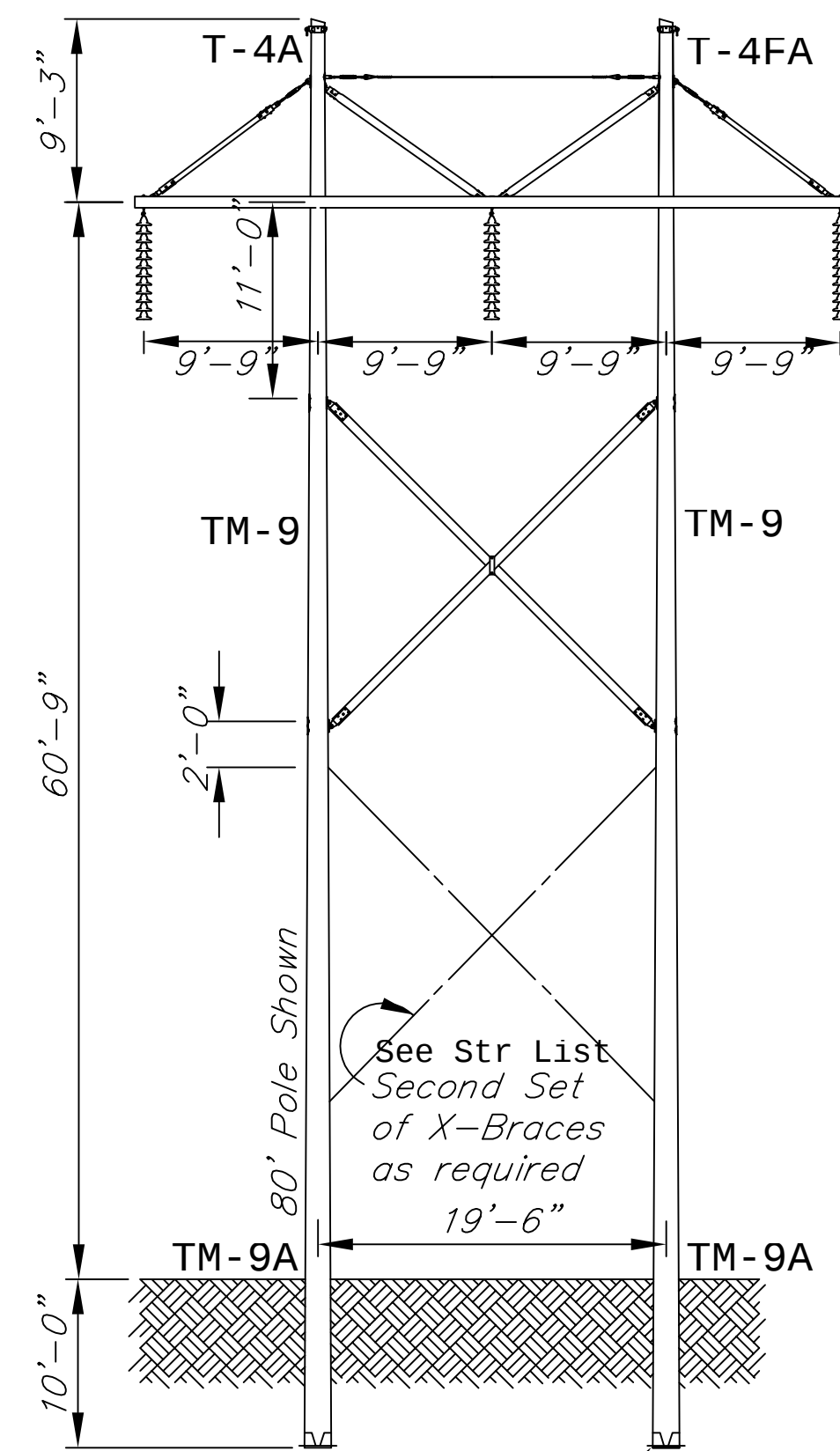
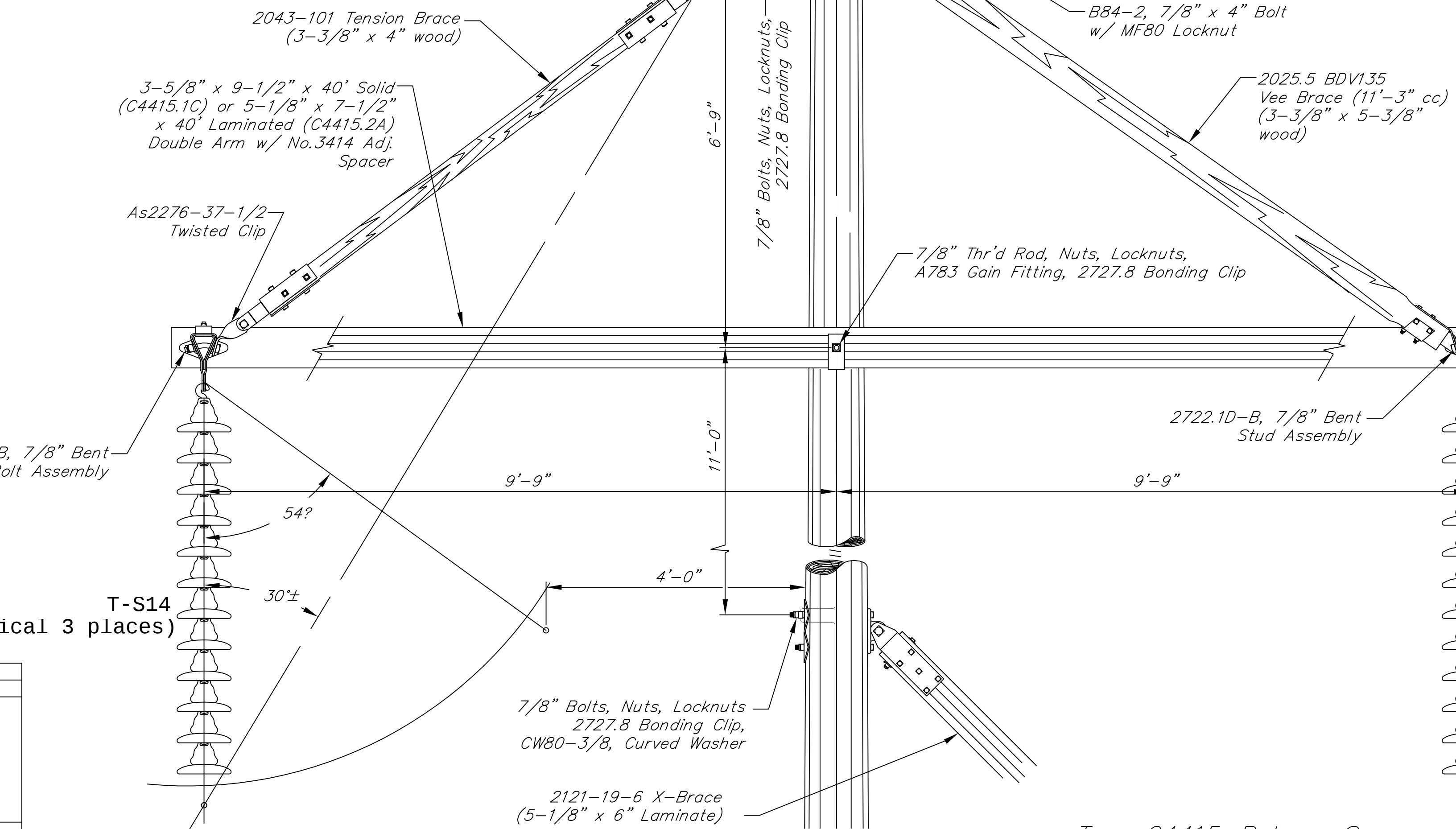
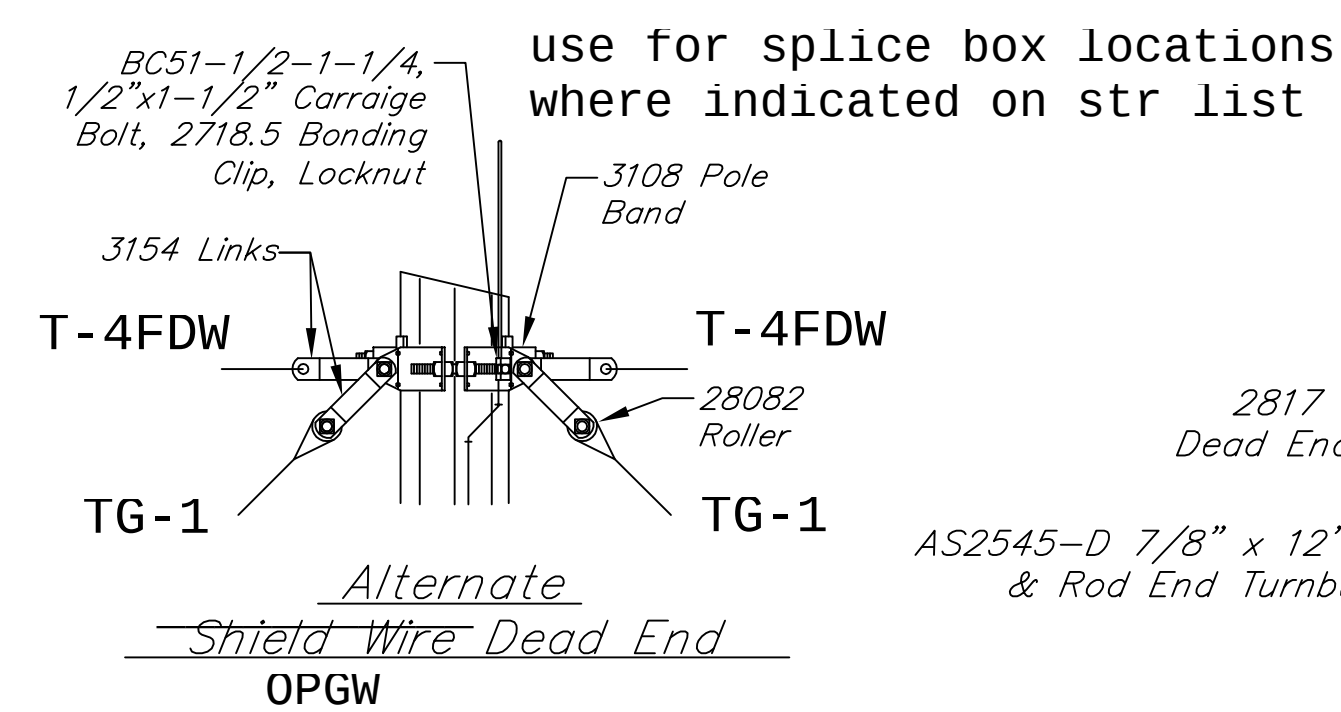




~~Install A-1895-2 Pole~~
~~Anchors when indicated~~
~~on Plan & Profile~~
TP-A (Typical all poles)



BILL OF MATERIAL	
ASSEMBLED ARM	
1	- C4415.2A Assembled Arm, consisting of:
2	- C4415.2A-1 Side Arm, 5-1/2"x7-1/2"x40"-0"Laminate
3	- 3414.2WF-100 Adj. Spacer Fitting
12	- W866-1-3/4, 5/8"x6" W.H.Bolt
6	- W558-1/2-1-3/4, 1/2"x8-1/2" W.H.Bolt
2	- AS2277-37-1/2 Clip
2	- 2722.1B-8, 7/8" Bent Bolt, w/ N80 & MF80
1	- 2722.10-B, 7/8" Bent Stud, w/ 2-N80 & 2-MF80
ARM MOUNTING HARDWARE	
2	- TR828-5, 7/8"x28" Thr'd Rod w/ 3-N80 & 2-MF80
4	- A783.1W Gain Fitting
2	- 2727.8 Bonding Clip
X-BRACE ASSEMBLED & MOUNTING HARDWARE	
1	- Set 2121-19-6 X-Brace, 19'-6" Pole Spacing
2	- 2840.1H CC Rods
2	- 2086.8A CC Strap
2	- B818-6, 7/8"x18" Bolt
2	- B816-6, 7/8"x16" Bolt
2	- B814-6, 7/8"x14" Bolt
4	- 2817D-15 Dead End Tee
4	- B103-1-1/2EX, 1"x3" Bolt, MF100
4	- 2727.8 Bonding Clip
4	- N80, 7/8" Nut
4	- MF80, 7/8" Locknut
4	- CW80-3/8 Curved Washer
BRACES ASSEMBLED	
2	- 2025.5BDV135 Vee Brace, (11'-3"CC Holes), 37-1/2' & 52-1/2' Fitts.
	(3-3/8"x5-3/8"x10'8" Wood)
2	- 2043-101 Tension Brace, (8'-5"CC Holes),
	(3-3/8"x4-3/8"x7'-7" Wood)

BRACE MOUNTING HARDWARE & CROSS TIE MATERIAL

- 3 - AS2545-0, 7/8"x12" Jaw & Rod End Eye Turnbuckle
- 2 - 28175-15 Dead End Tie (All Holes 15/16")
- 2 - AS2277 Clvis
- 2 - CW80, 7/8" Curved Washer
- 2 - 28082 Rollers
- 2 - B84-2, 7/8"x4" Bolt,MF80
- 4 - B814-6, 7/8"x14" Bolt,MF80
- 2 - 2727.8 Bonding Clip
- 2 - N80, 7/8" Nut
- 4 - MF80, 7/8" Locknut

SHIELD WIRE ATTACHMENT & GUYING HARDWARE

- 2 - 2835.7B-15-BCL Shield Wire Support (7-1/2"-12" Pole Diam.)
- 2 - B51-1/2-1-1/4, 1/2"x1-1/2" Bolt w/ MF50
- 2 - 2718.5 Bonding Clip

NOTE:

1. OPGW is on RT side looking AH on line towards Lange Sub.

DESIGNED AND DRAWN BY:



REV. DATE
1/6/94

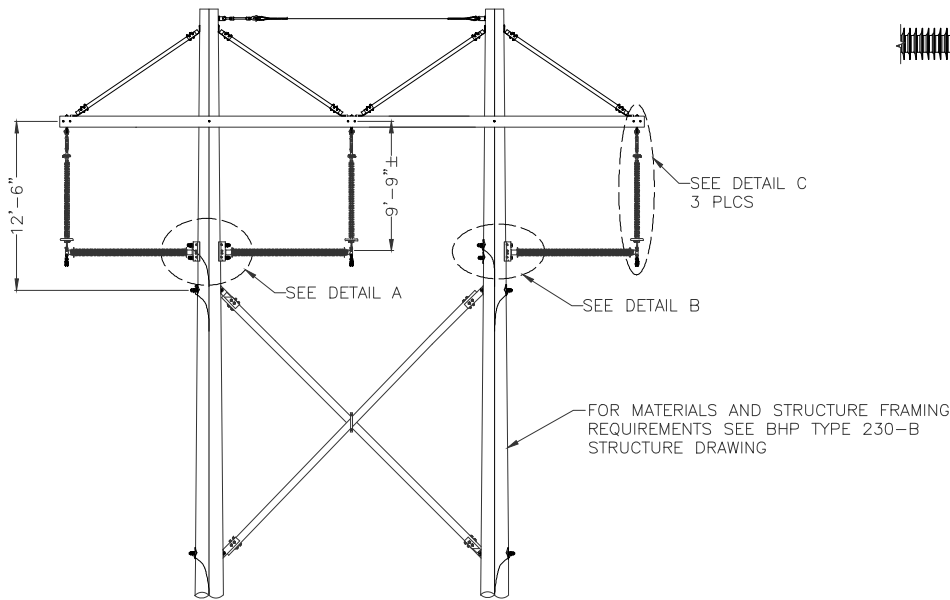
REV. NO.
1

DRAWING NO.

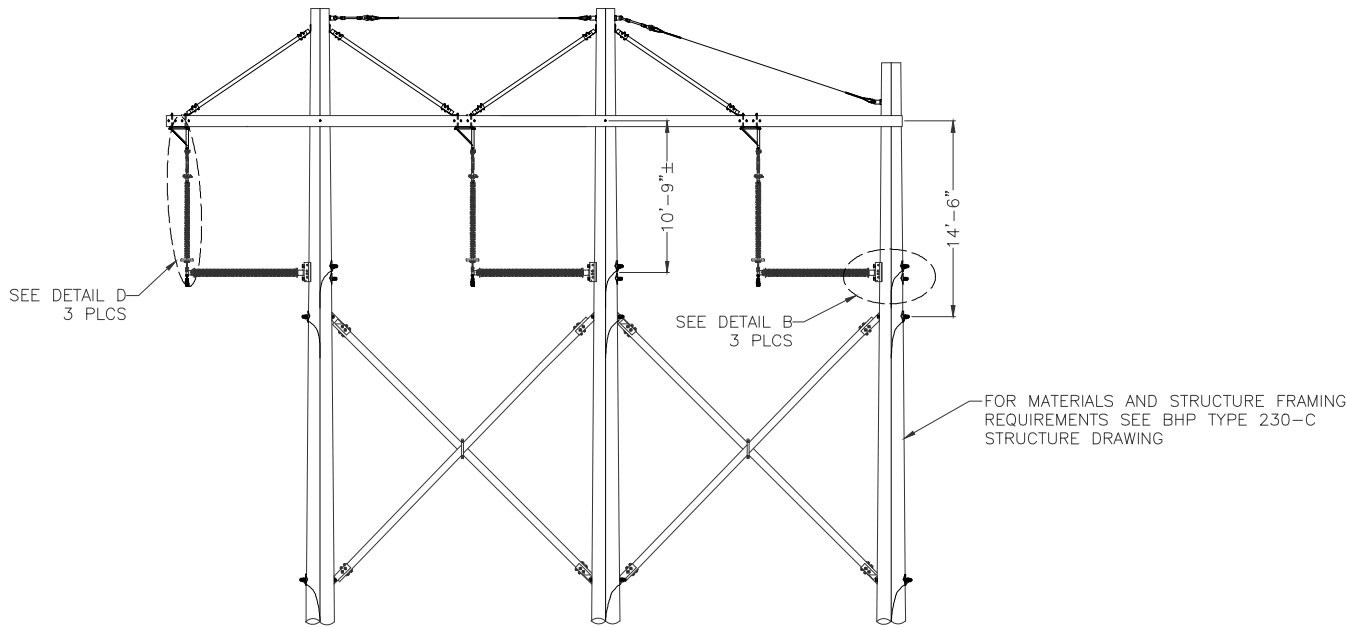
SHEET

230-B

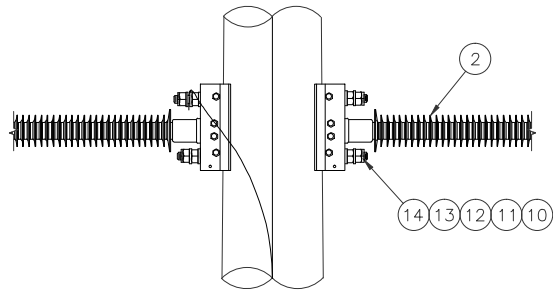
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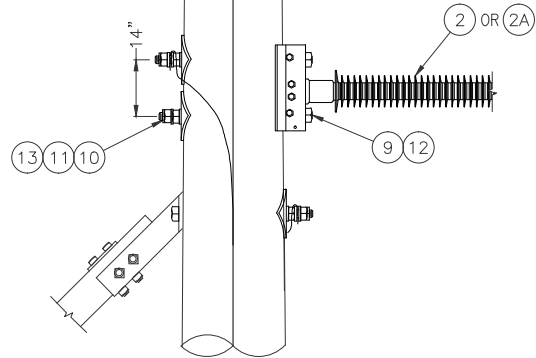
TYPE 230-B
STR. NO. 701, 800, 801, 808



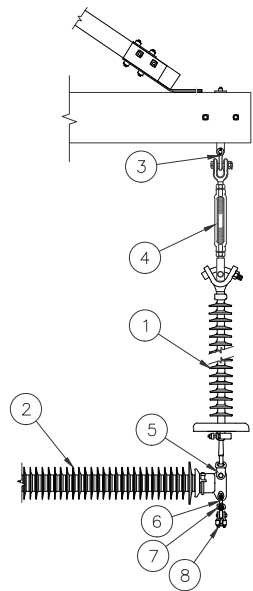
TYPE 230-C
STR. NO. 846, 847



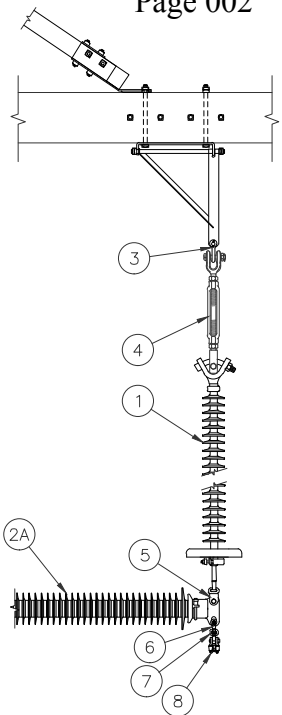
DETAIL A



DETAIL B



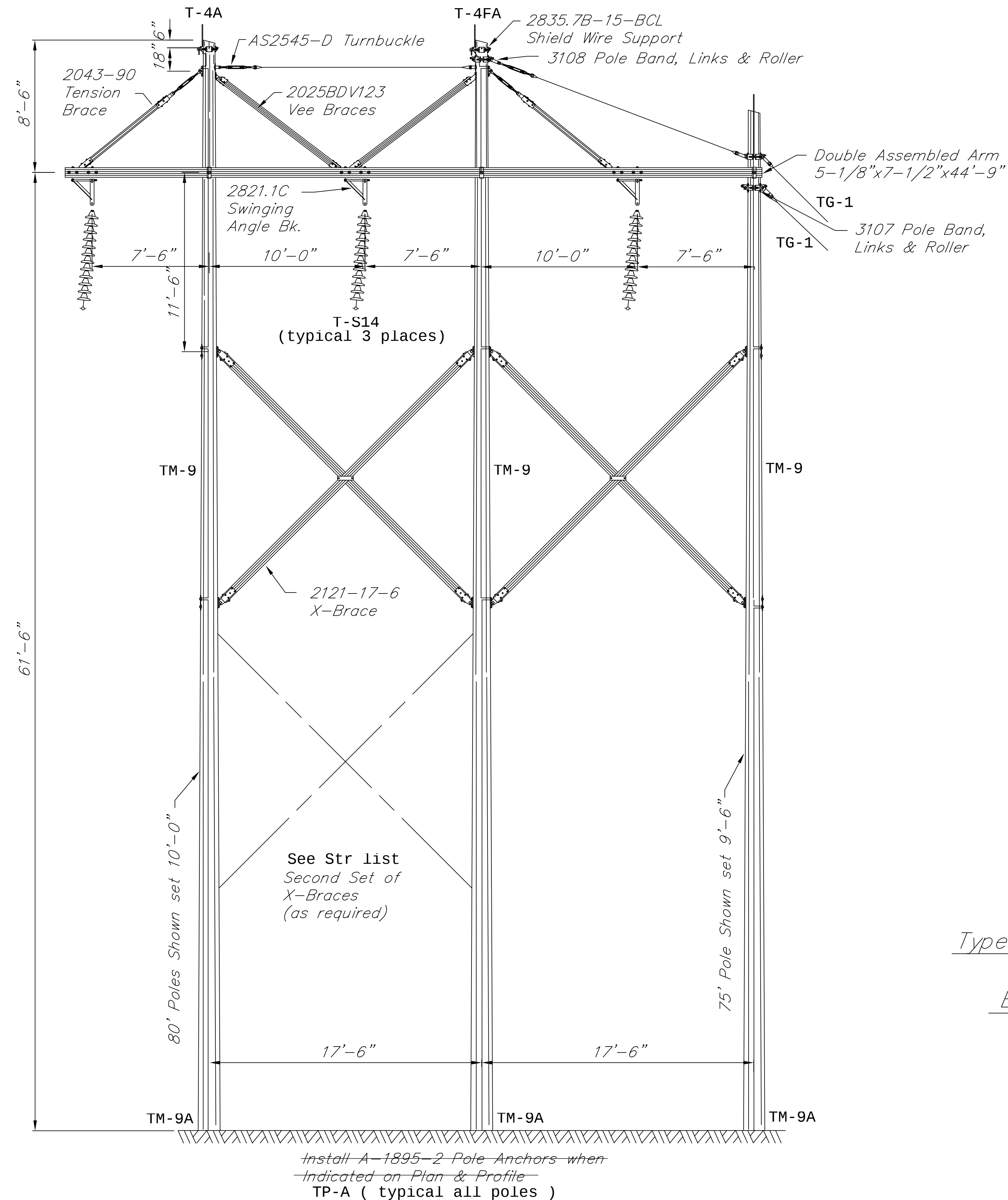
DETAIL C



DETAIL D

MATERIAL LIST					230-B	230-C
ITEM NO.	BHP CODE	DESCRIPTION	MANUFACTURER	CATALOG NO.		
1		POLYMER INSULATOR, 25,000 LBS., 98.1" SECTION LENGTH, Y-CLEVIS AND ANSI 52-5 BALL. FURNISH WITH CORONA RING	O.B. QUADRISIL	S025086S201A	QUANTITY	3
2		POLYMER HORIZONTAL LINE POST INSULATOR SERIES 300, 0' UPSWEEP, 110.0" X-LENGTH, BENDABLE CURVED BASE, 14", W/ 2-1-1/16" HOLES FOR WOOD POLE, DROP TONGUE. FURNISH WITHOUT CORONA RING	O.B. QUADRISIL	P300095SSAAC		3
2A		POLYMER HORIZONTAL LINE POST INSULATOR SERIES 300, 0' UPSWEEP, 89.3" X-LENGTH, BENDABLE CURVED BASE, 14", W/ 2-1-1/16" HOLES FOR WOOD POLE, DROP TONGUE. FURNISH WITHOUT CORONA RING	O.B. QUADRISIL	P300075SSAAD		3
3		ANCHOR SHACKLE, 50K, BNK	HUBBELL	AS50-BNK		3
4		TURNBUCKLE, JAW-EYE W/BOLTS & NUTS & LOCKNUTS	ANDERSON	TB34JE6BNKLN		3
5	480005	SOCKET/Y-CLEVIS, GALV., 30K	HUBBELL	SYC30		3
6	483054	Y-CLEVIS BALL, 30K	HUBBELL	YBC-30		3
7	427020	SOCKET EYE, 1-1/16", 30K	HUBBELL	SA10.5-13		3
8	401272	AGS SUSPENSION ASSY., FOR 1272 Kcmil ACSR "BITTERN"	PREFORMED	AGS-5139		3
9		MACHINE BOLT, GALV., 7/8" X LENGTH AS REQUIRED W/HH NUT				2
10		LOCKNUT, MF, 7/8", GALV.				6
11		BONDING CLIP, 7/8"	HUGHES	2727.8		6
12		WASHER, ROUND, 15/16" HOLE, GALV.				6
13		WASHER, SQUARE CURVED, 15/16" HOLE, 4"x4"x1/4", GALV.				2
14		DOUBLE ARMING BOLT, GALV., 7/8" X LENGTH AS REQ'D, W/HH NUTS				2

				BLACK HILLS POWER 			
				DETAIL SWING BRACE ASSEMBLY			
				SHT. 1 OF 1			
				BHP-T-244			
				0			
DATE	DRAWN BY	NO.	APPROVED BY	REVISION	DESCRIPTION	XX DRAWN BY GC APPROVED BY DZ	DATE 1/08/16 DATE 1/08/16



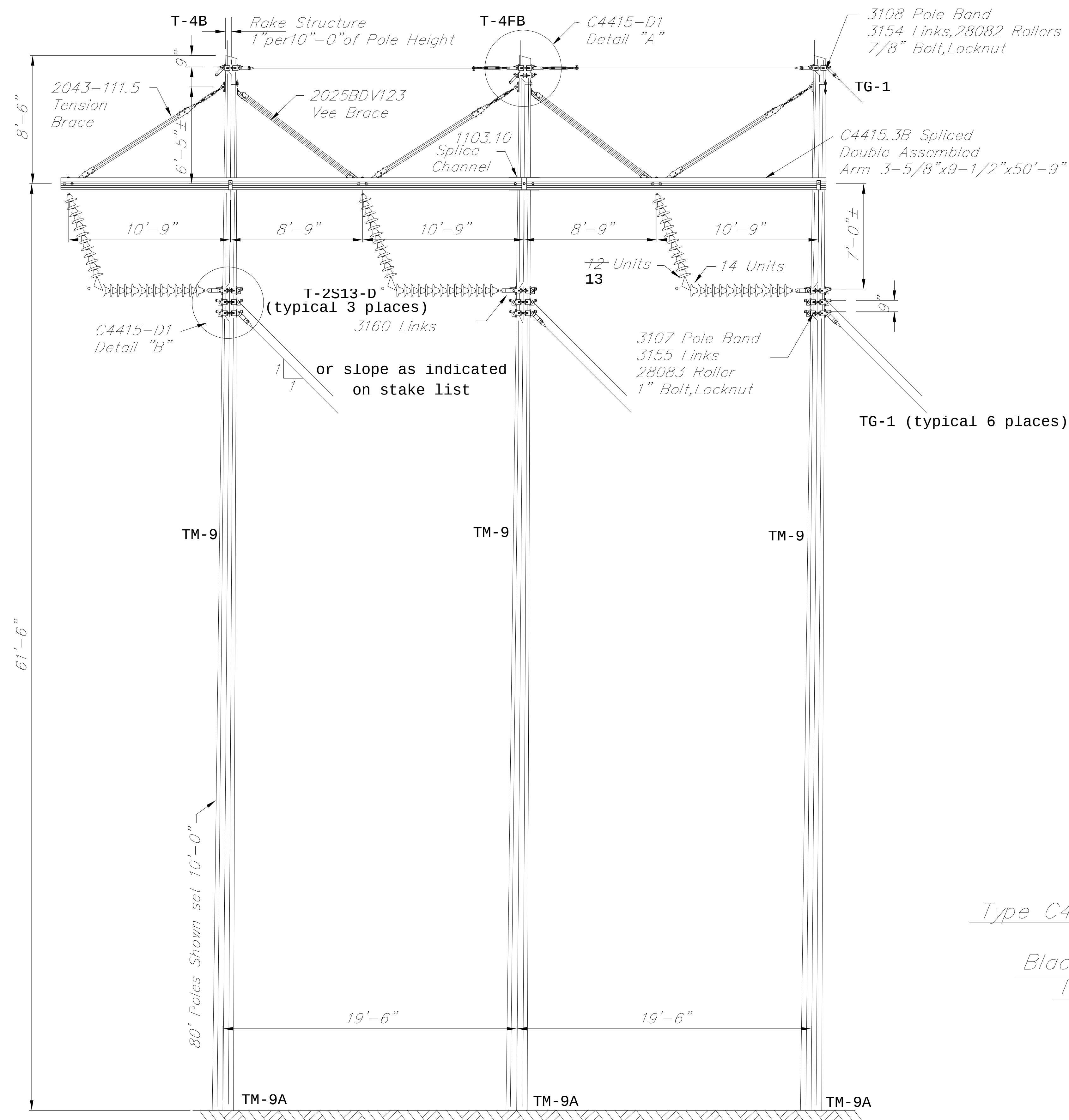
BILL OF MATERIAL	
ASSEMBLED ARM	
1 - C4415.3A Assembled Arm, consisting of: 1 - C4415.3A-1A Arm Assembly 2 - C4415.3A-1 Side Arm, 5-1/8"x7-1/2"x44'-9" Laminate 6 - 3414.2WF-100 Adj. Spacer Fitting 24 -WB66-1-3/4, 5/8"x6" W.H.Bolt 12 - WB58-1/2-1-3/4, 1/2"x8-1/2" W.H.Bolt 2 - AS2276-37-1/2 Twisted Clip 2 - 2722.1B-B, 7/8" Bent Bolt, w/ N80 & MF80 1 - 2722.1D-B, 7/8" Bent Stud, w/ 2-N80 & 2-MF80 2 - WB58-1/2-1-3/4, 1/2"x8-1/2" W.H.Bolt w/ LW50T	
ARM MOUNTING HARDWARE	
3 - TR828-5, 7/8"x28" Thr'd Rod, w/ 3-N80 & 2-MF80 6 - A783.1W Gain Fitting 3 - 2727.8 Bounding Clip 3 - 2821.1C Swinging Angle Brackets	
X-BRACE ASSEMBLED & MOUNTING HARDWARE	
2 - Set 2121-17-6 X-Brace, 17'-6" Pole Spacing 2 - 2840.1H CC Rods 2 - 2086.8A CC Strap 3 - B818-6, 7/8"x18" Bolt 6 - B816-6, 7/8"x16" Bolt 3 - B814-6, 7/8"x14" Bolt 8 - 2817D-15 Dead End Tee 8 - B103-1-1/2EX, 1"x3" Bolt,MF100 12 - 2727.8 Bounding Clip 12 - N80, 7/8" Nut 12 - MF80, 7/8" Locknut 8 - CW80-3/8, Curved Washer	
BRACES ASSEMBLED	
2 - 2025BDV123 Vee Brace,(10-3" CC Holes) 37-1/2 & 52-1/2 Fitgs. (3-3/8"x4-3/8"x9'-8" Wood) 2 - 2043-90 Tension Brace,(7'-6" CC Holes) (3-3/8"x4-3/8"x6'-8" Wood)	
BRACE MOUNTING HARDWARE & CROSS TIE MATERIAL	
4 - AS2545-D, 7/8"x12" Jaw & Rod Eye Turnbuckle 2 - 2817S-15 Dead End Tee (All Holes 15/16") 2 - AS2277 Clevis 2 - CW80, 7/8" Curved Washer 2 - 28082 Rollers 2 - B84-2, 7/8"x4" Bolt, MF80 4 - B814-6, 7/8"x14" Bolt 2 - 2727.8 Bonding Clip 2 - N80, 7/8" Nut 4 - MF80, 7/8" Locknut 2 - 3108.5 Pole Band Assembly (7"-10" Pole Diam.) 6 - 3154 Links 3 - 28082 Rollers 3 - B83-2, 7/8"x3" Bolt, MF80 1 - 3107.5 Pole Band Assembly (7"-10" Pole Diam.) 3 - BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt,MF50 3 - 2718.5 Bonding Clip 2 - 3155 Links 1 - 28083 Rollers 1 - B103-1/2-2-1/2, 1"x3-1/2" Bolt,MF80	
SHIELD WIRE ATTACHMENT	
2 - 2835.7B-15-BCL Shield Wire Support,(7-1/2"-12" Pole Diam.) 2 - B51-1/2-1-1/4, 1/2"x1-1/2" Bolt,MF50 2 - 2718.5 Bonding Clip	

Type C4415-C 1°-4° Angle Structure
230 Kv. Construction
Black Hills Power & Light Co.
Rapid City, South Dakota

DSGN.	XX
DR.	JLM
APPROVED BY	DATE

TRANSMISSION STANDARDS	
TYPE C4415-C, 1° - 4° ANGLE STRUCTURE	
230KV	
BLACK HILLS POWER AND LIGHT COMPANY	

DESIGNED AND DRAWN BY:	
REV. DATE	REV. NO.
1/6/94	1
DRAWING NO.	SHEET
230-C	1



BILL OF MATERIAL	
<u>ASSEMBLED ARM</u>	
1	- C4415.3B Assembled Arm, consisting of:
1	- C4415.3B-1A Arm Assembly
2	- C4415.3B-1 Side Arm, 3-5/8"x9-1/2"x30'-7"
2	- 3414.2EN-120 Adj. Spacer Fitting
8	- WB65-1-3/4, 5/8"x5" W.H.Bolt
4	- WB510-1/2-1-3/4, 1/2"x10-1/2" W.H.Bolt
2	- AS2276-45 Twisted Clip
1	- 2727.1B-B, 7/8" Bent Bolt, w/ N80 & MF80
1	- 2727.1D-B, 7/8" Bent Stud, w/ 2-N80 & 2-MF80
1	- C4415.3B-2A Arm Assembly
2	- C4415.3B-2 Side Arm, 3-5/8"x9-1/2"x19'-10"
1	- 3414.2EN-120 Adj. Spacer Fitting
4	- WB65-1-3/4, 5/8"x5" W.H.Bolt
4	- WB510-1/2-1-3/4, 1/2"x10-1/2" W.H.Bolt
1	- AS2276-45 Twisted Clip
1	- 2722.1D-B, 7/8" Bent Stud, w/ 2-N80 & 2-MF80
2	- 1103.10 Splice Channel
2	- WB85-1-3/4, 7/8"x5" W.H.Bolt, MF80
2	- WB510-1/2-1-3/4, 1/2"x10-1/2" W.H.Bolt w/ LW50T
<u>ARM MOUNTING HARDWARE</u>	
2	- TR826-5, 7/8"x26" Thr'd Rod, w/ 3-N80 & 2-MF80
1	- TR820-5, 7/8"x20" Thr'd Rod, w/ 3-N80 & 2-MF80
4	- A783.1Q Gain Fitting
3	- 2727.8 Bonding Clip
<u>CONDUCTOR ATTACHMENT & GUYING HARDWARE</u>	
9	- 3107.6 Pole Band Assembly (10"-12" Pole Diam.)
9	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
9	- 2718.5 Bonding Clip
12	- 3155 Links
6	- 28083 Rollers
6	- B103-1/2-2-1/2, 1"x3-1/2" Bolt, MF100
6	- 3160 Links
<u>BRACES ASSEMBLED & MOUNTING HARDWARE</u>	
2	- 2025BDV123 Vee Brace, (10'-3" CC Holes) 37-1/2 & 52-1/2 Fitts. (3-3/8"x4-3/8"x9'-8" Wood)
3	- 2043-111.5 Tension Brace (9'-3-1/2" CC Holes) (3-3/8"x4-3/8"x8'-6" Wood)
3	- AS2545-D, 7/8"x12" Jaw & Rod End Eye Turnbuckle
3	- 2817-15 Dead End Tee (All Holes 15/16")
4	- CW80-3/8, Curved Washer
3	- B816-6, 7/8"x16" Bolt
3	- B814-6, 7/8"x14" Bolt
3	- 2727.8 Bonding Clip
3	- N80, 7/8" Nut
6	- MF80, 7/8" Locknut
<u>CROSS TIE, SHIELD WIRE & GUYING HARDWARE</u>	
4	- 3108.6 Pole Band Assembly (9"-12" Pole Diam.)
2	- AS2545-D, Jaw & Rod End Eye Turnbuckle
5	- 28082 Rollers
14	- 3154 Links
5	- B83-2, 7/8"x3" Bolt, MF80
4	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
4	- 2718.5 Bonding Clip

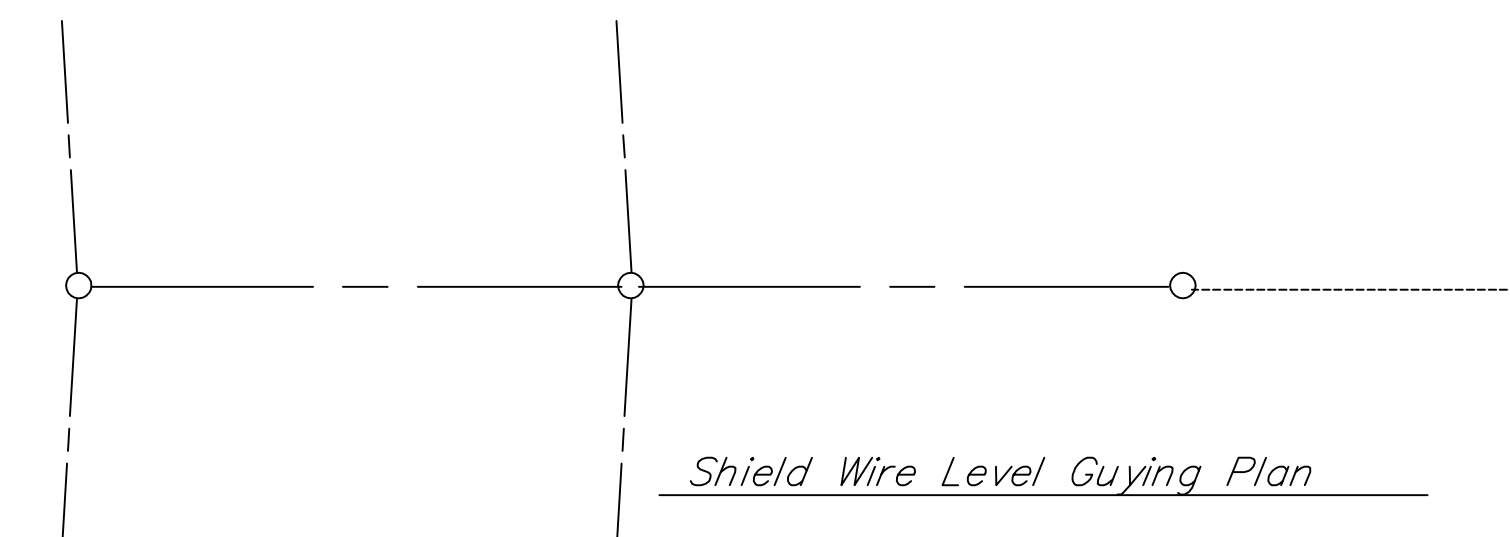
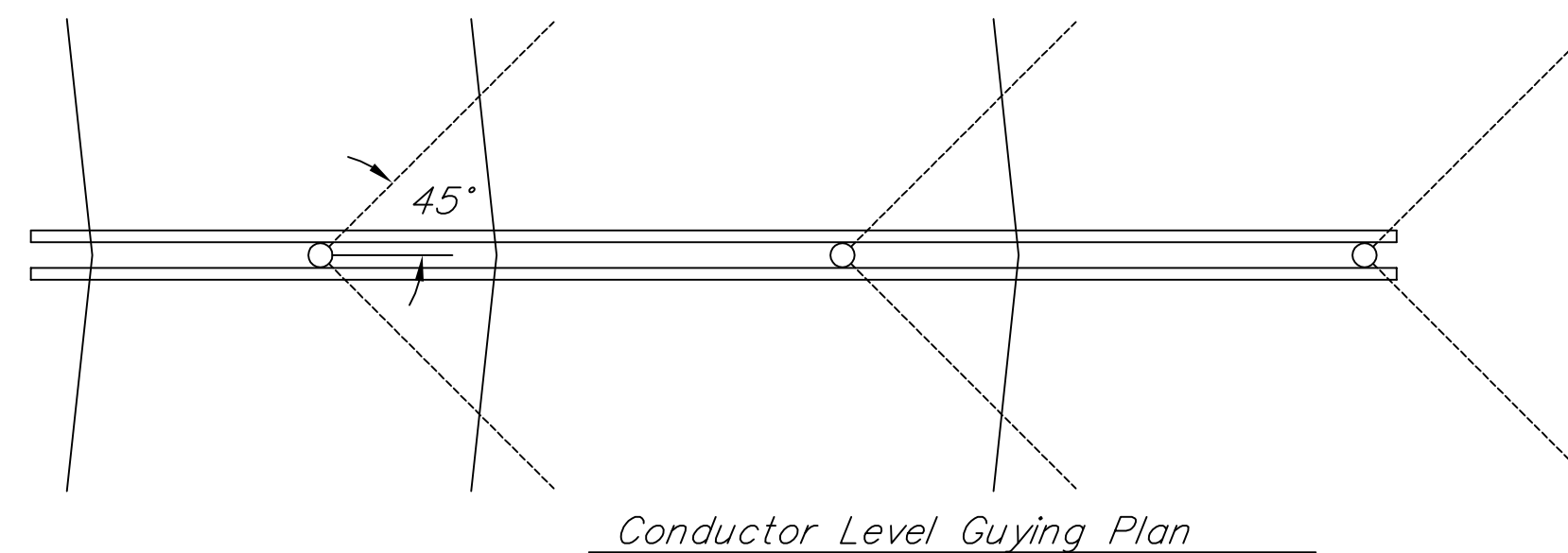
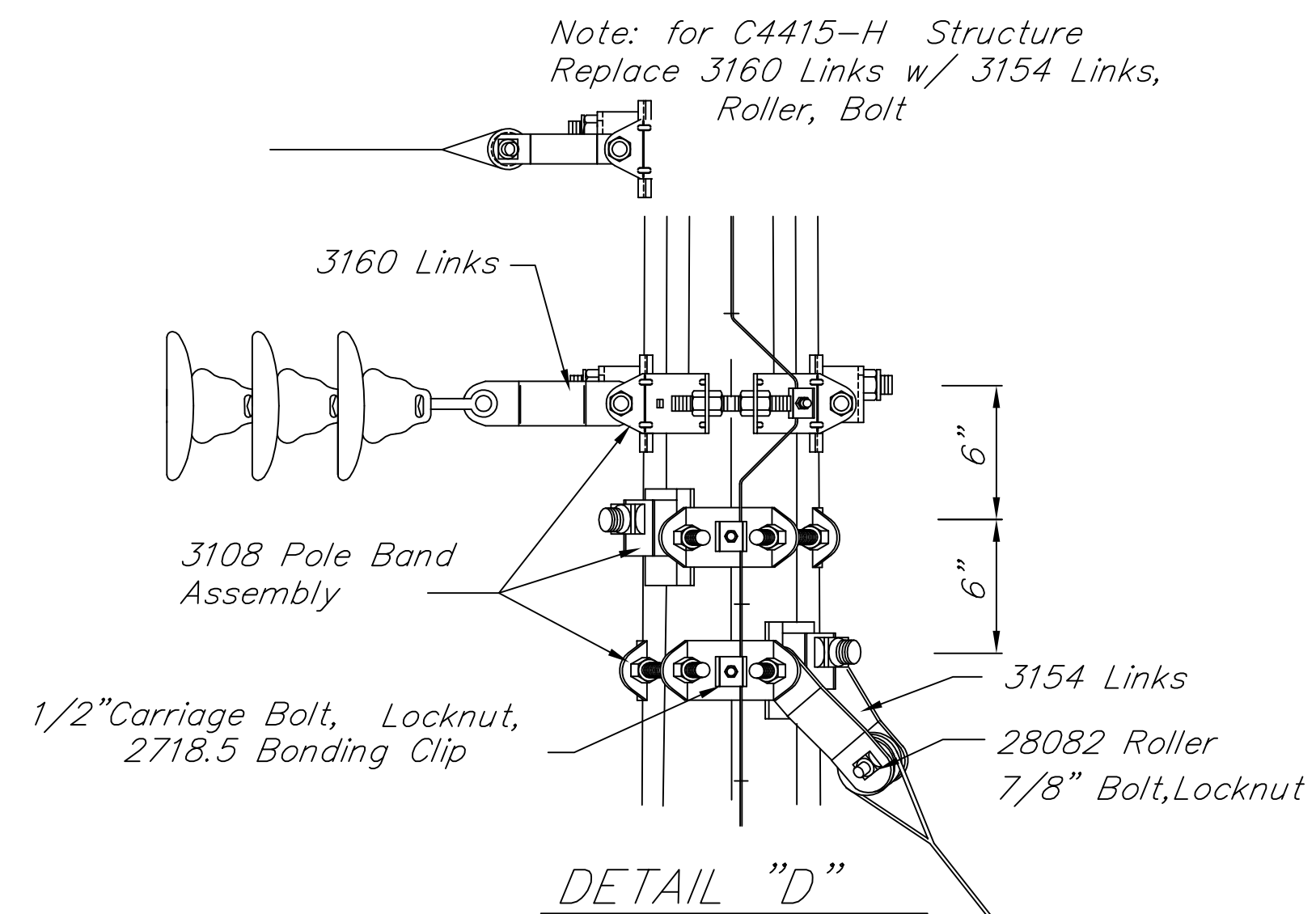
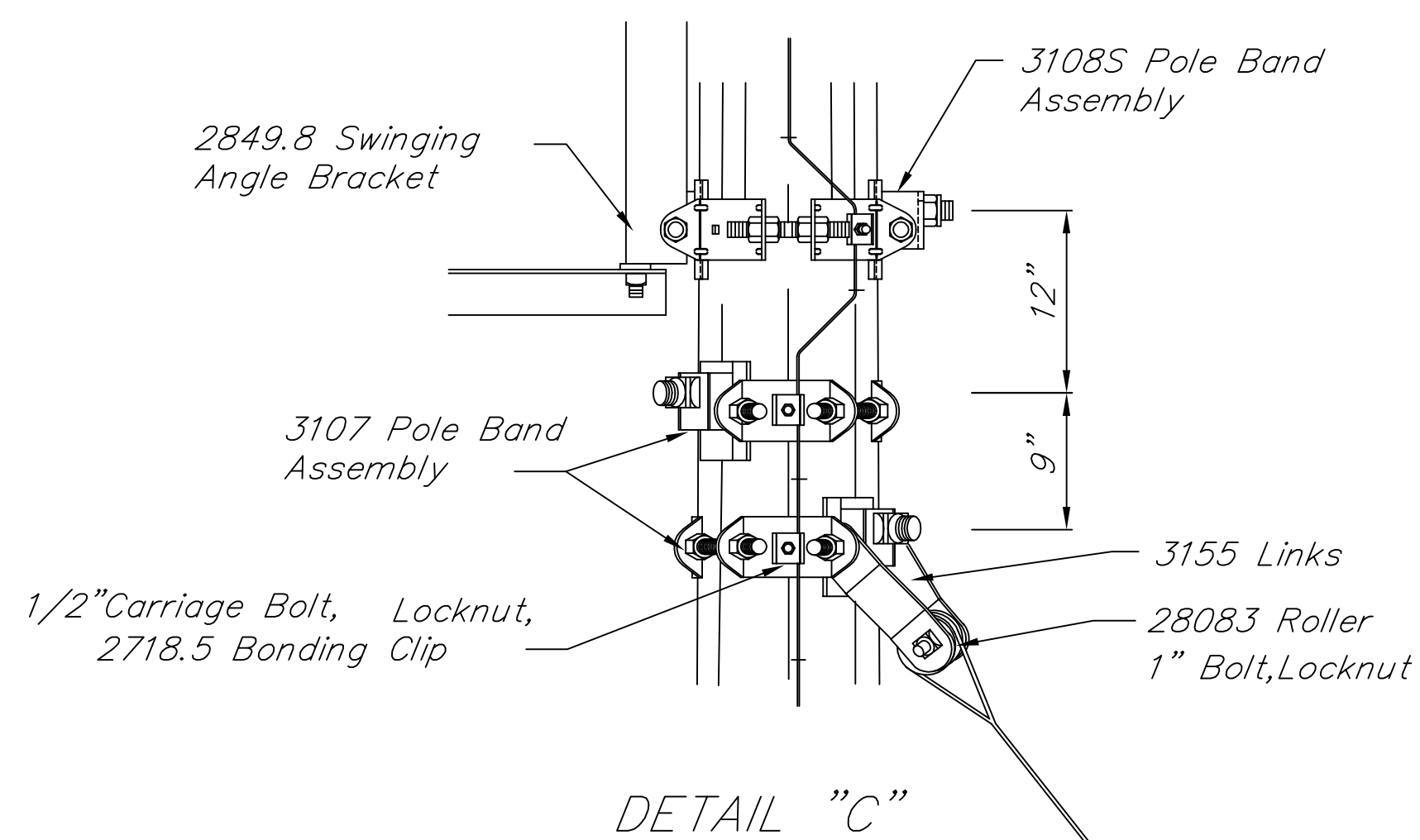
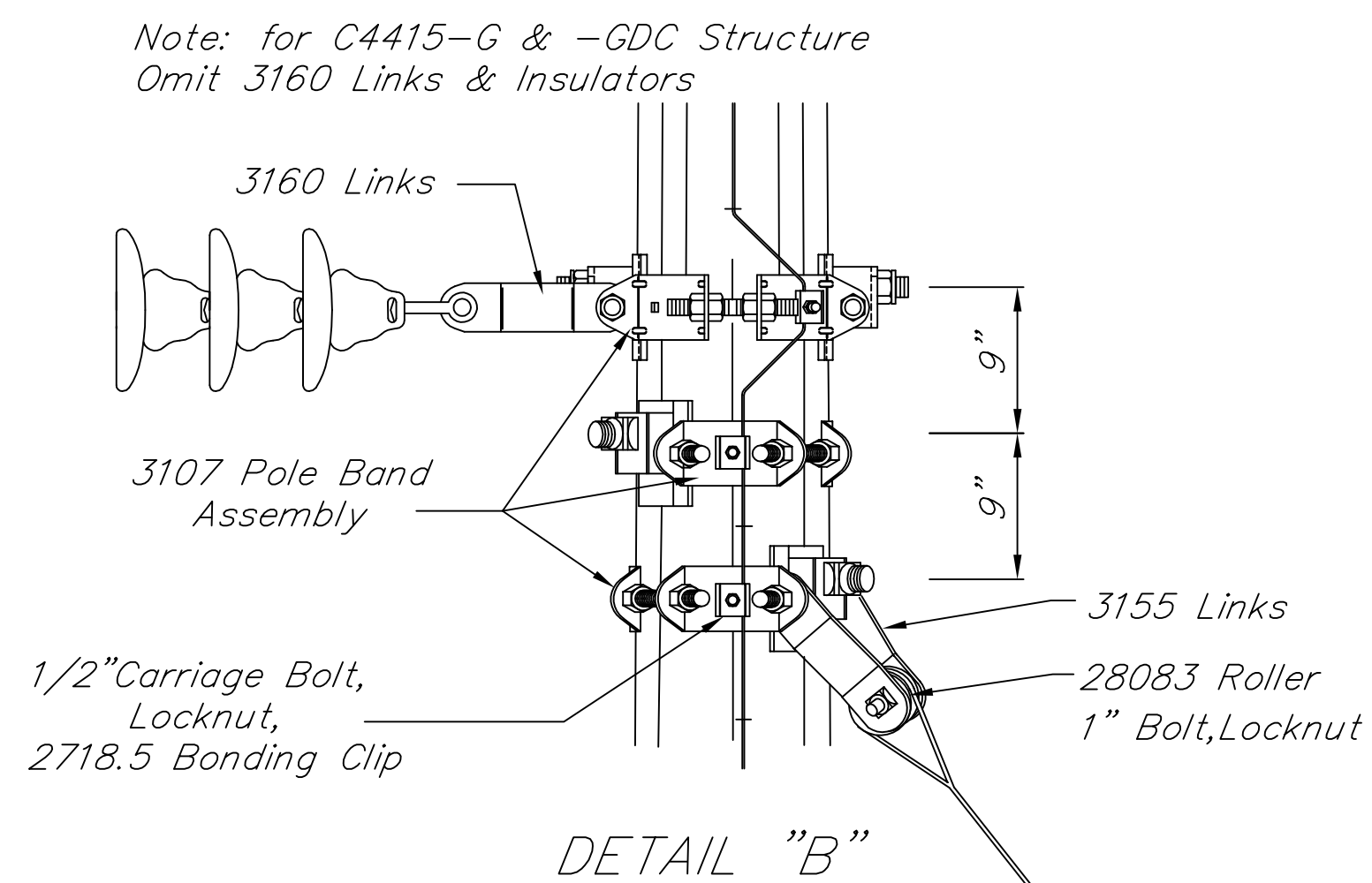
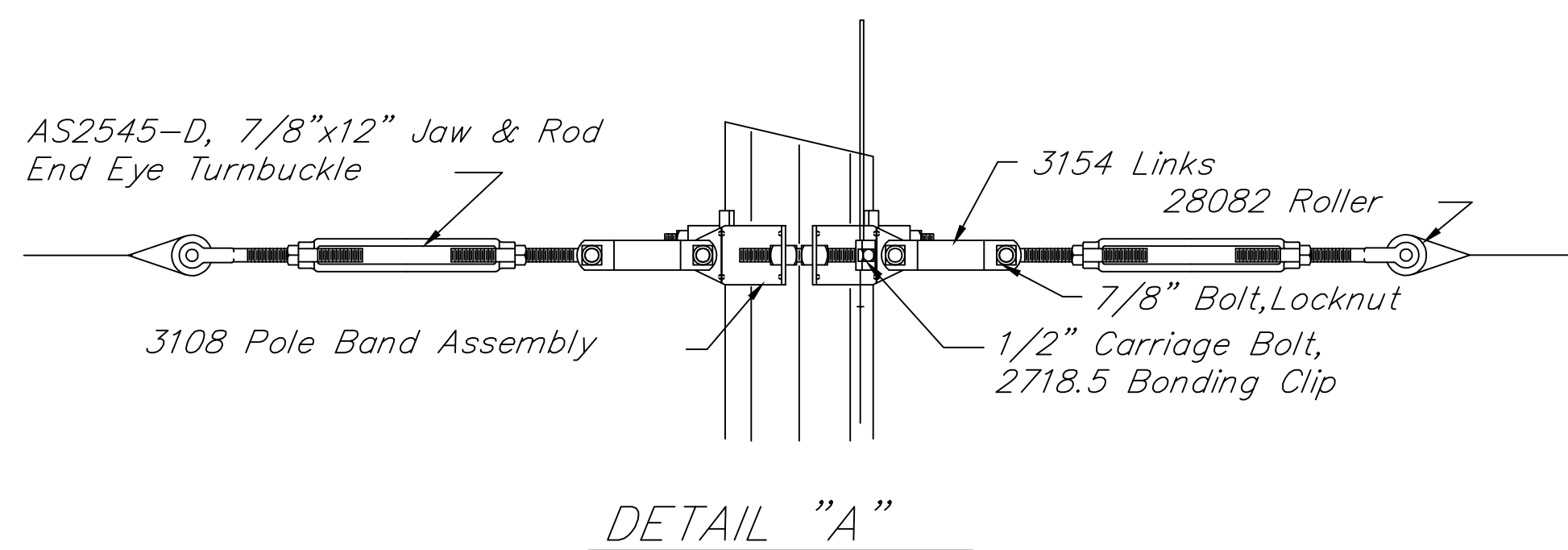
Type C4415-D 4°-12° Angle Structure
230 Kv. Construction
Black Hills Power & Light Co.
Rapid City, South Dakota

~~Install A1895-2 Pole Anchors when
Indicated on Plan & Profile~~
TP-A (typical all poles)

DSGN. XX	
DR. JLM	
APPROVED BY	DATE

TRANSMISSION STANDARDS
TYPE C4415-D, 4° - 12° ANGLE STRUCTURE
230KV
BLACK HILLS POWER AND LIGHT COMPANY

DESIGNED AND DRAWN BY:	
	
REV. DATE 1/6/94	REV. NO. 1
DRAWING NO. 230-D	SHEET 1

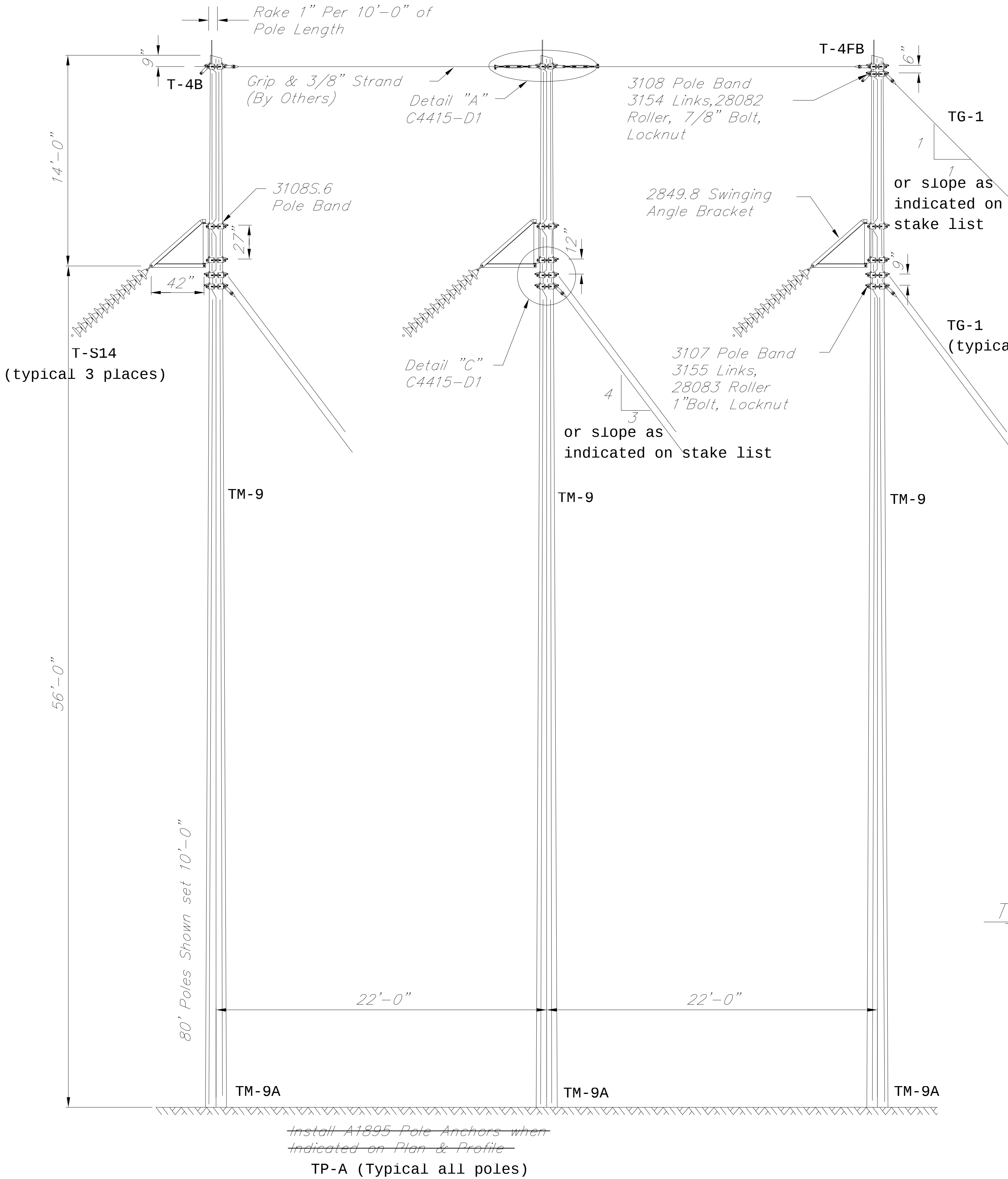


Guying Plan For C4415-D, & -DDC Structures

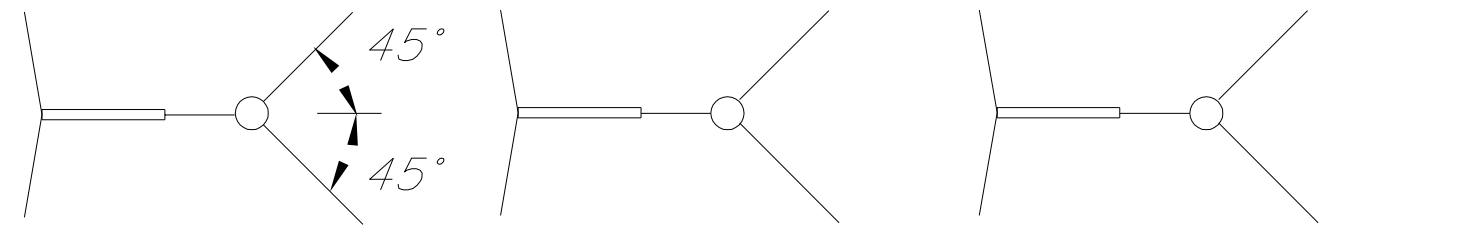
DSGN.	XX
DR.	JKM
APPROVED BY	DATE

TRANSMISSION STANDARDS
GUYING PLAN FOR C4415-D & -DDC STRUCTURES
230KV
BLACK HILLS POWER AND LIGHT COMPANY

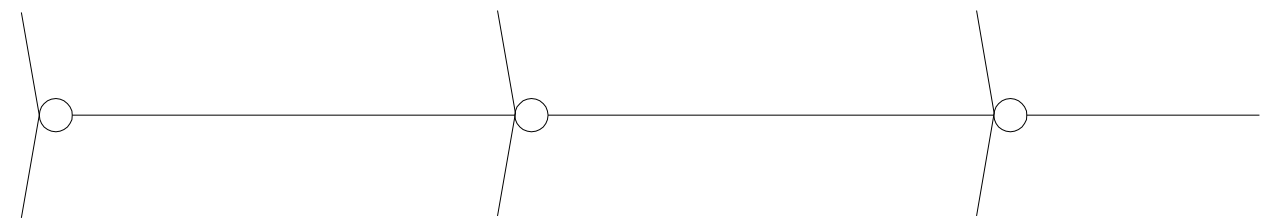
DESIGNED AND DRAWN BY:	
AUGHES BROTHERS Seward, Nebraska	
REV. DATE 1/6/94	REV. NO. 1
DRAWING NO. 230-D1	SHEET 1



BILL OF MATERIAL	
CONDUCTOR ATTACHMENT & GUYING HARDWARE	
3	- 2849.8 Swinging Angle Bracket
6	- 3108S.6 Pole Band Assembly (9"-12"Pole Diam.)
3	- 2718.5 Bonding Clip
3	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
6	- 3107.6 Pole Band Assembly (10"-12" Pole Diam.)
6	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
6	- 2718.5 Bonding Clip
12	- 3155 Links
6	- 28083 Rollers
6	- B103-1/2-2-1/2, 1"x3-1/2" Bolt, MF100
CROSS TIE, SHIELD WIRE & GUYING HARDWARE	
2	- AS2545-D, 7/8"x12" Jaw & Rod End Eye Turnbuckle
4	- 3108.6 Pole Band Assembly (9"-12" Pole Diam.)
5	- 28082 Rollers
5	- B83-2, 7/8"x3" Bolt, MF80
4	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
4	- 2718.5 Bonding Clip



Conductor Level Guying Plan



Shield Wire Level Guying Plan

Type C4415-E 12°-20° Angle Structure
230 Kv. Construction
Black Hills Power & Light Co.
Rapid City, South Dakota

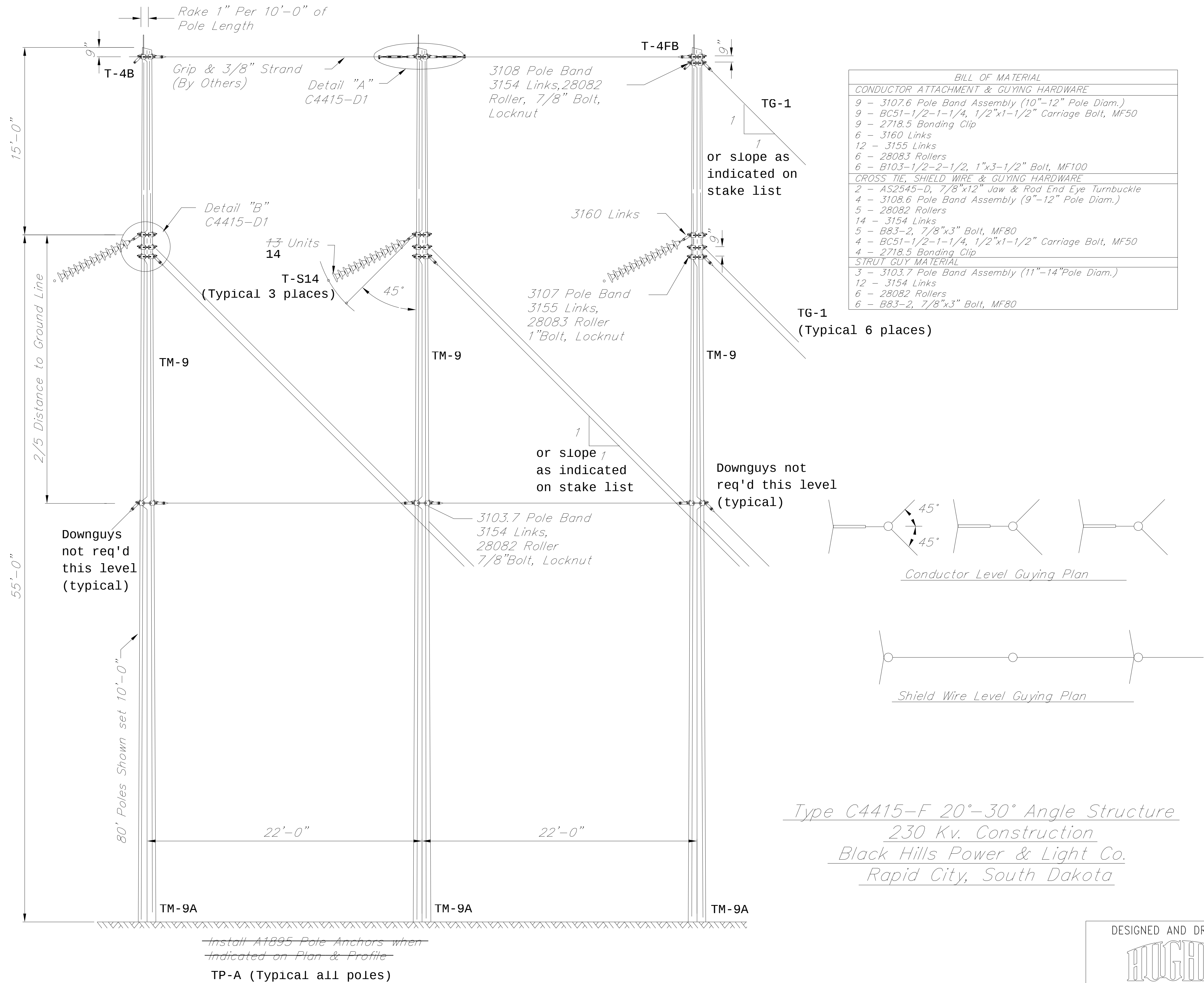
~~Install A1895 Pole Anchors when
Indicated on Plan & Profile~~

TP-A (Typical all poles)

DSGN.	XX
DR.	JLM
APPROVED BY	DATE

TRANSMISSION STANDARDS
TYPE C4415-E, 12° - 20° ANGLE STRUCTURE
230KV
BLACK HILLS POWER AND LIGHT COMPANY

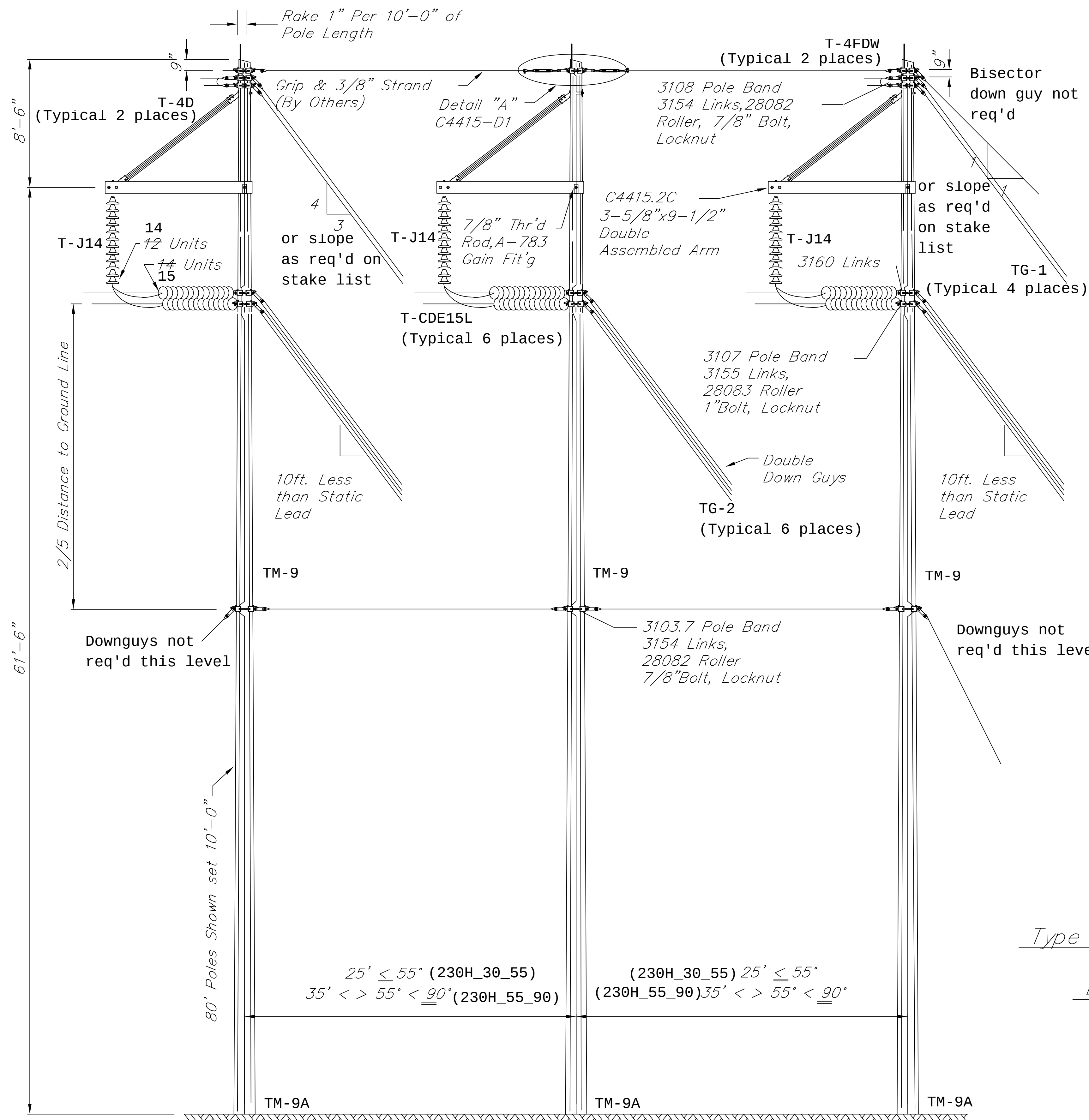
DESIGNED AND DRAWN BY:	
REV. DATE 1/6/94	REV. NO. 1
DRAWING NO. 230-E	SHEET 1



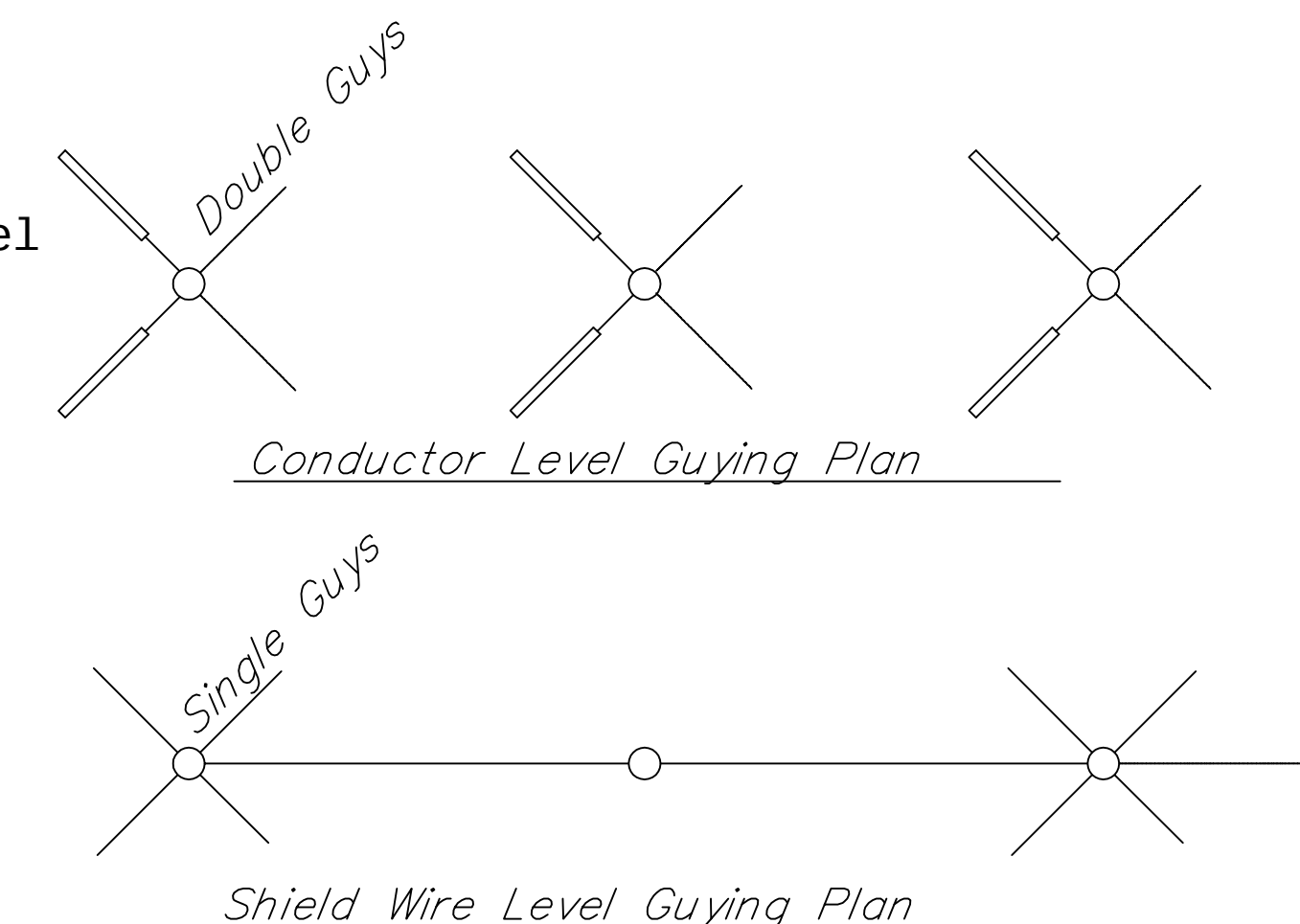
DSGN.	XX
DR.	JLM
APPROVED BY	DATE

TRANSMISSION STANDARDS	
TYPE C4415-F, 20° - 30° ANGLE STRUCTURE	
230KV	
BLACK HILLS POWER AND LIGHT COMPANY	

DESIGNED AND DRAWN BY:	
REV. DATE	REV. NO.
1/6/94	1
DRAWING NO.	SHEET
230-F	1



BILL OF MATERIAL	
ASSEMBLED ARM	
3	- C4415.2C Assembled Arm consisting of:
2	- C4415.2C-1 Arm, 3-5/8"x9-1/2"x9'-9"
1	- 3414.2EN-120 Adj. Spacer Fitting
4	- WB65-1-3/4, 5/8"x5" W.H. Bolt
2	- WB510-1/2-1-3/4, 1/2"x10-1/2" W.H.Bolt
1	- 2722.1B-B, 7/8" Bent Bolt w/ N80 & MF80
2	- WB510-1/2-1-3/4, 1/2"x10-1/2" W.H.Bolt, LW50T
ARM MOUNTING HARDWARE	
3	- TR826-5, 7/8 x 26" Thr'd Rod, 3 - N80, 2 - MF80
6	- A783.1Q Gain Fitting
3	- 2727.8 Bonding Clip
VEE BRACE ASSEMBLED & MOUNTING HARDWARE	
3	- 2025BDV123 Vee Brace, 10'-3" CC Holes, (3-3/8 x 4-3/8 x 9'-8" Wood), 37-1/2" & 52-1/2" Fit'gs
3	- B814-6, 7/8 x 14" Bolt with MF80
3	- 2727.8 Bonding Clip
3	- N80, 7/8" Nuts
3	- CW80-3/8 Curved Washer (4 x 4 x 3/8")
CONDUCTOR ATTACHMENT & GUYING HARDWARE	
6	- 3107.6 Pole Band Assembly (10"-12" Pole Diam.)
6	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
6	- 2718.5 Bonding Clip
12	- 3160 Links
12	- 3155 Links
6	- 28083 Rollers
6	- B103-1/2-2-1/2, 1"x3-1/2" Bolt, MF100
CROSS TIE, SHIELD WIRE & GUYING HARDWARE	
2	- AS2545-D, 7/8"x12" Jaw & Rod End Eye Turnbuckle
3	- 3108.6 Pole Band Assembly (9"-12" Pole Diam.)
9	- 28082 Rollers
18	- 3154 Links
9	- B83-2, 7/8"x3" Bolt, MF80
7	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
7	- 2718.5 Bonding Clip
STRUT GUY MATERIAL	
3	- 3103.7 Pole Band Assembly (11"-14" Pole Diam.)
12	- 3154 Links
6	- 28082 Rollers
6	- B83-2, 7/8"x3" Bolt, MF80
3	- BC51-1/2-1-1/4, 1/2"x1-1/2" Carriage Bolt, MF50
3	- 2718.5 Bonding Clip

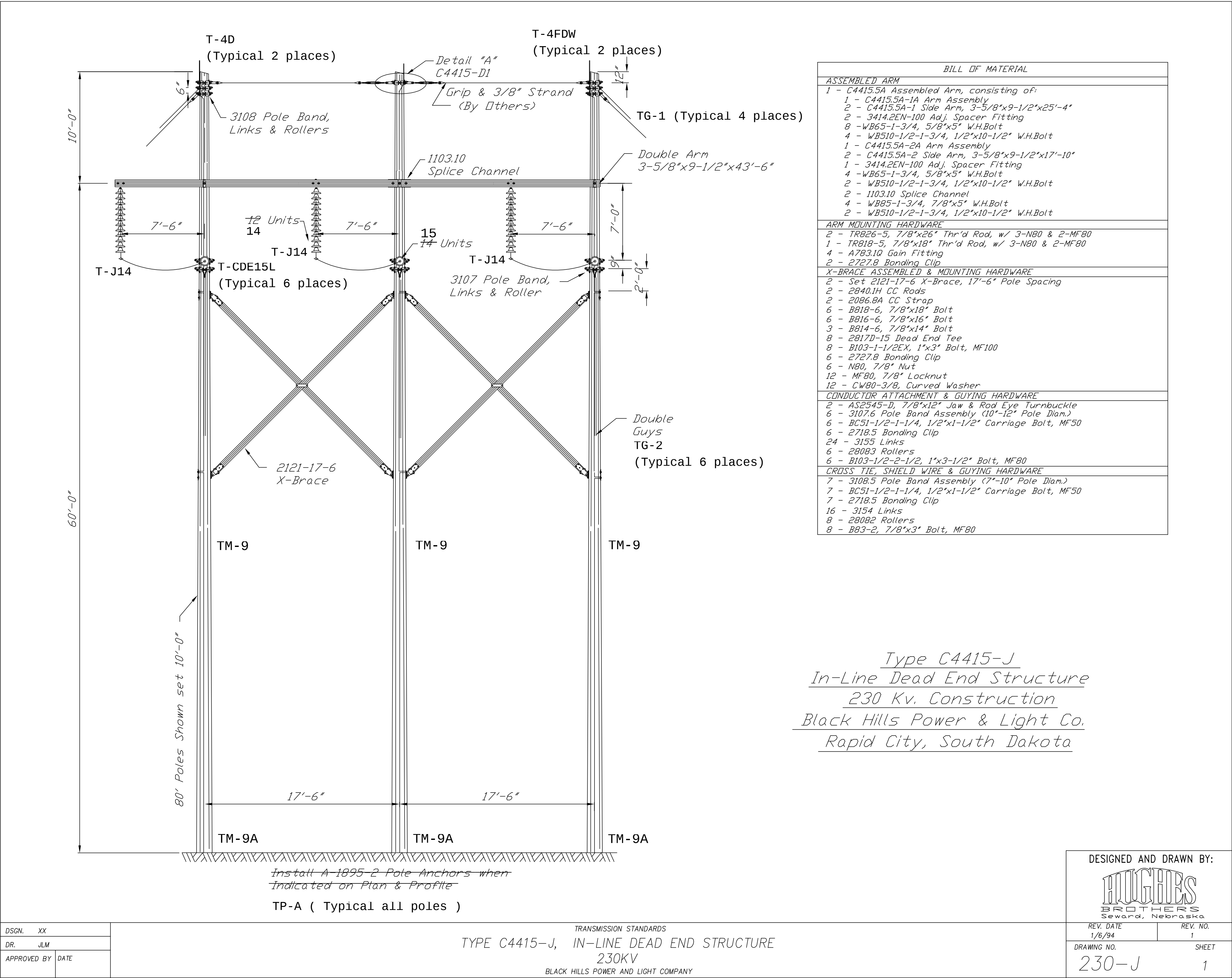


Type C4415-H 30°-90° Angle Structure
230 Kv. Construction
Black Hills Power & Light Co.
Rapid City, South Dakota

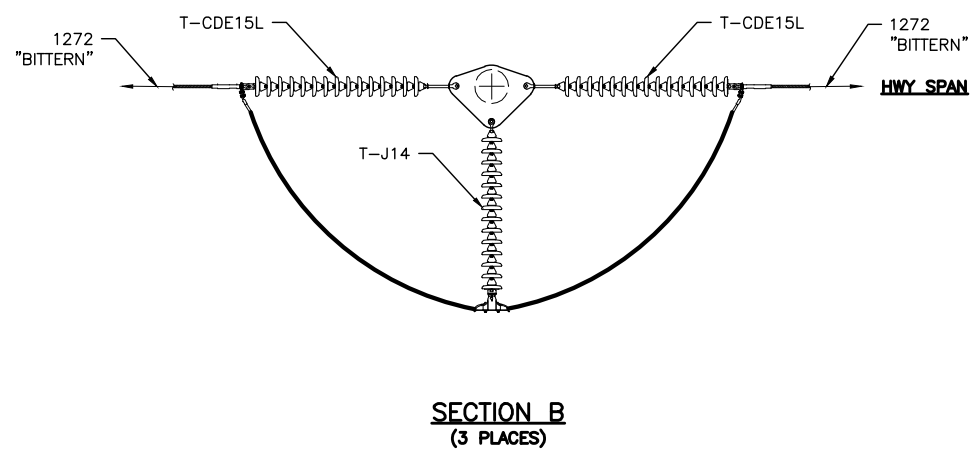
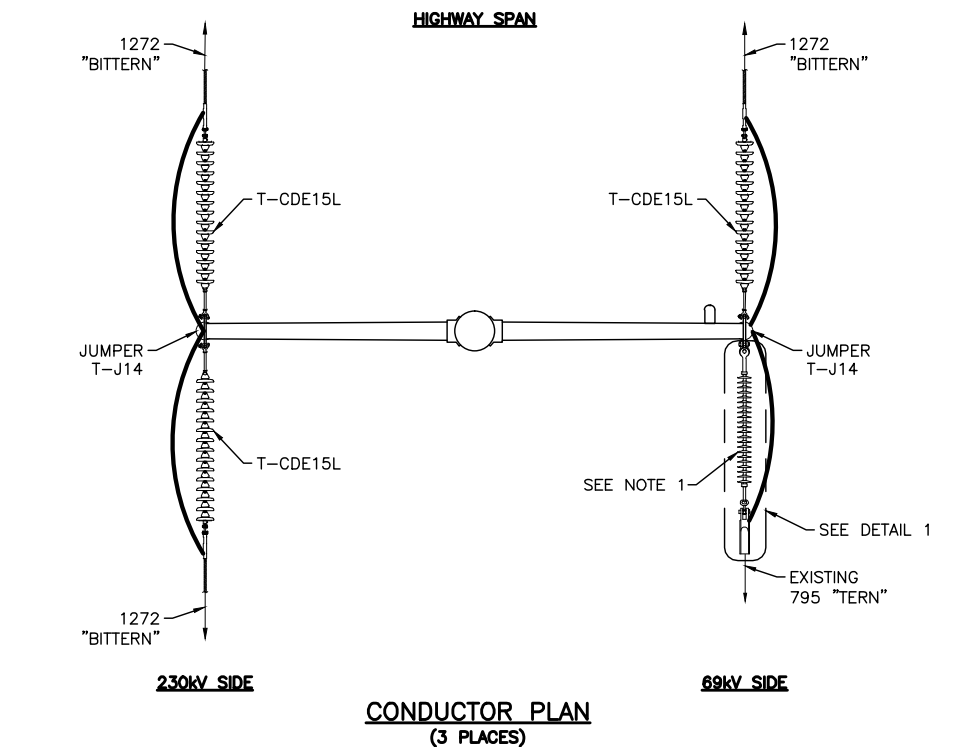
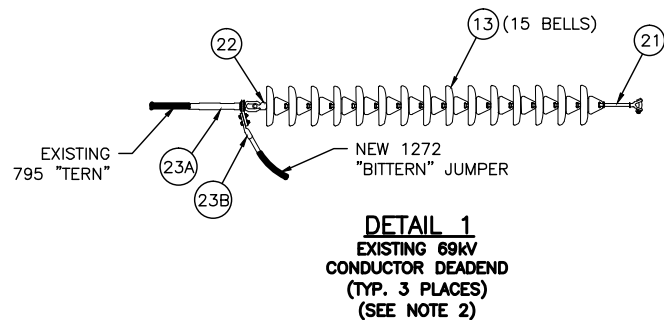
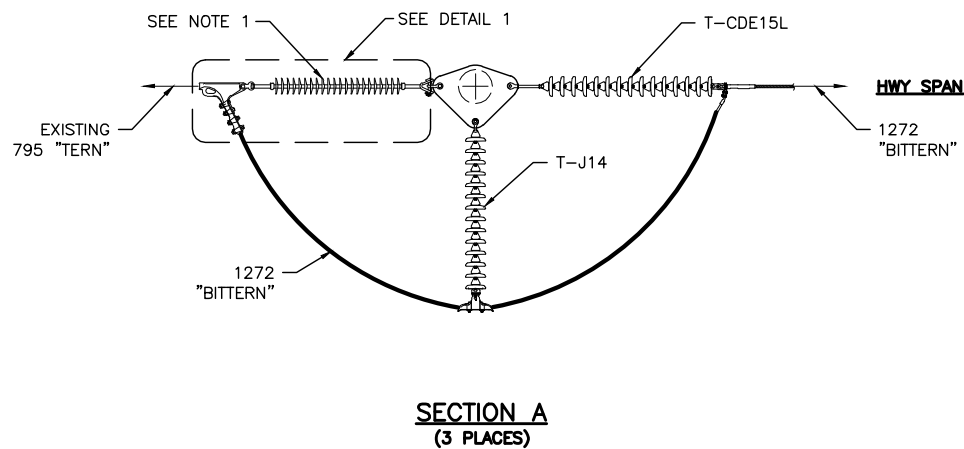
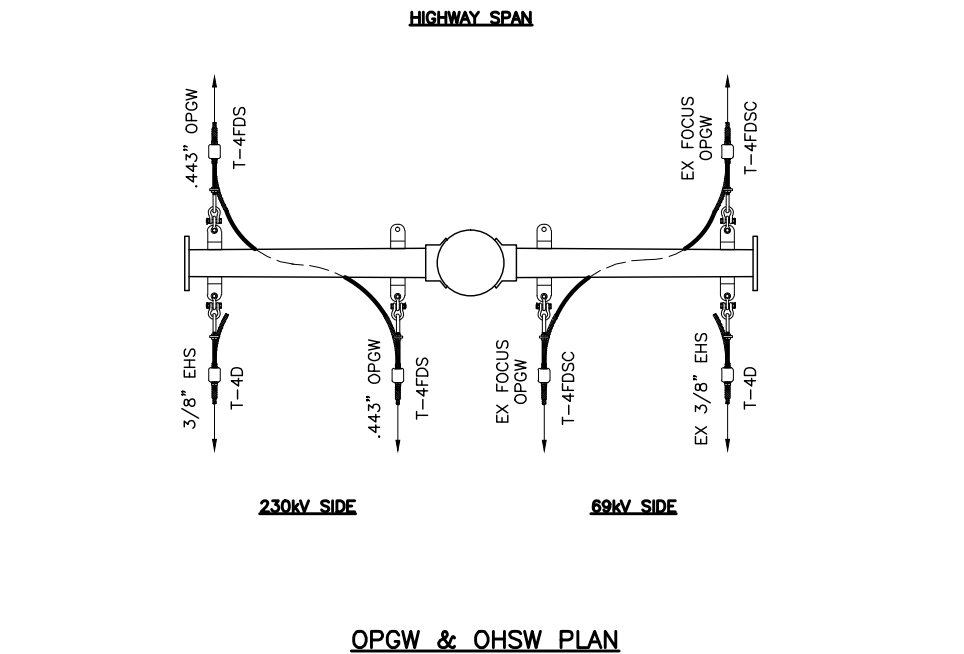
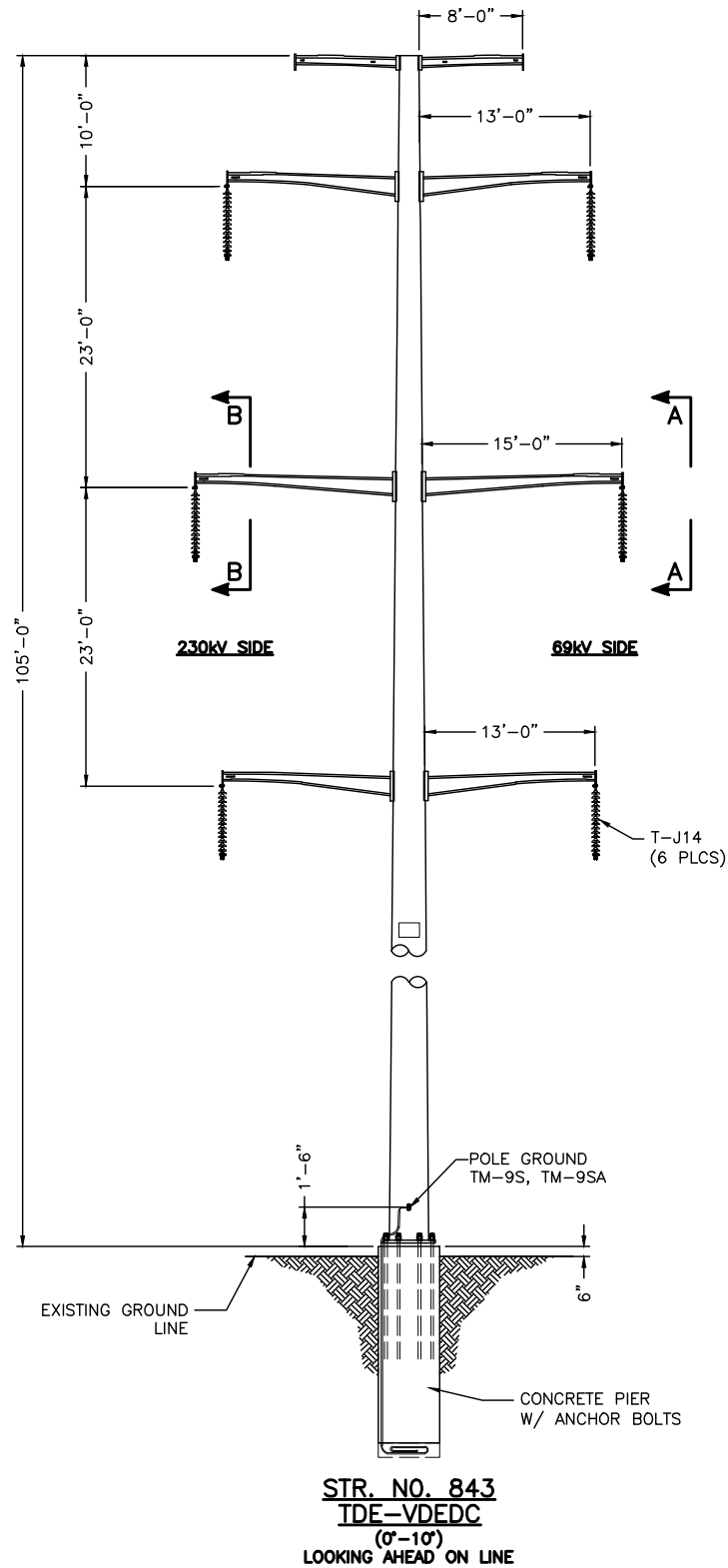
DSGN. XX	
DR. JLM	
APPROVED BY	DATE

TRANSMISSION STANDARDS
TYPE C4415-H, 30° - 90° ANGLE STRUCTURE
230KV
BLACK HILLS POWER AND LIGHT COMPANY

DESIGNED AND DRAWN BY:	
	
REV. DATE	
1/6/94	REV. NO. 1
DRAWING NO.	
230-H	
SHEET	
1	



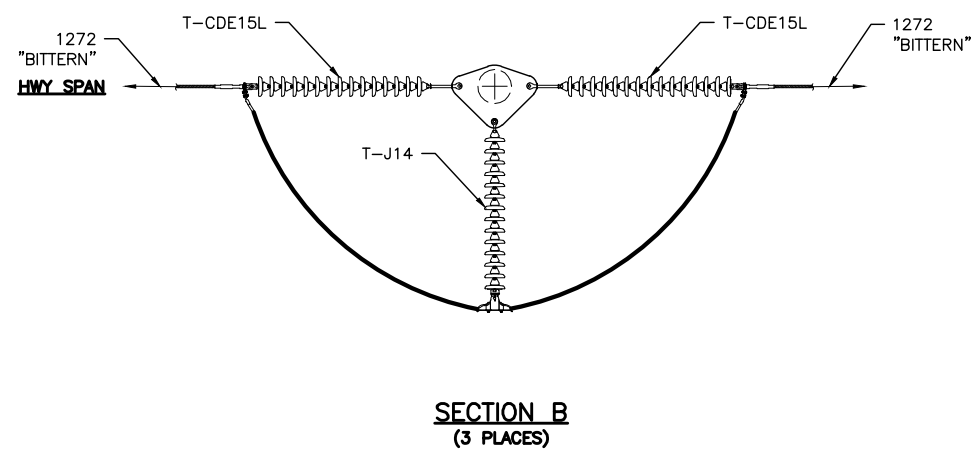
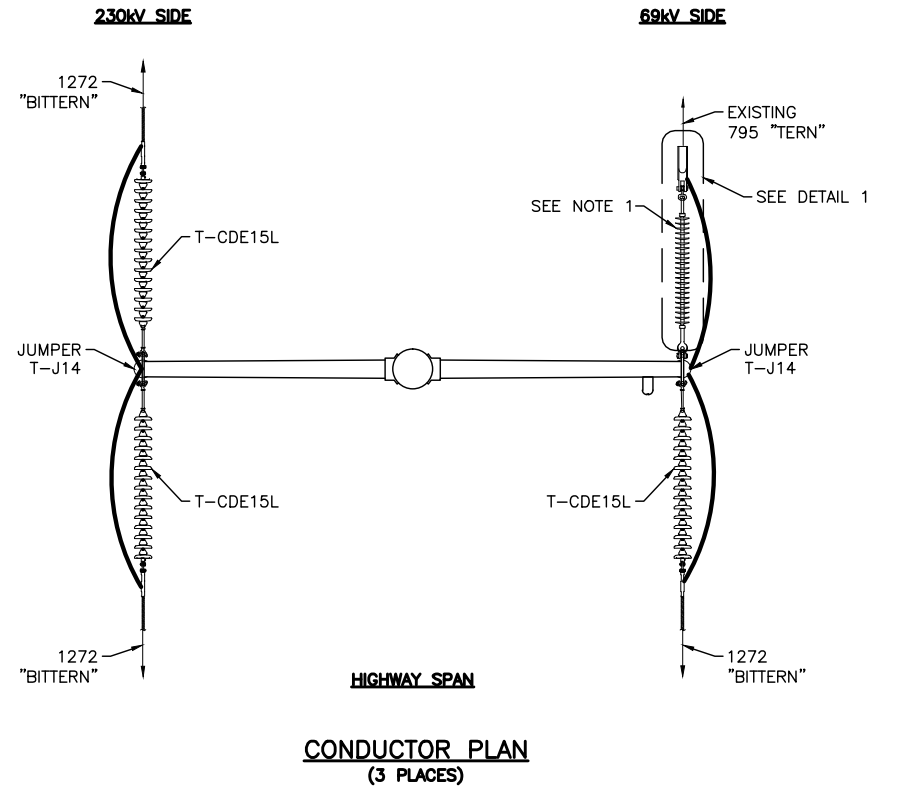
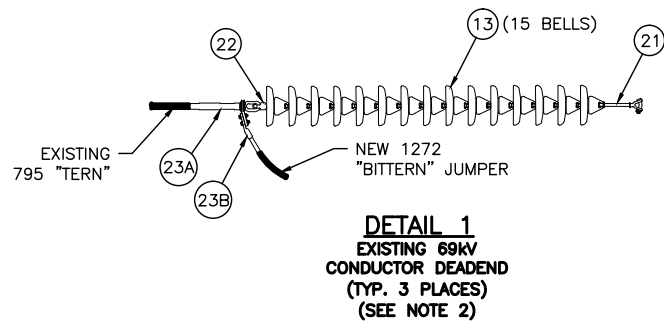
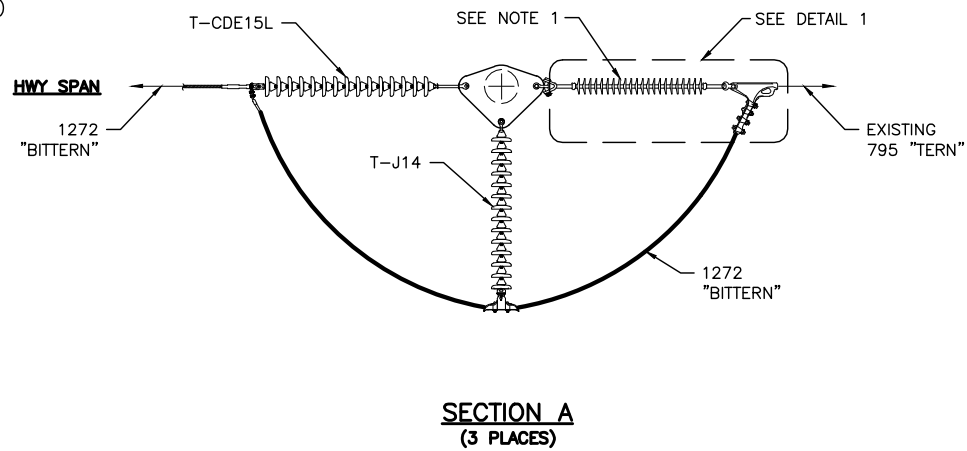
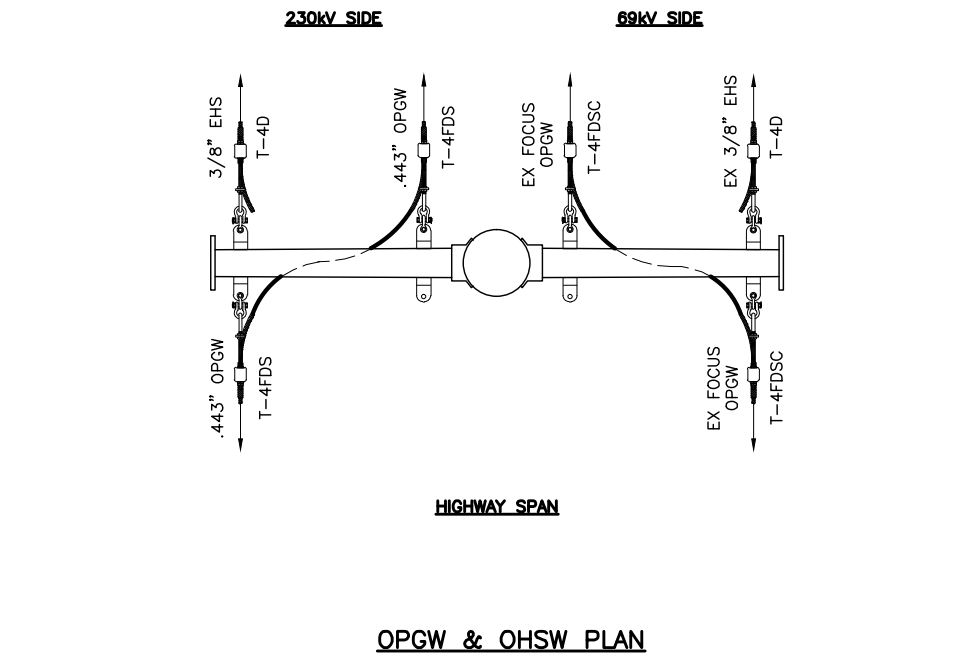
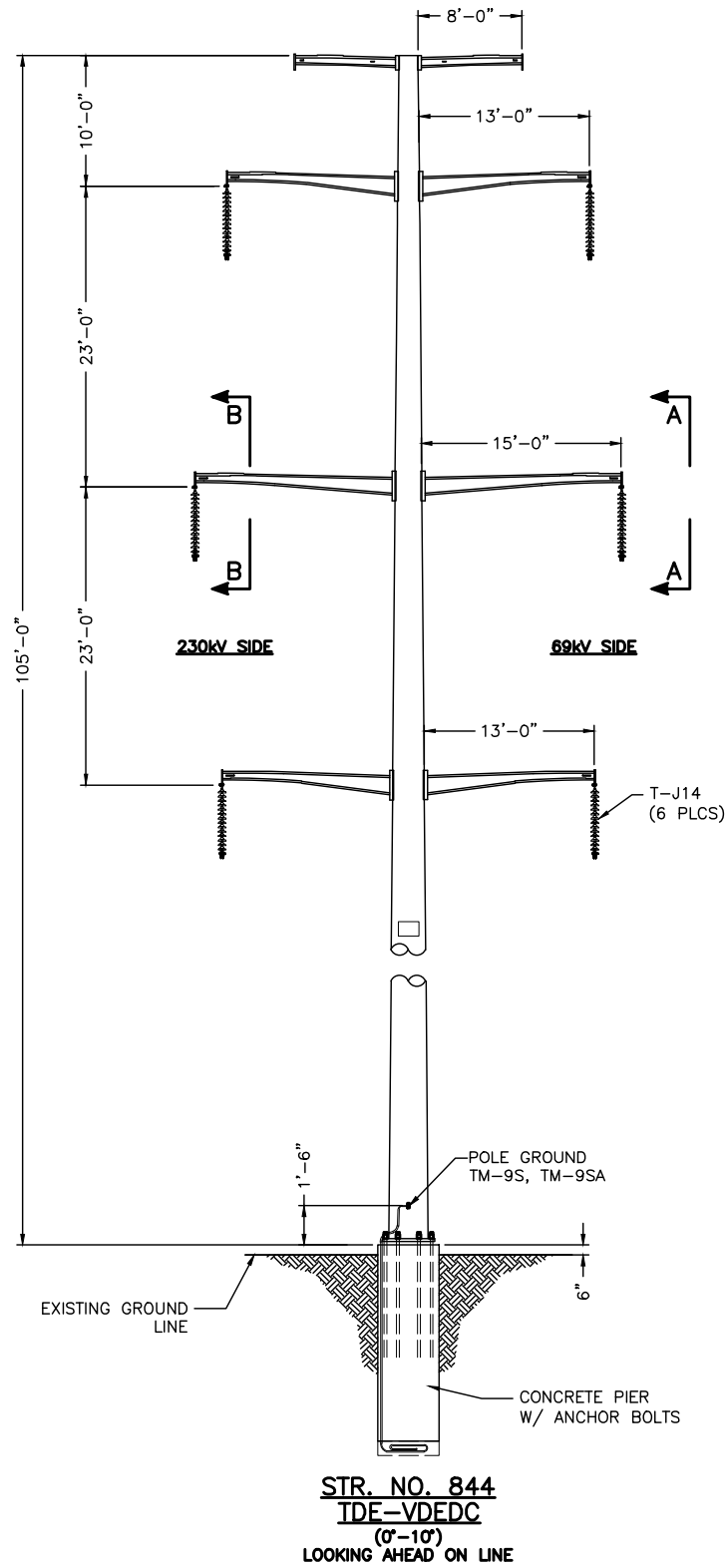
R:\Projects\T&D Projects\117390\DD\DWG\02 Struct\1_OSAGE-LANGE-ASSEMBLY\OSAGE SUB-HWY 44 XING\BHP-T-229.dwg Model Dec 08, 2015 11:03am



- NOTE:**
1. TRANSFER EXISTING 69kV CONDUCTOR, FOCUS OPGW AND 3/8" EHS OHGW TO DOUBLE CIRCUIT STEEL POLE. SPLICE NEW AS REQUIRED.
 2. SEE MASTER MATERIAL LIST FOR MATERIAL DESCRIPTION AND QUANTITY.

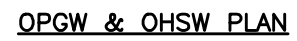
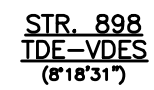
				BLACK HILLS POWER			
				STEEL POLE ASSEMBLY			
				TECKLA TO LANGE			
				230kV PROJECT HWY 44 CROSSING			
				TDE-VDEDC TANGENT			
06/11/15	GC	0	DZ	ISSUED FOR BIDDING			
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION			
06/11/15	GC	0	DZ	DATE 10/21/14			
DATE	DRAWN BY	NO.	APPROVED BY	DATE 10/21/14			
				BHP-T-229			

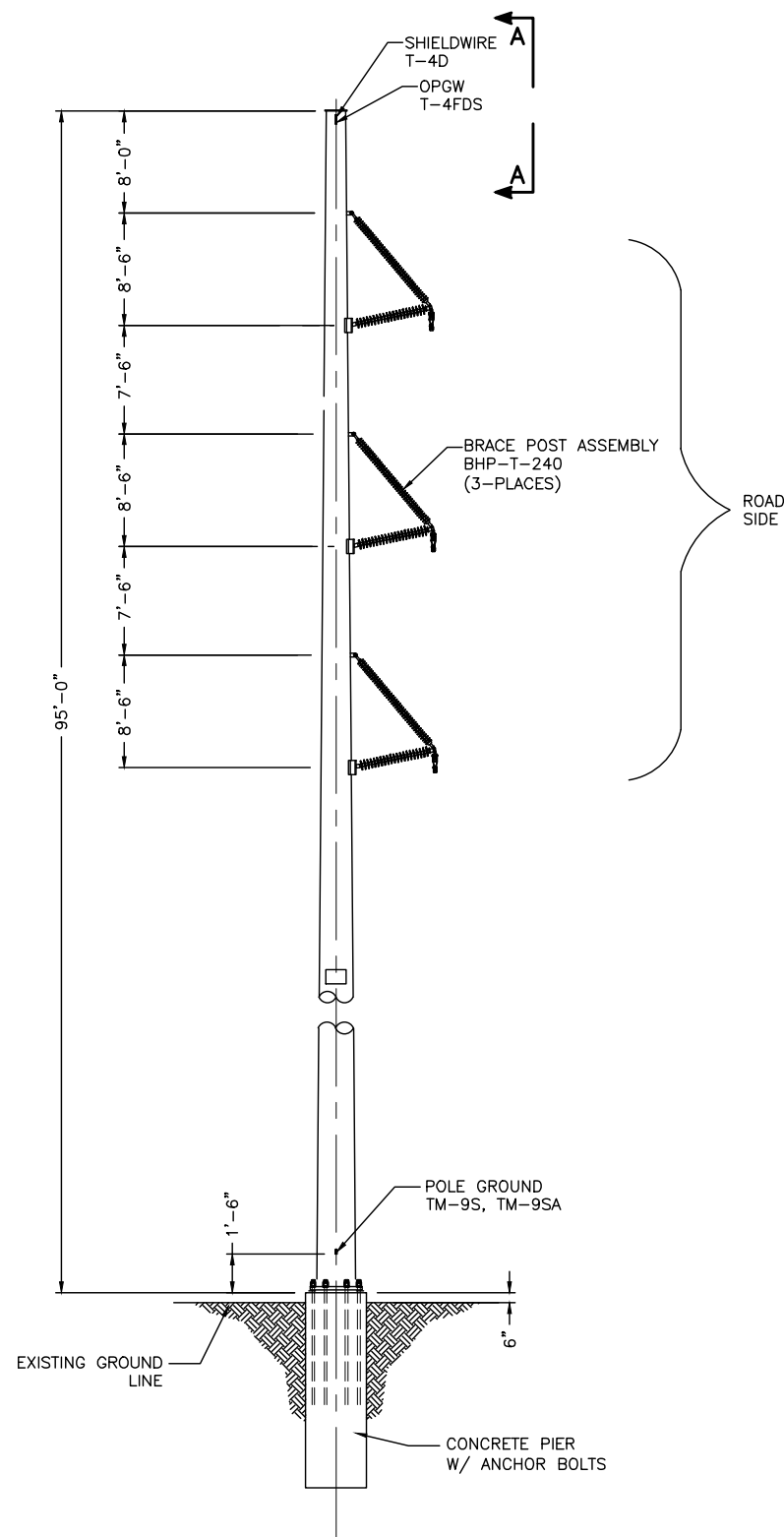
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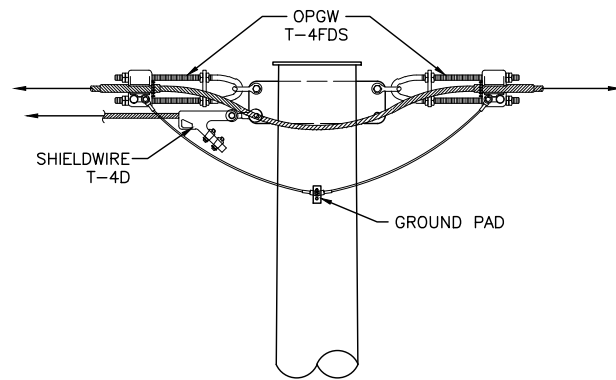
- NOTE:**
1. TRANSFER EXISTING 69kV CONDUCTOR, FOCUS OPGW AND 3/8" EHS OHSW TO DOUBLE CIRCUIT STEEL POLE. SPLICE NEW AS REQUIRED.
 2. SEE MASTER MATERIAL LIST FOR MATERIAL DESCRIPTION AND QUANTITY.

								BLACK HILLS POWER			
								STEEL POLE ASSEMBLY			
								TECKLA TO LANGE			
								230kV PROJECT HWY 44 CROSSING			
								TDE-VDEDC TANGENT			
06/11/15	GC	0	DZ	ISSUED FOR BIDDING				XX	SHT. 1 OF 1		
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION				DRAWN BY	GC	DATE	10/21/14
								APPROVED BY	DZ	DATE	10/21/14
								BHP-T-229A			

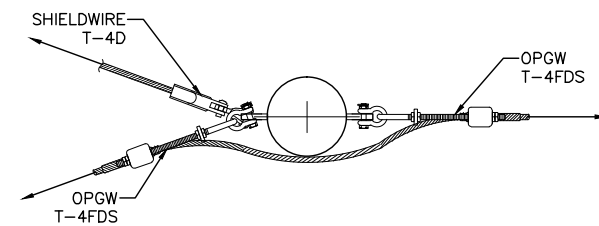
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STR 895
BPVTAN-DESW
(σ32'41")

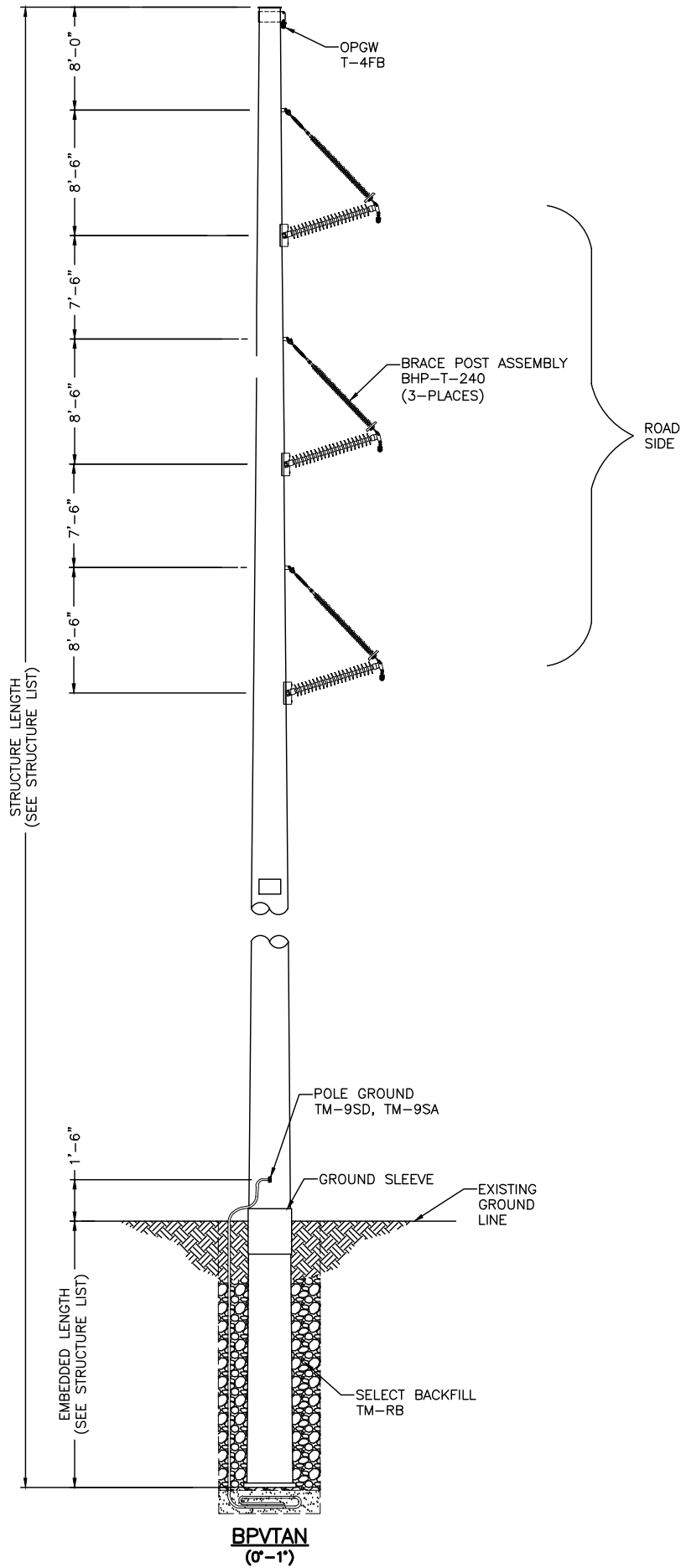


SECTION A



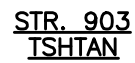
PLAN VIEW

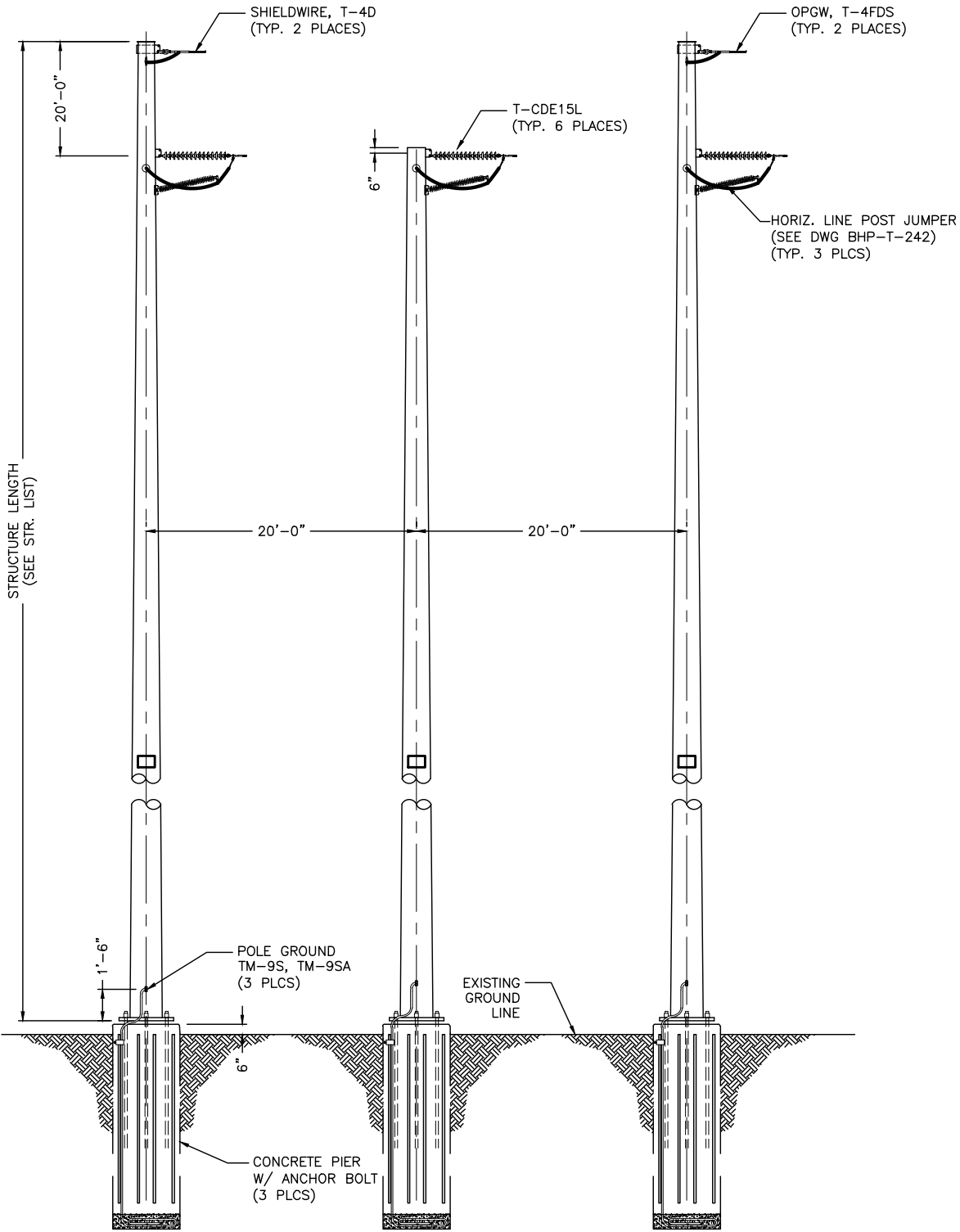
						BLACK HILLS POWER			
						STEEL POLE ASSEMBLY			
						TECKLA TO LANGE			
						230kV PROJECT SM PROPERTIES			
						BPVTAN-DESW ANGLE (0° - 2°) SH: 1 OF 1			
11/09/15	GC	1	DZ	ISSUED FOR REVIEW		XX	GC	DATE 10/05/15	DWG NO.
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		APPROVED BY	DZ	DATE 10/05/15	BHP-T-271



STRUCTURE TYPE BPVTAN	
STR. NO.	LINE ANGLE = $\angle$
896	0°00'00"
897	0°00'00"

					BLACK HILLS POWER			
					STEEL POLE ASSEMBLY			
					TECKLA TO LANGE			
					230kV PROJECT SM PROPERTIES			
					BPVTAN TANGENT (0° - 1°)			
10/05/15	GC	1	DZ	ISSUED FOR REVIEW	XX	DATE	10/05/15	DWG NO.
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION	APPROVED BY	DZ	DATE	10/05/15
					BHP-T-272			
					SHT. 1 OF 1			

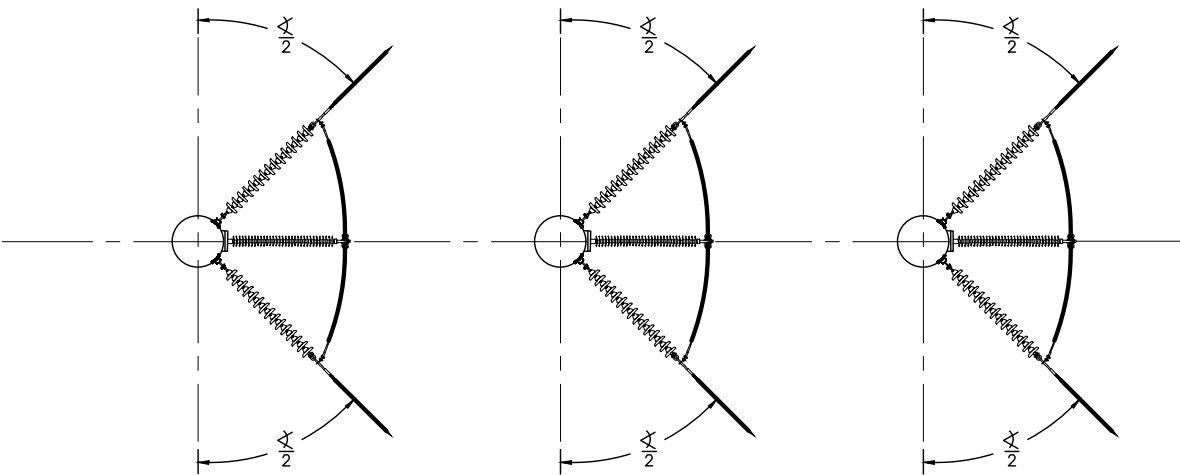
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TDE-VDES-3PJ



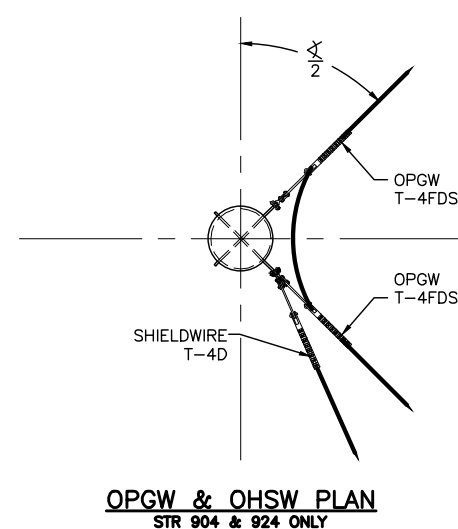
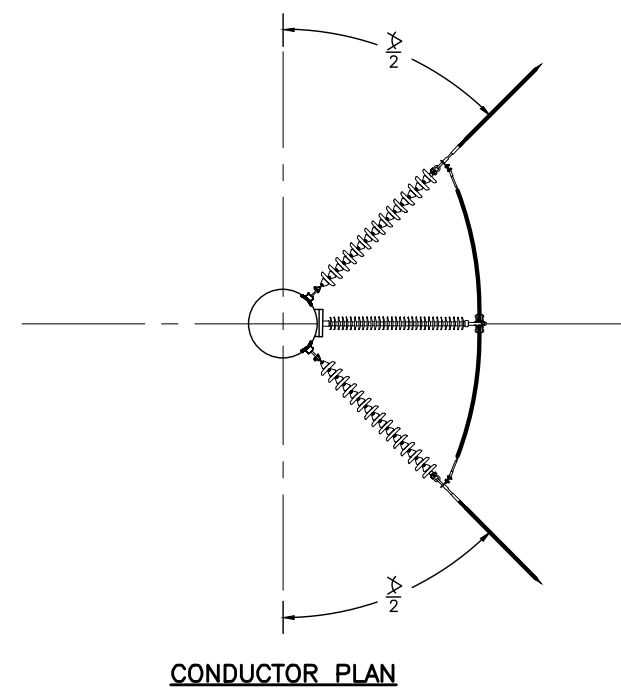
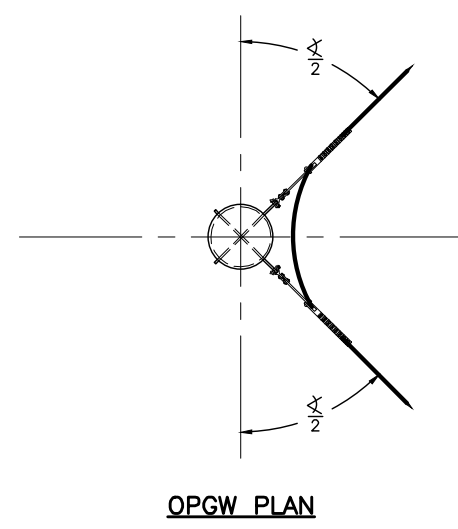
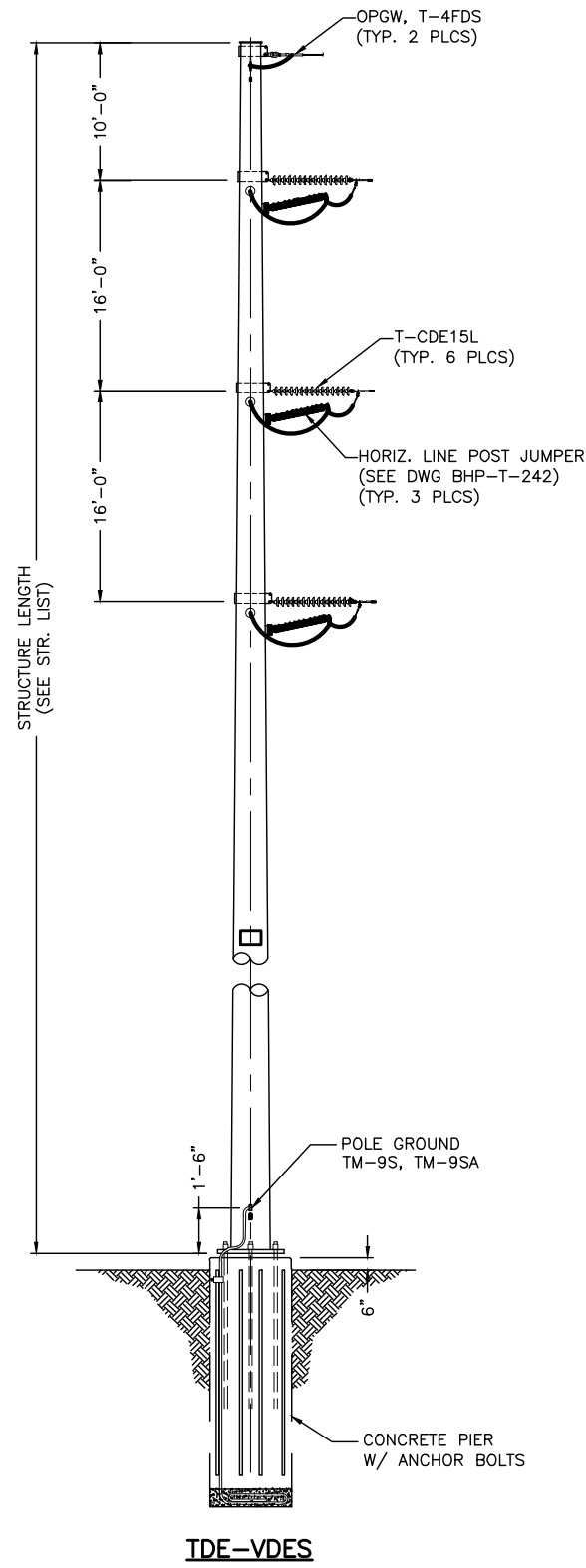
OPGW & OHSW PLAN



CONDUCTOR PLAN

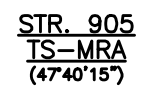
STRUCTURE TYPE TDE-VDES-3PJ	
STR. NO.	LINE ANGLE = $\angle$
899	8°13'50"
900	5°44'35"

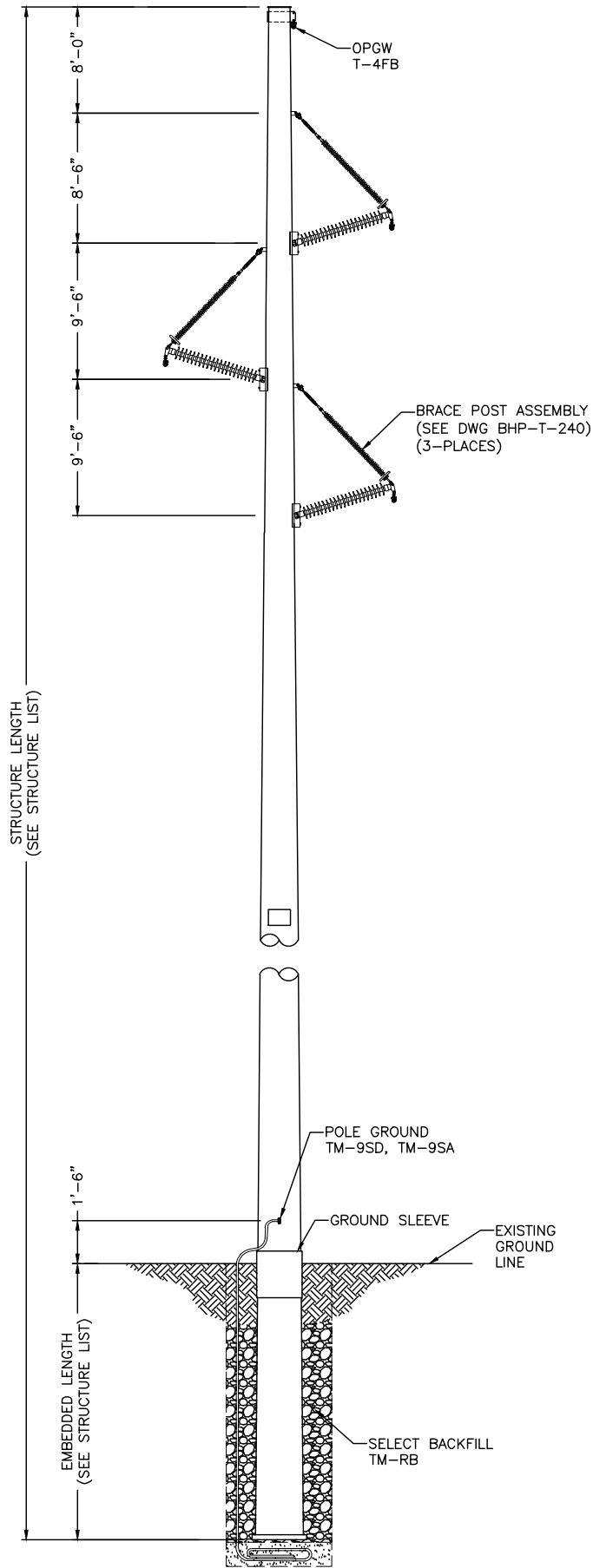
						BLACK HILLS POWER	
						STEEL POLE ASSEMBLY	
						TECKLA TO LANGE	
						230KV PROJECT GCC DAKOTA	
						TDE-VDES-3PJ ANGLE DE 0° - 10°	
10/05/15	GC	1	DZ	ISSUED FOR REVIEW		XX	
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		DATE	10/05/15
						DATE	10/05/15
						DWG NO.	BHP-T-231
						SHT.	1 OF 1



STRUCTURE TYPE TDE-VDES	
STR. NO.	LINE ANGLE = $\angle$
904	59°40'04"
909	102°20'21"
911	90°06'16"
912	104°57'30"
914	89°57'08"
915	90°42'12"
920	89°05'49"
922	89°17'40"
923	89°12'00"
924	0°00'00"

				BLACK HILLS POWER	
				STEEL POLE ASSEMBLY	
				TECKLA TO LANGE	
				230kV PROJECT LANGE AREA	
				TDE-VDES ANGLE DE (60° - 105°) SH. 1 OF 1	
10/05/15	GC	1	DZ	ISSUED FOR REVIEW	
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION	
10/05/15	GC	1	DZ	DATE 10/05/15 DWG NO. BHP-T-232	

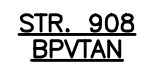
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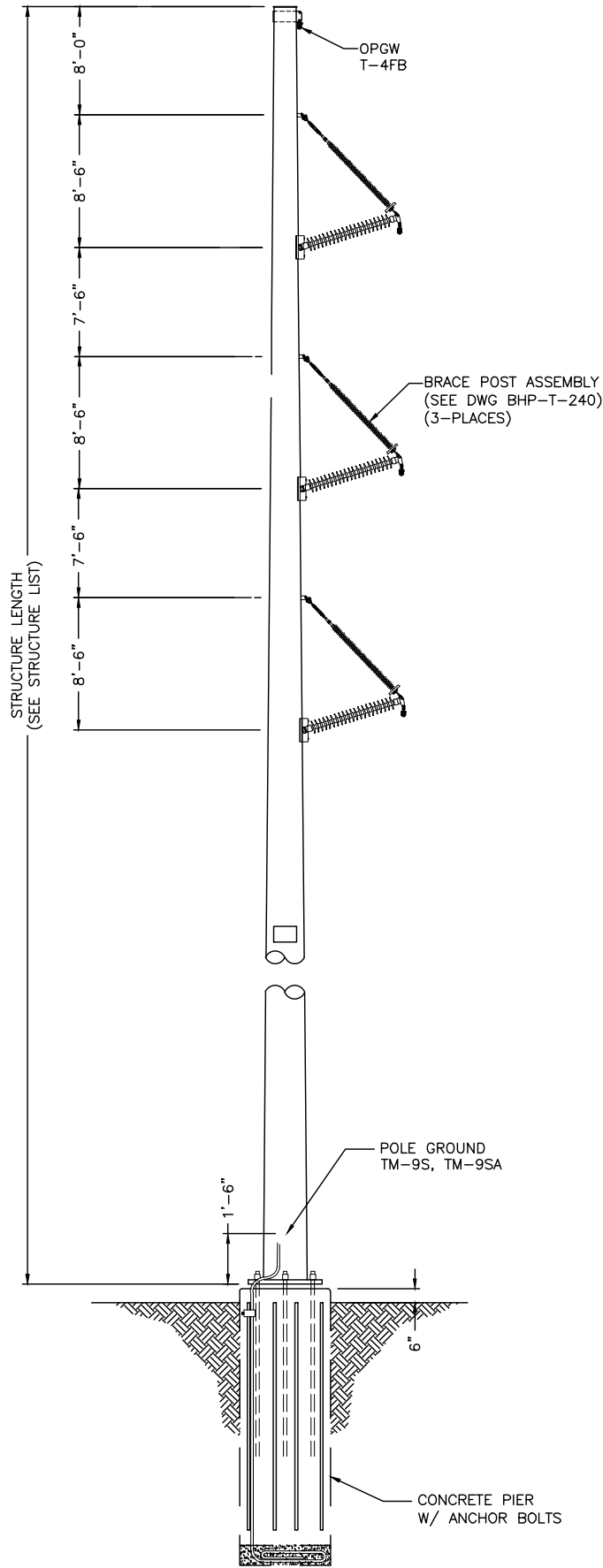


BPTAN

STRUCTURE TYPE BPTAN		
STR. NO.	LINE	ANGLE = $\angle$
910		0°00'00"
913		0°00'00"
916		0°00'00"
917		0°00'00"
918		0°00'00"
919		0°00'00"
921		0°00'00"

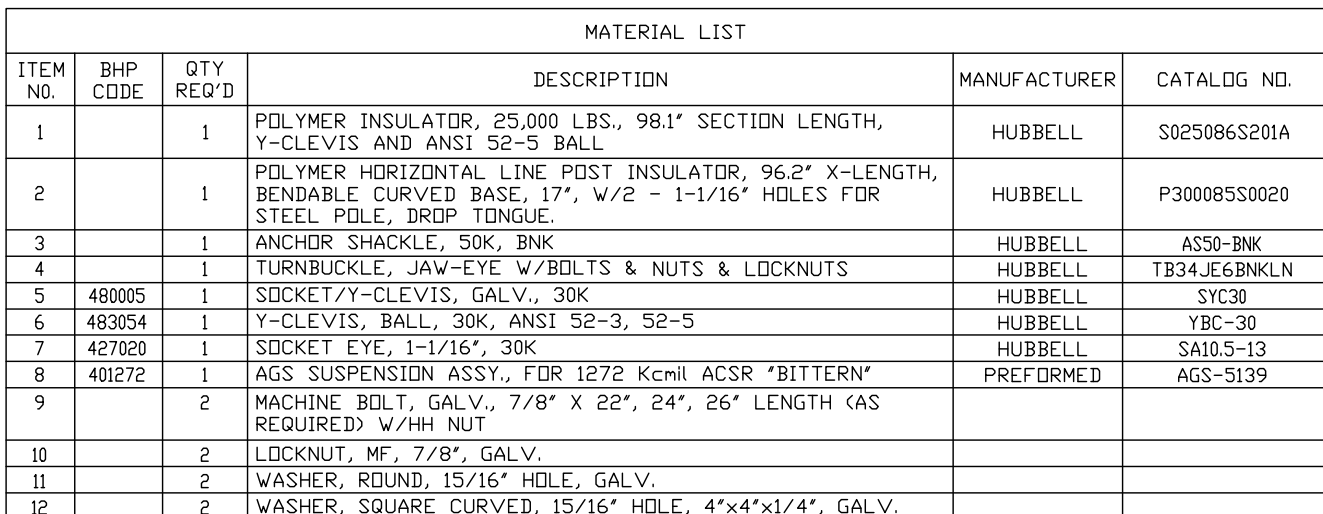
					BLACK HILLS POWER			
					STEEL POLE ASSEMBLY			
					TECKLA TO LANGE			
					230kV PROJECT LANGE AREA			
					BPTAN TANGENT (0° - 1°)			
10/05/15	GC	1	DZ	ISSUED FOR REVIEW	XX	DATE	10/05/15	DWG NO.
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION	APPROVED BY	DZ	DATE	10/05/15
					BHP-T-234			
					SHT. 1 OF 1			

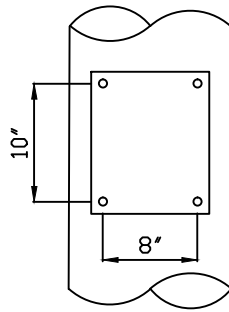
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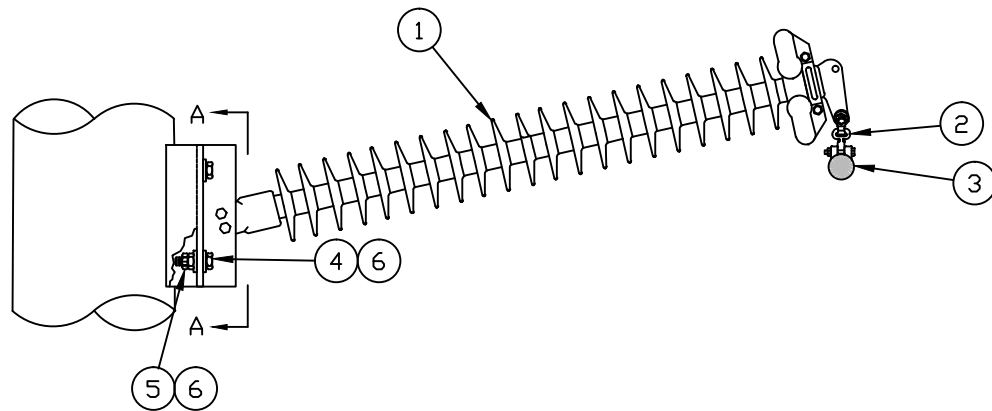
STRUCTURE TYPE BPLRA	
STR. NO.	LINE ANGLE = $\angle$
906	12°42'53"
907	2°52'48"

					BLACK HILLS POWER 			
					STEEL POLE ASSEMBLY			
					TECKLA TO LANGE			
					230kV PROJECT LANGE AREA			
					BPLRA ANGLE (3° - 13°)			
10/05/15	GC	1	DZ	ISSUED FOR REVIEW	XX	SHT. 1 OF 1		
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION	DRAWN BY GC	DATE 10/05/15	DWG NO.	BHP-T-236
					APPROVED BY DZ	DATE 10/05/15		

[illegible]



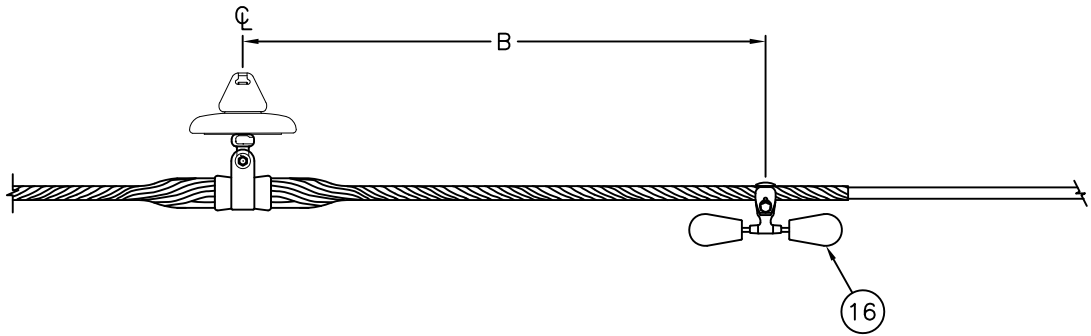
VIEW A-A



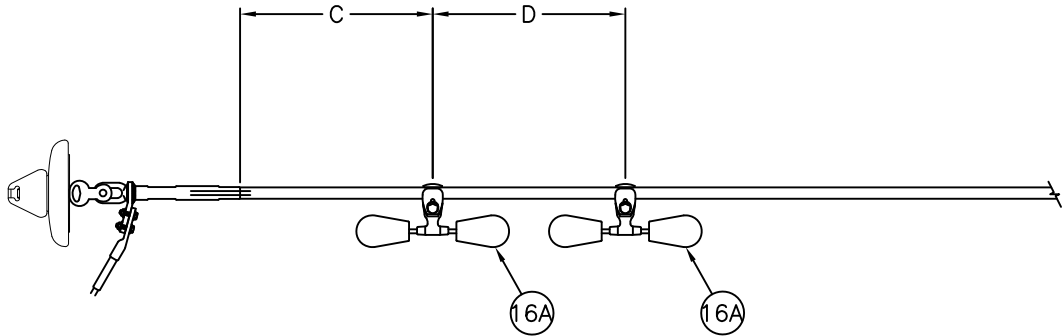
changed 003A to 013A
per BHP / Vendor
request

MATERIAL LIST					
ITEM NO.	BHP CODE	QTY REQ'D	DESCRIPTION	MANUFACTURER	CATALOG NO.
1		1	POLYMER HORIZONTAL LINE POST INSULATOR, 96.2" X-LENGTH, ALUM. BENDABLE FLAT BASE, 8" X 10" HOLE PATTERN, W/4-15/16" HOLES FOR STEEL POLE, 2-HOLE DROP TONGUE.	HUBBELL	P300085S003A
2	483054	1	Y-CLEVIS, BALL, 30K, ANSI 52-3, 52-5	HUBBELL	YBC-30
3	420147	1	SUSPENSION CLAMP, ALUM, 25K, W/SOCKET EYE, FOR 1272 KCMIL, ACSR "BITTERN"	HUBBELL	HAS-147-S
4		4	MACHINE BOLT, GALV., 7/8" X 2-1/2"		
5		4	LOCKNUT, MF, 7/8", GALV.		
6		8	WASHER, ROUND, 15/16" HOLE, GALV.		

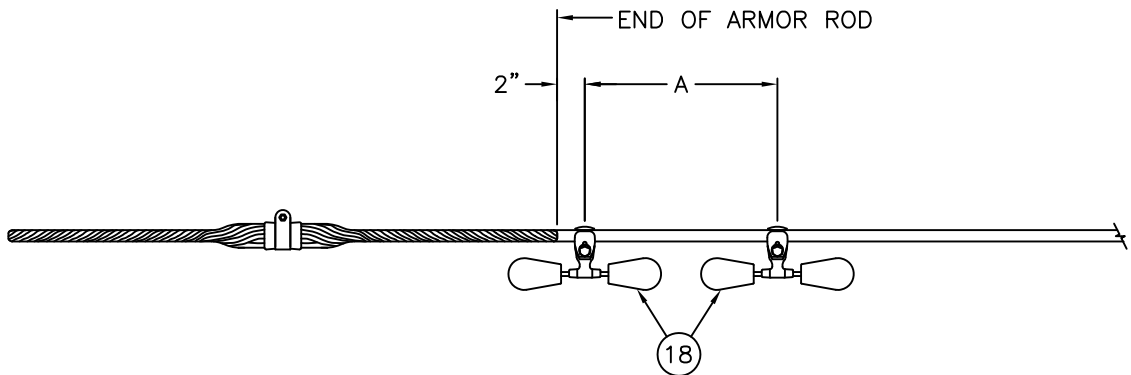
				BLACK HILLS POWER	
				DETAIL	
				JUMPER POST ASSEMBLY	
				W/FLAT BASE	
				SHT. 1 OF 1	
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION	BHP-T-242



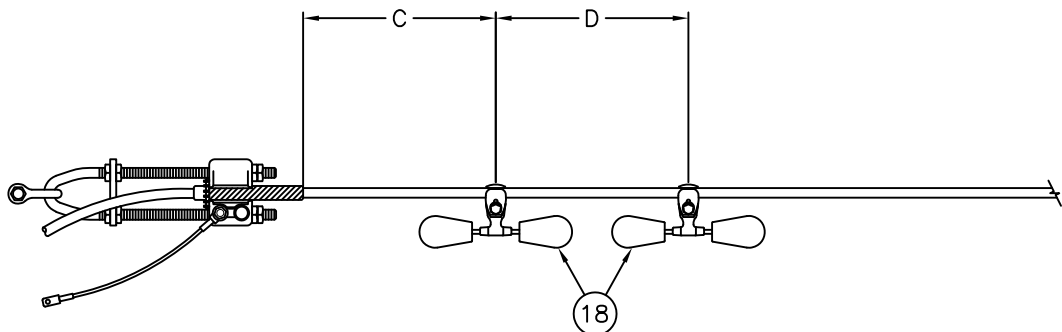
DETAIL 1
CONDUCTOR SUSPENSION



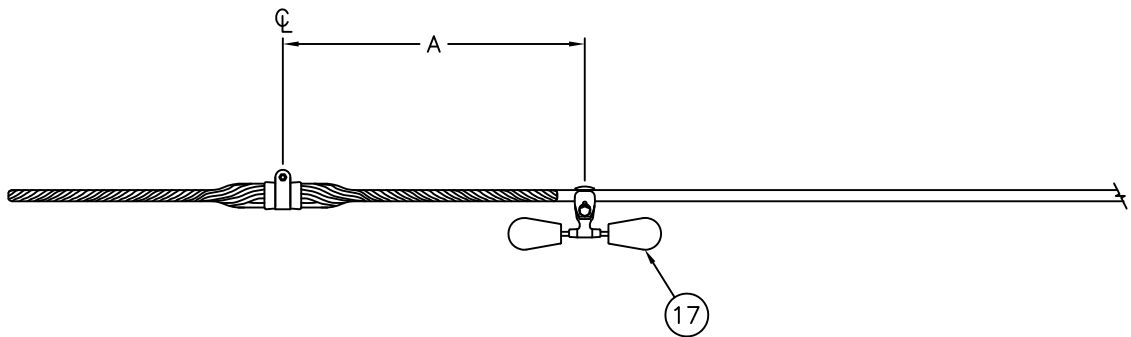
DETAIL 2
CONDUCTOR DEADEND



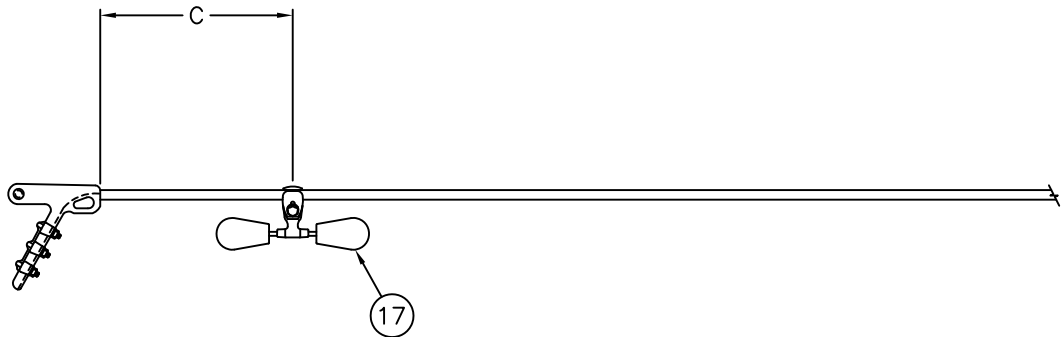
DETAIL 3
OPGW SUSPENSION



DETAIL 4
OPGW DEADEND



DETAIL 5
OHSW SUSPENSION

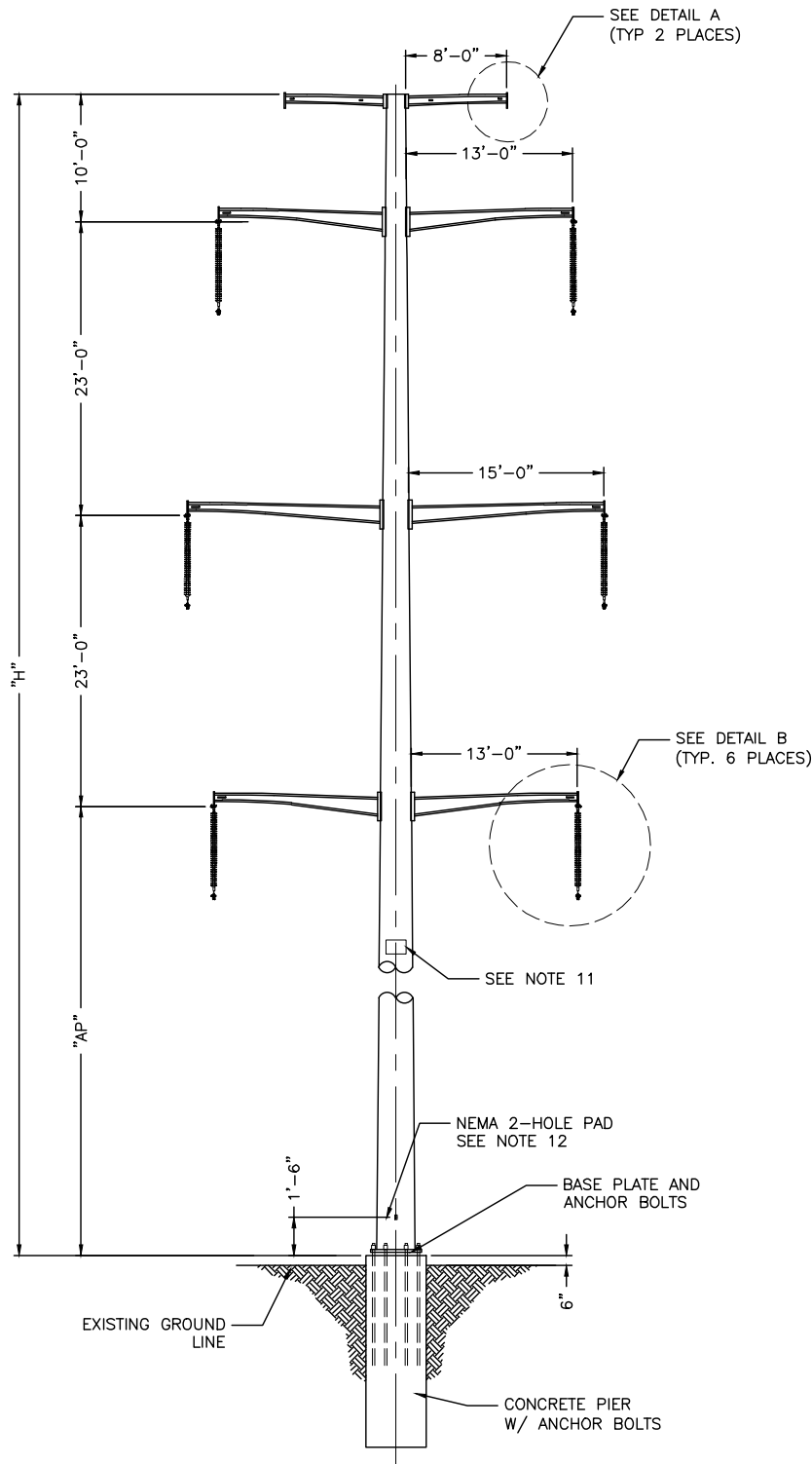


DETAIL 6
OHSW DEADEND

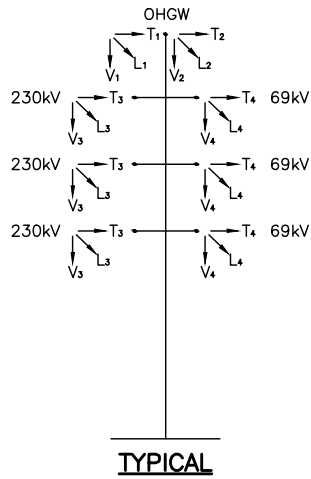
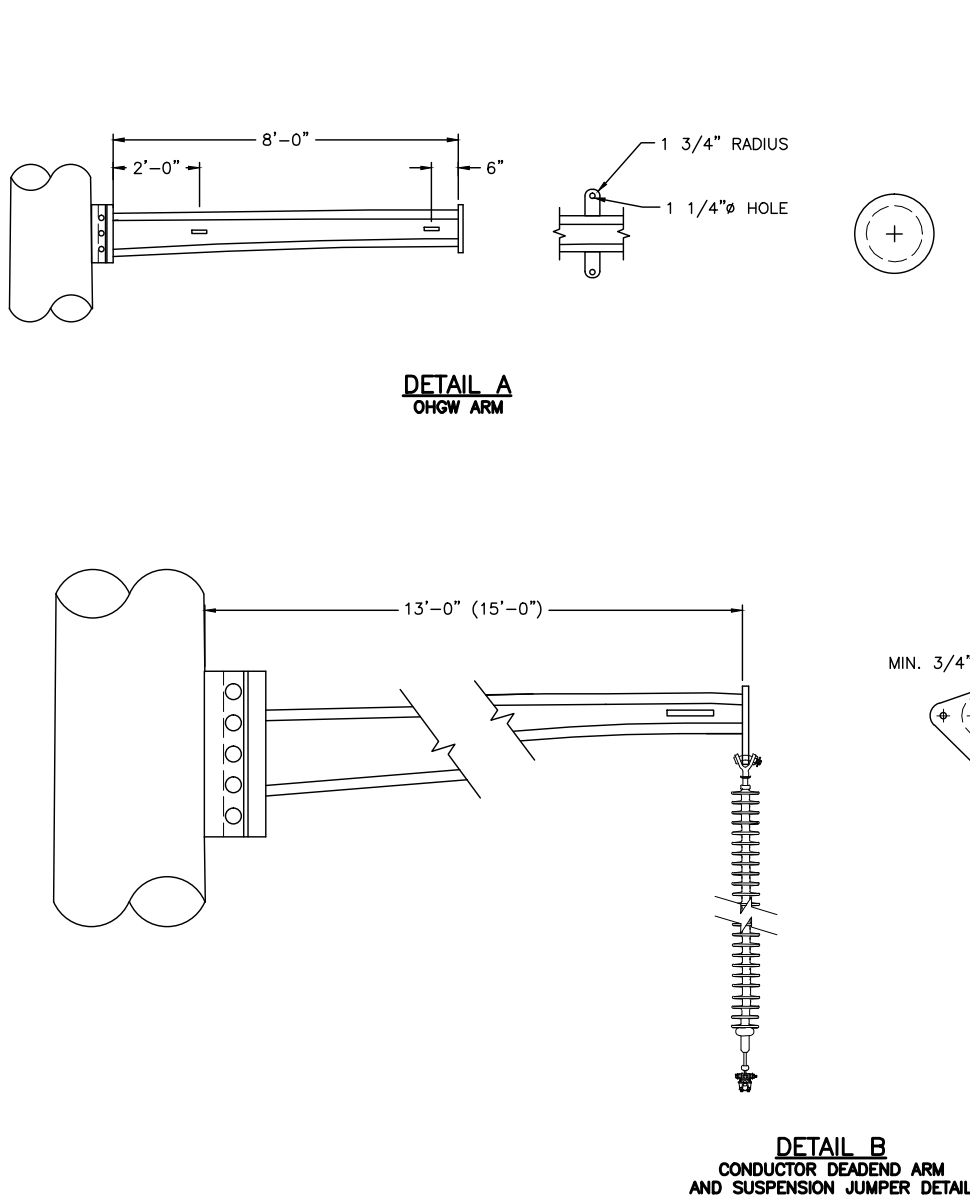
DAMPER SUMMARY				
ITEM	DAMPER CATALOG	QTY.	BOLT (in)	TORQUE (ft lbs)
16	1708AA-17	801	5/8	40
16A	1708AA-13	132	5/8	40
17	1701-2	69	7/16	20
18	OVD361/460	268	7/16	20

				BLACK HILLS POWER 			
				DAMPER PLACEMENT			
				SD STATE LINE TO LANGE			
				230kV PROJECT			
				SHT. 1 OF 1			
6/17/15	GC	0	DZ	ISSUED FOR CONSTRUCTION			
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION			
				XX	GC	DATE 10/21/14	DWG NO.
				APPROVED BY	DZ	DATE 10/21/14	BHP-T-251

R:\Projects\T&D Projects\117390\DD\DWG\02 Struct\1_OSAGE-LANGE\PERFORMANCE\OSAGE SUB - HWY 44 XING\BHP-T-206.dwg Model Nov 24, 2015 - 1:58pm gcowley



TDE-VDEDC
(0°-10°)
SEE STRUCTURE SCHEDULE



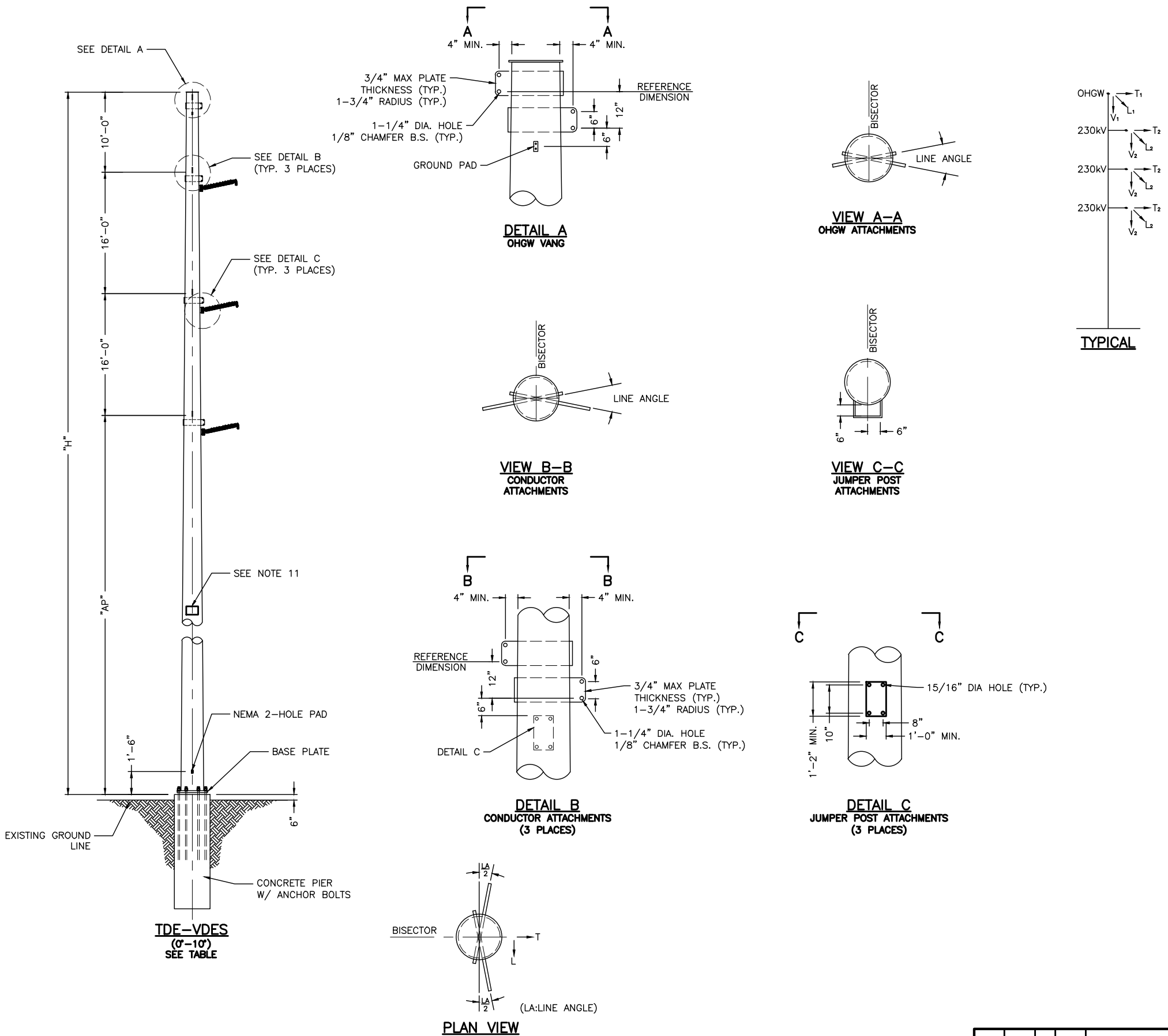
- NOTES:**
1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI). ALL ARMS SHALL BE PAINTED OVER WEATHERING.
 2. STRUCTURAL DESIGN SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
 3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE. TWO HOLE NEMA GROUND PADS ARE REQUIRED TO BE LOCATED ON THE UNDERSIDE OF EACH OHGW ARM, CENTERED ON EACH VANG.
 4. DESIGN LOADS ARE BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL AND AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
 5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
 6. ALL WIND FORCES APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
CASE 5 2.5
CASE 6 1.0
 7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
 8. ALLOWABLE LINE ANGLE IS 0-10 DEGREES.
 9. STRUCTURE DESIGN SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
 10. ALL LOADS SHALL BE APPLIED TO THE END OF THE ARM FOR POLE AND ARM DESIGN. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
 11. HIGH VOLTAGE SIGN.
 12. STEEL VENDOR SHALL PROVIDE REMOVABLE GROUND WIRE GUARD ON POLE SHAFT AND BASE PLATE AT POLE BASE.
 13. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.

- CASE DESCRIPTIONS:**
- I NESC HEAVY DE/INTACT
 - II EXTREME WIND DE/INTACT (21 PSF)
 - III NESC CONC. ICE/WIND DE/INTACT
 - IV CAMBER/DEFLECTION
 - V NESC HEAVY DE
 - VI EXTREME WIND DE

TYPE TDE-VDEDC POLES					
STR #	DESIGNATION	"H" (FT)	"AP" (FT)	LINE ANGLE	ALLOWABLE LINE ANGLE
843	TDE-VDEDC	105	49	5°08'46"	10°
844	TDE-VDEDC	105	49	9°28'01"	10°

DESIGN LOADS FOR STEEL POLE												
Case No	V1	T1	L1	V2	T2	L2	V3	T3	L3	V4	T4	L4
I	6.51	5.03	8.96	7.32	5.71	7.73	10.58	6.42	0.00	10.58	6.42	0.00
II	1.22	2.56	2.99	1.45	3.31	2.79	3.79	5.27	0.00	3.79	5.27	0.00
III	2.76	2.65	3.64	3.15	3.08	3.49	5.37	3.88	0.00	5.37	3.88	0.00
IV	1.72	0.44	1.49	1.95	0.52	1.79	4.04	0.99	0.00	4.04	0.99	0.00
V	5.20	2.75	12.38	5.74	3.01	14.17	7.05	2.25	11.46	7.05	2.25	11.46
VI	1.22	2.24	5.78	1.45	2.90	7.07	3.79	4.51	8.67	3.79	4.51	8.67

				BLACK HILLS POWER			
				STEEL POLE LOAD AND DESIGN			
				TECKLA TO LANGE			
				230kV PROJECT HWY 44 CROSSING			
				TDE-VDEDC TANGENT (0° - 10°) SHT. 1 OF 1			
06/11/15	GC	0	DZ	ISSUED FOR BIDDING			
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION			
				DRAWN BY GC DATE 10/21/14			
				APPROVED BY DZ DATE 10/21/14			
				BHP-T-206			



NOTES:

1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL DESIGN SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN LOADS ARE BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
CASE 5 2.5
CASE 6 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. LINE ANGLE IS SHOWN IN CHART BELOW.
9. STRUCTURE SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.

TYPE TDE-VDES POLES					
STR #	DESIGNATION	"H" (FT)	"AP" (FT)	LINE ANGLE	ALLOWABLE LINE ANGLE
898	TDE-VDES	95	53	8°18'31"	10°

CASE DESCRIPTIONS:

- I NESC HEAVY DE/INTACT
- II EXTREME WIND DE/INTACT (21 PSF)
- III NESC CONC. ICE/WIND DE/INTACT
- IV CAMBER/DEFLECTION
- V NESC HEAVY DE
- VI EXTREME WIND DE

DESIGN LOADS FOR STEEL POLE - TDE-VDES STR 898						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	4.36	4.65	8.22	5.93	6.08	0.00
II	0.97	2.32	2.99	2.06	5.04	0.00
III	2.08	2.40	3.49	3.06	3.65	0.00
IV	1.47	0.44	1.44	2.31	1.04	0.00
V	4.36	3.86	17.26	5.93	4.35	19.72
VI	0.97	2.02	6.48	2.06	4.10	10.71

						BLACK HILLS POWER	
						STEEL POLE LOAD AND DESIGN	
						TECKLA TO LANGE	
						230kV PROJECT SM PROPERTIES	
						TDE-VDES ANGLE DE (0° - 10°) SHT. 1 OF 1	
11/09/15	GC	1	DZ	ISSUED FOR REVIEW		DATE 10/05/15	DWG NO.
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		DATE 10/05/15	BHP-T-260

NOTES:

1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL STEEL SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN IS BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:

CASE 1

CASE 2

CASE 3

CASE 4

CASE 5

CASE 6

2.5

1.0

1.0

1.0

2.5

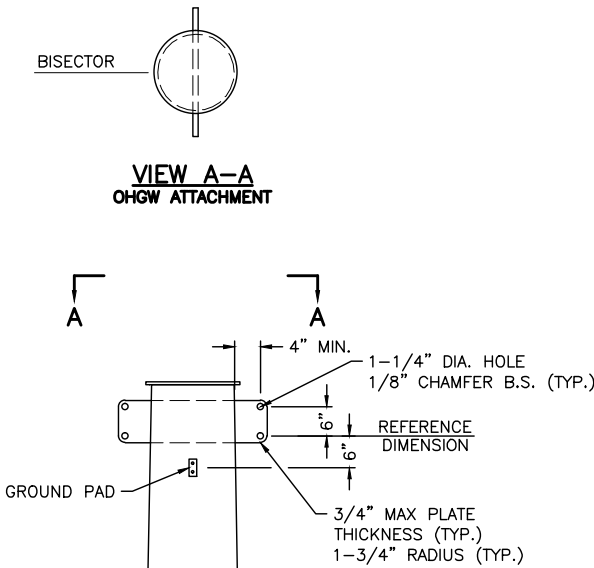
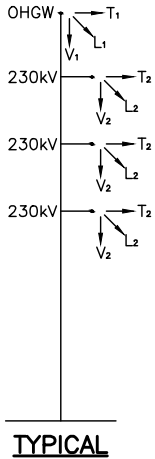
1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. LINE ANGLE (LA) IS 3-13 DEGREES.
9. STRUCTURE SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.

TYPE BPVTAN-DESW POLES					
STR #	DESIGN	"H" (FT)	"AP" (FT)	LINE ANGLE	ALLOWABLE LINE ANGLE
895	BPVTAN-DESW	95	46.5	0°32'41"	1°

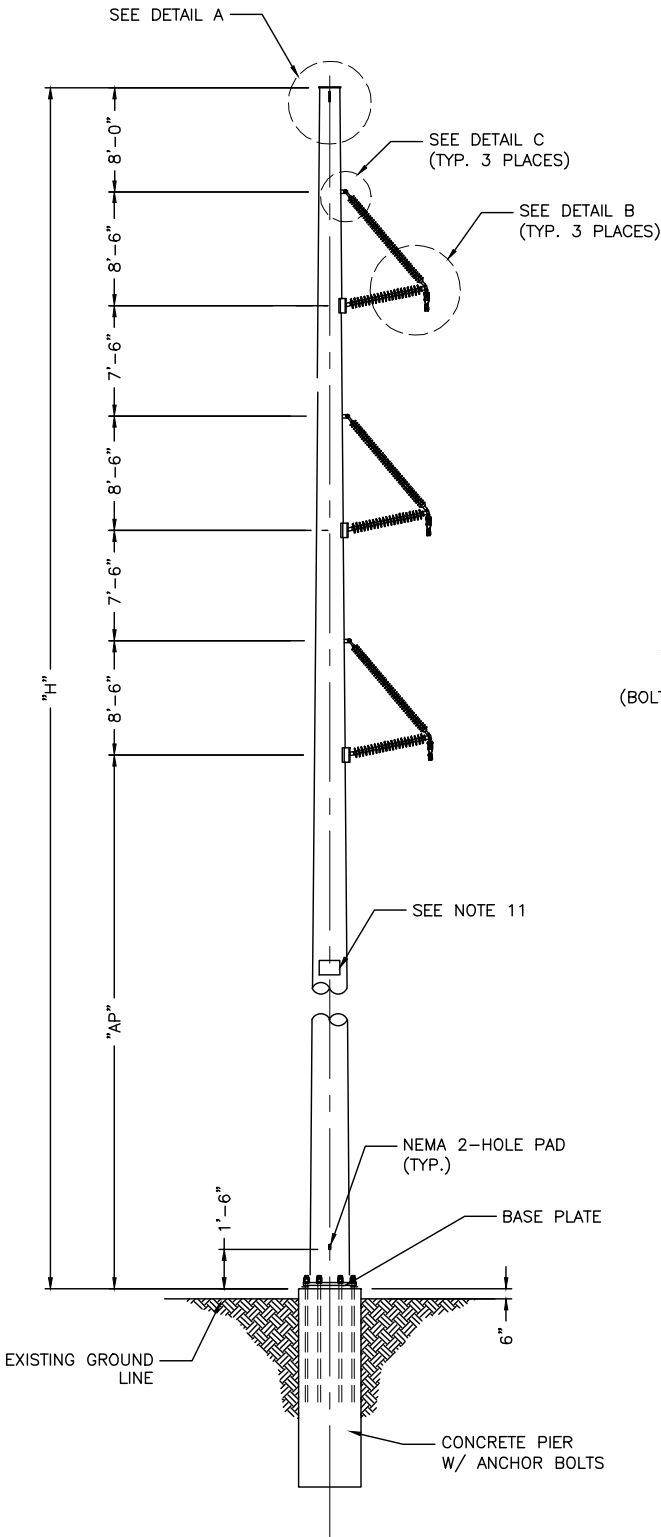
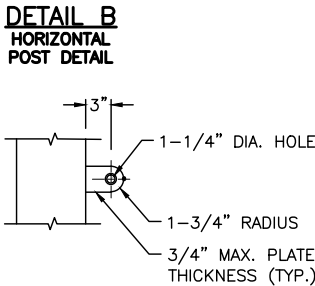
CASE DESCRIPTIONS:

- I
- II
- III
- IV
- V
- VI
- NESC HEAVY DE/INTACT
- EXTREME WIND DE/INTACT (21 PSF)
- NESC CONC. ICE/WIND DE/INTACT
- CAMBER/DEFLECTION
- NESC HEAVY DE
- EXTREME WIND DE

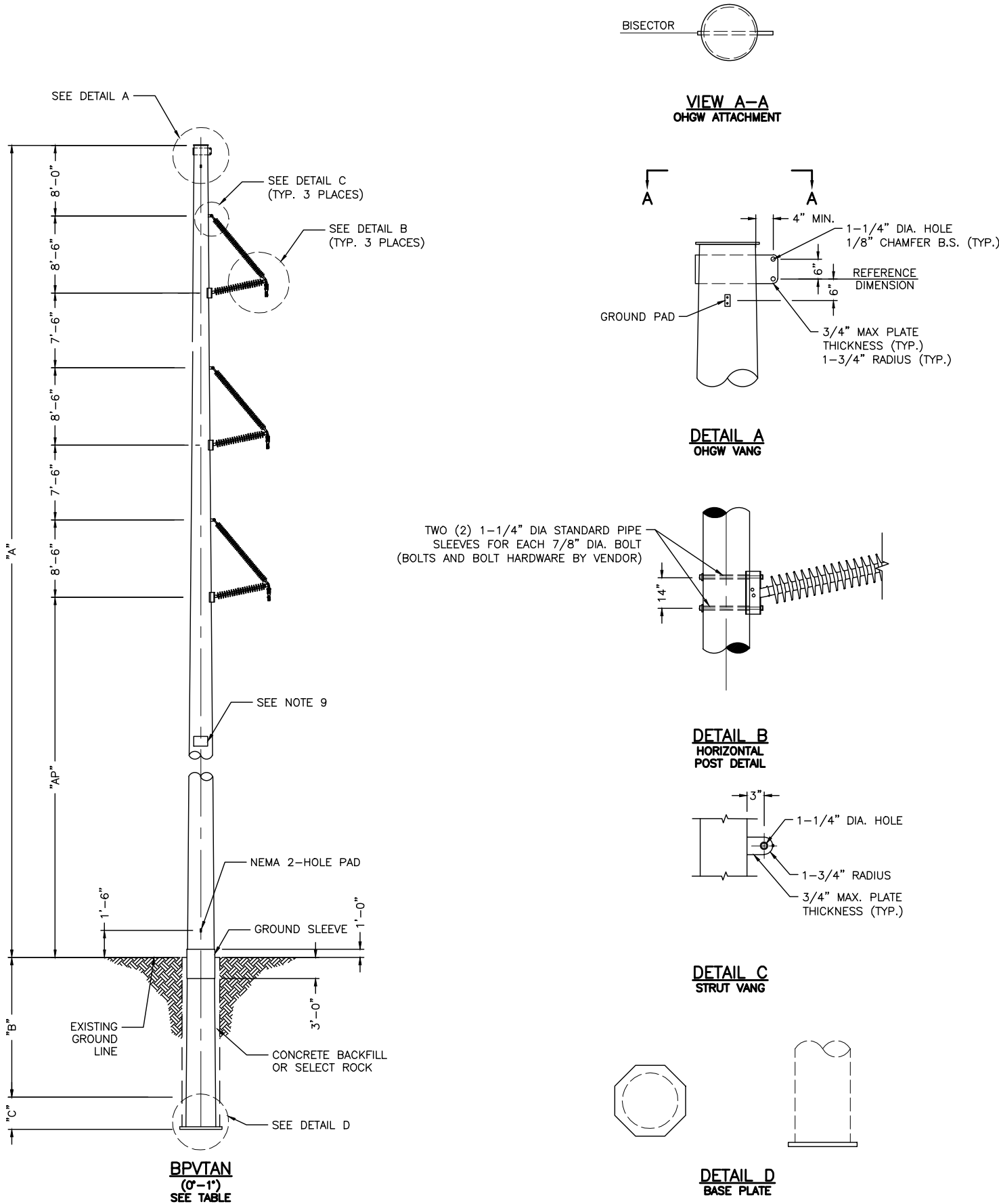
DESIGN LOADS FOR STEEL POLE - BPVTAN-DESW STR 895						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	3.72	1.70	6.60	4.77	2.01	0.00
II	0.83	1.01	2.50	1.63	2.18	0.00
III	1.84	0.99	3.00	2.48	1.38	0.00
IV	1.33	0.04	1.45	1.88	0.10	0.00
V	3.72	1.63	14.52	4.77	2.01	0.00
VI	0.83	0.98	6.00	1.63	2.18	0.00



TWO (2) 1-1/4" DIA STANDARD PIPE SLEEVES FOR EACH 7/8" DIA. BOLT (BOLTS AND BOLT HARDWARE BY VENDOR)



						BLACK HILLS POWER	
						STEEL POLE LOAD AND DESIGN	
						TECKLA TO LANGE	
						230kV PROJECT SM PROPERTIES	
						BPVTAN-DESW ANGLE (0° - 1°) SH. 1 OF 1	
11/09/15	GC	1	DZ	ISSUED FOR REVIEW		XX	
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		DATE	DWG NO.
						10/05/15	BHP-T-261



NOTES:

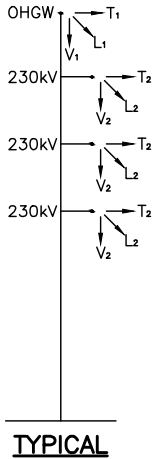
1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL STEEL SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN IS BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. ALLOWABLE LINE ANGLE IS 0-1 DEGREES.
9. HIGH VOLTAGE SIGN.
10. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.
11. POLE CLASS/LENGTH SHOWN IS A MINIMUM NOT INCLUDING THE DIMENSION "C" POLE BASE EXTENSION. MANUFACTURER SHALL BID THE POLE CLASS INDICATED WITH A LENGTH THAT IS AT LEAST DIMENSION "C" GREATER THAN INDICATED OVERALL LENGTH.

TYPE BPVTAN POLES					
STR #	POLE CLASS/LENGTH	"A" (FT)	"B" (FT)	"C" (FT)	LINE ANGLE
896	CUSTOM LD	115	15	5	0
897	CUSTOM LD	125.5	19.5	5	0

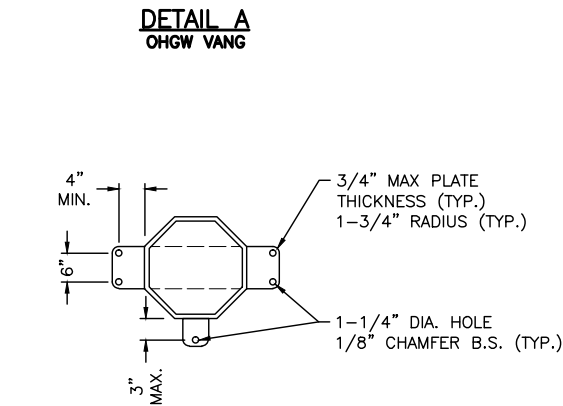
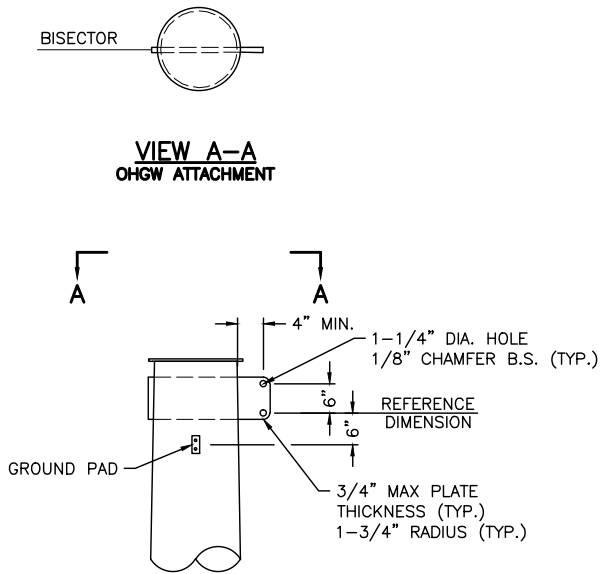
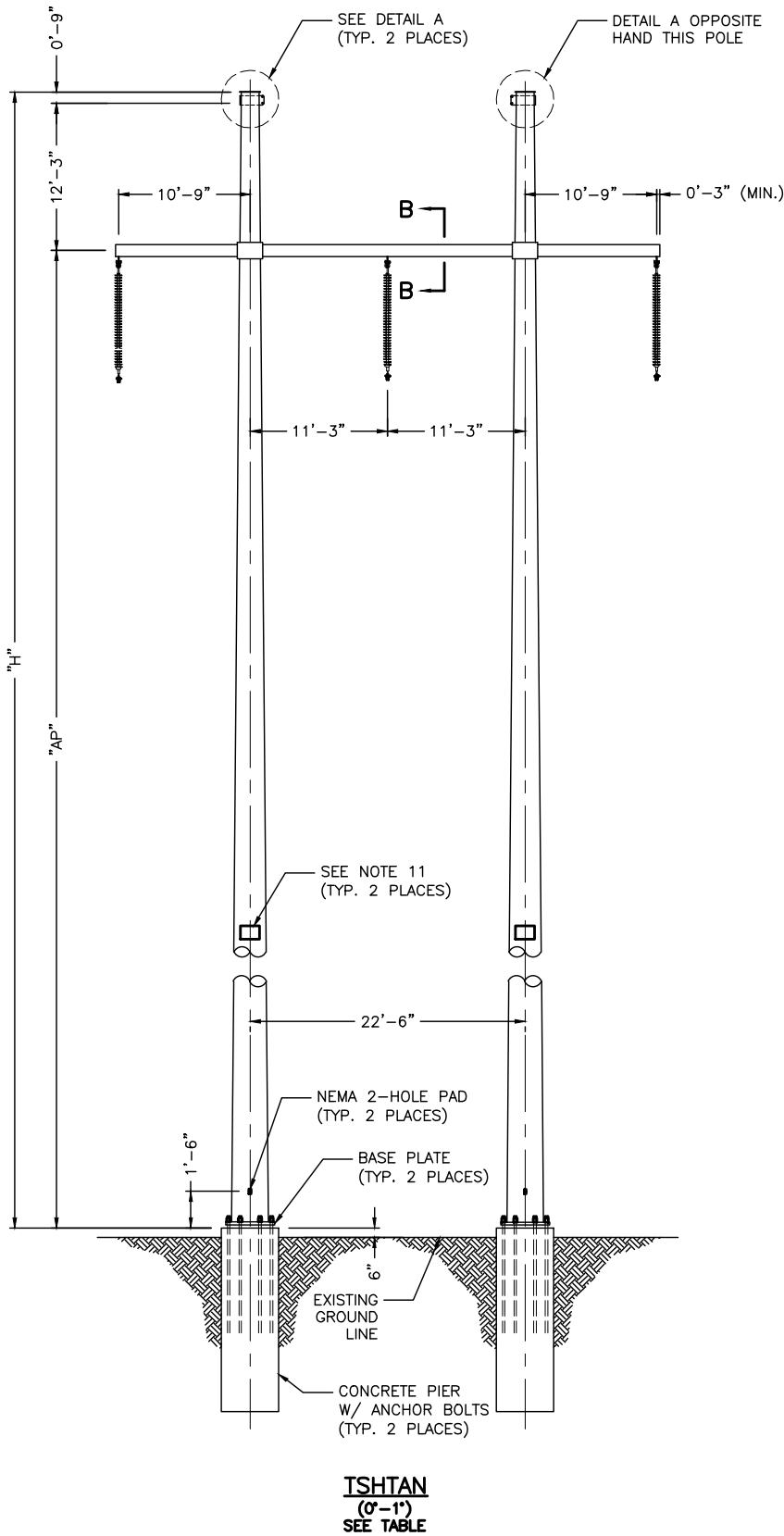
* SEE NOTE 11

- CASE DESCRIPTIONS:
- I NESC HEAVY INTACT
 - II EXTREME WIND (21 PSF)
 - III NESC CONC. ICE/WIND
 - IV CAMBER/DEFLECTION

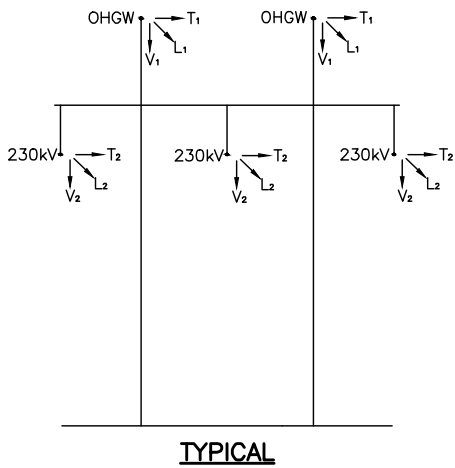
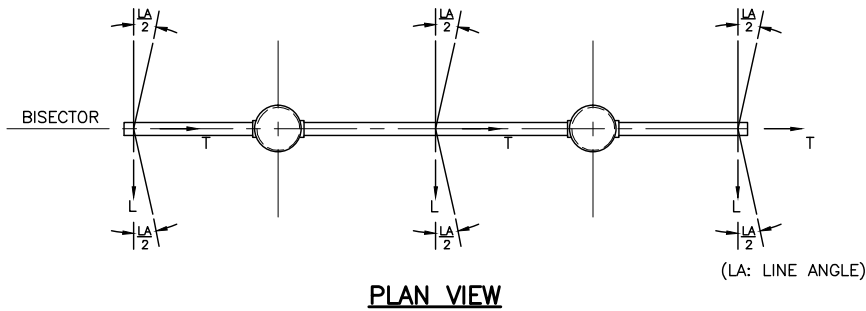
DESIGN LOADS FOR STEEL POLE - BPVTAN STR. 896, 897						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	2.22	1.35	0.00	4.77	2.30	0.00
II	0.49	0.83	0.00	1.63	2.51	0.00
III	1.06	0.79	0.00	2.48	1.59	0.00
IV	0.74	0.03	0.00	1.88	0.10	0.00



						BLACK HILLS POWER	
						STEEL POLE LOAD AND DESIGN	
						TECKLA TO LANGE	
						230kV PROJECT SM PROPERTIES	
						BPVTAN TANGENT (0° - 1°)	
10/05/15	GC	1	DZ	ISSUED FOR REVIEW		XX	SH. 1 OF 1
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		DATE 10/05/15	DWG NO. BHP-T-262



SECTION B-B
RIGGING AND SUSPENSION
INSULATOR ATTACHMENTS



NOTES:

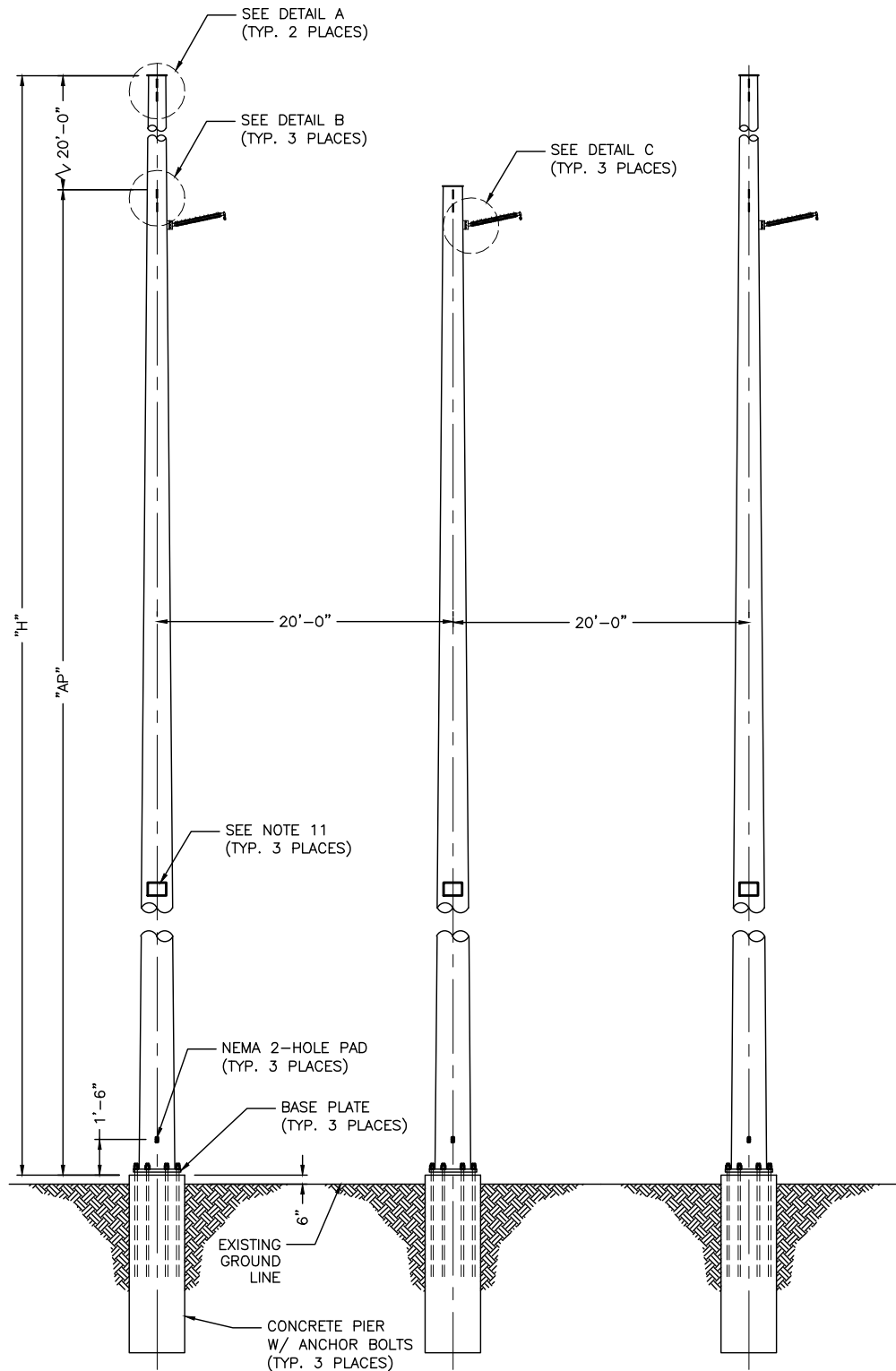
1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL DESIGN SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN LOADS ARE BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. LINE ANGLE IS SHOWN IN CHART BELOW.
9. STRUCTURE SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE FLANGE JOINTED.

TYPE TDE-VDES-3PJ POLES					
STR #	DESIGNATION	"H" (FT)	"AP" (FT)	LINE ANGLE	ALLOWABLE LINE ANGLE
903	TSHTAN	163	150	0°	1°

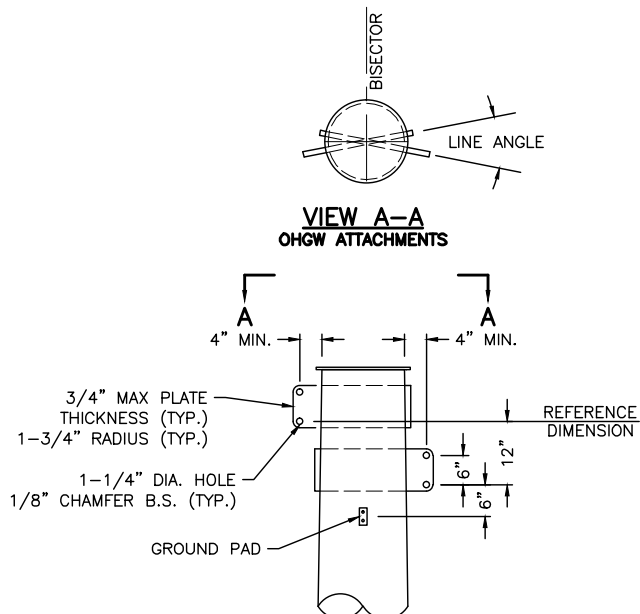
- CASE DESCRIPTIONS:
- I NESC HEAVY DE/INTACT
 - II EXTREME WIND DE/INTACT (21 PSF)
 - III NESC CONC. ICE/WIND DE/INTACT
 - IV CAMBER/DEFLECTION

DESIGN LOADS FOR STEEL POLE - TSHTAN						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	2.74	1.54	0.00	6.32	2.59	0.00
II	0.61	0.96	0.00	2.21	2.89	0.00
III	1.26	0.90	0.00	3.25	1.80	0.00
IV	0.86	0.03	0.00	2.46	0.10	0.00

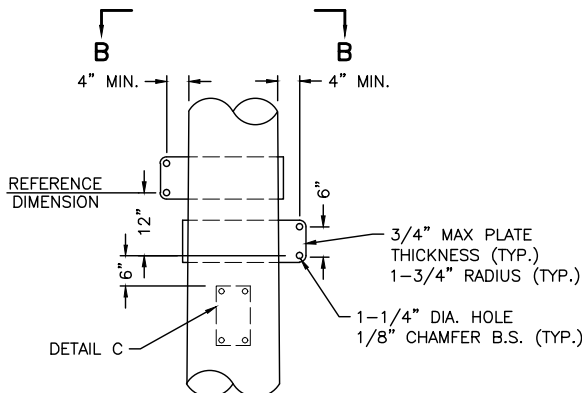
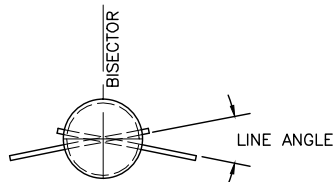
						BLACK HILLS POWER	
						STEEL POLE LOAD AND DESIGN	
						TECKLA TO LANGE	
						230kV PROJECT GCC DAKOTAH	
						TSHTAN ANGLE DE (0° - 1°)	
						SHT. 1 OF 1	
10/05/15	GC	1	DZ	ISSUED FOR REVIEW		DATE 10/05/15	DWG NO. BHP-T-210
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		DATE 10/05/15	1



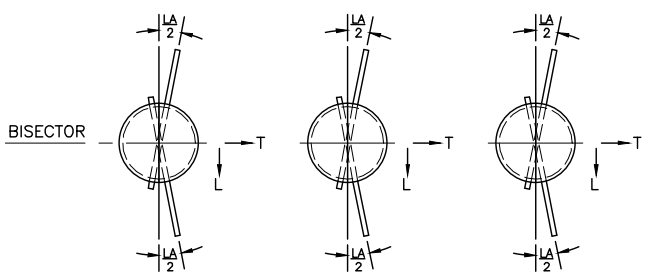
TDE-VDES-3PJ
(0°-10°)
SEE TABLE



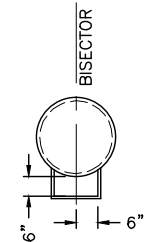
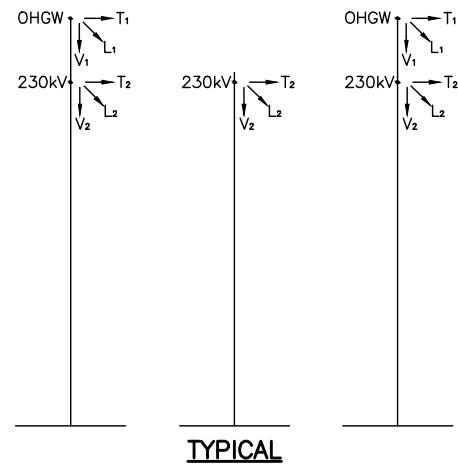
DETAIL A
OHGW VANG
(2 PLACES)



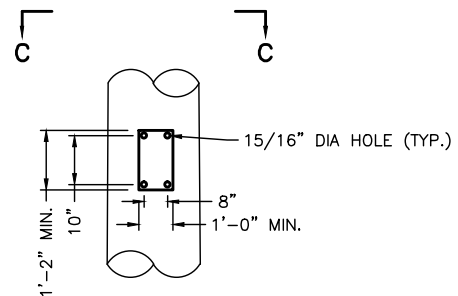
DETAIL B
CONDUCTOR ATTACHMENTS
(3 PLACES)



PLAN VIEW



VIEW C-C
JUMPER POST ATTACHMENTS



DETAIL C
JUMPER POST ATTACHMENTS
(3 PLACES)

NOTES:

1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL DESIGN SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN LOADS ARE BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
CASE 5 2.5
CASE 6 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. LINE ANGLE IS SHOWN IN CHART BELOW.
9. STRUCTURE SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.

TYPE TDE-VDES-3PJ POLES					
STR #	DESIGNATION	"H" (FT)	"AP" (FT)	LINE ANGLE	ALLOWABLE LINE ANGLE
899	TDE-VDES	130	110	8°13'50"	9°
900	TDE-VDES	130	110	5°44'35"	9°

CASE DESCRIPTIONS:

- I NESC HEAVY DE/INTACT
- II EXTREME WIND DE/INTACT (21 PSF)
- III NESC CONC. ICE/WIND DE/INTACT
- IV CAMBER/DEFLECTION
- V NESC HEAVY DE
- VI EXTREME WIND DE

DESIGN LOADS FOR STEEL POLE -- TDE-VDES-3PJ						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
1	3.27	3.13	0.49	7.87	5.80	0.38
2	0.73	1.74	0.66	2.78	4.92	0.20
3	1.46	1.66	0.24	4.02	3.46	0.12
4	0.98	0.28	0.00	3.03	0.91	0.02
5	3.27	2.42	9.46	7.87	4.28	19.74
6	0.73	1.44	4.49	2.78	4.11	10.47

				BLACK HILLS POWER			
				STEEL POLE LOAD AND DESIGN			
				TECKLA TO LANGE			
				230kV PROJECT GCC DAKOTAH			
				TDE-VDES-3PJ ANGLE DE 0° - 10° SHT. 1 OF 1			
10/05/15	GC	1	DZ	ISSUED FOR REVIEW			
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION			
10/05/15	GC	1	DZ	DATE 10/05/15 DWO NO. 1			
10/05/15	DZ	1	DZ	DATE 10/05/15			
				BHP-T-211			

NOTES:

1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL DESIGN SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN LOADS ARE BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:

CASE 1 2.5

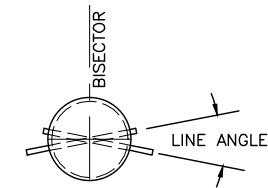
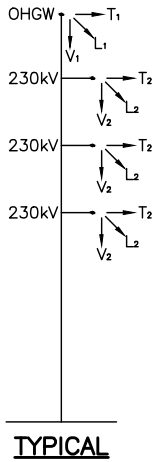
CASE 2 1.0

CASE 3 1.0

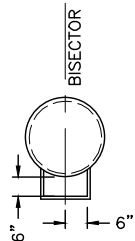
CASE 4 1.0

CASE 5 2.5

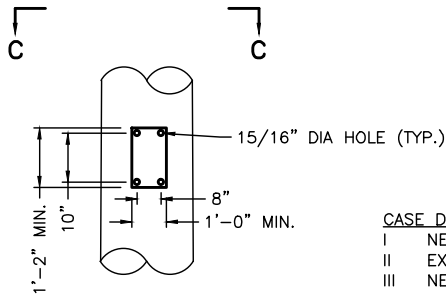
CASE 6 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. LINE ANGLE IS SHOWN IN CHART BELOW.
9. STRUCTURE SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.



VIEW A-A
OHGW ATTACHMENTS

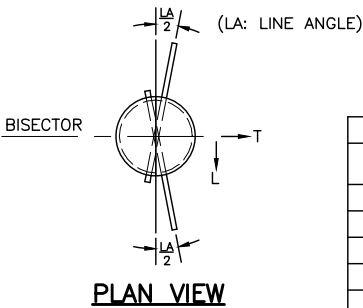
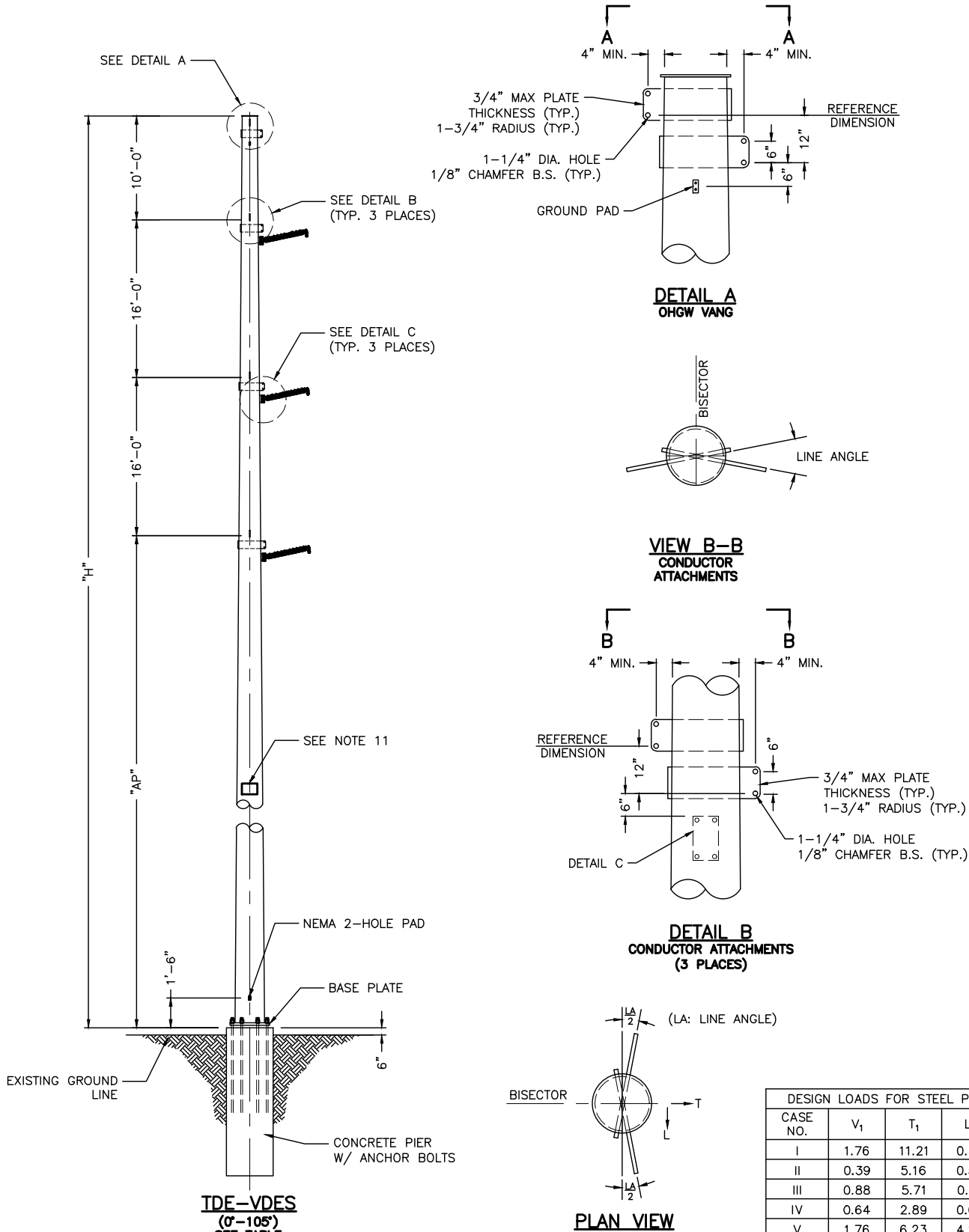


VIEW B-B
CONDUCTOR ATTACHMENTS



VIEW C-C
JUMPER POST ATTACHMENTS

- CASE DESCRIPTIONS:
- I NESC HEAVY DE/INTACT
- II EXTREME WIND DE/INTACT (21 PSF)
- III NESC CONC. ICE/WIND DE/INTACT
- IV CAMBER/DEFLECTION
- V NESC HEAVY DE
- VI EXTREME WIND DE



PLAN VIEW

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 904						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	3.83	14.64	8.35	5.16	23.09	0.00
II	0.74	6.87	3.16	1.78	13.60	0.21
III	1.81	6.97	3.37	2.67	12.33	0.84
IV	1.24	2.71	1.22	2.03	6.56	0.36
V	3.83	10.87	14.26	5.16	12.45	16.70
VI	0.74	4.99	6.11	1.78	7.83	8.86

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 909						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.76	10.91	0.50	3.42	26.89	4.02
II	0.39	5.08	0.58	1.13	14.55	2.59
III	0.88	5.62	0.15	1.80	14.60	2.28
IV	0.64	2.86	0.00	1.38	7.79	1.71
V	1.76	6.00	4.27	3.42	16.42	12.05
VI	0.39	3.06	2.13	1.13	9.39	6.54

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 911						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.56	9.32	0.00	2.84	19.67	0.00
II	0.35	3.94	0.00	0.92	10.17	0.00
III	0.80	4.93	0.00	1.51	10.56	0.00
IV	0.60	2.59	0.00	1.17	5.04	0.00
V	1.56	4.87	4.30	2.84	10.17	9.17
VI	0.35	2.10	1.77	0.92	5.49	4.52

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 914						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.56	8.55	2.12	2.84	23.82	5.16
II	0.35	4.23	1.04	0.92	11.61	3.47
III	0.80	4.39	0.87	1.51	13.44	2.78
IV	0.60	2.01	0.56	1.17	6.65	2.25
V	1.56	5.58	4.99	2.84	14.92	13.75
VI	0.35	2.79	2.43	0.92	8.01	6.95

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 920, 922, 923						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.82	10.70	0.00	3.61	23.07	0.00
II	0.40	5.31	0.00	1.20	12.40	0.00
III	0.91	5.28	0.00	1.90	11.97	0.00
IV	0.65	2.55	0.00	1.45	6.37	0.00
V	1.82	5.63	5.08	3.61	11.98	11.08
VI	0.40	2.83	2.47	1.20	6.74	5.66

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 915						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.43	8.38	2.12	2.45	20.58	2.29
II	0.32	4.12	1.04	0.77	9.84	2.08
III	0.75	4.29	0.87	1.32	11.09	0.69
IV	0.57	2.01	0.56	1.02	5.40	1.04
V	1.43	5.41	4.99	2.45	11.68	10.89
VI	0.32	2.68	2.43	0.77	6.25	5.56

DESIGN LOADS FOR STEEL POLE – TDE-VDES STR 924						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	3.06	1.17	6.93	2.84	0.98	11.96
II	0.68	0.70	3.55	0.92	1.18	6.10
III	1.59	0.69	3.45	1.51	0.71	6.25
IV	1.18	0.00	1.80	1.17	0.00	3.50
V	3.06	1.17	10.23	2.84	0.98	15.68
VI	0.68	0.70	4.65	0.92	1.18	8.00

10/05/15GC1DZ

DATEDRAWN BYNO. APPROVED BY

ISSUED FOR REVIEW

REVISION DESCRIPTION

BLACK HILLS POWER

STEEL POLE LOAD AND DESIGN

TECKLA TO LARGE

230kV PROJECT LARGE AREA

TDE-VDES ANGLE DE (60° - 105°) SH. 1 OF 1

BHP-T-212

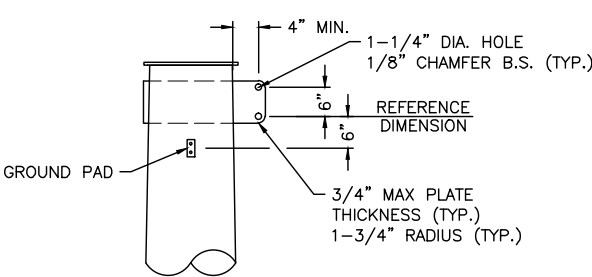
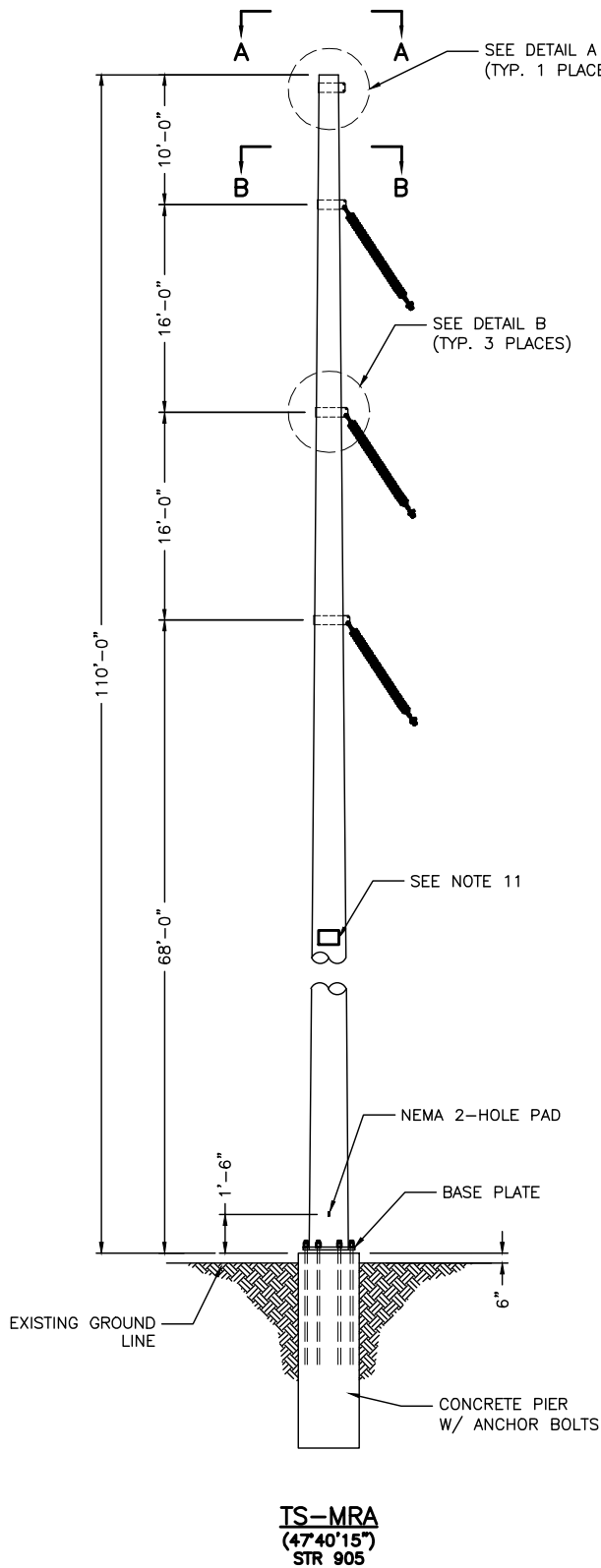
NOTES:

1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL DESIGN SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN LOADS ARE BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. ALLOWABLE LINE ANGLE (LA) IS 50°.
9. STRUCTURE DESIGN SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.

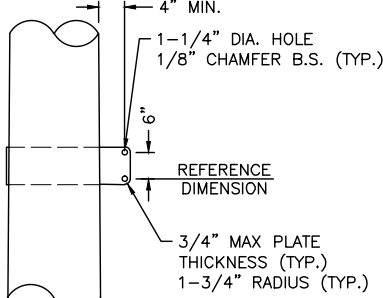
CASE DESCRIPTIONS:

- I NESC HEAVY DE/INTACT
- II EXTREME WIND DE/INTACT (21 PSF)
- III NESC CONC. ICE/WIND DE/INTACT
- IV CAMBER/DEFLECTION

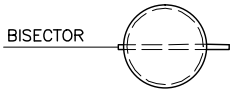
DESIGN LOADS FOR STEEL POLE - TDE-VDES STR 905						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.82	6.69	0.00	3.61	17.98	0.00
II	0.40	3.45	0.00	1.20	9.52	0.00
III	0.91	3.42	0.00	1.90	9.99	0.00
IV	0.65	1.52	0.00	1.45	5.34	0.00



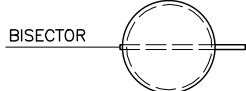
DETAIL A
OHGW VANG



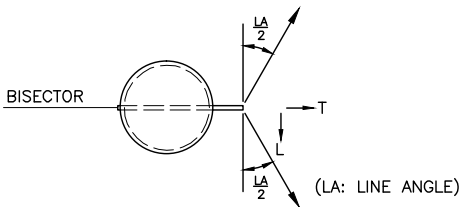
DETAIL B
CONDUCTOR VANG



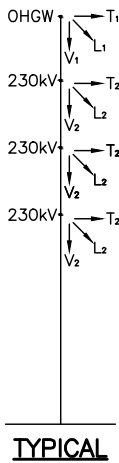
VIEW A-A
OHGW ATTACHMENT



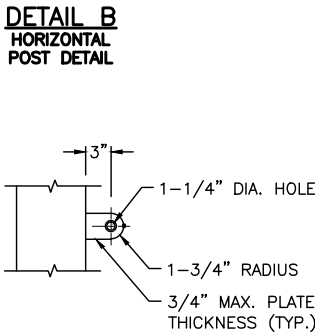
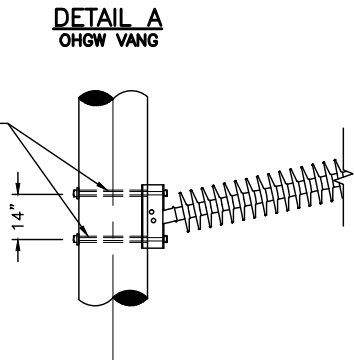
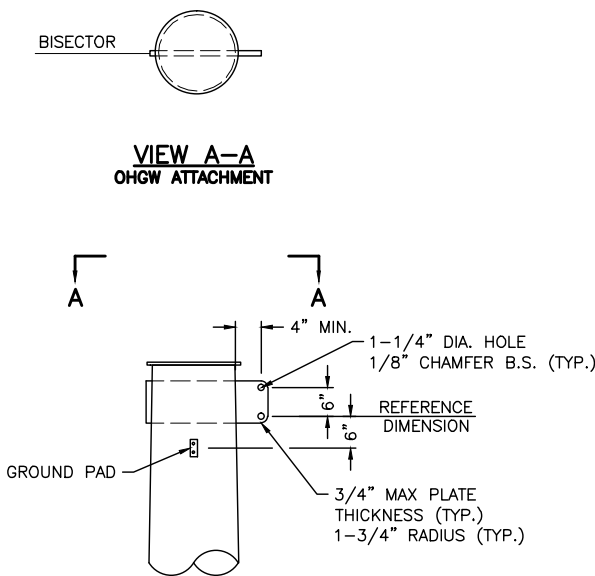
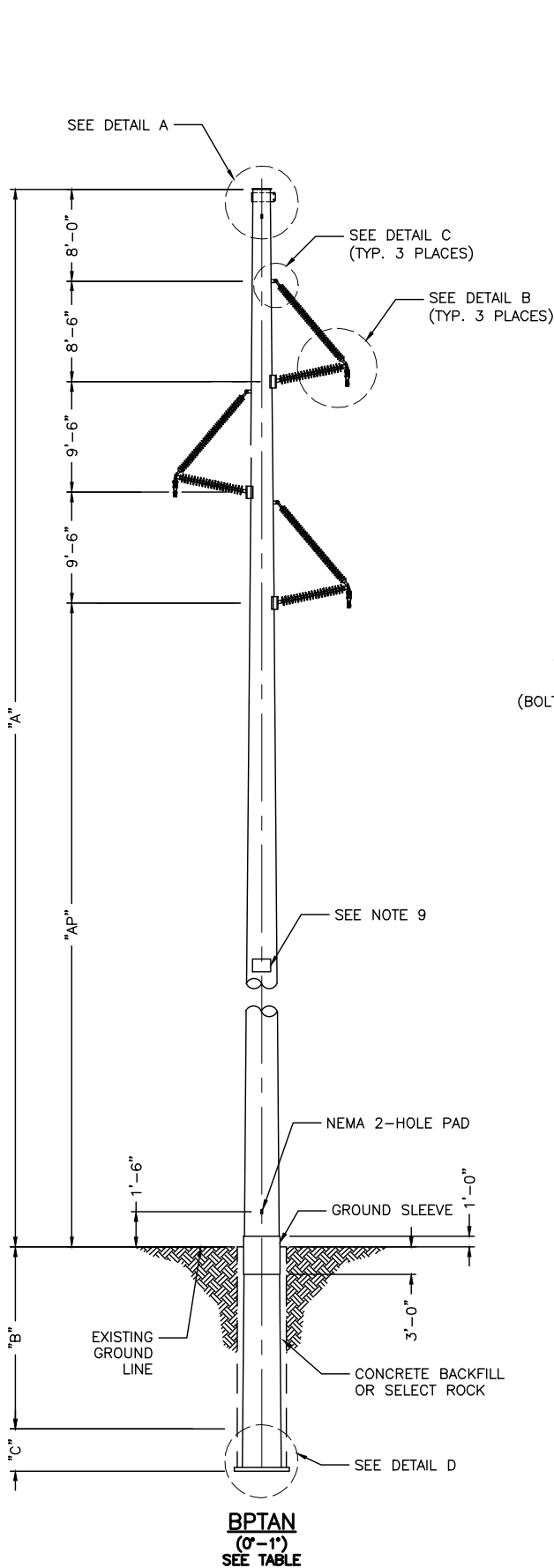
VIEW B-B
CONDUCTOR ATTACHMENT



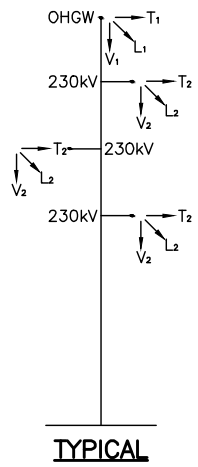
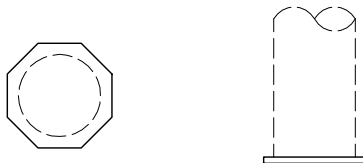
PLAN VIEW



						BLACK HILLS POWER 			
						STEEL POLE LOAD AND DESIGN			
						TECKLA TO LANGE			
						230kV PROJECT LARGE AREA			
						TS-MRA MEDIUM ANGLE			
						SHT. 1 OF 1			
10/05/15	GC	1	DZ	ISSUED FOR REVIEW			XX		
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION			DATE		
10/05/15	GC	1	DZ	10/05/15			DATE		
							BHP-T-213		



DETAIL C
STRUT VANG



NOTES:

1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL STEEL SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN IS BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. ALLOWABLE LINE ANGLE IS 0-1 DEGREES.
9. HIGH VOLTAGE SIGN.
10. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.
11. POLE CLASS/LENGTH SHOWN IS A MINIMUM NOT INCLUDING THE DIMENSION "C" POLE BASE EXTENSION. MANUFACTURER SHALL BID THE POLE CLASS INDICATED WITH A LENGTH THAT IS AT LEAST DIMENSION "C" GREATER THAN INDICATED OVERALL LENGTH.

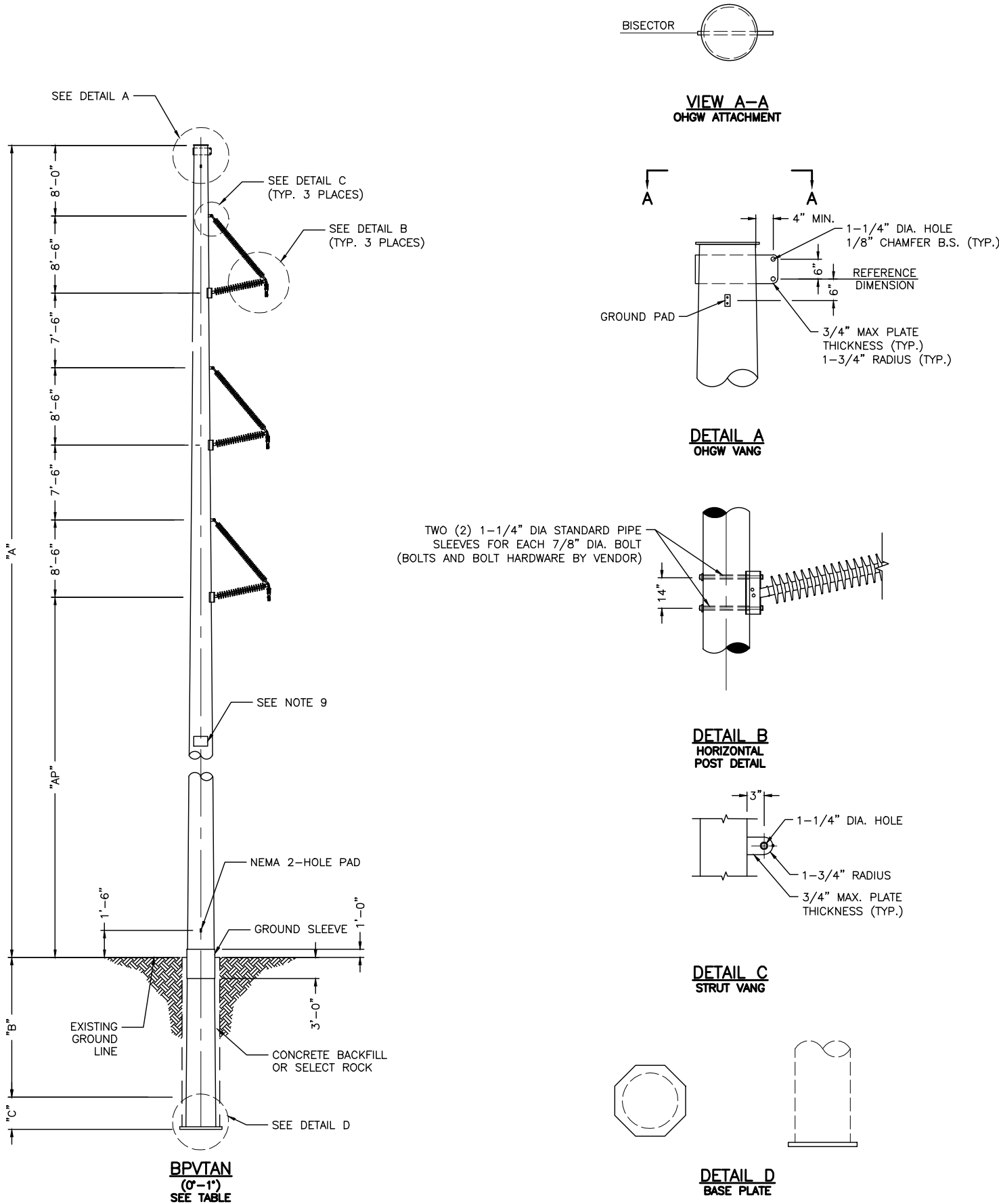
TYPE BPTAN POLES					
STR #	POLE CLASS/LENGTH	"A" (FT)	"B" (FT)	"C" (FT)	LINE ANGLE
910	LD6-85	74.5	10.5	5	0
913	LD9-120	106	14	5	0
916	CUSTOM LD	125.5	19.5	5	0
917	CUSTOM LD	110.5	14.5	5	0
918	LD9-120	106	14	5	0
919	LD9-120	106	14	5	0
921	LD6-105	92.5	12.5	5	0

* SEE NOTE 11

- CASE DESCRIPTIONS:
- I NESC HEAVY INTACT
 - II EXTREME WIND (21 PSF)
 - III NESC CONC. ICE/WIND
 - IV CAMBER/DEFLECTION

DESIGN LOADS FOR STEEL POLE - BPTAN CUSTOM LD						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	3.27	0.90	0.00	7.87	1.62	0.00
II	0.73	0.56	0.00	2.78	1.70	0.00
III	1.46	0.53	0.00	4.02	1.11	0.00
IV	0.98	0.03	0.00	3.03	0.11	0.00

						BLACK HILLS POWER	
						STEEL POLE LOAD AND DESIGN	
						TECKLA TO LANGE	
						230kV PROJECT LANGE AREA	
						BPTAN TANGENT (0° - 1°)	
10/05/15	GC	1	DZ	ISSUED FOR REVIEW		XX	SH. 1 OF 1
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		DATE 10/05/15	DWG NO. BHP-T-214



NOTES:

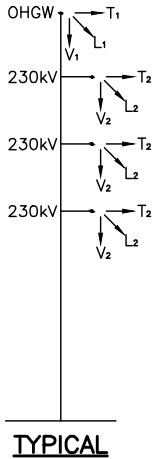
1. ALL STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL STEEL SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN IS BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
CASE 1 2.5
CASE 2 1.0
CASE 3 1.0
CASE 4 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. ALLOWABLE LINE ANGLE IS 0-1 DEGREES.
9. HIGH VOLTAGE SIGN.
10. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.
11. POLE CLASS/LENGTH SHOWN IS A MINIMUM NOT INCLUDING THE DIMENSION "C" POLE BASE EXTENSION. MANUFACTURER SHALL BID THE POLE CLASS INDICATED WITH A LENGTH THAT IS AT LEAST DIMENSION "C" GREATER THAN INDICATED OVERALL LENGTH.

TYPE BPTAN POLES					
STR #	POLE CLASS/LENGTH	"A" (FT)	"B" (FT)	"C" (FT)	LINE ANGLE
908	LD6-105	92.5	12.5	5	0

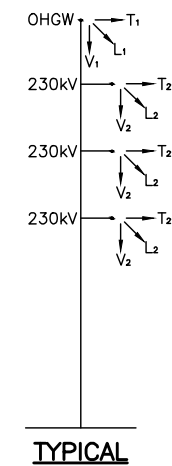
* SEE NOTE 11

- CASE DESCRIPTIONS:
- I NESC HEAVY INTACT
 - II EXTREME WIND (21 PSF)
 - III NESC CONC. ICE/WIND
 - IV CAMBER/DEFLECTION

DESIGN LOADS FOR STEEL POLE -- BPVTAN STR. 908						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	3.27	0.90	0.00	7.87	1.62	0.00
II	0.73	0.56	0.00	2.78	1.70	0.00
III	1.46	0.53	0.00	4.02	1.11	0.00
IV	0.98	0.03	0.00	3.03	0.11	0.00



						BLACK HILLS POWER			
						STEEL POLE LOAD AND DESIGN			
						TECKLA TO LANGE			
						230kV PROJECT LARGE AREA			
						BPVTAN TANGENT (0° - 1°)			
						SHT. 1 OF 1			
10/05/15	GC	1	DZ	ISSUED FOR REVIEW		XX	GC	DATE 10/05/15	DWG NO.
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION		APPROVED BY	DZ	DATE 10/05/15	BHP-T-215



1. DESIGN OF STEEL SHALL BE WEATHERING TYPE STEEL IN ACCORDANCE WITH ASTM-A871 (50 KSI) OR (65 KSI).
2. STRUCTURAL STEEL SHALL MEET ALL TECHNICAL REQUIREMENTS OF BLACK HILLS POWER TUBULAR STEEL POLE SPECIFICATIONS.
3. ALL STRUCTURAL JOINTS SHALL HAVE 2 HOLE NEMA GROUND PADS LOCATED ON BOTH SIDES OF THE JOINT AND 6 INCHES FROM THE JOINT SURFACE AND AT POLE TOP AND GROUND LINE.
4. DESIGN IS BASED ON 1272 KCMIL ACSR "BITTERN" CONDUCTOR AND 3/8 INCH EHS STEEL OR AFL DNO-4748 0.443" DIA. OPGW SHIELD WIRE.
5. ALL LOADS INDICATED IN LOADING TREES ARE ULTIMATE VALUES AND INCLUDE OVERLOAD FACTORS. ALL LOADS ARE SHOWN IN KIPS (LBS. X 1000).
6. ALL WIND FORCES ARE APPLIED TO THE POLE SURFACE SHALL HAVE THE WIND PRESSURE MULTIPLIED BY THE FOLLOWING OVERLOAD FACTORS:
 - CASE 1 2.5
 - CASE 2 1.0
 - CASE 3 1.0
 - CASE 4 1.0
7. ALL STRUCTURES AND ATTACHMENTS SHALL BE DESIGNED TO WITHSTAND, WITHOUT FAILURE OR YIELDING, THE SIMULTANEOUS APPLICATION OF THE DEAD LOAD OF POLE WEIGHT, WIND LOAD ON POLE, AND WIRE LOADS FOR EACH LOAD CASE.
8. LINE ANGLE (LA) IS 5-15 DEGREES.
9. STRUCTURE SHALL ALLOW FOR 1.0 DEGREE OF FOUNDATION ROTATION.
10. ALL VANGS SHALL BE DESIGNED FOR MAXIMUM LOADS.
11. HIGH VOLTAGE SIGN.
12. ALL SECTIONS SHALL BE SLIP JOINTED UTILIZING JACKING NUTS ON FOUR (4) FACES WITH LOCKING DEVICES.

TYPE BPLRA POLES					
STR #	DESIGN	"H (FT)	"AP" (FT)	LINE ANGLE	ALLOWABLE LINE ANGLE
906	BPLRA	90	41.5	12°42'53"	15°
907	BPLRA	90	41.5	2°52'48"	5°

CASE DESCRIPTIONS:

I	NESC HEAVY INTACT
II	EXTREME WIND (21 PSF)
III	NESC CONC. ICE/WIND
IV	CAMBER/DEFLECTION

DESIGN LOADS FOR STEEL POLE – BPLRA STR 906						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.69	2.55	0.00	3.22	6.33	0.00
II	0.38	1.37	0.00	1.06	3.88	0.00
III	0.85	1.34	0.00	1.71	3.65	0.00
IV	0.63	0.47	0.00	1.31	1.65	0.00

DESIGN LOADS FOR STEEL POLE – BPLRA STR 907						
CASE NO.	V ₁	T ₁	L ₁	V ₂	T ₂	L ₂
I	1.69	1.33	0.00	3.22	2.90	0.00
II	0.38	0.77	0.00	1.06	2.24	0.00
III	0.85	0.74	0.00	1.71	1.79	0.00
IV	0.63	0.16	0.00	1.31	0.55	0.00

[illegible]

Str No.	Station	Type	Fdn Type	Soil Boring No.	(A) AB Quant	(B) AB Length	(C) BC Diameter (in)	Bolt Mark	Top Template Mark	Bottom Template Mark	(D) Bisector Angle (degs)	Bisector Direction (LT or RT)	(E) Diameter (ft)	(F) Fnd Length (ft)	(G) Embed (ft)	(H) Reveal (ft)	Vertical Reinforcement		Horizontal Reinforcement				Total Concrete Quantity (c.y.)	Total Rebar Weight (lbs)	Comments
																	Size	Quantity	(J) Spacing (in)	(K) Hoops Req'd	Hoop Size	(L) Min. Hoop Dia. (in)			
843	1798+77.37	TDE-VDEDC	PIER	-	24	10'-0"	73	6010	6611	6612	-2.57	LT					#11	46	9	26	#6	88	34	5331	
844	1814+14.22	TDE-VDEDC	PIER	FMG A1-4	24	10'-0"	73	6010	6611	6612	-4.7	LT	8	18	17	1	#11	23	10	29	#5	82	37	3458	
895	2238+72.82	BPVTAN-DESW	PIER	FMG A1-1	8	10'-0"	44	6005	6016	6017	-0.3	LT	6	10	9	1	#11	15	6	21	#5	64	10	1212	rock verification at construction is required
898	2263+68.36	TDE-VDES	PIER	FMG A1-2	20	9'-6"	66	6006	6601	6602	-4.2	LT	7.5	22.5	21.5	1	#11	23	10	29	#5	82	37	3458	
899	2275+95.15	TDE-VDES-3PJ	LT PIER	FMG BH-1	16	8'-6"	58	6004	6022	6023	4.1	RT	7	16	15	1	#11	23	9	23	#6	76	23	2719	rock verification at construction is required
899	2275+95.15	TDE-VDES-3PJ	CTR PIER	FMG BH-1	12	8'-0"	52	6003	6020	6021	4.1	RT	7	16	15	1	#11	23	9	23	#6	76	23	2719	rock verification at construction is required
899	2275+95.15	TDE-VDES-3PJ	RT PIER	FMG BH-1	16	8'-6"	58	6004	6022	6023	4.1	RT	7	16	15	1	#11	23	9	23	#6	76	23	2719	rock verification at construction is required
900	2289+56.85	TDE-VDES-3PJ	LT PIER	FMG BH-2	16	8'-6"	58	6004	6022	6023	2.9	RT	7	33	32	1	#11	23	9	46	#5	76	47	5116	
900	2289+56.85	TDE-VDES-3PJ	CTR PIER	FMG BH-2	12	8'-0"	52	6003	6020	6021	2.9	RT	7	33	32	1	#11	23	9	46	#5	76	47	5116	
900	2289+56.85	TDE-VDES-3PJ	RT PIER	FMG BH-2	16	8'-6"	58	6004	6022	6023	2.9	RT	7	33	32	1	#11	23	9	46	#5	76	47	5116	
903	2318+09.53	TSHTAN	LT PIER	FMG BH-4	8	6'-3"	49	6011	6042	6043	0.0		6	24	23	1	#11	16	12	26	#5	64	25	2560	BH-5 properties used for fnd design, construction inspection required to verify properties
903	2318+09.53	TSHTAN	RT PIER	FMG BH-4	8	6'-3"	49	6011	6042	6043	0.0		6	24	23	1	#11	16	12	26	#5	64	25	2560	BH-5 properties used for fnd design, construction inspection required to verify properties
904	2329+51.58	TDE-VDES	PIER	FMG BH-5	32	9'-9"	82	6007	6603	6604	-29.8	LT	9	40	39	1	#11	42	6	81	#5	100	94	11360	design exceeds boring depth, engineering inspection required to verify properties
905	2336+47.39	TS-MRA	PIER	FMG BH-6	16	10'-0"	64	6010	6038	6039	-23.8	LT	7.5	26	25	1	#11	23	10	33	#5	82	43	3991	
906	2342+13.08	BPLRA	PIER	FMG BH-7	8	7'-9"	44	6001	6016	6017	-6.4	LT	6	23	22	1	#11	23	11	27	#5	64	24	3333	rock verification at construction is required
907	2346+89.09	BPLRA	PIER	FMG BH-8	4	9'-0"	36	6002	6024	6025	1.4	RT	5	15	14	1	#11	11	9	22	#5	52	11	1251	rock verification at construction is required
909	2356+31.48	TDE-VDES	PIER	FMG BH-9	20	10'-3"	72	6008	6605	6006	51.2	RT	8	26	25	1	#11	34	9	36	#5	88	48	5619	
911	2363+40.99	TDE-VDES	PIER	FMG BH-10	16	10'-6"	65	6009	6032	6033	-45.1	LT	7.5	27	26	1	#11	28	10	34	#5	82	44	4844	
912	2367+05.31	TDE-VDES	PIER	FMG BH-11	20	10'-6"	72	6009	6605	6606	52.5	RT	8	33	32	1	#11	34	9	46	#5	88	61	7165	
914	2379+41.50	TDE-VDES	PIER	FMG BH-12	20	10'-6"	65	6009	6607	6608	45.0	RT	7.5	29	28	1	#11	32	10	37	#5	82	47	5826	
915	2381+43.13	TDE-VDES	PIER	FMG BH-13	24	9'-9"	71	6007	6609	6610	-45.4	LT	8	33	32	1	#11	30	9	46	#5	88	61	6475	
920	2408+09.69	TDE-VDES	PIER	FMG BH-15	16	10'-3"	64	6008	6038	6039	-44.5	LT	7.5	27	26	1	#11	30	10	34	#5	82	44	5125	
922	2418+61.03	TDE-VDES	PIER	FMG BH-16	16	10'-3"	64	6008	6038	6039	44.6	RT	7.5	22	21	1	#11	30	10	28	#5	82	36	4169	
923	2423+57.18	TDE-VDES	PIER	FMG BH-17	16	10'-3"	64	6008	6038	6039	44.6	RT	7.5	24	23	1	#11	30	10	31	#5	82	39	4567	
924	2427+43.13	TDE-VDES	PIER	-	16	10'-0"	58	6010	6022	6023	0.0		7	24	23	1	#11	25	10	31	#5	76	34	3893	no boring, used BH-15 as most conservative for design. Verify soil properties at construction.

Controlling Reactions at Top of Foundation				
Str No.	Moment (k-ft)	Shear (kips)	Axial (kips)	Uplift (kips)
843	8381	99.9	100.8	NESC HVY SINGL DE
844	8381	99.9	100.8	NESC HVY SINGL DE
895	1706	18.0	30.5	NESC HVY W/SWDE
898	6012	79.9	47.5	NESC HVY SINGL DE
899	3727	31.7	38.2	NESC HVY SINGL DE
900	3727	31.7	38.2	NESC HVY SINGL DE
903	1478	13.5	16.9	EXT WIND
904	12079	92.6	87.6	NESC HVY DE INTACT
905	5533	64.8	38.4	NESC HVY
906	1573	23.7	21.0	NESC HVY
907	859	11.8	18.2	NESC HVY
909	7343	96.5	40.4	NESC HVY DE INTACT
911	5861	72.1	35.0	NESC HVY DE INTACT
912	7458	97.9	40.6	NESC HVY DE INTACT
914	6497	85.6	36.4	NESC HVY DE INTACT
915	7965	76.1	51.4	NESC HVY DE INTACT
920	5567	83.3	34.0	NESC HVY DE INTACT
922	5567	83.3	34.0	NESC HVY DE INTACT
923	5567	83.3	34.0	NESC HVY DE INTACT
924	4620	58.3	33.0	NESC HVY SINGL DE

NOTES:

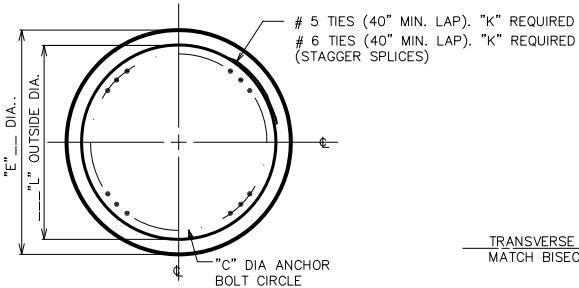
- LOADS ARE ULTIMATE DESIGN LOADS FROM NESC HEAVY OR 85MPH EXTREME WIND LOAD CASES.
- FOUNDATION IS DESIGNED BY LPILE WITH ULTIMATE CONTROLLING LOADS. MAX. PIER ROTATION OF 0.5 DEGREE AND REVEAL AS SHOWN IN THE DESIGN TABLE.
- FOUNDATION IS DESIGNED IN ACCORDANCE WITH SOIL PARAMETERS FROM FMG SOIL REPORT AND BORING LOGS LOCATED IN THE DESIGN FILE.
- ALL ANCHOR BOLTS, NUTS & TEMPLATES TO BE SUPPLIED BY STEEL POLE VENDOR.
- ALL FOUNDATION CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
- CONTRACTOR SHALL SUBMIT REBAR SHOP DRAWINGS TO BHP PRIOR TO START OF CONSTRUCTION.
- TOLERANCES:
A. THE TOP TEMPLATE OF THE ANCHOR BOLT ASSEMBLY SHALL BE LEVEL WITHIN 0.01 FOOT.
B. TOP OF CONCRETE ELEVATION WITHIN .25 FEET OF ELEVATION SHOWN.
C. THE TRANSVERSE AXIS OF THE POLE SHALL NOT DEVIATE BY MORE THAN 12 MINUTES OF ARC.
D. CIRCULAR TIES SHALL BE PLACED WITHIN A TOLERANCE OF 1 INCH.
E. VERTICAL REBARS SHALL BE PLACED WITHIN A TOLERANCE OF 1/2" VERTICALLY AND HORIZONTALLY.
F. REBAR CAGE AND EXCAVATION SHALL BE PLUMB WITHIN A TOLERANCE OF ONE PERCENT OF THE FOUNDATION DEPTH.
- TOP OF CONCRETE CAPS SHALL HAVE A LIGHT BROOM FINISH IN SUCH A WAY AS TO CREATE POSITIVE DRAINAGE FROM THE POLE
- EXCAVATION SHALL BE LEFT OPEN FOR NO MORE THAN 48 HOURS PRIOR TO CONCRETING. OPEN EXCAVATION SHALL BE SECURED BY THE CONTRACTOR.
- ENGINEER SHALL BE CONTACTED 48 HOURS PRIOR TO START OF FOUNDATION CONSTRUCTION.
- ESTIMATED NEAT LINE QUANTITY OF CONCRETE IS AS SHOWN IN THE TABLE.
- MAXIMUM CONCRETE SLUMP SHALL BE 5" ±, EXCEPT FOR TREMMIE SEE SPECS.
- SOILS RESISTANCE TESTS SHALL BE PERFORMED AT EACH POLE LOCATION. THE FOUNDATION ELECTRICAL RESISTANCE SHALL BE MEASURED NO SOONER THAN 14 DAYS AFTER THE FOUNDATION IS SET AND WITH ANY OVERHEAD GROUND WIRE ELECTRICALLY ISOLATED FROM THE FOUNDATION. IF THE SOIL RESISTANCE IS GREATER THAN 15 OHMS, GROUNDING SHALL BE INSTALLED IN ACCORDANCE WITH THE GROUNDING PLAN UNTIL THE RESISTANCE IS REDUCED TO LESS THAN 15 OHMS, UNLESS OTHERWISE DIRECTED BY THE ENGINEER. IF SOIL RESISTANCE IS INITIALLY MEASURED AS LESS THAN 15 OHMS, NO GROUNDING IS REQUIRED.
- ALL CONCRETE TO BE PROVIDED BY THE CONTRACTOR IN ACCORDANCE WITH BHP SPECIFICATIONS.
- ENGINEERING INSPECTION IS REQUIRED FOR ALL FOUNDATION WORK AND WHERE ROCK IS ENCOUNTERED. MODIFICATIONS TO EMBEDMENTS MAY BE REQUIRED FOR CONDITIONS THAT ARE DIFFERENT THAN ASSUMED.
- REFER TO TM-9S FOR FURTHER GROUNDING DETAILS

MATERIAL SPECIFICATIONS:

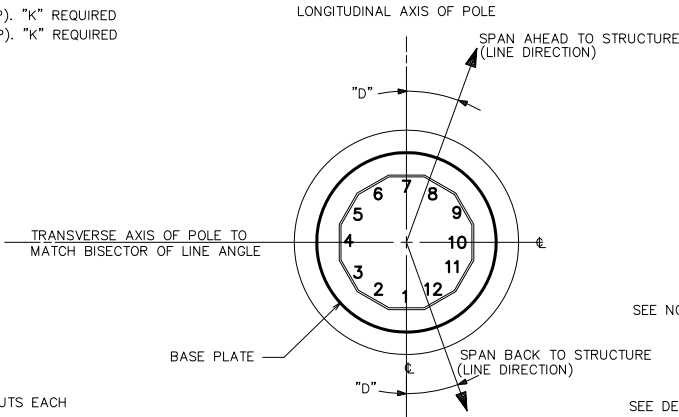
CONCRETE: 4000 PSI MINIMUM
ANCHOR BOLTS: ASTM A-615 GRADE 75
REINFORCEMENT: ASTM A-615 GRADE 60

REFERENCE DRAWINGS

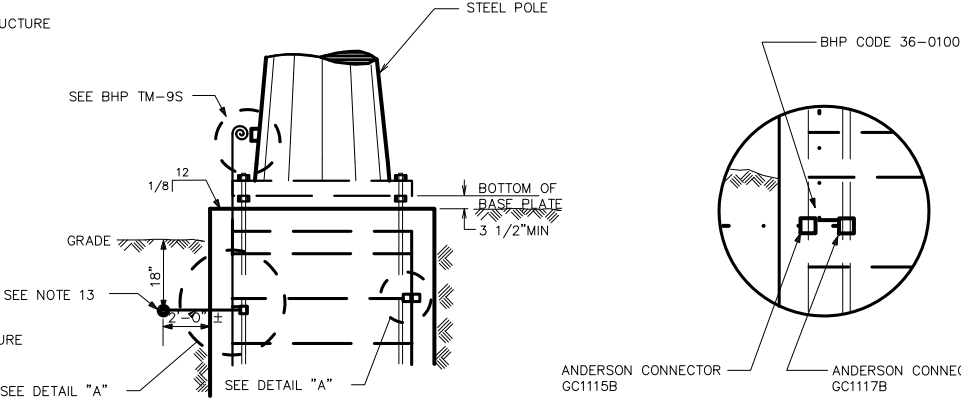
BHP-T-100 230KV PLAN AND PROFILES
BHP-T-229, 229A STRUCTURE ASSEMBLY AND DETAILS
230, 231, 232,
233, 236, 270,
271
"TBD" TRINITY MEYERS STEEL STRUCTURE AND ERECTION DETAILS
33349 SPEC NOTE SHT 1-3 TRINITY MEYERS ANCHOR BOLT CAGE INSTALLATION DETAILS
33349-032110AA TO
33349-26R210AA
SSG001 SHT 1-2



SECTION-A

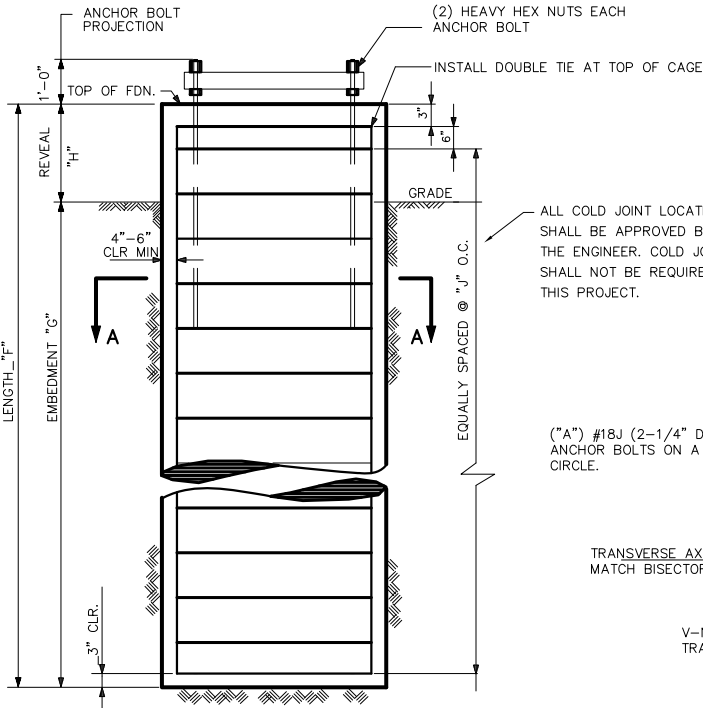


POLE ORIENTATION PLAN



GROUNDING & POLE SETTING DETAIL

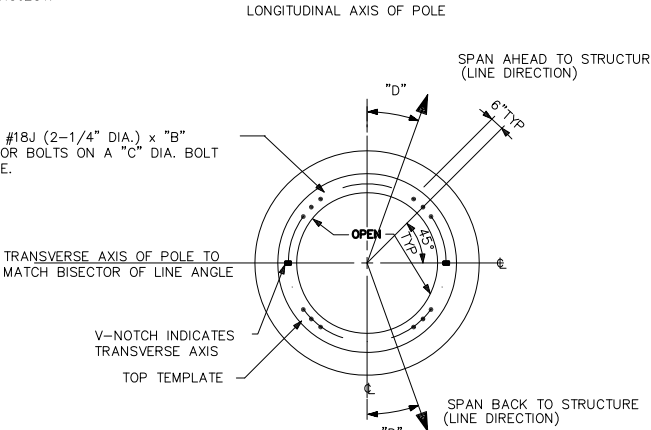
DETAIL "A"
(TYP 2 PLACES 180°APART)



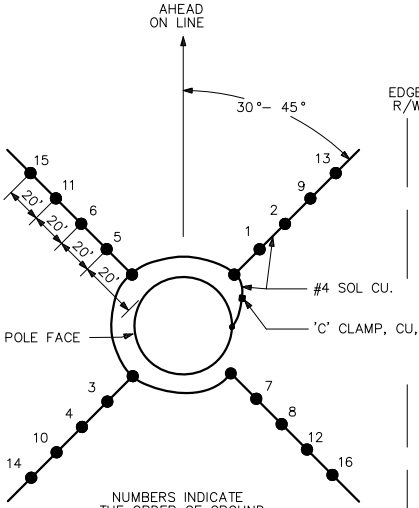
ELEVATION

ALL COLD JOINT LOCATIONS SHALL BE APPROVED BY THE ENGINEER. COLD JOINTS SHALL NOT BE REQUIRED ON THIS PROJECT.

("A") #18J (2-1/4" DIA.) x "B" ANCHOR BOLTS ON A "C" DIA. BOLT CIRCLE.



ANCHOR BOLT ORIENTATION PLAN



GROUNDING PLAN

SEE NOTE 13

				BLACK HILLS POWER			
				FOUNDATION DETAILS			
				TECKLA TO LANGE			
				SDSL TO LARGE SEGMENT			
				SHT. 1 OF 1			
03/29/16	DB	1	DZ	ISSUED FOR REVIEW			
DATE	DRAWN BY	NO.	APPROVED BY	REVISION DESCRIPTION			
				XX			
				DATE 03/29/16			
				BHP-T-280			