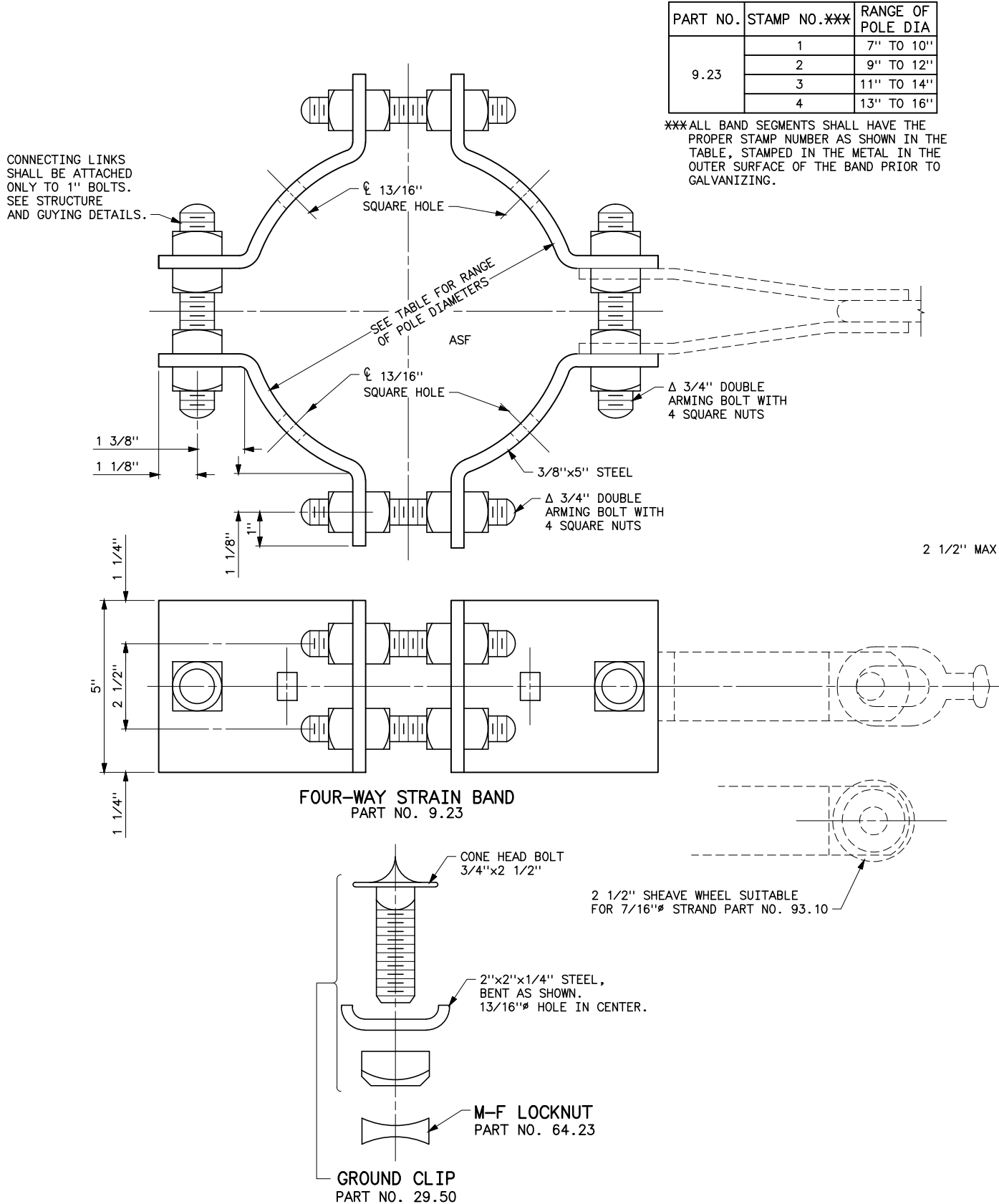
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDIN, IN ACCORDANCE WITH ASTM DESIGNATION A153.
2. * MACHINE BOLT TO BE INCLUDED WITH PART NUMBERS 58.11 AND 58.12 ONLY.
3. ** PART NUMBER 58.13 TO BE USED WITH OGW DEADENDS ONLY.
4. Δ BOLTS SHALL BE NEW-ROOLED, OPEN-HEARTH CLASS B STEEL CONFORMING TO FEDERAL SPEC. FF-B-575C TYPE I GRADE 2.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-3667		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE A FOUR-WAY STRAIN BAND		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6030

XREF(S):

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CONNECTING LINKS
PARTS NO. 58.06, 58.07, AND 58.08

PART NO.	"D"	MACHINE BOLT
58.06	13/16"	3/4"x2 1/2"
58.07	13/16"	3/4"x3 1/2"
** 58.08	13/16"	NONE

- NOTES
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING IN ACCORDANCE WITH ASTM DESIGNATION A153.
 2. * MACHINE BOLT TO BE INCLUDED WITH PARTS NO. 58.06 AND 58.07 ONLY.
 3. ** PART NO. 58.08 TO BE USED WITH OGW DEAD-ENDS ONLY.
 4. Δ BOLTS SHALL BE NEW-ROLLED OPEN HEARTH CLASS B STEEL CONFORMING TO FEDERAL SPECIFICATION FF-B-575C TYPE I GRADE 2.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.

SUPERSEDES DWG NO. 40-D-5186

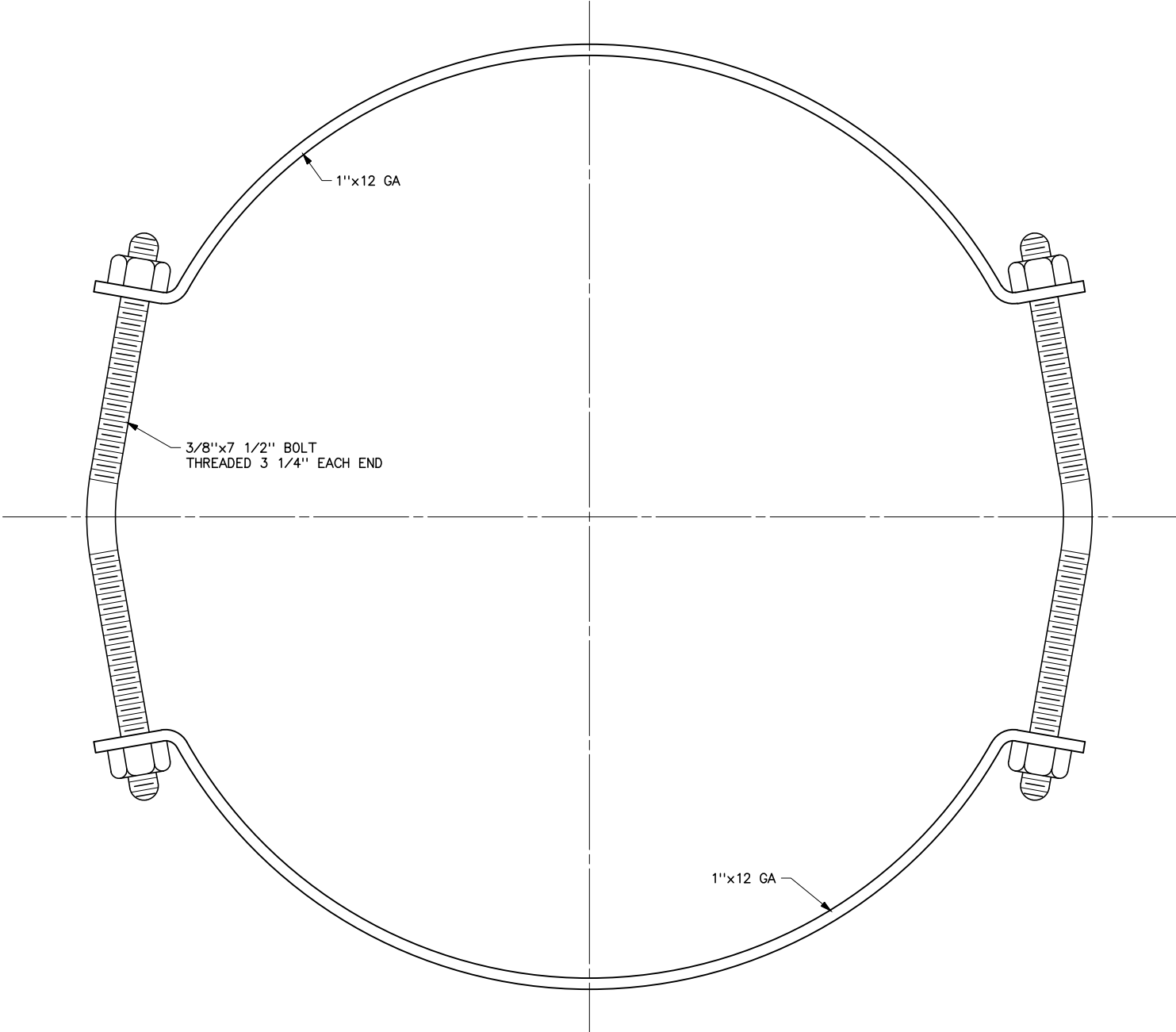
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE B FOUR-WAY STRAIN BAND

DESIGNED BUREC _____ APPROVED BUREC _____

A	AUGUST 6, 1979	41	6031
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Plotted By: court Aug 25, 2026- 1:07pm
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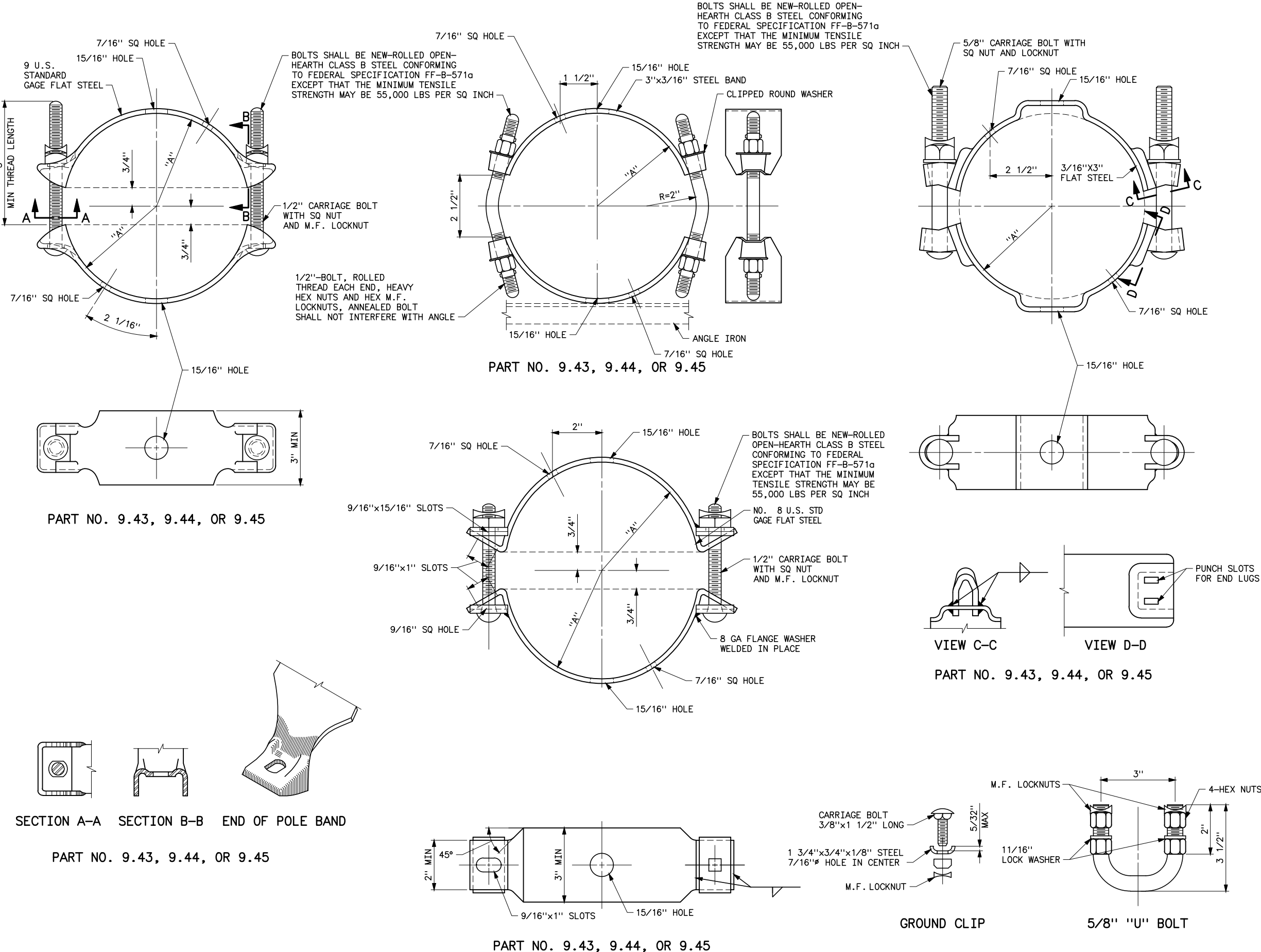
NOTES

- 1. TO BE ADAPTABLE TO 7 1/2" TO 10" POLE TOPS.
- 2. GALVANIZED AFTER BENDING AND DRILLING IN ACCORDANCE WITH ASTM DESIGNATION A-153-49T.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2781		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES POLE TOP BAND-PLAIN		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A	E AUGUST 6, 1979	41 6032

Plotted By: court Aug 25, 2026- 1:06pm
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Last Saved By: Court, Donita (CONTR) on 8/20/2026 7:34 AM



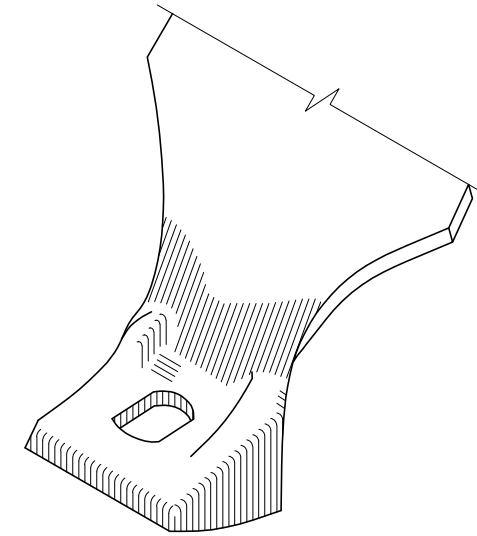
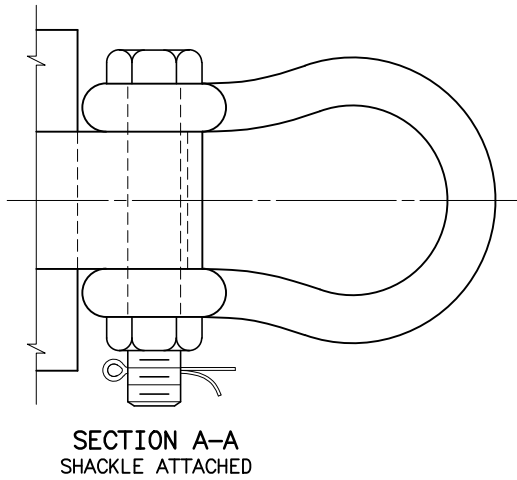
PART NO.	RADIUS "A"	RANGE OF POLE DIA	STAMP NO.*
9.43	4"	7" TO 9"	1
9.44	4 3/4"	8 1/2" TO 11"	2
9.45	5 3/4"	10 1/2 TO "13"	3

NOTES

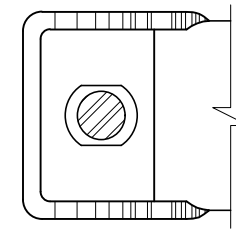
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING, IN ACCORDANCE WITH ASTM DESIGNATION A-153.
2. * BOTH SECTIONS OF THE BAND SHALL HAVE THE PROPER STAMP NUMBER, AS SHOWN IN THE TABLE, STAMPED IN THE METAL ON THE OUTSIDE SURFACE OF THE BAND PRIOR TO GALVANIZING, OR MAY BE STAMPED AFTER GALVANIZING, WITH A SUITABLE INDELIBLE INK.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

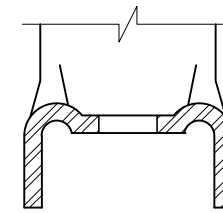
C	8/20/26 A7-KR	HISTORICAL REFERENCE
	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5994		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES POLE TOP BANDS FOR OVERHEAD GROUND WIRES		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6033



END OF POLE BAND

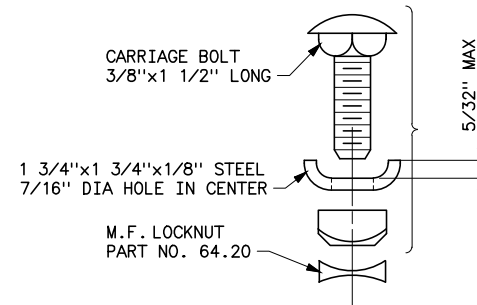


SECTION B-B

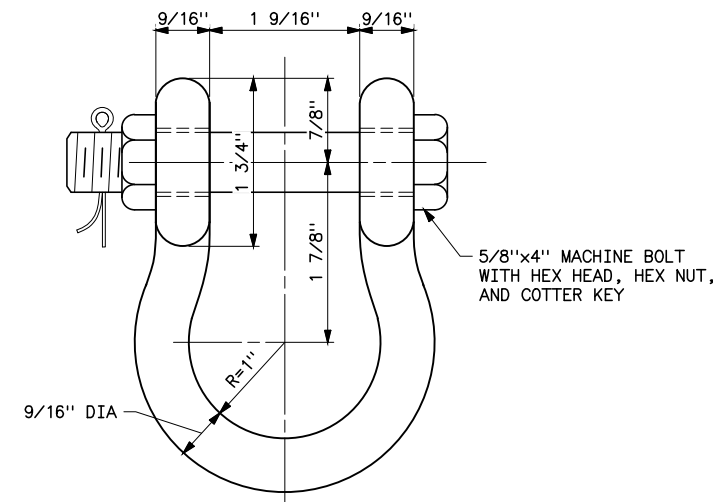


SECTION C-C

1. BAND IS SIMILAR TO HUBBARD & CO. DESIGN.
2. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING, IN ACCORDANCE WITH ASTM DESIGNATION A153.
3. NOT TO BE USED FOR DEAD-ENDING OVERHEAD GROUND WIRES.
4. *BOTH SECTIONS OF THE BAND SHALL HAVE THE PROPER STAMP NUMBER, AS SHOWN IN THE TABLE, STAMPED IN THE METAL ON THE OUTSIDE SURFACE OF THE BAND PRIOR TO GALVANIZING, OR MAY BE STAMPED AFTER GALVANIZING, WITH A SUITABLE INDELIBLE INK.



GROUND CLIP
PART NO. 29.40

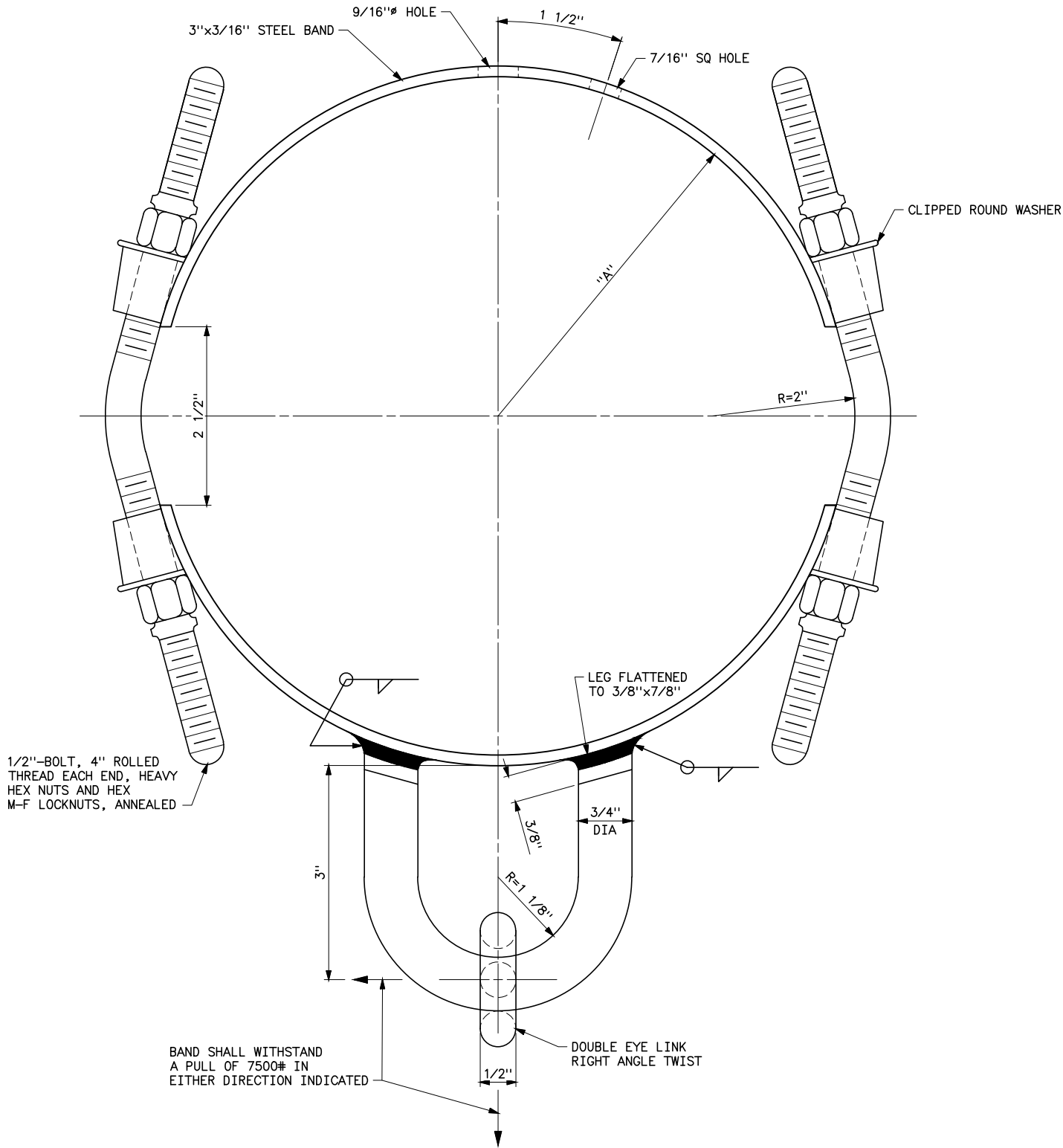


DETAIL OF SHACKLE
PART NO. 79.10

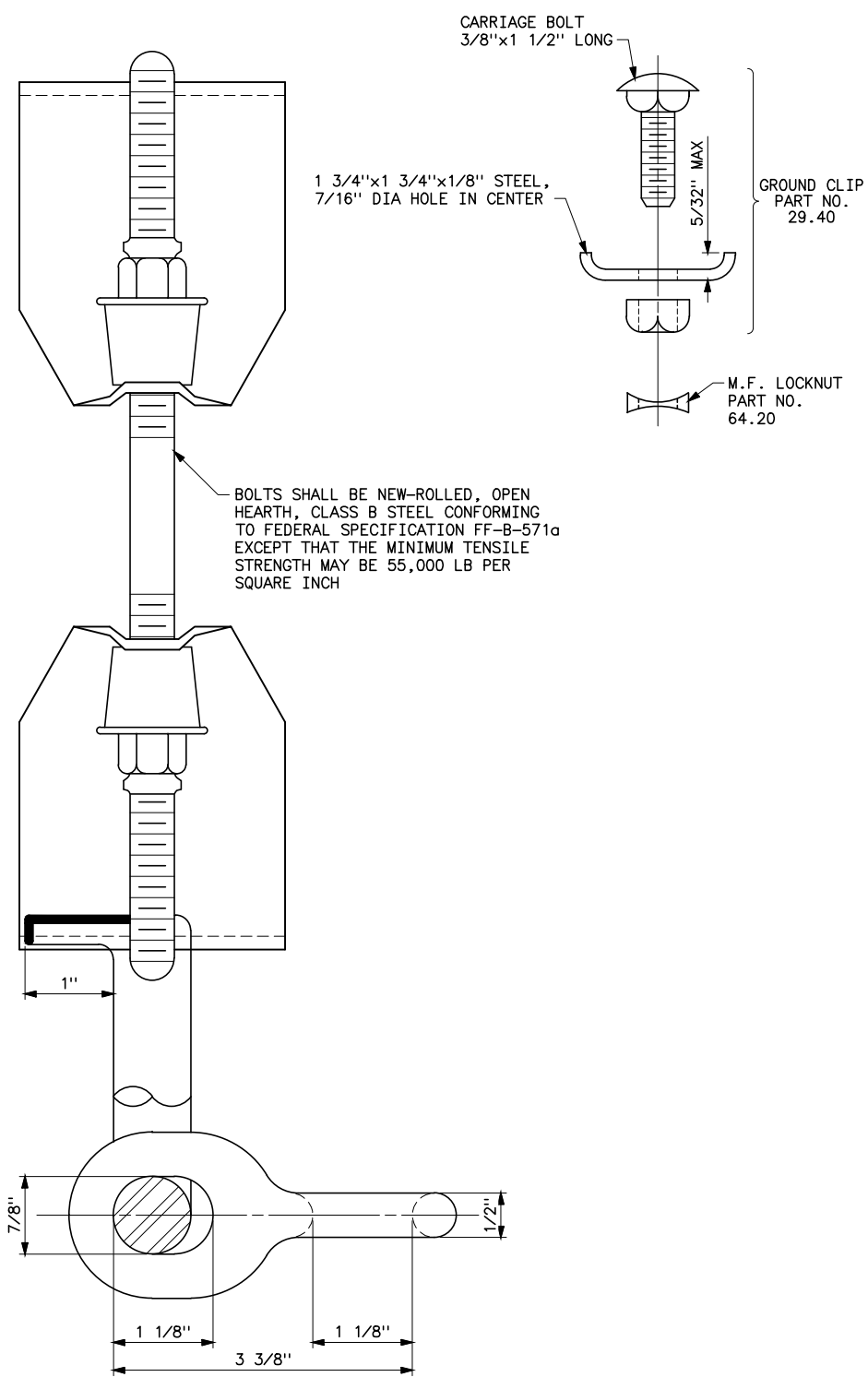
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2938		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE A POLE TOP BAND FOR OVERHEAD GROUND WIRE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A F	AUGUST 6, 1979	41 6034

Plotted By: court Aug 25, 2026- 1:05pm
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PART NO.	STAMP NO ✕	RADIUS "A"	RANGE OF POLE DIA
9.38	1	4"	7" TO 9"
9.39	2	4 3/4"	8 1/2" TO 11"
9.40	3	5 3/4"	10 1/2" TO 13"



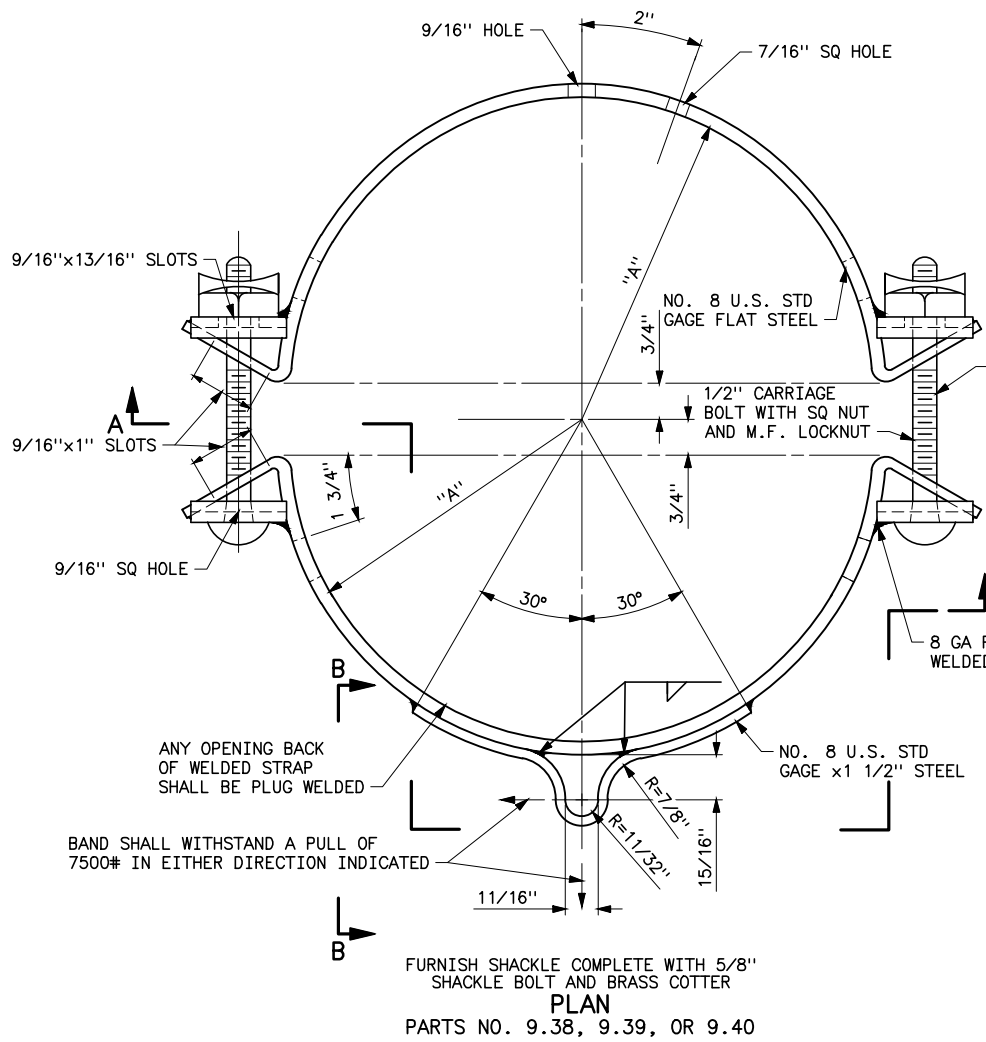
NOTES

1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING, IN ACCORDANCE WITH ASTM DESIGNATION A153.
2. ✕ BOTH SECTIONS OF THE BAND SHALL HAVE THE PROPER STAMP NUMBER, AS SHOWN IN THE TABLE, STAMPED IN THE METAL ON THE OUTSIDE SURFACE OF THE BAND PRIOR TO GALVANIZING, OR MAY BE STAMPED AFTER GALVANIZING, WITH A SUITABLE INDELIBLE INK.
3. NOT TO BE USED FOR DEAD-ENDING OVERHEAD GROUND WIRES.
4. BAND IS SIMILAR TO JOSLYN MFG. AND SUPPLY CO. DESIGN.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

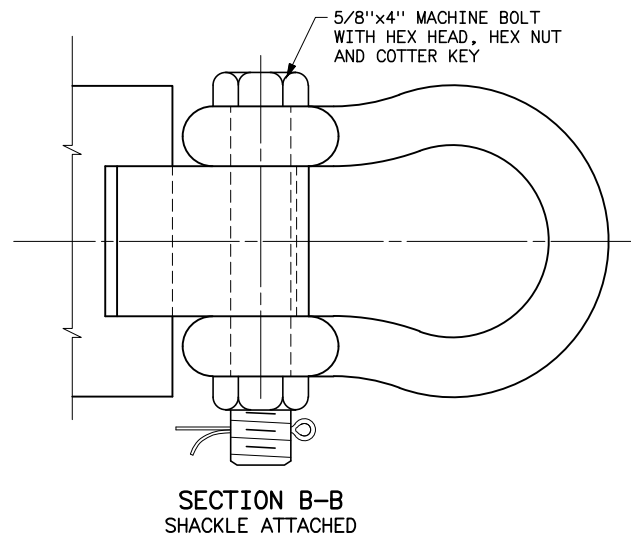
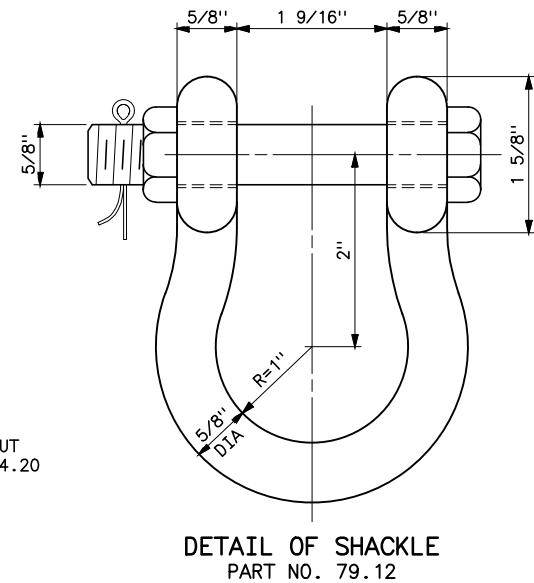
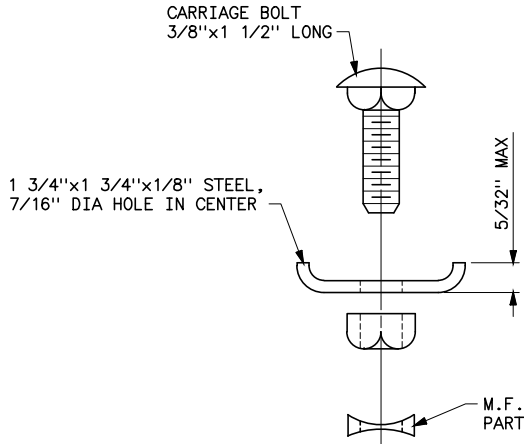
C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4837		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE B POLE TOP BAND FOR OVERHEAD GROUND WIRE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6035

Plotted By: court Aug 25, 2026- 1:04pm
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PART NO.	STAMP NO. *	RADIUS "A"	RANGE OF POLE DIA
9.38	1	4"	7" TO 9"
9.39	2	4 3/4"	8 1/2" TO 11"
9.40	3	5 3/4"	10 1/2" TO 13"

* BOTH SECTIONS OF THE BAND SHALL HAVE THE PROPER STAMP NUMBER, AS SHOWN IN THE ABOVE TABLE, STAMPED IN THE METAL ON THE OUTSIDE SURFACE OF THE BAND PRIOR TO GALVANIZING, OR MAY BE STAMPED AFTER GALVANIZING, WITH A SUITABLE INDELIBLE INK



NOTES

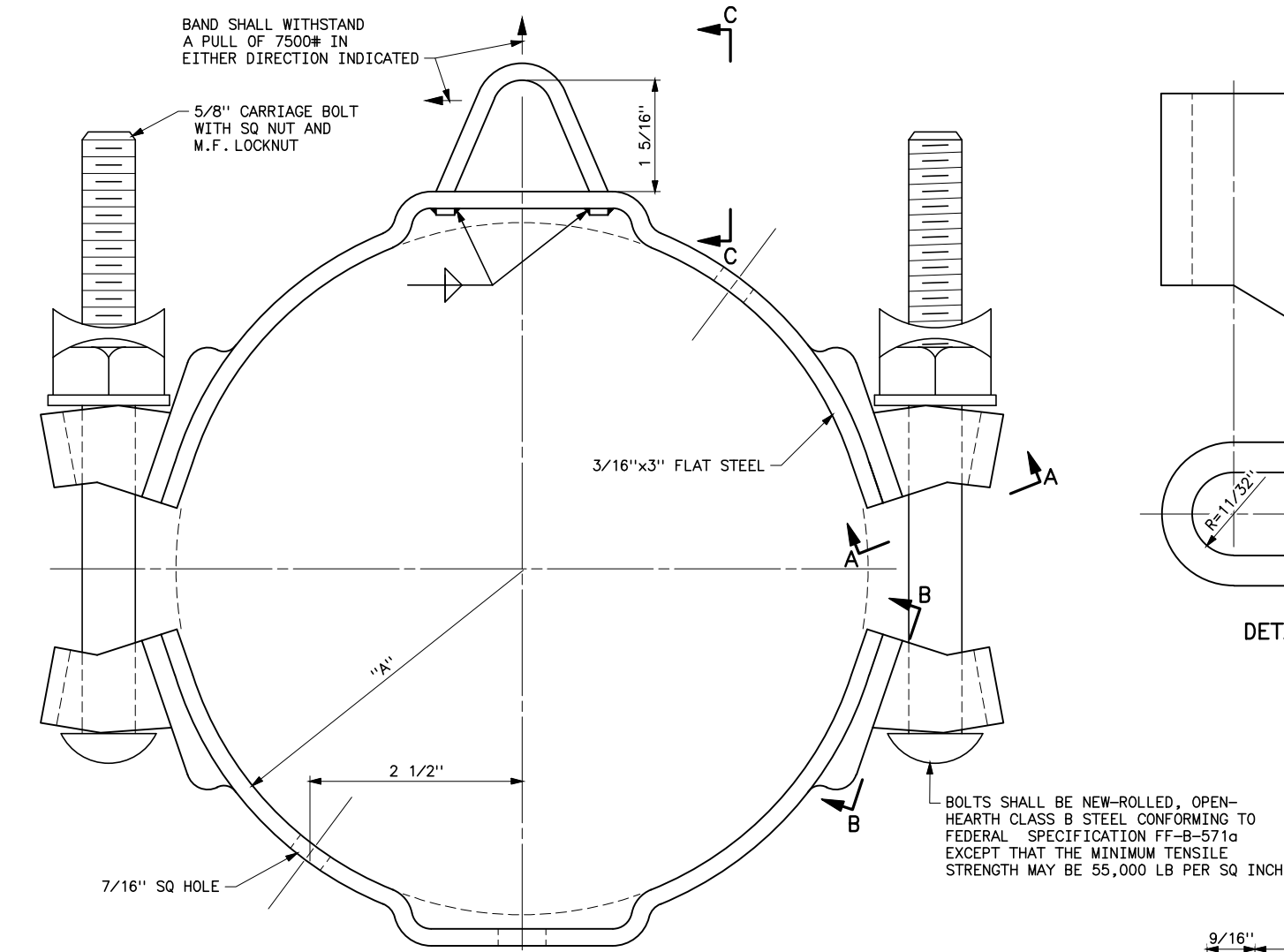
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING, IN ACCORDANCE WITH ASTM DESIGNATION A153.
2. NOT TO BE USED FOR DEAD-ENDING OVERHEAD GROUND WIRES.
3. BAND IS SIMILAR TO HUGHES BROTHERS DESIGN.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

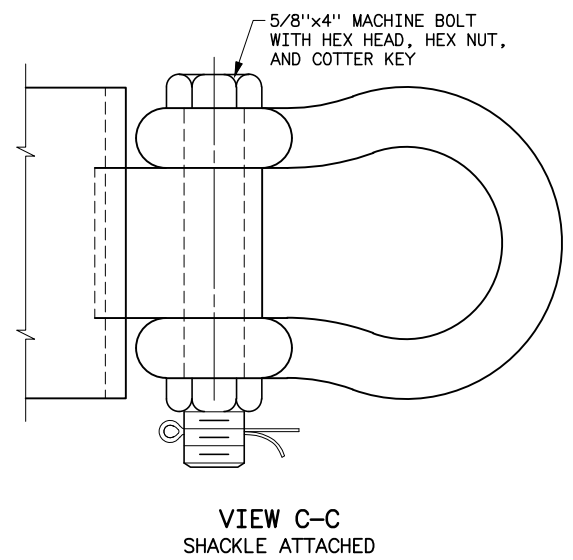
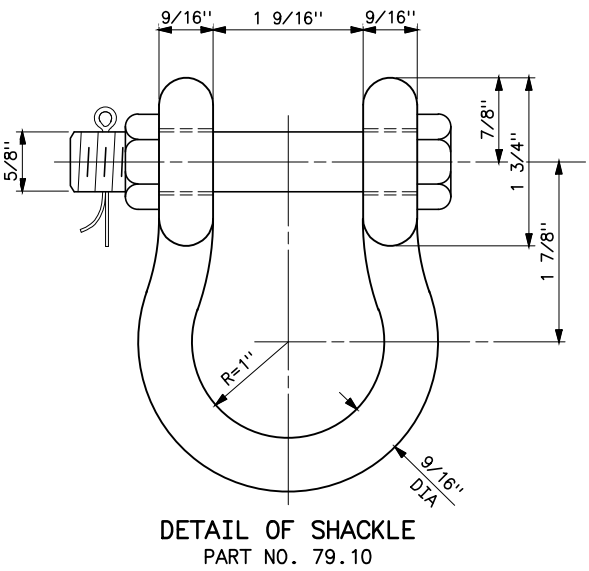
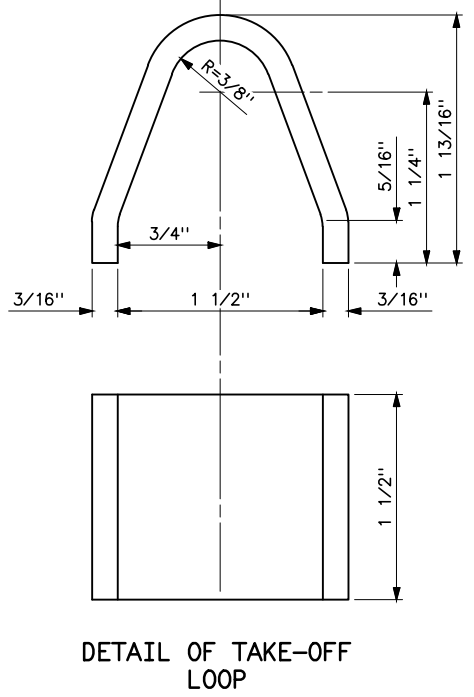
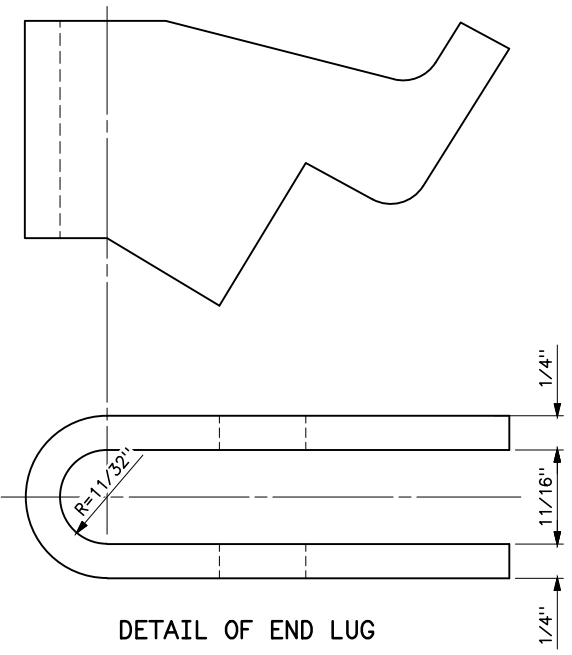
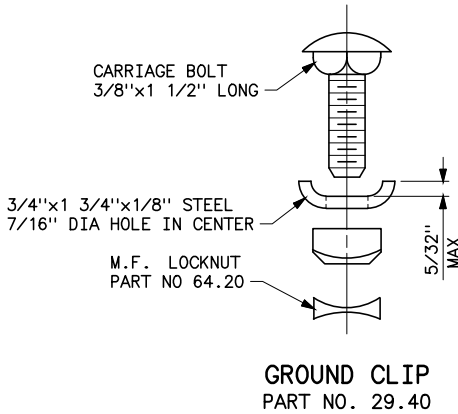
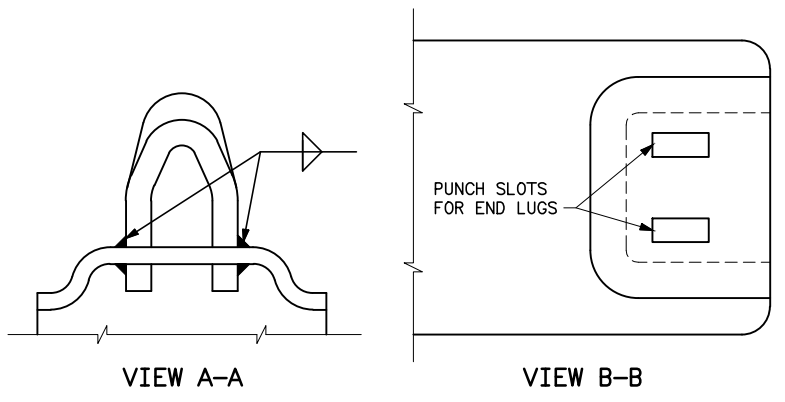
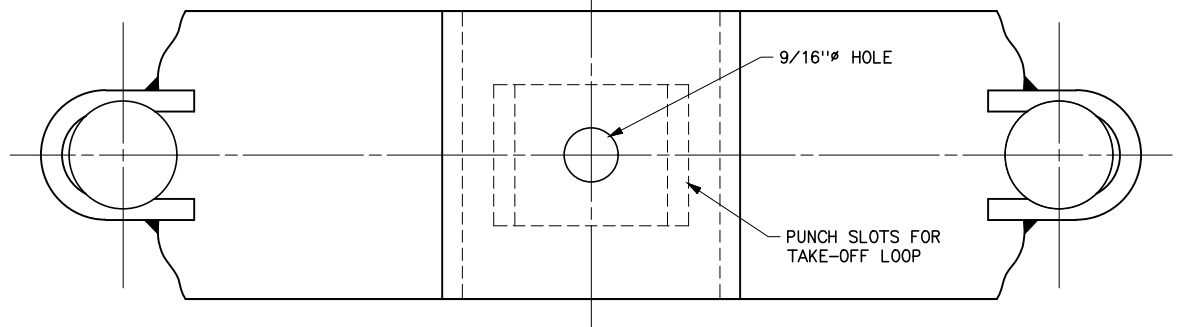
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B	5-28-14 A7-DDD	REDRAWN
SUPERSEDES DWG NO. 40-D-5024		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TRANSMISSION LINES TYPE C POLE TOP BAND FOR OVERHEAD GROUND WIRE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6036

XREF (S):

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Last Saved By: Court, Donita (CONTR) on 8/20/2026 7:37 AM



PARTS NO. 9.38, 9.39, OR 9.40



PART NO.	STAMP NO. *	RADIUS "A"	RANGE OF POLE DIA
9.38	1	4"	7" TO 9"
9.39	2	4 3/4"	8 1/2" TO 11"
9.40	3	5 3/4"	10 1/2" TO 13"

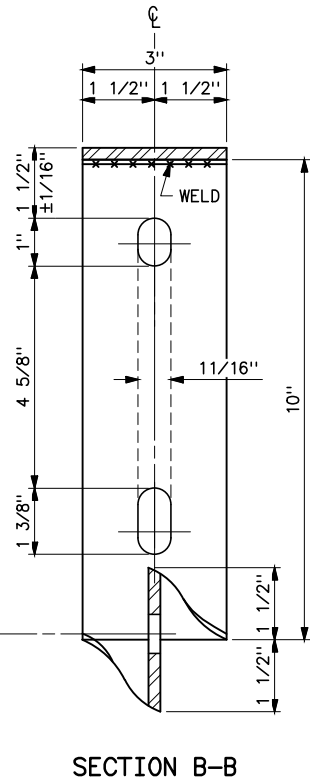
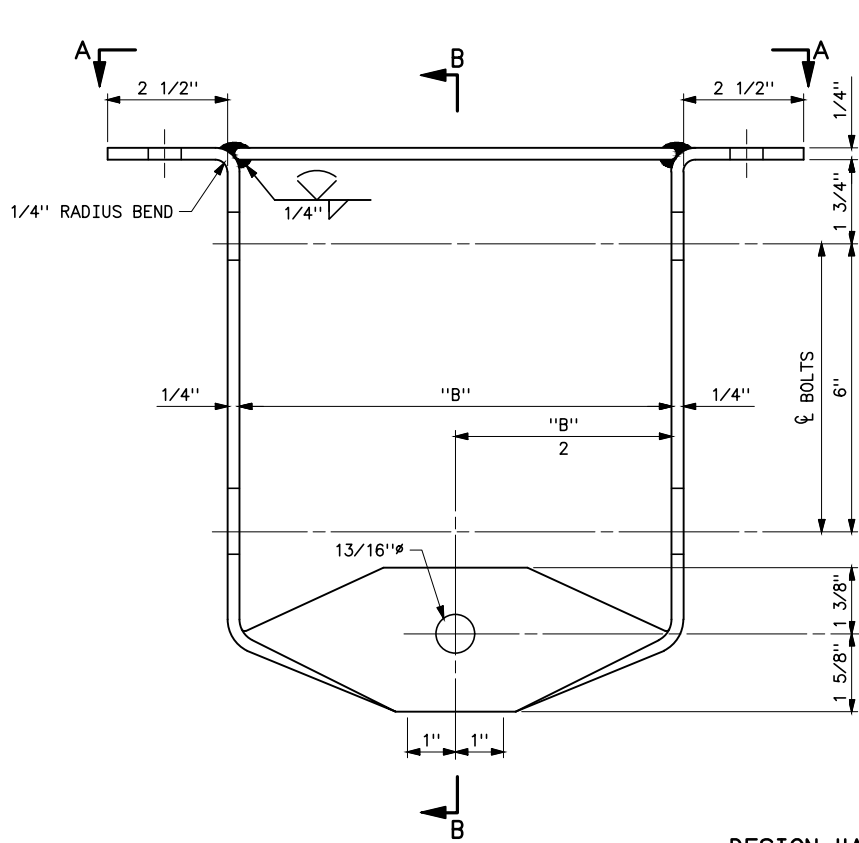
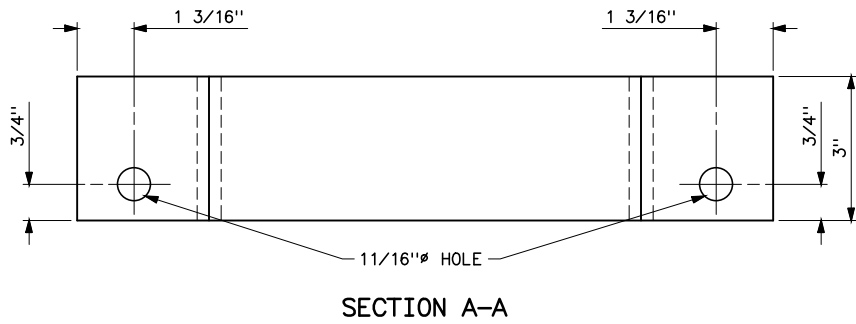
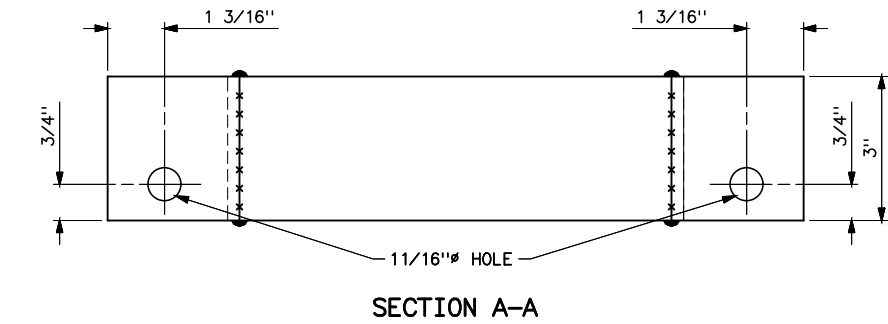
* BOTH SECTIONS OF THE BAND SHALL HAVE THE PROPER STAMP NUMBER AS SHOWN IN THE ABOVE TABLE, STAMPED IN THE METAL ON THE OUTSIDE SURFACE OF THE BAND PRIOR TO GALVANIZING, OR MAY BE STAMPED AFTER GALVANIZING, WITH A SUITABLE INDELIBLE INK.

- NOTES
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING, BENDING, AND WELDING IN ACCORDANCE WITH ASTM DESIGNATION A153.
 2. NOT TO BE USED FOR DEAD-ENDING OVERHEAD GROUND WIRES.
 3. BAND SIMILAR TO LINE MATERIAL CO. DESIGN.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

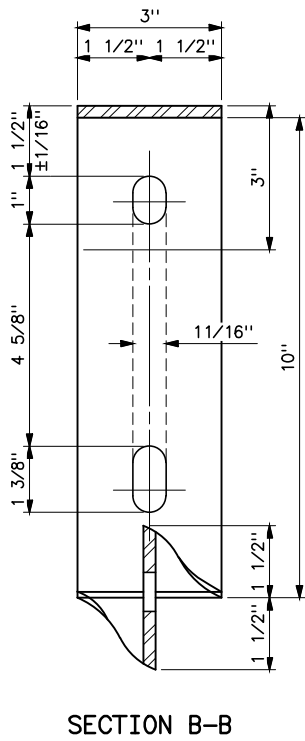
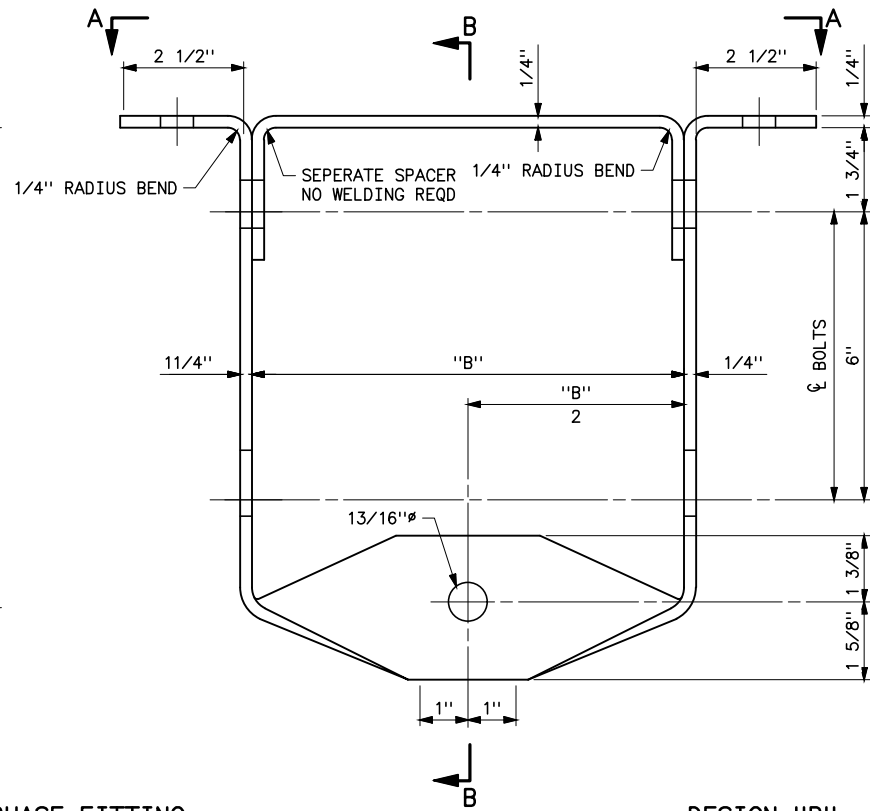
C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5202		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE D POLE TOP BAND FOR OVERHEAD GROUND WIRE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6037

Plotted By: court Aug 25, 2026- 1:03pm
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PHASE FITTING
ALTERNATE DESIGNS
PARTS NO. 40.49, 40.50, AND 40.51
(SEE TABLE FOR DIMENSION "B")

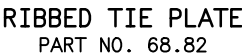
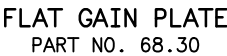
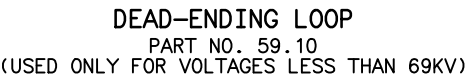
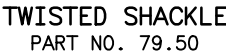
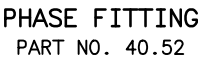
PART NO.	"B"
40.49	9"
40.50	10 1/2"
40.51	7 1/2"



NOTE
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING, BENDING, AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A153.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

A	8/20/26 A7-KR	HISTORICAL REFERENCE
SUPERSEDES DWG NO. 41 6038A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 69 AND 115KV H-FRAME POLE HARDWARE DETAILS (SHEET 1 OF 2)		
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER		
A	MAY 28, 2014	41 6038-1



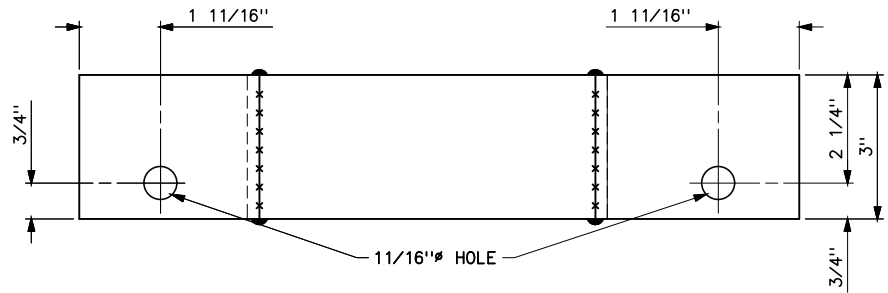
NOTE

1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING, BENDING, AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A153.

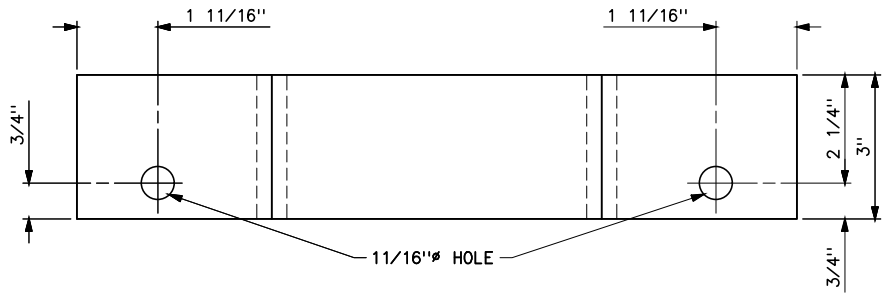
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

A	8/20/26 A7-KR	HISTORICAL REFERENCE	
	SUPERSEDES DWG NO. 41 6038A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES 69 AND 115KV H-FRAME POLE HARDWARE DETAILS (SHEET 2 OF 2)			
DESIGNED <u>BUREC</u> _____		APPROVED <u>ROSS W. CLARK</u> _____ ELECTRICAL ENGINEERING MANAGER	
C A	MAY 28, 2014	41	6038-2

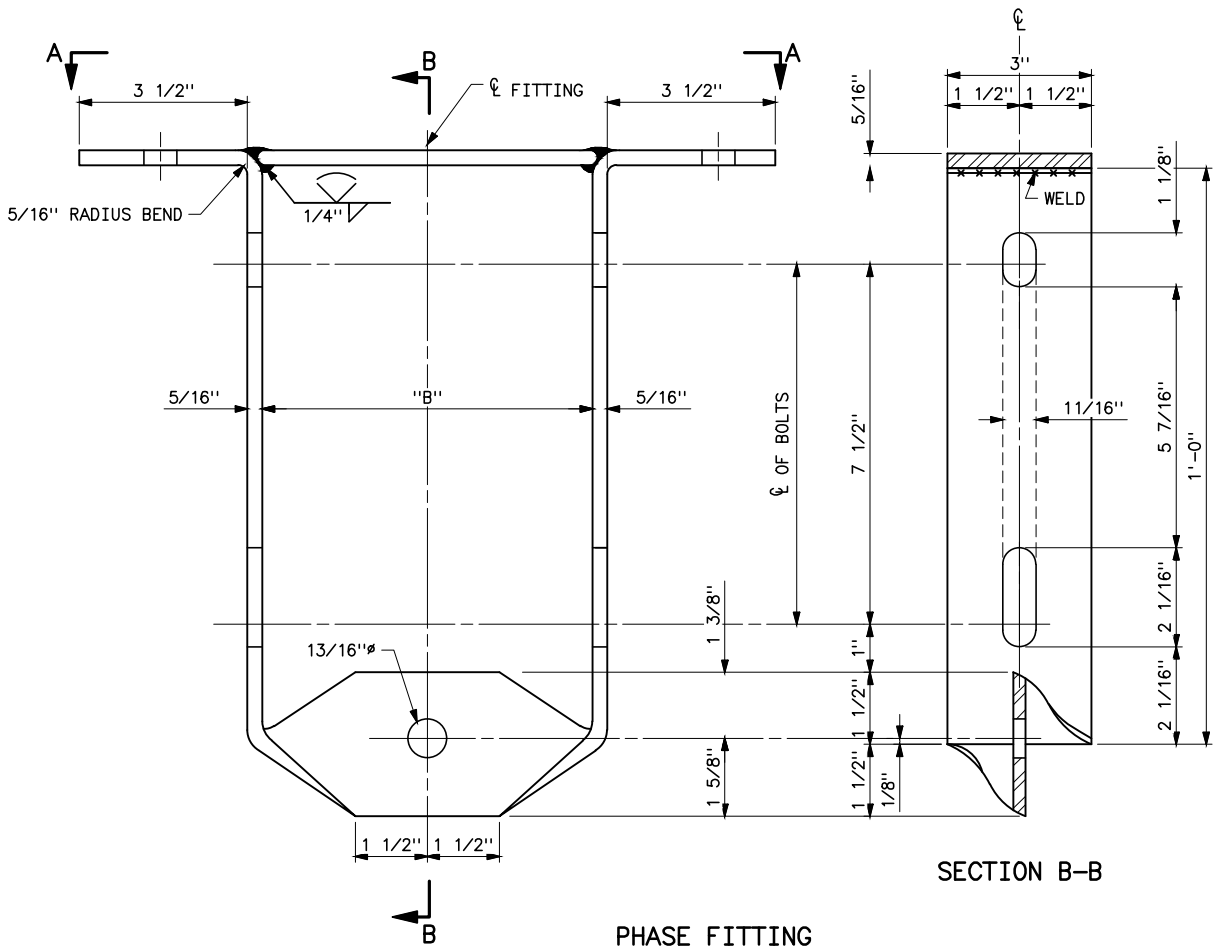
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SECTION A-A

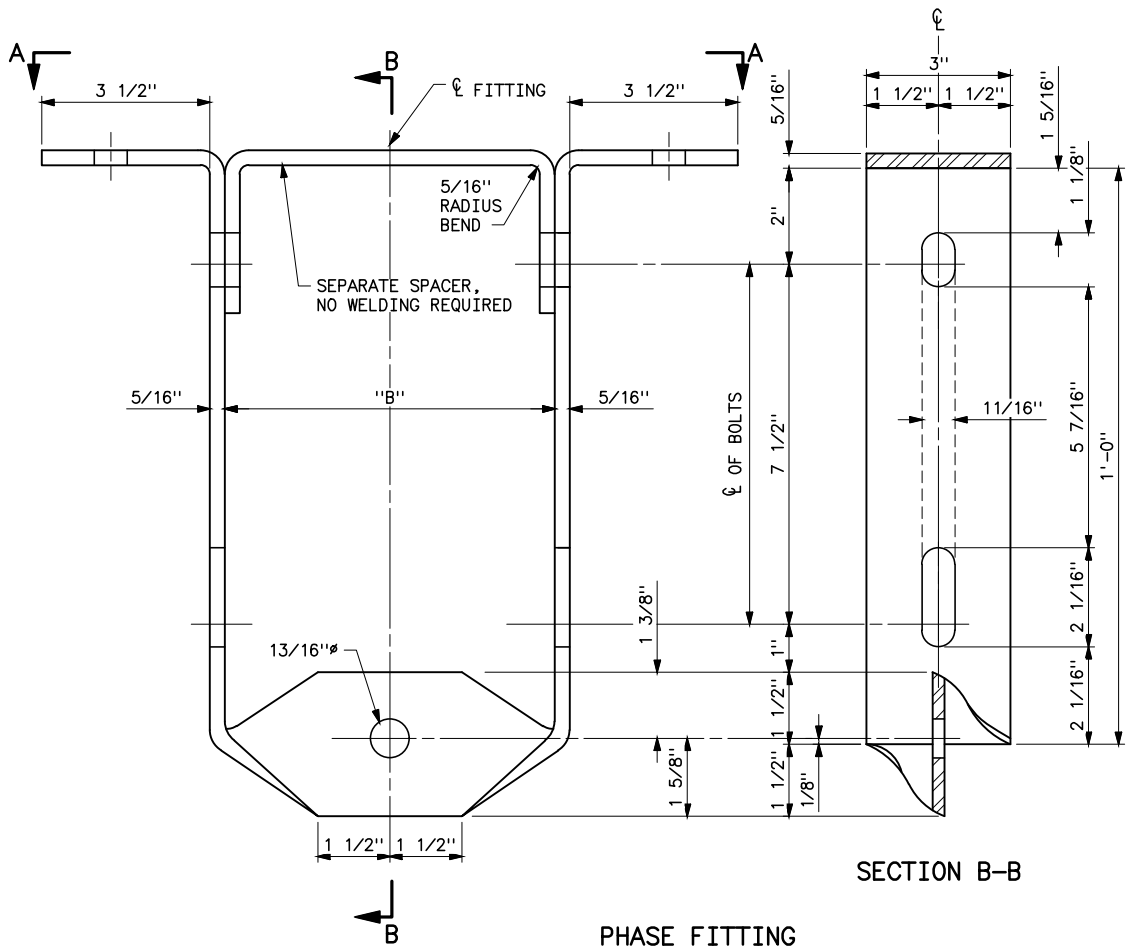


SECTION A-A



PHASE FITTING
DESIGN A

STEEL PARTS NO. 40.53 TO 40.56 INCLUDED
(SEE TABLE FOR DIMENSION "B")



PHASE FITTING
DESIGN B

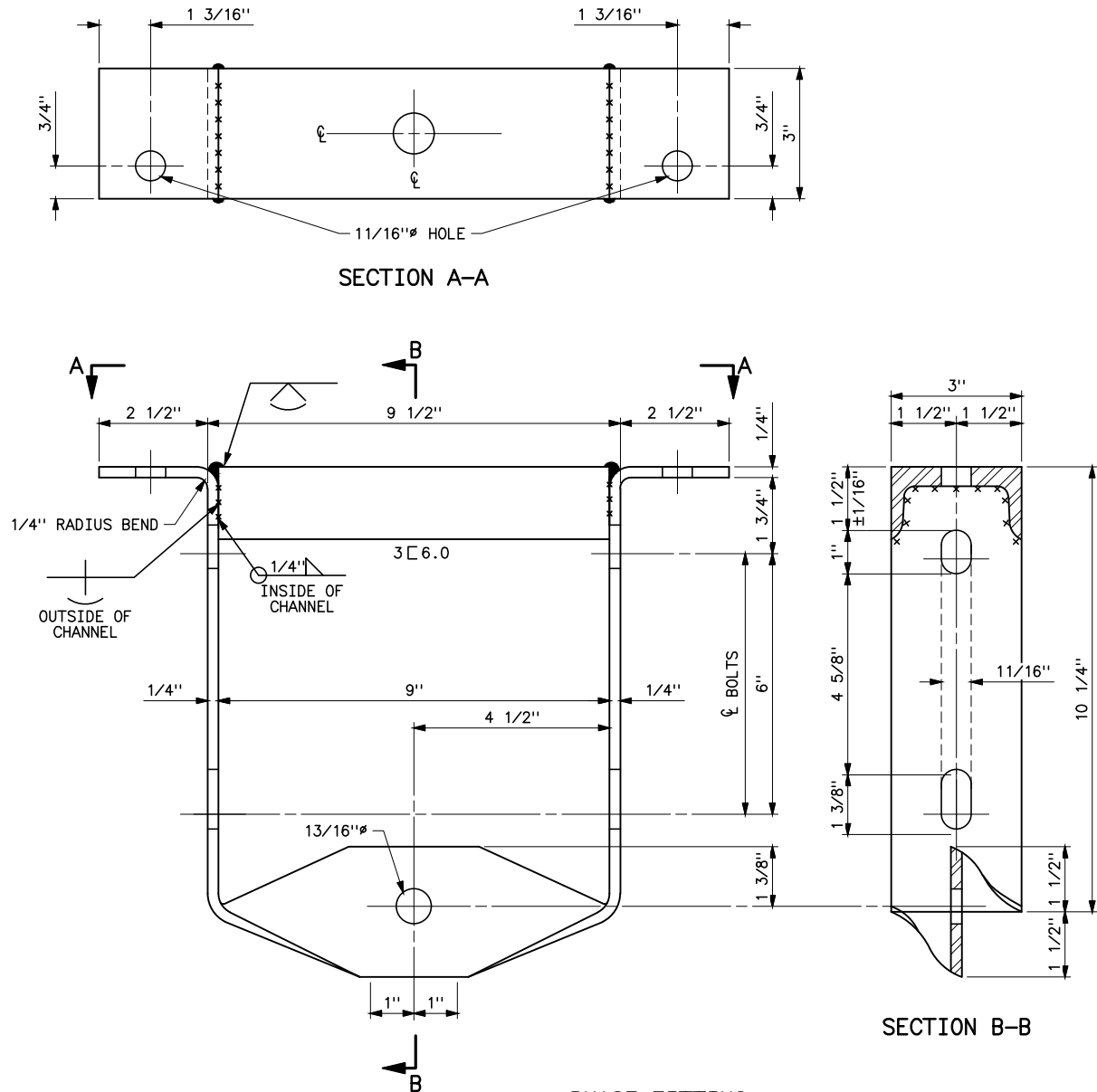
STEEL PARTS NO. 40.53 TO 40.56 INCLUDED
(SEE TABLE FOR DIMENSION "B")

PART NO.	"B"
40.53	7 1/2"
40.54	9"
40.55	10 1/2"
40.56	12"

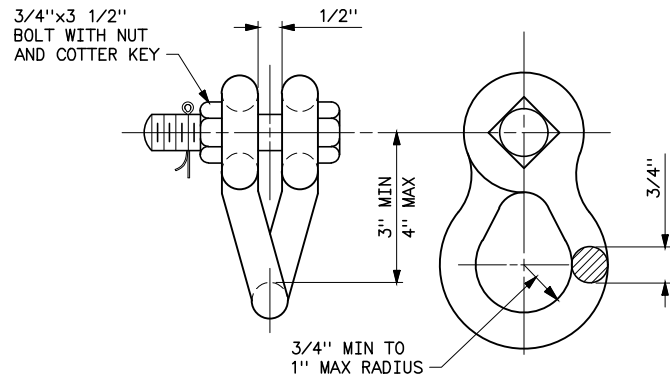
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

B	8/20/26 A7-KR	HISTORICAL REFERENCE
A	11-2-21 A7-KKR	CHANGED 138 AND 115KV TO CORRECT VOLTAGES 138 AND 161KV IN THE TITLE BLOCK.
SUPERSEDES DWG NO. 41 6039A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 138 AND 161KV, H-FRAME POLE HARDWARE DETAILS (SHEET 1 OF 2)		
DESIGNED BUREC _____		APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER
A	MAY 28, 2014	41 6039-1

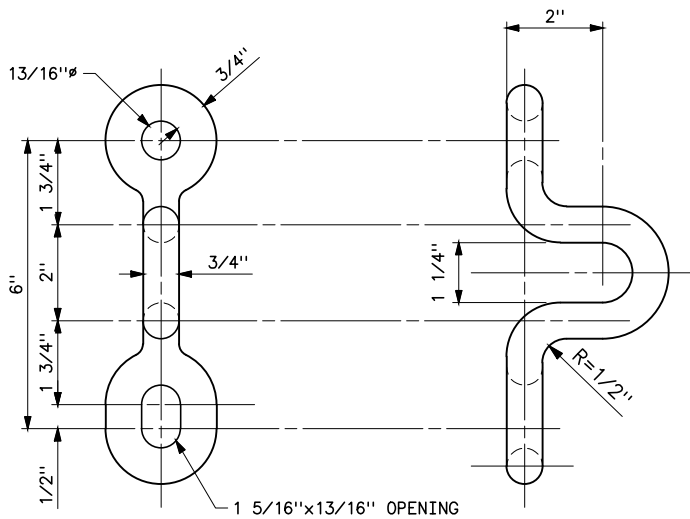
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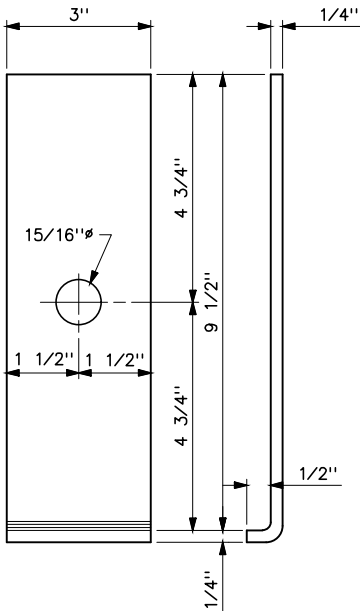
PHASE FITTING
PART NO. 40.52



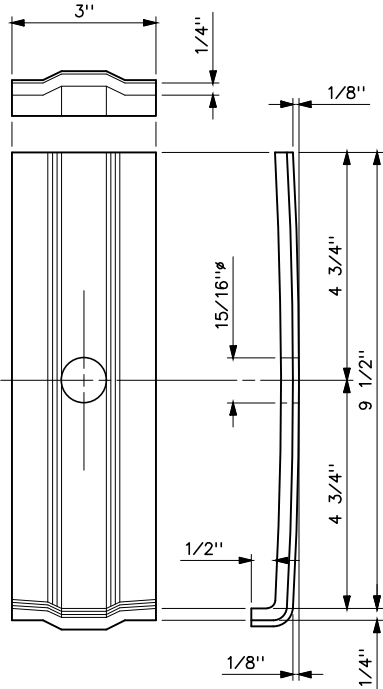
TWISTED SHACKLE
PART NO. 79.50



DEAD-ENDING LOOP
PART NO. 59.10
(USED ONLY FOR VOLTAGES LESS THAN 69KV)



FLAT GAIN PLATE
PART NO. 68.30

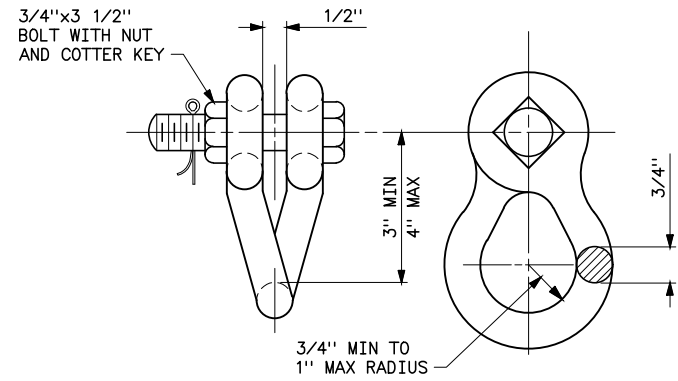
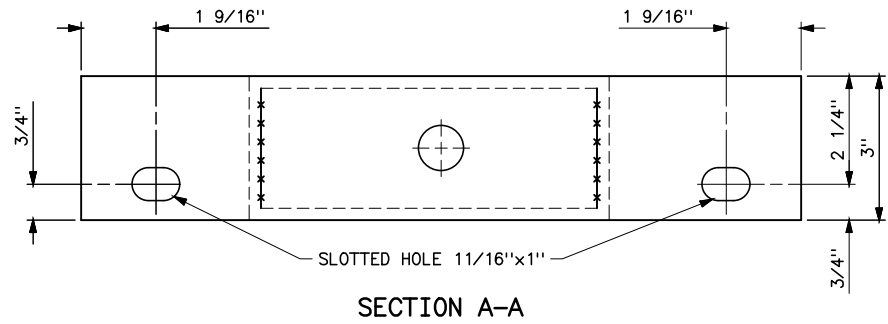


RIBBED TIE PLATE
PART NO. 68.82

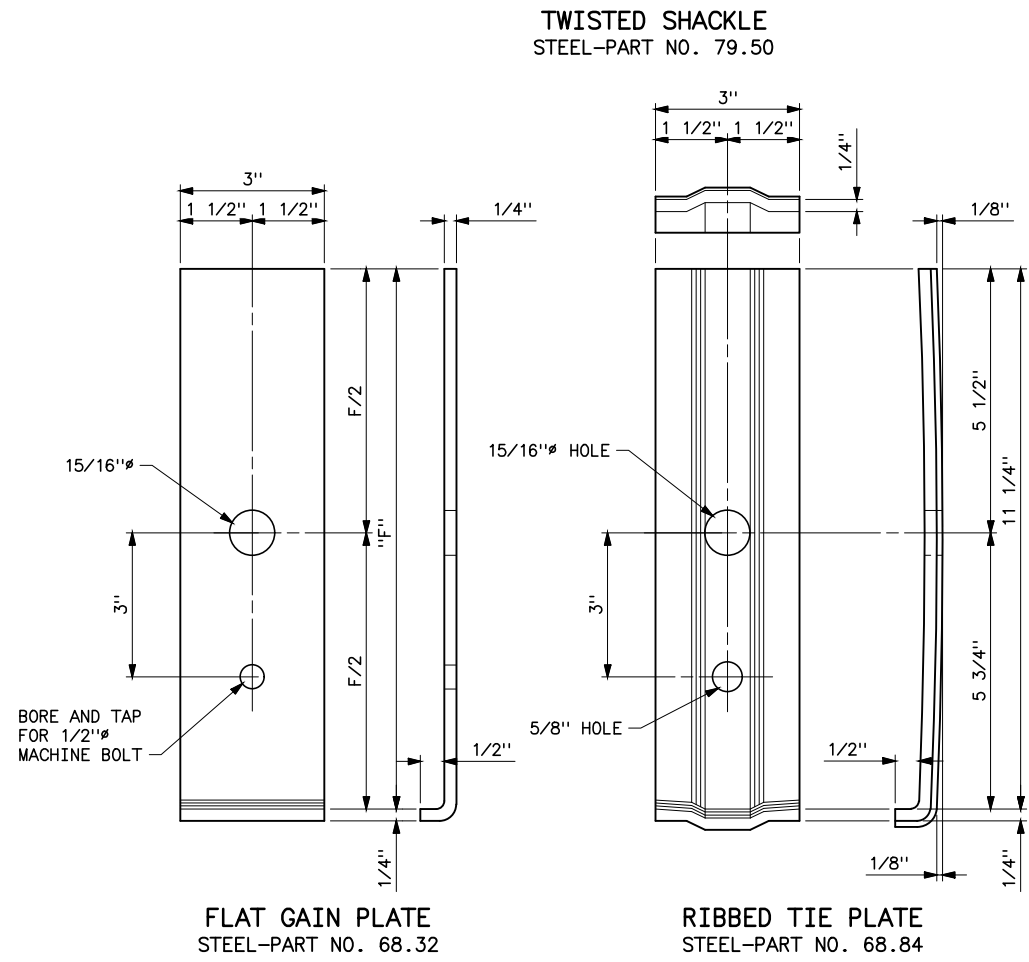
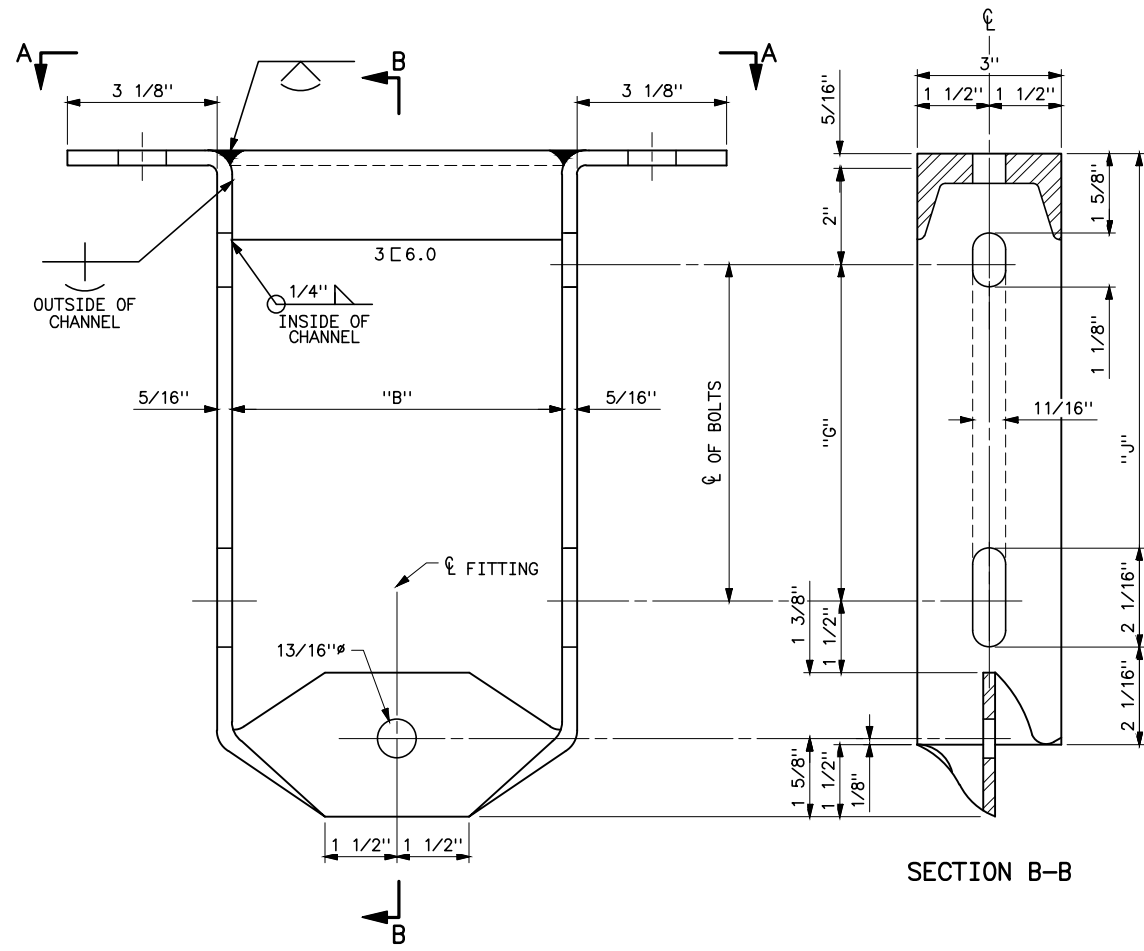
NOTE
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING, BENDING, AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A153.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

B	8/20/26 A7-KR	HISTORICAL REFERENCE
A	11-2-21 A7-KKR	CHANGED 69 AND 115KV TO CORRECT VOLTAGES 138 AND 161KV IN THE TITLE BLOCK.
SUPERSEDES DWG NO. 41 6039A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 138 AND 161KV, H-FRAME POLE HARDWARE DETAILS (SHEET 2 OF 2)		
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER		
A	MAY 28, 2014	41 6039-2



PART NO.	"B"
40.66	9"
40.67	10 1/2"
40.58	1'-0"



NOTE
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING, BENDING, AND FORGING IN ACCORDANCE WITH ASTM DESIGNATION A153.

CROSSARM DEPTH "F"	"G"	"J"
9"	5"	9 5/16"
10 1/2"	6 1/2"	11 1/16"
11 1/2"	7 1/2"	1'-0 1/16"

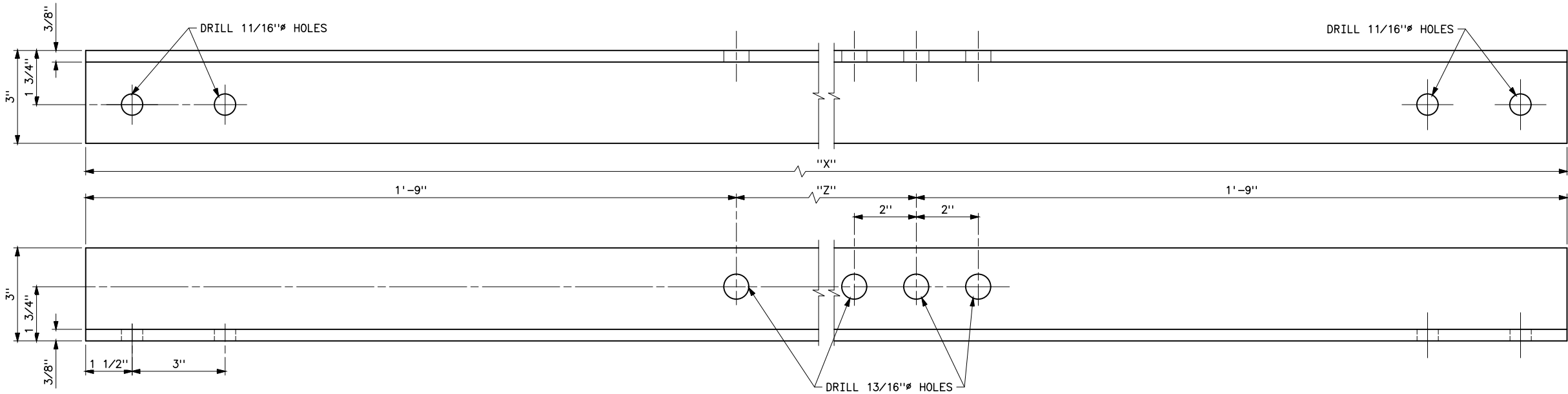
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

D	8/20/26 A7-KR	HISTORICAL REFERENCE
C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5991		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 230KV H-FRAME POLE HARDWARE DETAILS		
DESIGNED BUREC _____ APPROVED BUREC _____		
AUGUST 6, 1979	41	6040

Plotted By: court Aug 25, 2026- 1:01pm
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XREF(S):

Plotted By: court Aug 25, 2026- 1:01pm
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VOLTAGE	"X"	"Z"
69KV	13'-6"	10'-0"
115KV	15'-6"	12'-0"
138KV	17'-6"	14'-0"
161KV	20'-6"	17'-0"
230KV	25'-6"	22'-0"

NOTE

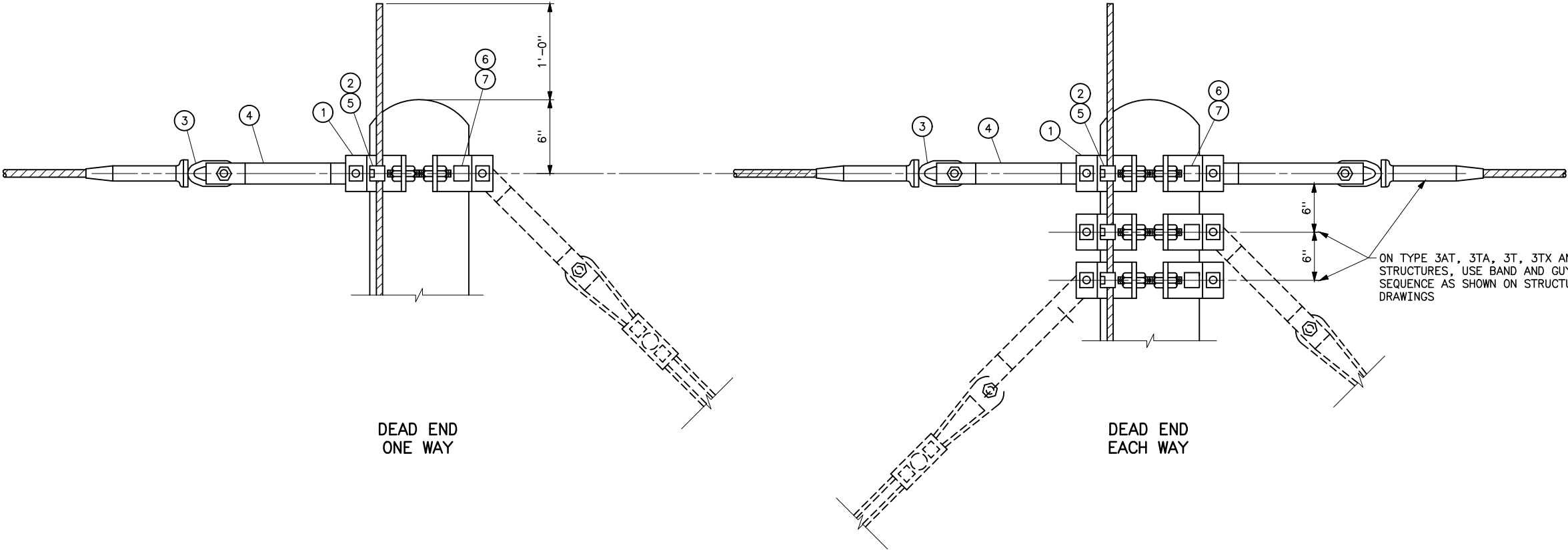
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING IN ACCORDANCE WITH ASTM DESIGNATION A153.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6133

D	8/25/26 A7-KR	HISTORICAL REFERENCE
C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5993		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 69,115,138,161 & 230KV H-FRAME ANGLE IRON DETAILS		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6041

XREF(S):

Aug 25, 2026 - 1:00pm Plotted By: court S:\Projects\Wise\StandardDrawings\Drawings\DesignDrawings\DrawingsReadyForFinal\Scripts\41_6042e.dwg Last Saved By: court IMAGES:



TYPICAL OGW ATTACHMENT USING EYE-TYPE COMPRESSION DEAD ENDS

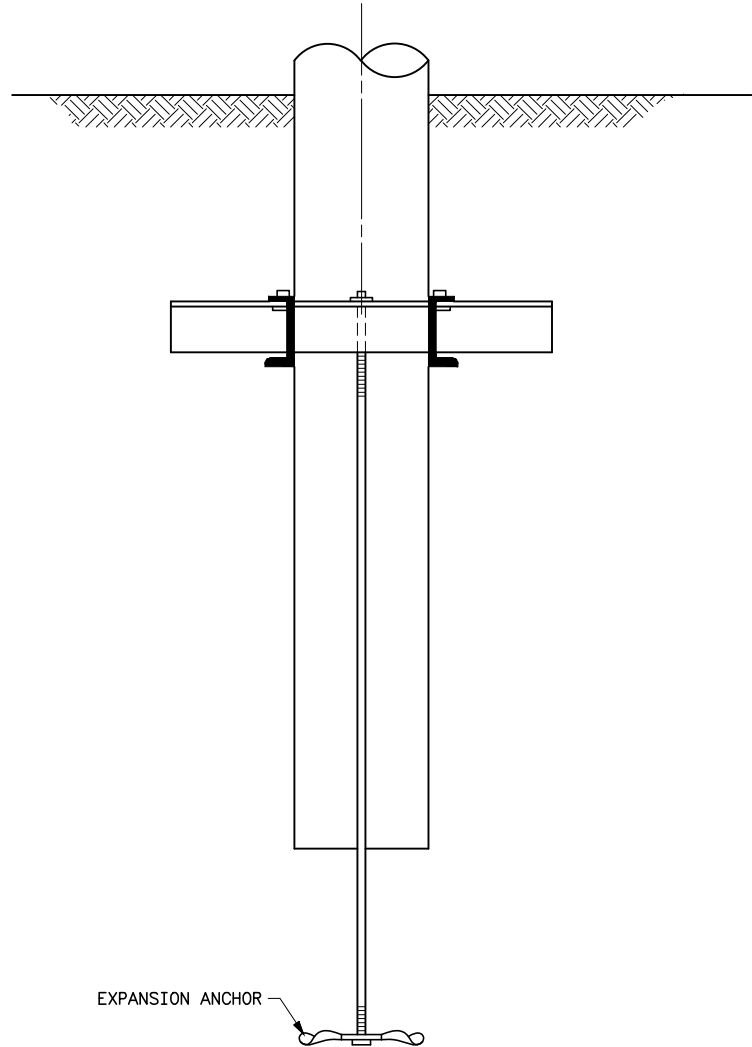
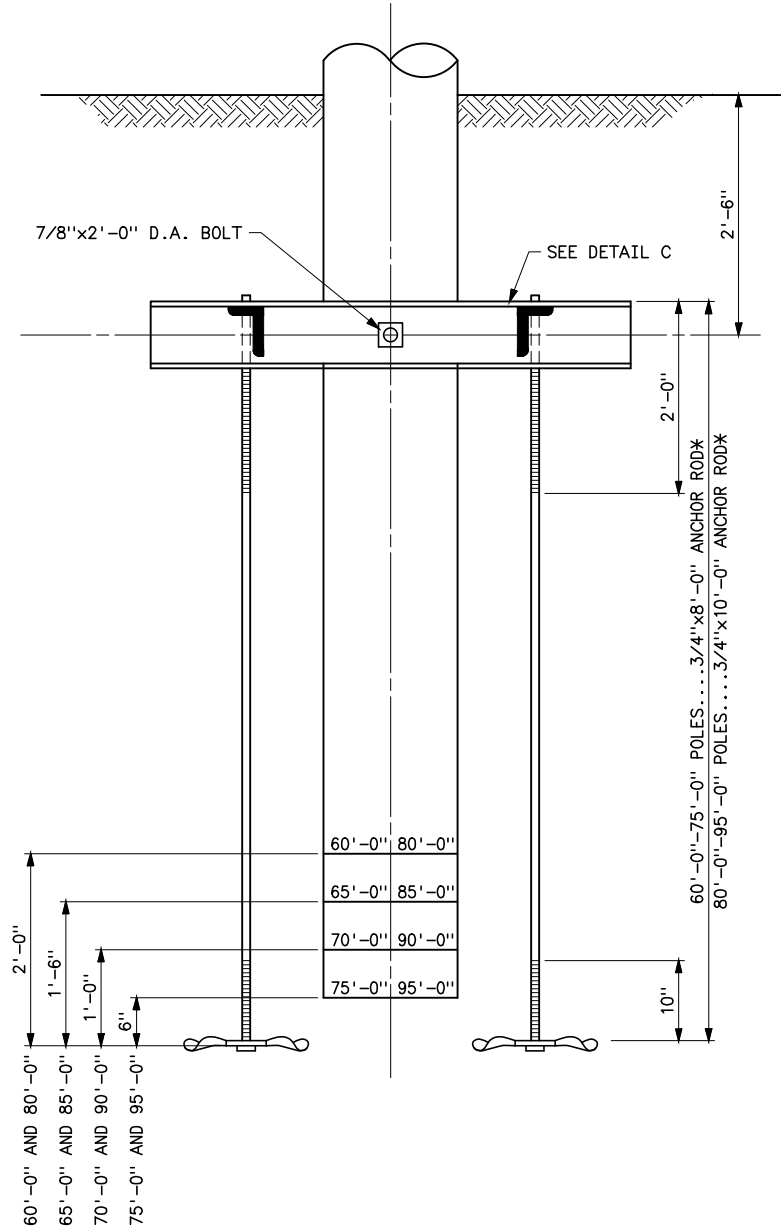
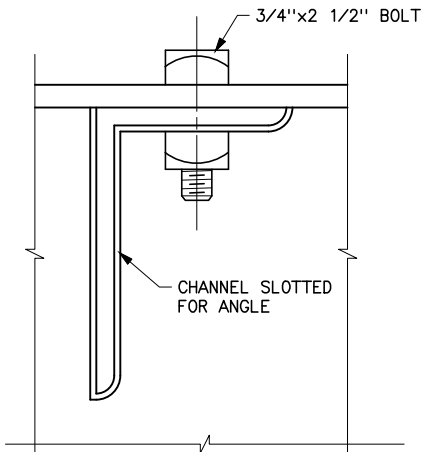
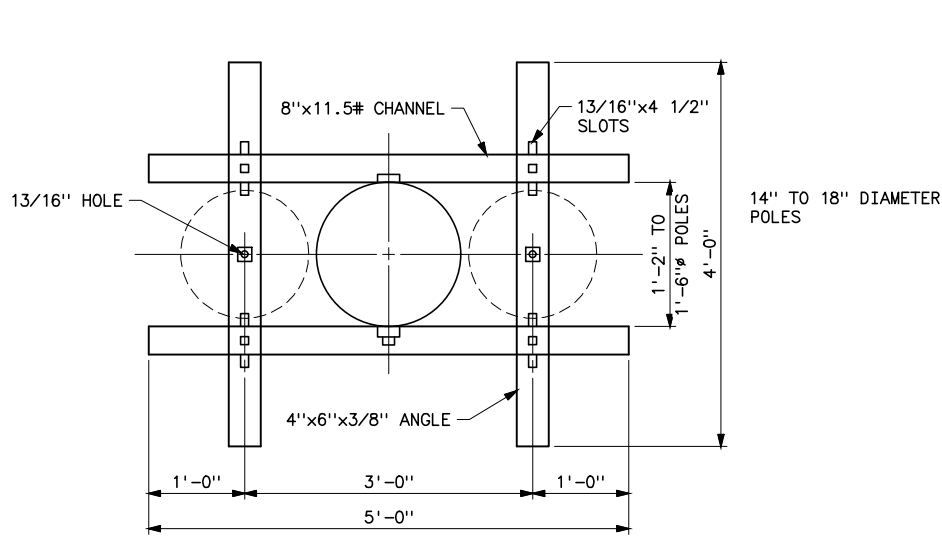
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

MATERIAL LIST		
ITEM NO.	DESCRIPTION	DWG NO. 41
1	BAND, FOUR-WAY STRAIN	6030
2	CLIP, GROUND, WITH 3/4x2 1/2 CONE HEAD BOLT	6030
3	COMPRESSION DEAD END, EYE-TYPE FOR OGW	
4	LINK, CONNECTING PAIR	6030
5	LOCKNUT FOR 3/4 BOLT	
6	LAG SCREW, 1/2x4, FETTER DRIVE THREAD	
7	WASHER, ROUND FLAT, 1 3/8 OD, 9/16 HOLE	

REFERENCE DRAWINGS

115KV		
TYPE 3DE	-----	41 6004
TYPE HS	-----	41 6010
TYPE HSB	-----	41 6011
TYPE 3TA	-----	41 6018
TYPE 3AT	-----	41 6074
TYPE 3T	-----	41 6075
TYPE 3TX	-----	41 6093
TYPE 4BT	-----	41
TYPE 4S	-----	41 6105
138 & 161KV		
TYPE 3DE	-----	
TYPE HS	-----	41 6006
TYPE HSB	-----	41 6007
TYPE 3TA	-----	41 6018
TYPE 3AT	-----	41
TYPE 3T	-----	41 6017
TYPE 3TX	-----	
TYPE 4BT	-----	
TYPE 4S	-----	

E	8/24/26 A7-KR	HISTORICAL REFERENCE	
D	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.	
C	3-20-92 A2-BH	REDRAWN	
SUPERSEDES DWG NO. 40-D-5764			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS WOOD-POLE DEAD END DETAILS FOR OVERHEAD GROUND WIRE			
DESIGNED BUREC _____ APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER			
C A/F	AUGUST 6, 1979	41	6042



NOTES

1. ANCHOR ASSEMBLY IS SIMILAR TO HUGHES BROTHERS DESIGN.
2. * ANCHOR RODS AND BOLTS SHALL BE GALVANIZED. THE ANCHOR ASSEMBLY SHALL BE COATED WITH A SUITABLE ASPHALT PAINT TO RESIST CORROSION.

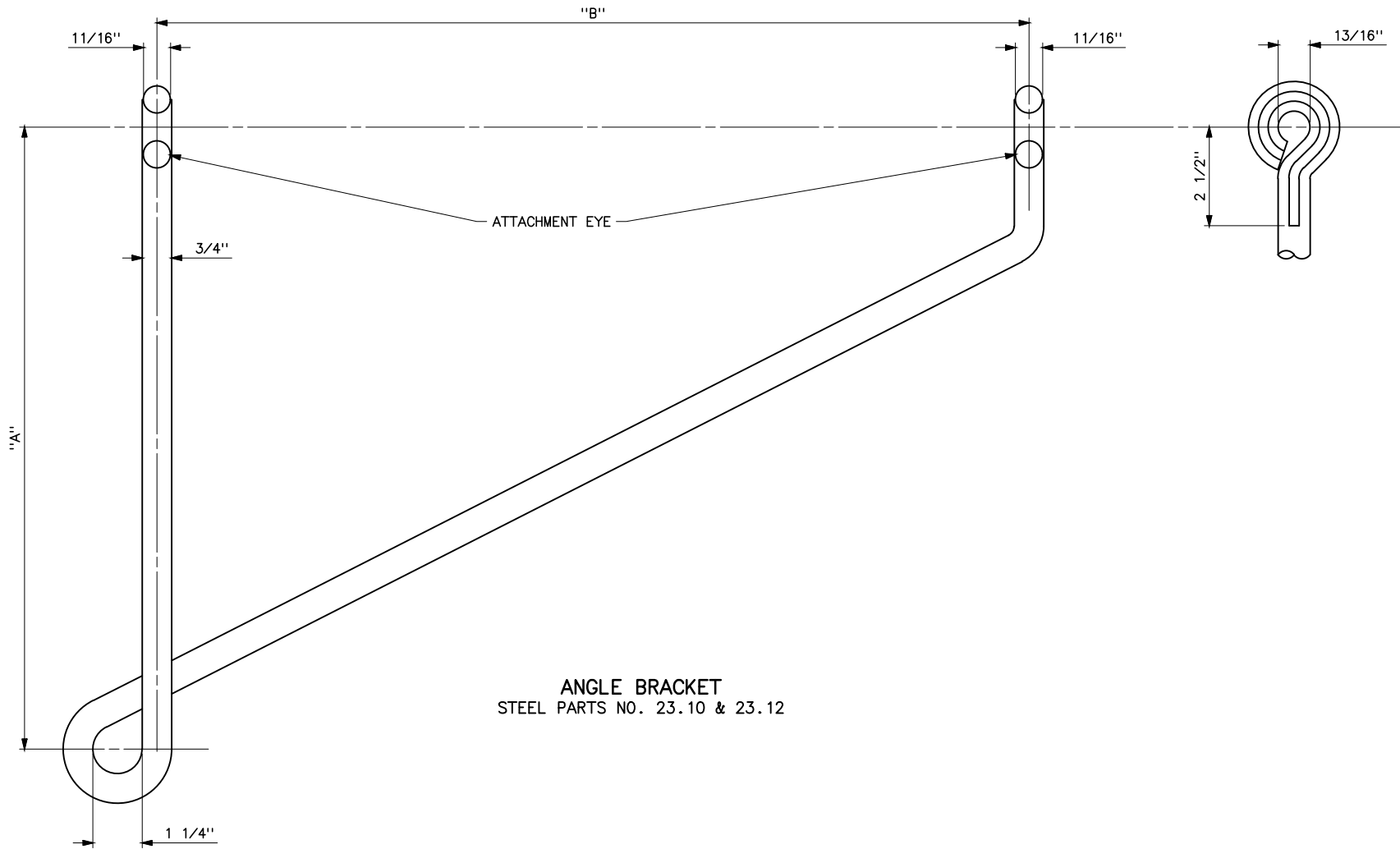
REFERENCE DRAWINGS

3AD STRUCTURE 69KV AND 115KV_____41 6003
3AD STRUCTURE 138KV AND 161KV_____41 6009

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

D	8/20/26 A7-KR	HISTORICAL REFERENCE
C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5699		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TRANSMISSION LINES DETAILS OF POLE ANCHOR		
DESIGNED BUREC _____ APPROVED BUREC _____		
AUGUST 6, 1979	41	6043

PART NO.	VOLTAGE	TYPE OF STRUCTURE	DIMENSIONS	
			A	B
23.10	69 & 115	HA & HAB	1'-0"	1'-2 1/2"
23.10	69	3AC	1'-0"	1'-2 1/2"
23.12	115	3AC	1'-6"	2'-1"
23.12	138 & 161	3AC & 3AD	1'-6"	2'-1"



ANGLE BRACKET
STEEL PARTS NO. 23.10 & 23.12

NOTES

- 1. FLATTEN EACH FACE OF BOTH ATTACHMENT EYES 11/16" AS SHOWN ON LEFT.
- 2. BRACKET SHALL BE GALVANIZED AFTER SHAPING IN ACCORDANCE WITH ASTM DESIGNATION A153.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4366		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES ANGLE BRACKET		
DESIGNED BUREC _____ APPROVED BUREC _____		
C A	AUGUST 6, 1979	41 6044

Plotted By: court Aug 25, 2026- 12:59pm S:\Projects\NISC\StandardDrawings\Drawings\DesignDrawings\Karens Drawings To Revise\Donita Working On\41_6044c.dwg Last Saved By: Court, Donita (CONTR) on 8/20/2026 8:16 AM

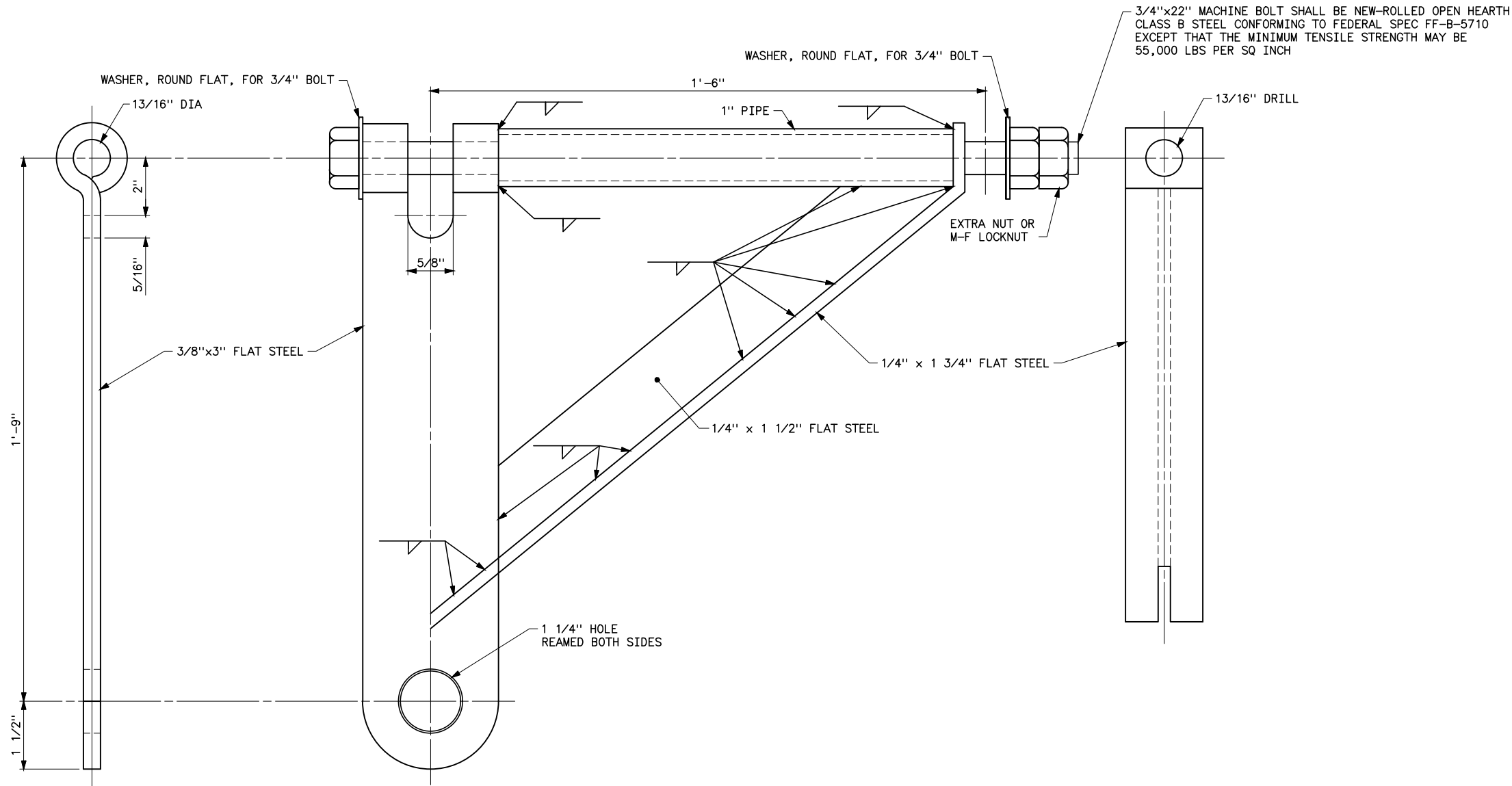
XREF(S):



1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING, IN ACCORDANCE WITH ASTM DESIGNATION A153.
2. BRACKET IS SIMILAR TO HUGHES BROTHERS DESIGN.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

C	8/24/26 A7-KR	HISTORICAL REFERENCE	
B	5-28-14 A7-DDD	REDRAWN	
SUPERSEDES DWG NO. 40-D-5719			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS TRANSMISSION LINES SWINGING ANGLE BRACKET			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
DATE	AUGUST 6, 1979	41	6045



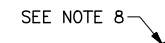
PART NUMBER 23.13

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

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B	5-28-14 A7-DDD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-6452			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS TRANSMISSION LINES SWINGING ANGLE BRACKET FOR TYPE 3AC & 3AD 230KV STRUCTURES			
DESIGNED BUREC _____ APPROVED BUREC _____			
NOVEMBER 15, 1979	41	6046	

Plotted By: court Aug 25, 2026- 12:58pm
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XREF(S):



SEE NOTE 8 

SEE NOTE 8

- SEE NOTE 8 

SEE NOTE 8

SEE NOTE 8 

SEE NOTE 8 

SEE NOTE 8 

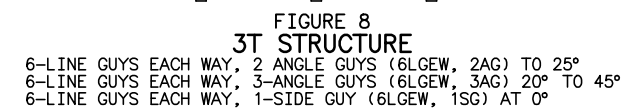
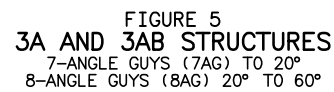
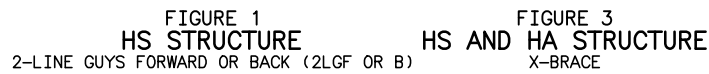
SEE NOTE 8 

SEE NOTE 8

SEE NOTE 8

SEE NOTE 8 

SEE NOTE 8 

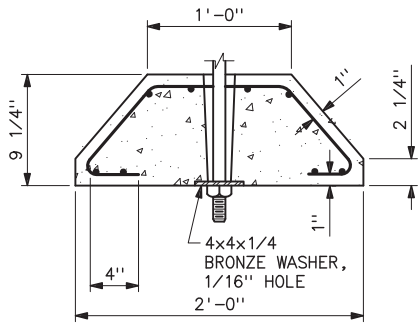


NOTES

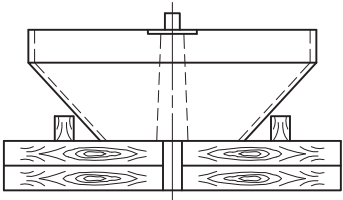
1. THE POLE BANDS AND ATTACHMENTS THAT HOLD THE INSULATOR ASSEMBLIES, OR FORM PART OF THE CROSS-TIE BETWEEN THE OUTER POLES ARE CONSIDERED STRUCTURE MATERIAL AND ARE LISTED ON THE INDIVIDUAL STRUCTURE DRAWINGS. THE BANDS AND ATTACHMENTS LISTED ABOVE ARE FOR GUYING ONLY AND ARE REQUIRED IN ADDITION TO THOSE ACCOUNTED FOR ON THE STRUCTURE DRAWINGS.
2. * WOOD GUY INSULATOR WITH WOOD MEMBER 129" LONG, 9"-0" CLEAR WOOD AND 49" AIR GAP 24" FROM WOOD, INCLUDES GUY THIMBLE AND 6" TWISTED LINK IF REQUIRED.
3. ** GUY PROTECTOR TO BE USED ONLY WHEN SPECIFIED IN STRUCTURE LIST.
4. *** TWO-PIECE X-BRACE INCLUDES 2-7/8"x16" MACHINE BOLTS, 2-7/8"x14" MACHINE BOLTS, 4-7/8" LOCKNUTS, AND 4-3 1/2"x3 1/2"x3/8" SQUARE CURVED WASHERS.
5. **** GUYS SHALL SEPARATE AT GUY CLAMP BELOW WOOD STRAIN INSULATOR, PASS ON OPPOSITE SIDES OF POLE, AND TERMINATE AT INDIVIDUAL ANCHORS.
6. EACH UNIVERSAL POLE BAND SHALL BE SUPPORTED AT DIAMETRICALLY OPPOSITE POINTS WITH A 1/2"x4 1/2" LAG SCREW. THE POLE SHALL BE BORED FOR THE LAG SCREWS WITH A 3/8" BIT, AND THE LAG SCREWS SCREWED INTO PLACE.

C	8/25/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2969		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINES GUY ARRANGEMENT AND DETAILS WITHOUT OVERHEAD GROUND WIRE 161KV		
DESIGNED BUREC _____ APPROVED BUREC _____		
DATE	OCTOBER 26, 1984	61 6048

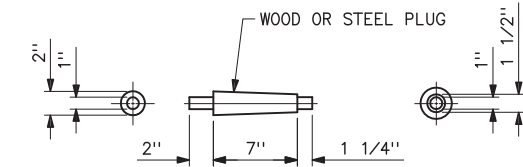
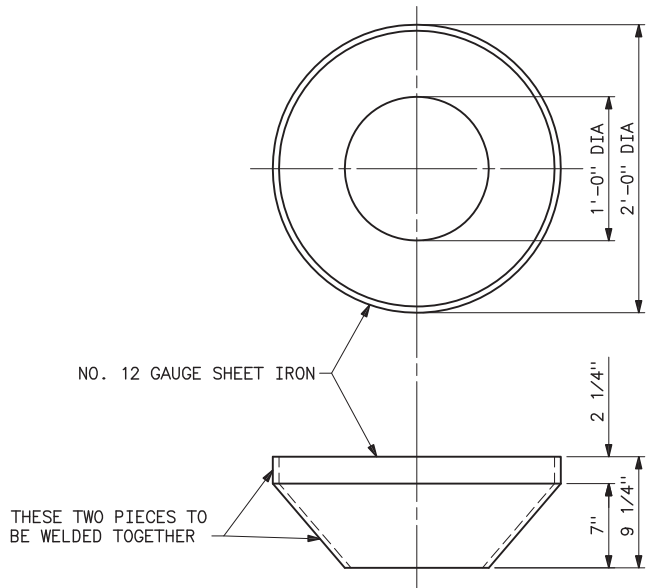
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**



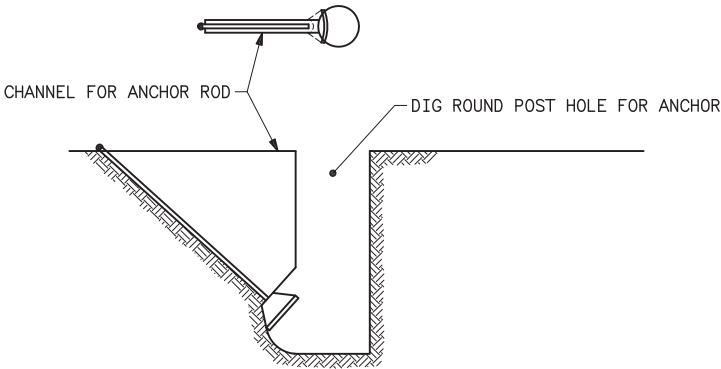
CONCRETE ANCHOR
REINFORCE WITH 12 PIECES OF WIRE TIED TOGETHER
WITH WIRE HOOPS AS SHOWN 0.1483 DIA COLD DRAWN
STEEL WIRE ASTM SPEC A82



SET UP FOR POURING CONCRETE ANCHOR
CONCRETE SHALL BE 1-2-4 MIX USING "PEA" GRAVEL

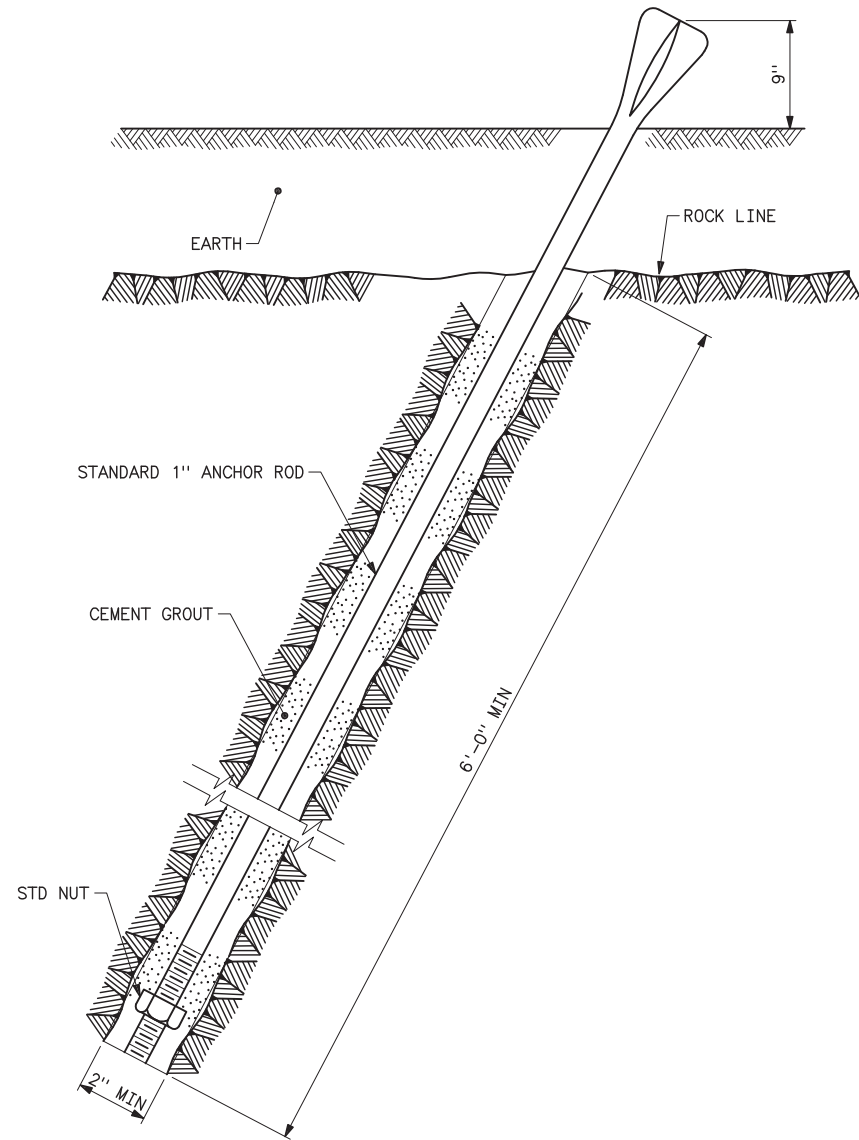


DETAILS OF FORM FOR CONCRETE ANCHOR



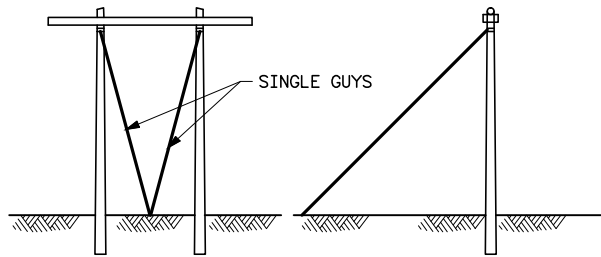
**DETAILS OF INSTALLATION
OF CONCRETE ANCHOR**
EARTH TO BE WELL TAMPED WHEN BACKFILLED

D	7-15-03 A7-RC	REVISED TITLE BLOCK ONLY.	
C	7-13-99 A3-RMC	REDRAWN.	
SUPERSEDES DWG NO. 40-D-3585			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS			
CONCRETE ANCHORS			
DESIGNED <u>BUREC</u> _____ APPROVED <u>ROSS M. CLARK</u> _____ ELECTRICAL ENGINEERING MANAGER			
CAE	AUGUST 6, 1979	41	6049

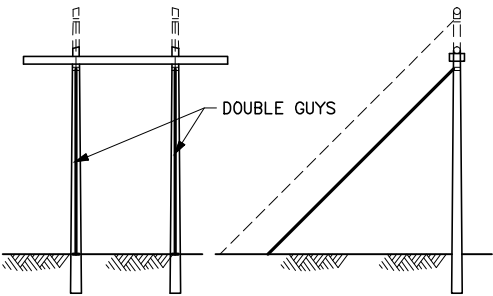


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C	7-13-99 A3-RMC	REDRAWN.	
SUPERSEDES DWG NO. 40-D-3610			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS			
ANCHOR ROD GROUTING DETAILS			
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER			
CAE	AUGUST 6, 1978	41	6050

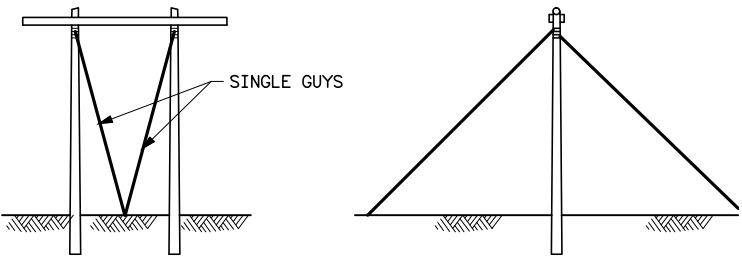


TWO LINE SINGLE GUYS, EITHER "FORWARD" OR "BACK"
1-LSG, F OR B
FIGURE NO. 1

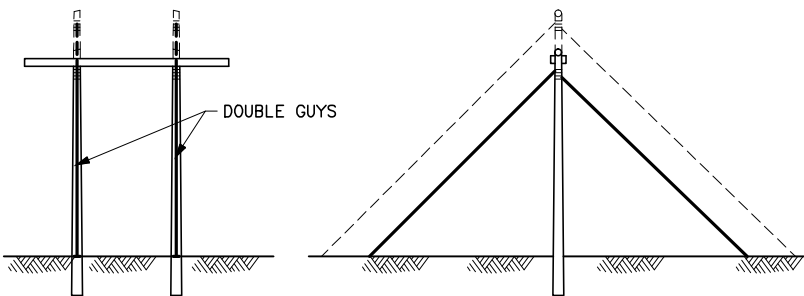


	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
FIG 2A	2-LDG, F OR B		2
FIG 2B		2-LDG, F OR B	2

FIGURE NO. 2

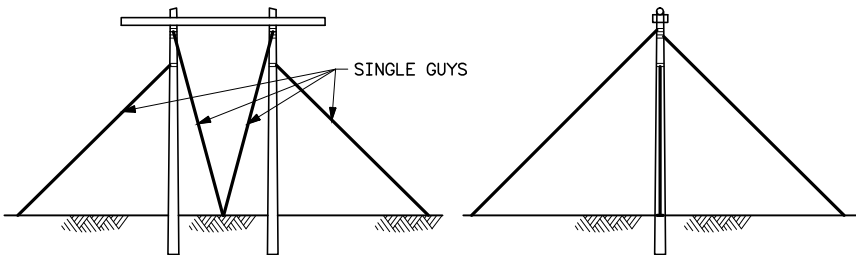


TWO LINE SINGLE GUYS EACH WAY
2-LSGEW
FIGURE NO. 3

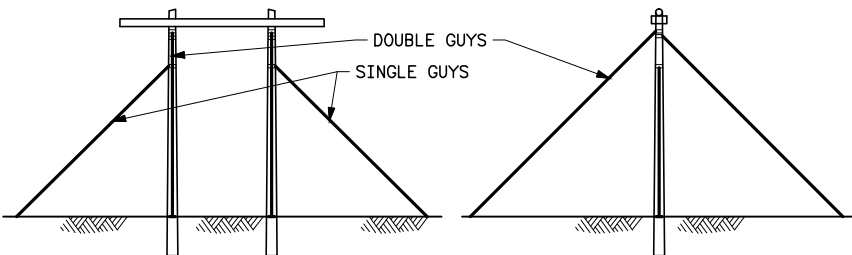


	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
FIG 4A	2-LDGEW		4
FIG 4B		2-LDGEW	4

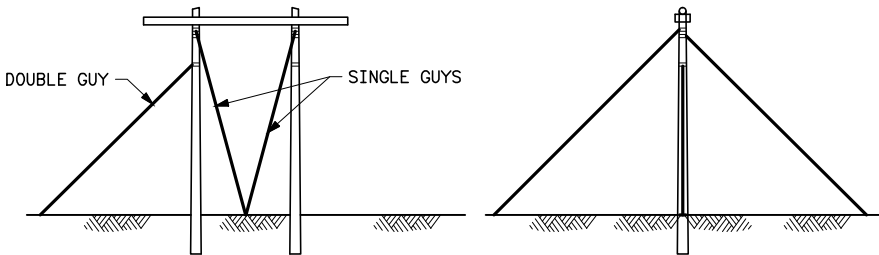
FIGURE NO. 4



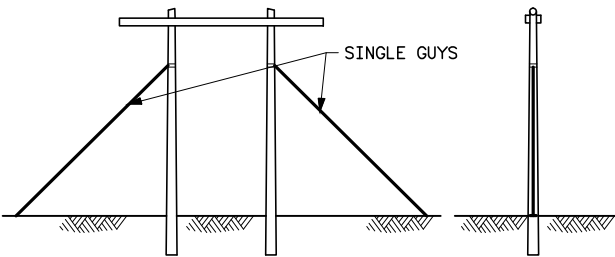
ONE SIDE SINGLE GUY EACH WAY AND TWO LINE SINGLE GUYS EACH WAY
1-SSGEW AND 2-LSGEW
FIGURE NO. 5



ONE SIDE SINGLE GUY EACH WAY AND TWO LINE DOUBLE GUYS EACH WAY
1-SSGEW AND 2-LDGEW
FIGURE NO. 6



ONE SIDE DOUBLE GUY "RIGHT OR "LEFT" AND TWO LINE SINGLE GUYS EACH WAY
1-SDG, R OR L AND 2-LSGEW
FIGURE NO. 7



ONE SIDE SINGLE GUY EACH WAY
1-SSGEW
FIGURE NO. 8

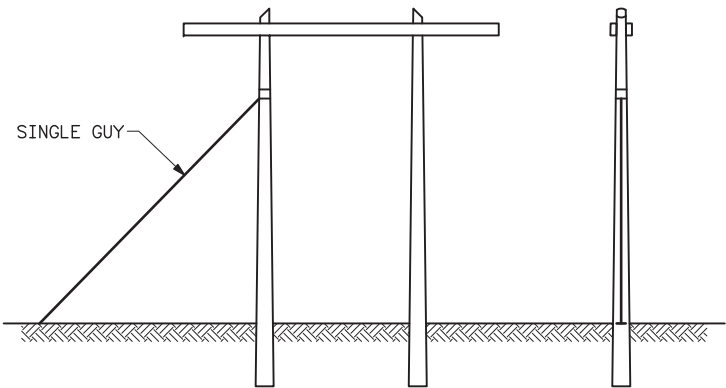
NOTES

1. "LDG, F OR B" - LINE DOUBLE GUY, FORWARD OR BACK.
2. "LDGEW" - LINE DOUBLE GUY EACH WAY.
3. "OGW" - OVERHEAD GROUND WIRE.

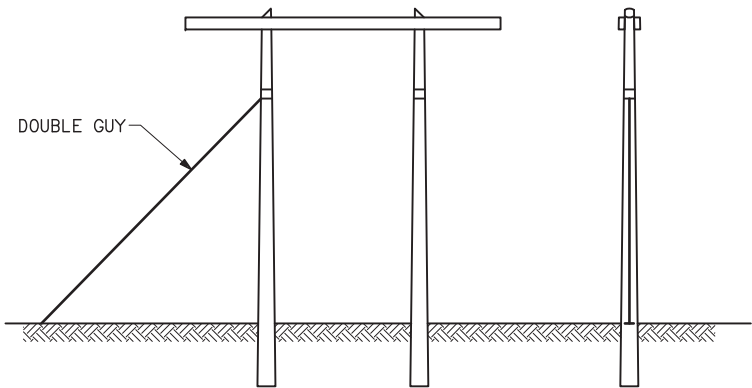
REFERENCE DRAWING

GUY ASSEMBLIES AND DETAILS----- 41 6047

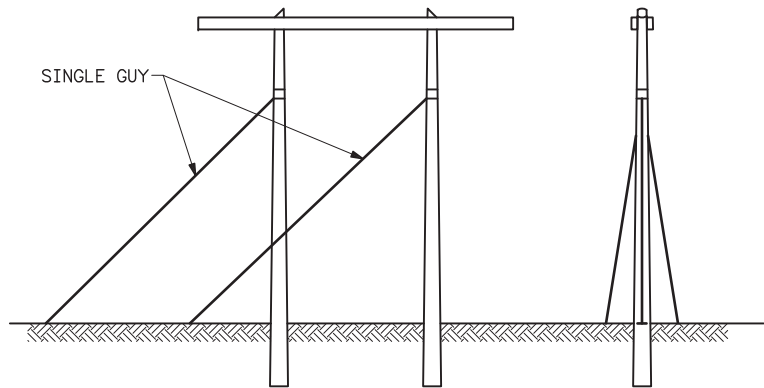
C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2757		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STANDARD GUY ARRANGEMENT 2-POLE TANGENT STRUCTURES		
DESIGNED BUREC----- APPROVED BUREC-----		
C _A F	AUGUST 6, 1979	41 6051



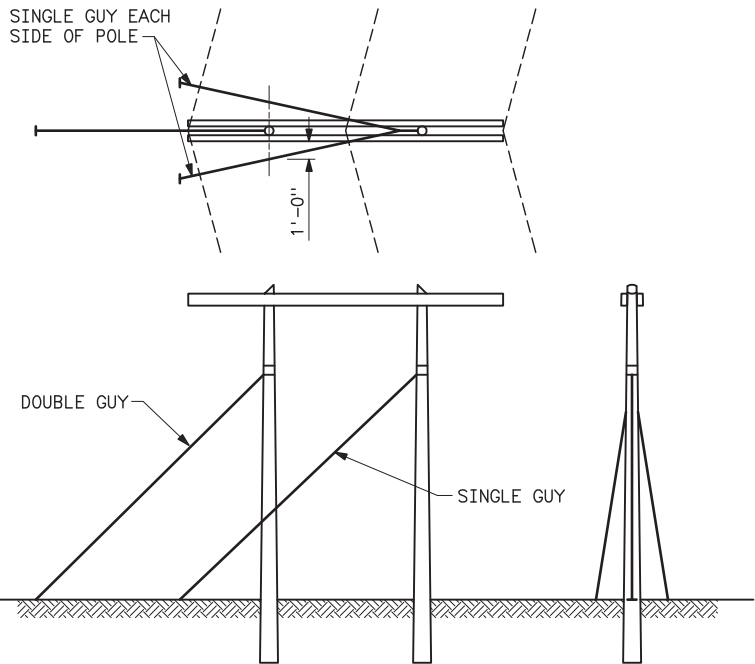
ONE ANGLE SINGLE GUY OR ONE SIDE SINGLE GUY RIGHT OR LEFT
1-ASG OR 1-SSG, R OR L
FIGURE NO. 1



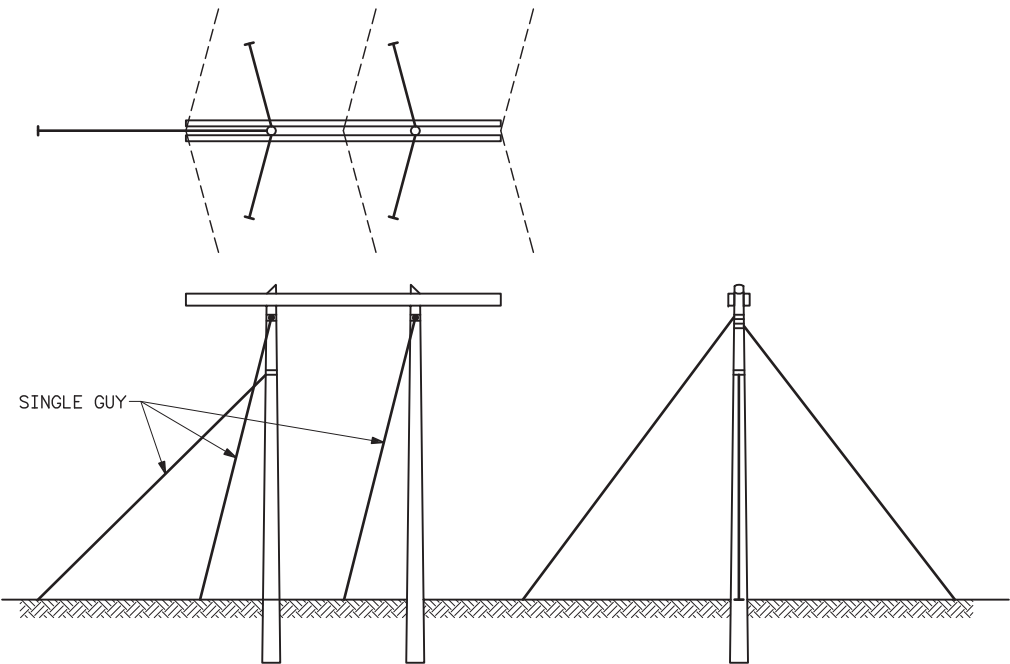
ONE ANGLE DOUBLE GUY
1-ADG
FIGURE NO. 2



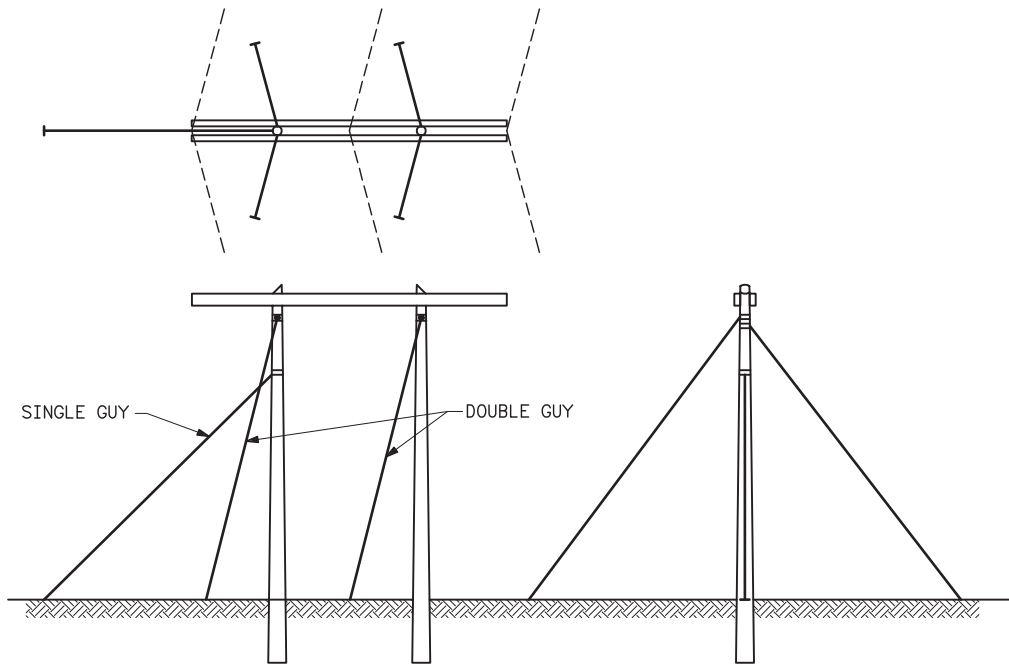
THREE ANGLE SINGLE GUYS
3-ASG
FIGURE NO. 3



TWO ANGLE SINGLE GUYS AND ONE ANGLE DOUBLE GUY
2-ASG AND 1-ADG
FIGURE NO. 4



ONE ANGLE SINGLE GUY AND TWO LINE SINGLE GUYS EACH WAY
1-ASG AND 2-LSGEW
FIGURE NO. 5



ONE ANGLE SINGLE GUY AND TWO LINE DOUBLE GUYS EACH WAY
1-ASG AND 2-LDGEW
FIGURE NO. 6

REFERENCE DRAWING
GUY ASSEMBLIES AND DETAILS.....41 6047

C	04-05-01 A7-KKR	REDRAWN ON CAE.	
	SUPERSEDES DWG. NO. E40-D-2758		
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
	STANDARD DESIGNS TRANSMISSION LINES STANDARD GUY ARRANGEMENT 2-POLE ANGLE STRUCTURES		
	DESIGNED <u>KAREN ROWE</u> _____ APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER		
C A F	APRIL 05, 2001	41	6052

Plotted By: Seela Jun 27, 2025- 9:04am
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IMAGES:

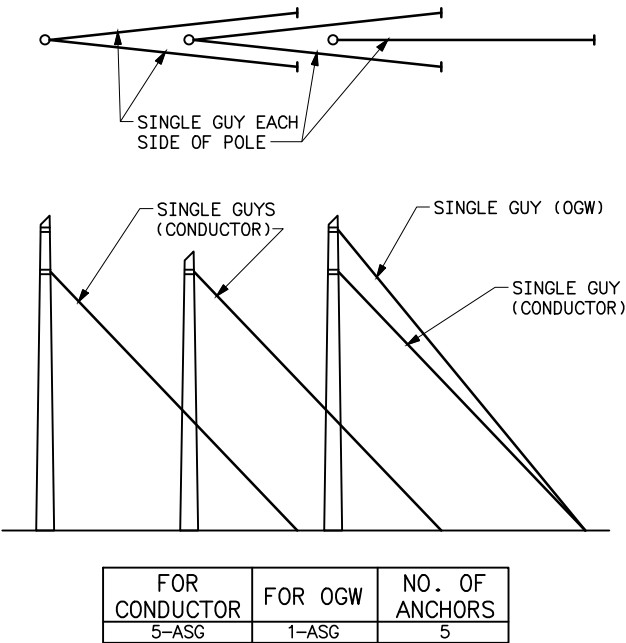
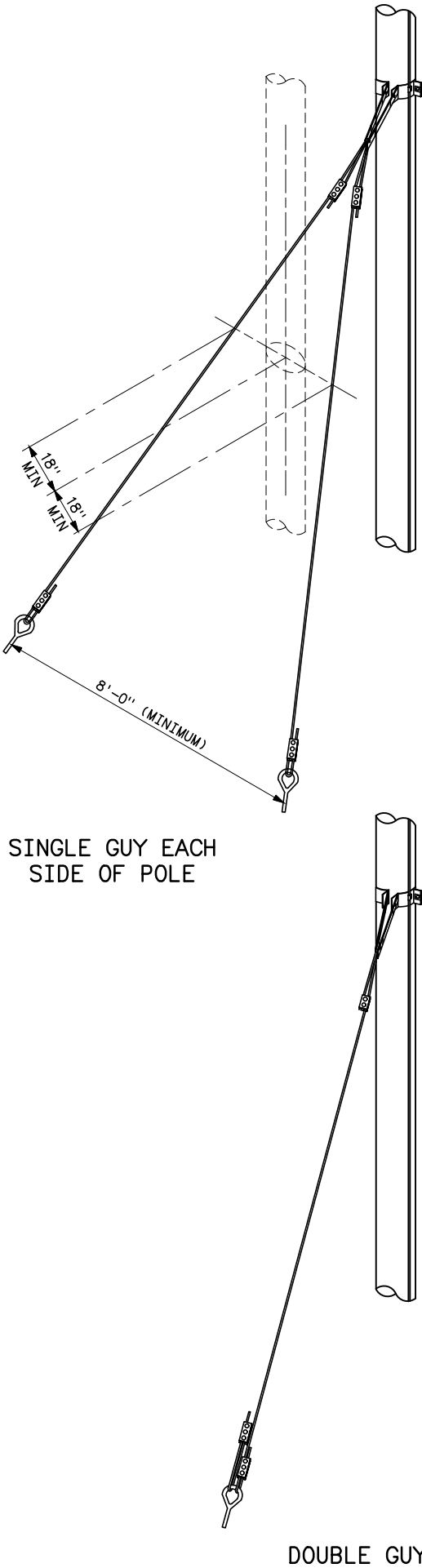


FIGURE NO. 1

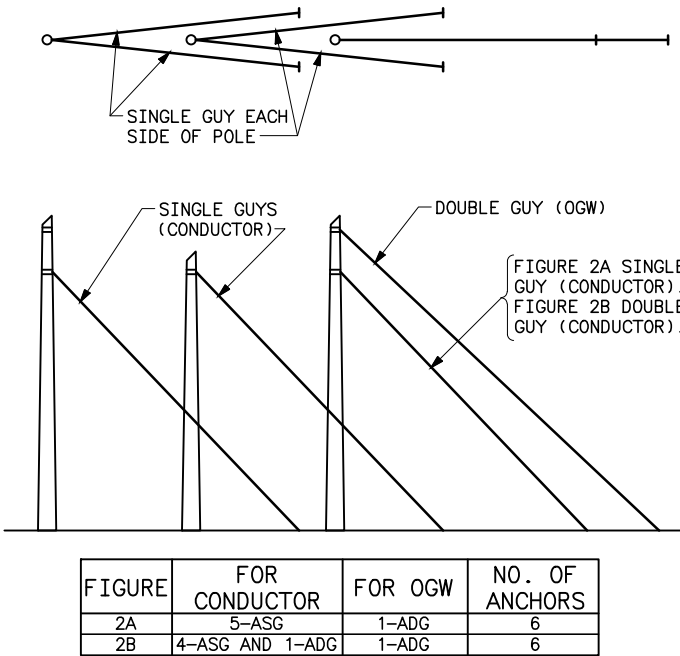


FIGURE NO. 2

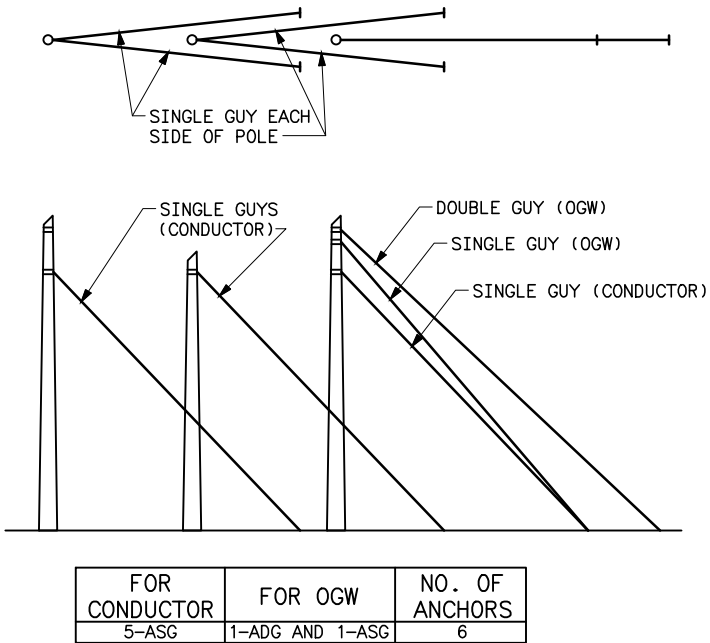


FIGURE NO. 3

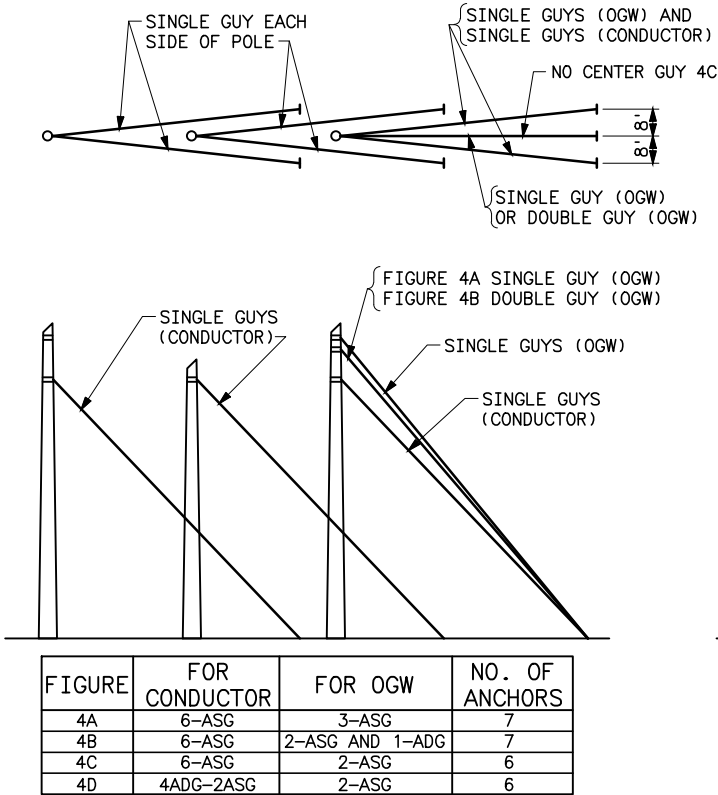


FIGURE NO. 4

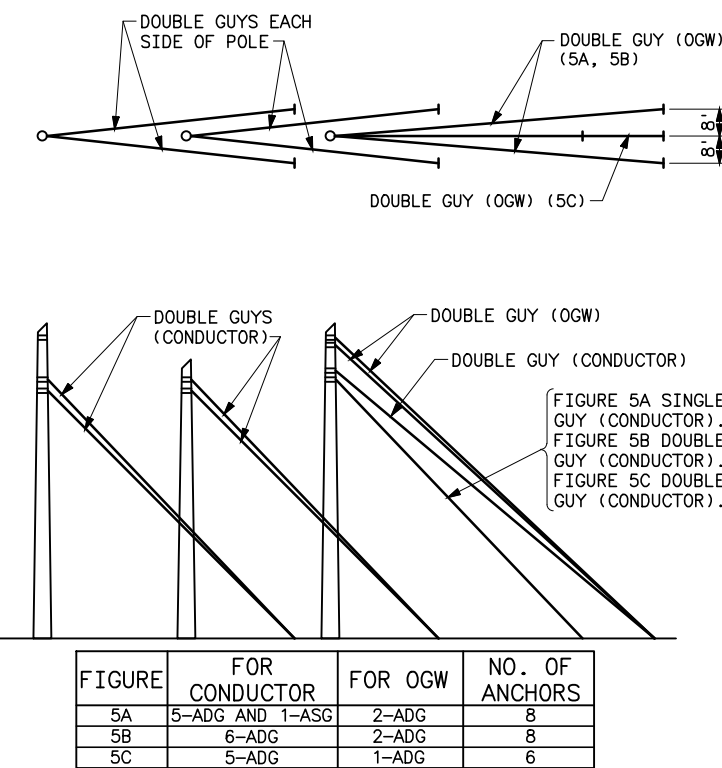


FIGURE NO. 5

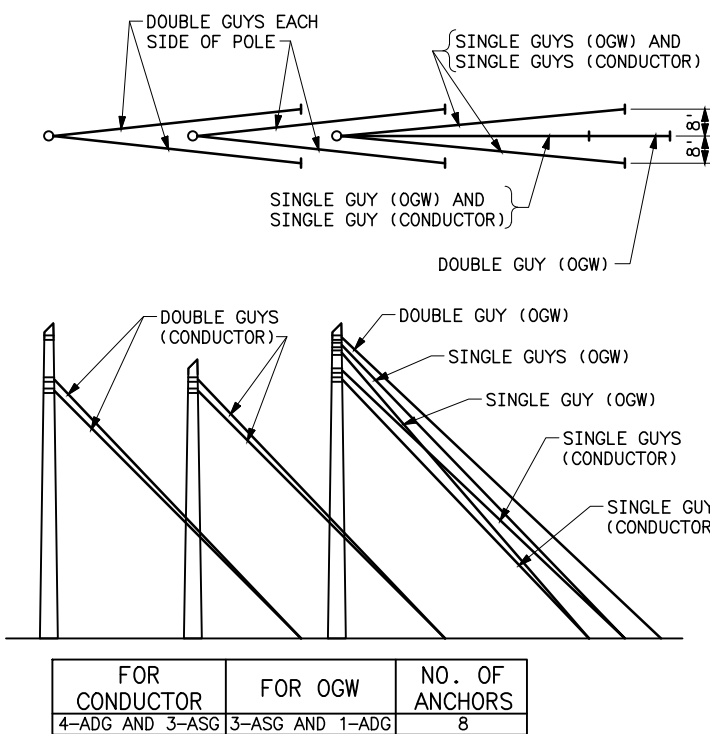


FIGURE NO. 6

ABBREVIATIONS

ASG -----ANGLE SINGLE GUY
ADG -----ANGLE DOUBLE GUY
OGW -----OVERHEAD GROUND WIRE

REFERENCE DRAWINGS

3A STRUCTURE 69 AND 115KV	41	6000
3AB STRUCTURE 69 AND 115KV	41	6001
3A STRUCTURE 138,161, AND 230KV	41	6013
3AB STRUCTURE 138,161, AND 230KV	41	6014
GUY ASSEMBLIES AND DETAILS	41	6047
3A-1 STRUCTURE 138,161, AND 230KV	41	6103
3AB-1 STRUCTURE 138,161, AND 230KV	41	6104
3A-1 STRUCTURE 69 AND 115KV	41	6107
3AB-1 STRUCTURE 69 AND 115KV	41	6108
3A-2 STRUCTURE 138, 161, AND 230KV	41	6171
3AB-2 STRUCTURE 138, 161, AND 230KV	41	6180

H	6-27-25 A7-KKR	ADDED 4D GUYING.
G	6-22-22 A7-KKR	ADDED 3A-2 AND 3AB-2 AND REFERENCE DRAWINGS.

F	3-24-21 A7-KKR	ADDED 4C AND 5C GUYING.
E	04-05-01 A7-KKR	REDRAWN. ADDED REFERENCE DRAWING NUMBERS FOR 69 AND 115KV 3A-1 AND 3AB-1 STRUCTURES.
SUPERSEDES DWG. NO. E40-D-4241		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES STANDARD GUY ARRANGEMENT FOR TYPE 3A AND 3AB STRUCTURES WITH OVERHEAD GROUND WIRES		
DESIGNED <u>KAREN ROWE</u> APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER		
A	APRIL 05, 2001	41 6053

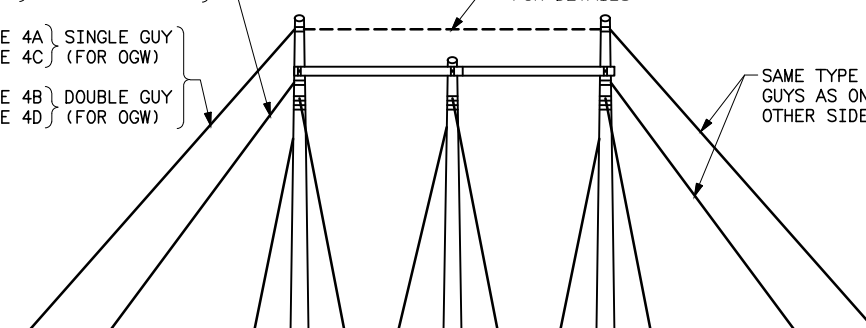
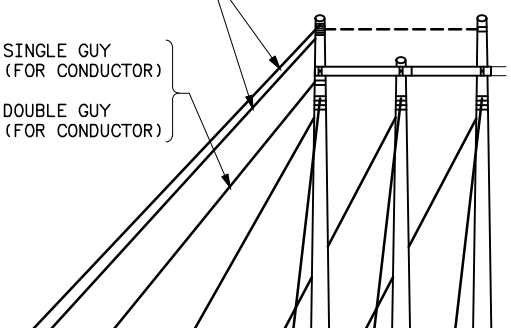
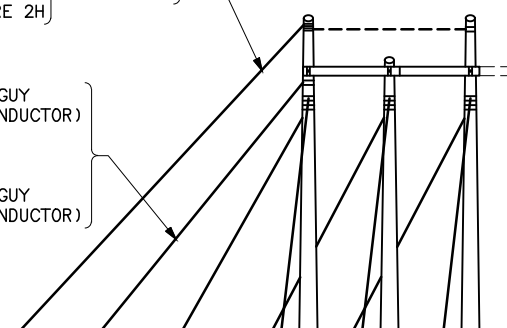
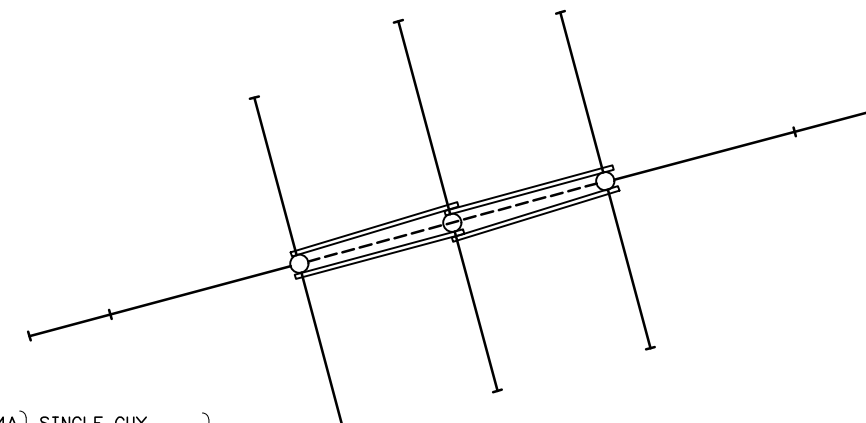
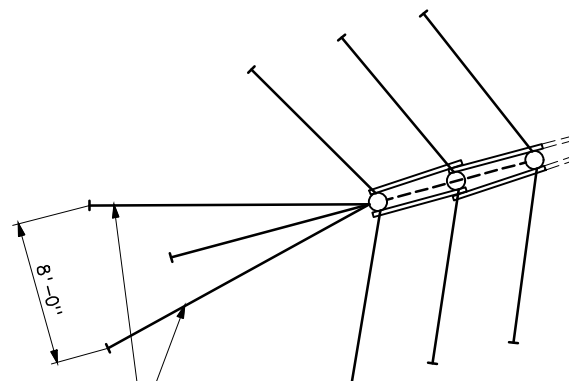
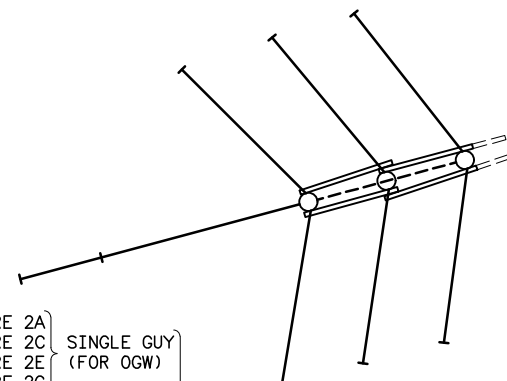
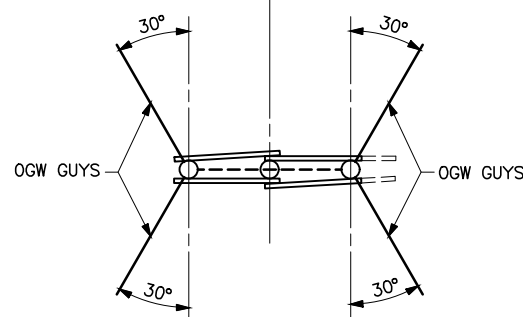
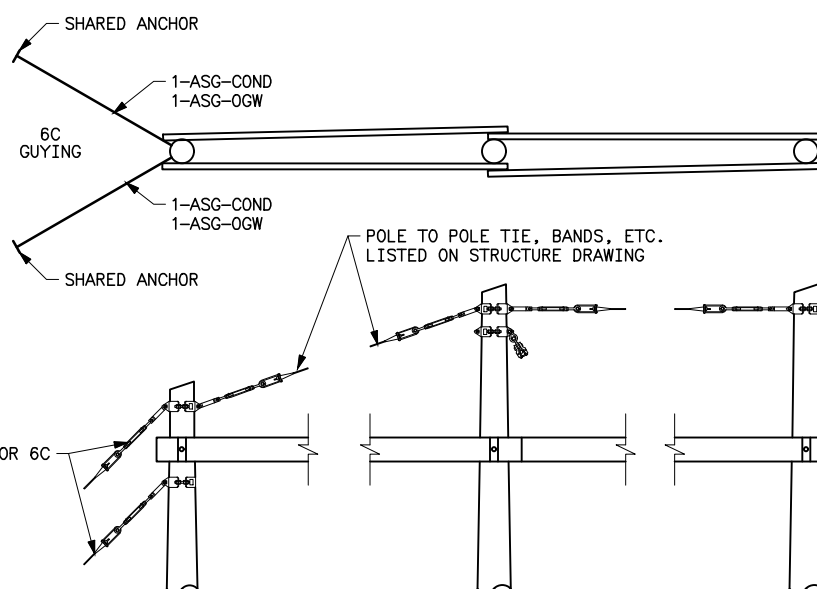


FIGURE	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
4A	3-LSGEW AND 1-SSGEW	1-SSGEW	10
4B	3-LSGEW AND 1-SDGEW	1-SDGEW	10
4C	3-LDGEW AND 1-SSGEW	1-SSGEW	10
4D	3-LDGEW AND 1-SDGEW	1-SDGEW	10

FOR 3T AND 3TX
FIGURE NO. 4



3AC, 3AC1 AND 3AD STRUCTURE
FIGURE NO. 6

```

LSGEW_____LINE SINGLE GUY EACH WAY
LDGEW_____LINE DOUBLE GUY EACH WAY
ASG_____ANGLE SINGLE GUY
ADG_____ANGLE DOUBLE GUY
SSGEW_____SIDE SINGLE GUY EACH WAY
SDGEW_____SIDE DOUBLE GUY EACH WAY
OGW_____OVERHEAD GROUND WIRES

```

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3T STRUCTURE 69 AND 115KV_-----41 6075
3TX STRUCTURE 69 AND 115KV_-----41 6093
3AC STRUCTURE 69 AND 115KV_-----41 6002
3AD STRUCTURE 69 AND 115KV_-----41 6009
GUY ASSEMBLIES AND DETAILS_-----41 6047
3AC-1 115KV SUSPENSION STRUCTURE_-----41 6127

```

D	3-24-21 A7-KKR	ADDED 6C GUYING.
C	04-05-01 A7-KKR	REDRAWN. ADDED REFERENCE DRAWING NUMBER FOR 3AC-1 115KV SUSPENSION STRUCTURE.
SUPERSEDES DWG. NO. E40-D-4243		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES STANDARD GUY ARRANGEMENT FOR TYPE 3T, 3TX, 3AC AND 3AD STRUCTURES WITH OVERHEAD GROUND WIRES		
DESIGNED <u>KAREN ROWE</u> _____ APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER		
*A-	APRIL 05, 2001	41 6054

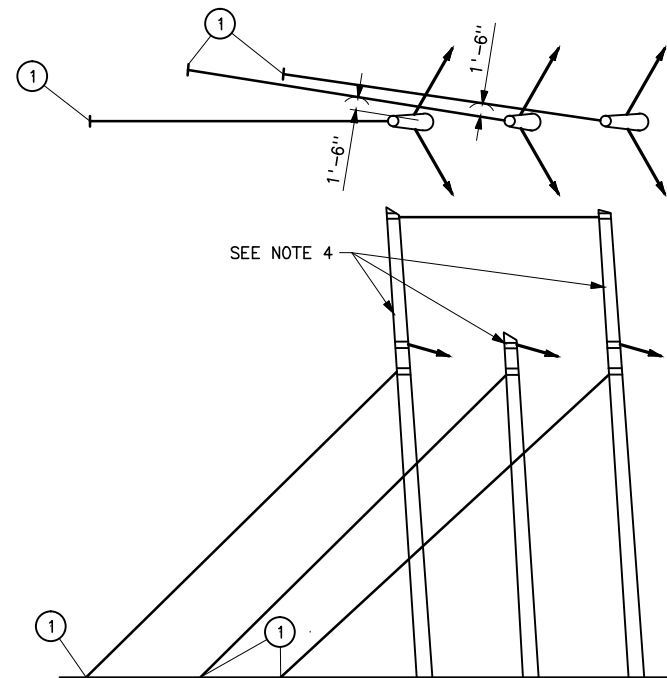
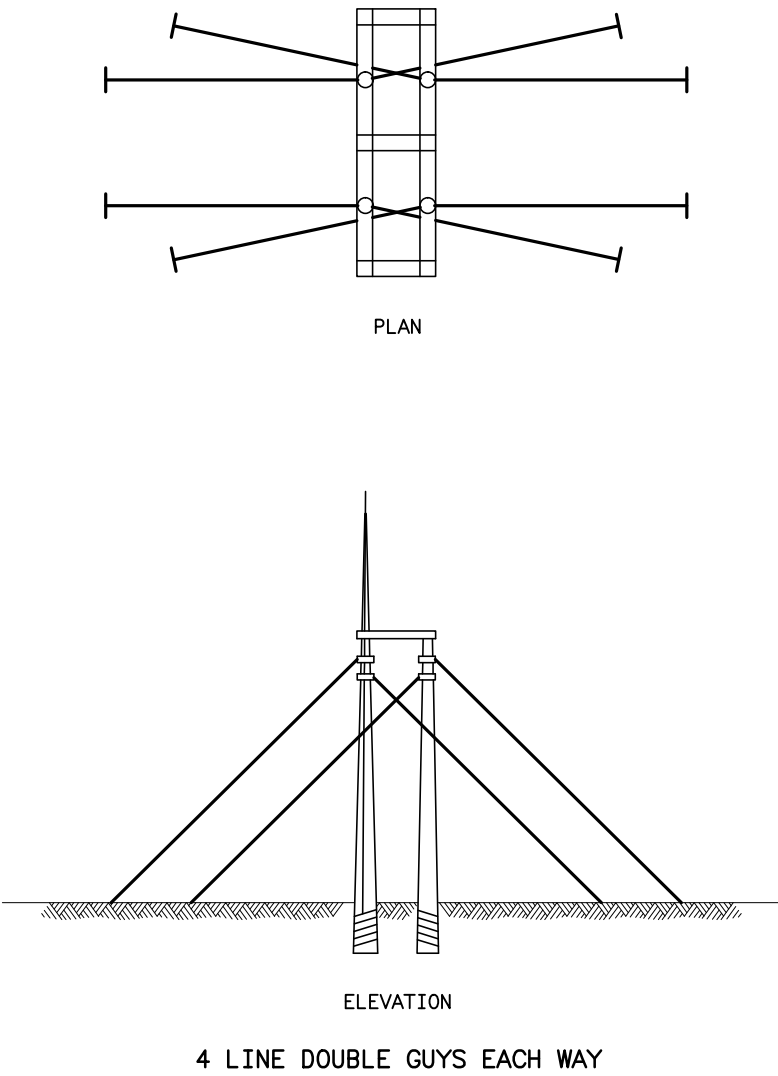


FIGURE 2
COMBINATIONS

OGW GUYS
1ADG
2ADG

Figure 1 consists of four diagrams illustrating the geometry of a roof truss system. The top diagram shows a cross-section with a central vertical axis and two side axes, with angles of 30° indicated. The middle diagram shows a side elevation with a central vertical axis and two side axes, with angles of 30° indicated. The bottom diagram shows a plan view of the roof structure, with a central vertical axis and two side axes, and angles of 30° indicated. Labels A, B, and C are used to identify specific points or components.

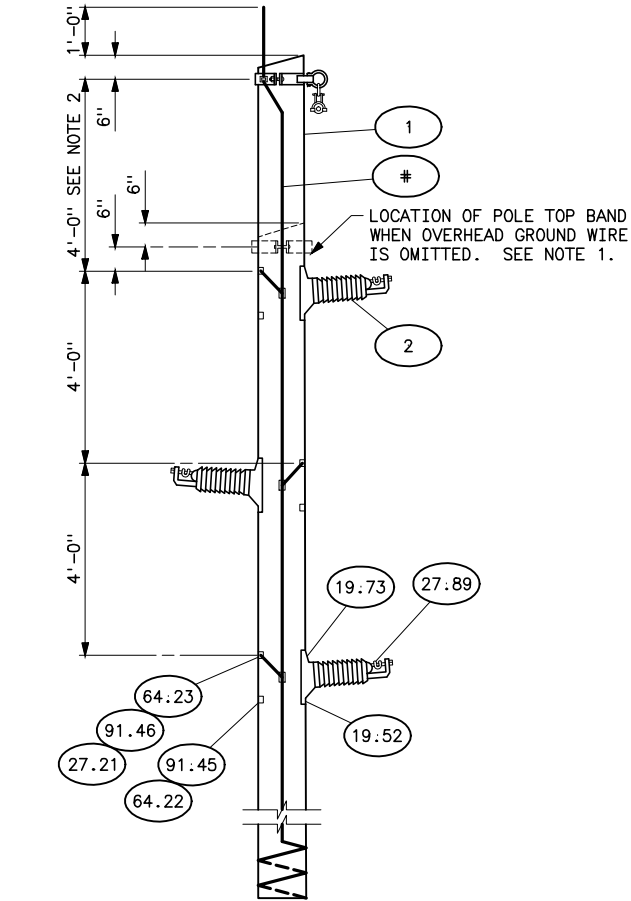


B	5-28-14 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-5002		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES STANDARD GUY ARRANGEMENT FOR TYPE 4SWT 115KV DISCONNECTING SWITCH STRUCTURE			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
C A F	APRIL 6, 1981	41	6056

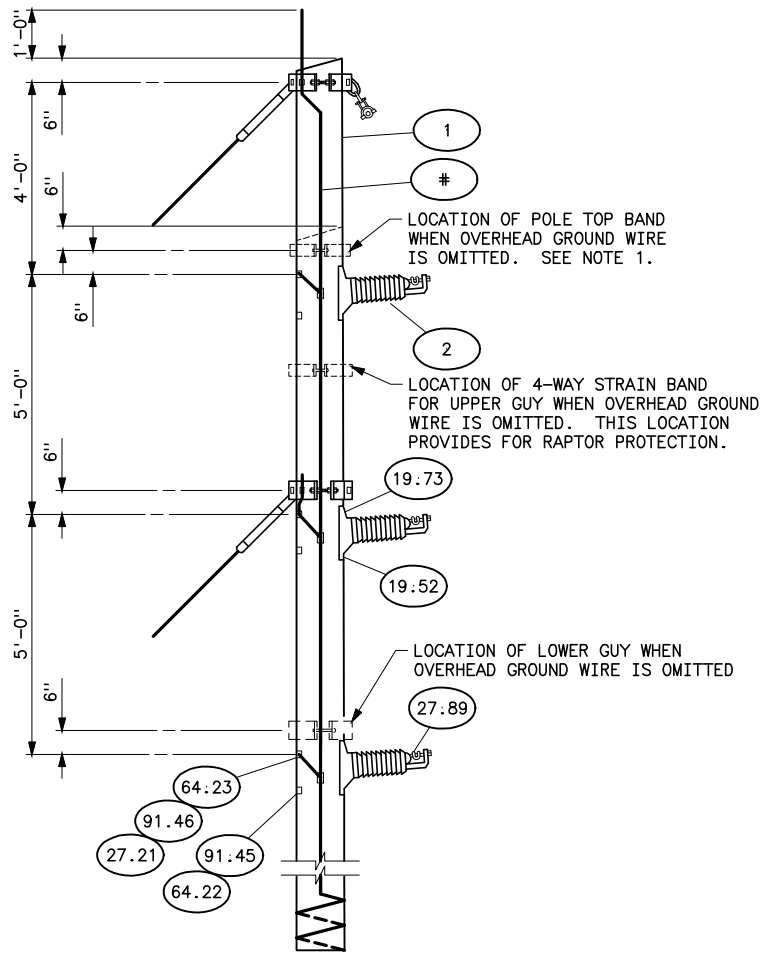
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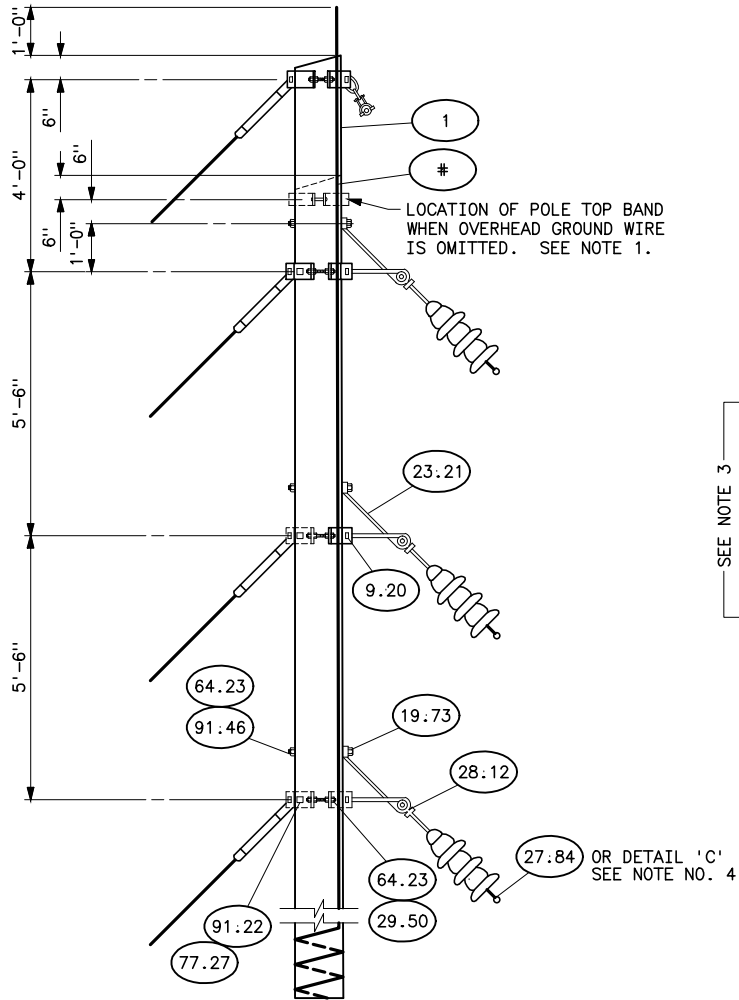
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TANGENT TYPE SS 0° TO 1° LINE ANGLES



SMALL ANGLE TYPE SSA 1° TO 15° LINE ANGLES



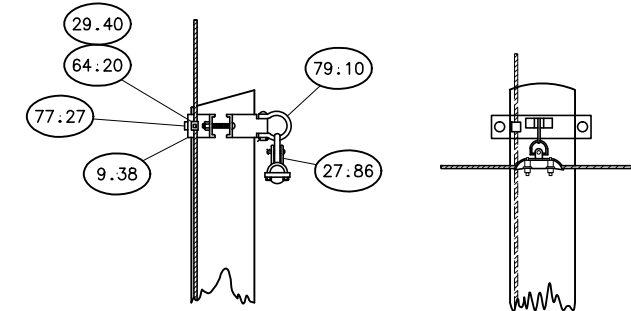
Δ LARGE ANGLE TYPE SAB
15° TO 60° LINE ANGLES

STRUCTURE MATERIALS							DWG 41
PART NO.	QUANTITY STRUCTURE TYPE			DESCRIPTION			
	SS	SSA	SAB				
1	1	1	1	POLE			
9.20	—	—	3	BAND, FOUR WAY STRAIN, TYPE A		6030	
29.50	—	—	3	CLIP, GROUND WITH 3/4"x2 1/2" CONEHEAD BOLT		6030	
64.23	—	—	3	LOCKNUT FOR 3/4" BOLT			
77.27	—	—	6	LAG SCREW, 1/2"x4" FETTER DRIVE THREAD			
91.22	—	—	6	WASHER, ROUND, FLAT, 1 3/8" OD 9/16" HOLE			
23.21	—	—	3	BRACKET, EXTENSION		6060	
19.73	—	—	3	BOLT, MACHINE 3/4"x14"			
91.46	—	—	3	WASHER, SQUARE, CURVED, 3"x3", 13/16" HOLE			
* GROUNDING MATERIAL, PART NO'S AND DESCRIPTIONS SHOWN ON DWG 41 1012 SEE NOTE 6							

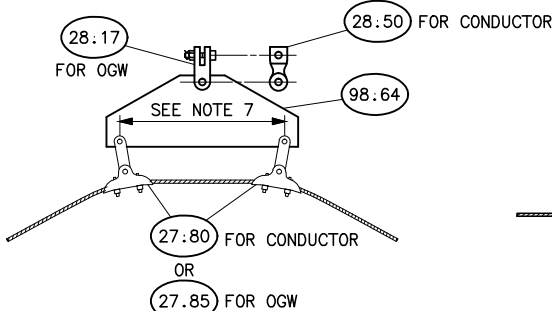
INSULATOR MATERIALS					
2	3	3	–	INSULATOR, LINE POST, (BIL TO BE SPECIFIED)	
27.89	3	3	–	CLAMP FOR LINE POST INSULATOR	
19.73	3	3	–	BOLT, MACHINE, 3/4"x14"	
19.52	3	3	–	BOLT, MACHINE , 5/8"x14"	
64.23	3	3	3	LOCKNUT FOR 3/4" BOLT	
64.22	3	3	–	LOCKNUT FOR 5/8" BOLT	
91.45	3	3	–	WASHER, SQUARE, CURVED, 3"x3", 11/16" HOLE	
91.46	3	3	–	WASHER, SQUARE, CURVED, 3"x3", 13/16" HOLE	
27.21	3	3	–	GROUNDING CLAMP FOR 3/4" BOLT TO NO. 2 AWG CWD	1012
51.64	–	–	✱	INSULATOR, SUSPENSION TYPE, 9" DIAMETER 5 3/4" SPACING	
28.12	–	–	3	Y-CLEVIS-BALL, HOT-LINE	
98.64	–	–	3	YOKE (SEE NOTE 4)	
27.80	–	–	6	CLAMP, SUSPENSION, WITH CLEVIS-EYE CONNECTOR (SEE NOTE 4)	
27.84	–	–	3	CLAMP, SUSPENSION, WITH SOCKET-EYE CONNECTOR (SEE NOTE 4)	
28.50	–	–	3	CLEVIS, SOCKET CONNECTOR (SEE NOTE 4)	

OVERHEAD GROUND WIRE MATERIALS						
9.38	1	—	—	BAND, POLE TOP		6034
29.40	1	—	—	CLIP, GROUND, WITH 3/8"x1 1/2" CARRIAGE BOLT		
64.20	1	—	—	LOCKNUT FOR 3/8" BOLT		
79.10	1	—	—	SHACKLE, ANCHOR TYPE		
9.20	—	1	1	BAND, FOUR WAY STRAIN, TYPE A		
29.50	—	1	1	CLIP, GROUND WITH 3/4"x2 1/2" CONEHEAD BOLT		
64.23	—	1	1	LOCKNUT FOR 3/4" BOLT		
77.27	—	2	2	LAG SCREW 1/2"x4" LETTER DRIVE THREAD		
91.22	—	2	2	WASHER, ROUND, FLAT, 1 3/8" OD 9/16" HOLE		
79.50	—	1	1	SHACKLE, TWISTED		
27.86	1	1	1	CLAMP, SUSPENSION WITH 2 1/4" LINK (SEE NOTE 4)		
27.85	—	—	2	CLAMP, SUSPENSION WITH CLEVIS-EYE CONNECTOR (SEE NOTE 4)		
28.17	—	—	2	CLEVIS-CLEVIS 90° CONNECTOR (SEE NOTE 4)		

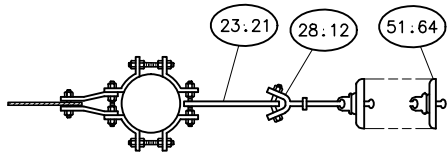
* QUANTITY AND CLASS TO BE SPECIFIED



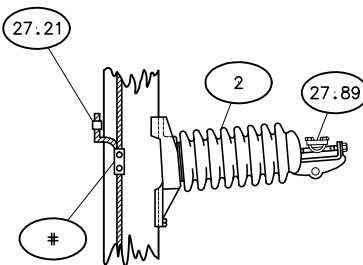
DETAIL A
OGW ATTACHMENT, TANGENT
TYPE SS



DETAIL C
YOKE ASSEMBLY FOR
CONDUCTOR & OGW TYPE SAB
(SEE NOTE 4)



DETAIL E
INSULATOR ATTACHMENT
TYPE SAB



DETAIL F
LINE POST INSULATOR

NOTES

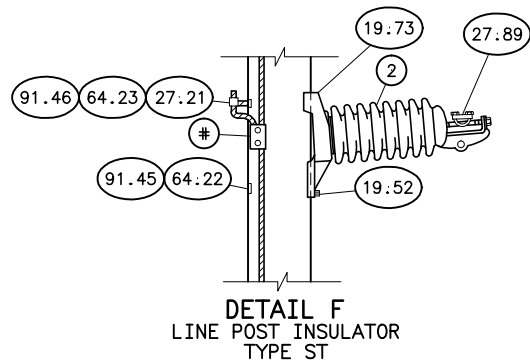
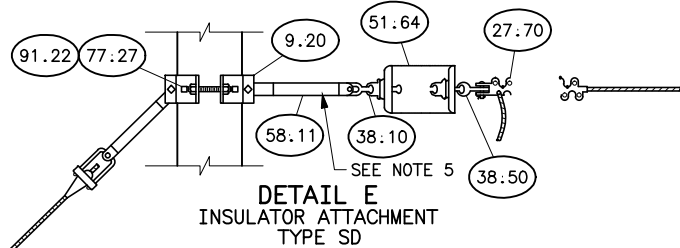
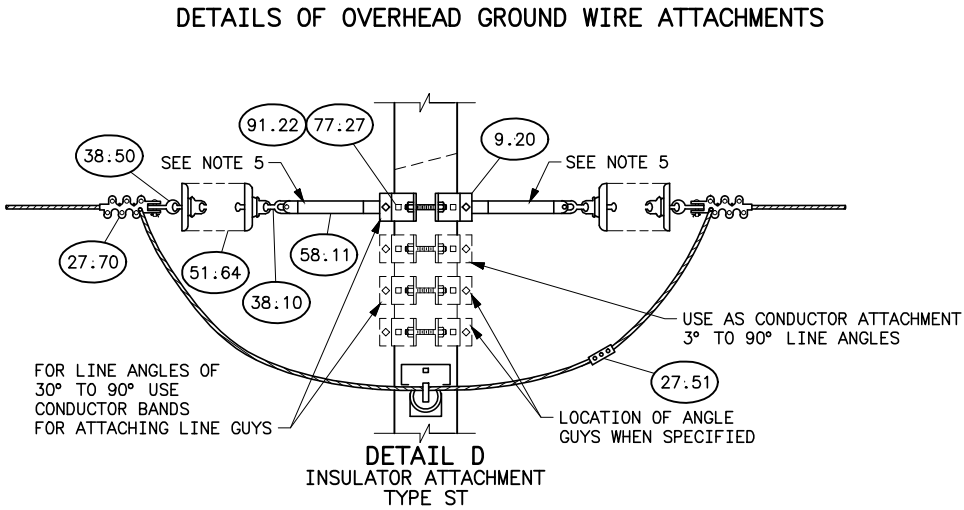
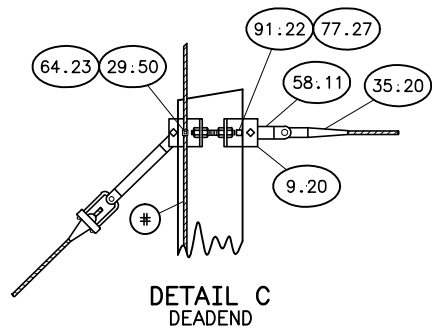
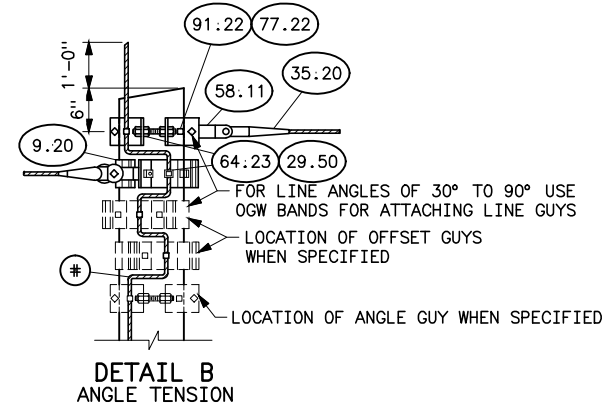
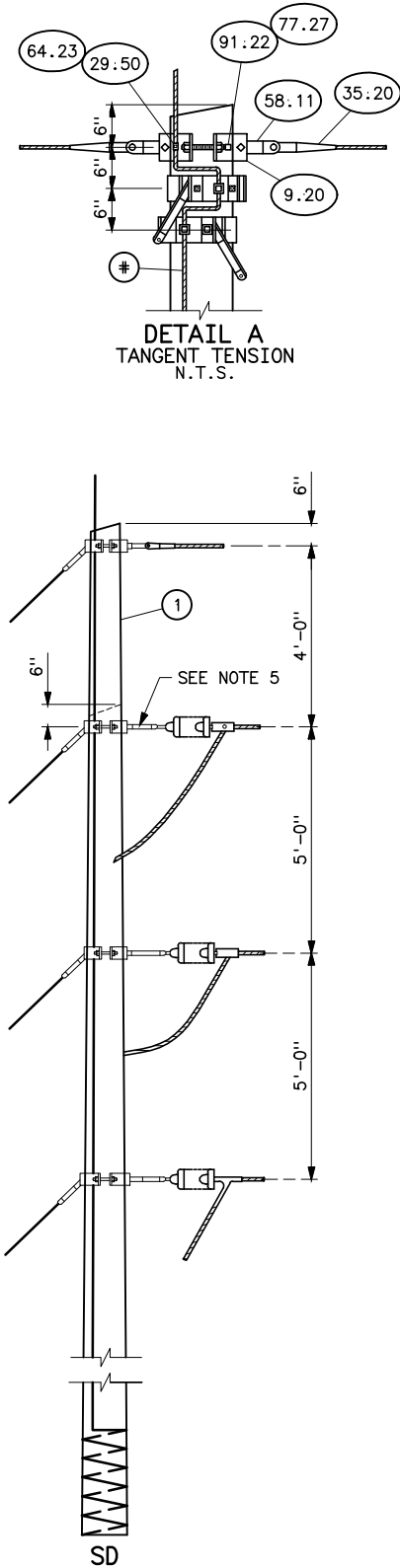
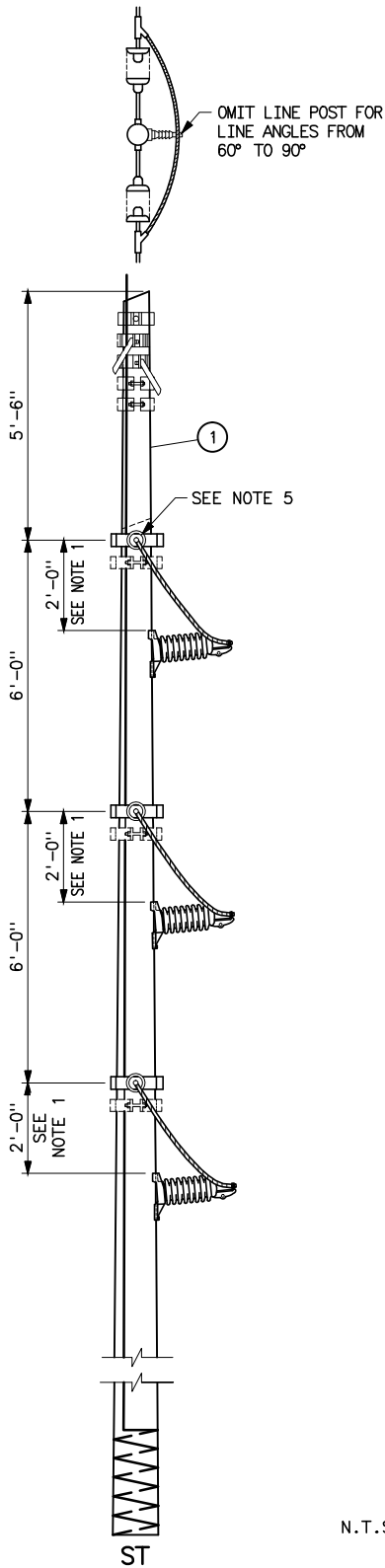
1. WHEN POLE TOP BAND IS SPECIFIED FOR STRUCTURES WITHOUT OVERHEAD GROUND WIRE, NO ANCHOR SHACKLE, PART NO. 79.10 IS REQUIRED.
2. MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO 1/2 OF TOP MOUNTING HOLES.
3. MATERIALS ARE FOR LINE POST INSULATORS AS SHOWN, OTHER MANUFACTURER'S LINE POST INSULATORS MAY REQUIRE DIFFERENT BOLT AND LOCKNUT SIZES.
4. YOKE ASSEMBLY OF DETAIL "C" SHALL BE USED FOR CONDUCTOR ASSEMBLIES AT LINE ANGLES OF 20° TO 60° FOR OVERHEAD GROUND WIRE ASSEMBLIES AT LINE ANGLES OF 30° TO 60°.
5. POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN FOR LINE ANGLES GREATER THAN 10°.
6. POLE GROUNDING NOT REQUIRED FOR STRUCTURES 15KV AND BELOW.
7. LENGTH OF SUSPENSION CLAMP PLUS 3 INCHES.

REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
GUY ASSEMBLIES AND DETAILS	41 6047
GUYING DETAILS FOR SINGLE POLE STRUCTURES	41 6059

B	5-28-14 A7-DDD	REDRAWN.
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
	TRANSMISSION LINE STANDARDS TYPES SS, SSA, & SAB 2.4 & 34.5KV TANGENT, SMALL ANGLES, & LARGE ANGLE STRUCTURES	
DESIGNED F.S. COOK		APPROVED C. CABRAL DIRECTOR, DIVISION OF ELECTRICAL DESIGN
NOVEMBER 1, 1979	41	6057

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NOTES

1. MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO ϕ OF TOP MOUNTING HOLE.
2. MATERIALS ARE FOR LINE POST INSULATORS AS SHOWN, OTHER MANUFACTURER'S LINE POST INSULATORS MAY REQUIRE DIFFERENT BOLT AND LOCKNUT SIZES.
3. POLE GROUNDING NOT REQUIRED FOR STRUCTURES 15KV AND BELOW.
4. POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN FOR LINE ANGLES GREATER THAN 10°.
5. FOR STRUCTURES WITHOUT OVERHEAD GROUND WIRE THE CONNECTING LINK PAIR, ON THE TOP CONDUCTOR ONLY, SHALL BE 36-INCHES LONG (MINIMUM) FOR RAPTOR PROTECTION.

STRUCTURE MATERIALS						
PART NO.	QUANTITY			DESCRIPTION	DWG 41	
	DEAD	END	ANGLE TENSION			
1	1	1	1	POLE		
9.20	3	3	6	BAND, FOUR WAY, STRAIN	6030	
29.50	3	3	6	CLIP, GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	6030	
64.23	3	3	6	LOCKNUT FOR 3/4" BOLT		
77.27	6	6	12	LAGSCREW, 1/2"x4" FETTER DRIVE THREAD		
91.22	6	6	12	WASHER, ROUND,FLAT 1 3/8" OD 9/16" HOLE		
58.11	3	6	6	LINK, CONNECTING PAIR (SEE NOTE 5)	6030	

INSULATOR MATERIALS						
PART NO.	QUANTITY			DESCRIPTION	DWG 41	
	DEAD	END	ANGLE TENSION			
2	-	3	3	INSULATOR, LINE POST (BIL TO BE SPECIFIED)		
27.89	-	3	3	CLAMP FOR LINE POST INSULATOR		
19.73	-	3	3	BOLT, MACHINE, 3/4"x14"		
19.52	-	3	3	BOLT, MACHINE, 5/8"x14"		
64.23	-	3	3	LOCKNUT FOR 3/4" BOLT		
64.22	-	3	3	LOCKNUT FOR 5/8" BOLT		
91.45	-	3	3	WASHER, SQUARE, CURVED, 3"x3"x11/16" HOLE		
91.46	-	3	3	WASHER, SQUARE, CURVED, 3"x3"x13/16" HOLE		
27.21	-	3	3	GROUNDING CLAMP FOR 3/4" BOLT TO NO. 2 AWG OWD	1012	
51.64	*	*	*	INSULATOR, SUSPENSION TYPE, 9" DIAMETER, 5 3/4" SPACING		
38.10	3	6	6	EYE-BALL CONNECTOR		
27.70	3	6	6	CLAMP, STRAIN, CLEVIS FITTING		
27.51		3	3	CLAMP, PARALLEL GROOVE, 3-BOLT FOR CONDUCTOR		
38.50	3	6	6	SOCKET-EYE CONNECTOR		

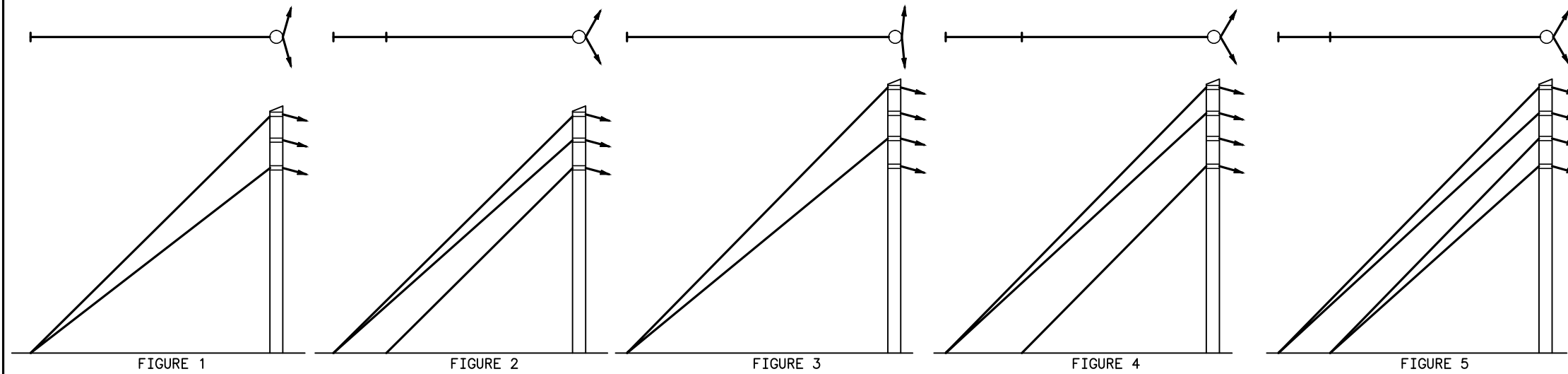
OVERHEAD GROUND WIRE MATERIALS						
PART NO.	QUANTITY			DESCRIPTION	DWG 41	
	DEAD	END	ANGLE			
9.20	1	1	2	BAND, FOUR WAY, STRAIN	6030	
35.20	1	2	2	DEADEND, COMPRESSION TYPE		
58.11	1	2	2	LINK, CONNECTIONG PAIR	6030	
29.50	1	1	2	CLIP, GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	6030	
64.23	1	1	2	LOCKNUT FOR 3/4" BOLT		
91.22	2	2	4	WASHER, ROUND, FLAT, 1 3/8" OD 9/16" HOLE		
77.27	2	2	4	LAGSCREW, 1/2"x4" FETTER DRIVE THREAD		

GROUNDING MATERIAL ,PART NUMBERS AND DESCRIPTIONS ARE SHOWN ON DWG 41 1012
SEE NOTE 3
* QUANTITY AND CLASS TO BE SPECIFIED

REFERENCE DRAWINGS

GROUNDING DETAILS----- 41 1012
GUY ASSEMBLIES AND DETAILS----- 41 6047
GUYING DETAILS FOR SINGLE POLE STRUCTURES----- 41 6059

B	5-28-14 A7-ODD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPES SD AND ST 2.4 & 34.5KV DEADEND, TANGENT, & ANGLE TENSION STRUCTURES		
DESIGNED E.S. COOK ----- APPROVED C. CABRAL ----- DIRECTOR, DIVISION OF ELECTRICAL DESIGN		
C _A F	NOVEMBER 1, 1979	41 6058



ANGLE GUYING REQUIREMENTS

STRUCTURE GUYING REQUIREMENTS						
STRUCTURE TYPE	LINE ANGLE	2.4KV		34.5KV		
		CONDUCTOR	FIGURE	CONDUCTOR	OGW	FIGURE
SSA	1° TO 15°	2-ASG	1	1-ASG	1-ASG	3
SAB	15° TO 60°	3-ASG	2	3-ASG	1-ASG	5
SD	0°	3-LSG	6	3-LSG	1-LSG	11
ST	0° TO 10°	1-LSGEW Δ 2-LSGEW	7	1-LSGEW	Δ 2-LSGEW	12
	10° TO 30°	2-ASG 1-LSGEW Δ 1-LSGEW	1 & 8	1-ASG 1-LSGEW	1-ASG Δ 1-LSGEW	3 & 13
	30° TO 60°	2-ASG 2-LSGEW	1 & 9	2-ASG 1-LSGEW	1-ASG 1-LSGEW	4 & 14
	60° TO 90°	3-LSGEW	10	3-LSGEW	1-LSGEW	15

EXPLANATION

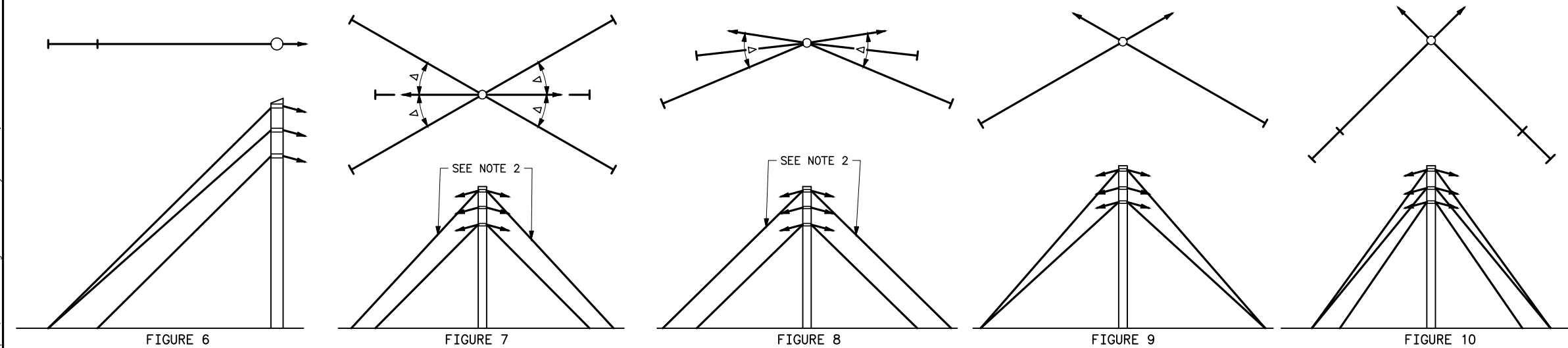
ASG	-----	ANGLE SINGLE GUY
LSG	-----	LINE SINGLE GUY
LSGEW	-----	LINE SINGLE GUY EACH WAY
Δ	-----	OFFSET GUY 30° FROM CONDUCTOR OR OVERHEAD GROUND WIRE
	-----	CONDUCTOR OR OVERHEAD GROUND WIRE

NOTES

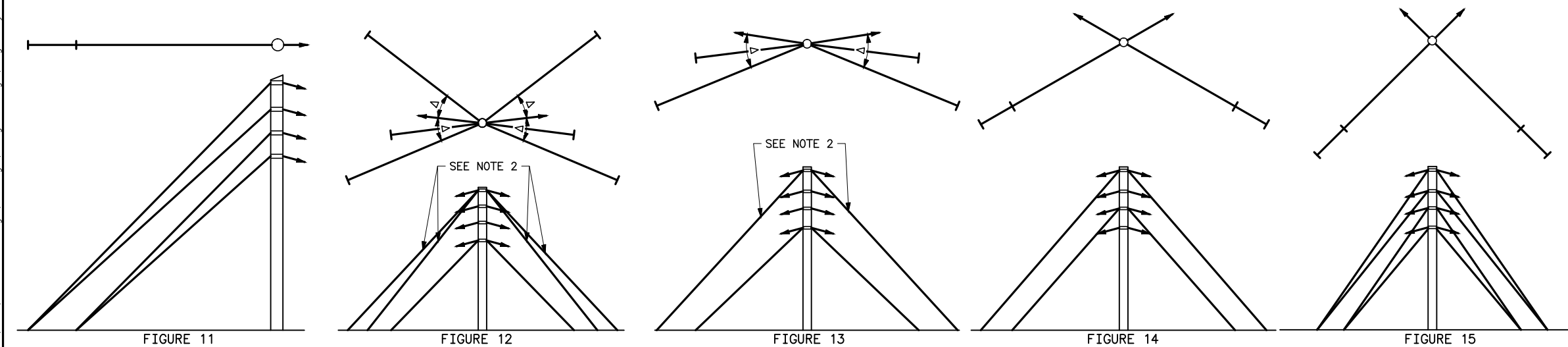
1. ALL TYPE SAB AND TYPE ST STRUCTURE WITH A LINE ANGLE OF 15° OR MORE SHALL BE GIVEN A RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH. RAKE SHALL BE AGAINST THE STRAIN.
2. USE GUY STRAIN INSULATORS.

REFERENCE DRAWING

GUY ASSEMBLIES AND DETAILS_____41 6047

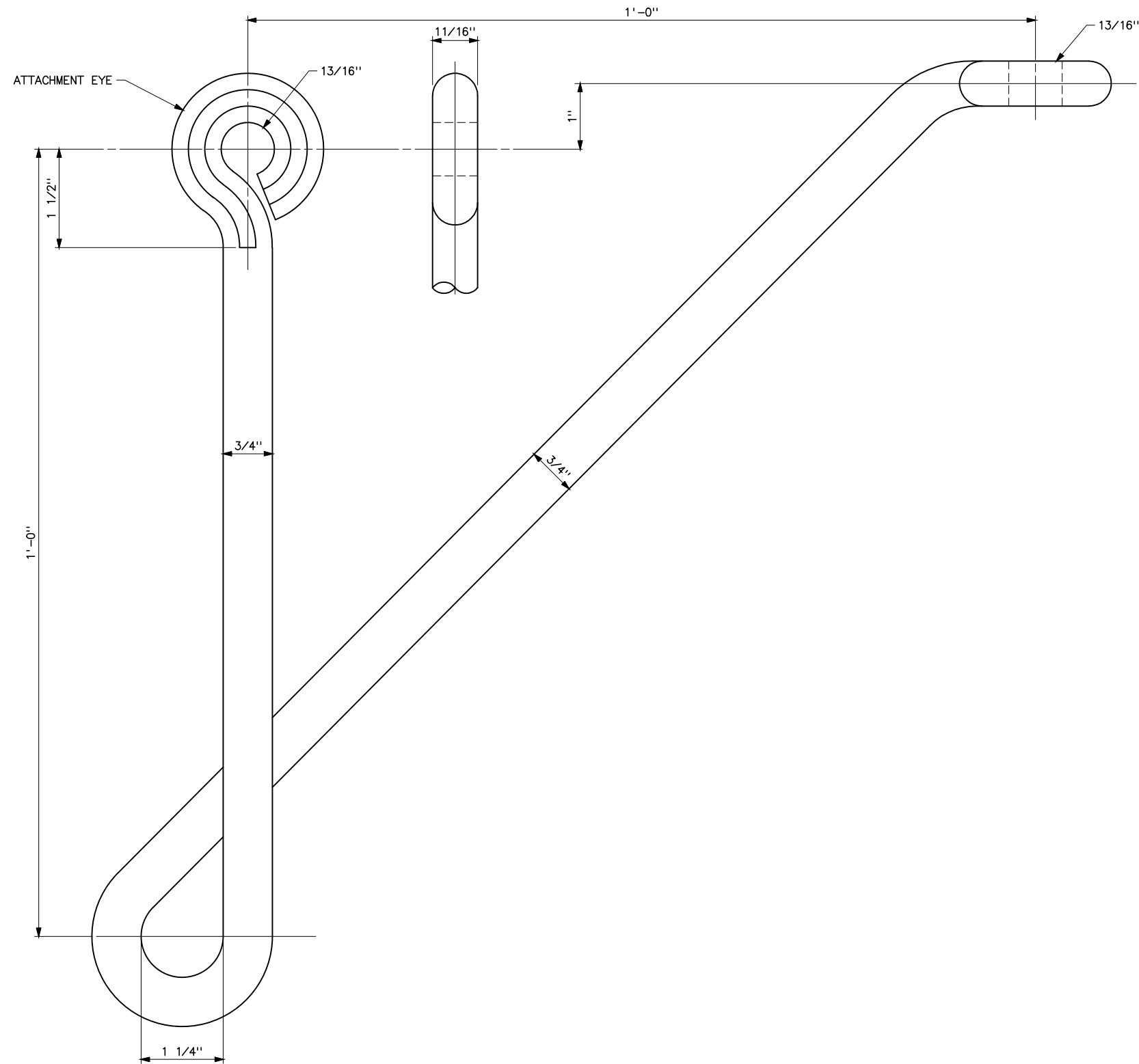


2.4KV LINE GUYING REQUIREMENTS



34.5KV LINE GUYING REQUIREMENTS

B	5-28-14 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS BUYING REQUIREMENTS FOR LINE POST CONSTRUCTION		
DESIGNED <u>F.S. COOK</u> _____ APPROVED <u>C.A. CABRAL</u> _____ DIRECTOR, DIVISION OF ELECTRICAL DESIGN		
CAL	NOVEMBER 1, 1979	41 6059

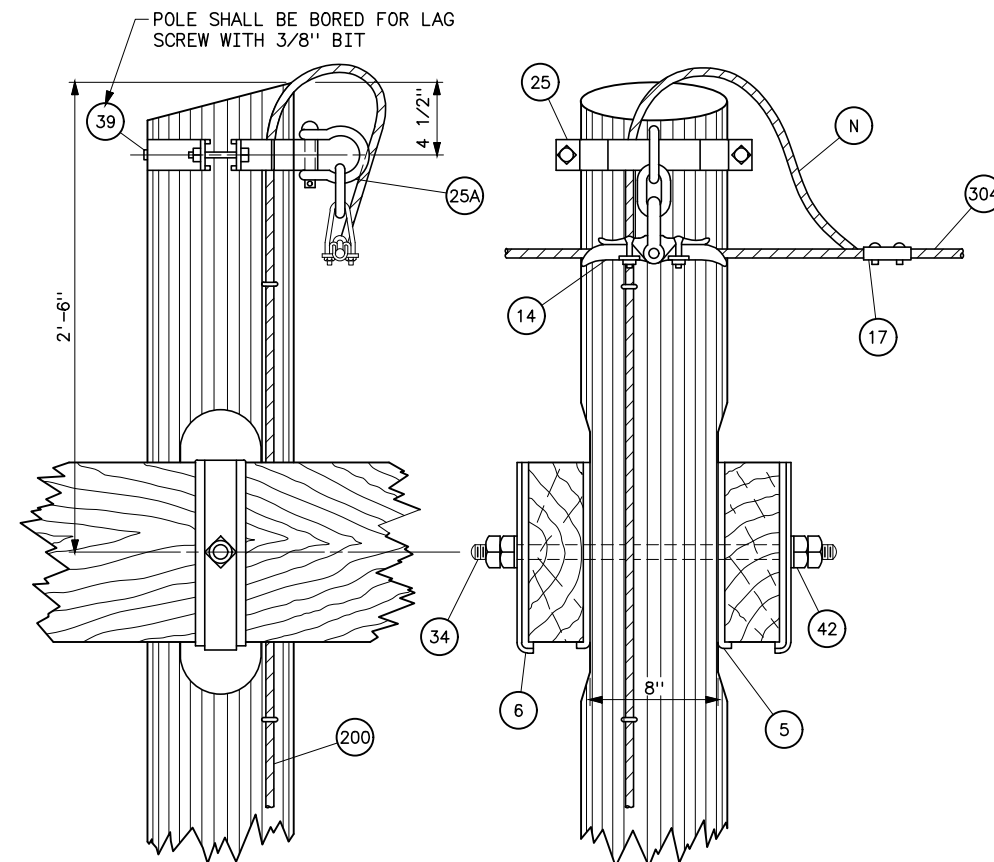


NOTES

1. BRACKET SHALL BE GALVANIZED AFTER BENDING AND SHAPING IN ACCORDANCE WITH THE LATEST EDITION OF ASTM DESIGNATION A153.
2. FLATTEN EACH FACE OF BOTH ATTACHMENT EYES TO 11/16" DIMENSION SHOWN AT LEFT.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

B	8/24/26 A7-KR	HISTORICAL REFERENCE	
A	5-28-14 A7-DDD	REDRAWN	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS EXTENSION BRACKET SAB STRUCTURES			
DESIGNED <u>F.S. COOK</u> _____ APPROVED <u>C.A. CABRAL</u> _____ CHIEF, ELECTRICAL DESIGN BRANCH			
C.A.F.	NOVEMBER 1, 1979	41	6060

[illegible]

LIST OF MATERIAL			
ITEM NO.	QUANTITY PER STRUCTURE		DESCRIPTION
	WITH OVERHEAD GROUND WIRE	WITHOUT OVERHEAD GROUND WIRE	
1	2	2	POLE,SEE STRUCTURE LIST FOR POLE HEIGHT AND TYPE OF GUYING
2	2	2	CROSS ARM, 3 3/4"x11 1/2"x34"-8" DRILLED PER DWG 41 6025
3	3	3	PHASE FITTING, DWG 41 6039, B=8 1/2"
5	4	4	FLAT GAIN PLATE, DWG 41 6039
6	4	4	RIBBED TIE PLATE, DWG 41 6039
7	12	12	3"x3"x1/4", FLAT SQUARE WASHER
9	3	3	SUSPENSION CLEVIS, DWG 41 6039
12	33	33	INSULATOR DISCS, 10"x5 3/4" SPACING, DWG 41 1000
13	3	3	CONDUCTOR SUSPENSION CLAMP WITH SOCKET FITTING
14	2	OMIT	SUSPENSION CLAMP WITH 2 1/4" LINK, FOR OVERHEAD GROUND WIRE
17	2	OMIT	CLAMP, GALVANIZED STEEL, FOR 5/16" TO 3/8" STEEL STRAND
19	3	3	SUSPENSION HOOK, DWG 41 1003
25	2	2	POLE TOP BAND LESS SHACKLE, DWG 41 6035
25A	2	OMIT	SHACKLE FOR POLE TOP BAND, DWG 41 6035
27	12	12	LOCKNUT FOR 5/8" BOLT
29	4	4	LOCKNUT FOR 1/2" BOLT
34	2	2	DOUBLE ARMING BOLT 7/8"x22", USE EXTRA NUTS FOR LOCKNUTS
39	2	2	LAG SCREW, 1/2"x4 1/2"
41	12	12	SPRING LOCK WASHER FOR 5/8" BOLT
42	4	4	SPRING LOCK WASHER FOR 7/8" BOLT
100 SERIES		GUYING MATERIAL. FOR DETAILS AND MATERIAL REQUIRED, SEE DWG 41 6067 OR 41 6048	
200 SERIES		GROUNDING MATERIAL. FOR DETAILS AND MATERIAL REQUIRED SEE DWG 41 6079 OR 41 1012	
300	-	-	CONDUCTOR
301	3	3	SETS OF ARMOR RODS AND CLIPS FOR ACSR ONLY
304	-	OMIT	OVERHEAD GROUND WIRE
43	12	12	MACHINE BOLT, 5/8"x6", 1 NUT
77	4	4	MACHINE BOLT, 1/2"x13", 1 NUT
78	4	4	SPRING LOCK WASHER FOR 1/2" BOLT
79	4	4	2"x2"x1/8" FLAT SQUARE STEEL WASHER

(N) WHEN OVERHEAD GROUND WIRES ARE NOT INSTALLED EXTEND 5/16" STRAND 2'-6" ABOVE POLE TOP BAND.

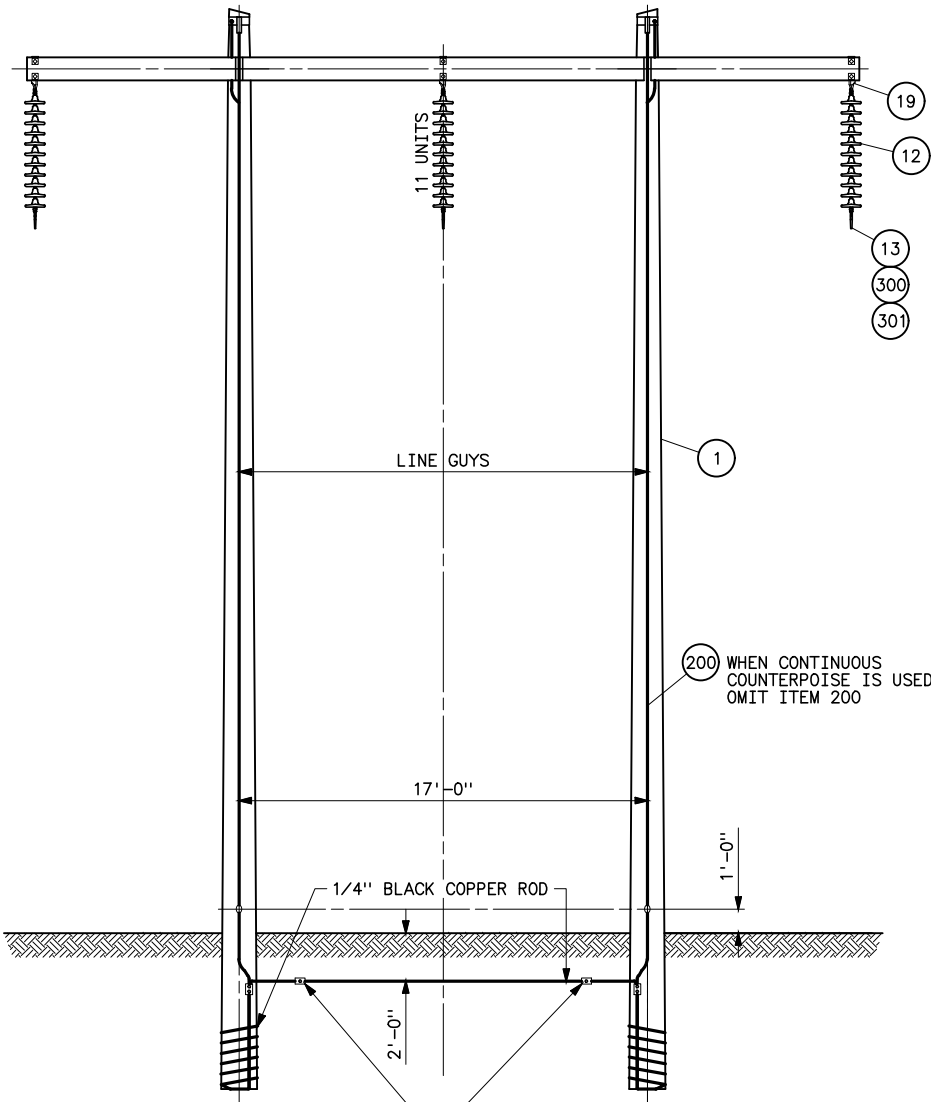
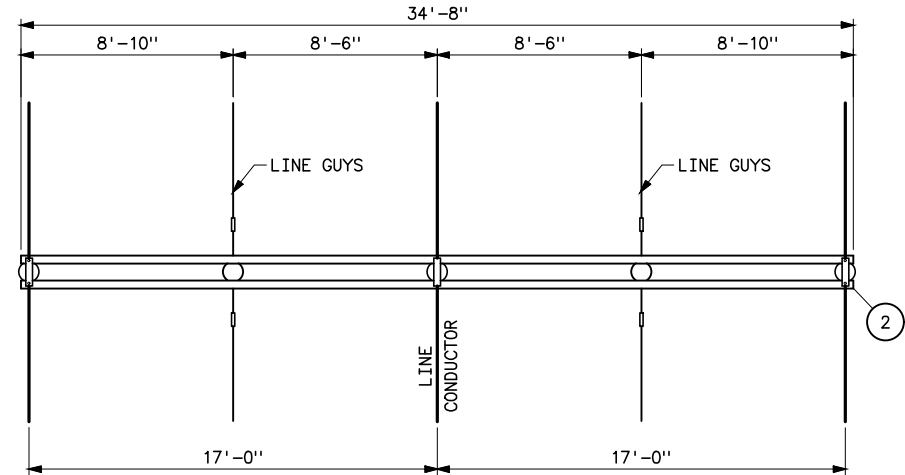
1. GROUND WIRE TO BE LOCATED ON POLE ABOVE CROSS ARM
SO AS TO AVOID BEING CHAFED BY GROUND WIRE CLAMP.

GROUNDING DETAILS	41	1012
GUYING DETAILS		
(WITHOUT OVERHEAD GROUND WIRE)	41	6048
GUYING DETAILS		
(WITH OVERHEAD GROUND WIRE)	41	6067
POLE DRILLING AND GAINING DETAILS	41	6078
GROUNDING AND COUNTERPOISE DETAILS		
(WITH OVERHEAD GROUND WIRE)	41	6079

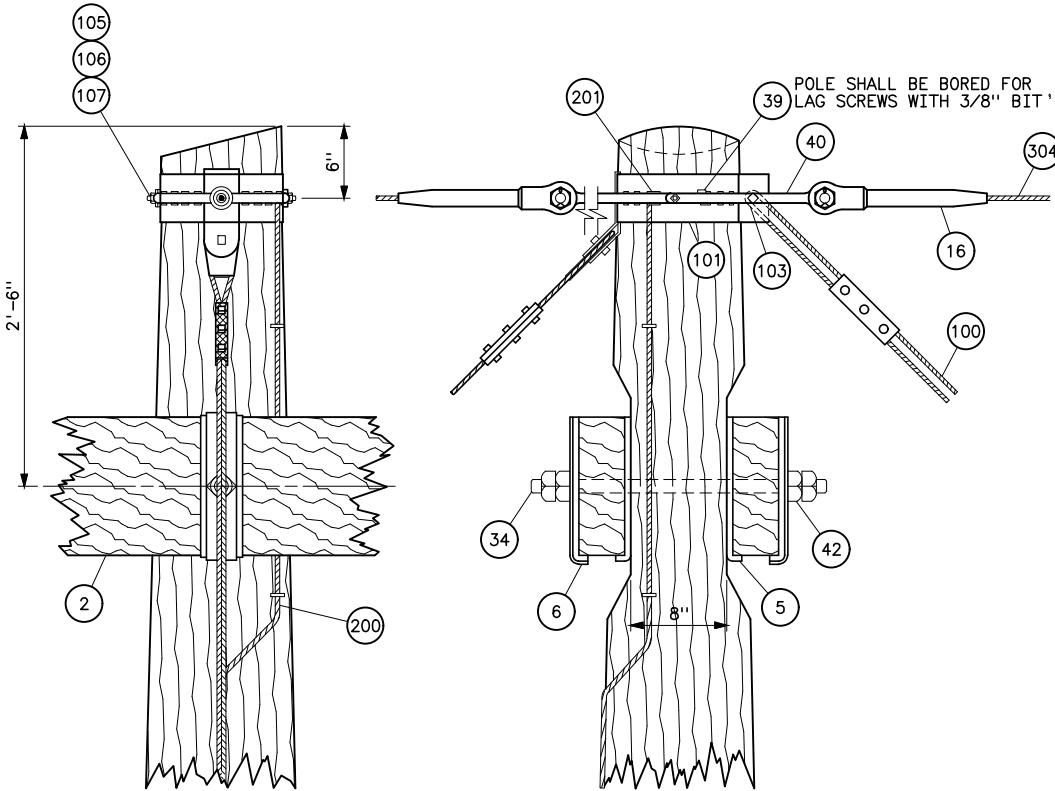
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2946		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE HS-161KV SUSPENSION STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A F	DECEMBER 4, 1979	41
		6061

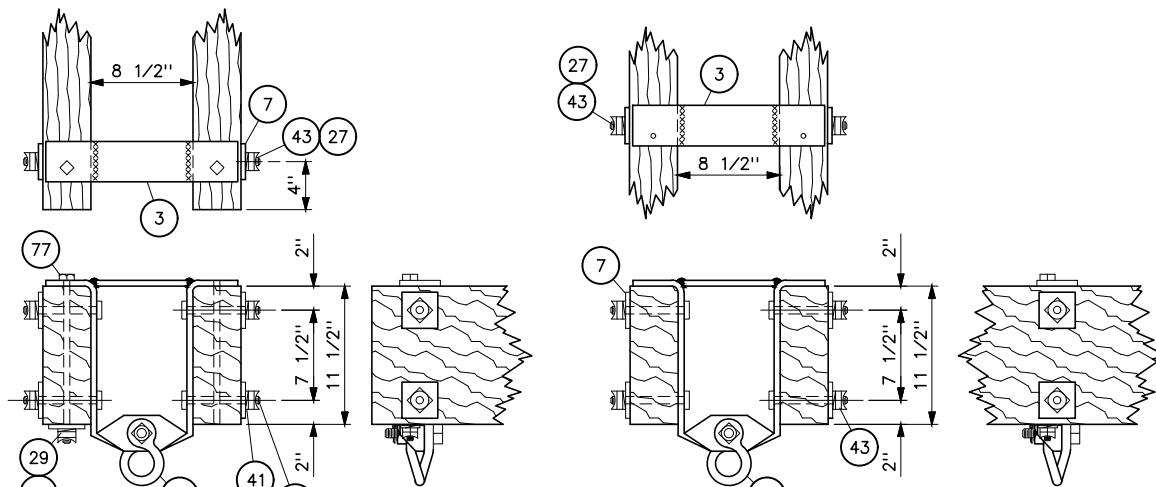
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IMAGES:
XREF(S):



WHEN CONTINUOUS COUNTERPOISE IS USED, CONNECT AT THESE POINTS SEE DWG 40-D-2957



POLE ATTACHMENT ASSEMBLY



END PHASE ASSEMBLY

CENTER PHASE ASSEMBLY

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

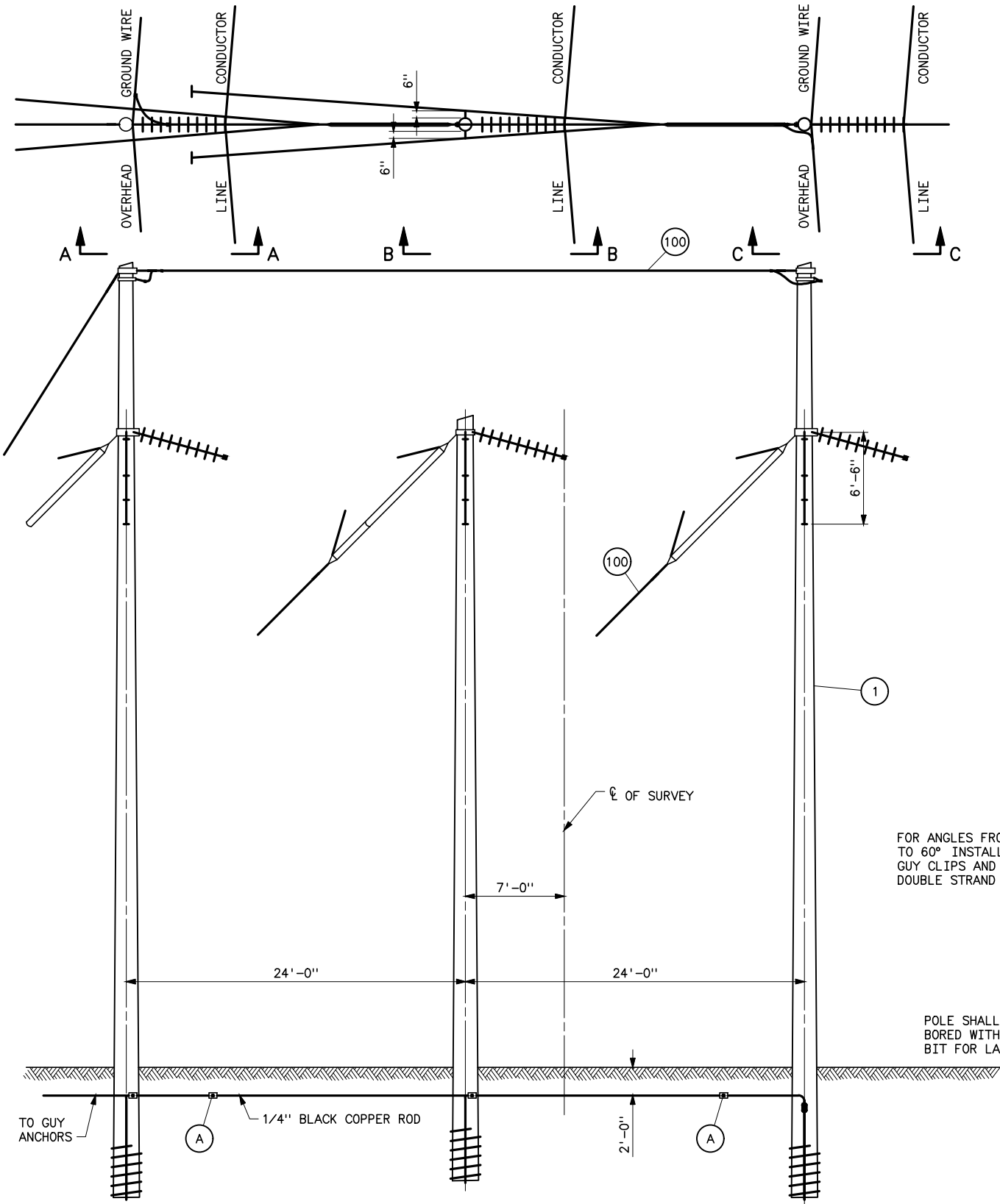
LIST OF MATERIAL			
ITEM NO.	QUANTITY PER STRUCTURE		DESCRIPTION
	WITH OVERHEAD GROUND WIRE	WITHOUT OVERHEAD GROUND WIRE	
1	2	THIS STRUCTURE REPLACED BY TYPE HS STRUCTURE	POLE, SEE STRUCTURE LIST FOR POLE HEIGHT AND TYPE OF GUYING
2	2		CROSS ARM, 3 3/4"x11 1/2"x34'-8" DRILLED PER DWG 41 6025
3	3		PHASE FITTING, DWG 41 6039, B=8 1/2"
5	4		FLAT GAIN PLATE, DWG 41 6039
6	4		RIBBED TIE PLATE, DWG 41 6039
7	12		3"x3"x1/4", FLAT SQUARE WASHER
9	3		SUSPENSION CLEVIS, DWG 41 6039
12	33		INSULATOR DISC 10"x5 3/4" SPACING, DWG 41 1000
13	3		CONDUCTOR SUSPENSION CLAMP WITH SOCKET FITTING
16	4		COMPRESSION TYPE DEAD END FOR OVERHEAD GROUND WIRE
19	3		SUSPENSION HOOK, DWG 41 1003
27	12		LOCKNUT FOR 5/8" BOLT
29	4		LOCKNUT FOR 1/2" BOLT
34	2		DOUBLE ARMING BOLT, 7/8"x22", USE EXTRA NUTS FOR LOCKNUTS
40	4		SETS OF STRAIN LINKS, DWG 40-D-3671
41	12		SPRING LOCK WASHERS FOR 5/8" BOLT
42	4	SPRING LOCK WASHERS FOR 7/8" BOLT	
100 SERIES			GUYING MATERIAL. FOR DETAILS AND MATERIAL REQUIRED IN ADDITION TO THAT LISTED BELOW, SEE 41 6048 OR 41 6067
101	2	-	UNIVERSAL POLE BAND, DWG 40-D-3179
103	2	-	GUY THIMBLE FOR 7/16" STRAND
105	4	-	3/4"x2 1/4", CONE HEAD BOLT, DWG 40-D-3179
106	4	-	LOCKNUT FOR 3/4" BOLT
107	4	-	3"x3"x3/16" SQUARE CURVED WASHER WITH 13/16" SQUARE HOLE
39	4	-	LAG SCREW, 1/2"x4 1/2"
200 SERIES			GROUNDING MATERIAL. FOR DETAILS AND MATERIAL SEE DWG 41 6079, 40-D-2957, 2970 OR 3669
300	-	-	CONDUCTOR
301	3	-	SETS OF ARMOR RODS AND CLIPS FOR ASCR ONLY
304	-	-	OVERHEAD GROUND WIRE
201	2	-	GROUNDING CLIP WITH 3/4"x2 1/4" CONE HEAD BOLT AND LOCKNUT
43	12	-	MACHINE BOLT, 5/8"x6", 1 NUT
77	4	4	MACHINE BOLT, 1/2"x13", 1 NUT
78	4	4	SPRING LOCK WASHER FOR 1/2" BOLT
79	4	4	2"x2"x1/8" FLAT SQUARE STEEL WASHER

REFERENCE DRAWINGS

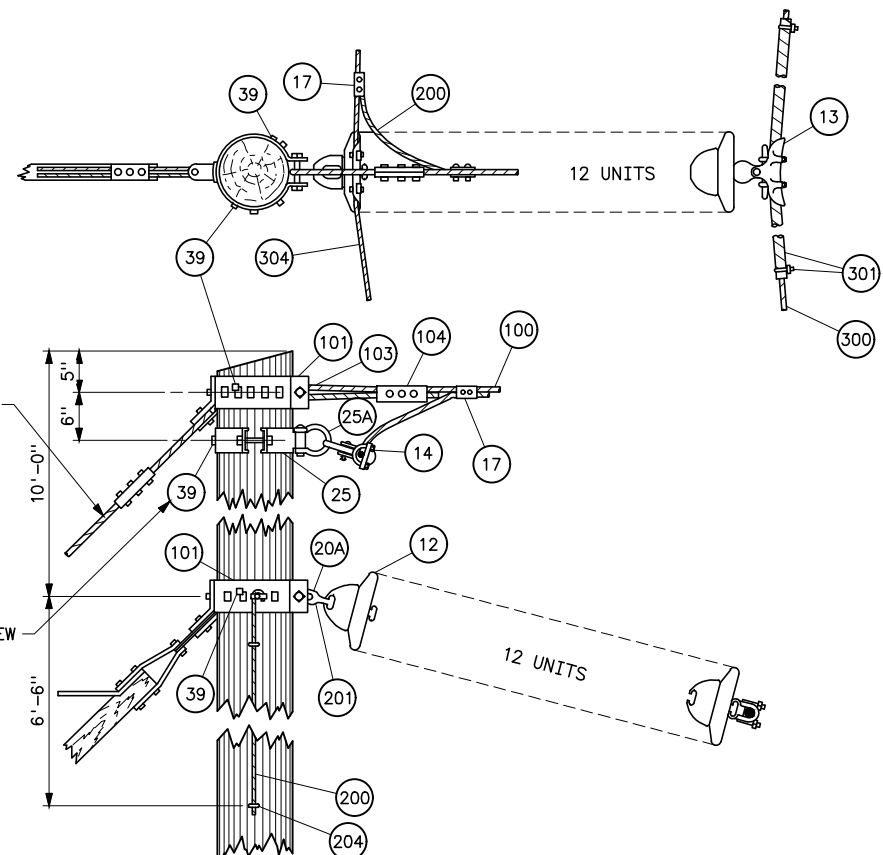
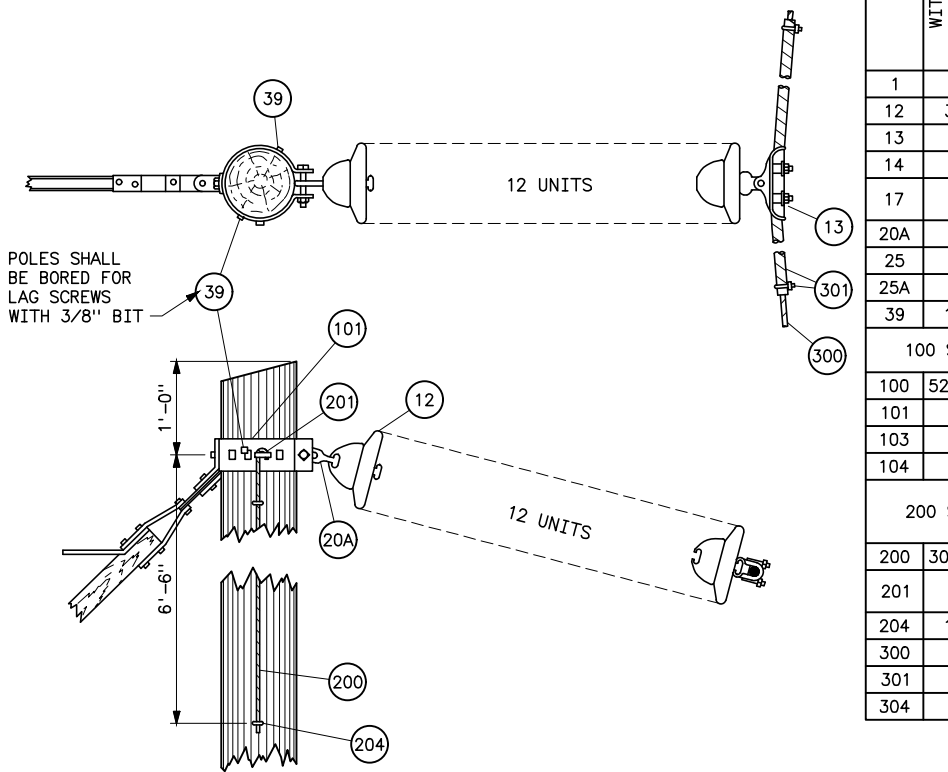
GUYING DETAILS,
WITHOUT OVERHEAD GROUND WIRE ----- 41 6048
GUYING DETAILS, WITH OVERHEAD GROUND WIRE --- 41 6067
POLE DRILLING AND GAINING DETAILS ----- 41 6078
GROUNDING AND COUNTERPOISE DETAILS,
WITH OVERHEAD GROUND WIRE ----- 40-D-2957
GROUNDING DETAILS,
WITHOUT OVERHEAD GROUND WIRE ----- 40-D-2970
GROUNDING DETAILS,
WITH OVERHEAD GROUND WIRE ----- 40-D-3669

B	8/20/26 A7-KR	HISTORICAL REFERENCE
A	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2949		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE HST-161KV SUSPENSION-GROUND WIRE TENSION-STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	OCTOBER 17, 1979	41 6062

Plotted By: Zia, Sep 01, 2026- 10:42am
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WHEN CONTINUOUS COUNTERPOISE IS USED CONNECT AT POINTS "A" ABOVE. SEE DWGS 41 6079_1 AND 41 6079_2



FOR ANGLES FROM 45° TO 60° INSTALL TWO GUY CLIPS AND TWO DOUBLE STRAND GUYS

POLE SHALL BE BORED WITH 3/8" BIT FOR LAG SCREW

LIST OF MATERIAL			
ITEM NO.	QUANTITY PER STRUCTURE		DESCRIPTION
	WITH OVERHEAD GROUND WIRE	WITHOUT OVERHEAD GROUND WIRE	
1	3	3	POLE, SEE STRUCTURE LIST FOR POLE HEIGHT AND TYPE OF GUYING
12	36	36	INSULATOR DISCS, 10"x5 3/4" SPACING, DWG 41 1000
13	3	3	CONDUCTOR SUSPENSION CLAMP WITH SOCKET FITTING
14	2	OMIT	SUSPENSION CLAMP WITH 2 1/4" LINK, FOR OVERHEAD GROUND WIRE
17	4	OMIT	CLAMP, GALVANIZED STEEL, FOR 5/16" TO 3/8" TO 7/16" STEEL STRAND
20A	3	3	BALL EYE CONNECTOR, WITH ARCING HORN ATTACHMENT
25	2	OMIT	POLE TOP BAND LESS SHACKLE. DWG 41 6034
25A	2	OMIT	SHACKLE FOR POLE TOP BAND, DWG 41 6034
39	12	10	LAG SCREW, 1/2"x4 1/2"
100 SERIES		GUYING MATERIAL. FOR DETAILS AND MATERIAL REQUIRED IN ADDITION TO THAT LISTED BELOW, SEE DWG 41 6067 OR 6048	
100	52 FT	52 FT	7/16" SM GALVANIZED STRAND
101	5	5	UNIVERSAL POLE BAND, DWG 40-D-3179
103	2	2	GUY THIMBLE FOR 7/16" STRAND
104	2	2	GUY CLAMP 6"-3 BOLT, NELA STD
200 SERIES		GROUNDING MATERIAL. FOR DETAILS AND MATERIAL REQUIRED IN ADDITION TO THAT LISTED BELOW, SEE DWGS 41 6079-1, 41 6079-2, 40-D-2970, OR 40-D-3669	
200	30 FT	21 FT	5/16" GALVANIZED 3-STRAND GROUND WIRE.
201	3	3	GROUNDING CLIP WITH 3/4" CONE HEAD BOLT AND LOCKNUT, DWG 40-D-3179
204	12	12	GALVANIZED STAPLES, 2" LONG WITH 1/2" OPENING
300	-	-	CONDUCTOR
301	3	3	SETS OF ARMOR RODS AND CLIPS FOR ACSR ONLY
304	-	OMIT	OVERHEAD GROUND WIRE

REFERENCE DRAWINGS

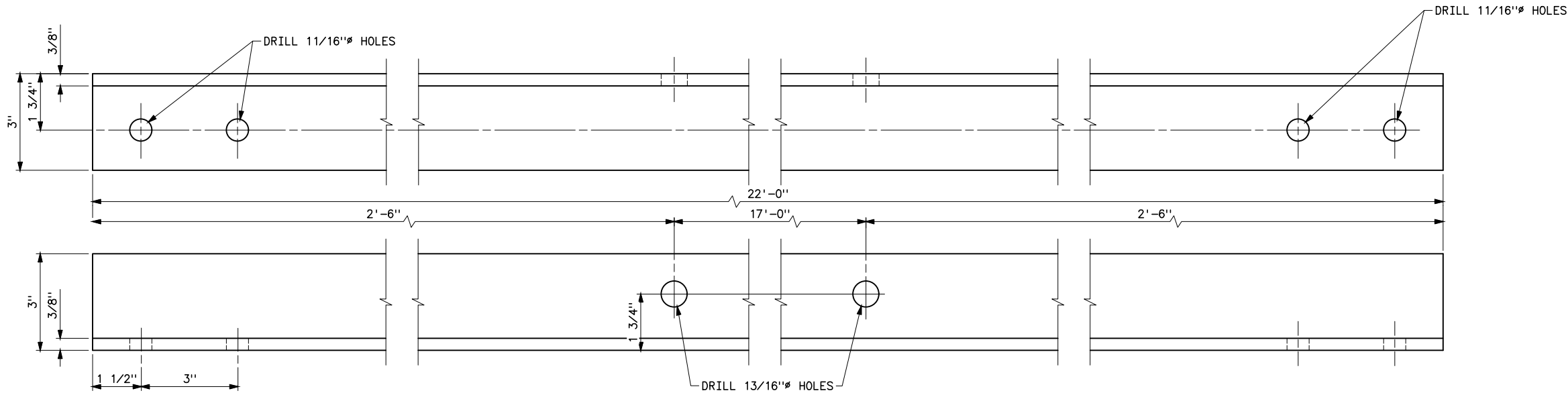
GUYING DETAILS (WITHOUT OVERHEAD GROUND WIRE) _____ 41 6048
GUYING DETAILS (WITH OVERHEAD GROUND WIRE) _____ 41 6067
GROUNDING AND COUNTERPOISE DETAILS (WITH OVERHEAD GROUND WIRE) _____ 41 6079-1 & -2
GROUNDING DETAILS (WITHOUT OVERHEAD GROUND WIRE) _____ 40-D-2970
GROUNDING DETAILS (WITH OVERHEAD GROUND WIRE) _____ 40-D-3699

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6171 (3A-2)

B	9/1/26 A7-KR	HISTORICAL REFERENCE
A	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2950		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE 3A-161KV MEDIUM ANGLE STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
DATE	MARCH 29, 1939	41 6063

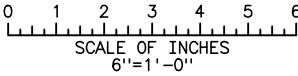


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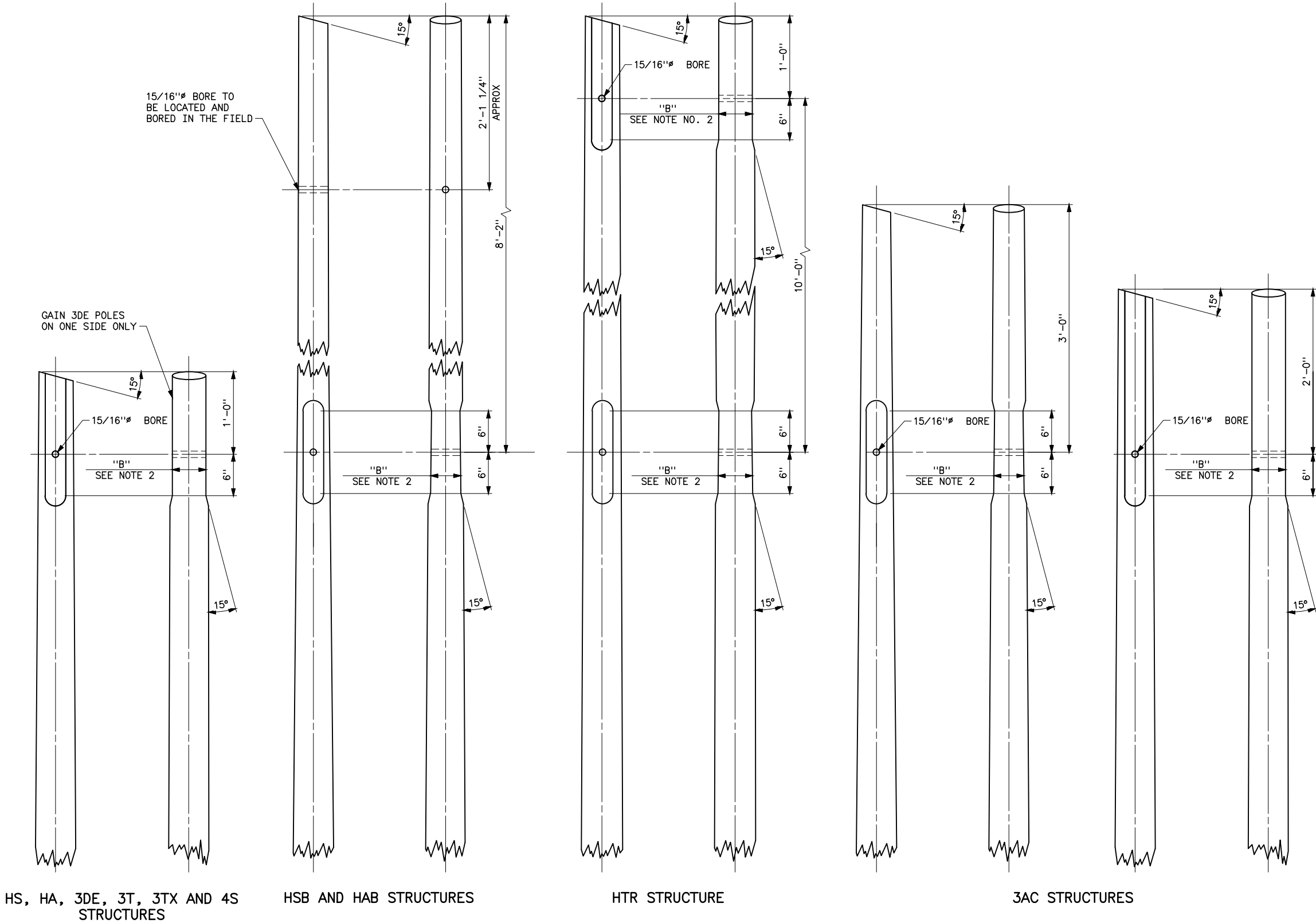
NOTE
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING
IN ACCORDANCE WITH ASTM DESIGNATION A153.

HISTORICAL REFERENCE ONLY NOT TO BE USED FOR NEW CONSTRUCTION SEE NEW STANDARD DESIGN DRAWING 41 6133		
C	8/25/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-6161		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 161KV H-FRAME ANGLE IRON DETAILS		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C	AUGUST 6, 1979	41 6065



XREF(S):

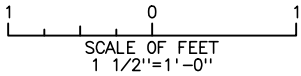
Plotted By: court Aug 25, 2026- 1:22pm
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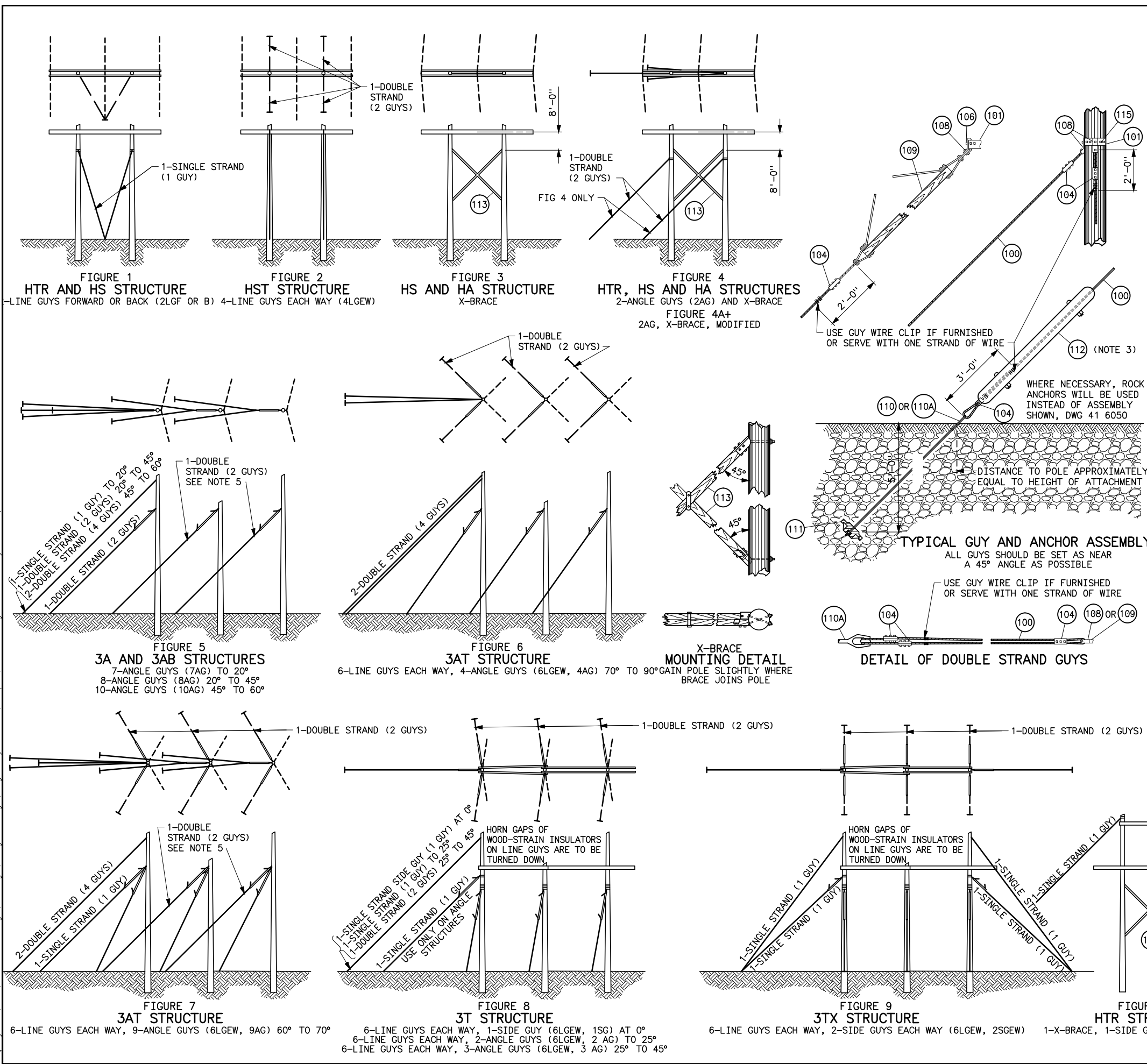


- NOTES**
- OPPOSITE FACES TO BE GAINED TO SAME WIDTH AND SHALL BE PARALLEL.
 - DIMENSION "B"
- | CIRCUMFERENCE OF POLE AT POINT OF GAIN | DIMENSION "B" |
|--|------------------|
| UNDER 25" | GAIN 1/4" DEEP |
| 25" TO 27" | 7 1/2" |
| 27" TO 30" | 8" |
| 30" TO 35" | 9" |
| 35" TO 45" | 10 1/2" |
| 45" AND OVER | GAIN 2" DEEP MAX |
- THIS DRAWING APPLIES TO STRUCTURES WITHOUT OGW.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2805		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 69KV & 115KV 2 & 3 POLE STRUCTURES DRILLING AND GAINING DETAILS WITHOUT OGW		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6066



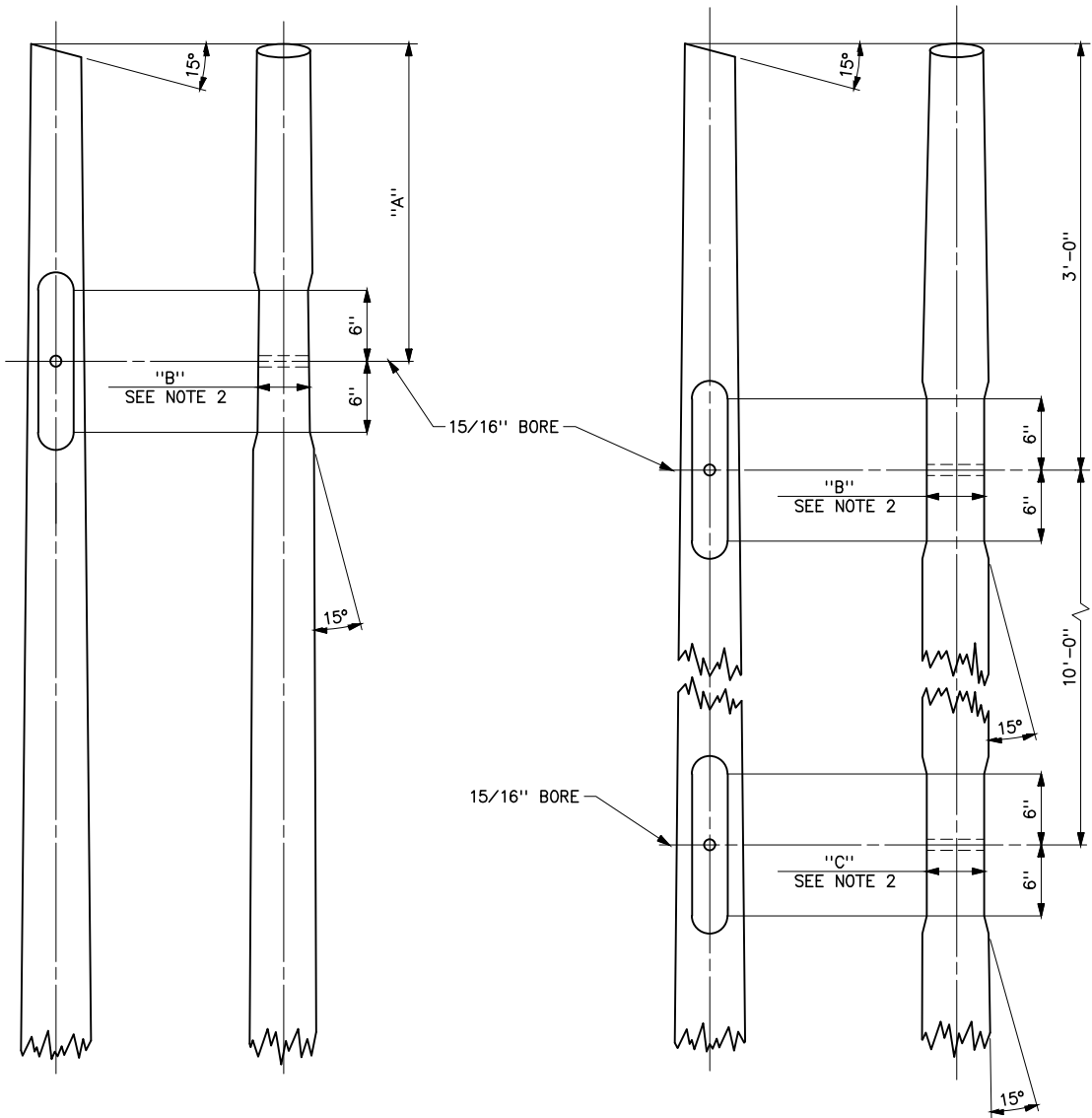


LIST OF MATERIAL																
ITEM NO.	MATERIAL REQUIRED		QUANTITIES REQUIRED FOR EACH TYPE OF GUYING													
			2LGF OR B	4LGEW	X-BRACE 1SG	X-BRACE W/2AG	7AG	8AG	10AG	6LGEW 4AG	6LGEW 9AG	6LGEW 2AG	6LGEW 3AG	6LGEW 2SGEW	6LGEW 1SG	
			FIG 1	FIG 2	FIG 1A	FIG 4	FIG 5			FIG 6	FIG 7	FIG 8		FIG 9	FIG 8	
100	GUY CABLE 7/16" S.M. FEET	40' POLE	85	410	52	65	220	265	370	515	655	290	340	375	260	
		45' POLE	100	460	58	70	265	320	435	625	795	390	450	480	335	
		50' POLE	110	505	65	85	305	365	490	725	930	480	540	580	440	
		55' POLE	125	560	71	100	355	420	560	830	1060	560	630	680	510	
		60' POLE	140	620	77	110	405	480	630	930	1200	660	730	780	605	
		65' POLE	150	670	84	125	445	525	690	1035	1325	745	825	880	685	
		70' POLE	165	715	90	140	495	580	760	1135	1465	830	920	980	760	
101	UNIVERSAL POLE BAND		2	-	1	1	-	-	-	-	-	7	7	8	6	
102	DEAD END CLEVIS		-	-	-	-	-	-	-	-	-	-	-	-	-	
103	GUY THIMBLE															
104	GUY CLAMP, 6" 3-BOLT, NELA STD		4	12	2	3	11	12	15	24	32	22	23	26	20	
105	3/4"-CONE HEAD BOLT		-	-	-	-	-	-	-	-	-	-	-	-	-	
106	3/4"-LOCKNUT		2	2	1	1	4	4	5	8	11	8	8	10	7	
107	3"x3"x3/16" SQ CURVED WASHER WITH 13/16" SQ HOLE		-	-	-	-	-	-	-	-	-	-	-	-	-	
108	GUY CLIP		2	2	1	1	4	4	5	8	11	8	8	10	7	
109	WOOD GUY INSULATOR (NOTE 2)		-	-	-	-	3	3	3	6	9	7	7	8	6	
115	1/2"x4 1/2" LAG SCREW		4	-	2	2	-	-	-	-	-	14	14	16	12	
110	ANCHOR ROD, 3/4"x8'-0" SINGLE EYE TYPE		-	-	1	-	5	4	4	-	5	2	1	-	1	
110A	ANCHOR ROD, 3/4"x8'-0" SINGLE EYE TYPE		1	4	-	1	1	2	3	8	8	6	7	8	6	
111	ANCHOR, DWG 41 6049		1	4	1	1	6	6	7	8	13	8	8	8	7	
112	GUY PROTECTOR (NOTE 3)		2	4	1	1	6	6	7	8	13	8	8	8	7	
113	TWO PIECE X-BRACE 17'-0" SPACING (NOTE 4)		-	-	1	1	-	-	-	-	-	-	-	-	-	

- NOTES
- THE POLE BANDS AND ATTACHMENTS THAT HOLD THE INSULATOR ASSEMBLIES, OR FORM PART OF THE CROSS TIES BETWEEN THE OUTER POLES ARE CONSIDERED STRUCTURE MATERIAL AND ARE LISTED ON THE INDIVIDUAL STRUCTURE DRAWINGS. THE BANDS AND ATTACHMENTS LISTED ABOVE ARE FOR GUYING ONLY AND ARE REQUIRED IN ADDITION TO THOSE ACCOUNTED FOR ON THE STRUCTURE DRAWINGS.
 - WOOD GUY INSULATOR WITH WOOD MEMBER 129" LONG, 9'-0" CLEAR WOOD AND 49" AIR GAP 24" FROM WOOD, INCLUDES SHEAVE WHEEL AND 6" EXTENSION LINK.
 - GUY PROTECTOR TO BE USED ONLY WHEN SPECIFIED IN STRUCTURE LIST.
 - TWO-PIECE X-BRACE INCLUDES 2-7/8"x16" MACHINE BOLTS, 2-7/8"x14" MACHINE BOLTS, 4-7/8" LOCKNUTS, AND 4-3 1/2"x3 1/2"x3/8" SQUARE CURVED WASHERS.
 - GUYS SHALL SEPARATE AT GUY CLAMP BELOW WOOD STRAIN INSULATOR, PASS ON OPPOSITE SIDES OF POLE, AND TERMINATE AT INDIVIDUAL ANCHORS.
 - EACH UNIVERSAL POLE BAND SHALL BE SUPPORTED AT DIAMETRICALLY OPPOSITE POINTS WITH A 1/2"x4 1/2" LAG SCREW. THE POLE SHALL BE BORED FOR THE LAG SCREWS WITH A 3/8" BIT AND THE LAG SCREWS SCREWED INTO PLACE.
 - + FOR MODIFIED GUYING AS SHOWN IN FIG 4A, USE SAME MATERIAL AS IN FIG 4, EXCEPT ADD 2 OF ITEM 110, 1 EACH OF ITEMS 111 AND 112 AND OMIT ITEM 110 A.

B	5-28-14 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-2958		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS GUY ARRANGEMENT AND DETAILS WITH OVERHEAD GROUND WIRE 161KV			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
CAE	FEBRUARY 13, 1981	41	6067

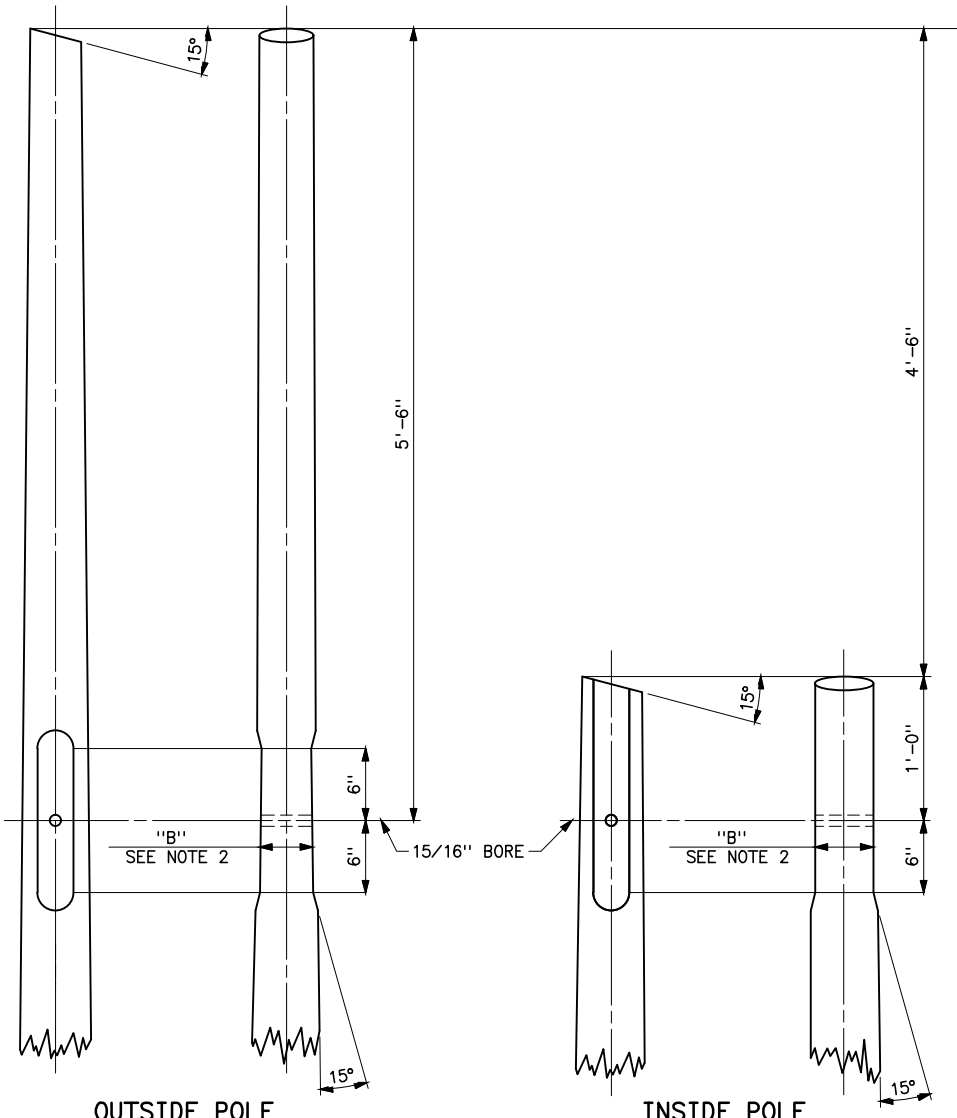
Plotted By: court Aug 25, 2026- 1:22pm
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IMAGES:



HS, HSB AND 3AC STRUCTURES
(SEE TABLE FOR DIMENSION "A")

TYPE OF STRUCTURE	DIMENSION "A"
HS	3'-0"
HSB	7'-8"
3AC	SEE DWG 41 6002

HTR STRUCTURES



OUTSIDE POLE

3T AND 3TX STRUCTURES

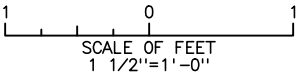
INSIDE POLE

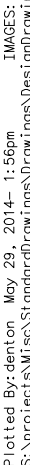
NOTES

1. OPPOSITE FACES TO BE GAINED TO SAME WIDTH AND SHALL BE PARALLEL.
2. DIMENSION "B" TO BE 9" IF POLE DIAMETER PERMITS, MINIMUM TO BE 8". GAIN TO BE CUT NOT MORE THAN 2 1/2" DEEP ON EACH SIDE.
3. DIMENSION "C" TO BE 10 1/2" IF POLE DIAMETER PERMITS, MINIMUM TO BE 9". GAIN TO BE CUT NOT MORE THAN 2 1/2" DEEP ON EACH SIDE.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4704		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES 115KV H-FRAME STRUCTURES DRILLING AND GAINING DETAILS WITH OGW - 39° PROTECTIVE ANGLE		
DESIGNED BUREC _____ APPROVED BUREC _____		
41	NOVEMBER 5, 1979	6068

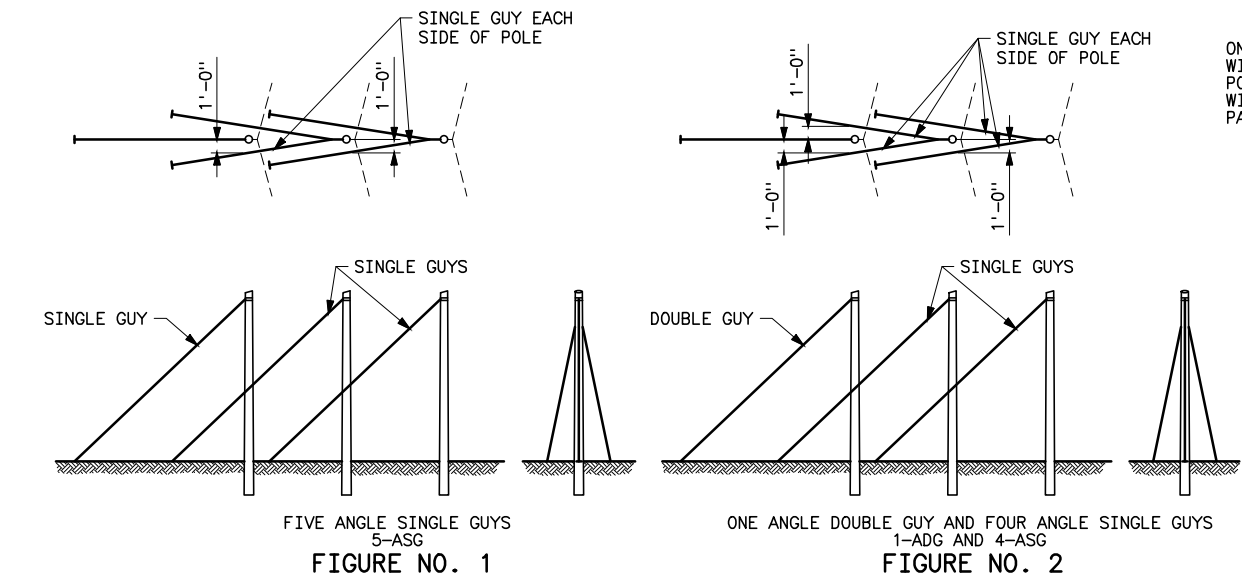




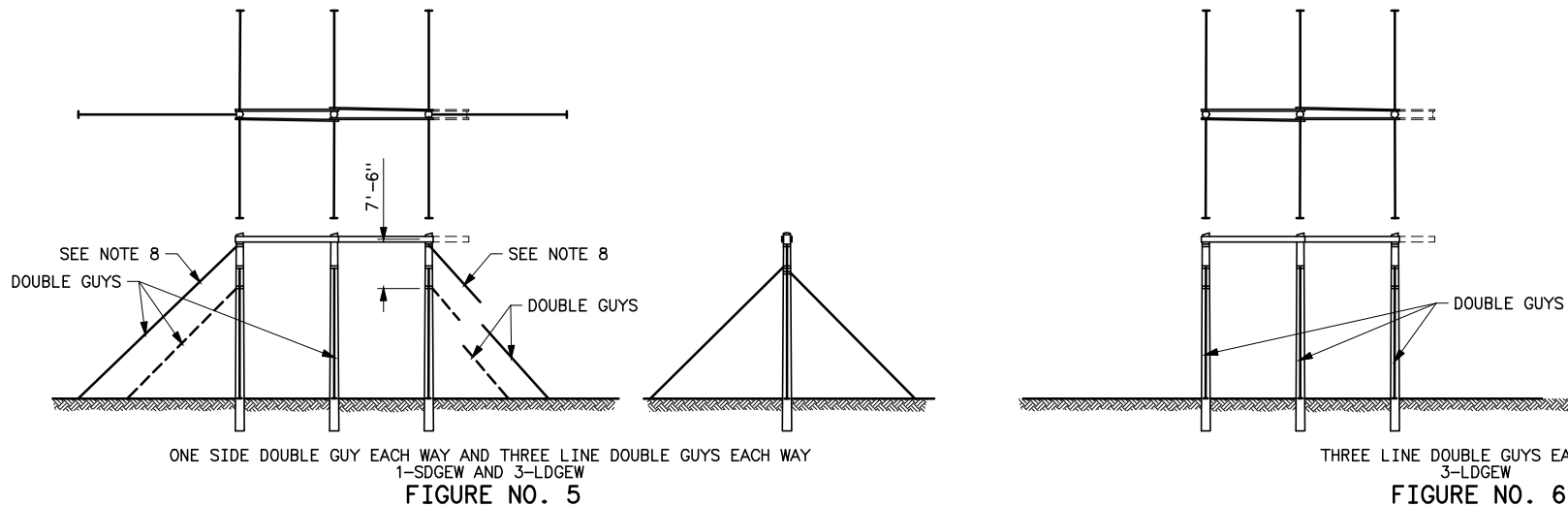
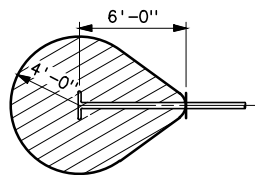
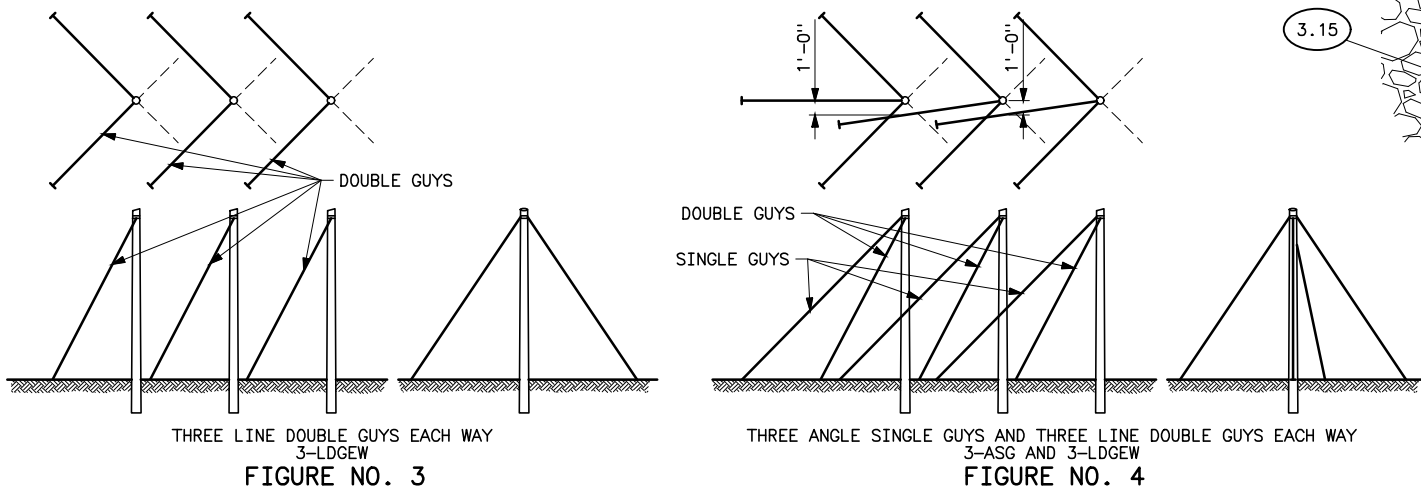
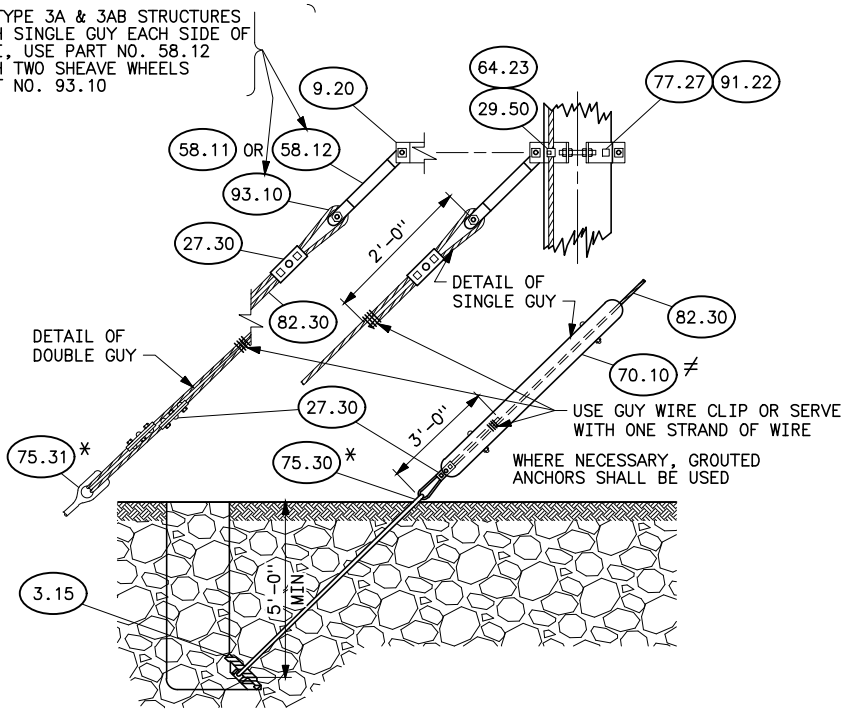
REFERENCE DRAWING
TYPE HSWT - WOOD FRAME - 69KV
STEEL DETAILS _____ 41 6089

B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DRAWING NO. 40-D-3171		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINES TYPE HSWT-WOOD FRAME-69KV AIR BREAK SWITCH STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
DATE	JULY 30, 1980	41 6069

Plotted By: court Aug 25, 2026- 1:21pm
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ON TYPE 3A & 3AB STRUCTURES WITH SINGLE GUY EACH SIDE OF POLE, USE PART NO. 58.12 WITH TWO SHEAVE WHEELS PART NO. 93.10



LIST OF MATERIALS							
ITEM NO.	MATERIAL REQUIRED	QUANTITIES REQUIRED FOR EACH TYPE OF GUYING					
		FIG NO. 1	FIG NO. 2	FIG NO. 3	FIG NO. 4	FIG NO. 5	FIG NO. 7
9.20	FOUR-WAY STRAIN BAND 41 6030 **	-	-	-	3	8	6
58.11	CONNECTING LINK (PR) 41 6030	1	1	6	9	8	6
58.12		2	2	-	-	-	-
27.30	GUY CLAMP-6" 3 BOLT	10	11	18	24	24	18
75.30	ANCHOR ROD 3/4"x8'*	5	4	-	3	-	-
75.31	THIMBLEYE	-	1	6	6	8	6
3.15	TWIN EYE	-	1	6	6	8	6
70.10	ANCHOR PLATE DWG 40-D-4842	5	5	6	9	8	6
93.10	GUY PROTECTOR	-	-	-	-	-	-
	SHEAVE WHEEL 41 6030	5	5	6	9	8	6
82.30	FOR 25'-0" POLE	160	185	370	465	455	324
	FOR 30'-0" POLE	195	230	455	570	555	400
	FOR 35'-0" POLE	225	270	540	675	655	476
	FOR 40'-0" POLE	260	310	625	780	755	552
	FOR 45'-0" POLE	295	350	695	870	855	629
	FOR 50'-0" POLE	325	390	780	975	955	705
	FOR 55'-0" POLE	360	430	865	1080	1060	781
29.50	FOR 60'-0" POLE	395	470	935	1170	1160	857
64.23	FOR 65'-0" POLE	420	505	1000	1260	1265	934
29.50	GROUND CLIP 41 6030	-	-	-	3	8	6
64.23	3/4" LOCKNUT	-	-	-	3	8	6
77.27	1/2"x4" LAG SCREW, FETTER DRIVE THREAD	-	-	-	6	16	12
91.22	WASHER, ROUND, FLAT, 1 3/8" OD 9/16" HOLE	-	-	-	6	16	12

NOTES

1. ≠ TO BE USED ONLY WHEN SPECIFIED.
2. ** THE FOUR-WAY STRAIN BANDS LISTED ABOVE ARE FOR GUYING ONLY AND ARE REQUIRED IN ADDITION TO THE BANDS THAT SUPPORT THE INSULATOR ASSEMBLIES. BANDS TO WHICH INSULATOR SUPPORT ASSEMBLIES ARE ATTACHED ARE CONSIDERED STRUCTURE MATERIAL AND ARE ACCOUNTED FOR ON STRUCTURE DRAWINGS.
3. LENGTH OF STRAND SHOWN IN TABLE IS BASED ON LEVEL GROUND CONDITIONS.
4. FOR LOCATION OF BANDS SEE INDIVIDUAL STRUCTURE DRAWINGS.
5. * USE 3/4"x8" ROD UNLESS 3/4"x10" ROD IS NEEDED TO OBTAIN 5 FOOT DEPTH.
6. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
7. WHERE ANCHORS ARE PLACED IN SANDY SOIL OR IN GROUND WHICH AFFORDS A POOR ANCHORAGE, EACH GUY SHALL BE TERMINATED BY A SEPARATE ANCHOR.
8. *** ON 3T STRUCTURES LOCATE SIDE GUYS IN POSITION INDICATED BY BROKEN LINES IN FIGURE NO. 5.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO.40-D-2759		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINES STANDARD GUY ARRANGEMENT ASSEMBLY 3-POLE STRUCTURES-HEAVY GUYING		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 6, 1979	41 6070

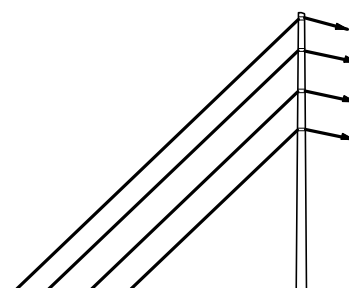
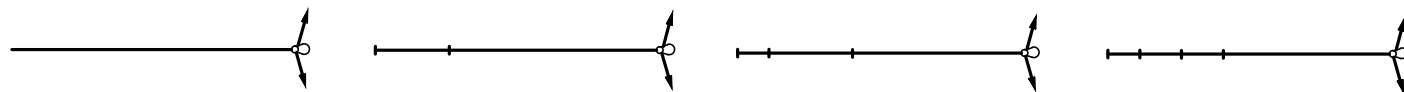


FIGURE 5
ANGLE GUYS (4-DG)

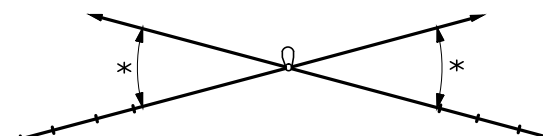
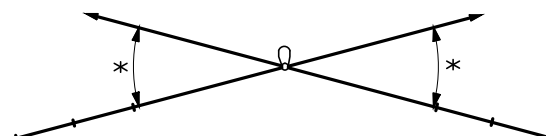
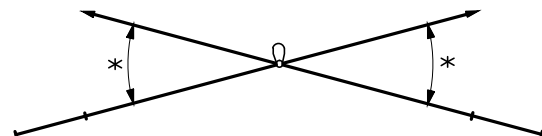


FIGURE 9
SEE NOTE 3
(4-LDGEW)

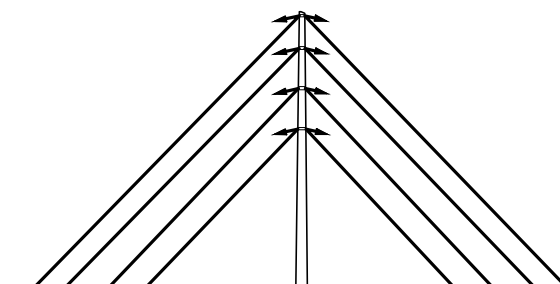
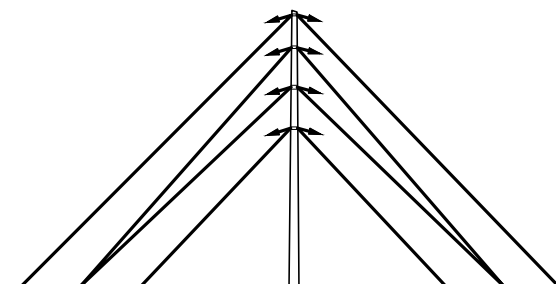
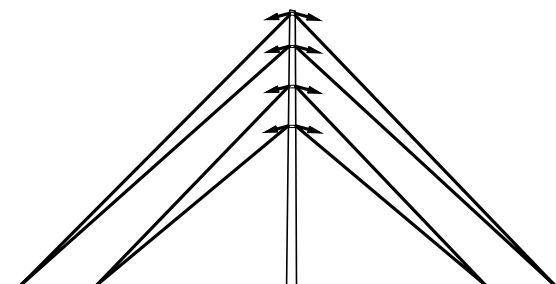
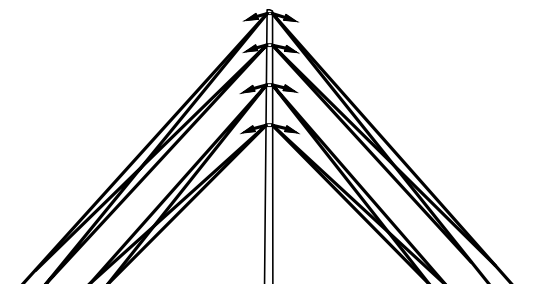
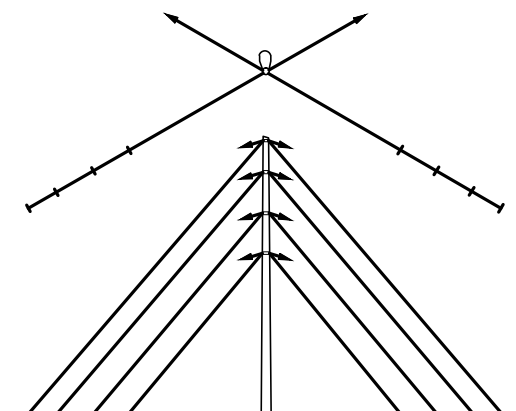
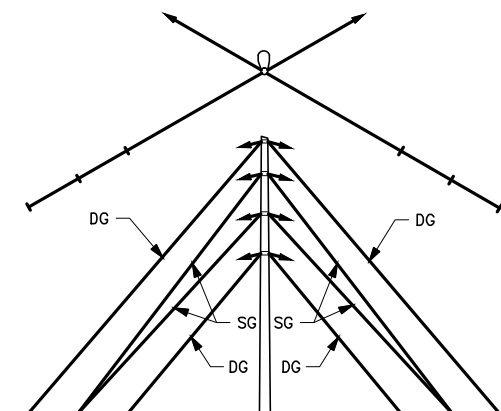
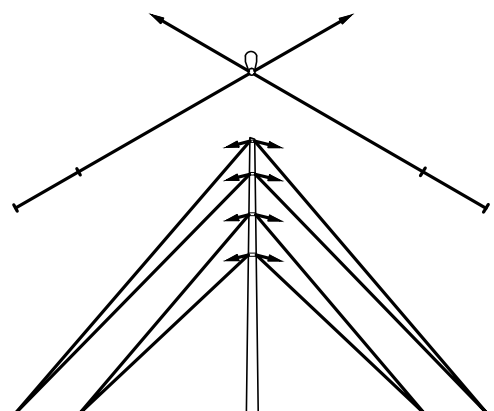


FIGURE 12
LINE GUYS 30° TO 90°, LINE ANGLE
(4-LDGEW)



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DG ----- DOUBLE GUY
SG ----- SINGLE GUY
ASG ----- ANGLE SINGLE GUY
ADG ----- ANGLE DOUBLE GUY
OGW ----- OVERHEAD GROUND WIRE
LSGEW ----- LINE SINGLE GUY EACH WAY
LSGEW ----- LINE DOUBLE GUY EACH WAY
┌----- CONDUCTOR OR OGW
* ----- OFFSET GUY 30° FROM CONDUCTOR
              OR OGW.  USE STRAIN INSULATORS FOR OGW
              AND 2 UPPER CONDUCTOR PHASE GUYS.
┌----- ANCHOR

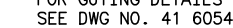
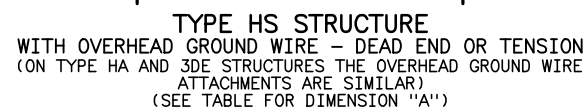
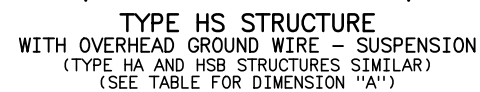
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1. ALL DEADEND STRUCTURES AND ANGLE STRUCTURES WITH A LINE ANGLE OF 5° OR MORE SHALL BE GIVEN RAKE OF 1/4-INCH FOR EACH FOOT OF POLE LENGTH. RAKE SHALL BE AGAINST THE STRAIN.
2. OFFSET LINE GUYS 30° FOR LINE ANGLES OF 0° TO 10°.
3. OFFSET LINE GUYS 30° FOR LINE ANGLES OF 10° TO 30°.

* OMIT ANGLE GUYS FOR LINE ANGLES EXCEEDING 60°

GUY ASSEMBLIES AND DETAILS_____41 6047

A	5-28-84 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS BUYING REQUIREMENTS FOR SINGLE POLE CONSTRUCTION WITH OVERHEAD GROUNDWIRE		
DESIGNED <u>HENRY JAMES KIENTZ</u>		APPROVED <u>C.A. CABRAL</u> DIRECTOR, DIVISION OF ELECTRICAL DESIGN
C.A.	MAY 23, 1980	41 6071



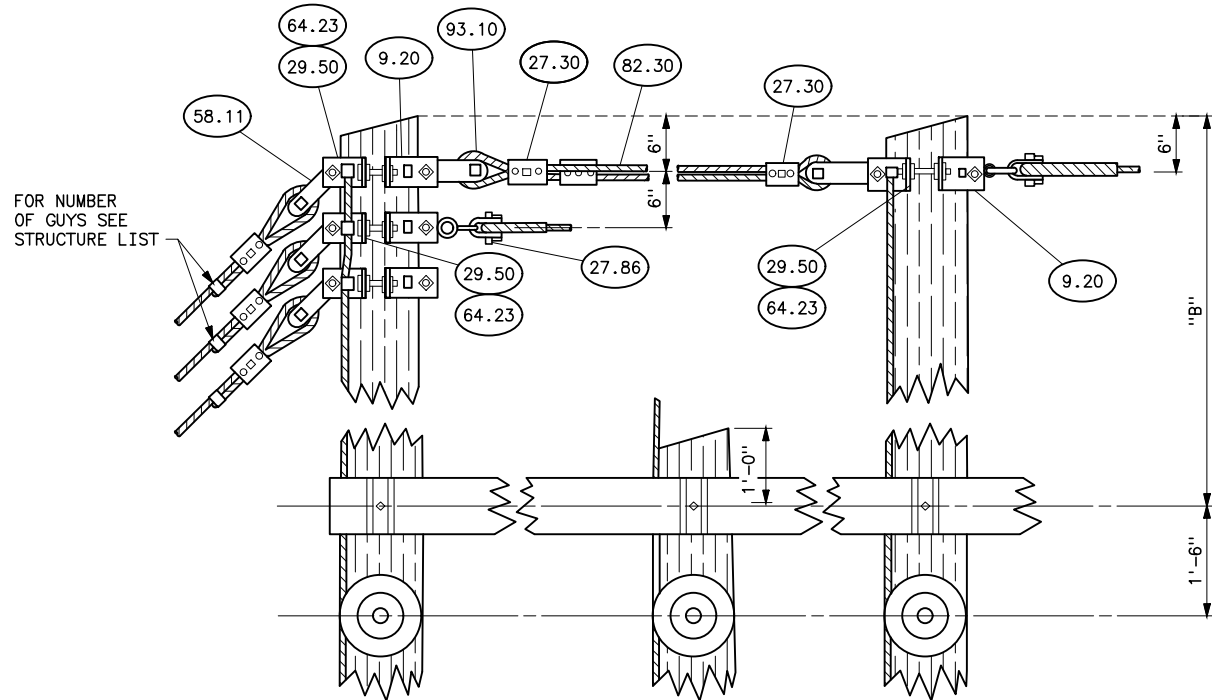
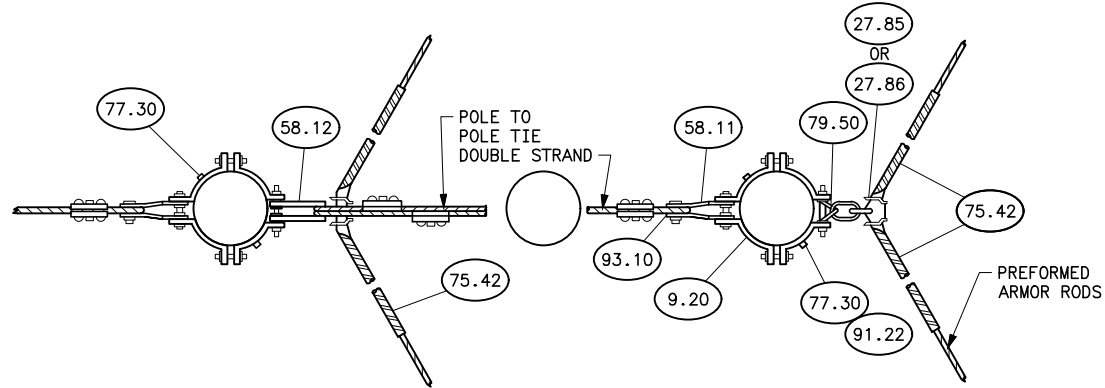
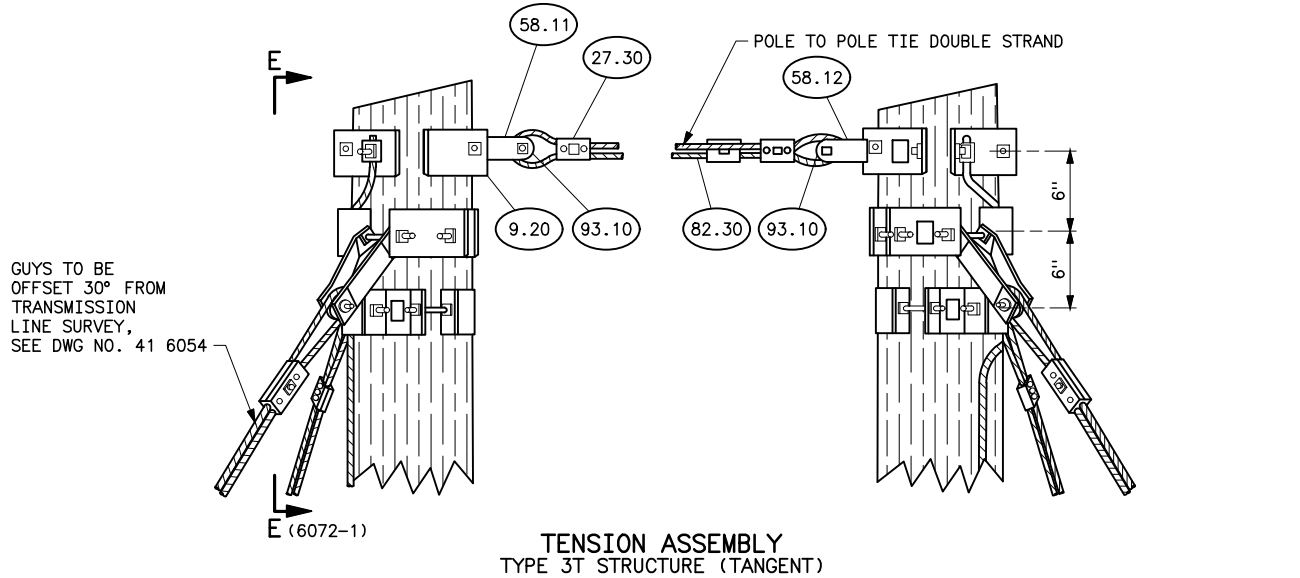
"A" AND "B" DIMENSIONS				
TYPE OF STRUCTURE	30° PROTECTIVE ANGLE		39° PROTECTIVE ANGLE	
	DIMENSION "A"	DIMENSION "B"	DIMENSION "A"	DIMENSION "B"
HS	6'-6"		3'-0"	
HA	6'-6"		3'-0"	
HTR	6'-6"		3'-0"	
HSB	7'-8"		7'-8"	
3AT		10'-0"		5'-6"
3T		10'-0"		5'-6"

1. SEE 41 6072-2 FOR GUYING QUANTITIES LIST OF MATERIALS TABLE AND NOTES.

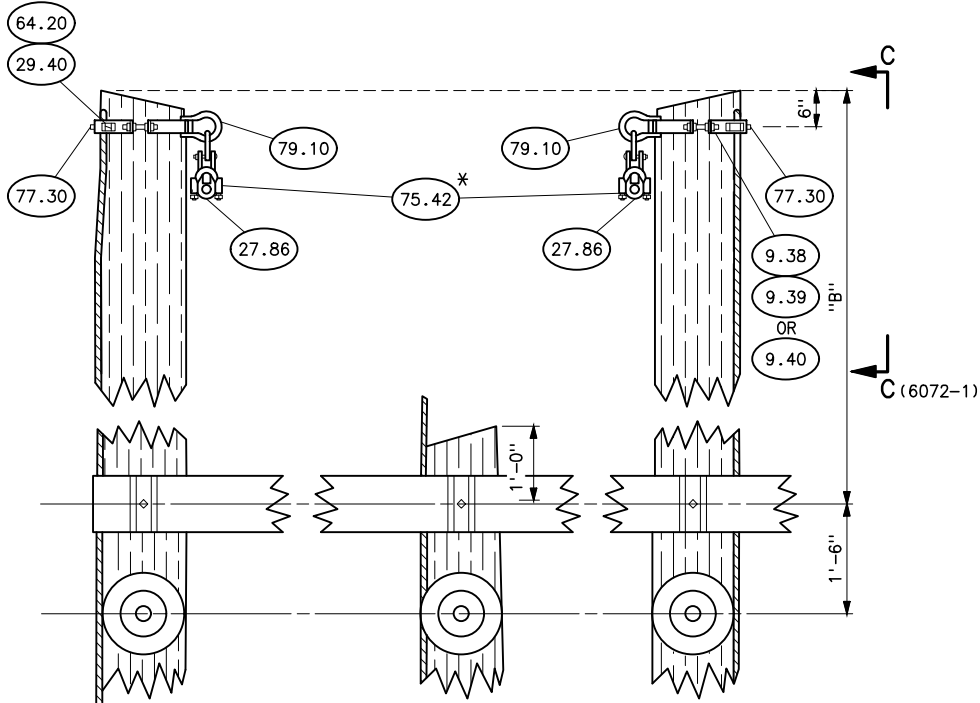
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

A	8/24/26 A7-KR	HISTORICAL REFERENCE
SUPERSEDES DWG NO. 41 6072A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS 69 AND 115KV TWO & THREE POLE STRUCTURES OVERHEAD GROUND WIRE DETAILS (SHEET 1 OF 2)		
DESIGNED <u>BUREC</u> _____		APPROVED <u>ROSS M. CLARK</u> _____ ELECTRICAL ENGINEERING MANAGER
C-A	MAY 28, 1944	41 6072-

Plotted By: court Aug 25, 2026- 1:19pm
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TYPE 3T STRUCTURE (ANGLE)
WITH OVERHEAD GROUND WIRE
(SEE TABLE FOR DIMENSION "B")



SUSPENSION ASSEMBLY
TYPE 3T STRUCTURE (TANGENT)
WITH OVERHEAD GROUND WIRE
(SEE TABLE FOR DIMENSION "B")

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

LIST OF MATERIALS

NEW ITEM NO.	QUANTITY								DESCRIPTION	
	HS-HA HSB-HTR	HS-HA			3A-3AB-3AT	3T				3DE
		TENSION	DEAD	END		TANGENT	ANGLE	TENSION		DEAD END
75.40	2*	-	-		2	2*	2	-	-	ARMOR RODS, PREFORMED FOR 3/8" HS STEEL
9.20	-	2	2		3	-	3	2	2	FOUR WAY STRAIN BAND, DWG 41 6030
9.38, 9.39 OR 9.40	2	-	-		-	2	-	-	-	POLE TOP BAND-LESS SHACKLE, DWG 41 6034
27.30	-	-	-		3	-	3	-	-	6"-3 BOLT, SMOOTH GROOVE GUY CLAMP
29.40	2	-	-		-	2	-	-	-	CLIP, GROUND WITH 3/8"x1 1/2" CARRAGE BOLT, DWG 41 6034
27.85 OR 27.86	2	-	-		2	2	2	-	-	SUSPENSION CLAMP WITH 2 1/4" LINK FOR OVERHEAD GROUND WIRE
29.50	-	2	2		3	-	3	2	2	GROUND, CLIP WITH 3/4"x2 1/2" CONE HEAD BOLT, DWG 41 6030
35.20	-	4	2		-	-	-	4	2	COMPRESSION TYPE DEAD END FOR OVERHEAD GROUND WIRE
58.11	-	-	-		1	-	1	-	-	CONNECTING LINK PR, 13/16" HOLE, 2 1/2" BOLT, DWG 41 6030
58.12	-	-	-		1	-	1	-	-	CONNECTING LINK PR, 13/16" HOLE, 3 1/2" BOLT, DWG 41 6030
58.13	-	4	2		-	-	-	4	2	CONNECTING LINK PR, 1 1/16" HOLE, DWG 41 6030
64.23	-	2	2		3	-	3	2	2	LOCKNUT FOR 3/4" BOLT
77.30	2	4	4		6	2	6	4	4	1/2"x4" LAG SCREW
79.10	2	-	-		-	2	-	-	-	SHACKLE FOR POLE TOP BAND, DWG 41 6034
79.50	-	-	-		2	-	2	-	-	SHACKLE, TWISTED, DWG 41 6038
93.10	-	-	-		3	-	3	-	-	SHEAVE WHEEL, DWG 41 6030
64.20	2	-	-		-	2	-	-	-	LOCKNUT FOR 3/8" BOLT

GUYING FOR OVERHEAD GROUND WIRE			2-LSGEW	2-LDGEW	2-LSG B OR F	2-LDG B OR F	1-ASG	1-ADG	1-ASG	2-ADG	2-ADG	1-ASG	1-ASG	1-ADG	1-ADG	2-LDGEW	2-LSG B OR F	2-LDG B OR F	
	3.15	-	4	4	2	2	1	1	2	2	3	-	1	1	2	2	4	2	ANCHOR, DWG 40-D-4842
	9.20	-	2	2	-	-	-	1	1	2	-	-	-	1	1	4	-	-	FOUR WAY STRAIN BAND, DWG 41 6030
	27.30	-	3	12	4	6	2	3	5	6	8	-	2	3	5	6	12	4	6"-3 BOLT, SMOOTH GROOVE GUY CLAMP
	29.50	-	2	2	-	-	-	1	1	2	-	-	-	1	1	4	-	-	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT, DWG 41 6030
	58.11	-	4	4	2	2	1	1	2	2	3	-	1	1	2	2	4	2	CONNECTING LINK PR, 13/16" HOLE, 2 1/2" BOLT, DWG 41 6030
	64.23	-	2	2	-	-	-	1	1	2	-	-	-	1	1	4	-	-	LOCKNUT FOR 3/4" BOLT
	70.10	-	2	2	1	1	1	1	2	2	3	-	1	1	2	2	4	1	GUY PROTECTOR*
	75.30	-	4	-	2	-	1	-	1	-	1	-	1	-	1	-	2	-	ANCHOR ROD, THIMBLE EYE
	75.31	-	-	4	-	2	-	1	1	2	2	-	-	1	1	2	4	-	ANCHOR ROD, TWIN EYE
	77.30	-	4	4	-	-	-	2	2	4	-	-	-	2	2	8	-	-	1/2"x4" LAG SCREW
	82.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7/16" SIEMENS-MARTIN, GALV STEEL STRAND
	93.10	-	4	4	2	2	1	1	2	2	3	-	1	1	2	2	4	2	SHEAVE WHEEL, DWG 41 6030
	91.22	-	4	4	-	-	-	2	2	4	-	-	-	2	2	8	-	-	WASHER, ROUND FLAT 1 3/8" O.D. 9/16" HOLE

"A" AND "B" DIMENSIONS				
TYPE OF STRUCTURE	30° PROTECTIVE ANGLE		39° PROTECTIVE ANGLE	
	DIMENSION "A"	DIMENSION "B"	DIMENSION "A"	DIMENSION "B"
HS	6'-6"		3'-0"	
HA	6'-6"		3'-0"	
HTR	6'-6"		3'-0"	
HSB	7'-8"		7'-8"	
3AT		10'-0"		5'-6"
3T		10'-0"		5'-6"

NOTES

1. THE GUYING QUANTITIES GIVEN IN THE 'LIST OF MATERIAL' TABLE ARE IN ADDITION TO THOSE GIVEN ON DRAWINGS 41 6051, 41 6070 AND 41 6073.
2. * TO BE USED ONLY WHEN SPECIFIED.
3. FOR LINE ANGLES UP TO AND INCLUDING 30°, USE SUSPENSION CLAMP ITEM NO. 27.86. USE PREFORMED ARMOR RODS ITEM NO. 75.42 ONLY WHEN SPECIFIED.
4. FOR LINE ANGLES GREATER THAN 30°, USE LARGE ANGLE SUSPENSION CLAMP ITEM NO. 27.85 WITH PREFORMED ARMOR RODS ITEM NO. 75.42.

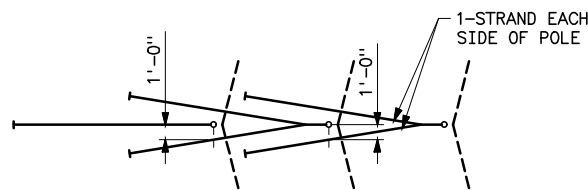
SUPERSEDES DWG NO. 41 6072A (IN PART)

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

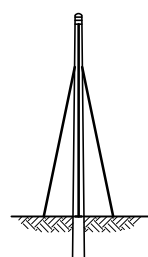
TRANSMISSION LINE STANDARDS
69 AND 115KV
TWO & THREE POLE STRUCTURES OVERHEAD
GROUND WIRE DETAILS (SHEET 2 OF 2)

DESIGNED BUREC _____ APPROVED ROSS M. CLARK
ELECTRICAL ENGINEERING MANAGER

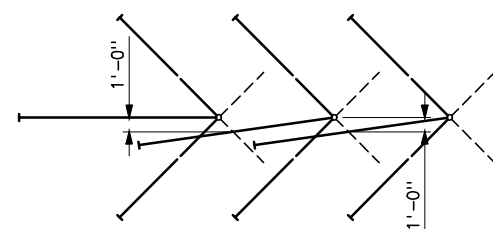
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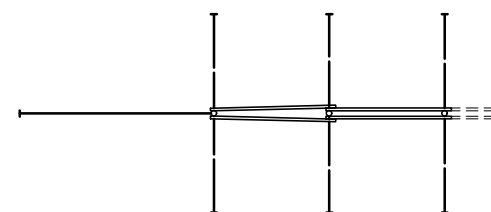
FIVE ANGLE GUYS
5-AG
FIGURE NO. 1



THREE GUYS EACH WAY
3-LGEW
FIGURE NO. 2



THREE ANGLE GUYS, THREE LINE GUYS EACH WAY
3-AG; 3-LGEW
FIGURE NO. 3



ONE SIDE GUYS RIGHT OR LEFT; THREE LINE GUYS EACH WAY
1-SG, R OR L; 3-LGEW
FIGURE NO. 5

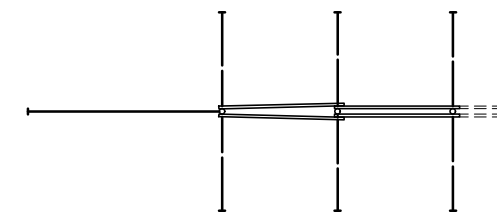
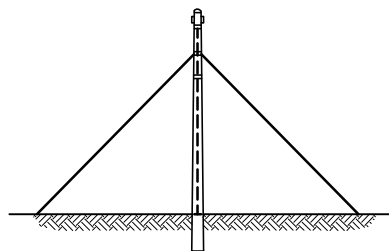
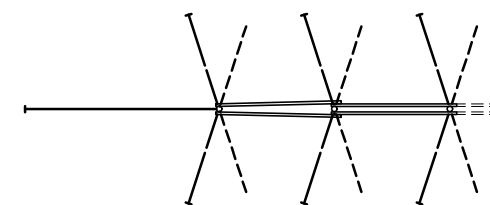
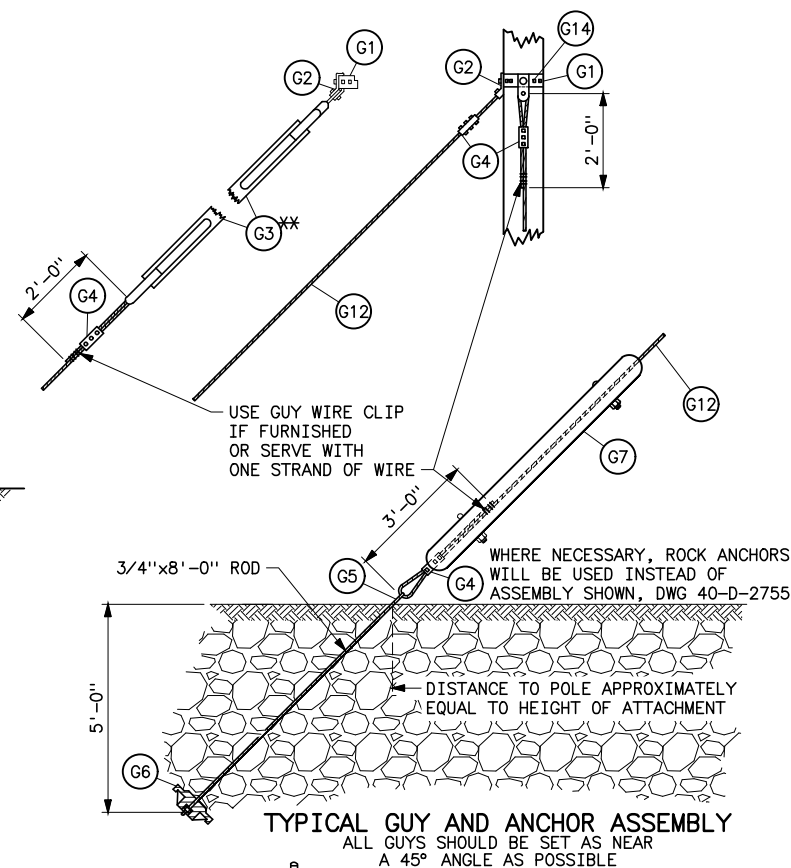
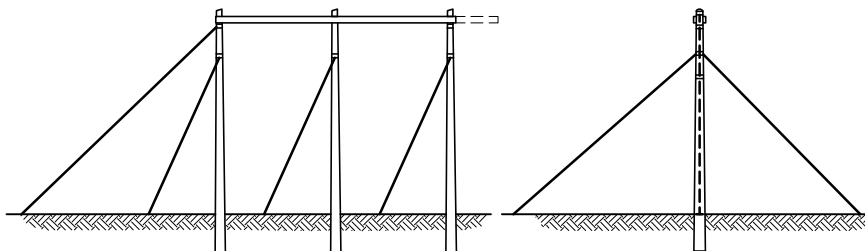


FIGURE NO. 4 ~~***~~



ONE ANGLE GUYS; THREE LINE GUYS EACH WAY
1-AG; 3-LGEW
FIGURE NO. 6



E GUY WIRE CLIP
FURNISHED
SERVE WITH
E STRAND OF WIR

WHERE NECESSARY, ROCK ANCHORS
WILL BE USED INSTEAD OF
ASSEMBLY SHOWN, DWG 40-D-2755

▲— DISTANCE TO POLE APPROXIMATELY

TYPICAL GUY AND ANCHOR ASSEMBLY
ALL GUYS SHOULD BE SET AS NEAR
A 45° ANGLE AS POSSIBLE

LIST OF MATERIALS								
ITEM NO.	MATERIAL REQUIRED		QUANTITIES REQUIRED FOR EACH TYPE OF BUYING					
			5-AG FIG NO. 1	3-LGEW FIG NO. 2	3-AG 3-LGEW FIG NO. 3	1-SGEW 3-LGEW FIG NO. 4	1-SG, R OR L 3-LGEW FIG NO. 5	1-AG 3-LGEW FIG NO. 6
G1	"UNIVERSAL" POLE BANDX		—	—	—	5	4	4
G2	GUY CLIP		3	6	9	8	7	7
G3	WOOD GUY INSULATORXX CONNECTING LINK AND GUY THIMBLE		3	6	9	8	7	7
G4	GUY CLAMP-6" 3 BOLT NELA STD		8	12	18	16	14	14
G5	ANCHOR ROD	THIMBLEYE	5	6	9	8	7	7
G5a		TWIN EYE	—	—	—	—	—	—
G6	ANCHOR PLATE DWG 40-D-259		5	6	9	8	7	7
G7	GUY PROTECTOR		5	6	9	8	7	7
G12	GUY CABLE 7/16" SM FOR 25' – POLE		160	185	280	250	220	220
	FOR 30' – POLE		195	230	345	300	270	270
	FOR 35' – POLE		225	270	415	360	315	315
	FOR 40' – POLE		260	310	465	415	370	370
	FOR 45' – POLE		295	350	525	470	405	405
	FOR 50' – POLE		325	390	585	520	460	460
	FOR 55' – POLE		360	430	645	570	500	500
	FOR 60' – POLE		395	470	705	630	550	550
	FOR 65' – POLE		420	500	750	670	590	590
WHEN USING WOOD GUY INSULATORS DEDUCT THIS AMOUNT OF CABLE FROM ANY GIVEN LENGTH ABOVE			25	50	75	65	60	60
G14	1/2"x4" LAG SCREW		—	—	—	10	8	8

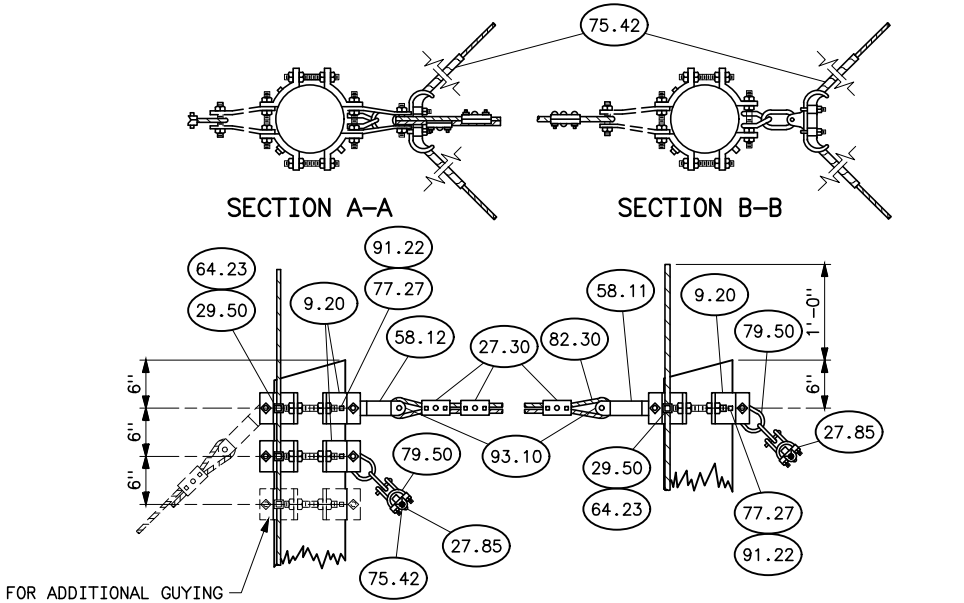
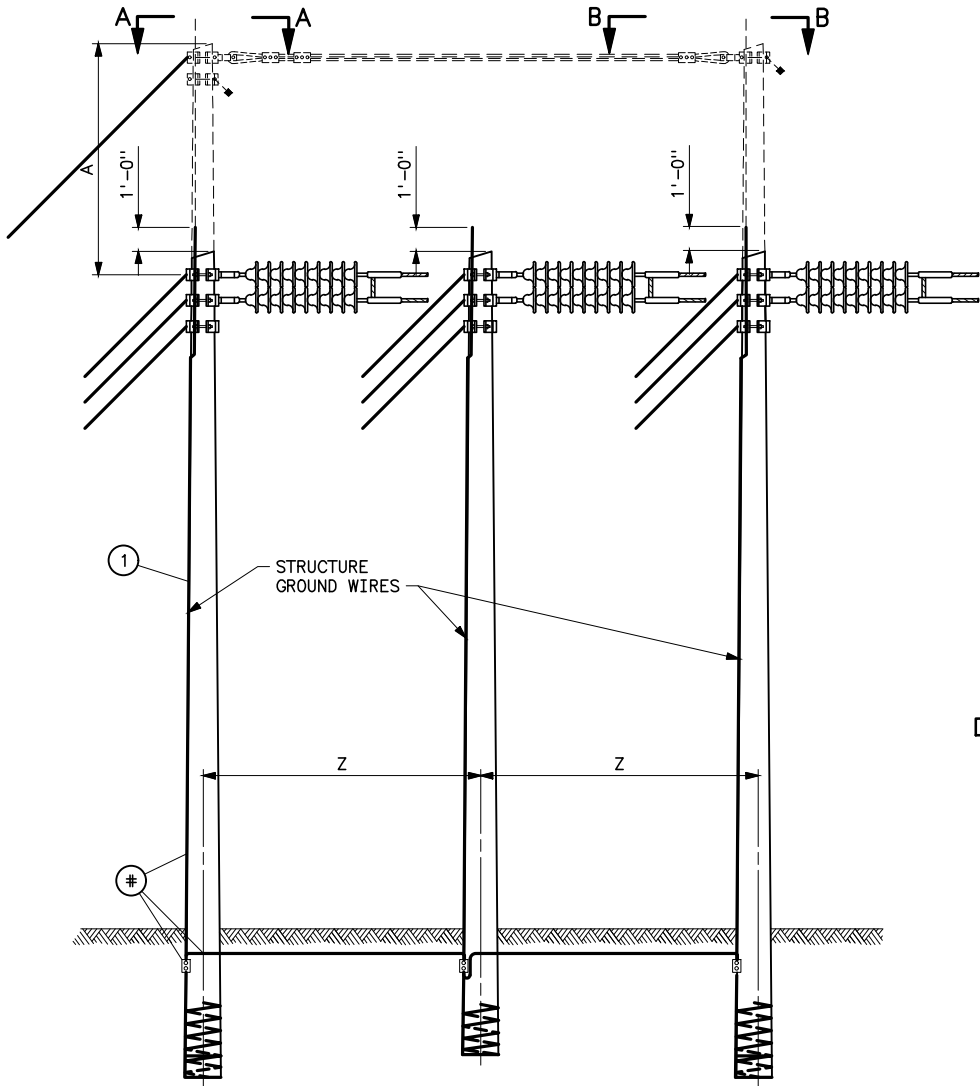
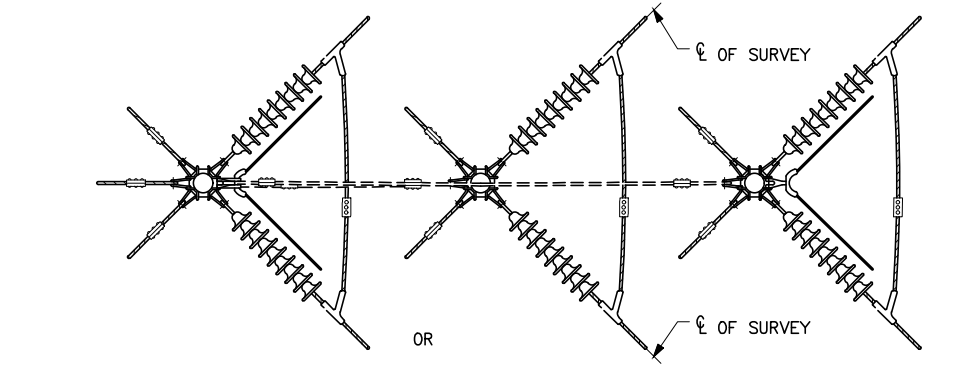
NOTES

1. * THE POLE BANDS LISTED ABOVE ARE FOR GUYING ONLY AND ARE REQUIRED IN ADDITION TO THE BANDS THAT HOLD THE INSULATOR ASSEMBLIES. BANDS TO WHICH INSULATOR ASSEMBLIES ARE ATTACHED ARE CONSIDERED LINE MATERIAL AND ARE ACCOUNTED FOR ON STRUCTURE DRAWINGS.
2. SEE INDIVIDUAL STRUCTURES DRAWINGS FOR HEIGHT OF GUY ATTACHMENT ON POLE.
3. LINE CONDUCTORS ARE INDICATED BY DOTTED LINES ON PLAN VIEWS.
4. ** TO BE USED ONLY WHERE SPECIFIED.
5. *** WHERE SIDE GUYS EACH WAY ARE REQUIRED ON 3T STRUCTURES, DROP SIDE GUYS TO POSITION INDICATED BY DOTTED LINES IN FIGURE NO. 4. BORE 3/8" HOLE IN POLE ON OPPOSITE SIDES OF POLE BAND AND SCREW IN 1/2"x4" LAG SCREW.
6. FOR STUB GUY MATERIAL SEE DWG 41 6052.
7. FOR HEAVY GUYING SEE DWG 41 6070.
8. FOR DETAILS OF UNIVERSAL POLE BAND (G1) AND GUY CLIP (G2) SEE DWG 40-D-3179.

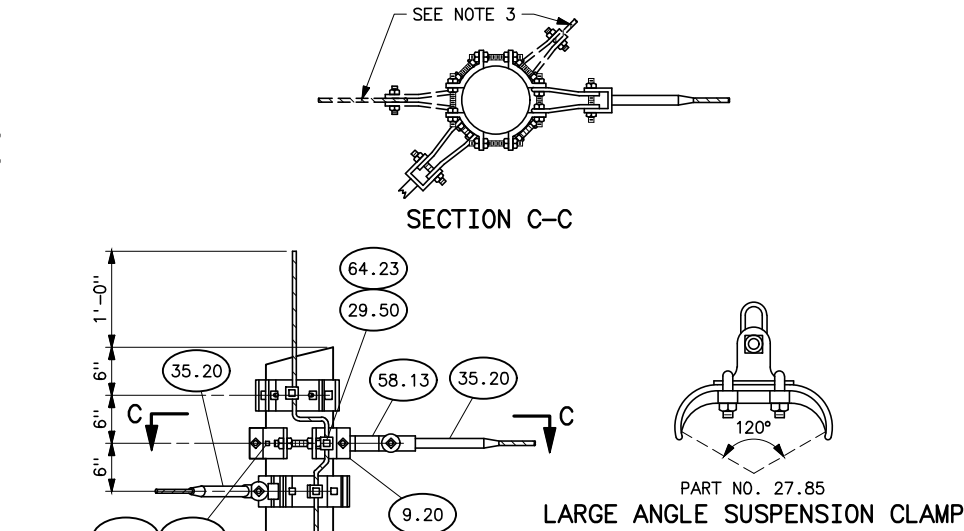
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-3166		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS GUY ARRANGEMENT-ASSEMBLY 3-POLE STRUCTURES LIGHT GUYING		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
6 A-	DECEMBER 4, 1979	41 6073

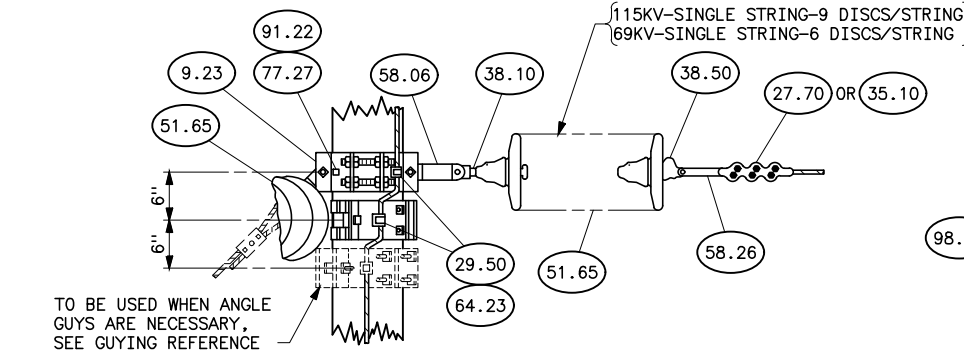
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IMAGES:



DETAIL OF OVERHEAD GROUND WIRE (SUSPENSION)
(ANGLES OF 45° TO 60° ONLY) AND POLE TIE ATTACHMENT



DETAIL OF OVERHEAD GROUND WIRE IN TENSION



DETAIL OF INSULATOR ATTACHMENT-SINGLE STRING

OVERHEAD GROUND WIRE IN SUSPENSION							
VOLTAGE	A		Z				
	WITH OGW	W/OUT OGW	ANGLE TURNED IN DEGREES				
			30° PROTECTIVE ANGLE	39° PROTECTIVE ANGLE	45-49	50-59	60-69 70-79 80-90
69KV	10'-0"	5'-6"	1'-0"	11'-6"	12'-0"		
115KV	10'-0"	5'-6"	1'-0"	13'-6"	14'-0"		USE OGW IN TENSION

OVERHEAD GROUND WIRE IN TENSION 30° PROTECTIVE ANGLE							
VOLTAGE	A		Z				
	WITH OGW	30° PROTECTIVE ANGLE	ANGLE TURNED IN DEGREES				
			45-49	50-59	60-69	70-79	80-90
69KV	10'-0"		15'-0"	17'-0"	19'-0"	21'-0"	23'-0"
115KV	10'-0"		16'-6"	18'-6"	20'-6"	22'-6"	24'-6"

OVERHEAD GROUND WIRE IN TENSION 39° PROTECTIVE ANGLE							
VOLTAGE	A		Z				
	WITH OGW	39° PROTECTIVE ANGLE	ANGLE TURNED IN DEGREES				
			45-49	50-59	60-69	70-79	80-90
69KV	5'-6"		12'-6"	13'-0"	13'-6"	14'-0"	15'-0"
115KV	5'-6"		14'-6"	15'-0"	16'-0"	17'-0"	18'-0"

DOUBLE INSULATOR STRING ASSEMBLY

REFERENCE DRAWINGS
GROUNDING DETAILS _____ 41 1012
GUY ARRANGEMENT, 3-POLE STRUCTURE, HEAVY GUYING _____ 41 6070
GUY ARRANGEMENT, 3-POLE STRUCTURE, LIGHT GUYING _____ 41 6073
GUY ARRANGEMENT, FOR TYPE 3AT STRUCTURES WITH OVERHEAD GROUND WIRES _____ 41 6099

STRUCTURE MATERIAL						
PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRE		W/OUT OVERHEAD GROUND WIRE			
	69KV	115KV	69KV	115KV		
1	3	3	3	3	POLE	
9.23	6	6	6	6	BAND, FOUR-WAY STRAIN, TYPE B	6031
29.50	6	6	6	6	CLIP, GROUND	6030
58.06	6	6	6	6	LINK, CONNECTING, PAIR	6031
64.23	6	6	6	6	LOCKNUT, FOR 3/4" BOLT	
77.27	12	12	12	12	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.22	12	12	12	12	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
	GROUNDING MATERIAL, PART NO'S. AND DESCRIPTION SHOWN ON DWG 40-D-4979					

INSULATOR MATERIAL						
	SINGLE STRING		DOUBLE STRING #		DESCRIPTION	DWG NO. 41
	69KV	115KV	69KV	115KV		
27.70 OR 35.10	6	6	6	6	CLAMP, STRAIN WITH CLEVIS FITTING FOR CONDUCTOR	
					DEAD END, COMPRESSION TYPE, FOR CONDUCTOR	
38.10	6	6	—	—	CONNECTOR, BALL EYE	1003
38.50	6	6			EYE SOCKET, 13/16" EYE, THICKNESS OF EYE-END 3/4" MIN, 13/16" MAX	
27.51 OR 31.20	3Δ	3Δ	3Δ	3Δ	CLAMP, PARALLEL GROOVE, 3-BOLT FOR CONDUCTOR	
					COMPRESSION JUMPER CONNECTOR FOR CONDUCTOR	
51.65	36	54	72	108	INSULATORS, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1002
58.26 OR 58.27 OR 58.28 OR 59.31	6	6	6	6	LINK, EXTENSION (STRAIN CLAMP OR DEAD END ATTACHMENT), SEE DWG NO. 41 1003 FOR DIMENSION OF LINKS)	1003
98.56	—	—	6	6	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS.	1004

OVERHEAD GROUND WIRE MATERIAL						
	SUSPENSION		TENSION		DESCRIPTION	DWG NO. 41
	69KV	115KV	69KV	115KV		
9.20	3	3	6	6	BAND, FOUR-WAY STRAIN	6030
27.30	3	3	3	3	CLAMP GUY, 6", 3-BOLT	
27.85	2	2	—	—	CLAMP, SUSPENSION, LARGE ANGLE, WITH 2 1/4" LINK	
29.50	3	3	6	6	CLIP, GROUND	6030
35.20	—	—	4	4	DEAD-END, COMPRESSION TYPE, FOR OGW	
58.11	1	1	1	1	LINK, CONNECTING, PAIR	6030
58.12	1	1	1	1	LINK, CONNECTING, PAIR	6030
58.13	—	—	4	4	LINK, CONNECTING, PAIR	6030
64.23	3	3	6	6	LOCKNUT, FOR 3/4" BOLT	
77.27	6	6	12	12	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.50	2	2	—	—	SHACKLE, TWISTED	6038
82.30	✖	✖	✖	✖	STEEL STRAND, 7-WIRE, 7/16", SIEMENS-MARTIN	
91.22	6	6	12	12	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	3	3	3	3	SHEAVE WHEEL, FOR 7/16, SIEMENS-MARTIN STRAND	6030
75.42	2 SETS		—	—	ROD, ARMOR, PREFORMED	

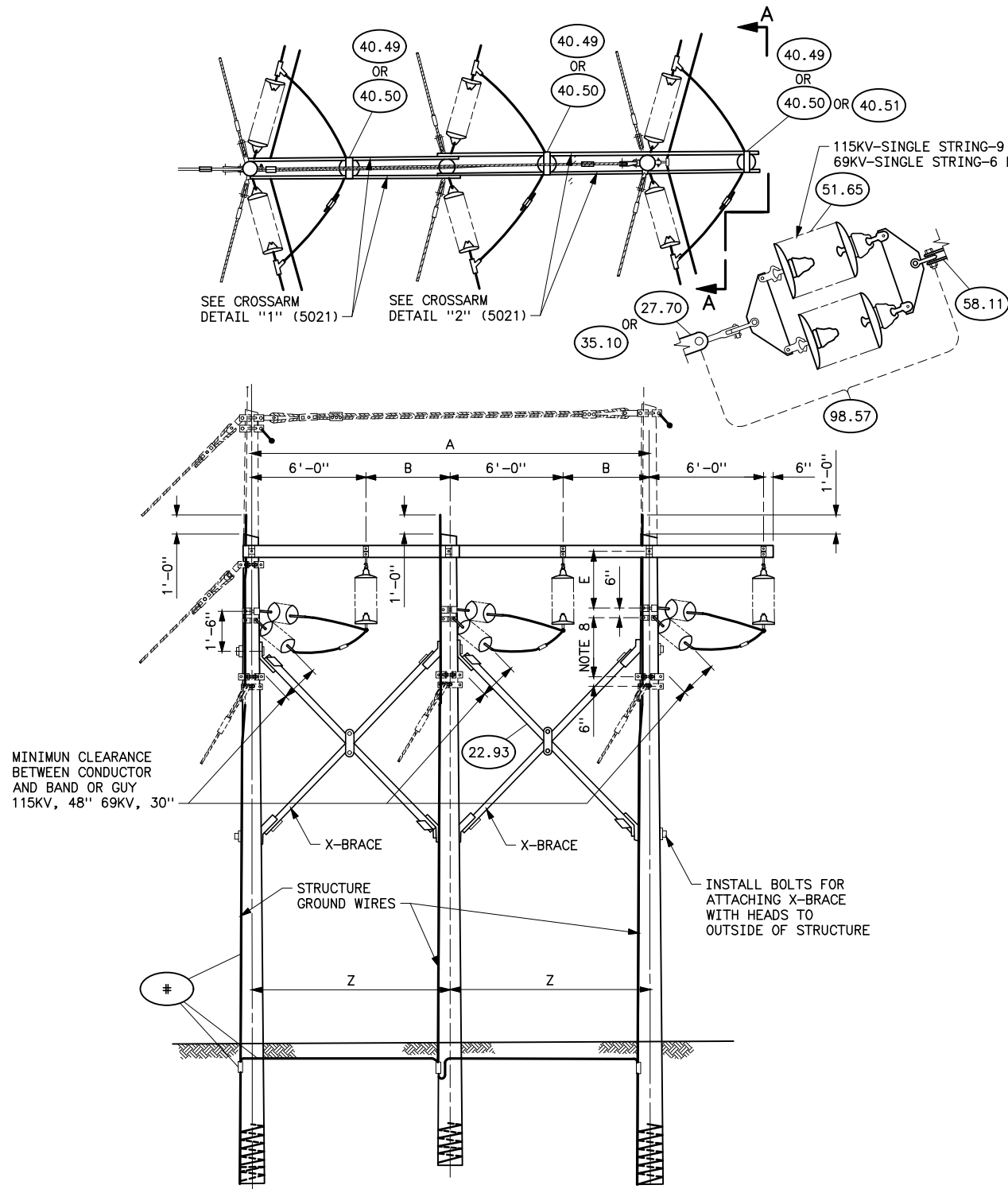
NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. * LENGTH OF STRAND EQUALS 4Z + 5 FT.
3. ** CLEARANCE BETWEEN ANY GUY AND ANY PHASE CONDUCTOR SHALL BE NOT LESS THAN 48 INCHES FOR 115KV LINES, AND SHALL BE NOT LESS THAN 30 INCHES FOR 69KV LINES.
4. # USE ONLY WHEN SPECIFIED.
5. POLES SHALL BE GIVEN RAKE OF 1/4 INCH FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN.
6. Δ MATERIAL NOT REQUIRED WHEN COMPRESSION-TYPE DEAD ENDS ARE USED.

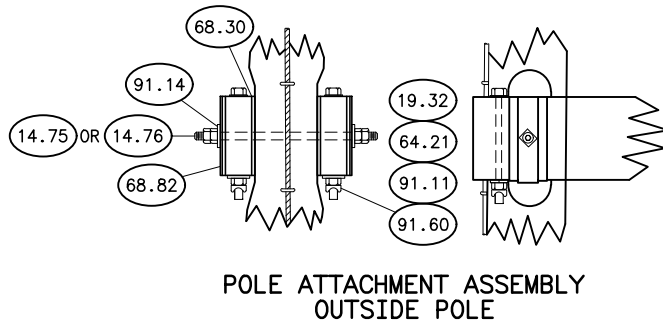
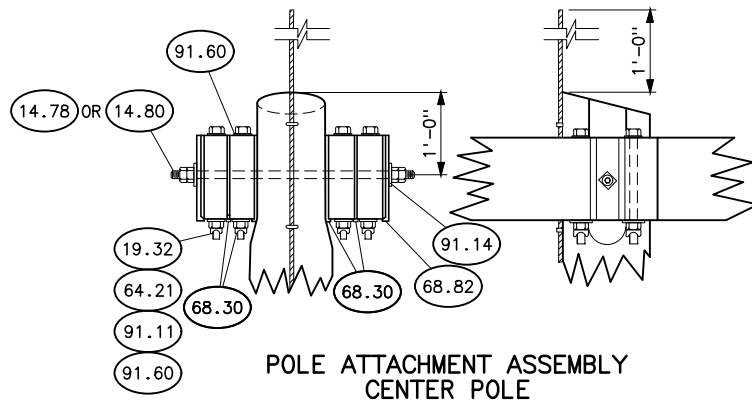
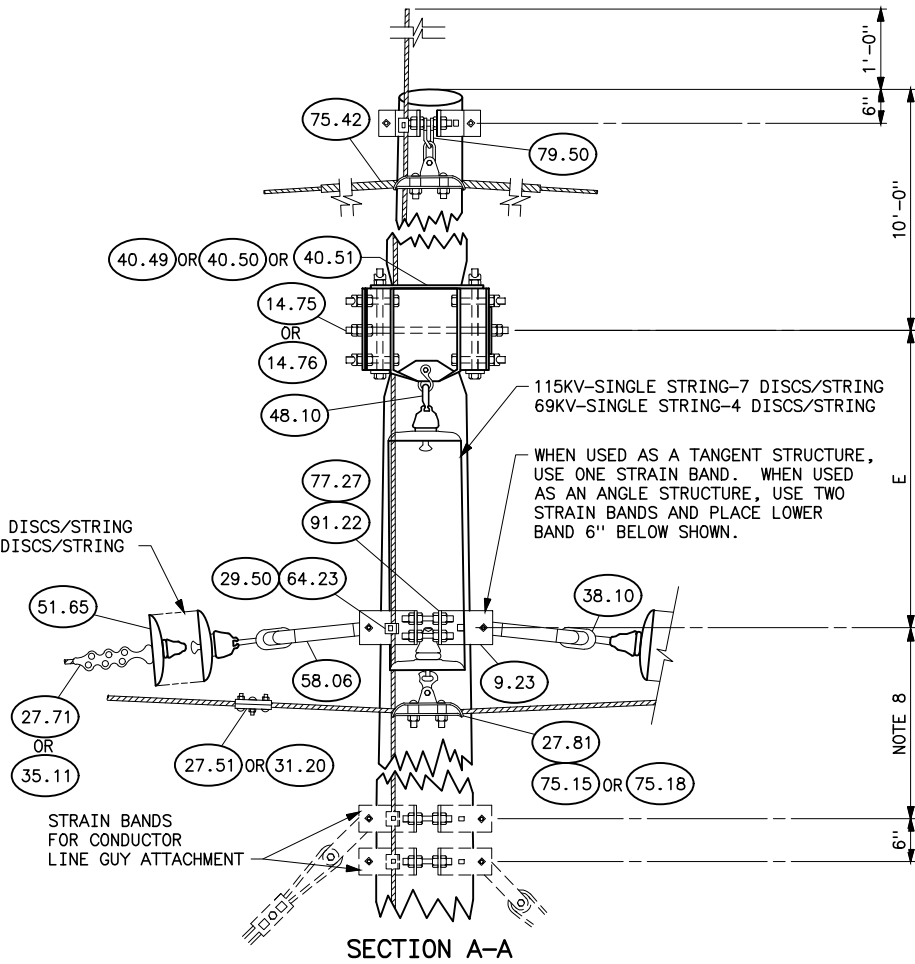
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6118 (3TA-1)

C	8/25/2026 A7-KR	HISTORICAL REFERENCE	
	SUPERSEDES DWG NO. 40-D-4812		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AT-69KV AND 115KV LARGE ANGLE STRUCTURE			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
A _F	AUGUST 6, 1979	41	6074

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115KV-SINGLE STRING-9 DISCS/STRING
69KV-SINGLE STRING-6 DISCS/STRING



NOTES

1. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE "B" POLE TOP BAND IS USED, DWG 41 6035.
2. * FOR LINE ANGLES UP TO AND INCLUDING 30°, USE SUSPENSION CLAMP PART NO. 27.86.
3. * FOR LINE ANGLES GREATER THAN 30°, USE LARGE SUSPENSION CLAMP PART NO. 27.85.
4. ** COMPRESSION JOINTS OR COMPRESSION REPAIR SLEEVES MAY BE USED IN PLACE OF ARMOR ROD SET IN JUMPER CONNECTIONS FOR CONDUCTORS 397,500 CIRCULAR MILS OR LARGER. WHERE COMPRESSION-TYPE DEAD ENDS ARE USED, THE JUMPERS SHALL BE ONE CONTINUOUS PIECE BETWEEN THE COMPRESSION-TYPE JUMPER TERMINALS.
5. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
6. Ø GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.
7. REFER TO 41 6075-2 FOR STRUCTURE MATERIAL, INSULATOR MATERIAL, AND OVERHEAD GROUND WIRE MATERIAL TABLES.
8. 2'-6" WITH X-B, 2'-0" WITHOUT X-B.

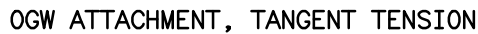
REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
DRILLING AND GAINING DETAILS WITH OGW	41 6021
GUY ARRANGEMENT FOR TYPE 3T WITH OGW	41 6054
DRILLING AND GAINING DETAILS WITHOUT OGW	41 6066
GUY ARRANGEMENT 3-POLE STRUCTURE	
HEAVY GUYING	41 6070
GUY ARRANGEMENT 3-POLE STRUCTURE	
LIGHT GUYING	41 6073

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

LIST OF DIMENSIONS					
DIMENSIONS	Z	A	B	E	
				69KV	115KV
STRUCTURE TYPE 3T	12'-0"	24'-0"	6'-0"	3'-0"	5'-0"
STRUCTURE TYPE 3T-1	14'-6"	29'-0"	8'-6"	3'-0"	5'-0"
STRUCTURE TYPE 3T-2	18'-0"	36'-0"	12'-0"	3'-0"	5'-0"

A	8/24/26 A7-KR	HISTORICAL REFERENCE
SUPERSEDES DWG NO. 41 6075B (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE 3T 69 AND 115KV 3-POLE TENSION STRUCTURE (SHEET 1 OF 2)		
DESIGNED BUREC	APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER	
A7	MAY 28, 2014	41 6075-1



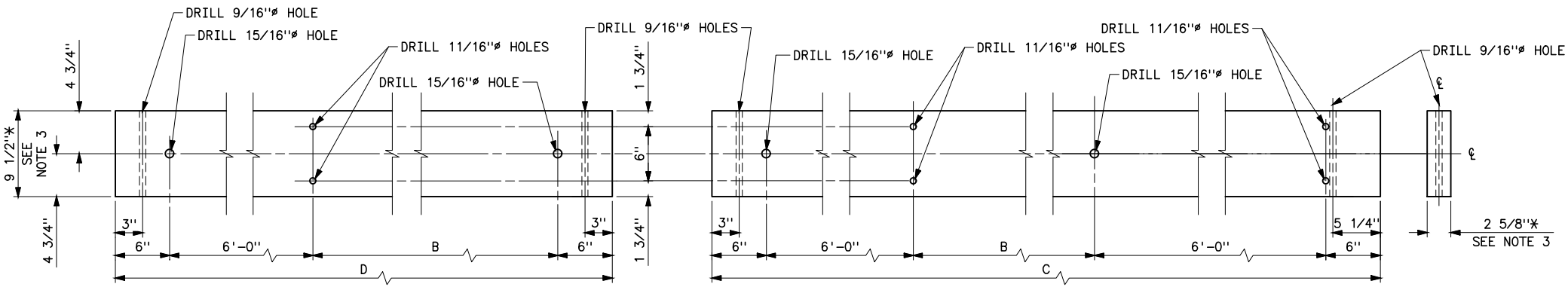
INSULATOR MATERIAL						
PART NO.	SINGLE STRING		DOUBLE STRING		DESCRIPTION	DWG NO. 41
	69KV	115KV	69KV	115KV		
27.70 OR 35.10	—	—	6	6	CLAMP, STRAIN, WITH CLEVIS FITTING, FOR CONDUCTOR	
					DEAD END, COMPRESSION TYPE, FOR CONDUCTOR	
27.71 OR 35.11	6	6	—	—	CLAMP, STRAIN, WITH SOCKET FITTING, FOR CONDUCTOR	1002
					DEAD END, COMPRESSION TYPE, WITH SOCKET FITTING	1002
27.51 OR 31.20	3	3	3	3	CLAMP, PARALLEL GROOVE, 3-BOLT FOR CONDUCTOR	
					COMPRESSION JUMPER CONNECTOR FOR CONDUCTOR **	
27.81	3	3	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING	1000
38.10	6	6	—	—	CONNECTOR, BALL EYE	1003
48.10	3	3	3	3	HOOK, SUSPENSION	1003
51.65	48	75	84	129	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	
75.15 OR 75.18	3	3	3	3	ROD, ARMOR, TAPERED, SINGLE SUPPORT FOR ACSR **	1000
					ROD, ARMOR, PREFORMED, SINGLE SUPPORT FOR ACSR **	
95.57	—	—	6	6	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS	1004

NOTE

1. REFER TO 41 6075-2 FOR LIST OF DIMENSIONS, NOTES AND REFERENCE DRAWINGS.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

A	8/18/26 A7-KR	HISTORICAL REFERENCE
SUPERSEDES DWG NO. 41 6075B (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE 3T 69 AND 115KV 3-POLE TENSION STRUCTURE (SHEET 2 OF 2)		
DESIGNED BUREC _____		APPROVED ROSS M. CLARK _____ ELECTRICAL ENGINEERING MANAGER
DATE	MAY 28, 2014	6075-2

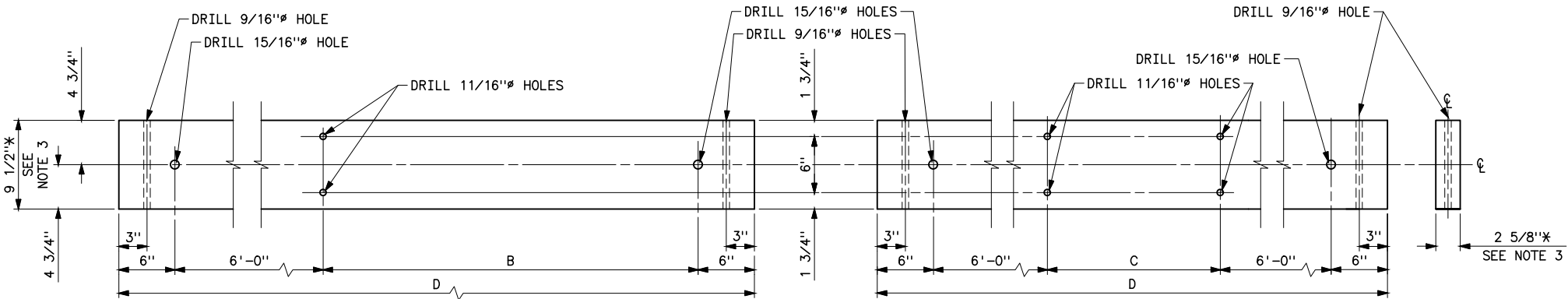


DETAIL 1, 2 5/8"x9 1/2"xD
SEE NOTE 2

DETAIL 2, 2 5/8"x9 1/2"xC
SEE NOTE 2

DIMENSIONS	B	C	D
STRUCTURE TYPE 3T	6'-0"	19'-0"	13'-0"
STRUCTURE TYPE 3T-1	8'-6"	21'-6"	15'-6"
STRUCTURE TYPE 3T-2	12'-0"	25'-0"	19'-0"

CROSSARM DETAILS FOR 3T, 3T-1 AND 3T-2 STRUCTURES



DETAIL 3, 2 5/8"x9 1/2"xD
SEE NOTE 2

DETAIL 4, 2 5/8"x9 1/2"xD
SEE NOTE 2

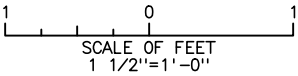
DIMENSIONS	B	C	D
STRUCTURE TYPE 3TX	18'-0"	12'-0"	25'-0"
STRUCTURE TYPE 3TX-1	24'-0"	18'-0"	31'-0"

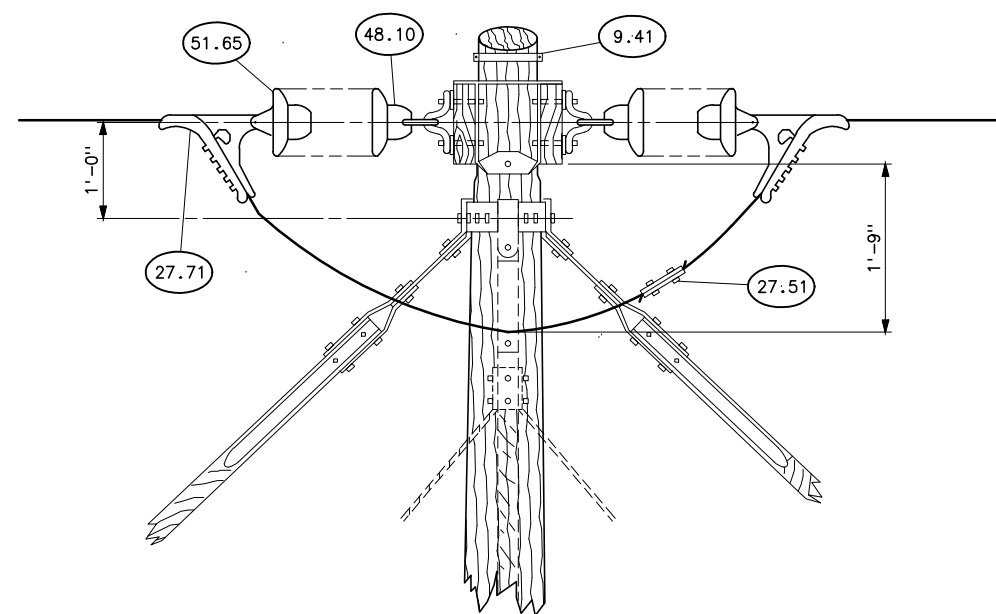
CROSSARM DETAILS FOR 3TX AND 3TX-1 STRUCTURES

- NOTES
- STRUCTURE SUPERCEDED BY TYPE 3TA - SEE DWG 41 6018.
 - TWO CROSSARMS REQUIRED PER STRUCTURE.
 - * - MINIMUM DIMENSIONS AFTER SEASONING AND SURFACING.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

D	8/24/26 A7-KR	HISTORICAL REFERENCE
C	9-24-12 A7-DD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5021		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES CROSS ARM DRILLING DETAILS 69KV & 115KV, 3T & 3TX STRUCTURES		
DESIGNED BUREC _____ APPROVED BUREC _____		
AUGUST 6, 1979	41	6076



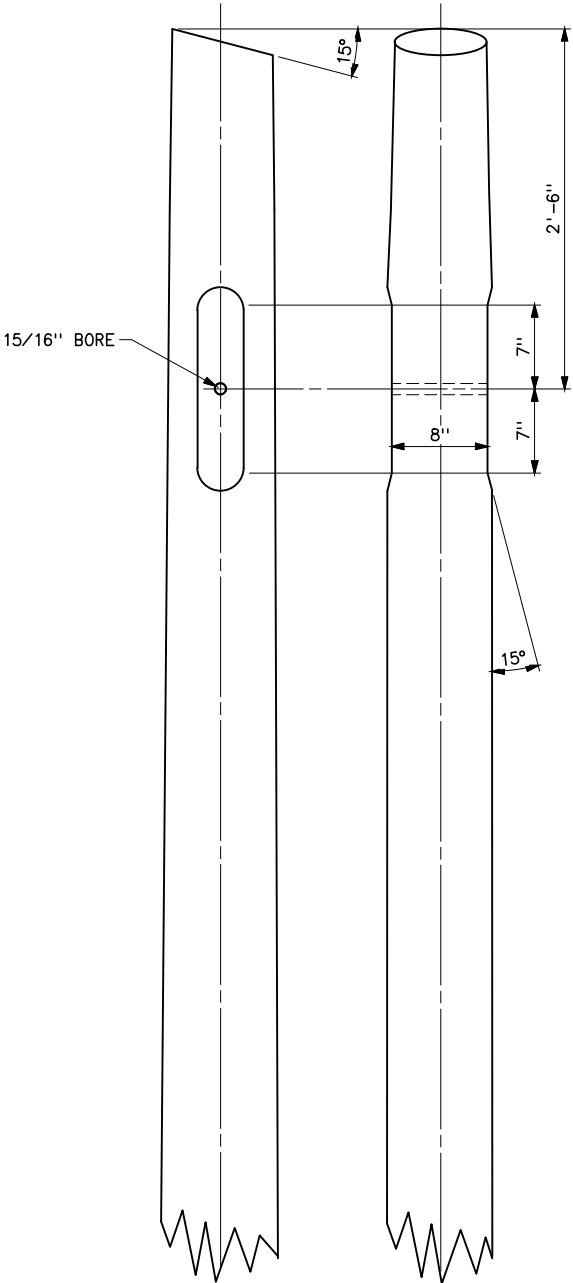


NOTES

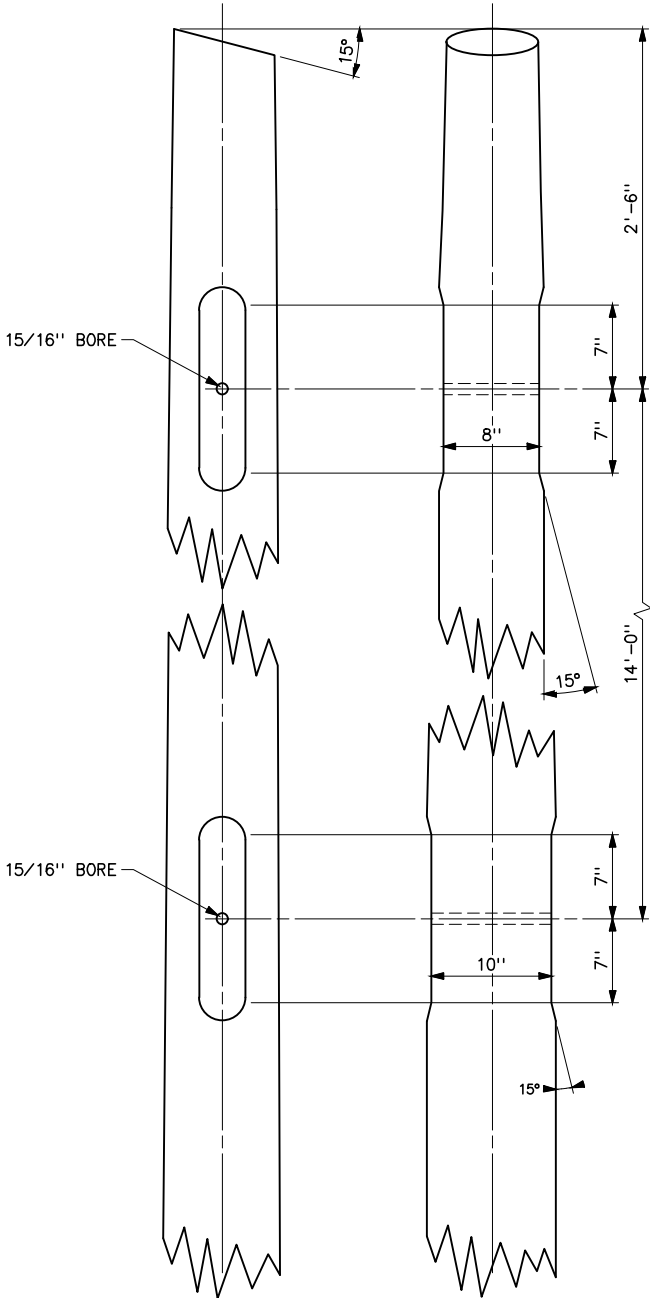
1. Δ - FOR OGW ATTACHMENT DETAILS SEE DWG 41 6084.
2. FOR POLE GROUNDING DETAILS SEE DWG 41 1012.

B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDED DWG NO. 40-D-2866		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS LONG SPAN STRUCTURE TYPE HT- 33 - 44KV		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A E	FEBRUARY 13, 1981	41
		6077

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HS, HA AND HST STRUCTURES



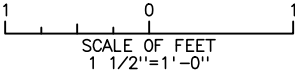
HTR STRUCTURES

NOTES

1. OPPOSITE FACES TO BE GAINED TO SAME WIDTH AND SHALL BE PARALLEL.
2. * - MINIMUM. LOWER GAIN TO BE CUT NOT MORE THAN 1" DEEP ON EACH SIDE.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2955		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES DRILLING & GAINING DETAILS 161KV H-FRAME POLES		
DESIGNED BUREC _____ APPROVED BUREC _____		
41	FEBRUARY 13, 1981	6078



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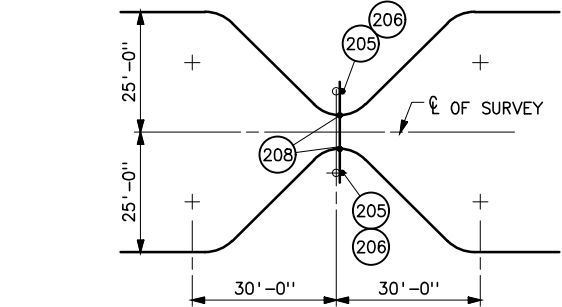


FIGURE 1
STRUCTURES HS AND HTR

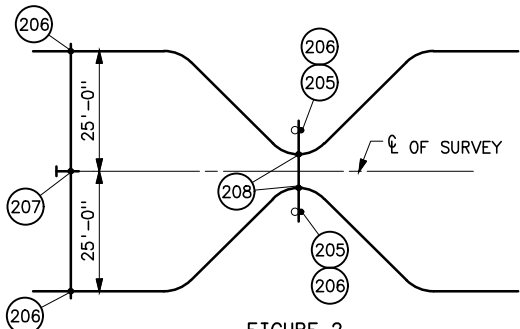


FIGURE 2
STRUCTURE HS WITH LINE GUYS

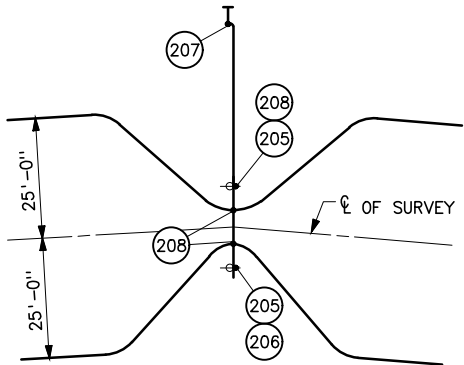


FIGURE 3
ANGLE STRUCTURES HA AND HS

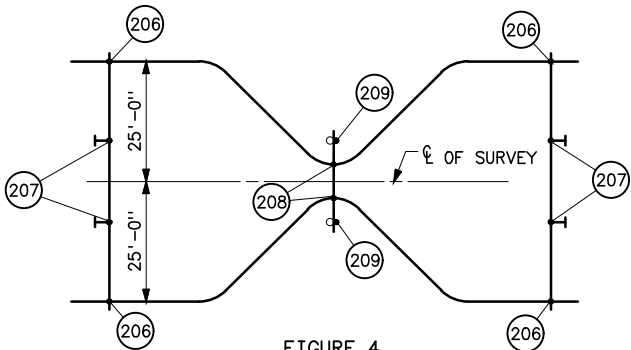


FIGURE 4
STRUCTURE HST

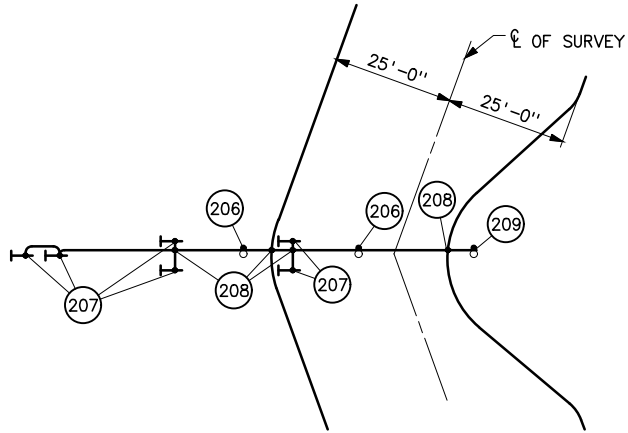


FIGURE 5
STRUCTURES 3A AND 3AB
ANGLES UP TO 45°

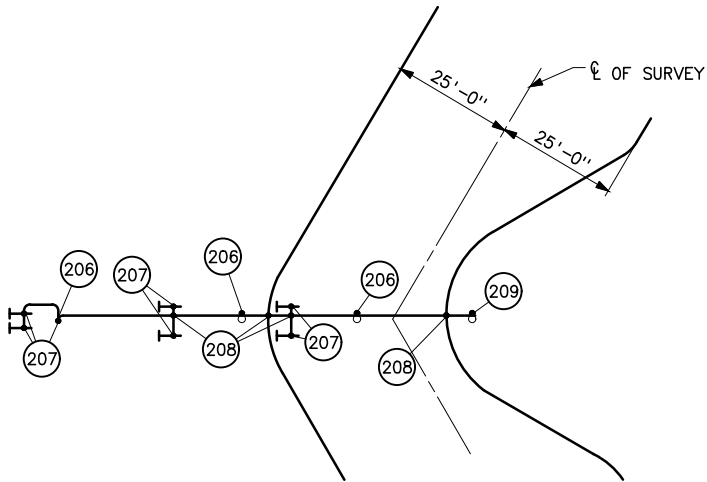


FIGURE 6
STRUCTURES 3A AND 3AB
ANGLES 45° TO 60°

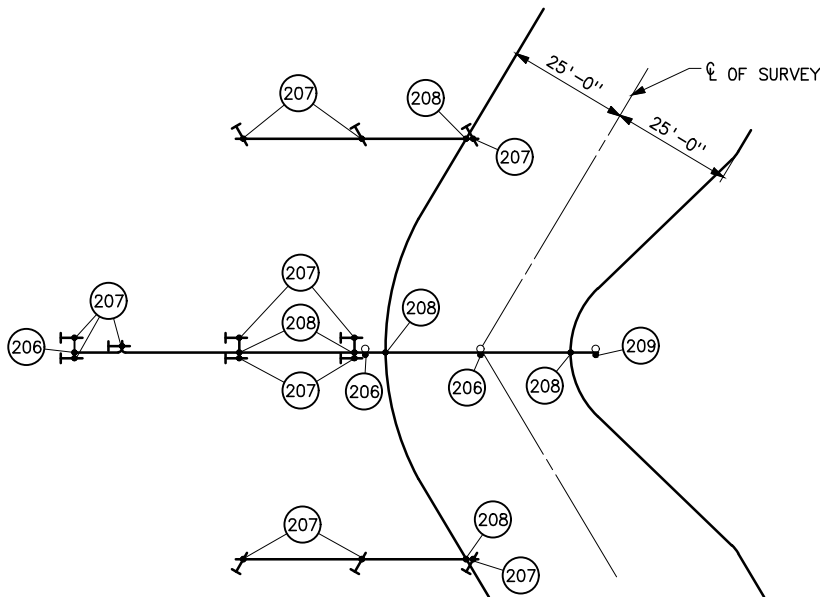


FIGURE 7
STRUCTURE 3AT
ANGLES 60° TO 70°

ITEM NO.	MATERIAL REQUIRED	QUANTITIES REQUIRED															5/16" 3 WIRE, GALV GROUND WIRE PER STRUCTURE	2"x1/2" GALV GROUND WIRE PER STRUCTURE
	STRUCTURE TYPE	HS, HSB	HS, HSB WITH LINE GUYS	HS AND HSB ANGLE	HA	HTR	HST	3A TO 45°	3A OVER 45°	3AB TO 45°	3AB OVER 45°	3AT 60°-70°	3AT 70°-90°	3T (20'-0'')	3T (25'-0'')	3TX		
		FIGURE NUMBER	1	2	3	3	1	4	5	6	5	6	7	8	9	9		
201	3/4" CONE HEAD BOLT GROUND CLIP AND LOCKNUT	-	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-	
203	STAPLES, COPPERWELD 2"x1/2"	32	32	32	32	32	32	48	48	48	48	48	48	48	48	48	48	
204	STAPLES, GALVANIZED STEEL 2"x1/2" 60'-0" POLE	74	74	74	74	74												
205	CONNECTOR 1/4" COPPER TO 5/16" STEEL	2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	
206	2-BOLT PARALLEL GROOVE CLAMP, BOTH SIDES FOR 1/4" COPPER ROD	2	4	1	1	1	4	2	3	2	3	3	5	4	4	3		
207	CLAMP 1/4"x3/4", COPPER ALLOY CADMIUM PLATED	-	1	1	1	1	-	4	6	7	6	7	13	8	8	8	8	
209	CROSS CONNECTOR FOR 2-1/4" COPPER RODS	2	2	3	3	3	2	4	4	4	4	6	2	4	4	6	ITEM NO.	
209	STRAIGHT CONNECTOR FOR 1/4" COPPER ROD	-	-	-	-	-	2	1	1	1	1	1	1	1	1	-	200 204	
202	1/4" CU ROD FOR WRAPPING POLE BUTTS	100	100	100	100	100	100	155	155	155	155	155	155	155	155	155	- -	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 40'-0" POLE	18	68	40	40	18	125	95	100	95	100	190	185	190	220	275	72 56	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 45'-0" POLE	18	68	45	45	18	125	100	105	100	105	195	190	200	230	285	82 60	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 50'-0" POLE	18	68	50	50	18	125	105	110	105	110	200	195	210	240	295	90 66	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 55'-0" POLE	18	68	55	55	18	125	110	115	110	115	205	200	220	250	305	100 70	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 60'-0" POLE	18	68	60	60	18	125	115	120	115	120	210	205	225	255	310	110 74	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 65'-0" POLE	18	68	65	65	18	125	120	125	120	125	215	215	235	265	320	118 78	
	1/4" CU ROD COUNTERPOISE CONNECTIONS FOR 70'-0" POLE	18	68	70	70	18	125	125	130	125	130	220	230	245	275	330	128 84	
COUNTERPOISE LINE SPLICES WILL BE MADE WITH CONNECTOR UNDER ITEM NO. 209.																		

NOTES

1. INSTALL 5/16" STEEL GROUND WIRE ON FACE OF POLE AS INDICATED ON INDIVIDUAL STRUCTURE DRAWINGS AND CONTINUE TO GROUND LINE. (ITEM 200).
2. INSTALL 1/4" COPPER ROD FROM GROUND LINE TO BASE OF POLE, ACROSS BUTT AND WRAP 5 COMPLETE TURNS AROUND BUTT, WITH STAPLE AT EACH HALF TURN AND AT POINTS DIAMETRICALLY OPPOSITE. (ITEMS 202 AND 203).
3. WHERE GROUND WIRE CROSSES UNIVERSAL POLE BAND, IT SHALL BE BONDED WITH 3/4"x2 1/4" SQUARE SHOULDERED CONE HEAD BOLT, GROUND CLIP, NUT AND LOCKNUT AS SHOWN ON THE 'CONNECTION TO UNIVERSAL POLE BAND' DETAIL ON 41 6079-2. (ITEM 201).
4. THE TWO 1/4" CONTINUOUS COUNTERPOISE COPPER RODS SHALL BE BURIED 2'-0" BELOW THE GROUND SURFACE AND 25'-0" FROM EACH SIDE ℓ OF SURVEY UNLESS OTHERWISE INDICATED.
5. THE MATERIAL LISTED ABOVE IS FOR GROUNDING ONLY AND IS REQUIRED IN ADDITION TO THAT ACCOUNTED FOR ON STRUCTURE DRAWINGS.
6. ITEM NO. 205 SHALL BE SEALED WITH COAL-TAR PAINT, IN ACCORDANCE WITH "SPECIFICATIONS FOR COAL-TAR PAINT, CA-50 GRADE", DATED JAN 1, 1947.
7. ITEMS NO. 206 AND 207 SHALL BE SEALED ONLY WHEN COPPER AND GALVANIZED STEEL ARE CLAMPED TOGETHER.
8. ≠-USE 3 GROUND CLIPS IF LINE GUYS ARE SPECIFIED.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

A	8/24/26 A7-KR	HISTORICAL REFERENCE
SUPERSEDES DWG NO. 41 6079A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS GROUNDING AND COUNTERPOISE DETAILS WITH OVERHEAD GROUND WIRE-161KV (SHEET 1 OF 2)		
DESIGNED BUREC _____ APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER		
CAL	MAY 28, 2014	41 6079-1

Plotted By: court Aug 25, 2026- 1:27pm
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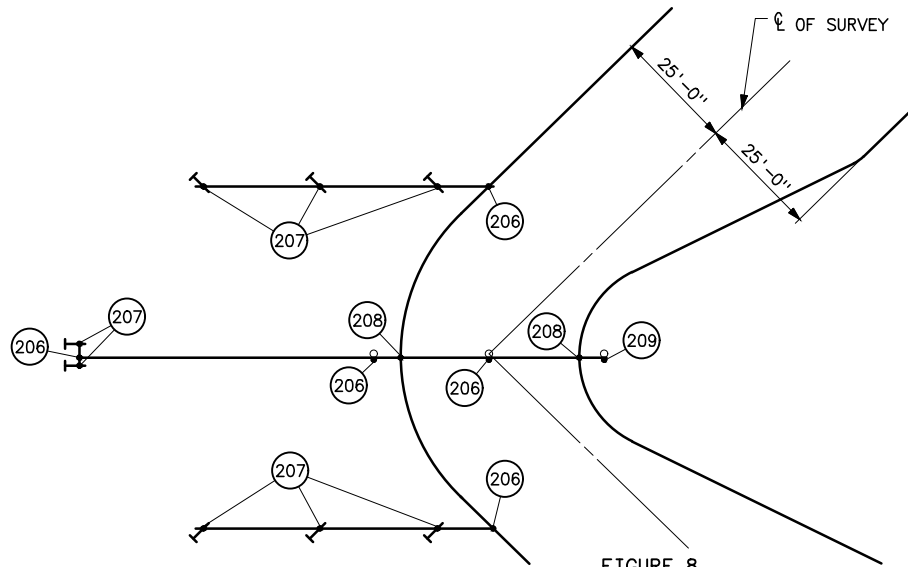


FIGURE 8
STRUCTURE 3AT
ANGLES 70° TO 90°

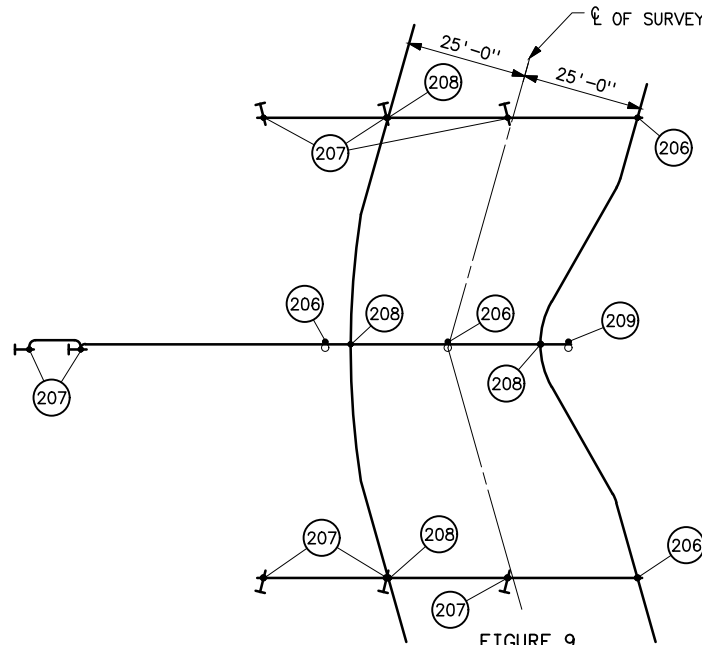


FIGURE 9
STRUCTURE 3T

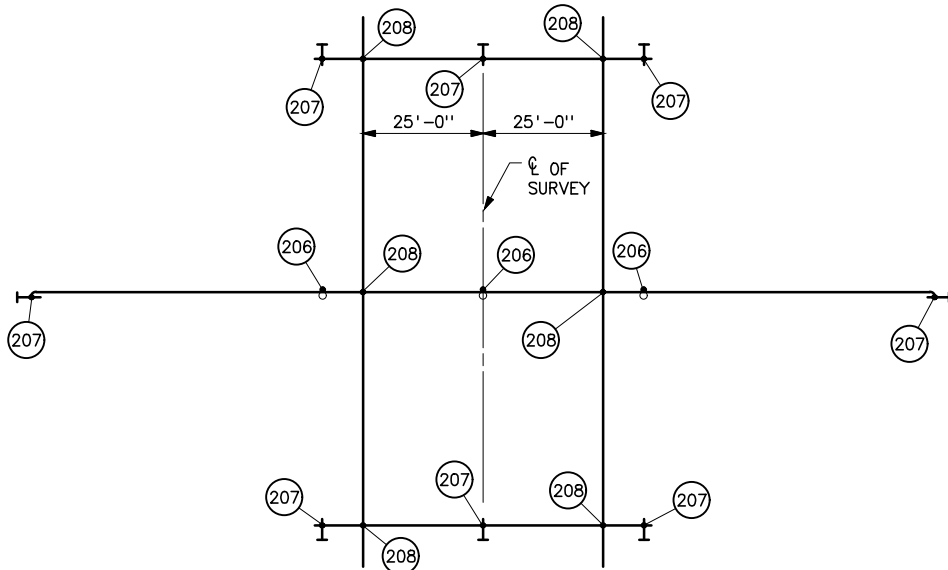
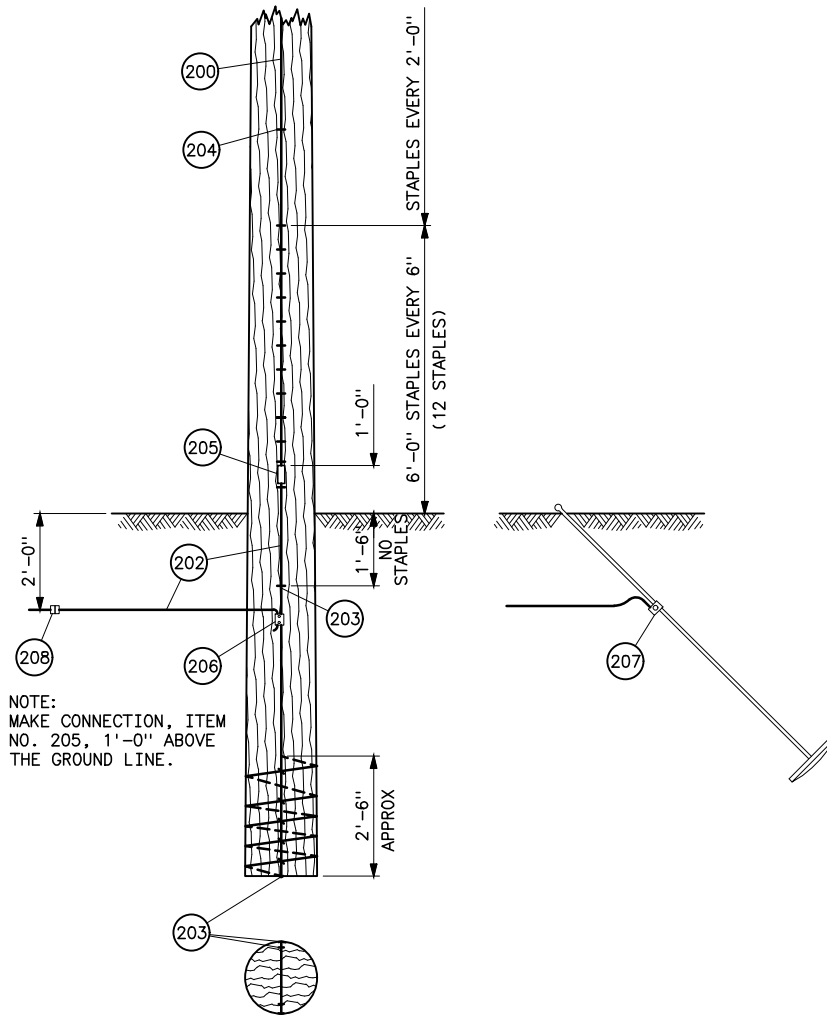
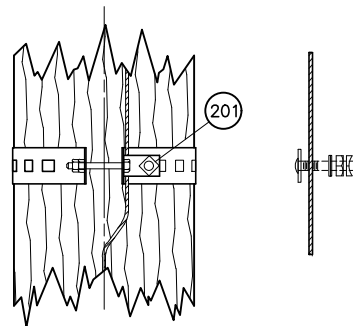


FIGURE 10
STRUCTURE 3TX



TYPICAL GROUNDING DETAIL
(2 POLE STRUCTURES)
HST STRUCTURES AND ALL 3-POLE STRUCTURES
SIMILAR EXCEPT OMIT ITEM NUMBERS 200, 204,
205, 210, AND 211



CONNECTION TO
UNIVERSAL POLE BAND

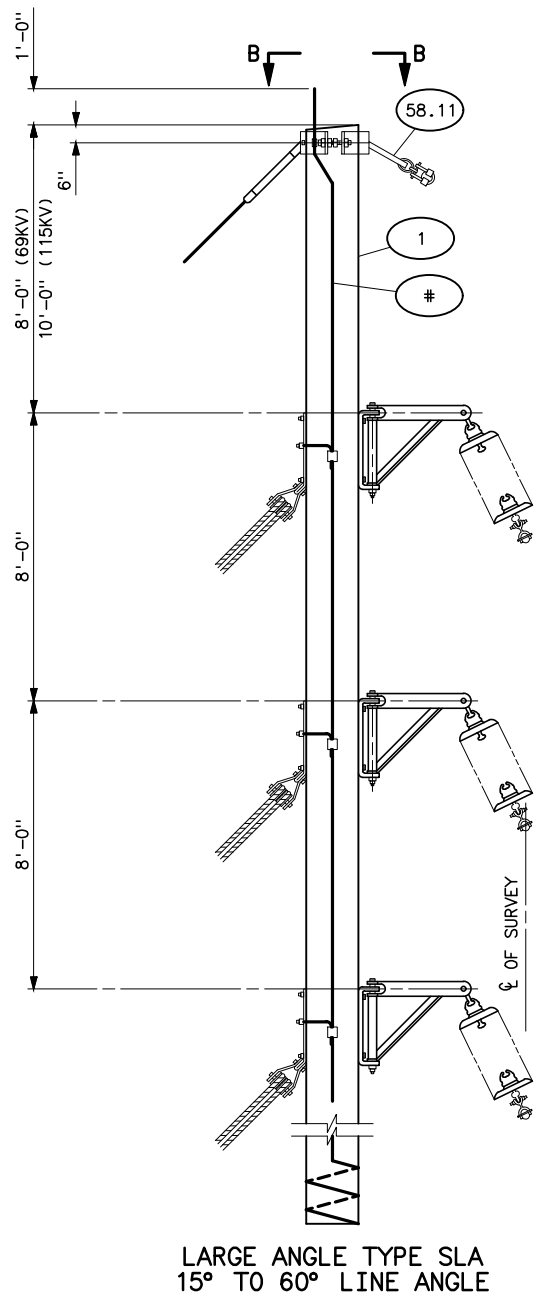
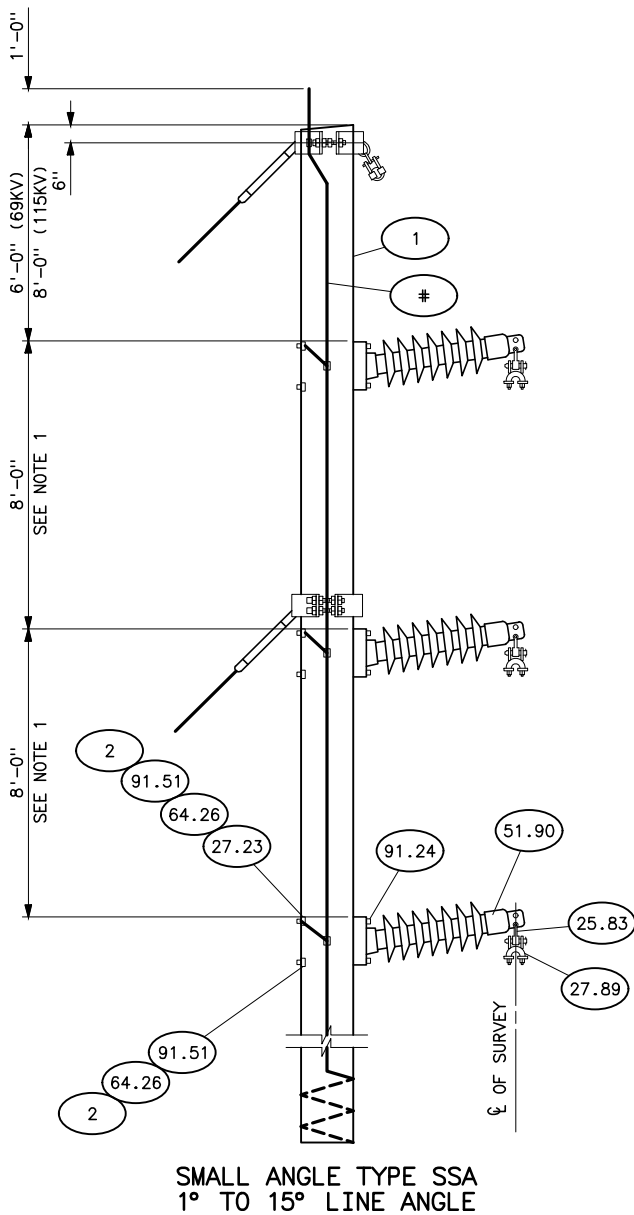
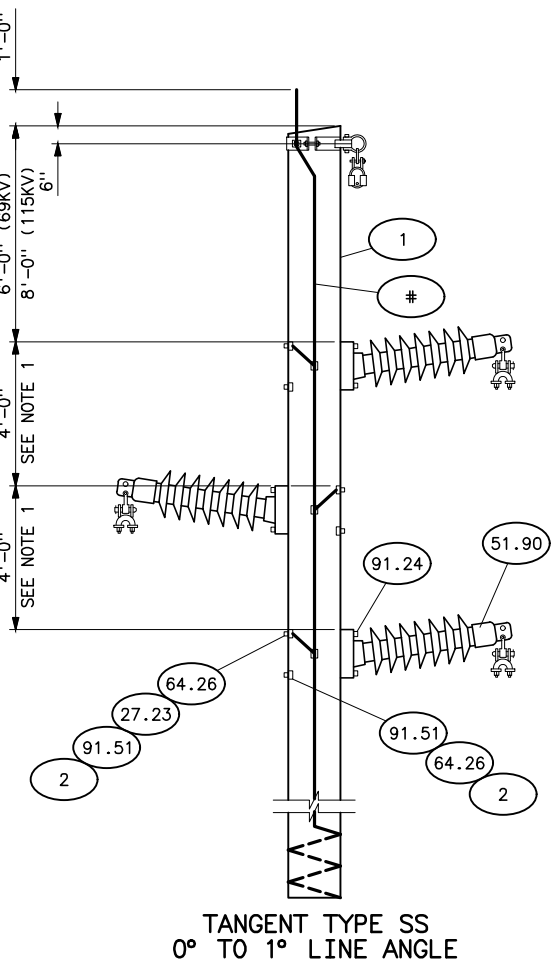
NOTE

1. REFER TO 41 6079-1 FOR NOTES, MATERIAL REQUIRED AND QUANTITIES REQUIRED.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

A	8/24/26 A7-KR	HISTORICAL REFERENCE	
	SUPERSEDES DWG NO. 41 6079A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS GROUNDING AND COUNTERPOISE DETAILS WITH OVERHEAD GROUND WIRE-161KV (SHEET 2 OF 2)			
DESIGNED BUREC		APPROVED ROSS M. CLARK ELECTRICAL ENGINEERING MANAGER	
C _A E	MAY 28, 2014	41	6079-2

Plotted By: court Aug 25, 2026- 1:26pm
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XREF(S):



STRUCTURE MATERIAL					
PART NO.	QUANTITY STRUCTURE TYPE			DESCRIPTION	DWG NO. 41
	SS	SSA	SLA		
1	1	1	1	POLE	
9.23	—	1	—	BAND, FOUR-WAY STRAIN, TYPE B	6031
23.22	—	—	3	BRACKET, EXTENSION, 21", COMPLETE WITH 3/4" ATTACHMENT BOLTS. HUGHES BROS. #2822.8	6045
29.50	—	1	1	CLIP, GROUND WITH 3/4"x2 1/2" CONEHEAD BOLT	6031
64.23	—	1	1	LOCKNUT FOR 3/4" BOLT	
91.13	—	—	6	LOCKWASHER SPRING FOR 3/4" BOLT	
2	6	6	—	BOLT, MACHINE, LENGTH AS REQUIRED	
27.23	3	3	—	GROUNDING CLAMP TO NO. 2 AWG CWD	
27.89	3	3	—	CLAMP FOR LINE POST INSULATOR	
51.90	3	3	—	INSULATOR LINE POST	
64.26	6	6	—	LOCKNUT	
91.24	6	6	—	WASHER, ROUND, FLAT, 3"x3"	
91.51	6	6	—	WASHER, SQUARE, CURVED, 3"x3"	
25.83	3	3	—	Y-CLEVIS-EYE 90°	
27.80	—	—	6	CLAMP, SUSPENSION, WITH CLEVIS-EYE CONNECTOR (NOTE 4)	
27.81	—	—	3	CLAMP, SUSPENSION, WITH SOCKET-EYE CONNECTOR (NOTE 3)	1000
28.80	—	—	3	Y-CLEVIS-BALL	1003
51.60	—	—	*	INSULATOR, SUSPENSION TYPE, 10" DIAMETER 5 3/4"	
98.53	—	—	3	YOKE, WITH SOCKET CLEVIS CONNECTOR (NOTE 4)	1004
9.20	—	1	1	BAND, FOUR WAY STRAIN, TYPE A	6030
9.38	1	—	—	BAND, POLE TOP, TYPE A	6035
27.85 OR 27.86	1	1	1	CLAMP, SUSPENSION WITH 2 1/4" LINK (NOTE 7)	
29.40	1	—	—	CLIP, GROUND, WITH 3/8"x1 1/2" CARRIAGE BOLT	
29.50	—	—	4	CLIP, GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	
58.11	—	—	1	LINK, CONNECTING PAIR	6030
64.20	1	—	—	LOCKNUT FOR 3/8" BOLT	
64.23	—	1	10	LOCKNUT FOR 3/4" BOLT	
77.27	1	2	2	LAG SCREW 1/2"x4" FETTER DRIVE THREAD	
79.10	1	—	—	SHACKLE, ANCHOR TYPE	6035
79.50	—	1	1	SHACKLE, TWISTED	6038
91.22	—	2	2	WASHER, ROUND, FLAT, 1 3/8" OD, 9/16" HOLE	

* CLASS 52-3 INSULATING UNITS. USE 6 UNITS PER STRING FOR 69KV AND 9 PER STRING FOR 115KV STRUCTURES.
GROUNDING MATERIAL PART NO'S. AND DESCRIPTION SHOWN ON DWG 41 1012.

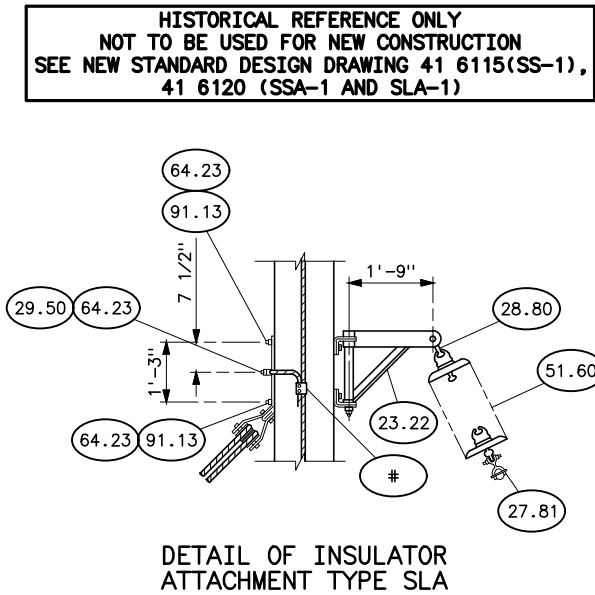
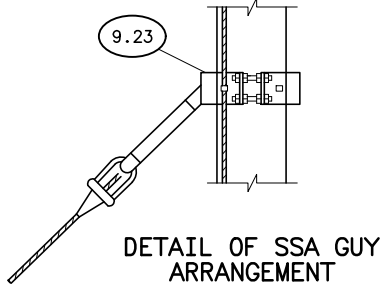
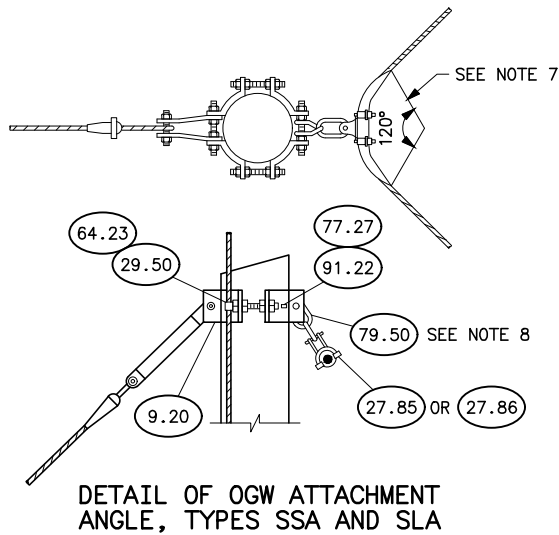
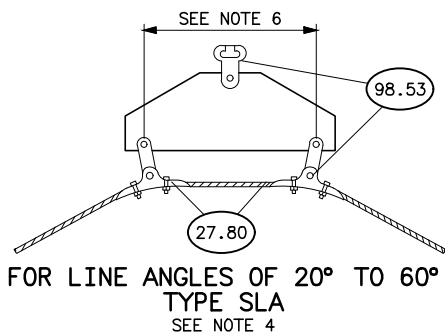
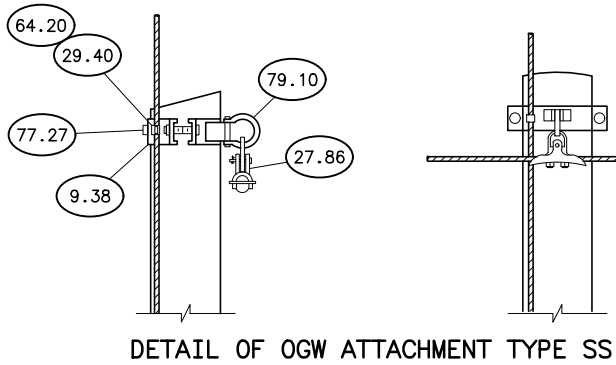
NOTES

- MEASUREMENTS FOR HORIZONTAL LINE POST MOUNTING LOCATIONS ARE TO ϕ OF TOP MOUNTING BOLT.
- ALL HARDWARE WILL BE OF THE SIZE RECOMMENDED BY THE INSULATOR MANUFACTURER.
- FOR LINE ANGLES UP TO AND INCLUDING 20° USE SUSPENSION CLAMP PART NO. 27.81.
- FOR LINE ANGLES OF 20° TO 60° USE SUSPENSION ASSEMBLY PART NO.'S 27.80 AND 98.53.
- POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN FOR LINE ANGLES GREATER THAN 5°.
- LENGTH OF SUSPENSION CLAMP PLUS A MINIMUM OF 3 INCHES.
- FOR LINE ANGLES UP TO AND INCLUDING 30° USE SUSPENSION CLAMP PART NO. 27.86. FOR LINE ANGLES OF 30° TO 60° USE SUSPENSION CLAMP PART NO. 27.85.
- USE PART NO. 58.11 IN ADDITION TO PARTS SHOWN ON ALL TYPE SLA STRUCTURES.

REFERENCE DRAWINGS

GROUNDING DETAILS-----41 1012
GUY ASSEMBLIES AND DETAILS-----41 6047
GUYING REQUIREMENTS FOR SINGLE POLE CONSTRUCTION WITH OVERHEAD GROUND WIRE-----41 6071

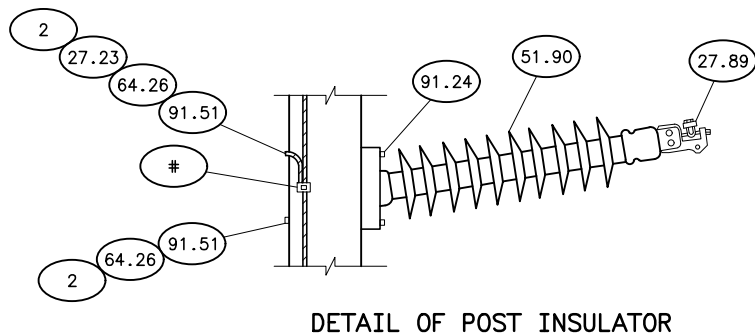
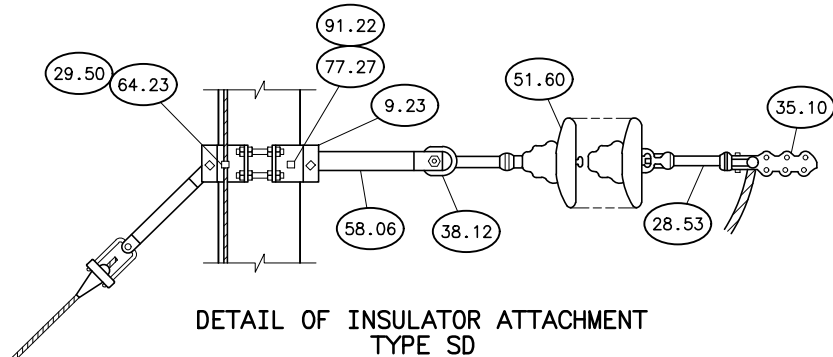
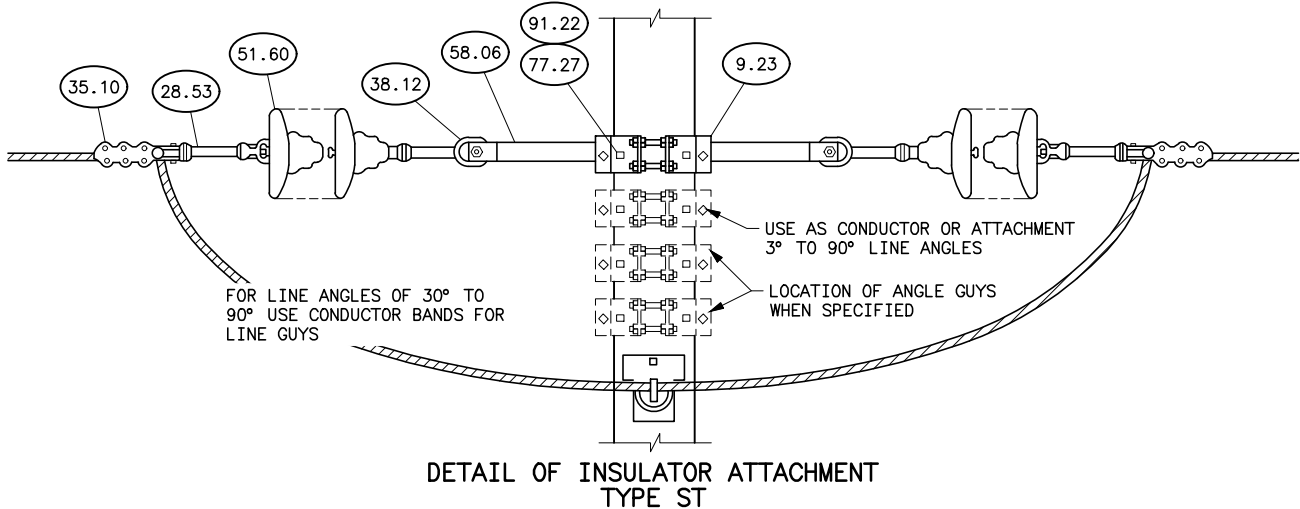
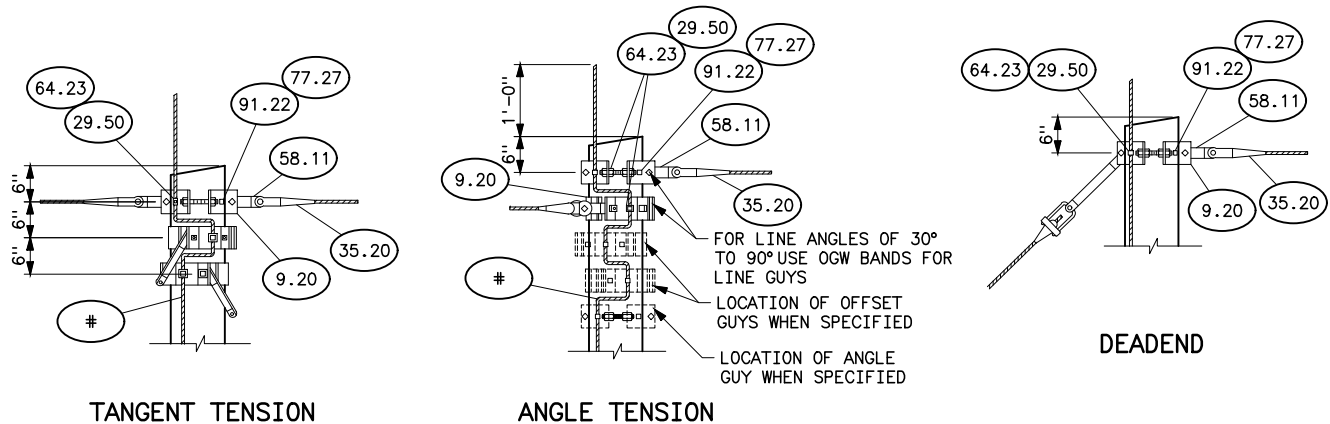
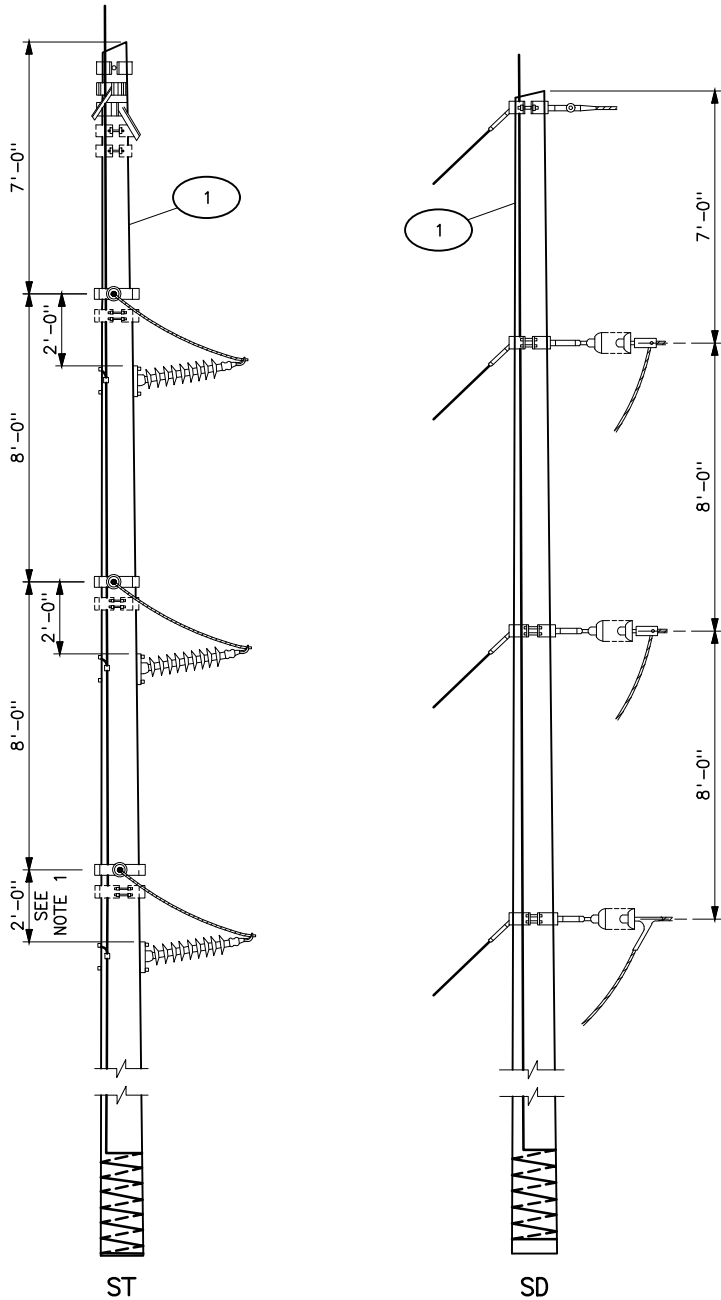
B	8/25/26 A7-KR	HISTORICAL REFERENCE	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARD TYPE SS, SSA, AND SLA 69 AND 115KV TANGENT, SMALL ANGLE AND LARGE ANGLE STRUCTURES			
DESIGNED <u>HENRY JAMES KIENTZ</u> APPROVED <u>C.A. CABRAL</u> DIRECTOR, DIVISION OF ELECTRICAL DESIGN			
C A E	MAY 23, 1980	41	6080



HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6115(SS-1),
41 6120 (SSA-1 AND SLA-1)

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IMAGES:



SEE NOTE 2

STRUCTURE MATERIALS						
PART NO.	QUANTITY			DESCRIPTION	DWG NO. 41	
	DEAD END	TANGENT TENSION	ANGLE TENSION			
1	1	1	1	POLE		
9.23	3	3	6	BAND, FOUR WAY, STRAIN, TYPE B	6031	
29.50	4	4	8	CLIP GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	6031	
64.23	4	4	8	LOCKNUT FOR 3/4" BOLT	6031	
77.27	8	8	16	LAGSCREW, 1/2"x4" FETTER DRIVE THREAD		
91.22	8	8	16	WASHER, ROUND, FLAT, 1 3/8" OD, 9/16" HOLE	6031	
58.06	3	6	6	LINK, CONNECTING PAIR	6031	
27.23	—	3	3	GROUNDING CLAMP FOR NO. 2 AWG CWD		
27.89	—	3	3	CLAMP FOR LINE POST INSULATOR		
2	—	6	6	BOLT, MACHINE, LENGTH AS REQUIRED		
51.90	—	3	3	INSULATOR LINE POST (SEE NOTE 4)		
64.26	—	6	6	LOCKNUT FOR 1 1/4" BOLT		
91.51	—	6	6	WASHER, SQUARE, CURVED, 3"x3"		
27.92	—	3	3	CLAMP TOP, ALUMINUM CAST		
28.53	3	6	6	SOCKET-CLEVIS, HOT LINE TYPE (9" MIN)		
35.10	3	6	6	COMPRESSION DEADEND WITH OVAL EYE FITTING		
38.12	3	6	6	BALL-OVAL EYE, HOT LINE TYPE (11" MIN)		
51.60	✱	✱	✱	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING		
91.24	—	6	6	WASHER, ROUND, FLAT, 3"x3"		
9.20	1	1	2	BAND, FOUR WAY STRAIN, TYPE A	6030	
35.20	1	2	2	DEADEND, COMPENSION TYPE		
58.11	1	2	2	LINK, CONNECTING PAIR	6030	
#	GROUNDING MATERIAL, PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

* CLASS 52-3 INSULATOR UNITS. USE 6 UNITS PER STRING FOR 69KV AND 9 UNITS PER STRING FOR 115KV STRUCTURE.

NOTES

- MEASUREMENTS FOR HORIZONTAL LINE POST MOUNTING LOCATIONS ARE TO C OF TOP MOUNTING BOLT.
- ALL HARDWARE WILL BE OF THE SIZE RECOMMENDED BY THE INSULATOR MANUFACTURER.
- POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN FOR THE LINE ANGLES GREATER THAN 5°.
- OMIT LINE POST FOR LINE ANGLES EXCEEDING 60°.

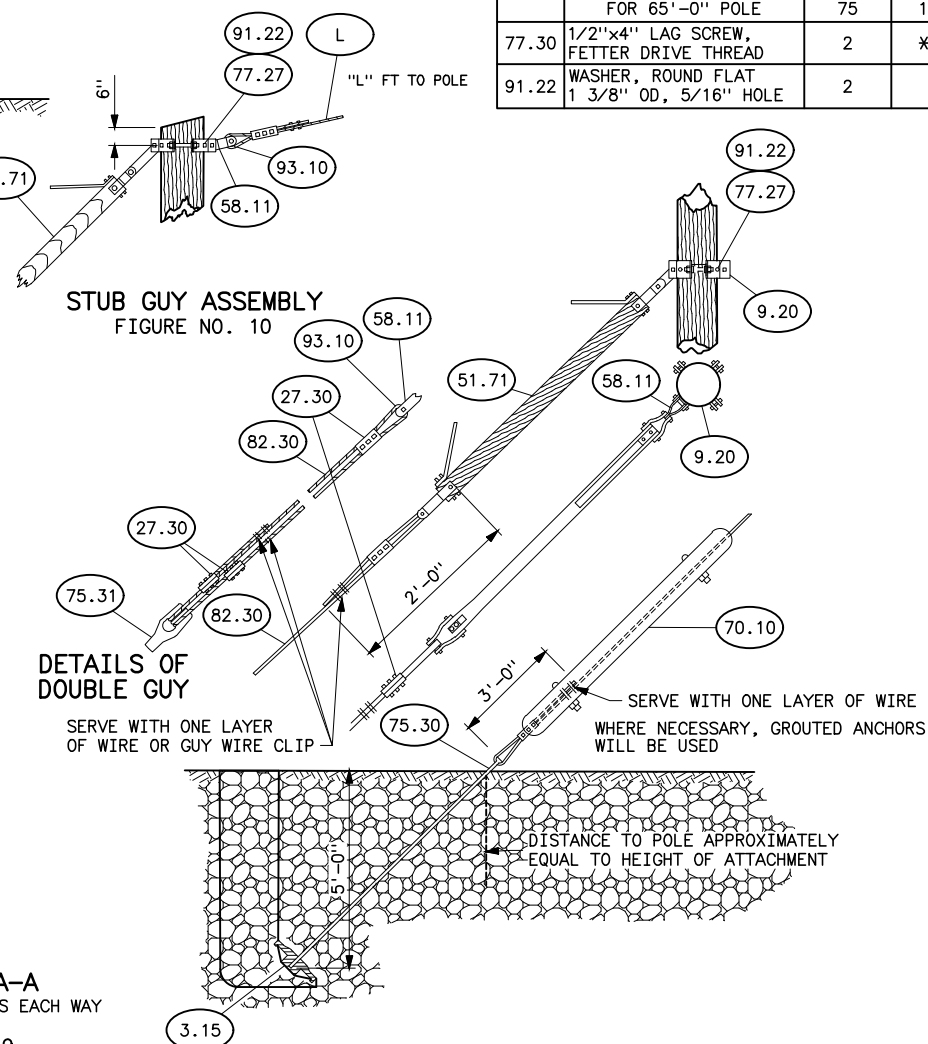
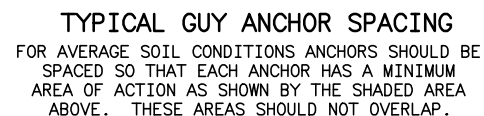
REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
GUY ASSEMBLIES AND DETAILS	41 6047
GUYING REQUIREMENTS FOR SINGLE POLE CONSTRUCTION WITH OVERHEAD GROUND WIRE	41 6071

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6116 (ST-1), 41 6121 (SD-1)

B	8/25/26 A7-KR	HISTORICAL REFERENCE
A	5-28-14 A7-DDD	REDRAWN.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARD TYPE SD AND ST 69 & 115KV DEADEND, TANGENT AND ANGLE TENSION STRUCTURES		
DESIGNED HENRY JAMES KEINTZ _____ APPROVED C.A. CABRAL DIRECTOR, DIVISION OF ELECTRICAL DESIGN		
C.A.E.	MAY 23, 1980	41 6081

XREF(S):

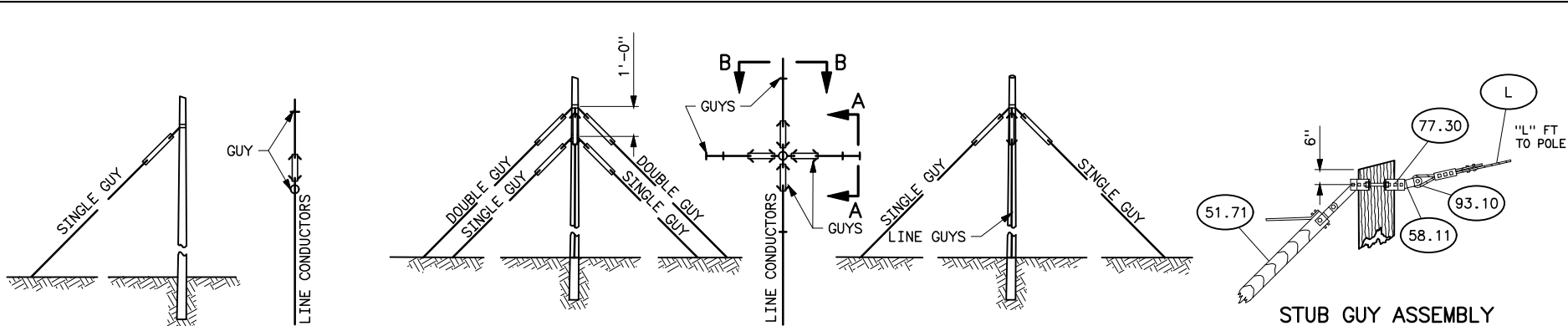


LIST OF MATERIALS												
NEW ITEM NO.	MATERIAL REQUIRED		QUANTITIES REQUIRED FOR EACH TYPE OF GUYING									
			1-ASG	SA STRUCTURES		1-ASG	1-LSGEW	1-LDGEW	SAT STRUCTURES			STUB GUY
				2-ASG	3-ASG	1-LSGEW			2-LSGEW	3-LSGEW	3-LDGEW	
			FIG NO. 1	FIG NO. 2	FIG NO. 3	FIG NO. 4	FIG NO. 5	FIG NO. 6	FIG NO. 7	FIG NO. 8	FIG NO. 9	FIG NO. 10
9.20	FOUR WAY STRAIN BAND*		1	* -	* -	3	2	2	* -	* -	* -	1
58.11	CONNECTING LINK PR		1	2	3	3	2	2	4	6	6	2
93.10	SHEAVE WHEEL		1	2	3	3	2	2	4	6	6	1
51.71	WOOD GUY** INSULATOR WITH CONNECTING LINK AND GUY THIMBLE		1	2	3	3	2	2	4	6	6	1
27.30	GUY CLAMP-6" 3-BOLT NELA STD		2	4	6	6	4	6	8	12	18	4
75.30	**	THIMBLEYE	1	-	1	3	2	-	-	2	-	1
75.31	ANCHOR ROD	TWINEYE	-	1	1	-	-	2	2	2	6	-
91.22	ROUND FLAT WASHER FOR 1/2" BOLT		2	-	-	2	2	2	-	-	-	4
3.15	ANCHOR DWG 41 6049		1	1	2	3	2	2	2	4	6	1
70.10	GUY PROTECTOR**		1	2	2	3	2	2	2	4	6	1
82.30	GALV CABLE- 7/16" SM FOR 25'-0" POLE		25	50	70	70	50	90	100	150	270	(L) FT+25 FT
	FOR 30'-0" POLE		30	60	90	90	60	110	120	180	330	(L) FT+30 FT
	FOR 35'-0" POLE		40	80	110	110	80	150	150	235	390	(L) FT+40 FT
	FOR 40'-0" POLE		45	90	130	130	90	170	180	260	480	(L) FT+45 FT
	FOR 45'-0" POLE		50	100	150	150	100	190	200	300	540	(L) FT+50 FT
	FOR 50'-0" POLE		55	110	165	165	110	210	220	330	600	(L) FT+55 FT
	FOR 55'-0" POLE		60	125	185	185	125	240	250	375	690	(L) FT+60 FT
	FOR 60'-0" POLE		70	140	205	205	140	270	280	420	780	(L) FT+70 FT
	FOR 65'-0" POLE		75	150	220	220	150	290	300	450	840	(L) FT+75 FT
77.30	1/2"x4" LAG SCREW, FETTER DRIVE THREAD		2	* -	* -	2	2	2	* -	* -	* -	4
91.22	WASHER, ROUND FLAT 1 3/8" OD, 5/16" HOLE		2			2	2	2				4

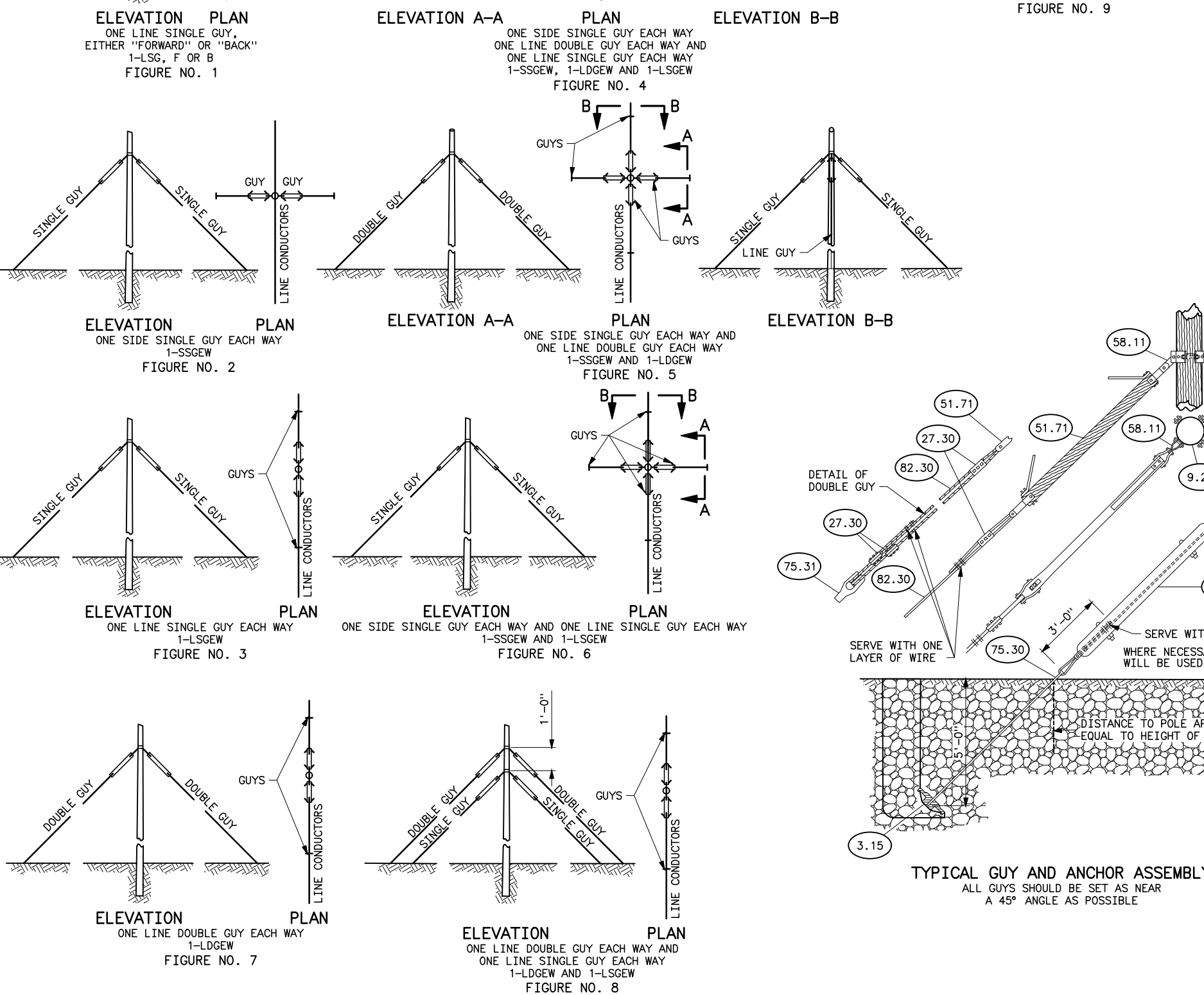
- ## NOTES
1. *NO STRAIN BANDS REQUIRED FOR SA AND SAT STRUCTURES AS THEY ARE CONSIDERED LINE MATERIAL AND ARE ACCOUNTED FOR ON STRUCTURE DRAWINGS.
 2. *WOOD GUY INSULATORS AND GUY PROTECTORS TO USED ONLY WHERE SPECIFIED.
 3. SEE INDIVIDUAL STRUCTURE DRAWINGS FOR HEIGHT OF ATTACHMENT ON POLE.
 4. WHERE ANCHORS HAVE TO BE PLACED IN SANDY SOIL OR IN GROUND WHICH AFFORDS A POOR ANCHORAGE, EACH GUY SHALL BE TERMINATED AT A SEPARATE ANCHOR. THE ANCHORS SHALL BE SET SIDE BY SIDE THE DISTANCE BETWEEN DEPENDING ON THE CONDITION OF THE SOIL.
 5. MATERIAL LISTED IN TABLE ASSUMES NORMAL ANCHORAGE CONDITIONS.
 6. IF EXTREMELY POOR ANCHORAGE IS ENCOUNTERED ADDITIONAL ANCHORS SHALL BE INSTALLED AS REQUIRED BY USING A NUMBER OF GUYS BRANCHING FROM EACH WOOD STRAIN INSULATOR AND EACH GUY TERMINATING IN A SEPARATE ANCHOR.
 7. EACH STRAIN POLE BAND SHALL BE SUPPORTED AT DIAMETRICALLY OPPOSITE POINTS BY A 1/2"x4" LAG SCREW.
 8. ***USE 3/4"x8'-0" ROD UNLESS 3/4"x10'-0" IS NEEDED TO TO OBTAIN 5'-0" MINIMUM DEPTH.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2747		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STANDARD GUY ARRANGEMENT ASSEMBLY SINGLE POLE ANGLE STRUCTURES		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A F	APRIL 13, 1981	41 6082



LIST OF MATERIALS										
NEW ITEM NO.	ITEM NO.	MATERIAL REQUIRED	QUANTITIES REQUIRED FOR EACH TYPE OF GUYING							
			1-LSG, FOR B FIG NO. 1	1-SSGEW FIG NO. 2	1-LSGEW FIG NO. 3	1-SSGEW 1-LDGEW FIG NO. 4	1-SSGEW 1-LDGEW FIG NO. 5	1-SSGEW 1-LDGEW FIG NO. 6	1-LDGEW FIG NO. 7	1-LDGEW 1-LSGEW FIG NO. 8
9.20	G1	FOUR WAY STRAIN BAND	1	1	1	2	1	1	1	2
58.11	G2	CONNECTING LINK (PR)	1	2	2	6	4	4	2	4
93.10	G13	SHEAVE WHEEL	1	2	2	6	4	4	2	4
51.71	G3	WOOD GUY** INSULATOR WITH CONNECTING HOOK AND GUY THIMBLE	1	2	2	6	4	4	2	4
27.30	G4	GUY CLAMP-6" 3-BOLT NELA STD	2	4	4	14	10	8	6	10
75.30	G5	** THIMBLEYE	1	2	2	4	2	4	-	2
75.31	G5A	ANCHOR ROD TWINEYE	-	-	-	2	2	-	2	2
91.22	-	ROUND FLAT WASHER FOR 1/2" BOLT	2	2	2	4	2	2	2	4
3.15	G6	ANCHOR (41 6049)	1	2	2	6	4	4	2	4
70.10	G7	GUY PROTECTOR**	1	2	2	6	4	4	2	4
82.30	G12	GALV CABLE- 7/16" SM FOR 25'-0" POLE	25	50	50	190	140	100	90	140
		FOR 30'-0" POLE	30	60	60	230	170	120	110	170
		FOR 35'-0" POLE	40	80	80	310	230	160	150	230
		FOR 40'-0" POLE	45	90	90	350	260	180	170	260
		FOR 45'-0" POLE	50	100	100	390	290	200	190	290
		FOR 50'-0" POLE	55	110	110	430	320	220	210	320
		FOR 55'-0" POLE	60	125	125	470	350	240	240	350
		FOR 60'-0" POLE	70	140	140	550	410	280	270	410
77.30	G14	1/2"x4" LAG SCREW	2	2	2	4	2	2	2	4



NOTES

1. EACH STRAIN POLE BAND SHALL BE SUPPORTED AT DIAMETRICALLY OPPOSITE POINTS BY A 1/2"x4" LAG SCREW. THE POLE SHALL BE BORED FOR THE LAG SCREW WITH A 3/8" BIT.
2. **GUY PROTECTORS AND WOOD INSULATORS TO USED ONLY WHERE SPECIFIED.
3. SEE INDIVIDUAL STRUCTURE DRAWINGS FOR HEIGHT OF ATTACHMENT ON POLE.
4. WHERE ANCHORS HAVE TO BE PLACED IN SANDY SOIL OR IN GROUND WHICH AFFORDS A POOR ANCHORAGE, EACH GUY SHALL BE TERMINATED AT A SEPARATE ANCHOR. THE ANCHORS SHALL BE SET SIDE BY SIDE: THE DISTANCE BETWEEN DEPENDING ON THE CONDITION OF THE SOIL.
5. MATERIAL LISTED IN TABLE ASSUMES NORMAL ANCHORAGE CONDITIONS.
6. IF EXTREMELY POOR ANCHORAGE IS ENCOUNTERED ADDITIONAL ANCHORS SHALL BE INSTALLED AS REQUIRED BY USING A NUMBER OF GUYS BRANCHING FROM EACH WOOD STRAIN INSULATOR AND EACH GUY TERMINATING IN A SEPARATE ANCHOR.
7. **USE 3/4"x8'-0" ROD UNLESS 3/4"x10'-0" IS NEEDED TO TO OBTAIN 5'-0" MINIMUM DEPTH.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.

SUPERSEDES DWG NO. 40-D-2748

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

TRANSMISSION LINE STANDARDS
STANDARD GUY ARRANGEMENT -
ASSEMBLY
SINGLE POLE TANGENT STRUCTURES

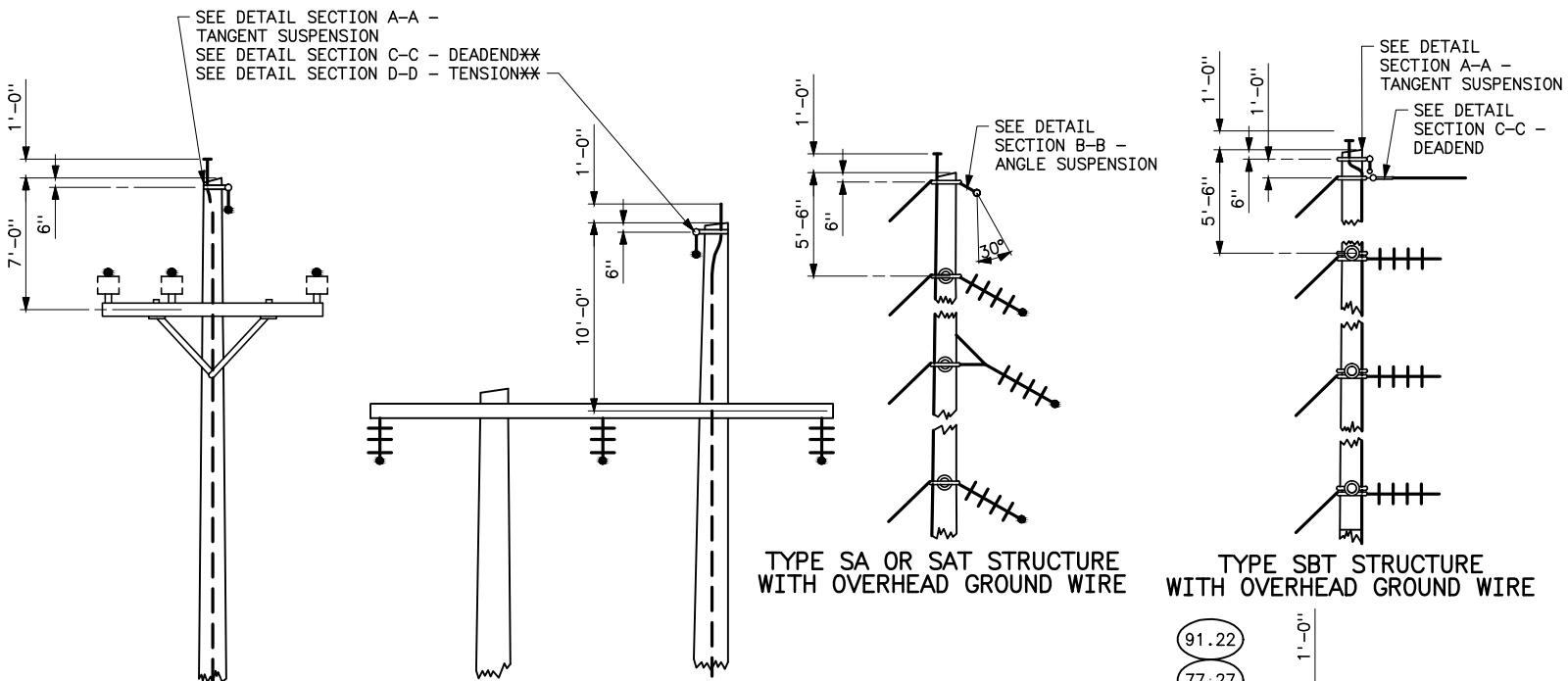
DESIGNED BUREC _____ APPROVED BUREC _____

APRIL 13, 1981	41	6083
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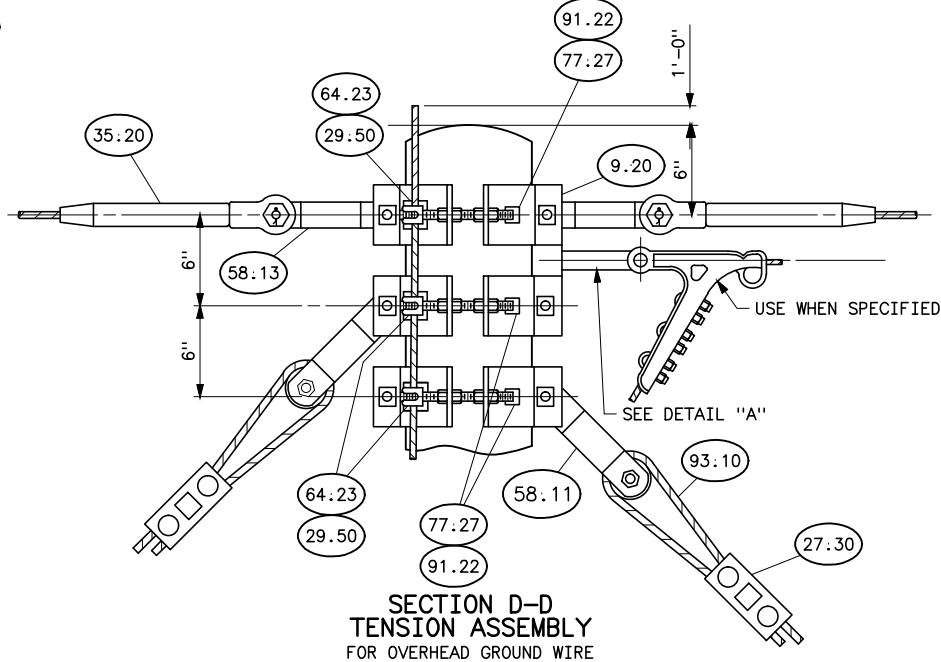
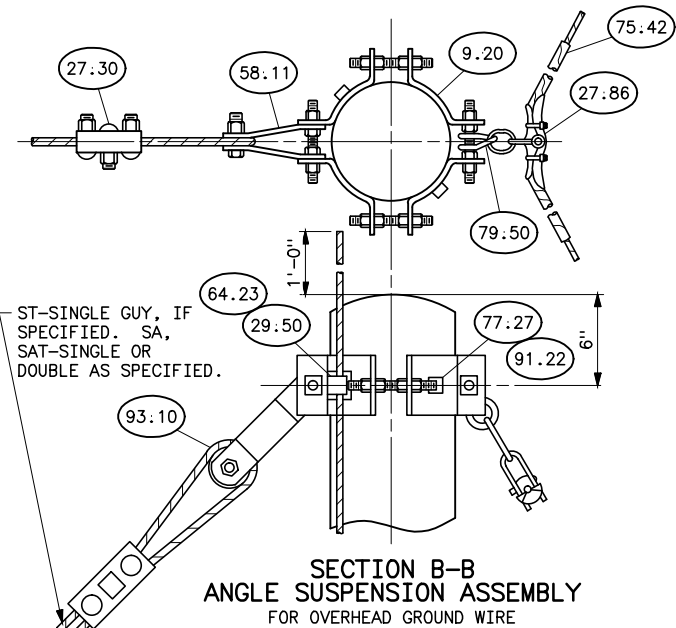
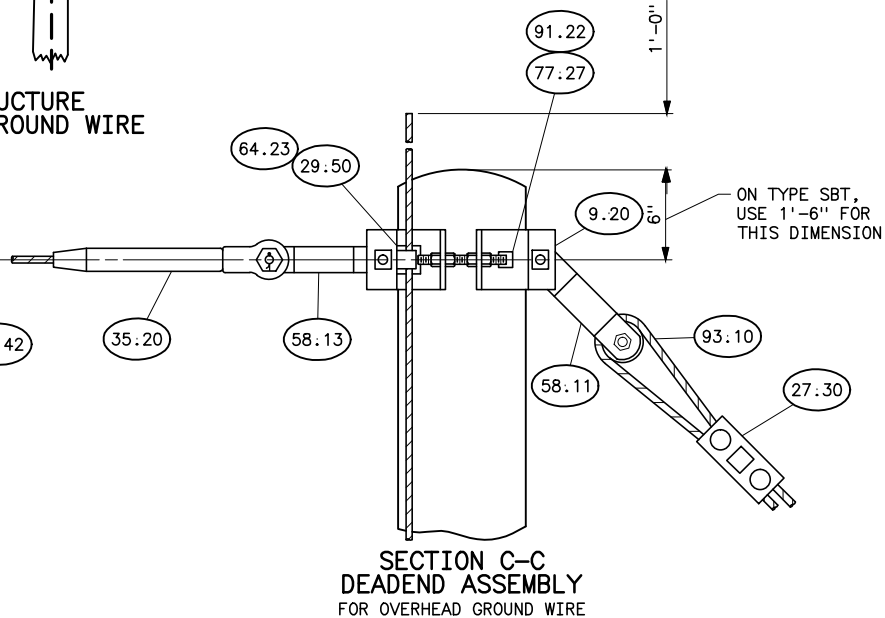
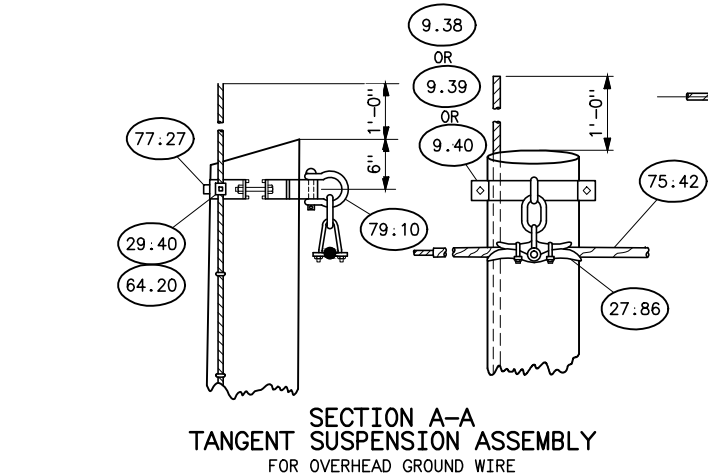
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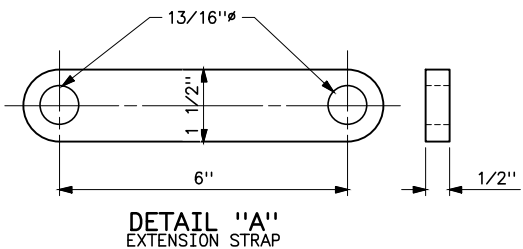
TYPE SS STRUCTURE WITH OVERHEAD GROUND WIRE (TYPES SD, ST SIMILAR)

TYPE HS STRUCTURE WITH OVERHEAD GROUND WIRE



LIST OF MATERIAL										
NEW ITEM NO.	QUANTITY								DESCRIPTION	
	SS OR HS			SA OR SAT	SBT	ST				
	SUSPENSION	DEADEND	TEN-SION	SUSPENSION	SUSPENSION (MAIN LINE) DEAD-END (BRANCH)	SUSPENSION		DEADEND		TEN SION
						TANGENT	ANGLE			
9.20	-	1	3	1	1	-	1	1	3	BAND, FOUR WAY STRAIN, DWG 41 6030
9.38, 9.39, 9.40	1	-	-	-	1	1	-	-	-	BAND, POLE TOP, DWGS 41 6034, 6035, 6036
27.58	1	-	-	-	1	-	-	-	-	CLAMP, PARRALLEL GROOVE, 2 BOLT, FOR 5/16" TO 7/16" STEEL STRAND
27.85*	-	-	-	1	-	-	-	-	-	CLAMP, SUSPENSION, LARGE ANGLE FOR OVERHEAD GROUND WIRE
27.86*	1	-	-	1	1	1	1	-	-	CLAMP, SUSPENSION, WITH 2 1/4" LINK FOR OVERHEAD GROUND WIRE
29.50	-	1	2	1	1	-	1	1	2	CLIP, GROUND, WITH 3/4"x2 1/2" CONE HEAD BOLT, DWG 41 6030
35.20	-	1	2	-	1	-	-	1	2	DEADEND, COMPRESSION TYPE, FOR OVERHEAD GROUND WIRE
58.11	-	1	2	1	1	-	1	1	2	LINK, CONNECTING, PAIR, DWG 41 6030
58.13	-	1	2	1	1	-	-	1	2	LINK, CONNECTING, PAIR FOR OGW DEADENDS, DWG 41 6030
64.23	-	1	2	1	1	-	1	1	2	LOCKNUT, FOR 3/4" BOLT
77.27	1	2	6	2	3	1	2	2	6	SCREW, LAG, 1/2"x4", FETTER DRIVE THREAD
79.10°	1	-	-	-	1	1	-	-	-	SHACKLE, ANCHOR TYPE, DWG 41 6034 OR 41 6036
79.50	-	-	-	1	-	-	1	-	-	SHACKLE, TWISTED, DWG 41 6038
GUYING FOR OVERHEAD GROUND WIRE	NO GUYS	2-LGF OR 2-LGB	2-LGEW	1- AG 2- AG	2-LGB	NO GUYS	0- AG 1- AG	2-LGF OR 2-LGB	2-LGEW	GUYING MATERIAL FOR OVERHEAD GROUND WIRE FOR OTHER GUYING DETAILS SEE DWGS 41 6082 & 6083
3.15	-	1	2	1 1	1	-	-	1 1	2	ANCHOR PLATE, CAST, DWG 41 6049
27.30	-	3	6	2 3	3	-	-	2 3	6	CLAMP, GUY, 3 BOLT, 6" LONG
70.10	-	1	2	1 1	1	-	-	1 1	2	PROTECTOR GUY, METAL Δ
75.30	-	-	-	1 -	-	-	-	1 -	-	ROD, ANCHOR, 3/4"x8'-0", THIMBLEYE
75.31	-	1	2	- 1	1	-	-	- -	2	ROD, ANCHOR, 3/4"x8'-0", TWINEYE
82.30	(SEE BILL OF MATERIAL)								STRAND, STEEL, 7/16" SIEMENS-MARTIN, 7-WIRE	
93.10	-	1	2	1 1	1	-	-	1 1	2	WHEEL, SHEAVE, FOR 7/16" SIEMENS-MARTIN STRAND
75.42Δ	1 SET	-	-	1 SET	1 SET	1 SET	1 SET	-	-	ROD, ARMOR, PREFORMED FOR 3/8" STEEL STRAND
29.40	1	-	-	-	1	1	-	-	-	CLIP, GROUND, WITH 3/8"x1 1/2" CARRIAGE BOLT
91.22	-	2	6	2	2	-	2	2	6	WASHER, ROUND, FLAT, 1 3/8" OD FOR 1/2" BOLT: 41 6034, 6035, 6036
64.20	1	-	-	-	1	1	-	-	-	LOCKNUT FOR 3/8" BOLT

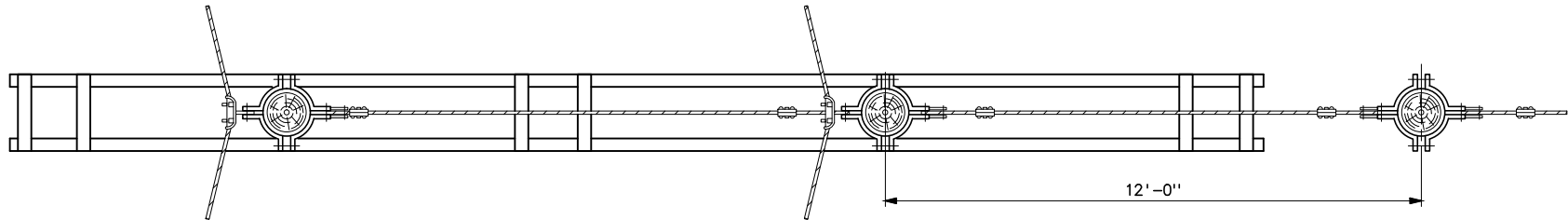
- NOTES
1. THE GUYING QUANTITIES GIVEN ABOVE ARE IN ADDITION TO THOSE GIVEN ON DWGS 41 6082 AND 41 6083.
 2. Δ TO BE USED ONLY WHERE SPECIFIED.
 3. * USE ITEM 27.86 ON LINE ANGLES LESS THAN 30°. USE ITEM 27.85 ON LINE ANGLES MORE THAN 30°.
 4. ** FOR USE ON TANGENT STRUCTURES ONLY.
 5. GUYS SHALL FORM A 45° VERTICAL ANGLE WITH THE POLE INSOFAR AS PRACTICABLE.
 6. ° ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE "B" POLE TOP BAND, DWG 41 6035 IS USED.



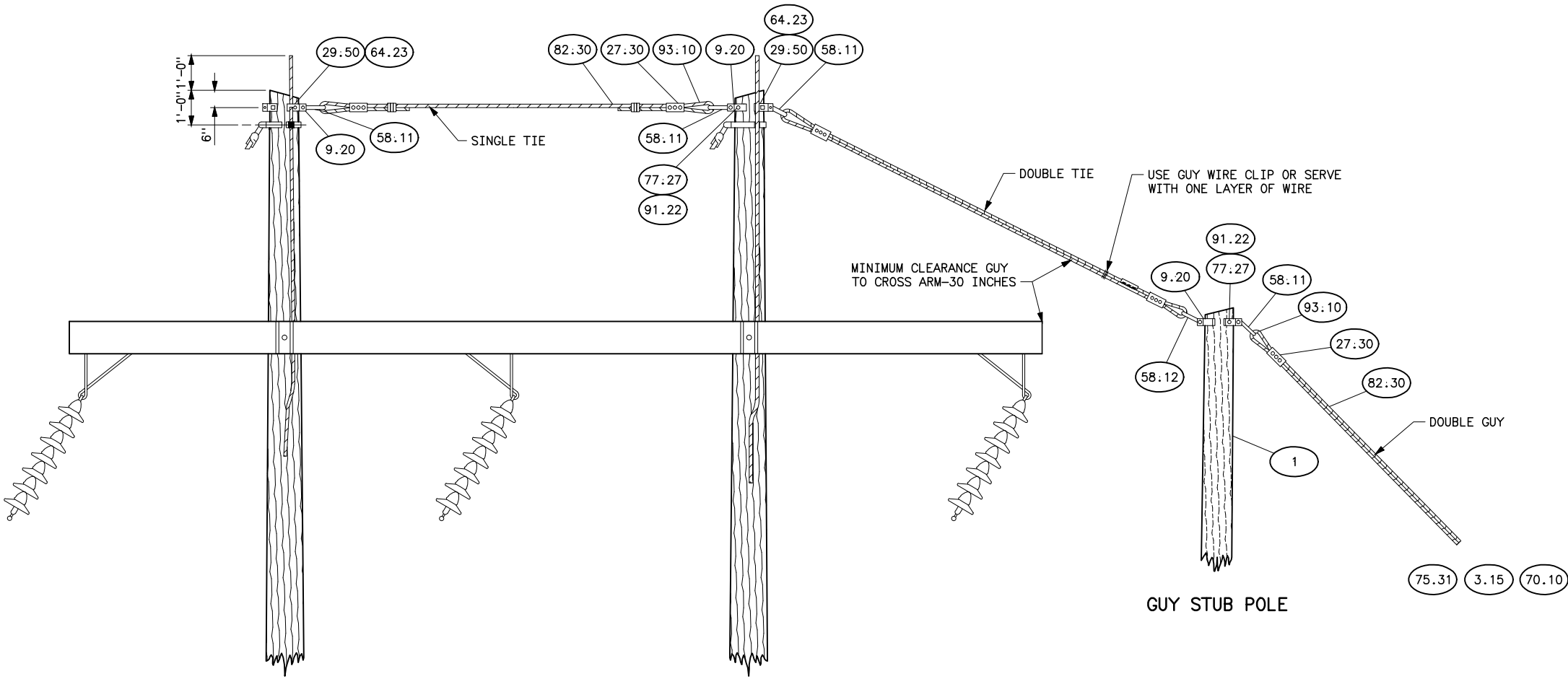
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5501		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS		
44KV SINGLE POLE STRUCTURES OVERHEAD GROUND WIRE DETAILS		
DESIGNED BUREC	APPROVED BUREC	
C _A E	APRIL 6, 1981	41 6084

Plotted By: denton Jun 04, 2014- 11:37am
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XREF(S):



LIST OF MATERIALS									
PART NO.	QUANTITY	DESCRIPTION							DWG NO. 41
1	1	STUB POLE – SEE STRUCTURE LIST FOR HEIGHT							
9.20	3	FOUR-WAY STRAIN BAND							6030
58.11	4 PAIRS	CONNECTING LINKS, 3/4"x2 1/2" BOLT							6030
27.30	8	GUY CLAMP 6", 3 BOLT							
75.31	1	ANCHOR ROD – TWINEYE, 3/4"x8'-0" ✕							
3.15	1	ANCHOR							6048
70.10	1	GUY PROTECTOR≠							
82.30	SEE TABLE AT RIGHT	STUB HEIGHT	45'-0"	50'-0"	55'-0"	60'-0"	65'-0"	70'-0"	
		7/16" GALV STRAND	172'-0"	187'-0"	202'-0"	217'-0"	232'-0"	247'-0"	
77.27	6	LAG SCREW 1/2"x4", FETTER DRIVE THREAD							
93.10	6	SHEAVE WHEEL							6030
58.12	1 PAIR	CONNECTING LINKS 3/4"x3 1/2" BOLT							6030
29.50	2	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT							6030
64.23	2	LOCKNUT TYPE "M-F" FOR 3/4" BOLT							
91.22	6	WASHER, ROUND, FLAT 1 3/8" OD, 9/16" HOLE							



NOTES

1. FOR CONDUCTOR GUYS AND ASSOCIATED HARDWARE, SEE DWG 41 6052 - STANDARD GUY ARRANGEMENT, H-FRAME ANGLE STRUCTURES.
2. MATERIAL CALLED FOR ON THIS DRAWING IS FOR GUYING OF OVERHEAD GROUND WIRES ONLY AND IS IN ADDITION TO MATERIAL LISTED ON REFERENCE DRAWINGS.
3. ≠TO BE USED ONLY WHEN SPECIFIED.
4. ✕USE 3/4"x8'-0" ROD UNLESS 3/4"x10'-0" IS NEEDED TO OBTAIN 5'-0" FOOT DEPTH.

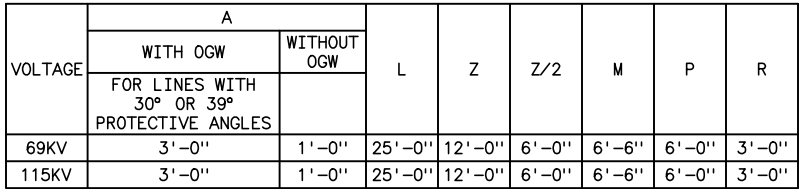
REFERENCE DRAWINGS

STANDARD GUY ARRANGEMENT -
H-FRAME ANGLE STRUCTURES ----- 41 6052
TYPE H STRUCTURE 69 & 115KV ----- 41 6088

B	5-28-14 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-4443		
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
	TRANSMISSION LINE STANDARDS GUY ARRANGEMENT 115KV GUY ARRANGEMNET FOR TYPE HA STRUCTURE WITH GUY STUB AND OVERHEAD GROUND WIRE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
C A F	SEPTEMBER 24, 1980	41	6086

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XREF(S):



1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. ≠ USE ONLY WHEN SPECIFIED.
3. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG 41 6035, IS USED.

GROUNDING DETAILS	41	1012
DRILLING AND GAINING DETAILS WITH OGW		
30° PROTECTIVE ANGLE	41	6021
GUY ARRANGEMENT - ASSEMBLY - H-FRAME	41	6051
DRILLING AND GAINING DETAILS (WITHOUT OGW)	41	6066
DRILLING AND GAINING DETAILS WITH OGW		
30° PROTECTIVE ANGLE	41	6068
GUY ARRANGEMENT - WITH GUY STUB AND		
OVERHEAD GROUND WIRE	41	6086
CONDUCTOR ARRANGEMENT - H-FRAME		
TRANSPOSITION	41	6094

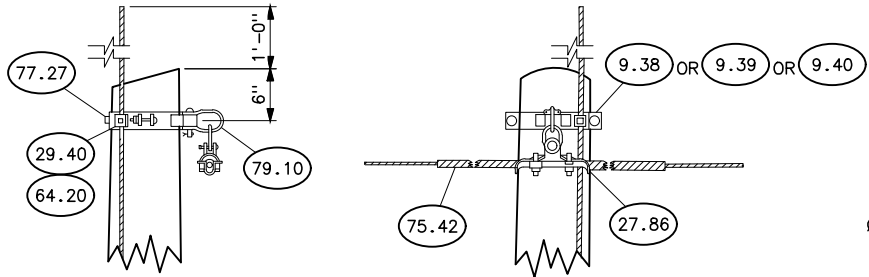
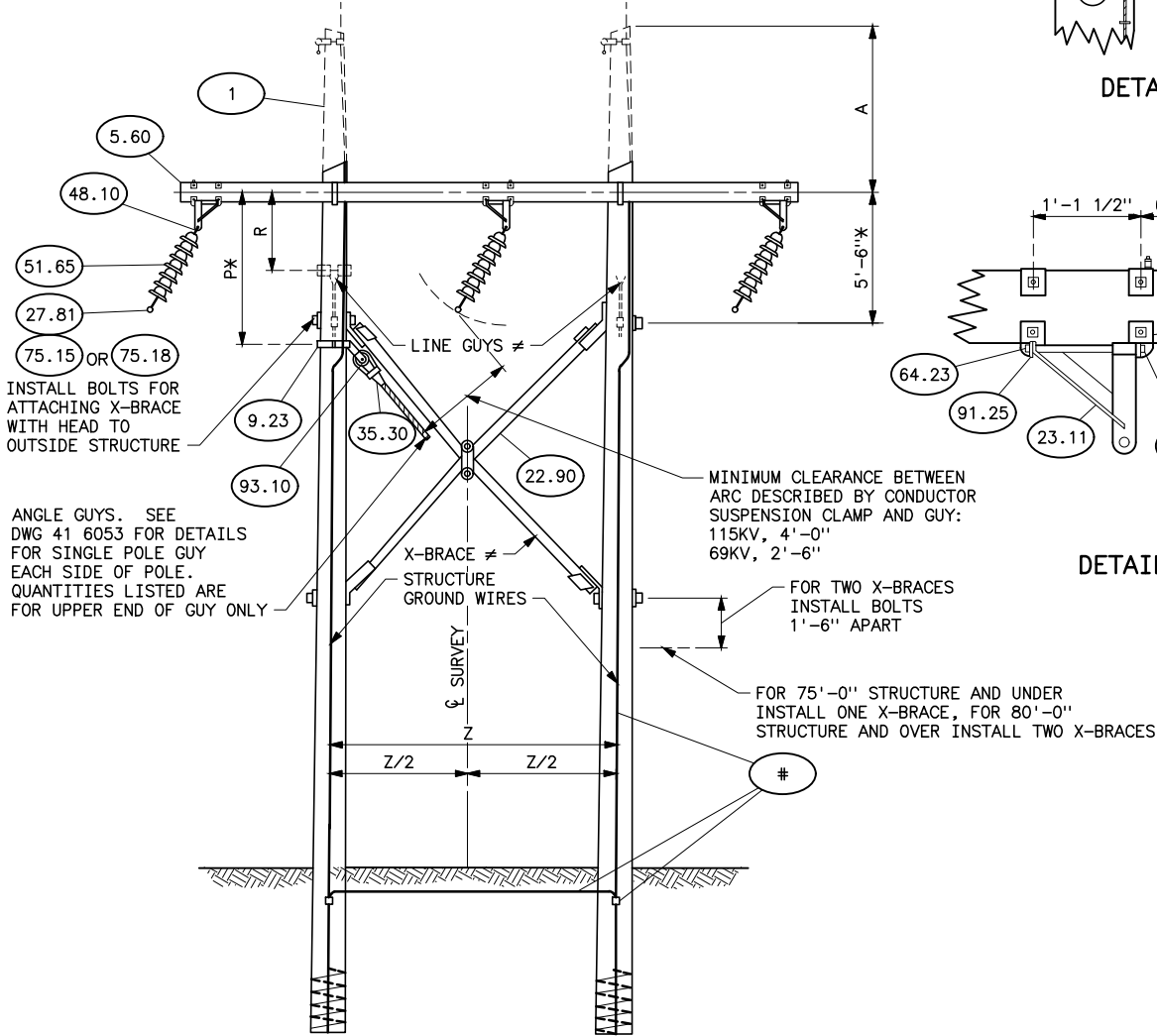
INSULATOR MATERIAL						DWG NO. 41
PART NO.	69KV		115KV		DESCRIPTION	
27.81	3		3		CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)	1000
48.10	3		3		HOOK, SUSPENSION	1003
51.65	12	3-STRINGS OF 4	21	3-STRINGS OF 7	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3		3		ROD, ARMOR, TAPERED SINGLE SUPPORT (FOR ACSR ONLY)	1000
					ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	

OVERHEAD GROUND WIRE MATERIAL			
PART NO.	SUSPENSION	DESCRIPTION	DWG NO. 41
9.38, 9.39 OR 9.40	2	BAND, POLE TAP	6034, 6035 6036, 6037
29.40	2	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	
27.86	2 Δ	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2 Δ	SHACKLE, ANCHOR TYPE	6034, 6036 6037
64.20	2	LOCKNUT FOR 3/8" BOLT	
75.42	2 SETS	ROD, ARMOR, PREFORMED	

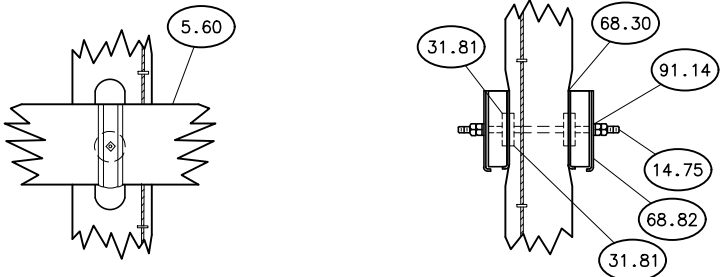
C	2-8-19 A7-KKR	REVISED DESCRIPTIONS FOR PART NO.'S 14.75 AND 14.77.
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4808		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS 69 AND 115KV TYPE HTR TRANSPOSITION STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
DATE	SEPTEMBER 29, 1980	41 6087

Plotted By: court Aug 25, 2026- 1:23pm
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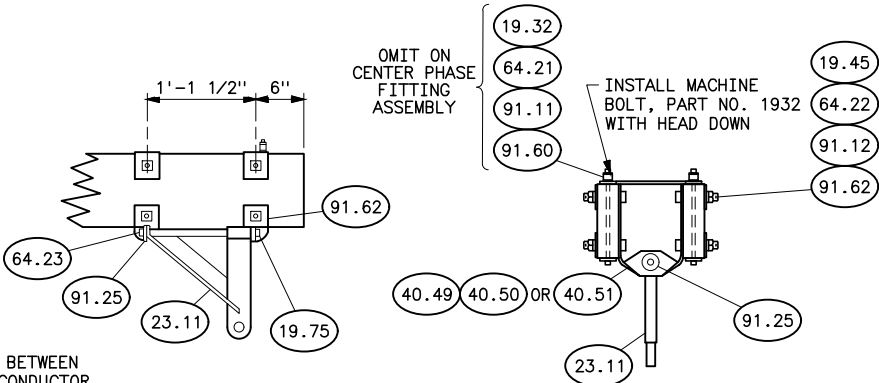
VOLTAGE	A			L	Z	M	W	Y	X	PX	R
	WITH OGW		WITHOUT OGW								
	30° PROTECTIVE ANGLES	39° PROTECTIVE ANGLES									
69 & 115KV	6'-6"	3'-0"	1'-0"	25'-0"	12'-0"	5'-6"	7'-0"	5'-0"	7'-6"	6'-6"	3'-0"



SUSPENSION
DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



DETAIL OF CROSSARM ATTACHMENT



DETAIL OF PHASE FITTING ASSEMBLY

NOTES

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. ≠ USE ONLY WHEN SPECIFIED.
3. * WHEN ADDITIONAL INSULATOR DISC IS USED ON ANGLE STRUCTURES AT RAILROAD OR MAIN HIGHWAY CROSSINGS, THIS DIMENSION SHALL BE INCREASED 6-INCHES.
4. ** DO NOT USE TENSION OR DEADEND ASSEMBLY FOR OVERHEAD GROUND WIRES ON TYPE HA STRUCTURE.
5. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG 41 6035, IS USED.
6. Ø GREATER THAN 20-INCH LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.

REFERENCE DRAWINGS

- GROUNDING DETAILS ----- 41 1012
DRILLING AND GAINING DETAILS WITH OGW ----- 41 6021
30° PROTECTIVE ANGLE ----- 41 6021
GUY ARRANGEMENT - ASSEMBLY - H-FRAME ----- 41 6052
STANDARD GUY ARRANGEMENT FOR TYPE 3A AND 3B ----- 41 6053
STRUCTURES WITH OVERHEAD GROUND WIRES ----- 41 6053
DRILLING AND GAINING DETAILS (WITHOUT OGW) ----- 41 6066
DRILLING AND GAINING DETAILS WITH OGW ----- 41 6066
39° PROTECTIVE ANGLE ----- 41 6068
GUY ARRANGEMENT - WITH GUY STUB AND ----- 41 6086
OVERHEAD GROUND WIRE ----- 41 6086

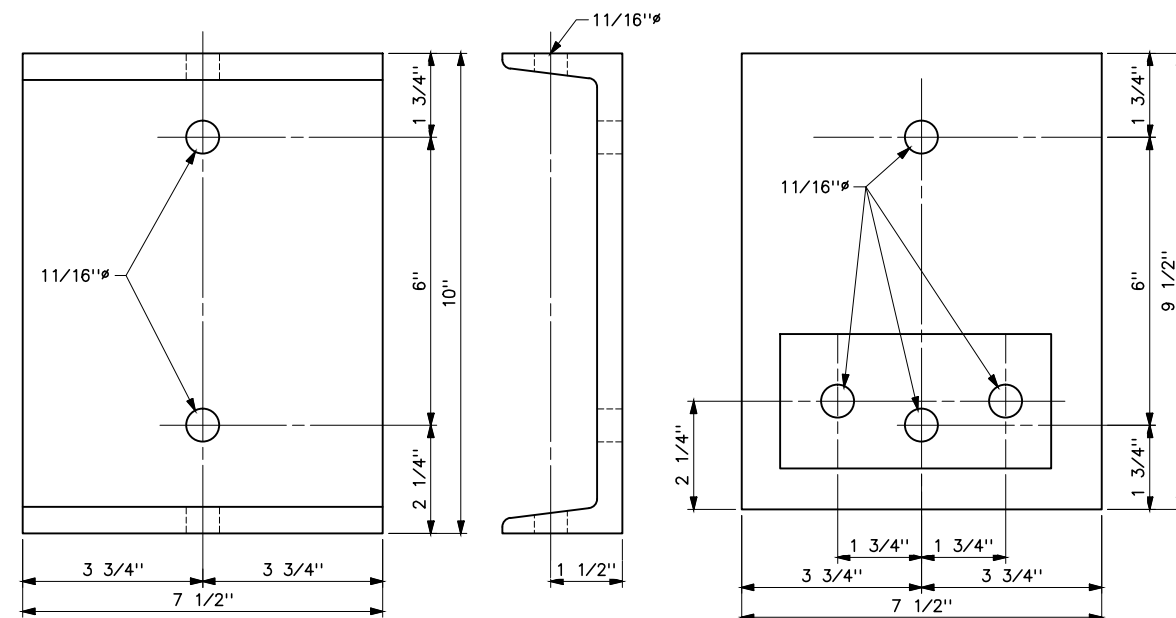
STRUCTURE MATERIAL					
PART NO.	QUANTITY		DESCRIPTION		DWG NO. 41
	WITH OVERHEAD GROUND WIRES	W/O OVERHEAD GROUND WIRES			
	69KV OR 115KV	69KV OR 115KV			
1	2	2	POLE		
5.60	2	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x25'-0"		6090
14.75	2	2	BOLT, DOUBLE ARMING, 7/8"x20" WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS		
19.32	4	4	BOLT, MACHINE, 1/2"x12"		
19.45	24	24	BOLT, MACHINE, 5/8"x5"		
19.75	3	3	BOLT, MACHINE, 3/4"x18"		
23.11	3	3	BRACKET, ANGLE		6091
31.81	8	8	CONNECTOR, 4" SHEAR PLATE, WOOD TO STEEL, FOR 7/8" BOLT		
40.49 40.50 40.51	6	6	FITTING, PHASE	SELECT PHASE FITTING WITH DIMENSION "B" NEAREST TO GAINING DIMENSION "B", DWG 41 6021 OR 41 6066	6038
64.21	4	4	LOCKNUT FOR 1/2" BOLT		
64.22	24	24	LOCKNUT FOR 5/8" BOLT		
68.30	4	4	PLATE, FLAT GAIN		6038
68.82	4	4	PLATE, RIBBED TIE		6038
91.11	4	4	LOCK WASHER, SPRING, FOR 1/2" BOLT		
91.12	24	24	LOCK WASHER, SPRING, FOR 5/8" BOLT		
91.14	4	4	LOCK WASHER, SPRING, FOR 7/8" BOLT		
91.25	6	6	WASHER, ROUND FLAT, FOR 3/4" BOLT		
91.60	4	4	WASHER, SQUARE FLAT, 2"x2"x1/8", 9/16" HOLE		
91.62	24	24	WASHER, SQUARE FLAT, 2 1/4"x2 1/4x3/16", 11/16" HOLE		
22.90	1 OR 2	1 OR 2	X-BRACE, COMPLETE WITH FITTINGS, (3 3/8"x4 3/8")		6029
9.23	1	1	BAND, FOUR-WAY STRAIN, TYPE B WITH GROUNDING CLIP		6031
35.30	2	2	DEADEND, AUTOMATIC VISE TYPE FOR GUY STRAND, SHORT BAIL		
93.10	2	2	SHEAVE WHEEL FOR 7/16" STRAND		6031
#	PART NO'S AND DESCRIPTION SHOWN ON DWG 41 1012				

INSULATOR MATERIAL						
PART NO.	69KV		115KV		DESCRIPTION	DWG NO. 41
27.81	3		3		CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)	1000
48.10	3		3		HOOK, SUSPENSION	1003
51.65	12	3-STRINGS OF 4	21	3-STRINGS OF 7	INSULATOR, SUSPENSION, TYPE, 10" DIAMETER, 5 3/4" SPACING	1000
75.15 OR 75.18	3		3		ROD, ARMOR, TAPERED SINGLE SUPPORT (FOR ACSR ONLY)	1000
					ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	

OVERHEAD GROUND WIRE MATERIAL			
PART NO.	SUSPENSION	DESCRIPTION	DWG NO. 41
9.38, 9.39 OR 9.40	2	BAND, POLE TAP	6035, 6036, 6037
29.40	2	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	
27.86	2 Δ	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2 Δ	SHACKLE, ANCHOR TYPE	6036, 6037
64.20	2	LOCKNUT FOR 3/8" BOLT	
75.42	2 SETS	ROD, ARMOR, PREFORMED	

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION
SEE NEW STANDARD DESIGN DRAWING 41 6124 (HA-1)

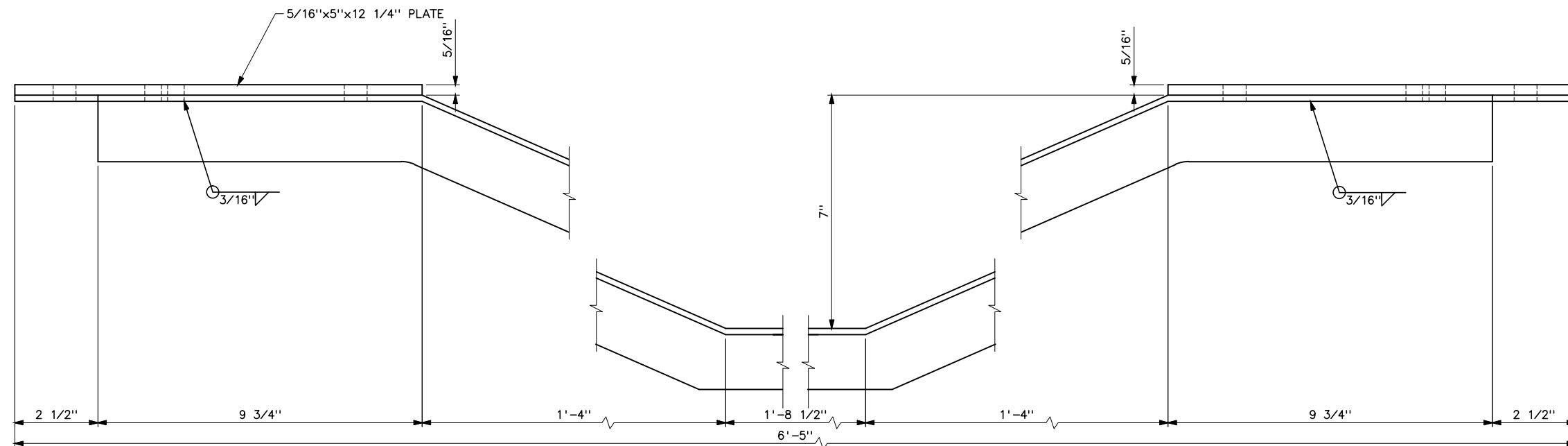
C	8/25/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4806		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE HA 69 AND 115KV SMALL ANGLE SUSPENSION STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 19, 1980	41 6088



ITEM NO. 26.30
CHANNEL TIE
10" CHANNEL @ 15.3# - MARK 3172-C
SIX REQUIRED PER STRUCTURE

ITEM NO. 68.10
BEARING PLATE
1/4" STEEL PLATE - MARK 3172-D
SIX REQUIRED PER STRUCTURE

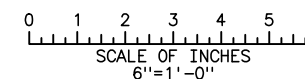
1. ALL MEMBERS TO BE HOT DIPPED GALVANIZED AFTER FABRICATION AND DRILLING IN ACCORDANCE WITH ASTM A-123-33.

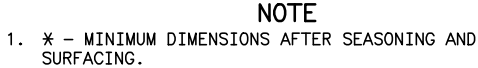


ITEM NO. 4.13
ANGLE SWITCH TIE
2"x2"x3/16" ANGLE - MARK 3172-B
THREE REQUIRED PER STRUCTURE

TYPE HSWT - WOOD FRAME-69KV
AIR BREAK SWITCH STRUCTURE_____41 6069

B	9/24/12 A7-DD	REDRAWN.
SUPERSEDES DWG NO. 40-D-3172		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HSWT - WOOD FRAME 69KV STEEL DETAILS		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C A F	AUGUST 19, 1980	41 6089





**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

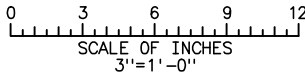
SUPERSEDES DWG NO. 40-D-4801

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

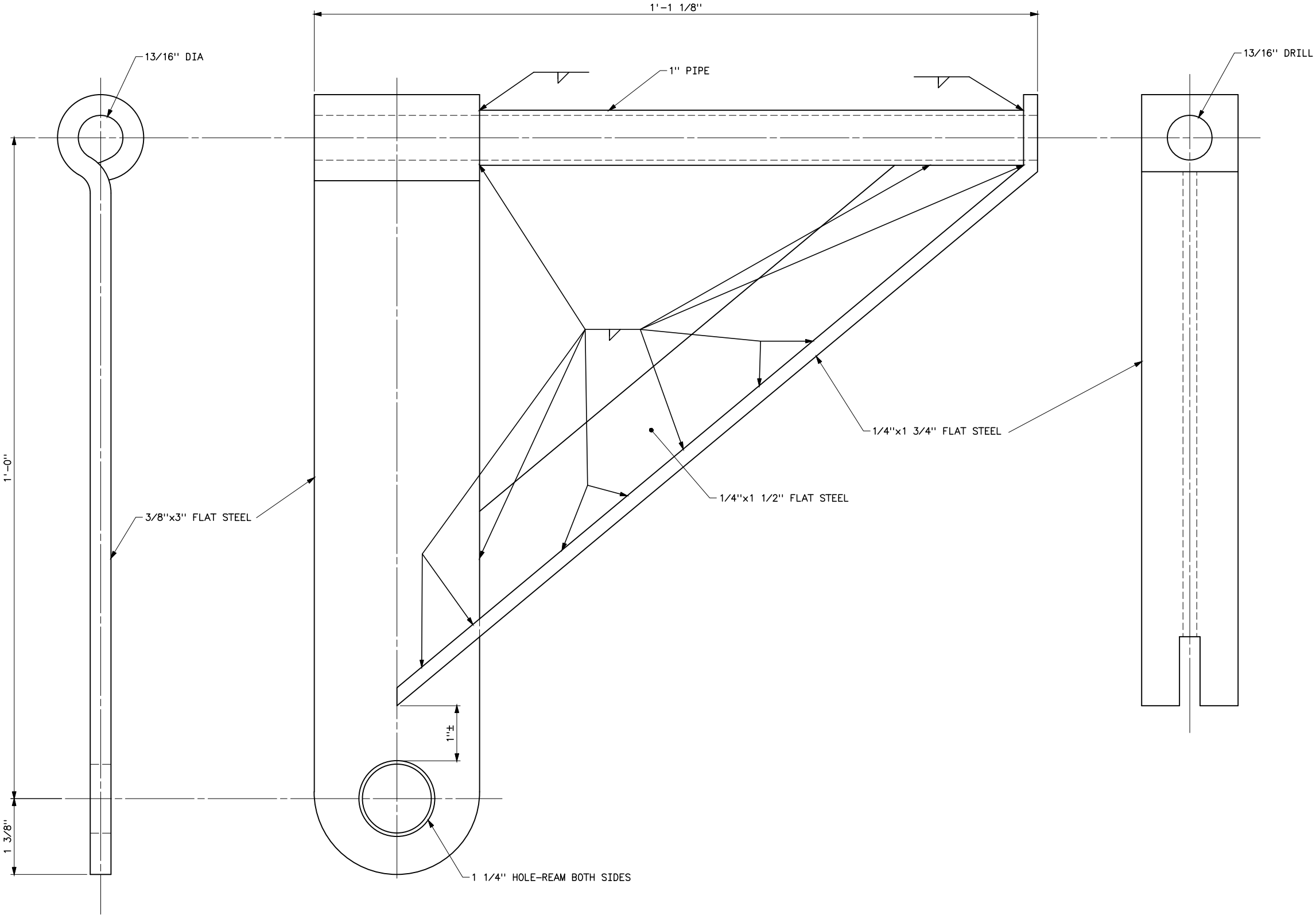
TRANSMISSION LINE STANDARDS
CROSSARM DRILLING DETAILS
69KV & 115KV, HA AND HAB STRUCTURES

DESIGNED BUREC _____ APPROVED BUREC _____

CASE	AUGUST 19, 1980	41	6090
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Plotted By: court Aug 25, 2026- 1:29pm
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NOTE
1. ALL MATERIAL SHALL BE GALVANIZED AFTER DRILLING AND BENDING, IN ACCORDANCE WITH ASTM DESIGNATION A153.

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

C	8/20/26 A7-KR	HISTORICAL REFERENCE	
B	5-28-14 A7-DDD	REDRAWN.	
SUPERSEDES DWG NO. 40-D-5932			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS SWINGING ANGLE BRACKET			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
C _A E	AUGUST 19, 1980	41	6091

XREF(S):



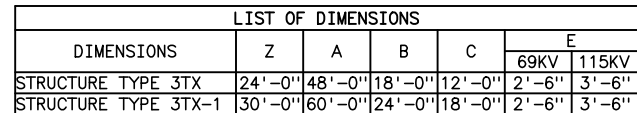
NOTES

1. MAXIMUM LINE TENSION 8000 POUNDS.
2. HOLES FOR MOUNTING SWITCHES SHALL BE FIELD DRILLED IN PLATES MK 5188-P-1.
3. ALL BOLTS 5/8"Ø, HOLES 11/16"Ø UNLESS OTHERWISE NOTED.
4. GALVANIZE ALL MATERIAL AFTER FABRICATION.
5. PEECE MARKS AS SHOWN SHALL BE PREFIXED WITH 5188
6. MARKS SHALL BE STAMPED ON MEMBERS BEFORE GALVANIZING.
7. LENGTH OF BOLT THREADS SHALL CONFORM TO AMERICAN STANDARD, B18.2.

REFERENCE DRAWINGS

GROUNDING DETAILS_____	41	10
115KV 4SWT STRUCTURE_____	41	60
GUY ARRANGEMENT_____	41	60

C	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5188		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS DISC SWITCH STRUCTURE 115KV STEEL DETAILS		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C/A	SEPTEMBER 24, 1980	41
		6092



- REFERENCE DRAWINGS

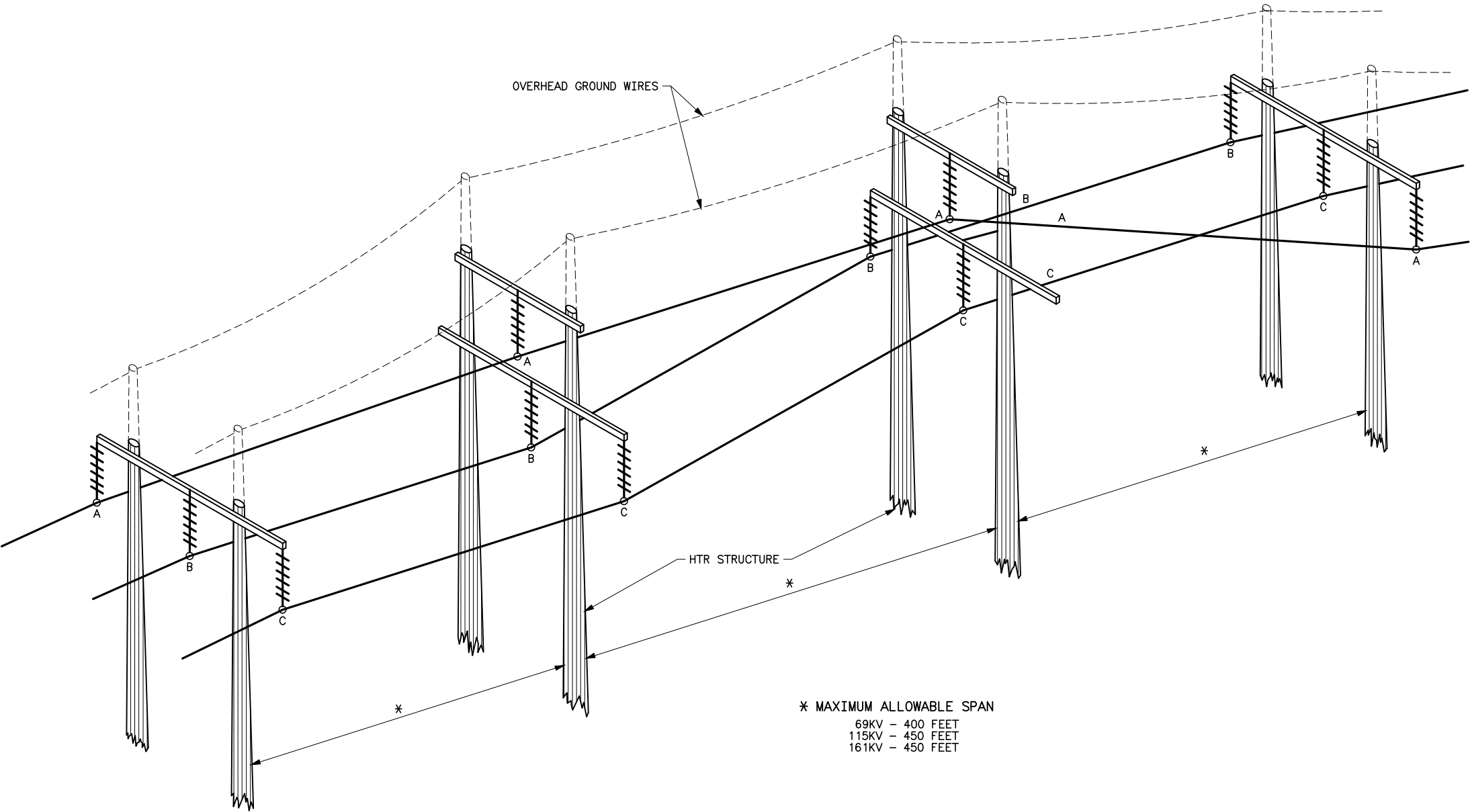
GROUNDING DETAILS	41	1012
DRILLING AND GAINING DETAILS WITH OGW	41	6021
GUY ARRANGEMENT FOR TYPE JTX WITH OGW	41	6054
DRILLING AND GAINING DETAILS WITHOUT OGW	41	6066
GUY ARRANGEMENT 3-POLE STRUCTURE HEAVY GUYING	41	6070
GUY ARRANGEMENT 3-POLE STRUCTURE LIGHT GUYING	41	6073

**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

INSULATOR MATERIAL							DWG NO.
PART NO.	SINGLE STRING		DOUBLE STRING		DESCRIPTION		
	69KV	115KV	69KV	115KV			
27.70 OR 35.10	—	—	6	6	CLAMP, STRAIN, WITH CLEVIS FITTING, FOR CONDUCTOR		41
					DEAD END, COMPRESSION TYPE, FOR CONDUCTOR		
27.71 OR 35.11	6	6	—	—	CLAMP, STRAIN, WITH SOCKET FITTING, FOR CONDUCTOR		
					DEAD END, COMPRESSION TYPE, WITH SOCKET FITTING, FOR CONDUCTOR		1002
27.51 OR 31.20	3	3	3	3	CLAMP, PARALLEL GROOVE, 3 BOLT, FOR CONDUCTOR		
					COMPRESSION JUMPER CONNECTOR, FOR CONDUCTOR *		
27.81	3	3	3	3	CLAMP, SUSPENSION, WITH SOCKET FITTING		1000
38.10	6	6	—	—	CONNECTOR, BALL-EYE		1003
48.10	3	3	3	3	HOOK, SUSPENSION		1003
51.65	48	75	84	129	INSULATOR, SUSPENSION TYPE, 5 3/4" SPACING		
75.15 OR 75.18	3	3	3	3	ROD, ARMOR, TAPERED, SINGLE SUPPORT, FOR ASCR*		1000
					ROD, ARMOR, PREFORMED, SINGLE SUPPORT, FOR ASCR*		1000
98.57	—	—	6	6	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS		1004

OVERHEAD GROUND WIRE MATERIAL						
PART NO.	TANGENT		ANGLE		DESCRIPTION	DWG NO. 41
	69KV	115KV	69KV	115KV		
29.50	4	4	6	6	CLIP, GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	6030
35.20	4	4	4	4	DEAD END, COMPRESSION TYPE, FOR OGW	
58.11	1	1	1	1	LINK, CONNECTING, PAIR	6030
58.12	1	1	1	1	LINK, CONNECTING, PAIR	6030
58.13	4	4	4	4	LINK, CONNECTING, PAIR	6030
64.23	4	4	6	6	LOCKNUT, FOR 3/4" BOLT	
77.27	8	8	12	12	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
82.30	4Z PLUS 5 FEET				STEEL STRAND, 7/16"-7-WIRE, SIEMENS-MARTIN STRAND	
91.22	8	8	12	12	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	3	3	3	3	WHEEL, SHEAVE, FOR 7/16" STRAND	6030
9.20	4	4	6	6	BAND, FOUR-WAY, STRAIN	6030
27.30	3	3	3	3	CLAMP, GUY 6", 3-BOLT	

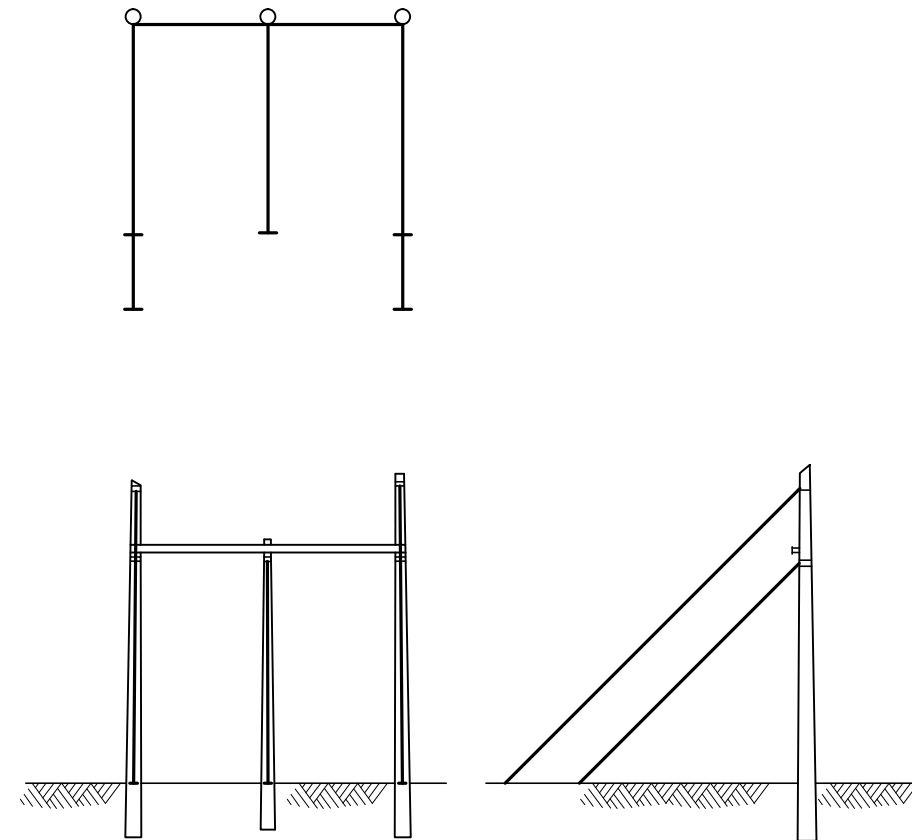
C	8/24/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4811		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS 69 AND 115KV TYPE 3TX 3-POLE LONG SPAN STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
DATE	SEPTEMBER 29, 1980	41
		6093



B	5-28-14	REDRAWN	
	A7-		
SUPERSEDES DWG NO. 40-D-2694			
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS CONDUCTOR ARRANGEMENT H-FRAME TRANSPOSITION			
DESIGNED <u>BUREC</u> _____		APPROVED <u>BUREC</u> _____	
C _A E	SEPTEMBER 29, 1980	41	6094

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XREF(S):



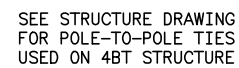
FOR OGW
2-LDG
2-LSG

REFERENCE DRAWINGS

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TYPE 3DE - 69 AND 115KV
  3-POLE SPECIAL DEAD END STRUCTURE_____ 41 6004
GUY ASSEMBLY AND DETAILS_____ 41 6047
TYPE 3BT/4BT 69 AND 115KV
  BRANCH LINE STRUCTURE_____ 41 6109

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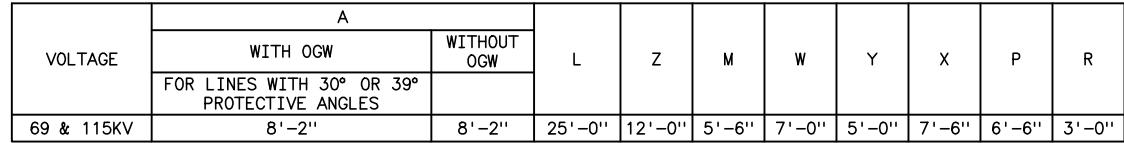


SINGLE GUYS	FIGURE 1A
	FIGURE 1C
DOUBLE GUYS	FIGURE 1B
	FIGURE 1D

	FOR CONDUCTOR	FOR OGW
FIGURE 1A	3-LSGEW, 2-LSG	2-LSG
FIGURE 1B	3-LDGEW, 2-LDG	2-LDG
FIGURE 1C	3-LDGEW, 2-LSG	2-LSG
FIGURE 1D	3-LSGEW, 2-LDG	2-LDG

FOR 4BT WITH OVERHEAD GROUND WIRE

B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5016		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS STANDARD GUY ARRANGEMENT FOR TYPE 3DE AND 3BT/4BT STRUCTURES WITH OVERHEAD GROUND WIRES		
DESIGNED BUREC _____ APPROVED BUREC _____		
C _A F	JUNE 24, 1981	41
		6095



- ## NOTES
1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
 2. ≠ USE ONLY WHEN SPECIFIED.
 3. * WHEN AN ADDITIONAL INSULATOR DISC IS USED ON ANGLE STRUCTURES AT RAILROAD OR MAIN HIGHWAY CROSSINGS, THIS DIMENSION SHALL BE INCREASED 6-INCHES.
 4. ** DO NOT USE TENSION OR DEADEND ASSEMBLY FOR OVERHEAD GROUND WIRES ON TYPE HAB STRUCTURE.
 5. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO. 41 6035 IS USED.
 6. Ø GREATER THAN 20-INCH LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLE.

REFERENCE DRAWINGS

GROUNDING DETAILS	-----	.41	1012
DRILLING AND GAINING DETAILS WITH OGW-	-----		
30° PROTECTIVE ANGLE	-----	.41	6021
GUY ARRANGEMENT-ASSEMBLY H-FRAME	-----	.41	6052
DRILLING AND GAINING DETAILS (WITHOUT OGW)	-----	.41	6066
DRILLING AND GAINING DETAILS WITH OGW-	-----		
30° PROTECTIVE ANGLE	-----	.41	6068
GUY ARRANGEMENT-WITH GUY STUB AND	-----		
OVERHEAD GROUND WIRE	-----	.41	6086

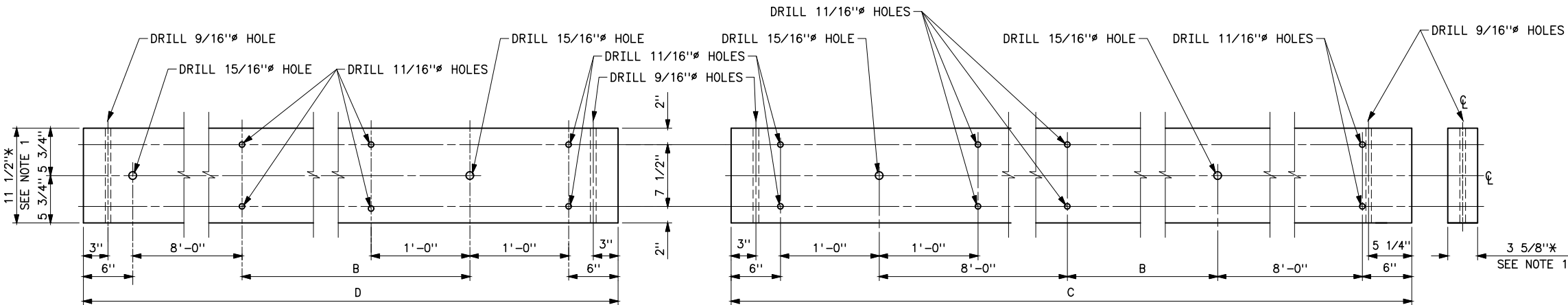
**HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION**

STRUCTURE MATERIAL				
PART NO.	QUANTITY		DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRES	W/OUT OVERHEAD GROUND WIRES		
	69KV OR 115KV	69KV OR 115KV		
1	2	2	POLE	
5.60	2	2	CROSSARM, WOOD, 2 5/8"x9 1/2"x25'	6090
14.72	2	2	BOLT, DOUBLE ARMING, 7/8"x14" WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS	
14.75	2	2	BOLT, DOUBLE ARMING, 7/8"x20" WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS	
19.32	4	4	BOLT, MACHINE, 1/2"x12"	
19.45	24	24	BOLT, MACHINE, 5/8"x5"	
19.75	3	3	BOLT, MACHINE, 3/4"x18"	
19.82	3	3	BOLT, MACHINE, 7/8"x3"	
22.68	2	2	BRACE, KNEE, SPACING 4'-8", DROP 5'-8", 3 3/8"x4 3/8" SECTION	
22.69	2	2	BRACE, KNEE, SPACING 6'-8", DROP 5'-8", 3 3/8"x4 3/8" SECTION	
23.10	3	3	BRACKET, ANGLE	6044
31.81	8	8	CONNECTOR, 4" SHEAR PLATE, WOOD TO STEEL FOR 7/8" BOLT	
40.49	3	3	FITTING, PHASE	6038
40.52	3	3	FITTING, PHASE	6038
64.21	4	4	LOCKNUT FOR 1/2" BOLT	
64.22	24	24	LOCKNUT FOR 5/8" BOLT	
64.23	3	3	LOCKNUT FOR 3/4" BOLT	
64.24	3	3	LOCKNUT FOR 7/8" BOLT	
68.30	4	4	PLATE, FLAT GAIN	6038
68.82	4	4	PLATE, RIBBED TIE	6038
91.11	4	4	LOCK WASHER, SPRING, FOR 1/2" BOLT	
91.12	24	24	LOCK WASHER, SPRING, FOR 5/8" BOLT	
91.14	11	11	LOCK WASHER, SPRING, FOR 7/8" BOLT	
91.25	6	6	WASHER, ROUND FLAT, FOR 3/4" BOLT	
91.60	4	4	WASHER, SQUARE FLAT, 2"x2"x1/8", 3/16" HOLE	
91.62	24	24	WASHER, SQUARE FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
22.90	1 or 2	1 or 2	X-BRACE, COMPLETE WITH FITTINGS, (3 5/8"x4 3/8")	6029
#	PART NO'S. AND DESCRIPTION SHOWN ON DWG 41 1012			

INSULATOR MATERIAL							DWG. NO.: 41
PART NO.	69KV		115KV		DESCRIPTION		
27.81	3		3		CLAMP, SUSPENSION, WITH SOCKET FITTING (FOR CONDUCTOR)		1000
48.10	3		3		HOOK, SUSPENSION		1003
51.65	12	3-STRINGS OF 4	21	3-STRINGS OF 7	INSULATOR, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING		1000
75.15 OR 75.18	3		3		ROD, ARMOR, TAPERED, SINGLE SUPPORT (FOR ACSR ONLY)		1000
					ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)		

OVERHEAD GROUND WIRE MATERIAL			
PART NO.	SUSPENSION XX	DESCRIPTION	DWG NO. 41
9.38,9.39 OR 9.40	2	BAND, POLE TOP	6034,6035
29.40	2	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	
27.86	2Δ	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
77.27	2	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2Δ	SHACKLE, ANCHOR TYPE	6034,6036
64.20	2	LOCKNUT FOR 3/8" BOLT	
75.42	2 SETS	ROD, ARMOR, PREFORMED	

B	5-28-14 A7-DDD	REDRAWN.
	SUPERSEDES DWG NO. 40-D-4807 UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
TRANSMISSION LINE STANDARDS TYPE HAB 69 AND 115KV SMALL ANGLE SUSPENSION STRUCTURE		
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____		
C _A E	JULY 2, 1981	41
		6096



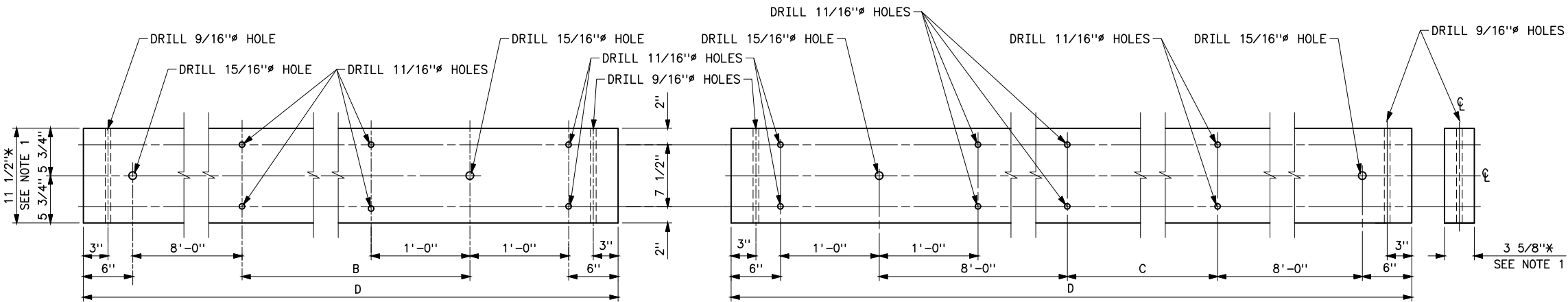
DETAIL 1, 3 5/8"x11 1/2"xD

DETAIL 2, 3 5/8"x11 1/2"xC

DIMENSIONS	B	C	D
STRUCTURE 3T	9'-0"	27'-0"	19'-0"
STRUCTURE 3T-1	12'-0"	30'-0"	22'-0"
STRUCTURE 3T-2	17'-0"	35'-0"	27'-0"

CROSSARM DETAILS FOR 3T, 3T-1, AND 3T-2 STRUCTURES
TWO CROSSARMS PER DETAIL 1 AND TWO CROSSARMS
PER DETAIL 2, REQUIRED PER STRUCTURE.

NOTE
1. * - MINIMUM DIMENISONS AFTER SEASONING AND SURFACING.



DETAIL 3, 3 5/8"x11 1/2"xD

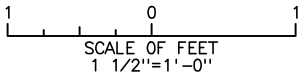
DETAIL 4, 3 5/8"x11 1/2"xD

DIMENSIONS	B	C	D
STRUCTURE 3TX	22'-0"	14'-0"	32'-0"

CROSSARM DETAILS FOR 3TX STRUCTURES
TWO CROSSARMS PER DETAIL 3 AND TWO CROSSARMS
PER DETAIL 4, REQUIRED PER STRUCTURE.

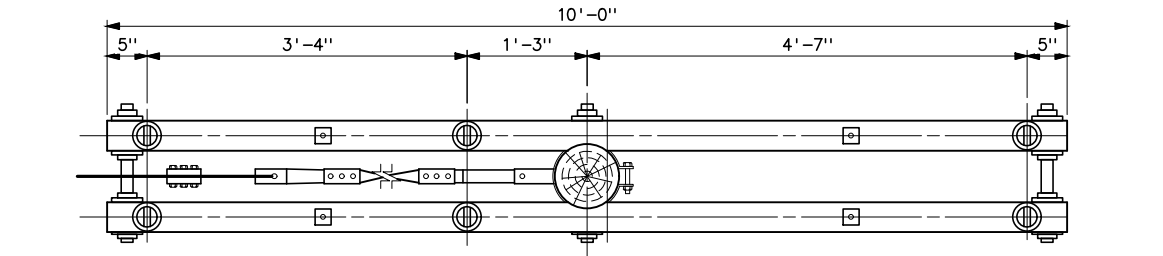
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	9-24-12 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-5696		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS CROSSARM DRILLING DETAILS 138KV & 161KV, 3T AND 3TX STRUCTURES		
DESIGNED BUREC _____ APPROVED BUREC _____		
A	AUGUST 3, 1981	41 6097

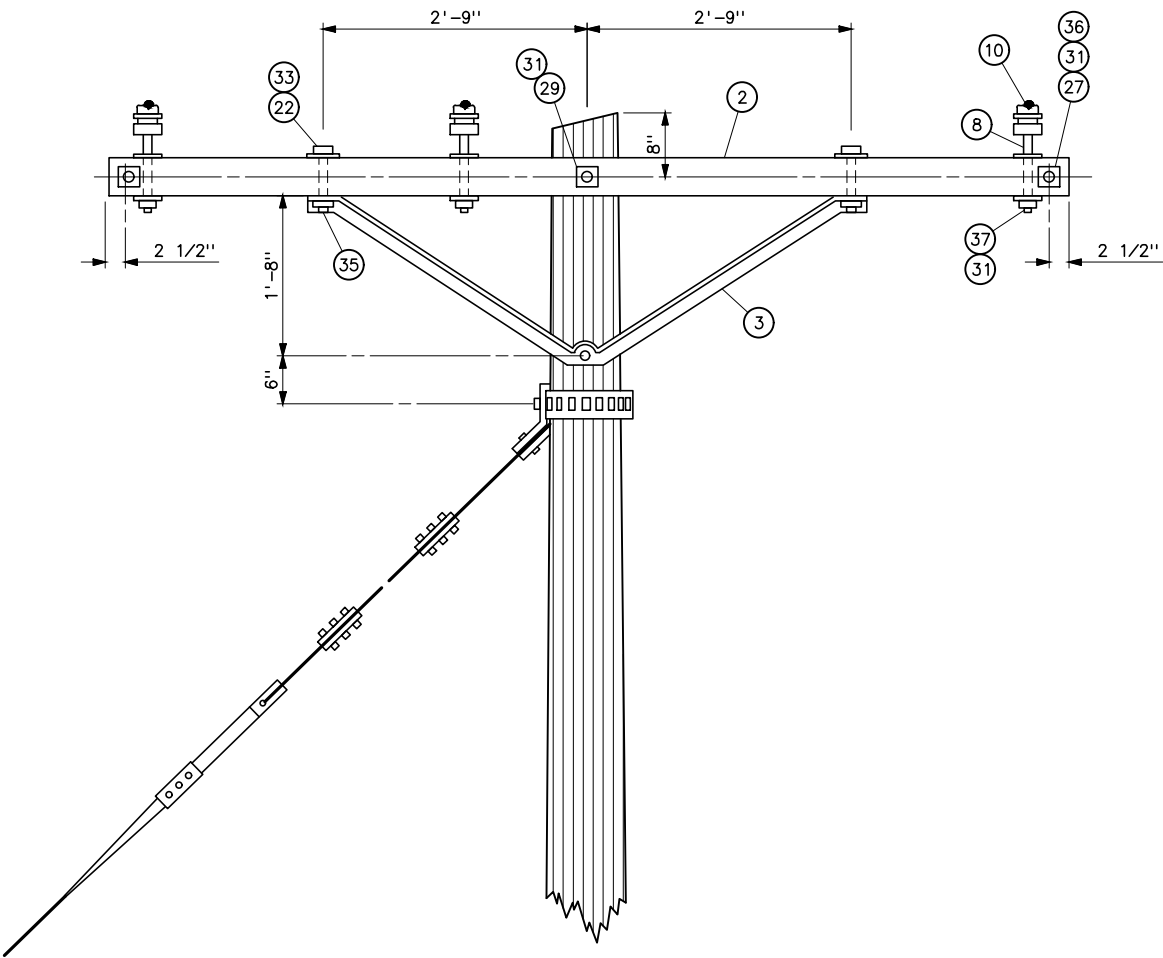


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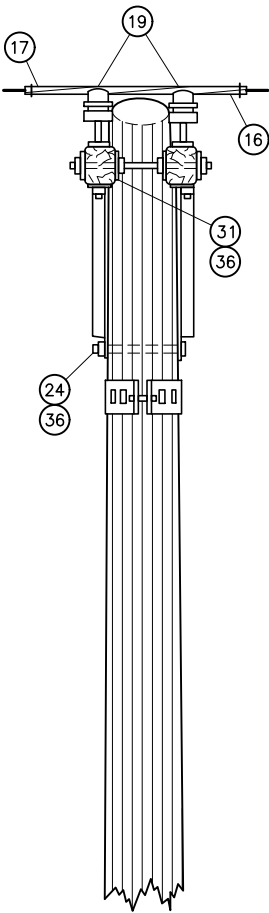
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PLAN



ELEVATION



SIDE VIEW

ITEM NO.	QUANTITY	DESCRIPTION
1	1	POLE, HEIGHT AS SPECIFIED ON STRUCTURE LIST
2	2	CROSS ARM X-3 3/4"x4 3/4"x10'-0"
3	2	CROSS ARM BRACE, DOUBLE SPAN, ANGLE, 66" SPAN, 20" DROP
8	6	INSULATOR PIN, 3/4"x6 3/4" SHANK, 6" HIGH, LOCK WASHER
10	6	INSULATOR, PIN TYPE, 1" PIN HOLE
16	3	SETS OF ARMOR RODS, DOUBLE SUPPORT FOR ACSR ONLY
17	6	ARMOR ROD CLIPS FOR ACSR ONLY
19	-	TIE WIRE PER DWG'S 40-D-3948 OR 41 6083
22	4	1/2"x7" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
24	1	5/8"x12" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
27	2	5/8"x20" DOUBLE ARMING BOLTS WITH 4 NUTS, 4 LOCK WASHERS
29	1	3/4"x20" DOUBLE ARMING BOLT USE EXTRA NUTS FOR LOCK NUTS, 2 LOCK WASHERS
31	16	3"x3"x1/4" FLAT SQAURE WASHER
33	4	2"x2"x1/8" FLAT SQAURE WASHER
35	4	LOCKNUT FOR 1/2" BOLT WITH SQAURE NUT
36	9	LOCKNUT FOR 5/8" BOLT WITH SQAURE NUT
37	6	LOCKNUT FOR 3/4" BOLT WITH SQAURE NUT

* X-ARM DRILLING: 3 3/4"x4 3/4"x10'-0" PER DWG 40-D-3025, ITEM 1
4"x5"x10'-0" PER DWG 40-D-3024, ITEM 2

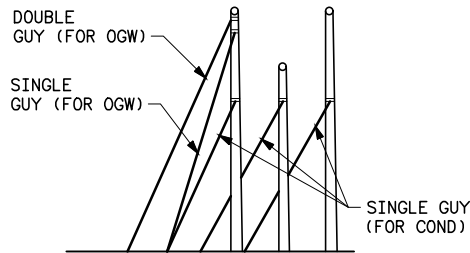
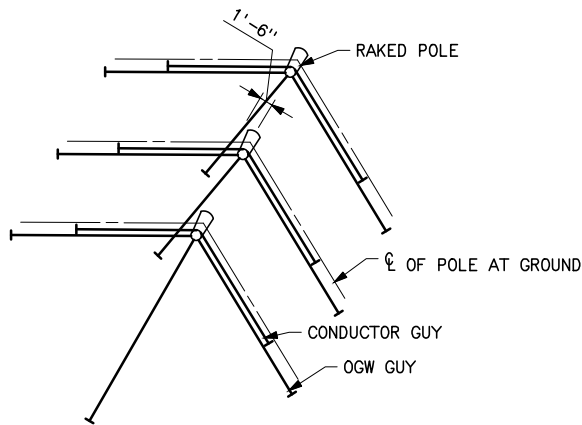
NOTES

1. NUMBER AND TYPE OF GUYS REQUIRED ARE SHOWN ON STRUCTURE LIST.
2. GUY ARRANGEMENTS ARE SHOWN ON DRAWING NUMBER 41 6082, 41 6083, AND 40-D-3059.
3. DRILL AND GAIN POLE AS SHOWN ON DRAWING 40-D-3027.
4. SIDE TIE TO BE USED ON ANGLE STRUCTURES.

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN
SUPERSEDES DWG NO. 40-D-3728		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE SD-13.2KV LONG SPAN CONSTRUCTION		
DESIGNED BUREC _____ APPROVED BUREC _____		
C _A E	OCTOBER 9, 1984	41 6098

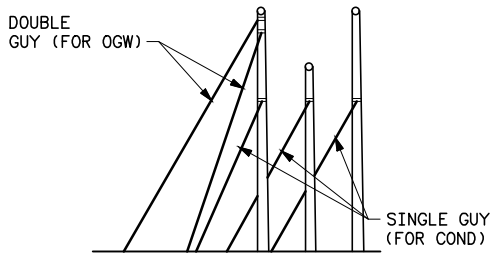
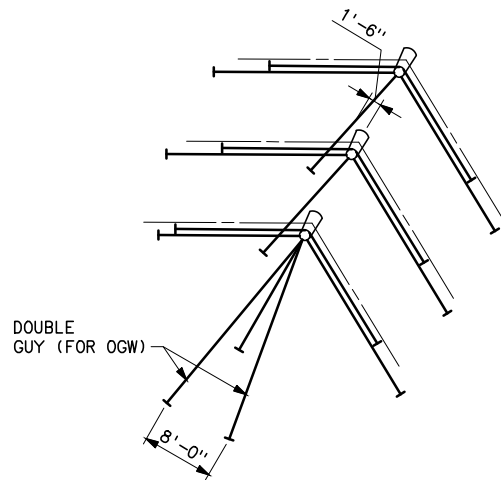
XREF(S):



LINE GUYS NOT SHOWN IN THIS VIEW

FIGURE	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
1A	3-LSGEW AND 3-ASG	1-ASG AND 1-ADG	10
1B	3-LDGEW AND 3-ASG	1-ASG AND 1-ADG	10
1C	3-LDGEW AND 3-LSGEW AND 3-ASG	1-ASG AND 1-ADG	16

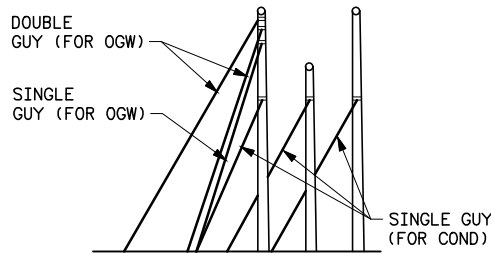
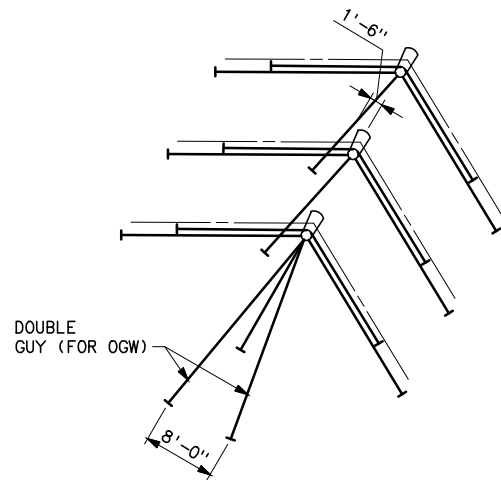
FIGURE NO. 1



LINE GUYS NOT SHOWN IN THIS VIEW

FIGURE	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
2A	3-LSGEW AND 3-ASG	2-ADG	11
2B	3-LDGEW AND 3-ASG	2-ADG	11
2C	3-LDGEW AND 3-LSGEW AND 3-ASG	2-ADG	17

FIGURE NO. 2



LINE GUYS NOT SHOWN IN THIS VIEW

FIGURE	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
3A	3-LSGEW AND 3-ASG	2-ADG AND 1-ASG	11
3B	3-LDGEW AND 3-ASG	2-ADG AND 1-ASG	11
3C	3-LDGEW AND 3-LSGEW AND 3-ASG	2-ADG AND 1-ASG	17

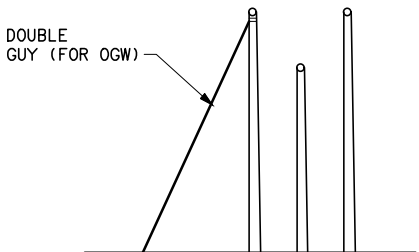
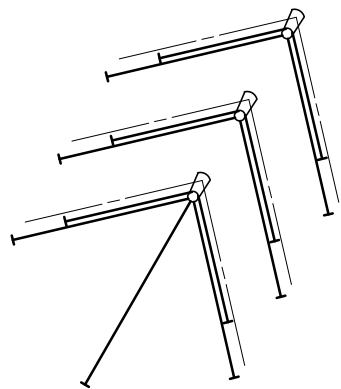
FIGURE NO. 3

NOTES

1. FOR OGW IN TENSION, SEE 3AT STRUCTURE SEE DWG NO'S 40-D-5006 AND 40-D-4812 FOR ARRANGEMENT OF BANDS.
2. "LSGEW" - LINE SINGLE GUY EACH WAY.
3. "LDGEW" - LINE DOUBLE GUY EACH WAY.
4. "ASG" - ANGLE SINGLE GUY.
5. "ADG" - ANGLE DOUBLE GUY.
6. "OGW" - OVERHEAD GROUND WIRE.

REFERENCE DRAWINGS

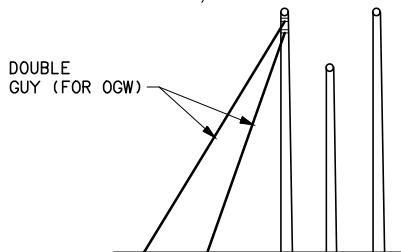
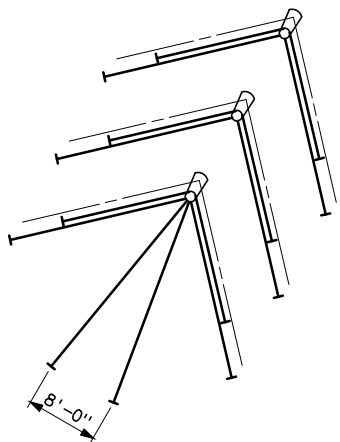
3AT STRUCTURE 138 AND 161KV-----40-D-5006
GUY ASSEMBLIES AND DETAILS-----41 6047
3AT STRUCTURE 69 AND 115KV-----41 6074



LINE GUYS NOT SHOWN IN THIS VIEW

FIGURE	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
4A	3-LSGEW	1-ADG	7
4B	3-LDGEW	1-ADG	7
4C	3-LDGEW AND 3-LSGEW	1-ADG	13

FIGURE NO. 4



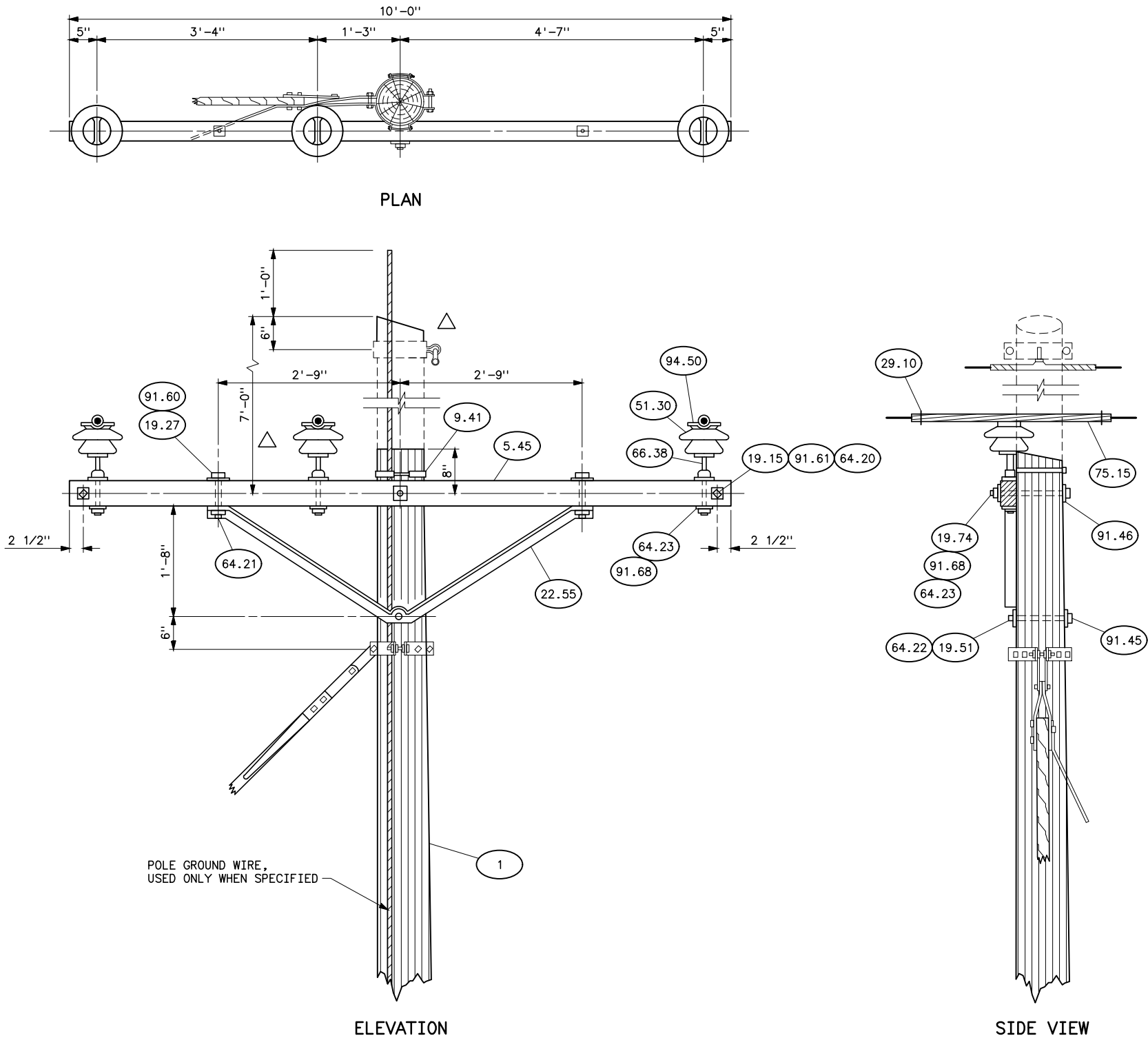
LINE GUYS NOT SHOWN IN THIS VIEW

FIGURE	FOR CONDUCTOR	FOR OGW	NO. OF ANCHORS
5A	3-LSGEW	2-ADG	8
5B	3-LDGEW	2-ADG	8
5C	3-LDGEW AND 3-LSGEW	2-ADG	14
5D	6-LDGEW	2-ADG	14

FIGURE NO. 5

D	6-22-22 A7-KR	ADDED FIGURE 5D GUYING.
C	4-20-20 A7-KR	TITLE BLOCK REVISION.
B	5-28-14 A7-DDD	REDRAWN.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINES STANDARD GUY ARRANGEMENT FOR TYPE 3AT STRUCTURES WITH OVERHEAD GROUND WIRES		
DESIGNED BUREC-----APPROVED BUREC-----		
C _A E	APRIL 4, 1986	41 6099



LIST OF MATERIAL			
NEW ITEM NO.	ITEM NO.	QUANTITY	DESCRIPTION
1	1	1	POLE, HEIGHT AS SPECIFIED ON STRUCTURE LIST
5.45	2	1	CROSS ARM ✕
22.55	3	1	CROSS ARM BRACE, DOUBLE SPAN, ANGLE, 66" SPAN, 20" DROP
9.41	5	1	POLE TOP BAND, DWG 41 6032
66.38	8	3	INSULATOR PIN, 3/4"x6 1/2" SHANK, 8" HIGH, LOCK WASHER
51.30	10	3	INSULATOR, PIN TYPE, 9" DIAMETER
75.15	15	3	SETS OF ARMOR RODS, SINGLE SUPPORT FOR ACSR ONLY
29.10	17	6	ARMOR ROD CLIPS FOR ACSR ONLY
94.50	19	-	TIE WIRE PER DWG'S 40-D-3948 OR 41 6083
19.27	22	2	1/2"x7" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
19.51	24	1	5/8"x12" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
19.74	26	1	3/4"x16" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
91.68	31	4	3"x3"x1/4" FLAT SQAURE WASHER, 13/16" HOLE
91.46	32	1	3"x3"x1/4" CURVED SQAURE WASHER, 13/16" HOLE
91.60	33	2	2"x2"x1/8" FLAT SQAURE WASHER, 9/16" HOLE
64.21	35	2	LOCKNUT FOR 1/2" BOLT WITH SQAURE NUT
64.22	36	1	LOCKNUT FOR 5/8" BOLT WITH SQAURE NUT
64.23	37	4	LOCKNUT FOR 3/4" BOLT WITH SQAURE NUT
19.15	-	2	3/8"x4 1/2" MACHINE BOLT
64.20	-	2	LOCKNUT FOR 3/8" BOLT
91.61	-	4	2"x2"x1/8" FLAT SQUARE WASHER 7/16" HOLE
91.45	-	1	3"x3"x1/4" CURVED SQUARE WASHER 11/16" HOLE

✕ X-ARM DRILLING: 3 3/4"x4 3/4"x10'-0" PER DWG 40-D-3024, ITEM 1
4"x5"x10'-0" PER DWG 40-D-3024, ITEM 2

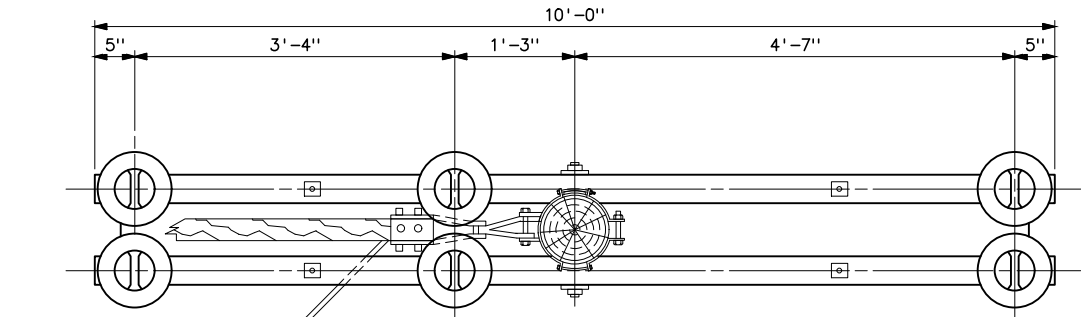
NOTES

1. DRILL AND GAIN POLE AS SHOWN ON DRAWING 40-D-3027.
2. Δ USE OVERHEAD GROUND WIRE ONLY WHEN SPECIFIED.
3. OVERHEAD GROUND WIRE ATTACHMENT DETAILS ARE SHOWN ON 41 6084.
4. POLE GROUNDING DETAILS ARE SHOWN ON 41 1012.

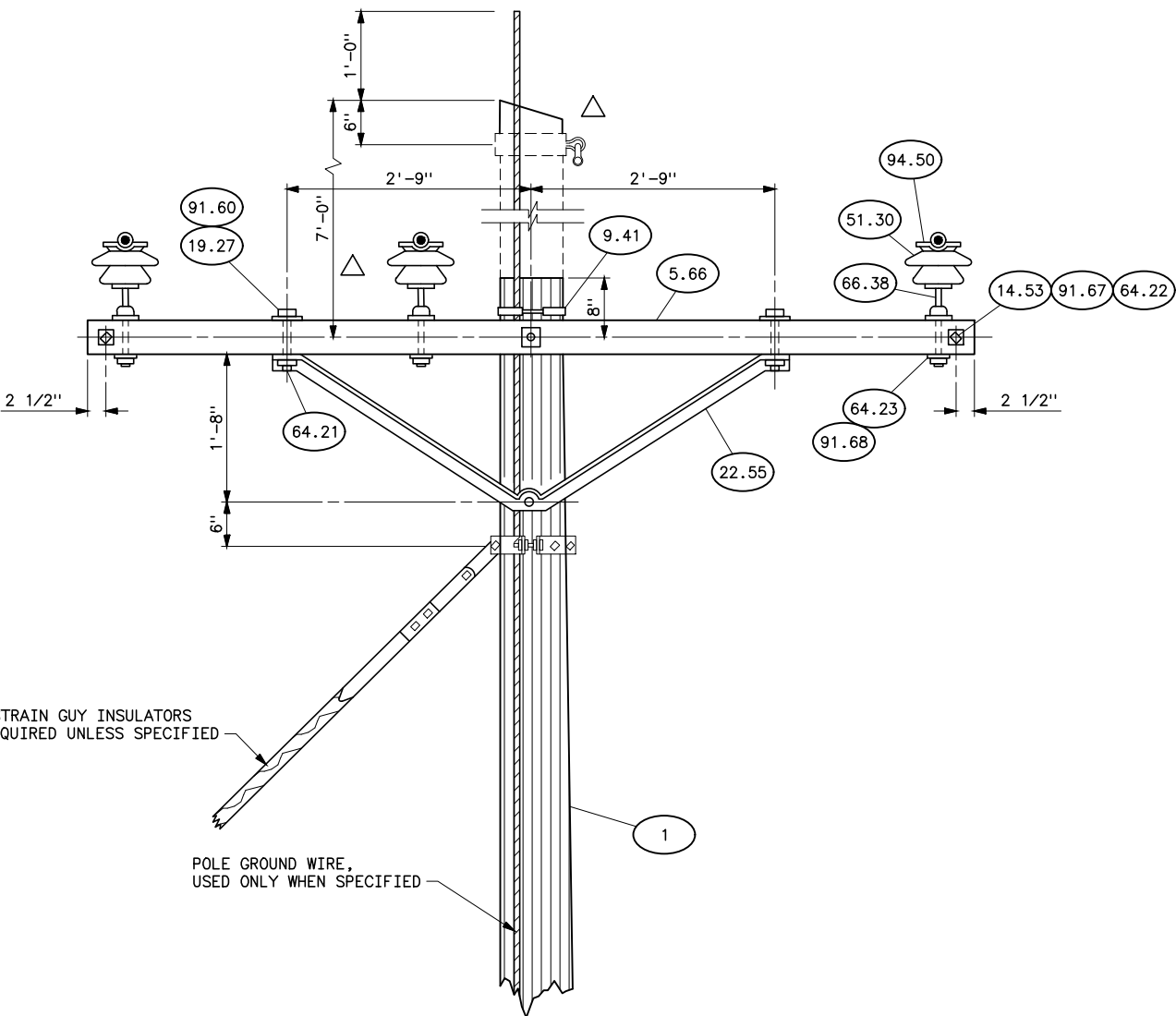
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN
SUPERSEDES DWG NO. 40-D-3028		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE SS-33KV FLAT TOP CONSTRUCTION		
DESIGNED BUREC _____ APPROVED BUREC _____ ELECTRICAL ENGINEERING MANAGER		
C _A E	FEBRUARY 9, 1987	41 6100

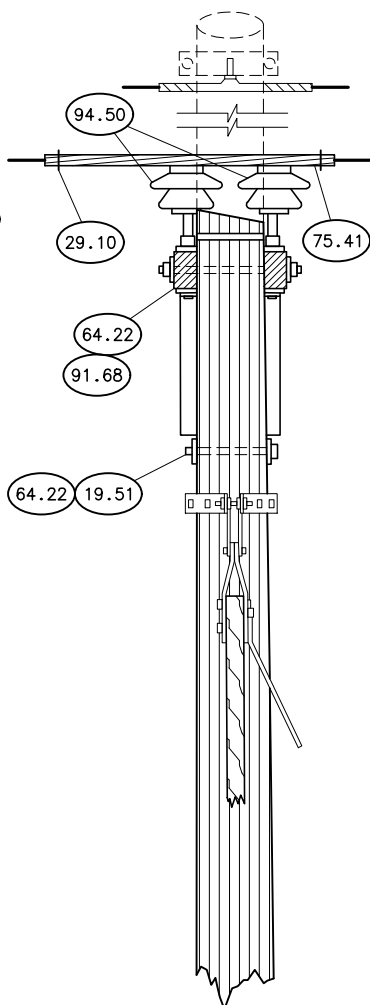
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IMAGES:



PLAN



ELEVATION



SIDE VIEW

LIST OF MATERIAL

NEW ITEM NO.	ITEM NO.	QUANTITY	DESCRIPTION
1	1	1	POLE, HEIGHT AS SPECIFIED ON STRUCTURE LIST
5.66	2	2	CROSS ARM X-DWG 40-D-3025
22.55	3	2	CROSS ARM BRACE, DOUBLE SPAN, ANGLE, 66" SPAN, 20" DROP
9.41	5	1	POLE TOP BAND, DWG 41 6032
66.38	8	6	INSULATOR PIN, 3/4"x6 1/2" SHANK, 8" HIGH, LOCK WASHER
51.30	10	6	INSULATOR, PIN TYPE, 9" DIAMETER
75.41	16	3	SETS OF ARMOR RODS, DOUBLE SUPPORT FOR ACSR ONLY
29.10	17	6	ARMOR ROD CLIPS FOR ACSR ONLY
94.50	19	-	TIE WIRE PER DWG'S 40-D-3948 OR 41 6083
19.27	22	4	1/2"x7" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
19.51	24	1	5/8"x12" MACHINE BOLT, SQUARE NUT AND LOCK WASHER
14.53	27	2	5/8"x20" DOUBLE ARMING BOLTS WITH 4 NUTS, 4 LOCK WASHERS
14.64	29	1	3/4"x20" DOUBLE ARMING BOLT, USE EXTRA NUTS FOR LOCK NUTS, 4 LOCK WASHERS
91.68	31	8	3"x3"x1/4" FLAT SQUARE WASHER, 13/16" HOLE
91.60	33	4	2"x2"x1/8" FLAT SQAURE WASHER, 9/16" HOLE
64.21	35	4	LOCKNUT FOR 1/2" BOLT WITH SQAURE NUT
64.22	36	9	LOCKNUT FOR 5/8" BOLT WITH SQAURE NUT
64.23	37	6	LOCKNUT FOR 3/4" BOLT WITH SQAURE NUT
91.67	-	8	3"x3"x1/4" CURVED SQUARE WASHER 11/16" HOLE

* CROSS ARM DRILLING: 3 3/4"x4 3/4"x10'-0" PER DWG 40-D-3025, ITEM 1
4"x5"x10'-0" PER DWG 40-D-3025, ITEM 2

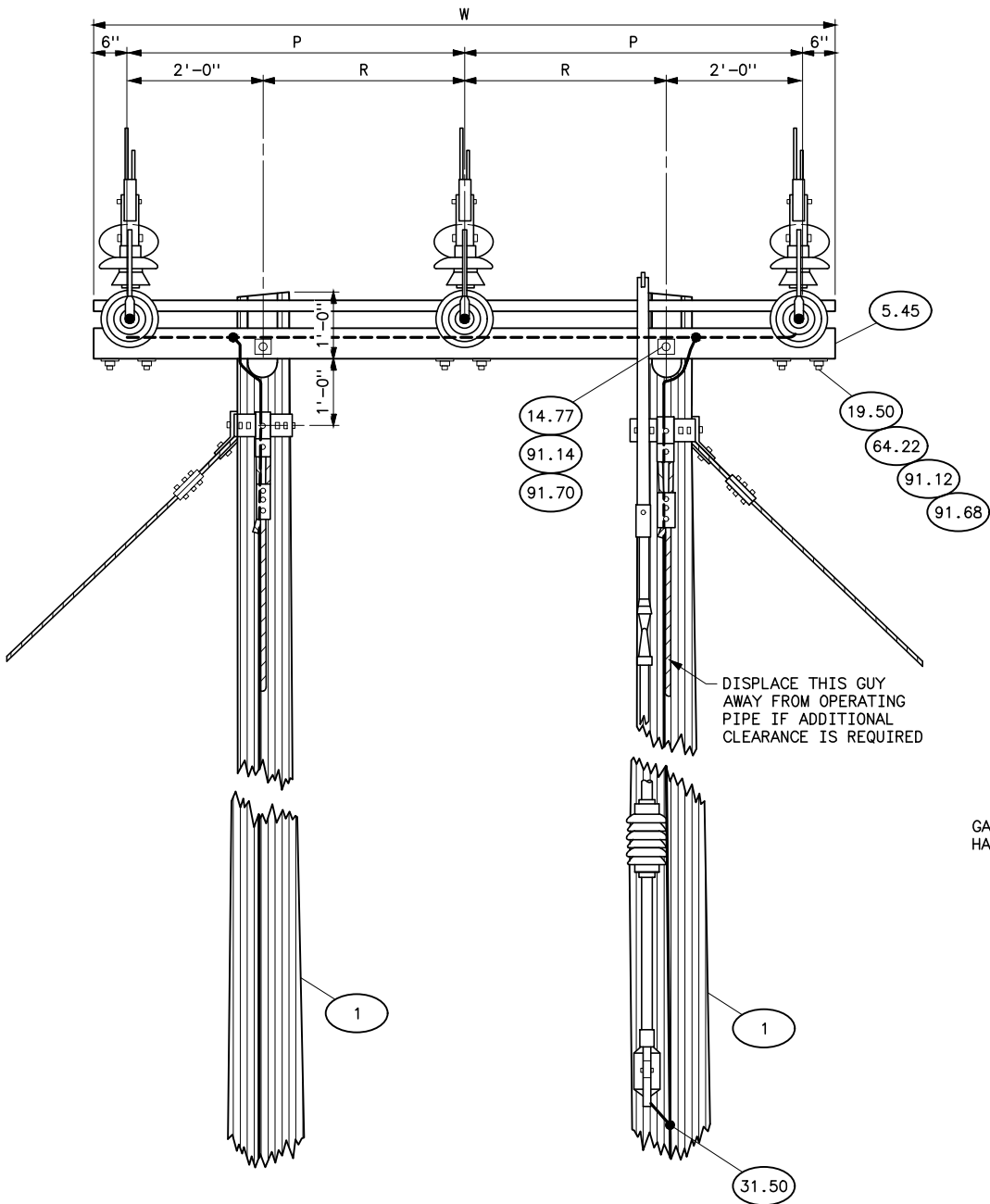
NOTES

1. NUMBER AND TYPE OF GUYS REQUIRED ARE SHOWN ON STRUCTURE LIST.
2. GUY ARRANGEMENTS ARE SHOWN ON DRAWING NUMBER 41 6082 AND 41 6083.
3. DRILL AND GAIN POLE AS SHOWN ON DRAWING 40-D-3027.
4. SIDE TIE TO BE USED ON ANGLE STRUCTURES.
5. ΔUSE OVERHEAD GROUND WIRE ONLY WHEN SPECIFIED.
6. OVERHEAD GROUND WIRE ATTACHMENT DETAILS ARE SHOWN ON 41 6084.
7. POLE GROUNDING DETAILS ARE SHOWN ON 41 1012.

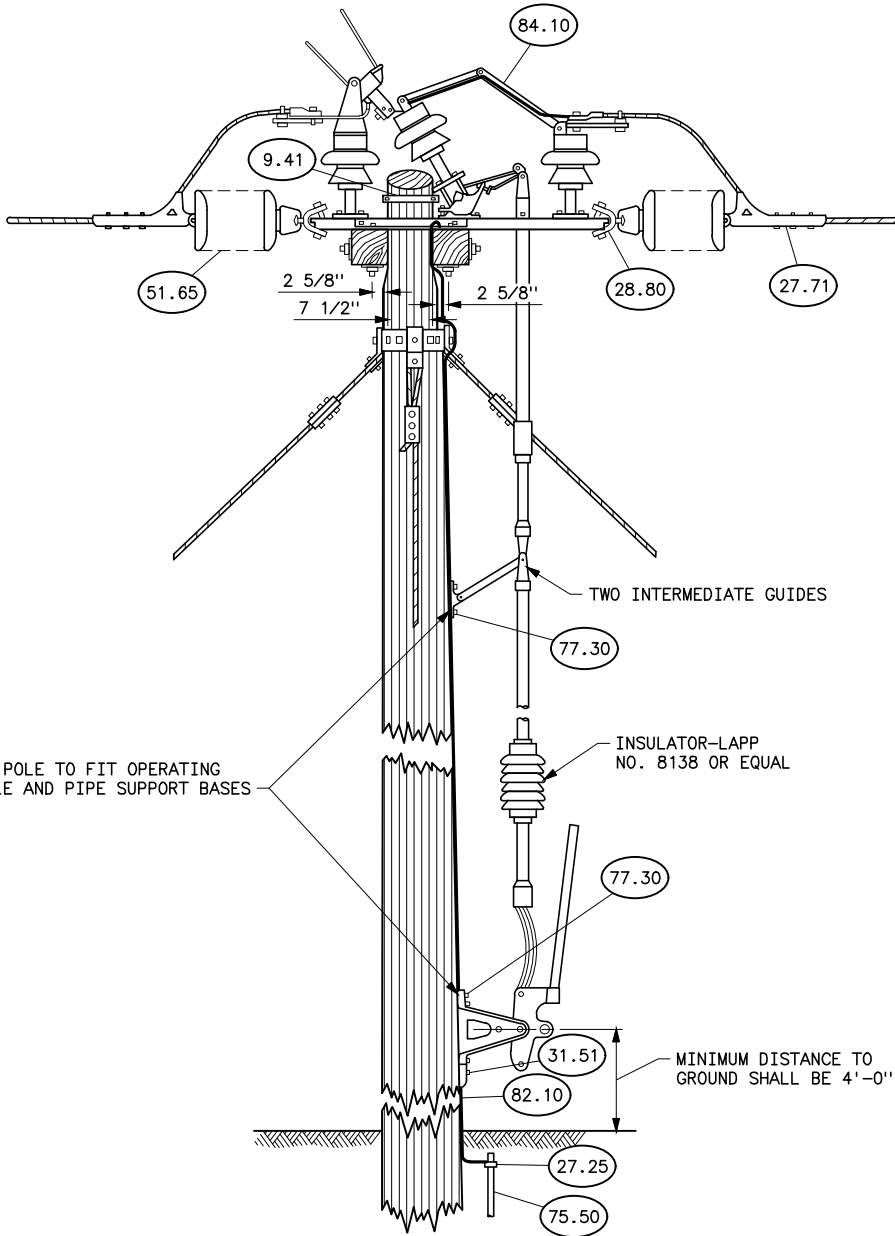
HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN
SUPERSEDES DWG NO. 40-D-3029		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINES TYPE SD-33KV FLAT TOP CONSTRUCTION		
DESIGNED BUREC _____ APPROVED BUREC _____		
C _A E	FEBRUARY 9, 1987	41 6101

XREF(S):



VOLTAGE	P	R	W
33KV	5'-0"	3'-0"	11'-0"
44KV	6'-0"	4'-0"	13'-0"



LIST OF MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLES, SEE STRUCTURE LIST FOR POLE HEIGHT AND TYPE OF GUYING
	-	SEE DWG 41 6051 OR 41 6052 FOR GUYING MATERIAL AND DETAIL
5.45	2	CROSS ARMS-5 1/2"x5 1/2"xW. DRILL 15/16" HOLES FOR THROUGH BOLTS AND 11/16" HOLES FOR SWITCH MOUNTING BOLTS.
9.41	2	POLE TOP BAND DWG 41 6082
51.65	6	INSULATOR ASSEMBLIES- DWG 41 1002
		33KV 3-10"x5 3/4" UNITS EACH
		43KV 4-10"x5 3/4" UNITS EACH
28.80	6	BALL CLEVIS-Y TYPE
27.71	6	STRAIN CLAMP, LINER AND SOCKET FILLING
19.50 64.22 91.12	12	5/8"x10" MACHINE BOLT, SQUARE NUT, LOCK NUT AND SPRING LOCK WASHER
91.68	12	3"x3"x1/4" FLAT SQUARE WASHER, 13/16" HOLE
77.30	6	1/2"x4" LAG SCREW, FETTER DRIVE
14.77 91.14	2	7/8"x24" DOUBLE ARMING BOLTS, USE EXTRA NUTS FOR LOCK NUTS, 2 SPRING LOCK WASHERS
84.10	1	AIR BREAK SWITCH COMPLETE
82.10	135 FT	NO. 4 AWG BARE ANNEALED COPPER WIRE
27.25	2	COPPER ALLOY GROUND ROD CLAMP
75.50	2	5/8"x10'-0" COPPERWELD GROUND ROD
31.51	5	LUG FOR NO. 4 COPPER WIRE
31.50	3	CONNECTOR FOR NO. 4 COPPER WIRE
91.70	4	3 1/2"x3 1/2"x3/8" FLAT SQUARE WASHER, 15/16" HOLE

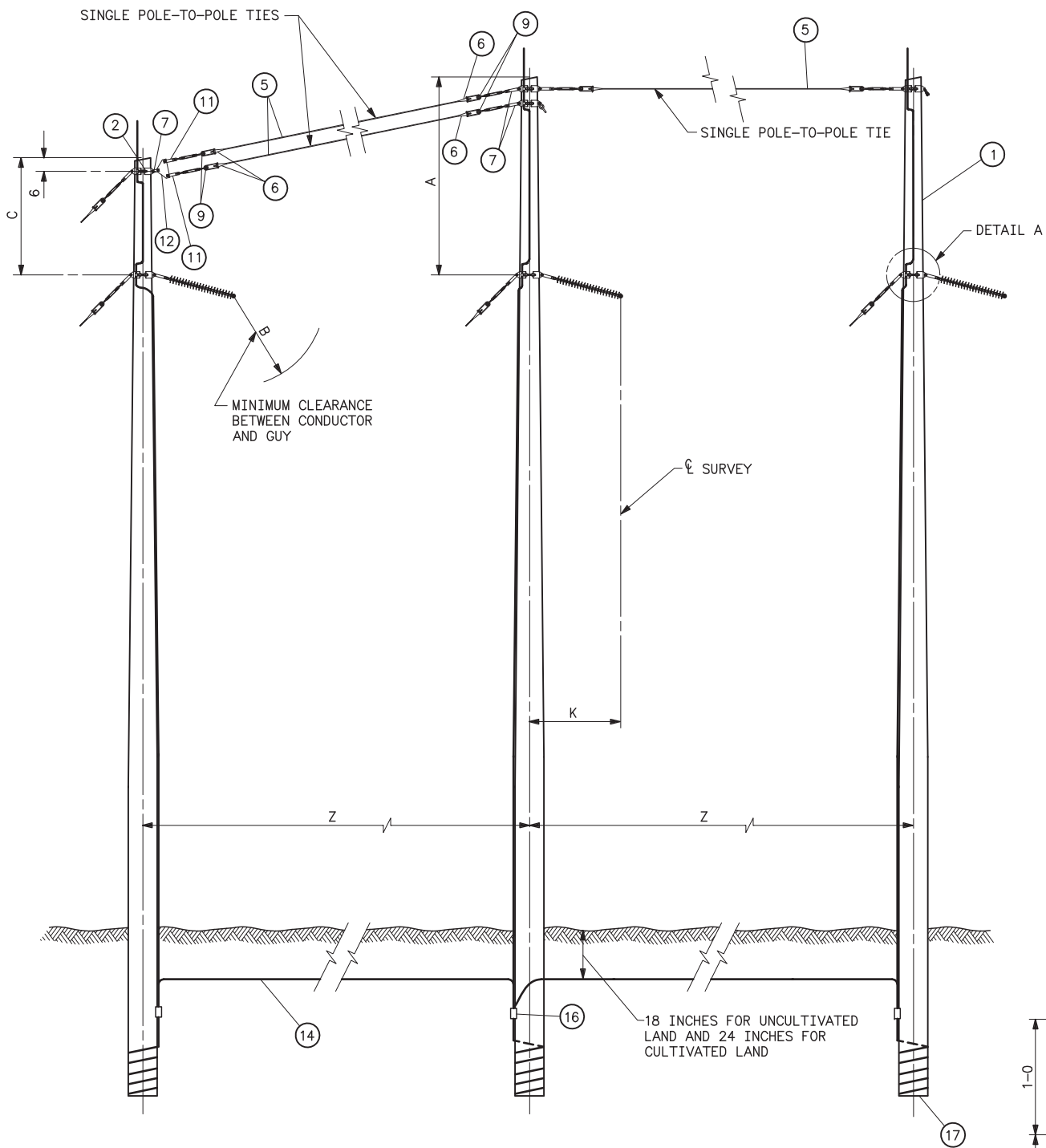
REFERENCE DRAWING 40-D-5327

HISTORICAL REFERENCE ONLY
NOT TO BE USED FOR NEW CONSTRUCTION

C	8/20/26 A7-KR	HISTORICAL REFERENCE
B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-3064		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
TRANSMISSION LINE STANDARDS TYPE HSWT-33 AND 44KV AIR BREAK SWITCH STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
C _A E	FEBRUARY 9, 1987	41 6102

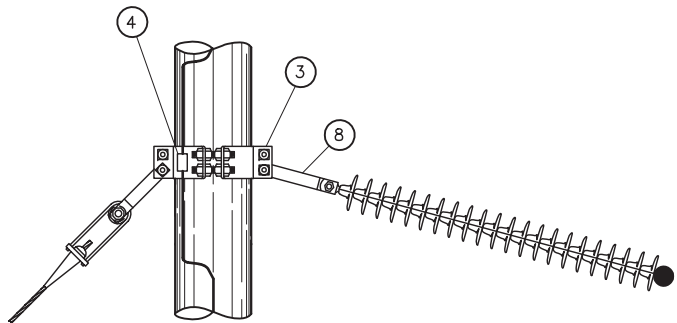
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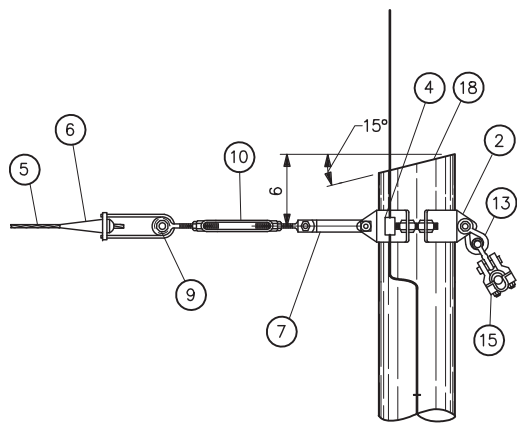
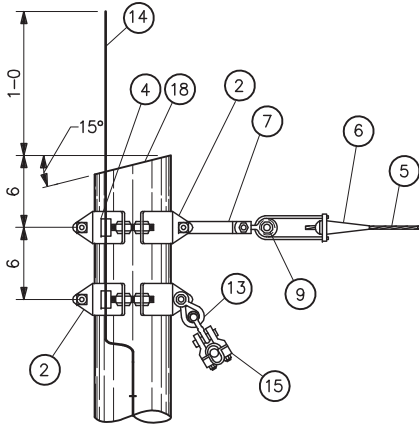


ELEVATION

VOLTAGE	DIMENSION				
	A	B	C	K	Z
138KV	10-0	5-0	5-6	6-0	23-0
161KV	10-0	5-6	5-6	6-6	24-0
230KV	11-0	6-5	6-6	7-6	25-0



DETAIL A



OVERHEAD GROUND WIRE ATTACHMENT

STRUCTURE MATERIAL

PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES)
8		1/2"x4 LAG SCREWS (2 PER BAND)
8		1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
3	3	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3112 SERIES)
4	7	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
5	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
6	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
7	5	1/4x2x17 CONNECTING LINK PAIR WITH 3/4"x 2 1/2 BOLT, 2 NUTS, AND COTTER KEY
8	3	1/4x3x17 CONNECTING LINK PAIR WITH 3/4"x 2 1/2 BOLT, 2 NUTS, AND COTTER KEY
9	6	2 1/2 SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
10	1	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
11	2	7/8"x12 CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
12	1	YOKE PLATE
13	2	TWISTED SHACKLE
14	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	2	OVERHEAD GROUND WIRE SUSPENSION ASSEMBLY
16	3	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
17	3	POLE BOTTOM PLATE (BLACKBURN NO. 110 OR EQUAL) ATTACHED TO POLE
18	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

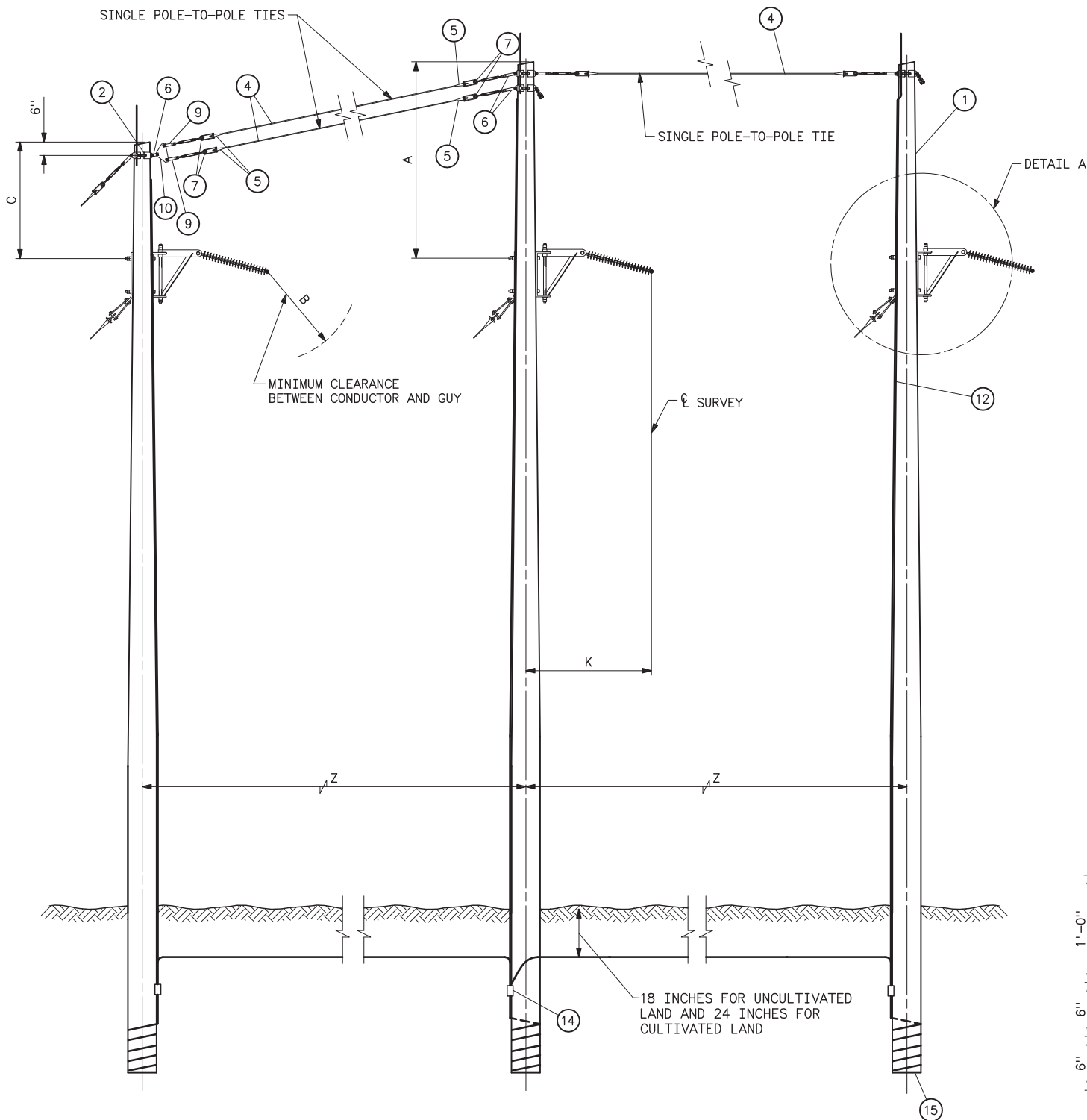
NOTES

- POLES SHALL BE RAKED 1/4 INCH FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16 INCH LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

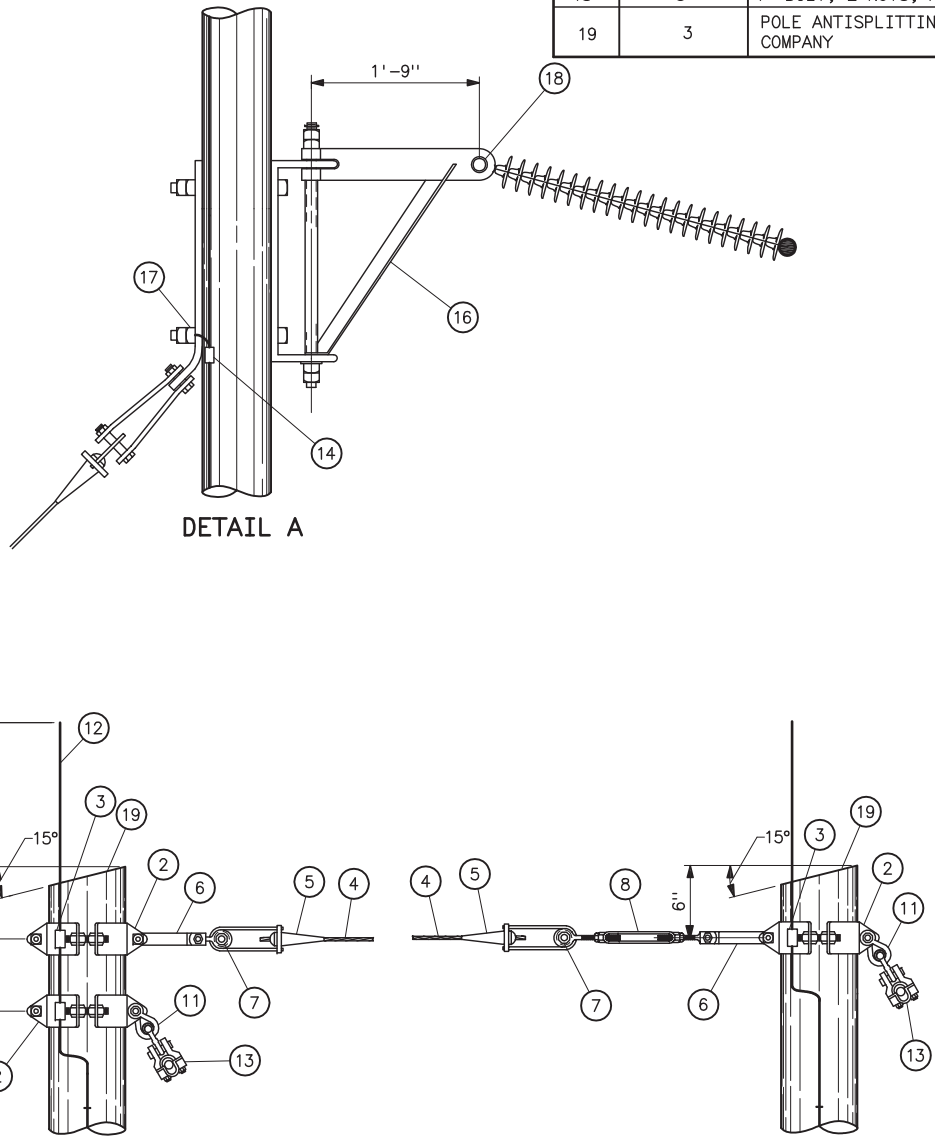
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPICAL DETAILS FOR DEAD END TEES	41 6138
GUY ASSEMBLIES AND DETAILS	41 6047
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB	
STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053

B	12-28-05 A7-KKR	ADDED REFERENCE DRAWINGS, STAR LOCK AND ADDED NOTE 4.
A	1-31-00 A3-KKR	REVISED AND REDRAWN ON CAE SYSTEM
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3A-1 138, 161 AND 230KV MEDIUM ANGLE STRUCTURE		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
CAE	APRIL 28, 1989	41 6103



ELEVATION

VOLTAGE	DIMENSION				
	A	B	C	K	Z
138KV	10'-0"	5'-0"	5'-6"	7'-0"	24'-0"
161KV	10'-0"	5'-6"	5'-6"	7'-6"	25'-0"
230KV	11'-0"	6'-5"	6'-6"	8'-6"	25'-0"



OVERHEAD GROUND WIRE ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES)
	8	1/2"x4 LAG SCREWS (2 PER BAND)
	8	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
3	4	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
4	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
5	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
6	5	1/4x2x17 CONNECTING LINK PAIR WITH 3/4"x2 1/2 BOLT, 2 NUTS, AND COTTER KEY
7	6	2 1/2 SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
8	1	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
9	2	7/8"x12 CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
10	1	YOKE PLATE
11	2	TWISTED SHACKLE
12	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
13	2	OVERHEAD GROUND WIRE SUSPENSION ASSEMBLY
14	3	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
15	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
16	3	EXTENSION BRACKET, 1-9, COMPLETE WITH 3/4 ATTACHMENT BOLTS, (EQUAL TO HUGHES BROS NO. 2822.8)
17	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)
18	3	1" BOLT, 2 NUTS, AND COTTER KEY
19	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

NOTES

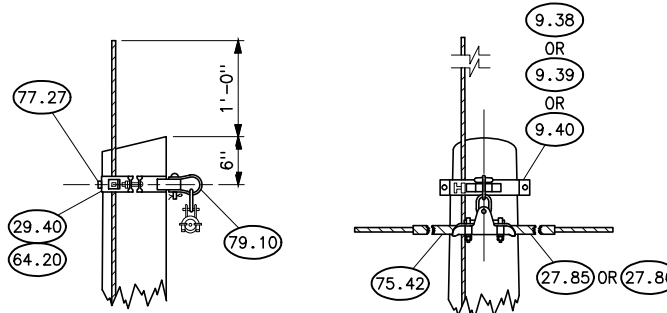
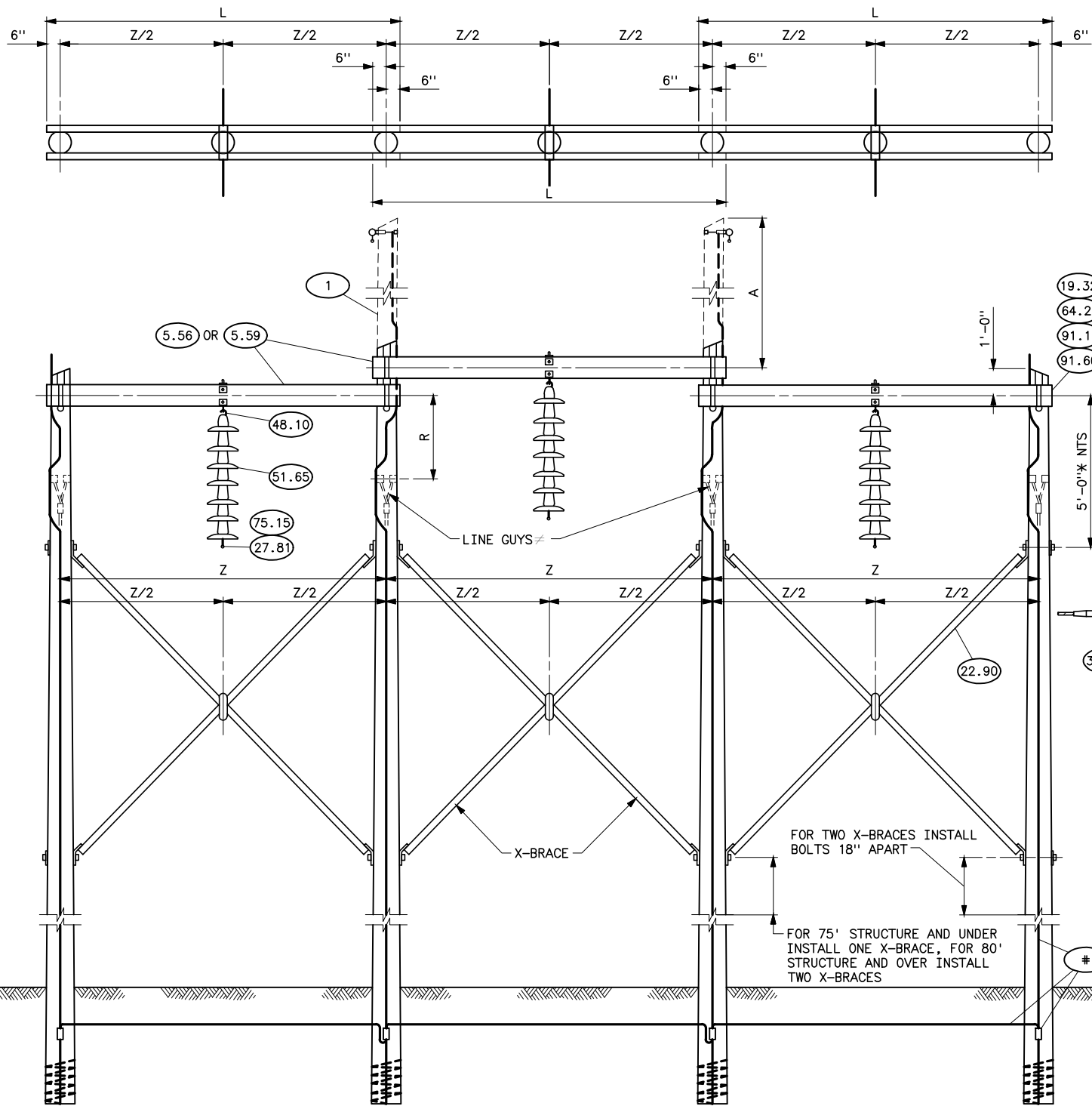
- POLES SHALL BE GIVEN RAKE OF 1/4 INCH FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16 INCH LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

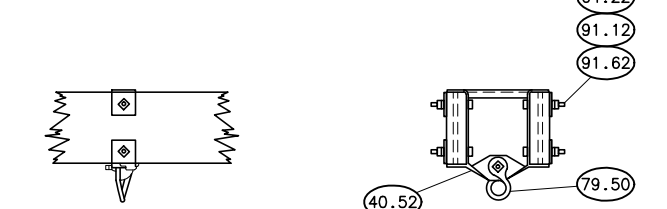
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
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OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPICAL DETAILS FOR DEAD END TEES	41 6138
GUY ASSEMBLIES AND DETAILS	41 6047
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB	
STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053

C	12-28-05 A7-KKR	ADDED REFERENCE DRAWINGS, STAR LOCK AND NOTE 4.
B	03-21-00 A3-KKR	FILLED IN BUBBLES ON DETAIL A.
A	1-31-00 A3-KKR	REVISED AND REDRAWN ON CAE SYSTEM
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AB-1 138, 161 AND 230KV MEDIUM ANGLE STRUCTURE		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
CAE	APRIL 28, 1989	41 6104

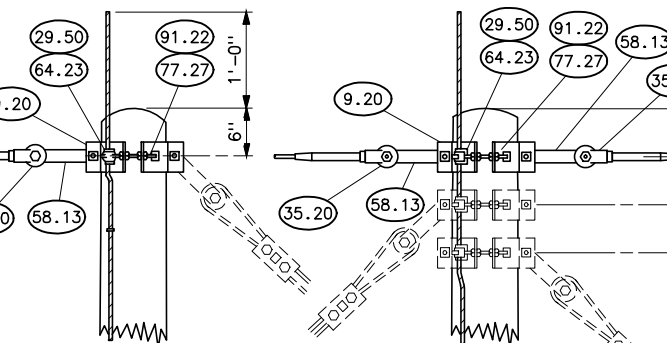
Plotted By: denton Mar 02, 2011- 3:00pm
Images: S:\Projects\Misc\StandardDrawings\Drawings\DesignReadyForFinal\Scripts\41_6105b.dwg Last Saved By: Debbie Denton on 3/2/2011 2:58 PM



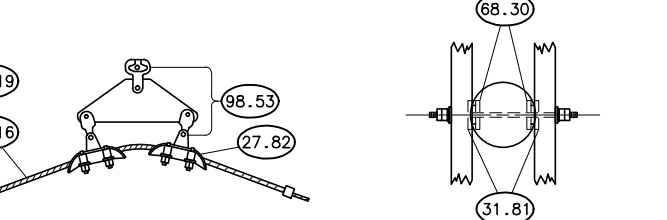
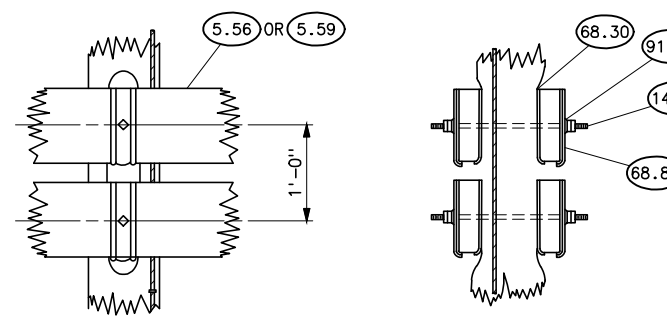
SUSPENSION



DETAIL OF PHASE FITTING ASSEMBLY



DEAD END
DETAIL OF OVERHEAD GROUND WIRE ATTACHMENT



SINGLE STRING WITH YOKE
DETAIL OF CROSSARM ATTACHMENT

STRUCTURE MATERIAL

PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	WITH OVERHEAD GROUND WIRES 69KV	115KV	W/OUT OVERHEAD GROUND WIRES 69KV	115KV		
1	4	4	4	4	POLE	
5.56	6	6	6	6	CROSSARM, WOOD, 2 5/8"x9 1/2"x13'-0" (TYPE 4S)	
5.59	6	6	6	6	CROSSARM, WOOD, 2 5/8"x9 1/2"x16'-0" (TYPE 4S-1)	
14.75	6	6	6	6	BOLT, DOUBLE ARMING, 7/8"x20" WITH 4 NUTS	
19.32	12	12	12	12	BOLT, MACHINE, 1/2"x12"	
19.45	12	12	12	12	BOLT, MACHINE 5/8"x5"	
31.81	24	24	24	24	CONNECTOR, 4" SHEAR PLATE, FOR 7/8" BOLT	
40.52	3	3	3	3	FITTING, PHASE	6038
64.21	12	12	12	12	LOCKNUT, 1/2" BOLT	
64.22	12	12	12	12	LOCKNUT, 5/8" BOLT	
68.30	12	12	12	12	PLATE, FLAT GAIN	6038
68.82	12	12	12	12	PLATE, RIBBED TIE	6038
22.90	3 OR 6	3 OR 6	3 OR 6	3 OR 6	X-BRACE, 2-PIECE 4S -- 3 3/8"x4 3/8" 4S-1 -- 3 3/8"x5 3/8"	6029
79.50	3	3	3	3	SHACKLE, TWISTED	6038
91.11	12	12	12	12	LOCKWASHER, SPRING, 1/2" BOLT	
91.12	12	12	12	12	LOCKWASHER, SPRING, 5/8" BOLT	
91.14	12	12	12	12	LOCKWASHER, SPRING, 7/8" BOLT	
91.60	24	24	24	24	WASHER, SQUARE FLAT, 2"x2"x1/8", 9/16" HOLE	
91.62	12	12	12	12	WASHER, SQUARE FLAT, 2 1/4"x2 1/4"x3/16", 11/16" HOLE	
#	GROUNDING MATERIAL, PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

INSULATOR MATERIAL

PART NO.	SINGLE STRING		SINGLE STRING WITH YOLK		DESCRIPTION	DWG NO. 41
	69KV	115KV	69KV	115KV		
48.10	3	3	3	3	HOOK, SUSPENSION	1003
51.65	12	21	12	21	INSULATOR, SUSPENSION TYPE, 5 3/4" SPACING	1000
75.15 OR 75.18	3	3	-	-	ROD, ARMOR, TAPERED, SINGLE SUPPORT (FOR ACSR ONLY)	1000
27.81	3	3	-	-	ROD, ARMOR, PREFORMED, SINGLE SUPPORT (FOR ACSR ONLY)	1000
27.82	-	-	6	6	CLAMP, SUSPENSION WITH SOCKET FITTING (FOR CONDUCTOR)	1000
75.16 OR 75.19	-	-	3	3	CLAMP, SUSPENSION WITHOUT CONNECTOR	
98.53	-	-	3	3	ROD, ARMOR, TAPERED, DOUBLE SUPPORT (FOR ACSR ONLY)	
	-	-	3	3	ROD, ARMOR, PREFORMED, DOUBLE SUPPORT (FOR ACSR ONLY)	
	-	-	3	3	YOKE, COMPLETE WITH FITTINGS	

OVERHEAD GROUND WIRE MATERIAL

PART NO.	SUSPENSION	DEAD END	TENSION	DESCRIPTION	DWG NO. 41
29.50	-	2	2	CLIP, GROUND WITH 3/4"x2 1/2" CONE HEAD BOLT	6030
35.20	-	2	4	DEAD END, COMPRESSION TYPE, FOR OGW	
58.13	-	2	4	LINK, CONNECTING, PR.	6030
64.20	2	-	-	LOCKNUT, 3/8" BOLT	
64.23	-	2	2	LOCKNUT, 3/4" BOLT	
75.42	2 SETS	-	-	ROD, ARMOR, PREFORMED	
77.27	2	4	4	LAGSCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2A	-	-	SHACKLE, ANCHOR TYPE	
91.22	-	4	4	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
9.20	-	2	2	BAND, FOUR-WAY STRAIN	6030
9.38, 9.39 OR 9.40	2	-	-	BAND, POLE TOP	6034, 6035, 6036, 6037
27.85 OR 27.86	2A	-	-	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.40	2	-	-	CLIP, GROUND WITH 3/8"x1 1/2" CARRIAGE BOLT	6034

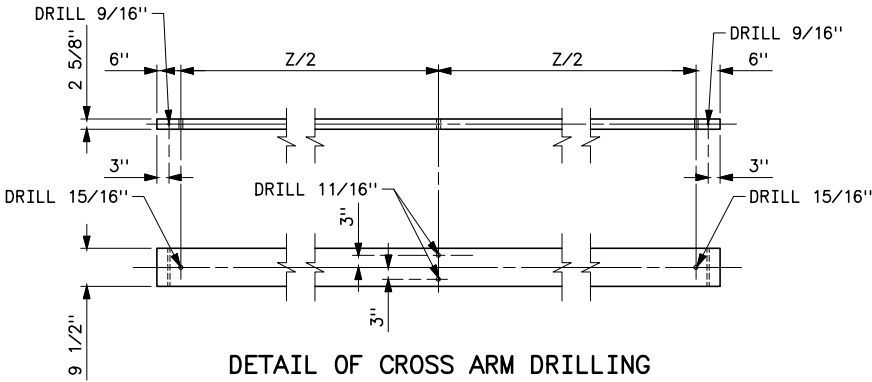
REFERENCE DRAWINGS

DRILLING AND GAINING DETAILS WITH OGW
30° PROTECTIVE ANGLE _____ 41 6021
GUY ARRANGEMENT-ASSEMBLY-H-FRAME _____ 41 6051 & 41 6052
DRILLING AND GAINING DETAILS (WITHOUT OGW) _____ 41 6066
DRILLING AND GAINING DETAILS WITH OGW
39° PROTECTIVE ANGLE _____ 41 6068

NOTES

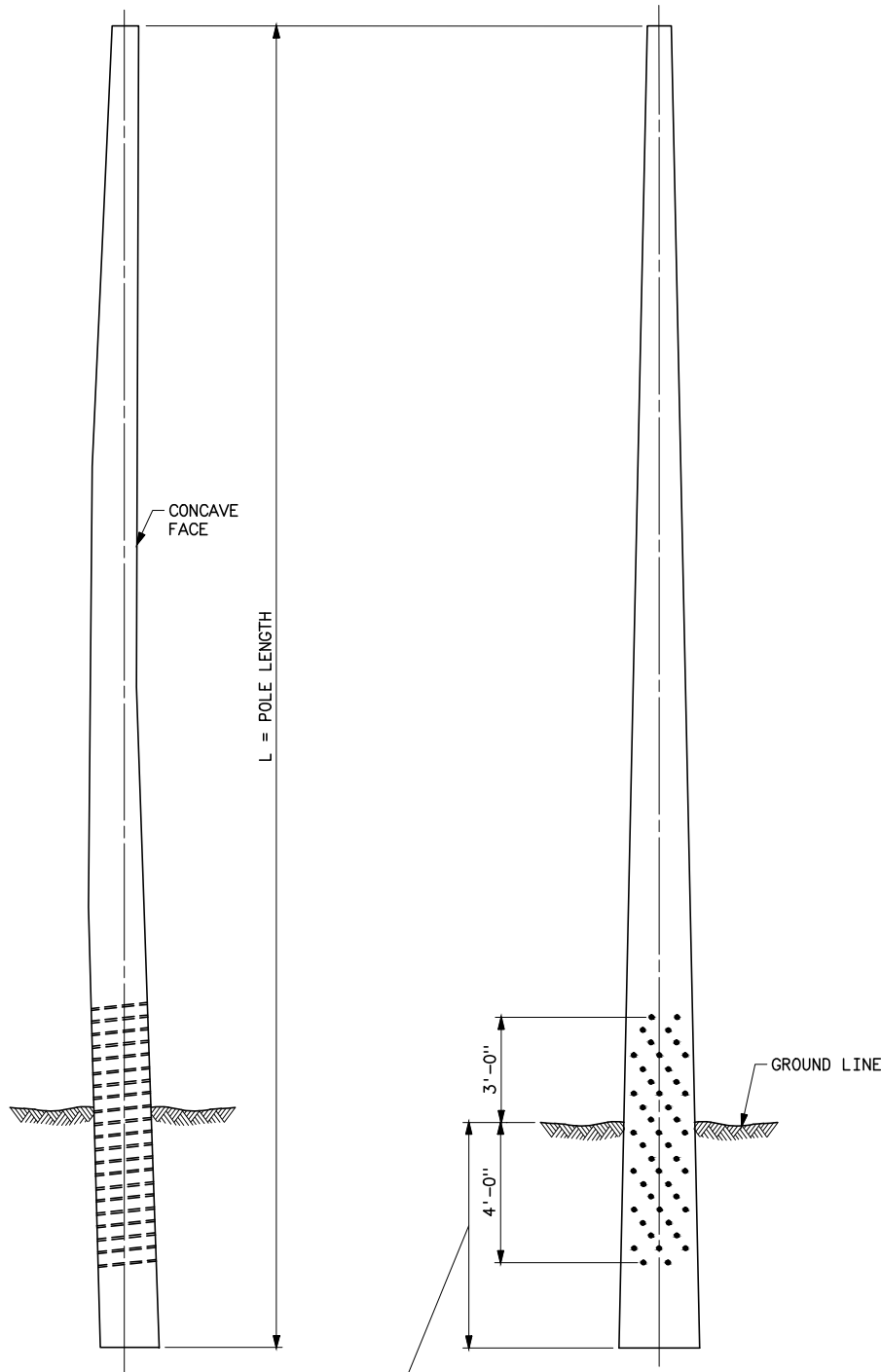
1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO. 41 6035 IS USED. FOR VERTICAL ANGLES GREATER THAN 20°, USE LARGE ANGLE, SUSPENSION CLAMP PART NO. 27.85.
3. * WHEN AN ADDITIONAL DISC IS USED ON ANGLE STRUCTURES, AT RAILROAD OR MAIN HIGHWAY CROSSINGS, THIS DIMENSION SHALL BE INCREASED ONE FOOT.
4. φ GREATER LENGTH MAY BE REQUIRED FOR EXTRA LARGE POLES.
5. ≠ USE ONLY WHEN SPECIFIED.

TYPE	VOLTAGE	A			L	Z	Z/2	R
		WITH OGW		WITHOUT OGW				
		30° PROTECTIVE ANGLE	39° PROTECTIVE ANGLE					
4S	69KV & 115KV	9'-0"	4'-6"	1'-0"	13'-0"	12'-0"	6'-0"	2'-0"
4S-1		9'-0"	4'-6"	1'-0"	16'-0"	15'-0"	7'-6"	3'-0"

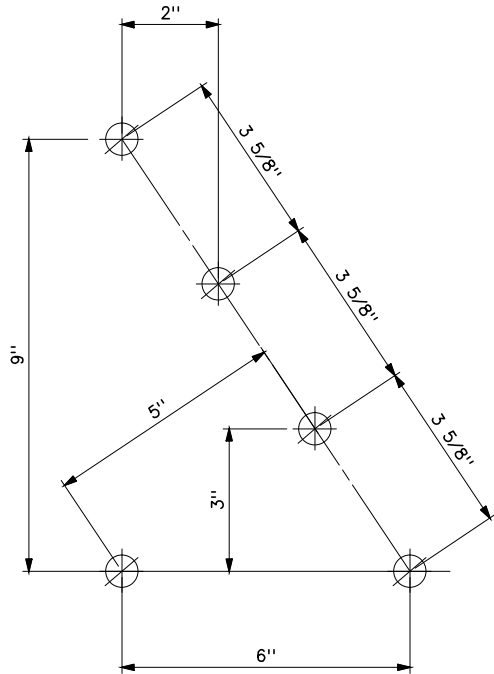


DETAIL OF CROSS ARM DRILLING

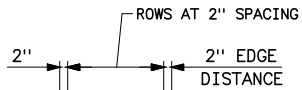
B	3-2-11 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-5425		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE 4S AND 4S-1, 69 AND 115KV SUSPENSION STRUCTURE			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
A E	MAY 4, 1988	41	6105



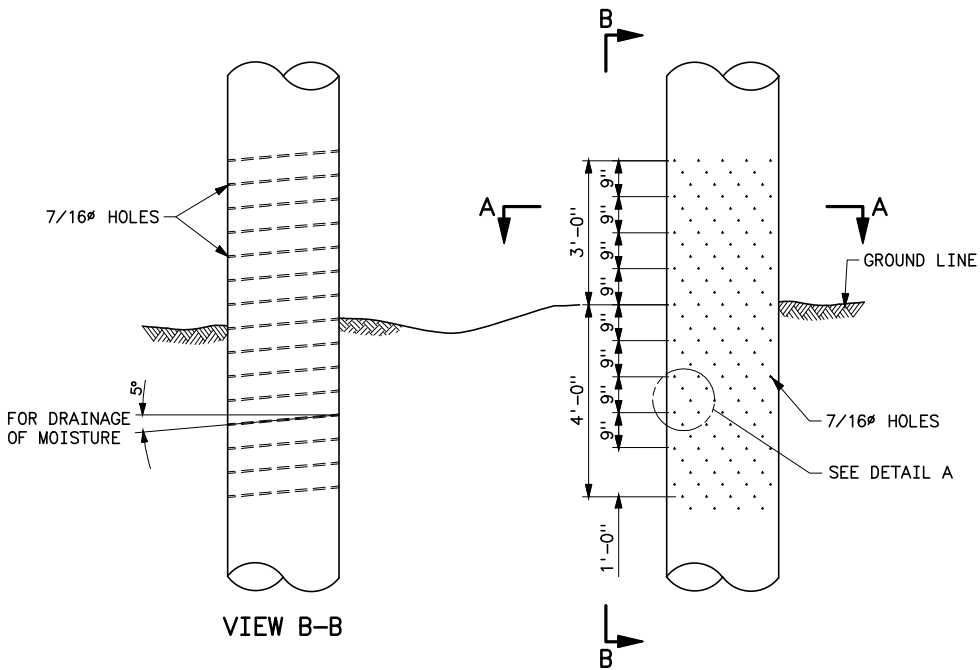
DEPTH OF SET POLE LENGTH (FT)	SET
40 TO 90 INCL	10% OF L PLUS 2 FT
90 TO 100	11 FT
105 TO 125 INCL	12 FT



DETAIL A
PATTERN FOR
HOLE DRILLING
TEMPLATE



SECTION A-A



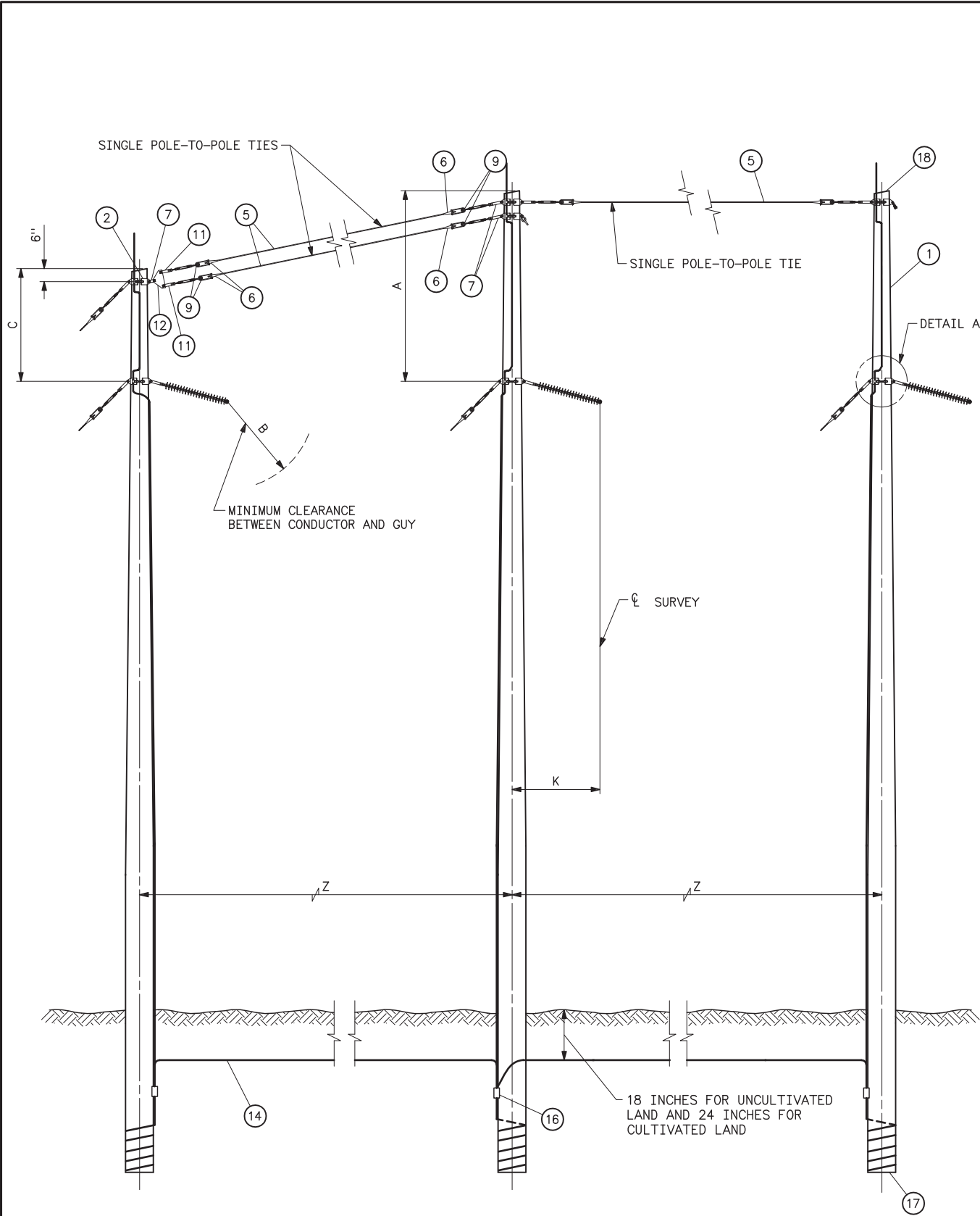
VIEW B-B

GROUND LINE HOLE DRILLING

NOTES

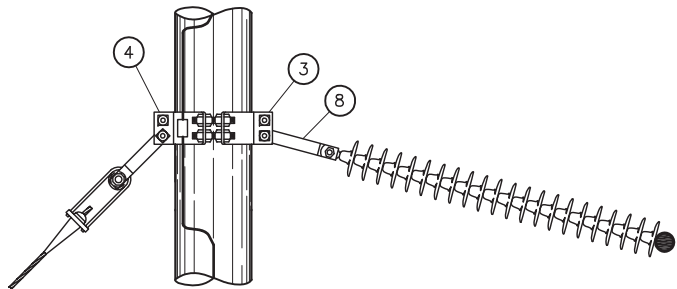
1. ALL HOLES TO BE MADE BEFORE TREATMENT
2. ALL HOLES SHALL BE COMPLETELY DRILLED THROUGH THE POLE FROM ONE DIRECTION
3. HOLES SHALL RUN PARALLEL TO CONDUCTOR

B	7-15-03 A7-DH	REVISED TITLE BLOCK ONLY.	
	3-27-95 A2-RMC	CHANGED DRILLED ZONE	
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
TRANSMISSION LINE STANDARDS DOUGLAS FIR POLES DRILLING DETAILS			
DESIGNED <u>K. ROWE</u> _____		APPROVED <u>R.W. McCAFFERTY</u> _____ DIRECTOR, DIVISION OF TRANSMISSION LINE AND BUILDING DESIGN	
A	JUNE 10, 1988	41	6106

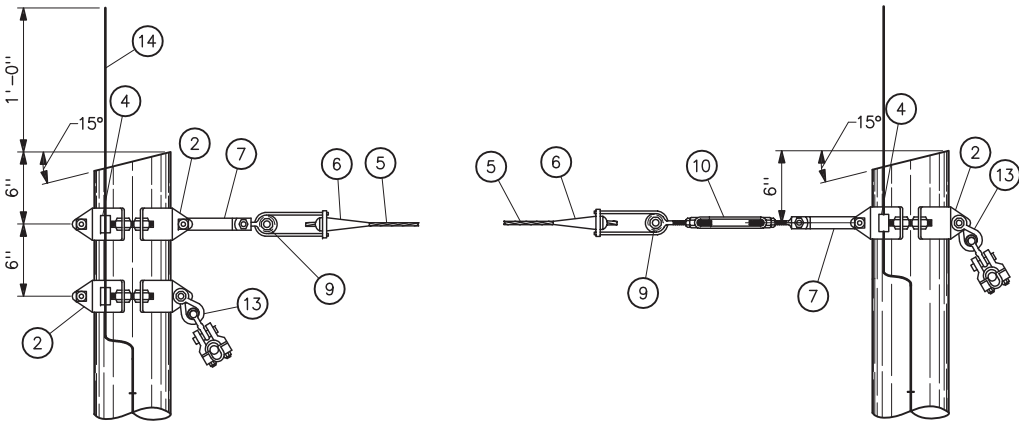


ELEVATION

VOLTAGE	DIMENSION				
	A	B	C	K	Z
115KV	10'-0"	4'-0"	5'-6"	5'-0"	18'-0"
69KV	10'-0"	2'-6"	5'-6"	3'-6"	13'-0"



DETAIL A



OVERHEAD GROUND WIRE ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) (SEE NOTE 4)
8		1/2"x4 LAG SCREWS (2 PER BAND)
8		1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
3	3	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3112 SERIES) (SEE NOTE 4)
4	7	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
5	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
6	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
7	5	1/4x2x17 CONNECTING LINK PAIR WITH 3/4"x2 1/2 BOLT, 2 NUTS, AND COTTER KEY
8	3	1/4x3x17 CONNECTING LINK PAIR WITH 3/4"x2 1/2 BOLT, 2 NUTS, AND COTTER KEY
9	6	2 1/2 SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
10	1	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
11	2	7/8"x12 CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
12	1	YOKE PLATE
13	2	TWISTED SHACKLE
14	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
16	3	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
17	3	POLE BOTTOM PLATE (BLACKBURN NO. 110 OR EQUAL) ATTACHED TO POLE
18	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

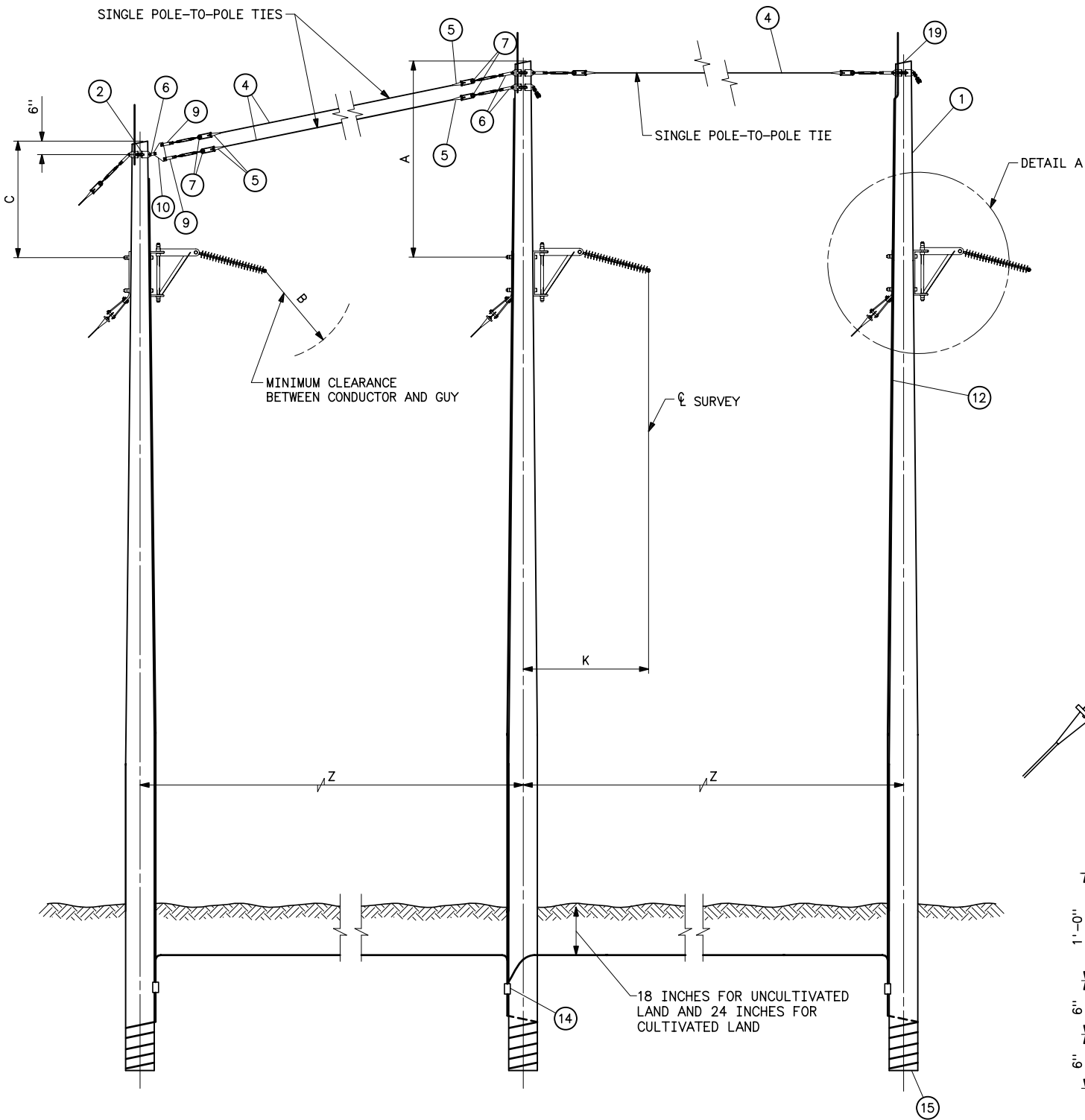
NOTES

- POLES SHALL BE RAKED 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16" LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

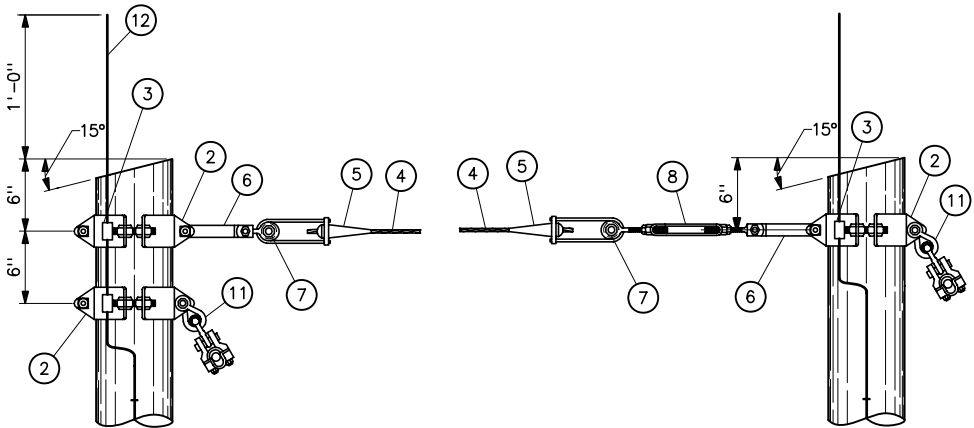
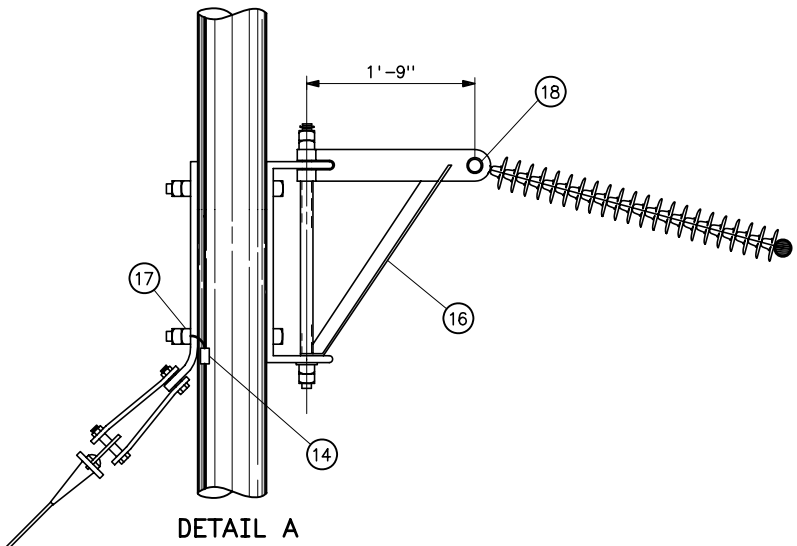
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB
STRUCTURES WITH OVERHEAD GROUND WIRES____41 6053
SUSPENSION INSULATOR ASSEMBLIES
SINGLE STRING_____41 1020
DOUBLE STRING_____41 1021
WOOD POLES STRUCTURES
GROUNDING DETAILS_____41 1012
OVERHEAD GROUND WIRE ASSEMBLY
DETAILS FOR WOOD POLES STRUCTURES_____41 1019
GUY ASSEMBLIES AND DETAILS_____41 6047
OPTICAL GROUND WIRE ASSEMBLIES_____41 1031
TYPICAL DETAILS FOR DEAD-END TEES_____41 6138

B	01-06-05 A7-KKR	REVISED REFERENCE DRAWINGS. ADDED STAR-LOCK AND NOTE 4.	
	A	12-31-96 A3-	REVISED AND REDRAWN ON CAE SYSTEM
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE 3A-1 69 AND 115KV MEDIUM ANGLE STRUCTURE			
DESIGNED KAREN ROWE		APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
CA	APRIL 28, 1989	41	6107



ELEVATION

VOLTAGE	DIMENSION				
	A	B	C	K	Z
115KV	10'-0"	4'-0"	5'-6"	6'-0"	19'-6"
69KV	10'-0"	2'-6"	5'-6"	4'-6"	14'-6"



OVERHEAD GROUND WIRE ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) (SEE NOTE 4)
	8	1/2"x4 LAG SCREWS (2 PER BAND)
	8	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND) (SEE NOTE 4)
3	4	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
4	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
5	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
6	5	1/4"x2x17 CONNECTING LINK PAIR WITH 3/4"x2 1/2 BOLT, 2 NUTS, AND COTTER KEY
7	6	2 1/2 SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
8	1	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
9	2	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
10	1	YOKE PLATE
11	2	TWISTED SHACKLE
12	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
14	6	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
15	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
16	3	EXTENSION BRACKET, 1'-9", COMPLETE WITH 3/4" ATTACHMENT BOLTS AND GUY PLATE (EQUAL TO HUGHES BROS NO. 2822.8)
17	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)
18	3	1" BOLT, 2 NUTS, AND COTTER KEY
19	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

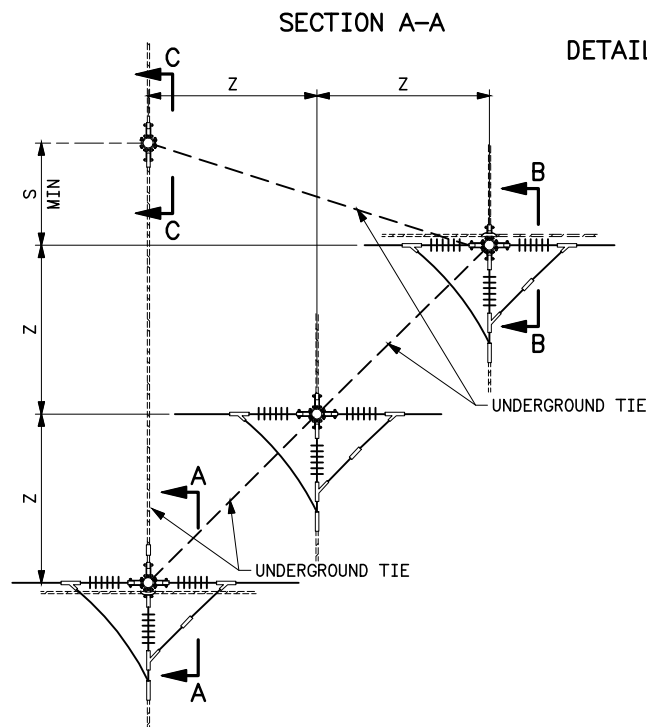
NOTES

- POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16" LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

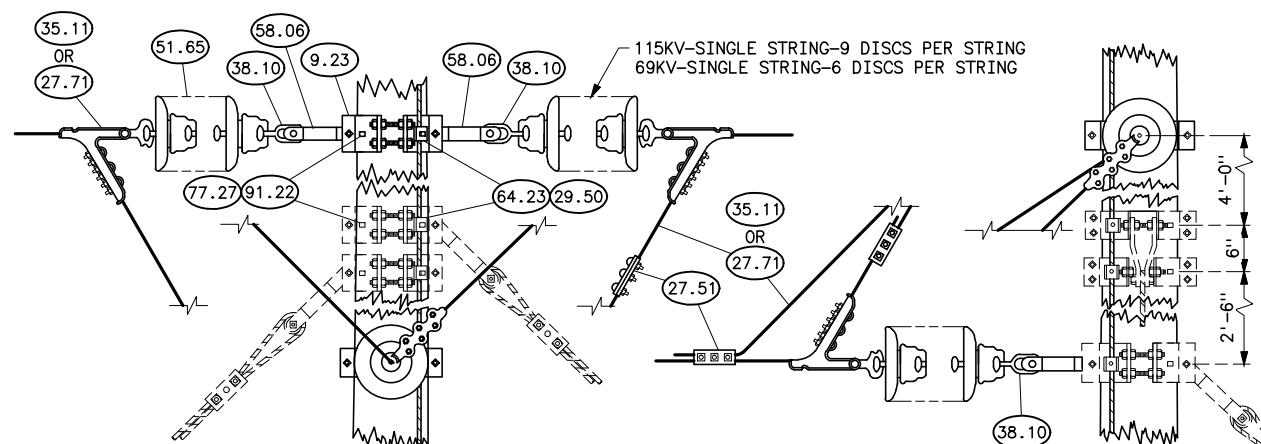
REFERENCE DRAWINGS

- GUY ARRANGEMENT, FOR TYPE 3A AND 3AB
STRUCTURES WITH OVERHEAD GROUND WIRES _____ 41 6053
SUSPENSION INSULATOR ASSEMBLIES _____
SINGLE STRING _____ 41 1020
DOUBLE STRING _____ 41 1021
OPTICAL GROUND WIRE ASSEMBLIES _____ 41 1031
TYPICAL DETAILS FOR DEAD END TEES _____ 41 6138
WOOD POLES STRUCTURES
GROUNDING DETAILS _____ 41 1012
OVERHEAD GROUND WIRE ASSEMBLY
DETAILS FOR WOOD POLES STRUCTURES _____ 41 1019
GUY ASSEMBLIES AND DETAILS _____ 41 6047

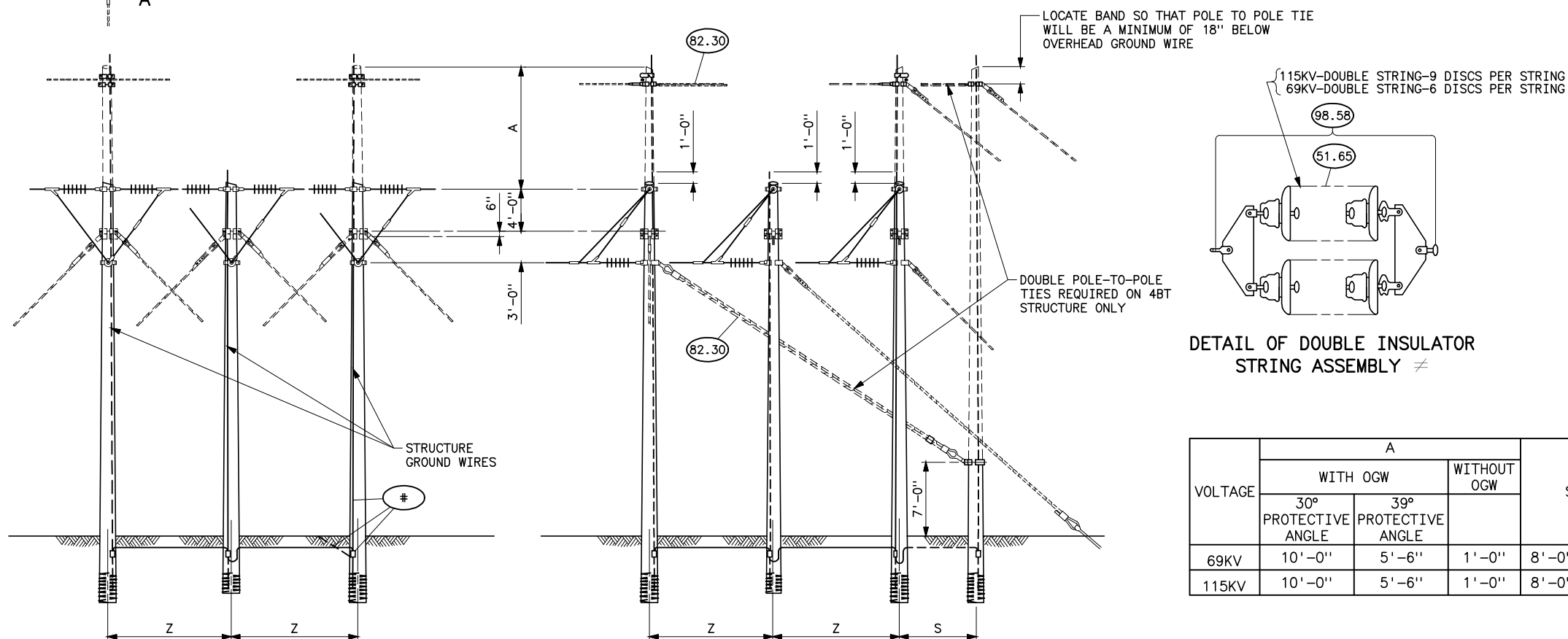
C B A	08-24-06 A7-KKR	ADDED PART NO. 18
	02-22-05 A7-KKR	REVISED REFERENCE DRAWINGS. ADDED STAR-LOCK AND NOTE 4.
	12-31-96 A3-	REVISED AND REDRAWN ON CAE SYSTEM
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AB-1 69 AND 115KV MEDIUM ANGLE STRUCTURE		
DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
A	APRIL 28, 1989	41 6108



SECTION B-B
DETAIL OF OVERHEAD GROUND WIRE AND POLE TIE ATTACHMENT



DETAIL OF CONDUCTOR DEAD END AND TENSION ASSEMBLY AND POLE ATTACHMENT



DETAIL OF DOUBLE INSULATOR STRING ASSEMBLY $\neq$

VOLTAGE	A			S	Z
	WITH OGW		WITHOUT OGW		
	30° PROTECTIVE ANGLE	39° PROTECTIVE ANGLE			
69KV	10'-0"	5'-6"	1'-0"	8'-0" MIN	12'-0"
115KV	10'-0"	5'-6"	1'-0"	8'-0" MIN	12'-0"

PART NO.	QUANTITY				DESCRIPTION	DWG NO. 41
	4BT WITH OGW		3BT WITHOUT OGW			
	69KV	115KV	69KV	115KV		
1	4	4	3	3	POLE	
9.23	6	6	6	6	BAND, FOUR-WAY STRAIN, TYPE B	6031
29.50	6	6	6	6	CLIP, GROUND WITH 3/4"x2 1/2" CONEHEAD BOLT	6030
58.06	9	9	9	9	LINK, CONNECTING PAIR	6031
64.23	6	6	6	6	LOCKNUT, FOR 3/4" BOLT	
77.27	12	12	12	12	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
91.22	12	12	12	12	WASHER, ROUND FLAT, 1 3/8" OD, 9/16" HOLE	
#	GROUNDING MATERIAL, PART NUMBERS AND DESCRIPTION SHOWN ON 41 1012					

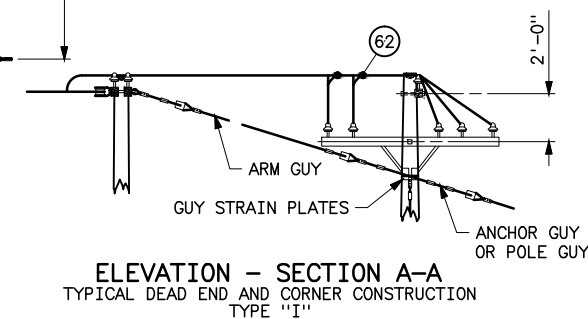
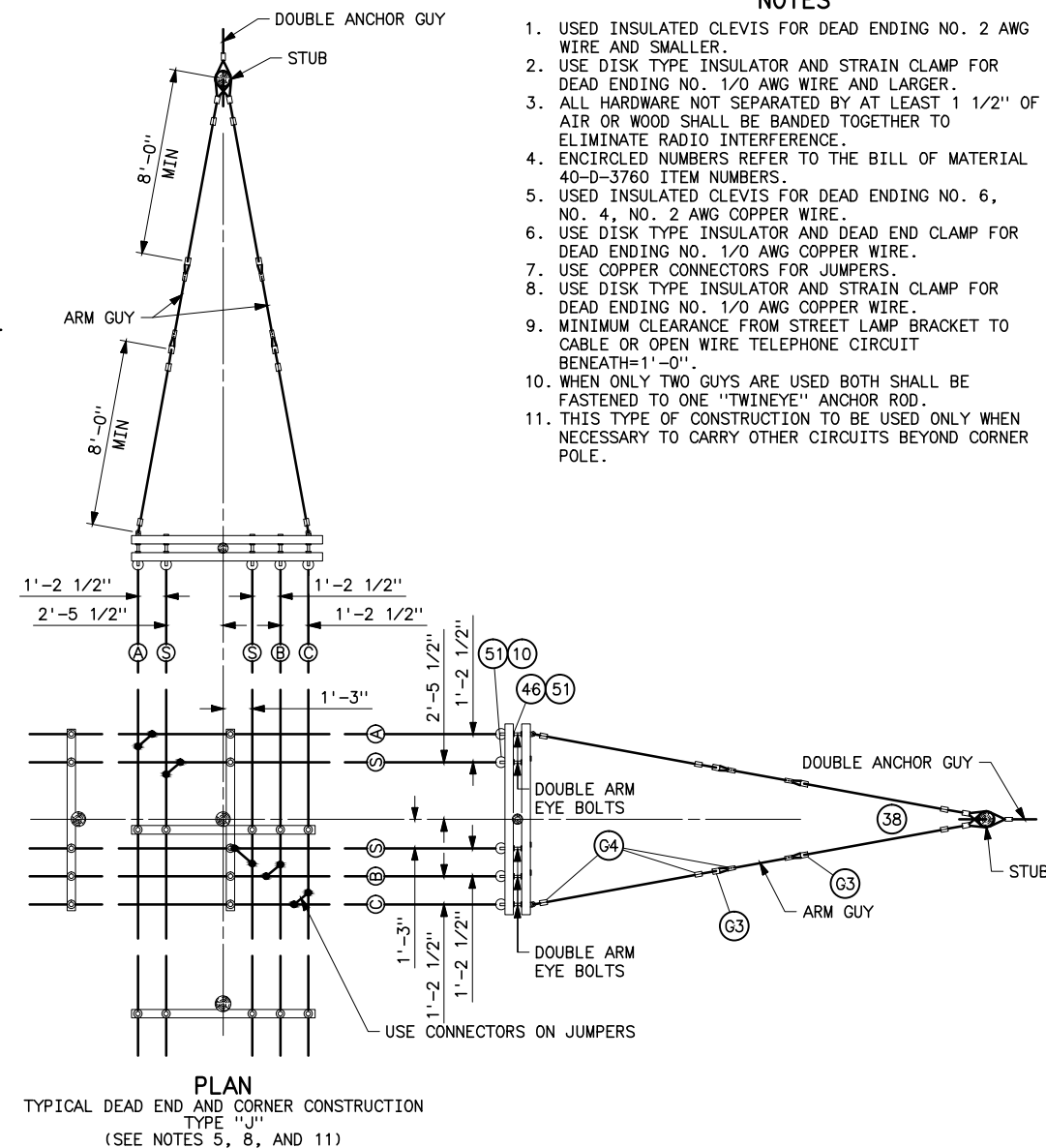
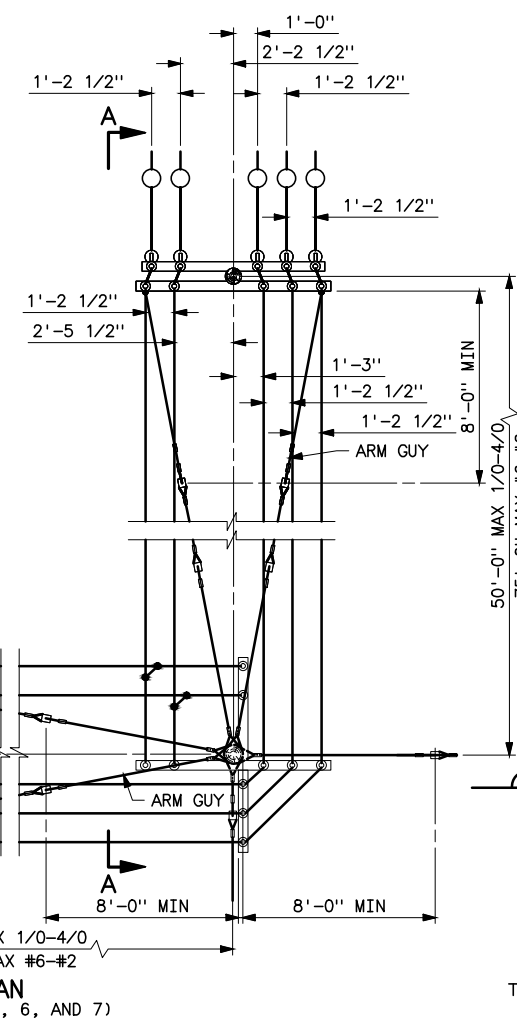
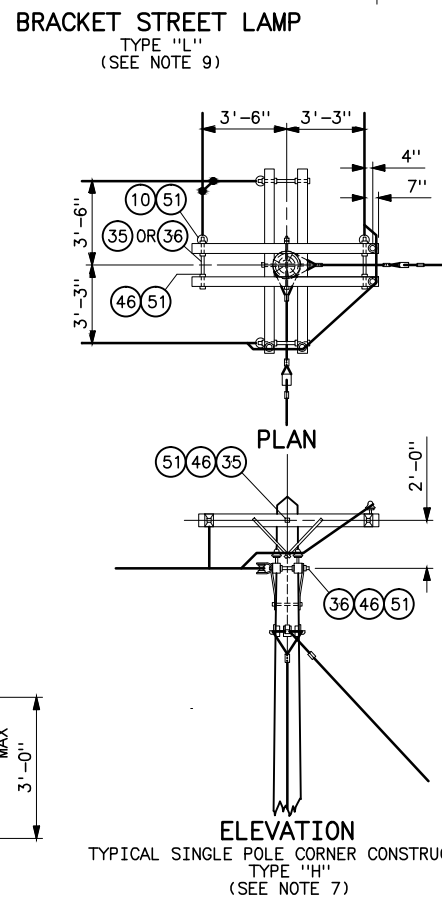
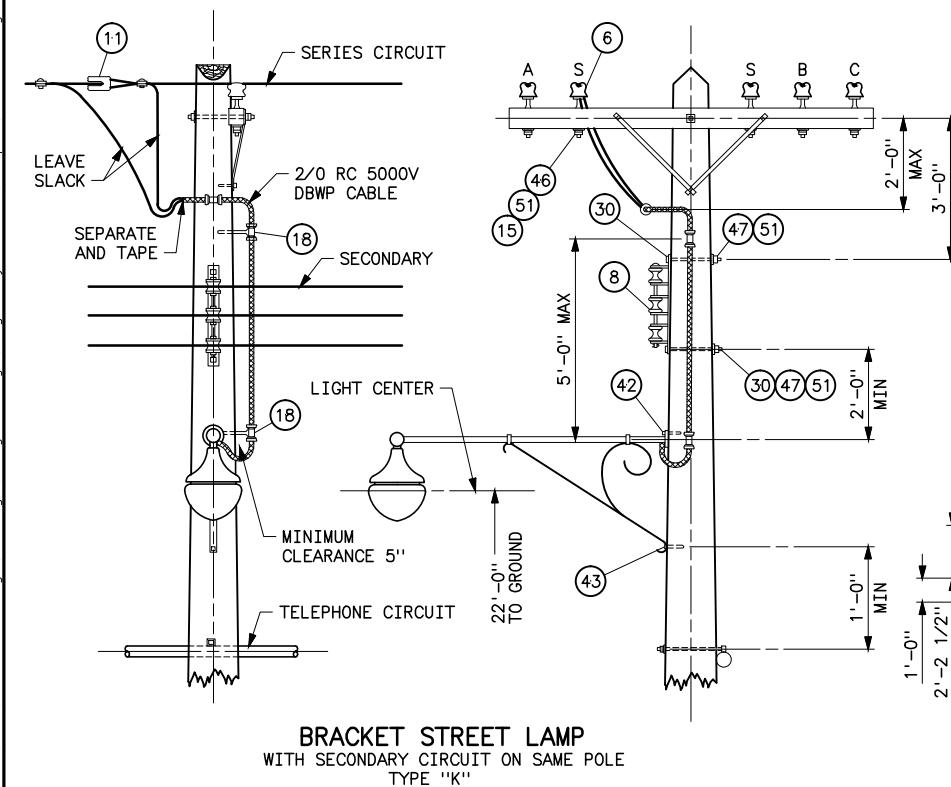
PART NO.	SINGLE STRING		DOUBLE STRING $\neq$		DESCRIPTION	DWG NO. 41
	69KV	115KV	69KV	115KV		
27.51	6	6	6	6	CLAMP, PARALLEL GROOVE, 3-BOLT, FOR CONDUCTOR	
27.71 OR 35.11	9	9	9	9	CLAMP, STRAIN SOCKET FITTING, FOR CONDUCTOR	1002
					DEAD END, COMPRESSION TYPE WITH SOCKET FITTING, FOR CONDUCTOR	1002
38.10	9	9	—	—	CONNECTOR, BALL EYE	
51.65	54	81	108	162	INSULATORS, SUSPENSION TYPE, 10" DIAMETER, 5 3/4" SPACING	1002
98.58	—	—	18	18	DOUBLE YOKE ASSEMBLY, COMPLETE WITH FITTINGS	1004

PART NO.	QUANTITY	DESCRIPTION	DWG NO. 41
9.20	4	BAND, FOUR-WAY STRAIN	6030
9.38, 9.39, 9.40	2	BAND, POLE TOP	6034, 6035, 6036, 6037
27.30	6	CLAMP, GUY, 3-BOLT, 6" LONG	
27.86	2	CLAMP, SUSPENSION, WITH 2 1/4" LINK	
29.40	2	CLIP, GROUND, WITH 3/8"x1 1/2" CARRIAGE BOLT	6034, 6035, 6036, 6037
29.50	4	CLIP, GROUND, WITH 3/4"x2 1/2" CONEHEAD BOLT	6030
35.20	2	DEAD END, COMPRESSION TYPE	
58.11	2	LINK, CONNECTING, PAIR	6030
58.12	2	LINK, CONNECTING, PAIR	
58.13	2	LINK, CONNECTING, PAIR	
64.20	2	LOCKNUT, FOR 3/8" BOLT	
64.23	4	LOCKNUT, FOR 3/4" BOLT	
77.27	8	LAG SCREW, 1/2"x4", FETTER DRIVE THREAD	
79.10	2Δ	SHACKLE, ANCHOR TYPE	6034, 6036, OR 6037
82.30	170 FT	STEEL STRAND, 7-WIRE, 7/16" SIEMENS-MARTIN (POLE-TO-POLE TIES)	
91.22	8	WASHER, ROUND, FLAT, 1 3/8" OD, 9/16" HOLE	
93.10	6	SHEAVE WHEEL, FOR 7/16" SIEMENS-MARTIN STRAND	6030
75.42	2 SETS	ROD, ARMOR, PREFORMED	

1. USE TWO LAG SCREWS AND WASHERS FOR EACH FOUR-WAY STRAIN BAND.
2. Δ ANCHOR TYPE SHACKLE AND 2 1/4" LINK NOT REQUIRED WHEN TYPE B POLE TOP BAND, DWG NO 41 6035 IS USED.
3. ≠ USE ONLY WHEN SPECIFIED.

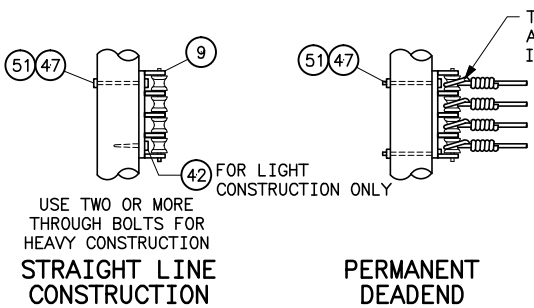
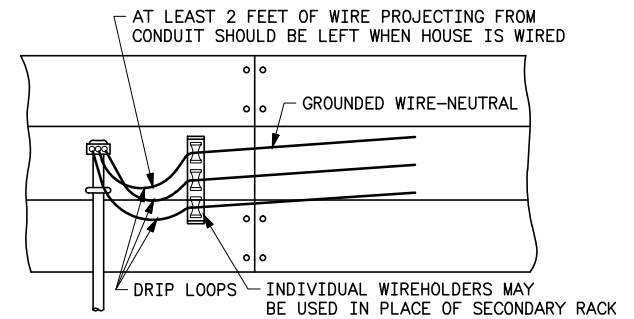
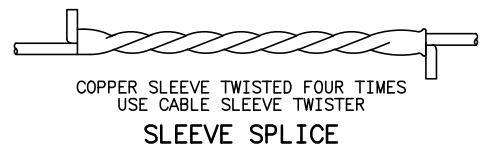
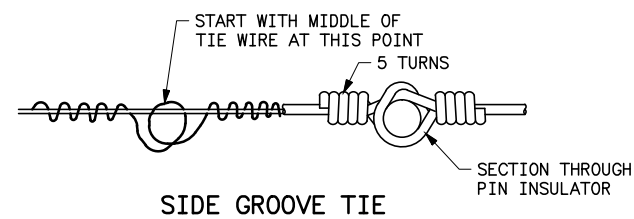
GROUNDING DETAILS_____	41	1012
GUY ARRANGEMENT_____	41	6095

B	3-2-11 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-4814		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3BT/4BT 69 AND 115KV BRANCH LINE STRUCTURE		
DESIGNED BUREC _____ APPROVED BUREC _____		
C _A F	MARCH 28, 1991	41
		6109



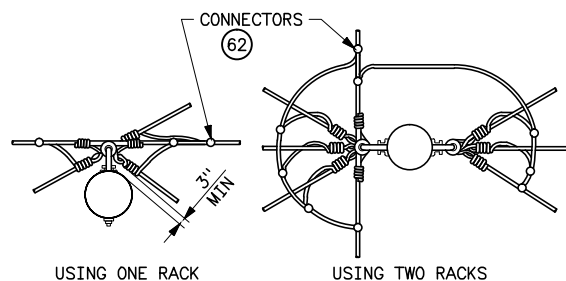
- ## NOTES
1. USED INSULATED CLEVIS FOR DEAD ENDING NO. 2 AWG WIRE AND SMALLER.
 2. USE DISK TYPE INSULATOR AND STRAIN CLAMP FOR DEAD ENDING NO. 1/0 AWG WIRE AND LARGER.
 3. ALL HARDWARE NOT SEPARATED BY AT LEAST 1 1/2" OF AIR OR WOOD SHALL BE Banded TOGETHER TO ELIMINATE RADIO INTERFERENCE.
 4. ENCIRCLED NUMBERS REFER TO THE BILL OF MATERIAL 40-D-3760 ITEM NUMBERS.
 5. USED INSULATED CLEVIS FOR DEAD ENDING NO. 6, NO. 4, NO. 2 AWG COPPER WIRE.
 6. USE DISK TYPE INSULATOR AND DEAD END CLAMP FOR DEAD ENDING NO. 1/0 AWG COPPER WIRE.
 7. USE COPPER CONNECTORS FOR JUMPERS.
 8. USE DISK TYPE INSULATOR AND STRAIN CLAMP FOR DEAD ENDING NO. 1/0 AWG COPPER WIRE.
 9. MINIMUM CLEARANCE FROM STREET LAMP BRACKET TO CABLE OR OPEN WIRE TELEPHONE CIRCUIT BENEATH=1'-0".
 10. WHEN ONLY TWO GUYS ARE USED BOTH SHALL BE FASTENED TO ONE "TWINEYE" ANCHOR ROD.
 11. THIS TYPE OF CONSTRUCTION TO BE USED ONLY WHEN NECESSARY TO CARRY OTHER CIRCUITS BEYOND CORNER POLE.

B	5-28-14 A7-DDD	REDRAWN.
SUPERSEDES DWG NO. 40-D-2929		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO		
ELECTRICAL DISTRIBUTION SYSTEMS STANDARD CONSTRUCTION DETAILS 2300 VOLTS		
DESIGNED BUREC _____ APPROVED BUREC _____		
C _A -	MARCH 5, 1992	41 6111

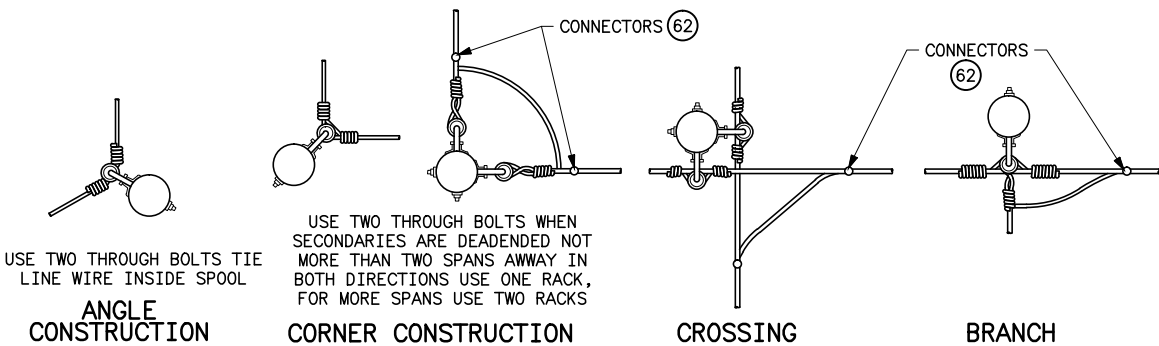


PERMANENT DEADEND

DEADEND FOR NO. 4 WIRE



USE COPPER MECHANICAL CONNECTORS FOR ALL CONNECTIONS WHERE STRAIN IS NOT TOO GREAT



ANGLE CONSTRUCTION

CORNER CONSTRUCTION

CROSSING

BRANCH

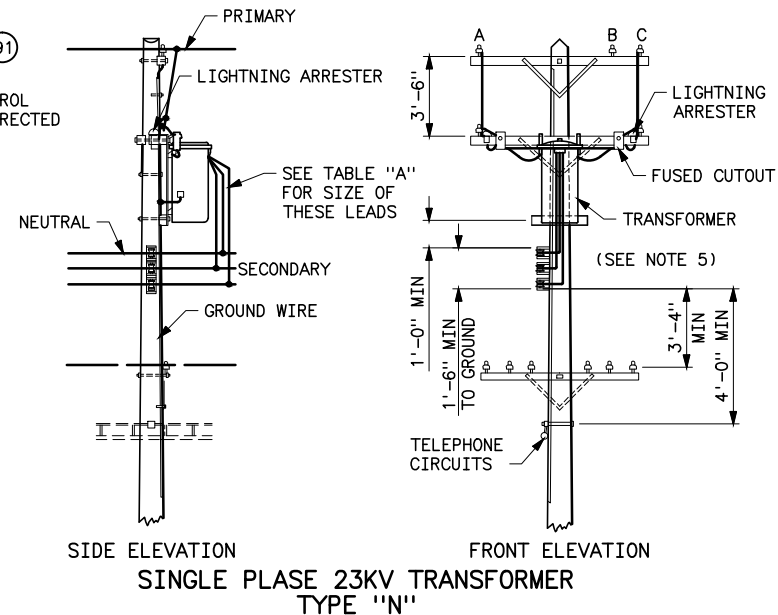
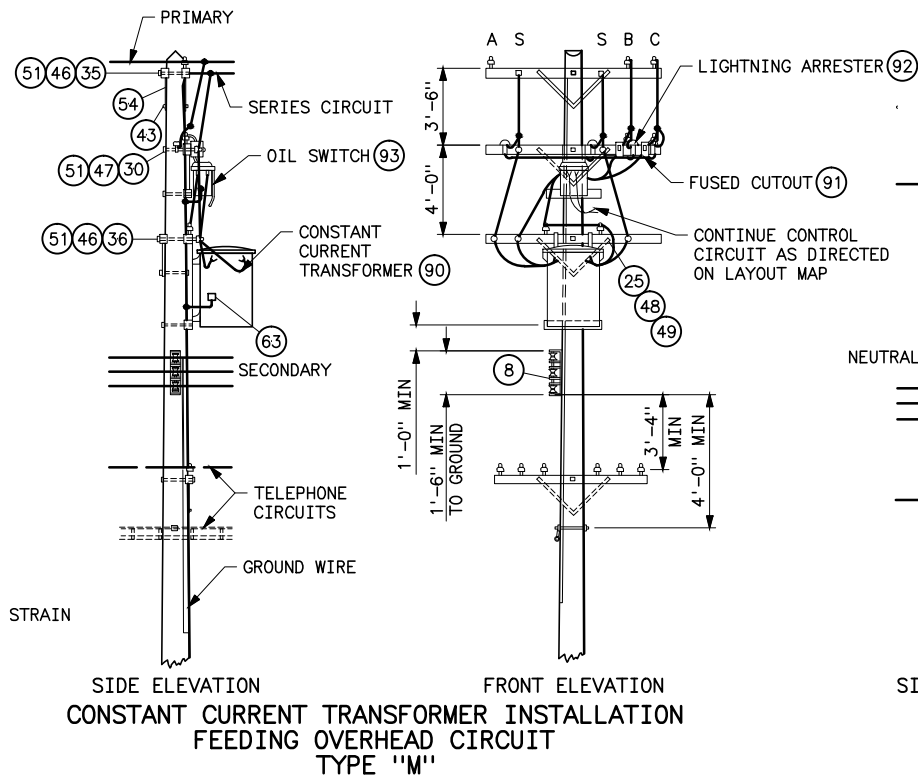
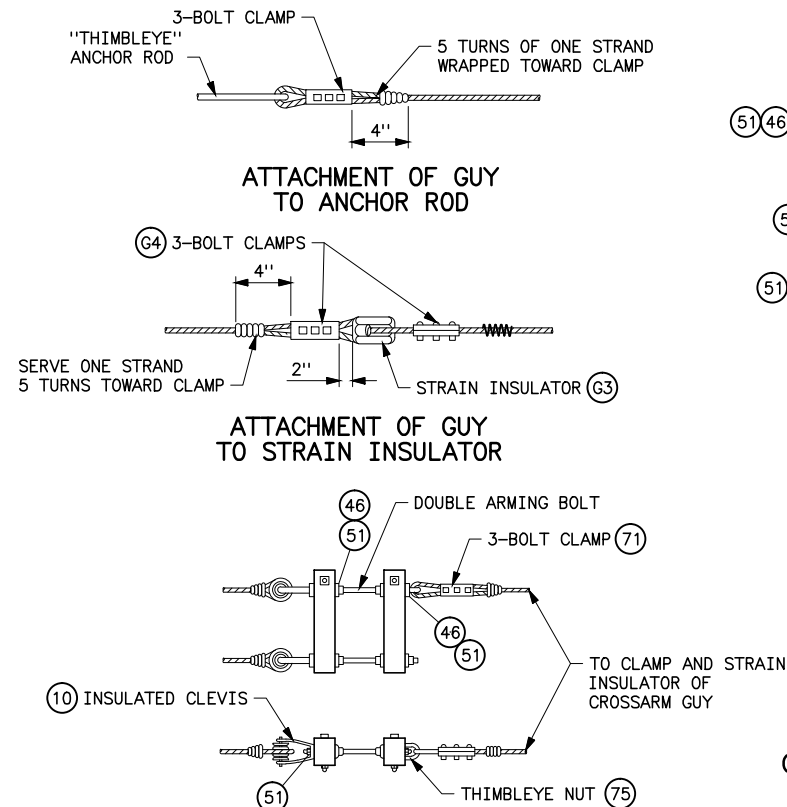
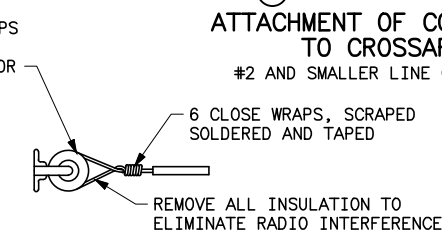
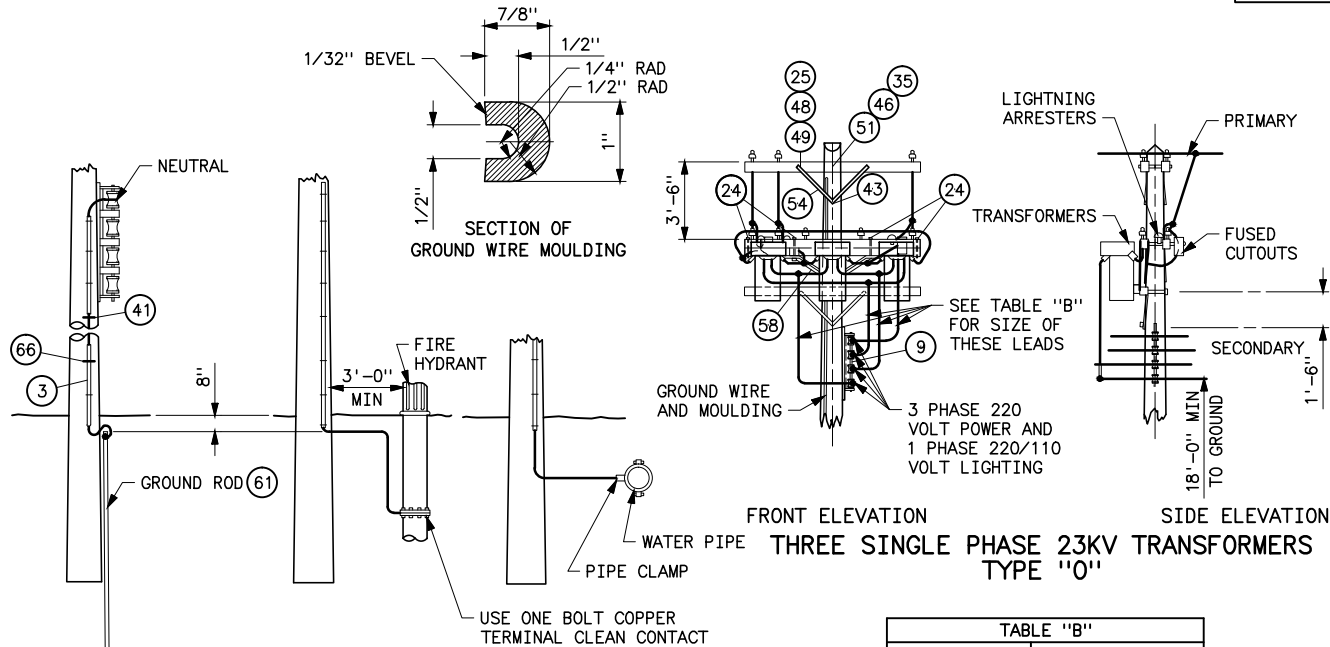


TABLE "A"	
SIZE OF SINGLE PHASE TRANSFORMER, KV-a	Mm SIZE OF SECONDARY LEADS, AWG
10	NO. 6
15	NO. 6
25	NO. 2
37 1/2	NO. 1
50	NO. 1/0

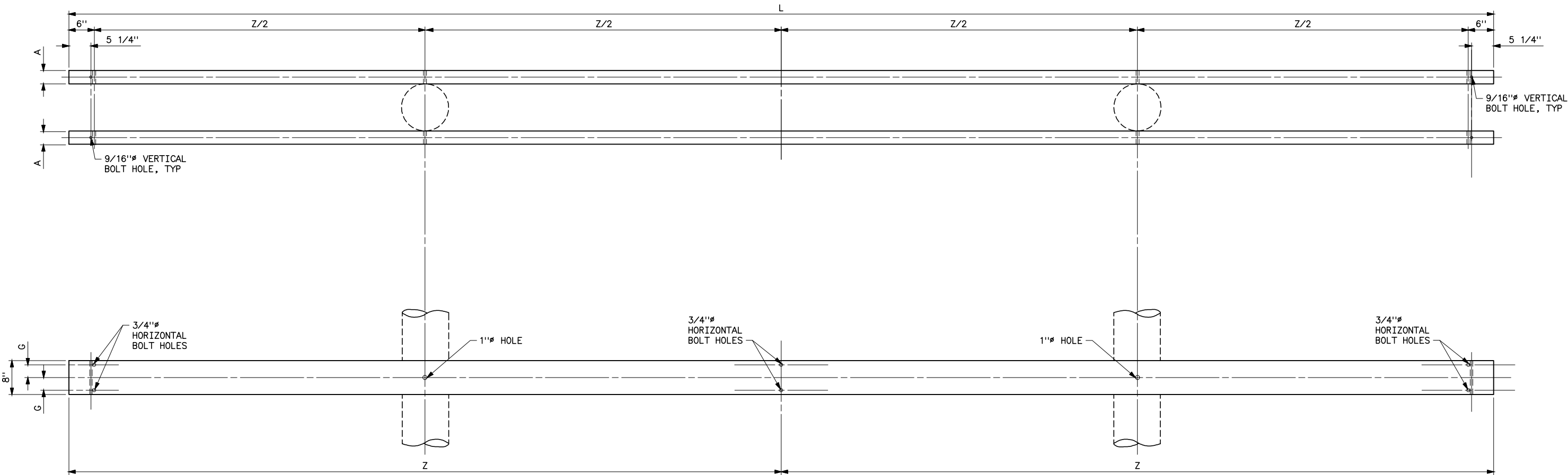
- NOTES**
- ALL HARDWARE NOT SEPARATED BY AT LEAST 1 1/2" OF AIR OR WOOD SHALL BE BONDED TOGETHER TO ELIMINATE RADIO INTERFERENCE.
 - ENCIRCLED NUMBERS REFER TO THE BILL OF MATERIAL DRAWING NO. 40-D-3760 ITEM NUMBERS.
 - GROUND WIRE SHALL BE NO. 4 AWG SOLID COPPER GROUND WIRE. LIGHTNING ARRESTER SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO THE EQUIPMENT IT IS TO PROTECT.
 - GROUND WIRE SHALL BE INSTALLED ON CONTINUOUS LENGTHS WITHOUT SPLICES.
 - METHOD OF CONNECTING AB AND BC PHASES IS SIMILAR TO THAT SHOWN FOR AC PHASES.



INSTALLATION OF GROUND WIRE ON POLE
(SEE NOTES 3 AND 4)

TABLE "B"	
SIZE OF THREE PHASE BANK, KV-a	Mm SIZE OF SECONDARY LEADS, AWG
3-10	NO. 6
3-15	NO. 2
3-25	NO. 1/0
3-37 1/2	NO. 3/0

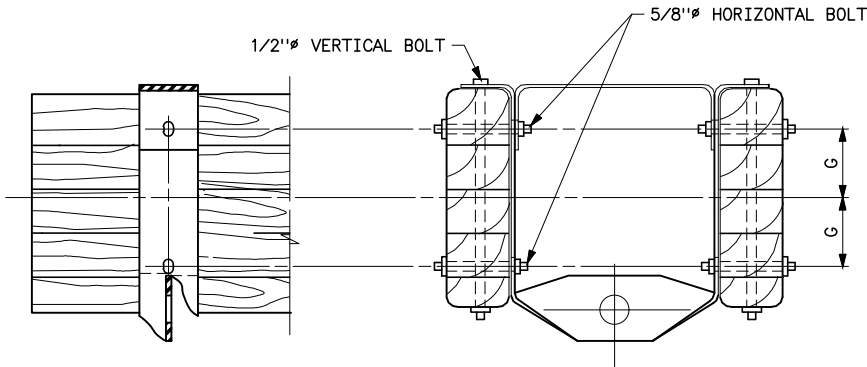
B	5-28-14 A7-DDD	REDRAWN.	
	SUPERSEDES DWG NO. 40-D-2930		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
ELECTRICAL DISTRIBUTION SYSTEMS STANDARD CONSTRUCTION DETAILS			
DESIGNED <u>BUREC</u> _____ APPROVED <u>BUREC</u> _____			
C A F	MARCH 5, 1992	41	6112



CROSSARM DRILLING DETAILS

NOTES

- 1. CROSSARMS SHALL BE GLUED LAMINATED.
- 2. THESE CROSSARMS SHALL BE USED ON EXISTING STRUCTURES WITH FIXED SPACER FITTINGS ONLY. ALL NEW STRUCTURES SHOULD USE STANDARD CROSSARM SIZES AND DETAILS SHOWN ON STANDARD DRAWING NUMBER 41 6113.



DETAIL OF FIXED SPACER FITTING
(STANDARD DESIGN PART NO. 40.49-40.68)

VOLTAGE	STRUCTURE TYPE	L	A	B	Z	Z/2	G	STANDAR DESIGN PART NO.	REFERENCE DRAWING NO.
69KV	HS	21'-0"	2 5/8"	9 1/2"	10'-0"	5'-0"	3"	40.49-40.52	41 6038-1, 41 6038-2
69KV	HSB	25'-0"	2 5/8"	9 1/2"	12'-0"	6'-0"	3"	40.49-40.52	41 6038-1, 41 6038-2
115KV	HS AND HSB	25'-0"	2 5/8"	9 1/2"	12'-0"	6'-0"	3"	40.49-40.52	41 6038-1, 41 6038-2
138KV	HS AND HSB	29'-0"	3 5/8"	11 1/2"	14'-0"	7'-0"	3 3/4"	40.53-40.56, 40.60, 40.61	41 6039-1, 41 6039-2
161KV	HS AND HSB	35'-0"	3 5/8"	11 1/2"	17'-0"	8'-6"	3 3/4"	40.53-40.56, 40.60, 40.61	41 6039-1, 41 6039-2
230KV	HSB	45'-0"	3 1/8"	10 1/2"	22'-0"	11'-0"	2 1/2"	40.66-40.68	41 6040

B

1-3-22
A7-KKR

A

09-13-01
A7-KKR

UPDATED DRAWING REFERENCES AND 230KV CROSSARM SIZE.

ADDED NOTE 2. DELETED "1" FROM TYPES.

SUPERSEDES DWG NO. 41 6023, 41 6025, 41 6027

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
HEADQUARTERS - GOLDEN, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
CROSSARM DRILLING DETAILS
HS AND HSB STRUCTURES
WITH FIXED SPACER FITTINGS

DESIGNED K.K. ROWE
DRAWN K.K. ROWE
CHECKED K.K. ROWE

RECOMMENDED K.K. ROWE
APPROVED ROSS M. CLARK
CHIEF, TRANSMISSION
LINE BRANCH

A

APRIL 18, 1995

41

6114

Plotted By: Denton Jan 03, 2022 11:39am
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IMAGES:

XREF(S):

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE SS-1	
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	HORIZONTAL LINE POST INSULATOR
3	6	MACHINE BOLT WITH NUT AND LOCKNUT (COORDINATE WITH INSULATOR MANUFACTURE FOR BOLT SIZE)
4	3	Y-CLEVIS EYE, 90° WITH BNK
5	3	CLAMP, FOR LINE POST INSULATOR WITH BNK
6	3	BONDING CLIP (EQUAL TO BROOKS MANUFACTURE BC SERIES OR HUGHES NO. 2727)
7	6	3x3x1/4 CURVED SQUARE WASHER WITH HOLE
8	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
9	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
10	3	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY

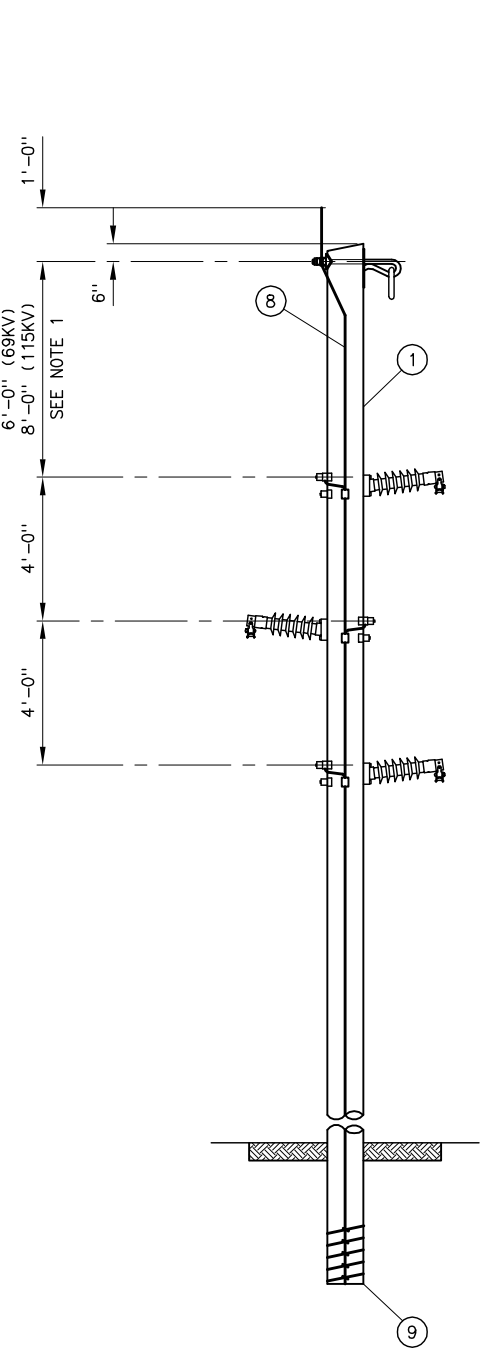
OVERHEAD GROUND WIRE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE SS-1	
21	1	SHIELD WIRE SUPPORT BRACKET W/1/2"Ø LINK AND 3/4"Ø BOLT (HUGHES BROS NO. 2812 FOR WOOD POLES, NO. 2855 FOR GLUED LAMINATED POLES)
22	1	BOND CLIP EQUAL TO HUGHES BROS NO. 2727 WITH EXTRA NUT

NOTES

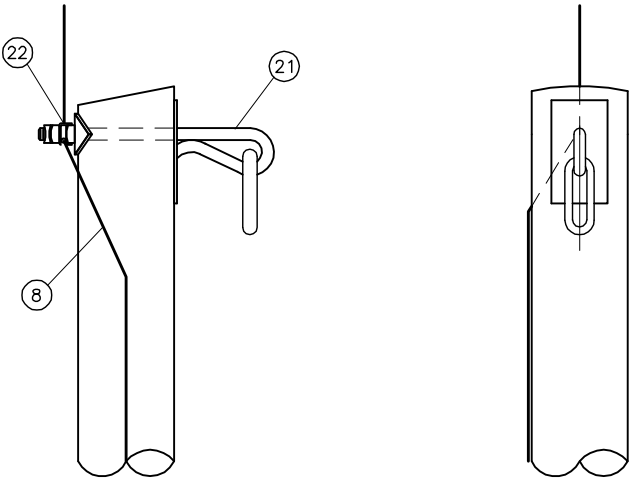
1. MEASUREMENTS FOR HORIZONTAL LINE POST ARE TO Ƿ OF TOP MOUNTING HOLES.
2. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
3. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

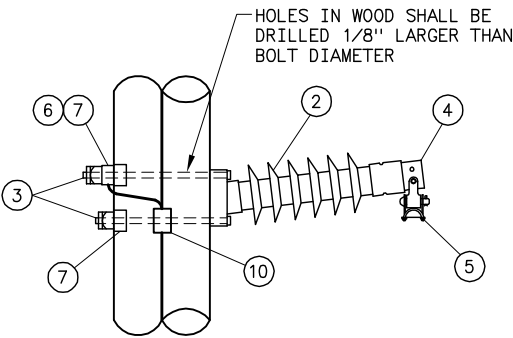
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
OPTICAL GROUND WIRE ASSEMBLIES	41 1031



TANGENT TYPE SS-1 0 TO 1° LINE ANGLE

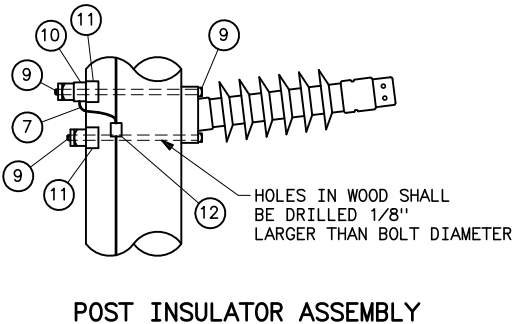
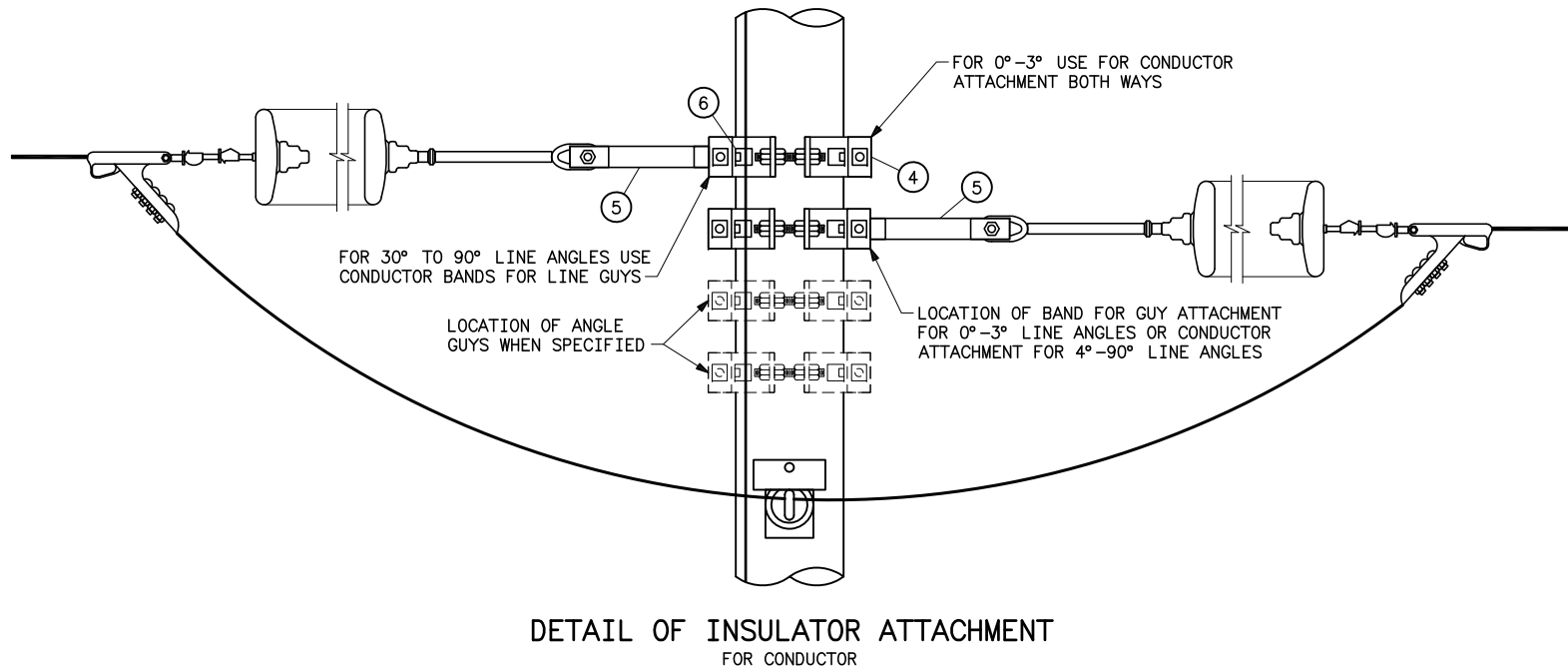
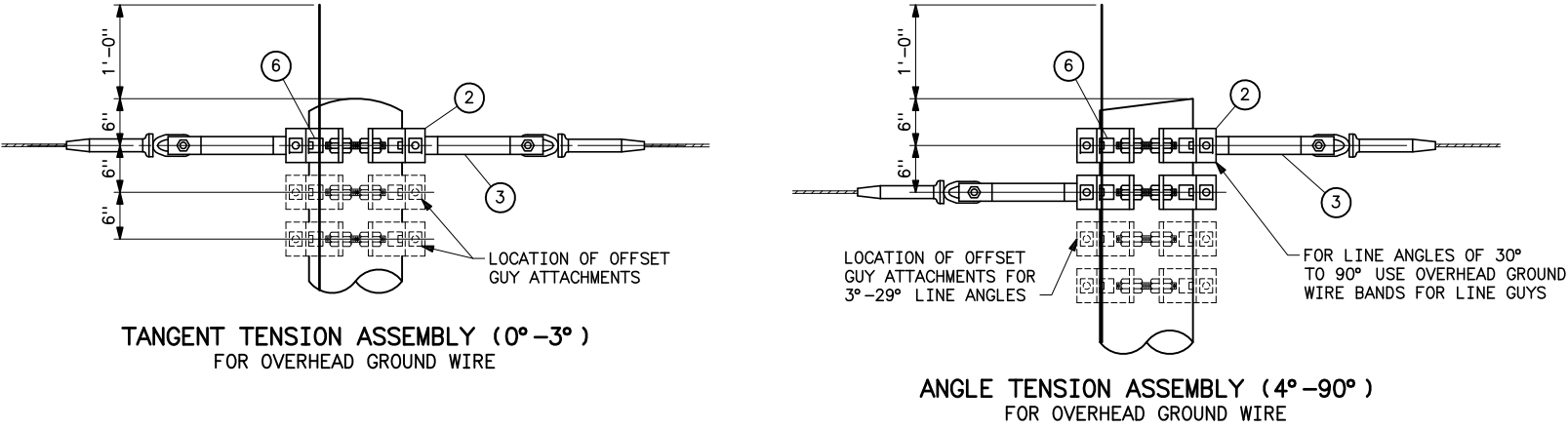


DETAILS OF OGW BONDING AND ATTACHMENT



POST INSULATOR ASSEMBLY

B	4-14-11 A7-KKR	CHANGED OGW ATTACHMENT	
	A	05-20-98 A3-	CHANGED DIMENSION FROM OGW ATTACHMENT TO FIRST POST INSULATOR.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE SS-1 69 AND 115KV TANGENT SUSPENSION STRUCTURE			
DESIGNED <u> KAREN ROWE </u> APPROVED <u> DOUG HANSON </u> CIVIL ENGINEERING MANAGER			
A	AUGUST 30, 1996	41	6115

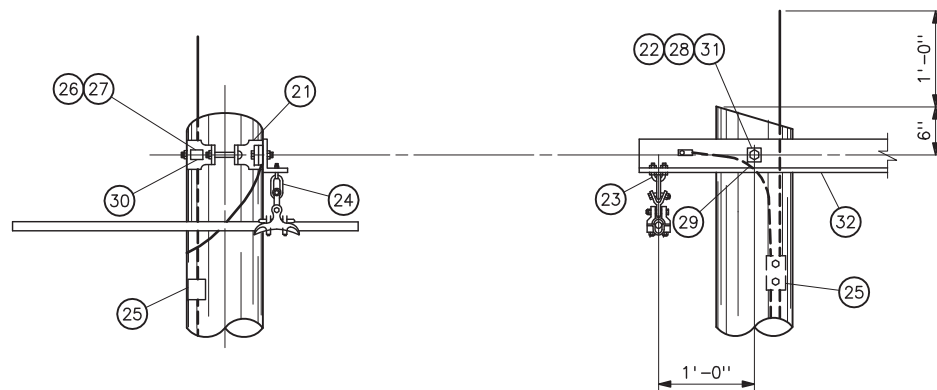


STRUCTURE MATERIAL			
PART NO.	QUANTITY STRUCTURE TYPE ST-1 AND LST-1		DESCRIPTION
	TANGENT TENSION	ANGLE TENSION	
1	1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	1	2	FOUR-WAY STRAIN BAND; HUGHES 3105 SERIES, OR APPROVED EQUAL WITH 2-1/2x4 LAG SCREWS & WASHERS PER BAND
3	2	2	CONNECTING LINK; PAIR WITH BNK HUGHES 3154, OR APPROVED EQUAL
4	3	6	FOUR-WAY STRAIN BAND: HUGHES 3112 SERIES OR APPROVED EQUAL
5	6	6	CONNECTING LINK; PAIR WITH BNK HUGHES 3157, OR APPROVED EQUAL
6	4	8	1/2# GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT) HUGHES 2718.55 OR EQUAL
7	AS REQ'D	AS REQ'D	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
8	1	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
9	-	-	MACHINE BOLT WITH NUT AND LOCKNUT (SUPPLIED WITH INSULATOR BRACKET)
10	3	3	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES NO. 2727) WITH NUT
11	6	6	3x3x1/4 CURVED SQUARE WASHER WITH BOLT HOLE
12	3	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

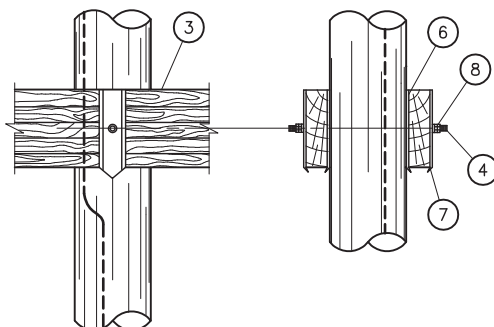
- NOTES**
- POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN FOR LINE ANGLES GREATER THAN 5°.
 - BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
 - ALL POLE BANDS SHALL BE BONDED WITH PART NUMBER 5.
 - EXTRA BANDS, LINKS, GROUNDING ASSEMBLIES, AND LAG SCREWS NEEDED FOR GUYING ARE NOT INCLUDED IN THIS QUANTITY.
 - HOLES IN WOOD SHALL BE DRILLED 1/8" LARGER THAN BOLT DIAMETER.
 - MEASUREMENTS FOR HORIZONTAL LINE POST MOUNTING ARE TO CENTERLINE OF TOP MOUNTING BOLT.
 - ALL HARDWARE WILL BE OF THE SIZE RECOMMENDED BY THE INSULATOR MANUFACTURER.
 - DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES, SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS	
GUY ASSEMBLIES AND DETAILS	41 6047
GUYING REQUIREMENTS FOR SINGLE POLE CONSTRUCTION WITH OVERHEAD GROUND WIRE	41 6071
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
WOOD POLE STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLY	41 1019
TENSION INSULATOR ASSEMBLIES - SINGLE STRING	41 1022
TENSION INSULATOR ASSEMBLIES - DOUBLE STRING	41 1023
HORIZONTAL POST - INSULATOR ASSEMBLIES	41 1024
OPTICAL GROUND WIRE ASSEMBLIES	41 1031

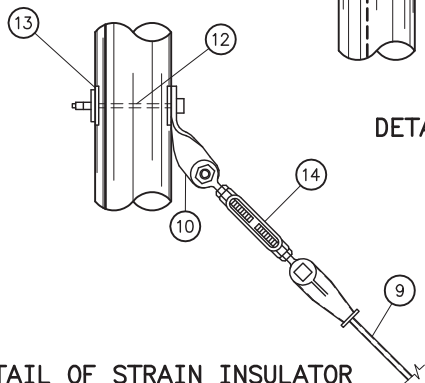
B	10-17-05 A7-KKR	ADDED LST-1 AND DRAWING REFERENCES.	
	A	01-25-05 A7-KKR	MINOR REVISIONS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE ST-1 AND LST-1 69 AND 115KV TANGENT AND ANGLE TENSION STRUCTURES			
DESIGNED KAREN ROWE		APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
A	AUGUST 30, 1996	41	6116



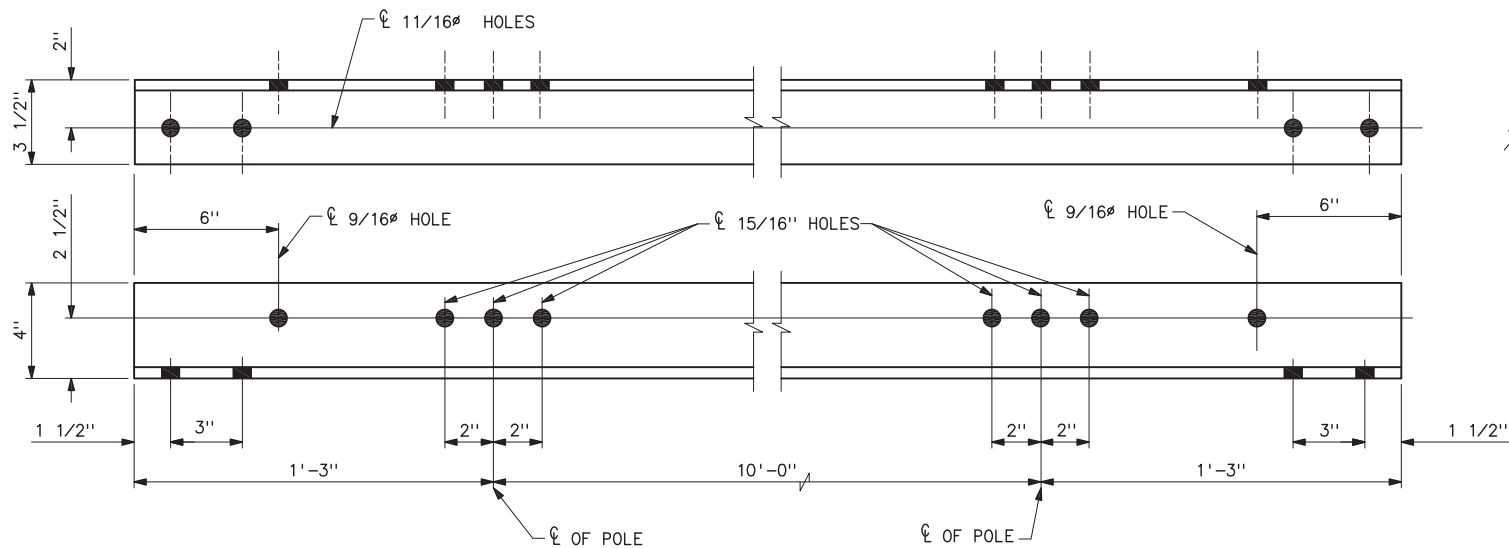
DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT



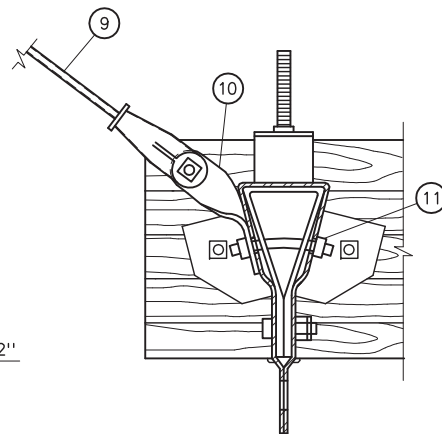
DETAIL OF WOOD ATTACHMENT



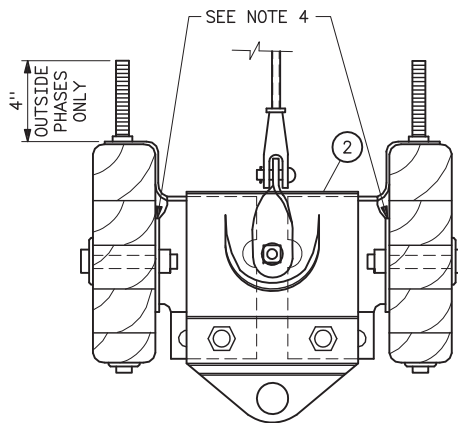
DETAIL OF STRAIN INSULATOR ATTACHMENT TO POLE



STEEL ANGLE (32)



DETAIL OF PHASE FITTING ASSEMBLY



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTING, COMPLETE WITH BOLTS, NUTS AND WASHERS (HUGHES BROS. TYPE 3414 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8"x9"x21'-0"
4	2	DOUBLE ARMING BOLT, 7/8"Øx REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8"x4 3/8" (HUGHES BROS. NO. 1042 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8"Ø BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (EQUAL TO HUGHES BROS. NO. AS2276)
11	2	7/8"Øx REQUIRED LENGTH BENT BOLT WITH LOCK WASHERS AND LOCKNUTS
12	2	7/8"Øx REQUIRED LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
13	2	4x4x1/4 CURVED WASHER, 15/16"Ø HOLE
14	2	TURNBUCKLE (HUGHES BROS. AS2545-B OR EQUAL)
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"Øx12"
23	2	"U" BOLT, 5/8"Øx3 WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2"Ø (HUGHES BROS. NO. 1329-B1 OR EQUAL)
25	2	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"x4" LAG SCREW WITH FETTER.DRIVE THREAD (ONE PER BAND)
27	2	1 3/8Ø FLAT ROUND WASHER WITH 9/16Ø HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8"Ø BOLT
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
30	4	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT).
31	2	SPRING LOCK WASHER FOR 7/8"Ø BOLT
32	1	STEEL ANGLE, 4x3 1/2x12-6 LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

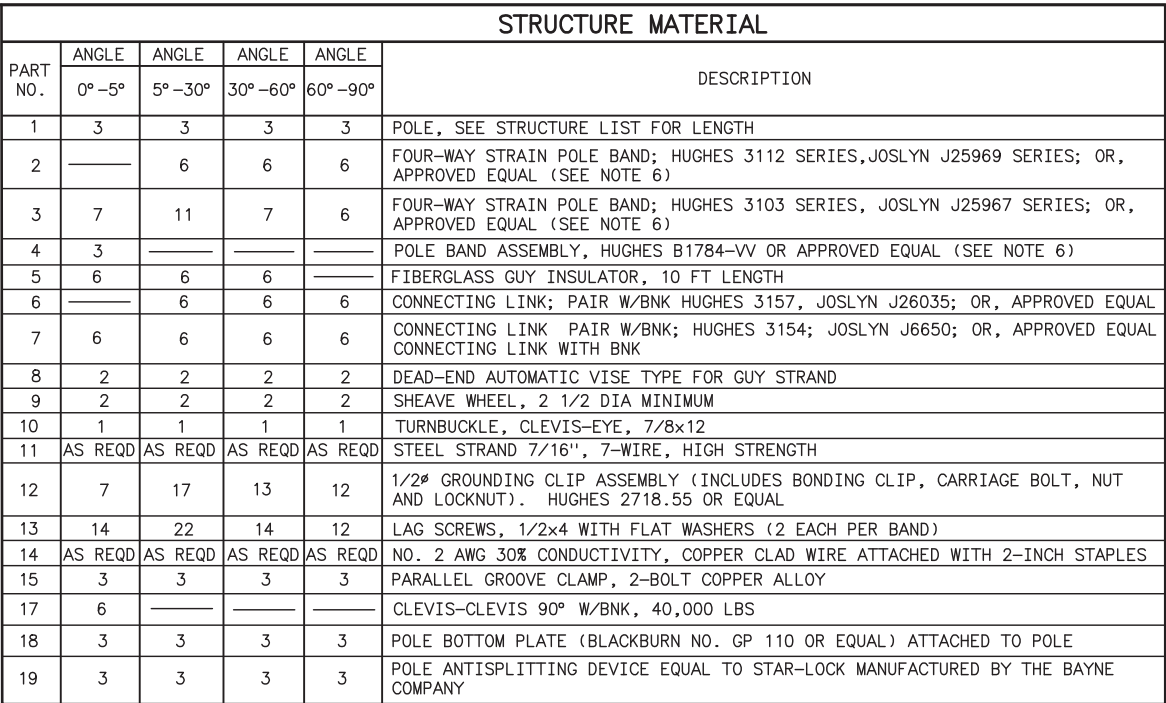
NOTES

1. STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
2. ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
4. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 INCH LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
5. BKN INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

WOOD POLES STRUCTURES		
GROUNDING DETAILS	41	1012
OVERHEAD GROUND WIRE ASSEMBLY		
DETAILS FOR WOOD POLES STRUCTURES	41	1019
CROSSARM DRILLING DETAILS HS-1 AND		
HSB-1 STRUCTURES	41	6113
OPTICAL GROUNDWIRE ASSEMBLIES	41	1031
SUSPENSION INSULATOR ASSEMBLIES		
SINGLE STRING	41	1020

A	04-14-05 A7-KKR	MINOR CHANGES. ADDED STAR-LOCK.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HS-1 69KV SUSPENSION STRUCTURE			
DESIGNED <u>KAREN ROWE</u> _____		APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER	
CAE	MAY 16, 1997	41	6117



PART NO.	QUANTITY	DESCRIPTION
	0° - 60°	
20	6	7/8"Ø x REQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16"Ø HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
4. ADDITIONAL POLE BAND IS NOT REQUIRED ON CENTER POLE FOR LINE ANGLES 60°-90°.
5. FOR 5°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) FOR GUYING ON EACH OUTSIDE POLE.
6. DEADEND TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEADEND TEES. SEE STANDARD DRAWING 41 6138.
7. USE X-RACE EQUAL TO HUGHES BROS NO. 2121 WHEN SPECIFIED.

TYPE 3TA-1 AND STRUCTURES		
STANDARD GUY STRUCTURES	41	6125
TENSION INSULATOR ASSEMBLIES		
SINGLE STRING	41	1022
DOUBLE STRING	41	1023
WOOD POLE STRUCTURES		
GROUNDING DETAIL	41	1012
OVERHEAD GROUND WIRE ASSEMBLY		
DETAILS FOR WOOD POLES STRUCTURES	41	1019
OPTICAL GROUND WIRE ASSEMBLIES	41	1031
TYPICAL DETAILS FOR DEAD END TEES	41	6138

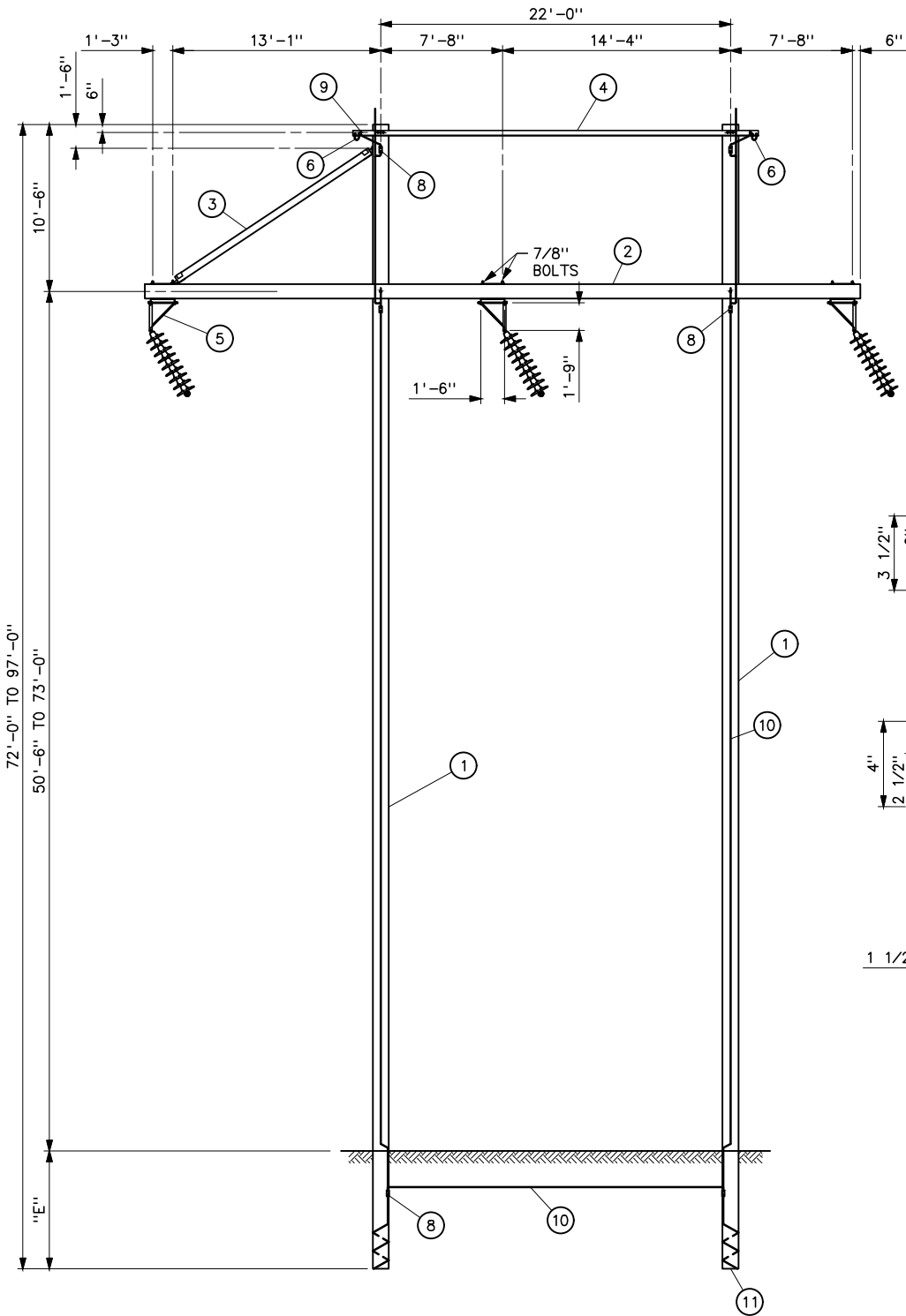
B	5-8-06 A7-KKR	ADDED X-BRACE OPTION
A	01-06-05 A7-KKR	REVISED REFERENCE DRAWINGS. ADDED STAR-LOCK AND NOTE 6.

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

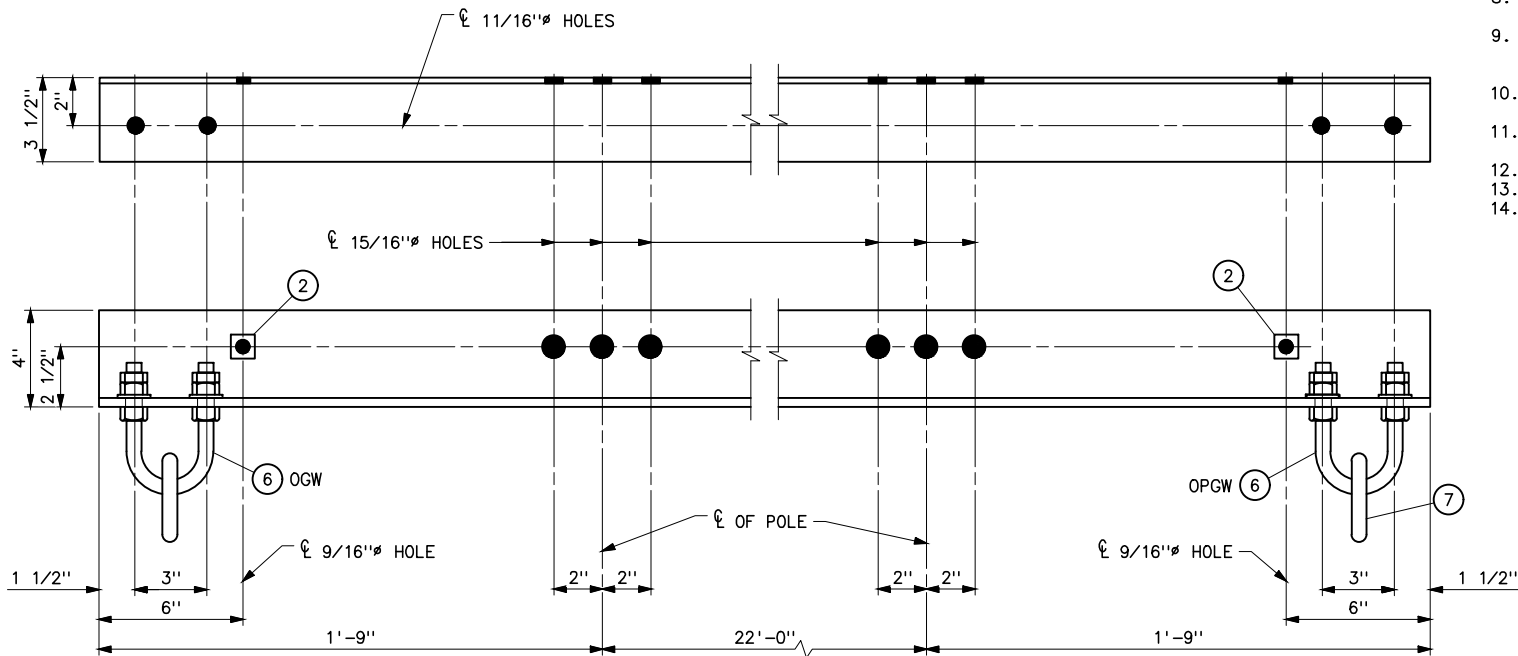
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TA-1 69 AND 115KV 3-POLE TENSION STRUCTURE

DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON _____
CIVIL ENGINEERING MANAGER

C _A E	DECEMBER 31, 1996	41	6118
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ELEVATION
UNGUYED 0°-5° GLU-LAM ANGLE SUSPENSION STRUCTURE



STEEL ANGLE (4)

NOT PROVIDED BY
GLUED LAMINATED
POLE MANUFACTURER

MATERIAL LIST		
PART NO.	QUANTITY	DESCRIPTION
1	2	GLUED LAMINATED RAKED POLE
2	1	GLUED LAMINATED CROSSARM
3	1	KNEE BRACE
4	1	4x3 1/2x3/8x25'-6" STEEL ANGLE
5	3	SWINGING ANGLE BRACKET, HUGHES BROS. 2823.8 OR EQUAL
6	2	"U" BOLT, 3/4" DIA x 3" with 4 HEX NUTS AND 2 LOCKNUTS, HUGHES BROS. 1331 OR EQUAL
7	2	5/8" CHAIN LINK, HUGHES BROS. 1329-B OR EQUAL
8	6	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
9	2	1/2 DIA GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT) EQUAL TO HUGHES BROS. 2718.55.
10	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
11	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTES

- OVERLOAD FACTOR:
NESC -----VERTICAL=1.5
TRANSVERSE (WIND)=2.5
TRANSVERSE (WIRE TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND -----ALL=1.33
- STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
- STRUCTURE GUYS ARE NOT PERMITTED.
- CONDUCTOR: 954 KOM, ACSR 45/7 RAIL
OGW: ONE 3/8", 7-STRAND, EXTRA HIGH STRENGTH.
OPGW: ONE .1248 INCHES SQUARED, .465"Ø, .314 LB/FT
RTS -----16,626 LB
- WIND SPAN -----700 FT
- WEIGHT SPAN -----400-1200 FT
- DESIGN FOR:
NESC HEAVY: 2017 EDITION, 1/2" RADIAL ICE, 4 PSF AT 0°F.
TENSIONS: CONDUCTOR (AHEAD AND BACK) -----10,744 LB
OGW (AHEAD AND BACK) -----4266 LB
OPGW (AHEAD AND BACK) -----5082 LB
HIGH WIND: 85 MPH WIND AT 60°F WITH 1.14 FACTOR FOR WIRES AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
60°F TENSION -----5378 LB
- GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE.
- GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
- INSTALL IN ACCORDANCE WITH MANUFACTURES RECOMMENDATIONS.
- POLES SHALL BE SET TO WITHIN 3" OF THE SPECIFIED SETTING.
- ANGLE RANGE FROM 0°-5°.
- POLE HEIGHT RANGE 72'-0" TO 97'-0".
- GRADE B CONSTRUCTION.

REFERENCE DRAWINGS

SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING -----	.41 1020
DOUBLE STRING -----	.41 1021
WOOD POLES STRUCTURES	
GROUNDING DETAILS -----	.41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES -----	.41 1019

B	4-20-23 A7-KR	CHANGED BOLT SIZE TO 7/8 INCH ON SWINGING ANGLE BRACKET PER UGPR REQUEST.
A	5-20-19 A7-KR	CHANGED MATERIAL LIST.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HA-GL 230KV ANGLE SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE ----- APPROVED DOUG HANSON ----- CIVIL ENGINEERING MANAGER		
C A E	FEBRUARY 25, 2005	41 6119

STRUCTURE MATERIAL			
PART NO.	QUANTITY STRUCTURE TYPE		DESCRIPTION
	SSA-1, LSSA-1	SLA-1, LSLA-1	
1	1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	6	–	MACHINE BOLT WITH NUT AND LOCKNUT (COORDINATE WITH INSULATOR MANUFACTURER FOR BOLT SIZE)
3	–	3	SWINGING ANGLE BRACKET, COMPLETE, BOLTS, WITH GUYING PLATE AND FITTINGS (HUGHES BROS. NO. 2822.8 OR EQUAL)
4	3	2	DEAD-END TEE EQUAL TO HUGHES BROS. NO. 2817R4.5-15-15C
5	4	2	7/8"Ø SQUARE HEAD BOLT WITH SQUARE NUT, AND LOCKNUT
6	2	4	DUCTILE DEAD END THIMBLE EQUAL TO ANDERSON TYPE DDT-07 WITH BNK, 40,000 LBS. ULT STRENGTH
7	1	–	TWISTED SHACKLE WITH BNK EQUAL TO HUGHES BROS. 2866
8	8	–	3x3x1/4 CURVED SQUARE WASHER WITH HOLE
9	–	1	EXTENSION LINK, COMPLETE WITH BNK (HUGHES BROS. NO. 1906-14 OR EQUAL)
10	AS REQD	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
11	5	4	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROTHERS NO. 2727)
12	5	4	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
13	1	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTES

1. MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO ̢ OF BOTTOM MOUNTING HOLES.
2. ALL HARDWARE WILL BE OF THE SIZE RECOMMENDED BY THE INSULATOR MANUFACTURER.
3. FOR LINE ANGLES OF 20° TO 60° USE DOUBLE SUSPENSION SHOE ASSEMBLIES.
4. POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST THE STRAIN FOR LINE ANGLES GREATER THAN 5° .
5. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

SSA-1 – SUSPENSION SMALL ANGLE

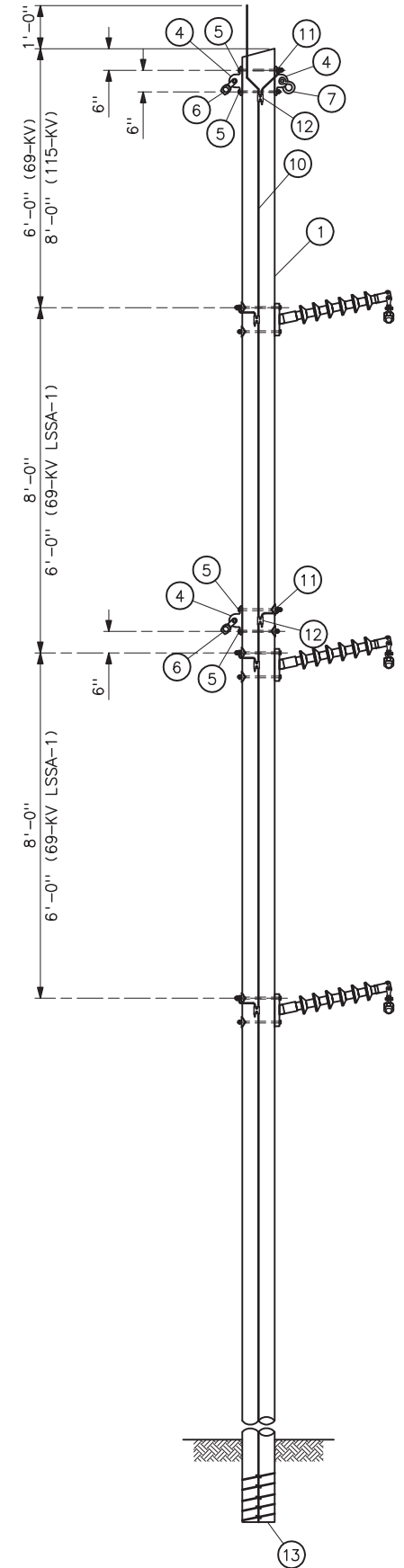
LSSA-1 – LIGHT LOADING SUSPENSION SMALL ANGLE

SLA-1 – SUSPENSION LARGE ANGLE

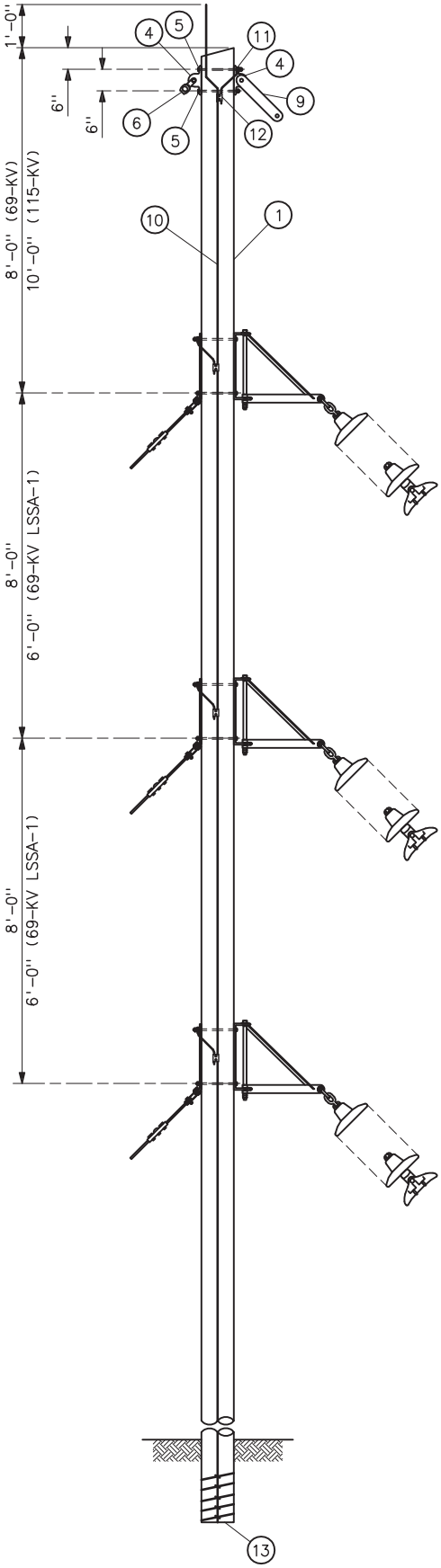
LSLA-1 – LIGHT LOADING SUSPENSION LARGE ANGLE

REFERENCE DRAWINGS

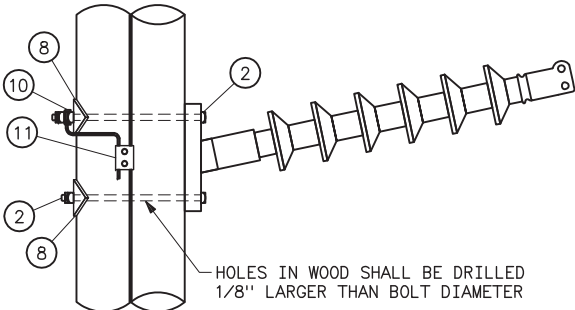
GUY ASSEMBLIES AND DETAILS.....	41 6047
GUYING REQUIREMENTS FOR SINGLE POLE CONSTRUCTION WITH OVERHEAD GROUND WIRE.....	41 6071
WOOD POLES STRUCTURES	
GROUNDING DETAILS.....	41 1012
WOOD POLES STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLIES.....	41 1019
SUSPENSION INSULATOR ASSEMBLIES – SINGLE STRING.....	41 1020
SUSPENSION INSULATOR ASSEMBLIES – DOUBLE STRING.....	41 1021
OPTICAL GROUND WIRE ASSEMBLIES.....	41 1031



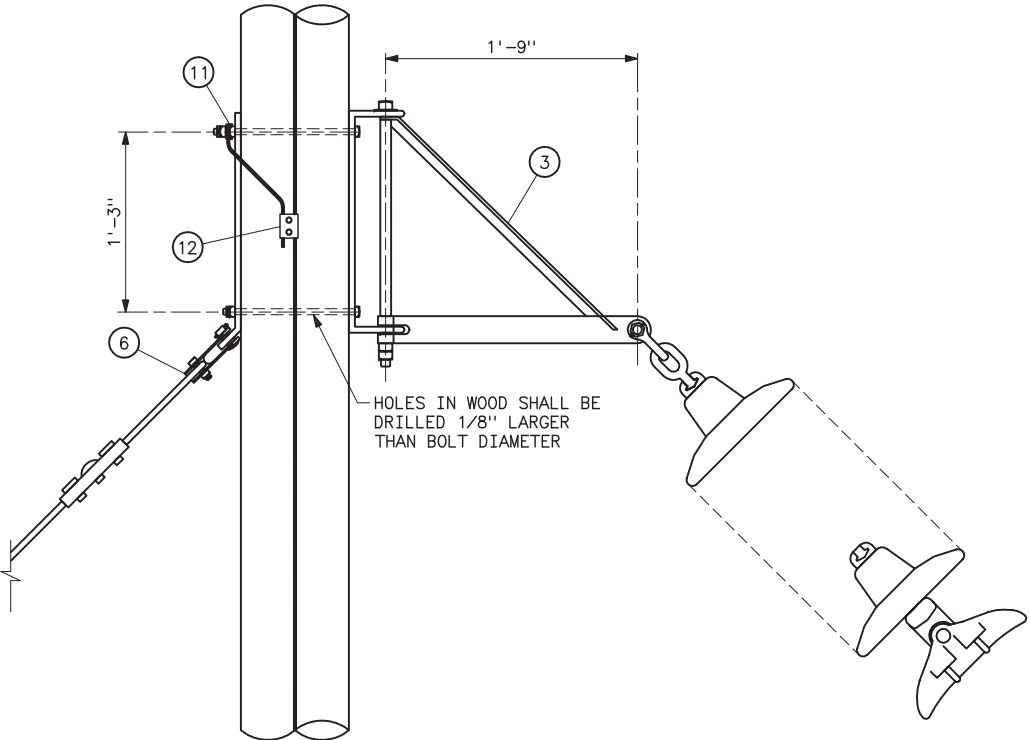
SMALL ANGLE TYPE SSA-1 AND LSSA-1
1 TO 15° LINE ANGLE



LARGE ANGLE TYPE SLA-1 AND LSLA-1
15 TO 60° LINE ANGLE



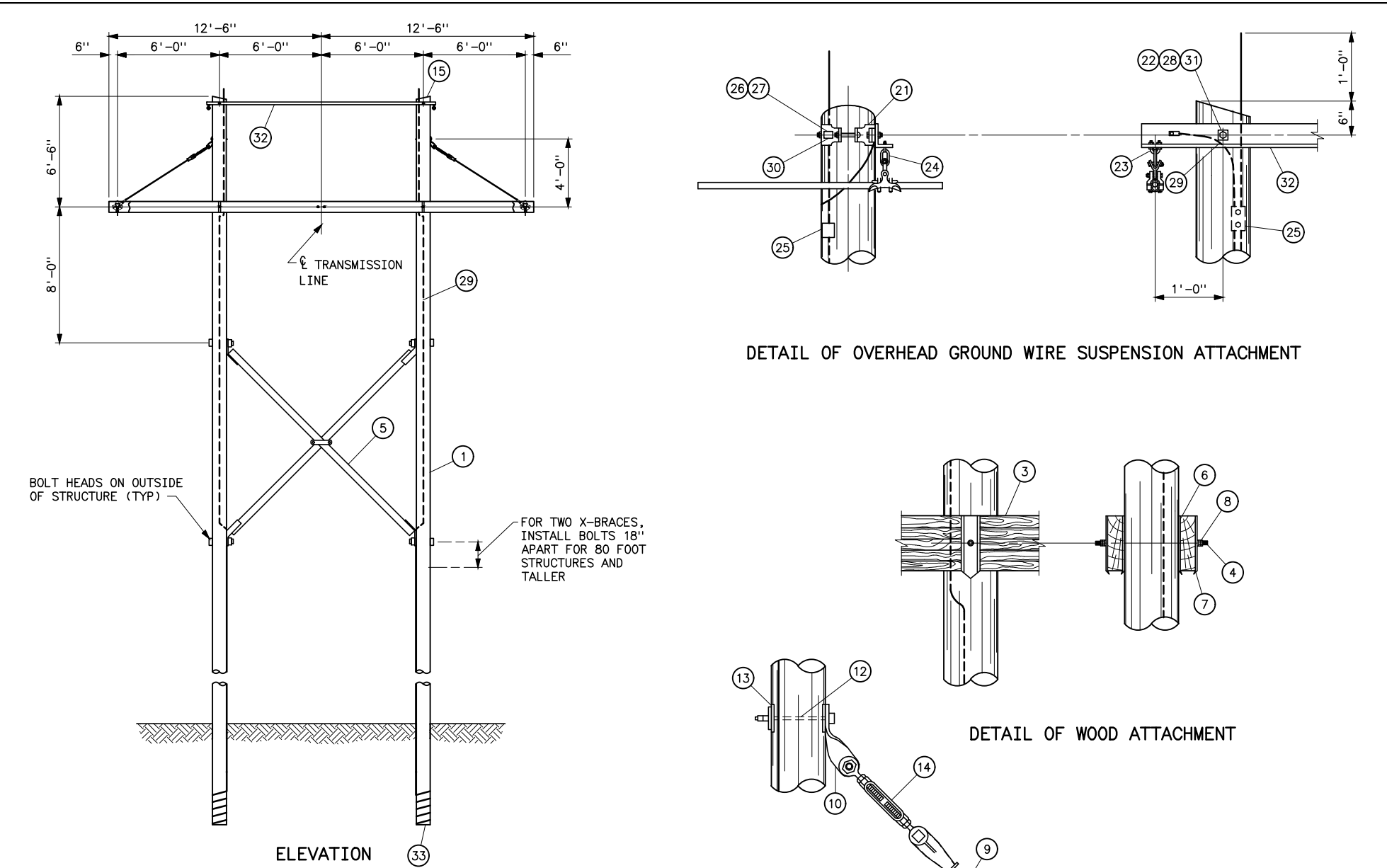
POST INSULATOR ASSEMBLY



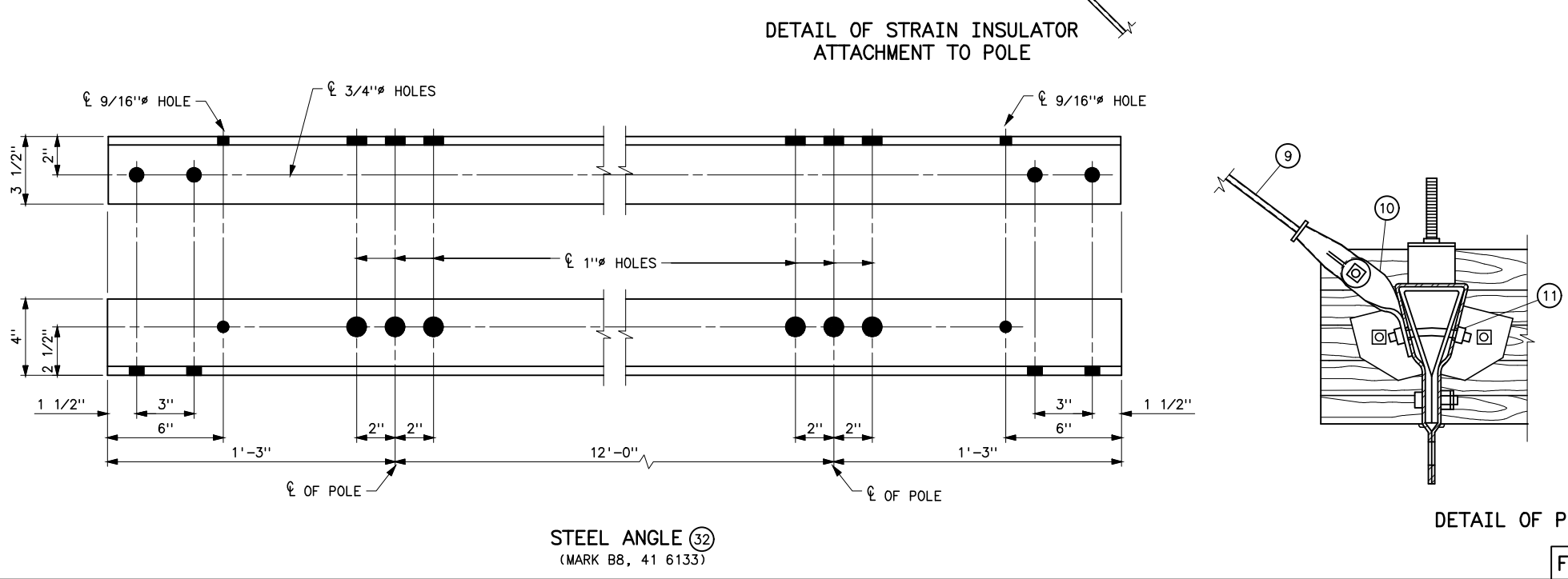
SUSPENSION INSULATOR ASSEMBLY
TYPE SLA-1 AND LSLA-1

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE – LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE SSA-1, LSSA-1, SLA-1 & LSLA-1 69&115KV SMALL AND LARGE ANGLE STRUCTURES		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
C.A.F. OCTOBER 18, 2005	41	6120

Plotted By: Seela Jul 01, 2025- 1:36pm
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DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT



STEEL ANGLE (32)
(MARK B8, 41 6133)

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, & WASHERS (HUGHES BROS. TYPE 3414.2 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8"x9"x25'-0"
4	2	DOUBLE ARMING BOLT, 7/8"x REQD LENGTH WUTH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8"x4 3/8" (HUGHES BROS. NO. 1042-12'-0" WITH 14'-10" LENGTH OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8"Ø BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK (HUGHES BROS. CF695-36-BNK, CC 47-1/8 INCHES, OR EQUAL)
10	4	TWISTED CLIP (EQUAL TO HUGHES BROS NO. AS2276)
11	2	7/8"Øx REQD LENGTH BENT BOLT WITH LOCK WASHERS AND LOCKNUTS
12	2	7/8"Øx REQD LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
13	2	4"x4"x1/4" CURVED WASHER, 15/16"Ø HOLE
14	2	TURNBUCKLE (HUGHES BROS NO. AS2545-B OR EQUAL)
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"Øx1'-0"
23	2	"U" BOLT, 5/8"Øx3" WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2"Ø (HUGHES BROS NO. 1329-B1 OR EQUAL)
25	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"Øx4" LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8"Ø FLAT ROUND WASHER WITH 9/16"Ø HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8"Ø BOLT
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
30	4	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT).
31	2	SPRING LOCK WASHER FOR 7/8"Ø BOLT
32	1	STEEL ANGLE, 4"x3 1/2"x3/8"x 14'-6" LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTES

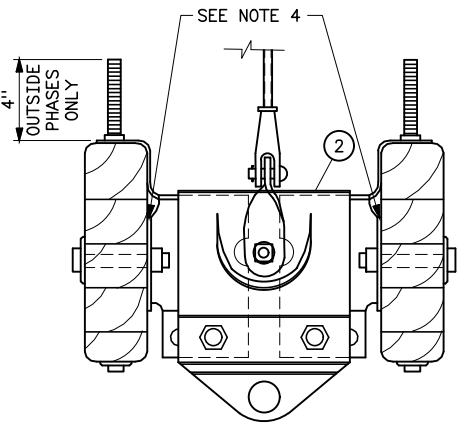
- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- IF THE HOLES IN CONNECTION PLATES ARE UNTAPPED, THEY SHALL MEASURE 1/16" LARGER THAN THE BOLT WITH AN ADDITIONAL LOCKNUT AND SPRING WASHER FOR EACH CONNECTION. TAPPED HOLES DO NOT REQUIRE THE ADDITIONAL LOCKNUT AND SPRING WASHER.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
CROSSARM DRILLING DETAILS HS-1 AND	
HSB-1 STRUCTURES	41 6113
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020

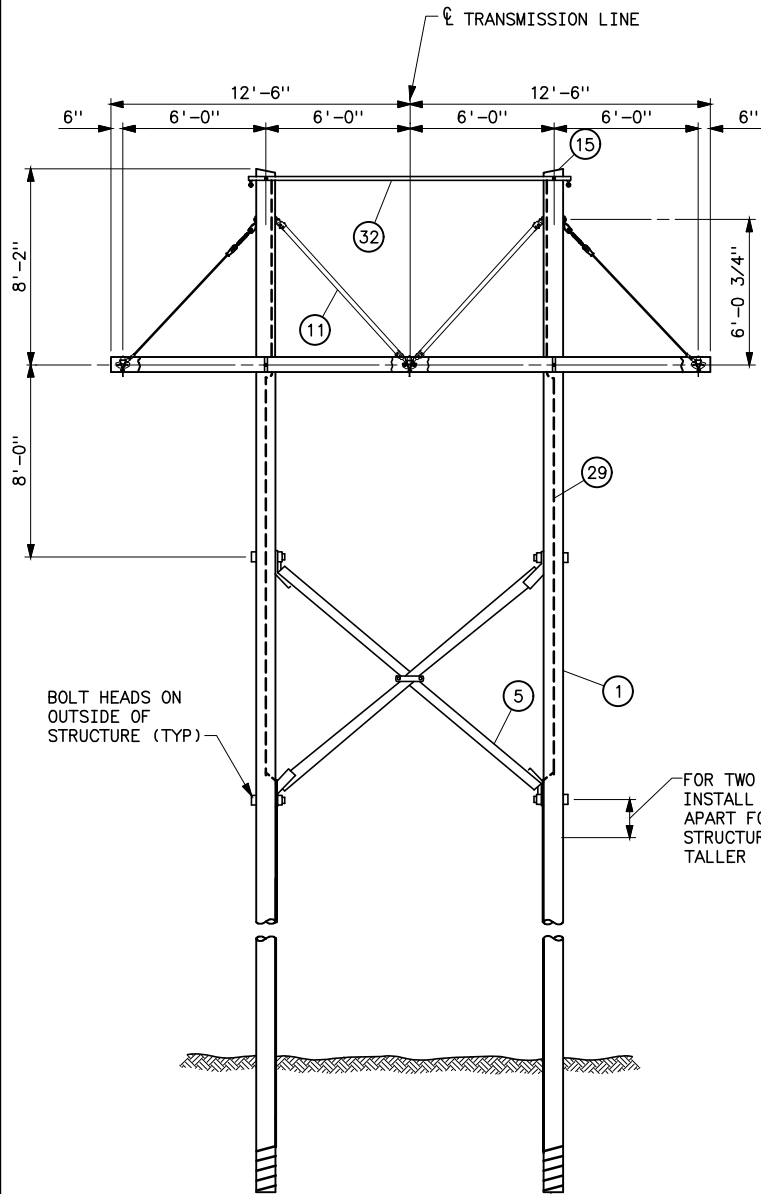
E	11-4-22 A7-KKR	REVISED NOTE 4
D	3-18-19 A7-KKR	ADDED HUGHES BROTHERS REF. LENGTHS TO PARTS 5 & 9.
C	12-4-13 A7-KKR	REVISED STEEL ANGLE HOLES.
B	3-6-06 A7-KKR	MINOR REVISIONS

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HS-1 115KV SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
6-23-25 A7-KKR	CHANGED THICKNESS OF STEEL ANGLE FROM 5/16 TO 3/8.	
AUGUST 30, 1996	41	6122

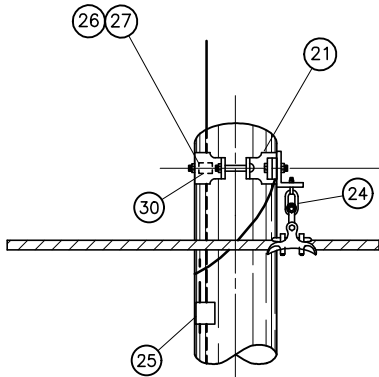


DETAIL OF PHASE FITTING ASSEMBLY

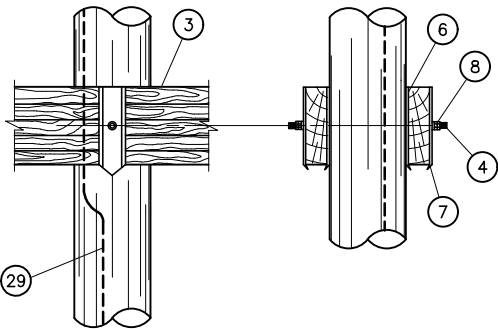
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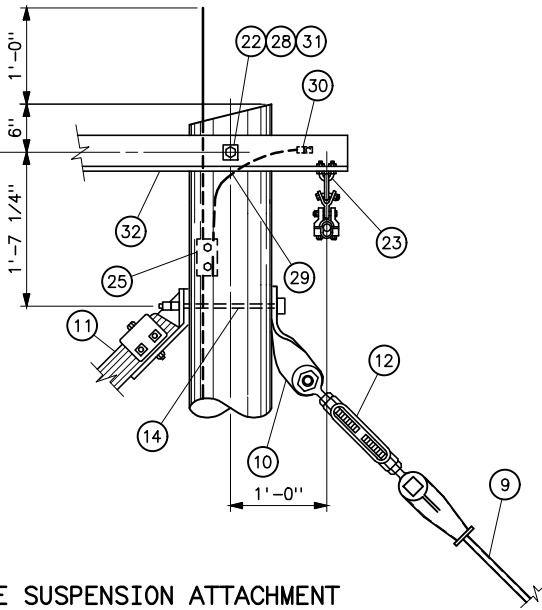
ELEVATION



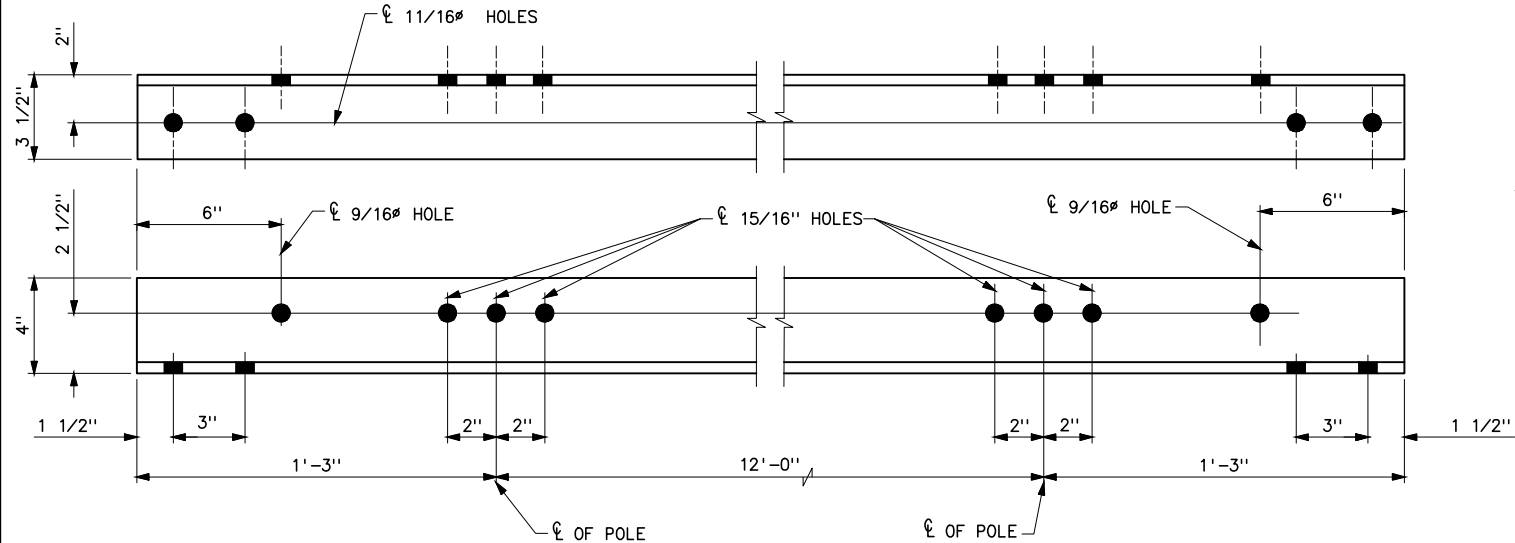
DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT AND BRACE ATTACHMENTS TO POLE



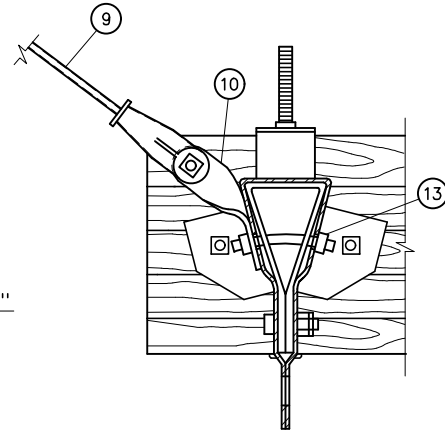
DETAIL OF WOOD ATTACHMENT



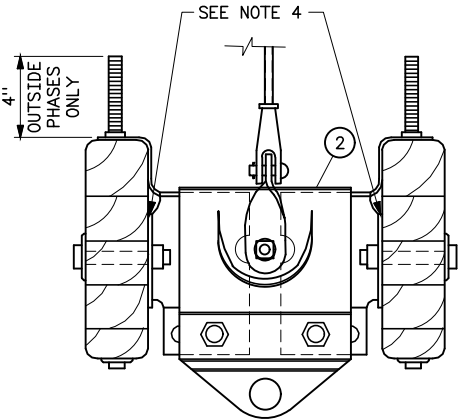
DETAIL OF CENTER PHASE FITTING ATTACHMENTS



STEEL ANGLE (32)



DETAIL OF END PHASE FITTING ASSEMBLY



STRUCTURE MATERIAL

PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE W/BOLTS, NUTS, & WASHERS (HUGHES BROS. TYPE 3414 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8"x9"x25'-0"
4	2	DOUBLE ARMING BOLT, 7/8"Ø x REQD LENGTH W/4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8"x4 3/8" (HUGHES BROS. NO. 1042 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8"Ø BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (HUGHES BROS NO. AS2276 OR EQUAL)
11	2	WOOD VEE BRACE, 3 3/8"x4"
12	2	TURNBUCKLE (HUGHES BROS. NO. AS2545-B OR EQUAL)
13	3	7/8"ØxREQD LENGTH BENT STUD WITH LOCK WASHERS AND LOCKNUTS, THREADED BOTH SIDES
14	2	7/8"ØxREQD LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL

PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"Øx1'-0"
23	2	"U" BOLT, 5/8"Øx3" WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2"Ø (HUGHES BROS. NO. 1329-B1 OR EQUAL)
25	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"Øx4" LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8"Ø FLAT ROUND WASHER WITH 9/16"Ø HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8"Ø BOLT
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
30	4	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT AND EQUAL TO HUGHES BROS. NO 2718.55)
31	2	SPRING LOCK WASHER FOR 7/8"Ø BOLT
32	1	STEEL ANGLE, 4x3 1/2x3/8x14'-6" LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTES

- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 INCH LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

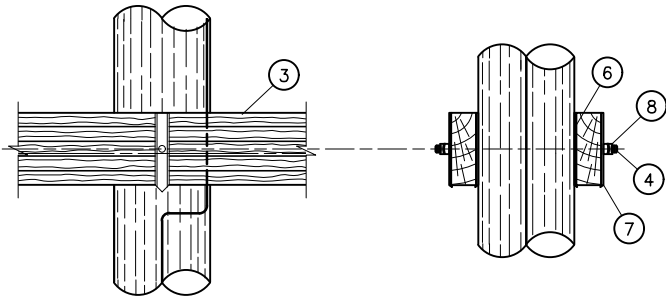
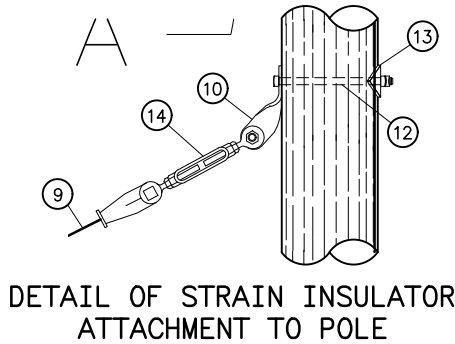
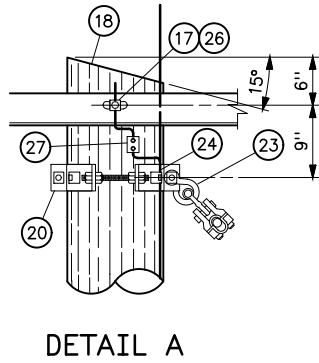
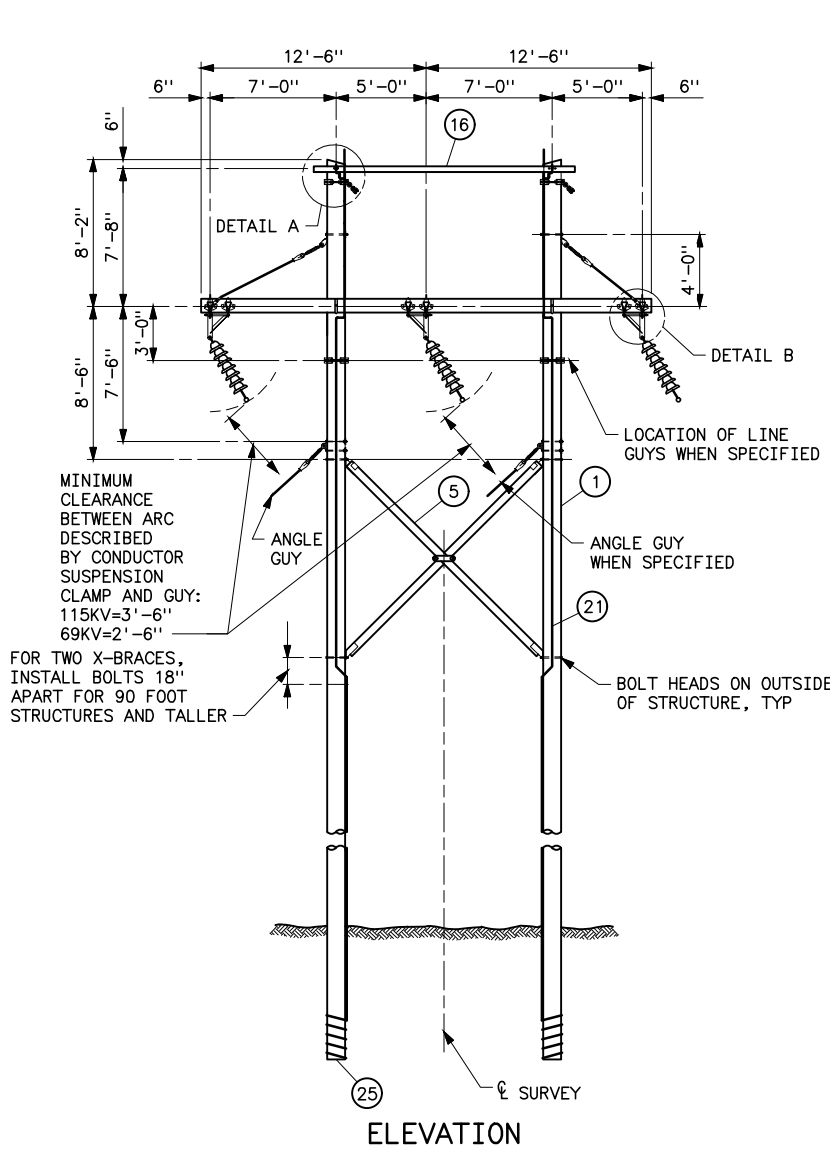
REFERENCE DRAWINGS

WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
CROSSARM DRILLING DETAILS HS-1 AND	
HSB-1 STRUCTURES	41 6113
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020

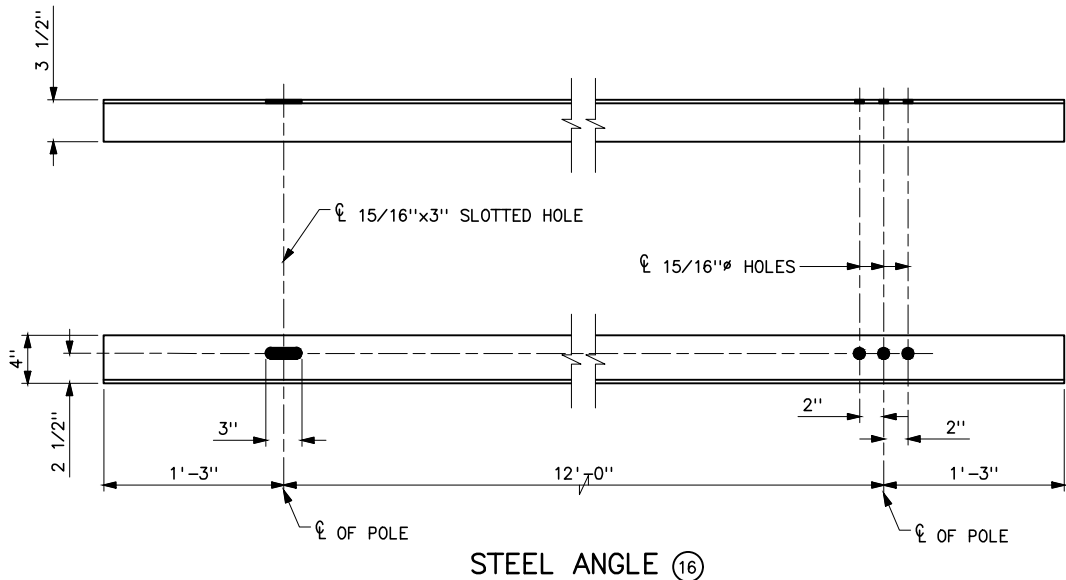
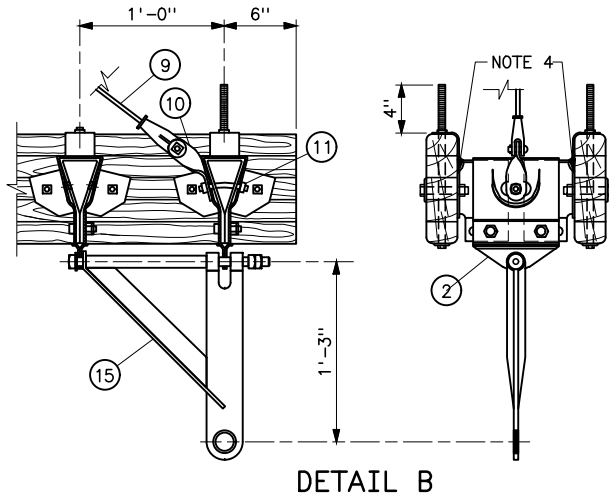
C	11-18-25 A7-KKR	CHANGED THICKNESS OF STEEL ANGLE FROM 5/16 TO 3/8.
B	1-30-12 A7-KKR	CORRECTED PART NUMBER IN 'DETAIL OF END PHASE FITTING ASSEMBLY'.
A	04-14-05 A7-KKR	MINOR CHANGES. ADDED STAR-LOCK.

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGN TRANSMISSION LINES TYPE HSB-1 69 AND 115KV SUSPENSION STRUCTURE			
DESIGNED KAREN ROWE		APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
DATE	AUGUST 30, 1996	41	6123

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DETAIL OF WOOD CROSSARM ATTACHMENT TO POLE



STEEL ANGLE (16)

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	6	ADJUSTABLE SPACER FITTING, COMPLETE WITH BOLTS, NUTS AND WASHERS (HUGHES BROS. TYPE 3414 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x25-0
4	2	DOUBLE ARMING BOLT, 7/8" x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8x4 3/8 (HUGHES BROS. NO. 1042 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (EQUAL TO HUGHES BROS. NO. AS2276)
11	2	7/8" x REQUIRED LENGTH BENT BOLT WITH LOCK WASHERS AND LOCKNUTS
12	2	7/8" x REQUIRED LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
13	2	4x4x1/4 CURVED WASHER, 15/16" HOLE
14	2	TURNBUCKLE (HUGHES BROS. AS2545-B OR EQUAL)
15	3	SWINGING ANGLE BRACKET, COMPLETE WITH FITTINGS (HUGHES BROS. NO. 2821.6 OR EQUAL)
16	1	STEEL ANGLE, 4x3 1/2x5/16x14-6 LONG
17	2	MACHINE BOLT, 7/8" x REQUIRED LENGTH WITH LOCKNUT, SPRING LOCK WASHER AND 4x4x1/4 CURVED WASHER ON BACK SIDE
18	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY.

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
20	2	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) (SEE NOTE 6)
	4	1/2"x4 LAG SCREWS (2 PER BAND)
	4	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
21	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
23	2	TWISTED SHACKLE (EQUAL TO HUGHES BROS. NO. 2866)
24	2	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). (EQUAL TO HUGHES BROS. 2718.55)
25	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
26	2	BONDING CLIP (EQUAL TO HUGHES BROS. NO. 2727)
27	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

NOTES

- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16" LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
WOOD POLE STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLY	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
GUY ASSEMBLIES AND DETAILS	41 6047
STANDARD GUY ARRANGEMENT, 2 POLE	
ANGLE STRUCTURES	41 6052
TYPICAL DETAILS FOR DEAD-END TEES	41 6138
CROSSARM DRILLING DETAILS -	
69 AND 115KV HA-1 STRUCTURE	41 6139

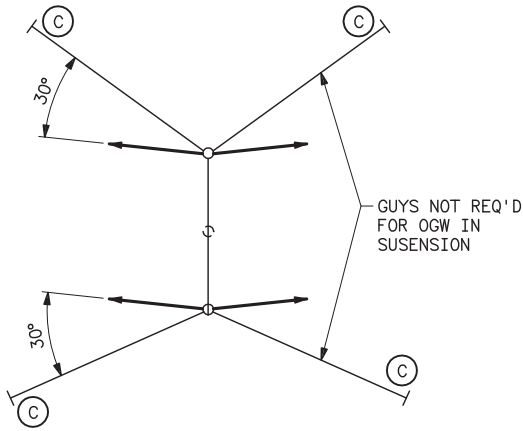
C	1-9-24 A7-KKR	MODIFIED GUY ATTACHMENT DISTANCE TO 7'-6" TO ACCOMMODATE POLYMER INSULATORS.
B	09-27-05 A7-KKR	MINOR REVISION, MOVED STEEL ANGLE TO TOP OF STRUCTURE AND MODIFIED STEEL ANGLE.
A	02-07-05 A7-KKR	REVISED DRAWING LIST. ADDED STAR-LOCK AND NOTE 6.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HA-1 69 AND 115KV SMALL ANGLE SUSPENSION STRUCTURE		
DESIGNED	KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER
DATE	MAY 01, 1997	41 6124

GUY AND ANCHOR REFERENCE CHART			
LINE GUYING			
CONDUCTOR GUYS	OGW GUYS	ANCHOR REF	NO. OF ANCHORS
3LSGEW	2LSGEW	(A) (C)	10
3LSGEW	2LDGEW	(A) (C)	10
3LDGEW	2LSGEW	(A) (C)	10
3LDGEW	2LDGEW	(A) (C)	10
3LSGEW-3LDGEW	2LDGEW	(A) (B) (C)	16
6LDGEW	2LDGEW	(A) (B) (C)	16

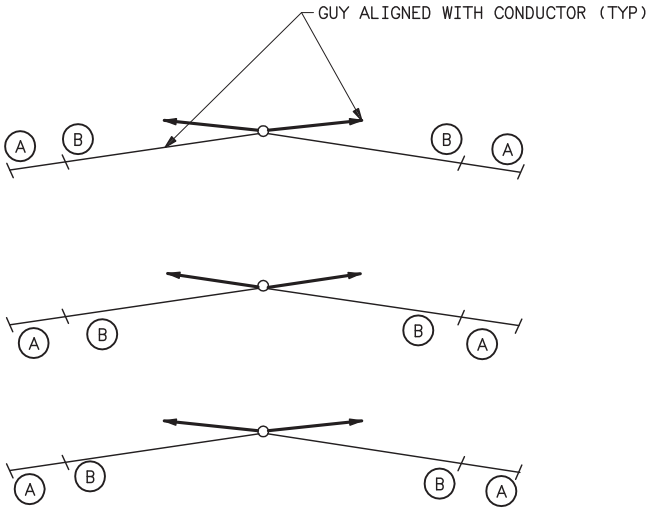
- OGW --- OVERHEAD GROUND WIRE
- COND --- CONDUCTOR
- LSGEW --- LINE SINGLE GUY EACH WAY
- LDGEW --- LINE DOUBLE GUY EACH WAY
- OGW AND CONDUCTOR
- --- ANCHOR IDENTIFICATION REFERENCE

- NOTES
- RAKE POLES AS FOLLOWS:
OGW: SUSPENSION 5°-60°
OGW: TENSION 10°-90°
 - POLE RAKE SHALL BE 1/4-INCH FOR EACH FOOT OF POLE ABOVE GROUND. RAKE SHALL BE AGAINST THE STRAIN.
 - REFER TO DRAWING NO. 41 6047 FOR ANCHOR SPACING.
 - REFER TO PLAN AND PROFILE DRAWINGS FOR ACTUAL GUY QUANTITIES AND TYPES AT EACH SITE.

REFERENCE DRAWING
GUY ASSEMBLIES AND DETAILS -----41 6047



SECTION A-A



SECTION B-B

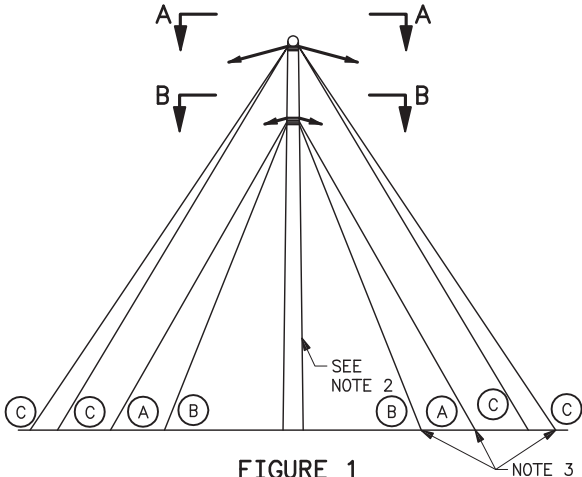
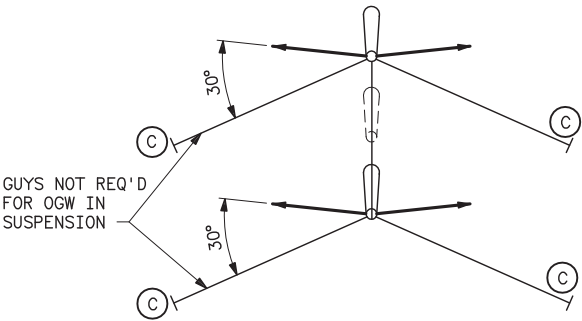
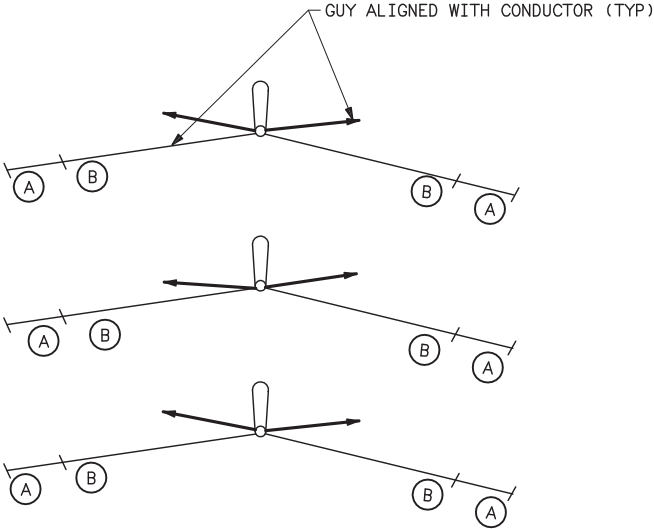


FIGURE 1
OGW AND CONDUCTOR LINE GUYING FOR LINE ANGLES 0° TO 10°



SECTION C-C



SECTION D-D

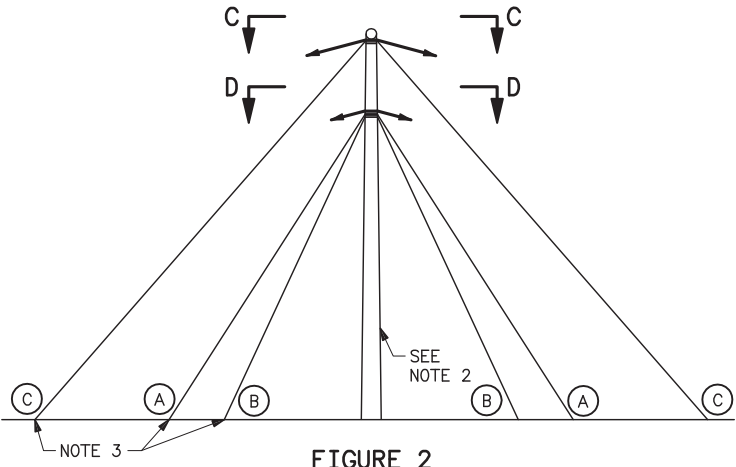
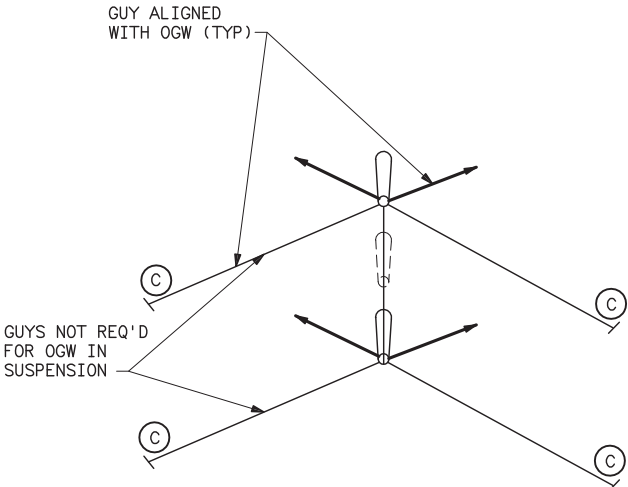
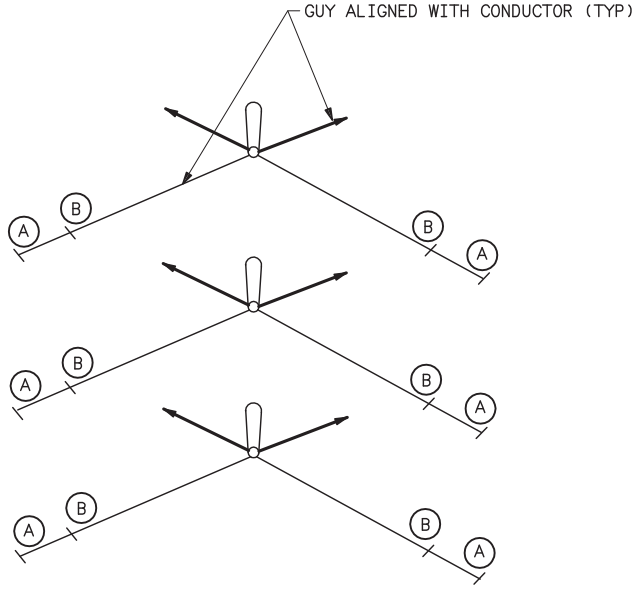


FIGURE 2
OGW AND CONDUCTOR LINE GUYING FOR LINE ANGLES 10° TO 30°



SECTION E-E



SECTION F-F

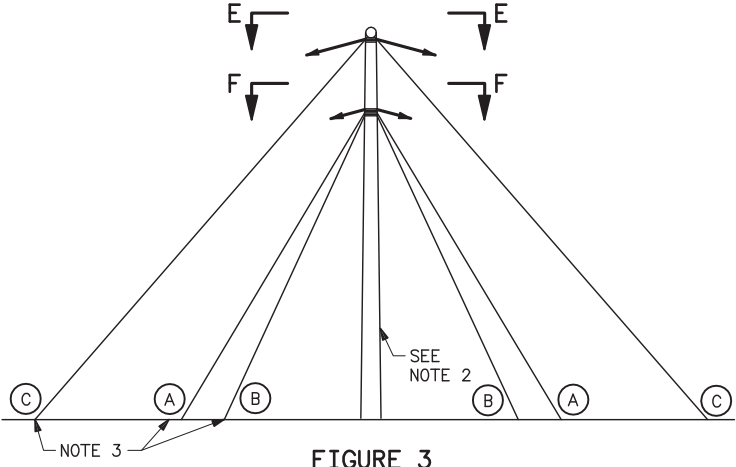


FIGURE 3
OGW AND CONDUCTOR LINE GUYING FOR LINE ANGLES 30° TO 90°

03-02-05
A7-KKR

REMOVED NOTE 4. NO LONGER OFFSETTING MIDDLE POLE GUYING.

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE 3TA-1 STRUCTURES
STANDARD GUY ARRANGEMENT

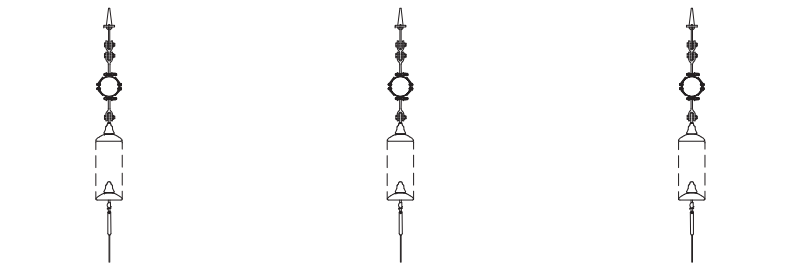
DESIGNED KAREN ROWE
APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER

DECEMBER 31, 1996

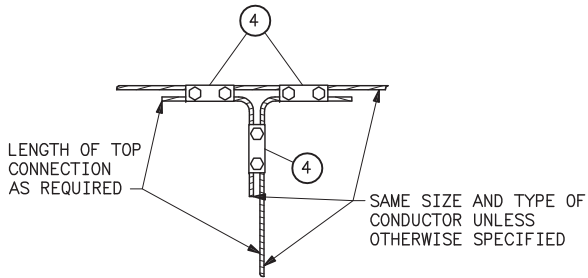
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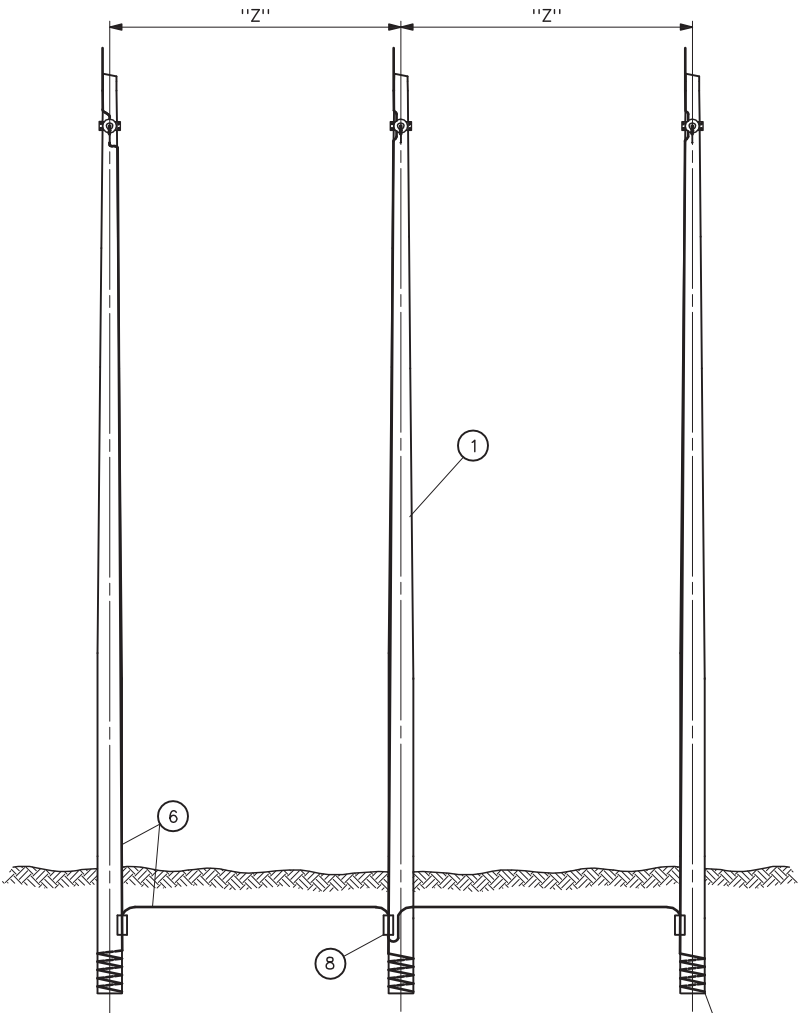
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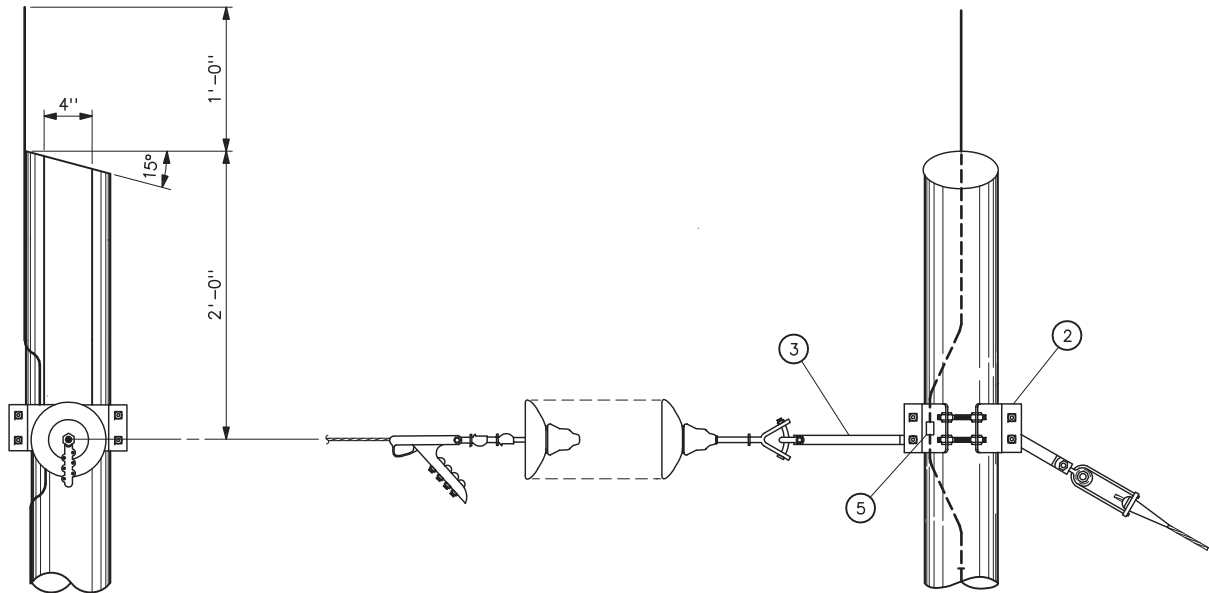
DETAIL OF TAP CONNECTION
(TOP AND BOTTOM CONNECTION SIMILAR)

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	FOUR-WAY STRAIN POLE BAND; HUGHES 3112 SERIES, JOSLYN J25969 SERIES; OR APPROVED EQUAL
3	3	1/4x3x17 CONNECTING LINK WITH 3/4x2 1/2 BOLT, 2 NUTS, AND COTTER KEY
4	18	PARALLEL GROOVE CLAMP, 2-BOLT FOR CONDUCTOR
5	3	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
6	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
7	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
8	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

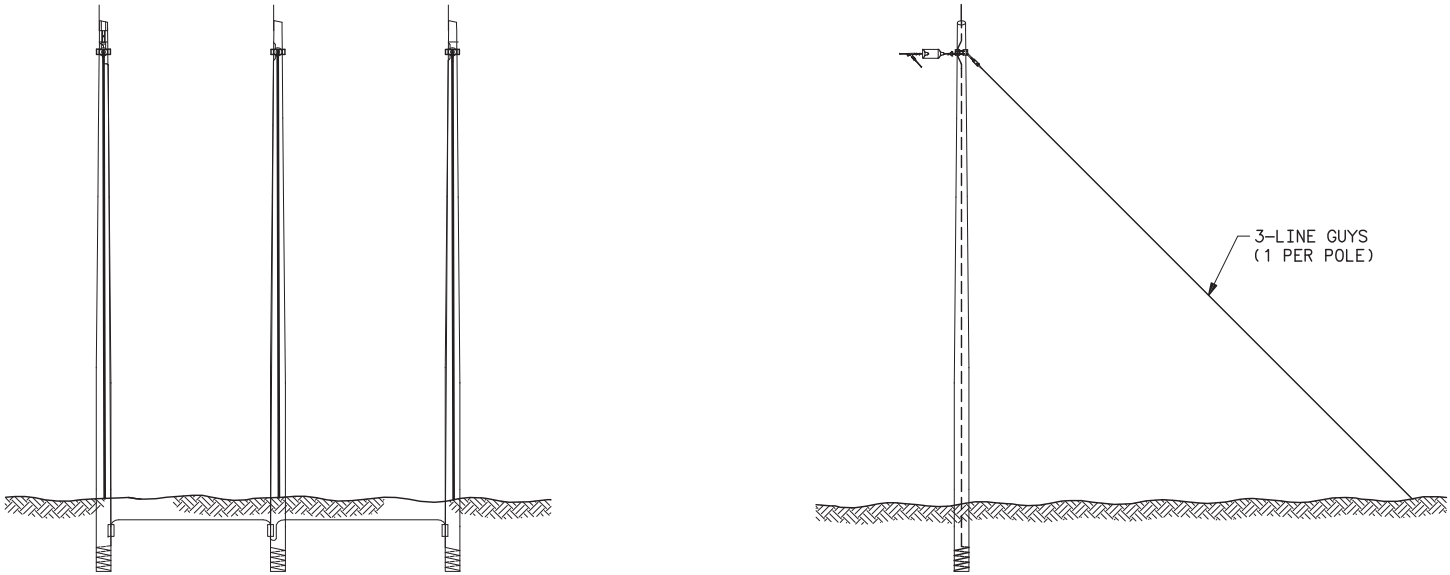
VOLTAGE	POLE SPACING "Z" (FEET)
69	10'-0"
115	12'-0"
138	14'-0"
161	17'-0"
230	22'-0"



ELEVATION



DETAIL OF CONDUCTOR DEAD END
AND POLE ATTACHMENT ASSEMBLY



STANDARD GUY ARRANGEMENT

NOTE

1. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES TENSION _____ 41 1002
INSULATOR ASSEMBLIES _____
WOOD POLES STRUCTURES _____
GROUNDING DETAILS _____ 41 1012
GUY ASSEMBLIES AND DETAILS _____ 41 6047

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - GOLDEN, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE 3DE-1
3-POLE SPECIAL DEAD-END STRUCTURE

DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON _____
CIVIL ENGINEERING MANAGER

C/F FEBRUARY 7, 1997 41 6126



NOTES

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ADJUST NUTS ON SWINGING ANGLE BRACKETS SO THAT BRACKET IS FREE TO SWING.
3. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
4. GAINING IS NOT REQUIRED IF ADJUSTED SPACER FITTING IS USED.
5. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16" LARGER THAN BOLT. ADD EXTRA LOCKNUTS AND SPRING WASHER FOR EACH CONNECTION.
6. GUYING REQUIREMENTS ARE SHOWN ON THE PLAN AND PROFILE DRAWINGS.
7. HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16" LARGER THAN CONNECTING LINK BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
8. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

D	3-10-26 A7-KR	ADDED GUYING REFERENCE DRAWING.
C	3-20-17 A7-KKR	REVISED PART NO. 13.
B	10-20-09 A7-KKR	REVISED PART NO. 20

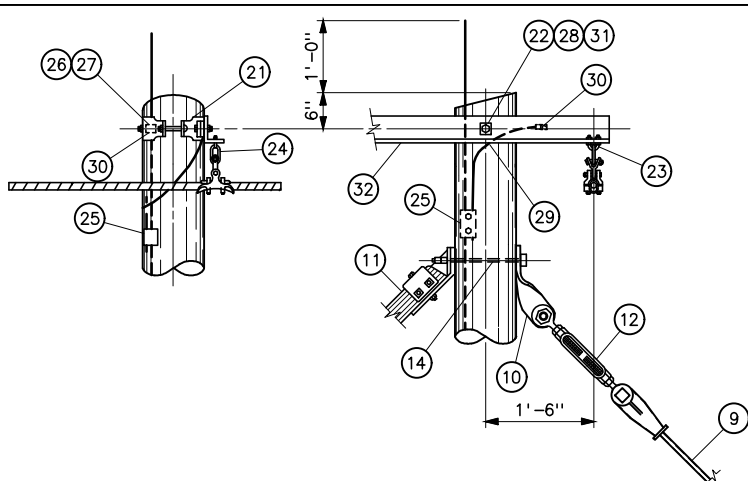
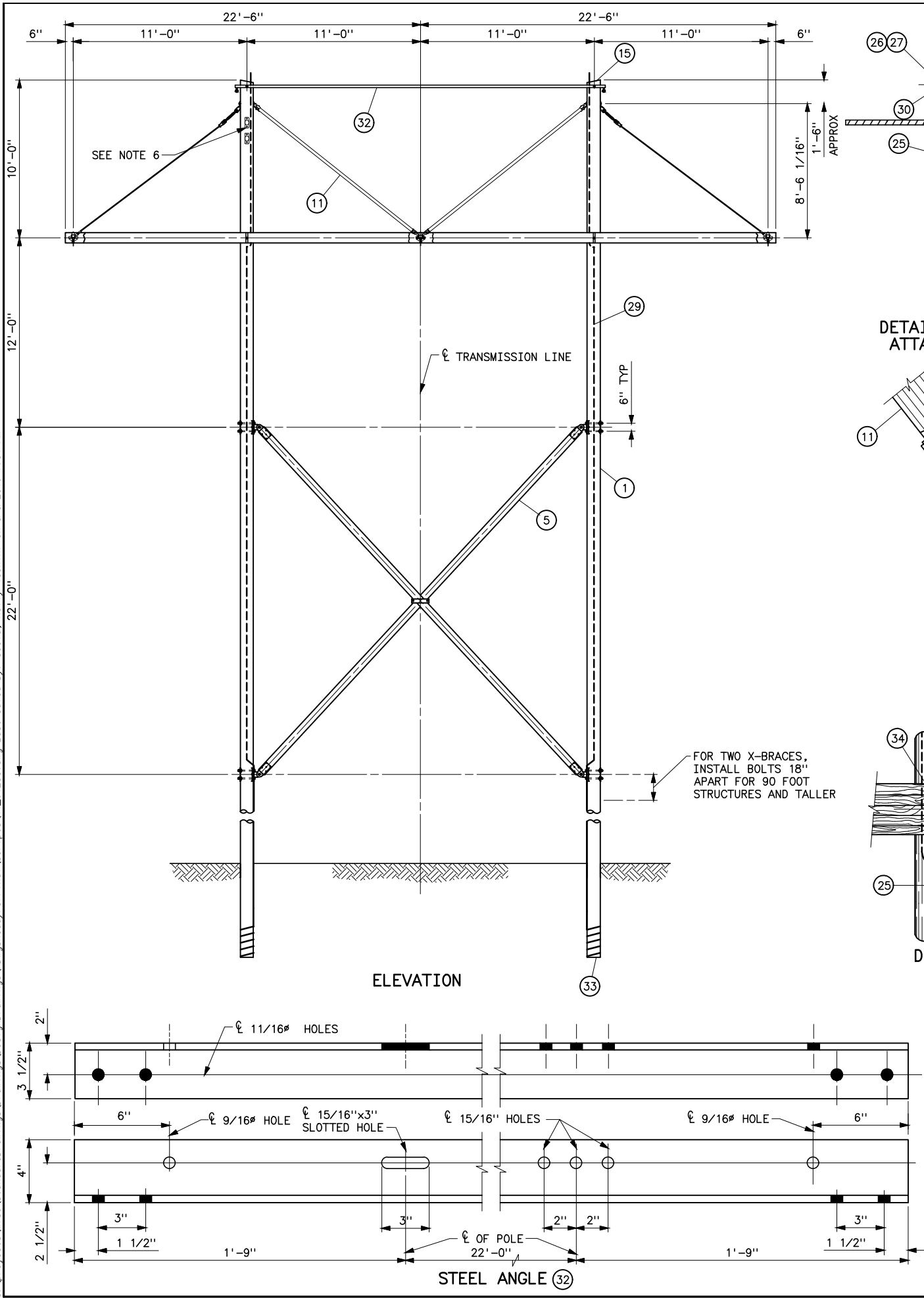
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - GOLDEN, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE 3AC-1 115KV
SUSPENSION STRUCTURE

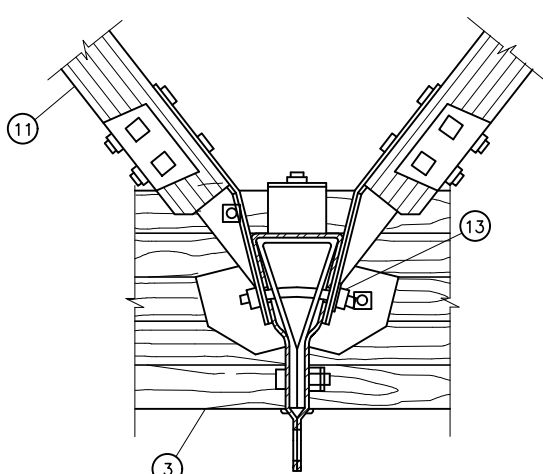
DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON _____
CIVIL ENGINEERING MANAGER

C _{AF}	DECEMBER 31, 1996	41	6127
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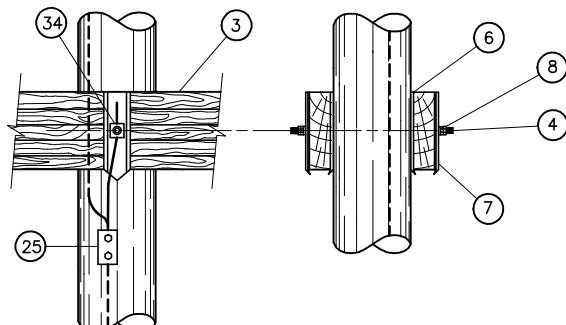
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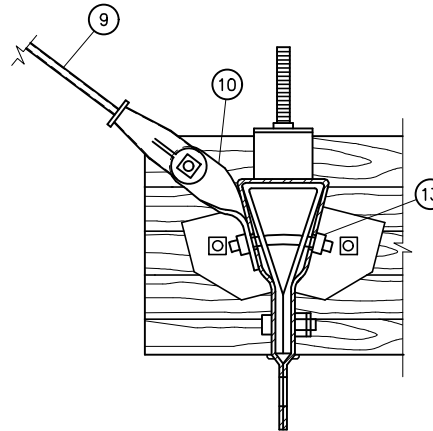
DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT AND BRACE ATTACHMENT TO POLE



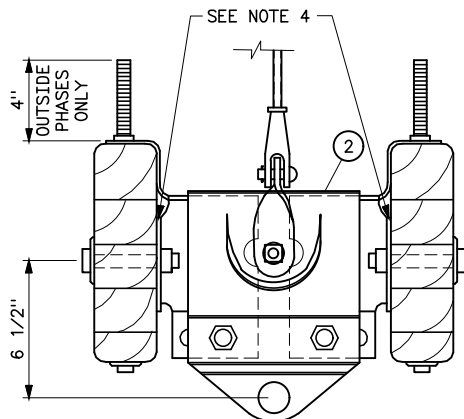
DETAIL OF CENTER PHASE FITTING ATTACHMENTS



DETAIL OF WOOD CROSSARM ATTACHMENT TO POLE



DETAIL OF PHASE FITTING ASSEMBLY



STRUCTURE MATERIAL

PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, AND WASHERS (HUGHES BROS. TYPE 3415 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x45-0
4	2	DOUBLE ARMING BOLT, 7/8"x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS. NO. 2121-22-0 WITH 28'-4" LENGTH OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 30,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK (HUGHES BROS. CF695-115-BNK, CC 126-1/8 INCHES, OR EQUAL)
10	4	TWISTED CLIP (HUGHES BROS. NO. AS2276 OF EQUAL)
11	2	WOOD VEE BRACE, 3 5/8x7 1/2, COMPLETE WITH FITTINGS, 8'-6" DROP, SPACING VARIES WITH POLE DIAMETER (HUGHES BROS. 12'-11 1/4" CC OR EQUAL)
12	2	TURNBUCKLE (HUGHES BROS. NO. AS2545-B OF EQUAL)
13	3	7/8"x REQUIRED LENGTH BENT STUD WITH LOCK WASHER AND LOCKNUTS, THREADED BOTH SIDES
14	2	7/8"x REQUIRED LENGTH WITH LOCK WASHER AND LOCKNUT
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL

PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"x1-0
23	2	"U" BOLT, 5/8"x3 WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2" (HUGHES BROS. NO. 1329-B1 OR EQUAL)
25	4	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"x4 LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8" BOLT
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2 INCH STAPLES
30	3	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
31	2	SPRING LOCK WASHER FOR 7/8" BOLT
32	1	STEEL ANGLE, 4x3 1/2x3/8x25-6 LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
34	2	BONDING CLIP (HUGHES BROS. NO. 2727 OR EQUAL)

NOTES

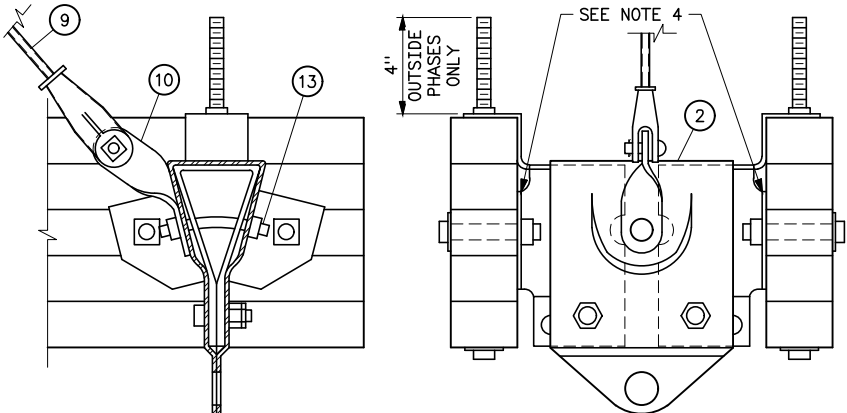
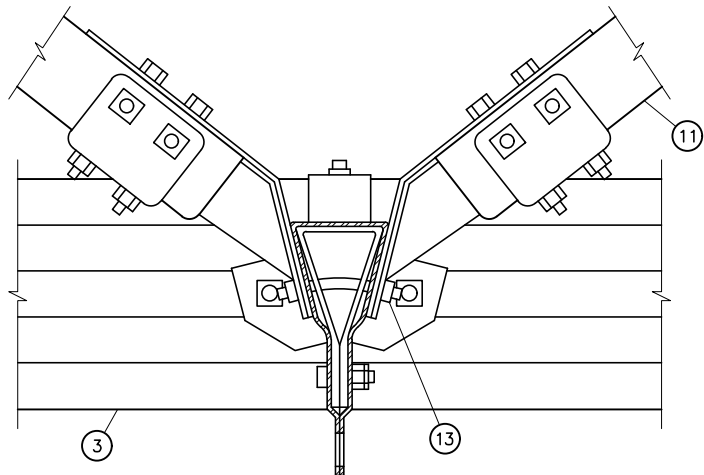
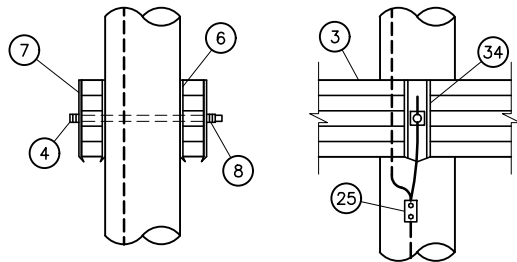
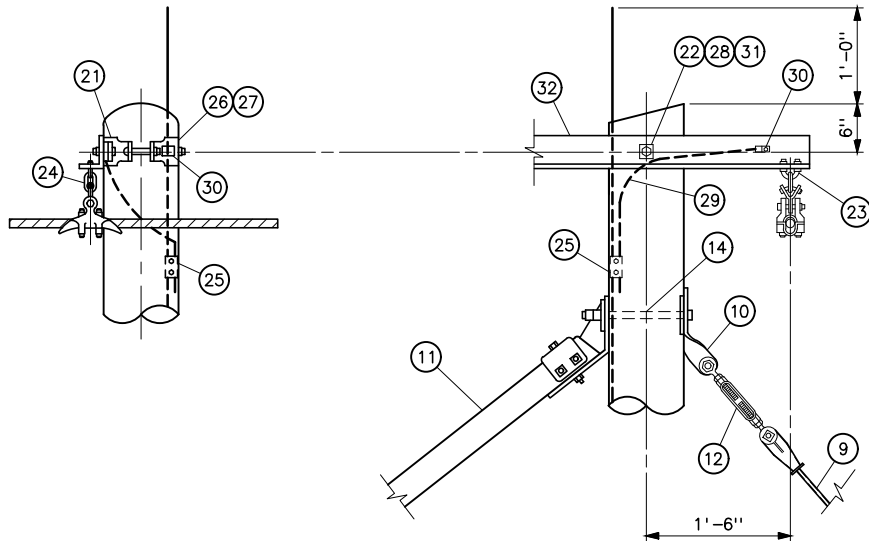
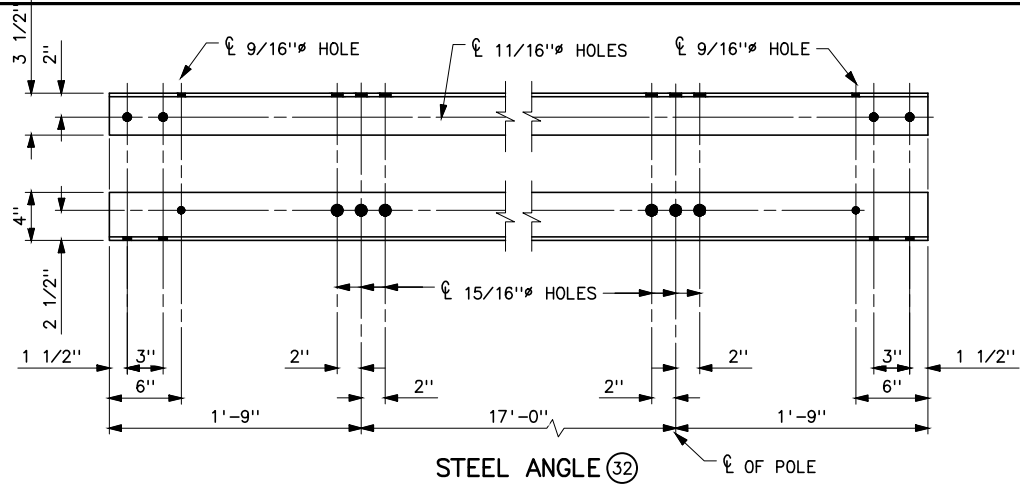
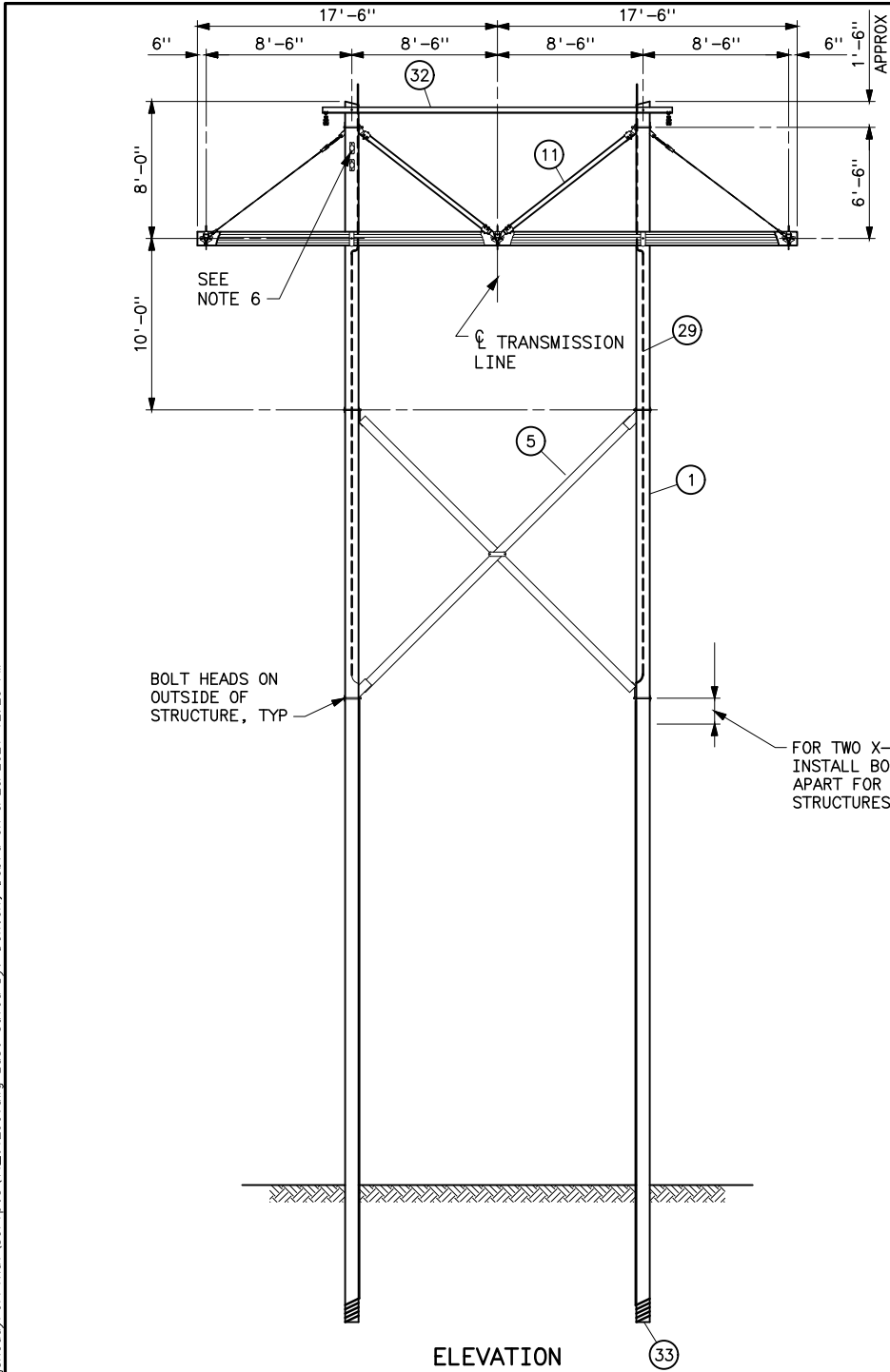
1. STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
2. ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
4. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
5. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
6. FOR DEAD ENDING OPGW, SPACE DEAD END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.

REFERENCE DRAWINGS

WOOD POLE STRUCTURE GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS	
FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
CROSSARM DRILLING DETAILS HS-1 AND	
HSB-1 STRUCTURES	41 6113
TYPICAL DETAILS FOR OPTICAL GROUND	
WIRE SPLICE STRUCTURES	41 6153

E	5-3-19 A7-KKR	ADDED HUGHES BROS. REF. LENGTHS TO PARTS 5, 9, & 11.
D	8-26-08 A7-KKR	CHANGED QUANTITY OF ITEM 33 FROM 1 TO 2.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HSB-1 230KV SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
41	FEBRUARY 7, 1997	6128

Plotted By: Denton Mar 23, 2021- 12:24pm
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IMAGES:



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTING COMPLETE WITH BOLTS, NUTS AND WASHERS (HUGHES BROS. TYPE 3415 OR EQUAL) (SEE NOTE 4)
3	2	GLUE LAMINATED WOOD CROSSARM, 3 1/8"x9"x35'-0"
4	2	DOUBLE ARMING BOLT, 7/8"x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACING, COMPLETE WITH FITTINGS, 3 3/8"x5 3/8" (HUGHES BROS. NO. 1042-17-0 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (HUGHES BROS. NO. AS2276 OR EQUAL)
11	2	WOOD VEE BRACE, 3 1/2"x7 1/2", COMPLETE WITH FITTINGS, 6'-6" DROP, SPACING VARIES WITH POLE DIAMETER
12	2	TURNBUCKLE (HUGHES BROS. NO. AS2545-B OR EQUAL)
13	2	7/8"x REQUIRED LENGTH BENT STUD WITH LOCK WASHER AND LOCKNUTS, THREADED BOTH SIDES
14	2	7/8"x REQUIRED LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"x1'-0"
23	2	"U" BOLT, 5/8"x3" WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2" (HUGHES BROS. NO. 1329-B1 OR EQUAL)
25	4	PARALLEL GROVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"x4" LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8" BOLT
29	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
30	3	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
31	2	SPRING LOCK WASHER FOR 7/8" BOLT
32	1	STEEL ANGLE, 4"x3 1/2"x3/8"x20'-6" LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
34	2	BONDING CLIP (HUGHES BROS. 2727 OR EQUAL)

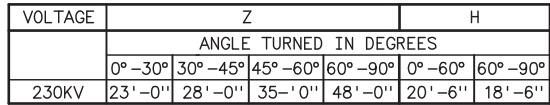
NOTES

- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 INCH LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
- FOR DEAD-ENDING OPGW, SPACE DEAD-END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.

REFERENCE DRAWINGS

WOOD POLE STRUCTURE GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS	
FOR WOOD POLE STRUCTURES	41 1019
CROSSARM DRILLING DETAILS HS-1	
AND HSB-1 STRUCTURES	41 6113
STEEL ANGLE DETAILS FOR WOOD POLE STRUCTURES	41 6133

C	3-23-21 A7-KKR	ADDED NOTE 6, REFERENCE DRAWING FOR STEEL ANGLES, AND CHANGED X-BRACE.
B	9-29-11 A7-KKR	FIXED CROSSARM SIZE
A	04-05-00 A3-KKR	FIXED STEEL ANGLE QUANTITY.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HSB-1 161KV SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
C/AE	AUGUST 15, 1998	41 6129

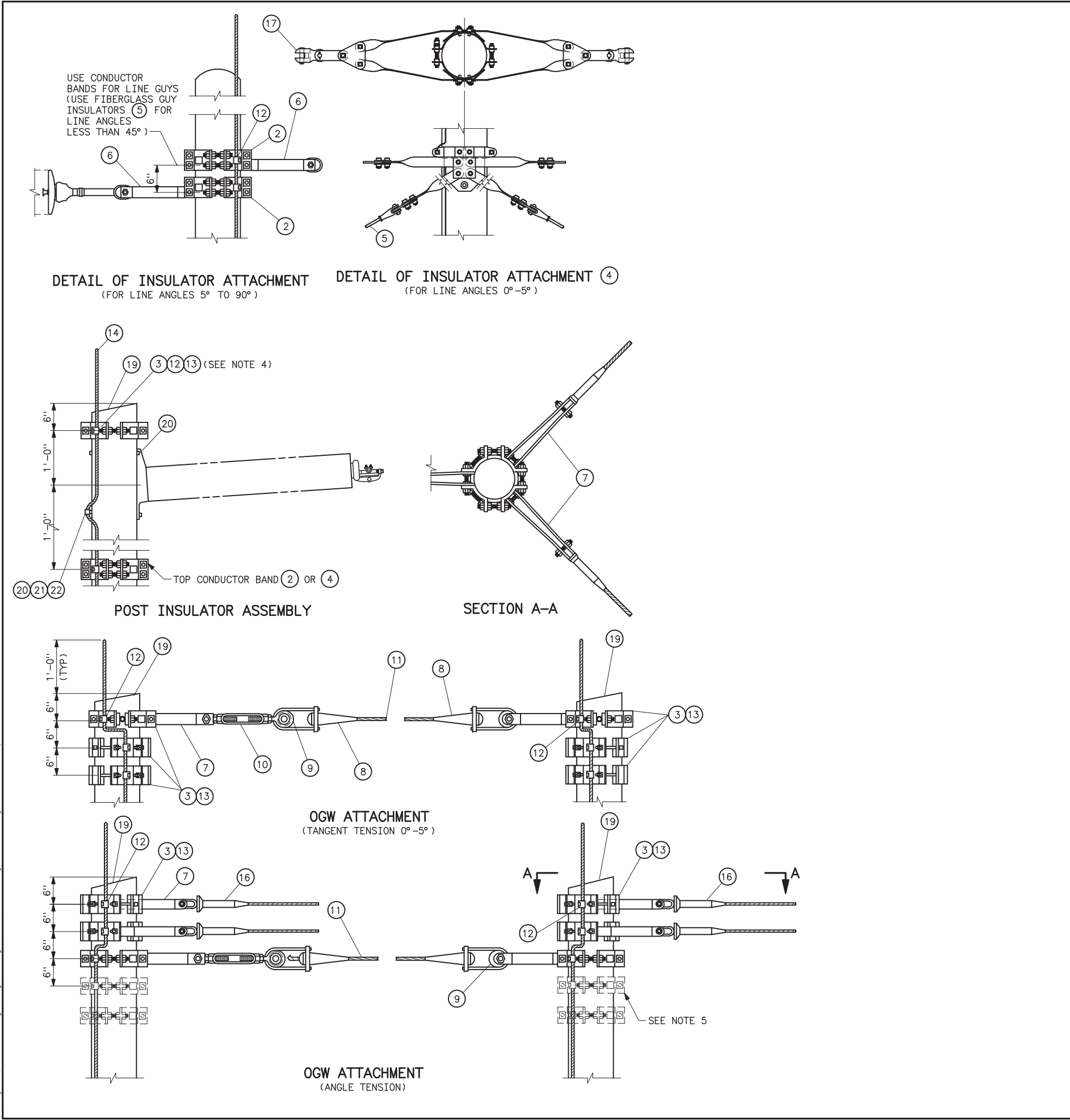


PART NO.	QUANTITY	DESCRIPTION
	0° -60°	
20	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
4. ADDITIONAL POLE BAND IS NOT REQUIRED ON CENTER POLE FOR LINE ANGLES 60°-90°.
5. FOR 5°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) OR DEADEND TEES FOR GUYING ON EACH OUTSIDE POLE.
6. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.
7. USE X-BRACE EQUAL TO HUGHES BROS NO.2121 WHEN SPECIFIED.

WOOD POLE STRUCTURES		
GROUNDING DETAILS	41	1012
OVERHEAD GROUND WIRE ASSEMBLY		
DETAILS FOR WOOD POLE STRUCTURES	41	1019
TENSION INSULATOR ASSEMBLIES		
SINGLE STRING	41	1022
DOUBLE STRING	41	1023
OPTICAL GROUND WIRE ASSEMBLIES	41	1031
TYPE 3TA-1 STRUCTURES		
STANDARD GUY ARRANGEMENT	41	6125
TYPICAL DETAILS FOR DEAD END TEES	41	6138

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STRUCTURE MATERIAL					
PART NO.	ANGLE	ANGLE	ANGLE	ANGLE	DESCRIPTION
	0°-5°	5°-30°	30°-60°	60°-90°	
1	3	3	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	—	6	6	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3112 SERIES, JOSLYN J25969 SERIES; OR, APPROVED EQUAL
3	7	11	7	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
4	3	—	—	—	POLE BAND ASSEMBLY, HUGHES B1784-VV OR APPROVED EQUAL
5	6	6	6	—	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6	—	6	6	6	CONNECTING LINK; PAIR W/BNK HUGHES 3157, JOSLYN J26035; OR, APPROVED EQUAL
7	6	6	6	6	CONNECTING LINK, PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK W/BNK
8	2	2	2	2	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	2	2	2	2	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	1	1	1	1	TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD	AS REQD	AS REQD	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
12	7	17	13	12	1/2# GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	14	22	14	12	LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD	AS REQD	AS REQD	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3	3	3	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
16	4	4	4	4	OVERHEAD GROUND WIRE TENSION ASSEMBLY
17	6	—	—	—	CLEVIS-CLEVIS 90° W/BNK, 40,000 LBS
18	3	3	3	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
19	3	3	3	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL (OMIT FOR 60° TO 90° ANGLES)		
PART NO.	QUANTITY	DESCRIPTION
	0°-60°	
20	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

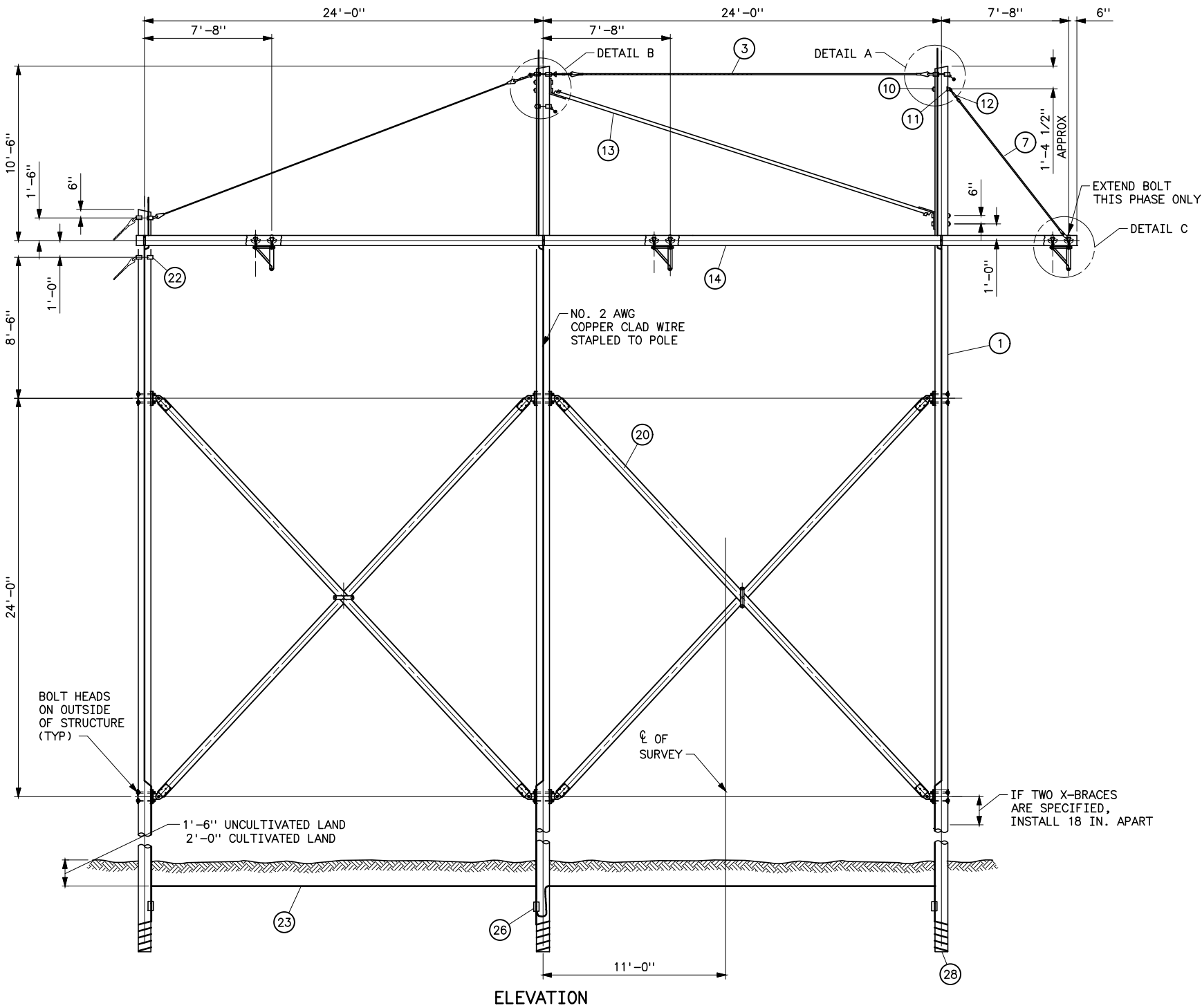
NOTES

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
4. ADDITIONAL POLE BAND IS NOT REQUIRED ON CENTER POLE FOR LINE ANGLES 60°-90°.
5. FOR 5°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) OR DEADEND TEES FOR GUYING ON EACH OUTSIDE POLE.
6. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.
7. USE X-BRACE EQUAL TO HUGHES BROS NO.2121 WHEN SPECIFIED.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
TYPICAL DETAILS FOR DEAD END TEES	41 6138

SUPERSEDES DWG NO. 41 6130 A IN PART		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TA-1 230KV 3-POLE TENSION STRUCTURE, SHEET 2		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
DECEMBER 31, 1999	41	6130-2



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES)
	8	1/2"x4 LAG SCREWS (2 PER BAND)
	8	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
3	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
4	4	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
5	4	1/4x2x17 CONNECTING LINK PAIR
6	4	2 1/2" SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
7	1	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPETE W/PINS AND COTTER KEYS
8	1	TWISTED CLIP (EQUAL TO HUGHES BROS. NO. AS2276)
9	1	7/8"x REQD LENGTH BENT BOLT WITH WASHER AND LOCKNUT
10	1	7/8"x14 SHOULDER EYE BOLT WITH LOCK WASHER AND LOCKNUT
11	2	4x4x1/4 CURVED WASHER, 15/16" HOLE
12	3	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNC (EQUAL TO HUGHES BROS. NO. AS2545-D)
13	1	WOOD VEE BRACE 5 1/8x6 GLUED LAMINATED, COMPLETE W/FITTINGS
14	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x56-8
15	6	FLAT GAIN PLATE, 15/16" HOLE
16	6	RIBBED TIE PLATE, 15/16" HOLE
17	3	7/8"x REQD LENGTH DOUBLE ARMING BOLT W/2 LOCK WASHERS & 4 NUTS EACH (USE EXTRA NUTS AS LOCKNUTS)
18	6	ADJUSTABLE SPACER FITTING MADE FROM 5/16" STEEL, COMPLETE W/FITTINGS (HUGHES BROS. 3415.13) OR EQUAL
19	3	SWINGING ANGLE BRACKET, COMPLETE W/FITTINGS (HUGHES BROS. NO. 2821.8, BROOKS MFR NO. 6203 OR EQUAL)
20	2 OR 4	5 1/8x6 GLUED LAMINATED WOOD X-BRACE COMPLETE W/FITTINGS (HUGHES BROS NO. 2121-24-0 OR EQUAL)
21	12	4" SHEAR PLATE FOR 7/8" BOLT
22	1	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3112 SERIES)
30	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
23	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
24	2	OVERHEAD GROUND WIRE SUSPENSION ASSEMBLY
25	2	TWISTED SHACKLE (EQUAL TO HUGHES BROS. NO. 2866)
26	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY FOR NO. 2 AWG COPPER CLAD WIRE
27	5	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
28	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
29	2	BONDING CLIP (HUGHES BROS. NO. 2727 OF EQUAL)

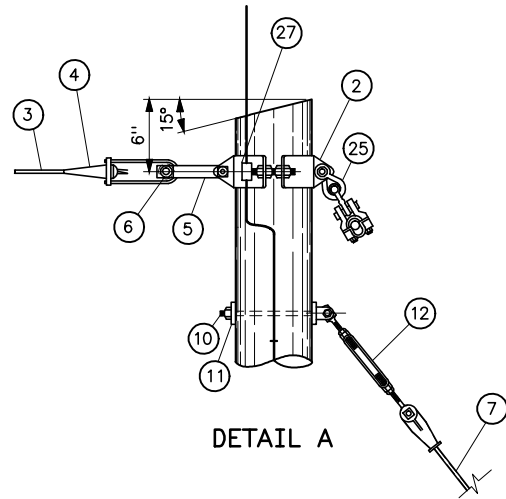
NOTES

- FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
- ADJUST NUTS ON SWINGING ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- GUYING REQUIREMENTS ARE SHOWN ON THE PLAN AND PROFILE DRAWINGS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16 INCH LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

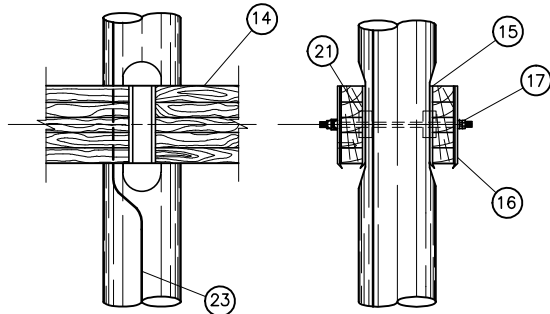
REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
GUY ASSEMBLIES AND DETAILS	41 6047
CROSSARM DRILLING DETAILS	41 6151
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW	41 6054
TYPE 3AC-1 230KV SUSPENSION STRUCTURE	41 6131-2
TYPICAL DETAILS FOR DEAD END TEES	41 6138

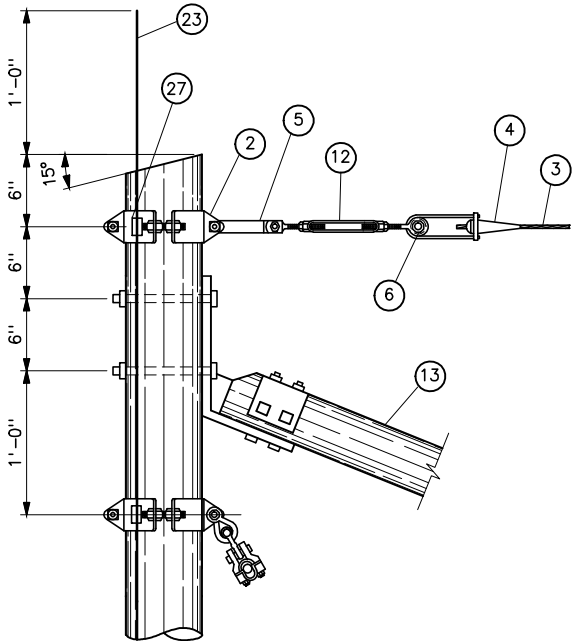
B	3-20-17 A7-KKR	REVISED PART NO. 13.
A	08-24-06 A7-KKR	CHANGED CROSSARM DEPTH TO 9 INCHES. FIXED DRILLING REFERENCE DRAWING NO.
SUPERSEDES DWG NO. 41 6131A (IN PART)		
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AC-1 230KV SUSPENSION STRUCTURE-SHEET 1		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
A	FEBRUARY 29, 2000	41 6131-1



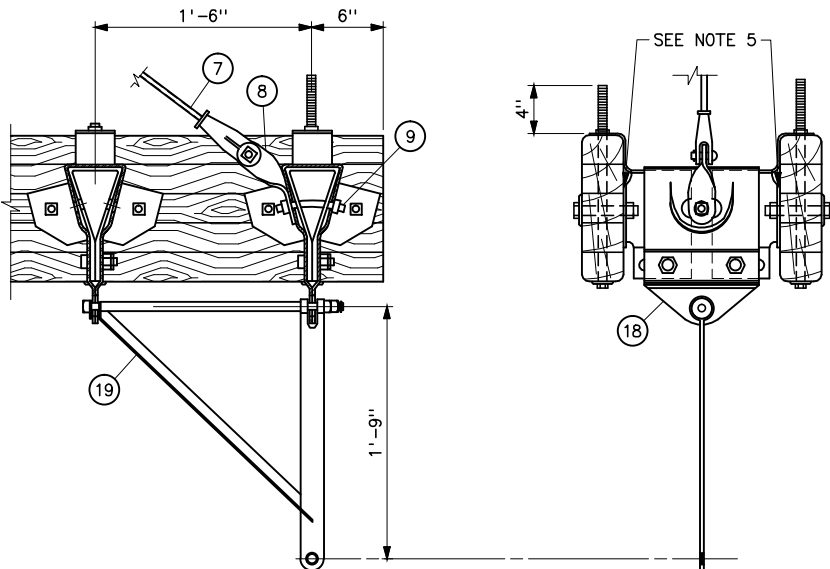
DETAIL A



DETAIL OF WOOD CROSSARM ATTACHMENT



DETAIL B
OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT



DETAIL C

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES)
	8	1/2"x4 LAG SCREWS (2 PER BAND)
	8	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
3	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
4	4	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
5	4	1/4x2x17 CONNECTING LINK PAIR
6	4	2 1/2" SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
7	1	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPETE W/PINS AND COTTER KEYS
8	1	TWISTED CLIP (EQUAL TO HUGHES BROS. NO. AS2276)
9	1	7/8"x REQD LENGTH BENT BOLT WITH WASHER AND LOCKNUT
10	1	7/8"x14 SHOULDER EYE BOLT WITH LOCK WASHER AND LOCKNUT
11	2	4x4x1/4 CURVED WASHER, 15/16" HOLE
12	3	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNC (EQUAL TO HUGHES BROS. NO. AS2545-D)
13	1	WOOD VEE BRACE 6 3/8x5 3/8, COMPLETE W/FITTINGS
14	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9 1/2x56-8
15	6	FLAT GAIN PLATE, 15/16" HOLE
16	6	RIBBED TIE PLATE, 15/16" HOLE
17	3	7/8"x REQD LENGTH DOUBLE ARMING BOLT W/2 LOCK WASHERS & 4 NUTS EACH (USE EXTRA NUTS AS LOCKNUTS)
18	6	ADJUSTABLE SPACER FITTING MADE FROM 5/16" STEEL, COMPLETE W/FITTINGS (HUGHES BROS. 3415.13) OR EQUAL
19	3	SWINGING ANGLE BRACKET, COMPLETE W/FITTINGS (HUGHES BROS. NO. 2821.8, BROOKS MFR NO. 6203 OR EQUAL)
20	2 OR 4	5 1/8x6 GLUED LAMINATED WOOD X-BRACE COMPLETE W/FITTINGS (HUGHES BROS NO. 2121-24-0 OR EQUAL)
21	12	4" SHEAR PLATE FOR 7/8" BOLT
22	1	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3112 SERIES)
30	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
23	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
24	2	OVERHEAD GROUND WIRE SUSPENSION ASSEMBLY
25	2	TWISTED SHACKLE (EQUAL TO HUGHES BROS. NO. 2866)
26	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY FOR NO. 2 AWG COPPER CLAD WIRE
27	5	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
28	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
29	2	BONDING CLIP (HUGHES BROS. NO. 2727 OF EQUAL)

NOTES

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ADJUST NUTS ON SWINGING ANGLE BRACKET SO THAT BRACKET IS FREE TO SWING.
3. ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
4. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
5. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
6. GUYING REQUIREMENTS ARE SHOWN ON THE PLAN AND PROFILE DRAWINGS.
7. HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16 INCH LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
8. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
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OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
GUY ASSEMBLIES AND DETAILS	41 6047
CROSSARM DRILLING DETAILS	41 6051
GUY ARRANGEMENT FOR TYPE 3AC WITH OGW	41 6054
TYPE 3AC-1 230KV SUSPENSION STRUCTURE	41 6131-1
TYPICAL DETAILS FOR DEAD END TEES	41 6138

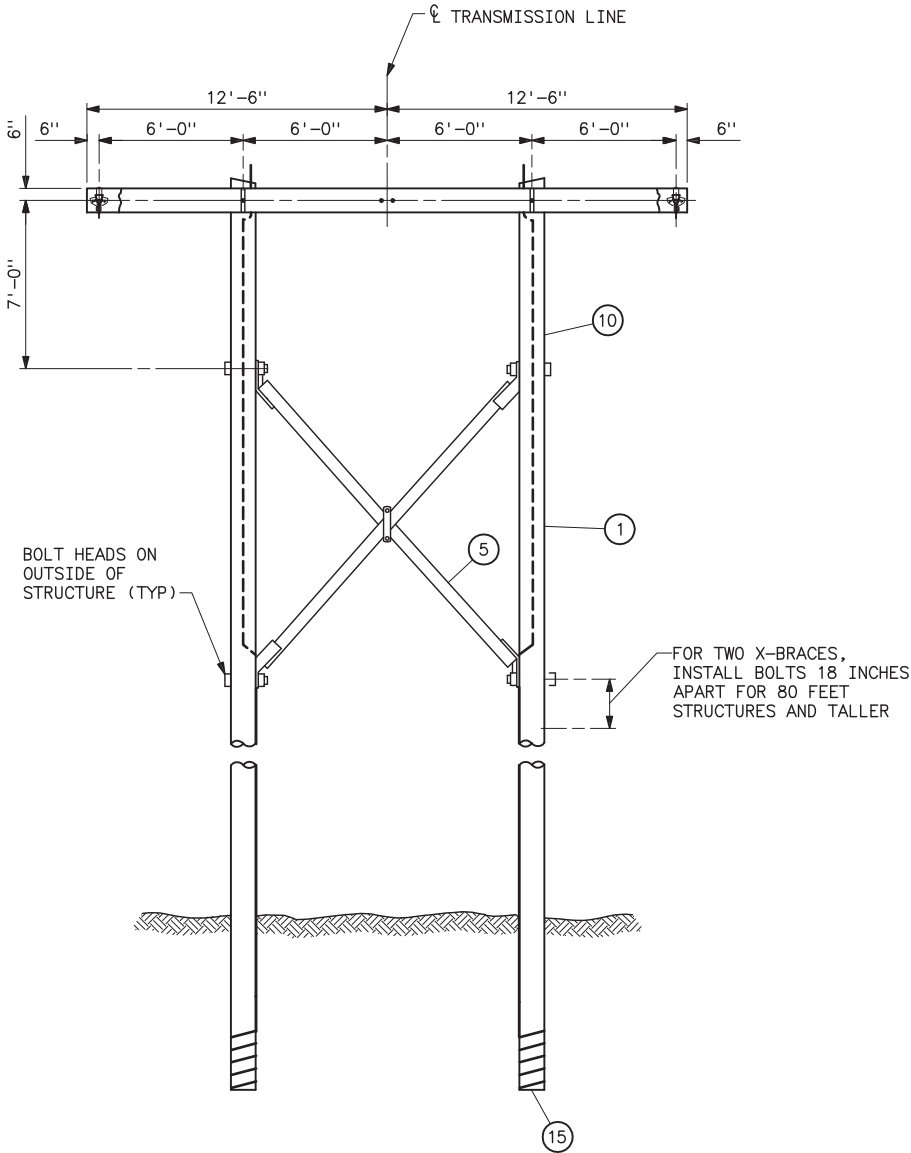
SUPERSEDES DWG NO. 41 6131A(IN PART)

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

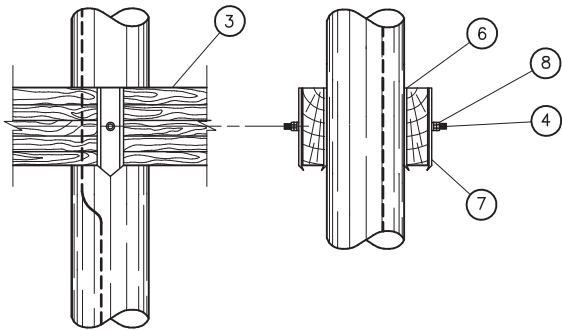
STANDARD DESIGNS
TRANSMISSION LINES
TYPE 3AC-1 230KV
SUSPENSION STRUCTURE-SHEET 2

DESIGNED KAREN ROWE APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER

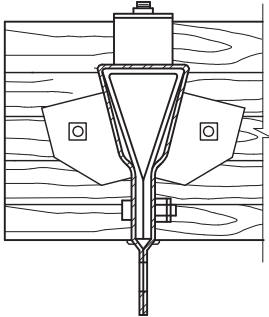
FEBRUARY 29, 2000 41 6131-2



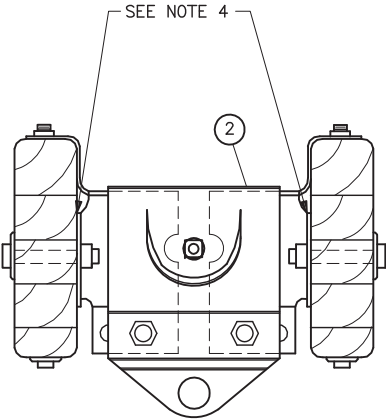
ELEVATION



DETAIL OF WOOD ATTACHMENT



DETAIL OF PHASE FITTING ASSEMBLY



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE W/BOLTS, NUTS, & WASHERS (HUGHES BROS. TYPE 3414 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x25-0
4	2	DOUBLE ARMING BOLT, 7/8"Ø x REQD LENGTH W/4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8 x 4 3/8 (HUGHES BROS. NO.1042 OR EQ)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8"Ø BOLT
9	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
10	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

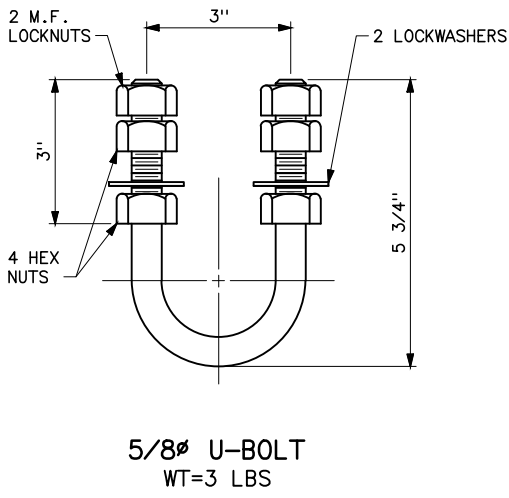
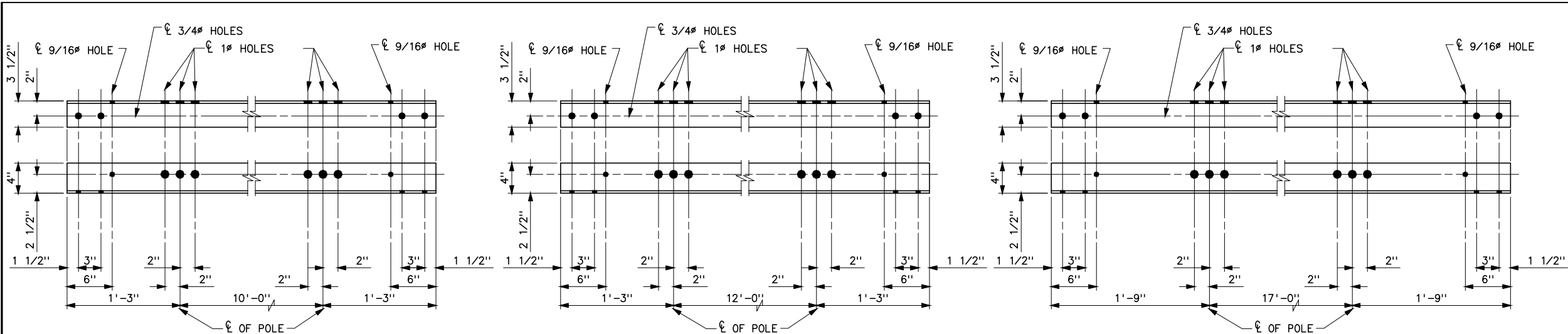
NOTES

1. STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
2. ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS
3. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
4. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
5. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES GROUNDING DETAILS _ _ _ _ 41 1012
CROSSARM DRILLING DETAILS HS-1 AND
HSB-1 STRUCTURES _ _ _ _ _ 41 6113

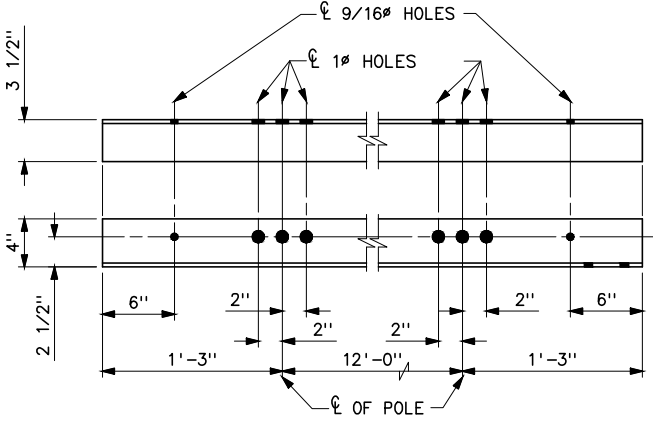
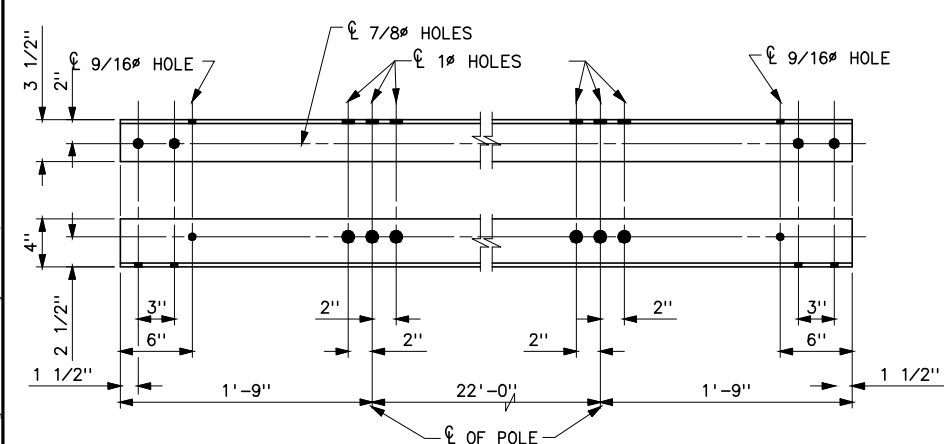
A	04-05-00 A3-KKR	REMOVED OGW MATERIALS.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HS-1A 115KV SUSPENSION STRUCTURE - NO OGW		
DESIGNED KAREN ROWE _ _ _ _ _ APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
C _A E	MARCH 10, 2000	41 6132



MARK B1
L 4x3 1/2x5/16x12'-6"
WT=97 LBS
(TYPE HS-1 69KV)

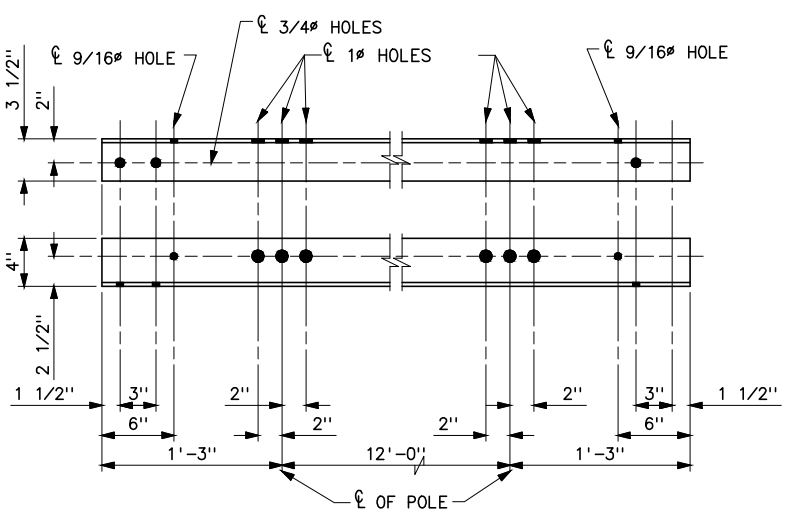
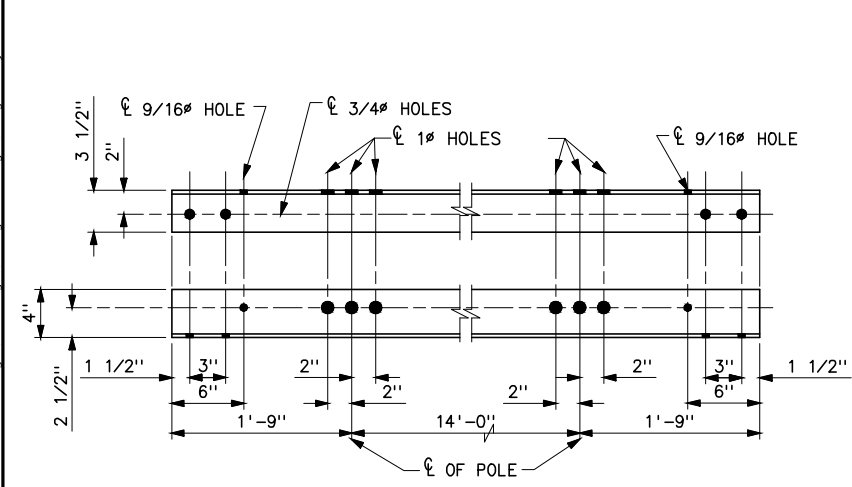
MARK B2
L 4x3 1/2x5/16x14'-6"
WT=112 LBS
(TYPE HSB-1 69 AND 115KV)

MARK B3
L 4x3 1/2x3/8x20'-6"
WT=187 LBS
(TYPE HSB-1 161KV)



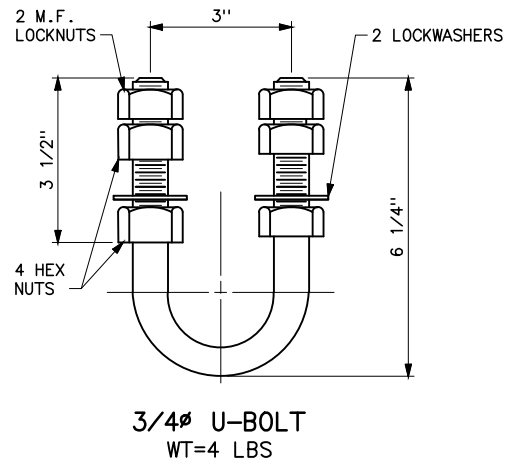
MARK B4
L 4x3 1/2x3/8x25'-6"
WT=232 LBS
(TYPE HSB-1 230KV)

MARK B5
L 4x3 1/2x5/16x14'-6"
WT=112 LBS
(TYPE HA-1 69 AND 115KV)



MARK B7
L 4x3 1/2x3/8x17'-6"
WT=161 LBS
(TYPE HSB-1 138KV)

MARK B8
L 4x3 1/2x3/8x14'-6"
WT=133 LBS
(TYPE HSB-1 69 AND 115KV)



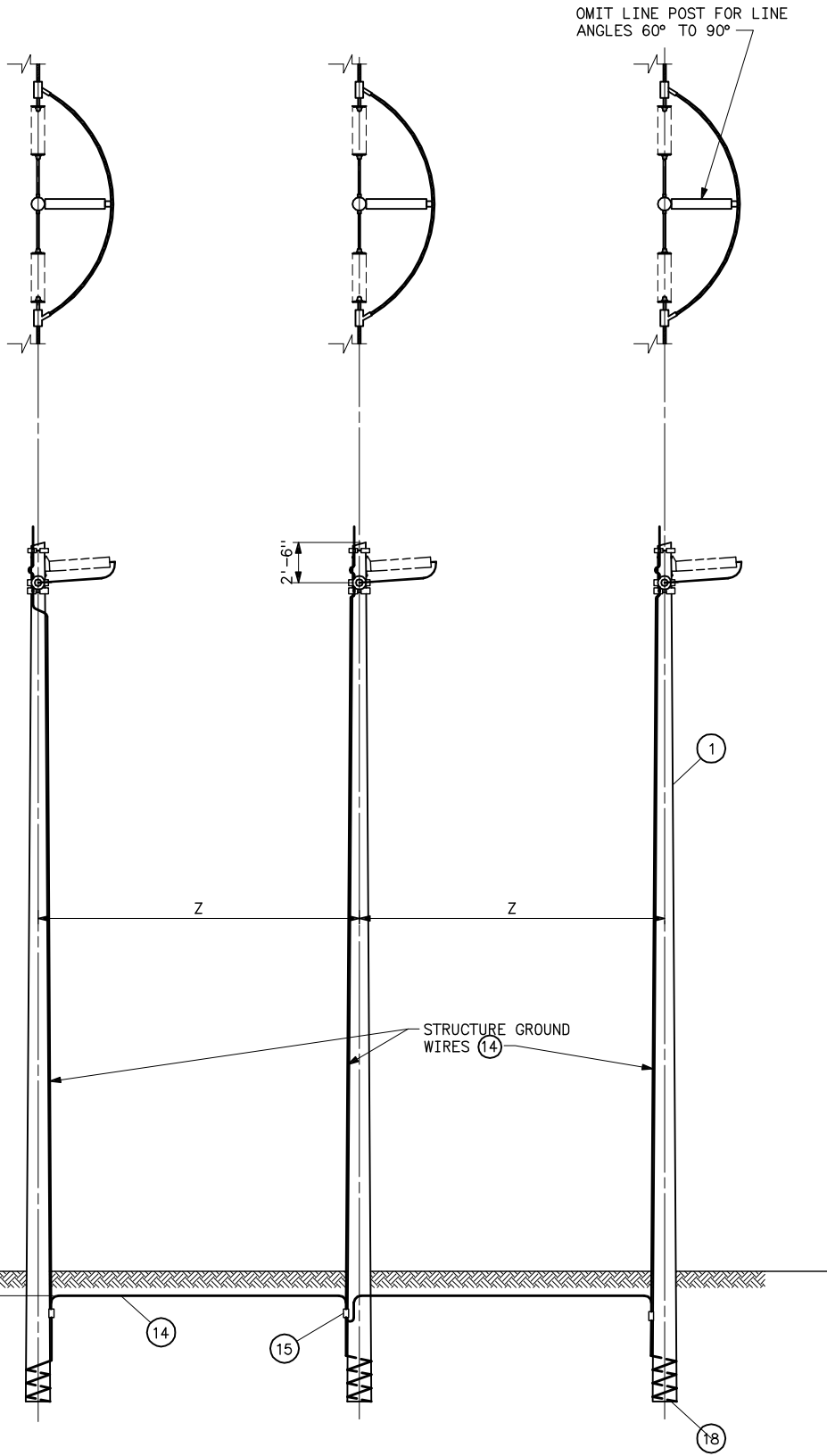
- NOTES**
1. STEEL SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
 2. STEEL U-BOLTS SHALL MEET IFI 136.
 3. NUTS, LOCKWASHERS AND LOCKNUTS SHALL MEET ANSI C135.1.
 4. THIS ANGLE IS NOT RECOMMENDED. IT WAS NOT ADEQUATE FOR FALL PROTECTION.

REFERENCE DRAWINGS

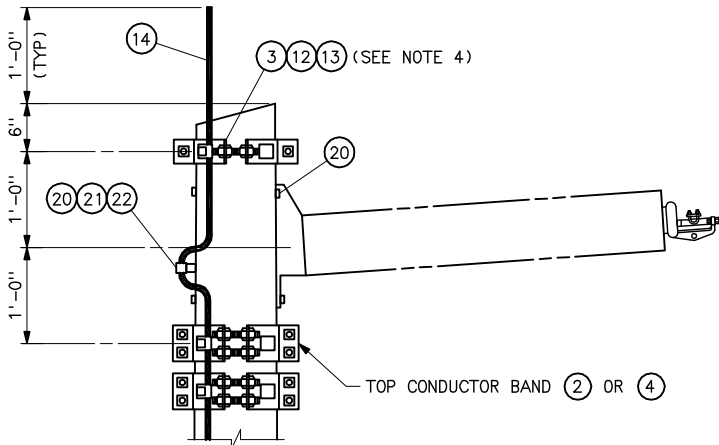
TYPE HSB-1 161KV	SUSPENSION STRUCTURE	41 6129
TYPE HSB-1 69 AND 115KV	SUSPENSION STRUCTURE	41 6123
TYPE HS-1 69KV	SUSPENSION STRUCTURE	41 6117
TYPE HSB-1 230KV	SUSPENSION STRUCTURE	41 6128
TYPE HS-1 115KV	SUSPENSION STRUCTURE	41 6122
TYPE HA-1 69 AND 115KV	SUSPENSION STRUCTURE	41 6124
TYPE HSB-1 138KV	SUSPENSION STRUCTURE	41 6159

G	1-8-24 A7-MJM	FIXED SPELLING ERRORS IN REV. BLOCKS E AND F. CORRECTED MARK B7 STEEL LENGTH, THICKNESS & WT.
F	10-30-20 A7-CTG	REVISED U-BOLTS FOR MORE LENGTH AND THREADS.
E	6-26-20 A7-KKR	ADDED MARK B8 FOR LOCATIONS WHERE HEAVIER ANGLE IS NEEDED.
D	6-26-20 A7-CTG	REMOVED MARK B6 SINCE IT WAS NOT ADEQUATE FOR FALL PROTECTION.
C	08-30-12 A7-CG	ADDED MARK B7, 3/4" U-BOLT AND MADE HOLES LARGER ON MARK B4.
B	02-05-09 A7-CG	REVISED HOLES IN STEEL
A	04-01-03 A7-CG	ADDED DIMENSION TO 9/16" HOLES ON MARK B6 EACH END.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES STEEL ANGLE DETAILS FOR WOOD POLE STRUCTURES		
DESIGNED <u>CHARLIE GARCIA</u> APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER		
SEPTEMBER 01, 2000	41	6133

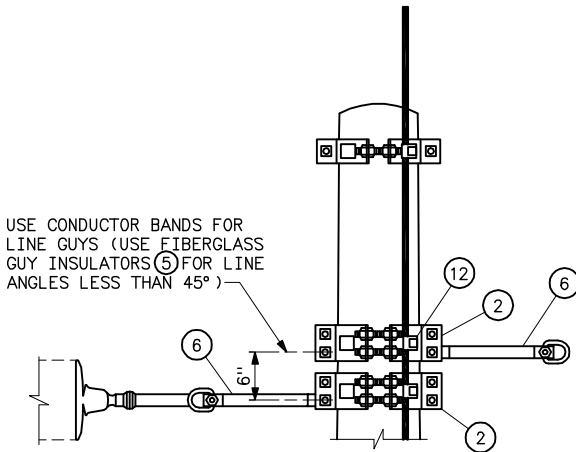
Plotted By: court Jan 08, 2024- 7:55am
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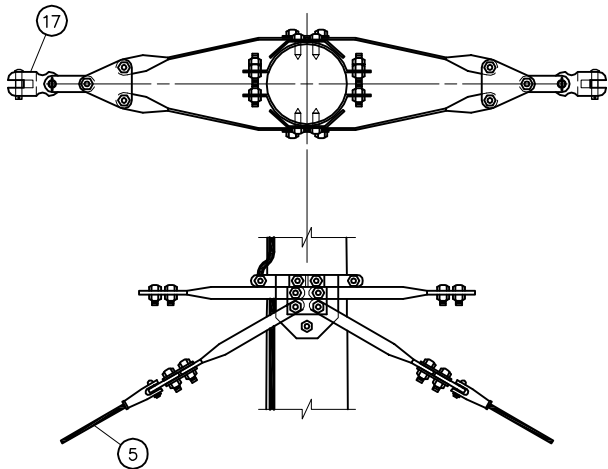
VOLTAGE	Z			
	ANGLE TURNED IN DEGREES			
	0°-30°	30°-45°	45°-60°	60°-90°
230KV	23'-0"	28'-0"	35'-0"	48'-0"
161KV	18'-0"	23'-0"	29'-0"	38'-0"
138KV	16'-0"	22'-0"	28'-0"	36'-0"
115KV	15'-0"	21'-0"	27'-0"	35'-0"
69KV	14'-0"	19'-0"	25'-0"	33'-0"
34.5KV	12'-0"	16'-0"	23'-0"	32'-0"



POST INSULATOR ASSEMBLY



DETAIL OF INSULATOR ATTACHMENT
(FOR LINE ANGLES 5° TO 90°)



DETAIL OF INSULATOR ATTACHMENT (4)
(FOR LINE ANGLES 0° TO 5°)

STRUCTURE MATERIAL					
PART NO.	ANGLE	ANGLE	ANGLE	ANGLE	DESCRIPTION
	0°-5°	5°-30°	30°-60°	60°-90°	
1	3	3	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	-	6	6	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3112 SERIES, JOSLYN J25969 SERIES; OR, APPROVED EQUAL
3	3	3	3	3	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
4	3	-	-	-	POLE BAND ASSEMBLY, HUGHES B1784-VV OR APPROVED EQUAL
5	6	6	6	-	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6	-	6	6	6	CONNECTING LINK; PAIR WITH BNK; HUGHES 3157, JOSLYN J26035; OR, APPROVED EQUAL
12	3	9	9	6	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT) HUGHES 2718.55 OR EQUAL
13	6	6	6	6	LAG SCREWS, 1/2x4 WITH FLAT WASHER (2 EACH PER BAND)
14	AS REQUIRED	AS REQUIRED	AS REQUIRED	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
15	3	3	3	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
17	6	-	-	-	CLEVIS-CLEVIS 90° WITH BNK, 40,000 LBS
18	3	3	3	3	POLE BOTTOM PLATE (BLACKBURN NO GP 110 OR EQUAL) ATTACHED TO POLE

POST INSULATOR ASSEMBLY MATERIAL
(OMIT FOR 60° TO 90° ANGLES)

PART NO.	ANGLE	DESCRIPTION
	0°-60°	
20	6	7/8" x REQUIRED LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROS. NO. 2727)

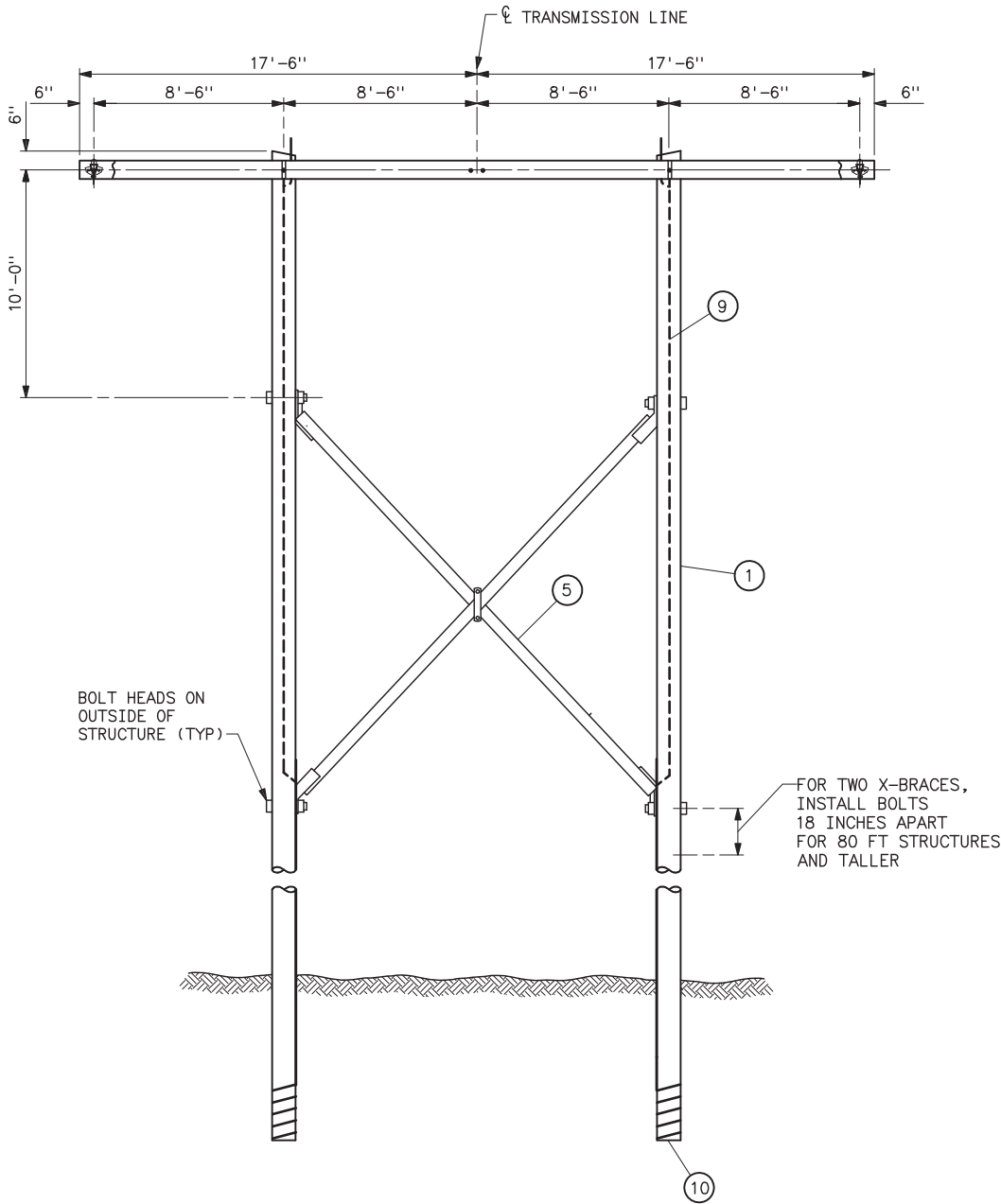
NOTES

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ALL HOLES SHALL BE BORED 1/8" LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATOR ARE USED ARE BASED ON BOLT SIZED SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
4. ADDITIONAL POLE BAND IS NOT REQUIRED ON CENTER POLE FOR LINE ANGLES 60°-90°.
5. FOR 5°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) FOR GUYING ON EACH OUTSIDE POLE.

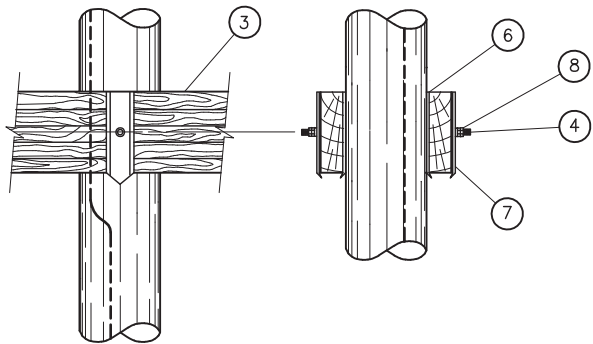
REFERENCE DRAWINGS

TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
WOOD POLES STRUCTURES	
TENSION INSULATOR ASSEMBLIES	41 1023
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
HORIZONTAL POST	
INSULATOR ASSEMBLIES	41 1024

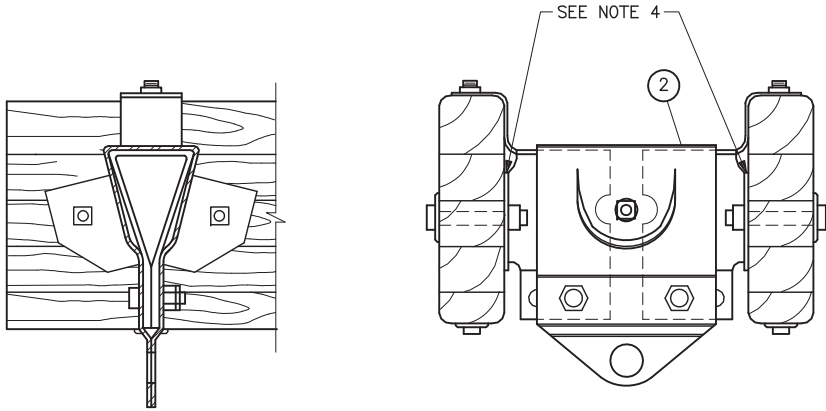
A	07-26-06 A7-KKR	ADDED DIMENSIONS FOR 34.5KV CONSTRUCTION.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
	STANDARD DESIGNS TRANSMISSION LINES TYPE 3TA-1 NO OGW 3-POLE TENSION STRUCTURE		
DESIGNED <u>KAREN ROWE</u> -----		APPROVED <u>DOUG HANSON</u> ----- CIVIL ENGINEERING MANAGER	
CA F	FEBRUARY 07, 2001	41	6134



ELEVATION



DETAIL OF WOOD ATTACHMENT



DETAIL OF PHASE FITTING ASSEMBLY

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE W/BOLTS, NUTS, & WASHERS (HUGHES BROS. TYPE 3414 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x35-0
4	2	DOUBLE ARMING BOLT, 7/8" x REQD LENGTH W/4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8 x 4 3/8 (HUGHES BROS. NO.1042 OR EQ)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
10	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTES

- 1. STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- 2. ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS
- 3. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- 4. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- 5. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

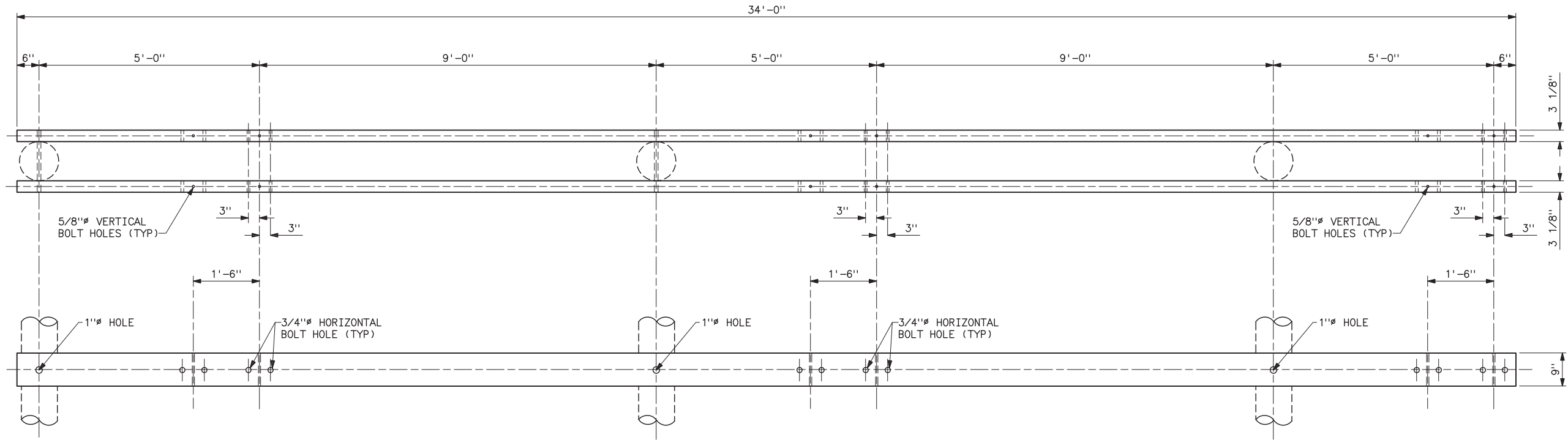
WOOD POLE STRUCTURES GROUNDING DETAILS ——— 41 1012
CROSSARM DRILLING DETAILS HS-1 AND
HSB-1 STRUCTURES ————— 41 6113

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE HS-1A 161KV
SUSPENSION STRUCTURE — NO OGW

DESIGNED KAREN ROWE ———— APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER

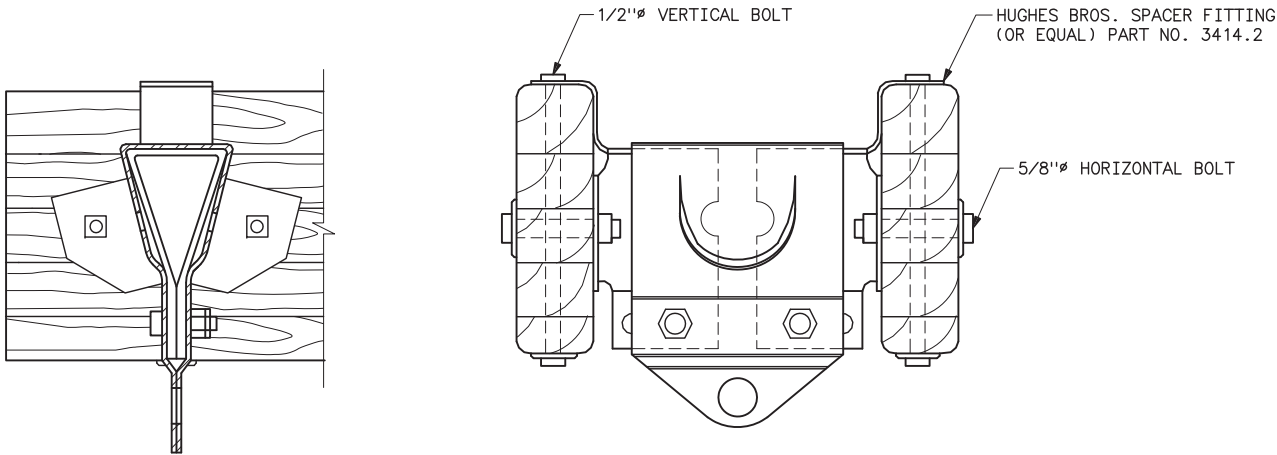
C_AE JUNE 10, 2002 41 6135



115-KV 3AC-1 CROSSARM DRILLING DETAILS

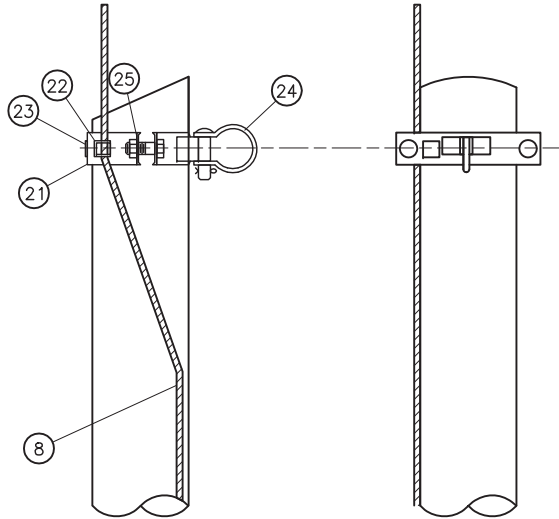
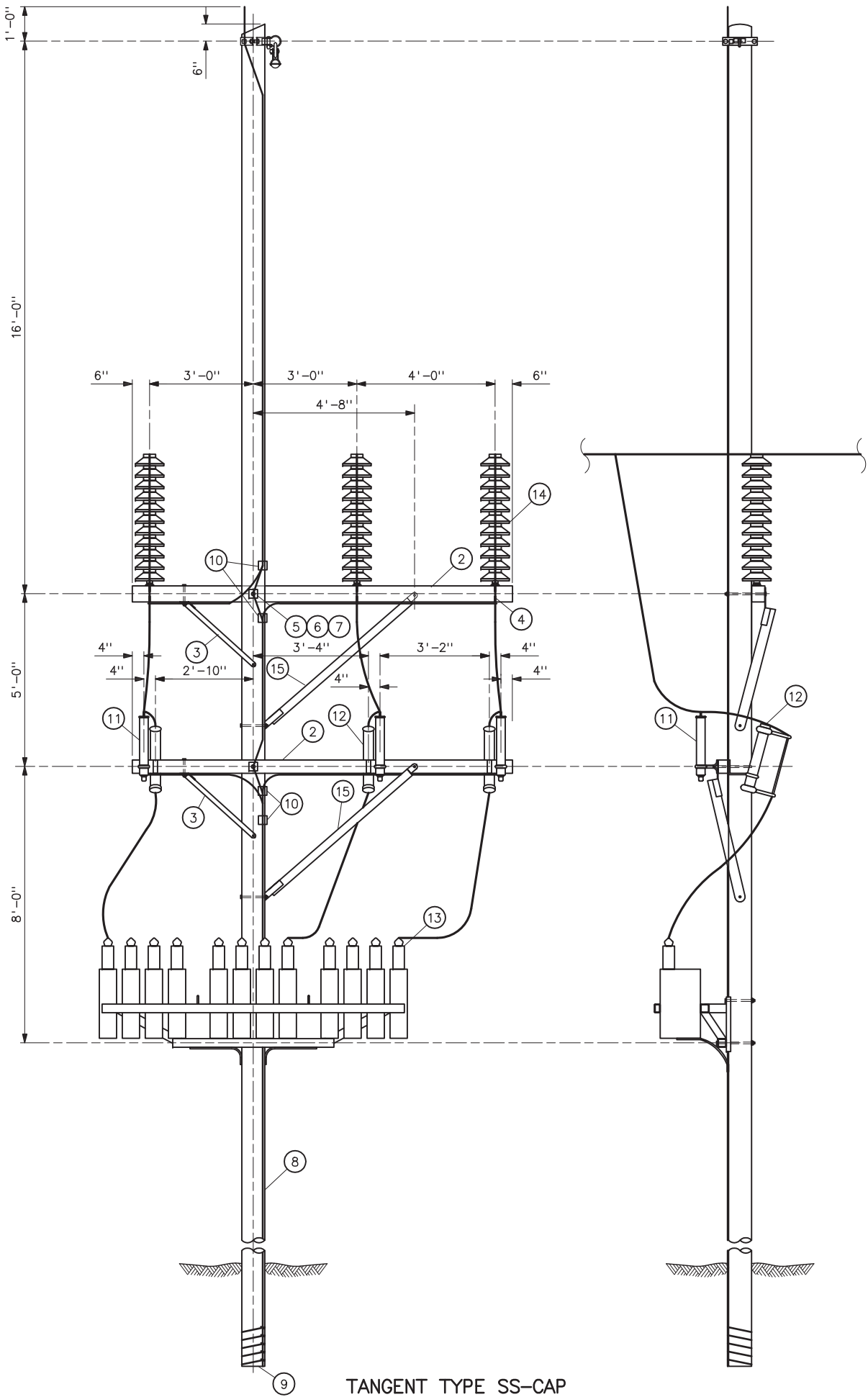
NOTES

- 1. CROSSARMS SHALL BE GLUED LAMINATED.
- 2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.



ADJUSTABLE PHASE FITTING

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINE CROSSARM DRILLING DETAILS 115KV 3AC-1 STRUCTURE WITH ADJUSTABLE PHASE FITTINGS		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
C.A.F.	JANUARY 20, 2005	41 6136



DETAILS OF OGW BONDING AND ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	SS-CAP	
1	1	POLE, 60', CLASS 1
2	2	CROSSARM, 4 5/8"x5 5/8"x11'-0"
3	2	WOOD BRACE, HUGHES BROS. 2045-C45-9-11 OR EQUAL
4	3	MACHINE BOLT WITH NUT AND LOCKNUT (COORDINATE WITH INSULATOR MANUFACTURER FOR BOLT SIZE)
5	2	MACHINE BOLTS 5/8"Øx REQUIRED LENGTH WITH NUT
6	2	3"x3"x1/4" CURVED SQUARE WASHER WITH HOLE
7	2	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES NO. 2727)
8	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
9	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
10	4	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
11	3	SURGE ARRESTOR (34.5KV)
12	3	CUTOUT, DIST., LOADBREAK (34.5KV)
13	1	THREE PHASE CAPACITOR BANK
14	3	POLYMER INSULATOR
15	2	ALLEY ARM BRACE 2 3/4"x3 1/2" HUGHES BROS. 1096 OR EQUAL

OVERHEAD GROUND WIRE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	SS—CAP	
21	1	POLE TOP BAND (HUGHES BROTHERS NO. 2837-B OR EQUAL)
22	1	3/8"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
23	1	LAG SCREW, 1/2"×4" WITH FLAT WASHER
24	1	ANCHOR SHACKLE WITH BNK
25	4	SPRING LOCKWASHER FOR 1/2"Ø BOLT

NOTES

1. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
2. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

WOOD POLES STRUCTURES
GROUNDING DETAILS_____41 1012
OVERHEAD GROUND WIRE ASSEMBLY
DETAILS FOR WOOD POLES STRUCTURES_____41 1019

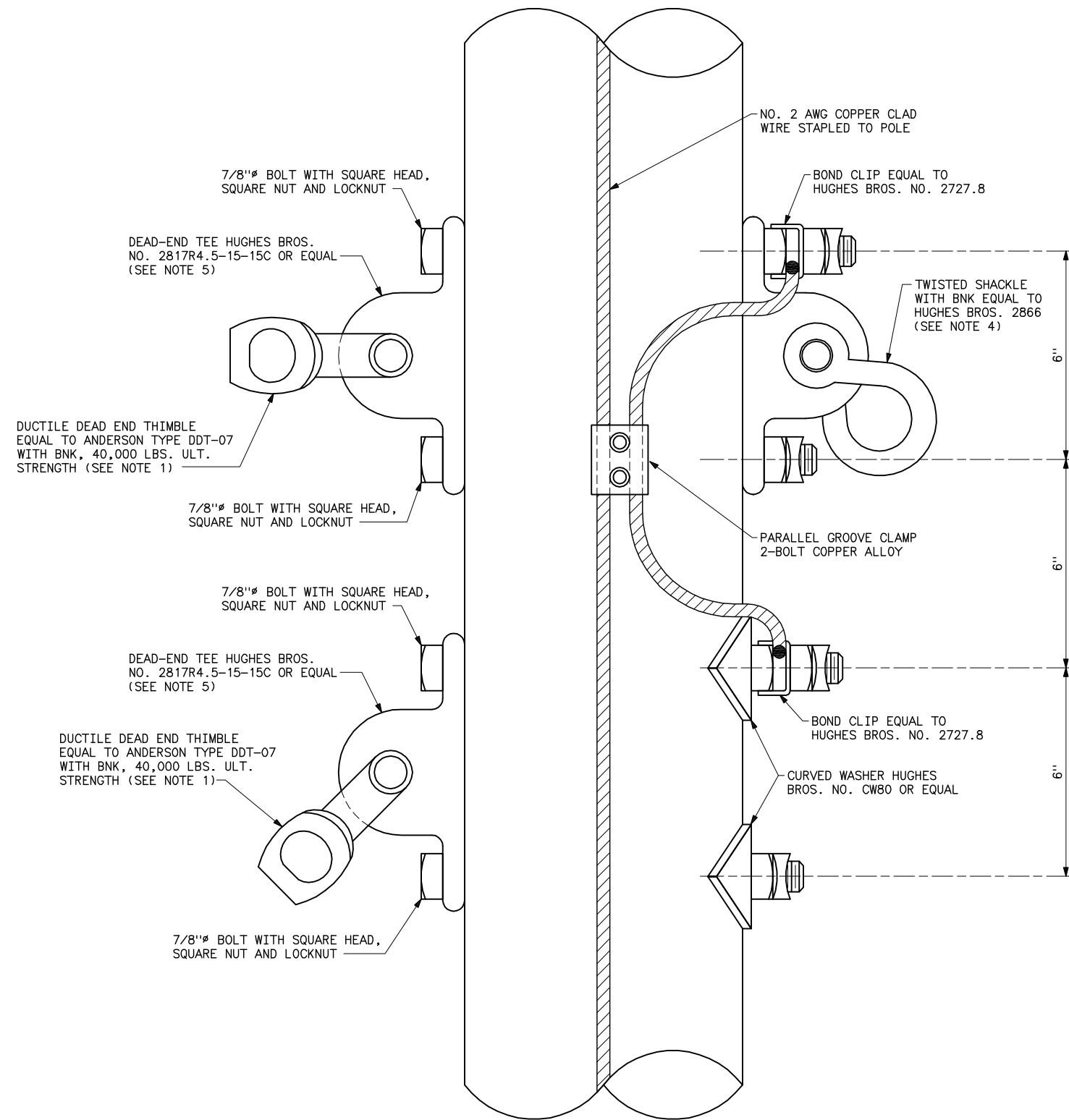
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE SS-CAP 34.5KV
TANGENT CAPACITOR STRUCTURE

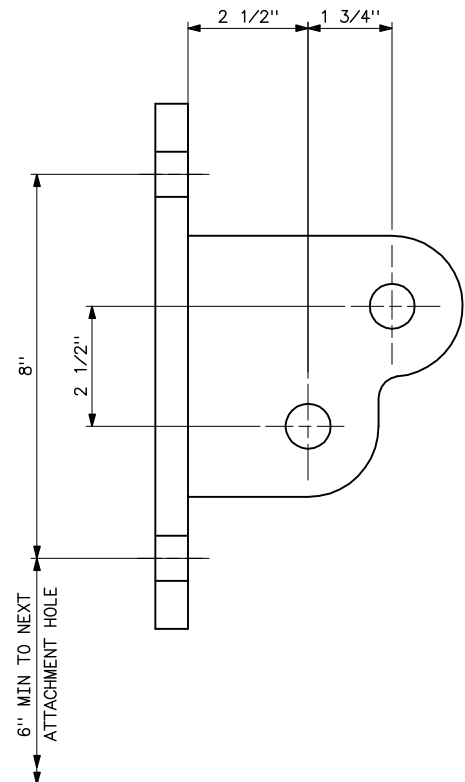
DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER

C.A.E. OCTOBER 07, 2004 41 6137

Plotted By: entwistle Nov 08, 2010- 2:25pm
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TYPICAL DETAILS FOR DEAD END TEES



DOUBLE GUYING DEAD-END TEE
HUGHES BROS NO. AS2720
OR EQUAL (SEE NOTE 6)

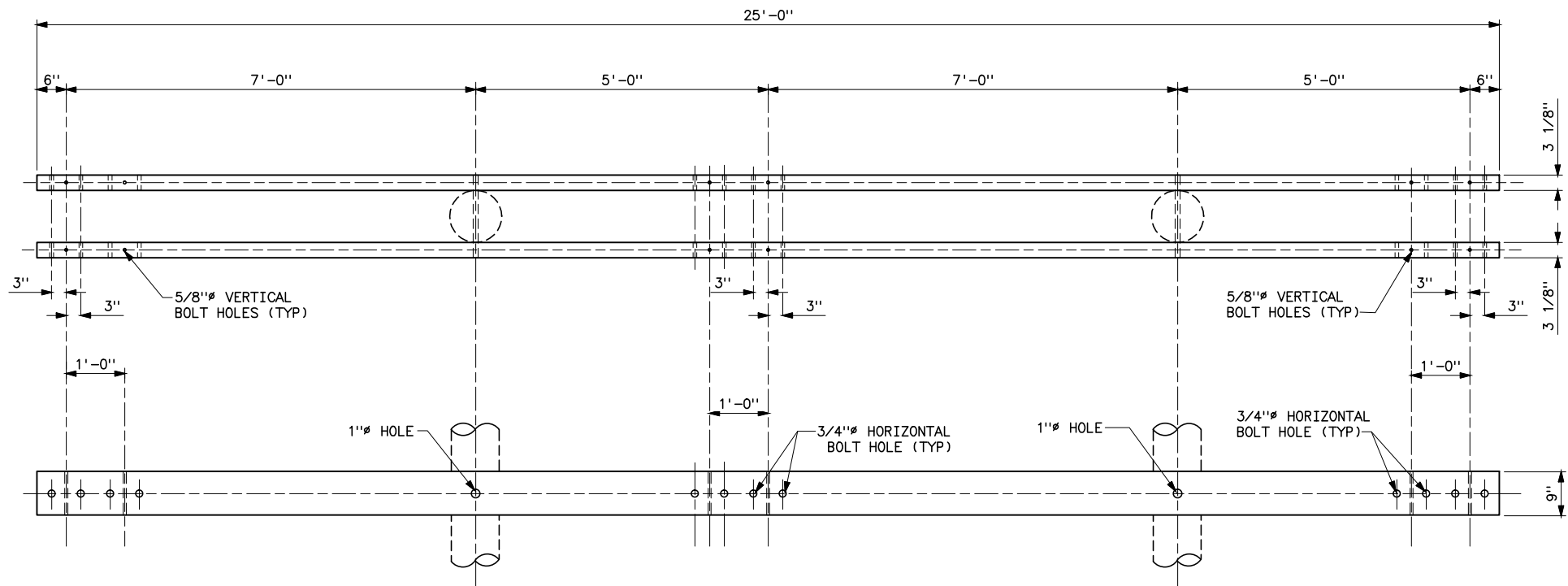
NOTES

1. DUCTILE DEAD END THIMBLE REPLACES CONNECTING LINKS AND SHEAVE WHEELS THAT ARE USED WITH POLE BAND CONSTRUCTION.
2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
4. FOR ANGLES LESS THAN 20 DEGREES REPLACE SHACKLE WITH CLEVIS-CLEVIS FITTING AND 16" EXTENSION LINK WITH BNK, 40,000 LBS. ULT. STRENGTH.
5. THE ULTIMATE STRENGTH OF DEAD-END TEE HUGHES BROS NO. 2817R4.5-15-15C IS 60,000 POUNDS. THIS DEAD-END TEE CAN ACCOMMODATE UP TO TWO DOUBLE GUYS WITH TWO EXTENSION LINKS AND TWO SHEAVE WHEELS.
6. THE DOUBLE GUYING DEAD-END TEE OPTION CAN BE USED IN PLACE OF TWO SINGLE DEAD-END TEES. THE ULTIMATE STRENGTH OF THE DOUBLE GUYING DEAD-END TEE HUGHES BROS NO. AS2720 IS 35,000 POUNDS PER ATTACHMENT. EACH ATTACHMENT CAN ACCOMMODATE UP TO ONE DOUBLE GUY.
7. OTHER DEAD-END TEES MAY BE USED AS LONG AS THE ULTIMATE STRENGTH PER ATTACHMENT IS AT LEAST 29,000 POUNDS.

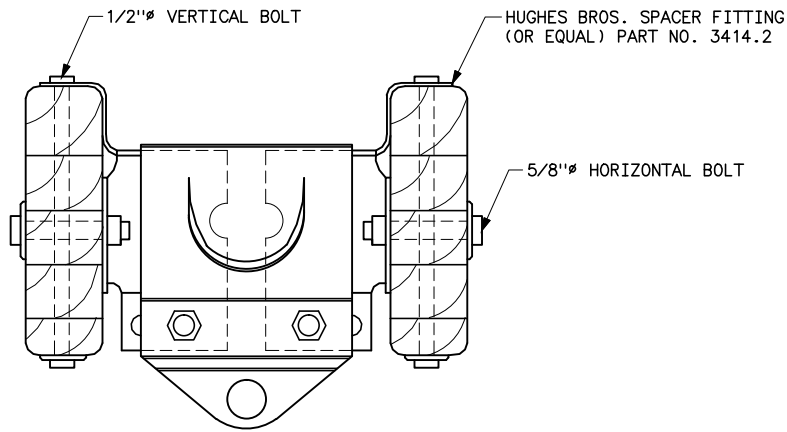
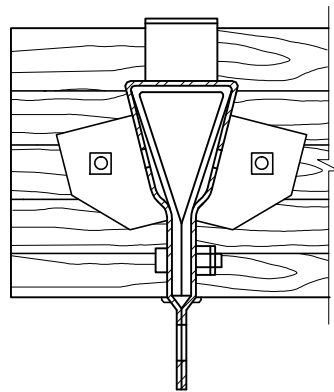
REFERENCE DRAWING

GUY ASSEMBLY AND DETAILS----- 41 6047

B	6-9-10 A7-KKR	ADDED DOUBLE GUYING DEAD-END TEE OPTION AND NOTES 5, 6, AND 7.
	02-28-06 A7-KKR	ADDED NOTE 4.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPICAL DETAILS FOR DEAD END TEES		
DESIGNED KAREN ROWE ----- APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
CA	JANUARY 24, 2005	41 6138



69 AND 115-KV HA-1 CROSSARM DRILLING DETAILS



ADJUSTABLE PHASE FITTING

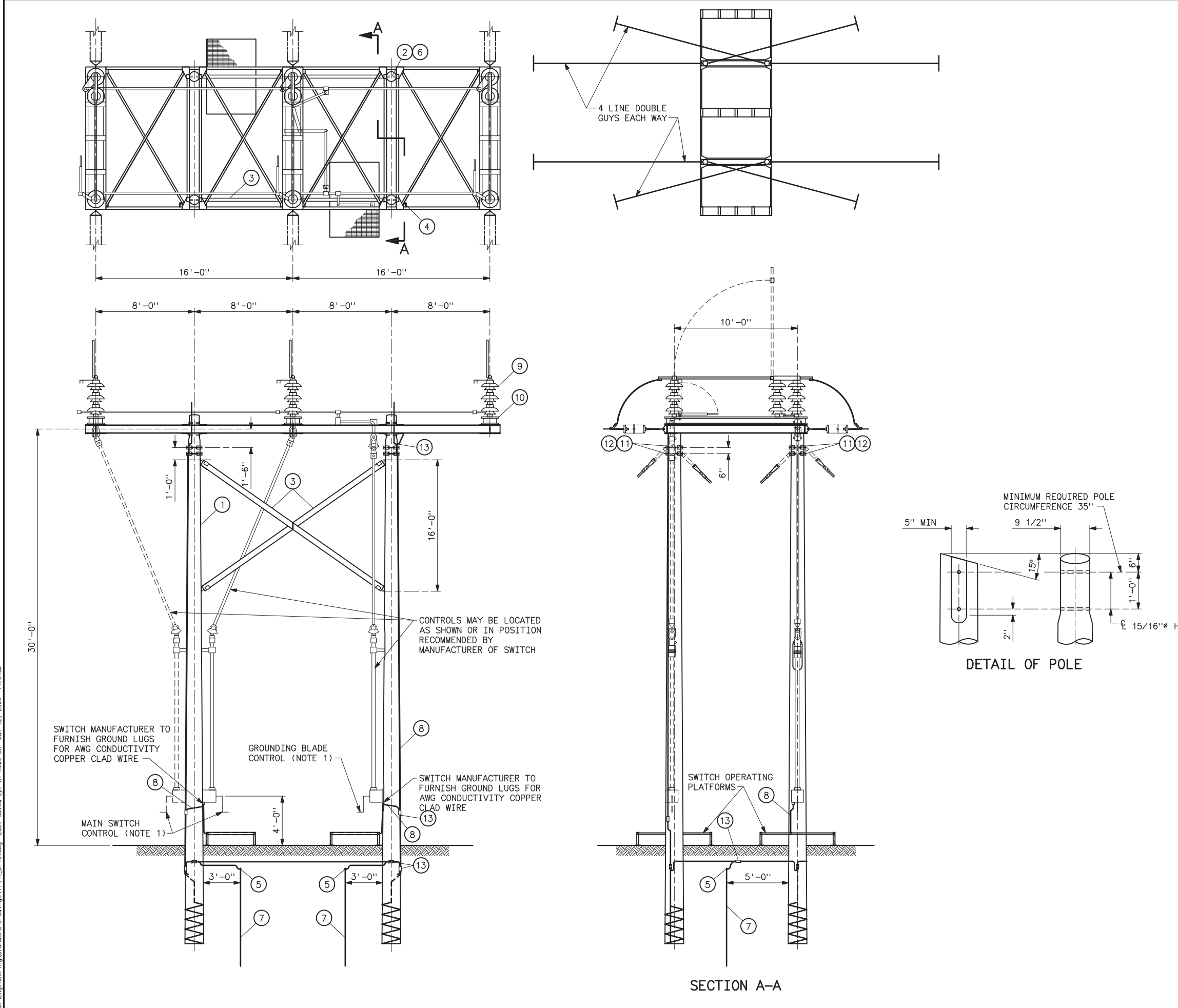
NOTES

- 1. CROSSARMS SHALL BE GLUED LAMINATED.
- 2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.

REFERENCE DRAWING

TYPE HA-1 69 AND 115KV SMALL ANGLE
SUSPENSION STRUCTURE _____ 41 6124

A	12/21/05 A7-KKR	CHANGED DIMENSION FOR SWINGING ANGLE BRACKET HOLES.
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO	
	STANDARD DESIGN TRANSMISSION LINE CROSSARM DRILLING DETAILS 69 AND 115KV HA-1 STRUCTURE WITH ADJUSTABLE PHASE FITTINGS	
DESIGNED <u>KAREN ROWE</u>		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER
DATE	JANUARY 20, 2005	41 6139



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	4	POLE, 40 FT MINIMUM CLASS 2 DOUGLAS FIR (CUT TO FIT)
2	8	MACHINE BOLT 7/8"Ø WITH SPRING LOCKWASHER, AND NUT
3	2	X-BRACING, COMPLETE WITH FITTINGS (3 3/4"x5 3/4") (EQUAL TO HUGHES BROS. 2094)
4	2	CLAMP, BELCHER FOR BONDING GROUND WIRE TO STEEL, 15/16"Ø HOLE SPACING, 1/2"Ø J-BOLT
5	2	CLAMP, COPPER ALLOY FOR GROUND ROD
6	16	CONNECTOR, SHEAR PLATE 4"Ø FOR 7/8"Ø BOLT (WOOD TO METAL)
7	2	GROUNDING ROD, COPPER-CLAD 5/8"Øx8 FT
8	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
9	1	AIR-BREAK SWITCH, COMPLETE WITH MOUNTING BOLTS
10	1	SWITCH BASE
11	8	FOUR-WAY STRAIN BAND (EQUAL TO HUGHES BROS. 3112 SERIES)
12	8	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT) HUGHES 2718.55 OR EQUAL
13	16	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

NOTE
1. SEE DETAIL E ON DRAWING 31 1075 FOR GROUNDING.

REFERENCE DRAWINGS	
GROUNDING DETAILS	41 1012
GUY ASSEMBLY AND DETAILS	41 6047
SWITCH OPERATING AND EQUIPMENT	
PLATFORMS-ELECTRICAL DESIGN AND DETAILS	41 6141
SWITCH OPERATING PLATFORM	31 2045

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

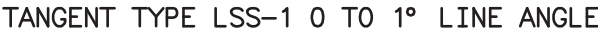
TRANSMISSION LINE STANDARDS
TYPE 4SWT 230-KV
DISCONNECTING SWITCH STRUCTURE - NO OGW

DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON _____
CIVIL ENGINEERING MANAGER

CA	JULY 15, 2005	41	6140
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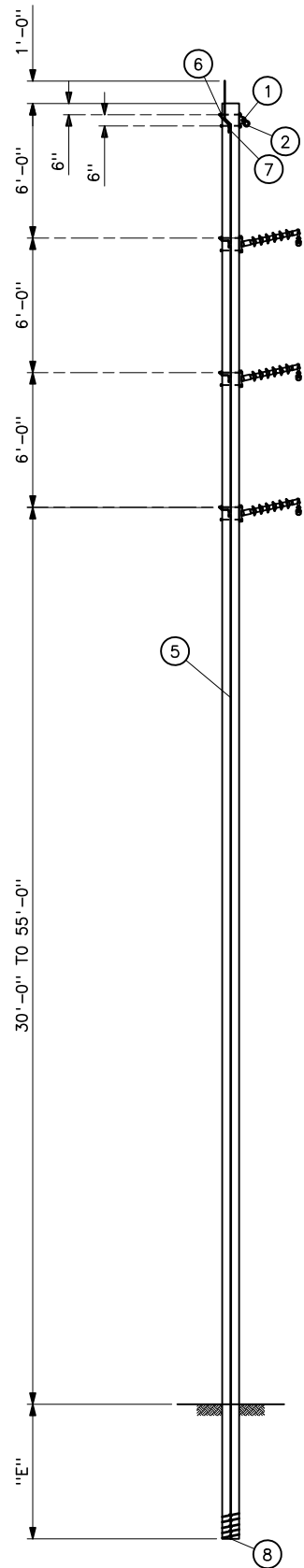
OVERHEAD GROUND WIRE MATERIAL		
PART NO.	QUANTITY STRUCTURE TYPE	DESCRIPTION
	LSS-1	
8	1	SHIELD WIRE SUPPORT BRACKET (HUGHES BROTHERS NO. 2812 OR EQUAL)

1. MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO C
OF TOP MOUNTING HOLES.
2. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR
ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE
AS REQUIRED.
3. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL
COTTER KEY REQUIRED.

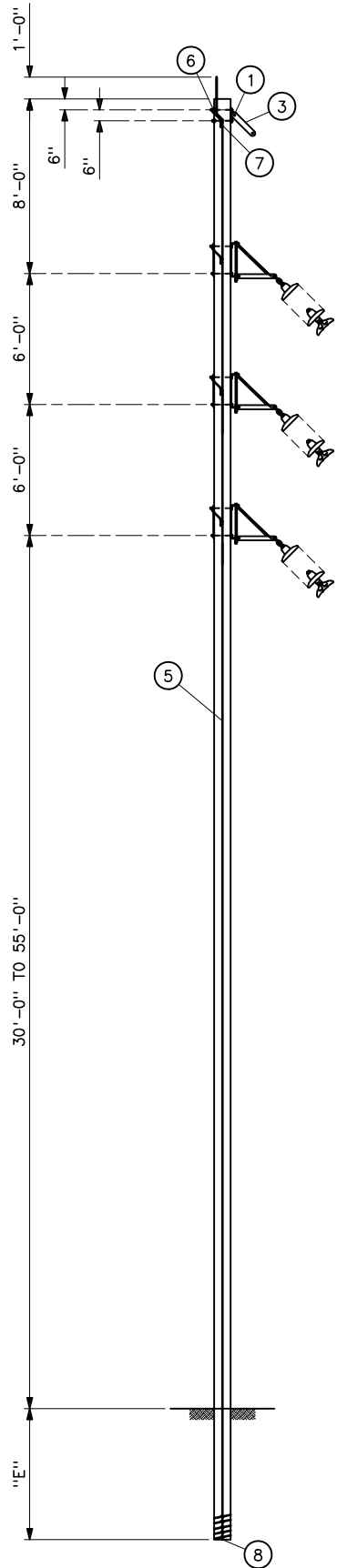
WOOD POLES STRUCTURES	
GROUNDING DETAILS_____	.41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES_____	.41 1019
HORIZONTAL POST INSULATOR ASSEMBLIES_____	.41 1024
OPTICAL GROUND WIRE ASSEMBLIES_____	.41 1031

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE LSS-1 69KV TANGENT SUSPENSION STRUCTURE-LIGHT LOADING			
DESIGNED <u>KAREN ROWE</u>		APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER	
C A F	OCTOBER 13, 2005	41	6142

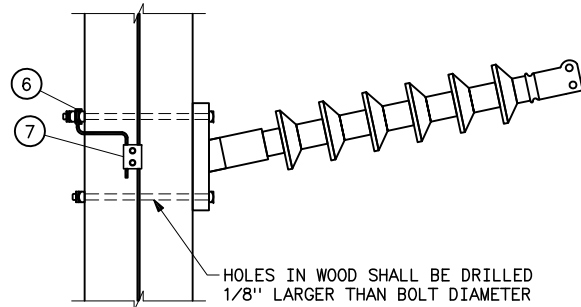
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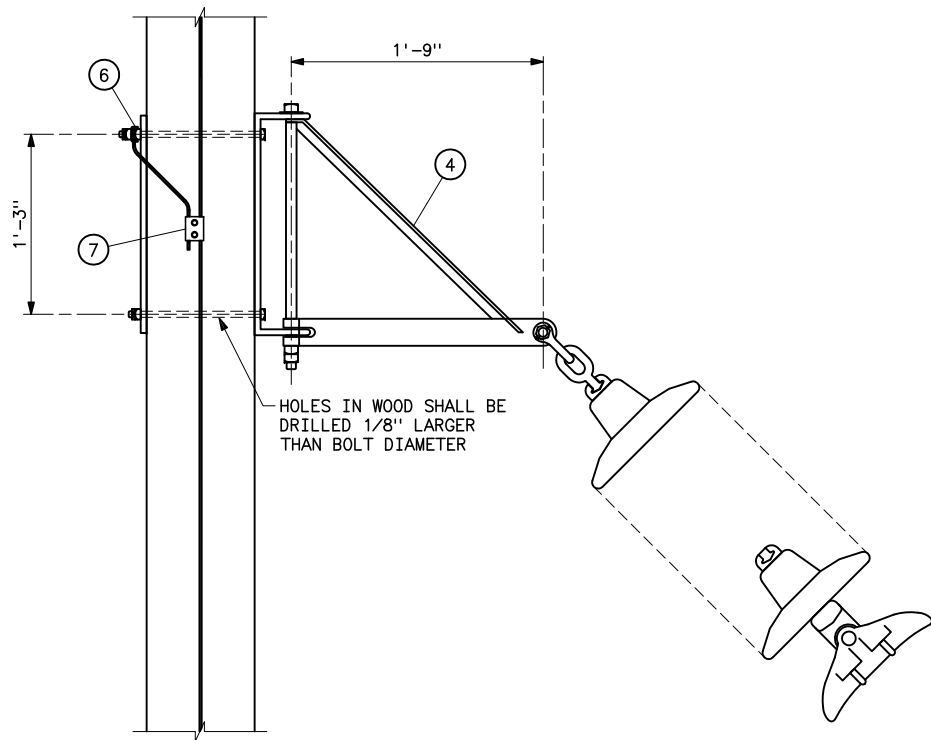
SMALL ANGLE TYPE LSSA-GL
1 TO 15° LINE ANGLE



LARGE ANGLE TYPE LSLA-GL
15 TO 60° LINE ANGLE



POST INSULATOR ASSEMBLY
(SUPPLIED BY OTHERS)
TYPE LSSA-GL



SUSPENSION INSULATOR ASSEMBLY
TYPE LSLA-GL

HARDWARE LIST			
PART NO.	QUANTITY STRUCTURE TYPE		DESCRIPTION
	LSSA-GL	LSLA-GL	
1	1	1	DEAD-END TEE EQUAL TO HUGHES BROS. NO. 2817-15-15C
2	1	-	TWISTED SHACKLE WITH BNK EQUAL TO HUGHES BROS. 2866
3	-	1	EXTENSION LINK, COMPLETE WITH BNK (HUGHES BROS. NO. 1906-14 OR EQUAL)
4	-	3	SWINGING ANGLE BRACKET, COMPLETE, BOLTS, WITH GUYING PLATE AND FITTINGS (HUGHES BROS. NO. 2822.8 OR EQUAL)
5	AS REQD	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
6	4	4	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROTHERS NO. 2727)
7	4	4	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
8	1	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

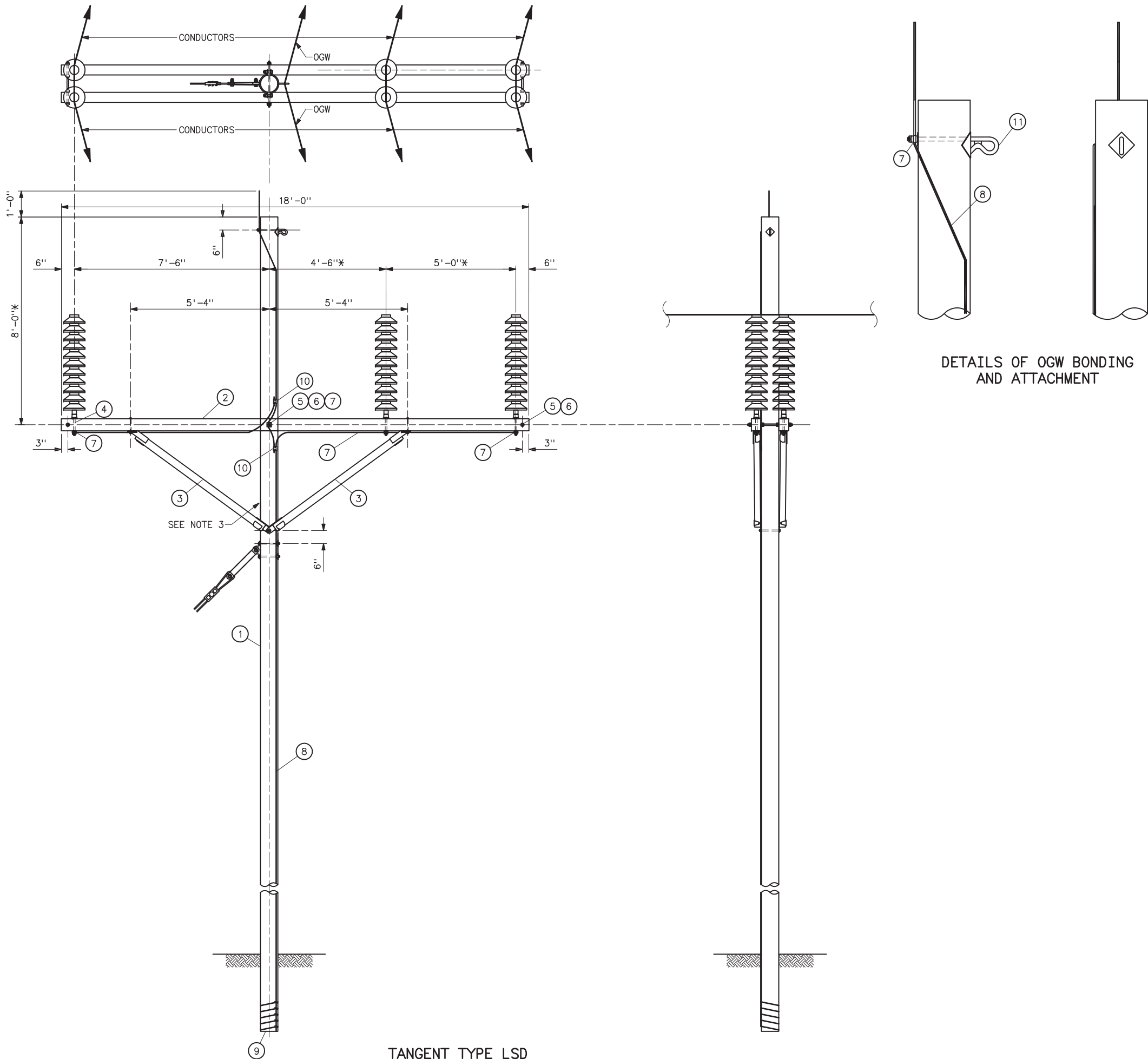
NOTES

- OVERLOAD FACTOR:
NESC-----VERTICAL=1.5
TRANSVERSE (WIND)=1.65
TRANSVERSE (WIND TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND-----ALL=1.33
- STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
- STRUCTURE GUYS ARE NOT PERMITTED.
- CONDUCTOR: 266.8 KCM, ACSR 26/7 "PARTRIDGE".
OPGW: ONE 0.607#, 0.375 LB/FT
RTS-----16,646 LB
- WIND SPAN-----400 FT
- WEIGHT SPAN-----600 FT
- DESIGN FOR:
NESC LIGHT: 2007 EDITION.
TENSIONS: CONDUCTOR TENSION-----2850 FT
OGW TENSION-----3130 LB
HIGH WIND: 85 MPH AT 60°F WITH 1.14 FACTOR FOR WIRE AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
CONDUCTOR TENSION-----2740 LB
OPGW TENSION-----2730 LB
60° F:
CONDUCTOR TENSION-----2070 LB
OPGW TENSION-----2370 LB
- GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE..
- GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENTS HARDWARE AND GROUNDING MATERIALS BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
- INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
- POLES SHALL BE SET WITHIN 3" OF THE SPECIFIED SETTING.
- GRADE B CONSTRUCTION.

REFERENCE DRAWINGS

WOOD POLES STRUCTURES	
GROUNDING DETAILS-----	41 1012
WOOD POLES STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLIES-----	41 1019
SUSPENSION INSULATOR ASSEMBLIES -	
SINGLE STRING-----	41 1020
SUSPENSION INSULATOR ASSEMBLIES -	
DOUBLE STRING-----	41 1021
OPTICAL GROUND WIRE ASSEMBLIES-----	41 1031

A	7-22-10 A7-KR	CHANGED OPGW, REVISED LOADING		
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGN TRANSMISSION LINES TYPE LSSA-GL AND LSLA-GL 69-KV SMALL & LARGE ANGLE SUSPENSION GLED LAMINATED WOOD STRUCTURES-LIGHT LOADING				
DESIGNED <u>KAREN ROWE</u> ----- APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER -----				
A	F	OCTOBER 27, 2005	41	6143



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	LSD	
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	2	CROSSARM, 4 5/8"x5 5/8"x18'-0"
3	4	ALLEY ARM BRACE 2 3/4"x3 1/2" HUGHES BROS. 1096.7R OR EQUAL WITH MOUNTING BOLTS, NUTS, AND LOCKWASHERS
4	3	MACHINE BOLT WITH NUT AND LOCKNUT (SUPPLIED WITH INSULATOR BRACKET)
5	3	3/4"Øx 20" DOUBLE ARMING BOLT USE EXTRA NUTS FOR LOCKNUTS (4 EXTRA NUTS FOR OUTSIDE CONNECTIONS)
6	10	LOCKWASHER FOR 3/4"Ø BOLT WITH HOLE (2 FOR BOLT THROUGH POLE, 4 EACH OUTSIDE BOLTS)
7	5	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES NO. 2727)
8	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
9	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
10	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

OVERHEAD GROUND WIRE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	LSD	
11	1	SHIELD WIRE SUPPORT BRACKET (HUGHES BROTHERS NO. 2812 OR EQUAL)

- NOTES
- 1. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
 - 2. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
 - 3. GUYING AS REQUIRED AS SHOWN ON PLAN AND PROFILES.
 - 4. * DIMENSIONS REQUIRED FOR BIRD SAFETY.

REFERENCE DRAWINGS	
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
GUY ASSEMBLIES AND DETAILS	41 6047

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE LSD 69-KV
FLAT TOP SUSPENSION STRUCTURE - LIGHT LOADING

DESIGNED KAREN ROWE APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER

NOVEMBER 02, 2005 41 6144

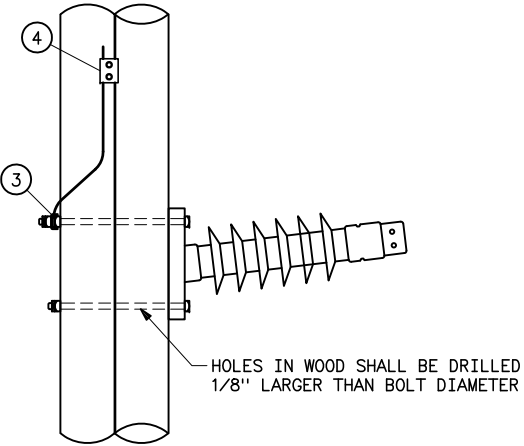
NOTES

1. OVERLOAD FACTOR:
NESC-----_VERTICAL=1.5
TRANSVERSE (WIND)=1.65
TRANSVERSE (WIND TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND-----ALL=1.33
2. STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
3. STRUCTURE GUYS ARE NOT PERMITTED.
4. CONDUCTOR: 266.8 KCM, ACSR 26/7 "PARTRIDGE".
OPGW: ONE 0.607#, 0.375 LB/FT
RTS-----16,646 LB
5. WIND SPAN-----400 FT
6. WEIGHT SPAN-----600 FT
7. DESIGN FOR:
NESC LIGHT: 2007 EDITION.
TENSIONS: CONDUCTOR (AHEAD AND BACK)-----2850 FT
OPGW (AHEAD AND BACK)-----3130 LB
HIGH WIND: 85 MPH AT 60°F WITH 1.14 FACTOR FOR WIRE AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
CONDUCTOR TENSION-----2740 LB
OPGW TENSION-----2730 LB
60° F:
CONDUCTOR TENSION-----2070 LB
OPGW TENSION-----2370 LB
8. GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE..
9. GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENTS HARDWARE AND GROUNDING MATERIALS BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
10. INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
11. POLES SHALL BE SET WITHIN 3" OF THE SPECIFIED SETTING.
12. GRADE B CONSTRUCTION.
13. MEASUREMENTS FOR HORIZONTAL LINE POST MOUNTING ARE TO CENTERLINE OF TOP MOUNTING BOLT.
14. FOR ANGLE TENSION (4° TO 90°) OFFSET DEAD END TEES.

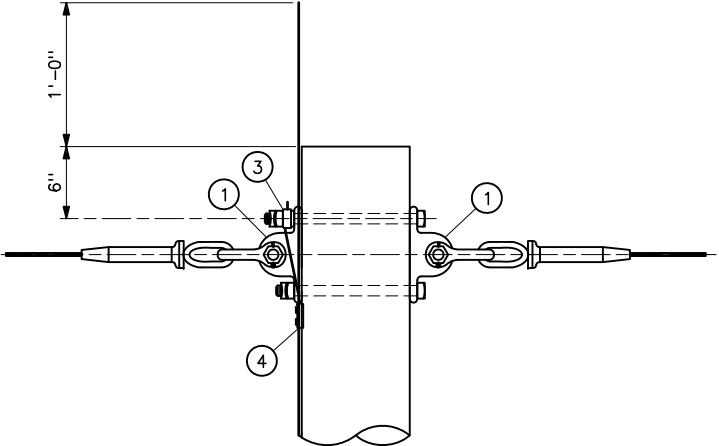
REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	.41 1012
WOOD POLE STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLIES	.41 1019
TENSION INSULATOR ASSEMBLIES -	
SINGLE STRING	.41 1022
TENSION INSULATOR ASSEMBLIES -	
DOUBLE STRING	.41 1023
HORIZONTAL POST - INSULATOR ASSEMBLIES	.41 1024
OPTICAL GROUND WIRE ASSEMBLIES	.41 1031

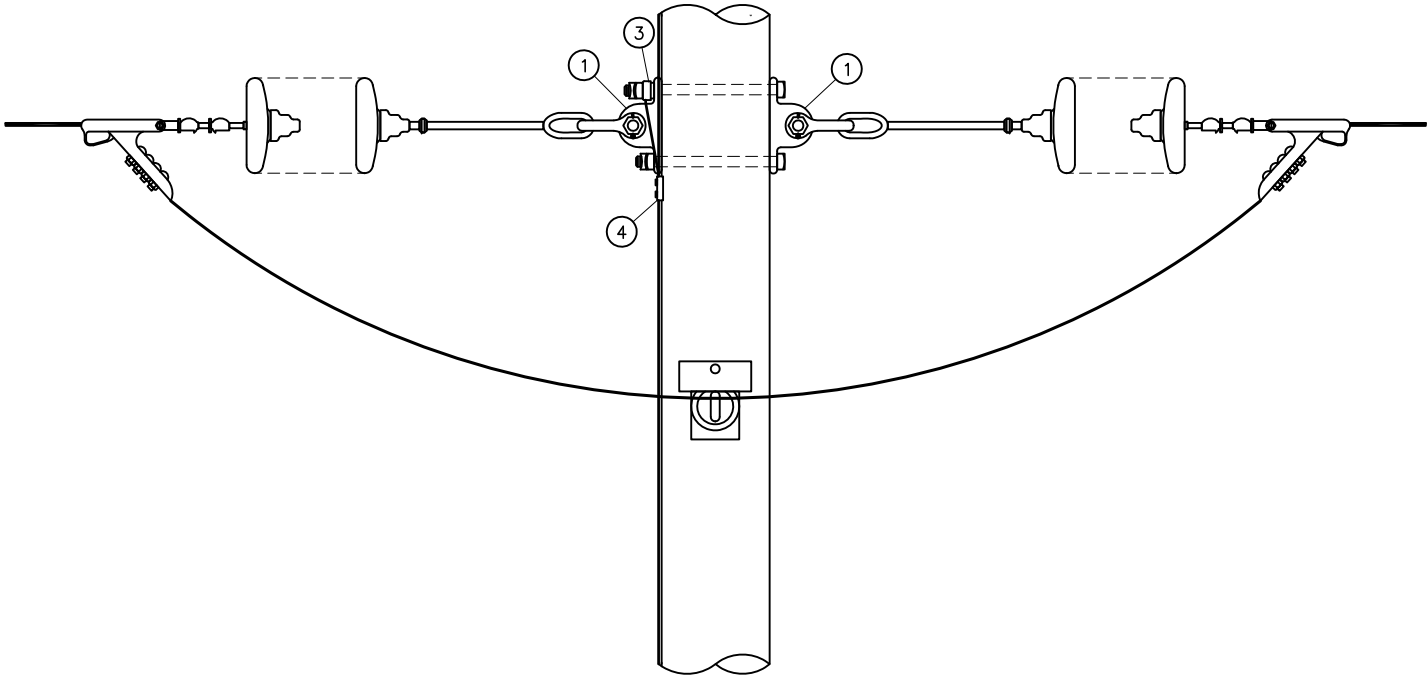
A	7-22-10 A7-KR	CHANGED OPGW, REVISED LOADING
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE LST-GL 69-KV TANGENT AND ANGLE TENSION GLUED LAMINATED WOOD STRUCTURE-LIGHT LOADING		
DESIGNED KAREN ROWE		APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER
A	NOVEMBER 17, 2005	41 6145



POST INSULATOR ASSEMBLY



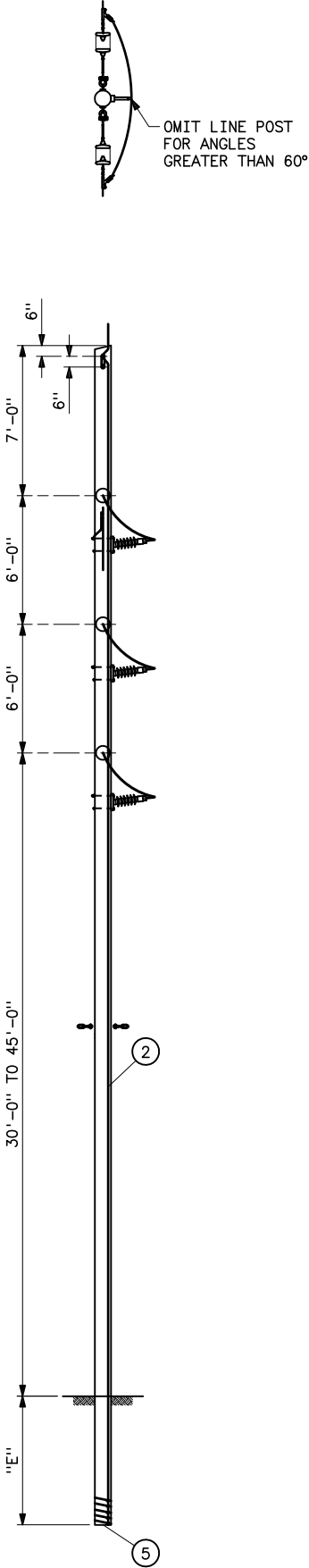
TANGENT TENSION ASSEMBLY (0°-3°)
FOR OVERHEAD GROUND WIRE
(SEE NOTE 2)

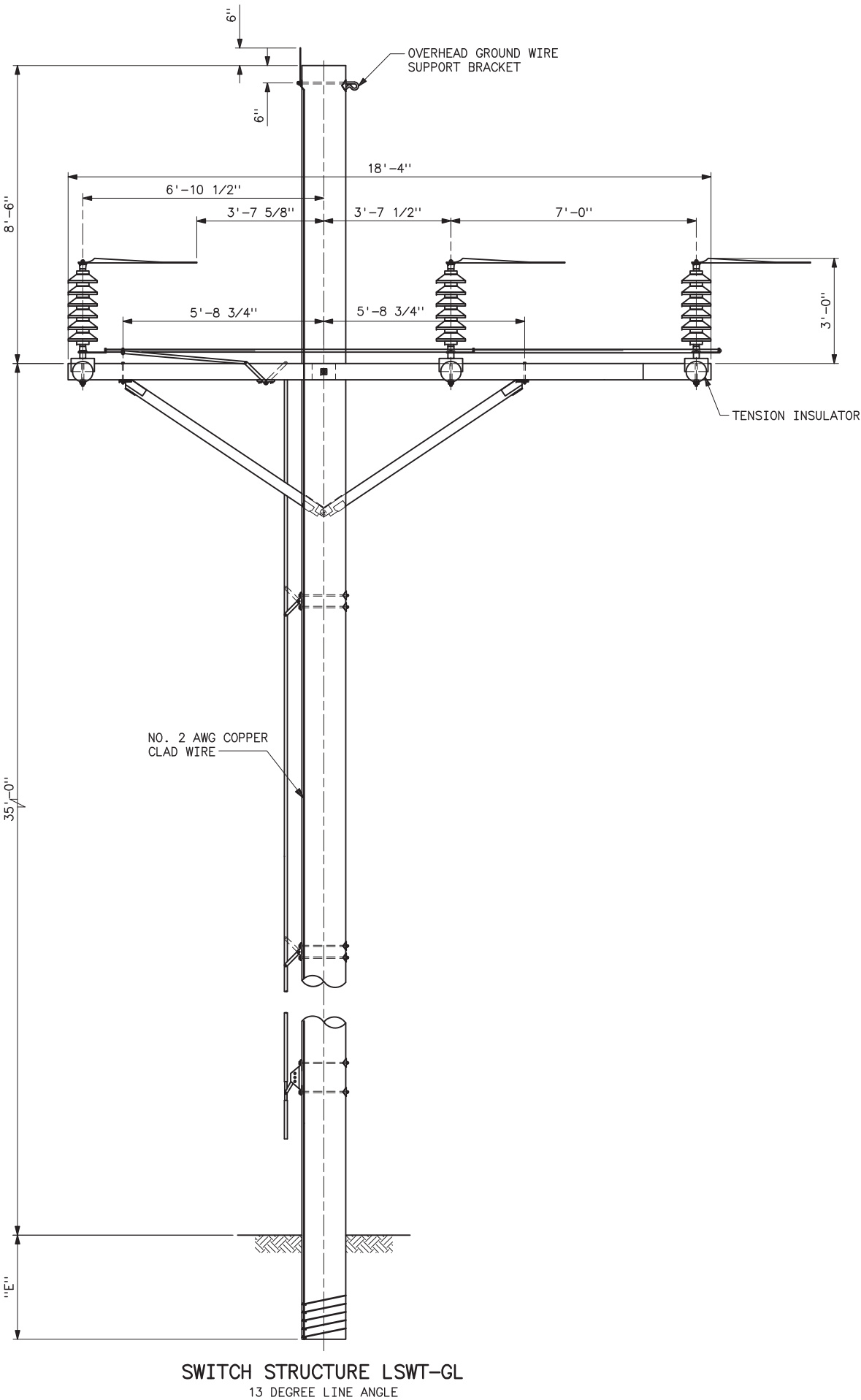


DETAIL OF INSULATOR ATTACHMENT
FOR CONDUCTOR
(SEE NOTE 14)

HARDWARE LIST

PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	LST-GL	
1	8	DEAD-END TEE EQUAL TO HUGHES BROS. NO. 2817-15-15C WITH BOLTS
2	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
3	8	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROTHERS NO. 2727)
4	4	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
5	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE





NOTES

- 1. OVERLOAD FACTOR:
NESC -----VERTICAL=1.5
TRANSVERSE (WIND)=1.65
TRANSVERSE (WIND TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND -----ALL=1.33
HIGH WIND: 85 MPH AT 60°F WITH 1.14 FACTOR FOR WIRE AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
- 2. STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
- 3. STRUCTURE GUYS ARE NOT PERMITTED.
- 4. GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE.
- 5. GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE AND GROUNDING MATERIALS BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
- 6. INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
- 7. POLES SHALL BE SET WITHIN 3" OF THE SPECIFIED SETTING.
- 8. GRADE B CONSTRUCTION.
- 9. PROVIDE BONDING FOR SWITCH PLATFORM.
- 10. 13 DEGREE LINE ANGLE.
- 11. TOTAL 3-POLE SWITCH WEIGHT=1525 LBS.

	CONDUCTOR: 266.8 KCM ACSR 26/7 "PARTRIDGE"		OPGW: 0.465", 0.304 LB/FT	
	SPAN BACK	SPAN AHEAD	SPAN BACK	SPAN AHEAD
SPAN	300	300	300	300
MAX DESIGN TENSION	2850	2850	3000	3000
HIGH WIND @ 60° F	2640	2640	2718	2718

REFERENCE DRAWINGS

- WOOD POLE STRUCTURES
- GROUNDING DETAILS -----41 1012
- WOOD POLE STRUCTURES
- OVERHEAD GROUND WIRE ASSEMBLY -----41 1019
- TENSION INSULATOR ASSEMBLIES -
- SINGLE STRING -----41 1022
- TENSION INSULATOR ASSEMBLIES -
- DOUBLE STRING -----41 1023
- OPTICAL GROUND WIRE ASSEMBLIES -----41 1031
- INERTIA ENGINEERING AND MACHINE WORKS
- 69KV, HORIZONTAL CONFIGURATION -----9316

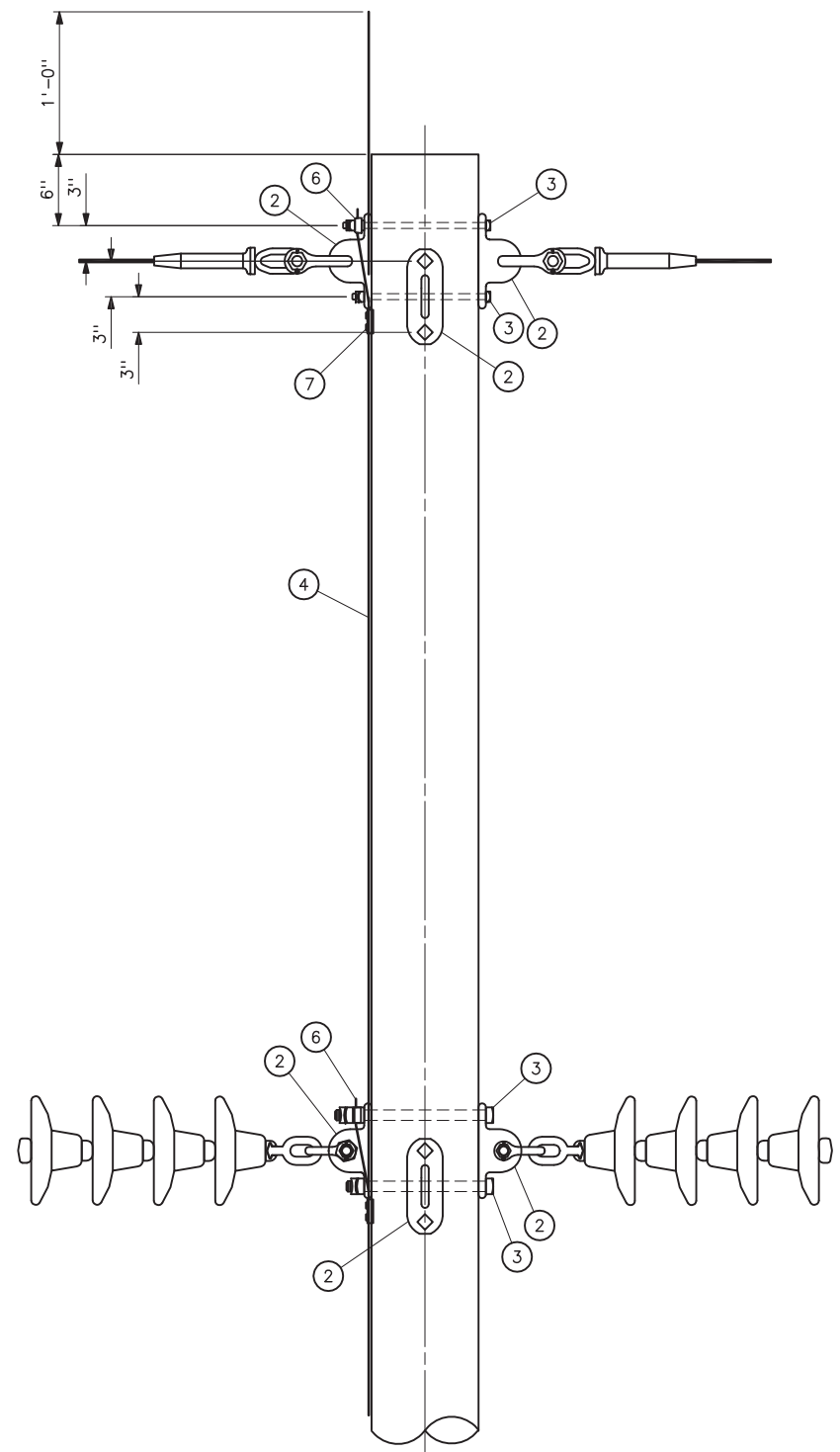
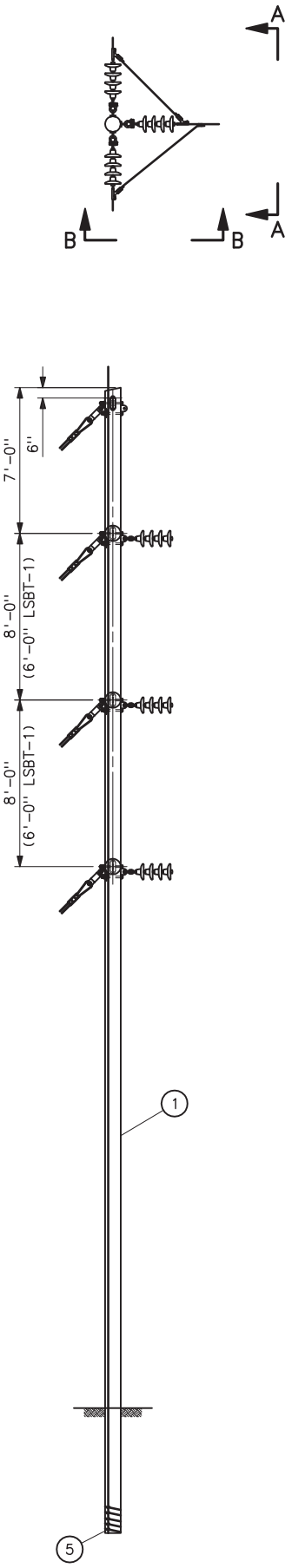
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGN
TRANSMISSION LINES
TYPE LSWT-GL 69-KV
SWITCH STRUCTURE-GLUED LAMINATED
LIGHT LOADING

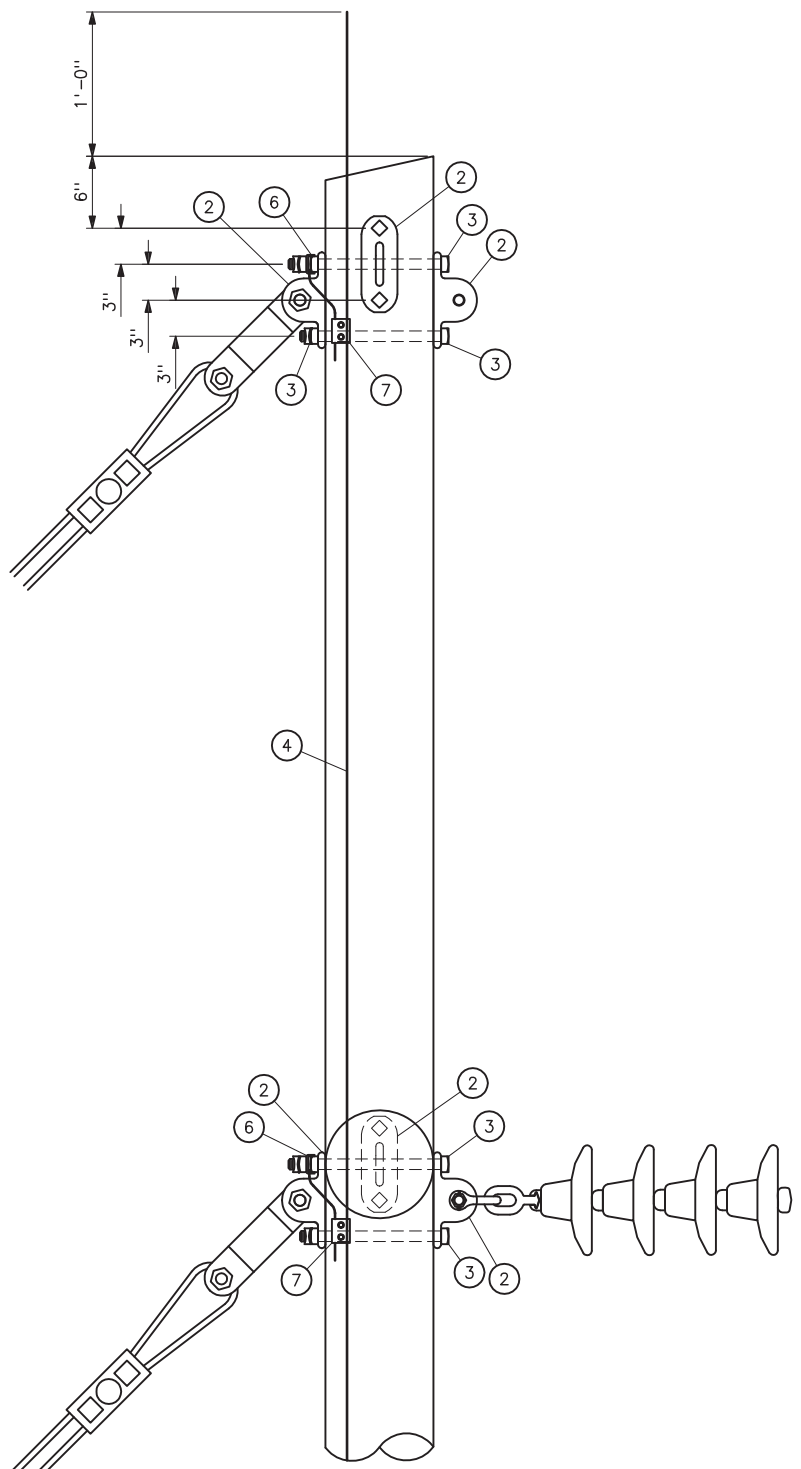
DESIGNED KAREN ROWE ----- APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER -----

C.A.F.	NOVEMBER 17, 2005	41	6146
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ELEVATION A-A



ELEVATION B-B

STRUCTURE MATERIAL		
PART NO.	QUANTITY STRUCTURE TYPE SBT-1 AND LSBT-1	DESCRIPTION
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	12	DEAD END TEE, HUGHES BROS NO. 2817R4.5-15-15C OR EQUAL
3	16	7/8"Ø BOLT WITH SQUARE HEAD, SQUARE NUT, AND LOCKNUT
4	AS REQ'D	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
5	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
6	8	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES NO. 2727) WITH NUT
7	8	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

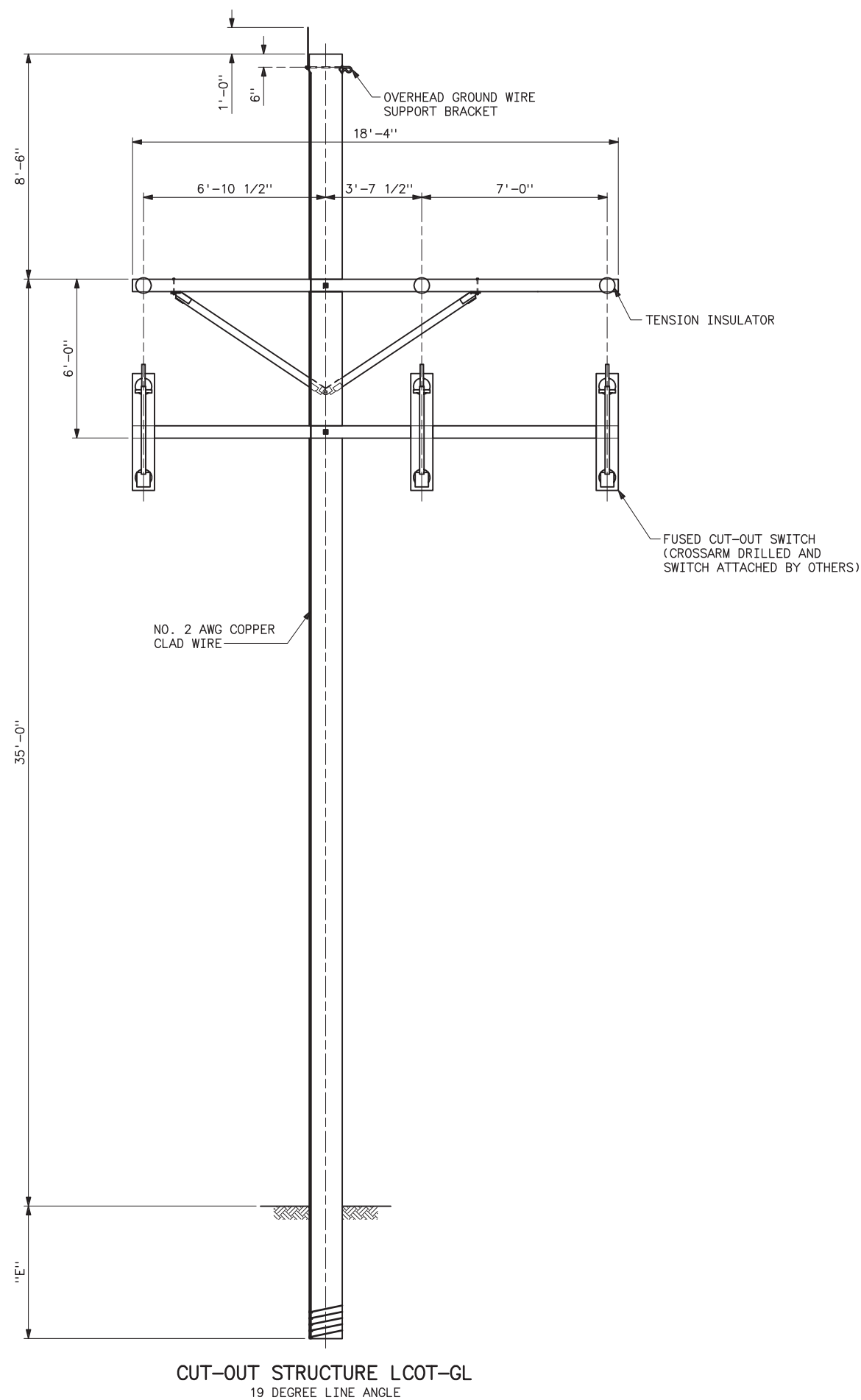
NOTES

1. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
2. HOLES IN WOOD SHALL BE DRILLED 1/8 INCH LARGER THAN BOLT DIAMETER.
3. NUMBER AND TYPE OF GUYS REQUIRED ARE SHOWN ON PLAN AND PROFILES.

REFERENCE DRAWINGS

GUY ASSEMBLIES AND DETAILS----- 41 6047
GUYING REQUIREMENTS FOR SINGLE POLE
CONSTRUCTION WITH OVERHEAD GROUND WIRE----- 41 6071
WOOD POLE STRUCTURES
GROUNDING DETAILS----- 41 1012
WOOD POLE STRUCTURES
OVERHEAD GROUND WIRE ASSEMBLY----- 41 1019
TENSION INSULATOR ASSEMBLIES-
SINGLE STRING----- 41 1022
TENSION INSULATOR ASSEMBLIES-
DOUBLE STRING----- 41 1023
OPTICAL GROUND WIRE ASSEMBLIES----- 41 1031

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE SBT-1 AND LSBT-1 69KV BRANCH LINE STRUCTURE		
DESIGNED <u>KAREN ROWE</u>	APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER	
C.A.F. NOVEMBER 18, 2005	41	6147



NOTES

- OVERLOAD FACTOR:
NESC -----VERTICAL=1.5
TRANSVERSE (WIND)=1.65
TRANSVERSE (WIND TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND -----ALL=1.33
- STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
- STRUCTURE GUYS ARE NOT PERMITTED.
- GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE.
- GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE AND GROUNDING MATERIALS BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
- INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
- POLES SHALL BE SET WITHIN 3" OF THE SPECIFIED SETTING.
- GRADE B CONSTRUCTION.
- PROVIDE BONDING FOR CUT-OUT SWITCH.
- 19 DEGREE LINE ANGLE.

	CONDUCTOR: 266.8 KCM ACSR 26/7 "PARTRIDGE"		OPGW: 0.465# 0.304 LB/FT	
	SPAN BACK	SPAN AHEAD	SPAN BACK	SPAN AHEAD
SPAN	300	300	300	300
MAX DESIGN TENSION	2850	2850	3000	3000
HIGH WIND 60°F	2640	2640	2718	2718

REFERENCE DRAWINGS

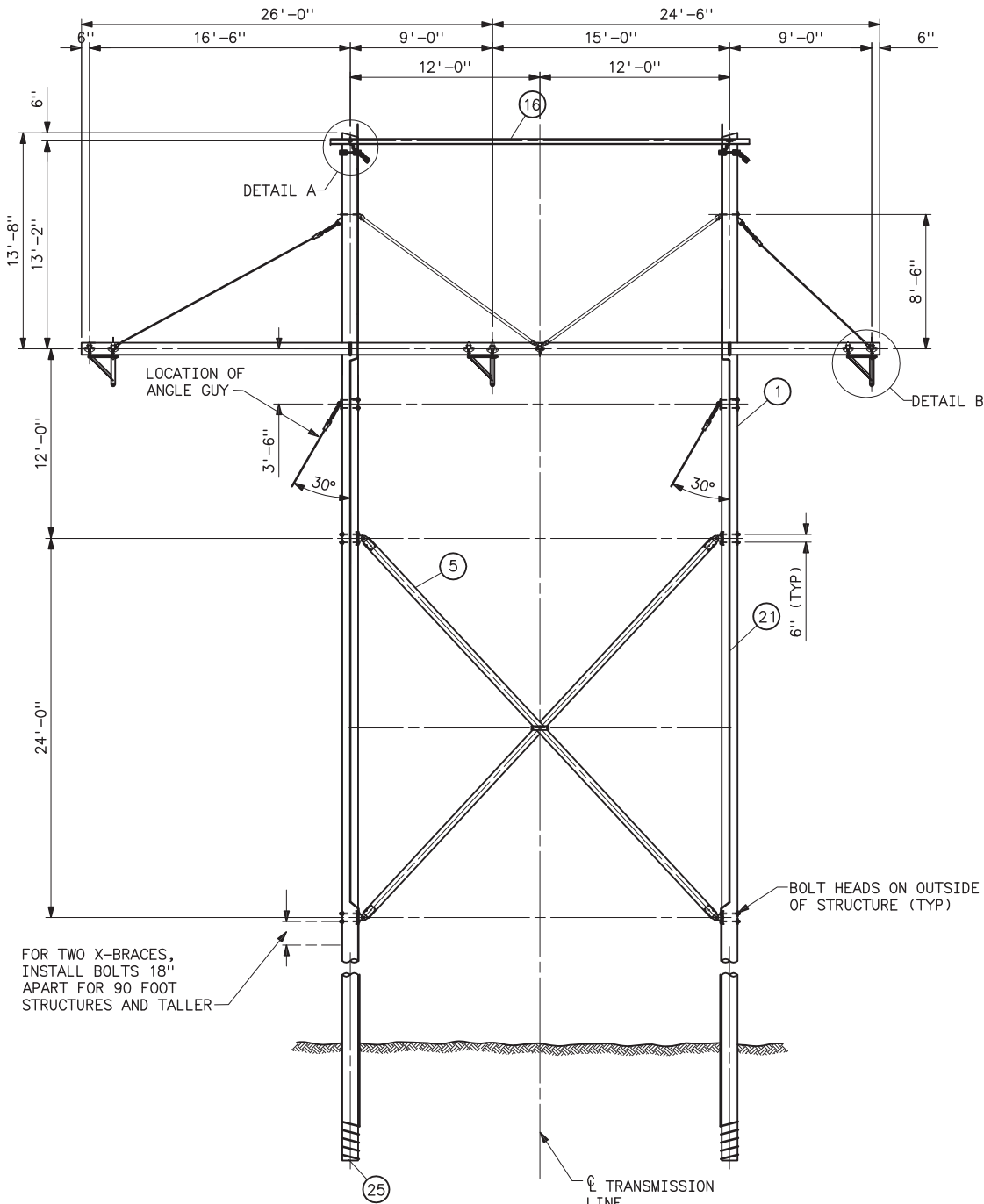
- WOOD POLE STRUCTURES
GROUNDING DETAILS -----41 1012
WOOD POLE STRUCTURES
OVERHEAD GROUND WIRE ASSEMBLY -----41 1019
TENSION INSULATOR ASSEMBLIES -
SINGLE STRING -----41 1022
TENSION INSULATOR ASSEMBLIES -
DOUBLE STRING -----41 1023
OPTICAL GROUND WIRE ASSEMBLIES -----41 1031

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

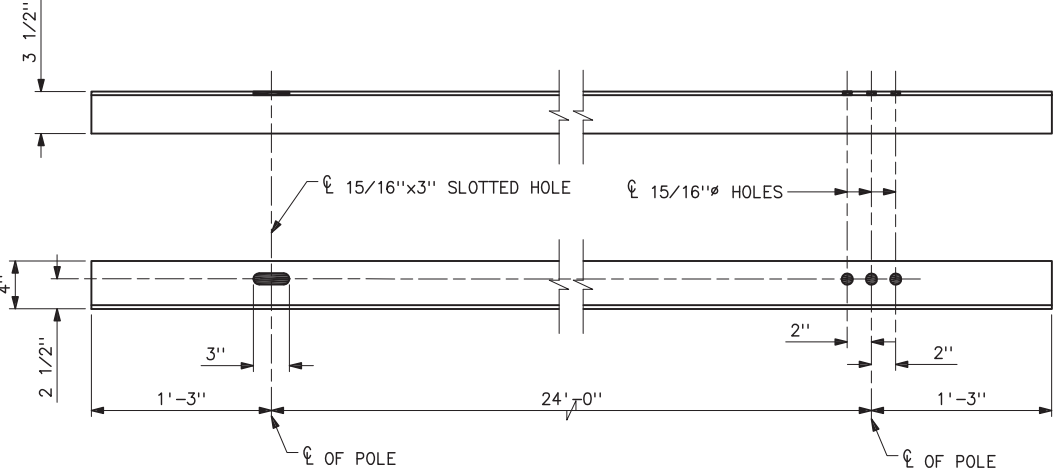
STANDARD DESIGNS
TRANSMISSION LINES
TYPE LCOT-GL 69-KV
CUT-OUT STRUCTURE LIGHT LOADING-GLUED LAMINATED

DESIGNED KAREN ROWE ----- APPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER -----

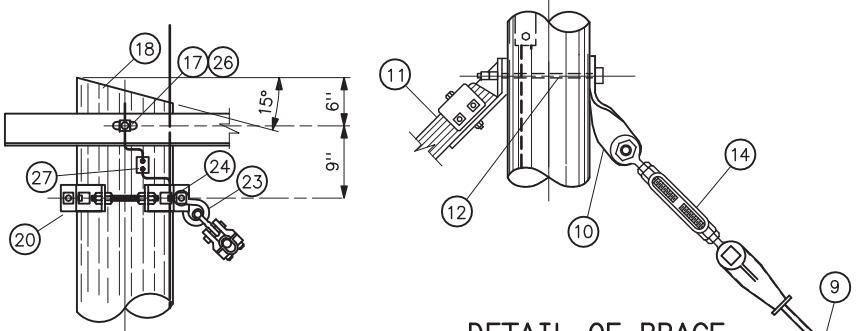
C.A.E. NOVEMBER 17, 2005 41 6148



ELEVATION

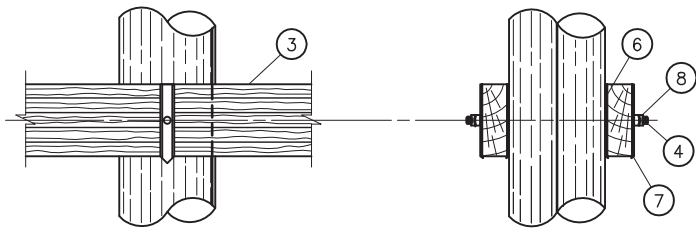


STEEL ANGLE (16)

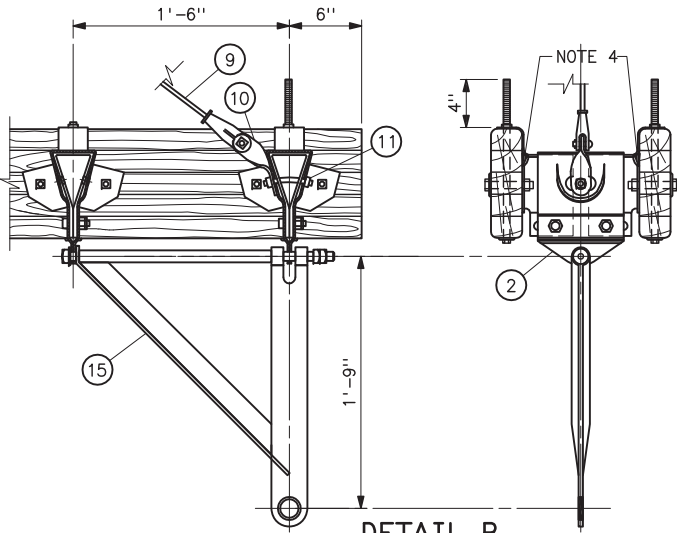


DETAIL A

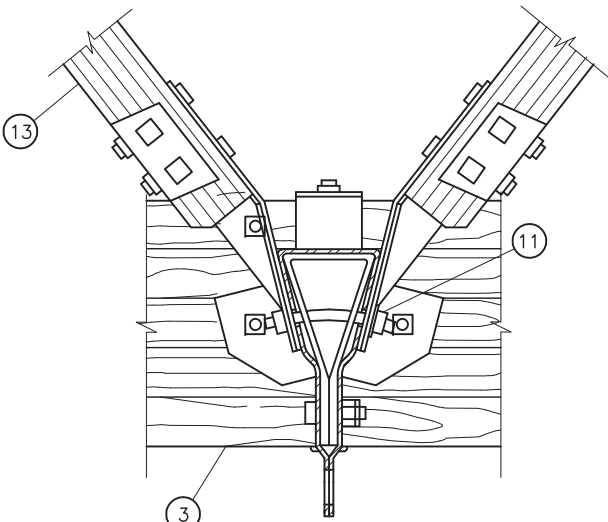
DETAIL OF BRACE ATTACHMENTS TO POLE



DETAIL OF WOOD CROSSARM ATTACHMENT TO POLE



DETAIL B



DETAIL OF CENTER ATTACHMENT OF V-BRACE

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	CLASS 1 POLE, SEE STRUCTURE LIST FOR HEIGHT
2	7	ADJUSTABLE SPACER FITTING, COMPLETE WITH BOLTS, NUTS AND WASHERS (HUGHES BROS. TYPE 3414 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x50-6
4	2	DOUBLE ARMING BOLT, 7/8" x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6(HUGHES BROS NO. 2121 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (EQUAL TO HUGHES BROS. NO. AS2276)
11	3	7/8" x REQUIRED LENGTH BENT STUD WITH LOCK WASHERS AND LOCKNUTS THREADED BOTH SIDES
12	2	7/8" x REQUIRED LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
13	2	WOOD VEE BRACE 3 1/2x7 1/2 COMPLETE WITH FITTINGS, 8'-6" DROP, SPACING VARIES WITH POLE DIAMETER
14	2	TURNBUCKLE (HUGHES BROS. AS2545-B OR EQUAL)
15	3	SWINGING ANGLE BRACKET, COMPLETE WITH FITTINGS (HUGHES BROS. NO. 2821.8 OR EQUAL)
16	1	STEEL ANGLE, 4x3 1/2x3/8x26-6 LONG
17	2	MACHINE BOLT, 7/8" x REQUIRED LENGTH WITH LOCKNUT, SPRING LOCK WASHER AND 4x4x1/4 CURVED WASHER ON BACK SIDE
18	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY.

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
20	2	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) (SEE NOTE 6)
	4	1/2"x4 LAG SCREWS (2 PER BAND)
	4	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
21	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
23	2	TWISTED SHACKLE (EQUAL TO HUGHES BROS. NO. 2866)
24	2	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). (EQUAL TO HUGHES BROS. 2718.55)
25	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
26	2	BONDING CLIP (EQUAL TO HUGHES BROS. NO. 2727)
27	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

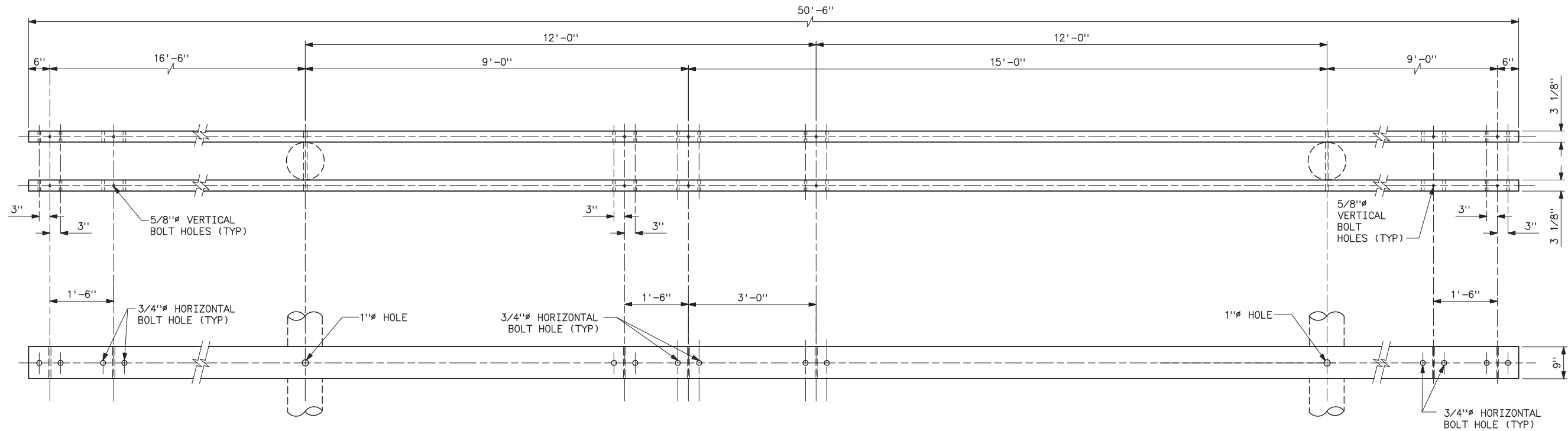
NOTES

1. STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
4. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16" LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
5. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.
6. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
WOOD POLE STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLY	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
GUY ASSEMBLIES AND DETAILS	41 6047
STANDARD GUY ARRANGEMENT, 2 POLE	
ANGLE STRUCTURES	41 6052
TYPICAL DETAILS FOR DEAD-END TEES	41 6138
CROSSARM DRILLING DETAILS	
230KV HA-1 STRUCTURE	41 6150

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HA-1 230KV SMALL ANGLE SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
DECEMBER 21, 2005	41	6149



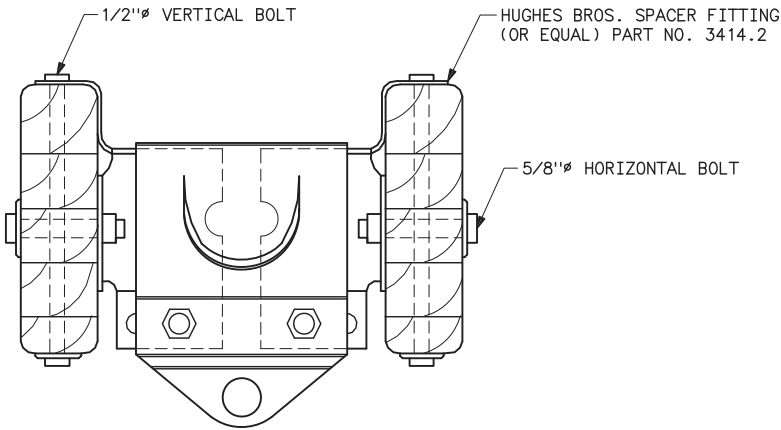
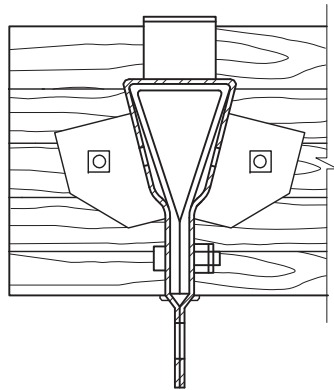
230-KV HA-1 CROSSARM DRILLING DETAILS

NOTES

- 1. CROSSARMS SHALL BE GLUED LAMINATED.
- 2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.

REFERENCE DRAWING

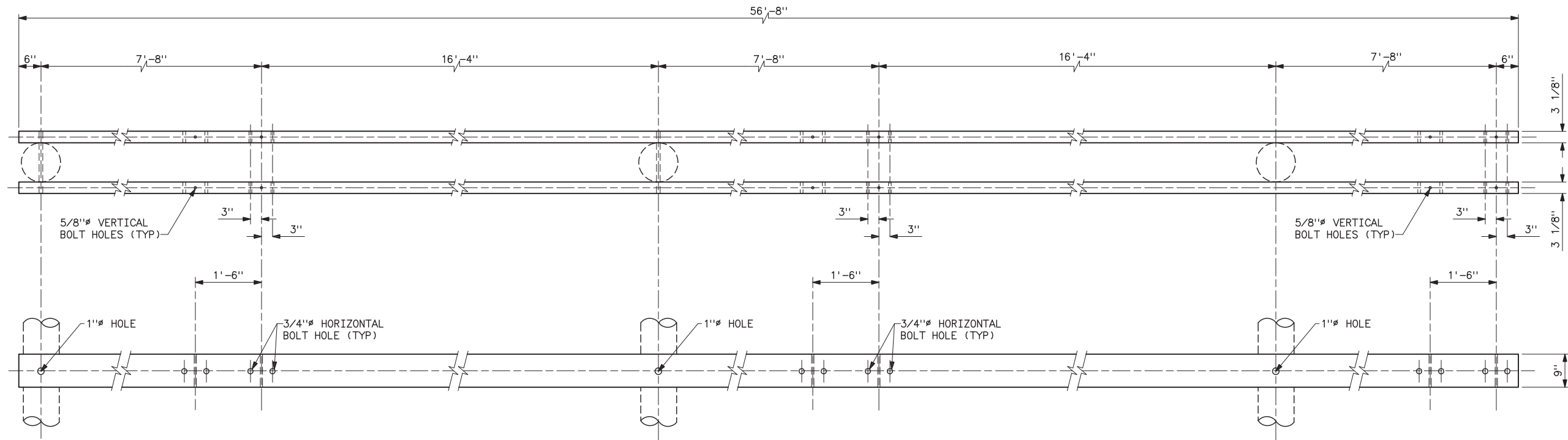
TYPE HA-1 230KV SMALL ANGLE
SUSPENSION STRUCTURE ----- 41 6149



ADJUSTABLE PHASE FITTING

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINE CROSSARM DRILLING DETAILS 230KV HA-1 STRUCTURE WITH ADJUSTABLE PHASE FITTINGS		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
CA 6150	DECEMBER 21, 2005	41 6150

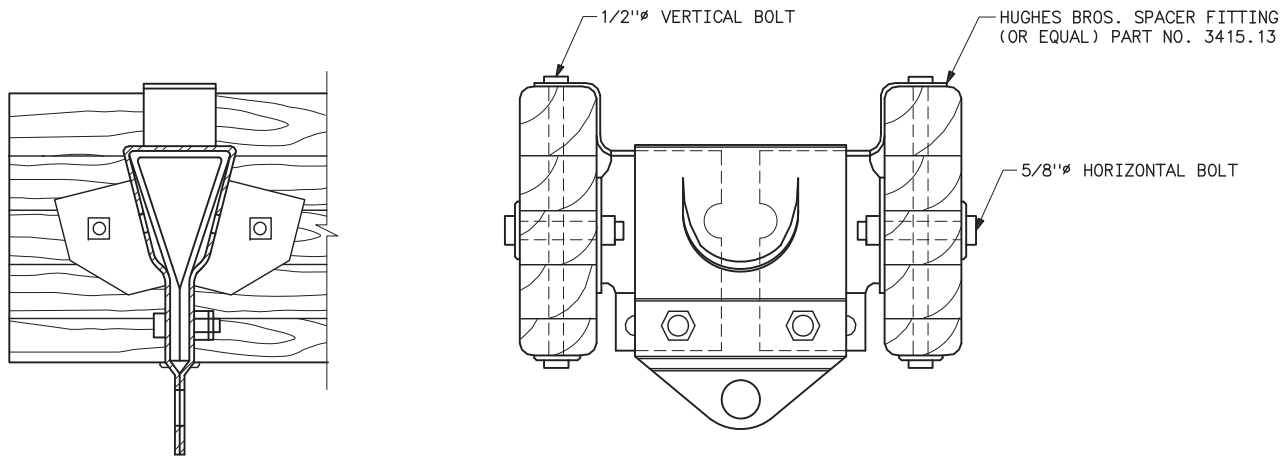
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230-KV 3AC-1 CROSSARM DRILLING DETAILS

NOTES

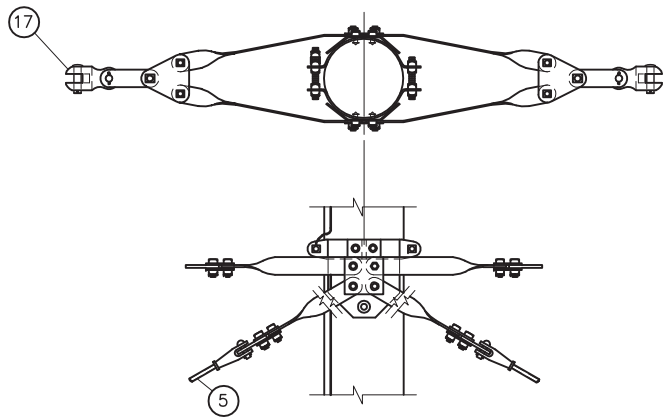
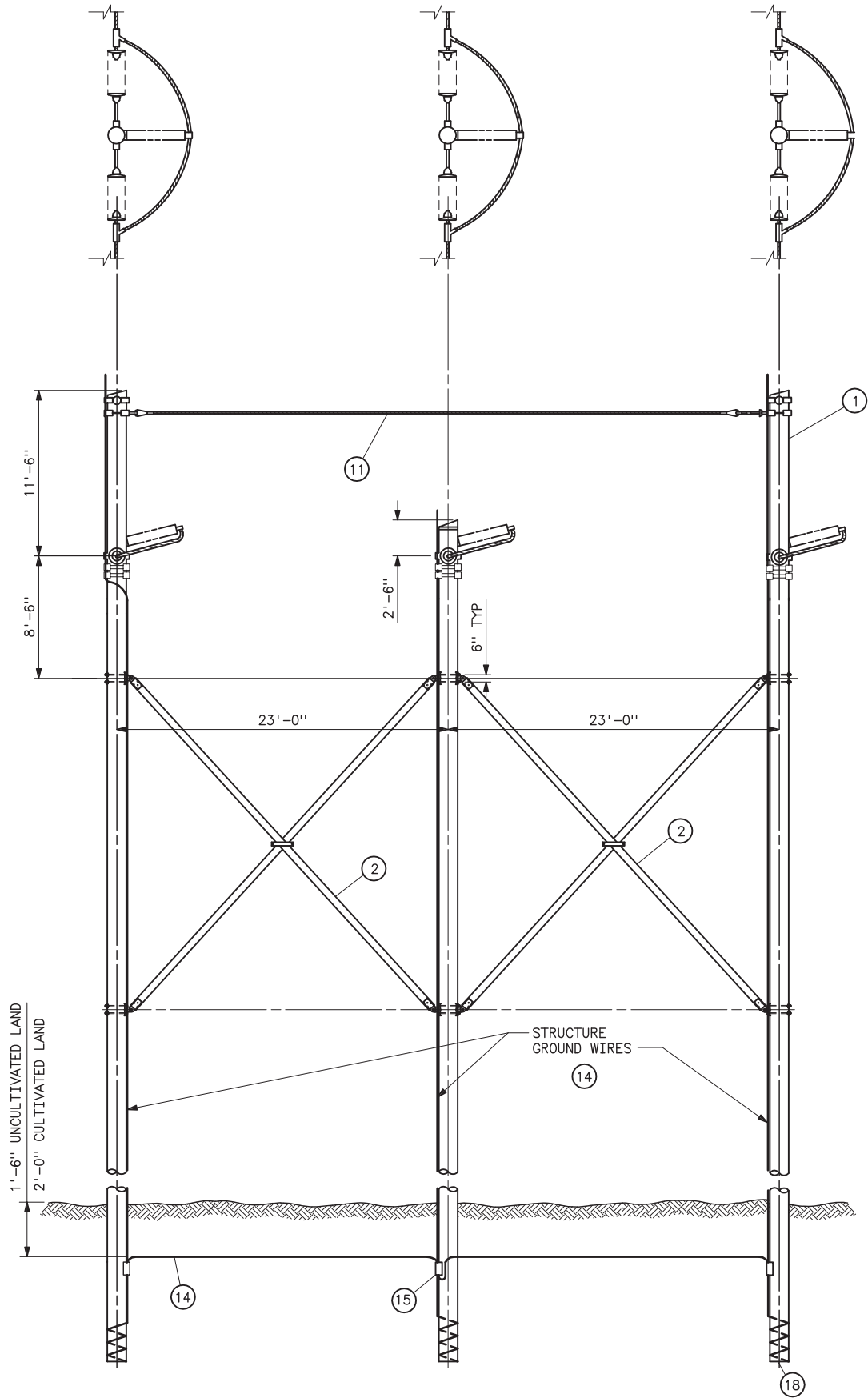
- 1. CROSSARMS SHALL BE GLUED LAMINATED.
- 2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.



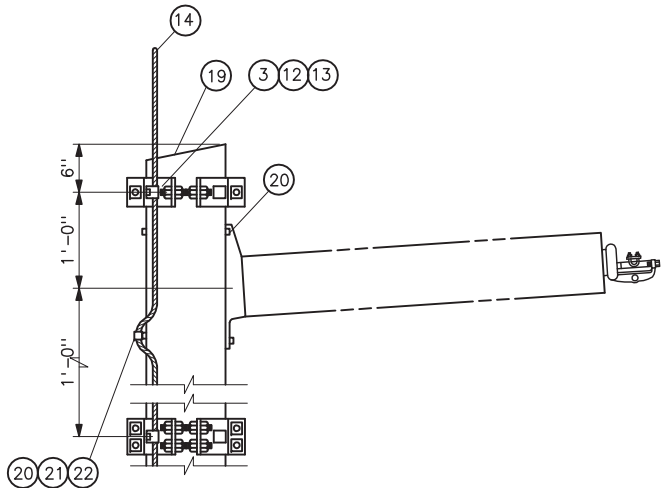
ADJUSTABLE PHASE FITTING

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINE CROSSARM DRILLING DETAILS 230KV 3AC-1 STRUCTURE WITH ADJUSTABLE PHASE FITTINGS		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
CAE	DECEMBER 21, 2005	41 6151

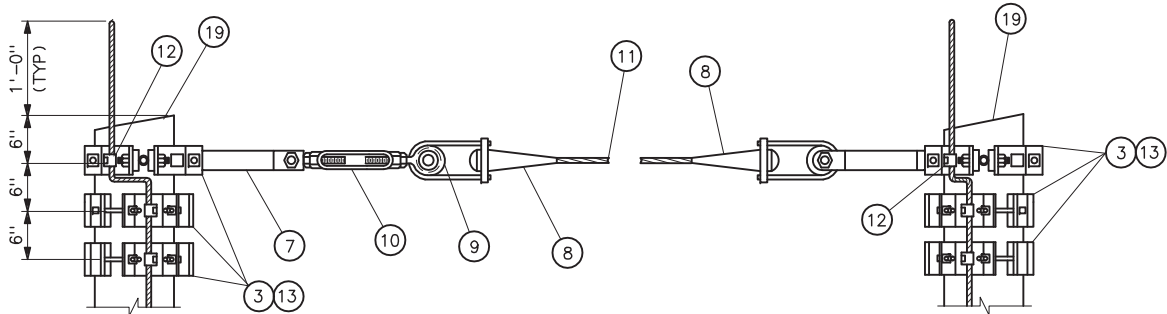
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DETAIL OF INSULATOR ATTACHMENT ④
(0° LINE ANGLE)



POST INSULATOR ASSEMBLY



OGW ATTACHMENT
(0° LINE ANGLE)

STRUCTURE MATERIAL

PART NO.	ANGLE		DESCRIPTION
	0°		
1	3		POLE, SEE STRUCTURE LIST FOR LENGTH
2	2		X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS NO. 2121 OR EQUAL)
3	7		FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
4	3		POLE BAND ASSEMBLY, HUGHES B1784-VV OR APPROVED EQUAL
5	6		FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6			
7	6		CONNECTING LINK, PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK W/BNK
8	2		DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	2		SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	1		TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD		STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
12	7		1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	14		LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD		NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3		PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
16	4		OVERHEAD GROUND WIRE TENSION ASSEMBLY
17	6		CLEVIS-CLEVIS 90° W/BNK, 40,000 LBS
18	3		POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
19	3		POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL

PART NO.	QUANTITY		DESCRIPTION
	0°		
20	6		7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6		4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
22	3		BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

NOTES

1. THE 3TD STRUCTURE IS USED FOR CASCADE PREVENTION.
2. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
3. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
4. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
5. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
TYPICAL DETAILS FOR DEAD END TEES	41 6138

UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - GOLDEN, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE 3TD 230KV
3-POLE TENSION DEAD END STRUCTURE

DESIGNED KAREN ROWE APPROVED DOUG HANSON
CIVIL ENGINEERING
MANAGER

C_A_FEBRUARY 15, 2006416152

OPTICAL GROUND WIRE SPLICE STRUCTURE MATERIALS

PART NO.	QUANTITY	DESCRIPTION
1	4*	DEAD-END TEE, HUGHES BROS. NO. 2817R4.5-15-15C OR EQUAL
2	2	DUCTILE DEAD END THIMBLE EQUAL TO ANDERSON TYPE DDT-07 WITH BNK, 40,000 LBS. ULT. STRENGTH (SEE NOTE 6)
3	4	7/8"Ø BOLT WITH SQUARE HEAD, SQUARE NUT AND LOCKNUT
4	2	BOND CLIP EQUAL TO HUGHES BROS. NO. 2727.8
5	1	PARALLEL GROOVE CLAMP 2-BOLT COPPER ALLOY
6	AS REQ'D	NO. 2 AWG COPPER CLAD WIRE

EXPLANATION

* _ _ _ _ _ SEE NOTES 4 AND 5

NOTES

1. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
2. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
3. FOR INSTALLATION ON TANGENT H-FRAME OR TENSION STRUCTURES ONLY.
4. THE DOUBLE GUYING DEAD-END TEE OPTION CAN BE USED IN PLACE OF TWO SINGLE DEAD-END TEES. THE ULTIMATE STRENGTH OF THE DOUBLE GUYING DEAD-END TEE HUGHES BROS NO. AS2720 IS 35,000 POUNDS PER ATTACHMENT. EACH ATTACHMENT CAN ACCOMMODATE UP TO ONE DOUBLE GUY.
5. OTHER DEAD-END TEES MAY BE USED AS LONG AS THE ULTIMATE STRENGTH PER ATTACHMENT IS AT LEAST 29,000 POUNDS.
6. A LINK AND ROLLER EQUAL TO HUGHES BROTHERS 3154 LINK AND 28062 ROLLER MAY ALSO BE USED.

REFERENCE DRAWINGS

OPTICAL GROUND WIRE ASSEMBLIES_ _ _ _ _ 41 1031
GUY ASSEMBLIES AND DETAILS_ _ _ _ _ 41 6047

* DOUBLE GUYING DEAD-END TEE
HUGHES BROS NO. AS2720
OR EQUAL (SEE NOTE 4)

A11-8-13A7-KKR

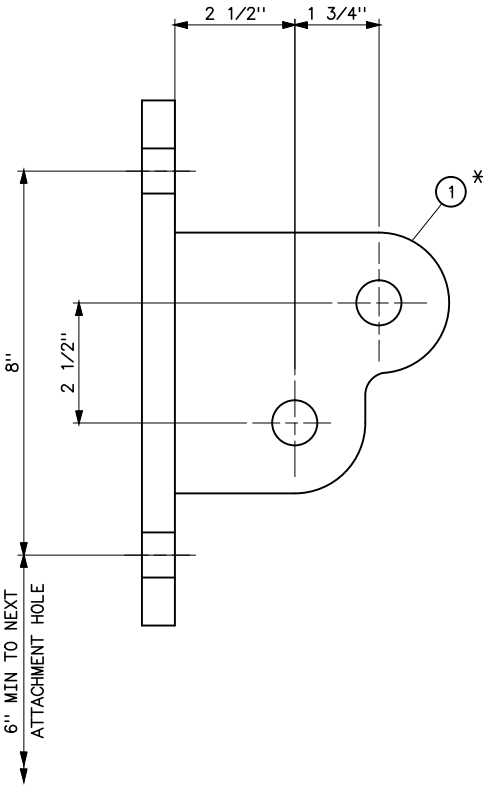
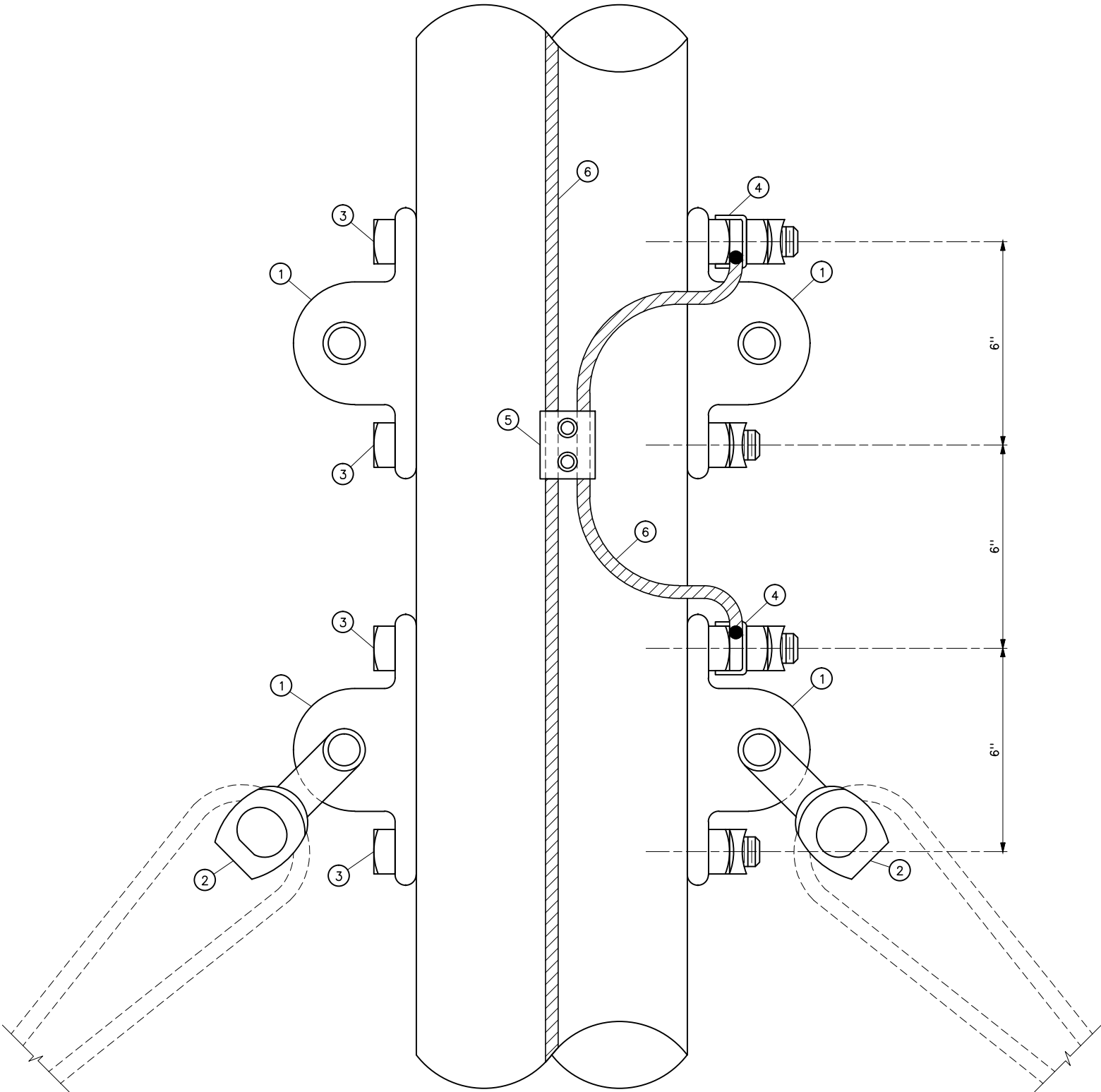
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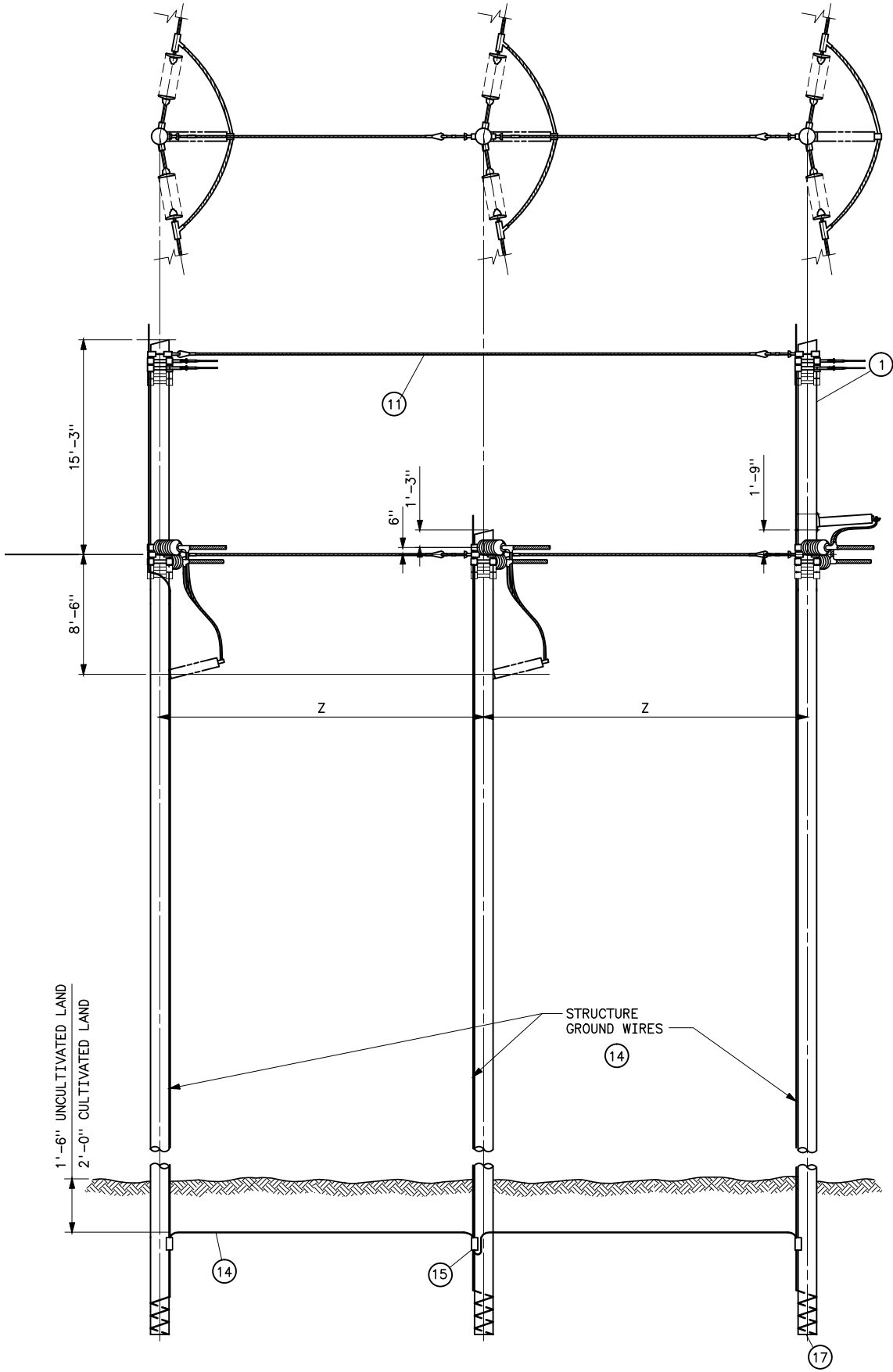
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPICAL DETAILS FOR OPTICAL
GROUND WIRE SPLICE STRUCTURES

DESIGNED KAREN ROWEAPPROVED DOUG HANSON
CIVIL ENGINEERING MANAGER

CAEFEBRUARY 28, 2006416153





VOLTAGE	Z			
	ANGLE TURNED IN DEGREES			
	10°-30°	30°-45°	45°-60°	60°-90°
230KV	23'-0"	28'-0"	35'-0"	48'-0"

STRUCTURE MATERIAL				
PART NO.	ANGLE	ANGLE	ANGLE	DESCRIPTION
	10°-30°	30°-60°	60°-90°	
1	3	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	9	9	9	FOUR-WAY STRAIN POLE BAND; HUGHES 3112 SERIES, JOSLYN J25969 SERIES; OR, APPROVED EQUAL
3	11	7	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
5	6	6	—	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6	6	6	6	CONNECTING LINK; PAIR W/BNK HUGHES 3157, JOSLYN J26035; OR, APPROVED EQUAL
7	10	10	10	CONNECTING LINK, PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK W/BNK
8	6	6	6	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	6	6	6	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	3	3	3	TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD	AS REQD	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
12	20	16	15	1/2# GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	22	14	12	LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD	AS REQD	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3	3	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
16	4	4	4	OVERHEAD GROUND WIRE TENSION ASSEMBLY
17	3	3	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
18	3	3	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL

PART NO.	QUANTITY	DESCRIPTION
	10°-90°	
19	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
20	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
21	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

NOTES

- FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
- ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
- MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
- FOR 10°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) OR DEADEND TEES FOR GUYING ON EACH OUTSIDE POLE. FOR 30°-90° LINE ANGLES USE, DEAD-END TEES DIRECTLY OPPOSITE OF OGW ATTACHMENT FOR GUYING.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.
- THE DISTANCE BETWEEN DEAD-END TEE MOUNTING HOLES SHALL BE 6 INCHES.

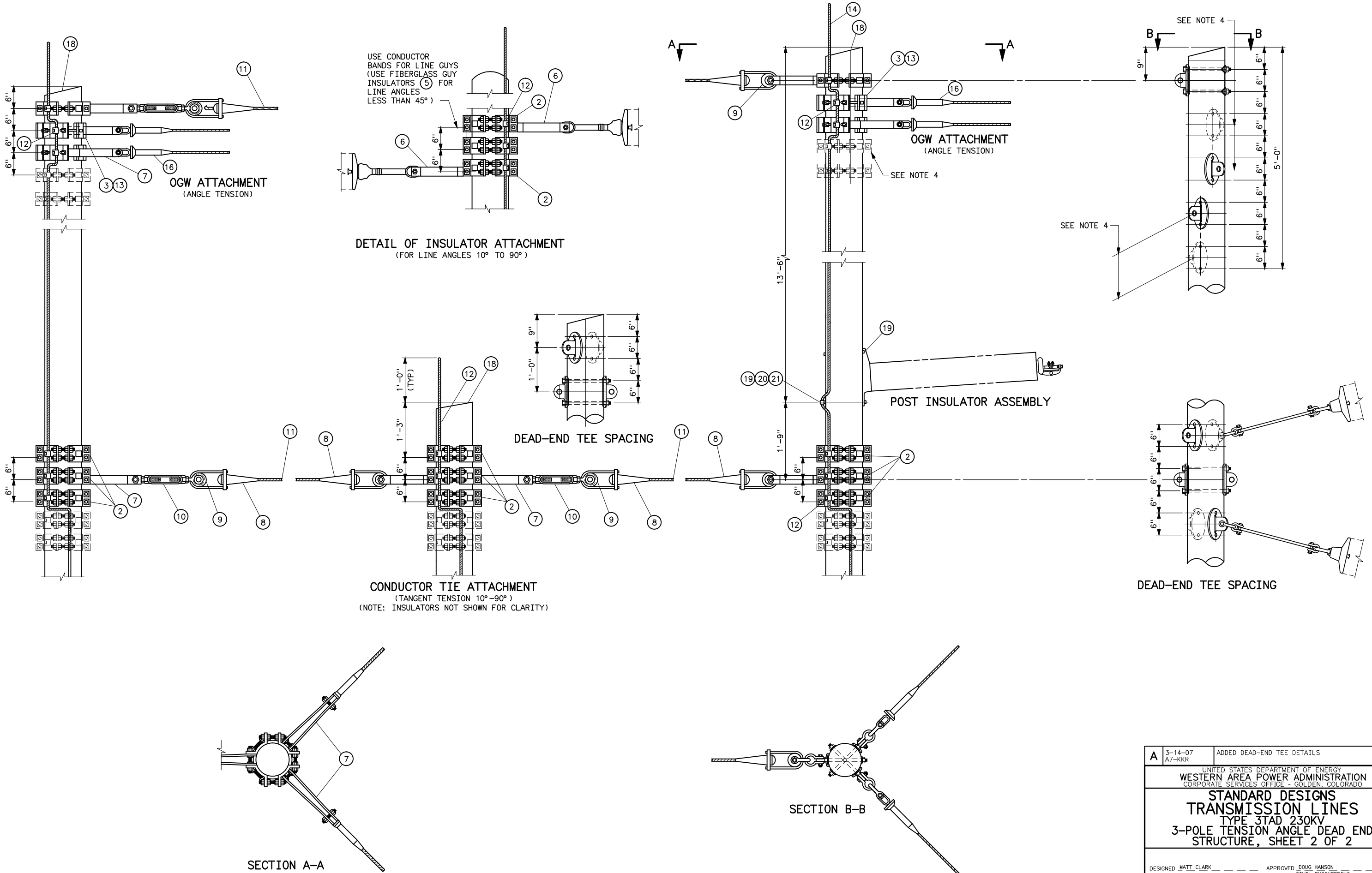
REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TAD STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6155
TYPICAL DETAILS FOR DEAD END TEES	41 6138

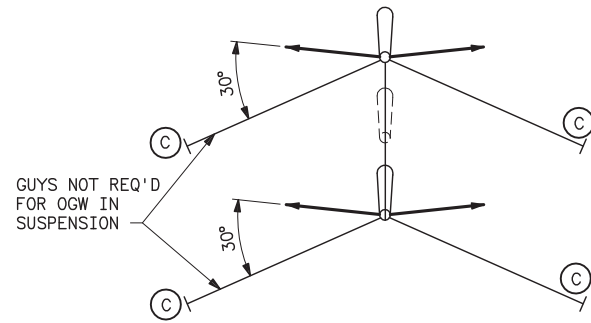
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STANDARD DESIGNS TRANSMISSION LINES TYPE 3TAD 230KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 1 OF 2			
DESIGNED <u>MATT CLARK</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER			
A	APRIL 3, 2006	41	6154-1

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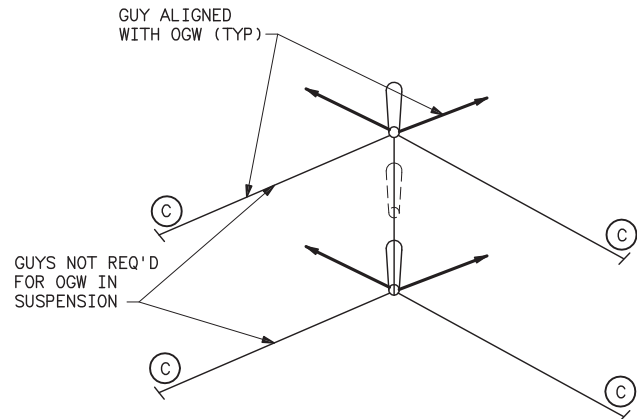
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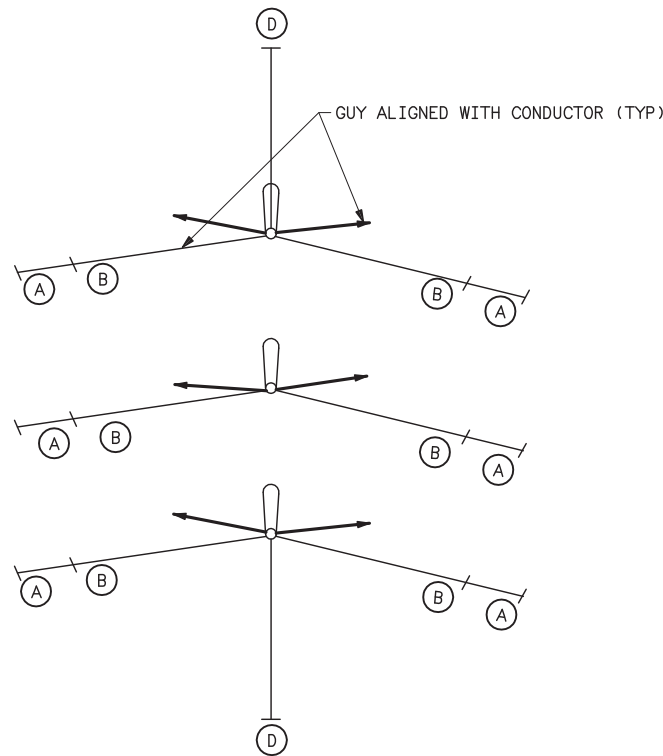
A	3-14-07 A7-KKR	ADDED DEAD-END TEE DETAILS	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
	STANDARD DESIGNS TRANSMISSION LINES TYPE 3TAD 230KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 2 OF 2		
DESIGNED <u>MATT CLARK</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER			
A	APRIL 3, 2006	41	6154-2



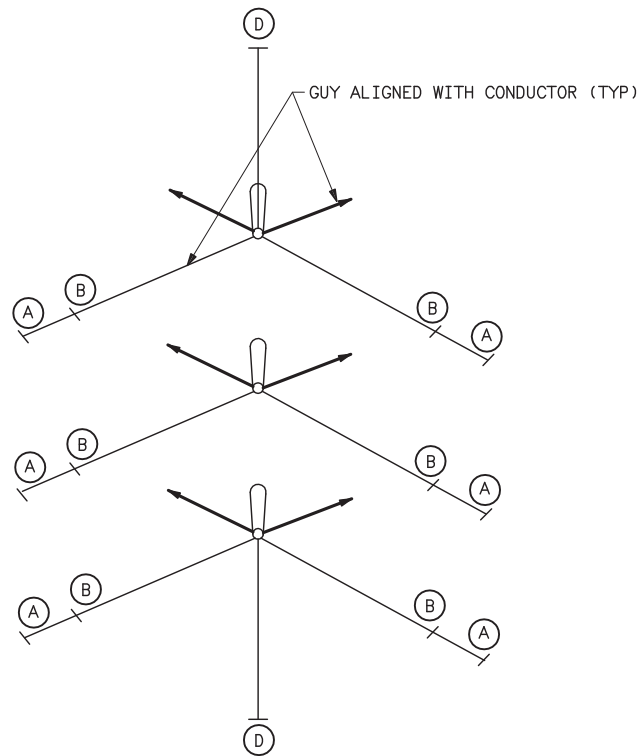
SECTION C-C



SECTION E-E



SECTION D-D



SECTION F-F

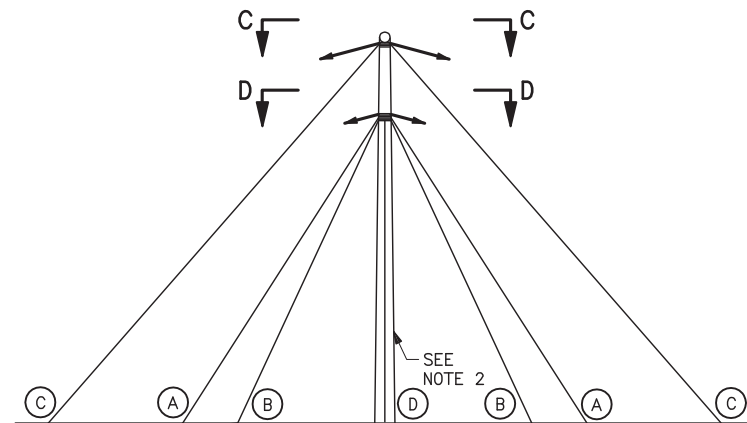


FIGURE 1
OGW AND CONDUCTOR LINE GUYING FOR LINE ANGLES 10° TO 30°

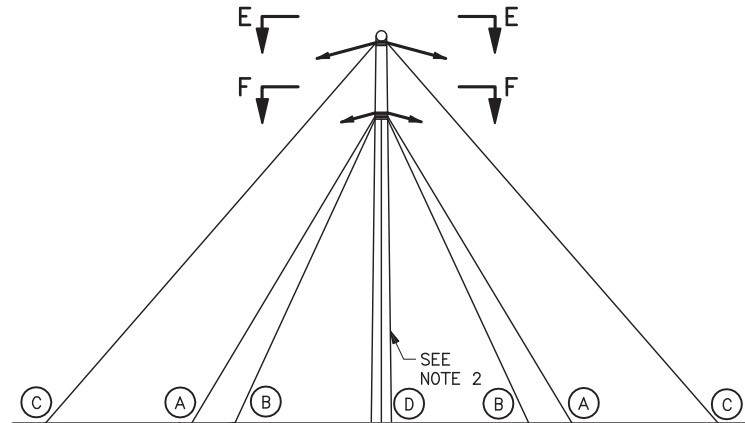


FIGURE 2
OGW AND CONDUCTOR LINE GUYING FOR LINE ANGLES 30° TO 90°

GUY AND ANCHOR REFERENCE CHART			
LINE GUYING			
CONDUCTOR GUYS	OGW GUYS	ANCHOR REF	NO. OF ANCHORS
3LDGEW-1SSGEW	2LDGEW	(A) (C) (D)	12
3LSGEW-3LDGEW-1SDGEW	2LDGEW	(A) (B) (C) (D)	18
6LDGEW-1SDGEW	2LDGEW	(A) (B) (C) (D)	18

OGW --- OVERHEAD GROUND WIRE
COND --- CONDUCTOR
LSGEW --- LINE SINGLE GUY EACH WAY
LDGEW --- LINE DOUBLE GUY EACH WAY
SSGEW --- SIDE SINGLE GUY EACH WAY
SDGEW --- SIDE DOUBLE GUY EACH WAY
--- OGW AND CONDUCTOR
○ --- ANCHOR IDENTIFICATION REFERENCE

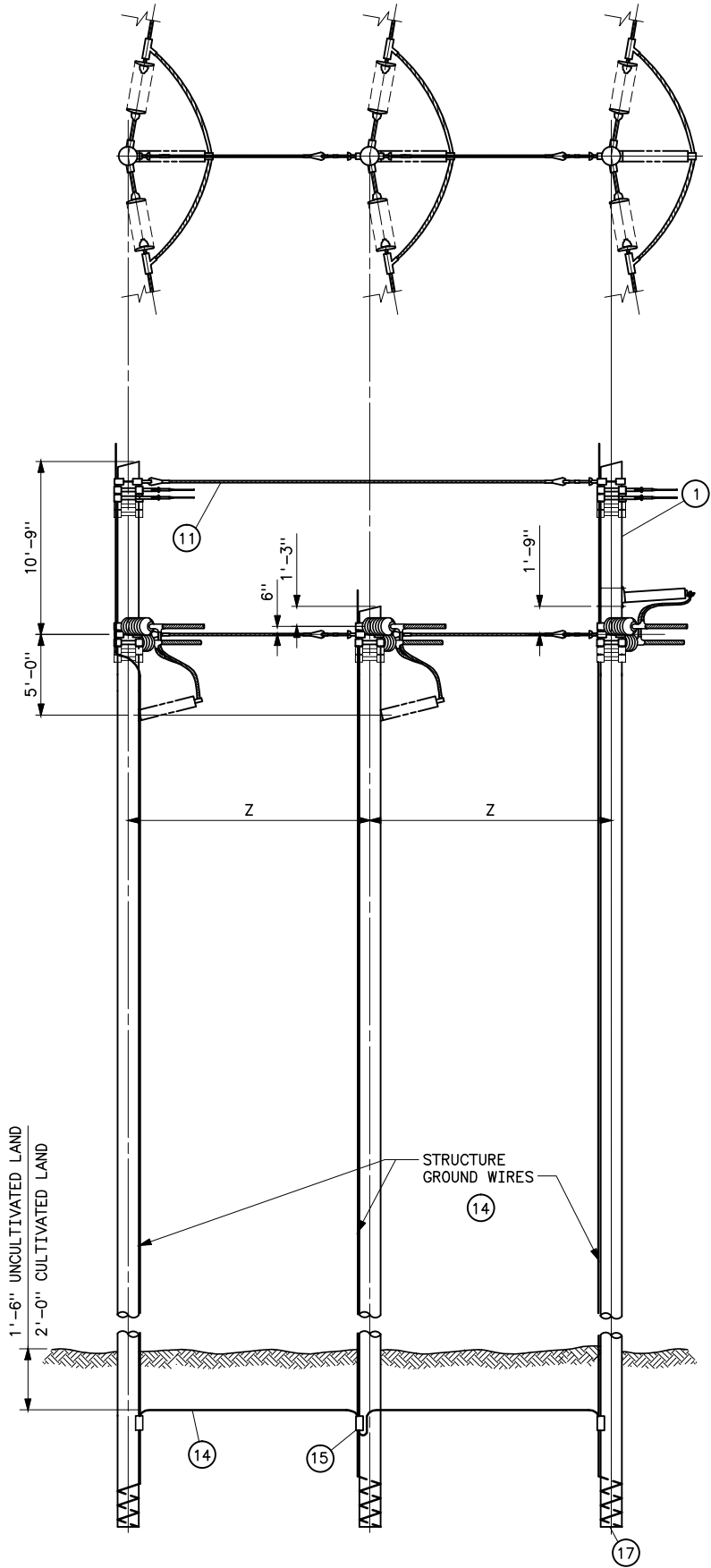
NOTES

1. RAKE POLES AS FOLLOWS:
OGW: SUSPENSION 10°-60°
OGW: TENSION 10°-90°
2. POLE RAKE SHALL BE 1/4-INCH FOR EACH FOOT OF POLE ABOVE GROUND. RAKE SHALL BE AGAINST THE STRAIN.
3. REFER TO DRAWING NO. 41 6047 FOR ANCHOR SPACING.
4. REFER TO PLAN AND PROFILE DRAWINGS FOR ACTUAL GUY QUANTITIES AND TYPES AT EACH SITE.

REFERENCE DRAWING

GUY ASSEMBLIES AND DETAILS -----41 6047

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TAD STRUCTURES STANDARD GUY ARRANGEMENT			
DESIGNED MATT CLARK	APPROVED DOUG HANSON		
CIVIL ENGINEERING MANAGER			
APRIL 3, 2006	41	6155	



VOLTAGE	Z				
	ANGLE TURNED IN DEGREES				
	10°-30°	30°-45°	45°-60°	60°-90°	
69KV	14'-0"	19'-0"	25'-0"	33'-0"	
115KV	15'-0"	21'-0"	27'-0"	35'-0"	

STRUCTURE MATERIAL				
PART NO.	ANGLE	ANGLE	ANGLE	DESCRIPTION
	10°-30°	30°-60°	60°-90°	
1	3	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	9	9	9	FOUR-WAY STRAIN POLE BAND; HUGHES 3112 SERIES, JOSLYN J25969 SERIES; OR, APPROVED EQUAL
3	11	7	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
5	6	6	—	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6	6	6	6	CONNECTING LINK; PAIR W/BNK HUGHES 3157, JOSLYN J26035; OR, APPROVED EQUAL
7	10	10	10	CONNECTING LINK, PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK W/BNK
8	6	6	6	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	6	6	6	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	3	3	3	TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD	AS REQD	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
12	20	16	15	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	22	14	12	LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD	AS REQD	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3	3	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
16	4	4	4	OVERHEAD GROUND WIRE TENSION ASSEMBLY
17	3	3	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
18	3	3	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL

PART NO.	QUANTITY	DESCRIPTION
	10°-90°	
19	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
20	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
21	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

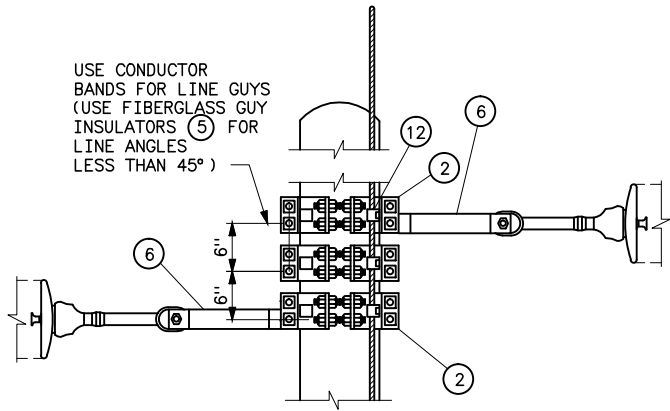
NOTES

- FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
- ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
- MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
- FOR 10°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) OR DEADEND TEES FOR GUYING ON EACH OUTSIDE POLE. FOR 30°-90° LINE ANGLES USE, DEAD-END TEES DIRECTLY OPPOSITE OF OGW ATTACHMENT FOR GUYING.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.
- THE DISTANCE BETWEEN DEAD-END TEE MOUNTING HOLES SHALL BE 6 INCHES.

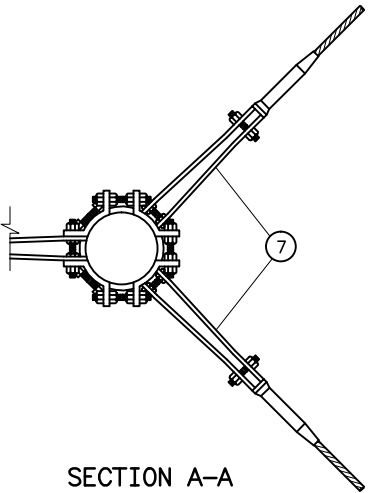
REFERENCE DRAWINGS

WOOD POLE STRUCTURES
GROUNDING DETAILS _____ 41 1012
OVERHEAD GROUND WIRE ASSEMBLY
DETAILS FOR WOOD POLE STRUCTURES _____ 41 1019
TENSION INSULATOR ASSEMBLIES
SINGLE STRING _____ 41 1022
DOUBLE STRING _____ 41 1023
OPTICAL GROUND WIRE ASSEMBLIES _____ 41 1031
TYPE 3TAD STRUCTURES
STANDARD GUY ARRANGEMENT _____ 41 6155
TYPICAL DETAILS FOR DEAD END TEES _____ 41 6138

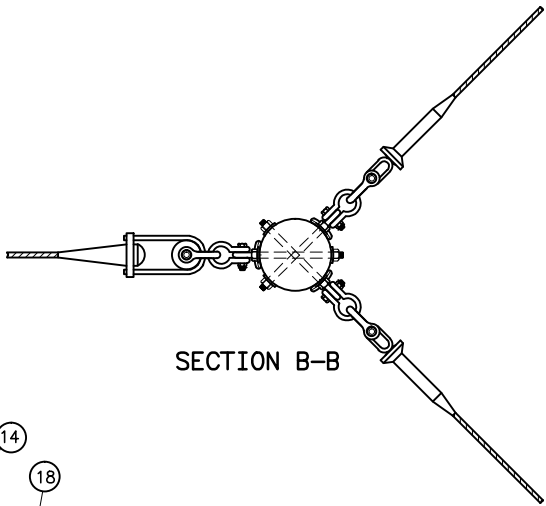
A	3-14-07 A7-KKR	ADDED NOTE 6, ADDED TO NOTE 4, CHANGED SPACING	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TAD 69 AND 115KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 1 OF 2			
DESIGNED <u>MATT CLARK</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER			
A F	APRIL 3, 2006	41	6156-1



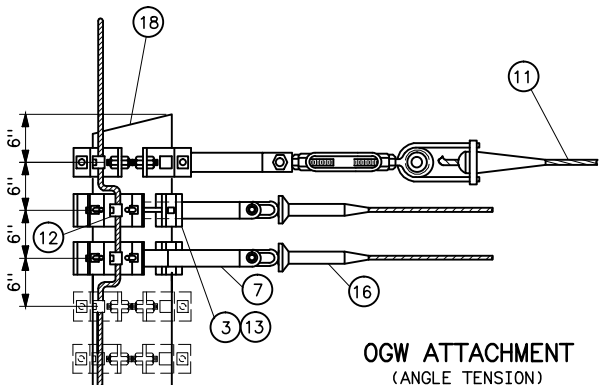
DETAIL OF INSULATOR ATTACHMENT
(FOR LINE ANGLES 10° TO 90°)



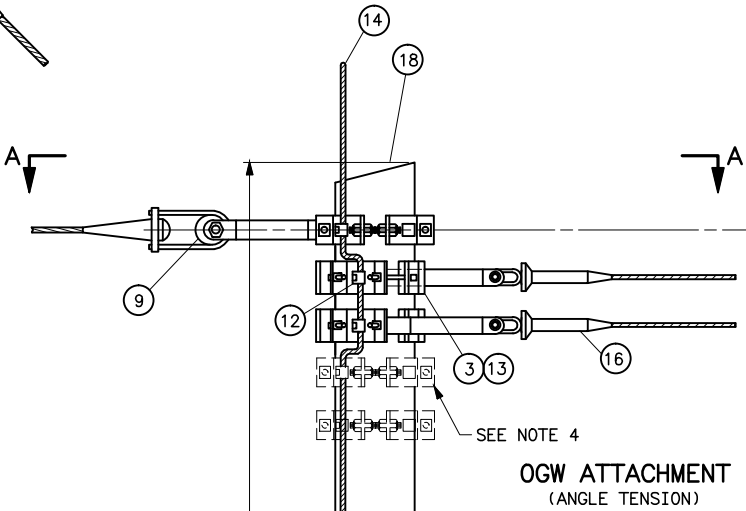
SECTION A-A



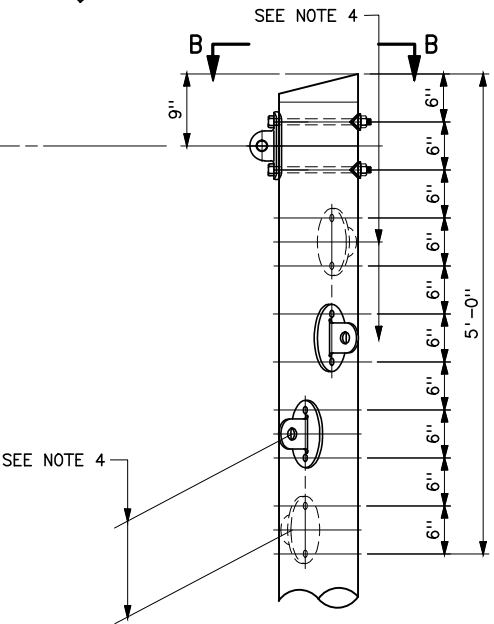
SECTION B-B



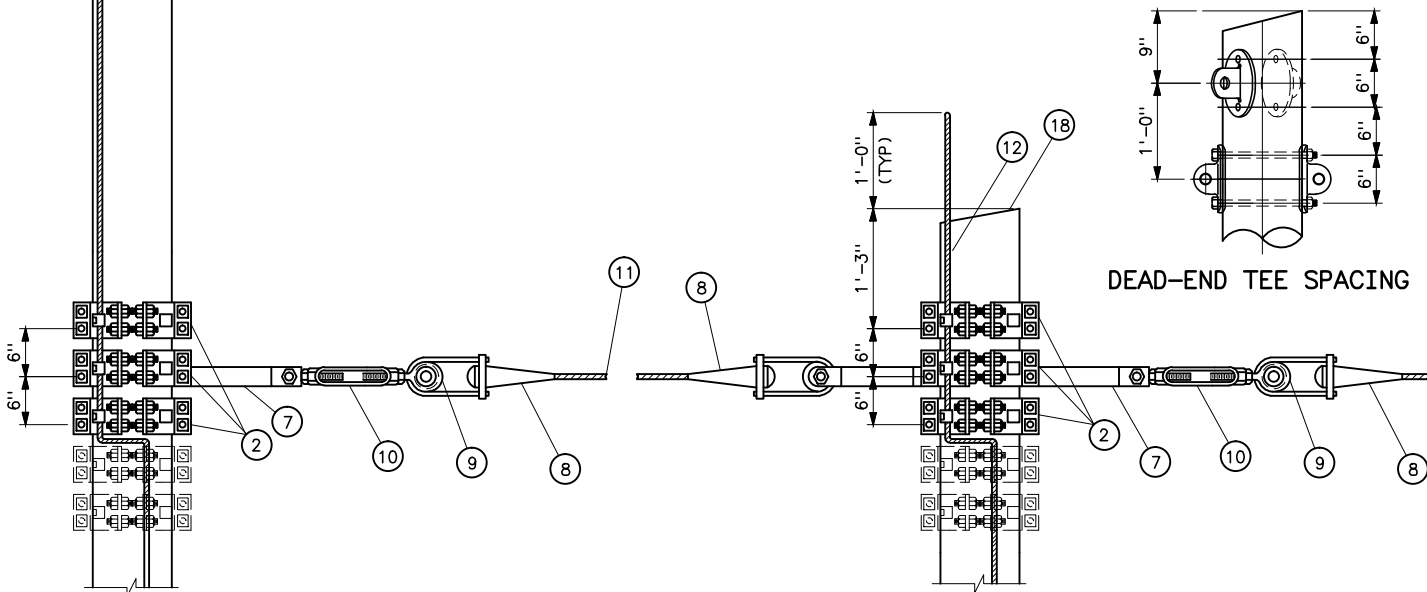
OGW ATTACHMENT
(ANGLE TENSION)



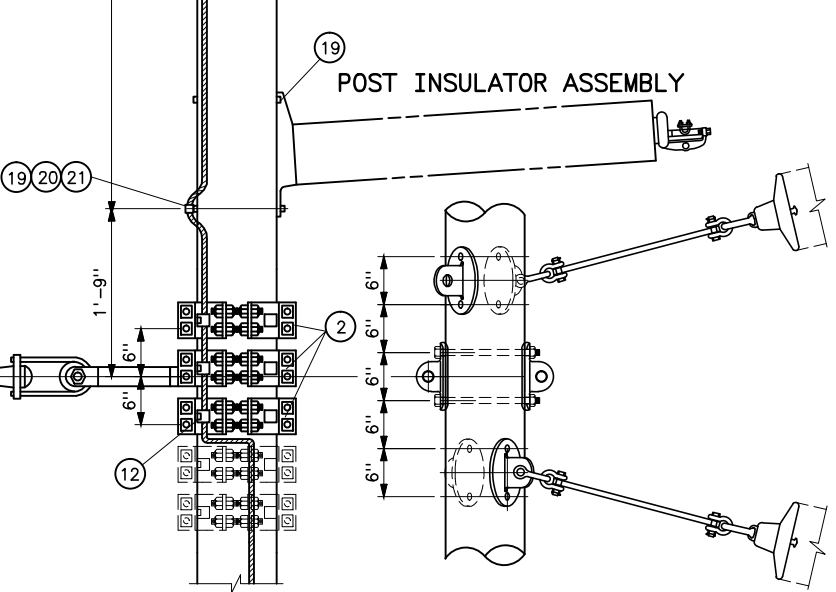
OGW ATTACHMENT
(ANGLE TENSION)



DEAD-END TEE SPACING

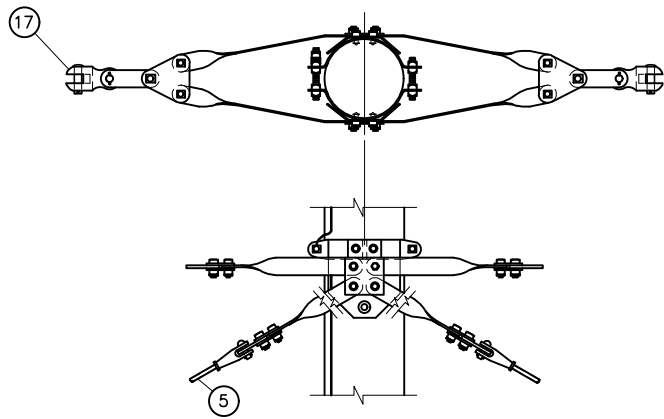
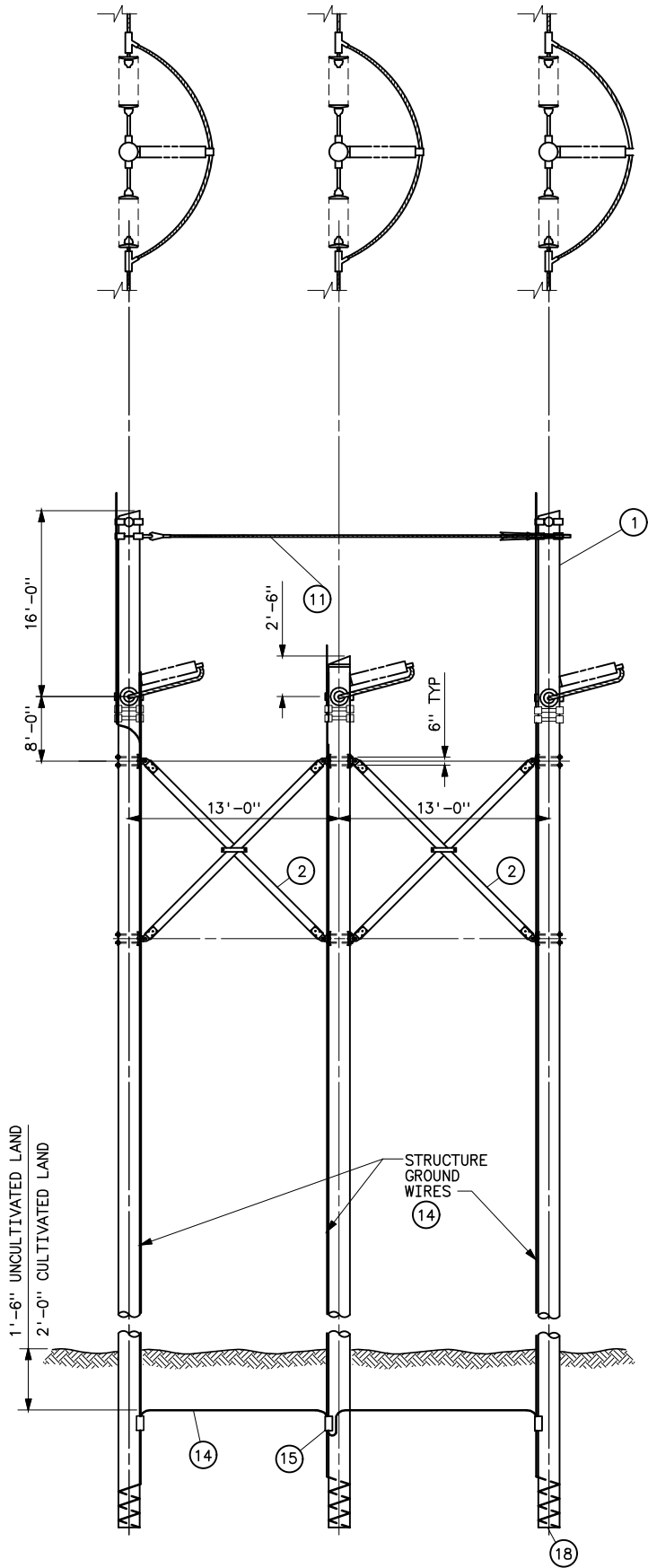


CONDUCTOR TIE ATTACHMENT
(TANGENT TENSION 10°-90°)
(NOTE: INSULATORS NOT SHOWN FOR CLARITY)

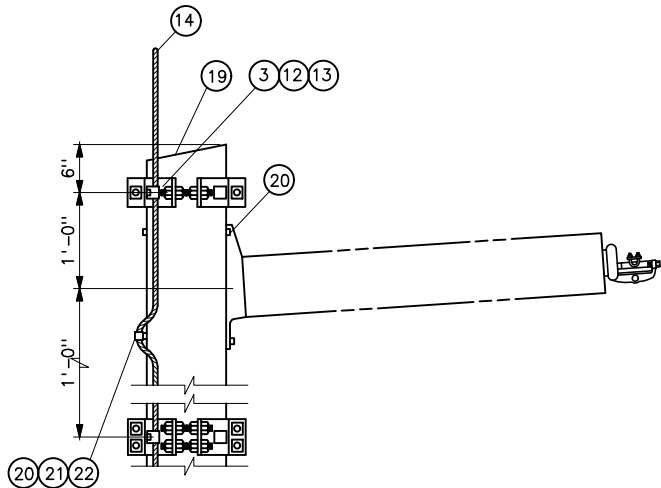


DEAD-END TEE SPACING

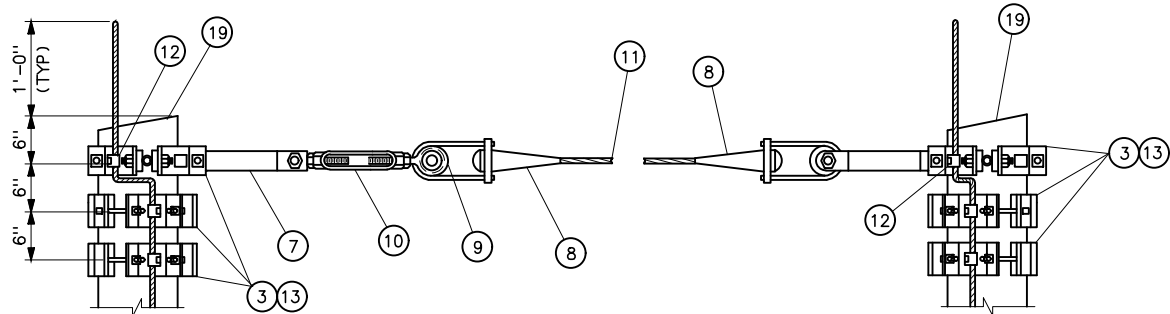
A	3-14-07 A7-KKR	ADDED DEAD-END TEE DETAILS
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TAD 69 AND 115KV 3-POLE TENSION ANGLE DEAD END STRUCTURE, SHEET 2 OF 2		
DESIGNED <u>MATT CLARK</u>	APPROVED <u>DOUG HANSON</u> CIVIL ENGINEERING MANAGER	A APRIL 3, 2006 41 6156-2



DETAIL OF INSULATOR ATTACHMENT ④
(0° LINE ANGLE)



POST INSULATOR ASSEMBLY



OGW ATTACHMENT
(0° LINE ANGLE)

STRUCTURE MATERIAL		
PART NO.	ANGLE	DESCRIPTION
	0°	
1	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	2	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS NO. 2121 OR EQUAL)
3	7	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
4	3	POLE BAND ASSEMBLY, HUGHES B1784-VV OR APPROVED EQUAL
5	6	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6		
7	6	CONNECTING LINK, PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK W/BNK
8	2	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	2	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	1	TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
12	7	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	14	LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
16	4	OVERHEAD GROUND WIRE TENSION ASSEMBLY
17	6	CLEVIS-CLEVIS 90° W/BNK, 40,000 LBS
18	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
19	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

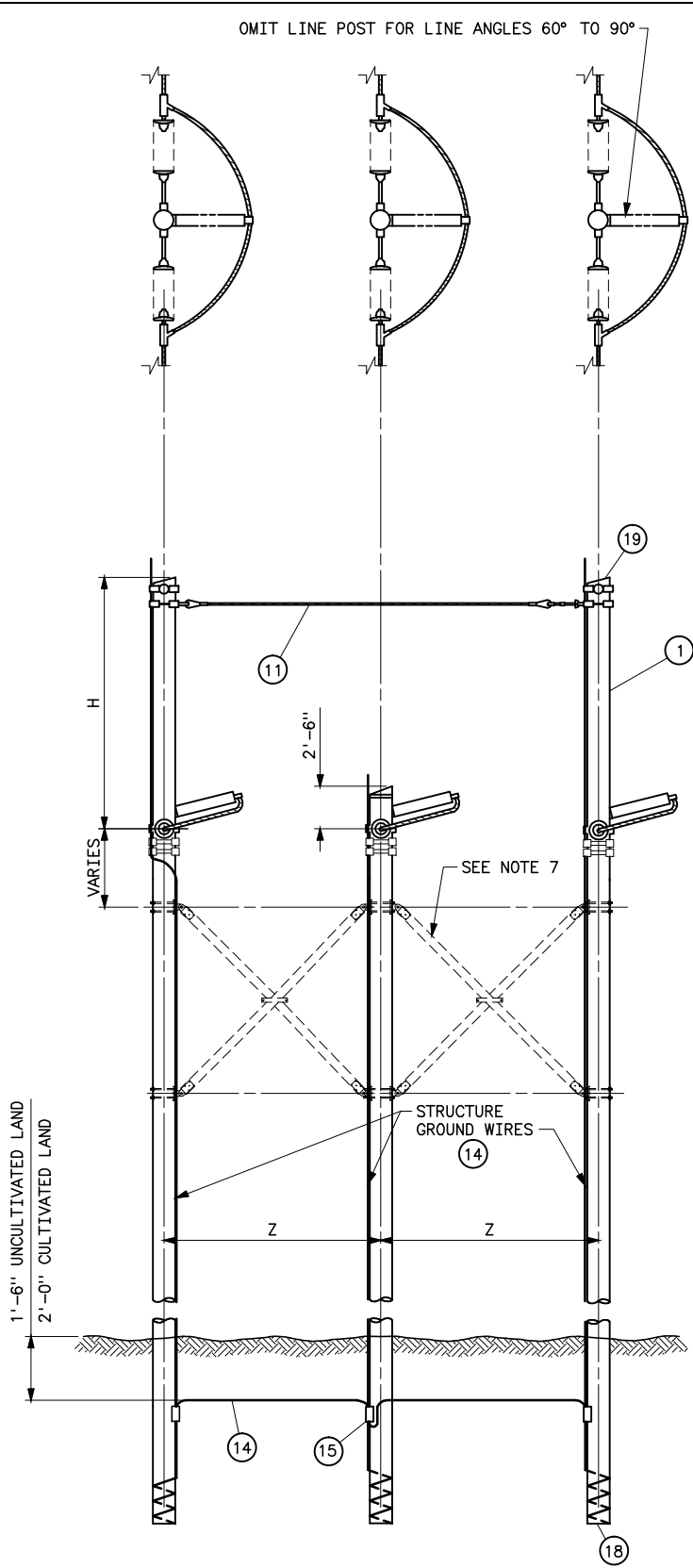
POST INSULATOR ASSEMBLY MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	0°	
20	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

- NOTES
1. THE 3TD STRUCTURE IS USED FOR CASCADE PREVENTION.
 2. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
 3. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
 4. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
 5. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

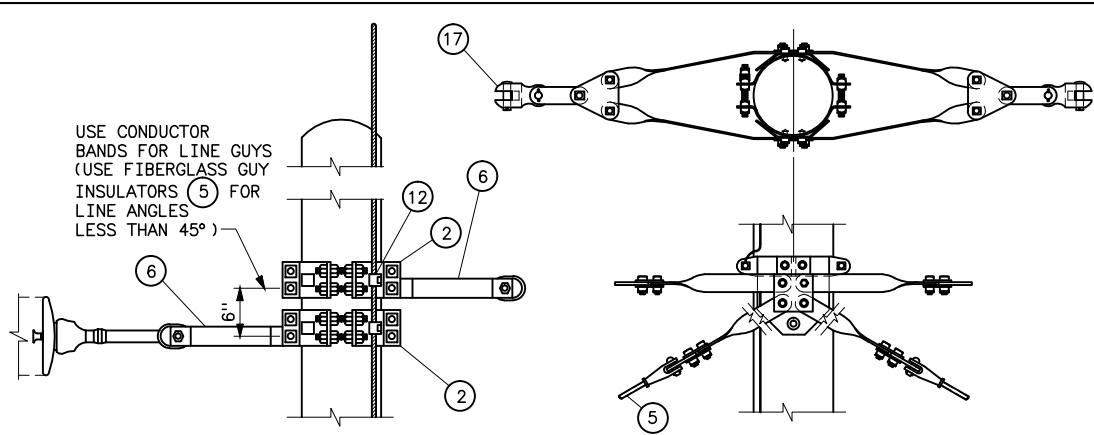
REFERENCE DRAWINGS		
WOOD POLE STRUCTURES		
GROUNDING DETAILS	41	1012
OVERHEAD GROUND WIRE ASSEMBLY		
DETAILS FOR WOOD POLE STRUCTURES	41	1019
TENSION INSULATOR ASSEMBLIES		
SINGLE STRING	41	1022
DOUBLE STRING	41	1023
OPTICAL GROUND WIRE ASSEMBLIES	41	1031
TYPE 3TA-1 STRUCTURES		
STANDARD GUY ARRANGEMENT	41	6125
TYPICAL DETAILS FOR DEAD END TEES	41	6138

A	3-10-26 A7-KR	CHANGED POLE TOP TO 16 FT FOR CLEARANCES. CHANGED DISTANCE TO X-BRACE.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - GOLDEN, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TD 115KV 3-POLE TENSION DEAD END STRUCTURE			
DESIGNED <u>KAREN ROWE</u> _____ APPROVED <u>DOUG HANSON</u> _____ CIVIL ENGINEERING MANAGER			
A/E	FEBRUARY 15, 2006	41	6157

Sep 28, 2010- 9:50am Plotted By: dion... IMAGES: S:\Projects\StandardDrawings\Drawings\CVI\N41_6118b.dwg Last Saved By: TAS on May 08, 2006- 1:01pm

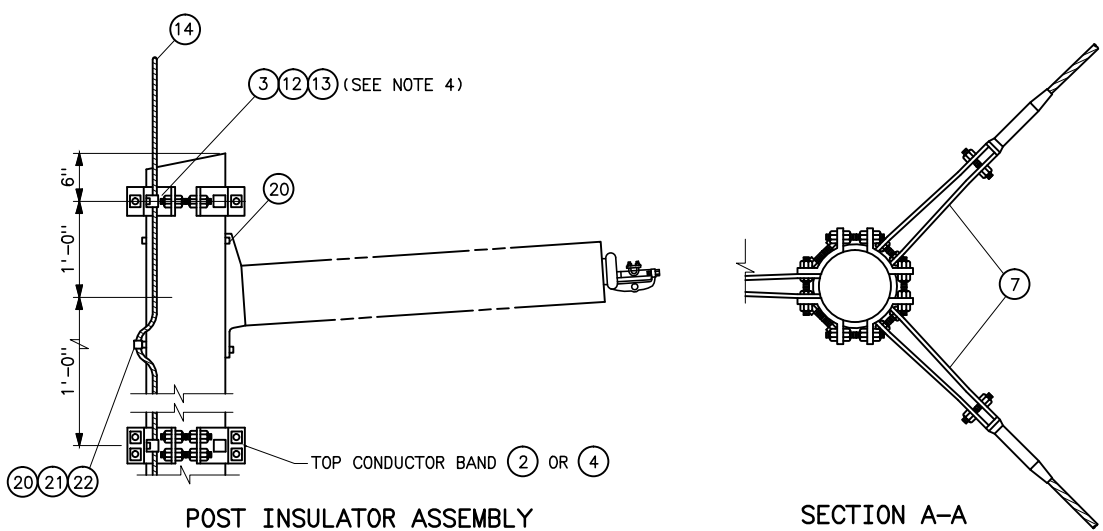


VOLTAGE	Z				H	
	ANGLE TURNED IN DEGREES					
	0°-30°	30°-45°	45°-60°	60°-90°	0°-60°	60°-90°
161KV	18'-0"	23'-0"	29'-0"	38'-0"	16'-0"	14'-0"
138KV	16'-0"	22'-0"	28'-0"	36'-0"	16'-0"	14'-0"



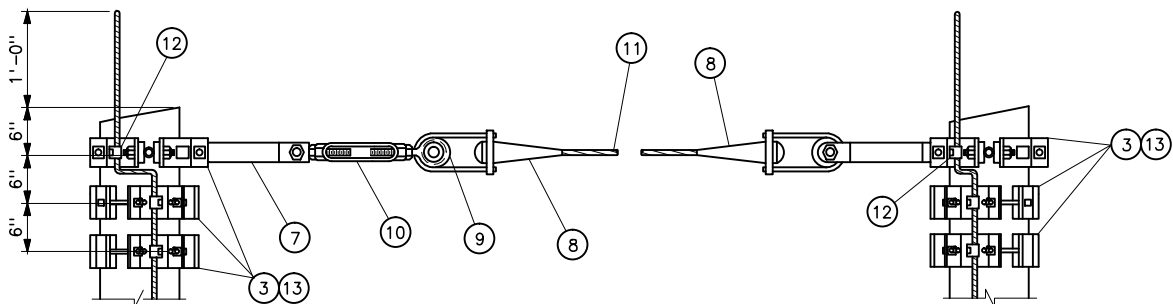
DETAIL OF INSULATOR ATTACHMENT
(FOR LINE ANGLES 5° TO 90°)

DETAIL OF INSULATOR ATTACHMENT ④
(FOR LINE ANGLES 0°-5°)

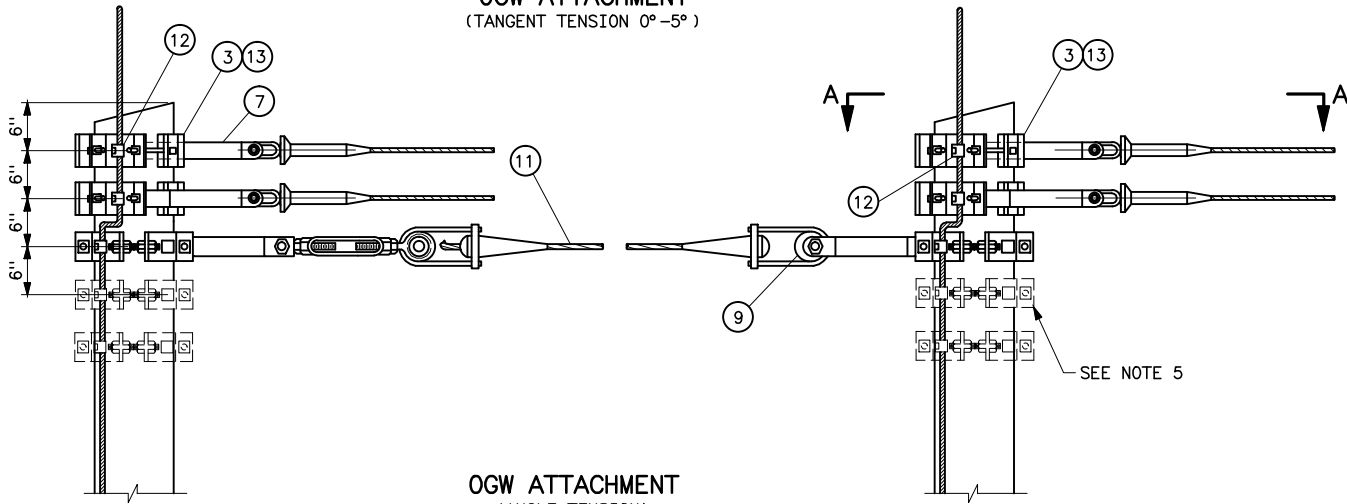


POST INSULATOR ASSEMBLY

SECTION A-A



OGW ATTACHMENT
(TANGENT TENSION 0°-5°)



OGW ATTACHMENT
(ANGLE TENSION)

PART NO.	STRUCTURE MATERIAL				DESCRIPTION
	ANGLE 0°-5°	ANGLE 5°-30°	ANGLE 30°-60°	ANGLE 60°-90°	
1	3	3	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	—	6	6	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3112 SERIES, JOSLYN J25969 SERIES; OR, APPROVED EQUAL (SEE NOTE 6)
3	7	11	7	6	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL (SEE NOTE 6)
4	3	—	—	—	POLE BAND ASSEMBLY, HUGHES B1784-VV OR APPROVED EQUAL (SEE NOTE 6)
5	6	6	6	—	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6	—	6	6	6	CONNECTING LINK; PAIR W/BNK HUGHES 3157, JOSLYN J26035; OR, APPROVED EQUAL
7	6	6	6	6	CONNECTING LINK PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK WITH BNK
8	2	2	2	2	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	2	2	2	2	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	1	1	1	1	TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD	AS REQD	AS REQD	AS REQD	STEEL STRAND 7/16", 7-WIRE, HIGH STRENGTH
12	7	17	13	12	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	14	22	14	12	LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD	AS REQD	AS REQD	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3	3	3	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
17	6	—	—	—	CLEVIS-CLEVIS 90° W/BNK, 40,000 LBS
18	3	3	3	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
19	3	3	3	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL
(OMIT FOR 60° TO 90° ANGLES)

PART NO.	QUANTITY	DESCRIPTION
	0° –60°	
20	6	7/8"ø x REQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16"ø HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

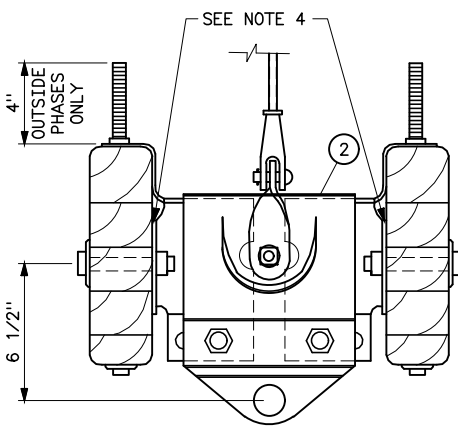
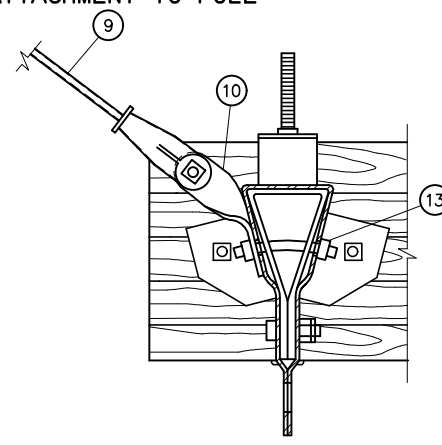
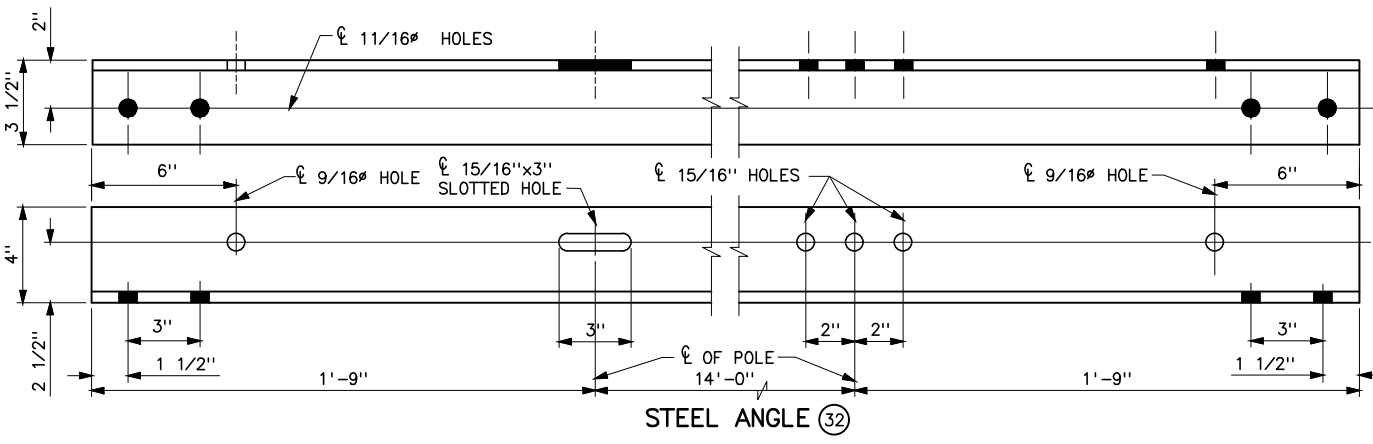
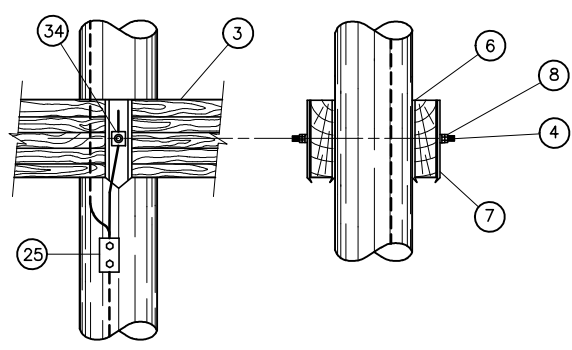
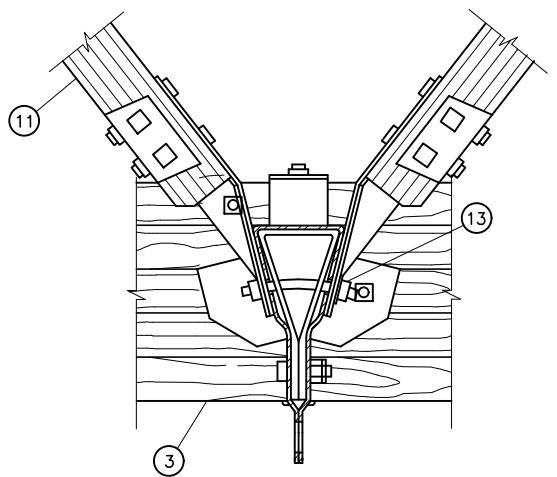
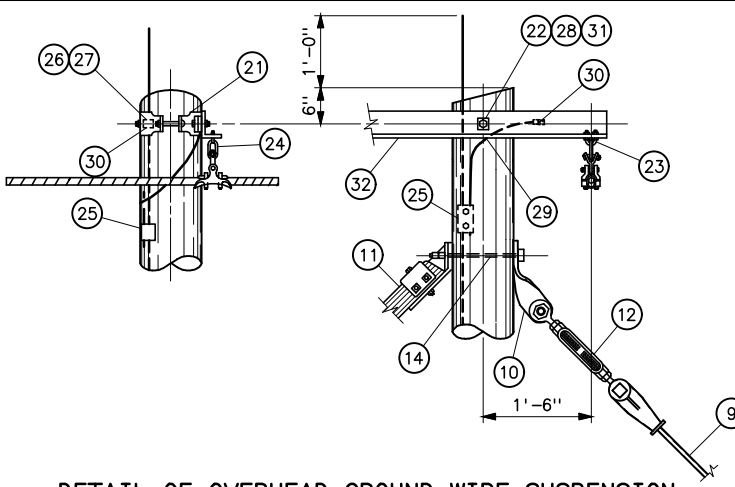
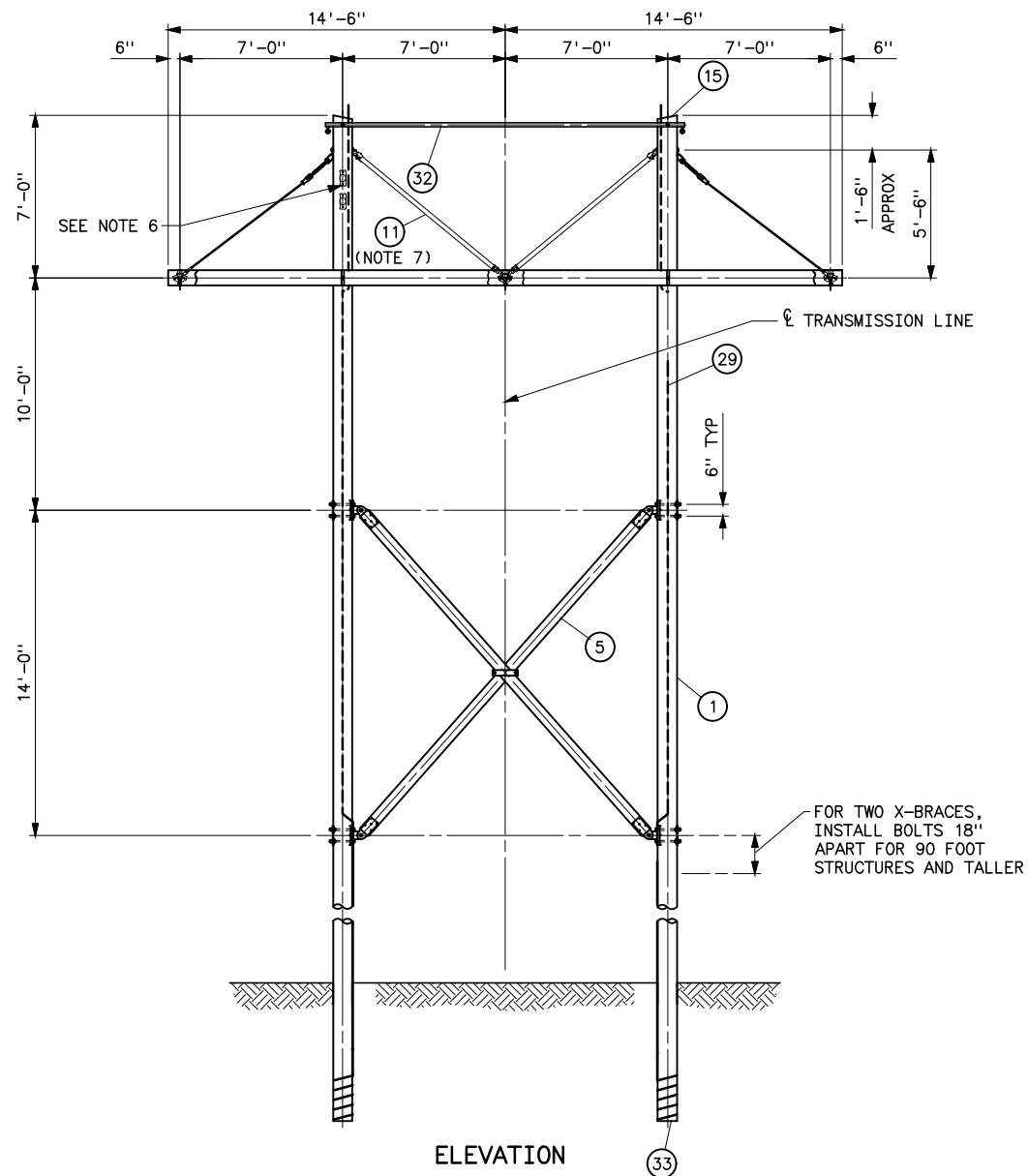
NOTES

1. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
2. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
4. ADDITIONAL POLE BAND IS NOT REQUIRED ON CENTER POLE FOR LINE ANGLES 60°-90°.
5. FOR 5°-30° LINE ANGLES ADD TWO ADDITIONAL BANDS (PART 3) FOR GUYING ON EACH OUTSIDE POLE.
6. DEADEND TEES SHALL BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEADEND TEES. SEE STANDARD DRAWING 41 6138.
7. USE X-BRACE EQUAL TO HUGHES BROS NO. 2121 WHEN SPECIFIED.

REFERENCE DRAWINGS

TYPE 3TA-1 AND STRUCTURES	
STANDARD GUY STRUCTURES	41 6125
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
WOOD POLE STRUCTURES	
GROUNDING DETAIL	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPICAL DETAILS FOR DEAD END TEES	41 6138

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TA-1 138 AND 161KV 3-POLE TENSION STRUCTURE		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
DATE OCTOBER 26, 2006	41	6158



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, AND WASHERS (HUGHES BROS. TYPE 3415 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x29-0
4	2	DOUBLE ARMING BOLT, 7/8x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS. NO. 2121-14-0 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8 BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 30,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (HUGHES BROS. NO. AS2276 OF EQUAL)
11	2	WOOD VEE BRACE, 3 1/2x5 1/2, COMPLETE WITH FITTINGS, 5'-6" DROP, SPACING VARIES WITH POLE DIAMETER
12	2	TURNBUCKLE (HUGHES BROS. NO. AS2545-B OF EQUAL)
13	3	7/8x REQUIRED LENGTH BENT STUD WITH LOCK WASHER AND LOCKNUTS, THREADED BOTH SIDES
14	2	7/8x REQUIRED LENGTH WITH LOCK WASHER AND LOCKNUT
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8x1-0
23	2	"U" BOLT, 5/8x3 WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2 (HUGHES BROS. NO. 1329-B1 OR EQUAL)
25	4	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2x4 LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8 BOLT
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2 INCH STAPLES
30	3	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
31	2	SPRING LOCK WASHER FOR 7/8 BOLT
32	1	STEEL ANGLE, 4x3 1/2x3/8x17'-6" LONG
33	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
34	2	BONDING CLIP (HUGHES BROS. NO. 2727 OR EQUAL)

- NOTES
- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
 - ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
 - GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
 - HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
 - BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
 - FOR DEAD ENDING OPGW, SPACE DEAD END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.
 - NO WOOD VEE-BRACE REQUIRED FOR HS-1 STRUCTURE.

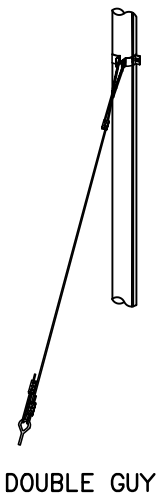
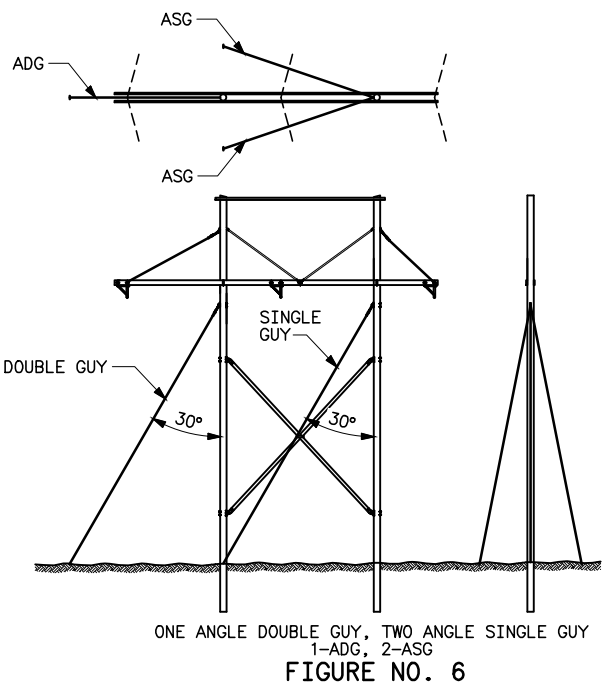
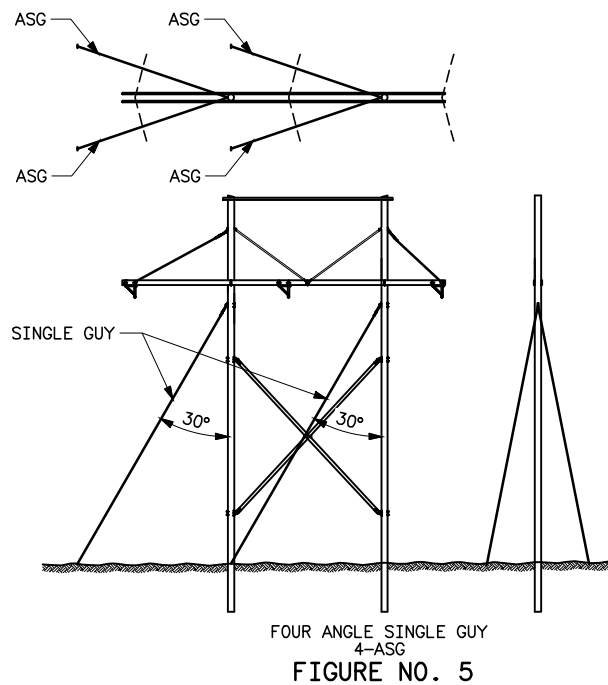
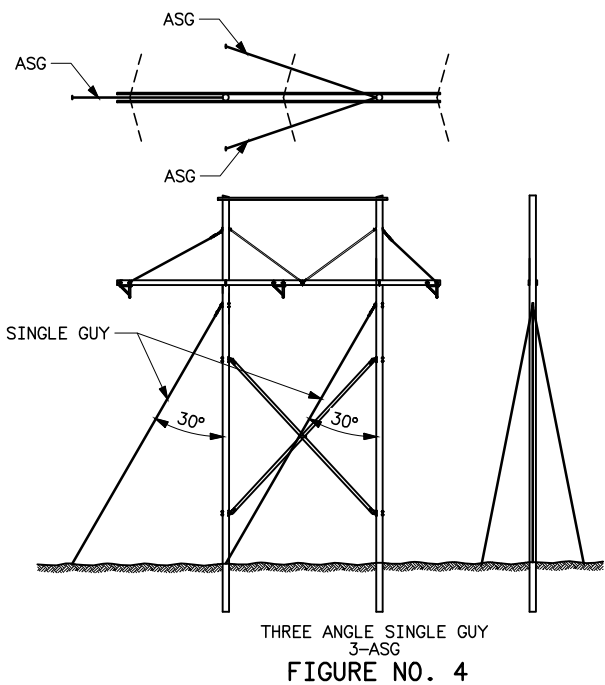
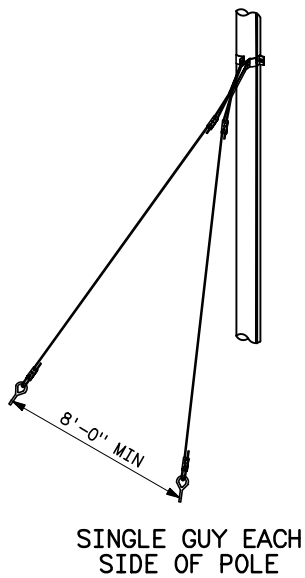
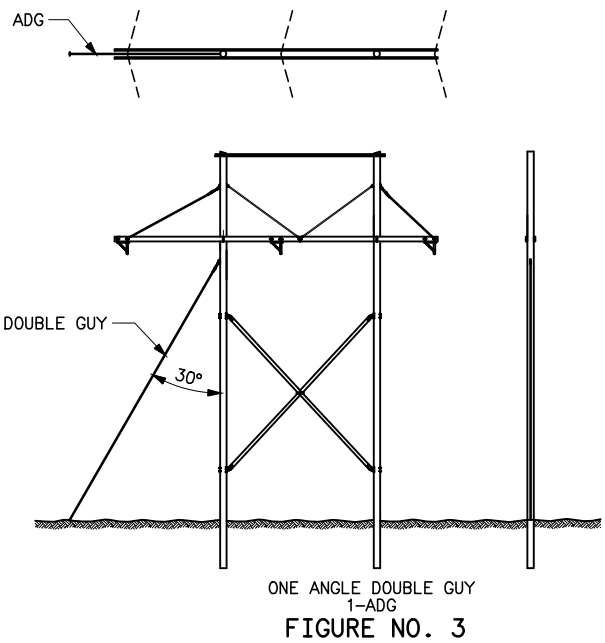
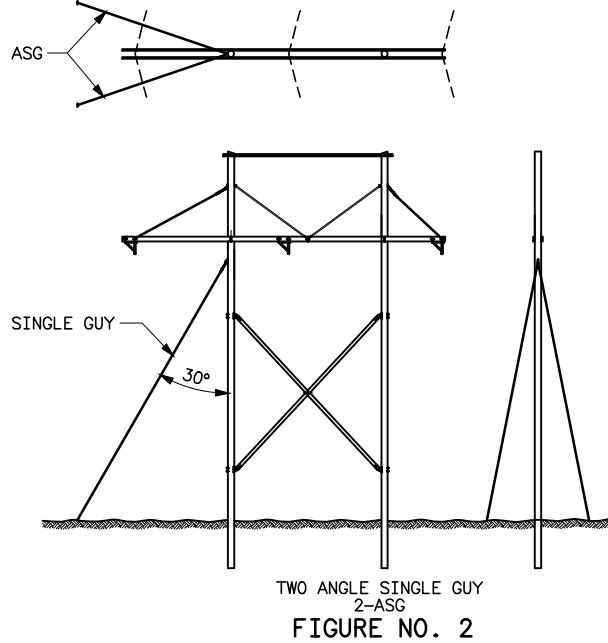
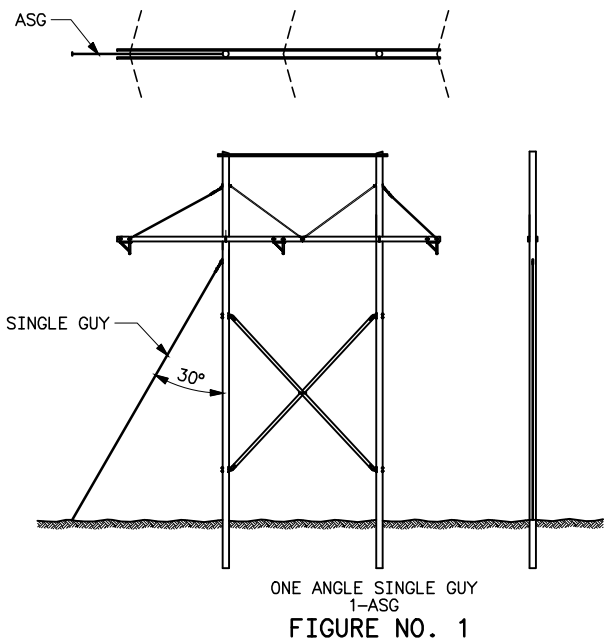
REFERENCE DRAWINGS		
WOOD POLE STRUCTURE GROUNDING DETAILS	41	1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS		
FOR WOOD POLE STRUCTURES	41	1019
SUSPENSION INSULATOR ASSEMBLIES		
SINGLE STRING	41	1020
OPTICAL GROUNDWIRE ASSEMBLIES	41	1031
CROSSARM DRILLING DETAILS HS-1 AND HSB-1 STRUCTURES	41	6113
TYPICAL DETAILS FOR OPTICAL GROUND WIRE SPLICE STRUCTURES	41	6153

B	5-9-19 A7-KKR	ADDED HS-1 OPTION WITHOUT WOOD VEE-BRACE, PART NO. 11.
A	1-30-12 A7-KKR	CHANGED LENGTH OF STEEL ANGLE.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HS-1 AND HSB-1 138KV SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
41	OCTOBER 26, 2006	6159

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ABBREVIATIONS

ASG _____ ANGLE SINGLE GUY
ADG _____ ANGLE DOUBLE GUY

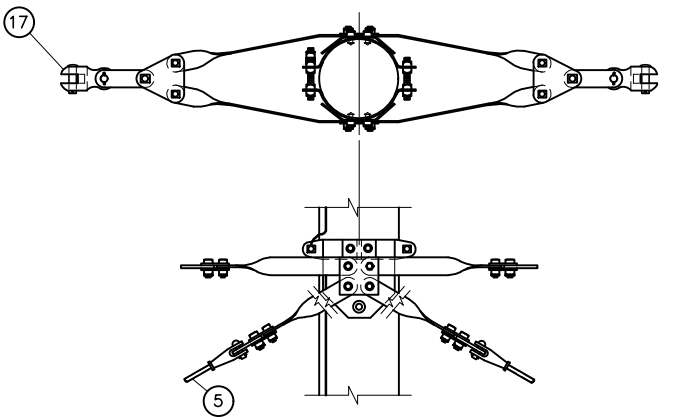
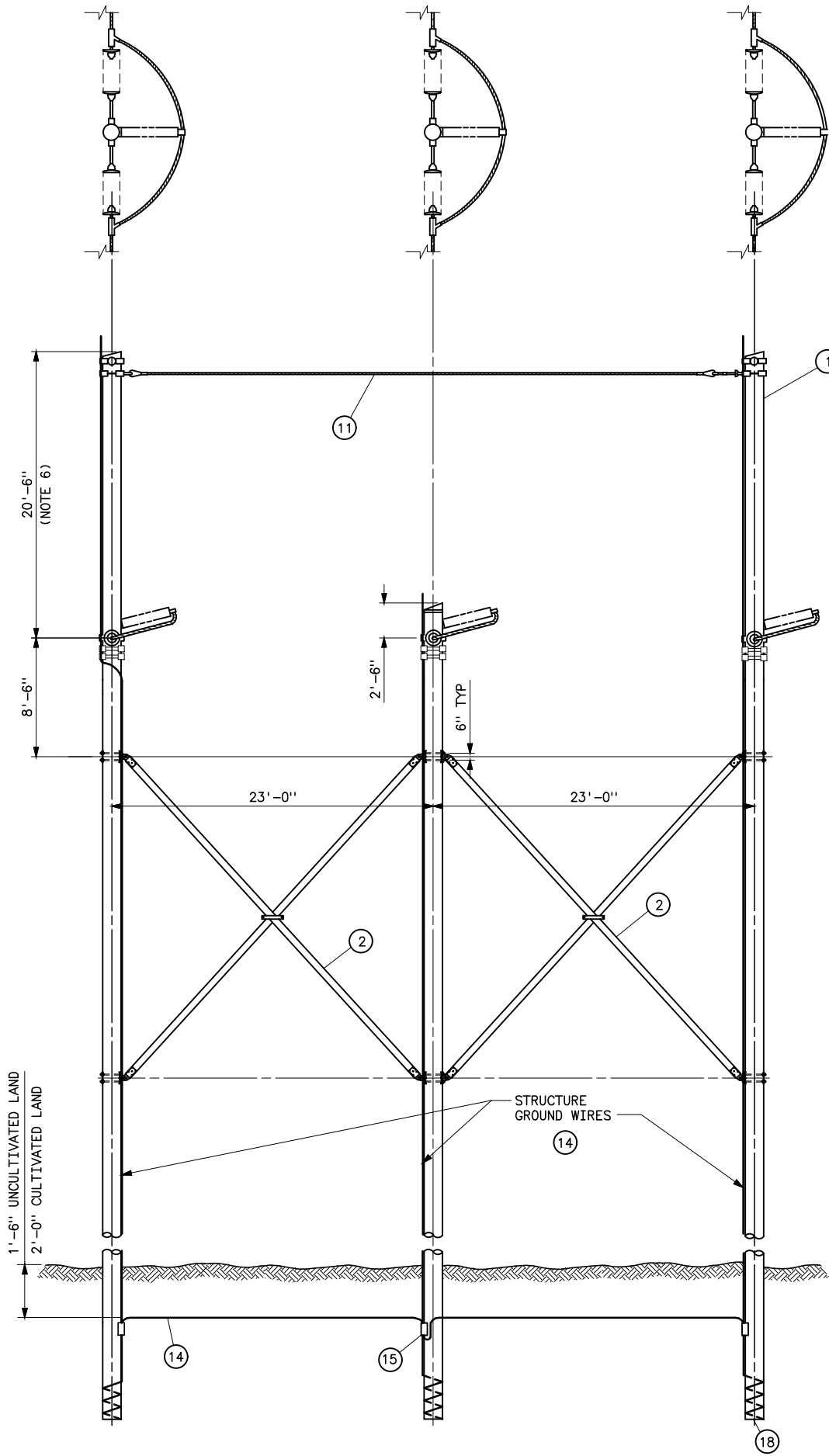


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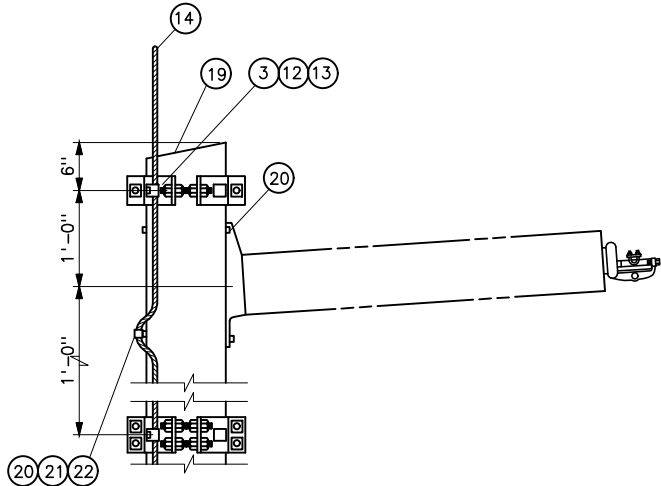
GUY ASSEMBLIES AND DETAILS _____ 41 6047
TYPE HA-1 230KV SMALL ANGLE
SUSPENSION STRUCTURE _____ 41 6149

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES STANDARD GUY ARRANGEMENT FOR TYPE HA-1 230KV ANGLE STRUCTURES		
DESIGNED KAREN ROWE _____	APPROVED D. HANSON _____ CIVIL ENGINEERING MANAGER	
DATE FEBRUARY 23, 2007	41	6161

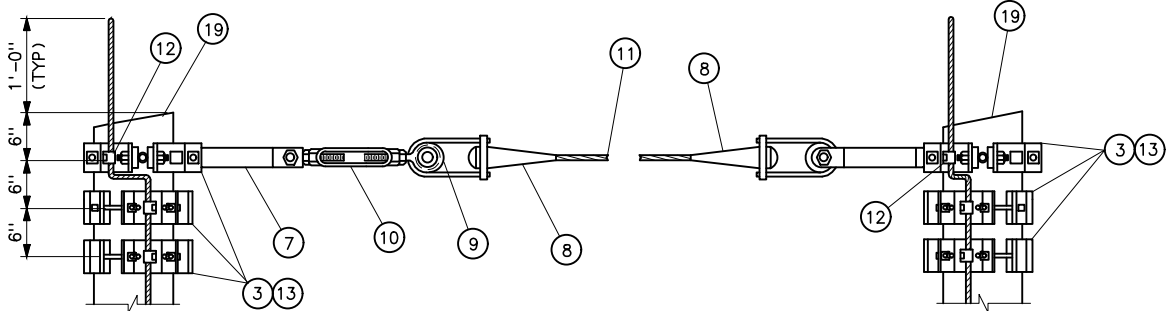
Plotted By: denton Jun 22, 2022- 7:10am
IMAGES: S:\projects\misc\StandardDrawings\Final\41-6162.dwg Last Saved By: Denton, Debra on 6/22/2022 7:09 AM



DETAIL OF INSULATOR ATTACHMENT ④
(0° LINE ANGLE)



POST INSULATOR ASSEMBLY



OGW ATTACHMENT
(0° LINE ANGLE)

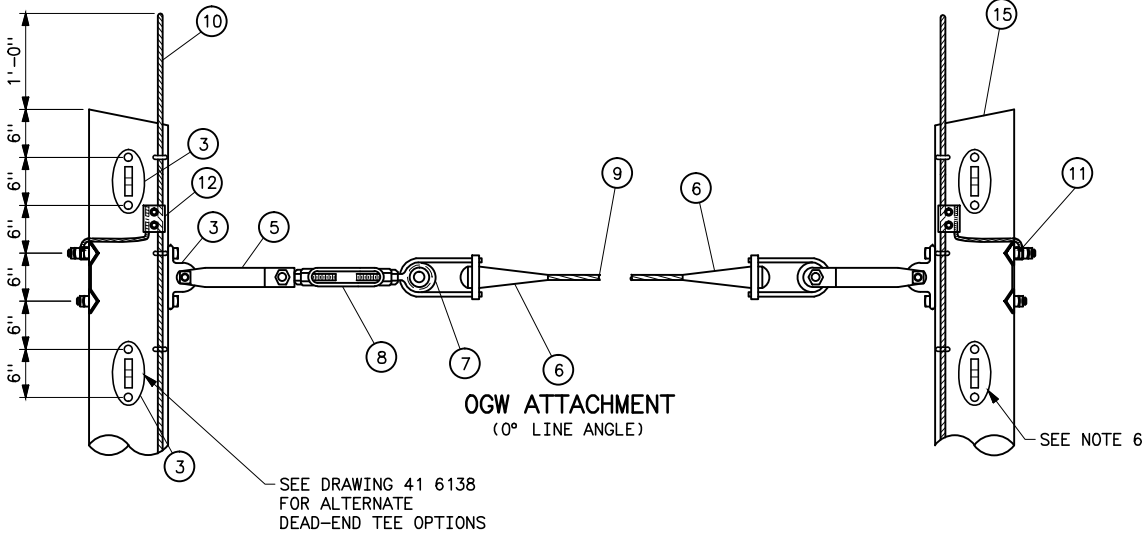
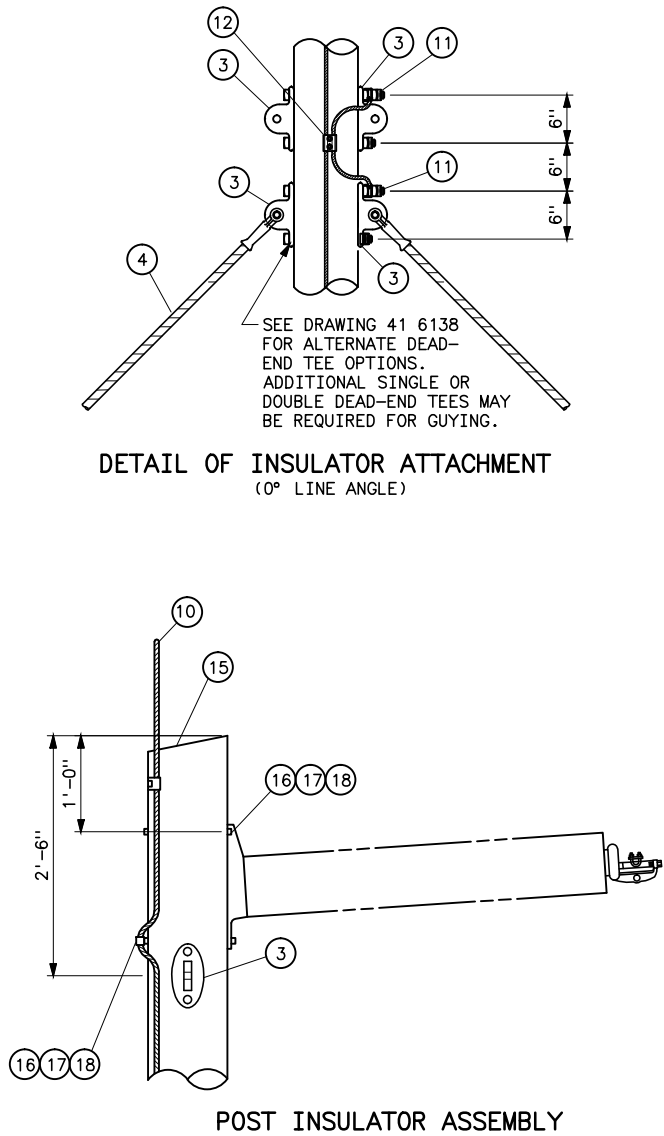
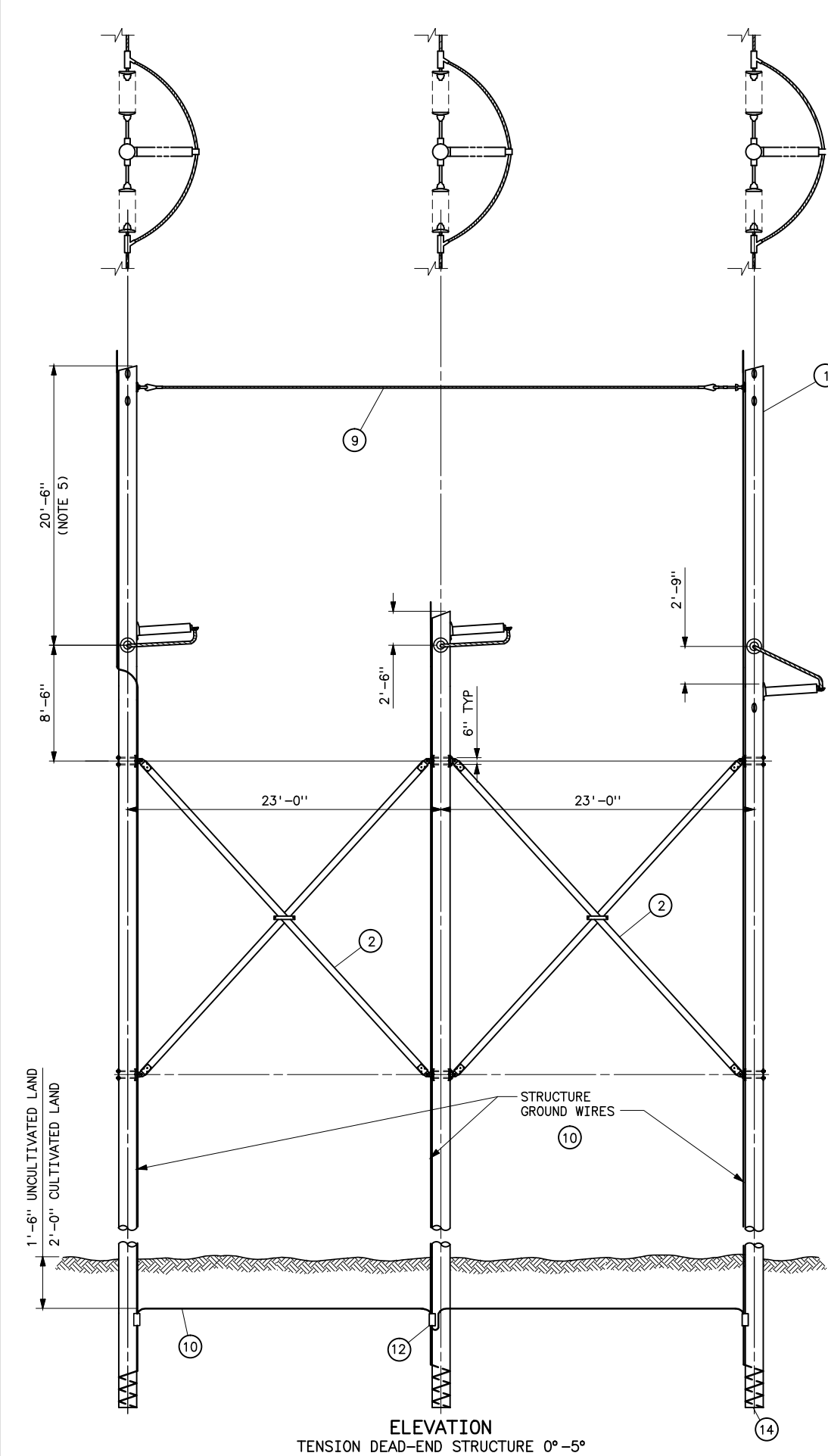
STRUCTURE MATERIAL		
PART NO.	ANGLE	DESCRIPTION
	0°	
1	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	2	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS NO. 2121 OR EQUAL)
3	7	FOUR-WAY STRAIN POLE BAND; HUGHES 3103 SERIES, JOSLYN J25967 SERIES; OR, APPROVED EQUAL
4	3	POLE BAND ASSEMBLY, HUGHES B1784-VV OR APPROVED EQUAL
5	6	FIBERGLASS GUY INSULATOR, 10 FT LENGTH
6		
7	6	CONNECTING LINK, PAIR W/BNK; HUGHES 3154; JOSLYN J6650; OR, APPROVED EQUAL CONNECTING LINK W/BNK
8	2	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
9	2	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
10	1	TURNBUCKLE, CLEVIS-EYE, 7/8x12
11	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
12	7	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
13	14	LAG SCREWS, 1/2x4 WITH FLAT WASHERS (2 EACH PER BAND)
14	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
15	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
16	4	OVERHEAD GROUND WIRE TENSION ASSEMBLY
17	6	CLEVIS-CLEVIS 90° W/BNK, 40,000 LBS
18	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
19	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	0°	
20	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
21	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
22	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

- NOTES**
1. THE 3TD STRUCTURE IS USED FOR CASCADE PREVENTION.
 2. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
 3. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
 4. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED ARE BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
 5. DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.
 6. 3TD-1 HAS 10 FOOT LONGER OUTSIDE POLES THAN 3TD STRUCTURE.

REFERENCE DRAWINGS	
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
TYPICAL DETAILS FOR DEAD END TEES	41 6138

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TD-1 230KV 3-POLE TENSION DEAD END STRUCTURE			
DESIGNED KAREN ROWE	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER		
41	JUNE 21, 2022	41	6162



STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	0° LINE ANGLE	
1	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	2	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS NO. 2121 OR EQUAL)
3	22	DEAD-END TEE, HUGHES BROS NO. 2817R4.5-15-15C OR EQUAL
4	6	FIBERGLASS GUY INSULATOR, 10 FT LENGTH,ULTIMATE STRENGTH 30,000 LBS
5	2	CONNECTING LINK
6	2	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
7	2	SHEAVE WHEEL, 2 1/2 DIA MINIMUM
8	1	TURNBUCKLE, CLEVIS-EYE, 7/8x12
9	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH
10	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
11	AS REQD	BONDING CLIP EQUAL TO HUGHES BROS NO. 2727.8 W/NUT
12	8	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
13	6	CLEVIS-CLEVIS 90° W/BNK, 40,000 LBS
14	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
15	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

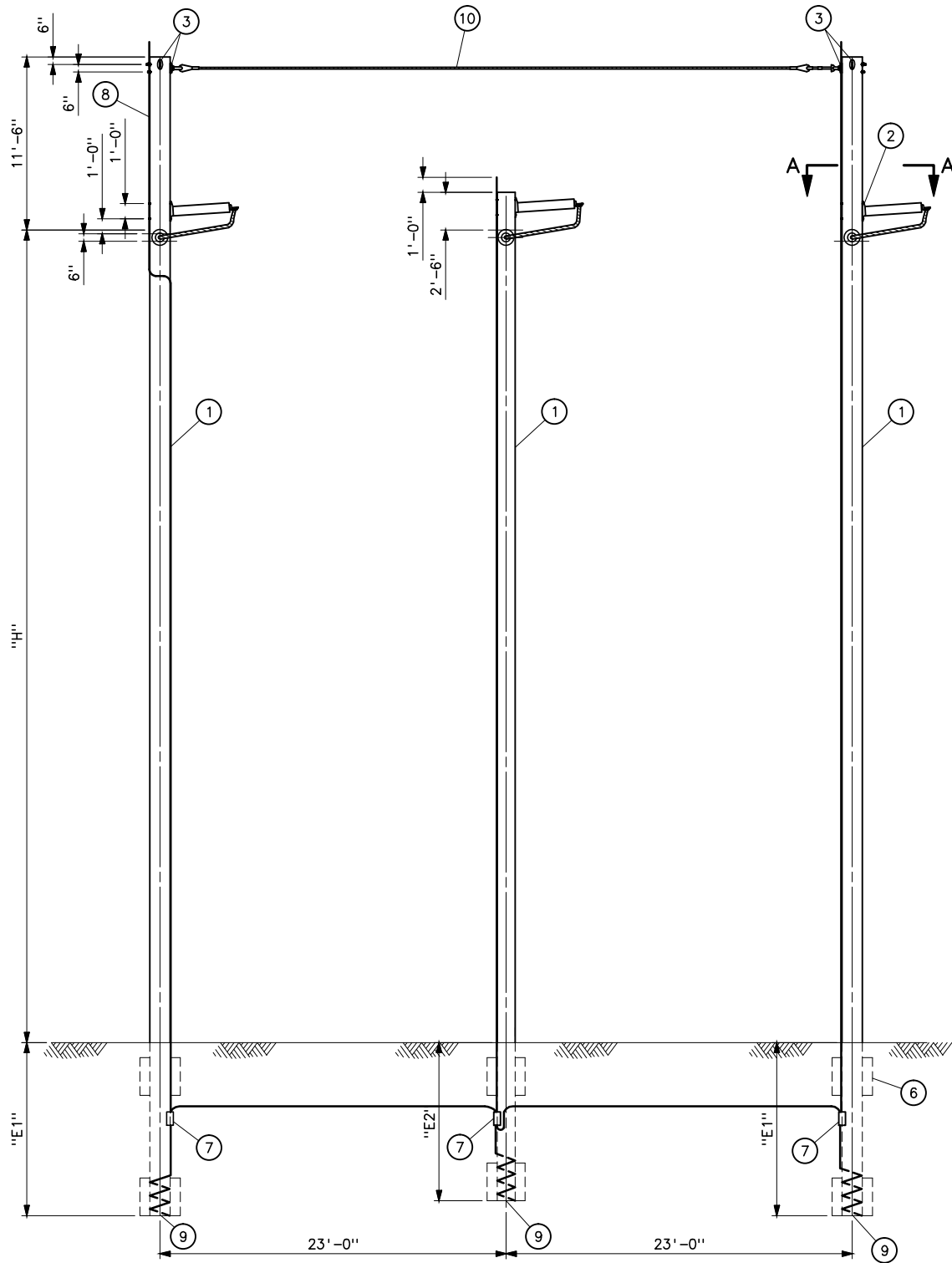
POST INSULATOR ASSEMBLY MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	0° LINE ANGLE	
16	6	7/8xREQD LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
17	6	4x4x1/4 CURVED SQUARE WASHER WITH 15/16" HOLE
18	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

- NOTES**
1. THE 3TD-2 STRUCTURE USES DEAD-END TEES AS OPPOSED TO POLE BANDS AND IS USED FOR CASCADE PREVENTION AND SMALL ANGLE DEAD-ENDS.
 2. FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
 3. ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
 4. MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED IS BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
 5. 3TD-2 HAS 10 FOOT LONGER OUTSIDE POLES THAN 3TD STRUCTURE
 6. DEAD END TEE MAY BE PLACED IN LINE WITH GUYS. ANCHOR SHACKLE SHALL BE USED IF NOT IN LINE.

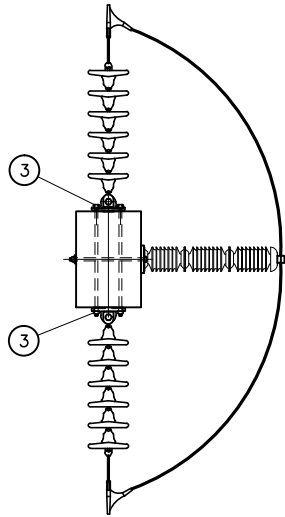
REFERENCE DRAWINGS	
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
TYPICAL DETAILS FOR DEAD END TEES	41 6138

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TD-2 230KV 3-POLE TENSION DEAD END STRUCTURE		
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER	
DATE JANUARY 27, 2011	41	6163

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ELEVATION
UNGUVED 0°-5°
GLUED LAMINATED TENSION DEAD-END STRUCTURE



SECTION A-A

- NOTES
- OVERLOAD FACTOR:
NESC ----- VERTICAL=1.5
TRANSVERSE (WIND)=2.5
TRANSVERSE (WIRE TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND ----- ALL=1.1
WIND PLUS ICE ----- ALL=1.1
RIME ICE ----- ALL=1.1
 - STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
 - STRUCTURE GUYS ARE NOT PERMITTED.
 - CONDUCTOR: 954 KCM, ACSR 45/7 RAIL
OGW: ONE 3/8", 7-STRAND, EXTRA HIGH STRENGTH.
OPGW: ONE .1248 INCHES SQUARED, .465"Ø, .314 LB/FT
RTS ----- 16,626 LB
 - WIND SPAN ----- 1100 FT
 - WIND PLUS ICE ----- 400-1200 FT
 - DESIGN FOR FOLLOWING INITIAL TENSIONS:
NESC HEAVY: 2007 EDITION, 1/2" RADIAL ICE, 4 PSF WIND AT 0°F.
CONDUCTOR ----- 10,030 LB
OGW ----- 4408 LB
OPGW ----- 5125 LB
60°F: CONDUCTOR ----- 4548 LB
OGW ----- 1444 LB
OPGW ----- 1678 LB
WIND AND ICE: 1/2" RADIAL ICE WITH 57 PSF ICE DENSITY
9 PSF WIND AT 0°F.
CONDUCTOR ----- 9566 LB
OGW ----- 4208 LB
OPGW ----- 4916 LB
HIGH WIND: 85MPH WIND AT 60°F WITH 1.15 FACTOR FOR WIRES AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
CONDUCTOR ----- 7134 LB
OGW ----- 2444 LB
OPGW ----- 3105 LB
RIME ICE: 1 1/2" RADIAL RIME ICE WITH 40 PCF ICE DENSITY, 4 PSF WIND AT 30°F
CONDUCTOR ----- 10,986 LB
OGW ----- 5244 LB
OPGW ----- 5989 LB
 - GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE.
 - GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
 - INSTALL IN ACCORDANCE WITH MANUFACTURES RECOMMENDATIONS.
 - POLES SHALL BE SET TO WITHIN 3" OF THE SPECIFIED SETTING.
 - ANGLE RANGE FROM 0°-5°.
 - POLE HEIGHT RANGE "H" 40FT TO 70FT.
 - GRADE B CONSTRUCTION.
 - DESIGN FOR OGW ON ONE SIDE AND OPGW ON OTHER SIDE.

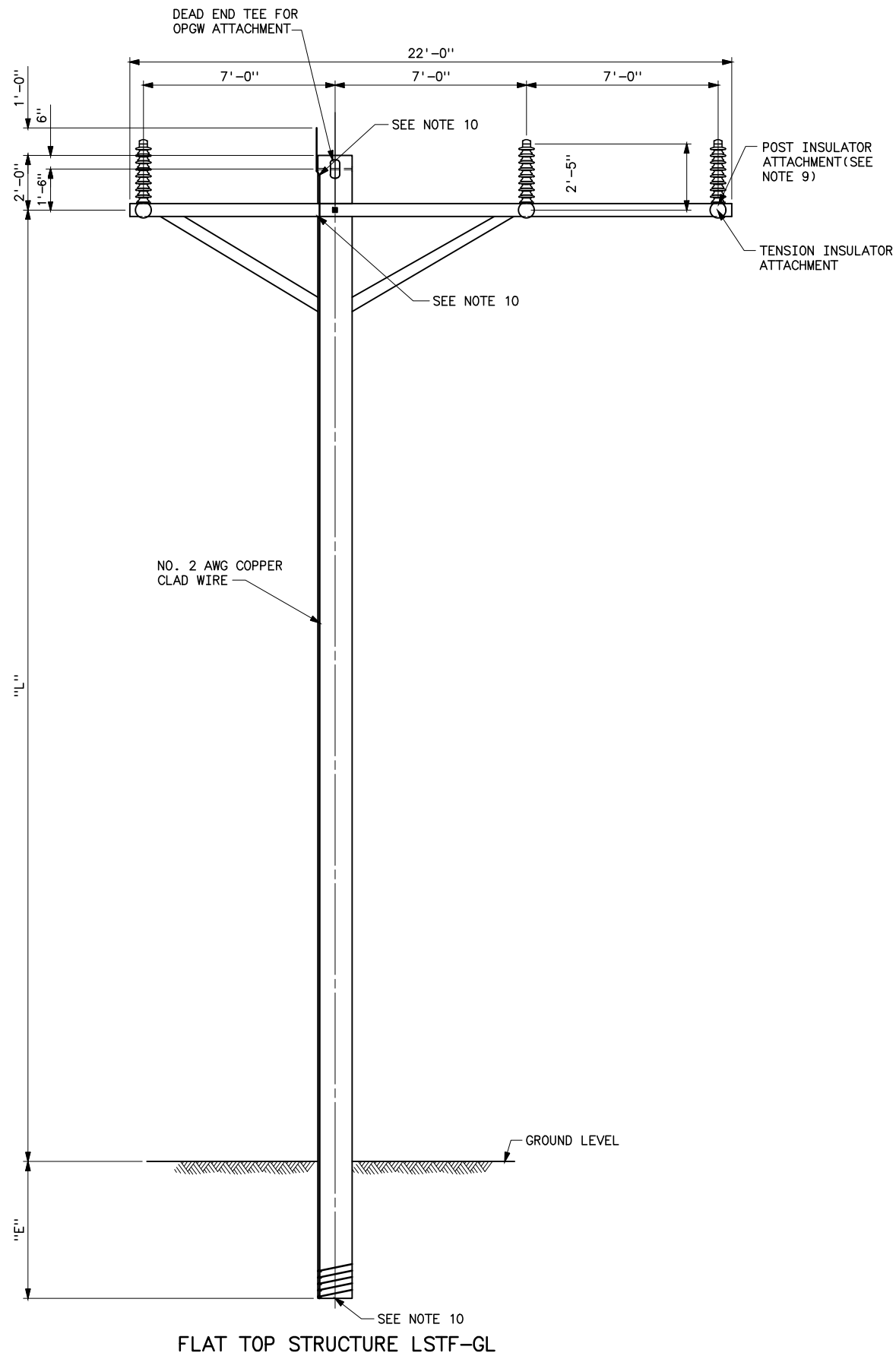
REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031

HARDWARE LIST		
PART NO.	QUANTITY	DESCRIPTION
1	3	LAMINATED RAKED POLE
2	3	POST INSULATOR SHIM
3	12	DEAD-END TEE
4	AS REQD	BONDING CLIPS EQUAL TO HUGHES BROS 2727
5	AS REQD	MACHINE BOLTS, WASHERS, LOCKNUTS, AND EYE NUTS
6	3	FOUNDATION ASSEMBLY KIT
7	AS REQD	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
8	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
9	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
10	AS REQD	STEEL STRAND 7/16, 7-WIRE, HIGH STRENGTH

NOT PROVIDED
BY GLUED
LAMINATED POLE
MANUFACTURER

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGN TRANSMISSION LINES TYPE 3TD-GL 230KV 3-POLE TENSION DEAD-END STRUCTURE			
DESIGNED KAREN ROWE	APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
C.A.E.	MARCH 5, 2010	41	6164



NOTES

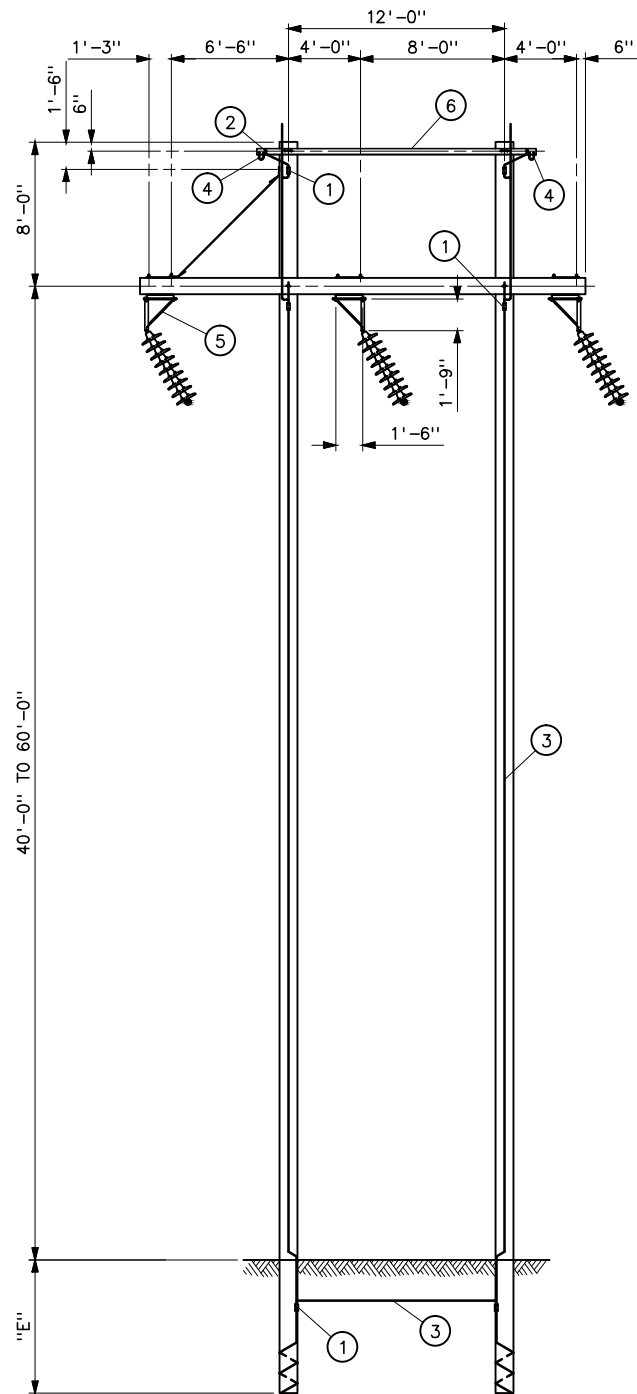
1. OVERLOAD FACTOR:
NESC -----VERTICAL=1.5
TRANSVERSE (WIND)=1.65
TRANSVERSE (WIND TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND -----ALL=1.33
2. STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
3. STRUCTURE GUYS ARE NOT PERMITTED.
4. GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE.
5. GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE AND GROUNDING MATERIALS BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
6. INSTALL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
7. POLES SHALL BE SET WITHIN 3" OF THE SPECIFIED SETTING.
8. GRADE B CONSTRUCTION.
9. TYPE SP-1, OVERHUNG POST INSULATOR ATTACHMENT ON STRUCTURES 3/14, 3/15, 3/16 AND 4/9.
TYPE SP-2, UNDERHUNG POST INSULATOR ATTACHMENT ON STRUCTURES 4/8, 1/17, AND 1/18. IN ACCORDANCE WITH STANDARD DRAWING 41 1033.
10. BOND DEAD END TEES IN ACCORDANCE WITH DRAWING 41 6138. BOND CROSSARM WITH PARALLEL GROVE CLAMP AND BONDING CLIP. ADD POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE.

STATION NO	L	ANGLE
3/14	20'	28.4°
3/15	20.5'	-22.9°
3/16	29'	28.9°
4/8	29'	0°
4/9	26.5'	-21.5°
1/17	29'	0°
1/18	29'	0°

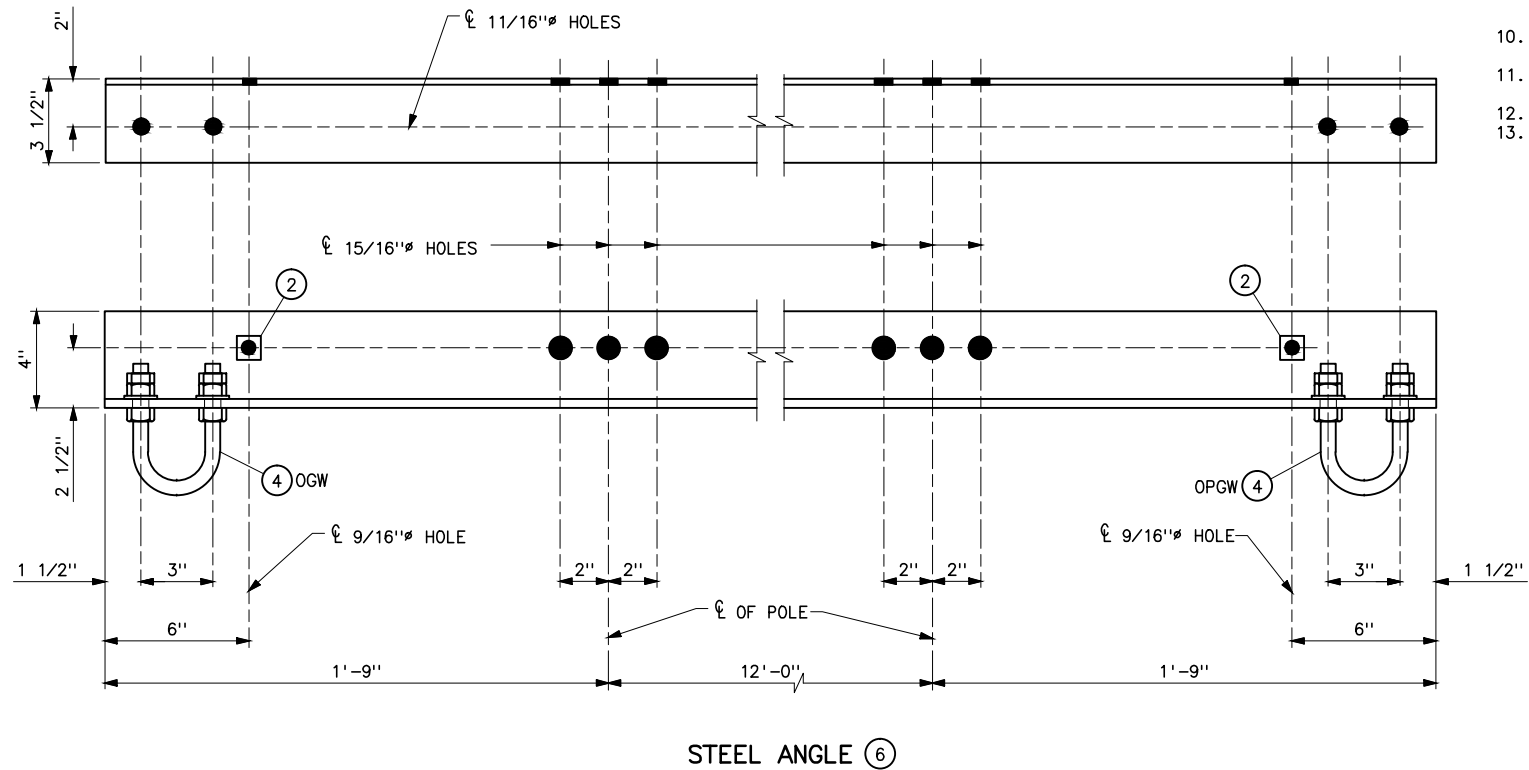
REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
WOOD POLE STRUCTURES	
OVERHEAD GROUND WIRE ASSEMBLY	41 1019
TENSION INSULATOR ASSEMBLIES -	
SINGLE STRING	41 1022
TENSION INSULATOR ASSEMBLIES -	
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
STATION POST	
JUMPER INSULATOR ASSEMBLIES	41 1033
TYPICAL DETAILS FOR DEAD END TEES	41 6138

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE LSTF-GL 69-KV FLAT TOP TENSION STRUCTURE LIGHT LOADING-GLUED LAMINATED			
DESIGNED KAREN ROWE, CHRIS KRUMM APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER			
CA	JUNE 21, 2022	41	6165



ELEVATION
UNGUYED 6°-10° GLU-LAM ANGLE SUSPENSION STRUCTURE



STEEL ANGLE ⑥

NOTES

- OVERLOAD FACTOR:
NESC _____VERTICAL=1.5
TRANSVERSE (WIND)=2.5
TRANSVERSE (WIRE TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND _____ALL=1.33
- STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
- STRUCTURE GUYS ARE NOT PERMITTED.
- CONDUCTOR: 477 KCM, ACSR 24/7 FLICKER
OGW: 3/8", 7-STRAND, HIGH STRENGTH.
- WIND SPAN _____720 FT
- WEIGHT SPAN _____600-1000 FT
- DESIGN FOR:
NESC HEAVY: 2007 EDITION, 1/2" RADIAL ICE, 4 PSF AT 0°F.
TENSIONS: CONDUCTOR (AHEAD AND BACK) _____7300 LB
OGW (AHEAD AND BACK) _____4630 LB
HIGH WIND: 85 MPH WIND AT 60°F WITH 1.14 FACTOR FOR WIRES AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
60°F TENSION _____3339 LB
- GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND BACKFILL MATERIAL FOR STRUCTURE.
- GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
- INSTALL IN ACCORDANCE WITH MANUFACTURES RECOMMENDATIONS.
- POLES SHALL BE SET TO WITHIN 3" OF THE SPECIFIED SETTING.
- ANGLE RANGE FROM 6°-10°.
- GRADE B CONSTRUCTION.

REFERENCE DRAWINGS

SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019

HARDWARE LIST

PART NO.	QUANTITY	DESCRIPTION
1	6	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
2	2	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). (EQUAL TO HUGHES BROS. 2718.55)
3	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
4	2	"U" BOLT, 5/8"x3" WITH 4 HEX NUTS AND 2 LOCKNUTS
5	3	SWINGING ANGLE BRACKET, HUGHES BROS. 2823.8 OR EQUAL
6	1	4x3 1/2x3/8x15'- 6" STEEL ANGLE

A	1-27-14 A7-KR	FIXED PART NO. 6 AND REMOVED OPGW REFERENCE.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HA-GL 115KV ANGLE SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE _____ APPROVED DOUG HANSON _____ CIVIL ENGINEERING MANAGER		
C A E	JUNE 15, 2010	41 6166

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE SS-1	
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	HORIZONTAL LINE POST INSULATOR
3	6	MACHINE BOLT WITH NUT AND LOCKNUT (COORDINATE WITH INSULATOR MANUFACTURE FOR BOLT SIZE)
4	3	Y-CLEVIS EYE, 90° WITH BNK
5	3	CLAMP, FOR LINE POST INSULATOR WITH BNK
6	3	BONDING CLIP (EQUAL TO BROOKS MANUFACTURE BC SERIES OR HUGHES NO. 2727)
7	6	3x3x1/4 CURVED SQUARE WASHER WITH HOLE
8	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
9	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
10	3	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY

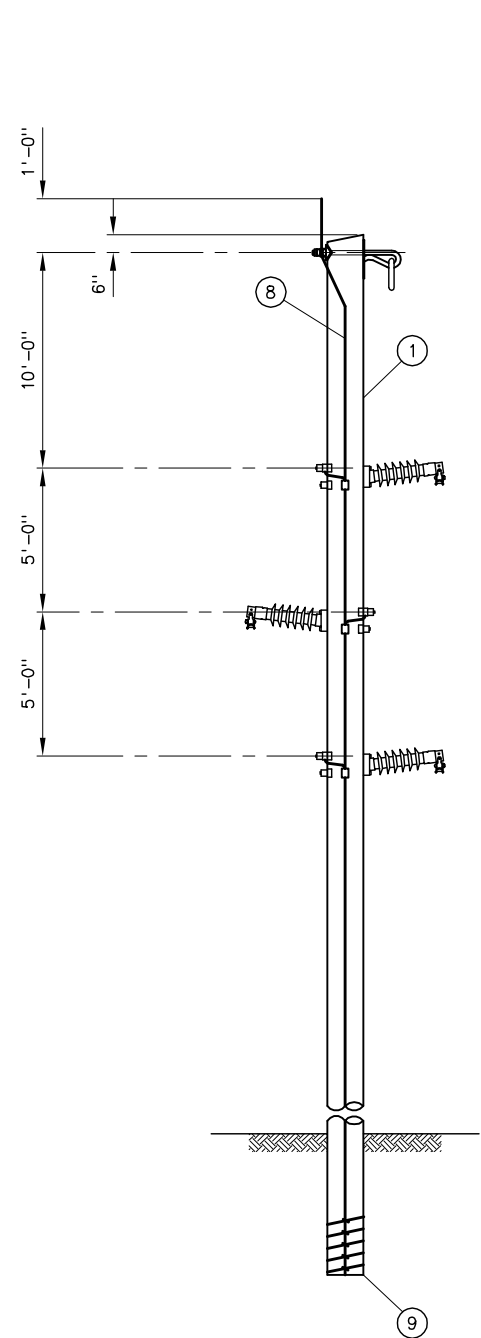
OVERHEAD GROUND WIRE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE SS-1	
21	1	SHIELD WIRE SUPPORT BRACKET (HUGHES BROS NO. 2812 FOR WOOD POLES, NO. 2855 FOR GLUED LAMINATED POLES) W/ 1/2"Ø LINK AND 3/4" BOLT DIAMETER
22	1	BOND CLIP EQUAL TO HUGHES BROS NO. 2727 WITH EXTRA NUT

NOTES

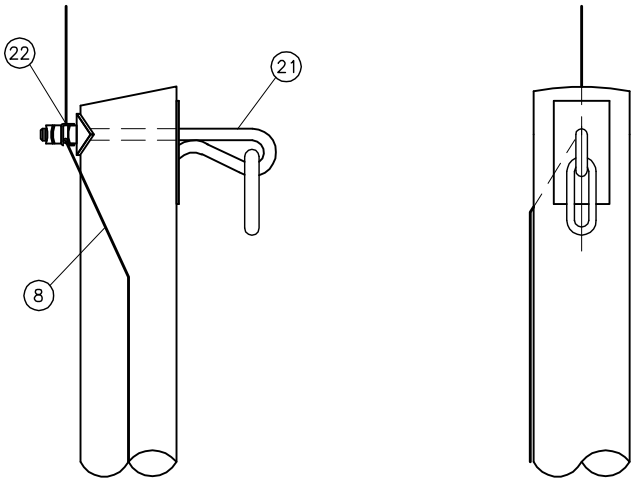
1. MEASUREMENTS FOR HORIZONTAL LINE POST ARE TO Ɔ OF TOP MOUNTING HOLES.
2. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
3. BNK INDICATES BOLT, NUT AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

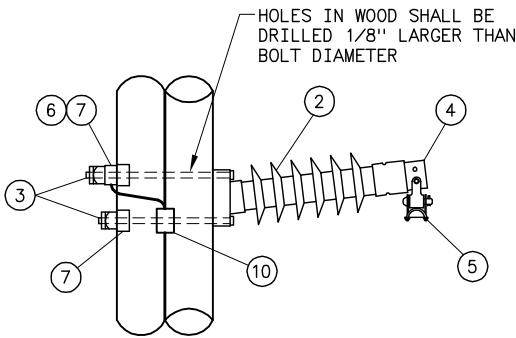
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
OPTICAL GROUND WIRE ASSEMBLIES	41 1031



TANGENT TYPE SS-1 0 TO 1° LINE ANGLE

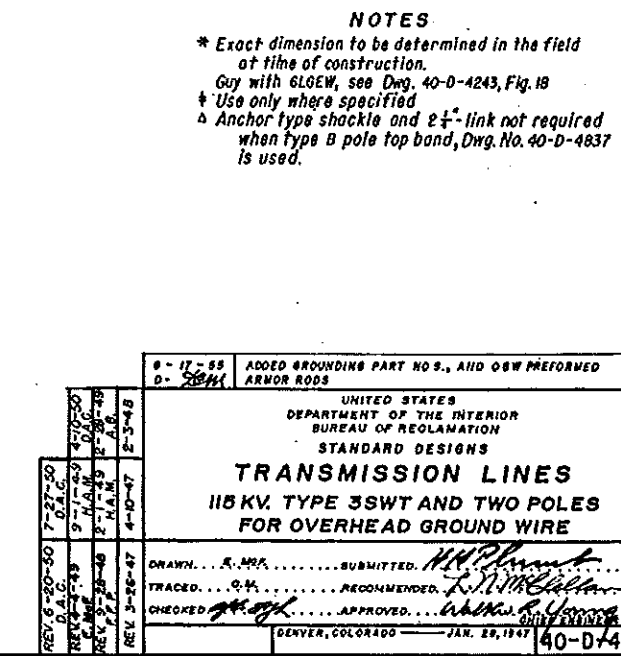


DETAILS OF OGW BONDING AND ATTACHMENT

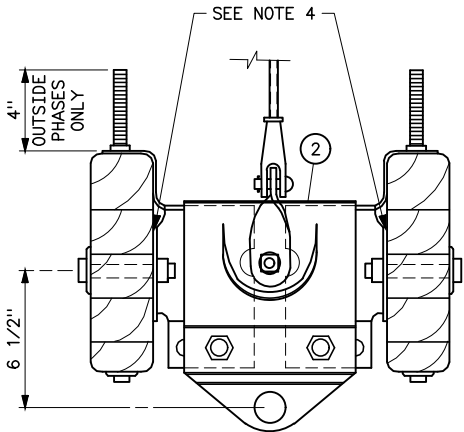
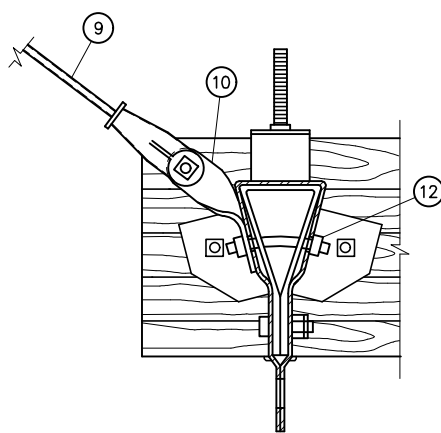
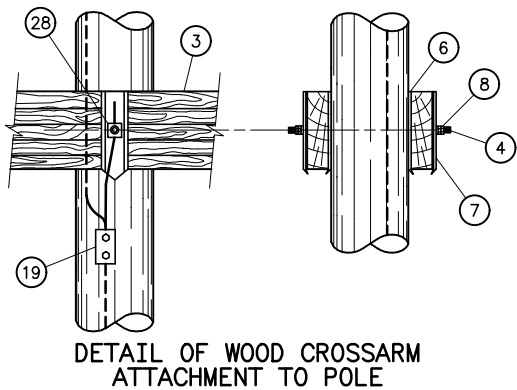
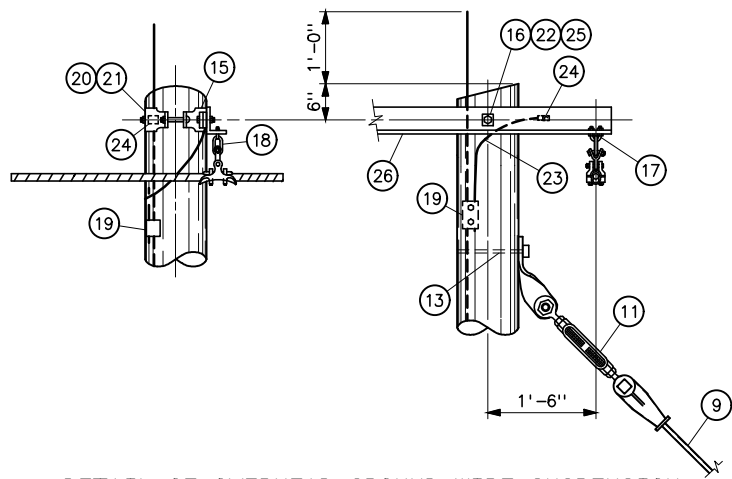
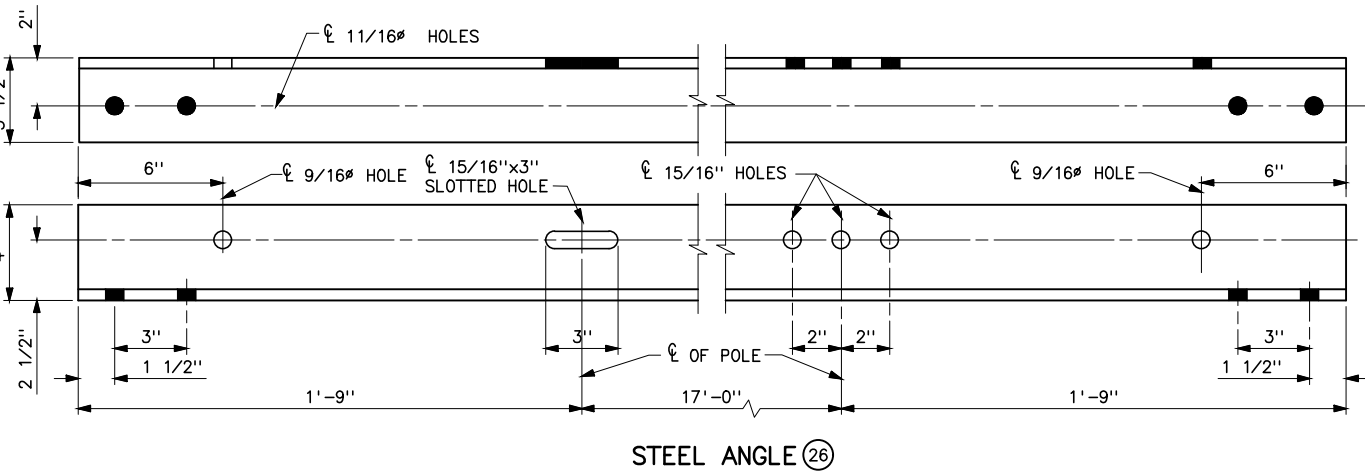
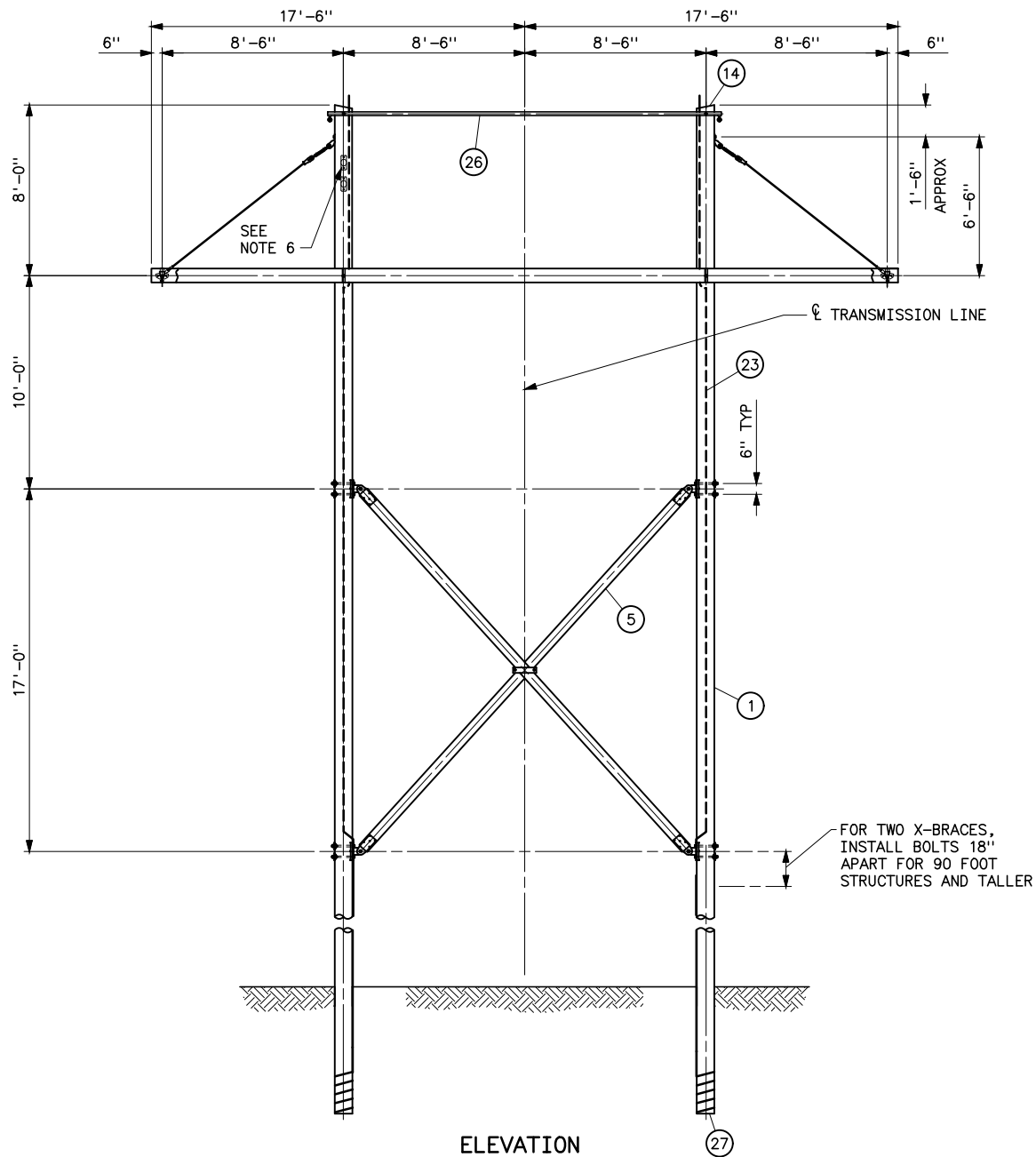


POST INSULATOR ASSEMBLY

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE SS-1 138KV TANGENT SUSPENSION STRUCTURE			
DESIGNED <u> KAREN ROWE </u>		APPROVED <u> DOUG HANSON </u> CIVIL ENGINEERING MANAGER	
A	MARCH 30, 2011	41	6167



Plotted By: Seela on 10/30/2006 11:51 AM
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STRUCTURE MATERIAL

PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, AND WASHERS (HUGHES BROS. TYPE 3415 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8"x9"x35'-0"
4	2	DOUBLE ARMING BOLT, 7/8"x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8"x5 3/8" (HUGHES BROS. NO. 1042-17-0 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 30,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (HUGHES BROS. NO. AS2276 OF EQUAL)
11	2	TURNBUCKLE (HUGHES BROS. NO. AS2545-B OF EQUAL)
12	3	7/8"x REQUIRED LENGTH BENT STUD WITH LOCK WASHER AND LOCKNUTS, THREADED BOTH SIDES
13	2	7/8"x REQUIRED LENGTH WITH LOCK WASHER AND LOCKNUT
14	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL

PART NO.	QUANTITY	DESCRIPTION
15	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
16	2	MACHINE BOLT, 7/8"x1'-0"
17	2	"U" BOLT, 5/8"x3" WITH 4 HEX NUTS AND 2 LOCKNUTS
18	2	CHAIN LINK 1/2" (HUGHES BROS. NO. 1329-B1 OR EQUAL)
19	4	PARALLEL GROVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
20	2	1/2"x4" LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
21	2	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (ONE PER BAND)
22	2	LOCKNUT FOR 7/8" BOLT
23	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
24	3	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
25	2	SPRING LOCK WASHER FOR 7/8" BOLT
26	1	STEEL ANGLE, 4"x3 1/2"x3/8"x20'-6" LONG
27	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
28	2	BONDING CLIP (HUGHES BROS. 2727 OR EQUAL)

NOTES

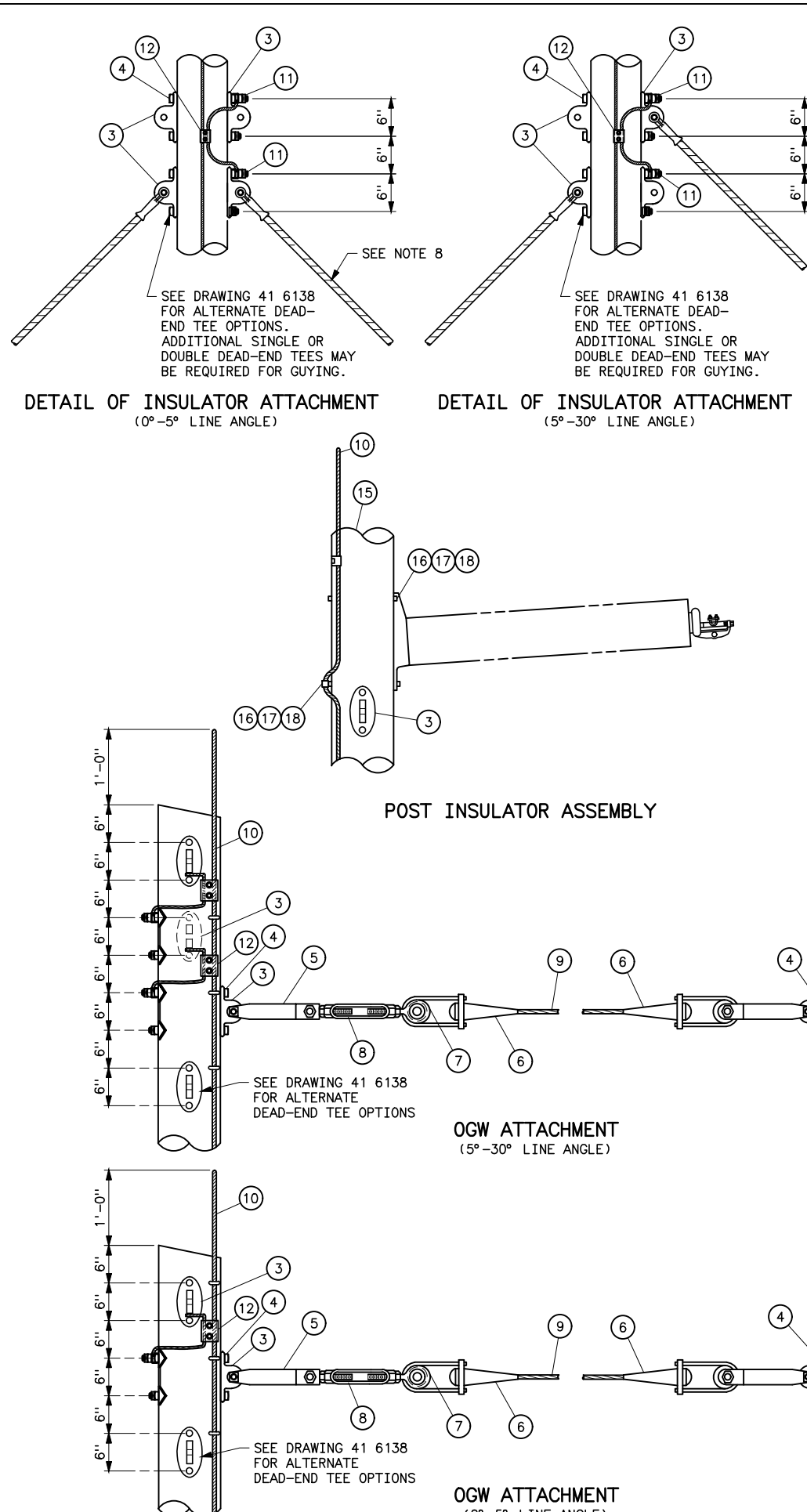
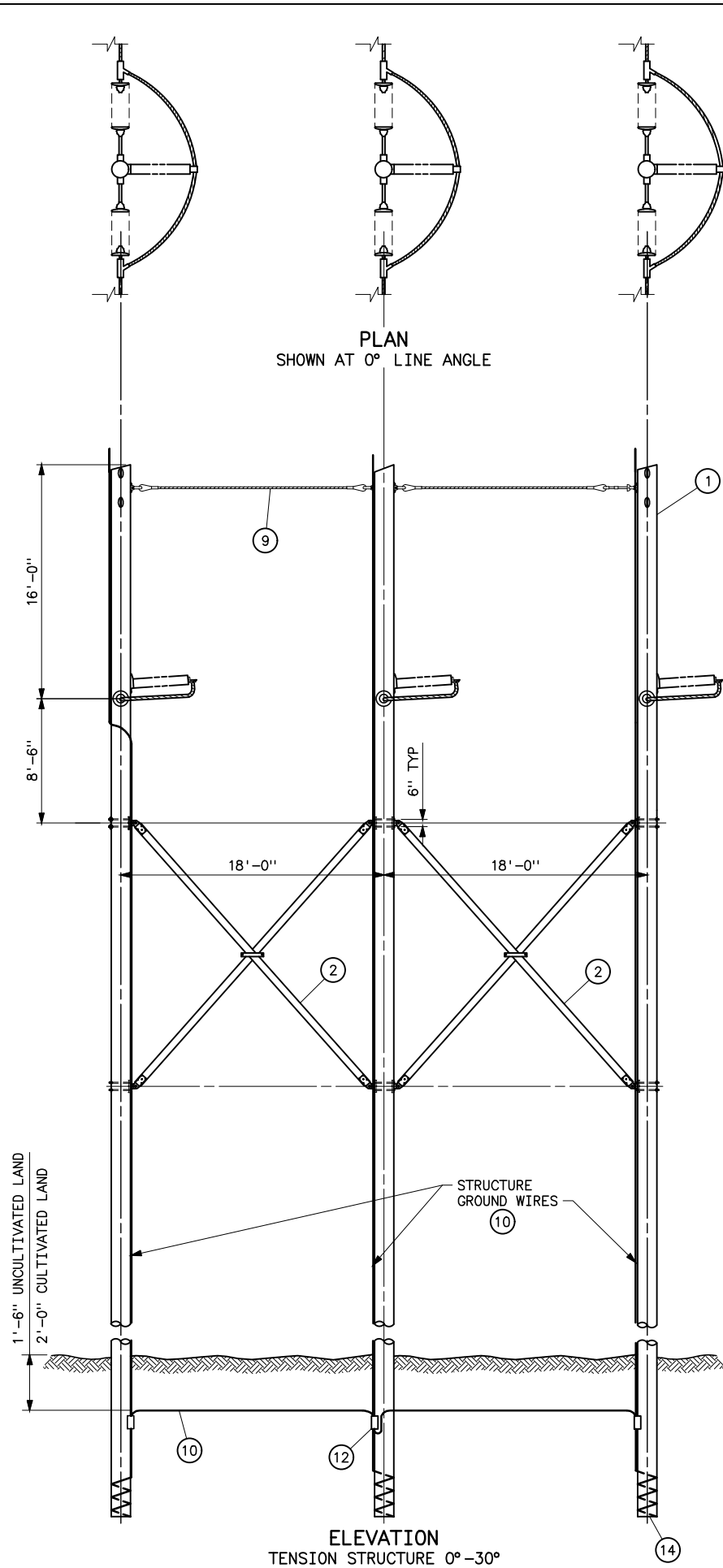
- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
- FOR DEAD ENDING OPGW, SPACE DEAD END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.

REFERENCE DRAWINGS

WOOD POLE STRUCTURE GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS	
FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
CROSSARM DRILLING DETAILS HS-1 AND HSB-1 STRUCTURES	41 6113
STEEL ANGLE DETAILS FOR WOOD POLE STRUCTURES	41 6133
TYPICAL DETAILS FOR OPTICAL GROUND WIRE SPLICE STRUCTURES	41 6153

A	5-3-19 A7-KKR	CHANGED TO HS-1 STRUCTURE REMOVED CENTER PHASE BRACING, AND CHANGED X-BRACE.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HS-1 161KV SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE APPROVED DOUG HANSON CIVIL ENGINEERING MANAGER		
DATE	OCTOBER 18, 2016	41 6169

Plotted By: Seela Jan 09, 2018- 7:28am
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STRUCTURE MATERIAL			
PART NO.	QUANTITY	QUANTITY	DESCRIPTION
	0°-5° LINE ANGLE	5°-30° LINE ANGLE	
1	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	2	2	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8"x6" (HUGHES BROS NO. 2121 OR EQUAL)
3	14*	14*	DEAD-END TEE, HUGHES BROS NO. 2817R4.5-15-15C OR EQUAL
4	AS REQD	AS REQD	7/8"x REQUIRED LENGTH MACHINE BOLTS WITH LOCKNUTS, LOCK WASHERS AND CURVED WASHERS AS NECESSARY
5	4	4	CONNECTING LINK
6	4	4	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
7	4	4	SHEAVE WHEEL, 2 1/2" DIA MINIMUM
8	2	2	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"
9	AS REQD	AS REQD	STEEL STRAND 7/16", 7-WIRE, HIGH STRENGTH
10	AS REQD	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
11	AS REQD	AS REQD	BONDING CLIP EQUAL TO HUGHES BROS NO. 2727.8 W/NUT
12	10	AS REQD	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
POST INSULATOR ASSEMBLY MATERIAL			
PART NO.	QUANTITY	DESCRIPTION	
	0°-30° LINE ANGLE		
16	6	7/8"x REQUIRED LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER	
17	6	4"x4"x1/4" CURVED SQUARE WASHER WITH 15/16"Ø HOLE	
18	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)	

- NOTES**
- THE 3TA-3 STRUCTURE USES DEAD-END TEES AS OPPOSED TO POLE BANDS AND EQUAL LENGTH POLES.
 - FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
 - ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
 - MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED IS BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
 - DEAD END TEE MAY BE PLACED IN LINE WITH GUYS. ANCHOR SHACKLE SHALL BE USED IF NOT IN LINE. REFER TO DRAWING 41 6138 FOR TYPICAL DEAD-END TEE DETAILS.
 - *QUANTITIES DO NOT INCLUDE GUYING.
 - USE FIBERGLASS GUY INSULATORS, 10 FT LENGTH ULTIMATE STRENGTH 30,000 LBS AS REQUIRED.

REFERENCE DRAWINGS	
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
TYPICAL DETAILS FOR DEAD END TEES	41 6138

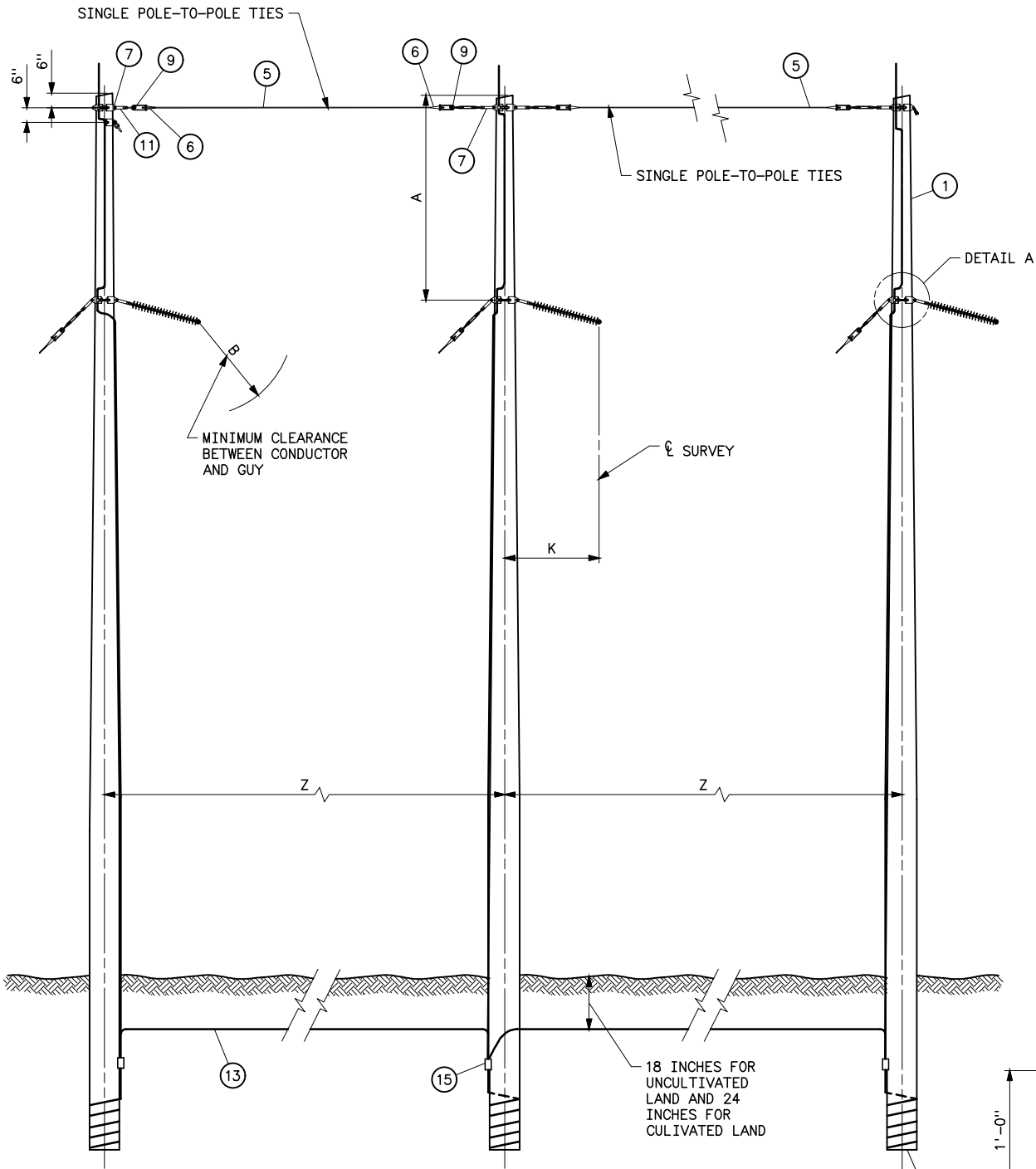
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
HEADQUARTERS - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE 3TA-3 161KV
3-POLE TENSION STRUCTURE

DESIGNED KAREN ROWE APPROVED CIVIL ENGINEERING MANAGER

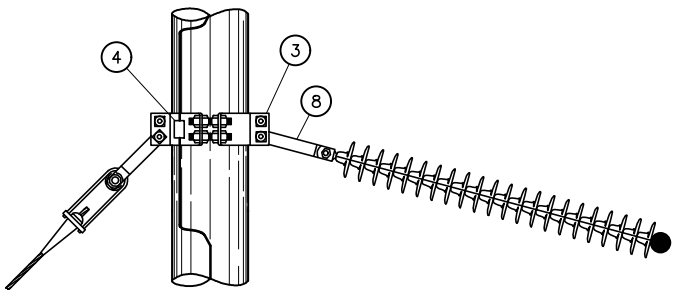
C_AE JANUARY 9, 2018 41 6170

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES)
	8	1/2"Øx4" LAG SCREWS (2 PER BAND)
	8	1 3/8"Ø FLAT ROUND WASHER WITH 9/16"Ø HOLE (2 PER BAND)
3	3	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3112 SERIES)
4	7	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
5	AS REQD	7/16"Ø HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
6	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
7	5	1/4"x2"x17" CONNECTING LINK PAIR WITH 3/4"Øx 2 1/2" BOLT, 2 NUTS, AND COTTER KEY
8	3	1/4"x3"x17" CONNECTING LINK PAIR WITH 3/4"Øx 2 1/2" BOLT, 2 NUTS, AND COTTER KEY
9	6	2 1/2" SHEAVE WHEEL SUITABLE FOR 7/16"Ø WIRE
10	1	7/8"Øx12" CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
11	2	7/8"Øx12" CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
12	2	TWISTED SHACKLE
13	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
14	2	OVERHEAD GROUND WIRE SUSPENSION ASSEMBLY
15	3	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
16	3	POLE BOTTOM PLATE (BLACKBURN NO. 110 OR EQUAL) ATTACHED TO POLE
17	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

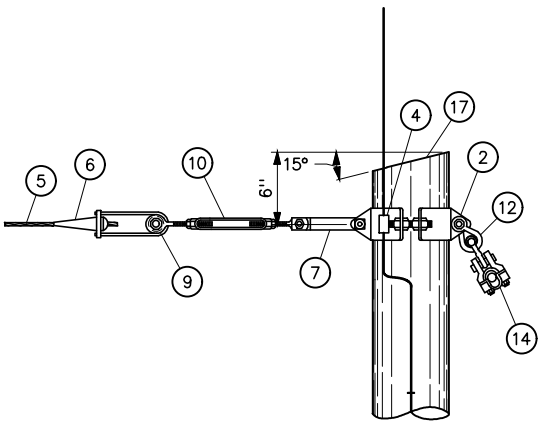
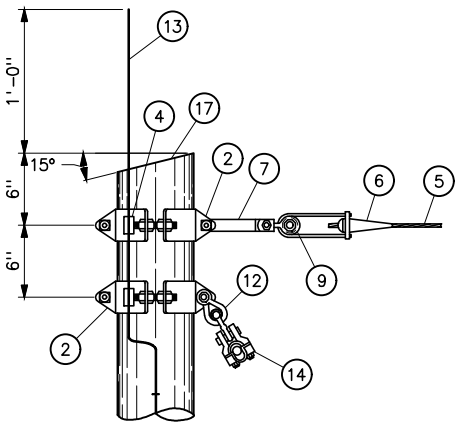


ELEVATION

VOLTAGE/ DIMENSION	A	B	K	Z
138KV	10'-0"	5'-0"	6'-0"	23'-0"
161KV	10'-0"	5'-8"	6'-6"	24'-0"
230KV	11'-0"	7'-0"	7'-6"	25'-0"



DETAIL A



OVERHEAD GROUND WIRE ATTACHMENT

NOTES

1. THE 3A-2 STRUCTURE HAS EQUAL POLE LENGTHS.
2. POLES SHALL BE RAKED 1/4 INCH FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
3. ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
4. HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16 INCH LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
5. DEAD-END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD-END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

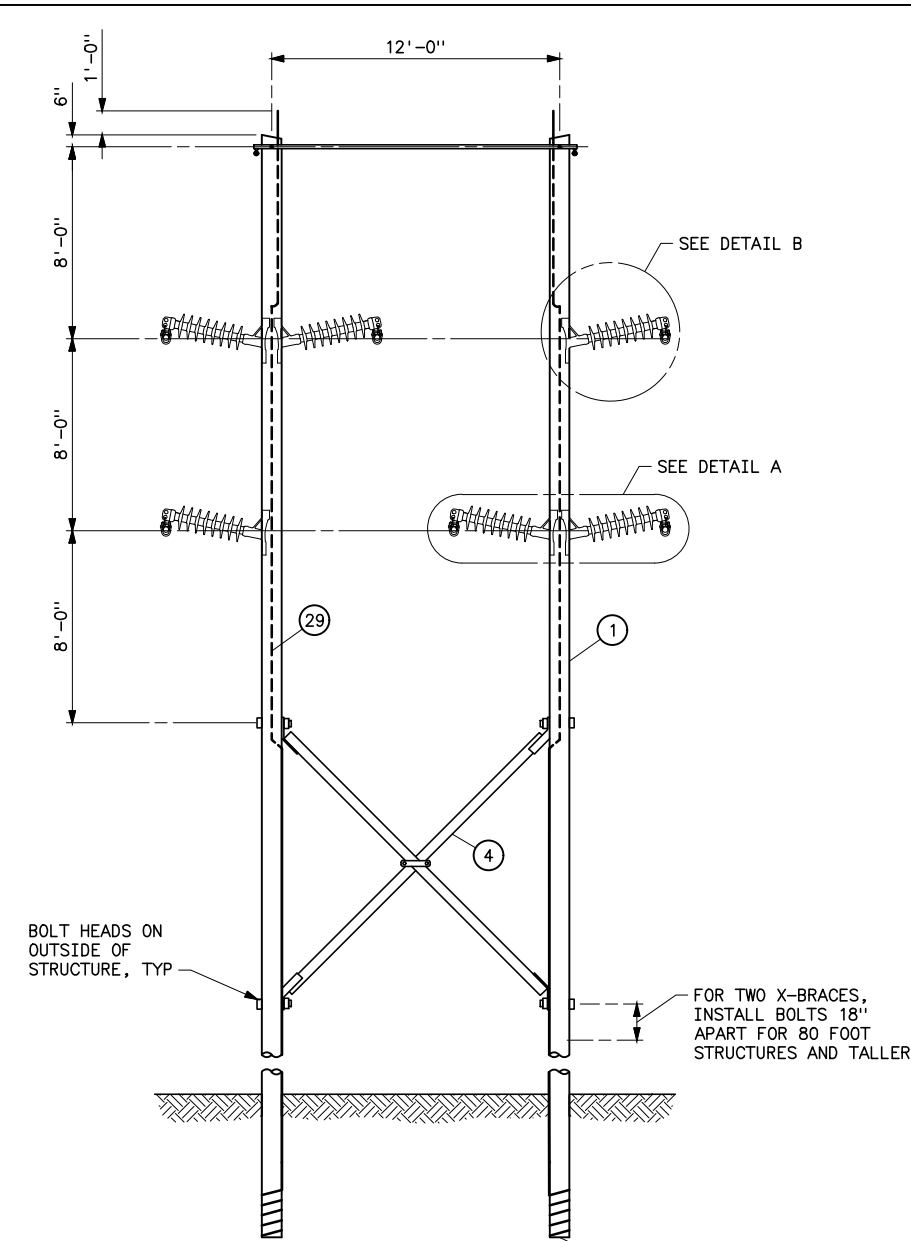
WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPICAL DETAILS FOR DEAD END TEES	41 6138
GUY ASSEMBLIES AND DETAILS	41 6047
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB	
STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053

A	6-21-22 A7-KKR	REVISED CLEARANCE VALUES "B".
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3A-2 138, 161 AND 230KV MEDIUM ANGLE STRUCTURE		
DESIGNED KAREN ROWE APPROVED CIVIL ENGINEERING MANAGER		
C _A E	AUGUST 8, 2017	41 6171

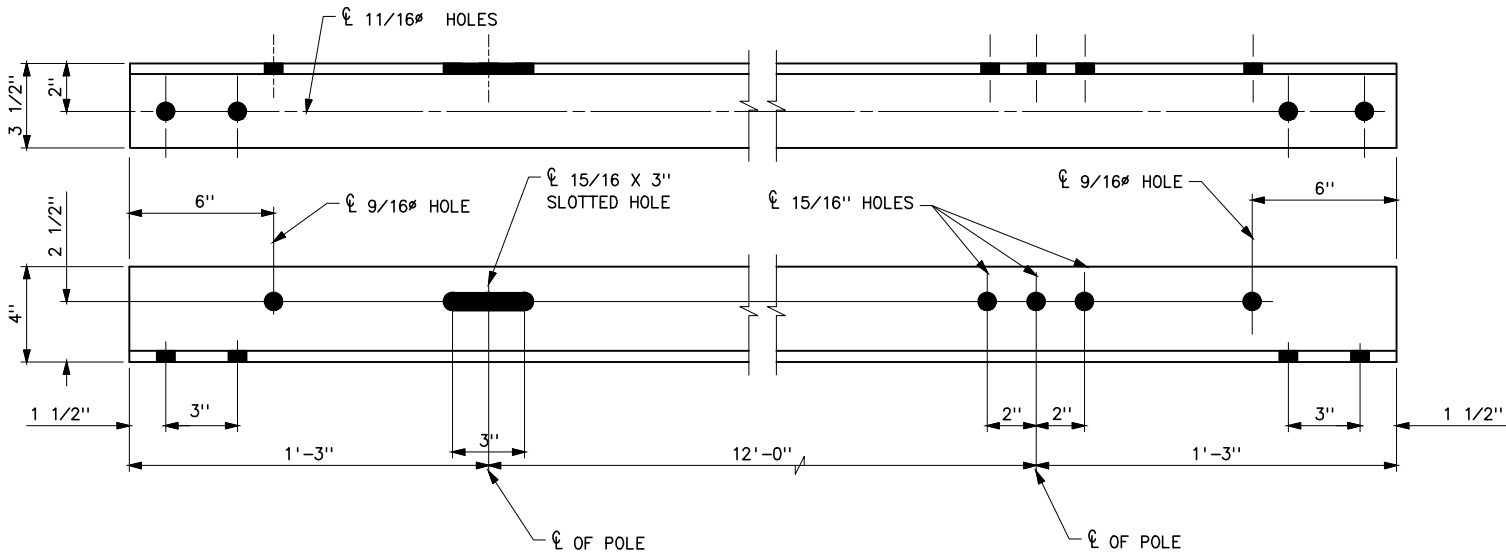
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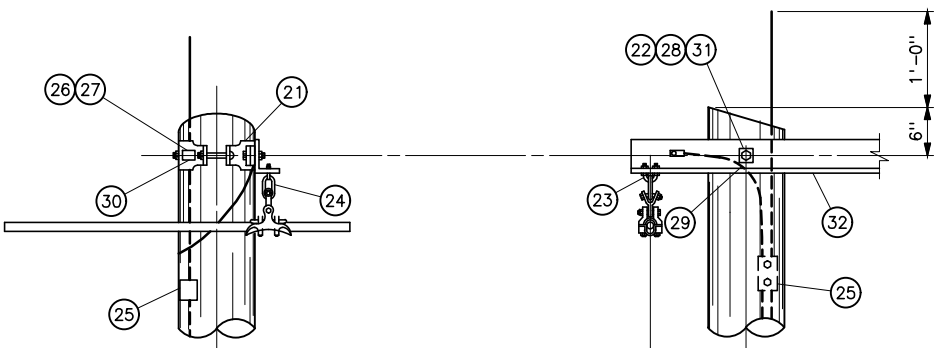
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ELEVATION



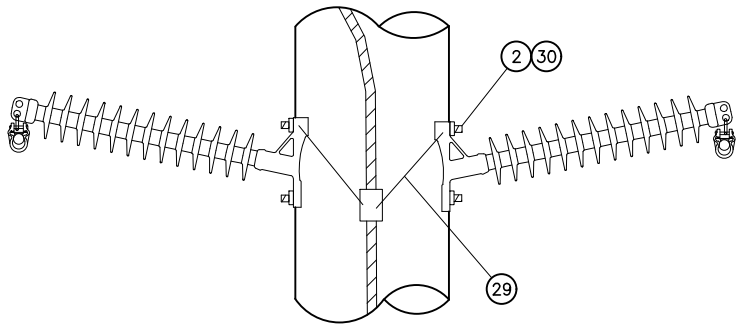
STEEL ANGLE (32)



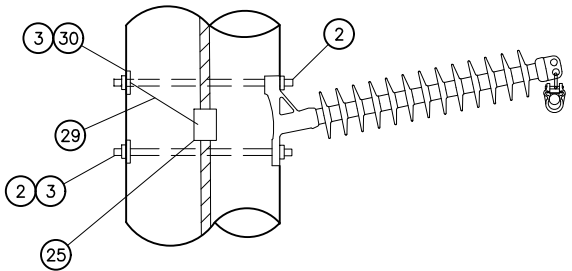
DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	CLASS 1 POLE, SEE STRUCTURE LIST FOR HEIGHT
2	8	DOUBLE ARMING BOLT, 3/4"Øx REQD LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS (SEE NOTE 4)
3	2	3x3x1/4 CURVED WASHER WITH 13/16"Ø HOLE (SEE NOTE 4)
4	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8"x4 3/8" (HUGHES BROS. NO. 1042 OR EQUAL)

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"Øx1'-0"
23	2	"U" BOLT, 5/8"Øx3" WITH HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2"Ø (HUGHES BROS NO. 1329-B1 OR EQUAL)
25	6	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"Øx4" LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8"Ø FLAT ROUND WASHER WITH 9/16"Ø HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8"Ø BOLT
29	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
30	6	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
31	2	SPRING LOCK WASHER FOR 7/8"Ø BOLT
32	1	STEEL ANGLE, 4"x3 1/2"x5/16"x14'-6" LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE



DETAIL A



DETAIL B
POST INSULATOR ASSEMBLY

NOTES

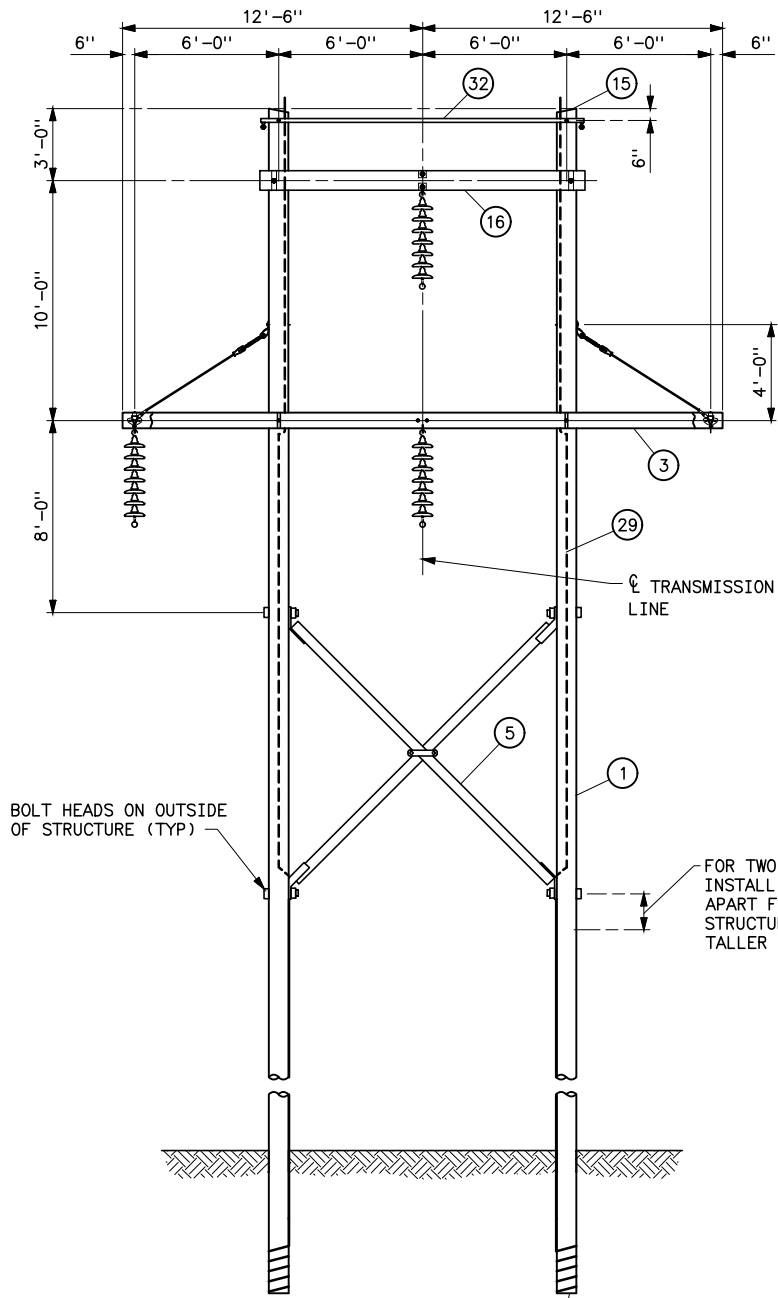
- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO OF TOP MOUNTING HOLES.
- BOLT, LOCKNUT, AND CURVED WASHER SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

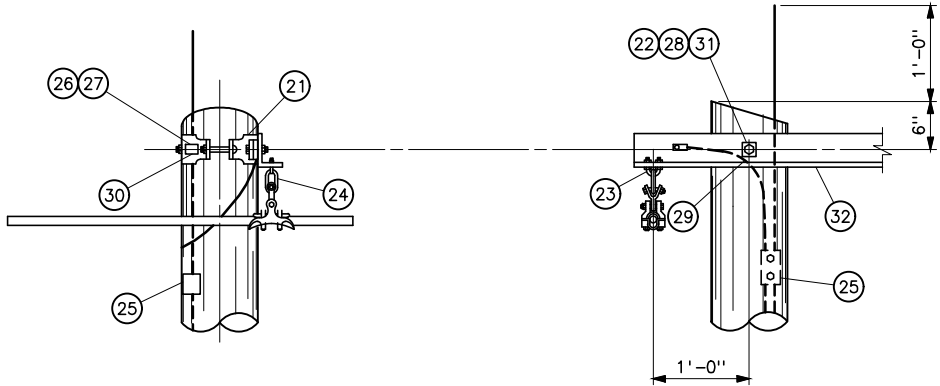
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
HORIZONTAL POST INSULATOR ASSEMBLIES	41 1024
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HP2X 115KV DOUBLE CIRCUIT SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
CAC	MAY 3, 2019	41 6172

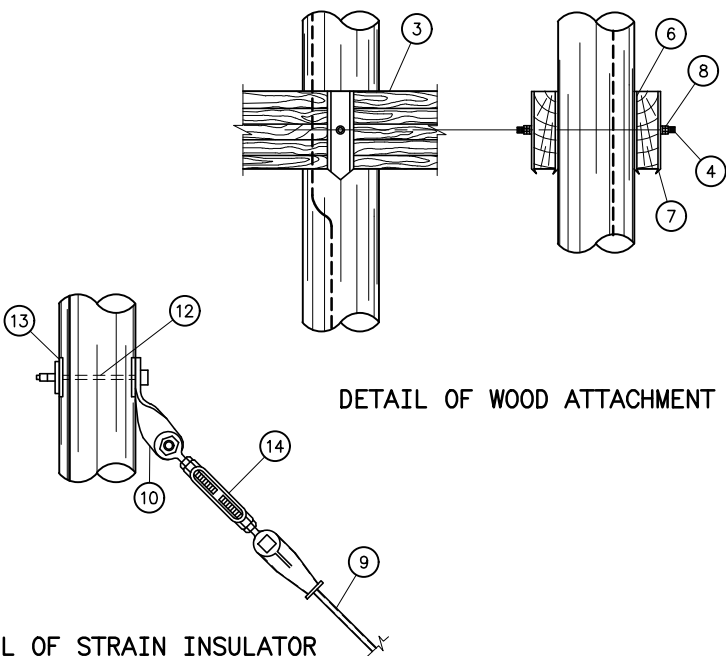
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ELEVATION

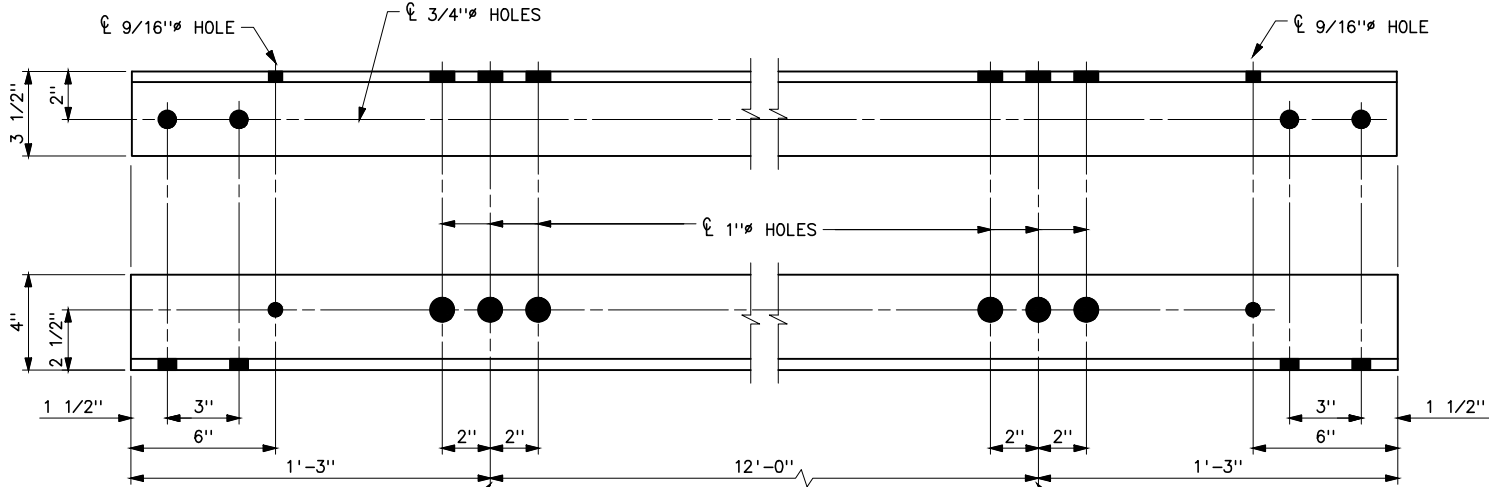


DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT

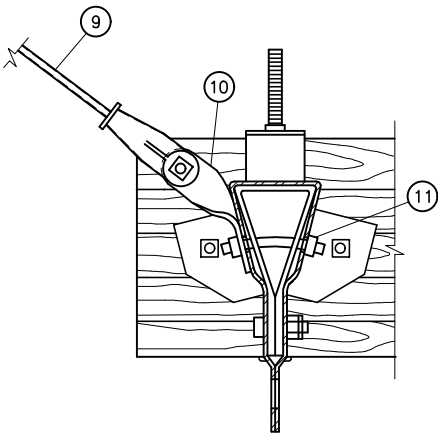


DETAIL OF WOOD ATTACHMENT

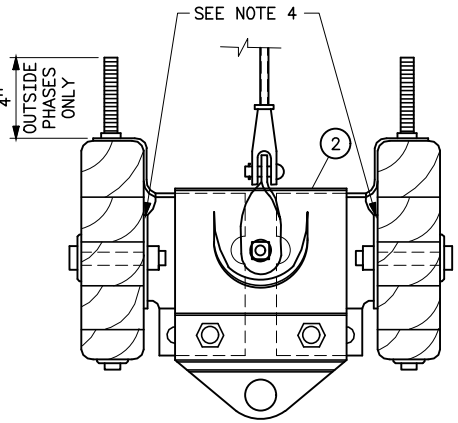
DETAIL OF STRAIN INSULATOR ATTACHMENT TO POLE



STEEL ANGLE (32)
(MARK B2, 41 6133)



DETAIL OF PHASE FITTING ASSEMBLY



STRUCTURE MATERIAL

PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, & WASHERS (HUGHES BROS. TYPE 3414.2 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8"x9"x25'-0"
4	4	DOUBLE ARMING BOLT, 7/8"x REQD LENGTH WUTH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 3 3/8"x4 3/8" (HUGHES BROS. NO. 1042-12'-0" WITH 14'-10" LENGTH OR EQUAL)
6	8	FLAT GAIN PLATE
7	8	RIBBED TIE PLATE
8	8	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 25,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK (HUGHES BROS. CF695-36-BNK, CC 47-1/8 INCHES, OR EQUAL)
10	4	TWISTED CLIP (EQUAL TO HUGHES BROS NO. AS2276)
11	2	7/8"x REQD LENGTH BENT BOLT WITH LOCK WASHERS AND LOCKNUTS
12	2	7/8"x REQD LENGTH BOLT WITH LOCK WASHER AND LOCKNUT
13	2	4"x4"x1/4" CURVED WASHER, 15/16" HOLE
14	2	TURNBUCKLE (HUGHES BROS NO. AS2545-B OR EQUAL)
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY
16	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x13'-0"

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL

PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8"x1'-0"
23	2	"U" BOLT, 5/8"x3" WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2" (HUGHES BROS NO. 1329-B1 OR EQUAL)
25	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
26	2	1/2"x4" LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
27	2	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (ONE PER BAND)
28	2	LOCKNUT FOR 7/8" BOLT
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
30	4	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT).
31	2	SPRING LOCK WASHER FOR 7/8" BOLT
32	1	STEEL ANGLE, 4"x3 1/2"x5/16"x 14'-6" LONG
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTES

1. STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
2. ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
3. GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
4. HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16" LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
5. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.

REFERENCE DRAWINGS

WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
CROSSARM DRILLING DETAILS HS-1 AND HSB-1 STRUCTURES	41 6113
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020

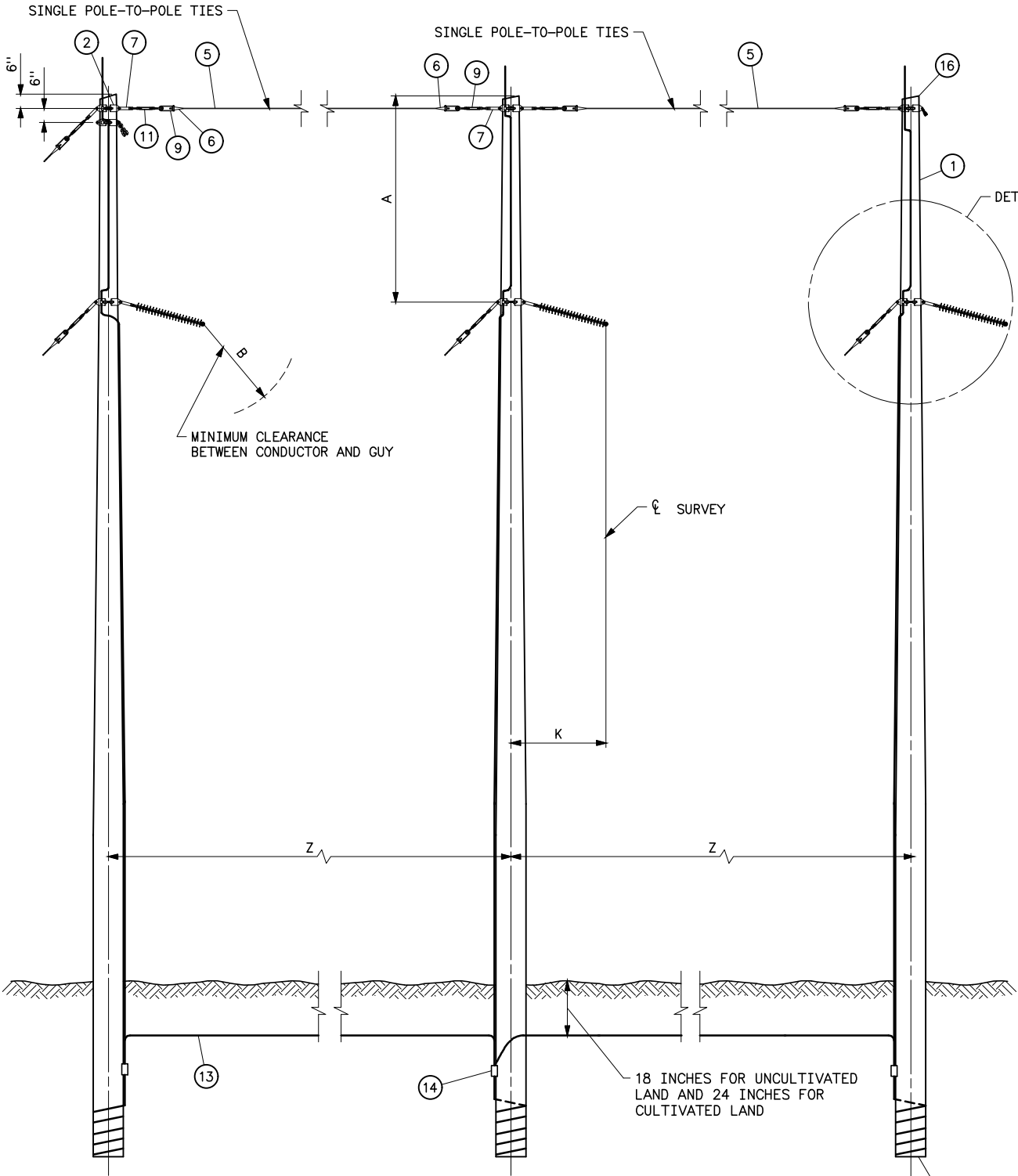
UNITED STATES DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
HEADQUARTERS - LAKEWOOD, COLORADO

STANDARD DESIGNS
TRANSMISSION LINES
TYPE HTR-1 115KV
TRANSPOSITION STRUCTURE

DESIGNED KAREN ROWE APPROVED GINA CRAWFORD
CIVIL ENGINEERING MANAGER

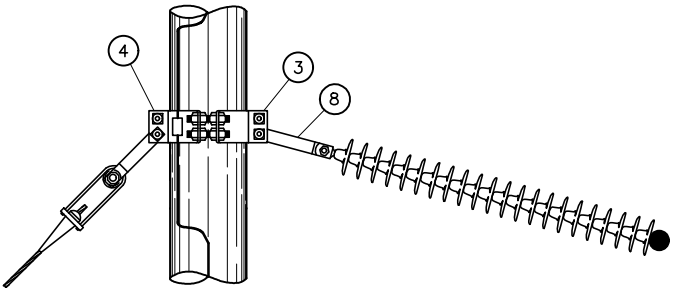
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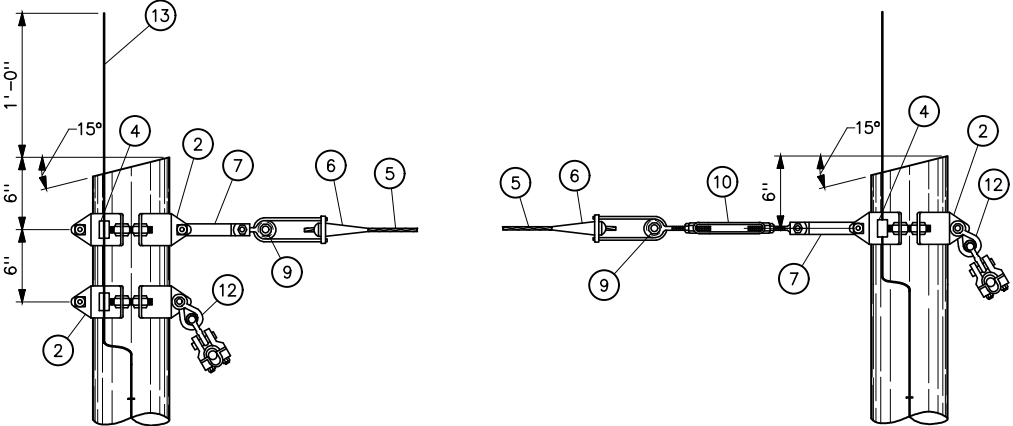


ELEVATION

DIMENSION	A	B	K	Z
VOLTAGE				
115KV	10'-0"	4'-0"	5'-0"	18'-0"
69KV	10'-0"	2'-6"	3'-6"	13'-0"



DETAIL A



OVERHEAD GROUND WIRE ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) (SEE NOTE 5)
	8	1/2"Øx4 LAG SCREWS (2 PER BAND)
	8	1 3/8"Ø FLAT ROUND WASHER WITH 9/16Ø HOLE (2 PER BAND)
3	3	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3112 SERIES) (SEE NOTE 5)
4	7	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
5	AS REQD	7/16"Ø HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
6	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
7	5	1/4x2x17 CONNECTING LINK PAIR WITH 3/4"Øx2 1/2 BOLT, 2 NUTS, AND COTTER KEY
8	3	1/4x3x17 CONNECTING LINK PAIR WITH 3/4"Øx2 1/2 BOLT, 2 NUTS, AND COTTER KEY
9	6	2 1/2" SHEAVE WHEEL SUITABLE FOR 7/16"Ø WIRE
10	1	7/8"Øx12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
11	2	7/8"Øx12 CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
12	2	TWISTED SHACKLE
13	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
14	3	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
15	3	POLE BOTTOM PLATE (BLACKBURN NO. 110 OR EQUAL) ATTACHED TO POLE
16	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

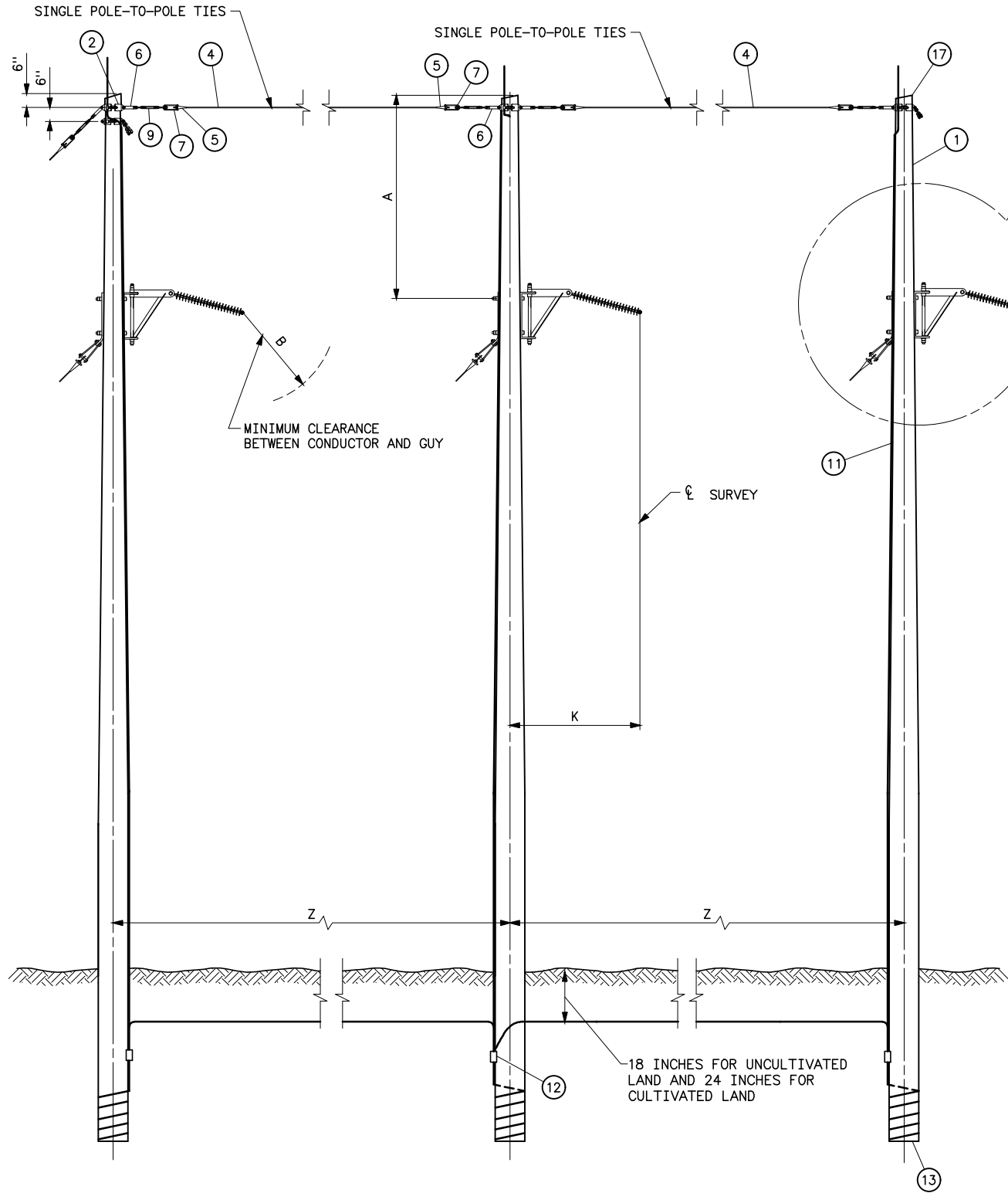
NOTES

- THE 3A-2 STRUCTURE HAS EQUAL POLE LENGTHS.
- POLES SHALL BE RAKED 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16" LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

REFERENCE DRAWINGS

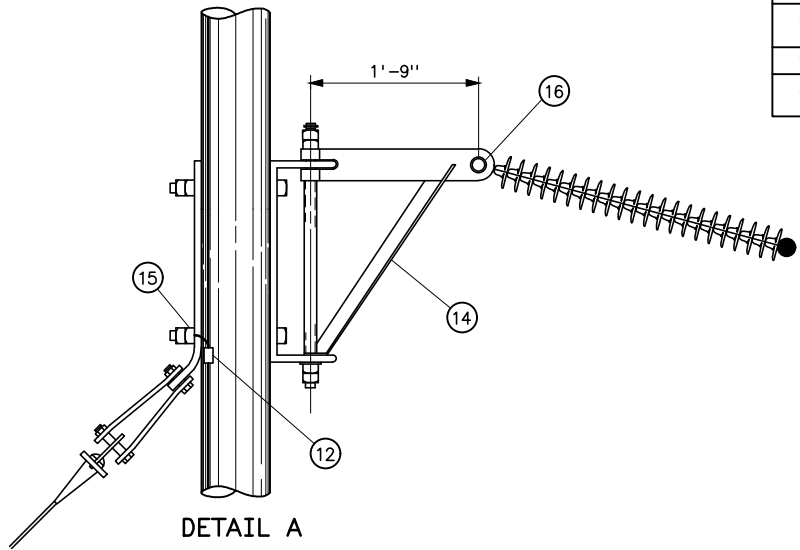
WOOD POLES STRUCTURES GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
SUSPENSION INSULATOR ASSEMBLIES	
DOUBLE STRING	41 1021
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
GUY ASSEMBLIES AND DETAILS	41 6047
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB	
STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053
TYPICAL DETAILS FOR DEAD-END TEES	41 6138

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3A-2 69 AND 115KV MEDIUM ANGLE STRUCTURE		
DESIGNED KAREN ROWE	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
DECEMBER 11, 2019	41	6174

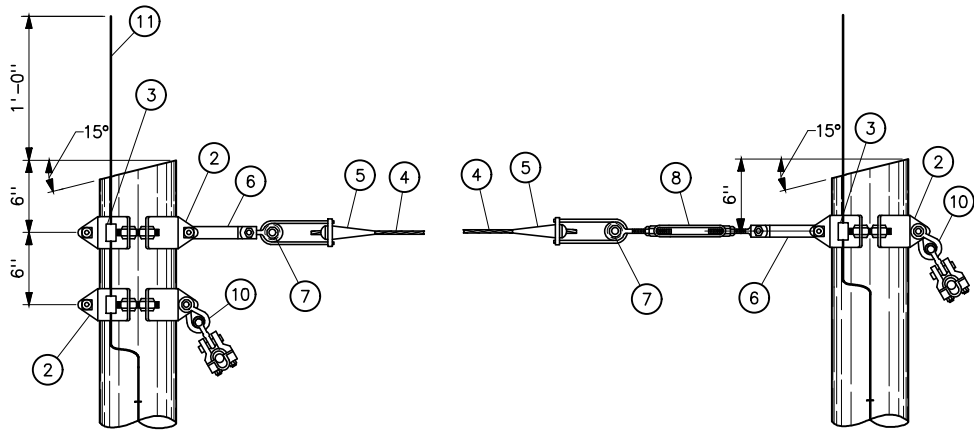


ELEVATION

DIMENSION	A	B	K	Z
VOLTAGE				
115KV	10'-0"	4'-0"	6'-0"	19'-6"
69KV	10'-0"	2'-6"	4'-6"	14'-6"



DETAIL A



OVERHEAD GROUND WIRE ATTACHMENT

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) (SEE NOTE 4)
	8	1/2"Øx4 LAG SCREWS (2 PER BAND)
	8	1 3/8"Ø FLAT ROUND WASHER WITH 9/16"Ø HOLE (2 PER BAND) (SEE NOTE 4)
3	4	1/2"Ø GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
4	AS REQD	7/16"Ø HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
5	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
6	5	1/4x2x17 CONNECTING LINK PAIR WITH 3/4"Øx2 1/2 BOLT, 2 NUTS, AND COTTER KEY
7	6	2 1/2" SHEAVE WHEEL SUITABLE FOR 7/16"Ø WIRE
8	1	7/8"Øx12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
9	2	7/8"Øx12 CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
10	2	TWISTED SHACKLE
11	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
12	6	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
13	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
14	3	EXTENSION BRACKET, 1'-9", COMPLETE WITH 3/4" ATTACHMENT BOLTS AND GUY PLATE (EQUAL TO HUGHES BROS NO. 2822.8)
15	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SRIES OR HUGHES BROS NO. 2727)
16	3	1"Ø BOLT, 2 NUTS, AND COTTER KEY
17	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

NOTES

- THE 3AB-2 STRUCTURE HAS EQUAL POLE LENGTHS.
- POLES SHALL BE GIVEN RAKE OF 1/4" FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8" LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16" LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.

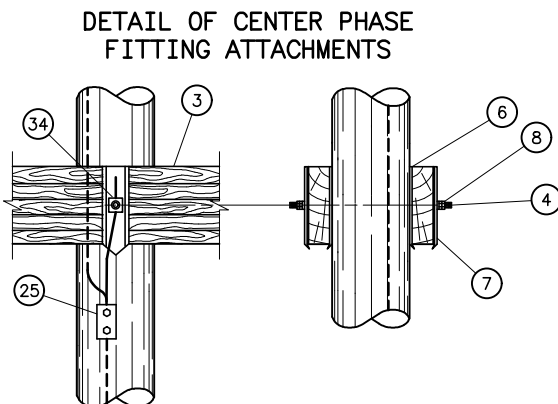
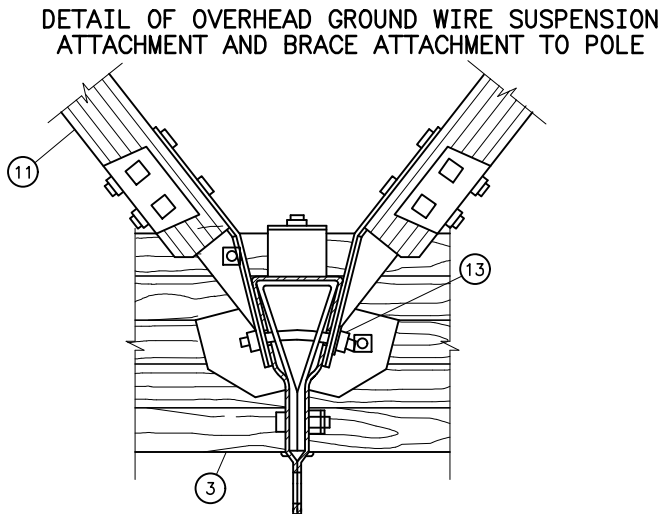
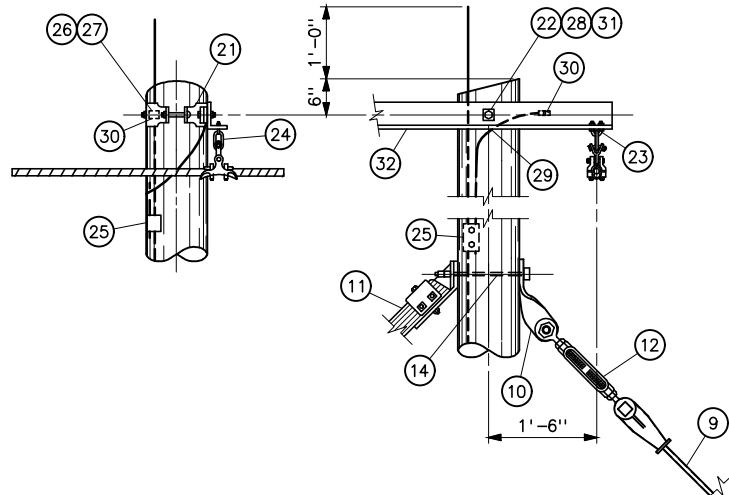
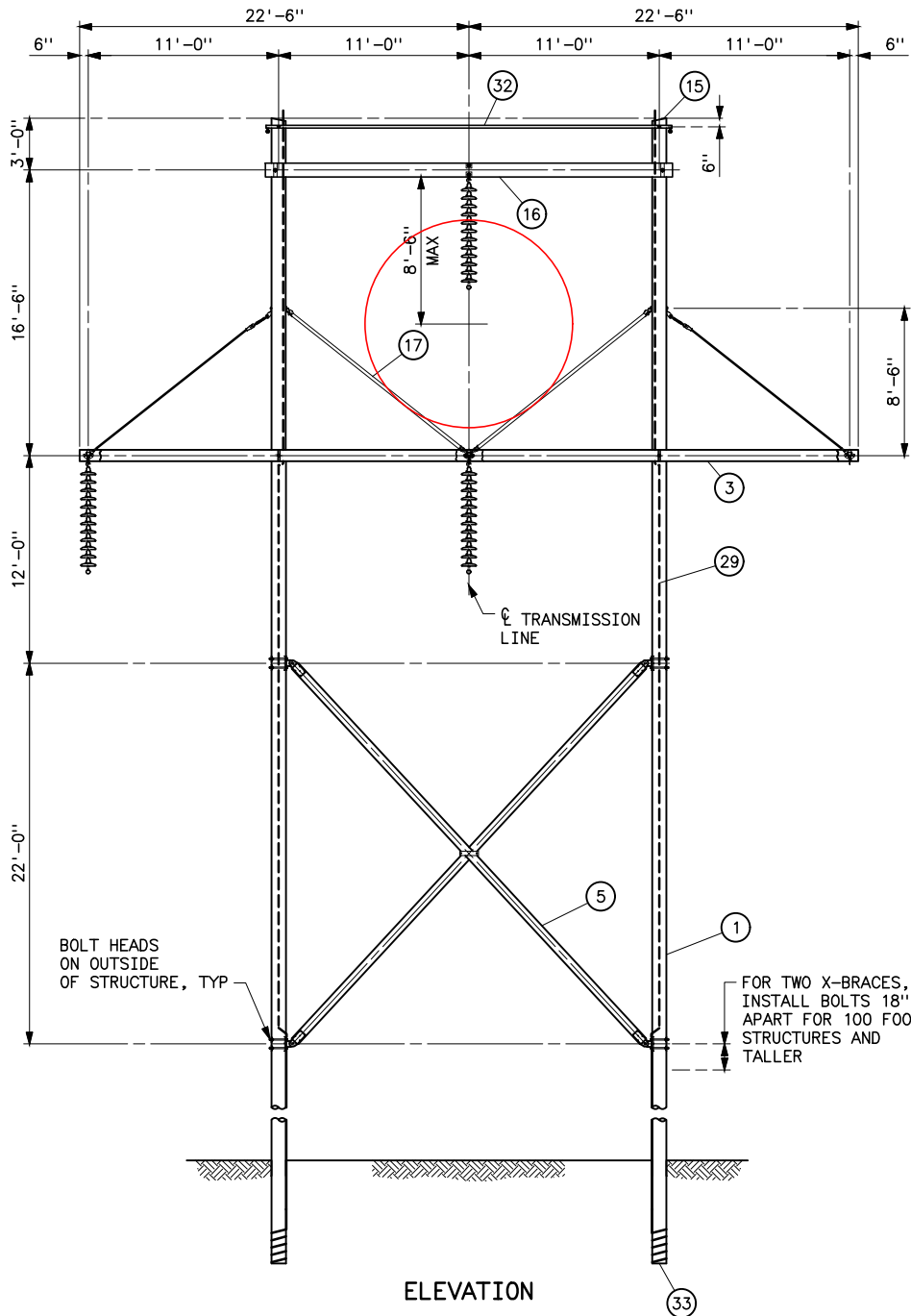
REFERENCE DRAWINGS

WOOD POLES STRUCTURES GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	
SUSPENSION INSULATOR ASSEMBLIES	41 1020
DOUBLE STRING	
OPTICAL GROUND WIRE ASSEMBLIES	41 1021
GUY ASSEMBLIES AND DETAILS	41 1031
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB	41 6047
STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053
TYPICAL DETAILS FOR DEAD-END TEES	41 6138

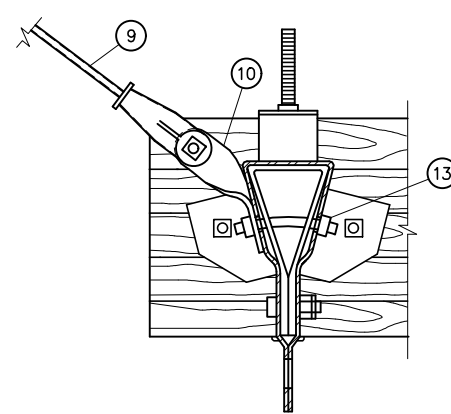
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3AB-2 69 AND 115KV MEDIUM ANGLE STRUCTURE		
DESIGNED KAREN ROWE	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
DECEMBER 11, 2019	41	6175

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DETAIL OF WOOD CROSSARM ATTACHMENT TO POLE

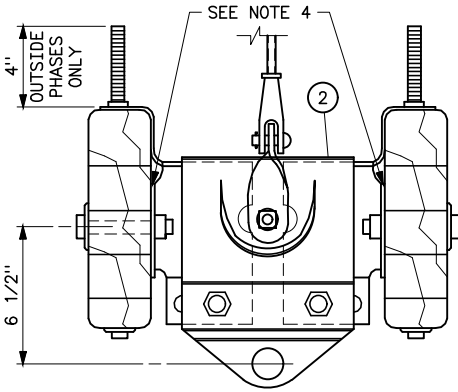


DETAIL OF PHASE FITTING ASSEMBLY

- NOTES
- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
 - ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
 - GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
 - HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
 - BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
 - FOR DEAD ENDING OPGW, SPACE DEAD END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.

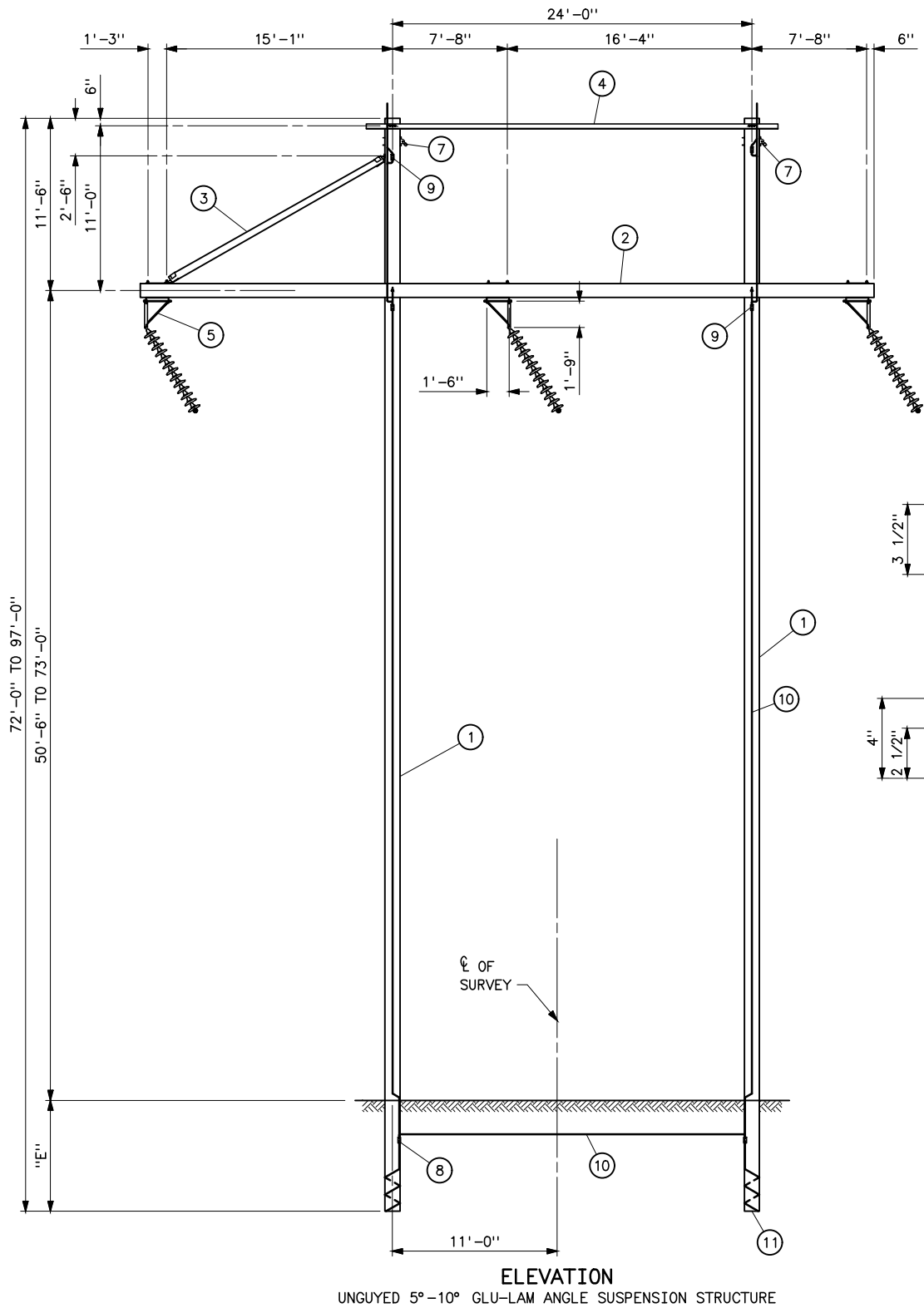
REFERENCE DRAWINGS

WOOD POLE STRUCTURE GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES SINGLE STRING	41 1020
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
CROSSARM DRILLING DETAILS HS-1 AND HSB-1 STRUCTURES	41 6113
TYPICAL DETAILS FOR OPTICAL GROUND WIRE SPLICE STRUCTURES	41 6153

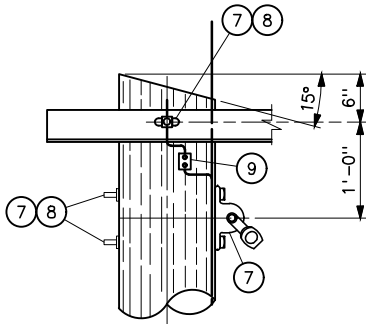


A	7-25-23 A7-KR	CHANGED 80 FOOT TO 100 FOOT ON NOTE FOR X-BRACES.
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO	
STANDARD DESIGNS TRANSMISSION LINES TYPE HTR-1 230KV TRANSPOSITION STRUCTURE		
DESIGNED <u>KAREN ROWE</u> _____ APPROVED <u>GINA CRAWFORD</u> _____ CIVIL ENGINEERING MANAGER		
C A E	MAY 11, 2021	41 6176

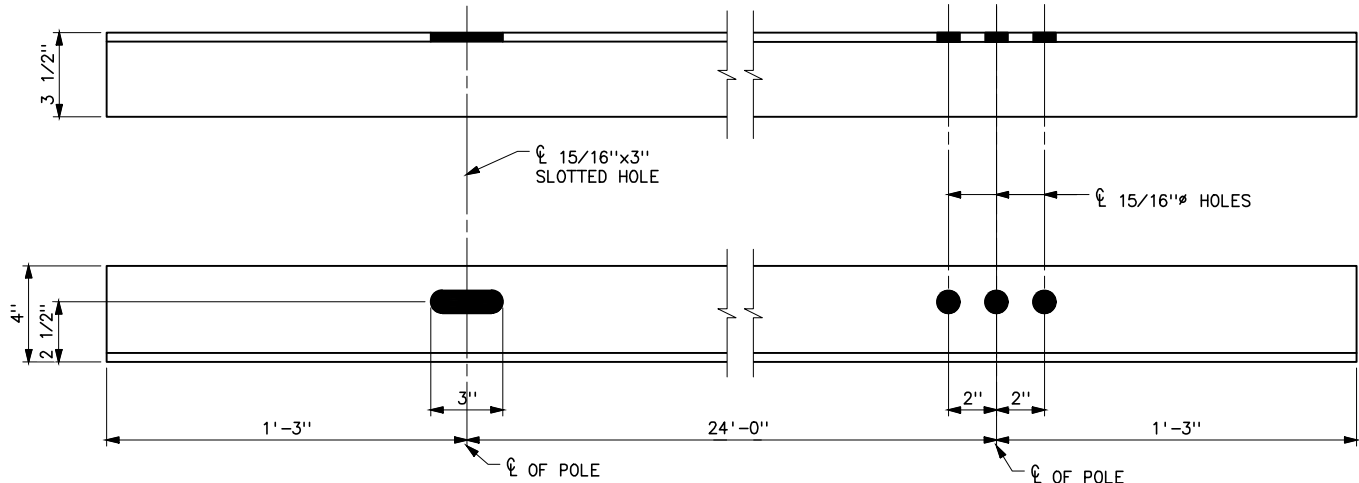
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IMAGES:



ELEVATION
UNGUYED 5°-10° GLU-LAM ANGLE SUSPENSION STRUCTURE



DETAIL A



STEEL ANGLE

MATERIAL LIST		
PART NO.	QUANTITY	DESCRIPTION
1	2	GLUED LAMINATED RAKED POLE
2	1	GLUED LAMINATED CROSSARM
3	1	KNEE BRACE
4	1	4"x3 1/2"x3/8"x26'-6" STEEL ANGLE
5	3	SWINGING ANGLE BRACKET, HUGHES BROS. 2823.8 OR EQUAL
7	2	DEAD END TEE MACHINE BOLTS, WASHERS, LOCKNUTS
8	AS REQD	BONDING CLIPS EQUAL TO HUGHES BROS. 2727
9	2	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
10	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
11	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOT PROVIDED BY
GLUED LAMINATED
POLE MANUFACTURER

NOTES

- OVERLOAD FACTOR:
NESC _____VERTICAL=1.5
TRANSVERSE (WIND)=2.5
TRANSVERSE (WIRE TENSION)=1.65
LONGITUDINAL=1.65
HIGH WIND _____ALL=1.33
- STRUCTURE AND ATTACHMENTS SHALL BE DESIGNED FOR THE SIMULTANEOUS APPLICATION OF DEAD LOAD, WIND ON THE STRUCTURE, AND WIRE LOADS.
- STRUCTURE GUYS ARE NOT PERMITTED.
- CONDUCTOR: 954 KCM, ACSR 45/7 RAIL
OGW: ONE 3/8", 7-STRAND, EXTRA HIGH STRENGTH.
OPGW: ONE .1248 INCHES SQUARED, .465", .314 LB/FT RTS _____16,626 LB
- WIND SPAN _____700 FT
- WEIGHT SPAN _____400-1200 FT
- DESIGN FOR:
NESC HEAVY: 2017 EDITION, 1/2" RADIAL ICE, 4 PSF AT 0°F.
TENSIONS: CONDUCTOR (AHEAD AND BACK) _____10,744 LB
OGW (AHEAD AND BACK) _____4266 LB
OPGW (AHEAD AND BACK) _____5082 LB
HIGH WIND: 85 MPH WIND AT 60°F WITH 1.14 FACTOR FOR WIRES AND 1.40 HEIGHT AND GUST FACTOR FOR THE STRUCTURE.
60°F TENSION _____5378 LB
- GLU-LAM MANUFACTURER SHALL DETERMINE EMBEDMENT DEPTH "E" AND RAKE.
- GLU-LAM MANUFACTURER SHALL PROVIDE ATTACHMENT HARDWARE BASED ON CRITERIA IN THE SPECIFICATIONS AND SUITABLE FOR ITS INTENDED USED.
- INSTALL IN ACCORDANCE WITH MANUFACTURES RECOMMENDATIONS.
- POLES SHALL BE SET TO WITHIN 3" OF THE SPECIFIED SETTING.
- ANGLE RANGE FROM 5°-10°.
- POLE HEIGHT RANGE 72'-0" TO 97'-0".
- GRADE B CONSTRUCTION.

REFERENCE DRAWINGS

SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019

B	10-15-24 A7-KR	REMOVED "U" BOLT AND REFERENCED DEADEND TEE FOR OGW ATTACHMENT.
	9-18-23 A7-KR	ADDED RAKE TO NOTE 8.
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGN TRANSMISSION LINES TYPE HLA-GL 230KV LARGE ANGLE SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE _____ APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER		
C _A E	OCTOBER 16, 2020	41 6177

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, AND WASHERS (HUGHES BROS. TYPE 3415 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x29'-0"
4	2	DOUBLE ARMING BOLT, 7/8" x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS. NO. 2121-14-0 OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	2	CLEVIS-CLEVIS FIBERGLASS GUY STRAIN, 30,000 LB MINIMUM ULTIMATE STRENGTH COMPLETE WITH BNK
10	4	TWISTED CLIP (HUGHES BROS. NO. AS2276 OF EQUAL)
11	2	WOOD VEE BRACE, 3 1/2x5 1/2, COMPLETE WITH FITTINGS, 5'-6" DROP, SPACING VARIES WITH POLE DIAMETER
12	2	TURNBUCKLE (HUGHES BROS. NO. AS2545-B OF EQUAL)
13	3	7/8" x REQUIRED LENGTH BENT STUD WITH LOCK WASHER AND LOCKNUTS, THREADED BOTH SIDES
14	2	7/8" x REQUIRED LENGTH WITH LOCK WASHER AND LOCKNUT
15	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR LOCK MANUFACTURED BY THE BAYNE COMPANY
16	3	SWINGING ANGLE BRACKET, COMPLETE WITH FITTINGS (HUGHES BROS. NO. 2821.6 OR EQUAL)

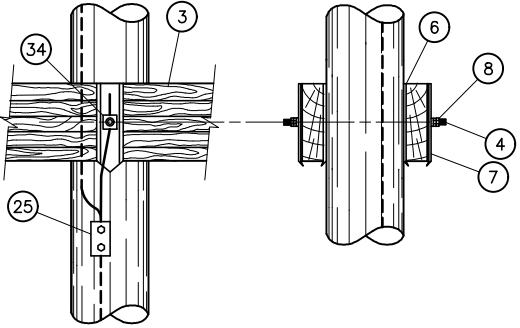
OVERHEAD GROUND WIRE AND GROUNDING MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
21	2	POLE TOP BAND (HUGHES BROS. NO. 2845-B OR EQUAL)
22	2	MACHINE BOLT, 7/8" x 1'-0"
23	2	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES) SEE NOTE 7
24	4	1/2" x 4 LAG SCREWS (2 PER BAND)
25	4	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
26	2	TWISTED SHACKLE (EQUAL TO HUGHES BROS. NO. 2866)
27	4	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
28	2	1/2" x 4 LAG SCREW WITH FETTER DRIVE THREAD (ONE PER BAND)
29	2	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (ONE PER BAND)
30	2	LOCKNUT FOR 7/8" BOLT
31	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2 INCH STAPLES
32	3	1/2" x 3" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
33	2	SPRING LOCK WASHER FOR 7/8" BOLT
34	1	STEEL ANGLE, 4x3 1/2x3/8x17'-6" LONG
35	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
36	2	BONDING CLIP (HUGHES BROS. NO. 2727 OR EQUAL)

REFERENCE DRAWINGS

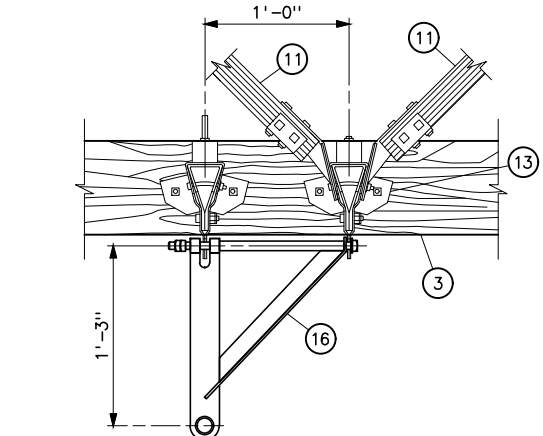
WOOD POLE STRUCTURE GROUNDING DETAILS ----- 41 1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS
FOR WOOD POLE STRUCTURES ----- 41 1019
SUSPENSION INSULATOR ASSEMBLIES
SINGLE STRING ----- 41 1020
OPTICAL GROUNDWIRE ASSEMBLIES ----- 41 1031
CROSSARM DRILLING DETAILS HS-1 AND
HSB-1 STRUCTURES ----- 41 6113
TYPICAL DETAILS FOR OPTICAL GROUND
WIRE SPLICE STRUCTURES ----- 41 6153

NOTES

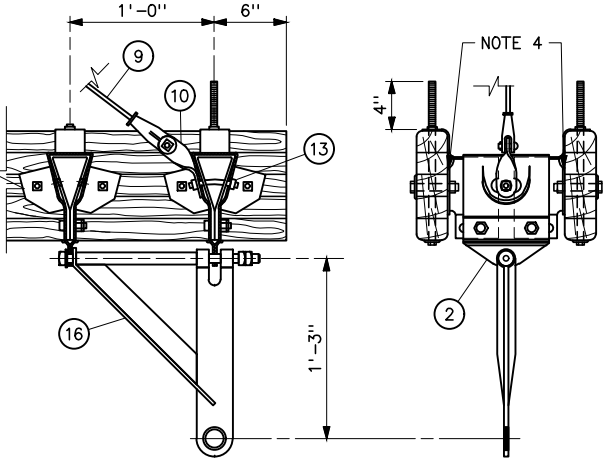
- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
- FOR DEAD ENDING OPGW, SPACE DEAD END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.



DETAIL OF WOOD CROSSARM ATTACHMENT TO POLE

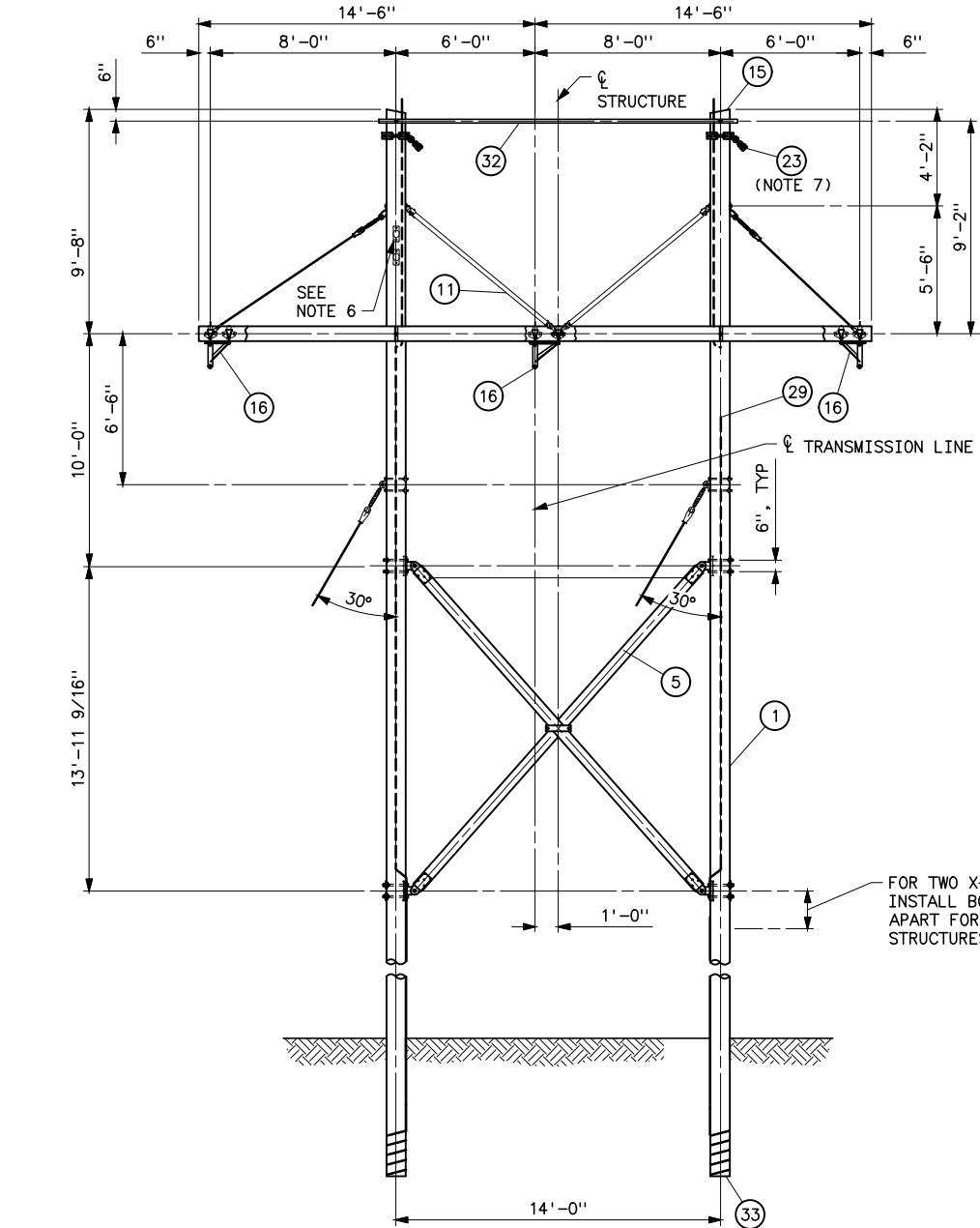
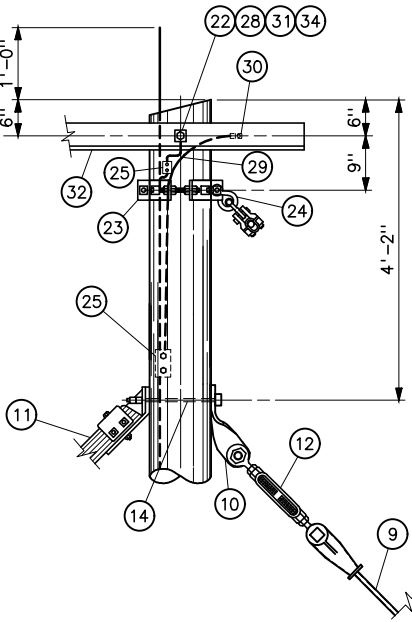


DETAIL OF CENTER PHASE FITTING ATTACHMENTS

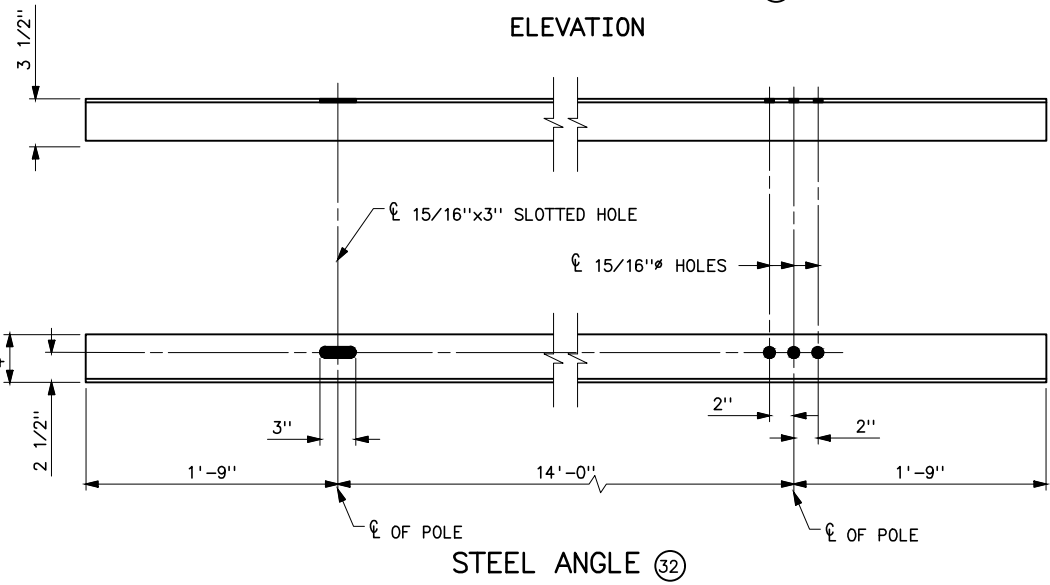


DETAIL OF PHASE FITTING ASSEMBLY

DETAIL OF OVERHEAD GROUND WIRE SUSPENSION ATTACHMENT AND BRACE ATTACHMENT TO POLE



ELEVATION

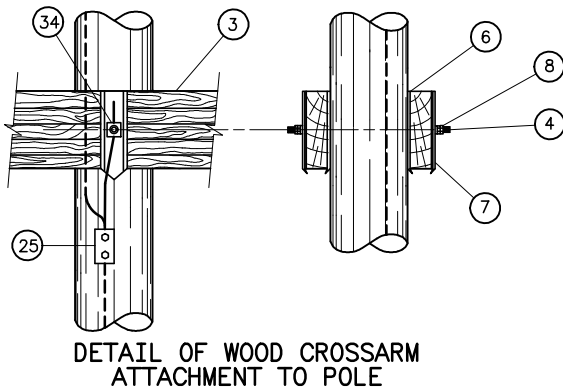
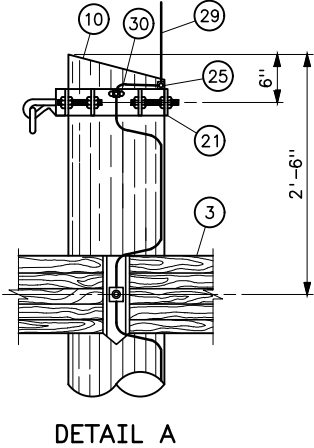
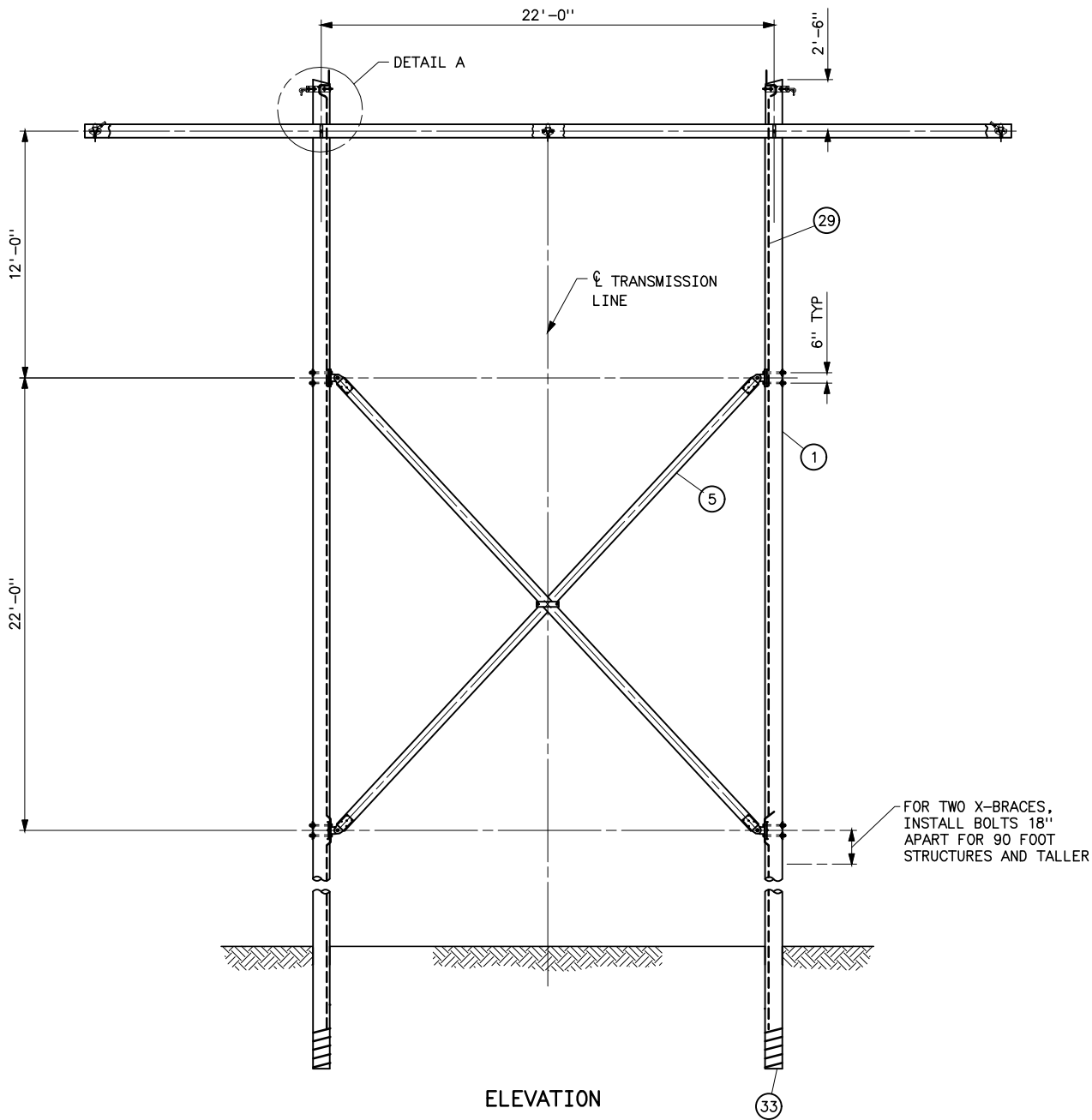


STEEL ANGLE (32)

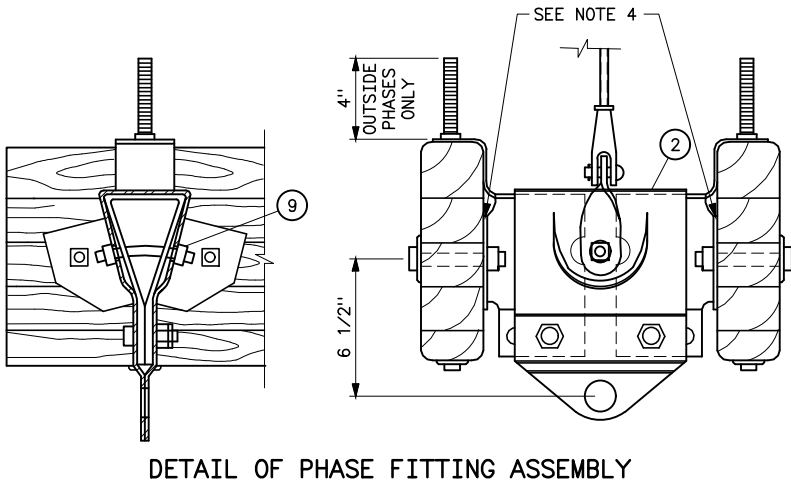
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE HA-1 138KV SMALL ANGLE SUSPENSION STRUCTURE			
DESIGNED KAREN ROWE		APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
41	MAY 11, 2021	41	6178

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XREF(S):



FOR TWO X-BRACES,
INSTALL BOLTS 18"
APART FOR 90 FOOT
STRUCTURES AND TALLER



STRUCTURE MATERIAL

PART NO.	QUANTITY	DESCRIPTION
1	2	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	3	ADJUSTABLE SPACER FITTINGS COMPLETE WITH BOLTS, NUTS, AND WASHERS (HUGHES BROS. TYPE 3415 OR EQUAL) (SEE NOTE 4)
3	2	GLUED LAMINATED WOOD CROSSARM, 3 1/8x9x45-0
4	2	DOUBLE ARMING BOLT, 7/8x REQUIRED LENGTH WITH 4 NUTS, USE EXTRA NUTS AS LOCKNUTS
5	1	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8x6 (HUGHES BROS. NO. 2121-22-0 WITH 28'-4" LENGTH OR EQUAL)
6	4	FLAT GAIN PLATE
7	4	RIBBED TIE PLATE
8	4	SPRING LOCK WASHER FOR 7/8" BOLT
9	3	7/8"x REQUIRED LENGTH BENT STUD WITH LOCK WASHER AND LOCKNUTS, THREADED BOTH SIDES
10	2	POLE ANTISPLITTING DEVICE EQUAL TO STAR LOCK MANUFACTURED BY THE BAYNE COMPANY

OVERHEAD GROUND WIRE AND GROUNDING MATERIAL

PART NO.	QUANTITY	DESCRIPTION
21	2	POLE BAND SHIELD WIRE SUPPORT INCLUDING CHAIN LINK (HUGHES BROS. NO. 2852)
22	2	MACHINE BOLT, 7/8x1-0
23	2	"U" BOLT, 5/8x3 WITH 4 HEX NUTS AND 2 LOCKNUTS
24	2	CHAIN LINK 1/2" (HUGHES BROS. NO. 1329-B1 OR EQUAL)
25	4	PARALLEL GROOVE CLAMP, 2 BOLT COPPER ALLOY OR COPPER CRIMPIT (BURNDY TYPE YC-C OR EQUAL)
29	AS REQUIRED	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2 INCH STAPLES
30	3	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT)
33	2	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
34	2	BONDING CLIP (HUGHES BROS. NO. 2727 OR EQUAL)

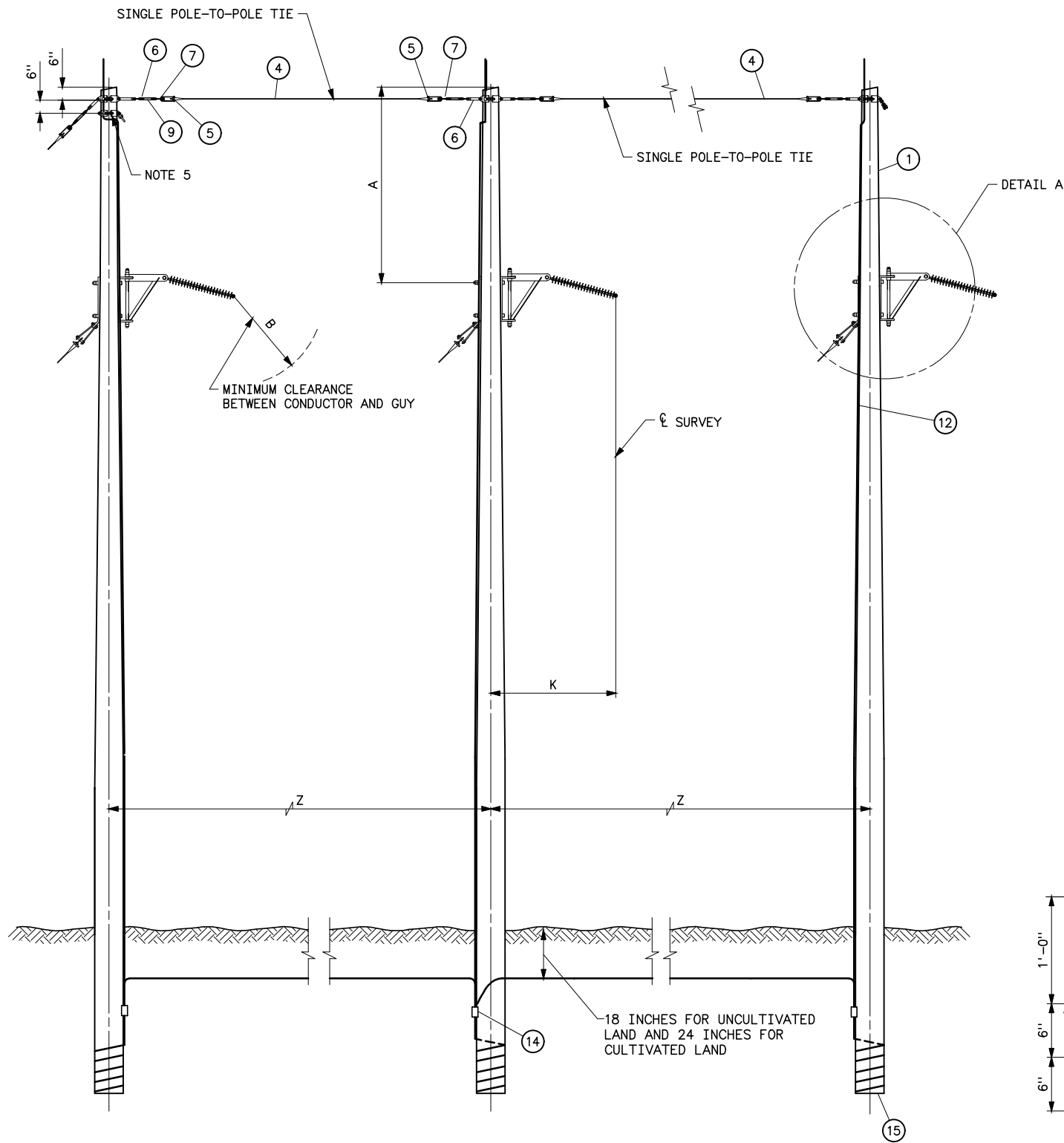
NOTES

- STEEL FOR STEEL ANGLES AND FOR BENT PLATES SHALL CONFORM TO ASTM A36. PIECES SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- GAINING IS NOT REQUIRED IF ADJUSTABLE SPACER FITTING IS USED.
- HOLE IN PLATE SHALL BE UNTAPPED AND MEASURE 1/16 LARGER THAN BOLT. ADD EXTRA LOCKNUT AND SPRING WASHER FOR EACH CONNECTION.
- BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
- FOR DEAD ENDING OPGW, SPACE DEAD END TEE TOP BOLT 6" BELOW BRACE ATTACHMENT.

REFERENCE DRAWINGS

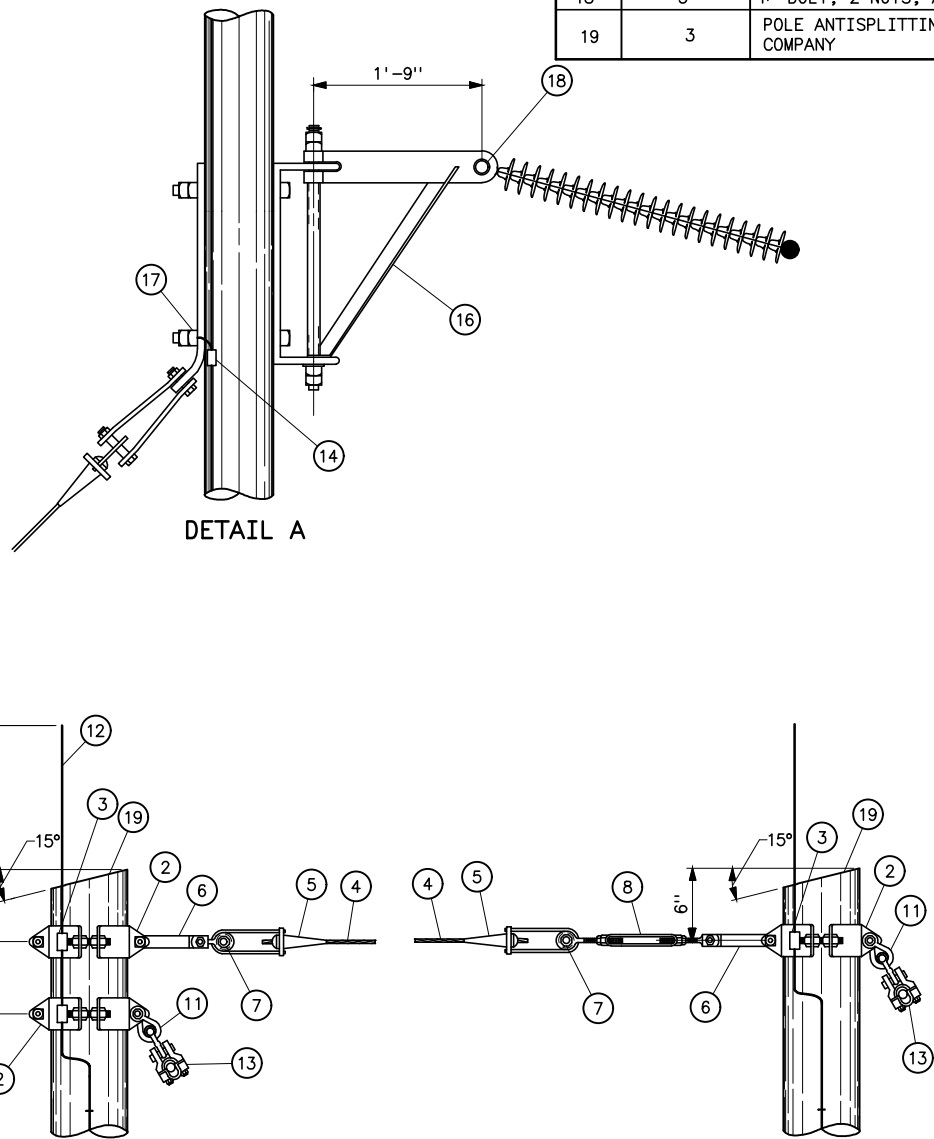
WOOD POLE STRUCTURE GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY DETAILS	
FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
OPTICAL GROUNDWIRE ASSEMBLIES	41 1031
CROSSARM DRILLING DETAILS HS-1 AND	
HSB-1 STRUCTURES	41 6113
TYPICAL DETAILS FOR OPTICAL GROUND	
WIRE SPLICE STRUCTURES	41 6153

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HS-2 230KV LOW TOP SUSPENSION STRUCTURE		
DESIGNED KAREN ROWE	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
DATE JANUARY 3, 2022	41	6179



ELEVATION

VOLTAGE/ DIMENSION	A	B	K	Z
138KV	10'-0"	5'-0"	7'-0"	24'-0"
161KV	10'-0"	5'-8"	7'-6"	25'-0"
230KV	11'-0"	7'-0"	8'-6"	25'-0"



OVERHEAD GROUND WIRE ATTACHMENTS

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
1	3	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	FOUR-WAY STRAIN POLE BAND (EQUAL TO HUGHES BROS. 3103 SERIES)
	8	1/2"x4 LAG SCREWS (2 PER BAND)
	8	1 3/8" FLAT ROUND WASHER WITH 9/16" HOLE (2 PER BAND)
3	4	1/2" GROUNDING CLIP ASSEMBLY (INCLUDES BONDING CLIP, CARRIAGE BOLT, NUT AND LOCKNUT). HUGHES 2718.55 OR EQUAL
4	AS REQD	7/16" HIGH STRENGTH WIRE (SEE SPECIFICATIONS)
5	6	AUTOMATIC COMPRESSION FITTING WITH SHORT BAIL
6	5	1/4x2x17 CONNECTING LINK PAIR WITH 3/4"x2 1/2 BOLT, 2 NUTS, AND COTTER KEY
7	6	2 1/2 SHEAVE WHEEL SUITABLE FOR 7/16" WIRE
8	1	7/8"x12 CLEVIS-EYE TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-D)
9	2	7/8"x12 CLEVIS-CLEVIS TURNBUCKLE W/BNK (EQUAL TO HUGHES BROS. NO. AS2545-C)
10	1	YOKE PLATE
11	2	TWISTED SHACKLE
12	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
13	2	OVERHEAD GROUND WIRE SUSPENSION ASSEMBLY
14	3	PARALLEL GROOVE CLAMP 2-BOLT, COPPER ALLOY
15	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
16	3	EXTENSION BRACKET, 1-9, COMPLETE WITH 3/4 ATTACHMENT BOLTS, (EQUAL TO HUGHES BROS NO. 2822.8)
17	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)
18	3	1" BOLT, 2 NUTS, AND COTTER KEY
19	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

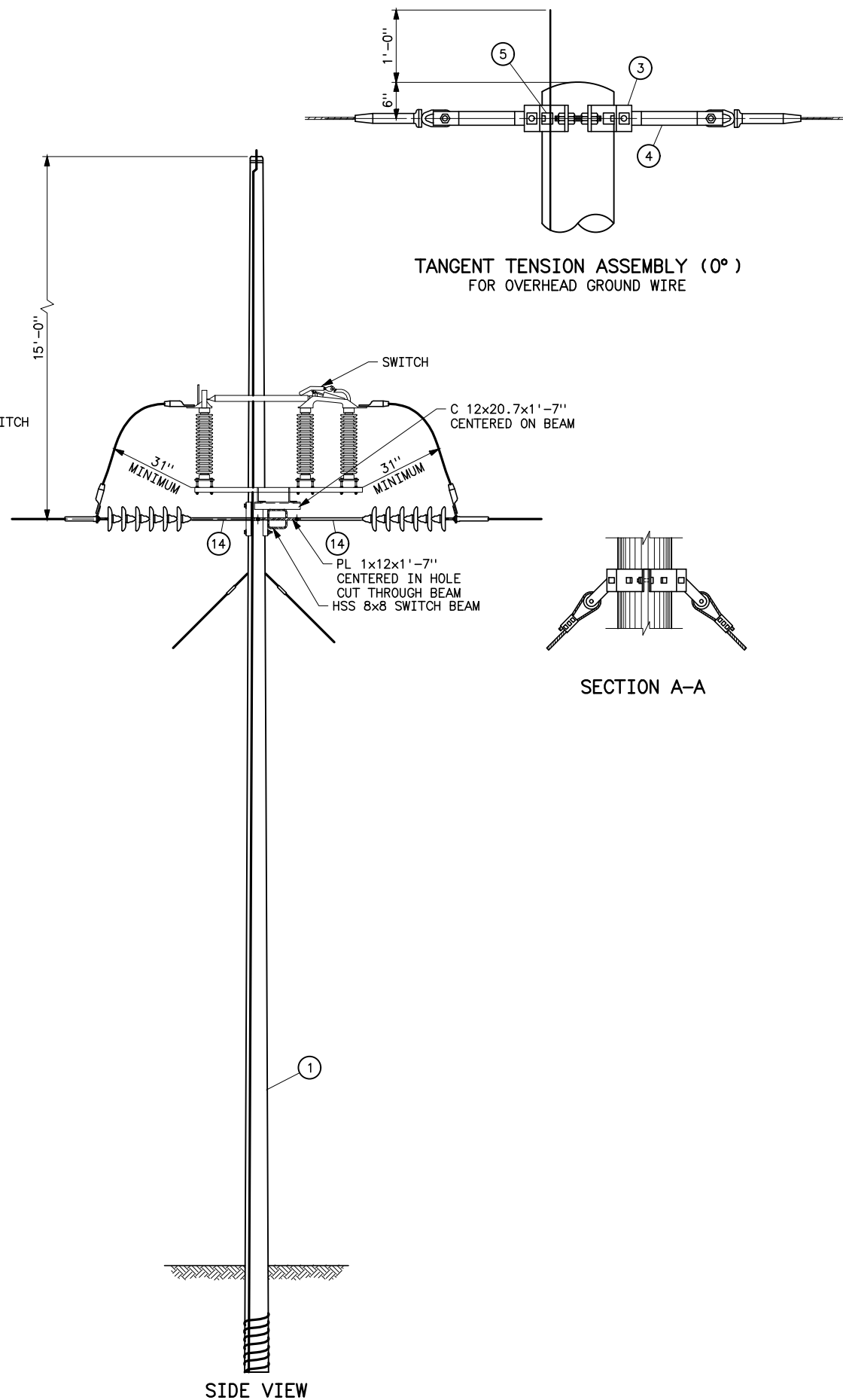
NOTES

- POLES SHALL BE GIVEN RAKE OF 1/4 INCH FOR EACH FOOT OF POLE LENGTH AGAINST STRAIN.
- ALL HOLES IN WOOD SHALL BE BORED 1/8 INCH LARGER THAN THEIR RESPECTIVE BOLT DIAMETERS.
- HOLES IN CONNECTING LINK PAIRS SHALL BE SIZED 1/16 INCH LARGER THAN CONNECTING BOLTS IN TURNBUCKLES AND STRAIN BANDS. BOLTS SHALL BE FURNISHED WITH 2 NUTS AND COTTER KEY.
- DEAD END TEES MAY BE USED IN LIEU OF POLE BANDS. CONNECTING LINKS, SHEAVE WHEELS AND GROUNDING CLIP ASSEMBLIES ARE NOT REQUIRED WITH DEAD END TEES. SEE STANDARD DRAWING 41 6138.
- OVERHEAD GROUNDWIRE MAY BE ATTACHED TO MIDDLE POLE INSTEAD OF OUTSIDE POLE IF NECESSARY FOR STRINGING.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
SUSPENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1020
DOUBLE STRING	41 1021
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPICAL DETAILS FOR DEAD END TEES	41 6138
GUY ASSEMBLIES AND DETAILS	41 6047
GUY ARRANGEMENT, FOR TYPE 3A AND 3AB	
STRUCTURES WITH OVERHEAD GROUND WIRES	41 6053

A	2-12-26 A7-KKR	REVISED TO SHOW OGW ATTACHMENT. ADDED NOTE 5.	
	UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
	STANDARD DESIGNS TRANSMISSION LINES TYPE 3AB-2 138, 161 AND 230KV MEDIUM ANGLE STRUCTURE		
	DESIGNED <u>KAREN ROWE</u> _____ APPROVED <u>GINA CRAWFORD</u> _____ CIVIL ENGINEERING MANAGER		
CAE	JUNE 21, 2022	41	6180

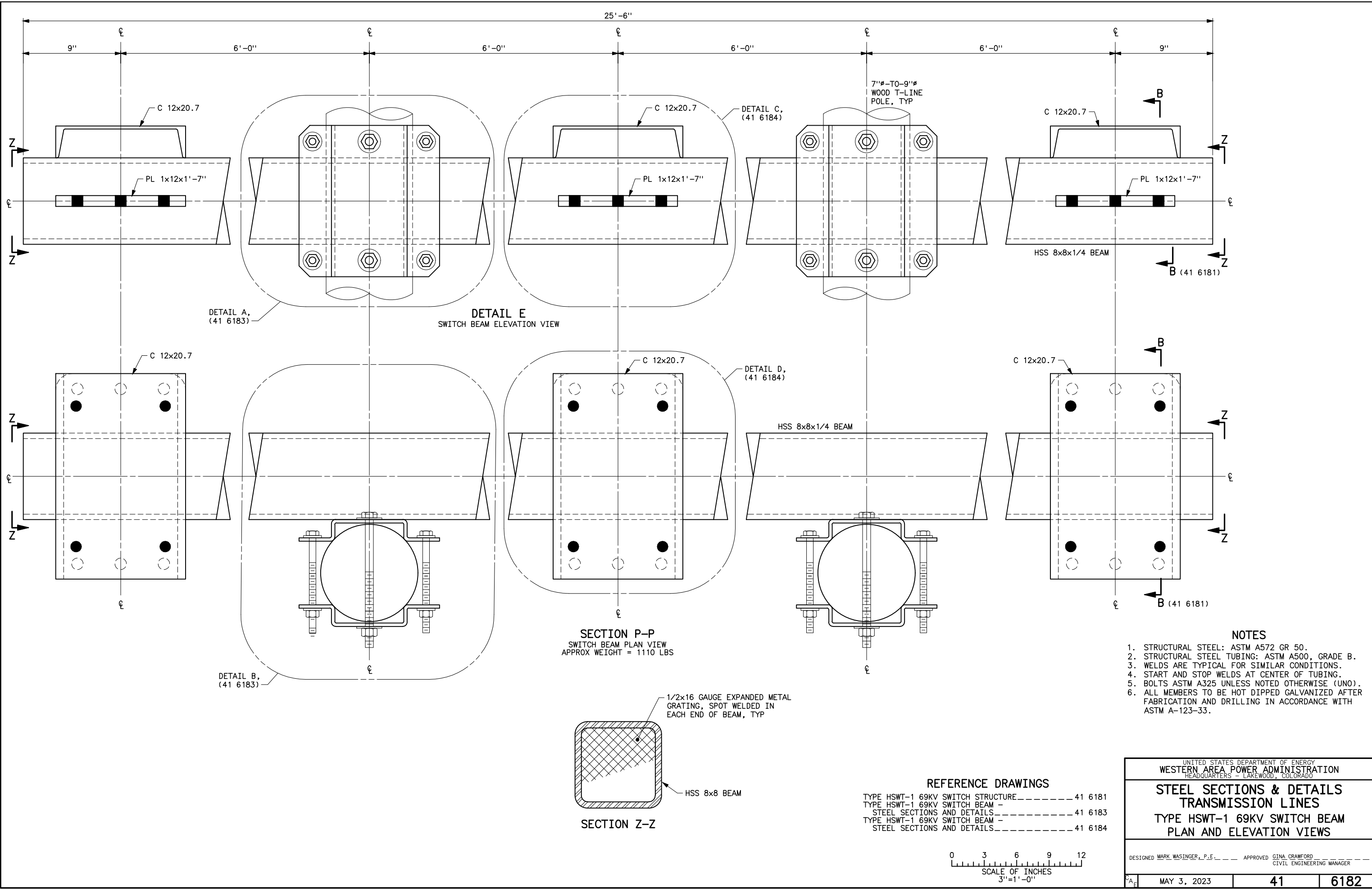


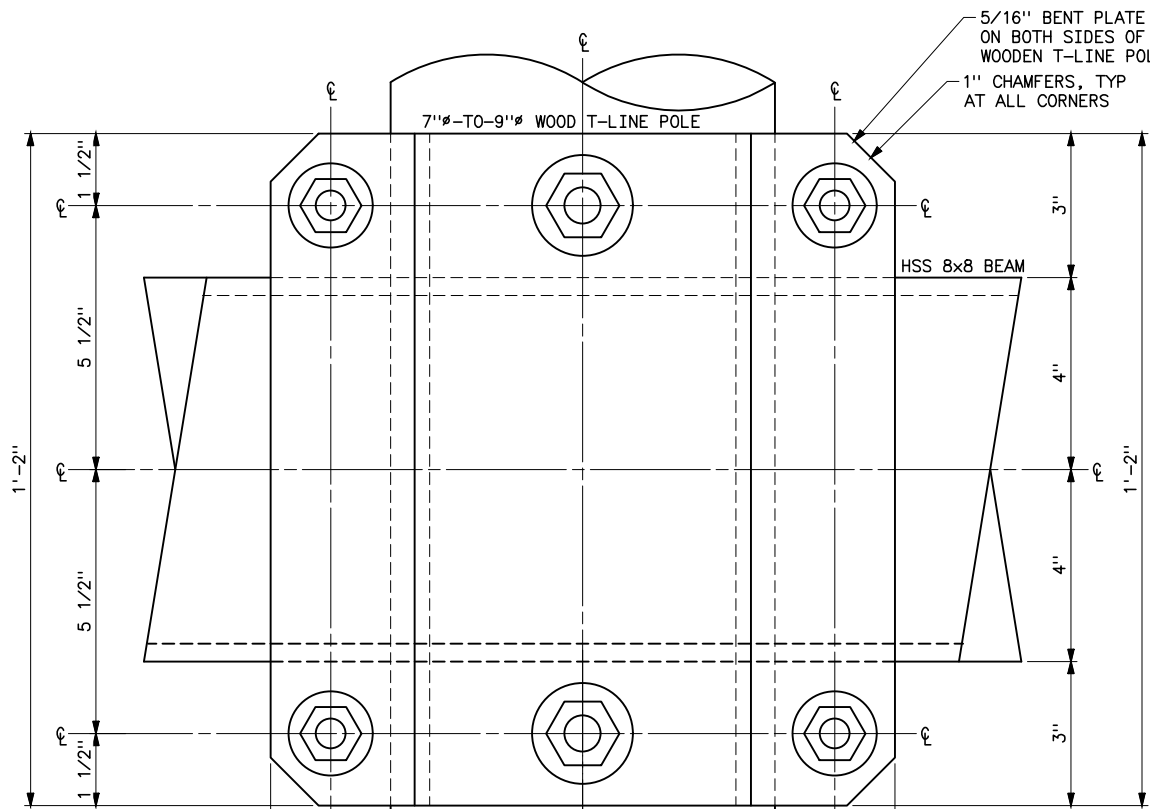
REFERENCE DRAWINGS

SUBSTATION STANDARDS SWITCH OPERATING	
PLATFORMS STEEL DESIGN AND DETAILS_____	31 2014
GUY ASSEMBLY AND DETAILS_____	41 6047
TRANSMISSION LINES	
TYPE HSWT-1 69KV SWITCH BEAM -	
STEEL SECTIONS AND DETAILS_____	41 6182
TRANSMISSION LINES	
TYPE HSWT-1 69KV SWITCH BEAM -	
STEEL SECTIONS AND DETAILS_____	41 6183
TRANSMISSION LINES	
TYPE HSWT-1 69KV SWITCH BEAM -	
STEEL SECTIONS AND DETAILS_____	41 6184

[Return to TOC](#)

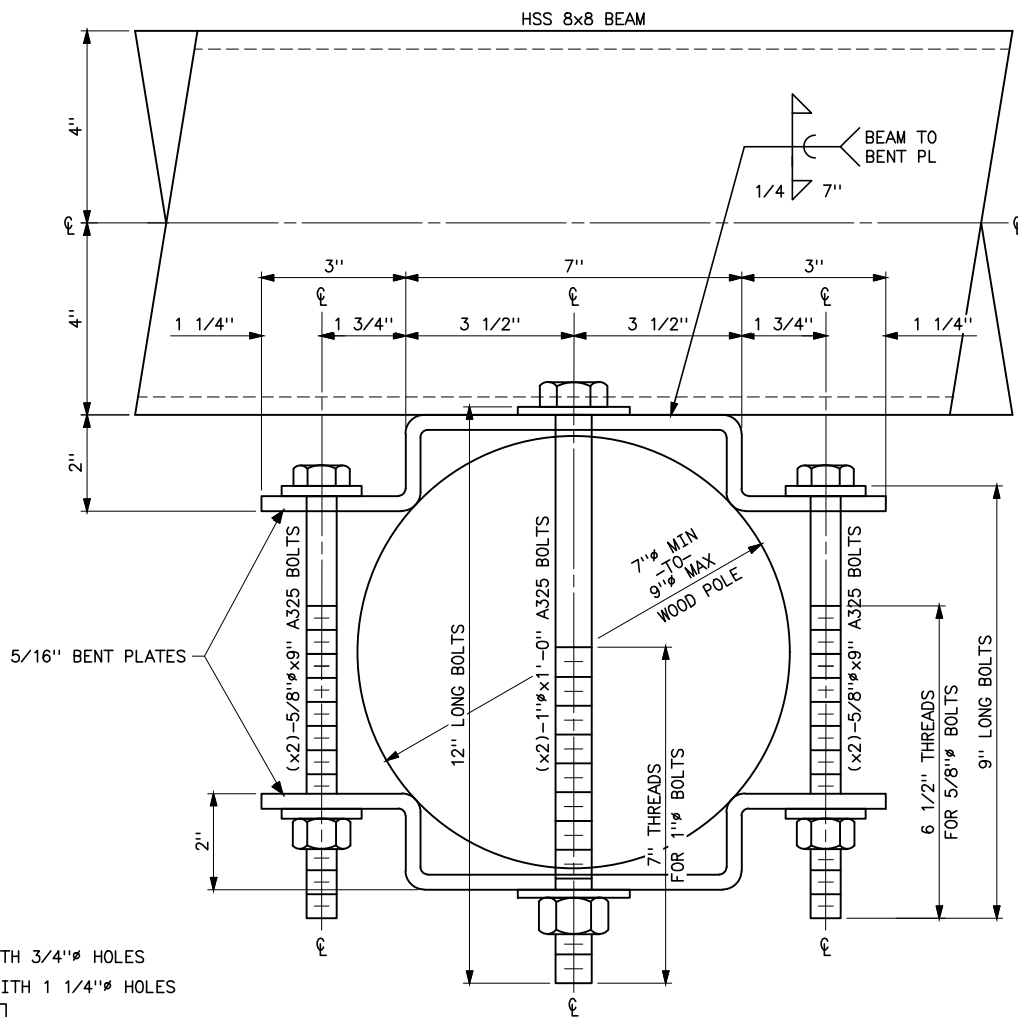
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IMAGES:





DETAIL A (41 6182)
BEAM CONNECTION TO WOODEN T-LINE POLE

(x4)-5/8"Øx9" A325N BOLTS WITH 3/4"Ø HOLES
(x2)-1"Øx1'-0" A325N BOLTS WITH 1 1/4"Ø HOLES
PROVIDE ONE NUT & TWO WASHERS
FOR ALL BOLTS SHOWN ON
SECTIONS C-C & E-E.

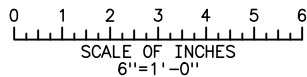


DETAIL B (41 6182)
BEAM CONNECTION TO WOODEN T-LINE POLE

- NOTES
1. STRUCTURAL STEEL: ASTM A572 GR 50.
 2. STRUCTURAL STEEL TUBING: ASTM A500, GRADE B.
 3. WELDS ARE TYPICAL FOR SIMILAR CONDITIONS.
 4. START AND STOP WELDS AT CENTER OF TUBING.
 5. BOLTS ASTM A325 UNLESS NOTED OTHERWISE (UNO).
 6. ALL MEMBERS TO BE HOT DIPPED GALVANIZED AFTER FABRICATION AND DRILLING IN ACCORDANCE WITH ASTM A-123-33.

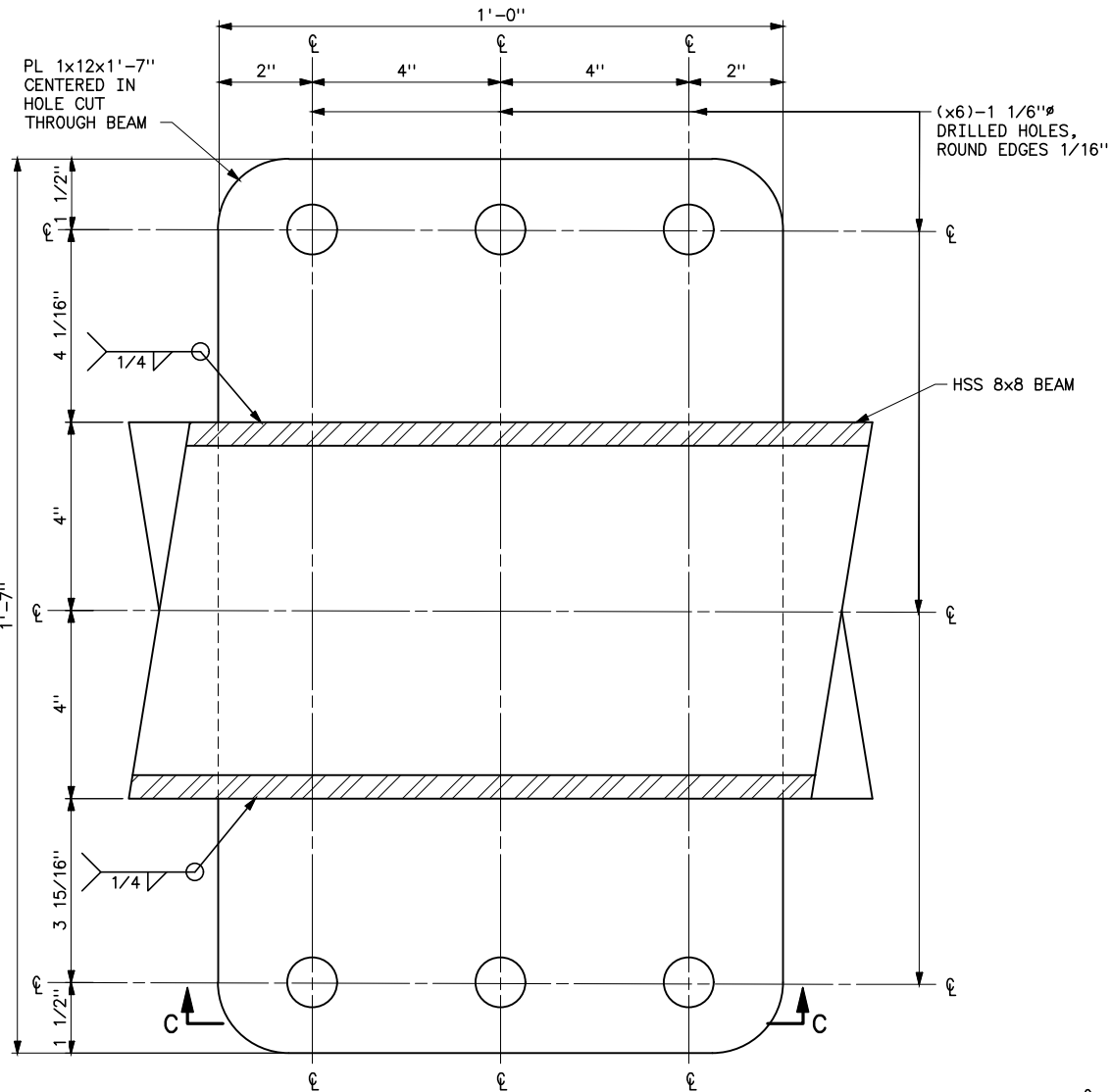
REFERENCE DRAWINGS

TYPE HSWT-1 69KV SWITCH STRUCTURE	41 6181
TYPE HSWT-1 69KV SWITCH BEAM	-
STEEL SECTIONS AND DETAILS	41 6182
TYPE HSWT-1 69KV SWITCH BEAM	-
STEEL SECTIONS AND DETAILS	41 6184

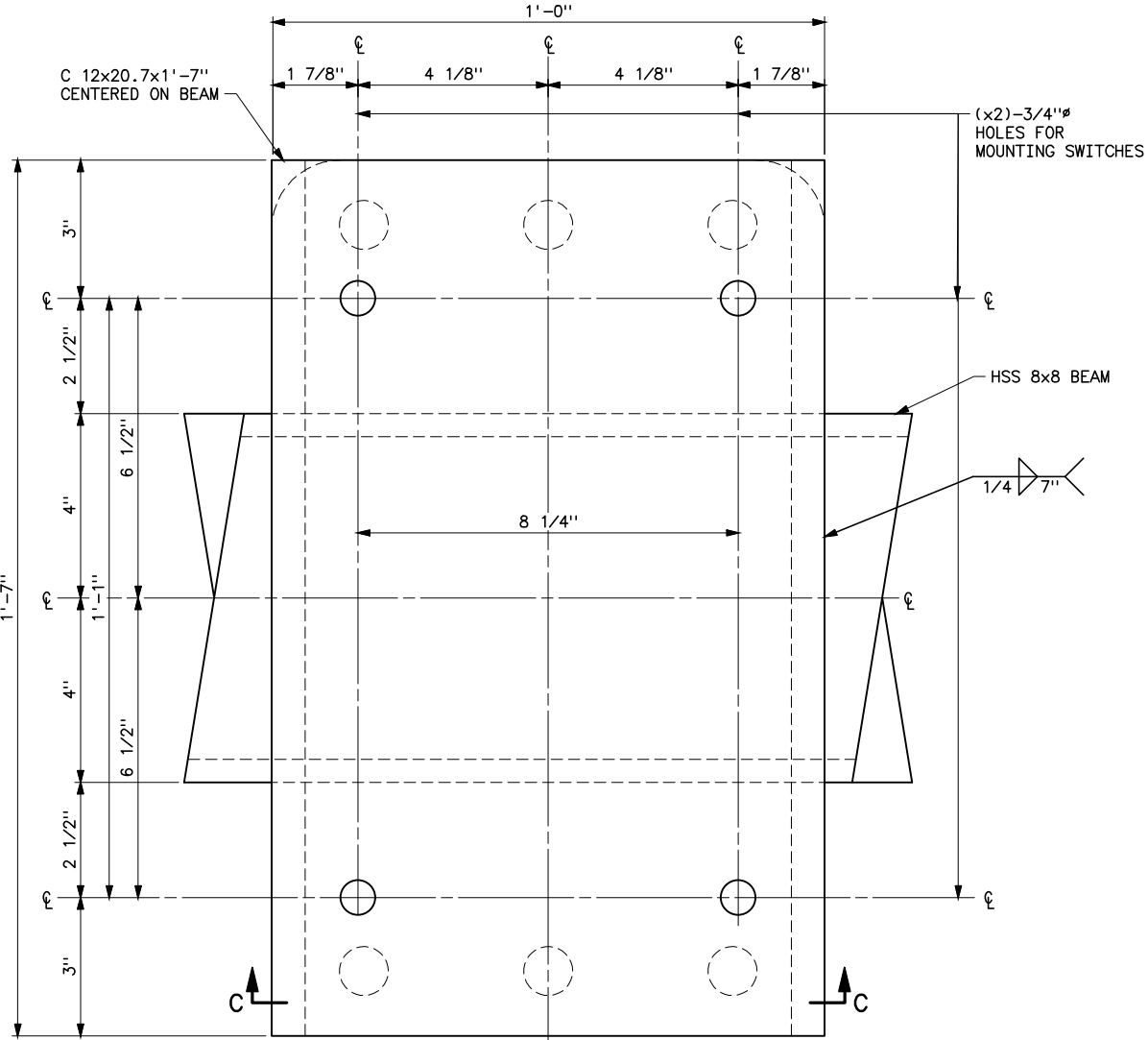


UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HSWT-1 69KV SWITCH BEAM STEEL SECTIONS AND DETAILS		
DESIGNED MARK WASINGER, P.E.	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
MAY 3, 2023	41	6183

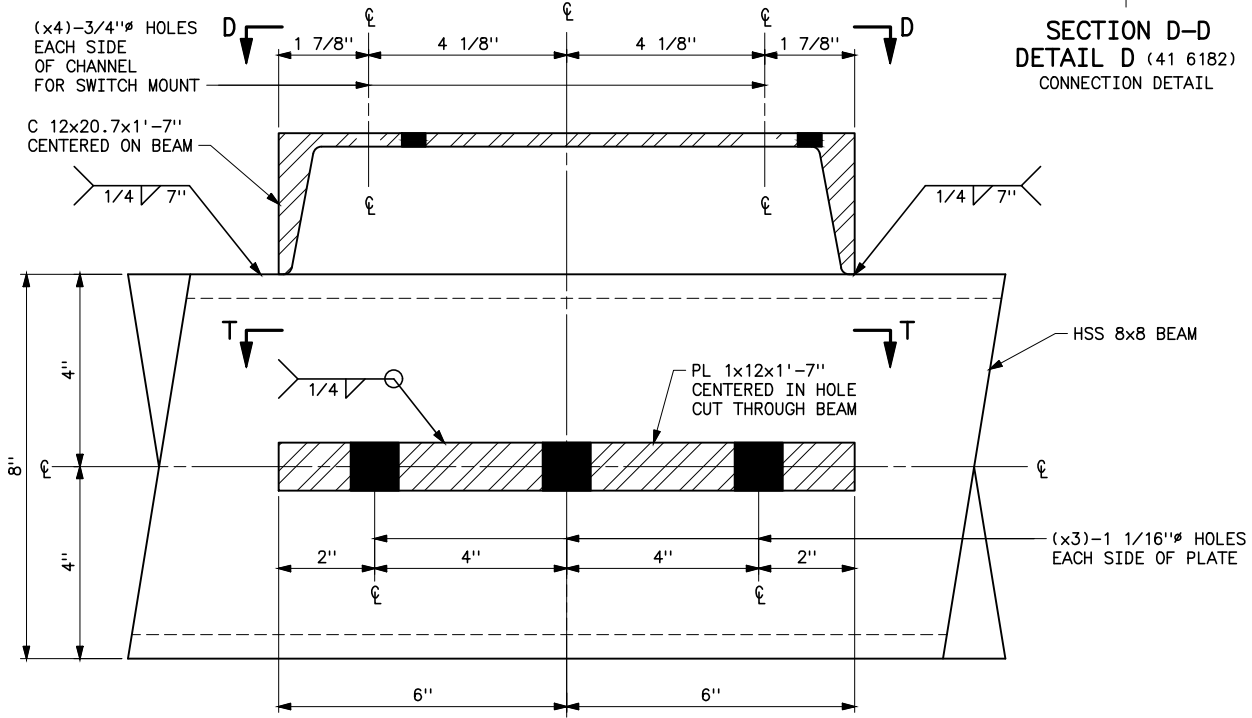
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XREF(S):



SECTION T-T
CONDUCTOR CONNECTION PLATE



SECTION D-D
DETAIL D (41 6182)
CONNECTION DETAIL



SECTION C-C
DETAIL C (41 6182)
CONNECTION DETAIL

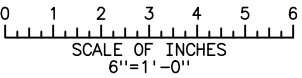
NOTES

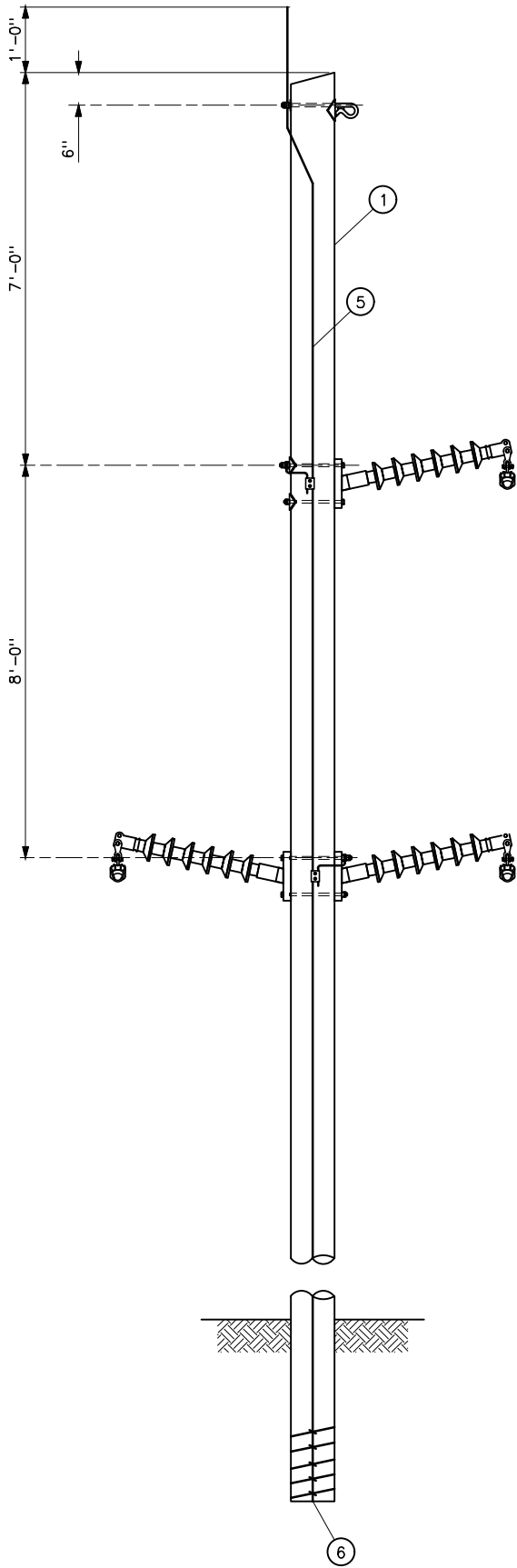
1. STRUCTURAL STEEL: ASTM A572 GR 50.
2. STRUCTURAL STEEL TUBING: ASTM A500, GRADE B.
3. WELDS ARE TYPICAL FOR SIMILAR CONDITIONS.
4. START AND STOP WELDS AT CENTER OF TUBING.
5. BOLTS ASTM A325 UNLESS NOTED OTHERWISE (UNO).
6. ALL MEMBERS TO BE HOT DIPPED GALVANIZED AFTER FABRICATION AND DRILLING IN ACCORDANCE WITH ASTM A-123-33.

REFERENCE DRAWINGS

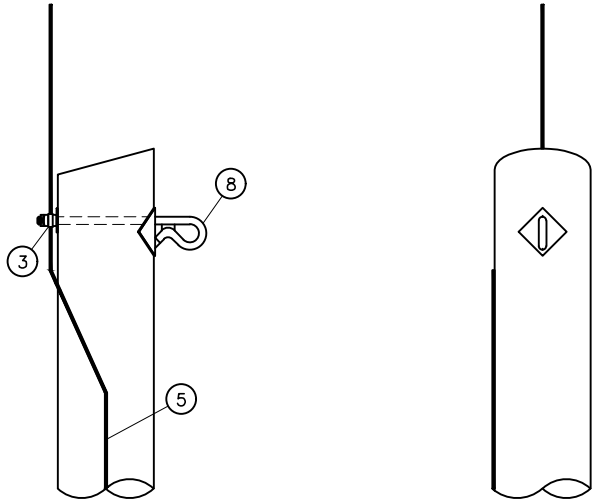
TYPE HSWT-1 69KV SWITCH STRUCTURE	41 6181
TYPE HSWT-1 69KV SWITCH BEAM	-
STEEL SECTIONS AND DETAILS	41 6182
TYPE HSWT-1 69KV SWITCH BEAM	-
STEEL SECTIONS AND DETAILS	41 6183

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE HSWT-1 69KV SWITCH BEAM STEEL SECTIONS AND DETAILS		
DESIGNED MARK WASINGER, P.E.	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
MAY 3, 2023	41	6184

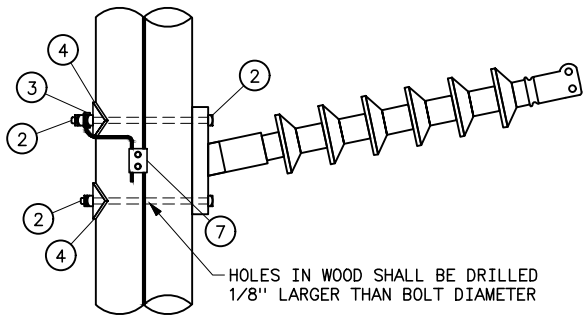




TANGENT TYPE SS-2 0° TO 1° LINE ANGLE



DETAILS OF OGW BONDING AND ATTACHMENT



POST INSULATOR ASSEMBLY

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	SS-2	
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	4	MACHINE BOLT WITH NUT AND LOCKNUT (COORDINATE WITH INSULATOR MANUFACTURER FOR BOLT SIZE)
3	3	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROTHERS NO. 2727)
4	2	3x3x1/4 CURVED SQUARE WASHER WITH HOLE
5	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
6	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
7	3	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY

OVERHEAD GROUND WIRE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	SS-2	
8	1	SHIELD WIRE SUPPORT BRACKET (HUGHES BROTHERS NO. 2812 OR EQUAL)

NOTES

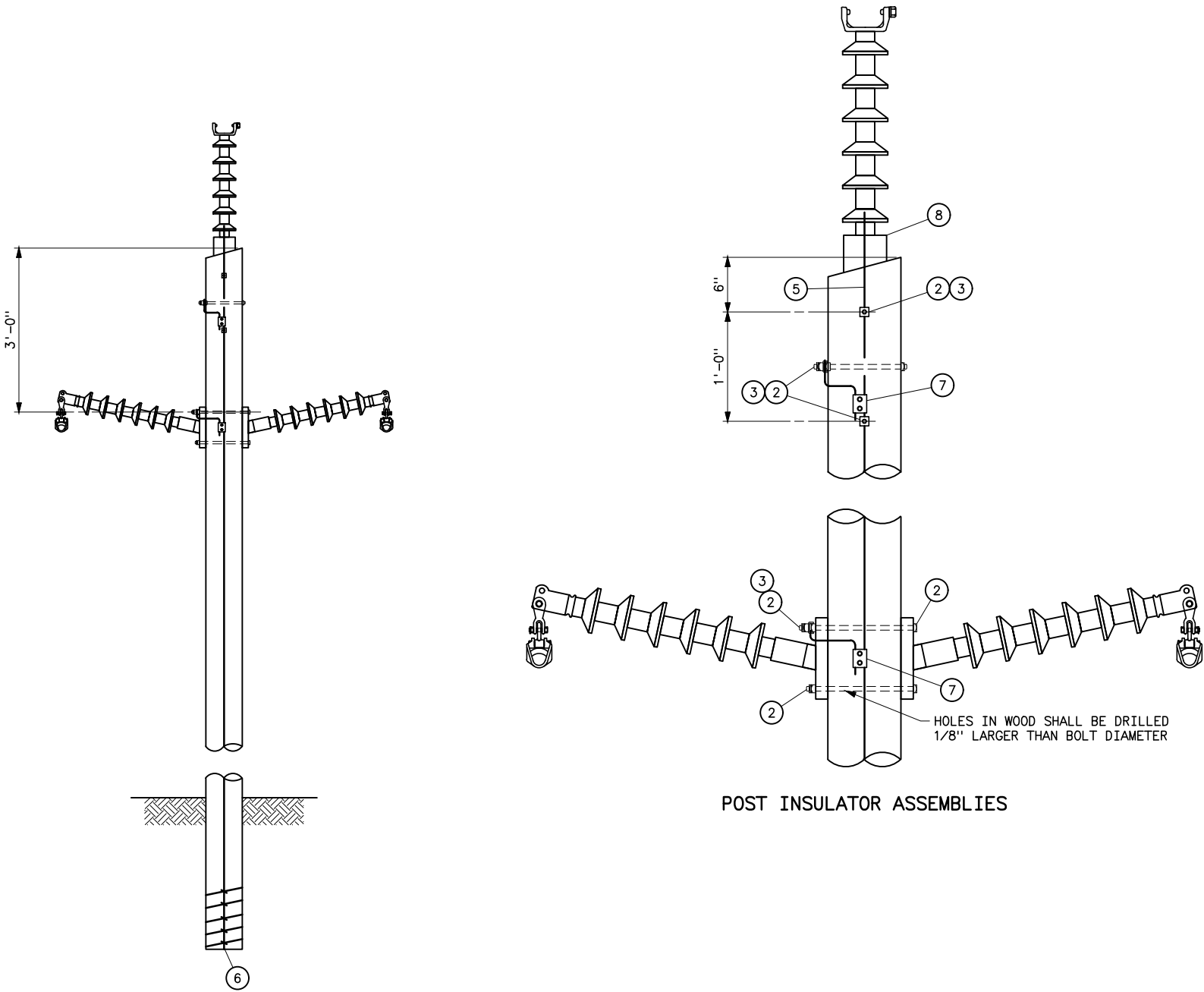
1. MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO ϕ OF TOP MOUNTING HOLES.
2. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
3. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
4. FOR TWO OVERHEAD GROUND WIRES, ADD ANOTHER SHIELD WIRE SUPPORT BRACKET, PART NO. 8, 6 INCHES BELOW THE SHIELD WIRE SUPPORT BRACKET SHOWN.

REFERENCE DRAWINGS

WOOD POLES STRUCTURES	
GROUNDING DETAILS	.41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	.41 1019
HORIZONTAL POST INSULATOR ASSEMBLIES	.41 1024
OPTICAL GROUND WIRE ASSEMBLIES	.41 1031

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE SS-2 115KV TANGENT SUSPENSION STRUCTURE			
DESIGNED KAREN ROWE		APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
C.A.F.	APRIL 20, 2023	41	6185

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	SS-DELTA	
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	AS REQD	MACHINE BOLT WITH NUT AND LOCKNUT (COORDINATE WITH INSULATOR MANUFACTURER FOR BOLT SIZE)
3	AS REQD	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROTHERS NO. 2727)
4	AS REQD	3x3x1/4 CURVED SQUARE WASHER WITH HOLE
5	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
6	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
7	AS REQD	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
8	1	POLE TOP INSULATOR BRACKET



SS-DELTA

POST INSULATOR ASSEMBLIES

NOTES

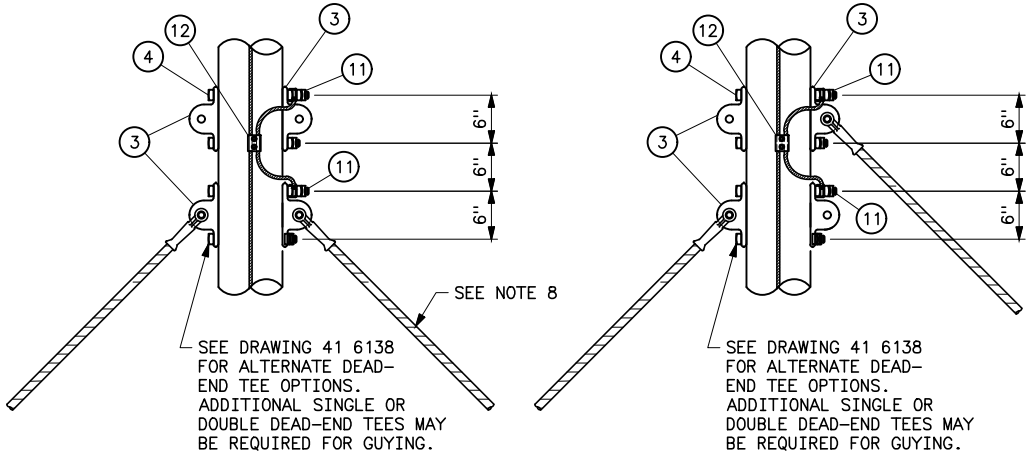
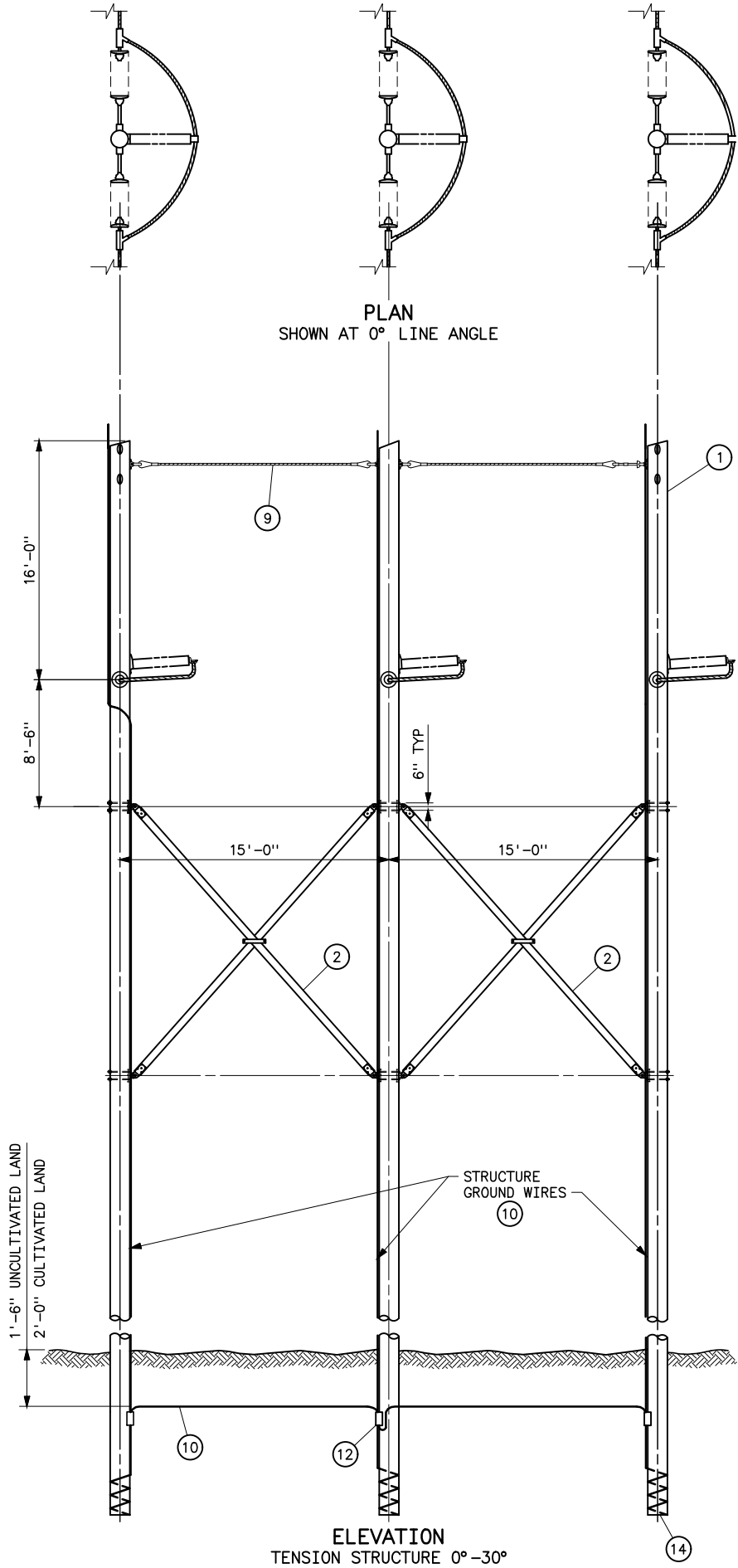
- 1. MEASUREMENTS FOR HORIZONTAL LINE POSTS ARE TO ϕ OF TOP MOUNTING HOLES.
- 2. BOLT AND LOCKNUT SIZES FOR LINE POST INSULATOR ATTACHMENTS MAY VARY FROM THOSE SHOWN. PROVIDE AS REQUIRED.
- 3. BNK INDICATES BOLT, NUT, AND STAINLESS STEEL COTTER KEY REQUIRED.
- 4. POLE TOP INSULATOR AND MOUNTING HARDWARE MAY DIFFER THAN WHAT IS SHOWN, ADDRESS ACCORDINGLY.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES GROUNDING DETAILS-----41 1012
HORIZONTAL POST INSULATOR ASSEMBLIES -----41 1024

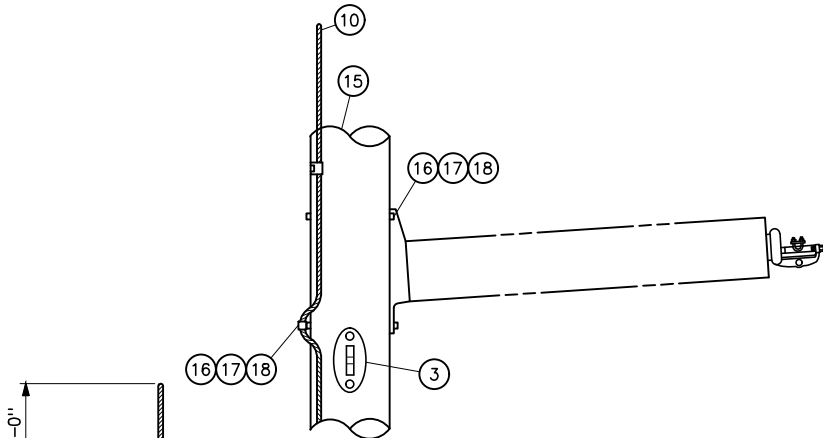
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE SS-DELTA 69KV TANGENT SUSPENSION STRUCTURE-NO OGW			
DESIGNED KAREN ROWE ----- APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER -----			
C _A E	JUNE 7, 2023	41	6186

Plotted By: seela Jul 13, 2023 11:10am
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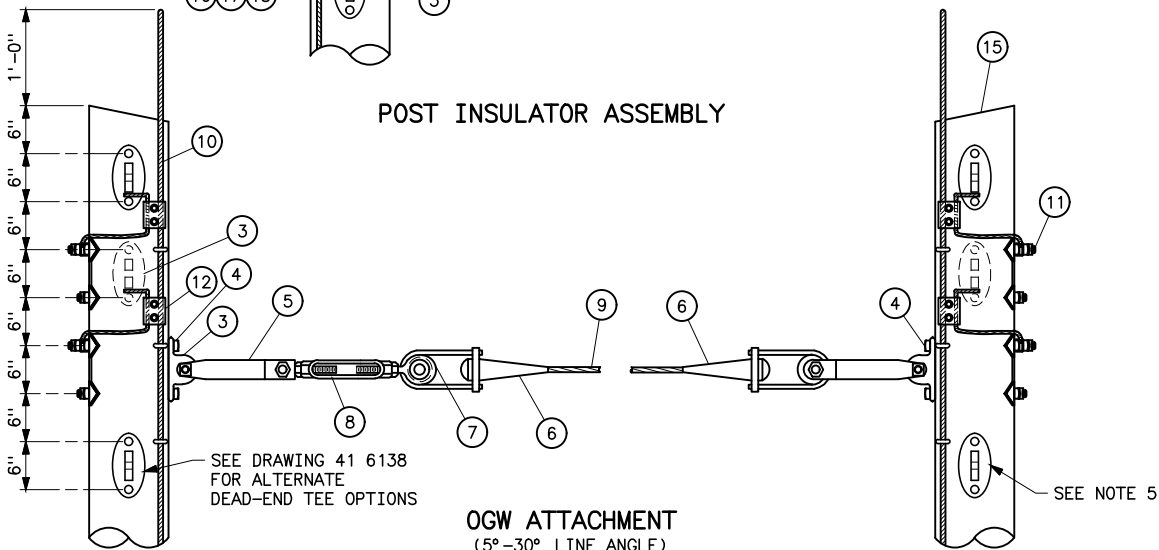


DETAIL OF INSULATOR ATTACHMENT
(0°-5° LINE ANGLE)

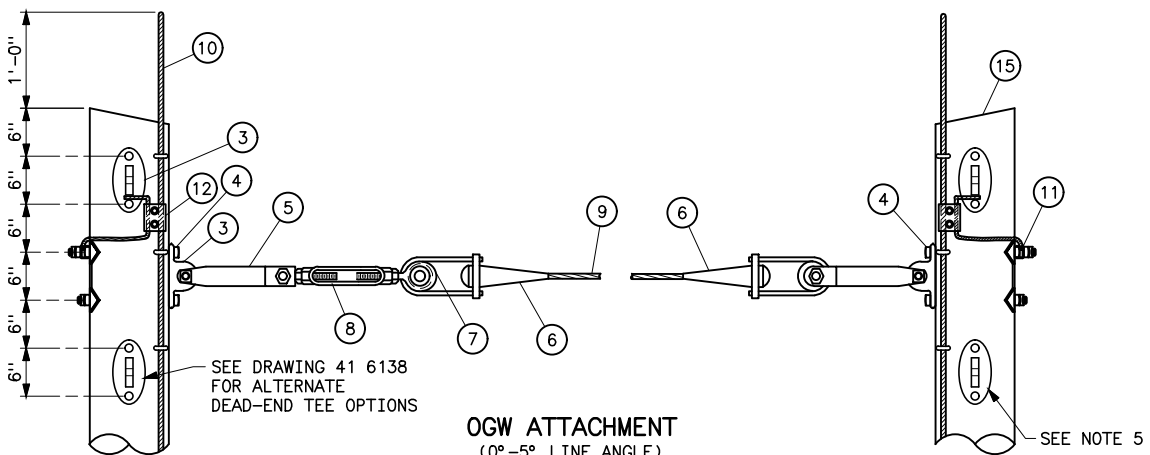
DETAIL OF INSULATOR ATTACHMENT
(5°-30° LINE ANGLE)



POST INSULATOR ASSEMBLY



OGW ATTACHMENT
(5°-30° LINE ANGLE)



OGW ATTACHMENT
(0°-5° LINE ANGLE)

STRUCTURE MATERIAL

PART NO.	QUANTITY	QUANTITY	DESCRIPTION
	0°-5° LINE ANGLE	5°-30° LINE ANGLE	
1	3	3	POLE, SEE STRUCTURE LIST FOR LENGTH
2	2	2	X-BRACE, COMPLETE WITH FITTINGS, 5 1/8"x6" (HUGHES BROS NO. 2121 OR EQUAL)
3	14*	14*	DEAD-END TEE, HUGHES BROS NO. 2817R4.5-15-15C OR EQUAL
4	AS REQD	AS REQD	7/8"x REQUIRED LENGTH MACHINE BOLTS WITH LOCKNUTS, LOCK WASHERS AND CURVED WASHERS AS NECESSARY
5	4	4	CONNECTING LINK
6	4	4	DEAD-END AUTOMATIC VISE TYPE FOR GUY STRAND
7	4	4	SHEAVE WHEEL, 2 1/2" DIA MINIMUM
8	2	2	TURNBUCKLE, CLEVIS-EYE, 7/8"x12"
9	AS REQD	AS REQD	STEEL STRAND 7/16", 7-WIRE, HIGH STRENGTH
10	AS REQD	AS REQD	NO. 2 AWG 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2-INCH STAPLES
11	AS REQD	AS REQD	BONDING CLIP EQUAL TO HUGHES BROS NO. 2727.8 W/NUT
12	10	AS REQD	PARALLEL GROOVE CLAMP, 2-BOLT COPPER ALLOY
14	3	3	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE
15	3	3	POLE ANTISPLITTING DEVICE EQUAL TO STAR-LOCK MANUFACTURED BY THE BAYNE COMPANY

POST INSULATOR ASSEMBLY MATERIAL

PART NO.	QUANTITY	DESCRIPTION
	0°-30° LINE ANGLE	
16	6	7/8"x REQUIRED LENGTH MACHINE BOLT WITH LOCKNUT AND LOCK WASHER
17	6	4"x4"x1/4" CURVED SQUARE WASHER WITH 15/16"ø HOLE
18	3	BONDING CLIP (EQUAL TO BROOKS MANU BC SERIES OR HUGHES BROS NO. 2727)

NOTES

- THE 3TA-3 STRUCTURE USES DEAD-END TEES AS OPPOSED TO POLE BANDS AND EQUAL LENGTH POLES.
- FITTINGS SHALL INCLUDE BOLTS, NUTS, AND WASHERS.
- ALL HOLES SHALL BE BORED 1/8 INCH LARGER IN WOOD POLE THAN THEIR RESPECTIVE BOLT DIAMETERS.
- MATERIAL REQUIRED WHERE HORIZONTAL LINE POST INSULATORS ARE USED IS BASED ON BOLT SIZES SHOWN. INSULATOR MAY REQUIRE BOLTS, LOCKNUTS, AND WASHERS OF DIFFERENT SIZES.
- DEAD END TEE MAY BE PLACED IN LINE WITH GUYS. ANCHOR SHACKLE SHALL BE USED IF NOT IN LINE.
- REFER TO DRAWING 41 6138 FOR TYPICAL DEAD-END TEE DETAILS.
- *QUANTITIES DO NOT INCLUDE GUYING.
- USE FIBERGLASS GUY INSULATORS, 10 FT LENGTH ULTIMATE STRENGTH 30,000 LBS AS REQUIRED.

REFERENCE DRAWINGS

WOOD POLE STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLE STRUCTURES	41 1019
TENSION INSULATOR ASSEMBLIES	
SINGLE STRING	41 1022
DOUBLE STRING	41 1023
OPTICAL GROUND WIRE ASSEMBLIES	41 1031
TYPE 3TA-1 STRUCTURES	
STANDARD GUY ARRANGEMENT	41 6125
TYPICAL DETAILS FOR DEAD END TEES	41 6138

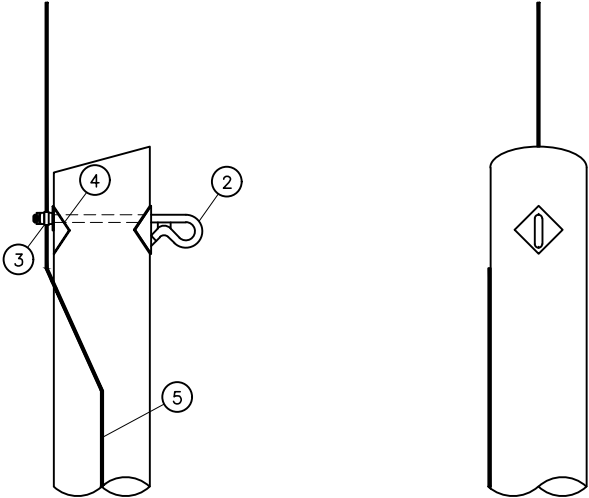
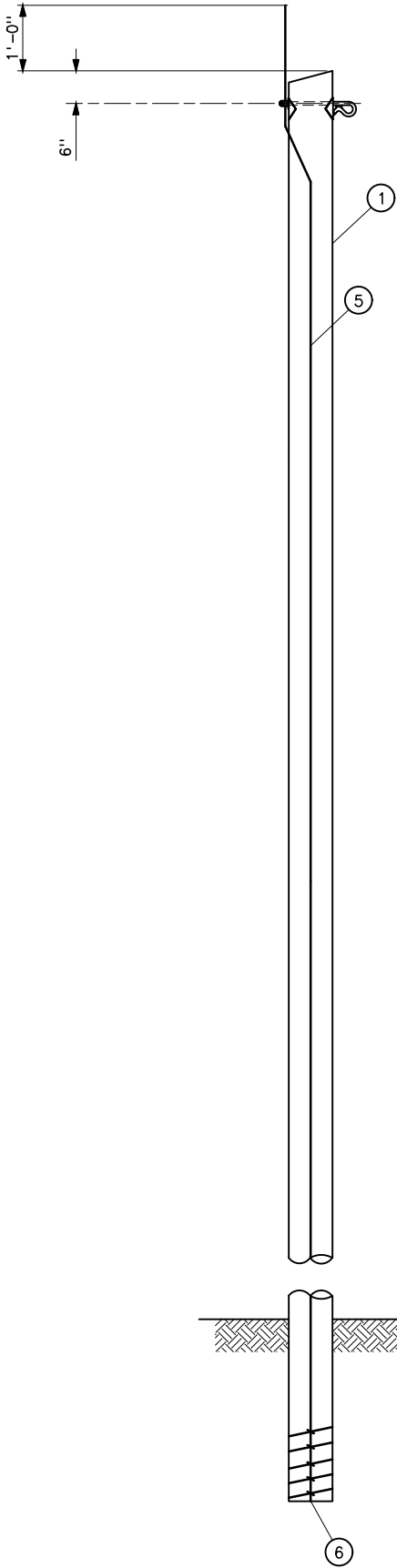
UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION HEADQUARTERS - LAKEWOOD, COLORADO		
STANDARD DESIGNS TRANSMISSION LINES TYPE 3TA-3 115KV 3-POLE TENSION STRUCTURE		
DESIGNED KAREN ROWE	APPROVED GINA CRAWFORD CIVIL ENGINEERING MANAGER	
DATE JULY 13, 2023	41	6187

STRUCTURE MATERIAL		
PART NO.	QUANTITY	DESCRIPTION
	STRUCTURE TYPE	
	SS-OGW	
1	1	POLE, SEE STRUCTURE LIST FOR HEIGHT
2	1	SHIELD WIRE SUPPORT BRACKET (HUGHES BROTHERS NO. 2812 OR EQUAL)
3	1	BONDING CLIP (EQUAL TO BROOKS MANUFACTURER BC SERIES OR HUGHES BROTHERS NO. 2727)
4	1	3x3x1/4 CURVED SQUARE WASHER WITH HOLE
5	AS REQD	NO. 2 AWG, 30% CONDUCTIVITY, COPPER CLAD WIRE ATTACHED WITH 2" STAPLES
6	1	POLE BOTTOM PLATE (BLACKBURN NO. GP 110 OR EQUAL) ATTACHED TO POLE

NOTE
BNK INDICATES BOLT, NUT, AND STAINLESS STEEL
COTTER KEY REQUIRED.

REFERENCE DRAWINGS	
WOOD POLES STRUCTURES	
GROUNDING DETAILS	41 1012
OVERHEAD GROUND WIRE ASSEMBLY	
DETAILS FOR WOOD POLES STRUCTURES	41 1019
OPTICAL GROUND WIRE ASSEMBLIES	41 1031

UNITED STATES DEPARTMENT OF ENERGY WESTERN AREA POWER ADMINISTRATION CORPORATE SERVICES OFFICE — LAKEWOOD, COLORADO			
STANDARD DESIGNS TRANSMISSION LINES TYPE SS-OGW TANGENT SUSPENSION STRUCTURE — OGW SUPPORT			
DESIGNED <u>KAREN ROWE</u>	APPROVED <u>GINA CRAWFORD</u> CIVIL ENGINEERING MANAGER		
CAE	JULY 27, 2026	41	6188



DETAILS OF OGW BONDING AND ATTACHMENT

TANGENT TYPE SS-OGW 0 TO 1° LINE ANGLE