

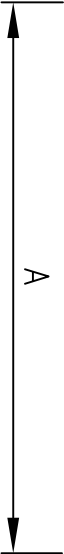
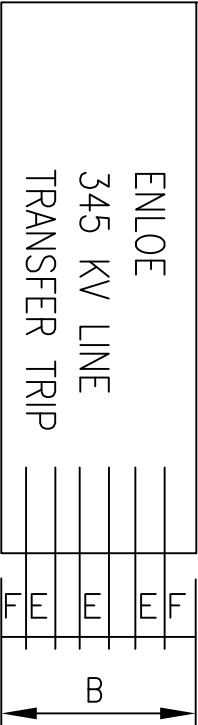
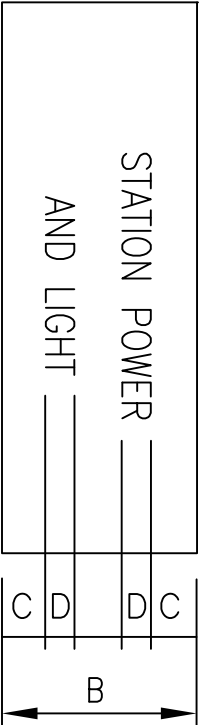
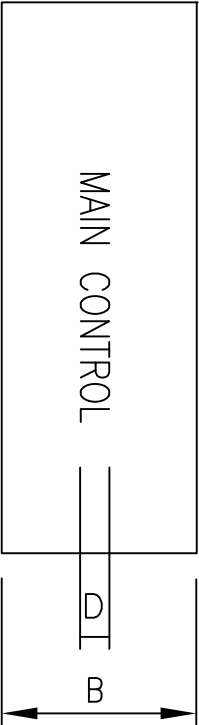
**GROUNDING DETAIL  
SWITCH OPERATORS-PLATFORM  
STRUCTURES-CONTROL BLDG. TRENCH**



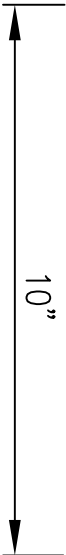
**guernsey**

ENGINEERS  
ARCHITECTS  
CONSULTANTS

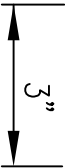
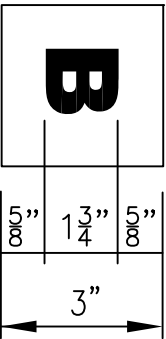
SCALE NA	DATE Oct-12	DRAWING NUMBER ES-1	REVISION C
DRN. BY BEL	CHD. BY JCC		
APPD. BY PMD	CONTRACT NO. SEE PROJECT	SHEET NO. 1	



NAMEPLATE SIZE NO.	NAMEPLATE DIMENSIONS					
	A	B	C	D	E	F
1	1 1/8"	7/16"	1/16"	3/32"		
2	1 1/2"	9/16"	1/8"	3/32"		
3	1 3/4"	5/8"	1/8"	1/8"		
4	2 1/4"	3/4"	1/8"	3/16"		
5	3	1	3/32"	1/8"	5/16"	9/16"
6	4	1 1/4"	1/4"	1/4"	3/16"	3/16"
7	6	1 3/4"	1/4"	1/2"	5/16"	1/4"




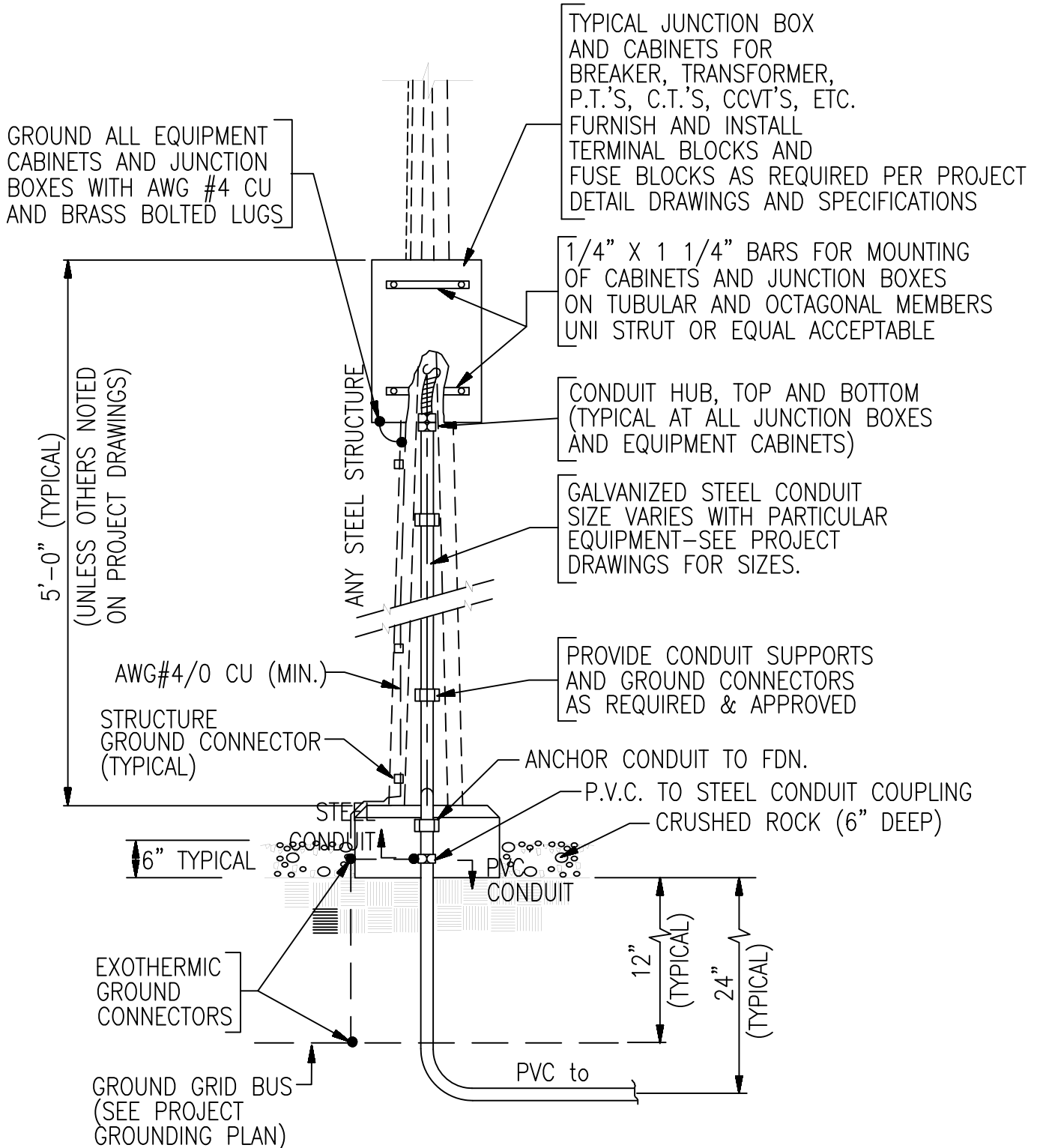
EQUIPMENT IDENTIFICATION



PHASE IDENTIFICATION

NOTE:  
SPACE BETWEEN LINES TO BE  
EQUAL TO OR SLIGHTLY LESS  
THAN DIMENSIONS C OR F

NAMEPLATE DETAILS			
		ENGINEERS ARCHITECTS CONSULTANTS	
SCALE NONE	DATE Oct-12	DRAWING NUMBER ES-12	REVISION A
DRAWN BY BEL	CHECKED BY JCC	SEE PROJECT	SHEET NO. XX
APPROVED BY PMD	CONTRACT NO.		



TYPICAL EQUIPMENT DETAILS  
CONDUIT, BURIED PVC & GROUNDING



ENGINEERS  
ARCHITECTS  
CONSULTANTS

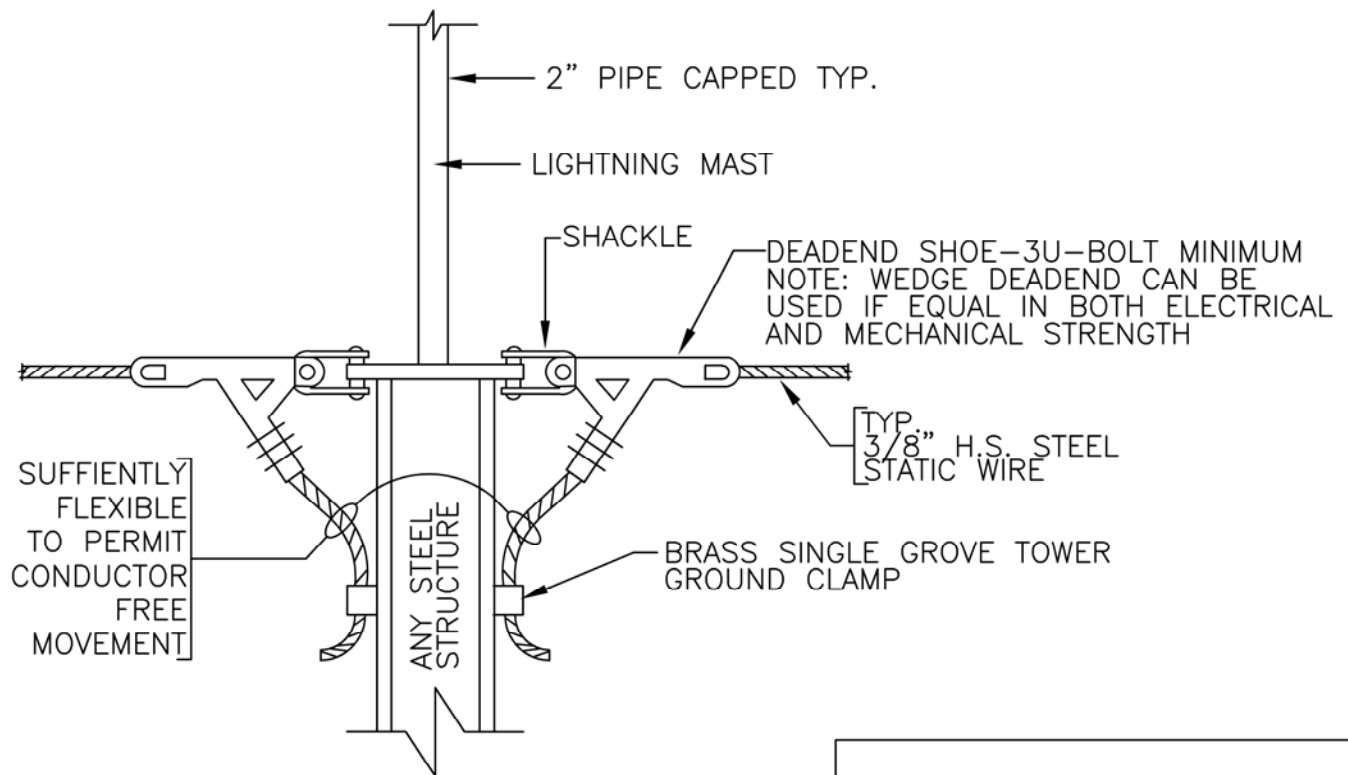
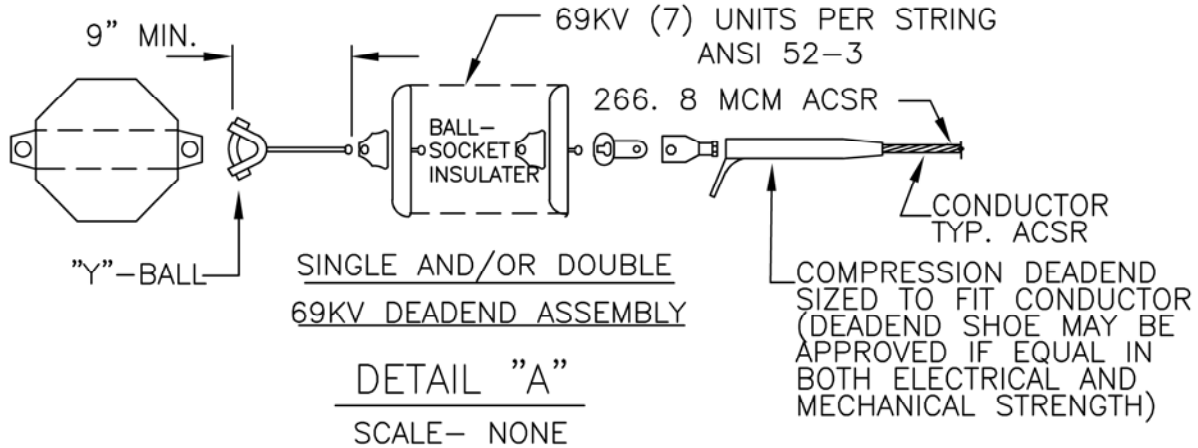
SCALE NA	DATE Oct-12	DRAWING NUMBER ES-21	REVISION A
DRAWN BY BEL	CHKD. BY JCC		
APPROD. BY PMD	CONTRACT NO.	SEE PROJECT	SHEET NO. 1

KV	POLYMER			NO. BALL UNITS *	SOCKET ANSI CLASS	MIN. RATING
	LAPP	NGK	MACLEAN (OR EQUAL)			
500	02K0715	502-SL1311-YK-95	S248175V05	28	52-11	50K
345	02K0714	502-SS1031-YK-41	S248138VB01	20	52-11	50K
230	CSE-100-EB199A	502-SS73AYJ	S648092FA01	16	52-11	50K
161	CS3-074SB-178A	502-SS451-YK-04	S148064VX05	14	52-11	50K
138	02K0713	302-SS461-YJ-04	S548069VX04	12	52-5	30K
115	CS2-054-YB-120A	251-SS350-YJ	S648051FX02	10	52-5	30K
69	02K0712	251-SS291-YJ	S148046VX16	7	52-5	30K
34.5	-	-	DS-35M	5	52-5	30K
24.9	-	-	DS-25M	4	52-5	30K
15	-	-	DS-28M	3	52-5	20K
5-2.4	-	-	DS-15M	3	52-5	20K

\* FOR LESS THAN 3300 FEET ELEVATION MEAN SEA LEVEL

NOTE:

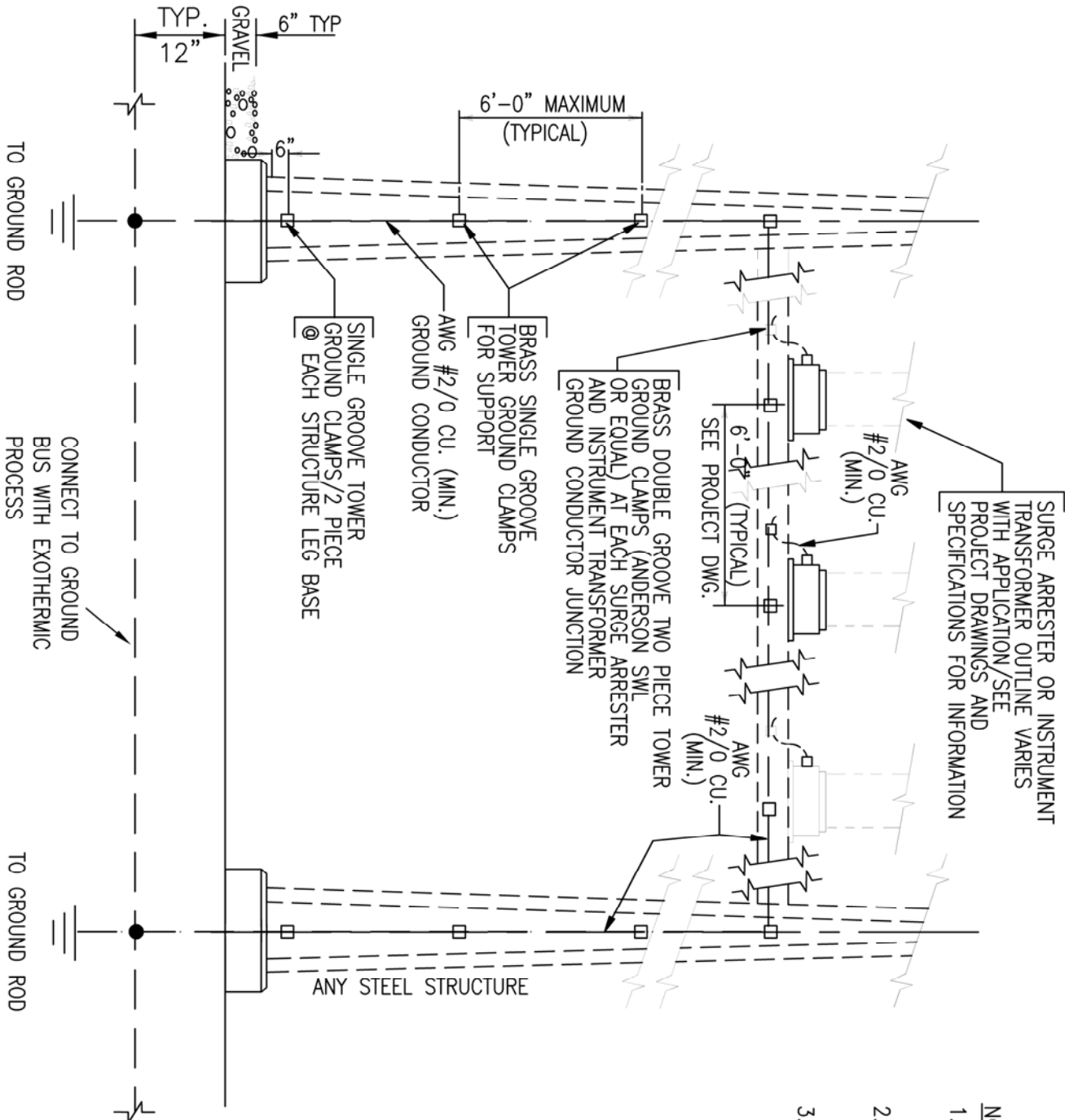
POLYMER INSULATORS CAN BE USED IF EQUAL IN BOTH ELECTRICAL AND MECHANICAL STRENGTH



## TYPICAL DEADEND DETAILS

ENGINEERS  
ARCHITECTS  
CONSULTANTS

SCALE NONE	DATE Nov-12	DRAWING NUMBER ES-25	REVISION A
DRN. BY BEL	CRD. BY JCC	APPR. BY PMD	CONTRACT NO. SEE PROJECT
SHEET NO. 1			

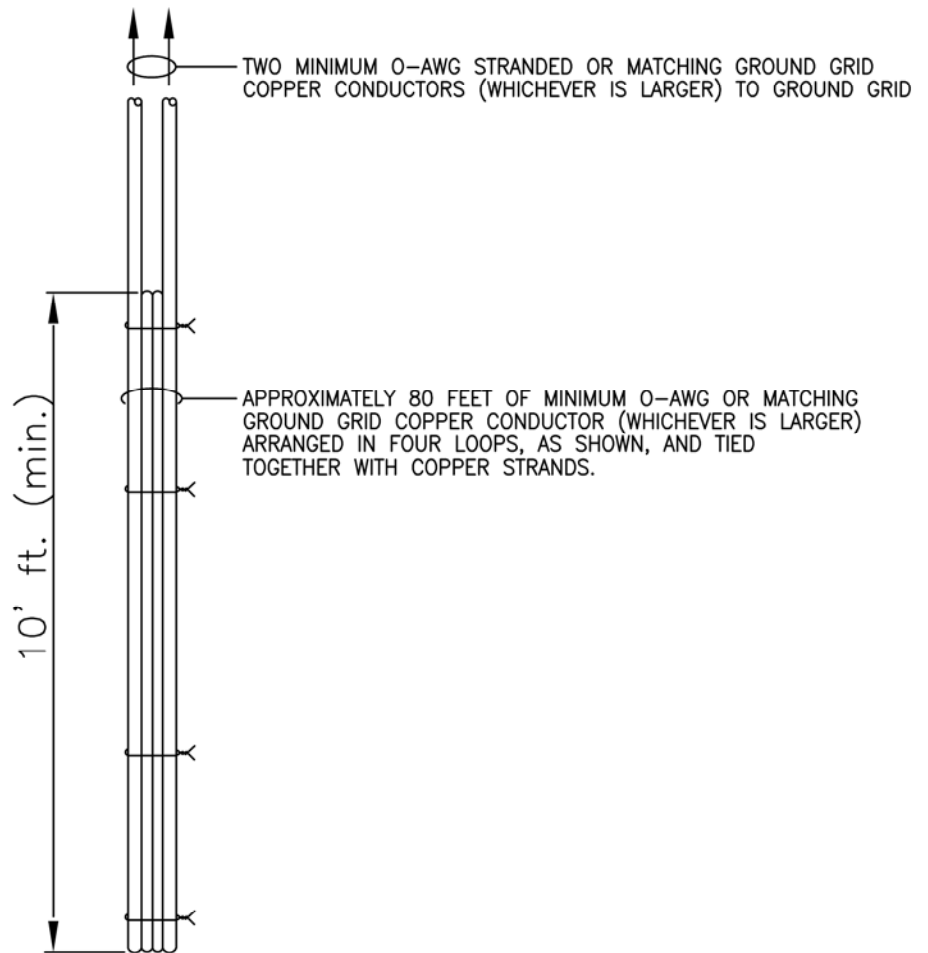


- NOTES:
1. STRUCTURE AND GROUNDING SHOWN GENERAL, SEE PROJECT DRAWINGS FOR DETAILS
  2. DETAILS VARY BY LOCATION OR APPLICATION, SEE PROJECT DETAIL SPECIFICATIONS.
  3. CONTRACTOR SHALL DETERMINE QUANTITIES AND ARRANGEMENT.

TYPICAL GROUNDING DETAILS:  
SURGE ARRESTERS &  
INSTRUMENT TRANSFORMERS

**guernsey** ENGINEERS  
ARCHITECTS  
CONSULTANTS

SCALE	DATE	DRAWING NUMBER	REVISION
NA	Oct-12	ES-27	A
DATE BY	DATE BY	DATE BY	DATE BY
BEL	JCC	SEE PROJECT	
APPROVED BY	PROJECT NO.	SHEET NO.	1
PMD			



## NOTES:

1. Well shall be uncased
2. Well shall extend to 15-feet below water line if unyielding rock is not encountered
3. Maximum depth of well shall be 100 feet
4. Electrode shall be forced to bottom of well and leads connected to ground grid as shown on station ground plan
5. Well shall be back filled with insitu soils except last 20 feet from top down shall be bentonite or other approved well sealing material.

ELECTRODE ASSEMBLY

## GROUND WELL FOR SUBSTATION GROUND GRIDS

### GROUND WELL FOR SUBSTATION GROUND GRIDS



ENGINEERS  
ARCHITECTS  
CONSULTANTS

SCALE NA	DATE Nov-12	DRAWING NUMBER ES-50	REVISION A
DRN. BY BEL	CRD. BY JCC		
APPD. BY PMD	CONTRACT NO.	SEE PROJECT	SHEET NO. 1

IPCEA METHOD ONE (K-1)				IPCEA METHOD ONE (K-1)				12/C				12/C	
CONDUCTOR	BASE	TRACER	ABBREV.	POTENTIALS	CURRENTS	3Ø	4/C	4/C	4/C	4/C	CONTROLS WITH SEPARATE TRIP & CLOSE CIRCUITS (2ND CABLE REQUIRED FOR ALARMS) (NOTE 1)	CIRCUIT SWITCHER CONTROLS (NOTE 1)	
2	BASE	TRACER	ABBREV.	BINDING	TERMINAL								
1	BLACK	.....	BK	BLACK	.....	AØ	AØ	X (HOT)	X (HOT)	POSITIVE	POSITIVE TO CONTROL PANEL CLOSE & RECLOSE	POSITIVE TO CONTROL PANEL	
2	WHITE	.....	W	WHITE	.....	NEUT	NEUT	2 (NEUT)	2 (NEUT)	NEGATIVE	NEGATIVE TO CONTROL PANEL CLOSE & RECLOSE	NEGATIVE TO CONTROL PANEL	
3	RED	.....	R	RED	.....	CØ 115V	X1	CØ	.....	NOTE 2	TRIP	TRIP CONTROL SY	
4	GREEN	.....	G	GREEN	.....	BØ 115V	X1	BØ	(GRD)	NOTE 2	GREEN LIGHT	GREEN LIGHT	
5	ORANGE	.....	O	ORANGE	.....	AØPOL	Y1		(GRD)	NOTE 2	CLOSE	CLOSE CONTROL SY	
6	BLUE	.....	BU	BLUE	.....	AØ BØ	Y1-Y3				RECLOSE INITIATE 52/b	RED LIGHT	
7	WHITE	BLACK	W-BK	WHITE	BLACK	.....	.....				TRIP - NEGATIVE	ALARM OR SUPPLY IND AS NEEDED	
8	RED	BLACK	R-BK	RED	BLACK	CØ67V	X2				CONTROL SY. TRIP Y/A (43R)	TRIP (RELAY)	
9	GREEN	BLACK	G-BK	GREEN	BLACK	BØ67V	X2				RECLOSE NEGATIVE	ALARM OR SUPPLY IND AS NEEDED	
10	ORANGE	BLACK	O-BK	ORANGE	BLACK	CØPOL	Y3				RECLOSE RESET 52/a	ALARM OR SUPPLY IND AS NEEDED	
11	BLUE	BLACK	BU-BK	BLUE	BLACK	BØ CØ	Y3-Y1				RECLOSE INITIATE 52/b	B6 (LOOKOUT)	
12	BLACK	WHITE	BK-W	BLACK	WHITE	AØ67V	X2				POSITIVE TO RELAY PANEL CS. TRIP & RELAY TRIP	B6 (LOOKOUT)	
							12/C						
CONDUCTOR	BASE	TRACER	ABBREV.	CONTROL WITH COMMON TRIP & CLOSE DC (POS) & (NEG) (NOTE 1)				CONTROL WITH SEPARATE TRIP #1, TRIP #2 AND CLOSE DC. (NOTE 1)				2 CABLES (1) CLOSE & TRIP#1 (2) CLOSE & TRIP#2	
1	BLACK	.....	BK	BLACK	.....	BK	POSITIVE TO RELAY & CONTROL PANEL				POSITIVE TO TRIP#2		
2	WHITE	.....	W	WHITE	.....	W	NEGATIVE TO RELAY & CONTROL PANEL				NEGATIVE TO TRIP#2		
3	RED	.....	R	RED	.....	R	RELAY & CONTROL TRIP				TRIP#1 (RELAY)		
4	GREEN	.....	G	GREEN	.....	G	GREEN LIGHT				TRIP#2 (RELAY)		
5	ORANGE	.....	O	ORANGE	.....	O	RELAY & CONTROL CLOSE				ALARM OR SUPPLY IND AS NEEDED		
6	BLUE	.....	BU	BLUE	.....	BU	RECLOSE INITIATE 52/b				ALARM OR SUPPLY IND AS NEEDED		
7	WHITE	BLACK	W-BK	WHITE	BLACK	W-BK	ALARM OR SUPPLY IND AS NEEDED				ALARM OR SUPPLY IND AS NEEDED		
8	RED	BLACK	R-BK	RED	BLACK	R-BK	ALARM OR SUPPLY IND AS NEEDED				ALARM OR SUPPLY IND AS NEEDED		
9	GREEN	BLACK	G-BK	GREEN	BLACK	G-BK	ALARM OR SUPPLY IND AS NEEDED				ALARM OR SUPPLY IND AS NEEDED		
10	ORANGE	BLACK	O-BK	ORANGE	BLACK	O-BK	RECLOSE RESET 52/b				ALARM OR SUPPLY IND AS NEEDED		
11	BLUE	BLACK	BU-BK	BLUE	BLACK	BU-BK	RECLOSE INITIATE 52/b				ALARM OR SUPPLY IND AS NEEDED		
12	BLACK	WHITE	BK-W	BLACK	WHITE	BK-W	ALARM OR SUPPLY IND AS NEEDED				ALARM OR SUPPLY IND AS NEEDED		

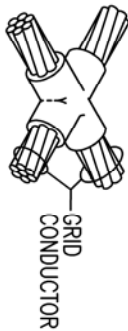
NOTE:  
 1. COLORS TO BE USED WHEN PRACTICAL.  
 2. WHEN PARALLELING 4 C USE RED WITH BLACK-  
 3. K2 METHOD 1 DOES NOT APPLY.  
 THESE CIRCUITS SHALL BE K1 METHOD 1 ONLY.

THE BELOW LISTED COLOR CODE FOR CURRENTS AND POTENTIAL PHASE IDENTIFICATION SHALL BE SUBSTITUTED FOR THE ABOVE ON THIS PROJECT				REMARKS
PHASING	K1	K2		
AØ	.....	.....		
BØ	.....	.....		
CØ	.....	.....		
NEUT	.....	.....		

## COLOR CODING OF RELAY & CONTROL CABLE



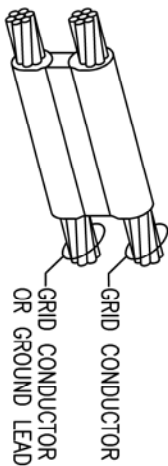
SCALE	DATE	DRAWING NUMBER	REVISION
NA	Nov-12	ES-101	A
DATE BY	DATE BY	CONTRACT NO.	SHEET NO.
BEL	JCC	SEE PROJECT	1
APPROV BY	PMO		



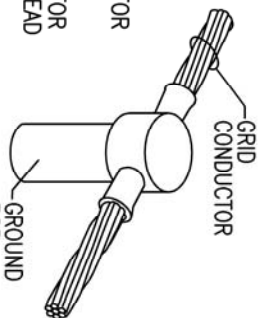
TYPE "A"



TYPE "B"

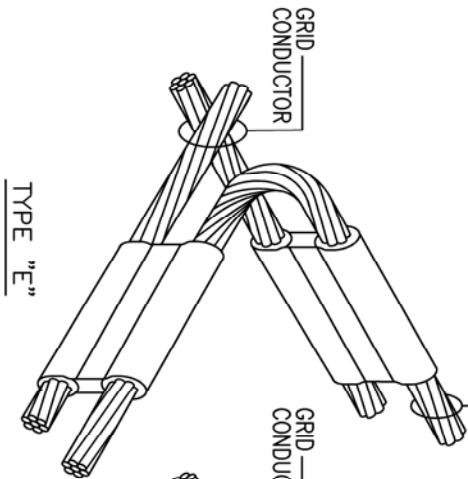


TYPE "C"

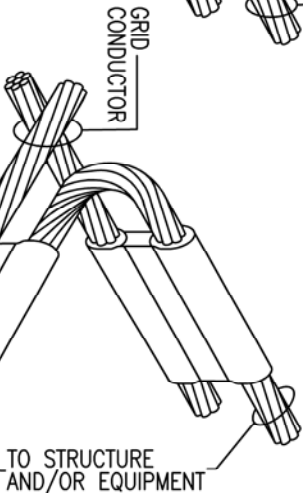


TYPE "D"

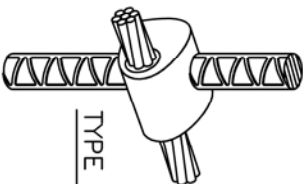
TO STRUCTURE  
AND/OR EQUIPMENT



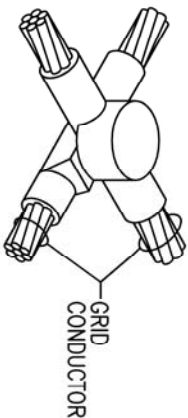
TYPE "E"



TYPE "F"



TYPE "H"



TYPE "G"

## GROUND GRID CONNECTIONS

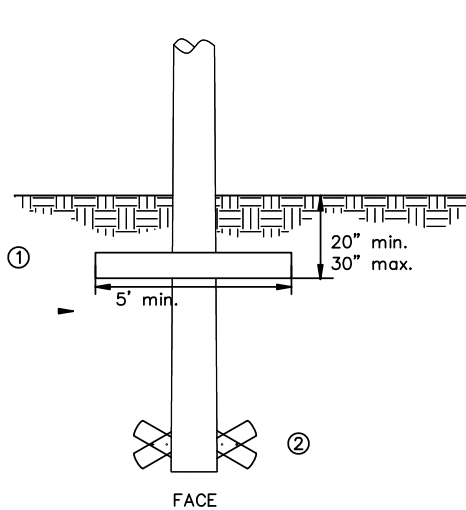
- GROUNDING NOTES:
1. FOR APPLICATION OF EXOTHERMIC CONNECTIONS, REFER TO THESE DETAILS AND GROUND GRID PLAN.
  2. GROUND GRID AND GROUND LEAD CONDUCTOR SIZE TO BE AS SPECIFIED ON SUBSTATION GROUND PLAN.
  3. STRUCTURE AND EQUIPMENT GROUND LEADS TO BE CONNECTED TO GROUND GRID AT LOCATIONS SHOWN SUBSTATION GROUND PLAN.
  4. TYPE A AND TYPE G ARE INTERCHANGEABLE AND EQUAL CONNECTION.
  5. CONTRACTOR SHALL DETERMINE QUANTITIES AND ARRANGEMENT TO MATCH GROUND GRID PLAN; SEE PROJECT DRAWINGS AND DETAIL SPECIFICATIONS.

GROUND GRID  
CONNECTIONS

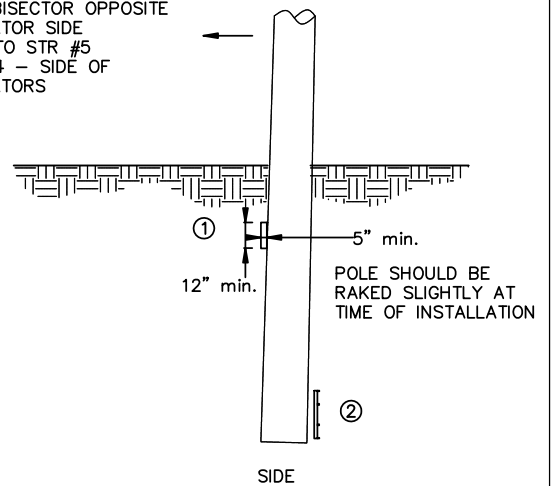


ENGINEERS  
ARCHITECTS  
CONSULTANTS

SCALE	DATE	DRAWING NUMBER	REVISION
1/4" = 1'	Oct-12	ES-102	A
DATE BY	DATE BY	SEE PROJECT	SHEET NO.
BEL	JCC		1
APPROVED BY	PROJECT NO.		
PMD			



DIRECTION OF TENSION  
 STR #1 - BISECTOR OPPOSITE  
 INSULATOR SIDE  
 STR #6 - TO STR #5  
 STR #3 & 4 - SIDE OF  
 INSULATORS



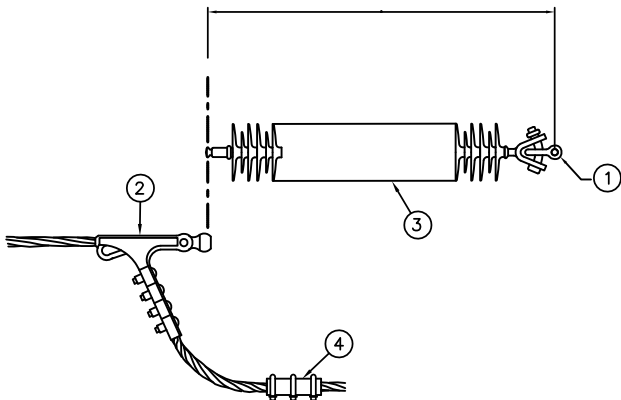
NOTES:

1. WOODEN POLE KEY, #2 ROUGH PINE, PRESSURE TREATED. PER SPECIFICATION "C2" OF THE AMERICAN WOOD PRESERVERS STANDARDS, WITH FINAL RETENTION SHALL BE 10-LBS PER CUBIC FOOT,
2. STEEL POLE KEY SHALL BE EXPANSION TYPE , CHASE P4817 OR ENGINEER APPROVED EQUAL.
3. IN THE EVENT A WOODEN POLE KEY IN UNAVAILABLE, USE EITHER A STEEL POLE KEY OR A CONCRETE POLE KEY IN ITS PLACE.

POLE KEY		
		PK-1

LIST OF MATERIALS

DWG. REF.	1	1W	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	1	—	Anchor Shackle, 25K	HPS AS25WBNK
2	1	1	Clamp, Bolted Deadend, 50K	HPS SD112S
3	1	—	Insulator, Deandend, 50K	NGK 301—SE280—YJ
4	1	—	Jumper Connector, Parallel Groove	HPS LCU70066



69 kV LINE SWITCHES

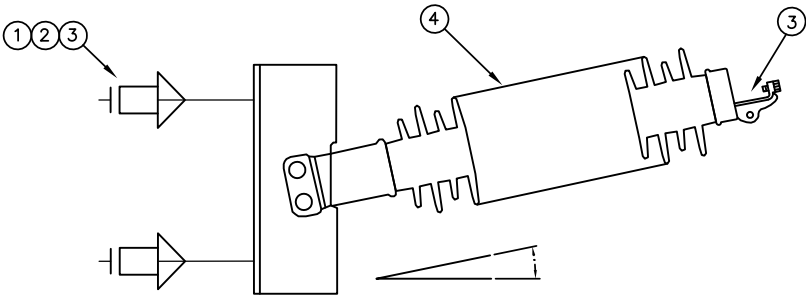
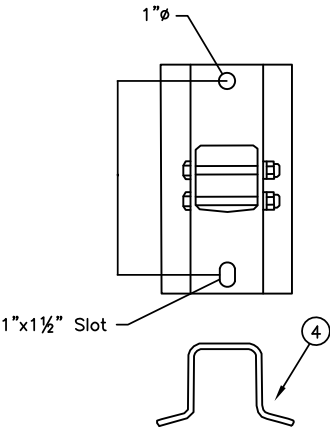
INSULATOR ASSEMBLIES

POLYMER INSULATORS  
DEADEND

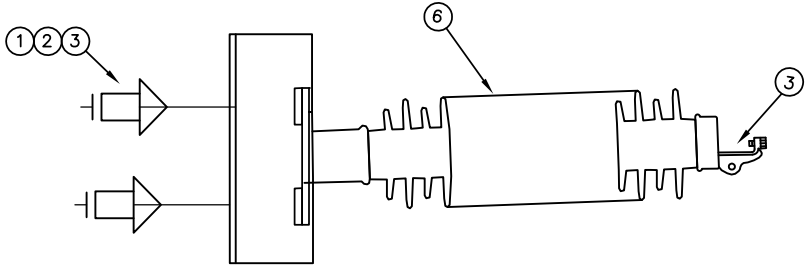
1	Issued for Construction	02/07	JAN 2014	TM—1
NO.	REVISION	DATE		

# LIST OF MATERIALS

DWG. REF.	QTY	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	2	3/4" Bolt, Machine, by req'd length	HPS 8918
2	2	3/4" Locknut, MF Type	HPS 3513
3	1	Clamp, Post Suspension	HPS TSC150
4	1	Insulator, Horiz. Post w/ Gain Base - Wood	NGK L2-SL-311-13
5	2	Washer, Flat, 4"sqx1/4",13/16"hole	HPS 681812
6	1	Insulator, Horiz. Post w/ Flat Base - Steel	NGK L2-SL-311-15



WOOD POLE ATTACHMENT



STEEL POLE ATTACHMENT

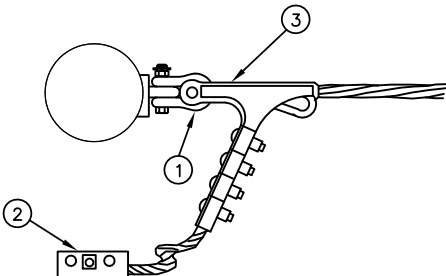
69 kV LINE SWITCHES

INSULATOR ASSEMBLIES

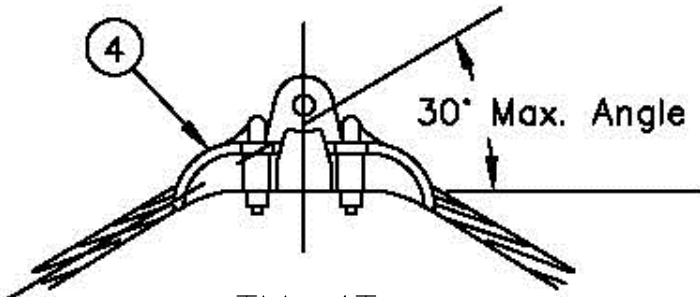
HORIZONTAL POST INSULATOR  
WITH CLAMP

1	Issued for Construction	02/07	JAN 2014	TM-3
NO.	REVISION	DATE		

			LIST OF MATERIALS	
DWG. REF.	TM-4 QTY	TM-4T QTY	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	1	1	Anchor Shackle, 25k	HPS AS25BNK
2	1	—	Clamp, 3 Bolt, 6"	HPS 6461
3	1	—	Clamp, Bolted Deadend (3/8" EHS)	HPS SWDE46N
4	—	1	Clamp, Suspension (to 30 Deg)	HPS MS46N



TM-4

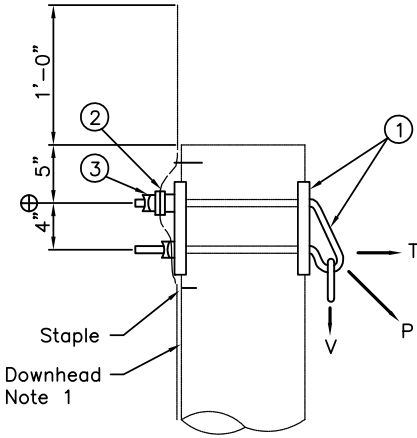


TM-4T

69 kV LINE SWITCHES	
O.H.G.W. ASSEMBLIES	
OHGW ASSEMBLY DEADEND	

1	Issued for Construction	02/07	JAN 2014	TM-4(T)
NO.	REVISION	DATE		

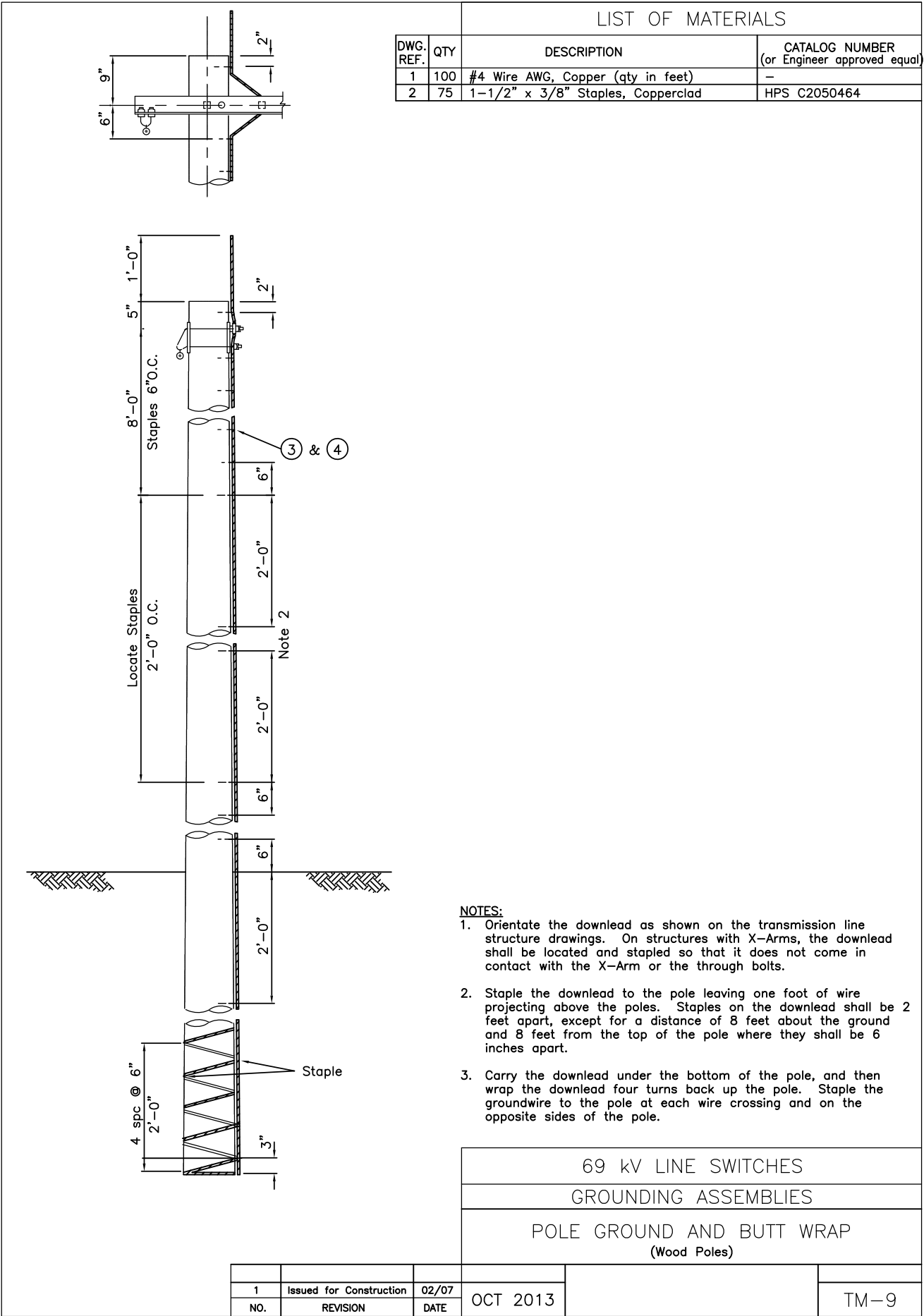
LIST OF MATERIALS			
DWG. REF.	QTY.	DESCRIPTION	CATALOG NUMBER (or Engineer Approved Equiv.)
1	1	Support, Double Bolt OHGW, 5/8" d.	HPS 5433
2	1	5/8" Clamp, Groundwire + 1 nut	AMP 81416-3
3	2	5/8" Locknut, MF Type	HPS 35-12



NOTES:

1. For placement of downlead and staples see respective structure drawings and drawing TM-9.

			O.H.G.W. SUPPORT ASSEMBLY	
			DOUBLE BOLT	
			Aug., 1986	TM-6
NO.	REVISION	DATE		



LIST OF MATERIALS			
DWG. REF.	QTY	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	100	#4 Wire AWG, Copper (qty in feet)	-
2	75	1-1/2" x 3/8" Staples, Copperclad	HPS C2050464

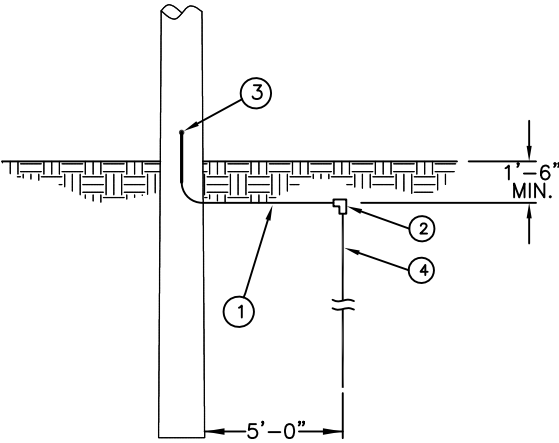
NOTES:

1. Orientate the download as shown on the transmission line structure drawings. On structures with X-Arms, the download shall be located and stapled so that it does not come in contact with the X-Arm or the through bolts.
2. Staple the download to the pole leaving one foot of wire projecting above the poles. Staples on the download shall be 2 feet apart, except for a distance of 8 feet about the ground and 8 feet from the top of the pole where they shall be 6 inches apart.
3. Carry the download under the bottom of the pole, and then wrap the download four turns back up the pole. Staple the groundwire to the pole at each wire crossing and on the opposite sides of the pole.

69 kV LINE SWITCHES			
GROUNDING ASSEMBLIES			
POLE GROUND AND BUTT WRAP (Wood Poles)			
1	Issued for Construction	02/07	OCT 2013
NO.	REVISION	DATE	
			TM-9

# LIST OF MATERIALS

DWG. REF.	QTY	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	10	#6or#4 Wire AWG, copper/copperclad	-
2	1	Clamp, Ground Rod, 3/4" bronze (90°)	HJ Enterprises AS-1084-005
3	1	Connector w/ 1/2" Bolt	Blackburn JAB34H
4	1	Rod, Ground, 3/4" x 8'-0", Copperclad	Eritech 613480



## NOTES:

- See Steel Pole Fabrication Drawings for locations of 1/2" Ground Connectors.

69 kV LINE SWITCHES

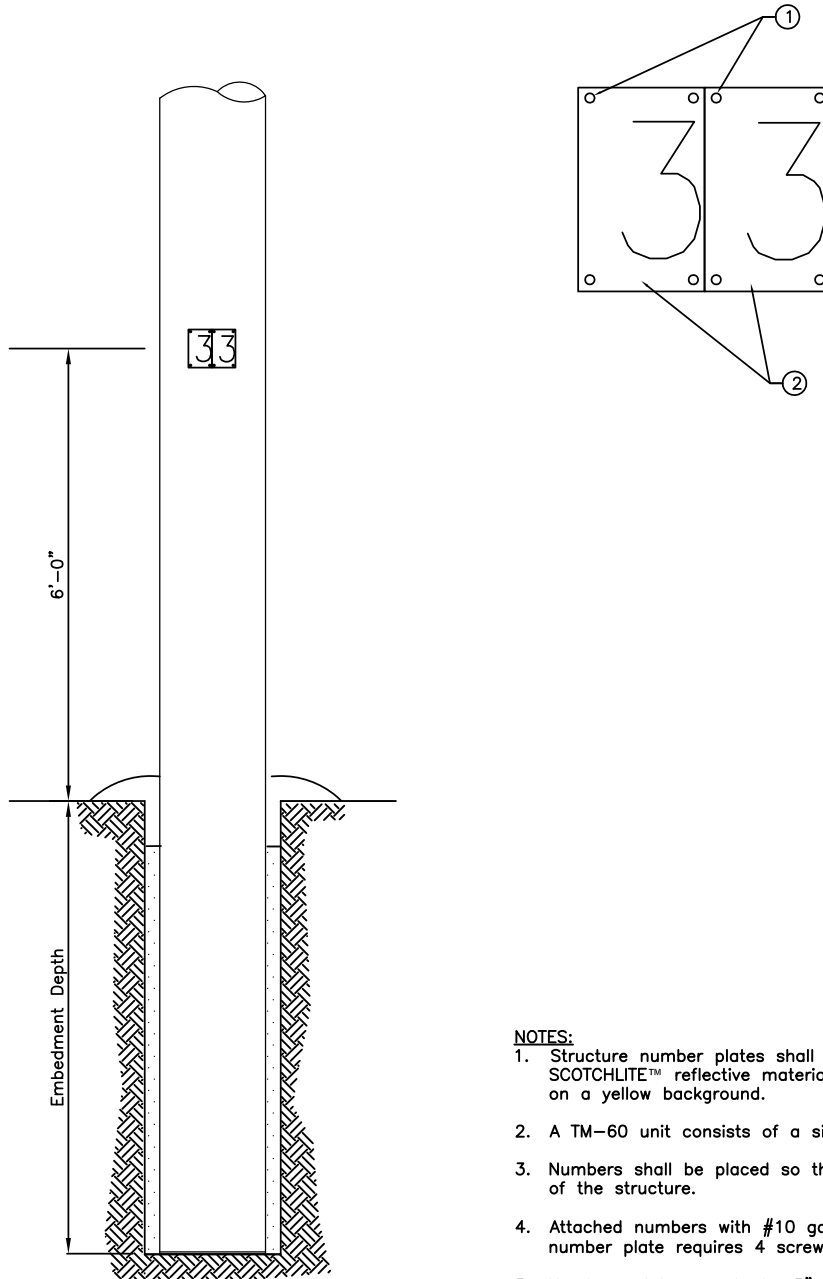
GROUNDING ASSEMBLIES

STEEL POLE STRUCTURE GROUND

1	Issued for Construction	02/07	OCT 2013	TM-9S
NO.	REVISION	DATE		

# LIST OF MATERIALS

DWG. REF.	QTY	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	4	#10 Galvanized 3/4" Screws	Dottie DOTRMDS103234
2	1	Structure Number	REF3T-0 thru REF3T-9



## NOTES:

- Structure number plates shall be aluminum with a 3M™ SCOTCHLITE™ reflective material finish. Numbers shall be black on a yellow background.
- A TM-60 unit consists of a single digit.
- Numbers shall be placed so they are visible from the road side of the structure.
- Attached numbers with #10 galvanized 3/4" screws. Each number plate requires 4 screws, one in each corner.
- Numbers plates are to be 3" tall with 4 pre-drilled 1/8" holes, one in each corner.

69 kV LINE SWITCHES

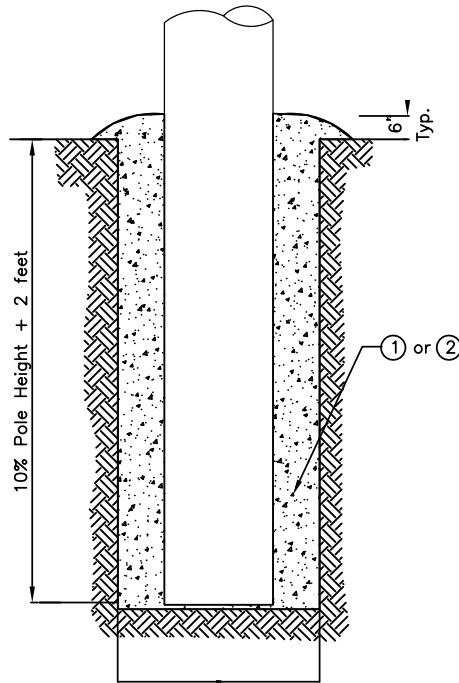
STRUCTURE IDENTIFICATION ASSEMBLIES

STRUCTURE NUMBER

1	Issued for Construction	02/07	OCT 2013	TM-60
NO.	REVISION	DATE		

# LIST OF MATERIALS

DWG. REF.	A	C	DESCRIPTION	CATALOG NUMBER (or Engineer approved equal)
1	—	1	Concrete, 3500 psi (See Spec., Sec.13)	—
2	1	—	Imported Backfill (Note 1 & 2)	—



## NOTES:

1. Gradation for imported backfill is shown in the table. The aggregate shall be well mixed in a stock pile, and pneumatically placed and tamped in 6-inch lifts.
2. The specification for aggregate give in the table is minimum. In areas where smaller fines are available at comparable cost, it is recommended that the engineer specify smaller fines.
3. Well tamped native backfill should be placed around the pole from 1" below G.L. up to G.L. Bank native soil against pole 1" above G.L.

## GRADATION FOR IMPORTED GRANULAR BACKFILL

SIZE OF GRAVEL (OR) CRUSHED STONE	SIZE OF MESH (in)
100% By Weight to pass 1" screen	1.00
60% – 90% By Weight to pass 1/2" screen	0.500
40% – 60% By Weight to pass no. 4 screen	0.187
25% – 50% By Weight to pass no. 8 screen	0.0937
20% – 40% By Weight to pass no. 16 screen	0.0469
15% – 30% By Weight to pass no. 40 screen	0.0165

69 kV LINE SWITCHES

FOUNDATION UNITS

POLE BACKFILL

1	Issued for Construction	02/07	OCT 2013	TM-101
NO.	REVISION	DATE		