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GENERAL

1. Purpose of Construction Standards

The Standards in this book have been prepared for the use of Ameren Corporation personnel concerned with the construction, operation and maintenance of the Company's electric distribution facilities. An understanding of the necessity for these system-wide construction standards is of the greatest importance to the continued expansion of Ameren's facilities.

Standards properly developed and applied accomplish the following objectives.

- a. Establish desired design criteria and performance levels.
- b. Insure uniform, safe and economical construction practices.
- c. Provide information on materials and their proper application.
- d. Minimize engineering and estimating time.
- e. Provide the basis for automated material and labor determination for work request and work order purposes.

2. Scope and Application

Ameren Corporation Standards cover the type of construction and the materials that shall be used for 4kV to 14.4kV distribution systems, outdoor lighting systems, and for 34kV and 69kV subtransmission systems.

The following guidelines shall be followed in applying these Standards.

- a. All new construction shall conform to these standards.
- b. When existing poles are replaced, all construction on the new poles shall conform to these standards.
- c. When additional circuits are installed, or circuits are replaced on existing poles, the arrangement shall conform to the standards as nearly as is reasonable and practical.
- d. Existing lines shall not be rebuilt for the sole purpose of conforming to these standards.

3. Conformance to National, State and Local Codes

Every effort has been made in the development of the Ameren Construction Standards to give proper recognition of and insure conformance to published codes of governmental bodies. All construction covered by the standards in this book meet the minimum requirements of the current edition of the National Electrical Safety Code.

4. Responsibility for Interpretation

Questions concerning the interpretation of these standards shall be directed to the Supervising Engineer in the Distribution Standards Group.

5. Standards Organization – Unitized Assemblies

This standards book is made up of various major sections, some providing basic units of assembly such as insulators, crossarms, guys, etc. Many of these basic units are then further employed as sub-assemblies in other sections, such as the configuration and switch sections of the book. However, there is a practical limit to the number of various combinations of these units for which standard drawings can be developed. As a result, several different standards are required to completely specify the construction for each pole.

6. Computerized Material and Labor Take-Off

Provisions have been incorporated into these standards which, when properly applied, will develop the associated materials, installation labor manhours and total costs by computer. This system of computerized materials take-off is now part of the DOJM system. In DOJM terminology, the Construction Standard bill-of-material is called a macro or supermacro. A major stock number or a labor code is called a comptable unit. Minor stock number for any particular macro are gathered together to form one compatible unit for all minor items on that Construction Standard. Some of the general provisions of the computerized material and labor take-off system are described in the following paragraphs.

a. Standards Numbering System

To provide for computerized material take-off, an eight digit standards numbering system has been developed. A separate number is assigned to each variation of construction and a complete bill of material is listed on the standard for each of the variations covered. This same number with an appropriate bill of materials and associated non-material operations, if any, are recorded on the computer. Specifying the proper eight-digit standard number will, in many instances, be all that is required to obtain the proper materials, labor and costs associated with the installation or removal of the standard. In other cases, one or more adders indicated in the Bill of Materials of the standard will have to be added separately.

b. Adder Items “@”

Where it is not practical to give all the variations of an assembly of different unit standards on one standard sheet, a reminder is given in the Bill of Materials that additional materials are required. This reminder is in the form of an “@” prefixing the standard number, stock number, or wire size specific item which must be specified separately.

c. Wire Size Variable “W”

In cases where the material required on a standard varies with the wire size, a system has been designed to indicate adders to be included with a wire size suffix. See Sheet 3 of this standard for appropriate wire size suffixes. This suffix will automatically provide the proper materials when an adder is called for. The computer selects from a wire size table such items as connectors, deadends, jumper and lead wire, ties, etc. If the adder is not suffixed with an acceptable wire size, DOJM will not allow the DOJM code to be entered.

d. Transformer Standards

Transformers are specified on work requests by their stock number. Materials which vary with the transformer size and type will be automatically specified along with the transformer by the computer. These items, such as leads, connectors and bolts, are indicated by the letter “T” on the transformer standard bill of materials. Other items must be specified by listing the Standard Number for mounting the transformer.

e. Additions and Deletions

Materials may be added to or deleted from a standard by listing them on the line construction work request (NTRY Screen). This may be done either by unit standard numbers or by stock numbers. This will be useful in cases such as where a different crossarm size is required, where wire sizes are different, where some items are already installed, etc.

GENERAL

ACCEPTABLE WIRE SIZE SUFFIXES

<u>NEUTRAL</u>			
WIRE	SIZE	SUFFIX	
#6	CU	Bare	6C
#4	CU	Bare	4C
#2	CU	Bare	2C
#1/0	CU	Bare	10C
#4	ACSR	Bare	4A
#1/0	AAAC	Bare	10A

<u>120/240 VOLTS OPEN WIDE SECONDARY</u>			
WIRE	SIZE	SUFFIX	
2-#6	CU	WP	6W
1-#6	CU	Bare	
2-4#	CU	WP	4W
1-#6	CU	Bare	
2-#2	CU	WP	2W
1-#4	CU	Bare	
2-#4/0	AA	Poly	40P
1-#1/0	AAAC	Bare	

<u>STATIC WIRE</u>			SUFFIX
3#7	AW	Bare	37AW
110.8	ACSR	Bare	110A

<u>COPPERWELD</u>			SUFFIX
#6A	CWC	Bare	6AC
#4A	CWC	Bare	4AC
#2A	CWC	Bare	2AC












<u>2.4kV through 69kV</u>			
WIRE	SIZE	SUFFIX	
#4	ACSR	Bare	4A
#2	ACSR	Bare	2A
#1/0	AAAC	Bare	10A
#3/0	ACSR	Bare	30A
#4/0	ACSR	Bare	40A
335.6	T-2ACSR	Bare	335T2
336.4	ACSR	Bare	336A
477	ACSR	Bare	477A
556.5	AA	Bare	556A
795	AA	Bare	795A
954	AA	Bare	954A
#4	ACSR	Poly	4P
#2	ACSR	Poly	2P
#1/0	AAAC	Poly	10P
336.4	AA	Poly	336P
556.5	AA	Poly	556P
#4	ACSR	TreeWire	4T
#2	ACSR	TreeWire	2T
#1/0	AAAC	TreeWire	10T
336.4	ACSR	TreeWire	336T
556.5	AA	TreeWire	556T
#6	CU	Bare	6C
#4	CU	Bare	4C
#2	CU	Bare	2C
#1/0	CU	Bare	10C
#4/0	CU	Bare	40C
350	CU	Bare	350C
500	CU	Bare	500C

GENERAL

<u>2.4kV through 69kV</u>			
WIRE	SIZE		SUFFIX
#6	CU	WP	6W
#4	CU	WP	4W
#2	CU	WP	2W
#1/0	CU	WP	10W
#4/0	CU	WP	40W
500	CU	WP	500W

1. For wire sizes and voltages not shown, material must be specified separately.

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
	OPEN SOLID BLADE SWITCH (MO)		OPEN BREAKER
	CLOSED SOLID BLADE SWITCH (MO)		CLOSED BREAKER
	OPEN SOLID BLADE SWITCH (IL)		OPEN RECLOSER
	CLOSED SOLID BLADE SWITCH (IL)		CLOSED RECLOSER
	CLOSED FUSED SWITCH		OPEN SECTIONALIZER
	OPEN FUSED SWITCH		CLOSED SECTIONALIZER
	OPEN SPLIT		REGULATOR
	CLOSED SPLIT		GENERATOR
	OVERHEAD TRANSFORMER (1PH)		CAPACITOR
	OVERHEAD TRANSFORMER (3PH)		NETWORK PROTECTOR
	PADMOUNT TRANSFORMER (1PH)		KEY INTERLOCK
	PADMOUNT TRANSFORMER (3PH)		OPEN LOAD BREAK ELBOW
	SPACER CABLE		CLOSED LOAD BREAK ELBOW
	OPEN CIRCUIT SWITCH PAD		RADIO CONTROL SYMBOL
	SWITCH PAD (MO)		STEPDOWN TRANSFORMER
	SWITCH PAD (IL)		LIGHTING SUBSTATION
	MANHOLE		MAJOR CUSTOMER
	HANDHOLE		CUSTOMER SUBSTATION MANUAL
	JUNCTION BOX (4 WAY)		CUSTOMER SUBSTATION AUTOMATIC
	JUNCTION BOX (2 WAY)		PRIMARY METER

<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
	FEEDER ORIGIN		SUBSTATION
	FAULT INDICATOR		DOWN GUY
	CABLE TERMINATION		SPAN GUY
	COMPANY POLE		TRANSMISSION TOWER
	FOREIGN POLE		TRANSMISSION TOWER (FOREIGN)
	NETWORK BUS POSITION		DEADEND
	ENCLOSED ROOM		JUNCTION
	VAULT		CABLE SPLICE
	REACTOR		WIRE/PHASE CHANGE
	CT BANK		MUNICIPAL STREETLIGHT
	CT ATTACHMENT		OVERHEAD FED STREETLIGHT
	POTENTIAL TRANSFORMER		UNDERGROUND FED STREETLIGHT
	COUPLING CAPACITOR		SUBSTATION TRANSFORMER
	REACTOR		METER ATTACHMENT
	HIGH SPEED GROUND SWITCH		RELAY ATTACHMENT
	WAVE TRAP		MISC EQUIPMENT (REPEATER)
	LIGHTNING ARRESTER		MISC EQUIPMENT (MCC /CRM)
	GROUND		AIRCRAFT WARNING MARKER
	DISTRICT TIE		



POLES

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POLES

Wood Pole Data

02 00 01 01

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This standard covers stock codes, weights, and loading criteria for wood poles, in particular Southern Yellow Pine (SYP) and Douglas Fir (DF). Those are the standard pole species for the Ameren Distribution System.

The weight and circumference in these tables are approximate and should be used as a guide for shipping and handling purposes. Poles are a natural resource and may vary in weight and size within their respective class.

Wood poles, wood cross-arms, and empty non-returnable wood reels removed from the Ameren System shall, whenever possible, be disposed of on the job or taken back to the Operating Center for disposal. However, Ameren or contractor crews may provide these to a land owner upon such landowner's request. In doing so, all Construction crews shall abide by Ameren's Corporate Procedure "Investment Recovery and Accommodation Sale Policy". As required in the procedure, the recipient(s) receiving wood poles or cross-arms are required to sign Form 5809NS. Construction crews may not provide landowner materials until Form 5809NS is approved by Ameren Supervision.

Wood pole sizes have been standardized. The sizes in the table are the only available sizes for their respective heights.

Table 1 - SYP Stock Codes

Height	Class					
	1	3	5	H1	H2	H4
30'	41 02 301	41 02 303	41 02 305	-	-	-
35'	41 02 351	41 02 353	41 02 355	-	-	-
40'	41 02 401	41 02 403	-	-	-	-
45'	41 02 451	41 02 453	-	-	41 02 245	45 02 445
50'	41 02 501	-	-	-	41 02 250	-
55'	41 02 551	-	-	41 02 155	41 02 953	41 02 855
60'	41 02 601	-	-	41 02 160	41 02 954	41 02 460
65'	41 02 651	-	-	41 02 165	41 02 988	41 02 465
70'	41 02 701	-	-	-	41 02 270	41 02 470
75'	41 02 751	-	-	-	41 02 275	41 02 475
80'	41 02 801	-	-	41 02 180	41 02 280	41 02 480
85'	41 02 851	-	-	41 02 185	41 02 285	-
90'	41 02 901	-	-	-	-	-

Table 2 - DF Stock Codes

Height	Class						
	1	H1	H2	H3	H4	H5	H6
50'	41 42 001	-	41 42 194	41 42 195	41 42 196	-	-
55'	41 42 002	41 42 197	41 42 198	41 42 199	41 42 200	-	-
60'	41 42 003	41 42 193	41 42 201	41 42 202	41 42 203	41 42 204	-
65'	41 42 004	41 42 077	41 42 205	41 42 206	41 42 207	41 42 208	-
70'	41 42 005	41 42 085	41 42 209	41 42 210	41 42 184	41 42 211	41 42 187
75'	41 42 049	41 42 078	41 42 101	41 42 212	41 42 213	41 42 214	41 42 215
80'	41 42 062	41 42 079	41 42 094	41 42 216	41 42 185	41 42 217	41 42 188
85'	41 42 063	41 42 075	41 42 090	41 42 218	41 42 219	41 42 220	41 42 221
90'	41 42 058	41 42 076	41 42 095	41 42 222	41 42 223	41 42 224	41 42 183
95'	41 42 035	41 42 084	41 42 097	41 42 225	41 42 186	41 42 226	41 42 189
100'	41 42 032	41 42 081	41 42 098	41 42 227	41 42 228	41 42 229	41 42 190
105'	41 42 067	41 42 096	41 42 091	41 42 230	41 42 231	41 42 232	41 42 233
110'	41 42 080	41 42 089	41 42 099	41 42 234	41 42 235	41 42 236	41 42 191
115'	41 42 086	41 42 088	41 42 100	41 42 237	41 42 238	41 42 239	41 42 240
120'	41 42 074	41 42 092	41 42 093	41 42 241	41 42 242	41 42 243	41 42 192
125'	-	-	41 42 244	-	-	-	-

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
8	10/01/20	KR	Title change; STK #s added; Modified disposal note; Comb. W/ 02 00 03 01
7	02/15/12	MJ	




POLES

Wood Pole Data

02 00 01 01

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Table 3 - Loading, Diameters and Weight

Wood Pole		Southern Yellow Pine & Douglas Fir					
Class		5	3	1	H1	H2	
Min. Top Circ. Ct(in)		19	23	27	29	31	
Horiz. Load (lbs) 		1,900	3,000	4,500	5,400	6,400	
Pole Height (Ft)	Class	SYP			DF		
		Min. Circ. (in)		Average Weight (lbs)	Min. Circ. (in)		Average Weight (lbs)
		Ground Line-Cg	6' from butt- Cg		Ground Line-Cg	6' from butt- Cg	
30	1	36.9	36.5	1,020	36.9	36.5	1,062
	3	32.4	32.0	770	32.4	32.0	851
	5	27.9	27.5	580	27.9	27.5	563
35	1	39.2	39.0	1,310	39.2	39.0	1,292
	3	34.2	34.0	985	34.2	34.0	1,040
	5	29.2	29.0	740	29.2	29.0	698
40	1	41.0	41.0	1,630	41.0	41.0	1,598
	3	36.0	36.0	1,225	36.0	36.0	1,242
45	1	42.8	43.0	1,965	42.8	43.0	1,940
	3	37.3	37.5	1,475	37.3	37.5	1,526
50	H2	-	-	-	-	-	-
	H1	-	-	-	-	-	-
	1	44.6	45.0	2,330	44.6	45.0	2,237
55	H2	-	-	-	-	52.0	3,294
	H1	-	-	-	-	49.5	2,808
	1	45.9	46.5	2,715	45.9	46.5	2,552
60	H2	-	-	-	52.5	54.0	3,852
	H1	-	-	-	49.6	51.0	3,380
	1	47.2	48.0	3,130	47.2	48.0	2,885
65	H2	-	-	-	51.0	55.5	4,320
	H1	-	-	-	47.8	52.5	3,821
	1	48.5	49.5	3,555	48.5	49.5	3,240
70	H2	-	-	-	55.2	57.0	4,815
	H1	-	-	-	52.2	54.0	4,289
	1	49.9	51.0	4,005	49.9	51.0	3,492
75	H2	-	-	-	57.6	59.0	5,297
	H1	-	-	-	53.6	55.5	4,694
	1	51.2	52.5	4,475	51.2	52.5	4,005

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
8	10/01/20	KR	Title change; STK #s added; Modified disposal note; Comb. W/ 02 00 03 01
7	02/15/12	MJ	




POLES

Wood Pole Data


02 00 01 01

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Table 3 - Continued

Wood Pole		Southern Yellow Pine & Douglas Fir					
Class		5	3	1	H1	H2	
Min. Top Circ. Ct(in)		19	23	27	29	31	
Horiz. Load (lbs) 		1,900	3,000	4,500	5,400	6,400	
Pole Height (Ft)	Class	SYP			DF		
		Min. Circ. (in)		Average Weight (lbs)	Min. Circ. (in)		Average Weight (lbs)
		Ground Line-Cg	6' from butt- Cg		Ground Line-Cg	6' from butt- Cg	
80	H2	-	-	-	57.8	60.0	5,841
	H1	-	-	-	53.6	57.0	5,184
	1	52.5	54.0	4,965	52.5	54.0	4,419
85	H2	-	-	-	61.5	61.5	6,413
	H1	-	-	-	56.8	58.5	5,702
	1	53.4	55.0	5,480	53.4	55.0	5,013
90	H2	-	-	-	59.2	63.0	7,011
	H1	-	-	-	56.3	59.5	6,242
	1	54.3	56.0	6,005	54.3	56.0	5,310
95	H2	-	-	-	60.5	64.5	7,628
	H1	-	-	-	57.1	61.0	6,818
	1	55.1	57.0	6,550	55.1	57.0	5,427
100	H2	-	-	-	62.7	65.5	8,240
	H1	-	-	-	59.4	62.0	7,362
	1	56.5	58.5	7,115	56.5	58.5	6,282

DESIGN NOTE(s):

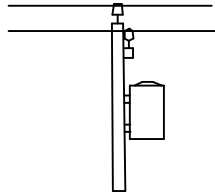
- Alternatives such as laminated wood, steel, and composite poles are available for special applications.
-  Minimum ultimate single point load (lbs) 2 feet from top of pole per ANSI C05.1.

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
8	10/01/20	KR	Title change; STK #s added; Modified disposal note; Comb. W/ 02 00 03 01
7	02/15/12	MJ	

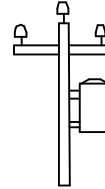
This Standard covers maximum equipment weights for wood poles that are excluded from DCS 02 00 02 01. The values listed in table below are for restrained poles only. **For unrestrained poles divide the listed values by 4.** It will not always be possible to utilize the maximum weights due to other restricting factors. Restricting factors, which can limit the load are the length and rating of gin poles, reef of blocks, load capacity of blocks, existing obstructions and clearances due to circuit configurations. All factors should be considered when determining the equipment weights, which can be installed on a wood pole.

Restrained Pole



THROUGH PRIMARY - LOAD
ON FACE OR BACK OF POLE

Unrestrained Pole



THROUGH PRIMARY - LOAD
ON FACE OR BACK OF POLE.
NO GUY

From Top (ft)	Maximum Equipment Weight (lbs.) on Restrained Pole		
	Class 5	Class 3	Class 1
30 & 35 Feet			
5	1,371	3,124	-
7	1,573	3,586	-
9	1,825	4,159	-
11	2,141	4,881	-
40 & 45 Feet			
5	-	2,670	4,794
7	-	2,959	5,312
9	-	3,296	5,919
11	-	3,696	6,636
13	-	4,172	7,491
50 & 55 Feet			
5	-	-	4,251
7	-	-	4,613
9	-	-	5,022
11	-	-	5,489
13	-	-	6,025
15	-	-	6,542



POLES

Standard Equipment Pole Sizes & Classes

02 00 02 01

1 of 2

Application				Exist Pole		New Pole		
				Ht.	WP Cl.	Ht.	WP Cl.	CP Dia. 2
1. Service poles and extensions on private property				30'	6	35'	3	12"
2. Single Phase Circuit:								
a. Joint Use Construction				35'	6	35'	3	12"
b. Non-Joint Use Construction				35'	6	35'	3	12"
3. Three Phase Circuit:								
a. Joint Use Construction				45'	6	45'	3	12"
b. Non-Joint Use Construction				40'	6	40'	3	12"
4. 16 kV Full Arm Terminal Pole 2				-	5	-	3	14"
4. 16 kV Side Arm Terminal Pole 2				-	4	-	3	14"
13.8 kV Terminal Pole 2				-	4	-	3	14"
34.5 kV Terminal Pole				-	3	-	1	12"/14"
13.2 kV Pole Top Switch				-	3	-	1	-
34.5 kV Pole Top Switch				-	-	-	H2	-
34.5 kV Group Operated Switch 2 3				-	-	-	H2	12"/14"
69 kV Group Operated Switch 2				-	-	-	-	12"/14"
T - L Pole or Cross-Corner Poles (Guying may be necessary)				One Class higher than the line poles.				
Side Arm Poles								
Transformer								
Single		Two	Three					
1-Phase	3-Phase							
> 25 kVA	-	-	-	-	7	-	3	12"
25 kVA	30 kVA	1-25 & 1-10 kVA	3-15 kVA	-	5	-	3	12"
50 kVA	45kVA	1-50 & 1-25 kVA	-	-	5	-	3	14"
75 kVA	75 kVA	-	-	-	5	-	3	14"
100 kVA	112 kVA	1-100 & 1-50 kVA	3-25 kVA	-	5	-	1	14"
167 kVA	150 kVA	1-167 & 1-50 kVA	3-50 kVA	-	3	-	1	14"
250 kVA	225 kVA		3-100 kVA	-	2	-	1	14"
	300 kVA		3-167 kVA	-	2	-	1	14"
	500 kVA		3-250 kVA	-	1	-	H1	14"
			3-333 kVA	-	H1	-	H2	12"/14"

REV	DATE	ENG	DESCRIPTION
5	10/01/20	KR	Added Note 4; converted to new format
4	01/01/20	KR	



POLES

Standard Equipment Pole Sizes & Classes

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Application						Exist. Pole	New Pole	
						Class	WP Class	CP Dia. 2
Two Pole Transformer Platform						3	1	14"
Center Support Pole for Platform Poles						3	1	14"
50 to 300 kVAR Capacitor Bank, 15 kV						5	1	14"
300 to 1200 kVAR Capacitor Bank, 15 kV						4	1	14"
Circuit Reclosers								
34 kV Electronic Recloser						-	H2	12"/14"
12 kV Single Phase Electronic Recloser						5	3	14"
12 kV Three Phase Electronic Recloser						5	1	14"
Voltage Regulators								
Single Phase			Two Or Three Phase					
kVa	Nameplate Amperes		kVa					
	2500 V	7620 V		2500 V	7620 V			
50	200	-	-	-	-	5	1	14"
76.2	-	100	-	-	-	4	1	14"
100	400	-	-	-	-	2	1	12"/14"
114.3	-	150	-	-	-	2	1	12"/14"
167	668	219	50	200	-	1	H2	12"/14"
250	-	328	76.2	-	100	1	H2	12"/14"
333	-	438	3-100	400	-	H1	H2	12"/14"
			3-167	-	219	H1	H2	12"/14"
			250 1	-	328	-	H2	12"/14"
			333 1	-	438	-	H2	12"/14"
			Two Pole Platform			-	-	-
			250	-	328	-	H2	12"/14"
			333	-	428	-	H2	12"/14"

DESIGN NOTE(s):

1. Consider using composite poles on any application candidate for replacement due to wood pole deflection caused by equipment weight.
2. Composite poles listed are the minimum required sizes. For longer and larger poles, contact Standards. Steel and laminated wood poles are also available for these applications.
3. For 34.5V group operated switches H2 wood poles are available for Missouri only.
4. The height and class of poles are determined by the number of conductors, the weight to be suspended, and ground clearance obstructions.

REV	DATE	ENG	DESCRIPTION
5	10/01/20	KR	Added Note 4; converted to new format
4	01/01/20	KR	



POLES

Composite Pole Data

02 00 04 01

1 of 2

This standard covers composite pole stock codes and weights used in Ameren Distribution and Sub-transmission system.

Table 1		Single Layer Composite Poles						
Height (Ft.)	12" Diameter		14" Diameter		15" Diameter		17" Diameter	
	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)
35'	41 35 012	542	41 35 014	917	41 35 015	1015	41 35 017	1253
40'	41 40 012	619	41 40 014	1048	41 40 015	1160	41 40 017	1432
45'	41 45 012	697	41 45 014	1179	41 45 015	1305	41 45 017	1611
50'	41 50 012	774	41 50 014	1310	41 50 015	1450	41 50 017	1790
55'	41 55 012	851	41 55 014	1441	41 55 015	1595	41 55 017	1969
60'	-	-	41 60 014	1572	41 60 015	1740	41 60 017	2148
65'	-	-	41 65 014	1703	41 65 015	1885	41 65 017	2327
70'	-	-	41 70 014	1834	41 70 015	2030	41 70 017	2506
75'	-	-	41 75 014	1965	41 75 015	2175	41 75 017	2685
80'	-	-	-	-	41 80 015	2320	41 80 017	2864
85'	-	-	-	-	41 85 015	2465	41 85 017	3043
90'	-	-	-	-	-	-	41 90 017	3222
95'	-	-	-	-	-	-	41 95 017	3401

Table 2		Dual Layer Composite Poles				
Height (Ft.)	12"/14" Diameter		14"/15" Diameter		15"/17" Diameter	
	35' to 55' = 10ft. Separation 60' to 75' = 15ft. Separation		35' to 55' = 10ft. Separation 60' to 85' = 15ft. Separation		35' to 55' = 10ft. Separation 60' to 95' = 15ft. Separation	
	2	2	2			
	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)
35'	41 35 826	1197	41 35 829	1642	41 35 832	1910
40'	41 40 826	1405	41 40 829	1918	41 40 832	2234
45'	41 45 826	1614	41 45 829	2194	41 45 832	2558
50'	41 50 826	1822	41 50 829	2470	41 50 832	2882
55'	41 55 826	2030	41 55 829	2746	41 55 832	3206
60'	41 60 826	2108	41 60 829	2877	41 60 832	3351
65'	41 65 826	2316	41 65 829	3153	41 65 832	3675
70'	41 70 826	2525	41 70 829	3429	41 70 832	3999
75'	41 75 826	2733	41 75 829	3705	41 75 832	4323
80'	-	-	41 80 829	3981	41 80 832	4647
85'	-	-	41 85 829	4257	41 85 832	4971
90'	-	-	-	-	41 90 832	5295
95'	-	-	-	-	41 95 832	5619

Table 3		Multi Layer Composite Poles				
Height (Ft.)	12"/14"/15" Diameter		14"/15"/17" Diameter		12"/14"/15"/17" Diameter	
	50' to 55' = 10ft. Separation 60' to 100' = 15ft. Separation 2		50' to 55' = 10ft. Separation 60' to 110' = 15ft. Separation 2		50' to 70' = 10ft. Separation 60' to 110' = 15ft. Separation 2	
	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)	Stock Code	Weight (lbs.)
50'	41 50 841	2692	41 50 846	3544	41 50 858	3408
55'	41 55 841	3045	41 55 846	3999	41 55 858	3940
60'	41 60 841	2978	41 60 846	3951	41 60 858	3515
65'	41 65 841	3331	41 65 846	4406	41 65 858	4047
70'	41 70 841	3685	41 70 846	4861	41 70 858	4580
75'	41 75 841	4038	41 75 846	5316	41 75 858	5112
80'	41 80 841	4391	41 80 846	5771	41 80 858	5644
85'	41 85 841	4745	41 85 846	6226	41 85 858	6177
90'	41 90 841	5098	41 90 846	6681	41 90 858	6709
95'	41 95 841	5452	41 95 846	7136	41 95 858	7242
100'	41 10 841	5805	41 10 846	7591	41 10 858	7774
105'	-	-	41 05 846	8046	41 05 858	8306
110'	-	-	41 01 846	8501	41 01 858	8839

DESIGN NOTE(s):

1. The composite poles in these charts are pre-drilled in the factory during fabrication. The poles are drilled to common standard configurations with an internal ground wire. Non-standard applications shall be communicated with the manufacturer for hole drilling locations.

2. 10' separation throughout pole will be an additional stock number. Contact Standards for those numbers. This would need to be applied in limited circumstances to help reduce deflection for larger structures.



POLES

Unguyed Composite Pole

02 00 04 02

1 of 3

This standard covers unguyed composite pole installations with standard configurations. The correct stock number for composite poles is determined by the number of wires, wire weight and tension, line angle, and NESC Grade B safety loading requirements. The tables apply to common applications in good soil without detailed calculations. Other unguyed or partially guyed pole applications will require communication with Standards.

Table 1		150' Ruling Span under NESC Heavy Loading				
1-1/0 AAAC Conductor (Tension = 1,200 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,200 lbs./ cond.)						
Description	Line Angle					
	Tangent	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥125' & <175'					
Pole Diameter (in)	12	12	12	12	14	14
Pole Height (ft)	40	40	40	40	40	45
Stock #	41 40 012	41 40 012	41 40 012	41 40 012	41 40 014	41 45 014
Configuration	03 12 01 **	03 12 01 **	03 12 01 **	03 12 01 **	03 12 01 **	03 12 01 **
Auger Size (in)	24	24	24	24	24	24
Pole Depth (ft)	6	7.5	7.5	7.5	7.5	9.5
Approx. Rake (in)	0	6	12	18	12	22
Backfill Stds	02 20 05 11	02 20 05 11	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 15

Table 2		200' Ruling Span under NESC Heavy Loading				
1-1/0 AAAC Conductor (Tension = 1,400 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,400 lbs./ cond.)						
Description	Line Angle					
	Tangent	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥175' & <225'					
Pole Diameter (in)	12	12	12	12	14	15
Pole Height (ft)	40	40	40	40	40	45
Stock #	41 40 012	41 40 012	42 40 012	43 40 012	41 40 014	41 45 015
Configuration	03 12 01 **	03 12 01 **	03 12 01 **	03 12 01 **	03 12 01 **	03 12 01 **
Auger Size (in)	24	24	24	24	24	30
Pole Depth (ft)	6	7.5	7.5	7.5	7.5	9.5
Approx. Rake (in)	0	8	12	20	14	15
Backfill Stds	02 20 05 11	02 20 05 11	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 15

Table 3		150' Ruling Span under NESC Heavy Loading				
3-556 AAC Conductor (Tension = 3,000 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,200 lbs./ cond.) & Comm.						
Description	Line Angle					
	Tangent	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥125' & <175'					
	Pole Diameter (in)	11	12	14	14/15	14/15
Pole Height (ft)	45	45	45	55	55	55
Stock #	41 45 012	41 45 012	41 45 014	41 55 829	41 55 829	41 55 832
Configuration	03 12 06 **	03 12 06 **	03 12 06 **	03 12 07 **	03 12 07 **	03 12 09 **
Auger Size (in)	24	24	30	30	30	30
Pole Depth (ft)	6	8	8	10.5	10.5	12
Approx. Rake (in)	0	14	26	16	24	20
Backfill Stds	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 12	02 20 05 15	02 20 05 15

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
2	10/01/20	KR	Combined 02 00 04 02, 03, 04, & 05; added Notes 1 & 2
1	10/17/12	MJ	



POLES

Unguyed Composite Pole

02 00 04 02

2 of 3

Table 4		200' Ruling Span under NESC Heavy Loading				
3-556 AAC Conductor (Tension = 3,700 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,400 lbs./ cond.) & Comm.						
Description	Line Angle					
	Tangent	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥175' & <225'					
Pole Diameter (in)	12	14	15	14/15	15/17	15/17
Pole Height (ft)	45	45	45	55	55	55
Stock #	41 45 012	41 45 014	41 45 015	41 55 829	41 55 832	41 55 832
Configuration	03 12 06 **	03 12 06 **	03 12 06 **	03 12 07 **	03 12 07 **	03 12 09 **
Auger Size (in)	24	24	30	30	30	30
Pole Depth (ft)	6	8	8	10.5	10.5	12
Approx. Rake (in)	0	24	22	24	20	28
Backfill Stds	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 12	02 20 05 12	02 20 05 15

Table 5		150' Ruling Span under NESC Heavy Loading				
3-954 ACSR Conductor (Tension = 3,000 lbs./ cond.) & 1-1/0 AAAC Static (Tension = 1,200 lbs./ cond.)						
Description	Line Angle					
	Tangent	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥125' & <175'					
Pole Diameter (in.)	14	12/14	12/14	14/15	15/17	14/15/17
Pole Height (ft)	60	60	60	60	60	65
Stock #	41 60 014	41 60 826	41 60 826	41 60 829	41 60 832	41 65 846
Configuration	03 69 51 01	03 69 52 02	03 69 52 03	03 69 10 01	03 69 10 01	03 69 15 01
Auger Size (in)	24	24	30	30	30	30
Pole Depth (ft)	8	9.5	9.5	11	11	13
Approx. Rake (in)	0	12	22	22	22	18
Backfill Stds	02 20 05 11	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 12	02 20 05 15

Table 6		200' Ruling Span under NESC Heavy Loading				
3-954 ACSR Conductor (Tension = 4,000 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,400 lbs./ cond.)						
Description	Line Angle					
	Tangent	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥175' & <225'					
Pole Diameter (in.)	14	12/14	14/15	15/17	15/17	14/15/17
Pole Height (ft)	60	60	60	60	60	65
Stock #	41 60 014	41 60 826	41 60 829	41 60 832	41 60 832	41 65 846
Configuration	03 69 51 01	03 69 52 02	03 69 52 03	03 69 10 01	03 69 10 01	03 69 15 01
Auger Size (in)	24	24	30	30	30	30
Pole Depth (ft)	8	9.5	9.5	11	11	13
Approx. Rake (in)	0	16	16	20	28	22
Backfill Stds	02 20 05 11	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 12	02 20 05 15

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
2	10/01/20	KR	Combined 02 00 04 02, 03, 04, & 05; added Notes 1 & 2
1	10/17/12	MJ	

Table 7		150' Ruling Span under NESC Heavy Loading				
3-954 ACSR Conductor (Tension = 3,000 lbs./ cond.) & 1-1/0 AAAC Static (Tension = 1,200 lbs./ cond.) 3-556 AAC Conductor (Tension = 3,100 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,200 lbs./ cond.)						
Description	Line Angle					
	Tangent◊2	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥125' & <175'					
Pole Diameter (in.)	14	14/15	15/17	14/15/17	◊1	12/14/15/17
Pole Height (ft)	70	70	70	80	◊1	75
Stock #	41 70 014	41 70 829	41 70 832	41 80 846	◊1	41 75 858
Configuration Stds	03 69 51 01 03 12 05 **	03 69 52 02 03 12 05 **	03 69 52 03 03 12 06 **	03 69 10 01 03 12 06 **	◊1	03 69 15 01 03 12 09 **
Auger Size (in)	24	30	30	30	◊1	30
Pole Depth (ft)	9	9	10.5	10.5	◊1	14
Approx. Rake (in)	0	20	24	30	◊1	30
Backfill Stds	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 12	◊1	02 20 05 15

Table 8		200' Ruling Span under NESC Heavy Loading				
3-954 ACSR Conductor (Tension = 4,000 lbs./ cond.) & 1-1/0 AAAC Static (Tension = 1,400 lbs./ cond.) 3-556 AAC Conductor (Tension = 3,700 lbs./ cond.) & 1-1/0 AAAC Neutral (Tension = 1,400 lbs./ cond.)						
Description	Line Angle					
	Tangent ②	Fixed		Floating		Deadend Corner
	≤1°	>1° & ≤10°	>10° & ≤20°	>20° & ≤40°	>40° & ≤60°	>60° & ≤90°
	Span Length ≥175' & <225'					
Pole Diameter (in.)	14	12/14	12/14/15	12/14/15/17	①	①
Pole Height (ft)	70	70	70	80	①	①
Stock #	41 70 014	41 70 829	41 70 841	41 80 858	①	①
Configuration Stds	03 69 51 01 03 12 06 **	03 69 52 02 03 12 06 **	03 69 52 03 03 12 06 **	03 69 10 01 03 12 07 **	①	①
Auger Size (in)	24	30	30	30	①	①
Pole Depth (ft)	9	10.5	10.5	12	①	①
Approx. Rake (in)	0	26	24	30	①	①
Backfill Stds	02 20 05 11	02 20 05 12	02 20 05 12	02 20 05 12	①	①

DESIGN NOTE(s):

- ① The loadings exceed composite pole limits. Call Standards to discuss other options.
- ② If OPGW is used at least a 15" pole will need to be used in tangent application.

INSTRUCTION(s):

The standard setting depth is 10% of the pole length plus 2 feet for class 1 and smaller poles and 10% of the pole length plus 3.5 feet for class H1 and larger. The setting depth of the pole in average and poor soil should be increased by 12 inches. Soil type shall be verified by Operating Centers.

The burial depth for composite poles changes from application to application. Composite poles are unlike a guyed wood pole due to certain forces being unaccounted for with guying. Here is a standard burial depth for composite poles and forces associated with the pole.

- 10% + 2' is used for tangent applications and Storm Structures for storm hardening
- 10% + 3.5' is used for line angles up to 20°, Switch applications, and Super Storm Structures
- 10% + 5' is used for line angles from 20° to 60°
- 10% + 6.5' is used for line angles from 60° to 90°

Additional setting depth is required in poor soil conditions. If poor or swampy soil conditions are visible then an additional 2' of burial depth will be required for embedment. Ameren does not have standards for soil conditions so this will be directly based on the Engineers judgement or best practice.

For swamp areas or poor soil conditions, utilize bearing plates at the bottom of the pole (Stock # 23 67 140).

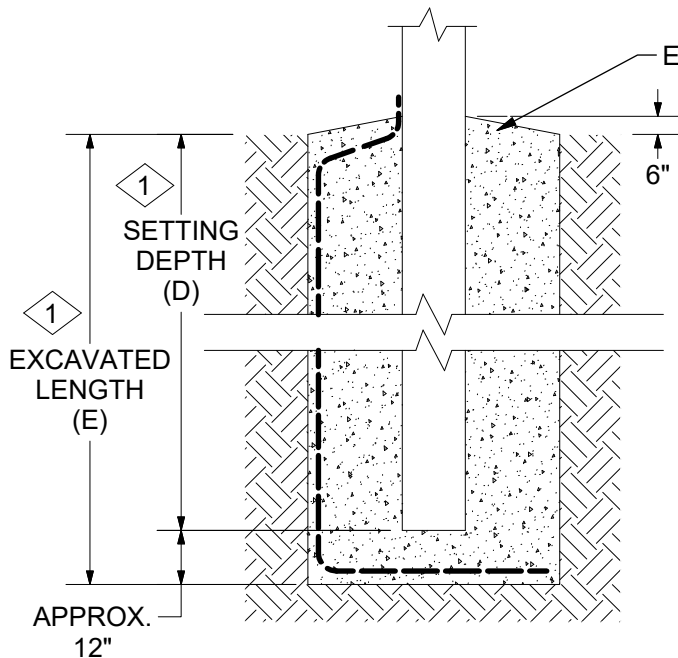
For backfilling procedures refer to DCS 02 20 05 **.

Length of Pole (ft)	Wood Pole - Class 1 & Smaller Poles					Wood Pole - Class H1 & Larger Poles				
	Setting Depth in Feet					Setting Depth In Feet				
	In Good Soil	In Solid Rock Where Depth of Soil is to Top of Rock:				In Good Soil	In Solid Rock Where Depth of Soil is to Top of Rock:			
6 ft		4 ft	2 ft	0 ft	6 ft		4 ft	2 ft	0 ft	
30	5.0	5.0	5.0	4.5	3.5	-	-	-	-	-
35	5.5	5.5	5.5	5.0	4.0	-	-	-	-	-
40	6.0	6.0	6.0	5.0	4.0	-	-	-	-	-
45	6.5	6.5	6.5	5.5	4.5	8.0	8.0	8.0	6.5	5.5
50	7.0	7.0	7.0	5.5	4.5	8.5	8.5	8.5	7.0	5.5
55	7.5	7.5	7.5	6.0	5.0	9.0	9.0	9.0	7.5	6.0
60	8.0	8.0	8.0	6.0	5.0	9.5	9.5	9.5	7.5	6.0
65	8.5	8.5	8.5	6.5	5.5	10.0	10.0	9.5	8.0	6.5
70	9.0	9.0	8.5	6.5	6.0	10.5	10.5	10.0	8.5	7.0
75	9.5	9.5	8.5	7.0	6.0	11.0	11.0	10.0	8.5	7.0
80	10.0	10.0	9.0	7.0	6.5	11.5	11.5	10.5	9.0	7.5
85	10.5	10.5	9.0	7.5	7.0	12.0	11.5	10.5	9.0	7.5
90	11.0	11.0	9.0	7.5	7.0	12.5	12.0	10.5	9.0	7.5
95	11.5	11.0	9.0	8.0	7.0	13.0	12.5	11.0	9.5	8.0
100	12.0	11.5	9.5	8.5	7.5	13.5	12.5	11.0	9.5	8.0
105	12.5	12.0	10.0	9.5	7.5	14.0	12.5	11.0	9.5	8.0
110	13.0	12.2	10.5	10.0	8.0	14.5	12.5	11.5	10.0	8.0
115	13.5	12.0	11.0	10.0	8.5	15.0	13.0	12.0	10.5	9.0
120	14.0	12.0	11.0	10.0	9.0	15.5	13.0	12.0	0.5	9.5
D = (L/10) + 2 Where D = Setting Depth (ft.) in good soil and L = Pole Length (ft.)						D = (L/10) + 3.5 Where D = Setting Depth (ft.) in good soil and L = Pole Length (ft.)				
E = D + 12", where E = Excavated Length										

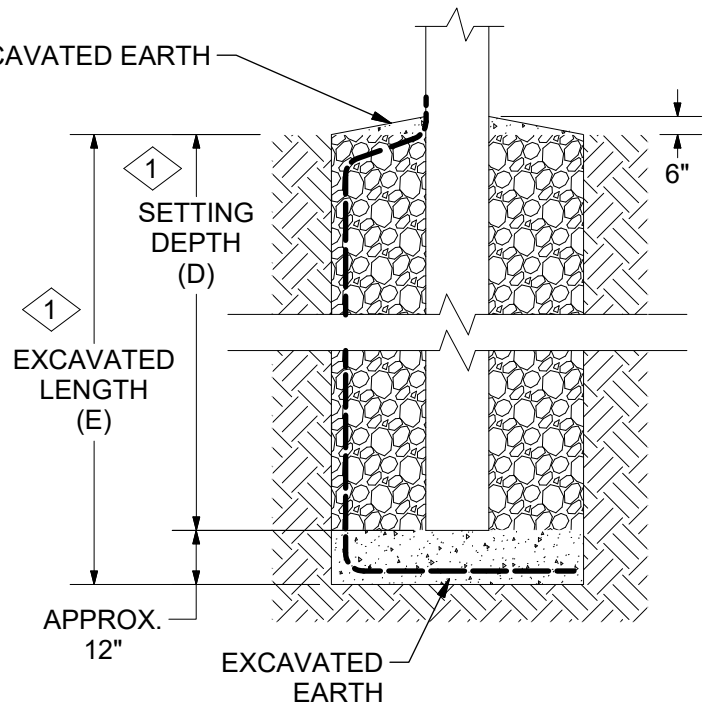
INSTRUCTION(s):

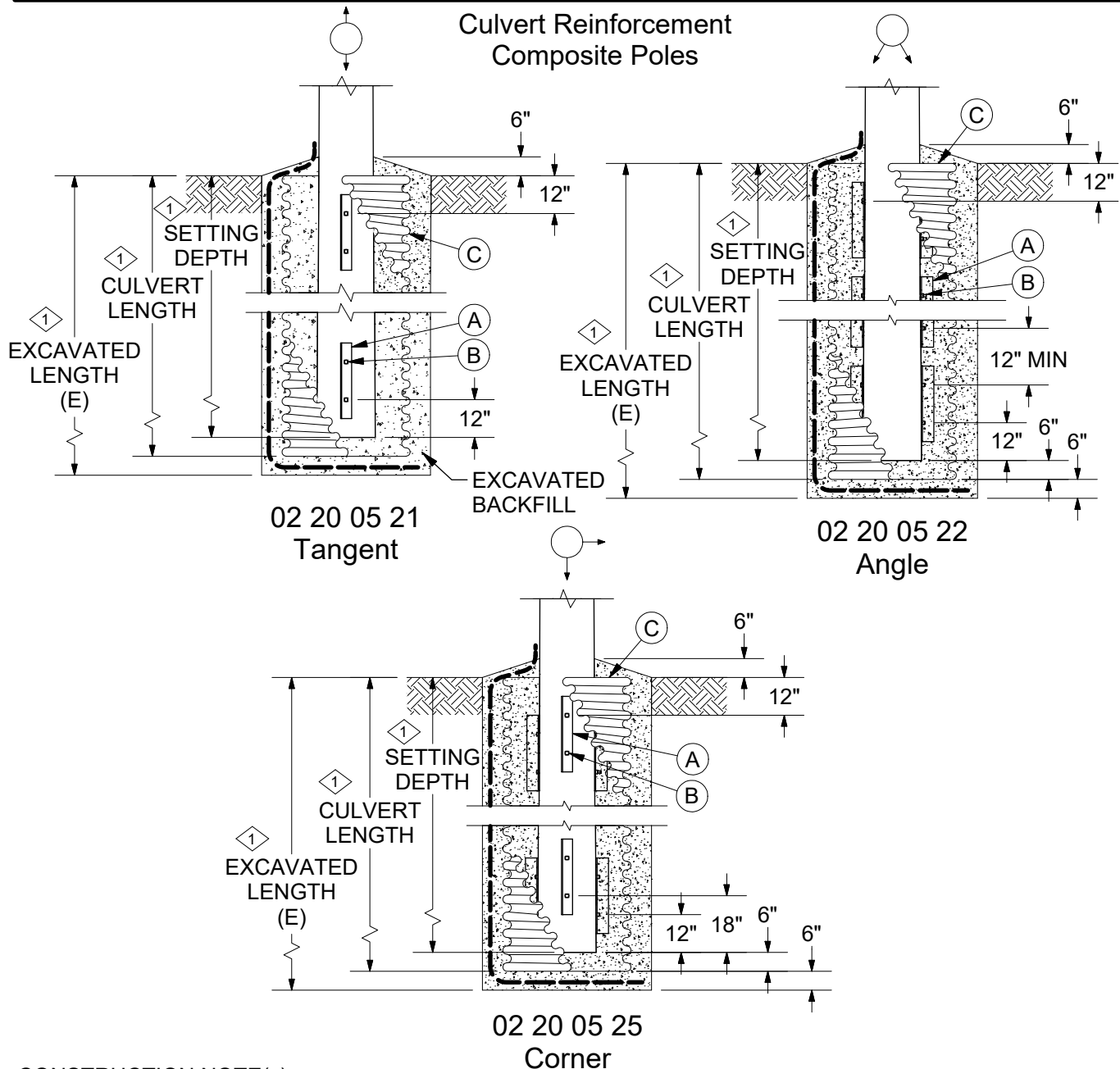
1. Rock backfill consisting of compacted 1" minus rock or larger must be used for composite poles and is preferred for all 3-phase distribution and sub-transmission poles.
2. Clean Rock Shall Never Be Used As Backfill!
3. The backfilling procedures for rock and native soil backfill with a pole ground are as follows:
 - a. When using rock backfill the pole shall be lowered into the hole after 12" of earth backfill, which shall cover the ground coil, has been thoroughly tamped at the bottom. The rock backfill shall be placed in the hole in a maximum of 12-inch layers and tamped thoroughly before adding the next layer. Tamping shall be performed with hydraulic mechanisms. The top 6" of material around the pole shall be dirt to prevent rock spoils on private property. All wood poles shall be set plumb, unless otherwise directed, and shall be checked during backfilling to make sure that they remain plumb. The hole shall be excavated to a diameter at least 8" larger than the base diameter of the pole.
 - b. Where rock backfill is not feasible for wood poles, native soil may be used for backfill. The wood pole shall be lowered into the hole after loose dirt at the bottom has been thoroughly tamped. The earth backfill shall be placed in the hole in a maximum of 12-inch layers and tamped thoroughly before adding the next layer. Tamping shall be performed with hydraulic, hand-tamping, or air-tamping mechanisms. Soil shall be mounded at the ground line to cover natural future settling. All wood poles shall be set plumb, unless otherwise directed, and shall be checked during backfilling to make sure that they remain plumb. Extra soil shall either be removed from the site or spread evenly over area adjacent to the pole, if not landscaped.

**Excavated Earth Backfill
Wood Poles**



**Rock Backfill
Wood Poles**





CONSTRUCTION NOTE(s):

1. See DCS **02 20 03 01** for most common wood and composite pole setting depths, and 02 00 04 02 for application specific setting depths. Poles without a pole ground do not require the extra excavated 12" of soil.
2. All storm structures require four brackets and super storm structures and switch poles require 8 brackets.
3. Angle brackets and additional bolts to be used on composite poles only.
4. Poles set in culverts shall be backfilled with 1" - 1.5" minus rock compacted in 12" or less lifts.

	ITEM	STK / DCS #	DESCRIPTION	02 20 05 **	21	22	25
2,3	A	23 06 126	Bracket, Angle, Fiberglass, 3 1/2" x 4" x 3/8" x 2'		4	8	8
2,3	B	23 52 118	Bolt, Mach., 3/4" x 20"		4	8	8
@	C	32 04 187	Pipe, Galv Stl, 18" Dia., 10'		1	1	1
		32 04 188	Pipe, Galv Stl, 24" Dia., 10'		1	1	1

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
4	10/01/20	KR	Revised drawings and Notes
3	01/01/20	KR	

Composite poles are an ideal option for storm hardening due to the amount of deflection they have rotationally, which can absorb the impact of cascading events. These poles can be used in un-guyed tangent applications. The tables list the stock numbers used in different configurations to minimize or halt a cascade event for tangent applications only. The recommendation for Sub-transmission is to install a storm pole every 1/4 mile or every fifth pole. Installation of Super Storm Poles is every mile or one in every 20 poles or at a double dead-end structure. A heavily guyed wood structure can be substituted as a storm pole as it will not accelerate or start a cascade. Storm hardening shall be used for distribution where cascading problems have occurred in the past.

Table 1 - Distribution Circuit

Height (ft.)	Stock Number					
	Single Phase		Three Phase			
			Single Circuit		Double Circuit	
	Storm Pole	Super Storm Pole	Storm Pole	Super Storm Pole	Storm Pole	Super Storm Pole
40'	41 40 012	41 40 014	-	-	-	-
45'	41 45 012	41 45 014	41 45 012	41 45 014	-	-
50'	-	-	41 50 012	41 50 014	41 50 014	41 50 826
55'	-	-	-	-	41 55 014	41 55 826

Table 2 - Sub-transmission Line

Height (ft.)	Stock Number					
	Single Circuit 34kV / 69kV		34kV or 69kV with Underbuild 2 4			
			Single Circuit		Double Circuit	
	Storm Pole	Super Storm Pole	Storm Pole	Super Storm Pole	Storm Pole	Super Storm Pole
50'	41 50 014	41 50 826	-	-	-	-
55'	41 55 014	41 55 826	41 55 014	41 55 826	-	-
60'	41 60 014	41 60 826	41 60 014	41 60 826	-	-
65'	41 65 014	41 65 826	41 65 014	41 65 826	41 65 014	41 65 826
70'	41 70 014	41 70 826	41 70 014	41 70 826	41 70 014	41 70 826
75'	41 75 014	41 75 826	41 75 014	41 75 826	41 75 015	41 75 829
80'	41 80 015	41 80 829	41 80 015	41 80 829	41 80 015	41 80 829
85'	41 85 015	41 85 829	41 85 015	41 85 829	41 85 017	41 85 832
90'	41 90 017	41 90 832	41 90 017	41 90 832	41 90 017	41 90 832

DESIGN NOTE(s):

1. Storm hardening recommendations for H-Frame structures shall be one complete structure every mile. This will be a Super Storm Pole of the 14"/15" size up to 80' tall. From there it shall be a 15"/17" pole. Refer to composite pole stock number standard for stock codes.

2. OPGW static will increase the size of the pole above 70' tall. Due to the higher tensions this will constitute the larger structure for both Storm Poles and Super Storm Poles.

3. All Storm Poles are buried 10% of the pole height plus 2 feet (10%+2') deep. All Super Storm Poles are buried 10% of the pole height plus 3.5' (10%+3.5') deep.

4. Double circuit stock numbers are valid for applications with and without Underbuild.



POLES

Composite Switch Poles
Stock Codes

02 30 10 02

1 of 1

Height (Ft.)	Composite Pole Gang Operated Switch Pole Stock Numbers		
	Single Circuit 34kV / 69kV	34kV or 69kV with 12kV Underbuild	
		Single Circuit	Double Circuit
55'	4155826	-	-
60'	4160826	4160826	-
65'	4165826	4165826	4165826
70'	4170826	4170826	4170826
75'	4175829	4175829	4175829
80'	4180829	4180829	4180829
85'	4185829	4185829	4185832
90'	4190832	4190832	4190832
95'	4195832	4195832	4195832

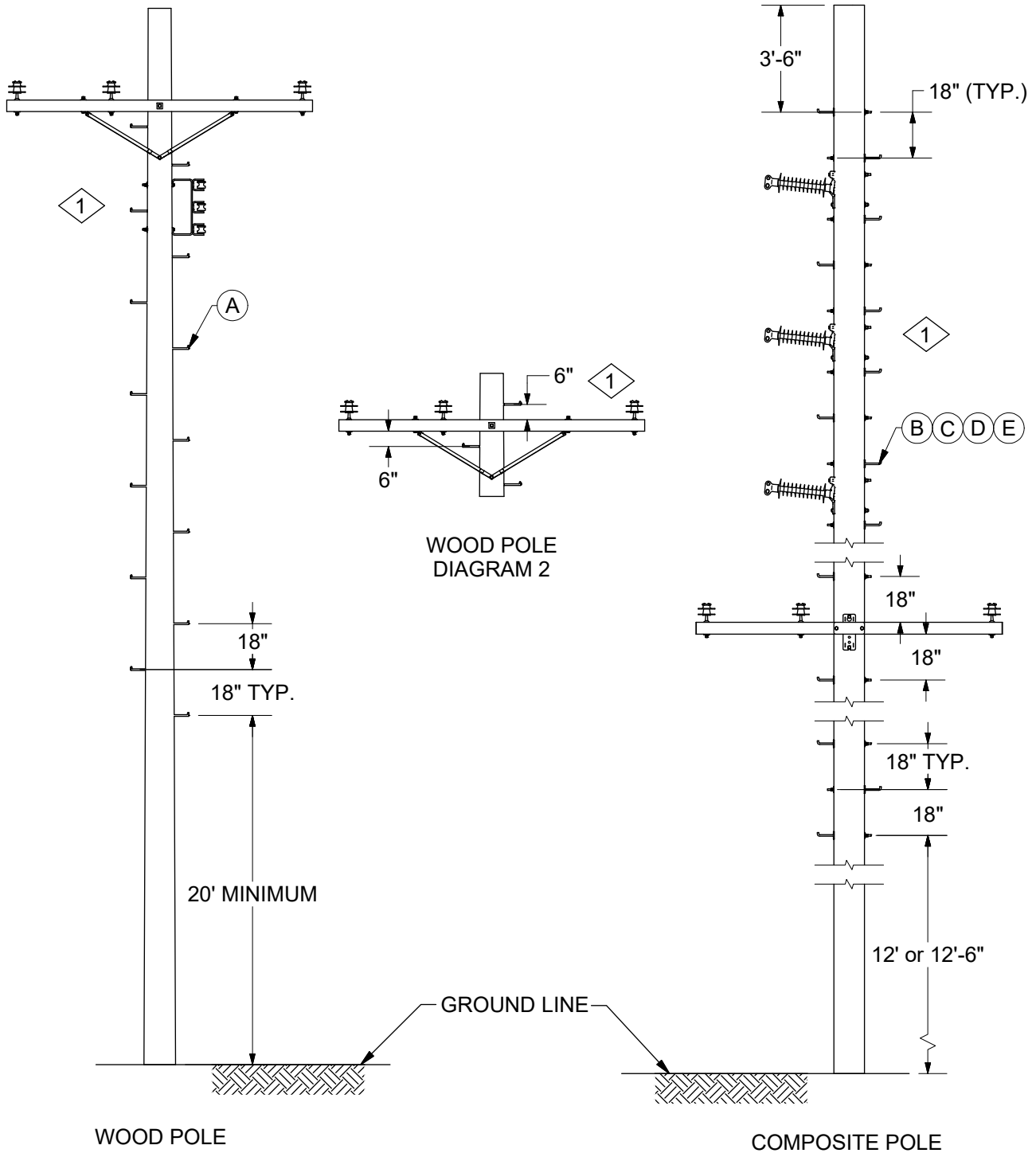
DESIGN NOTE(s):

1. All Composite Switch Poles are buried 10% of the pole height plus 3.5' (10%+3.5') deep. They will also include 8 angle brackets below grade per Standard 02 20 05 15.

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
1	10/01/20	KR	New Standard - Composite Switch Pole sizes
	xx/xx/xx	xxx	

The use of pole steps in Ameren Service Areas shall be on an as needed basis. The guidelines below must be adhered to in order to provide consistency and standardization across operating divisions.



CAUTION: Pole steps must NOT be in contact with ground wires or other grounded objects.

CONSTRUCTION NOTE(s):

1. Locate Step on opposite side of closest phase.

Wood Pole	
Pole Size	Std. No.
0-40 Ft.	02 00 30 01
45-50 Ft.	02 00 32 02
55-60 Ft.	02 00 32 03
65-70 Ft.	02 00 32 04
75-80 Ft.	02 00 32 05
85-90 Ft.	02 00 32 06

Composite Pole	
Pole Dia.	Std. No.
11"	02 00 32 10
12"	02 00 32 09
14"	02 00 32 11

	ITEM	STK / DCS #	DESCRIPTION	02 00 32 **	01	02	03	04	05	06	09	10	11
@ @ @ @	A	23 67 036	Step, Wood Pole, Hook Head, 5/8" X 10"		8	14	20	26	32	38	-	-	-
	B	23 67 492	Step, Composite Pole, Permanent, 12" Diameter		-	-	-	-	-	-	#	-	-
	C	23 67 506	Step, Composite Pole, Permanent, 11" Diameter		-	-	-	-	-	-	-	#	-
	D	23 67 507	Step, Composite Pole, Permanent, 14" Diameter		-	-	-	-	-	-	-	-	#
	E	23 17 466	Step, Composite Pole, Working Step, 11", 12", 14" Diameter		-	-	-	-	-	-	#	#	#

DESIGN NOTE(s):

2. Pole Steps

2.1 Poles shall not be stepped for any reason if any of the following apply:

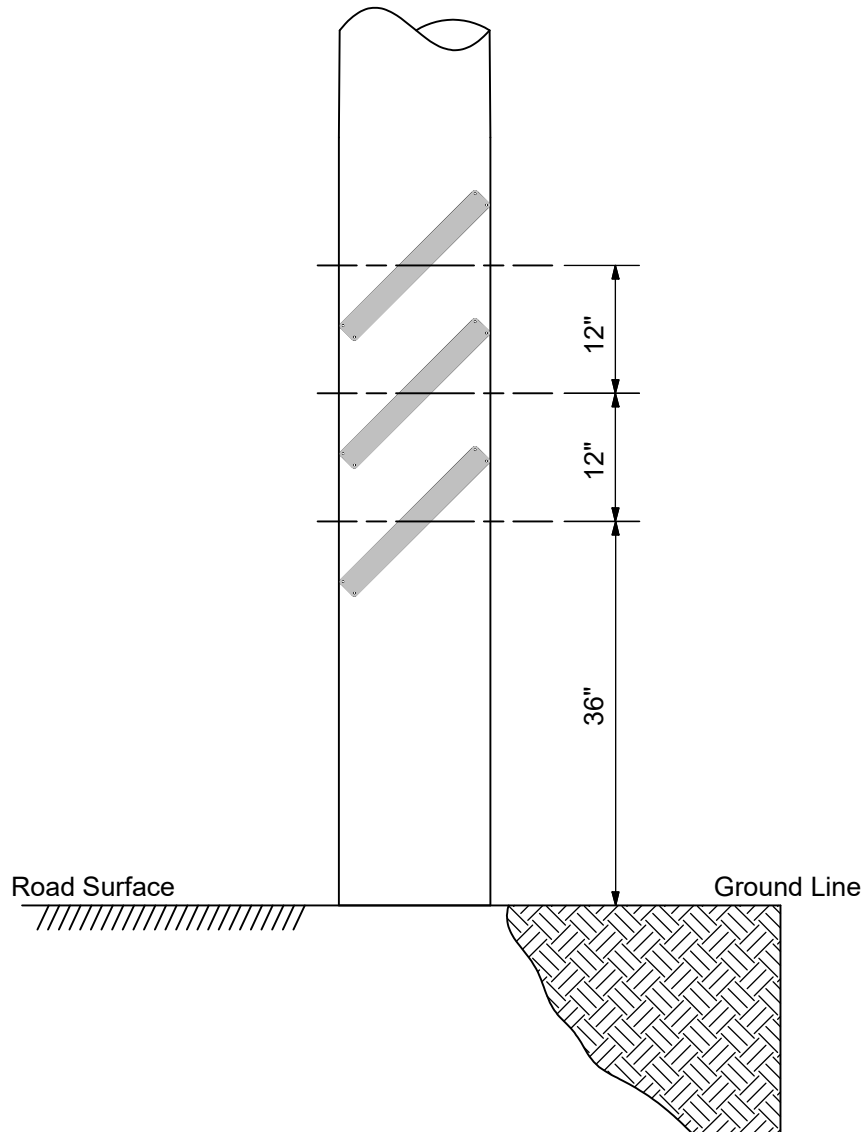
- a. Poles are adjacent to paved areas and are bucket truck accessible.
- b. Poles are located on or adjacent to school property, playgrounds, athletic fields or similar locations where large numbers of people may assemble.
- c. Poles are located adjacent to or within 10 (ten) feet of structures or appurtenances such as porches, garages, sheds, fences, stairways or windows.

2.2 Poles that do not meet any of the above criteria may be stepped if any of the following apply:

- a. Switch poles where the switch cannot be operated using an extend stick.
- b. Terminal poles.
- c. Recloser or sectionalizer poles.
- d. Poles that the Construction Superintendent deems appropriate to step due to unusual conditions.

2.3 Leave pole steps on the pole unless safety concerns require removal.

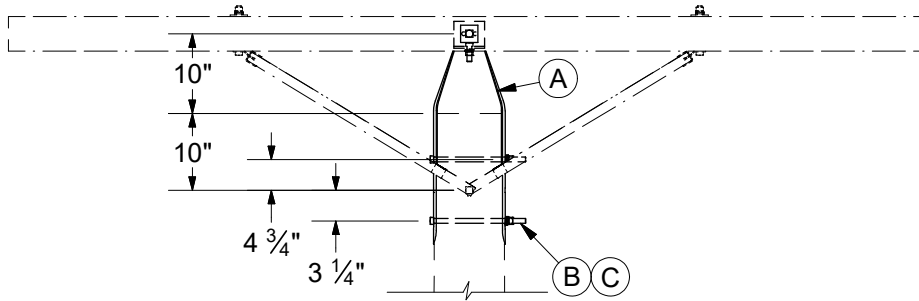
3. Composite poles are fabricated without step holes unless Operating Center or Design Center communicates with supplier prior to ordering or delivery.



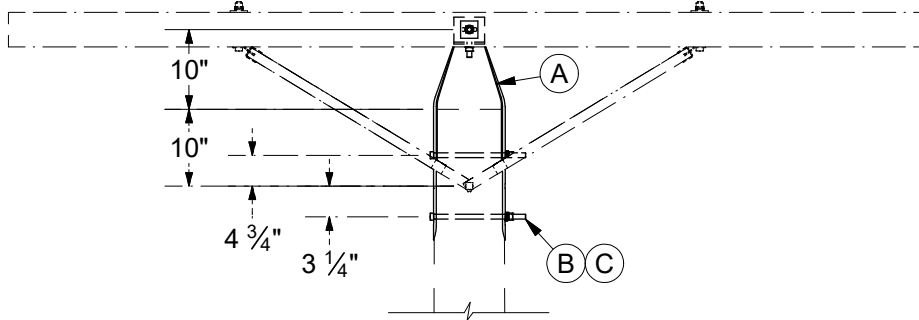
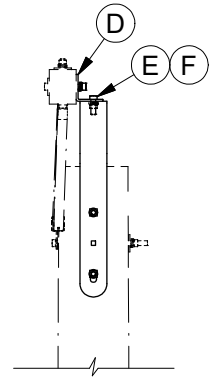
CONSTRUCTION NOTE(s):

1. Install the markers at 45° to the ground line and facing oncoming traffic. Lower ends of the diagonal markers must be toward road.
2. Markers must be positioned as specified to comply with manual of uniform traffic control devices (MUTCD) requirements.

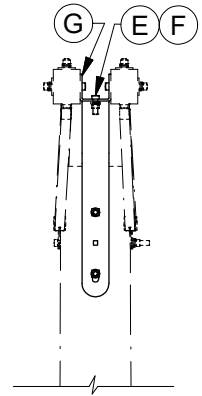
ITEM	STK / DCS#	DESCRIPTION	02 40 43 **	00
A	16 06 258	Marker - Pole, Visibility		3
B	23 64 005	Nail - Roofing, 1 1/2" x 11 GA x 7/16 HD		12



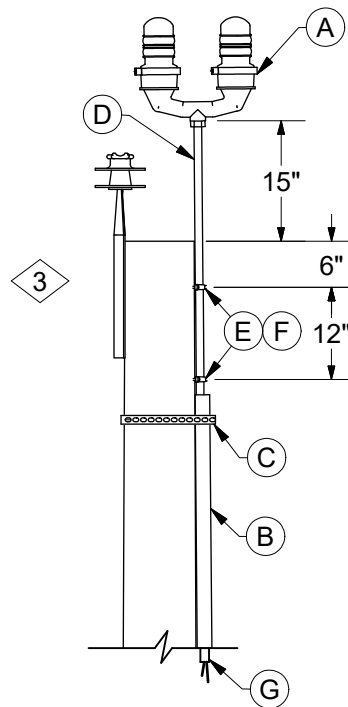
02 40 46 01
Single Arm



02 40 46 02
Double Arm



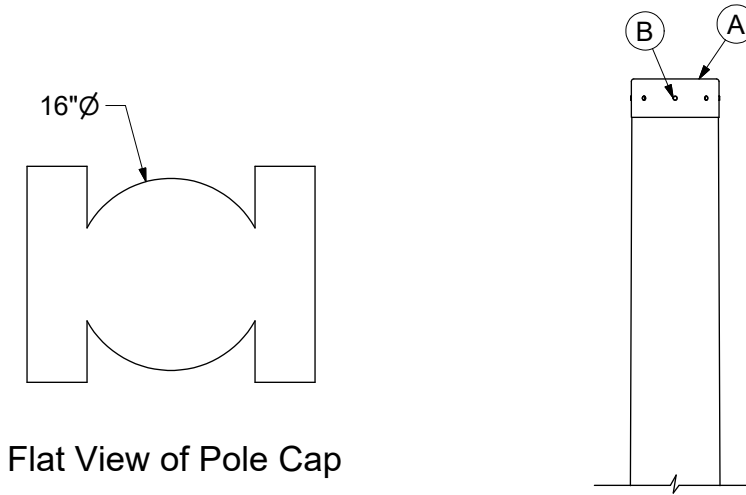
ITEM	STK / DCS #	DESCRIPTION	02 40 46 **	01	02
A	23 06 050	Bracket, Ridge Iron - 6-1/2" - 8" Dia.		1	1
B	23 52 065	Bolt, Mach., 5/8" x 12"		2	2
C	23 66 134	Lock Washer - 5/8" Double Coil		2	2
D	23 06 052	Bracket - Crossarm Support, Angle		1	-
E	23 52 049	Bolt, Mach., 5/8" x 2"		1	1
F	23 66 006	Washer - Lock 5/8"		1	1
G	23 06 051	Bracket - Crossarm Support, Double		-	1



ITEM	STK / DCS #	DESCRIPTION	02 40 48 **	00
A	40 05 223	Fixture, Obstruction Light		1
B	12 01 230	Conduit - 1-1/2" Schedule 40 (8-ft.)		2
C	27 60 035	Strap, Iron Hanger		2
D	40 03 033	Conduit 1" Heavy Wall (36" Long)		1
E	40 53 021	Clamp - Pipe 1"		2
F	23 60 002	Lag Screw - 1/4" x 4"		2
G	18 61 055	Cable - 600V, 2-14 AWG ft.		20

DESIGN NOTE(s):

- Structures within 20,000 ft. of a landing area may require an obstruction light. The Real Estate Department can help determine whether or not obstruction lights and/or marker balls are required in each specific location.
- For 4kV and 12kV circuits vertical configuration shall be used in first position. On 12kV 3Ø circuits the pole phase shall be located 32" from the center of the pole.
- Static wire pin, when required, may be attached in normal position.
- For 34kV/69kV single circuit static wire construction use DCS **03 69 01 ****.
- For 34kV/69kV double circuit static wire construction use DCS **03 69 02 ****.
- Pole extension shall not be used on poles where obstruction lights must be installed.



Flat View of Pole Cap

CONSTRUCTION NOTE(s):

1. Pole caps are required to be placed on poles cut off to accommodate other heights or sizes.
2. Steps for Installation:
 - a. Peel protective backing
 - b. Center and adhere to top of pole
 - c. Wrap tabs around pole and fold excess top over edges
 - d. Secure with Nails

ITEM	STK / DCS #	DESCRIPTION	02 40 49 **	00
A	54 17 470	16" Pole Top Cover		1
B	23 64 005	Nail - Roofing, 1-1/2" x 11 GA x 7/16" HD		8

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1. Historical Neutral Locations

1.1 CIPS Service Territory

Since at least 1986, CIPS Distribution Standard DS2100 has stated that the preferable location for the neutral is down 6'2" from the line arm on spans less than 200 feet. Where span lengths exceeded 200 feet, the 6'2" spacing was mandatory. However, it was permitted to place the neutral on the line arm or at 40" spacing to eliminate replacing otherwise adequate poles for increased height.

1.2 UE Service Territory

Prior to this edition being published, UE Distribution Construction Standards called for neutrals on new line poles without any equipment mounted on the pole to be 40" down from the line arm. This was applicable to both 4 kV and 12 kV areas. Several Standards indicate 22" spacing is permitted for existing construction on 4kV poles or on poles being converted from 2400 Volt single phase to 7200 Volt single phase.

2. Consolidated Ameren Standards

The Standards in this book show neutral spacing on all new configurations to be 6 ft. The previous range was to accommodate present conditions of most of the existing poles at being at 40" and many of the existing poles at 74".

2.1 New Pole Installations

New pole lines and relocated pole lines should use the 6 foot neutral spacing in general. Major advantage to the 6 foot spacing is that it permits a truck's basket to maneuver between the phase conductors and the neutral to reach the field side of the pole.

2.2 Working on Existing Poles or Replacing Existing Poles

The rule of permitting 40" to avoid replacing otherwise acceptable poles shall continue. When replacing a pole in a lead, the existing spacing should generally be used on the new pole, except that a 40" minimum neutral spacing from the line arm is required. Increasing from a 40" spacing to a 6' spacing would change the conductor tensions considerably and likely cause future problems.

General

The phase locations shown in this distribution standard shall be standard for the Ameren System. It is not intended to change all existing structures that do not conform to this standard. However, all new constructions, as well as reconstructed existing circuits, shall, to the extent it is practicable, be in accordance with this standard.

Vertical Construction

No standard phase locations are designated for vertical single circuit construction at corners or angles in a line. (Note Exception under 4160 Volt Single Phase Construction Insulated for 7200 Volt Operation). This will allow the most practicable positioning, based on the configuration of the adjacent poles. When possible, however, the phase locations should be selected so as to give the maximum distance between conductors. For example, for 4 kV and 12 kV when going from flat configuration (Fig. 2) to vertical, the phase designation from the top of the pole shall be B, A, and C. The neutral conductor, when present on vertical corners, shall take a position below the primary phase conductor.

4160 Volt Single Phase Construction Insulated for 7200 Volt Operation

Where a line is built for initial operation at 4160 volt single phase but is insulated and spaced for future 7200 volt operation, the conductor on the road side shall be considered the future phase wire and the field side conductor shall be the future multigrounded neutral. (See Figure 10 of this standard.) On private property the east, northeast, north and northwest sides shall be equivalent to the road side, while the west, southwest, south and southeast sides shall be equivalent to the field side. At vertical corners the road side conductor (future 7200 volt phase wire) shall occupy the high position on the pole. There will be instances where it will be impracticable to follow these general rules (e.g. where adjacent poles are on opposite sides of a winding road to keep line angles at a minimum). Where it is necessary to deviate from the standard conductor locations on poles adjacent to vertical corner poles the estimator shall show on his construction plats the conductor that must take the high position on the corner pole. This will obviate the need for construction changes when the line is cutover for 7200 volt operation.

When the line is cutover to 7200 volt operation all conductors in positions other than the standard shall be marked by fastening the proper identifying aluminum letter on the crossarm directly below the conductor.

Marking

Any deviations from the standard phase locations shall be plainly marked with letters "A", "B", "C", or "N" attached to the crossarm below the respective conductor. These deviations may be due to transpositions or unusual construction. In addition to the marking of these deviations, all three phase switch locations, three phase capacitor installations, three phase recloser installations, three phase sectionalizer installations, and three phase terminal poles shall be plainly marked with the proper phase letter. These letters shall be attached to the crossarm or pole so that phases can be readily identified.

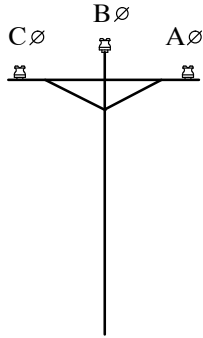
On long feeders with considerable distances between three phase switches, additional locations as required may also be marked to facilitate phase identification. Normally, these additional phase identification points should be located on poles where single phase taps take off from the three phase feeder main.

The phase locations on poles adjacent to vertical configurations shall be plainly marked to facilitate identification when making repairs. These letters shall be attached to the crossarm below the respective conductors.

CONFIGURATIONS Phase Locations (Preferred Locations)

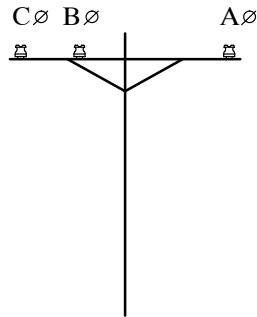
03 00 01 02

Sheet 1 of 1



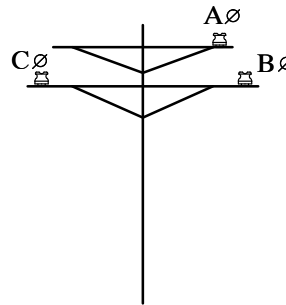
TRIANGULAR CONSTRUCTION

FIG. 1



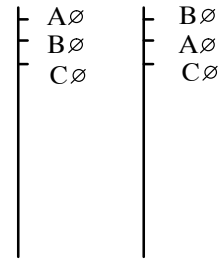
FLAT CONSTRUCTION

FIG. 2



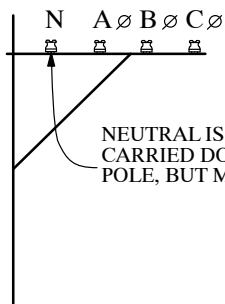
SINGLE CIRCUIT
2 ARM TRIANGULAR

FIG. 3



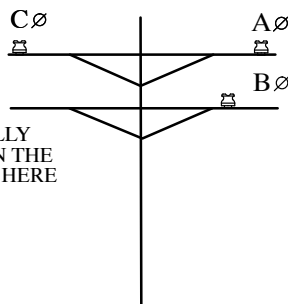
34 KV 4 OR 12 KV
VERTICAL CONSTRUCTION

FIG. 4



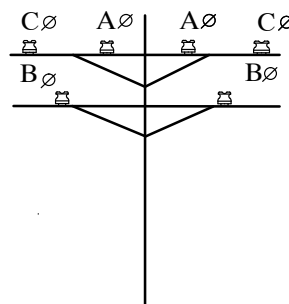
SIDEARM CONSTRUCTION

FIG. 5



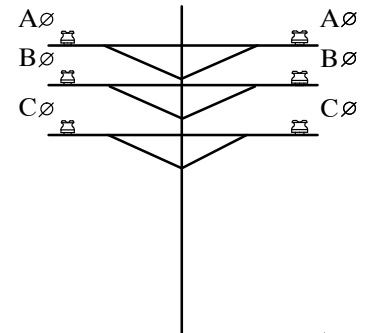
FUTURE DOUBLE CIRCUIT
2 ARM TRIANGULAR

FIG. 6



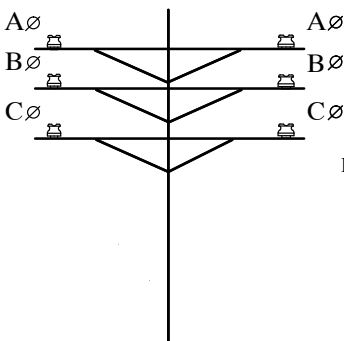
DOUBLE CIRCUIT
2 ARM TRIANGULAR

FIG. 7



DOUBLE CIRCUIT
3 ARM VERTICAL
SEE NOTE

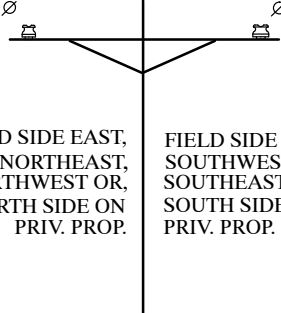
FIG. 8



34kV
DOUBLE CIRCUIT
3 ARM VERTICAL

FIG. 9

FUTURE NEUTRAL POSITION FOR
7200 V OPERATION

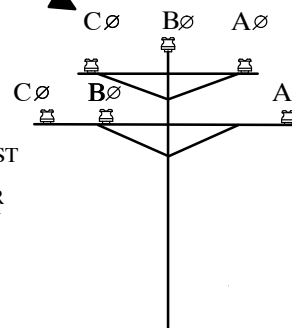


ROAD SIDE EAST,
NORTHEAST,
NORTHWEST OR,
NORTH SIDE ON
PRIV. PROP.

FIELD SIDE WEST
SOUTHWEST,
SOUTHEAST, OR
SOUTH SIDE ON
PRIV. PROP.

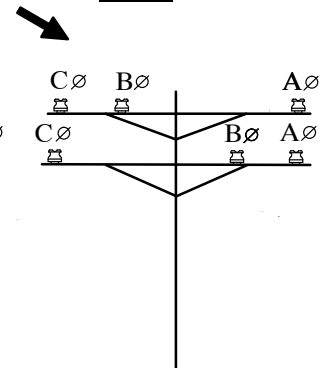
4160 V - SINGLE PHASE
INSULATED FOR FUTURE
7200 V OPERATION

FIG. 10



DOUBLE CIRCUIT
OVERHEAD

FIG. 11



DOUBLE CIRCUIT
UNDERBUILT

FIG. 12

NOTE:

Phase positions shown in Fig. 8 should be used only when this configuration is adjacent to poles with configuration shown in Fig. 6. When phases are in positions shown in Fig. 8, they shall be marked with identifying letters.

1. General

This standard gives the design limits of the structural elements employed in building standard configurations. These limits are based on the allowable loading of crossarms and pins as shown in Dist. Std. **29 00 04**, and also on required conductor separation to prevent midspan conductor contact.

2. Angle Limits

Tables 1, 2, 3, 4 and 5 specify the maximum angle capable of being turned on pins, insulators, fiberglass stand-offs, combination fiberglass and porcelain standoffs, and crossarms for various types of construction. This data is based on the transverse strength of the components of the structure and the load applied to it, due to the line angles.

3. Dead End Loadings

Table 6 specifies the maximum balanced dead end loading for unguyed crossarms. It shows the number of conductors permitted to dead end on a structure, depending on the size of conductor and the type of dead end structure. The data is based on standard conductor tensions and allowable equivalent horizontal loadings on the crossarm. The purpose of this table is to provide the information necessary to get the most out of a dead end structure without having to resort to crossarm guying.

TABLE 1A
Maximum Line Angles Capable of Being Turned on Pins and Crossarms
SHORT SPAN (STD. **07 00 07 03**)

Conductor Size AWG or kcmil	Pins (All) (See Note 4)		Single Crossarm # of Conductors (1200# arm limit)					DOUBLE CROSSARM									
								Without Grid Plate # of Conductors (2400#)					With Grid Plate (5) # of Conductors (4000#)				
	Sgl	DbI	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
	600#	1200#															
#4 ACSR	42	90	42	26	18	13	10	90	59	42	32	26	90	90	78	59	47
1/0 AAAC	25	56	25	16	11	8	6	56	35	25	19	16	90	64	46	35	29
110.8 ACSR	20	44	20	12	8	6	5	44	28	20	15	12	80	50	44	28	23
556.5 AAC	10	21	10	6	4	3	2	21	13	10	7	6	37	24	17	13	11
T2 Penguin	14	32	14	9	6	4	3	32	20	15	11	9	57	36	26	20	16
954 ACSR Rail	11	25	11	6.7	4.4	3	2	25	16	11	8	7	42	28	21	16	13

Notes:

- Maximum number of pins for single crossarm is 2. Maximum number of pins for double crossarm without grid plate is 4; and maximum number of pins for double crossarm with grid plate is 6. The number of conductors that can be deadended back to back (not on pins) is only limited by the strength of the joint between the arm(s) and the pole.
- Above table based on Grade N construction.

TABLE 1B
Maximum Line Angles Capable of Being Turned on Pins or Crossarms
MEDIUM SPAN (STD. 07 00 07 03)

Conductor Size AWG or kcmil	Pins (All) (See Note 4)		Single Crossarm # of Conductors (1200# arm limit)					DOUBLE CROSSARM									
								Without Grid Plate # of Conductors (2400#)					With Grid Plate (5) # of Conductors (4000#)				
	Sgl	Dbl	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
	600#	1200#															
#4 ACSR	33	79	33	20	14	10	7	79	48	34	25	20	90	90	62	47	38
1/0 AAAC	21	47	21	12	8	6	4	47	29	21	16	12	87	53	38	29	23
110.8 ACSR	14	32	14	8	5	4	3	32	20	14	11	8	57	36	26	20	16
556.5 AAC	7	17	7	4	3	2	1	17	10	7	5	4	29	19	14	10	8
T2 Penguin	11	24	11	6	4	1	–	34	15	11	8	6	43	27	20	15	12
954 ACSR Rail	9	20	9	5	3	2	1	20	12.5	9	6	5	36	23	16	12.6	10

Notes:

- Maximum number of pins for single crossarm is 2. Maximum number of pins for double crossarm without grid plate is 4; and maximum number of pins for double crossarm with grid plate is 6. The number of conductors that can be deadended back to back (not on pins) is only limited by the strength of the joint between the arm(s) and the pole.
- Above table based on Grade N construction.

TABLE 1C
Maximum Line Angles Capable of Being Turned on Pins or Crossarms
LONG SPAN (STD. 07 00 07 03)

Conductor Size AWG or kcmil	Pins (All) (See Note 4)		Single Crossarm # of Conductors (1200# arm limit)					DOUBLE CROSSARM									
								Without Grid Plate # of Conductors (2400#)					With Grid Plate (5) # of Conductors (4000#)				
	Sgl	Dbl	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
	600#	1200#															
#4 ACSR	28	65	28	16	11	7	5	65	40	28	21	16	90	75	52	40	32
1/0 AAAC	17	38	17	10	6	4	3	38	24	17	12	10	70	43	31	24	19
110.8 ACSR	8	19	8	5	3	2	1	19	12	8	6	5	33	21	15	12	9
556.5 AAC	6	14	6	3	2	1	–	14	9	6	4	3	25	16	11	9	7
T2 Penguin	8	19	8	4	3	1	–	19	12	8	6	4	35	22	16	12	9
954 (45/7) ACSR	6	14.6	6	3	1.8	1	–	14.6	9	6	4	3	26	17	12	9	7

Notes:

- Maximum number of pins for single crossarm is 2. Maximum number of pins for double crossarm without grid plate is 4; and maximum number of pins for double crossarm with grid plate is 6. The number of conductors that can be deadended back to back (not on pins) is only limited by the strength of the joint between the arm(s) and the pole.
- Above table based on Grade N construction.

TABLE 1D
Maximum Line Angles Capable of Being Turned on Pins or Crossarms
EXTRA LONG SPAN (STD. 07 00 07 03)

Conductor Size AWG or kcmil	Pins (All) (See Note 4)		Single Crossarm # of Conductors (1200# arm limit)					DOUBLE CROSSARM									
								Without Grid Plate # of Conductors (2400#)					With Grid Plate (5) # of Conductors (4000#)				
	Sgl	Dbl	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
	600#	1200#															
1/0 AAAC	14	30	14	8	5	3	2	30	20	14	10	8	61	38	27	20	16
110.8 ACSR	8	18	8	4	2	1	–	18	11	8	6	4	32	21	15	11	9
556 AAC	5	13	5	3	1	–	–	13	7	5	3	2	23	15	10	8	6
T2 Penguin	6.5	16	6.5	3.3	2	1	–	16	9.6	6.5	4.4	3.3	29	18	13	9.7	7.8
954 ACSR Rail	4.4	11.3	4.4	2	1	–	–	11.3	6.8	4.4	3	2	21	13	9	6.6	5

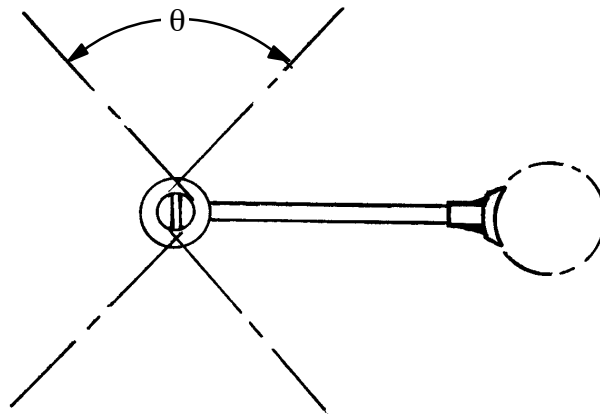
Notes:

- Maximum number of pins for single crossarm is 2. Maximum number of pins for double crossarm without grid plate is 4; and maximum number of pins for double crossarm with grid plate is 6. The number of conductors that can be deadended back to back (not on pins) is only limited by the strength of the joint between the arm(s) and the pole.
- Above table based on Grade N construction.

Select The Required Crossarm Assembly Unit Using The Following As A Guide

- The above table, based on maximum span length of applicable sag table, automatically takes care of vertical loadings. For shorter span lengths the crossarm may be strong enough; however, a strength calculation should be made. See Dist. Std. **29 00 04 01** for examples and allowable crossarm loads.
- Inadequate vertical strength for the number and size of conductors shown.
- Double arms and double dead end pole top construction shall always be used.
 - At all railroad crossings. Note: If tensions do not exceed 2000 lbs. per conductor during heavy loading; double pins and ties may be used. Double pole top pins mounted on the face of the pole may be used to meet this requirements. (Tensions for conductors sagged in accordance with Sag Table 1 does not exceed 2000 lbs. under heavy loaded conditions except for 556.5 kcmil A.A. and 795 kcmil A.A.).
 - On grade "B" circuits where the line angle exceeds 20°.
 - On grade "B" circuits at communications crossings, if the supply conductors are not continuous and of uniform tension in the crossing span and each adjacent span.
- Angles shown for single or double pins refer to crossarm pins and existing pole top pins mounted on the face of the pole.
- Grid gain plates (Dist. Std. **04 00 35**) shall be used only when required for the larger angles shown. Use caution to insure that pin angle limits are not exceeded (2 or 3 conductors). If pin limits are exceeded, use double dead ends.
- Above table based on grade N construction.

Table 2
Maximum Line Angle Capability of Distribution Standards

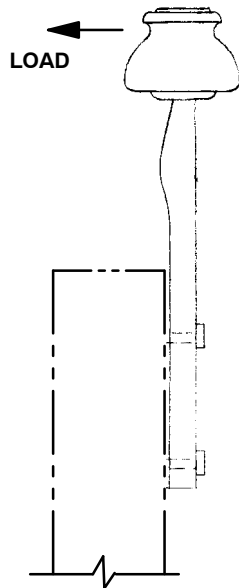


Side tie in tension or compression on pin insulator of full tension take off unit.

Sag Table	Conductor	Angle°
SHORT SPAN	#4 (7/1) ACSR	78
	1/0 AAAC, bare or poly	46
	1/0 ACSR, bare	59
	110.8 (12/7) ACSR, bare	45
	336.4 (18/1) ACSR	32
	556 (19) AAC	17
	335.6 T2 Pigeon	41
	432.2 T2 Penguin	35
	954 (45/7) ACSR	17
	556 (19) T2	12
MEDIUM SPAN	#4 (7/1) ACSR	62
	1/0 AAAC, bare or poly	38
	1/0 ACSR, bare	46
	110.8 (12/7) ACSR, bare	35
	336.4 (18/1) ACSR	23
	556 (19) AAC	14
	335.6 T2 Pigeon	31
	432.2 T2 Penguin	26
	954 (45/7) ACSR	12
	556 (19) T2	10

Sag Table	Conductor	Angle ^o
LONG SPAN	#4 (7/1) ACSR	52
	1/0 AAAC, bare or poly	31
	1/0 ACSR, bare	37
	110.8 (12/7) ACSR, bare	28
	336.4 (18/1) ACSR	18
	556 (19) AAC	11
	335.6 T2 Pigeon	25
	432.2 T2 Penguin	20
	954 (45/7) ACSR	9
	556 (19) T2	9

Table 3
Maximum Line Angle Capability of Distribution Standards
Dist. Stds. 06-12-01-02 Pole Top Pins

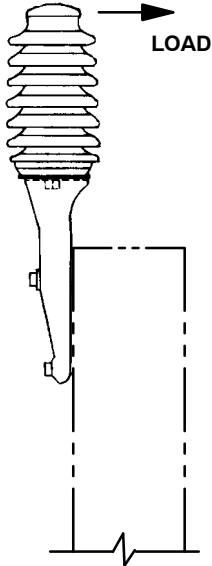


Pole Top Pin (1000# Limit, Transverse)

Sag Table	Conductor	Angle°
SHORT SPAN	#4 (7/1) ACSR	78
	1/0 AAAC, bare or poly	46
	1/0 ACSR, bare	59
	110.8 (12/7) ACSR, bare	45
	336.4 (18/1) ACSR	32
	556 (19) AAC	17
	335.6 T2 Pigeon	41
	432.2 T2 Penguin	35
	954 (45/7) ACSR	17
	556 (19) T2	12
MEDIUM SPAN	#4 (7/1) ACSR	62
	1/0 AAAC, bare or poly	38
	1/0 ACSR, bare	46
	110.8 (12/7) ACSR, bare	35
	336.4 (18/1) ACSR	23
	556 (19) AAC	14
	335.6 T2 Pigeon	31
	432.2 T2 Penguin	26
	954 (45/7) ACSR	12
	556 (19) T2	10
LONG SPAN	#4 (7/1) ACSR	52
	1/0 AAAC, bare or poly	31
	1/0 ACSR, bare	37
	110.8 (12/7) ACSR, bare	28
	336.4 (18/1) ACSR	18
	556 (19) AAC	11
	335.6 T2 Pigeon	25
	432.2 T2 Penguin	20
	954 (45/7) ACSR	9
	556 (19) T2	9
EXTRA LONG SPAN	1/0 AAAC, bare or poly	26
	1/0 ACSR, bare	31
	110.8 (12/7) ACSR, bare	23
	336.4 (18/1) ACSR	15
	556 (19) AAC	10
	335.6 T2 Pigeon	20
	432.2 T2 Penguin	16
	954 (45/7) ACSR	9
	556 (19) T	8

Table 4
Maximum Line Angle Capability of Distribution Standards
Dist. Stds. 06-34-01--**
Vertical Line Post Insulator (Tie Top) 25-05-064 F Neck 25-05-098 N Neck

Vertical Line Post (1120# Limit, Cantilever)



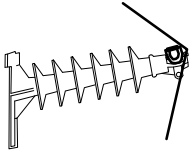
Sag Table	Conductor	F Neck Angle ***	N Neck Angle*
SHORT SPAN	#4 (7/1) ACSR	NL	15
	1/0 AAAC, bare or poly	52	15
	1/0 ACSR, bare	68	15
	110.8 (12/7) ACSR, bare	52	15
	336.4 (18/1) ACSR	36	15
	556 (19) AAC	19	15
	335.6 T2 Pigeon	47	15
	432.2 T2 Penguin	40	15
	954 (45/7) ACSR	19	15
	556 (19) T2	14	15
MEDIUM SPAN	#4 (7/1) ACSR	72	15
	1/0 AAAC, bare or poly	43	15
	1/0 ACSR, bare	52	15
	110.8 (12/7) ACSR, bare	40	15
	336.4 (18/1) ACSR	26	15
	556 (19) AAC	15	15
	335.6 T2 Pigeon	35	15
	432.2 T2 Penguin	29	15
	954 (45/7) ACSR	14	15
	556 (19) T2	11	15
LONG SPAN	#4 (7/1) ACSR	60	15
	1/0 AAAC, bare or poly	35	15
	1/0 ACSR, bare	42	15
	110.8 (12/7) ACSR, bare	32	15
	336.4 (18/1) ACSR	21	15
	556 (19) AAC	13	15
	335.6 T2 Pigeon	28	15
	432.2 T2 Penguin	23	15
	954 (45/7) ACSR	10	15
	556 (19) T2	10	15
EXTRA LONG SPAN	1/0 AAAC, bare or poly	31	15
	1/0 ACSR, bare	36	15
	110.8 (12/7) ACSR, bare	26	15
	336.4 (18/1) ACSR	17	15
	556 (19) AAC	12	15
	335.6 T2 Pigeon	23	15
	432.2 T2 Penguin	19	15
	954 (45/7) ACSR	10	15
	556 (19) T2	10	15

* All 15° line angles shown for N Neck insulators are based on top groove.

*** Angles shown in above table are for single insulators only. For multiple conductors on a crossarm use grade N loads in DCS 11 00 04 02 for the conductor, span and line angle being considered. Compare the total transverse load with the transverse crossarm intermittent load limits shown in Table 1 of DCS. 29 00 04 01.

Table 5

**Maximum Line Angle Capability of Distribution Standards
DCS 06 34 03 ** and 06 69 03 ** in Compression and Tension
34 and 69 kV Polymer Horizontal Line Post Insulator (Clamp Top Line Terminal)
Stock Nos. 25 05 145 and 25 05 095 (2500 LB Limit in Compression and Tension)**



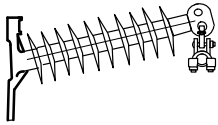
Sag Table	Conductor	Angle
SHORT SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	NL*
	336.4 (18/1) ACSR	NL*
	556 (19) AAC	47
	335.6 T2 Pigeon	NL*
	432.2 T2 Penguin	NL*
	954 (45/7) ACSR	47
	556 (19) T2	34
	954 (45/7) T2	23
MEDIUM SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	NL*
	336.4 (18/1) ACSR	66
	556 (19) AAC	37
	335.6 T2 Pigeon	90
	432.2 T2 Penguin	76
	954 (45/7) ACSR	34
	556 (19) T2	28
	954 (45/7) T2	18
LONG SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	84
	336.4 (18/1) ACSR	52
	556 (19) AAC	32
	335.6 T2 Pigeon	73
	432.2 T2 Penguin	60
	954 (45/7) ACSR	26
	556 (19) T2	26
	954 (45/7) T2	14
EXTRA LONG SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	80
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	69
	336.4 (18/1) ACSR	43
	556 (19) AAC	30
	335.6 T2 Pigeon	61
	432.2 T2 Penguin	50
	954 (45/7) ACSR	26
	556 (19) T2	26
	954 (45/7) T2	14

Table 5

Maximum Line Angle Capability of Distribution Standards

69 kV Polymer Horizontal Line Post Insulator (w/ 2-Hole Line Terminal Blade)

Stock No. 25 05 184 (Maximum Transverse Working Load – 5000 Lbs. (Tension & Compression))



Sag Table	Conductor	Angle
SHORT SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	NL*
	336.4 (18/1) ACSR	NL*
	556 (19) AAC	NL*
	335.6 T2 Pigeon	NL*
	432.2 T2 Penguin	NL*
	954 (45/7) ACSR	47
	556 (19) T2	76
	954 (45/7) T2	48
MEDIUM SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	NL*
	336.4 (18/1) ACSR	NL*
	556 (19) AAC	83
	335.6 T2 Pigeon	NL*
	432.2 T2 Penguin	NL*
	954 (45/7) ACSR	75
	556 (19) T2	61
	954 (45/7) T2	37
LONG SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	NL*
	336.4 (18/1) ACSR	NL*
	556 (19) AAC	71
	335.6 T2 Pigeon	NL*
	432.2 T2 Penguin	NL*
	954 (45/7) ACSR	58
	556 (19) T2	57
	954 (45/7) T2	30
EXTRA LONG SPAN	#4 (7/1) ACSR	NL*
	1/0 AAAC, bare or poly	NL*
	1/0 ACSR, bare	NL*
	110.8 (12/7) ACSR, bare	NL*
	336.4 (18/1) ACSR	NL*
	556 (19) AAC	65
	335.6 T2 Pigeon	NL*
	432.2 T2 Penguin	NL*
	954 (45/7) ACSR	57
	556 (19) T2	57
	954 (45/7) T2	30

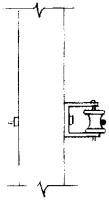
TABLE 7
TABLE GIVING MAXIMUM NUMBER OF CONDUCTORS
THAT CAN BE DEADENDED ON UNGUYED CROSSARMS
(BASED ON STANDARD CONDUCTOR TENSIONS)

Conductor Size	Sag Table Span	Sgl Arm DE	Dbl Arm DE	Double Arm DE	Fiberglass DE Arms	
		3-1/2" x 4-1/2" x 8Ft		3-3/4" x 4-3/4" x 10Ft	8 Ft.	10 Ft.
# 4 ACSR 7/1 Bare	Short	0	2	4	2	4
	Medium	0	2	4	2	4
	Long	0	2	4	2	4
1/0 AAAC (7) Bare	Short	0	2	2	2	4
	Medium	0	2	2	2	4
	Long	0	0	2	2	4
	X-Long	0	0	0	2	4
1/0 ACSR (6/1) Bare	Short	0	0	2	2	4
	Medium	0	0	2	2	4
	Long	0	0	2	2	4
	X-Long	0	0	2	2	4
336.4 ACSR (18/1) Bare	Short	0	0	2	2	4
	Medium	0	0	0	2	4
	Long	0	0	0	2	4
	X-Long	0	0	0	2	2
335.6 ACSR T2 Pigeon	Short	0	0	2	2	4
	Medium	0	0	0	2	4
	Long	0	0	0	2	4
	X-Long	0	0	0	2	2
556.5 AA (19) Bare	Short	0	0	0	2	2
	Medium	0	0	0	2	2
	Long	0	0	0	2	0
	X-Long	0	0	0	2	0
432.2 ACSR T2 Penguin	Short	0	0	0	2	4
	Medium	0	0	0	2	4
	Long	0	0	0	2	4
	X-Long	0	0	0	2	2
954 ACSR (45/7) Bare	Short	0	0	0	2	2
	Medium	0	0	0	2	0
	Long	0	0	0	2	0
	X-Long	0	0	0	2	0

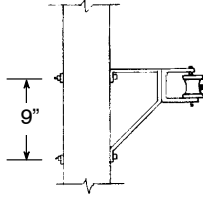
CONFIGURATIONS
Structural Elements – Design Limits

03 00 03 00
Sheet 11 of 11

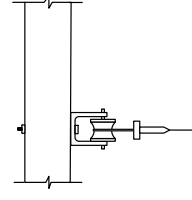
Conductor Size	Sag Table Span	Sgl Arm DE	Dbl Arm DE	Double Arm DE	Fiberglass DE Arms	
		3-1/2" x 4-1/2" x 8Ft		3-3/4" x 4-3/4" x 10Ft	8 Ft.	10 Ft.
556 AAC T2 Dahlia	Short	0	0	0	2	2
	Medium	0	0	0	2	0
	Long	0	0	0	2	0
	X-Long	0	0	0	2	0



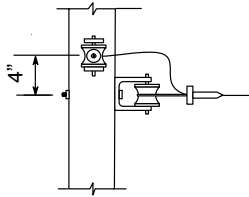
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THRU



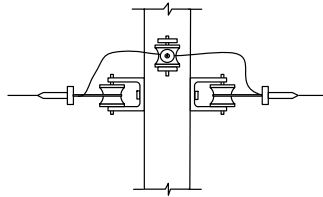
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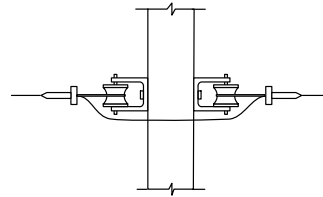
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DEADEND



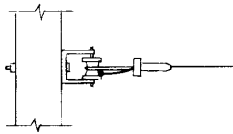
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90 DEG. ANGLE



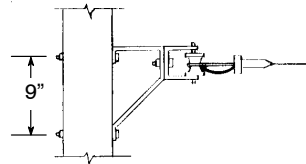
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"T" CORNER



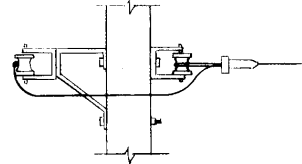
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LOOP AROUND



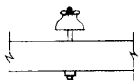
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THRU W/TAP



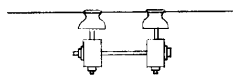
03 01 01 08
THRU W/EXT. W/TAP



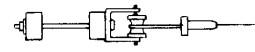
03 01 01 09
THRU W/EXT. W/TAP
ON BACK SIDE



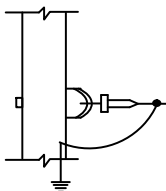
03 01 01 10
THRU X-ARM



03 01 01 11
THRU DBLE. X-ARM



03 01 01 12
DEADEND X-ARM



03 01 01 13
DEADEND
TENSION > 1500 LBS.

CONFIGURATIONS

Neutral

03 01 01 **

Sheet 2 of 2

		Std./ Stk. No.	Description 03 01 01 **	01	02	03	04	05	06	07	08	09	10	11	12	13
	A	06 01 01 01	Clevis, Secondary	1		1	2	1		1		1			1	
	B	06 01 01 03	Single Clevis Extension		1						1	1				
	C	23 52 095	Bolt, Mach, 3/4"x10"													1
	D	06 12 01 01	Crossarm Pin and Insulator										1	2		
@	E	SDEA*W	Deadend (See 08 01 10 00)			1	2	3	2	1	1	2			1	
@	F	PG*	See Std. 07 00 25 00				1	2	1	1	1	1				
@	G	TT*W	TopTie										1			
@	H	DTT*W	Double Top Tie											1		
@	I	DEA*W	Deadend (See 07 00 11 00)													1
	J	23 59 095	Eyelet, 3/4"													1
	K	06 01 01 02	Double Clevis					1	1							
	L	23 66 031	Washer, Square, 3/4"													1
@	M	12 00 10 **	Grounding Unit													1

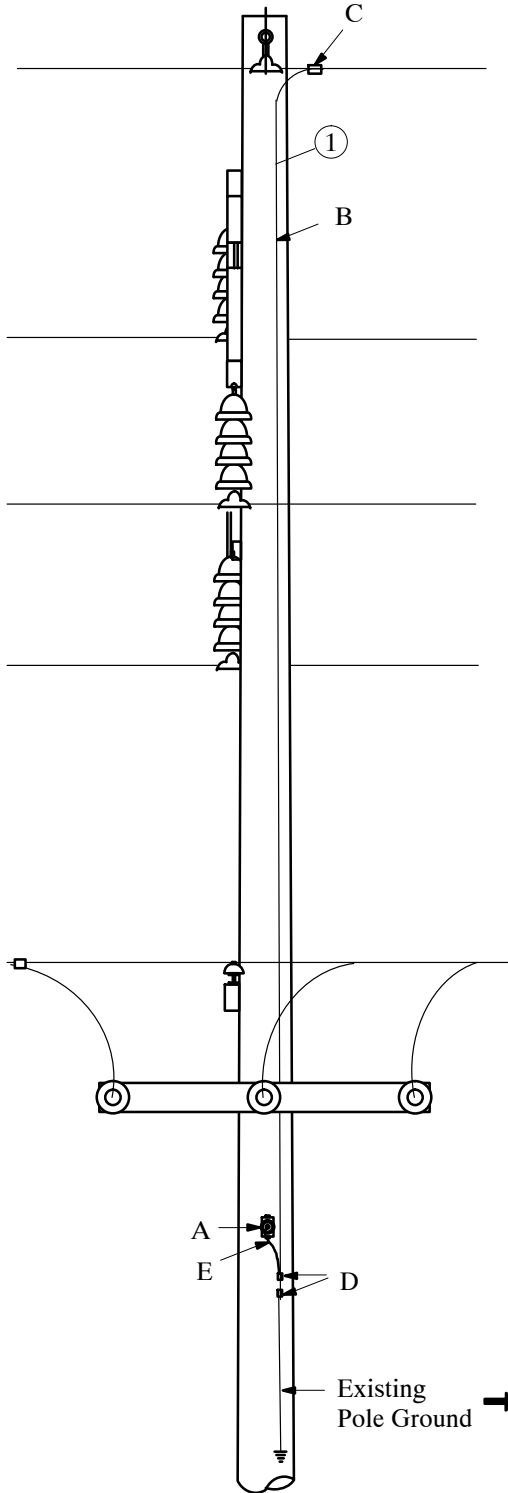
NOTE: If the deadend tension is greater than 1500 lbs., use Dist. Std. 03 01 01 13.

CONFIGURATIONS

Distribution Neutral Tap Connection to Sub-Transmission Static Wire

03 01 02 **

Sheet 1 of 1



Notes:

1. Connection from tap neutral to static/neutral wire must be at least the same ampacity as the tap neutral. For tap neutral, replace existing pole ground with #2 SD Cu. to a point 2-3' below tap neutral.
2. Install ground wire moulding in congested areas as required.
3. Install ground wire on quarter of pole that provides best clearance from center phase.

Tap Neutral

1/0 ACSR or AAAC

#4 ACSR

Std.

03 01 02 01

03 01 02 02

	Std./Stk. No.	Description	03 01 02 **	01	02
A	06 01 01 01	Clevis, Secondary		1	1
B	18 51 019	Wire, Cu, #2 SD, Poly Covered		30	
C	17 51 137	Clamp, PG		1	
D	17 51 032	Connector, Split Bolt		2	1
E	23 68 472	Deadend, Preformed, 1/0 ACSR or AAAC		1	
	23 68 469	Deadend, Preformed, #4 ACSR			1

CONFIGURATIONS

Preassembled Cable Secondary Secondary Run

03 01 03 **

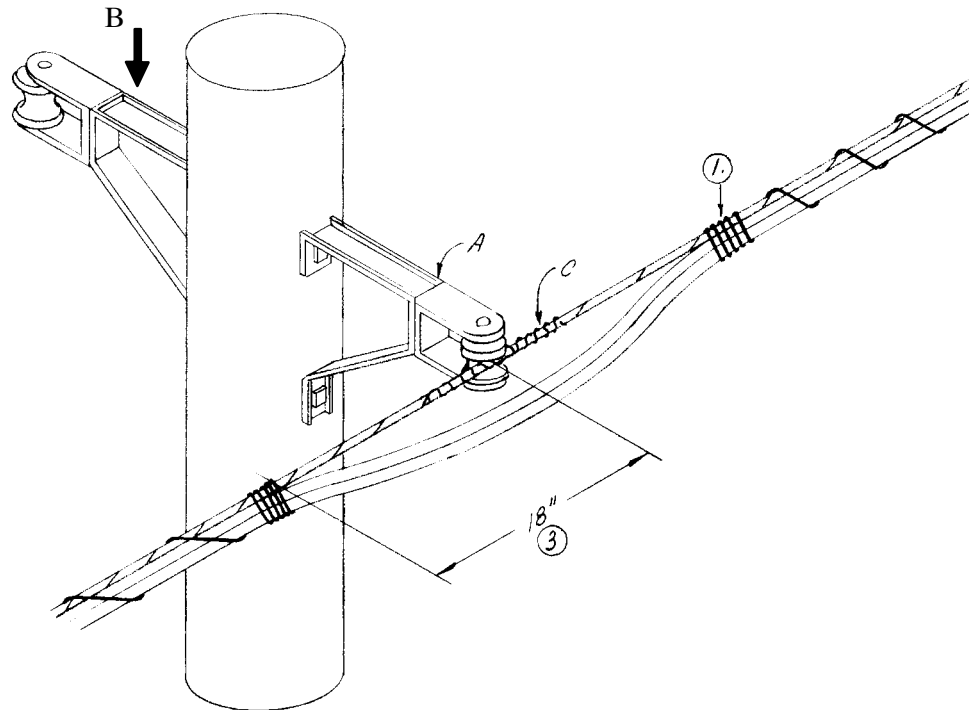
Sheet 1 of 1

Without Service Takeoff

03 01 03 01

With Service Takeoff

03 01 03 02



NOTES:

1. Terminate lashing ribbon with 5 close turns around entire cable and end on messenger with 2 turns and a half hitch. Train leads neatly and eliminate excess slack.
2. For Service Construction Details, see Dist. Std. **09 01 34 00**.
3. For ease in making connections, cable may be opened up as far as required.

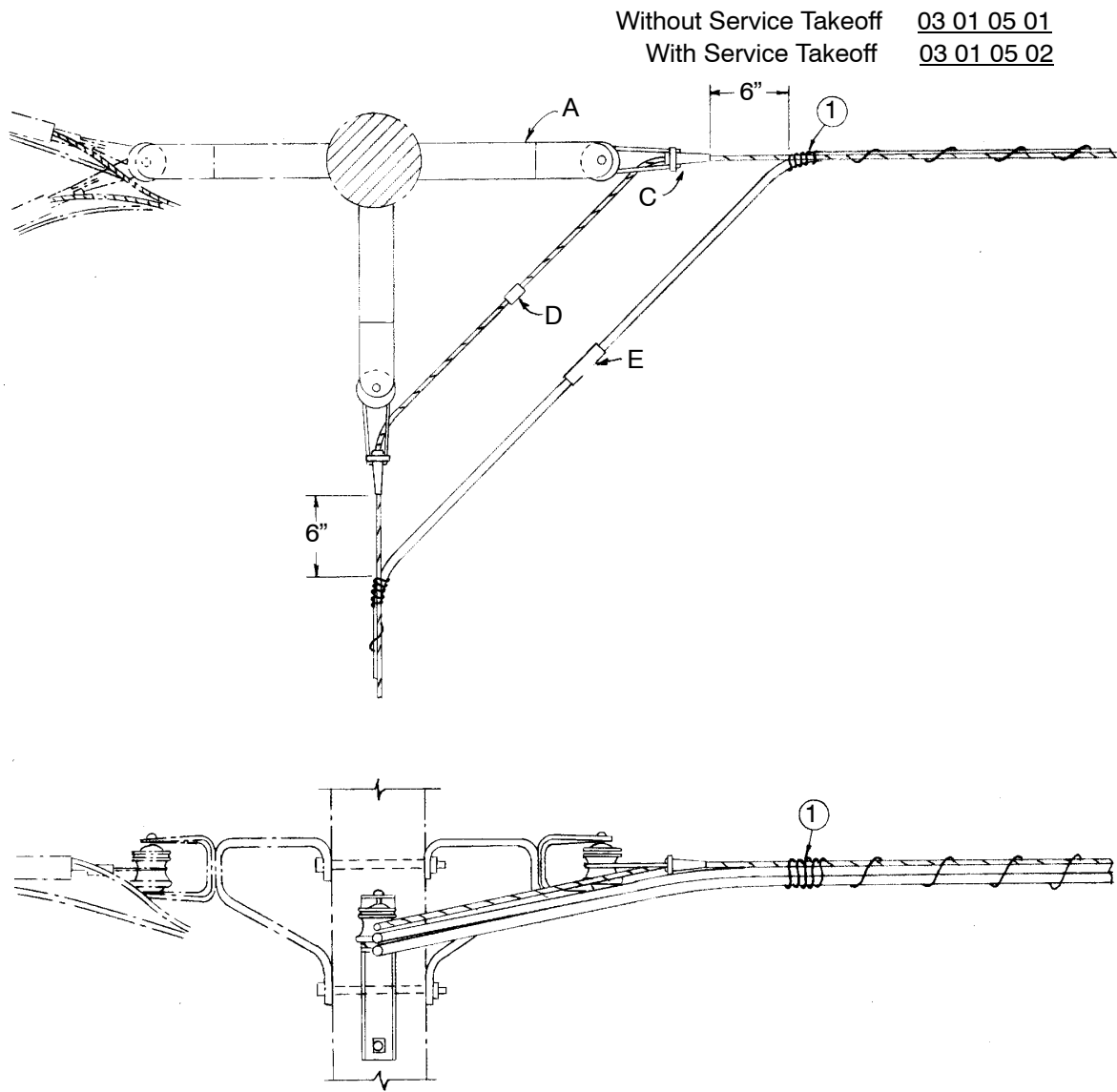
	Std. / Stk. No.	Description	03 01 03 **	01	02
A	06 01 01 03	Sgle. Clevis, Ext. Brkt.		1	
B	06 01 01 04	Dble. Sgle. Clevis Brkt.			1
C	23 68 358	Tie, Preformed, 1/0 AAAC		1	1

CONFIGURATIONS

Preassembled Cable Secondary L Corner

03 01 05 **

Sheet 1 of 1



NOTE:

1. Terminate lashing ribbon with 5 close turns around entire cable and end on messenger with two turns and a half hitch.

	Dist. Std. Or Stk. No.	Description	03 01 05 **	01	02
A	06 01 01 03	Sgle. Clevis, Ext. Brkt.		2	1
B	06 01 01 04	Dble. Sgle. Clevis Brkt.			1
C	23 78 333	Deadend, 1/0 AAAC		2	2
D	17 51 032	Clamp, 1/0 AAAC		1	1
E	17 51 138	Clamp, 4/0 AA		2	2

CONFIGURATIONS

Preassembled Cable Secondary Deadend

03 01 07 **

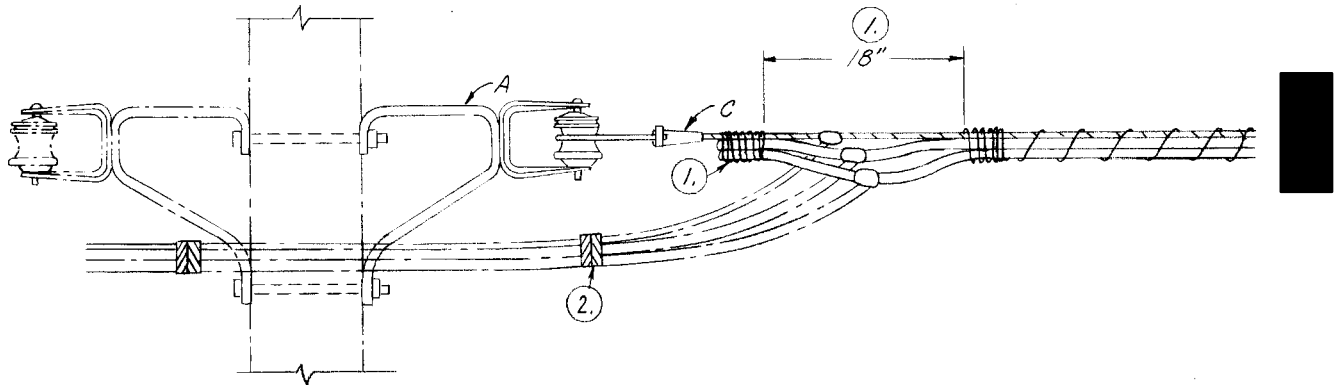
Sheet 1 of 1

Without Service Takeoff

03 01 07 01

With Service Takeoff

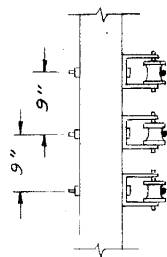
03 01 07 02



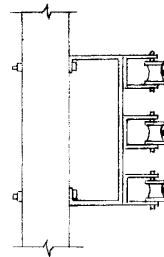
NOTES:

1. Open cable for distance of approximately 18" to allow room for making taps. Tape ends of conductors with rubber tape 25 53 008, followed by friction tape, 25 53 003, and lash cable to messenger on both sides of opening with 5 close turns around entire cable and end on messenger with 2 turns and a half hitch.
2. Bunch same phase wires to form a cable and tape as necessary.

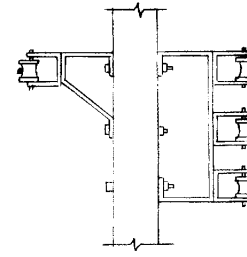
	Std. / Stk. No.	Description	03 01 07 **	01	02
A	06 01 01 03	Sgle. Clevis, Ext. Brkt.		1	
B	06 01 01 04	Dble. Sgle. Clevis Brkt.			1
C	23 78 333	Deadend 1/0 AAAC		1	1



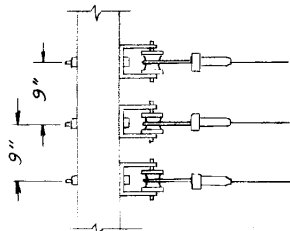
03 01 20 01
Thru



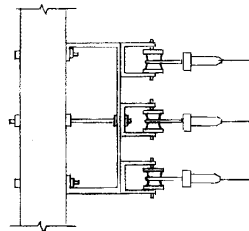
03 01 20 02
Thru w/Ext.
03 01 20 10
W/O Ext.



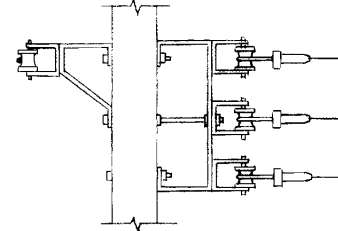
03 01 20 03
Thru w/Ext.
w/Service Ext.



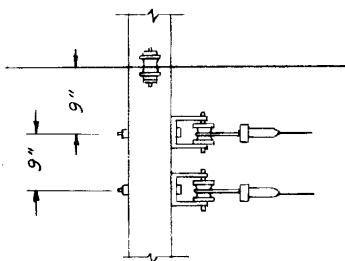
03 01 20 04
Deadend



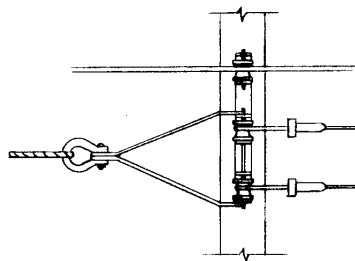
03 01 20 05
Deadend Ext.
03 01 20 11
Deadend w/o Ext.



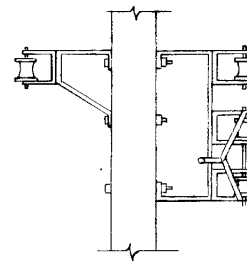
03 01 20 06
Deadend Ext.
w/Service Ext.



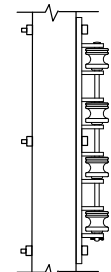
03 01 20 07
Neutral Thru
Sec. Deadend



03 01 20 08
Neutral Thru
Sec. Deadend w/Ext.



03 01 20 09
Neutral Thru
Sec. Deadend w/Ext.
Service w/Ext.



03 01 20 12
4 Wire Thru

Notes:

- When multiple secondary racks are installed on the same side of the poles, a 6" separation is required between the racks.

CONFIGURATIONS

Open Wire Secondary

03 01 20 **

Sheet 2 of 2

		Std. / Stk. No.	Description	03 01 20 **	01	02	03	04	05	06	07	08	09	10	11	12
@	A	06 01 01 01	Secondary Clevis		3			3			3					
	B	06 01 03 01	Ext. Bracket, 3-Clevis			1			1			1				
	C	06 01 03 02	Dble. Ext. Brkt's. 3 & 1 Clevis				1			1			1			
	D	11 00 49 01	Secondary Ext. Guy									1	1			
	E	DEP*W	Preformed Deadend					3	3	3	2	2	2		3	
		SDEA*W	Secondary Deadend					3	3	3	2	2	2		3	
	F	06 01 03 04	3 Spool Secondary Rack											1	1	
	G	06 01 07 01	4 Spool Secondary Rack													1

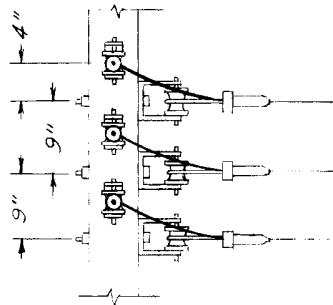
CONFIGURATIONS

Open Wire Secondary

90° Angle

03 01 21 **

Sheet 1 of 1

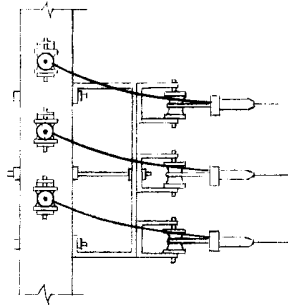


03 01 21 01

90 Deg. Angle

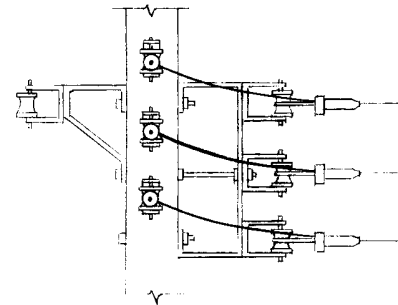
03 01 21 07

90 Deg. Angle w/3 Spool Rack



03 01 21 02

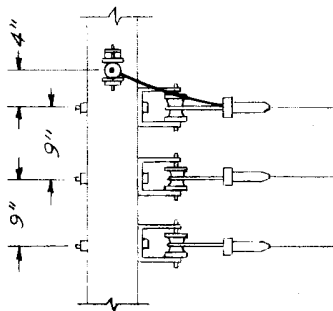
90 Deg. Angle w/ Ext.



03 01 21 03

90 Deg. Angle w/Ext.

Service w/Ext.



03 01 21 04

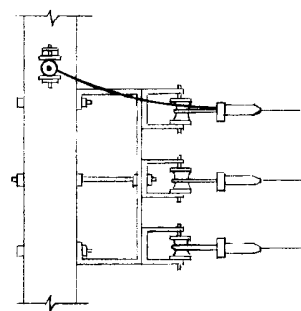
Sec. Deadend

Neutral 90 Deg. Angle

03 01 21 08

Sec. Deadend

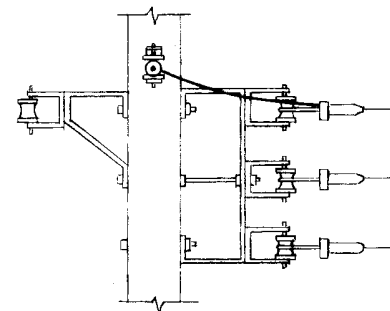
Neutral 90 Deg. Angle w/3 Spool Rack



03 01 21 05

Sec. Deadend w/Ext.

Neutral 90 Deg. Angle



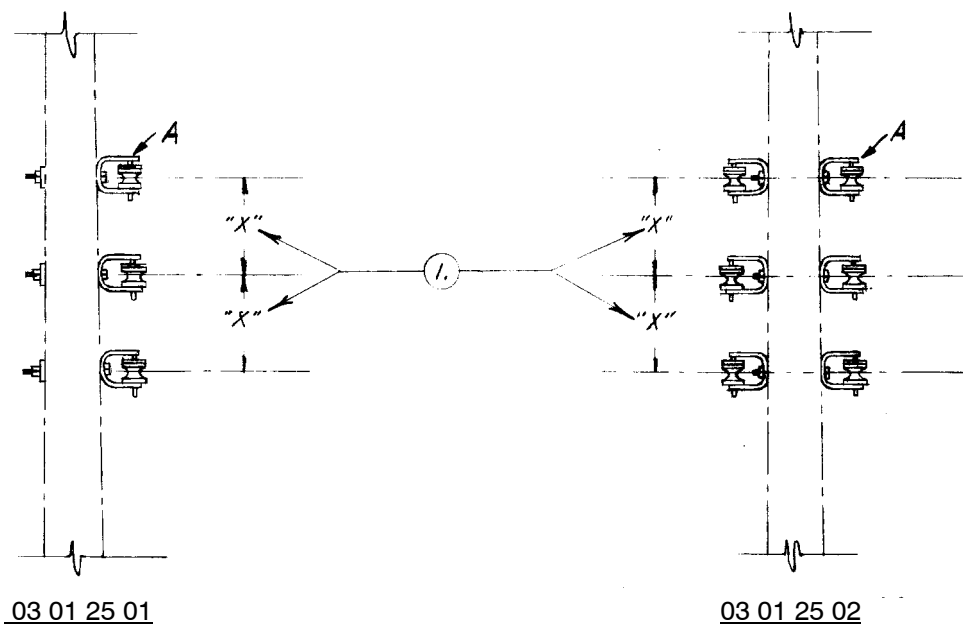
03 01 21 06

Sec. Deadend w/Ext.

Neutral 90 Deg. Angle

Service w/Ext.

		Dist. Std. Or Stk. No.	Description	03 01 21 **	01	02	03	04	05	06	07	08
-►@	A	06 01 01 01	Secondary Clevis		6	3	3	4	1	1	3	1
	B	06 01 03 01	Extension Brkt., 3- Clevis			1			1			
	C	06 01 03 02	Dble. Ext. Brkt's, 3 Clevis & 1 Clevis				1			1		
	D	DEP*W	Preformed Deadend		6	6	6	4	4	4		
		SDEA*W	Secondary Deadend		6	6	6	4	4	4	6	4
E	06 01 03 04		3 Spool Secondary Rack								1	1



	Std. / Stk. No.	Description	
A	06 01 01 01	Secondary Clevis	3

	Std. / Stk. No.	Description	
A	06 01 01 02	Service Takeoff	3

"X" = 9" for Spans up to 200 Ft.

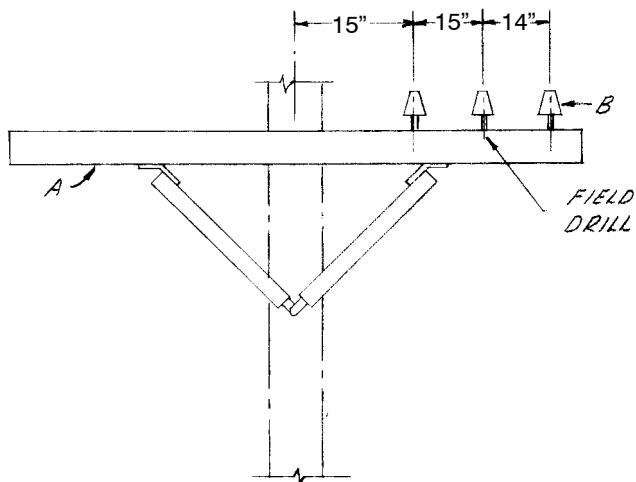
"X" = 12" for 200 Ft. to 250 Ft. Spans

"X" = 18" for 250 Ft. to 350 Ft. Spans

"X" = 24" for 350 Ft. to 400 Ft. Spans

NOTES:

1. This dimension may be reduced to 6" for spans up to 150 Ft. if necessary to meet joint use requirements.
2. Use secondary rack Stock No. 23-11-001 when available for spans up to 150 Ft.
3. For location of secondary clevises on rack with respect to primary circuits, see Dist. Std. 29 00 17 08.
4. This construction is applicable to only those cases where climbing space can be obtained without use of second-ary extension bracket.



8'

Sgle. Arm 03 01 26 03

Dble. Arm 03 01 26 04

3 Wire Secondary On One Side of Pole

1. This construction to be used only where existing facilities prohibit the use of secondary racks or clevises.
2. For location of secondary arms with respect to primary circuits, see Dist. Std. 29 00 17 16.

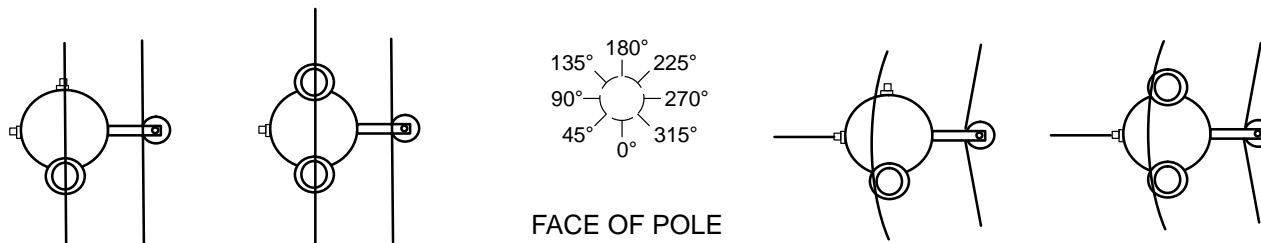
	Std. / Stk. No.	Description	03 01 26 **	03	04
A	04 00 20 02	Crossarm, Sgle., 8'		1	
	04 00 20 07	Crossarm, Dble., 8'			1
B	06 12 01 01	Insulator On Arm		3	6

CONFIGURATIONS

Single Phase
4 to 15 kV

03 12 01 **

Sheet 1 of 5

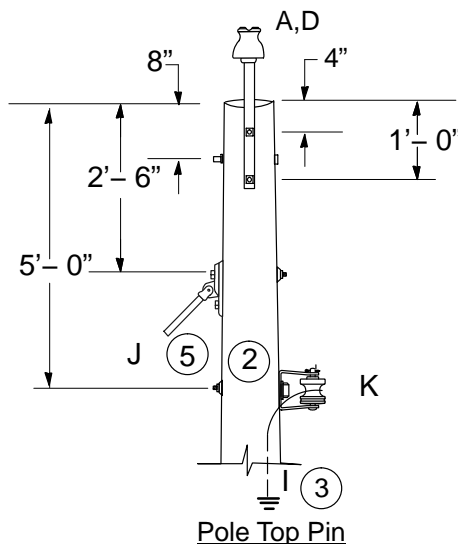


03 12 01 01
Tangent, Single Pin

03 12 01 03
Tangent, Double Pin

03 12 01 02 ①
Angle, Single Pin

03 12 01 22 ①
Angle, Double Pin



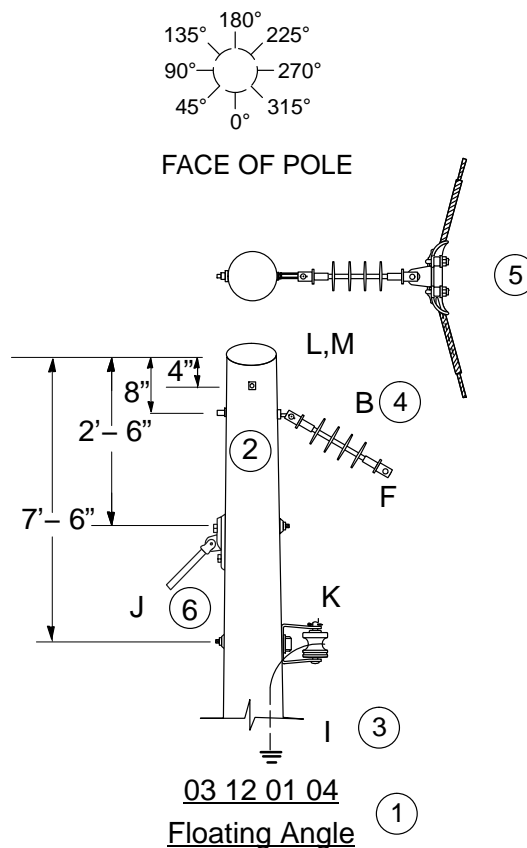
1. See DCS 03 00 03 00 for angle and span length limitations.
2. See DCS 02 00 04 02 for unguyed composite pole application.
3. Composite pole has factory installed (internal) pole ground in the 45° quadrant. Wood pole may require pole ground depending on application.
4. Double coil washer is not required on composite pole.
5. See DCS 11 00 02 02 for typical guy insulator placement.

		Std. / Stk. No.	Description	03 12 01 **	01	02	03	22
4	A	06 12 01 02	Insulator, Pole Top, Sgl Pin		1	1		
		06 12 01 13	Insulator, Pole Top, Dbl Pin				1	1
@	D	TT*W	Single Top Tie, See DCS 07 00 41 00		1			
		ST*W	Single Side Tie, See DCS 07 00 41 00			1		
		DTT*W	Double Top Tie, See DCS 07 00 41 00				1	
		DST*W	Double Side Tie, See DCS 07 00 41 00					1
@3	I	12 00 10 **	Grounding Unit, Wood Pole		@	@	@	@
		12 00 10 11	Grounding Unit, Composite Pole		1	1	1	1
@5	J	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)			1		1
@	K	03 01 01 **	Neutral		1	1	1	1

DISTRIBUTION
CONSTRUCTION STANDARDS



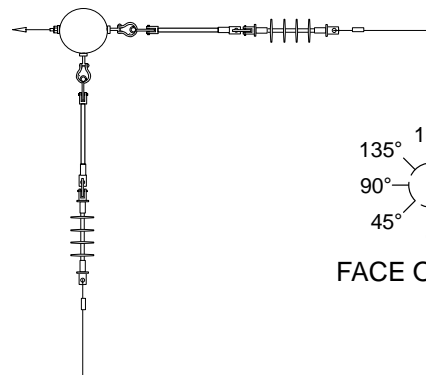
ENG: KR
REV. NO: 11
REV. DATE: 04/01/19



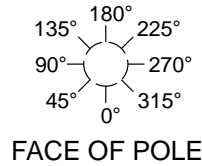
NOTES:

1. See DCS 07 00 16 00 for angle limitations.
2. See DCS 02 00 04 02 for unguyed composite pole application.
3. Composite pole has factory installed (internal) pole ground in the 45° quadrant. Wood pole may require pole ground depending on application.
4. If application is under-built (not top attachment on the pole), use DCS 03 12 02 04.
5. For ACSR, AAAC, and AAC conductors where spans exceed 300 feet, see DCS 07 00 08 01 for application of armor rods.
6. See DCS 11 00 02 02 for typical guy insulator placement.

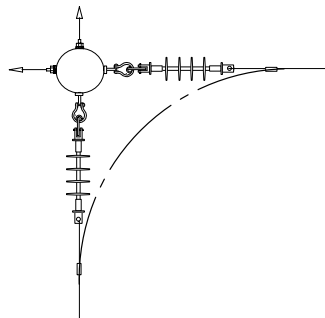
		Std. / Stk. No.	Description	03 12 01 **	04
@	B	06 12 30 02	Insulator, Floating Angle		1
	F	SC*W	Clamp, Suspension See DCS 07 00 16 00		1
@3	I	12 00 10 **	Grounding Unit, Wood Pole		@
		12 00 10 11	Grounding Unit, Composite Pole		1
@6	J	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)		1
@	K	03 01 01 **	Neutral		1
	L	23 52 065	Bolt, Mach., 5/8" x 12" (Anti-Split)		1
	M	23 66 031	Washer, Curved, 3/4"		2



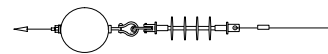
W/EXTENSION ①



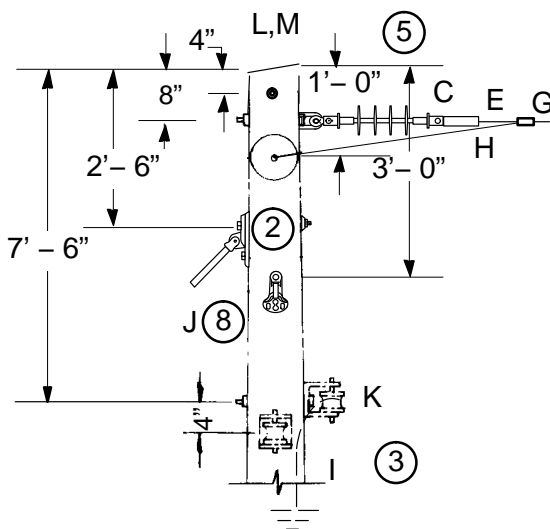
W/EXTENSION ①



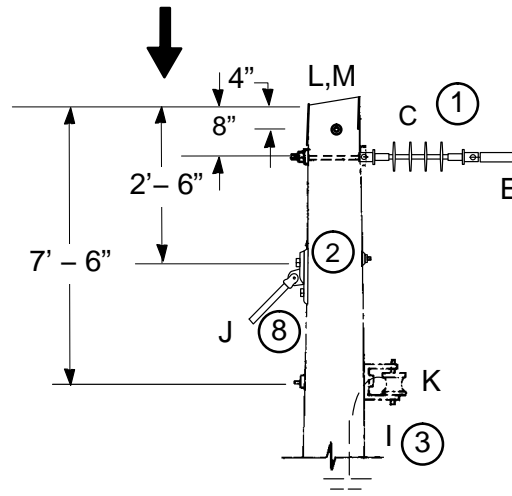
W/O EXTENSION ⑨



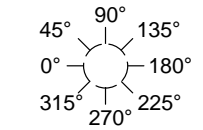
W/O EXTENSION ⑨



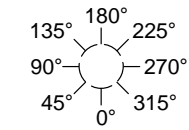
W/FG Extension 03 12 01 05
W/O FG Extension 03 12 01 12 ⑨
90 Deg. Angle



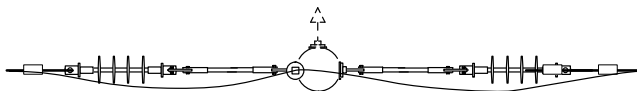
W/FG Extension 03 12 01 06 ①
W/O FG Extension 03 12 01 11 ⑨
Deadend



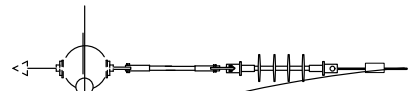
FACE OF POLE



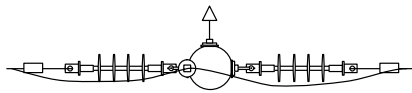
FACE OF POLE



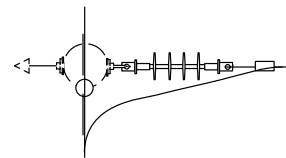
W/EXTENSION ①



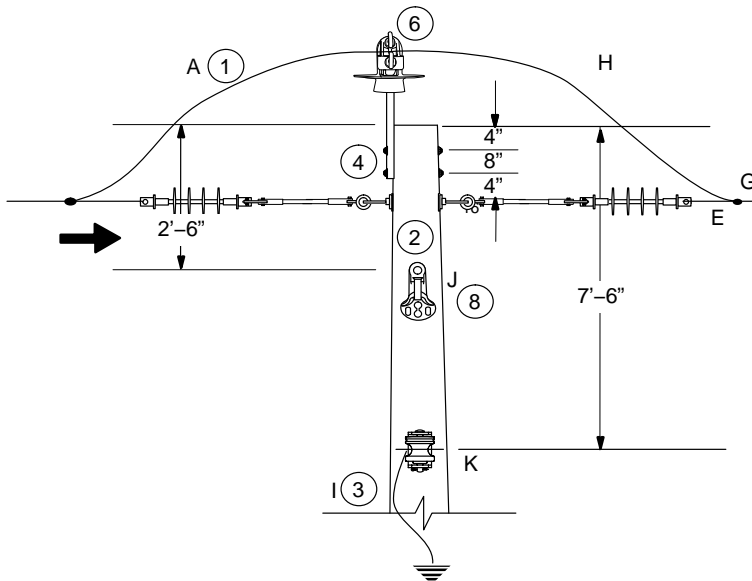
W/EXTENSION



W/O EXTENSION ⑨



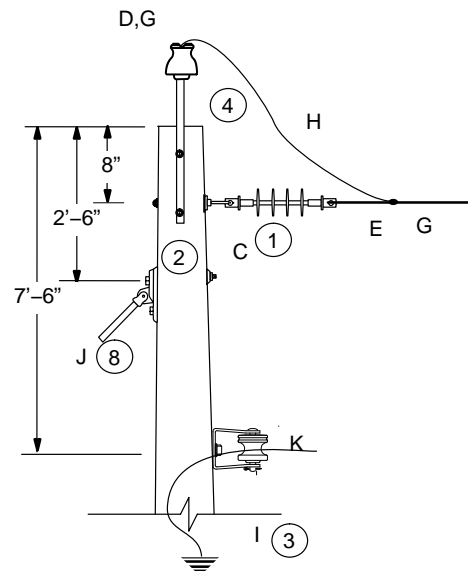
W/O EXTENSION ⑨



W/FG Extension
W/O FG Extension

03 12 01 07 ①
03 12 01 13 ⑨

LOOPOVER



W/FG Extension
W/O FG Extension

03 12 01 08 ①
03 12 01 14 ⑨

TAP

CONFIGURATIONS

Single Phase

4 to 15 kV

03 12 01 **

Sheet 5 of 5

NOTES:

1. For Ameren Mo., use FG extension if other equipment is installed on this pole and additional working space is needed.
2. See DCS 02 00 04 02 for unguyed composite pole application.
3. Composite pole has factory installed (internal) pole ground in the 45° quadrant. Wood pole may require pole ground depending on application.
4. Double coil washer is not required on composite pole.
5. If application is under-built (not top attachment on the pole), use DCS 03 12 02 05.
6. For jumper support application, hand tighten only and do not twist the eye off.
7. See DCS 17 31 50 ** and 17 31 51 ** for explanation of Operation Codes.
8. See DCS 11 00 02 02 for typical guy insulator placement.
9. Deadend on pole w/o fiberglass extension available Ameren Mo. Only.

		Std. / Stk. No.	Description	03 12 01 **	05	06	07	08	11	12	13	14
1,4	A	06 12 30 04	Pole Top, Loopover w/FG Extension				1					
9		06 12 30 14	Pole Top, Loopover w/o FG Extension								1	
1	C	06 12 30 01	Deadend w/FG Extension		2	1		1				
9		06 12 30 11	Deadend w/o FG Extension						1	2		1
@	D	TT*W	Top Tie See DCS 07 00 41 00					1				1
@	E	DEC*W	Clamp, Deadend See DCS 07 00 11 00		2	1	2	1	1	2	2	1
@	G	PG*	See DCS 07 00 25 00		2		2	2		2	2	2
@	H	PLW*W	Wire, Poly Covered, (ft.) See DCS 07 00 80 00		10		10	5		5	5	5
@ 3	I	12 00 10 **	Grounding Unit, Wood Pole		@	@	@	@	@	@	@	@
		12 00 10 11	Grounding Unit, Composite Pole		1	1	1	1	1	1	1	1
@ 8	J	11 00 4* **	Guying Unit (Down , Span, or Sidewalk)		2	1	1	1	1	2	1	1
@	K	03 01 01 **	Neutral		2	1	1	1	1	2	1	1
	L	23 52 065	Bolt, Mach., 5/8" x 12" (Anti-Split)		1	1			1	1		
	M	23 66 031	Washer, Curved, 3/4"		2	2			2	2		
7		252, 255, or 260	Install Jumper		1		1	1		1	1	1

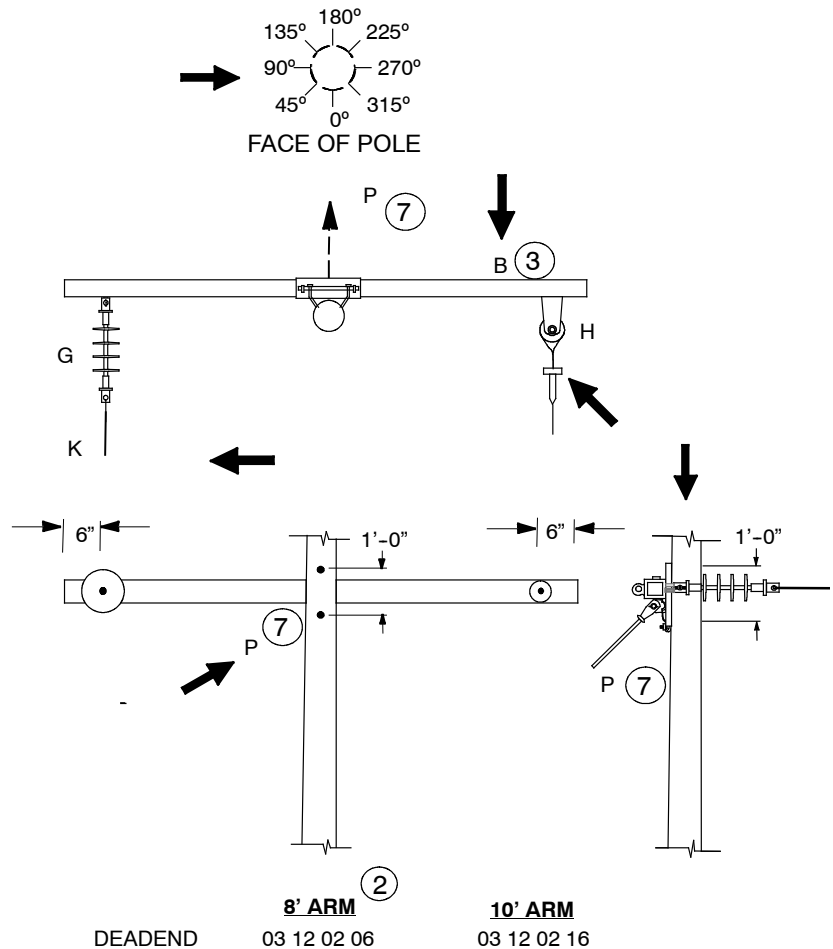
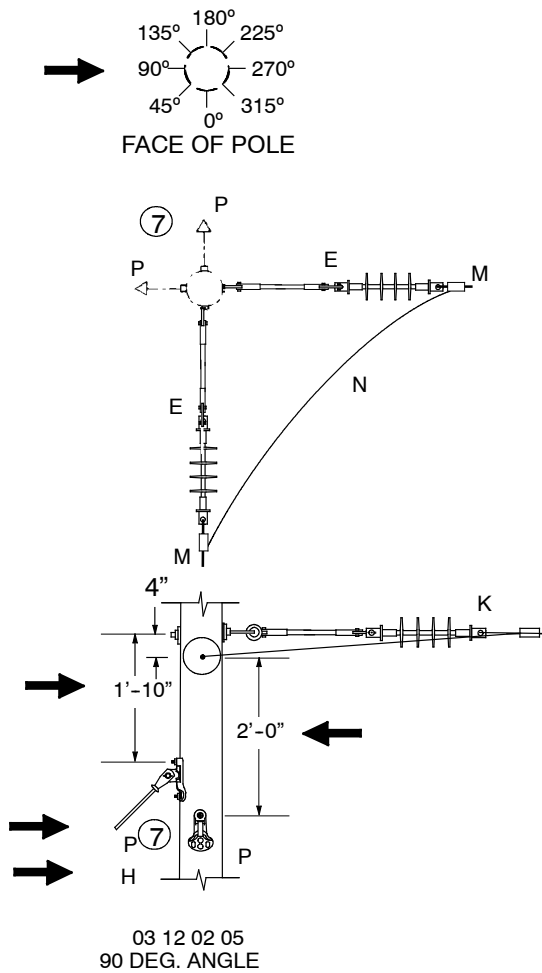
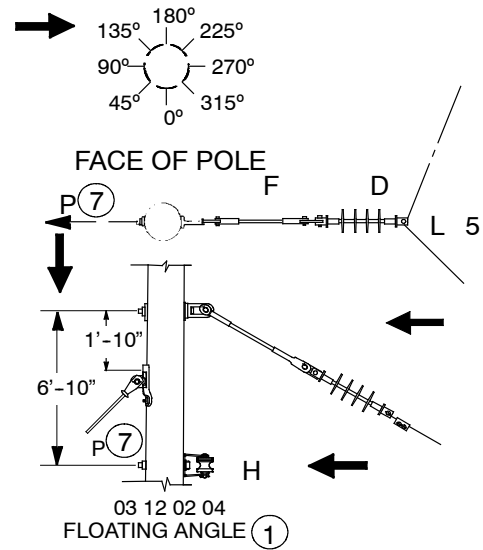
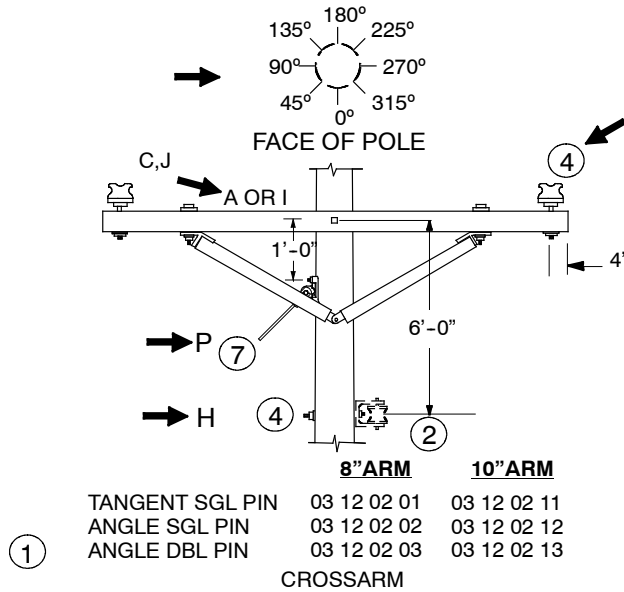
CONFIGURATIONS

Single Phase - Underbuild

4 to 15kV

03 12 02 **

Sheet 1 of 2



CONFIGURATIONS

Single Phase – Underbuild

4 to 15kV

03 12 02 **

Sheet 2 of 2

NOTES:

1. See DCS **03 00 03 00** for angle and span length limitations.
2. 8' crossarm available for use in Ameren Mo only.
3. See DCS **04 00 41 **** for maximum working loads for F/G deadend arms.
4. If neutral installed below arm, omit one pin insulator and see DCS **03 01 01 **** for neutral materials.
5. For ACSR, AAAC, and AAC conductors where spans exceed 300 feet, see DCS **07 00 08 01** for application of armor rods.
6. See DCS **17 31 50 **** and **17 31 51 **** for explanation of Operation Codes.
7. See DCS **11 00 02 02** for typical guy insulator placement.



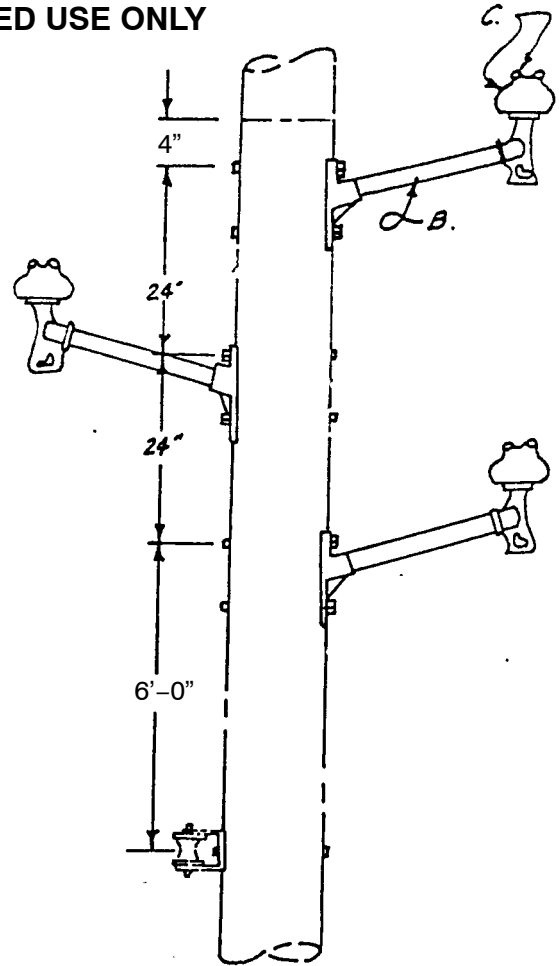
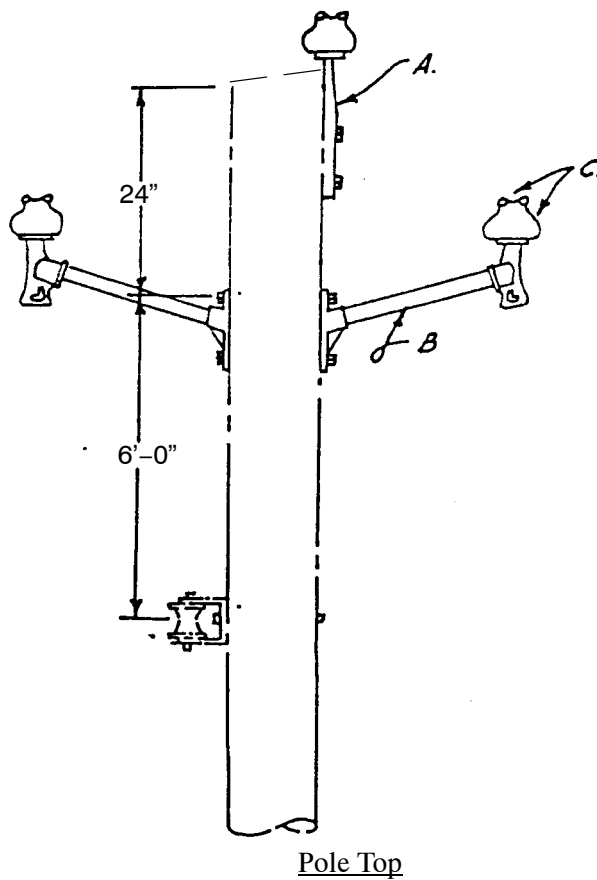
		Std. / Stk. No.	Description	03 12 02 **	01	02	03	04	05	06	11	12	13	16
2	A	04 00 20 02	Crossarm, 8' Wood, Sgl.		1	1								
		04 00 20 03	Crossarm, 10' Wood, Sgl.								1	1		
2,3	B	04 00 41 03	Crossarm, Deadend, FG, 8'							1				
		04 00 41 04	Crossarm, Deadend, FG, 10'											1
	C	06 12 01 01	Insulator, Arm, Sgl Pin		2	2					2	2		
		06 12 01 11	Insulator, Arm, Dbl Pin				2						2	
	D	06 12 30 02	Insulator, Floating Angle					1						
	E	06 12 30 01	Deadend w/ FG Extension						2					
	F	25 56 076	Insulator, Guy Strain, FG, 26"					1						
	G	06 12 34 01	Deadend On Arm							1				1
@	H	03 01 01 **	Neutral		1	1	1	1	2	1	1	1	1	1
2	I	04 00 41 14	Crossarm, Tangent, F/G, 8'				1							
		04 00 41 16	Crossarm, Tangent, F/G, 10'										1	
@	J	TT*W	Sgl Top Tie (See DCS 07 00 41 00)		2						2			
		ST*W	Sgl Side Tie (See DCS 07 00 41 00)			2						2		
		DST*W	Dble. Side Tie (See DCS 07 00 41 00)				2						2	
@5	K	DEC*W	Deadend, Clamp (See DCS 07 00 11 00)						2	1				1
@	L	SC*W	Suspension, Clamp (See 07 00 20 00)					1						
@	M	PG*W	See Std. (See DCS 07 00 25 00)						2					
@	N	PLW*W	Wire, Poly covered, (Ft.) (See DCS 07 00 80 00)						18					
@7	P	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)			1	1	1	2	1		1	1	1
6		252, 255, or 260	Install jumper						1					

CONFIGURATIONS
Armless – Two or Three Phase
4kV to 15kV

03 12 03 **

Sheet 1 of 1

MAINTENANCE AND LIMITED USE ONLY



2Ø 3Ø

Tangent 03 12 03 01 03 12 03 03
Angle 03 12 03 02 03 12 03 04

2Ø 3Ø

Underbuild

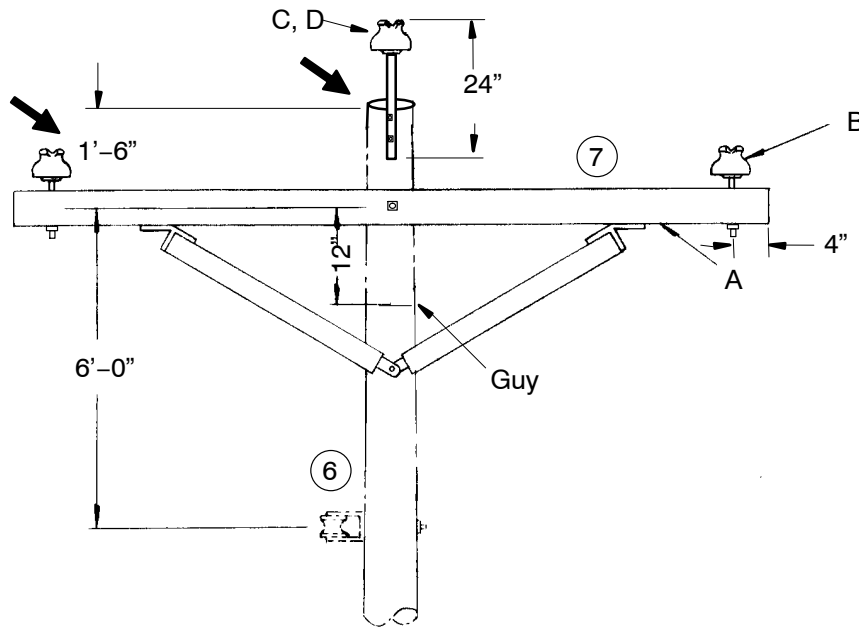
Tangent 03 12 03 05 03 12 03 07
Angle 03 12 03 06 03 12 03 08

		Std. / Stk. No.	Description	03 12 03 **							
				01	02	03	04	05	06	07	08
				Pole Top				Underbuild			
				2Ø		3Ø		2Ø		3Ø	
@	A	06 12 01 02	Insulator, Pole Top	1	1	1	1				
	B	06 12 21 04	Assembly – Standoff, 24" F.G.	1	1	2	2	2	2	3	3
	C	TT*W	Top Tie	2		3		2		3	
		ST*W	Side Tie		2		3		2		3

CONFIGURATIONS
Two or Three Phase
Tangent Or Angle On Wood Crossarm – 4 to 15 kV

03 12 05 **

Sheet 1 of 3



	3Ø	2Ø
Tangent 8' Sgle. Arm	03 12 05 01	03 12 05 07
Angle 8' Sgle. Arm	03 12 05 02	03 12 05 08
Tangent 10' Sgle. Arm	03 12 05 04	03 12 05 10
Angle 10' Sgle. Arm	03 12 05 05	03 12 05 11

NOTES:

1. See DCS **03 00 03** for angle and span length limitations.
2. See DCS **04 00 20 **** for arm detail.
3. For 2 phase configuration, eliminate the center phase position.
4. See DCS **02 00 04 03** for unguyed composite pole application.
5. Composite pole has factory installed pole ground; wood pole may require pole ground based on application.
6. See DCS **03 01 01 **** for neutral configuration.
7. 8 ft. crossarm available AmerenMO only.

		Std. / Stk. No.	Description	03 12 05 **									
				01	02	04	05	07	08	10	11		
7	A	04 00 20 02	Crossarm, 8' Sgl.	1	1			1	1				
		04 00 20 03	Crossarm, 10' Sgl.			1	1			1	1		
	B	06 12 01 01	Insulator, Arm, Sgl	2	2	2	2	2	2	2	2		
	C	06 12 01 02	Insulator, Pole Top, Sgl	1	1	1	1						
@	D	TT*W	Sgl Top Tie	3		3		2		2			
		ST*W	Sgl Side Tie		3		3		2		2		

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: MJ
REV. NO: 9
REV. DATE: 1/06/12

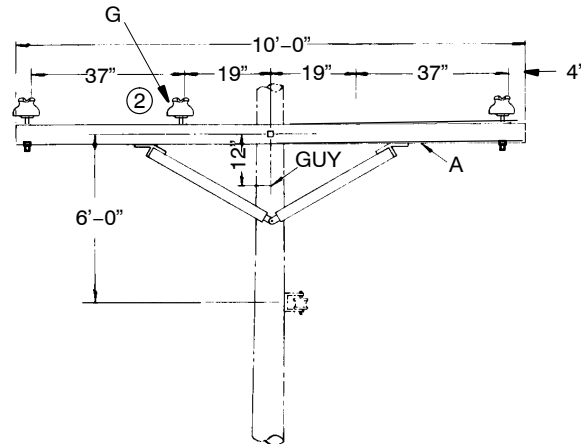
CONFIGURATIONS

Two or Three Phase

Tangent Or Angle On Wood Crossarm – 4 to 15 kV

03 12 05 **

Sheet 2 of 3



	<u>3Ø</u>	<u>2Ø</u>
TANGENT 10' SGLE. ARM	03 12 05 51	03 12 05 60
ANGLE 10' SGLE. ARM	03 12 05 52	03 12 05 61

➔ UNDERBUILD

NOTES:

1. See DCS **03 00 03** for angle and span length limitations.
2. Underbuild cover available AmerenIL only.

		Std. / Stk. No.	Description	03 12 05 **	51	52	60	61
					3Ø		2Ø	
@	A	04 00 20 03	Crossarm, 10' Sgle.		1	1	1	1
	C	06 12 01 01	Insulator, Arm		3	3	2	2
	E	TT*W	Top Tie, Sgl Pin		3		2	
		ST*W	Side Tie, Sgl Pin			3		2
2@	G	05 16 10 01	Cover – Single Pin		1	1		

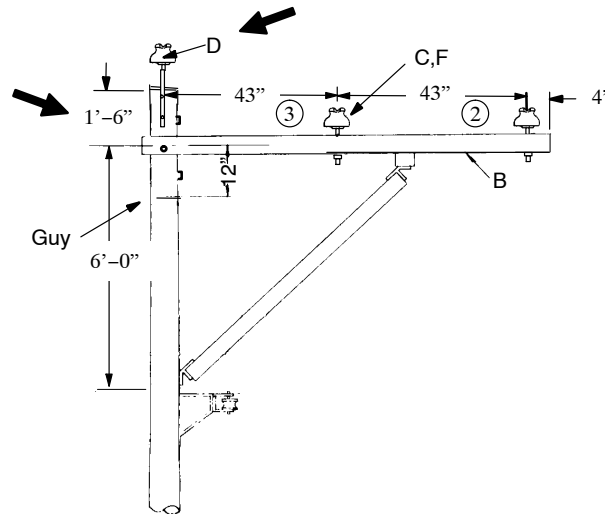
CONFIGURATIONS

Two or Three Phase

Tangent Or Angle On Wood Crossarm – 4 to 15 kV

03 12 05 **

Sheet 3 of 3



	<u>3Ø</u>	<u>2Ø</u>
TANGENT 8' SGLE. ARM	03 12 05 54	03 12 05 63
ANGLE 8' SGLE. ARM	03 12 05 55	03 12 05 64
ANGLE DBLE. ARM	03 12 05 56	03 12 05 65

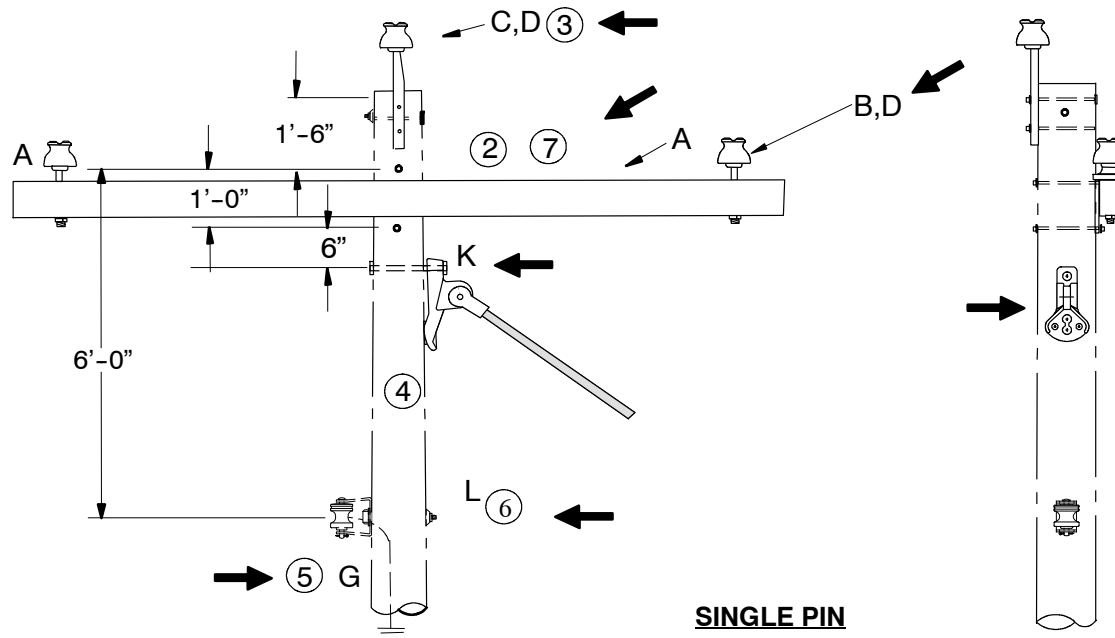
SIDE ARM ①

NOTES:

1. See DCS 03 00 03 for angle and span length limitations.
2. 8 ft. alley arm available AmerenMO only.
3. Cover available AmerenIL only.

		Std./ Stk. No.	Description	03 12 05 **					
				54	55	56	63	64	65
@				3Ø			2Ø		
	B	04 00 24 02	Sidearm, 8' Sgle.	1	1		1	1	
		04 00 24 05	Sidearm, 8' Dble.			1			1
	C	06 12 01 01	Insulator, Arm	2	2	4	1	1	4
	D	06 12 01 02	Insulator, Pole Top	1	1	2	1	1	
	E	TT*W	Top Tie	3			2		
		ST*W	Side Tie		3			2	
		DST*W	Double Side Tie			3			2
	3@	F	05 16 10 01	Cover – Single Pin	1	1			

Tangent Or Angle On Fiberglass Crossarm

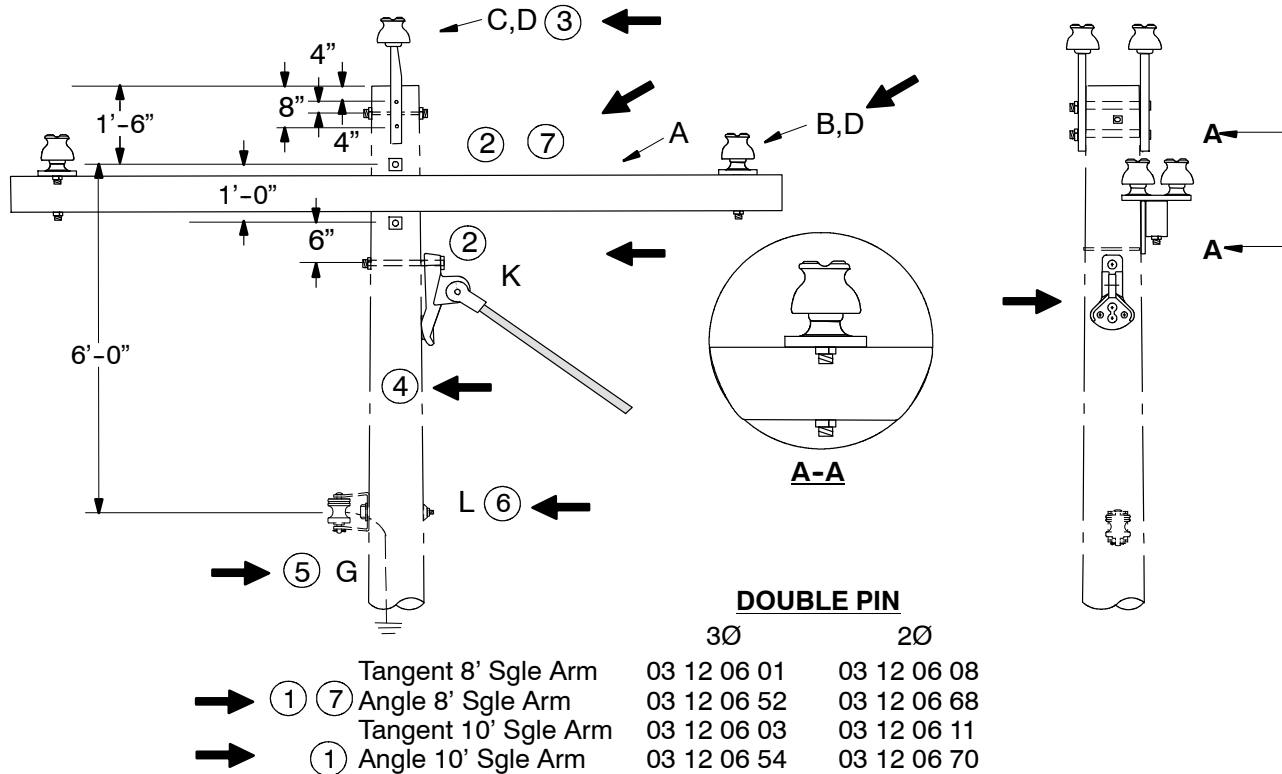


		SINGLE PIN	
		3Ø	2Ø
→ ① ⑦	Tangent 8' Sgle Arm	03 12 06 02	03 12 06 07
→ ① ⑦	Angle 8' Sgle Arm	03 12 06 13	03 12 06 14
→ ①	Tangent 10' Sgle Arm	03 12 06 04	03 12 06 10
→ ①	Angle 10' Sgle Arm	03 12 06 05	03 12 06 15

NOTES:

1. See DCS 03 00 03 00 for angle and span length limitations.
2. See DCS 04 00 41 ** for arm detail.
3. For 2 phase configuration, eliminate the center phase position.
4. See DCS 02 00 04 03 for unguyed composite pole application.
5. Composite pole has factory installed (internal) pole ground. Wood pole may require pole ground depending on application.
6. See DCS 03 01 01 ** for neutral configuration.
7. 8 ft. crossarm available Ameren Mo. only.R

		Std. / Stk. No.	Description	03 12 06 **	02	04	05	13	07	10	14	15
					3Ø				2Ø			
7	A	04 00 41 14	Crossarm, F/G, 8'		1			1	1		1	
		04 00 41 16	Crossarm, F/G, 10'			1	1			1		1
@	B	06 12 01 12	Insulator, Arm, Sgl Pin		2	2	2	2	2	2	2	2
	C	06 12 01 02	Insulator, Pole Top, Sgl Pin		1	1	1	1				
	D	TT*W	Top Tie, Sgl Pin See DCS 07 00 41 00		3	3			2	2		
5@	G	ST*W	Side Tie, Sgl Pin See DCS 07 00 41 00				3	3			2	2
		12 00 10 01	Grounding Unit, Wood Pole		@	@	@	@	@	@	@	@
		12 00 10 11	Grounding Unit, Composite Pole		1	1	1	1	1	1	1	1
@	K	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)				1	1			1	1
6@	L	03 01 01 01	Neutral, Tangent		1	1	1	1	1	1	1	1
		03 01 01 02	Neutral, Tangent w/Ext		1	1	1	1	1	1	1	1



NOTES:

- See DCS 03 00 03 00 for angle and span length limitations.
- See DCS 04 00 41 ** for arm detail.
- For 2 phase configuration, eliminate the center phase position.
- See DCS 02 00 04 03 for unguyed composite pole application.
- Composite pole has factory installed (internal) pole ground. Wood pole may require pole ground depending on application.
- See DCS 03 01 01 ** for neutral configuration.
- 8 ft. crossarm available Ameren Mo. only.R

		Std. / Stk. No.	Description	03 12 06 **	01	03	52	54	08	11	68	70
					3Ø				2Ø			
7	A	04 00 41 14	Crossarm, F/G, 8'		1		1		1		1	
		04 00 41 16	Crossarm, F/G, 10'			1		1		1		1
	B	06 12 01 11	Insulator, Arm, Dbl Pin		2	2	2	2	2	2	2	2
	C	06 12 01 13	Insulator, Pole Top, Dbl Pin		1	1	1	1				
@	D	DTT*W	Double Top Tie, Dbl Pin See DCS 07 00 41 00		3	3			2	2		
		DST*W	Double Side Tie, Dbl Pin See DCS 07 00 41 00				3	3			2	2
5@	G	12 00 10 01	Grounding Unit, Wood Pole		1	1	1	1	1	1	1	1
		12 00 10 11	Grounding Unit, Composite Pole		1	1	1	1	1	1	1	1
@	K	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)				1	1			1	1
6@	L	03 01 01 01	Neutral, Tangent		1	1	1	1	1	1	1	1
		03 01 01 02	Neutral, w/Ext		1	1	1	1	1	1	1	1

CONFIGURATIONS

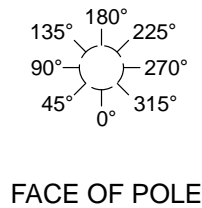
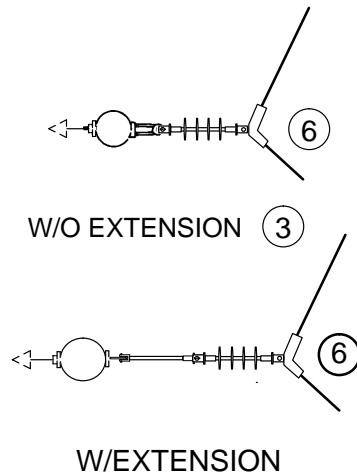
Two or Three Phase Floating and 90° Angles

4kV to 15kV

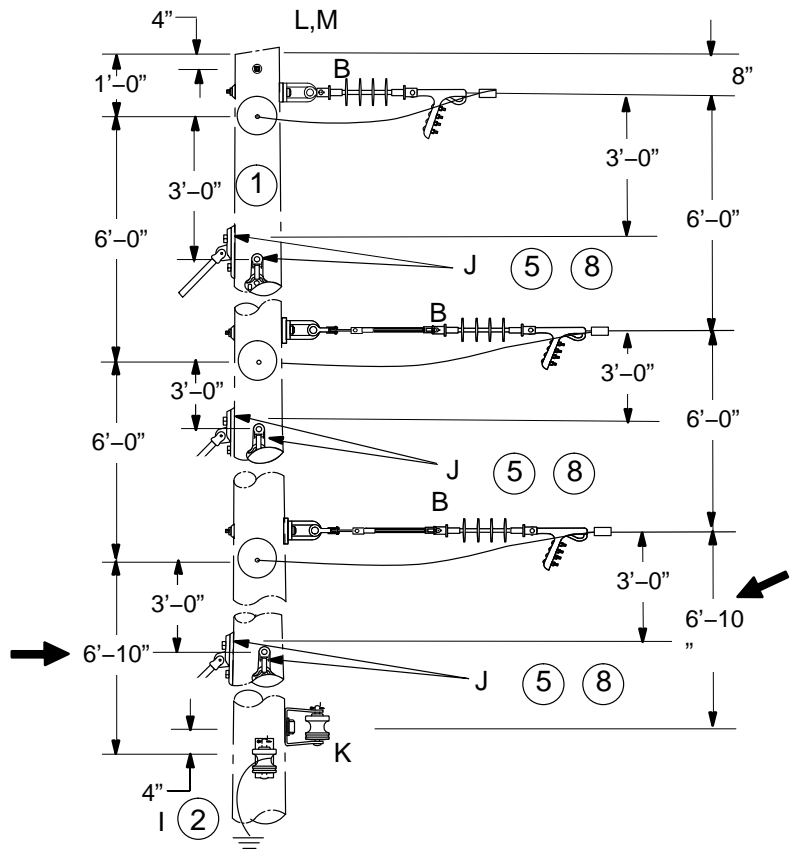
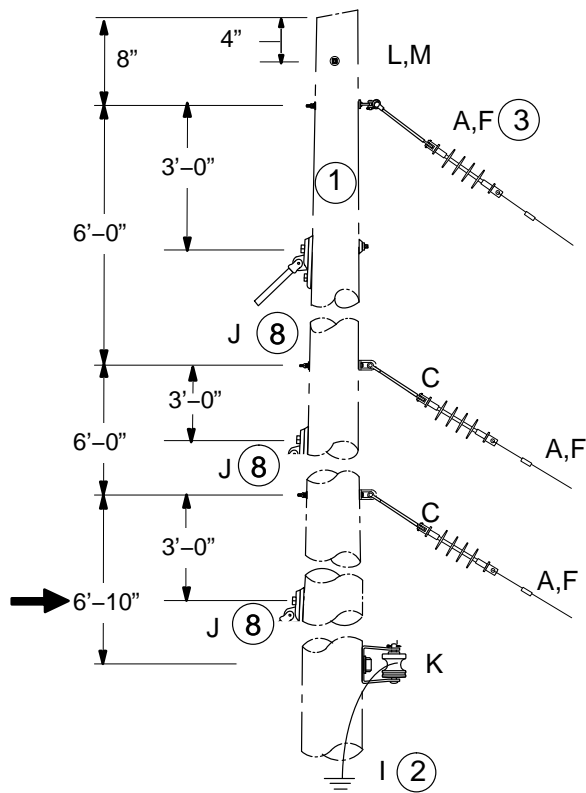
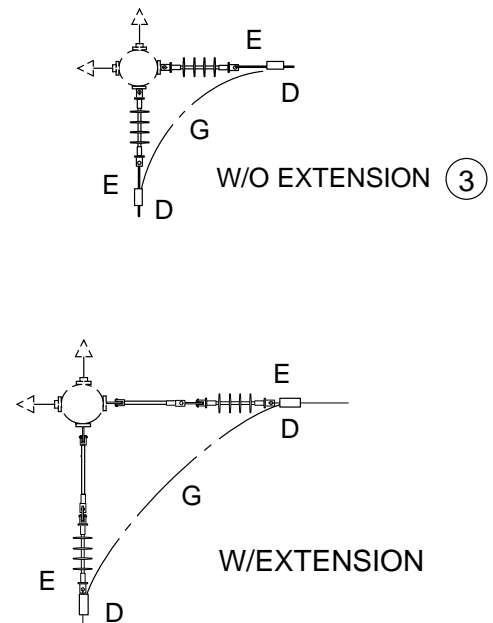
03 12 07 **

Sheet 1 of 2

FLOATING ANGLES



90° ANGLES



- (4) Floating Angle
- Deadend w/FG Extension in Top Phase
- Deadend w/o FG Extension in Top Phase

3Ø	2Ø
03 12 07 02	03 12 07 06
03 12 07 04	03 12 07 08
03 12 07 03	03 12 07 07

CONFIGURATIONS

Two or Three Phase Floating and 90° Angles

4kV to 15kV

03 12 07 **
Sheet 2 of 2

NOTES:

1. See DCS **02 00 04 03** for unguyed composite pole application.
2. Composite pole has factory installed (internal) pole ground in the 45° quadrant. Wood pole may require pole ground depending on application.
3. Use FG extension in top phase for climbing space if application is under-built (not top attachment on the pole). For 03 12 07 02 & 06 this requires ordering 1 additional FG extension.
4. 03 12 07 04 & 08 are for under-build construction and include FG extensions for the top phases.
5. If a span guy or guys are required or two through-bolts are used to attach the guy hook(s), the location of one or both of the guy hooks will need to be adjusted up or down 2 inches.
6. For ACSR, AAAC, and AAC conductors where spans exceed 300 feet, see DCS **07 00 08 01** for application of armor rods.
7. See DCS **17 31 50 **** and **17 31 51 **** for explanation of Operation Codes.
8. See DCS **11 00 02 02** for typical guy insulator placement.

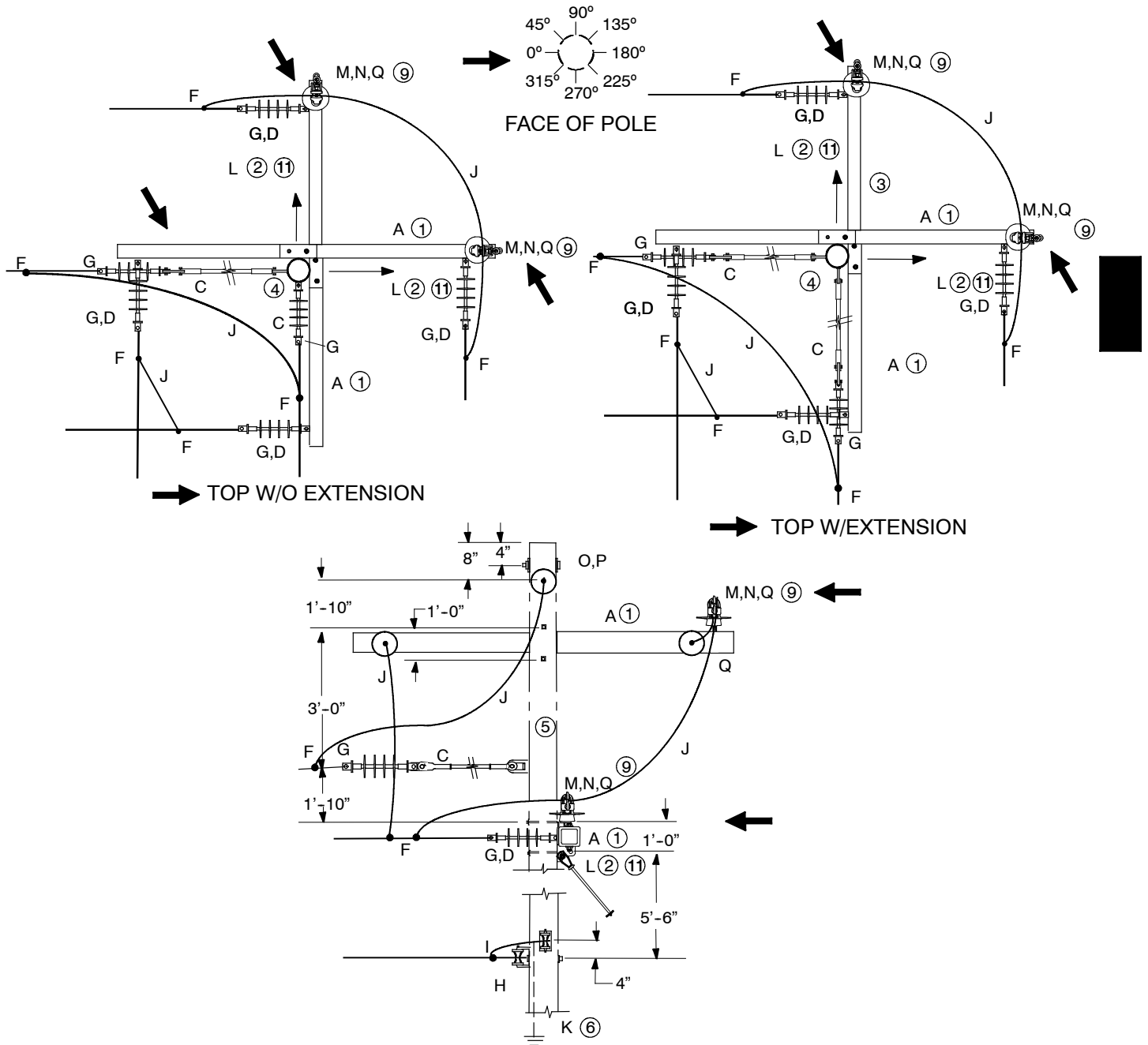
		Std. / Stk. No.	Description	03 12 07 **					
				02	03	04	06	07	08
				3Ø			2Ø		
	A	06 12 30 02	Insulator, Floating Angle	3			2		
	B	06 12 30 01	Deadend w/FG Extension		4	6		2	4
		06 12 30 11	Deadend w/o FG Extension		2			2	
3	C	25 56 076	Insulator, Guy Strain, FG, 26"	2			1		
@	D	PG*	See Std. 07 00 25 00		6	6		4	4
@	E	DEC*W	Deadend Clamp See DCS 07 00 11 00		6	6		4	4
@	F	SC*W	Suspension Clamp See DCS 07 00 16 00	3			2		
@	G	PLW*W	Wire, Poly covered, (Ft.) See DCS 07 00 80 00		30	30		20	20
@2	I	12 00 10 **	Grounding Unit, Wood Pole	@	@	@	@	@	@
		12 00 10 11	Grounding Unit, Composite Pole	1	1	1	1	1	1
@8	J	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)	3	6	6	2	4	4
@	K	03 01 01 **	Neutral	1	1	1	1	1	1
	L	23 52 065	Bolt, Mach., 5/8" X 12" (Anti Split)	1	1	1	1	1	1
	M	23 66 031	Washer, Curved, 3/4"	2	2	2	2	2	2
7		252, 255, or 260	Install Jumper		3	3		2	2

CONFIGURATIONS

Two or Three Phase Buck Arm - 90° Angle
4 to 15kV

03 12 09 **

Sheet 1 of 2



→	⑦ 8' FG Arm, Pole w/o Ext	3Ø 03 12 09 01	2Ø ④ 03 12 09 04
	⑧ 8' FG Arm, Pole w/Ext	03 12 09 03	03 12 09 04
	⑧ 10' FG Arm, Pole w/o Ext	03 12 09 05	03 12 09 08
	③ 10' FG Arm, Pole w/Ext	03 12 09 02	03 12 09 08

CONFIGURATIONS

Two or Three Phase Buck Arm – 90° Angle 4 to 15kV

03 12 09 **

Sheet 2 of 2

NOTES:

1. See DCS **04 00 41 **** for arm strength.
2. Attach guy to bracket of fiberglass arm.
3. Use 10' deadend arm with F/G extension on pole for underbuild application.
4. For 2 phase construction, keep the arm spacing as shown but eliminate the center phase position.
5. See DCS **02 00 04 03** for unguyed composite pole application.
6. Composite pole has factory (internal) installed pole ground in the 45° quadrant. Wood pole may require pole ground depending on application.
7. The 8' crossarm is available for Ameren Mo. only.
8. Deadend on pole w/o fiberglass extension available Ameren Mo. only.
9. For jumper support applications, hand tighten only and do not twist the eye off.
10. See DCS **17 31 50 **** and **17 31 51 **** for explanation of Operation Codes.
11. See DCS **11 00 02 02** for typical guy insulator placement.G

		Std. / Stk. No.	Description	03 12 09 **					
				01	02	03	05	04	08
3,7	A	04 00 41 03	Deadend Assy., F/G, 8'	2		2		2	
		04 00 41 04	Deadend Assy., F/G, 10'		2		2		2
8	C	06 12 30 01	Deadend w/FG Extension	1	2	2	1		
		06 12 30 11	Deadend w/o FG Extension	1			1		
@	D	06 12 35 01	Deadend on Arm	4	4	4	4	4	4
@	F	PG*	See Std. 07 00 25 00	6	6	6	6	4	4
@	G	DEC*W	Clamp, Deadend See 07 00 11 00	6	6	6	6	4	4
@	H	03 01 01 **	Neutral	@	@	@	@	@	@
@	I	17 51 032	Neutral PG Clamp	2	2	2	2	2	2
@6	J	PLW*W	Lead Wire, Poly Covered, Ft. See 07 00 80 00	30	30	30	30	20	20
@2,5,11	K	12 00 10 **	Grounding Unit, Wood Pole	@	@	@	@	@	@
		12 00 10 11	Grounding Unit, Composite Pole	1	1	1	1	1	1
@	L	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)	2	2	2	2	2	2
10	M	23 62 028	Pin, Insulator, Long Shank	2	2	2	2	2	2
	N	25 05 143	Insulator, Vice-Top, 15kV	2	2	2	2	2	2
	O	23 52 065	Bolt, Mach., 5/8" x 12" (Anti-Split)	1	1	1	1	1	1
	P	23 66 031	Washer, Curved, 3/4"	2	2	2	2	2	2
	Q	23 66 132	Washer, Flat, Sq., 4"x4", w/ 13/16" hole	4	4	4	4	4	4
		252, 255, or 260	Install Jumper	3	3	3	3	2	2

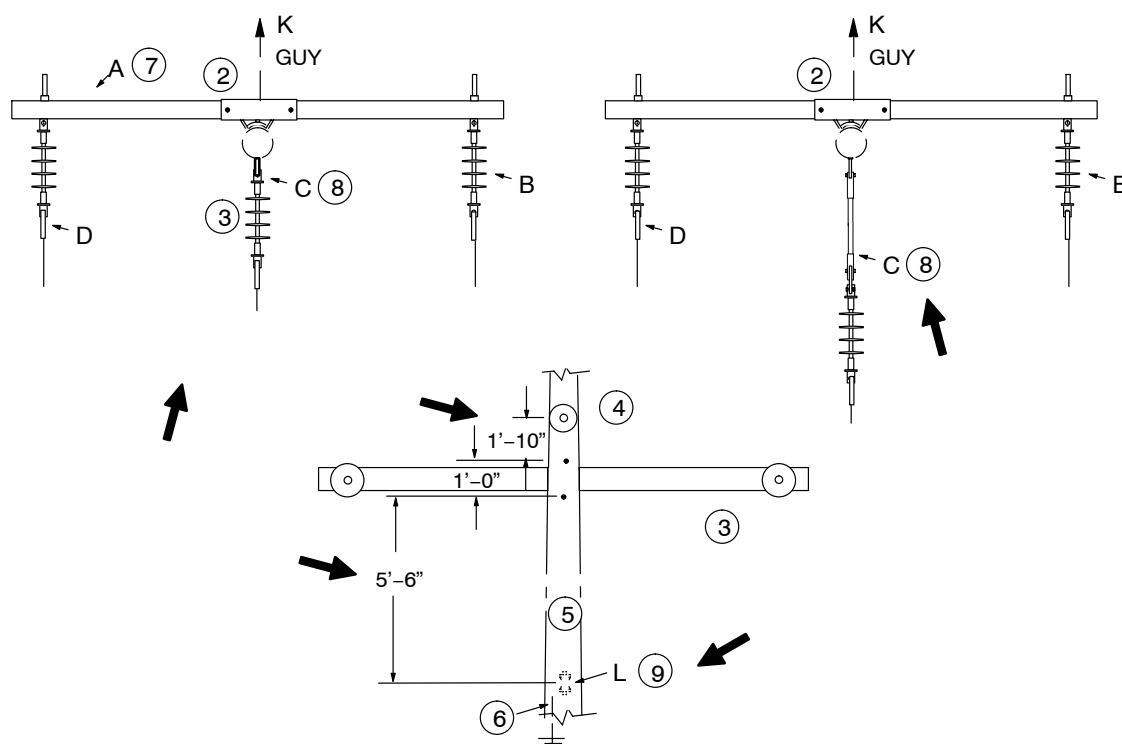
CONFIGURATIONS

Two or Three Phase Deadends

4 to 15kV

03 12 11 **

Sheet 1 of 2



	8' Arm	10' Arm
Std	03 12 11 01	03 12 11 52
Std	03 12 11 51	03 12 11 72
Std	03 12 11 31	03 12 11 54

NOTES:

1. See DCS **04 00 41** for arm strength.
2. Attach guy to bracket of F.G. arm.
3. Use 10' deadend arm with F/G extension for underbuild application.
4. For 2 phase construction, eliminate the center phase position.
5. See DCS **02 00 04 03** for unguyed composite pole application.
6. Composite pole has factory (internal) installed pole ground; wood pole may require pole ground based on application, and underbuild uses existing pole ground.
7. 8' crossarm available Ameren MO only.
8. Deadend on pole w/o fiberglass extension available Ameren MO only.
9. See DCS **03 01 01 **** for neutral configuration.

CONFIGURATIONS
Two or Three Phase Deadends
4 to 15kV

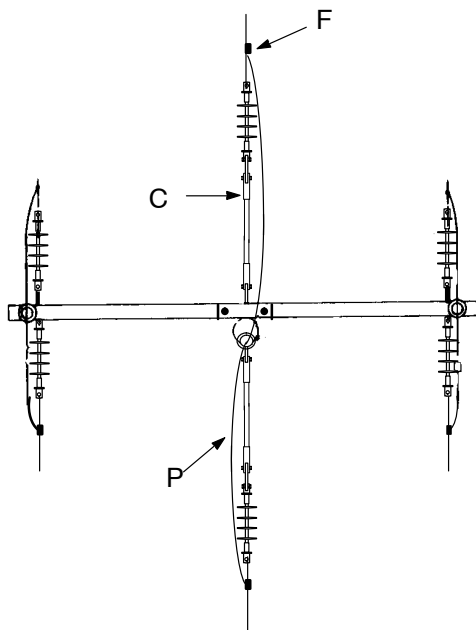
03 12 11 **

Sheet 2 of 2

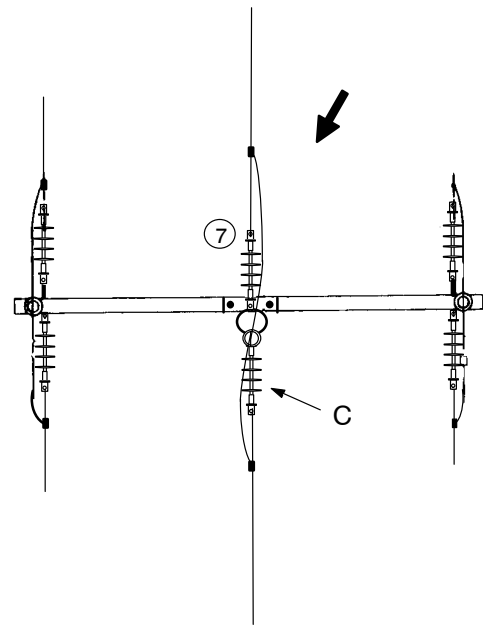


		Std. / Stk. No.	Description	03 12 11 **					
				01	51	52	72	31	54
				3Ø				2Ø	
7	A	04 00 41 03	Deadend Assy, FG Arm, 8'	1	1			1	
		04 00 41 04	Deadend Assy, FG Arm, 10'			1	1		1
	B	06 12 34 07	Deadend on Sgl Arm	2	2	2	2	2	2
8	C	06 12 30 01	Deadend on Pole w/FG Extension		1	1			
		06 12 30 11	Deadend on Pole w/o FG Extension	1			1		
@	D	DEC*W	Clamp, Deadend	3	3	3	3	2	2
6@	G	12 00 10 01	Grounding Unit, Wood Pole	1	1	1	1	1	1
		12 00 10 11	Grounding Unit, Composite Pole	1	1	1	1	1	1
5@	K	11 00 41 **	Guying Unit	1	1	1	1	1	1
9@	L	03 01 01 03	Neutral, Deadend	1	1	1	1	1	1

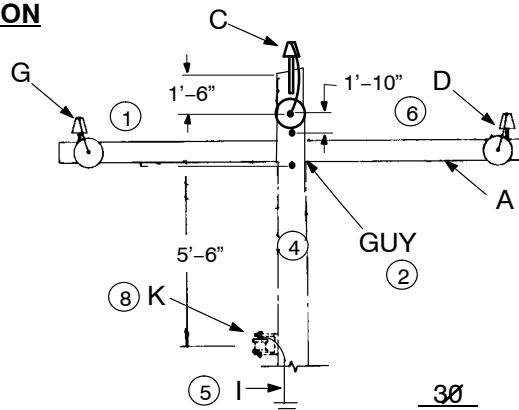
POLE TOP – F/G ARM



W/EXTENSION



W/O EXTENSION



Deadend – 8' Arm, Pole w/Ext.
Deadend – 8' Arm, Pole w/o Ext.
Deadend – 10' Arm, Pole w/Ext.
Deadend – 10' Arm, Pole w/o Ext.

<u>3Ø</u>	<u>2Ø</u> ③
03 12 14 65	03 12 14 69
03 12 14 73	03 12 14 69
03 12 14 64	03 12 14 68
03 12 14 74	03 12 14 68

NOTES:

1. See DCS **04 00 41** for arm strength.
2. Attach guy to center bracket of fiberglass arm for difference in tension.
3. For 2 phase construction, eliminate the center phase position
4. Contact Standards using unguyed composite pole for difference in conductor tension application.
5. Composite pole has factory (internal) installed pole ground; wood pole may require pole ground based on application.
6. 8' crossarm available AmerenMO only.
7. Deadend on pole w/o fiberglass extension available AmerenMO only.
8. See DCS **03 01 01 **** for neutral configuration.

CONFIGURATIONS
Two or Three Phase
Loopovers 4 to 15kV

03 12 14 **

Sheet 2 of 5

		Dist. Std. Or Stk. No.	Description	03 12 14 **					
				64	65	73	74	68	69
				3Ø				2Ø	
6	A	04 00 41 03	Deadend Assy. FG, 8'		1	1			1
		04 00 41 04	Deadend Assy. FG, 10'	1			1	1	
	C	06 12 30 04	Loopover w/FG Extension, Pole Top	1	1				
		06 12 30 14	Loopover w/o FG Extension, Pole Top			1	1		
	D	06 12 34 02	Loopover, Sgl Arm	2	3	3	3	1	2
@	F	DEC*W	Clamp, Deadend	6	6	6	6	4	4
@	G	TT*W	Top Tie, Sgl Pin	3	3	3	3	2	2
@5	I	12 00 10 01	Grounding Unit, Wood Pole	1	1	1	1	1	1
		12 00 10 11	Grounding Unit, Composite Pole	1	1	1	1	1	1
@	J	PG*	See Std. 07 00 25 00	6	9	9	9	4	
8@	K	03 01 01 01	Neutral, Thru	1	1	1	1	1	1
@	P	PLW*W	Lead Wire, Poly covered, Ft.	15	24	24	24	10	24
@		252 or 260	Install jumper	3	3	3	3	2	2

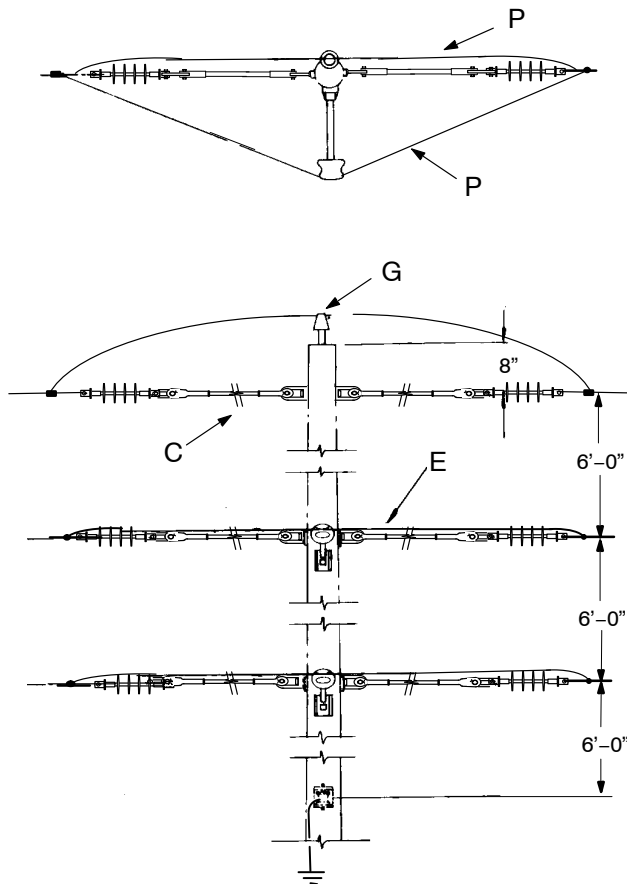
CONFIGURATIONS

Two or Three Phase

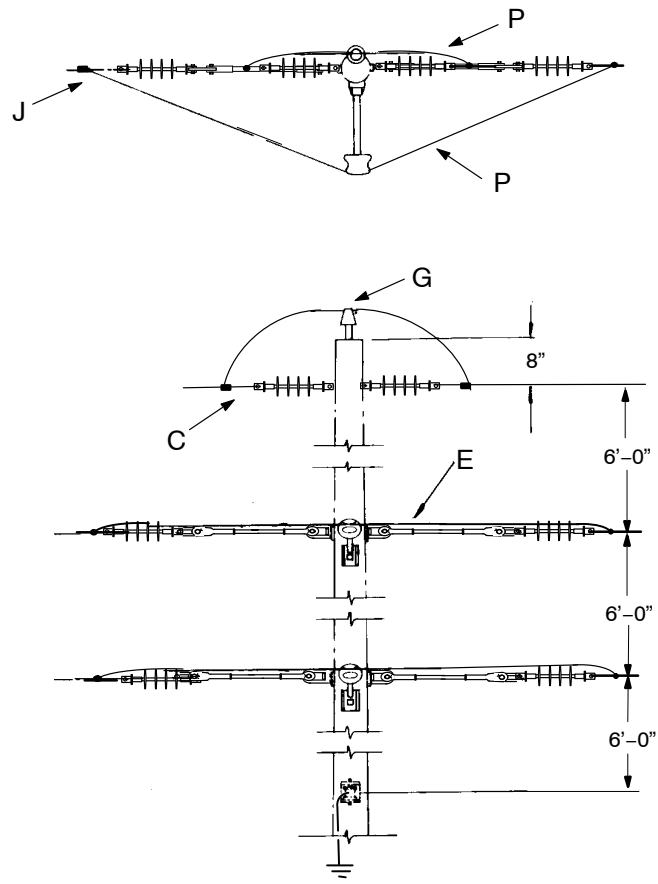
Loopovers 4 to 15kV

03 12 14 **

Sheet 3 of 5



W/EXTENSION

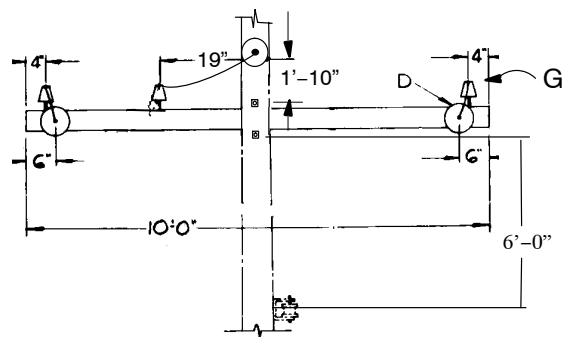
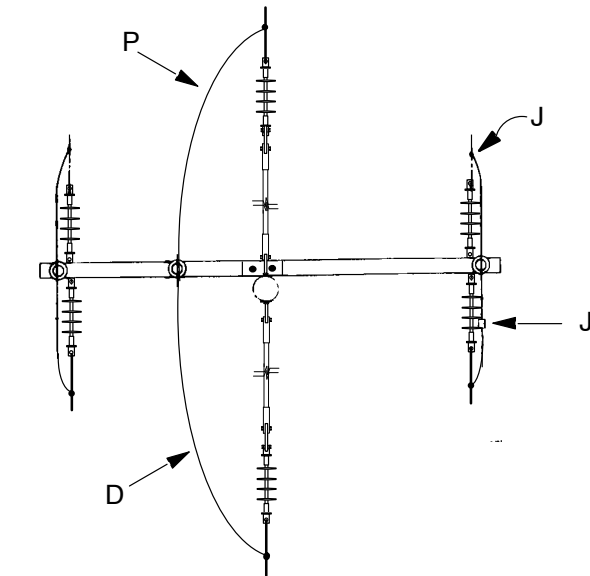


W/O EXTENSION

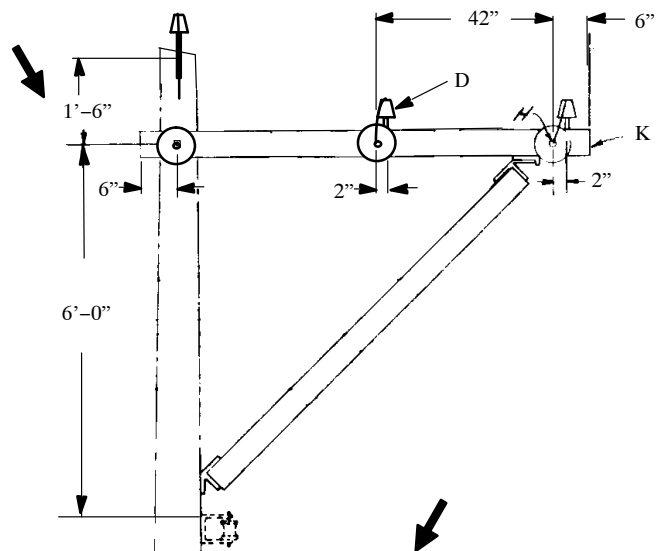
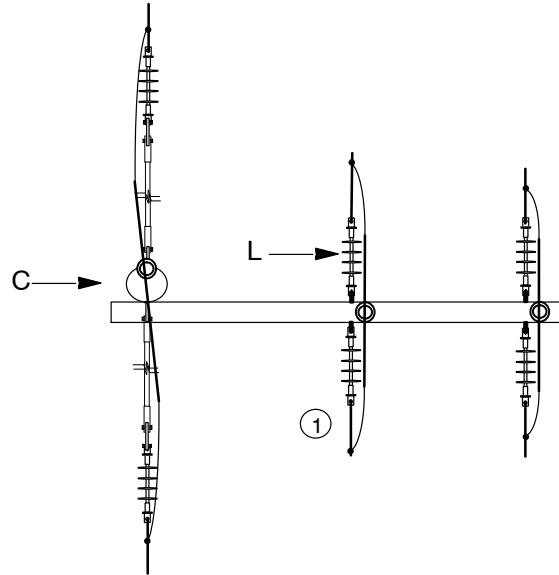
➔ Pole Top – w/o Extension
Pole Top – w/Extension
Underbuild

3Ø 2Ø
03 12 14 04 03 12 14 09
03 12 14 54 03 12 14 59
03 12 14 55 03 12 14 60

		Dist. Std. Or Stk. No.	Description	03 12 14 **	04	54	55	09	59	60
					3Ø			2Ø		
	C	06 12 30 04	Pole Top Loopover w/Extension			1			1	
		06 12 30 14	Pole Top Loopover w/o Extension		1			1		
	E	06 12 33 01	Looparound, Pole		2	2	3	1	1	1
@	F	DEC*W	Clamp, Deadend		6	6	6	4	4	4
@	G	TT*W	Top Tie, Sgl Pin		3	3	3	2	2	2
@	J	PG*	See Std. 07 00 25 00		6	6	6	4	4	4
@	P	PLW*W	Lead Wire, Poly covered, Ft.		15	15	15	10	10	10
@		252 or 260	Install jumper		3	3	3	2	2	2



DE Assy. 10' Arm 03 12 14 65 03 12 14 69
UNDERBUILD - F/G ARM



8' Arm 03 12 14 58 03 12 14 66
SIDEARM

NOTES:

1. Wildlife cover required for AmerenIL only.

CONFIGURATIONS
Two or Three Phase
Loopovers 4 to 15kV

03 12 14 **
Sheet 5 of 5

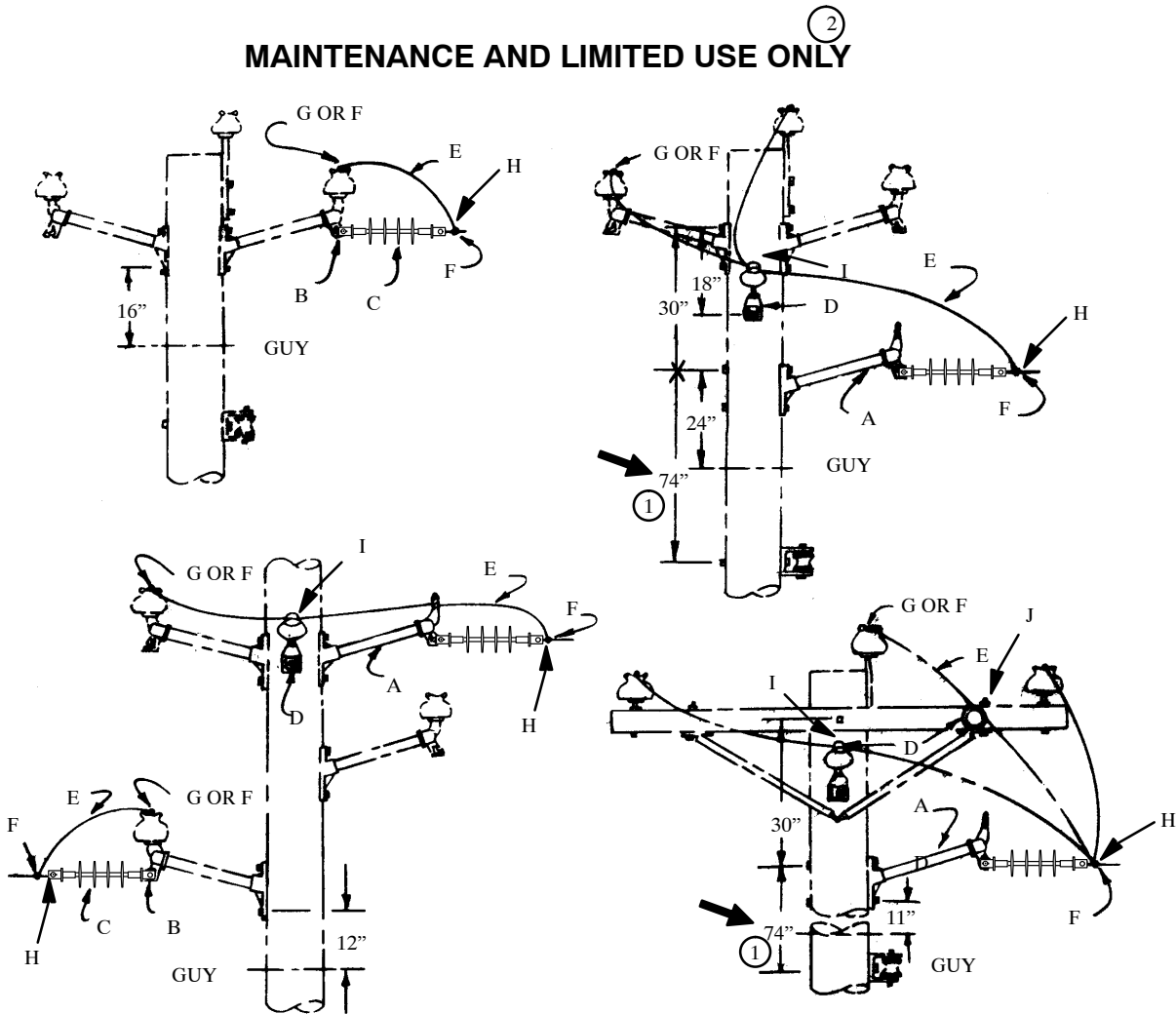
		Dist. Std. Or Stk. No.	Description	03 12 14 **			
				58	65	66	69
				3Ø		2Ø	
	C	06 12 30 04	Pole Top Loopover	1		1	
	D	06 12 34 02	Loopover Arm	2	3	1	2
	E	06 12 33 02	Looparound Pole				
@	F	DEC*W	Deadend Clamp	6	6	4	4
@	G	TT*W	Top Tie	3	3	2	2
	I	04 00 41 04	Crossarm, DE Assy., 10'		1		1
@	J	PG*	See Std. 07 00 25 00	6	9	4	4
@	P	PLW*W	Lead Wire, Poly covered, Ft.	15	24	15	24
	K	04 00 24 05	Sidearm, Double, 8'	1		1	
1@	L	05 16 12 01	Wildlife Cover – DE	2			
@		252 or 260	Install jumper	3	3	2	2

CONFIGURATIONS
Single Phase Tap from Two or Three Phase Line
4 to 15kV

03 12 20 **

Sheet 1 of 2

MAINTENANCE AND LIMITED USE ONLY



ARMLESS CONSTRUCTION

Near Phase	03 12 20 01
Top or Far Phase	03 12 20 02

CROSSARM CONSTRUCTION

Near Phase	03 12 20 05
Top Phase	03 12 20 06
Far Phase	03 12 20 02

Notes

1. See Dist. Std. 03 00 01 00 for neutral spacing information. May be reduced to 40" if pole space is limited.
2. This standard to be used only for non-fused single phase taps that do not pass through wooded areas and are of limited length (1 or 2 spans).

CONFIGURATIONS
Single Phase Tap from Two or Three Phase Line
4 to 15kV

03 12 20 **

Sheet 2 of 2

		Std. / Stk. No.	Description	03 12 20 **	01	02	05	06
	A	06 12 21 06	Assembly – Standoff, 24" FG			1	1	1
	B	23 68 181	Shackle – Deadend		2			
	C	25 06 052	Insulator – Deadend, 12 kV		1			
	D	06 12 20 04	Insulator – Standoff, 18" LD			1	1	
		06 12 01 01	Insulator – Crossarm					1
@	E	PLW*W	Lead Wire, Poly Covered Ft.		3	10	6	10
@	F	PG*	See Std. 07 00 25 00		2	2	2	2
@	G	HLC*W	Hot Line Clamp					
@	H	DEC*W	Deadend Clamp		1	1	1	1
@		252 or 260	Install connector or jumper		@	@	@	@
@	I	TT*W	Top Tie			1	1	
@	J	ST*W	Side Tie					1

CONFIGURATIONS

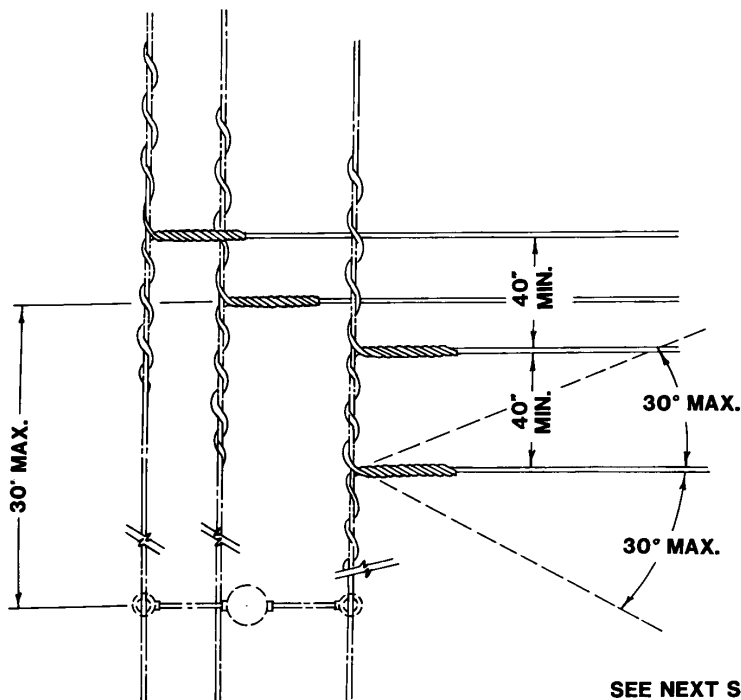
Aerial Mid-Span Tap



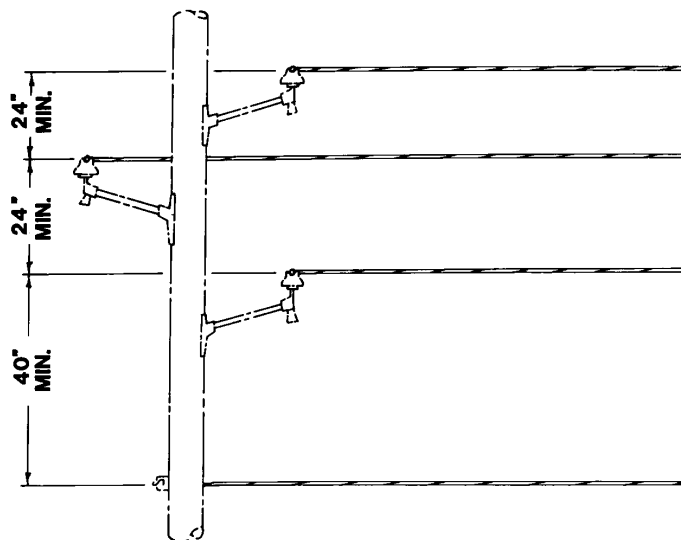
4 to 15kV

03 12 21 **

Sheet 1 of 2



SEE NEXT SHEET FOR SAG, TENSION AND SPAN LIMITATIONS.



STOCK NO.	LINE SIZE		COLOR CODE		01	02	03	04	05
	Main	Tap	Main	Tap					
17 54 284	#4 ACSR	#4 ACSR	Orange	Orange	1				
17 54 285	1/0 AAAC	#4 ACSR				1			
17 54 286	1/0 AAAC	1/0 AAAC	Yellow	Yellow			1		
17 54 287	556 AA	1/0 AAC	Orange	Black				1	
17 54 288	556 AA	556 AA	Orange	Orange					1
295	Operations Code				1	1	1	1	1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: MJ
REV. NO: 1
REV. DATE: 10/04/05
REAFFIRMED DATE: 02/21/12

Sag and Tension Table for Mid-Span Taps

LINE SIZE		TAP SPAN IN FEET				Tap Tension Per Conductor in Pounds
		40	60	80	100	
Main	Tap	Tap Sag in Inches				
#4 ACSR	#4 ACSR	6	13	24	37	27
1/0 AAAC	#4 ACSR	4	9	20	25	40
	1/0 AAC	5	12	22	34	51
556 AA	1/0 AAAC	5	11	19	30	58
	556 AA	15	34			85

NOTES:

1. Mid-span taps are permitted only under the following conditions:
 - a. The location is easily accessible to a basket truck, and
 - b. The run conductor(s) is full tension, and
 - c. The tap will be made on the nearest phase, or from vertical construction in the case of two or three phase taps, and
 - d. The tap can be made in accordance with the above sag and tension table, and
 - e. The mid-span tap will eliminate setting an additional pole.
2. Clearance shall be based on the run conductor's attachment height less three feet (3') less the sag indicated in the above table. Tap spans shall be as level as possible.
3. Switch(es) shall be installed at the first pole in the tap circuit.
4. Taps shall be limited to one per run conductor span.
5. Quantity specified in the material list is for tapping one conductor.
6. This Standard applicable for tangent construction. Angle construction satisfactory if angle complies with Dist. Std. 03 00 03 ** and tap(s) is within 10 ft. of insulator. Tap(s) 10 to 30 ft. from the insulator on angle construction require specific investigation.

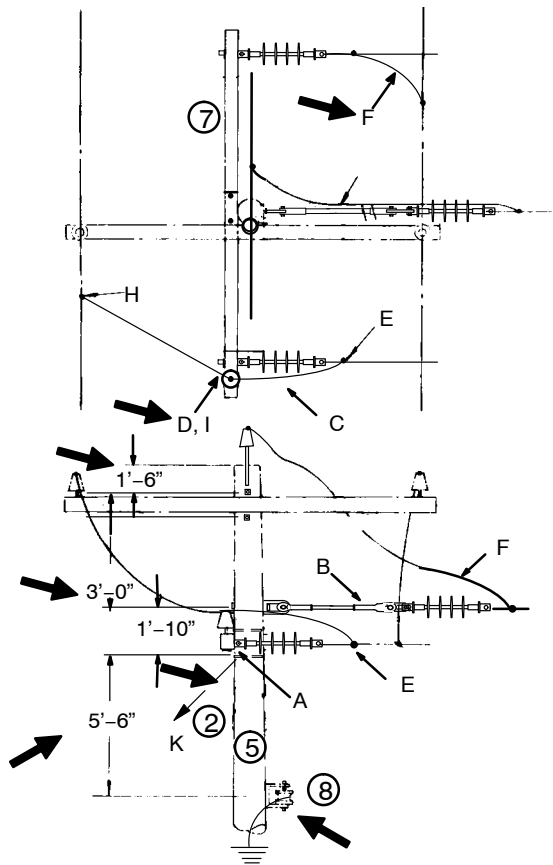
CONFIGURATIONS

Two or Three Phase Line—Two or Three Phase Tap

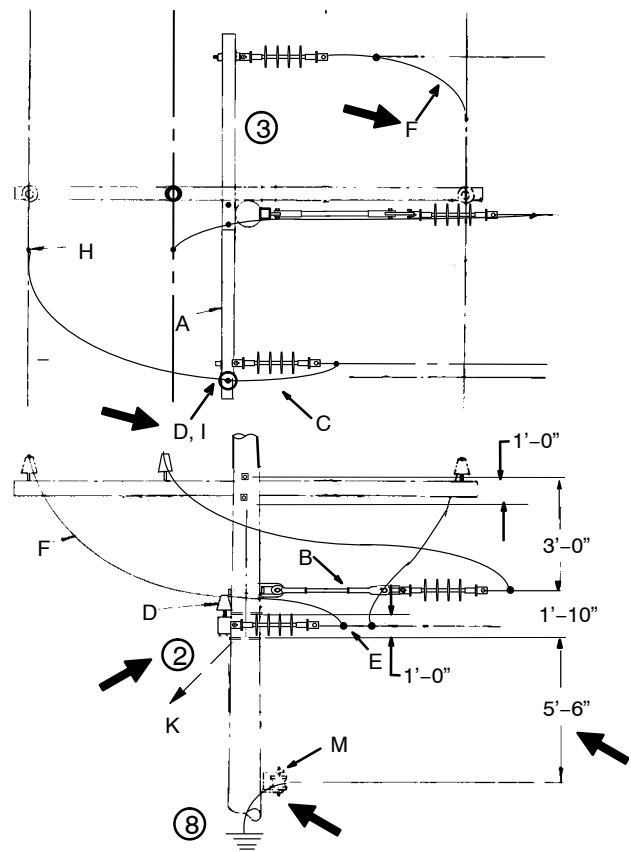
4 to 15kV

03 12 24 **

Sheet 1 of 3



OVERHEAD



UNDERBUILD

DEADEND TAP

3Ø

DE Assy 8' Arm
DE Assy 10' Arm

03 12 24 51
03 12 24 52

2Ø

03 12 24 53
03 12 24 54

NOTES:

1. See DCS 04 00 41 for arm strength.
2. Attach guy to center bracket of FG arm.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: MJ
REV. NO: 7
REV. DATE: 01/12/12

CONFIGURATIONS

Two or Three Phase Line–Two or Three Phase Tap 4 to 15kV

03 12 24 **

Sheet 2 of 3

1. Use 10' deadend arm with F/G extension on pole for underbuild application.
2. For 2 phase construction, eliminate the center phase position.
3. See DCS **02 00 04 03** for unguyed composite pole application.
4. Composite pole has factory (internal) installed pole ground; wood pole may require pole ground based on application, and underbuild uses existing pole ground.
5. 8' crossarm available AmerenMO only.
6. See DCS **03 01 01 **** for neutral configuration.



		Std. / Stk. No.	Description	03 12 24 **			
				51	52	53	54
				3Ø		2Ø	
7	A	04 00 41 03	Deadend Assy., FG, 8'	1		1	
		04 00 41 04	Deadend Assy., FG, 10'		1		1
	B	06 12 32 01	Deadend on Pole w/ FG Extension	1	1		
	C	06 12 34 01	Deadend on Sgl Arm	2	2	2	2
	D	06 12 01 01	Insulator and X-Arm Pin	1	1	1	1
@	E	PG*	See Std. 07 00 25 00	3	3	2	2
@	F	PLW*W	Lead Wire, Poly covered	24	24	16	16
5	G	12 00 10 01	Grounding Unit, Wood Pole	@	@	@	@
		12 00 10 11	Grounding Unit, Composite Pole	1	1	1	1
@	H	STC*W	Hot Tap w/Stirrup	3	3	2	2
@		PG*	See Std. 07 00 25 00	3	2	2	2
@	I	TT*W	Top Tie	1	1	1	1
@	J	DEC*W or DEA*W	Deadend Clamp	3	3	2	2
@	K	11 00 41 **	Guying Unit	1	1	1	1
@	M	03 01 01 07	Neutral, Tangent w/Tap	1	1	1	1
@		252 or 260	Install connector or jumper				

CONFIGURATIONS

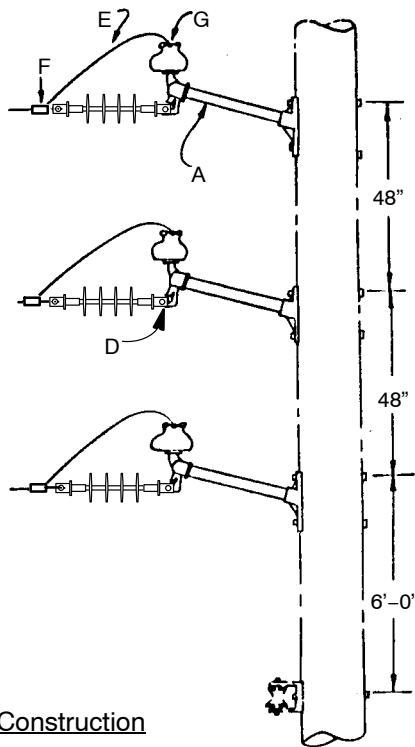
Two or Three Phase Line–Two or Three Phase Tap

4 to 15kV

03 12 24 **

Sheet 3 of 3

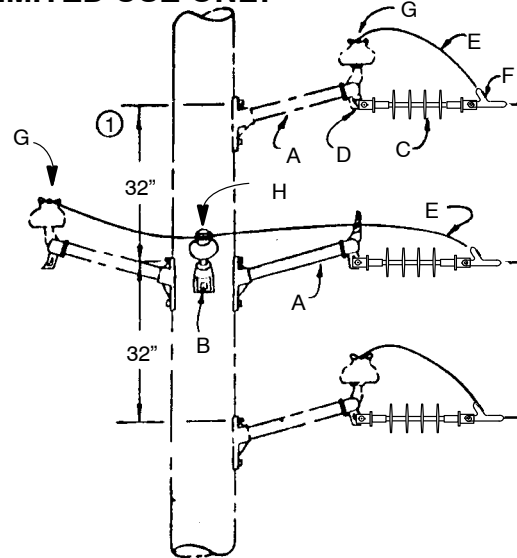
MAINTENANCE AND LIMITED USE ONLY



New Construction

3Ø Tap 03 12 24 01

2Ø Tap 03 12 24 04



Existing Construction

As Shown

3Ø Tap 03 12 24 02

2Ø Tap 03 12 24 05

(2 same side)

Opposite

03 12 24 03

03 12 24 11

(1 each side)

- On existing circuits this spacing can be obtained by raising the top phase 8" and lowering the bottom phase 8". Tap spans may not exceed 175'.

		Std. / Stk. No.	Description	03 12 24 **	01	02	03	04	05	11
					3 Ph			2 Ph		
	A	06 12 21 05	Assembly – Standoff, 24" F.G.		3			2		
		06 12 21 06	Assembly – Standoff, 24" F.G.			1	2			1
	B	06 12 20 04	Insulator – Standoff, 18"			1	2			1
	C	25 06 052	Insulator – Deadend, 12kV			3	3		2	2
	D	23 68 181	Shackle – Deadend			3	3		2	2
@	E	PLW*W	Lead Wire, Poly covered		9	15	21	6	6	12
@	F	PG*	See Std. 07 00 25 00		3	3	3	2	2	2
@	G	HLC*W	Hot Line Clamp w/Stirrup		3	3	3	2	2	2
		PG*	See Std. 07 00 25 00		3	3	3	2	2	2
@	H	TT*W	Top Tie		3	1	2	2		1
@	I	DEC* or DEA*W	Deadend Clamp		3	3	3	2	2	2
@		252 or 260	Install connector or jumper		@	@	@	@	@	@

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: MJ
REV. NO: 7
REV. DATE: 01/12/12

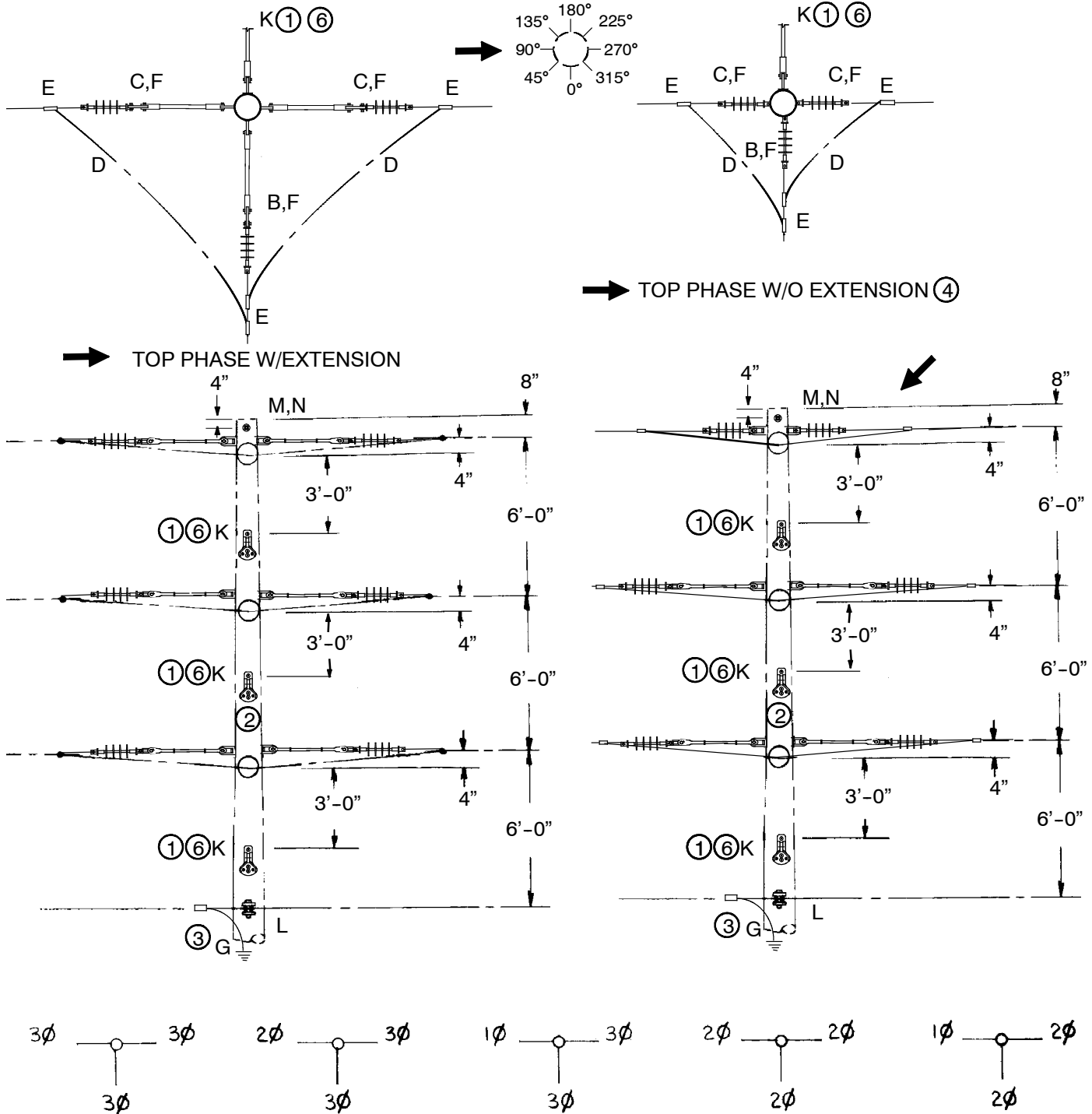
CONFIGURATIONS

Two Or Three Phase – Vertical Tap

4 or 12 kV

03 12 30 **

Sheet 1 of 2



→ Top Phase Deadend on Pole w/FG Extension

03 12 30 11

03 12 30 12

03 12 30 13

03 12 30 14

03 12 30 15

→ Top Phase Deadend on Pole w/o FG Extension ④

03 12 30 01

03 12 30 02

03 12 30 03

03 12 30 04

03 12 30 05

CONFIGURATIONS

Two Or Three Phase – Vertical Tap

4 or 12 kV

03 12 30 **

Sheet 2 of 2

NOTES:

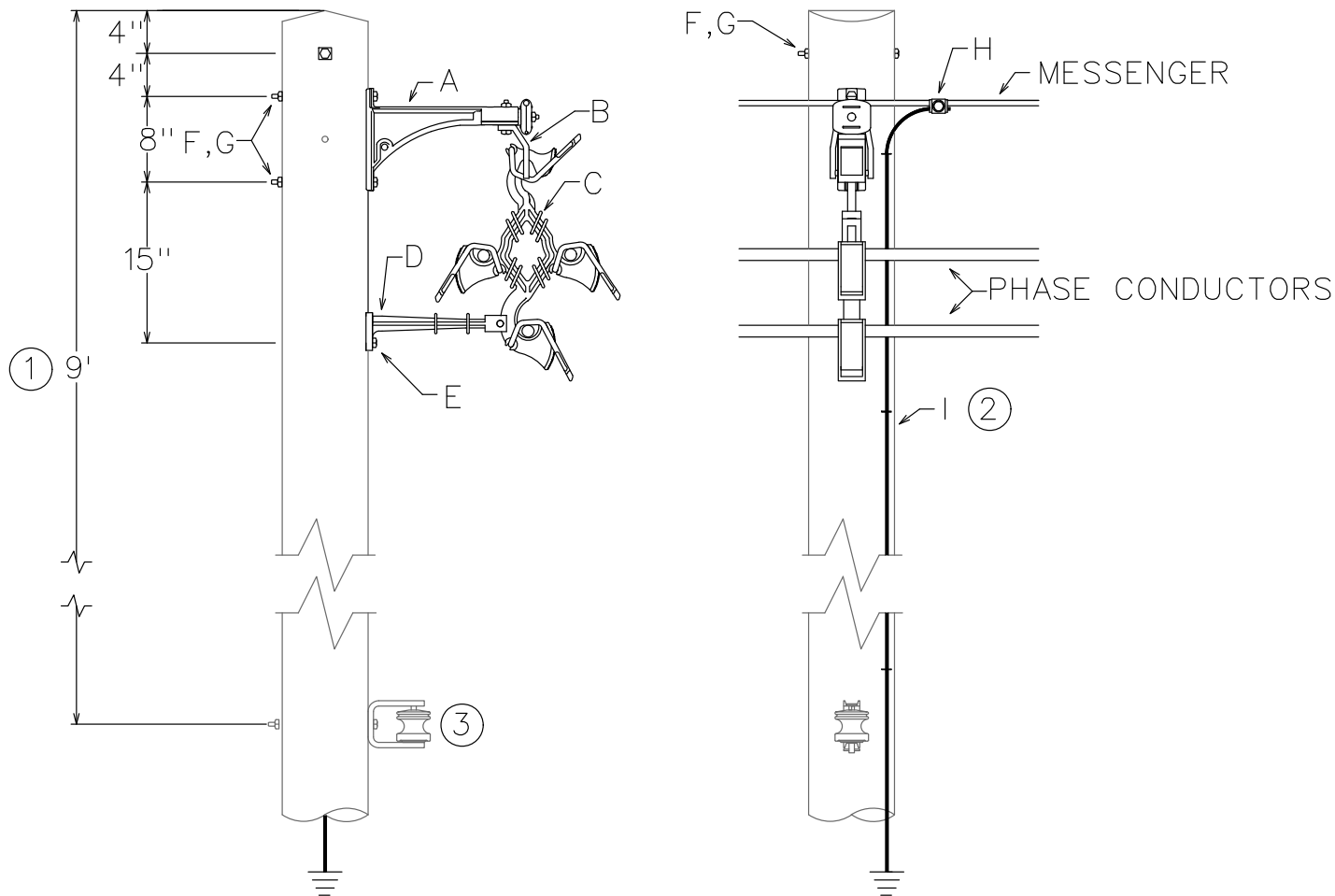
1. Top bolt of guy attachments should be centered between phase positions and between phase and neutral position.
2. See DCS **02 00 04 03** for unguyed composite pole application.
3. Composite pole has factory (internal) installed pole ground in the 45° quadrant. Wood pole may require pole ground depending on application.
4. Deadend on pole w/o fiberglass extension available Ameren Mo only.
5. See DCS **17 31 50 **** and **17 31 51 **** for explanation of Operation Codes.
6. See DCS **11 00 02 02** for typical guy insulator placement.D

		Std. / Stk. No.	Description	03 12 30 **										
				01	02	03	11	12	13	04	05	14	15	
				3Ø						2Ø				
4	B	06 12 30 01	Deadend on Pole w/FG Extension	2	3	4	3	4	5	1	2	2	3	
		06 12 30 11	Deadend on Pole w/o FG Extension	1	1	1				1	1			
4	C	06 12 30 03	Dbl Deadend on Pole w/Extension	2	1		3	2	1	1		2	1	
		06 12 30 13	Dbl Deadend on Pole w/o Extensions	1	1	1				1	1			
@	D	PLW*W	Lead Wire, Poly Covered See 07 00 80 00	30	25	20	30	25	20	20	15	20	15	
@	E	PG*	See 07 00 25 00	12	10	8	12	10	8	8	6	8	6	
@	F	DEC*W	Clamp, Deadend See 07 00 11 00	9	8	7	9	8	7	6	5	6	5	
@ 3	G	12 00 10 **	Grounding Unit, Wood Pole	@	@	@	@	@	@	@	@	@	@	
		12 00 10 11	Grounding Unit, Composite Pole	1	1	1	1	1	1	1	1	1	1	
@6	K	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)	3	4	5	3	4	5	2	3	2	3	
@	L	03 01 01 **	Neutral	1	1	1	1	1	1	1	1	1	1	
	M	23 52 065	Bolt, Mach., 5/8" x 12" (Anti-Split)	1	1	1	1	1	1	1	1	1	1	
	N	23 66 031	Washer, Curved, 3/4"	2	2	2	2	2	2	2	2	2	2	
5		252, 255, or 260	Install Jumper	6	5	4	6	5	4	4	3	4	3	

CONFIGURATIONS
15 KV & Below – Spacer Cable
Single Circuit – Tangent Structure

03 20 01 01

Sheet 1 of 1



	Std. / Stk. No.	Description	03 20 01 01
2@	A	23 56 075 Bracket, Messenger	1
	B	23 06 124 Stirrup, Spacer Support	1
	C	23 67 334 Spacer, High Density Polyethylene	1
	D	23 06 123 Bar, Anti-Sway	1
	E	23 60 007 Screw, Lag, Fetter Type, 1/2" x 4"	1
	F	23 52 065 Bolt, Machine, 5/8" x 12" (w/nut)	3
	G	23 66 027 Washer, Square 2- 1/4" x 2- 1/4" x 3/16" Thick	3
	H	17 51 032 Connector, PG, Pole Ground to Messenger	1
	I	12 00 10 01 7#10 Grounding Unit	1
		12 00 10 04 #2 Cu. Poly Grounding Unit	1

NOTES

1. This distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. See DCS 07 20 01 01 for spacer installation between poles.

CONFIGURATIONS

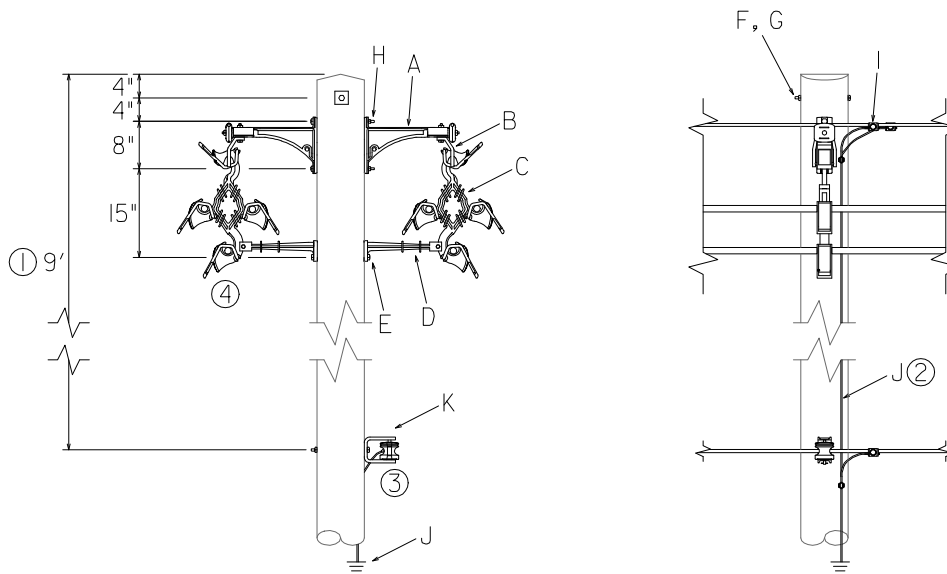
15kV & Below – Spacer Cable

Double Circuit – Tangent Structure

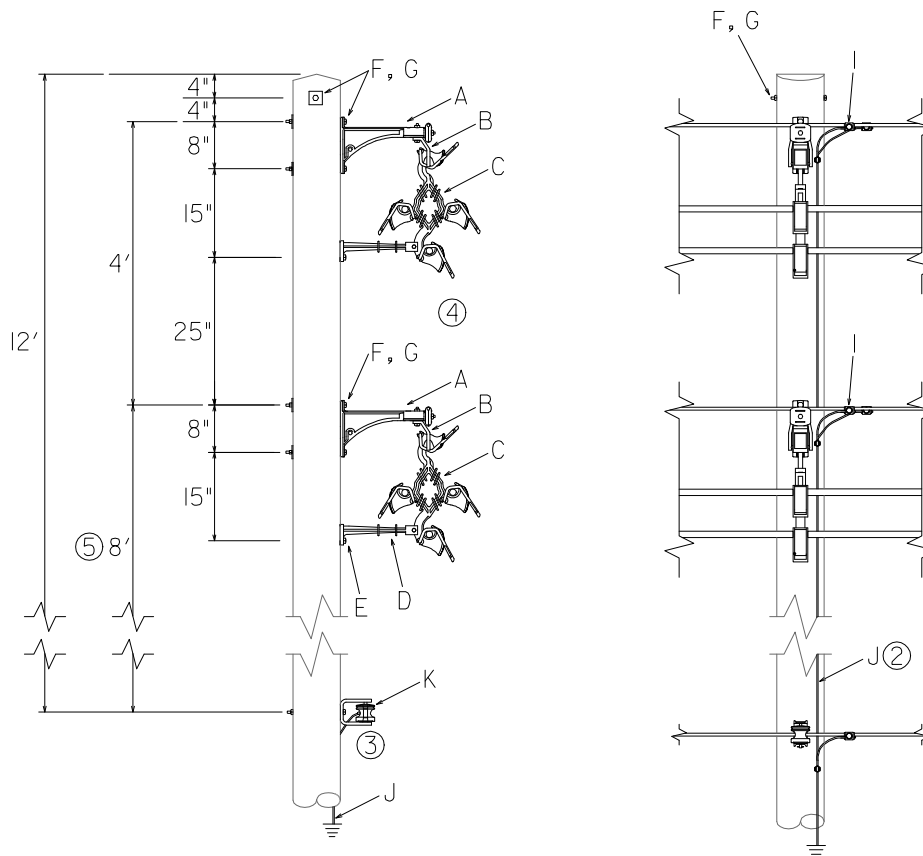
03 20 02 **

Sheet 1 of 2

01 - DOUBLE CIRCUIT TANGENT - BACK TO BACK CONFIGURATION



02 - DOUBLE CIRCUIT TANGENT - STACKED CONFIGURATION



CONFIGURATIONS
15kV & Below – Spacer Cable
Double Circuit – Tangent Structure

03 20 02 **

Sheet 2 of 2

		Std. / Stk. No.	Description	03 20 02 **	01	02
2@	A	23 56 075	Bracket, Messenger		2	2
	B	23 06 124	Stirrup, Spacer Support		2	2
	C	23 67 334	Spacer, High Density Polyethylene		2	2
	D	23 06 123	Bar, Anti-Sway		2	2
	E	23 60 007	Screw, Lag, Fetter Type, 1/2" x 4"		2	2
	F	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		1	5
	G	23 66 027	Washer, Square 2-1/4" x 2-1/4" x 3/16" Thick		2	6
	H	23 52 066	Bolt, Machine, 5/8" x 14" (w/ nut)		2	
	I	17 51 137	Clamp, Parallel Groove, Aluminum – Messenger to pole ground		2	2
	J	12 00 10 01	Grounding Unit, 7#10 Copperweld		1	1
@		12 00 10 04	Grounding Unit, #2 Cu. Poly		1	1
	K	03 01 01 **	Neutral Configuration			

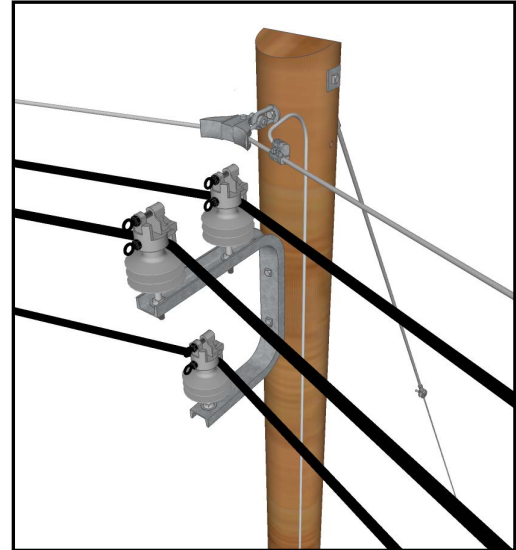
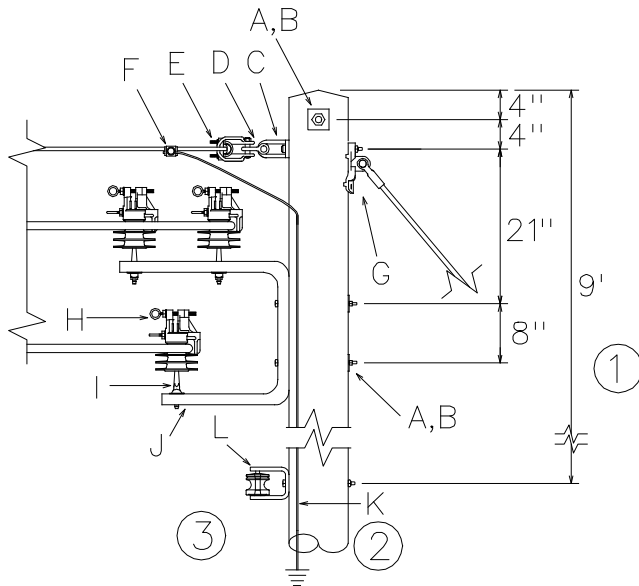
NOTES

1. The distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. See DCS **07 20 01 01** for spacer installation between poles.
5. The distance can be reduced to a minimum of 5 ft. If approved by Engineering.

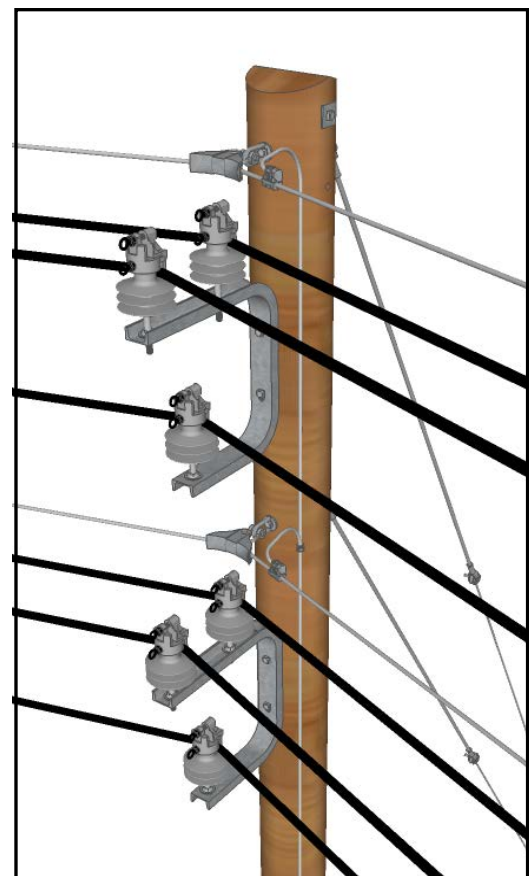
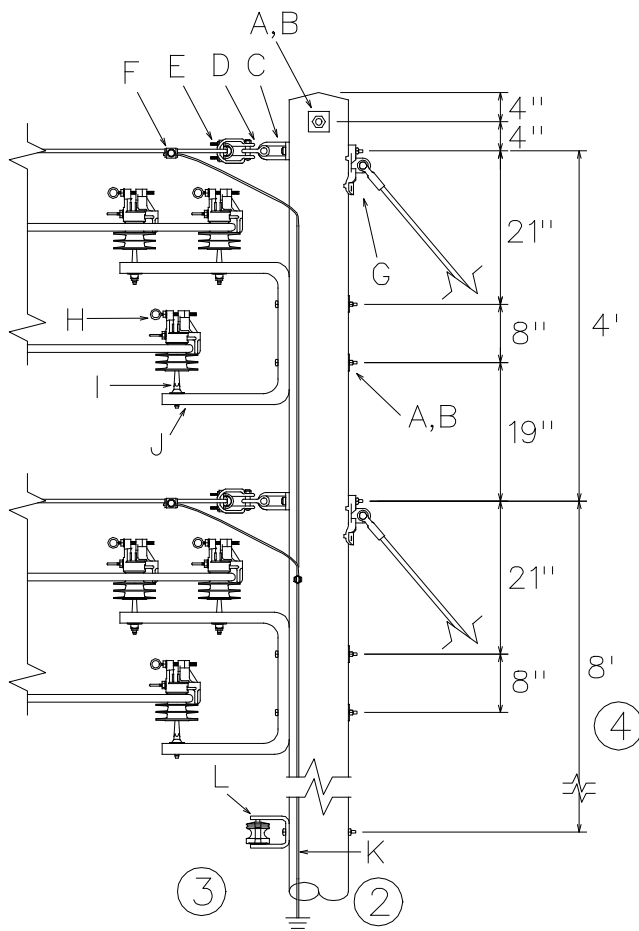
CONFIGURATIONS
4-15 kV Spacer Cable
Angle Structure 7° – 60°

03 20 03 **

Sheet 1 of 2



03 20 03 01 - SINGLE CIRCUIT



03 20 03 02 - DOUBLE CIRCUIT

CONFIGURATIONS
4–15 kV Spacer Cable
Angle Structure 7° – 60°

03 20 03 **

Sheet 2 of 2

		Std. / Stk. No.	Description	03 20 03 **	01	02
	A	23 52 066	Bolt, Machine, 5/8" x 14" (w/ nut)		3	5
	B	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16"		4	6
	C	23 59 095	Eyelet, NM, STD, 3/4"		1	2
	D	23 68 181	Shackle, Anchor, 9/16"		1	2
	E	23 18 342	Clamp, Suspension		1	2
	F	17 51 137	Connector, PG, Pole Ground to Messenger		1	2
@	G	11 00 42 **	Guying Unit w/ FG Strain Insulator & HD Guy Hook		1	2
	H	25 05 143	Insulator, Pin, 15 kV, Vise-Top		3	6
	I	23 62 151	Pin, Insulator, 1" Thread, Short Shank, 5/8"		3	6
	J	23 56 073	Bracket, Angle, Insulator Support		1	2
@	K	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1
@	L	03 01 01 **	Neutral Configuration			

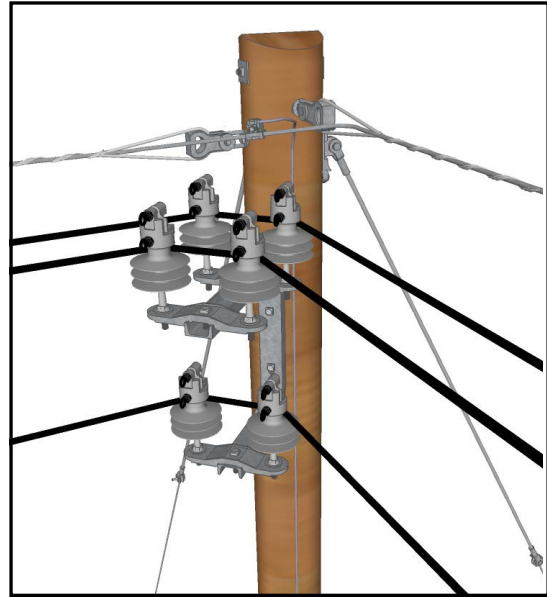
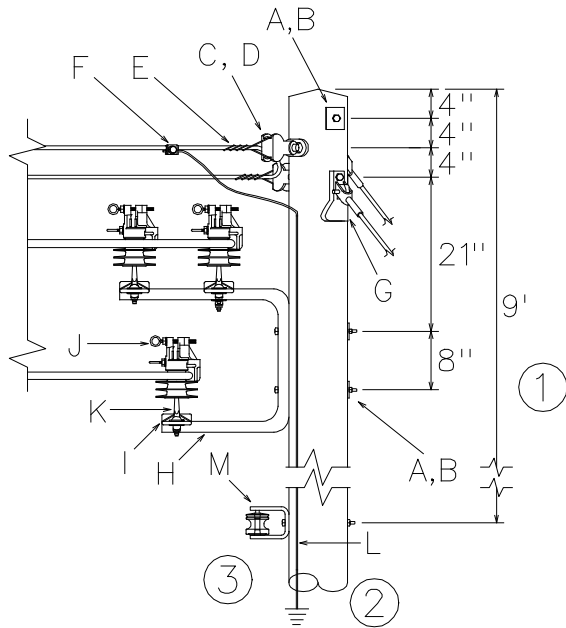
NOTES

1. The distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. The distance can be reduced to a minimum of 5ft. if approved by Engineering.

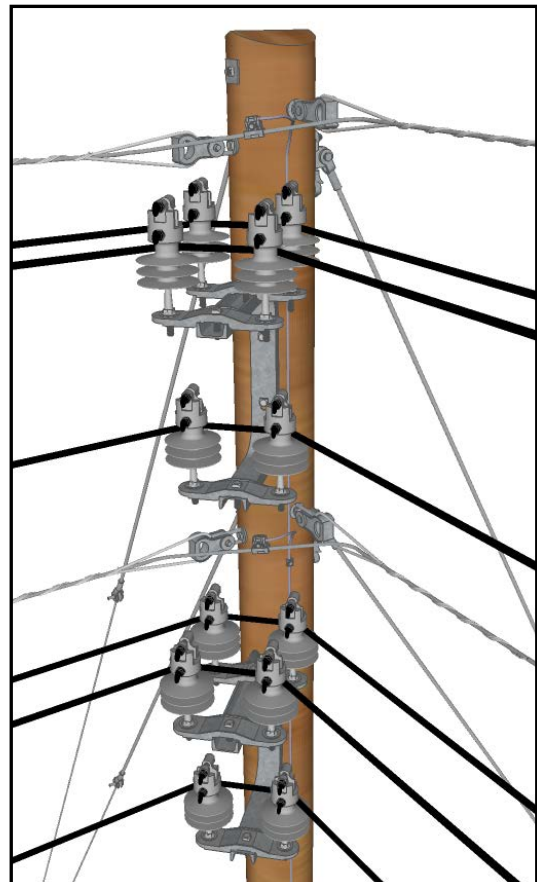
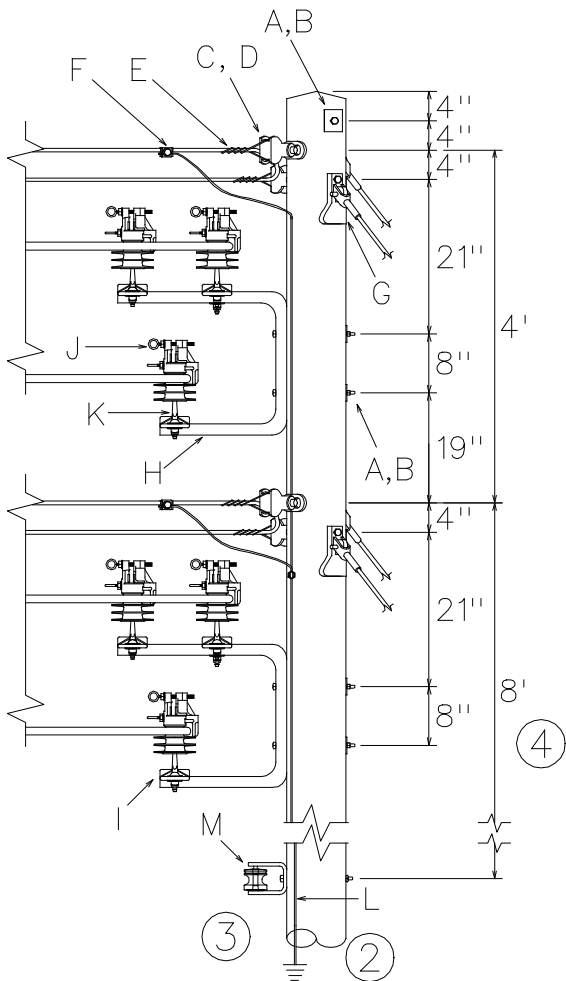
CONFIGURATIONS
4-15 kV Spacer Cable
Angle Structure 61° and ≤90°

03 20 04 **

Sheet 1 of 2



03 20 04 01 - SINGLE CIRCUIT



03 20 04 02 - DOUBLE CIRCUIT

CONFIGURATIONS
4-15 kV Spacer Cable
Angle Structure 61° and ≤90°

03 20 04 **

Sheet 2 of 2

		Std. / Stk. No.	Description	03 20 04 **	01	02
	A	23 52 066	Bolt, Machine, 5/8" x 14" (w/ nut)		3	5
	B	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16"		4	6
	C	23 59 095	Eyelet, NM, STD, 3/4"		2	4
	D	23 58 054	Clevis, NM, Thimble, Galvanized Steel		2	4
	E	23 68 713	Grip, Messenger/ Neutral, Preformed 7#6 - 052 AWA		2	4
	F	17 51 137	Connector, PG, Pole Ground to Messenger		1	2
@	G	11 00 42 **	Guying Unit w/ Fiberglass Insulator & HD Guy Hook		2	4
	H	23 56 073	Bracket, Angle, Insulator Support		1	2
	I	23 67 384	Plate, Mounting, Dbl Pin Insulator		3	6
	J	25 05 143	Insulator, Pin, 15kV, Vise-Top		6	12
	K	23 62 151	Pin, Insulator, 1" Thread, Short Shank, 5/8"		6	12
@	L	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1
@	M	03 01 01 **	Neutral Configuration			

NOTES

1. The distance can be reduced to a minimum of 6ft if needed when replacing a pole in an existing line.
2. A pole ground is required on every spacer cable pole. Install a covered 7#10 pole ground if no equipment is being installed or install a covered #2 pole ground if the equipment being installed requires it such as a riser, recloser, etc.
3. Secondary location if present. Connect secondary neutral to pole ground.
4. The distance can be reduced to a minimum of 5ft. if approved by Engineering.

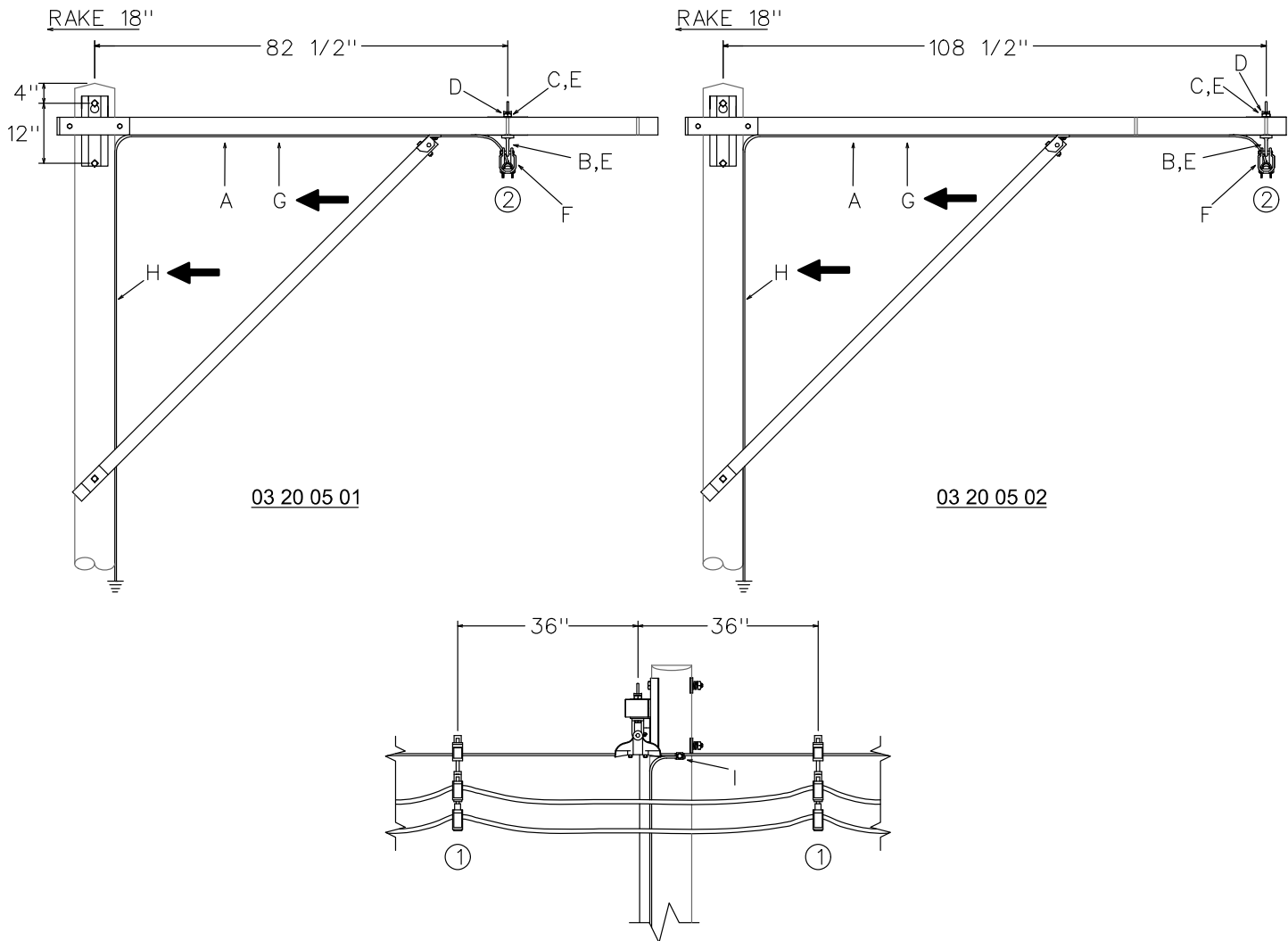
CONFIGURATIONS

15kV & Below – Spacer Cable

Single Circuit – Tangent Structure – Alley Arm Configuration

03 20 05 **

Sheet 1 of 1



		Std. / Stk. No.	Description	03 20 05 **	01	02
@	A	04 00 41 18	10' FG Alley Arm Assembly		1	1
	B	23 59 005	Eyelet, NM, 5/8"		1	1
	C	23 52 061	Bolt, Mach., 5/8" x 8"		1	1
	D	23 65 043	Nut, Lock, 5/8"		1	1
	E	23 66 132	Washer, Square, Galv. 4" x 4" x 3/16" w/ 13/16" hole		2	2
	F	23 18 342	Clamp, Suspension (conductor Range: 0.312" – 0.62")		1	1
	G	23 68 746	Clip, Electrical, Grd.		1	1
	H	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1
	I	17 51 032	Connector, PG, Pole Ground to Messenger		1	1

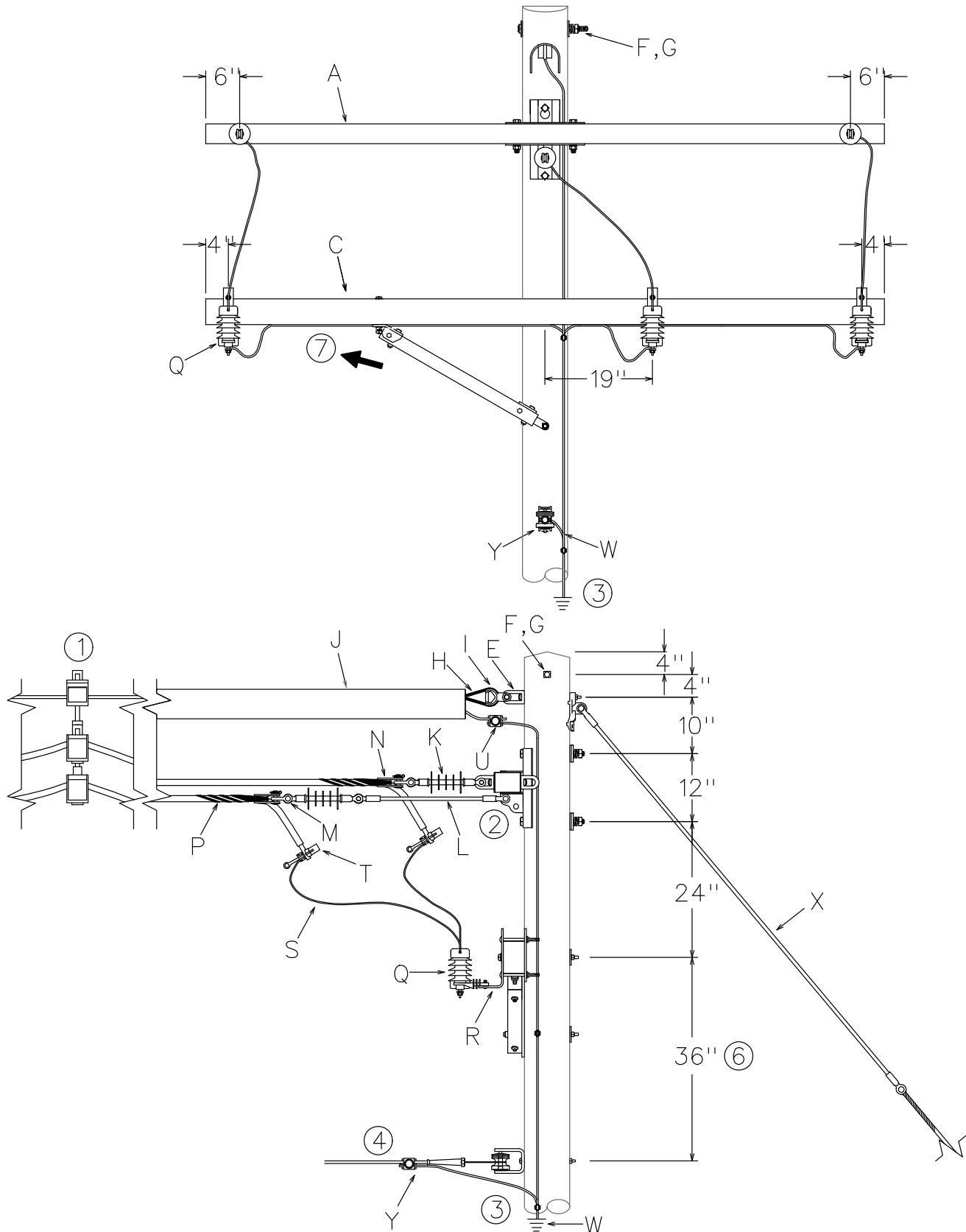
NOTES

1. Install spacers 3' from crossarm in each direction. See DCS 07 20 01 01 for spacer installation between poles.
2. Vertical load limited to 1500 lbs. Max spans are: 1/0 span = 258', 477 span = 167', and 795 span = 132'.

CONFIGURATIONS
 15 kV & Below – Spacer Cable
 Single Circuit – Dead End Structure

03 20 10 **

Sheet 1 of 4

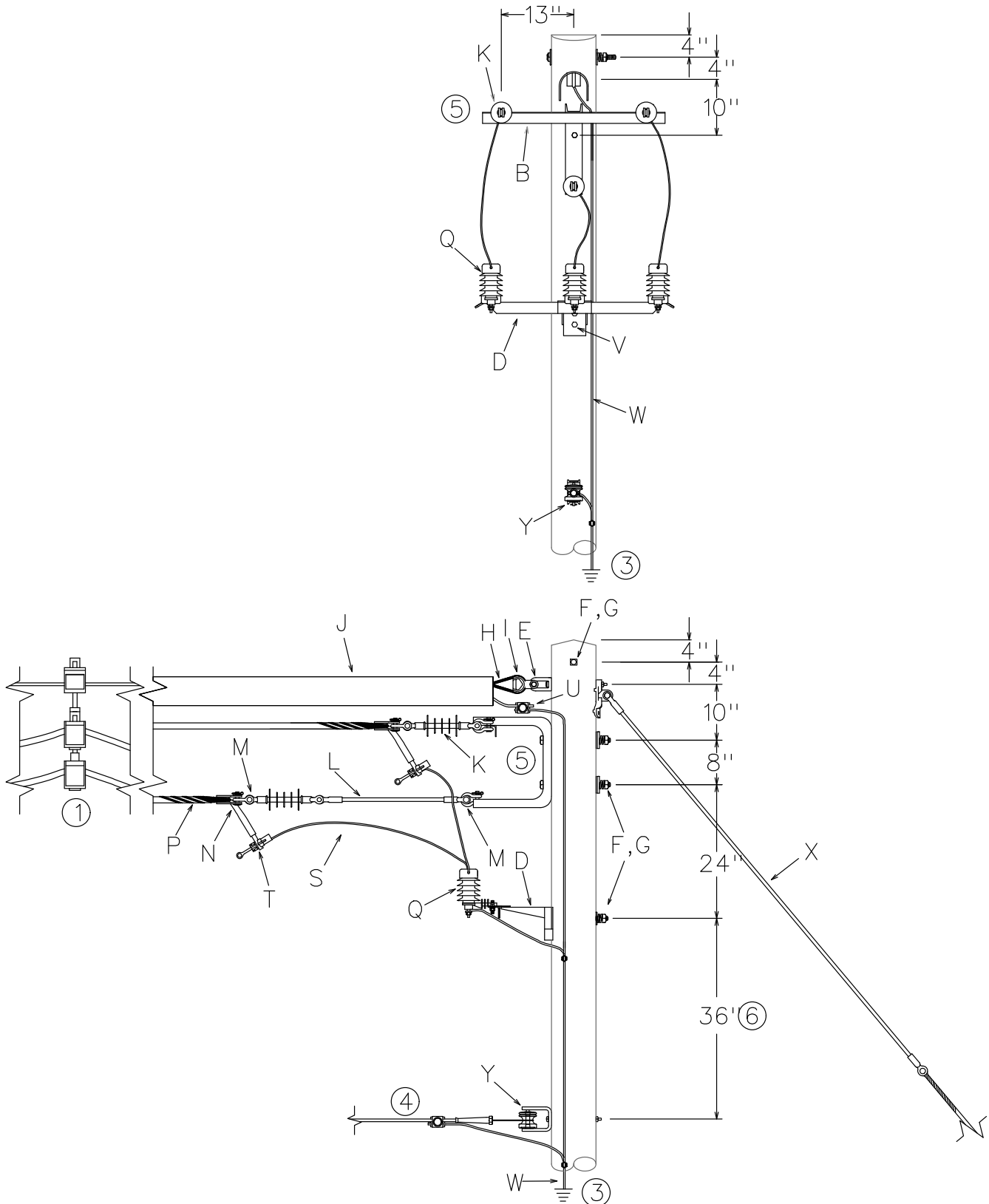


01 - DE ON FG CROSSARM - PREFERRED

CONFIGURATIONS
15 kV & Below – Spacer Cable
Single Circuit – Dead End Structure

03 20 10 **

Sheet 2 of 4

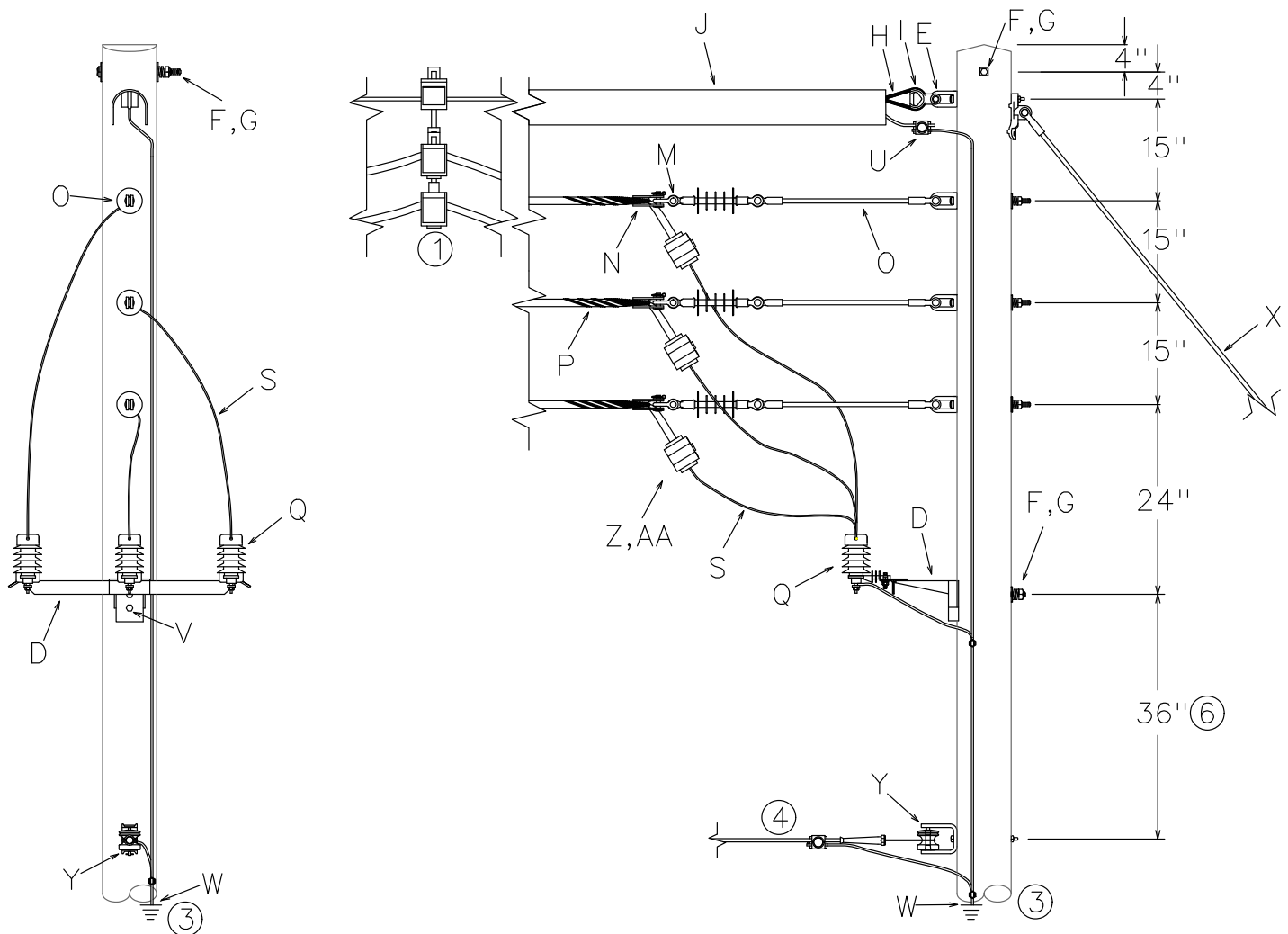


02 - DE ON SPACER CABLE BRACKET

CONFIGURATIONS
15 kV & Below – Spacer Cable
Single Circuit – Dead End Structure

03 20 10 **

Sheet 3 of 4



03 - VERTICAL DE ON POLE - LIMITED USE

CONFIGURATIONS
15 kV & Below – Spacer Cable
Single Circuit – Dead End Structure

03 20 10 **

Sheet 4 of 4

		Std. / Stk. No.	Description	03 20 10 **	01	02	03
	A	04 00 41 04	Deadend Assy., FG Arm, 10'		1		
	B	23 56 114	Spacer Cable Dead End Bracket			1	
	C	04 00 20 03	Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace)		1		
	D	17 08 057	Bracket, Mounting, Arrester			1	1
	E	23 59 095	Eyelet, NM, STD 3/4"		1	1	1
	F	23 52 065	Bolt, Mach., 5/8" x 12"		1	4	2
	G	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16"		2	5	3
	H	23 68 713	Grip, Messenger/ Neutral, Preformed 7#6 – 052AWA		1	1	1
	I	23 58 054	Clevis, NM, Thimble, Galvanized Steel		1	1	1
	J	69 58 293	Line Duc Cover – (Messenger Cover), Black, 8' Long (Each)		1	1	1
	K	25 06 052	Insulator, Suspension, 15kV, Poly		3	3	
	L	25 56 076	Insulator, Guy Strain, Fiberglass, 26", 15kV		1	1	
	M	23 68 181	Shackle – Anchor, 9/16"		3	6	3
	N	23 58 122	Clevis, Thimble, 7/8" Opening, Galvanized Steel		3	3	3
	O	06 12 30 01	Deadend on Pole with FG Ext.				3
@	P	23 68 701	Grip, Conductor Deadend, 15kV, 477 Spacer Cable		3	3	3
			Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00)		3	3	3
@	Q	10 01 144	Arrester, 10kV w/ Protective Cap		3	3	3
		10 01 133	Arrester, 3kV w/ Protective Cap		3	3	3
	R	17 58 054	Bracket, Switch/ Arrester Mounting		3		
	S	18 51 021	Wire, Poly #6 Cu., (FT.)		15	15	15
@	T	17 62 088	Clamp, Hot Line, 1/0 Through 477 Spacer Cable		3	3	
		17 62 143	Clamp, Hot Line, 795 Spacer Cable		3	3	
	U	17 51 137	Connector, PG, Pole Ground to Messenger		1	1	1
	V	23 60 007	Lag, Square Head, Galvanized, 1/2" x 4"			1	1
4,3@	W	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1	1
@	X	11 00 42 **	Guying Unit with FG Strain Insulator & HD Guy Hook				
@	Y	03 01 01 **	Neutral Configuration				
	Z	17 51 139	PG Clamp				3
	AA	38 51 608	Cover				3

NOTES:

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for space installation between poles.
2. Install the center phase of the spacer cable with Fiberglass Strain Insulator into the top hole on the DE arm.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Only use 03 20 10 02 when extending the line with open wire is unlikely or when required by clearance restrictions.
6. Distance may be reduced to 24" if approved by Engineering.
7. For installations on a composite pole, substitute a fiberglass crossarm, Stock #41 01 285, in place of the wood arm. Use electrical ground clips, stock #23 68 746, to attach the ground wire to the bottom of the fiberglass crossarm.

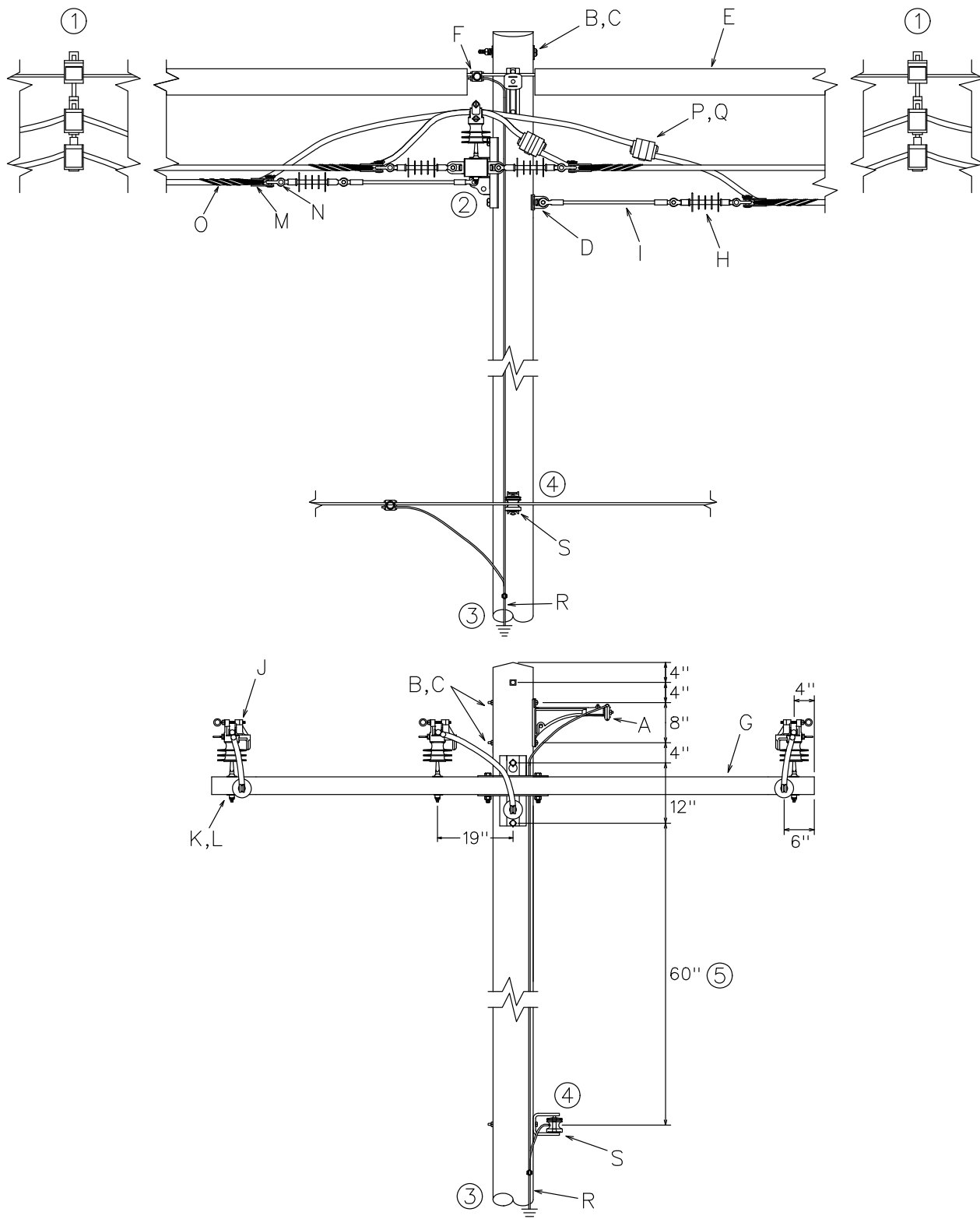
CONFIGURATIONS

15 kV & Below Spacer Cable

Three Phase Loopover – Spacer Cable to Spacer Cable

03 20 15 **

Sheet 1 of 3



01 - TANGENT MESSENGER

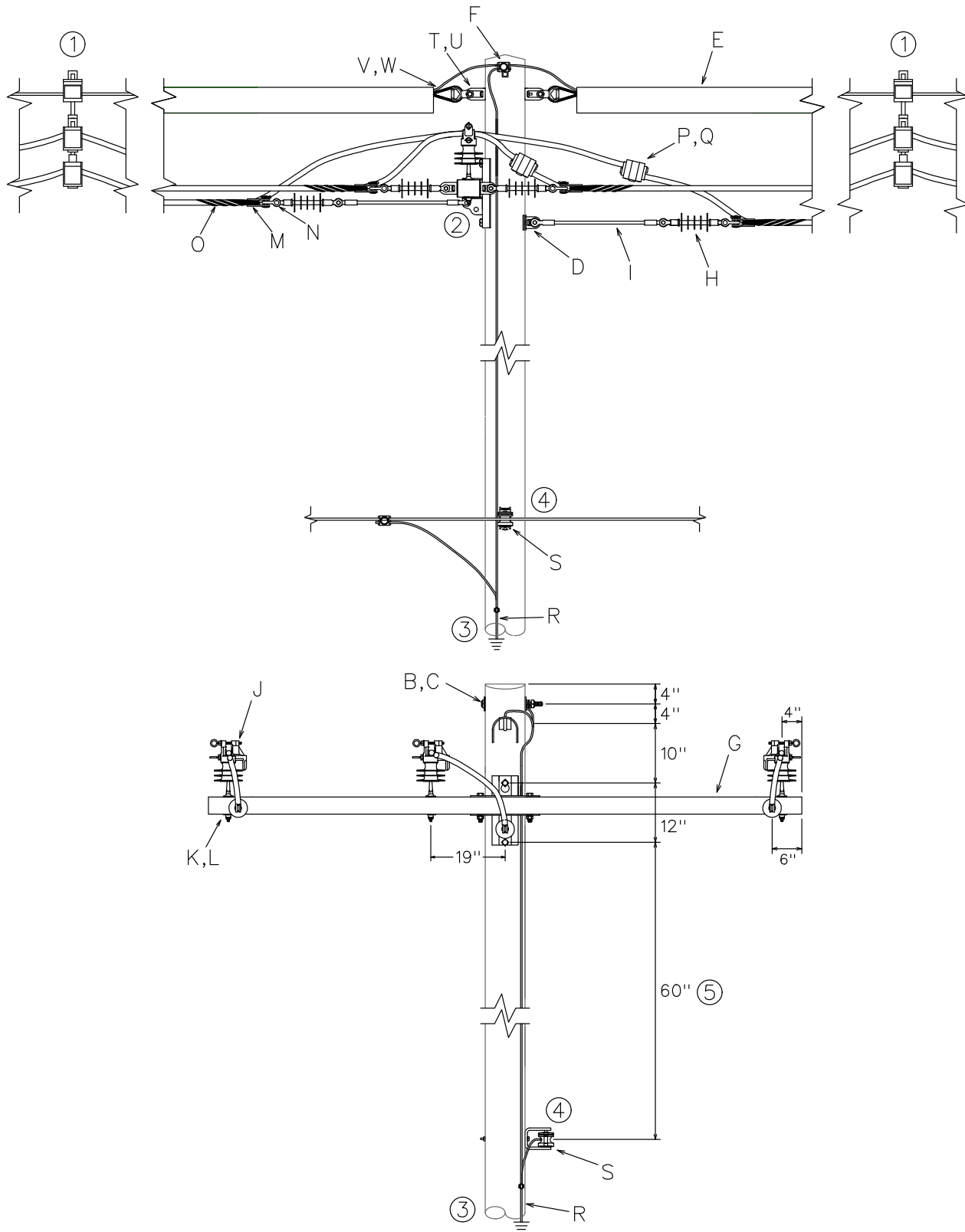
CONFIGURATIONS

15 kV & Below Spacer Cable

Three Phase Loopover – Spacer Cable to Spacer Cable

03 20 15 **

Sheet 2 of 3



02 - DOUBLE DEADEND MESSENGER

CONFIGURATIONS
15 kV & Below Spacer Cable
Three Phase Loopover – Spacer Cable to Spacer Cable

03 20 15 **

Sheet 3 of 3

		Std. / Stk. No.	Description	03 20 15 **	01	02
	A	23 56 075	Bracket, Messenger		1	
	B	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		3	1
	C	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick		4	2
	D	23 65 018	Eyebut, 3/4", Galvanized Steel		1	2
	E	69 58 293	Line Duc (Messenger Cover), Black, 8' Long (Each)		2	2
	F	17 51 137	Connector, PG, Pole Ground to Messenger		1	1
	G	04 00 41 04	Crossarm, Deadend, F/G, 10'		1	1
	H	25 06 052	Insulator, Suspension, 15kV, Poly		6	6
	I	25 56 076	Insulator, Strain, Fiberglass, 26", 15kV		2	2
	J	25 05 143	Insulator, Pin, 15kV, Vise-Top		3	3
	K	23 62 028	Pin, Insulator, Long Shank		3	3
	L	23 66 132	Washer, Flat, Sq., 4" x 4", w/ 13/16" hole		3	3
	M	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel		6	6
	N	23 68 181	Shackle – Anchor, 9/16"		6	6
@	O	23 68 701	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable (See 07 20 11 00)		6	6
			Size Grip per Existing Spacer Cable Conductor		6	6
@	P	PG*W	Clamp, Parallel Groove (See 07 00 25 00)		3	3
	Q	38 51 608	Cover, Large, Vice Type Connectors		3	3
@	R	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1
@	S	03 01 01 **	Neutral Configuration			
	T	23 59 095	Eyelet, 3/4", Galvanized Steel			1
	U	23 52 097	Bolt, 3/4" x 12"			1
	V	23 68 713	Grip Messenger/Neutral, Preformed – 052 AWA			2
	W	23 58 054	Clevis, NM, Thimble, Galvanized Steel			2

NOTES

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacing installation between poles.
2. Install the center phase of the spacer cable with fiberglass strain insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. This distance can be reduced to 40 inches if approved by engineering.

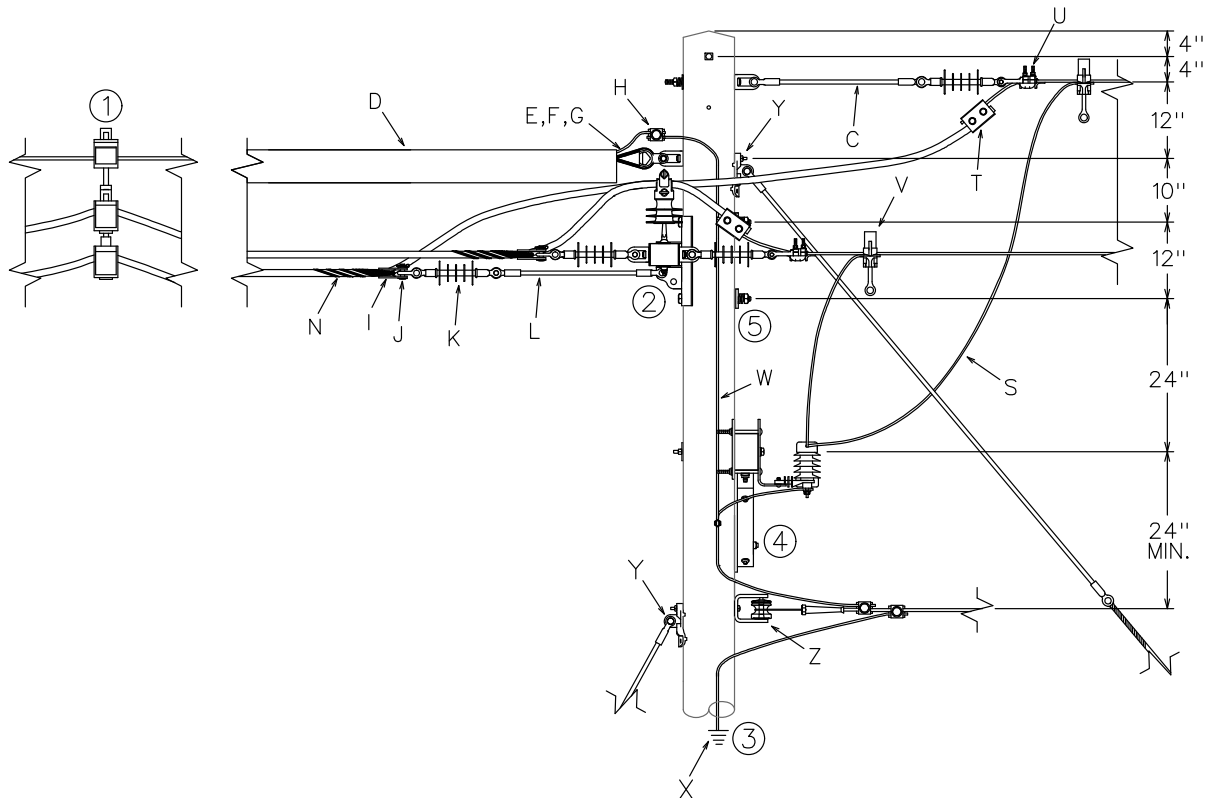
Sheet 1 of 3



CONFIGURATIONS
15 kV & Below – Spacer Cable
Three Phase Loopover – Spacer Cable to Open Wire

03 20 20 01

Sheet 2 of 3



		Std. / Stk. No.	Description	03 20 20 01	01
	A	23 52 065	Bolt, 5/8" x 12"		1
	B	23 66 027	Washer, Square, 2-1/4"		2
	C	06 12 30 01	Deadend on Pole w/ FG Extension		1
	D	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		1
	E	23 68 713	Grip, Messenger/Neutral, Preformed for - 052 AWA		1
	F	23 58 054	Clevis, NM, Thimble, Galvanized Steel		1
	G	23 59 095	Eyelet, NM, Thimble, 3/4", Galvanized Steel		1
	H	17 51 137	Clamp, PG - Messenger to Open Wire Neutral		2
	I	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel		3
	J	23 68 181	Shackle - Anchor, 9/16"		3
	K	25 06 052	Insulator, Suspension, 15kV, Poly		5
	L	25 56 076	Insulator, Strain, Fiberglass, 26"		1
	M	25 05 143	Insulator, Pin, 15kV, Vise-Top		3
@	N	23 68 701	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable		3
			Size Grip per existing Spacer Cable Conductor (See 07 20 11 00)		3
	O	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	P	04 00 20 03	Crossarm, Sgl., Wood, 10', (use only 1/2 of V-Brace)		1

CONFIGURATIONS
15 kV & Below – Spacer Cable
Three Phase Loopover – Spacer Cable to Open Wire

03 20 20 01

Sheet 3 of 3

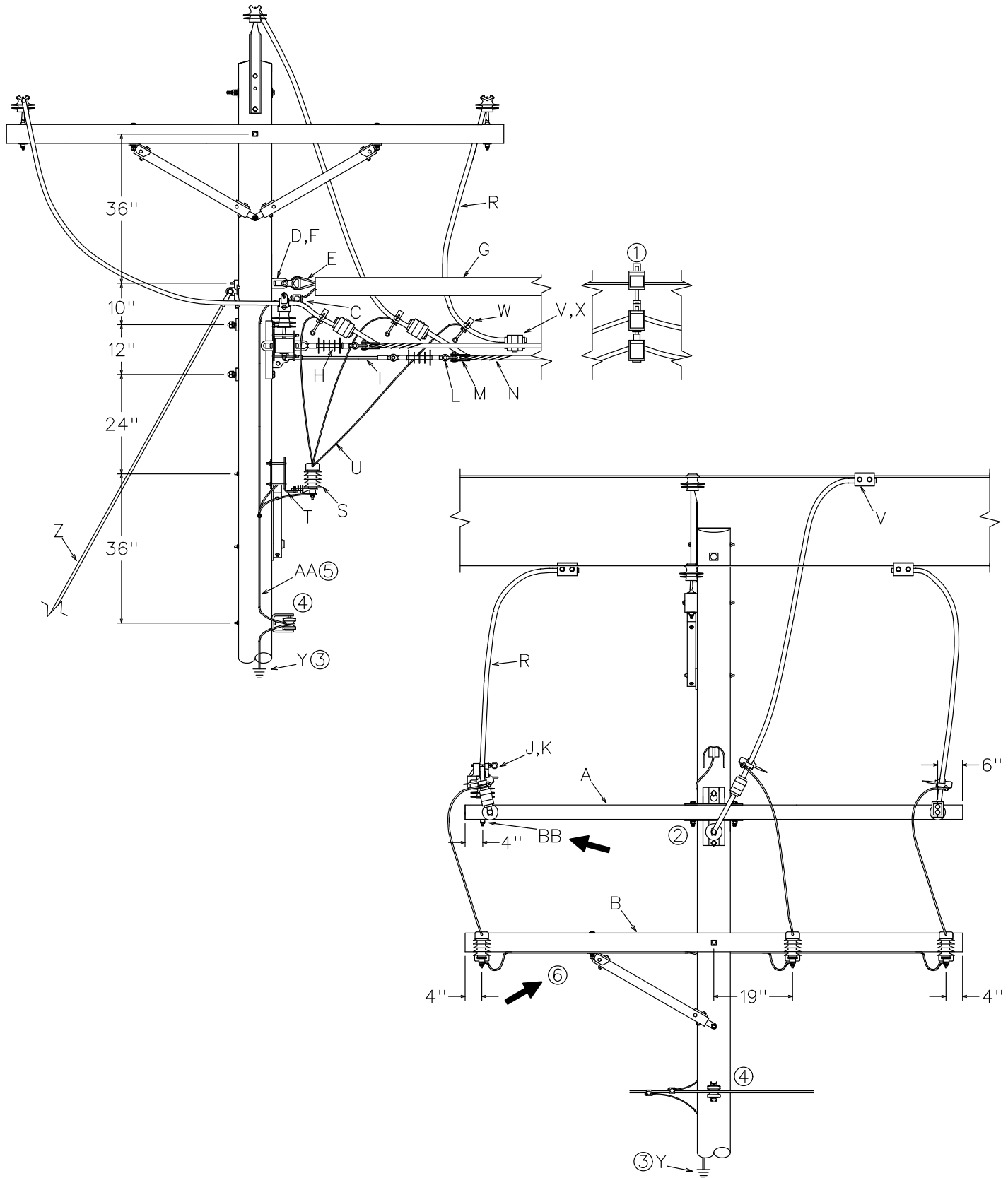
3 @	@	Q	10 01 144	Arrester, 10kV w/ Protective Cap	3
			10 01 133	Arrester, 3kV w/ Protective Cap	3
		R	17 58 054	Bracket, Switch/ Arrester Mounting	3
		S	18 51 021	Wire, Poly #6 Cu., (Ft.)	15
	@	T	PG*	Clamp, Parallel Groove (See 07 00 25 00)	3
	@	U	DEC*W	Clamp, Deadend	3
	@	V	HLC*W	Hot Line Clamp	3
		W	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)	15
	@	X	12 00 10 **	Grounding Unit, 7#10 Copperweld	1
	@	Y	11 00 42 **	Guying Unit with FG Strain Insulator & HD Guy Hook	
	@	Z	03 01 01 **	Neutral Configuration	
		AA	23 62 028	Pin, Insulator, Long Shank	3
		BB	23 66 132	Washer, Flat, Sq., 4" x 4" w/ 13/16" hole	3

NOTES

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacing installation between poles.
2. Install the center phase of the space cable with fiberglass Strain Insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS **12 00 10 01** ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger.
6. For installations on a composite pole, substitute a fiberglass crossarm, Stock #41 01 285, in place of the wood arm. Use electrical ground clips, stock #23 68 746, to attach the ground wire to the bottom of the fiberglass crossarm.

CONFIGURATIONS
15 kV & Below – Spacer Cable
Three Phase Tap From Open Wire

03 20 24 01
Sheet 1 of 2



CONFIGURATIONS

15 kV & Below – Spacer Cable Three Phase Tap From Open Wire

03 20 24 01

Sheet 2 of 2

	Std./Stk. No.	Description	03 20 24 01
	A 04 00 41 04	Deadend Assy, FG Arm, 10'	1
	B 04 00 20 03	Crossarm, Sgl, Wood, 10' (use only 1/2 of V-Brace)	1
	C 17 51 137	Connector, PG, Pole Ground to Messenger	1
	D 23 59 095	Eyelet, NM, STD, 3/4"	1
	E 23 68 713	Grip, Messenger/Neutral, Preformed for 7#6 – 052AWA	1
	F 23 58 054	Clevis, NM, Thimble, Galvanized Steel	1
	G 69 58 293	Line Duc Cover – (Messenger Cover), Black. 8' Long (Each)	1
	H 25 06 052	Insulator, Suspension, 15kV, Poly	3
	I 25 56 076	Insulator, Guy Strain, Fiberglass 26", 15kV	1
	J 25 05 143	Insulator, Pin, 15kV, Vice-Top	1
	K 23 62 028	Pin, Insulator, Long Shank	1
	L 23 68 181	Shackle – Anchor, 9/16"	3
	M 23 58 122	Clevis, Thimble, 7/8" Opening, Galvanized Steel	3
@	N 23 68 701	Grip, Conductor Deadend, 15kV, 477 Spacer Cable	3
		Size Grip per existing Spacer Cable Conductor (See 07 20 11 00)	3
	R LW*W	Wire, Poly Covered, S.D. (ft.) (See 07 00 80 00)	30
@	S 10 01 144	Arrester, 10kV w/ Protective Cap	3
	10 01 133	Arrester, 3kV w/ Protective Cap	3
	T 17 58 054	Bracket, Switch/Arrester Mounting	3
	U 18 51 021	Wire, Poly #6 CU., (FT.)	15
@	V PG*W	Clamp, Parallel Groove (See 07 00 25 00)	3
@	W HLC*W	Hot Line Clamp	3
	X 38 51 608	Cover, Large, Vice Type Connectors	3
@,3	Y 12 00 10 **	Grounding Unit, 7#10 Copperweld	1
@	Z 11 00 42 **	Guying Unit with FG Strain Insulator & HD Guy Hook	
5	AA 18 51 019	Wire, #2 Cu. Poly Covered (Ft.)	15
	BB 23 66 132	Washer, Flat, Sq., 4" x 4" w/ 13/16" hole	1

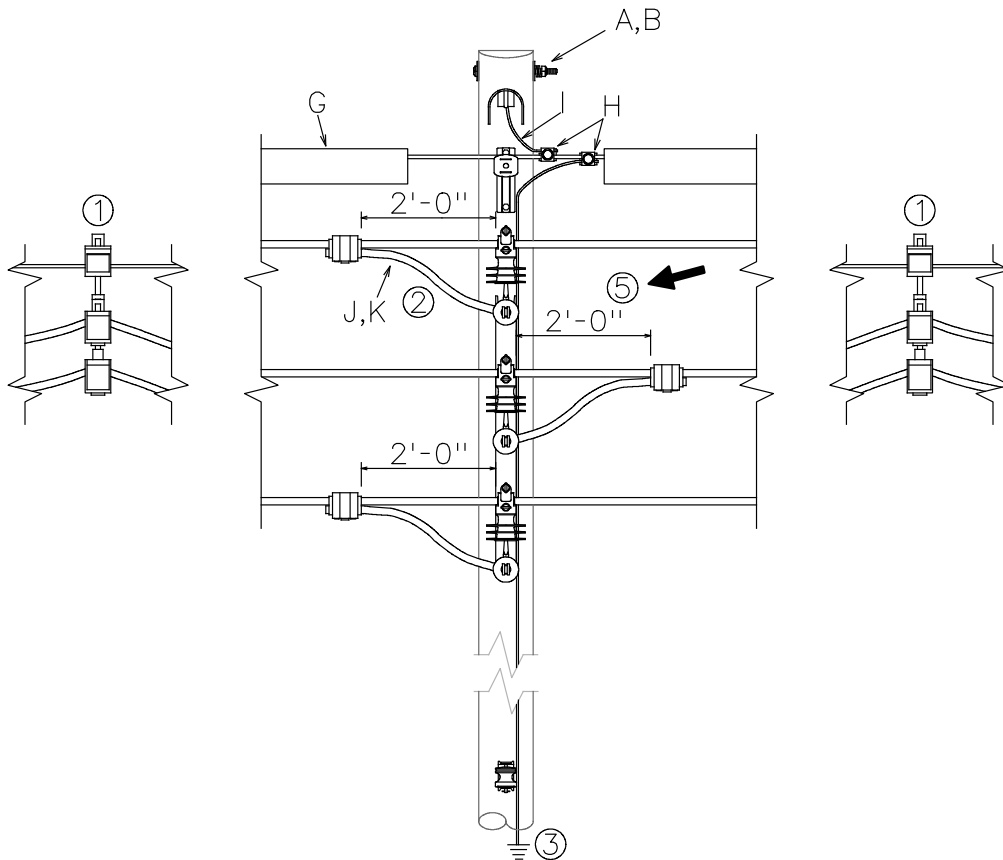
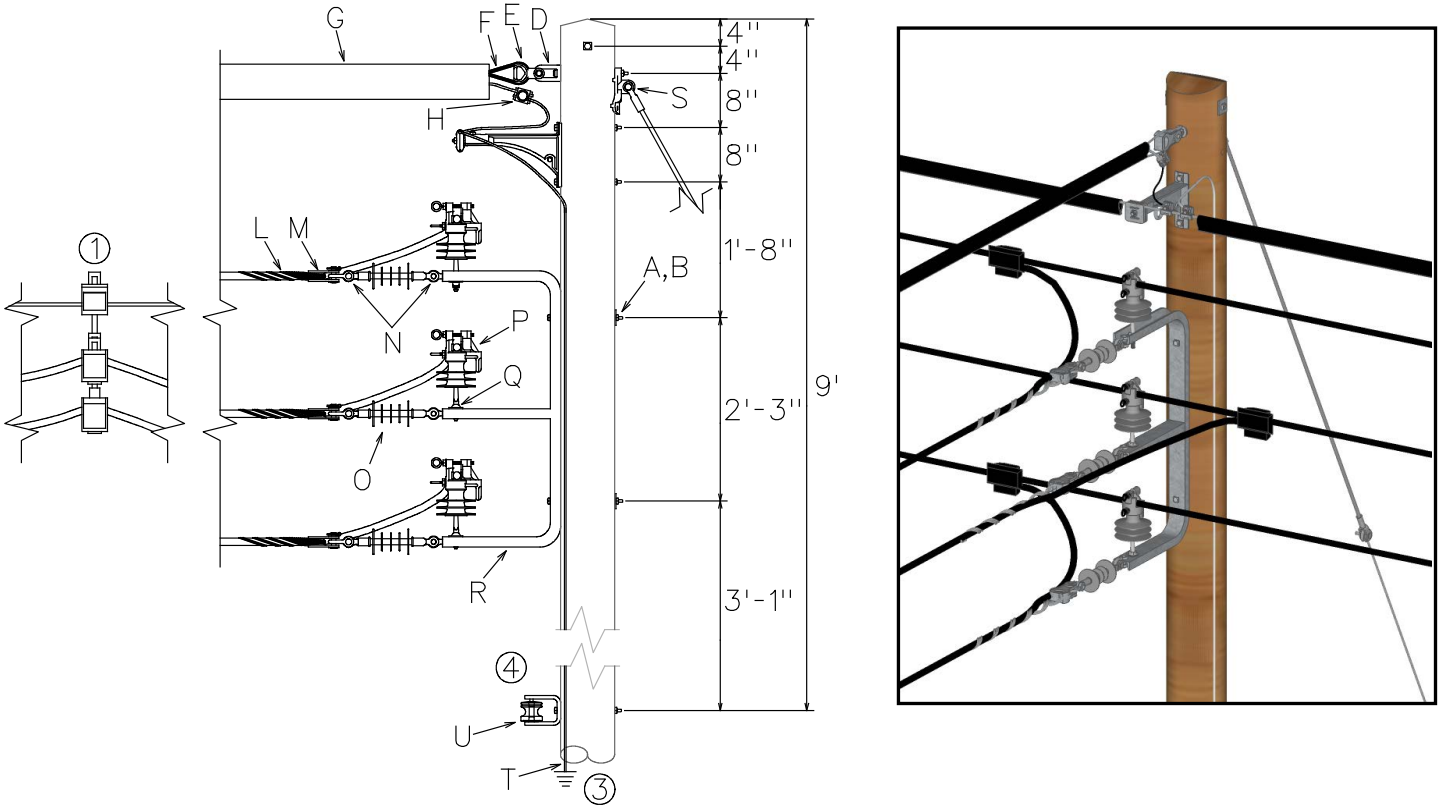
NOTES:

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacer installation between poles.
2. Install the center phase of the spacer cable with fiberglass strain insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger.
6. For installations on a composite pole, substitute a fiberglass crossarm, Stock #41 01 285, in place of the wood arm. Use electrical ground clips, stock #23 68 746, to attach the ground wire to the bottom of the fiberglass crossarm.

CONFIGURATIONS
15 kV & Below - Spacer Cable
Three Phase Lateral Tap

03 20 25 01

Sheet 1 of 2



DISTRIBUTION CONSTRUCTION STANDARDS



ENG: KR
REV. NO: 1
REV. DATE: 06/18/18

CONFIGURATIONS
15 kV & Below – Spacer Cable
Three Phase Lateral Tap

03 20 25 01

Sheet 2 of 2

		Std. / Stk. No.	Description	03 20 25 01	01
	A	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		3
	B	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick		4
	C	23 56 075	Bracket, Messenger		1
	D	23 59 095	Eyelet, 3/4", Galvanized Steel		1
	E	23 58 054	Clevis, NM, Thimble, Galvanized Steel		1
	F	23 68 713	Grip, Messenger/Neutral, Preformed – 052 AWA		1
	G	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		3
	H	17 51 137	Clamp, PG, Pole Ground to Messenger		3
	I	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)		3
@	J	PG*W	Clamp, PG, Conductor to Conductor		3
	K	38 51 608	Cover, Large, Vise Type Connectors		3
@	L	23 68 701	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable		3
			Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00)		3
	M	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel		3
	N	23 68 181	Shackle – Anchor, 9/16"		6
	O	25 06 052	Insulator, Suspension, 15kV, Poly		3
	P	25 05 143	Insulator, Pin, 15kV, Vise-Top		3
	Q	23 62 151	Pin, Insulator, 1" Thread, Short Shank, 5/8"		3
	R	23 56 105	Bracket, Vertical Tap		1
@	S	11 00 42 **	Guying Unit w/ FG Strain Insulator & HD Guy Hook		1
@	T	12 00 10 **	Grounding Unit, 7#10 Copperweld		1
@	U	03 01 01 **	Neutral Configuration		

NOTES

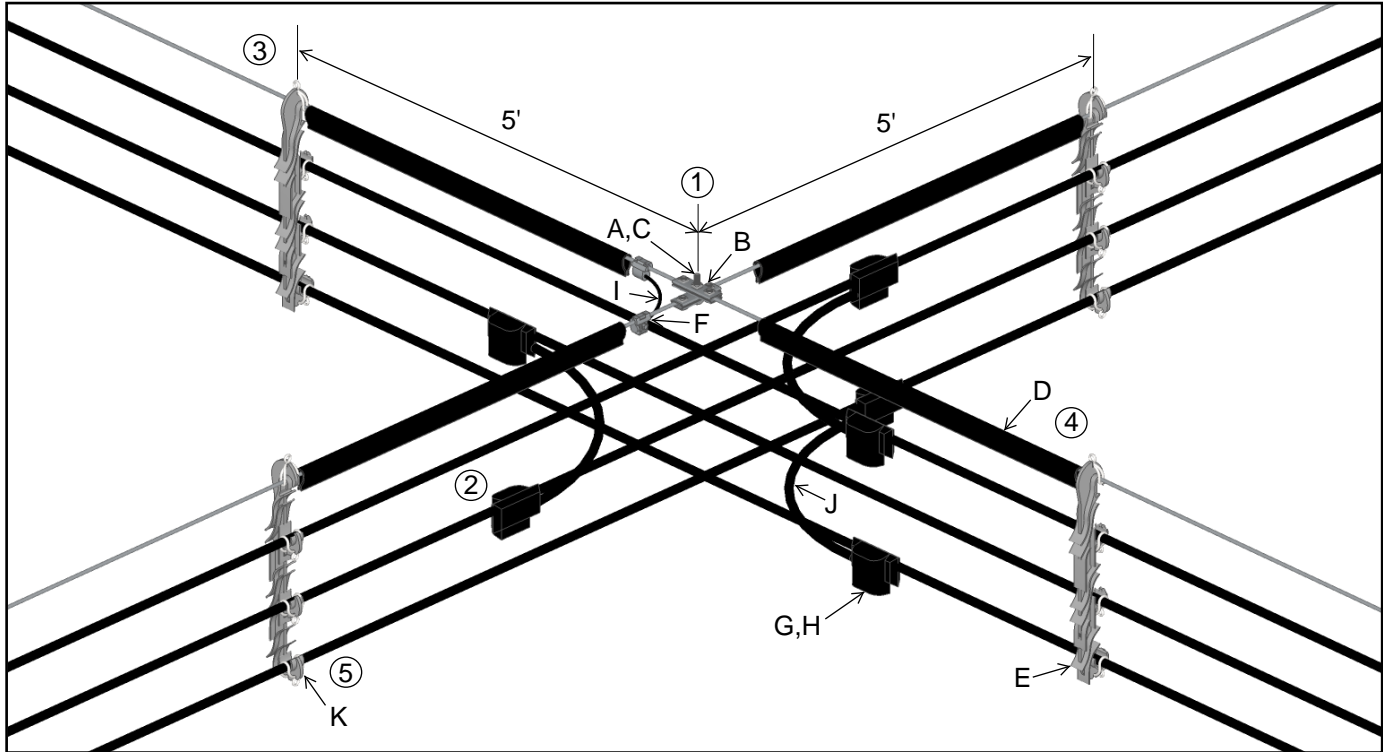
1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacing installation between poles.
2. Extend spacer cable conductor with the covering intact through the preform and connect with PG clamps to the tap/source conductor for all three primary conductors.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable is stripped to maintain the required 2'-0" of horizontal separation.R

CONFIGURATIONS

15kV & Below – Spacer Cable Three Phase Mid-Span Tap

03 20 30 01

Sheet 1 of 1



		Std./Stk. No.	Description	03 20 30 01	
	A	23 52 438	Bolt, Machine, 5/8" x 3" (w/ nut)		1
	B	23 68 657	Clamp, Cable		2
	C	23 65 043	Nut, Lock, 5/8"		1
4	D	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		2
3	E	23 67 411	Spacer, Aerial Cable, Vertical		4
	F	17 51 137	Clamp, PG, Messenger		2
@	G	PG*W	Clamp, PG, Conductor		6
	H	38 51 608	Cover, Large, Vise Type Connectors		6
	I	18 51 019	Wire, #2 Cu., Poly Covered (Ft.)		3
	J	18 51 052	Wire, Poly, SD, 350 CU. (Ft.)		12
5@	K	23 67 333	Ring, Conductor Tie		16

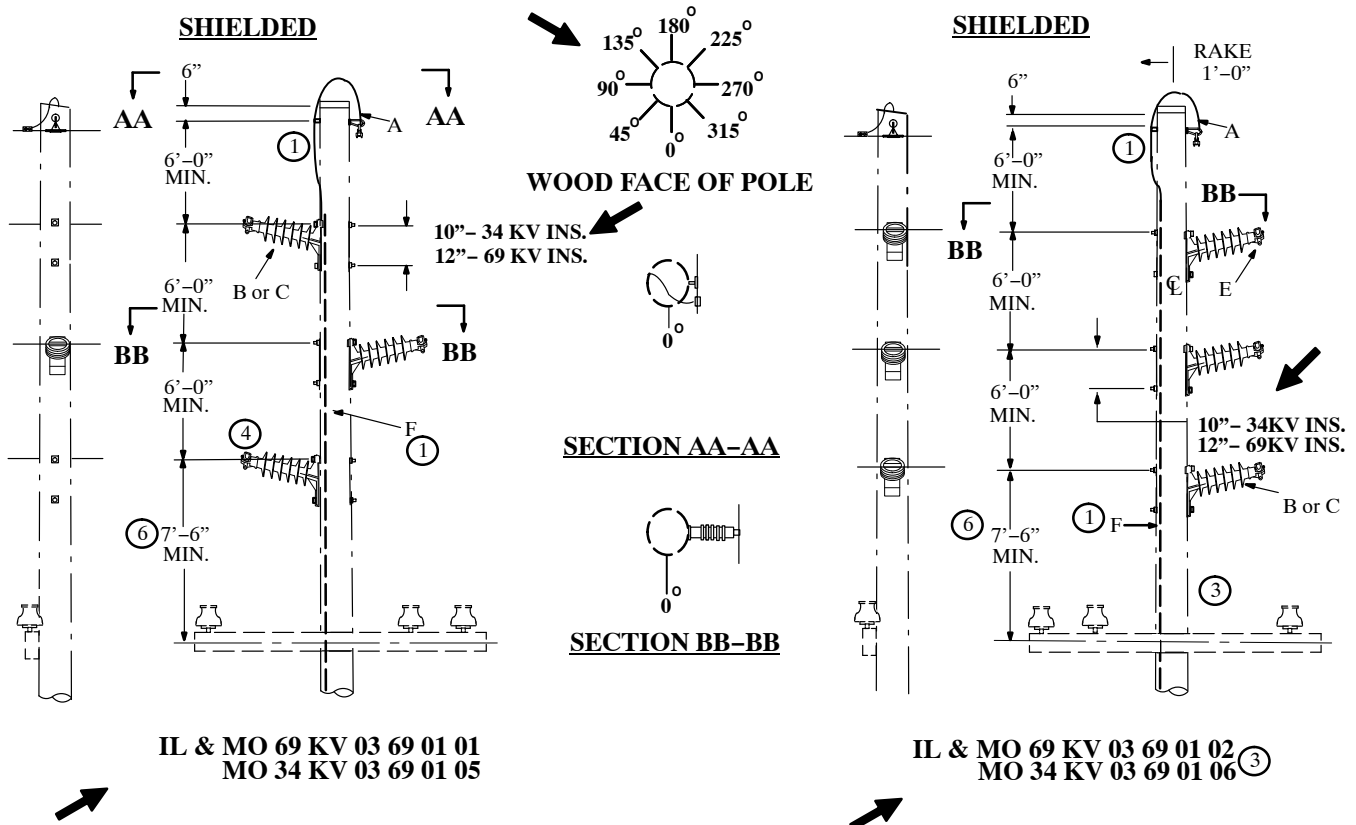
NOTES

1. This Standard is **Limited Use Only**. Use only to replace existing mid-span taps after close examination determines that the mid-span tap configuration cannot be engineered to be built with any other standard or configuration.
2. Alternate taps as shown in the drawing to maximize the distance between each tap. All taps are to be covered.
3. The vertical spacers are to be located 5' from the intersection of the messenger/conductors.
4. Cut the 8' pieces of line duc in 4' pieces to install between the vertical spacer and the intersection of the two messengers.
5. (4) Ring ties (23 67 333) are included with each vertical spacer (23 67 411), but may be ordered separately if existing vertical spacers are used.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Tangent Structure for Line Angle $\leq 1^\circ$

03 69 01 **

Sheet 1 of 3

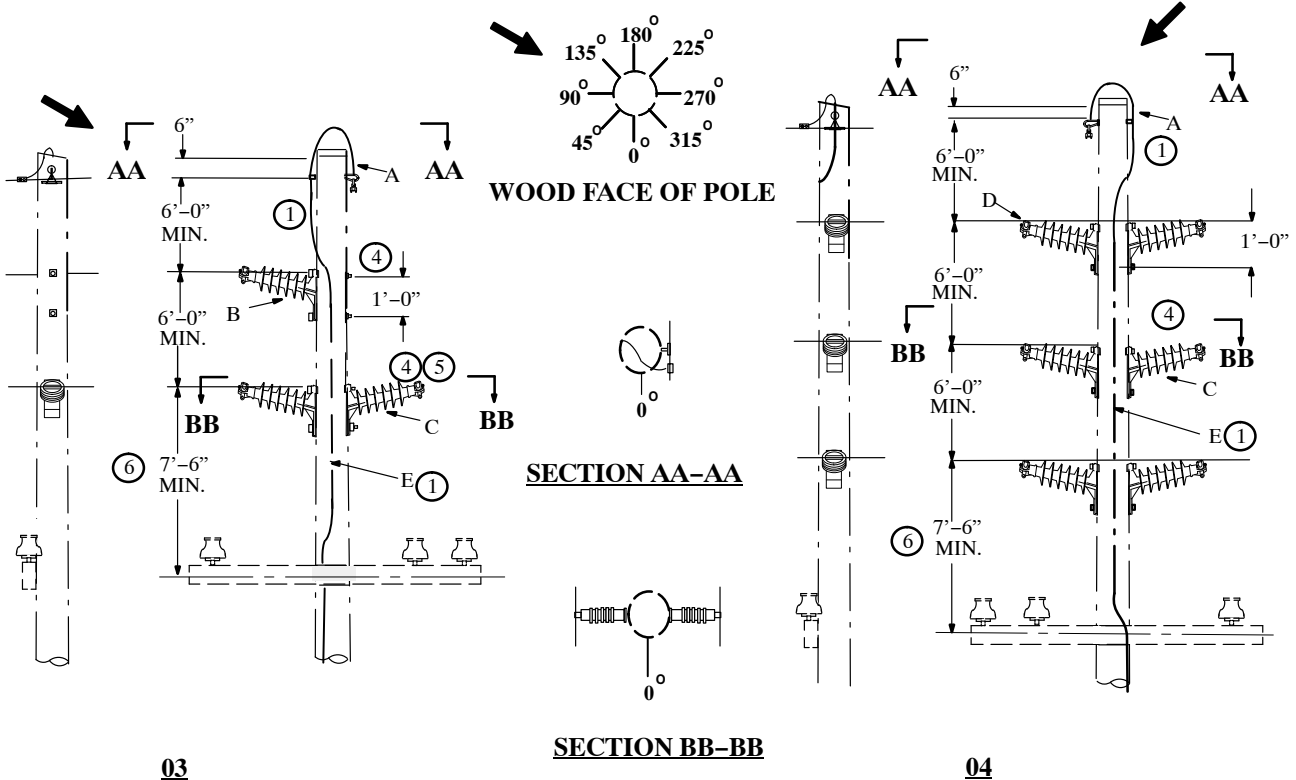


		Std./Stk. No.	Description	03 69 01 **	01	02	05	06
@	A	06 00 11 04	Static Support w/Susp. Clamp		1	1	1	1
	B	06 34 03 03	Insul., 34kV, Horz., Sgl Post w/Clamp Top				3	3
	C	06 69 03 03	Insul., 69kV, Horz., Sgl Post w/Clamp Top		3	3		
		06 69 03 01	Insul., 69kV, Horz., Sgl Post w/Susp. Clamp		3	3		
@	E	TC*W	Clamp, Top, Tang/Ang, Cond.		3	3	3	3
		SC*W	Clamp, Susp, Tang/Ang, Cond.		3	3		
@7	F	12 00 10 09	Grounding, Wood Pole		1	1	1	1
		12 00 10 12	Grounding, Composite Pole		1	1	1	1

CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Tangent Structure for Line Angle $\leq 1^\circ$

03 69 01 **

Sheet 2 of 3



		Std./Stk. No.	Description	03 69 01 **	03	04
@	A	06 00 11 04	Static Support w/Susp. Clamp		1	1
	B	06 69 03 03	Insul., 69 kV, Horz. Sgl Post w/Clamp Top		1	
@		06 69 03 01	Insul., 69 kV, Horz., Sgl Post w/Susp. Clamp		1	
	C	06 69 03 04	Insul., 69 kV, Horz., Dbl Post w/Clamp Top		1	3
@		06 69 03 02	Insul., 69 kV, Horz., Dbl Post w/Susp. Clamp		1	3
	D	TC*W	Clamp, Top, Tang/Ang, Cond.		1	3
@7		SC*W	Clamp, Susp., Tang/Ang, Cond.		1	3
	E	12 00 10 09	Grounding, Wood Pole		1	1
@4		12 00 10 12	Grounding, Composite Pole		1	1
	F	25 05 132	Insul, 138 kV, Horz., Dbl Post w/Susp. Clamp			

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Tangent Structure for Line Angle $\leq 1^\circ$

03 69 01 **

Sheet 3 of 3

NOTES:

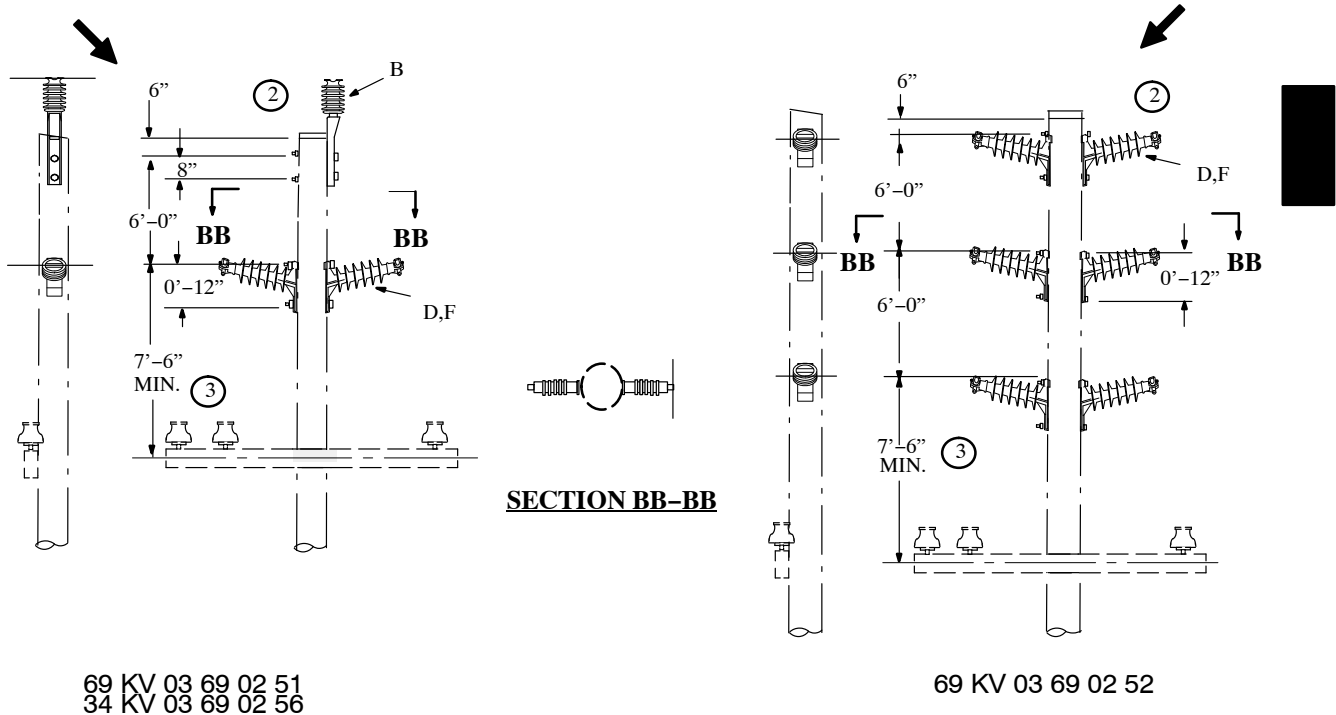
1. Install pole ground on wood pole as shown on configuration. Composite pole is pre-assembled with #2 Str. Cu. Pole ground at 45 degree quadrant. See DCS 12 00 10 09 or 12 00 10 12 for grounding detail.
2. A taller pole shall be selected to replace existing 4' spacing and also to provide adequate ground clearance. If taller pole does not provide adequate ground clearances, consider utilizing Standard 03.
3. This standard is to be used where a future second circuit is anticipated or where constrained by horizontal clearance requirements or right-of-way issues.
4. Modify configuration 01 to 03 for additional clearance or use 138kV insulator to maintain additional horizontal separation if galloping is a concern.
5. If future circuits are anticipated reposition back to back insulator arrangement to upper position to 03 if strength requirements and shielding angle are met.
6. Use 7'-6" spacing for tangent structure and 7'-0" spacing for deadend structure. (use top bolt of fiberglass arm)
7. Install ground clamp above grade on wood and below grade on composite pole. See DCS 12 00 10 **.
8. Use composite pole for storm structure as existing maintenance replacement or new line installation. See DCS 02 03 10 01 for storm pole selection.

CONFIGURATIONS
34kV or 69kV
Tangent Structure for Line Angle $\leq 1^\circ$

03 69 02 **

Sheet 1 of 2

LIMITED USE STANDARD



		Std./Stk. No.	Description	03 69 02 **	51	52	56
@	B	06 34 01 05	Ins., 34 kV, Vert. Tie Top F Neck w/Tie				1
		06 34 01 07	Ins., 69 kV, Vert. Tie Top N Neck w/Tie		1		
@	D	06 69 03 04	Insul., 69 kV, Horz., Dbl Post w/Clamp Top		1	3	1
		06 69 03 02	Insul., 69 kV, Horz., Dbl Post w/Susp. Clamp		1	3	1
@	F	TC*W	Clamp, Top, Tang/Ang, Cond.		2	6	2
		SC*W	Clamp, Susp., Tang/Ang, Cond.		2	6	2
@	G	12 00 10 09	Grounding, Wood Pole		1	1	1
		12 00 10 12	Grounding, Composite Pole		1	1	1
@2	H	12 34 01**	Arrester Assy.		1	1	1
@4	L	25 05 132	Insul, 138 kV, Horz., Dbl Post w/Susp. Clamp		1	1	1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: KR
REV. NO: 5
REV. DATE: 01/14/2016

CONFIGURATIONS
34kV or 69kV
Tangent Structure for Line Angle $\leq 1^\circ$

03 69 02 **

Sheet 2 of 2

NOTES:

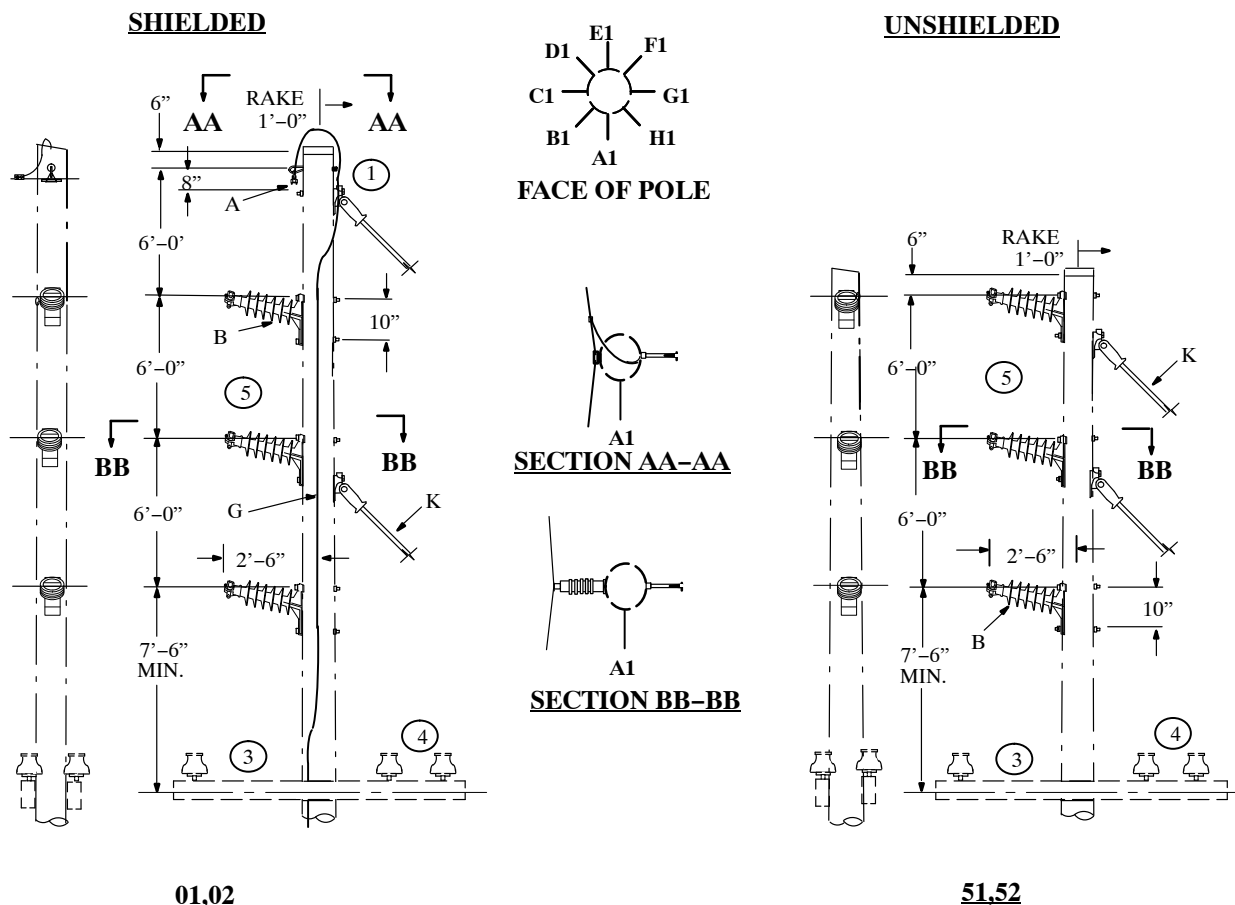
1. A taller pole should be selected to replace existing 4' phase spacing and also to provide adequate ground clearance.
2. See Dist. Std. **12 00 01 01** for lighting arresters application and construction.
3. Use 7'-6" distance to tangent and 7'-0" to deadend crossarm (top bolt on FG arm) hole.
4. Use 138kV insulator to maintain horizontal separation if galloping is a concern.



CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Fixed Angle Structure for Line Angle > 1° and ≤ 20°

03 69 05**

Sheet 1 of 2



NOTES:

1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant B1 on non-metallic pole.
2. Replace existing floating angle structure with new fixed angle structure if the angle is 20° or less.
3. See Dist. Std. **03 00 03 00** for underbuild line angle limitation and Dist. Std. **29 00 04 01** for crossarm(s) loading.
4. Reposition underbuild phases and pole ground if guying conflicts.
5. Contact Standards if existing vertical phase spacing is greater than 6' spacing in a galloping area.
6. See DCS **12 00 01 01** for lightning arrester application and construction.

CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Fixed Angle Structure for Line Angle > 1° and ≤ 20°

03 69 05**

Sheet 2 of 2

⑥

⑥

				69kV		34kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 10 **	01	51	02	52
	A	06 00 11 04	Static Tangent Support w/Suspension Clamp	1		1	
	B	06 34 03 08	Insulator, 34kV, Sgl Horiz. Line Post w/Trunion clamp			3	3
		06 69 03 01	Insulator, 69kV, Sgl Horiz. Line Post w/Suspension clamp	3	3		
	G	12 00 10 09	Grounding Unit	1		1	
@	H	12 34 02 **	Arrester Assembly		1		1
@	K	11 00 43 **	Guying Unit	2	2	2	2

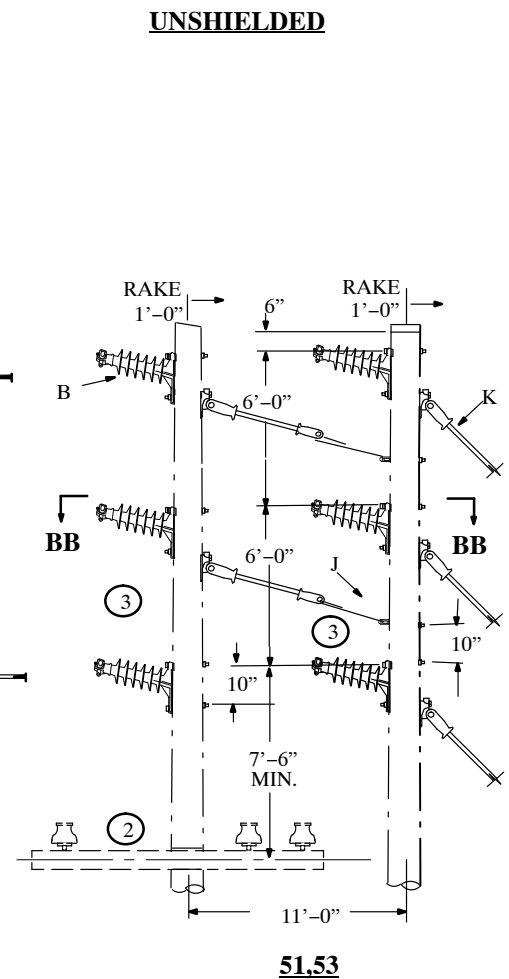
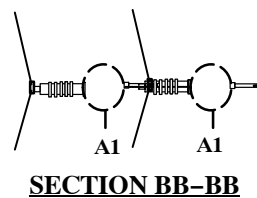
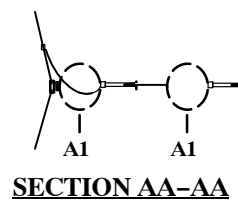
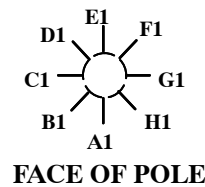
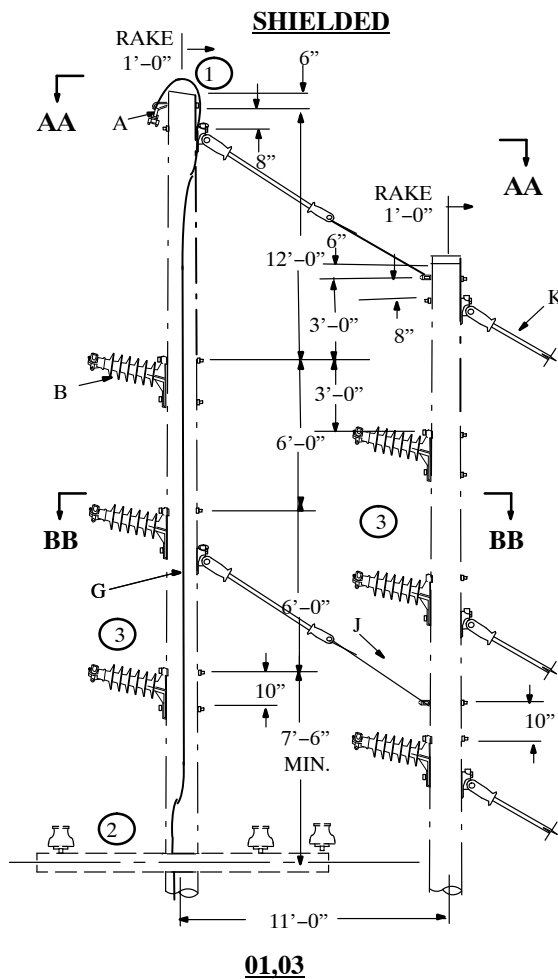
CONFIGURATIONS

Double Circuit – 34kV or 69kV
Fixed Angle Structure for Line Angle $> 1^\circ$ and $\leq 20^\circ$

03 69 06**

Sheet 1 of 4

DOUBLE POLE ARRANGEMENT



NOTES:

1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant B1 on non-metallic pole.
2. See Dist. Std. 03 00 03 00 for underbuild line angle limitations and Dist. Std. 29 00 04 01 for crossarm(s) loading.
3. Contact standards if existing vertical phase spacing is greater than 6' in a galloping area.
4. See DCS 12 00 01 01 for lightning arrester application and construction.

CONFIGURATIONS
Double Circuit – 34kV or 69kV
Fixed Angle Structure for Line Angle > 1° and ≤ 20°

03 69 06**

Sheet 2 of 4

④

④

				69kV		34kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 10 **	01	51	03	53
@	A	06 00 11 04	Static Tangent Support w/Suspension Clamp	1		1	
	B	06 34 03 08	Insulator, 34kV, Sgl Horiz. Line Post w/Trunion clamp			6	6
		06 69 03 01	Insulator, 69kV, Sgl Horiz. Line Post w/Suspension clamp	6	6		
	G	12 00 10 09	Grounding Unit	1		1	
	H	12 34 02 **	Arrester Assembly		1		1
	J	11 00 46 **	Span Guy Unit	2	2	2	2
	K	11 00 43 **	Guying Unit	3	3	3	3

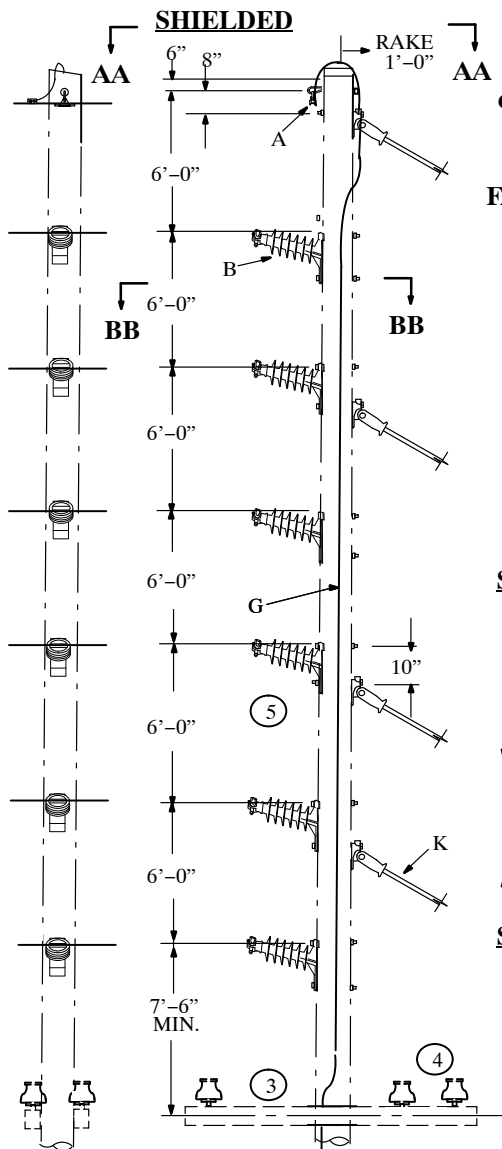
CONFIGURATIONS

Double Circuit – 34kV or 69kV
Fixed Angle Structure for Line Angle $> 1^\circ$ and $\leq 20^\circ$

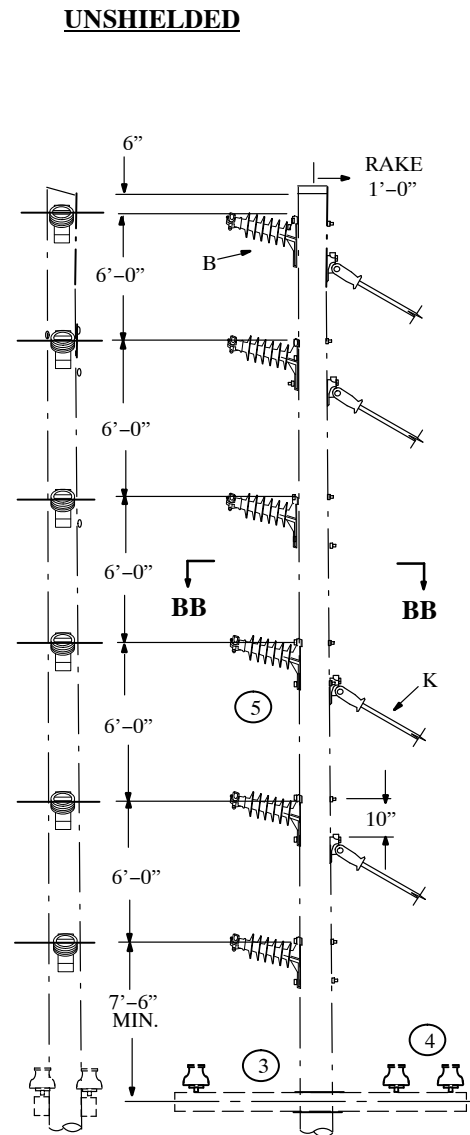
03 69 06**

Sheet 3 of 4

SINGLE POLE ARRANGEMENT



02,04



52,54

NOTES:

1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant B1 on non-metallic pole.
2. Replace existing floating angle structure with new fixed angle structure if the angle is 20° or less.
3. See Dist. Std. 03 00 03 00 for underbuild line angle limitation, and Dist. Std. 29 00 04 01 for crossarm(s) loading.
4. Reposition underbuild phases and pole ground if guying conflicts.
5. Contact standards if existing vertical phase spacing is greater than 6' in a galloping area.
6. See DCS 12 00 01 01 for lightning arrester application and construction.

CONFIGURATIONS
Double Circuit – 34kV or 69kV
Fixed Angle Structure for Line Angle > 1° and ≤ 20°

03 69 06**

Sheet 4 of 4

⑥

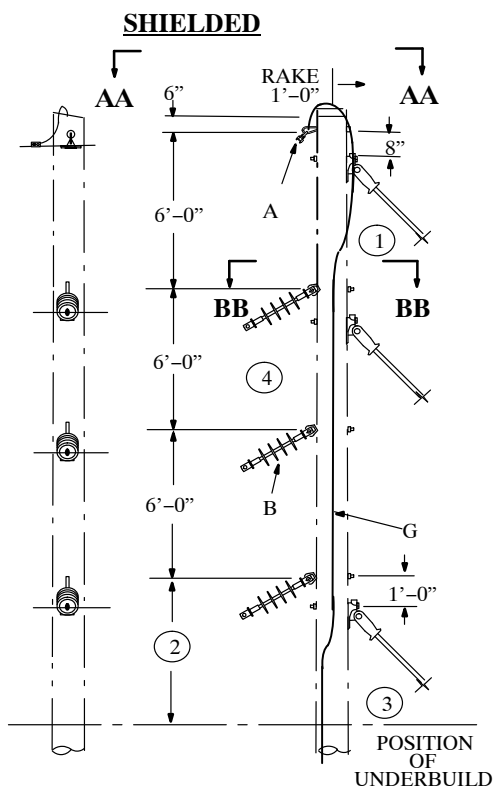
⑥

				69kV		34kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 10 **	02	52	04	54
@	A	06 00 11 04	Static Tangent Support w/Suspension Clamp	1		1	
	B	06 34 03 08	Insulator, 34kV, Sgl Horiz. Line Post w/Trun-nion clamp			6	6
		06 69 03 01	Insulator, 69kV, Sgl Horiz. Line Post w/Sus-pension clamp	6	6		
	G	12 00 10 09	Grounding Unit	1		1	
	H	12 34 02 **	Arrester Assembly		1		1
	J	11 00 46 **	Span Guy Unit				
	K	11 00 43 **	Guying Unit	4	4	4	4

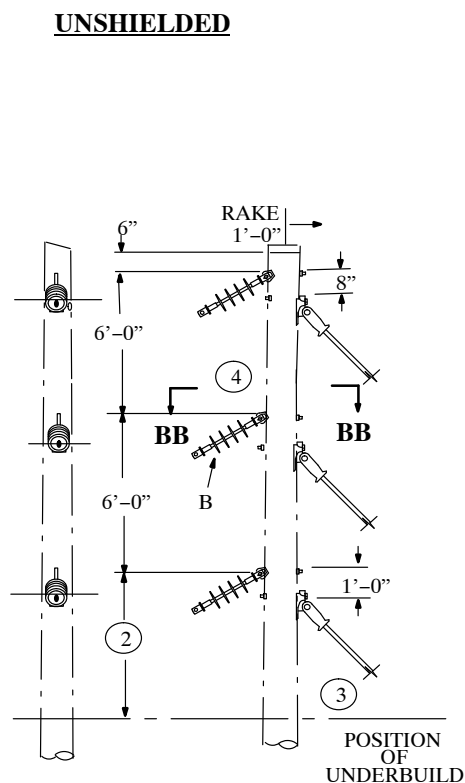
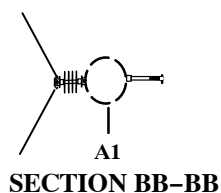
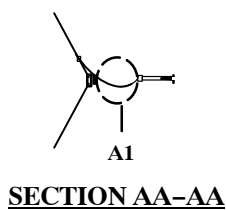
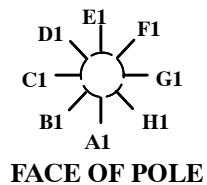
CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Floating Angle Structure for Line Angle $> 20^\circ$ and $\leq 60^\circ$

03 69 10**

Sheet 1 of 2



01.03



51.53

NOTES:

1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant H1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6".
3. Reposition underbuild phases and pole ground if guying conflicts.
4. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.
5. See DCS 12 00 01 01 for lightning arrester application and construction.

CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Floating Angle Structure for Line Angle > 20° and ≤ 60°

03 69 10**
 Sheet 2 of 2

⑤

⑤

					69kV		34kV	
					SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
@		Std. / Stk. No.	Description	03 69 10 **	01	51	03	53
	A	06 00 11 04	Static Support w/Suspension Clamp		1		1	
	B	06 34 60 08	Insulator, 34kV, Sgl Suspension w/ Suspension clamp				3	3
		06 34 60 17	Insulator, 69kV, Sgl Suspension w/ Suspension clamp		3	3		
	G	12 00 10 09	Grounding Unit		1		1	
	H	12 34 02 **	Arrester Assembly			1		1
	K	11 00 43 **	Guying Unit		3	3	3	3

CONFIGURATIONS

Double Circuit – 34kV or 69kV

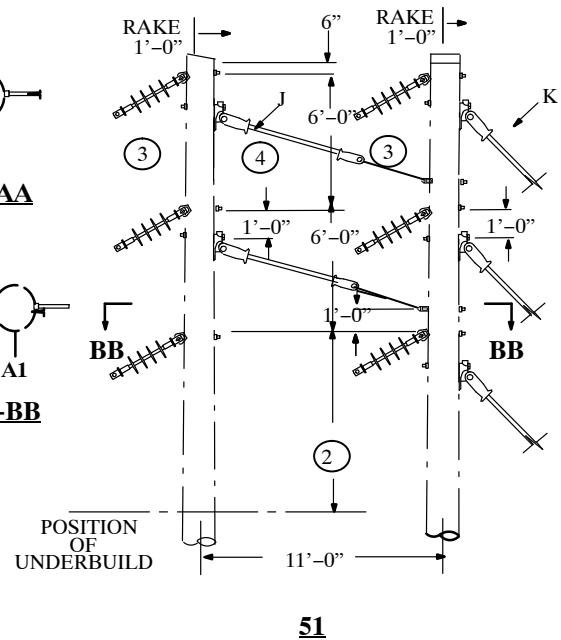
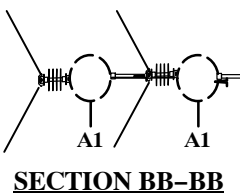
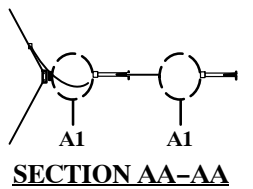
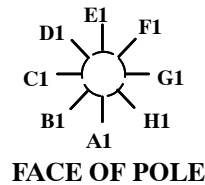
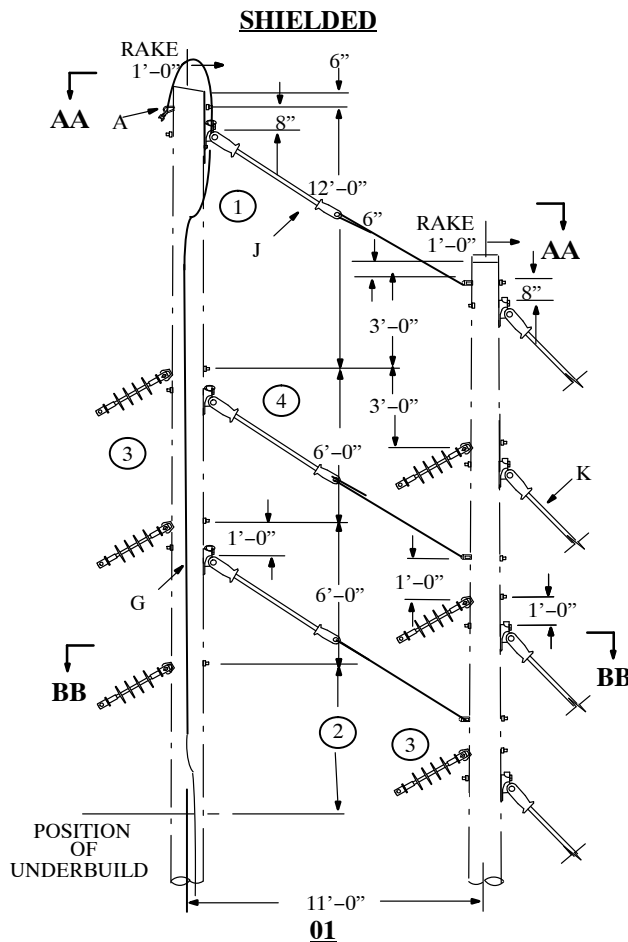
Floating Angle Structure for Line Angle > 20° and ≤ 60°

03 69 11**

Sheet 1 of 3

DOUBLE POLE ARRANGEMENT

UNSHIELDED



NOTES:

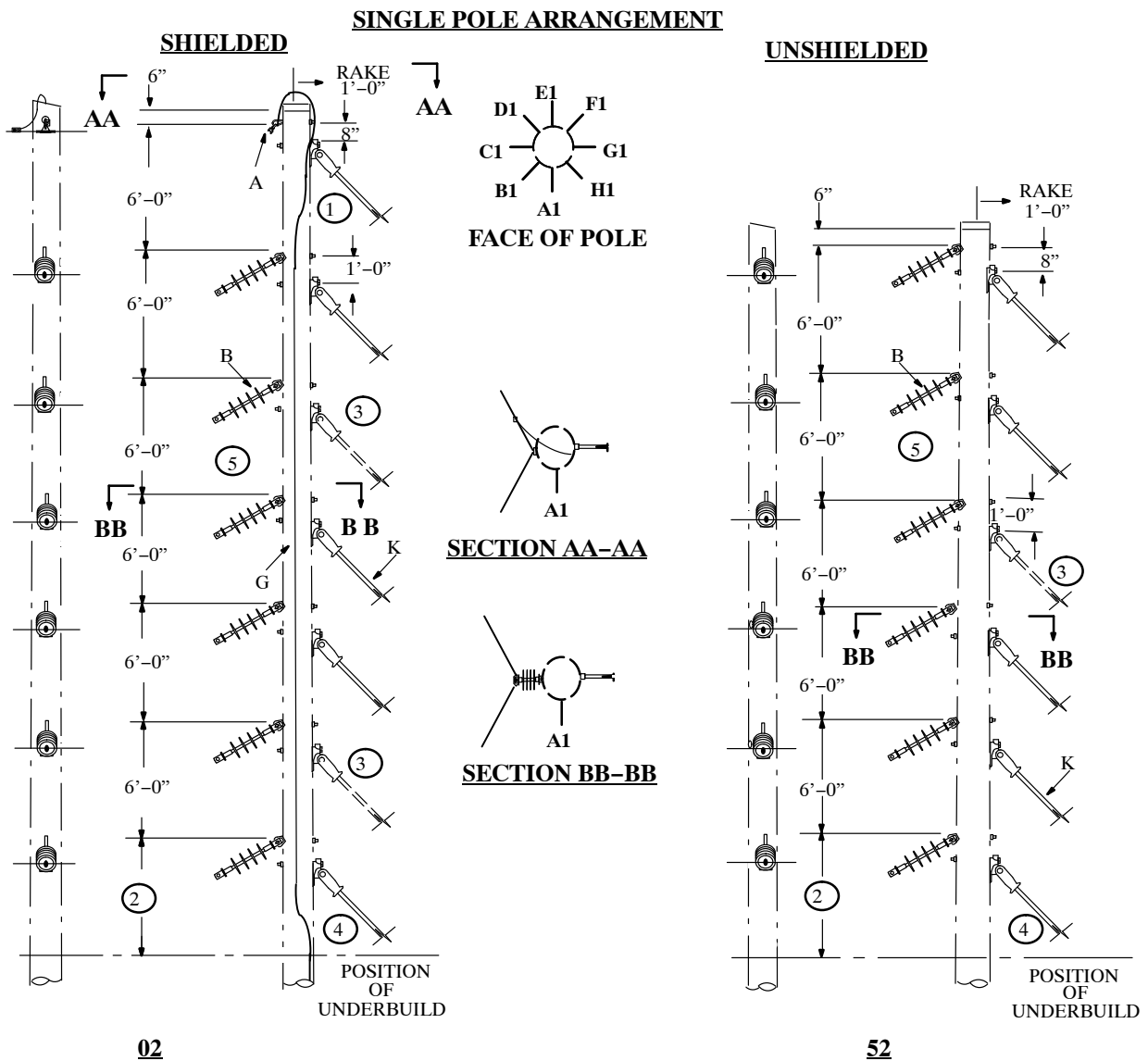
1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant H1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6" spacing.
3. Contact Standards if existing vertical phase spacing is greater than 6' spacing in a galloping area.
4. Lower span guy 2' on pole 1 if electrical clearance is an issue on pole 2 with line angle closer to 20°.
5. Item B can be replaced by two 35kV polymer deadend insulators (Stock No. 25 06 053 – section length 21-25 inches) if transverse load is ≤ to 7500 lbs.

		Std. / Stk. No.	Description	03 69 11 **	SHIELDED	UNSHIELDED
5	A	06 00 11 04	Static Support w/Suspension Clamp		01	51
	B	06 34 60 17	Insulator, 69kV, Susp. Polymer w/Clamps-Angle		1	6
	G	12 00 10 09	Grounding Unit		1	
	J	11 00 46 **	Span Guy Unit		3	2
	K	11 00 43 **	Down Guy Unit		4	3

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DCG
REV. NO: 1
REV. DATE: 12/19/11



NOTES:

1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant H1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6".
3. Guying may be required in this position depending on the conductor tension and line angle.

CONFIGURATIONS
Double Circuit – 34kV or 69kV
Floating Angle Structure for Line Angle > 20° and ≤ 60°

03 69 11**

Sheet 3 of 3

4. Reposition underbuild phases and pole ground if guying conflicts.
5. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.
6. Item B can be replaced by two 35kV polymer deadend insulators, Stock No. 25 06 053 (section length 21"–25") provided transverse load is ≤ 7500 lbs.

				SHIELDED	UNSHIELDED
		Std. / Stk. No.	Description	03 69 11 **	
6	A	06 00 11 04	Static Support w/Suspension Clamp	02	52
	B	06 34 60 17	Insulator, 69kV, Susp., Polymer w/Clamps – Angle	1	
	G	12 00 10 09	Grounding Unit	6	6
	K	11 00 43 **	Guying Unit	1	
@				5	5

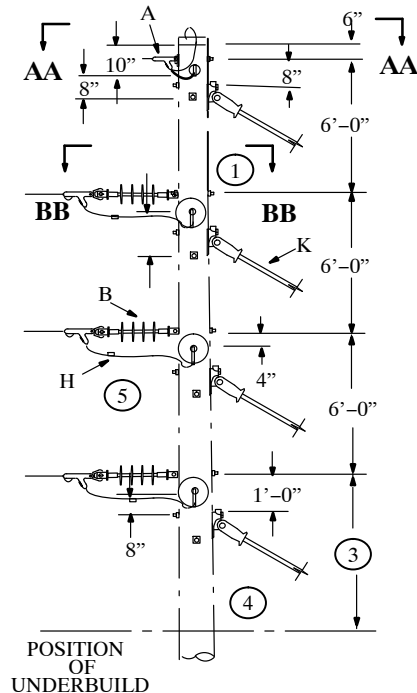
CONFIGURATIONS

Single Circuit – 34kV or 69kV
Deadend Corner Structure for Line Angle $> 60^\circ$ and $\leq 90^\circ$

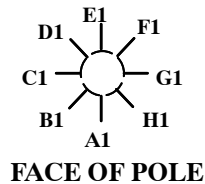
03 69 15**

Sheet 1 of 2

SHIELDED



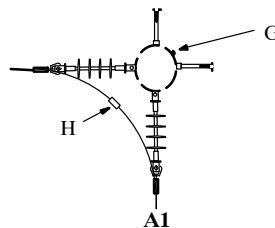
01,02



FACE OF POLE

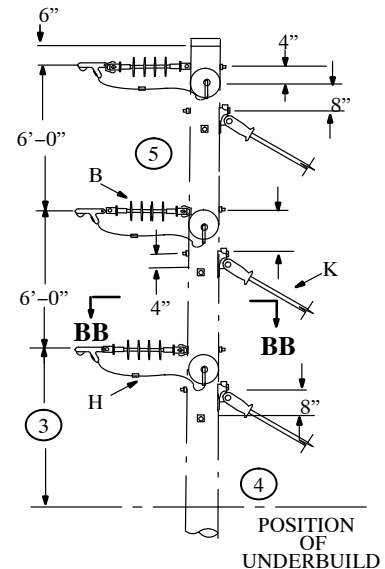


SECTION AA-AA



SECTION BB-BB

UNSHIELDED



51,52

NOTES:

1. Install pole ground at static support in quadrant E1, and at insulators, at underbuild crossarm, and above ground line in quadrant F1 on non-metallic pole.
2. Replace existing 4' phase spacing configuration with a 5' taller pole to gain 6' spacing.
3. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6".
4. Reposition underbuild phases and pole ground if guying conflicts.
5. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.

CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Deadend Corner Structure for Line Angle > 60° and ≤ 90°

03 69 15**

Sheet 2 of 2



				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
		Std. / Stk. No.	Description 03 69 15 **	01	51	02	52
	A	06 00 11 05	Deadend Static w/Clamp	1		1	
	B	06 34 60 02	Ins., 34 kV, Suspension, Sgl w/Deadend Clamp			6	6
		06 34 60 06	Ins., 69 kV, Suspension, Sgl w/Deadend Clamp	6	6		
	G	12 00 10 09	Grounding Unit	1		1	
@	H	PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)	3	3	3	3
@	K	11 00 43 **	Down Guy Unit	8	6	8	6
@	L	12 34 01 **	Arrester Assembly		1		1

CONFIGURATIONS

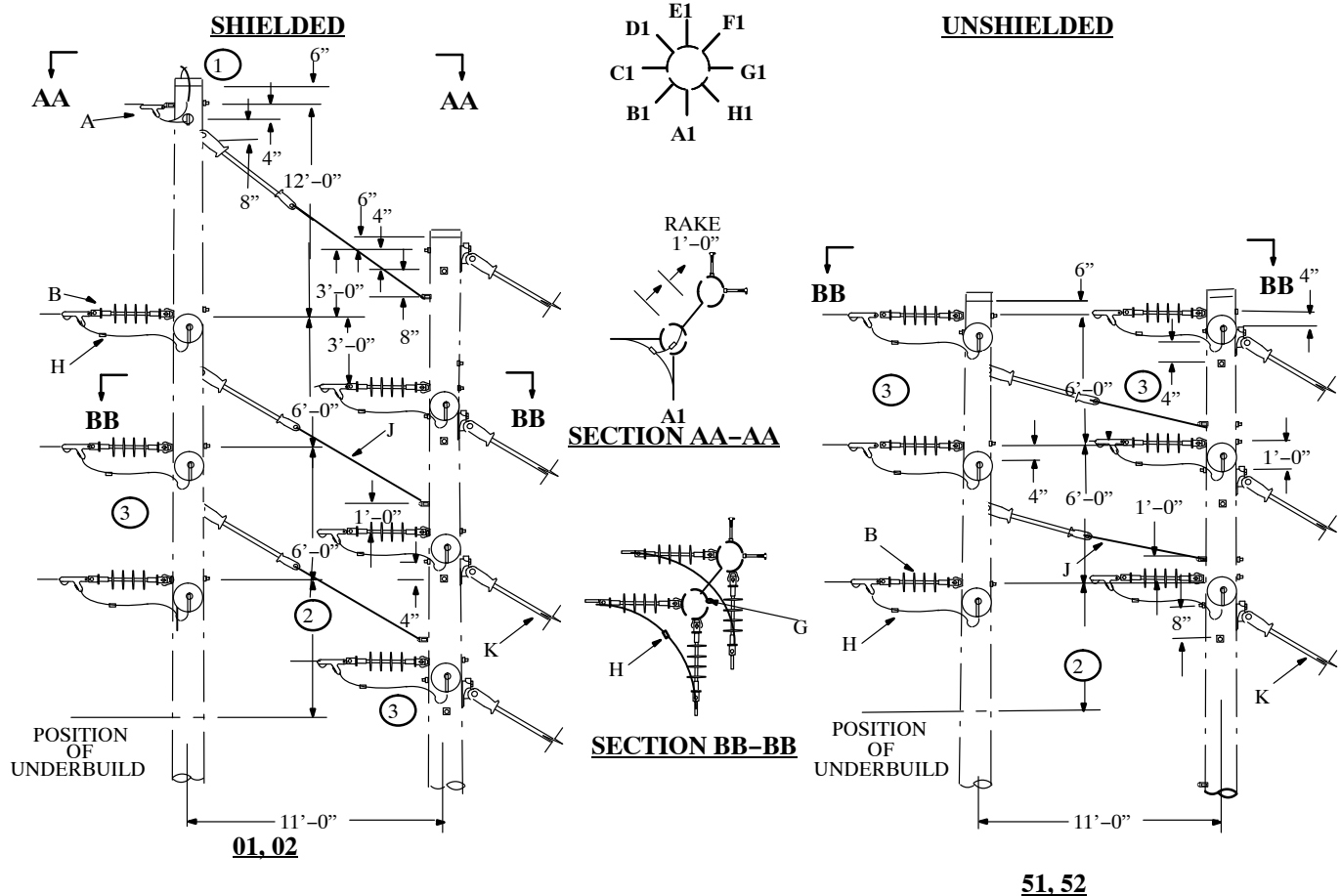
03 69 16**

Double Circuit – 34kV or 69kV

Sheet 1 of 4

Deadend Corner Structure for Line Angle $> 60^\circ$ and $< 90^\circ$

DOUBLE POLE ARRANGEMENT



NOTES:

1. Install pole ground at static support in quadrant E1, at insulators between quadrant E1 and F1, at underbuild crossarm and above ground line in quadrant F1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6".
3. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.
4. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS

03 69 16**

Double Circuit – 34kV or 69kV
Deadend Corner Structure for Line Angle > 60° and < 90°

Sheet 2 of 4

④

④

				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
		Std. / Stk. No.	Description 03 69 16 **	01	51	02	52
@	A	06 00 11 05	Deadend Static w/Clamp	1		1	
	B	06 34 60 02	Ins., 34 kV Sgl Deadend w/Clamp			12	12
		06 34 60 06	Ins., 69 kV, Sgl Deadend w/Clamp	12	12		
	G	12 00 10 09	Grounding Unit	1		1	
	H	PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)	6	6	6	6
	J	11 00 46 **	Span Guy Unit	3	2	3	2
	K	11 00 43 **	Down Guy Unit	8	6	8	6
@	L	12 34 02 **	Arrester Assembly		1		1

CONFIGURATIONS

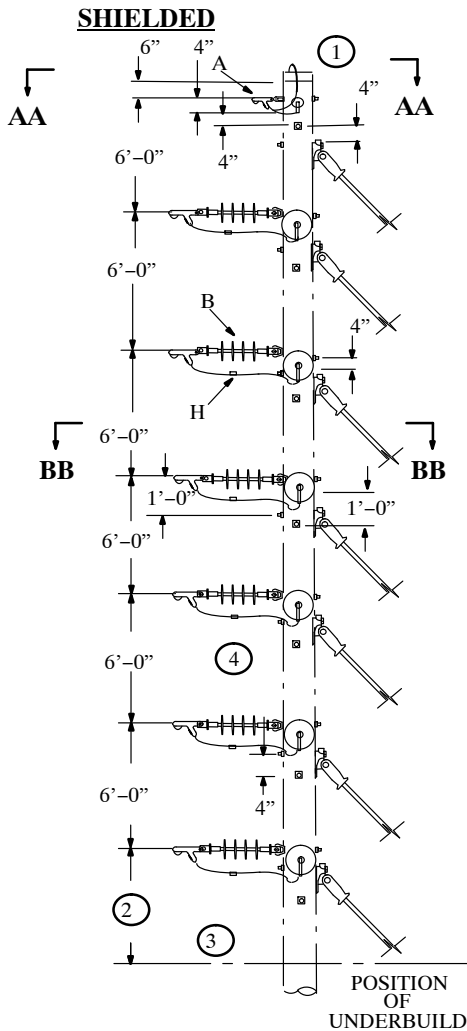
03 69 16**

Double Circuit – 34kV or 69kV

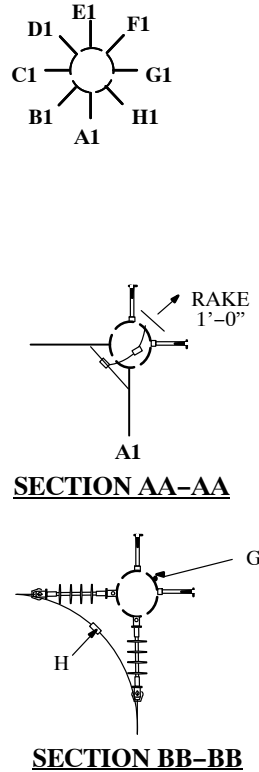
Sheet 3 of 4

Deadend Corner Structure for Line Angle $> 60^\circ$ and $< 90^\circ$

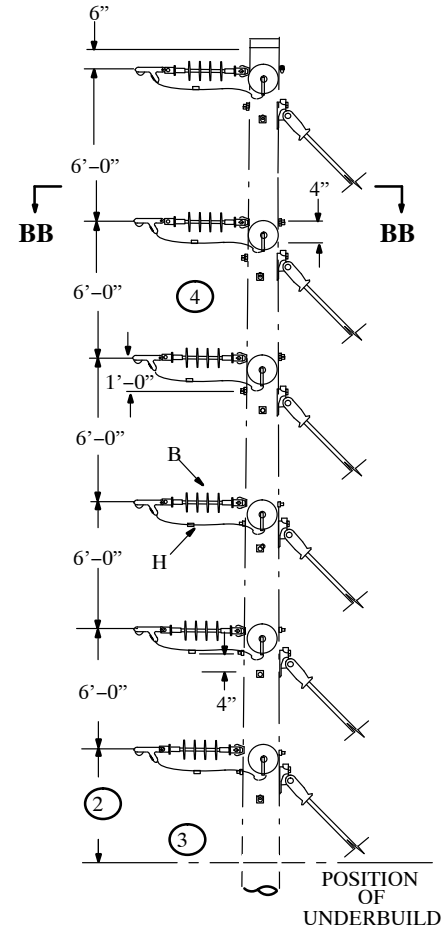
SINGLE POLE ARRANGEMENT



03, 04



UNSHIELDED



53, 54

NOTES:

1. Install pole ground at static support in quadrant E1, and at insulators and 2' above underbuild crossarm in quadrant F1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6".
3. Reposition underbuild phases and pole ground if guying conflicts.
4. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.
5. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS

03 69 16**

Double Circuit – 34kV or 69kV
Deadend Corner Structure for Line Angle > 60° and ≤ 90°

Sheet 4 of 4

⑤

⑤

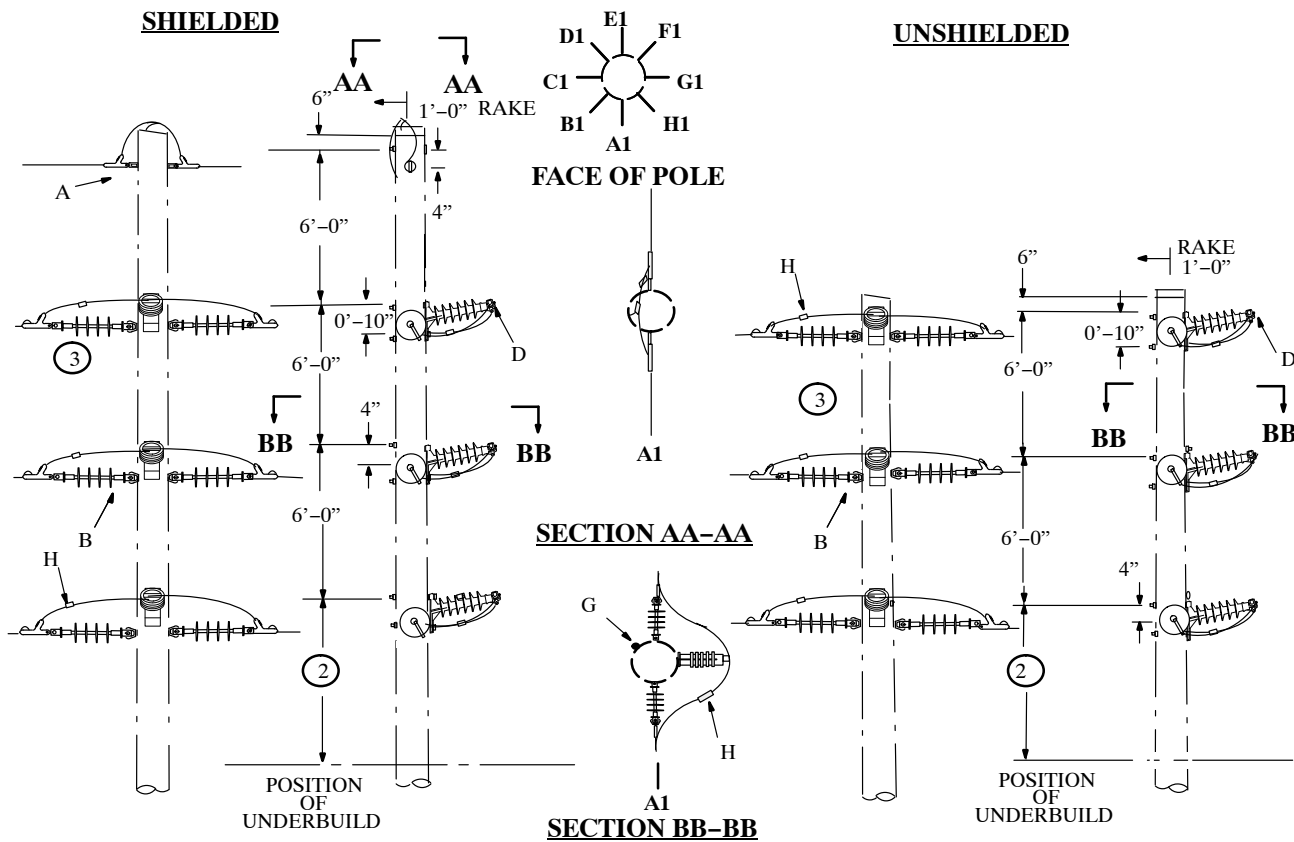
				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
		Std. / Stk. No.	Description 03 69 16 **	03	53	04	54
@	A	06 00 11 05	Deadend Static w/Clamp	1		1	
	B	06 34 60 02	Ins., 34 kV, Suspension, Sgl w/Deadend Clamp			12	12
		06 34 60 06	Ins., 69 kV, Suspension, Sgl w/Deadend Clamp	12	12		
	G	12 00 10 09	Grounding Unit	1		1	
	H	PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)	7	6	7	6
@	K	11 00 43 **	Down Guy Unit	14	12	14	12
@	L	12 34 01 **	Arrester Assembly		1		1

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 17**

Sheet 1 of 6

EQUAL TENSION



01

51

NOTES:

1. Install pole ground in quadrant C1 and at insulators, at underbuild crossarm, and above ground line in quadrant D1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate. But if underbuild is on arm then increase to 7'-6".
3. Contact Standards if required vertical phase spacing is greater than 6' in a galloping area.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 17**

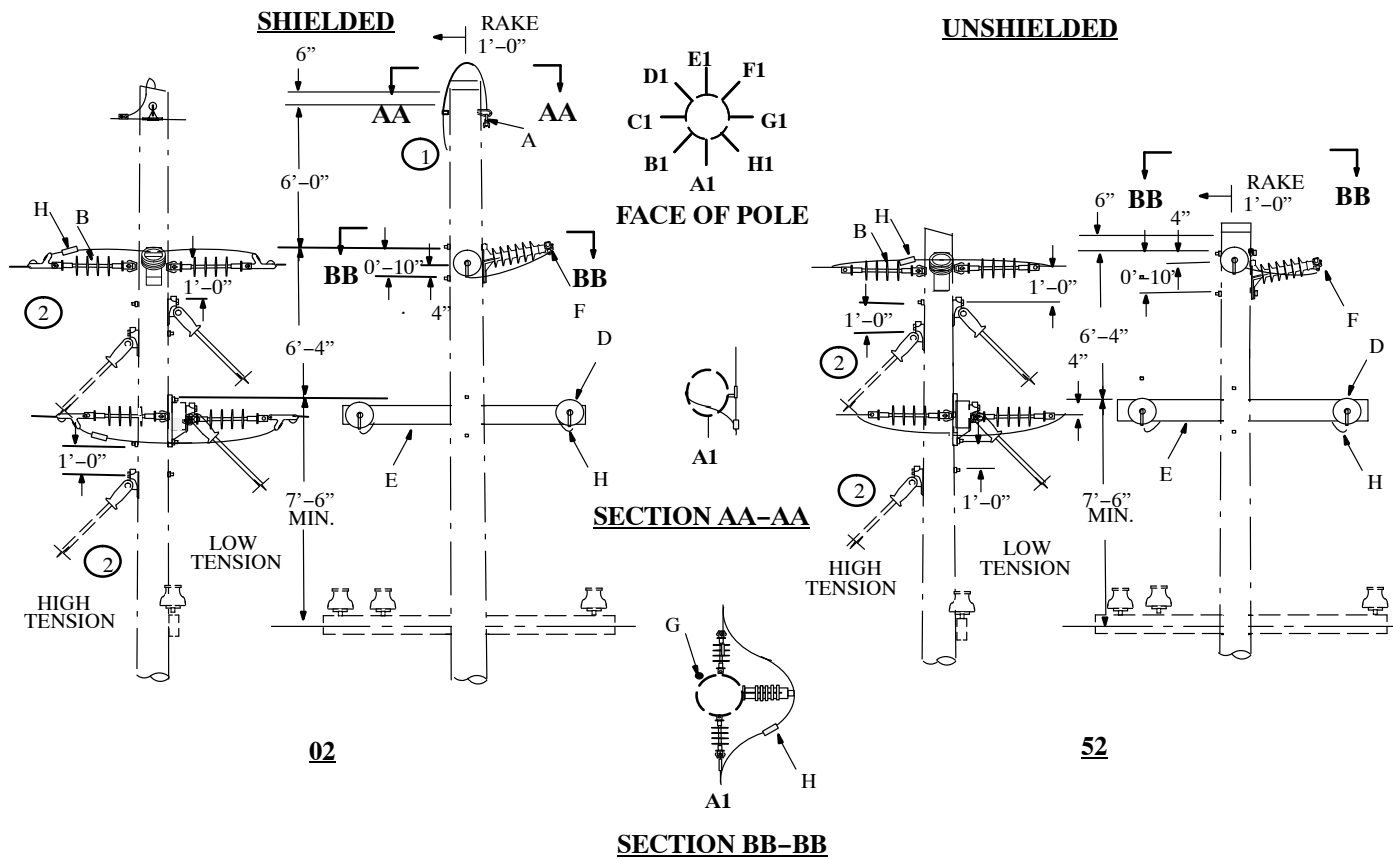
Sheet 2 of 6

				69kV		34kV		
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED	
@		Std. / Stk. No.	Description	03 69 11 **	01	51	04	54
	A	06 00 11 06	Deadend Clamp, Static		1		1	
	B	06 34 72 01	Deadend, 69kV, Dbl, Looparound w/Deadend Clamp		3	3		
		06 34 72 05	Deadend, 34kV, Dbl, Looparound w/Deadend Clamp				3	3
	D	TC*W	Clamp, Trunnion		3	3	3	3
@	G	12 00 10 09	Grounding Unit		1		1	
	H	PG**	Clamp, Parallel Groove (see DCS 07 00 25 00)		3	3	3	3
		252 or 260	Install Connector		@	@	@	@

CONFIGURATIONS
 Single Circuit – 34kV or 69kV
 Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 17**

Sheet 3 of 6



NOTES:

1. Install pole ground at static support in quadrant C1 and at insulators and 2' above underbuild crossarm in quadrant D1 on non-metallic pole.
2. Add down guy if this standard is used for storm structure with equal tension on both sides.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 17**

Sheet 4 of 6

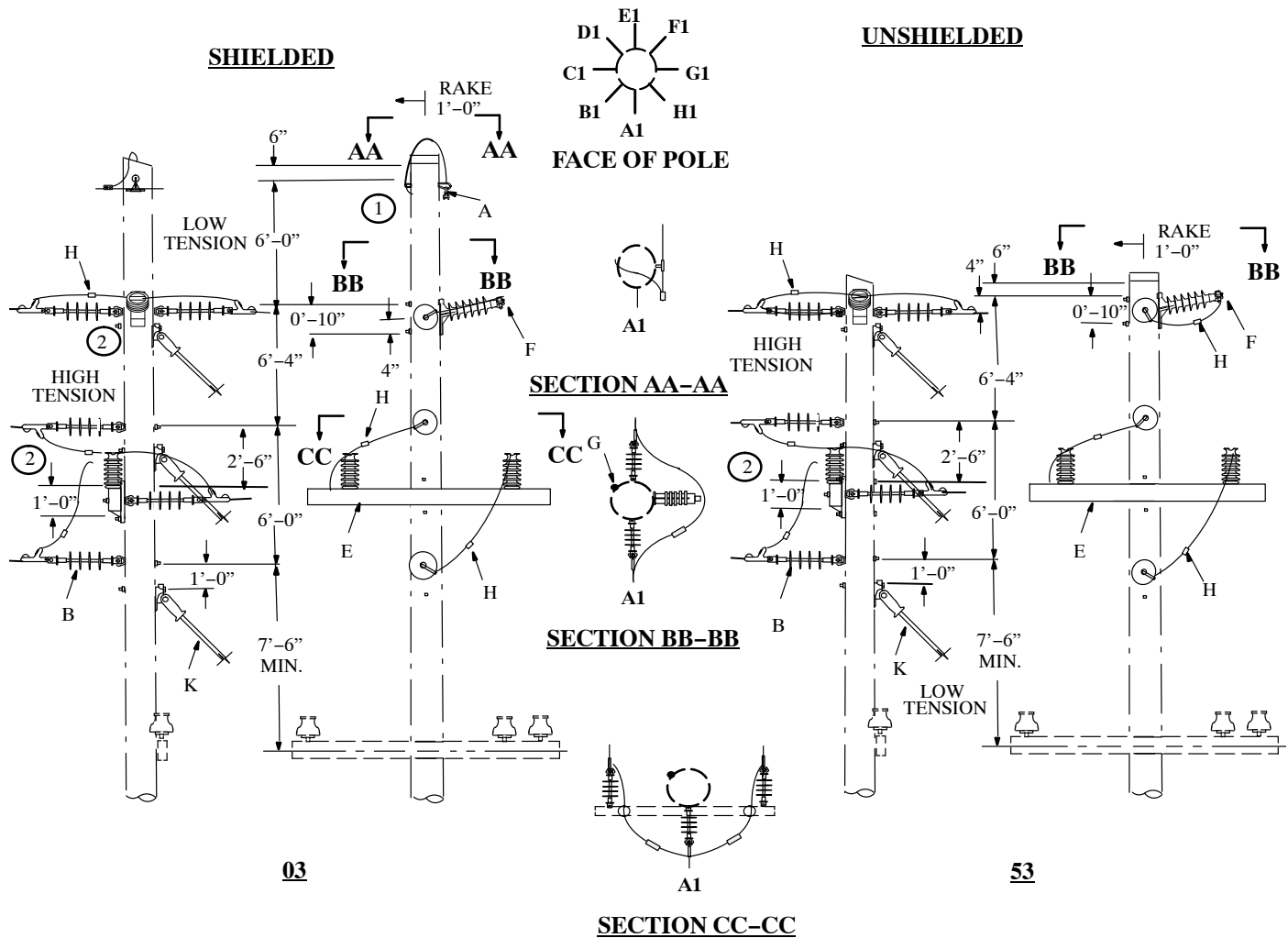
				69kV		34kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
		Std. / Stk. No.	Description 03 69 17 **	01	51	05	55
@	A	06 00 11 04	Static Tangent Support w/Suspension Clamp	1		1	
	B	06 34 72 01	Deadend, 69kV, Double Looparound w/DE Clamp	1	1		
		06 34 72 05	Deadend, 34kV, Double Looparound w/DE Clamp	1	1	1	1
	E	04 00 41 03	Fiberglass Deadend Arm Assembly, 8'	1	1	1	1
	F	TC*W	Clamp, Trunnion	1	1	1	1
@	G		Grounding Unit	1		1	
	H	PG*	Clamp, Parallel Groove (see DCS 07 00 25 00)	3	3	3	3
@	K	11 00 43 **	Guying Unit	2	2	2	2
		252 or 260	Install Connector	@	@	@	@

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 17**

Sheet 5 of 6

UNEQUAL TENSION-TRANSITION



NOTES:

1. Install pole ground at static support in quadrant C1 and at insulators and 2' above underbuild crossarm in quadrant D1 on non-metallic pole.
2. District engineering determines number of deadend arm(s) based on span length, line tension, and conductor weight.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 17**

Sheet 6 of 6

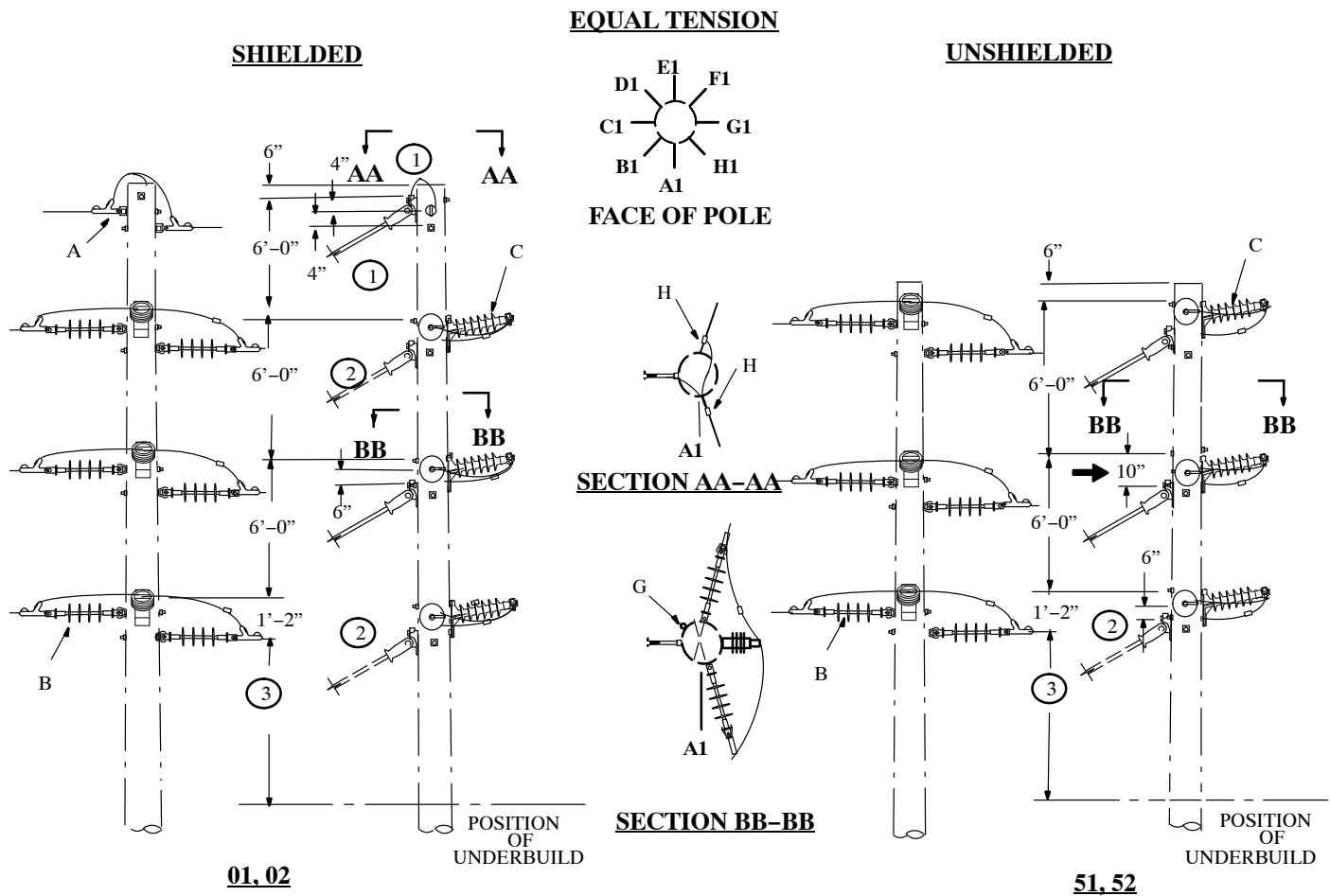
				69kV		34kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 17 **	03	53	05	55
	A	06 00 11 04	Static Tangent Support w/Suspension Clamp	1		1	
	B	06 34 72 01	Deadend, 69kV, Double Looparound w/DE Clamp	1	1		
		06 34 72 05	Deadend, 34kV, Double Looparound w/DE Clamp			1	1
	D	06 34 72 03	Deadend, 69kV, Double loopover w/DE Clamp	2	2		
		06 34 72 07	Deadend, 34kV, Double loopover w/DE Clamp			2	2
	E	12 00 10 09	Fiberglass Deadend Arm Assembly, 8'	1	1	1	1
@	F	TC*W	Clamp, Trunnion	1	1		
	G	12 00 10 09	Grounding Unit	1		1	
@	H	12 34 02 **	Clamp, Parallel Groove (see DCS 07 00 25 00)	3	3	3	3
@	K	11 00 46 **	Guying Unit	3	3	3	3
		252 or 260	Install Connector	@	@	@	@

CONFIGURATIONS

Single Circuit – 34kV or 69kV
Deadend Angle Structure for Line Angle $> 1^\circ$ and $\leq 60^\circ$

03 69 18**

Sheet 1 of 2



NOTES:

1. Install pole ground at static support in quadrant C1 and at insulators and 2' above underbuild crossarm in quadrant D1 on non-metallic pole.
2. Additional guys may be required depending on line tension and line angle.
3. If underbuild is in vertical configuration. 6' spacing is adequate, but if underbuild is on arm then increase to 7'-6".
4. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Angle Structure for Line Angle > 1° and ≤ 60°

03 69 18**

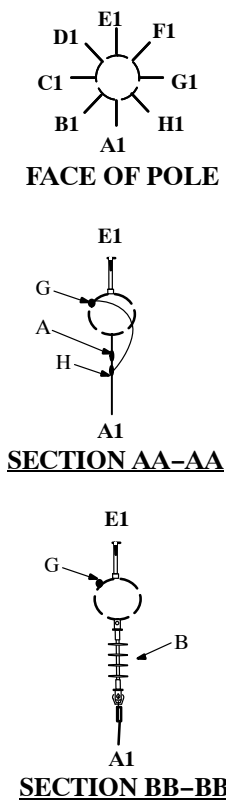
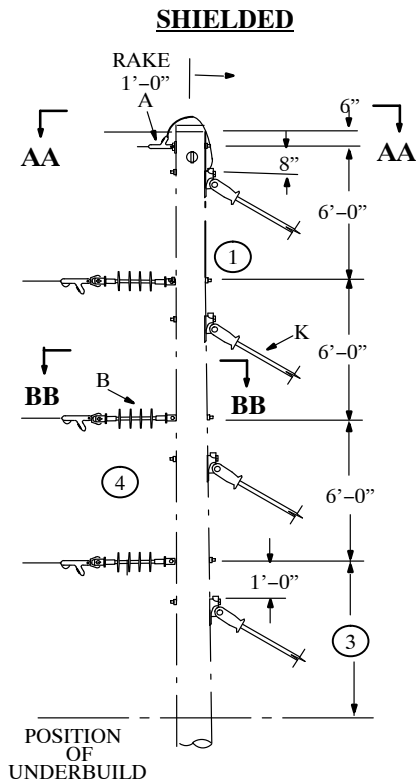
Sheet 2 of 2

				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 16 **	01	51	02	52
@	A	06 00 11 07	Deadend Static w/Clamp	2		2	
	B	06 34 60 02	Ins., 34 kV, Sgl Deadend w/Clamp			6	6
		06 34 60 06	Ins., 69 kV, Sgl Deadend w/Clamp	6	6		
	C	06 69 03 03	Ins., 69 kV, Hor. Line Post, Sgl w/Trunnion Clamp	3	3		
		06 34 03 03	Ins., 34 kV, Hor. Line Post, Sgl w/Trunnion Clamp			3	3
	G	12 00 10 09	Grounding Unit	1		1	
	H	PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)	2	2	2	2
	K	11 00 43 **	Down Guy Unit	4	3	4	3
@	L	12 34 02 **	Arrester Assembly		1		1
		252 or 260	Install Connector	@	@	@	@

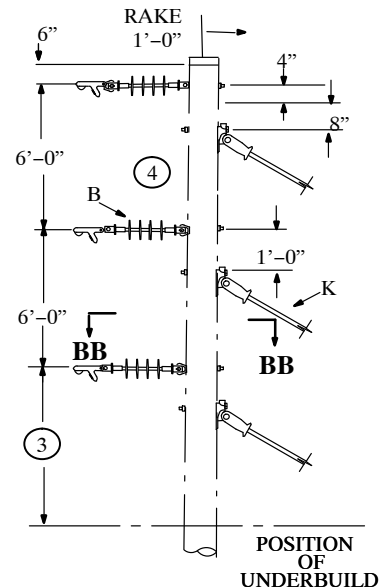
CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Endline Structure

03 69 19**

Sheet 1 of 4



UNSHIELDED



NOTES:

1. Install pole ground at static support in quadrant G1, and at insulators, at underbuild crossarm, and above ground line in quadrant F1 on non-metallic pole.
2. Replace existing 4' phase spacing configuration with a 5' taller pole to gain 6' spacing.
3. If underbuild is in vertical configuration, 6' is adequate, but if underbuild is on arm then increase to 7'-6".
4. Contact Standards if required phase spacing is greater than 6' in a galloping area.
5. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Endline Structure

03 69 19**

Sheet 2 of 4

⑤

⑤

				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
		Std. / Stk. No.	Description 03 69 19 **	01	51	02	52
	A	06 00 11 08	Deadend, Static w/Clamp	1		1	
	B	06 34 60 02	Ins., 34 kV, Suspension, Sgl w/Deadend Clamp			3	3
		06 34 60 06	Ins., 69 kV, Suspension, Sgl w/Deadend Clamp	3	3		
	G	12 00 10 09	Grounding Unit	1		1	
@	H	PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)	1		1	
@	K	11 00 43 **	Down Guy Unit	4	3	4	3
@	L	12 34 02 **	Arrester Assembly		1		1
		252 or 260	Install Connector	@	@	@	@

Sheet 3 of 4

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Deadend Endline Structure

03 69 19**

Sheet 4 of 4

③

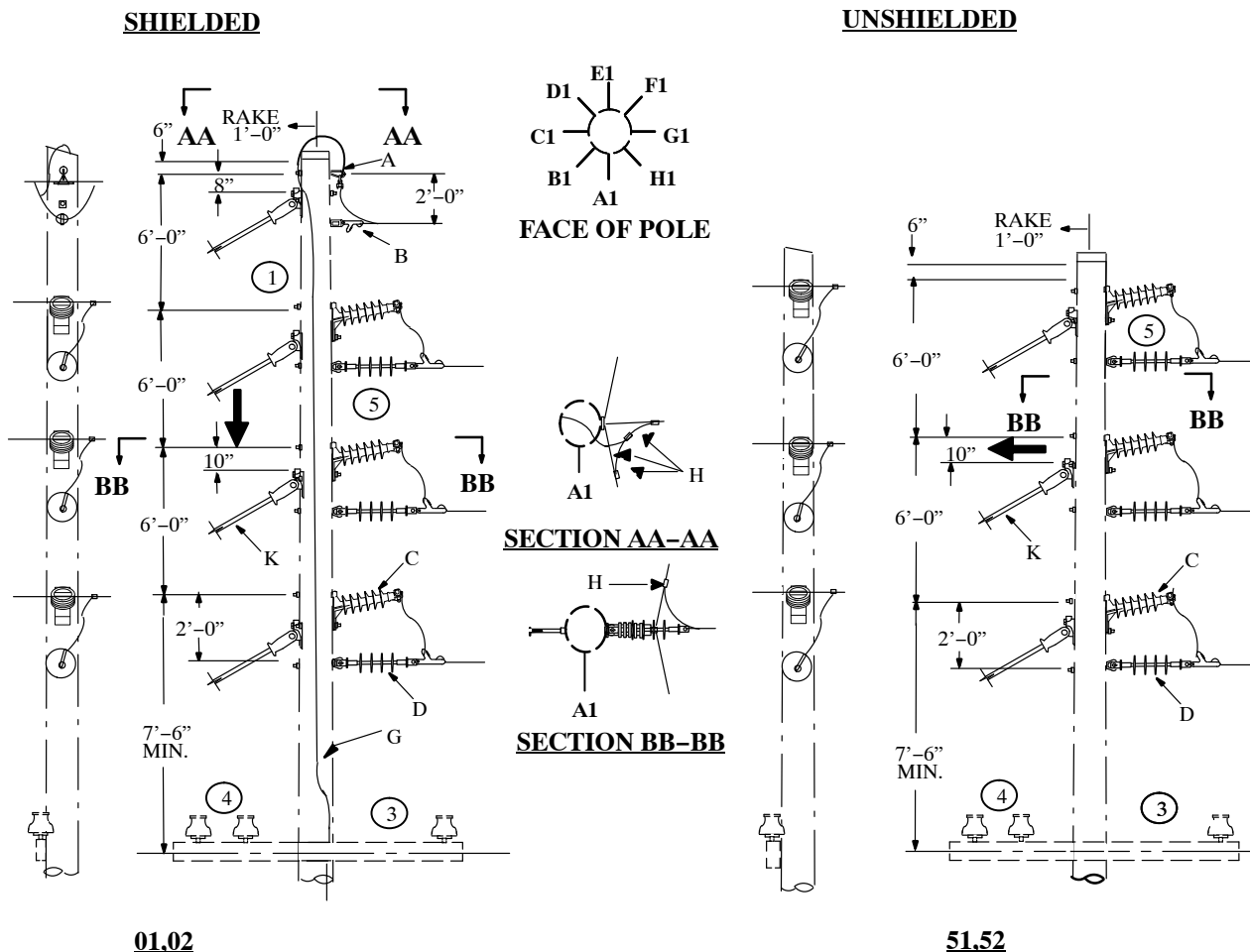
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				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description **	03 69 19	03	53	04	54
	A	06 00 11 05	Deadend, Static w/Clamp	2		2	
		06 34 60 02	Ins., 34 kV, Suspension, Sgl w/Deadend Clamp			1	1
	B	06 34 60 06	Ins., 69 kV, Suspension, Sgl 2/Deadend Clamp	1	1		
		06 34 60 09	Ins., 69 kV, Suspension, Sgl. w/Deadend Clamp	2	2		
	C	06 34 60 18	Ins., 69 kV, Suspension, Sgl. w/Deadend Clamp			2	2
	D	04 00 41 03	Deadend Arm Assy. Fiberglass, 8"	1	1	1	1
	G	12 00 10 09	Grounding Unit	1		1	
@	H	PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)	1		1	
@	K	11 00 43 **	Down Guy Unit	3	2	3	2
@	L	12 34 01 **	Arrester Assembly		1		1

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Tap Structure for Line Angle $> 0^\circ$ and $\leq 20^\circ$

03 69 20**

Sheet 1 of 2



NOTES:

1. Install pole ground at static support in quadrant C1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant H1 on non-metallic pole.
2. Replace existing floating angle structure with new fixed angle structure if the angle is 20° or less.
3. See Dist. Std. **03 00 03 00** for underbuild line angle limitation and Dist. Std. **29 00 04 01** for crossarm(s) loading.
4. Reposition underbuild phases and pole ground if guying conflicts.
5. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.
6. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Tap Structure for Line Angle > 0° and ≤ 20°

03 69 20**

Sheet 2 of 2

⑥

⑥

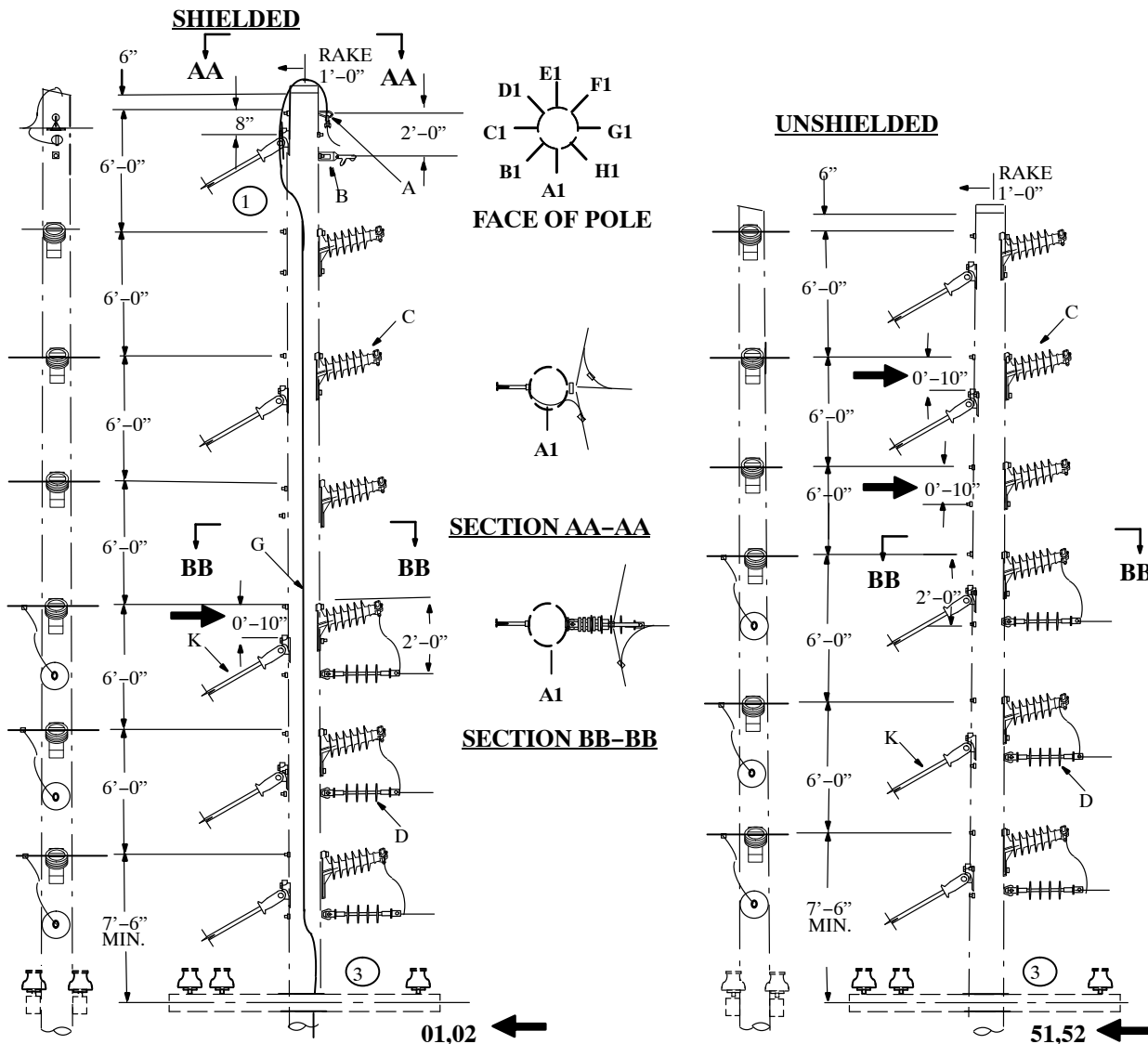
				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 20 **	01	51	02	52
	A 06 00 11 11	Deadend, Static Wire, 3-Way w/Pole Gnd		1		1	
	C 06 69 03 03	Ins., 69 kV, Hor. Line Post, Sgl, w/Trunnion Clamp		3	3		
	06 34 03 03	Ins., 34 kV, Hor. Line Post, Sgl, w/Trunnion Clamp				3	3
	D 06 34 60 06	Ins., 69kV, Suspension, w/Deadend Clamp		3	3		
	06 34 60 02	Ins., 34kV, Suspension, w/Deadend Clamp				3	3
	G 12 00 10 09	Grounding Unit		1		1	
@	H PG**	Clamp, Parallel Grove (see DCS 07 00 25 00)		4	3	4	3
@	K 11 00 43 **	Down Guy Unit		4	3	4	3
@	L 12 34 02 **	Arrester Assembly			1		1
	252 or 260	Install Connector		@	@	@	@

CONFIGURATIONS

Double Circuit – 34kV or 69kV
Tap Structure for Line Angle $> 0^\circ$ and $\leq 20^\circ$

03 69 21**

Sheet 1 of 2



NOTES:

1. Install pole ground at static support in quadrant G1, at insulators in quadrant A1, and 2' above underbuild cross-arm in quadrant H1 on non-metallic pole.
2. Replace existing floating angle structure with new fixed angle structure if the angle is 20° or less.
3. See Dist. Std. **03 00 03 00** for underbuild line angle limitation and Dist. Std. **29 00 04 01** for crossarm(s) loading.
4. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS
Double Circuit – 34kV or 69kV
Tap Structure for Line Angle > 0° and ≤ 20°

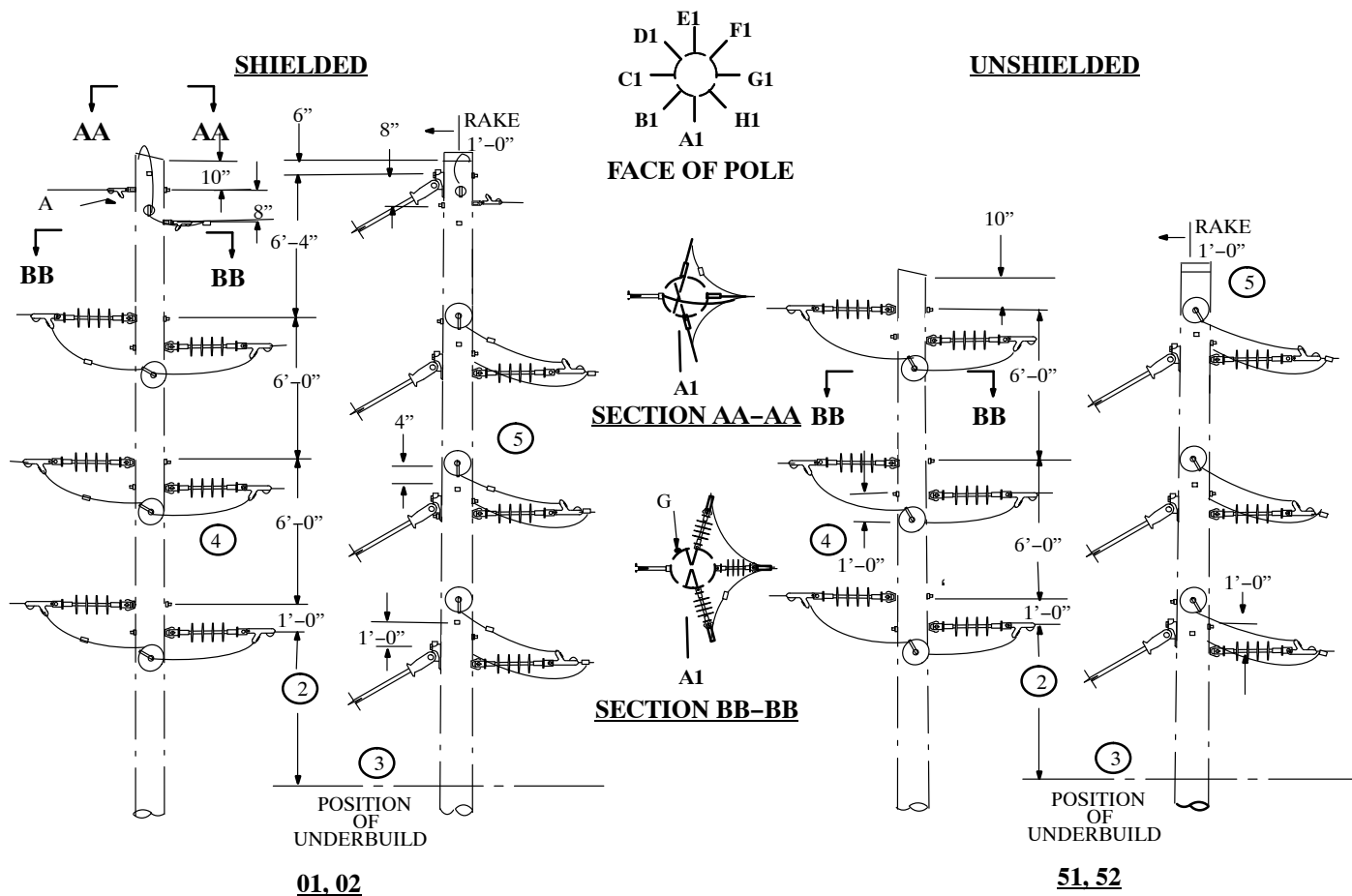
03 69 21**

Sheet 2 of 2



				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 22 **	01	51	02	52
@	A	06 00 11 04	Support, Shield Wire w/Suspension Clamp	1		1	
	B	06 00 11 01	Deadend, Shield Wire, w/DE Clamp	1		1	
	C	06 69 03 03	Ins., 69 kV, Hor. Line Post, Sgl. w/Trunnion Clamp	6	6		
		06 34 03 03	Ins., 34 kV, Hor. Line Post, Sgl. w/Trunnion Clamp			6	6
	D	06 34 60 06	Ins., 69 kV, Suspension, w/Deadend Clamp	3	3		
		06 34 60 02	Ins., 34 kV, Suspension, w/Deadend Clamp			3	3
	G	12 00 10 09	Grounding Unit	1		1	
	H	PG**	Clamp, Parallel Groove (See DCS 07 00 25 00)	4	3	4	3
	K	11 00 43 **	Down Guy Unit	4	3	4	3
	L	12 34 02 **	Arrester Assembly		1		1
		252 or 260	Install Connector	@	@	@	@

EQUAL LINE TENSION-T CORNER



NOTES:

1. Install pole ground at static support in quadrant D1 on non-metallic pole.
2. If underbuild is in vertical configuration, 6' spacing is adequate, but if underbuild is on arm then increase to 7'-6".
3. Reposition underbuild phases and pole ground if guying conflicts.
4. Contact Standards if existing vertical phase spacing is greater than 6' in a galloping area.
5. Install jumper with support if deadend tap has smaller wire size.
6. Contact Standards with questions about arrester application and configuration.

CONFIGURATIONS
Single Circuit – 34kV or 69kV
Tap Structure for Line Angle > 0° and ≤ 60°

03 69 22**

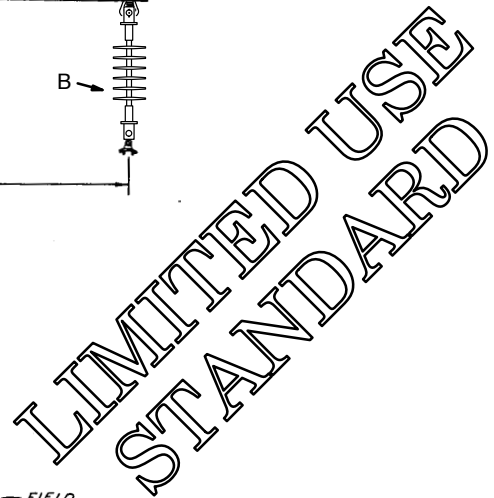
Sheet 2 of 2



				69 kV		34 kV	
				SHIELDED	UNSHIELDED	SHIELDED	UNSHIELDED
	Std. / Stk. No.	Description	03 69 22 **	01	51	02	52
	A	06 00 11 07	Deadend, Shield Wire, w/DE Clamp	1		1	
	B	06 34 60 06	Insulator, 69kV, Suspension, w/Deadend Clamp	9	9		
		06 34 60 02	Insulator, 34kV, Suspension, w/Deadend Clamp			9	9
	G	12 00 10 09	Grounding Unit	1		1	
@	H	PG**	Clamp, Parallel Groove (See DCS 07 00 25 00)	8	6	8	6
@	K	11 00 43 **	Down Guy Unit	4	3	4	3
@	L	12 34 02 **	Arrester Assembly		1		1
@		252 or 260	Install Connector	@	@	@	@

H-Frame – 69kV

Sheet 1 of 1



@



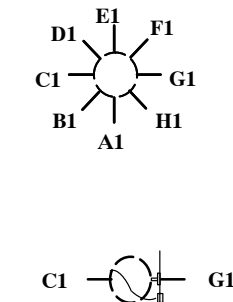
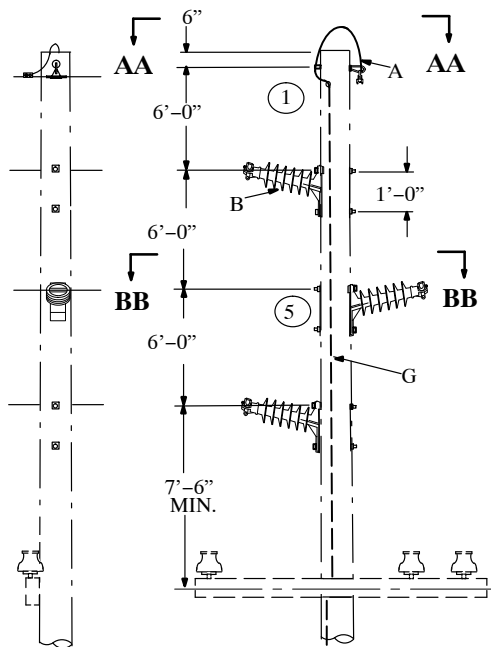
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REV. NO: 1
REV. DATE: 07/23/07

CONFIGURATIONS

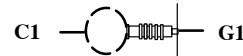
Unguyed Composite Pole – 34kV or 69kV Tangent Structure for Line Angle $\leq 1^\circ$

03 69 51 **

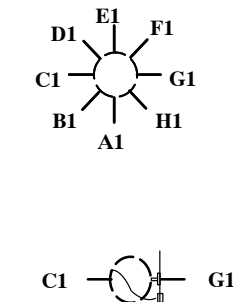
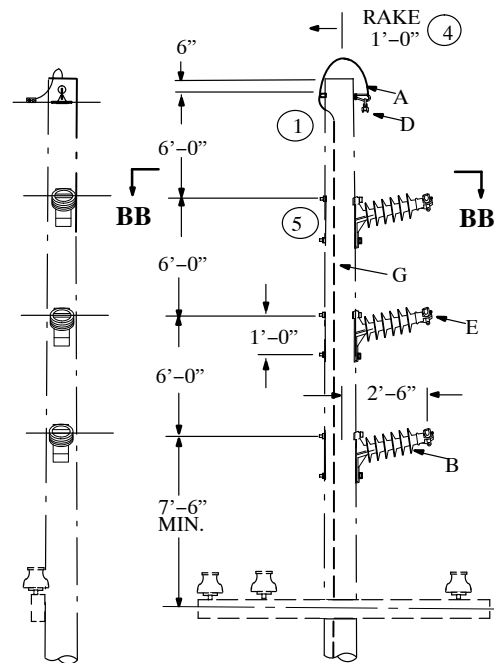
Sheet 1 of 2



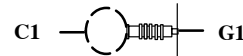
SECTION AA-AA



SECTION BB-BB



SECTION AA-AA



SECTION BB-BB

01

02

NOTES:

1. Factory (internal) installed pole ground in quadrant B1. See DCS 12 00 10 12 for grounding detail.
2. See DCS 02 00 04 04 and 02 00 04 05 for pole selection on tangent structure.
3. Use above configuration for storm structure on existing or new line installation. See DCS 02 30 10 01 for storm or super pole selection.
4. Pole rake for line with less than or equal to 1° line angle.
5. Double coil washer is not required on composite pole.

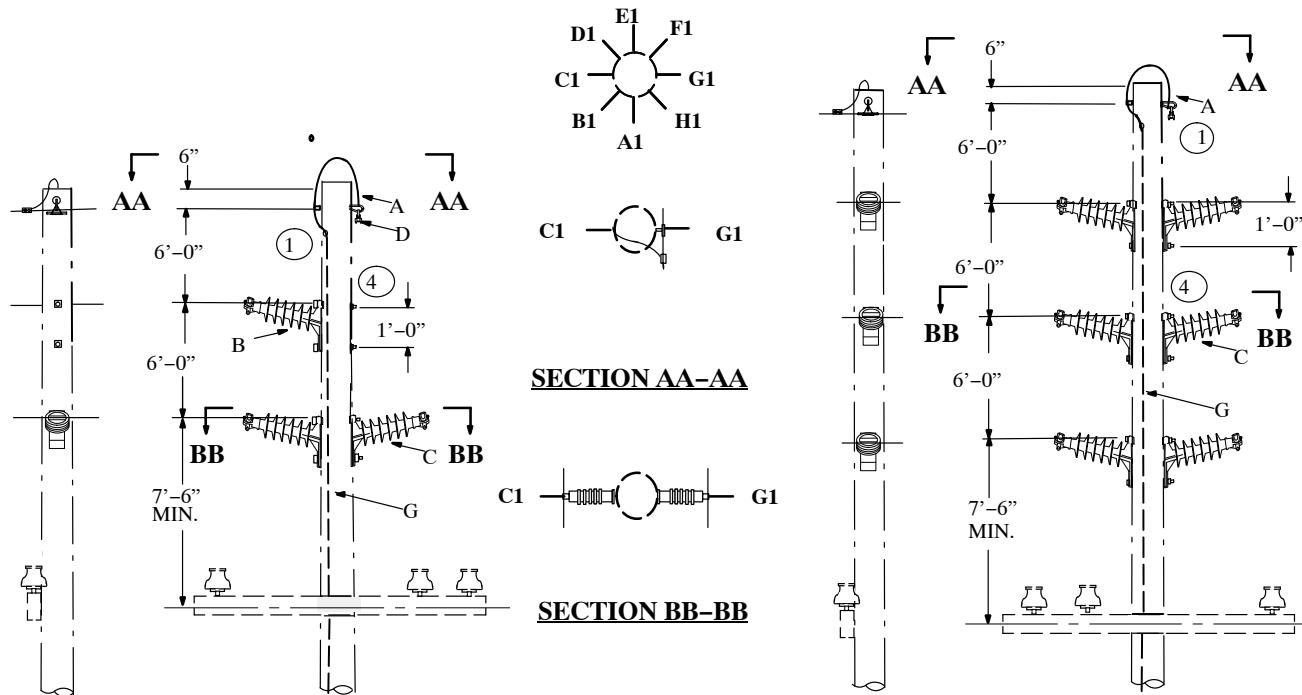
		Std./Stk. No.	Description	03 69 51 **	01	02
5@ @ @	A	06 00 11 04	Static Support w/Suspension Clamp		1	1
	B	06 69 03 03	Insulator, 69kV, Horz. Post, Single Polymer w/Trunnion Clamp		3	3
		06 69 03 01	Insulator, 69kV, Horz. Post, Single Polymer w/Susp. Clamp		3	3
	D	SC*W	Clamp, Suspension, Static wire		1	1
	E	TC*W	Clamp, Trunn, Tangent, Conductor		3	3
		SC*W	Clamp, Suspension, Tangent, Conductor		3	3
	G	12 00 10 12	Grounding Unit		1	1

CONFIGURATIONS

Unguyed Composite Pole – 34kV or 69kV Tangent Structure for Line Angle $\leq 1^\circ$

03 69 51 **

Sheet 2 of 2



NOTES:

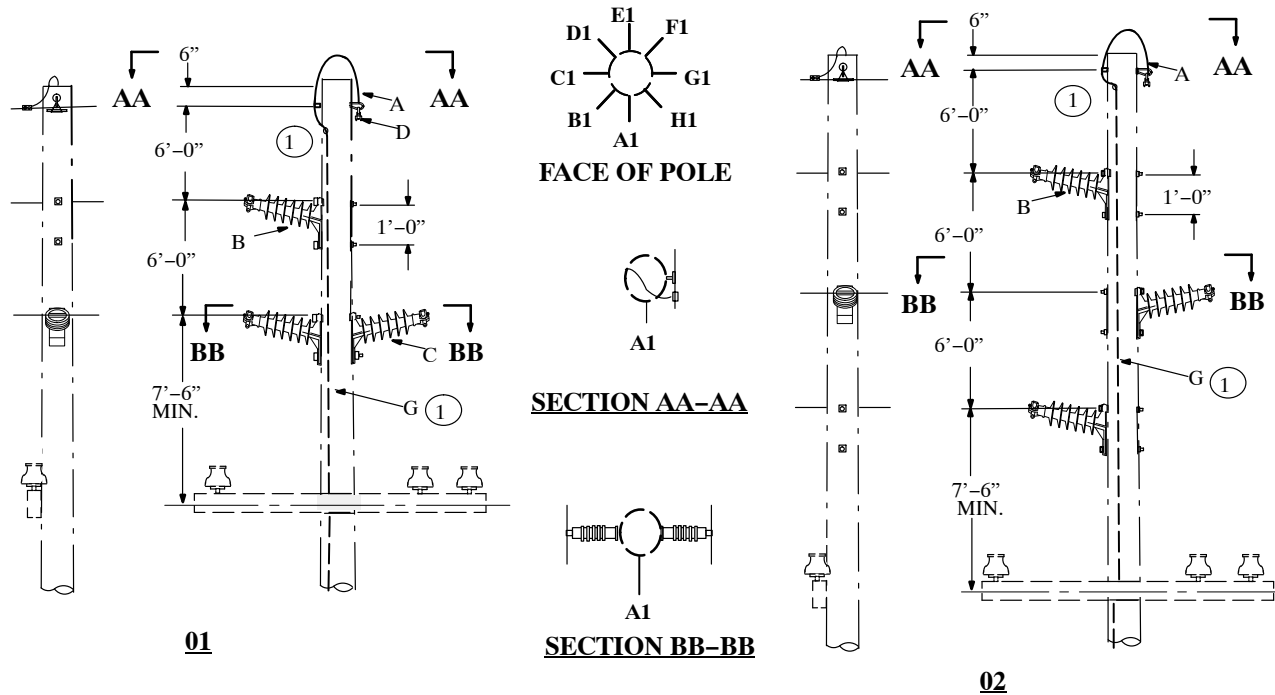
1. Factory (internal) installed pole ground in quadrant B1. See DCS **12 00 10 12** for grounding detail.
2. See DCS **02 00 04 04** and DCS **02 00 04 05** for proper pole selection on tangent structure.
3. Use above configuration for storm structure on existing or new line installation. See DCS **02 30 10 01** for storm pole selection.
4. Double coil washer is not required on composite pole.

		Std./Stk. No.	Description	03 69 51 **	03	04
@	A	06 00 11 04	Static Support w/Suspension Clamp		1	1
	B	06 69 03 03	Insulator, 69kV, Horz. Post, Single Polymer w/Trunn Clamps		1	
@		06 69 03 01	Insulator, 69kV, Horz. Post, Single Polymer w/Susp. Clamps		1	
	C	06 69 03 04	Insulator, 69kV, Horz. Post, Double Polymer w/Trunn. Clamps		1	3
@		06 69 03 02	Insulator, 69kV, Horz. Post, Double Polymer w/Susp. Clamps		1	3
	D	SC*W	Clamp, Suspension, Static wire		1	1
@	E	TC*W	Clamp, Trunn., Tangent, Conductor		3	6
		SC*W	Clamp, Suspension, Tangent, Conductor		3	6
	G	12 00 10 12	Grounding Unit		1	1

CONFIGURATIONS
 Unguyed Composite Pole – 34kV or 69kV
 Angle Structure for Line Angle >1° and ≤ 20°

03 69 52 **

Sheet 1 of 2



NOTES:

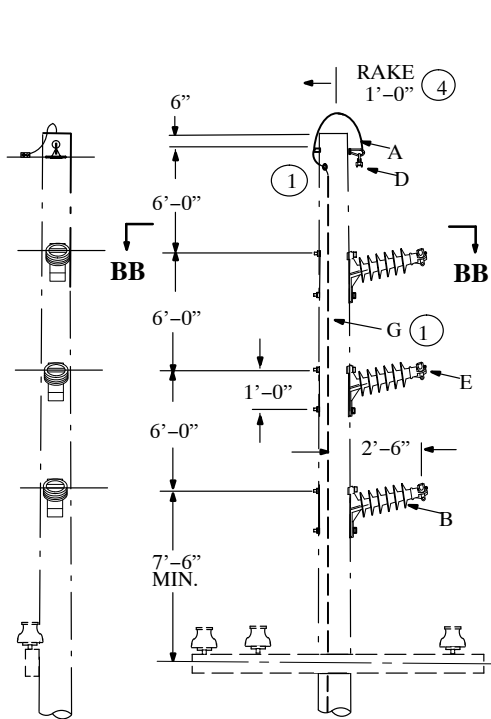
1. Factory (internal) installed pole ground in quadrant B1. See DCS 12 00 10 12 for grounding detail.
2. See DCS 02 00 04 04 and DCS 02 00 04 05 for proper conductor tension, depth, and pole rake based on line angle.

		Std./Stk. No.	Description	03 69 52 **	01	02
@	A	06 00 11 04	Static Support w/Suspension Clamp		1	1
	B	06 69 03 03	Insulator, 69kV Horz, Post, Single Polymer w/Trunnion Clamp		1	3
@		06 69 03 01	Insulator, 69kV Horz, Post, Single Polymer w/Susp. Clamp		1	3
	C	06 69 03 02	Insulator, 69kV Horz, Post, Double Polymer w/Susp. Clamp		1	
@		06 69 03 04	Insulator, 69kV Horz, Post, Double Polymer w/Trunnion Clamp		1	
	D	SC*W	Clamp, Suspension, Static wire		1	1
@	E	TC*W	Clamp, Trunn, Angle, Conductor		3	3
		SC*W	Clamp, Suspension, Angle, Conductor		3	3
@	F	02 20 05 12	Backfill and Reinforcement		1	1
	G	12 00 10 12	Grounding Unit		1	1

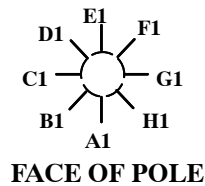
CONFIGURATIONS
 Unguyed Composite Pole – 34kV or 69kV
 Angle Structure for Line Angle >1° and ≤ 20°

03 69 52 **

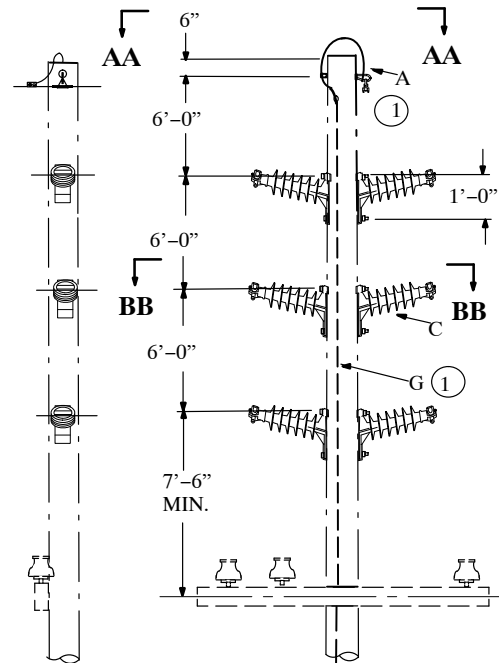
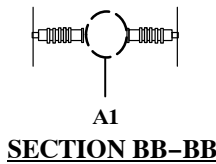
Sheet 2 of 2



03



SECTION AA-AA



04

NOTES:

1. Factory (internal) installed pole ground in quadrant B1. See DCS 12 00 10 12 for grounding detail.
2. See DCS 02 00 04 04 and DCS 02 00 04 05 for proper conductor tension, depth, and pole rake based on line angle.

		Std./Stk. No.	Description	03 69 52 **	03	04
@	A	06 00 11 04	Static Support w/Suspension Clamp		1	1
	B	06 69 03 03	Insulator, 69kV Horz, Post, Single Polymer w/Trunn Clamps		3	
@		06 69 03 01	Insulator, 69kV Horz, Post, Single Polymer w/Susp. Clamps		3	
	C	06 69 03 04	Insulator, 69kV Horz, Post, Double Polymer w/Trunn. Clamps			3
@		06 69 03 02	Insulator, 69kV Horz, Post, Double Polymer w/Susp. Clamps			3
	D	SC*W	Clamp, Suspension, Static wire		1	1
@	E	TC*W	Clamp, Trunn., Angle, Conductor		3	6
		SC*W	Clamp, Suspension, Angle, Conductor		3	6
@	F	02 20 05 12	Backfill and Reinforcement		1	1
	G	12 00 10 12	Grounding Unit		1	1

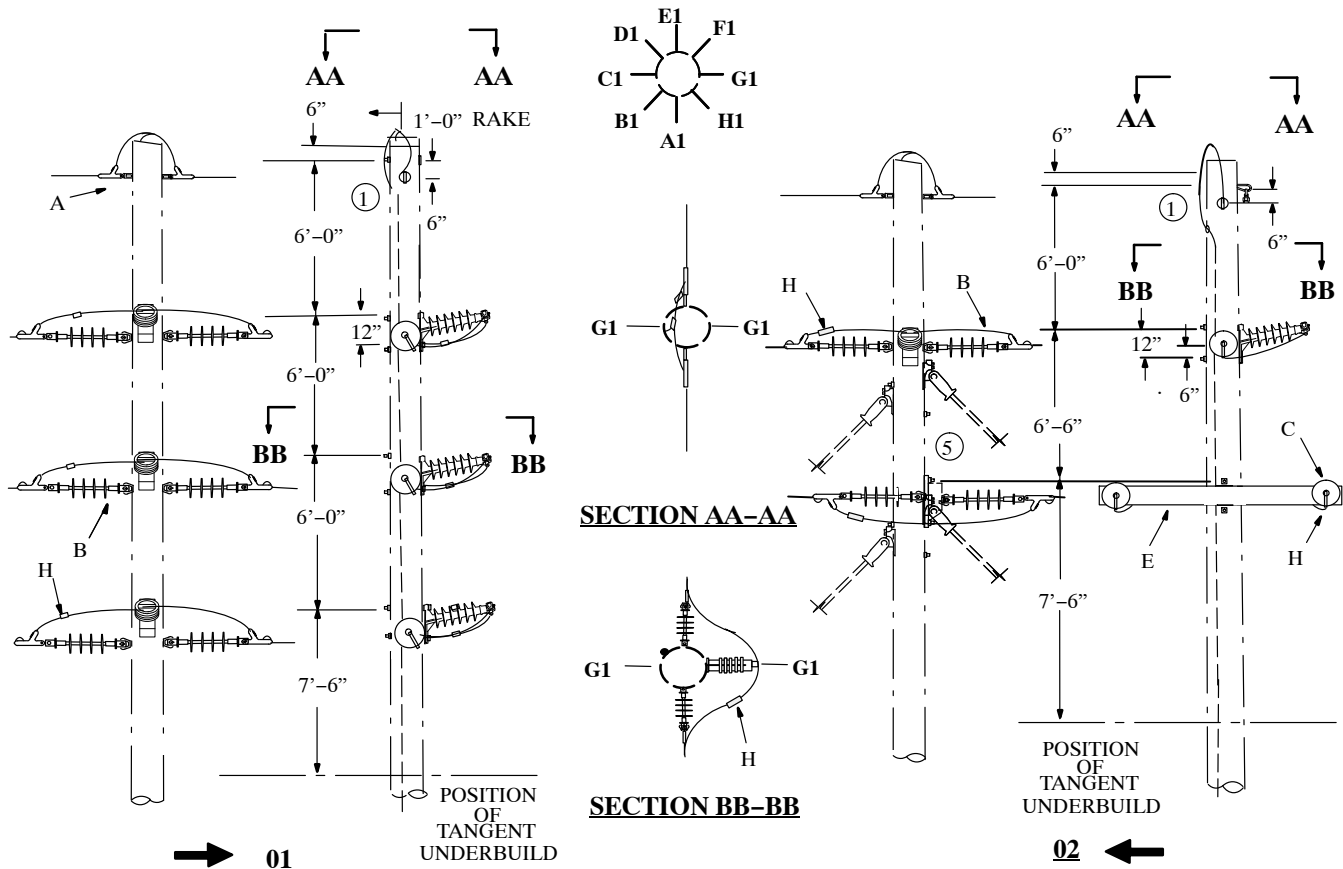
CONFIGURATIONS

Unguyed Composite Pole – 34kV or 69kV

Deadend Tangent Structure for Line Angle $\leq 1^\circ$

03 69 71**

Sheet 1 of 1



NOTES:

1. Factory (internal) installed pole ground in quadrant B1. See DCS 12 00 10 12 for grounding detail.
2. See DCS 02 00 04 04 and DCS 02 00 04 05 for pole selection on tangent structure.
3. Use above configuration for storm structure on existing or new line installation. See DCS 02 30 10 01 for storm or super pole selection. Use DCS 02 20 02 12 for area with poor soil.
4. 8' crossarm available Ameren Missouri only.
5. Use double arm if DE tension is higher than 4000# on 10' crossarm.

		Std. / Stk. No.	Description	03 69 71 **	01	02
4@	A	06 00 11 06	Deadend Clamp, Static		1	1
	B	06 34 72 01	Deadend, 69kV, Dbl, Looparound w/Deadend Clamp		3	1
	C	06 34 72 04	Deadend, 69kV, Dbl, Loopunder w/Deadend Clamp			2
	E	04 00 41 03	Fiberglass Deadend Arm Assembly, 8'			1
3@		04 00 41 04	Fiberglass Deadend Arm Assembly, 10'			1
	F	02 20 05 11	Backfill and Reinforcement, Tangent		1	1
		02 20 05 12	Backfill and Reinforcement, Angle		1	1
	G	12 00 10 12	Grounding Unit		1	1
@	H	PG**	Clamp, Parallel Groove (see DCS 07 00 25 00)		3	3
@	K	11 00 43 **	Guying Unit		2	2
		252 or 260	Install Connector		@	@

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: MJ
REV. NO: 01
REV. DATE: 09/13/13

CROSS ARMS

04



CROSSARMS AND FITTINGS

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FIBERGLASS ASSEMBLY LOADING CRITERIA.....	04 00 01 01
WOOD TANGENT ARM ASSEMBLY.....	04 00 20 **
WOOD SINGLE ALLEY ARM ASSEMBLY.....	04 00 24 **
WOOD DOUBLE ALLEY ARM ASSEMBLY.....	04 00 25 **
FIBERGLASS TANGENT ASSEMBLY.....	04 00 41 **
FIBERGLASS DEADEND ASSEMBLY.....	04 00 42 **
FIBERGLASS ALLEY ARM ASSEMBLY.....	04 00 43 **
FIBERGLASS SLABBED ALLEY ARM ASSEMBLY.....	04 00 44 **



CROSSARM AND FITTINGS

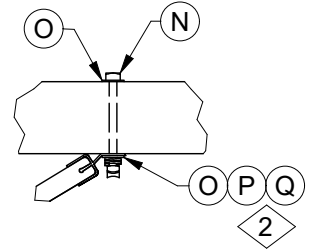
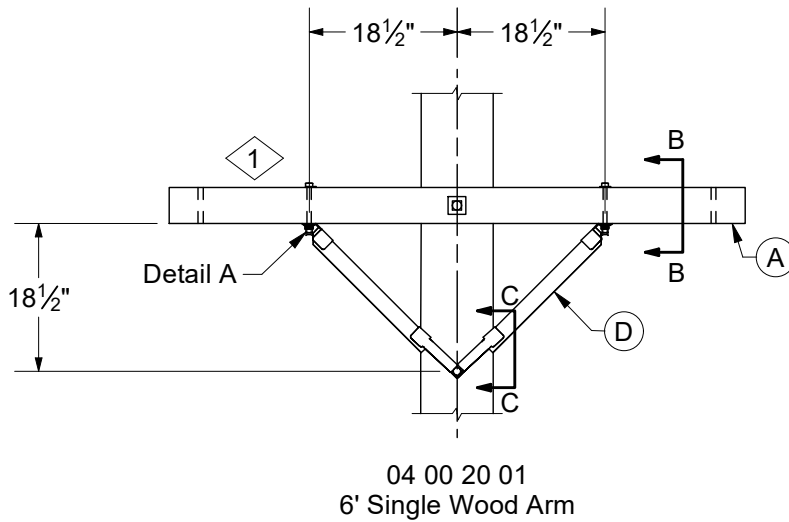
Fiberglass Assembly Loading Criteria

Fiberglass Crossarm Loadings									
Description	DCS #	Crossarm STK #	Ultimate Transverse Load (lbs/wire)	No. Wire	Ultimate Longitudinal Load (lbs/wire)	No. Wire	Ultimate Vertical Load (lbs/wire)	No. Wire	Weight
8' Tangent Arm	04 00 41 14	41 01 286	1,750	4	1,375	4	1750	4	41
10' Tangent Arm	04 00 41 16	41 01 285	3,500	4	1,375	4	1750	4	48
12' Tangent Arm	04 00 41 20	41 01 309	4,375	6	2,250	2	3125	2	74
			-	-	1,125	6	1625	6	74
16' Tangent Arm	04 00 41 21	41 01 312	4,375	6	1,625	2	2500	2	91
			-	-	875	6	1625	6	91
6' Dead End Arm	04 00 42 01	41 01 291	4,625	2	6,000	2	-	-	47
8' Dead End Arm	04 00 42 02	41 01 189	4,625	2	5,250	2	-	-	54
10' Dead End Arm	04 00 42 03	41 01 295	3,375	4	4,000	4	1,313	4	69
12' Dead End Arm	04 00 42 04	41 01 307	6,375	3	7,500	3	-	-	107
9' Double Stack HD Dead End Arm	04 00 42 05	41 01 301	6,813	4	7,875	4	-	-	159
11' Double Stack HD Dead End Arm	04 00 42 06	41 01 302	6,813	4	8,000	4	-	-	142
12' Double Stack HD Dead End Arm	04 00 42 07	41 01 308	13,625	2	10,000	2	-	-	167
			6,813	4	7,375	4	-	-	167
8' Alley Arm	04 00 43 01	41 01 293	625	2	500	2	675	2	54
10' Alley Arm	04 00 43 02	41 01 294	312.5	4	275	4	375	4	63

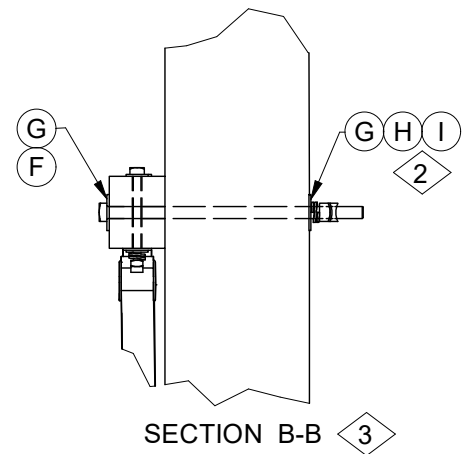
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DISTRIBUTION CONSTRUCTION STANDARDS

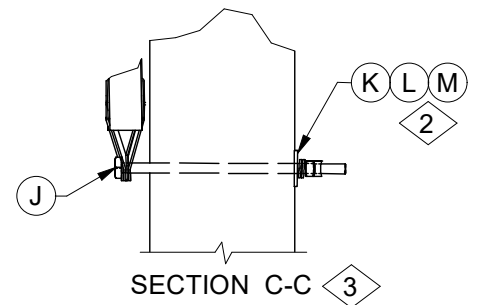
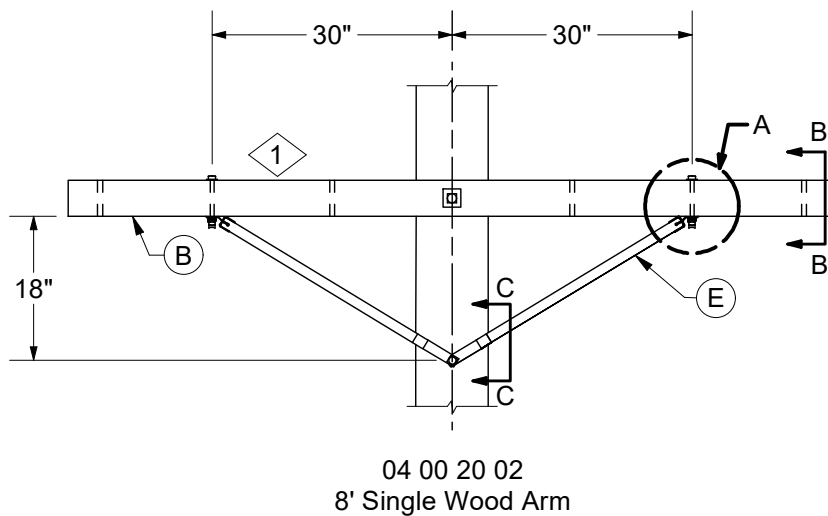
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2	01/01/21	KR	Converted to new format
1	04/11/11	MJ	



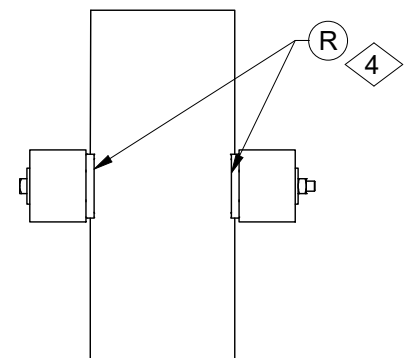
DETAIL A



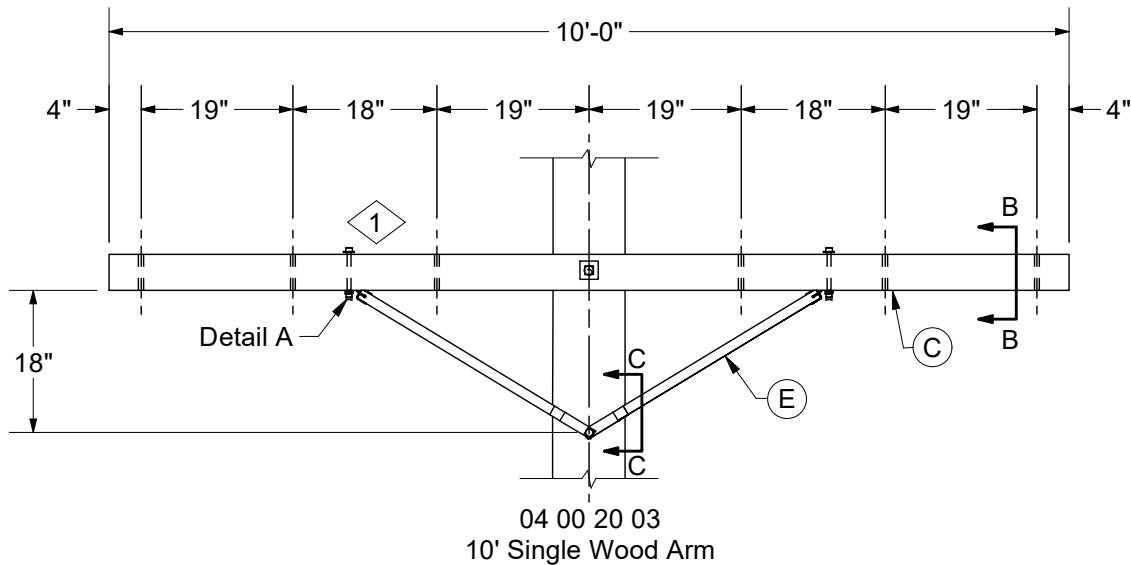
SECTION B-B



SECTION C-C



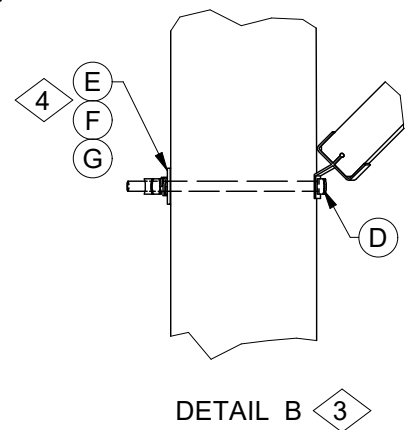
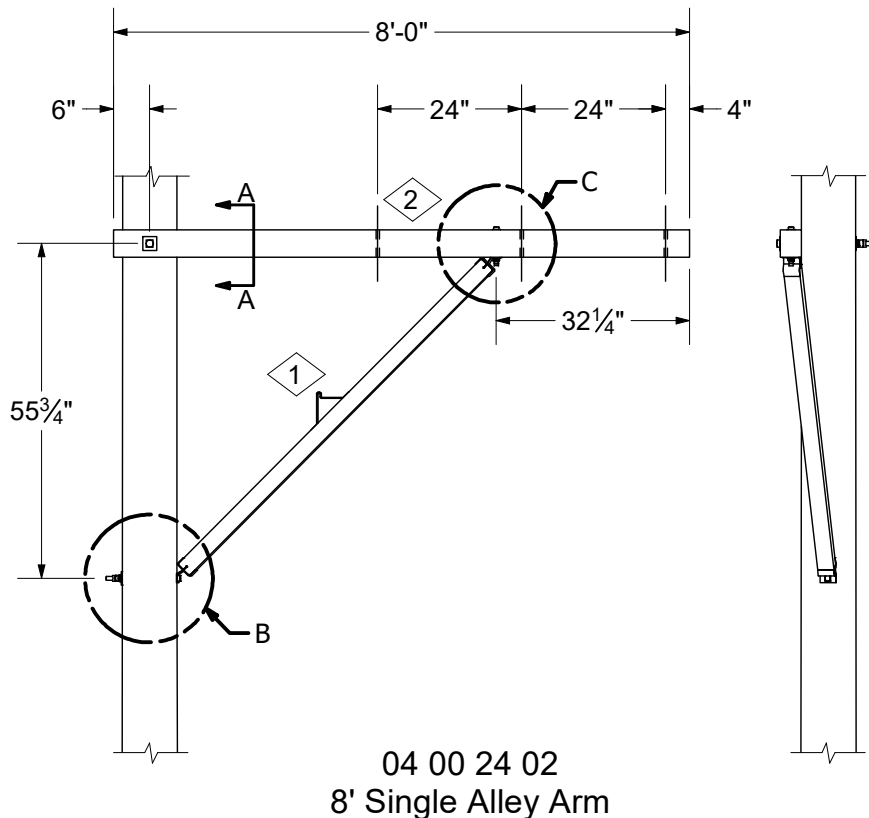
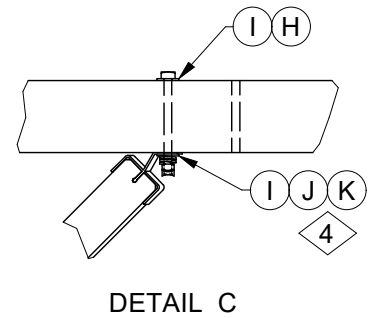
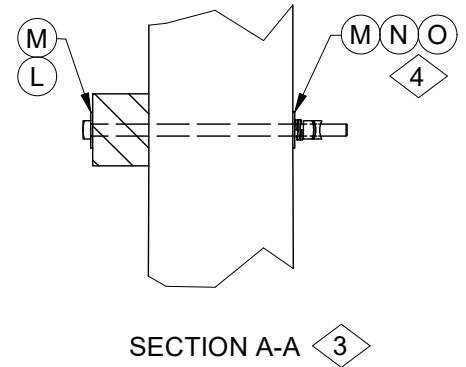
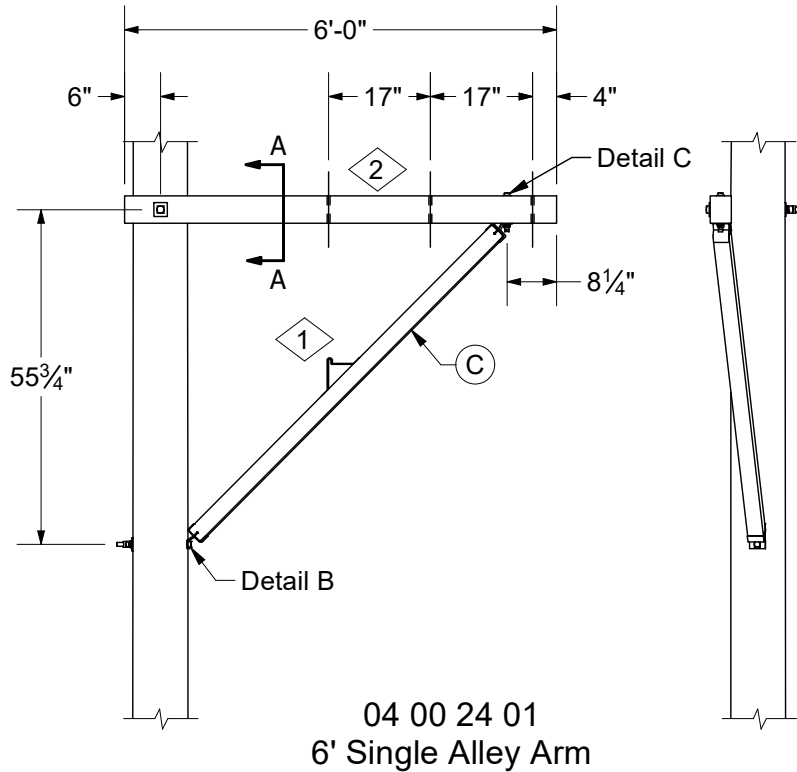
Double Arm Grid Gain Plate



CONSTRUCTION NOTE(s):

1. Field drill if required.
2. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock code number.
3. Always load the non-threaded portion of the bolt with arms and braces.
4. If back to back arms are needed, include item R. (Maintenance Only)
5. Use longer machine bolts for larger wood or composite poles if required.

ITEM	STK / DCS #	DESCRIPTION	04 00 20 **	01	02	03
A	41 01 006	6' Crossarm - 3-1/2" x 4-1/2"		1	-	-
B	41 01 014	8' Crossarm - 3-1/2" x 4-1/2"		-	1	-
C	41 01 008	10' Crossarm - 3-1/2" x 4-1/2"		-	-	1
D	41 56 063	Brace - 37" V		1	-	-
E	41 56 016	Brace - 60" V		-	1	1
F	23 52 254	Bolt, Mach., 3/4" x 16" w/ square nut		1	1	1
G	23 66 131	Washer, Square, 3/4"		2	2	2
H	23 66 135	Lock Washer - 3/4" Double Coil		1	1	1
I	23 65 042	Lock Nut - 3/4" Square		1	1	1
J	23 52 066	Bolt, Mach., 5/8" x 14" w/ square nut		1	1	1
K	23 66 027	Washer - Square 5/8"		1	1	1
L	23 66 134	Lock Washer - 5/8" Double Coil		1	1	1
M	23 65 043	Lock Nut - 5/8" Square		1	1	1
N	23 52 038	Bolt, Mach., 1/2" x 6" w/ square nut		2	2	2
O	23 66 017	Washer - Round 1/2"		4	4	4
P	23 66 133	Lock Washer - Double Coil 1/2"		2	2	2
Q	23 65 056	Lock Nut - 1/2" Square		2	2	2
@4 R	23 77 218	Plate, Grain, Grid, Crossarm		2	2	2





CROSSARMS AND FITTINGS

Wood Single Alley Arm Assembly

04 00 24 **

2 of 2

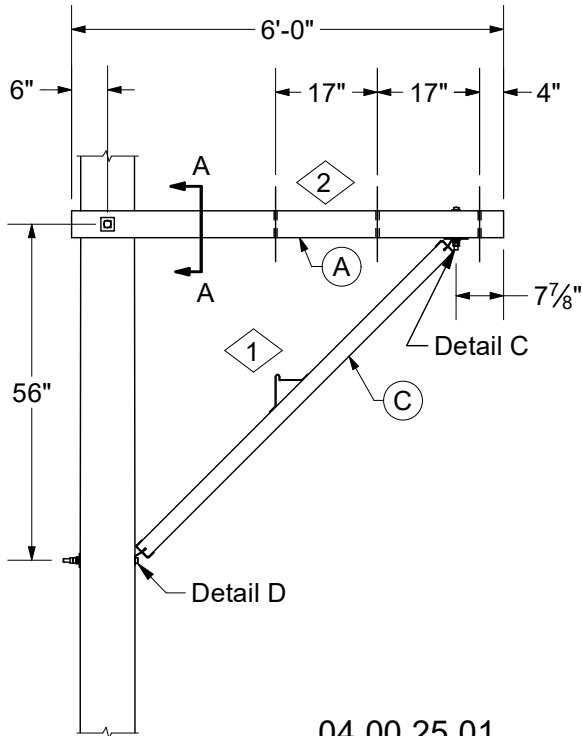
CONSTRUCTION NOTE(s):

1. Heel brace step, Stock #23 67 064 is optional and is not shown in material list.
2. Field drill, if required.
3. Always load the non-threaded portion of the bolt with arms and braces.
4. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock code number.
5. Use longer machine bolts for larger wood or composite poles if required.

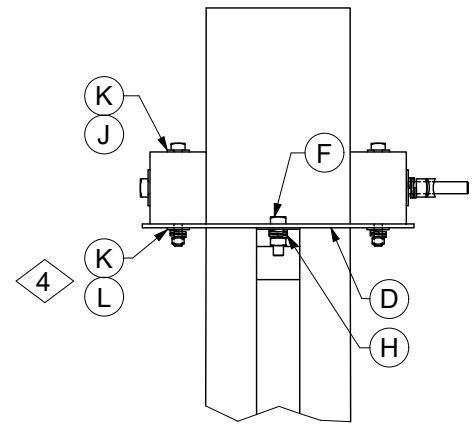
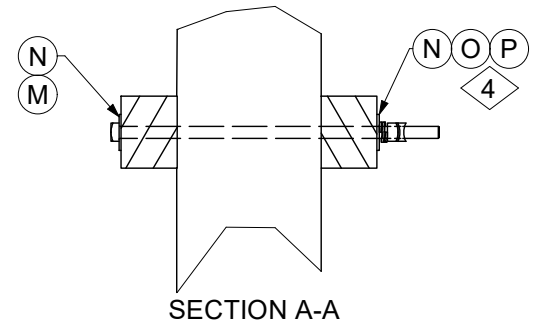
ITEM	STK / DCS #	DESCRIPTION	04 00 24 **	01	02
A	41 01 006	6' Crossarm - 3-1/2" x 4-1/2"		1	-
B	41 01 014	8' Crossarm - 3-1/2" x 4-1/2"		-	1
C	41 56 023	Heel Brace - 6'-0"		1	1
D	23 52 065	Bolt, Mach., 5/8" x 12" w/ square nut		1	1
E	23 66 027	Washer - Square 5/8"		1	1
F	23 66 134	Lock Washer - 5/8" Double Coil		1	1
G	23 65 043	Lock Nut - 5/8" Square		1	1
H	23 52 038	Bolt, Mach., 1/2" x 6" w/ square nut		1	1
I	23 66 017	Washer - Round 1/2"		2	2
J	23 66 133	Lock Washer - Double Coil 1/2"		1	1
K	23 65 056	Lock Nut - 1/2" Square		1	1
L	23 52 254	Bolt, Mach., 3/4" x 16" w/ square nut		1	1
M	23 66 131	Washer, Square, 3/4"		2	2
N	23 66 135	Lock Washer - 3/4" Double Coil		1	1
O	23 65 042	Lock Nut - 3/4" Square		1	1

DISTRIBUTION CONSTRUCTION STANDARDS

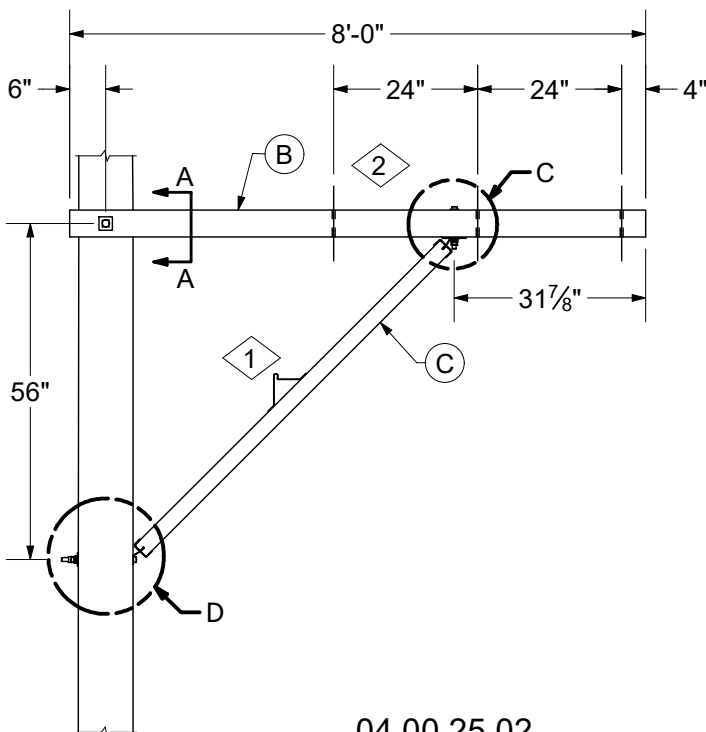
REV	DATE	ENG	DESCRIPTION
5	01/01/21	KR	Modified Drawing, added note 3
4	04/12/11	MJ	



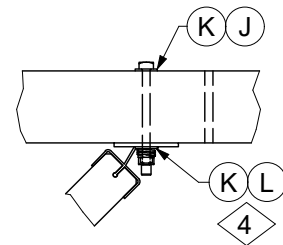
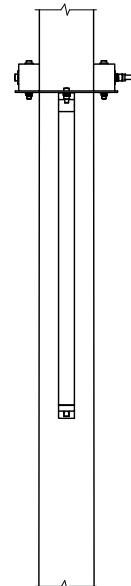
04 00 25 01
6' Double Alley Arm



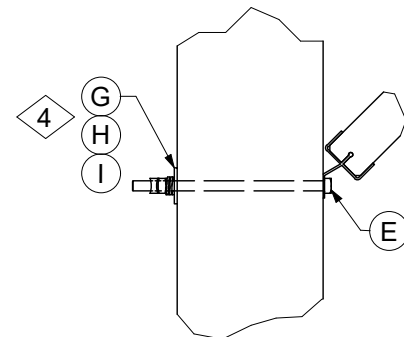
DETAIL B



04 00 25 02
8' Double Alley Arm



DETAIL C



DETAIL D 3



CROSSARMS AND FITTINGS

Wood Double Alley Arm Assembly

04 00 25 **

2 of 2

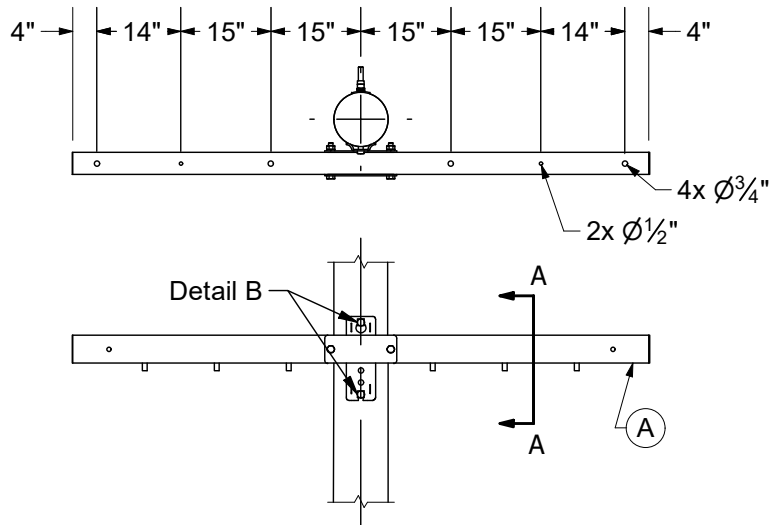
CONSTRUCTION NOTE(s):

1. Heel brace step, Stk. # 23-67-064 is optional and is not shown in material list.
2. Field drill, if required.
3. Always load the non-threaded portion of the bolt with arms and braces.
4. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock number.
5. Use longer machine bolts for larger wood or composite poles if required.

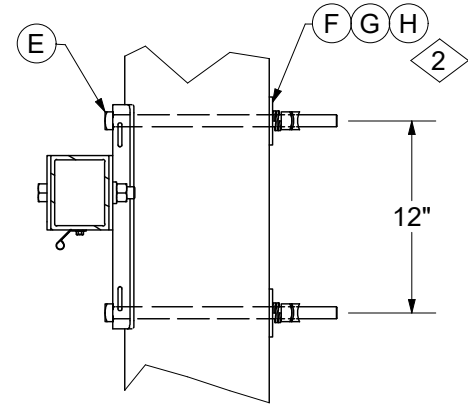
ITEM	STK / DCS #	DESCRIPTION	04 00 25 **	01	02
A	41 01 006	6' Crossarm - 3-1/2" x 4-1/2"		2	-
B	41 01 014	8' Crossarm - 3-1/2" x 4-1/2"		-	2
C	41 56 023	Heel Brace - 6'-0"		1	1
D	23 77 212	Plate Heel Brace - 8-3/4" to 13-3/8"		1	1
E	23 52 065	Bolt, Mach., 5/8" x 12" w/ square nut		1	1
F	23 52 049	Bolt, Mach., 5/8" x 2" w/ square nut		1	1
G	23 66 027	Washer - Square 5/8"		1	1
H	23 66 134	Lock Washer - 5/8" Double Coil		2	2
I	23 65 043	Lock Nut - 5/8" Square		1	1
J	23 52 038	Bolt, Mach., 1/2" x 6" w/ square nut		2	2
K	23 66 017	Washer - Round 1/2"		4	4
L	23 66 133	Lock Washer - Double Coil 1/2"		2	2
M	23 52 118	Bolt, Mach., 3/4" x 20" w/ square nut		1	1
N	23 66 131	Washer, Square, 3/4"		2	2
O	23 66 135	Lock Washer - 3/4" Double Coil		1	1
P	23 65 042	Lock Nut - 3/4" Square		1	1

DISTRIBUTION CONSTRUCTION STANDARDS

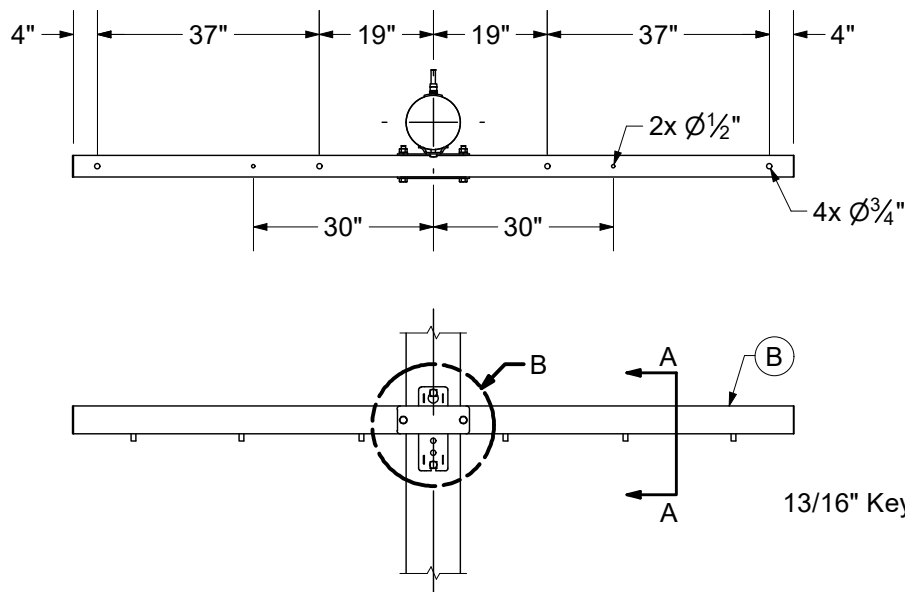
REV	DATE	ENG	DESCRIPTION
0	01/01/21	KR	New Issued Standard



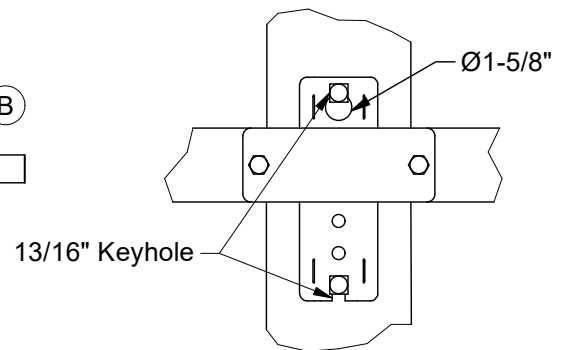
04 00 41 14
8' Tangent



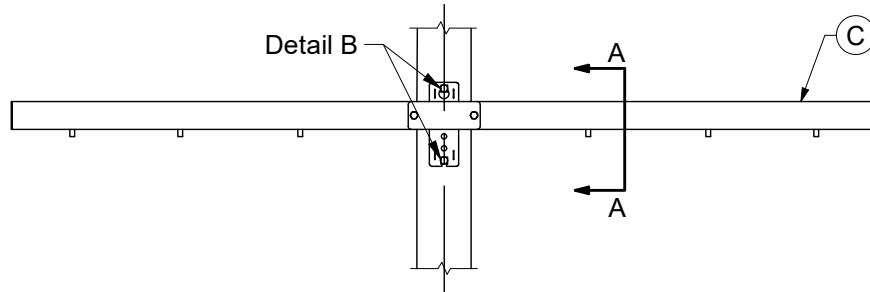
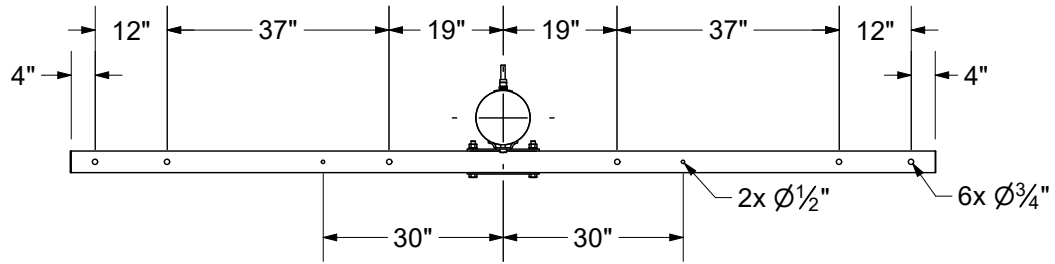
SECTION A-A 5



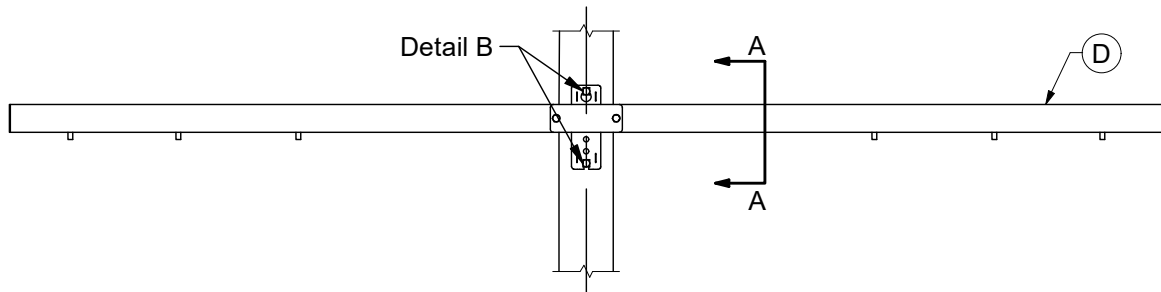
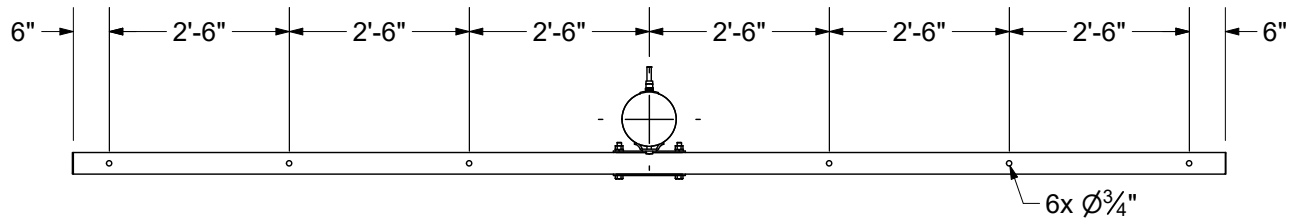
04 00 41 16
10' Tangent



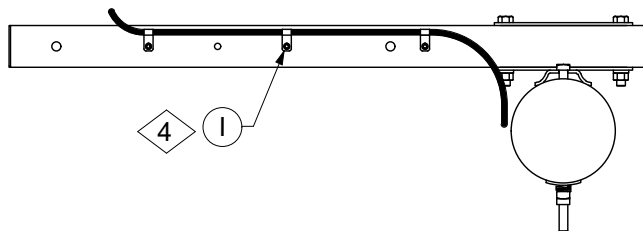
DETAIL B 5



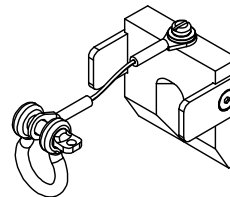
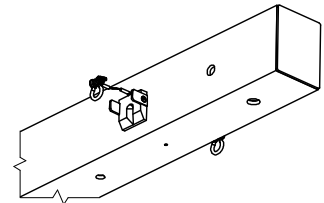
04 00 41 20
12' Tangent



04 00 41 21
16' Tangent



Bottom View



Hot Arm Block 3



CROSSARMS AND FITTINGS

Fiberglass Tangent Assembly

04 00 41 **

3 of 3

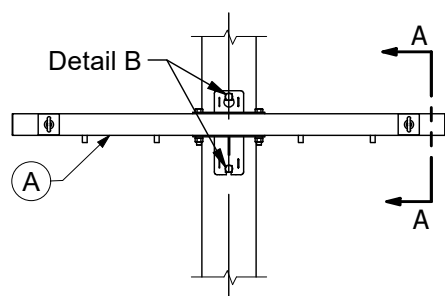
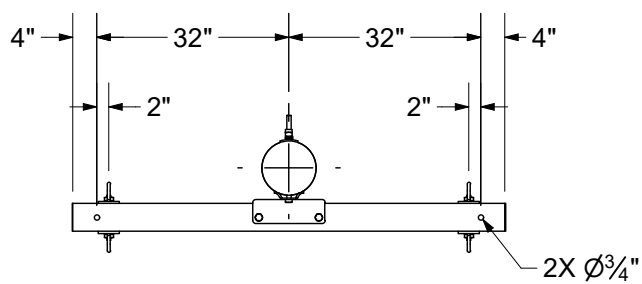
CONSTRUCTION NOTE(s):

1. Unbalanced loads require arm guys.
2. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock number.
3. When using fiberglass arms with hot arms a protective block to prevent the pin from fracturing the fiberglass arm is available (Stock #86 06 346).
4. When using a fiberglass arm with different devices a groundwire clip can be used below the arm to train the ground wire to the pole.
5. Always load the non-threaded portion of the bolt with arms and braces.
6. Use longer machine bolts for larger wood or composite poles if required.

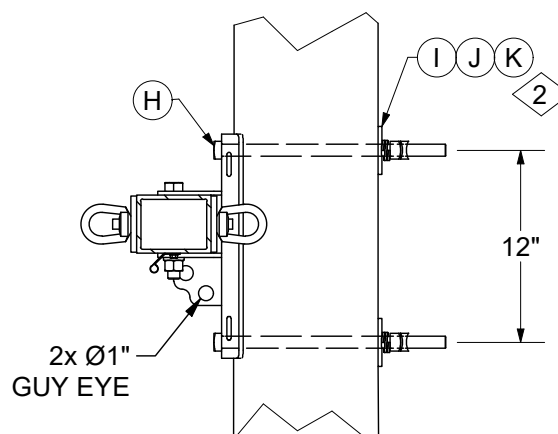
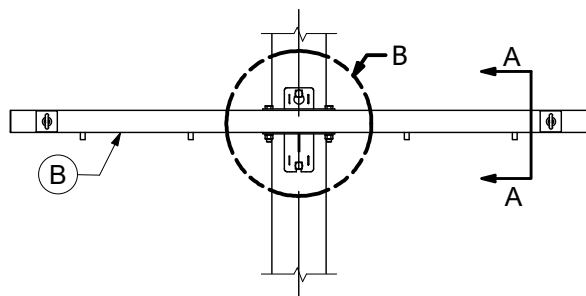
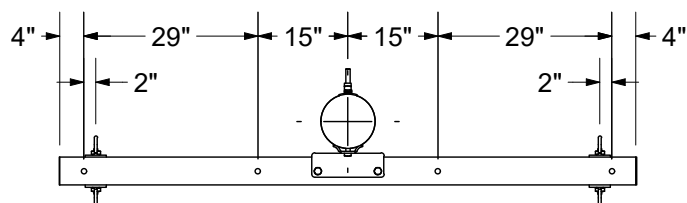
@4	ITEM	STK / DCS #	DESCRIPTION	04 00 41 **	14	16	20	21
	A	41 01 286	Crossarm - Tangent, F/G 8'		1	-	-	-
	B	41 01 285	Crossarm - Tangent, F/G 10'		-	1	-	-
	C	41 01 309	Crossarm - Tangent F/G 12'		-	-	1	-
	D	41 01 312	Crossarm - Tangent F/G 16'		-	-	-	1
	E	23 52 219	Bolt, Mach., 3/4" x 14" w/ square nut		2	2	2	2
	F	23 66 031	Washer, Curved, 3/4"		2	2	2	2
	G	23 66 135	Lock Washer - 3/4" Double Coil		2	2	2	2
	H	23 65 042	Lock Nut - 3/4" Square		2	2	2	2
	I	23 68 746	Grounding Clip Qty. 6		1	1	1	1

DISTRIBUTION CONSTRUCTION STANDARDS

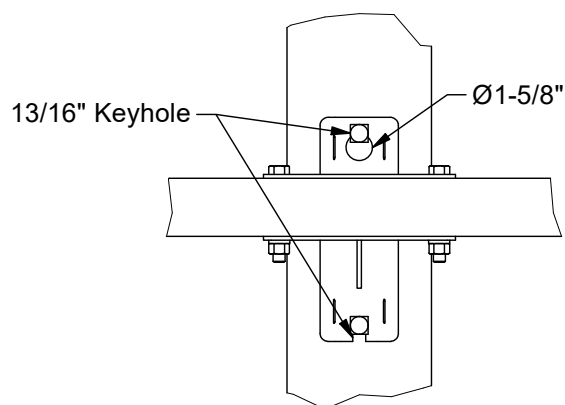
REV	DATE	ENG	DESCRIPTION
13	01/01/21	KR	Moved all fiberglass arms into new standards beside tangent arms.
12	03/10/16	WYW	



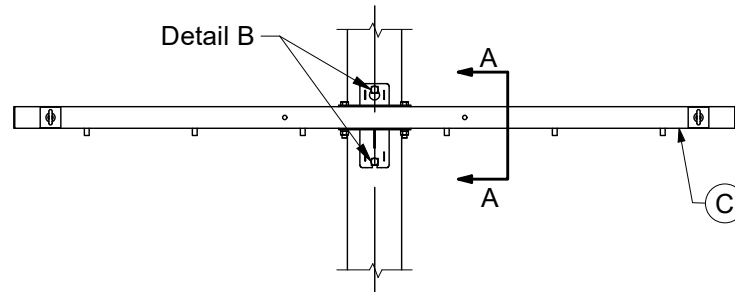
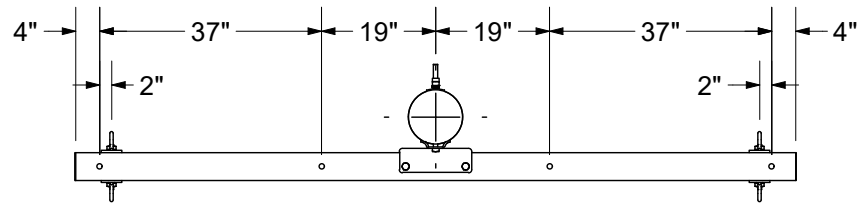
04 00 42 01
6' Deadend

SECTION A-A 

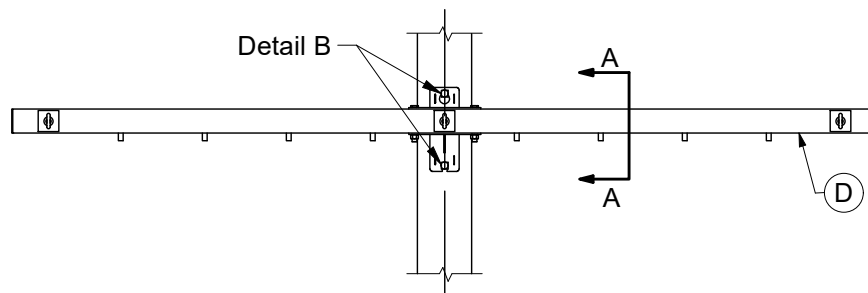
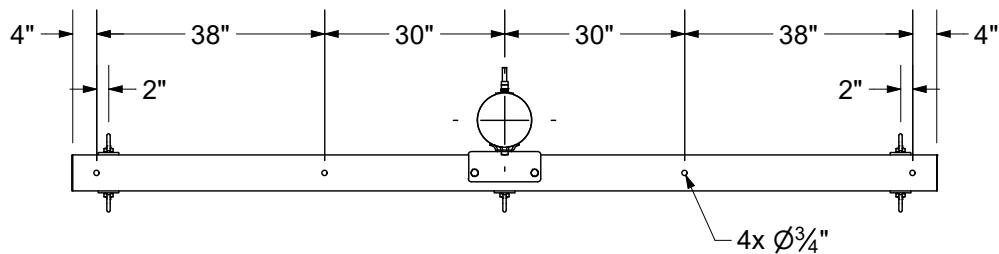
04 00 42 02
8' Deadend



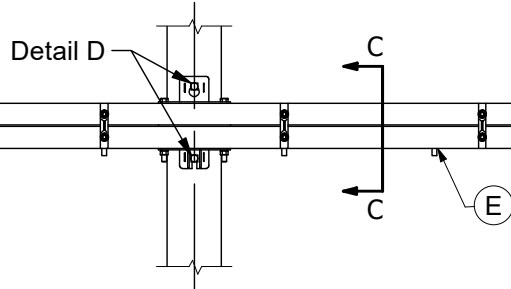
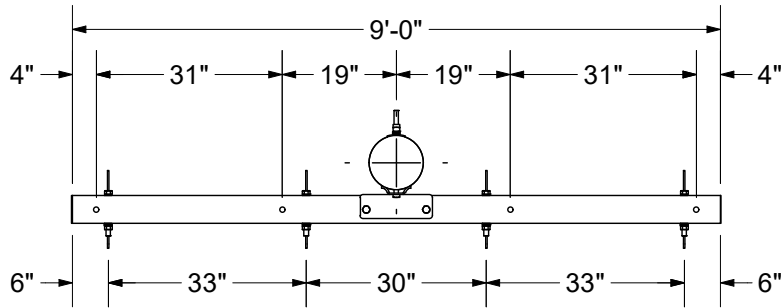
DETAIL B



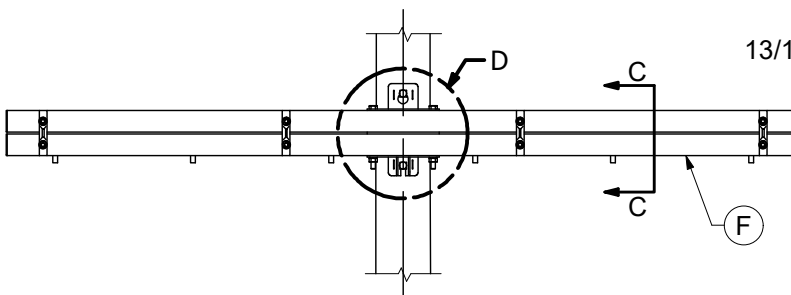
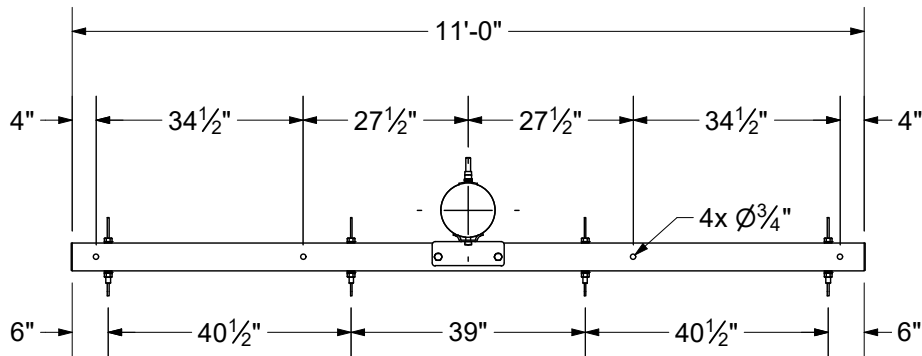
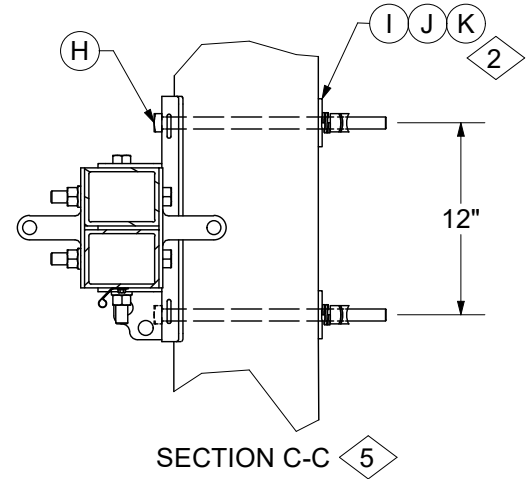
04 00 42 03
10' Deadend



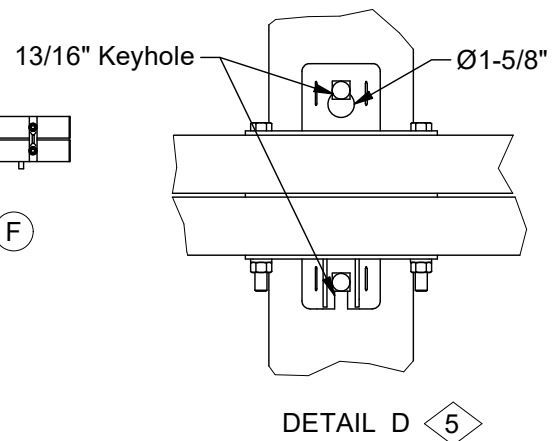
04 00 42 04
12' Deadend

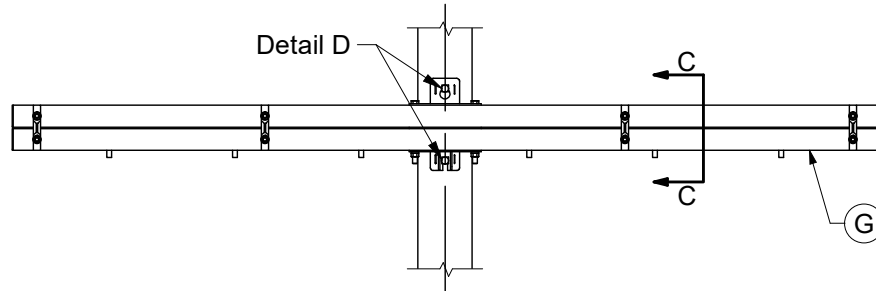
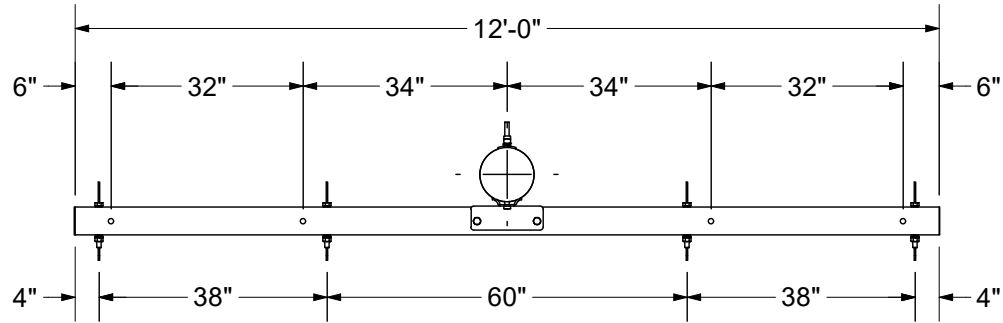


04 00 42 05
9' Double Stack HD Deadend

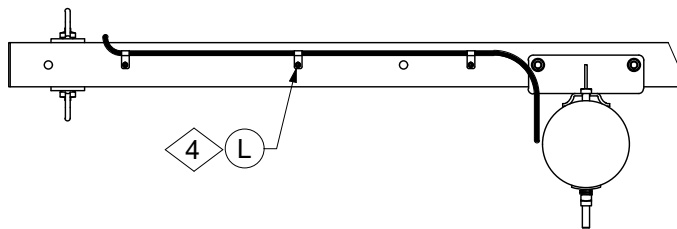


04 00 42 06
11' Double Stack HD Deadend

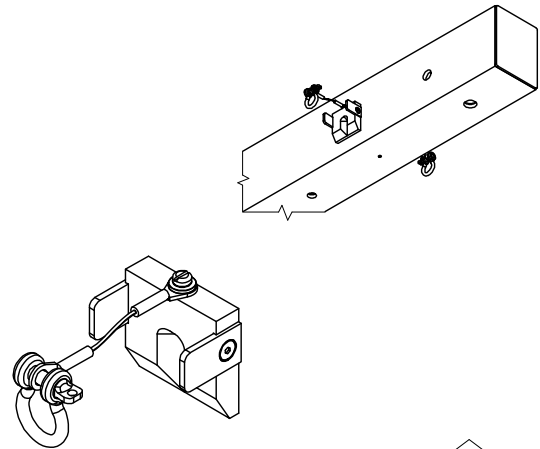




04 00 42 07
12' Double Stack HD Deadend



Bottom View



Hot Arm Block 3



CROSSARMS AND FITTINGS

Fiberglass Deadend Assembly

04 00 42 **

5 of 5

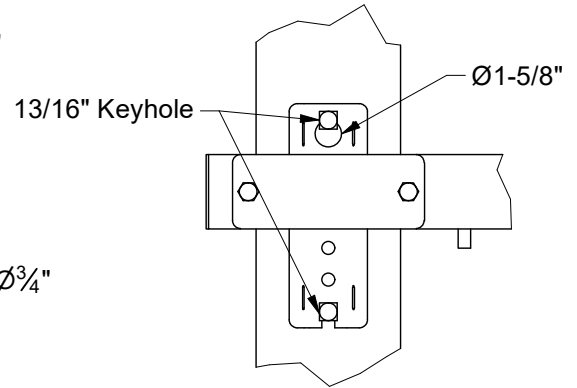
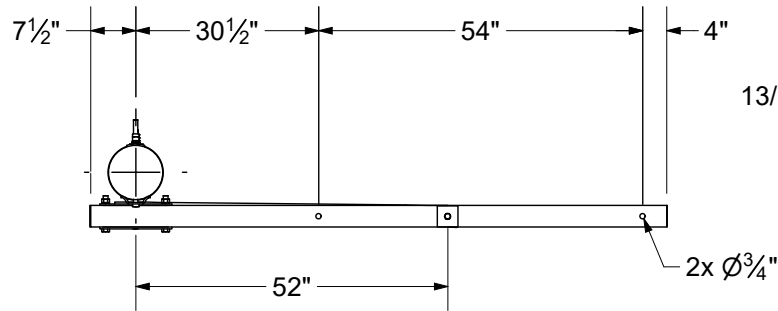
CONSTRUCTION NOTE(s):

1. Unbalanced loads require arm guys.
2. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock number.
3. When using fiberglass arms with hot arms a protective block to prevent the pin from fracturing the fiberglass arm is available (Stock #86 06 346).
4. When using a fiberglass arm with different devices a groundwire clip can be used below the arm to train the ground wire to the pole.
5. Always load the non-threaded portion of the bolt with arms and braces.
6. Use longer machine bolts for larger wood or composite poles if required.

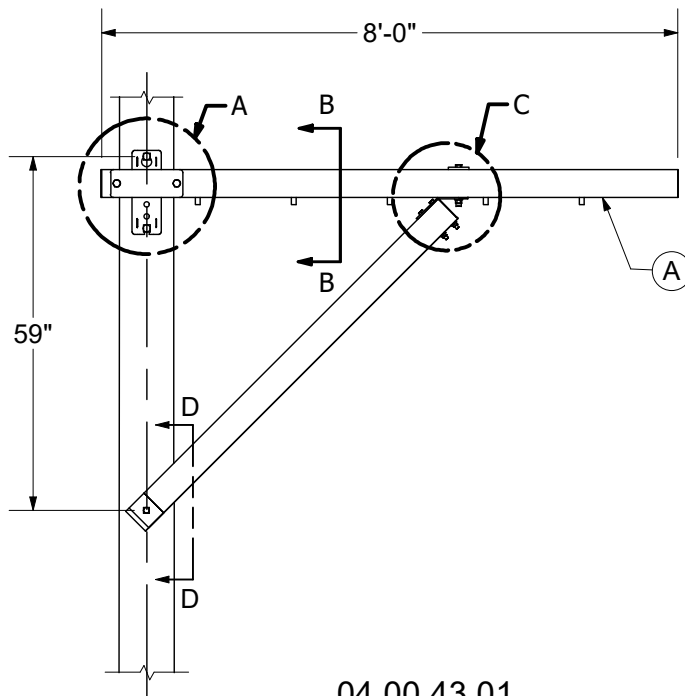
@4	ITEM	STK / DCS #	DESCRIPTION	04 00 42 **	01	02	03	04	05	06	07
	A	41 01 291	Crossarm - Deadend, F/G 6'		1	-	-	-	-	-	-
	B	41 01 189	Crossarm - Deadend, F/G 8'		-	1	-	-	-	-	-
	C	41 01 295	Crossarm - Deadend, F/G 10'		-	-	1	-	-	-	-
	D	41 01 307	Crossarm - Deadend, F/G 12'		-	-	-	1	-	-	-
	E	41 01 301	Crossarm - Double Stack HD Deadend 9'		-	-	-	-	1	-	-
	F	41 01 302	Crossarm - Double Stack HD Deadend 11'		-	-	-	-	-	1	-
	G	41 01 308	Crossarm - Double Stack HD Deadend 12'		-	-	-	-	-	-	1
	H	23 52 219	Bolt, Mach., 3/4" x 14" w/ square nut		2	2	2	2	2	2	2
	I	23 66 031	Washer, Curved, 3/4"		2	2	2	2	2	2	2
	J	23 66 135	Lock Washer - 3/4" Double Coil		2	2	2	2	2	2	2
	K	23 65 042	Lock Nut - 3/4" Square		2	2	2	2	2	2	2
	L	23 68 746	Grounding Clip Qty. 6		1	1	1	2	1	1	1

DISTRIBUTION CONSTRUCTION STANDARDS

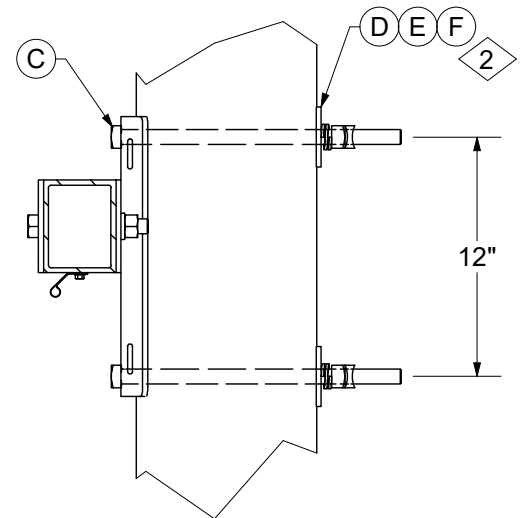
REV	DATE	ENG	DESCRIPTION
0	01/01/21	KR	New Issued Standard



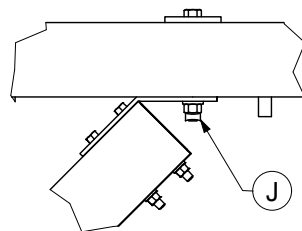
DETAIL A 5



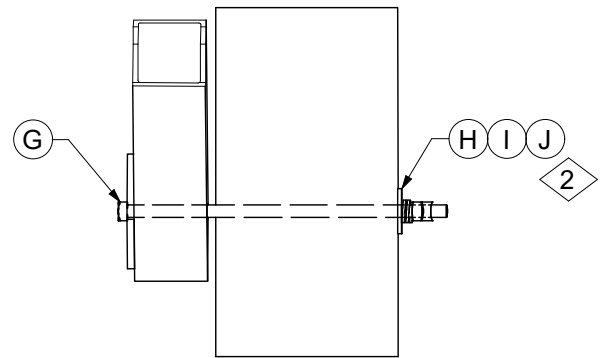
04 00 43 01
8' Alley Arm



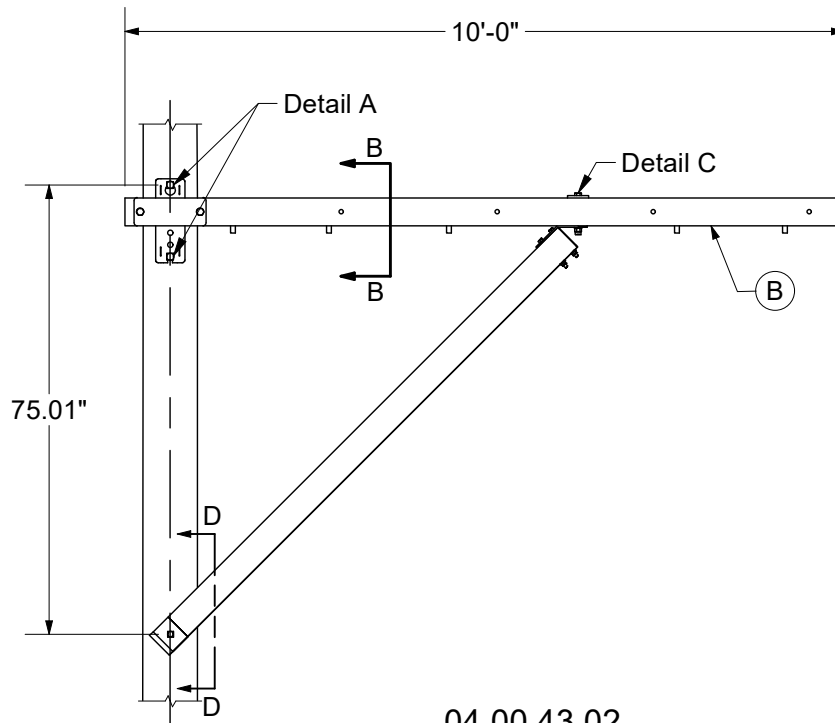
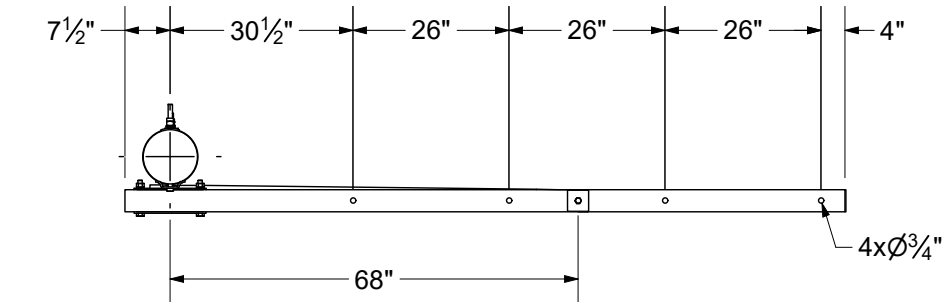
SECTION B-B 5



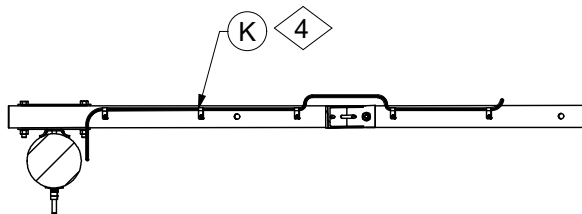
DETAIL C



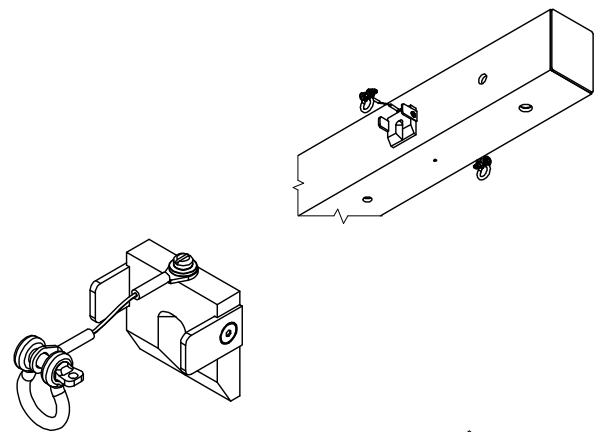
SECTION D-D 5



04 00 43 02
10' Alley Arm



Bottom View



Hot Arm Block 3



CROSSARMS AND FITTINGS

Fiberglass Alley Arm Assembly

04 00 43 **

3 of 3

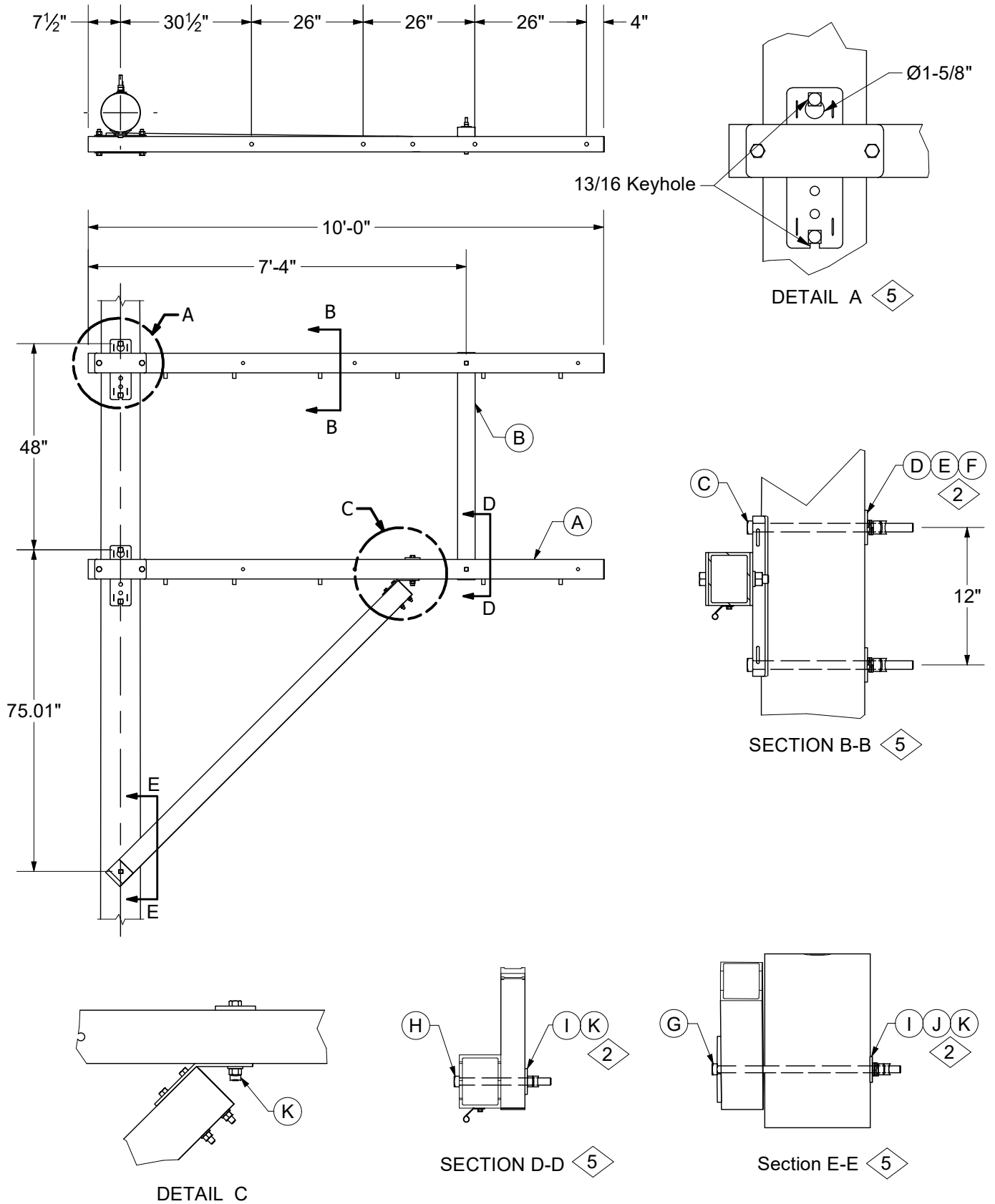
CONSTRUCTION NOTE(s):

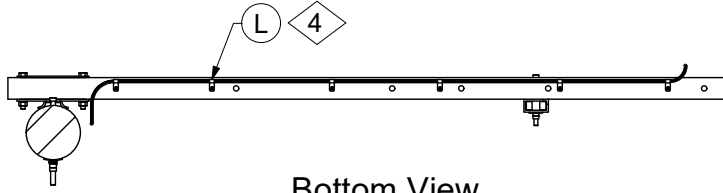
1. Unbalanced loads require arm guys.
2. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock number.
3. When using fiberglass arms with hot arms a protective block to prevent the pin from fracturing the fiberglass arm is available (Stock #86 06 346).
4. When using a fiberglass arm with different devices a groundwire clip can be used below the arm to train the ground wire to the pole.
5. Always load the non-threaded portion of the bolt with arms and braces.
6. Use longer machine bolts for larger wood or composite poles if required.

@4	ITEM	STK / DCS #	DESCRIPTION	04 00 43 **	01	02
	A	41 01 293	Crossarm - Alley, F/G 8'		1	-
	B	41 01 294	Crossarm - Alley, F/G 10'		-	1
	C	23 52 219	Bolt, Mach., 3/4" x 14" w/ square nut		2	2
	D	23 66 031	Washer, Curved, 3/4"		2	2
	E	23 66 135	Lock Washer - 3/4" Double Coil		2	2
	F	23 65 042	Lock Nut - 3/4" Square		2	2
	G	23 52 068	Bolt, Mach., 5/8" x 16" w/ square nut		1	1
	H	23 66 027	Washer - Square 5/8"		1	1
	I	23 66 134	Lock Washer - 5/8" Double Coil		1	1
	J	23 65 043	Lock Nut - 5/8" Square		2	2
	K	23 68 746	Grounding Clip Qty. 6		1	1

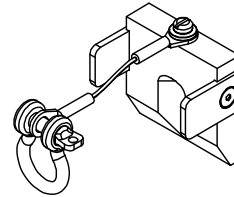
DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
0	01/01/21	KR	New Issued Standard





Bottom View



Hot Arm Block 3

CONSTRUCTION NOTE(s):

1. Unbalanced loads require arm guys.
2. Assemble items in order listed. Square nut provided with bolt is used after double coil washer. Double coil washer not needed on composite poles. Lock nuts must be placed after nut included with bolt stock number.
3. When using fiberglass arms with hot arms a protective block to prevent the pin from fracturing the fiberglass arm is available (Stock #86 06 346).
4. When using a fiberglass arm with different devices a groundwire clip can be used below the arm to train the ground wire to the pole.
5. Always load the non-threaded portion of the bolt with arms and braces.
6. Use longer machine bolts for larger wood or composite poles if required.

@4	ITEM	STK / DCS #	DESCRIPTION	04 00 44 **	01
	A	41 01 294	Crossarm - Alley, F/G 10'		2
	B	41 01 314	Crossarm - Alley Arm Brace F/G		1
	C	23 52 219	Bolt, Mach., 3/4" x 14" w/ square nut		4
	D	23 66 031	Washer, Curved, 3/4"		4
	E	23 66 135	Lock Washer - 3/4" Double Coil		4
	F	23 65 042	Lock Nut - 3/4" Square		4
	G	23 52 068	Bolt, Mach., 5/8" x 16" w/ square nut		1
	H	23 52 061	Bolt, Mach., 5/8" x 8" w/ square nut		2
	I	23 66 027	Washer - Square 5/8"		3
	J	23 66 134	Lock Washer - 5/8" Double Coil		1
	K	23 65 043	Lock Nut - 5/8" Square		4
	L	23 68 746	Grounding Clip Qty. 6		2

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25 KV & BELOW – CUTOUT COVER	05-15-10-01
25 KV & BELOW – CONDUCTOR COVER SINGLE PIN	05-16-10-**
25 KV & BELOW – CONDUCTOR COVER DOUBLE PIN	05-16-11-**
25 KV & BELOW – CONDUCTOR COVER DEADEND	05-16-12-**
■ Pole Wrap	05-16-13**

Purpose and Scope

This section covers the current products and construction practices for the protection of avian species common to Ameren's service areas in Illinois and Missouri. In addition, the wildlife guards for prevention of animal caused outages are included to improve reliability of distribution facilities.

Ameren's first approach is to maintain minimum horizontal and vertical conductor separation unless economics or existing conditions force the use of other methods. The areas intended for new overhead lines shall be evaluated for risk to the protected birds (resident or migratory). Lines scheduled for repair or replacement shall also be evaluated for this same risk.

Practices and Products

All Divisions must follow Ameren standards for new construction and existing retrofit to provide avian-friendly facilities. Other suggested practices or products are not acceptable unless evaluated and approved by Standards.

Wood or composite poles are preferred because the insulating nature of these materials reduces the clearances required for avian protection to less than those required for metal structures. After completion of construction all leftover scrap or reusable material shall be removed and disposed of in an appropriate manner.

Regulations and Compliance

All legal procedures must be followed by the Ameren Division when there is evidence of an avian injury or fatality in the vicinity of an Ameren overhead line (69 kV and below). In addition, the Division shall be proactive in correcting or modifying existing structures to eliminate the possibility of further injury or fatalities to avian species. This commitment is to meet the regulatory requirements for protecting avian species on new and existing circuits. The laws that are applicable are:

1. The Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703–712).
2. The Endangered Species Act (ESA; 1531–1544).
3. The Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. 668–668d)
4. Ameren Avian Protection Plan

1. General

The stock number for the critter line guard is 71-25-216. The line guard is used to prevent animals from crossing a section of overhead conductor leading to a substation or other distribution equipment. If the line guard is installed on an energized conductor, proper protective clothing, equipment and procedures must be followed.

2. Principle of Operation

The line guard includes five (5) rollers, two (2) wheels, two (2) "L" brackets, and six (6) cable ties. When properly installed the five rollers are placed between the two wheels and secured in place with the "L" brackets. When an animal (squirrel) tries to cross over the installed line guard, the rollers will rotate and the animal will be rolled off of the conductor. Line guard can be applied to lines with a voltage level of 69kV or less.

3. Line Guard Placement and Installation

A. For substation applications, place the line guard at least 5' outside the substation fence.

B. For other applications, place the line guard at least 2' from the pole or standing structure.

C. Verify the size (OD) of the conductor that the line guard will be installed on. The line guard rollers are fabricated with a 1" OD hole and two cutouts, one for 2" OD and another for 3" OD. The first groove on each roller represents 2", and the second groove represents 3". The cutouts can be easily removed with a knife.

Position one of the "L" brackets closest to the point the line guard will be protecting. If this work is being done with the conductor energized the "L" bracket can be replaced with a hot line clamp from the table on Sheet 2 of this standard. The hot line clamp can be installed with a "shotgun" hot stick. If the "L" bracket is used place it on the conductor and secure it into place with two cable ties. The cable ties must be placed through the holes provided and around the conductor. Pull the ties tight to hold the "L" bracket in place.

NOTE: The stainless steel cable ties will have sharp edges if the ties are cut off. Therefore, the ends of the ties should be bent over to remove any sharp edges.

D. Position the halves of the rollers around the conductor and snap them together. Each roller will have a series of four snaps. All of the snaps must be fastened.

NOTE: On conductors larger than 2" OD, the rollers will have only two snaps. If the cutout for a 3" hole is removed, the end snaps will also be removed. This will not affect the integrity or operation of the product.

E. While assembling the first and last rollers the wheels must be installed. Spread apart a wheel and place it on the end of the roller that faces the "L" bracket. Tightly fasten one cable tie at the base of the wheel (See Figure 1) to secure it to the roller.

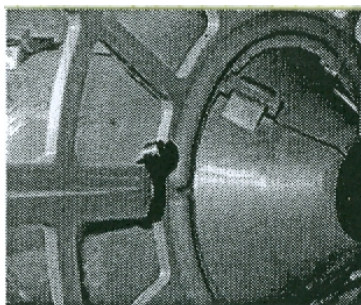


FIGURE 1

F. After all of the rollers have been snapped around the conductor, push the line guard assembly along the conductor until it is snug against the installed "L" bracket.

- G. Position the remaining “L” bracket (or hot line clamp) at the opposite end of the line guard assembly and secure it in place with two cable ties as described in Step #3.C. Remember to bend the ends of the stainless steel ties to eliminate any sharp edges.
4. When the line guard installation is complete, it should appear as shown in Figure 2.

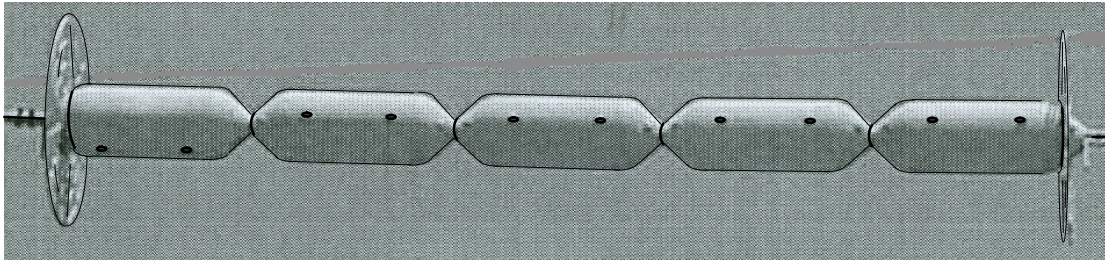


FIGURE 2

Available Hot Line Clamps:

Stock Number	Material	Conductor Range (Inches)	DOJM Code
23 78 394	Copper	0.128 – 0.414	HLC10C
23 78 183	Copper	0.162 – 0.745	HLC350C
17 62 088	Aluminum	0.157 – 0.905	HLC336A
17 62 112	Aluminum	0.502 – 1.031	HLC556A
17 62 143	Aluminum	0.939 – 1.490	HLC954A

1. GENERAL

The lightning arrester mounting bracket guard is used to prevent bird caused outages associated with birds perched on the grounded LA bracket making contact with an energized line lead.

2. PRINCIPLE OF OPERATION

The LA bracket guard covers the grounded metal mounting bracket and arrester mounting bolt on tank mounted arresters. The guards have flexible fingers that securely hold the guards in place. The guard is designed to fit brackets from all common polymer arrester suppliers. The guard has been tested to withstand 21kV to ground without a flashover.

The smooth, rounded profile of the guard acts as a perch deterrent. The UV stabilized polypropylene material exhibits excellent durability in all environments. See Figure 1.



Figure 1

3. INSTALLATION

- A. Make sure that the arrester is positioned properly and securely attached to the tank mounting bracket.
- B. Place the wildlife guard over the last insulating rib on the polymer arrester mounting bracket and over the tank mounting bracket and bolt.
- C. Push down on the wildlife guard until the flexible fingers, at the base of the guard, snap into place and securely hold the guard. No external ties or tape are required to hold the wildlife guard in place. See Figure 2 for an example of an installed cover.



Figure 2

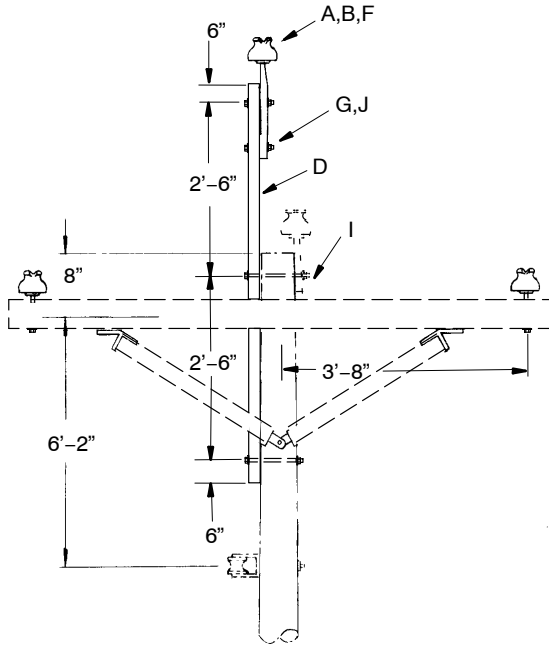
	Std. / Stk. No.	Description	05 00 00 05	QTY
A	69 56 037	Guard, Wildlife, for Covering LA Tank Bracket		1
B		Wildlife Guards Installation – OP Code 111		1

WILDLIFE PROTECTION
25 kV & Below
Existing Structure Modification

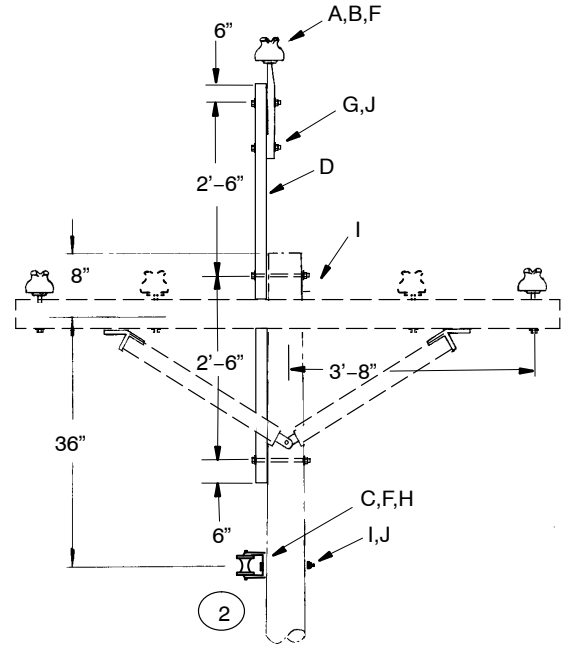
05 11 10 **

Sheet 1 of 1

This standard provides for modification of existing structures to increase spacing between conductors to reduce the likelihood of injury to or death of protected avian species. The 3-wire and 4-wire modification achieves mandated conductor spacing while retaining the eight foot crossarm used in the standard configuration.



3 - Wire Modification
05 11 10 01



4 - Wire Modification
05 11 10 02

NOTES:

4. See Dist. Std. 06 12 01 for insulator detail and 06 01 01 for secondary clevis detail.
5. See Dist. Std. 29 00 17 02 for neutral ground clearance.

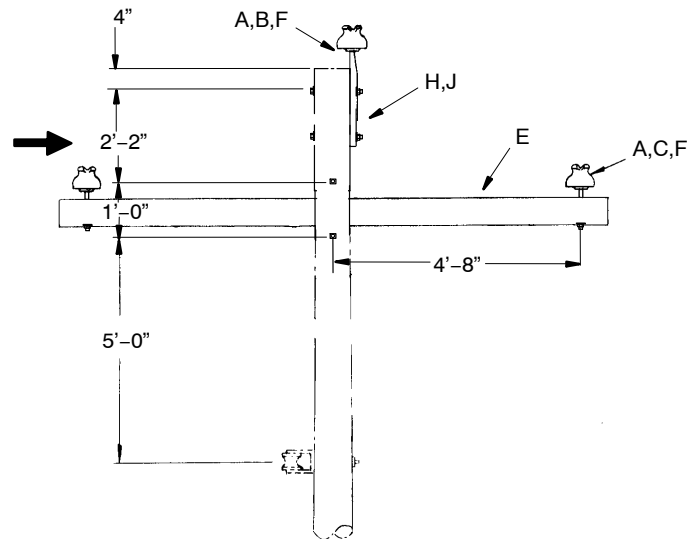
		Std. / Stk. No.	Description	05 11 10 **	01	02
@	A	25 05 069	Insulator, Pin type		1	1
	B	23 62 156	Pin, Pole Top, 24"		1	1
	C	23 06 040	Clevis, Sec., Insulator			1
	D	41 01 006	Crossarm, Wood Bayonet, 3-1/2" x 4-1/2" x 6'		1	1
	F	TT*W	Top Tie, See Dist. Std. 07 00 41 00		1	1
		ST*W	Side Tie, See Dist. Std. 07 00 41 00			1
	G	23 52 058	Bolt, Mach., 5/8" x 5"		2	2
	H	25 59 044	Insulator, Spool			1
	I	23 52 063	Bolt, Mach., 5/8" x 10"		2	2
		23 52 065	Bolt, Mach., 5/8" x 12"			1
	J	23 66 027	Washer, Square, 2-1/4"		4	5

WILDLIFE PROTECTION
25 kV & Below
New Structure Construction

05 11 20 01

Sheet 1 of 1

Ameren has several overhead flat configurations for use at 25 kV & below. The existing configuration may be on wood, steel or composite poles. Wood and composite poles are considered standard construction in areas with migratory bird population. New construction with crossarm configurations shall provide five feet conductor separation to reduce avian electrocution risk.



NOTES:

1. See Dist. Std. 06 12 01 for insulator detail.

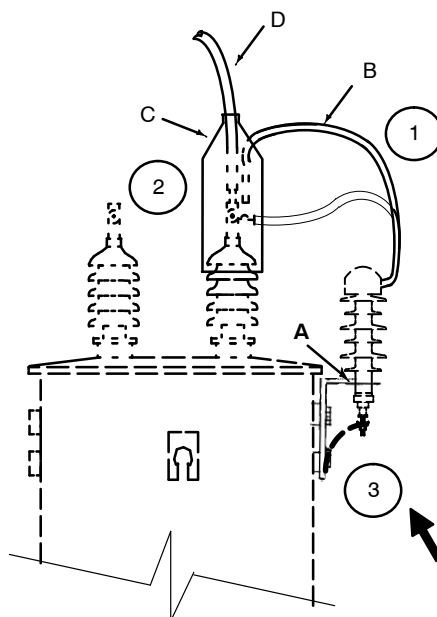
		Std. / Stk. No.	Description	05 11 20 01
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	B	23 62 156	Pin, Pole Top, 24"	1
	C	23 62 028	Pin, Crossarm	2
	E	41 01 285	Crossarm, Fiberglass, 3-5/8" x 4-5/8" x 10'	1
	F	TT*W	Top Tie, See Dist. Std. 07 00 41 00	3
	H	23 52 063	Bolt, Mach., 5/8" x 10"	2
	I	23 52 097	Bolt, Mach., 3/4" x 12"	2
	J	23 66 027	Washer, Square, 2-1/4"	4

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: MJ
REV. NO: 1
REV. DATE: 03/29/11

The transformer live parts should be covered to prevent circuit outage from wildlife contact. On Delta Primary Systems, wildlife guards must be installed on both HV bushings. When transformers are banked and the clam-shell wildlife guard is used, install the arrester lead in the side of the guard so that the primary leads can be installed in the top holes.



NOTES:

1. Bolt lead to arrester away from the transformer to keep the lead opening in the arrester guard away from animals.
2. Be sure the bushing guard completely covers the terminal and only the top bushing skirt.
3. Refer to DCS Section13 for transformer installation.

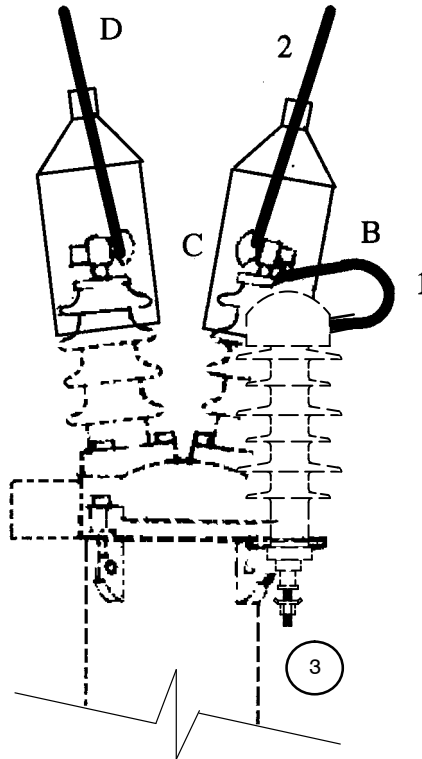
		Std. / Stk. No.	Description	05 12 10 **	01
	A	69 56 037	Guard, Wildlife, Arrester Bracket		1
	B	69 58 178	Wire, Lead, Arrester w/terms		1
	C	69 58 296	Guard, Clam-Shell, Wildlife		1
	D	18 51 025	Wire, Transformer Riser (ft.)		6
	F	111	Wildlife Guard Installation		1

WILDLIFE PROTECTION
25 kV & Below
Recloser & Sectionalizer Retrofit

05 14 10 **

Sheet 1 of 1

The recloser live parts should be covered to prevent circuit outage from wildlife contact.

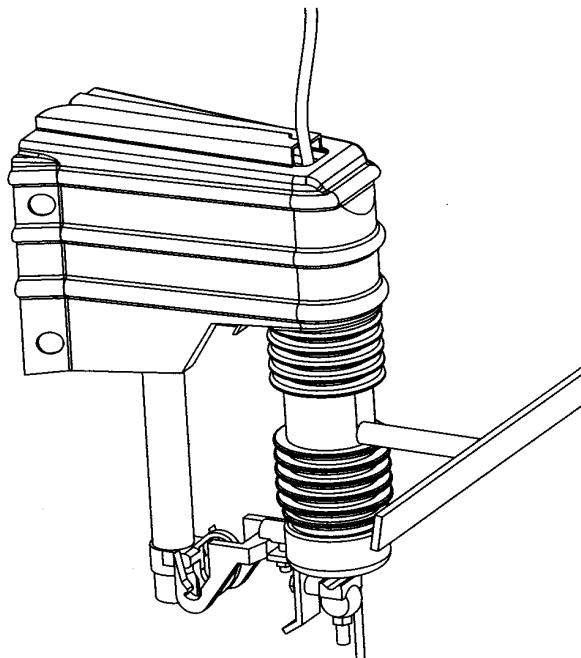


NOTES:

1. Bolt lead to arrester away from the tank to keep the lead opening in the arrester guard away from animals.
2. Be sure the bushing guard completely covers the terminal and only the top bushing skirt.
3. Refer to Dist. Section 10 for recloser and sectionalizer installation.
4. An arrester should be installed if one is not present.

		Std. / Stk. No.	Description	05 14 10 **	01	02	03
	A	10 01 145	Arrester 10kV w/o Bracket		1	1	1
	B	69 58 178	Wire-Lead, Arrester w/terms		1	1	1
	C	69 58 296	Guard, Clam-Shell, Wildlife		2	2	2
	D	18 51 025	Wire, SD., #4 Cu., Poly (ft.)		12		
		18 51 042	Wire, SD., #1/0 Cu., Poly (ft.)			12	
		18 51 023	Wire, SD., #4/0 Cu., Poly (ft.)				12
	E	111	Wildlife Guard Installation		1	1	1

The cutout live parts cover shown in this standard shall be used on the Ameren Distribution System to prevent circuit outage from wildlife contact. The cover is not intended for personal protection.



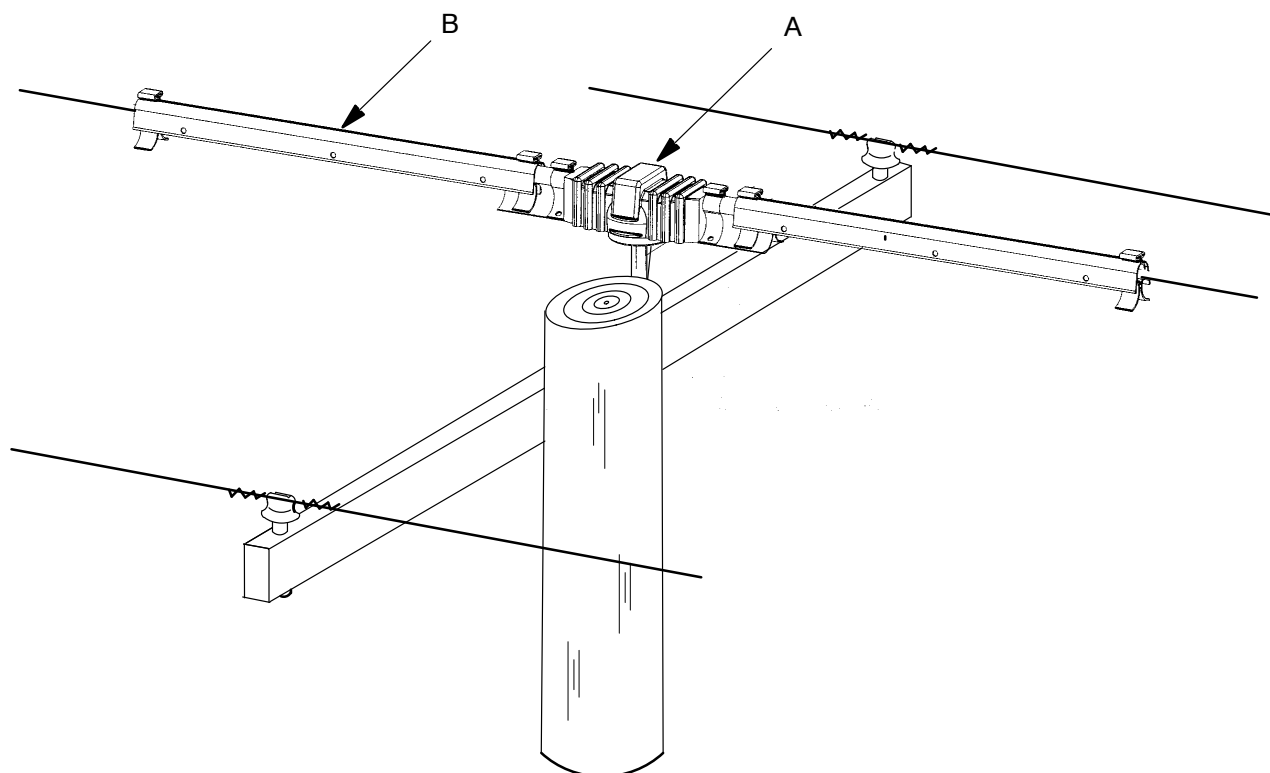
CAUTION: AT TEMPERATURES BELOW 0° F THE CUTOUT COVERS BECOME RIGID AND LOSE THEIR FLEXIBILITY. INSTALLING THE COVERS WITH A HOTSTICK MAY CAUSE THE COVERS TO BREAK.

NOTES:

1. Can be installed with live line tools.
2. Refer to Dist. Std. 10 12 01 ** for cutout installation.
3. The cover is intended for wildlife outage only.
4. Install the cutout cover from the front side. Push the cutout cover around the conductors. Pull the cover down until the interior fingers fully engage the sleet hood.

	Std. / Stk. No.	Description	05 15 10 **	01
A	23 17 411	Cover, Cutout		1
B	111	Cutout cover Installation		1

The conductor and insulator cover shown in this standard shall be used on Ameren Distribution System to prevent avian outage from distribution facilities where horizontal conductor spacing is less than five feet. The cover is not intended for personal protection.



01

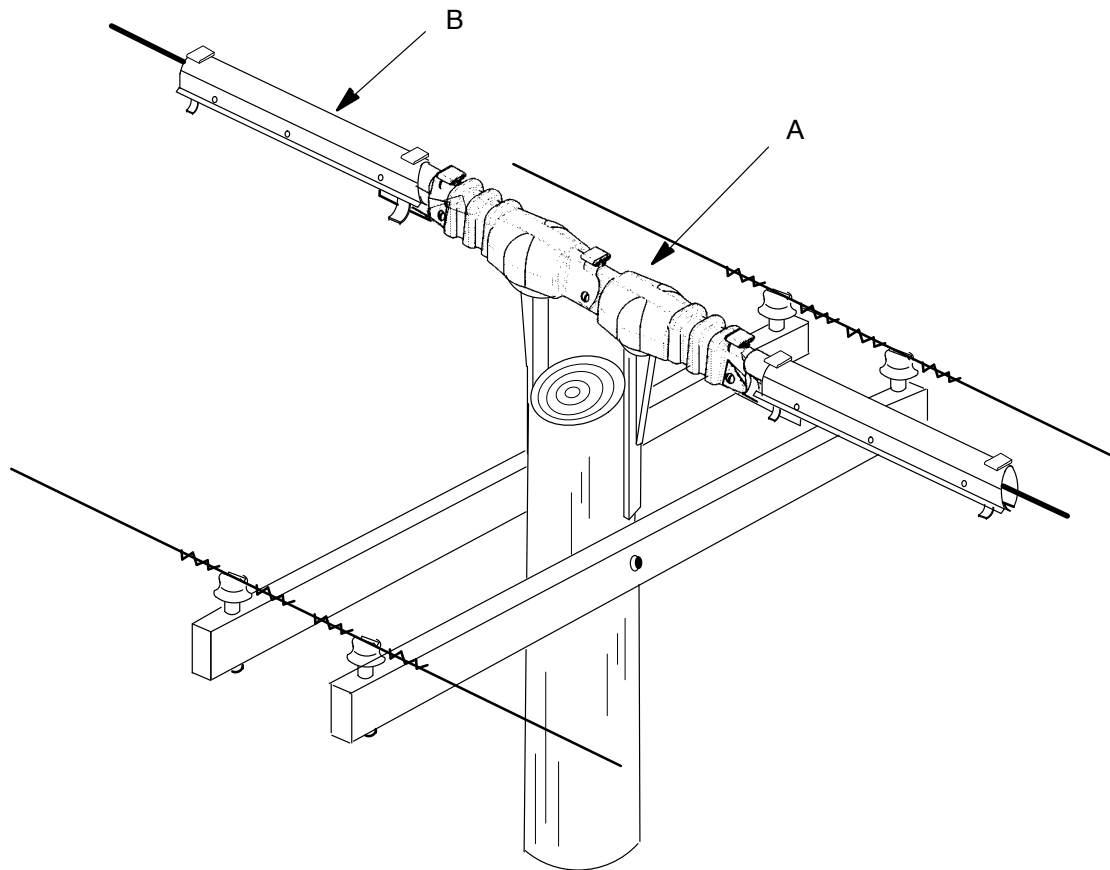
NOTES:

1. The cover is intended for wildlife outage only.
2. The cover can be installed with live line tools.
3. Cover fits #6 to 556 conductor on 55-5 pin, and 56-1 pin.
4. Install two covers on two interior-positions when existing arm has four conductor configuration.

4

	Std. / Stk. No.	Description	05 16 10 **	01	02
A	23 17 406	Cover, Single Pin Configuration		1	2
B	23 17 416	Cover, Extension Arm		2	4
C	111	Wildlife cover Installation		1	2

The wire and insulator cover shown in this standard shall be used on Ameren Distribution System to prevent avian outage from distribution facilities where horizontal conductor spacing is less than five feet. The cover is not intended for personal protection.



01

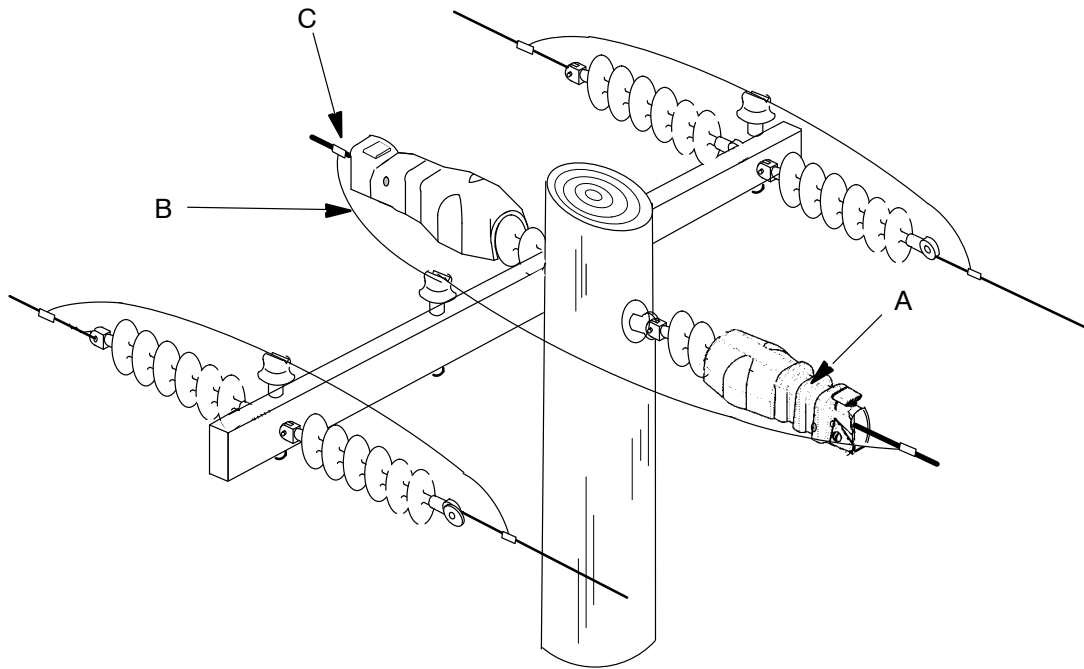
NOTES:

1. The cover is intended for wildlife outage only.
2. The cover can be installed with live line tools.
3. Install two covers on two interior-position when existing arm has four conductor configuration.

3

	Std. / Stk. No.	Description	05 16 11 **	01	02
A	23 17 408	Cover, Double pin configuration		1	2
B	23 17 416	Cover, Extension arm		1	4
C	111	Wildlife Cover Installation		1	2

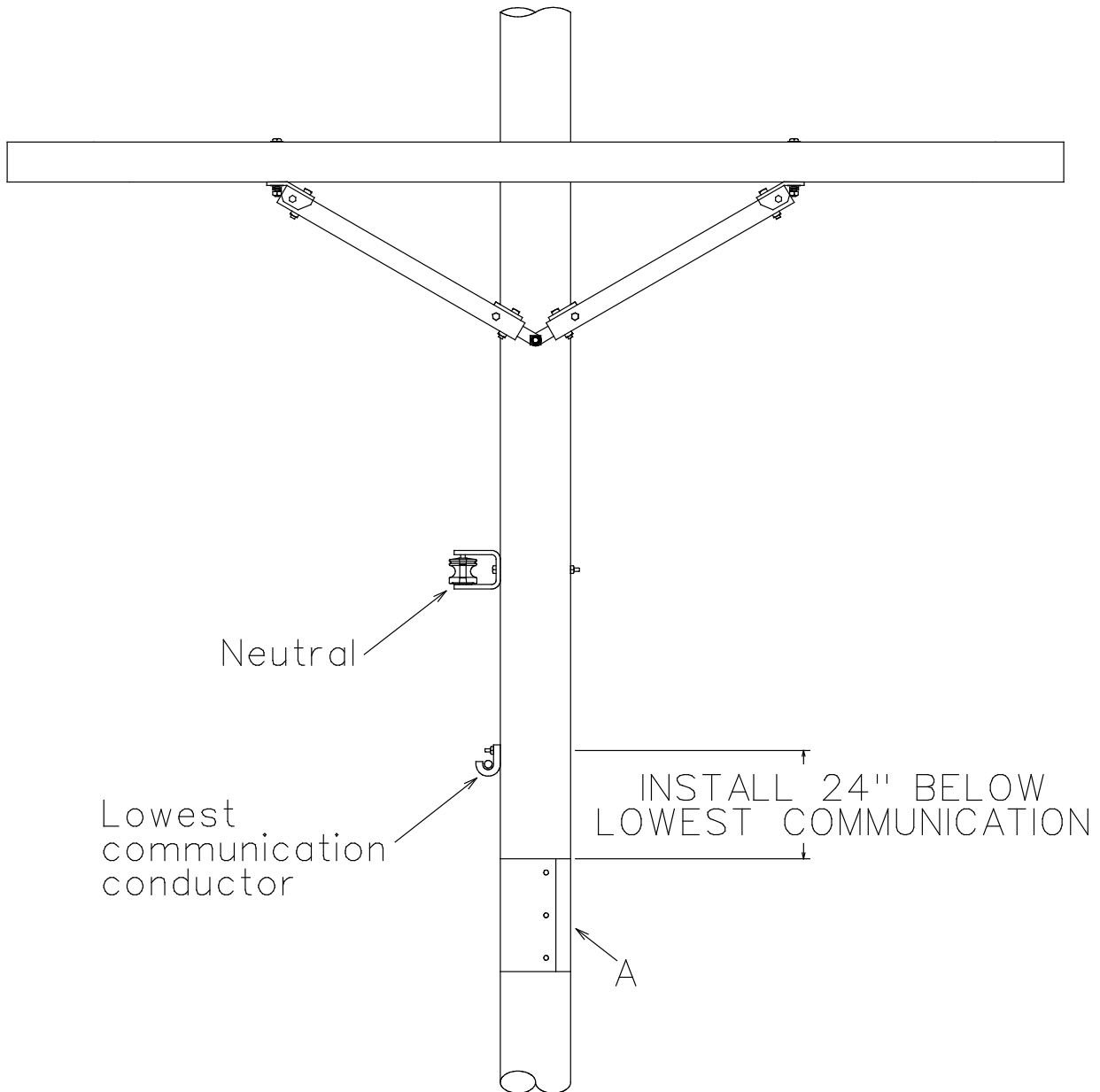
The conductor and insulator covers shown in this standard shall be used on the Ameren Distribution System to prevent wildlife outages on distribution facilities where horizontal conductor spacing is less than five feet. The cover is not intended for personal protection.



01

1. The cover is intended for wildlife protection only.
2. Item A can be installed using live line tools if required.
3. If configuration has four cross arms, use standard 05 16 12 02.
4. Item B is required if the jumper is bare conductor.

		Std. / Stk. No.	Description	05 16 12 **	01	02
2 4@	A	23 17 409	Cover, DE		2	4
	B	23 17 413	Cover, Loopover, up to 0.5" Cond. Diameter		10	20
		23 17 414	Cover, Loopover, 0.5" to 0.856" Cond. Diameter		10	20
	C	23 17 415	Tape, Insulating		1	1
	D	111	Wildlife cover Installation		1	2



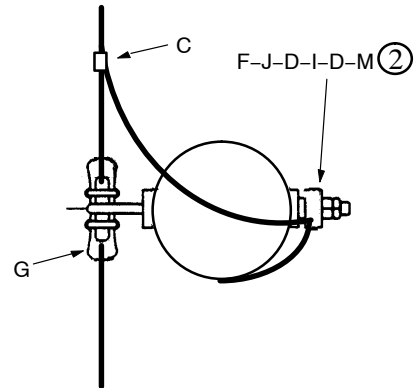
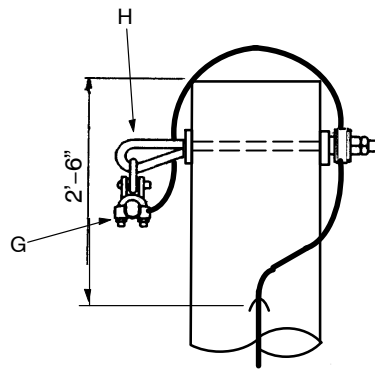
NOTES:

1. Pole wrap may be installed on poles requiring additional animal protection,
2. Pole wrap shall be installed two (2) feet below the lowest communication conductor.

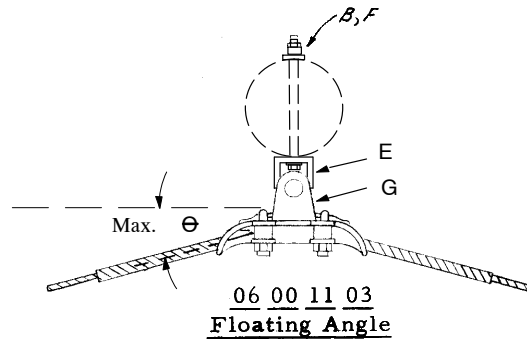
		Std. / Stk. No.	Description	05 16 13 **	01
	A	23 17 473	Animal Guard - Pole Wrap		1

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HORIZONTAL LINE POST INSULATORS – 69 KV	06-69-03**



06 00 11 04
34kV & 69kV Tangent and Angle

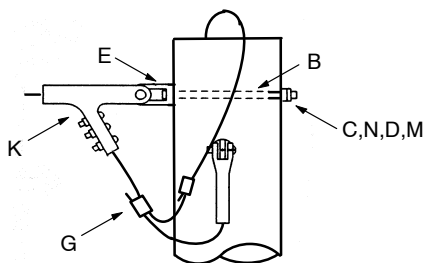


06 00 11 03
Floating Angle

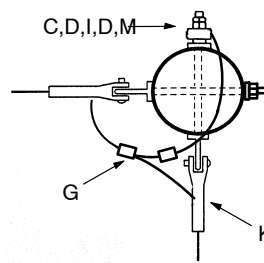
NOTE:

- For pole top static, see stds. 06 12 02, 06 12 03 **.
- Smallware must be assembled in order listed starting at pole face. Welded nut-washer included with item H not used on 04 and wood poles.

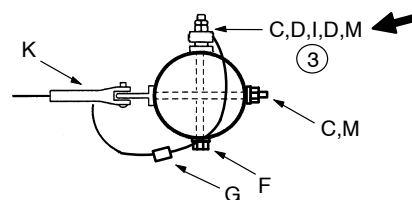
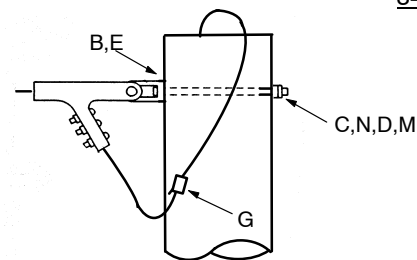
		Std. / Stk. No.	Description	06 00 11 **	03	04
@	B	23 52 097	Bolt, Machine 3/4" x 12"		1	
	C	23 68 234	Clamp, Guy Wire, 1/2" (used with 12/7 ACSR Static)		1	1
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)			1
	D	23 15 001	Nut, Square, 3/4"			2
@	E	23 59 095	Eyelet, 3/4" Bolt		1	
	F	23 66 131	Washer, Square, 3" x 3" w/ 3/4" Bolt Hole			1
	G	SC*W	Clamp, Suspension (armor over 300' span)		1	1
	H	23 68 458	Static Support, 3/4" x 14"			1
	I	23 68 496	Clip, Bonding, 3/4" Bolt Dia.			1
	J	23 66 135	Washer, Lock 3/4" Dbl. Coil Type			1
	M	23 65 042	Nut, Lock, 3/4" HDG Steel, Square			1



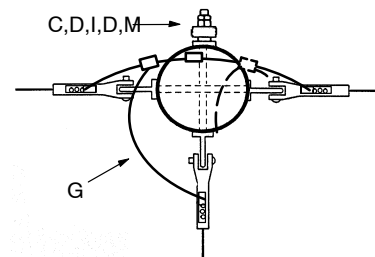
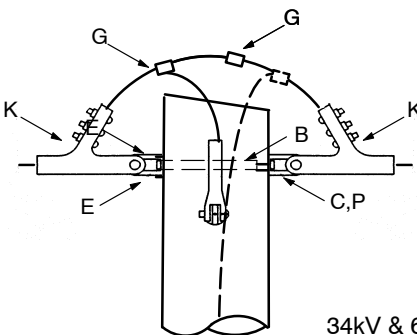
06 00 11 05
34kV & 69kV Corner Deadend



06 00 11 08
34kV & 69kV Deadend Endline



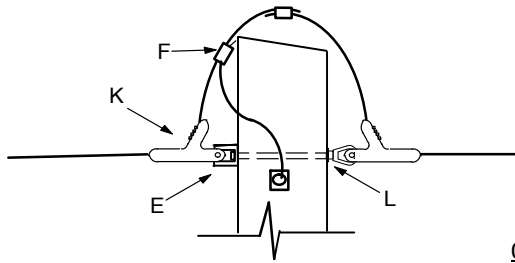
06 00 11 10
34kV & 69kV 3-Way Deadend w/o Pole Ground
06 00 11 11
34kV & 69kV 3-Way Deadend w/ Pole Ground



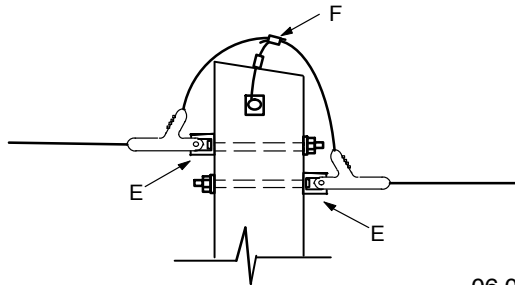
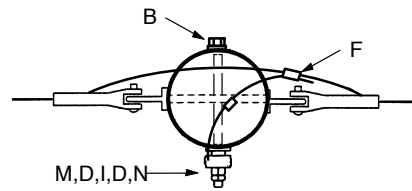
NOTES:

3. Assemble items in order listed to retain pole ground wire.

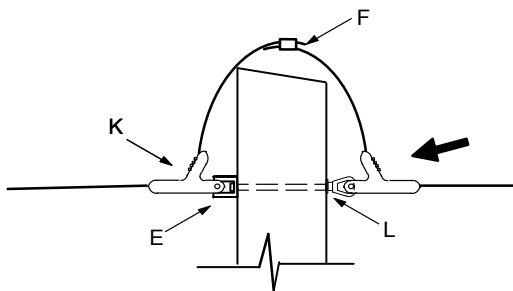
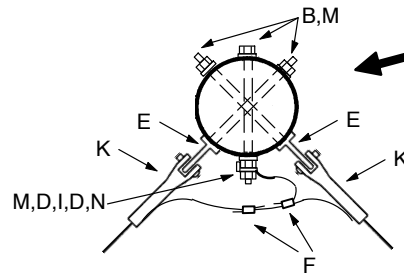
	Std. / Stk. No.	Description	06 00 11 **	05	08	10	11
@	B 23 52 097	Bolt, Mach., 3/4" x 12"		2	2	2	2
	C 23 66 031	Washer, Curved, Square, 3" x 3" w/ 3/4" Bolt Hole		2	1	2	2
	D 23 15 001	Nut, Square, 3/4"		1	1	1	2
	E 23 59 095	Eyelet, 3/4", Steel, HDG		2	1	2	2
	F 23 66 131	Washer, Square, 2 1/4" x 2 1/4" w/ Hole for 3/4" Bolt		2	2	1	1
	G 23 68 234 17 51 032	Clamp, Guy Wire, 1/2 inch (used with 12/7 ACSR Static)		2	1	2	3
		Clamp, Parallel Groove (used with 1/0 AAAC Static)		2	1	2	3
	I 23 68 496	Clip, Bonding, 3/4" Bolt Dia.		1	1		1
	K DEC*W	Clamp, Deadend		2	1	3	3
	M 23 65 042	Nut, Lock, 3/4" HDG Steel, Square		2	1	1	1
	N 23 66 135	Washer, Lock, 3/4", Dbl Coil Type		2	1	1	1
	P 23 65 018	Eyenuit, 3/4" Bolt				1	1



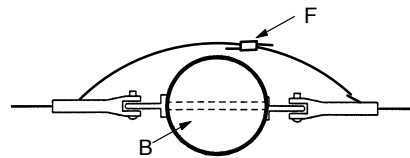
06 00 11 06
34kV & 69kV Deadend Tangent



06 00 11 07
34kV & 69kV Deadend Angle



06 00 11 09
34kV & 69kV Deadend Tangent

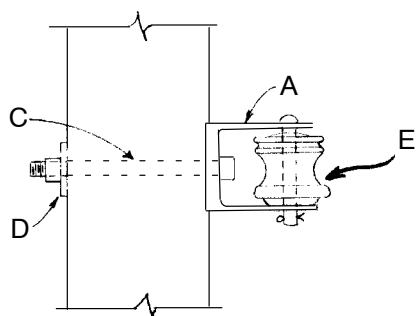


NOTES:

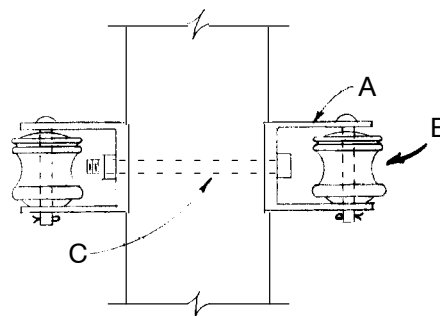
- Standard 06 00 11 09 used on switch pole ground wire not installed.

④

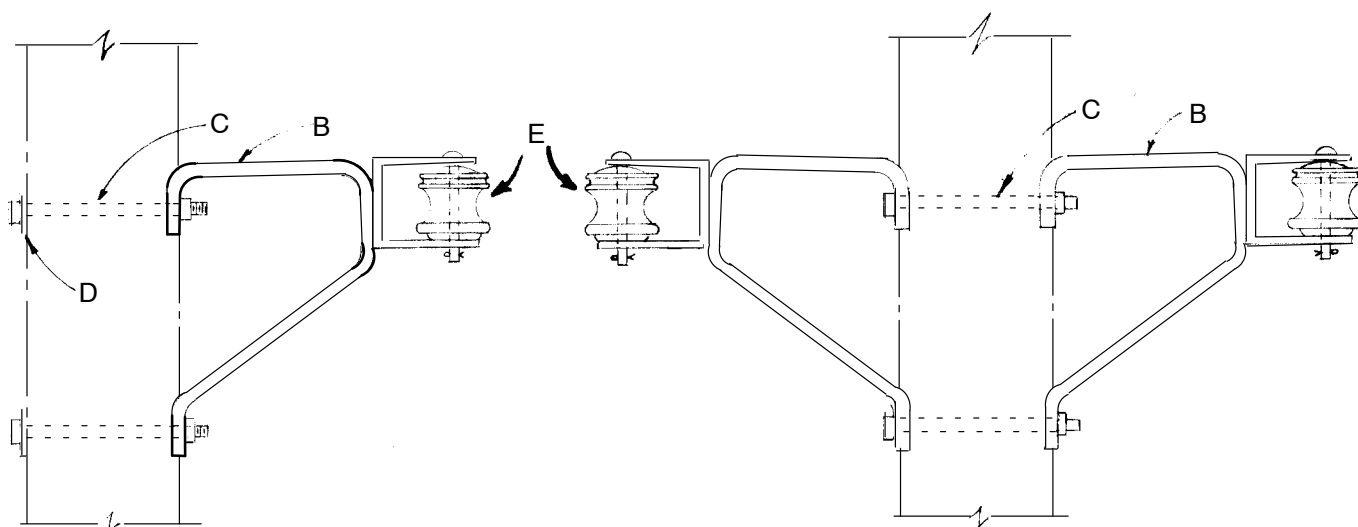
		Std. / Stk. No.	Description	06 00 11 **	06	07	09
@	B	23 52 097	Bolt, Mach., 3/4" x 12"		2	3	1
	D	23 65 059	Nut, Square, 3/4"		1	1	
	E	23 59 095	Eyelet, 3/4" Bolt		1	1	1
	F	23 68 234	Clamp, Guy Wire, 1/2" (used with 12/7 ACSR Static)		2	2	1
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)		2	2	1
	I	23 68 496	Clip, Bonding, 3/4" Bolt Dia.		1	1	
	K	DEC*W	Clamp, Deadend		2	2	2
	L	23 65 018	Eyenuit, 3/4" Bolt		1		1
	M	23 66 031	Washer, Square, Curved, 3" x 3" w/ 3/4" Bolt Hole		2	2	2
@	N	23 65 042	Nut, Lock, Square, Steel, HDG, 3/4"		1	2	



06 01 01 01
Secondary Clevis



06 01 01 02
Double Secondary Clevis



06 01 01 03
Single Clevis Extension Bracket

06 01 01 04
Dble - Single Clevis Extension Bracket

	Std. / Stk. No.	Description	06 01 01 **	01	02	03	04
A	23 06 040	Clevis, Sec. Insulator	1	2			
B	23 06 067	Brkt., Ext., 1 Clevis			1	2	
C	23 52 063	Bolt, Mach., 5/8" x 10"	1	1	2	2	
D	23 66 027	Washer, Square, 5/8"	1		2		
E	25 59 044	Insulator, Spool	1	2	1	2	

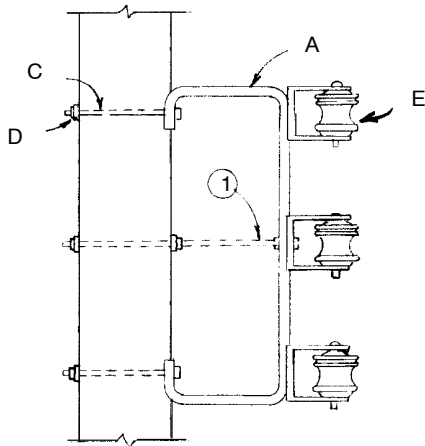
INSULATORS AND SUPPORTS

3 Wire Secondary Rack

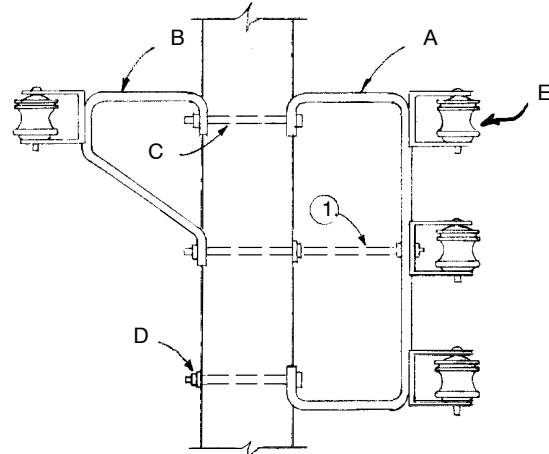
0 To 750 Volts

06 01 03 **

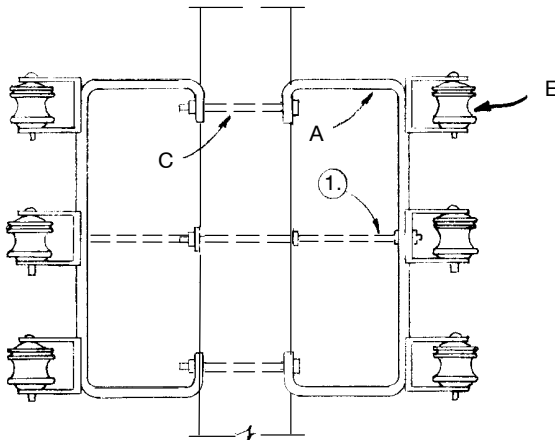
Sheet 1 of 1



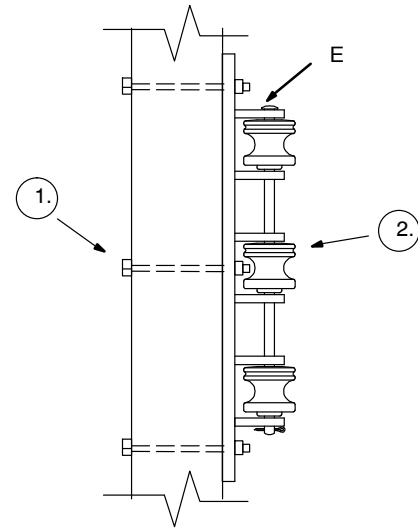
06 01 03 01
3 Clevis Extension Bracket



06 01 03 02
3 Clevis Extension Bracket
w/Single Clevis Bracket



06 01 03 03
Dble. - 3 Clevis Extension Bracket



06 01 03 04
3 Wire Secondary Rack

NOTES:

1. Reinforce with D.A. bolt for deadends or line angles in excess of 5°. Direction of center bolt can be reversed if threaded end interferes with clevis insulator.
2. Rack mounted directly on pole should be used in all cases unless climbing space requires use of the extension.

	Std. / Stk. No.	Description	06 01 03 **	01	02	03	04
	A 23 06 054	Bracket, Ext. 3 Clevis		1	1	2	-
	B 23 06 067	Bracket, Ext. 1 Clevis		-	1	-	-
	C 23 52 063	Bolt Mach., 5/8" x 10"		2	2	2	2
	D 23 66 027	Washer Square 5/8"		2	1	-	2
	E 25 59 044	Insulator, Spool		3	4	6	3
	F 23 11 001	Rack, Secondary, 3 Spool		-	-	-	1
@	G 23 53 014	Bolt, DA, 5/8" x 26"				1	
@	23 53 003	Bolt, DA, 5/8" x 18"		1	1		

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DCG
REV. NO: 4
REV. DATE: 7/05/11

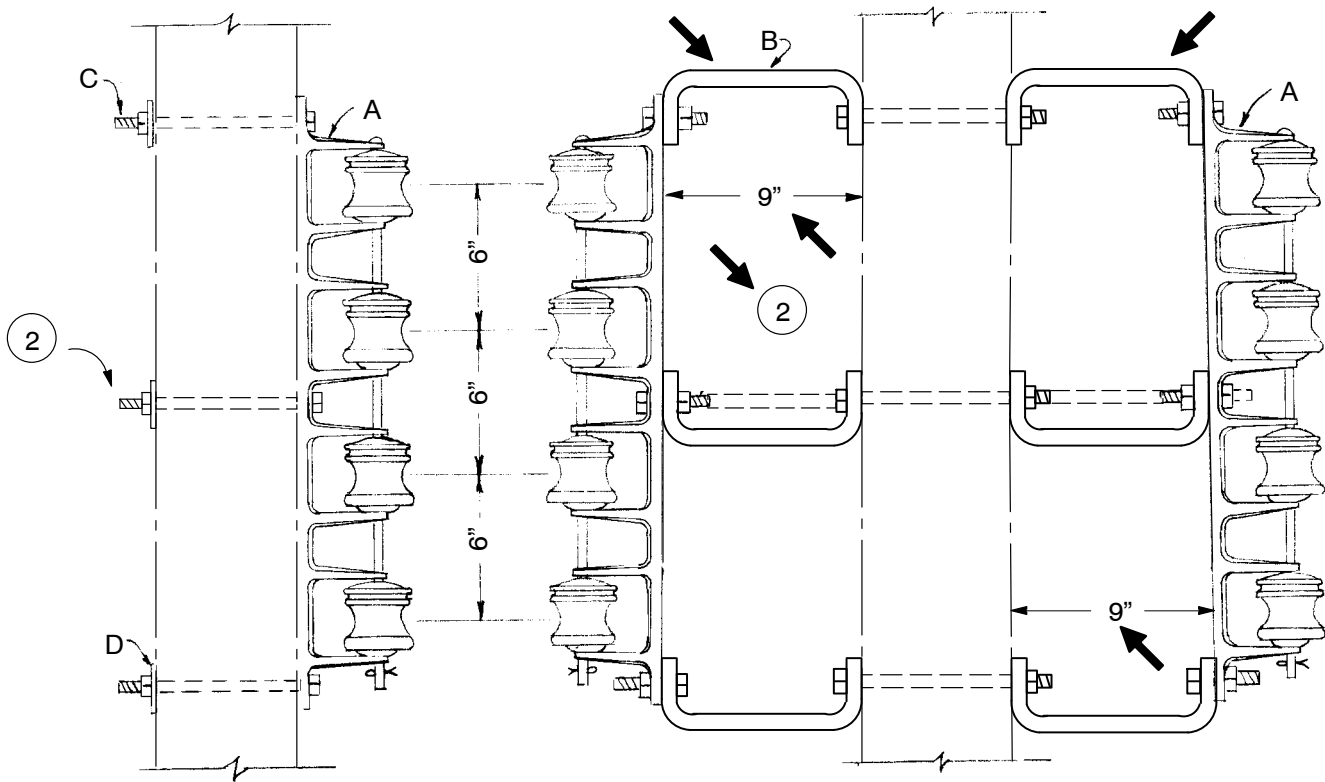
INSULATORS AND SUPPORTS

4 Wire Secondary Rack

0 To 750 V.¹

06 01 07 **

Sheet 1 of 1



06 01 07 01
4 Wire Secondary Rack

Single - 06 01 07 02
Double - 06 01 07 03
4 Wire Secondary Rack On Extension

NOTES:

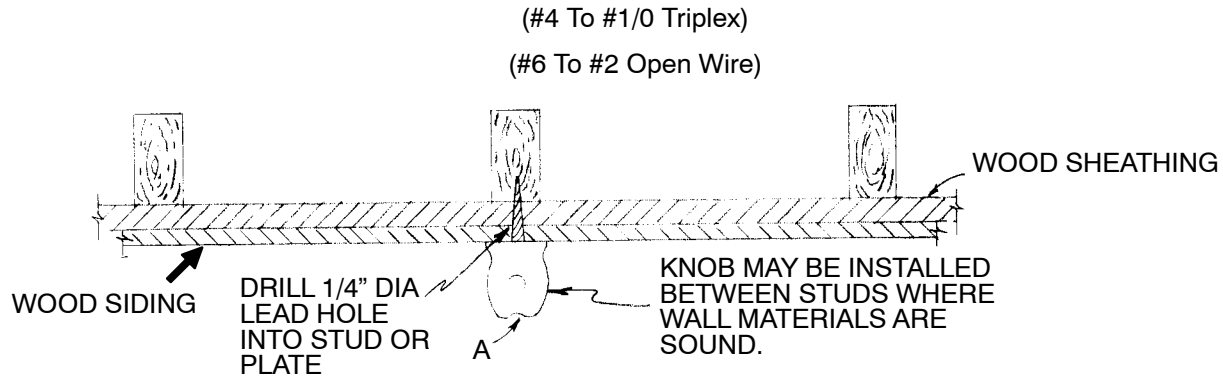
1. Normally used on 120/208 volt circuits.
2. Reinforce with D.A. bolt for line angles in excess of 5°.

	Std. / Stk. No.	Description	06 01 07 **	01	02	03
A	23 11 004	Rack, Sec. 4 Spool		1	1	2
B	23 56 056	Brkt., Ext., w/o Clevis			3	6
C	23 52 063	Bolt, Mach., 5/8" x 10"		2	2	2
D	23 66 027	Washer Square, 5/8"		2	2	2
E	23 52 049	Bolt Mach. 5/8" x 2"			2	4
F	23 53 014	Bolt D.A., 5/8" x 26"				1
	23 53 003	Bolt D.A., 5/8" x 18"			1	
G	25 59 044	Insulator, Spool		4	4	8

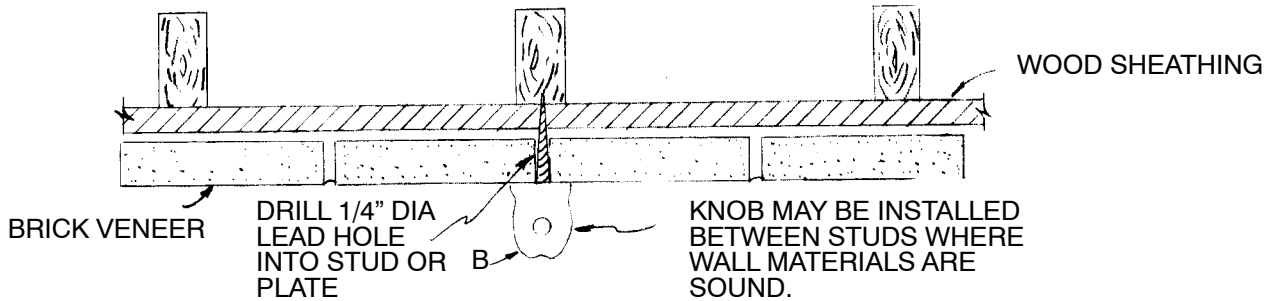
INSULATORS AND SUPPORTS
Service Attachment on Building and Mast
0 To 600 Volts

06 01 50 **

Sheet 1 of 3



06 01 50 01
Wood Siding



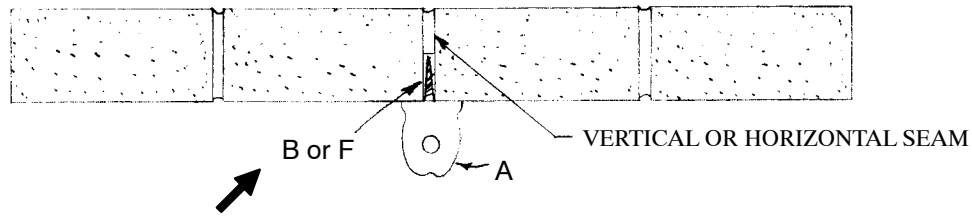
06 01 50 02
Brick Veneer or Composition Shingles

	Std. / Stk. No.	Description	06 01 50 **		01	02
A	23 06 077	Ins, Wire Holder, 2-1/4"			1	
B	23 17 241	Ins, Wire Holder, 3-1/2"				1

INSULATORS AND SUPPORTS
Service Attachment on Building and Mast
0 To 600 Volts

06 01 50 **

Sheet 2 of 3

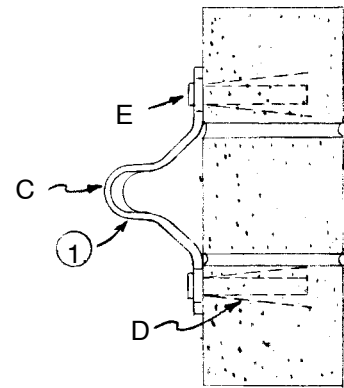
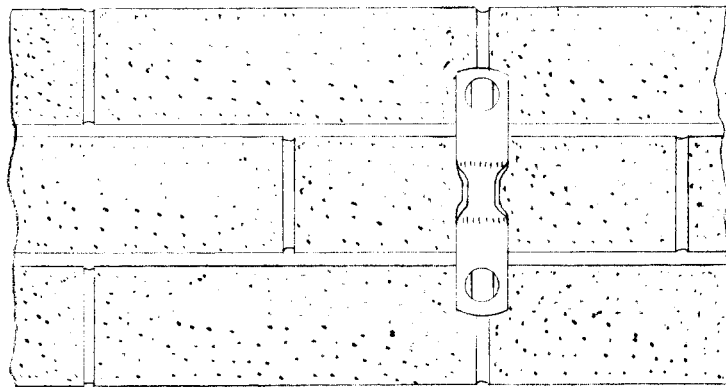


06 01 50 03

06 01 50 04

Solid Masonry – Brick Or Cement

#4 To #2 Triplex – #6 To #2 Open Wire



1/0 Al. MSGR – 06 01 50 05

4/0 Al. MSGR – 06 01 50 06

Solid Masonry – Brick Or Cement

#1/0 Or Larger Triplex Cable (2)

		Std. / Stk. No.	Description	06 01 50 **	03	04	05	06
3	A	23 06 077	Ins., Wire Holder 2-1/4"		1	1		
	B	21 51 055	Shield, Exp., #22 Screw			1		
	C	23 06 057	Bracket, Wall Triplex				1	1
	D	21 51 016	Shield, Exp., 3/8" Bolt				2	
		21 51 018	Shield, Exp., 1/2" Bolt					2
	E	23 52 194	Bolt, Mach., 3/8" x 3"				2	
		23 52 034	Bolt, Mach., 1/2" x 4"					2
4	F	21 51 181	Shield, Exp., for 5/16 – 9 Lag Screw		1			

1. Mount bracket vertically on seams so that it spans one brick.
2. Also use for smaller services where due to nature of masonry porcelain knobs are unsatisfactory.
3. To be used with porcelain body wireholder item A.
4. To be used with nylon body wireholder item A.

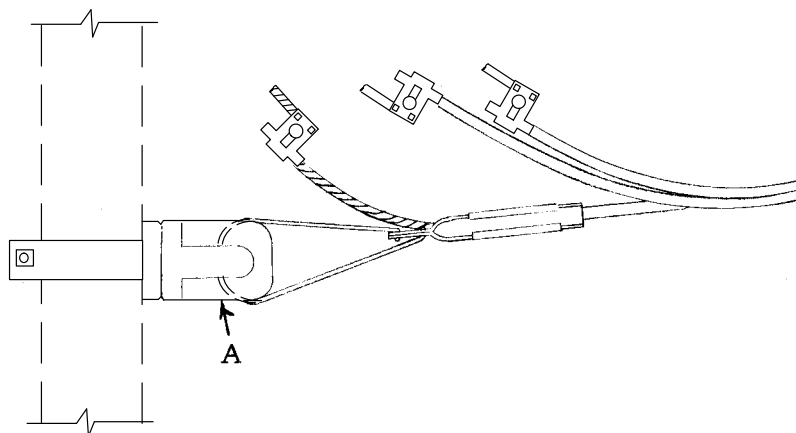
**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:DCG
REV. NO: 2
REV. DATE: 08/19/11

INSULATORS AND SUPPORTS
Service Attachment on Building and Mast
0 To 600 Volts

06 01 50 **
Sheet 3 of 3



06 01 50 07

06 01 50 08

SERVICE MAST
(1 1/4" – 2 1/2" DIA. CONDUIT)

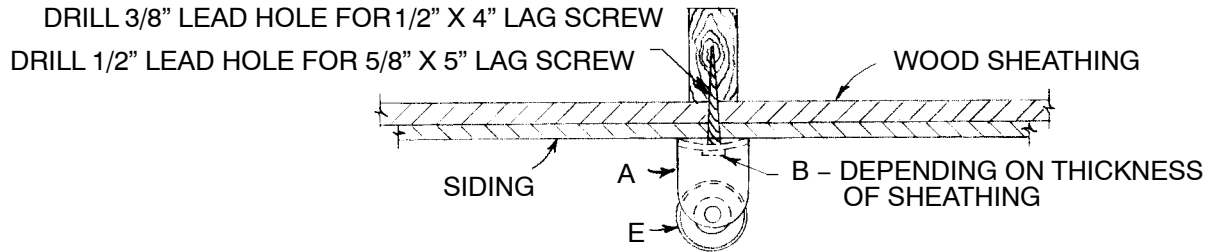
SERVICE MAST
(3" – 4" DIA. CONDUIT)

		Std. / Stk. No.	Description	06 01 50 **	07	08
	A	23 06 075	Insulator, Wire Holder, 1-1/4" – 2-1/2" Mast		1	
	B	23 06 082	Insulator, Wire Holder, 3"-4" Mast			1

INSULATORS AND SUPPORTS
Service Attachment on Building
0 To 600 Volts – (#6 Thru 750 MCM Conductors)

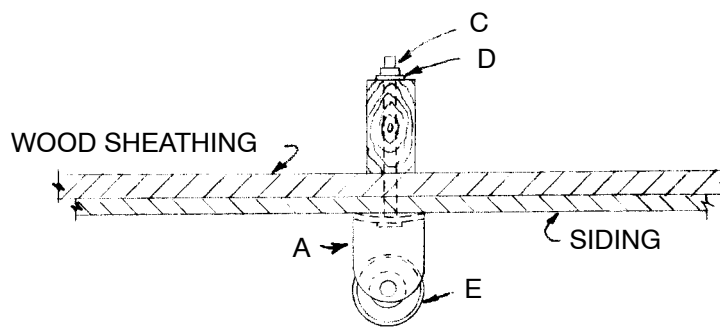
06 01 56 **

Sheet 1 of 1



06 01 56 01

Wood Siding, Brick Veneer
Or Composition Shingles



06 01 56 02

Wood Siding, Brick Veneer
Or Composition Shingles

(Normally used where stud is accessible from the inside.)

	Std. / Stk. No.	Description	06 01 56**	
A	23 06 040	Clevis, Secondary Insulator	01	02
@B	23 60 007	Screw, Lag, 1/2" x 4" or	1	
	23 60 011	Screw, Lag, 5/8" x 5"		
C	23 52 061	Bolt, Mach., 5/8" x 8"		1
D	23 66 027	Washer, Square, 5/8"		1
E	25 59 044	Insulator, Spool	1	1

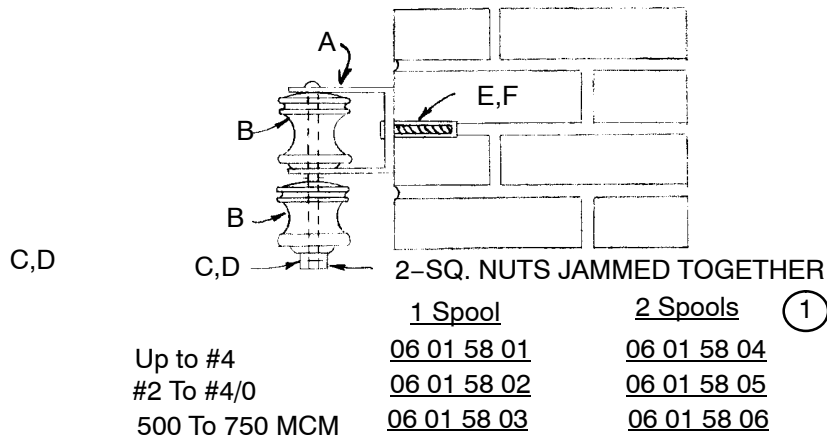
INSULATORS AND SUPPORTS

Service Attachment on Building

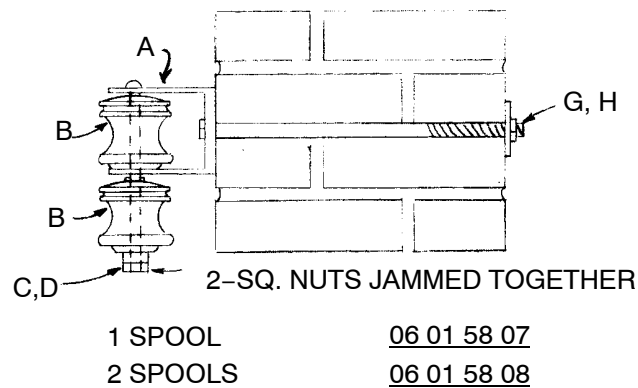
0 To 600 Volts

06 01 58 **

Sheet 1 of 1



Solid Masonry – Brick Or Cement



Solid Masonry – Brick Or Cement

(Use only when specified)

	Std. / Stk. No.	Description	06 01 58**	01	02	03	04	05	06	07	08
A	23 06 040	Clevis, Secondary Insulator		1	1	1	1	1	1	1	1
B	25 59 044	Insulator, Spool, 750 V.		1	1	1	2	2	2	1	2
C	23 52 061	Bolt, Mach., 5/8" x 8"					1	1	1		1
D	23 65 011	Nut, Square, 5/8"					1	1	1		1
E	21 51 016	Shield, Exp., 3/8"	1				1				
	21 51 018	Shield, Exp., 1/2"		1				1			
	21 51 019	Shield, Exp., 5/8"				1			1		
F	23 52 194	Bolt, Mach., 3/8" x 3"	1				1				
	23 52 034	Bolt, Mach., 1/2" x 4"			1			1			
	23 52 200	Bolt, Mach., 5/8" x 4"				1			1		
G	23 52 066	Bolt, Mach., 5/8" x 14"								1	1
H	23 66 027	Washer, Square, 5/8"								1	1

1. The double spool insulator is to be used only for attaching network cable to buildings excluding deadend constructions.

DISTRIBUTION
CONSTRUCTION STANDARDS



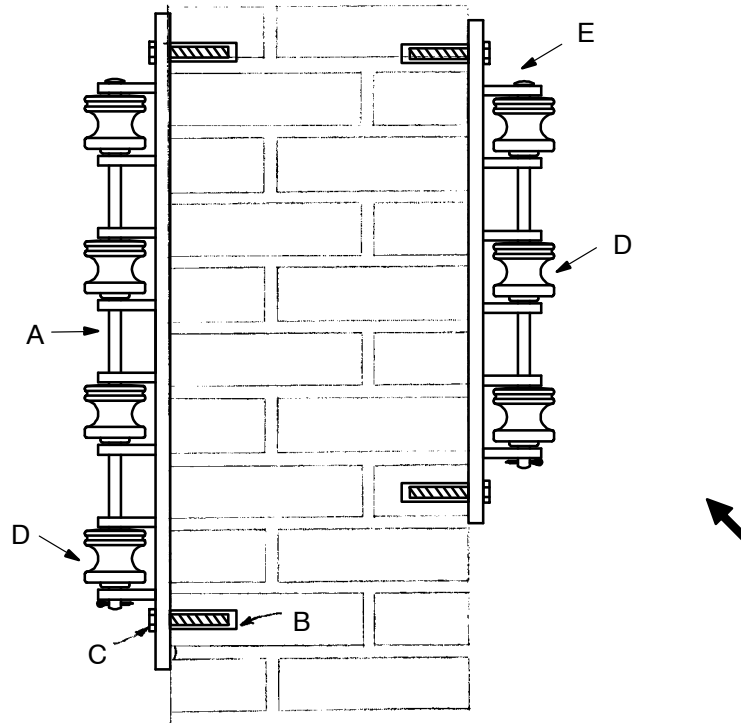
ENG: DCG
REV. NO: 1
REV. DATE: 9/18/00
REAFFIRMED DATE: 10/24/11

INSULATORS AND SUPPORTS

Service Attachment on Building

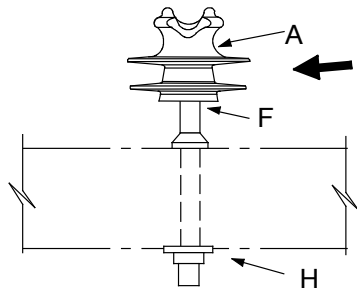
0 To 600 Volts

➔ **06 01 60 ****
Sheet 1 of 1

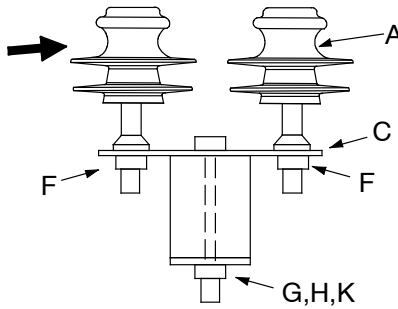


06 01 60 01, 4 Wire 06 01 60 02, 3 Wire
Solid Masonry – Brick Or Cement
(For fastening conductors up to 750 kcmil along walls)

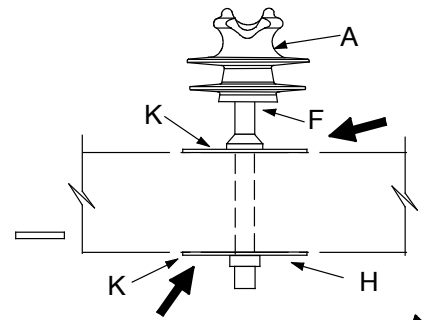
	Std. / Stk. No.	Description	06 01 60	01	02
A	23 11 004	Secondary Rack, 4 Wire		1	
B	21 51 016	Shield Expansion, 3/8"		2	2
C	23 52 194	3/8" x 3" Machine Bolt		2	2
D	25 59 044	Insulator, Spool		4	3
E	23 11 001	Secondary Rack, 3 Wire			1



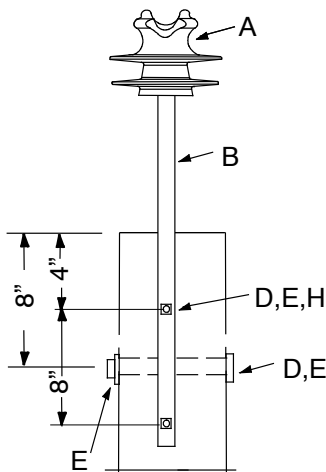
06 12 01 01
Sgl Pin and Insulator - Wood Arm



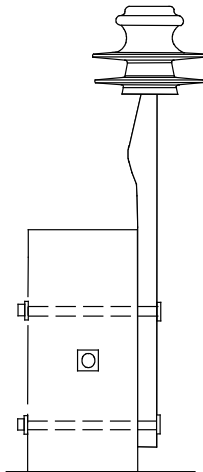
06 12 01 11
Dbl Pin and Insulator - FG Arm



06 12 01 12
Sgl Pin and Insulator-FG Arm



06 12 01 02
24" Sgl Pole Top Pin & Ins.

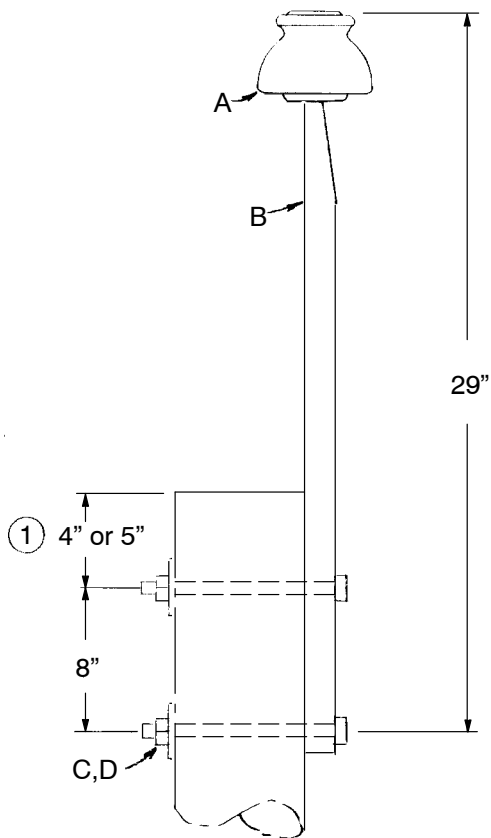


06 12 01 13
24" Dbl Pole Top Pin & Ins.

Notes:

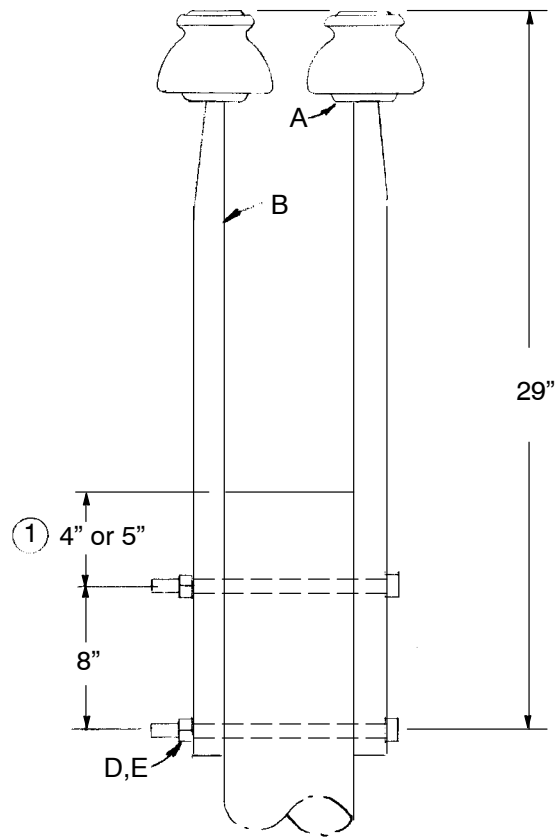
1. The 2" washer received with the pin should be used after the 4" washer to eliminate the coil washer from sliding inside the 4" washer.

		Std. / Stk. No.	Description	06 12 01 **	XA			Pole Top	
					01	11	12	02	13
	A	25 05 069	Insulator, Pin Type		1	2	1	1	2
	B	23 62 156	Pin, Pole Top, 24"					1	2
	C	23 77 212	Plate, Dbl Pin			1			
	D	23 52 065	Bolt, Mach., 5/8" x 12"					3	3
	E	23 66 031	Washer, Curved, 3/4"					4	2
	F	23 62 028	Pin, Insulator, Long Shank		1		1		
		23 62 136	Pin, Insulator, Short Shank			2			
	G	23 52 318	Bolt, Mach., 5/8" x 6"			1			
	H	23 66 134	Washer, Lock, Galvanized, 5/8" dbl coil type		1	1		3	3
	K	23 66 132	Washer, Flat, Sq., 4" x 4", w13/16" hole			1	2		



06 12 03 01

30" Pole Top & Insulator



06 12 03 02

30" Double Pole Top & Insulator

NOTES:

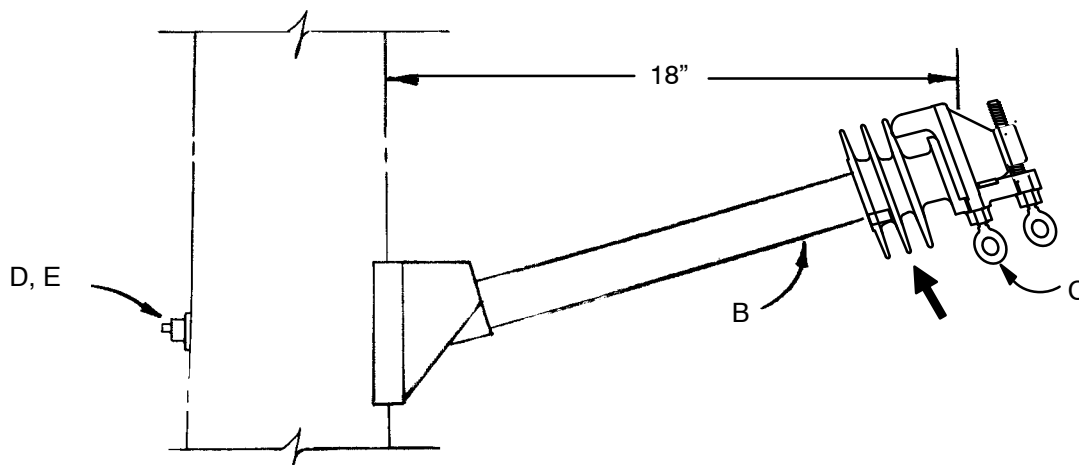
1. This dimension will vary according to pole top drilling.

	Std. / Stk. No.	Description	06 12 03 **	01	02
A	25 05 069	Insulator, Pin Type		1	2
B	23 62 115	Pin, Pole Top, 30"		1	2
C	23 52 063	Bolt , Mach., 5/8" x 10"		2	2
D	23 66 027	Washer Square 5/8"		2	

INSULATORS AND SUPPORTS
Arm – Training, Fiberglass
15 kV

06 12 20 04

Sheet 1 of 1



		Std. / Stk. No.	Description	06 12 20 04	
	B	23 12 123	Bracket, FG, Standoff, LD, 18"		1
	C	25 05 143	Insulator, Vise-Top, 15kV		1
	D	23 52 065	Bolt, Mach., 5/8" x 12"		1
	E	23 66 027	Washer, Square, 5/8"		1

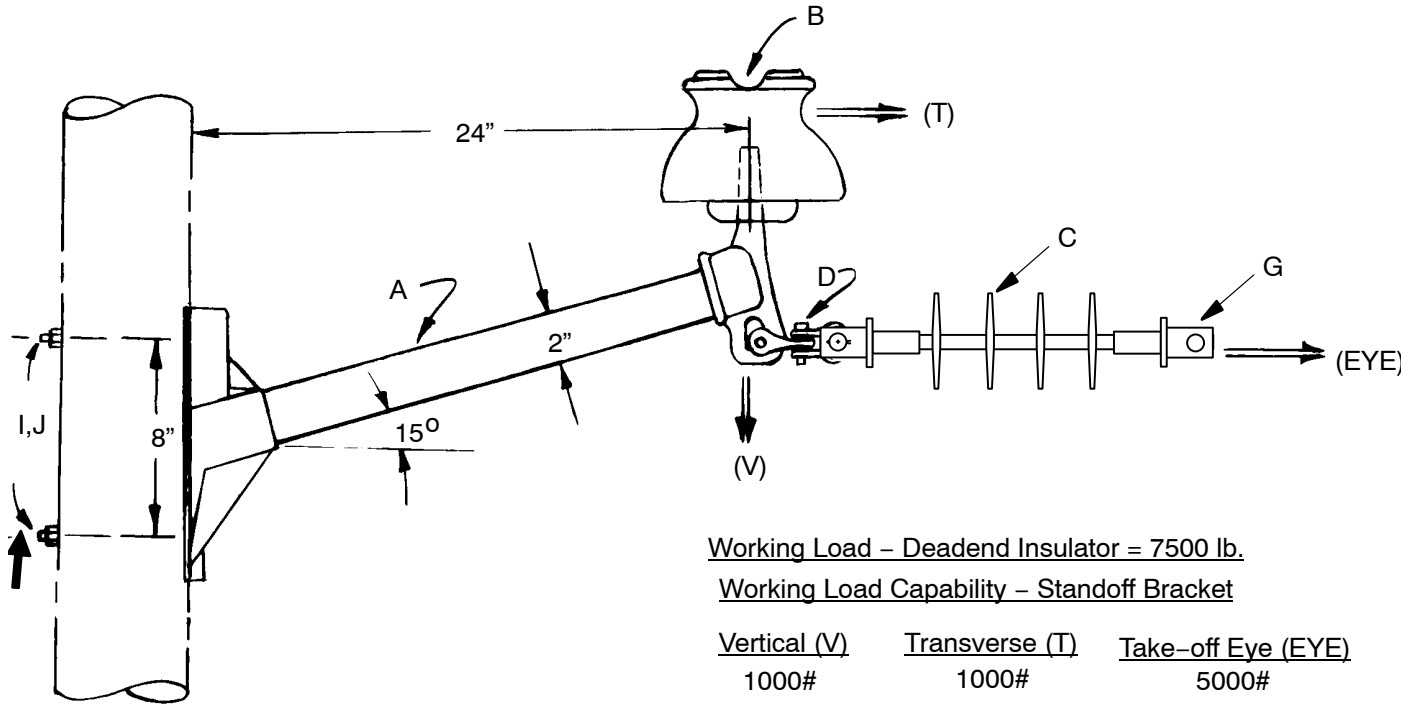
INSULATORS AND SUPPORTS

Assembly – Fiberglass Standoff

12 kV ←

06 12 21 **

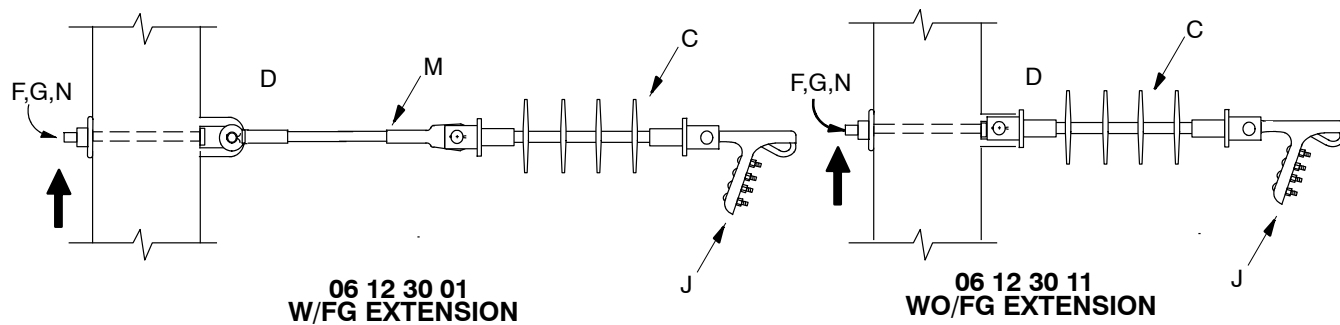
Sheet 1 of 1



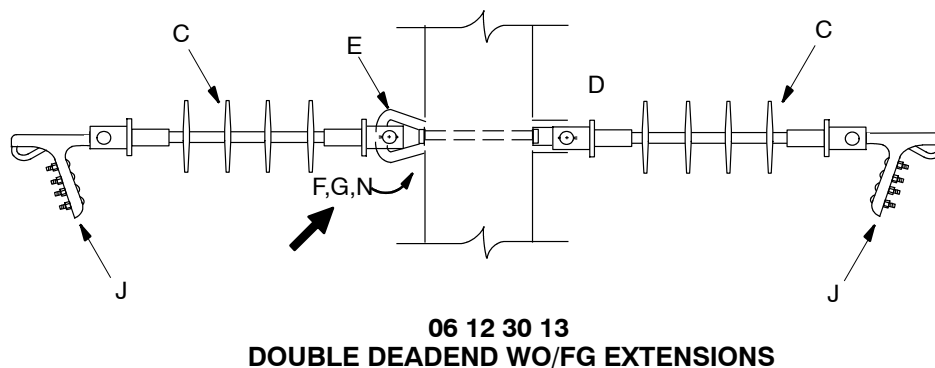
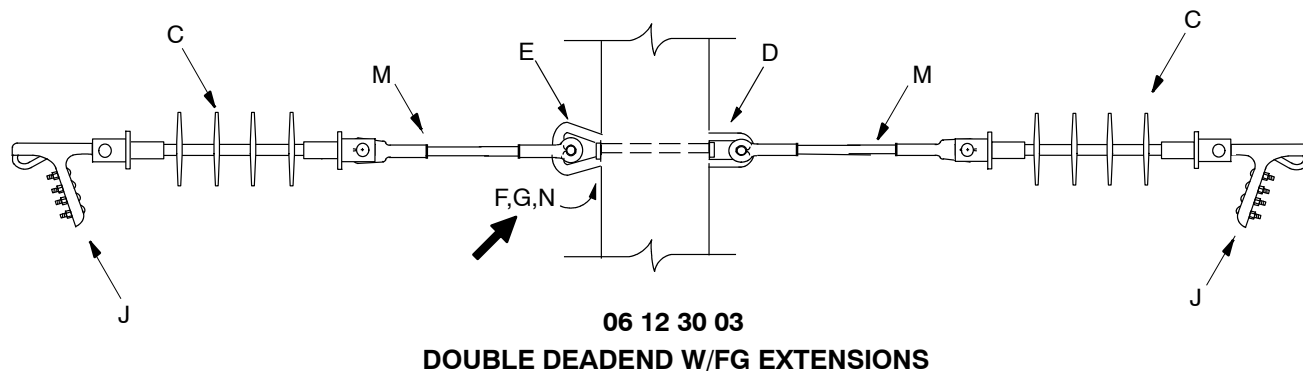
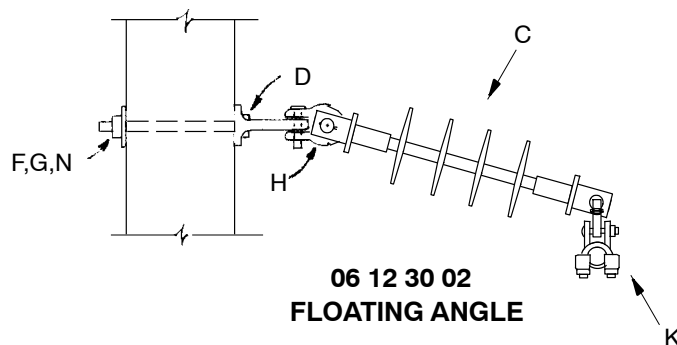
Fiberglass Standoff Assembly
with Full Tension Take-off Capability

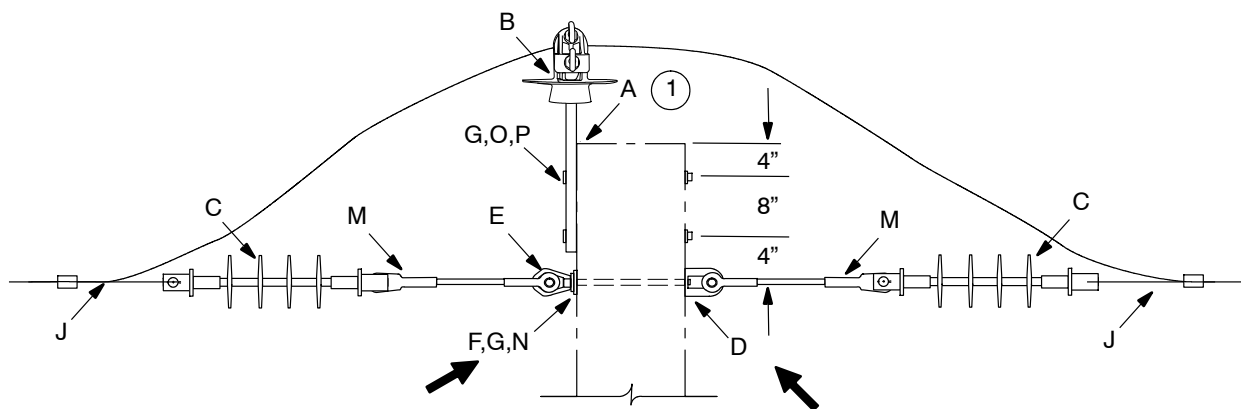
- 06-12-21-04 Single Insulator Only
- 06-12-21-05 Single Insulator & Deadend
- 06-12-21-06 Single Deadend Only

		Std. / Stk. No.	Description	06 12 21 **	12kV		
					04	05	06
@	A	23 06 085	Bracket, Standoff, 24" Fiberglass		1	1	1
	B	25 05 069	Insulator – Pin, 12kV		1	1	
	C	25 06 052	Insulator – Deadend, 12kV			1	1
	D	23 68 181	Shackle – Deadend			2	2
	G	DEC*W	Deadend Clamp			1	1
	I	23 52 065	Bolt, Mach, 5/8" x 12"		2	2	2
	J	23 66 027	Washer, Square, 5/8"		2	2	2

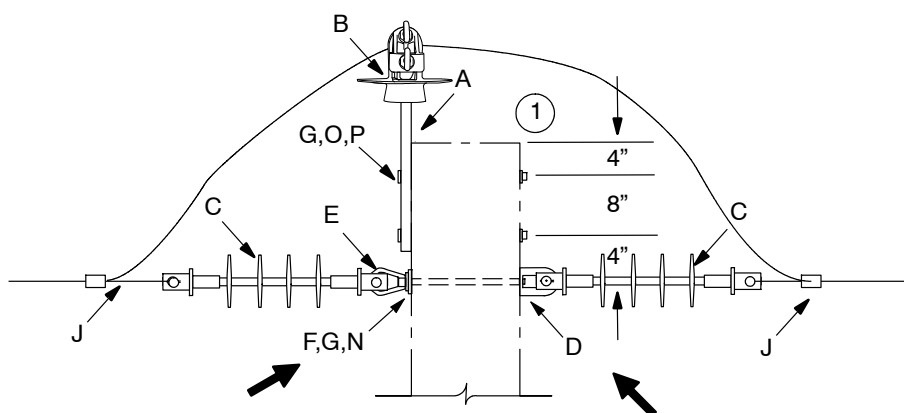


STRAIGHT DEADEND





06 12 30 04
W/FG Extension



06 12 30 14
WO/FG Extension
POLE TOP LOOPOVER

NOTES:

- For jumper support applications, hand tighten only and do not twist the eye off.

	Std. / Stk. No.	Description	06 12 30 **	01	02	03	04	11	13	14
	A 23 62 156	Pin, Pole Top					1			1
	B 25 05 143	Insulator, Vise- Top, 15kV					1			1
	C 25 06 052	Insulator, Suspension, 15kV		1	1	2	2	1	2	2
	D 23 59 095	Eyelet, 3/4"		1	1	1	1	1	1	1
	E 23 65 018	Eyenuit, 3/4"				1	1		1	1
	F 23 52 097	Bolt, Mach., 3/4" x 12"		1	1	1	1	1	1	1
	G 23 66 031	Washer, Curved , 3/4"		1	1	1	3	1	1	3
	H 23 68 181	Shackle, Deadend			1					
@	J DEC*W	Conductor Deadend clamp		1		2	2	1	2	2
@	K SC*W	Suspension Clamp			1					
	M 25 56 076	Insulator, Guy Strain, F/G, 26", 15k UTS		1		2	2			
	N 23 65 042	Nut, Lock, Square, Galv, 3/4"		1	1	1	1	1	1	1
	O 23 52 065	Bolt, Mach., 5/8" X 12"					2			2
	P 23 66 134	Washer, Lock, Galvanized, 5/8", Dbl Coil Type					2			2

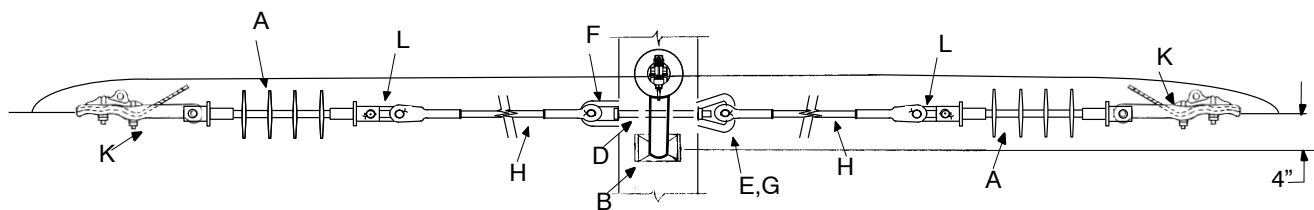
INSULATORS AND SUPPORTS

Deadends on Pole – Double

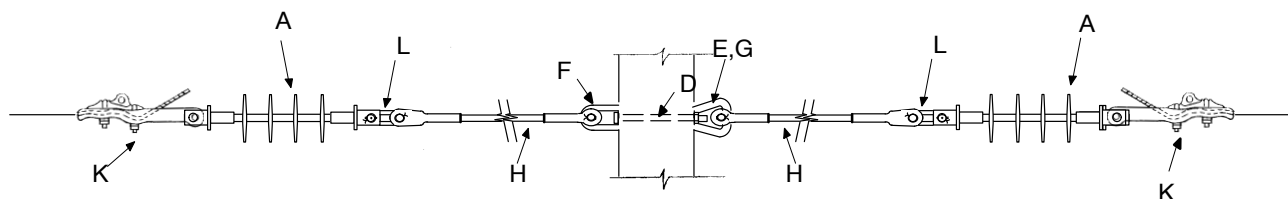
12 kV

06 12 33 **

Sheet 1 of 1

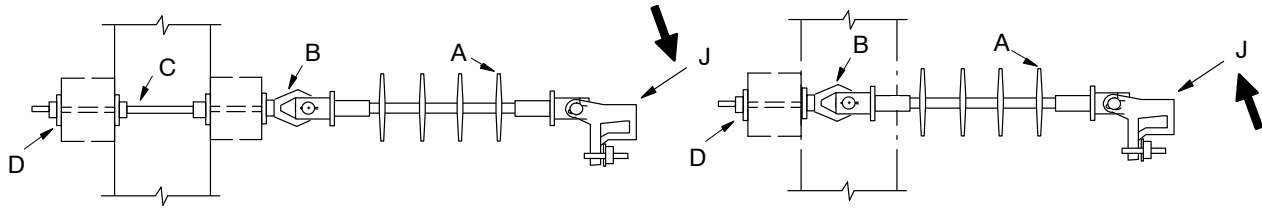


06 12 33 01
LOOPAROUND



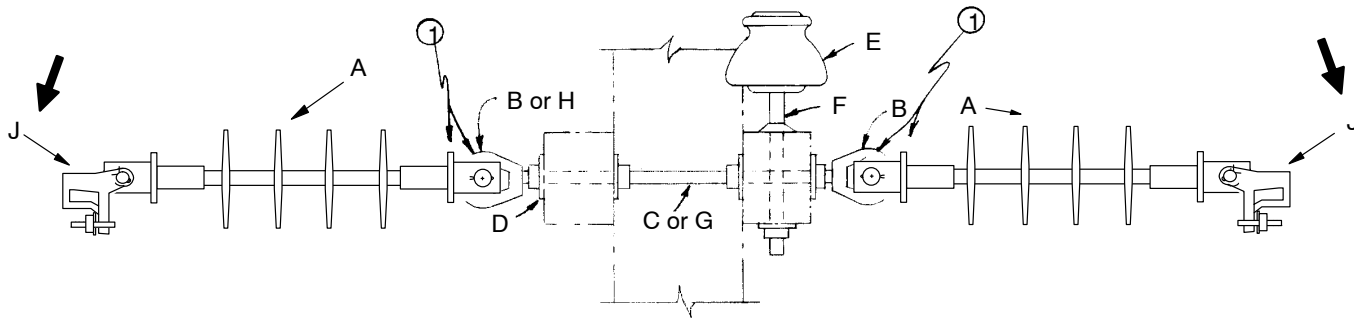
06 12 33 02
DOUBLE DEADEND WITH EXTENSIONS

		Std. / Stk. No.	Description	06 12 33 **	01	02
@	A	25 06 052	Ins., Suspension, 15 kV		2	2
	B	06 12 20 04	Brkt, FG, Standoff, LD, 18", w Vice-Top Insulator		1	
	D	23 52 097	Bolt, Mach., 3/4" X 12"		1	1
	E	23 66 031	Washer, Square, 3/4"		1	1
	F	23 59 095	Eyelet, 3/4"		1	1
	G	23 65 018	Eyenuit, 3/4"		1	1
@	H	25 56 076	Ins, Guy Strain, F/G, 26", 15 K UTS		2	2
	K	DE C*W	Clamp, Conductor, Deadend		2	2
	L	23 68 249	Link, Chain, Oval, 1"x2-1/4"		2	2



06 12 34 01
DEADEND ON CROSSARMS

06 12 34 07
DEADEND ON SINGLE CROSSARM



Dble. Arm 06 12 34 02
Sgl. Arm 06 12 34 03

LOOPOVER

06 12 34 04 ①
06 12 34 05
06 12 34 06

DOUBLE DEADEND

Notes:

1. Double deadend w/extension 06-12-34-04 install Item (K) between Items A & B.
2. Working load of deadend insulator = 7500 lb.

	Std. / Stk. No.	Description	06 12 34 **	01	02	03	04	05	06	07
@	A	25 06 052	Ins., Suspension, 12 kV	1	2	2	2	2	2	1
	B	23 65 012	Eyenuit, 5/8"	1	2	1	2	2	1	
	C	23 53 002	Bolt - D.A. 5/8" x 16"	1	1		1	1		
	D	23 66 027	Washer - Square 2-1/4"	4	4	2	4	4	2	2
	E	25 05 069	Ins., Pin Type		1	1				
	F	23 62 028	Pin, Insulator, X arm		1	1				
	G	23 52 058	Bolt - Machine 5/8" x 5"			1			1	
	H	23 59 005	Eyelet, 5/8"			1			1	1
	J	DEC*W	Clamp, Deadend	1	2	2	2	2	2	1
	K	23 59 042	Link, Extension, 6" Clevis-Eye				2			

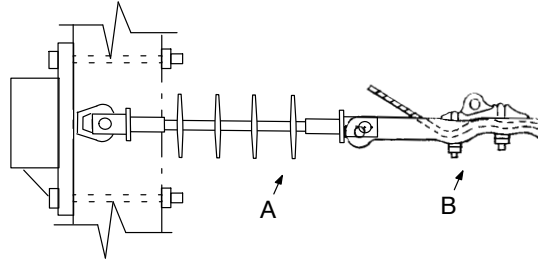
INSULATORS AND SUPPORTS

Deadends on Fiberglass Arm

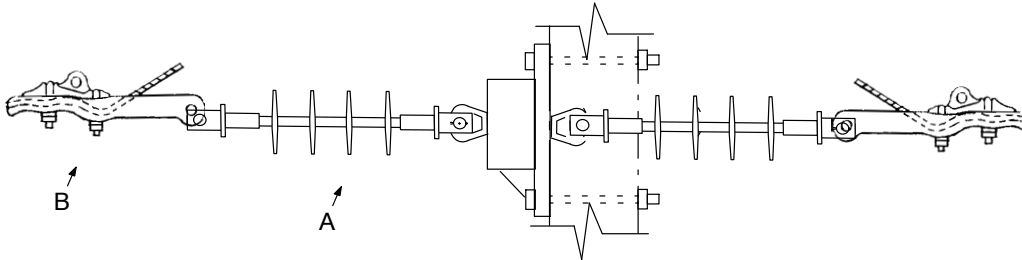
12 kV

06 12 35 **

Sheet 1 of 1



06 12 35 01 Single Deadend on FG Arm



06 12 35 02 Double Deadend on FG Arm

Notes:

1. Double deadend w/extension install if required.
2. Working load of deadend insulator = 7500 lb.

		Std. / Stk. No.	Description	06 12 35 **	01	02
1 @	A	25 06 052	Ins., Suspension, 12 kV		1	2
	B	DEC*W	Clamp, Deadend DCS 07 00 11 00		1	2
	C	25 56 076	Insulator, Guy Strain FG 26"			

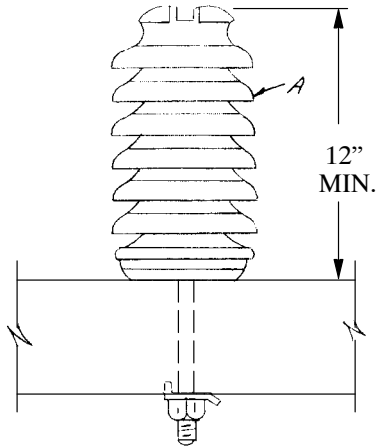
INSULATORS AND SUPPORTS

Vertical Line Post Insulators

34 kV & 69 kV

06 34 01 **

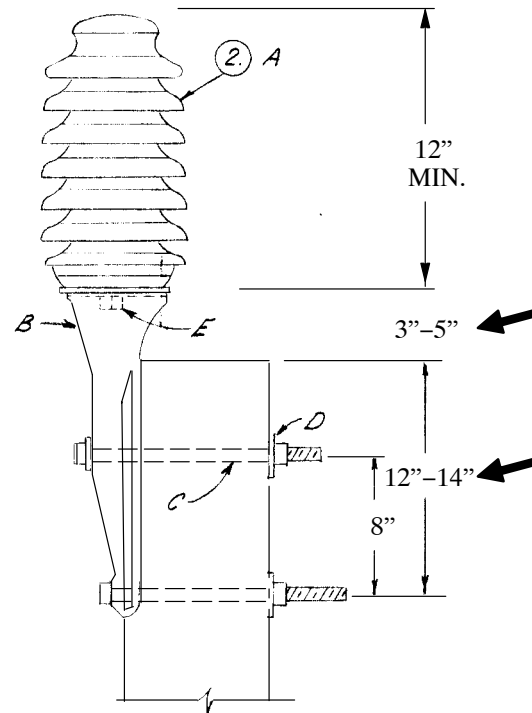
Sheet 1 of 1



34 kV 06 34 01 02

69 kV 06 34 01 04

Cross Arm Mounting



Pole Top Mounting

34 kV 06 34 01 05

69 kV 06 34 01 07

NOTES:

1. In 34kV industrial atmosphere where experience shows possible problems, use 69kV installation.
2. On angle poles install insulator on side of pole that pulls bracket against pole.

		Std. / Stk. No.	Description	06 34 01 **	02	04	05	07
					X-Arm		Pole Top	
A		25 05 064	Ins., L.P., 34kV, F Neck		1		1	
		25 05 098	Ins., L.P., 69kV, N Neck			1		1
B		23 06 021	Bracket, Pole Top				1	1
C		23 52 063	Bolt, Mach., 5/8" x 10"				2	2
D		23 66 027	Washer, Square, 5/8"				2	2
E		23 64 008	Stud, 3/4" x 1-3/4"				1	1

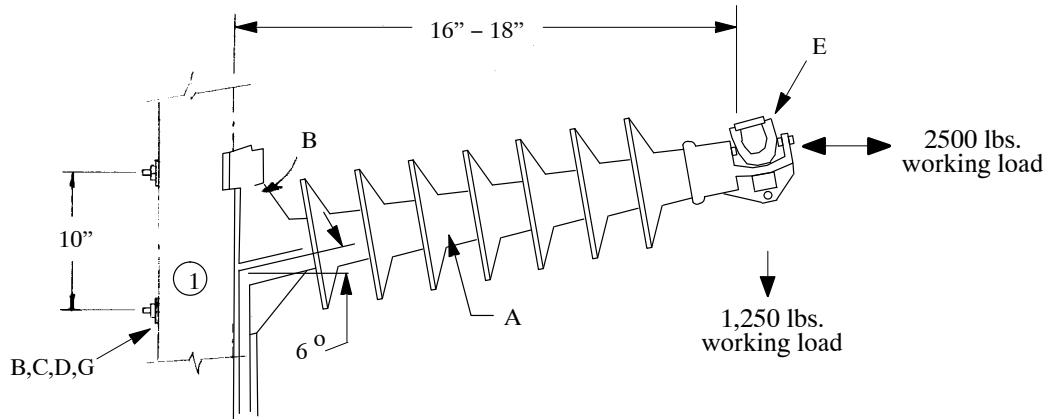
INSULATORS AND SUPPORTS

Horizontal Post Insulators

34 kV

06 34 03 **

Sheet 1 of 1



34 kV Horizontal Line Post, Polymer, Tangent/Angle, Single Insulator
 34 kV Horizontal Line Post, Polymer, Tangent/Angle, Double Insulator

06 34 03 03
 06 34 03 06

NOTES:

- Reverse bolt position if guy wire is attached to bottom bolt.

		Std. / Stk. No.	Description	06 34 03**	03	06
@	A	25 05 145	Ins., 34 kV, Hor. Line Post, Clamp Top		1	2
	B	23 52 219	Bolt, Mach., 3/4" x 14" (*)		2	
@		23 52 254	Bolt, Mach., 3/4" x 16" (*)		2	
	C	23 53 058	Bolt, DA, 3/4" x 16" (*)			2
@		23 53 059	Bolt, DA, 3/4" x 18" (*)			2
	D	23 66 031	Washer, Square, 3/4" Bolt, 3"x3", Galvanized		2	
	E	TC*W	Clamp, Trunnion		1	2
	G	23 66 135	Washer, Lock, 3/4" Dbl Coil Type		2	4

* Machine Bolts are furnished with 1 square nut and DA bolts are furnished with 4 square nuts.

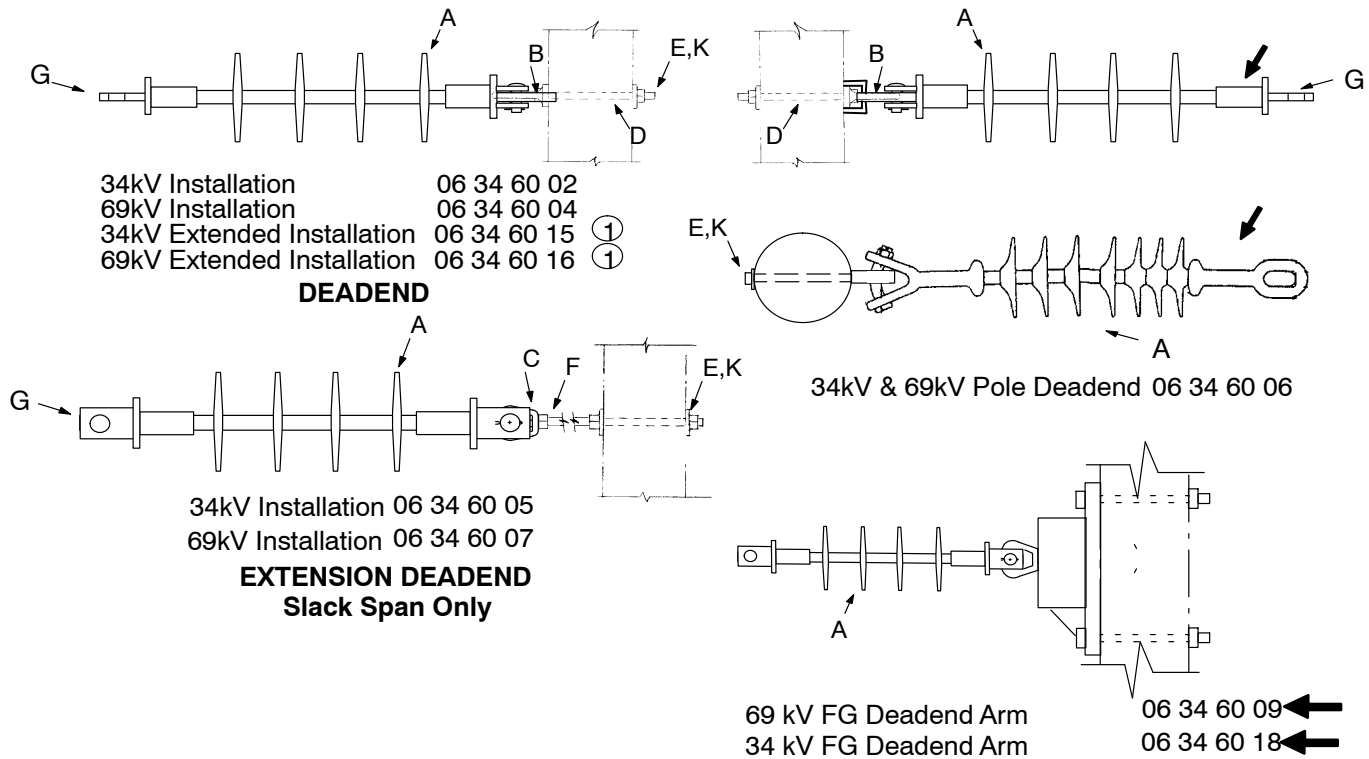
INSULATORS AND SUPPORTS

Floating Angle and Deadends

34 and 69 kV

06 34 60 **

Sheet 1 of 2



NOTES:

- On extended installations (other than slack span) install fiberglass strain insulator between eyelet and deadend insulator.

	Std/Stk No.	Description	06 34 60 **	Deadend								Ext. D.E.	
				02	04	06	09	15	16	18	05	07	
A	25 06 053	Insulator, 34 kV, Deadend		1				1		1	1		
	25 06 079	Insulator, 69 kV, Susp. (Oval Eye-Oval Eye)			1				1			1	
	25 06 113	Insulator, 69 kV Susp., 69kV, (Wye Clevis-Oval Eye)				1	1						
B	23 59 005	Eyelet, 5/8"		1	1			1	1				
	23 59 095	Eyelet, 3/4"				1							
C	23 65 012	Eyenuit, 5/8"									1	1	
D	23 52 066	Bolt, Mach., 5/8" x 14"		1	1			1	1				
	23 52 219	Bolt, Mach., 3/4" x 14"				1							
E	23 66 027	Washer, Square, 5/8" 2-1/4" x 2-1/4"		1	1			1	1		2	2	
	23 66 131	Washer, Square, 3/4", 2-1/4" x 2-1/4"				1							
F	23 53 044	Bolt, D.A., 5/8" x 32"									1	1	
G	DEC*W	Clamp, Conductor Deadend		1	1	1	1	1	1	1	1	1	
H	23 68 181	Shackle, Anchor			1				1			1	
I	25 56 076	Insulator, Strain, FG, 15K x 26" Section Length						1	1				
K	23 66 134	Washer, Lock, 5/8", Dbl Coil Type		1	1			1	1		1	1	

NOTES:

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DCG
 REV. NO: 6
 REV. DATE: 10/12/11

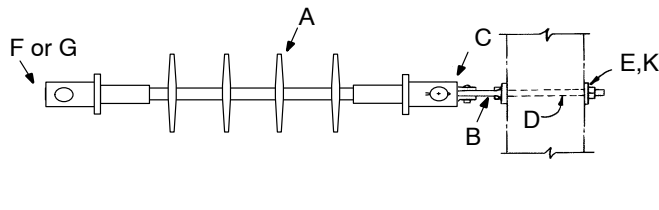
INSULATORS AND SUPPORTS

Floating Angle and Deadends

34 and 69 kV

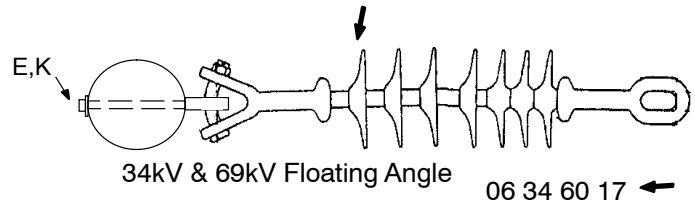
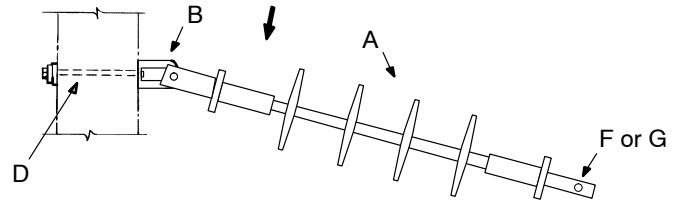
06 34 60 **

Sheet 2 of 2



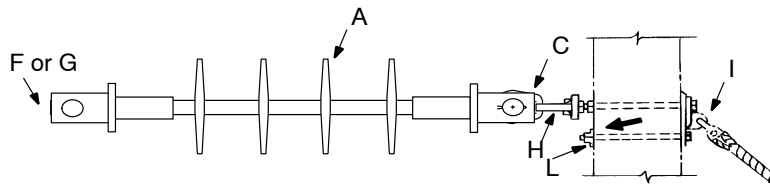
34kV Floating Angle, Unguyed 06 34 60 08
69kV Floating Angle, Unguyed 06 34 60 13

FLOATING ANGLE



34kV & 69kV Floating Angle

06 34 60 17 ←



34kV Floating Angle, Guyed 06 34 60 11
34kV Deadend to Pole, Guyed 06 34 60 12
69kV Floating Angle, Guyed 06 34 60 14
69kV Deadend to Pole, Guyed 06 34 60 10

FLOATING ANGLE OR DEADEND - GUYED

1. Item A-7500lb. working load.

		Std. / Stk. No.	Description	06 34 60 **	08	10	11	12	13	14	17
@	A	25 06 053	Insulator, 34 kV, Deadend		1		1	1			
		25 06 079	Insulator, 69kV, Susp. (Oval Eye-Oval Eye)			1			1	1	
		25 06 113	Insulator, 69kV, Susp. (Wye Clevis-Oval Eye)								1
	B	23 59 005	Eyelet, 5/8"		1						
		23 59 095	Eyelet, 3/4"								1
	C	23 68 181	Shackle, Deadend		1	1	1		1	1	
	D	23 52 066	Bolt, Mach., 5/8" x 14"		1				1		
		23 52 219	Bolt, Mach., 3/4" x 14"								1
	E	23 66 027	Washer, Square, 5/8", 2-1/4" x 2-1/4"		1				1		
		23 66 131	Washer, Square, 3/4", 2-1/4" x 2-1/4"								1
	F	SC*W	Clamp, Suspension		1		1		1	1	1
	G	DEC*W	Clamp, Conductor Deadend			1		1			
	H	23 65 018	Eyenuit, 3/4"			1	1	1		1	
	I	11 00 56 02	Hook, Guy, Heavy Duty			1	1	1		1	
	K	23 66 134	Washer, Lock, 5/8" - Dbl Coil Type		1				1		
		23 66 135	Washer, Lock, 3/4" - Dbl Coil Type			1	1	1		1	1

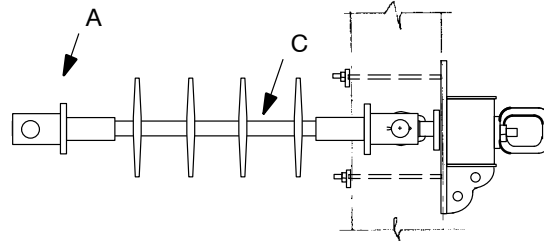
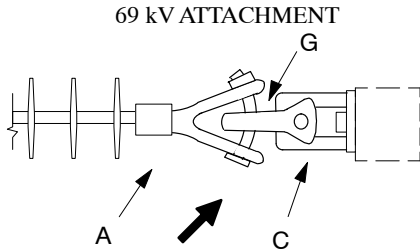
INSULATORS AND SUPPORTS

Crossarm Deadend

34 & 69 kV

06 34 66 **

Sheet 1 of 1



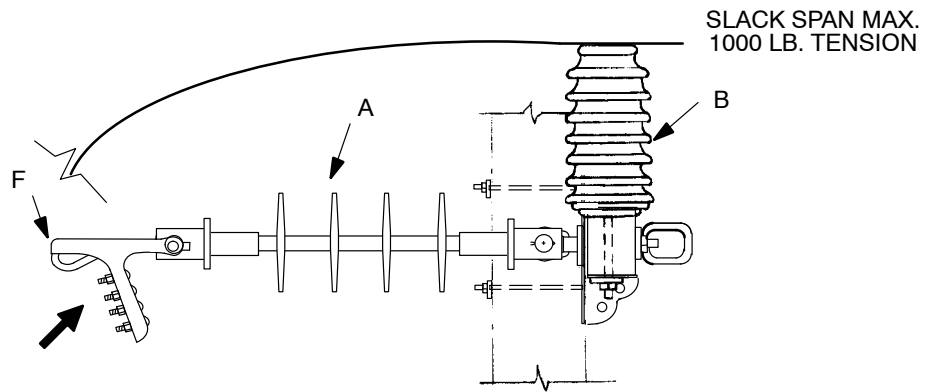
34 kV INSTALLATION

06 34 66 02

69 kV INSTALLATION

06 34 66 04

DEADEND ON CROSSARMS



34 kV INSTALLATION

06 34 66 05

69 kV INSTALLATION

06 34 66 07

ARM LOOPOVER SLACK SPAN

Note:

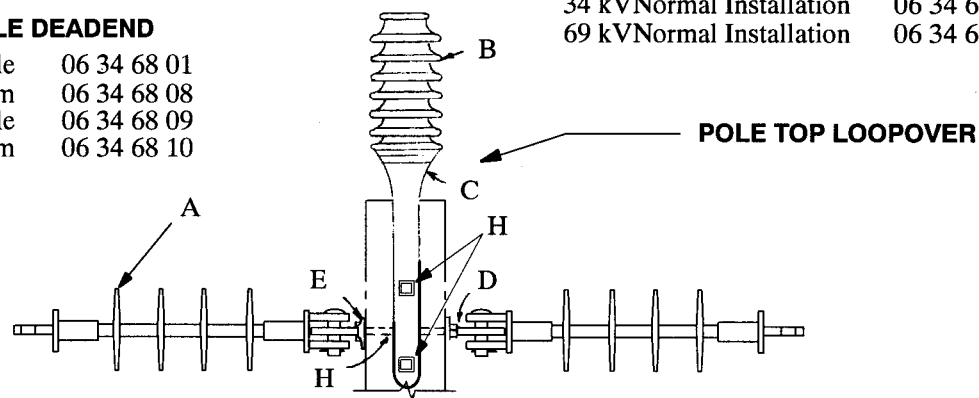
1. In 34kV industrial atmosphere where experience shows possible problems, use 69kV insulators.
2. Working load of 34 kV deadend insulator = 7,500 lbs.
Working load of 69 kV deadend insulator = 12,500 lbs.

		Std. / Stk. No.	Description	06 34 66 **	02	04	05	07
					D.E.		Slack	
→	A	25 06 113	Insulator, Susp., 69 kV, Polymer			1		1
		25 06 053	Insulator, Susp. 34 kV, Polymer	1			1	
	B	25 05 064	Ins., Line Post, 34 kV, F Neck				1	
		25 05 098	Ins., Line Post, Ind., 69 kV, N Neck					1
→@	F	DEC*W	Clamp, Deadend, Conductor	1	1	1	1	1
	G	23 68 181	Shackle, Deadend			1		1

DOUBLE DEADEND

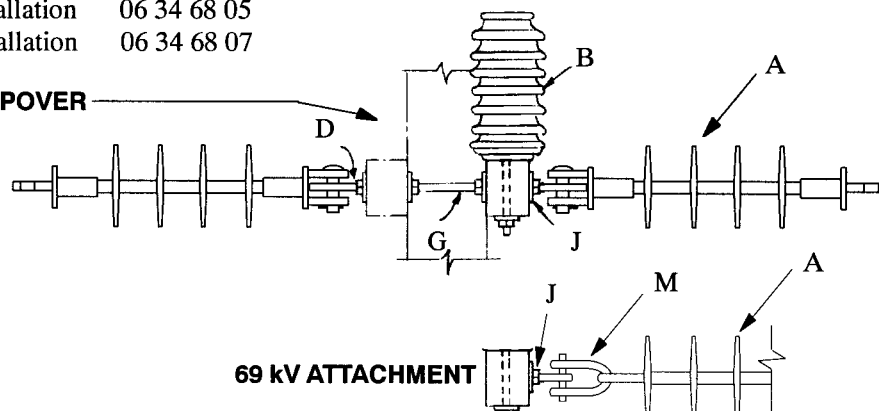
34 kV Pole	06 34 68 01
34 kV Arm	06 34 68 08
69 kV Pole	06 34 68 09
69 kV Arm	06 34 68 10

34 kV Normal Installation	06 34 68 02
69 kV Normal Installation	06 34 68 04



34 kV Normal Installation	06 34 68 05
69 kV Normal Installation	06 34 68 07

ARM LOOPOVER



Note:

1. In 34kV industrial atmosphere where experience shows possible problems, use 69kV installation.
2. To extend from pole or crossarm, insert strain insulator (25 56 059) and eye-eye link (23 59 064).
3. Working load of suspension insulator = 7500 lb.
4. Only to be used for recloser bypass to mount disconnect switches.

		Std. / Stk. No.	Description	06 34 68 **	01	02	04	05	07	08	09	10
@	A	25 06 113	Insulator, Susp., 34 kV, Polymer		2	2		2		2		
		25 06 053	Insulator, Susp. 69 kV, Polymer				2		2		2	2
	B	25 05 064	Ins., Line Post, 34 kV, F Neck			1		1				
		25 05 098	Ins., Line Post, Ind., 69 kV, N Neck				1		1			
	C	23 06 021	Bracket, Pole Top			1	1					
	D	23 65 012	Eyenuit, Oval, 5/8"		1	1	1	2	2	2	2	2
	E	23 59 005	Eyelet, Standard, 5/8"		1	1	1				1	1
	G	23 53 003	Bolt, D.A., 5/8" x 10"		1	1	1				1	1
	H	23 52 063	Bolt, Mach., 5/8" x 18"					1	1	1	1	1
	J	23 66 027	Washer, Square, 5/8"		2	2	2	4	4	4	2	4
	K	23 64 008	Stud, 3/4" x 1-3/4"			1	1					
	L	DEC*W	Conductor Deadend Clamp		2	2	2	2	2	2	2	2
	M	23 68 181	Shackle Deadend				2		2		2	2

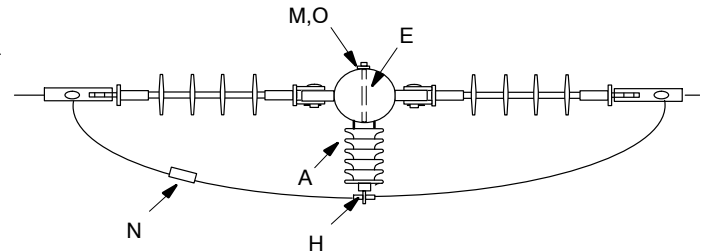
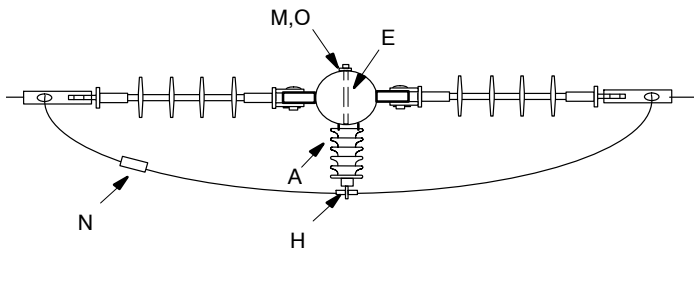
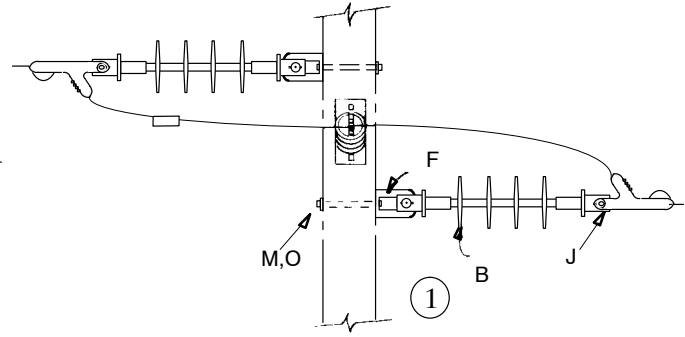
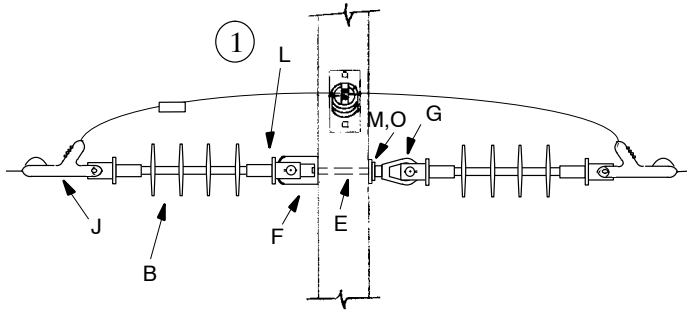
INSULATORS AND SUPPORTS

Double Deadend Loop

34 kV & 69 kV

06 34 72 **

Sheet 1 of 2



LOOPAROUND

06 34 72 01 69 kV
06 34 72 05 34 kV

LOOPAROUND

06 34 72 02 69 kV
06 34 72 06 34 kV

NOTE:

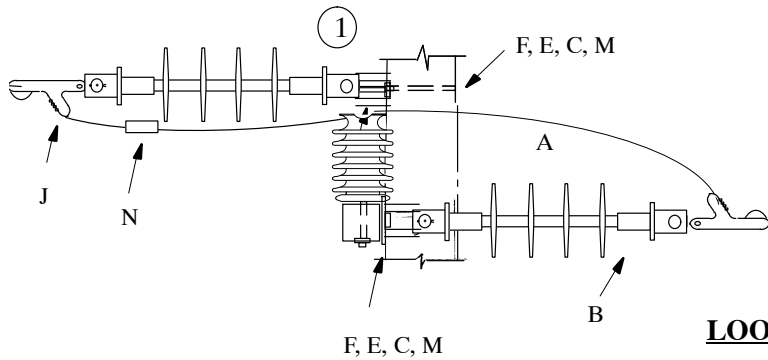
1. Use shackle to position deadend clamp properly if required.

		Std. / Stk. No.	Description	06 34 72**			
				69 kV	34 kV		
@	A	25 05 095	Ins., 69 kV., Hor. Line Post, Clamp Top	1	1		
		25 05 145	Ins., 34.5 kV, Hor. Line Post, Clamp Top			1	1
	B	25 06 113	Ins., 69 kV, Susp., Wye Clevis – Oval Eye	2	2		
		25 06 053	Ins., 34.5 kV, Deadend, Clevis – Pad Eye			2	2
	E	23 52 097	Bolt, Machine 3/4" x 12"	3	4	3	4
	F	23 59 095	Eyelet, 3/4"	1	2	1	2
	G	23 65 018	Eyenuit, 3/4"	1		1	
	H	TCA*W	Clamp, Trunnion	1	1	1	1
	J	DEC*W	Clamp, Deadend	2	2	2	2
	M	23 66 031	Washer, Square, 3/4"	3	4	3	4
@	N	PG**	Clamp, Parallel Grove – (see DCS 07 00 25 00)	1	1	1	1
	O	23 65 042	Nut, Lock, Square, Galv, 3/4"	3	4	3	4

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: WYW
REV. NO: 7
REV. DATE: 09/04/14



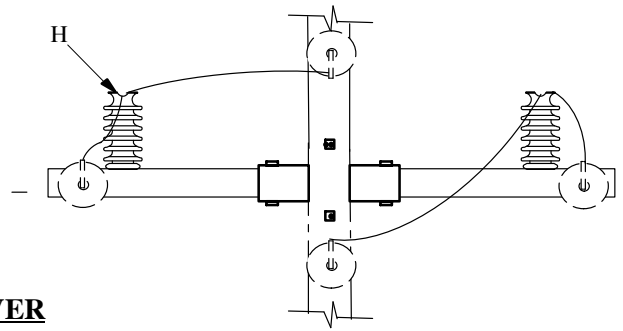
LOOPOVER

06 34 72 03

69 kV

06 34 72 07

34 kV



LOOPUNDER

06 34 72 04

69 kV

06 34 72 08

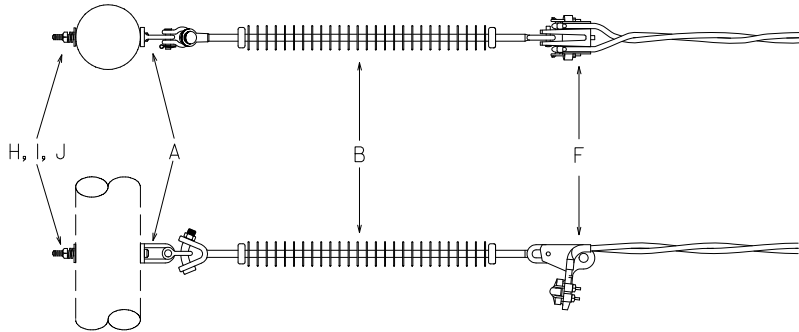
34 kV

NOTE:

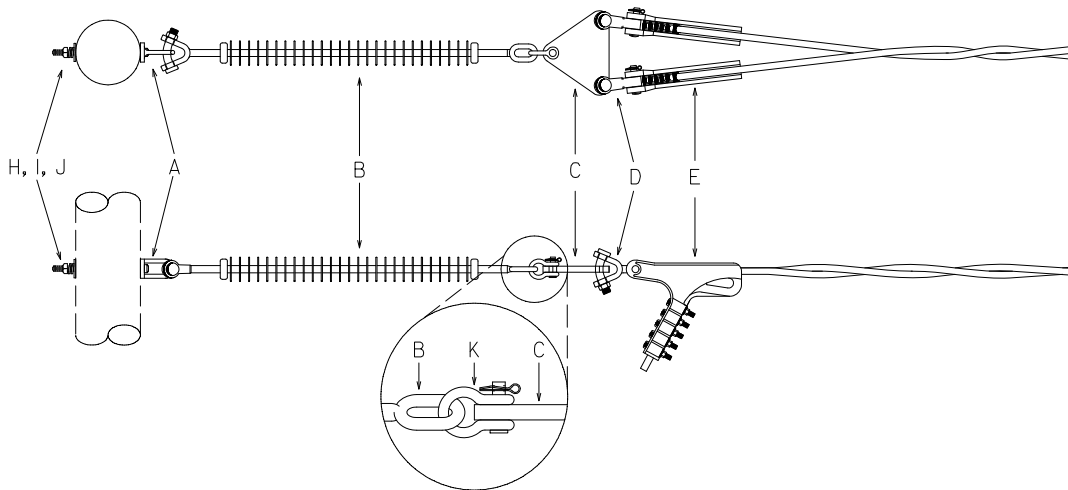
1. Use shackle to position deadend clamp properly if required.

		Std. / Stk. No.	Description	06 34 72**			
				03	04	07	08
@	A	06 34 01 04	Ins., 69 kV, Vertical, N-Neck, Tie Top, Xarm Mounted	2			
		06 34 01 02	Ins., 34 kV, Vertical, F-Neck, Tie Top, Xarm Mounted			2	
	B	25 06 113	Ins., 69 kV, Susp., Wye Clevis - Oval Eye	2	2		
		25 06 053	Ins., 34.5 kV, Deadend, Clevis - Pad Eye			2	2
	C	23 66 031	Washer, Square, 3/4"	2	2	2	2
	D	23 65 018	Eyenuit, 3/4"		2		2
	E	23 52 097	Bolt, Machine 3/4" x 12"	2	2	2	2
	F	23 59 095	Eyelet, 3/4"	2	2	2	2
@	H	TT*W	Tie, Top - Preformed (See DCS 007 00 41 00 for 34 kV)	2		2	
@		Hand Tie	Tie, Conductor (See DCS 07 00 41 00 for 69kV)				
@	J	DEC*W	Clamp, Deadend (see DCS 07 00 20 00)	2	2	2	2
	L	23 68 181	Shackle, Deadend	2	2	2	2
	M	23 65 042	Nut, Lock, Square, Galv. 3/4"	2	2	2	2
@	N	PG**	Clamp, Parallel Grove - (see DCS 07 00 25 00)	2	2	2	2

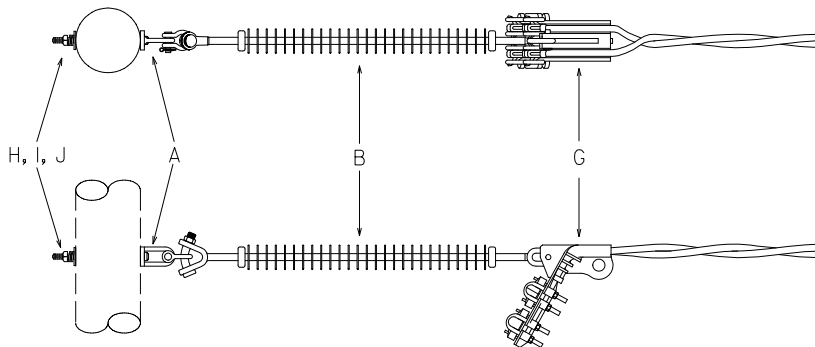
06 34 73 01



06 34 73 02



06 34 73 03



INSULATORS AND SUPPORTS
Primary Conductor and Fastenings
Deadend – 34kV & 69kV T2 4/0, 336, 556, & 954 Conductor

06 34 73 **

Sheet 2 of 2

	Stnd. / Stk. No.	Description	06 34 73 **	01	02	03
A	23 59 095	Eyelet, 3/4"		1	1	1
B	25 06 113	Insulator, Suspension, Wye–Clevis – Oval eye		1	1	1
C	23 67 388	Plate, Yoke, Triangular, 30k lbs. UTS		0	1	0
D	23 58 134	Wye–Clevis – Eye, 30k lbs. UTS		0	2	0
E	23 18 436	Clamp – Strain, Deadend 954 ACSR		0	2	0
F	23 18 404	Clamp – Strain, Deadend T2, 4/0 ACSR		1	0	0
G	23 18 406	Clamp – Strain, Deadend, T2, 336 ACSR, 556 AAC		0	0	1
H	23 52 219	Bolt, Mach., 3/4" x 14"		1	1	1
I	23 66 131	Washer, Square, 3/4", 2–1/4" x 2–1/4"		1	1	1
J	23 66 135	Washer, Lock, 3/4", Dbl Coil Type		1	1	1
K	23 68 181	Shackle, Deadend		0	1	0

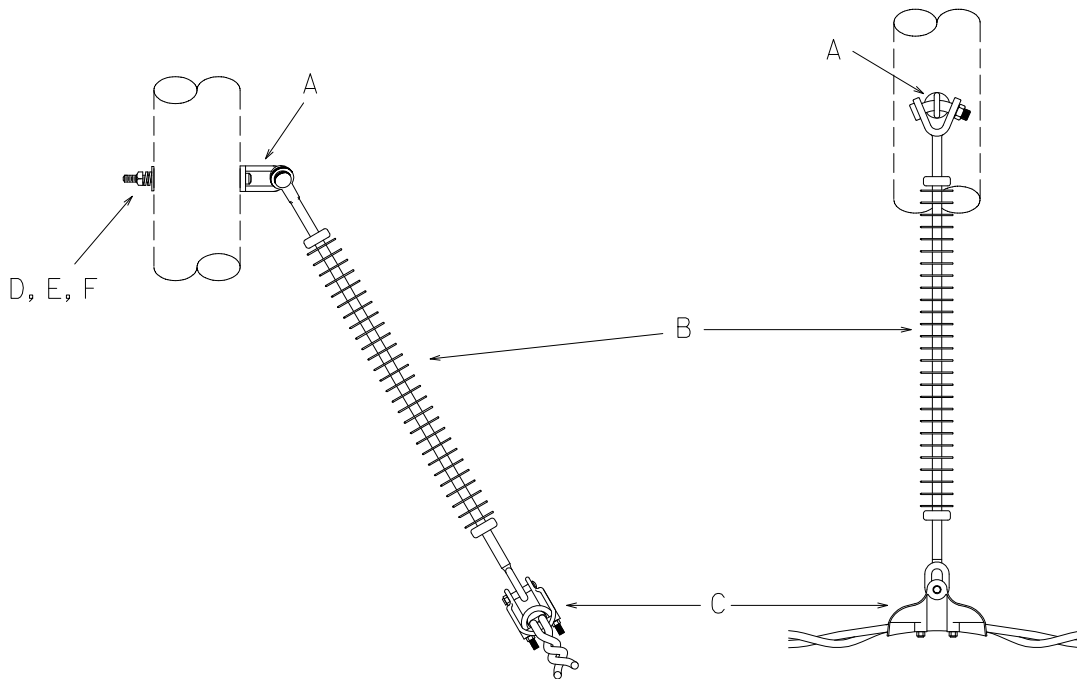
NOTES

1. Yoke plate not required for sizes other than 954.

INSULATORS AND SUPPORTS
Primary Conductor and Fastenings
Suspension – 34 & 69kV – T2, 4/0, 336, 556, 954

06 34 74 **

Sheet 1 of 1



		Std. / Stk. No.	Description	06 34 74 **	01	02	03	04
	A	23 59 095	Eyelet, 3/4"		1	1	1	1
	B	25 06 113	Insulator, Suspension, Wye-Clevis – Oval Eye		1	1	1	1
	C	23 78 455	Clamp, Suspension, T2, 4/0 ACSR		1			
		23 78 456	Clamp, Suspension, T2, 336 ACSR			1		
		17 02 176	Clamp, Suspension, T2, 556 AAC				1	
		23 78 451	Clamp, Suspension, T2, 954 ACSR					1
	D	23 52 219	Bolt, Mach., 3/4" x 14"		1	1	1	1
	E	23 66 131	Washer, Square, 3/4", 2-1/4" x 2-1/4"		1	1	1	1
	F	23 66 135	Washer, Lock, 3/4", Dbl. Coil Type		1	1	1	1

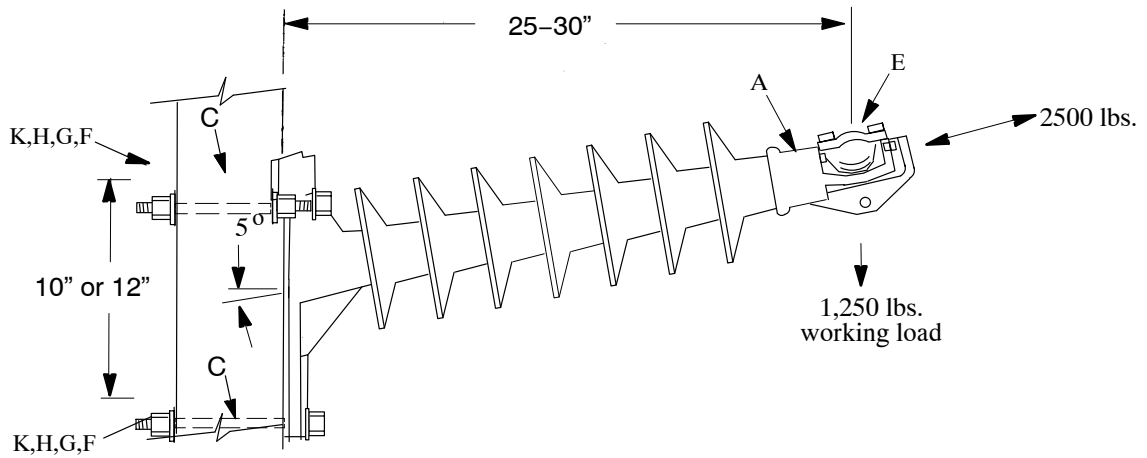
INSULATORS AND SUPPORTS

Horizontal Post Insulators

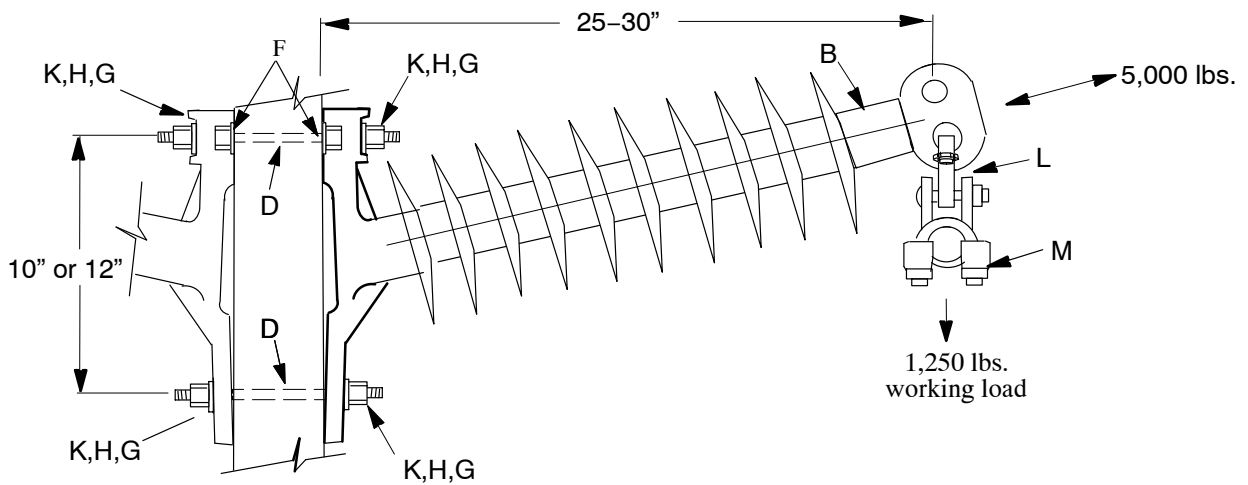
69 kV

06 69 03 **

Sheet 1 of 2



	<u>SINGLE</u>	<u>DOUBLE</u>
POLYMER INSULATOR W/TRUNNION CLAMP	06 69 03 03	06 69 03 04



	<u>SINGLE</u>	<u>DOUBLE</u>
POLYMER INSULATORS W/SUPENSION CLAMP	06 69 03 01	06 69 03 02

NOTES:

1. Reverse bolt position if guy wire is attached to bottom bolt.
2. Longer bolts are for use on larger diameter poles.

INSULATORS AND SUPPORTS
Horizontal Post Insulators
69 kV

06 69 03 **

Sheet 2 of 2

		Std. / Stk. No.	Description	06 69 03 **	01	02	03	04
	A	25 05 095	Insulator, Horiz. Post, 69 kV, Polymer, Trunnion Clamp				1	2
	B	25 05 184	Insulator, Horiz. Post, 69 kV, Polymer, Suspension Clamp	1	2			
@	C	23 52 219	Bolt, Mach., 3/4" x 14"	2		2		
		23 52 254	Bolt, Mach., 3/4" x 16"	2		2		
@	D	23 53 058	Bolt, DA, 3/4" x 16"		2		2	
		23 53 059	Bolt, DA, 3/4" x 18"		2		2	
@	E	TC*W	Clamp, Trunnion				1	2
	F	23 66 031	Washer, Square, for 3/4" Bolt, 3"x3", Galvanized	2		2		
	G	23 66 135	Washer, Lock, 3/4" Dbl Coil Type	2	4	2	4	
	H	23 15 001	Nut, Square, 3/4" x 10 TPI, Galvanized	*	*	*	*	
	K	23 65 042	Nut, Locking, 3/4", Galvanized	2	4	2	4	
	L	23 58 088	Wye Clevis-Eye, 11/16" hole, 5/8" Thick, 3/4" Pin Dia.	1	2			
@	M	SC*W	Clamp, Suspension	1	2			

* Furnished with DA bolts (4) or machine bolts (1).

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Copper – Bare

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Streng- th in "Lbs."	Con- ductor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft. "	Major Use (*Stan- dard)
6-Solid Soft Drawn		18-52-019	.162			.079				Gnd Wire
4-Solid Soft Drawn		18-52-020	.204			.126				Tie Wires & Sw Leads
2-Solid Soft Drawn		18-52-025	.258			.201				Tie Wires & Sw Leads
6-Solid Hard Drawn		18-02-010	.162	.02062	1,280	.079	.4908	.3873	.9252	Line Wire
4-Solid Hard Drawn		18-02-017 18-02-072	.204	.03278	1,970	.126	.5639	.4013	.9921	Line Wire
2-Solid Hard Drawn		18-02-020	.258	.05213	3,000	.201	.6725	.4193	1.0925	Line Wire
1/0-7 Str. Hard Drawn		18-02-022	.368	.08286	4,750	.326	.8659	.4560	1.2786	Line Wire
2/0-7 Str. Hard Drawn		18-02-024	.414	.1045	5,926	.410	.9785	.4713	1.3861	Line Wire
4/0-7 Str. Hard Drawn		18-02-027	.522	.1662	9,154	.653	1.2887	.5073	1.6850	Line Wire
350 kcmil-12 Str. H.D.		18-02-064	.710	.2749	15,140	1.081	1.8336	.5700	2.2202	Line Wire

Copper – Polyethylene – Covered

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Stren- gth in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resultant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft."	Major Use (*Standard)
6-Solid Hard Drawn		18-01-012	.222	.02062	1,216	.087	.5361	.4073	.09733	Line Wire
4-Solid Hard Drawn		18-01-017	.264	.03278	1,872	.135	.6102	.4213	1.0415	Line Wire
2-Solid Hard Drawn		18-01-020	.348	.05213	2,852	.218	.7455	.4493	1.1704	Line Wire
1/0-7 Str. Hard Drawn		18-01-022	.488	.08286	4,515	.357	.9715	.4960	1.3908	Line Wire
4/0-7 Str. Hard Drawn		18-01-025	.642	.1662	8,696	.696	1.4063	.5473	1.5090	Line Wire
6-Solid Soft Drawn		18-51-021	.230	.02062	763	.087	0.5411	0.4100	0.9790	Gnd Wire
2-7 Str. Soft Drawn		18-51-019	.382	.05213	2,107	.218	0.7666	0.4607	1.1944	Gnd Wire
1/0-7 Str. Soft Drawn		18-51-024	.488	.08286	3,219	.358	.9725	0.4960	1.3917	Trans Lead & Serv
4/0-7 Str. Soft Drawn		18-51-023	.648	.1701	6,456	.716	1.4301	0.5493	1.8430	Trans Lead & Serv
500 kcmil – 37 Str. S.D.		18-51-022 18-51-026	.963	.3927	15,260	1.626	2.5360	0.6543	2.9191	Trans Lead & Serv
750 kcmil – 61 Str. S.D.		18-51-020	1.162	.5890	22,900	2.415	3.4488	0.7207	3.8233	Trans Lead & Serv
4-Solid Soft Drawn		18-51-025	.424	.1780	**		**	**	**	Trans Lead

** Transformer Riser Wire

Copperweld Bare

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Streng th in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft."	Major Use (*Stan- dard)
8-Solid High Strength		27-09-094	.1285	.01297	1,660	.0458	.4367	0.3762	0.8764	Services
6-Solid High Strength		27-09-098	.162	.02062	2,433	.0729	.4847	0.3873	0.9204	Services

Copperweld Copper Bare

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Streng th in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft."	Major Use (*Stan- dard)
6A-3 Strand C.W.		27-09-082	.230	.02689	2,585	.102	.5561	0.4100	0.9909	Line Wire
4A-3 Strand C.W.		27-09-003	.290	.04276	3,938	.162	.6534	0.4300	1.0822	Line Wire
2A-3 Strand C.W.		27-09-132	.366	.06799	5,876	.257	.7953	.4553	1.216	Line Wire

5 kV Insulated Copper Polyethylene Jacket

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Streng th in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft."	Major Use (*Stan- dard)
6-Solid		18-53-011	.65			.27				In Fibre Conduit & Where
2-19 Str.		18-53-018	.76			.45				
1/0 - 19 Str.		18-53-022	.84			.60				
4/0 - 19 Str.		18-53-028	1.030			1.04				Open Wire Is
350 kcmil - 37, 61 Str.		18-53-102	1.25			1.63				Hazard- ous
750 kcmil - 91 Str.		18-07-021	1.64			3.17				

Aluminum – Bare

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Stren- gth in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft. "	Major Use (*Stan- dard)
4 Solid		18-55-028	.204			.0384				Tie Wire
4 ACSR 7/1	Swan- ate	18-05-005 18-05-084 18-05-085	.257	.0411	2,360	.0670	.5379	.4190	.9818	Line Wire
2 ACSR 7/1	Spa- rate	18-05-007 18-05-091	.325	.0654	3,640	.1067	.6199	.4417	1.0612	Line Wire
1/0 AAAC 7 Str.	Azusa	18-05-060 18-05-088	.398	.0968	4,460	.1157	.6743	.4660	1.1197	Line Wire**
1/0 ACSR 6/1	Raven	18-05-080	.398	.0968	4,380	.1452	.7038	.4660	1.1441	Line Wire
2/0 ACSR 6/1	Quail	18-05-026	.447	.1219	5,310	.183	.772	.482	1.210	Line Wire
3/0 ACSR 6/1	Pigeon	18-05-010	.502	.1538	6,620	.2309	.8541	.5007	1.2900	Line Wire
4/0 ACSR 6/1	Pen- guin	18-05-011	.563	.1939	8,350	.2911	.9523	.5210	1.3855	Line Wire
110.8 kcmil – ACSR 12/7	Minor- ca	18-05-117	.481	.1378	11,300	.2763	.8865	.4937	1.3147	Static Wire
335.6 kcmil ACSR T-2	Pigeon/ VR	18-05-122	.822	.3076	13,240	.461	1.283	.607	1.719	Line Wire (Gallop)
336.4 kcmil – ACSR 26/7	Linnet	18-05-014	.720	.3072	14,100	.463	1.2218	.5733	1.6496	Line Wire (34kV)
336.4 kcmil ACSR 18/1	Merlin	18-05-120	.684	.2789	8,680	.3653	1.1017	.5613	1.5365	Line Wire (34kV)
477 kcmil ACSR 18/1	Pelican	18-05-035	.814	.3955	11,800	.517	1.334	.605	1.765	Line Wire (34kV)
423.2 kcmil (2) 4/0 6/1 ACSR	T2 Pen- guin	18-05-241	0.922	0.3878	16,700	0.582	1.485	0.641	1.917	Line Wire
556.5 kcmil – AA 19 Str.	Dahlia	18-05-047 18-05-082 18-05-092	.856	.4370	9,750	.5224	1.3658	.6187	1.7994	Line Wire
556.5 kcmil – ACSR 26/7 Str.	Dove	18-05-033	.927	.5083	22,600	.7660	1.6535	.6423	2.0740	Line Wire
795 kcmil – AA 37 Str.	Arbutus	18-05-032	1.026	.6244	13,900	.7463	1.6955	.6753	2.1250	Line Wire
954 kcmil – AA 37 Str.	Magno- lia	18-05-043	1.124	.7495	16,400	.8956	1.9057	.7080	2.3330	Line Wire

Aluminum – Bare (Cont.)

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Stren- gth in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft. "	Major Use (*Stan- dard)
954 kcmil 45/7 ACSR	Rail	18-05-173	1.165	0.801	25,900	1.076	2.111	0.7217	2.531	Line Wire
3 – #7 Str. AW		27-09-099	.311	.0490	8,621	.1412	.6456	.4370	1.0796	Static Wire**
1113 kcmil (2) 556 (19) AAC	T2 Dahlia	18-05-250	1.401	0.8738	19,500	1.045	2.265	0.8003	2.702	Line Wire
1908 kcmil (2) 45/7 ACSR	T2 Rail	18-05-210	1.907	1.6022	51,800	2.15	3.711	0.969	4.136	Line Wire

**1/0 AAAC is used for static wire. Alumoweld is no longer used for static wire. See 12 00 01 01.

Aluminum Polyethylene Jacket

Conductor Size, Type and Stranding	Cond Code Name	Ameren Stock No.	Over- all Dia. In- ches	Wire Area Sq. In.	Ulti- mate Stren- gth in "Lbs."	Con- duc- tor Wt. "LBS/ FT"	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Ho- riz.- 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Resul- tant Wt. Incl. C=0.30 Heavy Loaded Wt. "Lbs./Ft. "	Major Use (*Stan- dard)
4 ACSR 7/1	Hick- ory	18-05-068	.317	.0411	2,280	.0820	.5912	.4390	1.0364	Line Wire
1/0 AAAC 7 Str.	Oilnut	18-05-067 18-05-090	.518	.0968	4,010	.1660	.7972	.5060	1.2442	Line Wire
4/0 AA 7 Str.	Olive	18-05-059 18-05-087	.632	.1662	3,440	.258	.9261	.5440	1.3740	Second- ary
336.4 kcmil – AA 19 Str.	Ano- na	18-05-052	.766	.2644	5,535	.3880	1.1705	.5887	1.6102	Line Wire
556.5 kcmil – AA 37 Str.	Paw Paw	18-05-053	.993	.4370	8,950	.6350	1.5567	.6643	1.9925	Line Wire

1. General

- a. Bare wire is the standard conductor for subtransmission and all overhead installations of distribution feeders, 15kV or less. It is to be used for both armless and crossarm construction. This includes both reconductoring and the installation of additional phases where covered wire had been previously installed.
- b. Use covered wire for 15kV or less:
 - 1) In extremely heavy tree conditions where excessive trimming permission cannot be obtained or where the beauty of the trees is important to the area.
 - 2) Where climbing or working space on the pole is restricted because of being too close to a building or other obstacle.

2. Conductor Current Ratings

Overhead conductor current ratings cover single and twisted pair conductors used in open overhead construction and existing spacer cable installations. Ratings are based on 2 feet per second crosswind, emissivity of 0.5 (for bare conductor; 0.91 for covered) and absorptivity of 0.5 (for bare conductor; 0.95 for covered).

Note: CLPU is Cold Load Pickup.

Conductor Type	Temperatures (°C)			
	Conductors		Ambient	
	Normal	Emergency		
#6 and #4 COPPER	80	90	Summer	40
COPPER (other)	90	100	Spring/Fall	10
AAC & AAAC	90	100	Winter	-13
ACSR	90	120	CLPU	0

SIZE		RATING (AMP)						
STD LINE CONDUCTORS		SN	SE	S/F N	S/F E	W N	W E	CLPU
1/0 AAAC (7)	Azusa	252	276	323	341	369	383	361
336 ACSR (18/1)	Merlin	511	645	659	759	754	835	795
556 AAC (19)	Dahlia	693	763	896	947	1026	1067	1004
954 (45/7) ACSR	Rail	981	1255	1273	1476	1460	1625	1548
1272 (45/7) ACSR	Bittern	1173	1506	1523	1773	1749	1952	1859

STD T2 LINE CONDUCTORS		SN	SE	S/F N	S/F E	W N	W E	CLPU
4/0 (6/1) ACSR (T2)	Penguin T2	535	652	692	767	793	844	804
336 (18/1) ACSR (T2)	Merlin T2	820	1048	1063	1233	1219	1357	1292
556 (19) AAC (T2)	Dahlia T2	1108	1227	1441	1528	1654	1723	1623
954 (45/7) ACSR (T2)	Rail T2	1587	2054	2070	2419	2381	2664	2538

STATIC (SHIELD) WIRES								
110.8 (12/7) ACSR	Minorca	234	281	301	330	344	363	346
1/0 AAAC (7)	Azusa	252	276	323	341	369	383	361

SIZE		RATING (AMP)						
Non-Std Conductors		SN	SE	S/F N	S/F E	W N	W E	CLPU
6 ACSR (6/1)	Turkey	102	125	130	147	148	161	154
4 ACSR (7/1)	Swanate	135	165	173	194	197	214	203
2 ACSR (6/1)	Sparrow	178	219	229	257	261	282	269
2 ACSR (7/1)	Sparate	178	219	229	257	261	282	269
1/0 ACSR (6/1)	Raven	235	288	302	338	345	372	354
2/0 ACSR (6/1)	Quail	269	329	346	387	395	426	405
3/0 ACSR (6/1)	Pigeon	308	377	396	443	453	488	464
3/0 ACSR (7)	Amherst	337	370	433	458	495	515	485
4/0 ACSR (6/1)	Penguin	353	432	454	507	520	558	532
4/0 AAAC (7)	Alliance	390	428	502	530	574	597	562
134.6 ACSR (12/7)	Leghorn	259	310	333	364	381	401	382
266.8 ACSR (18/1)	Waxwing	441	556	569	654	651	720	685
266.8 ACSR (26/7)	Partridge	450	568	580	667	664	734	699
335.6 ACSR (2-6/1)	T2 Pigeon	474	580	613	683	702	751	715
336.4 ACSR (26/7)	Linnet	520	658	672	774	769	852	811
336.4 ACSR (30/7)	Oriole	526	666	680	784	778	862	821
394.9 AAAC (19)	Canton	526	579	678	718	777	808	761
397.5 ACSR (26/7)	Ibis	578	733	747	862	856	949	903
397.5 ACSR (30/7)	Lark	585	742	756	873	866	961	914
477 (19) AAC	Cosmos	629	692	813	859	931	967	911
477 ACSR (18/1)	Pelican	636	807	822	949	942	1045	995
477 ACSR (26/7)	Hawk	649	824	839	969	961	1067	1016
477 ACSR (30/7)	Hen	657	834	849	981	973	1080	1028
556.5 ACSR (18/1)	Osprey	701	891	907	1048	1039	1153	1098
556.5 ACSR (26/7)	Dove	715	910	926	1069	1061	1178	1122
559.5 ACAR (15/4)	15/4	687	756	888	939	1018	1058	996
636 ACSR (24/7)	Rook	773	985	1001	1158	1147	1275	1214
636 ACSR (26/7)	Grosbeak	778	991	1007	1166	1155	1284	1222
795 ACSR (26/7)	Drake	896	1145	1161	1347	1332	1483	1412
795 ACSR (45/7)	Tern	875	1116	1134	1313	1301	1446	1377
636 AAC (37)	Orchid	754	831	976	1032	1118	1162	1095
795 AAC (37)	Arbutus	867	956	1122	1188	1287	1338	1260
927 ACAR (24/13)		935	1032	1211	1284	1389	1446	1362
954 AAC (37)	Magnolia	970	1071	1258	1333	1443	1502	1414
954 ACSR (54/7)	Cardinal	982	1251	1274	1472	1462	1620	1543
1024.5 ACAR (30/7)		1003	1108	1301	1378	1492	1553	1463
1272 AAC (61)	Narcissus	1156	1279	1501	1592	1723	1795	1690

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Data

07 00 01 03

Sheet 3 of 4

T-2 ACSR (2 x 3/0)	T2 Pigeon	474	580	613	683	702	751	715
T-2 ACSR (2 x 266.8)	T2 Partridge	720	918	933	1081	1070	1190	1133
T-2 ACSR (2 x 477)	T2 Pelican	1019	1309	1323	1540	1519	1696	1615
T-2 ACSR (2 x 477)	T2 Hawk	1036	1333	1347	1569	1547	1727	1645
T-2 ACSR (2 x 477)	T2 Hen	1046	1346	1360	1585	1562	1744	1662
T-2 AAC (2 x 795)	T2 Arbutus	1402	1554	1826	1939	2098	2187	2060
T-2 AAAC (2 x 3/0)	T2 Amherst	503	554	649	688	744	774	729

Bare Cu								
6 Cu SOL		126	137	161	169	183	190	178
4 Cu SOL		168	183	215	226	245	254	239
4 Cu (7)		171	186	218	230	249	258	243
2 Cu SOL		225	246	288	303	329	341	321
2 Cu (7)		228	250	293	308	334	347	326
1 Cu SOL		261	285	334	352	381	395	372
1 Cu (7)		264	289	339	357	387	401	378
1/0 Cu Sol		299	327	384	404	438	454	428
1/0 Cu (7)		306	335	393	414	448	465	438
2/0 Cu SOL		347	380	446	470	509	528	497
2/0 Cu (7)		356	390	457	482	523	542	511
3/0 Cu SOL		402	440	516	544	590	612	576
3/0 Cu (7)		410	449	527	556	602	625	588
4/0 Cu SOL		465	509	598	630	683	709	667
4/0 Cu (7)		474	520	610	644	698	724	682
250 Cu (19)		528	579	680	718	778	808	760
350 Cu (12)		660	726	851	900	975	1013	954
350 Cu (19)		652	717	841	889	963	1000	942
500 Cu (37)		817	899	1055	1116	1209	1256	1183
750 Cu (61)		1046	1155	1354	1435	1553	1617	1522
800 Cu (37)		1087	1201	1408	1493	1615	1686	1584
1000 Cu (61)		1241	1373	1609	1708	1846	1925	1812

SIZE		RATING (AMP)						
<u>Bare CW-CU</u>		SN	SE	S/F N	S/F E	W N	W E	CLPU
8A		103	113	132	139	151	156	147
6A		135	147	173	181	197	204	184
4A		180	196	230	242	263	272	256
2A		239	261	307	323	351	363	342
2/0 F		349	381	448	471	512	530	499
4/0 E		471	516	607	639	695	719	677

<u>Covered Al</u>								
4 ACSR (7/1)	Hickory	140	153	179	188	205	210	198
1/0 AAAC (7)	Oilnut	230	255	299	320	344	357	337
4/0 AA (7)	Olive	369	409	481	516	554	575	542
336.4 AA (19)	Anona	497	553	650	699	749	779	735
397.5 AA (19)	Moiles	543	606	714	769	824	857	808
556.5 AA (37)	PawPaw	670	749	883	953	1020	1062	1001

<u>Covered Cu</u>								
6 SOL		104	132	134	180	194	201	190
4 SOL		136	174	178	240	258	267	252
2 SOL		230	253	296	315	339	351	331
1/0 (7)		306	338	396	424	455	472	445
4/0 (7)		469	520	611	656	703	731	689
500 (37)		788	882	1038	1121	1199	1249	1178

Insulated Wire – 2400 Volt

	1–3 Conductors in Conduit or Triplexed in Air		Single Conductor in Air	
	Norm	Emer.	Norm	Emer.
6 CU	80	90	96	112
2 CU	140	165	167	195
1/0 CU	185	220	222	260
4/0 CU	290	340	343	400
350 CU	395	465	470	575
500 CU	485	570	589	688
750 CU	600	710	760	889

See Dist. Std. 10 00 01 for proper 4kV lead wire size.

Conductor InstallationHillside Construction

The sag tables published in the 07 00 07 section of the Construction Standards are primarily intended for use on level or nearly level terrain where the difference in support elevations of the various spans is relatively minor (Say zero to five foot in most cases, with an occasional maximum difference of 10 ft.).

In hillside construction, care must be taken to prevent conductor uplift on poles, crossarms, etc. This condition may be eliminated by increasing conductor sags, span lengths, raising of the lower support, or relocation of the supports. If none of these remedies are feasible, it may be necessary to deadend the conductors on the lower supports or on both structures.

Normally suspension type insulators should be used with wood crossarms or fiberglass standoffs on hillside construction rather than clamp type vertical line post insulators because of the limited amount of rotation available in the suspension clamp. Uplift should also be avoided on suspension type strings to prevent insulator curl and radio interference noise. The insulator swing must be checked at 0° F, 4 psf wind, no ice, INITIAL and 60° F with 6 psf wind, FINAL.

The use of topographic maps, profile plots and conductor sag templates will permit the determination of what will occur throughout the line once the pole elevations and locations are established.

1. General

Sag tables are divided by ruling span per conductor. The ruling spans are "Super Short Span" (100 ft.), "Short Span" (150 ft.), "Medium Span" (200 ft.), "Long Span" (250 ft.), and for larger conductors, "Extra Long Span" (300 ft.), "Super Long Span" (350 ft.).

All sags given for "Initial Sag" are for stringing of new conductors. For a given stringing temperature (Amb. Temp.) the conductor tension is also given.

Conductor integrity can be affected by temperature. For this reason, maximum operating temperature in "Final Sag" tables for all aluminum conductor (AAC) is limited to 212° F, and for aluminum conductor steel reinforced (ACSR) is limited to 248° F.

Sags given for "Final Sag" indicate the maximum sag for a conductor at the particular condition. The National Electrical Safety Code (NESC) requires that maximum sag (for vertical clearance above ground) be checked at:

- a. 32° F (0° C) with 1/2" ice, No Wind (FINAL) or 120° F, FINAL, for neutral conductors.
- b. Maximum operating design temperature of the line (No Wind).
- c. Conductor blowout must be checked at 60° F (16° C) FINAL with 6 psf wind to assure necessary clearance to structures adjacent to the line.
- d. Conductor separation between ellipses during galloping must not be less than the 60 Hz flashover distance at FINAL sag of conductor 32° F (0° C) with 1/2" ice and 2 psf wind.

1/0 AWG (7) AAAC "Azusa"

DE Tension = 1,000 Lbs

RBS = 4,460 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		50	60	70	80	90	100	110	120	130	140	150		
	15°, 1" ice, 4 psf wind	6	9	12	15	20	24	29	35	41	47	54	1,258	
	15°, 0.8" ice, 4 psf wind	5	7	10	13	17	21	25	30	35	41	47	1,060	
	0°, 0.5" ice, 4 psf wind + k	4	6	8	11	14	17	20	24	28	33	38	1,000	
	0	1	1	1	2	2	3	3	4	4	5	6	647	
	10	1	1	2	2	3	3	4	4	5	6	7	564	
	20	1	1	2	2	3	4	4	5	6	7	8	485	
	30	1	2	2	3	3	4	5	6	7	8	9	410	
	40	1	2	3	3	4	5	6	7	9	10	12	340	
	50	2	2	3	4	5	6	8	9	11	12	14	278	
	60° F, 21 psf wind	5	7	9	12	15	19	23	27	32	37	42	563	
	60° F, 6 psf wind	3	4	6	7	9	11	14	16	19	22	26	302	
	60° F, 4 psf wind	2	4	5	6	8	10	12	14	17	20	22	267	
	60	2	3	4	5	6	8	9	11	13	15	17	225	
	70	2	3	5	6	8	9	11	14	16	19	21	184	
	80	3	4	6	7	9	11	14	16	19	22	26	153	
	90	3	5	7	9	11	13	16	19	23	26	30	131	
	100	4	5	7	10	12	15	18	22	26	30	34	115	

Super Short Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL SAG (inches)											Tension Lbs
							R.S.						
		50	60	70	80	90		100	110	120	130	140	
-20		1	1	1	1	2	2	3	3	4	4	5	772
0		1	1	2	2	3	3	4	4	5	6	7	554
0°, 0.5" ice, 4 psf wind + k		4	6	8	11	14	17	20	24	28	33	38	1,000
30		2	2	3	4	5	6	8	9	11	13	15	268
32°, 0.5" ice,		4	6	8	11	13	16	20	24	28	32	37	617
32°, 0.5" ice, 2 psf wind		4	6	8	11	14	17	20	24	28	33	38	638
40		2	3	4	5	7	9	10	12	14	17	19	204
50		3	4	5	7	9	11	13	16	18	21	24	162
60		3	5	6	8	10	13	16	19	22	25	29	134
60° F, 6 psf wind		4	5	7	10	12	15	18	22	25	29	34	230
70		4	5	7	10	12	15	18	22	25	29	34	116
80		4	6	8	11	14	17	20	24	29	33	38	103
90		5	7	9	12	15	19	23	27	32	37	42	93
100		5	7	10	13	17	20	25	29	34	40	46	86
120		6	8	11	15	19	23	28	34	40	46	53	75
212		9	12	17	22	28	34	41	49	58	67	77	51

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 3 of 61

1/0 AWG (7) AAAC "Azusa"

DE Tension = 1,200 Lbs

RBS = 4,460 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range ②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		100	110	120	130	140	150	160	170	180	190	200		
	15°, 1" ice, 4 psf wind	19	23	28	33	38	43	49	56	62	70	77	1579	
	15°, 0.8" ice, 4 psf wind	17	20	24	28	33	38	43	48	54	60	67	1315	
	0°, 0.5" ice, 4 psf wind + k	14	17	20	24	27	32	36	41	45	51	56	1200	
	0	3	3	4	5	5	6	7	8	9	10	11	649	
	10	3	4	4	5	6	7	8	9	10	11	12	569	
	20	4	4	5	6	7	8	9	10	11	13	14	494	
	30	4	5	6	7	8	9	11	12	13	15	16	424	
	40	5	6	7	8	9	11	12	14	16	17	19	361	
	50	6	7	8	10	11	13	15	16	18	21	23	306	
	60° F, 21 psf wind	15	18	21	25	29	33	38	43	48	53	59	720	
	60° F, 6 psf wind	9	11	14	16	18	21	24	27	30	34	38	369	
	60° F, 4 psf wind	8	10	12	14	16	19	21	24	27	30	33	320	
	60	7	8	10	11	13	15	17	19	22	24	27	261	
	70	8	9	11	13	15	18	20	23	25	28	31	224	
	80	9	11	13	15	17	20	23	26	29	32	36	196	
	90	10	12	14	17	20	23	26	29	32	36	40	174	
	100	11	13	16	19	22	25	28	32	36	40	44	157	

Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		2	3	3	4	5	5	6	7	8	9	10	725
0		3	4	5	6	7	8	9	10	11	12	13	519
0°, 0.5" ice, 4 psf wind + k		14	17	20	24	27	32	36	41	45	51	56	1200
30		6	8	9	11	12	14	16	18	20	23	25	280
32°, 0.5" ice,		13	16	19	22	26	30	34	38	43	48	53	763
32°, 0.5" ice, 2 psf wind		14	16	20	23	27	30	35	39	44	49	54	791
40		8	9	11	13	15	17	19	22	24	27	30	232
50		9	11	13	15	17	20	23	25	29	32	35	198
60		10	12	15	17	20	23	26	29	33	36	40	173
60° F, 6 psf wind		12	14	17	20	23	26	30	34	38	42	47	297
70		11	14	16	19	22	25	29	33	37	41	45	154
80		12	15	18	21	24	28	32	36	40	45	50	140
90		13	16	19	23	26	30	35	39	44	49	54	129
100		15	18	21	25	28	33	37	42	47	52	58	120
120		16	20	24	28	32	37	42	47	53	59	65	106
212		23	28	34	39	46	52	60	67	76	84	93	75

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 4 of 61

1/0 AWG (7) AAAC "Azusa"

DE Tension = 1,400 Lbs

RBS = 4,460 Lbs

Medium Span - Feet												
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	Not Recommended					R.S.			Not Recommended			
	150	160	170	180	190	200	210	220	230	240	250	
15°, 1" ice, 4 psf wind	36	41	47	52	58	65	71	78	86	93	101	1877
15°, 0.8" ice, 4 psf wind	32	36	41	46	51	57	62	69	75	82	89	1558
0°, 0.5" ice, 4 psf wind + k	27	31	35	39	43	48	53	58	64	69	75	1400
0	6	7	7	8	9	10	11	12	13	15	16	680
10	6	7	8	9	10	12	13	14	15	17	18	603
20	7	8	9	11	12	13	14	16	17	19	20	531
30	8	10	11	12	14	15	17	18	20	22	23	464
40	10	11	12	14	16	17	19	21	23	25	27	404
50	11	13	14	16	18	20	22	24	26	29	31	352
60° F, 21 psf wind	27	31	35	39	44	49	54	59	64	70	76	872
60° F, 6 psf wind	18	20	23	25	28	31	35	38	41	45	49	442
60° F, 4 psf wind	16	18	20	22	25	28	31	34	37	40	43	381
60	13	14	16	18	20	23	25	27	30	32	35	308
70	14	16	19	21	23	26	28	31	34	37	40	272
80	16	18	21	23	26	29	32	35	38	41	45	242
90	18	20	23	26	29	32	35	38	42	46	50	219
100	20	22	25	28	32	35	38	42	46	50	55	200

Medium Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)										Tension Lbs	
							R.S.						
		150	160	170	180	190	200	210	220	230	240		250
-20		5	6	7	8	9	10	11	12	13	14	15	720
0		7	8	10	11	12	13	15	16	17	19	21	527
0°, 0.5" ice, 4 psf wind + k		27	31	35	39	43	48	53	58	64	69	75	1400
30		12	14	16	18	20	22	24	27	29	32	35	315
32°, 0.5" ice,		25	29	32	36	40	45	49	54	59	64	70	908
32°, 0.5" ice, 2 psf wind		26	29	33	37	41	45	50	55	60	65	71	941
40		14	16	19	21	23	26	28	31	34	37	40	272
50		16	19	21	24	26	29	32	35	39	42	46	239
60		18	21	24	26	29	33	36	39	43	47	51	213
60° F, 6 psf wind		21	24	27	31	34	38	42	46	50	55	59	365
70		20	23	26	29	32	36	40	44	48	52	56	194
80		22	25	28	32	35	39	43	47	52	56	61	178
90		24	27	31	34	38	42	47	51	56	61	66	165
100		25	29	33	37	41	45	50	55	60	65	71	155
120		28	32	36	41	45	50	56	61	67	73	79	138
212		40	45	51	57	64	71	78	86	93	102	110	99

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 5 of 61

1/0 AWG (7) AAAC "Azusa"

DE Tension = 1,650 Lbs

RBS = 4,460 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.	Not Recommended					
		200	210	220	230	240	250	260	270	280	290		300
	15°, 1" ice, 4 psf wind	55	61	67	73	80	86	93	101	108	116	124	2201
	15°, 0.8" ice, 4 psf wind	48	53	58	63	69	75	81	87	94	101	108	1839
	0°, 0.5" ice, 4 psf wind + k	41	45	49	54	59	64	69	74	80	86	92	1650
	0	8	9	10	11	12	13	14	15	16	18	19	831
	10	9	10	11	12	13	15	16	17	18	20	21	751
	20	10	11	12	14	15	16	17	19	20	22	23	674
	30	12	13	14	15	17	18	20	21	23	24	26	601
	40	13	14	16	17	19	20	22	24	26	27	29	534
	50	15	16	18	20	21	23	25	27	29	31	33	473
	60° F, 21 psf wind	40	44	48	53	57	62	67	73	78	84	90	1064
	60° F, 6 psf wind	24	27	29	32	35	38	41	44	48	51	55	567
	60° F, 4 psf wind	21	23	26	28	31	33	36	39	42	45	48	499
	60	17	18	20	22	24	26	28	30	33	35	37	419
	70	19	21	23	25	27	29	32	34	37	39	42	372
	80	21	23	25	28	30	33	35	38	41	44	47	333
	90	23	26	28	31	33	36	39	42	45	49	52	300
	100	26	28	31	34	37	40	43	47	50	54	58	273

Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		8	9	10	11	12	13	14	15	16	17	18	856
0		11	12	13	14	15	17	18	19	21	22	24	659
0°, 0.5" ice, 4 psf wind + k		41	45	49	54	59	64	69	74	80	86	92	1650
30		17	18	20	22	24	26	28	30	32	35	37	422
32°, 0.5" ice,		37	41	45	49	53	58	62	67	72	78	83	1097
32°, 0.5" ice, 2 psf wind		38	42	46	50	54	59	64	69	74	79	85	1136
40		19	21	23	25	27	30	32	35	37	40	43	366
50		22	24	26	29	31	34	37	39	42	46	49	321
60		24	27	29	32	35	38	41	44	48	51	55	286
60° F, 6 psf wind		30	33	36	39	43	46	50	54	58	62	67	468
70		27	30	33	36	39	42	46	49	53	57	61	259
80		29	32	36	39	42	46	50	54	58	62	66	237
90		32	35	39	42	46	50	54	58	62	67	72	219
100		34	38	41	45	49	53	58	62	67	72	77	204
120		39	43	47	51	56	60	65	70	76	81	87	181
212		55	61	67	73	79	86	93	100	108	116	124	127

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 6 of 61

1/0 AWG (7) AAAC "Azusa"

DE Tension = 1,850 Lbs

RBS = 4,460 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		250	260	270	280	290	300	310	320	330	340	350		
	15°, 1" ice, 4 psf wind	77	83	90	96	103	111	118	126	134	142	151	2470	
	15°, 0.8" ice, 4 psf wind	67	72	78	84	90	96	103	109	116	123	131	2070	
	0°, 0.5" ice, 4 psf wind + k	57	61	66	71	76	82	87	93	99	105	111	1850	
	0	12	13	14	15	16	17	18	20	21	22	23	916	
	10	13	14	15	16	17	19	20	21	23	24	25	835	
	20	14	16	17	18	19	21	22	23	25	27	28	757	
	30	16	17	19	20	21	23	24	26	28	29	31	683	
	40	18	19	21	22	24	25	27	29	31	33	35	615	
	50	20	21	23	25	27	28	30	32	34	37	39	551	
	60° F, 21 psf wind	54	59	63	68	73	78	84	89	95	100	106	1221	
	60° F, 6 psf wind	33	35	38	41	44	47	50	54	57	61	64	660	
	60° F, 4 psf wind	28	31	33	36	38	41	44	46	49	52	56	583	
	60	22	24	26	28	30	32	34	36	38	41	43	494	
	70	25	26	29	31	33	35	38	40	43	45	48	444	
	80	27	29	32	34	37	39	42	45	47	50	53	400	
	90	30	32	35	38	40	43	46	49	52	55	59	363	
	100	33	36	38	41	44	47	50	54	57	61	64	332	

Extra Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		12	13	14	15	16	17	18	20	21	22	23	912
0		15	16	18	19	20	22	23	25	26	28	30	719
0°, 0.5" ice, 4 psf wind + k		57	61	66	71	76	82	87	93	99	105	111	1850
30		23	24	26	28	30	32	35	37	39	42	44	484
32°, 0.5" ice,		51	55	59	64	68	73	78	83	89	94	100	1245
32°, 0.5" ice, 2 psf wind		52	56	61	65	70	75	80	85	91	96	102	1289
40		26	28	30	32	34	37	39	42	45	47	50	426
50		29	31	34	36	39	41	44	47	50	53	56	378
60		32	35	37	40	43	46	49	52	56	59	63	340
60° F, 6 psf wind		40	43	46	50	53	57	61	65	69	73	78	545
70		35	38	41	44	47	51	54	58	61	65	69	309
80		38	42	45	48	52	55	59	63	67	71	75	283
90		42	45	48	52	56	60	64	68	72	77	81	262
100		44	48	52	56	60	64	68	73	77	82	87	245
120		50	54	58	63	67	72	77	82	87	92	98	218
212		71	77	83	90	96	103	110	117	124	132	140	153

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

1/0 AWG (7) AAAC "Azusa"

DE Tension = 2,200 Lbs

RBS = 4,460 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		300	310	320	330	340	350	360	370	380	390		400
	15°, 1" ice, 4 psf wind	96	103	110	117	124	131	139	147	155	163	171	2841
	15°, 0.8" ice, 4 psf wind	82	87	93	99	105	111	118	125	131	138	146	2426
	0°, 0.5" ice, 4 psf wind + k	69	74	78	83	88	94	99	105	110	116	122	2200
	0	12	13	14	15	15	16	17	18	19	20	21	1309
	10	13	14	15	15	16	17	18	19	21	22	23	1222
	20	14	15	16	17	18	19	20	21	22	23	24	1136
	30	15	16	17	18	19	20	21	23	24	25	26	1051
	40	16	17	18	20	21	22	23	25	26	27	29	968
	50	18	19	20	21	23	24	25	27	28	30	31	888
	60° F, 21 psf wind	63	67	71	76	81	85	90	95	101	106	112	1521
	60° F, 6 psf wind	33	35	37	40	42	45	47	50	53	55	58	948
	60° F, 4 psf wind	27	29	31	33	35	37	39	41	43	46	48	880
	60	19	21	22	23	25	26	28	29	31	33	34	811
	70	21	23	24	26	27	29	31	32	34	36	38	738
	80	23	25	27	28	30	32	34	36	38	40	42	669
	90	26	28	29	31	33	35	37	39	41	44	46	606
	100	29	31	33	35	37	39	41	43	46	48	51	548

Super Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		12	13	14	15	16	17	18	19	20	21	22	1291
0		14	15	16	17	19	20	21	22	23	24	26	1080
0°, 0.5" ice, 4 psf wind + k		69	74	78	83	88	94	99	105	110	116	122	2200
30		20	21	23	24	26	27	29	30	32	34	35	787
32°, 0.5" ice,		59	63	68	72	76	81	85	90	95	100	105	1537
32°, 0.5" ice, 2 psf wind		61	65	69	74	78	83	88	93	98	103	108	1584
40		22	24	25	27	29	30	32	34	36	38	40	700
50		25	27	29	31	32	34	36	38	40	43	45	620
60		28	30	32	34	37	39	41	43	46	48	51	550
60° F, 6 psf wind		41	44	46	49	52	56	59	62	65	69	73	762
70		32	34	36	39	41	44	46	49	51	54	57	490
80		36	38	41	43	46	49	51	54	57	60	63	439
90		39	42	45	48	51	54	57	60	63	67	70	396
100		43	46	49	52	56	59	62	66	70	73	77	362
120		51	54	58	61	65	69	73	77	81	86	90	309
212		80	85	91	96	102	108	115	121	128	135	142	197

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 8 of 61

110.8 kcmil (12/7) ACSR "Minorca"

DE Tension = 1,000 Lbs

RBS = 11,300 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		50	60	70	80	90	100	110	120	130	140	150	
	15°, 1" ice, 4 psf wind	6	9	12	15	19	24	29	35	41	47	54	1423
	15°, 0.8" ice, 4 psf wind	6	8	11	14	18	22	27	32	38	44	50	1143
	0°, 0.5" ice, 4 psf wind + k	5	7	10	13	16	20	24	29	33	39	45	1000
	0	3	5	7	9	11	14	17	20	23	27	31	301
	10	4	5	7	10	12	15	18	22	26	30	34	275
	20	4	6	8	11	13	16	20	24	28	32	37	254
	30	4	6	9	11	14	18	21	25	30	35	40	237
	40	5	7	9	12	15	19	23	27	32	37	42	222
	50	5	7	10	13	16	20	24	29	33	39	45	210
	60° F, 21 psf wind	6	8	11	15	19	23	28	34	39	46	52	572
	60° F, 6 psf wind	5	8	10	14	17	21	26	31	36	42	48	259
	60° F, 4 psf wind	5	8	10	13	17	21	25	30	35	41	47	228
	60	5	8	10	13	17	21	25	30	35	41	47	200
	70	5	8	11	14	18	22	26	31	37	43	49	191
	80	6	8	11	15	18	23	27	33	38	44	51	184
	90	6	8	11	15	19	23	28	34	40	46	53	178
	100	6	9	12	15	19	24	29	35	41	47	54	173

Super Short Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL SAG (inches)										Tension Lbs	
							R.S.						
		50	60	70	80	90	100	110	120	130	140		150
-20		3	4	6	7	9	11	14	16	19	22	26	363
0		4	5	7	9	12	14	17	21	24	28	32	290
0°, 0.5" ice, 4 psf wind + k		5	7	10	13	16	20	24	29	33	39	45	1000
30		5	7	9	12	15	18	22	26	31	36	41	229
32°, 0.5" ice,		5	8	10	13	17	21	25	30	35	41	47	633
32°, 0.5" ice, 2 psf wind		5	8	10	14	17	21	26	30	36	41	48	653
40		5	7	9	12	16	19	23	28	33	38	43	216
50		5	7	10	13	17	20	25	29	34	40	46	204
60		5	8	10	14	17	21	26	31	36	42	48	195
60° F, 6 psf wind		5	8	11	14	18	22	26	31	37	43	49	253
70		6	8	11	14	18	22	27	32	37	43	50	189
80		6	8	11	15	18	23	28	33	39	45	51	183
90		6	8	12	15	19	24	28	34	40	46	53	177
100		6	9	12	15	20	24	29	35	41	47	54	172
120		6	9	12	16	21	25	31	37	43	50	57	163
248		8	12	16	21	27	33	40	47	56	64	74	127

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

110.8 kcmil (12/7) ACSR "Minorca"

DE Tension = 1,500 Lbs

RBS = 11,300 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	100	110	120	130	140	150	160	170	180	190		200
	15°, 1" ice, 4 psf wind	17	20	24	28	32	37	42	48	54	60	66	2064
	15°, 0.8" ice, 4 psf wind	15	18	22	26	30	34	39	44	49	54	60	1693
	0°, 0.5" ice, 4 psf wind + k	13	16	19	22	26	30	34	38	43	48	53	1500
	0	7	9	11	13	15	17	19	21	24	27	30	559
	10	8	10	12	14	16	19	21	24	27	30	33	502
	20	9	11	13	15	18	21	23	26	30	33	36	457
	30	10	12	14	17	19	22	25	29	32	36	40	419
	40	11	13	15	18	21	24	27	31	35	39	43	388
	50	11	14	17	19	22	26	29	33	37	41	46	363
	60° F, 21 psf wind	15	18	21	25	29	33	38	43	48	54	59	899
	60° F, 6 psf wind	13	15	18	21	25	29	32	37	41	46	51	434
	60° F, 4 psf wind	12	15	18	21	24	28	32	36	40	45	50	386
	60	12	15	18	21	24	27	31	35	40	44	49	341
	70	13	16	19	22	25	29	33	37	42	47	52	322
	80	14	16	20	23	27	31	35	39	44	49	54	306
	90	14	17	20	24	28	32	36	41	46	51	57	293
	100	15	18	21	25	29	33	38	42	48	53	59	284

Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190		200
-20		6	7	9	10	12	14	16	18	20	22	24	682
0		8	9	11	13	15	18	20	23	25	28	31	532
0°, 0.5" ice, 4 psf wind + k		13	16	19	22	26	30	34	38	43	48	53	1500
30		10	13	15	18	20	23	27	30	34	38	42	400
32°, 0.5" ice,		13	16	19	23	26	30	34	39	44	49	54	991
32°, 0.5" ice, 2 psf wind		14	16	20	23	27	30	35	39	44	49	54	1020
40		11	14	16	19	22	25	29	32	36	40	45	372
50		12	14	17	20	23	27	31	35	39	43	48	348
60		13	15	18	21	25	29	32	37	41	46	51	327
60° F, 6 psf wind		13	16	19	22	26	30	34	38	43	47	52	420
70		13	16	19	23	26	30	34	39	43	48	53	312
80		14	17	20	23	27	31	35	40	45	50	55	301
90		14	17	21	24	28	32	37	41	46	52	57	291
100		15	18	21	25	29	33	38	43	48	53	59	282
120		16	19	23	26	31	35	40	45	51	57	63	265
248		21	25	30	35	41	47	53	60	67	75	83	201

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

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Sheet 10 of 61

110.8 kcmil (12/7) ACSR "Minorca"

DE Tension = 2,000 Lbs

RBS = 11,300 Lbs

Medium Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→ Span (Ft)→	Not Recommended			R.S.			Not Recommended					
		150	160	170	180	190	200	210	220	230	240	250	
	15°, 1" ice, 4 psf wind	29	33	37	41	46	51	56	62	68	74	80	2677
	15°, 0.8" ice, 4 psf wind	26	29	33	37	41	46	50	55	60	66	71	2232
	0°, 0.5" ice, 4 psf wind + k	22	25	29	32	36	39	44	48	52	57	62	2000
	0	10	12	13	15	16	18	20	22	24	26	29	912
	10	11	13	15	16	18	20	22	25	27	29	32	820
	20	13	14	16	18	20	22	25	27	30	32	35	741
	30	14	16	18	20	22	25	27	30	33	36	39	674
	40	15	17	20	22	24	27	30	33	36	39	42	617
	50	16	19	21	24	26	29	32	35	39	42	46	569
	60° F, 21 psf wind	24	27	31	34	38	42	47	51	56	61	66	1253
	60° F, 6 psf wind	19	22	24	27	30	34	37	41	44	48	53	654
	60° F, 4 psf wind	18	21	23	26	29	33	36	39	43	47	51	590
	60	18	20	23	25	28	31	35	38	42	45	49	529
	70	19	22	24	27	30	34	37	41	44	48	53	495
	80	20	23	26	29	32	36	39	43	47	51	56	465
	90	21	24	27	31	34	38	42	46	50	54	59	440
	100	22	25	29	32	36	40	44	48	53	57	62	418

Medium Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs	
							R.S.							
		150	160	170	180	190	200	210	220	230	240	250		
-20		9	10	11	12	14	15	17	19	20	22	24	1086	
0		11	12	14	16	17	19	21	23	26	28	30	861	
0°, 0.5" ice, 4 psf wind + k		22	25	29	32	36	39	44	48	52	57	62	2000	
30		15	17	19	21	24	26	29	32	35	38	41	632	
32°, 0.5" ice,		22	25	28	31	35	39	43	47	51	56	61	1374	
32°, 0.5" ice, 2 psf wind		22	25	28	32	35	39	43	47	52	57	61	1410	
40		16	18	21	23	26	29	32	35	38	41	45	580	
50		17	20	22	25	28	31	34	38	41	45	49	536	
60		19	21	24	27	30	33	37	40	44	48	52	499	
60° F, 6 psf wind		20	23	25	29	32	35	39	43	47	51	55	625	
70		20	23	26	29	32	36	39	43	47	51	56	468	
80		21	24	27	30	34	37	41	45	49	54	58	447	
90		22	25	28	31	35	39	43	47	51	56	60	430	
100		23	26	29	32	36	40	44	48	53	58	63	415	
120		24	27	31	35	39	43	47	52	57	62	67	387	
248		33	38	42	48	53	59	65	71	78	85	92	284	

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 11 of 61

110.8 kcmil (12/7) ACSR "Minorca"

DE Tension = 2,500 Lbs

RBS = 11,300 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		200	210	220	230	240	250	260	270	280	290	300	
15°	1" ice, 4 psf wind	42	46	51	55	60	65	71	76	82	88	94	3266
15°	0.8" ice, 4 psf wind	37	41	45	49	53	58	62	67	72	78	83	2764
0°	0.5" ice, 4 psf wind + k	32	35	38	42	45	49	53	58	62	66	71	2500
0		12	14	15	16	18	19	21	23	24	26	28	1343
10		14	15	16	18	20	21	23	25	27	29	31	1225
20		15	16	18	20	21	23	25	27	29	31	34	1116
30		16	18	20	22	24	26	28	30	32	34	37	1017
40		18	20	22	24	26	28	30	33	35	38	40	929
50		20	22	24	26	28	30	33	36	38	41	44	851
60° F	21 psf wind	32	36	39	43	47	51	55	59	64	68	73	1637
60° F	6 psf wind	24	26	29	31	34	37	40	43	46	50	53	933
60° F	4 psf wind	22	25	27	30	32	35	38	41	44	47	50	858
60		21	23	26	28	31	33	36	39	42	45	48	784
70		23	25	28	30	33	36	39	42	45	48	51	727
80		25	27	30	33	35	38	42	45	48	52	55	677
90		26	29	32	35	38	41	44	48	51	55	59	634
100		28	31	34	37	40	44	47	51	55	59	63	597

Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		11	12	13	14	16	17	18	20	21	23	24	1536
0		13	14	16	17	19	21	22	24	26	28	30	1264
0°, 0.5" ice, 4 psf wind + k		32	35	38	42	45	49	53	58	62	66	71	2500
30		18	20	21	23	26	28	30	32	35	37	40	939
32°, 0.5" ice,		30	33	36	40	43	47	51	55	59	63	67	1778
32°, 0.5" ice, 2 psf wind		30	34	37	40	44	48	51	55	60	64	68	1819
40		19	21	24	26	28	30	33	35	38	41	44	856
50		21	23	26	28	31	33	36	39	42	45	48	785
60		23	25	28	30	33	36	39	42	45	48	52	724
60° F, 6 psf wind		25	28	30	33	36	39	42	46	49	53	57	878
70		25	27	30	33	36	39	42	45	48	52	56	672
80		26	29	32	35	38	41	45	48	52	56	60	628
90		28	30	33	37	40	43	47	50	54	58	62	602
100		29	32	35	38	41	45	49	52	56	61	65	578
120		31	34	38	41	45	48	52	57	61	65	70	536
248		44	49	53	58	63	69	74	80	86	93	99	379

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 12 of 61

110.8 kcmil (12/7) ACSR "Minorca"

DE Tension = 3,000 Lbs

RBS = 11,300 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs		
		Not Recommended						R.S.				Not Recommended			
		250	260	270	280	290	300	310	320	330	340	350			
	15°, 1" ice, 4 psf wind	56	60	65	70	75	80	86	91	97	103	109	3834		
	15°, 0.8" ice, 4 psf wind	49	52	57	61	65	70	75	79	85	90	95	3289		
	0°, 0.5" ice, 4 psf wind + k	41	45	48	52	55	59	63	67	72	76	81	3000		
	0	14	15	17	18	19	21	22	23	25	26	28	1825		
	10	15	17	18	19	21	22	24	25	27	28	30	1693		
	20	17	18	19	21	22	24	25	27	29	31	33	1565		
	30	18	19	21	23	24	26	28	29	31	33	35	1444		
	40	20	21	23	25	26	28	30	32	34	36	38	1329		
	50	21	23	25	27	29	31	33	35	37	39	42	1223		
	60° F, 21 psf wind	41	44	47	51	55	58	62	66	71	75	80	2050		
	60° F, 6 psf wind	27	29	31	34	36	39	41	44	47	50	53	1283		
	60° F, 4 psf wind	25	27	29	31	34	36	38	41	44	46	49	1203		
	60	23	25	27	29	31	33	35	38	40	43	45	1127		
	70	25	27	29	31	34	36	38	41	44	46	49	1040		
	80	27	29	31	34	36	39	42	44	47	50	53	963		
	90	29	31	34	36	39	42	45	48	51	54	57	896		
	100	31	34	36	39	42	45	48	51	54	57	61	836		

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)										Tension Lbs	
							R.S.						
		250	260	270	280	290	300	310	320	330	340		350
-20		13	14	15	16	17	19	20	21	23	24	25	2009
0		15	16	18	19	20	22	23	25	26	28	30	1708
0°, 0.5" ice, 4 psf wind + k		41	45	48	52	55	59	63	67	72	76	81	3000
30		20	21	23	25	27	28	30	32	34	37	39	1314
32°, 0.5" ice,		38	41	44	47	51	54	58	62	66	70	74	2199
32°, 0.5" ice, 2 psf wind		39	42	45	48	52	55	59	63	67	71	75	2244
40		22	23	25	27	29	31	33	35	38	40	42	1203
50		24	26	28	30	32	34	36	39	41	44	46	1103
60		26	28	30	32	34	37	39	42	45	47	50	1014
60° F, 6 psf wind		29	31	34	36	39	42	45	48	51	54	57	1183
70		28	30	32	35	37	40	43	45	48	51	54	936
80		30	32	35	38	40	43	46	49	52	55	59	869
90		32	35	37	40	43	46	49	52	56	59	63	815
100		33	36	39	42	45	48	51	54	58	61	65	781
120		36	39	42	45	49	52	55	59	63	67	71	720
248		53	58	62	67	72	77	82	87	93	98	104	489

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 13 of 61

110.8 kcmil (12/7) ACSR "Minorca"

DE Tension = 3,250 Lbs

RBS = 11,300 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	300	310	320	330	340	350	360	370	380	390	400	
	15°, 1" ice, 4 psf wind	74	79	84	89	94	100	106	112	118	124	131	4184
	15°, 0.8" ice, 4 psf wind	64	68	73	78	82	87	92	97	103	108	114	3586
	0°, 0.5" ice, 4 psf wind + k	55	58	62	66	70	74	79	83	88	92	97	3250
	0	20	21	22	24	25	27	28	30	31	33	35	1914
	10	21	22	24	25	27	28	30	32	34	35	37	1787
	20	22	24	26	27	29	31	32	34	36	38	40	1663
	30	24	26	28	29	31	33	35	37	39	41	43	1545
	40	26	28	30	32	34	36	38	40	42	44	46	1434
	50	28	30	32	34	36	38	40	43	45	48	50	1331
	60° F, 21 psf wind	53	57	60	64	68	72	76	81	85	90	94	2262
	60° F, 6 psf wind	35	38	40	43	45	48	51	54	56	59	63	1410
	60° F, 4 psf wind	33	35	37	40	42	45	47	50	52	55	58	1321
	60	30	32	34	37	39	41	44	46	49	51	54	1236
	70	33	35	37	39	42	44	47	49	52	55	58	1150
	80	35	37	40	42	45	48	50	53	56	59	62	1073
	90	37	40	42	45	48	51	54	57	60	63	66	1004
	100	40	42	45	48	51	54	57	60	64	67	71	943

Super Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		18	19	21	22	23	25	26	28	29	31	32	2062
0		21	22	24	25	27	29	30	32	34	36	37	1773
0°, 0.5" ice, 4 psf wind + k		55	58	62	66	70	74	79	83	88	92	97	3250
30		27	29	30	32	34	36	39	41	43	45	48	1396
32°, 0.5" ice,		50	53	57	60	64	68	72	76	80	84	89	2396
32°, 0.5" ice, 2 psf wind		51	54	58	62	65	69	73	77	82	86	90	2446
40		29	31	33	35	37	39	42	44	47	49	52	1290
50		31	34	36	38	40	43	45	48	50	53	56	1193
60		34	36	38	41	43	46	49	51	54	57	60	1107
60° F, 6 psf wind		38	41	44	46	49	52	55	58	61	65	68	1295
70		36	39	41	44	47	49	52	55	58	61	65	1031
80		39	42	44	47	50	53	56	59	62	66	69	963
90		41	44	47	50	53	56	59	63	66	70	73	908
100		43	46	49	52	55	58	62	65	69	72	76	874
120		46	49	52	56	59	63	66	70	74	78	82	811
248		66	71	76	80	85	90	96	101	107	112	118	564

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 14 of 61

336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 1,300 Lbs

RBS = 8,680 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	50	60	70	80	90	100	110	120	130	140	150	
	15°, 1" ice, 4 psf wind	6	8	11	15	18	23	27	33	38	44	51	1737
	15°, 0.8" ice, 4 psf wind	5	8	10	13	17	21	25	30	35	41	47	1427
	0°, 0.5" ice, 4 psf wind + k	4	6	9	11	14	18	21	26	30	35	40	1300
	0	3	4	6	7	9	12	14	17	19	23	26	473
	10	3	5	7	9	11	14	16	20	23	27	31	404
	20	4	6	8	10	13	15	19	22	26	30	35	355
	30	4	6	8	11	14	17	21	25	29	34	39	319
	40	5	7	9	12	15	19	23	27	32	37	42	291
	50	5	7	10	13	17	20	25	29	34	40	46	269
	60° F, 21 psf wind	6	9	12	15	20	24	29	35	41	47	54	778
	60° F, 6 psf wind	6	8	11	14	18	22	27	32	38	44	50	338
	60° F, 4 psf wind	5	8	11	14	18	22	27	32	37	43	49	294
	60	5	8	11	14	18	22	26	31	37	43	49	251
	70	6	8	11	15	19	23	28	33	39	45	52	237
	80	6	9	12	16	20	24	30	35	41	48	55	224
	90	6	9	13	16	21	26	31	37	43	50	58	213
	100	7	10	13	17	22	27	33	39	45	53	60	204

Super Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		2	3	4	5	7	8	10	12	14	16	19	652
0		3	5	6	8	10	13	15	18	21	25	28	435
0°, 0.5" ice, 4 psf wind + k		5	7	9	12	15	18	22	26	31	36	41	1277
30		5	7	9	12	15	18	22	26	31	36	41	303
32°, 0.5" ice,		5	8	10	13	17	21	25	30	35	41	47	792
32°, 0.5" ice, 2 psf wind		5	8	10	13	17	21	25	30	35	41	47	813
40		5	7	10	13	16	20	24	28	33	39	44	279
50		5	8	10	14	17	21	26	30	36	41	48	259
60		6	8	11	14	18	23	27	32	38	44	51	243
60° F, 6 psf wind		6	8	11	15	19	23	28	33	39	45	52	328
70		6	9	12	15	19	24	29	34	40	47	54	230
80		6	9	12	16	20	25	30	36	42	49	56	218
90		7	9	13	17	21	26	32	38	44	52	59	208
100		7	10	13	18	22	27	33	40	46	54	62	200
120		7	10	14	19	24	29	35	42	49	57	65	189
248		9	13	17	23	28	35	43	51	59	69	79	156

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 15 of 61

336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 1,800 Lbs

RBS = 8,680 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		100	110	120	130	140	150	160	170	180	190		200
	15°, 1" ice, 4 psf wind	16	20	24	28	32	37	42	48	53	59	66	2386
	15°, 0.8" ice, 4 psf wind	15	18	22	25	29	34	39	43	49	54	60	1988
	0°, 0.5" ice, 4 psf wind + k	13	15	18	22	25	29	33	37	41	46	51	1800
	0	7	9	11	13	15	17	19	22	24	27	30	732
	10	9	10	12	15	17	19	22	25	28	31	35	632
	20	10	12	14	17	19	22	25	28	32	35	39	557
	30	11	13	16	18	21	25	28	32	35	39	44	500
	40	12	15	17	20	24	27	31	35	39	43	48	456
	50	13	16	19	22	26	29	33	38	42	47	52	420
	60° F, 21 psf wind	16	20	24	28	32	37	42	47	53	59	65	1150
	60° F, 6 psf wind	14	17	21	24	28	32	37	42	47	52	58	521
	60° F, 4 psf wind	14	17	20	24	28	32	36	41	46	51	57	455
	60	14	17	20	24	27	32	36	41	45	51	56	392
	70	15	18	22	25	29	34	38	43	48	54	60	368
	80	16	19	23	27	31	36	40	46	51	57	63	347
	90	17	20	24	28	33	37	43	48	54	60	67	330
	100	17	21	25	29	34	39	45	50	57	63	70	315

Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		6	7	9	10	12	14	16	18	20	22	25	893
0		9	10	12	14	17	19	22	25	28	31	34	642
0°, 0.5" ice, 4 psf wind + k		13	16	19	22	26	29	33	38	42	47	52	1767
30		12	14	17	20	23	27	31	35	39	43	48	460
32°, 0.5" ice,		14	17	21	24	28	32	37	42	47	52	58	1148
32°, 0.5" ice, 2 psf wind		15	18	21	25	28	33	37	42	47	52	58	1177
40		13	16	19	22	25	29	33	37	42	47	52	424
50		14	17	20	24	27	31	36	40	45	50	56	394
60		15	18	21	25	29	33	38	43	48	54	59	370
60° F, 6 psf wind		15	18	22	26	30	34	39	44	49	55	61	495
70		16	19	23	26	31	35	40	45	51	57	63	349
80		17	20	24	28	32	37	42	48	54	60	66	332
90		17	21	25	29	34	39	44	50	56	63	69	316
100		18	22	26	31	35	41	46	52	59	65	72	303
120		20	24	28	33	38	44	50	57	63	71	78	281
248		24	29	34	40	47	54	61	69	77	86	96	230

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 16 of 61

336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 2,300 Lbs

RBS = 8,680 Lbs

Medium Span - Feet													
Condition →		INITIAL (Stringing) SAG (inches)										Tension Lbs	
Temp. Deg. F↓	R.S. Range②→ Span (Ft)→	Not Recommended					R.S.				Not Recommended		
		150	160	170	180	190	200	210	220	230	240		250
15°, 1" ice, 4 psf wind		29	34	38	42	47	52	58	63	69	76	82	3002
15°, 0.8" ice, 4 psf wind		27	30	34	38	43	47	52	57	63	68	74	2535
0°, 0.5" ice, 4 psf wind + k		23	26	29	32	36	40	44	48	53	58	63	2300
0		12	13	15	17	19	21	23	25	27	30	32	1064
10		13	15	17	19	21	24	26	29	31	34	37	926
20		15	17	19	22	24	27	30	33	36	39	42	816
30		17	19	22	24	27	30	33	36	40	43	47	729
40		19	21	24	27	30	33	37	40	44	48	52	660
50		20	23	26	29	33	36	40	44	48	52	57	605
60° F, 21 psf wind		27	31	35	40	44	49	54	59	65	70	76	1540
60° F, 6 psf wind		23	26	30	33	37	41	45	50	54	59	64	734
60° F, 4 psf wind		23	26	29	32	36	40	44	48	53	58	63	646
60		22	25	28	32	35	39	43	47	52	56	61	560
70		24	27	30	34	38	42	46	51	56	60	66	523
80		25	29	32	36	40	45	49	54	59	64	70	491
90		27	30	34	38	43	47	52	57	62	68	74	465
100		28	32	36	40	45	50	55	60	66	72	78	442

Medium Span - Feet													
Condition → Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		150	160	170	180	190	200	210	220	230	240	250	
-20		10	12	13	15	16	18	20	22	24	26	28	1210
0		14	16	18	20	22	24	27	29	32	35	38	898
0°, 0.5" ice, 4 psf wind + k		23	26	29	33	37	41	45	49	54	59	64	2262
30		19	22	25	28	31	34	38	41	45	49	53	643
32°, 0.5" ice,		25	28	31	35	39	44	48	53	58	63	68	1518
32°, 0.5" ice, 2 psf wind		25	28	32	36	40	44	48	53	58	63	69	1555
40		21	24	27	30	33	37	41	45	49	53	58	590
50		22	26	29	32	36	40	44	48	53	58	62	548
60		24	27	31	35	39	43	47	52	56	62	67	513
60° F, 6 psf wind		25	28	32	36	40	44	49	54	59	64	69	679
70		26	29	33	37	41	45	50	55	60	65	71	483
80		27	31	35	39	43	48	53	58	63	69	75	457
90		28	32	36	41	45	50	56	61	67	73	79	435
100		30	34	38	43	48	53	58	64	70	76	82	416
120		32	37	41	46	52	57	63	69	76	82	89	384
248		41	46	52	58	65	72	79	87	95	104	113	305

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 17 of 61

336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 2,800 Lbs

RBS = 8,680 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		200	210	220	230	240	250	260	270	280	290	300	
15°	1" ice, 4 psf wind	44	48	53	58	63	68	74	80	86	92	98	3592
15°	0.8" ice, 4 psf wind	39	43	47	52	56	61	66	71	76	82	88	3071
0°	0.5" ice, 4 psf wind + k	33	36	40	44	47	51	56	60	65	69	74	2800
0		15	16	18	20	21	23	25	27	29	31	34	1470
10		17	19	20	22	24	26	29	31	33	36	38	1299
20		19	21	23	25	27	30	32	35	37	40	43	1151
30		21	24	26	28	31	33	36	39	42	45	48	1027
40		24	26	29	31	34	37	40	43	47	50	53	924
50		26	29	32	35	38	41	44	48	51	55	59	840
60° F	21 psf wind	39	43	47	51	56	60	65	70	76	81	87	1950
60° F	6 psf wind	30	34	37	40	44	48	51	55	60	64	68	988
60° F	4 psf wind	29	32	36	39	42	46	50	54	58	62	66	879
60		28	31	34	38	41	44	48	52	56	60	64	772
70		31	34	37	41	44	48	52	56	60	64	69	715
80		33	36	40	43	47	51	56	60	64	69	74	667
90		35	39	42	46	50	55	59	64	68	73	79	627
100		37	41	45	49	53	58	63	67	73	78	83	593

Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		14	15	17	18	20	22	23	25	27	29	31	1582
0		18	20	22	24	26	28	31	33	36	38	41	1205
0°, 0.5" ice, 4 psf wind + k		33	37	40	44	48	52	56	61	65	70	75	2766
30		25	28	31	34	37	40	43	46	50	54	57	860
32°, 0.5" ice,		35	38	42	46	50	54	59	63	68	73	78	1905
32°, 0.5" ice, 2 psf wind		35	39	42	46	50	55	59	64	69	74	79	1949
40		28	31	34	37	40	44	47	51	55	59	63	787
50		30	33	37	40	43	47	51	55	59	63	68	727
60		32	36	39	43	47	51	55	59	64	68	73	677
60° F, 6 psf wind		34	37	41	45	49	53	57	62	67	71	76	885
70		35	38	42	46	50	54	58	63	68	73	78	635
80		37	40	44	48	53	57	62	67	72	77	82	600
90		39	43	47	51	56	60	65	70	76	81	87	569
100		40	45	49	54	58	63	68	74	79	85	91	542
120		44	49	53	58	63	69	75	80	86	93	99	498
248		57	63	70	76	83	90	97	105	113	121	129	382

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 18 of 61

336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 3,300 Lbs

RBS = 8,680 Lbs

Extra Long Span - Feet													
Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		250	260	270	280	290	300	310	320	330	340		350
	15°, 1" ice, 4 psf wind	59	64	69	74	80	85	91	97	103	109	116	4158
	15°, 0.8" ice, 4 psf wind	52	56	61	65	70	75	80	85	91	96	102	3598
	0°, 0.5" ice, 4 psf wind + k	44	47	51	55	59	63	67	72	76	81	86	3300
	0	18	19	21	22	24	25	27	29	31	33	35	1941
	10	20	21	23	25	26	28	30	32	34	36	38	1749
	20	22	24	25	27	29	31	33	36	38	40	43	1571
	30	24	26	28	30	33	35	37	40	42	45	48	1410
	40	27	29	31	34	36	39	42	44	47	50	53	1269
	50	30	32	35	37	40	43	46	49	52	55	58	1149
	60° F, 21 psf wind	49	53	58	62	66	71	76	81	86	91	97	2382
	60° F, 6 psf wind	36	39	42	45	49	52	56	59	63	67	71	1298
	60° F, 4 psf wind	34	37	40	43	46	50	53	56	60	64	67	1172
	60	33	35	38	41	44	47	50	54	57	60	64	1047
	70	36	38	42	45	48	51	55	58	62	66	70	962
	80	38	42	45	48	52	55	59	63	67	71	75	891
	90	41	45	48	52	56	59	63	68	72	76	81	830
	100	44	48	51	55	59	63	68	72	77	81	86	779

Extra Long Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		17	18	20	21	23	25	26	28	30	32	33	2002
0		22	24	25	27	29	31	34	36	38	40	43	1566
0°, 0.5" ice, 4 psf wind + k		44	48	51	55	59	63	68	72	77	81	86	3279
30		31	33	36	38	41	44	47	50	53	57	60	1121
32°, 0.5" ice,		28	30	33	35	38	40	43	46	49	52	55	2312
32°, 0.5" ice, 2 psf wind		45	49	53	57	61	65	69	74	79	84	89	2361
40		34	36	39	42	45	48	52	55	59	62	66	1021
50		37	39	43	46	49	53	56	60	64	68	72	938
60		39	43	46	49	53	57	61	65	69	73	77	869
60° F, 6 psf wind		42	45	49	53	57	60	65	69	73	78	82	1118
70		42	46	49	53	57	61	65	69	73	78	83	812
80		45	49	52	56	60	65	69	74	78	83	88	763
90		48	51	55	60	64	68	73	78	83	88	93	721
100		50	54	58	63	67	72	77	82	87	93	98	685
120		55	59	64	69	74	79	84	90	96	102	108	625
248		74	80	87	93	100	107	114	122	130	137	146	481

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 19 of 61

336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 3,800 Lbs

RBS = 8,680 Lbs

Extra Long Span - Feet												
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	Not Recommended					R.S.			Not Recommended			
	300	310	320	330	340	350	360	370	380	390	400	
15°, 1" ice, 4 psf wind	75	80	86	91	97	102	108	115	121	127	134	4703
15°, 0.8" ice, 4 psf wind	65	70	74	79	84	89	94	100	105	111	116	4117
0°, 0.5" ice, 4 psf wind + k	55	58	62	66	70	74	79	83	88	92	97	3800
0	20	21	23	24	26	27	29	30	32	34	36	2460
10	22	23	25	26	28	30	31	33	35	37	39	2261
20	24	25	27	29	31	32	34	36	38	40	42	2068
30	26	28	30	32	34	36	38	40	42	44	47	1883
40	29	31	33	35	37	39	42	44	46	49	51	1710
50	32	34	36	38	41	43	46	48	51	54	56	1553
60° F, 21 psf wind	60	64	68	72	77	81	86	91	96	101	106	2838
60° F, 6 psf wind	40	43	46	49	52	55	58	61	65	68	72	1679
60° F, 4 psf wind	38	40	43	46	48	51	54	57	60	64	67	1545
60	35	37	40	42	45	48	50	53	56	59	62	1413
70	38	41	43	46	49	52	55	58	61	65	68	1292
80	42	44	47	50	53	57	60	63	67	70	74	1187
90	45	48	51	54	58	61	65	68	72	76	80	1097
100	48	52	55	58	62	66	70	73	78	82	86	1021

Extra Long Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		20	21	23	24	26	27	29	30	32	34	36	2458
0		25	27	28	30	32	34	36	38	40	42	44	1975
0°, 0.5" ice, 4 psf wind + k		55	58	62	66	70	74	79	83	88	92	97	3800
30		34	37	39	42	44	47	50	52	55	58	61	1430
32°, 0.5" ice,		54	58	62	66	70	74	78	83	87	92	97	2735
32°, 0.5" ice, 2 psf wind		55	59	63	67	71	75	79	84	88	93	98	2790
40		38	41	43	46	49	52	55	58	61	64	68	1299
50		42	44	47	50	53	57	60	63	67	70	74	1189
60		45	48	51	54	58	61	65	68	72	76	80	1096
60° F, 6 psf wind		49	52	56	59	63	67	70	74	79	83	87	1381
70		48	52	55	59	62	66	70	74	78	82	86	1018
80		52	55	59	63	67	71	75	79	83	88	92	952
90		55	59	63	67	71	75	79	84	88	93	98	896
100		58	62	66	71	75	79	84	89	94	98	104	847
120		64	69	73	78	83	88	93	98	103	109	114	767
248		90	97	103	109	116	123	130	138	145	153	161	547

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 20 of 61

T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"

DE Tension = 1,000 LBS

RBS =16,700 Lbs

Super Short Span - Feet												
Condition→ Temp. R.S. Range ②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	Not Recommended					R.S.			Not Recommended			
	50	60	70	80	90	100	110	120	130	140	150	
15°, 1" ice, 4 psf wind	8	11	15	20	25	31	38	45	53	61	70	1507
15°, 0.8" ice, 4 psf wind	8	11	15	1	25	30	37	44	52	60	69	1206
0°, 0.5" ice, 4 psf wind + k	7	10	14	0	23	29	35	41	48	56	64	1000
0	6	9	13	0	21	26	31	37	44	51	58	338
10	7	10	13	0	22	27	33	39	46	53	61	323
20	7	10	14	0	23	28	34	41	48	56	64	309
30	7	11	14	0	24	29	36	42	50	58	66	297
40	8	11	15	0	25	31	37	44	52	60	69	286
50	8	11	15	0	25	31	38	45	53	62	71	278
60° F, 21 psf wind	8	12	16	0	27	33	40	48	56	65	75	773
60° F, 6 psf wind	8	12	16	0	26	33	39	47	55	64	73	344
60° F, 4 psf wind	8	12	16	0	26	32	39	47	55	64	73	306
60	8	12	16	0	26	32	39	46	55	63	73	271
70	8	12	16	0	27	33	40	48	56	65	75	264
80	8	12	17	0	28	34	41	49	57	67	76	258
90	9	12	17	0	28	35	42	50	59	68	78	253
100	9	13	17	0	28	35	43	51	59	69	79	249

Super Short Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL SAG (inches)										Tension Lbs	
							R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		6	9	12	16	20	24	30	35	41	48	55	358
0		7	10	13	17	22	27	33	39	46	53	61	324
0°, 0.5" ice, 4 psf wind + k		7	10	14	19	24	29	35	42	49	57	65	986
30		8	11	15	19	25	30	37	44	51	60	68	288
32°, 0.5" ice,		8	11	15	20	25	31	38	45	53	62	71	702
32°, 0.5" ice, 2 psf wind		8	11	15	20	25	31	38	45	53	62	71	718
40		8	11	15	20	25	31	38	45	53	61	70	279
50		8	12	16	21	26	32	39	46	54	63	72	272
60		8	12	16	21	27	33	40	48	56	65	75	265
60° F, 6 psf wind		8	12	16	21	27	33	40	48	56	65	75	336
70		8	12	17	22	27	34	41	49	57	66	76	259
80		9	12	17	22	28	34	42	49	58	67	77	255
90		9	13	17	22	28	35	42	50	59	68	78	252
100		9	13	17	23	29	35	43	51	60	69	79	248
120		9	13	18	23	29	36	44	52	61	71	82	242
248		10	15	20	27	34	42	51	60	71	82	94	210

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"

DE Tension = 2,000 LBS

RBS =16,700 Lbs

Short Span - Feet													
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→		INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		100	110	120	130	140	150	160	170	180	190	200	
15°, 1" ice, 4 psf wind		17	21	25	29	33	38	44	49	55	62	68	2752
15°, 0.8" ice, 4 psf wind		16	19	23	1	32	36	41	47	52	58	64	2281
0°, 0.5" ice, 4 psf wind + k		14	17	21	0	28	32	37	41	46	52	57	2000
0		11	13	16	0	22	25	28	32	36	40	44	796
10		12	15	17	0	24	27	31	35	39	43	48	729
20		13	16	19	0	25	29	33	37	42	46	51	680
30		14	17	20	0	27	31	35	40	44	49	55	639
40		14	17	21	0	28	33	37	42	47	52	58	604
50		15	18	22	0	30	34	39	44	49	55	61	574
60° F, 21 psf wind		18	21	25	0	35	40	45	51	57	64	71	1456
60° F, 6 psf wind		16	20	23	0	32	37	42	47	53	59	65	686
60° F, 4 psf wind		16	19	23	0	32	36	41	47	52	58	64	614
60		16	19	23	0	31	36	41	46	52	58	64	547
70		17	20	24	0	33	38	43	48	54	60	67	524
80		17	21	25	0	34	39	45	50	56	63	70	503
90		18	22	26	0	35	41	46	52	58	65	72	485
100		19	23	27	0	37	42	48	54	61	68	75	468

Short Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		10	12	14	17	19	22	25	28	32	35	39	891
0		12	14	17	20	23	27	30	34	39	43	48	734
0°, 0.5" ice, 4 psf wind + k		14	17	21	24	28	33	37	42	47	52	58	1973
30		15	18	21	25	28	33	37	42	47	52	58	603
32°, 0.5" ice,		16	19	23	27	31	36	41	46	52	58	64	1373
32°, 0.5" ice, 2 psf wind		16	19	23	27	32	36	41	47	52	58	64	1401
40		15	19	22	26	30	34	39	44	50	55	61	572
50		16	19	23	27	31	36	41	46	52	58	64	545
60		17	20	24	28	33	38	43	49	54	61	67	521
60° F, 6 psf wind		17	21	24	29	33	38	44	49	55	61	68	656
70		17	21	25	30	34	39	45	51	57	63	70	500
80		18	22	26	31	36	41	47	53	59	66	73	481
90		19	23	27	31	36	42	48	54	60	67	74	470
100		19	23	27	32	37	43	49	55	62	69	76	460
120		20	24	28	33	39	45	51	57	64	71	79	443
248		24	29	34	40	47	54	61	69	78	86	96	366

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"

DE Tension = 3,000 Lbs

RBS = 16,700 Lbs

Medium Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.	Not Recommended					
	Span (Ft)→	150	160	170	180	190	200	210	220	230	240	250	
	15°, 1" ice, 4 psf wind	27	31	35	39	44	48	53	59	64	70	76	3883
	15°, 0.8" ice, 4 psf wind	25	28	32	36	40	44	49	54	59	64	69	3310
	0°, 0.5" ice, 4 psf wind + k	21	24	27	31	34	38	42	46	50	55	59	3000
	0	13	15	17	19	21	23	25	28	30	33	36	1519
	10	14	16	18	21	23	26	28	31	34	37	40	1364
	20	16	18	20	23	26	28	31	34	37	41	44	1236
	30	17	20	22	25	28	31	34	37	41	45	48	1129
	40	19	22	24	27	30	34	37	41	44	48	53	1041
	50	20	23	26	29	33	36	40	44	48	52	56	967
	60° F, 21 psf wind	27	30	34	38	43	47	52	57	63	68	74	2178
	60° F, 6 psf wind	23	26	29	32	36	40	44	48	53	58	63	1111
	60° F, 4 psf wind	22	25	28	32	36	39	43	48	52	57	62	1005
	60	22	25	28	31	35	39	43	47	51	56	60	905
	70	23	26	30	33	37	41	45	50	54	59	64	852
	80	24	28	31	35	39	43	48	52	57	62	68	807
	90	26	29	33	37	41	46	50	55	60	66	71	767
	100	27	31	35	39	43	48	53	58	63	69	75	732

Medium Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		150	160	170	180	190	200	210	220	230	240		250
-20		11	13	14	16	18	20	22	24	26	29	31	1752
0		14	16	19	21	23	26	28	31	34	37	40	1360
0°, 0.5" ice, 4 psf wind + k		21	24	28	31	34	38	42	46	50	55	60	2988
30		19	22	25	28	31	34	38	42	45	49	54	1019
32°, 0.5" ice,		24	27	30	34	38	42	46	51	55	60	65	2104
32°, 0.5" ice, 2 psf wind		24	27	30	34	38	42	46	51	56	61	66	2142
40		21	24	27	30	33	37	41	45	49	53	58	946
50		22	25	29	32	36	40	44	48	52	57	62	884
60		24	27	30	34	38	42	46	51	56	60	66	832
60° F, 6 psf wind		24	28	31	35	39	43	48	52	57	62	68	1033
70		25	28	32	36	40	44	49	54	59	64	69	787
80		26	30	34	38	42	47	51	56	62	67	73	749
90		28	31	35	40	44	49	54	59	65	71	77	715
100		29	32	37	41	46	51	56	61	67	73	79	689
120		30	34	38	43	48	53	58	64	70	76	83	660
248		37	42	48	54	60	66	73	80	88	96	104	528

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 23 of 61

T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"

DE Tension = 4,000 Lbs

RBS = 16,700 Lbs

Long Span - Feet													
Condition→ Temp. R.S. Range ②→ Deg. F↓ Span (Ft)→		INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		200	210	220	230	240	250	260	270	280	290		300
15°, 1" ice, 4 psf wind		38	42	46	50	55	59	64	69	74	80	85	4958
15°, 0.8" ice, 4 psf wind		34	38	41	45	49	53	57	62	67	72	77	4319
0°, 0.5" ice, 4 psf wind + k		28	31	34	38	41	45	48	52	56	60	64	4000
0		14	15	17	18	20	22	24	25	27	29	31	2505
10		15	17	19	20	22	24	26	28	30	32	35	2264
20		17	19	21	23	25	27	29	31	33	36	38	2046
30		19	21	23	25	27	30	32	34	37	40	43	1851
40		21	23	25	27	30	32	35	38	41	44	47	1682
50		23	25	28	30	33	36	38	41	45	48	51	1537
60° F, 21 psf wind		35	38	42	46	50	54	59	63	68	73	78	2962
60° F, 6 psf wind		27	29	32	35	38	42	45	49	52	56	60	1674
60° F, 4 psf wind		26	28	31	34	37	40	43	47	50	54	58	1539
60		25	27	30	33	36	39	42	45	48	52	56	1413
70		27	29	32	35	38	42	45	49	52	56	60	1308
80		29	32	35	38	41	45	48	52	56	60	64	1219
90		31	34	37	40	44	48	52	56	60	64	69	1143
100		32	36	39	43	47	51	55	59	64	68	73	1077

Long Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		12	14	15	16	18	19	21	23	24	26	28	2824
0		16	17	19	21	23	25	27	29	31	33	36	2207
0°, 0.5" ice, 4 psf wind + k		28	31	34	38	41	45	48	52	56	60	64	4000
30		22	24	27	29	32	35	37	40	43	47	50	1579
32°, 0.5" ice,		30	34	37	40	44	48	52	56	60	64	69	2887
32°, 0.5" ice, 2 psf wind		31	34	37	41	44	48	52	56	60	65	69	2933
40		24	27	29	32	35	38	41	44	48	51	55	1438
50		26	29	32	35	38	41	45	48	52	56	59	1321
60		29	31	35	38	41	45	48	52	56	60	64	1224
60° F, 6 psf wind		30	33	36	40	43	47	51	55	59	63	67	1488
70		31	34	37	40	44	48	52	56	60	64	69	1143
80		33	36	39	43	47	51	55	59	64	68	73	1074
90		34	38	42	46	50	54	58	63	67	72	77	1015
100		36	40	44	48	52	57	61	66	71	76	82	964
120		38	42	47	51	55	60	65	70	75	81	87	909
248		49	54	60	65	71	77	83	90	97	104	111	709

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"

DE Tension = 5,000 Lbs

RBS = 16,700 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended				R.S.		Not Recommended					
		250	260	270	280	290	300	310	320	330	340	350	
	15°, 1" ice, 4 psf wind	49	53	57	61	66	70	75	80	85	90	96	6,001
	15°, 0.8" ice, 4 psf wind	43	47	50	54	58	62	66	71	75	80	84	5,320
	0°, 0.5" ice, 4 psf wind + k	36	39	42	45	48	51	55	58	62	66	70	5,000
	0	15	16	18	19	20	22	23	25	26	28	30	3,589
	10	16	18	19	21	22	24	25	27	29	30	32	3,316
	20	18	19	21	22	24	26	28	29	31	33	35	3,051
	30	20	21	23	24	26	28	30	32	34	36	38	2,797
	40	21	23	25	27	29	31	33	35	37	39	42	2,558
	50	23	25	27	29	31	34	36	38	41	43	46	2,338
	60° F, 21 psf wind	42	46	49	53	57	61	65	69	74	78	83	3,811
	60° F, 6 psf wind	29	31	34	36	39	42	44	47	50	53	57	2,414
	60° F, 4 psf wind	27	29	32	34	37	39	42	45	47	50	53	2,272
	60	26	28	30	32	34	37	39	42	44	47	50	2,139
	70	28	30	32	35	37	40	43	46	48	51	55	1,962
	80	30	33	35	38	41	44	47	50	53	56	59	1,807
	90	33	35	38	41	44	47	50	54	57	60	64	1,672
	100	35	38	41	44	47	51	54	57	61	65	69	1,555

Extra Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		14	15	16	18	19	20	22	23	24	26	27	3,907
0		17	19	20	22	23	25	27	28	30	32	34	3,170
0°, 0.5" ice, 4 psf wind + k		36	39	42	45	48	51	55	58	62	66	70	5,000
30		24	26	28	30	32	34	37	39	42	44	47	2,290
32°, 0.5" ice,		37	40	43	47	50	53	57	61	65	69	73	3,711
32°, 0.5" ice, 2 psf wind		37	40	44	47	50	54	58	61	65	69	73	3,762
40		26	29	31	33	36	38	41	43	46	49	52	2,068
50		29	31	34	36	39	42	45	48	51	54	57	1,880
60		32	34	37	40	43	46	49	52	55	59	62	1,722
60° F, 6 psf wind		34	37	40	43	46	49	53	56	60	63	67	2,034
70		34	37	40	43	46	50	53	56	60	64	67	1,588
80		37	40	43	46	50	53	57	61	64	68	73	1,476
90		40	43	46	50	53	57	61	65	69	73	78	1,381
100		42	46	49	53	57	61	65	69	73	78	82	1,299
120		46	50	54	58	62	66	71	75	80	85	90	1,188
248		60	65	70	75	81	87	93	99	105	111	118	909

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"

DE Tension = 6,000 Lbs

RBS = 16,700 Lbs

Super Long Span - Feet													
Condition →		INITIAL (Stringing) SAG (inches)										Tension Lbs	
Temp. Deg. F ↓	R.S. Range② → Span (Ft) →	Not Recommended					R.S.			Not Recommended			
		300	310	320	330	340	350	360	370	380	390		400
15°, 1" ice, 4 psf wind		60	64	69	73	77	82	87	92	97	102	107	7019
15°, 0.8" ice, 4 psf wind		52	56	59	63	67	71	75	80	84	88	93	6316
0°, 0.5" ice, 4 psf wind + k		43	46	49	52	55	58	62	65	69	72	76	6000
0		17	18	19	20	22	23	24	25	27	28	30	4693
10		18	19	20	22	23	24	26	27	29	30	32	4416
20		19	20	22	23	24	26	27	29	30	32	34	4140
30		20	22	23	25	26	28	29	31	33	34	36	3866
40		22	23	25	26	28	30	31	33	35	37	39	3597
50		24	25	27	28	30	32	34	36	38	40	42	3335
60° F, 21 psf wind		49	52	56	59	63	67	71	75	79	83	87	4719
60° F, 6 psf wind		30	32	34	36	39	41	43	46	48	51	54	3329
60° F, 4 psf wind		28	30	32	34	36	38	40	42	45	47	49	3200
60		25	27	29	31	33	35	37	39	41	43	45	3083
70		28	29	31	33	35	38	40	42	44	47	49	2844
80		30	32	34	36	39	41	43	46	48	51	53	2622
90		33	35	37	39	42	44	47	49	52	55	58	2419
100		35	38	40	43	45	48	51	54	56	59	63	2235

Super Long Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)										Tension Lbs	
							R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		16	17	18	19	20	21	23	24	25	27	28	4978
0		19	20	21	23	24	26	27	29	30	32	33	4180
0°, 0.5" ice, 4 psf wind + k		43	46	49	52	55	58	62	65	69	72	76	6000
30		25	27	29	30	32	34	36	38	40	42	45	3131
32°, 0.5" ice,		43	46	49	52	56	59	62	66	69	73	77	4573
32°, 0.5" ice, 2 psf wind		44	47	50	53	56	60	63	67	70	74	78	4627
40		28	30	31	33	36	38	40	42	44	47	49	2837
50		31	33	35	37	39	42	44	46	49	52	54	2575
60		34	36	38	41	43	46	48	51	54	57	60	2347
60° F, 6 psf wind		37	40	43	45	48	51	54	57	60	63	66	2684
70		37	39	42	44	47	50	53	56	59	62	65	2149
80		40	42	45	48	51	54	57	60	64	67	71	1980
90		43	46	49	52	55	58	62	65	69	72	76	1835
100		46	49	52	56	59	63	66	70	74	78	82	1712
120		52	56	59	63	67	71	75	79	83	88	92	1513
248		69	74	79	84	89	94	100	105	111	117	123	1135

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 26 of 61

556.5 kcmil (19) AAC "Dahlia"

DE Tension = 1,000 Lbs

RBS = 9,750 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		50	60	70	80	90	100	110	120	130	140		150
	15°, 1" ice, 4 psf wind	8	11	15	19	25	30	37	44	51	60	68	1481
	15°, 0.8" ice, 4 psf wind	7	11	14	19	24	29	36	42	50	58	66	1184
	0°, 0.5" ice, 4 psf wind + k	7	10	13	17	22	27	33	39	46	53	61	1000
	0	6	9	12	16	20	25	30	36	42	48	56	317
	10	7	9	13	17	21	26	32	37	44	51	59	301
	20	7	10	13	18	22	27	33	39	46	54	62	287
	30	7	10	14	18	23	29	35	41	48	56	64	275
	40	7	11	15	19	24	30	36	43	50	58	67	264
	50	8	11	15	20	25	31	37	44	52	60	69	255
	60° F, 21 psf wind	8	12	16	21	27	33	40	48	56	65	75	720
	60° F, 6 psf wind	8	12	16	21	26	32	39	46	54	63	72	317
	60° F, 4 psf wind	8	12	16	21	26	32	39	46	54	63	72	280
	60	8	11	16	20	26	32	39	46	54	63	72	246
	70	8	12	16	21	27	33	40	48	56	65	74	238
	80	8	12	17	22	28	34	41	49	57	67	76	231
	90	9	13	17	22	28	35	42	50	59	68	79	225
	100	9	13	18	23	29	36	43	52	61	70	81	219

Super Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		6	8	11	14	18	22	27	32	38	44	50	350
0		6	9	12	16	20	25	30	36	43	49	57	311
0°, 0.5" ice, 4 psf wind + k		7	10	13	17	22	27	33	39	46	53	61	1000
30		7	10	14	19	23	29	35	42	49	57	65	271
32°, 0.5" ice,		8	11	15	19	24	30	36	43	51	59	68	681
32°, 0.5" ice, 2 psf wind		8	11	15	19	24	30	36	43	51	59	68	698
40		8	11	15	19	24	30	36	43	51	59	68	261
50		8	11	15	20	25	31	38	45	53	61	70	252
60		8	12	16	21	26	32	39	46	55	63	73	243
60° F, 6 psf wind		8	12	16	21	26	32	39	47	55	64	73	313
70		8	12	16	21	27	33	40	48	56	65	75	236
80		9	12	17	22	28	34	42	49	58	67	77	229
90		9	13	17	23	29	35	43	51	60	69	79	223
100		9	13	18	23	29	36	44	52	61	71	82	217
120		10	14	19	24	31	38	46	55	64	75	86	206
212		11	16	22	29	37	46	55	66	77	90	103	172

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 27 of 61

556.5 kcmil (19) AAC "Dahlia"

DE Tension = 2,500 Lbs

RBS = 9,750 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	100	110	120	130	140	150	160	170	180	190	200	
	15°, 1" ice, 4 psf wind	15	18	21	25	29	33	37	42	47	53	58	3081
	15°, 0.8" ice, 4 psf wind	13	16	19	22	26	30	34	38	43	48	53	2638
	0°, 0.5" ice, 4 psf wind + k	11	13	16	18	21	24	28	31	35	39	43	2500
	0	5	7	8	9	11	12	14	16	18	20	22	1424
	10	7	8	9	11	13	15	17	19	21	24	26	1193
	20	8	9	11	13	15	17	20	22	25	28	31	1012
	30	9	11	13	15	18	20	23	26	29	32	36	875
	40	10	12	15	17	20	23	26	29	33	37	41	772
	50	11	14	16	19	22	25	29	33	37	41	45	694
	60° F, 21 psf wind	15	18	22	26	30	34	39	44	49	54	60	1581
	60° F, 6 psf wind	13	16	19	22	25	29	33	37	42	46	51	788
	60° F, 4 psf wind	13	15	18	21	25	28	32	37	41	46	51	707
	60	12	15	18	21	24	28	32	36	40	45	49	632
	70	13	16	19	23	26	30	34	39	44	49	54	583
	80	14	17	21	24	28	33	37	42	47	52	58	543
	90	15	19	22	26	30	35	39	44	50	55	61	510
	100	16	20	23	27	32	37	42	47	53	59	65	482

Short Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)										Tension Lbs	
							R.S.						
		100	110	120	130	140	150	160	170	180	190		200
-20		4	5	6	7	8	10	11	12	14	15	17	1826
0		6	8	9	11	13	15	17	19	21	23	26	1211
0°, 0.5" ice, 4 psf wind + k		11	13	16	18	21	25	28	32	35	39	44	2469
30		10	12	15	17	20	23	26	30	33	37	41	760
32°, 0.5" ice,		13	15	18	22	25	29	33	37	41	46	51	1599
32°, 0.5" ice, 2 psf wind		13	16	19	22	25	29	33	37	42	47	52	1631
40		12	14	17	19	23	26	29	33	37	42	46	682
50		13	15	18	21	25	28	32	37	41	46	51	621
60		14	17	20	23	27	31	35	39	44	49	55	573
60° F, 6 psf wind		14	17	20	24	27	32	36	41	45	51	56	724
70		15	18	21	25	29	33	38	42	48	53	59	534
80		16	19	23	26	31	35	40	45	51	56	63	502
90		17	20	24	28	32	37	42	48	54	60	66	475
100		17	21	25	29	34	39	45	50	56	63	70	451
120		19	23	27	32	37	43	49	55	62	69	76	413
212		25	31	36	43	50	57	65	73	82	91	101	311

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 28 of 61

556.5 kcmil (19) AAC "Dahlia"

DE Tension = 3,500 Lbs

RBS = 9,750 Lbs

Medium Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		150	160	170	180	190	200	210	220	230	240	250	
	15°, 1" ice, 4 psf wind	24	28	31	35	39	43	48	53	57	63	68	4126
	15°, 0.8" ice, 4 psf wind	22	25	28	31	35	38	42	46	51	55	60	3629
	0°, 0.5" ice, 4 psf wind + k	17	20	22	25	28	31	34	37	41	44	48	3500
	0	7	8	9	10	11	13	14	15	17	18	20	2476
	10	8	9	10	12	13	14	16	17	19	21	23	2167
	20	9	11	12	14	15	17	18	20	22	24	26	1880
	30	11	12	14	16	17	19	21	23	26	28	30	1624
	40	12	14	16	18	20	22	24	27	29	32	35	1408
	50	14	16	18	21	23	25	28	31	34	37	40	1231
	60° F, 21 psf wind	23	26	30	33	37	41	45	50	54	59	64	2312
	60° F, 6 psf wind	18	20	23	25	28	31	34	38	41	45	49	1299
	60° F, 4 psf wind	17	19	22	24	27	30	33	36	40	43	47	1192
	60	16	18	21	23	26	29	32	35	38	41	45	1090
	70	18	21	23	26	29	32	35	39	42	46	50	978
	80	20	23	25	29	32	35	39	43	47	51	55	890
	90	22	24	28	31	35	38	42	46	51	55	60	818
	100	23	26	30	33	37	41	46	50	55	59	65	759

Medium Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs	
							R.S.							
		150	160	170	180	190	200	210	220	230	240	250		
-20		7	8	8	10	11	12	13	14	16	17	18	2650	
0		9	11	12	13	15	17	18	20	22	24	26	1895	
0°, 0.5" ice, 4 psf wind + k		18	21	24	26	29	33	36	39	43	47	51	3314	
30		15	17	19	21	24	27	29	32	35	38	41	1180	
32°, 0.5" ice,		21	24	27	30	33	37	40	44	49	53	57	2234	
32°, 0.5" ice, 2 psf wind		21	24	27	30	33	37	41	45	49	53	58	2273	
40		17	19	22	24	27	30	33	36	40	43	47	1042	
50		19	21	24	27	30	33	37	41	44	48	52	935	
60		21	24	27	30	33	37	41	45	49	53	58	852	
60° F, 6 psf wind		22	24	28	31	35	38	42	46	51	55	60	1058	
70		22	26	29	32	36	40	44	48	53	58	62	786	
80		24	27	31	35	39	43	47	52	57	62	67	731	
90		26	29	33	37	41	46	50	55	60	66	71	686	
100		27	31	35	39	44	48	53	59	64	70	76	648	
120		30	34	39	43	48	54	59	65	71	77	84	586	
212		41	47	53	59	66	73	80	88	96	105	114	431	

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

556.5 kcmil (19) AAC "Dahlia"

DE Tension = 4,000 Lbs

RBS = 9,750 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended			R.S.			Not Recommended					
		200	210	220	230	240	250	260	270	280	290	300	
	15°, 1" ice, 4 psf wind	38	42	46	50	54	59	64	69	74	79	85	4752
	15°, 0.8" ice, 4 psf wind	33	37	40	44	48	52	56	60	65	70	75	4195
	0°, 0.5" ice, 4 psf wind + k	27	30	33	36	39	42	46	49	53	57	61	4000
	0	11	12	13	15	16	17	19	20	22	23	25	2821
	10	12	14	15	16	18	19	21	23	24	26	28	2520
	20	14	15	17	19	20	22	24	26	28	30	32	2234
	30	16	18	19	21	23	25	27	29	31	33	36	1973
	40	18	20	22	24	26	28	30	33	35	38	40	1743
	50	20	22	25	27	29	32	34	37	40	43	46	1546
	60° F, 21 psf wind	34	38	41	45	49	53	58	62	67	72	77	2787
	60° F, 6 psf wind	25	28	30	33	36	39	42	45	49	52	56	1624
	60° F, 4 psf wind	24	26	29	31	34	37	40	43	47	50	54	1500
	60	23	25	27	30	33	35	38	41	44	48	51	1382
	70	25	28	30	33	36	39	42	46	49	53	57	1248
	80	28	30	33	36	40	43	47	50	54	58	62	1138
	90	30	33	36	40	43	47	51	55	59	63	67	1047
	100	32	36	39	43	46	50	55	59	63	68	73	972

Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		11	12	14	15	16	18	19	21	22	24	25	2778
0		15	17	18	20	22	24	26	28	30	32	34	2069
0°, 0.5" ice, 4 psf wind + k		29	32	35	38	41	45	49	52	56	61	65	3754
30		23	25	28	30	33	36	38	41	45	48	51	1381
32°, 0.5" ice,		31	35	38	42	45	49	53	57	62	66	71	2609
32°, 0.5" ice, 2 psf wind		32	35	38	42	46	50	54	58	62	67	71	2654
40		25	28	31	34	36	40	43	46	50	53	57	1238
50		28	31	34	37	40	44	47	51	55	59	63	1124
60		30	33	37	40	44	47	51	55	59	64	68	1032
60° F, 6 psf wind		32	35	38	42	46	50	54	58	62	67	72	1276
70		33	36	40	43	47	51	55	60	64	69	74	957
80		35	39	42	46	50	55	59	64	69	74	79	895
90		37	41	45	49	54	58	63	68	73	78	84	842
100		39	43	48	52	57	61	66	72	77	83	88	797
120		43	48	52	57	62	68	73	79	85	91	97	725
212		59	65	71	78	84	92	99	107	115	123	132	536

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 30 of 61

556.5 kcmil (19) AAC "Dahlia"

DE Tension = 4,500 Lbs

RBS = 9,750 Lbs

Extra Long Span - Feet													
Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		250	260	270	280	290	300	310	320	330	340		350
	15°, 1" ice, 4 psf wind	52	57	61	66	71	75	81	86	91	97	103	5348
	15°, 0.8" ice, 4 psf wind	46	50	53	57	62	66	70	75	80	85	90	4746
	0°, 0.5" ice, 4 psf wind + k	38	41	44	47	50	54	58	61	65	69	74	4500
	0	15	16	18	19	21	22	23	25	27	28	30	3213
	10	17	18	20	21	23	24	26	27	29	31	33	2916
	20	19	20	22	23	25	27	29	30	32	34	36	2631
	30	21	22	24	26	28	30	32	34	36	38	41	2362
	40	23	25	27	29	31	33	35	38	40	43	45	2117
	50	26	28	30	32	35	37	40	42	45	48	50	1900
	60° F, 21 psf wind	46	49	53	57	61	66	70	75	79	84	89	3266
	60° F, 6 psf wind	32	35	37	40	43	46	49	52	56	59	63	1978
	60° F, 4 psf wind	30	33	35	38	41	44	47	50	53	56	59	1841
	60	29	31	33	36	38	41	44	47	50	53	56	1712
	70	32	34	37	40	42	45	49	52	55	58	62	1552
	80	35	37	40	43	46	50	53	57	60	64	68	1418
	90	38	41	44	47	50	54	58	61	65	69	74	1305
	100	40	44	47	51	54	58	62	66	70	75	79	1211

Extra Long Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		16	18	19	21	22	24	25	27	29	30	32	2989
0		21	23	25	27	29	31	33	35	37	39	42	2300
0°, 0.5" ice, 4 psf wind + k		40	43	47	50	54	58	62	66	70	74	79	4212
30		31	33	36	38	41	44	47	50	53	57	60	1603
32°, 0.5" ice,		43	46	50	54	58	62	66	70	75	79	84	2994
32°, 0.5" ice, 2 psf wind		43	47	50	54	58	62	66	71	75	80	85	3044
40		34	37	39	42	45	49	52	55	59	62	66	1450
50		37	40	43	46	50	53	57	61	64	68	73	1325
60		40	43	47	50	54	58	62	66	70	74	79	1223
60° F, 6 psf wind		42	46	49	53	57	61	65	69	73	78	82	1504
70		43	47	50	54	58	62	66	71	75	80	84	1138
80		46	50	54	58	62	66	71	75	80	85	90	1067
90		49	53	57	61	66	70	75	80	85	90	96	1006
100		51	56	60	64	69	74	79	84	90	95	101	953
120		57	61	66	71	76	81	87	93	98	105	111	868
212		76	83	89	96	103	110	117	125	133	141	150	644

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 31 of 61

556.5 kcmil (19) AAC "Dahlia"

DE Tension = 4,750 Lbs

RBS = 9,750 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		300	310	320	330	340	350	360	370	380	390	400		
	15°, 1" ice, 4 psf wind	70	75	80	85	90	96	101	107	113	119	125	5731	
	15°, 0.8" ice, 4 psf wind	62	66	70	75	79	84	89	94	99	104	110	5073	
	0°, 0.5" ice, 4 psf wind + k	51	55	58	62	66	70	74	78	82	86	91	4750	
	0	22	23	25	26	28	30	31	33	35	37	39	3234	
	10	24	26	27	29	31	33	34	36	38	40	42	2953	
	20	26	28	30	32	34	36	38	40	42	44	47	2685	
	30	29	31	33	35	37	39	42	44	46	49	51	2435	
	40	32	34	36	39	41	43	46	49	51	54	57	2209	
	50	35	37	40	42	45	48	51	53	56	59	62	2007	
	60° F, 21 psf wind	60	64	69	73	78	82	87	92	97	102	107	3554	
	60° F, 6 psf wind	43	46	49	52	55	58	62	65	69	72	76	2128	
	60° F, 4 psf wind	41	43	46	49	52	55	59	62	65	69	72	1976	
	60	39	41	44	47	49	52	55	59	62	65	68	1832	
	70	42	45	48	51	54	57	60	64	67	71	75	1680	
	80	45	49	52	55	58	62	66	69	73	77	81	1551	
	90	49	52	56	59	63	67	70	74	79	83	87	1441	
	100	52	56	60	63	67	71	75	80	84	89	93	1347	

Super Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		24	26	28	30	31	33	35	37	39	41	43	2886
0		31	33	35	37	40	42	45	47	50	52	55	2281
0°, 0.5" ice, 4 psf wind + k		54	58	62	66	70	74	78	83	87	92	97	4466
30		42	45	48	51	54	57	61	64	67	71	75	1676
32°, 0.5" ice,		57	61	65	69	74	78	83	87	92	97	102	3221
32°, 0.5" ice, 2 psf wind		58	62	66	70	74	79	83	88	93	98	103	3277
40		46	49	52	55	59	62	66	70	74	77	82	1538
50		50	53	56	60	64	67	71	75	79	84	88	1424
60		53	57	60	64	68	72	77	81	85	90	95	1328
60° F, 6 psf wind		56	59	63	67	72	76	80	85	89	94	99	1637
70		57	60	64	68	73	77	82	86	91	96	101	1246
80		60	64	68	73	77	82	86	91	96	101	107	1176
90		63	67	72	76	81	86	91	96	101	107	112	1116
100		66	71	76	80	85	90	96	101	107	112	118	1063
120		72	77	82	88	93	99	104	110	116	122	129	975
212		96	103	109	116	123	131	138	146	154	162	171	736

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 32 of 61

T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 2,000 Lbs

RBS =17,360 Lbs

Super Short Span - Feet												
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	Not Recommended					R.S.			Not Recommended			
	50	60	70	80	90	100	110	120	130	140	150	
15°, 1" ice, 4 psf wind	5	7	10	13	17	21	25	30	35	40	46	2,564
15°, 0.8" ice, 4 psf wind	5	7	10	12	16	19	24	28	33	38	44	2,152
0°, 0.5" ice, 4 psf wind + k	4	6	8	10	13	16	20	24	28	32	37	2,000
0	3	4	6	8	10	12	15	18	21	24	28	899
10	4	5	7	9	11	14	17	20	24	28	32	775
20	4	6	8	10	13	16	19	23	27	31	36	686
30	4	6	9	11	14	18	21	25	30	35	40	619
40	5	7	9	12	16	19	23	28	33	38	43	568
50	5	7	10	13	17	21	25	30	35	41	47	527
60° F, 21 psf wind	6	9	12	15	19	24	29	35	41	47	54	1,307
60° F, 6 psf wind	6	8	11	14	18	23	27	32	38	44	51	614
60° F, 4 psf wind	6	8	11	14	18	22	27	32	38	44	50	551
60	6	8	11	14	18	22	27	32	38	44	50	493
70	6	8	12	15	19	24	28	34	40	46	53	465
80	6	9	12	16	20	25	30	36	42	49	56	441
90	7	9	13	17	21	26	32	37	44	51	59	421
100	7	10	13	17	22	27	33	39	46	53	61	402

Super Short Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL SAG (inches)											Tension Lbs
							R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		2	3	4	6	7	9	11	13	15	17	20	1,226
0		3	5	6	8	11	13	16	19	22	26	30	833
0°, 0.5" ice, 4 psf wind + k		4	6	8	11	14	17	20	24	29	33	38	1,936
30		5	7	9	12	15	19	23	27	31	36	42	590
32°, 0.5" ice,		5	7	10	13	17	21	25	30	35	40	46	1,267
32°, 0.5" ice, 2 psf wind		5	7	10	13	17	21	25	30	35	40	46	1,290
40		5	7	10	13	16	20	24	29	34	40	45	545
50		5	8	11	14	17	22	26	31	37	42	49	509
60		6	8	11	15	19	23	28	33	39	45	52	478
60° F, 6 psf wind		6	8	11	15	19	23	28	33	39	45	52	596
70		6	9	12	16	20	24	29	35	41	48	55	453
80		6	9	12	16	21	25	31	37	43	50	57	431
90		7	10	13	17	22	27	32	38	45	52	60	411
100		7	10	14	18	23	28	34	40	47	55	63	394
120		7	11	14	19	24	29	35	42	49	57	66	375
248		9	13	17	23	29	36	43	51	60	70	80	310

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 3,000 Lbs

RBS =17,360 Lbs

Short Span - Feet													
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
	Not Recommended					R.S.			Not Recommended				
	100	110	120	130	140	150	160	170	180	190	200		
15°, 1" ice, 4 psf wind	14	17	20	24	28	32	36	41	46	51	57	3,740	
15°, 0.8" ice, 4 psf wind	13	16	19	22	26	29	33	38	42	47	52	3,201	
0°, 0.5" ice, 4 psf wind + k	11	13	16	18	21	24	28	31	35	39	44	3,000	
0	7	8	10	12	14	16	18	20	22	25	28	1,585	
10	8	10	12	14	16	18	21	23	26	29	32	1,355	
20	9	11	13	16	18	21	24	27	30	34	37	1,182	
30	10	13	15	18	20	23	27	30	34	38	42	1,052	
40	12	14	17	19	23	26	29	33	37	42	46	952	
50	13	15	18	21	25	28	32	36	41	45	50	873	
60° F, 21 psf wind	15	19	22	26	30	35	40	45	50	56	62	2,027	
60° F, 6 psf wind	14	17	20	23	27	31	35	40	45	50	55	998	
60° F, 4 psf wind	14	17	20	23	27	31	35	40	44	49	55	900	
60	14	16	20	23	27	30	35	39	44	49	54	810	
70	14	17	21	24	28	33	37	42	47	52	58	757	
80	15	19	22	26	30	35	39	44	50	55	61	714	
90	16	20	23	27	32	36	42	47	53	59	65	676	
100	17	21	25	29	33	38	44	49	55	62	68	644	

Short Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→	FINAL (Clearance) SAG (inches)												Tension Lbs
						R.S.							
	100	110	120	130	140	150	160	170	180	190	200		
-20	6	7	8	9	11	13	14	16	18	20	22	1,948	
0	8	10	11	13	16	18	20	23	26	29	32	1,374	
0°, 0.5" ice, 4 psf wind + k	11	14	16	19	22	26	29	33	37	41	45	2,876	
30	11	14	16	19	22	26	29	33	37	41	46	958	
32°, 0.5" ice,	13	16	19	23	26	30	34	39	43	48	54	1,947	
32°, 0.5" ice, 2 psf wind	13	16	19	23	26	30	34	39	44	49	54	1,979	
40	12	15	18	21	24	28	32	36	40	45	50	878	
50	13	16	19	23	26	30	35	39	44	49	54	814	
60	14	17	21	24	28	32	37	42	47	52	58	761	
60° F, 6 psf wind	15	18	21	25	29	33	38	42	48	53	59	941	
70	15	19	22	26	30	34	39	44	50	55	61	717	
80	16	20	23	27	32	36	41	47	52	58	65	301	
90	17	21	24	29	33	38	43	49	55	61	68	291	
100	18	21	26	30	35	40	45	51	58	64	71	282	
120	19	23	28	33	38	43	49	56	62	70	77	265	
248	24	29	34	40	46	53	60	68	77	85	95	465	

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 4,000 Lbs

RBS = 17,360 Lbs

Medium Span - Feet													
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→		INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.				Not Recommended		
		150	160	170	180	190	200	210	220	230	240	250	
15°, 1" ice, 4 psf wind		24	28	31	35	39	43	48	53	57	63	68	4,870
15°, 0.8" ice, 4 psf wind		22	25	29	32	36	40	44	48	52	57	62	4,239
0°, 0.5" ice, 4 psf wind + k		18	21	24	26	29	33	36	39	43	47	51	4,000
0		10	12	13	15	16	18	20	22	24	26	28	2,436
10		12	13	15	17	19	21	23	25	27	30	32	2,107
20		13	15	17	19	22	24	26	29	32	34	37	1,836
30		15	17	20	22	24	27	30	33	36	39	42	1,619
40		17	19	22	24	27	30	33	37	40	44	47	1,448
50		19	21	24	27	30	33	37	40	44	48	52	1,312
60° F, 21 psf wind		25	29	32	36	41	45	49	54	59	65	70	2,796
60° F, 6 psf wind		21	24	27	31	34	38	42	46	50	55	59	1,459
60° F, 4 psf wind		21	24	27	30	33	37	41	45	49	53	58	1,326
60		21	23	26	30	33	36	40	44	48	53	57	1,203
70		22	25	28	32	36	39	43	48	52	57	62	1,114
80		24	27	30	34	38	42	46	51	56	61	66	1,041
90		25	29	32	36	40	45	49	54	59	64	70	979
100		27	30	34	38	43	47	52	57	63	68	74	926

Medium Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		150	160	170	180	190	200	210	220	230	240	250	
-20		9	10	11	13	14	16	17	19	21	23	25	2,772
0		12	14	16	17	19	22	24	26	29	31	34	2,024
0°, 0.5" ice, 4 psf wind + k		23	26	29	32	36	40	44	48	53	58	63	3,817
30		18	20	23	25	28	31	35	38	42	45	49	1,393
32°, 0.5" ice,		22	25	28	32	35	39	43	47	52	57	61	2,661
32°, 0.5" ice, 2 psf wind		22	25	28	32	36	39	43	48	52	57	62	2,701
40		19	22	25	28	31	35	38	42	46	50	54	1,267
50		21	24	27	30	34	38	41	45	50	54	59	1,166
60		23	26	29	33	36	40	45	49	53	58	63	1,084
60° F, 6 psf wind		23	27	30	34	38	42	46	50	55	60	65	1,328
70		24	28	31	35	39	43	48	52	57	62	68	1,015
80		26	29	33	37	41	46	51	55	61	66	72	957
90		27	31	35	39	44	48	53	59	64	70	76	908
100		29	32	37	41	46	51	56	61	67	73	79	865
120		31	35	40	45	50	55	61	67	73	80	86	793
248		40	45	51	57	64	71	78	85	93	102	110	623

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 35 of 61

T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 5,000 Lbs

RBS = 17,360 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		200	210	220	230	240	250	260	270	280	290	300	
	15°, 1" ice, 4 psf wind	35	39	43	47	51	55	60	65	70	75	80	5,963
	15°, 0.8" ice, 4 psf wind	32	35	38	42	46	50	54	58	62	67	72	5,265
	0°, 0.5" ice, 4 psf wind + k	26	29	32	35	38	41	44	48	51	55	59	5,000
	0	13	14	16	17	19	20	22	24	25	27	29	3,401
	10	15	16	18	19	21	23	25	26	28	31	33	3,014
	20	16	18	20	22	24	26	28	30	32	35	37	2,663
	30	19	20	22	25	27	29	31	34	36	39	42	2,356
	40	21	23	25	28	30	33	35	38	41	44	47	2,098
	50	23	26	28	31	34	36	39	42	46	49	52	1,885
	60° F, 21 psf wind	35	38	42	46	50	54	59	63	68	73	78	3,617
	60° F, 6 psf wind	27	30	33	36	39	43	46	50	53	57	61	2,025
	60° F, 4 psf wind	26	29	32	35	38	41	45	48	52	56	59	1,862
	60	26	28	31	34	37	40	43	47	50	54	58	1,710
	70	28	31	34	37	40	44	47	51	55	59	63	1,567
	80	30	33	37	40	44	47	51	55	59	64	68	1,449
	90	32	36	39	43	47	51	55	59	64	68	73	1,351
	100	35	38	42	46	50	54	58	63	68	73	78	1,268

Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		12	13	14	16	17	19	20	22	23	25	27	3,649
0		16	17	19	21	23	25	27	29	31	33	36	2,767
0°, 0.5" ice, 4 psf wind + k		27	30	33	36	39	43	46	50	54	58	62	4,765
30		23	25	28	30	33	36	39	42	45	48	52	1,909
32°, 0.5" ice,		31	34	37	40	44	48	52	56	60	64	69	3,409
32°, 0.5" ice, 2 psf wind		31	34	37	41	44	48	52	56	60	65	69	3,457
40		25	28	31	34	37	40	43	46	50	53	57	1,726
50		28	31	34	37	40	43	47	51	54	58	63	1,578
60		30	33	36	40	43	47	51	55	59	63	68	1,457
60° F, 6 psf wind		31	35	38	41	45	49	53	57	61	66	71	1,763
70		32	36	39	43	47	51	55	59	63	68	73	1,357
80		34	38	42	46	50	54	58	63	68	73	78	1,273
90		36	40	44	48	53	57	62	66	72	77	82	1,201
100		38	42	47	51	55	60	65	70	75	81	87	1,140
120		42	47	51	56	61	66	71	77	83	89	95	1,039
248		56	62	68	74	81	88	95	102	110	118	126	784

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 36 of 61

T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 6,000 Lbs

RBS = 17,360 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		250	260	270	280	290	300	310	320	330	340	350		
	15°, 1" ice, 4 psf wind	47	51	55	59	63	68	72	77	82	87	92	7,024	
	15°, 0.8" ice, 4 psf wind	42	45	49	52	56	60	64	68	73	77	82	6,284	
	0°, 0.5" ice, 4 psf wind + k	34	37	40	43	46	49	52	56	59	63	67	6,000	
	0	15	17	18	19	21	22	24	25	27	29	30	4,432	
	10	17	18	20	21	23	24	26	28	30	31	33	4,025	
	20	19	20	22	24	25	27	29	31	33	35	37	3,632	
	30	21	23	24	26	28	30	32	34	37	39	41	3,264	
	40	23	25	27	29	32	34	36	38	41	43	46	2,928	
	50	26	28	30	33	35	37	40	43	45	48	51	2,632	
	60° F, 21 psf wind	44	47	51	55	59	63	67	72	76	81	86	4,490	
	60° F, 6 psf wind	32	34	37	40	43	46	49	52	55	59	62	2,728	
	60° F, 4 psf wind	30	33	35	38	41	43	46	49	53	56	59	2,546	
	60	29	31	34	36	39	42	44	47	50	53	57	2,377	
	70	32	34	37	40	43	46	49	52	55	59	62	2,160	
	80	35	37	40	43	47	50	53	57	60	64	68	1,979	
	90	38	41	44	47	50	54	58	61	65	69	74	1,827	
	100	40	44	47	51	54	58	62	66	70	75	79	1,700	

Extra Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		15	16	17	19	20	22	23	25	26	28	29	4,565
0		19	21	22	24	26	27	29	31	33	35	37	3,586
0°, 0.5" ice, 4 psf wind + k		36	39	42	45	48	51	55	58	62	66	70	5,722
30		27	29	32	34	37	39	42	45	47	50	53	2,513
32°, 0.5" ice,		39	42	45	49	52	56	60	64	68	72	76	4,193
32°, 0.5" ice, 2 psf wind		39	42	46	49	53	56	60	64	68	72	77	4,247
40		30	33	35	38	41	44	47	50	53	56	59	2,265
50		33	36	39	42	45	48	51	54	58	61	65	2,060
60		36	39	42	45	49	52	56	59	63	67	71	1,892
60° F, 6 psf wind		38	41	45	48	51	55	59	63	67	71	75	2,255
70		39	42	46	49	53	56	60	64	68	72	77	1,752
80		42	45	49	53	56	60	64	69	73	78	82	1,634
90		45	48	52	56	60	64	69	73	78	83	88	1,535
100		47	51	55	59	64	68	73	77	82	87	93	1,450
120		52	57	61	66	70	75	80	86	91	97	102	1,312
248		72	78	84	91	97	104	111	119	126	134	142	949

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 37 of 61

T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"

DE Tension = 7,000 Lbs

RBS = 17,360 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		300	310	320	330	340	350	360	370	380	390	400		
	15°, 1" ice, 4 psf wind	59	63	67	71	76	80	85	90	95	100	105	8,059	
	15°, 0.8" ice, 4 psf wind	52	55	59	63	66	70	74	79	83	87	92	7,294	
	0°, 0.5" ice, 4 psf wind + k	42	45	48	51	54	57	60	64	67	71	75	7,000	
	0	18	19	20	22	23	24	26	27	29	30	32	5,501	
	10	19	21	22	23	25	26	28	29	31	33	34	5,098	
	20	21	22	24	25	27	29	30	32	34	35	37	4,697	
	30	23	24	26	28	29	31	33	35	37	39	41	4,302	
	40	25	27	29	30	32	34	36	38	40	42	45	3,923	
	50	28	30	31	33	36	38	40	42	44	47	49	3,564	
	60° F, 21 psf wind	52	56	59	63	67	71	75	79	84	88	93	5,415	
	60° F, 6 psf wind	35	37	39	42	45	47	50	53	56	59	62	3,586	
	60° F, 4 psf wind	33	35	37	39	42	44	47	49	52	55	58	3,403	
	60	31	33	35	37	39	42	44	46	49	52	54	3,235	
	70	34	36	38	41	43	46	48	51	54	57	60	2,940	
	80	37	39	42	44	47	50	53	56	59	62	65	2,681	
	90	40	43	46	49	52	55	58	61	64	68	71	2,457	
	100	44	47	50	53	56	59	63	66	70	74	77	2,266	

Super Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		18	19	20	22	23	24	26	27	29	30	32	5,513
0		22	24	25	27	28	30	32	34	35	37	39	4,465
0°, 0.5" ice, 4 psf wind + k		44	47	50	53	56	60	63	67	70	74	78	6,692
30		31	33	35	37	40	42	44	47	49	52	55	3,209
32°, 0.5" ice,		47	50	53	57	60	64	67	71	75	79	83	5,010
32°, 0.5" ice, 2 psf wind		47	50	54	57	61	64	68	72	76	80	84	5,069
40		34	36	39	41	44	46	49	52	55	58	61	2,892
50		38	40	43	45	48	51	54	57	60	63	67	2,624
60		41	44	47	50	53	56	59	62	66	69	73	2,399
60° F, 6 psf wind		44	47	50	54	57	60	64	67	71	75	79	2,810
70		45	48	51	54	57	61	64	68	72	75	79	2,211
80		48	51	55	58	62	65	69	73	77	81	85	2,052
90		51	55	59	62	66	70	74	78	83	87	92	1,917
100		55	58	62	66	70	75	79	83	88	93	97	1,803
120		61	65	69	74	78	83	88	93	98	103	108	1,618
248		88	94	101	107	113	120	127	134	142	149	157	1,120

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 38 of 61

954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 1,500 Lbs

RBS = 25,900 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	50	60	70	80	90	100	110	120	130	140	150	
	15°, 1" ice, 4 psf wind	7	10	14	18	23	28	34	40	47	55	63	2099
	15°, 0.8" ice, 4 psf wind	7	10	13	18	22	27	33	40	46	54	62	1729
	0°, 0.5" ice, 4 psf wind + k	6	9	12	16	21	25	31	36	43	50	57	1500
	0	6	9	12	15	19	24	29	34	40	47	54	676
	10	6	9	12	16	20	25	30	36	43	49	57	640
	20	7	10	13	17	21	27	32	38	45	52	60	609
	30	7	10	14	18	22	28	34	40	47	54	62	582
	40	7	10	14	18	23	29	35	41	49	56	65	560
	50	7	11	15	19	24	30	36	43	50	59	67	541
	60° F, 21 psf wind	8	11	15	20	26	32	38	45	53	62	71	1098
	60° F, 6 psf wind	8	11	15	20	25	31	37	45	52	61	70	593
	60° F, 4 psf wind	8	11	15	20	25	31	37	45	52	61	70	555
	60	8	11	15	20	25	31	37	45	52	61	70	523
	70	8	11	16	20	26	32	39	46	54	63	72	507
	80	8	12	16	21	27	33	40	47	56	64	74	492
	90	8	12	17	22	27	34	41	49	57	66	76	478
	100	9	12	17	22	28	35	42	50	58	68	78	467

Super Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		5	8	10	13	17	21	25	30	35	41	47	769
0		6	9	12	15	19	24	29	34	40	47	54	676
0°, 0.5" ice, 4 psf wind + k		6	9	12	16	21	25	31	36	43	50	57	1498
30		7	10	14	18	22	28	34	40	47	54	62	582
32°, 0.5" ice,		7	10	14	18	23	29	35	41	48	56	65	1106
32°, 0.5" ice, 2 psf wind		7	10	14	18	23	29	35	41	48	56	65	1121
40		7	10	14	19	23	29	35	42	49	57	65	560
50		7	11	15	19	24	30	36	43	50	59	67	540
60		8	11	15	20	25	31	37	45	52	61	70	523
60° F, 6 psf wind		8	11	15	20	25	31	37	45	52	61	70	593
70		8	11	16	20	26	32	39	46	54	63	72	507
80		8	12	16	21	27	33	40	47	56	64	74	492
90		8	12	17	22	27	34	41	49	57	66	76	478
100		9	12	17	22	28	35	42	50	59	68	78	467
120		9	13	17	23	29	36	43	51	60	70	80	454
248		10	15	20	26	33	41	50	59	70	81	93	394

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 39 of 61

954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 3,000 Lbs

RBS = 25,900 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		100	110	120	130	140	150	160	170	180	190	200		
	15°, 1" ice, 4 psf wind	15	18	22	26	30	34	39	44	49	55	61	3858	
	15°, 0.8" ice, 4 psf wind	15	18	21	25	29	33	37	42	47	53	58	3272	
	0°, 0.5" ice, 4 psf wind + k	13	15	18	21	25	28	32	37	41	46	51	3000	
	0	11	13	15	18	21	24	27	30	34	38	42	1539	
	10	12	14	17	20	23	26	30	34	38	42	47	1391	
	20	13	15	18	21	25	28	32	36	41	45	50	1280	
	30	14	16	20	23	27	30	35	39	44	49	54	1189	
	40	15	18	21	25	28	33	37	42	47	52	58	1115	
	50	15	19	22	26	30	35	39	44	50	55	61	1051	
	60° F, 21 psf wind	17	21	25	29	34	39	44	50	56	62	69	2018	
	60° F, 6 psf wind	16	20	24	28	32	37	42	47	53	59	65	1126	
	60° F, 4 psf wind	16	20	23	27	32	37	42	47	53	59	65	1057	
	60	16	20	23	27	32	36	42	47	53	59	65	997	
	70	17	21	24	29	33	38	44	49	55	61	68	950	
	80	18	21	26	30	35	40	45	51	58	64	71	909	
	90	19	22	27	31	36	42	47	53	60	67	74	873	
	100	19	23	28	33	38	43	49	56	62	70	77	840	

Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		9	10	12	14	17	19	22	25	28	31	34	1894
0		11	13	16	18	21	24	28	31	35	39	44	1487
0°, 0.5" ice, 4 psf wind + k		13	16	19	22	25	29	33	37	42	47	52	2938
30		14	17	20	24	27	31	36	40	45	50	56	1161
32°, 0.5" ice,		15	18	22	26	30	34	39	44	49	55	61	2095
32°, 0.5" ice, 2 psf wind		15	18	22	26	30	34	39	44	49	55	61	2122
40		15	18	21	25	29	33	38	43	48	53	59	1092
50		16	19	23	26	31	35	40	45	51	56	63	1032
60		16	20	24	28	32	37	42	48	53	59	66	982
60° F, 6 psf wind		17	20	24	28	33	37	42	48	54	60	66	1108
70		17	21	25	29	34	39	44	50	56	62	69	937
80		18	22	26	30	35	40	46	52	58	65	72	898
90		19	23	27	32	37	42	48	54	61	68	75	863
100		19	23	28	33	38	44	50	56	63	70	78	832
120		21	25	30	35	41	47	53	60	67	75	83	779
248		25	30	36	42	49	56	64	72	81	90	100	650

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 40 of 61

954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 4,000 Lbs

RBS = 25,900 Lbs

Medium Span - Feet												
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	Not Recommended					R.S.			Not Recommended			
	150	160	170	180	190	200	210	220	230	240	250	
15°, 1" ice, 4 psf wind	26	30	34	38	42	47	51	56	62	67	73	5053
15°, 0.8" ice, 4 psf wind	25	28	32	36	40	44	48	53	58	63	69	4336
0°, 0.5" ice, 4 psf wind + k	21	24	27	31	34	38	42	46	50	55	59	4000
0	17	19	21	24	27	30	33	36	39	43	46	2180
10	18	21	24	26	29	33	36	39	43	47	51	1977
20	20	23	26	29	32	36	39	43	47	51	56	1812
30	22	25	28	31	35	39	42	47	51	55	60	1678
40	23	26	30	33	37	41	46	50	55	59	65	1566
50	25	28	32	36	40	44	48	53	58	63	69	1472
60° F, 21 psf wind	28	32	37	41	46	51	56	61	67	73	79	2743
60° F, 6 psf wind	26	30	34	38	42	47	52	57	62	68	73	1565
60° F, 4 psf wind	26	30	34	38	42	47	51	56	62	67	73	1472
60	26	30	34	38	42	46	51	56	61	67	73	1392
70	27	31	35	40	44	49	54	59	65	70	76	1322
80	29	33	37	42	46	51	56	62	68	74	80	1262
90	30	34	39	43	48	54	59	65	71	77	84	1208
100	31	36	40	45	50	56	61	67	74	80	87	1161

Medium Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		150	160	170	180	190	200	210	220	230	240	250	
-20		15	17	19	21	23	26	29	31	34	37	41	2491
0		18	21	23	26	29	32	35	39	43	46	50	2010
0°, 0.5" ice, 4 psf wind + k		22	25	29	32	36	39	44	48	52	57	62	3844
30		23	26	29	33	37	41	45	49	54	59	64	1586
32°, 0.5" ice,		26	29	33	37	41	45	50	55	60	65	71	2795
32°, 0.5" ice, 2 psf wind		26	29	33	37	41	45	50	55	60	65	71	2829
40		24	28	31	35	39	43	48	52	57	62	68	1490
50		26	29	33	37	41	46	51	55	61	66	72	1408
60		27	31	35	39	44	48	53	59	64	70	76	1337
60° F, 6 psf wind		27	31	35	40	44	49	54	59	65	70	76	1505
70		28	32	37	41	46	51	56	61	67	73	79	1275
80		30	34	38	43	48	53	58	64	70	76	83	1221
90		31	35	40	45	50	55	61	67	73	79	86	1173
100		32	37	41	46	52	57	63	69	76	82	89	1130
120		34	39	44	50	55	61	68	74	81	88	96	1055
248		42	48	54	61	68	75	83	91	99	108	117	863

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 41 of 61

954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 5,000 Lbs

RBS = 25,900 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		200	210	220	230	240	250	260	270	280	290		300
	15°, 1" ice, 4 psf wind	38	42	46	50	55	59	64	69	74	80	85	6215
	15°, 0.8" ice, 4 psf wind	35	39	43	47	51	55	60	64	69	74	79	5390
	0°, 0.5" ice, 4 psf wind + k	30	34	37	40	44	48	51	55	60	64	68	5000
	0	22	24	27	29	32	35	38	40	44	47	50	2912
	10	24	27	30	32	35	38	41	45	48	51	55	2640
	20	27	29	32	35	38	42	45	49	52	56	60	2415
	30	29	32	35	38	42	45	49	53	57	61	65	2228
	40	31	34	38	41	45	49	53	57	61	66	70	2072
	50	33	37	40	44	48	52	56	61	65	70	75	1941
	60° F, 21 psf wind	40	44	48	52	57	62	67	72	78	83	89	3499
	60° F, 6 psf wind	36	40	43	47	52	56	61	65	70	75	81	2047
	60° F, 4 psf wind	36	39	43	47	51	56	60	65	70	75	80	1930
	60	35	39	43	47	51	55	60	64	69	74	79	1829
	70	37	41	45	49	54	58	63	68	73	78	84	1732
	80	39	43	47	52	56	61	66	71	77	82	88	1648
	90	41	45	50	54	59	64	69	75	80	86	92	1575
	100	43	47	52	57	62	67	72	78	84	90	96	1509

Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		20	23	25	27	29	32	35	37	40	43	46	3161
0		25	28	30	33	36	39	42	46	49	53	56	2576
0°, 0.5" ice, 4 psf wind + k		32	35	39	42	46	50	54	59	63	67	72	4738
30		32	35	38	42	46	50	54	58	62	67	71	2035
32°, 0.5" ice,		36	40	44	48	52	57	61	66	71	76	81	3502
32°, 0.5" ice, 2 psf wind		36	40	44	48	52	57	61	66	71	76	82	3542
40		34	37	41	45	49	53	57	62	66	71	76	1910
50		36	40	43	47	52	56	61	65	70	75	81	1803
60		38	42	46	50	54	59	64	69	74	79	85	1710
60° F, 6 psf wind		38	42	46	51	55	60	65	70	75	80	86	1919
70		40	44	48	52	57	62	67	72	78	83	89	1630
80		41	46	50	55	60	65	70	76	81	87	93	1559
90		43	48	52	57	62	68	73	79	85	91	97	1496
100		43	47	52	57	62	67	72	78	84	90	96	1440
120		48	53	58	64	69	75	81	88	94	101	108	1343
248		60	66	73	79	86	94	101	109	118	126	135	1078

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 42 of 61

954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 6,000 Lbs

RBS = 25,900 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		250	260	270	280	290	300	310	320	330	340	350	
	15°, 1" ice, 4 psf wind	50	54	58	63	67	72	77	82	87	92	98	7346
	15°, 0.8" ice, 4 psf wind	46	50	54	58	62	66	71	76	80	85	90	6435
	0°, 0.5" ice, 4 psf wind + k	40	43	46	50	53	57	61	65	69	73	78	6000
	0	27	29	32	34	36	39	42	44	47	50	53	3724
	10	30	32	35	37	40	43	46	49	52	55	58	3386
	20	33	35	38	41	44	47	50	53	57	60	64	3097
	30	35	38	41	44	48	51	54	58	62	65	69	2853
	40	38	41	45	48	51	55	59	63	67	71	75	2646
	50	41	44	48	51	55	59	63	67	71	76	80	2470
	60° F, 21 psf wind	51	55	59	63	68	73	78	83	88	93	99	4287
	60° F, 6 psf wind	45	48	52	56	60	64	68	73	78	82	87	2581
	60° F, 4 psf wind	44	48	51	55	59	63	68	72	77	81	86	2441
	60	44	47	51	55	59	63	67	71	76	80	85	2319
	70	46	50	54	58	62	66	71	76	80	85	90	2190
	80	49	53	57	61	65	70	75	80	85	90	95	2077
	90	51	55	59	64	69	73	78	84	89	94	100	1978
	100	53	58	62	67	72	77	82	88	93	99	105	1891

Extra Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		26	28	30	33	35	38	40	43	45	48	51	3861
0		32	34	37	40	43	46	49	52	55	59	62	3176
0°, 0.5" ice, 4 psf wind + k		42	46	49	53	57	61	65	69	73	78	83	5629
30		40	43	47	50	54	58	62	66	70	74	79	2512
32°, 0.5" ice,		47	51	55	59	63	68	72	77	82	87	92	4220
32°, 0.5" ice, 2 psf wind		47	51	55	59	63	68	72	77	82	87	92	4267
40		43	46	50	54	58	62	66	70	75	79	84	2356
50		46	50	54	58	62	66	71	76	80	85	90	2221
60		48	52	56	60	64	69	74	79	83	89	94	2105
60° F, 6 psf wind		49	53	57	61	66	70	75	80	85	90	96	2355
70		50	55	59	63	68	73	78	83	88	93	99	2004
80		53	57	62	66	71	76	81	86	92	98	103	1915
90		55	59	64	69	74	79	85	90	96	102	108	1835
100		57	62	67	72	77	82	88	94	100	106	112	1764
120		62	67	72	77	83	89	95	101	107	114	121	1643
248		78	85	91	98	105	113	120	128	136	145	153	1293

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 43 of 61

954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 7,500 Lbs

RBS = 25,900 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range ②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		300	310	320	330	340	350	360	370	380	390	400	
	15°, 1" ice, 4 psf wind	60	64	68	72	77	81	86	91	96	101	106	8856
	15°, 0.8" ice, 4 psf wind	54	58	62	66	70	74	78	82	87	92	96	7900
	0°, 0.5" ice, 4 psf wind + k	46	49	52	55	59	62	66	69	73	77	81	7500
	0	27	29	31	33	35	37	39	42	44	46	49	5291
	10	30	32	34	36	39	41	43	46	48	51	53	4831
	20	33	35	37	40	42	45	47	50	53	56	58	4412
	30	36	38	41	44	46	49	52	55	58	61	64	4037
	40	39	42	45	47	50	53	56	60	63	66	70	3709
	50	42	45	48	51	54	58	61	65	68	72	75	3425
	60° F, 21 psf wind	57	61	65	69	74	78	83	87	92	97	102	5436
	60° F, 6 psf wind	47	51	54	57	61	64	68	72	76	80	84	3488
	60° F, 4 psf wind	46	50	53	56	60	63	67	71	75	79	83	3323
	60	46	49	52	55	59	62	66	69	73	77	81	3180
	70	49	52	56	59	63	67	70	74	79	83	87	2969
	80	52	56	59	63	67	71	75	79	84	88	93	2787
	90	55	59	63	67	71	75	80	84	89	93	98	2629
	100	58	62	66	71	75	79	84	89	94	99	104	2491

Super Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		28	30	32	34	36	38	40	42	45	47	49	5221
0		34	36	39	41	44	46	49	52	54	57	60	4283
0°, 0.5" ice, 4 psf wind + k		49	53	56	60	63	67	71	75	79	83	87	6944
30		44	47	50	53	56	60	63	67	70	74	78	3312
32°, 0.5" ice,		54	58	62	66	70	74	78	82	87	92	96	5261
32°, 0.5" ice, 2 psf wind		54	58	62	66	70	74	78	83	87	92	97	5314
40		47	50	54	57	61	64	68	72	76	80	84	3080
50		50	54	57	61	65	69	73	77	81	85	90	2881
60		54	57	61	65	69	73	77	82	86	91	95	2711
60° F, 6 psf wind		55	59	62	66	71	75	79	84	88	93	98	3009
70		57	61	64	69	73	77	82	86	91	96	101	2563
80		60	64	68	72	77	81	86	91	96	101	106	2434
90		63	67	71	76	81	85	90	95	101	106	111	2320
100		66	70	75	79	84	89	94	100	105	111	116	2219
120		71	76	81	86	91	97	102	108	114	120	126	2049
248		94	100	107	113	120	128	135	143	150	158	167	1554

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 44 of 61

T2 - (2) 556.5 kcmil (19) AAC "Dahlia"

DE Tension = 2,000 Lbs

RBS = 19,500 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		50	60	70	80	90	100	110	120	130	140		150
	15°, 1" ice, 4 psf wind	6	9	12	15	19	24	29	34	40	46	53	2,654
	15°, 0.8" ice, 4 psf wind	6	8	11	15	19	23	28	33	39	45	52	2,222
	0°, 0.5" ice, 4 psf wind + k	5	7	10	13	16	20	24	29	34	39	45	2,000
	0	4	6	9	11	14	18	21	25	30	34	39	897
	10	5	7	9	12	16	19	23	28	32	38	43	817
	20	5	7	10	13	17	21	25	30	35	41	47	755
	30	6	8	11	14	18	22	27	32	38	44	50	704
	40	6	9	12	15	19	24	29	34	40	47	53	662
	50	6	9	12	16	20	25	30	36	42	49	56	626
	60° F, 21 psf wind	7	10	14	18	22	28	34	40	47	54	62	1,445
	60° F, 6 psf wind	7	10	13	17	21	27	32	38	45	52	60	712
	60° F, 4 psf wind	7	10	13	17	21	27	32	38	45	52	60	650
	60	7	10	13	17	21	26	32	38	45	52	59	595
	70	7	10	14	18	22	28	33	40	47	54	62	569
	80	7	10	14	18	23	29	35	41	49	56	65	545
	90	8	11	15	19	24	30	36	43	51	59	68	525
	100	8	11	15	20	25	31	38	45	53	61	70	506

Super Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		4	5	7	9	11	14	17	20	24	28	32	1,108
0		5	6	9	12	15	18	22	26	30	35	41	874
0°, 0.5" ice, 4 psf wind + k		5	7	10	13	16	20	24	29	34	39	45	2,000
30		6	8	11	15	18	23	28	33	39	45	51	690
32°, 0.5" ice,		6	9	12	15	20	24	29	35	41	47	54	1,389
32°, 0.5" ice, 2 psf wind		6	9	12	15	20	24	29	35	41	47	54	1,410
40		6	9	12	15	20	24	29	35	41	47	54	650
50		6	9	13	16	21	26	31	37	43	50	58	616
60		7	10	13	17	22	27	32	39	45	52	60	586
60° F, 6 psf wind		7	10	13	17	22	27	33	39	46	53	61	702
70		7	10	14	18	23	28	34	40	47	55	63	561
80		7	10	14	19	24	29	35	42	49	57	66	538
90		8	11	15	19	25	30	37	44	51	60	68	518
100		8	11	15	20	25	31	38	45	53	62	71	500
120		8	12	16	22	27	34	41	48	57	66	76	469
212		10	15	21	27	34	42	51	60	71	82	94	376

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 45 of 61

T2 - (2) 556.5 kcmil (19) AAC "Dahlia"

DE Tension = 4,000 Lbs

RBS = 19,500 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		100	110	120	130	140	150	160	170	180	190		200
	15°, 1" ice, 4 psf wind	13	16	19	22	26	30	34	38	43	48	53	4,737
	15°, 0.8" ice, 4 psf wind	12	15	18	21	24	28	32	36	40	44	49	4,130
	0°, 0.5" ice, 4 psf wind + k	10	12	14	17	20	23	26	29	32	36	40	4,000
	0	6	8	9	11	12	14	16	18	21	23	25	2,477
	10	7	9	11	13	15	17	19	22	24	27	30	2,095
	20	9	11	13	15	17	20	22	25	28	31	35	1,804
	30	10	12	14	17	19	22	25	29	32	36	40	1,585
	40	11	13	16	19	22	25	28	32	36	40	44	1,418
	50	12	15	18	21	24	27	31	35	39	44	49	1,289
	60° F, 21 psf wind	15	18	22	26	30	34	39	44	49	55	61	2,636
	60° F, 6 psf wind	14	16	20	23	27	30	35	39	44	49	54	1,397
	60° F, 4 psf wind	13	16	19	23	26	30	34	39	43	48	54	1,286
	60	13	16	19	22	26	30	34	38	43	48	53	1,186
	70	14	17	21	24	28	32	36	41	46	51	57	1,103
	80	15	18	22	26	30	34	39	44	49	55	61	1,034
	90	16	19	23	27	32	36	41	47	52	58	64	975
	100	17	21	24	29	33	38	43	49	55	61	68	925

Short Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		5	6	7	8	10	11	13	14	16	18	20	3,198
0		7	9	11	12	14	16	19	21	24	26	29	2,151
0°, 0.5" ice, 4 psf wind + k		10	12	15	17	20	23	26	30	33	37	41	3,878
30		11	13	16	19	22	25	28	32	36	40	44	1,416
32°, 0.5" ice,		13	16	19	22	25	29	33	37	42	46	51	2,600
32°, 0.5" ice, 2 psf wind		13	16	19	22	25	29	33	37	42	47	52	2,634
40		12	15	18	21	24	27	31	35	40	44	49	1,284
50		13	16	19	22	26	30	34	38	43	48	53	1,180
60		14	17	21	24	28	32	37	41	46	52	57	1,096
60° F, 6 psf wind		15	18	21	25	29	33	37	42	47	53	58	1,300
70		15	19	22	26	30	34	39	44	50	55	61	1,027
80		16	20	23	27	32	36	42	47	53	59	65	969
90		17	21	25	29	33	38	44	49	55	62	68	919
100		18	22	26	30	35	40	46	52	58	65	72	876
120		20	24	28	33	38	44	50	56	63	70	78	805
212		26	31	37	43	50	58	66	74	83	93	103	613

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 46 of 61

T2 - (2) 556.5 kcmil (19) AAC "Dahlia"

DE Tension = 5,000 Lbs

RBS = 19,500 Lbs

Medium Span - Feet													
Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		150	160	170	180	190	200	210	220	230	240		250
	15°, 1" ice, 4 psf wind	24	27	31	34	38	42	47	51	56	61	66	5,937
	15°, 0.8" ice, 4 psf wind	22	25	28	32	35	39	43	47	52	56	61	5,215
	0°, 0.5" ice, 4 psf wind + k	18	21	23	26	29	32	35	39	42	46	50	5,000
	0	11	12	14	16	18	19	21	24	26	28	30	3,220
	10	13	14	16	18	20	22	25	27	30	32	35	2,792
	20	14	16	19	21	23	26	28	31	34	37	40	2,443
	30	16	19	21	23	26	29	32	35	38	42	45	2,165
	40	18	21	23	26	29	32	36	39	43	46	50	1,946
	50	20	23	26	29	32	35	39	43	47	51	55	1,771
	60° F, 21 psf wind	26	29	33	37	42	46	51	56	61	66	72	3,471
	60° F, 6 psf wind	22	25	29	32	36	40	44	48	53	57	62	1,902
	60° F, 4 psf wind	22	25	28	32	35	39	43	47	52	56	61	1,758
	60	22	25	28	31	35	39	42	47	51	55	60	1,629
	70	23	27	30	34	37	42	46	50	55	60	65	1,513
	80	25	28	32	36	40	44	49	54	59	64	69	1,416
	90	26	30	34	38	42	47	52	57	62	68	74	1,335
	100	28	32	36	40	45	50	55	60	66	72	78	1,265

Medium Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		150	160	170	180	190	200	210	220	230	240	250	
-20		10	11	13	14	16	18	20	21	23	26	28	3,537
0		14	16	18	20	22	24	27	30	32	35	38	2,566
0°, 0.5" ice, 4 psf wind + k		19	22	25	28	31	34	38	42	45	49	54	4,661
30		20	22	25	28	31	35	38	42	46	50	54	1,800
32°, 0.5" ice,		23	26	30	33	37	41	45	50	54	59	64	3,266
32°, 0.5" ice, 2 psf wind		23	26	30	33	37	41	45	50	54	59	64	3,307
40		21	24	27	31	34	38	42	46	50	55	59	1,649
50		23	26	30	33	37	41	45	50	54	59	64	1,526
60		25	28	32	36	40	44	49	53	58	63	69	1,425
60° F, 6 psf wind		25	29	32	36	41	45	49	54	59	65	70	1,685
70		26	30	34	38	42	47	52	57	62	67	73	1,341
80		28	32	36	40	45	50	55	60	66	71	77	1,269
90		29	33	38	42	47	52	57	63	69	75	81	1,207
100		31	35	39	44	49	54	60	66	72	78	85	1,152
120		33	38	43	48	53	59	65	72	78	85	92	1,062
212		44	50	56	63	70	77	85	94	102	111	121	814

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 47 of 61

T2 - (2) 556.5 kcmil (19) AAC "Dahlia"

DE Tension = 6,000 Lbs

RBS = 19,500 Lbs

Long Span - Feet													
Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.				Not Recommended		
		200	210	220	230	240	250	260	270	280	290		300
	15°, 1" ice, 4 psf wind	35	39	43	47	51	55	60	65	69	74	80	7,098
	15°, 0.8" ice, 4 psf wind	32	36	39	43	47	51	55	59	64	68	73	6,282
	0°, 0.5" ice, 4 psf wind + k	27	29	32	35	38	42	45	49	52	56	60	6,000
	0	16	17	19	21	22	24	26	28	31	33	35	4,032
	10	18	19	21	23	25	27	30	32	34	37	40	3,560
	20	20	22	24	26	29	31	34	36	39	42	45	3,155
	30	22	25	27	29	32	35	38	41	44	47	50	2,817
	40	25	27	30	33	36	39	42	45	48	52	56	2,539
	50	27	30	33	36	39	42	46	49	53	57	61	2,311
	60° F, 21 psf wind	37	41	45	49	53	58	63	67	73	78	83	4,323
	60° F, 6 psf wind	31	34	37	41	44	48	52	56	60	65	69	2,456
	60° F, 4 psf wind	30	33	36	40	43	47	51	55	59	63	68	2,282
	60	30	33	36	39	43	46	50	54	58	62	67	2,125
	70	32	35	39	42	46	50	54	58	62	67	72	1,970
	80	34	38	41	45	49	53	58	62	67	72	77	1,840
	90	36	40	44	48	52	57	61	66	71	76	82	1,730
	100	38	42	46	51	55	60	65	70	75	81	86	1,636

Long Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		16	17	19	21	22	24	26	28	31	33	35	4,021
0		21	23	25	27	30	32	35	38	40	43	46	3,047
0°, 0.5" ice, 4 psf wind + k		29	32	35	39	42	46	49	53	57	62	66	5,474
30		28	31	34	38	41	44	48	52	56	60	64	2,210
32°, 0.5" ice,		34	37	41	45	49	53	57	62	67	71	76	3,944
32°, 0.5" ice, 2 psf wind		34	38	41	45	49	53	57	62	67	72	77	3,993
40		31	34	37	41	44	48	52	56	61	65	69	2,034
50		33	37	40	44	48	52	56	61	65	70	75	1,890
60		35	39	43	47	51	55	60	65	70	75	80	1,769
60° F, 6 psf wind		36	40	44	48	52	57	61	66	71	76	82	2,084
70		38	41	46	50	54	59	64	69	74	79	85	1,667
80		40	44	48	53	57	62	67	73	78	84	90	1,580
90		42	46	51	55	60	65	71	76	82	88	94	1,504
100		44	48	53	58	63	68	74	80	86	92	98	1,438
120		47	52	57	63	68	74	80	86	93	100	107	1,327
212		62	68	75	82	89	97	104	113	121	130	139	1,018

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 48 of 61

T2 - (2) 556.5 kcmil (19) AAC "Dahlia"

DE Tension = 7,000 Lbs

RBS = 19,500 Lbs

Extra Long Span - Feet													
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→		INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		250	260	270	280	290	300	310	320	330	340	350	
15°, 1" ice, 4 psf wind		48	52	56	60	64	69	73	78	83	88	94	8,227
15°, 0.8" ice, 4 psf wind		43	47	51	54	58	62	67	71	76	80	85	7,336
0°, 0.5" ice, 4 psf wind + k		36	39	42	45	48	51	55	59	62	66	70	7,000
0		20	22	23	25	27	29	31	33	35	37	39	4,906
10		22	24	26	28	30	32	34	36	39	41	44	4,399
20		25	27	29	31	33	36	38	41	43	46	49	3,944
30		28	30	32	35	37	40	43	45	48	51	54	3,548
40		31	33	36	38	41	44	47	50	53	56	60	3,210
50		34	36	39	42	45	48	52	55	58	62	66	2,925
60° F, 21 psf wind		48	52	56	60	65	69	74	79	84	89	94	5,197
60° F, 6 psf wind		39	42	45	48	52	55	59	63	67	71	75	3,069
60° F, 4 psf wind		37	40	44	47	50	54	58	61	65	69	73	2,868
60		37	39	43	46	49	53	56	60	64	68	72	2,686
70		40	43	46	50	53	57	61	65	69	73	77	2,485
80		42	46	49	53	57	61	65	69	74	78	83	2,316
90		45	49	53	57	61	65	69	74	79	84	89	2,172
100		48	52	56	60	64	69	74	79	83	89	94	2,049

Extra Long Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		21	23	25	27	29	31	33	35	37	39	42	4,587
0		27	30	32	34	37	39	42	45	48	51	54	3,575
0°, 0.5" ice, 4 psf wind + k		40	43	46	50	53	57	61	65	69	73	78	6,306
30		37	40	43	47	50	53	57	61	65	69	73	2,647
32°, 0.5" ice,		45	49	53	57	61	65	69	74	79	83	88	4,637
32°, 0.5" ice, 2 psf wind		45	49	53	57	61	65	70	74	79	84	89	4,692
40		40	43	47	50	54	58	62	66	70	74	79	2,443
50		43	47	50	54	58	62	66	71	75	80	85	2,274
60		46	50	54	58	62	66	71	75	80	85	90	2,132
60° F, 6 psf wind		47	51	55	59	64	68	73	77	82	87	93	2,502
70		49	53	57	61	66	70	75	80	85	90	96	2,011
80		52	56	60	65	69	74	79	84	90	95	101	1,906
90		54	58	63	68	73	78	83	89	94	100	106	1,815
100		57	61	66	71	76	81	87	93	99	105	111	1,735
120		61	66	72	77	83	88	94	100	107	113	120	1,601
212		80	87	93	100	108	115	123	131	140	148	157	1,228

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 49 of 61

T2 - (2) 556.5 kcmil (19) AAC "Dahlia"

DE Tension = 8,000 Lbs

RBS = 19,500 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs
		Not Recommended					R.S.			Not Recommended			
		300	310	320	330	340	350	360	370	380	390	400	
	15°, 1" ice, 4 psf wind	61	65	69	74	78	83	87	92	97	103	108	9,324
	15°, 0.8" ice, 4 psf wind	55	58	62	66	70	74	79	83	88	92	97	8,378
	0°, 0.5" ice, 4 psf wind + k	45	48	51	55	58	61	65	69	72	76	80	8,000
	0	24	26	27	29	31	33	35	37	39	41	43	5,836
	10	27	28	30	32	34	36	38	41	43	45	47	5,304
	20	29	31	33	36	38	40	42	45	47	50	52	4,811
	30	32	35	37	39	42	44	47	49	52	55	58	4,364
	40	36	38	41	43	46	48	51	54	57	60	63	3,968
	50	39	42	44	47	50	53	56	59	63	66	69	3,623
	60° F, 21 psf wind	59	63	67	72	76	81	85	90	95	100	105	6,095
	60° F, 6 psf wind	45	48	52	55	58	62	65	69	73	77	81	3,752
	60° F, 4 psf wind	44	47	50	53	56	60	63	67	70	74	78	3,529
	60	42	45	48	51	54	58	61	65	68	72	75	3,327
	70	46	49	52	56	59	63	66	70	74	78	82	3,074
	80	49	53	56	60	63	67	71	75	79	83	88	2,858
	90	53	56	60	64	68	72	76	80	85	89	94	2,673
	100	56	60	64	68	72	76	81	85	90	95	100	2,514

Super Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		27	29	31	33	35	37	39	41	43	46	48	5,215
0		34	36	39	41	44	46	49	52	55	58	60	4,149
0°, 0.5" ice, 4 psf wind + k		50	54	57	61	65	69	72	77	81	85	89	7,153
30		45	48	52	55	58	62	65	69	73	77	81	3,115
32°, 0.5" ice,		56	60	64	68	72	77	81	86	90	95	100	5,346
32°, 0.5" ice, 2 psf wind		57	60	64	68	73	77	82	86	91	96	101	5,408
40		49	52	56	59	63	67	71	75	79	83	87	2,880
50		53	56	60	64	68	72	76	80	84	89	94	2,683
60		56	60	64	68	72	76	81	85	90	95	100	2,516
60° F, 6 psf wind		58	62	66	70	74	79	83	88	93	98	103	2,940
70		60	64	68	72	76	81	86	91	95	101	106	2,373
80		63	67	71	76	81	85	90	95	101	106	112	2,250
90		66	70	75	80	85	90	95	100	106	111	117	2,142
100		69	74	79	84	89	94	99	105	111	117	123	2,047
120		75	80	85	91	96	102	108	114	120	127	133	1,888
212		98	105	112	119	126	134	141	149	157	166	174	1,444

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 50 of 61

1272 kcmil (45/7) ACSR "Bittern"

DE Tension = 1,500 Lbs

RBS = 34,100 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended			R.S.			Not Recommended					
		50	60	70	80	90	100	110	120	130	140		150
	15°, 1" ice, 4 psf wind	8	12	16	21	26	32	39	46	54	63	72	2098
	15°, 0.8" ice, 4 psf wind	8	11	16	20	26	32	38	46	54	62	72	1749
	0°, 0.5" ice, 4 psf wind + k	8	11	15	19	24	30	36	43	51	59	68	1500
	0	7	10	14	19	23	29	35	42	49	57	65	744
	10	8	11	15	19	24	30	36	43	51	59	68	716
	20	8	11	15	20	25	31	38	45	53	61	70	691
	30	8	12	16	21	26	32	39	46	54	63	72	671
	40	8	12	16	21	27	33	40	48	56	65	75	652
	50	9	12	17	22	28	34	41	49	58	67	77	634
	60° F, 21 psf wind	9	13	17	23	29	35	43	51	60	69	80	1171
	60° F, 6 psf wind	9	13	17	22	28	35	42	50	59	68	79	682
	60° F, 4 psf wind	9	13	17	22	28	35	42	50	59	68	79	647
	60	9	13	17	22	28	35	42	50	59	68	79	618
	70	9	13	18	23	29	36	43	51	60	70	80	603
	80	9	13	18	23	30	37	44	53	62	72	82	589
	90	9	13	18	24	30	37	45	54	63	73	84	576
	100	9	14	19	24	31	38	46	55	64	74	85	569

Super Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		7	10	13	17	22	27	32	39	45	52	60	804
0		7	10	14	19	24	29	35	42	49	57	66	739
0°, 0.5" ice, 4 psf wind + k		8	11	15	19	24	30	36	43	51	59	68	1500
30		8	12	16	21	26	32	39	47	55	64	73	667
32°, 0.5" ice,		8	12	16	21	27	33	40	48	56	65	74	1178
32°, 0.5" ice, 2 psf wind		8	12	16	21	27	33	40	48	56	65	74	1191
40		8	12	16	21	27	33	40	48	56	65	75	648
50		9	12	17	22	28	34	41	49	58	67	77	631
60		9	13	17	22	28	35	42	50	59	69	79	615
60° F, 6 psf wind		9	13	17	23	28	35	43	51	59	69	79	678
70		9	13	18	23	29	36	44	52	61	71	81	600
80		9	13	18	24	30	37	44	53	62	72	83	587
90		9	13	18	24	30	37	45	54	63	73	84	576
100		9	14	19	24	31	38	46	55	64	74	85	569
120		10	14	19	25	31	39	47	56	66	76	87	557
248		11	16	22	28	36	44	53	63	74	86	99	492

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 51 of 61

1272 kcmil (45/7) ACSR "Bittern"

DE Tension = 3,000 Lbs

RBS = 34,100 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	100	110	120	130	140	150	160	170	180	190	200	
	15°, 1" ice, 4 psf wind	17	21	25	29	34	39	44	50	56	62	69	3929
	15°, 0.8" ice, 4 psf wind	17	20	24	28	33	37	43	48	54	60	67	3341
	0°, 0.5" ice, 4 psf wind + k	15	18	22	25	29	34	38	43	49	54	60	3000
	0	13	16	19	23	26	30	35	39	44	49	54	1595
	10	14	17	21	24	28	32	37	42	47	52	58	1496
	20	15	18	22	26	30	34	39	44	49	55	61	1413
	30	16	19	23	27	31	36	41	46	52	58	64	1342
	40	17	20	24	28	33	38	43	49	55	61	67	1279
	50	18	21	25	30	34	40	45	51	57	64	70	1224
	60° F, 21 psf wind	19	23	27	32	37	43	49	55	62	69	76	2168
	60° F, 6 psf wind	18	22	26	31	36	41	47	53	60	66	74	1292
	60° F, 4 psf wind	18	22	26	31	36	41	47	53	60	66	74	1229
	60	18	22	26	31	36	41	47	53	59	66	73	1176
	70	19	23	27	32	37	43	49	55	62	69	76	1132
	80	20	24	28	33	39	44	51	57	64	71	79	1093
	90	20	25	29	34	40	46	52	59	66	74	81	1058
	100	21	25	30	36	41	47	54	61	68	76	84	1026

Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		12	14	17	20	23	26	30	34	38	42	47	1832
0		14	17	20	23	27	31	35	40	45	50	55	1560
0°, 0.5" ice, 4 psf wind + k		15	18	22	25	29	34	38	43	49	54	60	3000
30		16	20	24	28	32	37	42	47	53	59	65	1315
32°, 0.5" ice,		17	21	25	29	34	39	44	50	56	62	69	2253
32°, 0.5" ice, 2 psf wind		17	21	25	29	34	39	44	50	56	62	69	2276
40		17	21	25	29	34	39	44	50	56	62	69	1255
50		18	22	26	30	35	40	46	52	58	65	72	1202
60		19	23	27	32	37	42	48	54	60	67	75	1155
60° F, 6 psf wind		19	23	27	32	37	42	48	54	61	68	75	1271
70		19	23	28	33	38	44	50	56	63	70	77	1113
80		20	24	29	34	39	45	51	58	65	72	80	1075
90		21	25	30	35	41	47	53	60	67	75	83	1041
100		21	26	31	36	42	48	55	62	69	77	86	1010
120		22	27	32	38	44	50	57	64	72	80	89	969
248		26	32	38	44	51	59	67	76	85	94	105	827

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 52 of 61

1272 kcmil (45/7) ACSR "Bittern"

DE Tension = 4500 Lbs

RBS = 34,100 Lbs

Medium Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	150	160	170	180	190	200	210	220	230	240	250	
	15°, 1" ice, 4 psf wind	27	31	35	39	43	48	53	58	63	69	75	5636
	15°, 0.8" ice, 4 psf wind	26	29	33	37	41	46	50	55	60	66	71	4879
	0°, 0.5" ice, 4 psf wind + k	22	26	29	32	36	40	44	48	53	58	62	4500
	0	18	21	24	27	30	33	36	40	43	47	51	2624
	10	20	23	26	29	32	36	39	43	47	51	56	2418
	20	22	25	28	31	35	38	42	46	51	55	60	2246
	30	23	26	30	33	37	41	45	50	54	59	64	2102
	40	25	28	31	35	39	44	48	53	58	63	68	1979
	50	26	29	33	37	41	46	51	56	61	66	72	1874
	60° F, 21 psf wind	29	33	38	42	47	52	57	63	69	75	81	3180
	60° F, 6 psf wind	27	31	35	40	44	49	54	59	65	70	76	1950
	60° F, 4 psf wind	27	31	35	39	44	49	54	59	64	70	76	1859
	60	27	31	35	39	44	48	53	59	64	70	76	1782
	70	28	32	37	41	46	51	56	61	67	73	79	1702
	80	30	34	38	43	48	53	58	64	70	76	83	1630
	90	31	35	40	45	50	55	61	67	73	79	86	1567
	100	32	37	41	46	52	57	63	69	76	82	89	1510

Medium Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		150	160	170	180	190	200	210	220	230	240	250	
-20		16	18	21	23	26	29	32	35	38	41	45	2994
0		20	22	25	28	31	35	38	42	46	50	54	2470
0°, 0.5" ice, 4 psf wind + k		23	26	29	33	37	41	45	49	54	58	63	4442
30		24	28	31	35	39	43	48	52	57	62	68	1995
32°, 0.5" ice,		26	30	34	38	42	47	52	57	62	68	73	3307
32°, 0.5" ice, 2 psf wind		26	30	34	38	42	47	52	57	62	68	73	3339
40		26	29	33	37	41	46	50	55	60	66	71	1884
50		27	31	35	39	44	48	53	58	64	69	75	1788
60		28	32	37	41	46	51	56	61	67	73	79	1705
60° F, 6 psf wind		29	33	37	41	46	51	56	62	67	73	80	1870
70		30	34	38	43	48	53	58	64	70	76	83	1632
80		31	35	40	45	50	55	61	67	73	79	86	1567
90		32	37	41	46	52	57	63	69	76	82	89	1509
100		33	38	43	48	53	59	65	72	78	85	92	1457
120		36	40	46	51	57	63	70	76	83	91	99	1366
248		43	48	55	61	68	76	83	91	100	109	118	1143

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 53 of 61

1272 kcmil (45/7) ACSR "Bittern"

DE Tension = 6,000 Lbs

RBS = 34,100 Lbs

Long Span - Feet														
Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.				Not Recommended			
		200	210	220	230	240	250	260	270	280	290	300		
	15°, 1" ice, 4 psf wind	37	41	45	49	53	58	63	68	73	78	83	7280	
	15°, 0.8" ice, 4 psf wind	35	38	42	46	50	54	59	63	68	73	78	6396	
	0°, 0.5" ice, 4 psf wind + k	30	33	36	40	43	47	51	55	59	63	68	6000	
	0	22	25	27	30	32	35	38	41	44	47	50	3832	
	10	25	27	30	33	35	38	42	45	48	52	55	3503	
	20	27	29	32	35	38	42	45	49	52	56	60	3225	
	30	29	32	35	38	41	45	49	52	56	61	65	2989	
	40	31	34	37	41	44	48	52	56	61	65	69	2789	
	50	33	36	40	43	47	51	56	60	64	69	74	2619	
	60° F, 21 psf wind	39	43	47	52	56	61	66	71	76	82	88	4243	
	60° F, 6 psf wind	35	39	43	47	51	55	60	65	69	74	80	2689	
	60° F, 4 psf wind	35	39	42	46	51	55	59	64	69	74	79	2571	
	60	35	38	42	46	50	54	59	64	68	73	78	2471	
	70	37	41	45	49	53	57	62	67	72	77	83	2343	
	80	39	43	47	51	56	60	65	70	76	81	87	2232	
	90	40	45	49	53	58	63	68	74	79	85	91	2133	
	100	42	46	51	56	61	66	71	77	83	89	95	2045	

Long Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		21	23	25	27	30	32	35	38	40	43	46	4175
0		25	28	31	33	36	39	43	46	50	53	57	3405
0°, 0.5" ice, 4 psf wind + k		31	34	38	41	45	49	53	57	61	65	70	5782
30		32	35	39	42	46	50	54	58	63	67	72	2694
32°, 0.5" ice,		36	39	43	47	52	56	60	65	70	75	81	4331
32°, 0.5" ice, 2 psf wind		36	40	43	47	52	56	61	65	70	75	81	4371
40		34	38	41	45	49	53	58	62	67	72	77	2529
50		36	40	44	48	52	56	61	66	71	76	81	2388
60		38	42	46	50	55	59	64	69	75	80	86	2267
60° F, 6 psf wind		38	42	46	51	55	60	65	70	75	81	86	2479
70		40	44	48	53	57	62	67	73	78	84	90	2161
80		42	46	50	55	60	65	70	76	82	88	94	2067
90		43	48	53	57	63	68	73	79	85	91	98	1984
100		45	50	55	60	65	71	76	82	89	95	102	1910
120		48	53	59	64	70	76	82	88	95	102	109	1782
248		59	65	72	78	85	93	100	108	116	124	133	1459

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 54 of 61

1272 kcmil (45/7) ACSR "Bittern"

DE Tension = 7,500 Lbs

RBS = 34,100 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		250	260	270	280	290	300	310	320	330	340		350
	15°, 1" ice, 4 psf wind	48	51	55	60	64	68	73	78	83	88	93	8882
	15°, 0.8" ice, 4 psf wind	44	48	51	55	59	63	68	72	77	81	86	7903
	0°, 0.5" ice, 4 psf wind + k	38	41	44	47	50	54	58	61	65	69	74	7500
	0	26	28	30	33	35	37	40	42	45	48	51	5187
	10	28	31	33	36	38	41	44	46	49	52	56	4746
	20	31	33	36	39	41	44	47	51	54	57	60	4360
	30	33	36	39	42	45	48	51	55	58	62	65	4024
	40	36	39	42	45	48	52	55	59	63	67	71	3735
	50	39	42	45	48	52	56	59	63	67	71	76	3485
	60° F, 21 psf wind	48	52	56	61	65	69	74	79	84	89	95	5368
	60° F, 6 psf wind	42	46	49	53	57	61	65	69	73	78	82	3531
	60° F, 4 psf wind	42	45	49	52	56	60	64	68	72	77	82	3390
	60	41	45	48	52	55	59	63	67	72	76	81	3269
	70	44	47	51	55	59	63	67	72	76	81	86	3082
	80	46	50	54	58	62	66	71	76	80	85	90	2918
	90	49	52	57	61	65	70	75	79	85	90	95	2775
	100	51	55	59	64	68	73	78	83	89	94	100	2648

Extra Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		250	260	270	280	290	300	310	320	330	340	350	
-20		25	27	29	31	34	36	39	41	44	46	49	5361
0		31	33	36	39	41	44	47	50	54	57	60	4380
0°, 0.5" ice, 4 psf wind + k		40	43	46	50	53	57	61	65	69	74	78	7080
30		39	42	46	49	53	56	60	64	68	72	77	3432
32°, 0.5" ice,		45	49	53	57	61	65	70	74	79	84	89	5358
32°, 0.5" ice, 2 psf wind		45	49	53	57	61	65	70	74	79	84	89	5405
40		42	45	49	53	56	60	64	69	73	78	82	3210
50		45	48	52	56	60	64	69	73	78	82	87	3021
60		47	51	55	59	63	68	72	77	82	87	92	2858
60° F, 6 psf wind		48	52	56	60	64	69	73	78	83	88	94	3115
70		50	54	58	62	67	71	76	81	86	92	97	2716
80		52	56	61	65	70	75	80	85	91	96	102	2591
90		54	59	63	68	73	78	84	89	95	100	106	2481
100		57	61	66	71	76	81	87	93	99	105	111	2382
120		61	66	71	76	82	88	94	100	106	113	119	2214
248		76	82	88	95	102	109	117	124	132	140	149	1779

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 55 of 61

1272 kcmil (45/7) ACSR "Bittern"

DE Tension = 9,000 Lbs

RBS = 34,100 Lbs

Super Long Span - Feet													
Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		300	310	320	330	340	350	360	370	380	390		400
	15°, 1" ice, 4 psf wind	58	62	66	70	75	79	84	88	93	98	103	10455
	15°, 0.8" ice, 4 psf wind	53	57	60	64	68	72	77	81	85	90	95	9405
	0°, 0.5" ice, 4 psf wind + k	45	48	51	54	58	61	65	68	72	76	80	9000
	0	29	31	33	35	37	40	42	44	47	49	52	6639
	10	32	34	36	38	41	43	46	48	51	53	56	6117
	20	34	37	39	42	44	47	50	52	55	58	61	5640
	30	37	40	42	45	48	51	54	57	60	63	66	5210
	40	40	43	46	49	52	55	58	61	64	68	71	4828
	50	43	46	49	52	55	59	62	66	69	73	77	4492
	60° F, 21 psf wind	57	61	65	69	73	77	82	86	91	96	101	6557
	60° F, 6 psf wind	48	51	54	58	61	65	69	72	76	80	85	4494
	60° F, 4 psf wind	47	50	53	57	60	64	67	71	75	79	83	4334
	60	46	49	53	56	59	63	67	70	74	78	82	4196
	70	49	53	56	60	63	67	71	75	79	83	87	3938
	80	52	56	59	63	67	71	75	79	84	88	93	3712
	90	55	59	63	67	71	75	79	84	89	93	98	3513
	100	58	62	66	70	75	79	84	88	93	98	103	3337

Super Long Span - Feet													
Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390		400
-20		30	32	34	36	38	40	43	45	48	50	53	6546
0		36	38	41	44	46	49	52	55	58	61	64	5391
0°, 0.5" ice, 4 psf wind + k		48	52	55	59	62	66	70	74	78	82	86	8352
30		46	49	52	56	59	63	66	70	74	78	82	4215
32°, 0.5" ice,		55	58	62	66	70	74	79	83	88	92	97	6394
32°, 0.5" ice, 2 psf wind		55	58	62	66	70	75	79	83	88	93	97	6446
40		49	53	56	60	63	67	71	75	79	83	88	3933
50		52	56	60	63	67	71	76	80	84	89	93	3692
60		56	59	63	67	71	76	80	85	89	94	99	3484
60° F, 6 psf wind		57	60	64	68	73	77	82	86	91	96	101	3783
70		59	63	67	71	75	80	85	89	94	99	104	3302
80		62	66	70	75	79	84	89	94	99	104	110	3144
90		65	69	73	78	83	88	93	98	104	109	115	3003
100		67	72	77	82	87	92	97	102	108	114	120	2879
120		73	78	83	88	93	99	105	111	117	123	129	2667
248		92	99	105	112	119	126	133	140	148	156	164	2105

NOTES:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 56 of 61

T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 2,500 Lbs

RBS = 51,800 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
		Not Recommended					R.S.			Not Recommended				
		50	60	70	80	90	100	110	120	130	140	150		
	15°, 1" ice, 4 psf wind	7	10	13	17	22	27	33	39	46	53	61	3,287	
	15°, 0.8" ice, 4 psf wind	7	10	13	17	22	27	32	38	45	52	60	2,805	
	0°, 0.5" ice, 4 psf wind + k	6	9	12	16	20	24	30	35	41	48	55	2,500	
	0	6	8	12	15	19	24	28	34	40	46	53	1,376	
	10	6	9	12	16	20	25	30	36	42	49	56	1,301	
	20	7	9	13	17	21	26	32	38	44	51	59	1,236	
	30	7	10	13	18	22	27	33	39	46	54	62	1,180	
	40	7	10	14	18	23	28	34	41	48	56	64	1,135	
	50	7	11	14	19	24	30	36	43	50	58	66	1,094	
	60° F, 21 psf wind	8	11	15	20	25	31	38	45	53	61	70	1,922	
	60° F, 6 psf wind	8	11	15	20	25	31	37	44	52	60	69	1,155	
	60° F, 4 psf wind	8	11	15	20	25	31	37	44	52	60	69	1,102	
	60	8	11	15	20	25	31	37	44	52	60	69	1,057	
	70	8	11	15	20	26	32	38	45	53	62	71	1,024	
	80	8	12	16	21	26	33	39	47	55	64	73	994	
	90	8	12	16	21	27	33	41	48	57	66	75	966	
	100	9	12	17	22	28	34	42	49	58	67	77	942	

Super Short Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL SAG (inches)											Tension Lbs
							R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		5	7	10	13	17	21	25	30	35	40	46	1,574
0		6	8	12	15	19	24	28	34	40	46	53	1,376
0°, 0.5" ice, 4 psf wind + k		6	9	12	16	20	24	30	35	41	48	55	2,498
30		7	10	13	18	22	27	33	39	46	54	62	1,180
32°, 0.5" ice,		7	10	14	18	23	28	34	41	48	55	63	1,947
32°, 0.5" ice, 2 psf wind		7	10	14	18	23	28	34	41	48	55	63	1,964
40		7	10	14	18	23	29	35	41	48	56	64	1,134
50		7	11	14	19	24	30	36	43	50	58	66	1,093
60		8	11	15	20	25	31	37	44	52	60	69	1,057
60° F, 6 psf wind		8	11	15	20	25	31	37	44	52	60	69	1,154
70		8	11	15	20	26	32	38	45	53	62	71	1,024
80		8	12	16	21	26	33	39	47	55	64	73	994
90		8	12	16	21	27	33	41	48	57	66	75	966
100		9	12	17	22	28	34	42	49	58	67	77	941
120		9	13	17	23	29	35	43	51	60	69	79	916
248		10	15	20	26	33	41	50	59	69	80	92	793

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 57 of 61

T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 4,000 Lbs

RBS = 51,800 Lbs

Short Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		100	110	120	130	140	150	160	170	180	190		200
	15°, 1" ice, 4 psf wind	17	21	25	29	34	39	44	50	56	62	69	5,168
	15°, 0.8" ice, 4 psf wind	17	20	24	28	33	38	43	49	55	61	67	4,448
	0°, 0.5" ice, 4 psf wind + k	15	19	22	26	30	34	39	44	50	55	61	4,000
	0	14	17	20	24	28	32	36	41	46	51	57	2,274
	10	15	18	22	26	30	34	39	44	49	55	61	2,131
	20	16	19	23	27	31	36	41	46	52	58	64	2,012
	30	17	20	24	28	33	38	43	49	55	61	67	1,916
	40	18	21	25	30	35	40	45	51	57	64	71	1,832
	50	18	22	26	31	36	41	47	53	60	66	74	1,758
	60° F, 21 psf wind	20	24	28	33	38	44	50	57	64	71	79	3,037
	60° F, 6 psf wind	19	23	28	32	38	43	49	55	62	69	77	1,845
	60° F, 4 psf wind	19	23	28	32	38	43	49	55	62	69	77	1,762
	60	19	23	27	32	37	43	49	55	62	69	76	1,692
	70	20	24	28	33	39	45	51	57	64	71	79	1,632
	80	20	25	29	35	40	46	52	59	66	74	82	1,579
	90	21	26	30	36	41	48	54	61	68	76	84	1,530
	100	22	26	31	37	43	49	56	63	71	79	87	1,485

Short Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		12	15	18	21	24	28	31	35	40	44	49	2,626
0		14	17	21	24	28	32	37	41	46	52	57	2,254
0°, 0.5" ice, 4 psf wind + k		15	19	22	26	30	35	40	45	50	56	62	3,960
30		17	21	24	29	33	38	44	49	55	61	68	1,901
32°, 0.5" ice,		18	21	25	30	35	40	45	51	57	64	71	3,094
32°, 0.5" ice, 2 psf wind		18	21	25	30	35	40	45	51	57	64	71	3,120
40		18	21	26	30	35	40	45	51	58	64	71	1,820
50		19	22	27	31	36	42	47	53	60	67	74	1,748
60		19	23	28	32	38	43	49	55	62	69	77	1,683
60° F, 6 psf wind		19	23	28	33	38	43	49	56	62	70	77	1,835
70		20	24	29	34	39	45	51	57	64	72	80	1,625
80		21	25	30	35	40	46	53	59	67	74	82	1,573
90		21	26	31	36	42	48	54	61	69	77	85	1,525
100		22	26	31	37	43	49	56	63	71	79	87	1,481
120		23	28	33	39	45	52	59	67	75	83	92	1,404
248		27	32	39	45	53	60	69	78	87	97	107	1,208

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 58 of 61

T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 5,500 Lbs

RBS = 51,800 Lbs

Medium Span - Feet													
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→		INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.				Not Recommended		
		150	160	170	180	190	200	210	220	230	240		250
15°, 1" ice, 4 psf wind		29	33	37	41	46	51	56	62	67	73	80	6,986
15°, 0.8" ice, 4 psf wind		28	32	36	40	45	49	55	60	65	71	77	6,060
0°, 0.5" ice, 4 psf wind + k		25	28	32	36	40	45	49	54	59	64	70	5,500
0		23	26	29	33	36	40	44	49	53	58	63	3,203
10		24	28	31	35	39	43	47	52	57	62	67	2,997
20		26	29	33	37	41	46	50	55	60	66	71	2,830
30		27	31	35	39	43	48	53	58	64	69	75	2,685
40		28	32	37	41	46	51	56	61	67	73	79	2,559
50		30	34	38	43	48	53	58	64	70	76	83	2,449
60° F, 21 psf wind		32	37	41	46	52	57	63	69	76	83	90	4,165
60° F, 6 psf wind		31	35	40	45	50	55	61	67	73	80	86	2,559
60° F, 4 psf wind		31	35	40	45	50	55	61	67	73	79	86	2,446
60		31	35	40	45	50	55	61	67	73	79	86	2,350
70		32	37	41	46	52	57	63	69	76	82	89	2,263
80		33	38	43	48	53	59	65	72	78	85	92	2,184
90		34	39	44	50	55	61	67	74	81	88	96	2,112
100		36	40	46	51	57	63	70	77	84	91	99	2,047

Medium Span - Feet													
Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)										Tension Lbs	
							R.S.						
		150	160	170	180	190	200	210	220	230	240	250	
-20		20	23	26	29	32	36	40	44	48	52	56	3,590
0		24	27	30	34	38	42	46	51	55	60	65	3,082
0°, 0.5" ice, 4 psf wind + k		26	29	33	37	41	46	50	55	60	66	71	5,346
30		28	32	36	40	45	49	55	60	65	71	77	2,611
32°, 0.5" ice,		29	33	38	42	47	52	58	63	69	75	82	4,196
32°, 0.5" ice, 2 psf wind		29	33	38	42	47	52	58	63	69	75	82	4,229
40		29	33	37	42	47	52	57	63	69	75	81	2,495
50		30	35	39	44	49	54	60	65	71	78	84	2,393
60		32	36	41	45	51	56	62	68	74	81	88	2,302
60° F, 6 psf wind		32	36	41	46	51	56	62	68	75	81	88	2,506
70		33	37	42	47	53	58	64	70	77	84	91	2,220
80		34	39	44	49	54	60	66	73	80	87	94	2,146
90		35	40	45	50	56	62	69	75	82	90	97	2,079
100		36	41	46	52	58	64	71	78	85	92	100	2,017
120		38	43	49	55	61	68	75	82	90	98	106	1,908
248		45	51	58	65	73	80	89	97	106	116	126	1,612

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 59 of 61

T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 7,000 Lbs

RBS = 51,800 Lbs

Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		200	210	220	230	240	250	260	270	280	290		300
	15°, 1" ice, 4 psf wind	41	45	49	54	58	63	69	74	79	85	91	8,764
	15°, 0.8" ice, 4 psf wind	39	43	47	52	56	61	66	71	77	82	88	7,658
	0°, 0.5" ice, 4 psf wind + k	35	39	42	46	50	55	59	64	68	73	79	7,000
	0	31	34	37	41	44	48	52	56	60	65	69	4,198
	10	33	36	40	43	47	51	56	60	64	69	74	3,928
	20	35	39	42	46	50	55	59	64	68	73	79	3,698
	30	37	41	45	49	53	58	62	67	72	78	83	3,500
	40	39	43	47	51	56	61	66	71	76	82	87	3,328
	50	41	45	49	54	59	64	69	74	80	86	92	3,177
	60° F, 21 psf wind	45	50	54	59	65	70	76	82	88	94	101	5,316
	60° F, 6 psf wind	43	47	52	57	62	67	72	78	84	90	96	3,307
	60° F, 4 psf wind	43	47	52	56	61	67	72	78	84	90	96	3,164
	60	42	47	51	56	61	66	72	77	83	89	96	3,043
	70	44	49	54	59	64	69	75	81	87	93	100	2,924
	80	46	51	56	61	66	72	78	84	90	97	103	2,817
	90	48	52	58	63	68	74	80	87	93	100	107	2,721
	100	49	54	59	65	71	77	83	90	96	103	111	2,633

Long Span - Feet

Temp. Deg. F↓	Condition→ Span (Ft)→	FINAL (Clearance) SAG (inches)											Tension Lbs
							R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		28	31	34	38	41	45	48	52	56	60	64	4,526
0		33	36	40	43	47	51	56	60	64	69	74	3,932
0°, 0.5" ice, 4 psf wind + k		37	40	44	48	53	57	62	67	72	77	82	6,698
30		39	43	47	51	56	61	66	71	76	82	87	3,333
32°, 0.5" ice,		41	46	50	55	60	65	70	75	81	87	93	5,291
32°, 0.5" ice, 2 psf wind		41	46	50	55	60	65	70	76	81	87	93	5,331
40		41	45	49	54	59	63	69	74	80	85	91	3,182
50		42	47	51	56	61	66	72	77	83	89	95	3,049
60		44	49	53	58	63	69	75	80	86	93	99	2,931
60° F, 6 psf wind		44	49	54	59	64	69	75	81	87	93	100	3,187
70		46	50	55	61	66	72	77	83	90	96	103	2,824
80		47	52	57	63	68	74	80	86	93	100	107	2,728
90		49	54	59	65	71	77	83	89	96	103	110	2,641
100		51	56	61	67	73	79	85	92	99	106	114	2,561
120		53	59	65	71	77	84	90	97	105	112	120	2,420
248		64	71	78	85	93	101	109	117	126	135	145	2,012

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03

Sheet 60 of 61

T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 9,000 Lbs

RBS = 51,800 Lbs

Extra Long Span - Feet													
Condition→ Temp. R.S. Range②→ Deg. F↓ Span (Ft)→	INITIAL (Stringing) SAG (inches)											Tension Lbs	
	Not Recommended						R.S.				Not Recommended		
	250	260	270	280	290	300	310	320	330	340	350		
15°, 1" ice, 4 psf wind	51	55	59	64	68	73	78	83	88	94	99	10,956	
15°, 0.8" ice, 4 psf wind	48	52	56	61	65	69	74	79	84	89	95	9,687	
0°, 0.5" ice, 4 psf wind + k	43	46	50	53	57	61	65	70	74	79	83	9,000	
0	35	38	41	44	47	51	54	58	61	65	69	5,734	
10	38	41	44	48	51	55	58	62	66	70	74	5,317	
20	41	44	47	51	55	59	63	67	71	75	80	4,963	
30	43	47	51	54	58	62	67	71	76	80	85	4,659	
40	46	50	54	58	62	66	71	75	80	85	90	4,398	
50	48	52	56	61	65	70	74	79	84	90	95	4,171	
60° F, 21 psf wind	55	60	64	69	74	79	85	90	96	102	108	6,765	
60° F, 6 psf wind	51	56	60	64	69	74	79	84	89	95	101	4,302	
60° F, 4 psf wind	51	55	60	64	69	74	79	84	89	94	100	4,123	
60	51	55	59	64	68	73	78	83	89	94	100	3,972	
70	53	58	62	67	72	77	82	87	93	98	104	3,796	
80	56	60	65	70	75	80	85	91	97	103	109	3,640	
90	58	62	67	72	78	83	89	94	100	107	113	3,500	
100	60	65	70	75	81	86	92	98	104	111	117	3,374	

Extra Long Span - Feet													
Condition→ Temp. Deg. F↓ Span (Ft)→		FINAL (Clearance) SAG (inches)										Tension Lbs	
							R.S.						
		250	260	270	280	290	300	310	320	330	340		350
-20		34	36	39	42	45	48	52	55	59	62	66	6,007
0		39	42	46	49	53	56	60	64	68	72	77	5,150
0°, 0.5" ice, 4 psf wind + k		45	49	53	57	61	65	70	74	79	84	89	8,440
30		47	51	55	59	63	68	72	77	82	87	92	4,290
32°, 0.5" ice,		51	56	60	64	69	74	79	84	90	95	101	6,664
32°, 0.5" ice, 2 psf wind		52	56	60	65	69	74	79	84	90	95	101	6,712
40		50	54	58	62	67	71	76	81	86	92	97	4,078
50		52	56	61	65	70	75	80	85	90	96	102	3,891
60		54	59	63	68	73	78	83	89	94	100	106	3,725
60° F, 6 psf wind		55	59	64	69	74	79	84	90	95	101	107	4,041
70		56	61	66	71	76	81	87	92	98	104	111	3,578
80		59	63	68	73	79	84	90	96	102	108	115	3,446
90		61	66	71	76	82	87	93	100	106	112	119	3,326
100		63	68	73	79	85	90	97	103	109	116	123	3,218
120		67	72	78	84	90	96	103	109	116	123	131	3,028
248		82	89	96	103	111	119	127	135	144	152	162	2,455

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

PRIMARY CONDUCTOR AND FASTENINGS

Conductor Installation Sagging Method

07 00 07 03
Sheet 61 of 61

T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"

DE Tension = 12,000 Lbs

RBS = 51,800 Lbs

Super Long Span - Feet

Temp. Deg. F↓	Condition→ R.S. Range②→ Span (Ft)→	INITIAL (Stringing) SAG (inches)										Tension Lbs	
		Not Recommended					R.S.			Not Recommended			
		300	310	320	330	340	350	360	370	380	390		400
	15°, 1" ice, 4 psf wind	57	61	65	69	74	78	83	87	92	97	102	13,929
	15°, 0.8" ice, 4 psf wind	54	57	61	65	69	73	77	82	86	91	95	12,556
	0°, 0.5" ice, 4 psf wind + k	46	49	52	55	59	62	66	70	74	77	82	12,000
	0	34	36	38	41	43	46	49	51	54	57	60	8,594
	10	37	39	42	45	47	50	53	56	59	62	66	7,877
	20	40	43	46	48	51	54	58	61	64	68	71	7,249
	30	43	46	49	52	56	59	62	66	69	73	77	6,705
	40	47	50	53	56	60	63	67	71	75	79	83	6,237
	50	50	53	57	60	64	68	72	76	80	84	89	5,833
	60° F, 21 psf wind	61	65	69	73	78	83	87	92	97	103	108	8,854
	60° F, 6 psf wind	54	58	61	65	69	73	78	82	87	91	96	5,893
	60° F, 4 psf wind	53	57	61	65	69	73	77	81	86	90	95	5,671
	60	53	57	60	64	68	72	76	81	85	90	94	5,483
	70	56	60	64	68	72	76	81	85	90	95	100	5,180
	80	59	63	67	72	76	81	85	90	95	100	105	4,914
	90	62	66	71	75	80	84	89	94	100	105	110	4,681
	100	65	69	74	79	83	88	94	99	104	110	116	4,474

Super Long Span - Feet

Temp. Deg. F↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		34	36	38	41	43	46	49	51	54	57	60	8,608
0		40	43	46	49	52	55	58	61	65	68	72	7,201
0°, 0.5" ice, 4 psf wind + k		50	54	57	61	65	68	72	76	81	85	89	10,953
30		50	54	57	61	65	68	72	76	81	85	89	5,782
32°, 0.5" ice,		57	61	65	69	74	78	83	87	92	97	102	8,602
32°, 0.5" ice, 2 psf wind		57	61	65	69	74	78	83	87	92	97	102	8,660
40		53	57	61	65	69	73	77	81	86	90	95	5,438
50		57	60	64	68	73	77	81	86	91	96	100	5,140
60		60	64	68	72	77	81	86	91	96	101	106	4,880
60° F, 6 psf wind		60	64	69	73	78	82	87	92	97	102	107	5,269
70		63	67	71	76	80	85	90	95	100	106	111	4,651
80		65	70	74	79	84	89	94	99	105	110	116	4,449
90		68	73	78	82	88	93	98	104	109	115	121	4,268
100		71	76	81	86	91	96	102	108	114	120	126	4,107
120		76	81	86	92	98	103	109	116	122	128	135	3,828
248		98	104	111	118	126	133	141	149	157	165	174	2,981

NOTES:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

The below table provides the tension to be strung at 50 feet ruling span for all application on distribution circuit and sub-transmission line. The unguyed (self-sustain) wood pole is covered in DCS **02 20 04 01**.

Conductor	Tension [Lbs]							
	DE	Initial (Stringing)			Final (Clearance)			
		30° F	60° F	90° F	0° F	60° F	212° F	248° F
1/0 AWG (7) AAAC "Azusa"	175	18	17	17	19	17	14	-
110.8 kcmil (12/7) ACSR "Minorca"	207	43	42	41	45	42	-	37
336.4 kcmil (18/1) ACSR "Merlin"	243	56	54	52	58	54	-	48
T2 - (2) 4/0 AWG (6/1) ACSR "Penguin"	293	87	84	82	90	83	-	75
556.5 kcmil (19) AAC "Dahlia"	285	80	77	74	83	77	65	-
T2 - (2) 336.4 kcmil (18/1) ACSR "Merlin"	342	111	107	105	115	107	-	96
954.0 kcmil (45/7) ACSR "Rail"	403	165	158	154	172	158	-	141
T2 - (2) 556.5 kcmil (19) AAC "Dahlia"	425	160	154	148	167	160	130	-
1272 kcmil (45/7) ACSR "Bittern"	462	213	206	202	222	206	-	186
T2 - (2) 954.0 kcmil (45/7) ACSR "Rail"	627	318	307	302	332	307	-	277

The below tables shows the sags to which conductors are to be strung and clearances to be verified.

Temp. Deg. F ↓	Condition → R.S. Range ② → Span (Ft) →	INITIAL (Stringing) SAG [inches]									
		Not Recommended			R.S.			Not Recommended			
		0	10	20	30	40	50	60	70	80	90 100
0°	0.5" ice, 4 psf wind + k	0	1	4	9	15	24	34	46	61	77 95
0		0	1	4	8	15	24	34	46	60	76 94
30		0	1	4	9	16	25	36	49	64	81 100
60		0	1	4	9	17	26	37	51	66	84 103
90		0	1	4	10	17	27	38	52	68	86 106
100		0	1	4	10	17	27	39	52	69	87 107

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG [inches]									
							R.S.		①	①	①
		0	10	20	30	40	50	60	70	80	90 100
0		0	1	4	8	15	24	34	46	60	76 94
30		0	1	4	9	16	25	36	49	64	81 100
32°	0.5" ice,	0	1	4	9	16	25	36	49	65	82 101
60		0	1	4	9	17	26	37	51	67	84 104
90		0	1	4	10	17	27	38	52	68	86 106
100		0	1	4	10	17	27	38	52	68	86 107
120		0	1	4	10	17	27	39	53	69	87 108
212		0	1	5	11	19	30	43	58	76	96 118
248		0	1	5	11	19	30	43	59	77	98 120

Note:

- Horizontal configuration is not recommended on span length greater than 75 feet.
- Ruling span range is for initial line design between 25' to 74' for conductor sag accuracy.

ADSS Sag and Tension

	Stock #	Diameter	MRCL	Weight	Weight ½" Ice-4psf Wind K=0.30	Weight 1" ice
DNA-28144 48-count ADSS	16-16-274	0.528"	2960	0.093 lbs/ft	1.192 lbs/ft	1.993 lbs/ft

100' Span

Temperature	Ice	Wind	Sag (ft)	Tension (lbs)
0°	½"	4psf + k	1.0	1615
32°F	1"	0	1.7	1675
60°F	0	0	0.1	1482

200' Span

Temperature	Ice	Wind	Sag (ft)	Tension (lbs)
0°	½"	4psf + k	3.8	1759
32°F	1"	0	5.4	1974
60°F	0	0	0.1	1482

300' Span

Temperature	Ice	Wind	Sag (ft)	Tension (lbs)
0°	½"	4psf + k	7.5	1934
32°F	1"	0	10.3	2285
60°F	0	0	0.9	1481

400' Span

Temperature	Ice	Wind	Sag (ft)	Tension (lbs)
0°	½"	4psf + k	12	2117
32°F	1"	0	16	2585
60°F	0	0	1.5	1479

500' Span

Temperature	Ice	Wind	Sag (ft)	Tension (lbs)
0°	½"	4psf + k	17	2299
32°F	1"	0	22.4	2871
60°F	0	0	2.35	1478

DNO-11706 OPGW Slack Spans

DE Tension = 250 Lbs

RBS = 19,837 Lbs

Slack Span – 50 Feet

Temp. Deg. F↓	Condition→	Sag (Inches)					Tension Lbs
	R.S. Range ②→			R.S.			
	Span (Ft)→	30	40	50	60	70	
	15º, 1” ice, 4 psf wind	14	18	22	26	31	413
	0º, 0.5” ice, 4 psf wind + k	13	17	21	25	30	250
	0	13	17	21	25	30	63
	30	14	17	22	26	31	61
	60	14	18	22	27	32	59
	90	15	19	23	28	33	57

DE Tension = 500 Lbs

Slack Span – 100 Feet

Temp. Deg. F↓	Condition→	Sag (Inches)					Tension Lbs
	R.S. Range ②→			R.S.			
	Span (Ft)→	80	90	100	110	120	
	15º, 1” ice, 4 psf wind	28	35	44	53	63	819
	0º, 0.5” ice, 4 psf wind + k	27	34	42	51	61	500
	0	26	33	41	50	59	128
	30	26	33	41	50	59	123
	60	28	36	44	53	64	119
	90	29	37	46	55	66	115

DNO-11706 OPGW

DE Tension = 1,900 Lbs

RBS = 19,800 Lbs

Super Short Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range @→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	50	60	70	80	90	100	110	120	130	140	150	
	15º, 1” ice, 4 psf wind	4	6	8	10	13	16	19	23	27	32	36	2,242
	15º, 0.8” ice, 4 psf wind	3	5	7	9	11	14	17	20	24	27	31	1,961
	0º, 0.5” ice, 4 psf wind + k	3	4	5	7	9	11	13	16	19	22	25	1,933
	0	1	1	2	2	3	4	5	6	6	8	9	1,469
	10	1	2	2	3	3	4	5	6	7	8	10	1,297
	20	1	2	2	3	4	5	6	7	8	10	11	1,133
	30	1	2	3	4	5	6	7	8	10	11	13	979
	40	2	2	3	4	5	7	8	10	11	13	15	840
	50	2	3	4	5	6	8	9	11	13	15	18	720
	60º F, 21 psf wind	3	5	7	9	11	14	16	20	23	27	31	1,066
	60º F, 6 psf wind	2	4	5	6	8	10	12	14	17	19	22	688
	60º F, 4 psf wind	2	3	5	6	8	9	11	14	16	19	21	653
	60	2	3	4	6	7	9	11	13	15	18	20	621
	70	3	4	5	7	8	10	12	15	17	20	23	543
	80	3	4	6	8	10	12	14	17	20	23	26	481
	90	3	5	6	8	11	13	16	19	22	26	29	432
	100	4	5	7	9	12	14	17	21	24	28	32	394

Super Short Span - Feet

Temp. Deg. F ↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		1	1	2	2	3	3	4	5	5	6	7	1,756
0		1	2	2	3	3	4	5	6	7	8	9	1,346
0º, 0.5” ice, 4 psf wind + k		3	4	6	7	9	11	14	16	19	22	25	1,900
30		2	2	3	4	6	7	8	10	12	13	15	824
32º, 0.5” ice		3	4	6	8	10	12	14	17	20	23	27	1,264
32º, 0.5” ice, 2 psf wind		3	4	6	8	10	12	15	17	20	24	27	1,285
40		2	3	4	5	7	8	10	12	14	16	18	696
50		2	3	5	6	8	9	11	14	16	19	21	595
60		3	4	5	7	9	11	13	16	18	21	25	518
60º F, 6 psf wind		3	4	6	7	9	12	14	17	19	23	26	591
70		3	4	6	8	10	12	15	18	21	24	28	459
80		3	5	7	9	11	14	16	20	23	27	31	414
90		4	5	7	10	12	15	18	21	25	29	33	378
100		4	6	8	10	13	16	19	23	27	32	36	349
120		5	7	9	12	15	18	22	26	31	36	41	306
248		7	11	15	19	24	30	36	43	50	58	67	190

Notes:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 75' to 124' for conductor sag accuracy.

DNO-11706 OPGW

DE Tension = 2,200 Lbs

RBS = 19,800 Lbs

Short Span – Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range @→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	100	110	120	130	140	150	160	170	180	190	200	
	15º, 1” ice, 4 psf wind	13	16	19	22	26	29	33	38	42	47	52	2,754
	15º, 0.8” ice, 4 psf wind	12	14	17	19	23	26	29	33	37	42	46	2,374
	0º, 0.5” ice, 4 psf wind + k	9	11	14	16	19	21	24	27	31	34	38	2,248
	0	4	5	5	6	7	8	10	11	12	13	15	1,507
	10	4	5	6	7	8	9	11	12	13	15	17	1,350
	20	5	6	7	8	9	11	12	14	15	17	19	1,204
	30	5	6	8	9	10	12	14	15	17	19	21	1,070
	40	6	7	9	10	12	13	15	17	19	21	24	952
	50	7	8	10	11	13	15	17	19	21	24	26	849
	60º F, 21 psf wind	11	13	15	18	21	24	27	31	35	39	43	1,352
	60º F, 6 psf wind	8	10	12	14	16	18	20	23	26	29	32	852
	60º F, 4 psf wind	8	9	11	13	15	17	20	22	25	28	31	805
	60	7	9	11	12	14	17	19	21	24	27	29	762
	70	8	10	12	14	16	18	21	24	26	29	33	690
	80	9	11	13	15	18	20	23	26	29	32	36	630
	90	10	12	14	16	19	22	25	28	31	35	39	580
	100	10	13	15	18	20	24	27	30	34	38	42	538

Short Span – Feet

Temp. Deg. F ↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190		200
-20		3	4	5	6	6	7	8	10	11	12	13	1,694
0		4	5	6	7	8	10	11	12	14	15	17	1,327
0º, 0.5” ice, 4 psf wind + k		10	12	14	16	19	22	25	28	31	35	39	2,200
30		6	8	9	11	12	14	16	18	20	23	25	899
32º, 0.5” ice		10	12	14	17	19	22	25	29	32	36	39	1,524
32º, 0.5” ice, 2 psf wind		10	12	14	17	20	22	26	29	32	36	40	1,552
40		7	9	10	12	14	16	18	20	23	25	28	798
50		8	10	11	13	15	18	20	23	26	28	32	715
60		9	11	13	15	17	20	22	25	28	31	35	647
60º F, 6 psf wind		9	11	13	16	18	21	23	27	30	33	37	742
70		9	11	14	16	19	21	24	27	31	34	38	592
80		10	12	15	17	20	23	26	30	33	37	41	547
90		11	13	16	19	22	25	28	32	36	40	44	510
100		12	14	17	20	23	27	30	34	38	43	47	478
120		13	16	19	22	26	30	34	38	43	48	53	428
248		20	24	29	34	40	45	52	58	65	73	81	279

Notes:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 125' to 174' for conductor sag accuracy.

DNO-11706 OPGW

DE Tension = 2,500 Lbs

RBS = 19,800 Lbs

Medium Span – Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S Range ②→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	150	160	170	180	190	200	210	220	230	240	250	
	15º, 1” ice, 4 psf wind	25	29	32	36	40	45	49	54	59	64	70	3,227
	15º, 0.8” ice, 4 psf wind	22	25	29	32	36	39	44	48	52	57	62	2,762
	0º, 0.5” ice, 4 psf wind + k	19	21	24	27	30	33	37	40	44	48	52	2,560
	0	8	9	10	12	13	14	16	17	19	21	22	1,578
	10	9	10	11	13	14	16	17	19	21	23	25	1,435
	20	10	11	12	14	16	17	19	21	23	25	27	1,302
	30	11	12	14	15	17	19	21	23	25	27	30	1,181
	40	12	13	15	17	19	21	23	25	28	30	33	1,074
	50	13	15	17	19	21	23	25	28	30	33	36	980
	60º F, 21 psf wind	20	23	26	29	32	36	40	43	47	52	56	1,615
	60º F, 6 psf wind	15	17	20	22	24	27	30	33	36	39	42	1,008
	60º F, 4 psf wind	15	17	19	21	24	26	29	32	34	37	41	950
	60	14	16	18	20	23	25	28	30	33	36	39	899
	70	15	17	20	22	24	27	30	33	36	39	42	829
	80	16	19	21	24	26	29	32	35	39	42	46	769
	90	18	20	23	25	28	31	35	38	42	45	49	717
	100	19	21	24	27	30	33	37	41	44	48	52	673

Medium Span – Feet

Temp. Deg. F ↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		150	160	170	180	190	200	210	220	230	240		250
-20		7	9	10	11	12	13	15	16	18	19	21	1,687
0		9	11	12	13	15	17	18	20	22	24	26	1,362
0º, 0.5” ice, 4 psf wind + k		19	22	25	28	31	34	38	41	45	49	53	2,500
30		13	14	16	18	20	23	25	27	30	32	35	995
32º, 0.5” ice		19	22	25	28	31	34	37	41	45	49	53	1,771
32º, 0.5” ice, 2 psf wind		19	22	25	28	31	34	38	42	45	49	54	1,805
40		14	16	18	20	22	25	27	30	33	36	39	906
50		15	17	20	22	24	27	30	33	36	39	42	831
60		16	19	21	24	26	29	32	35	39	42	46	768
60º F, 6 psf wind		17	20	22	25	28	31	34	37	41	44	48	883
70		18	20	23	25	28	31	35	38	42	45	49	715
80		19	22	24	27	30	34	37	41	44	48	53	669
90		20	23	26	29	32	36	39	43	47	51	56	630
100		21	24	27	31	34	38	42	46	50	54	59	597
120		23	27	30	34	38	42	46	50	55	60	65	541
248		35	40	45	50	56	62	68	75	82	89	97	364

Notes:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 175' to 224' for conductor sag accuracy.

DNO-11706 OPGW

DE Tension = 2,800 Lbs

RBS = 19,800 Lbs

Long Span – Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range @→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	200	210	220	230	240	250	260	270	280	290	300	
	15º, 1” ice, 4 psf wind	39	43	47	52	57	61	66	72	77	83	88	3,679
	15º, 0.8” ice, 4 psf wind	35	38	42	46	50	54	59	63	68	73	78	3,138
	0º, 0.5” ice, 4 psf wind + k	30	33	36	39	43	46	50	54	58	62	67	2,871
	0	13	15	16	18	19	21	23	24	26	28	30	1,683
	10	15	16	18	19	21	23	25	26	28	31	33	1,548
	20	16	17	19	21	23	25	27	29	31	33	36	1,424
	30	17	19	21	23	25	27	29	31	34	36	39	1,310
	40	19	21	23	25	27	29	32	34	37	39	42	1,208
	50	20	22	24	27	29	31	34	37	39	42	45	1,118
	60º F, 21 psf wind	31	34	38	41	45	48	52	57	61	65	70	1,870
	60º F, 6 psf wind	23	26	28	31	34	36	39	43	46	49	53	1,165
	60º F, 4 psf wind	23	25	27	30	32	35	38	41	44	47	51	1,098
	60	22	24	26	29	31	34	37	39	42	46	49	1,038
	70	23	26	28	31	34	36	39	42	46	49	52	968
	80	25	27	30	33	36	39	42	45	49	52	56	906
	90	26	29	32	35	38	41	45	48	52	56	59	853
	100	28	31	34	37	40	44	47	51	55	59	63	805

Long Span – Feet

Temp. Deg. F ↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		200	210	220	230	240	250	260	270	280	290		300
-20		13	14	16	17	19	20	22	24	25	27	29	1,731
0		16	17	19	21	23	24	26	29	31	33	35	1,437
0º, 0.5” ice, 4 psf wind + k		30	34	37	40	44	48	52	56	60	64	69	2,800
30		20	22	25	27	29	32	34	37	40	43	46	1,105
32º, 0.5” ice		30	33	36	40	43	47	50	54	59	63	67	2,013
32º, 0.5” ice, 2 psf wind		30	33	37	40	43	47	51	55	59	63	68	2,053
40		22	24	27	29	32	34	37	40	43	46	50	1,022
50		24	26	29	31	34	37	40	43	47	50	53	950
60		25	28	31	34	36	40	43	46	50	53	57	888
60º F, 6 psf wind		27	29	32	35	38	42	45	49	52	56	60	1,021
70		27	30	33	36	39	42	46	49	53	57	61	835
80		29	31	35	38	41	45	48	52	56	60	64	788
90		30	33	36	40	43	47	51	55	59	63	68	747
100		32	35	38	42	46	49	53	58	62	67	71	711
120		35	38	42	46	50	54	58	63	68	73	78	651
248		50	55	61	67	72	79	85	92	99	106	113	448

Notes:

1. See comments in front of section for conditions including wind and ice.
2. Ruling span range is for initial line design between 225' to 274' for conductor sag accuracy.

DNO-11706 OPGW

DE Tension = 3,100 Lbs

RBS = 19,800 Lbs

Extra Long Span - Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range @→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	250	260	270	280	290	300	310	320	330	340	350	
	15º, 1” ice, 4 psf wind	55	59	64	69	74	79	84	90	95	101	107	4,117
	15º, 0.8” ice, 4 psf wind	49	53	57	61	65	70	75	80	85	90	95	3,506
	0º, 0.5” ice, 4 psf wind + k	42	45	49	53	56	60	64	69	73	78	82	3,183
	0	19	21	23	24	26	28	30	32	34	36	38	1,815
	10	21	23	24	26	28	30	32	34	36	39	41	1,685
	20	23	24	26	28	30	32	35	37	39	42	44	1,565
	30	24	26	28	30	33	35	37	40	42	45	47	1,455
	40	26	28	30	33	35	37	40	43	45	48	51	1,354
	50	28	30	32	35	37	40	43	46	48	51	55	1,264
	60º F, 21 psf wind	43	46	50	54	57	61	66	70	74	79	84	2,121
	60º F, 6 psf wind	32	35	37	40	43	46	49	52	56	59	63	1,326
	60º F, 4 psf wind	31	33	36	39	41	44	47	51	54	57	60	1,251
	60	30	32	35	37	40	43	46	49	52	55	58	1,183
	70	32	34	37	40	43	46	49	52	55	59	62	1,112
	80	34	36	39	42	45	48	52	55	59	62	66	1,048
	90	36	38	41	45	48	51	55	58	62	66	70	991
	100	37	40	44	47	50	54	58	61	65	69	73	940

Extra Long Span - Feet

Temp. Deg. F ↓	Condition→	FINAL (Clearance) SAG (inches)										Tension Lbs	
	Span (Ft)→						R.S.						
		250	260	270	280	290	300	310	320	330	340		350
-20		19	21	23	24	26	28	30	32	34	36	38	1,812
0		23	25	27	29	31	33	35	37	40	42	45	1,538
0º, 0.5” ice, 4 psf wind + k		43	47	50	54	58	62	66	70	75	80	84	3,100
30		29	31	34	36	39	41	44	47	50	53	56	1,224
32º, 0.5” ice		42	45	49	52	56	60	64	68	73	77	82	2,254
32º, 0.5” ice, 2 psf wind		42	46	49	53	57	61	65	69	73	78	83	2,299
40		31	33	36	39	41	44	47	50	54	57	60	1,143
50		33	36	38	41	44	47	50	54	57	61	64	1,072
60		35	38	41	44	47	50	54	57	61	64	68	1,010
60º F, 6 psf wind		37	40	43	46	49	53	56	60	64	68	72	1,160
70		37	40	43	46	50	53	57	60	64	68	72	955
80		39	42	45	49	52	56	60	64	68	72	76	907
90		41	44	48	51	55	59	63	67	71	75	80	864
100		43	46	50	54	57	61	66	70	74	79	84	826
120		46	50	54	58	62	67	71	76	81	86	91	761
248		66	72	77	83	89	95	102	108	115	122	130	533

Notes:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 275' to 324' for conductor sag accuracy.

DNO-11706 OPGW

DE Tension = 3,400 Lbs

RBS = 19,800 Lbs

Super Long Span – Feet

Temp. Deg. F↓	Condition→	INITIAL (Stringing) SAG (inches)											Tension Lbs
	R.S. Range @→	Not Recommended					R.S.			Not Recommended			
	Span (Ft)→	300	310	320	330	340	350	360	370	380	390	400	
	15º, 1” ice, 4 psf wind	72	76	81	87	92	97	103	109	115	121	127	4,544
	15º, 0.8” ice, 4 psf wind	64	68	72	77	82	87	92	97	102	107	113	3,869
	0º, 0.5” ice, 4 psf wind + k	55	59	62	66	71	75	79	84	88	93	98	3,496
	0	26	27	29	31	33	35	37	39	41	44	46	1,968
	10	28	29	31	33	35	37	40	42	44	46	49	1,841
	20	29	31	34	36	38	40	42	45	47	50	52	1,722
	30	31	34	36	38	40	43	45	48	50	53	56	1,612
	40	34	36	38	41	43	46	48	51	54	57	60	1,511
	50	36	38	41	43	46	49	51	54	57	60	63	1,420
	60º F, 21 psf wind	55	59	62	66	71	75	79	84	88	93	98	2,374
	60º F, 6 psf wind	41	44	47	49	53	56	59	62	66	69	73	1,495
	60º F, 4 psf wind	39	42	45	48	51	54	57	60	63	67	70	1,412
	60	38	40	43	46	49	52	55	58	61	64	67	1,337
	70	40	43	46	49	52	55	58	61	64	68	71	1,262
	80	42	45	48	51	54	58	61	65	68	72	75	1,195
	90	45	48	51	54	57	61	64	68	72	76	79	1,134
	100	47	50	53	57	60	64	68	71	75	79	83	1,080

Super Long Span – Feet

Temp. Deg. F ↓	Condition→	FINAL (Clearance) SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		300	310	320	330	340	350	360	370	380	390	400	
-20		26	28	30	32	34	36	38	40	42	45	47	1,920
0		31	33	35	37	39	42	44	47	49	52	54	1,657
0º, 0.5” ice, 4 psf wind + k		57	60	64	68	73	77	81	86	91	96	100	3,400
30		37	40	43	45	48	51	54	57	60	63	67	1,351
32º, 0.5” ice		54	58	62	66	70	74	78	83	87	92	97	2,495
32º, 0.5” ice, 2 psf wind		55	59	62	66	70	75	79	83	88	93	97	2,545
40		40	43	45	48	51	54	57	61	64	67	71	1,270
50		42	45	48	51	54	58	61	64	68	72	75	1,198
60		45	48	51	54	57	61	64	68	72	76	79	1,135
60º F, 6 psf wind		47	50	53	57	60	64	68	71	75	79	84	1,302
70		47	50	53	57	60	64	68	71	75	79	84	1,078
80		49	53	56	60	63	67	71	75	79	83	88	1,027
90		52	55	59	63	66	70	74	79	83	87	92	982
100		54	58	61	65	69	73	78	82	86	91	96	941
120		58	62	66	70	75	79	84	89	93	98	103	871
248		82	88	94	100	106	112	118	125	132	139	146	617

Notes:

- See comments in front of section for conditions including wind and ice.
- Ruling span range is for initial line design between 325' to 374' for conductor sag accuracy.

Line Guards and Armor Rods

Preformed line guards and armor rods shall be used to protect ACSR, AAAC, and AAC conductors from damage at an insulator or in suspension or angle clamps as indicated below. Armor rods and line guards do not need to be installed when preformed ties are used. Therefore, performed ties should be used in all possible applications.

The following guidelines shall apply:

1. **Line Guards** shall be used:
 - A) In all hand tied applications where the conductor spans are under 300' in length (on both sides of the pin insulator).
2. **Armor Rods** shall be used:
 - A) In all hand tied applications where the conductor spans exceed 300' in length (on either side of the pin insulator).
 - B) In all clamp top post insulators and suspension clamps where the conductor spans exceed 300' in length (on either side of the insulator).

Line guards and armor rods may be used as patch rods to restore full conductivity and strength. They can be used if not more than 25% of the strands in the outer layer of the conductor have been damaged, and if the length of the damaged portion is not too great to prohibit their use.

Taps onto preformed line guards and armor rods (with a hot line clamp) are acceptable. However, they should not be installed for the sole purpose of making a tap. A stirrup clamp should be used for this application.

The following size **Line Guards** are available:

Wire Size		Rod O.D. (Inches)	No. Rods Per Set	Length (Inches)	Color Code	Ameren Stock No.
*6	Solid Cu.	0.102	7	19	Green	1759076
4 ACSR	7/1 Str.	0.121	8	19	Orange	1759032
2 ACSR	7/1 Str.	0.121	9	21	Red	1759033
1/0 ACSR	6/1 Str.	0.121	12	25	Yellow	1759034
3/0 ACSR	6/1 Str.	0.121	14	29	Orange	1759035
336.4 ACSR	18/1 Str.	0.146	15	35	Blue	1759036
336.4 ACSR	26/7 Str.	0.146	16	37	Green	1759044
477 ACSR	18/1 Str.	0.146	18	41	Purple	1759037
556.5 AAC	19 Str.	0.146	19	41	Blue	1759071
795 AAC	37 Str.	0.182	18	47	Brown	1759084
954 AAC	37 Str.	0.250	15	49	Orange	1759059
954 ACSR	45/7 Str.	0.250	15	51	Purple	1759104

*These Copperweld line guards shall be used to protect #6 copper conductors on 2.4/4.16kV circuits that are being converted to 7.2/12.47kV operation. They shall be installed at the time of conversion. These guards shall not be installed hot on circuits energized at 12kV.

PRIMARY CONDUCTOR AND FASTENINGS
Preformed Armor Rods & Line Guards

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Sheet 2 of 2

The following size **Armor Rods** are available:

Wire Size		Rod O.D. (Inches)	No. Rods Per Set	Length		Color Code	Ameren Stock No.	
				Single	Double		Single	Double
3 #7 A.W.	3 Str.	0.114	10	46	–	Black	1759085	–
4 ACSR	7/1 Str.	0.146	7	40	–	Orange	1759020	–
2 ACSR	7/1 Str.	0.146	9	44	–	Red	1759021	–
1/0 ACSR	6/1 Str.	0.167	9	52	64	Yellow	1759022	1759025
3/0 ACSR	6/1 Str.	0.167	11	56	68	Orange	1759023	1759026
336.4 ACSR	18/1 Str.	0.204	12	68	–	Blue	1759040	–
336.4 ACSR	26/7 Str.	0.204	12	72	–	Green	1759028	–
477 ACSR	18/1 Str.	0.250	11	76	–	Purple	1759058	–
556.5 AAC	19 Str.	0.250	12	70	–	Blue	1759061	–

Wire	Stock No.	Weight	Automatic Splices	Compression Sleeves		Presses and Dies		Nico Press
Stock No's. Maj. and Min.			17-60 (2)	17-60		86-11		85-36
		Lbs./Ft		Full Tension	Jumper or Loop	12 Ton Hand or Power Press 87-29-006	60 Ton Power Hyd. Press 84-06-002	
#4 ACSR – Bare	18 05 005	.0674	332	258	–	–	–	112
#4 ACSR – Poly	18 05 068	.1475	332	258		–	–	112
#1/0 AAAC – Bare	18 05 060	.1140	328	260	–	–	–	112
#1/0 AAAC – Poly	18 05 067	.1660	328	260	–	–	–	112
#1/0 ACSR – 6/1 Bare	18 05 113	.1452	340	260	–	–	–	112
110.8 ACSR – 12/7 Bare	18 05 117	.2763	–	389	–	–	–	–
336.4 Kcmil ACSR – 18/1 Bare	18 05 036	.3653	333	254	209	139	–	–
336.4 Kcmil AA – 19 Str. Poly.	18 05 052	.388		170	209	037 (3)	–	–
556.5 Kcmil – 19 Str. AA Bare	18 05 047	.5224	327		196	131	–	–
556.5 Kcmil – 37 Str. AA-Poly.	18 05 053	.632	327		196	131	–	–
795 Kcmil 37 Str. AA – Bare	18 05 032	.7463	335	286	287	–	169	–
954 Kcmil 37 Str. AA – Bare	18 05 043	.8955		185	291	–	169	–
3 #7 Alumoweld (1)	27 09 099	.141		272	–	134	–	–

1. Use 1/0 AAAC or 110.8 (12/7) ACSR for new static wire construction.
2. OK to use automatic splices on full tension spans but not in slack spans. Use bolted connectors or compression sleeves on highway or river crossings.
3. This die for full tension sleeves only. All other dies work on both full tension and loop sleeves for a given conductor.

Wire	Stock No. 18 05	Deadends			Angle Clamps	Armor Rod	Line Guard (5)	Stirrup Clamp	Hot Line Clamp
Stock No's. Maj. and Min.			23-78	23-18		17-59	17-59	17-62	17-62
			Auto- matic (3)	Straight		Sgle Double Length			
#4 ACSR – Bare	005	–	365	294	17 02 016	020 –	032	166	088 (6)
#4ACSR – Poly	068	–	365	294	17 02 016	– –	–	166	088 (6)
#1/0 AAAC – Bare	060	–	362	294	23 18 040 (4)	022 025	034	166	088 (6)
#1/0 AAAC – Poly	067	–	362	294	17 02 016	– –	–	166	088
110.8 ACSR –12/7 Bare	117	–	–	397	23 78 401	–	127	166	183
336.4 Kcmil ACSR –18/1 Bare	036	–	–	292	23 18 264 (4)	040 –	036	167	112 (5)
336.4Kcmil AA – 19 Str. Poly.	052	–	–	292	23 18 040 (4)	– –	–	167	088 (6)
556.5 Kcmil – 19 Str. AA Bare	047	–	–	292	23 18 302 (4)	061 –	071	167	
556.5 Kcmil – 37 Str. AA–Poly.	053	–	–	292	23 18 040 (4)	– –	–	167	–
795 Kcmil 37 Str. AA – Bare	032	–	–	292	23 18 302 (4)	– –	084	167	143 (7)
954 Kcmil 37 Str. AA – Bare	043	–	–	368	23 18 302 (4)	– –	059	167	143 (7)
	27 09			23 68					
3 #7 Alumoweld (1)	099	–	–	325 (2)	17 02 016	– –	085	–	

1. Use 1/0 AAAC or 110.8 (12/7) ACSR for new static wire construction.
2. Preformed grip.
3. Do NOT use automatic deadends on low tension spans, slack spans, or highway and river crossings. For these applications use bolted deadends.
4. Suitable for suspension construction also.
5. May be used for repairing conductor where less than 25% of strands are damaged.
6. For use with stirrup clamps
7. For use over bare conductor
8. For use over armor.

NON-STANDARD PRIMARY CONDUCTORS & FASTENINGS
Associated Conductor Materials Quick Reference Index
For Maintenance Reference Only

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Sheet 1 of 2

Wire	Stock No.	Weight	Automatic Splices	Compression Sleeves		Presses and Dies		Nico Press
Stock No's. Maj. and Min.			17-63	17-60		86-11		85-36
		Lbs./Ft		Full Tension	Jumper or Loop	12 Ton Hand or Power Press 87-29-006	60 Ton Power Hyd. Press 84-06-002	
#6 Bare Cu.	18 02 010	.029	038					095
#6 Poly Cu.	18 01 012	.112	038	006 (1)				095
#4 Bare Cu.	18 02 017	.126	040					
#4 Poly Cu.	18 01 017	.164	040	103 (1)				128
#2 Bare Cu.	18 02 020	.201	080					
#2 Poly Cu.	18 01 020	.260	080	104 (1)				128
#1/0 Bare Cu.	18 02 022	.326	044					
#1/0 Poly Cu.	18 01 022	.424	044	121 (1)	207	106		
#4/0 Bare Cu.	18 02 027	.653	046					
#4/0 Poly Cu.	18 01 025	.800	046	123 (1)	155	107		
350 kcmil Bare Cu.	18 02 064	1.091		124		108		
#8 Sol. C.W.	27 09 094	.046		163				095-128
#3/0 ACSR	18 05 010		17-60-337	253	203	138(2)- 109(3)		
266.5 kcmil 18/1 ACSR	18 05 039	.2397	17-60-338	AL 203 (1) ST 204		AL 176 ST 175		
336.4 kcmil 26/7 ACSR	18 05 014	.4624		AL 565 ST 133		AL 113 ST 114		
477 kcmil 18/1 ACSR	18 05 035	.518		AL 169 ST 134	179	AL 115 ST 110		

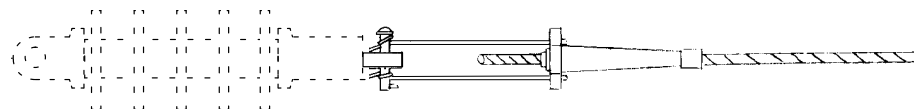
1. Do not use automatic splices on low tension or slack spans, only on full tension. Do not use automatic splices on highway or railroad crossings. Use compression splices instead.
2. Die for full tension splice only.
3. Die for loop splice only.

NON-STANDARD PRIMARY CONDUCTORS & FASTENINGS
Associated Conductor Materials Quick Reference Index
For Maintenance Reference Only

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Sheet 2 of 2

Wire	Stock No.	Deadends			Angle Clamp	Armor Rod (4)	Line Guard (4)	Stirrup Clamp	Hot Line Clamp
Stock No's. Maj. and Min.	18-	23-78	23-18	23-78		17-59	17-59	17-62	23-78
		Automatic (1)	Straight	Quad-rant or Snail					
#6 Bare Cu.	02 010								
#6 Poly Cu.	01 012	375	394		17 02 016			165	183 (5)
#4 Bare Cu.	02 017								
#4 Poly Cu.	01 017	374	394		17 02 016			165	183 (5)
#2 Bare Cu.	02 030								
#2 Poly Cu.	01 020	373	394		17 02 016			165	183 (5)
#1/0 Bare Cu.	02 022	-							
#1/0 Poly Cu.	01 022	-	395	290 (2)	17 02 016	079		165	183 (5)
#4/0 Bare Cu.	02 027	-							183 (5)
#4/0 Poly Cu.	01 025	-	395		17 62 006 (3)	046 (2)		153	
350 kcmil Bare Cu.	02 064	-		050 (2)	17 62 006 (3)				
#8 Sol. C.W.	27 09 094	17 60 199	(Offset Sleeve)						
									17-62
#3/0 ACSR	05 010	-	292	-	23 18 040 (3)	S.L. 023 D.L. 026	035	167	088 (6)
266.8 kcmil 18/1 ACSR	05 039	-	292		23 18 040 (3)	038		167	112 (6)
336.4 kcmil 26/7 ACSR	05 014	-	292		23 18 264 (3)	040	044	167	112 (6)
477 kcmil 18/1 ACSR	05 035	-	292		23 18 264 (3)	058	037	167	112 (6)

1. Do NOT use automatic deadends on low tension spans, slack spans, or highway and river crossings. For these applications use bolted deadends.
2. Use with tensions over 4000 lbs.
3. Suitable for suspension construction also.
4. Preformed line guards and patch rods preferred for repairing conductors.
5. For use with stirrup clamp.
6. For use over bare conductor

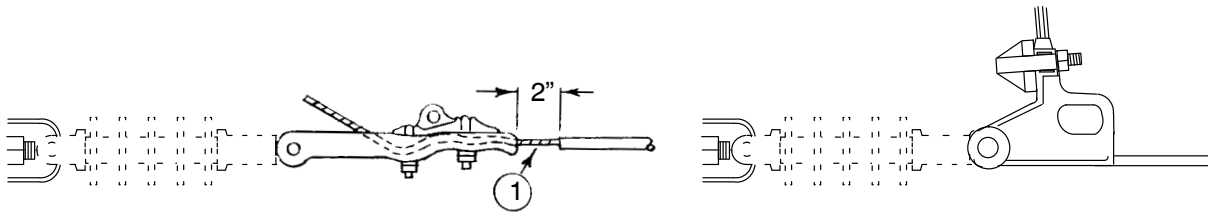


Automatic Type

Std. / Stk. No.	Description	New / Maint.	DOJM Code
23 78 365	Clamp, Deadend, Auto, #4 ACSR	N	DEA4A
23 78 364	Clamp, Deadend, Auto, #2 ACSR	N	DEA2A
23 78 362	Clamp, Deadend, Auto, 1/0 AAAC	N	DEA10A
23 78 375	Clamp, Deadend, Auto, #6 CU	M	DEA6C
23 78 374	Clamp, Deadend, Auto, #4 CU	M	DEA4C
23 78 373	Clamp, Deadend, Auto, #2 CU	M	DEA2C

NOTES:

1. The wire shall be fed completely through the automatic deadend chuck. The jaws of the deadend shall be set by applying a sharp heavy pull on the line conductor. Do not strike deadend body to set the deadend chuck.
2. Do NOT use automatic deadends on low tension spans, slack spans, or highway and river crossings. For these applications use bolted deadends.

STYLE ASTYLE B

Std. / Stk. No.	Description	New / Maint	DOJM Code	Style
23 18 394	Clamp, Deadend, 3 #7 A.W.	M	DEC37AW	A
23 18 394	Clamp, Deadend, #6 CU	M	DEC6C	A
23 18 394	Clamp, Deadend, #4 CU	M	DEC4C	A
23 18 394	Clamp, Deadend, #2 CU	M	DEC2C	A
23 18 394	Clamp, Deadend, #1/0 CU	M	DEC10C	A
23 18 395	Clamp, Deadend, #4/0 CU	M	DEC40C	A
23 18 395	Clamp, Deadend, 350 CU	M	DEC350C	A
23 18 395	Clamp, Deadend, 500 CU	M	DEC500C	A
23 18 399	Clamp, Deadend, 750 CU	M	DEC750C	A
23 18 399	Clamp, Deadend, 1000 CU	M	DEC1000C	A
23 18 394	Clamp, Deadend, 6A CWC	M	DEC6AC	A
23 18 394	Clamp, Deadend, 4A CWC	M	DEC4AC	A
23 18 394	Clamp, Deadend, 2A CWC	M	DEC2AC	A
23 18 400	Clamp, Deadend, #4 ACSR	M	DEC4A	B
23 18 400	Clamp, Deadend, #2 ACSR	M	DEC2A	B
23 18 400	Clamp, Deadend, 1/0 ACSR or 1/0 AAAC	N	DEC10A	B
23 18 292	Clamp, Deadend, 3/0 ACSR	N	DEC30A	A
23 18 292	Clamp, Deadend, 4/0 ACSR	N	DEC40A	A
23 18 292	Clamp, Deadend, 110 ACSR	N	DEC110A	A
23 18 404	Clamp, Deadend, 335.6 ACSR T-2	N	DEC335T2	B
23 18 404	Clamp, Deadend, 432-2 ACSR T-2	N	DEC432T2	B
23 18 292	Clamp, Deadend, 336 ACSR	N	DEC336A	A
23 18 292	Clamp, Deadend, 477 ACSR	N	DEC477A	A
23 18 292	Clamp, Deadend, 556 AA	N	DEC556A	A
23 18 368	Clamp, Deadend, 795 AA	N	DEC795A	A
23 18 368	Clamp, Deadend, 954 AA	N	DEC954A	A

NOTE:

1. On covered conductors remove insulation to this point. Tape according to Dist. Std. 07 00 27 00.

FOR THE ELIMINATION OF KNOWN GALLOPING CONDUCTORS

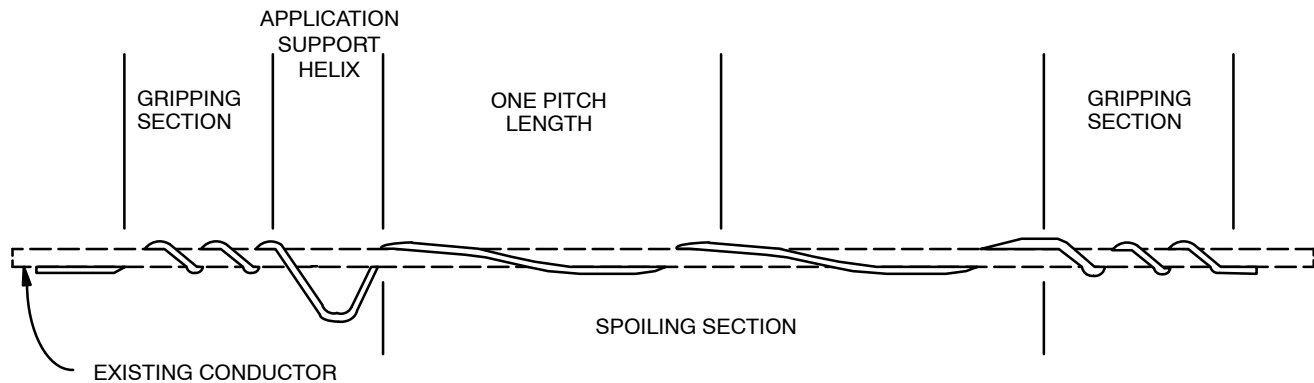


FIGURE 1

AIR FLOW SPOILER (AFS)

TABLE 1

SPAN LENGTH (FT)	SPOILERS / SPAN	SPAN LENGTH (FT)	SPOILERS / SPAN
< 120	2	451 – 500	9
121 – 180	3	501 – 550	10
181 – 240	4	551 – 600	11
241 – 300	5	601 – 650	12
301 – 350	6	651 – 700	13
351 – 400	7	701 – 750	14
401 – 450	8	751 – 800	15

STND. / STK. NO.	DESCRIPTION	07 00 14 **	01	02	03	04	05	06
17 63 181	Spoiler, Airflow 1/0 AAAC 7 STR or 1/0 ACSR 6/1		*					
17 63 240	Spoiler, Airflow 3/0, 4/0, or 110.8 ACSR							*
17 63 182	Spoiler, Airflow 336.4 ACSR 18/1			*				
17 63 183	Spoiler, Airflow 556.5 AA 19 STR				*			
17 63 184	Spoiler, Airflow 795 (37) AAC, 954 (37) AAC or 954 (45/7) ACSR					*		
296	OPERATION CODE		*	*	*	*	*	*

* USE APPROPRIATE QUANTITIES FOR SPAN LENGTH PER TABLE 1

NOTES:

1. Leave 15' between each AFS.
2. Each AFS is approximately 15' in length.
3. For a span requiring an EVEN number of AFS, install per Figure 2.
4. For a span requiring an ODD number of AFS, install per Figure 3.

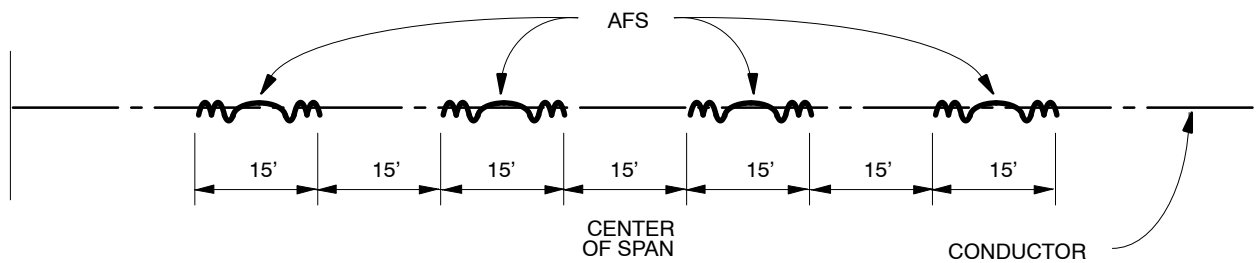


FIGURE 2
EVEN NUMBER OF AFS

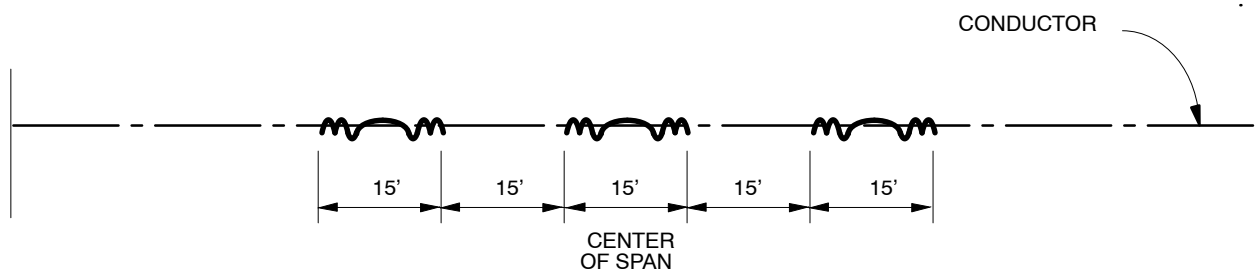
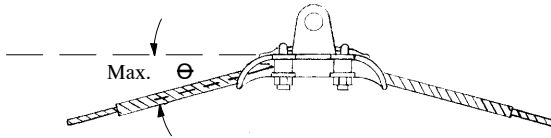


FIGURE 3
ODD NUMBER OF AFS



$$\text{Max. } \theta = 30^{\circ}$$

UP TO 477 ACSR

$$\text{Max. } \theta = 22.5^{\circ}$$

FOR 556 AND
LARGER

Note:

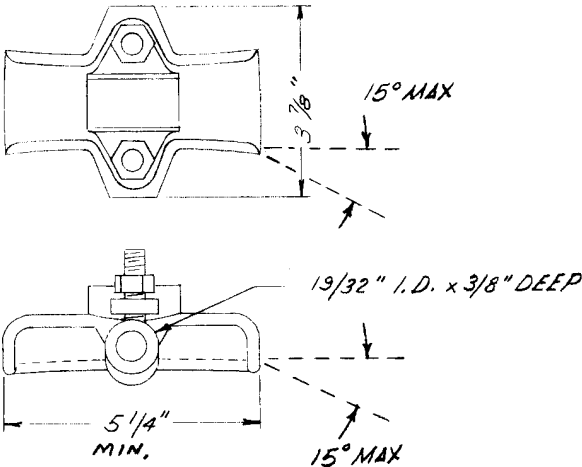
1. Armor rods not required for spans 300' and shorter.

SPANS 300' AND SHORTER

Stk. No.	Description	DOJM Code
23 78 417	Clamp, Susp., #2 CU	SC2C
23 78 417	Clamp, Susp., #1/0 CU	SC10C
23 78 417	Clamp, Susp., #2/0 CU	SC20C
23 78 417	Clamp, Susp., #4/0 CU	SC40C
23 78 417	Clamp, Susp., #6A CWC	SC6AC
23 78 417	Clamp, Susp., #4A CWC	SC4AC
23 78 417	Clamp, Susp., #2A CWC	SC2AC
23 18 342	Clamp, Susp., #4 ACSR	SC4A
23 18 342	Clamp, Susp., #2 ACSR	SC2A
23 18 342	Clamp, Susp., 3/0 ACSR	SC30A
23 18 342	Clamp, Susp., 4/0 ACSR	SC40A
23 78 414	Clamp, Susp., 335.6 ACSR T-2	SC335T2
23 78 402	Clamp, Susp., 477 ACSR	SC477A
23 18 302	Clamp, Susp., 795 AA	SC795A
23 78 417	Clamp, Susp., 3 #1 AW	SC37AW

SPANS GREATER THAN 300'

Stk. No.	Description	DOJM Code
23 18 342	Clamp, Susp. #4 ACSR	SC4AR
17 59 020	Rod, Armor, #4 ACSR	
23 18 342	Clamp, Susp. #2 ACSR	SC2AR
17 59 021	Rod, Armor, #2 ACSR	
23 78 402	Clamp, Susp. 3/0 ACSR	SC30AR
17 59 023	Rod, Armor, 3/0 ACSR	
23 18 372	Clamp, Susp. 4/0 ACSR	SC40AR
17 59 039	Rod, Armor, 4/0 ACSR	
23 18 302	Clamp, Susp. 477 ACSR	SC477AR
17 59 058	Rod, Armor, 477 ACSR	
23 18 302	Clamp, Susp. 795 AA	SC795AR
17 59 068	Rod, Armor 795AA	



Notes:

- 1. This trunnion to be used if line angle is less than or equal to 5 degrees.
- 2. Armor rods not required for spans 300' and shorter.

Spans 300' and Shorter

Stk. No.	Description	DOJM Codes
23 78 331	Clamp, Trunnion, 795 AA	TC795A

Spans Greater Than 300'

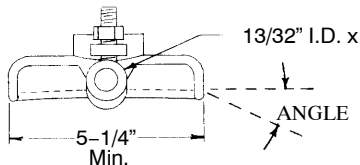
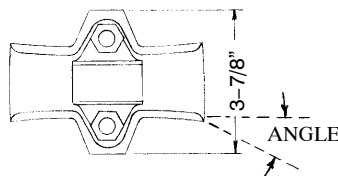
Stk. No.	Description	DOJM Codes
23 78 330	Clamp, Trunnion, 795 AA	TC795AR
17 59 068	Rod, Armor, 795 AA	

PRIMARY CONDUCTOR AND FASTENINGS

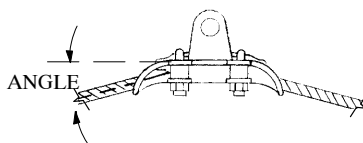
Conductor Clamps
34kV and 69kV

07 00 20 00

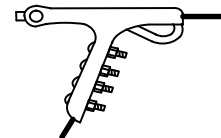
Sheet 1 of 1



TRUNNION



SUSPENSION



DEADEND

Configurations	Tangent / Angle				Deadend	
	Span ≤ 300'		Span > 300'		All Spans	
Description	Stk. No.	DOJM	Stk. No.	DOJM	Stk. No.	DOJM
TRUNNION						
Clamp, Trunnion, 1/0 AAAC	23 78 401	TC10A	23 78 401	TC10AR		
Rod, Armor, 1/0 AAAC			17 59 022			
Clamp, Trunnion, 556 AA	23 78 331	TC556A	23 78 332	TC556AR		
Rod, Armor, 556 AAC			17 59 061			
Clamp, Trunnion, 954 ACSR	23 78 332	TC954A	23 78 330	TC954ARS		
Rod, Armor, 954 ACSR			17 59 125			
SUSPENSION						
Clamp, Suspension, 1/0 AAAC	23 18 342	SC10A	23 78 402	SC10AR		
Rod, Armor, 1/0 AAAC			17 59 022			
Clamp, Suspension, 110.8 ACSR	23 18 342	SC110A	23 78 311	SC110AR		
Rod, Armor, 110.8 ACSR			17 59 164			
Clamp, Suspension, 556 AA	23 18 372	SC556A	23 18 302	SC556AR		
Rod, Armor, 556 AA			17 59 061			
Clamp, Suspension, 954 ACSR	23 18 302	SC954A	23 18 396	SC954ARS		
Rod, Armor, 954 ACSR			17 59 125			
Clamp, Suspension, T2, 4/0 ACSR	23 78 455					
Clamp, Suspension, T2, 336 ACSR	23 78 456					
Clamp, Suspension, T2, 556 AAC	17 02 176					
Clamp, Suspension, T2, 954 ACSR	23 78 451					
DEADEND						
Clamp, Deadend, 1/0 AAAC					23 68 529	DEC10AS
Clamp, Deadend, 110 ACSR					23 68 529	DEC110AS
Clamp, Deadend, 556 AA					23 18 405	DEC556AS
Clamp, Deadend, 954 ACSR					23 18 436	DEC954AS
Clamp, Deadend, T2, 4/0					23 18 404	
Clamp, Deadend, T2, 336, 556					23 18 406	
Clamp, Deadend, T2, 954 (x2)					23 18 436	

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: KSP
REV. NO: 3
REV. DATE: 02/23/16

General

Hot line clamps shall be used to make connections on lines rated over 5000 volts phase to phase where the connection must be made "hot" or where it is likely that the connection will have to be disconnected and reconnected with some degree of frequency. **Avoid the use of hot line clamps where currents exceed 250 amps** (i.e. 1/0 AAAC taps maximum), except with T-2 conductors.

Bronze hot line clamps shall be installed on aluminum stirrup clamps. Aluminum hot line clamps shall be installed on line conductors protected with *existing* armor rod or line guard. (Do not install additional rods or guards; use a new stirrup clamp). However, aluminum and bronze hot line clamps shall be connected directly to unprotected line conductors of like material (Al. to Al. or Cu. to Cu.) **when making no load taps**. This includes switches and lightning arresters.

INSTALLATION OF HOT LINE CLAMPS AND STIRRUP CLAMPS

- a. Use the proper size and type clamps as shown in the following tables.
- b. Install the hot line clamps over armor rods where present (keeping the clamps at least one loop (or pitch) length in from the end of the rods), or onto bails of stirrup clamps.
- c. Where possible clean copper surfaces with emery cloth or by scraping and aluminum surfaces by wire brushing.
- d. Apply corrosion resisting lubricant, 31 59 058 – BT.
- e. Stirrup clamps in combination with hot line clamps are acceptable for use on conductors 1/0 and smaller.

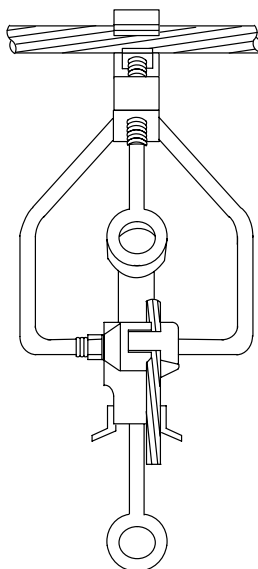
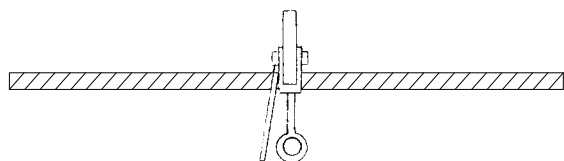
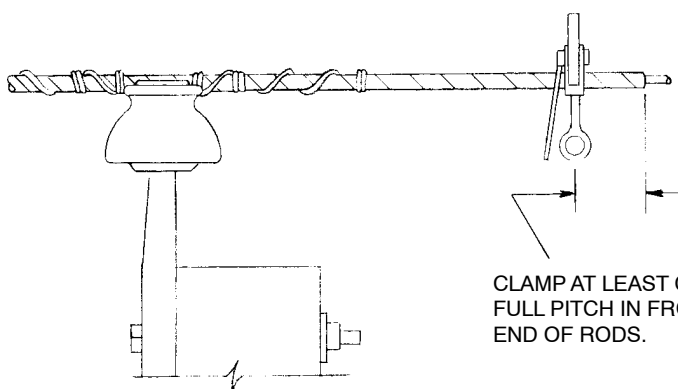


TABLE 1. Clamp on stirrup

Stk. No.	Description	DOJM Code
17 62 165	Clamp, Stirrup, #6 Cu	STC6C
23 78 394	Clamp, Hot Line, Cu.	
17 62 165	Clamp, Stirrup, #4 Cu	STC4C
23 78 394	Clamp, Hot Line, Cu.	
17 62 165	Clamp, Stirrup, #2 Cu	STC2C
23 78 394	Clamp, Hot Line, Cu.	
17 62 165	Clamp, Stirrup, 1/0 Cu	STC10C
23 78 394	Clamp, Hot Line, Cu.	
17 62 153	Clamp, Stirrup, 4/0 Cu	STC40C
23 78 394	Clamp, Hot Line, Cu.	
17 62 153	Clamp, Stirrup, 350 Cu	STC350C
23 78 394	Clamp, Hot Line, Cu.	
17 62 153	Clamp, Stirrup, 500 Cu	STC500C
23 78 394	Clamp, Hot Line, Cu.	
17 62 166	Clamp, Stirrup, #4 Al.	STC4A
23 78 394	Clamp, Hot Line, Cu.	
17 62 166	Clamp, Stirrup, #2 Al.	STC2A
23 78 394	Clamp, Hot Line, Cu.	
17 62 166	Clamp, Stirrup, 1/0 Al.	STC10A
23 78 394	Clamp, Hot Line, Cu.	
17 62 166	Clamp, Stirrup, 2/0 ACSR	STC20A
23 78 394	Clamp, Hot Line, Cu.	
17 62 166	Clamp, Stirrup, 3/0 ACSR	STC30A
23 78 394	Clamp, Hot Line, Cu.	
17 62 166	Clamp, Stirrup, 4/0 ACSR	STC40A
23 78 394	Clamp, Hot Line, Cu.	
17 62 186	Clamp, Stirrup, 335.6 ACSR T-2	STC335T2
23 78 394	Clamp, Hot Line, Cu.	
17 62 186	Clamp, Stirrup, 336 ACSR	STC336A
23 78 394	Clamp, Hot Line, Cu.	
17 62 186	Clamp, Stirrup, 477 ACSR	STC477A
23 78 394	Clamp, Hot Line, Cu.	
17 62 186	Clamp, Stirrup, 556 AA	STC556A
23 78 394	Clamp, Hot Line, Cu.	
17 62 167	Clamp, Stirrup, 795 AA	STC795A
23 78 394	Clamp, Hot Line, Cu.	
17 62 167	Clamp, Stirrup, 954 AA	STC954A
23 78 394	Clamp, Hot Line, Cu.	



FOR NO LOAD TAPS –
FUSED SWITCHES AND
LIGHTNING ARRESTORS



EXISTING ARMOR

CLAMP AT LEAST ONE
FULL PITCH IN FROM
END OF RODS.

TABLE 2. Clamp on bare conductor

Stk. No.	Description	DOJM Code
23 78 394	Clamp, Hot Line, #6 Cu, BARE	HLC6C
23 78 394	Clamp, Hot Line, #4 Cu, BARE	HLC4C
23 78 394	Clamp, Hot Line, #2 Cu, BARE	HLC2C
23 78 394	Clamp, Hot Line, 1/0 Cu, BARE	HLC10C
23 78 183	Clamp, Hot Line, 4/0 Cu, BARE	HLC40C
23 78 183	Clamp, Hot Line, 350 Cu, BARE	HLC350C
17 62 088	Clamp, Hot Line, #4 ACSR, BARE	HLC4A
17 62 088	Clamp, Hot Line, #2 ACSR, BARE	HLC2A
17 62 088	Clamp, Hot Line, 1/0 AL, BARE	HLC10A
17 62 088	Clamp, Hot Line, 2/0 ACSR, BARE	HLC20A
17 62 088	Clamp, Hot Line, 3/0 ACSR, BARE	HLC30A
17 62 088	Clamp, Hot Line, 4/0 ACSR, BARE	HLC40A
17 62 190	Clamp, Hot Line, 335.6 ACSR T-2	HLC335T2
17 62 088	Clamp, Hot Line, 336 ACSR, BARE	HLC336A
17 62 112	Clamp, Hot Line, 477 ACSR, BARE	HLC477A
17 62 112	Clamp, Hot Line, 556 AA, BARE	HLC556A
17 62 143	Clamp, Hot Line, 795 AA, BARE	HLC795A
17 62 143	Clamp, Hot Line, 954 AA, BARE OR 954 ACSR, BARE	HLC954A

TABLE 3. Clamp on conductor with existing armor rods.

Stk. No.	Description	DOJM Code
17 62 088	Clamp, Hot Line, #4 ACSR, w/Armor	HLC4AR
17 62 088	Clamp, Hot Line, #2 ACSR, w/ Armor	HLC2AR
17 62 088	Clamp, Hot Line, 1/0 AL, w/Armor	HLC10AR
17 62 088	Clamp, Hot Line, 2/0 ACSR, w/Armor	HLC20AR
17 62 088	Clamp, Hot Line, 3/0 ACSR, w/Armor	HLC30AR
17 62 143	Clamp, Hot Line, 4/0 ACSR, w/Armor	HLC40AR
17 62 143	Clamp, Hot Line, 336 ACSR, w/Armor	HLC336AR
17 62 143	Clamp, Hot Line, 477 ACSR, w/Armor	HLC477AR
17 62 143	Clamp, Hot Line, 556 AA, w/Armor	HLC556AR

Connectors

This section covers the various connectors to be used in making copper to copper, aluminum to aluminum, and aluminum to copper connections. Each connector shall be used only on the types and ranges of conductors for which it is shown.

a. Copper to Copper Connectors

The following sizes of split bolt and two bolt connectors shall be standard for use in making copper to copper conductor connections.

Stock No.	Type of Connector	Conductor Range		Alternative options to Split Bolt	DOJM Code
		Main	Tap	Vice connectors	
17 54 001	Split Bolt	10 Str	12 Sol	–	SB1
17 54 002	Split Bolt	8 Str	10 Sol	–	SB8
17 54 003	Split Bolt	6 Sol	10 sol	–	SB6
17 54 004	Split Bolt	4 Sol	8 Sol	17 54 962	SB4
17 54 005	Split Bolt	2 Sol	6 Sol	17 04 251	SB2
17 54 182	Split Bolt	2 Str	4 Sol		SB2ST
17 54 145	Two Bolt	4 AWG – 1/0	8 AWG – 1/0	17 04 252	TB10
17 54 139	Two Bolt	3 AWG – 2/0	8 AWG – 2/0		TB20
17 54 140	Two Bolt	1 AWG – 4/0	8 AWG – 4/0	–	TB40
17 54 132	Two Bolt	2/0 – 350	8 AWG – 350	–	TB350
17 54 141	Two Bolt	3/0 – 500	8 AWG – 500	–	TB500
17 54 142	Two Bolt	500 – 1000	8 AWG – 1000	–	TB1000

b. Aluminum to Aluminum And Aluminum to Copper Connectors

The parallel groove clamps listed below are acceptable means of making aluminum to aluminum or aluminum to copper conductor connections within the types and ranges of conductors specified for each. In no instance shall these connectors be used for making copper to copper connections. When making aluminum to copper connections the copper wire should be on the low side to prevent soluble copper salts from eroding the aluminum connector.

Parallel Groove Clamps

Stock No.	Conductor Range				DOJM Code
	Main (ACSR & AA)		Tap (ACSR, AA, & CU)		
	ACSR	AWG & CM	ACSR	AWG & CM	
17 51 032	6 – 1/0	6 sol – 1/0 str	6 – 1/0	6 sol – 1/0 str	PGSS
17 51 137	1/0 – 336.4	1/0 str – 350 kcmil	6 – 1/0	6 sol – 1/0 str	PGSM
17 51 138	1/0 – 336.4	1/0 str – 350 kcmil	1/0 – 336.4	1/0 str – 350 kcmil	PGMM
17 51 139	336.4 – 795	397.5 – 954 kcmil	6 – 2/0	6 sol – 2/0 str	PGSL
17 51 136	397.5 – 795	400 – 1000 kcmil	3/0 – 397.5	3/0 str – 350 kcmil	PGML
17 51 135	397.5 – 795	400 – 1000 kcmil	397.5 – 795	400 – 1000 kcmil	PGLL

Notes:

- Where there is a choice of clamps available for a specific connection, the smallest clamp shall be selected.
- A Service Entrance Clamp, Stock No. 17 51 146 (not listed above) shall be used for connecting #6 ACSR Duplex cable to #10 Cu Pole & Bracket Cable.

c. Applications

The following shall be used to select both the line (A) and tap (B) connectors when making a tap, connecting a loop (over or around), or connecting a switch. The table below also indicates the copper lead wire to be used. However, this must be selected with the appropriate DOJM code indicated in Standard 07 00 80 (bare conductor) or Standard 07 00 81 (covered conductor).

Where a small tap to a large line combination has no connector shown (such as a 1/0 AAAC tap from a 954 AA line), use the next larger lead wire. For example: use a 4/0 cu. rather than 1/0 cu. for 1/0 AAAC to 954 AA).

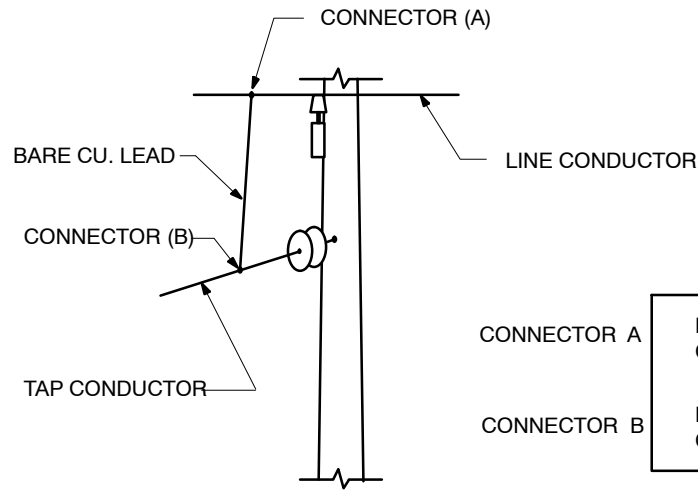


TABLE KEY

CONNECTOR A	DOJM CODE	STOCK NUMBER
CONNECTOR B	DOJM CODE	STOCK NUMBER

Wire Size Tap Conductor	Wire Size Bare S.D. Cu. Lead	Wire Size – Line Conductor						
		954 AA	795 AA	556 AA	477 ACSR	336 ACSR	1/0 AAAC or 1/0 ACSR	4 ACSR
4 ACSR Bare or Poly	4			PGSL 1751139 PGSS 1751032	PGSL 1751139 PGSS 1751032	PGSM 1751137 PGSS 1751032	PGSS 1751032 PGSS 1751032	PGSS 1751032 PGSS 1751032
1/0 AAAC, ACSR Bare or Poly	1/0			PGSL 1751139 PGSS 1751032	PGSL 1751139 PGSS 1751032	PGSM 1751137 PGSS 1751032	PGSS 1751032 PGSS 1751032	PGSS 1751032 PGSS 1751032
336 ACSR Bare or Poly	350	PGML 1751136 PGMM 1751138	PGML 1751136 PGMM 1751138	PGML 1751136 PGMM 1751138	PGML 1751136 PGMM 1751138	PGMM 1751138 PGMM 1751138		
477 ACSR Bare or Poly	350	PGML 1751136 PGML 1751136	PGML 1751136 PGML 1751136	PGML 1751136 PGML 1751136	PGML 1751136 PGML 1751136	PGMM 1751138 PGML 1751136		
556 AA Bare or Poly	350	PGML 1751136 PGML 1751136	PGML 1751136 PGML 1751136	PGML 1751136 PGML 1751136	PGML 1751136 PGML 1751136			
795 AA Bare or Poly	500	PGLL 1751135 PGLL 1751135	PGLL 1751135 PGLL 1751135	PGLL 1751135 PGLL 1751135				
954 AA Bare or Poly	750	PGLL 1751135 PGLL 1751135	PGLL 1751135 PGLL 1751135					
6 Cu. Bare or Poly	4			PGSL 1751139 SB4 1754004	PGSL 1751139 SB4 1754004	PGSM 1751137 SB4 1754004	PGSS 1751032 SB4 1754004	PGSS 1751032 SB4 1754004
4 Cu. Bare or Poly	4			PGSL 1751139 SB4 1754004	PGSL 1751139 SB4 1754004	PGSM 1751137 SB4 1754004	PGSS 1751032 SB4 1754004	PGSS 1751032 SB4 1754004
2 Cu. Bare or Poly	2			PGSL 1751139 SB2 1754005	PGSL 1751139 SB2 1754005	PGSM 1751137 SB2 1754005	PGSS 1751032 SB2 1754005	PGSS 1751032 SB2 1754005
1/0 Cu. Bare or Poly	1/0			PGML 1751136 TB10 1754145	PGML 1751136 TB10 1754145	PGSM 1751137 TB10 1754145	PGSS 1751032 TB10 1754145	PGSS 1751032 TB10 1754145
4/0 Cu. Bare or Poly	4/0	PGML 1751136 TB40 1754140	PGML 1751136 TB40 1754140	PGML 1751136 TB40 1754140	PGML 1751136 TB40 1754140	PGMM 1751138 TB40 1754140	PGSM 1751137 TB40 1754140	
350 Cu. Bare or Poly	350	PGML 1751136 TB350 1754132	PGML 1751136 TB350 1754132	PGML 1751136 TB350 1754132	PGML 1751136 TB350 1754132	PGMM 1751138 TB350 1754132		
500 Cu. Bare or Poly	500	PGLL 1751135 TB500 1754141	PGLL 1751135 TB500 1754141	PGLL 1751135 TB500 1754141	PGLL 1751135 TB500 1754141			

1. Use of Rubber Tape

There are two standard types of rubber tape as follows:

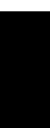
■ Rubber Base – Stock #25 53 080 used for voltages of 1000 volts or less between phases. Its normal application is with rubber insulated wire. Use two layers half lapped and cover with same amount of friction tape.

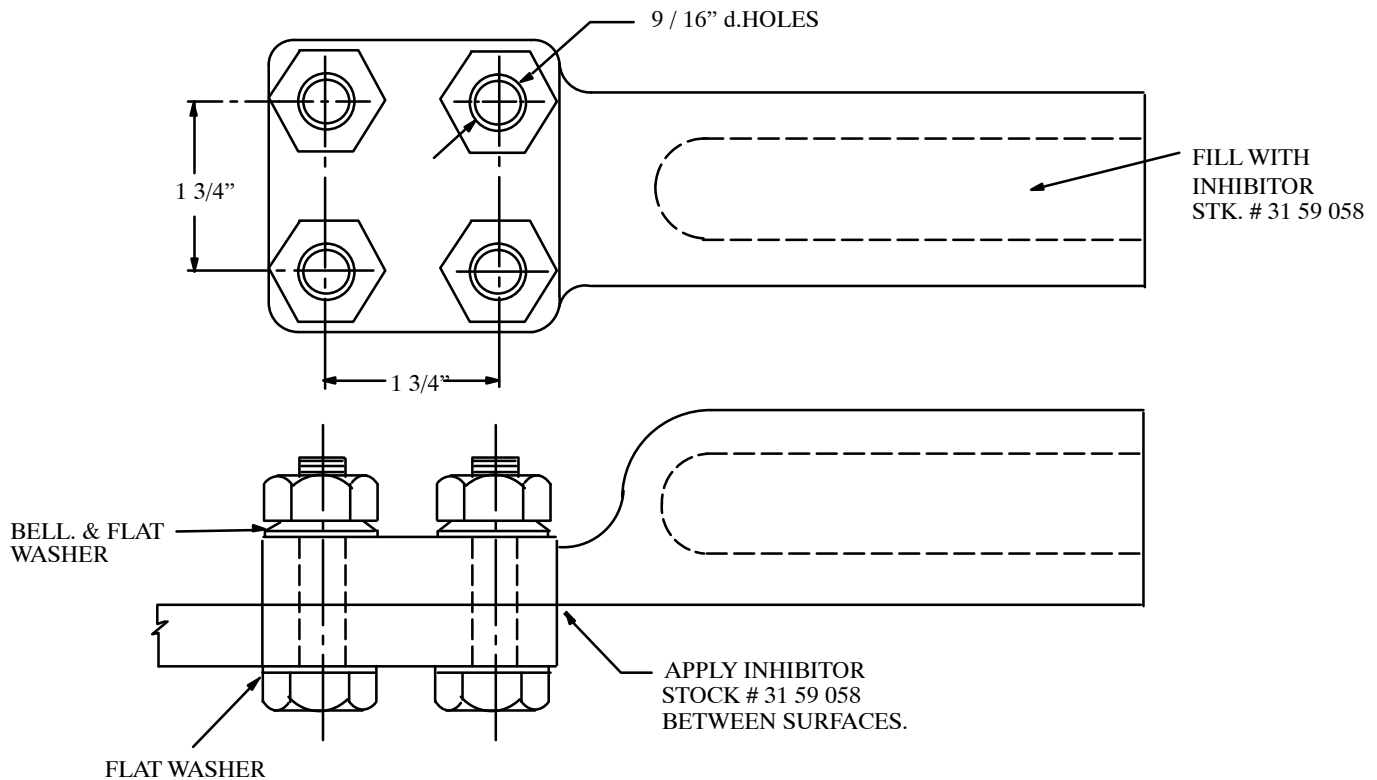
Oil Base – Stock #25 53 070 (1" wide) or #25 53 074 (1-1/2" wide) used for voltages of 1000 volts or more between phases. This tape is normally used with rubber insulated wire such as primary leads to transformers and for cable joints and terminals. Specific instructions for the use of this tape accompany standards on splices, joints, terminals, etc.

2. Use of Friction Tape

Friction tape Stock #25 53 003 (3/4" wide) or #25 53 027 (1-1/2" wide) shall be used to cover taps, splices, etc., with- in the climbing and working spaces on Overhead Construction 5kV and below where weatherproof conductors are used. Apply two layers half lapped.

Tape will not adhere to corrosion resisting lubricant, therefore on aluminum taps it will be necessary to wipe the ex- cess lubricant from the connection before taping. The tape must be securely anchored to the polyethylene jacket be- fore taping over the coated connection.





1. Install with 12 Ton Press and Burndy die.
2. Install with 60 Ton Press and Alcoa die.

Stk. No.	Description	DOJM Code*	Die	Note
17 55 311	Lug, Connecting, 1/0 ACSR, 2 Hole	CL10A	B74AH-10AH	1
17 55 315	Lug, Connecting, 335.5 ACSR T-2, 2 Hole	CL335T2	B75AH	1
17 55 318	Lug, Connecting, 336 ACSR, 2 Hole	CL336A	B76AH	1
17 55 324	Lug, Connecting, 477 ACSR, 2 Hole	CL477A	24AH	2
17 55 327	Lug, Connecting, 556 AA, 2 Hole	CL556A2H	24AH	2
17 55 192	Lug, Connecting, 556 AA, 4 Hole	CL556A	U317	1
17 55 193	Lug, Connecting, 795 AA, 4 Hole	CL795A	30AH	2
17 55 194	Lug, Connecting, 795 ACSR, 45/7, 4 Hole	CL795AC	30AH	2
17 55 211	Lug, Connecting, 954 AA, 4 Hole	CL954A	30AH	2

*DOJM codes include stainless steel bolts (1/2" x 2", Stock No. 21 56 078), flat washers (1/2" ss, Stock No. 12 56 053) and Belleville washers (1/2" ss, Stock No. 12 56 052). See Dist. Std. 59 52 00 43 for procedures on installation of Belleville washers.

Preformed Ties

The preferred method of attaching aluminum conductors under tension to pin type or post type insulators on lines up thru 34kV is with preformed ties. Preformed top, side, double top, and double sided ties are available for the following conductors listed in [Table I](#) below. Pads, when supplied with these ties must be used to insure a proper fit between the tie and conductor. On covered conductors these ties are to be installed over the insulation.

TABLE KEY

DOJM CODE STOCK NO.

TABLE I – Preformed Ties

Nominal Conductors	Top Tie	Side Tie	Dbl. Top Tie	Dbl. Side Tie	Post Top Tie	Color Code
#4 ACSR, Bare	TT4A 23-68-347	ST4A 23-68-360	DTT4A 23-68-384	DST4A 23-68-396		Orange
#4 ACSR, Poly Covered #2 ACSR, Bare	TT4P TT2A 23-68-345	ST2A 23-68-359	DTT2A 23-68-386	DST2A 23-68-393		Red
1/0 AAAC, Bare 1/0 ACSR, Bare	TT10A 23-68-350	ST10A 23-68-337	DTT10A 23-68-385	DST10A 23-68-376	PTT10A 23-68-399	Yellow
1/0 AAAC, Poly Covered 3/0 AAAC, Bare 3/0 ACSR, Bare 110.8 ACSR, Bare	TT10P TT30A TT110A 23-68-351	ST10P ST30A ST110A 23-68-339				Orange
2/0 ACSR, Bare	TT20A 23-68-387					Blue
#4 ACSR, Tree Wire 4/0 ACSR, Bare	TT4T TT40A 23-68-390	ST4T ST40A 23-68-331	DTT4T DTT40A 23-68-383	DST4T DST40A 23-68-392		Red
1/0 AAAC, Tree Wire 336.4 ACSR, Bare	TT10T TT336A 23-68-343	ST10T ST336A 23-68-332	DTT10T DTT336A 23-68-395	DST10T DST336A 23-68-391	PTT10T PTT336A 23-68-362	Brown
335.6 ACSR T-2	TT335T2 23-68-491	ST335T2 23-68-338	DTT335T2 23-68-494	DST335T2 23-68-375		Red or Blue
477 ACSR, Bare	TT477A 23-68-491	ST477A 23-68-492	DTT477A 23-68-494	DST477A 23-68-493		Red
556.5 AAC, Bare	TT556A 23-68-344	ST556A 23-68-338	DTT556A 23-68-374	DST556A 23-68-375	PTT556A 23-68-348	Blue
336.4 ACSR, Tree Wire 556 AAC, Poly Covered	TT336T TT556P 23-68-354	ST336T ST556P 23-68-333				Green
795 AAC, Bare					PTT795A 23-68-349	Green
954 AAC, Bare				DST954A 23-68-379	PTT954A 23-68-356	Yellow

Conventional Hand Ties

Conventional hand ties are to be used only for those conductors on lines up thru 34kV for which preformed ties are not specified, such as copper conductors, slack-span installations, and miscellaneous wire sizes and types which may be encountered on existing lines. Table II below specifies the correct tie wire for each type of conductor.

TABLE II – Hand Ties

Type Conductor	Tie Wire	Stock No.	Unit	Top Tie	Side Tie	Dbl. Side Tie
Aluminum – AA, AAAC, ACSR Bare or Covered ²	#4 Al., Bare	18-55-028	Ft.	10	10	16
Copper–Bare, CW or CWC #6 thru 500 kcmil	#6 Cu, Bare, S.D. or #8 Cu, Bare, S.D.	18-52-019 18-52-068	Ft.	10	10	16
Copper–Bare, CW or CWC #6 thru 500 kcmil	#6 Cu, Bare, S.D., 42" UE Only	18-52-009	Ea	1	1	2
Copper – Covered ³ #6 thru #2	#4 Cu, Poly, SD, SOL.	18-51-025	Ft.	5	5	10
#6 thru #2	#4 Al, Poly, 42" MO Only	18-55-040	Ea	1	1	2
1/0 thru 500 kcmil	#6 Cu, Poly, SD, SOL.	18-51-021	Ft	5	5	10

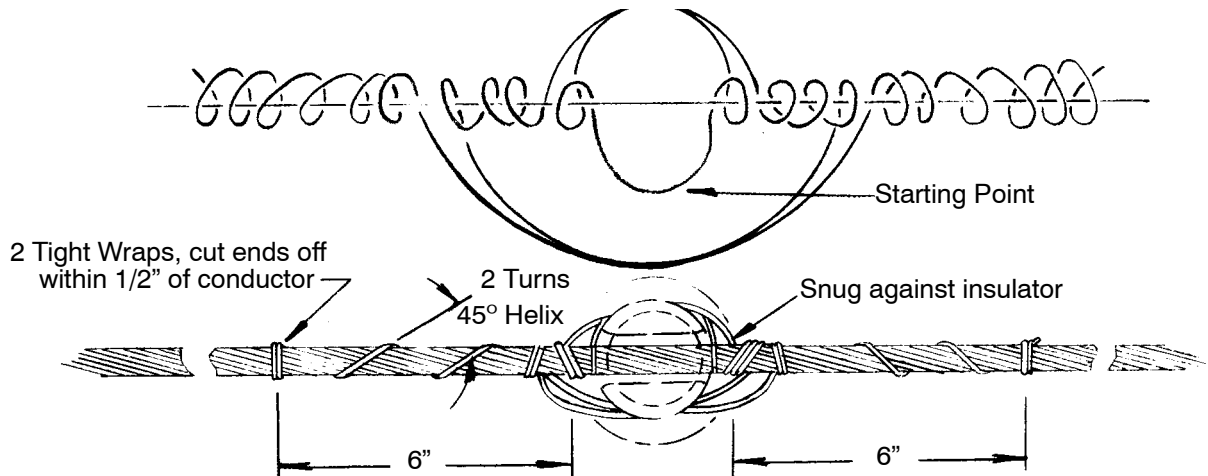
1. Armor Rods or Line Guards are required for all bare aluminum hand ties.

<u>Conductor</u>	<u>Armor Rod Stk. No.</u>	<u>Unit</u>
#4 ACSR	17-59-020	Set
1/0 AAAC	17-59-022	Set
336.4 ACSR	17-59-040	Set
556.5 AA	17-59-071	Set

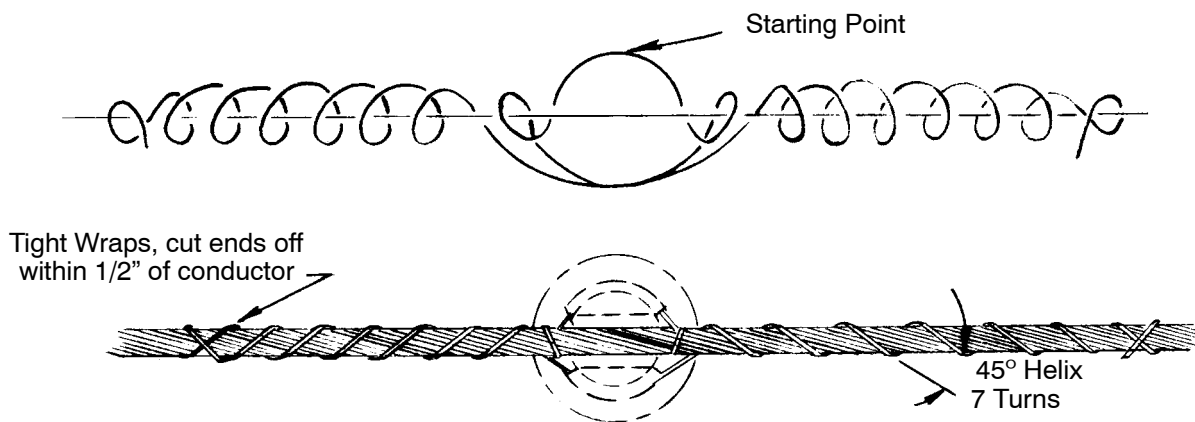
2. On aluminum conductor make the tie as snug and tight as possible by hand up to the last two turns (buttons), then use pliers to continuously cinch these last two buttons. Use the flat face of the plier against the conductor and avoid nicking the tie wire by using a continuous cinch rather than a bite.
3. The cottonbraid or polyethylene covering on covered copper conductor converted to 7.2 kV or higher must be removed at all insulator ties to a point 6" beyond the ends of the tie wires. The conductor shall then be tied in as if a bare copper conductor.

(CONVENTIONAL HAND TOP TIES)

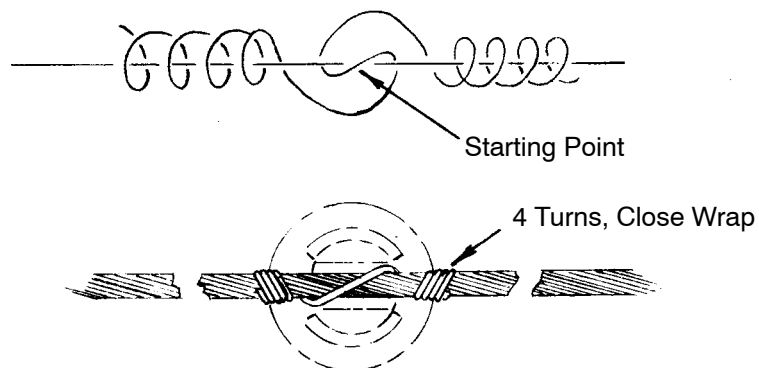
Top Tie for Aluminum Conductor – Bare or Covered



Top Tie for Bare Copper Conductor

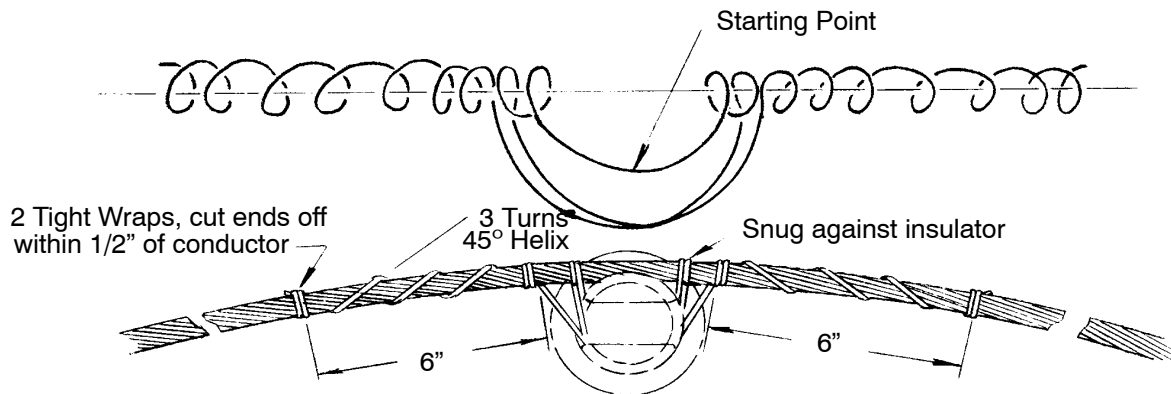


Top Tie for Covered Copper Conductor – 4kV



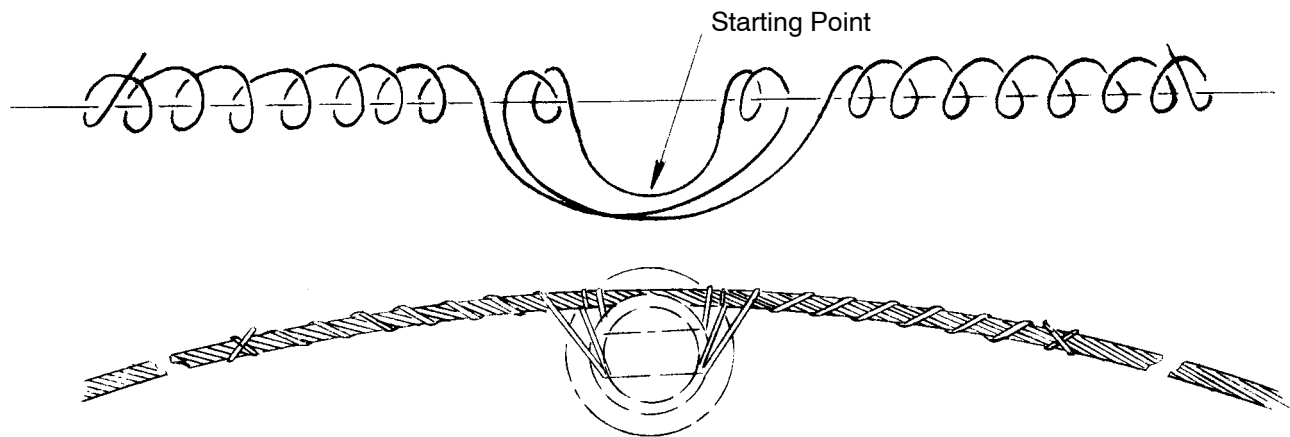
(CONVENTIONAL HAND SIDE TIES)

Side Tie for Aluminum Conductor – Bare or Covered



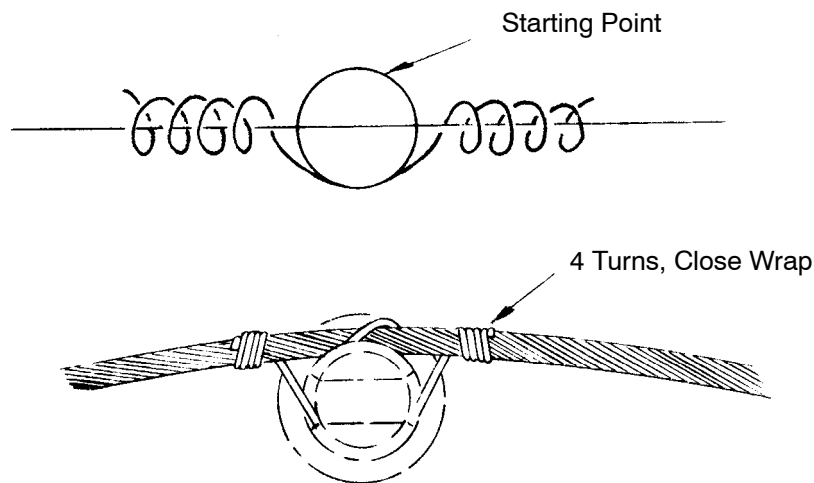
Double Ties: Make Two Single Ties – Reduce spiral length between insulators as necessary.

Side Tie for Bare Copper Conductor



Double Ties: Make Two Single Ties – Reduce spiral length between insulators as necessary.

Side Tie for Covered Copper Conductor – 4kV

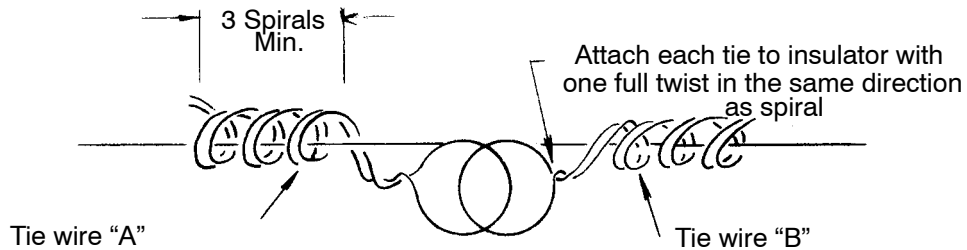


Double Ties: Make two single ties.

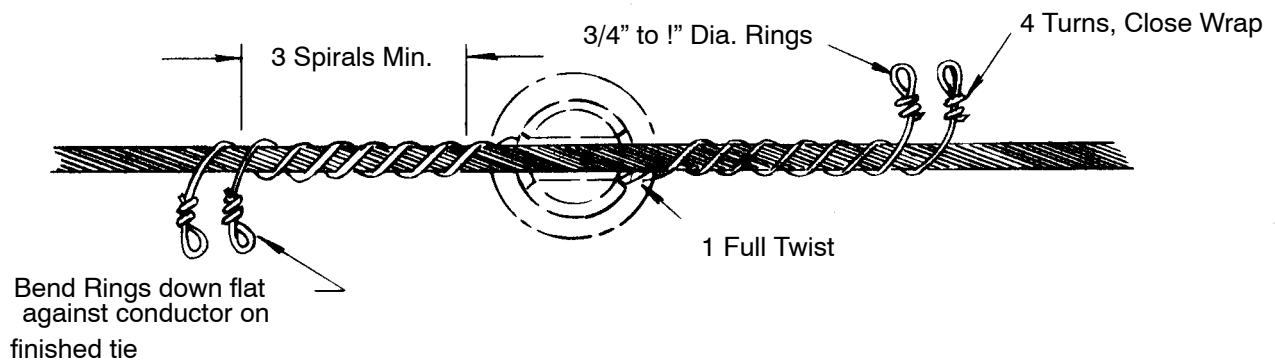
(Live Line Ties)

For Use on Bare Aluminum or Copper Conductors

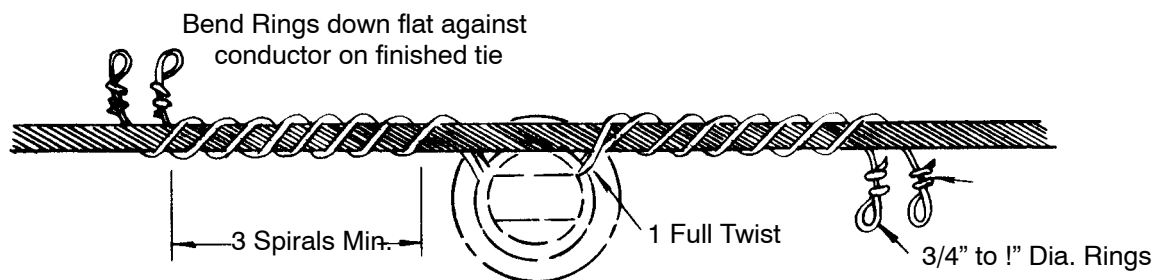
This same tie may be used as either a Hot Tap Tie or Hot Side Tie as Shown Below.



Live Line Tying Schematic

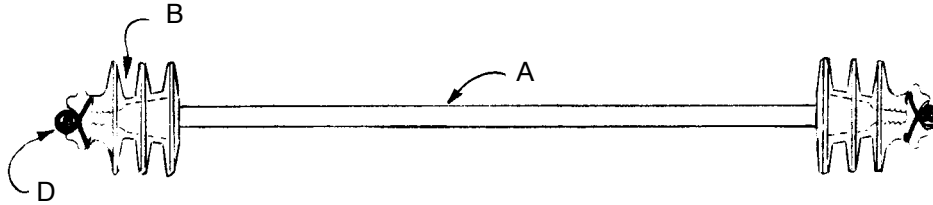


Completed Top Tie



Completed Side Tie

Double Ties: Same as single tie except that only one tie is installed on each insulator.



NOTES:

1. Spacers are to be used at known problem locations to prevent phases from coming in contact with each other.
2. Rod lengths are selected based on the normal separation between phases.
3. Conductors may be hand-tied to the insulators in either the top or side groove with the top groove position preferred.

	Std. / Stk. No.	Description	07 0045 **	01	02	03	04
				12kV		34kV	
A	23 17 290	Spacer – Rod, 36"		1		1	
	23 17 278	Spacer – Rod, 48"			1		1
B	25 05 069	Insulator – 12kV, Synthetic		2	2		
	25 05 080	Insulator – 34kV, Synthetic				2	2
C	23 62 125	Adapter – thrd 1" to 1-3/8"				2	2
D	18 55 028	Wire – Tie, Al, #4 AWG		20	20	20	20

PRIMARY CONDUCTORS AND FASTENINGS
Miscellaneous Lead Wire
Bare and Poly Covered S.D. Copper or A.A.

07 00 80 00

Sheet 1 of 1

Tap or Line Conductor	Lead – S.D. Bare Copper or AA			Lead – Poly Covered S.D. Cu or AA	
	Size	Stock No.	DOJM Codes	Stock No. ³	DOJM Codes
4 ACSR Bare	4 Cu	18 52 020	LW4A	18 51 025	PLW4A
1/0 AAAC, ACSR, Bare	1/0 Cu	18 52 026	LW10A	18 51 024	PLW10A
336.4 ACSR Bare	350 Cu	18 52 023	LW336A	18 51 052	PLW336A
477 ACSR Bare	350 Cu	18 52 023	LW477A	18 51 052	PLW477A
556.5 AA Bare	350 Cu	18 52 023	LW556A	18 51 052	PLW556A
² 795 AA Bare	795 Al	18 05 032	LW795A	2	2
² 954 AA, ACSR, Bare	954 Al	18 05 043	LW954A	2	2
4 ACSR Poly.	4 Cu	18 52 020	LW4P	18 51 025	PLW4P
1/0 AAAC Poly.	1/0 Cu	18 52 026	LW10P	18 51 024	PLW10P
336.4 AA Poly.	4/0 Cu	18 52 024	LW336P	18 51 052	PLW336P
556.5 AA Poly.	350 Cu	18 52 023	LW556P	18 51 052	PLW556P
#6 Cu. Bare	4 Cu	18 52 020	LW6C	18 51 025	PLW6C
#4 Cu. Bare	4 Cu	18 52 020	LW4C	18 51 025	PLW4C
#2 Cu. Bare	2 Cu	18 52 025	LW2C	18 51 019	PLW2C
#1/0 Cu. Bare	1/0 Cu	18 52 026	LW10C	18 51 024	PLW10C
#4/0 Cu. Bare	4/0 Cu	18 52 024	LW40C	18 51 023	PLW40C
350 Cu. Bare	350 Cu	18 52 023	LW350C	18 51 052	PLW350C
500 Cu. Bare	500 Cu	18 52 021	LW500C	18 51 022	PLW500C
#6 Cu. Poly	4 Cu	18 51 020	LW6W	18 51 025	PLW6W
#4 Cu. Poly	4 Cu	18 51 020	LW4W	18 51 025	PLW4W
#2 Cu. Poly	2 Cu	18 52 025	LW2W	18 51 019	PLW2W
#1/0 Cu. Poly	1/0 Cu	18 52 026	LW10W	18 51 024	PLW10W
#4/0 Cu. Poly	4/0 Cu	18 52 024	LW40W	18 51 023	PLW40W
500 Cu. Poly	500 Cu	18 51 021	LW500W	18 51 022	PLW500W

NOTES:

1. Lead size is based on current capacity of tap for tap standards and of line for line sectionalizing. Line conductor (of equal size) may be used.
2. Applicable to 34.5kV air break switches. Use Stock No. 23 17 425 conductor cover.
3. Poly covered leads are to be used for jumpers to prevent wildlife outages.

Tap or Line Conductor	Lead – 2400 V. Insulated Copper ³		
	Size	Stock No.	DOJM Code
4 ACSR Bare	2	18 53 018	ILW4A
1/0 AAAC, ACSR Bare	4/0	18 53 028	ILW10A
336.4 ACSR Bare	350(2)	18 53 102	ILW336A
477 ACSR Bare	350(2)	18 53 102	ILW477A
556.5 AA Bare	350(2)	18 53 102	ILW556A
4 ACSR Poly.	2	18 53 018	ILW4P
1/0 AAAC Poly.	1/0	18 53 022	ILW10P
336.4 AA Poly.	350	18 53 102	ILW336P
556.5 AA Poly.	350(2)	18 53 102	ILW556P
#6 Cu. Bare	2	18 53 018	ILW6C
#4 Cu. Bare	2	18 53 018	ILW4C
#2 Cu. Bare	1/0	18 53 022	ILW2C
#1/0 Cu. Bare	4/0	18 53 028	ILW10C
#4/0 Cu. Bare	350	18 53 102	ILW40C
350 Cu. Bare	350(2)	18 53 102	ILW350C
500 Cu. Bare	350(2)	18 53 102	ILW500C
#6 Cu. Poly	2	18 53 018	ILW6W
#4 Cu. Poly	2	18 53 018	ILW4W
#2 Cu. Poly	1/0	18 53 022	ILW2W
#1/0 Cu. Poly	4/0	18 53 028	ILW1/0W
#4/0 Cu. Poly	350	18 53 102	ILW4/0W
350 Cu. Poly	350(2)	18 53 102	ILW350W
500 Cu. Poly	350(2)	18 53 102	ILW500W

NOTES:

1. Lead size is based on current capacity of tap for tap standards and of line for line sectionalizing.
2. The 350 kcmil maximum size of the 2400kV lead has the same emergency rating as the highest rated substation exit cable. A larger size is not needed.
3. The lead wires on this standard are for use on 2.4/4.16kV installations. For higher voltage installations refer to DCS 07 00 80 00.

Spacer Cable – Phase Conductors

Conductor Size, Type and Stranding	Ameren Stock No.	Voltage Rating	Over-all Dia. Inches	Conductor Dia. Inches	Conductor Wt. "Lbs./ Ft."	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Horiz.-4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Major Use
1/0 Al. 7 Str. – Compact	18-53-113	5kV	.508	.336	.788	.778	.503	Line Wire ①
1/0 Al. 7 Str. – Compact	18-07-331	15kV	.638	.336	.909	.909	.546	Line Wire ①
1/0 Al. 7 Str. – Compressed	18-07-300	15kV	.688	.376	.213	--	--	Line Wire ②
3/0 Al. 7 Str. – Compressed	18-07-301	15kV	.764	.452	.323	--	--	Line Wire ②
350 MCM Al. 19 Str. – Compressed	18-07-345	5kV	.849	.679	1.276	1.276	.616	Line Wire ①
477 MCM Al. 19 Str. – Compact	18-07-346	5kV	.892	.722	1.415	1.415	.631	Line Wire ①
350 MCM Al. 19 Str. – Compressed	18-07-302	15kV	.999	.687	.515	--	--	Line Wire ②
477 MCM Al. 19 Str. – Compact	11-1337 ④	15kV	1.022	.722	1.579	1.579	.674	Line Wire ①
477 MCM Al. 19 Str. – Compact	18-07-347	15kV	1.062	.722	.662	--	--	Line Wire ③
500 MCM Al. 35 Str. – Compressed	18-07-303	15kV	1.089	.777	.646	--	--	Line Wire ②
795 MCM Al. 37 Str. – Compact	18-07-351	5kV	1.102	.932	1.890	1.890	.701	Line Wire ①
795 MCM Al. 37 Str. – Compact	18-07-352	15kV	1.232	.932	2.089	2.089	.744	Line Wire ①

NOTES

1. Legacy IP Conductor – For removal only.
2. Legacy CILCO Conductor – For removal only.
3. Ameren Standard Conductor – For all new installations.
4. This Legacy IP conductor no longer has Ameren stock number. It has been merged with the new Hendrix 477 Compact conductor in EMPRV.

Spacer Cable – Messenger

Conductor Size, Type and Stranding	Ameren Stock No.	Voltage Rating	Over-all Dia. Inches	Ultimate Strength in "Lbs"	Conductor Wt. "Lbs./ Ft."	Vert. Wt. Of Cond. +1/2" Ice "Lbs./ Ft."	Horiz. – 4Lbs Wind on 1/2" Ice "Lbs./ Ft."	Major Use
3/8" – 7 Str. C.W.	18-53-113	5 & 15kV	.385	11,440	.3239	--	--	Messenger ②
3/8" – 7 Str. C.W.	18-53-113	5 & 15kV	.385	13,896	.324	.874	.462	Messenger ①
7#7 Alumoweld	27-09-122	5 & 15kV	.433	19,060	.330	.910	.478	Messenger ①
1/2" – 7 Str. C.W.	42-5140 ④	5 & 15kV	.486	16,890	.515	--	--	Messenger ②
052 AWA – 7 Str.	27-59-081	5 & 15kV	.486	17,120	.346	--	--	Messenger ③

NOTES

1. Legacy IP Conductor – For removal only.
2. Legacy CILCO Conductor – For removal only.
3. Ameren Standard Conductor – For all new installations.
4. This Legacy CILCO messenger was made obsolete prior to converting it to an Ameren stock number. 1/2" CW messenger was typically only installed with 500 MCM Al. Conductor.

1. General

- a. Bare wire is the standard conductor for overhead installations of distribution facilities of 15kV or less. Bare Wire should be the first choice for any installation of overhead distribution including Spacer Cable reconductor/rebuilds.
- b. Spacer cable should not be installed in Operating Centers where spacer cable is not already installed. It would require spacer cable specific material to be stocked in the storeroom.
- c. Spacer cable is a viable alternative when clearance is an issue such as:
 - i. Inadequate horizontal clearance to buildings or structures.
 - The compact design of spacer cable offers more clearance from obstacles than open-wire.
 - 2017 NESC Table 234-1, Footnote 2 allows the horizontal clearance to be reduced by 2ft. when spacer cable is installed.
 - ii. Inadequate ROW exists and obtaining additional ROW is cost and/or time prohibitive.
 - iii. Tree trimming requirements would be too extensive to satisfy homeowners.

2. General Installation Practices

- a. Maintain 2 ft. rule:
 - i. Stagger taps and other areas where the covering has been removed to provide a minimum of 2 ft. of horizontal separation between the opening and other openings or ground points.
 - ii. Install Line Duc over the messenger anywhere the cable covering is stripped to maintain the required 2 ft. of horizontal separations.
- b. Lightning protection:
 - i. Ground the messenger at every pole.
 - ii. Install lightning arresters where:
 - The covering has been removed.
 - At all equipment locations.
 - At transitions to open wire.
 - iii. Note that arresters are not required if the covering has been reinsulated.
 - iv. There are no minimum amount of lightning arresters per mile. Arresters only need to be installed as indicated above.
- c. Spacers & Insulators:
 - i. Install a spacer with an anti-sway bracket at every tangent pole.
 - ii. Install spacers every 25 to 33 feet as evenly spaced as possible between tangent poles.
 - iii. Install spacers about 40 feet from dead-end structure to avoid stress at the first spacer.
 - iv. Replace porcelain spacers with poly spacers (stk # 23 67 334) when working on a pole.
 - v. Dead-end messenger and connector using preformed grips when available. See DCS 07 20 11 00.

3. Conductor Current Ratings

Ampacity Ratings in Amps

Conductor Type	Stock number	Voltage Rating	Summer		Winter	
			Normal	Emergency	Normal	Emergency
1/0 Al. 7 Str. – Compact	-- ①	5kV	200	262	327	365
1/0 Al. 7 Str. – Compact	18 07 331 ①	15kV	188	257	322	359
1/0 Al. 7 Str. – Compressed	18 07 300 ②	15kV	188	261	327	365
3/0 Al. 7 Str. – Compressed	18 07 301 ②	15kV	249	347	434	485
350 MCM Al. 19 Str. – Compressed	18 07 345 ①	5kV	401	564	701	788
350 MCM Al. 19 Str. – Compressed	18 07 302 ②	15kV	388	548	684	768
477 MCM Al. 19 Str. – Compact	18 07 346 ①	5kV	477	673	837	941
477 MCM Al. 19 Str. Compact	18 07 347 ③	15kV	461	654	816	917
500 MCM Al. 35 Str. – Compressed	18 07 303 ②	15kV	481	685	854	961
795 MCM Al. 37 Str. – Compact	18 07 351 ①	5kV	649	928	1151	1300
795 MCM Al. 37 Str. – Compact	18 07 352 ①	15kV	627	900	1120	1263

Notes:

1. Legacy IP Conductor – For reference only
2. Legacy CILCO Conductor – For reference only
3. Ameren Standard Conductor – For all new installations
4. This Legacy IP Round conductor no longer has an Ameren Stock number. It has merged with the new Hendrix 477 Compact conductor in EMPRV.
5. Ampacity values are based on the following ambient temperatures: Summer Normal/Emergency at 40°C and Winter Normal/Emergency at -13°C.

1. General

The procedure for installing and sagging spacer cable is much different than bare wire conductor. The steps are:

- a. Pull in the messenger and tension it using a dynamometer.
- b. Pull in the conductors using (PBR-3) Roll-By Stringing Blocks.
- c. Tension the conductors while still in the String Blocks.
- d. Remove the Stringing Block and install spacers.

The information needed to install new cable is shown below in the "Initial Sag" section. Consult the *Hendrix Spacer Cable Installation Guide* for more details.

The conductors can be pulled through angles up to 90°, for pulling lengths up to 5,000 ft., as long as the maximum pulling tension does not exceed 4,000 lbs.

After the spacers have been installed, you have a spacer cable system that can be modeled as a whole. The sag of this system is shown below in the "Final Sag" section. This information can be used for pole selection and checking clearances.

The Final Sag Tables have been organized by ruling span lengths per messenger and conductor types. The ruling spans are "Super Short Span" (100 ft.), "Short Span" (150 ft.), "Medium Span" (200 ft.), "Long Span" (250 ft.) and "Extra Long Span" (300 ft.).

Sags given for "Final Sag" indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

The National Electric Safety Code (NESC) requires that maximum sag (for vertical clearance above ground) be checked at:

- a. 32° F (0° C) with 1/2" ice, No wind (Final) or 120° F, FINAL
- b. Maximum operating design temperature of the line (No Wind)

Other items to consider are:

- a. Conductor Blowout must be checked at 60° F (16° C) FINAL with 6 psf wind to assure necessary clearance to structures adjacent to the line.
- b. Note that spacer cable systems do not gallop thus they do not need to be modeled for galloping.

2. Initial Sag

The messenger wire supports the three conductors and can also be used as the system neutral. The Hendrix 052AWA is the only messenger to be used for new construction.

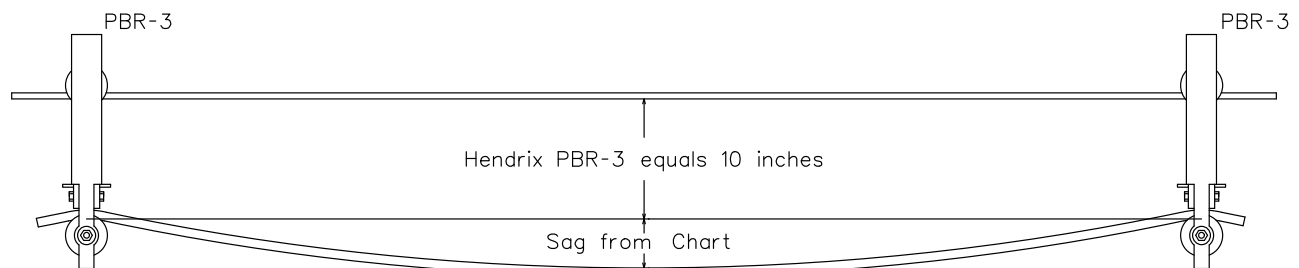
The messenger wire is pulled in and tensioned to the initial tensions shown below, prior to conductor installation.

Initial Tension Table for 052 AWA Messenger for All Span Lengths						
Ambient Temperature during installations (°F)	0	20	40	60	80	100
Tension (lbs.) – All Span Lengths	3,400	3,000	2,600	2,300	2,000	1,700

The values shown above are 300 lbs. above the final desired tension to compensate for the loss of tension which occurs when dead-ending (catching off) the messenger and "settling in"

Once the messenger has been properly tensioned, the conductors can be installed and tensioned to the sag shown below.

Conductor Sag Table – 477 kcmil Al, 19 Strand, Compact Hendrix Conductor					
Ambient Temperature during installations (°F)	10–29	30–49	50–69	70–89	90–109
Sag between roll-by blocks (in) as shown in the illustration below	3	4	5	6	7



3. Final Sag

052 AWA Messenger with 477 Al, 19 Strand, Compact Conductor

DE Tension = 4,912 Lbs

Super Short Span

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		50	60	70	80	90	100	110	120	130	140	150	
-20		3	4	5	7	8	10	12	14	16	19	21	3845
0		3	4	6	15	9	11	13	15	18	20	23	3548
0°, 0.5” ice, 4 psf wind + k		6	9	12	15	18	21	24	28	32	35	39	4912
30		4	5	7	9	11	13	15	18	20	23	26	3206
32°,0.5” ice		7	9	12	15	18	21	25	28	32	36	39	4527
32°,0.5” ice, 2 psf wind		7	9	12	15	18	21	25	28	32	36	40	4574
40		4	5	7	9	11	13	16	18	21	24	27	3077
50		4	6	8	10	12	14	17	19	22	25	28	2954
60		4	6	8	10	12	15	17	20	23	26	29	2835
60°F, 6 psf wind		5	7	9	12	14	17	19	22	25	28	32	3104
70		5	7	9	11	13	16	18	21	24	27	30	2721
80		5	7	9	11	14	16	19	22	25	28	31	2612
90		6	8	10	12	15	17	20	23	25	28	32	2509
100		6	8	10	13	15	18	21	23	26	29	33	2411
120		7	9	12	14	17	19	22	25	28	31	35	2231

DE Tension = 5,873 Lbs

Short Span

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs	
	Span (Ft)→							R.S.						
		100	110	120	130	140	150	160	170	180	190	200		
-20		10	12	14	16	19	21	24	27	30	33	36	3807	
0		11	13	15	18	20	23	26	29	32	35	38	3531	
0°, 0.5" ice, 4 psf wind + k		21	24	28	32	35	39	43	48	52	56	61	5873	
30		13	15	18	20	23	26	29	32	35	38	42	3161	
32°,0.5" ice		21	25	28	32	36	39	43	48	52	56	60	5161	
32°,0.5" ice, 2 psf wind		21	25	28	32	36	40	44	48	52	57	61	5228	
40		13	16	18	21	24	27	30	33	36	39	43	3050	
50		14	17	19	22	25	28	31	34	37	40	44	2945	
60		15	17	20	23	26	29	32	35	38	42	45	2846	
60°F, 6 psf wind		17	19	22	25	28	32	35	38	42	45	49	3249	
70		16	18	21	24	27	30	33	36	39	43	46	2753	
80		16	19	22	25	28	31	34	37	40	44	47	2665	
90		17	20	23	25	28	32	35	38	42	45	49	2582	
100		18	21	23	26	29	33	36	39	43	46	50	2504	
120		19	22	25	28	31	35	38	41	45	48	52	2361	

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

052 AWA Messenger with 477 Al, 19 Strand, Compact Conductor

DE Tension = 6,749 Lbs

Medium Span

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs	
	Span (Ft)→							R.S.						
		150	160	170	180	190	200	210	220	230	240	250		
-20		21	24	27	30	33	36	39	42	46	49	53	4049	
0		23	26	29	32	35	38	41	45	48	52	55	3812	
0°, 0.5” ice, 4 psf wind + k		39	43	48	52	56	61	66	70	75	80	85	6749	
30		26	29	32	35	38	42	45	48	52	56	60	3495	
32°,0.5” ice		39	43	48	52	56	60	65	70	74	79	84	5972	
32°,0.5” ice, 2 psf wind		40	44	48	52	57	61	66	70	75	80	85	6054	
40		27	30	33	36	39	43	46	50	53	57	61	3399	
50		28	31	34	37	40	44	47	51	55	58	62	3308	
60		29	32	35	38	42	45	49	52	56	60	64	3220	
60°F, 6 psf wind		32	35	38	42	45	49	53	57	61	65	69	3714	
70		30	33	36	39	43	46	50	54	57	61	65	3137	
80		31	34	37	40	44	47	51	55	59	63	66	3058	
90		32	35	38	42	45	49	52	56	60	64	68	2983	
100		33	36	39	43	46	50	54	57	61	65	69	2912	
120		35	38	41	45	48	52	56	60	64	68	72	2779	

DE Tension = 7,557 Lbs

Long Span

Temp. Deg. F ↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		200	210	220	230	240	250	260	270	280	290	300	
-20		36	39	42	46	49	53	56	60	64	68	72	4304
0		38	41	45	48	52	55	59	63	67	71	75	4095
0°, 0.5" ice, 4 psf wind + k		61	66	70	75	80	85	90	95	101	106	111	7557
30		42	45	48	52	56	60	63	67	71	75	79	3813
32°,0.5" ice		60	65	70	74	79	84	89	94	99	105	110	6715
32°,0.5" ice, 2 psf wind		61	66	70	75	80	85	90	95	100	105	111	6811
40		43	46	50	53	57	61	65	69	73	77	81	3726
50		44	47	51	55	58	62	66	70	74	78	83	3644
60		45	49	52	56	60	64	68	72	76	80	84	3564
60°F, 6 psf wind		49	53	57	61	65	69	73	77	82	86	91	4139
70		46	50	54	57	61	65	69	73	77	81	86	3488
80		47	51	55	59	63	66	70	75	79	83	87	3415
90		49	52	56	60	64	68	72	76	80	84	89	3346
100		50	54	57	61	65	69	73	78	82	86	90	3279
120		52	56	60	64	68	72	76	80	85	89	93	3153

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions

3/8" EHS Copperweld Messenger

1/0 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		4	12	19	28	44
0°, 0.5" ice, 4 psf wind + k		19	35	55	74	98
60°F		7	15	25	38	54
120°F		10	19	30	47	63
Heavy Loading Tension (Lbs)		4000	4650	5300	5900	6420

477 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		11	22	36	53	72
0°, 0.5" ice, 4 psf wind + k		23	42	66	74	121
60°F		13	26	42	60	80
120°F		18	29	48	67	88
Heavy Loading Tension (Lbs)		4600	5600	6400	7150	7950

795 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)			
				R.S.	
		100	150	200	250
0°		14	29	45	68
0°, 0.5" ice, 4 psf wind + k		26	48	76	104
60°F		17	33	51	73
120°F		20	37	56	79
Heavy Loading Tension (Lbs)		5100	6200	6900	8050

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions

7#7 Alumoweld Messenger

1/0 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		4	10	18	28	40
0°, 0.5" ice, 4 psf wind + k		18	34	54	75	99
60°F		7	15	24	37	51
120°F		11	21	32	48	63
Heavy Loading Tension (Lbs)		4360	5190	5880	6550	7225

477 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		10	22	35	51	69
0°, 0.5" ice, 4 psf wind + k		22	41	63	88	115
60°F		13	27	41	59	78
120°F		17	32	48	66	86
Heavy Loading Tension (Lbs)		5030	6100	7000	7925	8700

795 SAC 5kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		10	22	35	51	69
0°, 0.5" ice, 4 psf wind + k		22	41	63	88	115
60°F		13	27	41	59	78
120°F		17	32	48	66	86
Heavy Loading Tension (Lbs)		5450	6450	7730	8560	9650

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions

3/8" EHS Copperweld Messenger

1/0 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		6	14	25	37	51
0°, 0.5" ice, 4 psf wind + k		20	38	57	75	115
60°F		9	19	30	45	64
120°F		12	23	36	55	72
Heavy Loading Tension (Lbs)		4100	4800	5540	6220	6700

477 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		11	24	39	57	78
0°, 0.5" ice, 4 psf wind + k		24	46	69	98	137
60°F		14	28	45	64	85
120°F		18	32	51	71	89
Heavy Loading Tension (Lbs)		4880	5800	6800	7600	8300

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
7#7 Alumoweld Messenger

1/0 15kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		5	11	18	28	40
0°, 0.5" ice, 4 psf wind + k		16	31	49	69	90
30°		6	12	21	32	45
32°, 0.5" ice		16	30	47	65	86
32°, 0.5" ice, 2 psf wind		16	30	47	66	87
60°F		7	15	25	36	50
60°F, 4 psf wind		9	18	29	42	56
60°F, 6 psf wind		10	20	32	46	61
90°F		9	18	29	41	55
120°F		11	21	33	46	61
167°F		15	27	39	54	69
Heavy Loading Tension (Lbs)		4219	4935	5604	6228	6813

477 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		10	21	34	49	67
0°, 0.5" ice, 4 psf wind + k		20	38	58	81	107
30°		11	23	37	53	71
32°, 0.5" ice		20	37	57	80	104
32°, 0.5" ice, 2 psf wind		20	38	58	80	105
60°F		13	40	40	57	75
60°F, 4 psf wind		14	27	42	59	78
60°F, 6 psf wind		15	29	44	62	82
90°F		15	43	43	60	79
120°F		17	46	46	64	83
167°F		20	51	51	70	90
Heavy Loading Tension (Lbs)		4859	5829	6715	7532	8294

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY IP – This information is **FOR MAINTENANCE USE ONLY**

795 SAC 15kV Spacer Cable – MAINTENANCE USE ONLY

Temp. Deg. F ↓	Condition → Span (Ft) →	FINAL SAG (inches)				
				R.S.		
		100	150	200	250	300
0°		14	27	43	61	82
0°	0.5" ice, 4 psf wind + k	23	42	64	89	117
30°		15	29	46	65	85
32°	0.5" ice	23	42	64	88	115
32°	0.5" ice, 2 psf wind	23	42	64	89	116
60°F		17	31	48	68	89
60°F	4 psf wind	17	32	50	70	92
60°F	6 psf wind	18	34	52	72	95
90°F		18	34	51	71	93
120°F		20	36	54	74	96
167°F		23	39	59	79	102
Heavy Loading Tension (Lbs)		5324	6463	7493	8440	9320

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY CILCO – This information is **FOR MAINTENANCE USE ONLY**

Final Sags and Tensions
3/8" Copperweld Messenger
1/0 15kV Spacer Cable – **MAINTENANCE USE ONLY**

DE Tension = 4,495 Lbs

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		5	6	8	9	11	12	14	16	18	20	22	2916
0		6	7	8	10	12	13	15	17	19	21	23	2671
0°, 0.5” ice, 4 psf wind + k		18	22	25	28	32	36	39	43	47	52	56	4495
30		6	8	10	12	13	15	17	19	22	24	26	2326
32°,0.5” ice		18	21	24	27	31	34	38	41	45	49	53	3848
32°,0.5” ice, 2 psf wind		18	21	24	28	31	35	38	42	46	50	54	3921
40		7	9	10	12	14	16	18	20	23	25	27	2218
50		8	9	11	13	15	17	19	21	24	26	29	2114
60		8	10	12	13	15	18	20	22	24	27	30	2015
60°F, 6 psf wind		11	13	15	18	20	23	26	28	32	34	37	2377
70		9	10	12	14	16	18	21	23	26	28	31	1921
80		9	11	13	15	17	19	22	24	27	29	32	1831
90		10	12	14	16	18	20	23	25	28	30	33	1747
100		10	12	14	17	19	21	24	26	29	32	34	1667
120		12	14	16	18	21	23	26	28	31	34	37	1523

3/8" Copperweld Messenger
3/0 15kV Spacer Cable – **MAINTENANCE USE ONLY**

DE Tension = 4,677 Lbs

Temp. Deg. F↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		7	8	10	12	13	15	17	20	22	24	37	3019
0		8	9	11	13	15	17	19	21	24	26	29	2793
0°, 0.5” ice, 4 psf wind + k		20	23	26	30	34	37	42	46	50	54	59	4677
30		9	10	12	14	16	19	21	24	26	29	32	2479
32°,0.5” ice		19	22	26	29	33	36	40	44	48	52	57	4057
32°,0.5” ice, 2 psf wind		19	23	26	29	33	37	41	45	49	53	57	4125
40		9	11	13	15	17	20	22	25	27	30	33	2382
50		10	12	14	16	18	20	23	25	28	31	34	2289
60		10	12	14	16	19	21	24	26	29	32	35	2200
60°F, 6 psf wind		13	15	18	20	23	26	28	31	35	38	41	2541
70		11	13	15	17	19	22	25	27	30	33	36	2115
80		11	13	15	18	20	23	26	28	31	34	37	2034
90		12	14	16	19	21	24	26	29	32	35	38	1957
100		12	15	17	19	22	25	27	30	33	36	39	1885
120		13	16	19	21	24	27	29	32	35	39	42	1752

Note:

- Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY CILCO – This information is **FOR MAINTENANCE USE ONLY**

3/8" Copperweld Messenger
350 MCM 15kV Spacer Cable – MAINTENANCE USE ONLY

DE Tension = 5,072 Lbs

Temp. Deg. F ↓	Condition→	FINAL SAG (inches)											Tension Lbs
	Span (Ft)→						R.S.						
		100	110	120	130	140	150	160	170	180	190	200	
-20		9	11	13	16	18	21	23	26	29	32	35	3212
0		10	12	15	17	19	22	25	27	30	34	37	3015
0°, 0.5” ice, 4 psf wind + k		22	25	29	33	37	41	46	50	55	60	64	5072
30		12	14	16	19	21	24	27	30	33	36	40	2743
32°,0.5” ice		22	25	29	33	36	40	45	49	54	58	63	4483
32°,0.5” ice, 2 psf wind		22	25	29	33	37	41	45	50	54	59	63	4547
40		12	14	17	19	22	25	28	31	34	37	41	2659
50		13	15	17	20	23	26	29	32	35	38	42	2578
60		13	15	18	21	23	26	29	33	36	39	43	2501
60°F, 6 psf wind		16	18	21	24	27	30	34	37	41	44	48	2876
70		14	16	19	21	24	27	30	33	37	40	44	2427
80		14	17	19	22	25	28	31	34	38	41	45	2356
90		15	17	20	23	26	29	32	35	39	42	46	2288
100		15	18	21	24	27	30	33	36	40	43	47	2224
120		17	19	22	25	28	31	35	38	42	45	49	2104

1/2" Copperweld Messenger
500 MCM 15kV Spacer Cable – MAINTENANCE USE ONLY

DE Tension = 6,710 Lbs

Temp. Deg. F↓	Condition→	FINAL SAG (inches)							Tension Lbs
	Span (Ft)→					R.S.			
		110	120	130	140	150	160	170	
-20		10	12	14	16	18	20	23	4742
0		11	13	15	17	19	22	24	4412
0°, 0.5” ice, 4 psf wind + k		21	25	28	32	35	39	43	6710
30		12	15	17	19	22	24	27	3958
32°,0.5” ice		22	25	28	32	35	39	43	5945
32°,0.5” ice, 2 psf wind		22	25	28	32	36	39	43	6012
40		13	15	18	20	22	25	28	3818
50		14	16	18	21	23	26	29	3685
60		14	17	19	21	24	27	30	3557
60°F, 6 psf wind		16	19	21	24	27	30	33	3950
70		15	17	20	22	25	28	31	3436
80		16	18	20	23	26	29	32	3320
90		16	19	21	24	27	30	33	3211
100		17	19	22	25	28	30	33	3107
120		18	21	24	27	29	32	36	2916

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

NOTE: The following conductors are installed in LEGACY CILCO – This information is **FOR MAINTENANCE USE ONLY**

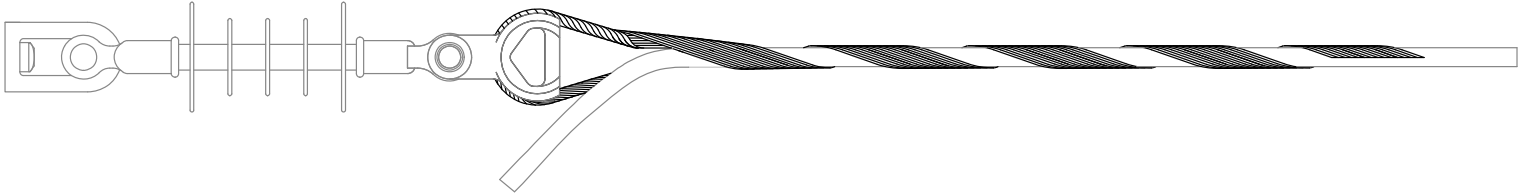
1/2" Copperweld Messenger
500 MCM 15kV Spacer Cable – MAINTENANCE USE ONLY

DE Tension = 7,907 Lbs

Temp. Deg. F↓	Condition→	FINAL SAG (inches)							Tension Lbs
	Span (Ft)→				R.S.				
		170	180	190	200	210	220	230	
-20		21	23	26	28	31	34	37	5354
0		22	25	27	30	33	36	39	5043
0°, 0.5" ice, 4 psf wind + k		41	45	49	53	57	62	66	7907
30		25	27	30	33	36	39	42	4613
32°,0.5" ice		41	45	49	53	57	61	65	7065
32°,0.5" ice, 2 psf wind		41	45	49	53	57	62	66	7147
40		26	28	31	34	37	40	43	4479
50		27	29	32	35	38	41	44	4351
60		27	30	33	36	39	42	45	4227
60°F, 6 psf wind		31	34	37	40	44	47	51	4708
70		28	31	34	37	40	43	47	4109
80		29	32	35	38	41	45	48	3995
90		30	33	36	39	42	46	49	3886
100		31	34	37	40	44	47	50	3782
120		33	36	39	42	46	49	53	3588

Note:

1. Sags given indicate the **sag of the messenger** with the weight of the entire spacer cable system (Messenger, conductors, and spacers) at the particular condition. The distance from the messenger to the lowest conductor at the maximum conductor sag, 20 inches, must be added to the messenger sag for final sag of the conductor.

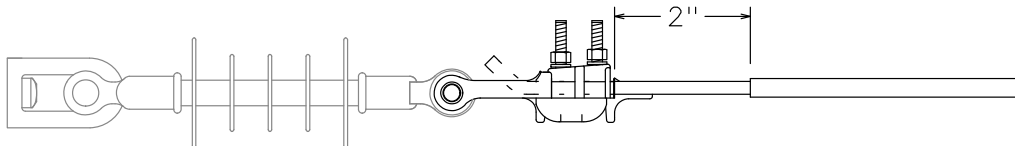


Preformed Type – Phase Conductors

Std. / Stk. No.	Description	07 20 11 00	New / Maint	Legacy Co.
17 69 064	Deadend, Preformed, 1/0 5kV		M	IP
23 78 433	Deadend, Preformed, 1/0 15kV		M	IP
23 78 433	Deadend, Preformed, 1/0 15kV		M	CILCO
17 69 061	Deadend, Preformed, 350 MCM 5kV		M	IP
17 69 058	Deadend, Preformed, 350 MCM 15kV		M	CILCO
17 69 060	Deadend, Preformed, 477 MCM 5kV		M	IP
23 68 701	Deadend, Preformed, 477 MCM 15kV		N	IP & New Installs
17 69 058	Deadend, Preformed, 500 MCM 15kV		M	CILCO
17 69 058	Deadend, Preformed, 795 MCM 5kV		M	IP
17 69 062	Deadend, Preformed, 795 MCM 15kV		M	IP

Preformed Type – Messenger

Std. / Stk. No.	Description	07 20 11 00	New / Maint	Legacy Co.
23 68 543	Deadend, Preformed, 7#7 Alumoweld		M	IP
23 68 277	Deadend, Preformed, 1/2" CW		M	CILCO
17 69 061	Deadend, Preformed, 052 AWA		N	New Installs



Clamp Type – Phase Conductors – **LIMITED USE and MAINTENANCE ONLY**

Std. / Stk. No.	Description	07 20 11 00	New / Maint	Legacy Co.
23 18 397	Clamp, Deadend, 1/0 Al. 15kV		M	CILCO
23 18 397	Clamp, Deadend, 3/0 Al. 15kV		M	CILCO
23 18 292	Clamp, Deadend, 350 MCM Al. 15kV		M	CILCO
23 18 292	Clamp, Deadend, 500 MCM Al. 15kV		M	CILCO

Clamp Type – Messenger – **LIMITED USE and MAINTENANCE ONLY**

Std. / Stk. No.	Description	07 20 11 00	New / Maint	Legacy Co.
23 18 394	Clamp, Deadend, 3/8" CW		M	CILCO
23 18 395	Clamp, Deadend, 1/2" CW		M	CILCO

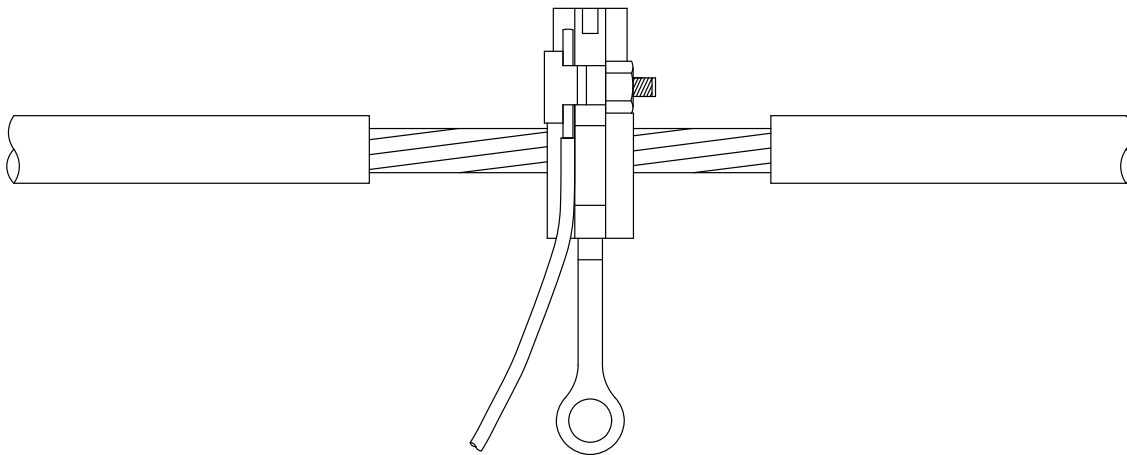
General

Hot line clamps shall be used to make connections on lines rated over 5000 volts phase to phase where the connection must be made "hot" or where it is likely that the connection will have to be disconnected and reconnected with some degree of frequency. **Avoid the use of hot line clamps where currents exceed 250 amps**

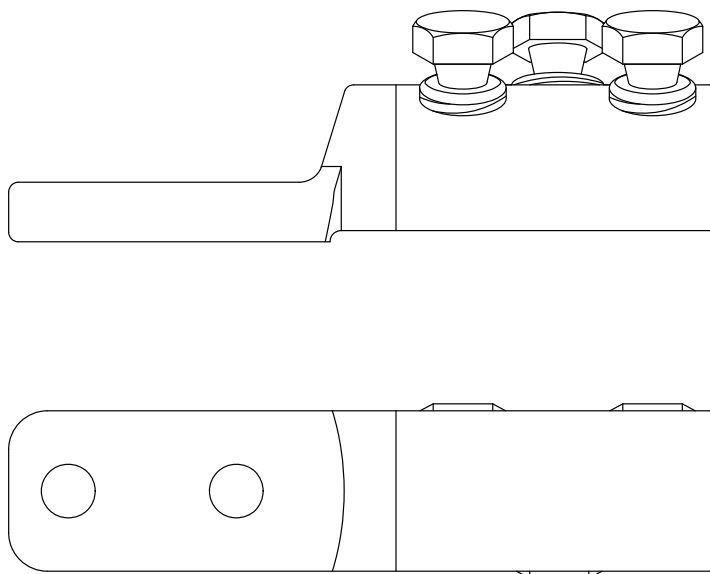
Aluminum hot line clamps shall be connected directly to unprotected aluminum line conductors of like material **when making no load taps**. This includes switches and lightning arresters.

INSTALLATION OF HOT LINE CLAMPS

- a. Use the proper size and type clamps as shown in the following tables.
- b. Apply corrosion resisting lubricant, 31 59 058 – BT.



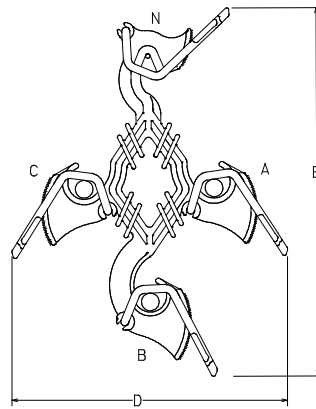
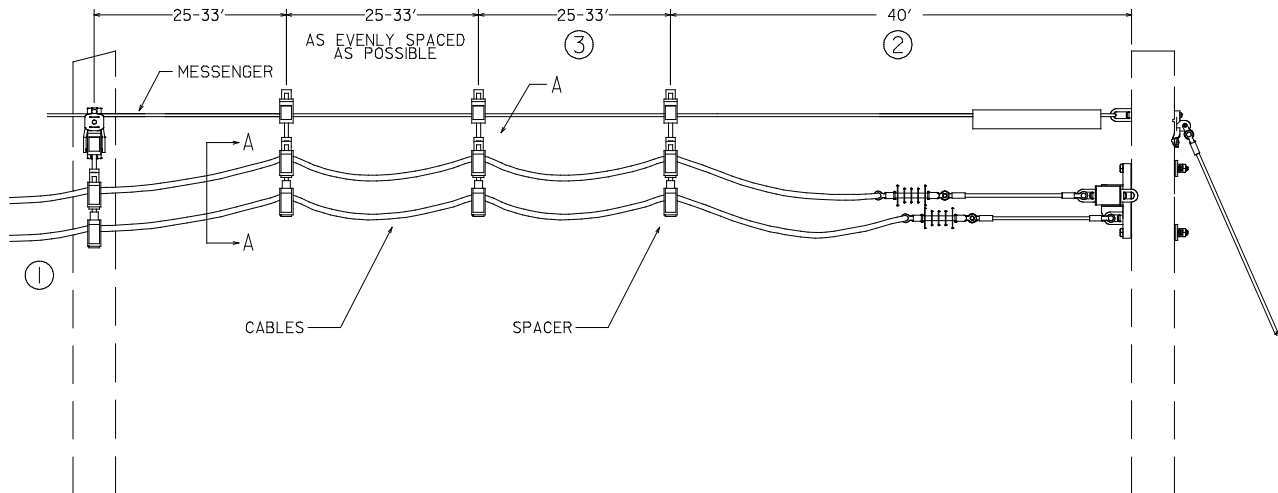
Std. / Stk. No.	Description	07 20 21 00
17 62 088	Clamp, Hot Line, 1/0 Al. – Spacer Cable	
17 62 088	Clamp, Hot Line, 3/0 Al. – Spacer Cable	
17 62 088	Clamp, Hot Line, 350 MCM Al. – Spacer Cable	
17 62 088	Clamp, Hot Line, 477 MCM Al. – Spacer Cable	
17 62 112	Clamp, Hot Line, 500 MCM Al. – Spacer Cable	
17 62 112	Clamp, Hot Line, 795 MCM Al. – Spacer Cable	



Std. / Stk. No.	Description	07 20 30 00
17 55 804	Lug, Connecting, Shear Bolt, 350 MCM Al. 19 Str. – 5kV	
17 55 804	Lug, Connecting, Shear Bolt, 477 MCM Al. 19 Str. Round – 5kV	
17 55 804	Lug, Connecting, Shear Bolt, 350 MCM Al. 19 Str. – 15kV	
17 55 804	Lug, Connecting, Shear Bolt, 477 MCM Al. 19 Str. Round – 15kV	
17 55 804	Lug, Connecting, Shear Bolt, 477 MCM Al. 19 Str. Compact – 15kV	
17 55 804	Lug, Connecting, Shear Bolt, 500 MCM Al. 35 Str. – 15kV	
17 55 804	Lug, Connecting, Shear Bolt, 795 MCM Al. 37 Str. – 5kV	
17 55 804	Lug, Connecting, Shear Bolt, 795 MCM Al. 37 Str. – 15kV	

Notes

1. For spacer cable conductor sizes 1/0 and 3/0, there are no lugs available. A PG clamp shall be used to connect a short poly covered copper lead wire to the spacer cable that could then be terminated into the device.



Detail A-A

Dim. (in)		Conductor Spacing (in)			Min. Leakage Distance (in)	Messenger Range	Cable Range (in)	Max. System Voltage (KV)	Short Circuit Rating (kA)	Weight (lbs)
D	E	AN	AC	BC						
161/2	23 1/2	8 1/2	8	8	10 3/4	.375-.750	.438-2.00	15	13.5	2.5

		Std. / Stk. No.	Description	07 20 45 01	
	A	23 67 334	Spacer, High Density Polyethylene		1

NOTES

- When replacing an existing pole built to the old standard with spacers three foot on either side of the pole, remove these two spacers as long as the next spacer is less than 33 feet away on either side.
- Install spacers about 40 ft. From dead-end structures.
- Install spacers every 25-33 FT as evenly spaced as possible.

General

Maintaining the proper conductor clearance is one of the most important steps to insuring reliable operation of spacer cable. This can be achieved either by separation or insulation. There must be 2 ft. of horizontal separation between any two exposed primary conductors or between exposed primary conductors and ground points. If this clearance cannot be achieved, the vertical spacing must revert back to that of bare wire conductor. For this reason, properly staggering the openings, covering openings, and installation of Line Duc (a covering to insulate the messenger) is vital for achieving the desired reliability. This proper staggering of openings is detailed in the construction standards for each configuration.

This standard will address the methods and materials for:

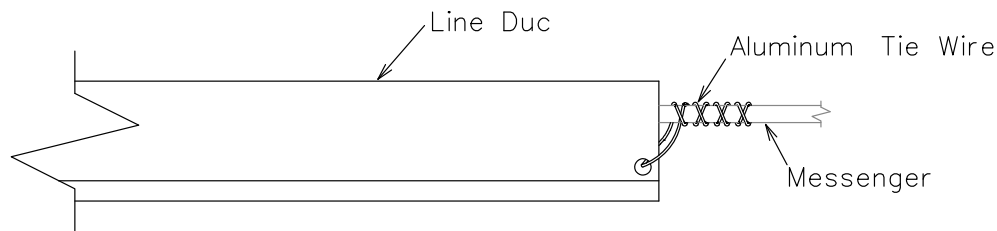
- a. Messenger Splices
- b. Installing Line Duc
- c. Conductor Splices & Coverings
 - Splice kits
 - Covering openings with tape
 - Covering taps with Line Duc

Messenger Splices

Std. / Stk. No.	Description	07 20 85 00
17 63 300	Splice, NM, 55 in. Long, Preformed, 7#6 AWA or 052 AWA	
17 63 299	Splice, NM, 38 in. Long, Preformed, 7#8 AWA or 252 AWA	
17 60 582	Connector, Splice, Automatic, 7#7 AWA	
17 60 165	Sleeve, Conductor, 3/8" Copperweld	
17 60 235	Sleeve, Conductor, 1/2" Copperweld	

Once the messenger has been repaired, install a #2 copper jumper wire to restore full electrical conductivity.



Installing Line Duc

Hendrix Line Duc must be installed on the messenger above a tap, or any other open point, to avoid outages. All taps should be a minimum of 2'-0" horizontal separation from ground points, splices, spacers, brackets, etc. When installing multiple taps, they should be offset from each other by a minimum of 2'-0". Secure one end of the Line Duc with aluminum tie wire as shown in the above drawing.

Conductor Splices & Coverings

Stk. No.	Conductor Size	Legacy Co.	Description	07 20 85 00
17 60 731	1/0 Al. 7 Str.	IP	Sleeve, Compression, 1/0 Spacer Cable	
17 55 782			Splice, Cold Shrink, 1/0 AWG – 3/0 AWG, Poly	
17 60 462	1/0 Al. 7 Str.	CILCO	Sleeve, Compression, 1/0 Spacer Cable	
17 55 782			Splice, Cold Shrink, 1/0 AWG – 3/0 AWG, Poly	
17 60 584	3/0 Al. 7 Str.	CILCO	Sleeve, Compression, 3/0 Spacer Cable	
17 55 782			Splice, Cold Shrink, 1/0 AWG – 3/0 AWG, Poly	
17 60 209	350 MCM Al. 19 Str.	IP	Sleeve, Compression, 350 MCM Spacer Cable	
17 55 783			Splice, Cold Shrink, 4/0 AWG – 266.8 KCMIL	
17 60 654	477 MCM Al. 19 Str.–Round	IP	Sleeve, Compression, 397.5 KCMIL – 500 KCMIL	
17 55 791			Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL	
17 60 650	350 MCM Al. 19 Str.	CILCO	Sleeve, Compression, 350 KCMIL	
17 55 791			Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL	
17 60 650	477 MCM Al. 19 Str.–Compact	New Installs	Sleeve, Compression, 477 MCM Compact Spacer Cable	
17 55 791			Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL	
17 60 653	477 MCM Al. 19 Str.–Round to 477 MCM Al. 19 Str.–Compact	IP & New Installs	Sleeve, Compression, 477 Compact to 477 Round	
17 55 791			Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL	
17 60 572	500 MCM Al. 35 Str.	CILCO	Sleeve, Compression, 500 MCM Spacer Cable	
17 55 791			Splice, Cold Shrink, 336.4 KCMIL – 477 KCMIL	
17 60 694	795 MCM Al. 37 Str.	IP	Sleeve, Compression, 795 MCM Spacer Cable	
17 55 784			Splice, Cold Shrink, 795 MCM Spacer Cable	

Covering openings with tape**Step 1**

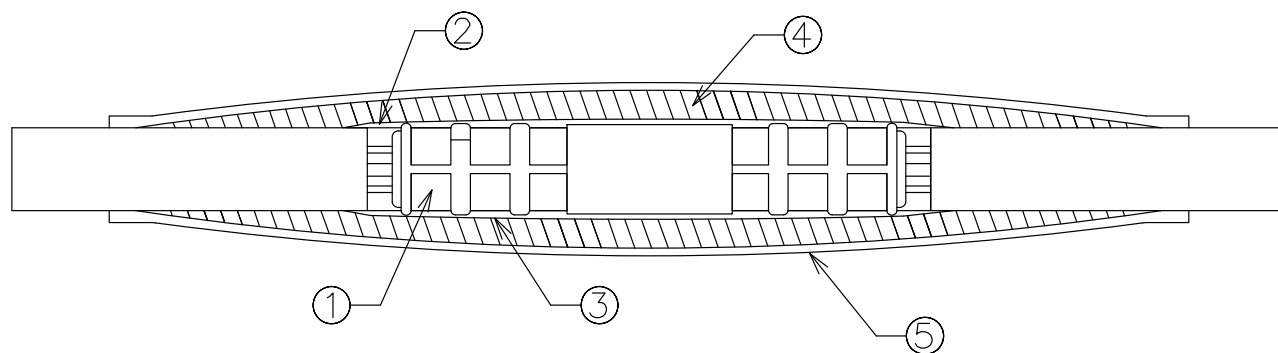
If the conductor has a semiconducting layer, Install one half-lapped layer of semiconducting tape, 25 53 076. This step is omitted if the conductor doesn't have a semiconducting layer.

Step 2

Install half-lapped layers of filler tape, 25 53 123, to match the thickness of the original conductor installation.

Step 3

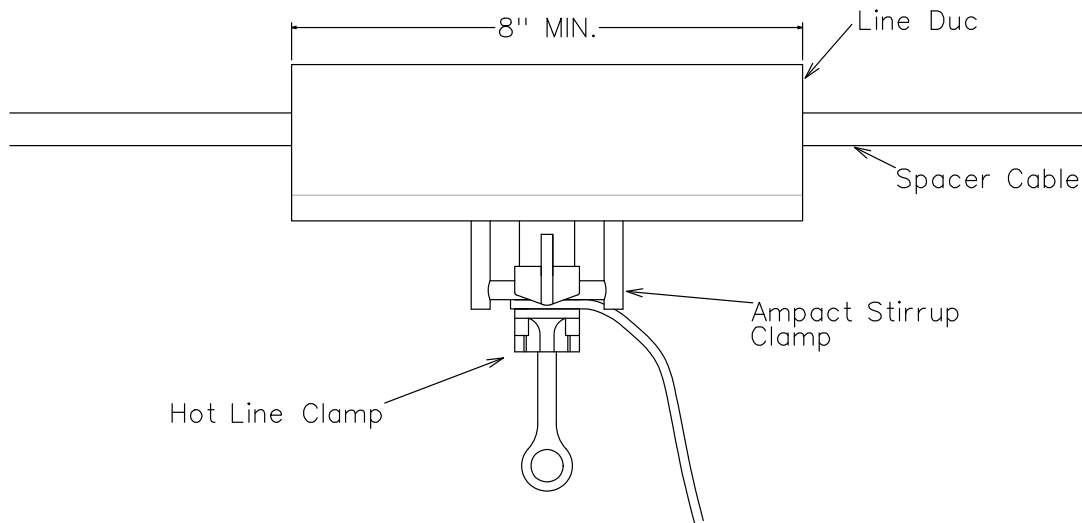
Install three half-lapped layers of tape, 25 53 077.



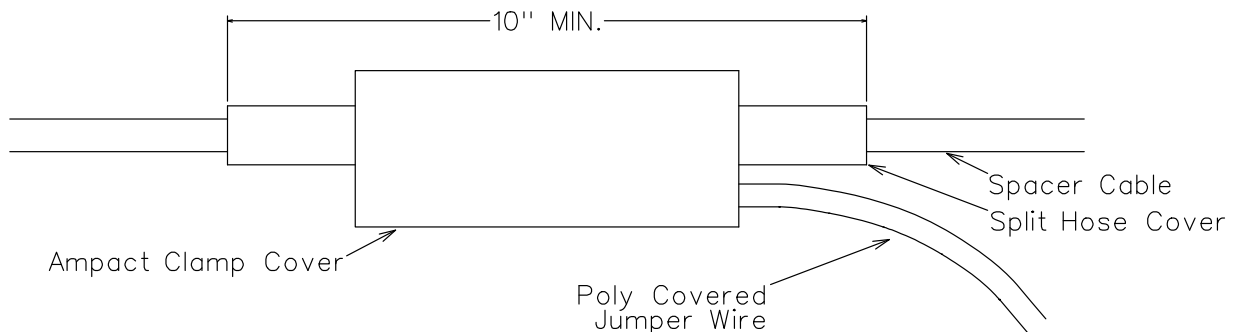
1. Partial Tension Compression Sleeve
2. Strips – 3M Insulating Mastic
3. Roll – 3M Semi-conducting Tape
4. 3M Rubber Mastic Tape
5. 3M Cold Shrink Silicone Splice (Length of tube is approximately 22")

Covering taps with Line Duc

On poles where uncovered Ampact style stirrup clamps that do not have the required 2 feet separation are installed on spacer cable, Jumbo Line Duc (69 58 293) may be used to cover the stirrup clamp to reduce the possibility of phase to phase or phase to ground wildlife contact. This should be used as a maintenance practice only. Line Duc may need to be heated or stretched to fit cover the stirrup clamp. The Line Duc will NOT fit over the new style hot line clamps. If the pole is getting replaced, then the taps should be re-installed with the appropriate 2 feet spacing as identified in the standard.



On poles where uncovered Ampact style connectors are used to connect jumpers on spacer cable, an Ampact cover (stk# 40 79 742) and split hose (stk# 71 25 214) may be used to reduce the possibility of phase to phase or phase to ground wildlife contact. This should be used as a maintenance practice only. If the pole is getting replaced, then the jumpers should be re-installed with the appropriate and connectors with covers shall be used as identified in the standard.



NOTES

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■ SECONDARY CONNECTIONS & FASTENINGS, TRIPLEX ALUMINUM CABLE SECONDARY SPLIT	08-01-24**

1. GENERAL

This standard prescribes standard types, sizes, and major uses for secondary conductors, fittings, and fastenings. Connectors, sleeves and other fittings which are used with primaries, as well as secondaries, are specified in Section 07 (Primary Conductors & Fastenings.)

2. CONDUCTORS

2.1 Sizes and Current Ratings

Triplex

Conductor	Messenger	Code Name	Current Rating (amps)	R.B.S. (pounds)	Phase Dia. (inches)	Msgr Dia. (inches)	Stock Number
1/0 AA XLP 300 V ⁽¹⁾	1/0 ACSR	Neritina	Summer 205 Winter 265	4380	0.477	0.398	18-05-095
4/0 AA XLP 300 V ⁽¹⁾	4/0 ACSR	Zuzara	Summer 315 Winter 410	8350	0.626	0.563	18-05-089

Open Wire

Phase Conductor	Neutral	Code Name	Current Rating (amps)	R.B.S. (pounds)	Phase Dia. (inches)	Msgr Dia. (inches)	Stock Number
4/0 AA XLP		Olive	Summer 385	3440	0.626		18-05-059
	1/0 AAAC bare	Azuza	Winter 425	4460		0.398	18-05-060
1/0 AAAC XLP		Oilnut	Summer 262	4010	0.518		18-05-067
	1/0 AAAC bare	Azuza	Winter 289	4460		0.398	18-05-060

Parallel Lashed

Phase Conductor	Messenger	Code Name	Current Rating (amps)	R.B.S. (pounds)	Phase Dia. (inches)	Msgr Dia. (inches)	Stock Number
4/0 AA XLP		San Juan	Summer 315		0.626		18-05-069
300V ⁽¹⁾	1/0 AAAC bare		Winter 410	4460		0.398	
3/0 AA XLP		Padre Island	Summer 275		0.57		18-05-187
300 V ⁽¹⁾	3/0 AAAC bare		Winter 360	6790		0.502	

Notes:

1. Line-to-Ground insulation

2.2 Major Use

Triplex cable shall be used for new construction.

Open wire or parallel lashed cables can be used if rebuilding or if conditions warrant (example: transfer of existing conductor or short extension of span or two to match existing construction; large number of flying services required). If multiplex cable is used, **the messenger will serve as the primary system neutral if the conductor is 1/0 or larger.** If the messenger of the multiplex cable is smaller than 1/0, a separate 1/0 AAAC neutral must be installed.

2.3 Sag

Open wire secondary conductors can be sagged using the tables shown in Dist. Std. 08 00 01 01. The table for bare 1/0 AAAC neutral is shown in Dist. Std. 07 00 07 **.

Triplex and quadruplex cables used as secondary should use the sag tables shown in Dist. Std. 08 00 01 02.

3.0 NEUTRAL CONNECTIONS ON POLES

- 3.1 7#10 Copperweld wire shall never be used as a neutral conductor or to connect neutral conductors at a pole.
- 3.2 The minimum size neutral conductor at a pole shall be #2 AWG copper wire or the smaller of the two neutral wires being connected at the pole.

4/0 AAC POLY

Short Span – SPAN (in feet)

AMB TEMP DEG F	INITIAL (Stringing) SAG (in Inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Ten- sion
0	20	25	29	34	40	46	52	59	66	74	81	183
30	23	27	32	38	44	51	58	65	73	81	90	166
40	23	28	33	39	45	52	59	67	75	84	93	161
50	24	29	34	40	47	54	61	69	77	86	95	157
60	24	30	35	41	48	55	63	71	79	88	98	153
70	25	30	36	42	49	56	64	72	81	90	100	149
80	26	31	37	43	50	58	66	74	83	93	103	146
90	26	32	38	44	51	59	67	76	85	95	105	143
100	27	32	39	45	53	60	69	78	87	97	107	140

Medium Span – SPAN (in feet)

AMB TEMP DEG F	INITIAL (Stringing) SAG (in Inches)											
	150	160	170	180	190	200 R.S.	210	220	230	240	250	Initial Ten- sion
0	27	31	35	40	44	49	54	59	65	70	76	309
30	32	36	41	45	51	56	62	68	74	81	88	269
40	33	37	42	47	53	58	64	71	77	84	91	258
50	34	39	44	49	55	61	67	73	80	87	95	249
60	35	40	45	51	57	63	69	76	83	90	98	241
70	37	42	47	53	59	65	72	79	86	93	101	233
80	38	43	48	54	60	67	74	81	89	96	105	226
90	39	44	50	56	62	69	76	83	91	99	108	220
100	40	45	51	57	64	71	78	86	94	102	111	214

4/0 AAC POLY

Short Span – SPAN (in feet)

DE Tension = 944 LBS.

COND TEMP DEG F	FINAL SAG (in Inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	19	23	28	33	38	43	49	56	62	70	77
0	21	25	30	35	41	47	53	60	67	75	83
32 + 1/2" ice	24	29	34	40	47	54	61	69	77	86	95
30	23	28	33	39	45	51	58	66	74	82	91
50	24	29	35	41	47	54	62	70	78	87	97
60	25	30	36	42	49	56	63	72	80	89	99
70	25	31	37	43	50	57	65	73	82	92	102
90	27	32	38	45	52	60	68	77	86	96	106
120	28	34	41	48	55	63	72	82	91	102	113
194	32	39	46	54	63	72	82	92	104	116	128

Medium Span – SPAN (in feet)

DE Tension = 1306 LBS.

COND TEMP- DEG F	FINAL SAG (in Inches)										
	150	160	170	180	190	200 R.S.	210	220	230	240	250
-20	27	31	35	39	44	49	54	59	64	70	76
0	30	34	39	43	48	54	59	65	71	77	84
32 + 1/2" ice	38	43	49	55	61	68	74	82	89	97	106
30	34	39	44	49	55	60	67	73	80	87	95
50	36	41	47	52	58	65	71	78	86	93	101
60	38	43	48	54	60	67	74	81	88	96	104
70	39	44	50	56	62	69	76	83	91	99	107
90	41	46	52	59	66	73	80	88	96	105	113
120	44	50	56	63	70	78	86	94	103	112	122
194	51	58	65	73	81	90	99	109	119	130	141

1/0 AAAC POLY

Short Span – SPAN (in feet)

Amb Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	5	6	8	9	10	12	14	15	17	19	21	474
30	8	9	11	13	15	18	20	23	25	28	31	320
40	9	11	13	15	17	20	22	25	28	32	35	284
50	10	12	14	16	19	22	25	28	32	35	39	255
60	11	13	16	18	21	24	28	31	35	39	43	234
70	12	14	17	20	23	27	30	34	38	43	47	211
80	13	15	18	22	25	29	33	37	41	46	51	195
90	14	17	20	23	27	31	35	40	44	49	55	182
100	15	18	21	25	29	33	37	42	47	53	58	171

Medium Span

Amb Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	150	160	170	180	190	200 R.S.	210	220	230	240	250	Initial Tension
0	11	13	15	17	18	20	22	25	27	29	32	489
30	16	18	20	23	25	28	31	34	37	40	44	355
40	17	20	22	25	28	31	34	37	41	44	48	323
50	19	22	24	27	30	34	37	41	44	48	53	297
60	20	23	26	29	33	36	40	44	48	52	57	274
70	22	25	28	32	35	39	43	47	52	56	61	255
80	23	27	30	34	38	42	46	51	55	60	65	239
90	25	28	32	36	40	44	49	54	59	64	69	225
100	26	30	34	38	42	47	52	57	62	68	73	213

1/0 AAAC 7 STR POLY
Short Span – SPAN (in feet)

DE Tension = 1152 LBS.

Cond Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	5	6	7	8	10	11	13	14	16	18	20
0	7	8	10	12	14	16	18	20	23	25	28
32 + 1/2" ice	16	19	23	27	31	36	41	46	52	58	64
30	10	13	15	18	20	23	27	30	34	38	42
50	13	15	18	21	25	28	32	36	41	45	50
60	14	16	20	23	27	31	35	39	44	49	54
70	15	18	21	25	29	33	37	42	47	53	58
90	16	20	24	28	32	37	42	47	53	59	66
120	19	23	27	32	37	42	48	55	61	68	76
194	24	29	35	41	47	54	61	69	78	87	96

Medium Span

DE Tension = 1348 LBS.

Cond Temp. Deg. F	FINAL SAG (in inches)										
	150	160	170	180	190	200 R.S.	210	220	230	240	250
-20	12	13	15	17	19	21	23	25	27	30	32
0	15	17	19	22	24	27	29	32	35	38	42
32 + 1/2" ice	30	34	39	43	48	54	59	65	71	77	84
30	20	23	26	29	32	36	40	44	48	52	56
50	24	27	30	34	38	42	46	51	55	60	65
60	25	29	32	36	40	45	49	54	59	64	70
70	27	30	34	38	43	47	52	57	63	68	74
90	29	34	38	42	47	52	58	63	69	76	82
120	33	38	43	48	54	59	65	72	79	86	93
194	42	47	54	60	67	74	82	90	98	107	116

SECONDARY CONDUCTORS & FASTENINGS**08 00 01 02**

Multiplex Cable Secondary

Sag Tables

Sheet 1 of 6

#6 AAC Duplex w/#6 – 6/1 ACSR Neutral (Shepherd)

Short Span – Span (in feet)

Cond. Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	4	4	5	6	7	8	9	10	11	13	14	330
10	4	5	5	6	7	8	10	11	12	13	15	311
20	4	5	6	7	8	9	10	11	13	14	16	292
30	4	5	6	7	8	9	11	12	14	15	17	273
40	5	5	7	8	9	10	12	13	15	16	18	253
50	5	6	7	8	10	11	13	14	16	18	20	234
60	5	7	8	9	11	12	14	16	17	19	22	215
70	6	7	8	10	11	13	15	17	19	21	23	196
80	6	8	9	11	13	15	17	19	21	23	26	179
90	7	9	10	12	14	16	18	20	23	26	28	162
100	8	9	11	13	15	18	20	23	25	28	31	148

DE Tension = 714 lbs

Short Span – Span (in Feet)

Cond. Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	7	9	10	12	14	16	18	21	23	26	29
0	9	11	13	15	17	20	22	25	28	31	35
32 + 1/2" ice	21	26	31	36	42	48	55	62	69	77	86
20	10	12	14	16	19	22	25	28	31	35	39
30	10	12	14	17	20	23	26	29	32	36	40
40	10	13	15	17	20	23	26	30	34	37	41
50	11	13	15	18	21	24	27	31	35	39	43
60	11	13	16	19	22	25	28	32	36	40	44
70	11	14	16	19	22	26	29	33	37	41	45
80	12	14	17	20	23	26	30	34	38	42	47
90	12	15	17	20	24	27	31	35	39	44	48
100	12	15	18	21	24	28	32	36	40	45	49
120	13	16	19	22	26	30	34	38	43	47	52
194	16	19	23	27	31	36	40	46	51	57	63

SECONDARY CONDUCTORS & FASTENINGS**08 00 01 02**

Multiplex Cable Secondary

Sag Tables

Sheet 2 of 6

#2 AAC Triplex w/#4 – 6/1 ACSR Neutral (Cockle)

Short Span – Span (in feet)

Cond. Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	28	34	40	47	55	63	72	81	91	101	112	540
10	28	34	41	48	56	64	73	82	92	103	114	534
20	29	35	41	49	56	65	74	83	93	104	115	528
30	29	35	42	49	57	65	74	84	94	105	116	522
40	29	36	42	50	58	66	75	85	95	106	118	516
50	30	36	43	50	58	67	76	86	96	107	119	510
60	30	36	43	51	59	68	77	87	97	109	120	505
70	30	37	44	51	60	68	78	88	98	110	122	499
80	31	37	44	52	60	69	79	89	100	111	123	494
90	31	38	45	53	61	70	80	90	101	112	124	489
100	31	38	45	53	62	71	80	91	102	113	126	484

DE Tension = 968 lbs

Short Span – Span (in Feet)

Cond. Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	30	36	43	50	58	67	76	86	97	108	119
0	31	37	44	52	60	69	78	88	99	110	122
32 + 1/2" ice	34	41	49	58	67	77	88	99	111	124	137
20	31	38	45	53	61	70	80	90	101	113	125
30	32	38	46	53	62	71	81	91	102	114	127
40	32	39	46	54	63	72	82	92	104	115	128
50	32	39	47	55	63	73	83	93	105	117	129
60	33	40	47	55	64	74	84	94	106	118	131
70	33	40	48	56	65	74	85	95	107	119	132
80	33	40	48	56	65	75	85	96	108	121	134
90	34	41	49	57	66	76	86	97	109	122	135
100	34	41	49	58	67	77	87	98	110	123	136
120	35	42	50	59	68	78	89	100	112	125	139
194	37	45	53	63	73	84	95	107	120	134	148

SECONDARY CONDUCTORS & FASTENINGS**08 00 01 02**

Multiplex Cable Secondary

Sag Tables

Sheet 3 of 6

1/0 AAC Triplex w/1/0 – 6/1 ACSR Neutral (Neritina)

Short Span – Span (in feet)

Cond. Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	19	22	27	31	36	42	48	54	60	67	74	815
10	19	23	27	32	37	43	49	55	62	69	76	794
20	20	24	28	33	38	44	50	56	63	70	78	775
30	20	24	29	34	39	45	51	58	65	72	80	756
40	20	25	29	35	40	46	52	59	66	74	82	739
50	21	25	30	35	41	47	54	60	68	75	84	722
60	21	26	31	36	42	48	55	62	69	77	86	707
70	22	26	31	37	43	49	56	63	71	79	87	692
80	22	27	32	38	44	50	57	64	72	80	89	678
90	23	28	33	38	45	51	58	66	74	82	91	664
100	23	28	33	39	46	52	60	67	75	84	93	651

DE Tension = 1495 lbs

Short Span – Span (in Feet)

Cond. Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	19	23	27	32	37	42	48	55	61	68	76
0	20	24	29	34	39	45	51	58	65	72	80
32 + 1/2" ice	24	29	35	41	47	54	61	69	78	87	96
20	21	25	30	35	41	47	54	61	68	76	84
30	21	26	31	36	42	48	55	62	70	78	86
40	22	27	32	37	43	49	56	64	71	79	88
50	23	27	32	38	44	51	58	65	73	81	90
60	23	28	33	39	45	52	59	66	74	83	92
70	23	28	34	40	46	53	60	68	76	85	94
80	24	29	34	40	47	54	61	69	78	86	96
90	24	30	35	41	48	55	63	71	79	88	98
100	25	30	36	42	49	56	64	72	81	90	99
120	26	31	37	44	50	58	66	74	83	93	103
194	29	35	41	49	56	65	74	83	93	104	115

SECONDARY CONDUCTORS & FASTENINGS**08 00 01 02**

Multiplex Cable Secondary

Sag Tables

Sheet 4 of 6

4/0 AAC Triplex w/4/0 – 6/1 ACSR Neutral (Zuzara)

Short Span – Span (in feet)

Cond. Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	24	29	34	40	46	53	60	68	76	85	94	642
10	24	29	35	41	47	54	62	70	78	87	96	629
20	25	30	35	41	48	55	63	71	79	89	98	617
30	25	30	36	42	49	56	64	72	81	90	100	606
40	25	31	37	43	50	57	65	74	82	92	102	595
50	26	31	37	44	51	58	66	75	84	94	104	585
60	26	32	38	45	52	59	67	76	85	95	105	575
70	27	32	39	45	52	60	69	77	87	97	107	565
80	27	33	39	46	53	61	70	79	88	98	109	556
90	28	33	40	47	54	62	71	80	90	100	111	548
100	28	34	40	48	55	63	72	81	91	101	112	540

DE Tension = 1495 lbs

Short Span – Span (in Feet)

Cond. Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	23	28	33	39	46	52	60	67	75	84	93
0	24	29	35	41	48	55	62	70	79	88	97
32 + 1/2" ice	27	33	39	46	53	61	69	78	88	98	108
20	25	31	36	43	50	57	65	73	82	91	101
30	26	31	37	43	50	58	66	74	83	93	103
40	26	32	38	44	51	59	67	76	85	95	105
50	27	32	38	45	52	60	68	77	86	96	107
60	27	33	39	46	53	61	69	78	88	98	108
70	28	33	40	47	54	62	71	80	89	100	110
80	28	34	40	47	55	63	72	81	91	101	112
90	28	34	41	48	56	64	73	82	92	103	114
100	29	35	42	49	57	65	74	83	93	104	115
120	30	36	43	50	58	67	76	86	96	107	119
194	31	38	45	53	62	71	81	91	102	114	126

SECONDARY CONDUCTORS & FASTENINGS**08 00 01 02**

Multiplex Cable Secondary

Sag Tables

Sheet 5 of 6

1/0 AAC Quadruplex w/1/0 AAC Neutral (Criollo)

Short Span – Span (in feet)

Cond. Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	25	30	35	42	48	55	63	71	80	89	99	615
10	25	30	36	42	49	57	64	73	81	91	100	602
20	26	31	37	43	50	58	66	74	83	93	103	590
30	26	32	38	44	51	59	67	76	85	94	105	579
40	27	32	38	45	52	60	68	77	86	96	107	569
50	27	33	39	46	53	61	69	78	88	98	109	558
60	28	33	40	47	54	62	71	80	90	100	111	549
70	28	34	40	48	55	63	72	81	91	101	112	539
80	29	35	41	48	56	64	73	83	93	103	114	530
90	29	35	42	49	57	65	74	84	94	105	116	522
100	30	36	43	50	58	66	76	85	96	107	118	514

DE Tension = 1194 lbs

Short Span – Span (in Feet)

Cond. Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	27	32	38	45	52	60	68	77	87	96	107
0	28	34	40	47	54	62	71	80	90	100	111
32 + 1/2" ice	32	38	45	53	62	71	81	91	102	114	126
20	29	35	41	48	56	65	73	83	93	104	115
30	29	35	42	49	57	66	75	84	95	105	117
40	30	36	43	50	58	67	76	86	96	107	119
50	30	36	43	51	59	68	77	87	98	109	121
60	31	37	44	52	60	69	78	88	99	111	122
70	31	38	45	53	61	70	80	90	101	112	124
80	32	38	45	53	62	71	81	91	102	114	126
90	32	39	46	54	63	72	82	92	104	116	128
100	32	39	47	55	64	73	83	94	105	117	130
120	33	40	48	56	65	75	85	96	108	120	133
194	36	44	52	62	71	82	93	105	118	132	146

SECONDARY CONDUCTORS & FASTENINGS**08 00 01 02**

Multiplex Cable Secondary

Sag Tables

Sheet 6 of 6

4/0 AAC Quadruplex w/4/0 AAC Neutral (Oldenberg)

Short Span – Span (in feet)

Cond. Temp. Deg. F	INITIAL (Stringing) SAG (in inches)											
	100	110	120	130	140	150 R.S.	160	170	180	190	200	Initial Tension
0	23	28	33	39	45	51	58	66	74	82	91	641
10	23	28	34	40	46	53	60	68	76	85	94	625
20	24	29	35	41	47	54	61	69	78	87	96	610
30	25	30	35	42	48	55	63	71	80	89	98	596
40	25	30	36	42	49	57	64	73	81	91	100	582
50	26	31	37	43	50	58	66	74	83	93	103	570
60	26	32	38	44	51	59	67	76	85	95	105	558
70	27	32	39	45	52	60	69	77	87	97	107	547
80	27	33	39	46	54	61	70	79	88	99	109	537
90	28	34	40	47	55	63	71	80	90	101	111	527
100	28	34	41	48	56	64	73	82	92	102	113	532

DE Tension = 1495 lbs

Short Span – Span (in Feet)

Cond. Temp. Deg. F	FINAL SAG (in inches)										
	100	110	120	130	140	150 R.S.	160	170	180	190	200
-20	24	29	35	41	47	54	62	70	78	87	96
0	25	31	36	43	50	57	65	73	82	91	101
32 + 1/2" ice	29	35	41	49	56	65	74	83	93	104	115
20	26	32	38	45	52	59	68	76	86	95	106
30	27	33	39	46	53	61	69	78	87	97	108
40	27	33	40	46	54	62	70	79	89	99	110
50	28	34	40	47	55	63	72	81	91	101	112
60	28	34	41	48	56	64	73	82	92	103	114
70	29	35	42	49	57	65	74	84	94	105	116
80	29	36	42	50	58	66	76	85	96	106	118
90	30	36	43	51	59	68	77	87	97	108	120
100	31	37	44	52	60	69	78	88	99	110	122
120	31	38	45	53	62	71	81	91	102	114	126
194	35	42	50	59	68	78	89	101	113	126	139

SECONDARY CONDUCTORS & FASTENINGS

Ties – Wire, Preformed

08 01 01 **

Sheet 1 of 1

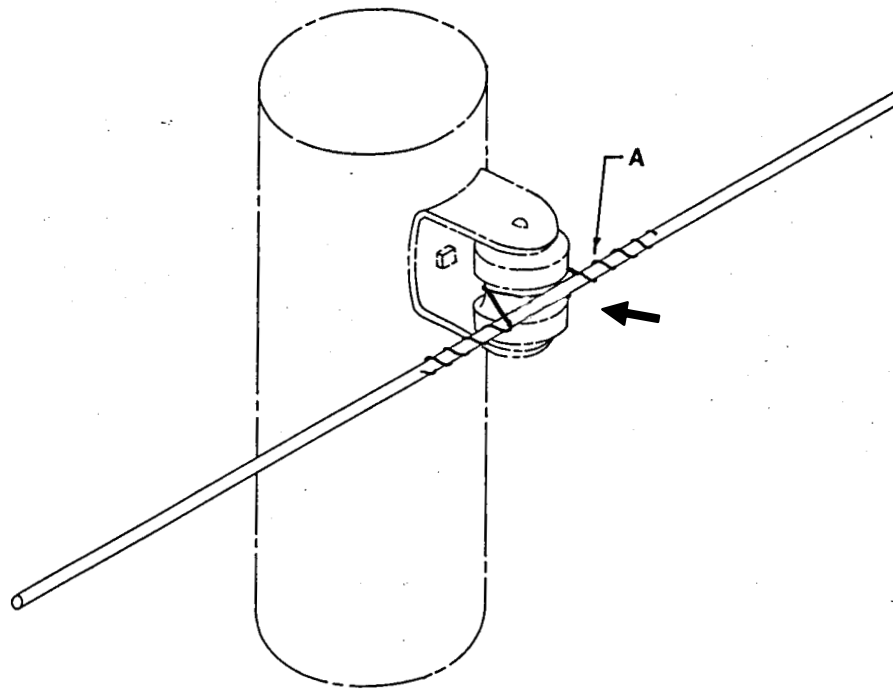
1/0 AAAC NEUTRAL – 08 01 01 01

→ 1/0 ACSR XLP – 08 01 01 05

4 ACSR NEUTRAL – 08 01 01 02

4/0 ACSR BARE – 08 01 01 03

4/0 XLP – 08 01 01 04

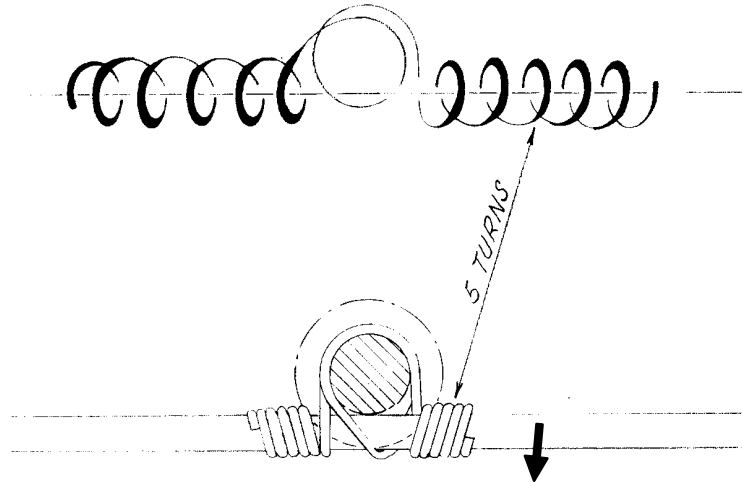


	Description	08 01 01	Stk. No. DOJM Code	01	02	03	04	05
A	Tie, Preformed, 1/0 AAAC		23 68 358 SPT10A	1				
A	Tie, Preformed, 1/0 ACSR XLP		23 68 485 SPT10P					1
A	Tie, Preformed, # 4 ACSR Bare		23 68 389 SPT4A		1			
A	Tie, Preformed, 4/0 ACSR Bare		23 68 388 SPT40A			1		
A	Tie, Preformed, 4/0 XLP		23 68 401 SPT40P				1	

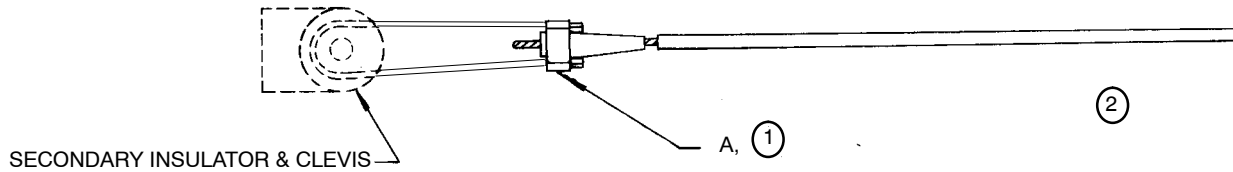
**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DCG
REV. NO: 3
REV. DATE: 03/04/05
REAFFIRMED DATE: 09/21/11



Type of Conductor	Tie Wire	Stock No. DOJM Code	Units	Qty.
#6 – #2 Cu., Poly	#4 Cu., Poly	18 01 017 HTP1	Ft.	5
#6 – #2 Cu., Poly	#4 Al., Poly, 42" UE Only	18 55 040 HTP2	Ea.	1
1/0 – 500 Cu., Poly	#6 Cu., Poly	18 51 021 HTP3	Ft.	5
#4 Cu., Bare	#6 Cu., Bare, 42" UE Only	18 52 009 HTC	Ea.	1
4/0 AA Poly	#6 Cu., Poly	18 51 021 HTP3	Ft.	5
1/0 AAAC Bare	#4 Al., Bare	18 55 028 HTA	Ft.	3

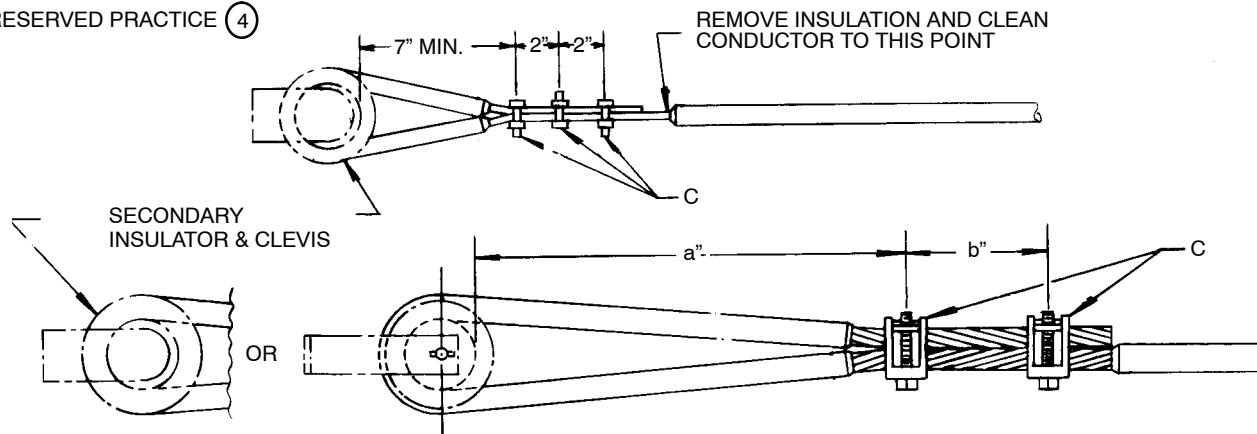


		Conductor	Description (Preferred)	Stock No. DOJM Code
A	A	#6 Sol. Cu.	Deadend, Automatic, Secondary Spool, #6 Cu.	23 78 357 SDEA6C
		#4 Sol. Cu.	Deadend, Automatic, Secondary Spool, #4 Cu.	23 78 353 SDEA4C
		#2 Sol. Cu.	Deadend, Automatic, Secondary Spool, #2 Cu.	23 78 355 SDEA2C
		#2 Str. Cu.	Deadend, Automatic, Secondary Spool, #2 Str. Cu.	23 78 388 SDEA2StrC
		#4 ACSR	Deadend, Automatic, Secondary Spool, #4 ACSR	23 78 358 SDEA4A
		#2 ACSR	Deadend, Automatic, Secondary Spool, #2 ACSR	23 78 359 SDEA2A
		1/0 AAAC	Deadend, Automatic, Secondary Spool, 1/0 AAAC (bare)	23 78 333 SDEA10A
		1/0 AAAC	Deadend, Automatic, Secondary Spool, 1/0 AAAC (poly covered)	23 68 532 SDEA10AP
		1/0 Str. Cu.	Deadend, Automatic, Secondary Spool, 1/0 Str. Cu.	23 78 389 SDEA10StrC
		3/0 AAAC	Deadend, Automatic, Secondary Spool, 3/0 AAAC (PPAC Neutral)	23 68 533 SDEA30A
		4/0 Str. Cu.	Deadend, Automatic, Secondary Spool, 4/0 Str. Cu.	23 68 534 SDEA40StrC
		4/0 AA, AAAC, ACSR	Deadend, Automatic, Secondary Spool, 4/0 AA, AAAC, ACSR	23 78 334 SDEA40A

NOTES:

1. The wire shall be fed completely through the automatic deadend chuck and the jaws of the deadend shall be set by applying a sharp heavy pull on the line conductor. See Work Practice IV-B-1-1 for method of installing automatic deadend.
2. Conductor may be the messenger of triplex or a single wire, such as part of an open wire secondary.

RESERVED PRACTICE (4)



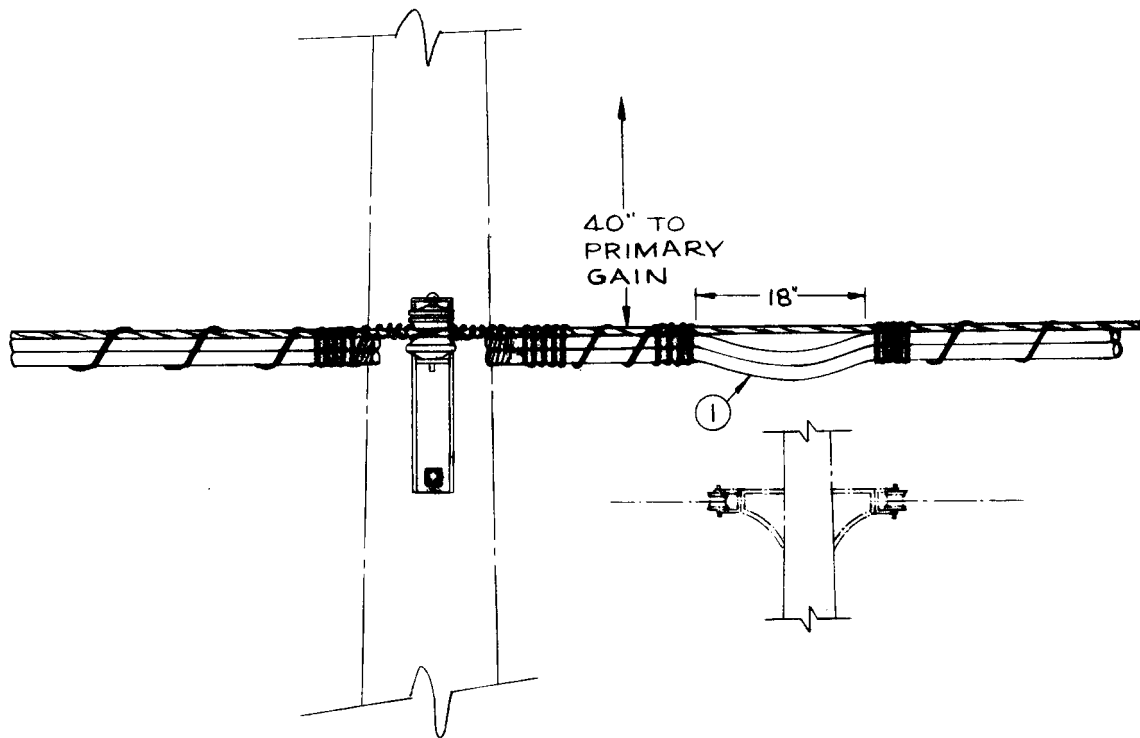
	Conductor	Description	Stock No. DOJM Code	Qty. Used	"a" dim.	"b" dim.
C	#6 Sol. Cu.	Connector, Split bolt, 2 – #6 Cu.	17 54 003 SB6	3	7"	4"
	#4 Sol. Cu.	Connector, Split bolt, 2 – #4 Cu.	17 54 004 SB4	3	7"	4"
	#2 Sol. Cu.	Connector, Split bolt, 2 – #2 Cu.	17 54 005 SB2	3	7"	4"
	1/0 Cu.	Connector, Two Bolt, 2 – 1/0 Cu.	17 54 145 TB10	2	7"	4"
	2/0 Cu.	Connector, Two Bolt, 2 – 2/0 Cu.	17 54 139 TB20	2	7"	4"
	4/0 Cu.	Connector, Two Bolt, 2 – 4/0 Cu.	17 54 140 TB40	2	7"	4"
	500 Cu.	Connector, Two Bolt, 2 – 500 Cu.	17 54 141 TB500	2	18"	6"
	1000 Cu.	Connector, Two Bolt, 2 – 1000 Cu.	17 54 142 TB1000	2	18"	6"

3. This method shall be used when automatic type deadends are not available. Both aluminum and copper deadends are normally stocked.

SECONDARY CONDUCTORS & FASTENINGS
Preassembled Cable Secondary
Secondary Split

08 01 20 00

Sheet 1 of 1

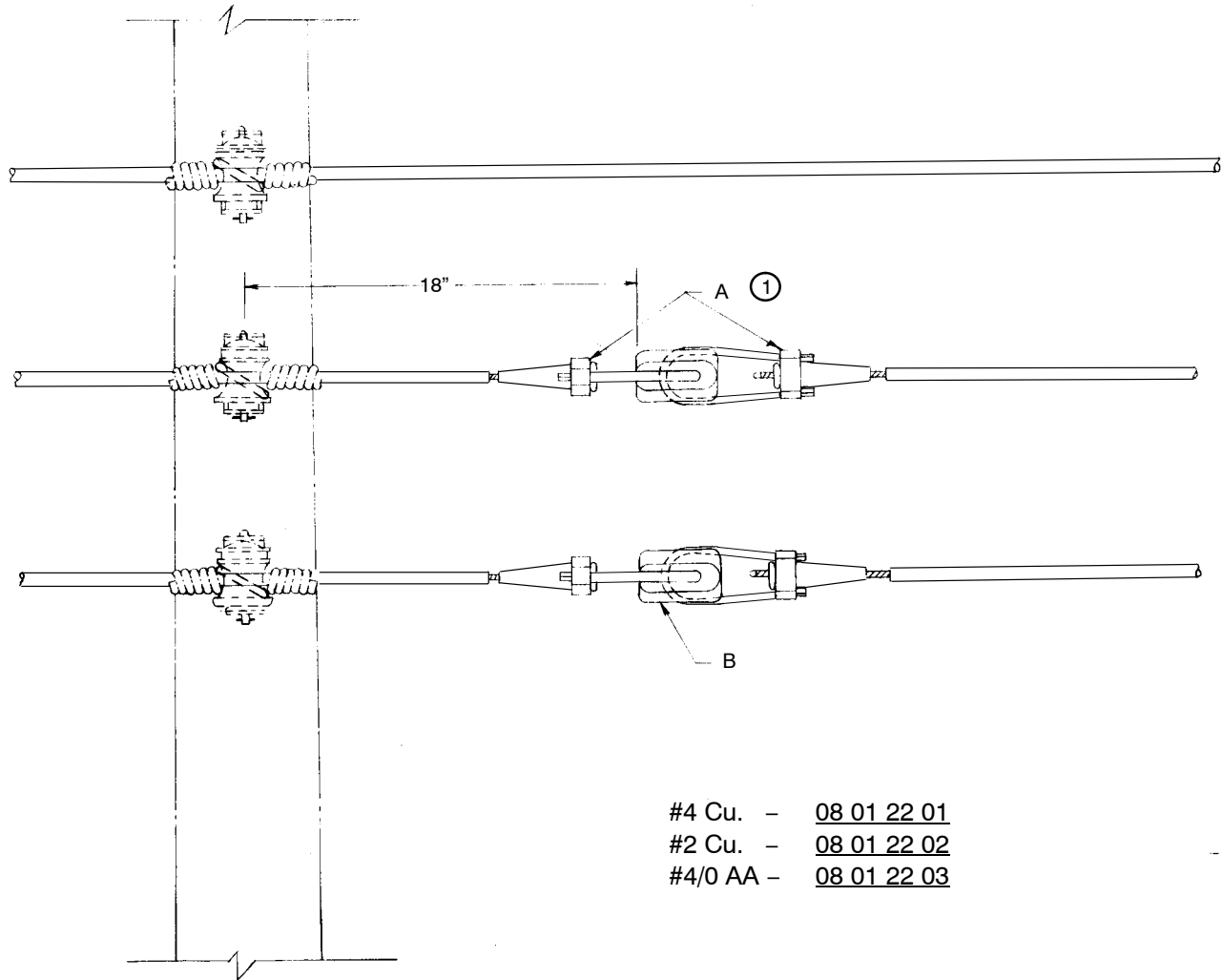


	Dist. Std. or Stock No.	Description	
A	101	Install Sec. Split	1

1. Construction crew to open cable for distance of approximately 18" to allow room for making taps. Open cable only on side of pole where services are to be installed. Tape ends of conductors with rubber tape 25 53 080 followed by friction tape 25 53 003 and lash cable to messenger on both sides of opening with 5 close turns around entire cable and end on messenger with 2 turns and a half hitch.
2. For service construction details, see Dist. Std. 09.

ALTERNATE

SEE 080123** FOR PREFERRED CONSTRUCTION



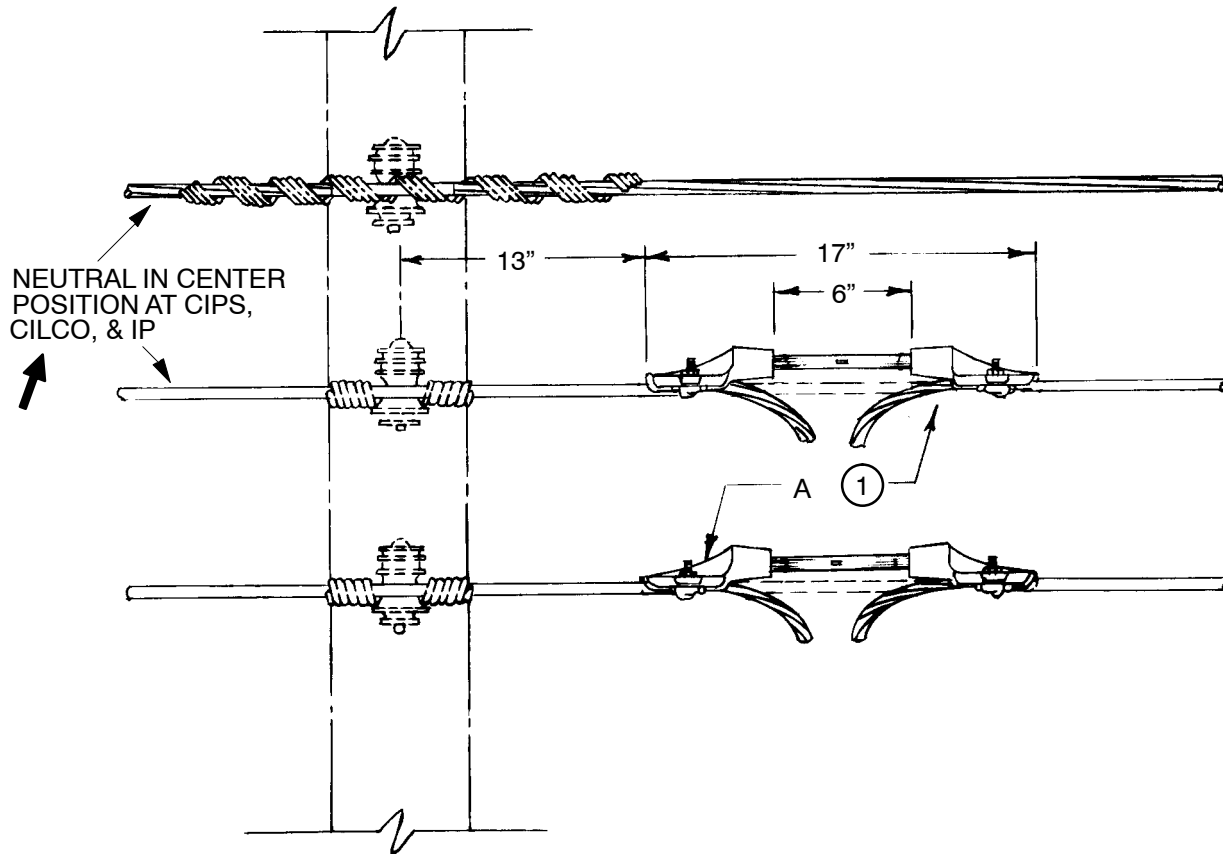
#4 Cu. - 08 01 22 01
 #2 Cu. - 08 01 22 02
 #4/0 AA - 08 01 22 03

	Dist. Std. or Stock No.	Description	08 01 22 **	01	02	03
A	23 78 353	Deadend, Auto, 4 Cu.		4		
	23 78 355	Deadend, Auto, 2 Cu.			4	
	23 78 334	Deadend, Auto, 4/0 AA				4
B	25 56 047	Insulator, Guy		2	2	2
	101	Install Secondary Split		2	2	2

NOTES:

- The wire shall be fed completely through the automatic deadend chuck and the jaws of the deadend shall be set by applying a sharp heavy pull on the line conductor. See Work Practice IV-B-1-1 for method of installing automatic deadend.

PREFERRED



	Dist. Std. or Stock No.	Description	08 01 23 **	01
A	25 56 056	Insulator, Sec. Split, #4 Cu – 4/0 AA		2
	101	Install Secondary Split		2

NOTES:

1. To Install: Skin the wire, clamp the split to the wire, cut the conductor and fold legs back.

To Remove: Unfold legs, connect two legs with appropriate compression sleeve, remove split.

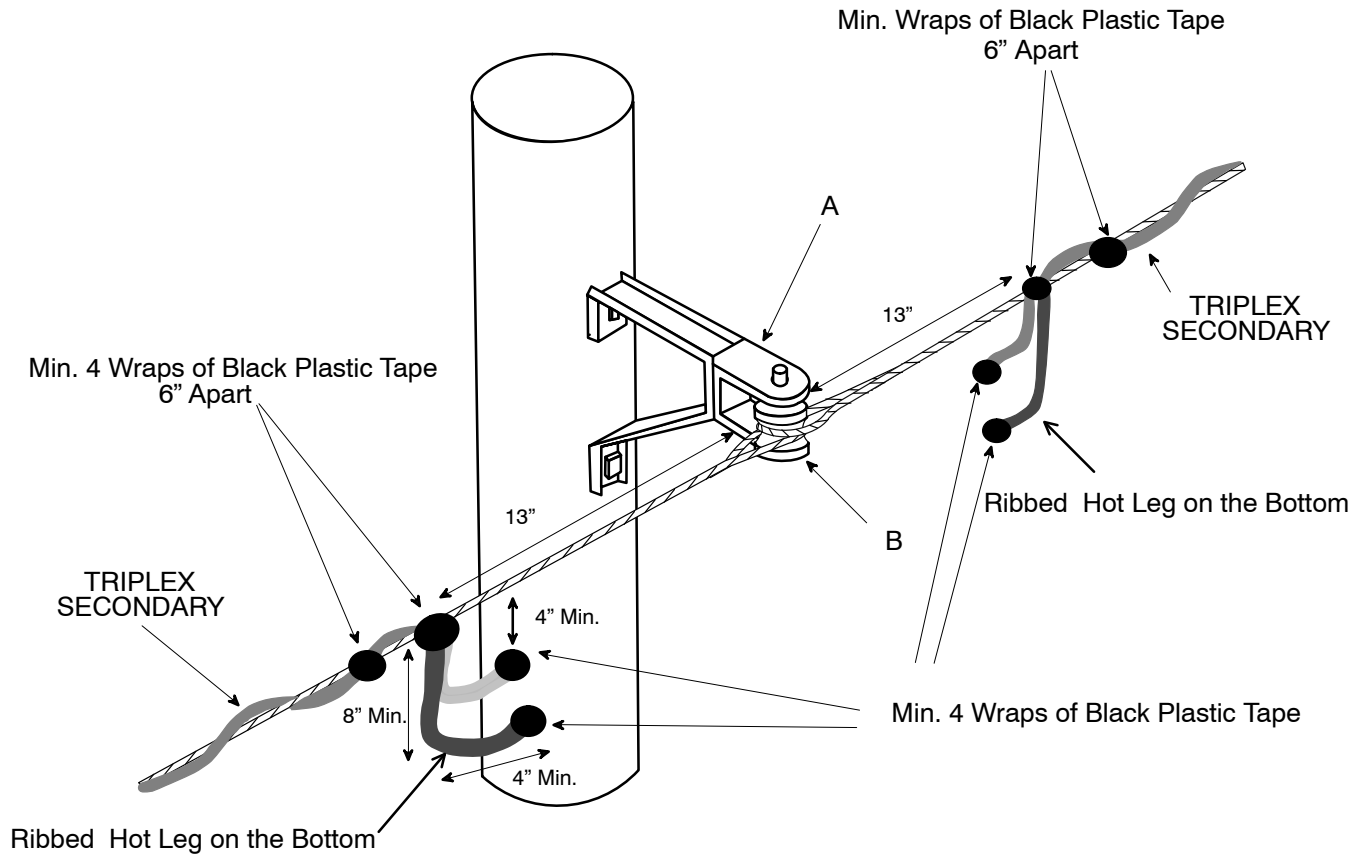
SECONDARY CONNECTIONS & FASTENINGS

TRIPLEX ALUMINUM CABLE

Secondary Split

08 01 24 **

Sheet 1 of 1



01 Straight Through
02 Dead-end

		Dist. Std. /Stk No.	Description	01	02
	A	06 01 01 03	Single Clevis Extension	1	1
@	B	08 01 03 00	Tie Wire	1	
	C	25 53 055	Tape, Vinyl Plastic, Black, 3/4" x 66' (RL)	1	1
@	D	SDEA*W	Dead-end (See 08 01 10 00)		2
@	E	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		1
		101	Install Secondary Split	1	1

NOTES:

1. Wrap the ends of the wires with vinyl plastic tape (Stock # 25-53-055).
2. Wrap the secondary legs to the messenger wire with plastic tape (Stock # 25-53-055).
3. Stagger the ends of the wires by a minimum distance of 4 inches apart so that they cannot contact each other.
4. For triplex dead-end split use the 02 standard applying an automatic dead-end clamp to the messenger wire on each side of the spool insulator.
5. When closing the split, use the same size conductor with PG connectors. Do not use a jiffy jumper.



SERVICES

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SERVICES

Standard Conductor Data

09 00 01 01

1 of 1

This standard covers standard conductor sizes, respective stock codes, and ampacities.

Table 1 - Triplex Cable

Insul. Cond.	Messenger	Stock #	Dia. (in.)	Wt. (#/ft)	Summer	Winter
#2 AA - 7 Str.	#2 AA - 7 Str.	18 05 040	0.77	.241	150	195
1/0 AA - 19 Str.	1/0 AA - 19 Str.	18 05 044	1.00	.381	205	265
4/0 AA - 19 Str.	4/0 AA - 19 Str.	18 05 064	1.31	.719	315	410

Table 2 - Quadruplex Cable

Insul. Cond.	Messenger	Stock #	Dia. (in.)	Wt. (#/ft)	Summer	Winter
1/0 A.A. - 19 Str.	1/0 A.A. - 7 Str.	18 05 104	1.09	0.644	180	235
4/0 A.A. - 19 Str.	4/0 A.A. - 19 Str.	18 05 105	1.47	1.099	275	360

CONSTRUCTION NOTE(s):

1. Triplex cable shall be used for all new 3 wire service drop installations where its current rating is adequate and the voltage is less than 300 volts. Quadruplex cable should only be used on 4-wire services. Where the ratings of triplex and quadruplex cables are exceeded, open wire services shall be installed using covered conductors tabulated in DCS **Section 7**. These conductors may also be used for repair and maintenance of existing open wire services.
2. #2 Triplex shall be used for most 200 Amp services. #1/0 and larger triplex and quadruplex are primarily for commercial or industrial customer where larger capacity is needed.
3. Triplex cable should not be used on 480 volt service. It is rated 600 volts phase to phase, not phase to ground. Quadruplex cable can be used for 277/480 volt service, but not for 480 volt, 3 wire service since the bare messenger must be grounded by NESC.
4. All connections of services to customer's service wires shall be adequately arranged to prevent moisture entrance at the weatherhead. Preferable construction is for the weatherhead to be above the service wire connections with a drip loop in the latter. For services larger than residential and small commercial, see DCS **09 01 12 00**.
5. Tree guards should be used on original installations of triplex service cables where the cables go through trees or where trees have become a problem since the original installation. These 2 piece plastic tree guards are stocked for #4 (Stock #25 54 047), #2 (Stock #25 54 048) and #1/0 (Stock #25 54 049) triplex cable. The tree guard for #4 triplex (Stock #25 54 047) may be used for #6 duplex cable if the ends of the guard are securely taped to the cable.



SERVICES

Expansion Shields

09 00 01 02

1 of 2

Table 1 - Standard Expansion Shields Stock Codes and Working Loads

Expansion Shield		Safe Working Load (Tension) In Lbs
Size	Stock #	
1/4"	21 51 009	175 (with lag screw)
1/4"	21 51 010	300 (with machine bolt)
5/16"	21 51 181	350 (with lag screw)
3/8"	21 51 055	350 (with lag screw)
3/8"	21 51 016	865 (with machine bolt)
1/2"	21 51 017	920 (with lag screw)
1/2"	21 51 018	1370 (with machine bolt)
5/8"	21 51 019	2430 (with machine bolt)

Table 2 - Expansion Shields Used for House Knob

Expansion Shield		Drill Size	Exp. Shield Used With Wood Screw Type Wireholder		Application
Size	Stock #		Screw Size	Wireholder Stock #	
3/8"	21 51 055	5/8"	#22 x 2-1/4" Woodscrew	23 06 077	Used to attach wireholder insulators to masonry walls.

2 Table 3 - Expansion Shields for Wood or Lag Screws

Expansion Shield		Drill Size	Exp. Shield Used With			
Size	Stock #		Brass Screw		Lag	
			Size	Stock #	Size	Stock #
1/4"	21 51 009	1/2"	#14 x 2"	21 71 022	1/4" x 2" 1/4" x 2-1/2" 1/4" x 4"	21 65 017 21 65 018 23 60 002

Table 4 - Expansion Shields for Machine Bolts

Expansion Shield		Drill Size	Expansion Shield Used With		Application
Size	Stock #		Bolt Size	Bolt Stock #	
3/8"	21 51 016	5/8"	3/8" x 3"	23 52 194	Fastening clevises deadending up to #4 AWG services inclusive. Up to 750 kcmil on brackets along masonry walls.
1/2"	21 51 018	7/8"	1/2" x 4"	23 52 034	Fastening clevises deadending up to #2 to 4/0 AWG services inclusive
5/8"	21 51 019	1"	5/8" x 4"	23 52 200	Fastening clevises, deadending 500 kcmil and 750 kcmil services and network cable brackets on masonry walls.



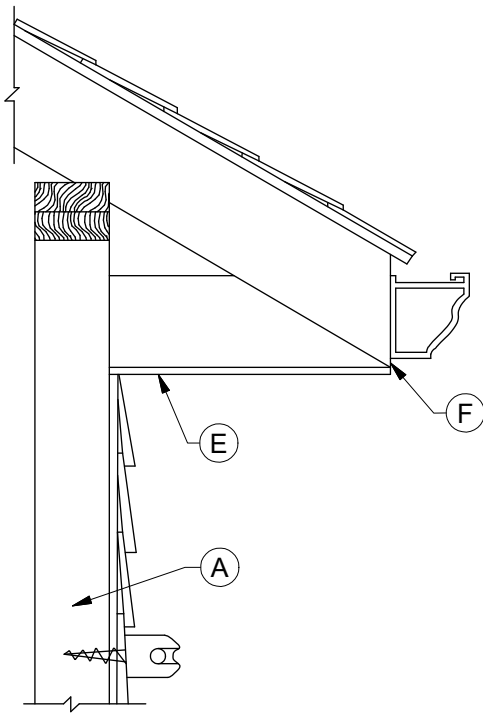
SERVICES

Expansion Shields

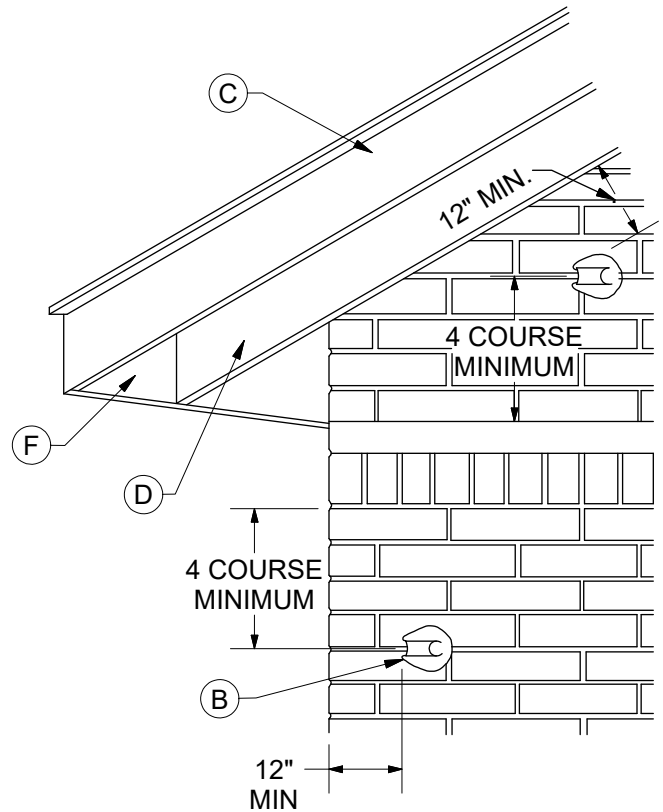
CONSTRUCTION NOTE(s):

1. Safe working loads given are for a good installation in a good grade of masonry. For expansion shields used with machine bolts (normally used for the heavier loads) this means placing the shield in brick or concrete or if a brick seam is used, it shall be narrow and preferably filled with a cement mortar.
2. The expansion shield shown in Table 3 is for use with wood screws and lag screws. This assembly is normally used to attach service entrance cable, corner brackets and service entrance boxes to masonry walls. The length of the lag screw used will depend on the condition of the masonry and how deep the shield is set in the wall. The #14 x 2" screw shown is also used to fasten meter, meter enclosures, service entrance cable, etc. to wood frame building. In masonry this screw with shield is convenient to use and provides good holding power in sound masonry walls for light loads.

REV	DATE	ENG	DESCRIPTION
1	01/01/21	WYW	Data moved from DCS 09 00 01 01
	xx/xx/xx	xxx	

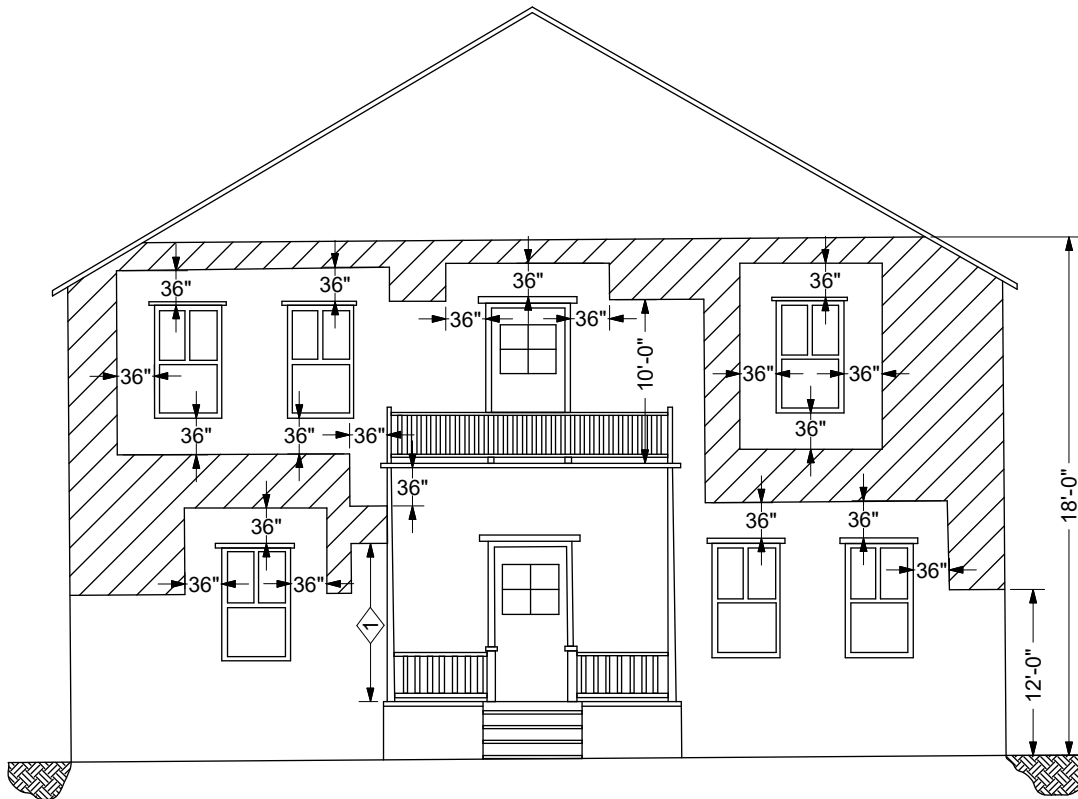


Frame-Composition Shingle or
Brick Veneer Construction



Brick or Solid Masonry Construction

ITEM	DESCRIPTION	Acceptable/Un-acceptable Point of Attachment
A	Building Studs	Acceptable
B	Mortar Joints	Acceptable
C	Outside Trim Board	Attachment allowed only if adequately reinforced
D	Inside Trim Board (Brick Building)	Attachment allowed only if adequately reinforced
E	Soffit Board	Attachment allowed only if adequately reinforced
F	Fascia Board	Un-Acceptable
G	Fire Walls, Parapet Walls or Chimneys	Un-Acceptable



CONSTRUCTION NOTE(s):

1. The first point of attachment for new electric service shall be in shaded spaces not less than 12' nor more than 18' above ground. It maybe necessary to attach services higher in order to meet minimum ground clearances on DCS 09 00 03 01. Existing services may be reconducted to the original clearance or a minimum of 10' above ground. A service mast may be used if necessary to obtain the minimum clearances.
2. The customer's service outlet not be located above 18', but it may be necessary to attach services higher than 18' to meet the minimum ground clearances on DCS **09 00 03 01**.
3. Triplex cable or separate open wire service busses on buildings shall be placed in the spaces shown shaded.
4. Service conductors passing by doors, porches, fire escapes or similar locations, shall have a clearance of not less than 36 inches. Service conductors passing by windows shall have a clearance of not less than 36 inches.
5. Where the form of the building will not permit triplex cable or open wire service busses from the point of attachment to the service outlets, service entrance cable may be used for runs up to 15'. For runs in excess of 15', the information must be submitted to Ameren project contact and must be approved by the appropriate Supervising Engineer before the project. Service entrance cable is only rated for 300 volts.
6. When service entrance cable is used, clearances between windows, openings, fire escapes, etc, and the service attachment or the service busses on the building may be reduced to 6 inches. This is a preferred minimum which may however be reduced if necessary.
7. Service conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings. Overhead wires shall not be run such that they obstruct entrance to these building openings.



SERVICES

Attachment Clearances

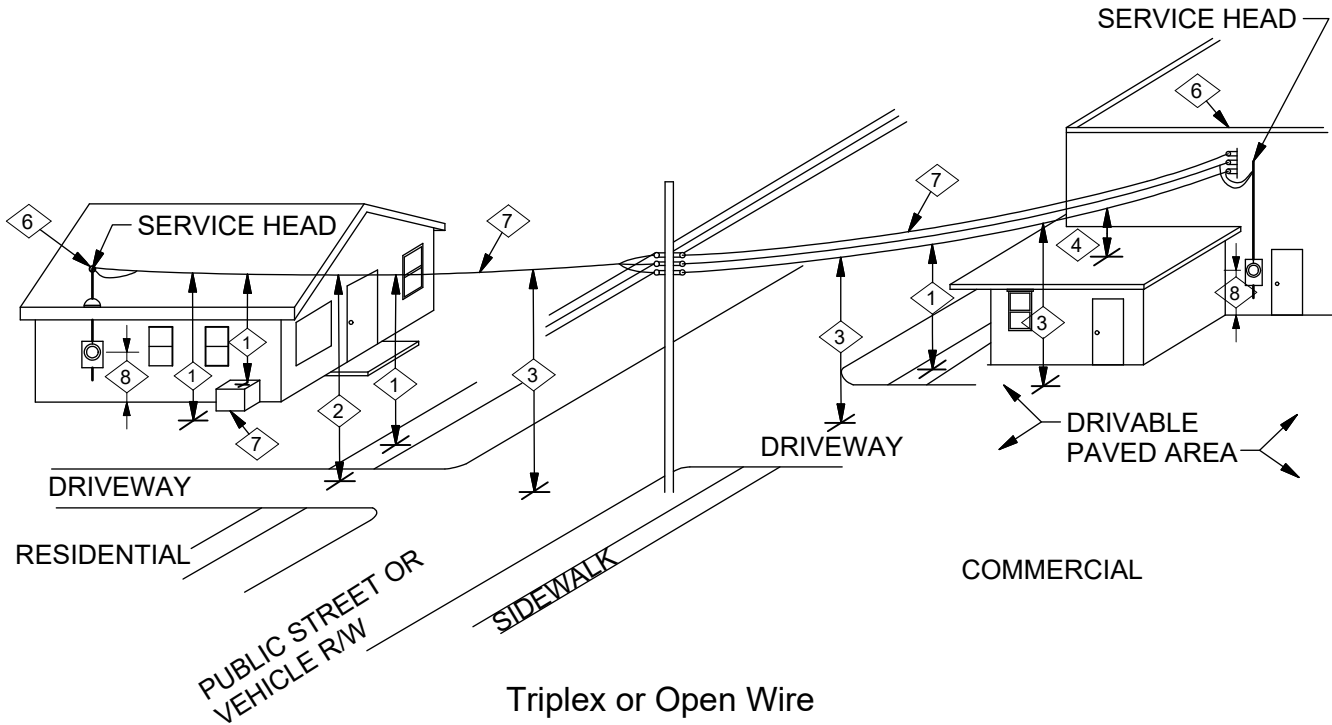
09 00 02 05
600V
2 of 2

8. In some instances the first set of wire attachments cannot be located in an acceptable space which will permit either direct connection or extension of a triplex cable or open wire bus to the service outlet. Examples of this are inadequate ground clearances in the service span, building materials that preclude fastenings being placed on them, load center being so placed that the service entrance location is confined to a specific part of the building, etc.

In these cases, the use of Service Entrance Cable is permitted from the first point of attachment to the service entrance. Service Entrance Cable is only rated for 300 volt services

9. On existing services when the customer has not changed the original service entrance facilities, the service wires maybe replaced at the original clearances. If the customer has installed a new service entrance, then the new facilities and service wires must comply with the current requirements.

REV	DATE	ENG	DESCRIPTION
2	01/01/21	WYW	Revised note 1 and combined w/DCS 09 00 02 06
1	10/06/11	DCG	



DESIGN NOTE(s):

Over Ground (per 2017 NESC 232)

1. 12 ft. (triplex) or 12.5 ft. (open wire) over spaces and ways subject to pedestrian or restricted traffic only (no vehicles over 8 ft. high).

EXCEPTION: Where height of a residential building does not allow these clearances, clearance may be reduced to 10 ft. at the drip loop or service drop for triplex cable limited to 150 volts to ground or 10.5 ft. for open wire limited to 300 volts to ground.

2. 16 ft. (triplex) or 16.5 ft. (open wire) over driveways, parking lots and alleys.

EXCEPTION: Where height of a residential building does not allow these clearances, clearance may be reduced to 12 ft. for triplex service limited to 150 volts to ground or 12.5 ft. for open wire limited to 300 volts to ground.

3. 16 ft. (triplex) or 16.5 ft. (open wire) over roads, streets, alleys, non-residential driveways, parking lots and other areas subject to truck traffic.

EXCEPTION: Services over state and federal commercial highways shall be no less than 18 ft. Services over Illinois limited access highways shall be no less than 20 ft.

Over Roofs (includes Parking Garages) (per 2017 NESC 234C)

4. Clearances from highest point in roof shall not be less than:

- A. 3.5 ft. (triplex) or 10.5 ft. (open wire) over roofs not accessible to pedestrians (see note 9).
- B. 11 ft. (triplex) or 11.5 ft. (open wire) over roofs accessible to pedestrians.
- C. 11 ft. (triplex) or 11.5 ft. (open wire) over roofs accessible to vehicles but not truck traffic.
- D. 16 ft. (triplex) or 16.5 ft. (open wire) over roofs accessible to truck traffic.



SERVICES

Service Installation Clearances

09 00 03 01
600V
2 of 2

EXCEPTIONS:

A. For services attached to a building (including drip loops) and where voltage between conductors does not exceed 300 volts on a non-accessible roof, a reduction in clearance over the roof is permitted as follows:

I. 3 feet

II. 18 inches within 6 feet of and terminated at a through the roof raceway or approved support located not more than 4 feet from the edge of roof.

- 5. Any equipment housing including air conditioning, platform or projection which a person might stand on.
- 6. Service mast or bracket attachment or upright of adequate size and height to support services required.
- 7. Normally triplex conductors, but may also be separate conductors as shown for commercial services.
- 8. Meter height is 3'-0" to 5'-6" except 6'-6" over walkways less than 3" wide.
- 9. A roof is considered accessible to pedestrians if there is a means of access through a doorway, ramp, stairway, or permanently mounted ladder.

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
7	01/01/21	WYW	Removed Fig 1, renumbered drawing and re-formatted notes
6	04/01/19	WYW	



SERVICES

Unguyed Sag Tables

09 00 04 01
600V
1 of 1

The table below provides wire sag conditions that will result in 600 lbs. or less tension under NESC heavy loaded conditions. Sag values may be increased to reduce tension provided the minimum L-G clearance specified in DCS 09 00 03 01 is maintained. Sag values are based on an attachment height of 12 feet at the user's facility and 22 feet at the pole (or secondary if service is a flying loop) except where noted. In case of uneven terrain adjustments in the attachments heights may be necessary.

Unguyed Sag						
Conductor	Temperature Deg. F Initial	Span (ft.) / Sag (in.)				
		25	50	75	100	125
#6 Duplex (w/ #6 ACSR neutral)	0 - 32	32	65	65	63	60
	33 - 50	32	65	66	64	62
	51 - 68	32	65	66	66	64
	69 - 85	32	65	66	66	65
	86 -100	32	65	67	66	65
#2 Triplex (w/ 1/0 AAC neutral)	0 - 32	27	62	65	57	45
	33 - 50	27	62	66	59	48
	51 - 68	27	62	66	60	49
	69 - 85	27	63	67	61	51
	86 -100	28	63	67	62	53
1/0 Triplex (w/ 1/0 AAC neutral)	0 - 32	36	56	66	61	66 ⁴
	33 - 50	36	57	67	63	68 ⁴
	51 - 68	36	57	67	64	69 ⁴
	69 - 85	36	57	68	65	71 ⁴
	86 -100	37	58	68	66	72 ⁴
4/0 Triplex (w/ 4/0 AAC neutral)	0 - 32	29	69	56	62	91 ³
	33 - 50	29	70	57	64	92 ³
	51 - 68	29	70	57	65	93 ³
	69 - 85	30	70	58	66	94 ³
	86 -100	30	70	58	66	95 ³
1/0 Quadruplex (w/ 1/0 AAC neutral)	0 - 32	8	55	49	47	75 ⁵
	33 - 50	9	55	50	49	77 ⁵
	51 - 68	9	56	51	50	78 ⁵
	69 - 85	10	56	51	51	79 ⁵
	86 -100	10	56	52	52	80 ⁵
4/0 Quadruplex (w/ 4/0 AAC neutral)	0 - 32	28	54	49	67 ⁵	⁶
	33 - 50	29	54	50	68 ⁵	⁶
	51 - 68	29	55	51	69 ⁵	⁶
	69 - 85	29	55	51	70 ⁵	⁶
	86 -100	29	55	52	71 ⁵	⁶

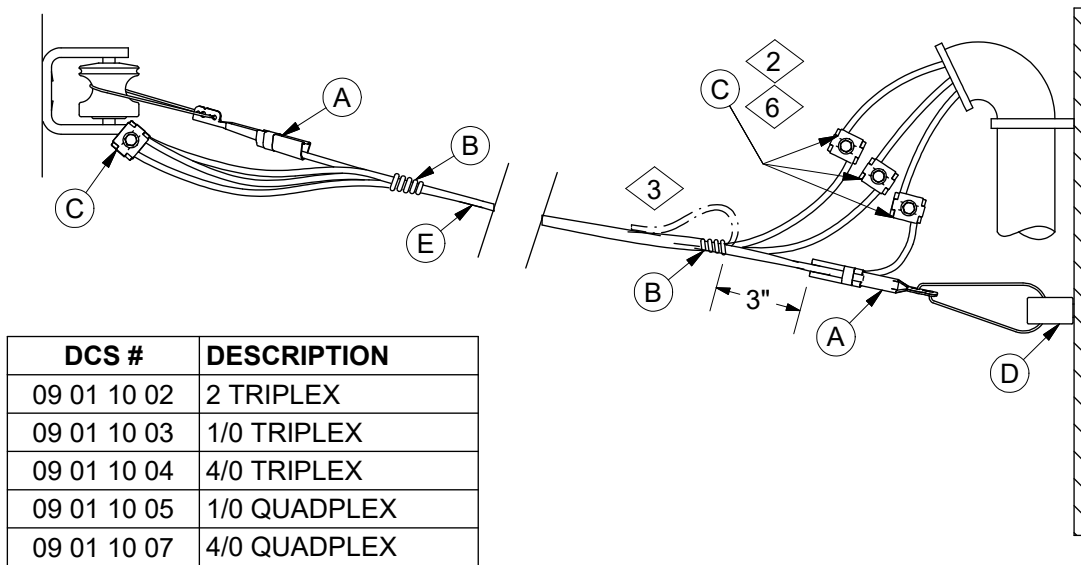
CONSTRUCTION NOTE(s):

- Maximum tension may be less than 600 lbs. when limited by conductor strength or minimum sags.
- Maximum final sag may occur at either NESC heavy loaded conditions or at maximum conductor operating temperature of 90°C (194°F) at which all of these conductors are rated.

- ³ Minimum attachment height at pole (or secondary for flying loops): 30 feet.
- ⁴ Minimum attachment height at pole (or secondary for flying loops): 25 feet.
- ⁵ Minimum attachment height at pole (or secondary for flying loops): 26 feet.
- ⁶ For spans exceeding those in the table please contact Standards.

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
5	01/01/21	WYW	Converted to new format
4	01/17/08	DCG	



CONSTRUCTION NOTE(s):

1. For #2, 1/0 and 4/0 Triplex, spans shall not exceed 140 feet.

2. Use parallel groove clamps on 1/0 and larger services. Do not use insulated sleeves on bare messenger. Use bare sleeves or parallel groove clamps.

3. For 2 wire service, tape house end of the unused lead. Fold back triplex cable and tape securely thereto.

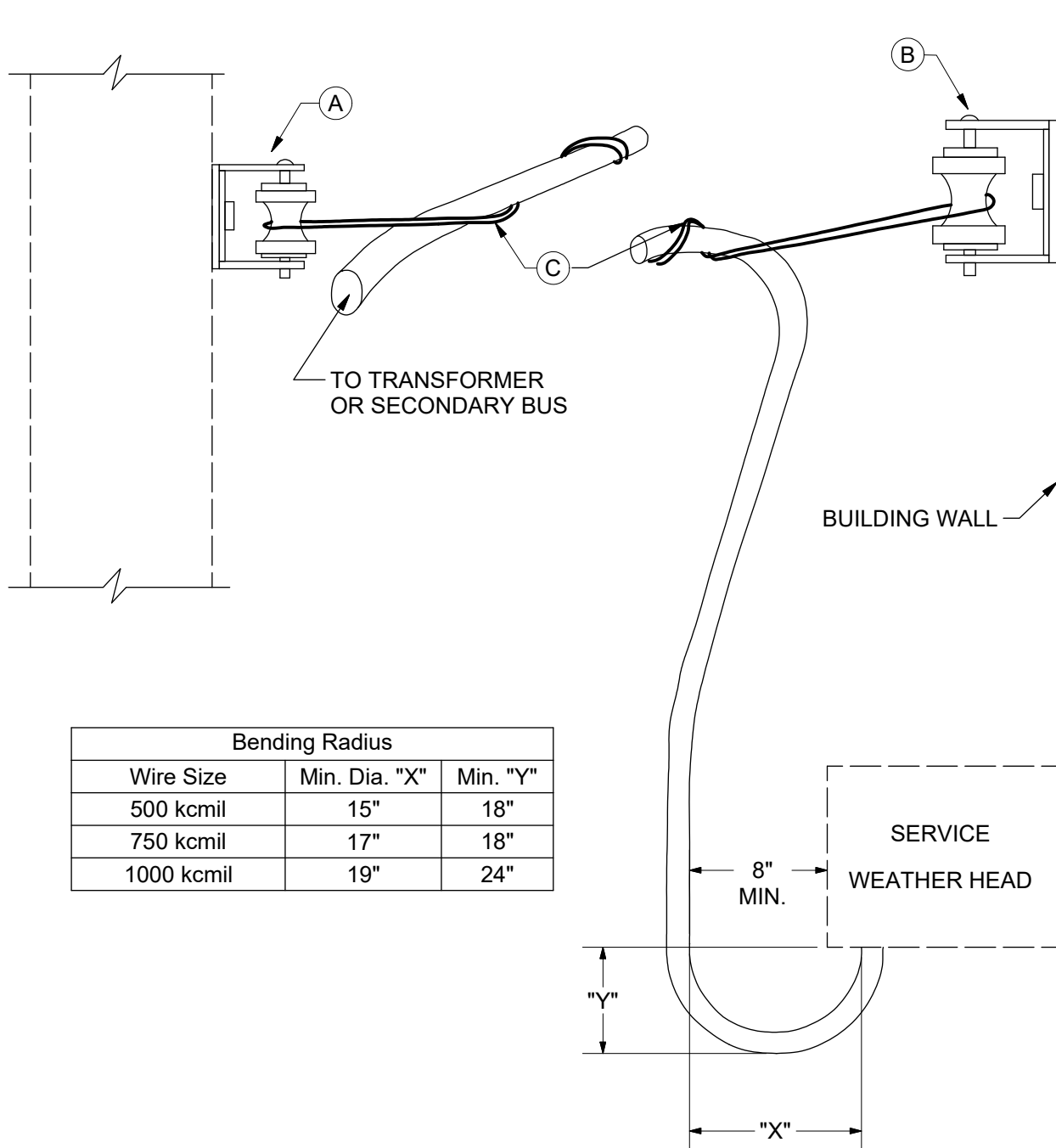
4. See DCS **09 00 02 04** for maximum height of service masts.

5. See DCS **09 00 04 01** for service sag table and **09 00 03 01** for service clearance chart.

6. Use compression sleeve for smaller than 1/0 conductor. The available compression sleeves are shown as below:

- Stock #17 60 403 for #2 str to #2 str insulated (red/red)
- Stock #17 60 406 for #2 str to #4 str insulated (red/orange)
- Stock #17 60 404 for #2 solid to #4 str, non-insulated (orange/orange)

	ITEM	STK / DCS #	DESCRIPTION	09 01 10 **	02	03	04	05	07
2,6 @ @ @	A	17 51 123	Clamp, DE, #2 Triplex		2	-	-	-	-
		17 51 125	Clamp, DE, 1/0 Triplex & Quad.		-	2	-	2	-
		17 51 144	Clamp, DE, 4/0 Triplex & Quad.		-	-	2	-	2
	B	25 53 078	Tape, Plastic 1-1/2"		1	1	1	1	1
	C	07 00 25 00	Clamp, Parallel Groove		6	6	6	8	8
	D	09 01 51 **	Service Attachment		1	1	1	1	1
	E	18 05 040	Cable, Triplex, #2		#	-	-	-	-
		18 05 044	Cable, Triplex, 1/0		-	#	-	-	-
		18 05 064	Cable, Triplex, 4/0		-	-	#	-	-
		18 05 104	Cable, Quadplx., 1/0		-	-	-	#	-
		18 05 105	Cable, Quadplx., 4/0		-	-	-	-	#

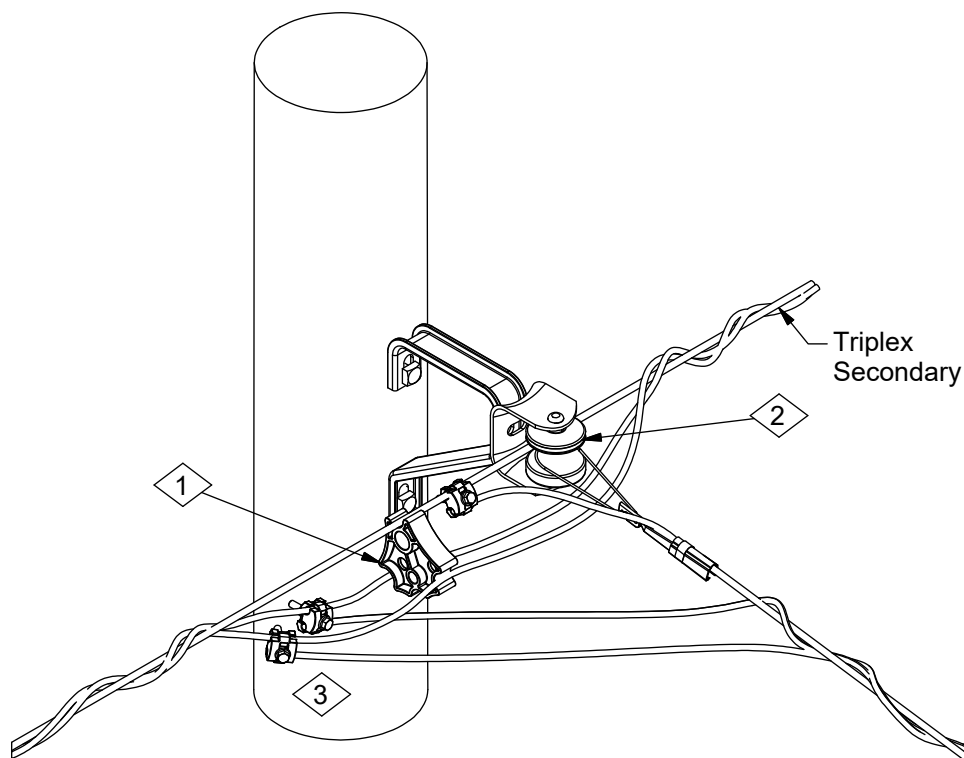


Bending Radius		
Wire Size	Min. Dia. "X"	Min. "Y"
500 kcmil	15"	18"
750 kcmil	17"	18"
1000 kcmil	19"	24"

CONSTRUCTION NOTE(s):

- Where more convenient, use DCS **08 01 10 **** for heavy services.

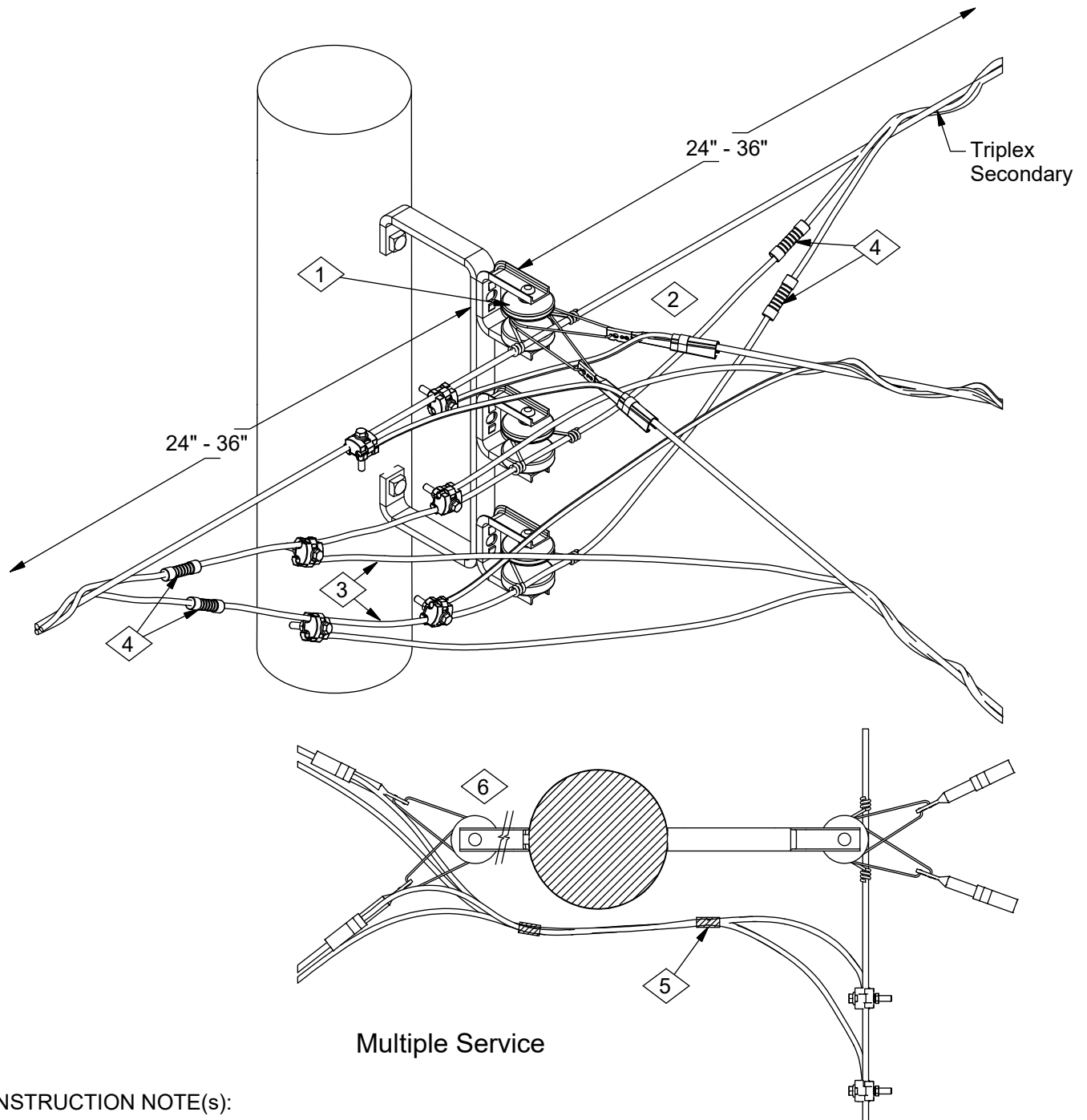
	ITEM	STK / DCS #	DESCRIPTION	09 01 12 **	00
@	A	06 01 01 01	Secondary Clevis		1
	B	09 01 52 **	Service Attachment		1
@	C	23 18 058	Grip, Preformed, Poly covered for 500 kcmil Cu		2
		23 68 703	Grip, Preformed, Poly covered for 750 kcmil Cu		2
		23 68 700	Grip, Preformed, Poly covered for 1000 kcmil Cu		2



Single Service

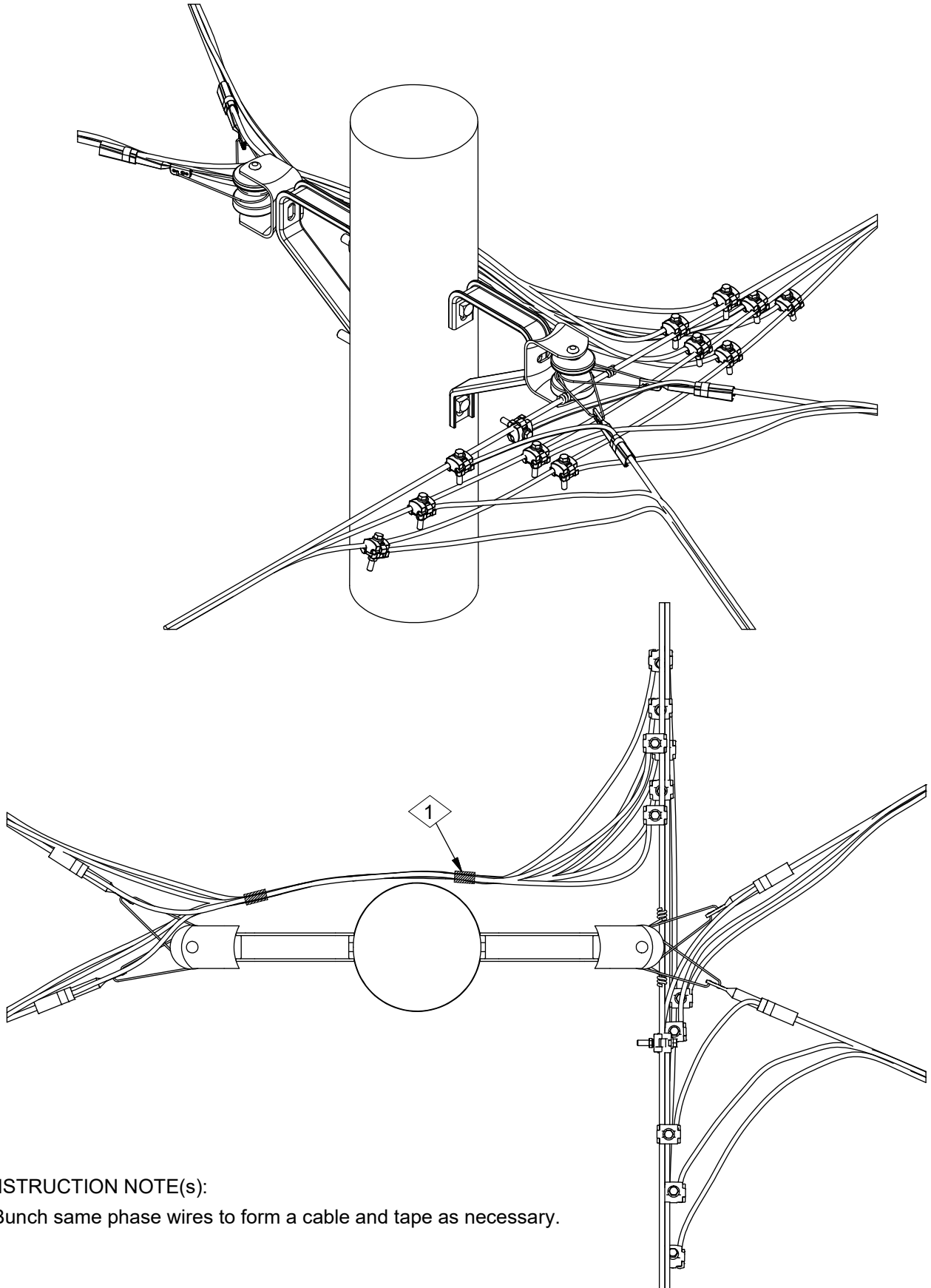
CONSTRUCTION NOTE(s):

1. Insert triplex spacer Stock #23 17 227 between conductors.
2. Attach wedge clamp to the secondary insulator or triplex spacer.
3. Stagger the location of the connections to allow the connections to contact one another.



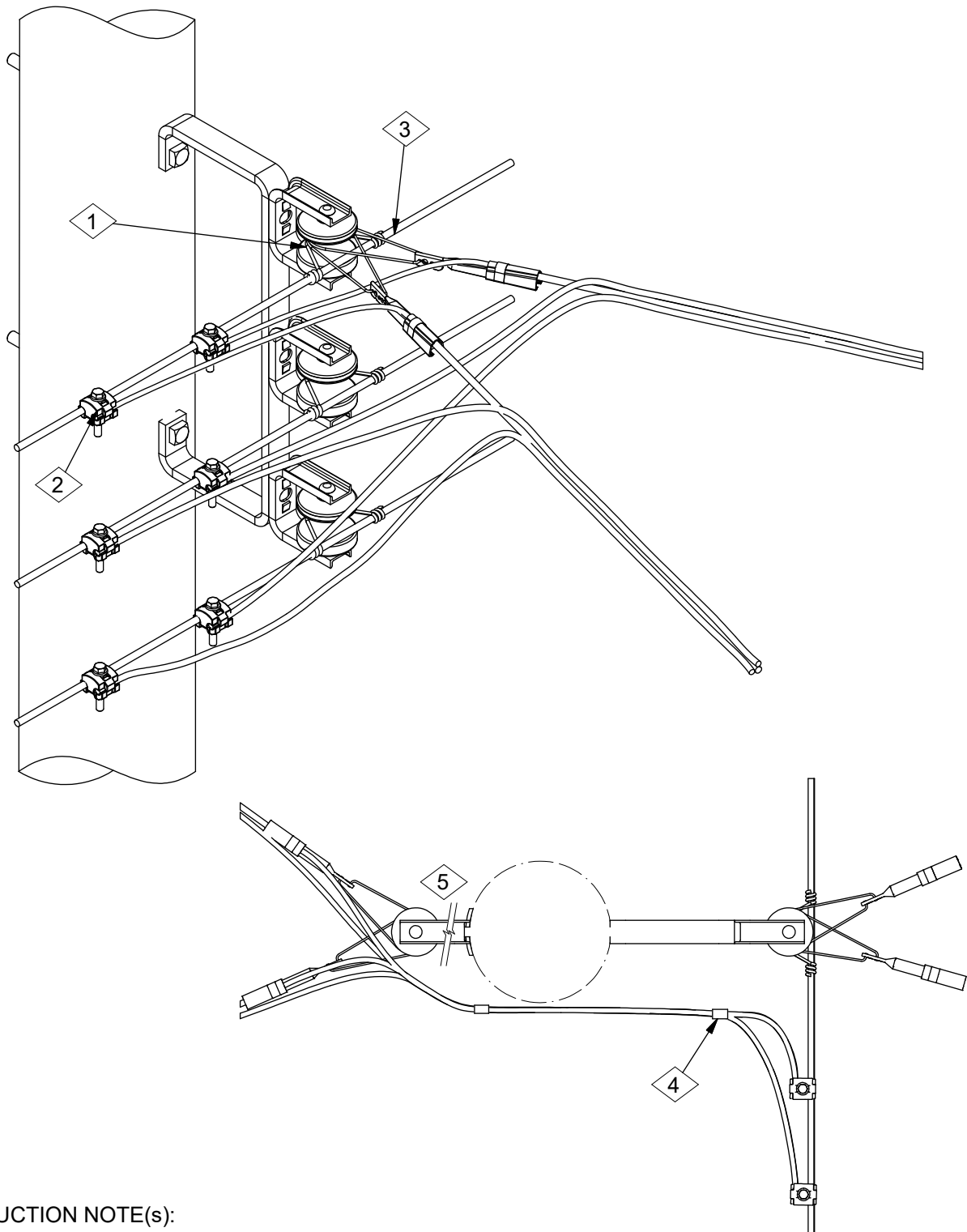
CONSTRUCTION NOTE(s):

- ① Neutral position on rack should be consistent with operating company practice.
- ② Attach wedge clamp for service to the neutral conductor insulator.
- ③ Use 8 to 10 feet of new 600V wire (obtained from new triplex of same size) for extension to lower phase position or rack.
- ④ Use non-tension sleeves to splice the new insulated conductors into the triplex secondary (Stock #17 60 418) for 4/0 to 4/0Al.).
- ⑤ Bunch same phase wires to form a cable and tape as necessary.
- ⑥ When required, use extension bracket on both sides, DCS **06 01 03 ****.



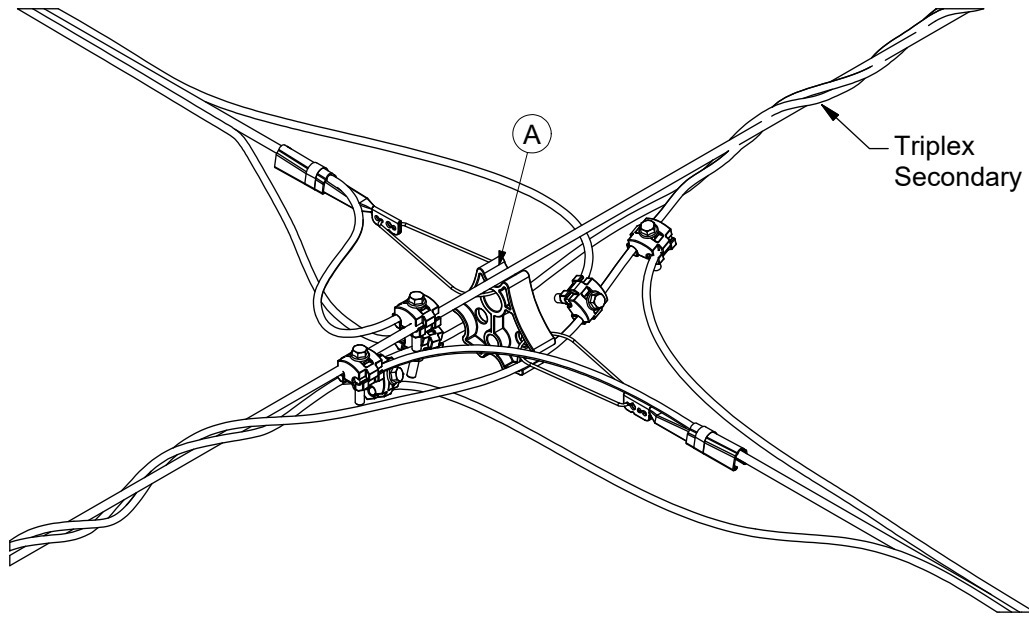
CONSTRUCTION NOTE(s):

1. Bunch same phase wires to form a cable and tape as necessary.

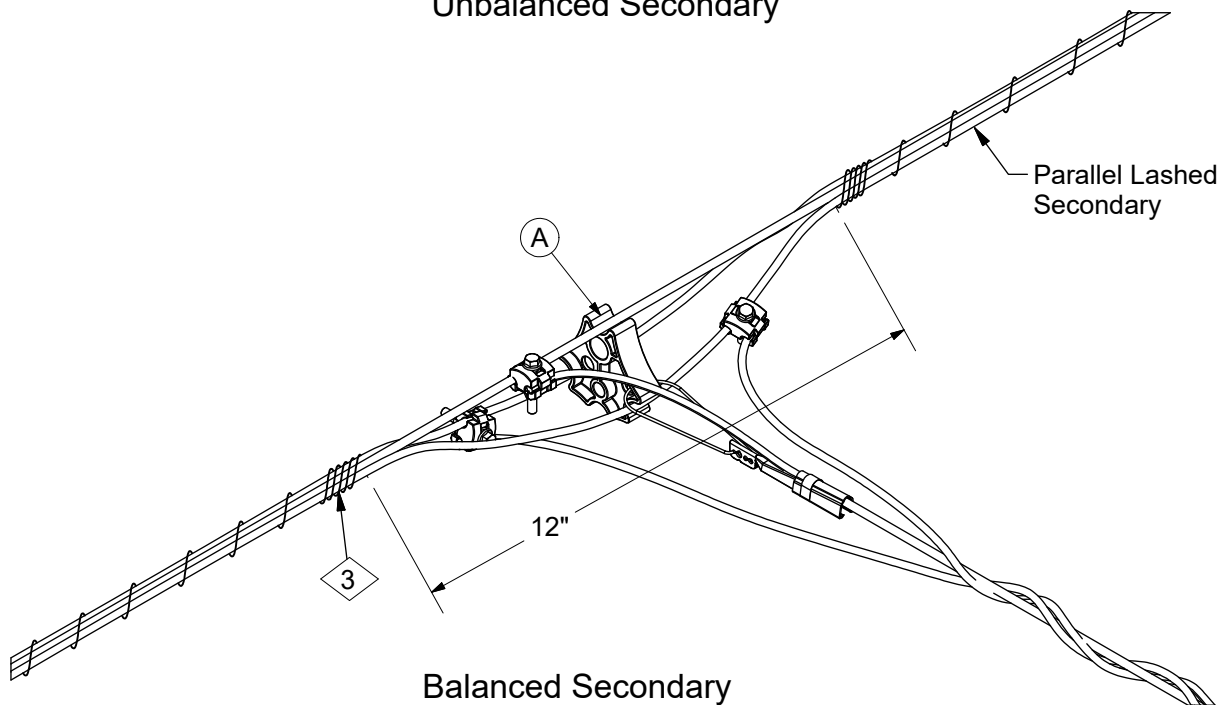


CONSTRUCTION NOTE(s):

1. Attach wedge clamp to neutral conductor insulator.
2. To prevent corrosion, apply lubricant before and after installing clamp, on voltage below 5kV tape connector.
3. Secondary conductor may be tied to either inside or outside of clevis.
4. Bunch same phase wires to forma cable and tape as necessary.
5. When required, use extension bracket on both sides, DCS 06 01 03 **.



Unbalanced Secondary

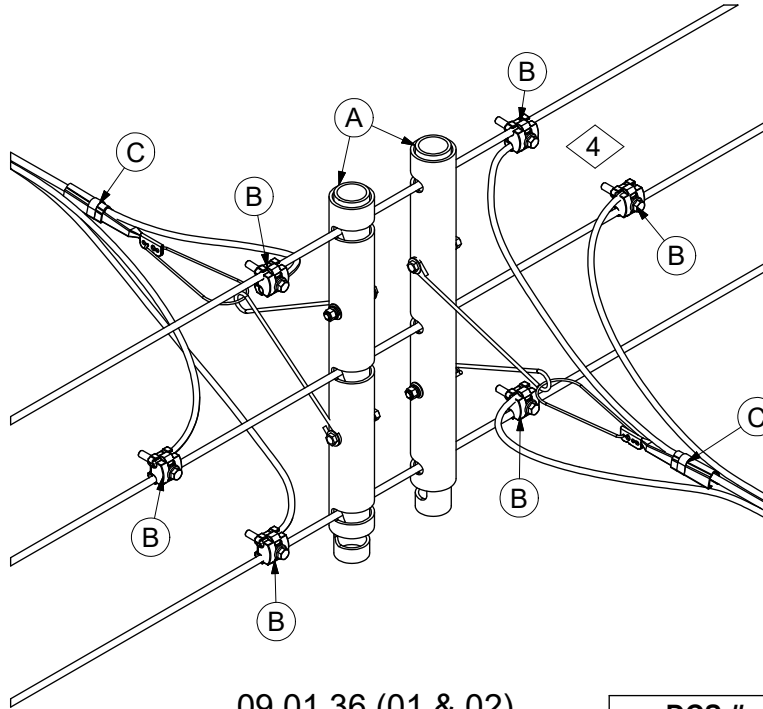


Balanced Secondary

CONSTRUCTION NOTE(S):

1. Pole separations in excess of 125 feet may require the installation of pole to pole or pole to anchor guying. For this condition or with 1/0 or larger services, use DCS **09 01 38 ****.
2. See DCS **09 01 10 **** for installation of service.
3. Terminate lashing ribbon with 5 close turns around entire cable and end on messenger with 2 turns and a half hitch. Train neatly and eliminate excess slack.

ITEM	STK / DCS #	DESCRIPTION	09 01 34 **	00
A	23 17 227	Spacer, Electrical Cable, 600v		1



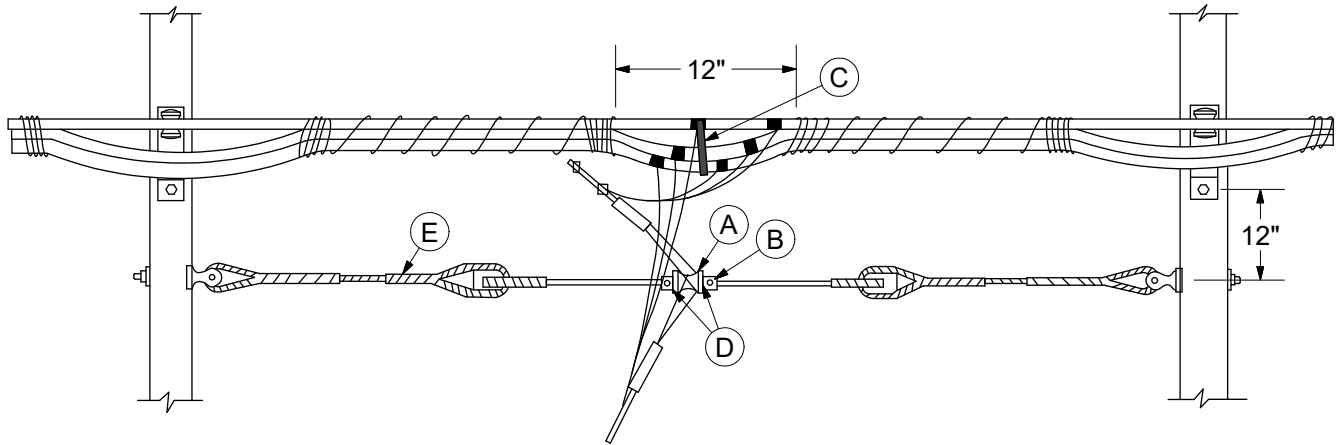
09 01 36 (01 & 02)

DCS #	DESCRIPTION
09 01 36 01	Balanced
09 01 36 02	Unbalanced

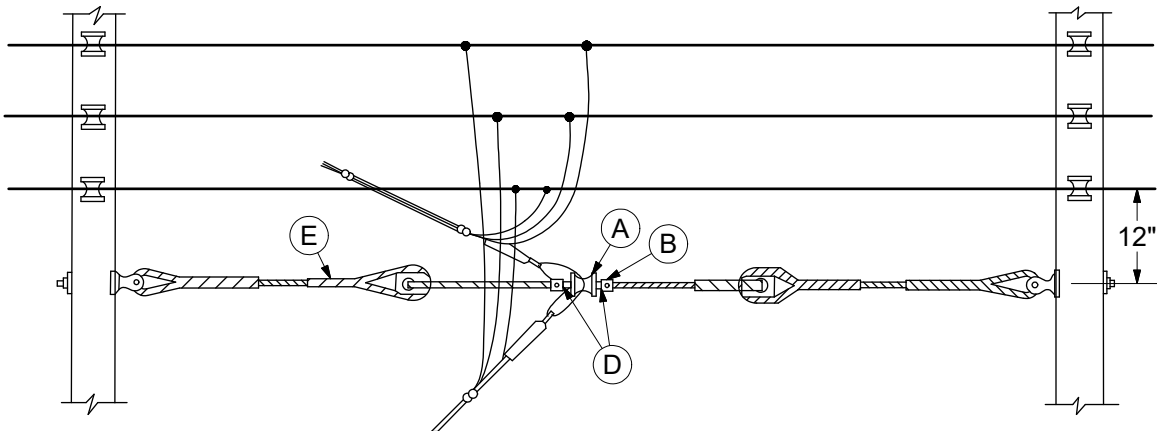
CONSTRUCTION NOTES:

1. This type of flying service is preferred for open wire secondary. See DCS **09 01 38 02** for alternate method.
2. Installation of unbalanced flying services in spaces where the construction is light and pole separation is in excess of 125 feet may require the installation of pole to pole or pole to anchor guying. Refer to DCS **09 01 38 02**.
3. See DCS **09 01 10 **** for termination of cable at house.
4. To prevent corrosion, apply lubricant (Stock #31 59 058) before and after installing clamp. On voltages below 5 kV, tape connector.
5. #2 triplex can be used for spans up to 140 feet, providing clearances required between low point of triplex service cable and finished ground grade is maintained. Refer to DCS **09 00 03 01**.
6. This type of flying service shall not be used for 1/0 or larger triplex. Use alternate construction, DCS **09 01 38 02**.
7. Secondary spreader includes telescoping tubes and one bridle to be used for unbalanced services. If a spare or salvaged bridle is available this can be added for balanced services (back-to-back). Otherwise, install a second unbalanced spreader facing the opposite direction.
8. Aluminum duplex cable, Stock #18 05 048, used for multiple street lighting circuits, may be attached to secondary as shown above. Use Stock #17 51 123 for wedge clamp.

ITEM	STK / DCS #	DESCRIPTION	09 01 36 **	01	02
A	23 17 219	Spreader Sec. 2 Cu & 4/0 AA		2	1
B	17 51 032	Clamp, Parallel Groove		6	3
C	17 51 123	Clamp, DE, #2 Triplex		2	1



09 01 38 01
Parallel Lashed or Triplex Secondary

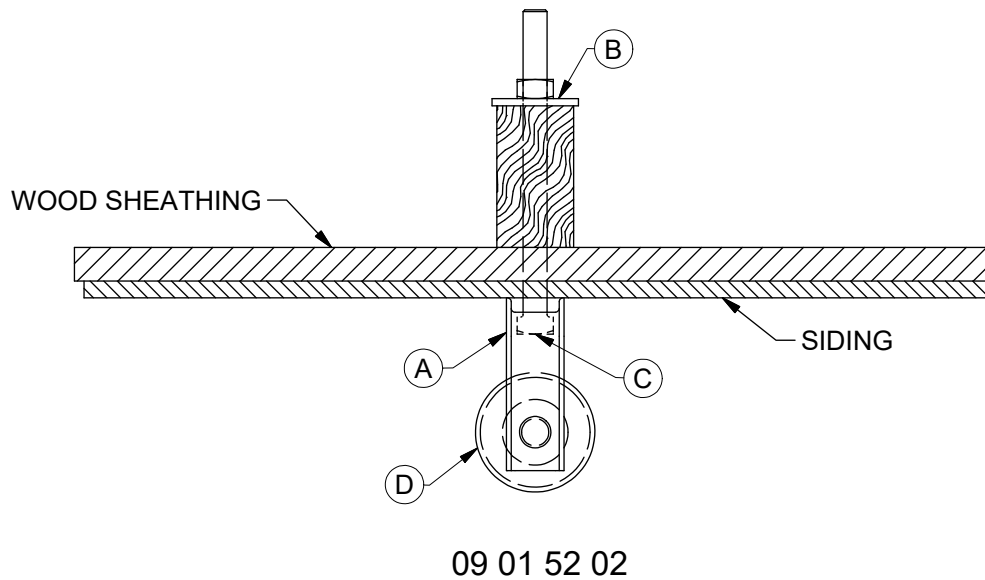
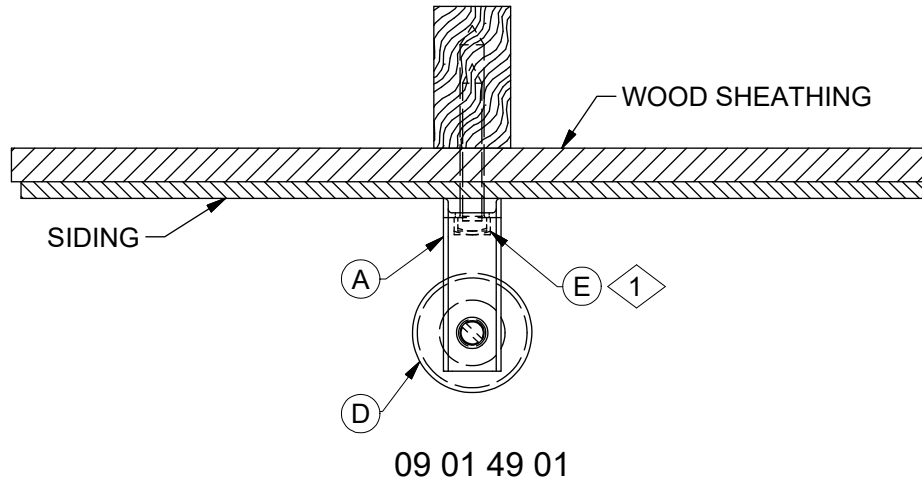


09 01 38 02
Open Wire Secondary

CONSTRUCTION NOTE(s):

1. Installation of unbalanced flying services in spaces where the construction is light and pole separation is in excess of 125 feet may require the use of these standards.

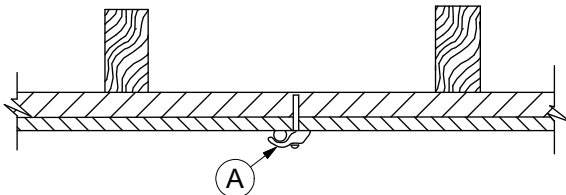
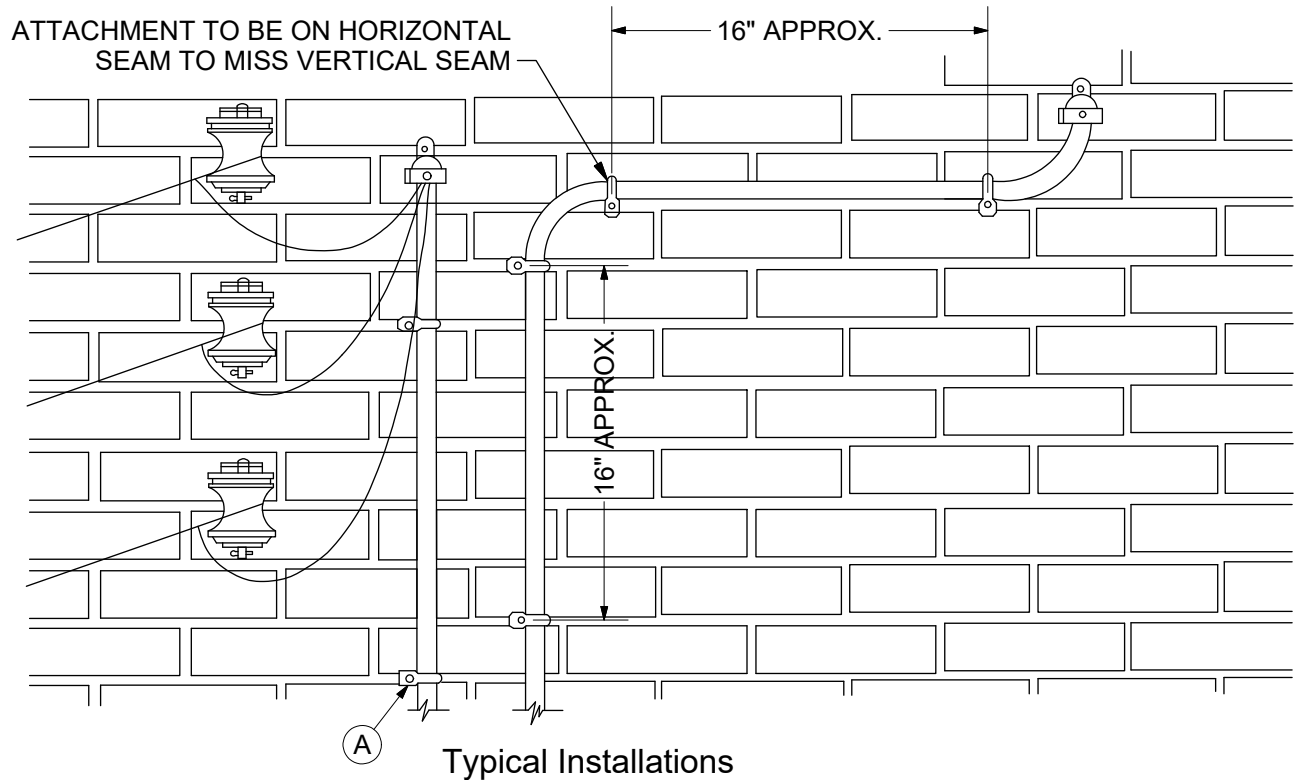
@	ITEM	STK / DCS #	DESCRIPTION	09 01 38 **	01	02
	A	25 59 044	Insulator, Spool		1	1
	B	17 51 032	Clamp, Parallel Groove		2	2
	C	23 17 227	Spacer, Electrical Cable, 600v		1	-
	D	23 66 017	Washer - Round 1/2"		2	2
	E	11 00 46 03	Insulated, Guy Unit		1	1



CONSTRUCTION NOTE(s):

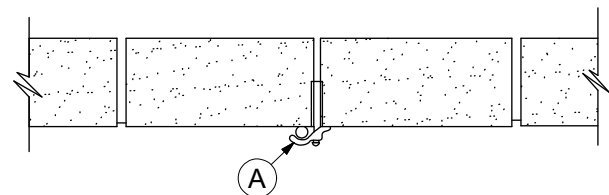
1. Item E depends on thickness of sheathing:
 - a) Drill 3/8" lead hole for 1/2" x 4" lag screw
 - b) Drill 1/2" lead hole for 5/8" x 5" lag screw
2. Normally used where stud is accessible from the inside.

1,@	ITEM	STOCK #	DESCRIPTION	09 01 49 **	01	02
	A	23 06 040	Clevis - Secondary		1	1
	B	23 66 027	Washer - Square 5/8"		-	1
	C	23 52 061	Bolt, Mach., 5/8" x 8" w/ square nut		-	1
	D	25 59 044	Insulator, Spool		1	1
	E	23 60 011	Lag Screw - 5/8" x 5"		1	-
		23 60 007	Lag Screw - 1/2" x 4"		1	-



09 01 50 01

Wood Siding Composition Shingles



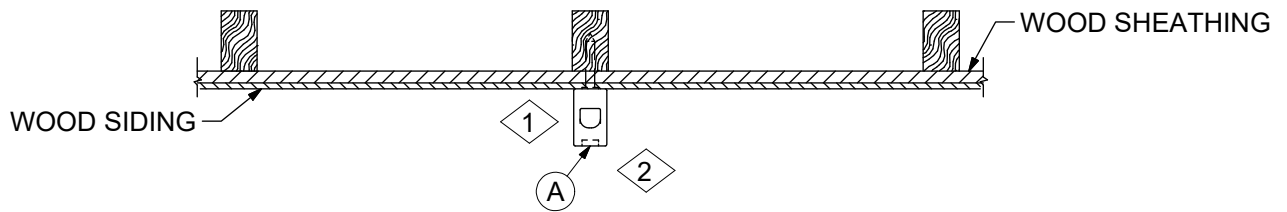
09 01 50 02

Solid Masonry Brick - Brick Veneer or Cement

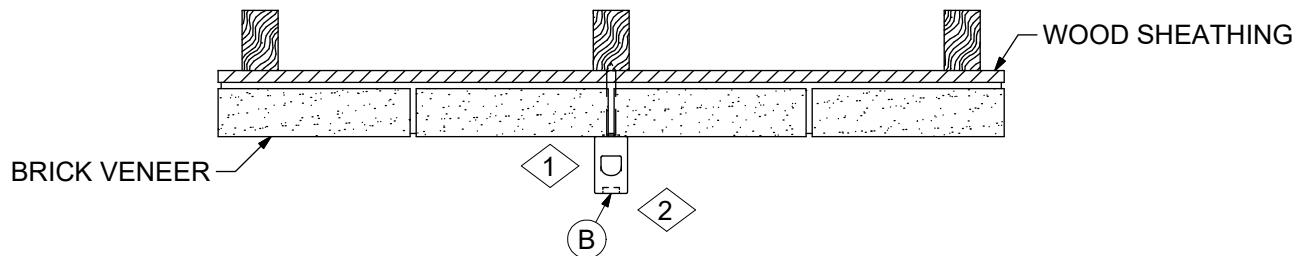
CONSTRUCTION NOTE(S):

- Cable straps shall be installed in horizontal seams within 2 ft. of corner of building or side of window and shall be installed in vertical seams within 1 ft. of top of wall or upper or lower edge of window.

ITEM	STK / DCS #	DESCRIPTION	09 01 50 **	01 or 02
A	21 71 022	Screw		As REQ'D
	40 59 107	Cable Strap for #8-2		
	40 59 014	Cable Strap for #4 - 3 & #2-3		
	21 51 009	Shield Expansion		



09 01 51 01
Wood Siding

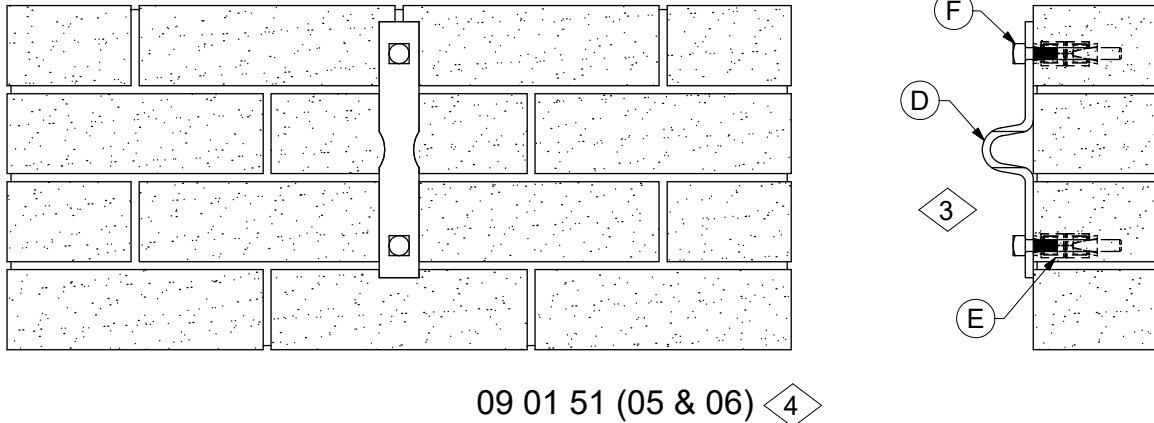
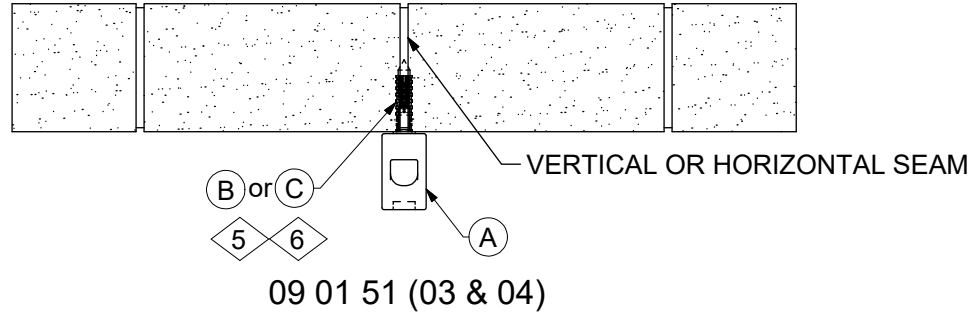


09 01 51 02
Brick Veneer or Composition Shingles

CONSTRUCTION NOTE(s):

1. Drill a lead hole 1/4" in diameter into stud or plate.
2. Knob may be installed between studs where wall materials are sound.

ITEM	STK / DCS #	DESCRIPTION	09 01 51 **	01	02
A	23 06 077	Insulator Wire Holder - 2-1/4"		1	-
B	23 17 241	Insulator Wire Holder - 3-1/2"		-	1



DCS #	DESCRIPTION
09 01 51 03	#4 to #2 Triplex or Open Wire
09 01 51 04	
09 01 51 05	1/0 Al Messenger
09 01 51 06	4/0 Al Messenger

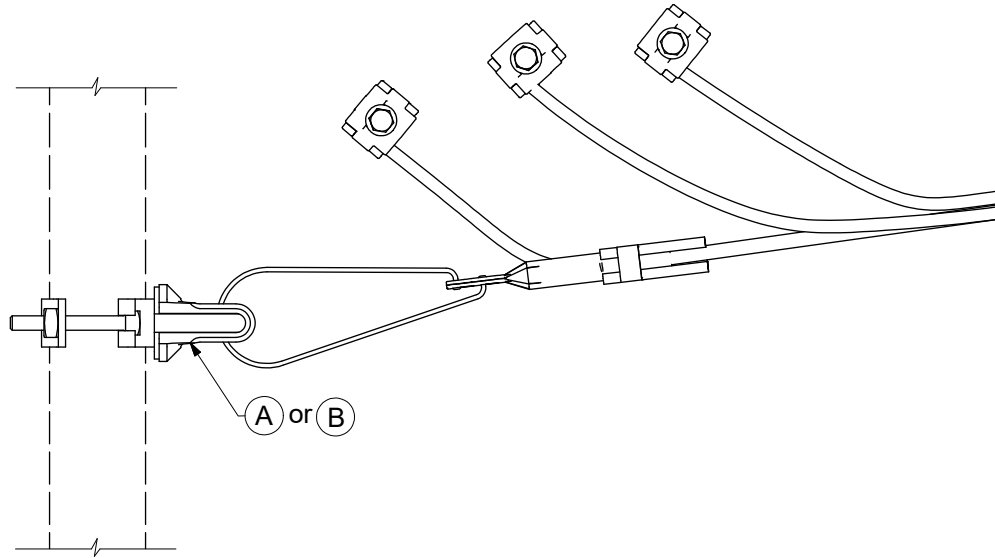
CONSTRUCTION NOTE(s):

- 3 Mount bracket vertically on seams so that it spans one brick.
- 4 Also use for smaller services where due to nature of masonry porcelain knobs are unsatisfactory.
- 5 To be used with porcelain body wire holder item A.
- 6 To be used with nylon wire holder item A.

	ITEM	STK / DCS #	DESCRIPTION	09 01 51 **	03	04	05	06
5	A	23 06 077	Insulator Wire Holder - 2-1/4"		1	1	-	-
	B	21 51 055	Shield, Exp., #22 Screw		-	1	-	-
6	C	21 51 181	5/16" EXPANSION SHIELD		1	-	-	-
3	D	23 06 057	Bracket, Wall Triplex		-	-	1	1
	E	21 51 018	Shield, Exp., 1/2"		-	-	-	2
		21 51 016	Shield, Exp., 3/8"		-	-	2	-
	F	23 52 034	Bolt, Mach., 1/2" x 4" w/ square nut		-	-	-	2
		23 52 194	Bolt, Mach., 3/8" x 3" w/ square nut		-	-	2	-

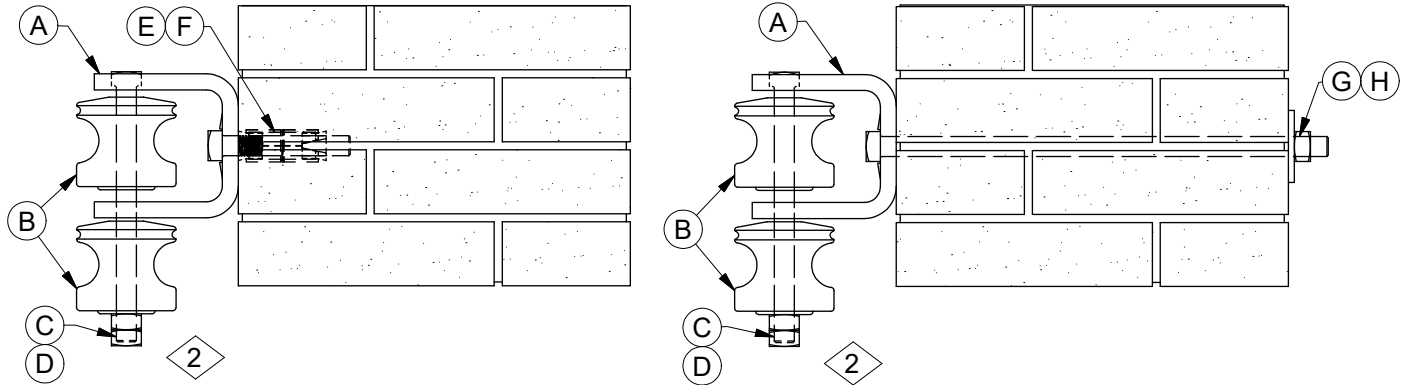
DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
1	01/01/21	WYW	Moved from DCS 06 01 50 **



09 01 51 (07 & 08)

ITEM	STK / DCS #	DESCRIPTION	09 01 51 **	07	08
A	23 06 075	Insulator, Wire Holder, 1-1/4" to 2-1/2" Mast		1	-
B	23 06 082	Insulator, Wire Holder, 3" to 4" Mast		-	1



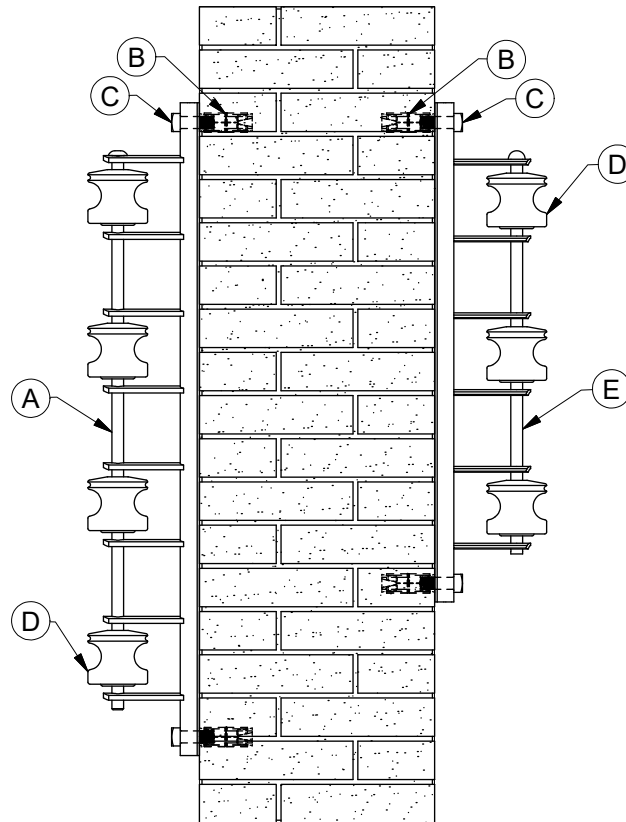
Solid Masonry - Brick Or Cement		
DCS #	Description	Conductor Range
09 01 53 01	1 Spool	Up to #4
09 01 53 02	1 Spool	#2 to #4/0
09 01 53 03	1 Spool	500 to 750 MCM
09 01 53 04	2 Spools 1	Up to #4
09 01 53 05	2 Spools 1	#2 to #4/0
09 01 53 06	2 Spools 1	500 to 750 MCM

Solid Masonry - Brick Or Cement		
DCS #	Description	Application
09 01 53 07	1 Spool	To be used when the stud is accessible from inside.
09 01 53 08	2 Spools 1	

CONSTRUCTION NOTE(s):

1. The double spool insulator is to be used only for attaching network cable to buildings excluding deadend constructions.
2. The 2 square nuts are jammed together.

ITEM	STOCK #	DESCRIPTION	09 01 53 **	01	02	03	04	05	06	07	08
A	23 06 040	Clevis - Secondary Insulator		1	1	1	1	1	1	1	1
B	25 59 044	Insulator, Spool		1	1	1	2	2	2	1	2
C	23 52 061	Bolt, Mach., 5/8" x 8" w/ square nut		-	-	-	1	1	1	-	1
D	23 65 011	Nut, Square, 5/8"		-	-	-	1	1	1	-	1
E	21 51 016	Shield, Exp., 3/8"		1	-	-	1	-	-	-	-
	21 51 018	Shield, Exp., 1/2"		-	1	-	-	1	-	-	-
	21 51 019	Shield, Exp., 5/8"		-	-	1	-	-	1	-	-
F	23 52 194	Bolt, Mach., 3/8" x 3" w/ square nut		1	-	-	1	-	-	-	-
	23 52 034	Bolt, Mach., 1/2" x 4" w/ square nut		-	1	-	-	1	-	-	-
	23 52 200	Bolt, Mach., 5/8" x 4" w/ square nut		-	-	1	-	-	1	-	-
G	23 52 066	Bolt, Mach., 5/8" x 14" w/ square nut		-	-	-	-	-	-	1	1
H	23 66 027	Washer - Square 5/8"		-	-	-	-	-	-	1	1



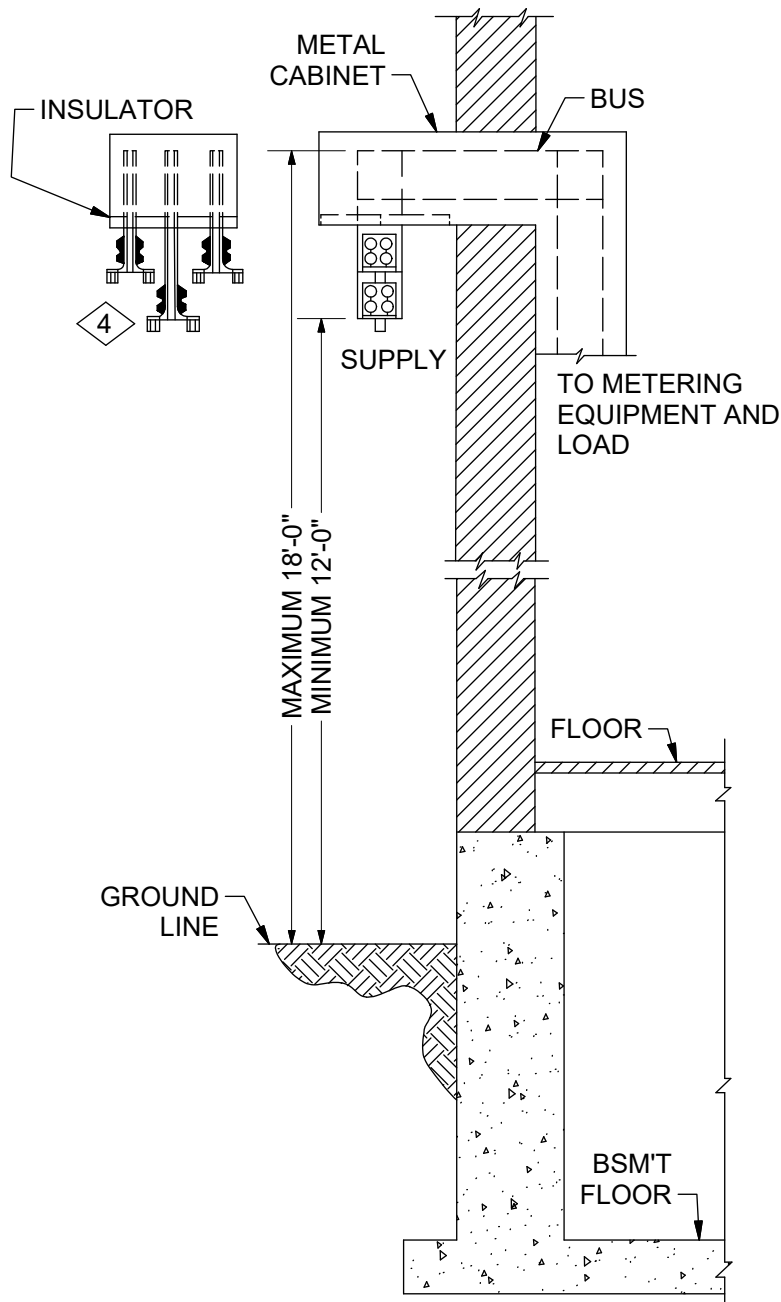
DCS #	DESCRIPTION
09 01 54 01	4-Wire
09 01 54 02	3-Wire

CONSTRUCTION NOTE(s):

- The square nut provided with machine bolt, is not used for this application.

	ITEM	STOCK #	DESCRIPTION	09 01 54 **	01	02
1	A	23 11 004	Rack, Secondary, 4-Wire		1	-
	B	21 51 019	Shield, Exp., 5/8"		2	2
	C	23 52 438	Bolt, Mach., 5/8" x 3" w/ square nut		2	2
	D	25 59 044	Insulator, Spool		4	3
	E	23 11 001	Rack, Secondary, 3-Wire		-	1

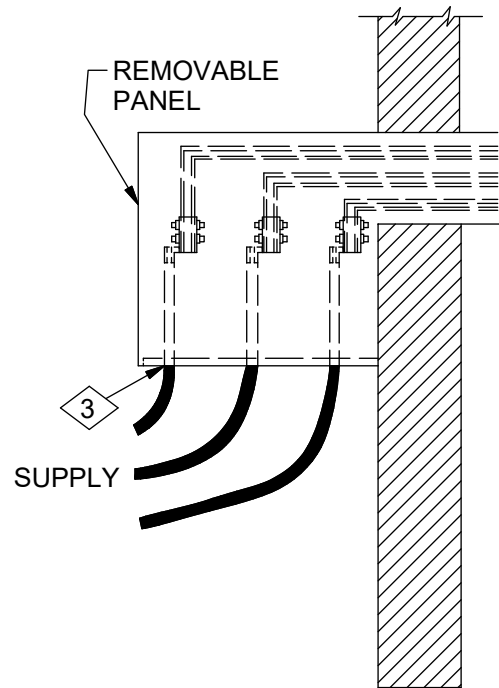
Method 1



Equipment to be Furnished by Customer

Method 2

(Drawing shall be submitted for approval)



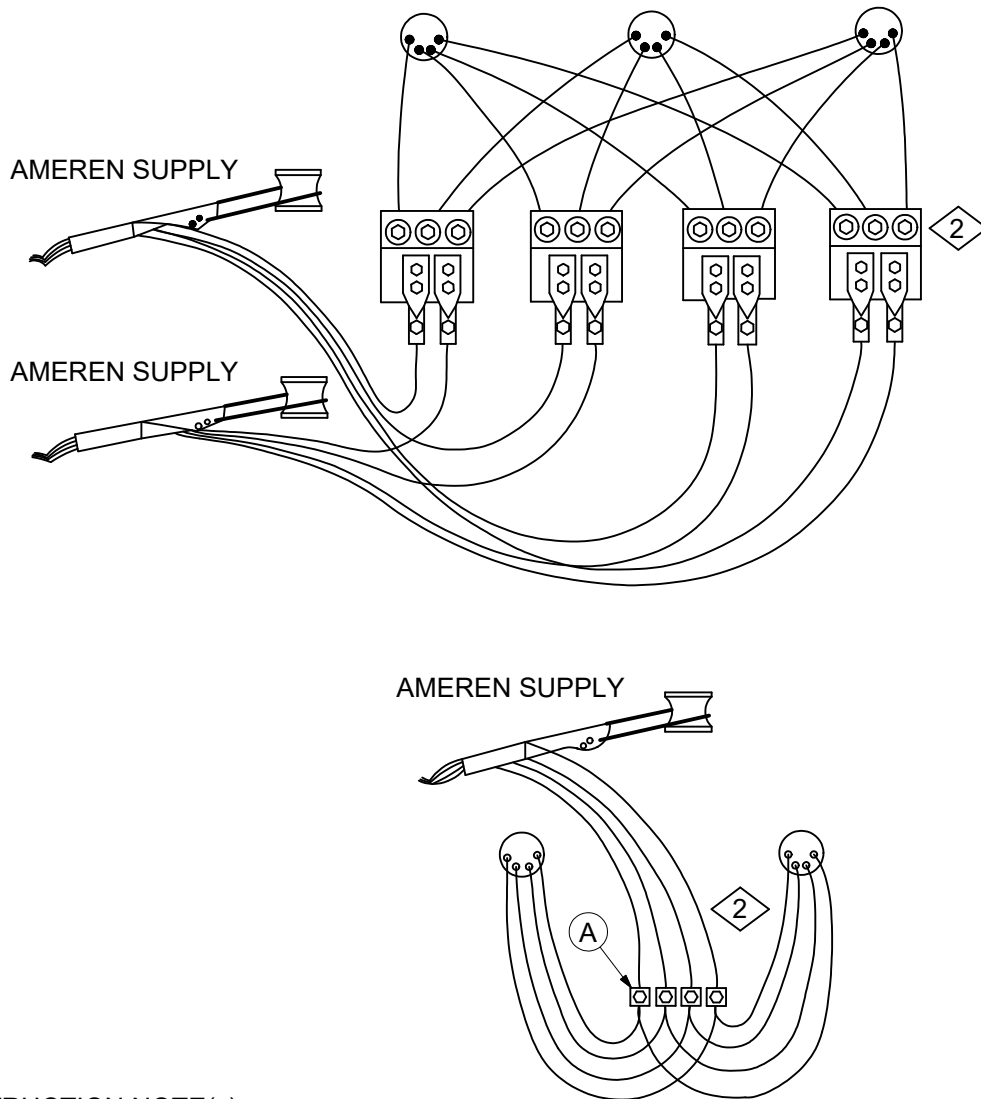
Metal Cabinet - Bolts & Lugs		
Service Size - Amps	NO.	Lug Size
0 - 1000	1	500 / 750
1001 - 2000	2	500 / 750
2001 - 3000	3	500 / 750
3001 - 4000	4	500 / 750

CONSTRUCTION NOTE(s):

1. All equipment, including connector lugs and everdur bolts, shall be furnished and installed by customer. Ameren to make connection to service wires.
2. Any deviation from this standard shall be approved by Ameren Engineer prior to installation.

3. Insulator board to be drilled for conductors. Size to be determined by Ameren.

4. 3-Wire shown. For 4-Wire add 4th Bus.

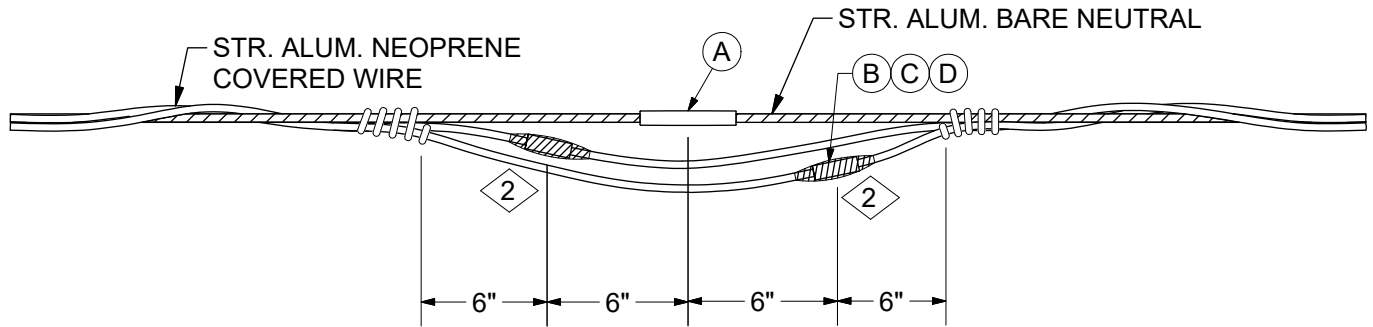


CONSTRUCTION NOTE(s):

1. This type of connection is undesirable and to be used only when a bus-bar outlet cannot be used. Each job shall be specifically approved and configuration agreed upon by Ameren Engineer prior to construction.

2. Customer:
- Gather service entrance conductors
 - Provide 2 and 3 barrel NEMA 4-hole lugs and bolt together
- Company:
- Make final connection and tape
 - Tape conductors together for mechanical support

	ITEM	STK / DCS #	DESCRIPTION	09 01 58 **	00
@	A	17 64 244	Connector Insulated Set Screw, 6 Holes, #4 AWG to 600kcmil, Al or Cu		#
		17 64 245	Connector Insulated Set Screw, 6 Holes, 250kcmil to 750kcmil, Al or Cu		#



CONSTRUCTION NOTE(s):

- Triplex splicing sleeve shall be used to make full tension splices in triplex cables. The available sleeves are shown as follows:

Stock #	Size
17 60 160	1/0 Al
17 60 187	#2 Al
17 60 188	#4 Al
17 60 625	#2 - #4 Al

- Tape with two layers half lapped rubber based tape (Stock #25 53 080) and cover with same amount DF Friction tape (Stock #25 53 003).

ITEM	STK / DCS #	DESCRIPTION	09 01 60 **	01	02	03
A	17 60 188	Sleeve, Splicing, 4 Al.		1	-	-
	17 60 187	Sleeve - Compression Cu 1/0 to #2		-	1	-
	17 60 160	Sleeve, Full Tension, 1/0 Al.		-	-	1
B	17 60 180	Sleeve - Compression, Non Tension 5/8" O.D. #3 or #4		2	-	-
	17 60 182	Sleeve - #2 Al		-	2	-
	17 60 319	Sleeve - Compression 1/0 Str. to 1/0		-	-	2
C	25 53 080	Tape, Rubber, Insl.		1	1	1
D	25 53 003	Tape, Friction		1	1	1
E	23 68 313	Tie, Cable, Tplx., Poly.		2	2	2

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1. SWITCHES FOR 2.4 KV THROUGH 14.4 KV APPLICATIONS

A. Fused Switches – (for link type expulsion fuses)

All fused switches are stocked with a cartridge (fuse tube). Cartridges are available for replacement only.

The 15 kV, 100 amp, 110 kV BIL, open style fused switch (Stock Number 54-07-208) may be used on 2.4 kV through 14.4 kV circuits. This switch will be used in nearly all new installations and replacements where practical.

The 15 kV, 200 amp, 110 kV BIL, open style fused switch (Stock Number 54-07-209) may be used on 2.4 kV through 14.4 kV circuits. This switch will be used in nearly all new installations and replacements where practical.

The 27 kV, 100 amp, 125 kV BIL, open style fused switch (Stock Number 54-07-240) may be used on 7.2 kV through 14.4 kV circuits. It shall not be used on 2.4/4.16 kV circuits. This switch (for years the most commonly installed) will not be frequently used.

The 5 kV, 100 amp porcelain enclosed fused switch (Stock Number 54-06-046) may be used on 2.4/4.16 kV circuits where the 15 kV switch does not have adequate clearance, and for special replacements.

B. Solid Blade Switches

The 15 kV, 300 amp, 110 kV BIL, open style switch (Stock Number 54-07-210) may be used on 2.4 kV through 14.4 kV circuits. The 15 kV, 100 amp fused switch can be converted to a 300 amp device by removing the cartridge and inserting a solid blade (Stock Number 54-07-243).

The 27 kV, 100 amp fused switch (Stock Number 54-07-240) can be converted to a 200 amp device by removing the cartridge and inserting a solid blade (Stock Number 54-07-199).

The 5 kV, 200 amp porcelain enclosed switch (Stock Number 54-06-047) may be used on 2.4/4.16 kV circuits. The 5 kV, 100 amp porcelain enclosed fused switch can be converted to a 200 amp device by removing the cartridge and inserting a solid blade (Stock Number 54-06-049). 5 kV porcelain enclosed switches should be used only where the 15 kV switch does not have adequate clearance, and for special replacements.

The 15 kV, 600 amp underslung switch (Stock Number 54-07-204) may be used on 2.4 kV through 14.4 kV circuits. The switch blade is attached and cannot be removed.

The 15 kV, 600 amp single insulator disconnect switch (Stock Number 54-07-296) may be used on 2.4 kV through 14.4 kV circuits in terminal pole applications. The switch blade is attached and cannot be removed.

The 15 kV, 600 amp open style in line switch (Stock Number 54-07-205) may be used on 2.4 kV through 14.4 kV circuits only where special conditions warrant.

C. Group Operated Switches

The 15 kV, 600 amp, group operated switch, (Stock Number 54-07-239) may be used on terminal poles serving padmount transformers to prevent ferroresonance, or on primary metering poles where three phase disconnection is required. The switch is equipped with load interrupters. The switch mounts on the face of the pole on a horizontal beam below the overhead connections. It may be used on 2.4 kV through 13.8 kV circuits.

2. SWITCHES FOR 19.9/34.5 KV APPLICATION

A. Single Phase Switches

The 27 kV, 100 amp, 150 kV BIL fused switch (Stock Number 54-07-234) can be used for applications thru 34.5kV if on single phase to neutral or three phase solidly grounded WYE connected circuits where the TRV (Temporary Recovery Voltage) does not exceed 27kV.

The 34.5 kV, 200 amp, SMD-20 fused switch (Stock Number 54-06-052) may be used on 19.9/34.5 kV capacitor banks or conventional transformers if asymmetrical fault current is greater than 12 kA but not more than 16 kA. For asymmetrical fault currents above 16 kA contact Standards.

The 34.5 kV, 900 amp underslung switch (Stock Number 54-07-302) may be used on 14.4/24.9 kV and 19.9/34.5 kV circuits or lower distribution voltage circuits where loads in excess of 600 amps are anticipated and clearances permit. The switch blade is attached and cannot be removed.

B. Group Operated Switches

The 34.5 kV, 1200 amp, frame mounted switches without loadbreak interrupter shall be used on circuits where sectionalizing requires simultaneous interruption of all three phases. It is generally capable of interrupting charging current.

The 34.5 kV, 1200 amp, frame mounted switches with loadbreak interrupters shall be used on circuits where sectionalizing requires simultaneous interruption of all three phases and where interruption of load or circulating current is required.

The non-loadbreak switch may be converted to loadbreak interrupting by the addition of loadbreak interrupters. These switches have a mounting bracket to attach the load interrupter units. Installation instructions are included with each switch and kit.

Non-frame mounted, group operated switches (Stock Number 54-08-316) are to be scrapped when removed. Send switches to Dorsett for spare parts.

In addition to the switch bodies (mounting base, insulators and hot parts,) each switch should also include 1-5', 1-13.5', and 1-17.5' piece of 2" diameter Schedule 40 galvanized steel vertical pipe complete with pipe guides. One 8' insulating fiberglass insulator and one 34kV TR210 skytone gray porcelain station post operating rod insulator with provisions for attaching to the vertical operating pipe (for isolating the 34kV from underbuilt circuits) and from the switch operating handle shall be included. The switch operating handle shall have provisions to ground to a driven ground electrode. All switches shall comply with ANSI 37.30 and related ANSI Standards.

34kV Standard Group Operated Switches:

Stock No. (Note)	kV	Amp	Switch without or with Interrupters	Weight (Lbs.)
54-08-433	34.5	1200	Turner TS2, Three Phase with LBRK – Vertical Mount	999
54-08-437	34.5	1200	Turner TS2, Three Phase with LBRK – Flat Top Mount	999
54-08-438	34.5	1200	Turner TS2, Three Phase with LBRK – Terminal Pole Mount	999
54-08-442	34.5	1200	Seeco, Three Phase with LBRK – Vertical Mount	1400
54-08-447 (1)	34.5	1200	Seeco, Three Phase with LBRK – Flat Top Mount	1300
54-08-446	34.5	1200	Seeco, Three Phase with LBRK – Terminal Pole Mount	1150

Note:

1. Differential tension shall not exceed 333 pounds per phase using the DE tension listed in DCS **07 00 07 03**.

3. SWITCHES FOR 69 KV APPLICATION – Group Operated Switches

The 69 kV, 1200 amp, frame mounted switches without loadbreak interrupter shall be used on circuits which are capable of interrupting charging current :

The 69 kV, 1200 amp, frame mounted switches with loadbreak interrupters shall be used on circuits where sectionalizing requires simultaneous interruption of all three phases and where interruption of load or circulating current is required.

69kV Standard Group Operated Switches:

Stock No.	kV	Amp	Switch without or with Interrupters	Configuration
54 09 393	69	1200	Turner, CS2, Three-Phase GOP Switch without LBRK Interrupter	Triangle or Delta
54 09 395	69	1200	Turner, CS2, Three-Phase GOP Switch with LBRK Interrupter	Triangle or Delta
54 09 392	69	1200	Turner, CS2, Three-Phase GOP Switch without Interrupter	Phase over Phase
54 09 394	69	1200	Turner, CS2, Three-Phase GOP Switch with LBRK	Phase over Phase
54 09 369	69	1200	SEECO, Three Phase GOP Switch without Interrupters	Triangle or Delta
54 09 035	69	1200	SEECO, Three Phase GOP Switch with Interrupters	Triangle or Delta
54-09-368	69	1200	SEECO, Three Phase Switch without Interrupters	Phase over Phase
54-09-370	69	1200	SEECO, Three Phase Switch with Interrupters	Phase over Phase

In addition to the switch bodies (mounting base, insulators and hot parts,) each switch should also include 3–21' sections of 2" schedule 40 galv. steel operating pipe, one U-joint for operating pipe plus all necessary hardware for assembling insulators and live parts to switch bases shall be included. One 8' insulating fiberglass insulator and 1–34 kV TR210 skytone gray porcelain station post operating rod insulators with provisions for attaching to the vertical operating pipe for isolating the control mechanism from underbuilt circuits. The switch operating handle shall have provisions for grounding to a driven ground rod or a formed ground electrode. All switches shall comply with ANSI 37.30 and related ANSI Standards.

4. MOTOR OPERATOR

Motor operators shall include a 24 volt battery (or two 12 volt batteries in series), battery charger (powered by 120 VAC), a 24VDC to 12VDC converter (if single 24V battery provided) to power RTU and radio, a swing-out door to mount radio and RTU, remote/local switch with position terminal to provide dispatch status, low voltage DC and loss of AC alarm relays, knife blade switch plus weatherproof supply conduit for 120VAC.

Secondary arrester should be installed from factory at entrance of motor operator cabinet on 120V supply.

The following stock coded motor operators come pre-wired for an RTU. The RTU is optional and has to be ordered separately. Please contact Standards Engineering if RTU is to be installed in the motor operator cabinet by the manufacturer.

List of Motor Operators:

	Stock No.	kV		Description
	54 08 416	34	24VDC	Motor operator for Turner 34kV D switch
	54 08 430	34 or 69	24VDC	Motor Operator for Turner 34 (TSB) or 69kV (CSB) Switch
	54 09 349	69	24VDC	Motor operator for Turner 69kV D switch
	54 09 371	34 or 69	24VDC	Motor operator for SEECO 34 or 69kV switch
	54 02 011	–	–	GE Ibox RTU
	54 02 031			Novatech Orion RTU

5. RECOMMENDED LEAD SIZE

When a switch is used for sectionalizing circuits, the tap conductor (load side of switch) will determine the size of the switch leads. Poly covered soft drawn copper wire shall be used for leads to open style switches, as indicated in Standard **07 00 80 00**. EPR, 2400 volt, insulated copper wire shall be used to connect porcelain enclosed switches, as indicated in Standard **07 00 81 00**.

When a switch is used for underground cable feeds, the lead from the open style switch to the line conductor shall be poly covered soft drawn copper wire, while the lead to the terminator shall be poly covered hard drawn or soft drawn copper wire as indicated in the appropriate terminal pole Standard.

When a fused switch is used to connect a device such as a transformer or capacitor, the lead size will be specified in that particular equipment section of the Standards book.

Group operated 34.5 kV & 69 kV, 1200 amp switch leads shall be the same as the line conductor. The leads will be attached to the switch per Standard **07 00 30 00** with 556.6 kcmil or 954 kcmil lugs.

6. OVERCURRENT PROTECTION

A. Fuse Links – Expulsion Type

Fuse links are used in fused switches to protect the circuit by isolating overhead feeder taps, underground cable circuits, conventional transformers, and capacitor banks on the distribution system.

The use of 200 amp fuses shall be reviewed by a System Protection Engineer for coordination.

B. Power Fuses (Solid Material) and Mountings

Power fuses are used for higher current ratings, greater interrupting capacity, coordination requirements, and other special conditions such as a contaminated atmosphere and limited space.

The solid material fuse element is called a Refill. The Refill is held by a Fuseholder, which is placed in a Mounting. The stock number of the Mounting includes the Fuseholder.

Solid material fuses are specified by voltage and current. The Mountings are also specific to these Refills.

Refil Type	Rated Voltage	Refill Amperage Available	Interrupting Amps Asymm./Symm.*	Overhead Mounting Stock Number	Padmount Swgr. Mounting Stock Number
SM-4	7.5 kV	15-200	27,500/15,600	54-03-050	
SM-4	14.4 kV	20-200	20,000/12,500	54-03-060	***
SM-4	34.5 kV	65-125	10,000/6,250	54-03-054	
SM-5	7.5 kV	50-400	44,500/26,000	54-03-051	
SM-5	14.4 kV	30-250	40,000/25,000	54-03-064	54-07-226/233
SM-5	25 kV	30-250	32,000/20,000	54-03-053	
SM-5	34.5 kV	1-250	28,000/17,500	54-03-048	
SMU**	14.4 kV	100-200	22,400/14,000	54-06-050	54-07-212/213/ 216/217
SMU**	34.5 kV	1-200	16,000/10,000	54-06-052	

* Asymmetrical amperages shown are at normal applied system voltages (2.4/4.16 kV, 7.2/12/47 kV 14.4/24.9 kV, 19.9/34.5 kV), not the nominal rated voltage of the device.

** The SMU Refills do not have separate Fuseholders. They fit directly into the SMD-20 units. The end fittings on the old Refill is reused on the new Refill

*** Ameren Missouri switchgear prior to 2001 contains SM-4 Fusing.

The overhead SM-4 and SM-5 fuse holders are not loadbreak devices but may be opened and closed with a hook stick.

The 14.4 kV, SMD-20 switch (which uses the SMU fuses) is a loadbreak device and may be opened and closed with a hook stick while using the Loadbuster tool. Mount spare refill holder (mounting: Stock Number 40-04-242) 10' above ground on pole.

Liquid power fuses are no longer available.

C. Reclosers and Sectionalizers

Reclosers and sectionalizers are used to protect circuits by isolating a faulted section of a circuit. They shall be used on circuits 14.4 kV and below. All available reclosers and sectionalizers are identified in the Materials and Tools Catalog. Refer to EDD (Electrical Distribution Design) article PS-50 covering reclosers and sectionalizers

D. Tripsavers

Tripsavers are cutout mounted electronic reclosers that are powered by line current using an internal CT. There are 40 amp, 100 amp and 200 amp models that can carry their rated current continuously. Common size fuse T-links have stock numbers for Tripsavers that are already programmed with T-link TCC curves. There are also stock numbers for Tripsavers that are not already programmed.

Tripsavers have a symmetrical fault current rating of 6.3 kA while Ameren's standard 100 amp fused cutout has a symmetrical fault current rating of 10 kA and the 200 amp cutout is rated for 7.5 kA. A Tripsaver requires a minimum level of current to initially power up: 1 amp for 40 amp model, 4 amps for 100 amp model and 8 amps for 200 amp model. To power the control, the current must not fall below: 0.5 amps for 40 amp model, 1.5 amps for 100 amp model and 3 amps for the 200 amp model. If the current falls below this threshold, the Tripsaver can rely on fault current to power up the Tripsaver, but there could be a delay in operation depending on the fault current level.

7. TRANSFORMER FUSING

A. Types of Fuses

Link fuses (T and X) shall be used in fused switches to isolate most Conventional (C), Protected (P), and Completely Self Protected (CSP) transformers which are: 1) pole mounted, or 2) pad mounted and isolated by a fused terminal pole.

Power fuses (SMU, SM-4, or SM-5) shall be used to isolate Conventional (C), Protected (P), and Completely Self Protected (CSP) transformers when **any** of the following conditions exist:

- 1) the fault interrupting requirements are above the capacity of the link type fused switch (100 amp fused switch, 54-07-208, 10kA asymm. @ 15kV, 16kA asymm. @ 2.4kV) (100 amp fused switch 54-07-234, 12 kA asymm. @ 27 kV) (200 amp fused switch, 54-07-209, 12kA asymm. @ 15kV, 16kA asymm. @2.4kV)
- 2) a pole mounted transformer and the fuse rating is greater than 100 amps (three phase transformers larger than 500kVA @4.16 kV, or 1500 kVA @12.47 kV)
- 3) the transformer is fed by padmounted switchgear.

Contact Distribution Standard Engineer for fuses rated above 100 amps.

External fuses shall be used to isolate Completely Self Protected (CSP) transformers, unless the transformer is not installed on the backbone, existing pole space does not allow for installation of a fused switch, and the number of customers that could be affected by transformer failure is deemed acceptable.

B. Link Fuses For All Ameren Single Phase Pole Mount Transformers (Bold indicates new common sizes).

SINGLE PHASE TRANSFORMERS				
kVA	SYSTEM VOLTAGE			
	2400V Delta 4160V Grd. Y/2400V	7200V Delta 12470V Grd. Y/7200V 13200V Grd. Y/7620V 13800V Grd. Y/7970V	14400V Delta 24940V Grd. Y/14400V	34500V Grd. Y/19920V
1	–	3/4X	–	–
3	3-1/2X	3-1/2X	3-1/2X	–

FUSES AND SWITCHES

General

10 00 01 01

Sheet 7 of 10

5	3-1/2X	3-1/2X	3-1/2X	-
7.5	3-1/2X	3-1/2X	3-1/2X	-
10	5-1/2X	3-1/2X	3-1/2X	3/4X
15	7X	3-1/2X	3-1/2X	1X
25	15T	8T	3-1/2X	1-1/2X
37	20T	7X	3-1/2X	-
50	30T	10T	5-1/2X	3-1/2X
75	50T	15T	7X	4X
100	65T	20T	10T	7X
150	100T	30T	15T	-
167	100T	30T	15T	-
200	100T	40T	20T	-
250	140T	40T	25T	-
333	140T	50T	25T	-
500	-	80T	50K	-

THREE PHASE TRANSFORMERS - SINGLE UNIT OR BANKS				
kVA*	SYSTEM VOLTAGE (PHASE-TO-PHASE)			
	2400V	4160V	7200V	12470V, 12000V, 13200V, 13800V, 14400V
9	3-1/2X	3-1/2X	3-1/2X	3-1/2X
15	5-1/2X	3-1/2X	3-1/2X	3-1/2X
30	10T	5-1/2X	3-1/2X	3-1/2X
45	15T	7X	5-1/2X	3-1/2X
75	25T	12T	7X	8T
112	40T	20T	12T	7X
150	50K	25T	15T	10T
225	65T	40T	25T	15T
300	100T	50T	30T	20T
450	140T	100T	50K	30T
500	140T	80T	50K	30T
600	200T	100T	65T	40T
750	200T	140T	65T	40T
1000		140T	100T	50T
1500				80T
2000				100T
2500				140T

* Three-phase kVA or 3x single phase kVA.

For three-phase banks with closed delta secondary where one of the transformers is larger than the other two (grounded mid-tap 120/240 Volt), select fuse for each transformer from the above fuse link table based on the individual transformer kVA and system voltage.

Example: 1-100kVA and 2-25kVA transformers on 4160 GrdY/2400 V circuit

From above fuse link chart:

100kVA – use 300kVA line and 4160 V column to select 50T fuse

2-25kVA – use 75kVA line and 4160 V column to select 12T fuses.

C. Power Fuses for Single-Phase Pole Mounted Transformers

kVA	SMU-20 Fusing		SM-4 Fusing	SM-5 Fusing
	4.16kV	12.47kV	4.16kV	4.16kV
25	15 E Slow	10 E Std.	15 E Slow	15 E Slow
50	30 E Slow	10 E Std.	30 E Slow	30 E
75	50 E Slow	15 E Slow	50 E Slow	50 E Std.
100	65 E Slow	20 E Slow	65 E Slow	65 E Slow
167	100 E Slow	30 E Slow	100 E Slow	100 E Slow
250	150 E Slow	40 E Slow	150 E Slow	150 E Slow
333	200 E Std.	50 E Slow	200 E Std.	200 E Std.
500		80 E Slow		300 E Std.

Power Fuses for Transformers

kVA	SMU-20 Fusing		SM-4 Fusing	SM-5 Fusing
	4.16kV	12.47kV	4.16kV	4.16kV
75	15 E Slow	10 E Std.	15 E Slow	15 E Slow
150	25 E Slow	10 E Std.	50 E Slow	25 E Slow
300	50 E Slow	20 E Slow	50 E Slow	50 E Slow
500	80 E Slow	30 E Slow	80 E Slow	80 E Slow
750	150 E Slow	40 E Slow	150 E Slow	150 E Slow
1000	200 E Std.	50 E Slow	200 E Std.	200 E Std.
1500		80 E Std.	*	300 E Std.
2000		100 E Std.	*	400 E Std.
2500		150 E Std.	*	400 E Std.

* 4.16 kV Transformers over 750 kVA, or feeders over 2 miles in length will require further review by Energy Delivery Technical Services.

** 12.47 kV Transformers over 1,000 kVA, or feeders over 5 miles in length will require further review by Energy Delivery Technical Services.

Padmounted switchgear shall use SMU refills. Prior to 2001, AmerenUE used SM-4 refills.

Bay-O-Net Fuses for Loop Feed Pad Mounted Transformers – See DCS 59 51 53 40

8. CAPACITOR FUSING

A. Fusing for Ameren Capacitor Banks

Capacitors installed on lines at 2.4 kV through 34.5 kV shall be fused with expulsion type link fuses except as noted.

Three Phase kVAR	Phase to Phase Voltage							
	2400 V	4160 V	7200 V	12470 V	13200 V	13800 V	14400 V	34500 V
150	40 T	25 T	12 T	10 T	10 T	10 T		
300	100 K	40 T	25 T	15 T	15 T	12 T	12 T	
450		65T		25T	20 T			
600	140 T	80 T	50 K	30 T	30 T	25 T	25 T	
900***			65T	40 T	40 T			
1200****				65 T	65 T		50 K	
2400								*
4500								**

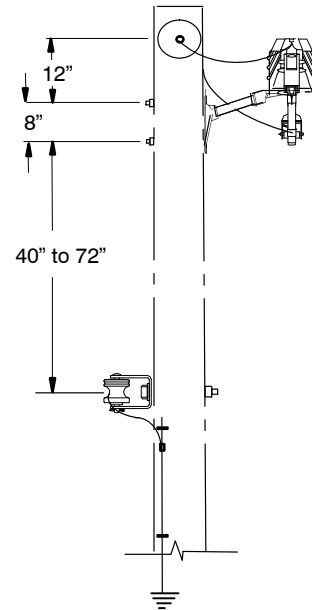
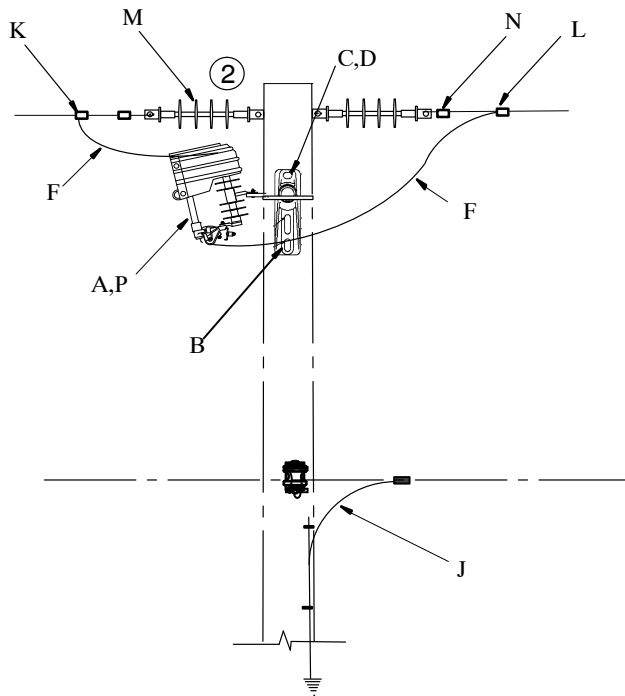
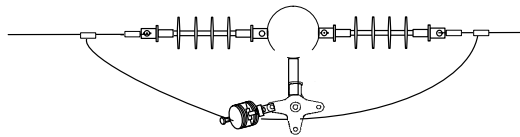
- * Use a 50 K fast refill (20-04-343) in a SMD-20 fused switch (54-06-052) if available fault current is less than 16 kA asymm.
Use a 50 Std. refill (20-04-340) in a SM5 fuse mounting (54-03-048) if available fault current is greater than 16 kA asymm. but not more than 28 kA asymm.
Contact Distribution Standards for construction details.
- ** Use a 80 E Slow refill (20-04-355) in a SMD-20 fused switch (54-06-052) if available fault current is less than 16 kA asymm.
Use a 80 E Slow refill (20-04-233) in a SM5 fuse mounting (54-03-048) if available fault current is greater than 16 kA asymm. but not more than 28 kA asymm.
Contact Distribution Standards for construction details.
- *** Bank composed of 6 – 150 kVAR units
- **** Bank may be composed of 6 – 200 kVAR units

FUSES AND SWITCHES
Single Phase Sectionalizing – All Construction
100–300 Amp – 4 or 12 kV

10 12 01 **

Sheet 1 of 2

100 AMP FUSED	10 12 01 01
200 AMP FUSED	10 12 01 02
300 AMP SOLID BLADE	10 12 01 03



NOTES:

1. Use DCS **12 00 10 01** for ground coil application on new pole installation.
2. Double deadend on pole w/o FG extension available AmerenMO only.

FUSES AND SWITCHES
Single Phase Sectionalizing – All Construction
100–300 Amp – 4 or 12 kV

10 12 01 **

Sheet 2 of 2

		Std. / Stk. No.	Description	10 12 01 **	01	02	03
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		54 07 209	Switch, Fuse, 200A, 15kV			1	
		54 07 210	Switch, Solid Blade, 300A, 15kV				1
	B	23 56 063	Bracket, Fiberglass, Switch and Arrester		1	1	1
	C	23 52 065	Bolt, Mach., 5/8" x 12"		2	2	2
	D	23 66 027	Washer, Square, 5/8"		2	2	2
	F	PLW*P	Wire, CU, Poly, SD, (ft.), DCS 07 00 80 00		15	15	15
	J	12 00 10 02	Grounding Unit – Ground Rod		1	1	1
		12 00 10 01	Grounding Unit – Ground Coil		1	1	1
	K	PG*	Clamp, Parallel Groove, DCS 07 00 25 00		1	1	1
	M	06 12 30 03	Dbl Deadend on Pole w/ FG Extension		1	1	1
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension		1	1	1
	N	DEC*W or DEA*W	Clamp, Deadend, DCS 07 00 11 00		2	2	2
	O		Link, Fuse (Sized by Engineer)		1	1	1
	P	05 15 10 01	Cover, Cutout		1	1	1

FUSES AND SWITCHES

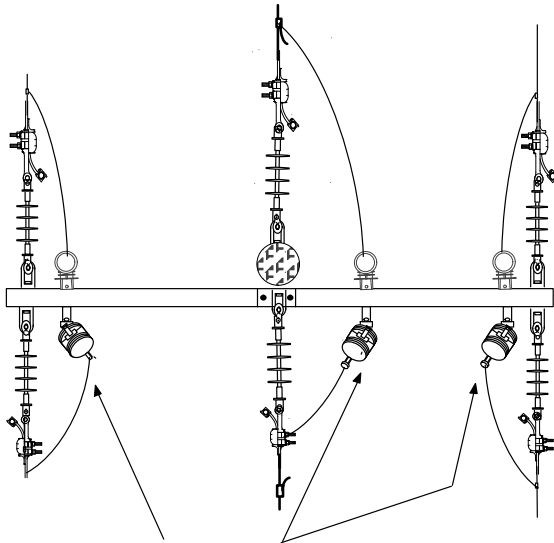
Three Phase Sectionalizing

100-300 Amp – 4 or 12 kV

10 12 10 **

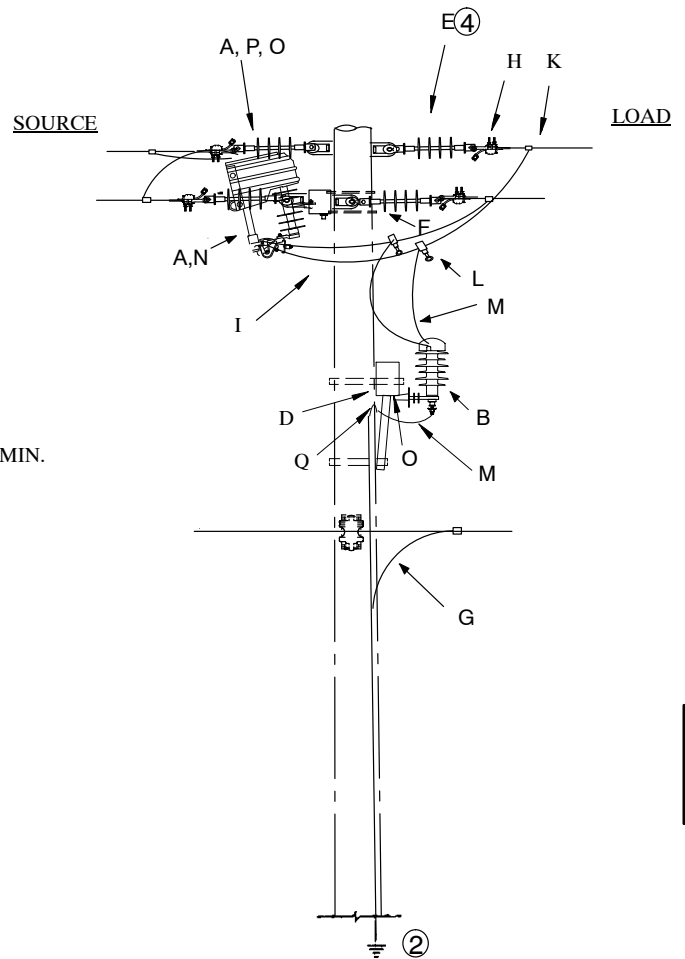
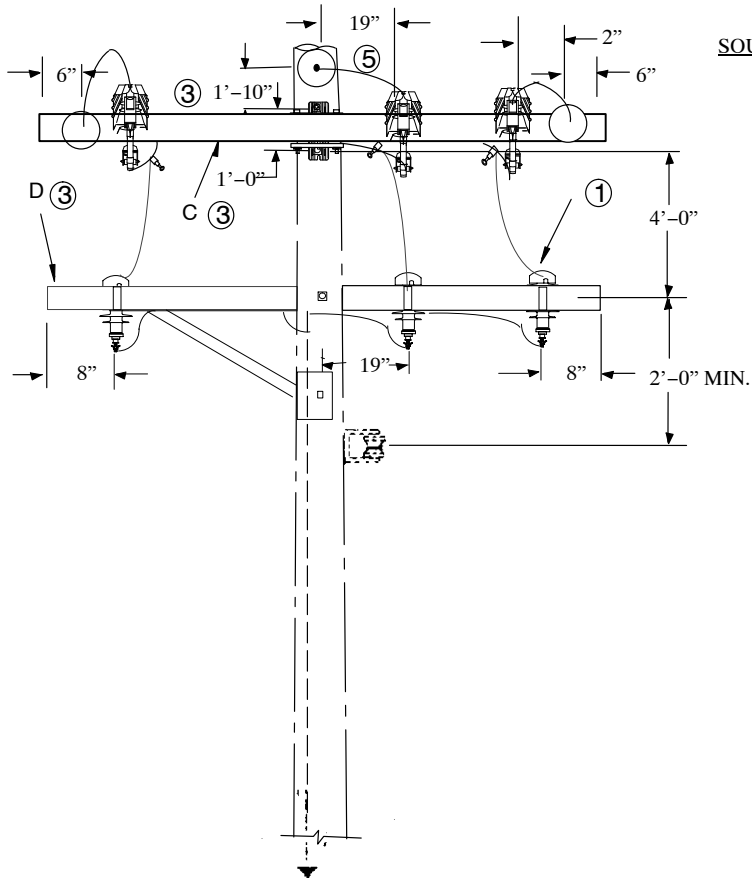
Sheet 1 of 2

MISSOURI ONLY



TURN SWITCHES TOWARD POLE

100 AMP. FUSED	10 12 10 01
200 AMP. FUSED	10 12 10 02
300AMP. SOLID BLADE	10 12 10 03



FUSES AND SWITCHES

Three Phase Sectionalizing

100–300 Amp – 4 or 12 kV

10 12 10 **

Sheet 2 of 2

NOTES:

1. This installation is permissible for existing installation in Missouri. For new installations, arresters are not required for normally closed switch installations. Where switches are normally open, install arresters on adjacent poles. Refer to DCS 12 00 01 01 for arresters selection.
2. Use DCS 12 00 10 01 for ground coil application on new pole installation.
3. Double deadend on pole w/o FG extension available AmerenMO only.
4. Underbuild construction requires deadend on pole w/FG extension.

		Std. / Stk. No.	Description	10 12 10 **	01	02	03
1@	A	54 07 208	Switch, Fuse, 100A., 15kV	3			
		54 07 209	Switch, Fuse, 200A., 15kV		3		
		54 07 210	Switch, Solid Blade, 300A., 15kV				3
@	B	10 01 144	Arrester, 10kV w/Protective Cap	3	3	3	3
		10 01 133	Arrester, 3kV w/Protective Cap	3	3	3	3
@	C	04 00 41 03	Crossarm, Deadend, FG, 8'	1	1	1	1
		04 00 41 04	Crossarm, Deadend, FG, 10'	1	1	1	1
@	D	04 00 20 03	Crossarm, Sgl, Wood, 10' (use only 1/2 of V-Brace)	1	1	1	1
		04 00 20 02	Crossarm, Sgl, Wood, 8' (use only 1/2 of V-Brace)	1	1	1	1
3@	E	06 12 30 03	Dbl Deadend on Pole w/ FG Extension	1	1	1	1
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension	1	1	1	1
	F	06 12 34 05	Double Deadend on Arm	2	2	2	2
2	G	12 00 10 02	Grounding Unit – Ground Rod	1	1	1	1
@	H	DEC*W or DEA*W	Clamp, Deadend	6	6	6	6
@	I	PLW*W	Wire, Poly covered, S.D. (ft.)	30	30	30	30
@	J	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)	3	3	3	3
		HLC*W	Clamp, Hot Line	3	3	3	3
@	K	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00	3	3	3	3
	L	23 78 183	Clamp, Hot Line	3	3	3	3
	M	18 51 021	Wire, Poly Covered, #6 Cu., (Ft.)	15	15	15	15
@	N		Link, Fuse (Sized by Designer)	3	3		
	O	17 58 054	Bracket, Mounting Switch, Arrester	6	6	6	6
	P	05 15 10 01	Cover – Cutout	3	3	3	3
	Q	17 54 182	Connector, Split Bolt	2	2	2	2

FUSES AND SWITCHES

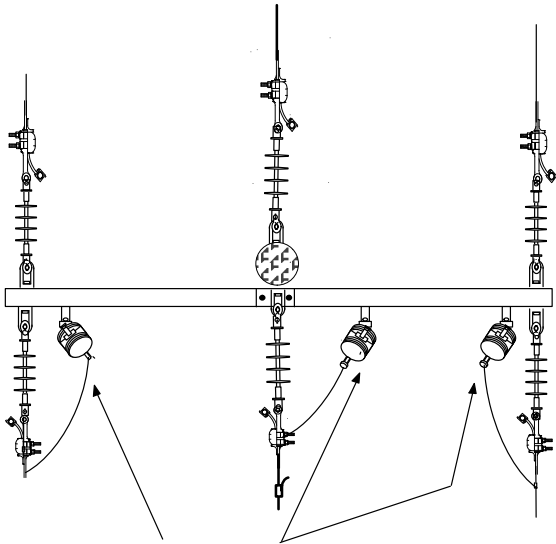
Three Phase Sectionalizing

100-300 Amp – 4 or 12 kV

10 12 11 **

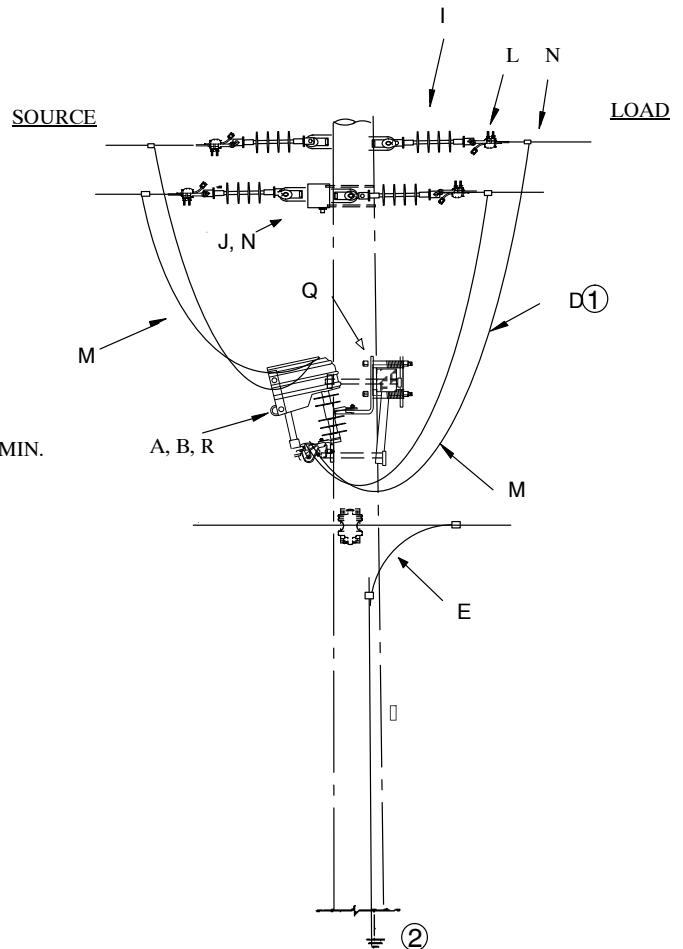
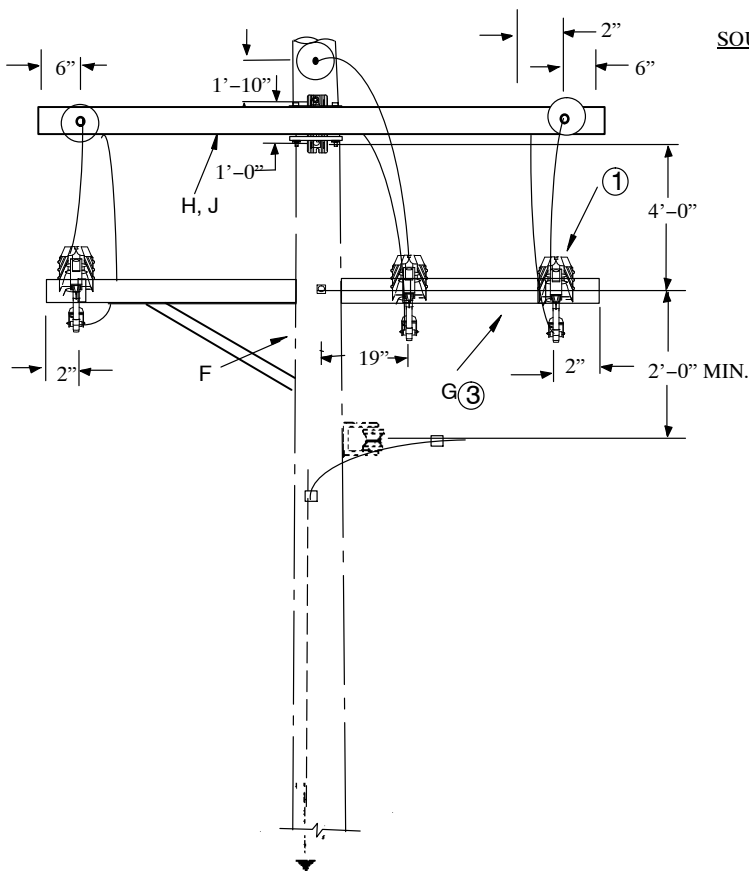
Sheet 1 of 3

ALTERNATIVE 1



TURN SWITCHES TOWARD POLE

100 AMP. FUSED	10 12 11 01
200 AMP. FUSED	10 12 11 02
300AMP. SOLID BLADE	10 12 11 03



FUSES AND SWITCHES

Three Phase Sectionalizing

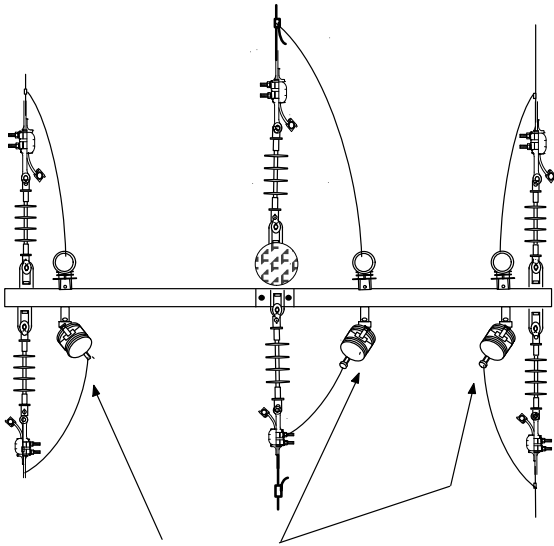
100-300 Amp – 4 or 12 kV

10 12 11 **

Sheet 2 of 3

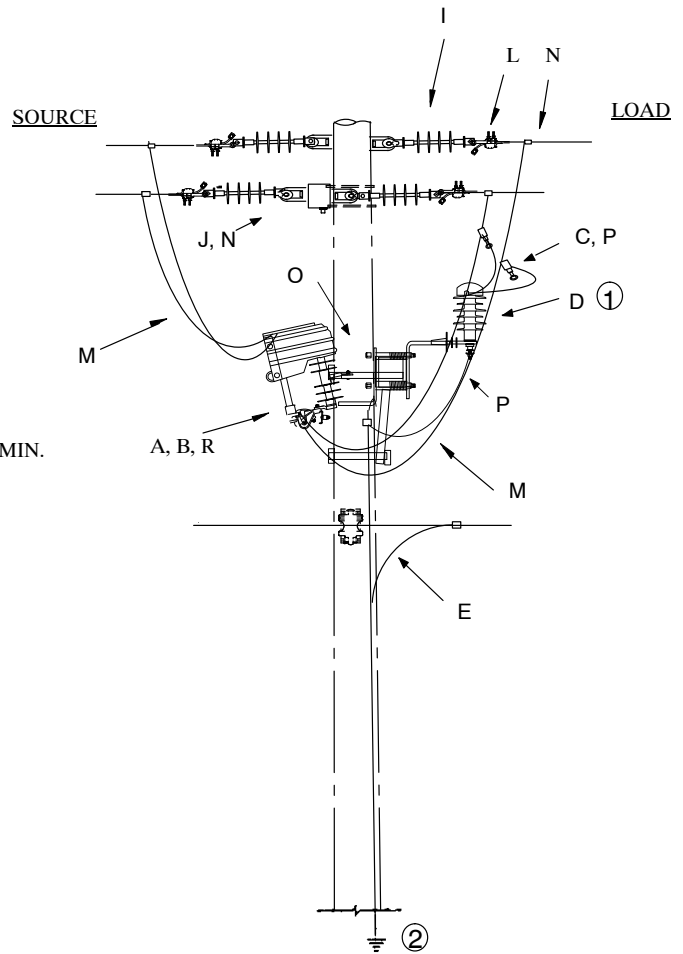
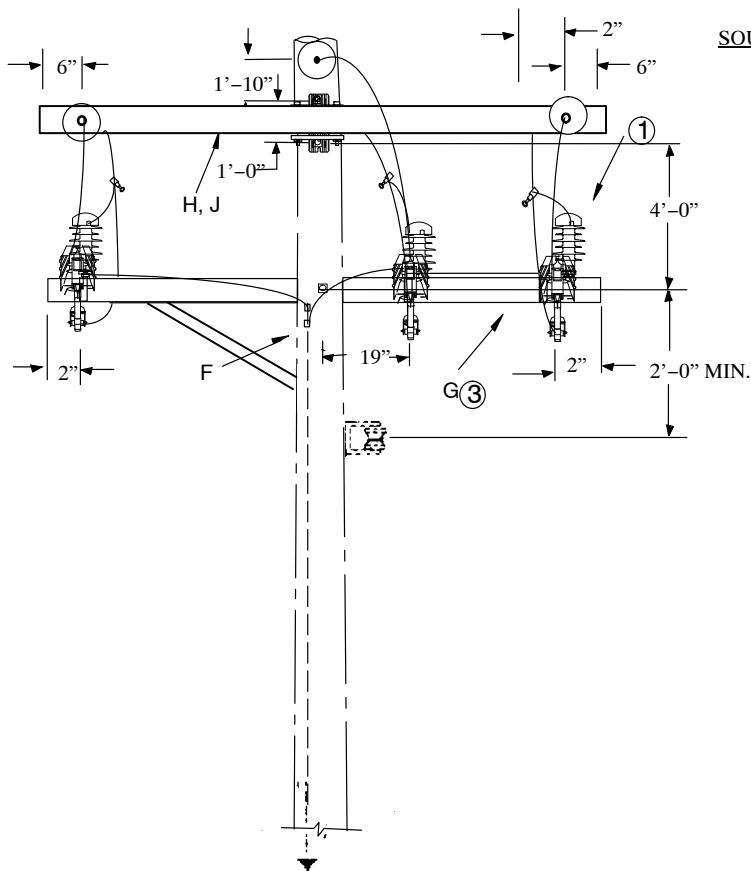
MISSOURI ONLY

ALTERNATIVE 2



TURN SWITCHES TOWARD POLE

100 AMP. FUSED	10 12 11 04
200 AMP. FUSED	10 12 11 05
300AMP. SOLID BLADE	10 12 11 06



FUSES AND SWITCHES

Three Phase Sectionalizing

100–300 Amp – 4 or 12 kV

10 12 11 **

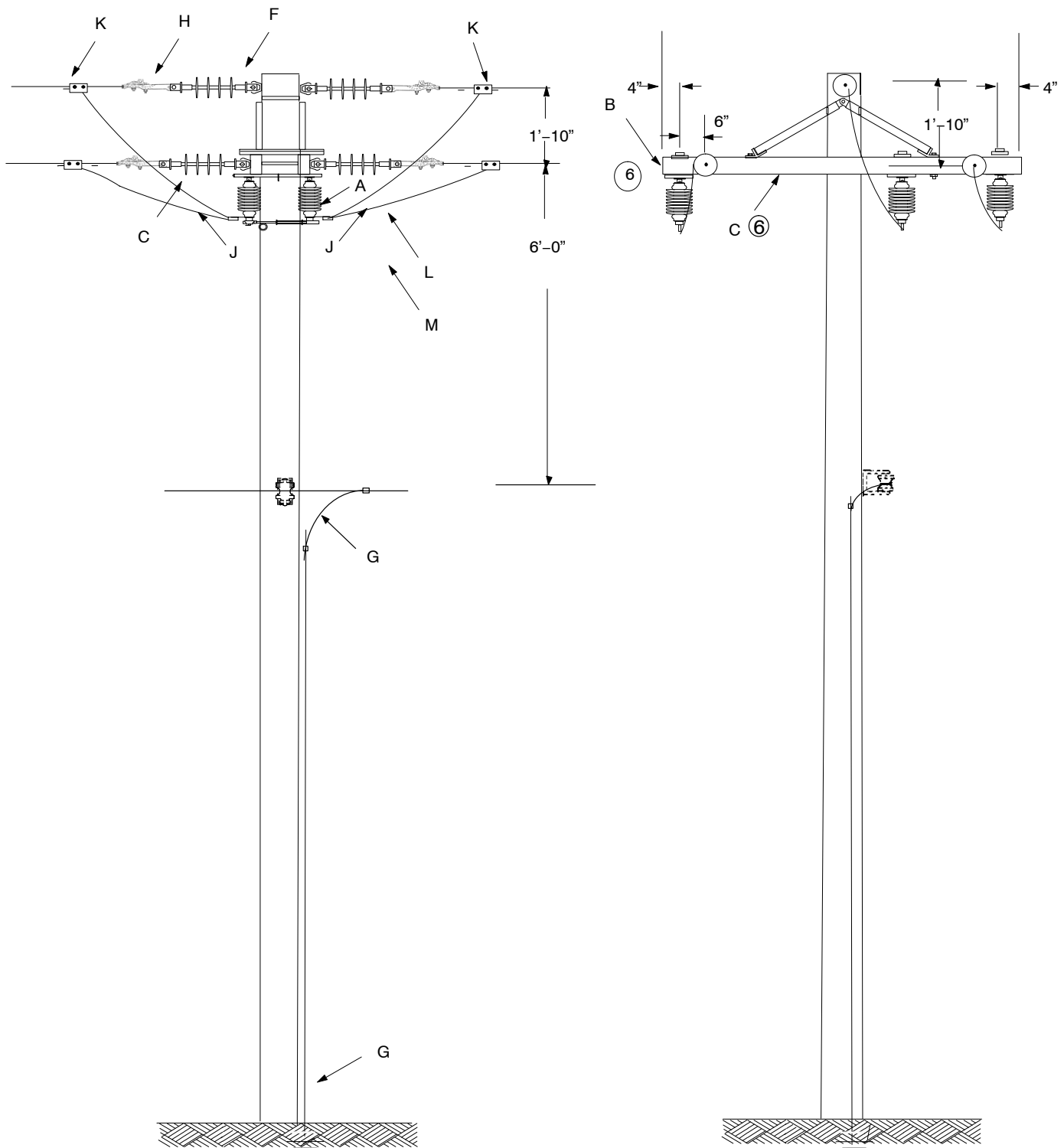
Sheet 3 of 3

NOTES:

1. Alternative 2 is permissible for existing installation in Missouri. For new installation, both Illinois and Missouri, ar-resters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS **12 00 01 01** for arresters selection.
2. Use DCS **12 00 10 01** for ground coil application on new pole installation
3. 8' crossarm available AmerenMO only.
4. Double deadend on pole w/o FG extension available AmerenMO only.

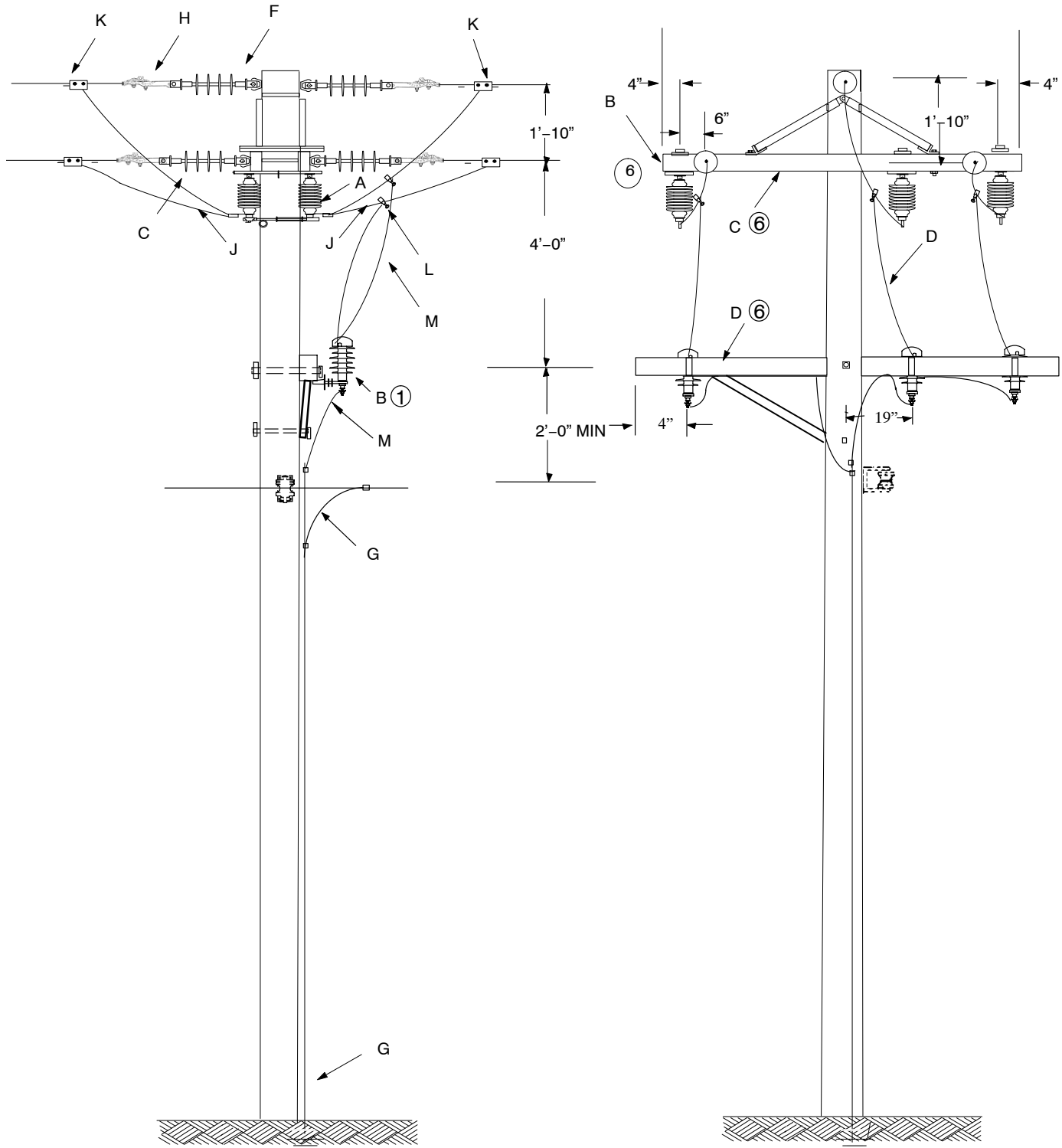
		Std. / Stk. No.	Description	10 12 11 **	01	02	03	04	05	06
1 @	A	54 07 208	Switch, Fuse, 100A, 15 kV		3			3		
		54 07 209	Switch, Fuse, 200A, 15kV			3			3	
		54 07 210	Switch, Solid Blade, 300 A, 15kV				3			3
	B		Link, Fuse (Sized by Engineer)		3	3		3	3	
	C	23 78 183	Clamp, Hot Line					3	3	3
	D	10 01 144	Arrester, 10 kV w/ Protective Cap					3	3	3
		10 01 133	Arrester, 3 kV w/ Protective Cap1103					3	3	3
	E	12 00 10 02	Grounding Unit – Rod		1	1	1	1	1	1
		12 00 10 01	Grounding Unit – Coil		1	1	1	1	1	1
	F	17 54 182	Connector, Split Bolt					1	1	1
	G	04 00 20 03	Crossarm, 10', Sgl, Wood (use only 1/2 of V-brace)		1	1	1	1	1	1
		04 00 20 02	Crossarm, 8', Sgl, Wood (use only 1/2 of V-brace)		1	1	1	1	1	1
	H	04 00 41 04	Crossarm, Double DE, F/G, 10'		1	1	1	1	1	1
	I	06 12 30 03	Dbl Deadend on Pole w/ FG Extension		1	1	1	1	1	1
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension		1	1	1	1	1	1
	J	06 12 35 02	Deadend, Dbl., on F/G crossarm		2	2	2	2	2	2
	M	PLW*W	Wire, Poly Covered, S.D. (ft.)		30	30	30	30	30	30
	N	PG*	Clamp, Parallel Groove DCS 07 00 25 00		6	6	6	6	6	6
	O	23 56 088	DBL Sided NEMA Bracket for Arrester and Cutout					3	3	3
	P	18 51 021	Wire, S.D. Cu, #6 Poly					20	20	20
	Q	17 58 054	Bracket, Mounting Switch or Arrester		3	3	3			
	R	05 15 10 01	Cover, Cutout		3	3	3	3	3	3

ALTERNATIVE 1 – 10 12 12 01



ALTERNATIVE 2 – 10 12 12 02

MISSOURI ONLY



FUSES AND SWITCHES

Three Phase Sectionalizing – Crossarm Pole Top Construction

600 Amp – 4 or 12 kV

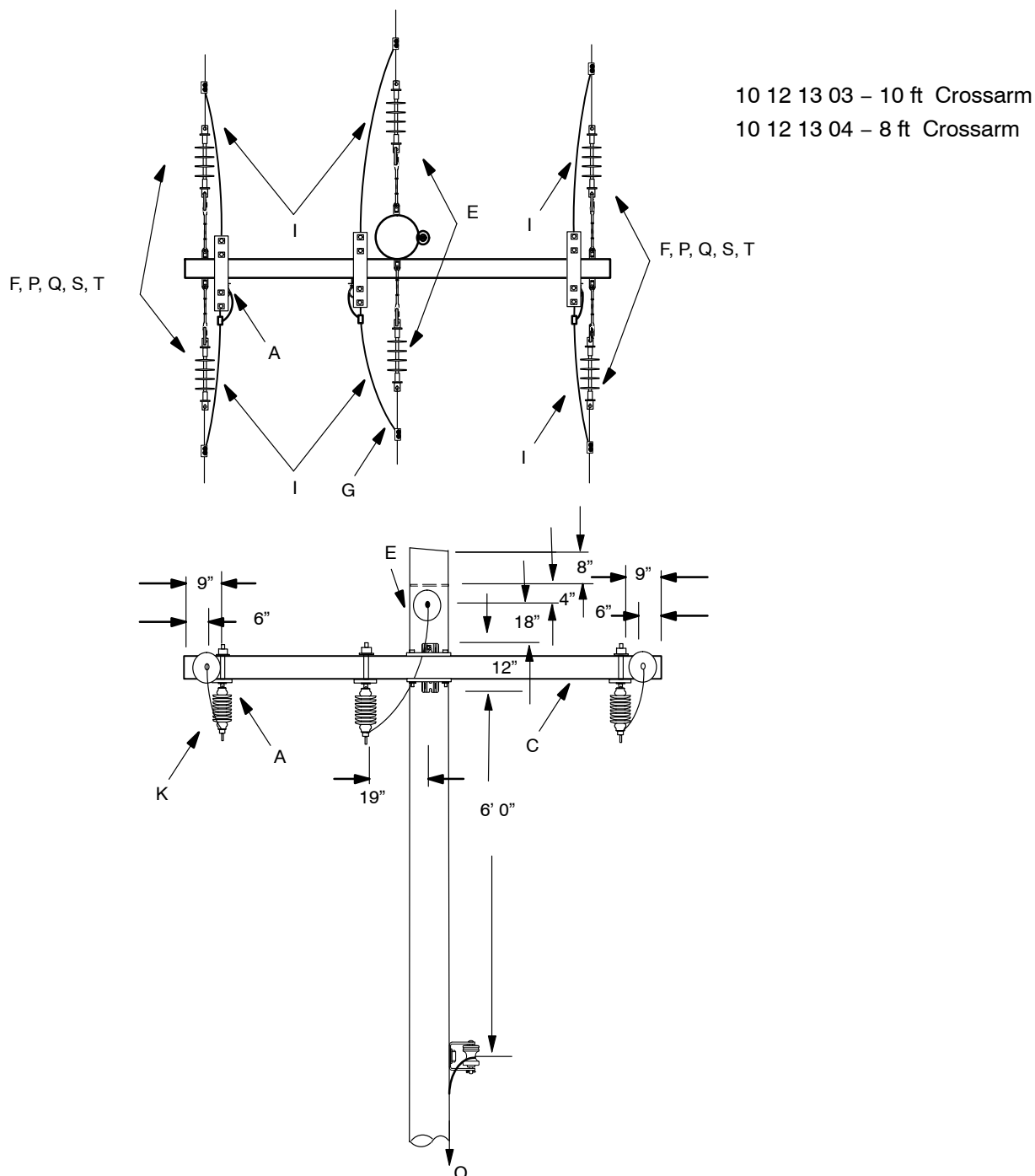
10 12 12**
Sheet 3 of 3

NOTES:

1. Alternative 2 is permissible for existing installation in Missouri. For new installation, both Illinois and Missouri, arresters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS **12 00 01 01** for arresters selection.
2. If insulators are not at least 2" from switch base using a single eye clevis, install one additional eye clevis in each deadend. On angle poles, a shackle may also be necessary to obtain clearances.
3. Use DCS **12 00 10 01** for ground coil application on new pole installation.
4. When required, switch number tag shall be installed here.
5. Double deadend on pole w/o FG extension available Missouri only.
6. 8' crossarm available Missouri only.

		Std. / Stk. No.	Description	10 12 12**	01	02
1@	A	54 07 204	Switch, Dis., 600A, 15kV		3	3
	B	10 01 144	Arrester, 10kV w/ Protective Cap			3
		10 01 133	Arrester, 3kV w/ Protective Cap			3
8@	C	04 00 20 07	Crossarm, Dbl, Wood. 8' (use only ½ of V-Brace)	1		1
		04 00 20 08	Crossarm, Dbl, Wood. 10' (use only ½ of V-Brace)	1		1
6@	D	04 00 20 02	Crossarm, Sgl, Wood. 8' (use only ½ of V-Brace)			1
		04 00 20 03	Crossarm, Single 10' (use only 1/2 of V-brace)			1
2	E	06 12 34 04	Double Deadend on Arm	2		2
5@	F	06 12 30 03	Double Deadend on Pole w/ FG Extension	1		1
		06 12 30 13	Double Deadend on Pole w/o FG Extension	1		1
3	G	12 00 10 02	Grounding Unit – Ground Rod	1		1
@	H	DEC*W	Clamp, Deadend – DCS 07 00 11 00	6		6
@	J	LW*W	Wire, Poly Covered (ft.)	30		30
@	K	PG*	Clamp, Parallel Groove (See Std, 07 00 25 00)	6		6
	L	23 78 183	Clamp, Hot Line			3
	M	18 51 021	Wire, Poly, #6 Cu., Ft.			15

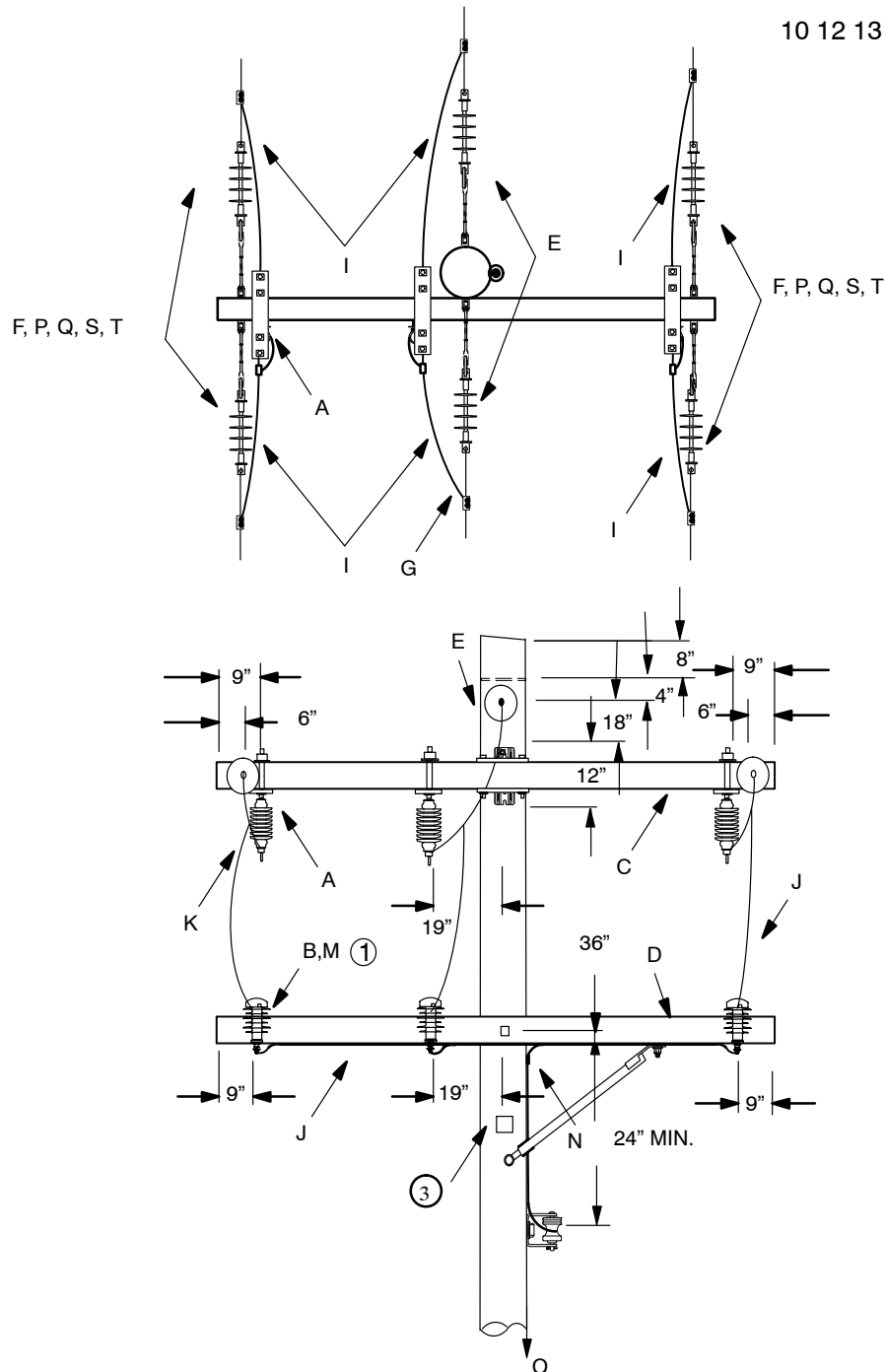
ALTERNATIVE 1



ALTERNATIVE 2
 MISSOURI ONLY

10 12 13 01 – 10 ft Crossarm

10 12 13 02 – 8 ft Crossarm



FUSES AND SWITCHES

Three Phase Sectionalizing – Crossarm Pole Top Construction

600 Amp – 4 or 12 kV

10 12 13 **

Sheet 3 of 3

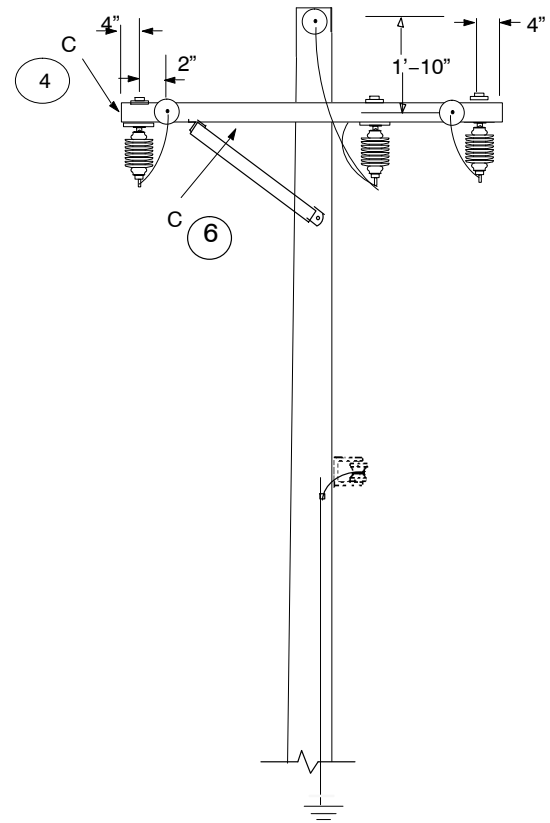
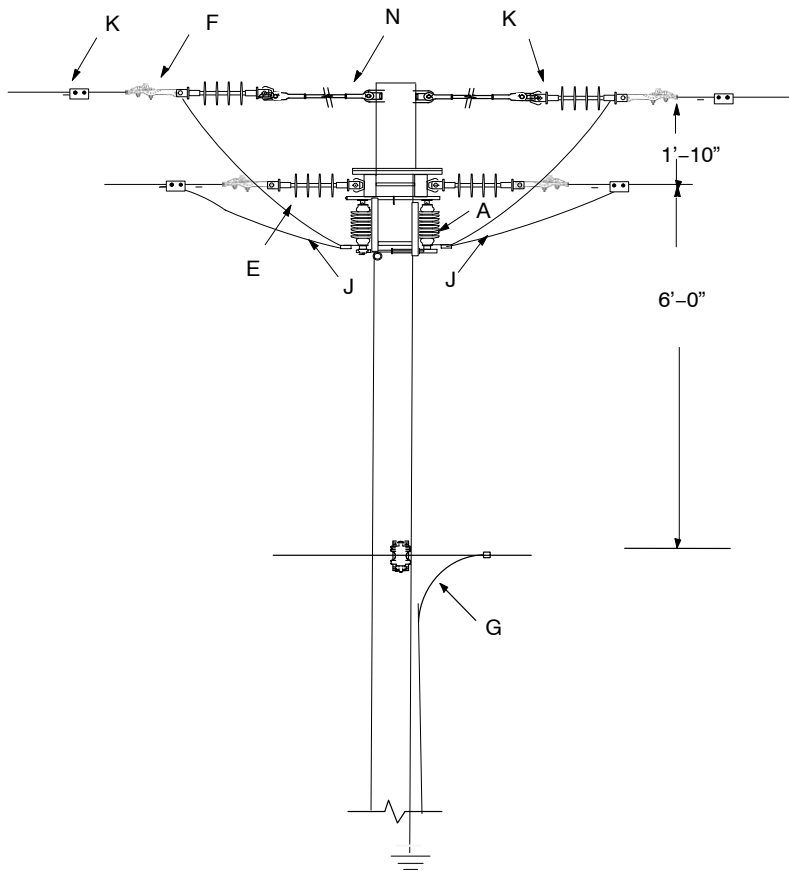
NOTES:

1. Alternative 2 is permissible for existing installation in Missouri. For new installation, both Illinois and Missouri, ar-resters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS 12 00 01 01 for arresters selection.
2. Double deadend on pole w/o FG extension available Missouri only.
3. When required, switch number tag shall be installed here.
4. 8' crossarm available Missouri only.
5. Install mounting bolts for switch as close to the crossarm as possible. Tighten bolts evenly and do not distort or warp switch base and backplate. Do not use bolts in outside/end mounting holes.

		Std. / Stk. No.	Description	10 12 13 **	01	02	03	04
1@	A	54 07 204	Switch, Dis., 600A, 15kV	3	3	3	3	
	B	10 01 144	Arrester, 10kV	3	3			
		10 01 133	Arrester, 3kV	3	3			
4	C	04 00 41 03	Crossarm, Deadend, FG, 8'		1		1	
		04 00 41 04	Crossarm, Deadend, FG, 10'	1		1		
4	D	04 00 20 02	Crossarm, Sgl, Wood 8' (use only 1/2 of V-brace)		1			
		04 00 20 03	Crossarm, Sgl, Wood 10' (use only 1/2 of V-brace)	1				
2	E	06 12 30 03	Dbl Deadend on Pole w/ FG Extension	1		1		
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension		1		1	
	F	25 06 052	Ins., Suspension, 12kV	4	4	4	4	
@	G	DEC*W	Clamp, Deadend, DCS 07 00 11 00	4	4	4	4	
@	H	PG*	Clamp, Parallel Groove, DCS 07 00 25 00	6	6	6	6	
@	I	PLW*W	Wire, Poly covered, (ft.) , DCS 07 00 80 00	15	15	15	15	
	J	18 51 021	Wire, Poly, #6 Cu., Ft.	15	15			
	K	23 78 183	Clamp, Hot Line, #6 to 400kcmil cu Main & #6 to 4/0 cu Tap	3	3			
	L	18 51 021	Clamp, PG. #6 -1/0	1	1	1	1	
	M	17 58 054	Bracket, Switch/Arrester Mounting	3	3			
	N	17 54 373	Split Bolt	1	1			
@	O	12 00 10 02	Grounding Unit – Existing Pole – Ground Rod	1	1	1	1	
		12 00 10 01	Grounding Unit – New Pole – Ground Coil	1	1	1	1	
	P	23 52 058	Bolt–Mach 5/8" x 5"	2	2	2	2	
	Q	23 59 005	Eyelet 5/8"	2	2	2	2	
	R	23 65 012	Eyenuit 5/8"	2	2	2	2	
	S	23 66 027	Washer 5/8" SQ	4	4	4	4	
	T	25 56 076	Insulator, Guy Strain F/G 26"	4		4		
@	U	25 56 076	Insulator, Guy Strain, F/G, 26", 15k UTS	1		1		

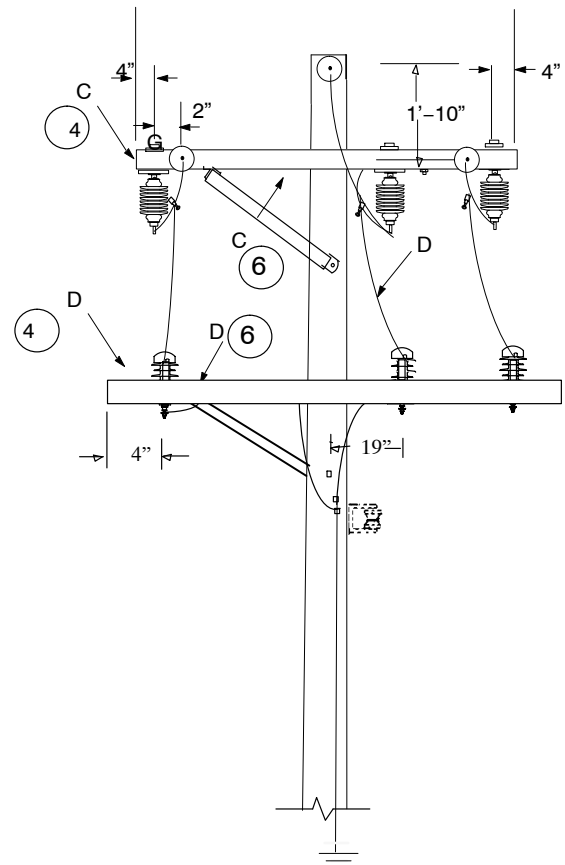
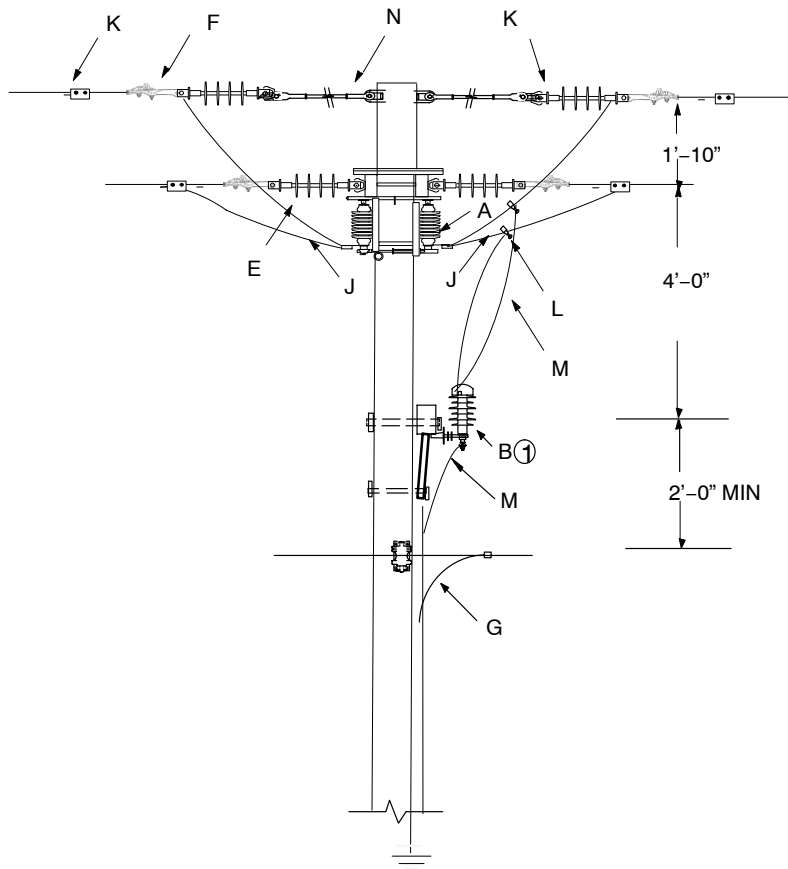
MISSOURI ONLY

ALTERNATIVE 1 – 10 12 14 01



ALTERNATIVE 2 – 10 12 14 02

MISSOURI ONLY



FUSES AND SWITCHES

Three Phase Sectionalizing – Crossarm Pole Top Construction

600 Amp – 4 or 12 kV

10 12 14**

Sheet 3 of 3

NOTES:

1. Alternative 2 is permissible for existing installation in Missouri. For new installation, both Illinois and Missouri, arresters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS **12 00 01 01** for arresters selection.
2. If insulators are not at least 2" from switch base using a single eye clevis, install one additional eye clevis in each deadend. On angle poles, a shackle may also be necessary to obtain clearances.
3. When required, switch number tag shall be installed here.
4. 8' crossarm available AmerenMO only.
5. Double deadend on pole w/o FG extension available Missouri only.

		Std. / Stk. No.	Description	10 12 14**	01	02
1@	A	54 07 204	Switch, Dis., 600A, 15kV		3	3
	B	10 01 144	Arrester, 10kV			3
		10 01 133	Arrester, 3kV			3
4@	C	04 00 20 08	Crossarm, Dbl, Wood 10' (use only 1/2 of V-brace)	1	1	
		04 00 20 07	Crossarm, Dbl, Wood 8' (use only 1/2 of V-brace)	1	1	
4@	D	04 00 20 03	Crossarm, Sgl, Wood 10' (use only 1/2 of V-brace)			1
		04 00 20 02	Crossarm, Sgl, Wood 8' (use only 1/2 of V-brace)			1
2@	E	06 12 34 04	Double Deadend on Arm	2	2	
	F	DEC*W	Clamp, Deadend, DCS 07 00 11 00	4	4	
@	G	12 00 10 02	Grounding Unit on Existing Pole – Ground Rod	1	1	
		12 00 10 01	Grounding Unit on New Pole – Ground Coil	1	1	
@	J	PLW*W	Wire, Poly covered, (ft.), DCS 07 00 80 00	30	30	
@	K	PG*	Clamp, Parallel Groove, DCS 07 00 25 00	6	6	
5@	L	23 78 183	Clamp, Hot Line			3
	M	18 51 021	Wire, Poly, #6 Cu., Ft.			15
	N	06 12 30 03	Dbl Deadend on Pole w/ FG Extension	1	1	
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension	1	1	

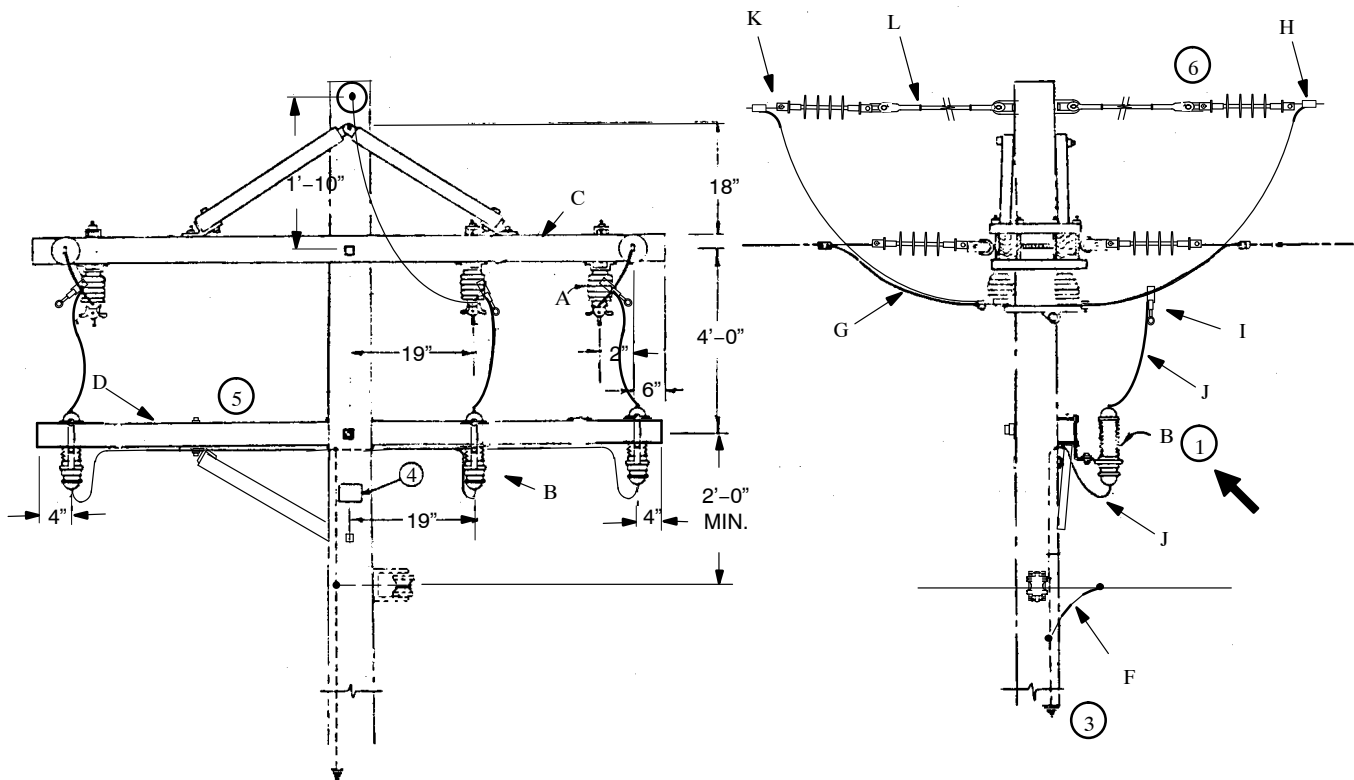
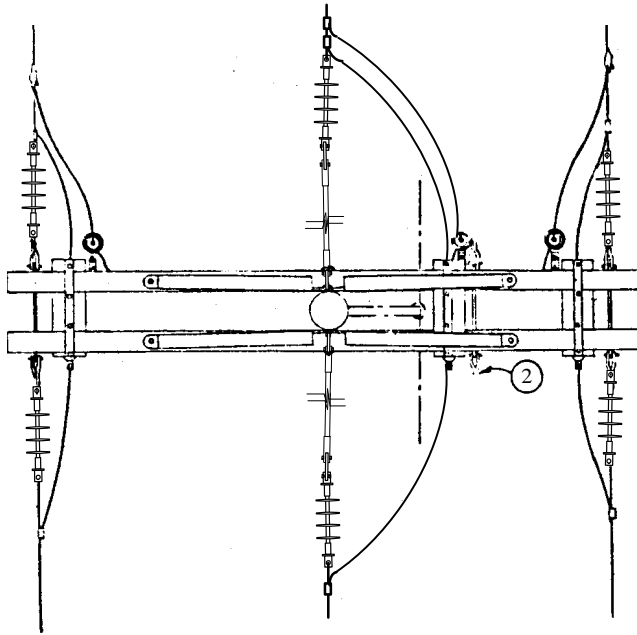
FUSES AND SWITCHES

Three Phase Sectionalizing – Crossarm Underbuild Construction
600 Amp – 4 or 12 kV

10 12 16 02

Sheet 1 of 2

MISSOURI ONLY



FUSES AND SWITCHES

Three Phase Sectionalizing – Crossarm Underbuild Construction

600 Amp – 4 or 12 kV

10 12 16 02

Sheet 2 of 2

NOTES:

1. This installation is permissible for existing installation in Missouri. For new installation, both Illinois and Missouri, arresters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS **12 00 01 01** for arresters selection.
2. If insulators are not at least 2" from switch base using a single eye clevis, install one additional eye clevis in each deadend. On angle poles a shackle may also be necessary to obtain clearances.
3. Use DCS **12 00 10 01** for ground coil application on new pole installation.
4. When required, switch number tag shall be installed here.

		Std. / Stk. No.	Description	10 12 16 02	
1@	A	54 07 204	Switch, Dis., 600A, 15kV		3
	B	10 01 144	Arrester, 10 kV, w/ Protective Cap		3
		10 01 133	Arrester, 3 kV, w/ Protective Cap		3
	C	04 00 20 08	Crossarm, Double, 10'		1
5@	D	04 00 20 03	Crossarm, Sgl, Wood, 10' (use only 1/2 of V-brace)		1
		04 00 20 02	Crossarm, Sgl, Wood, 8' (use only 1/2 of V-brace)		1
2	E	06 12 34 04	Double Deadend		2
3@	F	12 00 10 02	Grounding Unit – Ground Rod		1
		12 00 10 01	Grounding Unit – Ground Coil		1
@	G	PLW*W	Wire, Poly covered (Ft.)		30
@	H	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		6
	I	23 78 183	Clamp, Hot Line		3
	J	18 51 021	Wire, Poly #6 Cu., Ft.		15
@	K	DEC*W	Clamp, Deadend		4
@	L	06 12 30 03	Dbl Deadend on Pole w/ FG Extension		1
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension		1

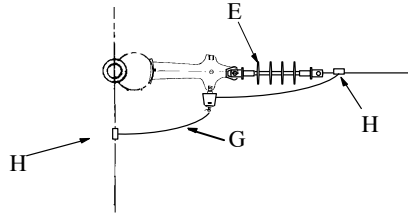
FUSES AND SWITCHES

Single Phase Tap From Single Phase

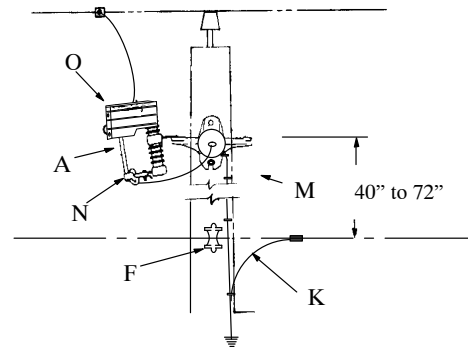
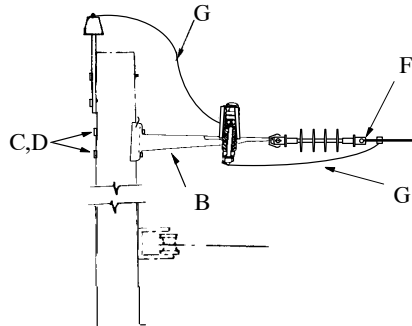
All Construction – 100–300 Amp. – 4 or 12 kV

10 12 19 **

Sheet 1 of 1



100 AMP. FUSED	10 12 19 01
200 AMP. FUSED	10 12 19 02
300 AMP. SOLID BLADE	10 12 19 03

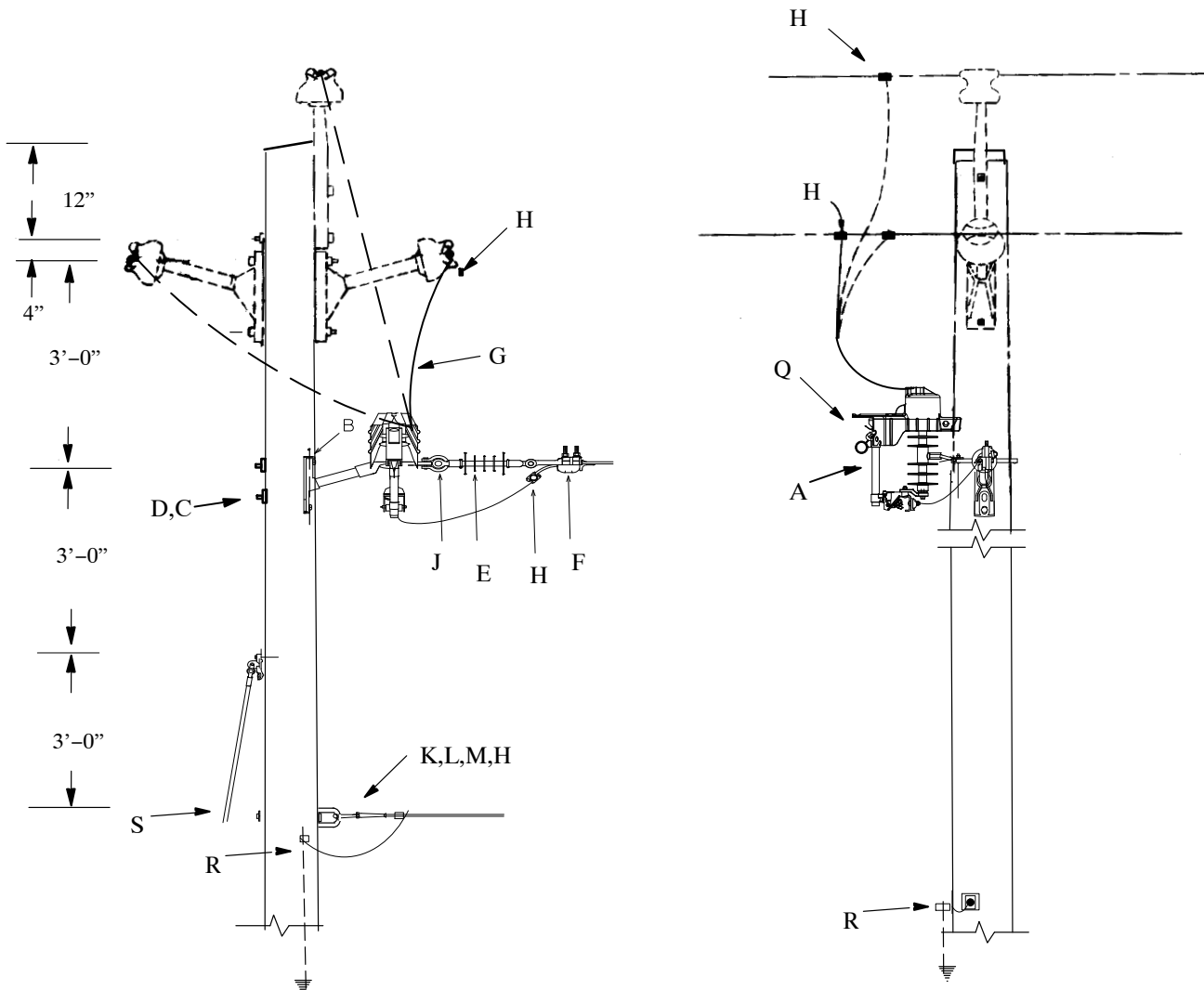


		Std. / Stk. No.	Description	10 12 19 **	01	02	03
@	A	54 07 208	Switch, Fuse, 100A, 15 kV		1		
		54 07 209	Switch, Fuse, 200A, 15kV			1	
		54 07 210	Switch, Solid Blade, 300A, 15kV				1
	B	23 56 063	Bracket, Switch , Arr. and Deadend		1	1	1
	C	23 52 065	Bolt, Mach., 5/8" x 12"		2	2	2
	D	23 66 027	Washer, Square, 5/8"		2	2	2
	E	25 06 052	Ins., Suspension, 12kV		1	1	1
	F	DEC*W or DEA*W	Clamp, Deadend		1	1	1
	G	PLW*W	Wire, Poly Covered (ft.), DCS 07 00 80 00		10	10	10
	H	PG*	Clamp, Parallel Groove DCS 07 00 25 00		2	2	2
@	K	12 00 10 01	Grounding Unit – New Pole – Ground Coil		1	1	1
		12 00 10 02	Grounding Unit – Existing Pole – Ground Rod		1	1	1
@	N		Link, Fuse (Sized by Engineer)		1	1	
	O	05 15 10 01	Cutout Cover		1	1	1

FUSES AND SWITCHES
Single Phase Tap From Three Phase – Armless Construction
100–300 Amp – 4 or 12kV

10 12 21 **

Sheet 1 of 2



- 100 AMP. FUSED 10 12 21 01
200 AMP. FUSED 10 12 21 02
300 AMP. SOLID BLADE 10 12 21 03

FUSES AND SWITCHES
 Single Phase Tap From Three Phase – Armless Construction
 100–300 Amp – 4 or 12kV

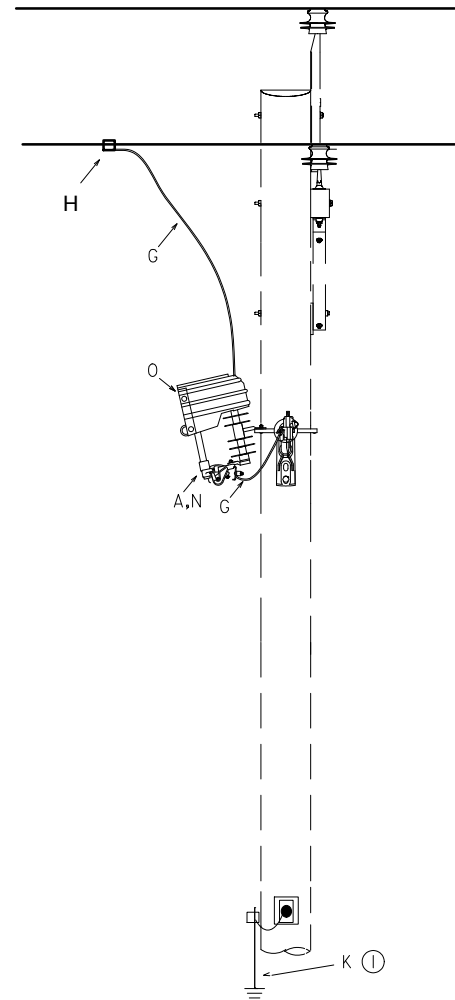
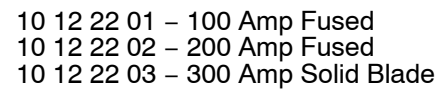
10 12 21 **

Sheet 2 of 2

		Std. / Stk. No.	Description	10 12 21 **		
				01	02	03
@	A	54 07 208	Switch, Fuse, 100A., 15 kV	1		
		54 07 209	Switch, Fuse 200A., 15kV		1	
		54 07 210	Switch, Solid Blade, 300A., 15kV			1
	B	23 56 063	Bracket, Switch, Arrestor and Deadend	1	1	1
	C	23 52 065	Bolt, Mach., 5/8" x 12"	2	2	2
	D	23 66 027	Washer, Square, 5/8"	2	2	2
	E	25 06 052	Ins., Suspension, 12kV	1	1	1
	F	DEC*W or DEA*W	Clamp, Deadend, DCS 07 00 11 00	1	1	1
	G	PLW*W	Wire, Poly covered (ft.), DCS 07 00 80 00	10	10	10
	H	PG*	Clamp, Parallel Groove, DSC 07 00 25 00	3	3	3
	I	12 00 10 01	Grounding Unit – New Pole – Ground Coil	1	1	1
		12 00 10 02	Grounding Unit – Existing Pole – Ground Rod	1	1	1
	P		Link, Fuse (Sized by Engineer)	1	1	
	Q	05 15 10 01	Cover, Cutout	1	1	1
	R	17 54 182	Connector, Split Bolt	1	1	1
	J	23 68 181	Shackle, Deadend	1	1	1
	K	23 59 095	Eyelet, 3/4"	1	1	1
	L	SDEA*W	Deadend, Automatic, Secondary, DCS 08 01 10 00	1	1	1
	M	23 52 097	Bolt, Machine, 3/4" x 12"	1	1	1
	S	11 00 **	Guy Unit	1	1	1

FUSES AND SWITCHES
Single Phase Tap From Three Phase ←
All Construction – 100–300 Amp. 4 & 12kV

Sheet 1 of 2



FUSES AND SWITCHES
Single Phase Tap From Three Phase ←
All Construction – 100–300 Amp. 4 & 12kV

10 12 22 **

Sheet 2 of 2

		Std. /Stk. No.	Description	10 12 22 **	01	02	03
	A	54 07 208	Switch, Fuse, 100A, 15 KV		1		
		54 07 209	Switch, Fuse, 200A, 15 KV			1	
		54 07 210	Switch, Solid Blade, 300A, 15 KV				1
	B	23 56 063	Bracket NEMA, Switch and Dead End		1	1	1
	C	23 52 065	Bolt, Mach., 5/8" x 12"		2	2	2
	D	23 66 027	Washer, Square, 5/8"		2	2	2
	E	25 06 052	Ins., Suspension, 15 KV		1	1	1
@	F	DEC*W	Clamp, Deadend DCS 07 0011 00		1	1	1
@	G	PLW*W	Wire, Poly Covered (ft.) DCS 07 00 80 00 & 07 00 01 03		10	10	10
@	H	PG*	Clamp, Parallel Groove or Split Bolt or Two Bolt. See 07 00 25 00		4	4	4
1@	I	23 68 181	Shackle, Deadend		1	1	1
	K	12 00 10 01	Grounding Unit – New Pole – Ground Coil		1	1	1
		12 00 10 02	Grounding Unit – Existing Pole – Ground Rod		1	1	1
	M	23 66 031	Washer, SQ, 3/4"		1	1	1
	N		Link, Fused, (sized by Engineer)		1	1	1
	O	23 17 411	Cover, Cutout		1	1	1
	P	23 59 095	Eyelet, 3/4"		1	1	1
@	R	SDEA*W	Deadend, Automatic, Secondary. See 08 01 10 00		1	1	1
	Q	23 52 097	Bolt, Machine 3/4" x 12"		1	1	1
2@	S	11 00 ** **	Guy Unit		2	2	2

NOTES:

1. Use DCS **12 00 10 01** for ground coil application on new pole installation.
2. This distance may be reduced to 40 inches if approved by engineering. Center the guy attachment between the primary and neutral if this distance is reduced.

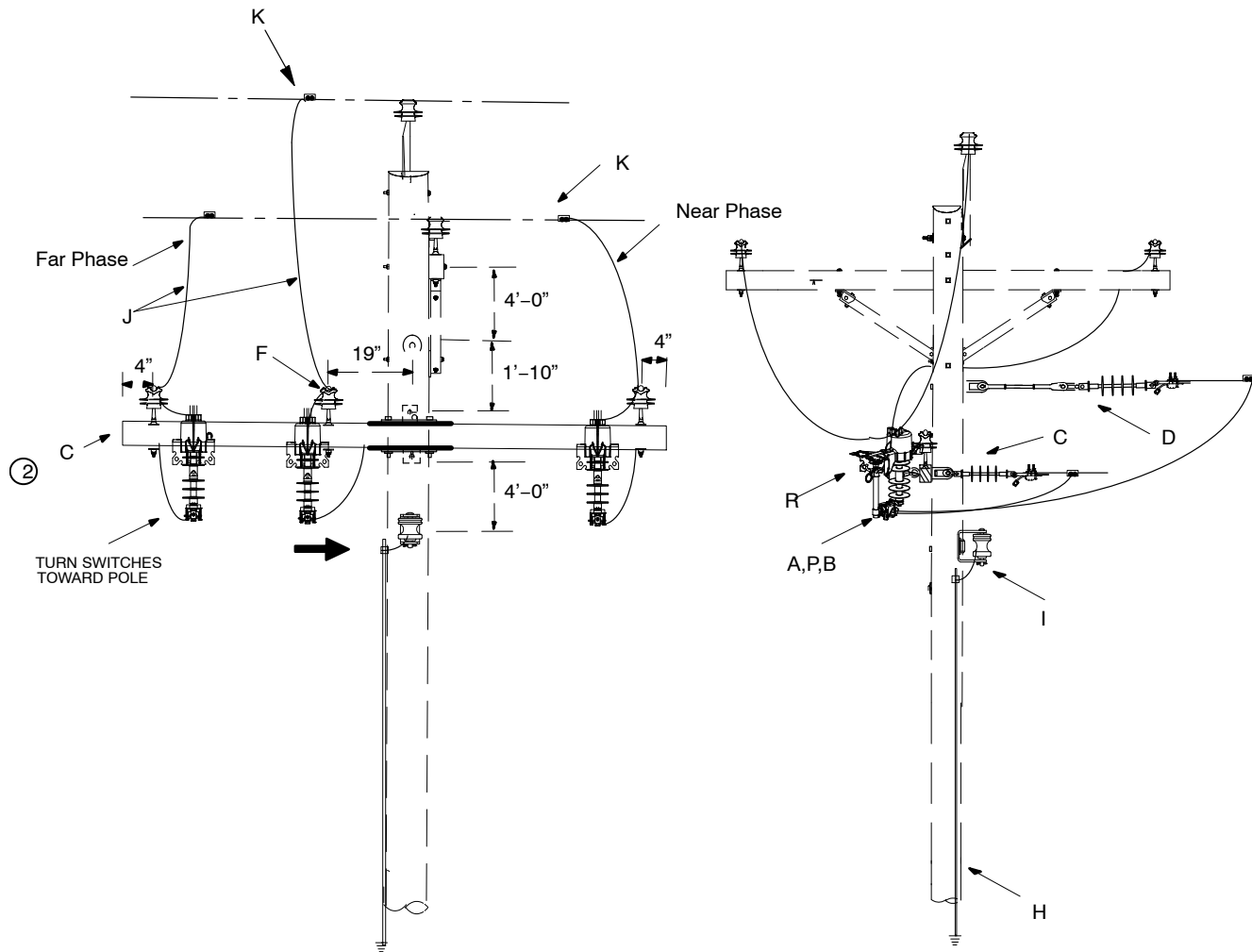
FUSES AND SWITCHES

Two or Three Phase Tap – Crossarm Construction

100 – 300 Amp 4 or 12kV

10 12 23 **

Sheet 1 of 2



	<u>2 PHASE</u>	<u>3 PHASE</u>
100 AMP FUSED	10 12 23 01	10 12 23 04
200 AMP FUSED	10 12 23 02	10 12 23 05
300 AMP SOL. BL.	10 12 23 03	10 12 23 06

FUSES AND SWITCHES
Two or Three Phase Tap – Crossarm Construction
100 – 300 Amp 4 or 12kV

10 12 23 **

Sheet 2 of 2

Notes:

1. Use DCS **12 00 10 01** for ground coil application on new pole installation.
2. 8' crossarm available AmerenMO only.

		Std / Stk.	Description	10 12 23 **					
				2 PHASE			3 PHASE		
				01	02	03	04	05	06
	A	54 07 208	Switch, Fused, 100A, 15 kV	2			3		
		54 07 209	Switch, Fused, 200A, 15 kV		2			3	
		54 07 210	Switch, Solid Blade, 300A, 15 kV			2			3
2@	B	17 58 054	Bracket NEMA, Switch	2	2	2	3	3	3
	C	04 00 41 03	Crossarm, Deadend, F/G, 8'	1	1	1	1	1	1
		04 00 41 04	Crossarm, Deadend, F/G, 10'	1	1	1	1	1	1
	D	06 12 30 01	Deadend on Pole w/FG Extension				1	1	1
	E	06 12 34 01	Deadend on Single Arm	2	2	2	2	2	2
	F	06 12 01 01	Insulator and X-Arm Pin	2	2	2	3	3	3
@	G	DEC*W or DEA*W	Clamp, Deadend	2	2	2	3	3	3
1@	H	12 00 10 02	Grounding Unit – Existing Pole – Ground Rod	1	1	1	1	1	1
		12 00 10 01	Grounding Unit – New Pole – Ground Coil	1	1	1	1	1	1
@	I	03 01 01 03	Neutral Deadend	1	1	1	1	1	1
	J	PLW*W	Wire, Poly covered, S.D.(ft.) DCS 07 00 80 00	20	20	20	30	30	30
@	K	PG*	Clamp, Parallel Groove DCS 07 00 25 00	4	4	4	6	6	6
@	P		Link, Fused (Sized By Designer)	2	2		3	3	
	R	05 15 10 01	Cover – Cutout	2	2	2	3	3	3

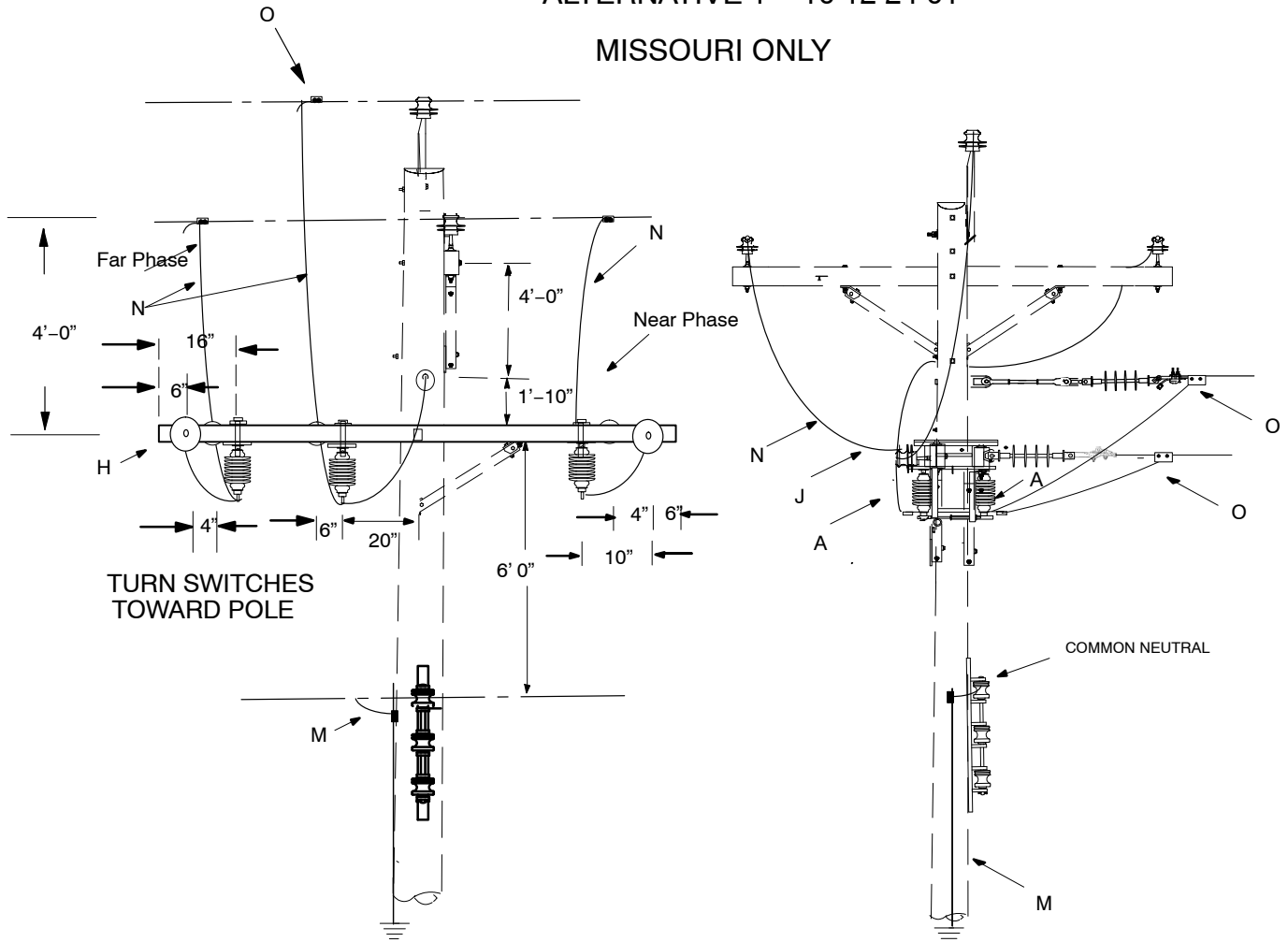
FUSES AND SWITCHES
Three Phase Tap Crossarm Construction
600 Amp – 4 or 12 kV

10 12 24 **

Sheet 1 of 3

ALTERNATIVE 1 – 10 12 24 01

MISSOURI ONLY

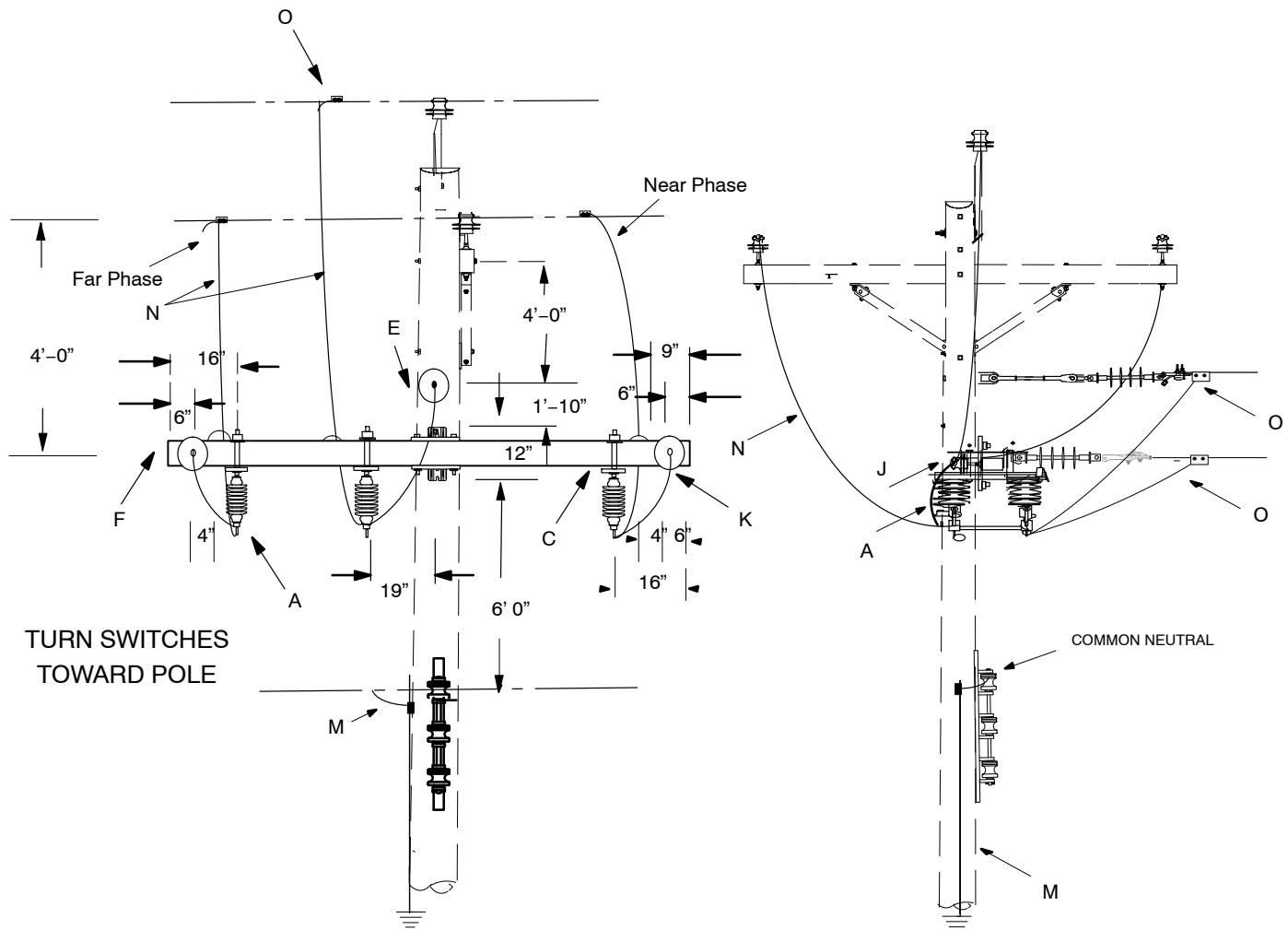


FUSES AND SWITCHES
Three Phase Tap Crossarm Construction
600 Amp – 4 or 12 kV

10 12 24 **

Sheet 2 of 3

ALTERNATIVE 2 – 10 12 24 02



FUSES AND SWITCHES

Three Phase Tap Crossarm Construction

600 Amp – 4 or 12 kV

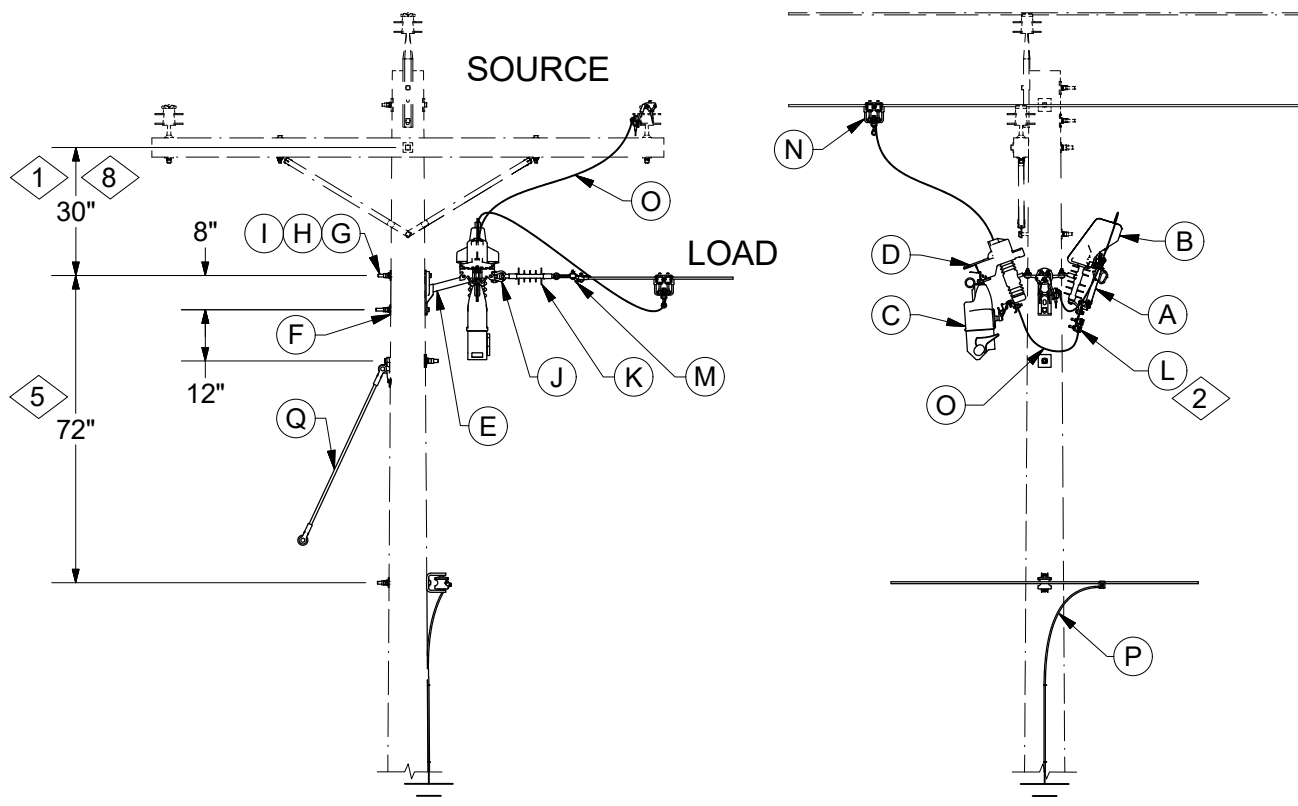
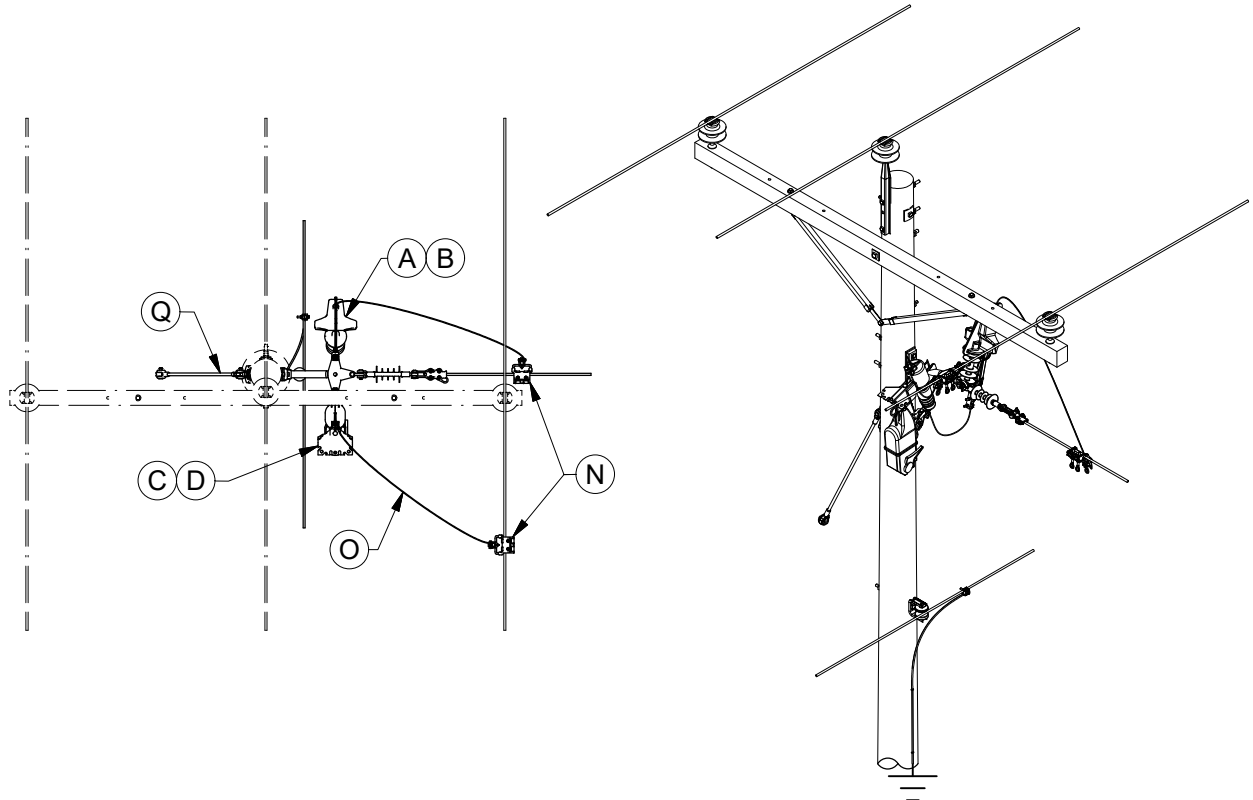
10 12 24 **

Sheet 3 of 3

NOTES:

1. Alternative 1 – installing the switch on double crossarms is permissible in Missouri.
2. Use DCS **12 00 10 01** for ground coil application on new pole installation.
3. When required, switch number tag shall be installed here.

		Std. / Stk. No.	Materials Description	10 12 24 **	01	02
	A	54 07 204	Switch, Disc., 600A, 15kV		3	3
	D	23 62 128	Adaptor Pin 1"		4	2
	F	04 00 41 04	Crossarm, Deadend, FG, 10'			1
	H	04 00 20 08	Crossarm & Brace, 10' Dbl.		1	
@	I	DEC*W	Clamp, Deadend		2	2
	J	25 05 143	Vice Top Insulator 15kV		4	2
	K	06 12 34 01	Deadend on Crossarm		2	2
	L	06 12 30 01	Deadend on Pole w/ FG Extension		1	1
1@	M	12 00 10 02	Grounding Unit – Ground Rod		1	1
		12 00 10 01	Grounding Unit – Ground Coil		1	1
@	N	PLW*W	Wire, Poly covered, S.D. (Ft.)		20	20
@	O	PG*	Clamp, Parallel Groove See 07 00 25 00		6	6
	R	17 54 182	Connector, Split Bolt		1	1





FUSES AND SWITCHES

Tripsaver II
Single Phase Tap

10 12 25 **

4 - 15kV

2 of 3

Construction Note(s):

- 1 For armless construction, apply dimension shown to upper bolt of lowest insulator. For single phase pole, use 36" from the top of the pole.
- 2 Replace two bolt connectors on 600 amp switch with stock #17 51 114, when conductor (item N) is smaller than 1/0.

Operation Note(s):

3. When closing Tripsaver, do not pick up load.
 - Open solid blade switch.
 - Close Tripsaver.
 - Close solid blade switch.
4. When opening Tripsaver
 - Open 600 amp switch with Loadbuster
 - Open Tripsaver

DCS #	DESCRIPTION	STK #
10 12 25 01	100A 65T Tripsaver II	69 10 253
10 12 25 02	100A 80T Tripsaver II	69 10 254
10 12 25 03	100A 100T Tripsaver II	69 10 255
10 12 25 04	100A 40T Tripsaver II	69 10 258
10 12 25 05	100A User Programmed Tripsaver II	69 10 260
10 12 25 06	200A 100T Tripsaver II	69 10 269
10 12 25 07	200A 140T Tripsaver II	69 10 270
10 12 25 08	200A User Programmed Tripsaver II	69 10 267
10 12 25 09	40A User Programmed Tripsaver II	69 10 264

	ITEM	STK / DCS #	DESCRIPTION	10 12 25 **	QTY
7	A	54 07 296	Switch - Disconnect 15kV 600 Amp		1
	B	23 17 512	Wildlife Guard - Vertical Switch 600 Amp		1
	C	-	Tripsaver II - See chart above		1
	D	23 17 411	Wildlife Guard - Cover Cutout		1
	E	23 56 063	Bracket - Equipment Mount 3 Position		1
	F	23 66 027	Washer - Square 5/8"		2
	G	23 52 065	Bolt, Mach., 5/8" x 12"		2
	H	23 66 134	Lock Washer - 5/8" Double Coil		2
	I	23 65 043	Lock Nut - 5/8" Square		2
	J	23 68 181	Shackle - Deadend		1
	K	25 06 052	Insulator - Deadend, 12 kV		1
	L	17 51 114	Connector - One Bolt #8 to 2/0		1
	@ M	07 00 11 00 @	Clamp, Deadend DCS 07 00 11 00		1
@	N	07 00 21 00 @	Hotline Clamp and Stirrup DCS 07 00 21 00		2
@	O	07 00 80 00 @	Wire - Poly Covered (ft.) DCS 07 00 80 00		10
@	P	12 00 10 02	Grounding Unit - Existing Pole - Ground Rod		1
		12 00 10 01	Grounding Unit - New Pole - Ground Coil		1
@	Q	11 00 ** ** @	Guy Unit		1

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
005	07/01/20	DT	Conversion to new standard book format
004	04/01/19	DT	Added Connector 17 51 114 and replaced switch avian protection



FUSES AND SWITCHES

Tripsaver II
Single Phase Tap

10 12 25 **

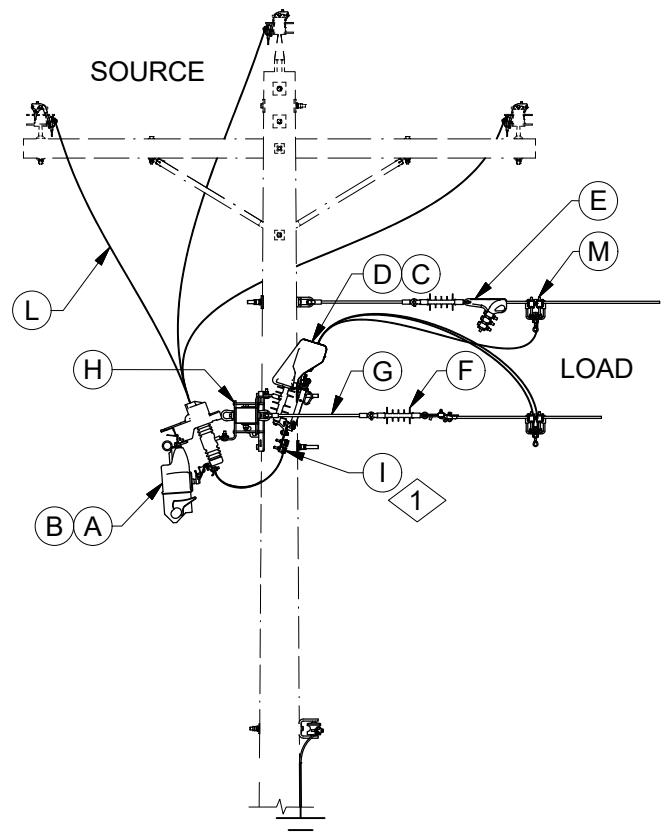
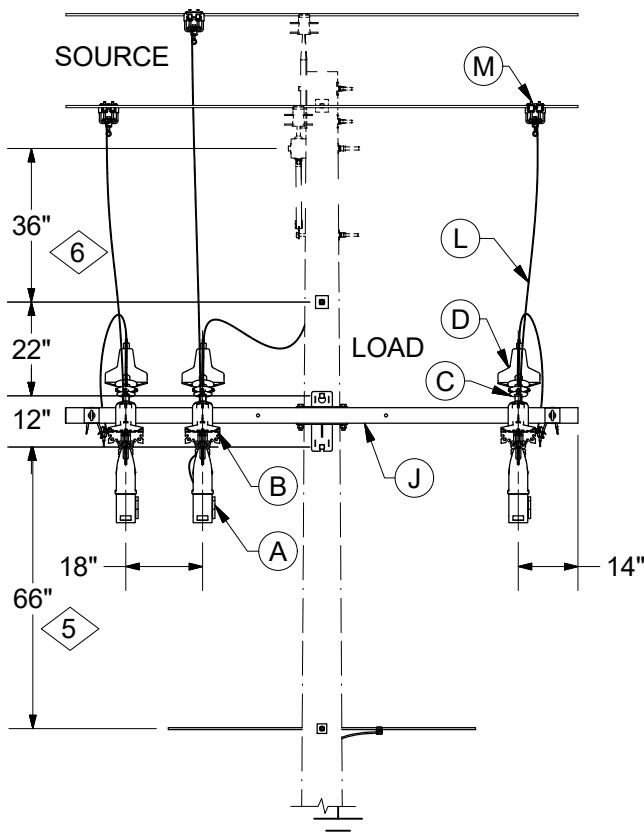
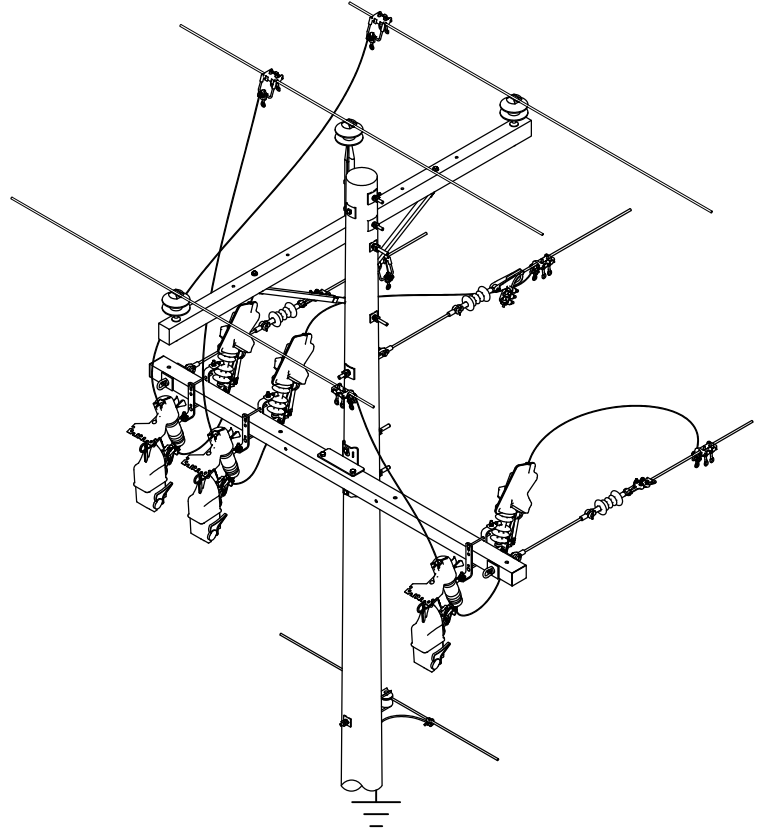
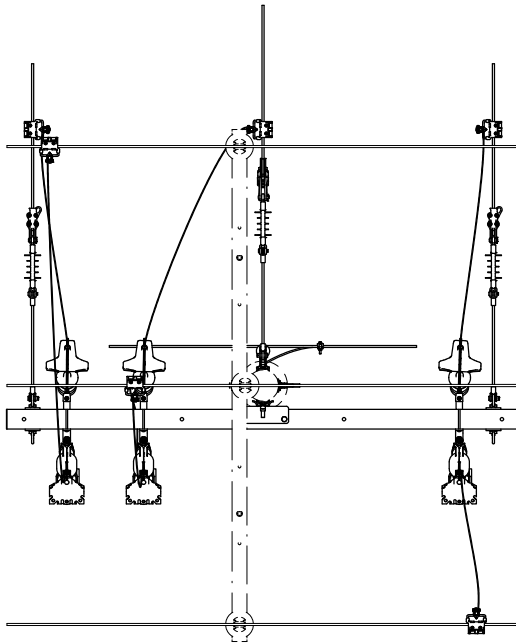
4 - 15kV

3 of 3

Design Note(s):

- 5 This dimension may be reduced to 40" for existing poles to prevent replacement of otherwise serviceable poles.
6. Stock # 69 10 260 is to be programmed by user. The stock # 69 10 259 is the programming kit if needed.
7. Maximum line tension of 5,000 pounds for item E.
- 8 This dimension may be reduced to 24" for existing pole to prevent replacement of otherwise serviceable poles.
9. If fused cutouts are currently installed on a three poiont bracket with this configuration, tripsavers may be installed using existing dimensions.

REV	DATE	ENG	DESCRIPTION
005	07/01/20	DT	Conversion to new standard book format
004	04/01/19	DT	Added Connector 17 51 114 and replaced switch avian protection





FUSES AND SWITCHES

Tripsaver II
Two or Three Phase Tap

10 12 26 **

4 - 15kV

2 of 2

Construction Note(s):

- 1 Replace two bolt connectors on 600 amp switch with stock # 17 51 114, when conductor (item K) is smaller than 1/0.

Operation Note(s):

2. When closing Tripsaver, do not pick up load.
- Open solid blade switch.
 - Close Tripsaver.
 - Close solid blade switch.
3. When opening Tripsaver
- Open 600 amp switch with Loadbuster
 - Open Tripsaver

DCS #		DESCRIPTION	STK #
2 Phase	3 Phase		
10 12 26 01	10 12 26 04	100A 65T Tripsaver II	69 10 253
10 12 26 02	10 12 26 05	100A 80T Tripsaver II	69 10 254
10 12 26 03	10 12 26 06	100A 100T Tripsaver II	69 10 255
10 12 26 07	10 12 26 08	100A 40T Tripsaver II	69 10 258
10 12 26 09	10 12 26 10	100A User Programmed Tripsaver II	69 10 260
10 12 26 11	10 12 26 12	200A 100T Tripsaver II	69 10 269
10 12 26 13	10 12 26 14	200A 140T Tripsaver II	69 10 270
10 12 26 15	10 12 26 16	200A User Programmed Tripsaver II	69 10 267
10 12 26 17	10 12 26 18	40A User Programmed Tripsaver II	69 10 264

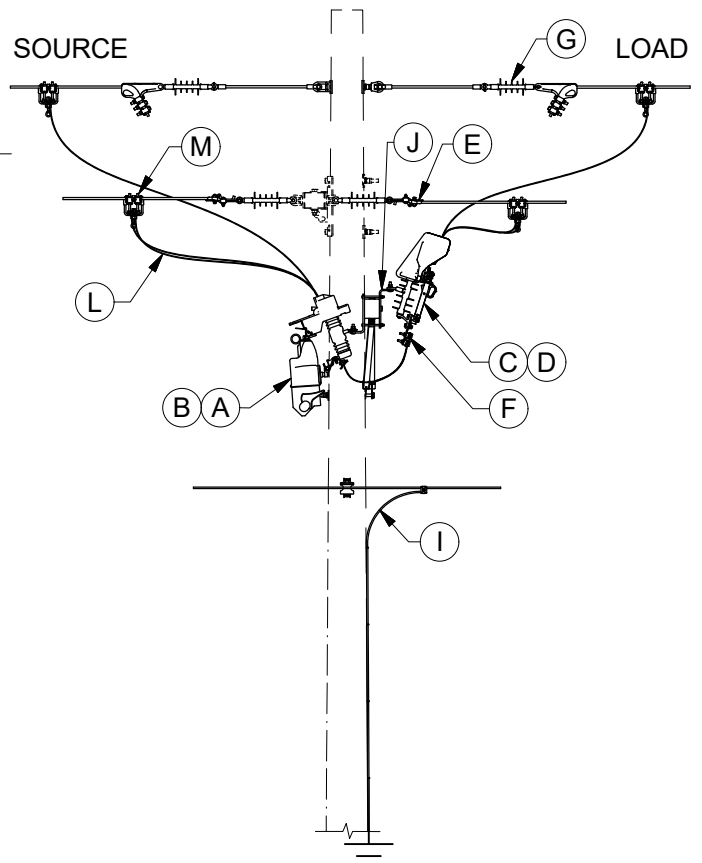
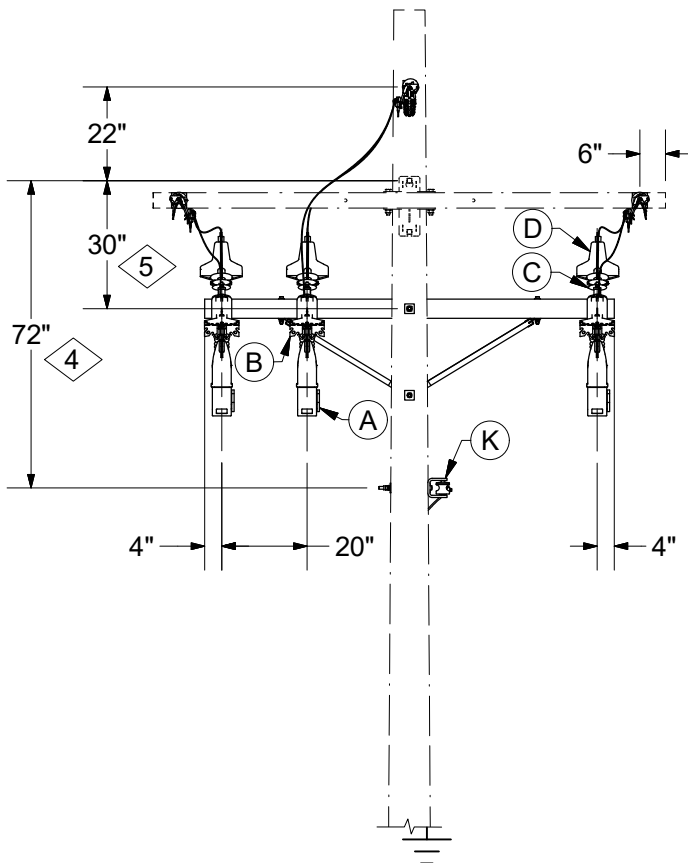
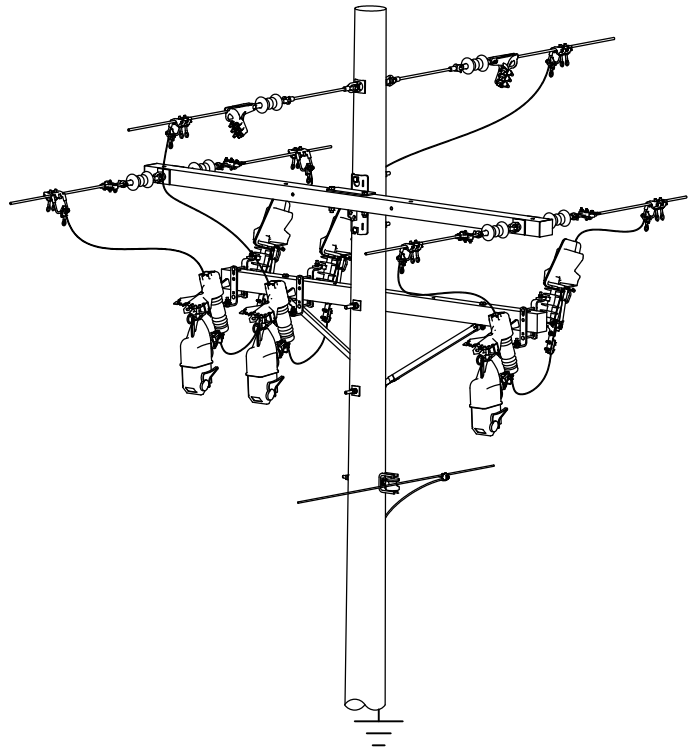
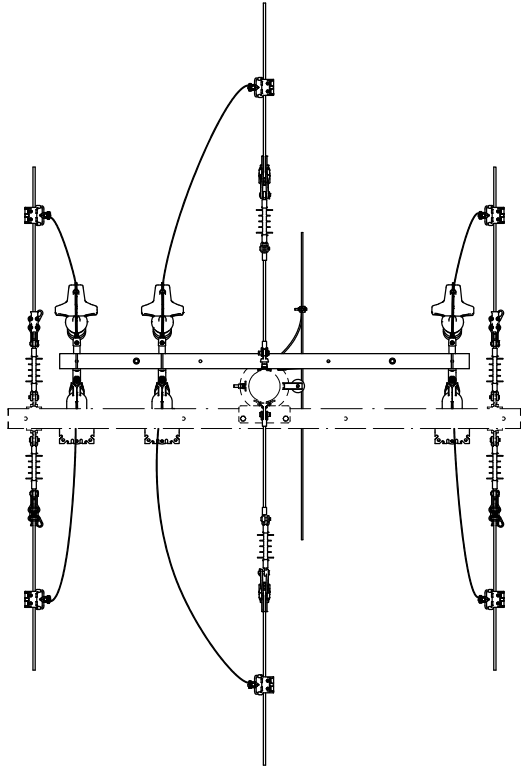
	ITEM	STK / DCS #	DESCRIPTION	10 12 26 **	2 Phase	3 Phase
@	A	-	Tripsaver II - See chart above		2	3
	B	23 17 411	Wildlife Guard - Cover Cutout		2	3
	C	54 07 296	Switch - Disconnect 15kV 600 Amp		2	3
	D	23 17 512	Wildlife Guard - Vertical Switch 600 Amp		2	3
	E	06 12 30 01 @	Deadend on Pole w/FG Extension		1	1
	F	06 12 35 01 @	Deadend on FG Single Arm		2	2
	G	25 56 076	Insulator - Guy Strain F/G 26"		2	2
	H	23 56 088	Bracket - Crossarm Double Sided NEMA		2	3
	I	17 51 114	Connector - One Bolt #8 to 2/0		4	6
	J	04 00 41 03	Crossarm - Deadend FG 8'		1	1
@	K	04 00 41 04	Crossarm - Deadend FG 10'		1	1
		12 00 10 02	Grounding Unit - Existing Pole - Ground Rod		1	1
@		12 00 10 01	Grounding Unit - New Pole - Ground Coil		1	1
@	L	07 00 80 00 @	Wire - Poly Covered S.D. (ft.)		20	30
@	M	07 00 21 00 @	Hotline Clamp and Stirrup		4	6

Design Note(s):

4. Stock # 69 10 260, 69 10 264, and 69 10 269 must be programmed by the end user.
- 5 This dimension may be reduced to 40" for existing poles to prevent replacement of otherwise serviceable poles.
- 6 This dimension may be reduced to 24" for existing poles to prevent replacement of otherwise serviceable poles.
7. If fused cutout are currently installed on a crossarm with this configuration, Tripsavers may be installed using existing crossarm dimensions.

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
004	07/01/20	DT	Updated to new book format
003	04/01/19	DT	Updates to switch connectors and avian protection





FUSES AND SWITCHES

Two or Three Phase Sectionalizing Tripsaver II

10 12 27 **
4 - 15kV
2 of 2

Construction Note(s):

1. Replace two bolt connectors on 600 amp switch with stock #17 51 114, when conductor (item M) is smaller than 1/0.

Operation Note(s):

2. When closing Tripsaver, do not pick up load.
 - Open solid blade switch.
 - Close Tripsaver.
 - Close solid blade switch.

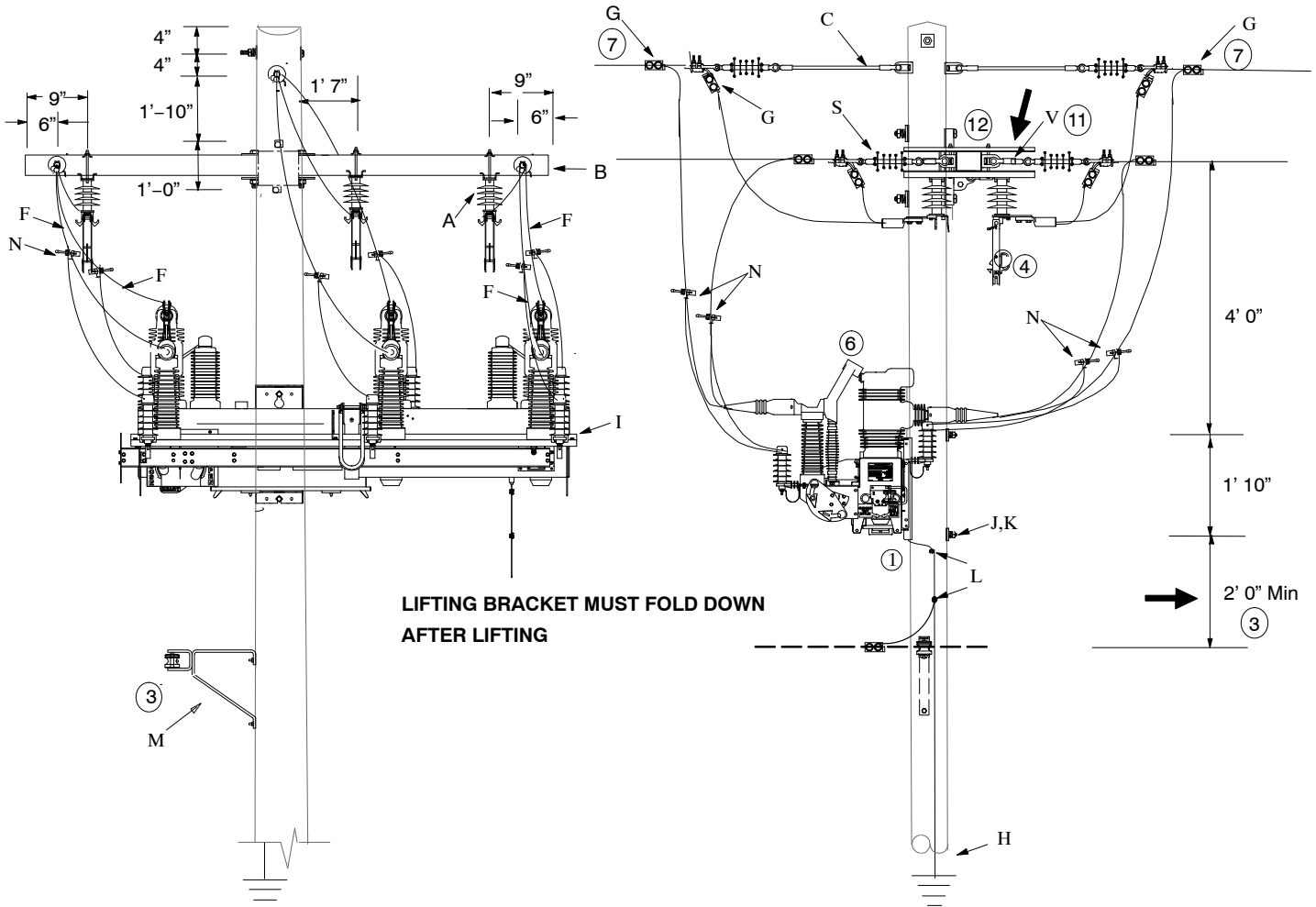
DCS #		DESCRIPTION	STK #
2 Phase	3 Phase		
10 12 27 01	10 12 27 04	100A 65T Tripsaver II	69 10 253
10 12 27 02	10 12 27 05	100A 80T Tripsaver II	69 10 254
10 12 27 03	10 12 27 06	100A 100T Tripsaver II	69 10 255
10 12 27 07	10 12 27 08	100A 40T Tripsaver II	69 10 258
10 12 27 09	10 12 27 10	100A User Programmed Tripsaver II	69 10 260
10 12 27 11	10 12 27 12	200A 100T Tripsaver II	69 10 269
10 12 27 13	10 12 27 14	200A 140T Tripsaver II	69 10 270
10 12 27 15	10 12 27 16	200A User Programmed Tripsaver II	69 10 267
10 12 27 17	10 12 27 18	40A User Programmed Tripsaver II	69 10 264

	ITEM	STK / DCS #	DESCRIPTION	10 12 27 **	2 Phase	3 Phase
	A	-	Tripsaver II - See chart above		2	3
	B	23 17 411	Wildlife Guard - Cover Cutout		2	3
	C	54 07 296	Switch - Disconnect 15kV 600 Amp		2	3
	D	23 17 512	Wildlife Guard - Vertical Switch 600 Amp		2	3
	E	06 12 35 02 @	Deadend on FG Single Arm		2	4
	F	17 51 114	Connector - One Bolt #8 to 2/0		4	6
@	G	06 12 30 13 @	Dbl Deadend on Pole w/o FG Extension			1
		06 12 30 03 @	Dbl Deadend on Pole w/FG Extension			1
@	H	04 00 20 03	10' Single Wood Crossarm		1	1
		04 00 20 02	8' Single Wood Crossarm		1	1
		04 00 41 03	8' F/G Deadend Crossarm		1	1
		04 00 41 04	10' F/G Deadend Crossarm		1	1
@	I	12 00 10 02	Grounding Unit - Existing Pole - Ground Rod		1	1
		12 00 10 01	Grounding Unit - New Pole - Ground Coil		1	1
@	J	23 56 088	Bracket - Crossarm Double Sided NEMA		2	3
@	K	03 01 ** **	Clevis - Secondary		1	1
@	L	07 00 80 00 @	Wire - Poly Covered S.D. (ft.)		20	30
@	M	07 00 21 00 @	Hotline Clamp and Stirrup DCS 07 00 21 00		4	6

Design Note(s):

3. Stock #69 10 260, 69 10 264, and 69 10 267 must be programmed by user.
4. This dimension may be reduced to 40" for existing poles to prevent replacement of otherwise serviceable poles.
5. This dimension may be reduced to 24" for existing poles to prevent replacement of otherwise serviceable poles.
6. If fused cutouts are currently installed on a crossarm with this configuration, tripsavers may be installed using existing crossarm dimensions.

S & C INTELLIRUPTER



NOTES:

1. Intellirupter recloser frame must be connected to ground with #2 Cu. Pole ground to neutral connection must be #2 Cu.
2. Tool for removal / install of radio module and control module is 46 01 645.
3. Install neutral/secondary using extension brackets on the side of the pole with only one phase to allow access to the compartments on the bottom of the intellirupter. The neutral/secondary may be dead-ended to the pole as long as they are mounted 36 inches below the bottom mounting bolt of the intellirupter.
4. Switch to open towards climbing side of pole.
5. 8' Crossarm can be used if existing on pole in MO.
6. Integral disconnect switches on recloser shall be in the open position while connecting primary leads to the recloser.

FUSES AND SWITCHES

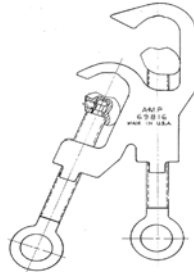
Three Phase Recloser

with Remote Control–600 Amp–15kV

10 12 33 **

Sheet 2 of 2

7. The recloser leads shall be connected to the line connector with a piggy-back clamp (stock #85 38 392) (see picture below) during the installation. The lightning arresters shall be connected to the recloser leads with hot line clamps and the hot line clamps must be installed 36" away from the aluminum base of the Interrupter. Then, the recloser leads shall be permanently connected with parallel groove clamps and the piggy-back clamps shall be removed.



Stock #85 38 392

8. Interruption Recloser weights 1010 lbs.
9. Use DCS 12 00 10 03 for ground with existing poles; use DCS 12 00 10 04 for ground with new pole installation.
10. Double deadend on pole w/o FG extension available AmerenMO only.
11. Install 26" fiberglass extension to provide clearance between insulator and switch.
12. Only install the two inside bolts on the switch and slide them as close to the crossarm as possible.
13. External power supply, powered off secondary, required for installing on circuits less than 12.47 kV. Contact Distribution Standards for installation instructions.

		Std. / Stk. No.	Description	10 12 33**	02
5 10@	A	54 07 204	Switch, Dis., 600A, 15kV		3
	B	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	C	06 12 30 03	Dbl Deadend on Pole F/G Extension		1
		06 12 30 13	Dbl Deadend on Pole w/o F/G Extension		1
	F	18 51 052	Wire, Poly, SD, 350 Cu. (Ft.)		100
@	G	PG*	Clamp. Parallel Groove (see Std. 07 00 25 00)		13
9@	H	12 00 10 03	Grounding Unit (with #2 S.D. Cu) – Ground Rod		1
		12 00 10 04	Grounding Unit (with #2 S.D. Cu) – Ground Coil		1
8	I	69 10 250	Recloser, S&C Interruption, 15kV, 600A w/Comm Module		1
3@	J	23 52 219	Bolt, Galv., 3/4" x 14"		2
	K	23 66 031	Curved Washer, Galv., 3/4" SQ		2
	L	17 54 373	Split Bot #4 Cu to #2 Cu		2
	M	03 01 01	Neutral Configuration		1
	N	23 78 183	Clamp, Hot Line		6
13@	S	06 12 35 02	Double Deadend on FG Arm		2
	V	25 56 076	Insulator, Strain FG 26"		4
	Y	69 10 252	4 kV power supply		1

FUSES AND SWITCHES

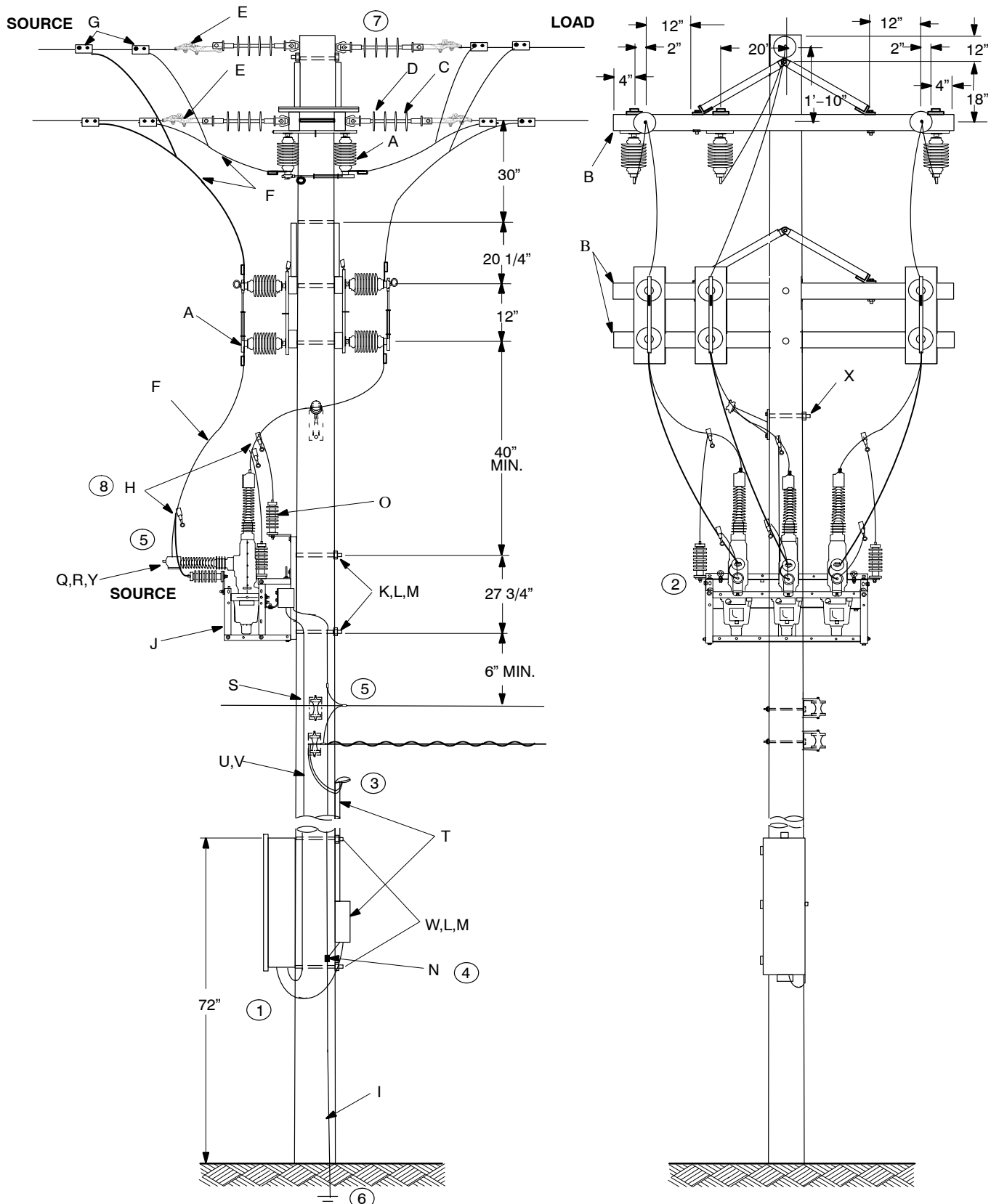
Three Phase Recloser

with Remote Control-800 Amp-15kV

10 12 34 **

Sheet 1 of 2

G & W RECLOSER WITH BYPASS AND DISCONNECT SWITCHES



FUSES AND SWITCHES

Three Phase Recloser

with Remote Control-800 Amp-15kV

10 12 34 **

Sheet 2 of 2

NOTES

1. Recloser comes with a 30' control cable. A 50' (Stk. No. 69 10 233) and a 35' (Stk. No. 69 12 234) may be substituted.
2. Join arrester grounds together and connect to frame and pole ground.
3. Secondary voltage can be supplied with duplex.
4. Control cabinet and circuit breaker/receptical box must be connected to pole ground, with #6 S.D. Cu.
5. Bond ground to distribution system neutral. Bond duplex neutral to distribution system neutral.
6. Use DCS **12 00 10 04** for ground coil application on new pole installation.
7. Double deadend on pole w/o FG extension available AmerenMO only.
8. The lightning arresters shall be connected to the recloser leads with hot line clamps and the hot line clamps must be installed 36" away from the connecting busing.

		Std. / Stk. No.	Description	10 12 34 **	01
7@ @ @ @ 6	A	54 07 204	Disc., Switch, 600 A, 15 kV,		9
	B	04 00 20 07	Crossarm, Double 8 Ft.		3
	C	06 12 34 04	Double Deadend on Arm		2
	D	06 12 30 03	Dbl Deadend on Pole w/ FG Extension		1
		06 12 30 13	Dbl Deadend on Pole w/o FG Extension		1
	E	DEC*W	Clamp, Deadend		6
	F	18 51 022	Wire, 500 kcmil, Poly., S.D.		150
	G	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		12
	H	17 02 175	Hot Line Clamp, 500kcmil Cu Main/#4 Cu Tap		6
	I	12 00 10 03	Grounding Unit		1
	J	69 10 237	Recloser, G&W Viper, 15kV, 800 A		1
	K	23 52 066	Bolt, Galv., 5/8" x 14"		2
	L	23 66 027	Washer, Galv., 11/16", Square		4
	M	23 66 046	Washer, Galv., 11/16", Round		4
	N	17 54 003	Connector, Split Bolt		2
	O	10 01 144	Lightning Arrester, 10kV		6
	P	18 51 025	Wire, #4 Cu, Poly		30
	Q	17 54 955	Lug, 1/0 - 500 Cu.		6
	R	17 51 234	Lug, #8 TO 2/0 Cu.		6
	S	06 01 01 03	Sgle. Clevis, Ext. Brkt		1
	T	54 17 486	Circuit Breaker, Receptical Box, w/Riser 120V, 20A		1
	U	41 56 041	Moulding - Plastic 3/4" x 8'		4
	V	23 64 028	Staple - for 3/4" moulding		16
	W	23 52 068	Bolt, Galv., 5/8" x 16"		2
	X	06 12 20 04	Training Arm with Pin Insulator		1
	Y	69 58 181	Guard, Wildlife		6

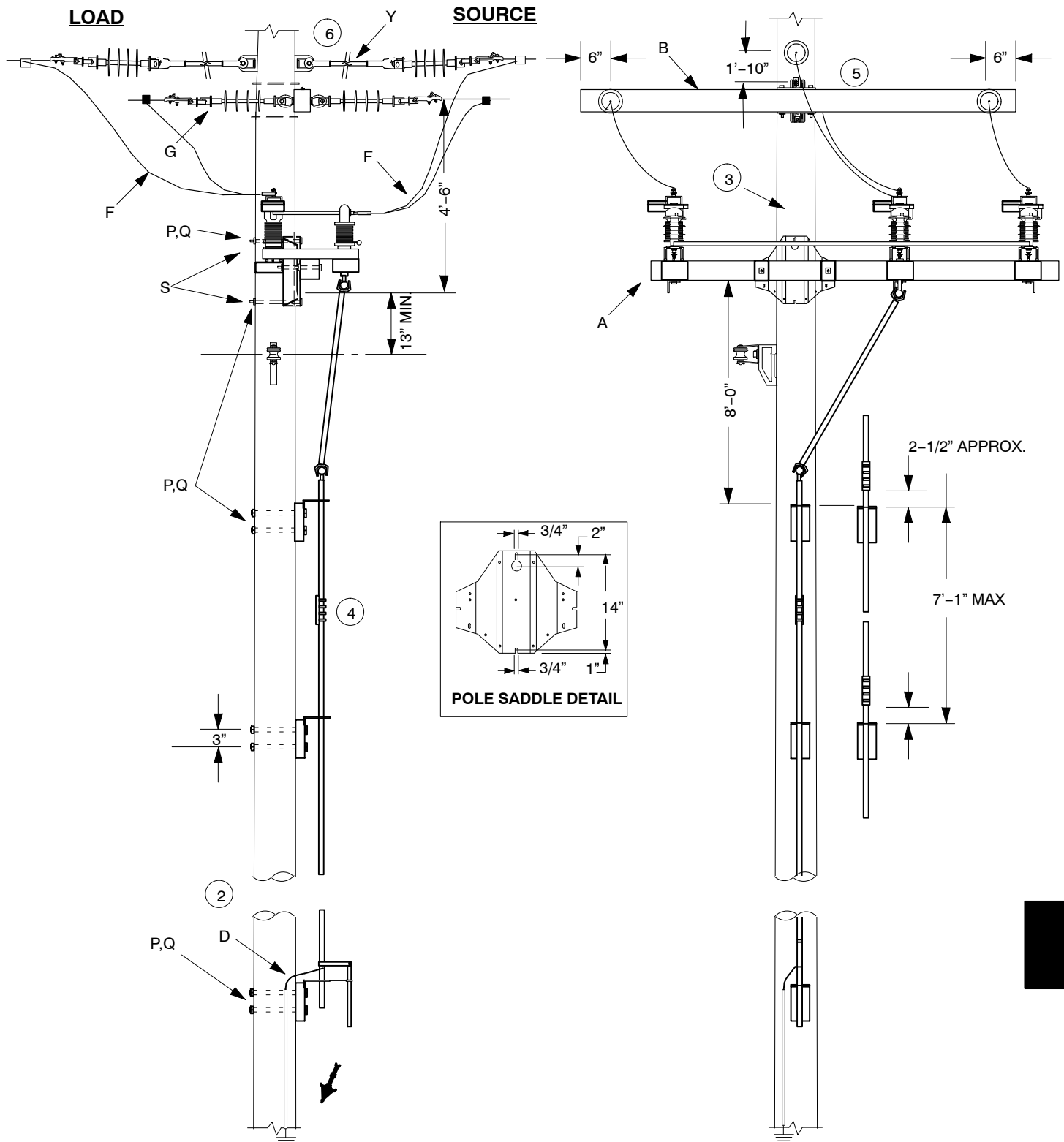
FUSES AND SWITCHES

Three Phase Sectionalizing

15kV – 600Amp. – Group Operated, Air-Break Switch

10 12 35 01

Sheet 1 of 2



FUSES AND SWITCHES
Three Phase Sectionalizing
15kV – 600Amp. – Group Operated, Air-Break Switch

10 12 35 01

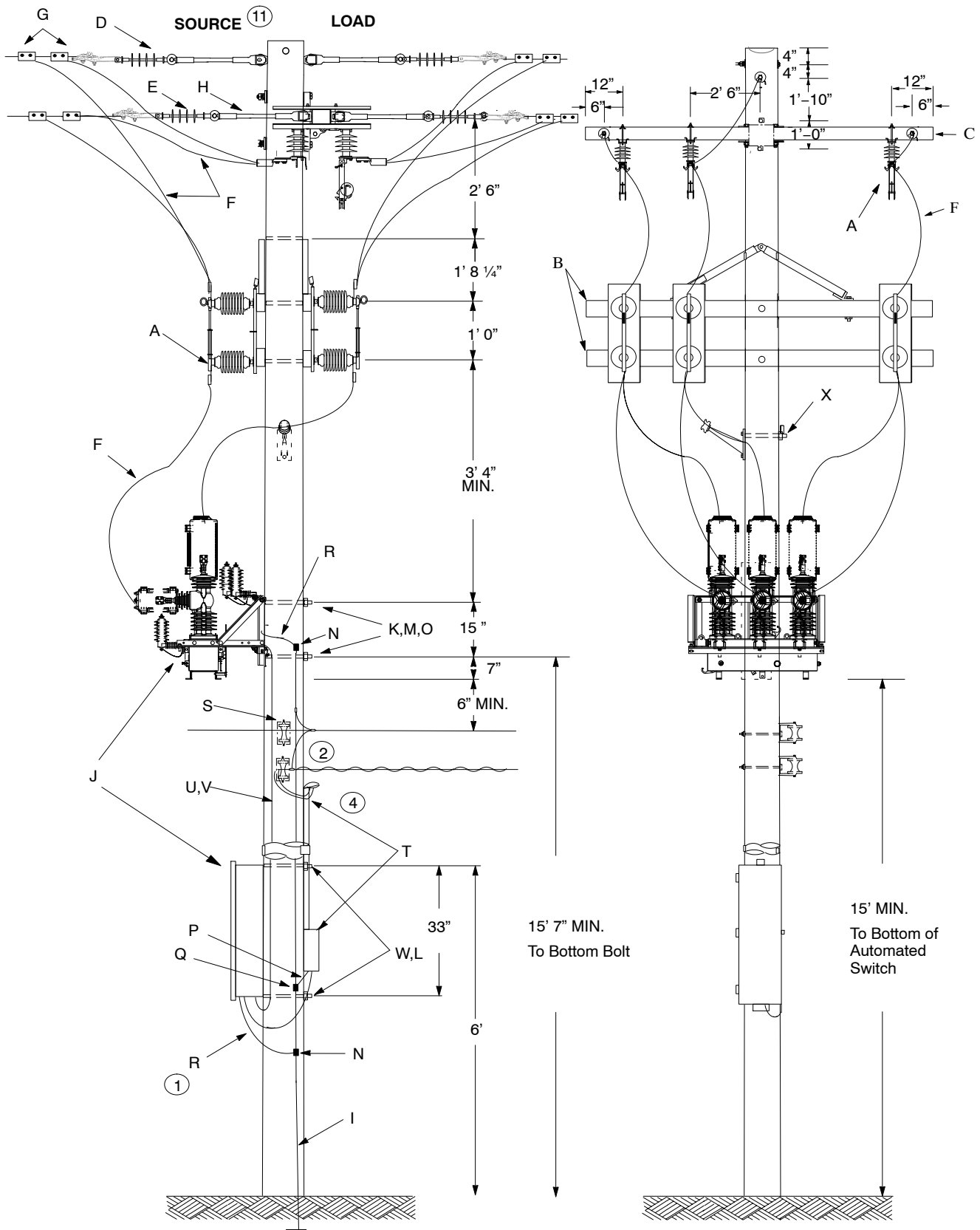
Sheet 2 of 2

NOTES:

1. For new installation, both Illinois and Missouri, arresters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS **12 00 01 01** for arresters selection.
2. Grounding unit the switch handle.
3. When required, switch number tag shall be installed here.
4. Insulator must be installed in this section.
5. 8' crossarm available AmerenMO only.
6. Double deadend on pole w/o FG extension available AmerenMO only.

		Std. / Stk. No.	Description	10 12 35 01	Qty
5@ @ @ @ 6@	A	54 07 273	Switch, Group Operated 15kV		1
	B	04 00 41 03	Crossarm, Deadend, F/G, 8'		1
		04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	D	12 69 11 05	Grounding Unit-Ground Rod		1
		12 69 11 06	Grounding Unit-Ground Coil		1
	E	PG*W	Clamp, PG, DCS 07 00 25 00		6
	F	18 51 052	Wire, SD Cu, 350 kcmil, Poly covered		30
	G	06 12 35 02	Double Deadend on FG Crossarm		2
	P	23 52 066	Bolt, Galv., 5/8" x 14"		8
	Q	23 66 027	Washer, Galv., 11/16" Square		4
	S	23 66 046	Washer, Galv, 11/16" Round		2
	X	DEC*W	Clamp, Deadend, DCS 07 00 30 00		4
	Y	06 12 30 03	Double Deadend on Pole w/ FG Extension		1
		06 12 30 13	Double Deadend on Pole w/o FG Extension		1

Automated Sectionalizer for DER Applications



FUSES AND SWITCHES

Three Phase Sectionalizer

Automated-630 Amp-15kV

10 12 36 01

Sheet 2 of 2

NOTES

1. Control cabinet and equipment frame shall be bonded to pole ground with #2 poly covered copper. Circuit breaker box shall be bonded to pole ground with #6 poly covered copper.
2. Bond pole ground to distribution system neutral. If present, bond duplex neutral to distribution system neutral.
3. If antenna installation is required in supply space, see **25 90 00 00** for clearance requirement. If antenna installation is required in communications zone, see **29 00 17 11** for clearance requirement.
4. Minimum 40" clearance required (at pole) from lowest point on secondary (or weatherhead drip loop, whichever is lower) to communications, if present.
5. Use DCS **12 00 10 04** for ground coil application on new pole installation.
6. Voltage sensors come calibrated for 7.2 kV line to ground voltage. Automated switch rated for 630 amp continuous current and 12.5 kA withstand symmetrical fault current.
7. 10 kV lightning arresters come preinstalled. See DCS **12 00 01 01** when different arresters are required.
8. Control cabinet comes with a 55' control and power cables.
9. Automated switch assembly weighs 400 lbs. Control cabinet weighs 105 lbs.
10. 120V supply power must be provided for control cabinet through the circuit breaker box, item T.
11. The "source" side shall be in the direction of the feeder, the "load" side shall be on the distributed generation side.

		Std. / Stk. No.	Description	10 12 36 **	01
	A	54 07 204	Disc., Switch, 600 A, 15 kV,		9
	B	04 00 20 11	Crossarm, Double 10 Ft. Vertically		2
	C	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	D	06 12 30 03	Dbl Deadend on Pole w/ FG Extension		1
	E	06 12 35 02	Dbl Deadend on Arm		2
	F	18 51 052	Wire, 350 kcmil, Poly., S.D.		140
@	G	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		12
	H	25 56 076	Insulator, Strain, Fiberglass 26"		4
5@	I	12 00 10 03	Grounding Unit, #2 Cu		1
		12 00 10 04	Grounding Coil, #2 Cu		1
	J	69 10 262	Automated Switch, G&W Diamondback		1
	K	23 52 219	Bolt, Galv., 3/4" x 14"		2
	L	23 66 027	Washer, Flat, 5/8", Square		2
	M	23 66 031	Washer, Curved., 3/4"		2
	N	17 54 182	Connector, Split Bolt, #2 Cu - #4 Cu		2
	O	23 66 135	Washer, Lock, 3/4", Dbl Coil		2
	P	18 51 021	Wire, #6 Cu, Poly Covered		3
	Q	17 54 005	Connector, Split Bolt, #2 Cu - #6 Cu		1
	R	18 51 019	Wire, #2 Cu, Poly Covered		6
@	S	06 01 01 **	Secondary Clevis		1
		06 01 03 **	Secondary Rack		1
	T	54 17 486	Circuit Breaker Box, w/Riser 120V, 15A, sec. arrest.		1
	U	41 56 041	Moulding - Plastic 3/4" x 8'		4
	V	23 64 028	Staple - for 3/4" moulding		16
	W	23 52 068	Bolt, Galv., 5/8" x 16"		2
	X	06 12 20 04	Training Arm with Vice-Top Insulator		1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DT
REV. NO: NEW
REV. DATE: 7/01/19

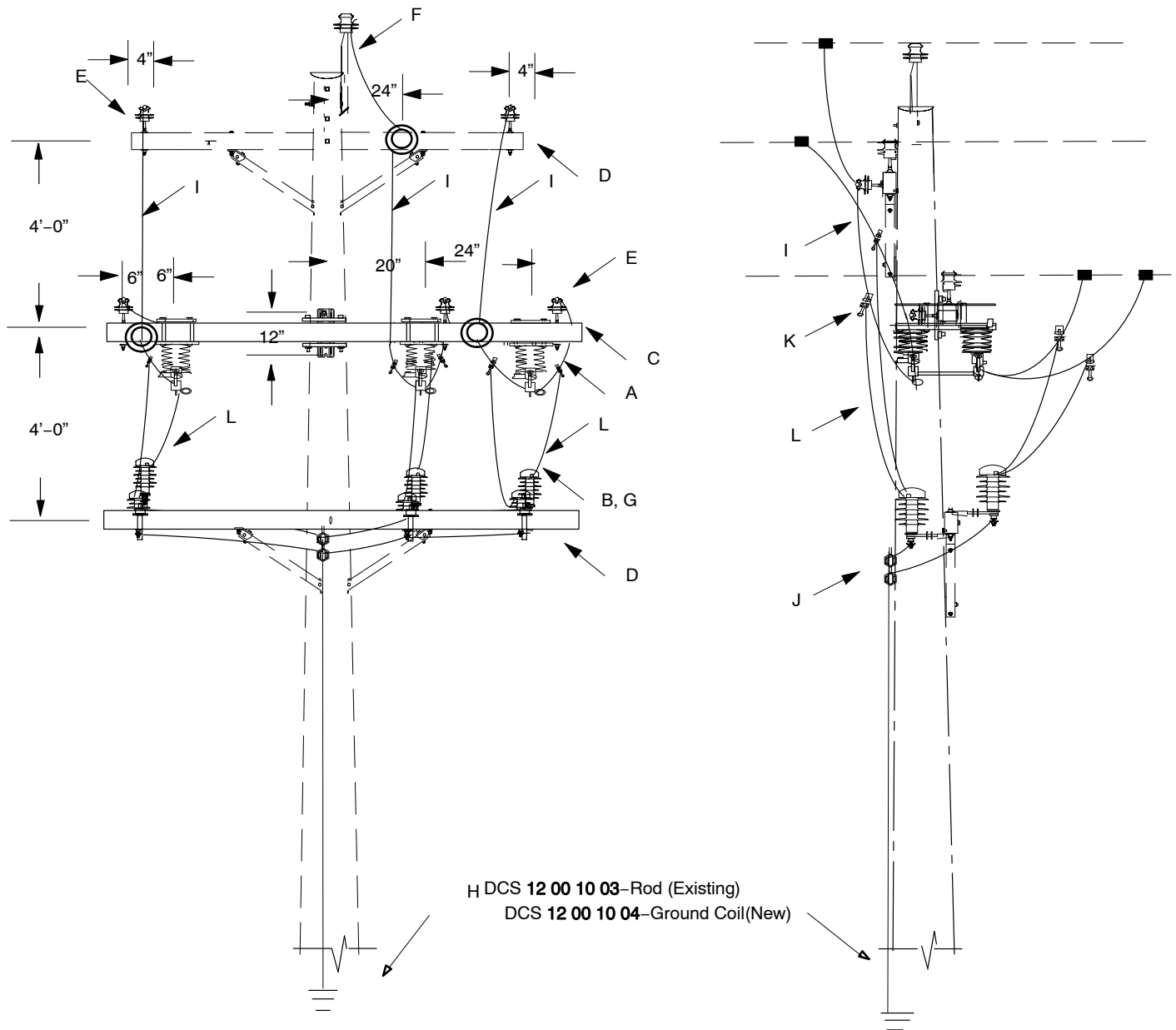
FUSES AND SWITCHES
Double Circuit Tie Switch
Crossarm Construction – 600 Amp – 4 or 12 kV

10 12 50 **

Sheet 1 of 3

10 12 50 01 – Arresters On the Same Structure

MISSOURI ONLY



FUSES AND SWITCHES

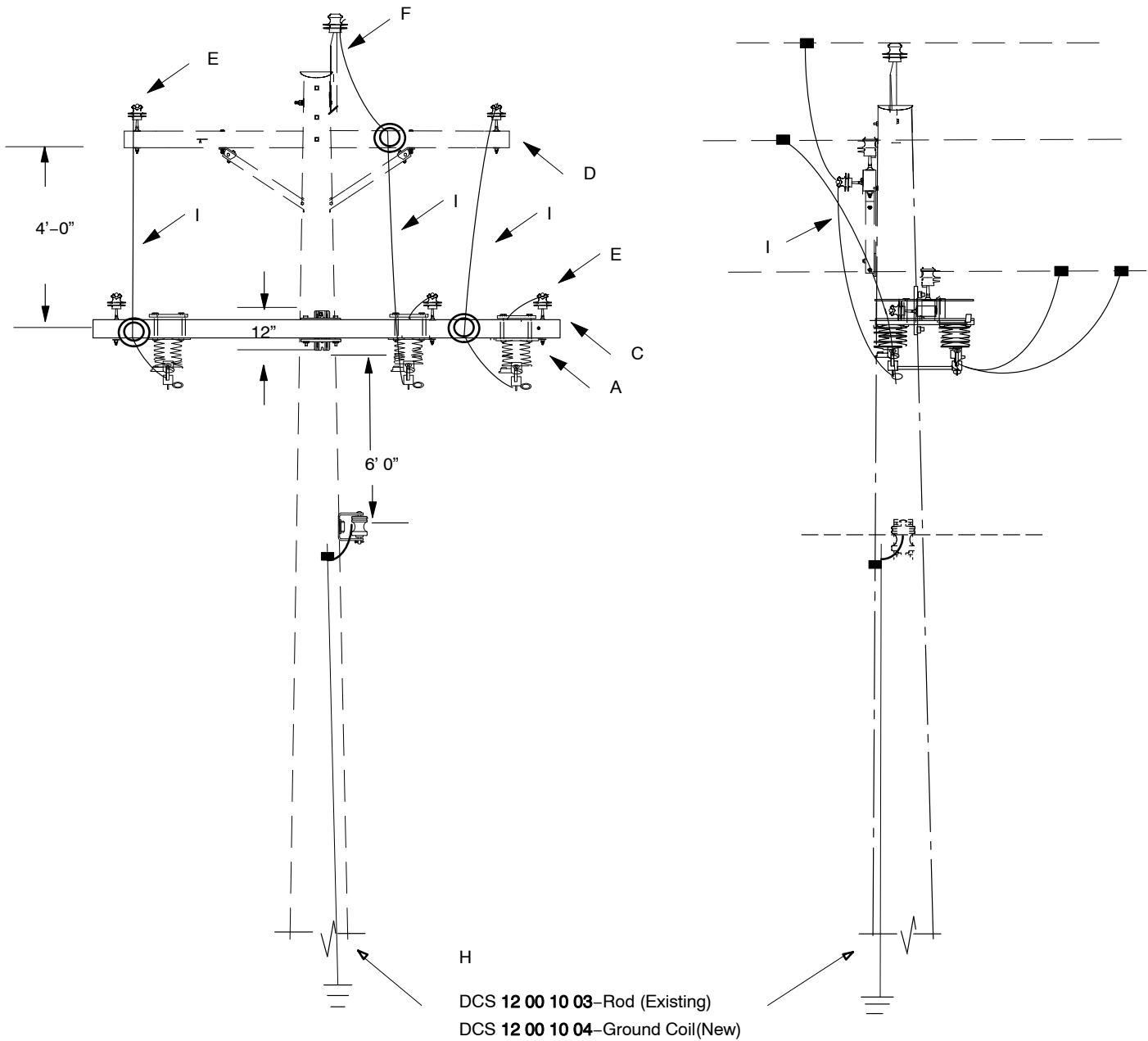
Double Circuit Tie Switch

Crossarm Construction – 600 Amp – 4 or 12 kV

10 12 50 **

Sheet 2 of 3

10 12 50 02 – Arresters On Adjacent Structures



Notes:

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:WYW
REV. NO: 6
REV. DATE: 06/30/16

FUSES AND SWITCHES

Double Circuit Tie Switch

Crossarm Construction – 600 Amp – 4 or 12 kV

10 12 50 **

Sheet 3 of 3

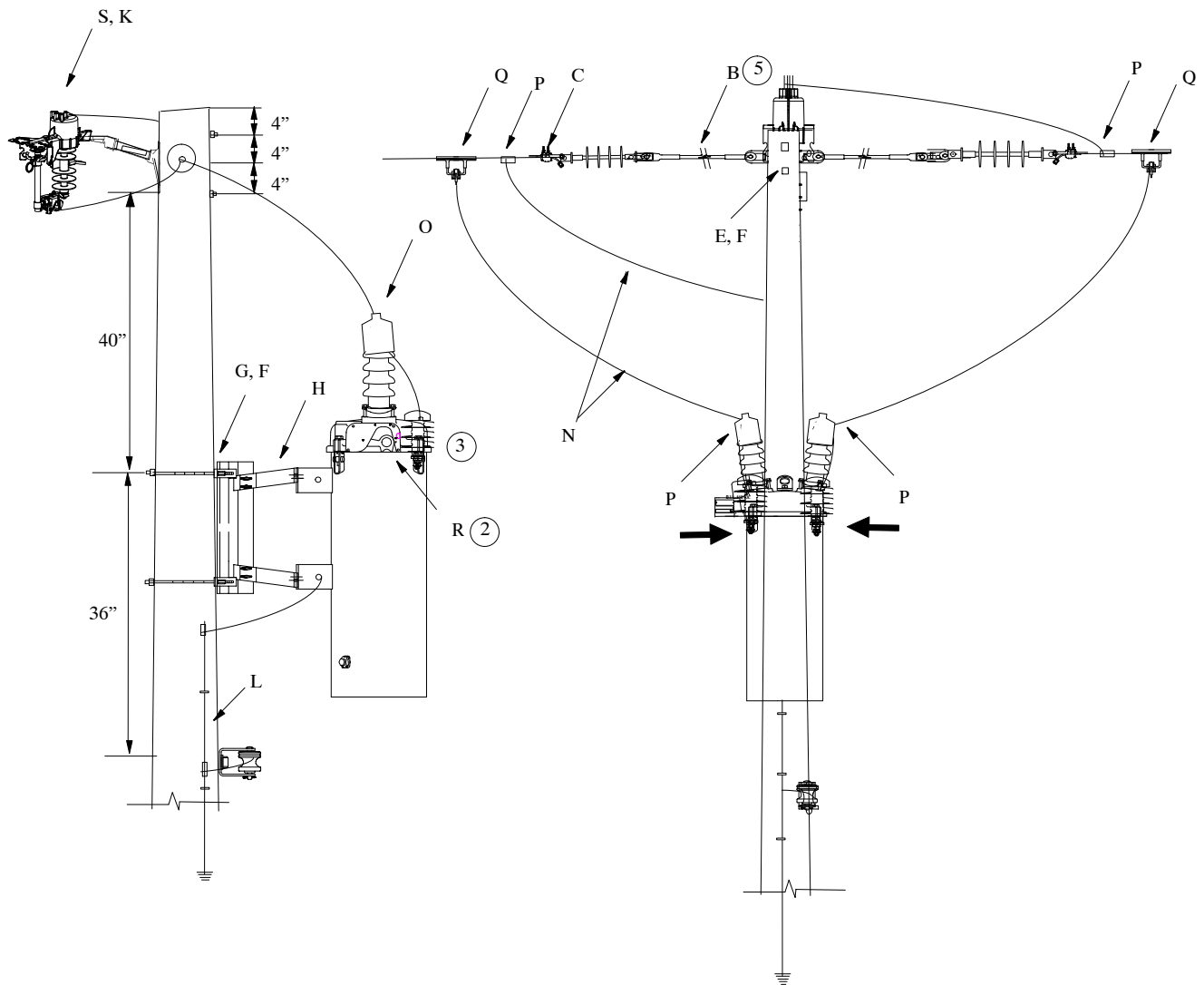
1. DCS 10 12 50 01 is permissible for existing installation in Missouri. For new installation, both Illinois and Missouri, arresters are not required for normally closed switch installations; where switches are normally open, install both sets of arresters on adjacent poles. Refer to DCS 12 00 01 01 for arresters selection.
2. Use DCS 12 00 10 04 for ground coil application on new pole installation.
3. When required, switch number tag shall be installed here.
4. 8' crossarm available Missouri only.
5. Install mounting bolts for switch as close to the crossarm as possible. Tighten bolts evenly and do not distort or warp switch base and backplate. Do not use bolts in outside/end mounting holes.

		Std. / Stk. No.	Description	10 12 50 **	01	02
1@	A	54 07 204	Switch, Dis., 600A, 15kV		3	3
	B	10 01 144	Arrester, 10kV		6	
		10 01 133	Arrester, 3kV		6	
4@	C	04 00 41 04	Crossarm, Deadend, FG, 10'		1	1
	D	04 00 20 03	Crossarm, Sgl, Wood 10'		1	
		04 00 20 02	Crossarm, Sgl, Wood 8'		1	
	E	06 12 01 01	Pin & Insulator		5	5
	F	06 12 01 02	Pin 24" Sgl Pole Top & Insulator		1	1
	G	23 56 088	DBL Sided NEMA Bracket for Arrester and Cutout		3	
2@	H	12 00 10 03	Grounding Unit – Ground Rod		1	1
		12 00 10 04	Grounding Unit – Ground Coil		1	1
@	I	PLW*W	Wire, Poly, S.D. (Ft.)		40	40
@	J	PG*	Clamp, Parallel Groove See 07 00 25 00		7	7
		HLC*W	Clamp, Hot Line 07 00 21 00		6	6
@	K	HLC*W	Clamp, Hot Line 07 00 21 00		6	
	L	18 51 021	Wire S.D. #6 Cu. Poly (Ft.)		20	
	M	25 05 143	Vice Top Insulator 15kV		3	3
	N	23 62 128	Adaptor Pin 1"		3	3

FUSES AND SWITCHES
Single Phase Recloser
25-280 Amp – 12 kV

10 12 60 01

Sheet 1 of 2



FUSES AND SWITCHES
Single Phase Recloser
25–280 Amp – 12 kV

10 12 60 01

Sheet 2 of 2

NOTES:

1. Reclosers with only one mounting lug shall be mounted in top hole of mounting unit.
2. Recloser shall be turned in tank to position shown.
3. Lightning arresters shall be mounted on tank cover lug on source and load sides of recloser.
4. Fuse cartridge may be substituted for solid blade if sensitive circuit or extended outage anticipated.
5. Double deadend on pole w/o FG extension available AmerenMO only.

		Std. / Stk. No.	Description	10 12 60 01	
8@	A	10 01 144	Arrester, Lightning		2
	B	06 12 30 03	Double Deadend on Pole w/ FG Extension		1
@		06 12 30 13	Double Deadend on Pole w/o FG Extension		1
	C	DEC*W or DEA*W	Clamp, Deadend		2
6	D	23 17 291	Mounting Recloser		1
	E	23 52 063	Bolt, Machine, 5/8 x 10"		2
7@	F	23 66 027	Washer, Square, 2–1/4"		4
	G	23 53 003	Bolt, D.A., 5/8" x 18"		2
@	H	23 52 049	Bolt, Mach., 5/8" x 2"		2
	J	23 06 127	Bracket, Fiberglass, Switch		1
6	K	54 07 210	Switch, Disc., 300A, 15kV		1
	L	12 00 10 02	Grounding Unit, Ground Rod		1
@		12 00 10 01	Grounding Unit, Ground Coil		1
	N	PLW*W	Wire, Poly Covered, S.D. (Ft.)		15
@	O	69 58 181	Guard, Wildlife		2
	P	PG*	Clamp, Parallel Groove DCS 07 00 25 00		6
@	Q	STC*W	Clamp, Stirrup, With Hot Line Clamp DCS 07 00 21 00		2
	R	69 10 XXX	Recloser		1
4 @	S	05 15 10 01	Cover – Cutout		1

FUSES AND SWITCHES

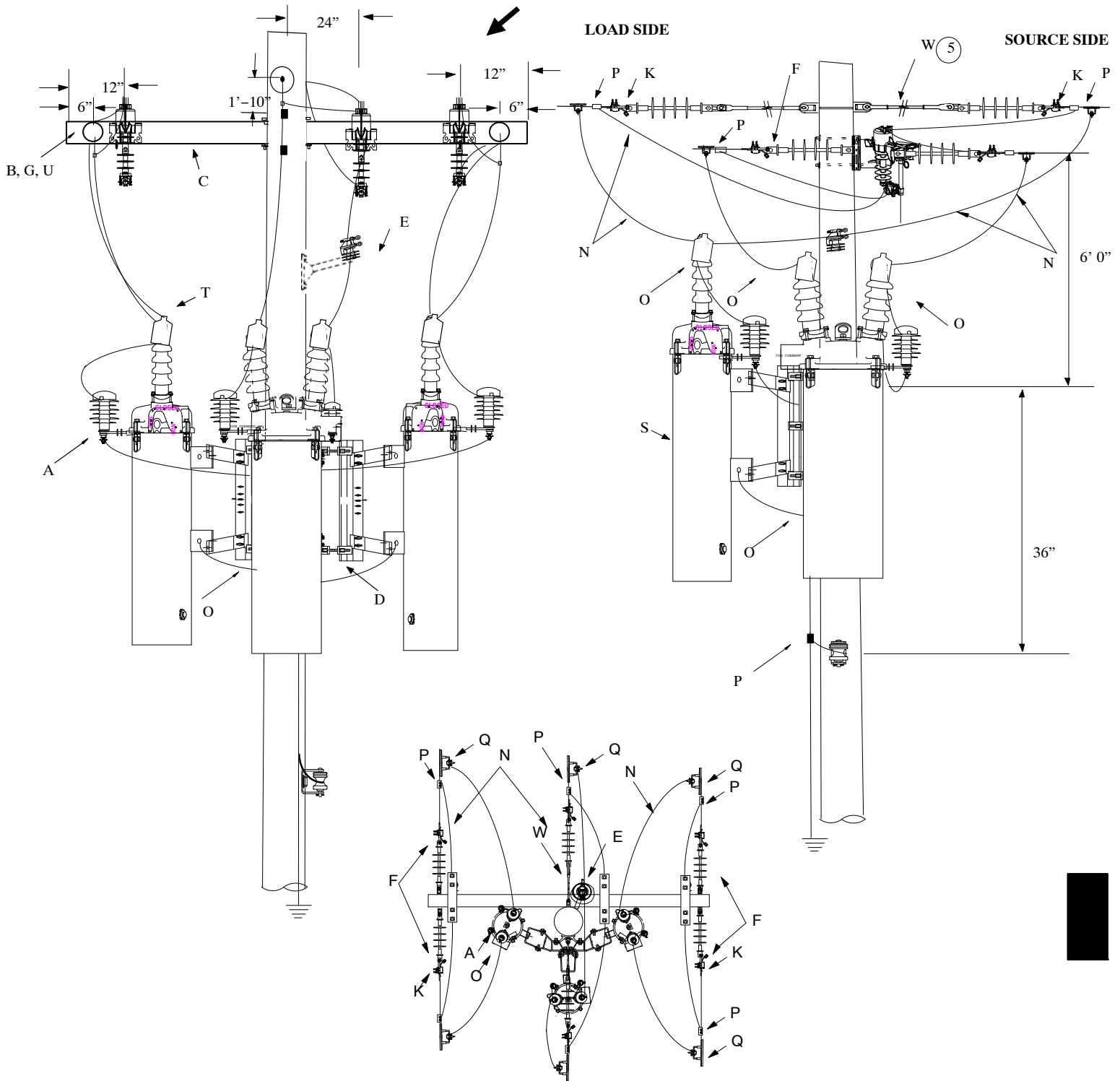
Three Phase Recloser

25-280 Amp - 12 kV

10 12 62 01

Sheet 1 of 2

For #2 Cu or 1/0 Al or Smaller



FUSES AND SWITCHES

Three Phase Recloser

25–280 Amp – 12 kV

10 12 62 01

Sheet 2 of 2

NOTES:

1. Reclosers with only one mounting lug shall be mounted in top hole of mounting unit.
2. Recloser shall be turned in tank to position shown.
3. Lightning arrester shall be mounted on tank cover lug on both source and source sides.
4. Fuse cartridge may be substituted for solid blade if sensitive circuit or extended outage anticipated.
5. Double deadend on pole w/o FG extension available AmerenMO only.
6. Underbuild construction requires deadend on pole w/ FG extension.

		Std. / Stk. No.	Description	10 12 62 01	
4	A	10 01 144	Arrester, Lightning 10kV		6
	B	54 07 210	Switch, Disc., 300A 15kV		3
	C	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	D	23 17 209	Mounting Unit, Recloser		1
	E	23 06 089	Arm, Training Fiberglass, 12"		1
	F	06 12 34 05	Double Deadend on Arm		2
	G	17 58 054	Bracket, Switch & LA's		3
	H	25 05 143	Vice Top Insulator, 15kV		1
	I	23 52 065	Mach Bolt, 5/8" x 12"		1
	J	23 66 027	Washer SQ 5/8"		1
@	K	DEC*W or DEA*W	Clamp, Deadend, DCS 07 00 20 00		4
@	M	12 00 10 03	Grounding Unit, Ground Rod		1
		12 00 10 04	Grounding Unit, Ground Coil		1
@	N	PLW*W	Wire, Poly Covered, S.D., (Ft.), DCS 07 00 80 00		60
	O	18 51 021	Wire, Poly, #6 Cu. (Ft.)		15
@	P	PG*	Clamp, Parallel Groove, DCS 07 00 25 00		9
@	Q	STC*W	Clamp, Stirrup, with Hot Line, DCS 07 00 21 00		6
@	S	69 10 XXX	Recloser, Mat Spec 2.1.170		3
	T	69 58 181	Guard, Wildlife		6
	U	05 15 10 01	Cover – Cutout		3
5@	W	06 12 30 03	Double Deadend on pole w/ FG Extension		1
		06 12 30 13	Double Deadend on pole w/o FG Extension		1

FUSES AND SWITCHES

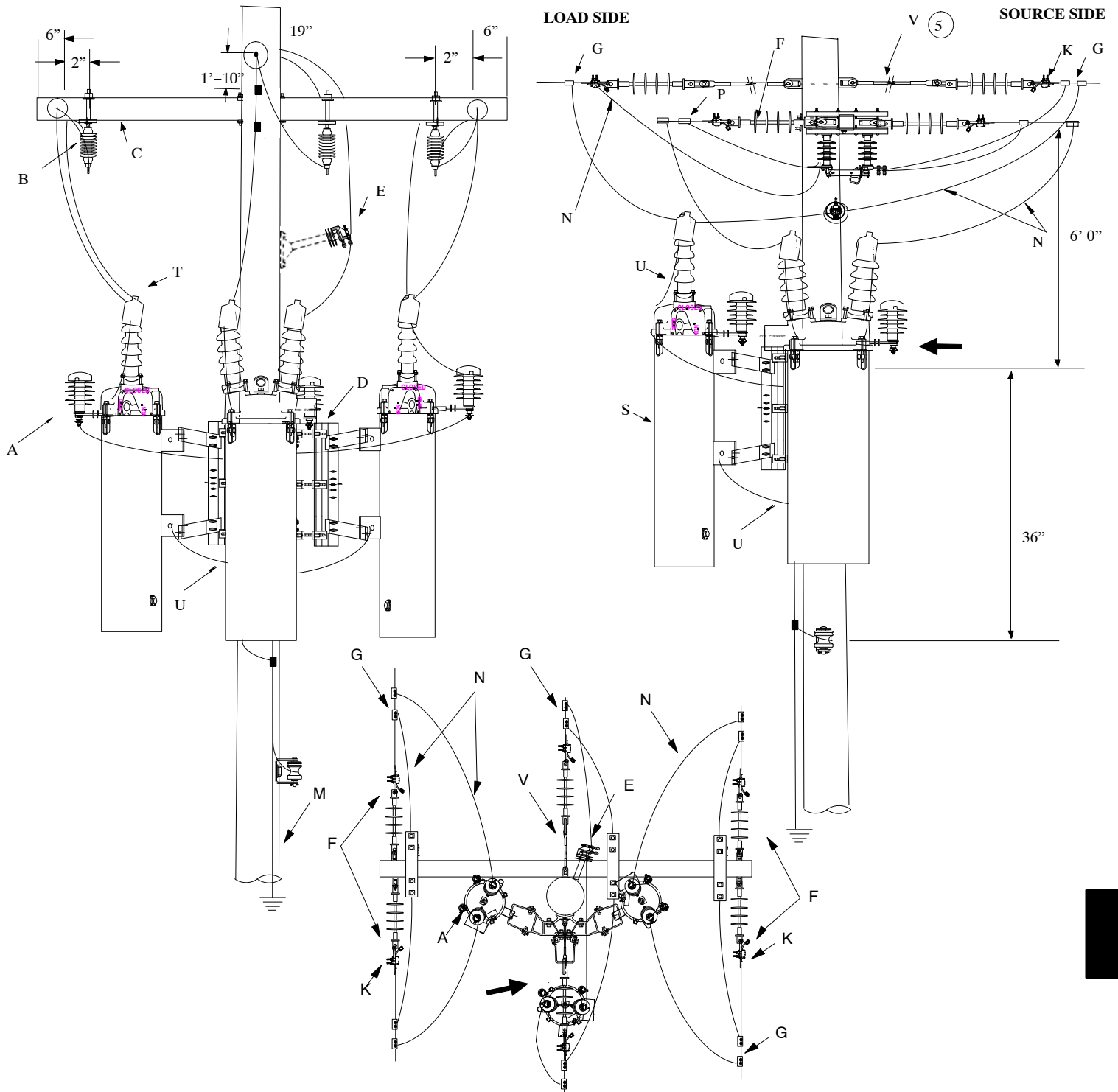
Three Phase Recloser

280 Amp – 12 kV

10 12 62 03

Sheet 1 of 2

For 336.4 ACSR OR Larger



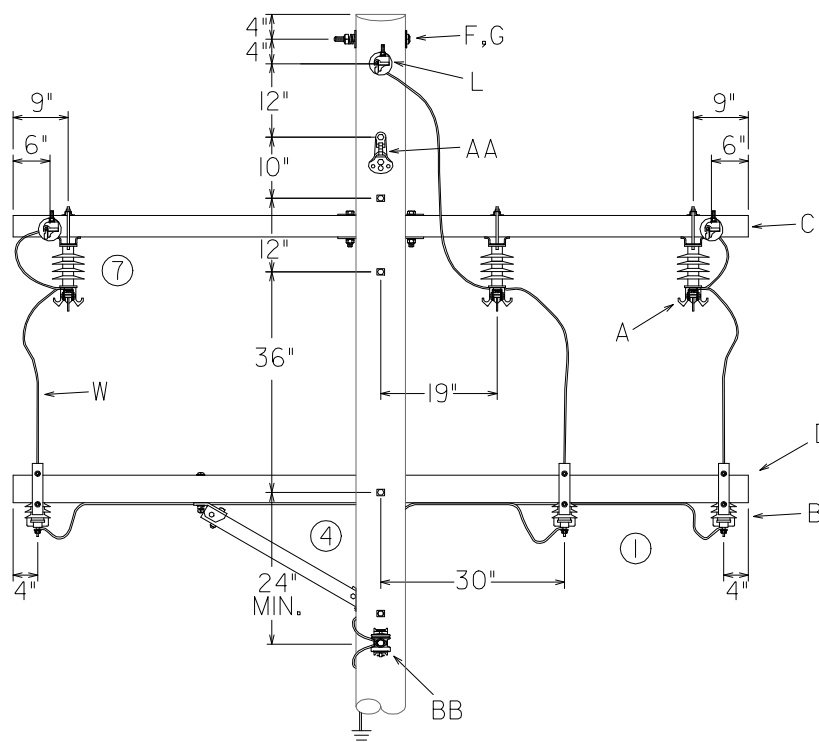
FUSES AND SWITCHES

Three Phase Sectionalizing – Spacer Cable to Open Wire

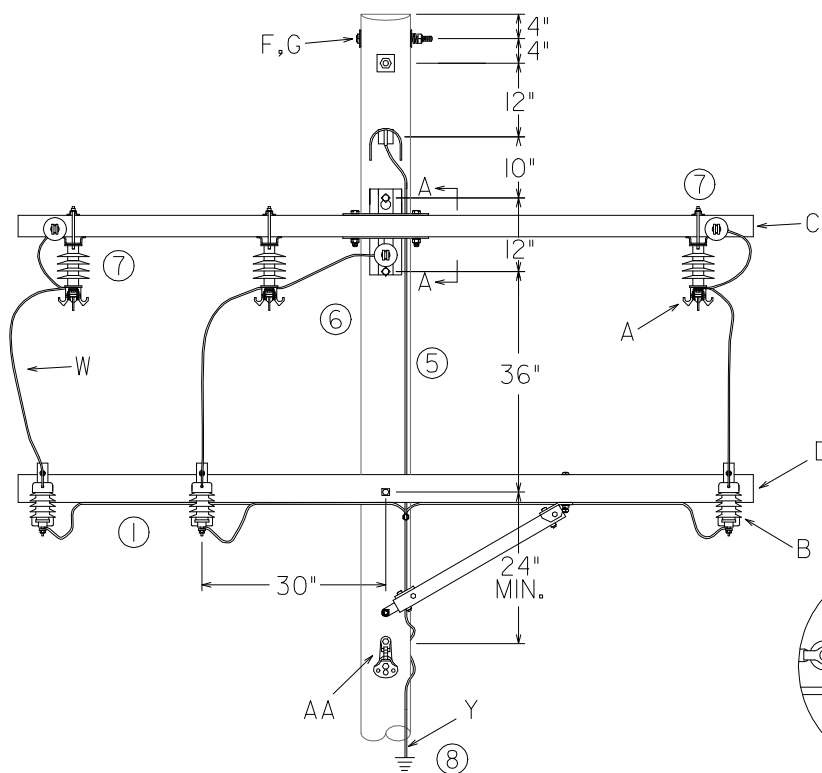
600 Amp – 4 or 12 kV

10 20 05 01

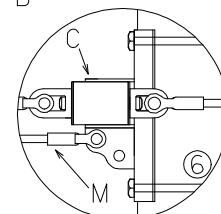
Sheet 1 of 4



OPEN WIRE SIDE



SPACER CABLE SIDE



Detail A-A

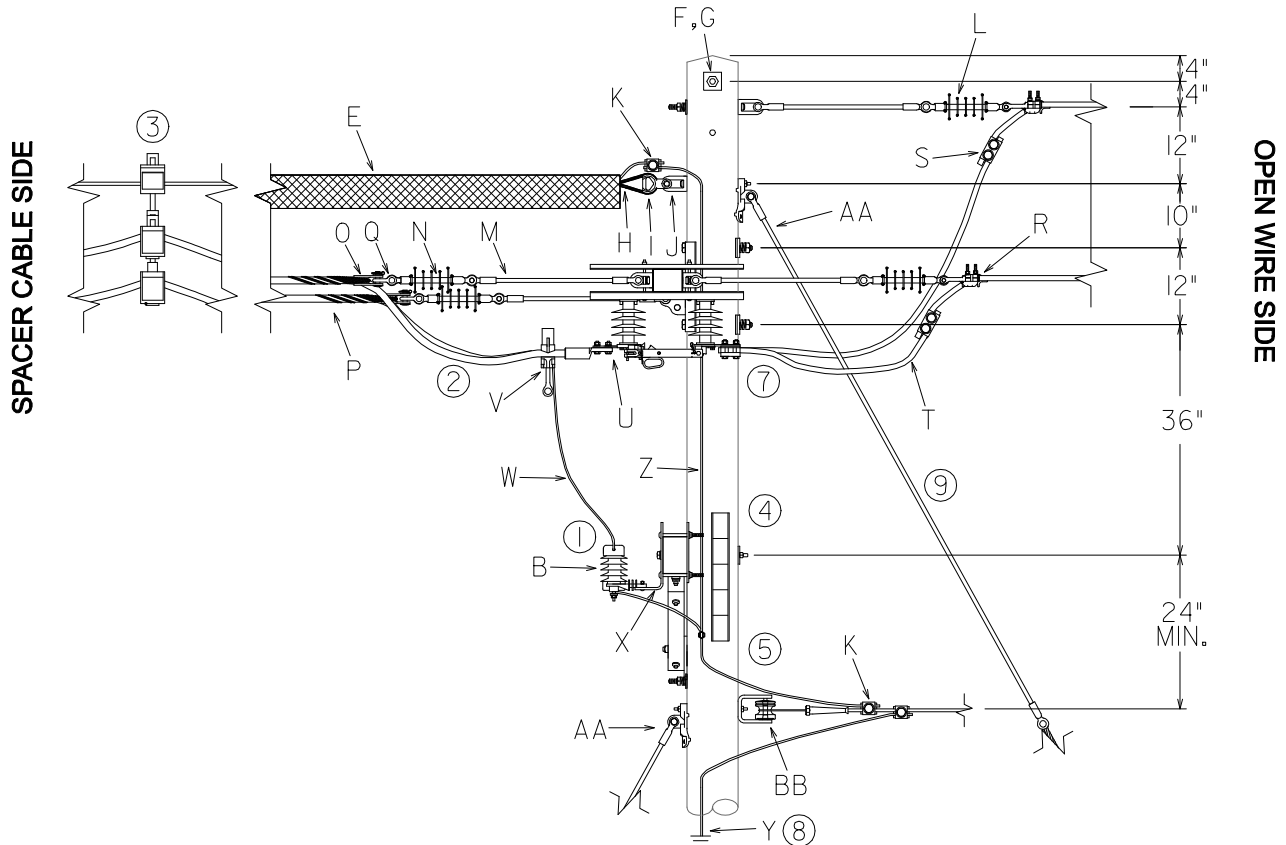
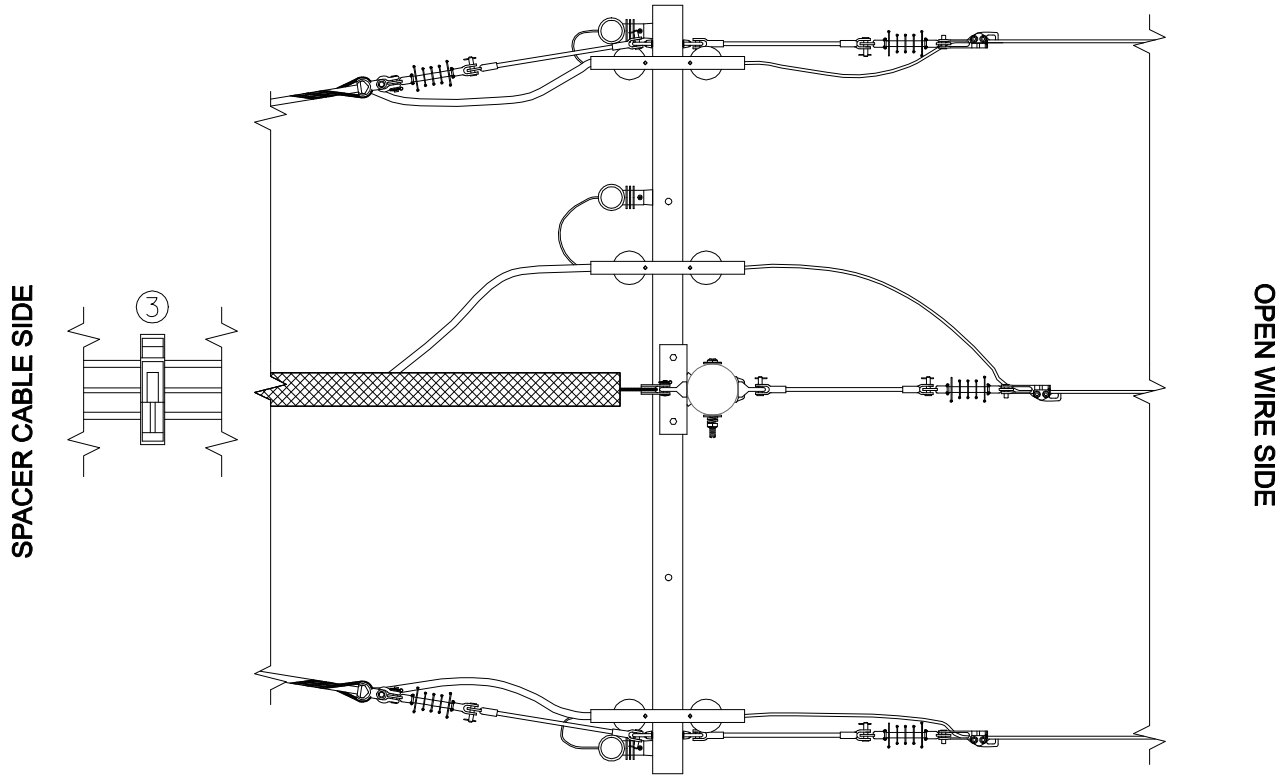
FUSES AND SWITCHES

Three Phase Sectionalizing – Spacer Cable to Open Wire

600 Amp – 4 or 12 kV

10 20 05 01

Sheet 2 of 4



FUSES AND SWITCHES
 Three Phase Sectionalizing – Spacer Cable to Open Wire
 600 Amp – 4 or 12 kV

10 20 05 01

Sheet 3 of 4

		Std. / Stk. No.	Description	10 20 05 01
7 1@	A	54 07 204	Switch, Dis., 600A, 15kV	3
	B	10 01 144	Arrester, 10kV w/ Protective Cap	3
		10 01 133	Arrester, 3kV w/ Protective Cap	3
	C	04 00 41 04	Crossarm, Deadend, F/G, 10'	1
	D	04 00 20 03	Crossarm, Sgl., Wood, 10', (use only 1/2 of V-Brace)	1
	E	69 58 293	Line Duc (Messenger Cover), Black, 8' Long (Each)	1
	F	23 52 065	Bolt, 5/8" x 12"	1
	G	23 66 027	Washer, Square, 2-1/4"	2
	H	23 68 713	Grip, Messenger/ Neutral, Preformed for 7#6 AW-052AWA	1
	I	23 58 054	Clevis, NM, Thimble, Galvanized Steel	1
	J	23 59 095	Eyelet, NM, STD, 3/4", Galvanized Steel	1
	K	17 51 137	Clamp, PG – Messenger to Open Wire Neutral	2
	L	06 12 30 01	Deadend on Pole w/ FG Extension	1
6	M	25 56 076	Insulator, Strain, Fiberglass, 26"	5
	N	25 06 052	Insulator, Suspension, 15kV, Poly	5
@	O	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel	3
	P	17 69 063	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable	3
		17 69 **	Size Grip per existing Spacer Cable Conductor	3
@	Q	23 68 181	Shackle – Anchor, 9/16"	3
	R	DEC*W	Clamp, Deadend	3
@	S	PG*W	Clamp, Parallel Groove (See 07 00 25 00)	3
2	T	18 51 052	Wire, Poly, SD, 350 Cu. (Ft.)	15
	U	17 55 804	Lug, Shear Bolt, 1/0 Through 795 Spacer Cable	3
	@ V	17 62 088	Clamp, Hot Line, 1/0 Through 477 Spacer Cable	3
		17 62 143	Clamp, Hot Line, 795 Spacer Cable	3
	W	18 51 021	Wire, Poly #6 Cu., (Ft.)	15
8@	X	17 58 054	Bracket, Switch/Arrester Mounting	3
	Y	12 00 10 **	Grounding Unit, 7#10 Copperweld to Neutral	1
	5 Z	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)	15
9@	AA	11 00 42 **	Guying Unit w/ FG Strain Insulator & HD Guy Hook	
@	BB	03 01 01 **	Neutral Configuration	

NOTES

1. Install proper voltage arresters at this location. Where switches are normally open, install additional set of arresters on the Open-wire side of the arrester arm. See Dist. Std. 12 12 01 **.
2. Extend spacer cable conductor with covering intact through the preform into the switch using shear bolt lugs.
3. Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
4. Switch number tag shall be installed here.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger. Route along the single switch side of the pole.
6. Install the center phase of the spacer cable with fiberglass Strain Insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.

FUSES AND SWITCHES
Three Phase Sectionalizing – Spacer Cable to Open Wire
600 Amp – 4 or 12 kV

10 20 05 01

Sheet 4 of 4

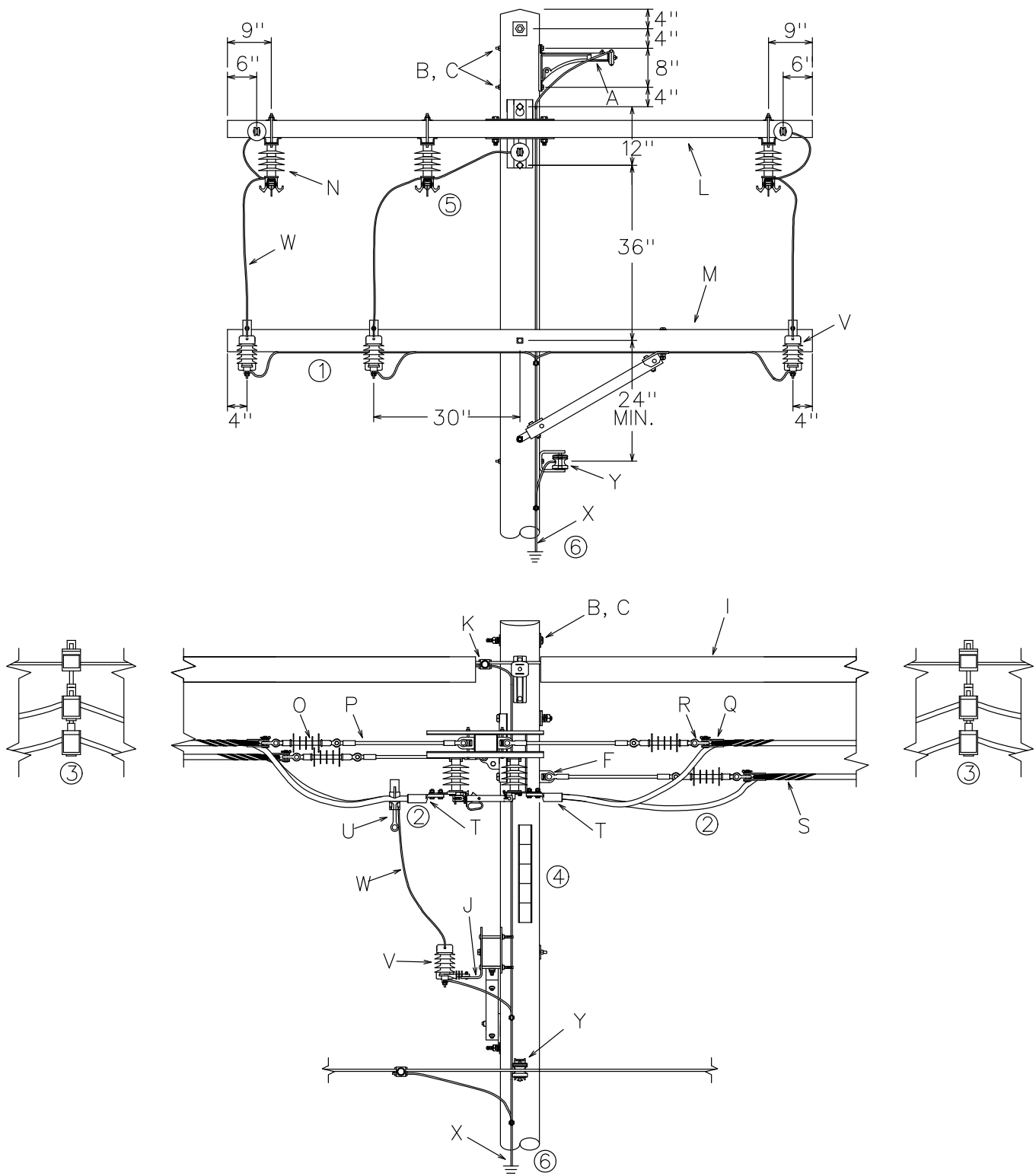
7. Only install the two inside bolts on the switch and slide them as close to the crossarms as possible.
8. Use DCS **12 00 10 01** for ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
9. Size anchor and guying for heavy loading deadend tension of spacer cable.



FUSES AND SWITCHES
Three Phase Sectionalizing – Spacer Cable to Spacer Cable
600 Amp – 4 or 12 kV

10 20 10 **

Sheet 1 of 3



01 - TANGENT MESSENGER

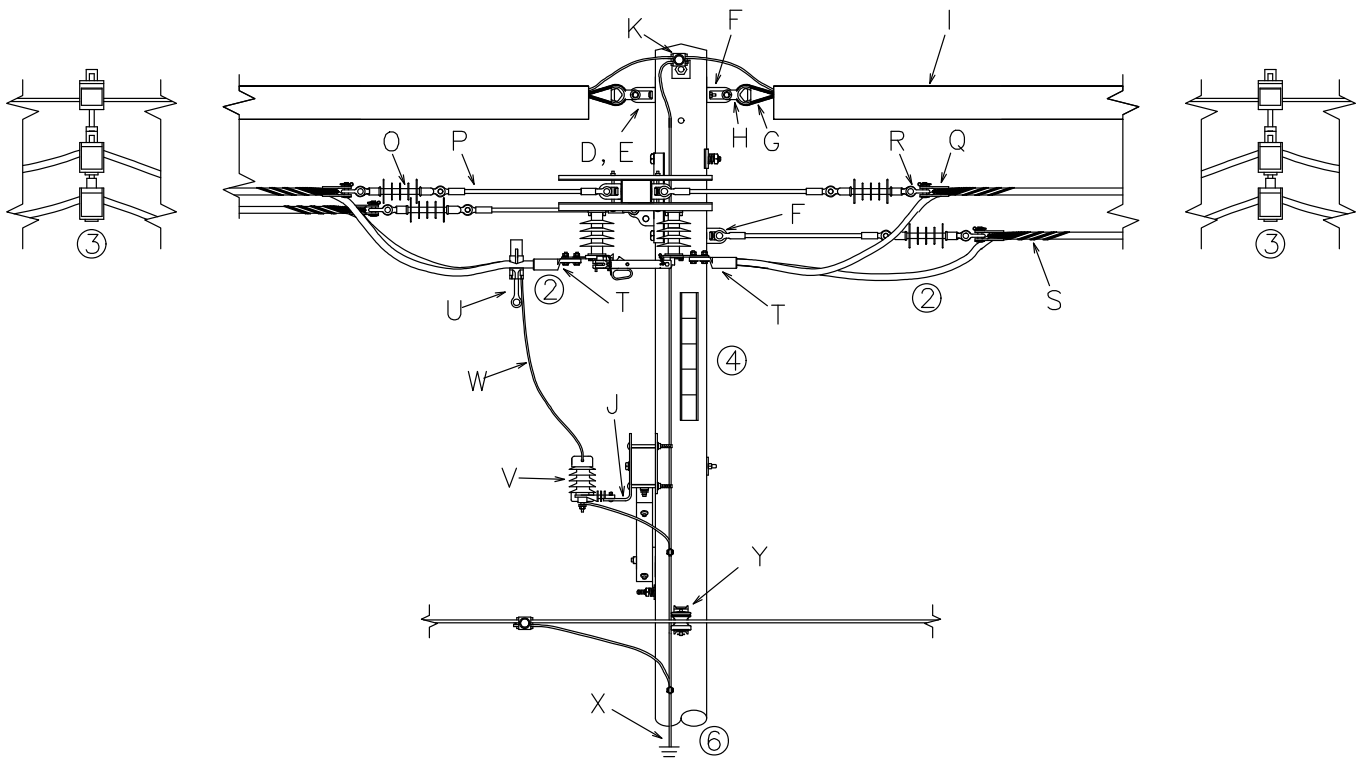
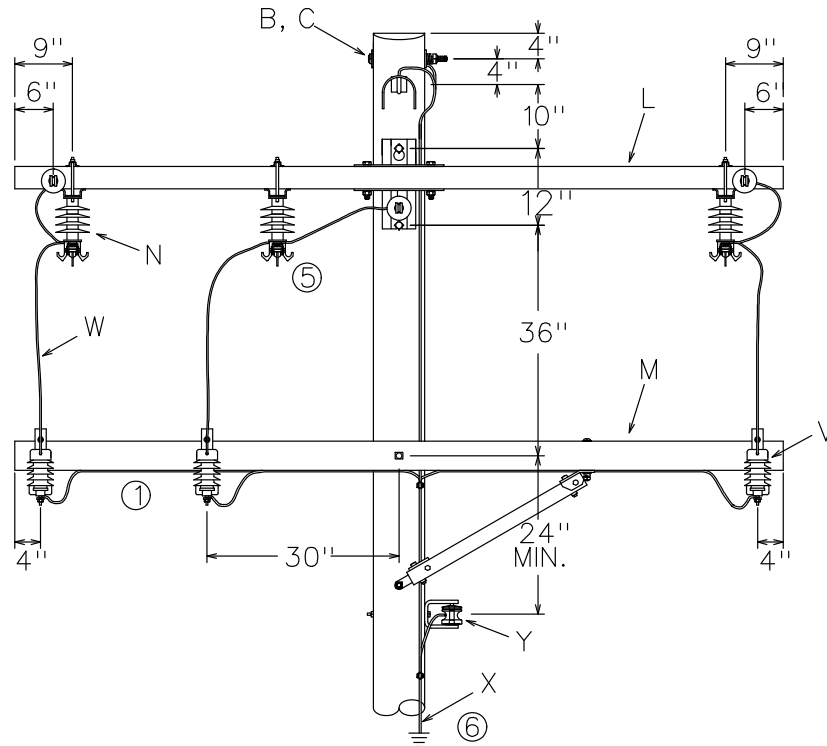
FUSES AND SWITCHES

Three Phase Sectionalizing – Spacer Cable to Spacer Cable

600 Amp – 4 or 12 kV

10 20 10 **

Sheet 2 of 3



02 - DEAD END MESSENGER

FUSES AND SWITCHES

Three Phase Sectionalizing – Spacer Cable to Spacer Cable

600 Amp – 4 or 12 kV

10 20 10 **

Sheet 3 of 3

		Std. / Stk. No.	Description	10 20 10 **	01	02
	A	23 56 075	Bracket, Messenger		1	
	B	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		3	1
	C	23 66 027	Washer, Square 2-1/4" x 3/16" Thick		4	2
	D	23 59 095	Eyelet, 3/4", Galvanized Steel			1
	E	23 52 097	Bolt, 3/4" x 12"			1
	F	23 65 018	Eyebolt, 3/4", Galvanized Steel		1	2
	G	23 68 713	Grip, Messenger/ Neutral, Preformed – 052 AWA			2
	H	23 58 054	Clevis, NM, Thimble, Galvanized Steel			2
	I	69 58 293	Line Duc (Messenger Cover), Black, 8' Long (Each)		2	2
	J	17 58 054	Bracket, Switch/ Arrester Mounting		3	3
	K	17 51 137	Connector, PG, Pole Ground to Messenger		1	1
	L	04 00 41 04	Crossarm, Deadend, F/G, 10'		1	1
	M	04 00 20 03	Crossarm, Sgl., Wood, 10', (use only 1/2 of V-Brace)		1	1
5	N	54 07 204	Switch, Dis., 600A, 15kV		3	3
	O	25 06 052	Insulator, Suspension, 15kV, Poly		6	6
	P	25 56 076	Insulator, Strain, Fiberglass, 26", 15kV		6	6
	Q	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel		6	6
	R	23 68 181	Shackle – Anchor, 9/16"		6	6
@	S	23 68 701	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable		6	6
			Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00)		6	6
2	T	17 55 804	Lug, Shear Bolt, 350 Through 795 Spacer Cable		6	6
@	U	17 62 088	Clamp, Hotline, 1/0 Through 477 Spacer Cable		3	3
		17 62 143	Clamp, Hotline, 795 Spacer Cable		3	3
1@	V	10 01 144	Arrester, 10kV w/ Protective Cap		3	3
		10 01 133	Arrester, 3kV w/ Protective Cap		3	3
	W	18 51 025	Wire, #4 Cu. Poly Covered (Ft.)		15	15
6@	X	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1
@	Y	03 01 01 **	Neutral Configuration			

NOTES:

1. Install proper voltage arresters at this location. Where switches are normally open, install additional set of arresters on an adjacent pole for unprotected side of switches.
2. Extend spacer cable conductor with covering intact through the preform into the switch using compression lugs.
3. Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
4. Where required, switch number tag shall be installed here.
5. Only install the two inside bolts on the switch and slide them as close to the crossarm as possible.
6. Use DCS 12 00 10 01 for ground coil application on new poles installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

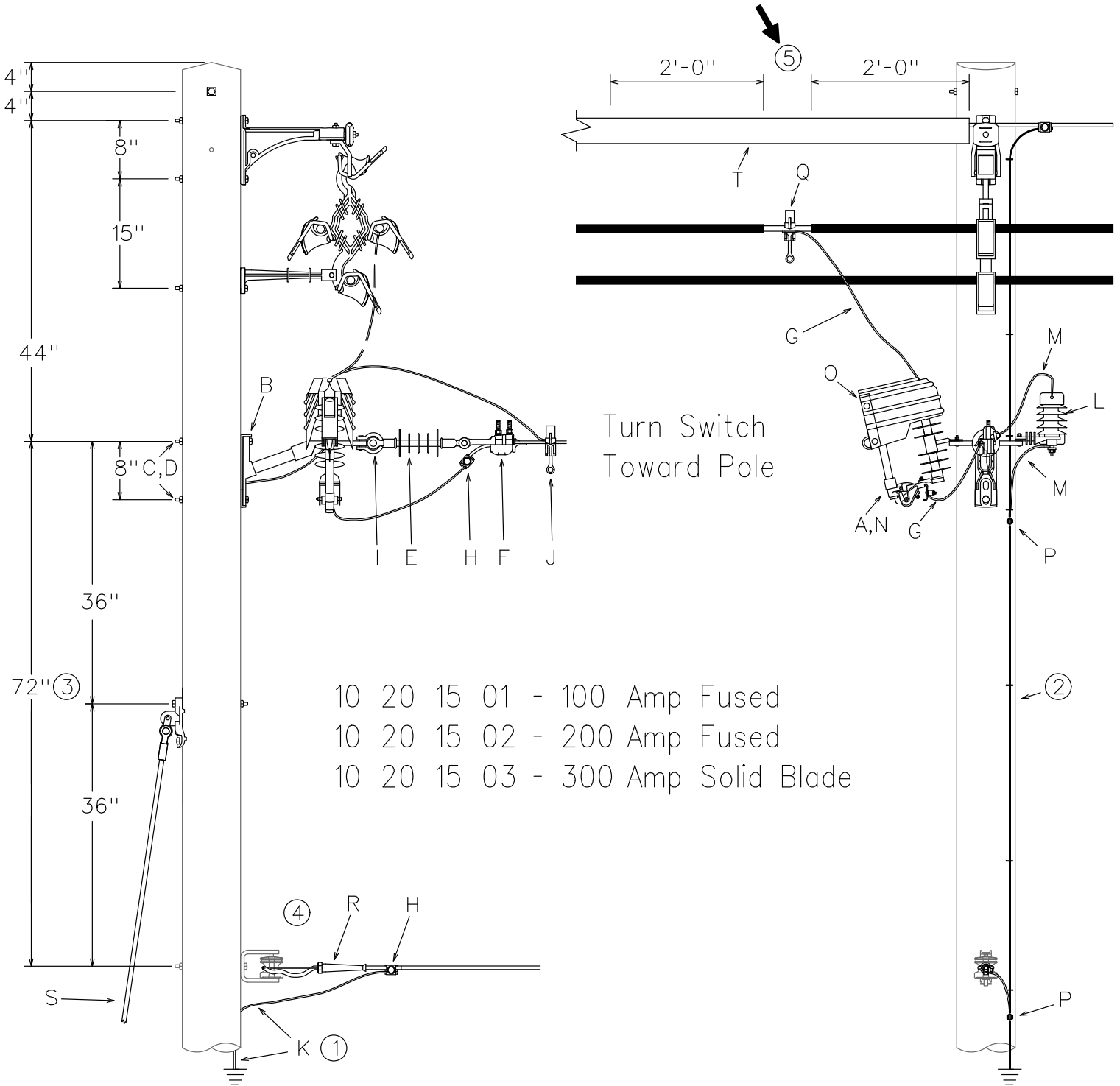
FUSES AND SWITCHES

Single Phase Tap From Spacer Cable

100 to 300 Amp – 15 KV & Below

10 20 15 **

Sheet 1 of 2



FUSES AND SWITCHES

Single Phase Tap From Spacer Cable 100 to 300 Amp – 15 KV & Below

10 20 15 **

Sheet 2 of 2

		Std. /Stk. No.	Description	10 20 15 **	01	02	03
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">1,2@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">4 @</div> <div style="margin-bottom: 10px;">3 @</div> </div>	A	54 07 208	Switch, Fuse, 100A, 15 KV		1		
		54 07 209	Switch, Fuse, 200A, 15 KV			1	
		54 07 210	Switch, Solid Blade, 300A, 15 KV				1
	B	23 56 063	Bracket, Switch, Arrester, and Dead End		1	1	1
	C	23 52 065	Bolt, Mach., 5/8" x 12"		2	2	2
	D	23 66 027	Washer, Square, 5/8"		2	2	2
	E	25 06 052	Ins., Suspension, 15 KV		1	1	1
	F	DEC*W	Clamp, Deadend (See 07 00 11 00)		1	1	1
	G	PLW*W	Wire, Poly Covered (ft.) (See 07 00 80 00 & 07 00 01 03)		10	10	10
	H	PG*	Clamp, Parallel Groove or Split Bolt or Two Bolt. (See 07 00 25 00)		2	2	2
	I	23 68 181	Shackle, Deadend		1	1	1
	J	HLC*W	Clamp, Hot Line See 07 00 21 00		1	1	1
	K	12 00 10 02	7#10 Pole Ground with Ground Rod		1	1	1
		12 00 10 03	#2 Cu. Pole Ground with Ground Rod		1	1	1
	L	10 01 144	Arrester, 10 KV w/ Protective Cap		1	1	1
		10 01 133	Arrester, 3 KV w/ Protective Cap		1	1	1
	M	18 51 021	Wire, S.D., #6 Cu, Poly (ft.)		6	6	6
	N		Link, Fused, (sized by Engineer)		1	1	1
	O	23 17 411	Cover, Cutout		1	1	1
	P	17 54 373	Connector, Split Bolt		2	2	2
	Q	17 62 088	Clamp, Hotline, 1/0 through 477 Spacer Cable		1	1	1
		17 62 143	Clamp, Hotline, 795 Spacer Cable		1	1	1
	R	SDEA*W	Deadend, Automatic, Secondary. (See 08 01 10 00)		1	1	1
	S	11 00 ** **	Guy Unit		1	1	1
	T	69 58 293	Line DUC, Messenger Cover, Black (Each)		1	1	1

NOTES

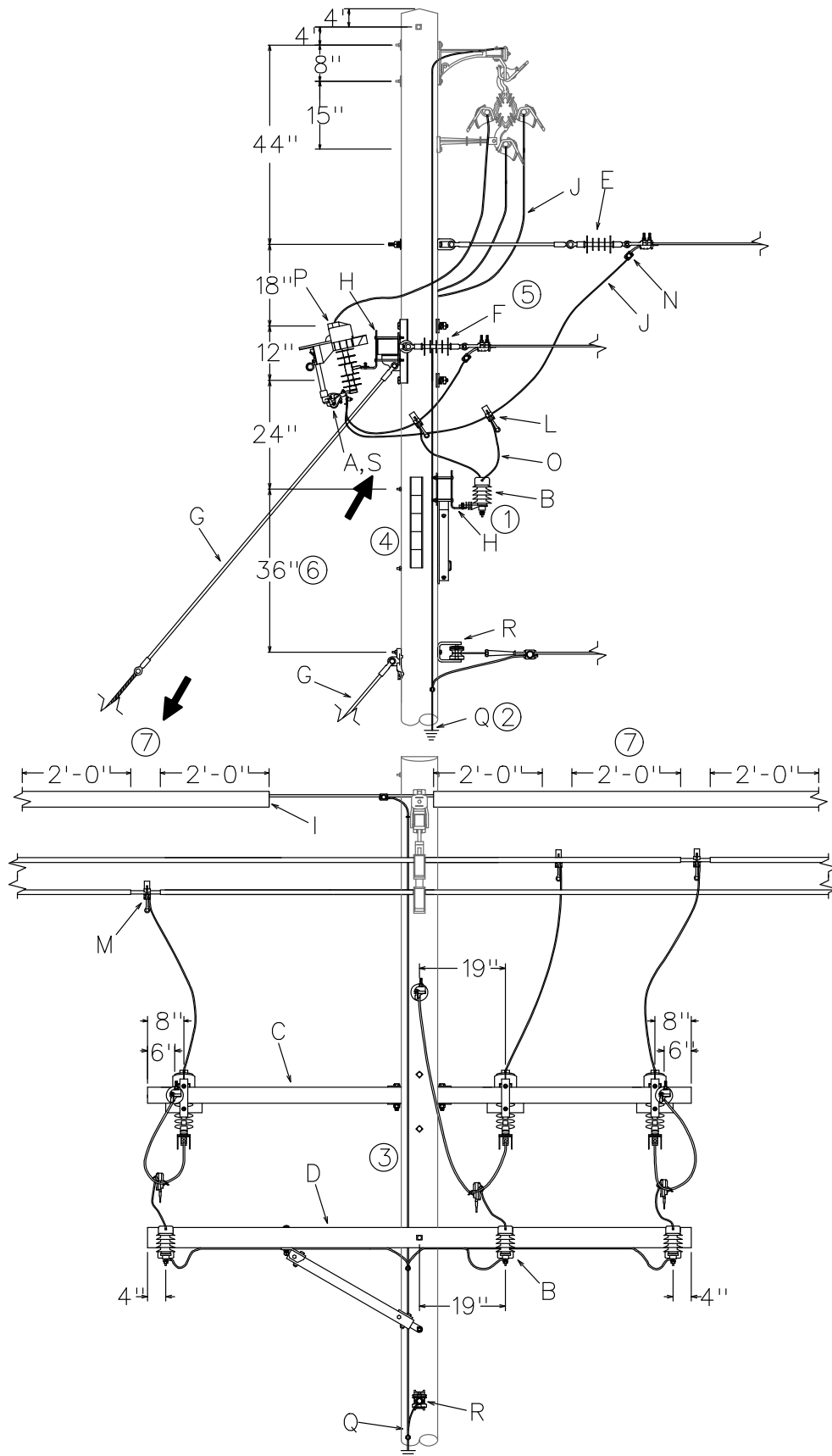
1. The pole ground is included with a new pole. Only needed when mounting switch on existing pole
2. The conductor between the messenger and open-wire tap neutral must be #2 copper if the messenger is the system neutral, i.e. there is no secondary neutral present
3. This distance may be reduced to 40 inches if approved by engineering. Center the guy attachment between the primary and neutral if this distance is reduced.
4. Use a primary dead end clamp for tensions greater than 1,500 pounds.
5. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

FUSES AND SWITCHES

15kV & Below – Spacer Cable – Two or Three Phase Tap
100 to 300 Amp

10 20 20 **

Sheet 1 of 2



FUSES AND SWITCHES
15kV & Below – Spacer Cable – Two or Three Phase Tap
100 to 300 Amp

10 20 20 **
Sheet 2 of 2

		Std. / Stk. No.	Description	10 20 20 **	2 Phase			3 Phase		
					01	02	03	04	05	06
@1	A	54 07 208	Switch, Fused, 100A, 15kV		2			3		
		54 07 209	Switch, Fused, 200A, 15kV			2			3	
		54 07 210	Switch, Solid Blade, 300A, 15kV				2			3
@1	B	10 01 144	Arrester, 10kV w/ Protective Cap		2	2	2	3	3	3
		10 01 133	Arrester, 3kV w/ Protective Cap		2	2	2	3	3	3
@	C	04 00 41 04	Crossarm, Deadend, FG 10'		1	1	1	1	1	1
	D	04 00 20 03	Crossarm, Sgl, Wood, 10' (use only 1/2 of V-brace)		1	1	1	1	1	1
	E	06 12 30 01	Deadend on pole with FG extension, 10'					1	1	1
@	F	06 12 35 02	Deadend on single arm		1	1	1	1	1	1
	G	11 00 42 **	Guying Unit w/ FG Strain Insulator and HD Guy Hook							
	H	17 58 054	Bracket, Switch/Arrester Mounting		4	4	4	6	6	6
@	I	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		2	2	2	2	2	2
	J	PLW*W	Wire, Poly Covered, S.D. (ft) (DCS 07 00 80)		20	20	20	30	30	30
	L	23 78 394	Clamp, Hotline, #6 to 2/0		2	2	2	3	3	3
@	M	17 62 088	Clamp, Hotline, 1/0 through 477 Spacer Cable		2	2	2	3	3	3
		17 62 143	Clamp, Hotline, 795 Spacer Cable		2	2	2	3	3	3
	N	PG*	Clamp, Parallel Groove (DCS 07 00 25 00)		2	2	2	3	3	3
@2,3	O	18 51 021	Wire, #6 CU., S.D. Covered (ft)		6	6	6	9	9	9
	P	05 15 10 01	Cover – Cutout		2	2	2	3	3	3
	Q	12 00 10 **	#2 Copper Ground Unit		1	1	1	1	1	1
@	R	03 01 01 **	Neutral Configuration							
@	S		Link, Fused, (sized by Engineer)		2	2		3	3	

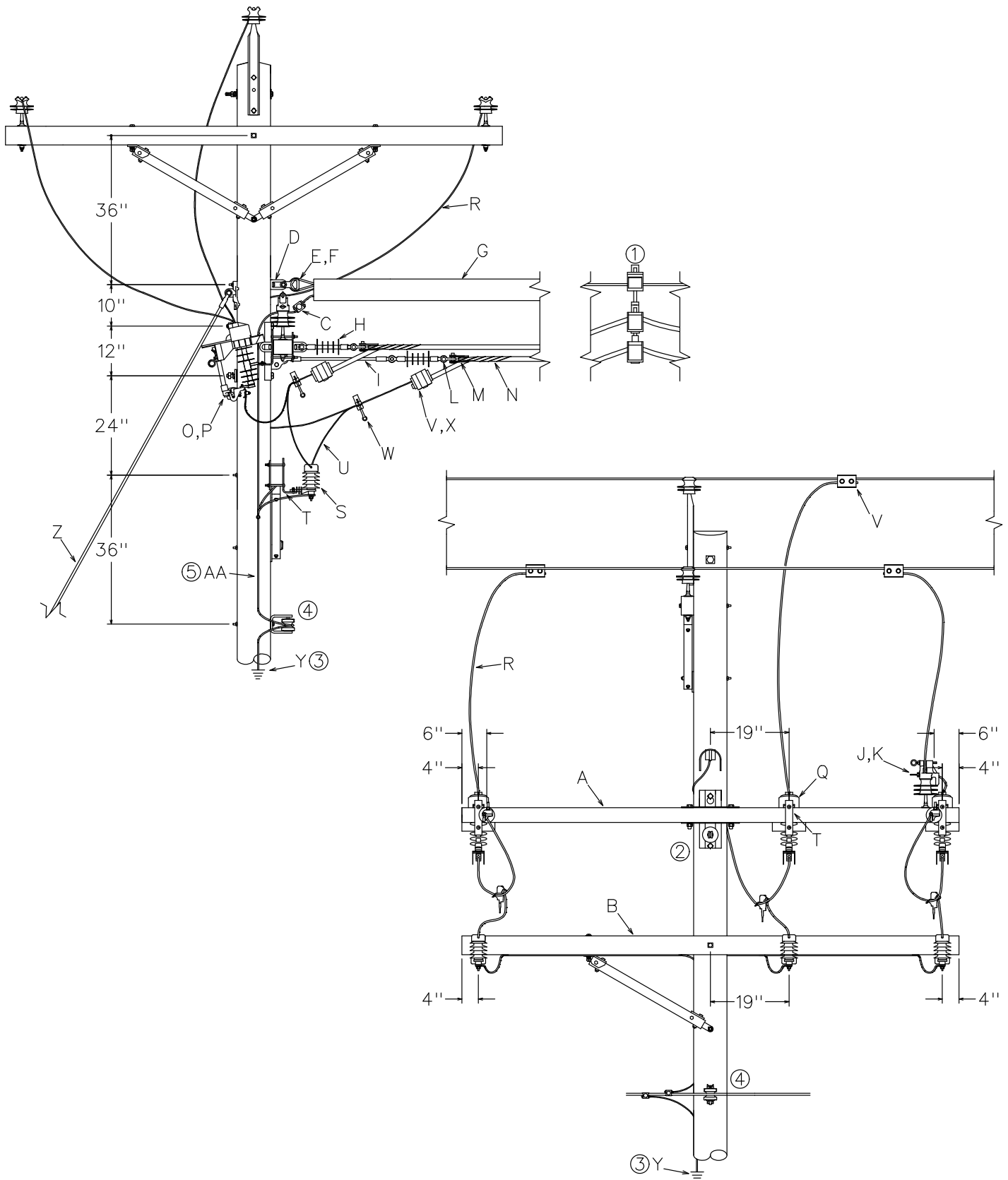
NOTES

1. Install proper voltage arresters at this location. Where switches are normally open, install additional set of arresters on the spacer cable side of the switch.
2. The pole ground is included with a new pole. Only needed when installing tap on an existing pole.
3. The ground wire between the messenger and open-wire tap neutral must be #2 copper if the messenger is the system neutral, i.e. there is no secondary neutral present.
4. Switch number tag shall be installed here.
5. The mirror of this configuration can be built with the dead-end arm and switches installed under the spacer cable and the open wire extending in the opposite direction than shown in the drawing.
6. This distance may be reduced to 24 inches if approved by engineering.
7. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

FUSES AND SWITCHES
15 kV & Below – Spacer Cable
Three Phase Tap From Open Wire 100 to 300 Amp

10 20 25 **

Sheet 1 of 2



FUSES AND SWITCHES
15 kV & Below – Spacer Cable
Three Phase Tap From Open Wire 100 to 300 Amp

10 20 25 **

Sheet 2 of 2

		Std./Stk. No.	Description	10 20 25 **	01	02	03
	A	04 00 41 04	Deadend Assy, FG Arm, 10'		1	1	1
	B	04 00 20 03	Crossarm, Sgl, Wood, 10' (use only 1/2 of V-Brace)		1	1	1
	C	17 51 137	Connector, PG, Pole Ground to Messenger		1	1	1
	D	23 59 095	Eyelet, NM, STD, 3/4"		1	1	1
	E	23 68 713	Grip, Messenger/Neutral, Preformed for 7#6 – 052AWA		1	1	1
	F	23 58 054	Clevis, NM, Thimble, Galvanized Steel		1	1	1
	G	69 58 293	Line Duc Cover – (Messenger Cover), Black. 8' Long (Each)		1	1	1
	H	25 06 052	Insulator, Suspension, 15kV, Poly		3	3	3
	I	25 56 076	Insulator, Guy Strain, Fiberglass 26", 15kV		1	1	1
	J	25 05 143	Insulator, Pin, 15kV, Vice-Top		1	1	1
	K	23 62 028	Pin, Insulator, Long Shank		1	1	1
	L	23 68 181	Shackle – Anchor, 9/16"		3	3	3
	M	23 58 122	Clevis, Thimble, 7/8" Opening, Galvanized Steel		3	3	3
@	N	23 68 701	Grip, Conductor Deadend, 15kV, 477 Spacer Cable		3	3	3
			Size Grip per existing Spacer Cable Conductor (See 07 20 11 00)		3	3	3
	O	54 07 208	Switch, Fused, 100A		3		
		54 07 209	Switch, Fused, 200A			3	
		54 07 210	Switch, Solid Blade, 300A				3
@	P		Link, Fuse (Sized by Engineer)		3	3	
	Q	23 17 411	Cover, Cutout		3	3	3
@	R	LW*W	Wire, Poly Covered, S.D. (ft.) (See 07 00 80 00)		30	30	30
@	S	10 01 144	Arrester, 10kV w/ Protective Cap		3	3	3
		10 01 133	Arrester, 3kV w/ Protective Cap		3	3	3
	T	17 58 054	Bracket, Switch/Arrester Mounting		6	6	6
	U	18 51 021	Wire, Poly #6 CU., (FT.)		15	15	15
@	V	PG*W	Clamp, Parallel Groove (See 07 00 25 00)		3	3	3
		HLC*W	Hot Line Clamp		3	3	3
@	W	HLC*W	Hot Line Clamp		3	3	3
	X	38 51 608	Cover, Large, Vice Type Connectors		3	3	3
@,3	Y	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1	1
@	Z	11 00 42 **	Guying Unit with FG Strain Insulator & HD Guy Hook				
5	AA	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)		15	15	15

NOTES:

1. Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See DCS 07 20 01 01 for spacer installation between poles.
2. Install the center phase of the spacer cable with fiberglass Strain Insulator into the top hole on the DE arm. This leaves the bottom hole for guying if needed.
3. Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
4. Secondary location if present. Connect secondary neutral to pole ground.
5. Extend #2 poly covered ground wire (18 51 019) from open wire neutral to the messenger.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



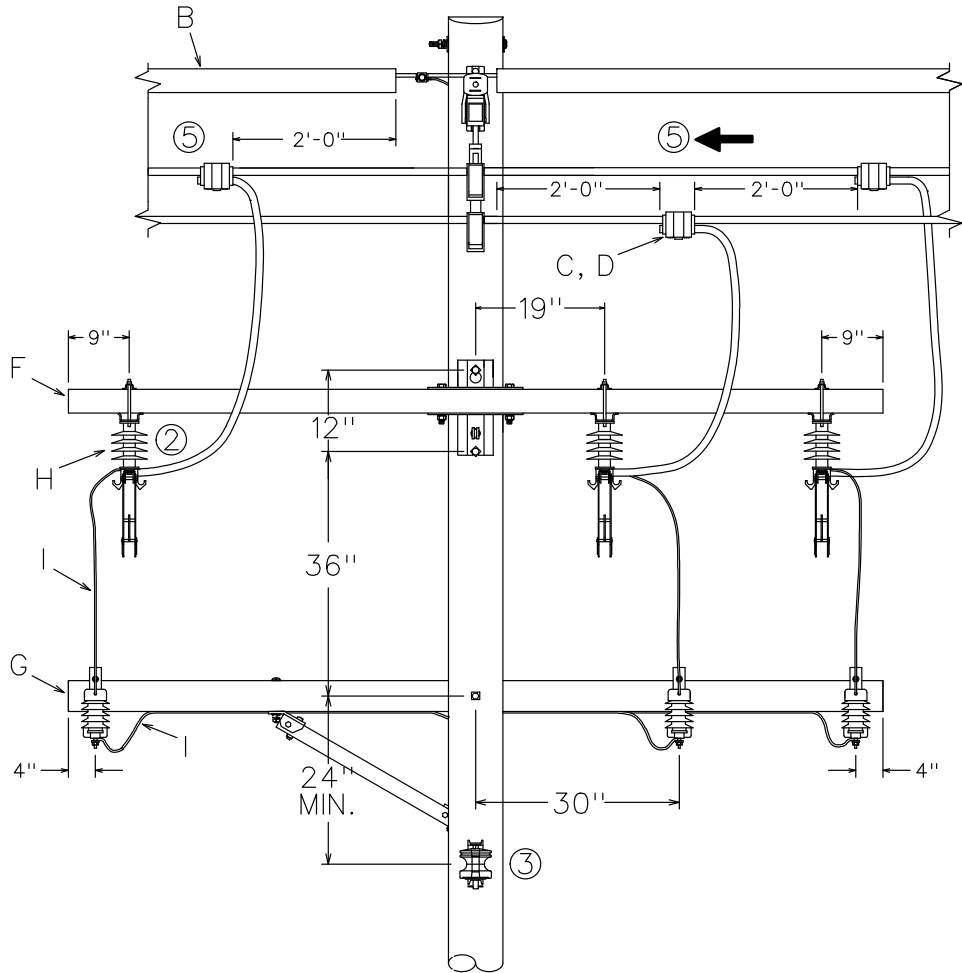
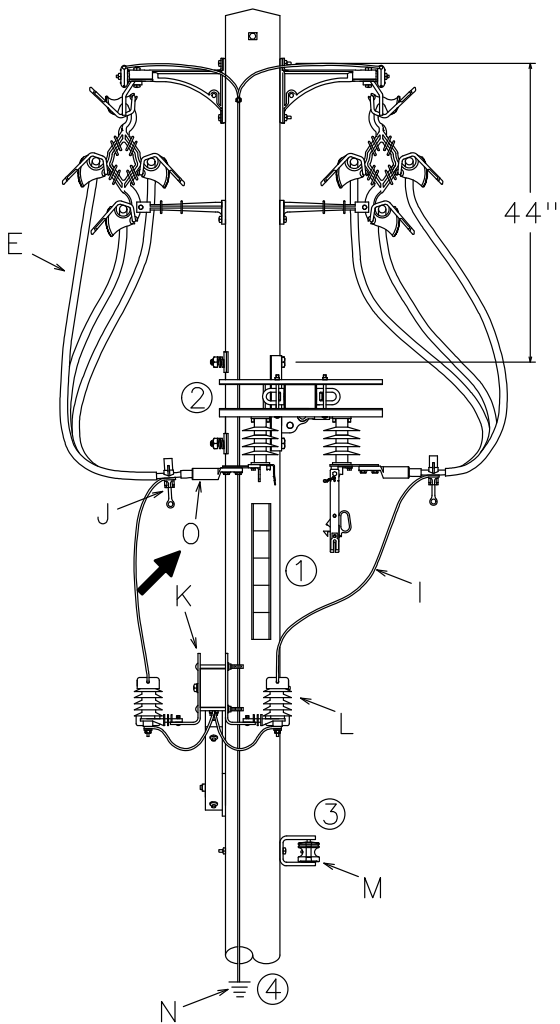
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REV. DATE: 07/3/18

FUSES AND SWITCHES

15kV & Below – Spacer Cable
Double Circuit 600A Tie Switch

10 20 30 01

Sheet 1 of 2



DISTRIBUTION CONSTRUCTION STANDARDS



ENG: DT
REV. NO: 1
REV. DATE: 07/03/18

FUSES AND SWITCHES
15kV & Below – Spacer Cable
Double Circuit 600A Tie Switch

10 20 30 01

Sheet 2 of 2

		Std./Stk. No.	Description	10 20 30 01	
@	A	03 20 02 01	Double Circuit – Tangent – Back to Back Configuration		
	B	69 58 293	Line Duc (Messenger Cover), Black, 8' Long (Each)		2
@	C	PG*W	Clamp, PG, Conductor to Conductor		6
	D	38 51 608	Cover, Large, Vise Type Connectors		6
	E	18 51 052	Wire, Poly, SD, 350 Cu. (Ft.)		36
	F	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	G	04 00 20 03	Crossarm, Sgl., Wood, 10', (use only 1/2" of V-Brace)		1
2	H	54 07 204	Switch, Dis., 600A, 15kV		3
	I	18 51 021	Wire, #6 Cu. Poly Covered (Ft.)		40
@	J	17 62 088	Clamp, Hotline, 1/0 Through 477 Spacer Cable		6
		17 62 143	Clamp, Hotline, 795 Spacer Cable		6
	K	23 56 088	Bracket, Crossarm, CO/LA – Double		3
@	L	10 01 144	Arrester, 10kV w/ Protective Cap		6
		10 01 133	Arrester, 3kV w/ Protective Cap		6
@	M	03 01 01 **	Neutral Configuration		
@	N	12 00 10 03	Grounding Unit, #2 Cu. Pole Ground With Ground Rod		1
		12 00 10 04	Grounding Unit, #2 Cu. Pole Ground With Ground Coil		1
	O	17 55 804	Lug, Shear Bolt, 350 Through 795 Spacer Cable		6

NOTES:

- Where required, switch number tag shall be installed here.
- Only install the two inside bolts on the switch and slide them as close to the crossarm as possible.
- Secondary location if present. Connect secondary neutral to pole ground.
- Use DCS **12 00 10 04** for ground coil application on new pole installation. Use DCS **12 00 10 03** for ground rod application on existing pole installation.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

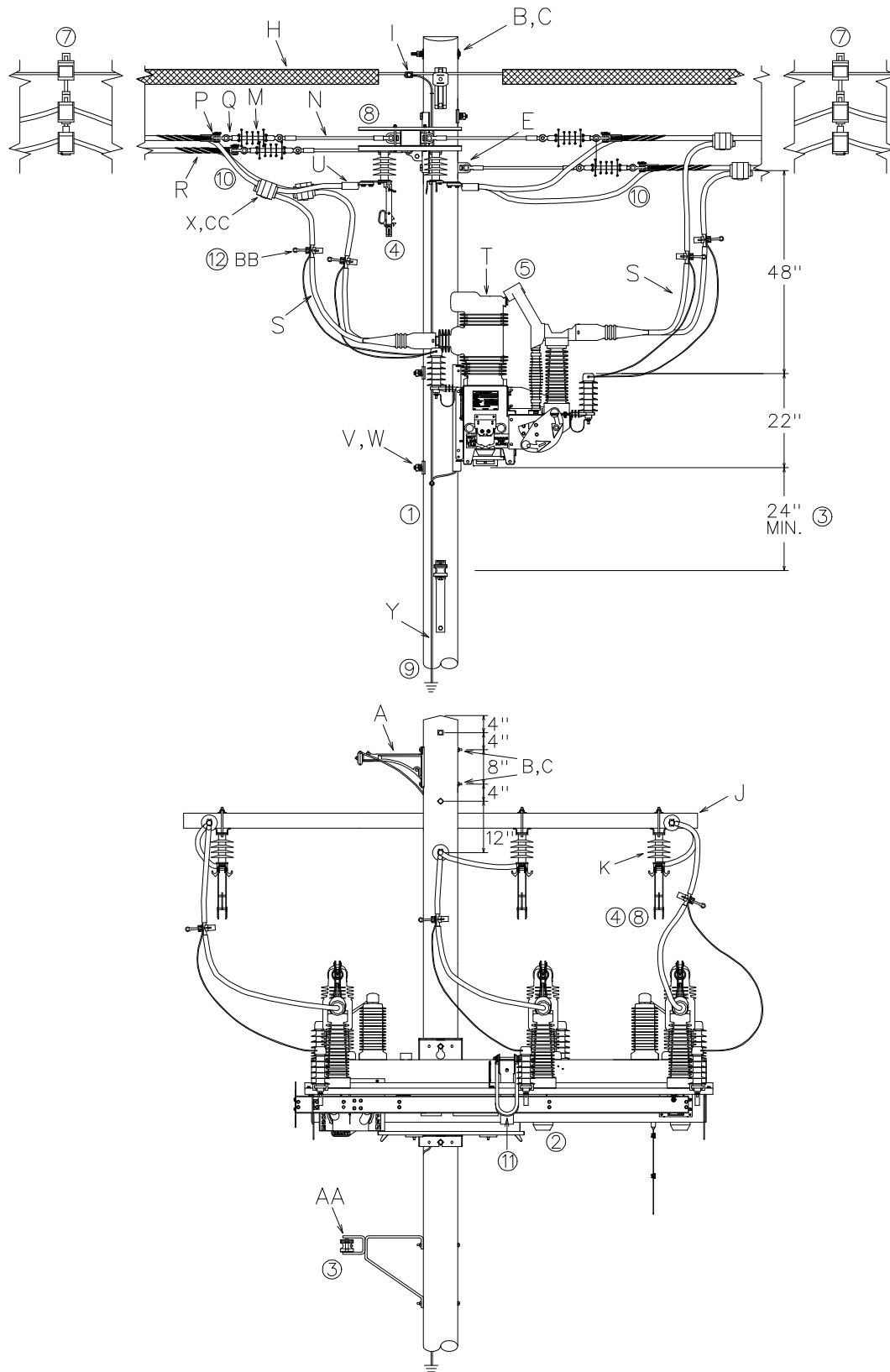
CONFIGURATIONS

Three Phase Recloser – Spacer Cable

With Remote Control – 600 Amp – 15kV

10 20 33 **

Sheet 1 of 4



01 - SPACER CABLE TO SPACER CABLE

Sheet 2 of 4



CONFIGURATIONS
Three Phase Recloser – Spacer Cable
With Remote Control – 600 Amp – 15kV

10 20 33 **

Sheet 3 of 4

		Std. / Stk. No.	Description	10 20 33 **	01	02
	A	23 56 075	Bracket, Messenger		1	
	B	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		3	1
	C	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick		3	1
	D	23 59 095	Eyelet, 3/4" Galvanized Steel			1
	E	23 65 018	Eyenuit, 3/4" Galvanized Steel		1	
	F	23 68 713	Grip, Messenger/Neutral, Preformed 7#6 – 052 AWA			2
	G	23 58 054	Clevis, NM, Thimble, Galvanized Steel			1
	H	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		2	1
	I	17 51 137	Clamp, PG, Pole Ground to Messenger		1	1
	J	04 00 41 04	Crossarm, Deadend, F/G, 10'		1	1
4,8	K	54 07 204	Switch, Dis., 600A, 15kV		3	3
	L	06 12 30 01	Deadend on Pole w/ FG Extension			1
	M	25 06 052	Insulator, Suspension, 15kV, Poly		6	5
	N	25 56 076	Insulator, Strain, Fiberglass, 26", 15kV		6	5
@	O	DEC*W	Clamp, Deadend			3
	P	23 58 122	Clevis, Thimble, 7/8" Opening, Galvanized Steel		6	3
	Q	23 68 181	Shackle – Anchor, 9/16"		6	3
@	R	17 69 063	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable		6	3
		17 69 ***	Size Grip per Existing Spacer Cable Conductor		6	3
	S	18 51 052	Wire, Poly, SD, 350 Cu. (Ft.)		75	100
5,6	T	69 10 250	Recloser, S&C Intellirupter, 15kV, 600A w/ Comm Module		1	1
10	U	17 55 804	Lug, Shear Bolt, 1/0 Through 795 Spacer Cable		6	3
	V	23 52 219	Bolt, Galv., 3/4" x 14"		2	2
	W	23 66 031	Washer, NM, Curved, 3/4"		2	2
@	X	PG*W	Clamp, Parallel Groove (See 07 00 25 00)		6	9
1,9 @	Y	12 00 10 **	Grounding Unit, #2 CU Poly Covered		1	1
@	Z	11 00 42 **	Guying Unit w/ FG Strain Insulator & HD Guy Hook			1
3 @	AA	03 01 01 **	Neutral Configuration		1	1
12	BB	23 78 183	Clamp, Hot Line		6	6
	CC	38 51 608	Cover		6	3

NOTES

- Intellirupter recloser frame must be connected to ground with #2 copper wire. Pole ground to neutral connection must be #2 copper wire.
- Tool to remove/install radio module and control is 46 01 645
- Install neutral/secondary using extension brackets. Install to the one phase side of the pole to allow access to the compartments on the bottom of the intellirupter. The neutral/ secondary may be dead-ended to the pole as long as they are mounted 36 inches below the bottom mounting bolt of the intellirupter.
- Switches are to open towards the climbing side of the pole.

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: WYW
REV. NO: NEW
REV. DATE: 09/15/17

CONFIGURATIONS
Three Phase Recloser – Spacer Cable
With Remote Control – 600 Amp – 15kV

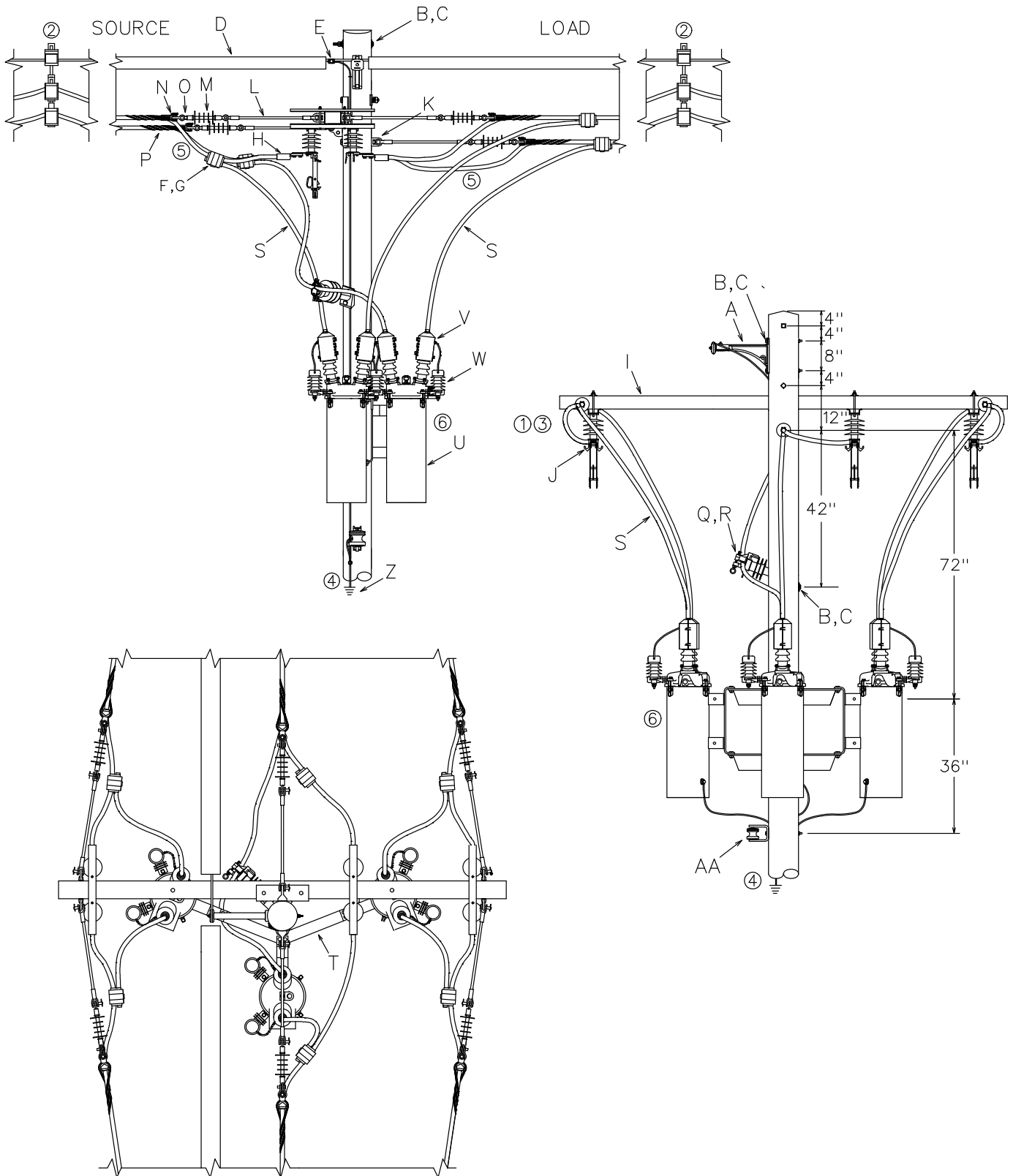
10 20 33 **

Sheet 4 of 4

-
5. Integral disconnect switches on recloser shall be in the open position while connecting primary leads to the recloser.
 6. Intellirupter Recloser weight is 1,010 lbs.
 7. Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
 8. Only install to two inside bolts on the switch and slide them as close to the crossarms as possible.
 9. Use DCS **12 00 10 04** for ground coil application on the new pole installation. Use DCS **12 00 10 03** for ground rod application on existing pole installation.
 10. Extend spacer cable conductor with covering intact through the preform into the switch using shear bolt lugs.
 11. Fold lifting bracket down after lifting.
 12. The lightning arresters shall be connected to the recloser leads with hot-line clamps installed a minimum of 36 inches away from the aluminum base of the intellirupter. The arrester wire is included with the intellirupter.

FUSES AND SWITCHES
Three Phase Recloser – Spacer Cable
280 Amp – 12kV

10 20 35 01
Sheet 1 of 2



FUSES AND SWITCHES

Three Phase Recloser – Spacer Cable

280 Amp – 12kV

10 20 35 01

Sheet 2 of 2

		Std./Stk. No.	Description	10 20 35 01	
	A	23 56 075	Bracket, Messenger		1
	B	23 52 065	Bolt, Machine, 5/8" x 12" (w/nut)		4
	C	23 66 027	Washer, Square 2-1/4" x 2-1/4" x 3/16" Thick		4
	D	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		2
	E	17 51 137	Connector, PG, Pole Ground to Messenger		1
@	F	PG*W	Clamp, Parallel Groove (See 07 00 25 00)		6
	G	38 51 608	Cover		6
	H	17 55 804	Lug, Shear Bolt, 350 Through 795 Spacer Cable		6
	I	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
1,3	J	54 07 204	Switch, Dis., 600A, 15kV		3
	K	23 65 018	Eyenuit, 3/4", Galvanized Steel		1
	L	25 56 076	Insulator, Strain, Fiberglass, 26", 15kV		6
	M	25 06 052	Insulator, Suspension, 15kV, Poly		6
	N	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel		6
	O	23 68 181	Shackle – Anchor, 9/16"		6
@	P	23 68 701	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable		6
			Size Grip per Existing Spacer Cable Conductor (See 07 20 11 00)		6
	Q	25 05 143	Insulator, Vise-Top, 15kV		1
	R	23 12 122	Bracket, FG, Standoff, LD, 10"		1
	S	18 51 024	Wire, Poly, S.D., 1/0 Cu. (Ft.)		36
	T	23 17 209	Mounting, NM, Recloser		1
6	U	69 10 143	Recloser		3
	V	69 58 181	Guard, Clam-Shell, Wildlife		6
	W	10 01 144	Arrester, Lightning, 10kV		6
	X	23 52 219	Bolt, Galv., 3/4" x 14"		2
	Y	23 66 031	Washer, NM, Curved, 3/4"		2
@,4	Z	12 00 10 **	Grounding Unit, #2 CU Poly Covered		1
@	AA	03 01 01 **	Neutral Configuration		

NOTES:

- Switches are to open toward the climbing side of the pole.
- Install the first spacer (23 67 334) about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
- Only install to two inside bolts on the switch and slide them as close to the crossarms as possible.
- Use DCS 12 00 10 04 for ground coil application on new pole installation. Use DCS 12 00 10 03 for ground rod application on existing pole installation.
- Extend spacer cable conductor with covering intact through the preform into the switch using shear bolt lugs.
- Reclosers should be turned in tank to position shown so all operating handles are accessible from the load side of the pole.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DT
REV. NO: 1
REV. DATE: 10/01/19

Installation, Grounding, & Insulator Placement Information

- A. Installation Instructions 34 kV Group Operated Switches – 34 kV group operated switches are fully assembled and adjusted, and require proper lifting.
1. Once the switch is unbolted from a wood frame, which the switch is shipped on, the switch can be raised with a winch line by the lifting bracket on the top of the switch. However, the switch should not be raised until the bottom phase interrupter has been removed if it is assembled with the switch.
 2. To remove the lower phase interrupter, remove the 4–1/2" galvanized bolts that secure the interrupter to the vertical mounting member. Save these bolts, nuts and washers.
 3. Once the switch has been carefully lifted and is mounted on the pole, the lower phase interrupter can be remounted with the original bolts and hardware. Remove lifting bracket.
 4. Check lever stops at base of rotating insulator for full opening and closing.
 5. Install vertical operating pipe rods, lever, and guide bearings. Start from the top and work down. Tighten "U" bolts but leave set screw loose if it exists. Install 8 ft. fiberglass rod insulator (stock #54 08 324) between sub-transmission and distribution lines. The 8ft fiberglass rod insulator is to be installed with a minimum of 24" above distribution line and a minimum of 12" below the lowest electric line. One 34.5kV, TR-210 porcelain operating rod insulator (stock #25 09 045) is to be installed at minimum of 8 ft. above the ground between the lowest electric and manually operated handle to protect operator in case of flashover.
 6. Check that switch opens properly with a moderate speed:
 - a. Blade contacts interrupter finger in the "red" zone.
 - b. Arc horns open
 - c. Interrupter clicks, opening the circuit
 - d. Blade opens fully and interrupter lever snaps back.
 - e. All arcing horns release simultaneously.
 - f. For TSB switch, check to see that blade position indicator is green.
 7. Check to insure that the switch is closed properly with a fast even motion:
 - a. All blades are latched in the closed position.
 - b. All pick-up fingers bypass the interrupter actuator rods without restriction.
 - c. For TSB, check to insure that the switch is closed properly with a moderate even motion. Confirm blade position indicator is red.
 8. Repeat Step #6 and #7 several times to insure the switch opens and closed properly.
 9. Install operating handle 4 ft. above the ground (14 ft. where traffic damage or vandalism is likely)
 10. Adjust operating handle travel so some pressure is needed to lock open or closed.
 11. Tighten all piercing screw until a slug is punched through the pipe and tighten all nuts.
 12. Coat all ungalvanized steel with Galvanox with stock #30 01 222.
- B. Installation 69 kV Switches Instructions – Install and adjust 69kV switches according to manufacturer's instruction since each switch supplier has its own mounting assembly. All 69kV switches shall be installed on composite or steel structures for new installation.
- C. **Pole ground wire, ground mat and switch operating rod insulators requirements and installations for normal closed group operated switches:**

FUSES AND SWITCHES
Group Operated 34.5 kV & 69 kV Switches
Installation, Grounding, & Insulator Placement Information

10 34 01 01

Sheet 2 of 3

1. Switch is mounted on a steel pole with or without motor operator:

- a. A pole ground wire is not required but there must be provisions (Rivnuts) for grounding a shield wire, primary system neutral (if present), a motor operator cabinet (if present), and the base of the pole. The manually operated switch handle must be grounded directly to the driven ground rod or the field formed electrode riser with a #2 cu ground wire. The motor operator cabinet can be bonded to a steel pole or connected to the ground electrode.
- b. A ground mat is required for a steel pole. Refer to DCS 12 69 11 02.
- c. Operating rod insulators, TR-210 porcelain operating rod insulator, stock #25 09 045 and 8 ft fiberglass insulator, stock #54 08 324 shall be eliminated on a steel pole which come with the switch, and both items should be put back in the stock with stock # as assigned.

2. Switch is mounted on a wood pole and manually operated:

- a. Pole ground wire shall be omitted/removed.
- b. Operating rod insulators: 8ft fiberglass rod insulator and 1-34kV rod insulator between circuits are required:
Install 8 ft. fiberglass rod insulator between sub-transmission and distribution lines. The 8ft fiberglass rod insulator is to be installed with a minimum of 24" above distribution line and a minimum of 12" below the lowest electric line . One 34.5kV, TR-210 porcelain operating rod insulator is be installed at minimum of 8 ft. above the ground between the lowest electric and manually operated handle to protect operator in case of flashover.
- c. Attach the switch operating handle to a driven ground rod or a field formed ground electrode with #2 cu ground wire.
- d. A ground mat is not required. Refer to DCS 12 69 11 04.

3. Switch is mounted on a wood pole with a motor operator:

- a. A #2 cu pole ground wire is required to extend up the pole for grounding of motor operator cabinet, switch operating handle, primary system neutral (if present) and static wire.
- b. Operating rod insulators: 8ft fiberglass rod insulator and 1-34kV rod insulator between circuits are required:
Install 8 ft. fiberglass rod insulator between sub-transmission and distribution lines. The 8ft fiberglass rod insulator is to be installed with a minimum of 24" above distribution line and a minimum of 12" below the lowest electric line . One 34.5kV, TR-210 porcelain operating rod insulator is be installed at minimum of 8 ft. above the ground between the lowest electric and manually operated handle to protect operator in case of flashover.
- c. A ground mat is required. Refer to DCS 12 69 11 01.

4. Switch is mounted on a composite pole with or without motor operator:

- a. A ground mat is required. See DCS 12 69 11 03.
- b. Static wire, primary system neutral (if present), switch operating handle, and motor operator (if present) must be bonded to the #2 cu pole ground wire which comes with the pole.
- c. Operating rod insulators: 8ft fiberglass rod insulator and 1-34kV rod insulator between circuits are required:
Install 8 ft. fiberglass rod insulator between sub-transmission and distribution lines. The 8ft fiberglass rod insulator is to be installed with a minimum of 24" above distribution line and a minimum of 12" below the lowest electric line . One 34.5kV, TR-210 porcelain operating rod insulator is be installed at minimum of 8 ft. above the ground between the lowest electric and manually operated handle to protect operator in case of flashover.

Installation, Grounding, & Insulator Placement Information

D. Normal open switch

In addition to the grounding requirement stated above, arresters on source and load sides are required.

Refer to DCS **10 34 05**, DCS **10 34 07**, DCS **10 69 05**, DCS **10 69 07**, DCS **10 69 09**, DCS **10 69 20**, and DCS **10 69 30** for arresters installations. The arresters must be bonded to the pole ground, or bonded to the shield wire if no pole ground exists on the switch structure. Refer to DCS **12 00 01 01** for arresters' selection.

E. Removal Instructions

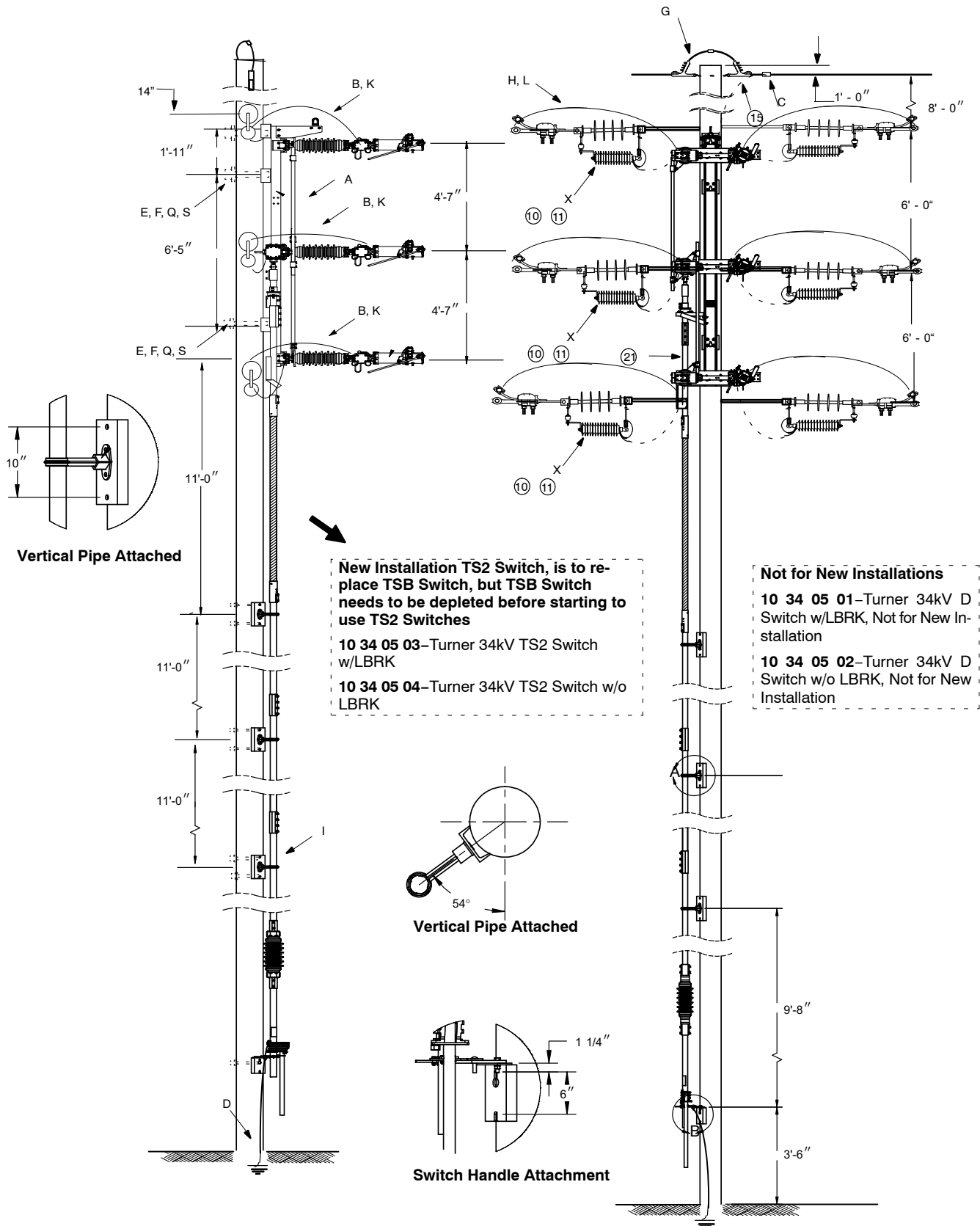
1. Remove vacuum Interrupters before any other disassembly. Handle with care and place in a separate box by themselves for return to salvage.
2. Remove switches and handle carefully to prevent breaking porcelain or stressing blades or contacts. All parts should be kept together for return to salvage. Tighten nuts and bolts enough so they are not lost in shipping.

F. Switch Pole Location

Switch pole shall be installed at a location, not subject to heavy vehicle and pedestrian traffic and with a level footing to allow safely operating of the switch.

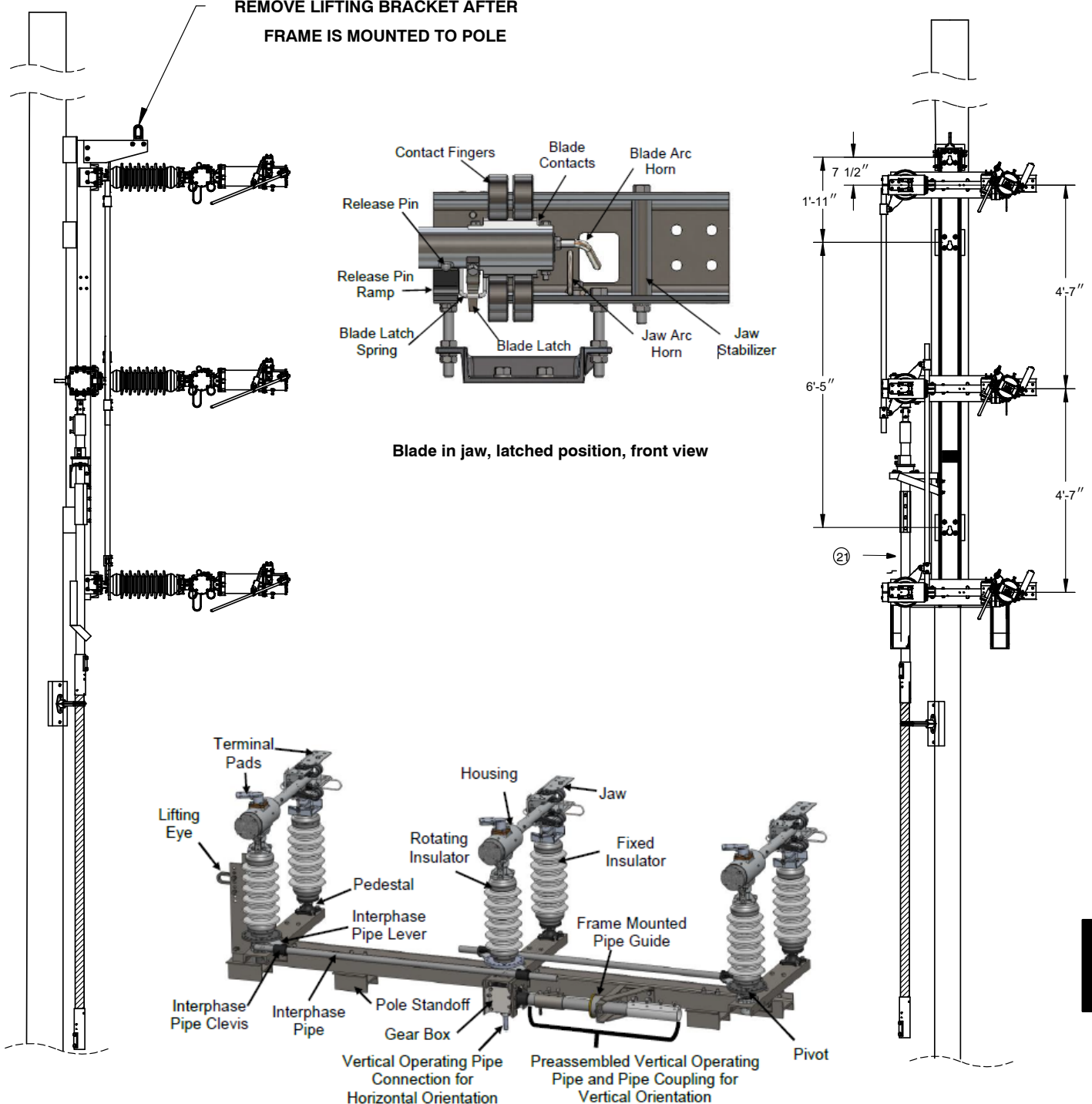
- G. For switch with radial feed, the jaw end should be installed on the portion of line that can be de-energized if possible.

Turner 34kV TS2 Switch



Turner 34kV TS2 Switch

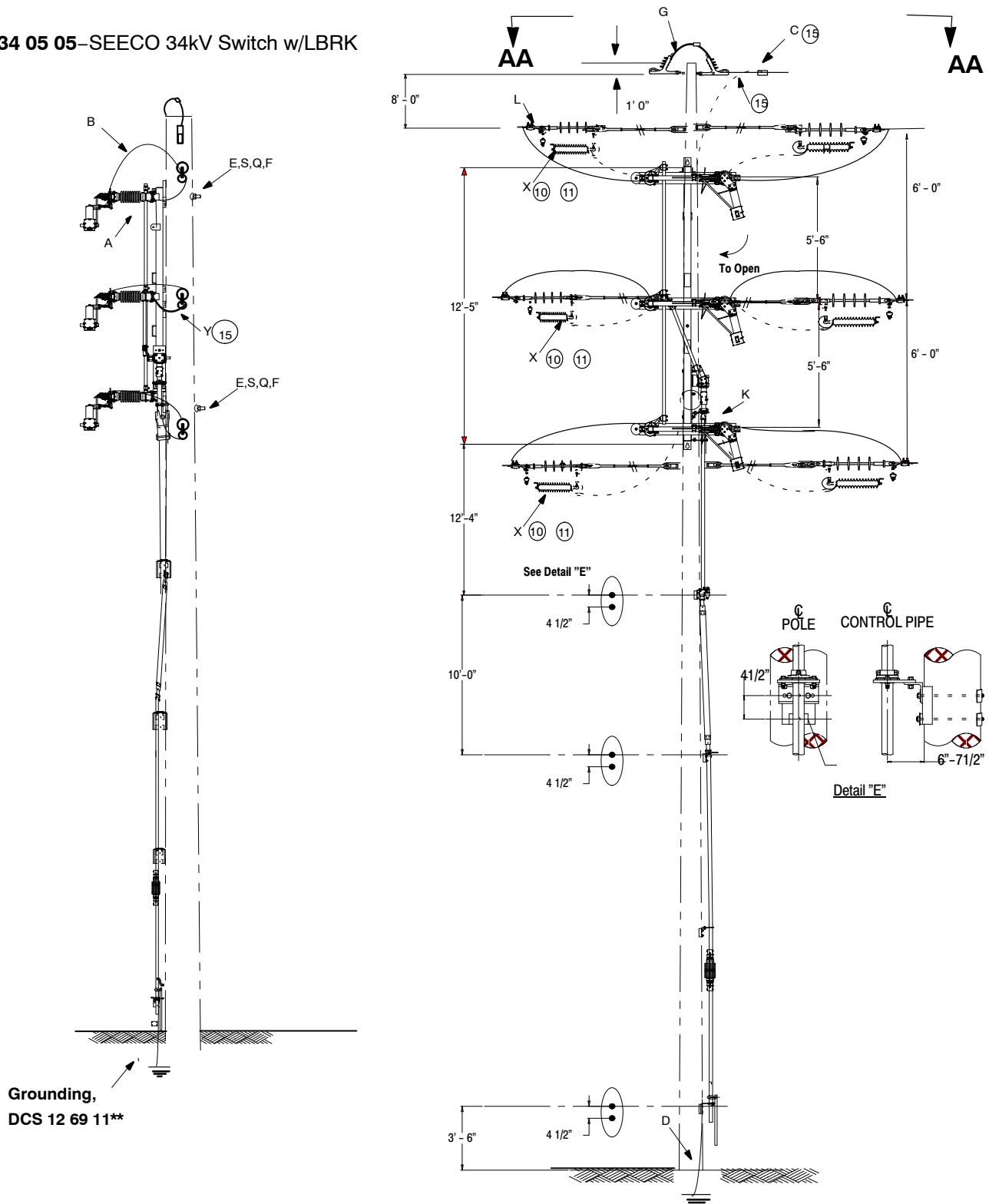
REMOVE LIFTING BRACKET AFTER
 FRAME IS MOUNTED TO POLE



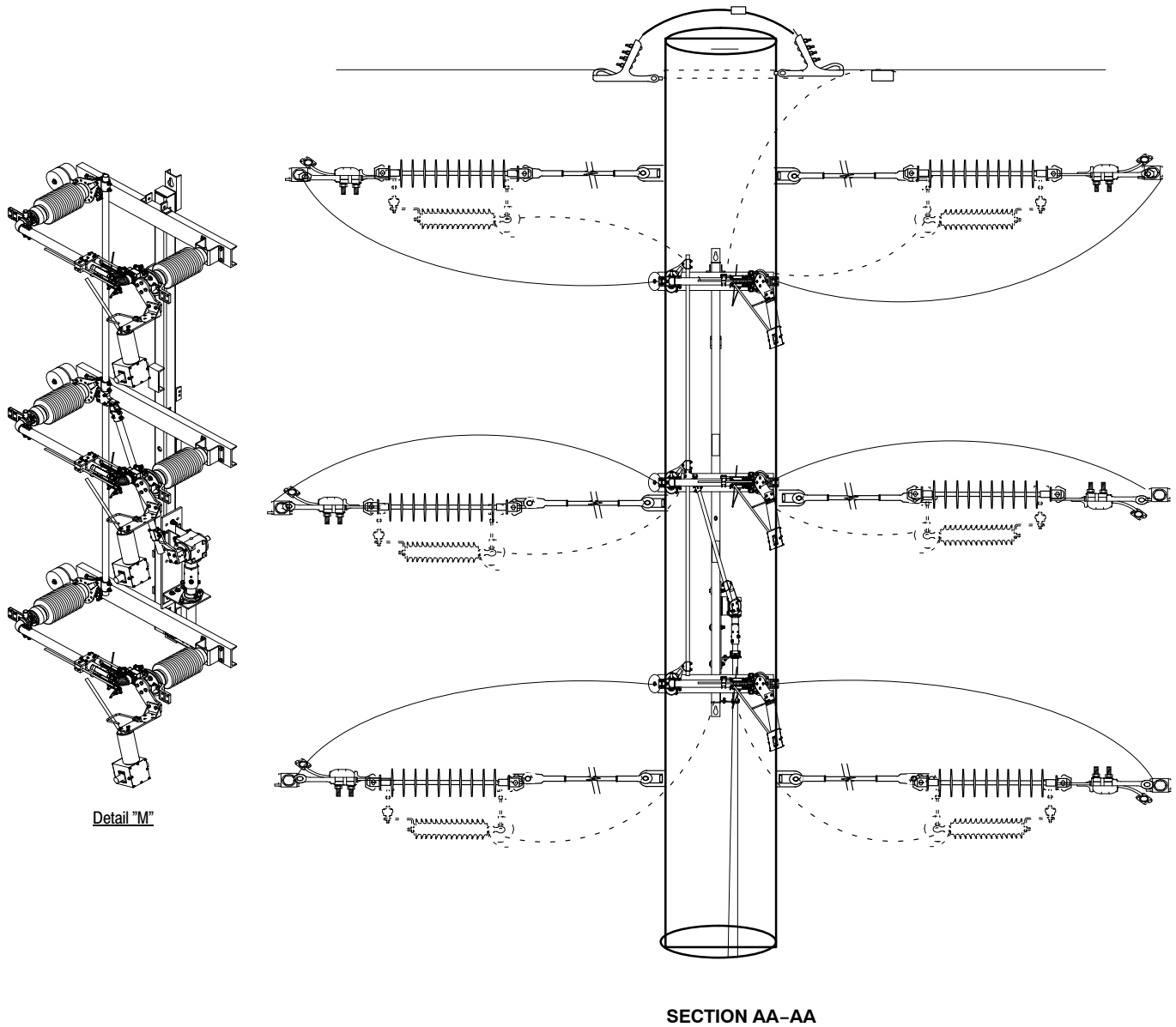
TS2 Switch Vertical Orientation

SEECO 34kV Switch - Alternative

10 34 05 05—SEECO 34kV Switch w/LBRK



SEECO 34KV SWITCH



FUSES AND SWITCHES
Single Circuit Sectionalizing
Vertical Construction – 1200 Amp – 34kV

10 34 05 **

Sheet 5 of 6

NOTES:

1. Switch handle must be grounded , refer to DCS **12 69 11 ****. Pole ground, operating pipe insulators, and ground mat installations and requirements, refer to DCS **10 34 01 01**, Section C.
2. See DCS **06 00 11 **** for shield wire details.
3. When operating handle is subject to vehicular damage or vandalism, increase mounting height to approx. 14 ft.
4. Install padlock on handle to prevent switch operation by the public.
5. Use 2 hand lines to prevent switch from turning while it is raised to mounting height.
6. Install 1–8 ft. fiberglass section to isolate underbuild (or future secondary). Refer to DCS **10 34 01 01**
7. Install 1–34kV TR210 operating rod insulator below secondary (or future secondary). Refer to DCS **10 34 01 01**
8. If motor operator is required, refer to DCS **10 00 01 01** and **10 69 10 ****.
9. The group operated switch weights 1080 lbs including load interrupters and 800 lbs. without load interrupters.
10. Arresters are not required for normally closed switch installation unless the switch with sensor devices which may be susceptible to lightning . Where switches are normally open, install both sets of arresters as shown. Refer to DCS **12 00 01 01** for arresters' selection.
11. The line arrester shown from the drawing is suspended from the compressed–on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps, and will not work with porcelain deadend bells. The disconnect coupling assembly detaches the line end of the arrestor should the arrestor fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis–eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
12. Caution: To prevent damage to the interrupter, do not install the bottom interrupter and keep unattached when lifting the switch vertically until the switch is installed on the pole, then attach the interrupter.
13. Remove lifting bracket.
14. Ground terminal of arresters to be bonded to switch base.
15. The lead connection is only required if the arresters are installed and grounded to the switch base.
16. The stock #54 08 314 and stock #5408317 are Turner 34kV D switches not for new installation.
17. The stock #54 08 433 and stock #54 08 434 are Turner 34kV TS2 switches for new installation. TS2
18. Only needed if additional vertical pipe is required.
19. Group operated 34.5kV, 1200 amp switch leads shall be the same as the line conductor. The leads will be attached to the switch per DCS **07 00 30 **** with 556.6kcmil or 954kcmil lugs.
20. The stock #43 08 442 are SEEEO 34kV switch with LBRK.
21. Field cut pipe lengths as needed

FUSES AND SWITCHES
Single Circuit Sectionalizing
Vertical Construction – 1200 Amp – 34kV

10 34 05 **

Sheet 6 of 6

		Std. / Stk. No.	Description	10 34 05 **	01	02	03	04	05
16	A	54 08 314	Turner D Switch, 34 kV, 1200A w/o LBRK(not for new installation)		1				
16		54 08 317	Turner D Switch, 34 kV, 1200A w/LBRK(not for new installation)	1					
17		54 08 433	Turner TS2 Switch, 34kV, 1200A w/LBRK Vertical Mount			1			
17		54 08 434	Turner TS2 Switch, 34kV, 1200A w/o LBRK Vertical Mount				1		
		54 08 442	SEECO 34kV, 1200A w/LBRK Vertical Mount						1
	J	54 08 327	Kit, for 34 kV Switch Vertical Construction	1	1				
@	B	LW*W	Wire, Bare, – Std. 07 00 80 00	60	60	60	60	60	60
10@	C	17 51 032	Clamp, Parallel Groove #6AWG – 1/0AWG	8	8	8	8	8	8
1@	D	12 69 11 **	Grounding Unit – Switching Pole	1	1	1	1	1	1
	E	23 52 219	Bolt, Machine 3/4" Sq. Head/Sq. Nut x 14"	3	3	3	3	3	3
	F	23 65 042	Nut, Lock, MF Galv 3/4"	3	3	3	3	3	3
@	G	06 00 11 09	Deandend, Looparound, Static Wire	1	1	1	1	1	1
	H	06 34 60 15	Pole, Deadend, 34 kV	6	6	6	6	6	6
18@	I	32 01 821	2" x 10' Steel Pipe w/Coupling	1	1	1	1	1	1
@	K	CL*W	Lug, Compression – Std. 07 00 20 00	6	6	6	6	6	6
@	L	DEC*W	Clamp, Deadend – Std. 07 00 30 00	6	6	6	6	6	6
	Q	23 66 031	Washer, Curved, 3/4"	3	3	3	3	3	3
	S	23 66 131	Washer, Flat, 3/4"	3	3	3	3	3	3
10,11@	X	10 01 237	Arrester, Line Protection, 30 kV Rated	As Req.	As Req.	As Req.	As Req.	As Req.	As Req.
10,11,15@	Y	18 51 021	Wire, #6 Cu SD Poly Covered	As Req.	As Req.	As Req.	As Req.	As Req.	As Req.
*1@	AA	18 51 091	Wire, #2 Cu SD Poly Covered	As Req.	As Req.	As Req.	As Req.	As Req.	As Req.
*1@	BB	23 64 001	Staple, Steel Coated Cu	As Req.	As Req.	As Req.	As Req.	As Req.	As Req.
*1@	DD	17 52 142	Clamp, PG, Bronze, Cable(two) #4 to 2/0 Cu	1	1	1	1	1	1

* Only needed when arresters are required, see note 10.

Shaded standards: 10 34 05 01 and 10 34 05 02 are no longer available for new installations.

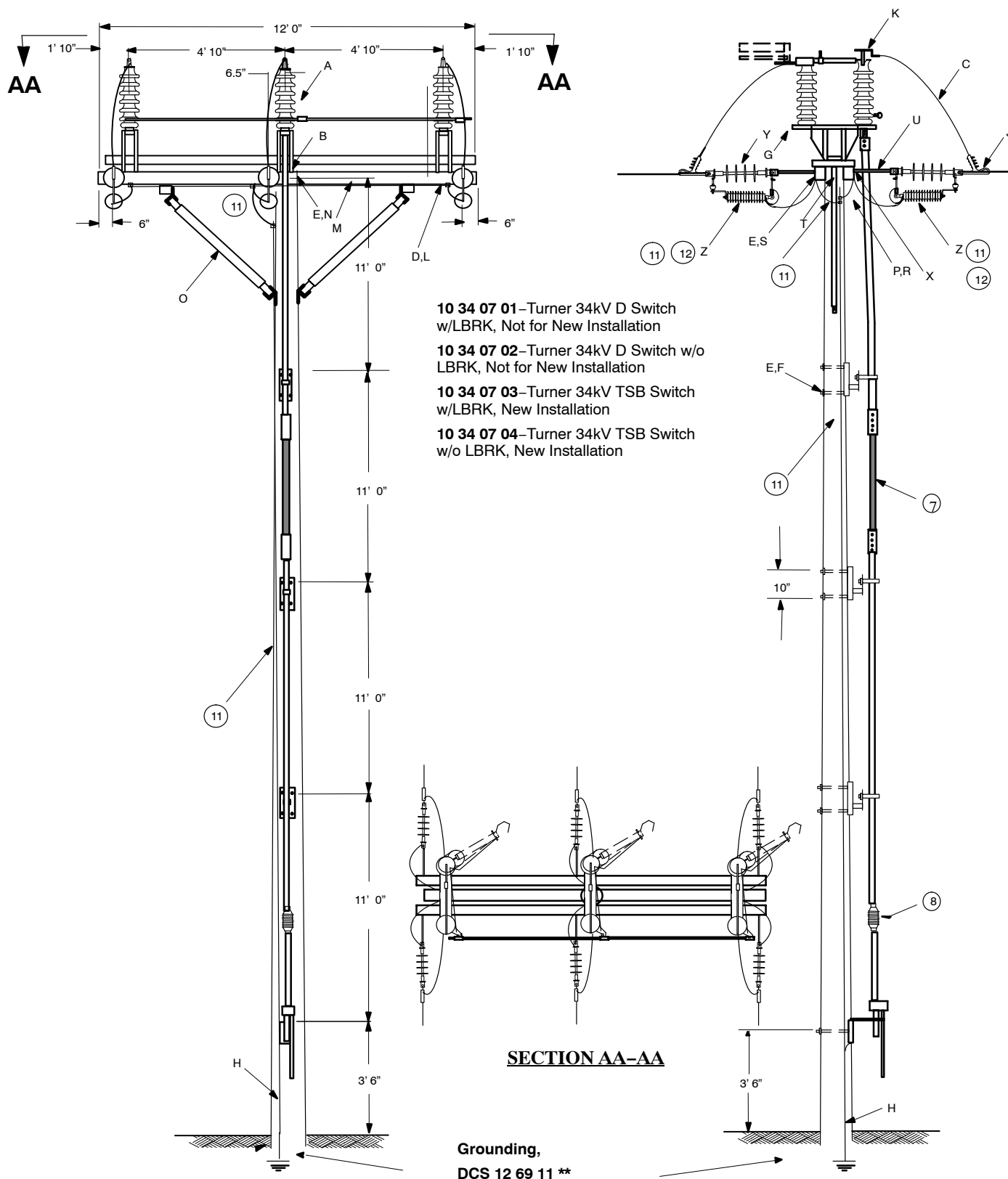
FUSES AND SWITCHES

Single Circuit Sectionalizing

Flat Crossarm Construction – 1200 Amp – 34kV

10 34 07 **

Sheet 1 of 3



FUSES AND SWITCHES
Single Circuit Sectionalizing
Flat Crossarm Construction – 1200 Amp – 34kV

10 34 07 **

Sheet 2 of 3

NOTES:

1. Install grounding unit on switch handle, refer to DCS **12 69 11****. For pole ground, vertical pipe insulators, and ground mat requirement, refer to DCS **10 34 01 01**, Section C.
2. The configuration has no provision for installing static shield wire; otherwise use DCS **10 34 05 ****
3. Vertical Operating Pipe shipped with the Switch is for pole length up to 50 feet. Additional steel pipe is required if a taller pole is called for.
4. When operating handle is subject to vehicular damage or vandalism, increase mounting height to approx. 14 ft.
5. Install padlock on handle to prevent switch operation by the public.
6. Place channels flange up.
7. Install 1–8 ft. fiberglass section to isolate underbuild (or future secondary). Refer to DCS **10 34 01 01**.
8. Install 1–34kV TR210 operating rod insulator below secondary (or future secondary). Refer to DCS **10 34 01 01**.
9. If motor operator is to be installed, refer to DCS **10 00 01 01** and **10 69 10 ****.
10. The group operated switch weights 1080 lbs. including load interrupters and 800 lbs. without load interrupters.
11. Arresters are not required for normally closed switch installations unless the switch with sensor devices which may be susceptible to lightning. Where switches are normally open, install both sets of arresters as shown and pole ground wire to the top of the pole for grounding path of the arresters. Refer to DCS **12 00 01 01** for arresters' selection.
12. The line arrester shown from the drawing is suspended from the compressed-on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps, and will not work with porcelain deadend bells. The disconnect coupling assembly detaches the line end of the arrestor should the arrestor fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis-eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
13. Caution: To prevent damage to interrupters do not install the bottom interrupter and keep unattached when lifting the switch vertically until the switch is installed on the pole, then attach the interrupter.
14. Remove lifting bracket.
15. The switches, stock #54 08 314 and stock #54 08 317 are not for new installation.
16. The switches, stock #54 08 437 and stock #54 08 439 are for new installation.
17. Group operated 34.5kV, 1200 amp switch leads shall be the same as the line conductor. The leads will be attached to the switch per DCS **07 00 30 **** with 556.6kcmil or 954kcmil lugs.

FUSES AND SWITCHES
Single Circuit Sectionalizing
Flat Crossarm Construction – 1200 Amp – 34kV

10 34 07 **

Sheet 3 of 3

		Std. / Stk. No.	Description	10 34 07 **	01	02	03	04
14	A	54 08 314	Turner D Switch, 34kV, 1200A w/o LBRK (not for new installation)			1		
14		54 08 317	Turner D Switch, 34kV, 1200A w/LBRK (not for new installation)	1				
15		54 08 437	Turner TSB Switch, 34kV, 1200A w/LBRK–Flat Top Mount				1	
15		54 08 439	Turner TSB Switch, 34kV, 1200A w/o LBRK–Flat Top Mount					1
	B	54 08 328	Mounting Kit, for 34 kV D Switch Flat Top Construction	1	1			
@	C	LW*W	Wire, Bare (Ft.) – Std. 07 00 80 00	45	45	45	45	
	D	23 52 041	Bolt, Mach. –1/2" x 8"	12	12	12	12	
	E	23 66 027	Washer, Sq –2 1/4"	26	26	26	26	
	F	23 52 065	Bolt, Mach – 5/8" x 12"	9	9	9	9	
11@	G	17 51 032	Clamp, Parallel Groove #6AWG – 1/0AWG	6	6	6	6	
1@	H	12 69 11 **	Grounding Unit – Switch Pole	1	1	1	1	
3@	I	32 01 821	Pipe, Steel Galv. 2" x 10' w Coupling, Turner	1	1	1	1	
	J	DEC*W	Clamp, Deadend – Std. 07 00 30 00	6	6	6	6	
@	K	CL*W	Lug, Compression – Std. 07 00 20 00	6	6	6	6	
	L	23 66 017	Washer, Round 1/2"	12	12	12	12	
	M	41 01 023	4" x 6" x 12'–0" Crossarm	2	2	2	2	
	N	23 52 069	Bolt, Machine, 5/8" x 18"	1	1	1	1	
	O	41 56 021	5'–0" Wood Heel Brace	2	2	2	2	
	P	23 52 049	Bolt, Machine, 5/8" x 2"	2	2	2	2	
	R	23 66 006	Washer, Lock, 5/8" Galv. Steel	2	2	2	2	
	S	23 52 256	Bolt, Machine, 5/8" x 7"	4	4	4	4	
	T	23 53 004	5/8" x 20" Spacer Bolt	3	3	3	3	
	U	23 65 012	5/8" Eyenut	6	6	6	6	
	V	23 51 015	Bolt, Clevis, 3/4" x 10"	6	6	6	6	
	W	23 65 018	3/4" Eyenut	6	6	6	6	
	X	23 77 210	Plate Heel Brace, 13–3/8" to 19"	2	2	2	2	
	Y	25 06 053	Insulator, Susp. 34 kV	6	6	6	6	
11@	Z	10 01 237	Arrester, Lightning, 30 kV, Metal Oxide	As Req.	As Req.	As Req.	As Req.	
*1@	AA	18 51 091	Wire, #2 Cu Covered SD	As Req.	As Req.	As Req.	As Req.	
*1@	BB	23 64 001	Staple, Cu Coated Steel	As Req.	As Req.	As Req.	As Req.	
*1@	CC	23 64 038	Staple, Molding Galv.	As Req.	As Req.	As Req.	As Req.	
*1@	DD	17 52 142	Clamp, PG, Grounding, Bronze, Cable (two) #4 to 2/0 Cu	1	1	1	1	

* Only needed when a pole ground is required. See Dist. Std. **10 34 01 01**.

FUSES AND SWITCHES

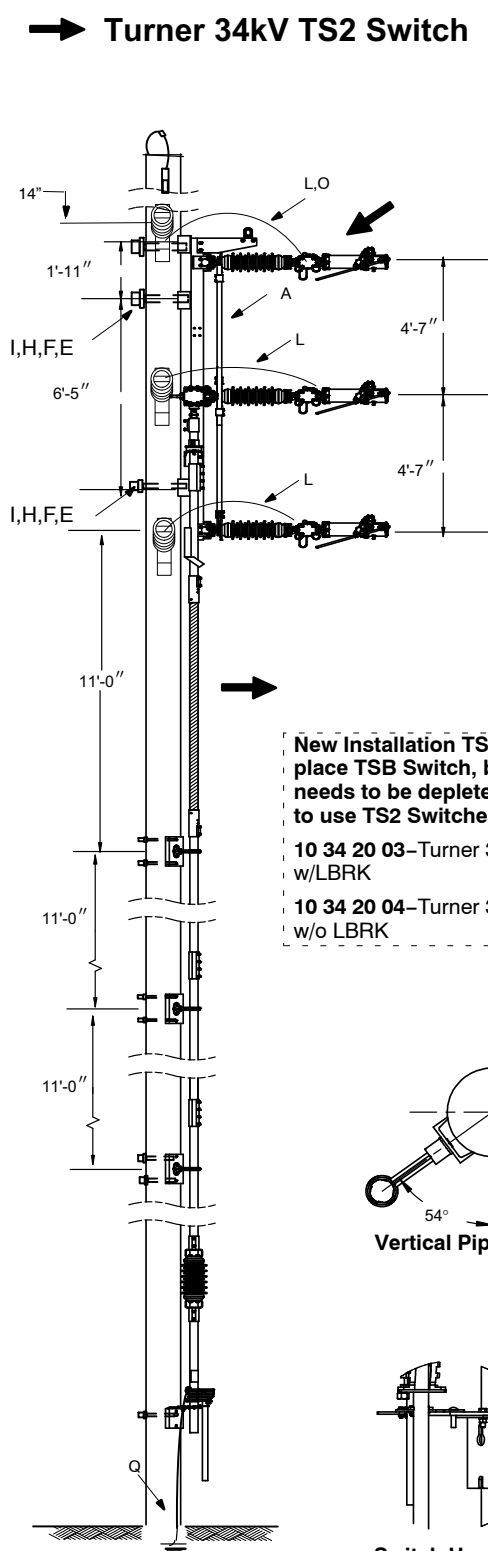
Double Circuit Tie Switch

1200 Amp – 34kV

10 34 20 **

Sheet 1 of 4

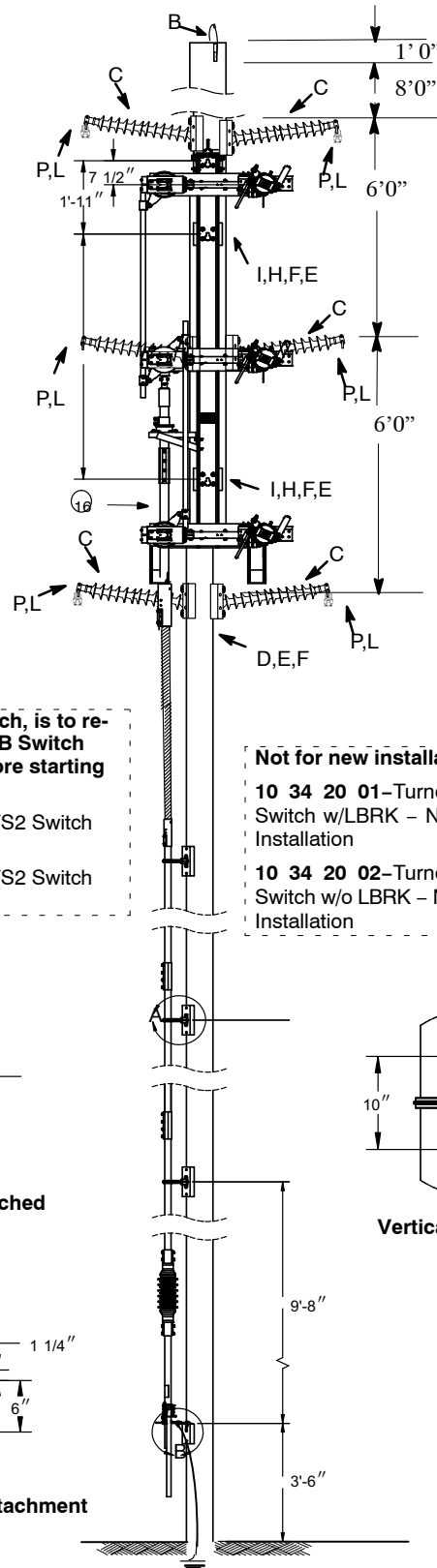
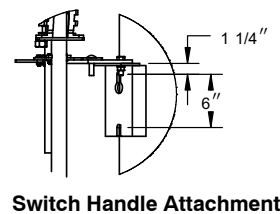
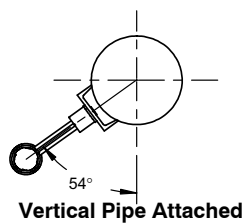
➔ Turner 34kV TS2 Switch



New Installation TS2 Switch, is to replace TSB Switch, but TSB Switch needs to be depleted before starting to use TS2 Switches

10 34 20 03–Turner 34kV TS2 Switch w/LBRK

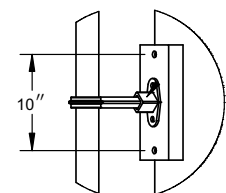
10 34 20 04–Turner 34kV TS2 Switch w/o LBRK



Not for new installations

10 34 20 01–Turner 34kV D Switch w/LBRK – Not for New Installation

10 34 20 02–Turner 34kV D Switch w/o LBRK – Not for New Installation



FUSES AND SWITCHES

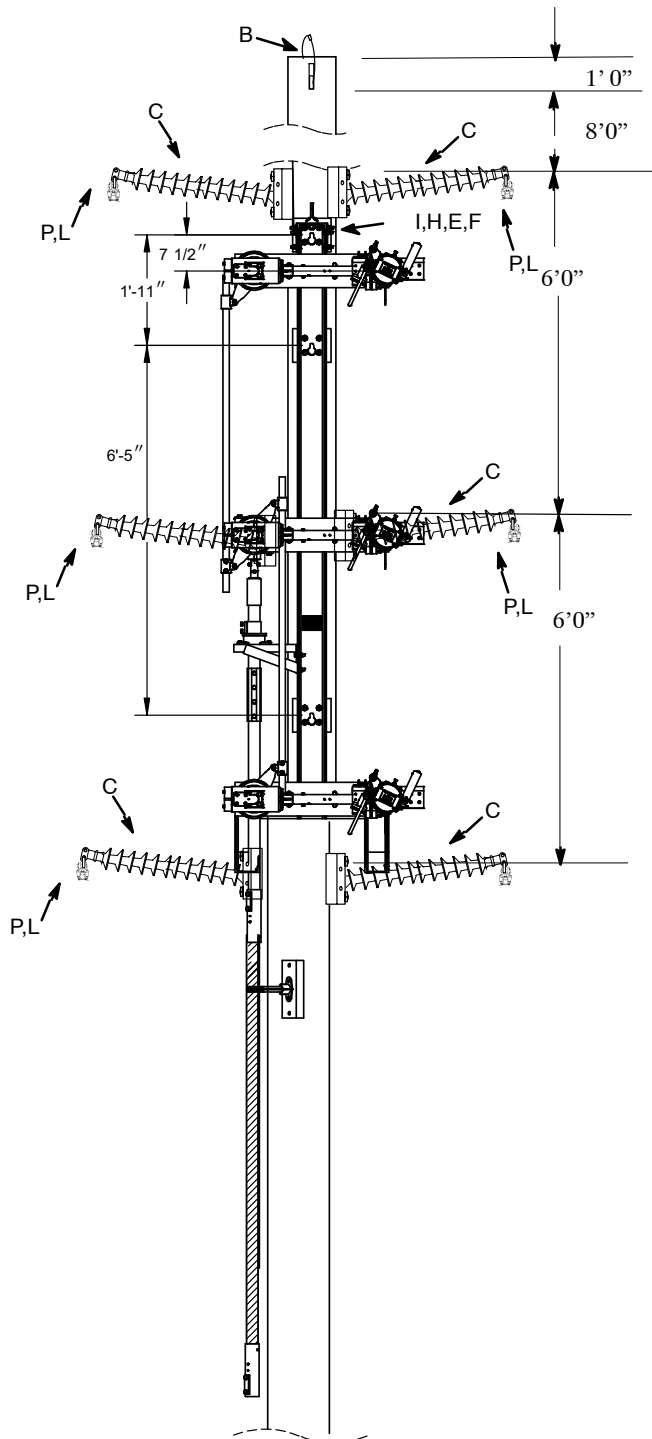
Double Circuit Tie Switch

1200 Amp – 34kV

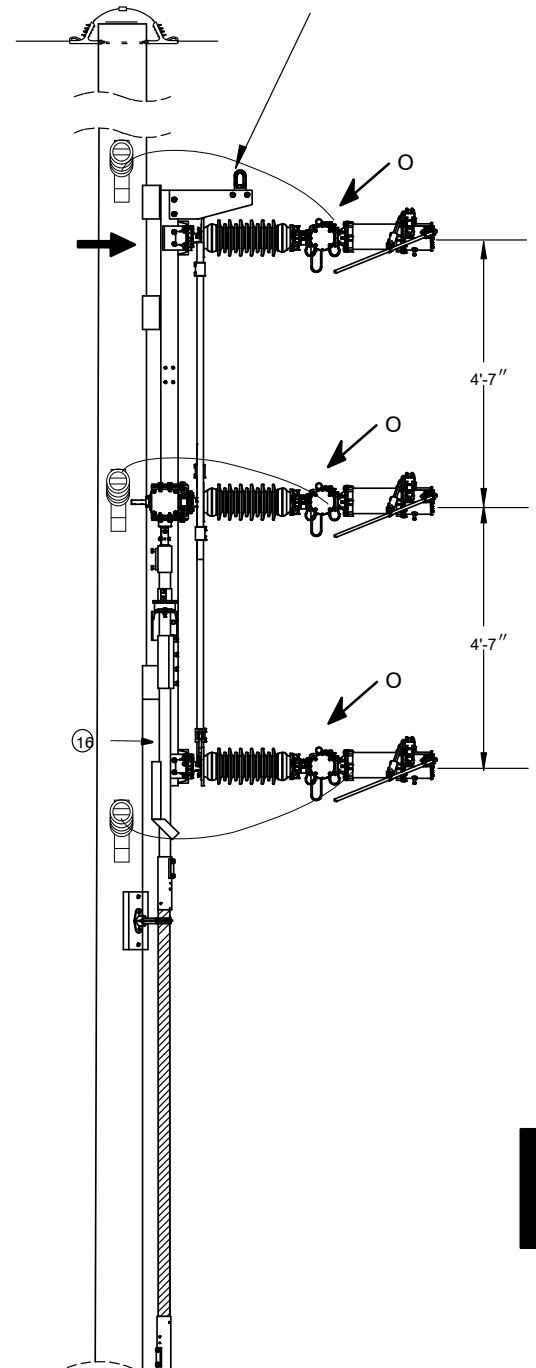
10 34 20 **

Sheet 2 of 4

➔ Turner 34kV TS2 Switch



REMOVE LIFTING BRACKET AFTER
FRAME IS MOUNTED TO POLE



FUSES AND SWITCHES
Double Circuit Tie Switch
1200 Amp – 34kV

10 34 20 **

Sheet 3 of 4

NOTES:

1. Install Grounding unit on switch handle, See DCS **12 69 11 ****. Pole ground requirement, see DCS **10 34 01 01**, Section C.
2. See DCS **06 00 11 **** for shield wire details.
3. When operating handle is subject to vehicular damage or vandalism, increase mounting height to approx. 14ft.
4. Install padlock on handle to prevent switch from turning while it is raised to mounting height.
5. Use 2 hand lines to prevent switch from turning while it is raised to mounting height.
6. Install 1–8ft. fiberglass section or 1–34kV operating rod insulator to isolate underbuild (or future secondary).
7. Install 1–34kV TR210 operating rod insulator below secondary (or future secondary).
8. If motor operator is to be installed, see DCS **10 00 01 01** and **10 69 10 ****.
9. The group operator switch weights 1080lbs including interrupters and 800lbs without interrupters.
10. Caution: To prevent damage to interrupters, do not install the bottom interrupter when lifting the switch vertically. Attached the bottom interrupter after the switch is installed on the pole.
11. Remove lifting bracket from switch.
12. Order additional steel pipe only when is required.
13. The switches, stock #54 08 314 and stock #54 08 317 are not for new installation.
14. The switches, stock #54 08 433 and stock #54 08 434 are for new installation.
15. Group operated 34.5kV, 1200 amp switch leads shall be the same as the line conductor. The leads will be attached to the switch per DCS **07 00 30 **** with 556.6kcmil or 954kcmil lugs.
- 16. Field cut pipe lengths as needed.

FUSES AND SWITCHES

Double Circuit Tie Switch

1200 Amp – 34kV

10 34 20 **

Sheet 4 of 4

		Std. / Stk. No.	Description	10 34 20 **	01	02	03	04
13	A	54 08 314	Turner D Switch, 34 kV, 1200 A. w/o LBRK			1		
13		54 08 317	Turner D Switch, 34 kV, 1200 A., w/LBRK	1				
14		54 08 433	Turner TS2 Switch, 34kV, 1200A w/LBRK Ver- tical Mount				1	
14		54 08 434	Turner TS2 Switch, 34kV, 1200A w/o LBRK Vertical Mount					1
	G	54 08 327	Kit for 34kV Switch Vertical Construction	1	1			
@	B	06 00 11 **	Deadend, Looparound, Static Wire	1	1	1	1	1
	C	25 05 132	Insulator, Line Post, Horizontal, 138kV	6	6	6	6	6
	D	23 53 060	Bolt, DA, 3/4" x 20"–top	4	4	4	4	4
		23 53 062	Bolt, DA, 3/4" x 22"–bottom	2	2	2	2	2
	E	23 66 031	Washer, Curved, 3" x 3" for 3/4" Bolt	12	12	12	12	12
	F	23 56 042	Nut Locking, 3/4" M–F	15	15	15	15	15
	H	23 66 011	Washer, Round, 3/4" Bolt	15	15	15	15	15
	I	23 52 254	Bolt, Mach., 3/4" x 16"	2	2	2	2	2
	J	23 52 070	Bolt, Mach., 5/8" x 20"	8	8	8	8	8
	K	23 66 027	Washer, Square, 5/8"	8	8	8	8	8
	L	23 58 063	Wye Clevis – (Rotated) Eye Fitting	6	6	6	6	6
@	M	LW*W	Wire, Bare – Std. 07 00 80 00	60	60	60	60	60
	N	PG*	Clamp, Parallel Groove – Std. 07 00 25 00	12	12	12	12	12
@	O	CL*W	Lug, Compression – Std. 07 00 30 00	12	12	12	12	12
@	P	SC*W	Clamp, Suspension – Std. 07 00 20 00	3	3	3	3	3
@	Q	12 69 11 **	Grounding Unit – Switch Pole	1	1	1	1	1
12@	R	32 01 821	2"x10' Galv. Steel Pipe with Coupling	1	1	1	1	1

Shaded standards 10 34 20 01 and 10 34 20 02 are not for new installations.

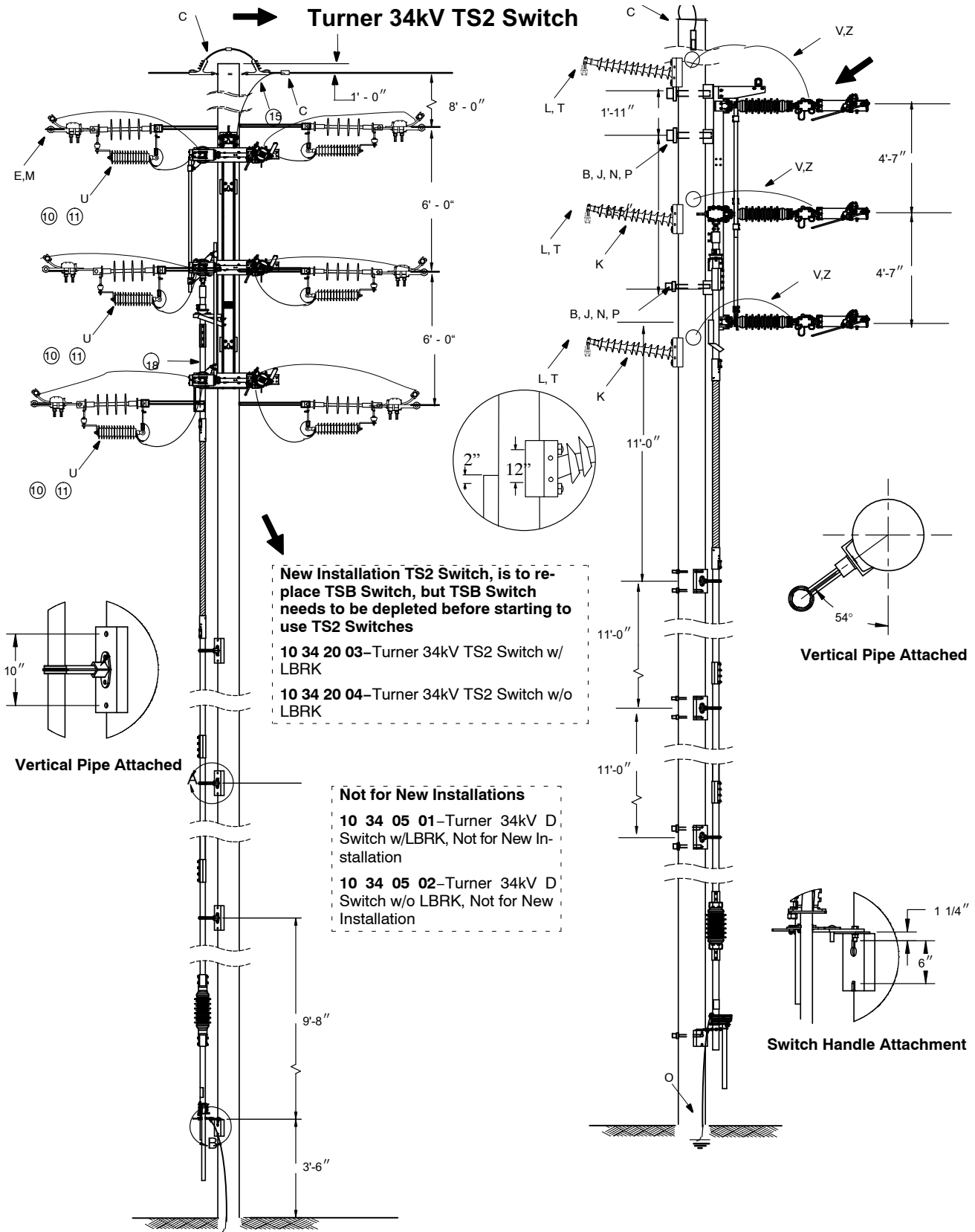
FUSES AND SWITCHES

Double Circuit Sectionalizing

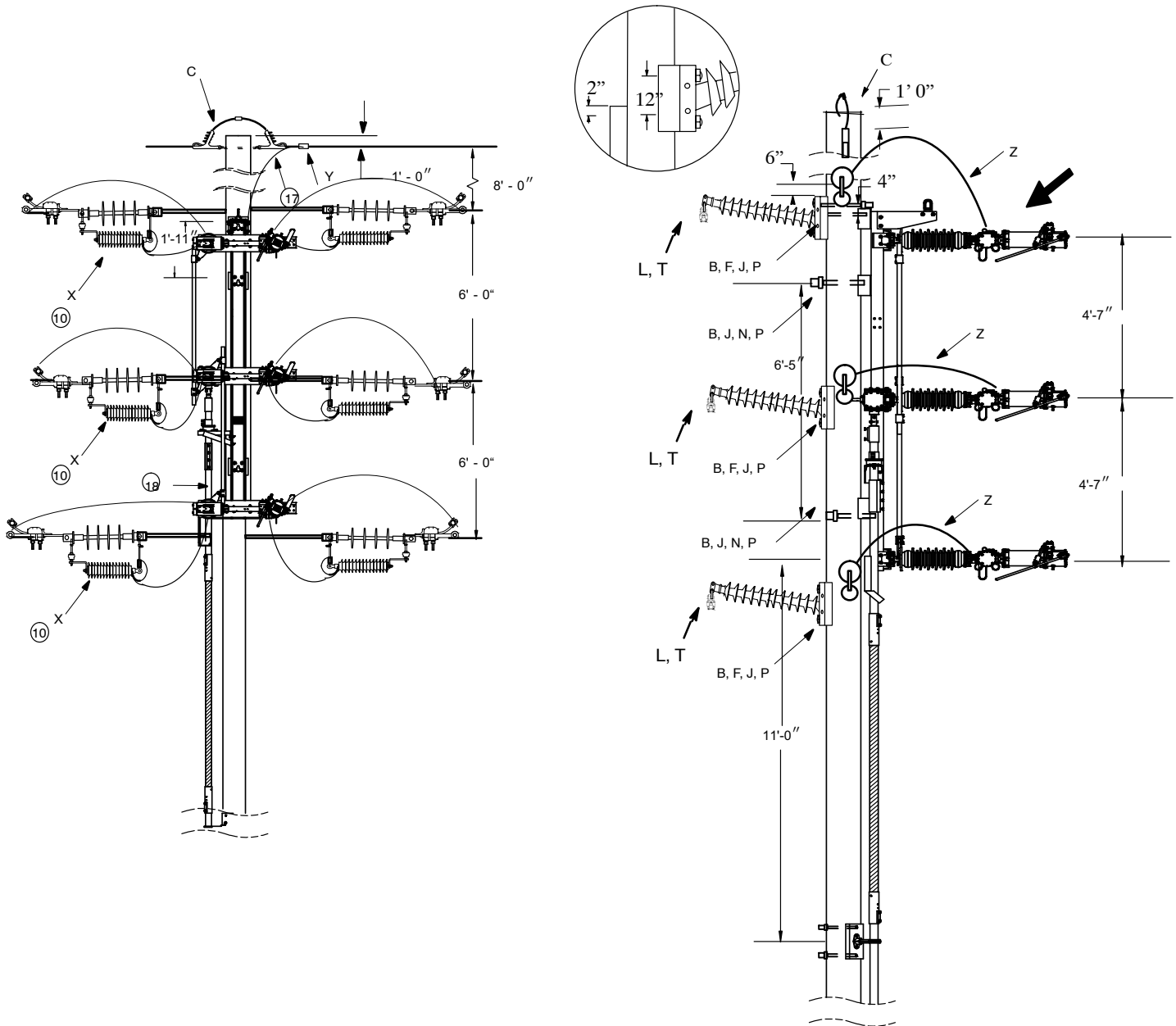
1200 Amp – 34 kV

10 34 26 **

Sheet 1 of 4



➔ **Turner 34kV TS2 Switch**



FUSES AND SWITCHES
Double Circuit Sectionalizing
1200 Amp – 34 kV

10 34 26 **

Sheet 3 of 4

NOTES:

1. Install grounding unit on switch handle see Dist. Std. **12 00 01 01**. Pole ground requirement, see DCS **10 34 01 01**, Section C.
2. See Dist. Std. **06 00 11**** for shield wire details.
3. When operating handle is subject to vehicular damage or vandalism, increase mounting height to approx. 14 ft.
4. Install padlock on handle to prevent switch operation by the public.
5. Use 2 hand lines to prevent switch from turning while it is raised to mounting height.
6. Install 1–8 ft. fiberglass section or 1–34kV TR210 operating rod insulator to isolate underbuild (or future secondary).
7. Install 1–34kV TR210 operating rod insulator below secondary (or future secondary).
8. If motor operator is to be installed, see Dist. Std. **10 00 01 01** and **10 69 10 ****.
9. The group operated switch weights 1080 lbs. including load interrupters and 800 lbs. without load interrupters.
10. Arresters are not required for normally closed switch installation unless the switch with sensor devices which may be susceptible to lightning . Where switches are normally open, install both sets of arresters as shown. Refer to DCS **12 00 01 01** for arresters' selection.
11. Caution: to prevent damage to interrupters, do not install the bottom interrupter and keep unattached when lifting the switch vertically until the switch is installed on the pole, and then attach the interrupter.
12. Remove lifting bracket.
13. The switch is not for new installation.
14. The switch is for new installation.
15. Only needed if additional vertical pipe is required.
16. Group operated 34.5kV, 1200 amp switch leads shall be the same as the line conductor. The leads will be attached to the switch per DCS **07 00 30 **** with 556.6kcmil or 954kcmil lugs.
17. The lead connection is only required if the arresters are installed and grounded to the switch base.
18. Field cut pipe lengths as needed.

FUSES AND SWITCHES

Double Circuit Sectionalizing

1200 Amp – 34 kV

10 34 26 **

Sheet 4 of 4

		Std. / Stk. No.	Description	10 34 26 **	01	02	03	04
13	A	54 08 314	Turner D Switch, 34kV, 1200A, w/o LBRK		1			
13		54 08 317	Turner D Switch, 34kV, 1200A, w/LBRK	1				
14		54 08 433	Turner TS2 Switch, 34kV, 1200A, w/LBRK			1		
14		54 08 434	Turner TS2 Switch, 34kV, 1200A, w/o LBRK					1
	R	54 08 327	Kit for 34kV Switch Vertical Construction	1	1			
	B	23 56 042	Nut, Locking, 3/4" M-F	15	15	15	15	
@	C	06 00 11 **	Deadend, Looparound, Static Wire	1	1	1	1	
@	D	DEC*W	Clamp, Deadend – Std. 07 00 11 00	6	6	6	6	
	E	25 56 059	Insulator, F.G. Strain, 26"	6	6	6	6	
	F	23 53 060	Bolt, DA, 3/4" x 20"	4	4	4	4	
		23 53 062	Bolt, DA, 3/4" x 24"	2	2	2	2	
	G	23 52 070	Bolt, Mach. 5/8" x 20"	8	8	8	8	
	H	23 66 027	Washer, Square, 5/8"	8	8	8	8	
15@	I	32 01 821	2" x 10' Steel Pipe w/coupling	1	1	1	1	
	J	23 66 031	Washer, Curved, 3" x 3", for 3/4" Bolt	15	15	15	15	
	K	25 05 132	Insulator, Line Post, Horizontal, 138 kV	3	3	3	3	
	L	23 58 063	Wye Clevis – (Rotated) Eye Fitting	3	3	3	3	
	M	06 34 60 15	Deadend, Pole, 34.5 kV, Double	6	6	6	6	
	N	23 52 254	Bolt, Mach, 3/4" x 16"	2	2	2	2	
		23 52 213	Bolt, Mach, 3/4" x 24"	1	1	1	1	
@	O	12 69 11 **	Grounding Unit – Switch Pole	1	1	1	1	
	P	23 66 011	Washer, Round, 3/4" Bolt	6	6	6	6	
	S	23 59 064	Eye-Eye Link	6	6	6	6	
@	T	SC*W	Clamp, Suspension – Std. 07 00 20 00	3	3	3	3	
10@	U	10 01 237	Arrester, Line protection, 30kV Duty Cycle, 24.4kV MCOV Rated	As Req.	As Req.	As Req.	As Req.	
@	V	CL*W	Lug, Compression – Std. 07 00 30 00	6	6	6	6	
@	Y	PG*	Clamp, Parallel Groove – Std. 07 00 25 00	6	6	6	6	
@	Z	LW*W	Wire, Bare – Std. 07 00 80 00	30	30	30	30	

Shaded standards are not for new installations.

FUSES AND SWITCHES

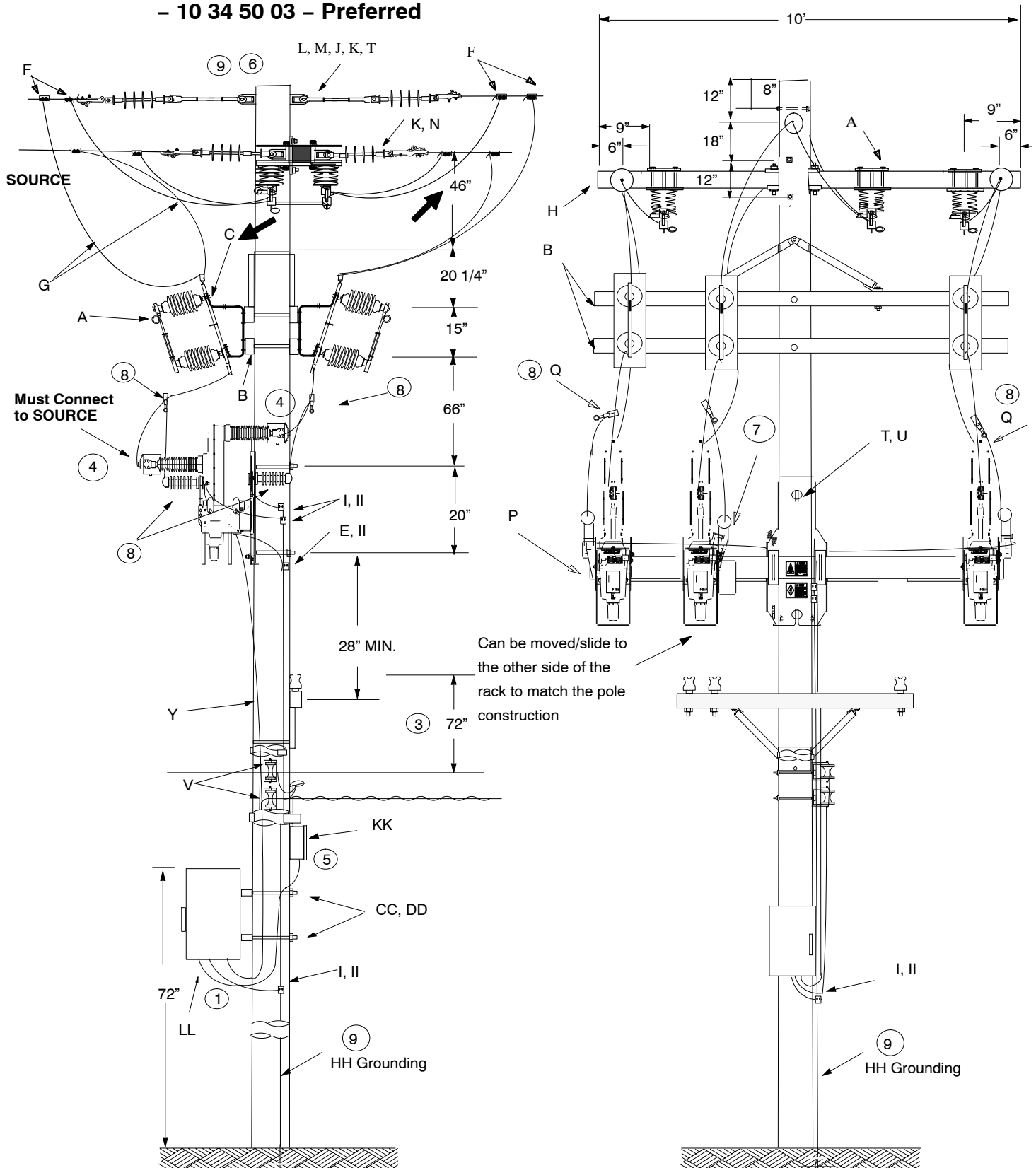
Three Phase Recloser

with Remote Control-800 Amp-34kV

10 34 50 **

Sheet 1 of 4

G & W "Z" STYLE VIPER RECLOSER - 10 34 50 03 - Preferred



FUSES AND SWITCHES

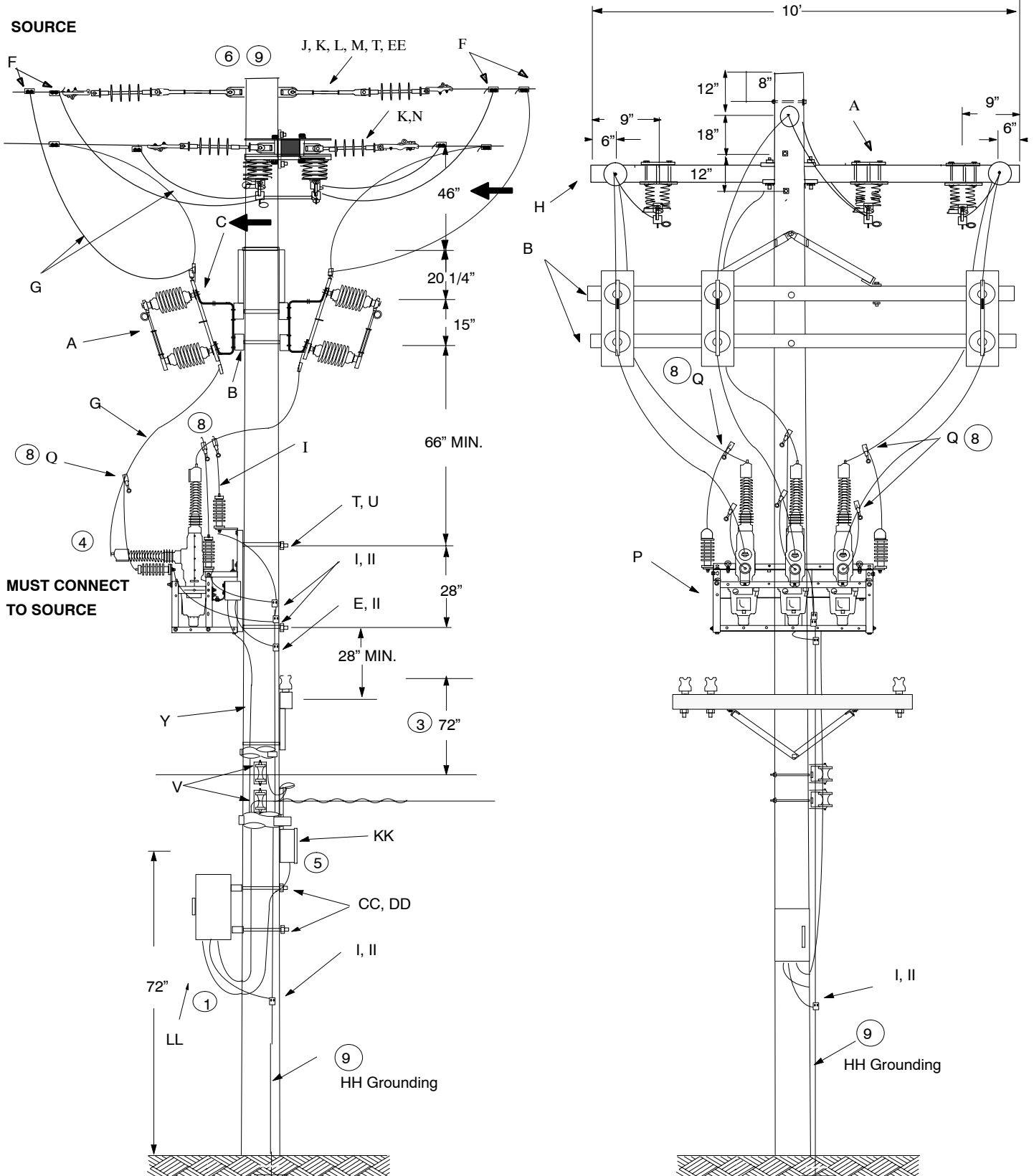
Three Phase Recloser

with Remote Control-800 Amp-34kV

10 34 50 **

Sheet 2 of 4

G & W "L" STYLE VIPER RECLOSER - 10 34 50 04 - Not Preferred



**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
REV. NO: 16
REV. DATE: 09/29/17

FUSES AND SWITCHES
Three Phase Recloser
with Remote Control–800 Amp–34kV

10 34 50 **

Sheet 3 of 4

NOTES

1. Control cables can be ordered in other lengths: G & W 35' – stock #69 10 234. If a different cable is used for G&W, place the extra 50' cable back into stock #69 10 233.
2. The maximum height – measured from the ground to the bottom of the recloser – shall be 3 feet less than the length of the control cable (ie. 49 feet above ground if cable is 52 feet long).
3. See DCS **03 00 01 00** for spacing information. May be reduced to 40" if pole space is limited.
4. Position lugs so the cable enters the animal guard through the side entry point, in order to direct cables to the switches.
5. Secondary breaker / receptacle box shall be connected to ground wire with #6, S.D. copper. Incoming wire must be protected.
6. If static present, maintain 8' separation from the static wire to the center of phase crossarm.
7. The middle arresters should always be mounted on the pole side, the outside pole arresters should be mounted to the outside of the viper arm. The arrangement will maximize the phase–phase spacing of energized parts.
8. The lightning arresters pre–installed on the viper recloser by the factory come with 36 ft of #4 cu poly covered wire and the poly covered wire must be connected to the recloser leads with hot line clamps. The hot line clamps must be installed 36" away from the base of recloser or any exposed component.
To installed the viper recloser on un–grounded delta system, the lightning arresters rated 24.4kV MCOV pre–installed on the viper recloser by factory must be removed and replaced with 29kV MCOV arrester (stock #10 01 252), and return the removed arresters (stock #10 01 148) back to store.
9. **If system neutral is present**, bond #2 Cu ground to the system neutral. **If system neutral is not present and a static/shield wire is present**, then bond the #2 Cu ground to the static/shield wire. **If system neutral and static wire are both present**, only bond the #2 Cu ground to the system neutral.

FUSES AND SWITCHES
Three Phase Recloser
with Remote Control–800 Amp–34kV

10 34 50 **

Sheet 4 of 4

		Std. / Stk. No.	Description	10 34 50 **	03	04
@	A	54 07 302	Disc., Switch, 900 A, 34 kV,		9	9
	B	04 00 20 10	Crossarm, Double 10 Ft.		2	2
	C	23 06 131	Bracket, Angle Mount, Bypass Switch		6	6
	E	18 51 019	Wire, #2 Cu Poly (Ft)		10	10
	F	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		12	12
	G	18 51 022	Wire, 500 Cu, Poly (Ft.)		110	110
	H	04 00 41 04	Crossarm, Deadend, F/G, 10'		1	1
	J	25 56 076	Insulator, Guy Strain F/G 26"		2	2
	K	25 06 053	34kV Deadend Insulator		6	6
	L	23 59 095	Eyelet, 3/4"		1	1
	M	23 65 018	Eyenuit, 3/4"		1	1
	N	DEC*W	Clamp, Deadend, DCS 07 00 20 00		6	6
	P	69 10 235	Recloser, 35kV, 800 Amp (G&W) L Style (obsolete)			1
		69 10 248	Recloser, 35kV, 800 Amp (G&W) Z Style (standard)		1	
	Q	17 02 175	Hot Line Clamp, 500kcmil Cu Main/#4 Cu Tap		6	6
	R	17 51 234	Lug, 1 Bolt, #8 – 2/0 Cu.		6	6
8@	S	10 01 252	Lightning Arrester, 29kV MCOV (un–Grd Delta System)		6	6
	T	23 52 097	Bolt, Mach., 3/4" x 12"		2	2
	U	23 66 031	Washer, Curved, 3/4"		2	2
	V	06 01 01 03	Secondary Clevis and Insulator		1	1
	Y	23 64 001	Staple – for 3/8"Wx2"Lx0.44" Dia.		12	12
9@	CC	23 66 027	Washer, SQ, 5/8"		2	2
	DD	23 52 066	Bolt, Mach., 5/8" x 14"		2	2
	HH	12 00 10 04	Ground Unit, #2 Cu Poly, Ground Coil		1	1
		12 00 10 03	Ground Unit, #2 Cu Poly, Ground Rod		1	1
	II	17 54 373	Connector – PG, 2–2/0 Cu to Cu		8	8
	KK	54 17 486	Circuit Breaker, w/Riser 120V 20A		1	1
	LL	10 01 032	Secondary Surge Device		1	1

FUSES AND SWITCHES

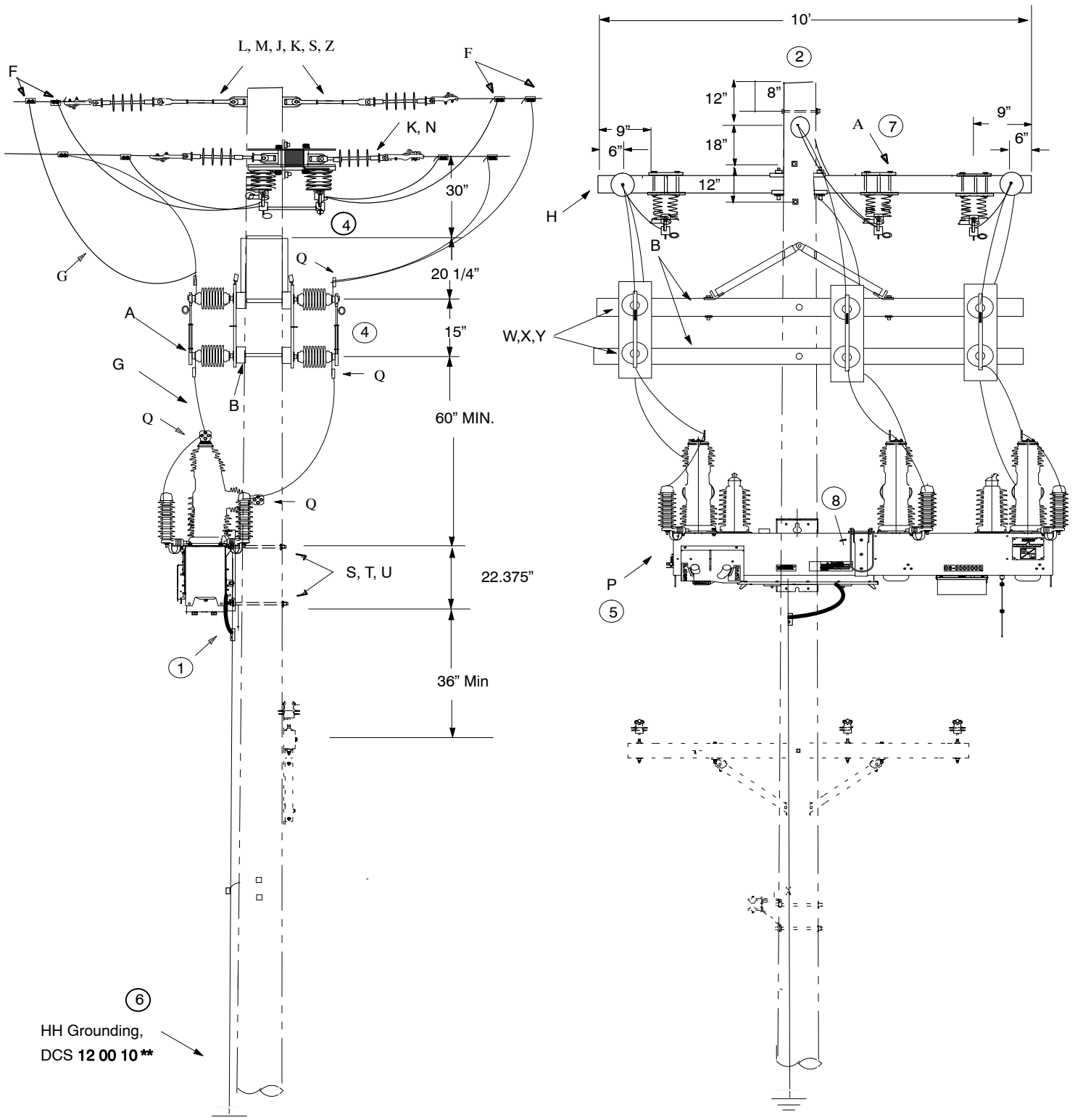
Three Phase Recloser

with Remote Control-800 Amp-34kV

10 34 51 **

Sheet 1 of 3

S&C INTELLIRUPTER RECLOSER



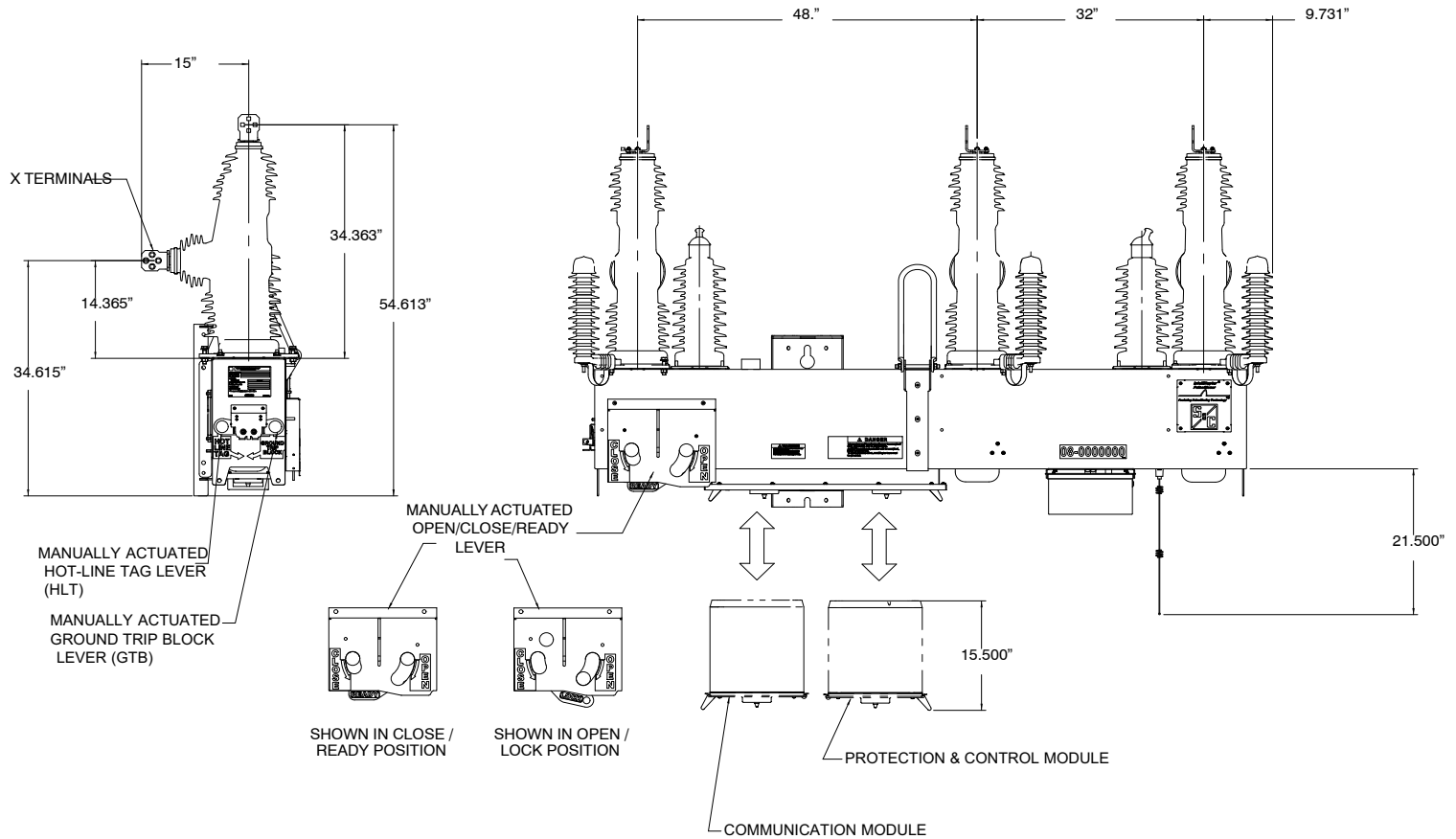
FUSES AND SWITCHES

Three Phase Recloser

with Remote Control–800 Amp–34kV

10 34 51 **

Sheet 2 of 3



NOTES

1. Interruption recloser frame must be connected to ground with #2 Cu. Pole ground to neutral connection must be #2 Cu.
2. If system neutral is present, bond #2 Cu ground to the system neutral is present. If system neutral is not present and a static/shield wire is present, then bond the #2 Cu ground to the static/shield wire. If system neutral and static wire are both present, only bond the #2 Cu ground to the system neutral.
3. Tool to removal / install radio module and control is 46 01 645.
4. Switch to open towards climbing side of pole.
5. Interruption Recloser weight is 900 lbs.
6. Use DCS 12 00 10 03 – ground rod and DCS 12 00 10 04 – ground coil installation on new pole installation.
7. **Only install the two inside bolts on the switch and slide them as close to the crossarm as possible.**
8. Make sure lifting bails are folded down before energizing.

FUSES AND SWITCHES
Three Phase Recloser
with Remote Control–800 Amp–34kV

10 34 51 **

Sheet 3 of 3

		Std. / Stk. No.	Description	10 34 51 **	01
@	A	54 07 302	Disc., Switch, 900 A, 34 kV,		9
	B	04 00 20 10	Crossarm, Double 10 Ft.		2
	E	18 51 019	Wire, #2 Cu Poly (Ft)		10
	F	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		12
	G	18 51 022	Wire, 500 Cu, Poly (Ft.)		110
	H	04 00 41 04	Crossarm, Deadend, F/G, 10'		1
	J	25 56 076	Insulator, Guy Strain F/G 26"		2
	K	25 06 053	34kV Deadend Insulator		6
	L	23 59 095	Eyelet, 3/4"		1
	M	23 65 018	Eyenuit, 3/4"		1
	N	DEC*W	Clamp, Deadend, DCS 07 00 20 00		6
	P	69 10 247	Recloser, 35kV, 800 Amp S&C IntelliRupter		1
	Q	17 54 177	Connector, Cable to Flat 1/0 to 500 kcmil, Spade Type, Bronze		18
	S	23 52 097	Bolt, Mach., 3/4" x 12"		3
	T	23 66 031	Washer, Curved, 3/4"		2
	U	23 66 135	Washer Lock DBL, Coil, 3/4"		2
	W	23 52 441	Bolt, Carriage, Galvanized		18
	X	21 75 735	Washer, 3/8"		18
	Y	23 65 057	Nut, Lock, 3/8"		18
	Z	23 66 131	Washer, SQ, 3/4"		2
@	HH	12 00 10 04	Ground Unit, #2 Cu Poly, Ground Coil		1
		12 00 10 03	Ground Unit, #2 Cu Poly, Ground Rod		1
	II	17 54 373	Connector – PG, 2–2/0 Cu to Cu		1

FUSES AND SWITCHES

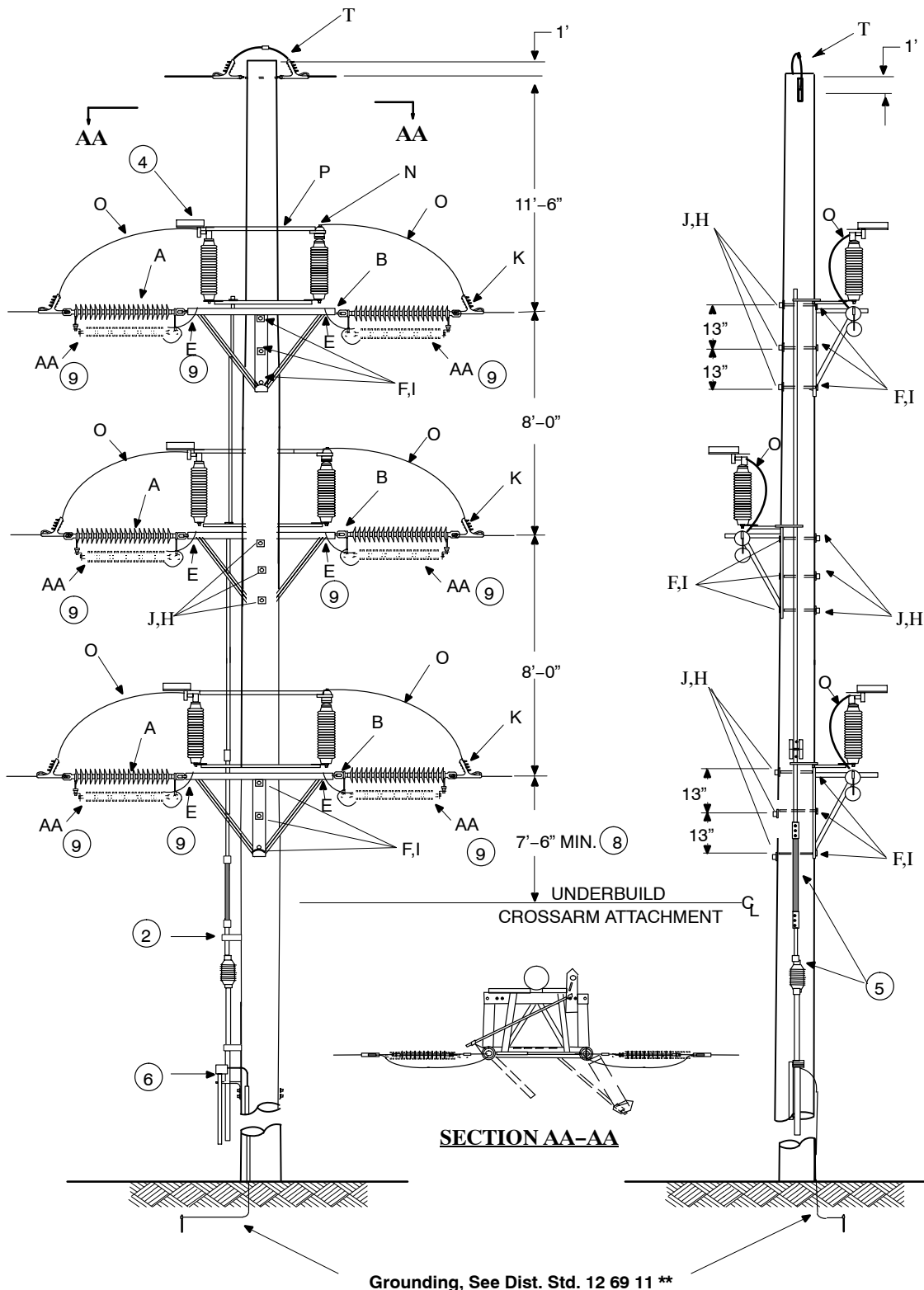
69kV Side Break Switch

Triangular Configuration

10 69 05 **

Sheet 1 of 5

Turner Switch 69kV 1200A Loadbreak Interrupters 10 69 05 01
Turner Switch 69kV 1200A without Loadbreak Interrupters 10 69 05 02



FUSES AND SWITCHES

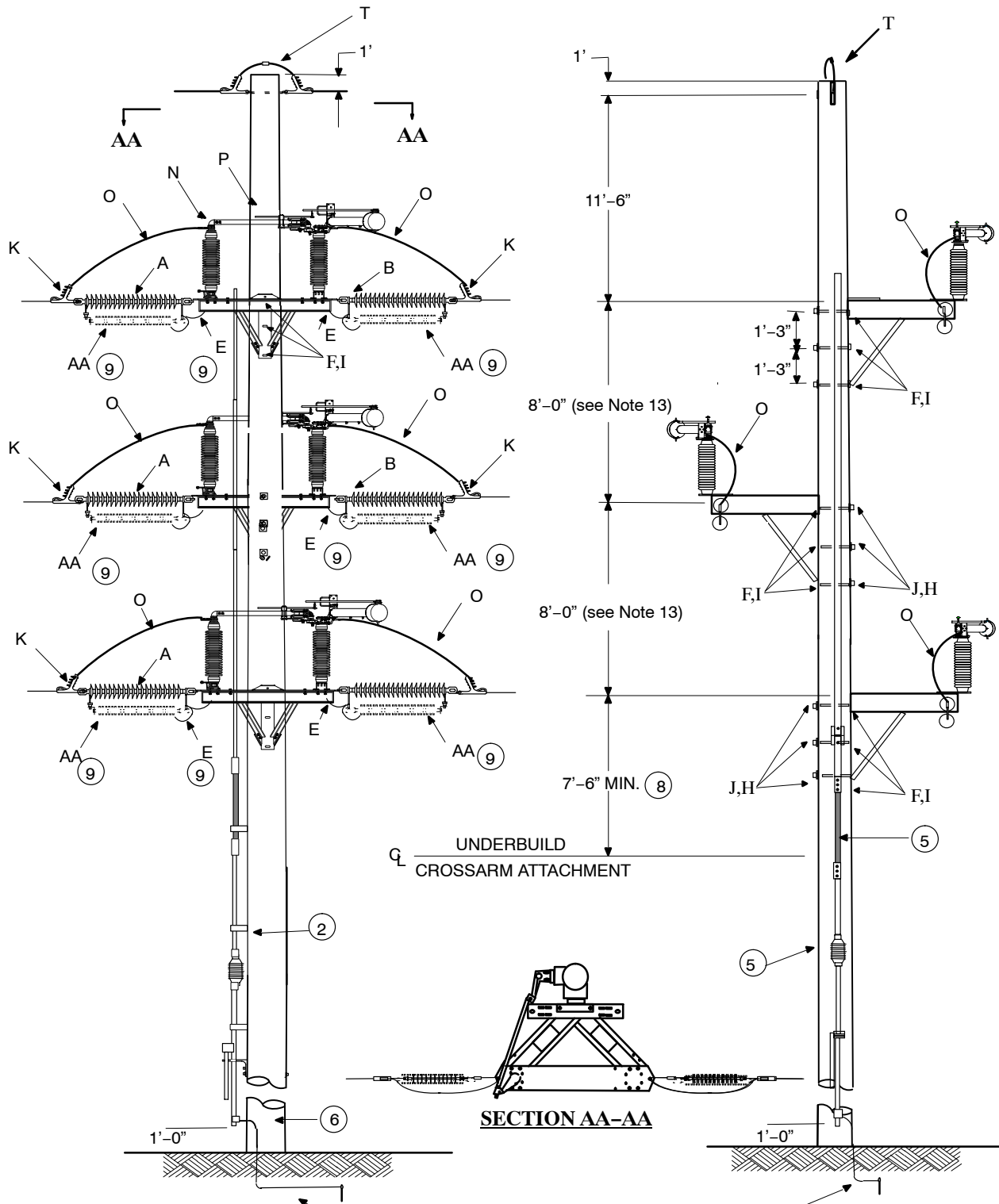
69kV Side Break Switch

Triangular Configuration

10 69 05 **

Sheet 2 of 5

SEECO Switch 69kV 1200A Load Interrupters 10 69 05 03
SEECO Switch 69kV 1200A without Load Interrupters 10 69 05 04



Grounding. See Dist. Std. 12 69 11 **

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: WYW
REV. NO: 5
REV. DATE: 07/27/17

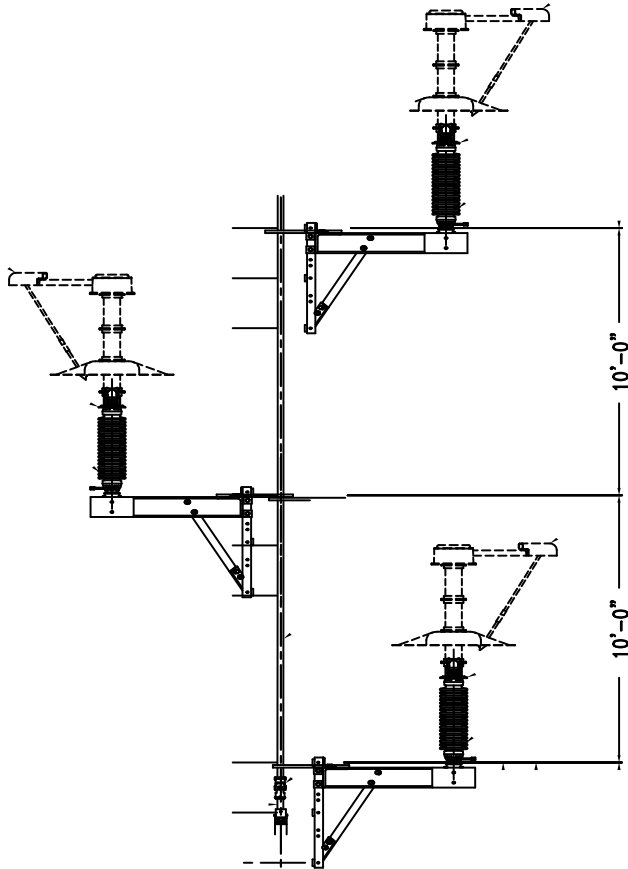
NOTES

1. See DCS **06 00 11**** for shield wire details.
2. Evenly space pipe guides 10'-0" to 15'-0" apart.
3. Each phase of the group operated switch with insulators and interrupting devices weighs approximately 600 pounds.
4. Switch can be equipped with or without loadbreak interrupting devices.
5. For switch pole grounding, operating rod insulators and ground mat requirement and installation, refer to DCS **10 34 01 01**.
6. The switch operating handle must be grounded to a driven ground rod or a field formed ground electrode, refer to DCS **12 69 11****.
7. If motor operator is required, see Dist. Std. **10 69 10 ****
8. The space may be decreased if distribution conductor is T-2.
9. Arresters are used for normally open switches, or switches with sensor devices which may be susceptible to lightning. The line arrester is suspended from the compressed-on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps. The disconnect coupling assembly detaches the line end of the arrester should the arrester fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis-eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base.

Notes (as suggestion):

1. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
2. The arrester assembly will not work with porcelain deadend bells.
3. If space is limited on the switch pole but available on adjacent pole, install the arresters on the adjacent pole.
10. Install padlock on handle to prevent switch operation by the public.
11. Train phase conductor thru DE clamp and terminate with compression lug to attach to switch terminal.
12. Where to mount switch's number plate is based on your local description.
13. For maintaining 8ft spacing, the interrupter must be side mount to the insulator as shown from the standards; otherwise the spacing has to be 10ft for stacked mount of the interrupter, as page 4 shown. We are no longer purchase the stacked mount interrupter but still maintaining. The stacked mount interrupter can be replaced with the side mount interrupter.

**Note 13. If Interrupter is stacked on the insulator,
the spacing must be 10 ft in between phases.**



FUSES AND SWITCHES
69kV Side Break Switch
Triangular Configuration

10 69 05 **

Sheet 5 of 5

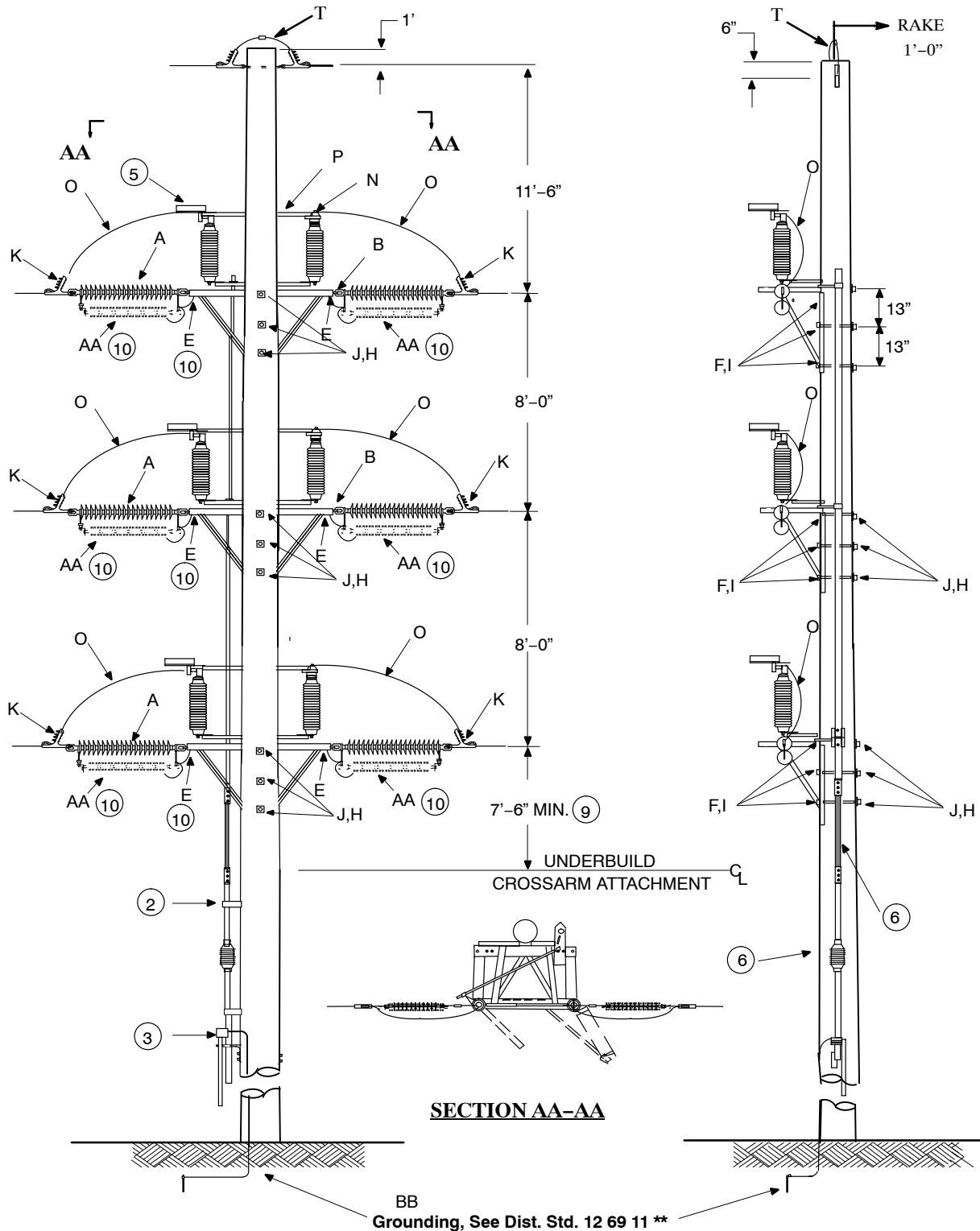
		Std. / Stk. No.	Description	10 69 05 **	01	02	03	04
@		Contact Dist. Engr.	Composite or Steel Pole		1	1	1	1
	A	25 06 113	Insulator, Polymer, Suspension, Wye Clevis- Oval Eye, 42"L (nominal)		6	6	6	6
	B	23 68 440	Shackle, Anchor, 3/4" Pin, 1-1/16" opening, Galv.		12	12	12	12
9@	E	17 51 032	Clamp, Parallel Groove, #6AWG-1/0 AWG AL		6	6	6	6
@	F	23 52	Bolt, Mach., Galv., 3/4" Sq. Head/Sq. Nut, length as required		9	9	9	9
	H	23 65 042	Nut, Lock, MF, Galv., 3/4"		9	9	9	9
	I	23 66 131	Washer, Sq. Flat, Galv., 3/4"		9	9	9	9
	J	23 66 031	Washer, Sq. Curved, Galv., for 3/4" Bolt		11	11	11	11
@	K	DEC*W	Clamp, Deadend (wire type and size required), DCS 07 00 17 00		6	6	6	6
	N	CL*W	Lug, Compr. Terminal, AL, DCS 07 00 30 00		12	12	12	12
11@	O	LW&W	Wire, Bare, DCS 07 00 01 01		As Req.	As Req.	As Req.	As Req.
6	P	54 09 395	Turner CS2 Switch, 69kV, 1200 Amp., Pole Mounted, Side Break w/Interrupter		1			
		54 09 393	Turner CS2 Switch, 69kV, 1200 Amp., Pole Mounted, Side Break w/o Interrupter			1		
		54 09 035	SEECO Switch, 69kV, 1200 Amp., Pole Mounted, Side Break w/Interrupter				1	
		54 09 369	SEECO Switch, 69kV, 1200 Amp., Pole Mounted, Side Break w/o Interrupter					1
	Q	22 13 099	Lock, Switch, 7/8" vertical opening		1	1	1	1
12	R	16 01 229	Plate, Number & Caution Sign, Alum.		1	1	1	1
	T	06 00 11 09	Deadend Looparound, Static Wire		1	1	1	1
9@	AA	10 01 236	Arrester, Line Protection, 60kV Rated, 48kV MCOV		6	6	6	6
@	BB	12 69 11**	Grounding Unit		1	1	1	1

FUSES AND SWITCHES
69kV Side Break Switch
Vertical Configuration

10 69 07 **

Sheet 1 of 5

Turner Switch 69kV 1200A Load Interrupters 10 69 07 01
Turner Switch 69kV 1200A without Load Interrupters 10 69 07 02



FUSES AND SWITCHES

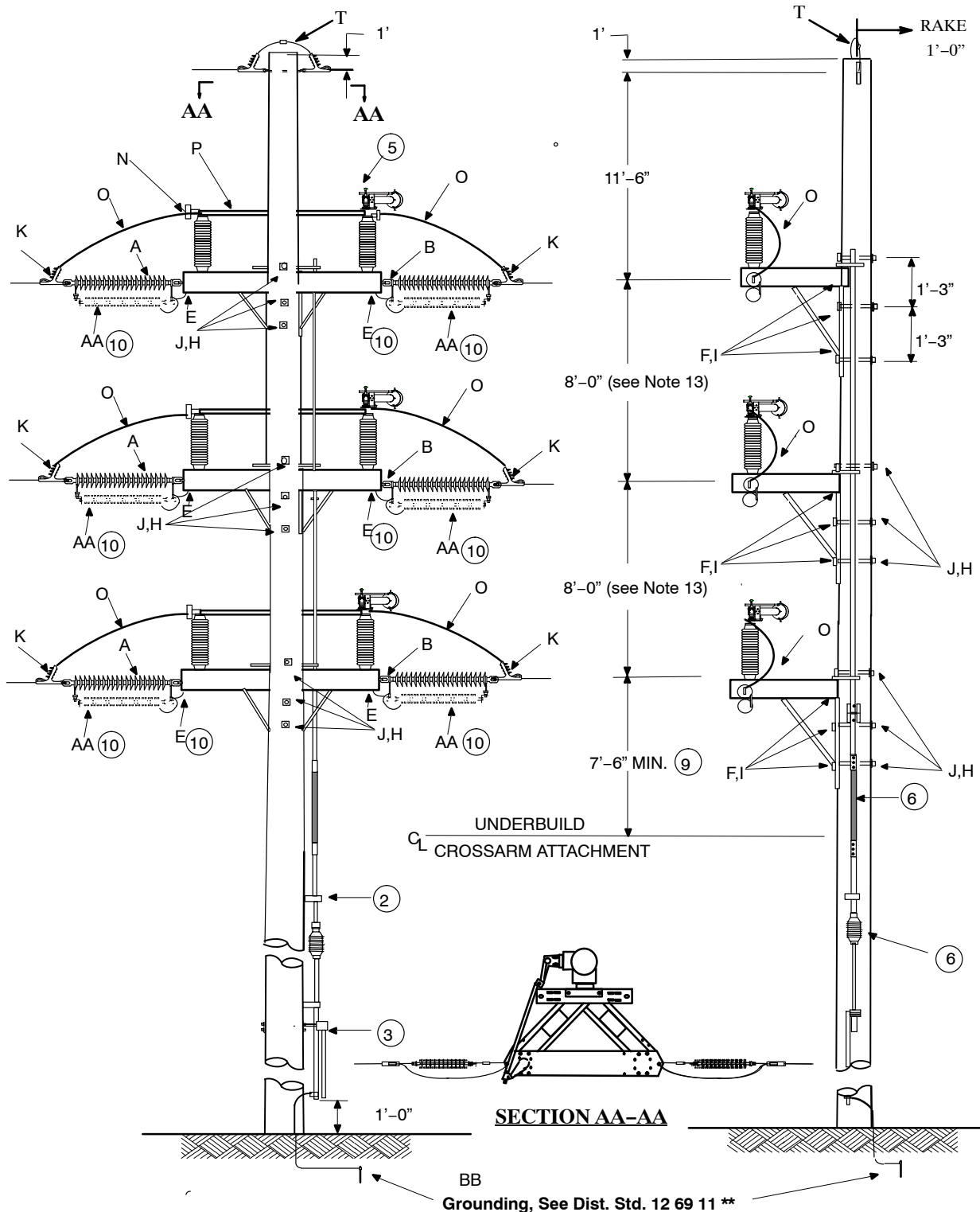
69kV Side Break Switch

Vertical Configuration

10 69 07 **

Sheet 2 of 5

SEECO Switch 69kV 1200A Loadbreak Interrupters 10 69 07 03
SEECO Switch 69kV 1200A without Loadbreak Interrupters 10 69 07 04



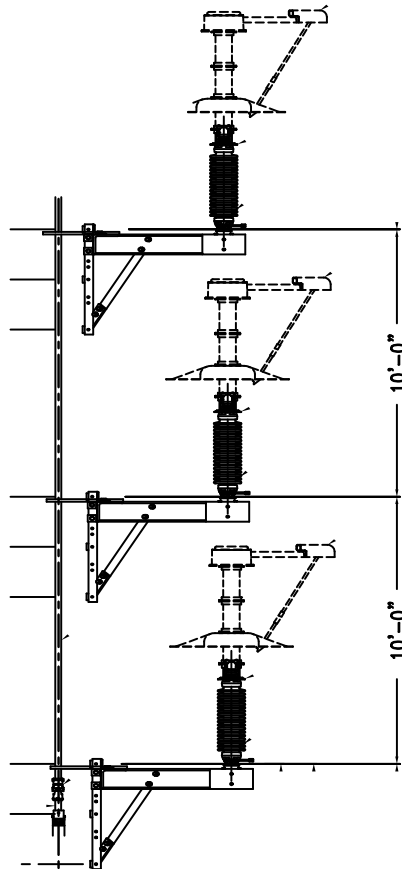
NOTES

1. See DCS **06 00 11**** for shield wire details.
2. Evenly space pipe guides 10'-0" to 15'-0" apart.
3. Install padlock on handle to prevent switch operation by the public.
4. Each phase of the group operated switch with insulators and interrupting devices weighs approximately 600 pounds.
5. Switch can be equipped with or without loadbreak interrupting devices.
6. For switch pole grounding, operating rod insulators and ground mat requirement and installation, refer to DCS **10 34 01 01**.
7. The switch operating handle must be grounded to a driven ground rod or a field formed ground electrode. Refer to DCS **12 69 11****.
8. If motor operator is required, refer to DCS **10 69 10 ****
9. The space may be decreased if distribution conductor is T-2.
10. Arresters are used for normally open switches, or switches with sensor devices which may be susceptible to lightning. The line arrester is suspended from the compressed-on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps. The disconnect coupling assembly detaches the line end of the arrester should the arrester fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis-eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base.

Notes (as suggestion):

1. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
2. The arrester assembly will not work with porcelain deadend bells.
3. If space is limited on the switch pole but available on adjacent pole, install the arresters on the adjacent pole.
11. Train phase conductors thru DE clamp and terminate with compression lugs to attach to switch terminals.
12. Where to mount switch's number plate is based on your local description.
13. For maintaining 8ft spacing, the interrupter must be side mount to the insulator as shown from the standards; otherwise the spacing has to be 10ft for stacked mount of the interrupter, as page 4 shown. We are no longer purchase the stacked mount interrupter but still maintaining. The stacked mount interrupter can be replaced with the side mount interrupter.

**Note 13. If Interrupter is stacked on the insulator,
the spacing must be 10 ft in between phases.**



FUSES AND SWITCHES
69kV Side Break Switch
Vertical Configuration

10 69 07 **

Sheet 5 of 5

		Std. / Stk. No.	Description	10 69 07**	01	02	03	04
		Contact Dist. Eng.	Composite or Steel Pole		1	1	1	1
	A	25 06 113	Insulator, Polymer, Suspension, Wye Clevis-Oval Eye, 42" L (nominal)		6	6	6	6
	B	23 68 440	Shackle, Anchor, 3/4" Pin, 1-1/16" Opening, Galv.		12	12	12	12
10@	E	17 51 032	Clamp, Parallel Groove, #6AWG-1/0 AWG AL		6	6	6	6
@	F	23 52 103	Bolt, Mach., Galv., 3/4" Sq. Head/Sq. Nut, 18" Length		9	9	9	9
	H	23 65 042	Nut, Lock, MF, Galv., 3/4"		9	9	9	9
	I	23 66 131	Washer, Sq. Flat, Galv., 3/4"		9	9	9	9
	J	23 66 031	Washer, Sq. Curved, Galv., for 3/4" Bolt		9	9	9	9
@	K	DEC*W	Clamp, Deadend (wire type and size required), DCS 07 00 17 00		6	6	6	6
@	N	CL*W	Lug, Compr. Terminal, Al., DCS 07 00 30 00		6	6	6	6
11@	O	LW&W	Wire, Bare, DCS 07 00 01 01		As Req.	As Req.	As Req.	As Req.
	P	54 09 394	Turner Switch, CS2 69kV, 1200 Amp., Pole Mounted, Vertical Mount, Side Break w/Interrupter		1			
		54 09 392	Turner Switch, CS2 69kV, 1200 Amp., Pole Mounted, Vertical Mount Side Break w/o Interrupter			1		
		54 09 370	SEECO Switch, 69kV, 1200 Amp., Pole Mounted, Vertical Mount, Side Break w/Interrupter				1	
		54 09 368	SEECO Switch, 69kV, 1200 Amp., Pole Mounted, Vertical Mount, Side Break w/o Interrupter					1
	Q	22 13 099	Lock, Switch, 7/8" Vertical Opening		1	1	1	1
12	R	16 01 229	Plate, Number & Caution Sign, Alum.		1	1	1	1
	T	06 00 11 09	Deadend - Looparound, Static Wire		1	1	1	1
10@	AA	10 01 236	Arrester, Line Protection, 60kV Rated, 48kV MCOV		6	6	6	6
	BB	12 69 11 **	Grounding Unit		1	1	1	1

FUSES AND SWITCHES

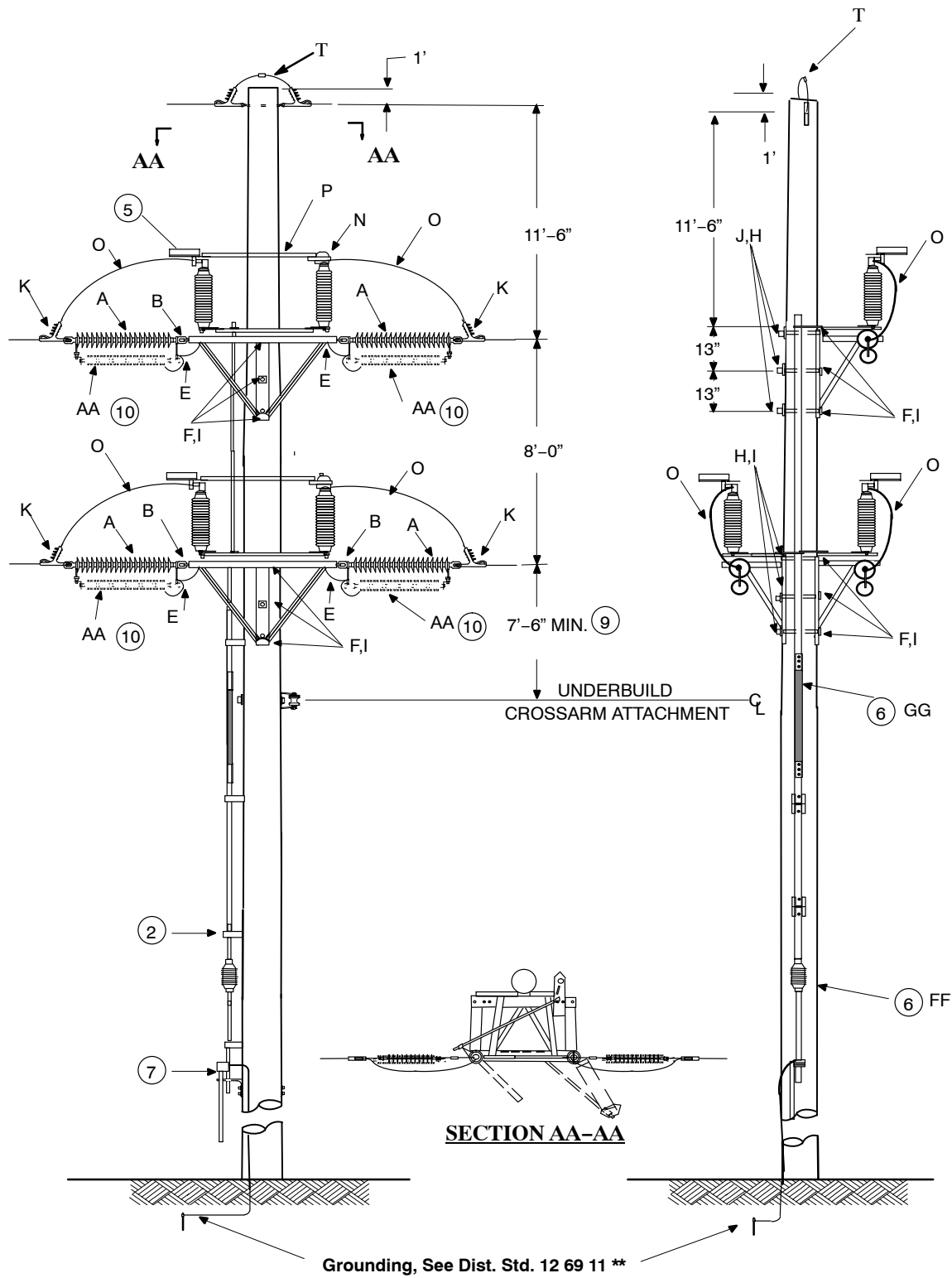
69kV Side Break Switch

Delta Configuration

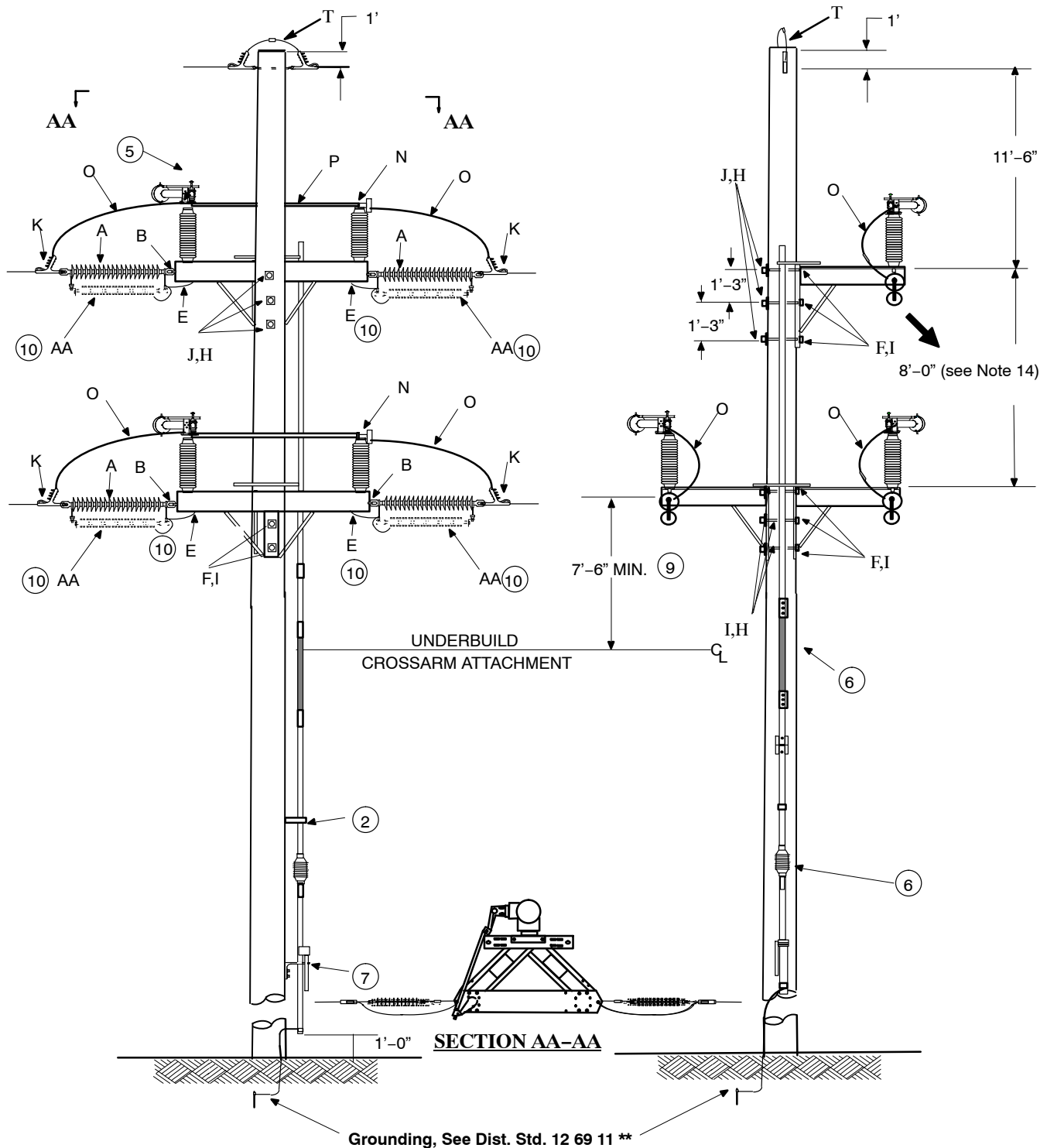
10 69 09 **

Sheet 1 of 5

Turner 69kV – 1200 Amp – Load Interrupter 10 69 09 01
Turner 69kV – 1200 Amp – without Load Interrupter 10 69 09 02



SEECO 69kV – 1200 Amp – Load Interrupters 10 69 09 03
SEECO 69kV – 1200 Amp – without Load Interrupters 10 69 09 04



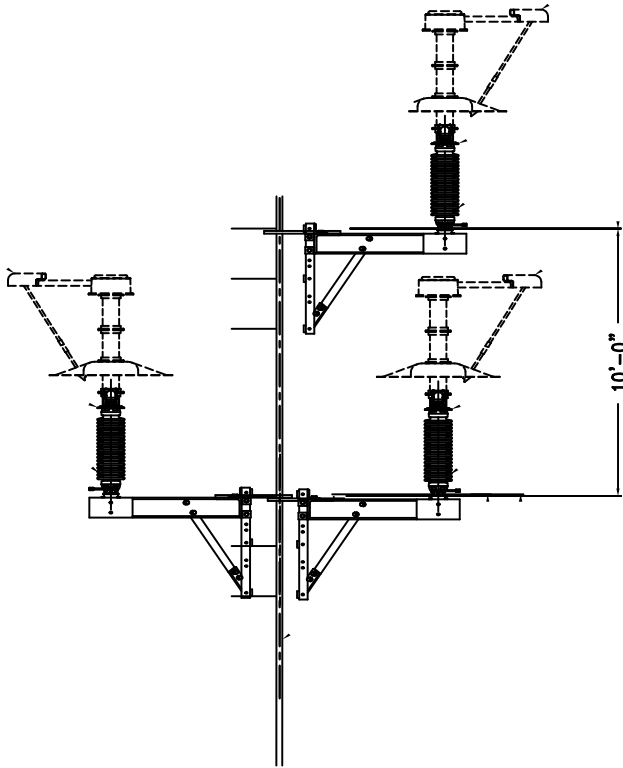
NOTES

1. Refer to DCS **06 00 11**** for shield wire details.
2. Evenly space pipe guides 10'-0" to 15'-0" apart.
3. Install padlock on handle to prevent switch operation by the public.
4. Each phase of the group operated switch with insulators and interrupting devices weighs approximately 600 pounds.
5. Switch can be equipped with or without loadbreak interrupting devices.
6. For switch pole grounding, operating rod insulators and ground mat requirement and installation, refer to DCS **10 34 01 01**.
7. The switch operating handle must be grounded to a driven ground rod or a field formed ground electrode, refer to **12 69 11****.
8. If motor operator is required, refer to DCS **10 69 10 ****.
9. The space may be decreased if distribution conductor is T-2.
10. Arresters are used for normally open switches, or switches with sensor devices which may be susceptible to lightning. The line arrester is suspended from the compressed-on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps. The disconnect coupling assembly detaches the line end of the arrester should the arrester fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis-eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base.

Notes (as suggestion):

1. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
2. The arrester assembly will not work with porcelain deadend bells.
3. If space is limited on the switch pole but available on adjacent pole, install the arresters on the adjacent pole.
11. Install padlock on handle to prevent switch operation by the public.
12. Train phase conductor thru DE clamp and terminate with compression lug to attach to switch terminal.
13. Where to mount switch's number plate is based on your local description.
14. For maintaining 8ft spacing, the interrupter must be side mount to the insulator as shown from the standards; otherwise the spacing has to be 10ft for stacked mount of the interrupter, as page 4 shown. We are no longer purchase the stacked mount interrupter but still maintaining. The stacked mount interrupter can be replaced with the side mount interrupter.

➔ **Note 14. If Interrupter is stacked on the insulator,
the spacing must be 10 ft in between phases.**



FUSES AND SWITCHES
69kV Side Break Switch
Delta Configuration

10 69 09 **

Sheet 5 of 5

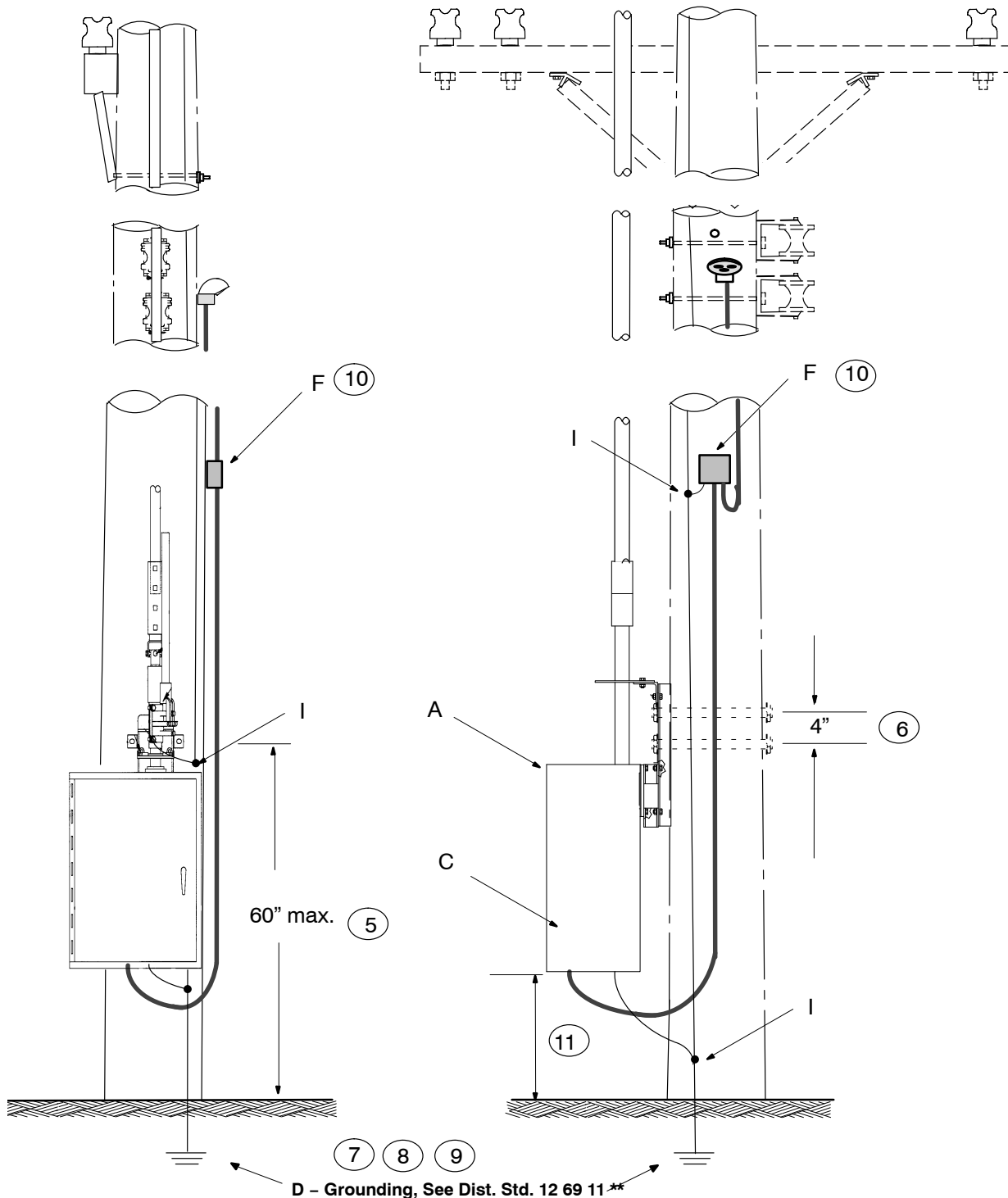
		Std. / Stk. No.	Description	10 69 09 **	01	02	03	04
@		Contact Dist. Engr.	Composite or Steel Pole		1	1	1	1
10@	A	25 06 113	Insulator, Polymer, Suspension, Wye Clevis-Oval Eye, 42" Long (nominal)		6	6	6	6
	B	23 68 440	Shackle, Anchor, 3/4" Pin, 1 1/16" opening, Galv.		12	12	12	12
	E	17 51 032	Clamp, Parallel Groove, #6AWG-1/0 AWG AL		6	6	6	6
	F	23 52 103	Bolt, Mach., Galv., 3/4" Sq. Head/Sq. Nut, 18" length		6	6	6	6
	H	23 65 042	Nut, Lock, MF, Galv., 3/4"		6	6	6	6
	I	23 66 131	Washer, Sq. Flat, Galv., 3/4"		9	9	9	9
	J	23 66 031	Washer, Sq. Curved, Galv., for 3/4" Bolt, 3"-3"		3	3	3	3
@	K	DEC*W	Clamp, Deadend (wire typed and size required), DCS 07 00 17 00		6	6	6	6
@	N	CL*W	Lug, Compr. Terminal, Al.. DCS 07 00 30 00		12	12	12	12
12@	O	LW&W	Wire, Bare, DCS 07 00 01 01		As Req.	As Req.	As Req.	As Req.
	P	54 09 395	Turner CS2 Switch, 69kV, 1200 Amp., Pole Mounted, Delta Mount, Side Break w/Interrupters		1			
		54 09 393	Turner CS2 Switch, 69kV, 1200 Amp., Pole Mounted, Delta Mount, Side Break w/o Interrupters			1		
		54 09 035	SEECO Switch, 69kV, 1200 Amp., Pole Mounted, Delta Mount, Side Mount w/Interrupters				1	
		54 09 369	SEECO Switch, 69kV, 1200 Amp., Pole Mounted, Delta Mount, w/o Interrupters					1
13	Q	22 13 099	Lock, Switch, 7/8" Vertical Opening		1	1	1	1
	R	16 01 229	Plate, Number & Caution Sign, Alum.		1	1	1	1
	T	06 00 11 09	Deadend - Looparound, Static Wire		1	1	1	1
10@	AA	10 01 236	Arrester, Line Protection, 60kV Rated, 48kV MCOV		6	6	6	6
	BB	12 69 11**	Grounding Unit		1	1	1	1

See Dist. Std. 10 34 ** ** for 34kV Switch Pole Installation
See Dist. Std. 10 69 ** ** for 69kV Switch Pole Installation



34 & 69kV – 1200 Amp – SEECO Motor Operator

See Dist. Std. 10 34 ** ** for 34kV Switch Pole Installation
See Dist. Std. 10 69 ** ** for 69kV Switch Pole Installation



Notes:

1. Stk no. 54 08 416 for Turner 34kV D Switch – DCS 10 69 10 01 – not for new switch installations
Stk no. 54 08 430 for Turner 34kV TS2 and TSB and Turner 69kV CS2 and CSB Switch – DCS 10 69 10 04
Stk no. 54 09 349 for Turner 69kV D switch –DCS 10 69 10 02 – not for new switch installations
Stk no. 54 09 371 for SEEEO's 34kV & 69kV switches – DCS 10 69 10 03
2. If a motor operator is to be installed on a new or existing switch, the switch should be completely and properly adjusted and operating satisfactorily prior to motor operator installation. If the motor operator is to be mounted on an existing switch, proper maintenance should be performed. (In Illinois, contact Distribution Automation to schedule adjustment and commissioning of motor operator and RTU.)
3. Pull fuses and/or open knife switches to disconnect power to the motor operator before working inside cabinet to avoid hazard of electric shock.
4. Use the aluminum support channel for lifting the motor operator.
5. Locate the required mounting heights for the motor operator. This would normally be at a height where an operating person can easily access the manual handle. Align operator power shaft with switch vertical operating pipe, with a level. Mount the motor operator securely to the switch structure or pole with through bolts and lag screws.
6. Each supplier of motor operator requires different mounting; see details of motor operator installation furnished with each motor operator.
7. If motor operator is mounted on wood pole:
 - a. A #2 cu pole ground wire is required for grounding of motor operator cabinet, static wire, circuit breaker box and switch handle.
 - b. Operating rod insulators between circuits are required, See DCS 10 34 01 01.
 - c. A ground mat is required, See DCS 12 69 11 01.
 - d. The motor operator cabinet and switch operating handle must be grounded to the driven ground rod or a field formed ground electrode with a #2 cu wire, See 12 69 11**.
8. If motor operator is mounted on steel pole:
 - a. A pole ground wire is not required but there must be provisions (Rivnuts) for grounding a shield wire, a primary system neutral (if present), a motor operator cabinet, circuit breaker box and the base of the pole.
 - b. The motor operator cabinet must be grounded to the pole ground wire.
 - c. Operating rod insulators, TR-210 porcelain operating rod insulator, stock #25 09 045 and 8 ft. fiberglass insulator, stock #54 08 324 shall be eliminated on a steel pole which come with the switch, and both items should be put back in the stock with stock # as assigned.
 - d. The operating handle shall be grounded to a driven ground rod or a field formed ground electrode with a #2 cu.
 - e. A ground mat is required. See DCS 12 69 11 02.
9. If motor operator is mounted on composite pole:
 - a. The #2 cu pole ground wire comes with the pole must be bonded to the grounding electrode at the base of the pole, motor operator, circuit breaker box and shield wire, and a primary system neutral (if present).
 - b. Operating rod insulators between circuits are required, See DCS 10 34 01 01.
 - c. The operating handle shall be grounded to a driven ground rod or a field formed ground electrode with a #2 cu wire.
 - d. A ground mat is required. See DCS 12 69 11 03.
10. Attach secondary breaker box to pole and route black, white and green wires in 10' of ½" liquid-tight conduit to controller and route black and white wires in 20' of ¾" liquid-tight conduit to the weatherhead.
11. If the bottom of cabinet is mounted at 12" or less above ground line, a protective barrier should be considered by spreading some rocks under the cabinet and around pole to prevent physical damage from mowing equipment.
12. If antenna installation is required in supply space, see 25 90 00 00 for clearance requirement. If antenna installation is required in communications zone, see 29 00 17 11 for clearance requirement.

FUSES AND SWITCHES

Motor Operator

10 69 10 **

Sheet 4 of 4

		Std. / Stk. No.	Description	10 69 10 **	01	02	03	04
1 @ 7,8,9@	A	54 08 416	Motor Operator for Turner D 34kV Switch	1				
		54 08 430	Motor Op. for Turner TSB or TS2 34kV and 69kV Switch					1
		54 09 349	Motor Operator for Turner D 69kV Switch		1			
		54 09 371	Motor Operator for SEECO 34kV or 69kV Switch				1	
	C	54 02 011	GE iBox	1	1	1	1	1
		54 02 031	NovaTech Orion	1	1	1	1	1
	D	12 69 11 **	Grounding Unit	1	1	1	1	1
	F	54 17 486	Circuit Breaker Box, 120V, 15A w/10' of 1/2" and 20' of 3/4" Liquidtight Conduit	1	1	1	1	1
	G	23 52 070	Bolt, Mach., 5/8" x 20"	2	2	2	2	2
	H	23 66 027	Washer, Flat, 5/8"	2	2	2	2	2
	I	17 54 373	Connector, Split Bolt, Bronze (range #14str – #2str)	3	3	3	3	3

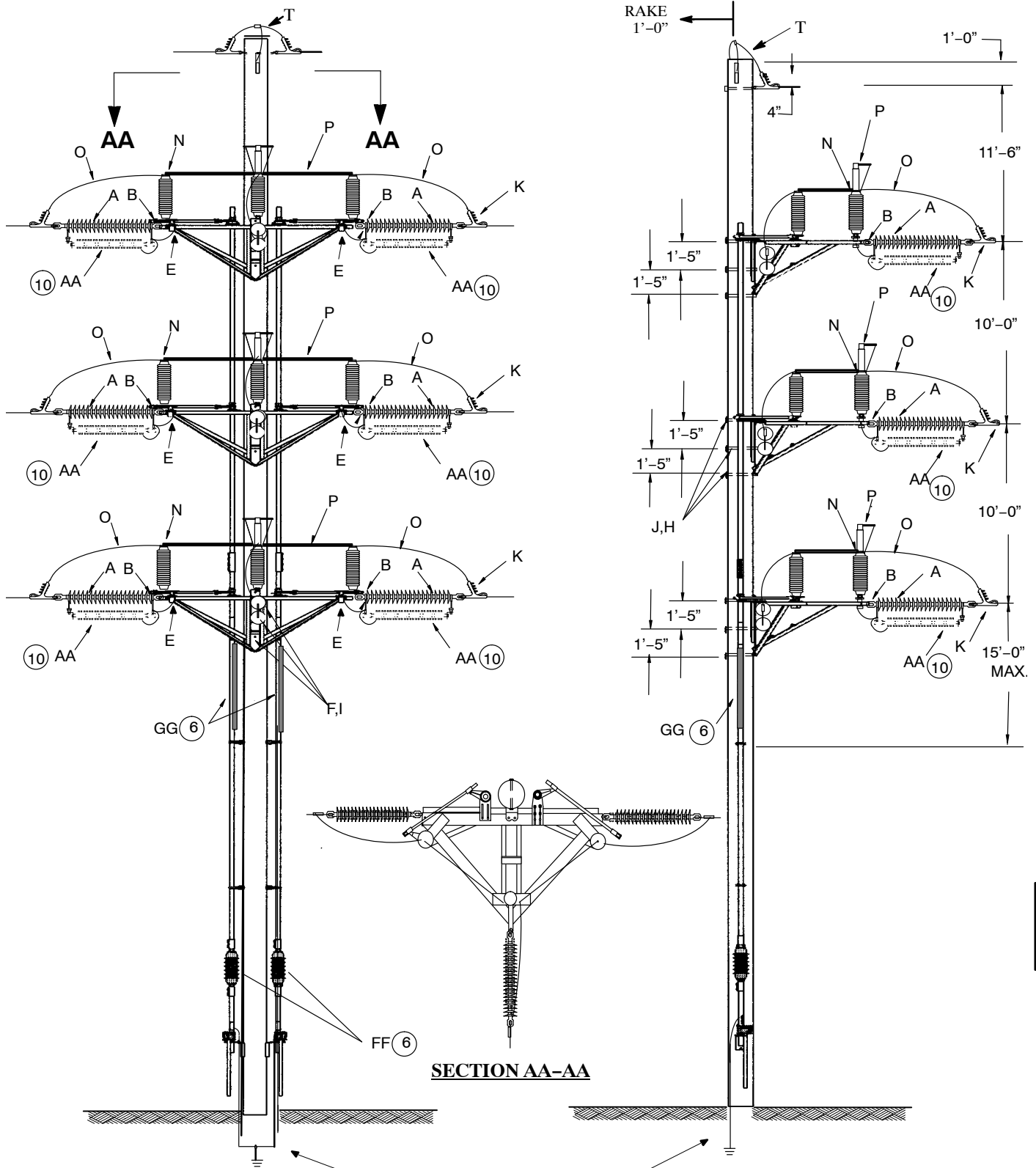
FUSES AND SWITCHES

69kV Side Break Switch

2-Way Phase Over Phase Mounting

10 69 20 **
Sheet 1 of 4

Turner 69kV – 1200 Amp – Loadbreak Interrupters 10 69 20 01
Turner 69kV – 1200 Amp – without Loadbreak Interrupters 10 69 20 02



Grounding, See Dist. Std. 12 69 11 **

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
REV. NO: 3
REV. DATE: 06/30/16

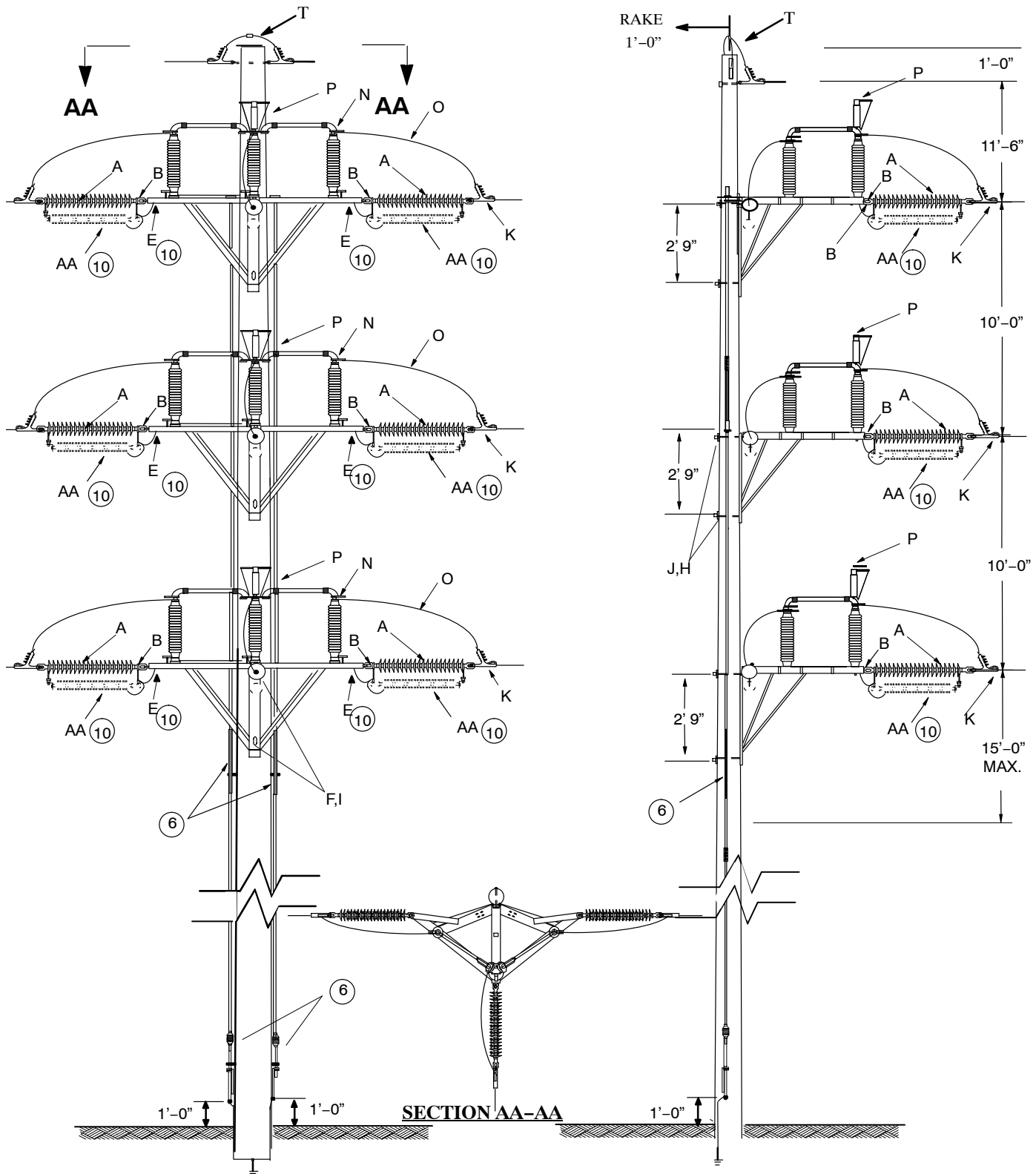
FUSES AND SWITCHES

69kV Side Break Switch

2-Way Phase Over Phase Mounting

10 69 20 **
Sheet 2 of 4

SEECO Switch 69kV – 1200 Amp – Loadbreak Interrupters 10 69 20 03
SEECO Switch 69kV – 1200 Amp – without Loadbreak Interrupters 10 69 20 04



Grounding, See Dist. Std. 12 69 11 **

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
REV. NO: 3
REV. DATE: 06/30/16

FUSES AND SWITCHES
69kV Side Break Switch
2-Way Phase Over Phase Mounting

10 69 20 **
Sheet 3 of 4

		Std. / Stk. No.	Description	10 69 05 **	01	02	03	04
@		Contact Dist. Eng.	Composite or Steel Pole		1	1	1	1
	A	25 06 113	Insulator, Polymer, Suspension, Wye Clevis- Oval Eye, 42"L (nominal)		9	9	9	9
	B	23 68 440	Shackle, Anchor, 3/4" Pin, 1-1/16" opening, Galv.		18	18	18	18
10@	E	17 51 032	Clamp, Parallel Groove, #6AWG-1/0 AWG AL		6	6	6	6
	F	23 52 103	Bolt, Mach., Galv., 3/4" Sq. Head/Sq. Nut, 18" Length		9	9	9	9
	H	23 65 042	Nut, Lock, MF, Galv., 3/4"		9	9	9	9
	I	23 66 131	Washer, Sq. Flat, Galv., 3/4"		9	9	9	9
	J	23 66 031	Washer, Sq. Curved, Galv., for 3/4" Bolt		9	9	9	9
@	K	DEC*W	Clamp, Deadend (wire type and size required)		9	9	9	9
	N	CL*W	Lug, Compr. Terminal, AL, DCS 07 00 30 00		12	12	12	12
11@	O	LW *W	Wire, Bare, DCS 07 00 01 01		As Req.	As Req.	As Req.	As Req.
	P	Special Order Item	Turner CSB Switch, 69kV, 1200 Amp., LBRK 2-Way		1			
		Special Order Item	Turner CSB Switch, 69kV, 1200 Amp., Non LBRK 2-Way			1		
		Special Order Item	SEECO Switch, 69kV, 1200 Amp., LBRK 2-Way				1	
		Special Order Item	SEECO Switch, 69kV, 1200 Amp., Non LBRK 2-Way					1
	Q	22 13 099	Lock, Switch, 7/8" vertical opening		3	3	3	3
9	R	16 01 229	Plate, Number & Caution Sign, Alum.		3	3	3	3
10@	AA	10 01 236	Arrester, Line Protection, 60kV Rated, 48kV MCOV		As Req.	As Req.	As Req.	As Req.
@	T	06 00 11 **	Deadend - Looparound, Static Wire		1	1	1	1
@	AAA	12 69 11 **	Grounding Unit		1	1	1	1

FUSES AND SWITCHES
69kV Side Break Switch
2-Way Phase Over Phase Mounting

10 69 20 **
Sheet 4 of 4

NOTES:

1. See Dist. Std. **06 00 11**** for shield wire details
2. Evenly space pipe guides 10'-0" to 15'-0" apart
3. Refer to DCS **12 69 11 **** for grounding switch pole. The switch handle must be grounded to a driven ground rod or a field formed ground electrode.
4. Switch weight must be considered when determining pole class. Each switch with insulators and interrupting devices weights approximately 2109 Pounds.
5. Switch can be equipped with or without load interrupting devices.
6. Switch pole grounding, operating rod insulators and ground mat requirement and installation, refer to DCS **10 34 01 01**.
7. If motor operator is to be installed, See Dist. Std. **10 00 01 01** & **10 69 10 ****.
8. The space shall be increased 7'-6" when distribution conductor is not T-2.
9. Where to mount switch's number plate is based on your local description
10. Arresters are used for normally open switches, or switches with sensor devices which may be susceptible to lightning. The line arrester is suspended from the compressed-on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps. The disconnect coupling assembly detaches the line end of the arrester should the arrester fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis-eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base.

Notes (as suggestion):

1. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
2. The arrester assembly will not work with porcelain deadend bells.
3. If space is limited on the switch pole but available on adjacent pole, install the arresters on the adjacent pole.
11. Train phase conductors thru DE clamp and terminate with compression lugs to attach to switch terminals.
12. If pull offs from switch frame other than 0°, 90°, or 180°, precaution must be taken to avoid torque to the switch frame out of alignment.
13. The operating rod insulator (8 ft. interphase fiberglass insulator for isolating 69 kV from underbuilt circuits and one TR210 porcelain station post insulators for isolating underbuilt circuits from the switch operating handle) can be eliminated for a steel pole.

FUSES AND SWITCHES

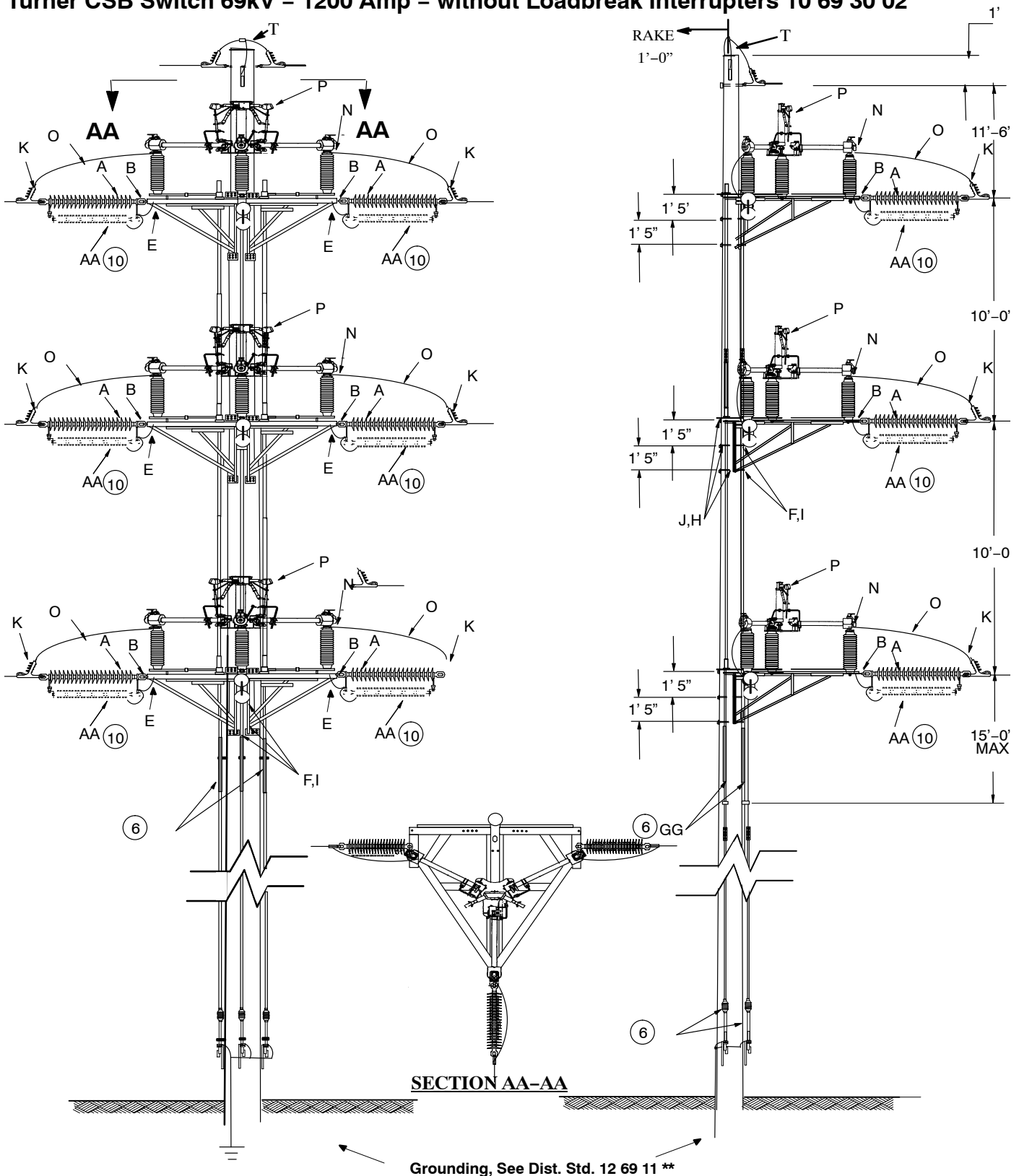
69kV Side Break Switch

10 69 30 **

Sheet 1 of 4

3-Way Phase Over Phase Mounting

Turner CSB Switch 69kV - 1200 Amp - Loadbreak Interrupters 10 69 30 01
Turner CSB Switch 69kV - 1200 Amp - without Loadbreak Interrupters 10 69 30 02



DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: WYW
REV. NO: 3
REV. DATE: 06/30/16

Sheet 2 of 4

ENG: WYW
REV. NO: 3
REV. DATE: 06/30/16

3-Way Phase Over Phase Mounting

NOTES:

1. See DCS **06 00 11**** for shield wire details
2. Evenly space pipe guides 10'-0" to 15'-0" apart
3. Refer to DCS **12 69 11**** for grounding switch structure. The switch handle must be grounded to a driven ground rod or a field formed ground electrode.
4. Switch weight must be considered when determining pole class. Each switch with insulators and interrupting devices weights approximately 2109 Pounds.
5. Switch can be equipped with or without loadbreak interrupting devices.
6. Switch pole grounding, operating rod insulators and ground mat requirement and installation, refer to DCS **10 34 01 01**.
7. If motor operator is required, See DCS **10 00 01 01** & **10 69 10 ****.
8. The space shall be increased 7'-6" when distribution conductor is not T-2.
9. Where to mount switch's number plate is based on your local description.
10. Arresters are used for normally open switches, or switches with sensor devices which may be susceptible to lightning. The line arrester is suspended from the compressed-on end fittings of the polymer deadend insulator and supported by aluminum hot line clamps. The disconnect coupling assembly detaches the line end of the arrester should the arrester fail and will cause the arrester to pivot and drop down into a vertical position which makes the failed arrester much more visible. The disconnect coupling assembly with a 3/8" threaded stud that can be inserted into the tap lead eyebolt of the hot line clamp on the line end and an eyebolt with 3/8" stud that can be inserted into the tap lead eyebolt of the hot line clamp on the ground end. One of the tinned copper leads (on the left (pole end) of the assembly) is to shunt the clevis-eye connection to eliminate radio noise. The longer tinned copper lead is for connection to a pole ground wire or a metal switch based with line clamp (stk no. 23 78 394) connected the line end on a stainless bolt (stk no. 21 56 433, 21 75 106 (hex nut), and 21 61 142 (washer)), which is bolted on the switch base.

Notes (as suggestion):

1. Use some Loctite on the threads of the 3/8" bolts to keep bolts from coming loose and also use a 3/8" carriage head bolt through the hot line clamp eyebolt which would keep the assembly from falling if the hot line clamp tap lead eyebolt should loosen.
2. The arrester assembly will not work with porcelain deadend bells.
3. If space is limited on the switch pole but available on adjacent pole, install the arresters on the adjacent pole.
11. Train phase conductors thru DE clamp and terminate with compression lugs to attach to switch terminals.
12. If pull offs are from switch frame other than 0°, 90°, or 180°, precaution must be taken to avoid torque to the switch frame out of alignment.
13. The operating rod insulator (8 ft. interphase fiberglass for isolating 69 kV underbuilt circuits and one TR210 porcelain station post insulators for isolating underbuilt circuit from the switch operating handle) can be eliminated for a steel pole.

FUSES AND SWITCHES

69kV Side Break Switch

10 69 30 **

Sheet 4 of 4

3-Way Phase Over Phase Mounting

		Std. / Stk. No.	Description	10 69 05 **	01	02	03	04
		Contact Dist. Eng.	Composite or Steel Pole		1	1	1	1
	A	25 06 113	Insulator, Polymer, Suspension, Wye Clevis- Oval Eye, 42"L (nominal)		9	9	9	9
	B	23 68 440	Shackle, Anchor, 3/4" Pin, 1-1/16" opening, Galv.		18	18	18	18
10@	E	17 51 032	Clamp, Parallel Groove, #6AWG-1/0 AWG AL		6	6	6	6
@	F	23 52	Bolt, Mach., Galv., 3/4" Sq. Head/Sq. Nut, length as required		9	9	9	9
	H	23 65 042	Nut, Lock, MF, Galv., 3/4"		9	9	9	9
	I	23 66 131	Washer, Sq. Flat, Galv., 3/4"		9	9	9	9
	J	23 66 031	Washer, Sq. Curved, Galv., for 3/4" Bolt		11	11	11	11
@	K	DEC*W	Clamp, Deadend (wire type and size required)		9	9	9	9
@	N	CL*W	Lug, Compr. Terminal, AL, DCS 07 00 30 00		12	12	12	12
11@	O	LW *W	Wire, Bare, DCS 07 00 01 01		As Req.	As Req.	As Req.	As Req.
	P	Special Order Item	Turner CSB Switch, 69kV, 1200 Amp., LBRK 3-Way		1			
		Special Order Item	Turner CSB Switch, 69kV, 1200 Amp., Non LBRK 3-Way			1		
		Special Order Item	SEECO Switch, 69kV, 1200 Amp., LBRK 3-Way				1	
		Special Order Item	SEECO Switch, 69kV, 1200 Amp., Non LBRK 3-Way					1
	Q	22 13 099	Lock, Switch, 7/8" vertical opening		3	3	3	3
9	R	16 01 229	Plate, Number & Caution Sign, Alum.		3	3	3	3
@	T	06 00 11 **	Deadend - Loop around, Static Wire		1	1	1	1
10	AA	10 01 236	Arrester, Line Protection, 60kV Rated, 48kV MCOV		As Req.	As Req.	As Req.	As Req.
	BB	12 69 11**	Grounding Unit		1	1	1	1
			Number Switch		3	3	3	3

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1. GENERAL

Guys are used to sustain unbalanced forces imposed on a structure at corners, angles, deadends, large differences in span lengths, and changes of grade of construction. Guys shall be considered as taking the entire load in the direction in which they act, with the pole or structure acting as a strut only, resisting the vertical component of all forces.

The strength requirements of guy and anchor systems are governed by the National Electric Safety Code which specifies criteria for calculating conductor tensions and imposes overload factors to be used under different circumstances.

Guying is preferable to oversized self sustained poles. Where adequate guying cannot be obtained due to right-of-way or other difficulties, self sustained poles, within their limitations, may be used. Loadings and other details for self sustained poles are covered in Dist. Stds. **02 00 04 02** thru **02 00 04 05**.

2. GUY WIRE & FITTINGS

Three sizes and grades of galvanized steel guy wire are stocked for normal use. The maximum tension and associated fittings for each guy wire is given below in Table 1. The maximum tensions shown are 90 percent of the rated breaking strength, in accordance with the NESC. In Illinois, 1/4" guy wire is not used.

TABLE 1

GUY WIRE			PREFORMED GRIP	AUTOMATIC DEADEND
Stock No.	Size & Grade	Max. Tension (lbs)	Stock No.	Stock No.
27 59 016	1/4" Galv. E.H.S	5,985	23 68 241	23 68 300
27 59 020	3/8" Galv. E.H.S.	13,860	23 68 237	23 68 299
27 59 022	7/16" Galv. E.H.S.	18,720	23 68 238	23 68 301

In general, all guy strand shall be secured to the pole fitting or to guy insulators with preformed guy grips. Automatic Deadends may only be used with galvanized guy wire at the anchor or guy pole. Due to increased cost, there is no need for more than one automatic installed per guy lead.

3. ANCHORS & ANCHOR RODS

Three types of anchors are available for use in the distribution system; power installed screw anchors, expanding anchors and rock anchors.

3.1 Power installed screw anchors are the preferred anchors for use in all soils other than solid rock. Access with a power digger equipped with wrench assembly is required for installation. Two strengths of these anchors are stocked; a 6,000 ft-lb series for use in sandy to hard pan soils, and a 10,000 ft-lb series for use in rockier soils in which the 6,000 ft-lb anchors cannot be installed. Only square shaft anchors shall be used in Illinois for down guys on Sub-Transmission (34.5kV and 69kV).

3.2 Expanding anchors can be installed in most any soil in which an 8" to 12" diameter hole, depending on anchor size, can be augered. Because of the time needed to install these anchors, usage is generally limited to locations not accessible to power equipment.

3.3 Rock anchors are an expanding type anchor which must be installed in at least 12" of solid rock. A 2" or 2-1/4" diameter hole is needed for installation. Rod lengths from 30" to 96" are available to meet site requirements.

Standard sizes, holding strengths and methods of installation for each type of anchor are shown in Dist. Std.

11 00 60 ** thru **11 00 63 ****.

4. USE OF GUY INSULATORS

Guy strain insulators are used to: (1) protect pedestrians and line workers if a guy accidentally contacts supply conductors, (2) minimize the possibility of plant damage which may result in unsafe conditions, and (3) increase the structure BIL and reduce lightning caused outages.

All guys attached to poles supporting energized conductors or equipment shall have a minimum of one guy strain insulator inserted in each guy. EXCEPTION: Stub-pole to anchor guys generally do not require an insulator unless the exposure between the energized pole and the stub-pole cannot be isolated. One insulator typically cannot be located to satisfy all of the following requirements. Additional insulators shall be used as required.

Where multiple guys are required, **the insulators in each guy shall be located so that in case any guy sags down upon another, the insulators will not become ineffective (NESC Rule 215C2).**

DCS **11 00 02 01** demonstrates the general concepts of proper guy strain insulator placement described in this DCS. DCS **11 00 02 02** gives more detailed guidance for guy strain insulator placement for many of Ameren's typical structure configurations.

If necessary, a fiberglass (FG) guy strain insulator may be used to allow a guy to be located in closer proximity to a conductor than would otherwise be allowed. **In no instance, however, shall any conductive portion of the guy or the insulator be located in closer proximity to a conductor than is specified in DCS 11 00 02 03.**

To achieve the requirements from the NESC as described in this DCS, it will often be necessary to link two or more FG guy strain insulators together.

4.1 Distribution

In Missouri, FG or porcelain guy strain insulators may be used in guys associated with circuits 15 kV and below. In Illinois, only FG guy strain insulators shall be used. Insulators shall be installed to meet all of the following placement criteria that apply:

- a) A FG guy strain insulator shall be used at the pole attachment of all anchor or span guys. EXCEPTION: Stub-pole to anchor guys do not require insulators if the span guys are effectively isolated and there are no energized conductors or communication attachments on the stub-pole.
- b) On non-joint use poles, an insulator (or at least 12" of a FG insulator) must be located between primary voltage and secondary voltage (including neutral) supply circuits. This insulator must be located so that:
 - i. It prevents the possibility of voltage transfer between the primary and secondary circuits during normal operation of the guy, and
 - ii. If the guy wire breaks below the insulator, it will fall below all primary voltage supply conductors and above any secondary conductors (including the neutral) as it rests against the pole.
- c) On non-joint use poles, an insulator (or at least 12" of a FG insulator) must be located between the lowest supply conductor (primary, secondary, or neutral) and ground. The insulator must be located so that:
 - i. It prevents the possibility of voltage transfer between the lowest supply conductor and ground during normal operation of the guy, and
 - ii. If the guy wire breaks below the insulator, the insulator falls below the lowest supply conductor and the bottom of the insulator must fall a minimum of 8 ft. above the ground as it rests against the pole.
- d) On joint use poles, in addition to a) and b) above an insulator (or at least 12" of a FG insulator) must be located between the lowest supply conductor (primary, secondary, or neutral) and the highest communication cable. This insulator must be located so that:

- i. Any guy passing within twelve inches (12") of a supply conductor and also passing within twelve inches (12") of a communication cable shall have an insulator located below the lowest supply conductor and above the highest communication cable (NESC Table 235 – 6, Note (1)).
 - ii. It prevents the possibility of voltage transfer between the supply circuits and communication cable during normal operation of the guy, and
 - iii. If the guy wire breaks below the insulator, it will fall below all supply conductors and above any communication cables as it rests against the pole.
- e) On joint use poles, an insulator (or at least 12" of a FG insulator) must be located between the lowest communication cable and ground. The insulator must be located so that:
- i. It prevents the possibility of voltage transfer between the lowest communication cable and ground during normal operation of the guy, and
 - ii. If the guy wire breaks below the insulator, the insulator falls below the lowest communication cable and the bottom of the insulator must fall a minimum of 8 ft. above the ground as it rests against the pole.
- EXCEPTION: This insulator is not required if the communication cables are self-supported fiber-optic (with no metallic messenger).

4.2 Sub Transmission

Guys associated with 34.5kV or 69kV circuits require a FG guy strain insulator be used in place of a porcelain insulator. In addition to the protective role, FG guy strain insulators serve to increase the BIL level of ungrounded structures associated with these circuits. FG guy strain insulators shall be installed to meet all of the following placement criteria that apply in addition to the criteria in section 4.1 of this DCS:

- a) A FG guy strain insulator shall be used at the pole attachment of all anchor or span guys. EXCEPTION: Stub-pole to anchor guys do not require insulators if the span guys are effectively isolated and there are no energized conductors on the stub-pole.
- b) If no underbuilt circuits are present, at least 24" of a FG insulator must be located between the lowest 34.5kV or 69 kV conductor and ground. The insulator must be located so that:
 - i. It prevents the possibility of voltage transfer between the lowest supply conductor and ground during normal operation of the guy, and
 - ii. If the guy wire breaks below the insulator, the insulator falls below the lowest supply conductor and the bottom of the insulator must fall a minimum of 8 ft. above the ground as it rests against the pole.
- c) If an underbuilt circuit is present, at least 24" of a FG insulator shall be located to effectively isolate the lowest 34.5kV or 69kV conductor and the highest distribution underbuilt conductor.

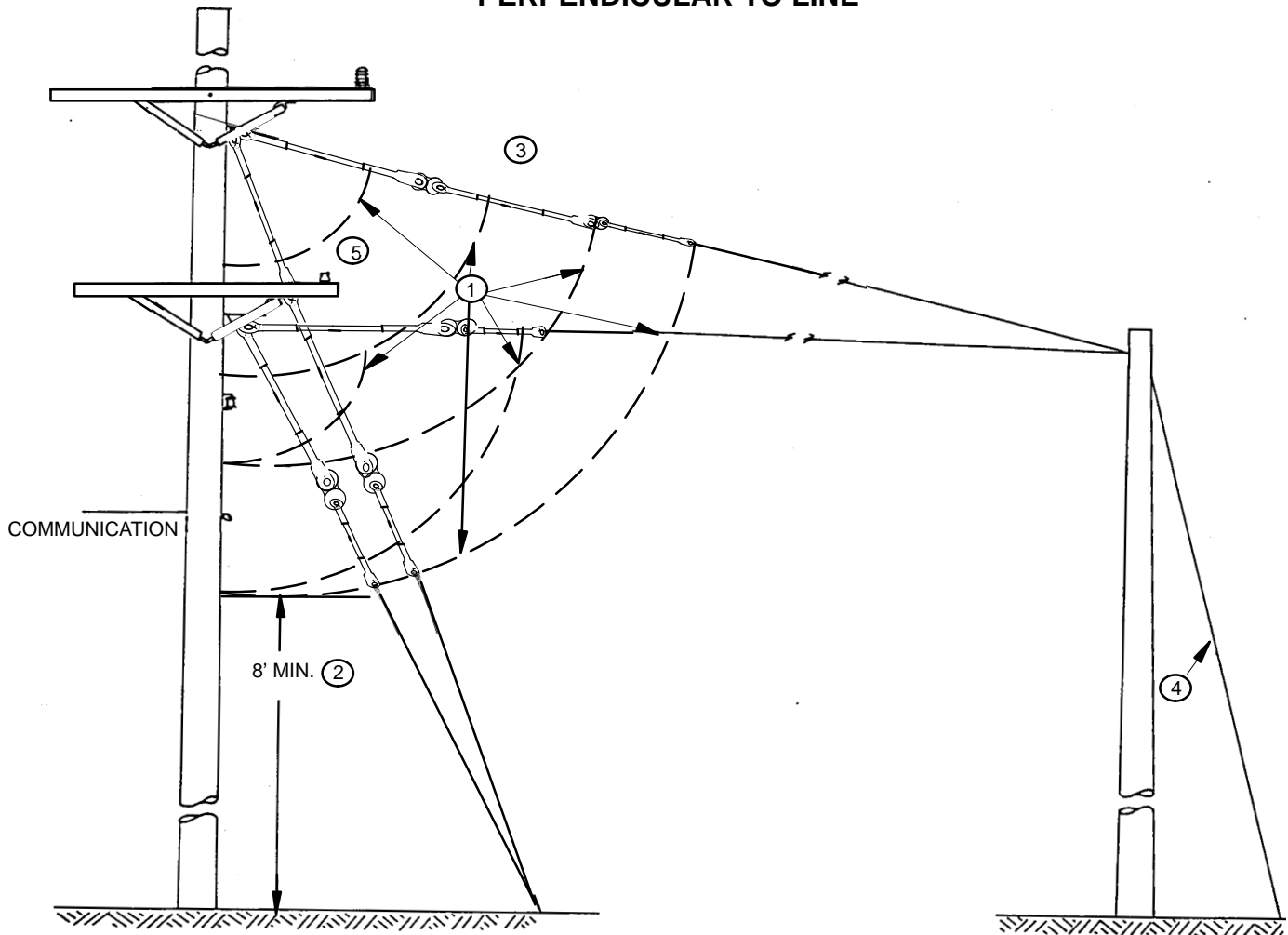
4.3 Span Guys

All of the requirements of sections 4.1 and 4.2 of this DCS also apply to span guys.

5. GUY MARKERS

Guy MARKERS shall be installed on the ground end of all anchor guys. Where two or more guys are attached to the same anchor, only one MARKER is required and shall be installed on the highest guy wire.

PERPENDICULAR TO LINE

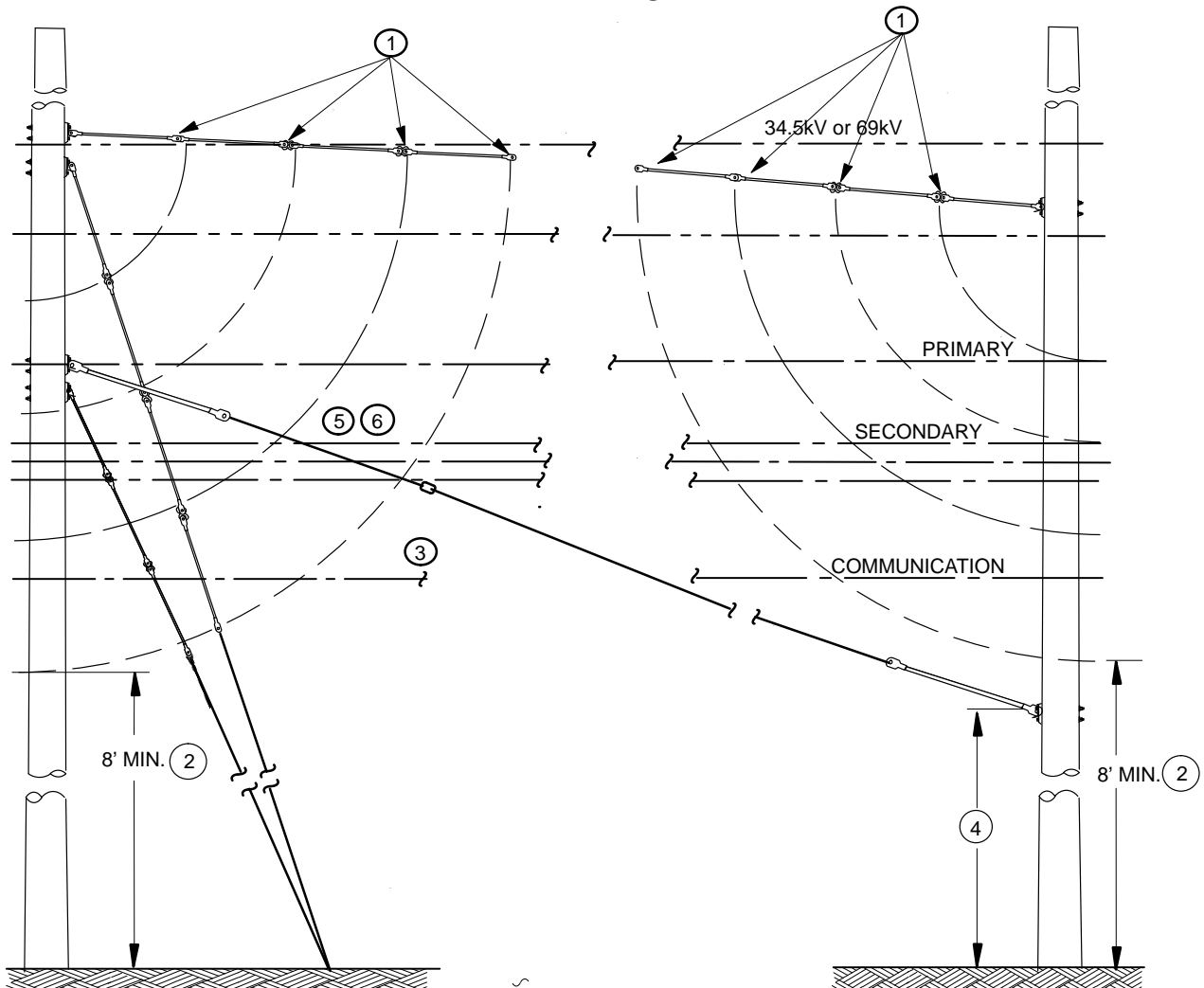


NOTES:

Reference: NESC, 2017 Edition, Rule 215C2

1. Guys must be insulated such that if they break and fall into the pole, insulation will be provided between subtrans mission and primary distribution circuits, between primary and secondary distribution circuits, between secondary distribution and communication circuits, and below the communication circuits. (Note: Guy insulators must fall between all circuits.)
2. The bottom of the lowest insulator must fall a minimum of eight (8) feet above ground level.
3. In Illinois, only fiberglass guy strain insulators shall be used. In Missouri, porcelain guy strain insulators may be used for guys associated with circuits 15kv and below. In both Illinois and Missouri, fiberglass guy strain insulators must be used in all guys associated with 34.5kV and 69kV circuits.
4. Stub pole to anchor guys require no insulator if the span guys attached to the stub pole have been effectively isolated with insulators and there are no other energized conductors on the stub pole.
5. See Dist. Std. 11 00 02 03 for minimum clearances of guys to conductors.

PARALLEL TO LINE



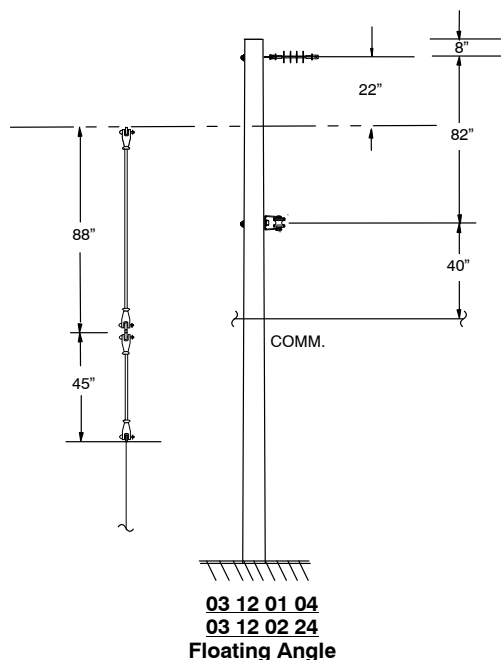
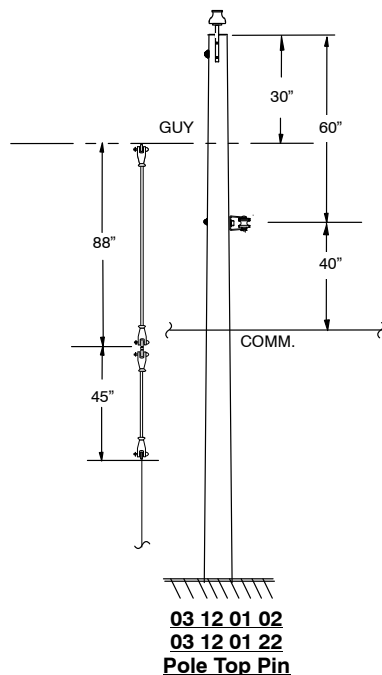
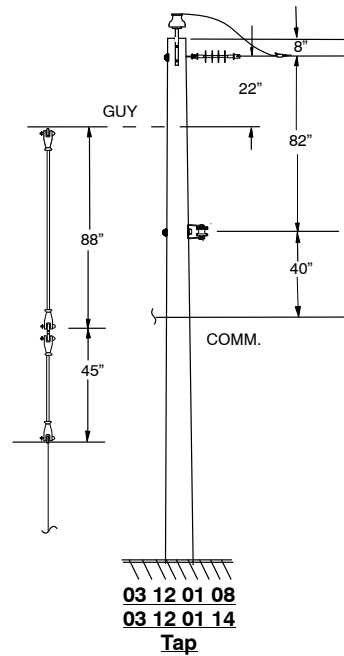
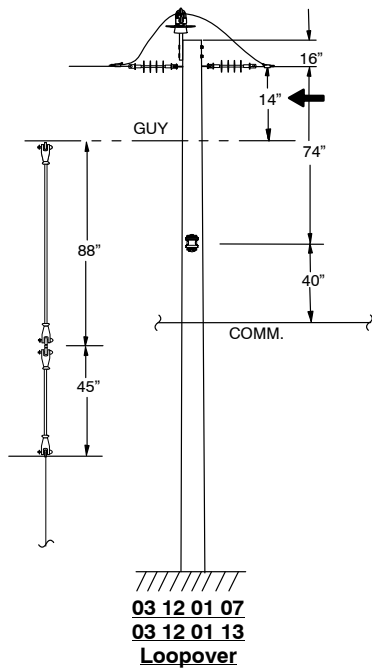
NOTES:

Reference: NESC, 2017 Edition, Rule 215C2

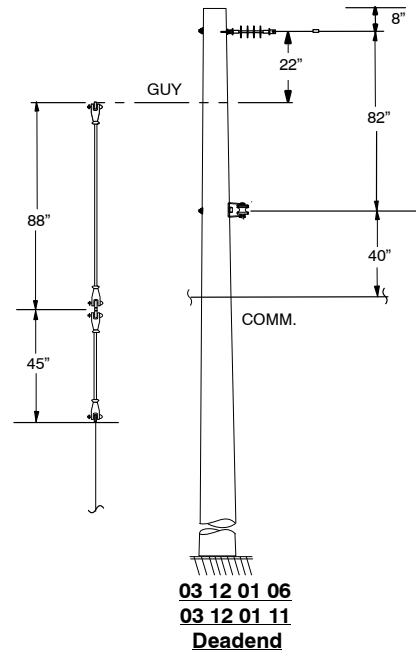
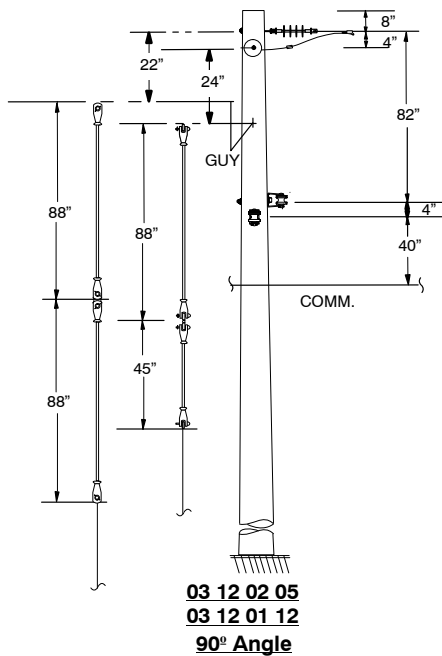
1. Guys must be insulated such that if they break and fall into the pole, insulation will be provided between subtransmission and primary distribution circuits, between primary and secondary distribution circuits, between secondary distribution and communication circuits, and below the communication circuits. (Note: Guy insulators must fall between all circuits.)
2. The bottom of the lowest insulator must fall a minimum of eight (8) feet above ground level.
3. In Illinois, only fiberglass guy strain insulators shall be used. In Missouri, porcelain guy strain insulators may be used for guys associated with circuits 15kv and below. In both Illinois and Missouri, fiberglass guy strain insulators must be used in all guys associated with 34.5kV and 69kV circuits.
4. Guys shall be attached a minimum of twelve (12) feet above ground on a pole, or higher as needed to satisfy mid-span clearance requirements. (This assumes a 45" FG guy insulator to meet the 8' MIN ground level rule.)
5. See Dist. Std. 11 00 02 03 for minimum clearances of guys to conductors.
6. If a span guy passes over or through supply conductors, two (2) insulators shall be used, each satisfying the above requirements.

PURPOSE – The purpose of this standard is to show combinations of FG guy strain insulators that will provide proper guy insulation on many of Ameren’s standard structures. Although only the neutral and one communication attachment is shown these FG guy strain insulator combinations are based on the structure having a single-phase secondary rack and two communication attachments. Note: The guy attachment dimensions in this DCS are presented in inches (instead of feet-inches) for easy comparison to the inches nomenclature used for the FG guy strain insulators.

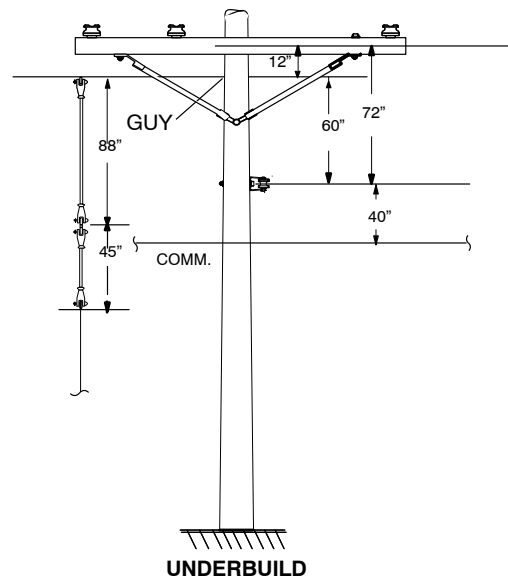
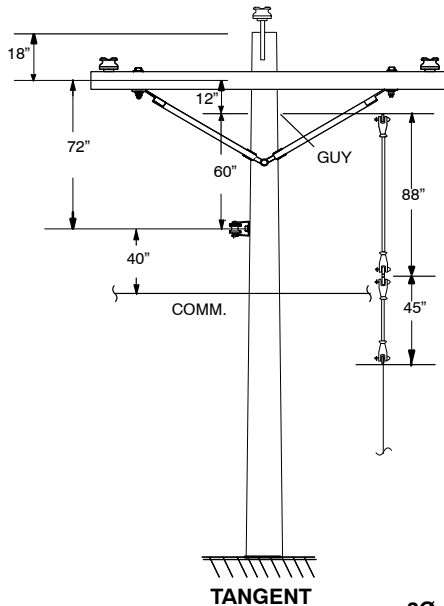
Single Phase – 4 to 15kV



Single Phase – 4 to 15kV



One, Two or Three Phase Angle on Wood Crossarm 4 to 15kV

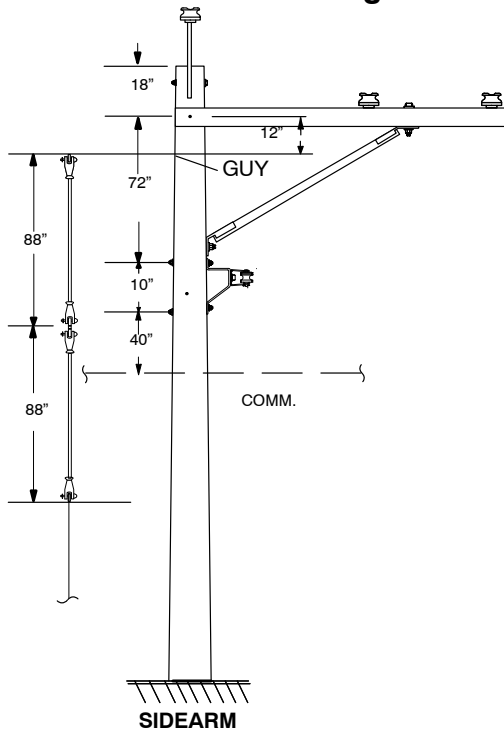


	TANGENT	30	20
Preferred Avian	Angle 10' Sgle. Arm	03 12 05 05	03 12 05 11
	Angle 8' Sgle. Arm	03 12 05 02	03 12 05 08

30 20 10

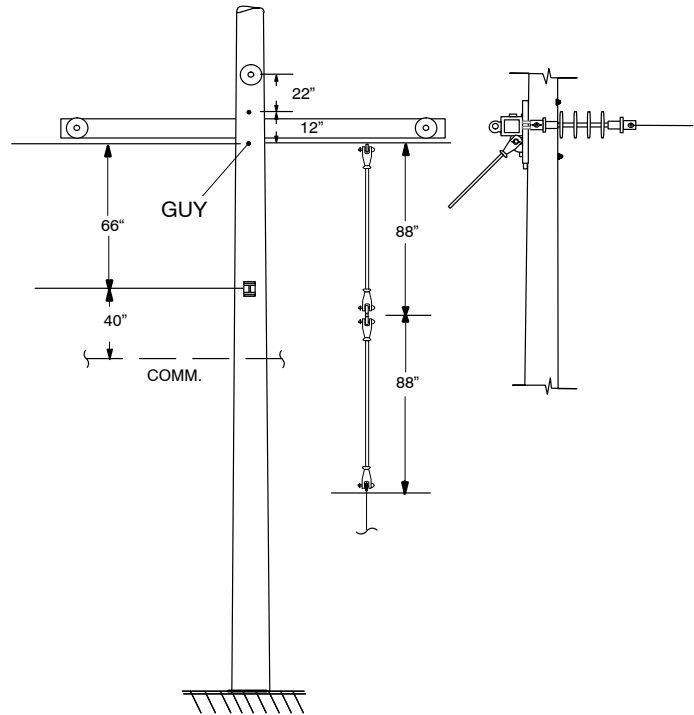
Angle 8' Sgle. Arm	03 12 02 02
Angle 8' Dble. Arm	03 12 02 03
Angle 10' Sgle. Arm	03 12 05 52 03 12 05 61 03 12 02 12
Angle 10' Dble. Arm	03 12 02 13

**One, Two or Three Phase
Angle on Wood Crossarm 4 to 15kV**



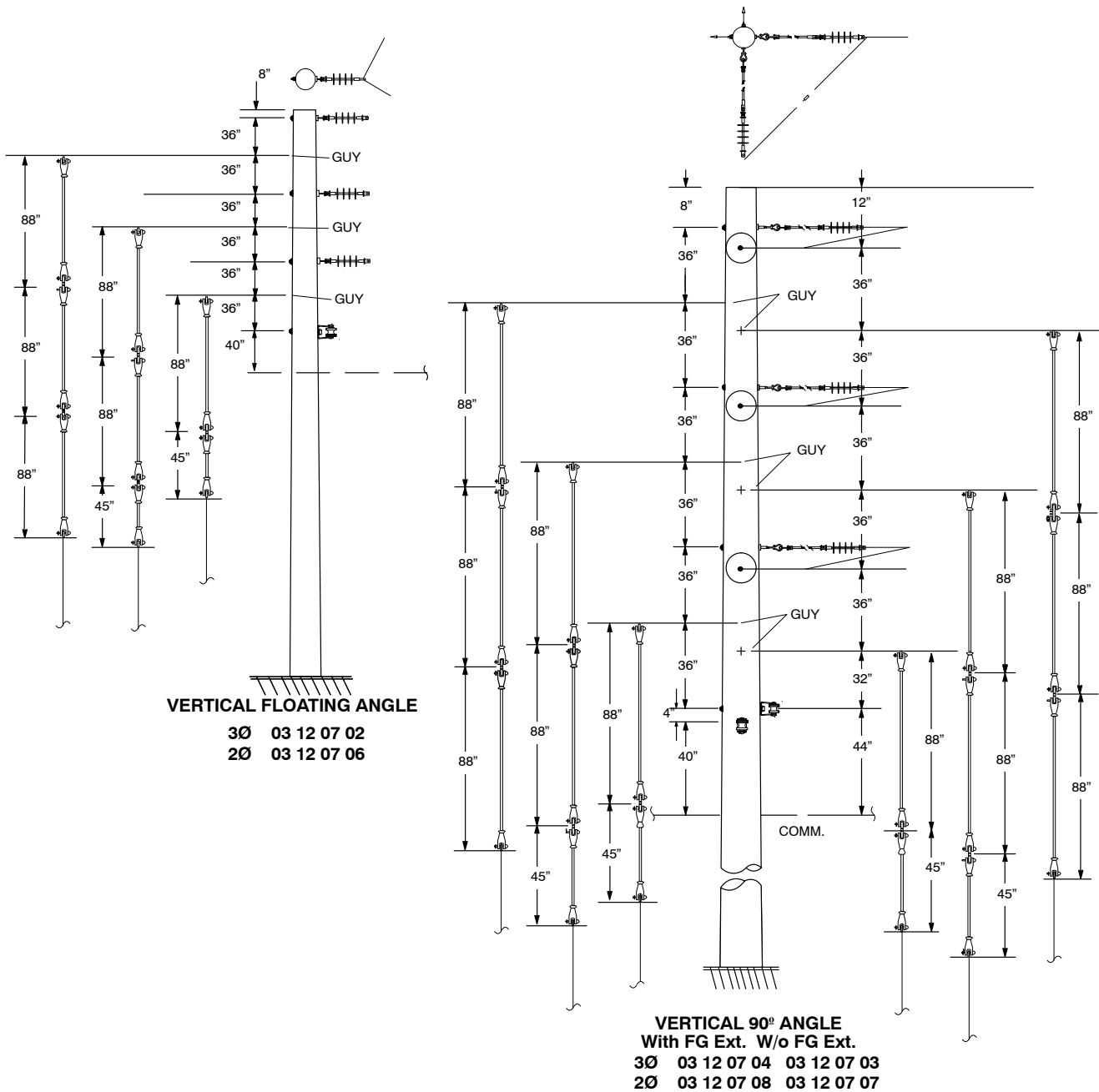
	30	20
Tangent 8' Sgle. Arm	03 12 05 54	03 12 05 63
Angle 8' Sgle. Arm	03 12 05 55	03 12 05 64
Angle 8' Dble. Arm	03 12 05 56	03 12 05 65

Deadend Arm-Pole Top or Underbuild

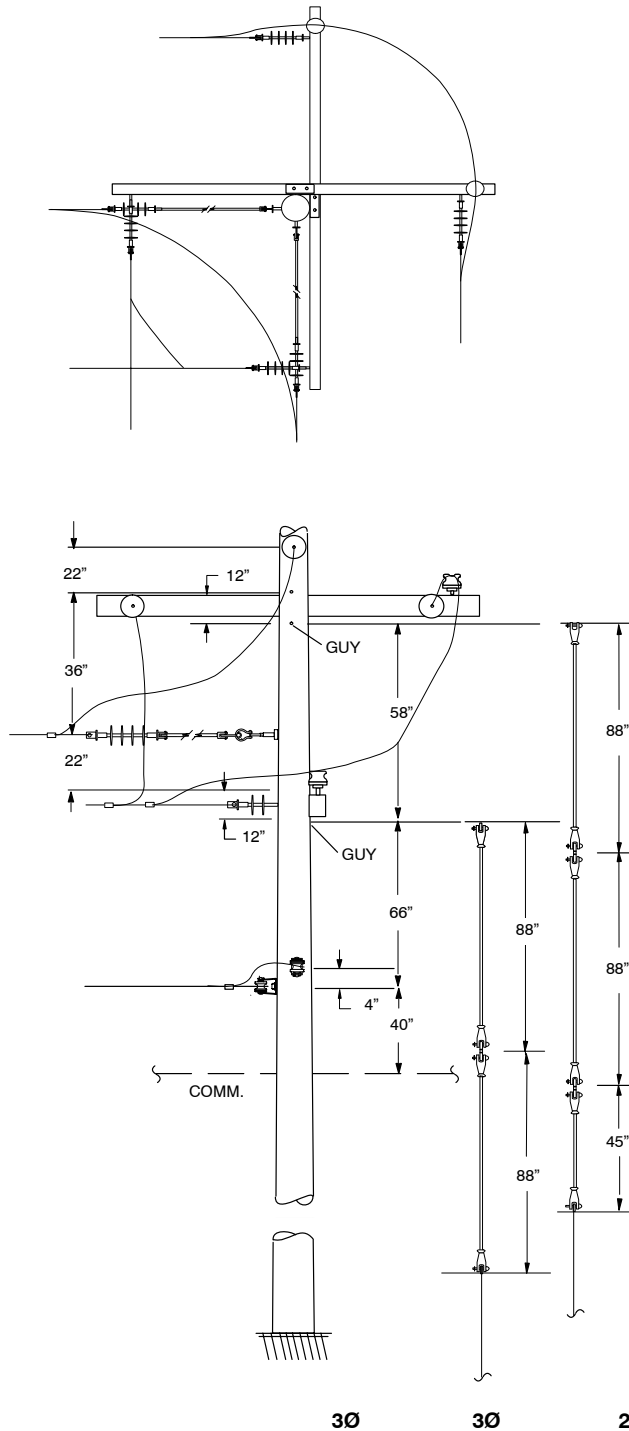


	30	20	10
DE Assy 8' Arm	03 12 11 01	03 12 11 31	03 12 02 06
DE Assy 10' Arm	03 12 11 52	03 12 11 54	03 12 02 16

Two or Three Phase Floating and 90° Angle 4 to 15kV

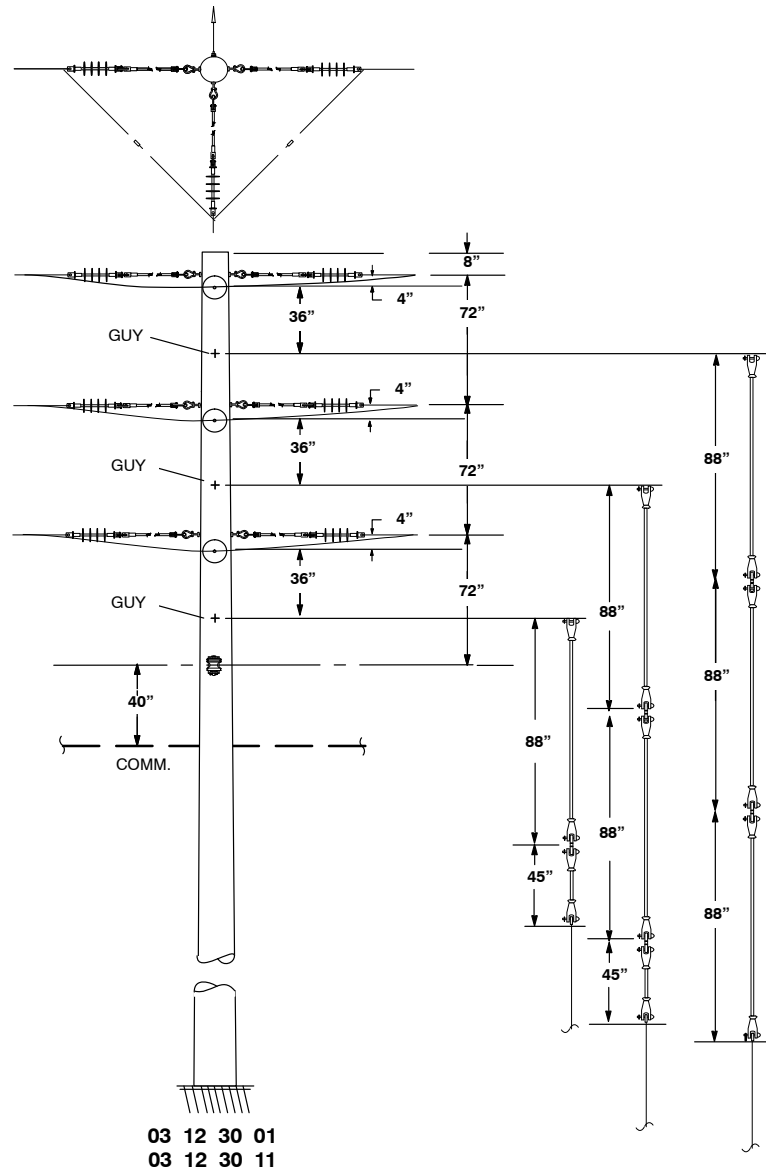


**Two or Three Phase Buck Arm – 90° Angle
4 to 15kV**

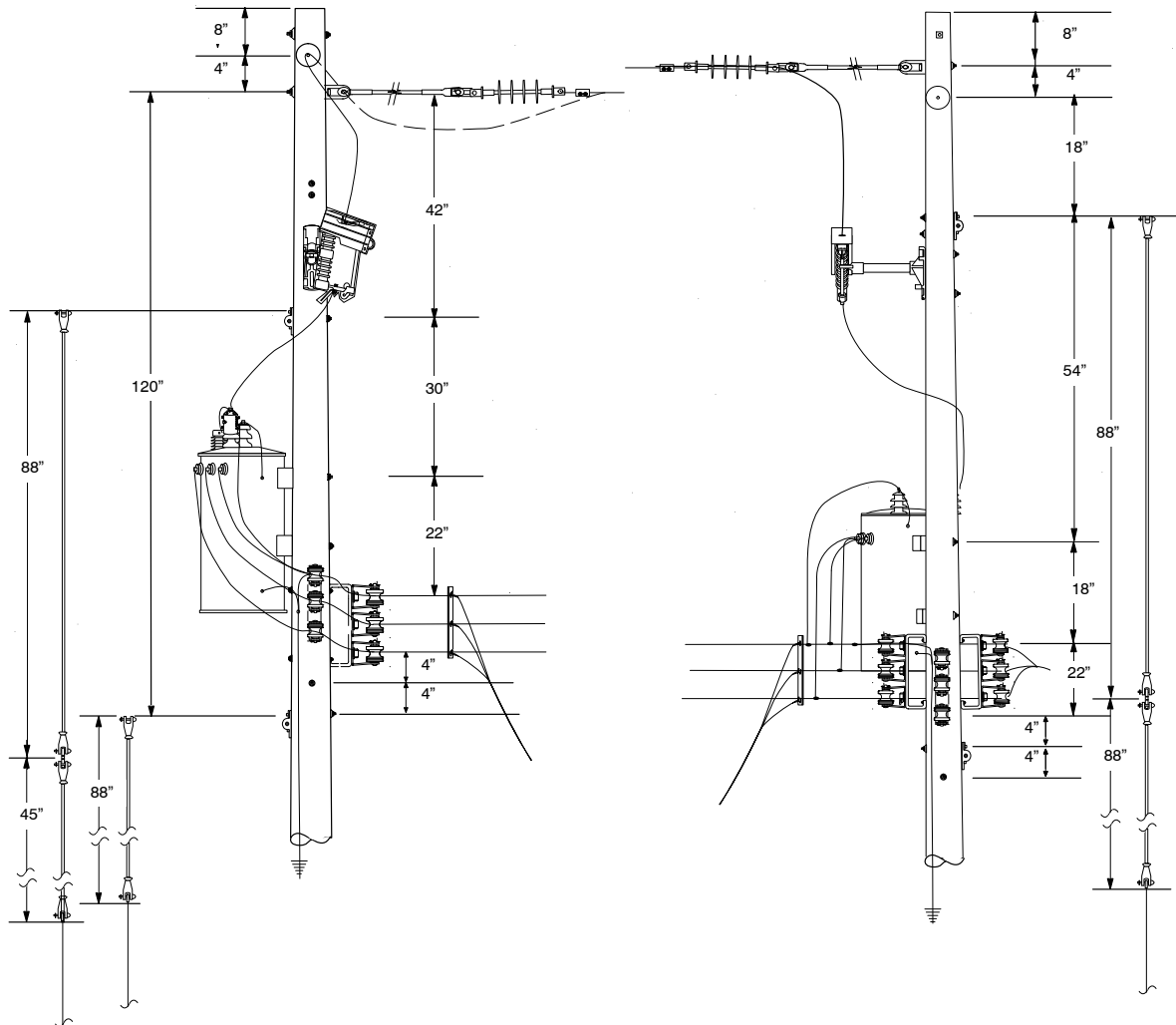


	3Ø		3Ø		2Ø	
	W/Ext.		W/o Ext.		(NOT SHOWN)	
8' F.G. ARMS	03	12 09 03	03	12 09 01	03	12 09 04
10' F.G. ARMS	03	12 09 02	03	12 09 05	03	12 09 08

**Two or Three Phase – Vertical Tap
4 to 12 kV**



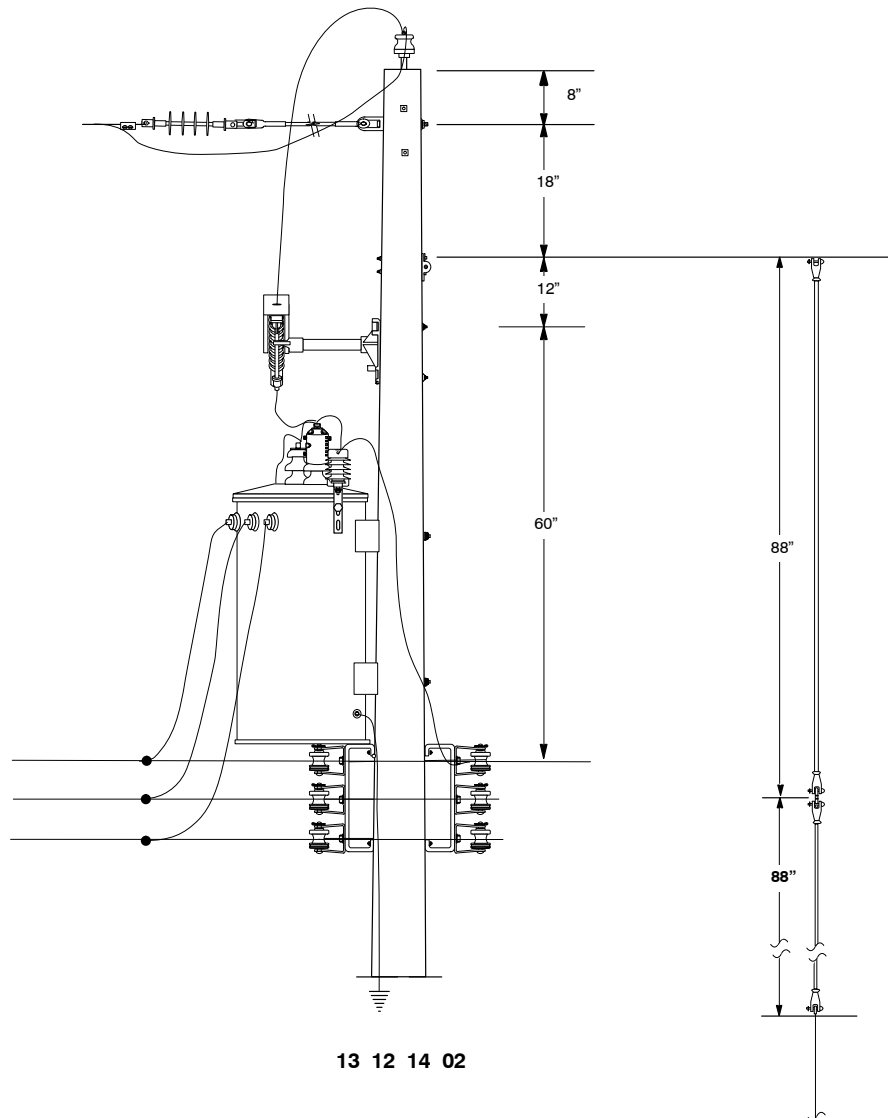
3 to 100kVA Deadend or "L" Corner



On "L" corners, where a guy can only be installed below the transformer, a Class 4 or heavier pole shall be used. A class 4 pole will provide adequate strength for deadending 1-1/0 bare AAAC at 1,360 lbs. Max. Tension (non-standard intermediate span urban construction). For conductor tension greater than this, contact Distribution Standards for determination of pole class.

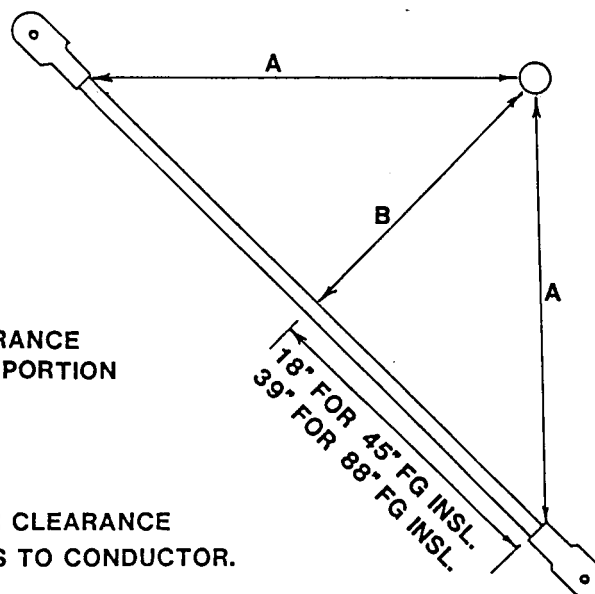
DEADEND - 13 12 10 01
"L" CORNER - 13 12 10 02

Transformer, 1PH, T Corner



**'A' IS THE MINIMUM CLEARANCE
FROM ANY CONDUCTIVE PORTION
OF GUY TO CONDUCTOR.**

**'B' IS THE MINIMUM CLEARANCE
FROM FIBERGLASS TO CONDUCTOR.**



Phase To Phase	Span Guy Parallel To Conductor ¹			All Other ¹		
	A	B ²		A	B ²	
		45"FG	88"FG ⁷		45"FG	88"FG ⁷
0–4 kV	12" ^{3,6}	9"	9"	6" ³	5"	5"
12.47–14.4 kV	15"	12"	12"	9" ³	7"	7"
34.5 kV	30" ⁴	24" ⁵	18"	30" ⁴	24" ⁵	13"
69 kV	38"	34" ⁵	29"	32"	27" ⁵	24"

Reference: NESC, 2017 Edition, Rule 235E

NOTES:

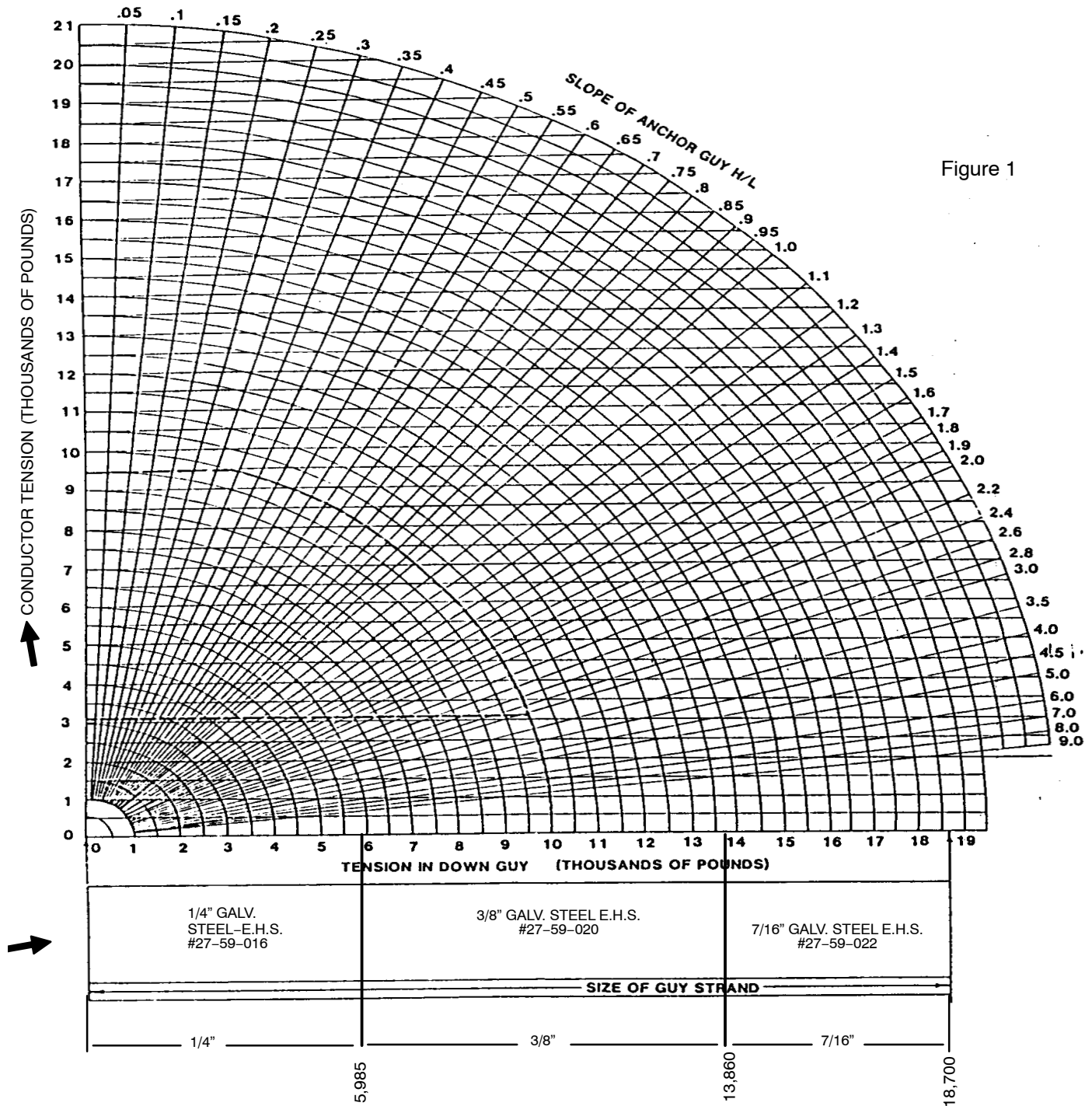
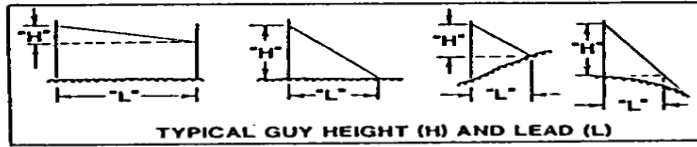
1. "Parallel" means in same general direction as line conductors. "All Other" includes down guys and span guys that cross over or under line conductors.
2. "B" is the minimum clearance required to the insulator or insulated section of guy wire between two insulators provided that the "A" minimum clearance to the uninsulated end fitting or guy wire is maintained.
3. On joint use poles, guys which pass within twelve inches (12") of supply conductors and also pass within twelve inches (12") of communication cables require a strain insulator to be located at a point below the lowest supply conductor and above the highest communication cable (NESC Table 235–6, Note 1: 2017 Edition).
4. 30" is based on Ameren's use of 200 kV BIL .
5. This clearance required to maintain the air gap clearance to conductive parts. No reduction in clearance is allowed.
6. For neutral conductors, dimension "A" can be reduced to 6".
7. Longer FG insulators or daisy chained insulators will not allow further reduction of clearance to guy insulators.

GUYING

Chart for Selection of Guy Strand

11 00 03 01

Sheet 1 of 2



TO SIMPLIFY THE WORK OF SELECTING THE CORRECT GUY AND ANCHOR FOR A GIVEN LOAD, DIST. STD. 11 00 03 01 HAS BEEN PREPARED. NOTE THAT THE TOTAL LOAD IS THE SUMMATION OF THE CONDUCTOR TENSIONS INVOLVED SINCE SAFETY AND OTHER REQUIRED FACTORS HAVE BEEN INCORPORATED IN THE CONDUCTOR TENSIONS SHOWN IN DIST. STD. 11 00 04 02 BY CHOOSING A GRADE.

INSTRUCTION FOR USE OF GUY CHART

EXAMPLE: To determine the size guy strand for 3-1/0 AAAC & 1/0 Neutral – Urban Grade "C", 150' short span construction 15° line angle, joint use pole. Guy height (H) = 32', guy lead(L) = 10', use pole configuration in accord with Dist. Std. 03 12 05 ** Sht. 1 40' pole.

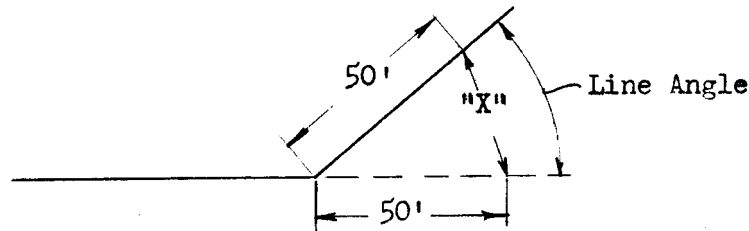
1. Determine the height over lead ratio. $H/L = 32/10 = 3.2$ (Radial Line).
2. From Sheet 1 Dist. Std. 11 00 04 02, the conductor tension is 482 lbs. for 1/0. Total for 3 phases and neutral is $482 \times 4 = 1928$ lbs.
3. Locate this value on vertical scale of chart on Figure 1 and project this value horizontally to the right to the intersection with radial line 3.2.
4. Follow this point on the arc of the circle to the lower scale. Read the tension in the anchor guy, (6500#) and size guy wire, (3/8" Galv. Steel EHS).

TO DETERMINE THE VERTICAL LOADING ON THE POLE DUE TO GUYING

5. Determine the inverse of the height over lead ratio $1/H/L = 1/3.2 = .312$ (Radial Line).
6. Locate the value of guy tension (Step 4) on horizontal scale and follow this point on the arc of the circle to the intersection with radial line .312.
7. Project this value horizontally to vertical scale and read the vertical thrust (V.T. = 6200).
8. Divide the value obtained from the vertical scale by the correction factor for the grade of construction used ($V.T. = 6200 \div 1.14 = 5438$). This is the true vertical thrust on the pole due to the guy. Correction factors for the grade of construction are N=1.0 C = 1.14, and B = 1.5.

GENERAL NOTE: To extend the limits of this chart or to create an intersection of the horizontal load and slope lines, divide the horizontal load to be guyed by 2, 3, or 4, and multiply the actual tension by the same number.

METHOD OF DETERMINING LINE ANGLES



Line Angle Degrees	Distance "X"	Line Angle Degrees	Distance "X"	Line Angle Degrees	Distance "X"
1	0'-10"	21	18'-3"	41	35'-2"
2	1'-9"	22	19'-2"	42	36'-0"
3	2'-8"	23	20'-0"	43	36'-10"
4	3'-6"	24	20'-8"	44	37'-5"
5	4'-4"	25	21'-7"	45	38'-6"
6	5'-3"	26	22'-6"	46	39'-5"
7	6'-1"	27	23'-4"	47	40'-0"
8	7'-0"	28	24'-3"	48	40'-10"
9	7'-10"	29	25'-1"	49	41'-7"
10	8'-8"	30	26'-0"	50	42'-5"
11	9'-6"	31	26'-9"	51	43'-0"
12	10'-5"	32	27'-7"	52	43'-10"
13	11'-3"	33	28'-5"	53	44'-7"
14	12'-1"	34	29'-4"	54	45'-5"
15	13'-0"	35	30'-2"	55	46'-1"
16	13'-9"	36	30'-0"	56	46'-11"
17	14'-8"	37	31'-10"	57	47'-7"
18	15'-6"	38	32'-8"	58	48'-6"
19	16'-4"	39	33'-5"	59	49'-3"
20	17'-4"	40	34'-2"	60	50'-0"

NOTE:

A close approximation of the line angle may be obtained by measuring 50 feet out along either the line or line extended. From this point measure the distance "X". This distance in feet will approximate the line angle in degrees.

For more accurate results use the method sketched above and the table.

SHORT SPAN (150' RULING SPAN)

Line Angle Deg.	4/0 AA Poly			1/0 AAAC 7 STR 1/0 AAAC 7 STR POLY			556.5 AAC 19 STR			954 45/7 ACSR		
	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N
1	231	198	98	209	177	91	318	262	145	357	296	161
2	258	216	115	244	200	112	405	319	198	443	353	213
3	285	234	131	278	223	133	491	377	250	530	411	265
4	313	252	147	313	246	154	577	434	302	616	468	318
5	340	270	164	347	269	175	664	492	354	702	526	370
6	367	288	180	382	292	195	750	549	407	788	583	422
7	394	306	197	416	315	216	836	607	459	875	641	474
8	421	324	213	451	338	237	922	664	511	961	698	527
9	448	342	229	485	360	258	1008	721	563	1047	755	579
10	475	360	246	519	383	279	1094	779	615	1132	812	631
15	609	449	327	690	497	383	1522	1064	875	1561	1098	890
20	742	537	408	860	610	486	1948	1347	1133	1986	1381	1148
25	873	625	488	1028	722	588	2369	1628	1389	2407	1661	1404
30	1003	711	567	1194	832	689	2786	1905	1643	2824	1938	1657
35	1131	796	646	1357	941	788	3198	2179	1893	3235	2212	1907
40	1257	879	722	1519	1047	887	3604	2449	2139	3640	2481	2154
45	1381	961	798	1677	1152	983	4003	2714	2382	4039	2746	2396
50	1501	1040	872	1832	1255	1078	4394	2974	2620	4429	3005	2634
55	1619	1118	944	1984	1355	1170	4777	3229	2853	4811	3259	2867
60	1734	1194	1014	2131	1453	1261	5151	3477	3080	5184	3506	3094
DE	1558	1038	944	1980	1320	1200	4950	3300	3000	4950	3300	3000

NOTE: Grade N represents tensions with no overload capacity factors.

SHORT SPAN (150' RULING SPAN)

Line Angle Deg.	110.8 12/7 ACSR			T2 4/0 6/1 ACSR			T2 556 AAC 19 STR			T2 954 45/7 ACSR		
	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N
1	220	186	95	284	240	122	415	341	190	536	435	250
2	254	209	116	327	269	148	530	418	260	709	550	355
3	289	232	137	370	298	175	646	494	329	882	665	459
4	323	255	158	413	327	201	761	571	399	1054	780	564
5	358	278	179	456	355	227	876	648	469	1227	895	669
6	392	301	200	499	384	253	991	724	539	1399	1010	773
7	427	324	220	542	413	279	1105	801	608	1571	1125	878
8	461	347	241	585	441	305	1220	877	678	1744	1240	982
9	495	370	262	628	470	331	1335	954	747	1916	1354	1086
10	530	392	283	671	498	357	1449	1030	817	2088	1469	1191
15	700	506	387	884	640	487	2020	1410	1163	2945	2040	1710
20	870	619	490	1096	781	616	2588	1788	1507	3796	2607	2227
25	1038	730	592	1306	921	743	3150	2163	1849	4640	3169	2739
30	1204	841	693	1513	1058	869	3706	2533	2187	5476	3725	3246
35	1367	949	792	1718	1194	994	4256	2898	2520	6301	4274	3747
40	1528	1056	890	1919	1327	1116	4797	3258	2849	7113	4815	4241
45	1686	1161	987	2116	1458	1237	5329	3612	3172	7913	5347	4726
50	1841	1263	1081	2310	1586	1355	5851	3958	3490	8697	5868	5203
55	1993	1364	1174	2499	1711	1471	6361	4298	3800	9465	6379	5670
60	2140	1461	1264	2683	1833	1583	6860	4629	4104	10215	6877	6126
DE	1980	1320	1200	2475	1650	1500	6600	4400	4000	9900	6600	6000

MEDIUM SPAN (200' RULING SPAN)

Line Angle Deg.	1/0 AAAC 7 STR			556.6 AA 19 STR			954 45/7 ACSR			110.8 12/7 ACSR		
	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N
1	273	232	118	416	343	188	476	394	214	290	246	125
2	314	259	142	522	414	253	591	471	284	333	275	151
3	354	286	166	629	485	317	706	548	354	376	304	177
4	394	312	191	735	556	382	821	624	423	419	332	203
5	434	339	215	842	627	446	936	701	493	463	361	230
6	474	366	240	948	698	511	1051	778	563	506	390	256
7	515	393	264	1054	769	575	1166	854	632	549	418	282
8	555	419	288	1160	839	640	1281	931	702	592	447	308
9	595	446	313	1267	910	704	1395	1007	772	634	475	334
10	635	473	337	1372	981	768	1510	1083	841	677	504	360
15	834	605	458	1900	1332	1089	2081	1463	1187	891	646	489
20	1032	737	578	2425	1682	1407	2648	1841	1531	1103	787	618
25	1227	867	697	2945	2028	1722	3209	2215	1872	1312	926	746
30	1421	995	815	3459	2370	2035	3765	2584	2210	1520	1064	872
35	1611	1122	931	3967	2707	2343	4313	2949	2543	1724	1200	996
40	1799	1246	1045	4467	3040	2647	4854	3308	2872	1925	1333	1119
45	1983	1368	1158	4958	3367	2946	5385	3661	3195	2122	1464	1239
50	2164	1487	1268	5441	3687	3240	5906	4007	3512	2316	1592	1357
55	2340	1604	1376	5912	4000	3527	6415	4345	3822	2505	1716	1473
60	2512	1718	1481	6373	4306	3807	6913	4675	4125	2689	1838	1586
DE	2310	1540	1400	6105	4070	3700	6600	4400	4000	2475	1650	1500

NOTE: Grade N represents tensions with no overload capacity factors.

MEDIUM SPAN (200' RULING SPAN)

Line Angle Deg.	T2 4/0 6/1 ACSR			T2 556 AAC			T2 954 45/7 ACSR		
	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N
1	377	319	162	537	443	243	700	570	325
2	433	357	196	674	534	326	916	714	456
3	489	394	230	810	626	409	1132	858	586
4	545	432	264	947	717	492	1348	1002	717
5	601	469	298	1084	808	574	1564	1146	848
6	657	506	332	1220	899	657	1779	1289	979
7	713	543	366	1356	989	740	1995	1433	1109
8	769	581	400	1493	1080	822	2210	1576	1240
9	824	618	434	1629	1171	905	2425	1720	1370
10	880	655	468	1765	1262	987	2640	1863	1500
15	1158	840	636	2443	1713	1399	3711	2576	2150
20	1433	1023	803	3116	2161	1807	4775	3285	2796
25	1706	1204	969	3783	2606	2212	5830	3988	3436
30	1975	1383	1133	4444	3045	2613	6874	4682	4069
35	2241	1559	1295	5095	3478	3009	7905	5368	4695
40	2502	1732	1454	5737	3905	3400	8920	6044	5312
45	2759	1902	1611	6368	4324	3783	9919	6708	5919
50	3010	2069	1764	6987	4736	4160	10899	7360	6515
55	3256	2231	1915	7593	5138	4529	11858	7997	7098
60	3495	2389	2061	8184	5530	4889	12795	8619	7668
DE	3218	2145	1950	7838	5225	4750	12375	8250	7500

NOTE: Grade N represents tensions with no overload capacity factors.

LONG SPAN (250' RULING SPAN)

Line Angle Deg.	1/0 AAAC 7 STR			556.5 AA 19 STR			954 45/7 ACSR			110.8 12/7 ACSR		
	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N
1	339	288	145	508	421	228	595	493	268	360	306	155
2	386	320	174	629	501	301	739	589	355	412	341	186
3	434	351	203	749	582	375	883	685	442	464	375	218
4	481	383	232	870	663	448	1027	781	529	516	410	249
5	528	414	260	991	743	521	1170	876	616	567	444	280
6	576	446	289	1112	823	594	1314	972	704	619	478	312
7	623	477	318	1232	904	667	1458	1068	791	671	513	343
8	670	509	346	1353	984	740	1601	1163	878	722	547	374
9	718	540	375	1473	1064	813	1744	1259	964	774	581	405
10	765	572	404	1593	1144	886	1887	1354	1051	825	616	437
15	999	728	546	2192	1543	1250	2601	1829	1484	1081	786	592
20	1232	883	688	2788	1940	1611	3309	2301	1914	1335	955	747
25	1463	1036	828	3377	2332	1969	4012	2768	2341	1587	1122	900
30	1691	1187	967	3961	2720	2323	4706	3230	2762	1835	1287	1051
35	1915	1336	1103	4537	3103	2673	5392	3686	3179	2080	1450	1200
40	2136	1482	1238	5104	3480	3018	6067	4135	3590	2322	1610	1347
45	2353	1626	1370	5661	3850	3357	6731	4576	3994	2558	1766	1492
50	2565	1766	1500	6208	4213	3690	7382	5009	4390	2790	1920	1633
55	2773	1903	1627	6743	4568	4016	8019	5431	4778	3016	2069	1772
60	2975	2037	1751	7265	4915	4334	8641	5844	5156	3237	2215	1907
DE	2723	1815	1650	6930	4620	4200	8250	5500	5000	2970	1981	1800

NOTE: Grade N represents tensions with no overload capacity factors.

LONG SPAN (250' RULING SPAN)

Line Angle Deg.	T2 4/0 6/1 ACSR			T2 556 AAC			T2 954 45/7 ACSR		
	Grade			Grade			Grade		
	B	C	N	B	C	N	B	C	N
1	468	398	201	644	536	287	865	706	399
2	536	443	242	788	632	375	1124	878	556
3	603	488	283	932	728	462	1383	1051	713
4	671	533	324	1076	824	549	1642	1224	870
5	739	578	365	1219	920	636	1901	1396	1027
6	806	623	406	1363	1015	723	2159	1568	1184
7	873	668	447	1507	1111	810	2418	1741	1341
8	941	712	488	1650	1206	897	2676	1913	1497
9	1008	757	529	1793	1302	984	2934	2085	1654
10	1075	802	569	1936	1397	1071	3192	2257	1810
15	1409	1024	772	2650	1872	1504	4477	3113	2590
20	1741	1245	974	3358	2344	1934	5754	3963	3364
25	2070	1463	1174	4060	2811	2360	7020	4806	4132
30	2394	1679	1371	4754	3272	2781	8272	5639	4893
35	2714	1891	1566	5439	3728	3198	9509	6462	5644
40	3029	2100	1758	6113	4176	3608	10727	7273	6384
45	3338	2304	1947	6776	4616	4012	11925	8070	7112
50	3640	2504	2132	7427	5048	4408	13101	8851	7827
55	3936	2700	2312	8063	5470	4795	14251	9615	8526
60	4224	2890	2489	8683	5881	5173	15374	10362	9210
DE	3878	2585	2350	8250	5500	5000	14850	9900	9000

NOTE: Grade N represents tensions with no overload capacity factors.

EXTRA LONG SPAN (300' RULING SPAN)

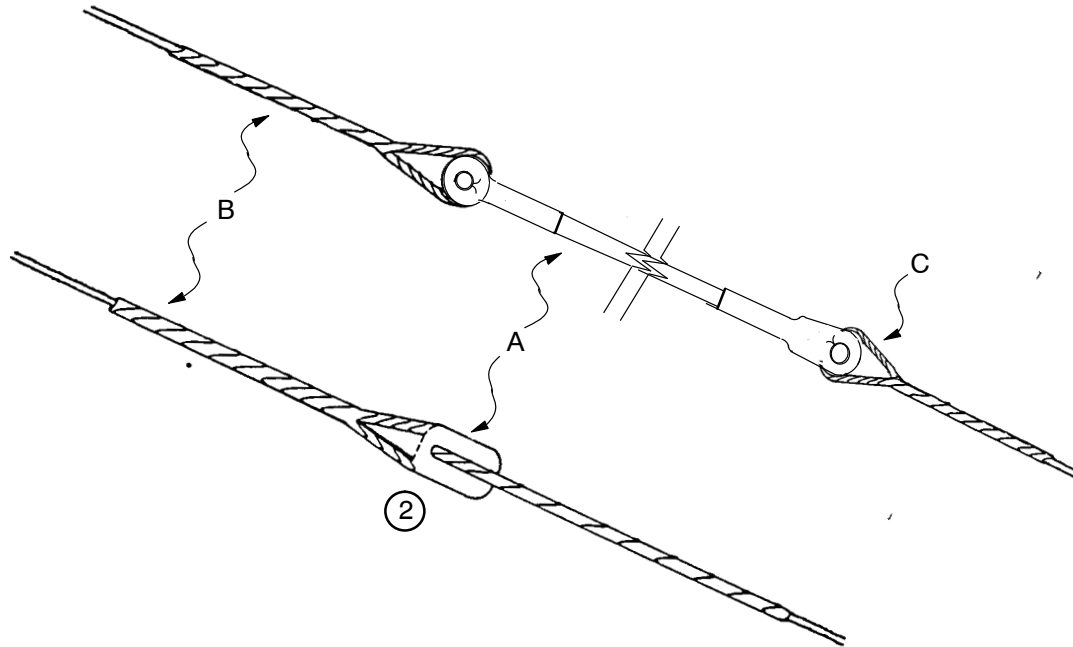
Line Angle Deg.	1/0 AAAC 7 STR			556.5 AAC 19 STR			954 45/7 ACSR			110.8 12/7 ACSR		
	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N	Grade B	Grade C	Grade N
1	403	343	172	594	495	264	685	572	304	431	366	185
2	456	379	204	723	581	343	829	668	391	491	406	221
3	509	414	237	853	667	421	973	764	478	552	447	258
4	562	449	269	982	754	500	1117	860	565	612	487	295
5	615	485	301	1111	840	578	1260	956	652	672	527	331
6	669	520	333	1241	926	656	1404	1051	740	732	567	368
7	722	555	365	1370	1012	735	1548	1147	827	793	607	404
8	775	591	398	1499	1098	813	1691	1242	914	853	647	441
9	827	626	430	1628	1184	891	1834	1338	1000	913	687	477
10	880	661	462	1757	1270	969	1977	1433	1087	973	727	514
15	1143	836	622	2398	1697	1359	2690	1908	1520	1272	926	695
20	1404	1010	780	3036	2121	1746	3398	2379	1950	1568	1123	875
25	1663	1181	937	3667	2541	2129	4100	2846	2376	1861	1318	1054
30	1918	1350	1093	4292	2957	2509	4793	3307	2797	2151	1510	1230
35	2169	1517	1246	4908	3366	2883	5478	3762	3214	2437	1700	1404
40	2416	1681	1397	5515	3770	3253	6152	4209	3624	2718	1886	1576
45	2659	1842	1545	6112	4166	3616	6814	4650	4027	2994	2069	1744
50	2897	1999	1690	6696	4554	3972	7464	5080	4422	3264	2247	1909
55	3129	2152	1832	7269	4934	4320	8099	5502	4810	3528	2422	2071
60	3355	2301	1971	7827	5304	4661	8719	5828	5188	3786	2592	2228
DE	3053	2035	1850	7425	4950	4500	8250	5500	5000	3465	2310	2100

NOTE: Grade N represents tensions with no overload capacity factors.

EXTRA LONG SPAN (300' RULING SPAN)

Line Angle Deg.	T2 4/0 6/1 ACSR			T2 556 AAC 19 STR			T2 954 45/7 ACSR		
	Grade			Grade			Grade		
	B	C	N	B	C	N	B	C	N
1	560	476	240	744	624	327	986	812	448
2	639	529	288	888	720	415	1245	985	605
3	718	581	336	1032	816	502	1504	1157	762
4	797	634	384	1176	912	589	1763	1330	919
5	876	687	432	1319	1008	676	2022	1503	1076
6	955	739	480	1463	1103	763	2280	1675	1232
7	1034	792	528	1606	1199	850	2539	1847	1389
8	1113	844	575	1750	1294	937	2797	2019	1546
9	1191	896	623	1893	1390	1024	3055	2191	1702
10	1270	949	671	2036	1485	1111	3313	2363	1858
15	1661	1209	909	2749	1959	1543	4597	3218	2638
20	2049	1467	1144	3456	2430	1973	5873	4068	3412
25	2434	1722	1378	4157	2897	2399	7138	4910	4180
30	2813	1974	1609	4850	3357	2820	8389	5742	4940
35	3187	2223	1837	5534	3812	3236	9624	6564	5690
40	3556	2467	2062	6207	4259	3646	10841	7373	6430
45	3917	2706	2282	6869	4698	4049	12037	8168	7157
50	4271	2940	2499	7517	5128	4444	13210	8947	7871
55	4617	3169	2710	8151	5548	4830	14358	9710	8569
60	4954	3391	2917	8770	5957	5208	15479	10454	9252
DE	4538	3025	2750	8250	5500	5000	14850	9900	9000

NOTE: Grade N represents tensions with no overload capacity factors.

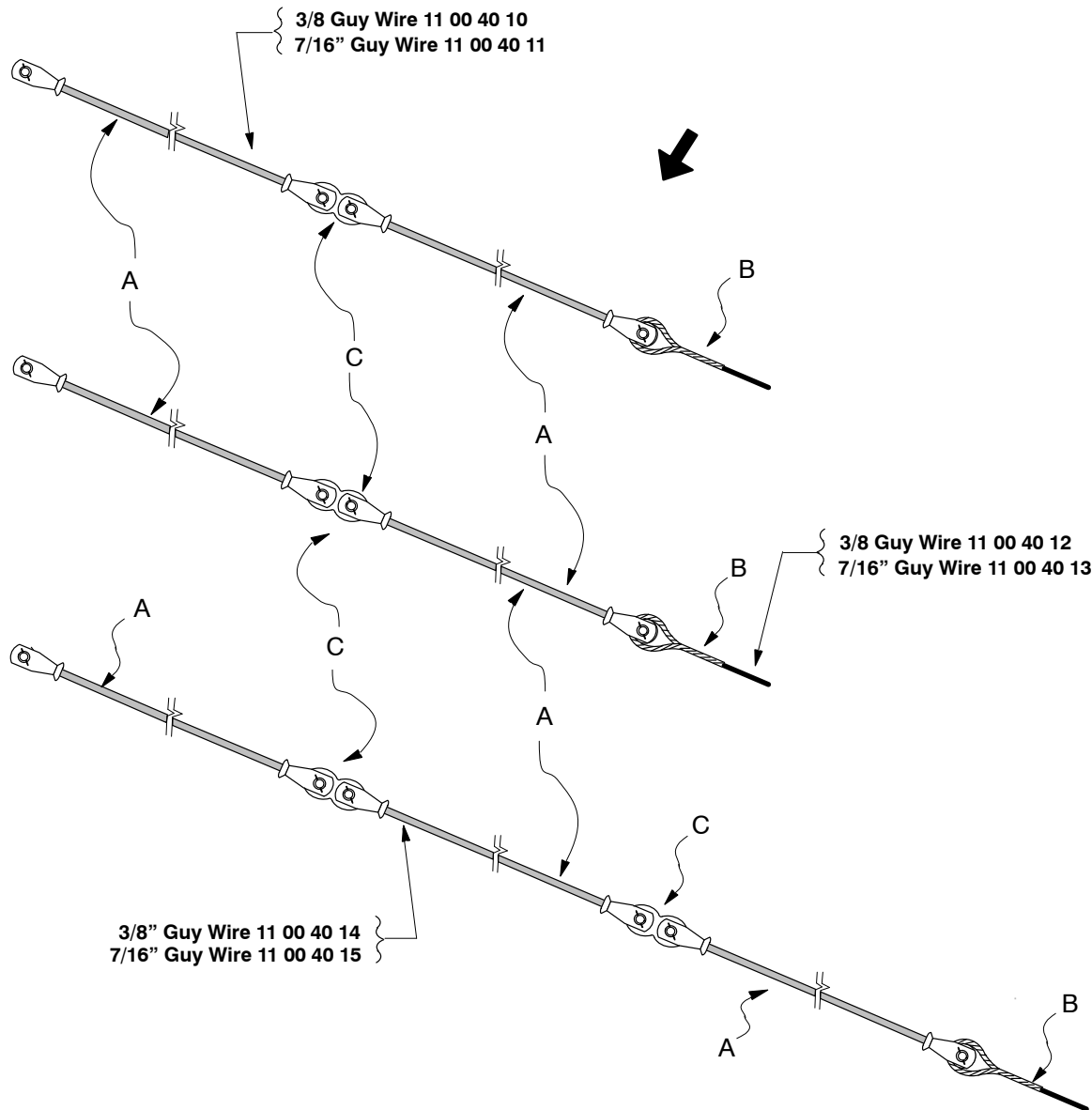


	<u>Porcelain Strain Ins.</u>	<u>45" Fiberglass Ins.</u>	<u>88" Fiberglass Ins.</u>
1/4" Guy Wire	11 00 40 01	11 00 40 04	11 00 40 07
3/8" Guy Wire	11 00 40 02	11 00 40 05	11 00 40 08
7/16" Guy Wire	11 00 40 03	11 00 40 06	11 00 40 09

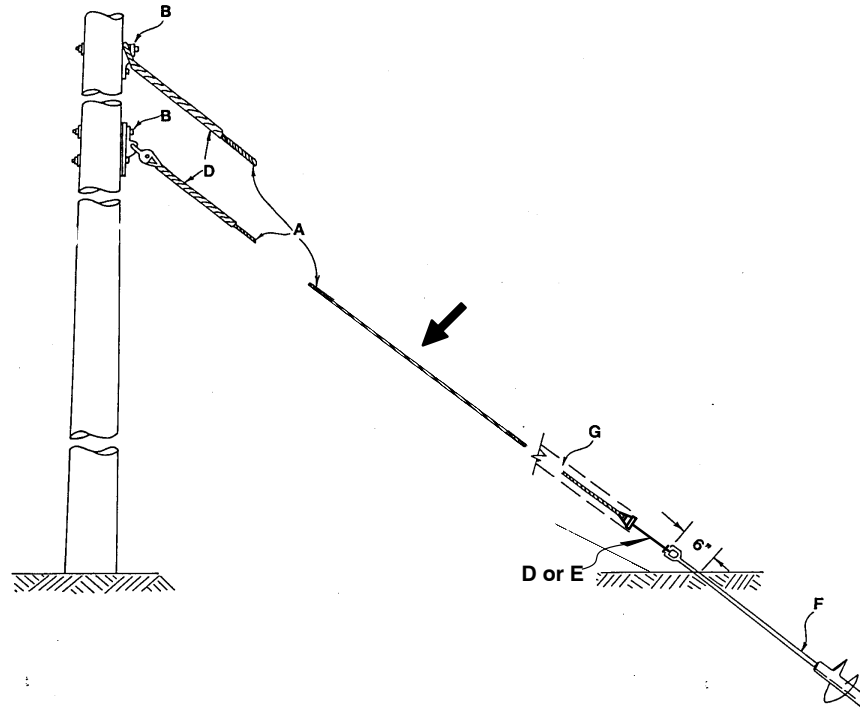
NOTE:

1. If installing insulator in existing guy, Operation Code 918 must be added.
2. Porcelain insulators to be used in Missouri only.

1@	2	A	B	C	D	Std. / Stk. No.	Description	11 00 40 **	01	02	03	04	05	06	07	08	09
									15kV Insl.			Fiberglass Insl.					
									01	02	03	04	05	06	07	08	09
						25 56 047	Insulator – 15kV, 1/4"		1								
						25 56 048	Insulator – 15kV, 3/8" or 7/16"			1	1						
						25 56 070	Insulator – Fiberglass, 45"					1	1	1			
						25 56 058	Insulator – Fiberglass, 88"								1	1	1
						23 68 241	Grip – Guy, 1/4"		2			2			2		
						23 68 237	Grip – Guy, 3/8"			2			2			2	
						23 68 238	Grip – Guy, 7/16"				2			2			2
						23 68 327	Roller – Guy								1	1	1
						918	Install Guy		2	2	2	2	2	2	2	2	2



		Std. /Stk. No.	Description	11 00 40 **	10	11	12	13	14	15
	A	25 56 070	Insulator – Fiberglass, 45"		1	1			1	1
		25 56 058	Insulator – Fiberglass, 88"		1	1	2	2	2	2
	B	23 68 237	Grip – Guy 3/8"		1		1		1	
		23 68 238	Grip – Guy 7/16"			1		1		1
	C	23 59 064	Link – Figure 8		1	1	1	1	2	2
	D	918	Install Guy		2	2	2	2	3	3



NOTE:

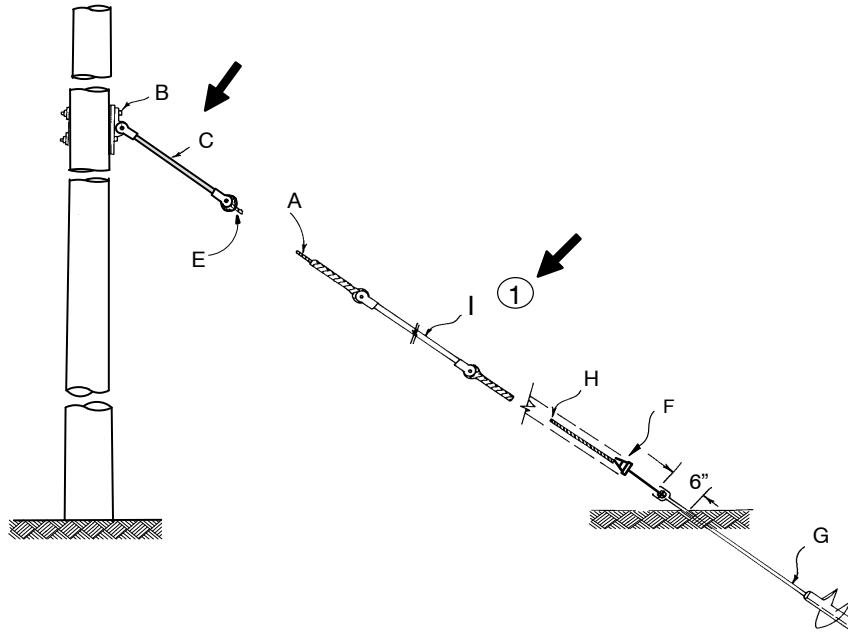
1. This DCS may only be used on guy stub poles where the span guy is insulated and there are no other energized conductor or communication attachments on the pole.
2. DCS 11 00 41 01 for 1/4" guy is not to be used in Illinois.

	Std. / Stk. No.	Description	11 00 41 **		
			01 1/4"	02 3/8"	04 7/16"
A	27 59 016	Wire – Guy, 1/4"	40		
	27 59 020	Wire – Guy, 3/8"		40	
	27 59 022	Wire – Guy, 7/16"			40
B	11 00 56 01	Hook – Guy, Light Duty	1		
	11 00 56 02	Hook – Guy, Heavy Duty		1	1
D	23 68 241	Grip – Guy, 1/4"	3		
	23 68 237	Grip – Guy, 3/8"		3	
	23 68 238	Grip – Guy, 7/16"			3
E	23 68 300	Deadend – Auto 1/4"	1		
	23 68 299	Deadend – Auto 3/8"		1	
	23 68 301	Deadend – Auto 7/16"			1
@ F	11 00 60 **	Anchor – Screw	1	1	1
	11 00 63 **	Anchor – Screw, Hi-Torque	1	1	1
G	23 78 091	Protector – Guy	1	1	1
@ I	11 00 40 **	Assembly – Insulator, Guy	1	1	1
	918	Install Guy	2	2	2

GUYING Sub Transmission Anchor Guy Fiberglass Insulator

11 00 42 **

Sheet 1 of 1



NOTES:

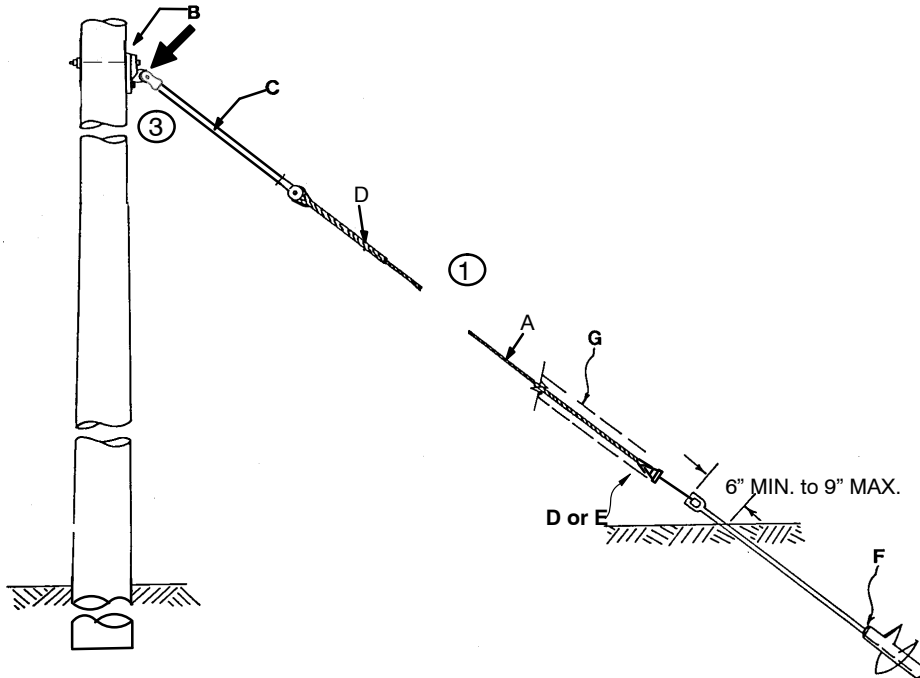
1. Omit insulator if not required. Insert additional insulators if needed. See DCS 11 00 01 ** for insulator location and requirements.
2. 88"FG insulator (Stk. No. 25 56 058) may be used in place of the 45"FG insulator where required.
3. For anchors with three guys attached, use DCS 11 00 42 05 or 11 00 42 06.

		Std. / Stk. No.	Description **	11 00 42	02	04	05	06
					3/8"	7/16"	3/8"	7/16"
@	A	27 59 020	Wire – Guy, 3/8"		40		120	
		27 59 022	Wire – Guy, 7/16"			40		120
@	B	11 00 56 03	Hook – Guy, Heavy Duty	1	1	3	3	
		11 00 56 04	Hook – Guy, Heavy Duty	1	1	3	3	
2@	C	25 56 070	Insulator – Guy, FG 45"	1	1	3	3	
		25 56 058	Insulator – Guy, FG 88"	1	1	3	3	
	E	23 68 237	Grip – Guy, 3/8"	1			3	
		23 68 238	Grip – Guy, 7/16"		1			3
3	F	23 68 299	Deadend – Auto, 3/8"	1			2	
		23 68 301	Deadend – Auto, 7/16"		1			2
		23 68 744	Deadend – Auto, 3/8", Long Bail				1	
		23 78 454	Deadend – Auto, 7/16", Long Bail					1
@	G	11 00 60 **	Anchor – Screw	1	1	1	1	1
		11 00 63 **	Anchor – Screw, Hi-Torque	1	1	1	1	1
	H	23 78 091	Marker – Guy	1	1	1	1	1
1@	I	11 00 40 **	Assembly – Insulator, Guy	1	1	3	3	
		918	Install Guy	2	2	6	6	

GUYING Anchor Guy Fiberglass Insulator At The Pole

11 00 43 **

Sheet 1 of 1



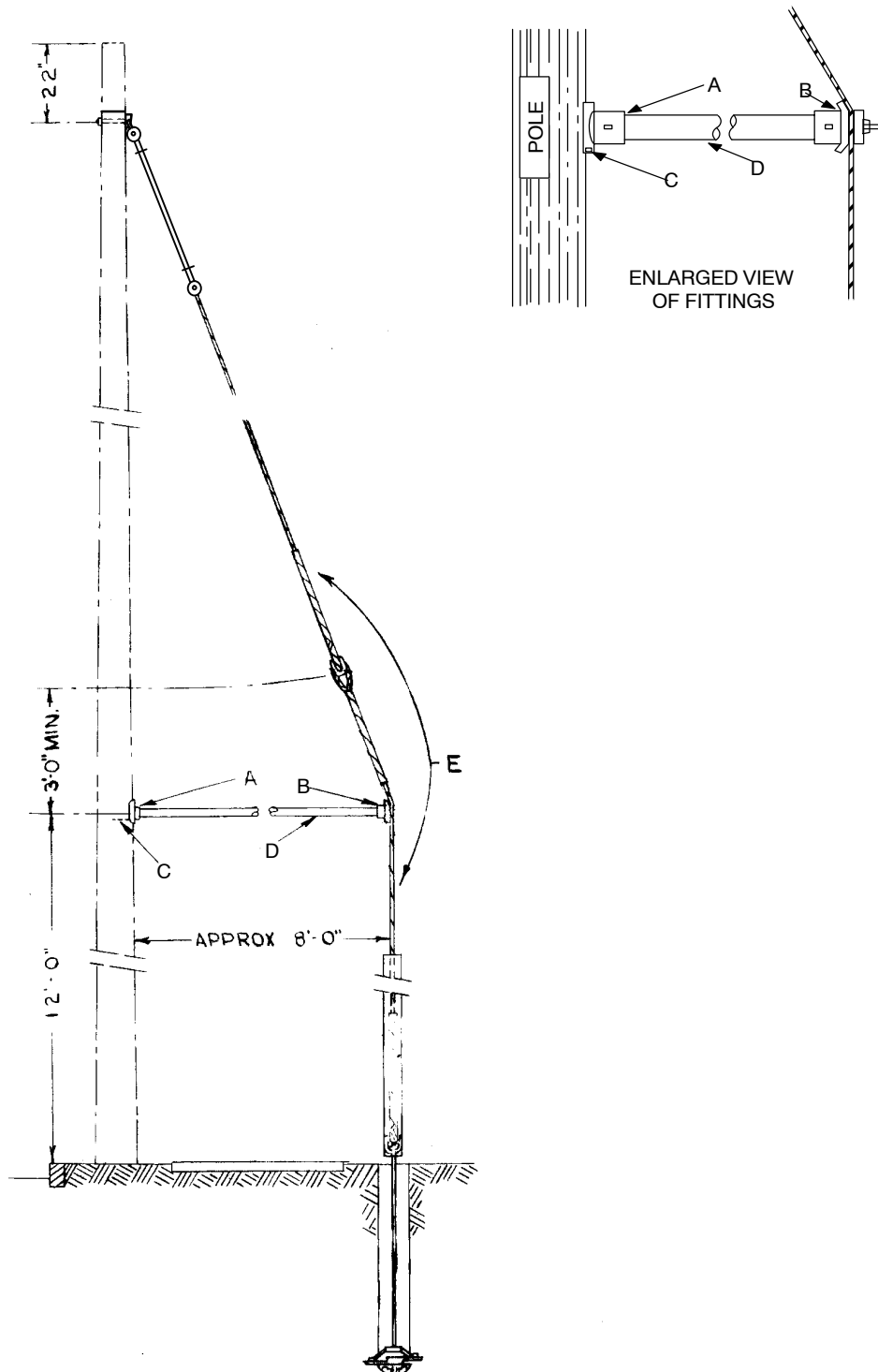
NOTES:

1. Insert additional insulator if needed. See DCS 11 00 01 ** for insulator location and requirements.
2. Use 88" guy strain if additional electrical clearance is required where 45" does not meet the NESC code.
3. See DCS 11 00 56 ** for guy hook assembly.

		Std. / Stk. No.	Description 11 00 43 **	01	03	05	07	09	11
				1/4"	3/8"	7/16"			
2	A	27 59 016	Wire – Guy, 1/4"	40	40				
		27 59 020	Wire – Guy, 3/8"			40	40		
		27 59 022	Wire – Guy, 7/16"					40	40
	B	11 00 56 03	Hook – Guy, HD	1	1	1	1	1	1
	C	25 56 070	Insulator – Guy, FG 45"	1		1		1	
		25 56 058	Insulator – Guy, FG 88"		1		1		1
	D	23 68 241	Grip – Guy, 1/4"	1	1				
		23 68 237	Grip – Guy, 3/8"			1	1		
		23 68 238	Grip – Guy, 7/16"					1	1
	E	23 68 300	Deadend–Auto, 1/4"	1	1				
		23 68 299	Deadend–Auto, 3/8"			1	1		
		23 68 301	Deadend–Auto, 7/16"					1	1
	F	11 00 60 **	Anchor – Screw	1	1	1	1	1	1
		11 00 63 **	Anchor – Screw, Hi–Torque	1	1	1	1	1	1
	G	23 78 091	Marker – Guy	1	1	1	1	1	1
1@	H	11 00 40 **	Assembly – Insulator, Guy	1	1	1	1	1	1
		918	Install Guy	2	2	2	2	2	2

GUYING
Sidewalk Guy
Assembly Unit

11 00 44 00
Sheet 1 of 2



GUYING Sidewalk Guy Assembly Unit

11 00 44 00
Sheet 2 of 2

Pole Ht.	Pole Class	Max. Conductor Tension Units ^{1,2}					
		Grade C			Grade B		
		1/4" Guy	3/8" Guy	7/16" Guy	1/4" Guy	3/8" Guy	7/16" Guy
30	4	1.53	2.28	2.28	1.02	1.16	1.16
	5	1.53	1.78	1.78	0.91	0.91	0.91
35	1	1.40	3.25	4.39	0.93	2.17	2.78
	3	1.40	3.25	3.54	0.93	1.80	1.80
	4	1.40	2.77	2.77	0.93	1.41	1.41
	5	1.40	2.13	2.13	0.93	1.08	1.08
40	3	1.26	2.92	3.95	0.84	1.94	2.14
	4	1.26	2.92	3.32	0.84	1.70	1.70
45	4	1.13	2.39	2.39	0.75	1.59	1.59

Pole Ht.	Pole Class	Max. Conductor Tension Units Limiting Component					
		Grade C			Grade B		
		1/4" Guy	3/8" Guy	7/16" Guy	1/4" Guy	3/8" Guy	7/16" Guy
30	4	Guy Wire	Pole @ Strut	Pole @ Strut	Guy Wire	Pole @ Strut	Pole @ Strut
	5	Guy Wire	Pole @ Strut	Pole @ Strut	Pole @ Strut	Pole @ Strut	Pole @ Strut
35	1	Guy Wire	Guy Wire	Guy Wire	Guy Wire	Guy Wire	Pole @ Strut
	3	Guy Wire	Guy Wire	Pole @ Strut	Guy Wire	Pole @ Strut	Pole @ Strut
	4	Guy Wire	Pole @ Strut	Pole @ Strut	Guy Wire	Pole @ Strut	Pole @ Strut
	5	Guy Wire	Pole @ Strut	Pole @ Strut	Guy Wire	Pole @ Strut	Pole @ Strut
40	3	Guy Wire	Guy Wire	Guy Wire	Guy Wire	Guy Wire	Pole @ Strut
	4	Guy Wire	Guy Wire	Column Loading	Guy Wire	Pole @ Strut	Pole @ Strut
45	4	Guy Wire	Column Loading	Column Loading	Guy Wire	Column Loading	Column Loading

	DIST. STD STOCK NO.	DESCRIPTION	REQ'D
A	23 67 263	Plate, Sidewalk Guy	1
B	23 68 422	Fitting, Guy End	1
C	23 60 007	Screw, Lag, 1/2" x 4"	3
3 D	40 83 022	Pipe, Galv, 2" x 10'-0"	10
@ E	11 00 43 **	Guy-Anchor, Insulator	1
	918	Install Guy	2

Notes:

1. A conductor tension unit is a resultant force (in 1,000 lb. units) for a given conductor and line angle.
2. These are the maximum resultant tensions (before applying NESC Load Factors) that these poles can support under these given installation parameters. For other pole heights, classes, guy and strut attachment heights, refer to Engineering Design Manual LS-30 and associated Guying Tool.
3. Maximum conductor tension limits are based on an 8ft guy strut. Using the full 10ft length of pipe for the guy strut will allow slightly higher conductor tensions.

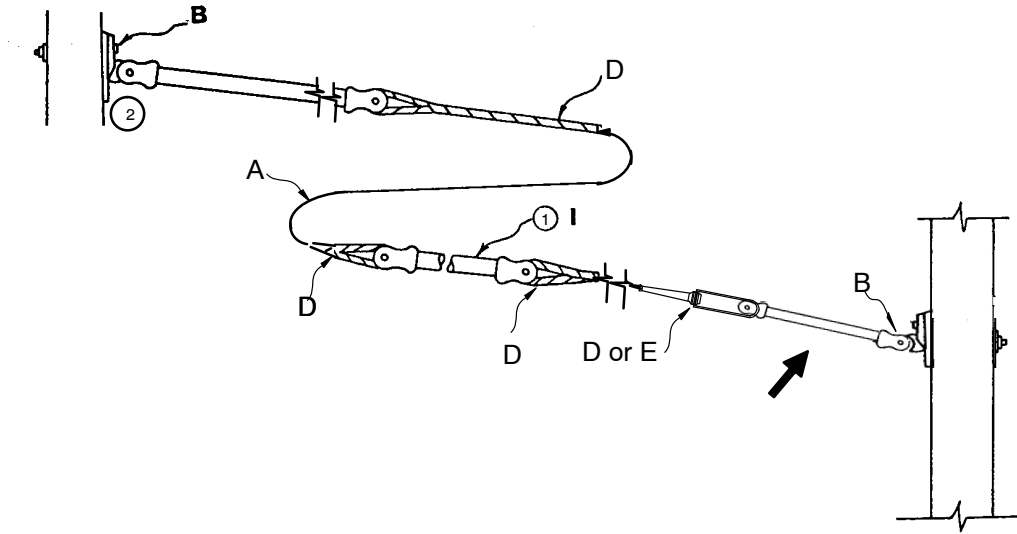
GUYING

Span Guy – Pole to Pole

Fiberglass Insulator at the Pole

11 00 46 **

Sheet 1 of 1



NOTES

1. Add insulators as required. See DCS 11 00 01 01 for insulator location and requirements.
2. See DCS 11 00 56 ** for guy hook installation.

	Std. / Stk. No.	Description	11 00 46 **	01	03	05	07	15	16
				1/4" Guy		3/8" Guy		7/16" Guy	
A	27 59 016	Wire – Guy, 1/4"		150	150				
	27 59 020	Wire – Guy, 3/8"				150	150		
	27 59 022	Wire – Guy, 7/16"						150	150
B	11 00 56 04	Hook – Guy, HD		2	2	2	2	2	2
C	25 56 070	Insulator – Guy, FG 45"		2		2		2	
	25 56 058	Insulator – Guy, FG 88"			2		2		2
D	23 68 241	Grip – Guy, 1/4"		1	1				
	23 68 237	Grip – Guy, 3/8"				1	1		
	23 68 238	Grip – Guy, 7/16"						1	1
E	23 68 300	Deadend – Auto, 1/4"		1	1				
	23 68 299	Deadend – Auto, 3/8"				1	1		
	23 68 301	Deadend – Auto, 7/16"						1	1
@1	I	11 00 40 **	Assembly – Insulator, Guy	1	1	1	1	1	1
	918	Install Guy		2	2	2	2	2	2

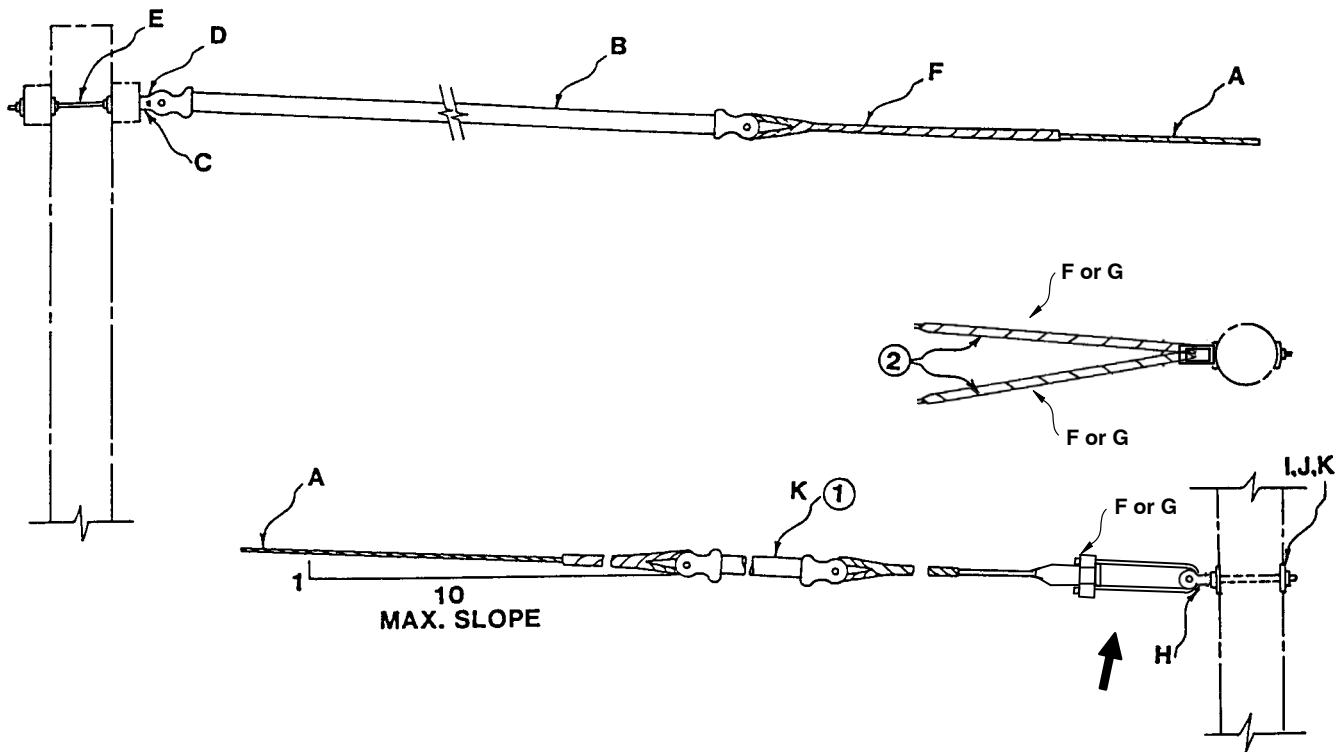
GUYING

Span Guy – Arm to Pole

Fiberglass Insulator at the Arm

11 00 48 **

Sheet 1 of 1



NOTES:

1. Omit second insulator if not required. See Dist. Std. 11 00 01 ** for insulator location and requirements.
2. Materials listed are for single unit. For double unit call for two guys.

	Std. / Stk. No.	Description	11 00 48 **	01	02	03	04
A	27 59 016	Wire – Guy, 1/4"	150	150			
	27 59 020	Wire – Guy, 3/8"			150	150	
B	25 56 070	Insulator – Guy, FG 45"	1		1		
	25 56 058	Insulator – Guy, FG 88"		1		1	
C	23 65 012	Eyenuit, 5/8"	1	1	1	1	
D	23 66 027	Washer – Sq. 2-1/4"	4	4	4	4	
E	23 53 002	Bolt – Mach., 5/8" x 16"	1	1	1	1	
F	23 68 241	Grip – Guy, 1/4"	1	1			
	23 68 237	Grip – Guy, 3/8"			1	1	
G	23 68 300	Deadend – Auto, 1/4"	1	1			
	23 68 299	Deadend – Auto, 3/8"			1	1	
H	23 68 096	Eye – Guy	1	1	1	1	
I	23 66 031	Washer Curved	2	2	2	2	
J	23 52 095	Bolt – Mach., 3/4" x 10"	1	1	1	1	
K	11 00 40 **	Assembly – Insulator, Guy	1	1	1	1	
	918	Install Guy	2	2	2	2	

**DISTRIBUTION
CONSTRUCTION STANDARDS**

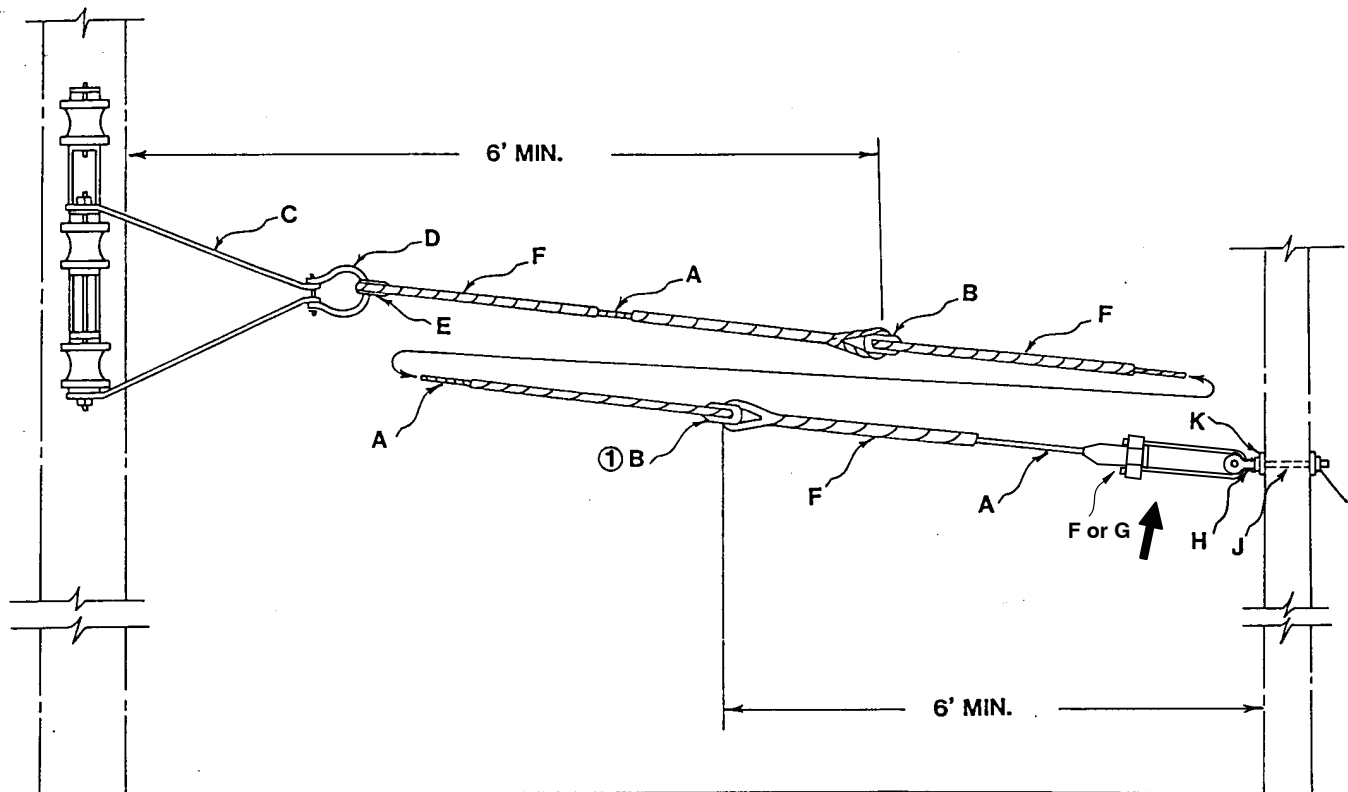


ENG: DDG
REV. NO: 8
REV. DATE: 04/01/10

GUYING Secondary Extension Bracket to Pole 0 – 750 Volts

11 00 49 **

Sheet 1 of 1

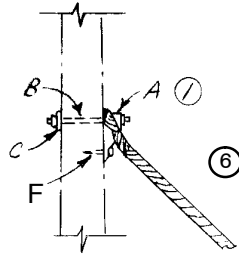


NOTE:

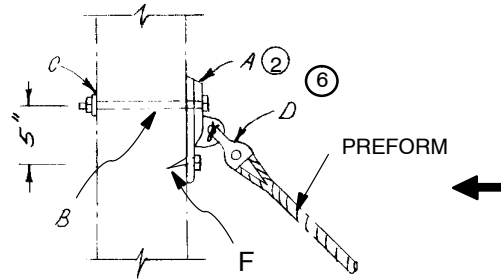
1. Omit second insulator if not required. See Dist. Std. 11 00 01 ** for insulator location and requirements.



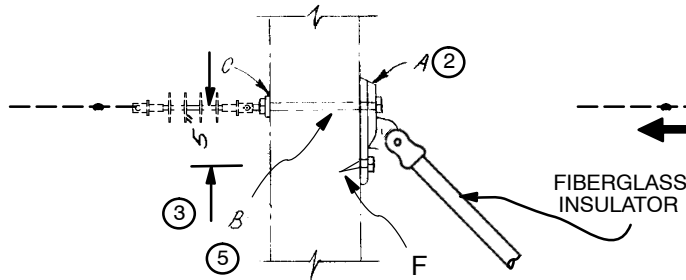
	Std. / Stk. No.	Description	11 00 49 **	01
A	27 59 016	Wire – Guy, 1/4"GS (Ft.)		150
B	25 56 047	Insulator – Guy, 15kV		2
C	23 68 330	Link, Guy (Pair)		1
D	23 68 181	Shackle, Deadend		1
E	23 68 094	Thimble, Guy, 3/8"		1
F	23 68 241	Grip, Pref., 1/4 GS		3
G	23 68 300	Deadend – Auto, 1/4"		1
H	23 68 096	Eye – Guy		1
J	23 52 095	Bolt – Mach., 3/4" x 10"		1
K	23 66 031	Washer, Curved		2
	918	Install Guy		2



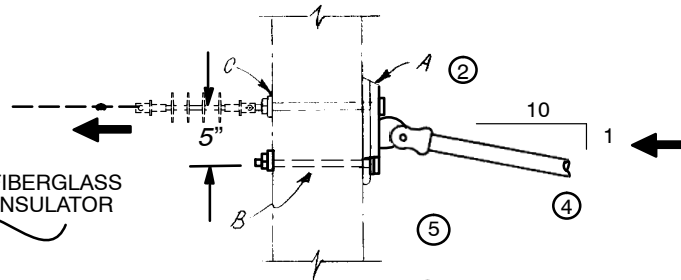
11 00 56 01



11 00 56 02
11 00 56 05③



Primary DE **11 00 56 03**
Secondary DE **11 00 56 06**



11 00 56 04⑦

NOTES:

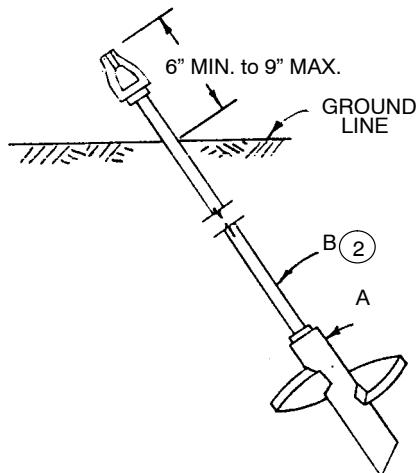
1. Working load of light duty hook (90 % of ultimate) is 9000 lb.
2. Working load of heavy duty hook (90 % of ultimate) is 18000 lb.
3. Use a 5/8" bolt only when guy is behind a 5/8" eyelet, secondary clevis, or light duty guy hook w/ 1/4" guy wire.
4. See DCS **11 00 46 **** for span guy.
5. The top bolt used for guy hook attachment may also be used to attach polymer DE or eyelet bolt.
6. These configurations may only be used for stub pole guys with no energized conductors.
7. For composite pole applications, only through-bolt mounting DCS **11 00 56 04** is acceptable. Lag bolts are not to be used with composite poles.

		Std. /Stk. No.	Description	11 00 56 **	01	02	03	04	05	06
1	A	23 68 056	Hook, Guy, Light Duty		1					
2		23 78 345	Hook, Guy, Heavy Duty			1	1	1	1	1
3	B	23 52 063	Bolt, Mach., 5/8" x 10"		1				1	1
		23 52 097	Bolt, Mach., 3/4" x 12"			1	1	2		
	C	23 66 031	Washer, Curved, 3-1/4" x 3-1/8"		1	1	1	2	1	1
	D	23 58 054	Clevis, Thimble			1			1	
7	F	23 60 007	Screw, Lag, 1/2" x 4"		1	2	2		2	2

GUYING Screw Anchors 6,000 Lb. Torque Capacity

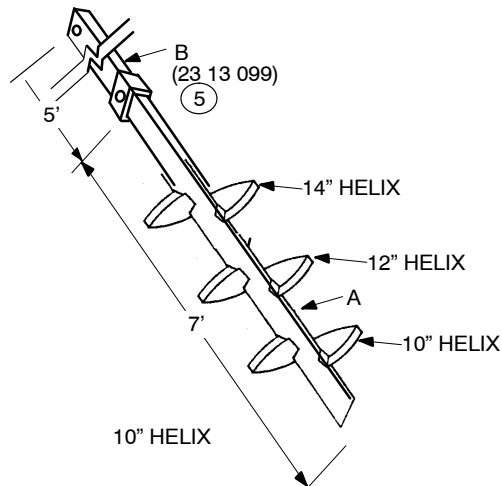
11 00 60 **

Sheet 1 of 1



ROUND ROD SINGLE HELIX

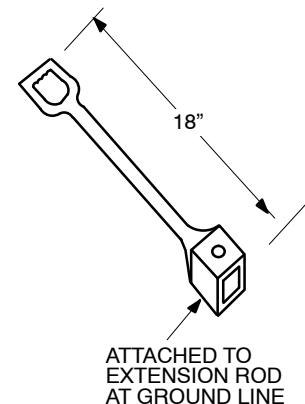
10" 11 00 60 01
14" 11 00 60 03



SQUARE SHAFT MULTI HELIX

10", 12" & 14" 11 00 60 06

TWIN EYE GUY ADAPTER



Size	Holding Power – Lbs.			Standard
	Sand	Clay	Clay Pan	
10"	12,000	15,000	16,500	11 00 60 01
14"	18,000	22,000	25,000	11 00 60 03
10", 12", & 14"	35,000	40,000	60,000	11 00 60 06

NOTES:

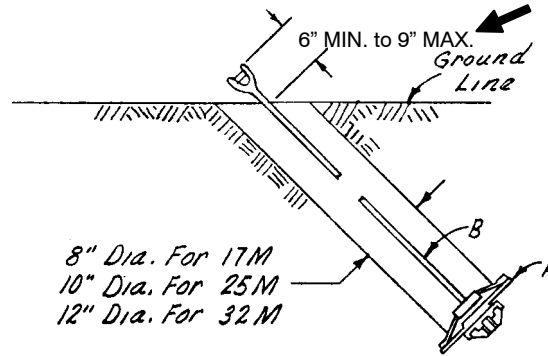
- Expanding anchors, Dist. Std. **11 00 61 **** may be used if power installation equipment is unavailable or if soil condition, particularly rocks makes use of screw anchor or high torque screw anchor impractical.
- 3'-6" sectional rods (Stk. No. 23 63 097) may also be used in poor soil to obtain greater setting depth of the anchor.
- High torque screw anchors, Dist. Std. **11 00 63 **** should be used only where power installation equipment is available and soil conditions are such that regular screw anchors would twist off at the helix.
- Guy eye nut/adaptor is provided with the rod. If it is necessary to order separately, the stock numbers are;
-Twin eye nut for round rod – 23 59 075
-Triple eye adapter for square shaft – 23 13 112
- The top helix must be a minimum 6' deep. Therefore, extension rod (23 13 099) must be used in all cases. Continue to install until there is approximately one-quarter (1/4) turn per foot in the square shaft.
- Drive wrench for square shaft anchors is Stock No. 86 14 736.
- Multiple anchors must be spaced a minimum 5' apart.

		Std. / Stk. No.	Description	11 00 60 **	01	03	06
	A	23 13 131	Anchor – 10" Helix, 1-3/8" Hub		1		
		23 13 092	Anchor – 14" Helix, 1-3/8" Hub			1	
		23 13 138	Anchor – 10", 12", & 14" Helix, w/Twin Eye Guy Adaptor				1
	B	23 63 090	Rod – Anchor, 7', with Twin Eye Nut		1	1	
		23 13 099	Rod – Anchor Extension, 5'				1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DDG
REV. NO: 6
REV. DATE: 08/31/15



Anchor Size	Holding Power – Lbs.			Standard No.
	Sand	Clay	Hard Pan	
17M	11,500	17,500	23,000	11 00 61 01
25M	17,000	25,000	32,000	11 00 61 02
32M	21,000	32,000	36,000	11 00 61 03

NOTE:

- Screw anchors, Dist. Std. **11 00 60 **** are preferred and should be used if power installation equipment is available and soil condition is satisfactory.

		Std. / Stk. No.	Description	11 00 61 **	01	02	03
A		23 13 005	Anchor – Exp., 17M	1			
		23 13 007	Anchor – Exp., 25M		1		
		23 13 094	Anchor – Exp., 32M				1
B		23 63 019	Rod – Anchor, 3/4" x 8'	1			
		23 63 022	Rod – Anchor, 1" x 8'		1	1	

Installation of Expanding Anchors

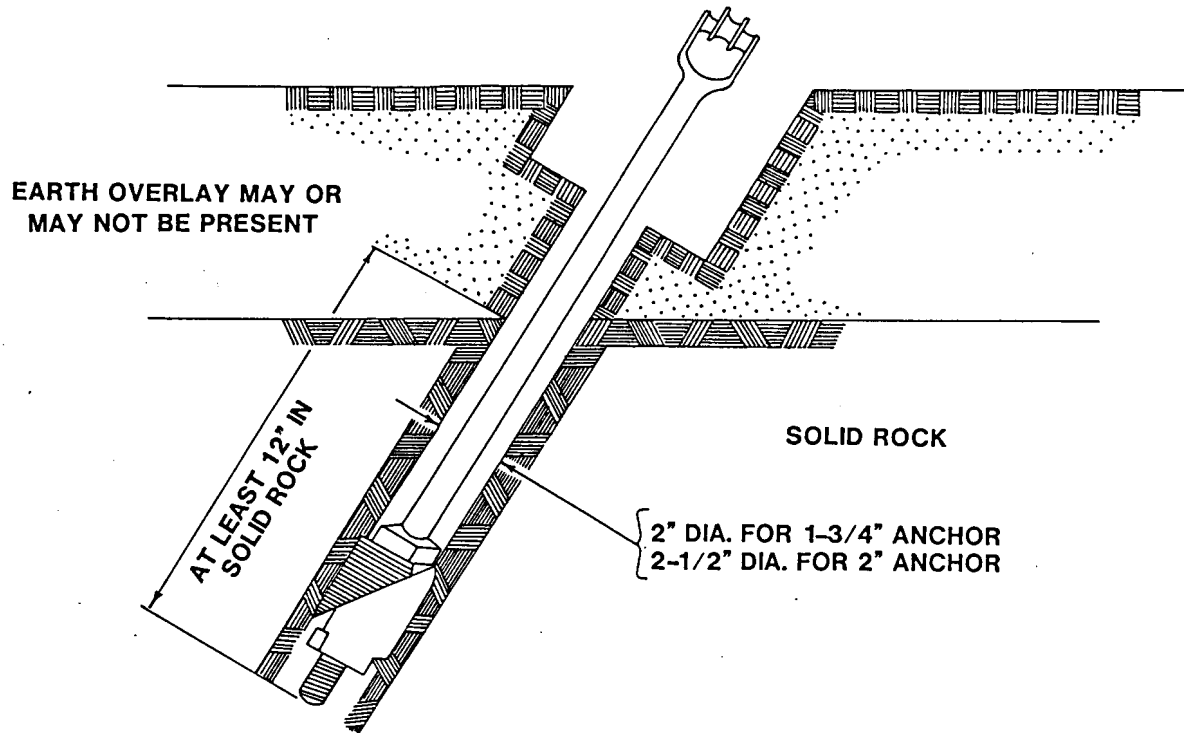
1. Using an adjustable earth auger (Stock No. 85-01-026), drill a hole of such depth that the anchor rod will extend 6 to 9 inches above the ground line when the anchor is expanded; and at such an angle that the anchor rod will be as near as possible to the angle the guy wire will assume after the load is applied to it.

For 17-M anchors, the hole shall be 8 inches in diameter; for 22-M anchors, the hole shall be 10 inches in diameter; and for 32-M anchors, the hole shall be 12 inches in diameter.

2. Screw the anchor rod into the unexpanded anchor. Take any measurements of the anchor and rod which may be necessary in checking for complete expansion later.

Clean all loose dirt from the bottom of the hole and insert the anchor. Press the anchor firmly against the bottom of the hole, with the anchor rod held as close as possible to the angle the guy wire will assume after the load has been applied.

3. Expand the anchor, using a tubular anchor spreader (Stock No. 85-32-093) for 17-M anchors. For 25-M and 32-M anchors, use expanding and tamping bar (Stock No. 85-36-001). When the latter is used, it must be rotated around the anchor rod between blows in order that the expanding force will be distributed to all sides of the anchor. The first few blows must be heavy to insure the shearing of retaining bolts or wire, and proper positioning of the anchor blades in the side walls of the hole.
4. Make sure the anchor is completely expanded. When expansion is complete, the sound of the spreader striking the anchor will be a more "solid" sound than while the anchor is being expanded. Check visually, using a light; and take measurements to compare with those made before the anchor was placed in the hole to determine whether the anchor is completely expanded.
5. The backfill is one of the most important factors in making a good anchor installation. Cover the anchor with a thin layer of loose dirt, and tamp as solidly as possible around the anchor blades. Complete the backfill to the ground line, tamping each shovel-full of earth thoroughly. All of the earth which was removed from the hole should be used in the backfill.
6. Where expanding anchors are installed in good soil under water or in good soil that is very wet, the first 30 inches of backfill shall consist of very thoroughly tamped chat, crushed stone (not larger than egg size) or clean gravel. The backfill shall then be completed as usual. The use of chat, crushed stone or gravel will substantially improve the anchor's holding power under these adverse conditions allowing normal tensions to be applied.



Size and Use
Standard Rock Anchors

- 1-3/4" Anchor with 3/4" Diameter Tripleye Rod
- 2-1/4" Anchor with 1" Diameter Tripleye Rod

These are expanding type anchors and do not require grout or concrete for installation. When set in solid rock at least 12" deep, these anchors will develop the full strength of the anchor rod.

Stock No.	Rod Length	Rod Diameter	*Breaking Load	Size Rock Drill
23 13 053	30"	3/4"	23,000	2"
23 13 054	53"	3/4"	23,000	2"
23 13 106	72"	3/4"	23,000	2"
23 13 056	96"	3/4"	23,000	2"
23 13 118	53"	1"	36,000	2-1/2"
23 13 117	96"	1"	36,000	2-1/2"

*Rated tensile strength of rod. Actual holding strength will depend on characteristics of installation, i.e., Type of rock, Depth in rock.

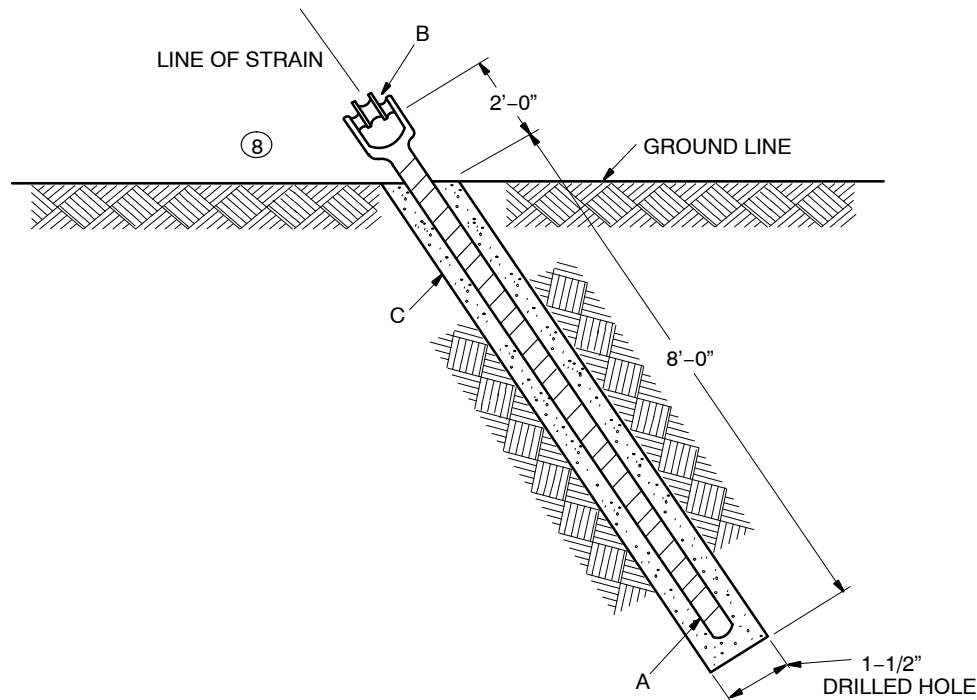
Installation of Rock Anchors

- Rock anchors shall be used only in solid rock. Drill a hole using a rock bit at least 12 inches deep in the rock. The hole shall be at such an angle that will allow the anchor rod to be as near as possible to the angle the guy wire will assume when it is loaded.
- Place the anchor in the bottom of the hole. Expand the anchor by turning the rod with a wrench or bar in the eye of the rod.

GUYING Rock Anchor Rebar Type with Resin Bonding

11 00 62 01

Sheet 1 of 1



NOTES:

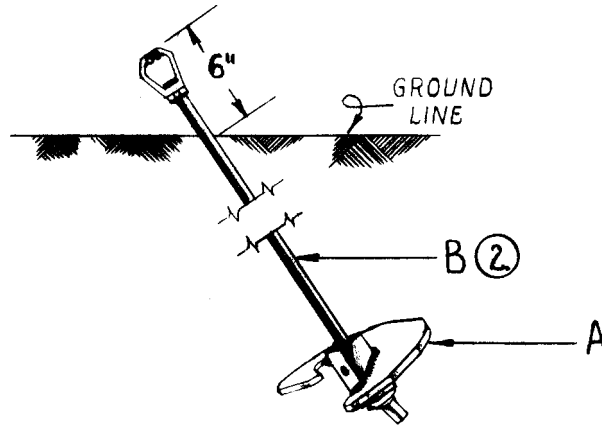
1. 1-1/2" diameter hole can be drilled with boring bar if in a dry environment; for wet environment use a hammer drill.
2. Dust and loose rock chips must be removed prior to inserting resin cartridges.
3. Resin cartridges should be warmed to 55 – 60 F prior to insertion. Curing time at these temperatures is 15 to 30 minutes. Curing time increases at lower temperatures.
4. Use hooked rod to check for seams in drilled hole and for depth of hole.
5. Hole should be drilled as nearly in line with the down guy as possible. Misalignment by more than 10 degrees can result in premature failure.
6. Following cartridge insertion the 10 foot rebar (item A) should be inserted in the hole, puncturing the cartridges. A 3/4 inch adaptor should be attached to the threaded end of the rebar and the rebar rotated 60 seconds using a mechanical driver to disperse the hardener throughout the resin.
7. Center rebar in hole as nearly as possible and support while resin is curing.
8. If surface of rock is below surface of soil item D can be used to extend the attachment point. Thimbleye nut should not extend more than 2 feet above ground line.

		Stock No.	Materials Description	11 00 62 **	01
	A	23 13 154	Anchor-Rebar, #8 Grade 60, Galv., 10'-0" Long w/ 1" – 8 NC x 12" Long Threaded		1
	B	23 65 061	Nut, Thimbleye, for 1 – 8 NC Thrd., 36,000 Lb UTS		1
	C	14 12 377	Anchor – Fast Lock T – Resin (Celitite), WilliamsForm Cat. No. S6R-35-305-15-30.		7
	D	23 63 097	Extension, 1" Dia. x 3-1/2 Ft., Threaded w/Coupler		1

GUYING High Torque Screw Anchors Alternate

11 00 63 **

Sheet 1 of 1



Anchor Size	Holding Power – Lbs.				Standard No.
	Clay	Claypan	Hardpan	Laminated Rock	Single Section Rod
8"	Note 3	12,500	20,000	24,000	11 00 63 01
10"	Note 3	16,500	25,000	28,000	11 00 63 03

NOTES:

- Expanding anchors, Dist. Std. **11 00 61 **** may be used if power installation equipment is unavailable or if soil condition, particularly rocks, makes use of high torque screw anchors impossible.
- 3'-6" rods must be used with some installation equipment.
- Screw anchors, Dist. Std. **11 00 60 **** must be used in this type soil. They should also be used where soil conditions permit because of the increased expense of these high torque screw anchors over regular screw anchors.

		Std. / Stk. No.	Description	11 00 63 **	01	03
	A	23 13 123	Anchor – 8" Helix		1	
		23 13 124	Anchor – 10" Helix			1
	B	23 63 090	Rod – Anchor, 7', with Twin Eye Nut		1	1

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1. General

This section outlines standard ratings of lightning protective equipment, methods of installation, equipment to be grounded, and methods of grounding.

2. Lightning Protection

Two types of lightning protective equipment are used to protect OH lines and associated equipment. These are Overhead Static Wire and Lightning Arresters.

2.1 Overhead Static Wire

This is a grounded overhead wire installed above the circuit to be protected to shield it from lightning. It is located at an elevation such that a line passing through the static wire and the outermost conductor below it is at a 30° maximum angle with a vertical line. This continuous overhead static wire is grounded by means of a formed copper wire grounding electrode at each pole.

2.1.1 Installation of Static Wire

The preferred method of lightning protection of overhead sub-transmission circuits is through use of an overhead static wire. The static wire shall be grounded at every pole except manually operated group air break switch poles. The best protection is afforded by low pole ground resistance (less than 15 ohms).

Existing circuits which qualify for improved lightning protection shall be protected in this manner. Additional pole height may be required to add a static wire. A fiberglass pole top extension or a wood bayonet can be used for added height.

2.2 Lightning Arresters

Metal Oxide Varistor (MOV) arresters are normally used for protection of overhead distribution circuits or equipment where conditions warrant (e.g. high ground resistance or retrofitting shielded circuits with a poor history of lightning performance). These arresters (mostly zinc oxide) are solid state and are direct connected from line to ground. MOV arresters are sensitive to temporary system overvoltage such as may occur due to ferroresonance or to single phase switching of ungrounded wye-delta transformer banks. In such instances contact Standards engineering for recommendations. Higher voltage arresters may be required.

There are many silicon carbide internally and externally gaped arresters still on the system. These allow a higher discharge voltage than MOV arresters, reducing the surge protective margin. When these are found during work on a pole they should be replaced with a polymer housed metal oxide (MOV) arrester (especially at riser poles).

2.2.1 Installation of Lightning Arresters

When installed to protect equipment, arresters shall be installed as near as practical to the equipment to be protected. See Table 2 for equipment to be protected.

Arresters are also installed on sub-transmission for general line protection. In this application, arresters should be installed on the top phase of every pole where a 30° shield angle exists. Skipping spans severely reduces the ability of the arresters to protect against direct stroke flashovers. Where lines run through wooded areas or close (within 1-1/2 pole heights) to any type of structure at least as tall as the top phase, induce flashovers may be experienced. If outages are experienced in this circumstance, arresters should be installed on the remaining phases of the circuit(s) at roughly 600' intervals. Where a shield angle greater than 30° exists, arresters should be placed on all three phases of every pole in open territory. Where the line runs through areas shielded by trees or other structures, arresters should be installed on all three phases at roughly 600' intervals.

Distribution underbuild, particularly when built with all three phases on one crossarm, will many times experience flashovers from the ground lead of either static construction or arresters on the sub-transmission circuit(s). If experience indicates this to be the case, arresters should be installed on the B phase (closest to the pole).

In all cases the primary connection lead as well as the ground lead should be as short as possible and free of any sharp bends. **Under no circumstances should "pigtail" coils be made in the arrester connecting leads.**

Installation notes:

1. Connect the arrester ground lead before connecting the arrester to the line.
2. Install wildlife guards on line terminals of all line arresters and cover (stk #69 56 037) over transformer sidewall bracket arrester attachment bolt.
3. Do not reconnect arresters with a blown ground lead disconnector.
4. Arresters removed for any reason shall not be re-installed.

TABLE 1. Standard Lightning Arrester Ratings (See NOTES As Below)				
App	Type Circuit	Rating	*MCOV	Stock Number
OH	2400 V Delta	3 kV	2.55 kV	10-01-133
	4160 Gnd Y/2400 V	3 kV	2.55 kV	10-01-133
	4160 Gnd Y/2400 V Trf. Mnt	3 kV	2.55 kV	10-01-122
	4160 Gnd Y/2400 V Terminal Pole	3 kV	2.55 kV	10-01-133
	4160/2400 V with Isolated Neut	3 kV	2.55 kV	10-01-133
	4160 V without Neutral Extended	6 kV	5.10 kV	10-01-184
	4800 V Delta	6 kV	5.10 kV	10-01-184
	12470 Gnd Y/7200 V	10 kV	8.4 kV	10-01-144
	12470 Gnd Y/7200 V Trf Mnt	10 kV	8.4 kV	10-01-145
	12470 Gnd Y/7200 V Terminal Pole	9 kV	7.65 kV	10-01-129
	12470 Gnd Y/7200 V Terminal Pole	10 kV	8.4 kV	10-01-146(3)
	12470 Delta or 14,400 Un-Grounded, Gapped	15 kV	12.7 kV	10-01-188
	13200 Gnd Y/7620 V	10 kV	8.4 kV	10-01-144
	13800 Gnd Y/7970 V	12 kV	10.2 kV	10-01-008
	13800 V Un-Grounded	15 kV	12.7 kV	10-01-008
	13800 or 14400 Delta	18 kV	15.3 kV	10-01-143
	13800 Gnd Y/7970 V Terminal Pole	10 kV	8.4 kV	10-01-146
	24900 Gnd Y/14400 V (Solidly Grounded)	18 kV	15.3 kV	10-01-143
	34500 Gnd Y/19.9kV (Solidly Grounded (Transformer)	27kV	22kV	10-01-234
	34500 Gnd Y/19920 V (solidly Grounded)	30 kV	24.4 kV	10-01-148 (1)(4)
	34500 Gnd Y/19920 V (solidly Grounded)	30 kV	24.4 kV	10-01-147(2)(4)
	34500 Gnd Y/19920 V Terminal Pole	27 kV	22 kV	10-01-137
	34500 Gnd Y/19920 V Terminal Pole, Gapped	27 kV	22 kV	10-01-199(5)
OH	34500 Gnd Y/19920 V Suspended with Side Post Insulator	30 kV	24.4 kV	10-01-239 (4)
	34500 V Un-grounded Delta /Suspended with Side Post Insulator(13)	36 kV	29 kV	10-01-249(5)
	34500 Gnd Y/19920 V Suspended with DE Insulator	30 kV	24.4 kV	10-01-237
	34500 V Un-grounded Delta /Suspended with DE Insulator (13)	36 kV	29 kV	10-01-248
	34500 Gnd Y/19920 V (Solidly Grounded) -- Intermediate Class	30 kV	24.4 kV	10-01-240(6)
	34500 Gnd Y/19920 V (Solidly Grounded) - -- Intermediate Class	30 kV	24.4 kV	10-01-241(7)
	34500 V Un-grounded Delta - -- Intermediate Class (13)	36 kV	29 kV	10-01-243(9)
	34500 V Un-grounded Delta - -- Intermediate Class (13)	36 kV	29 kV	10-01-242(8)
	69000 V Gnd Y - -- Intermediate Class	60 kV	48 kV	10-01-245(10)
UG	69000 V Gnd Y Suspended with Side Post Insulator	60 kV	48 kV	10-01-158
	69000 V Gnd Y Suspended with DE Insulator	60 kV	48 kV	10-01-236
	12470 V URD	10 kV	8.4 kV	10-01-138
	12470 V URD (Parking Stand Arrester)	10 kV	8.4 kV	10-01-151
	34000 V URD (Small Interface) (11)	27 kV	22 kV	10-01-163
	34000 V URD (Large Interface)(12)	27 kV	22 kV	10-01-177
	34000 V URD (Small Interface)(11)(13)	36 kV	29 kV	10-01-255
SEC	34000 V URD (Large Interface)(12)(13)	36 kV	29 kV	10-01-154
	1 Phase 120 or 120/240 V	175 V		10-01-032

*Maximum Continuous Operating Voltage (MOV)

NOTES:

THIS TABLE DOES NOT APPLY TO ANY ARRESTERS ANYWHERE IN SUBSTATIONS.

- (1) Direct pole mounting
- (2) Crossarm mounting
- (3) Use only when problems are experienced with 9kV (10-01-129) operating frequently or failing due to higher operation voltages (proximity to substation, etc.).
- (4) The suspended arrester is to replace stock #10 01 148 and stock #10 01 147.
- (5) Use on un-grounded delta system.
- (6) Base mount for use on primary metering structure.
- (7) Crossarm mount for use on primary metering structure.
- (8) Base mount for use on un-grounded delta primary metering structure.
- (9) Crossarm mount for use on un-grounded delta primary metering structure.
- (10) Base mount for use on primary metering structure.
- (11) Small Interface is to mount on radial feed.
- (12) Large Interface is to mount on loop feed.
- (13) For un-grounded delta 34kV system.

TABLE 2. Equipment To Be Protected by Lightning Arresters	
Equipment	Arrester Location
Distribution Transformers	Primary Side
Voltage Regulators - Pole Installations	Primary & Secondary Sides
Constant Current Regulators - Pole Installations	Primary & Secondary Sides
Terminal Poles - Lead and Non-Lead Cables	On terminal pole and on same phase on structures each side of riser poles.
Line Switches - Normally Closed	Arresters not required
Line Switches - Normally Open	Install both sets of arresters on adjacent pole for Illinois; for Missouri, install arresters on a separate bracket arm below the switch, and install additional set of arrester on adjacent pole of unprotected side, or install both arresters on adjacent pole if space is limited.
Airbreak Switches - Normally Open - 35 & 69kV	Install both sets of arresters across the dead-end insulators on the switch pole shown DCS 10 34** and 10 69**.
Capacitors	On capacitor rack
Time Switches	On switch
Meters (only on approval of Engineering)	On service entrance equipment
Unshielded Distribution Lines	On crossarm, pole face or primary apparatus. Minimum of 4 arresters per phase per mile (counting apparatus arresters if separated by 600 ft or more).
Deadend Poles (Unshielded Circuits)	Top Phase (Vert): All Phases (Flat)

3. Grounding Practices

3.1 General

Ground rods will continue to be used for grounding pad mounted equipment and existing pole ground installations. For new pole ground installations a formed #2 soft-drawn copper electrode shall be used. This electrode is to be placed at the bottom of the pole and covered with at least six inches of native soil. The vertical lead of the electrode should be trained to the side of the pole hole so that it will not be covered by the crushed rock backfill. If the desired resistance is not obtained additional ground rods can be driven in parallel with the formed electrode but a minimum separation distance of six feet shall be maintained.

3.2 The Common Neutral System

Either a 2400/4160 Y volt or a 7200/12470 Y volt common neutral distribution system is normally used at Ameren. These systems use a continuous metallic conductor which serves as both the primary and secondary neutral conductor. This neutral conductor must be attached to grounds at various points throughout its length to insure adequate grounding of the circuit. These grounds (Table 3) will consist of customers' grounds, lightning arrester grounds, and static wire grounds and occasionally a ground installed solely to provide adequate grounding of the common neutral. Where a common neutral is present, all grounds installed for any purpose shall be bonded to it.

3.3 Number of Grounds – Common Neutral

At least four grounds are required, (counting equipment grounds but not counting customers' grounds), in each mile of common neutral circuit for **both overhead and underground circuits (maximum 1320 feet spacing)**. In cases of random lay underground with other utilities, at least 8 grounds per mile are required. Where it is necessary to install additional grounds because of this requirement, approximately uniform spacing shall be used. See Table 3.

3.4 Size of Ground Wire

The size of ground wire will vary according to the type of equipment being grounded and shall conform to Table 3. In areas of frequent damage/vandalism, 7#10 copperweld should be substituted for the #6 soft drawn copper pole ground wire.

3.5 Multiple Ground Leads on Same Pole

Where both Ameren and communication systems are grounded on a joint use structure, NESC Rule 97G requires that either a single pole ground lead shall be used for both systems or the Ameren and communication ground leads shall be bonded together. This bond should be at the communication worker safety zone (40" below lowest Ameren attachment if made by Communication Company or

at the neutral if connection is made by Ameren.) Where Ameren is maintaining isolation* between primary and secondary neutrals, the communication system ground shall be connected only to the primary neutral ground lead.

The same requirement for bonding of separate ground leads at the neutral level applies for all instances where multiple ground leads are installed (i.e., static/shield wire and system neutral ground leads; Ameren and other electric utility system neutral ground leads).

*See DCS 13 00 06 06, 13 00 06 08, and the delta primary connection diagrams in 13 00 07 02 thru 13 00 07 12 for situations requiring isolation of Ameren primary and secondary neutrals.

3.6 Multiple Ground Rods on Same Pole

Where separate ground rods are used for separate pole grounds, NESC Rule 99C requires a bond wire not smaller than #6 copper or equivalent to be placed between the two ground rods. This bond should be visible at the pole base. All separate ground rods shall be bonded together except where Ameren is maintaining isolation between primary and secondary neutrals.

*See DCS 13 00 06 06, 13 00 06 08. And the delta primary connection diagrams in 13 00 07 02 thru 13 00 07 12 for situations requiring isolation of Ameren primary and secondary neutrals.

3.7 Equipment To Be Grounded (*)

TABLE 3. Equipment To Be Grounded and Size Of Ground Wire			
Case No.	Equipment or Circuit To Be Grounded	Min. Size of Ground Wire	Other Requirements
1	Lightning Arrester	#6	See Note 2 for Sec Lightning Arresters
2	Cable Sheath Grounds	#2	Wipe ground leads to cable sheath at base of potheads and also to standpipe on pole. Inter-connect solidly with arrester ground leads.
3	Concentric Neutral on Terminal Pole	#2	Twist together and route close to arrester and on to the neutral using #2. Tie short #6 SD cu to arrester ground terminal.
4	Capacitors	#6	Hangers are cases to be bonded together and connected solidly to arrester ground lead.
5	Regulator Cases	#6	Connect solidly to arrester ground lead. Keep leads short.
6	Secondary Neutral or Grounded Conductor	7#10 CW	Connect solidly to pole ground.
7	Common Neutral	7#10 CW	A minimum of four grounds per mile, in addition to customers' grounds, is required.
8	Metal Cable Risers	#6	Separate grounds shall be installed for risers carrying non-lead sheath cables.

9	Airbreak Switch	#2	All airbreak switch handles shall be grounded through a separate ground lead and rod. Inter-connection shall be made with arrester ground lead or to the OH static wire.
10	Transformer Cases	#4	All transformer cases shall be grounded. Ground lead from transformer case shall be closely and solidly connected to arrester ground lead.
11	Transformer Windings -pole mounted	#6	See DCS 13 00 06 and 13 00 07 for connection diagrams.
12	Transformer Windings -pad mounted	#2	See DCS Section 50.
13	Metal Lamp Posts & Metal Poles	#6	Metal lamp posts and metal line or guying posts shall be effectively grounded.
14	Reclosers/Sectionalizers	#6	Connect arrester ground lead solidly to equipment tank.
15	S&C Interruption/G&W Wiper Recloser	#2	Connect the recloser bracket to pole ground.
16	Static wire	#2	Connect to pole ground on every pole unless otherwise noted on construction standards.
17	Customer Service	#6	Connect to metallic water pipe system. Otherwise to driven ground rod.
18	Instrument Transformers	#12	Cases of instrument transformers shall be grounded. Grounding of secondary windings shall be per Engineering instructions.
19	Meter Sockets, Troughs & Enclosures	#12	Meter sockets, troughs and enclosure shall be grounded.
20	Long Runs of UG Cable May Require an External Ground Connection	#2	See DCS 41 34 37** for an example of an external ground connection on a splice.

NOTES:

- 1 Pole line hardware (including cluster bracket and streetlight brackets) must not be grounded except with engineering approval.
- 2 Where a lightning arrester is installed on a secondary or service the arrester ground lead shall be solidly connected to any one or combination of the following grounds:
 - a The neutral or grounded service wire.
 - b Customer's common grounding conductor.
 - c Customer's equipment grounding conductor.
 - da. A separate grounding conductor such as a driven rod.

3.8 Ground Wire Attachment and Covering

The ground wire shall be run in a straight line or a smooth curve and shall clear hardware by at least 2 inches. The static ground wire from 34kV circuits shall be routed on the opposite side of the pole away from the closest phase of any underbuilt circuit. Avoid making sharp bends in ground wires. Take care when driving staples onto ground wires to avoid damaging the wire.

Where the ground wire passes over a messenger or guy wire, a loop shall be formed to clear the messenger or guy wire. If necessary a bridge shall be made

from a 6" length of plastic molding, placing the half round of the molding against the pole and taping the ground wire in place in the groove.

Where guarding is not required, grounds shall be protected by being substantially attached closely to the surface of the pole or other structure in areas of exposure to mechanical damage and, where practical, on the portion of the structure having least exposure.

A 4'0" section of molding may be placed over the ground wire in the working area on badly congested poles. The purpose of the molding is to keep linemen's climbers from damaging the ground wire when working on primary circuits.

Ground wire molding is required for installations with no common neutral and separate arrester/equipment tank and secondary neutral grounds. These separate grounds shall be made with 600 volt insulated conductor (use stk #18 53 011) and shall be covered with plastic molding for a distance of 8 feet from the ground. The arrester/tank ground and secondary ground can be connected using an isolation arrester (stk #10 01 019). One ground wire can be connected to a driven ground or coiled ground electrode at the base of the pole but the other ground wire shall be carried (buried) to a driven ground rod at least 20 feet from the base of the pole and connected with #2 SD bare copper conductor.

3.9 Static Wire at Substation

1/0 AAC or 12/7 ACSR static wire shall be electrically continuous and tied into the bulk substation ground grid. Where the connection into the substation cannot be made overhead, direct bury a 4/0 bare copper conductor from the last pole with static termination to the substation ground grid. The 4/0 size conductor allows some safety margin for corrosion. The downlead from the static wire to the 4/0 conductor shall be #2 copper.

3.10 Static Wire Personal Protective Grounds

a Wire Common Neutral

1/0 AAC or 110.8 (12/7) ACSR (or other shield wires having current capacity of 250 amps or greater) may be used for direct connection of protective grounds on 35 and 69 kV circuits if there is a common neutral and #2 copper pole grounds (or other pole grounds with current capacity of at least 50 amps) connected to the shield wire for at least two poles in each direction. The common neutral must also be connected to the down leads at each pole.

b Without Common Neutral

1/0 AAC or 110.8 (12/7) ACSR (or other shield wires having current capacity of 250 amps or greater) may be used for direct connection of protective grounds on 35 and 69 kV circuits with no common neutral present if #2 copper down leads are grounded at every 4th pole (no more than 1200 feet apart); a supplementary grounded rod must be driven at least 6 feet from the closest ground rod. This extra ground rod shall be connected with #2 copper to the #2 copper down lead.

0. Alumoweld Static Wire

Alumoweld static wires have been installed in the past. Do not connect protective grounds to Alumoweld. It may fuse if a fault occurs. To improve protective grounding on 35 kV lines with Alumoweld static and poor ground resistance, #2 copper downleads may be installed at intervals of 4 spans (no more than 1200 feet). Protective grounds can then be connected to the #2 Cu. A supplemental ground is required from #2 copper downlead to a second driven ground.

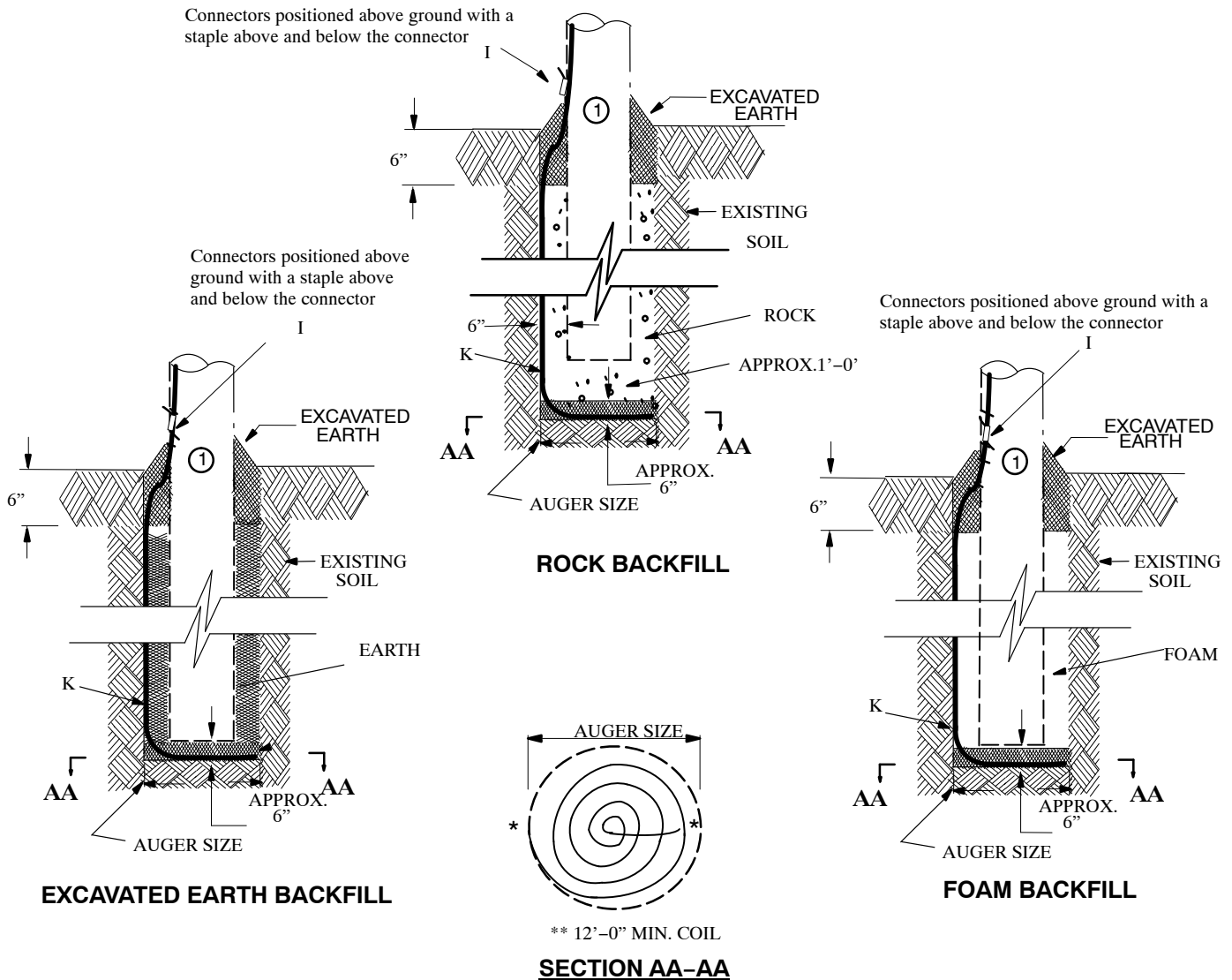
3.12 Static Wire/Common Neutral System

1/0 AAC or 110.8 (12/7) ACSR (or other static wires having current capacity of 250 amps or greater) may be used as the common neutral for lower voltage underbuilt circuits where the run is 3000 feet or more. In such cases the static wire must be continuous and connected to the source transformer neutral with #2 SD poly covered wire.

The static wire shall not be used in place of the secondary neutral. Where secondary is present the secondary neutral shall be paralleled with the static wire neutral and interconnected at every static wire ground down lead. However, where this would result in short discontinuous sections of neutral a continuous neutral shall be installed from the source transformer.

To equalize ground potential static wire ground leads, arrester ground leads, neutral ground leads and equipment case ground leads shall be bonded together with the only exceptions noted in the transformer section of these standards.

BELOW GRADE – NEW CONSTRUCTION



12 00 10 01-7#10 CW Pole Ground/Ground Coil 15kV&Below

12 00 10 04-#2 Cu Pole Ground/Ground Coil 15kV &Below

➔ 12 00 10 09-#2 Cu Pole Ground/Ground Coil 34&69kV

12 00 10 11-Composite Pole 12kV

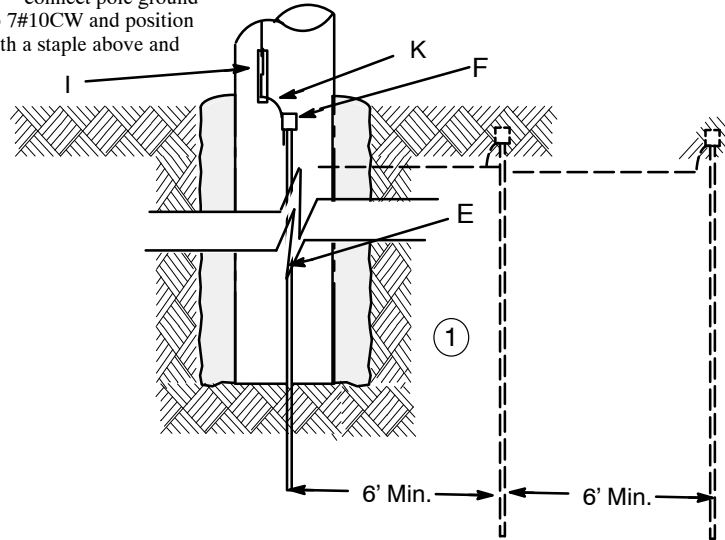
12 00 10 12-Composite Pole 34&69kV

NOTES:

1. Train below grade ground wire approximately 8" above ground line to line up with pole ground wire above grade.
Avoid making sharp bends.
2. See DCS 02 for pole setting depth, reinforcement, and backfill detail.

BELOW GRADE – EXISTING CONSTRUCTION

Non-Tension Sleeve Reducer – connect pole ground wire with #2 solid Cu Bare to 7#10CW and position above ground against pole with a staple above and below the connector



12 00 10 02–7#10 CW Pole Ground/Ground Rod 12kV&Below

➔ 12 00 10 10– #2 Cu Pole Ground/Ground Rod 34&69kV

12 00 10 03–#2 Cu Pole Ground/Ground Rod

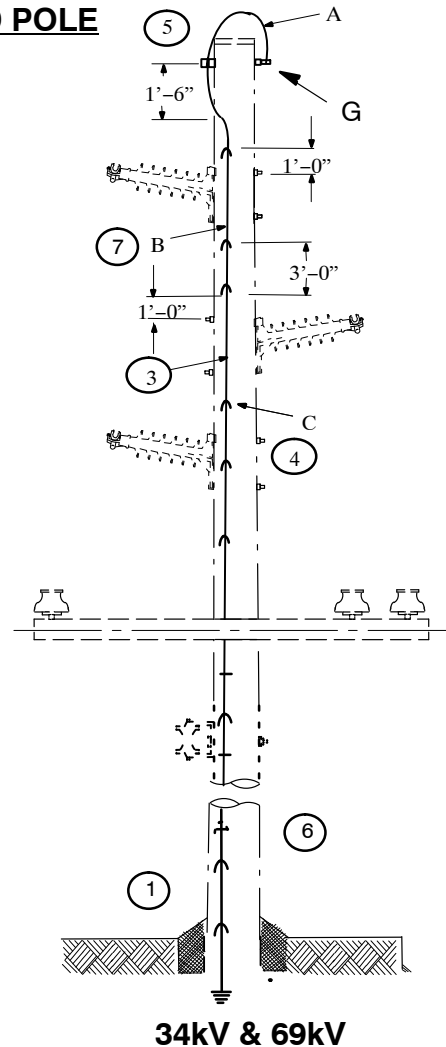
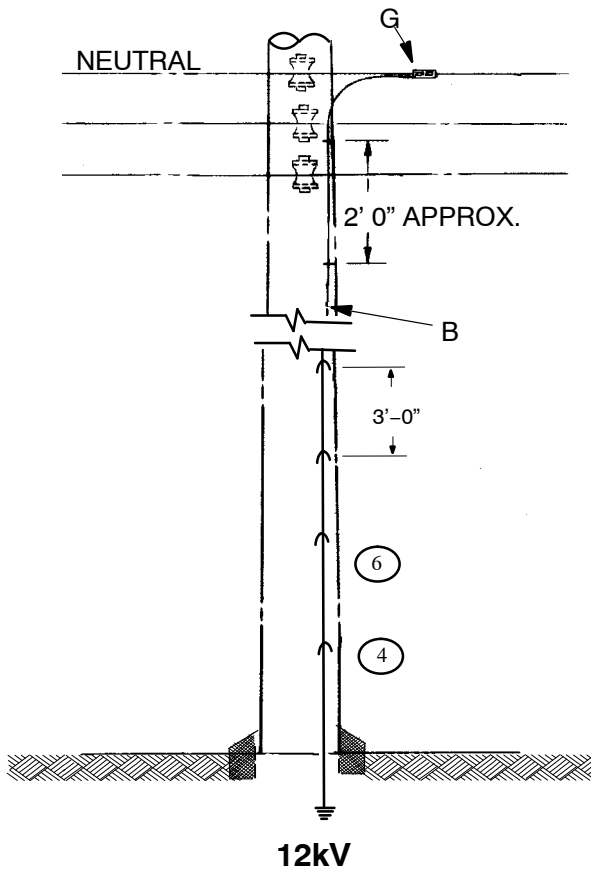
NOTES:

1. Ground resistance will normally be less than 25 ohms with one coil or one rod. In rocky or sandy soil where experience indicates ground resistance may exceed 25 ohms, install additional coil or rods spaced not less than 6' apart. Doubling the number of rods or coils or doubling the length of the rod reduces ground resistance by 40%.

If additional grounding is needed:

- a) terminal poles – a #2 bare Cu counterpoise wire 100'–150' long may be placed in the cable trench and connected to the ground lead.
- b) in rocky soil where driving a rod is difficult – a counterpoise, as stated in a), may be placed in a trench at least 18" deep.

ABOVE GRADE – WOOD POLE



12 00 10 01&04 – New installation

12 00 10 02&03 – Existing Pole Installation

12 00 10 07 – Add Staples

12 00 10 05 – Add Ground Molding/Staples



12 00 10 09–New–2 Cu Pole Ground/Field Formed Coil–34&69kV



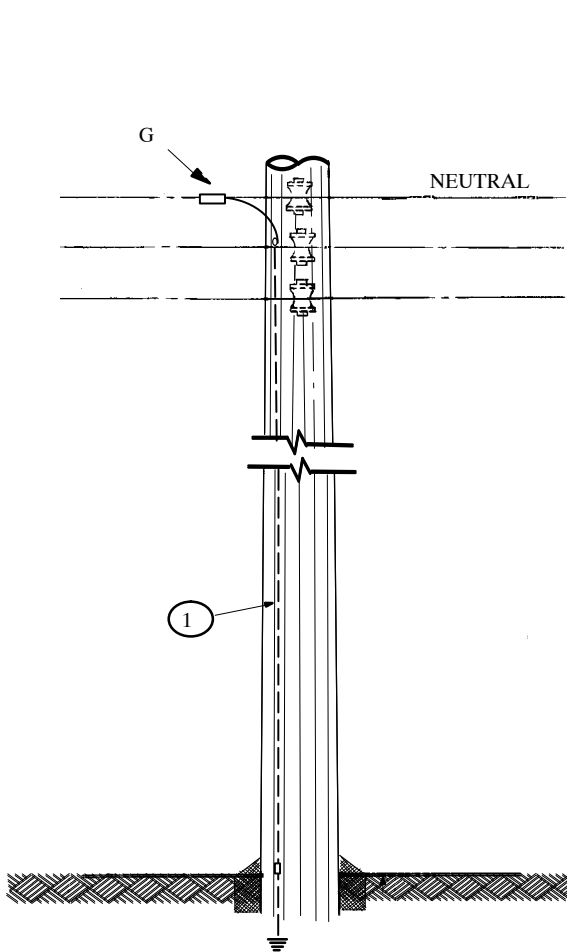
12 00 10 10 –Existing–#2 Cu Pole Ground/Ground Rod 34&69kV

12 00 10 07–Replacement–Add Staples

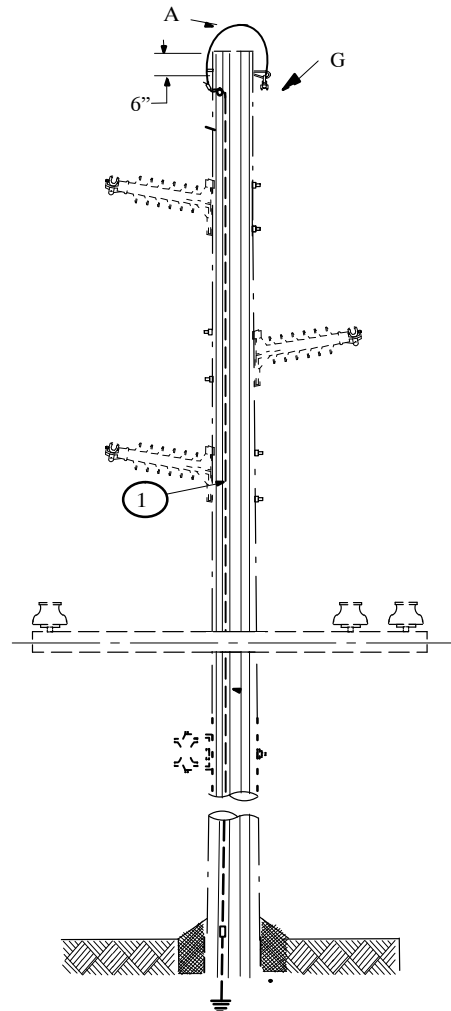
NOTES:

1. The ground wire shall be run in as straight a line down the pole without making sharp bends in such a manner as to clear hardware by at least 2 inches. Avoid damaging ground wire when installing staples.
2. According to an NESC subcommittee's interpretation, metal brackets and straps used to support non-conductive conduits do not need to be grounded. However, conductive material conduits that enclose electrical supply lines or are exposed to contact with open supply conductors must be effectively grounded.
3. Refer to DCS Section 03 for proper grounding position on different structure configuration.
4. Staples are to be spaced 3' on pole ground wire and 1'–6" from top of the pole on 34kV and 69kV line.
5. See DCS 06 00 11 ** for static support assembly and DCS 12 34 01 ** and 12 34 02 ** for lightning arrester connection.
6. Reconnect existing ground wire with 7#10 CW if pole ground wire is missing using DCS 12 00 10 07.
7. Install plastic molding on an existing bare wire pole ground when re-framing an existing pole using DCS 12 00 10 05.

ABOVE GRADE- COMPOSITE POLE



12kV
12 00 10 11-Composite Pole



34kV & 69kV
12 00 10 12-Composite Pole

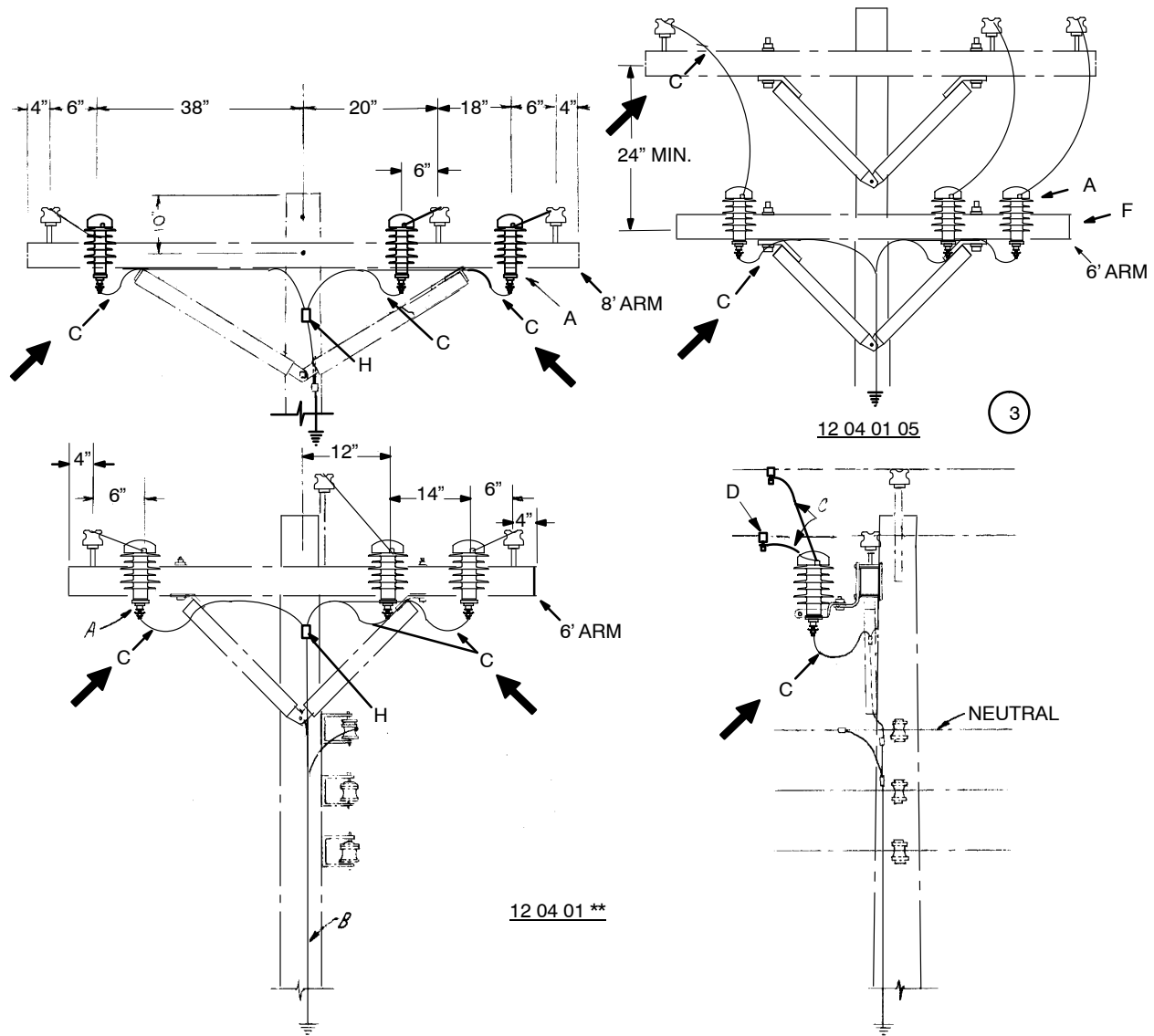
Notes:

1. Factory installed #2 Cu pole ground.

		Std./Stk. No	Description	12 00 10 **									
				01	02	03	04	05	07	09	10	11	12
2	A	27 09 215	Wire, 7#10, CW Poly Covered (ft.)	40	40				15				
		18 51 019	Wire, #2 Cu. Poly covered (ft.)			40	40			70	70		
	B	41 56 041	Molding – Grd. Wire, 3/4” x 8’ Long					1					
	C	23 64 001	Staple, Ground Wire, Serrated, Cu Clad	10	10	10	10	10	10	20	20		
	D	23 64 028	Staple, for 3/4” Plastic Molding, Zn Plated Stl					10					
	E	23 13 069	Rod, Ground, 5/8” x 8’ Cu Bond		1	1					1		
	F	17 52 032	Clamp, Grd. Rod, 5/8” for #8 – 1/0		1	1					1		
	G	17 51 032	Clamp, PG. #6 – 1/0	1	1	1	1			1	1	1	1
	I	17 60 749	Non-Tension Sleeve Reducer, Compression – #2 Cu, Sol to 7#10 CW or #2 Cu, Str.	1	1		1			1	1	1	1
1 @	K	18 52 025	Wire, #2 Bare Cu, Sol (ft.)	20	2		20			30	2	20	30
	L	17 60 730	Non-Tension Sleeve, Compression, 7#10 CW						2				
		OP 301	Install Below Grade Ground Coil	1			1			1		1	1
		OP 302	Install Above Grade Pole Ground	1			1	1	1	1			
		OP 401	Install Pole Ground/Ground Rod		1	1					1		

Note:

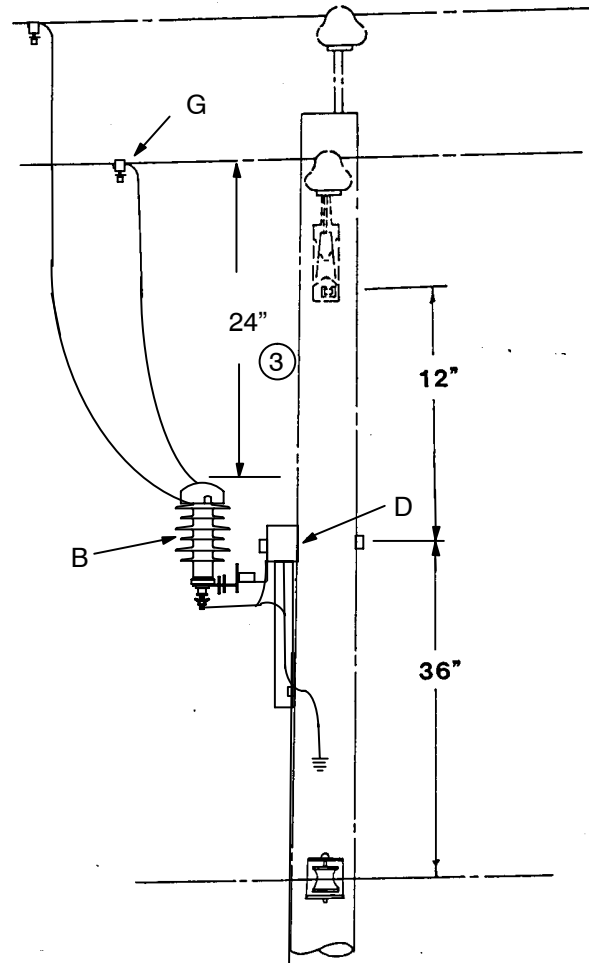
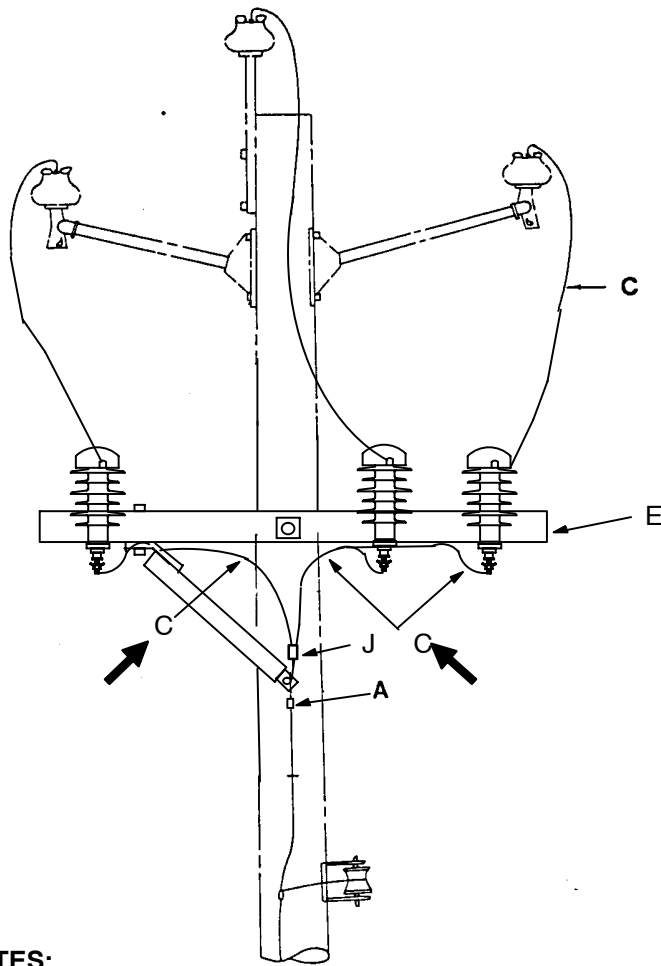
1. Use the appropriate connector for the ground wire size being replaced. Non-tension sleeve stock #17 60 730 can be used for 7#10 CW connections, reducing non-tension sleeve stock #17 60 749 can be used for #2 solid Cu to 7#10 CW or #2 stranded Cu connections, and split-bolt stock #17 54 373 can be used for most other connections.
2. If a distribution circuit is added to a subtransmission pole with 7 #10 Copperweld or #6 Cu pole ground wire and the static wire is used for the distribution system neutral, the pole ground wire must be changed to #2 Cu or larger.



NOTES

1. Route the ground wires in a straight line or a smooth curve. Avoid making sharp bends in ground wires.
2. Take care when driving the staples onto the ground wires to avoid damaging the wire.
3. If space allows, arresters on separate arm allows installation with 2 man crew instead of 3 in some areas.

		Std. / Stk. No.	Description	12 04 01 **	01	02	03	05
					1-Ph	2-Ph	3-Ph	3-Ph
@	A	10 01 133	Arrester-3 kV		1	2	3	3
@	B	12 00 10 **	Grounding Unit		1	1	1	1
	C	18 51 021	Wire, Cu., #6 S.D., Covered (Ft.)		6	12	17	28
@	D	HLC*W	Clamp, Hot Line		1	2	3	3
	E	17 58 054	Bracket, Crossarm, Arrester		1	2	3	3
	F	04 00 20 01	Crossarm, 6'			1	1	1
	H	17 54 004	Connector, Elect., Split Bolt		1	1	1	1



NOTES:

1. Route the ground wires in a straight line or a smooth curve. Avoid making sharp bends in ground wires.
2. Take care when driving the staples onto the ground wires to avoid damaging the wire.
3. If space allows, 2' spacing allows installation with 2 man crew instead of 3 in some areas.

		Std. / Stk. No.	Description	12 04 01 **	04
					3 Ph
@	A	12 00 10 **	Grounding Unit		1
	B	10 01 133	Arrester, 3kV		3
	C	18 51 021	Wire, Cu, #6 S.D., Poly Covered (Ft.)		23
	D	17 58 054	Bracket, Crossarm		3
	E	04 00 20 01	Crossarm, 6' (Use only 1/2 of V-brace)		1
	G	HLC*W	Clamp, Hot Line		3
	J	17 54 004	Connector, Elect., Split Bolt		1

Sheet 1 of 5

AMEREN MO

AMEREN MO

AMEREN IL

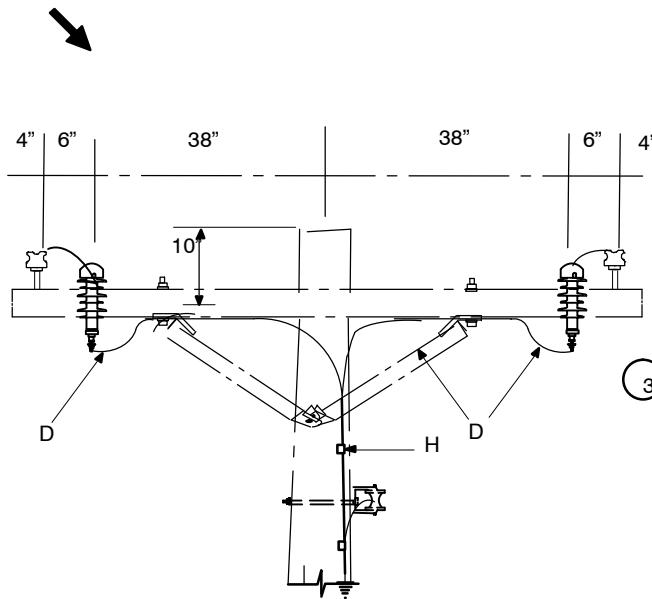
AMEREN IL & MO

LIGHTNING PROTECTION AND GROUNDING

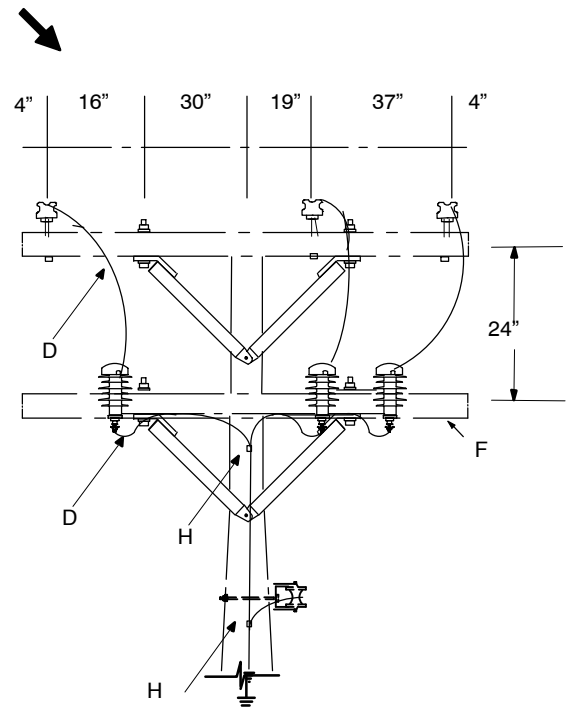
Lightning Arrester Installation
4-15 kV – Existing Circuit

12 12 01 **

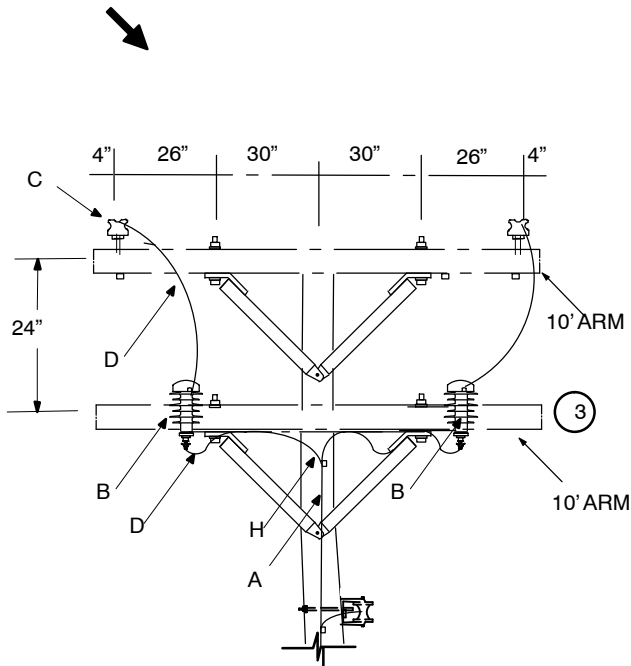
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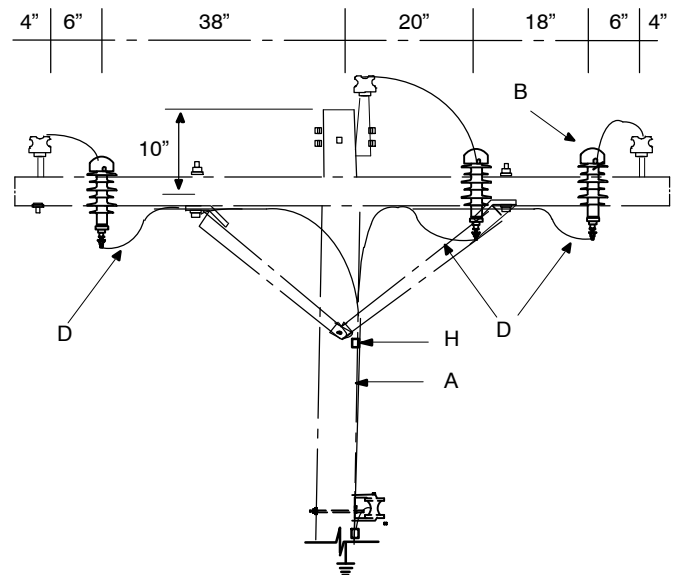
12 12 01 05
AMEREN MO



12 12 01 07
AMEREN IL & MO

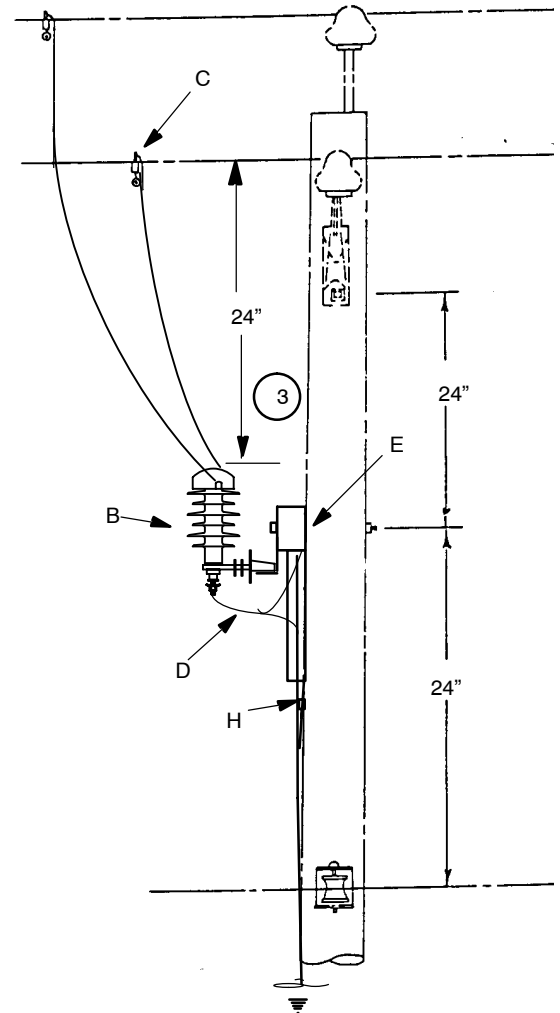


12 12 01 06
AMEREN IL & MO



12 12 01 08
AMEREN MO

Sheet 3 of 5



12 12 01 10 – 6 FT CROSSARM – AMEREN MO

LIGHTNING PROTECTION AND GROUNDING**Lightning Arrester Installation
4–15 kV – Existing Circuit****12 12 01 ****

Sheet 4 of 5

NOTES:

1. Route the ground wires in a straight line or a smooth curve. Avoid making sharp bends in ground wires.
2. Take care when driving the staples onto the ground wires to avoid damaging the wire.
3. For IL, arresters must be installed on separate arm – 10 ft, For MO, if space allows, arresters on separate arm allows installation with 2 man crew instead of 3 in some areas.
4. Arresters Selection, Refer to DCS 12 00 01 01 – Table 1.

		Std. / Stk. No.	Description 12 12 01 **	01	02	03	04	05
				1 Ph	1 Ph	1 Ph	1 Ph	2Ph
@ 4 @	A	12 00 10 **	Grounding Unit	1	1	1	1	1
	B	10 01 133	Arrester, 3kV, MCOV	1	1	1	1	2
		10 01 144	Arrester, 8.4kV MCOV	1	1	1	1	2
		10 01 188	Arrester, 12.7kV MCOV	1	1	1	1	2
10 01 008		Arrester, 10.2kV MCOV	1	1	1	1	2	
@	C	HLC*W	Clamp, Hot Line – DCS 07 00 21 00	1	1	1	1	2
	D	18 51 021	Wire, Copper, #6 SD Poly Covered (ft)	10	10	6	6	12
	E	17 58 054	Bracket, Crossarm, Arr.	1				2
	G	23 06 127	Bracket, Fiberglass, Switch and Arrester		1	1	1	
	F	04 00 20 01	Crossarm, 6'					
	I	04 00 20 03	Crossarm,10'					
	H	17 54 373	Connector, Elect., Split bolt	2	2	2	2	2
	J	23 52 095	Bolt, Machine, 3/4" x 10" w/Sq Nut		2	2	2	
	K	23 66 027	Washer, Square, 3/4" Bolt		4	4	4	
	L	23 65 042	Nut, Lock, Square, Galv, ¾"		2	2	2	
	M	PG**	Clamp, Parallel Groove – DCS 07 00 25 00	1	1	1	1	1

LIGHTNING PROTECTION AND GROUNDING

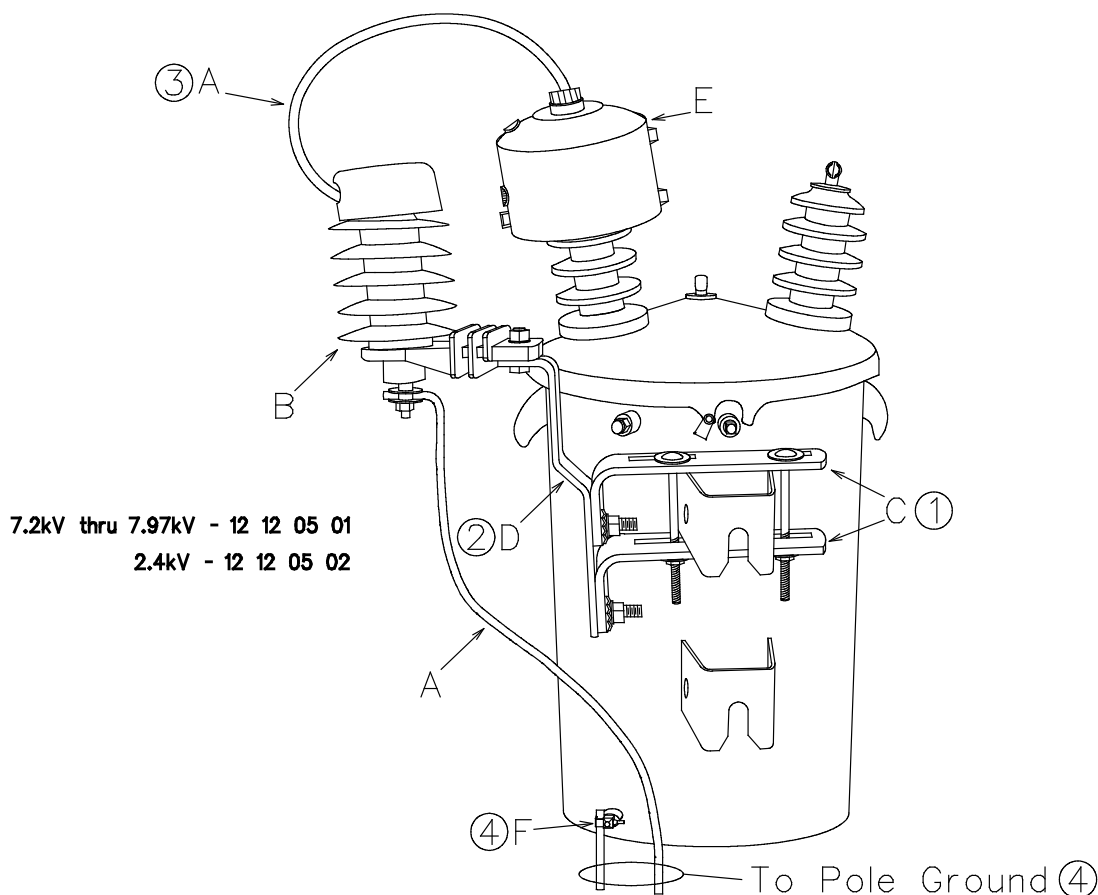
Lightning Arrester Installation
4–15 kV – Existing Circuit

12 12 01 **

Sheet 5 of 5

		Std. / Stk. No.	Description	12 12 01 **	06	07	08	09	10
					2 Ph	3 Ph	3 Ph	3 Ph	3 Ph
@ 4 @	A	12 00 10 **	Grounding Unit		1	1	1	1	1
	B	10 01 133	Arrester, 2.55kV MCOV		2	3	3	3	3
		10 01 144	Arrester, 8.4kV MCOV		2	3	3	3	3
		10 01 188	Arrester, 12.7kV MCOV		2	3	3	3	3
		10 01 008	Arrester, 10.2kV MCOV		2	3	3	3	3
@	C	HLC*W	Clamp, Hot Line – DCS 07 00 21 00		2	3	3	3	3
	D	18 51 021	Wire, Copper, #6 SD Poly Covered (ft)		16	24	20	23	23
	E	17 58 054	Bracket, Crossarm, Arr.		2	3	3	3	3
	G	23 06 127	Bracket, Fiberglass, Switch and Arrester						
	F	04 00 20 01	Crossarm, 6'						1
	I	04 00 20 03	Crossarm, 10'		1	1		1	
	H	17 54 373	Connector, Elect., Split bolt		2	2	2	2	2
	J	23 52 095	Bolt, Machine, 3/4" x 10" w/Sq Nut						
	K	23 66 027	Washer, Square, 3/4" Bolt						
	L	23 65 042	Nut, Lock, Square, Galv, ¾"						
	M	PG**	Clamp, Parallel Groove – DCS 07 00 25 00		1	1	1	1	1

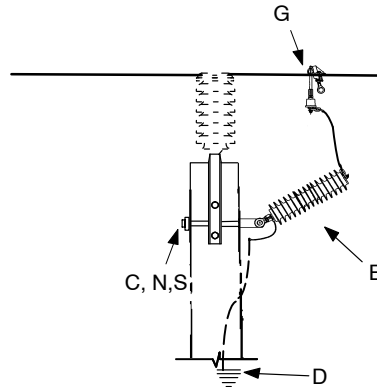
Purpose - This DCS is for mounting arrester adjacent to the H1 bushing on a transformer that does NOT have existing lugs for tank mounting of the arrester. Use when arrester is being moved from Energized Zone to transformer level on existing/older transformer installations.



NOTES

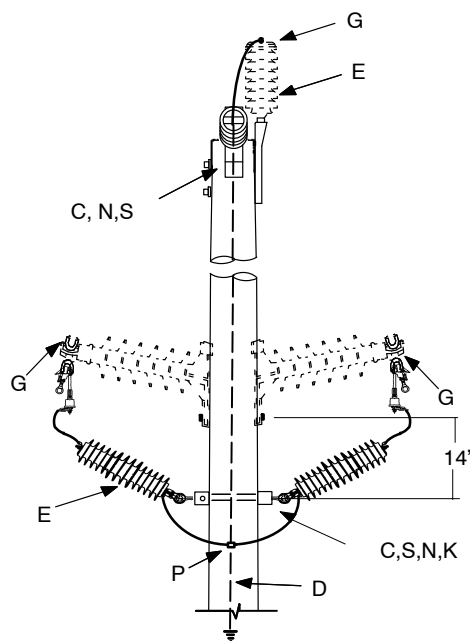
- For transformers with cover mounted primary bushings, install the cutout/arrester crossarm mounting bracket oriented as shown on the top hanger bracket of the transformer.
- Stk. No. 23 06 122 comes with a copper strap that is to be removed and returned to the storeroom for recycling.
- Make sure the wire opening in the arrester cap is oriented away from the mounting bracket.
- Bond the arrester ground directly to the pole ground and use the ground lug to separately bond the tank to pole ground

		Std. / Stk. No.	Description	12 12 05 **	01	02
2	A	18 51 021	Wire, Ground, #6, S.D. Poly covered (Ft.)		7	7
	B	10 01 144	Arrester, 10kV		1	
		10 01 133	Arrester, 3kV			1
	C	23 56 088	Bracket, Crossarm, Cutout/Arrester		1	1
	D	23 06 122	Bracket, L-Shaped, Transformer Mtg., Arrester		1	1
	E	69 58 296	Guard, Wildlife, Clam-Shell, Short		1	1
	F	69 58 121	Ground, Transformer Tank, #8 Sol. To #2 Str. Cu.		1	1



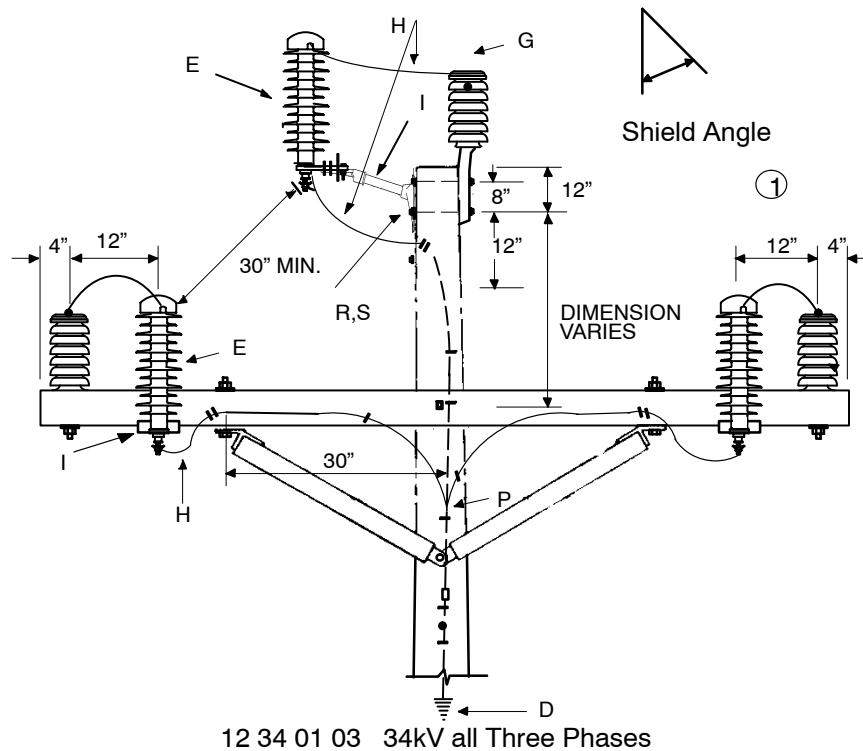
12 34 01 04 69 kV
12 34 01 05 34 kV

TOP PHASE



12 34 01 01 34 kV
12 34 01 06 69 kV

THREE PHASE



NOTES:

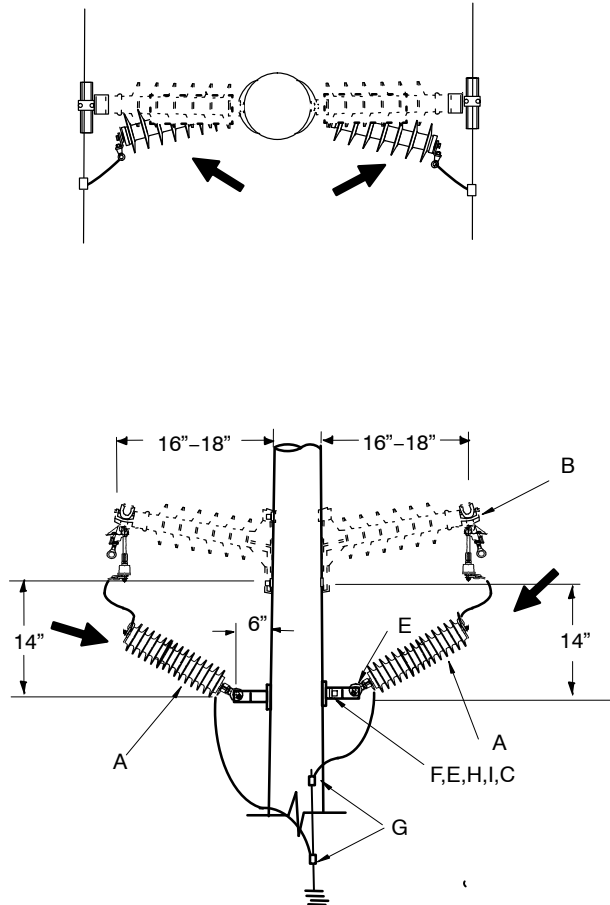
1. If the shield formed by the pole top insulator and the outside crossarm insulator is less than 30 deg., arrester on the top phase only. If the angle exceeds 30 deg., arresters on all three phases.
2. Arresters should be installed on every pole in open ground, every third pole if shielded by trees or buildings.
3. Not for use in new construction. This Standard is only for lightning protection of existing subtransmission configurations.
4. Use double staples to hold ground wire in the event the ground lead isolator blows off. Distance from the double staples to the ground lead isolator should be 6" minimum.
5. Route the ground wires in a straight line or a smooth curve. Avoid making sharp bends in ground wires.
6. Take care when driving the staples onto the ground wires to avoid damaging the wire.
7. Stock #10 01 147 and Stock #10 01 148 are not for new installation.
8. Stock #10 01 239 and stock #10 01 158 are for New installation.

LIGHTNING PROTECTION AND GROUNDING
Lightning Arrester Installation
Single Circuit–Existing 34 & 69 kV (Not for New Construction)

12 34 01 **

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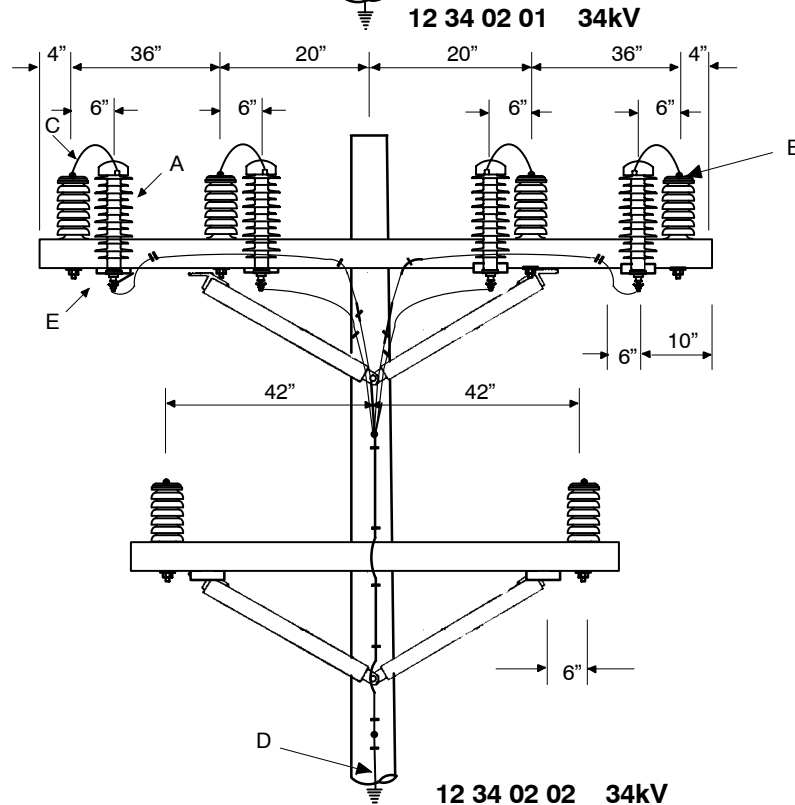
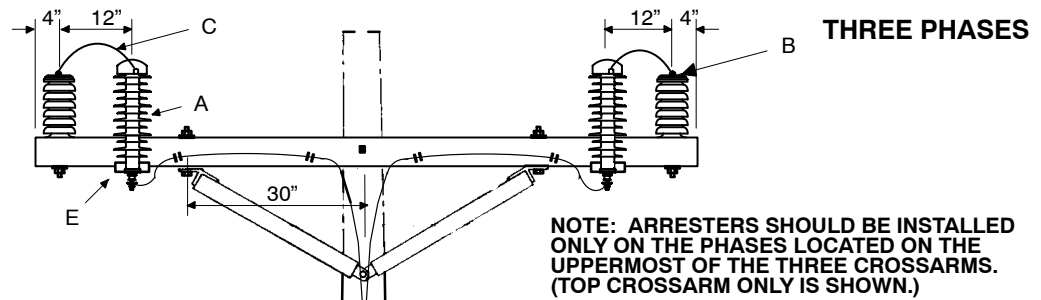
		Std. / Stk. No.	Description	01	03	04	05	06
	C	23 52 097	Bolt, Mach., 3/4" x 12"	1		1	1	1
@	D	12 00 10 **	Grounding Unit	1	1	1	1	1
7	E	10 01 147	Arrester, 30kV, 24.4kV MCOV Crossarm Mt.		2			
7		10 01 148	Arrester, 30kV, 24.4kV MCOV Pole Mt.		1			
8		10 01 158	Arrester, 60kV, 48kV MCOV W/Clevis, Susp			1		3
8		10 01 239	Arrester, 30kV, 24.4kV MCOV, W/Clevis, Susp	3			1	
@	F	HLC*W	Hot Line Clamp DCS 07 00 21 00		3			
@	G	STC*W	Clamp, Stirrup DCS 07 00 21 00	3		1	1	3
	H	18 51 021	Wire, Copper, Poly Covered, #6 S.D.		20			
	I	17 58 054	Bracket, Crossarm, Arrester		2			
		23 06 127	Bracket, fiberglass, Switch and Arrester		1			
	K	23 59 095	Eyelet, 3/4" Bolt	2				2
	L	23 65 018	Eyenuit, 3/4" Bolt	1				1
	N	23 66 031	Washer, Square, Curved 3" x 3" 3/4"	4	4	2	2	4
@	P	P.G.	Clamp, P.G. (see Std. 07 00 25 00)	3		1	1	3
	R	23 53 070	Bolt, Dbl., Arm, 3/4" x 14"		2			
	S	23 65 042	Nut, Lock, Square, Galv, 3/4"	3	4	1	1	3



NOTES:

1. Arresters should be installed on every pole.
2. Items A includes base mounted clevis, tinned copper ground and line terminal leads, disconnect, and hot line clamps. Stirrup clamp on end of line terminal lead need to be ordered separately.
3. Use care when driving staples onto covered pole ground wire to avoid damaging the wire.

		Std. / Stk. No.	Description	12 34 02 **	03	04
2 @ @ @	A	10 01 239	Arrester, 30kV, 24.4kV MCOV Suspended	1	2	
	B	STC*W	Clamp, Stirrup – DCS 07 00 21 00	1	2	
	C	23 53 059	Bolt, DA, 3/4" x 18", HDG w/4 Sq Nuts		1	
	D	12 00 10 **	Grounding Unit	1	1	
	E	23 65 018	Eyenuit, 3/4"		1	
	F	23 66 031	Washer, Square 3/4", Galvanized	2	2	
	G	PG**	Clamp, PG, Bronze – DCS 07 00 25 00	1	2	
	H	23 59 095	Eyelet, 3/4" Bolt	1	1	
	I	23 65 042	Nut, Lock, Square, Galv, 3/4"	1	2	
	J	23 52 097	Bolt, Mach, 3/4: x 12"	1		



NOTES:

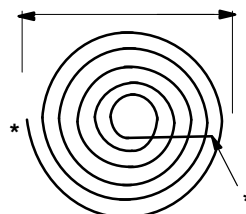
- Arresters should be installed on every pole
- Use double staples to hold ground wire in case the ground lead isolator blows off. Distance from the doubles staples to the ground lead isolator should be 6" maximum.
- Arrange arrester brackets to position arresters low on the cross but not low enough to place the top of the arrester below the phase wire.
- Route the ground wires in a straight line or a smooth curve. Avoid making sharp bends in ground wires.
- Use care when driving staples onto covered pole ground wire to avoid damaging the wire.

		Std. / Stk. No.	Description	12 34 02 **	01	02
@	A	10 01 147	Arrester, 30 kV 24.4kV MCOV, Crossarm Mount		2	4
	B	HLC*W	Clamp, Hot Line		2	4
@	C	18 51 021	Wire, Copper, Poly Covered, #6 S.D.		15	20
	D	12 00 10 **	Grounding Unit		1	1
	E	17 58 054	Bracket, Crossarm, Arrester		2	4

Ground the switch handle and secure the connector to the pole

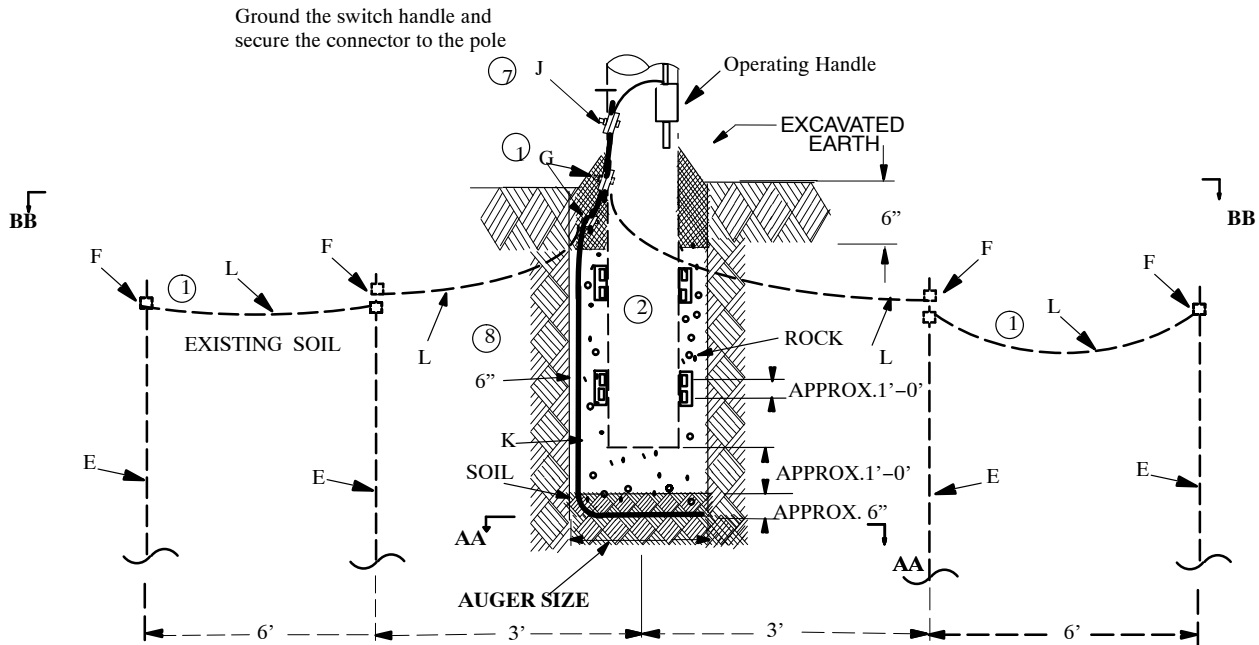


****12'-0" MIN. FIELD FORMED COIL**

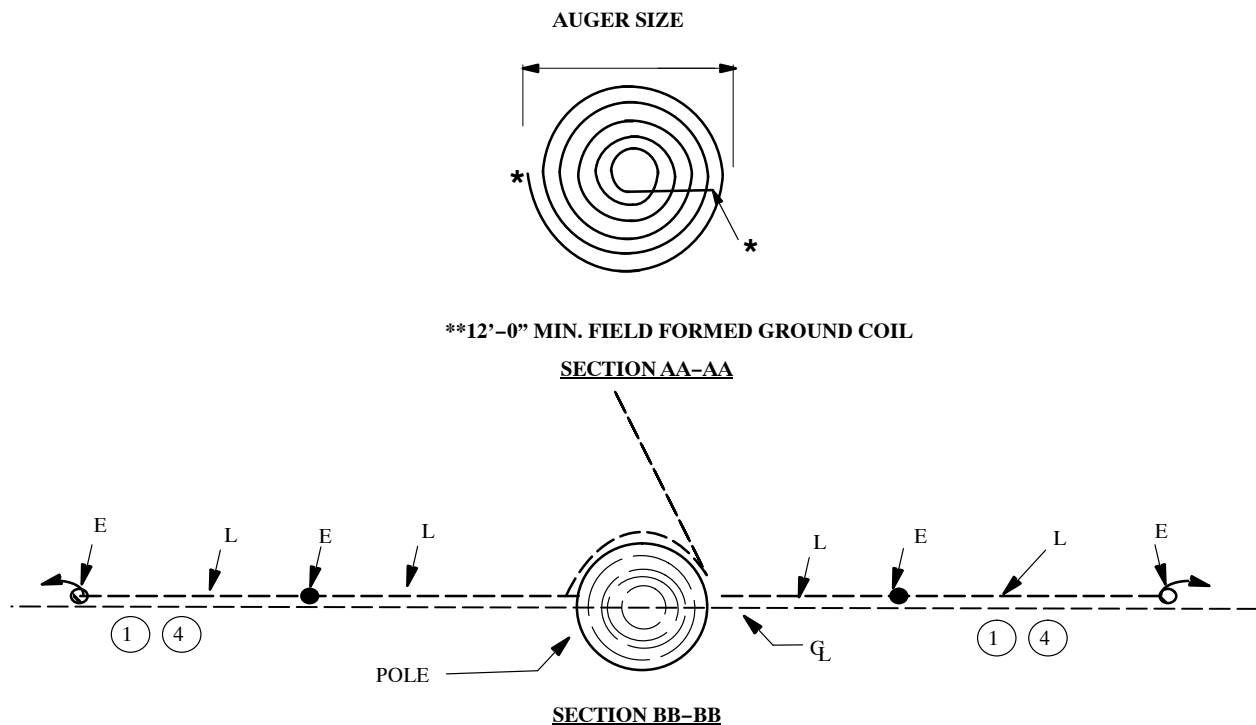


SECTION AA-AA

Without Ground Mat



12 69 11 04 – Wood Pole without Motor Operator



NOTES:

1. Ground resistance will normally be less than 25 ohms with one rod. In rocky or sandy soil where experience indicates ground resistance may exceed 25 ohms, install additional rods spaced 6' apart. Doubling the number or length of the rod reduces ground resistance by 40%.
 - a. If additional grounding is needed, terminal poles, a #2 bare copper counterpoise wire 100'–150' long may be placed in the cable trench and connected to the ground lead.
 - b. In rocky soil where driving a rod is difficult – a counterpoise, as stated in a) may be placed in a trench at least 18" deep.
2. Refer to DCS Sections 02 for pole setting depth associated with backfill material and method.
3. Ground mat to be installed under operating handle. Always place some crushed rock on top of ground mat to add better ground support for operating the switch.
4. Ground rods to be installed along conductor center-line if more than one rod is required.
5. Stock #23 17 405 – Above grade grounding platform covers some crashed rocks.
6. For pole grounding requirement, see DCS 10 34 01 01.
7. SEECO switch uses stock #17 52 140 for grounding the operating handle strip.
Turner switch uses stock # 17 51 032 for grounding the operating handle strip.
8. If switch is to be mounted on an existing pole, a driven ground may be used.
9. Ground switch handle for 15kV group operated switch: 12 69 11 05 – Grounding with Rod;
12 69 11 06 – Grounding with coil.

		Std. / Stk. No.	Description	12 69 11 **	01	02	03	04	05	06
6@	A	18 51 019	Wire, #2 Cu Poly Covered – Pole Ground Wire	As Req.			With Pole			
6@	C	23 64 001	Staple – 3/8" for Grd. Wire	10						
1@	E	23 63 027	Rod – Ground 5/8"x8'	2	2	2	2	2	1	
1@	F	17 52 032	Clamp – Grd. Rod. 5/8" for #8 – 1/0	2	2	2	2	2	1	
1@	H	17 52 142	Clamp – PG, #4 Sol. Cu to 2/0 Str. Cu	4	4	4	4	2		
1@	G	17 51 032	Clamp, PG, Grd, #4 Cu to 2/0 Str Cu					2		1
5	I	23 17 405	Ground Platform 4' x 3', Galv. Steel – above grade	1	1	1				
8	K	18 52 025	Wire, Misc. #2 Bare Cu., S.D. – Field Formed Ground Coil (ft.)	30	30	30	30	30		30
7@	J	17 52 140	Clamp, Grounding Cable to Flat #4 Sol Cu to 300MCM Cu	1	1	1	1	1	1	1
		17 51 032	Clamp, PG, Grd, #4 Cu to 2/0 Str Cu	1	1	1	1	1		
1@	L	18 52 025	Wire, Misc. #2 Bare Cu., S.D. – Connection from Ground Rods (ft.)	30	30	30	30	30	2	2
		303	Operation Code, Install Ground Rods	1	1	1	1	1	1	1
		306	Operation Code, Pole Ground	0.5						
		307	Operation Code, Grounding Connection	0.5	0.5	0.5	0.5	0.5		0.5

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13-34-02-**

SEE STANDARD 01-00-03-01 FOR LIST OF ALL "MAINTENANCE ONLY STANDARDS"

1.GENERAL

Three general types of distribution transformers are used on the Ameren System. These differ from each other principally in the type and hookup of lightning arresters and switches used to protect the transformers. For purposes of uniformity the three transformer types will be referred to as:

- Conventional Transformers (C)
- Protected Transformers (P)
- Completely Self Protected Transformers (CSP)

2.CONVENTIONAL TRANSFORMERS (C)

These transformers require separately mounted lightning arresters and fused switches for their protection. Some Conventional transformers are still purchased new. A considerable number installed in past years are still in service. As non-standard Conventional transformers are removed from service they will be converted to Protected transformers by mounting lightning arresters on the transformers before they are placed in our transformer stock.

3.PROTECTED TRANSFORMERS (P)

Transformers of this type have lightning arresters mounted on the transformer. Since the discharge path of the lightning arrester is by way of the transformer tank, good tank grounds are imperative.

Protected transformers are standard for most new purchases of single phase and three phase transformers.

Protected transformers shall have separately mounted fused switches installed. Transformers whose primary winding are connected phase-to-ground are provided with only one lightning arrester. This arrester is normally connected to the H₁ bushing, but may be shifted to the side of the tank giving the best clearances. The arrester shall be connected to the phase lead which is connected to the fused switch. Transformers whose primary winding are connected phase-to-phase will have two arresters mounted on the transformer.

4.COMpletely SELF PROTECTED TRANSFORMERS (CSP)

Completely Self Protected transformers have built into the unit internal primary fuse links (designed to open only on internal transformer faults) and a secondary breaker for protection against external overloads. These devices are all under oil. In addition, integrally mounted lightning arresters are provided. The discharge path of the lightning arresters is by way of the transformer tank, therefore, good tank grounds are imperative.

Single phase Completely Self Protected transformers are no longer purchased new. Three phase units in sizes 30 kVA to 150 kVA inclusive for 4.16kV and in sizes 30 kVA and 45 kVA for 12.47 kV units are still purchased new.

Completely Self Protected transformers shall have separately mounted fused switches installed unless pole spare does not allow and the number of customers affected by transformer failure is deemed acceptable. Only in such cases may the transformer be directly connected to the line wires.

Non-standard Completely Self Protected transformers removed from service (both single and three phase) will be refurbished provided they are in good condition and meet Ameren's refurbishing criteria. These transformers should be used first to defer purchase of new transformers.

5.CAUTION:

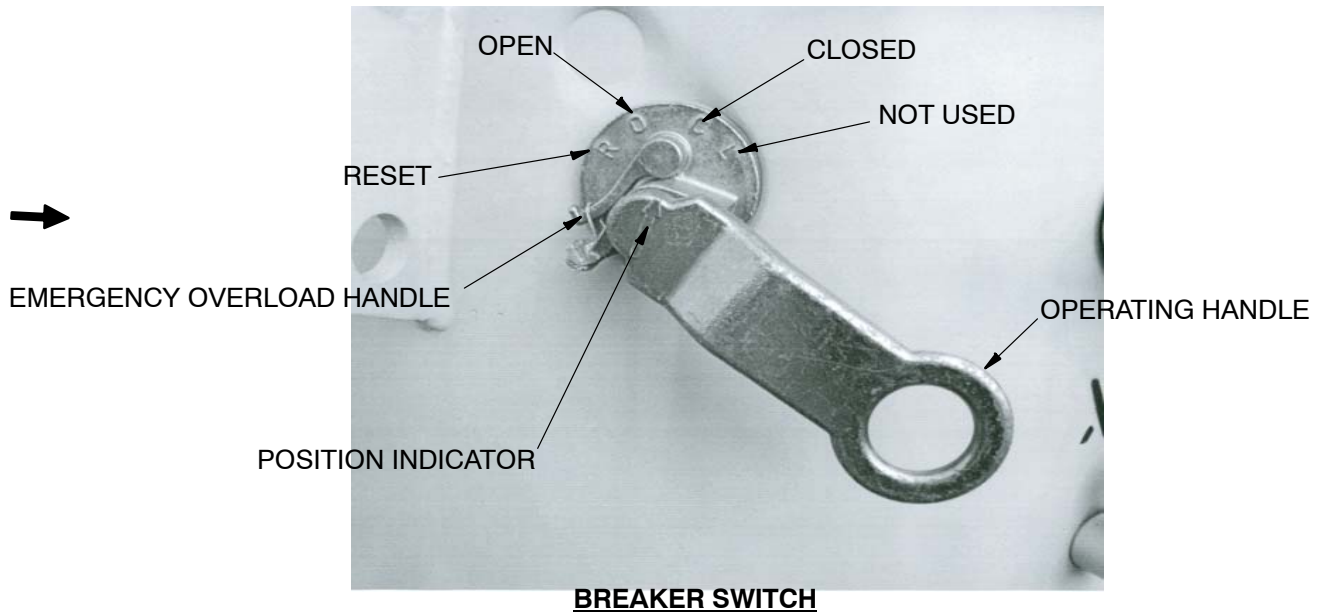
Care should be exercised in connecting primary leads to transformers.

On single phase transformers connected phase-to-neutral the neutral connection shall be made before the primary lead is connected.

On single phase transformers connected phase-to-phase both primary terminals will be hot after the first primary lead is connected.

On three phase transformers all primary terminals will be hot after the first primary lead is connected.

6.BREAKER OPERATION ON CSP TRANSFORMERS



To Reset the breaker after it has opened due to overload move the handle to the "Reset" position and then move it to the "Close" position.

To Open the breaker raise handle until pointer coincides with the word "Open."

To Close breaker (when it has not opened due to overload) lower handle until pointer coincides with the word "Close". On some units, this will be sufficient to close the breaker. On other units, it is necessary to move the handle to the Reset "R" position before it can be closed. This is true even though the transformer has not tripped on overload.

The breaker will trip free of the handle permitting the closing on a short circuit with safety.

CSP transformers may also be equipped with an emergency overload control. Adjustment of this device will increase the capacity of the transformer for emergency loading. The emergency control is operated by a handle located so as to be partially concealed by the larger breaker operating handle.

In case the breaker has tripped because of excessive overload, an attempt should first be made to reset the breaker in the usual manner without moving the emergency control handle. Usually this will be possible, and no other action will be necessary. If the tripping is the result of overload, then the transformer should be replaced with a larger unit. However, if this replacement cannot be made immediately and if the breaker cannot be reclosed, then it may be possible to reclose the breaker by use of the emergency overload device. First rotate the emergency handle clockwise, then the breaker handle can be moved to the reset position and the breaker reclosed in the usual manner.

The transformer should be allowed to carry this loading only until the transformer can be replaced, preferably not more than a day.

Some Completely Protected transformers have two secondary breakers connected in parallel. Both breakers must be closed to secure full capacity on these transformers.

7.480 VOLT THREE WIRE SERVICE FROM 480Y/277 VOLT FOUR WIRE TRANSFORMERS

CAUTION: Do not make these conversions on three-phase transformers that have the primary and secondary neutrals internally connected together.

A. Three-wire 480 volt service is non-standard for new installations.

B. Corner-Grounded Three-Wire Service

1. Remove the secondary neutral ground strap(s) from all transformers.
2. Tape the secondary neutral terminal to prevent accidental contact and any misunderstanding as to which terminals are being used and the type service being provided.
3. Run a #2 copper lead from the "A" phase secondary terminal to the tank ground connector. Ground the transformer tank(s) to a driven ground rod and to the common system neutral (if present).

CAUTION: After the "A" phase secondary terminal is energized, the taped neutral terminal is energized.

4. Before connecting the customer's cable, determine which cable the customer has grounded (if any) and connect that cable to the now grounded "A" phase secondary terminal.

C. Un-Grounded Three-Wire Service

1. Remove the secondary neutral ground strap(s) from all transformers.
2. Ground the transformer tank(s) to a driven ground rod and to the common system neutral (if present).

8.UN-GROUNDED Y PRIMARY TO Δ SECONDARY

A. This connection is non-standard for new installations.

B. For un-grounded Y primary to Δ secondary connected transformers, when primary voltage is lost to one of the bank phases or one of the cutouts is opened, a high temporary over-voltage can be impressed across tank mounted arresters. Therefore, for 2.4 and 4.16kV transformers 6kV rated arrester stock# 10-01-184 is used. For 7.2 through 14.4 kV transformers 15 kV rated arrester stock # 10-01-188 is used.

9.OPEN Y OR OPEN Δ PRIMARY TO OPEN Δ SECONDARY

A. Open Y primary to open Δ secondary connections should only be used where the three phase load is small and three primary phases are not available. 120/240 V, 3-phase, 4-wire open Δ service is provided with this connection. This connection can also be used for temporary situations where one transformer in a closed Y to closed Δ bank of three transformers has failed. The capacity of this connection is 86.6% of the two remaining transformers or 57.7% of the initial three transformers (based on three equal size transformers).

B. Open Δ primary to open Δ secondary connections should only be used for temporary situations where one transformer in a closed Δ to closed Δ bank of three transformers has failed. The capacity of this connection is 86.6% of the two remaining transformers or 57.7% of the initial three transformers (based on three equal size transformers).

TRANSFORMER VOLTAGE CODE EXPLANATION

VOLTAGES	
CODES	PRIMARY & SECONDARY
AA	2400/4160Y X 7200/12470Y X 7620/13200Y - 120/240
AD	2400/4160Y X 7200/12470Y X 7620/13200Y - 240/480
AN	2400 CURRENT TRANSFORMER
AP	2400 CURRENT TRANSFORMER
AU	2400/4160Y X 7200/12470Y X 7620/13200Y - 277
BA	2400/4160Y - 120/240
BD	2400/4160Y - 240/480
BJ	2400/4160Y - 2400
BM	2400/4160Y - 7200/12470Y
BR	2400/4160Y - 240/120
BT	2400/4160Y - 480
BU	2400/4160Y - 277
BW	2400/4160Y - 240
CA	4160/7200Y - 120/240
CD	4160/7200Y - 240/480
CM	4160/7200Y - 7200/12470Y
CU	4160/7200Y - 277
DE	4160Y - 240 X 480
DF	4160Y - 480Y/277
DG	4160Y - 240
DH	4160Y - 480
DQ	4160Y - 240 W/120 MIDTAP
EC	4160 - 208Y/120
EF	4160 - 480Y/277
EH	4160 - 480
EQ	4160 - 240 W/120 MIDTAP
FA	4160GRDY/2400 - 120/240
FC	4160GRDY/2400 - 208Y/120
FF	4160GRDY/2400 - 480Y/277
FR	4160GRDY/2400 - 240/120
GA	24940GRDY/14400 - 120/240
HA	BLANK
HB	13200 - 216Y/125
HF	BLANK
HN	7200 CONSTANT CURRENT
HP	7200 CONSTANT CURRENT
HQ	13200Y - 240 W/120 MIDTAP
HR	BLANK
IA	12000 - 120/240
IJ	12470 - 2400/4160Y
IU	12000 - 277
JA	7200/12470Y - 120/240
JD	7200/12470Y - 240/480
JJ	7200/12470Y - 2400/4160Y
JR	7200/12470Y - 240/120
JT	7200/12470Y - 480
JU	7200/12470Y - 277
JW	7200/12470Y - 240
KC	12470Y - 208Y/120
KE	12470Y - 240 X 480
KF	12470Y - 480Y/277
KG	12470Y - 240
KH	12470Y - 480
KQ	12470Y - 240 W/120 MIDTAP
KU	12470Y - 277
LC	12470 - 208Y/120
LF	12470 - 480Y/277
LG	12470 - 240
LJ	12470 - 2400/4160Y
LQ	12470 - 240 W/120 MIDTAP
LX	12470 - 4160Y/2400
MA	12470GRDY/7200 - 120/240
MC	12470GRDY/7200 - 208Y/120
MF	12470GRDY/7200 - 480Y/277

VOLTAGES	
CODES	PRIMARY & SECONDARY
MK	12470GRDY/7200 - 120
MQ	12470GRDY/7200 - 240 W/MIDTAP
MR	12470GRDY/7200 - 240/120
MU	12470GRDY/7200 - 277
MX	12470GRDY/7200 - 4160Y/2400
MZ	12470GRDY/7200 - 480/240
NC	13200 - 208Y/120
NF	13200 - 480Y/277
NU	13200 - 277
OA	19920/34500Y - 120/240
OD	19920/34500Y - 240/480
OM	19920/34500Y - 7200/12470Y
OU	19920/34500Y - 277
PB	13800 - 216Y/125
PC	13800 - 208Y/120
PF	13800 - 480Y/277
PM	13800 - 7200/12470Y
PU	13800 - 277
QA	34500 - 120/240
QB	34500 - 2400/4160Y X 7200/12470Y
QD	34500 - 240/480
QF	34500 - 480Y/277
QJ	34500 - 2400/4160Y
QK	34500 - 120
QM	34500 - 7200/12470Y
QT	34500 - 480
QU	34500 - 277
RA	14400/24940Y - 120/240
RD	14400/24940Y - 240/480
RJ	14400/24940Y - 2400/4160Y
RM	14400/24940Y - 7200/12470Y
RO	14400/24940Y - 7620/13200Y
RR	14400/24940Y - 240/120
RU	14400/24940Y - 277
RX	13200GRDY/7620 X 12470GRDY/7200 - 240/120
SA	13200GRDY/7620 - 120/240
SB	13200GRDY - 216Y/125
SC	13200GRDY/7620 - 208Y/120
SD	13200GRDY/7620 - 240/480
SF	13200GRDY/7620 - 480Y/277
SK	13200GRDY/7620 - 120
SR	13200GRDY/7620 - 240/120
SU	2400/4160Y X 7620/13200Y - 277
SW	2400/4160Y X 7620/13200Y - 120/240
SX	13200GRDY/7620 - 4160Y/2400
SZ	13200GRDY/7620 - 480/240
TA	13800GRDY/7970 - 120/240
TC	BLANK
TF	4160GRDY/2400 X 12470GRDY/7200 X 13200GRDY/7620 - 480Y/277
TR	13800GRDY/7970 - 240/120
TX	4160GRDY/2400 X 13200GRDY/7620 - 120/240
UA	7970/13800Y - 120/240
UB	14400 - 216Y/125
UC	14400 - 120/240
UD	7970/13800Y - 240/480
UE	14400 - 240/480
UF	14400 - 480Y/277
UJ	14400 - 2400/4160Y
UR	4160GRDY/2400 X 13200GRDY/7620 - 240/120
UU	14400 - 277
VA	34500GRDY/19920 - 120/240 (1 BUSHING - 150KV BIL)
VC	34500GRDY/19920 - 208Y/120
VD	34500GRDY/19920 - 240/480

VOLTAGES	
CODES	PRIMARY & SECONDARY
VF	34500GRDY/19920 – 480Y/277
VM	34500GRDY/19920 – 7200/12470Y
VR	34500GRDY/19920 – 240/120
VU	34500GRDY/19920 – 277
WA	4160GRDY/2400 X 12470GRDY/7200 – 120/240
WC	4160GRDY/2400 X 12470GRDY/7200 – 208Y/120
WF	4160GRDY/2400 X 12470GRDY/7200 – 480Y/277
WR	4160GRDY/2400 X 12470GRDY/7200 – 240/120
WX	4160GRDY/2400 X 12470GRDY/7200 X 13200GRDYY/7620 – 120/240
XA	2400/4160Y X 7200/12470Y – 120/240
XC	4160 X 12470 – 208Y/120
XD	2400/4160Y X 7200/12470Y – 240/480
XF	4160 X 12470 – 480Y/277
XG	4160 X 12470 – 240
XH	4160 X 12470 – 480
XQ	4160 X 12470 – 240 W/120 MIDTAP
XU	2400/4160Y X 7200/12470Y – 277

VOLTAGES	
CODES	PRIMARY & SECONDARY
YA	7620/13200Y – 120/240
YD	7620/13200Y – 240/480
YJ	7620/13200Y – 2400/4160Y
YO	13800Y – 7620/13200Y
YQ	13800Y – 240
YU	7620/13200Y – 277
ZA	13200GRDY/7620 X 12470GRDY/7200 – 120/240
ZC	4160GRDY/2400 X 13200GRDY/7620 – 208Y/120
ZD	2400/4160Y X 7620/13200Y – 240/480
ZF	4160GRDY/2400 X 13200GRDY/7620 – 480Y/277
ZQ	4160Y X 13200Y – 240 W/120 MIDTAP
ZR	4160GRDY/2400 X 12470GRDY/7200 X 13200GRDY/7620 – 240/120
ZZ	4160GRDY/2400 X 12470GRDY/7200 X 13200GRDY/7620 – 480/240

TRANSFORMER TYPE/STYLE CODE EXPLANATION

CODES	TYPES/STYLES
A	CILCO padmount, 3Ø, radial feed, dead-front, w/bayonets
B	CILCO padmount, 3Ø, loopfeed, dead-front, w/4-way switch or IP w/600A Bushing
C	Crossarm mount or IP 2400V 1Ø w/LA
D	Direct polemount, CSP, w/LA
E	Direct polemount, CSP, w/2 LA's
F	Direct polemount, conventional, w/LA
G	Direct polemount, conventional, no LA
H	Platform type, conventional, no LA
I	Direct polemount, w/breaker, w/LA
J	CIPS direct polemount, conventional, no LA
K	UE dry type or CILCO minipad, 1Ø, w/bayonet
L	Padmount, 3Ø, loopfeed, dead-front
M	Padmount, 3Ø, radial feed, dead-front
N	CIPS platform type, 1Ø, conventional
O	CILCO padmount, 3Ø, selective primary, w/external fuses
P	Platform type, conventional, w/LA
Q	Vault type, 1Ø
R	CIPS padmount, 3Ø, radial feed, live-front
S	Subway type
T	CIPS direct polemount, 3Ø
U	CIPS platform type, 3Ø
V	Vault type, 3Ø
W	Padmount, 1Ø, no bayonet
X	Padmount, 1Ø, 32" high
Y	Padmount, 1Ø, low profile, w/bayonet
Z	Padmount, live-front

Note: The Style Codes are used by all companies unless marked for a specific legacy company (UE, CIPS, CILCO, IP).

Transformer Stock Number Format = AANNNA

A = Alpha

N = Numeral

AA = Primary and Secondary Voltages

NNNN = Transformer Size w/Leading Zeros

(Ex. 25 kVA = 0025, 150 kVA = 0150)

A = Style Code Letter

Example: JA0025F

JA=7200/12470Y-120/240 Transformer Voltage

0025=25kVA Transformer

F=Pole Type, Conventional, w/Lightning Arrester

TRANSFORMERS

Stock Numbers

13 00 01 02

Sheet 1 of 5

Single-Phase Transformers - Pole and Platform Mount

Stock Number by kVA													
Voltage Primary-Secondary	Primary Bushings	Voltage Code	1	10	15	25	50	75	100	167	250	333	500
2400/4160Y-120/240	2	BA		0010C 0010F	0015C 0015F	0025C 0025F	0050C 0050F	0075C 0075F	0100C 0100F	0167C 0167F	0250C 0250P	0333C	
2400/4160Y-240/480	2	BD				0025F	0050C 0050F	0075C 0075F	0100C 0100F	0167C 0167F 0167P	0250C 0250P	0333P	0500P
2400/4160Y-277	2	BU							0100C	0167C	0250C	0333C	0500P
2400/4160Y-7200/12470Y	2	BM					0050G		0100G 0100P	0167G 0167P	0250G 0250P	0333G	
2400/4160Y x 7200/12470Y-120/240	2	XA		0010F		0025F	0050F	0075F	0100F	0167F	0250F	0333F	0500F
2400/4160Y x 7200/12470Y-240/480	2	XD		0010F		0025F	0050F		0100F	0167F	0250F	0333F	0500P
2400/4160Y x 7200/12470Y x 7620/13200Y-120/240	2	AA		0010F		0025F	0050F	0075F	0100F	0167F	0250F		
2400/4160Y x 7200/12470Y x 7620/13200Y-240/480	2	AD				0025F	0050F	0075F	0100F	0167F	0250F		
2400/4160Y x 7200/12470Y x 7620/13200Y-277	2	AU				0025F	0050F	0075F	0100F	0167F	0250F	0333F	0500P
4160/7200Y-120/240	2	CA				0025G	0050G	0075G	0100G	0167G			
4160/7200Y-277	2	CU								0167G			
7200/12470Y-120/240	2	JA		0010F	0015F	0025F	0050F	0075F	0100F	0167F	0250F	0333F	0500P
7200/12470Y-240/480	2	JD				0025F	0050F	0075F	0100F	0167F	0250F	0333F	0500P
7200/12470Y-277	2	JU					0050F		0100F	0167F	0250F	0333F	0500P
7620/13200Y-120/240	2	YA		0010F		0025F	0050F			0167F			
7620/13200Y-240/480	2	YD									0250F		
7620/13200Y-277	2	YU									0250F		
7620/13200Y-2400/4160Y	2	YJ							0100F	0167F	0250F		
7970/13800Y-120/240	2	UA			0015F	0025F	0050F	0075F	0100F	0167F			
7970/13800Y-240/480	2	UD				0025F	0050F		0100F	0167F			
12470 GrdY/7200-120	1	MK	0001F										
13200 GrdY/7620-120	1	SK	0001F										
14400/24940Y-120/240	2	RA			0015G	0025G	0050G	0075G	0100G	0167G	0250G	0333G	0500G
14400/24940Y-240/480	2	RD				0025G	0050G	0075G	0100G	0167G		0333G	0500G
14400/24940Y-2400/4160Y	2	RJ				0025G	0050G	0075G	0100G	0167G		0333G	
14400/24940Y-7200/12470Y	2	RM					0050G	0075G	0100G	0167G		0333G	0500G
14400/24940Y-277	2	RU				0025G	0050G		0100G	0167G	0250G	0333G	0500H
19920/34500Y-120/240	2	OA				0025G	0050G		0100G				
19920/34500Y-240/480	2	OD				0025G	0050G	0075G	0100G	0167G			
34500 GrdY/19920-120/240	1	VA	0010F	0015F		0025F	0050F	0075F	0100F	0167F			
34500-120	2	QK	0010G										
34500-120/240	2	QA				0025F	0050F		0100F	0167F	0250F		
34500-277	2	QU					0050F		0100F	0167F	0250F	0333F	0500P

NOTES:

- Transformers with voltage codes starting with B have side-wall mounted 4 kV primary bushings except for those with type code C and those 250 kVA and larger.
- Type code C, F, and P transformers have tank mounted arresters. Type code G and H transformers do not have arresters.
- Type code H and P transformers are platform mount transformers.

Three-Phase Transformers - Pole Mount

Stock Number by kVA								
Voltage Primary-Secondary	Primary Bushings	Voltage Code	30	45	75	150	300	500
4160Δ-208Y/120	3	EC	0030D	0045D	0075D	0150D	0300F	0500F
4160Y-240	3	DG	0030D	0045D	0075D	0150D	0300F	0500F
4160Δ-480Y/277	3	EF	0030F	0045F	0075F	0150F	0300F	0500F
12470Δ-208Y/120	3	LC	0030I	0045I	0075F	0150F	0300F	0500F
12470Y-240	3	KG	0030I	0045I	0075F	0150F	0300F	0500F
12470Δ-480Y/277	3	LF	0030F	0045F	0075F	0150F	0300F	0500F
13200Δ-208Y/120	3	NC					0300F	0500F
13200Δ-480Y/277	3	NF			0075F	0150F	0300F	0500F

NOTES:

1. Transformers with 4160 primary voltage have side-wall mounted 4 kV primary bushings.
2. All three-phase transformers have tank mounted arresters.
3. Type code D and I are CSP transformers.

Three-Phase Transformers - Platform Mount

Stock Number by kVA										
Voltage Primary-Secondary	Primary Bushings	Voltage Code	225	300	500	750	1000	1500	2000	2500
4160Δ-208Y/120	3	EC	0225P	0300P	0500P	0750P	1000P			
4160Y-240	3	DG	0225P	0300P	0500P	0750P	1000P			
4160Δ-480Y/277	3	EF	0225P	0300P	0500P	0750P	1000P	1500P	2000P	2500P
12470Δ-208Y/120	3	LC	0225P	0300P	0500P	0750P	1000P			
12470Y-240	3	KG	0225P	0300P	0500P	0750P	1000P			
12470Δ-480Y/277	3	LF	0225P	0300P	0500P	0750P	1000P	1500P	2000P	2500P
13200Δ-208Y/120	3	NC	0225P	0300P	0500P	0750P	1000P			
13200Δ-480Y/277	3	NF		0300P	0500P	0750P	1000P	1500P	2000P	2500P
34500Δ-480Y/277	3	QF			0500P	0750P	1000P	1500P	2000P	2500P

NOTES:

1. All platform mounted transformers have cover mounted primary bushings.
2. All platform mounted transformers have tank mounted arresters except those with 34500 volt primary.

Single-Phase Transformers - Pad Mount

Stock Number by kVA							
Voltage Primary-Secondary	Voltage Code	25	50	75	100	167	250
4160 GrdY/2400-240/120	FR	0025X 0025Y	0050X 0050Y	0075X 0075Y	0100X 0100Y	0167X 0167Y	
4160 GrdY/2400 x 12470 GrdY/7200-240/120	WR	0025X 0025Y	0050X 0050Y	0075X 0075Y	0100X 0100Y	0167W 0167X 0167Y	0250W
4160 GrdY/2400 x 12470 GrdY/7200 x 13200 GrdY/7620-240/120	ZR	0025Y	0050Y	0075Y	0100Y	0167X	0250X
4160 GrdY/2400 x 12470 GrdY/7200 x 13200 GrdY/7620-480/240	ZZ	0025Y		0075Y			
12470 GrdY/7200-240/120	MR	0025X 0025Y	0050X 0050Y	0075X 0075Y	0100X 0100Y	0167W 0167X 0167Y	
12470 GrdY/7200-480/240	MZ	0025Y		0075Y			
13200 GrdY/7620-240/120	SR	0025Y	0050Y	0075Y	0100Y		
13200 GrdY/7620-480/240	SZ			0075Y			
13800 GrdY/7970-240/120	TR	0025X 0025Y	0050X 0050Y	0075X 0075Y	0100X 0100Y	0167X 0167Y	
34500 GrdY/19920-240/120	VR	0025Y	0050Y		0100Y	0167Y	

NOTES:

1. All single-phase padmount transformers have a non-field replaceable weak-link fuse or isolation link to clear the transformer from the circuit in the event of a winding failure.
2. Type code X are high-profile transformers used in all of Missouri, and Alton and E. St. Louis Illinois. They are equipped with a secondary breaker in series with a weak-link fuse. Exception: ZRxxxxX transformers are equipped with a Bay-O-Net fuse in series with an isolation link.
3. Type code Y are low-profile transformers used primarily in Illinois. They are equipped with a Bay-O-Net fuse in series with an isolation link. Exception: VRxxxxY transformers are equipped with a Bay-O-Net fuse in series with a current-limiting fuse.
4. Type code W are high-profile transformers used in Illinois. They are equipped with only a non-field replaceable weak-link fuse.

TRANSFORMERS

Stock Numbers

13 00 01 02
Sheet 4 of 5

Three-Phase Transformers - Pad Mount

Stock Number by kVA											
Voltage Primary-Secondary	Voltage Code	75	150	300	500	750	1000	1500	2000	2500	3000
4160Δ-208Y/120	EC	0075L 0075M	0150L 0150M	0300L 0300M	0500M	0750M	1000M				
4160Δ-480Y/277	EF		0150L 0150M	0300L 0300M	0500M	0750M	1000M	1500M 1500Z	2000M 2000Z	2500M 2500Z	
4160Δ x 12470Δ-240Δ/120 Midtap	XQ	0075R	0150R	0300R	0500R						
4160 GrdY/2400 x 12470 GrdY/7200-208Y/120	WC	0075L 0075M	0150L 0150M	0300L 0300M	0500M	0750M	1000M				
4160 GrdY/2400 x 12470 GrdY/7200-480Y/277	WF		0150L 0150M	0300L 0300M	0500M	0750M	1000M	1500M 1500Z	2000M 2000Z		
4160 GrdY/2400 x 13200 GrdY/7620-208Y/120	ZC	0075A 0075L	0150A 0150L	0300A 0300L	0500A 0500L						
4160 GrdY/2400 x 13200 GrdY/7620-480Y/277	ZF	0075A 0075L	0150A 0150L	0300A 0300L	0500A 0500L						
4160Y x 13200Y-240Δ/120 Midtap	ZQ	0075A 0075L	0150A 0150L	0300A 0300L	0500A 0500L						
12470Δ-208Y/120	LC	0075L 0075M	0150L 0150M	0300L 0300M	0500L 0500M	0750L 0750M	1000L 1000M				
12470Δ-480Y/277	LF		0150L 0150M	0300L 0300M	0500L 0500M	0750L 0750M	1000L 1000M	1500M	2000M	2500M	
12470 GrdY/7200-208Y/120	MC	0075L 0075M	0150L 0150M	0300L 0300M	0500L 0500M	0750L 0750M	1000L 1000M				
12470 GrdY/7200-480Y/277	MF		0150L 0150M	0300L 0300M	0500L 0500M	0750L 0750M	1000L 1000M	1500M	2000M	2500M	
12470Y-240Δ/120 Midtap	KQ		0150L	0300L	0500L	0750L	1000L				
13200Δ-208Y/120	NC		0150M	0300M	0500M	0750M	1000M				
13200Δ-480Y/277	NF		0150M	0300M	0500M	0750M	1000M	1500M	2000M	2500M	
13200 GrdY/7620-208Y/120	SC	0075A 0075L	0150A 0150L	0300A 0300L	0500A 0500L	0750A					
13200 GrdY/7620-480Y/277	SF	0075A 0075L	0150A 0150L	0300A 0300L	0500A 0500L	0750A 0750L	1000A 1000L	1500M	2000M	2500M	
13200Y-240Δ/120 Midtap	HQ	0075A 0075L	0150A 0150L	0300A 0300L	0500A 0500L						
13200 GrdY/7620-4160 GrdY/2400	SX			0300A 0300L	0500A 0500L	0750A 0750L	1000A 1000L	1500M	2000M	2500M	
34500Δ-208Y/120	QC				0500L	0750L					
34500Δ-480Y/277	QF				0500L	0750L	1000L	1500L 1500M	2000M	2500L 2500M	3000M
34500 GrdY/19920-208Y/120	VC			0300L	0500L	0750L					
34500 GrdY/19920-480Y/277	VF				0500L	0750L	1000L	1500L		2500L	

NOTES:

1. Type code A transformers are radial feed. They are equipped with Bay-O-Net fuses.
2. Type code M transformers are radial feed. They do not have fuses.
3. Type code L transformers are loop feed. They are equipped with Bay-O-Net fuses. Exception: See Note 7.
4. Type code R and Z transformers are live-front radial feed. They do not have fuses. **THESE TRANSFORMERS ARE NOT TO BE INSTALLED NEW. THEY ARE ONLY AVAILABLE FOR LIKE-KIND REPLACEMENT.**
5. Voltage code EF and WF transformers 1500 kVA and larger are equipped with 15 kV, 600 Amp non-loadbreak bushings.
6. All QFxxxxM transformers are equipped with 35 kV, 600 Amp non-loadbreak bushings.
7. All VCxxxxL, VFxxxxL, QCxxxxL, and QFxxxxL transformers are equipped with 35 kV, 200 Amp loadbreak bushings (large interface). These transformers are also equipped with current limiting fuses instead of Bay-O-Net fuses.

Three-Phase Transformers - Network

Stock Number by kVA						
Voltage Primary-Secondary	Voltage Code	500	750	1000	1500	2000
13200Δ-216Y/125	HB	0500S	0750S	1000S		
13200Δ-480Y/277	NF	0500S	0750S	1000S		
13800Δ-216Y/125	PB	0500S	0750S			
13800Δ-480Y/277	PF			1000S	1500S	
14400Δ-216Y/125	UB	0500S		1000S		
14400Δ-480Y/277	UF			1000S	1500S	2000S

NOTES:

1. Voltage code HB and NF transformers are used in Bloomington and Decatur, IL.
2. Voltage code PB and PF transformers are used in St. Louis, MO.
3. Voltage code UB and UF transformers are used in Peoria, IL.

Three-Phase Transformers - Commercial Subsurface

Stock Number by kVA						
Voltage Primary-Secondary	Voltage Code	150	225	300	500	750
12470Y/7200-208Y/120	MC	0150V	0225V	0300V	0500V	0750V
12470Y/7200-480Y/277	MF				0500V	0750V
4160Y/2400 x 12470Y/7200-208Y/120	WC	0150V		0300V	0500V	0750V
4160Y/2400 x 12470Y/7200-480Y/277	WF				0500V	0750V

NOTES:

1. Commercial Subsurface Transformers are only used in Champaign, Galesburg, and Ottawa, IL.

1. Transformer Installations

Details of transformer installations will vary based on the number of phases, voltage, whether delta or wye connected, kVA rating, whether common or isolated neutral, and grounding requirements. Some special considerations are detailed below and should be used in conjunction with the other transformer construction standards.

2. Transformer Removals

Transformers removed from service shall be either retained at the district for future use or returned to the shop.

2.1 GUIDELINES FOR RETAINING A TRANSFORMER FOR RE-USE

- a. The transformer was known to be working when removed and is less than 35 years old.
- b. The transformer is a current design (for example, not iron tanks).
- c. The transformer is in good condition if:
 1. There are no broken bushings.
 2. It is not leaking oil.
 3. The paint is okay, very little rust present.
 4. Tanks are not badly dented and hanger brackets are not broken.
 5. If a padmount, it has a penta head bolt and the integrity of the cabinet security has not been compromised.

Transformers that meet these requirements do not need to be returned to the shop.

2.2 OPERATIONS TO BE PERFORMED PRIOR TO RE-USE:

- a. Replace porcelain arrester with polymer arrester on overhead transformers.
- b. On CSP transformers, remove all leads and check the low voltage breaker operation and continuity.
- c. On overhead transformers 7200 volts and above, install a wildlife guard. Refer to Dist. Std. 05-12-10-01.
- d. On CSP transformers, reset the emergency overload lever to the normal position and install a meter seal, Stock No. 49-05-860.

3. Grounding of Transformer Tanks

On all transformer installations, tanks shall be grounded by connecting the transformer grounding wire to the tank grounding lug provided for this purpose. On older style steel and cast iron tanked transformers the Transformer Shop will install the grounding lug, usually located on or near the lower right hanger bracket (facing secondary of transformer).

All single-phase transformers with two primary bushings, which are intended for phase to neutral connection, shall be equipped with an external ground connecting the primary neutral to the transformer tank (See Dist. Std. 13 00 06 02). Also all single-phase transformers having 120/240 volt secondaries with solderless connector type secondary bushings shall have a grounding strap between the secondary neutral bushing and the transformer tank. Note that where grounding rules require the interconnection of the secondary and arrester ground leads through a spark gap the grounding strap shall be removed (See Dist. Std. 13 00 06 06).

All transformer tanks shall be regarded as being "hot" when not positively known to be effectively grounded.

4. Single-Phase Delta Primary Systems

When a transformer is used on a delta primary system, lightning arresters must be attached to each primary bushing (See Dist. Std. 13 00 06 06).

5. Three-Phase Service

Three-phase service where the secondary voltage is 480Y/277 or 480 volts may be provided using three-phase transformers or by banking three single-phase transformers.

Three single-phase conventional transformers shall be banked for 120/208Y or 240 volt service.

CSP transformers should not be banked.

CAUTION:

If single-phase transformers having 120/240 volt secondaries are banked for three-phase service the grounding strap between the secondary neutral bushing and the tank must be removed on all transformers otherwise circulating currents may, under some conditions, be set up through one half the secondary coil of adjacent transformers, transformer tanks, and ground. See Dist. Stds. 13 00 07 04, 13 00 07 05, 13 00 07 08, and 13 00 07 09.

6. "Open" Transformer Banks

The open wye-open delta and open delta-open delta type transformer banks are used to supply power to small three-phase customers in addition to taking care of their lighting requirements. These customers require a four-wire service and only two transformers. When connecting two transformers together to form a transformer bank, the bank will be referred to as an "open bank".

The open wye-open delta bank may be used where three-phase service is required but only two primary phases are present. The "open bank" may also be used in emergencies where one transformer in a bank of three fails and service must be restored immediately.

When an "open bank" is used, the capacity is only 57% of the three-phase rating of a closed bank of three transformers. If an "open bank" is used in an emergency situation, measures must be taken to reduce load. Additionally, the failed transformer should be replaced as soon as possible.

7. PARALLELING TRANSFORMERS

No attempt should be made to parallel a three-phase transformer with a bank of three single-phase transformers. Differences in phase shifts (angular displacements) will not permit paralleling.

8. 480 VOLT THREE WIRE SERVICE FROM 480Y/277 VOLT FOUR WIRE TRANSFORMER

See Dist. Stds. 13 00 01 01, 51 12 00 **, 51 12 01 **, and 51 12 02 **.

9. ELIMINATION OF STRAY VOLTAGES

Relatively low levels of neutral-to-earth (stray) voltage may produce adverse effects in especially sensitive installations, such as dairy farms. If the neutral-to-earth voltage on the customer's premise cannot be reduced by conventional methods such as tightening connectors, replacing connectors, or adding ground rods, a neutral isolation device may be utilized. See Dist. Std. 13 00 06 08.

1. Secondary Leads

The following copper lead sizes shall be used for connections from overhead transformer secondary terminals to a secondary, a secondary bus, or an individual secondary service. Aluminum leads shall not be used. Exception: If a transformer installation serves only one customer, aluminum service conductor can be extended to the transformer secondary terminals provided pin terminal connectors with copper studs are used.

Where a three-phase installation consists of a bank of three single-phase transformers the lead sizes between the transformers secondary terminals shall be determined by the size of the individual transformers, their single-phase voltage, and the change-out overload rating. The lead size from the transformers to the secondary/service bus shall be determined by the size of the bank, the three-phase voltage, and the change-out overload rating.

For 208Y/120 Volt and 480Y/277 Volt banks, the size of both the transformer-to-transformer and transformer-to-secondary/service bus leads are the same. For 240 Volt and 480 Volt delta banks, the size of the transformer-to-transformer leads can be smaller than the transformer-to-secondary/service bus leads. The three-phase tables in this standard reflect the preceding sizing criteria. For paralleled transformers, the transformer-to-transformer lead size is based on the kVA of the largest single transformer. The transformer-to-secondary lead size is based on the total kVA of the paralleled transformers. Tables of lead sizes for paralleling transformers are not provided since it is a non-standard application to be used only in emergency situations.

Where customer's circuit is over 50 Amps and involves more than one metallic duct, connections should not be made unless each of the phase wires and neutral are in each duct. This is an NEC requirement to avoid heating the metallic ducts by induced currents.

167 kVA and larger transformers with 120/240 and 240/480 Volt secondary have four (4) secondary bushings so that the secondary windings can be externally connected in series or parallel depending on the application. If the windings are to be connected in series, the external connection wire size must match the phase wire size (if single-phase) or transformer-to-transformer wire size (if banked three-phase delta). If the windings are to be connected in parallel, the external connection wire size can be one-half (1/2) the phase wire size (if single-phase or banked three-phase wye).

TABLE 1.1

Single-Phase 120/240 Volt 3-Wire and 240 Volt 2-Wire

Transformer kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Phase	Neutral	
15 & Smaller	#6	#6	18 51 021
25	#2	#2	18 51 019
37-1/2	1/0	1/0	18 51 024
50	4/0	4/0	18 51 023
75	350	350	18 51 052
100	500	500	18 51 022
167	2-350	2-350	18 51 052
200	2-500	2-500	18 51 022
250	2-500	-	18 51 022
333	2-750	-	18 51 020

TABLE 1.2

Single-Phase 120 Volt 2-Wire and 120/240 Volt With Paralleled Windings

For Use In 208Y/120 Volt Three-Phase Banks

Transformer kVA		Cross-Linked Polyethylene Covered Copper Wire	
Single-Phase	Three-Phase Bank ⁽¹⁾	Size (AWG or KCMIL)	Stock Number
15 & Smaller	45	#2	18 51 019
25	75	1/0	18 51 024
37-1/2	112-1/2	4/0	18 51 023
50	150	350	18 51 052
75	225	500	18 51 022
100	300	2-350	18 51 052
167	500	2-750	18 51 020

Notes:

1. See Table 1.5

TABLE 1.3

Single-Phase 480 Volt 2-Wire

Transformer kVA	Cross-Linked Polyethylene Covered Copper Wire	
	Size (AWG or KCMIL)	Stock Number
37-1/2 & Smaller	#6	18 51 021
50	#2	18 51 019
75	1/0	18 51 024
100	1/0	18 51 024
167	350	18 51 052
200	500	18 51 022
250	500	18 51 022
333	750	18 51 020

TABLE 1.4
Three-Phase 240 Volt

Transformer or Bank kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Transformer to Transformer ⁽¹⁾	Transformer to Secondary/Service	
30 & Smaller	#6	#6	18 51 021
45	#2	#2	18 51 019
75	1/0	1/0	18 51 024
112-1/2	4/0	4/0	18 51 023
150	4/0	4/0	18 51 023
225	500	500	18 51 022
300	1-350	2-350	18 51 052
500	1-500	2-500	18 51 022
750	2-750	2-750	18 51 020
1000	2-750	3-750	18 51 020

Notes:

1. Applicable only to a bank of single-phase transformers.

TABLE 1.5
Three-Phase 208Y/120 Volt 4-Wire

Transformer or Bank kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Phase ⁽¹⁾	Neutral ⁽²⁾	
30 & Smaller	#6	#6	18 51 021
45	#2	#2	18 51 019
75	1/0	1/0	18 51 024
150	350	350	18 51 052
225	500	500	18 51 022
300	2-350	2-350	18 51 052
500	2-750	2-750	18 51 020
750	3-750	3-750	18 51 020
1000	3-750	3-750	18 51 020

Notes:

1. Wire size is the same for the Transformer-to-Transformer (banked single-phase transformers) and Transformer-to-Secondary/Service leads.
2. Full-size neutrals are required to accommodate the harmonic currents associated with increased usage of electronic office equipment.

TABLE 1.6

Three-Phase 480 Volt

Transformer or Bank kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Transformer to Transformer ⁽¹⁾	Transformer to Secondary/Service	
75 & Smaller	#2	#2	18 51 019
112-1/2	#2	#2	18 51 019
150	1/0	1/0	18 51 024
225	4/0	4/0	18 51 023
300	4/0	4/0	18 51 023
500	500	500	18 51 022
750	750	750	18 51 020
1000	1-500	2-500	18 51 022
1500	2-750	2-750	18 51 020
2000	2-750	3-750	18 51 020
2500	2-750	3-750	18 51 020

Notes:

1. Applicable only to a bank of single-phase transformers.

TABLE 1.7

Three-Phase 480Y/277 Volt 4-Wire

Transformer or Bank kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Phase ⁽¹⁾	Neutral ⁽²⁾	
75 & Smaller	#2	#2	18 51 019
112-1/2	#2	#2	18 51 019
150	1/0	1/0	18 51 024
225	4/0	4/0	18 51 023
300	4/0	4/0	18 51 023
500	500	500	18 51 022
750	750	750	18 51 020
1000	2-500	2-500	18 51 022
1500	2-750	2-750	18 51 020
2000	3-750	3-750	18 51 020
2500	3-750	3-750	18 51 020

Notes:

1. Wire size is the same for the Transformer-to-Transformer (banked single-phase transformers) and Transformer-to-Secondary/Service leads.
2. Full-size neutrals are required to accommodate the harmonic currents associated with increased usage of electronic office equipment.

TABLE 1.8

Three-Phase 240 Delta/120 Volt Grounded Center Tap⁽¹⁾

Transformer Bank kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Transformer to Transformer	Transformer to Secondary/Service ⁽²⁾	
3-10	#6	#6	18 51 021
3-15	#2	#2	18 51 019
3-25	1/0	1/0	18 51 024
3-50	4/0	4/0	18 51 023
3-100	1-350	2-350	18 51 052
2-10 & 1-25	#2	#2	18 51 019
2-25 & 1-50	1/0	1/0	18 51 024
2-50 & 1-100	350	350	18 51 052
2-100 & 1-167	1-350	2-350	18 51 052
2-167 & 1-250	1-500	2-500	18 51 022
3-167	1-500	2-500	18 51 022
3-250	2-750	2-750	18 51 020
3-333	2-750	3-750	18 51 020

Notes:

1. Bank of three single-phase transformers. This table is provided for maintenance of existing installations.
2. Center tap neutral is the same size as the Transformer-to-Secondary/Service phase conductors.

TABLE 1.9

Three-Phase 120/240 Volt Open Wye-Open Delta, Grounded Center Tap⁽¹⁾

Transformer Bank kVA	Cross-Linked Polyethylene Covered Copper Wire		
	Size (AWG or KCMIL)		Stock Number
	Transformer to Transformer ⁽²⁾	Transformer to Secondary/Service ⁽³⁾	
2-10	#6	#6	18 51 021
1-25 & 1-10	#2	#2	18 51 019
1-50 & 1-10	1/0	1/0	18 51 024
2-25	#2	#2	18 51 019
1-50 & 1-25	1/0	1/0	18 51 024
1-100 & 1-25	350	350	18 51 052
2-50	1/0	1/0	18 51 024
1-100 & 1-50	350	350	18 51 052
1-167 & 1-50	350	2-350	18 51 052

Notes:

1. This transformer connection has one 208 V phase-to-neutral "wild" phase, and two 120 V phase-to-neutral "lighter" phases. All phase-to-phase voltages are 240 V.
2. Transformer-to-transformer and "wild" phase transformer-to-secondary/service leads are the same size.
3. Transformer-to-Secondary/Service "lighter" phase and center tap neutral leads are the same size.

2. Primary Phase Leads

TABLE 2.1

Single-Phase and Three-Phase 2400-4160 Volt Transformers With Cover Mounted Bushings

Maximum KVA		Cross-Linked Polyethylene Covered Copper Wire Size ⁽¹⁾	Stock Number
Single-Phase 2400V	Three-Phase 4160V		
333	1000	#4 CU, Solid	18 51 025
500	1500	#2 CU, 7 Strand	18 51 019
1000	2500	4/0 CU, 19 Strand	18 51 023

Notes:

1. Where long primary leads are required, a #2 or larger conductor shall be used for mechanical strength.

TABLE 2.2

Single-Phase and Three-Phase 2400–4160 Volt Transformers With Side-Wall Mounted Bushings

Maximum KVA		EPR Covered Copper Wire Size ⁽¹⁾	Stock Number
Single-Phase 2400V	Three-Phase 4160V		
167	500	#6 CU, 7 Strand – 5KV	18 53 011
250	750	#2 CU, 7 Strand – 5KV	18 53 018
333	1000	1/0 CU, 19 Strand – 5KV	18 53 022

Notes:

- Where long primary leads are required, a #2 or larger conductor shall be used for mechanical strength.

TABLE 2.3

Single-Phase and Three-Phase 5000–15000 Volt Transformers With Cover Mounted Bushings

Maximum KVA		Cross-Linked Polyethylene Covered Copper Wire Size ⁽¹⁾	Stock Number
Single-Phase	Three-Phase		
500	2500	#4 CU, Solid	18 51 025

Notes:

- Where long primary leads are required, a #2 or larger conductor shall be used for mechanical strength.

3. Primary Neutral Leads

3.1 Two Bushing Transformers

All single-phase, two bushing transformers, connected phase-to-neutral shall have the neutral bushing grounded twice. One of the grounding connections is from the neutral bushing to the grounded transformer tank. The second grounding connection is from the neutral bushing to the common neutral and is to be clearly separated from all other common neutral connections.

For all kVA sizes of 7.2 thru 19.9 kV transformers and 2.4 kV transformers thru 333 kVA, the grounding connections are made using a single piece of #4 soft-drawn solid covered copper wire (Stock Number 18 51 025) by extending the lead from the grounding boss on the transformer tank through the primary neutral bushing to the common neutral. Use a gradual sweep when taking the lead through the primary neutral bushing to the common neutral. See DCS 13 00 06 02. For 500 kVA 2.4 kV transformers, use #2 CU (Stock Number 18 51 019) from the primary neutral bushing to the common neutral.

3.2 Single Bushing Transformers

All single-phase, single bushing transformers, connected phase to neutral shall have two separate grounding connections to the tank. One connection shall be made from the tank to the earth ground. The second connection shall be made from the tank to the common neutral and is to be clearly separated from all other common neutral connections. In all instances, this connection shall be made with #4 soft-drawn solid covered copper wire (Stock Number 18 51 025).

**SINGLE PHASE – POLE OR PLATFORM MOUNTED (1)
5kV AND BELOW (TYPICAL VALUES)
SINGLE – VOLTAGE**

KVA SIZE	HEIGHT (INCHES)		WIDTH (INCHES)(3)	WEIGHT (POUNDS)	OIL (GAL)
	Side Bushings	Cover Bushings (2)			
10	30	34	23	235	10
15	30	34	27	310	13
25	30	40	28	475	17
50	36	42	32	800	28
75	40	50	32	900	38
100	46	50	36	1100	50
167	50	54	38	1805	79
250	50	58	41	2360	95
333	58	66	41	2860	104
500	–	66	41	3215	104

NOTES:

1. This table does not include step-up/step-down transformers.
2. Distance from upper support lug to HV terminal for cover mounted bushings is 15" ± 3".
3. Width includes cooling fins and tank mounted arresters in their extended positions.

**THREE PHASE – POLE MOUNTED (1)
5kV AND BELOW (TYPICAL VALUES)**

KVA SIZE	HEIGHT (INCHES)	WIDTH (INCHES)(2)	WEIGHT (POUNDS)	OIL (GAL)
30	61	40	1450	71
45	61	40	1480	71
75	61	40	1830	81
150	61	40	1900	85
225	70	56	2500	90
300	70	56	3200	115
500	74	56	3800	150

NOTES:

1. This table does not include step-up/step-down transformers.
2. Width includes cooling fins and tank mounted arresters in their extended positions.

**SINGLE PHASE – POLE OR PLATFORM MOUNTED(1)
7.2 THRU 14.4 kV (TYPICAL VALUES)
SINGLE – VOLTAGE**

KVA SIZE	HEIGHT (INCHES)(2)	WIDTH (INCHES)(3)	WEIGHT (POUNDS)	OIL (GAL)
1	26	15	110	4
10	36	25	285	14
15	39	26	365	16
25	40	28	510	18
50	48	31	800	33
75	52	31	900	38
100	60	32	1120	66
167	60	39	1805	83
250	60	41	2360	95
333	75	52	2720	85
500	75	52	3060	98

NOTES:

1. This table does not includes step-up/step-down transformers.
2. Thru 13.8 kV, distance from upper support lug to HV terminal is 15" \pm 3".
For 14.4 kV, distance from upper support lug to HV terminal is 16.5" \pm 3" thru 167 kVA, and 19.5" \pm 3" for 250 thru 500 kVA.
3. Width includes cooling fins and tank mounted arresters in their extended positions.

**THREE PHASE – POLE MOUNTED (1)
12.47 THRU 13.8 kV (TYPICAL VALUES)**

KVA SIZE	HEIGHT (INCHES)(2)	WIDTH (INCHES)(#3)	WEIGHT (POUNDS)	OIL (GAL)
30	65	40	1435	72
45	65	40	1500	72
75	65	40	1815	83
150	66	40	2275	91
225	70	56	2600	120
300	72	56	3125	125
500	81	56	4105	150

NOTES:

1. This table does not include step-up/step-down transformers.
2. Distance from upper support lug to HV terminal is 15" \pm 3".
3. Width includes cooling fins and tank mounted arresters in their extended positions.

SINGLE PHASE – POLE OR PLATFORM MOUNTED(1)
19.9 and 34.5kV (TYPICAL VALUES)
SINGLE – VOLTAGE

KVA SIZE	HEIGHT (INCHES)(2)		WIDTH (INCHES)(3)		WEIGHT (POUNDS)		OIL (GAL)	
	19.9kV	34.5kV	19.9kV	34.5kV	19.9kV	34.5kV	19.9kV	34.5kV
10	44	48	29	32	380	685	17	32
15	44	–	32	–	435	–	18	–
25	44	49	32	32	500	685	18	36
50	50	58	34	42	815	1090	32	62
75	52	–	34	–	1255	–	42	–
100	55	62	34	42	1430	1890	56	85
167	55	70	36	47	1710	2200	58	94
250	–	66	–	48	–	2610	–	95
333	–	74	–	48	–	2770	–	105
500	–	82	–	48	–	5650	–	125

NOTES:

1. This table does not include step-up/step-down transformers.
2. Distance from upper support lug to HV terminal is 16.5" ± 3" thru 167 kVA and 19.5" ± 3" for 250 thru 500 kVA.
3. Width includes cooling fins and tank mounted arresters in their extended positions.

SINGLE PHASE – POLE MOUNTED (1)
DOUBLE AND TRIPLE VOLTAGE (TYPICAL VALUES)

KVA SIZE	HEIGHT (INCHES)(2)	WIDTH (INCHES)(3)	WEIGHT (POUNDS)	OIL (GAL)
10	36	27	485	20
25	42	27	500	23
50	46	31	955	42
75	54	32	1425	42
100	54	34	1430	64
167	58	39	1970	86
250	62	39	2415	93
333	66	41	2960	105
500	66	41	3505	105

NOTES:

1. This table does not include step-up/step-down transformers.
2. Distance from upper support lug to HV terminal is 15" ± 3".
3. Width includes cooling fins and tank mounted arresters in their extended positions.

THREE PHASE – PLATFORM MOUNTED (1) 5 THRU 13.2kV (TYPICAL VALUES)

KVA SIZE	HEIGHT (INCHES)	WIDTH (INCHES) (2)	DEPTH (INCHES) (2)	OIL (GALS)	WEIGHT (POUNDS)
225	67	61	30	241	4040
300	67	61	32	241	4385
500	67	61	41	241	5500
750	75	75	49	413	8200
1000	75	77	49	437	9900
1500	78	81	49	441	10300
2000	89	81	49	565	13800
2500	89	86	49	602	17400

NOTES:

1. This table does not include step-up/step-down transformers.
2. Width and depth dimensions include cooling fins and tank mounted arresters in their extended positions.

THREE PHASE – PAD MOUNTED (1) 5 THRU 13.2kV (TYPICAL VALUES)

KVA SIZE	HEIGHT (INCHES)	WIDTH (INCHES) (2)	DEPTH (INCHES) (2)	OIL (GALS)	WEIGHT (POUNDS)
75	62	74	50	175	3200
150	62	74	53	175	4000
300	64	74	59	259	6500
500	69	74	66	316	8000
750	74	76	68	394	8700
1000	74	76	70	416	12400
1500	74	80	80	521	13200
2000	80	92	86	561	17000
2500	80	96	92	557	17300

NOTES:

1. This table does not include step-up/step-down transformers.
2. Width and depth dimensions include cooling fins. Refer to DCS 34 21 05 ** for pad requirements for these transformers.

SINGLE PHASE – PAD MOUNTED
2.4 THRU 7.97kV (TYPICAL VALUES)

KVA SIZE	TYPE (1)	HEIGHT (INCHES)	WIDTH (INCHES) (2)	DEPTH (INCHES) (2)	OIL (GALS)	WEIGHT (POUNDS) (3)
25	I	32	36	35	56	1070
50	I	32	40	38	75	1330
75	I	32	40	42	87	2035
100	I	36	40	44	104	2035
167	I	42	40	45	116	2855
250	I	42	40	51	120	2855
25	II	24	34	34	36	680
50	II	24	34	36	40	840
75	II	24	34	38	69	1005
100	II	32	36	38	69	1300
167	II	32	36	44	91	1840

NOTES:

1. Type I are also referred to as high-profile transformers. Type II are also referred to as low-profile transformers.
2. Width and depth dimensions include cooling fins where applicable. Refer to DCS 34 21 05 ** for pad requirements for these transformers.
3. Weights for Type I padmount transformers are based on WR (dual voltage transformers) or ZR (triple voltage transformers). Single voltage transformers will typically weigh less.

SINGLE PHASE – PAD MOUNTED
19.9kV (TYPICAL VALUES)

KVA SIZE	TYPE	HEIGHT (INCHES)	WIDTH (INCHES) (1)	DEPTH (INCHES) (1)	OIL (GALS)	WEIGHT (POUNDS)
25	I	36	38	38	81	1295
50	I	36	38	39	82	1415
100	I	36	38	43	97	1815
167	I	42	38	45	120	2500

NOTES:

1. Width and depth dimensions include cooling fins where applicable. Use pad stock #12-06-163 for these transformers per DCS 34 21 04 **.

THREE PHASE – PLATFORM MOUNTED (1)
35kV (TYPICAL VALUES)

KVA SIZE	HEIGHT (INCHES)	WIDTH (INCHES)(2)	DEPTH (INCHES) (2)	OIL (GALS)	WEIGHT (POUNDS)
500	84	77	48	385	6635
750	88	81	52	451	8900
1000	88	81	54	456	9200
1500	88	84	77	456	10785
2000	96	100	62	585	14500
2500	105	110	70	605	16500

NOTES:

1. This table does not include step-up/step-down transformers.
2. Width and depth dimensions include cooling fins and tank mounted arresters in their extended positions.

THREE PHASE – PAD MOUNTED (1)
35kV (TYPICAL VALUES)

KVA SIZE	HEIGHT (INCHES)	WIDTH (INCHES)(2)	DEPTH (INCHES)(2)	OIL (GALS)	WEIGHT (POUNDS)
300 (3)	67	84	62	590	9300
500 (3)	77	87	66	685	11700
750 (3)	77	87	68	685	13400
1000 (3)	77	87	73	700	13300
1500 (4)	77	89	86	960	17600
2000 (5)	77	92	86	755	13065
2500 (4)	77	96	96	970	21100
3000 (5)	77	100	96	835	17900

NOTES:

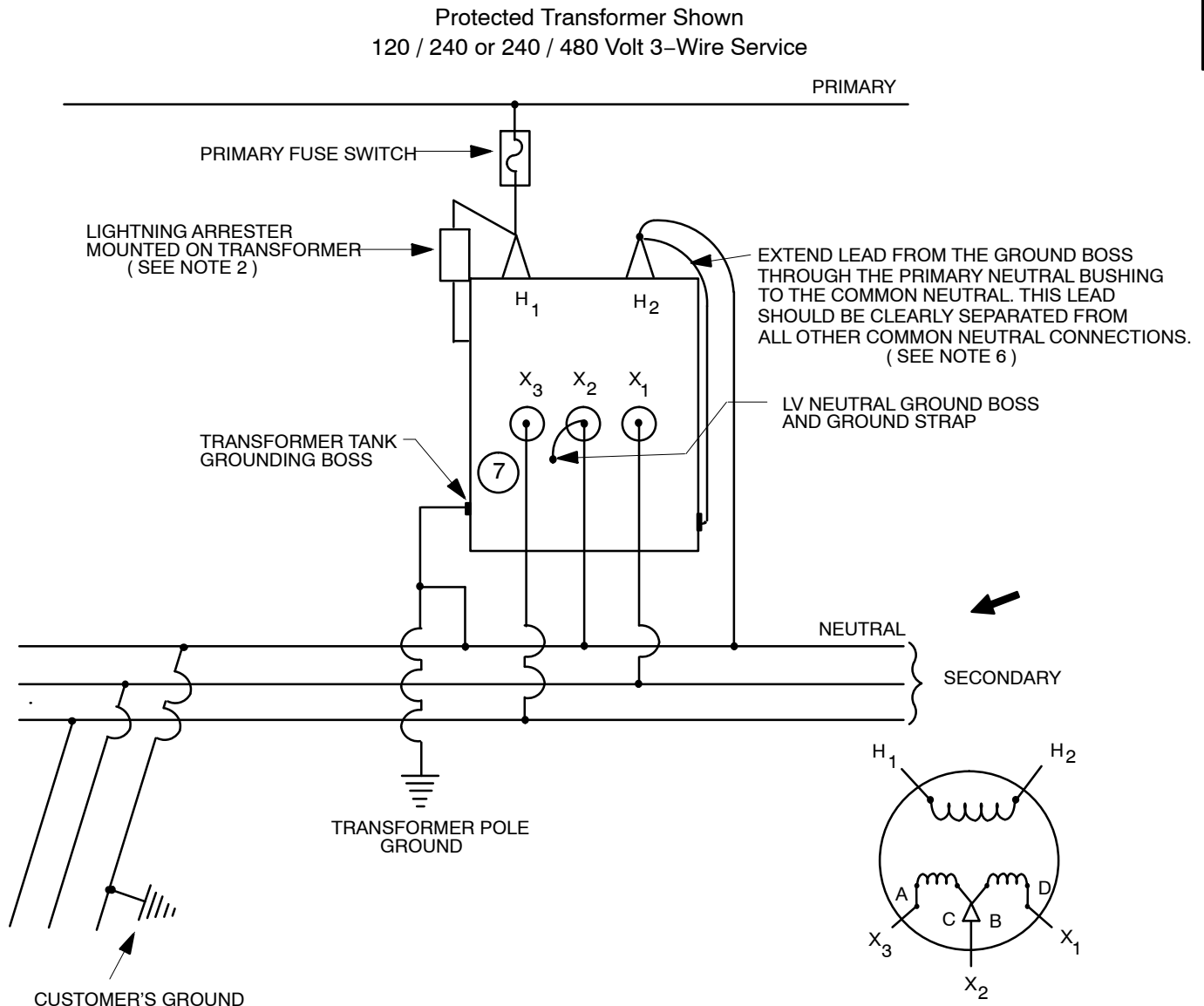
1. This table does not include step-up/step-down transformers.
2. Width and depth dimensions include cooling fins, but do not include the fuse cabinet provided on loop-feed transformers. With the fuse cabinet, the width of a loop-feed transformer can be up to 117". Refer to DCS 34 11 00 00 for pad requirements for those transformers.
3. 300 kVA thru 1000 kVA are only purchased as loop-feed.
4. 1500 kVA and 2500 kVA are purchased in both radial-feed and loop-feed styles with these dimensions and weights based on the loop-feed style.
5. 2000 kVA and 3000 kVA transformers are only purchased as radial-feed.

TRANSFORMERS

Single Phase Three Wire Secondary Connection Diagram 15 kV and Below – Grounded Wye Primary Systems

13 00 06 02

Sheet 1 of 1



NOTES:

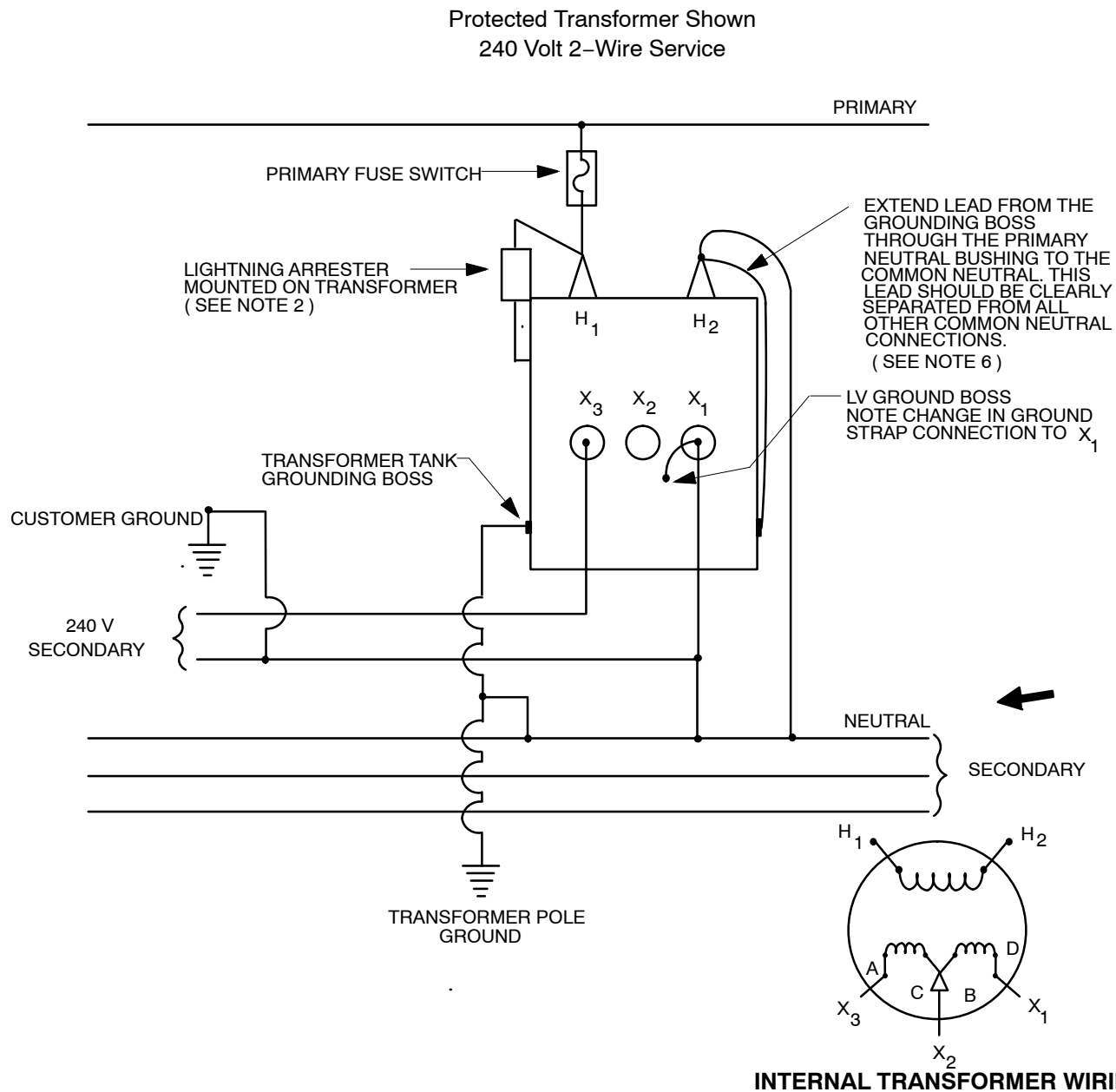
1. Some 2400/4160 Y transformers have sidewall mounted HV bushings.
2. Primary phase connection may be on either the H₁ or H₂ bushing, with the lightning arrester connected to the same bushing. The ground lead is then connected to the other "H" bushing.
3. See 13 00 01 01 for information about conventional and completely self protected transformers (CSP). See 13 00 03 01 for primary and secondary leads.
4. Transformers with a single HV bushing have one end of the winding grounded to the tank.
5. Transformer shown is additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of the x₁ and x₃ bushings are reversed.
6. Do not bend the primary neutral lead too severely. Use a gradual sweep when taking the lead to the common neutral.
7. "Power Leg" to be connected to the bottom wire of an open wire secondary. Note: "Power Leg" is the secondary leg closest to the energized primary bushing, H₁ above. If open wire secondary is not utilized there is no "Power Leg" connotation.

TRANSFORMERS

Single Phase Two Wire Secondary Connection Diagram 15 kV and Below – Grounded Wye Primary Systems

13 00 06 03

Sheet 1 of 2



NOTES:

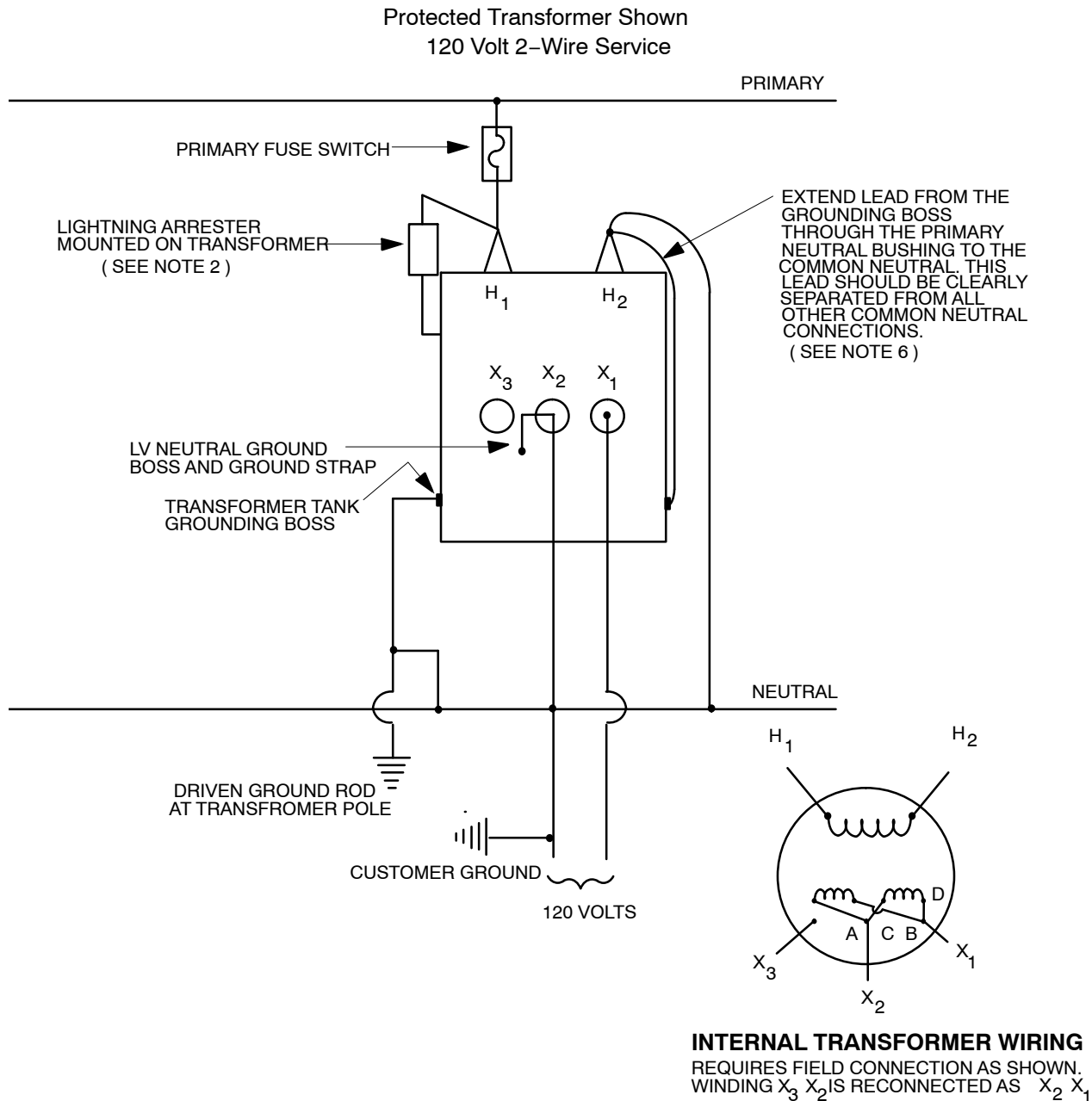
1. 2400/4160 Y transformers may have sidewall mounted HV bushings.
2. Primary phase connection may be on either the H_1 or H_2 bushing, with the lightning arrester connected to the same bushing. The ground lead is then connected to the other "H" bushing.
3. See 13 00 01 01 for information about conventional and completely self protected transformers (CSP). See 13 00 03 01 for primary and secondary leads.
4. Transformers with a single HV bushing have one end of the winding grounded to the tank.
5. Transformer shown is a additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x_1 and x_3 bushings are reversed.
6. Do not bend the primary neutral lead too severely. Use a gradual sweep when taking the lead to the common neutral.

TRANSFORMERS

Single Phase Two Wire Secondary Connection Diagram 15 kV and Below – Grounded Wye Primary Systems

13 00 06 03

Sheet 2 of 2



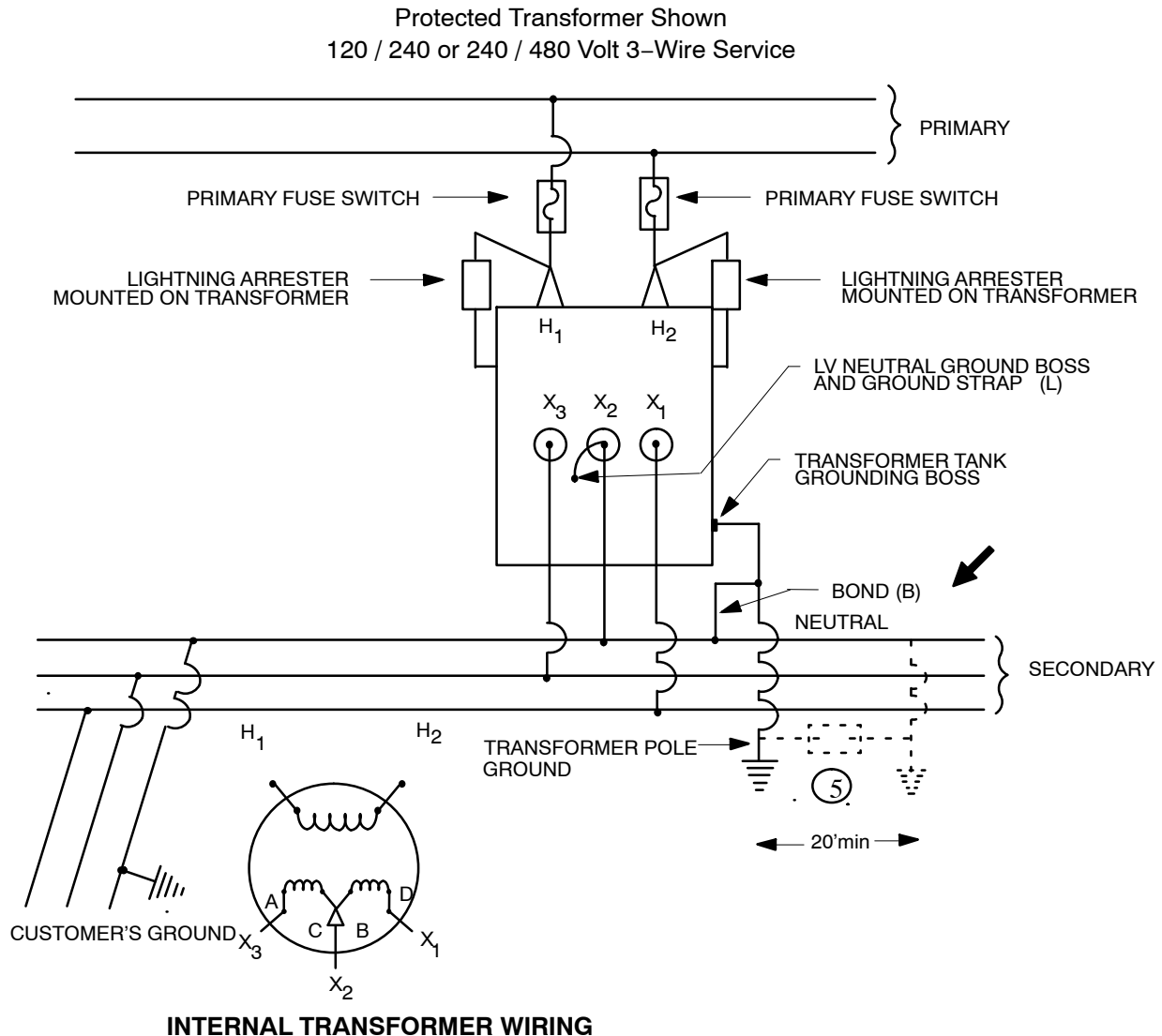
NOTES:

1. 2400/4160 Y transformers may have sidewall mounted HV bushings.
2. Primary phase connection may be on either the H₁ or H₂ bushing, with the lightning arrester connected to the same bushing. The ground lead is then connected to the other "H" bushing.
3. See 13 00 01 01 for information about conventional and completely self protected transformers (CSP). See 13 00 03 01 for primary and secondary leads.
4. Transformers with a single HV bushing have one end of the winding grounded to the tank.
5. Transformer shown is additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x₁ and x₃ bushings are reversed.
6. Do not bend the primary neutral lead too severely. Use a gradual sweep when taking the lead to the common neutral.

TRANSFORMERS
Single Phase Three Wire Secondary Connection Diagram
15 kV and Below-Delta Primary Systems

13 00 06 06

Sheet 1 of 2



NOTES:

1. 2400/4160Y or 4160 two wire transformers may have sidewall mounted HV bushings.
2. Lightning arresters must be connected to the H₁ and H₂ bushings.
3. See 13 00 01 01 for information about conventional and completely self protected transformers (CSP). See 13 00 03 01 for primary and secondary leads.
4. Transformer shown is additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x₁ and x₃ bushings are reversed.

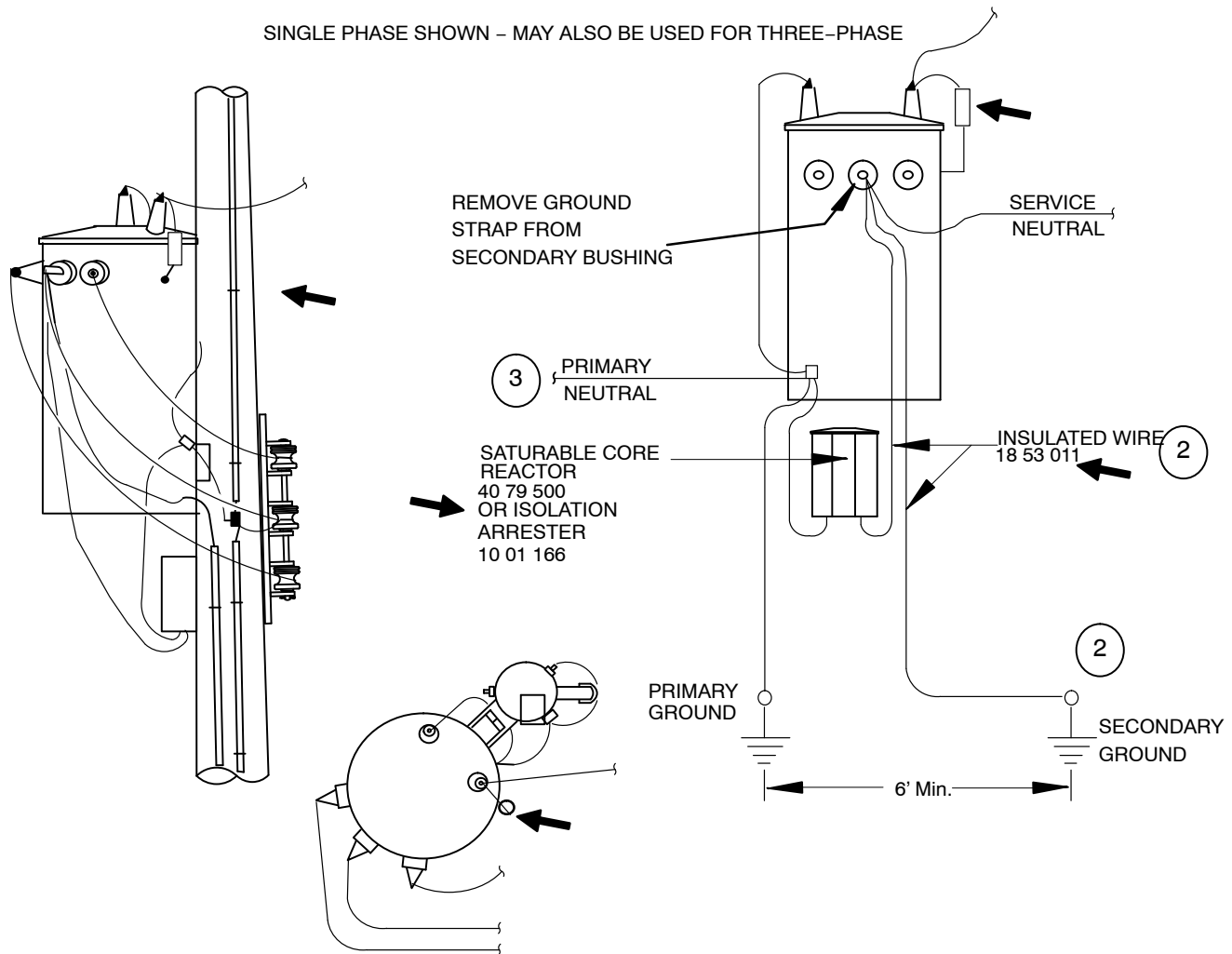
TRANSFORMERS
Single Phase Three Wire Secondary Connection Diagram
15 kV and Below-Delta Primary Systems

13 00 06 06

Sheet 2 of 2

5. The lightning arrester ground and secondary neutral can only be tied solidly together as shown, if one or the other or both of the following requirements are met:
- a) The secondary neutral shall have at least one connection to a continuous metallic underground water pipe system.
 - b) The secondary neutral shall be connected to a primary neutral or shield wire having not less than four ground connections in each mile of continuous line in addition to a ground connection at each individual service.

If the above requirements cannot be met, proceed as follows: Remove ground strap (L) and omit bond (B). Drive an additional ground rod for the secondary neutral not less than 20 ft. from the arrester ground rod and connect the ground lead through an isolation arrester (Stock #10-01-019) to the lightning arrester/transformer tank ground lead (shown dotted in figure). The secondary grounding conductor shall be insulated for 600V (use riser wire Stock #18-53-011). Both ground leads must be covered with plastic moulding for a distance of 8 ft. from the ground. The resistance of both grounds should not exceed 25 ohms.



NOTES:

1. Relatively low levels of neutral-to-earth (stray) voltage may produce adverse effects in especially sensitive installations, such as dairy farms. Usually stray voltages result from factors such as earth currents, ground electrode resistance, earth resistivity, or impedance of current-carrying neutral conductors. If neutral-to-earth voltage on the customer's premise (as measured by Ameren personnel with customer's main disconnect in the open position, or with only 240V loads connected) cannot be reduced to 1.0 volt AC or less across a 470 OHM 5% resistor by conventional methods such as tightening connectors, replacing connectors, or adding ground rods, a neutral isolation device may be utilized. **All options to eliminate stray voltages should be explored prior to installing either a saturable core reactor or an isolation arrester.**
2. Rule 97D2 of the National Electrical Safety Code allows the primary and secondary neutrals of a multi-grounded system to be separated but interconnected through a spark gap or similar isolation device. The gap or device shall have a 60Hz. breakdown voltage not exceeding 3 kV. Additionally, at least one other grounding connection on the secondary neutral shall be provided. This secondary grounding electrode shall be installed at least six feet from the primary grounding electrode. The secondary grounding conductor shall be insulated for 600V and must be covered with plastic moulding for a distance of 8 ft. from the ground. Resistance of the secondary ground should not exceed 25 ohms.
3. The system neutral must be connected to the grounded primary neutral bushing and the pole ground that connects the lightning arrester and transformer tank ground.
4. The reactor or isolation arrester ground must be completely isolated from other grounds.

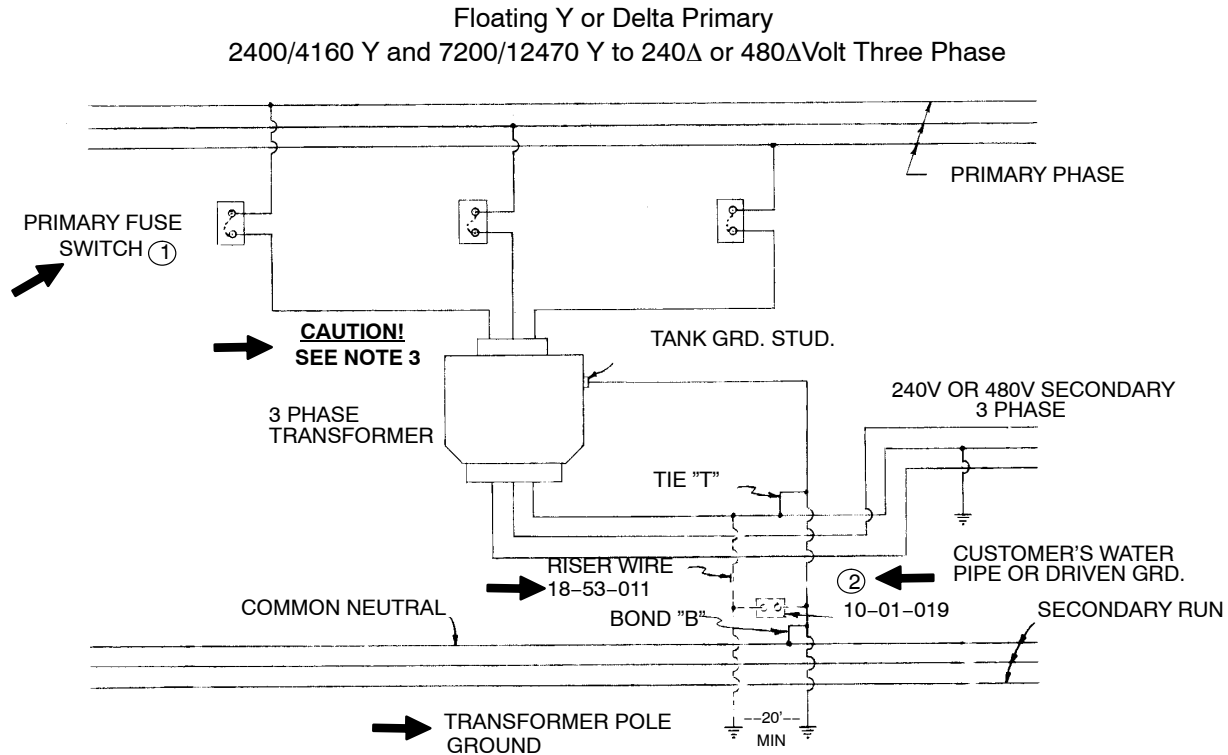
TRANSFORMERS

Connection Diagram

Three Phase

13 00 07 02

Sheet 1 of 1



NOTES:

1. If installing CSP transformer, install fused switches as shown unless pole space does not allow and number of customers affected by transformer failure is deemed acceptable.
2. If a common neutral is not present omit bond "B" and tie "T" and install a second ground rod a minimum distance of 20 feet from the ground at the pole. Connect the lightning arrester/transformer tank ground and secondary ground together through an isolation arrester (stock # 10-01-019). The ground lead to the secondary ground rod shall be insulated for 600V (use stock # 18-53-011). Both ground leads must be covered with plastic moulding for a distance of 8 feet from the ground. The resistance of both grounds should not exceed 25 ohms.
3. For 4.16kV Y transformers use 6kV arrester stock # 10-01-184. For 12.47kV Y transformers use 15kV arrester stock # 10-01-188.

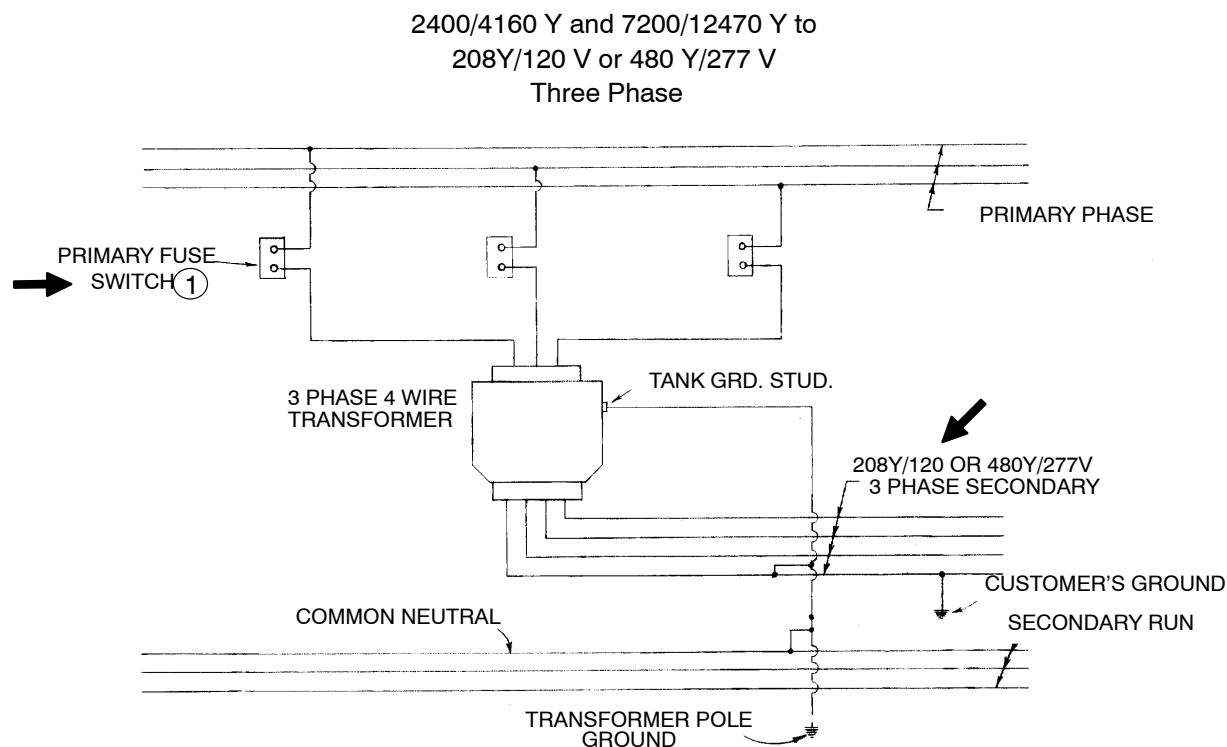
TRANSFORMERS

Connection Diagram

Three Phase

13 00 07 03

Sheet 1 of 1



NOTES:

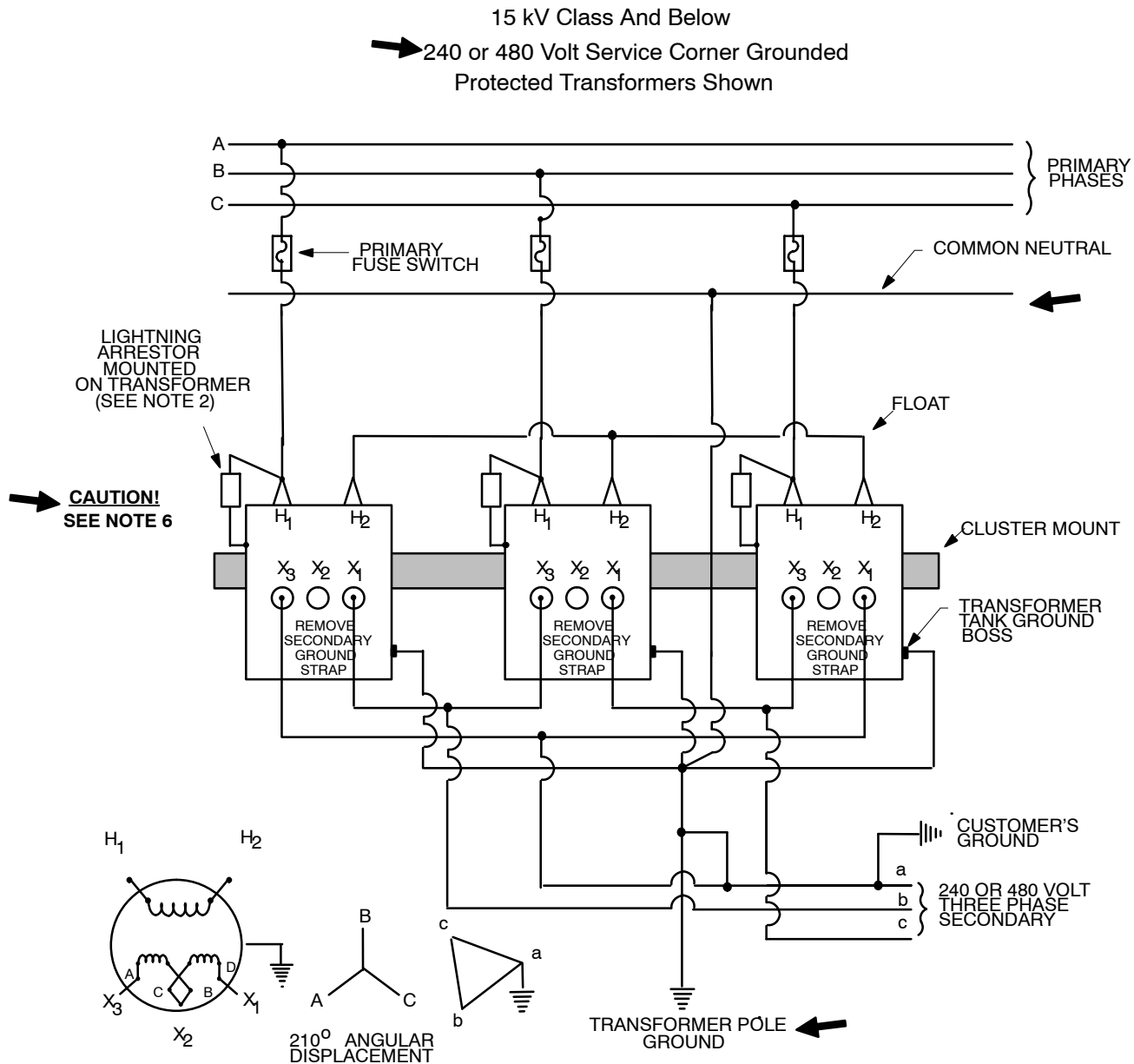
1. If installing CSP transformer, install fused switches as shown unless pole space does not allow and number of customers affected by transformer failure is deemed acceptable.

TRANSFORMERS

13 00 07 04

Single Phase Transformer Cluster Mount Connection Diagram 3 ϕ Floating-Wye Primary w/Grd. Delta Secondary

Sheet 1 of 1



NOTES:

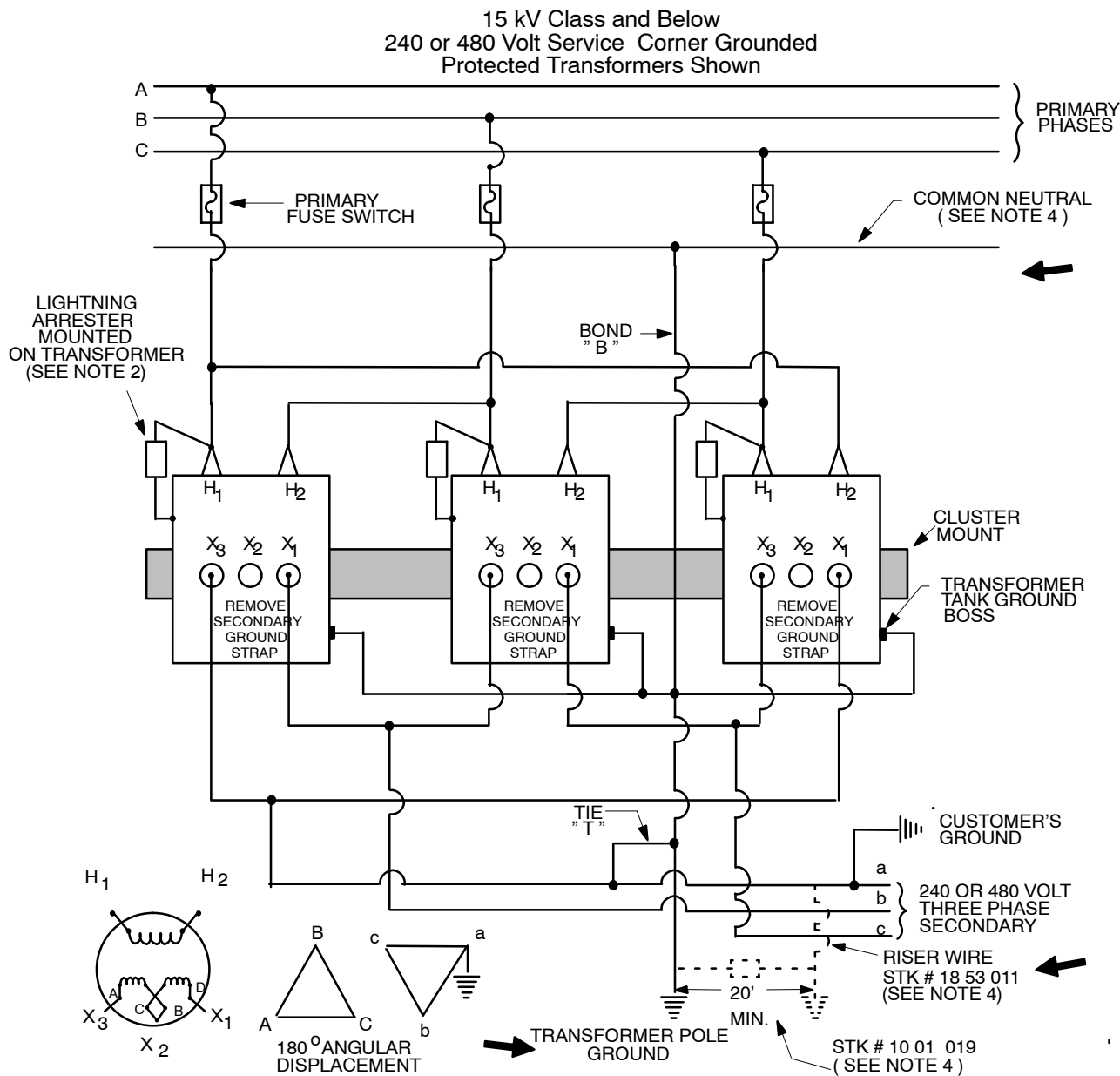
- 2400/4160 Y transformers may have sidewall mounted HV bushings.
- Primary phase connections may be on either H₁ or H₂ bushings, with the lightning arresters connected to the same bushings. The floating neutral is then connected to the other "H" bushings.
- Transformers with three secondary bushings shown. Some transformers may have four secondary bushings.
- Transformer impedances do not need to match.
- Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x₁ and x₃ bushings are reversed.
- For 7.2, 7.62, and 7.97 kV transformers use 15 kV arrester stock # 10-01-188. For 2.4 kV transformers use 6 kV arrester stock # 10-01-184.

TRANSFORMERS

13 00 07 05

Single Phase Transformer Cluster Mount Connection Diagram 3Ø 2.4/7.2/14.4kV Delta Prim.Sys.w/Grounded Delta Secondary

Sheet 1 of 1

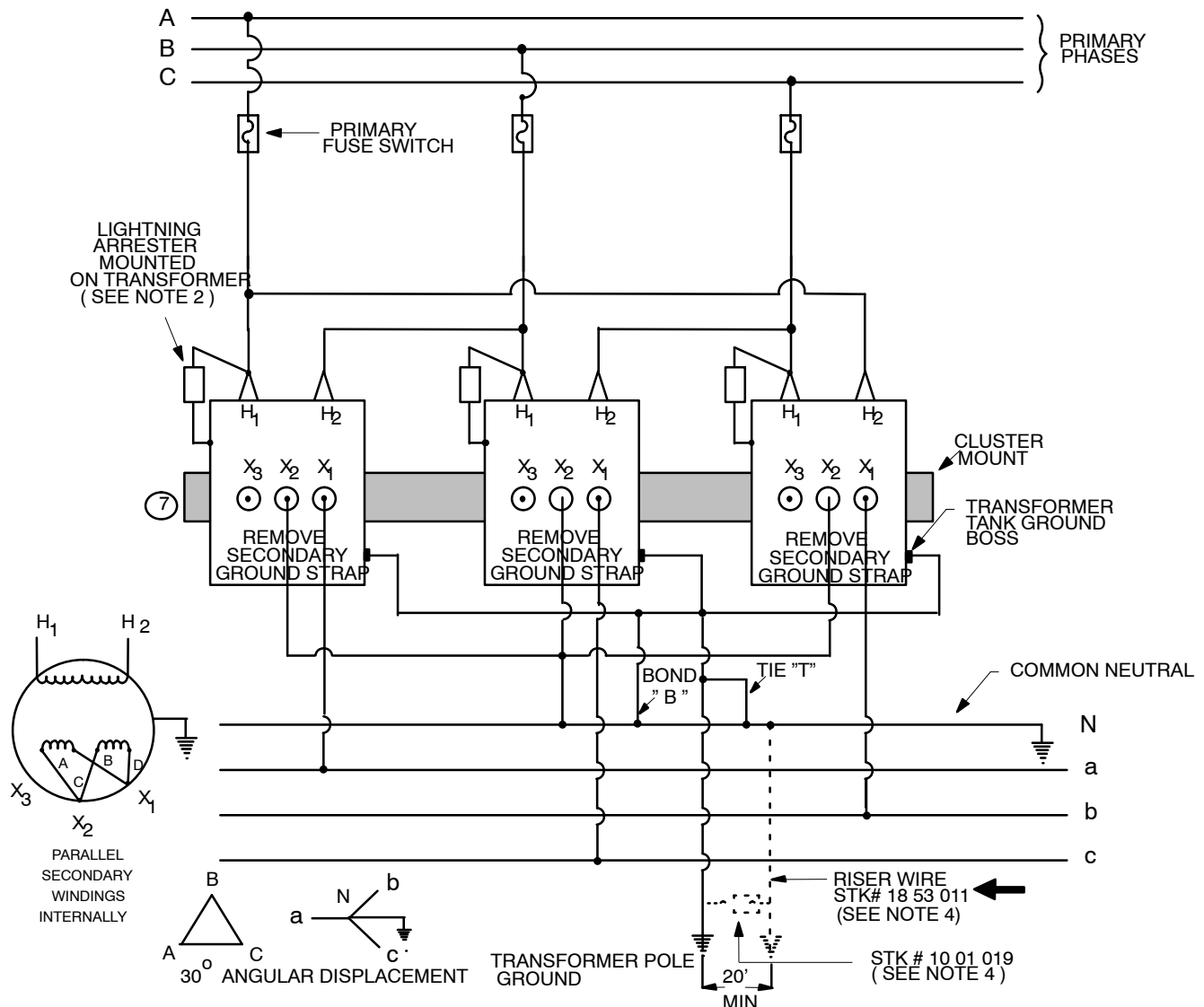


NOTES:

- 2400 / 4160 Transformers may have sidewall mounted HV bushings.
- Lightning arrester may be on either H₁ or H₂ bushing.
- Transformers with three secondary bushings shown. Some transformers may have four secondary bushings.
- If a common neutral is not present omit bond "B" and tie "T" and install a second ground rod a minimum distance of 20 feet from the ground rod at the pole. Connect the lightning arrester/transformer tank ground and secondary ground together through an isolation arrester (Stock # 10-01-019). The ground lead to the secondary ground rod shall be insulated for 600V (use Stock # 18-53-011). Both ground leads must be covered with plastic moulding for a distance of 8 ft. from the ground. The resistance of both grounds should not exceed 25 ohms. These requirements are to meet NESC 097.D.1.
- Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers positions of x₁ and x₃ bushings are reversed.
- Transformer impedances must be closely matched (+/-10%).

Single Phase Transformer Cluster Mount Connection Diagram 3 Ø 2.4kV/7.2kV/14.4kV Delta Prim. Systems With Grd.Wye Sec.

15 kV Class And Below
120/208 Y or 277/480 Y Volt Service
Protected Transformers Shown



NOTES:

1. 2400/4160 Y transformers may have sidewall mounted HV bushings.
2. Lightning arrester may be on either H₁ or H₂ bushing.
3. Transformers with three secondary bushings shown. Some (120/240V) transformers may have four secondary bushings. Units with three secondary bushings must be reconnected internally to parallel the secondary windings. Units with four secondary bushings can have the secondaries paralleled externally. If 277V transformers are used, they have only two secondary bushings.
4. If a common neutral is not present omit bond "B" and tie "T" and install a second ground rod a minimum distance of 20 feet from the ground rod at the pole. Connect the lightning arrester/transformer tank ground and secondary ground together through an isolation arrester (Stock #10-01-019). The ground lead to the secondary ground rod shall be insulated for 600V (use Stock #18-53-011). Both ground leads must be covered with plastic moulding for a distance of 8 ft. from the ground. The resistance of both grounds should not exceed 25 ohms. These requirements are to meet NESC 097.D.1.
5. Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers position of x₁ and x₂ bushings are reversed.

TRANSFORMERS

13 00 07 08

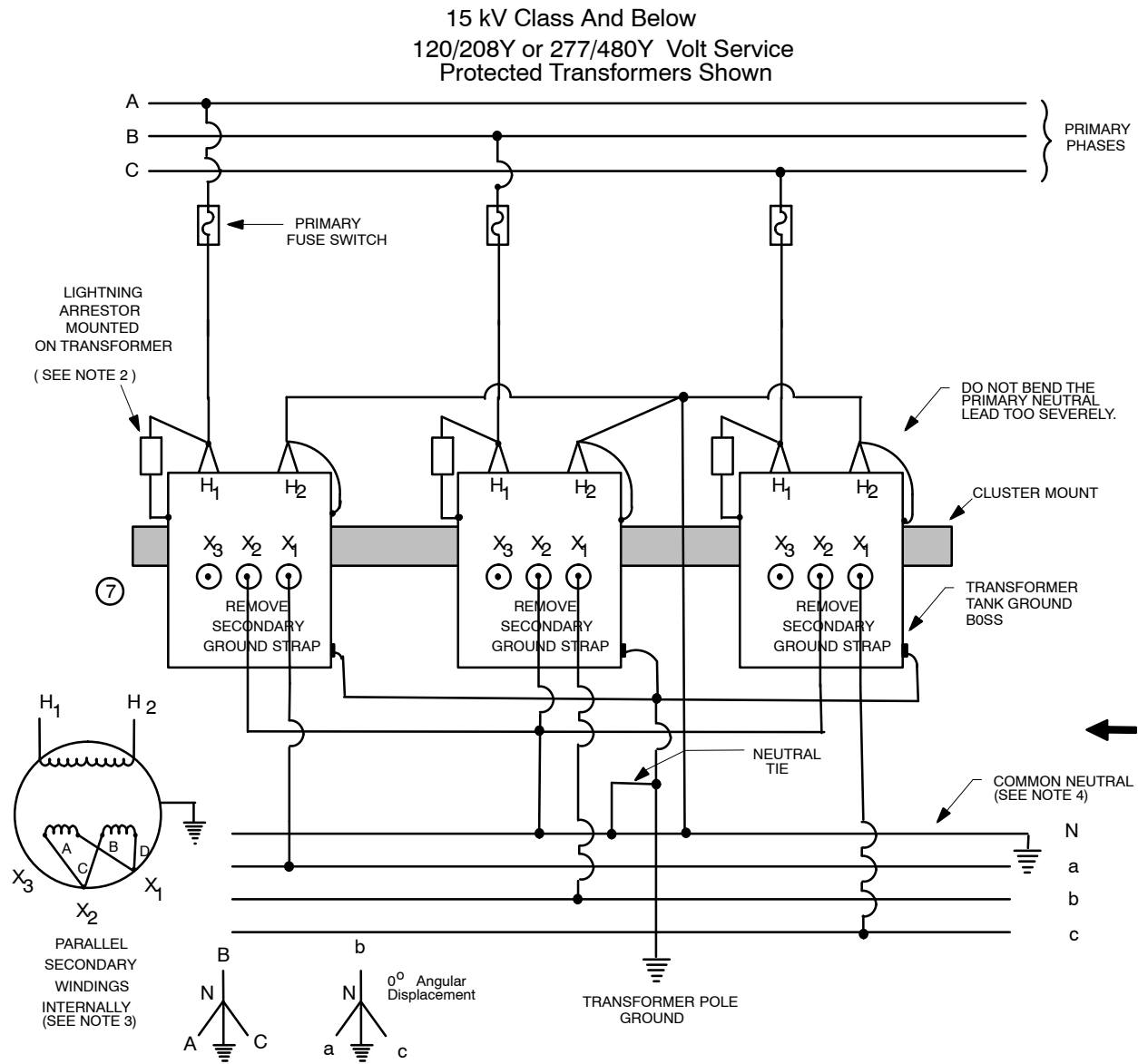
Single Phase Transformer Cluster Mount Connection Diagram
3 Ø 2.4kV/7.2kV/14.4kV Delta Prim. Systems With Grd.Wye Sec.

Sheet 2 of 2

6. Transformer impedances do not need to match.
7. Use tag, Stock Number 16-01-301 to identify transformers that have been wired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally.

Single Phase Transformer Cluster Mount Connection Diagram 3 ∅ Grounded-Wye Primary With Grounded-Wye Secondary

Sheet 1 of 1



NOTES:

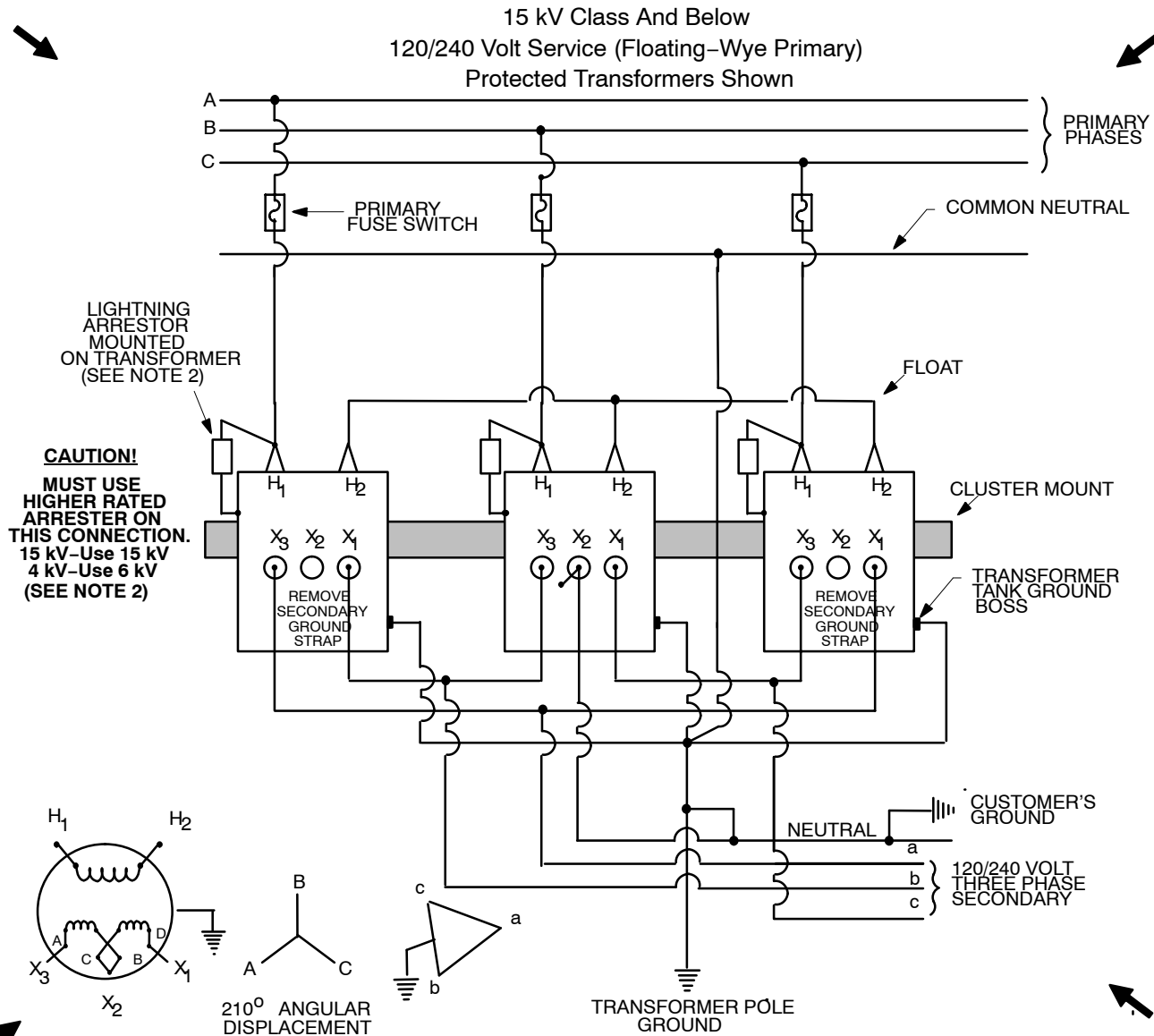
- 2400/4160 Y transformers may have sidewall mounted HV bushings.
- Primary phase connections may be on either H₁ or H₂ bushings, with the lightning arresters connected to the same bushings. The grounded neutral is then connected to the other "H" bushings.
- Transformers with three secondary bushings shown. Some transformers may have four secondary bushings. Units with three secondary bushings must be reconnected internally to parallel the secondary windings. Units with four secondary bushings can have the secondaries paralleled externally. If 277V transformers are used, they have only two secondary bushings.
- The transformer primary neutral bus must be solidly connected to the system neutral.
- Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers position of x₁ and x₃ bushings are reversed.
- Transformer impedances do not need to match.
- Use tag, Stock Number 16-01-301 to identify transformers that have been wired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally.

TRANSFORMERS

13 00 07 10

Single Phase Transformer Cluster Mount Connection Diagram 3 ϕ Floating-Wye Primary w/4-Wire Delta Secondary

Sheet 1 of 1



NOTES:

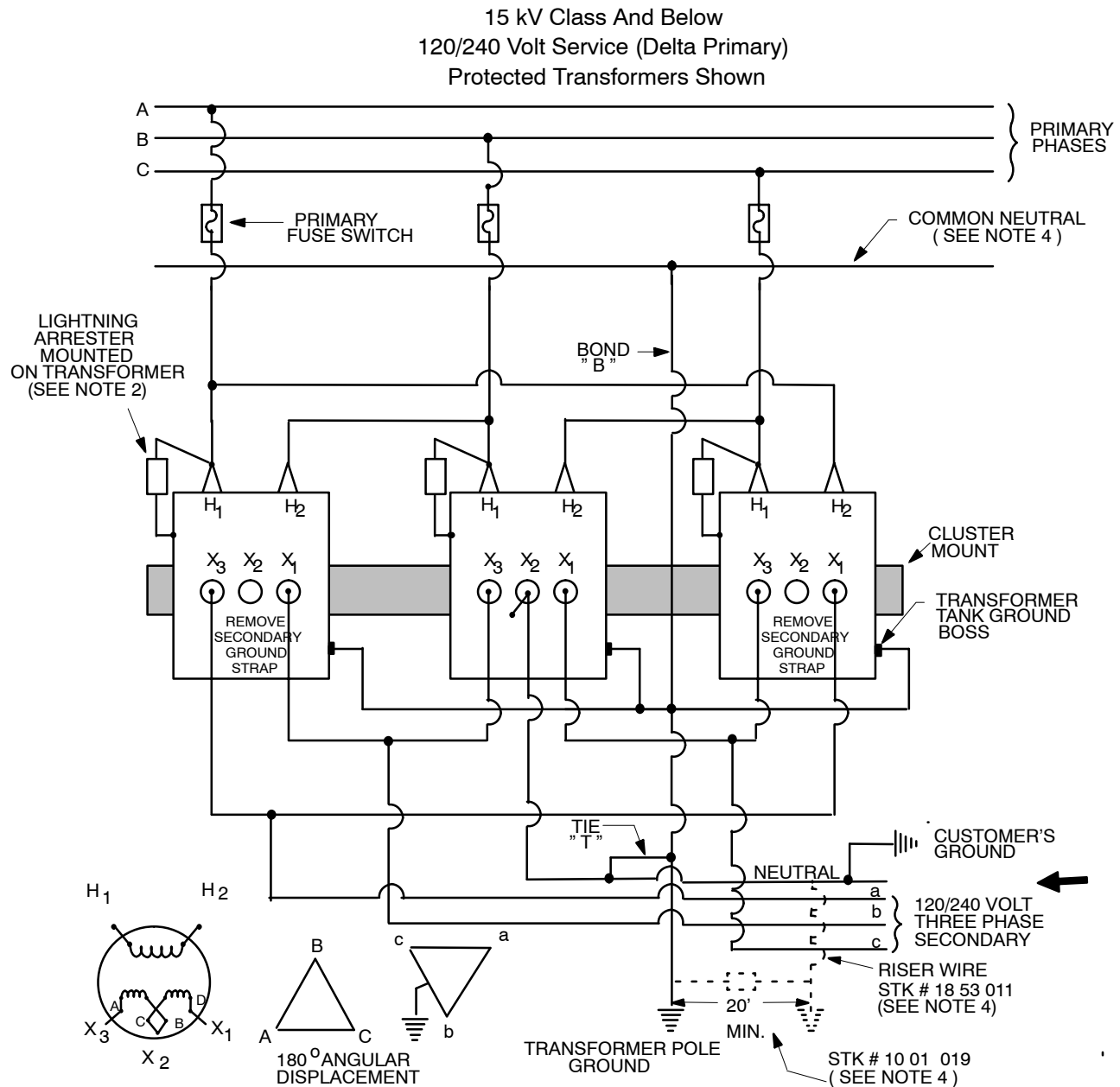
- 2400/4160 Y transformers may have sidewall mounted HV bushings.
- a. For 7.2, 7.62, and 7.97 kV transformers use 15 kV arrester stock number 10-01-188. For 2.4 kV transformers use 6 kV arrester stock number 10-01-184.
b. Primary phase connections may be on either H₁ or H₂ bushings with the lightning arresters connected to the same bushings. The floating neutral is then connected to the other "H" bushings.
- Transformers with three secondary bushings shown. Some transformers may have four secondary bushings.
- Transformer impedances do not need to match.
- Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x₁ and x₃ bushings are reversed.
- The transformer with the mid-tap carries 2/3 of the single-phase load and 1/3 of the three-phase load. The other two transformers each carry 1/3 of the three-phase load and 1/6 of the single-phase load.
- Phase rotation can be changed by reversing the secondary leads on the mid-tapped transformer (preferably on the secondary).

TRANSFORMERS

Single Phase Transformer Cluster Mount Connection Diagram 3 ϕ Delta Primary w/4-Wire Delta Secondary

13 00 07 11

Sheet 1 of 2



NOTES:

- 2400/4160 transformers may have sidewall mounted HV bushings.
- Lightning arrester may be on either H₁ or H₂ bushing.
- Transformers with three secondary bushings shown. Some transformers may have four secondary bushings.
- If a common neutral is not present omit bond "B" and tie "T" and install a second ground rod a minimum distance of 20 feet from the ground rod at the pole. Connect the lightning arrester/transformer tank ground and secondary ground together through an isolation arrester (stock # 10-01-019). The ground lead to the secondary ground rod shall be insulated for 600V (use stock # 18-53-011). Both ground leads must be covered with plastic moulding for a distance of 8 ft. from the ground. The resistance of both grounds should not exceed 25 ohms. These requirements are to meet NESC 097.D.1.
- Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x₁ and x₃ bushings are reversed.

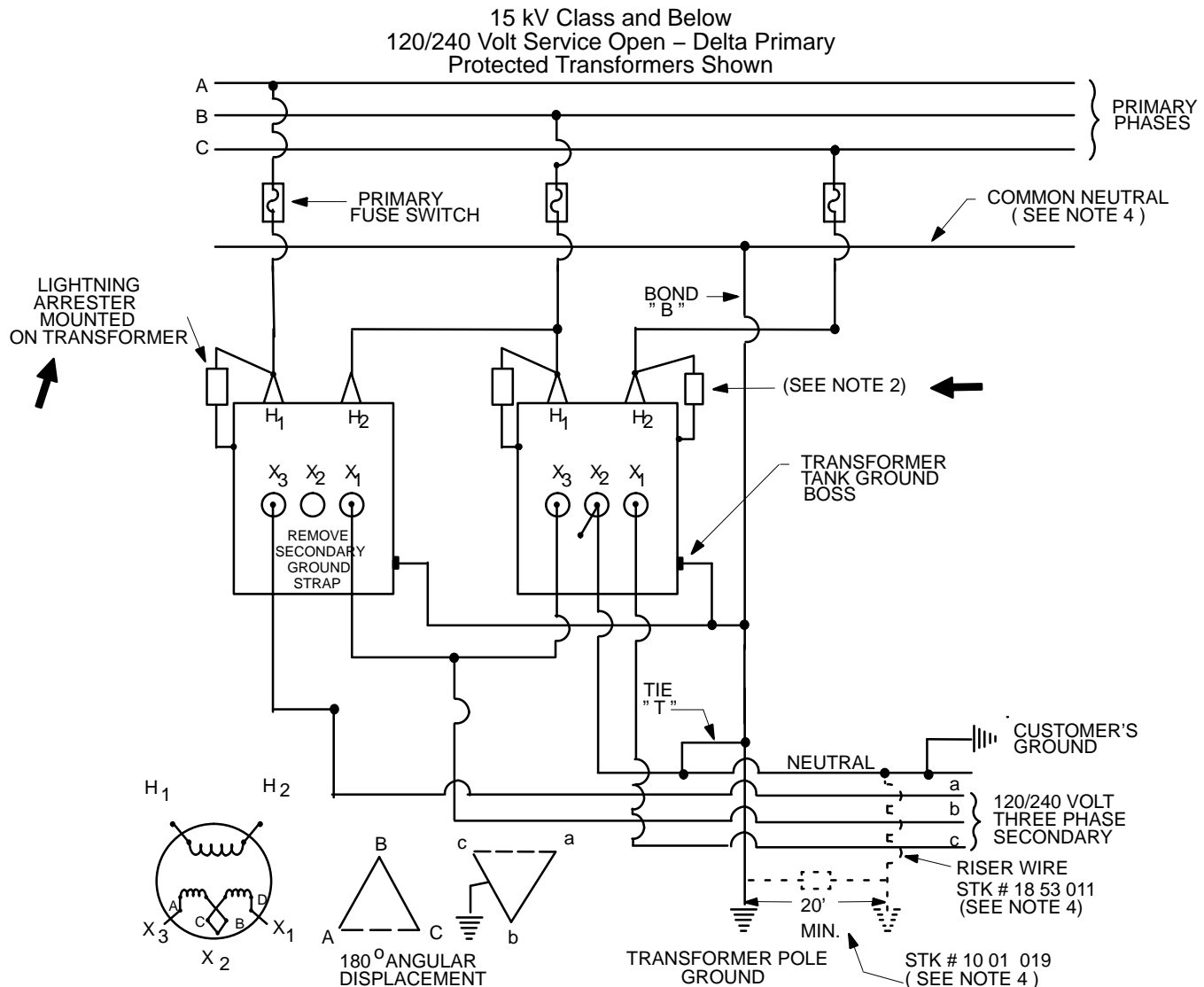
TRANSFORMERS
Single Phase Transformer Cluster Mount Connection Diagram
3 \emptyset Delta Primary w/4-Wire Delta Secondary

13 00 07 11

Sheet 2 of 2

6. Transformer impedances must be closely matched (+/-10%).
7. The transformer with the midtap carries 2/3 of the single-phase load and 1/3 of the three-phase load. The other two transformers each carry 1/3 of the three-phase load and 1/6 of the single-phase load.
8. Phase rotation can be changed by reversing any pair of primary line leads or by reversing the two secondary leads on the mid-tapped transformer (preferably on the secondary).

Single Phase Transformer Connection Diagram Open – Delta Primary w/ 4–Wire Open–Delta Secondary



NOTES:

- 2400 / 4160 Transformers may have sidewall mounted HV bushings.
- Add arrester to H2 of this transformer if transformer does not already have arresters on both bushings.
- Transformers with three secondary bushings shown. Some transformers may have four secondary bushings.
- If a common neutral is not present omit bond "B" and tie "T" and install a second ground rod a minimum distance of 20 feet from the ground rod at the pole. Connect the lightning arrester/transformer tank ground and secondary ground together through an isolation arrester (stock # 10-01-019). The ground lead to the secondary ground rod shall be insulated for 600V (use stock # 18-53-011). Both ground leads must be covered with plastic moulding for a distance of 8ft from the ground. The resistance of both grounds should not exceed 25 ohms. These requirements are to meet NESC 097.D.1.
- Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers positions of x_1 and x_3 bushings are reversed.
- Transformer impedances do not need to match.
- A 3–wire delta secondary can be provided by removing the lead and ground strap from X_2 on the mid–tapped transformer and bonding the "A" phase at the pole and customer service grounds.

TRANSFORMERS
Single Phase Transformer Connection Diagram
Open – Delta Primary w/ 4–Wire Open–Delta Secondary

13 00 07 12

Sheet 2 of 2

8. The mid–tapped transformer supplies all of the single–phase load and 1/2 of the three–phase load. The total three–phase load should not exceed 1.73 times the kVA of the smallest transformer.
9. Phase rotation can be changed by reversing any pair of primary line leads or by reversing the two secondary leads on the mid–tapped transformer (preferably on the secondary).

TRANSFORMERS

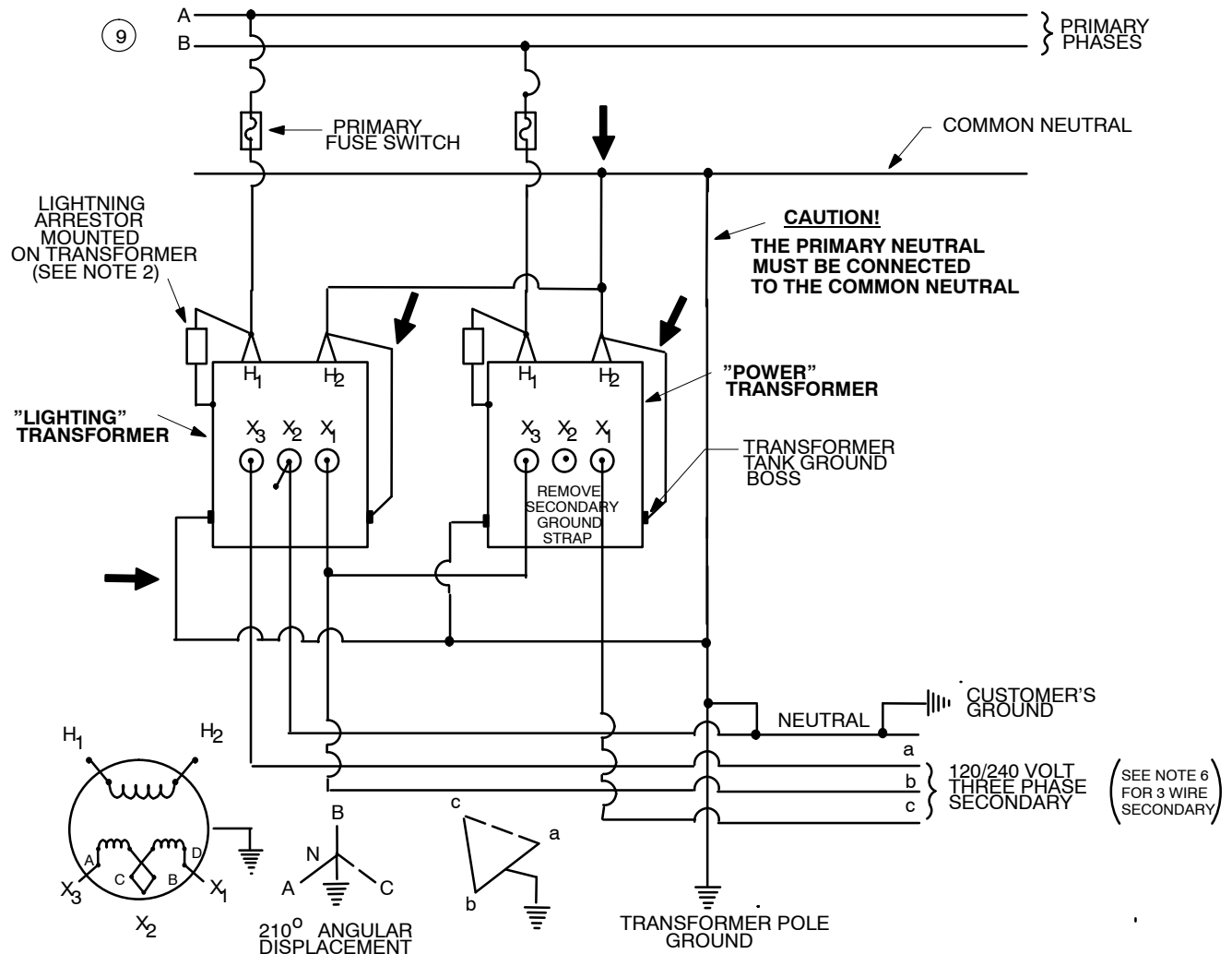
Single Phase Transformer Connection Diagram

Open – Wye Primary w/ 4–Wire Open–Delta Secondary

13 00 07 13

Sheet 1 of 2

15 kV Class And Below
120/240 Volt Service Open – Wye Primary
Protected Transformers Shown



NOTES:

1. 2400/4160 transformers may have sidewall mounted HV bushings.
2. Primary phase connections may be on either H₁ or H₂ bushings, with the lightning arresters connected to the same bushings. The neutral is then connected to the other "H" bushings.
3. Transformers with three secondary bushings shown. Some transformers may have four secondary bushings.
4. Transformer impedances do not need to match.
5. Transformers shown are additive polarity. Transformers 200 kVA and smaller with H.V. winding rated 8660 volts or less are additive polarity. All others are subtractive polarity. For subtractive polarity transformers, positions of x₁ and x₃ bushings are reversed.
6. A 3-wire delta secondary can be provided by removing the lead and ground strap from x₂ on the mid-tapped transformer and bonding the "a" phase at the pole and customer service grounds.
7. The mid-tapped transformer supplies all of the single-phase load and 1/2 of the three-phase load. The total three-phase load should not exceed 1.73 times the kVA of the smallest transformer.
8. Phase rotation can be changed by reversing the two secondary leads on the mid-tapped transformer (preferably on the secondary).

TRANSFORMERS
Single Phase Transformer Connection Diagram
Open – Wye Primary w/ 4–Wire Open–Delta Secondary

13 00 07 13

Sheet 2 of 2

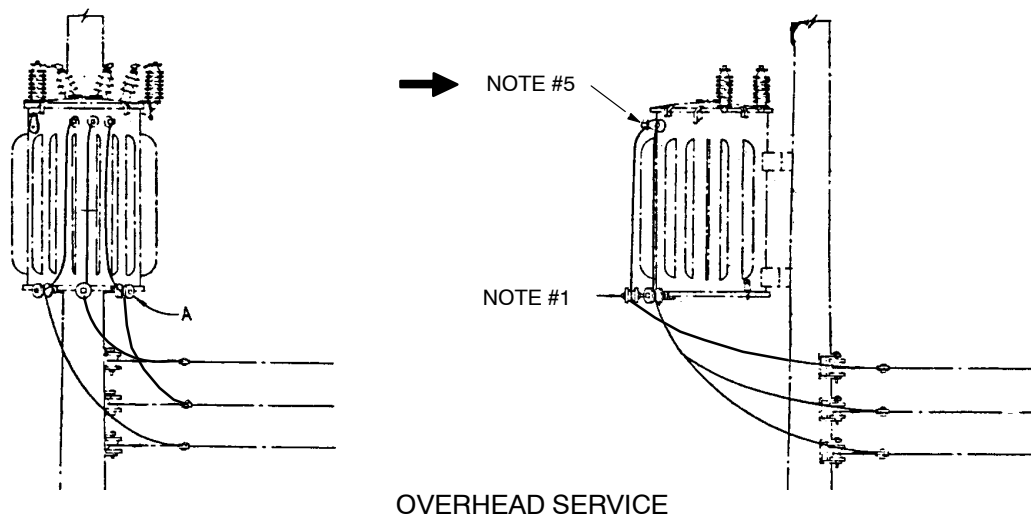
9. Primary connection shown is for AmerenIL (ABC rotation). Primary connection for AmerenMO (CBA rotation) should be reversed. Connecting the leading primary phase to the “Lighting” transformer gives better utilization of transformer capacity, less voltage dip, and less voltage unbalance.

TRANSFORMERS

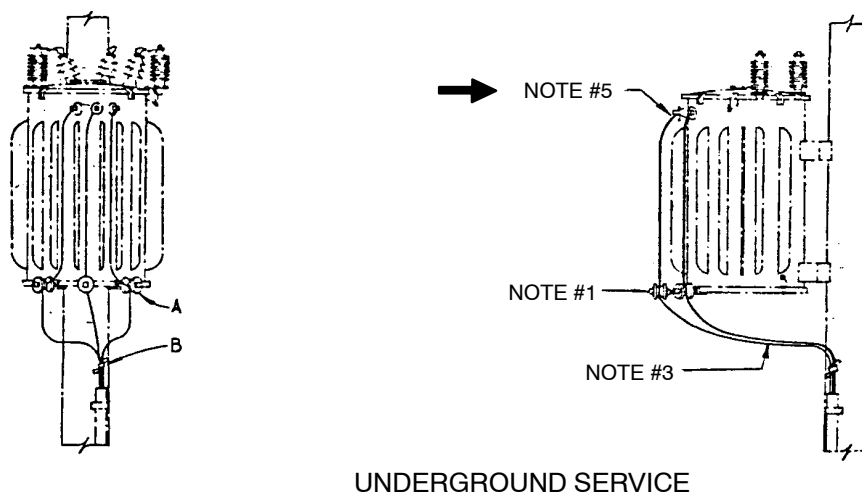
Secondary and Services Training and Supports For Single or Three Phase

13 01 01 **

Sheet 1 of 2



	Std. / Stk. No.	Description	13 01 01 **	01
A	69 08 249	Bracket – Transformer Secondary Lead		3



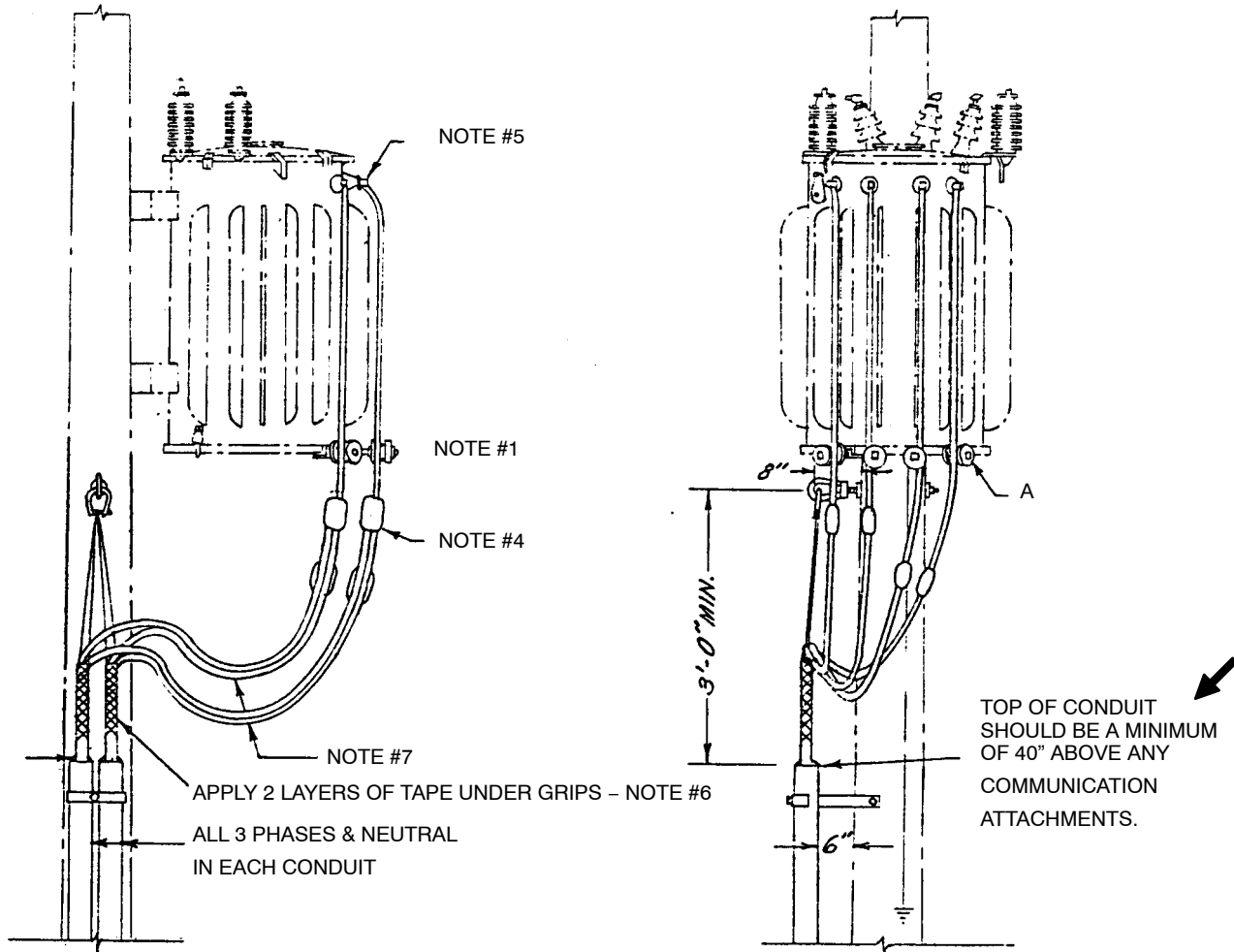
	Std. / Stk. No.	Description	13 01 01 **	02
A	69 08 249	Bracket – Transformer Secondary Lead		3
B	49 17 181	Strap – Poly.		1

TRANSFORMERS

Secondary and Services Training and Supports For Single or Three Phase

13 01 01 **

Sheet 2 of 2

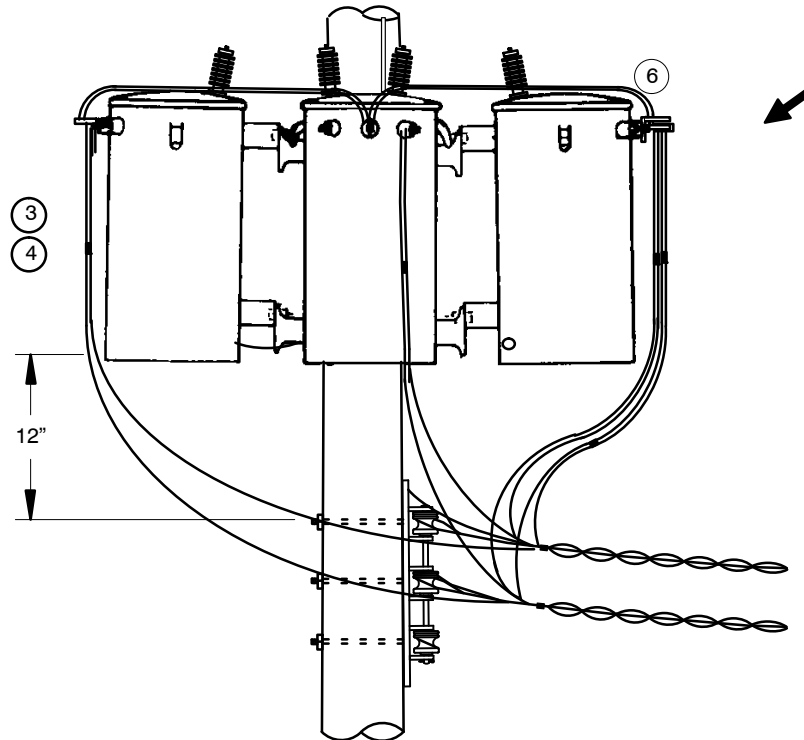


TWO UNDERGROUND CABLES

	Std. / Stk. No.	Description	13 01 01 **	03
A	69 08 249	Bracket - Transformer Secondary Lead		4

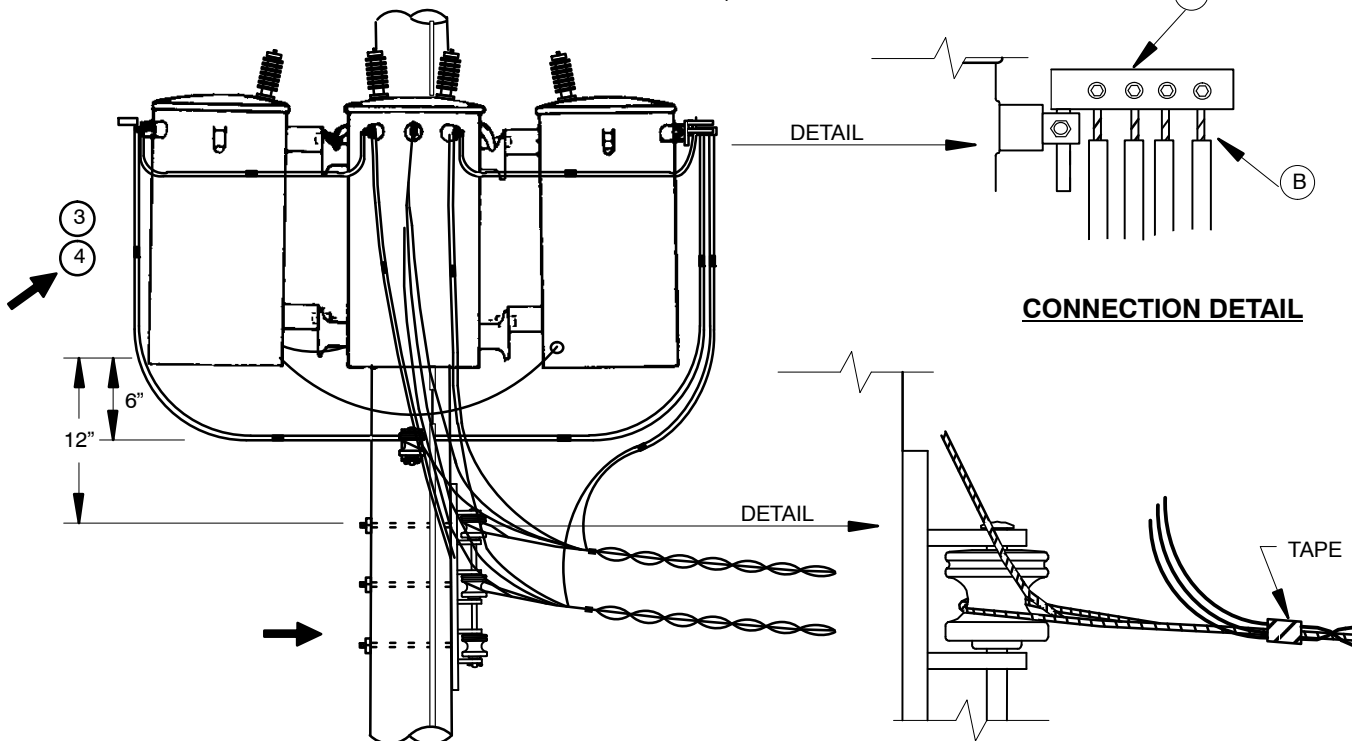
NOTES:

1. This standard shows the training of secondary leads, using a bracket, Stock No. 69-08-249, which attaches to the bottom of the transformer. The bracket may be used with either 1Ø or 3Ø secondary and with all primary distribution voltages.
2. For additional clearance from the transformer use 1/2" x 8" machine bolts, Stock No. 23-52-041. Use 5/8" nuts, Stock No. 23-65-011 as spacers.
3. If an underground service must be located on a transformer pole with overhead secondary, attach the underground service to the secondary, per Dist. Std. 14 02 01 ** NOT TO THE TRANSFORMER.
4. Cover with sealing compound (Stock No. 31-53-055) and tape so that water cannot enter strands.
5. Do not put aluminum conductors in transformer bushing connectors. Use copper secondary leads as per Dist. Std. 13 00 03 01, or pin terminal lug connectors with copper studs as per Dist. Std. 13 01 04 **. For transformers with secondary spade connections (1Ø > 100kVA and 3Ø > 300kVA) cable-to-flat lug connectors can be used (stock codes 17-55-289 or 17-55-344).
6. See Dist. Std. 14 02 02 for cable grips, conduits, and stand off bracket.
7. Pair cables, tape together and form drip loop.



Wye Secondary

13 01 04 03 - 1/0 thru 750 kCMIL
13 01 04 04 - 4/0 thru 500 kCMIL



Delta Secondary ⑦

➔ 13 01 04 01 - 1/0 thru 750 kCMIL
13 01 04 02 - 4/0 thru 500 kCMIL



		Std. / Stk. No.	Description	130104 **	01	02	03	04
2	A	17 54 245	Lug, 1/0 – 750 kcmil, 4 Position		7		6	
		17 54 214	Lug, 4/0 – 500 kcmil, 4 Position			7		6
	B	30 52 360	Compound, Sealing		1	1	1	1
			Multiple Service Lug Operation Code 399		7	7	6	6

NOTES:

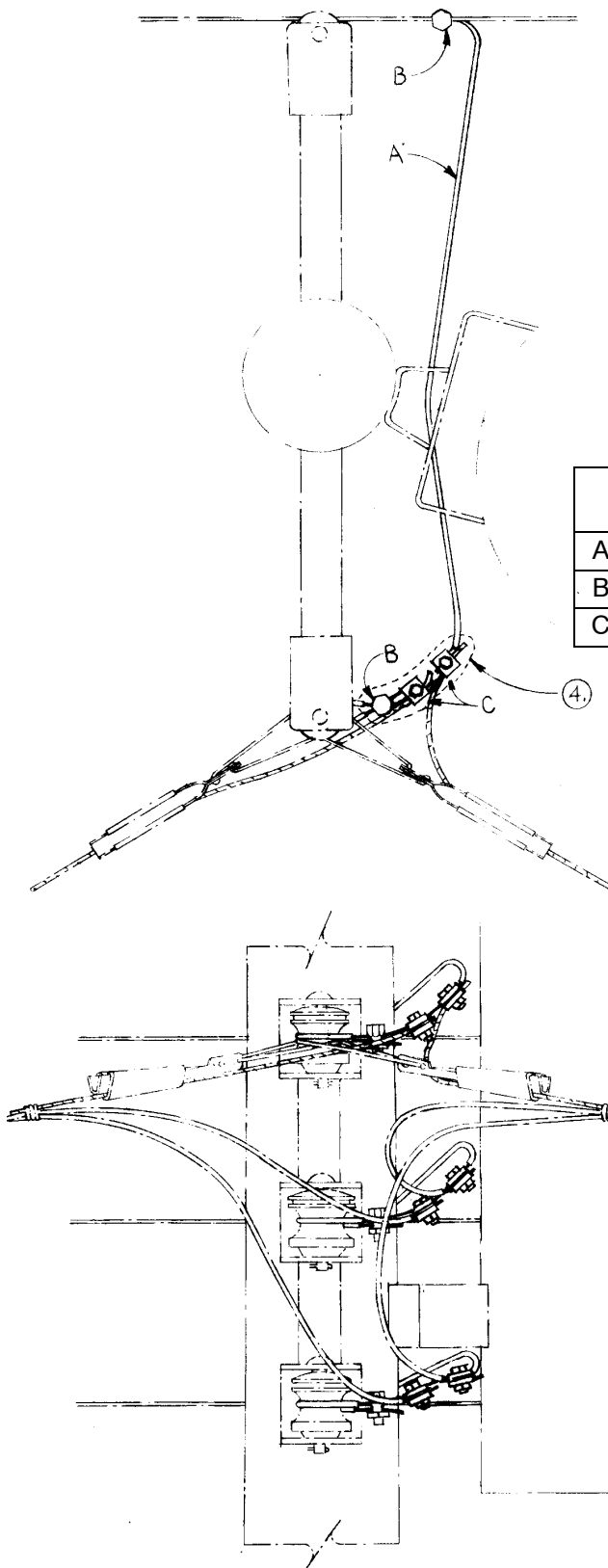
1. Clean cable surfaces and apply a liberal coating of corrosion inhibitor compound (stock # 31 59 058).
2. Use stock # 30 52 360 to weather seal lugs.
3. For buss sizing between the transformer secondary bushings see DCS 13 00 03 01.
4. For wye connected secondary see connection diagram on DCS 13 00 07 08 or 13 00 07 09. For delta connected secondary see connection diagram on DCS 13 00 07 04, 13 00 07 05, 13 00 07 10 or 13 00 07 11.
5. The messengers of the quadruplex cables shall be grounded at the pole by connecting to the secondary neutral, if available, or to a ground rod. Exception: For non-standard ungrounded three-wire services the messengers are not grounded.
6. For wye connected secondary, neutral will need to be connected to the X2 bushing of either the left or right transformer.
7. For ungrounded or corner-grounded delta, use DCS 13 01 04 03 or 13 01 04 04.

TRANSFORMERS

Secondary and Services – Secondary Service Bus for Triplex Cable – Single Phase

13 01 07 00

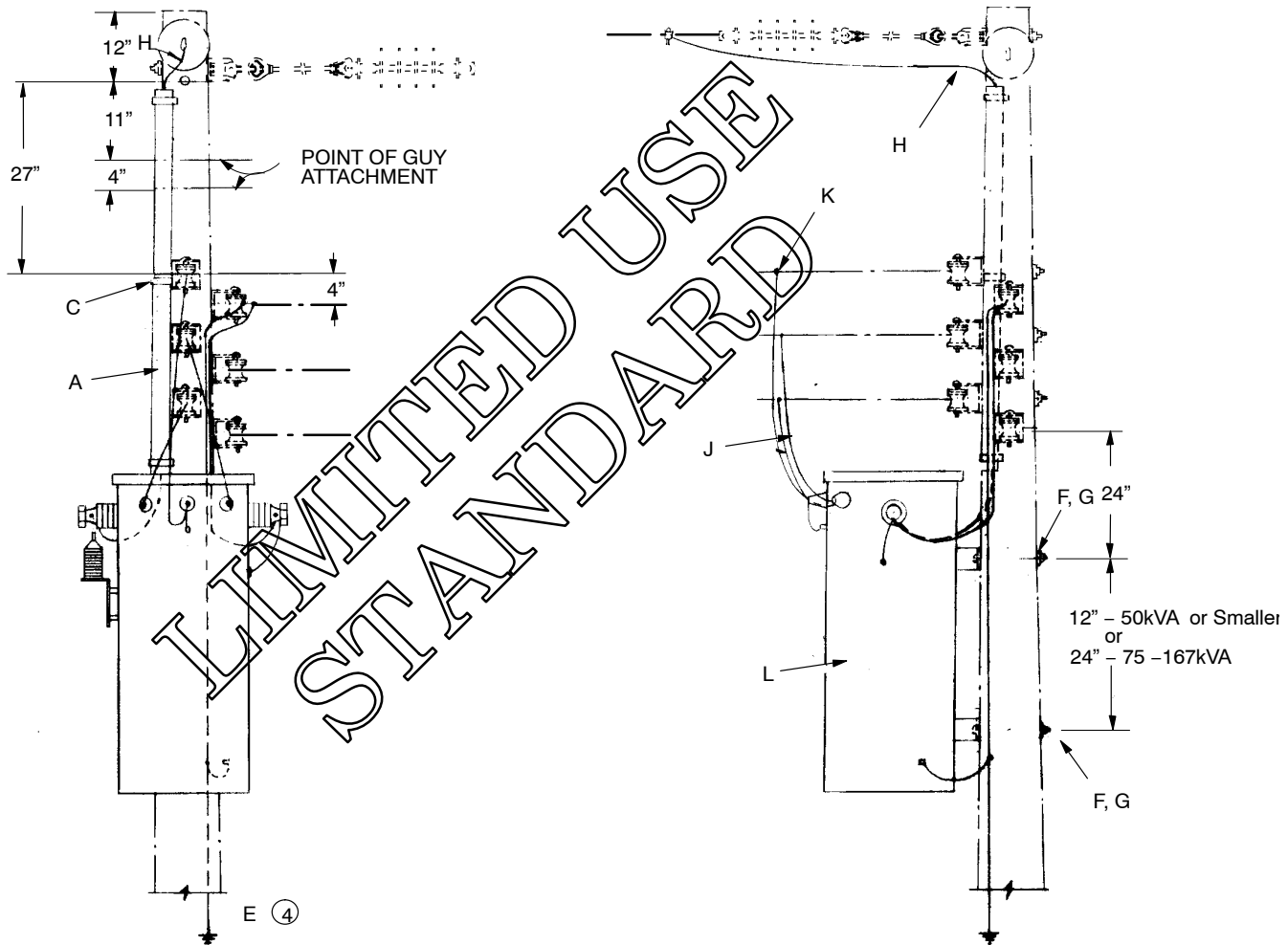
Sheet 1 of 1



1. Service buses shall be installed only where it is evident that two or more services will be required from each side of pole.
2. Normally a service bus should not be added to an existing installation when an additional service is installed.
3. In many cases it may be desirable to install the service bus for the neutral only and connect the covered wires of the triplex cable directly to the secondary.
4. Apply corrosion resisting lubricant and tape connectors in accordance with Dist. Std. 07 00 25 00 and 07 00 27 00.

	Std. / Stk. No.	Description	Req'd
A	18 01 020	Wire – #2 Copper – W.P.	10
B	17 54 005	Connector – #2 Copper	6
C	17 51 032	Clamp – P.G.	6

FOR NEW CONVENTIONAL TRANSFORMER USE DCS 13 12 10 02 or 13 12 14 02



		Std. / Stk. No.	Description	
@4 T T T T T @	A	12 51 197	Conduit, Plastic, 1" (ft.)	6
	C	23 64 033	Staple – 1-1/2" x 3"	3
	E	12 00 10 **	Grounding Unit	1
	F	23 52 063	Bolt, Mach., 5/8" x 10" (50kVA or smaller) OR	2
		23 52 095	Bolt, Mach., 3/4" x 10" (75 – 167kVA)	2
	G	23 66 027	Washer, Square, 5/8" (50kVA or smaller) OR	2
		23 66 031	Washer, Curved, 3/4" (75 – 167kVA)	2
	H		Wire, Ins., 5 kV (Ft.) (See 13 00 03 01)	10
	J		Secondary Leads (Ft.) (See 13 00 03 01)	9
	K	PG*	See 07 00 25 00	3
	L		Transformer	1

TRANSFORMERS

4kV – 120/240 V. – Single Phase 1 to 167 kVA "T" or "L" Corner
CSP Maintenance Construction

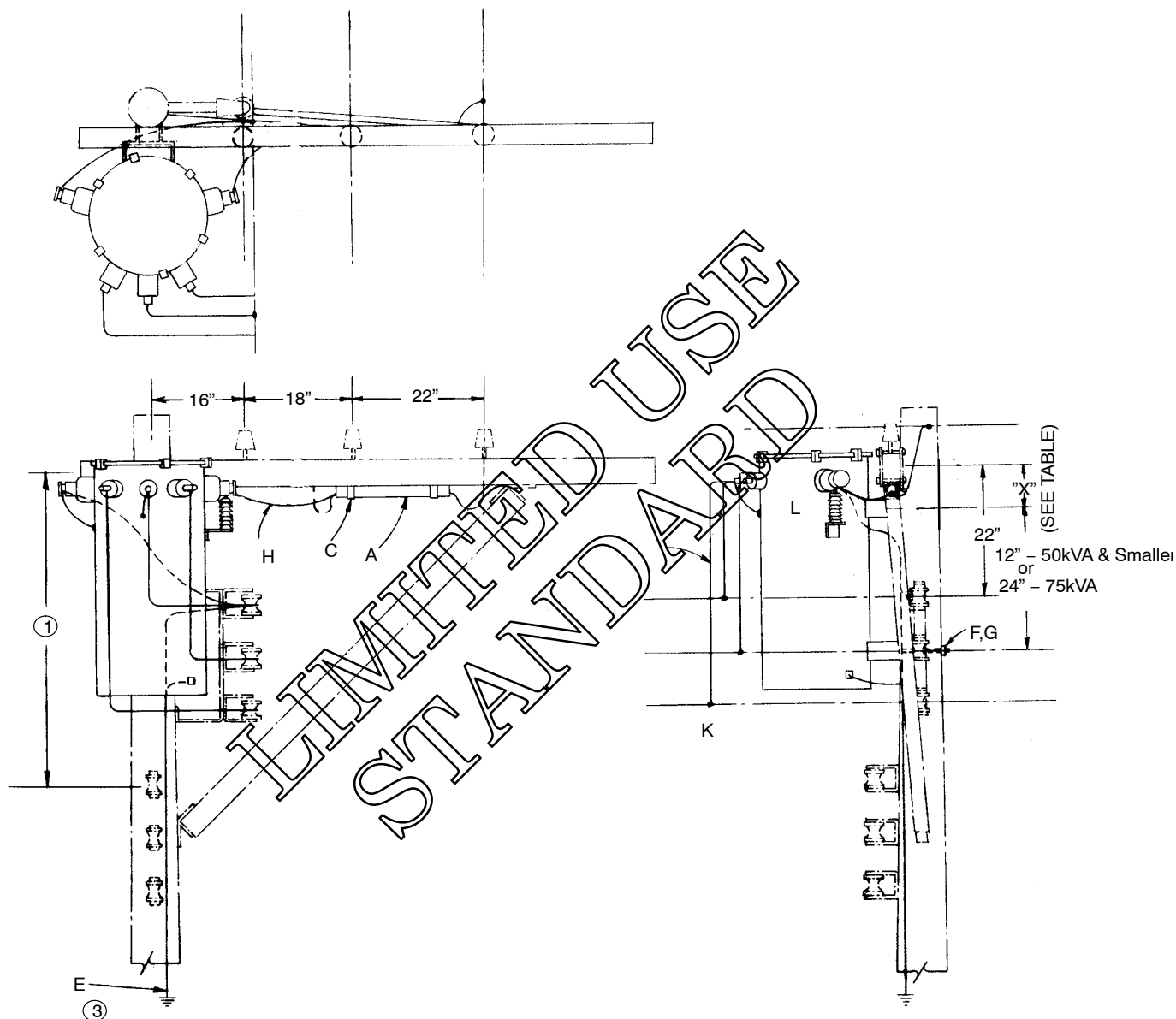
13 04 14 01

Sheet 2 of 2

NOTES:

1. The primary connection shall be made on the H₂ bushing on the side opposite the breaker operation handle.
2. Some 37-1/2 kVA and larger CSP transformers have two secondary breakers.
3. Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
4. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

FOR NEW CONVENTIONAL TRANSFORMER INSTALLATION USE DCS 13 12 21 02



	Dimension "X"
Transformers with 24" Spacing btwn. Mounting Lugs	8"
Transformers with 12" Spacing btwn. Mounting Lugs	12"

		Std. / Stk. No.	Description	
@3 T T T T T @	A	12 51 197	Conduit, Plastic, 1" (ft.)	2
	C	23 64 033	Staple – 1–1/2" x 3"	2
	E	12 00 10 **	Grounding Unit	1
	F	23 52 063	Bolt, Mach., 5/8" x 10" (50kVA & smaller) OR	2
		23 52 095	Bolt, Mach., 3/4" x 10" (75kVA)	2
	G	23 66 027	Washer, Square, 5/8" (50kVA & smaller) OR	2
		23 66 031	Washer, Curved, 3/4" (75kVA)	2
	H		Wire, Ins., 5 kV (Ft.) (See 13 00 03 01)	6
	J		Secondary Leads (Ft.) (See 13 00 03 01)	9
	K	PG*	See 07 00 25 00	3
	L		Transformer	1

NOTES:

1. When secondary is deadended on transformer pole, locate secondary clevises 44" below primary arm for transformers 15kVA and below, and 52" below primary arm for 25 and 37–1/2kVA transformers.
2. For 50 & 75kVA transformers, measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
3. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

LIMITED USE
STANDARD

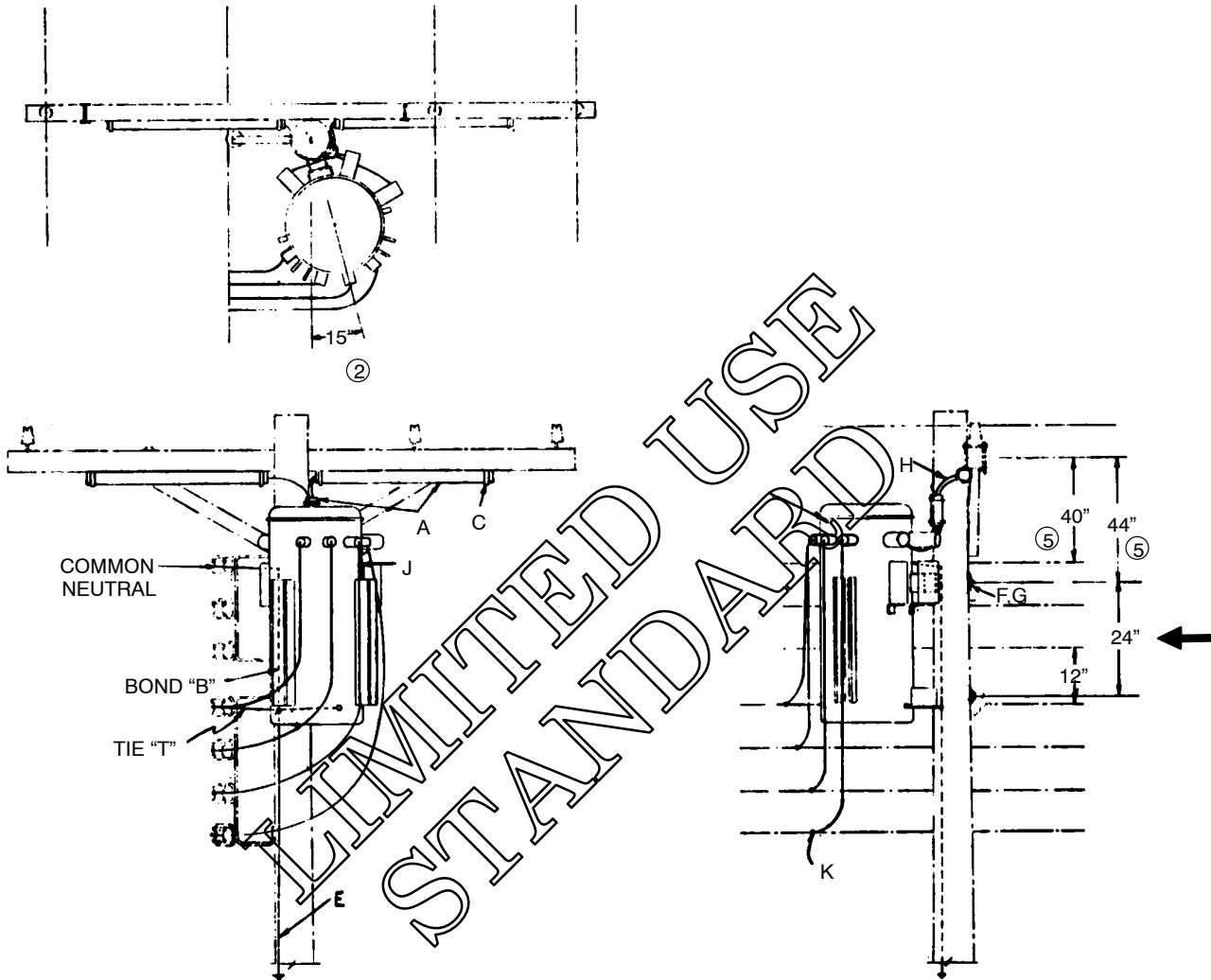
TRANSFORMERS

4kV – Three Phase – 3 or 4 Wire

→ 30-45 kVA – 1000# Maximum

13 04 50 01

Sheet 1 of 2



		Std. / Stk. No.	Description	
7 T T T T T @	A	12 01 280	Conduit, Plastic, 2" (ft.)	10
	C	27 60 035	Iron, Hanger (Ft.)	6
	E	12 00 10 01	Grounding Unit	1
	F	23 52 063	Bolt, Mach., 5/8" x 10" (30 kVA) OR	2
		23 52 095	Bolt, Mach., 3/4" x 10" (45 kVA)	2
	G	23 66 027	Washer, Curved, 5/8" (30 kVA) OR	2
		23 66 031	Washer, Curved, 3/4" (45 kVA)	2
	H		Wire, Ins., 5 kV (Ft.) (See 13 00 03 01)	12
	J		Secondary Leads (Ft.) (See 13 00 03 01)	15
	K	PG*	See 07 00 25 00	4
	L		Transformer	1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DG
REV. NO: 4
REV. DATE: 07/07/11

NOTES:

- 1. If common neutral is not present, refer to DCS 13 00 07 02 for installation of grounds.
- 2. 15° may be obtained by taking 1/24th of pole circumference.
- 3. A three phase service (no secondary) may be placed at any point on the pole that permits required clearances.
- 4. Switches are required for C transformers.
- 5. These dimensions are for new construction. On existing construction, spacing may be 26" from primary to through bolt and 22" from primary to secondary.
- 6. When transformer is installed directly under conductor deadends, provide set of switches on line arm.
- 7. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

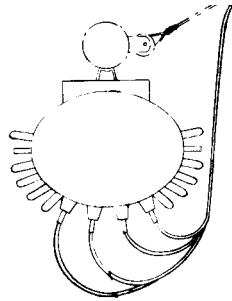
LIMITED USE
STANDARD

TRANSFORMERS

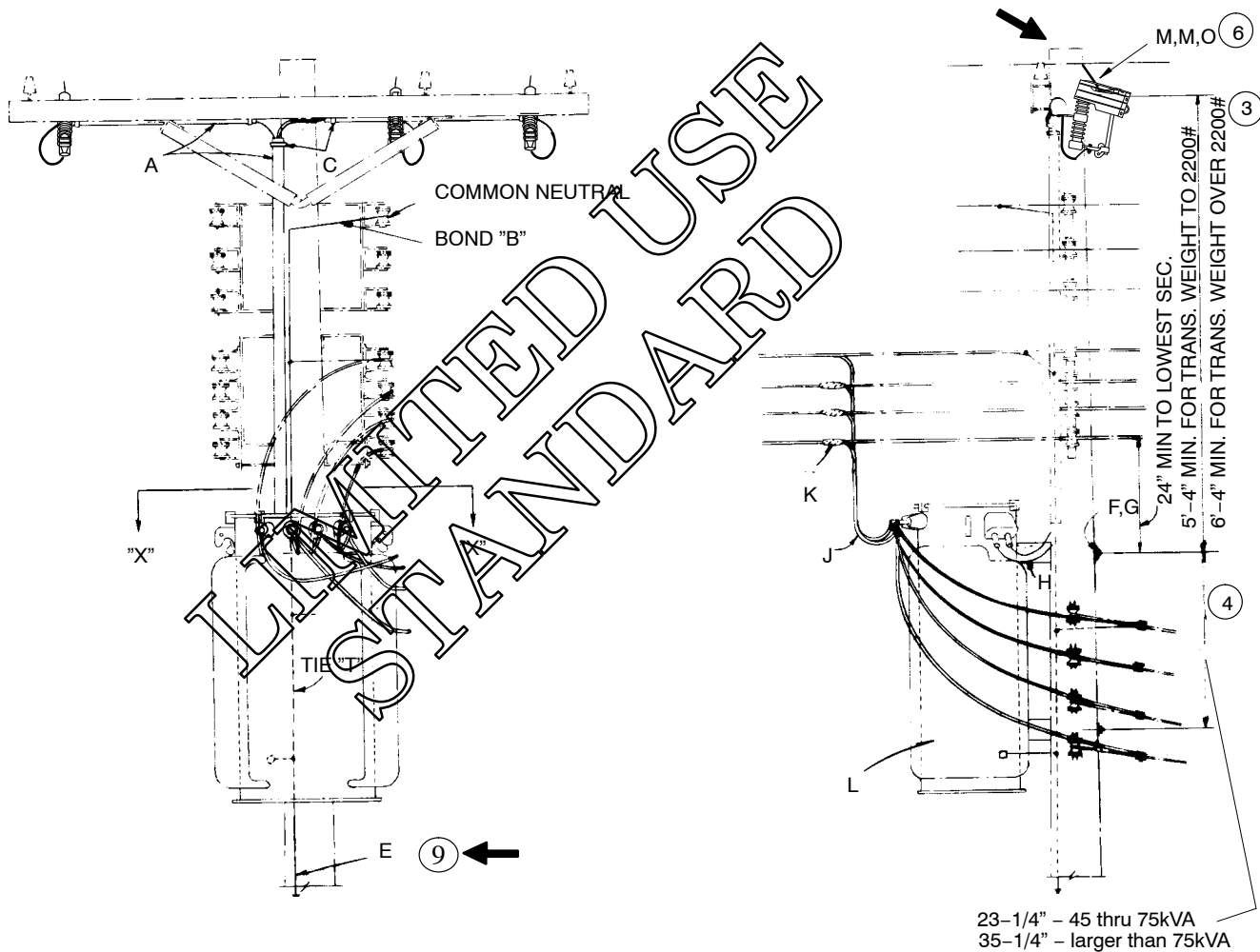
4kV – Three Phase – 3 or 4 Wire
45–500 kVA

13 04 54 01

Sheet 1 of 2



SECTION XX



TRANSFORMERS
4kV – Three Phase – 3 or 4 Wire
45–500 kVA

13 04 54 01

Sheet 2 of 2

		Std. / Stk. No.	Description	
@9 T T T T T @ @6 @6 @6	A	12 01 280	Conduit, Plastic, 2" (ft.)	15
	C	27 60 035	Strip, Hanger (Ft.)	10
	E	12 00 10 **	Grounding Unit	1
	F	23 52 095	Bolt, Mach., 3/4" x 10" (45 thru 300kVA) OR	2
		23 52 268	Bolt, Mach., 1" x 14" (500kVA)	2
	G	23 66 031	Washer, Curved, 3/4" (45 thru 300kVA) OR	2
		23 66 106	Washer, Curved, 1" (500kVA)	2
	H		Wire, Ins., 5 kV (Ft.) (See 13 00 03 01)	30
	J		Secondary Leads (Ft.) (See 13 00 03 01)	24
	K	PG*	See 07 00 25 00	4
	L		Transformer	1
	M	05 15 10 01	Cover, Cutout	3
	N	54 07 208	Switch, Fused, Open Type	3
	O	17 58 054	Bracket, Crossarm, Heavy Duty	3

NOTES:

1. A 3 phase service (no secondary) may be at any point on the pole that permits required clearances.
2. If common neutral is not present, refer to DCS 13 00 07 02 for installation of grounds.
3. For transformers above 3400#, this distance shall be determined by space necessary for hoisting equipment.
4. Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
5. A 15" crescent wrench is required for 1" bolts.
6. For C transformers, switches are required.
7. Units weighing in excess of 3400#'s must be mounted using 1" bolts.
8. When transformer is installed directly under conductor deadends, provide set of switches on line arm.
9. Use DCS 12 00 10 02 for ground rod application on existing pole installation. Use DCS 12 00 10 01 for ground coil application on new pole installation.

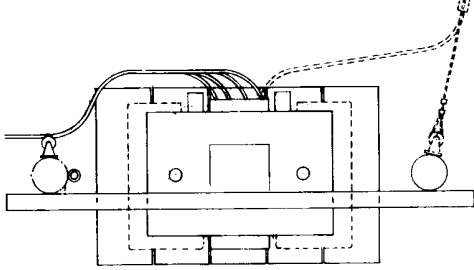
TRANSFORMERS

4kV – Three Phase – 3 or 4 Wire
750 kVA

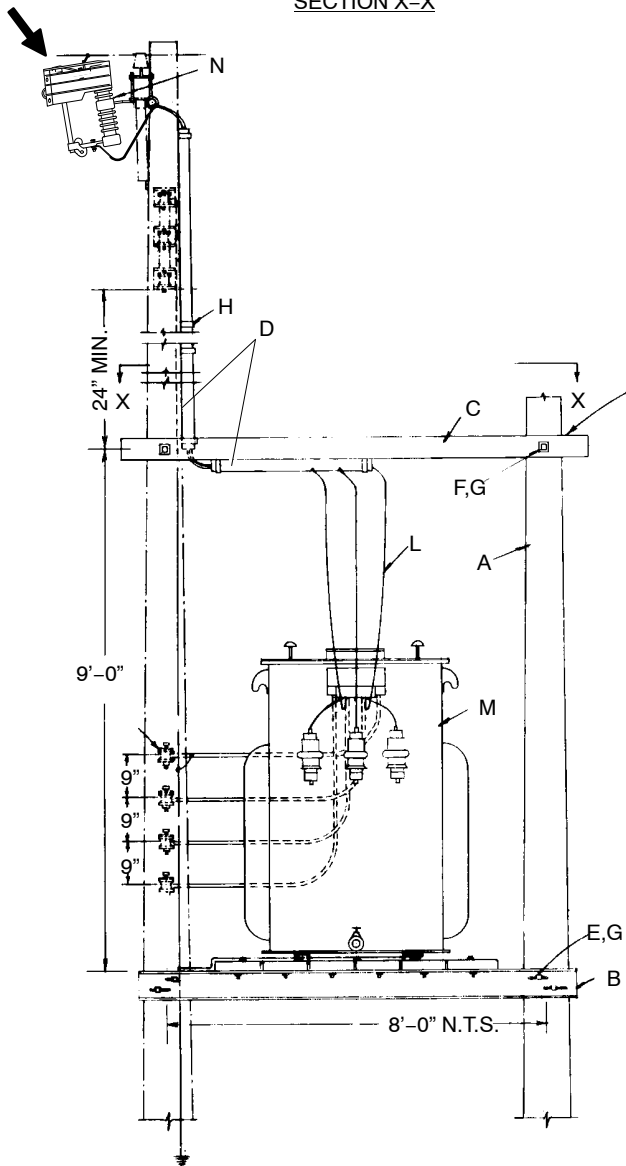
13 04 58 02

Sheet 1 of 2

OPTIONAL SERVICE TAKEOFF
SEE DCS 09 01 12 00

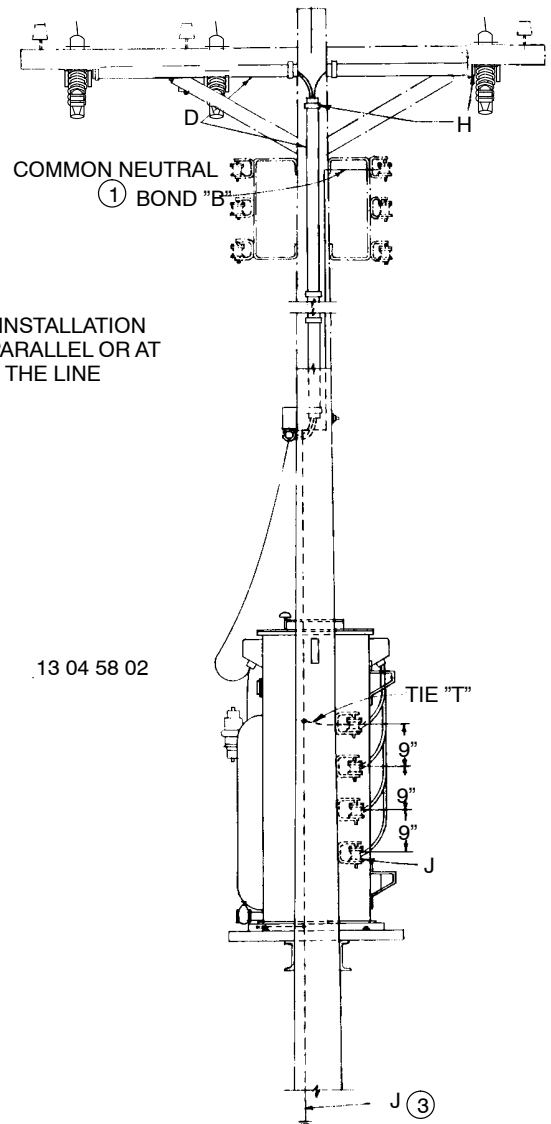


SECTION X-X



② MOUNTING UNIT INSTALLATION
MAY BE EITHER PARALLEL OR AT
RIGHT ANGLE TO THE LINE

15' CLEARANCE 13 04 58 02



TRANSFORMERS
4kV – Three Phase – 3 or 4 Wire
750 kVA

13 04 58 02

Sheet 2 of 2

		Std. / Stk. No.	Description	13 04 58 02	
T @ @	A	41 02 351	Pole, Stub, 35', Class 1		1
	B	23 17 174	Platform, Trans, 8'-0"		1
	C	41 01 008	Arm, Cross, 10'		1
	D	12 01 280	Conduit, Plastic, 2" (ft.)		15
	E	23 52 069	Bolt, Mach., 5/8" x 18"		4
	F	23 52 065	Bolt, Mach., 5/8" x 12"		2
	G	23 66 027	Washer, Square, 5/8"		20
	H	27 60 035	Strip, Hanger (Ft.)		6
	J	12 00 10 **	Grounding Unit		1
	K	06 01 01 01	Secondary Clevis		4
	L		Wire, Ins., 5 kV (Ft.) (See 13 00 03 01)		60
	M		Transformer		1
	N	10 12 ** **	Switch Assembly		1

NOTES:

1. If common neutral is not present, refer to DCS 13 00 07 02 for installation of grounds.
2. Transformer may be rotated 90° if necessary for more convenient service take-off.
3. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

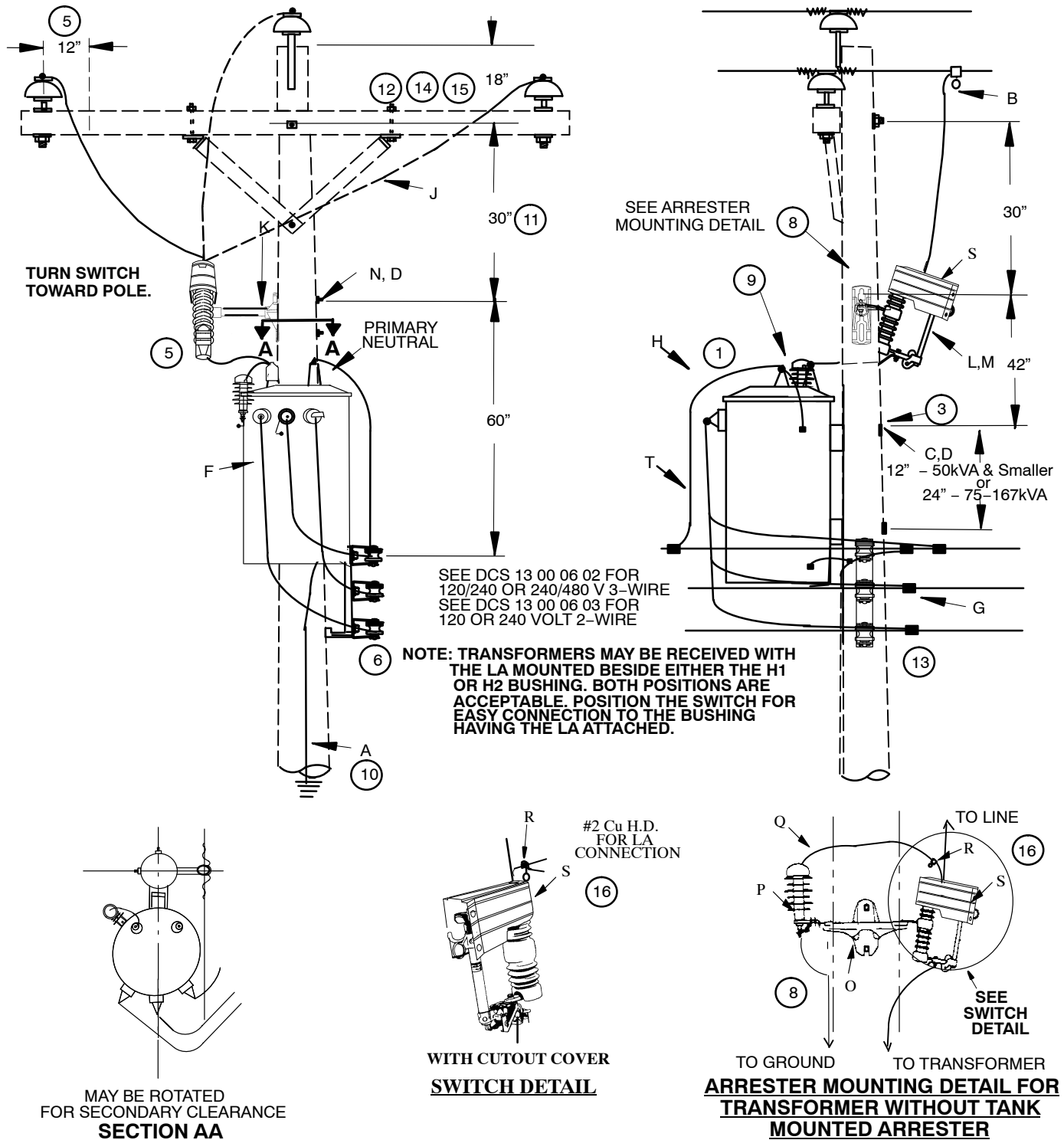
TRANSFORMERS

15 kV and Below – Grounded Wye Primary System
1–167 KVA – Single Phase – Protected

13 12 00 01

Sheet 1 of 3

FOR CSP TRANSFORMER INSTALLATION SEE NOTE 7
FOR TRANSFORMER WITHOUT TANK MOUNTED ARRESTER SEE NOTE 8



TRANSFORMERS
15 kV and Below – Grounded Wye Primary System
1–167 KVA – Single Phase – Protected

13 12 00 01

Sheet 2 of 3

		Std. / Stk. No.	Description	13 12 00 01
@10	A	12 00 10 **	Grounding Unit	1
@	B	HLC*W	Hot Line Clamp	1
T	C	23 52 065	Bolt, Mach., 5/8" x 12" (50 kVA & smaller) OR	2
		23 52 097	Bolt, Mach., 3/4" x 12" (75 – 167 kVA)	2
T	D	23 66 027	Washer, Square, 5/8" (50 kVA & smaller) OR	4
		23 66 031	Washer, Curved, 3/4" (75 – 167 kVA)	2
T	F		Secondary Leads (Ft.) (See 13 00 03 01)	12
T	G	PG*	See 07 00 25 00	3
@	H		Transformer (see 13 00 01 02)	1
T9	J	18 51 025	Wire, Trans. Riser, #4, S.D. Poly covered (FT.)	12
	K	23 06 127	Bracket, Cutout	1
5, 7	L	54 07 208	Switch, Fused, Open Type	1
@4	M		Link, Fuse	1
	N	23 52 065	Bolt,, Mach, 5/8" x 12"	2
@8	O	23 56 063	Bracket, 3 Position, Equipment Mount	1
@8	P		Arrester, Lightning (see 12 00 01 01)	1
@8	Q	18 51 021	Wire, #6Cu, S.D. Poly Covered	@
@8,16	R	23 78 394	Clamp, Hotline, #6 to 2/0	1
	S	23 17 411	Cover – Cutout	1
T	T	18 51 025	Wire, #4 Cu, S.D., Covered	10

NOTES:

- Arrester may be shifted to most convenient side of tank on two bushing transformers.
- Deadend construction – Deadend primary one span past transformer pole if there is another pole in the lead. If not, see DCS 13 12 10 02.
- Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
- See DCS 10 00 01 01 for fuse selections.
- Switch may be mounted on either side of pole or on the crossarm. If the switch is mounted on the crossarm, it should be positioned 12" from the pin insulator or from the pole. The transformer may be raised 12" to 24" when the switch is located on the crossarm. Omit items K and N.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- If installing a CSP transformer, a fused switch shall be installed as shown. Exception: If existing pole space does not allow for installation of a fused switch and the number of customers affected by transformer failure is deemed acceptable, then items K, L, M, N, and S may be omitted and connect the transformer primary lead to the overhead conductor.
- If installing a transformer that does not have a tank mounted lightning arrester use items O, P, Q, and R and install the appropriate lightning arrester on the bracket beside the switch. Keep arrester leads as short as possible. See note 16 for avian protection requirements.
- 2400/4160Y transformer may have side wall or cover mounted HV bushings. If side wall mounted bushings:
 - Build according to this DCS except use 2.5kV primary lead wire stock # 18 53 011, or
 - If pole is congested, 2.5kV primary lead wire stock # 18 53 011 in conduit similar to DCS 13 04 14 01 may be used.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

TRANSFORMERS
15 kV and Below – Grounded Wye Primary System
1–167 KVA – Single Phase – Protected

13 12 00 01

Sheet 3 of 3

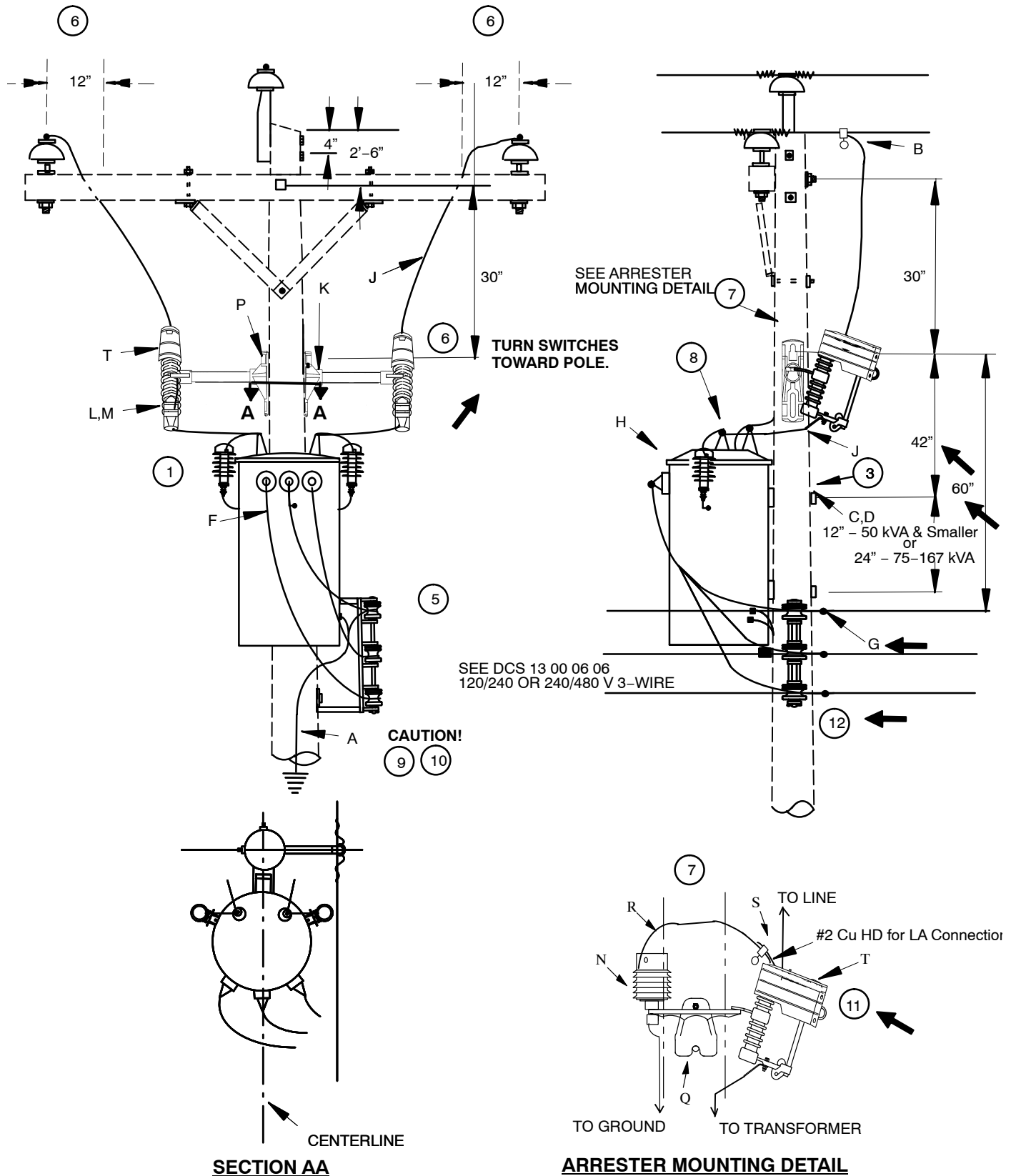
11. This dimension is to top bolt position if FG crossarm is used.
12. Use DCS 05 11 10 01 for existing structure modification or DCS 05 16 10 01 for pin cover in area with eagle population.
13. If pole is NOT truck accessible, make secondary connections on the climbing side of the pole.
14. Use DCS 03 12 05 ** for new pole installation.
15. On single-phase pole lines where future addition of crossarm for adding additional phases is not reasonably expected, this dimension can be reduced to 6" (i.e., total of 36" from the pole top to the top bolt of the cutout bracket).
16. For all of Illinois and locations in Missouri where additional avian protection is needed, omit the piece of #2 copper wire and hotline clamp R. Connect the #6 copper poly covered arrester wire Q directly to the fused switch connector.

TRANSFORMERS

15 kV and Below – Delta Primary System
1-167 KVA – Single Phase – Protected

13 12 00 10

Sheet 1 of 2



TRANSFORMERS
15 kV and Below – Delta Primary System
1–167 KVA – Single Phase – Protected

13 12 00 10

Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 00 10
@9,10	A	12 00 10 **	Grounding Unit	1
@	B	HLC*W	Hot Line Clamp	2
T	C	23 52 065	Bolt, Mach., 5/8" x 12" (50 kVA or Smaller) or	2
		23 52 097	Bolt, Mach., 3/4" x 12" (75–167 kVA)	2
T	D	23 66 027	Washer, Square, 5/8" (50 kVA or Smaller) or	2
		23 66 031	Washer, Curved, 3/4" (75–167 kVA)	2
T	F		Secondary Leads (Ft.) (See 13 00 03 01)	12
T	G	PG*	See 07 00 25 00	3
@	H		Transformer (See 13 00 01 02)	1
	J	18 51 025	Wire, Trans. Riser (FT.)	12
	K	23 06 127	Bracket, Cutout	2
6	L	54 07 208	Switch, Fused, Open Type	2
@ 4	M		Link, Fuse	2
@1	N		Arrester, Lightning (See 12 00 01 01)	@
	P	23 52 065	Bolt, Mach., 5/8" x 12"	2
@7	Q	23 56 063	Bracket, 3 Position, Equipment Mount	@
@7,11	R	18 51 021	Wire, #6 Cu, S.D. Poly Covered	@
@7	S	23 78 394	Clamp, Hotline, #6 to 2/0	@
	T	23 17 411	Cover – Cutout	2

NOTES:

- Arresters must be connected to each HV bushing. Transformers coded BA, BD, JA, JD, XA, and XD have one arrester included, all others have no arrester. See Note #7 for additional information.
- Deadend construction – Deadend primary one span past transformer pole if there is another pole in the lead. If not, see DCS 13 12 10 02.
- Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
- See DCS 10 00 01 01 for fuse selections.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Switches may be mounted on the crossarm. If the switches are mounted on the crossarm, they should be positioned 12" from the pin insulators. The transformer may be raised 12" to 24" when the switches are located on the crossarm. Omit items K and P.
- If installing a transformer that does not have a tank mounted lightning arrester use items N, Q, R, and S and install the appropriate lightning arrester on the bracket beside the switch. Keep arrester leads as short as possible. See note 11 for avian protection requirements.
- 2400/4160 Y transformers may have sidewall or cover mounted HV bushings.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
- Arrester ground and secondary ground may be required to be separate. See DCS 13 00 06 06 for details on this requirement.
- For all of Illinois and locations in Missouri where additional avian protection is needed, omit the #2 bare CU stud and hot line clamp S and connect the #6 poly covered arrester lead wire R directly to the fused switch connector.
- If pole is NOT truck accessible, make secondary connections on climbing of the pole.

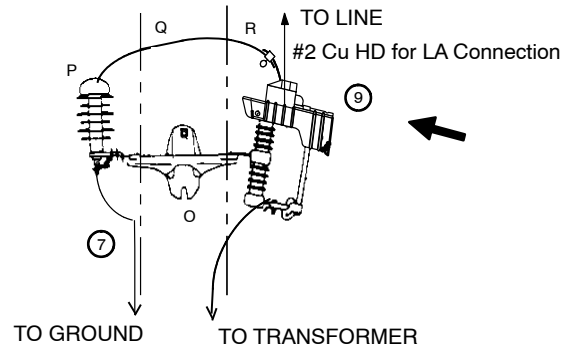
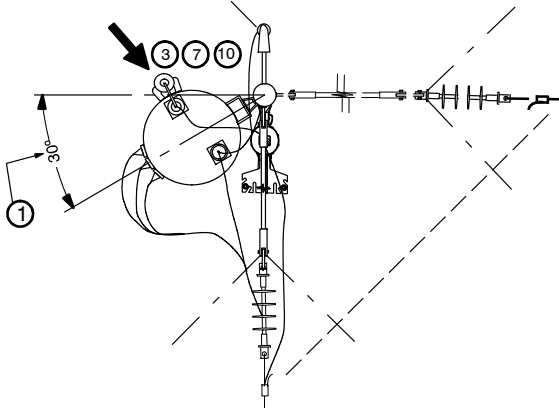
TRANSFORMERS

15kV and Below - 120/240 Volts - Single Phase
1 To 167 kVA Deadend or "L" Corner

13 12 10 **

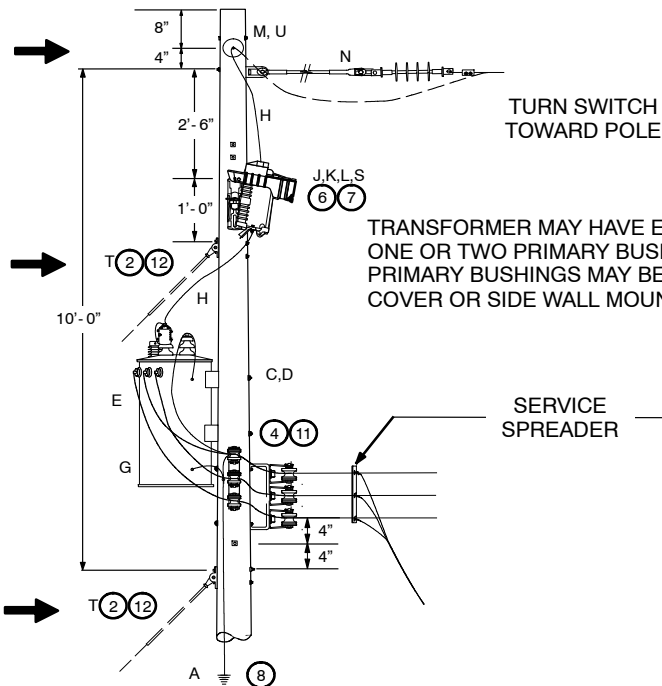
Sheet 1 of 2

FOR TRANSFORMER WITHOUT TANK MOUNTED ARRESTER SEE NOTES 7 & 10. ←

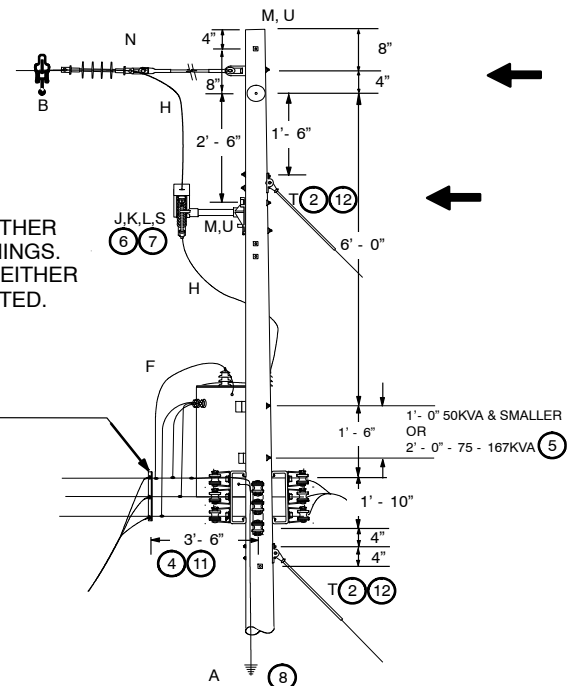


ARRESTER MOUNTING DETAIL

MISSOURI ONLY



→ "L" CORNER - 13 12 10 02



← DEADEND - 13 12 10 01
"L" CORNER - 13 12 10 02

NOTES:

1. Angle is shown as 30°; but may be varied depending on the size and shape of the transformer, to obtain proper clearance from the secondary.
2. On "L" corners, where guy must be installed below transformer, a Class 4 or heavier pole shall be used. A Class 4 pole will provide adequate strength for deadending 1-1/0 bare AAAC at 1,360 lbs. max. tension (non-standard intermediate span urban construction). For conductor tension greater than this, contact Distribution Standards for determination of pole class.
3. Arrester may be shifted to the most convenient side of tank on two bushing transformers.
4. Where primary deadends, and secondary runs through, construct as on DCS 13 12 00 01.
5. For 75 thru 167 kVA transformers, measure distance between mounting slots and drill so that transformer rests evenly on both bolts.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DG
REV. NO: 14
REV. DATE: 05/24/2018

TRANSFORMERS

15kV and Below - 120/240 Volts - Single Phase

1 To 167 kVA Deadend or "L" Corner

13 12 10 **

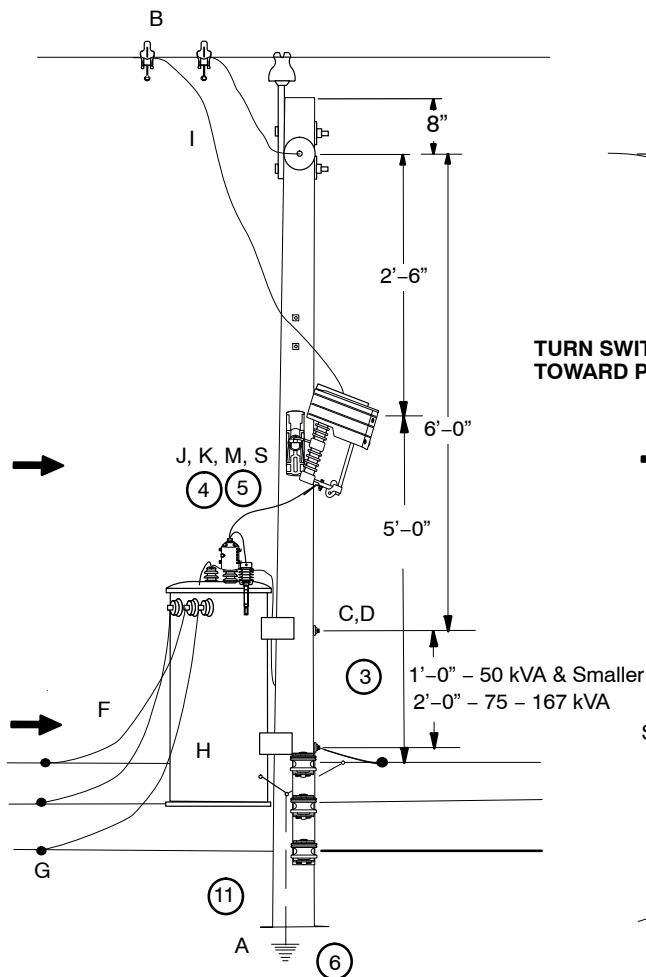
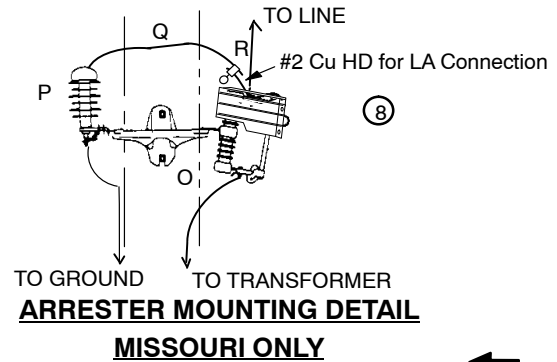
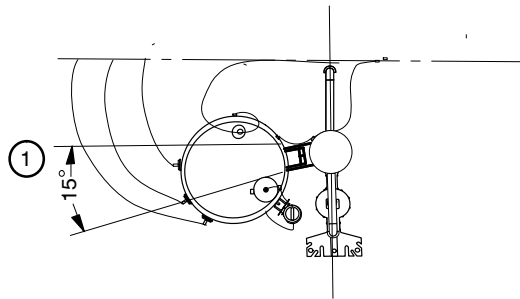
Sheet 2 of 2

6. If a CSP transformer is used, a fused switch shall be provided as shown. Exception: If existing pole space does not allow for installation of a fused switch and the number of customers affected by transformer failure is deemed acceptable, then items J, K, L, M and S may be omitted and connect the transformer primary lead to the overhead conductor.
7. In Missouri, if installing a transformer that does not have a tank mounted lightning arrester use items O, P, Q, and R and install the appropriate lightning arrester on the bracket beside the switch. Keep arrester leads as short as possible. See note 9 for avian protection requirements.
8. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
9. For locations in Missouri where additional avian protection is needed, omit the #2 bare CU stud and hot line clamp R and connect the #6 CU poly covered arrester lead wire directly to the fused switch connector.
10. In Illinois, if the transformer does not have provision for tank mounting the arrester, install the arrester on the upper transformer mounting bracket per DCS 12 12 05 **.
11. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
12. See DCS 11 00 02 02 for typical guy insulator placement.

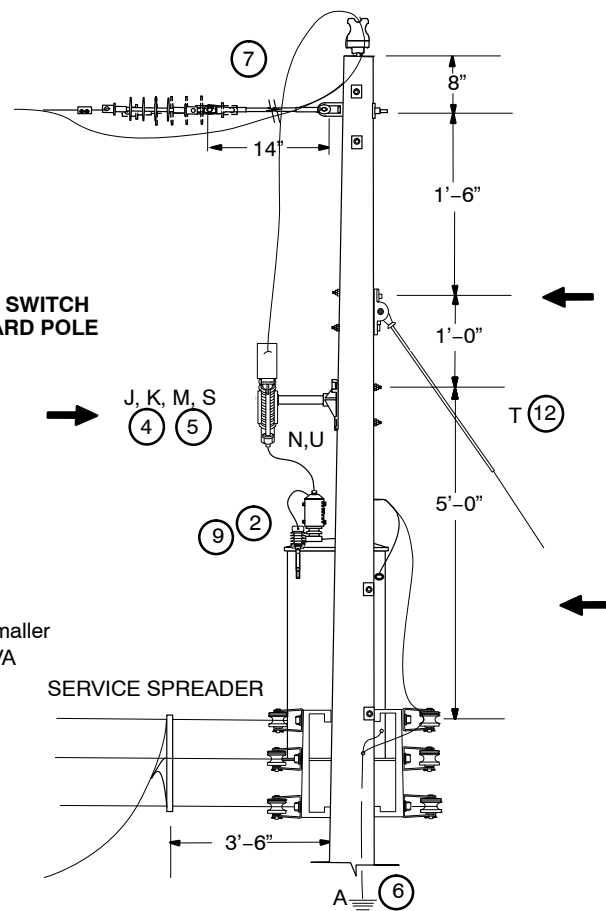


		Std. / Stk. No.	Description	13 12 10	01	02
@8	A	12 00 10 **	Grounding Unit		1	1
@	B	HLC*W	Hot Line Clamp (See 07 00 21 00)		1	1
T	C	23 52 066	Bolt, Mach., 5/8" x 14" (50 kVA & Smaller) or		2	2
		23 52 219	Bolt, Mach., 3/4" x 14" (75 kVA - 167 kVA)		2	2
T	D	23 66 027	Washer, Square, 5/8" (50 kVA & Smaller) or		2	2
		23 66 031	Washer, Curved, 3/4" (75 kVA - 167 kVA)		2	2
T	E		Secondary Leads (Ft.) (See 13 00 03 01)		9	9
T	F	PG*	See 07 00 25 00		4	4
@	G		Transformer (see 13 00 01 02)		1	1
	H	18 51 025	Wire, Trans. Riser (Ft.)		6	6
	J	23 06 127	Bracket, Cutout		1	1
	K	54 07 208	Switch, Fused, Open Type		1	1
@	L		Link, Fuse (sized for transformer) (See 10 00 01 01)		1	1
	M	23 52 065	Bolt, Mach., 5/8" x 12"		3	3
	N	06 12 30 01	Deadend W / EXT		1	2
@7	O	23 56 063	Bracket, 3 Position, Equipment Mount		1	1
@7	P		Arrester, Lightning (See 12 00 01 01)		1	1
@7	Q	18 51 021	Wire, #6 Cu, S.D. Poly Covered (Ft.)		2	2
@7,9	R	23 78 394	Clamp, Hotline, #6 to 2/0		1	1
	S	23 17 411	Cover - Cutout		1	1
@12	T	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)		1	2
	U	23 66 027	Washer, Square, 2- 1/4" x 2- 1/4" x 3/16"		3	3

**FOR CSP TRANSFORMER INSTALLATION SEE NOTE 4.
 FOR TRANSFORMER WITHOUT TANK MOUNTED ARRESTER SEE NOTES 5 & 10**



**TURN SWITCH
TOWARD POLE**



TRANSFORMERS
15kV and Below – 120/240 Volts – Single Phase
1 to 167kVA "T" Corner

13 12 14 02

Sheet 2 of 3

		Std. / Stk. No.	Description	13 12 14 02
@6	A	12 00 10 **	Grounding Unit	1
@	B	HLC*W	Hot Line Clamp (See 07 00 21 00)	1
T	C	23 52 066	Bolt, Mach., 5/8" x 14" (50 kVA or Smaller) or	2
		23 52 219	Bolt, Mach., 3/4" x 14" (75–167 kVA)	2
T	D	23 66 027	Washer, Square, 5/8" (50 kVA or Smaller) or	2
		23 66 031	Washer, Curved, 3/4" (75–167 kVA)	2
T	F		Secondary Leads (Ft.) (See 13 00 03 01)	9
T	G	PG*	See 07 00 25 00	4
@	H		Transformer (See 13 00 01 02)	1
T	I	18 51 025	Wire, Trans. Riser (Ft.)	6
	J	54 07 208	Switch, Fused, Open Type	1
	K	23 06 127	Bracket, Cutout	1
@	M		Link, Fuse (sized for transformer) (See 10 00 01 01)	1
	N	23 52 065	Bolt, Mach., 5/8" x 12"	2
@5	O	23 56 063	Bracket, 3 Position, Equipment Mount	1
@5	P		Arrester, Lightning (See 12 00 01 01)	1
@5	Q	18 51 021	Wire, #6 CU, S.D. Poly Covered (Ft.)	@
@5,8	R	23 78 394	Clamp, Hotline, #6 to 2/0	1
	S	23 17 411	Cover, Cutout	1
@12	T	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)	1
	U	23 66 027	Washer, Square, 2–1/4" x 2–1/4" x 3/16"	2

NOTES:

- Angle is shown as 15°, but may be varied depending on the size and shape of the transformer to obtain proper clearance from the secondary.
- Arrester may be shifted to the most convenient side of tank on two bushing transformers.
- For 75 thru 167 KVA transformers, measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
- If a CSP transformer is used, a fused switch shall be provided as shown. Exception: If existing pole space does not allow for installation of a fused switch and the number of customers affected by transformer failure is deemed acceptable, then items J, K, M, N, & S may be omitted and connect the transformer primary lead to the overhead conductor.
- In Missouri, if installing a transformer that does not have a tank mounted lightning arrester use items O, P, Q, and R and install the appropriate lightning arrester on the bracket beside the switch. Keep arrester leads as short as possible. See note 8 for avian protection requirements.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
- If there is space available on the pole, the fused switch for the primary tap can be installed on "T" corners. Refer to DCS 10 12 19 **.
- For locations in Missouri where additional avian protection is needed, omit the #2 bare CU stud and hotline clamp R and connect the #6 CU poly covered arrester lead wire Q directly to the fused switch connector.
- 2400/4160 Y transformer may have side wall or cover mounted HV bushings. If side wall mounted bushings:
 - Build according to this DCS except use 2.5kV primary lead wire stock #18 53 011, or
 - If pole is congested, 2.5kV primary lead wire stock #18 53 011 in conduit similar to DCS 13 04 14 01 may be used.

TRANSFORMERS
15kV and Below – 120/240 Volts – Single Phase
1 to 167kVA "T" Corner

13 12 14 02

Sheet 3 of 3

-
10. In Illinois, if the transformer does not have provision for tank mounting the arrester, install the arrester on the upper transformer mounting bracket per DCS 12 12 05 **.
 11. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
 12. See DCS 11 00 02 02 for typical guy insulator placement.

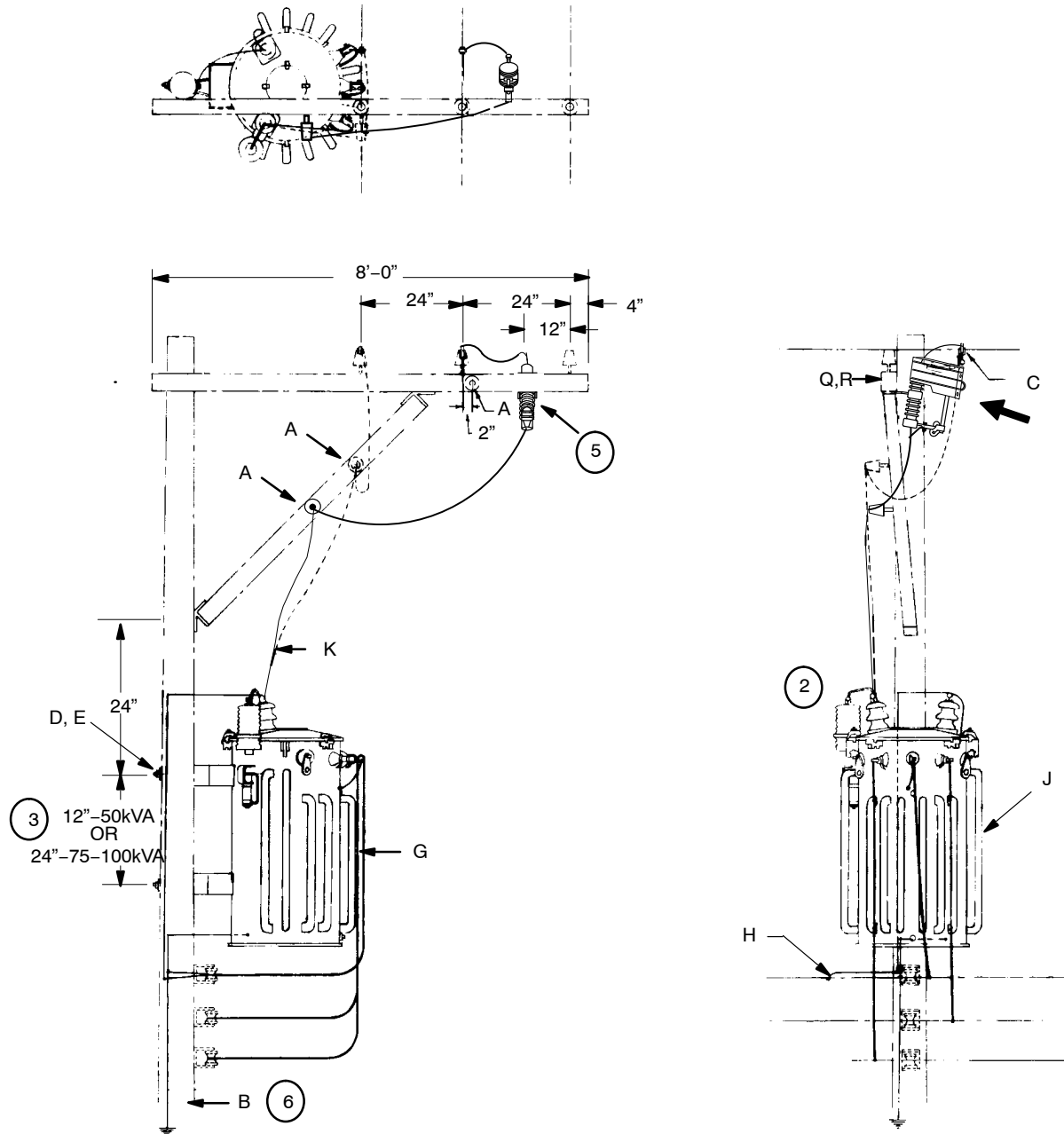
TRANSFORMERS
12kV – 120/240 Volts – Single Phase
1 To 100 kVA Side Arm Construction

13 12 21 02

Sheet 1 of 2

FOR CSP TRANSFORMER INSTALLATION SEE NOTE 1.

FOR TRANSFORMER WITHOUT TANK MOUNTED ARRESTER SEE NOTE 5.



TRANSFORMERS
12kV – 120/240 Volts – Single Phase
1 To 100 kVA Side Arm Construction

13 12 21 02

Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 21 02	
<div style="display: flex; flex-direction: column; align-items: center;"> <div>@6</div> <div>@</div> <div>T</div> <div>T</div> <div>T</div> <div>T</div> <div>T</div> <div>@</div> <div></div> <div>@4</div> <div>@5</div> <div>@5</div> <div>@5</div> <div>@5</div> </div>	A	06 12 01 01	Pin and Insulator		1
	B	12 00 10 **	Grounding Unit		1
	C	HLC*W	Hot Line Clamp		1
	D	23 52 063	Bolt, Mach., 5/8" x 10" (50 kVA & smaller) OR		2
		23 52 095	Bolt, Mach., 3/4" x 10" (75–100 kVA)		2
	E	23 66 027	Washer, Square, 5/8" (50 kVA & smaller) OR		2
		23 66 031	Washer, Curved, 3/4" (75–100 kVA)		2
	G		Secondary Leads (Ft.) (See 13 00 03 01)		12
	H	PG*	See 07 00 25 00		4
	J		Transformer		1
	K	18 51 025	Wire – Trans. Riser (Ft.)		10
	L	54 07 208 & 17 58 054	Switch, Fused, Open Type & Bracket, Crossarm, Heavy Duty		1
	M		Link, Fuse		1
	N		Arrester, Lightning (See 12 00 01 01)		1
	O	18 51 021	Wire, #6 Cu. S.D. Poly Covered		@
	P	23 78 394	Clamp, Hotline, #6 to 2/0		1
	Q	17 58 054	Bracket, Crossarm, Heavy Duty		1
	R	05 15 10 01	Cover, Cutout		1

NOTES:

- For CSP transformers, a fused switch shall be installed as shown.
- Arrester may be shifted to the most convenient side of tank on two bushing transformers.
- Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
- See DCS 10 00 01 01 for fuse selections.
- If installing a transformer that does not have a tank mounted lightning arrester use items "N", "O", "P" and "Q" and install the appropriate lightning arrester on the crossarm beside the switch. Keep the arrester leads as short as possible. The wire on the line side of the switch may be changed to bare copper (Stk. #18 02 020) in order to make the arrester line side connection.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

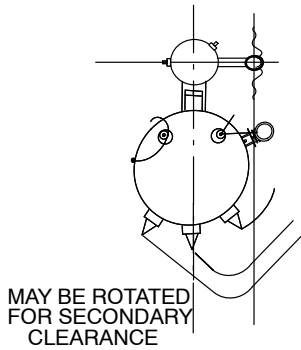
TRANSFORMERS

15kV and Below – 120/240 Volts – Single Phase
1–167 kVA – Armless Underbuild

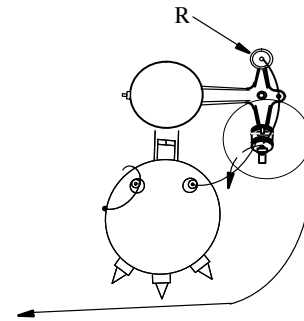
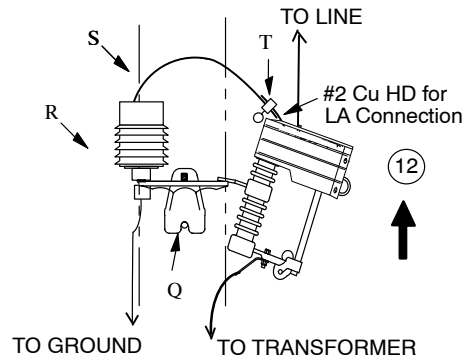
13 12 34 **

Sheet 1 of 2

FOR CSP TRANSFORMER INSTALLATION SEE NOTE 8.

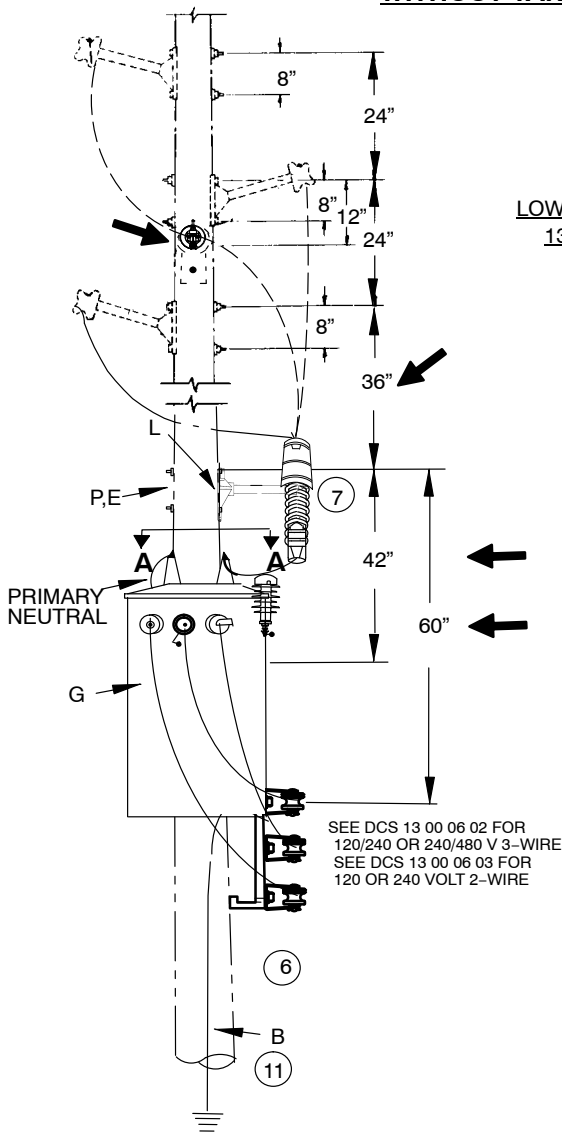


SECTION AA



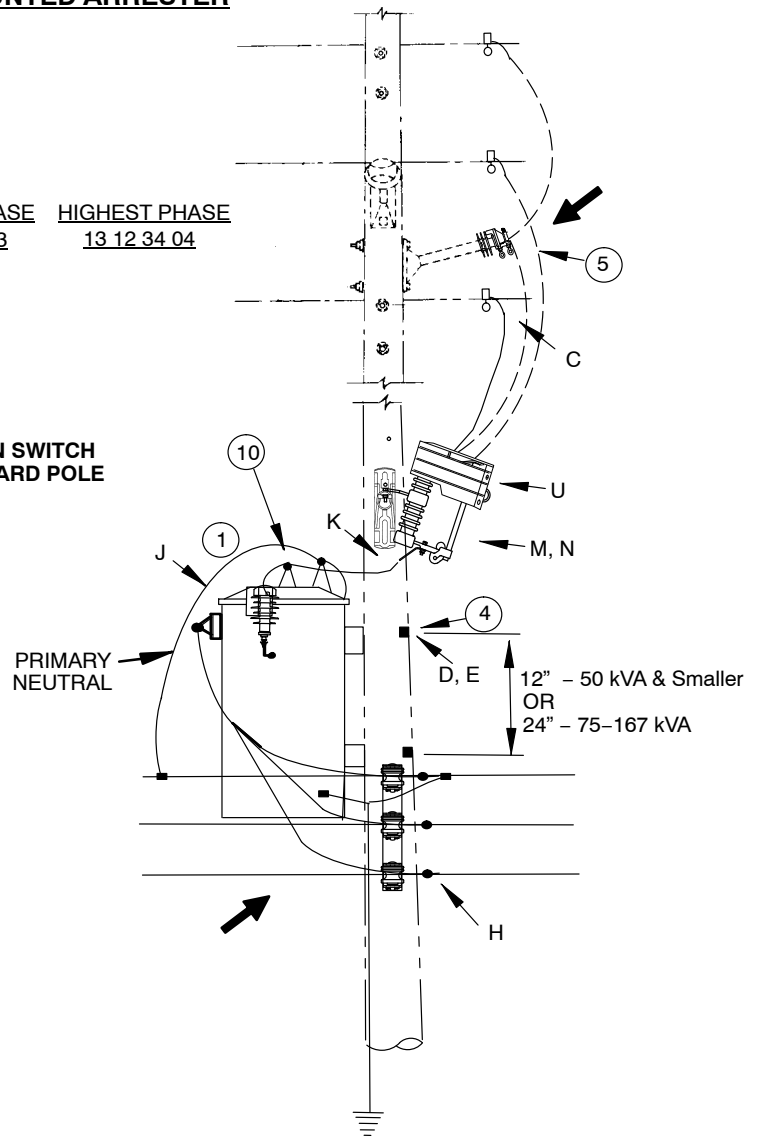
BRACKET DETAIL

9 ARRESTER MOUNTING DETAIL FOR TRANSFORMER WITHOUT TANK MOUNTED ARRESTER



LOWEST PHASE 13 12 34 03
HIGHEST PHASE 13 12 34 04

TURN SWITCH TOWARD POLE



TRANSFORMERS
15kV and Below – 120/240 Volts – Single Phase
1–167 kVA – Armless Underbuild

13 12 34 **
Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 34 **	03	04
<div style="display: flex; flex-direction: column; align-items: center;"> <div>@11</div> <div>@</div> <div>T</div> <div>T</div> <div>T</div> <div>T</div> <div>@</div> <div></div> <div></div> <div>@3</div> <div>@9</div> <div>@9</div> <div>@9</div> <div>@9,12</div> </div>	A	06 12 20 04	Insulator, Standoff, L.D.			1
	B	12 00 10 **	Grounding Unit		1	1
	C	HLC*W	Hot Line Clamp		1	1
	D	23 52 065	Bolt, Mach., 5/8" x 12" (50 kVA & Smaller) or		2	2
		23 52 097	Bolt, Mach., 3/4" x 12" (75–167 kVA)		2	2
	E	23 66 027	Washer, Square, 5/8" (50 kVA & Smaller) or		4	4
		23 66 031	Washer, Curved, 3/4" (75–167 kVA)		2	2
	G		Secondary Leads (Ft.) (See 13 00 03 01)		12	12
	H	PG*	See 07 00 25 00		4	4
	J		Transformer (see 13 00 01 02)		1	1
	K	18 51 025	Wire, Trans. Riser (Ft.)		12	12
	L	23 06 127	Bracket, Cutout		1	1
	M	54 07 208	Switch, Fused		1	1
	N		Link, Fuse (sized for transformer)		1	1
	P	23 52 065	Bolt, Machine, 5/8" x 12"		2	2
	Q	23 56 063	Bracket, 3 Position, Equipment Mounting		1	1
	R		Arrester, Lightning (See 12 00 01 01)		1	1
	S	18 51 021	Wire, #6 Cu, S.D. Poly Covered	@	@	@
	T	23 78 394	Clamp, Hotline, #6 to 2/0		1	1
	U	23 17 411	Cover – Cutout		1	1

NOTES:

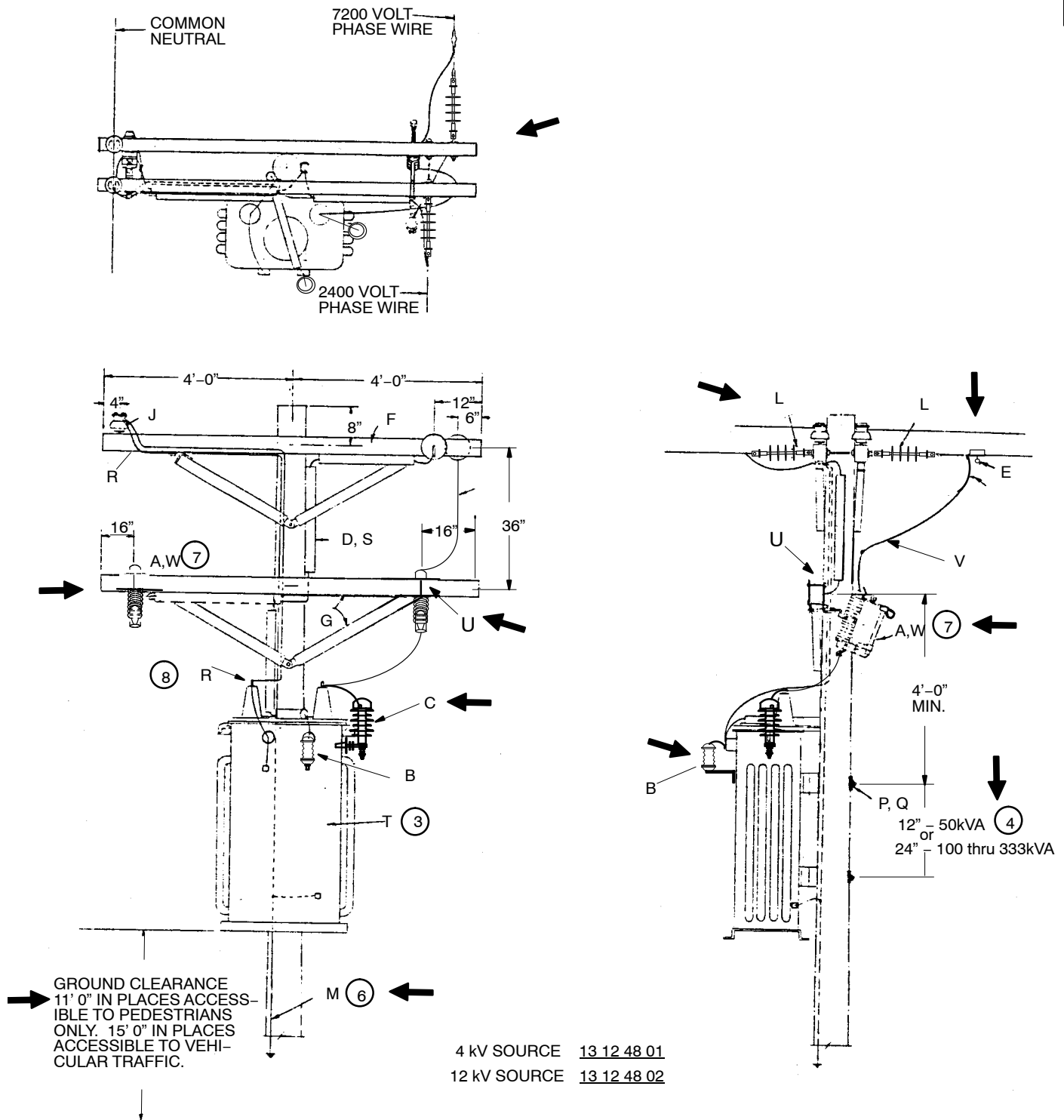
- Arrester may be shifted to most convenient side of tank on two bushing transformers.
- Deadend construction – deadend primary one span past transformer pole if there is another pole in the lead. If not, see DCS 13 12 10 02 for primary deadend on transformer pole.
- See DCS 10 00 01 01 for fuse information.
- Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
- When transformer must be connected to top phase, install 24" fiberglass standoff.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Switch may be mounted on either side of the pole.
- If installing a CSP Transformer, a fused switch shall be installed as shown. Exception: If existing pole space does not allow for installation of a fused switch and the number of customers affected by transformer failure is deemed acceptable, then items L, M, N, P, and U may be omitted and connect the transformer primary lead to the overhead conductor.
- If installing a transformer that does not have a tank mounted lightning arrester use items Q, R, S, and T and install the appropriate lightning arrester on the bracket beside the switch. Keep arrester leads as short as possible. See note 12 for avian protection requirements.
- 2400/4160 Y transformer may have side wall or cover mounted HV bushings.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
- For all of Illinois and locations in Missouri where additional avian protection is needed, omit the #2 bare CU stud and hotline clamp T and connect the #6 CU poly covered arrester lead wire S directly to the fused switch connector.

TRANSFORMERS

7200V. – 2400 V. Step-Up or Down

13 12 48 **

Sheet 1 of 2



TRANSFORMERS

7200V. – 2400 V. Step-Up or Down

13 12 48 **

Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 48 **	
				01 4kV	02 12k
	A	54 07 208	Switch, Fuse, 100A, 15kV	1	1
	B	10 01 122	Arrester, Lightning, 3kV, w/Transformer Bkt	1	1
	C	10 01 145	Arrester, Lightning, 10kV, w/Transformer Bkt	1	1
	D	12 51 197	Conduit, Plastic, 1" (Ft.)	16	16
	@ E	HLC*W	Clamp, Hot Line	1	1
	F	04 00 20 07	Crossarm, Double 8'	1	1
	G	04 00 20 02	Crossarm, Single, 8'	1	1
	J	06 12 01 01	Pin and Insulator	3	2
	L	06 12 34 01	Deadend	2	2
	@6 M	12 00 10 **	Grounding Unit	1	1
	@ O	STC*W	Hot Tap With/Stirrup	1	1
T	P	23 52 063	Bolt, Mach., 5/8" x 10" (50kVA) OR	2	2
		23 52 095	Bolt, Mach., 3/4" x 10" (100 – 333kVA)	2	2
T	Q	23 66 027	Washer, Square, 5/8" (50kVA) OR	2	2
		23 66 031	Washer, Curved, 3/4" (100 – 333kVA)	2	2
@8	R		Wire, Bare, S.D. (Ft.) (See 13 00 03 01)	30	30
@	S		Wire, Ins., 5kV (Ft.) (See 13 00 03 01)	35	25
@	T		Transformer	1	1
	U	17 58 054	Bracket, Crossarm, Arrester	1	1
	V	18 51 025	Wire, Cu., #4 S.D., Covered	10	10
@5	W		Link, Fuse	1	1

NOTES:

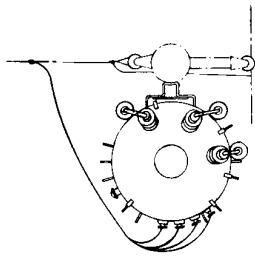
1. Install switch on source side only.
2. Install arresters on both source and load sides.
3. Connection shown is for subtractive polarity. On additive polarity transformers, secondary bushings are reversed.
4. Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
5. See DCS 10 00 01 01 for fuse selection.
6. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
7. Drawing depicts 12kV source. If 4kV source, route 4kV lead to fused switch installed on left side of drop-arm and install pin and insulator J on right side of drop-arm for 12kV lead support.
8. For 50 thru 167kVA transformer use #6 Cu (stock # 18 52 019) from the neutral bushing to the common neutral. For 250 and 333kVA transformer use #4 Cu (stock # 18 52 020).

TRANSFORMERS

12kV – 3 Phase – 3 or 4 Wire
30 – 500 kVA

13 12 54 04

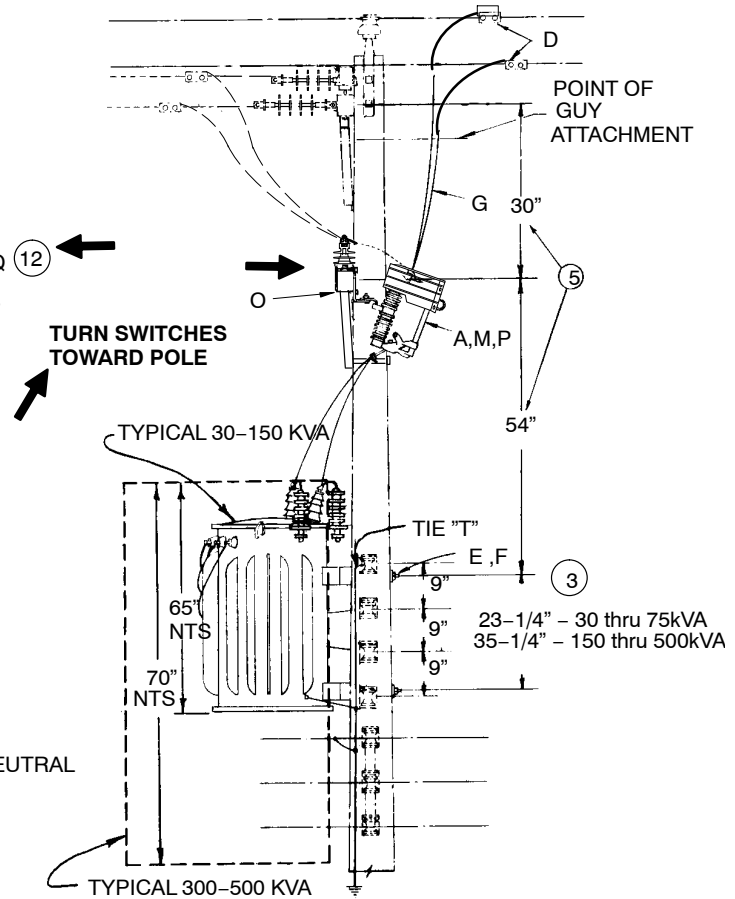
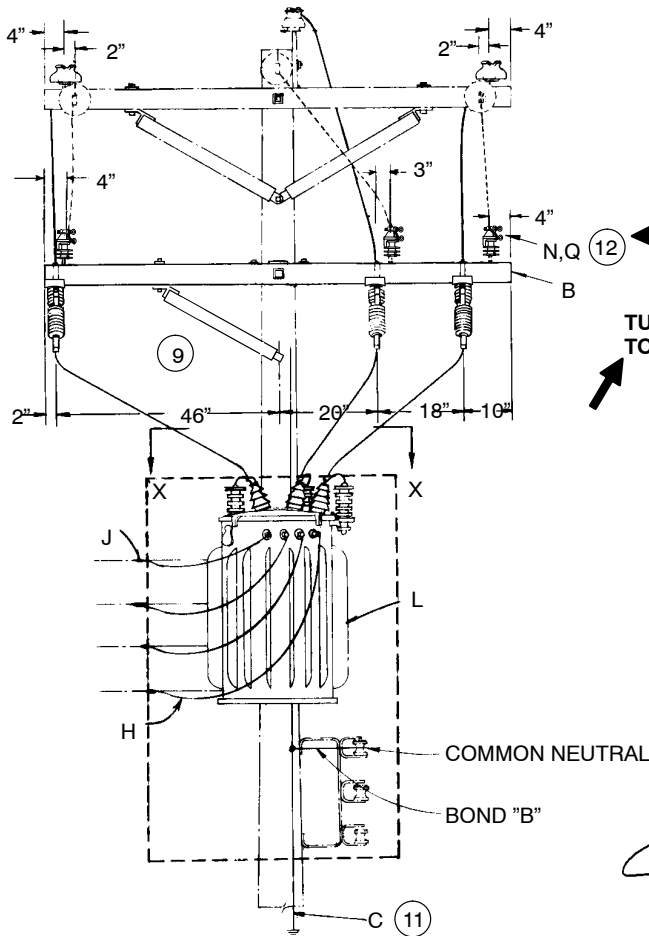
Sheet 1 of 2



SECTION X - X

CAUTION

ALL PRIMARY TERMINALS ARE HOT AFTER THE FIRST PHASE WIRE IS CONNECTED.



TRANSFORMERS

12kV – 3 Phase – 3 or 4 Wire

30 – 500 kVA

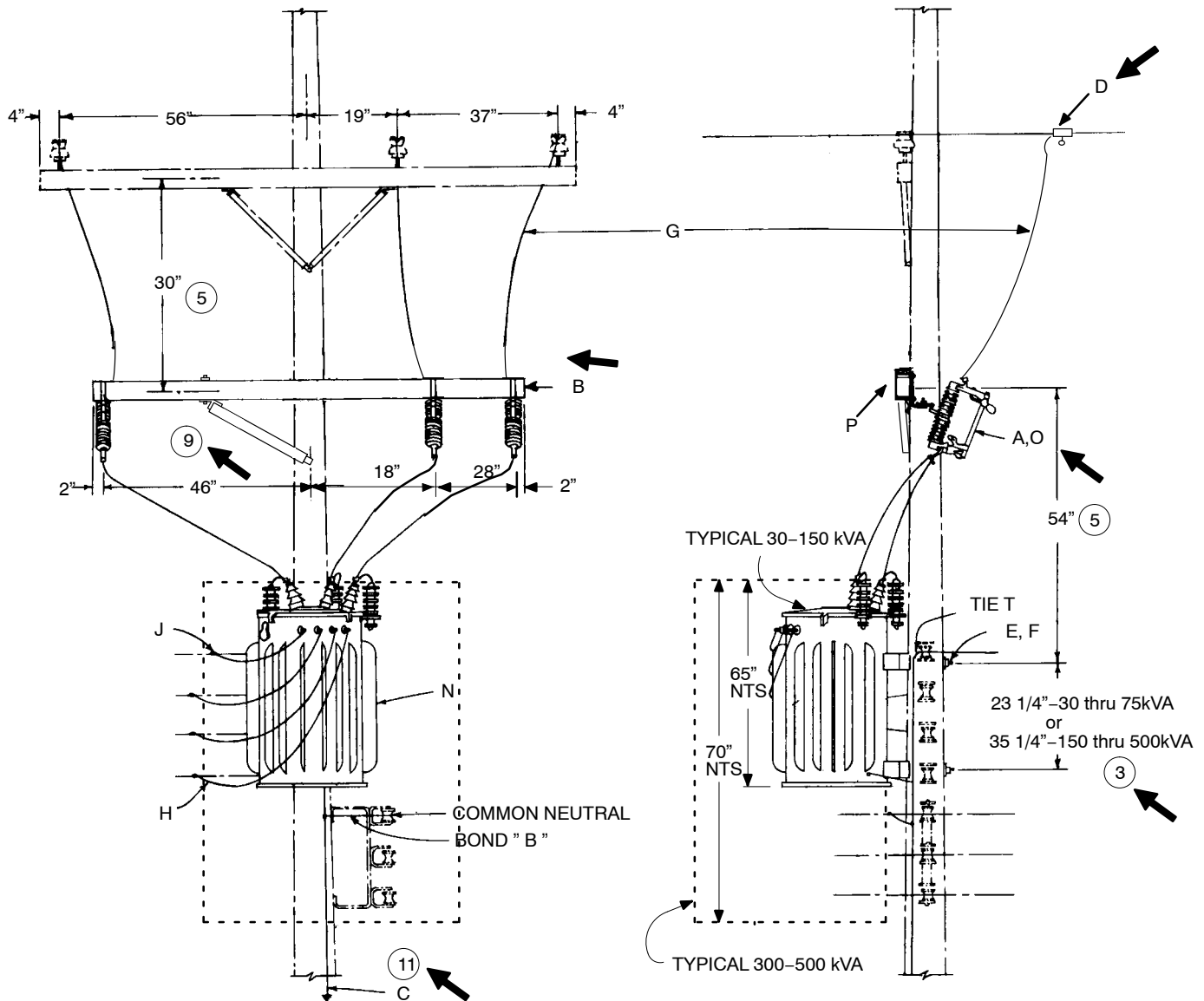
13 12 54 04

Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 54 04
@9	A	54 07 208	Switch, Fused, Open Type	3
	B	04 00 20 02	Crossarm, 8' w/60" V Brace	1
		04 00 20 03	Crossarm, 10' w/60" V Brace	1
@11	C	12 00 10 **	Grounding Unit	1
@	D	HLC*W	Hot Line Clamp	3
T	E	23 52 065	Bolt, Mach., 5/8" x 12" (30kVA) or	2
		23 52 097	Bolt, Mach., 3/4" x 12" (45 thru 300kVA) or	2
		23 52 268	Bolt, Mach., 1" x 14" (500kVA)	2
T	F	23 66 027	Washer, Square, 5/8" (30kVA) or	2
		23 66 031	Washer, Curved, 3/4" (45 thru 300kVA) or	2
		23 66 106	Washer, Curved, 1" (500kVA)	2
T	G	18 51 025	Primary Leads, S.D. (ft.)	35
T	H		Secondary Leads (ft.) (see 13 00 03 01)	20
T	J	PG*	See 07 00 25 00	4
@	L		Transformer (See 13 00 01 02)	1
@10	M		Fuse, Link	3
@12	N	25 05 143	Insulator, Vice-Top, 15 kV	3
@12	O	17 58 054	Bracket, Crossarm, Heavy Duty	3
	P	23 17 411	Cover, Cutout, 100A	3
	Q	23 62 028	Pin, Insulater	3

NOTES:

1. If common neutral is not present refer to DCS 13 00 07 02 for installation of grounds.
2. Turn switches toward pole.
3. Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
4. Units weighing in excess of 3400#'s must be mounted using 1" bolts.
5. These dimensions may be reduced for existing installation to 24" and 48".
6. See DCS 02 00 02 00 for pole class.
7. See DCS 13 00 04 01 for dimensions and weights of transformers.
8. Instructions for converting a 480Y/277 volt four wire transformer to 480 volt three wire service are shown on DCS 13 00 01 01.
9. Use only one V brace. Keep the extra brace for future use.
10. See DCS 10 00 01 01 for fuse selection.
11. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
12. Insulators are only required for installation on a dead-end structure.



TRANSFORMERS
12kV – 3 Phase – 3 or 4 Wire
→ 30 – 500 kVA Underbuild

13 12 56 02

Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 56 02	
9 @11 @ T T T T @ @10	A	54 07 208	Switch, Fused, Open Type		3
	B	04 00 20 02	Crossarm 8' w/60" V Brace		1
	C	12 00 10 **	Grounding Unit		1
	D	HLC*W	Hot Line Clamp		3
	E	23 52 063	Bolt, Mach., 5/8" x 10" (30kVA) OR		2
		23 52 095	Bolt, Mach., 3/4" x 10" (45 thru 300kVA) OR		2
		23 52 268	Bolt, Mach., 1" x 14" (500kVA)		2
	F	23 66 027	Washer, Square, 5/8" (30kVA) OR		2
		23 66 031	Washer, Curved, 3/4" (45 thru 300kVA) OR		2
		23 66 106	Washer, Curved, 1" (500kVA)		2
	G	18 51 025	Primary Leads, (Ft.)		35
	H		Secondary Leads (Ft.) (See 13 00 03 01)		20
	J	PG*	See 07 00 25 00		4
	N		Transformer		1
	O		Fuse, Link		3
	P	17 58 054	Bracket, Crossarm, Heavy Duty		3

NOTES:

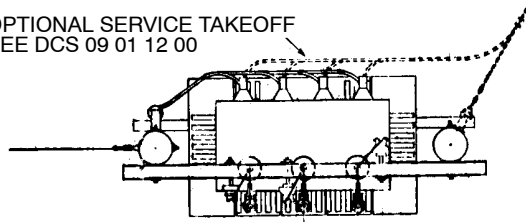
1. If common neutral is not present refer to DCS 13 00 07 02 for installation of grounds.
2. Turn switches toward pole.
3. Measure distance between mounting slots and drill so that transformer rests evenly on both bolts.
4. Units weighing in excess of 3400#s must be mounted using 1" bolts.
5. These dimensions may be reduced for existing installations to 24" and 48".
6. Instructions for converting a 480Y/277 volt four wire transformer to 480 volt three wire service are shown on DCS 13 00 01 01.
7. See DCS 13 00 04 01 for dimensions and weights of transformers.
8. See DCS 02 00 02 00 for pole class.
9. Use only one V brace. Keep the extra brace for future use.
10. See DCS 10 00 01 01 for fuse selection.
11. Use DCS 12 00 10 02 for ground rod application on existing pole installation. Use DCS 12 00 10 09 for ground coil application on new pole installation.

TRANSFORMERS
12kV – 3 Phase – 3 or 4 Wire
750 kVA

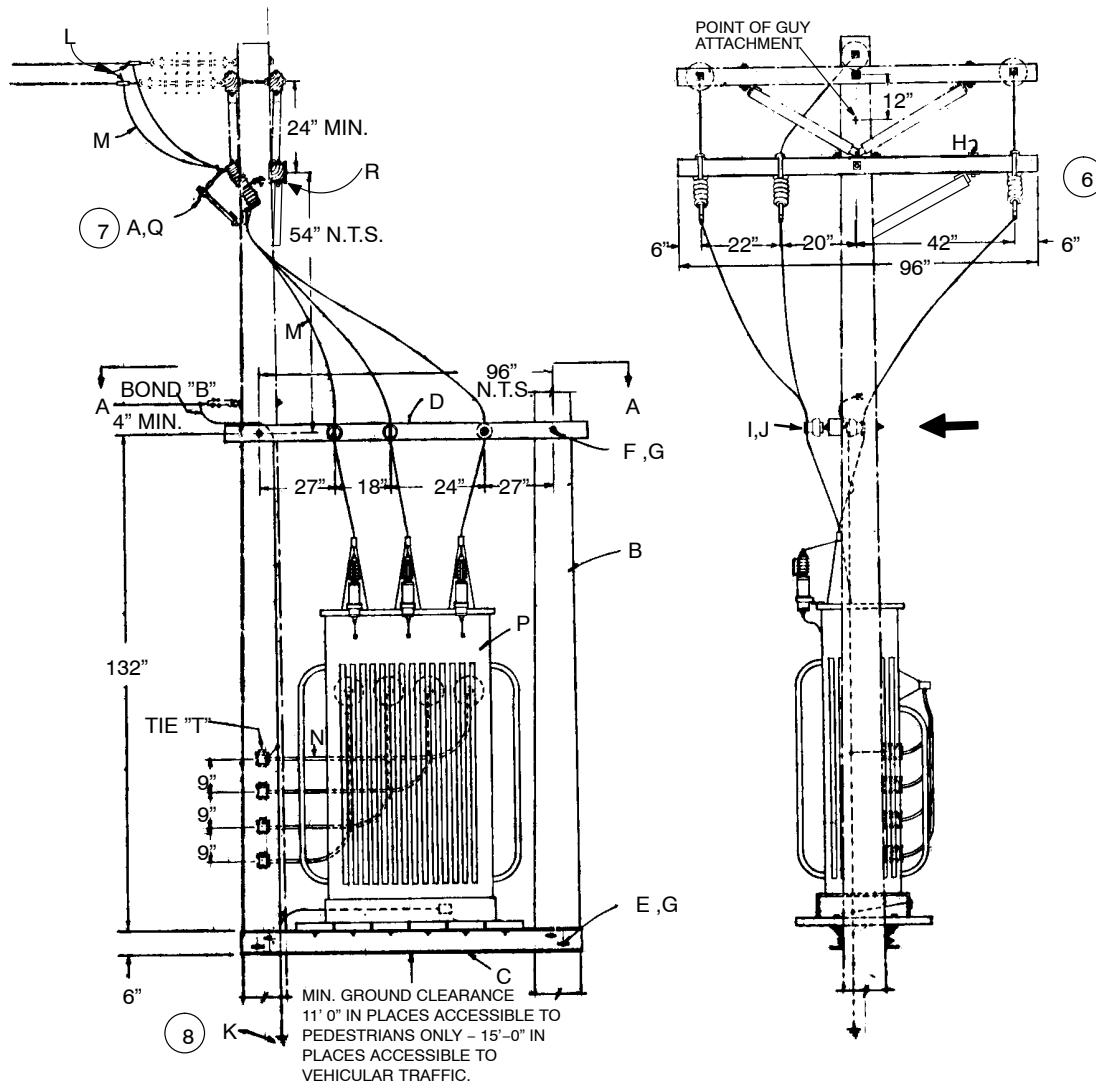
13 12 58 02

Sheet 1 of 2

OPTIONAL SERVICE TAKEOFF
SEE DCS 09 01 12 00



SECTION AA



TRANSFORMERS
12kV – 3 Phase – 3 or 4 Wire
750 kVA

13 12 58 02
Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 58 02	
	A	54 07 208	Switch, Fused, Open Type		3
	B	41 02 351	Pole, Stub, 35', Class 1		1
	C	23 17 174	Platform, Trans., 8'-0"		1
	D	41 01 008	Crossarm, 10'		1
	E	23 52 069	Bolt, Mach., 5/8" x 18"		4
	F	23 52 065	Bolt, Mach., 5/8" x 12"		2
	G	23 66 027	Washer, Square, 5/8"		20
6	H	04 00 20 02	Crossarm, 8' W/ 60" V Brace		1
6	I	23 62 028	Pin, Insulator		3
	J	25 05 143	Insulator, Vice – Top, 15KV		3
@8	K	12 00 10 **	Grounding Unit		1
@	L	HLC*W	Hot Line Clamp		3
T	M	18 51 025	Primary Leads (Ft.)		35
T	N		Secondary Leads (Ft.) (See 13 00 03 01)		20
T	O	PG*	See 07 00 25 00		4
@	P		Transformer		1
@7	Q		Link, Fuse		3
	R	17 58 054	Bracket, Crossarm, Heavy Duty		3

NOTES:

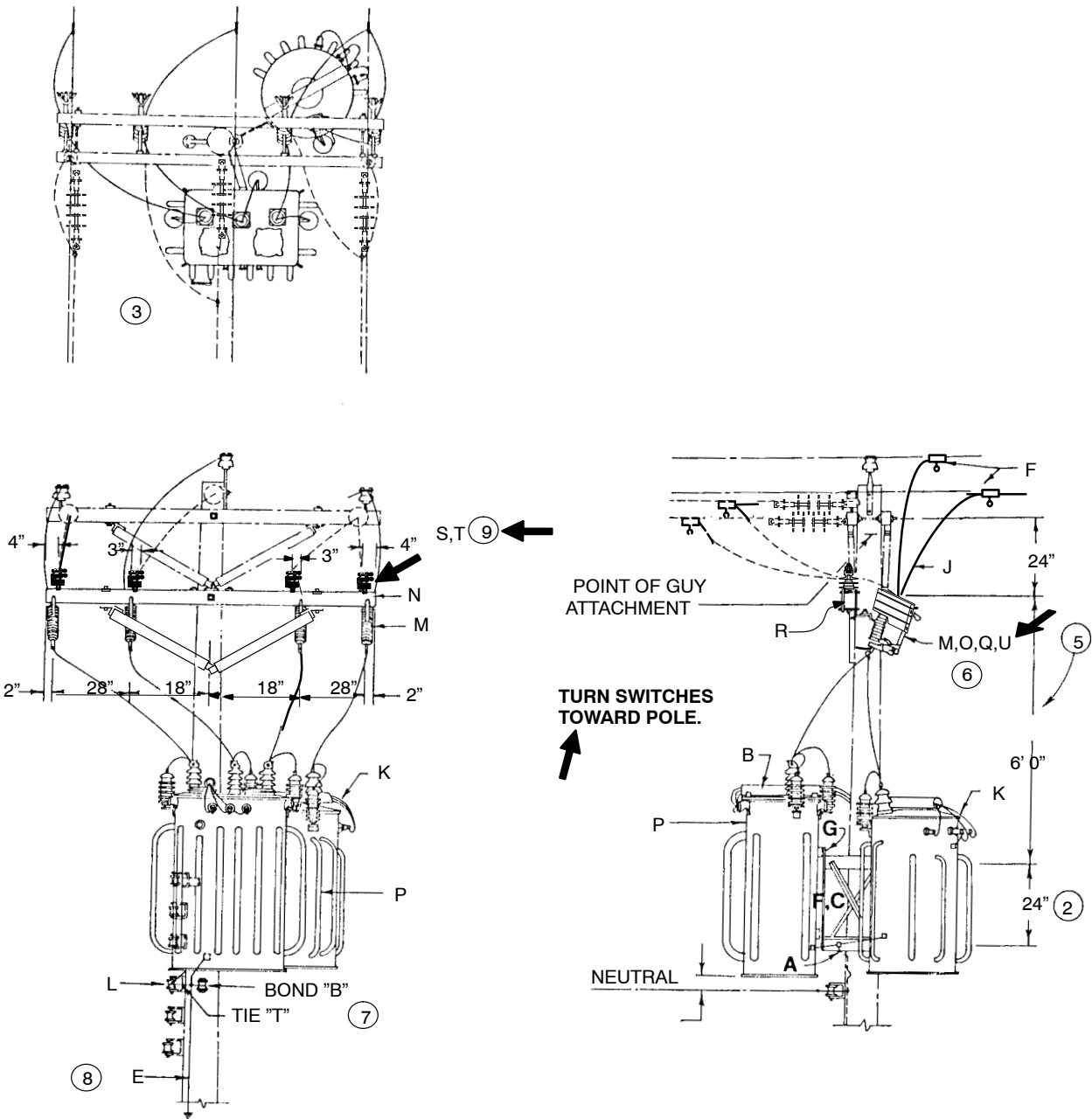
1. If common neutral is not present refer to DCS 13 00 07 02 for installation of grounds.
2. See DCS 13 01 01 ** for underground service arrangement.
3. Instructions for converting a 480/277 voly four wire transformer to 480 volt three wire service are shown on DCS 13 00 01 01.
4. See DCS 13 00 04 01 for dimensions and weights of transformers.
5. See dcs 02 00 02 00 for pole class.
6. Use only one V brace. Keep extra brace for future use.
7. See DCS 10 00 01 01 for fuse selection.
8. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

TRANSFORMERS

12kV – 120/240 1-Phase and 12 kV 3-Phase Cluster
3400# Max. (One Unit) 5000# Max. Total Weight

13 12 75 02

Sheet 1 of 2



CAUTION-ALL PRIMARY TERMINALS ARE HOT AFTER FIRST PHASE WIRE IS CONNECTED.

TRANSFORMERS

12kV – 120/240 1-Phase and 12 kV 3-Phase Cluster
3400# Max. (One Unit) 5000# Max. Total Weight

13 12 75 02

Sheet 2 of 2

		Std. / Stk. No.	Description	13 12 75 02	
	A	23 17 202	Mounting Unit, Cluster		1
	B	12 01 279	Conduit, PVC, 3" (ft.)		5
	C	23 52 097	Bolt, Mach., 3/4" x 12"		2
@8	E	12 00 10 **	Grounding Unit		1
@	F	HLC*W	Hot Line Clamp		4
T	G	23 52 049	Bolt, Mach., 5/8" x 2" OR		2
		23 52 187	Bolt, Mach. 3/4" x 2-1/2"		2
T	H	23 66 031	Washer, Curved, 3/4"		2
T	J	18 51 025	Primary Leads, (ft.)		35
T	K		Secondary Leads (ft.) (See 13 00 03 01)		30
T	L	PG*	See 07 00 25 00		8
	M	54 07 208	Switch – Fused		4
	N	04 00 20 02	Crossarm – 8', w/60" V Brace		1
@6	O		Link, Fuse Single Phase Transformer		1
@	P		Transformer (see 13 00 01 02)		2
@6	Q		Link, Fuse Three Phase Transformer		3
	R	17 58 054	Bracket, Crossarm, Heavy Duty		4
@9	S	25 05 143	Insulator, Vice-Top, 15kv		4
@9	T	23 62 028	Pin, Insulator		4
	U	23 17 411	Cover, Cutout, 100A		4

NOTES:

1. Single phase transformer shall be connected to outside phase only.
2. The 3Ø transformer must have 24" spacing between mounting lugs, and must be equipped for direct pole mounting.
3. Mount cluster bracket on pole on angle such that mounting face for 3Ø transformer is parallel with crossarm.
4. Measure distance between mounting slots on cluster bracket and drill pole so that weight rests evenly on both bolts.
5. This dimension may be reduced for existing installations to 4'0".
6. See DCS 10 00 01 01 for fuse selection.
7. If common neutral is not present refer to DCS 13 00 07 02 for installation of grounds.
8. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
9. Insulators are only required for installation on a dead-end structure.

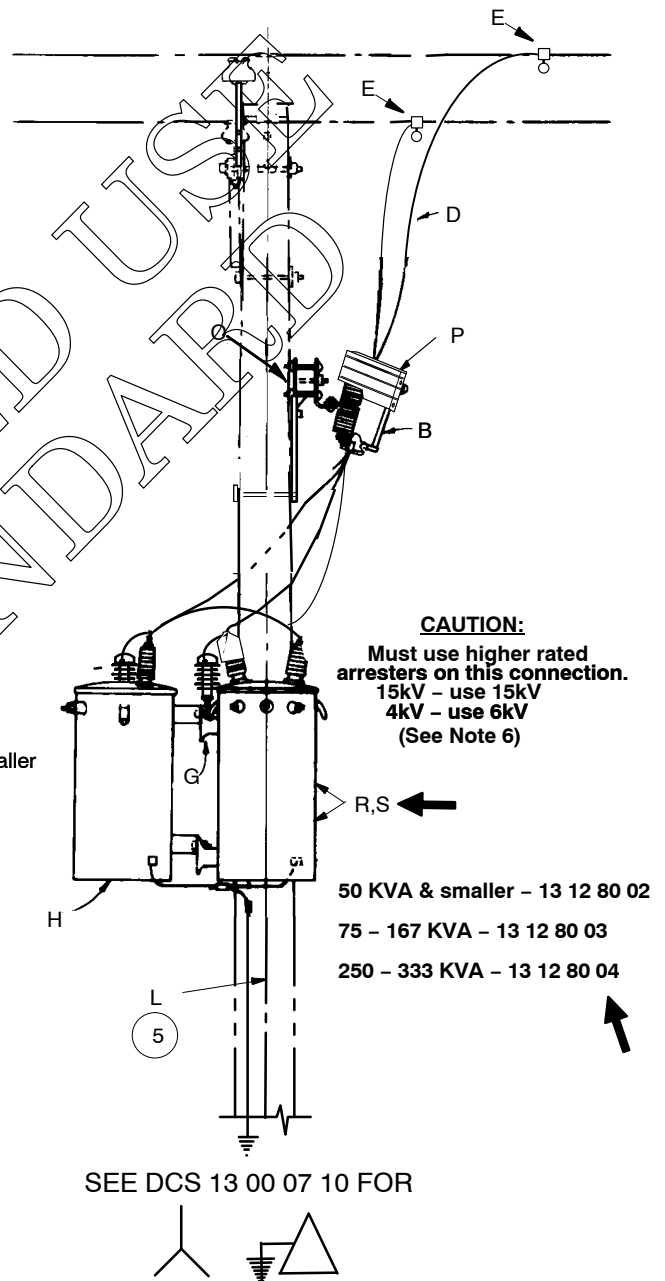
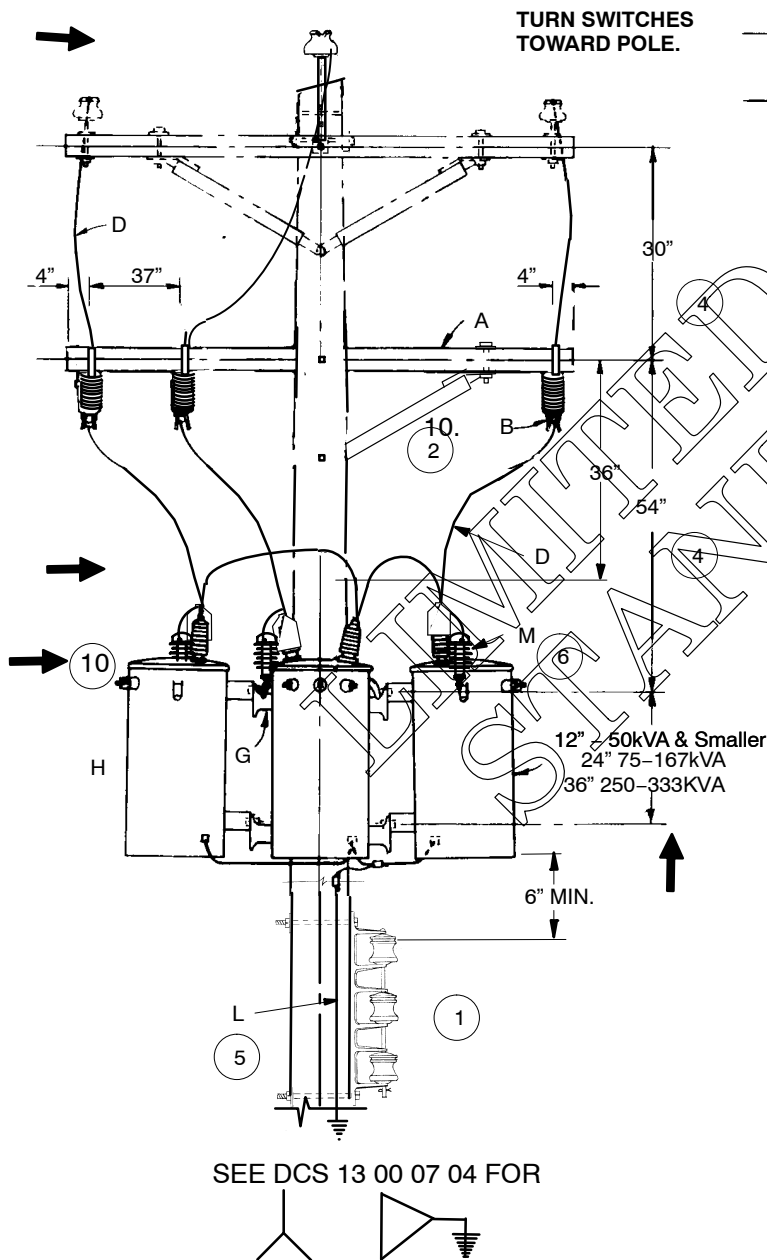
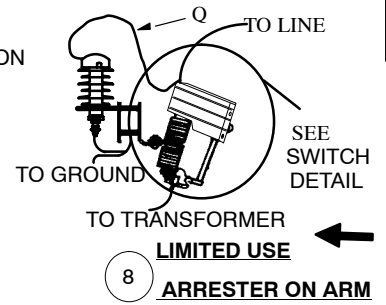
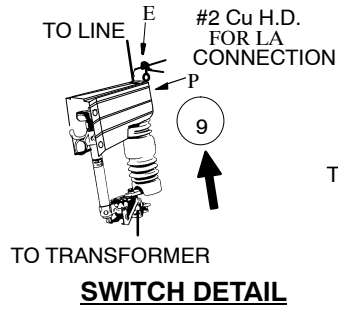
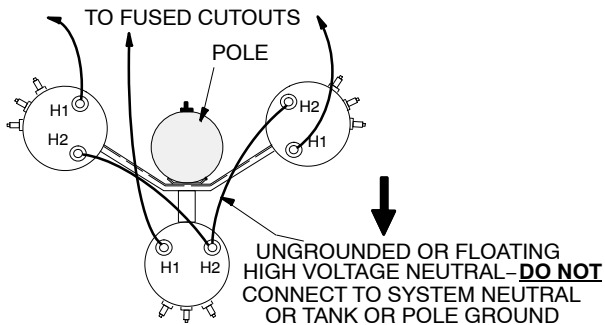
TRANSFORMERS

Three Single Phase Cluster Mounted 15kV and Below Grounded Wye Primary Systems

13 12 80 **

Sheet 1 of 2

FLOATING WYE PRIMARY CONNECTION



CAUTION:
Must use higher rated
arresters on this connection.
15kV - use 15kV
4kV - use 6kV
(See Note 6)

50 KVA & smaller - 13 12 80 02
75 - 167 KVA - 13 12 80 03
250 - 333 KVA - 13 12 80 04

TRANSFORMERS

Three Single Phase Cluster Mounted 15kV and Below Grounded Wye Primary Systems

13 12 80 **

Sheet 2 of 2



		Std. / Stk. No.	Description	13 12 80 **	02	03	04
2	A	04 00 20 03	Crossarm 10' w/ 60" V Brace		1	1	1
7	B	54 07 208	Switch Fused 100A 15kV		3	3	3
T	D		Primary Leads (ft.) (See 13 00 03 01)		40	40	40
@9	E	HLC*W	Hot Line Clamp		6	6	6
	G	23 17 209	Mounting Unit 3 Pos. Light (Up To Three 50 KVA Trans)		1		
		23 17 202	Mounting Unit 3 Pos. Heavy (Three 75-167 KVA Trans)			1	
		23 17 354	Mounting Unit 3 Pos. Xtra Heavy (Three 250- 333 KVA)				1
@	H		Transformer (see 13 00 01 02)		3	3	3
T	J		Secondary Leads (Ft.) (See 13 00 03 01)				
T	K	PG*	See 07 00 25 00		1	1	1
@5	L	12 00 10 **	Grounding Unit		1	1	1
@6	M	10 01 184	Arresters, 6kV		3	3	3
		10 01 188	Arresters, 15kV		3	3	3
@3	N		Link, Fuse		3	3	3
8	O	17 58 054	Bracket, Crossarm, Heavy Duty		3	3	3
	P	23 17 411	Cover - Cutout		3	3	3
@8	Q	18 51 021	Wire #6 CU, S.D. Poly Covered (ft.)		6	6	6
	R	23 52 219	Bolt, Mach., 3/4"x 14"		2	2	
	S	23 66 031	Washer, Curved, 3/4"		2	2	

NOTES:.

- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Use only one V brace. Keep the extra brace for future use.
- See DCS 10 00 01 01 for fuse selection.
- These dimensions may be reduced to 24" and 48" for installation on existing pole.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
- For 7.2, 7.62, and 7.97 kV transformers use 15 kV arrester stock code 10 01 188. For 2.4 kV transformers use 6kV arrester stock code 10 01 184.
- For transformer banks greater than 500 KVA on 4KV circuits, substitute 200A fused switches stock #54 07 209.
- Use only for installations where arresters cannot be mounted on the transformer tanks. Substitute cross arm bracket with stock #23 56 088 and mount arresters on cross arm back-to-back with the fused switches. See note 9 for avian protection requirements.
- For all of Illinois and locations in Missouri where additional avian protection is needed, omit the #2 bare CU stud and hotline clamp E and connect the #6 CU poly covered arrester lead wire Q directly to the fused switch connector.
- 2400/4160 Y Transformers may have sidewall or cover mounted HV bushings. If sidewall mounted bushings:
 - Build according to this DCS except use 2.5KV primary lead wire table 2.2 of DCS 13 00 03 01 or
 - If pole is congested, 2.5 KV primary lead wire in conduit similar to DCS 13 04 54 01.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DG
REV. NO: 9
REV. DATE: 06/10/15

TRANSFORMERS

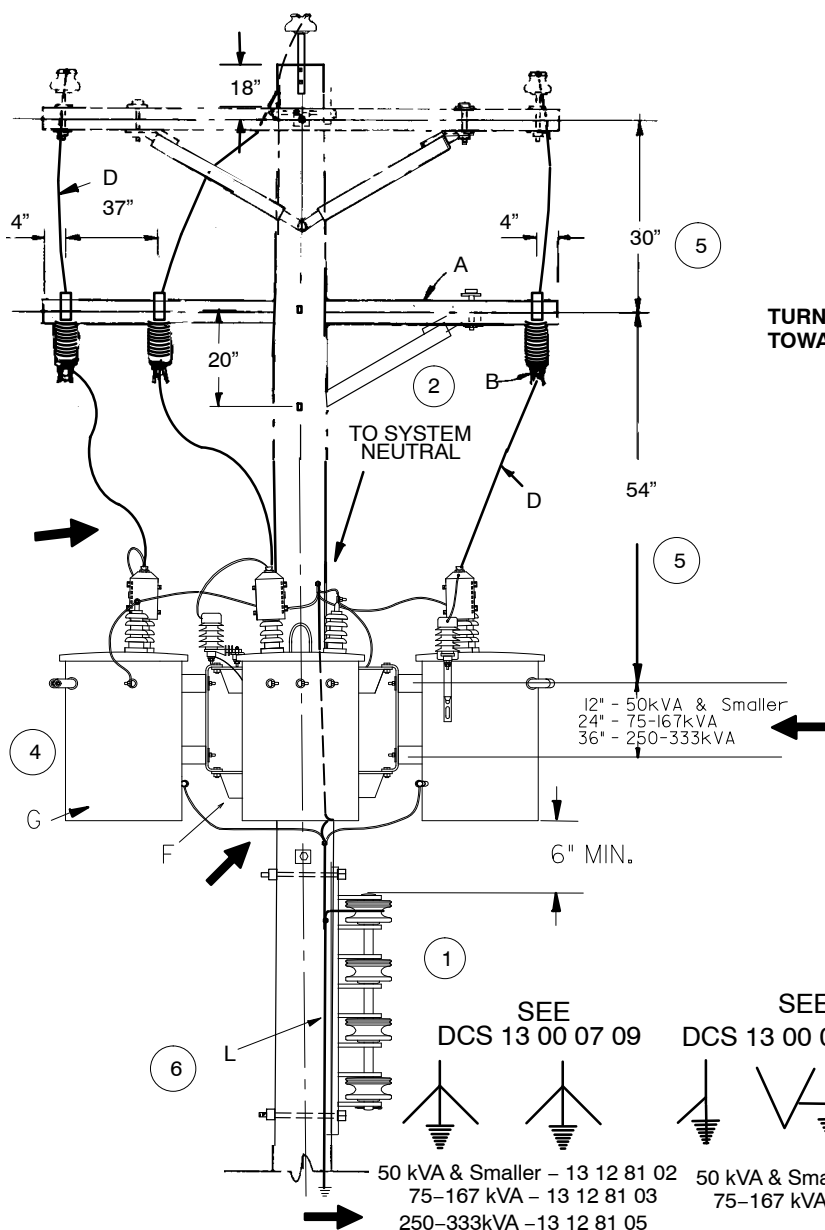
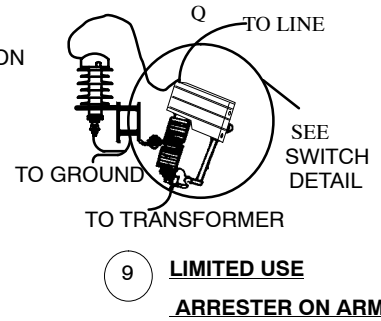
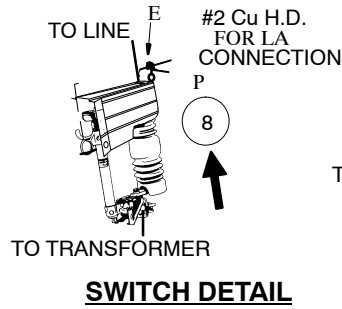
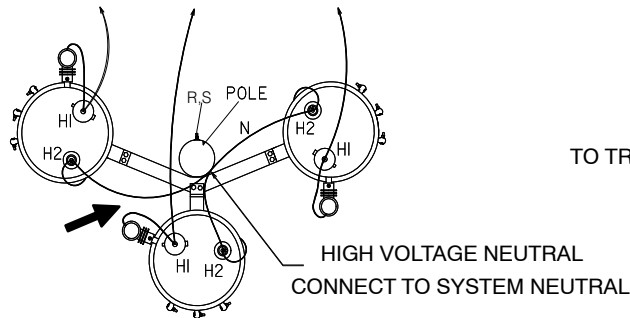
Three Single Phase Cluster Mounted

15 kV and Below Grounded Wye Primary Systems

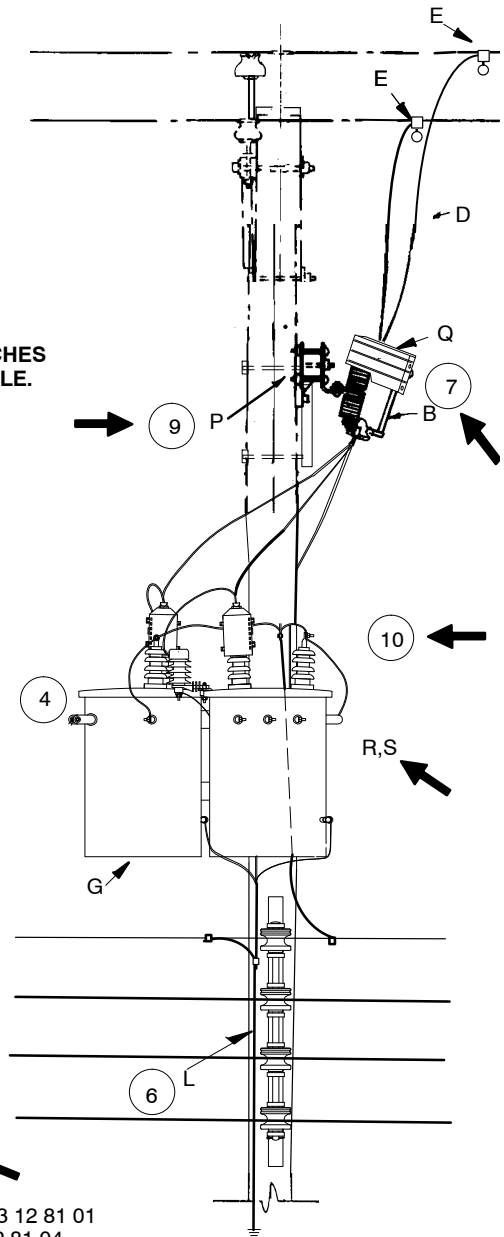
13 12 81 **

Sheet 1 of 2

GROUNDWYE PRIMARY CONNECTION TO FUSED CUTOUTS AND COMMON NEUTRAL



TURN SWITCHES
TOWARD POLE.



TRANSFORMERS
Three Single Phase Cluster Mounted
15 kV and Below Grounded Wye Primary Systems

13 12 81 **

Sheet 2 of 2



		Std. / Stk. No.	Description	13 12 81**	01	02	03	04	05
2	A	04 00 20 03	Crossarm 10' w/ 60" V Brace		1	1	1	1	1
7	B	54 07 208	Switch, Fused, 100A, 15kV		2	3	3	2	3
T10	D		Primary Leads (ft.) (See 13 00 03 01)		30	40	40	30	40
@8	E	HLC*W	Hot Line Clamp		4	6	6	4	6
	F	23 17 209	Mounting Unit 3 Pos. Light (Up To Three 50 KVA Trans.)		1	1			
		23 17 202	Mounting Unit 3 Pos. Heavy (Three 75–167 KVA Trans.)				1	1	
		23 17 354	Mounting Unit 3 Pos. Xtra Hvy (Three 250–333 KVA)						1
@	G		Transformer		2	3	3	2	3
@T	H		Secondary Leads (Ft.) (See 13 00 03 01)						
T	K	PG*	See 07 00 25 00		1	1	1	1	1
@6	L	12 00 10 **	Grounding Unit		1	1	1	1	1
@3	N		Link, Fuse		2	3	3	2	3
@4	O	16 01 301	Tag, Banked Transformer			3	3		3
9	P	17 58 054	Bracket, Crossarm, Heavy Duty		2	3	3	2	3
7	Q	23 17 411	Cover – Cutout		2	3	3	2	3
	R	23 52 219	Bolt, Mach., 3/4" x 14"		2	2	2	2	
	S	23 66 031	Washer, Curved, 3/4"		2	2	2	2	

NOTES:

1. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
2. Use only one V Brace. Keep the extra brace for future use.
3. See DCS 10 00 01 01 for fuse selection.
4. Use tag, Stock #16 01 301 to identify transformers that have been rewired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally. See DCS 13 00 07 09.
5. These dimensions may be reduced to 24" and 48" for installation on existing pole.
6. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
7. For transformer banks greater than 500 KVA on 4KV circuits, substitute 200A fused switches stock #54 07 209.
8. For all of Illinois and locations in Missouri where additional avian protection is required, omit #2 CU HD wire and hot line clamps and connect #6 CU poly covered arrester lead wire directly to the fused switch connector.
9. ONLY FOR INSTALLATION WHERE ARRESTERS CANNOT BE MOUNTED ON THE TRANSFORMER TANKS, substitute crossarm bracket with stock #23 56 088 and mount arresters on crossarm back-to-back with the fused switches. See note 8 for avian protection.
10. 2400/4160Y transformers may have side wall or cover mounted HV bushings. If side wall mounted bushings:
 - a. Build according to this DCS except use 2.5 KV primary lead wire per Table 2.2 of DCS 13 00 03 01, or
 - b. If pole is congested, 2.5KV primary lead wire in conduit similar to DCS 13 04 54 01.

TRANSFORMERS

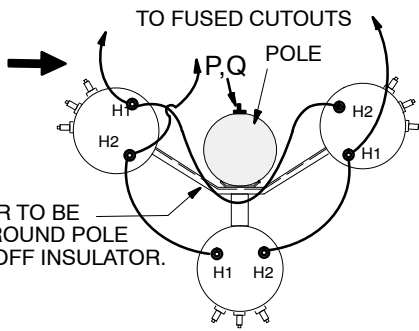
Three Single Phase Cluster Mounted

→ 15kV and Below Delta Primary Systems

13 12 82 **

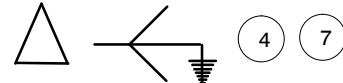
Sheet 1 of 2

DELTA PRIMARY CONNECTION

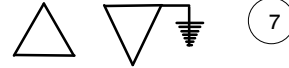


NOTE:
THIS JUMPER TO BE
CARRIED AROUND POLE
ON STAND-OFF INSULATOR.

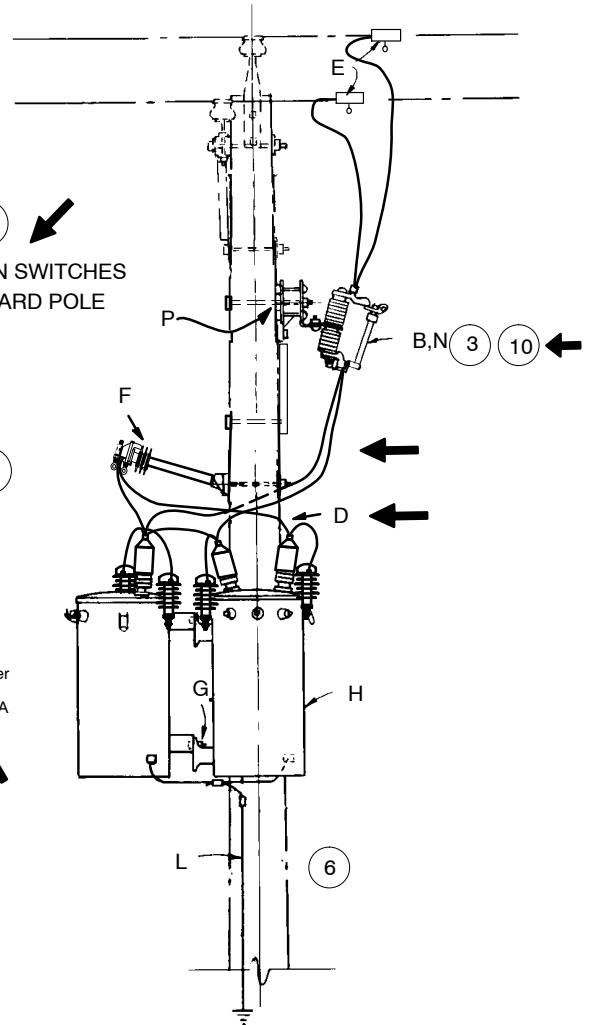
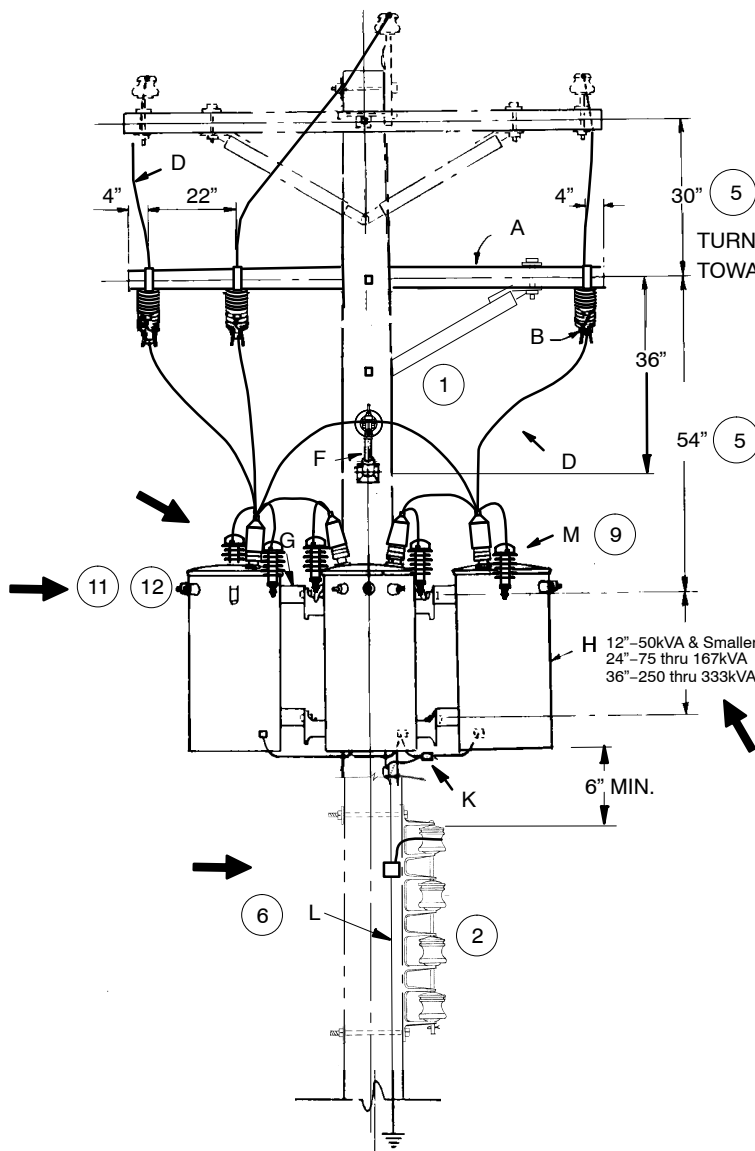
DCS 13 00 07 08



DCS 13 00 07 05



DCS 13 00 07 12



TRANSFORMERS
 Three Single Phase Cluster Mounted
 → 15kV and Below Delta Primary Systems

13 12 82 **

Sheet 2 of 2



		Std. / Stk. No.	Description	13 12 82 **	01	02	03	04	05
1	A	04 00 20 03	Crossarm 10' w/ 60" V brace		1	1	1	1	1
10	B	54 07 208	Switch Fused 100A 15kV		2	3	3	2	3
T11	D	18 51 025	Primary Leads (Ft.)		30	40	40	30	40
@	E	HLC*W	Hot Line Clamp		2	3	3	2	3
	F	06 12 20 04	Insulator, Standoff 18" LD		1	1	1	1	1
	G	23 17 209	Mounting Unit 3 Pos. Light (Up To Three 50 KVA Trans.)		1	1			
		23 17 202	Mounting Unit 3 Pos. Heavy (Three 75–167 KVA Trans.)				1	1	
		23 17 354	Mounting Unit 3 Pos. Xtra Hvy. (Three 250–333 kVA)						1
@	H		Transformer		2	3	3	2	3
@T	J		Secondary Leads (Ft.) (See 13 00 03 01)						
T	K	PG*	See 07 00 25 00		1	1	1	1	1
@6	L	12 00 10 **	Grounding Unit		1	1	1	1	1
@9	M		Lightning Arresters (See 12 00 01 01)		2	3	3	2	3
@3	N		Link, Fuse		2	3	3	2	3
@4	O	16 01 301	Tag, Banked Transformer		2	3	3	2	3
	P	17 58 054	Bracket, Crossarm, Heavy Duty		2	3	3	2	3
	Q	23 52 219	Bolt, Mach, 3/4" X 14"		2	2	2	2	
	R	23 66 031	Washer, Curved 3/4"		2	2	2	2	

NOTES:

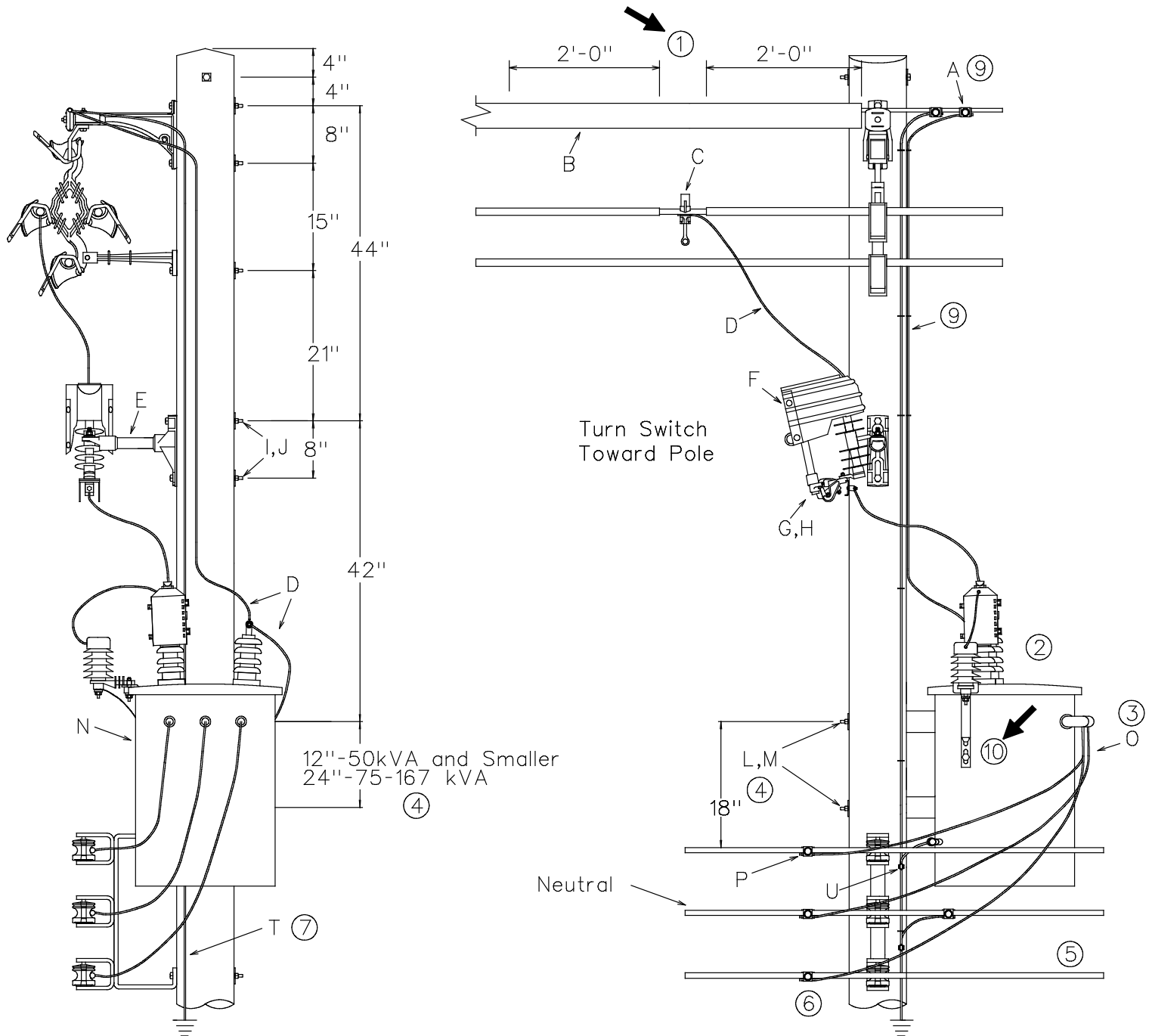
- Use only one V-brace. Keep the extra brace for future use.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- See DCS 10 00 01 01 for fuse selection.
- Use tag, Stock #16–01–301 to identify transformers that have been rewired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally. See DCS 13 00 07 08.
- These dimensions may be reduced to 24" and 48" for installation on an existing pole.
- Use DCS 12 00 10 01 for ground coil application on new pole installation and DCS 12 00 10 02 for ground rod application on existing pole installation.
- For closed delta primary applications: 50 kVA and smaller – use 13 12 82 02
 75 kVA thru 167 kVA – use 13 12 82 03
 250 kVA thru 333 kVA – use 13 12 82 05
- For open delta primary applications: 50 kVA and smaller – use 13 12 82 01
 75 kVA thru 167 kVA – use 13 12 82 04
- 14.4kV transformers must have arresters ordered separately and field installed. Use arrester Stock #10–01–143 with tank mounting bracket Stock #23–06–122.
- For transformer banks greater than 500 kVA on 4 kV circuits, substitute 200 A fused switches stock #54–07–209.
- 2400/4160Y transformers may have side wall or cover mounted HV bushings. If side wall mounted bushings:
 - Build according to this DCS except use 2.5 kV primary lead wire per Table 2.2 of DCS 13 00 03 01, or
 - If pole is congested, 2.5 kV primary lead wire in conduit similar to DCS 13 04 54 01.
- If arresters cannot be mounted on transformer tanks, refer to switch details and associated notes on DCS 13 12 81**.

TRANSFORMERS

15kV & Below - Spacer Cable - Grounded Wye Primary
1 to 167kVA - Single Phase - Protected

13 20 00 01

Sheet 1 of 2



TRANSFORMERS
15kV & Below – Spacer Cable – Grounded Wye Primary
1 to 167kVA – Single Phase – Protected

13 20 00 01

Sheet 2 of 2

		Std. /Stk. No.	Description	13 20 00 01	
9	A	17 51 137	Connector, PG		1
1	B	69 58 293	Line DUC (Messenger Cover), Black (Each)		1
@	C	17 62 088	Hot Line Clamp 1/0 through 477 Spacer Cable		1
		17 62 143	Hot Line Clamp 795 Spacer Cable		1
	D	18 51 025	Wire, Trans. Riser #4, S.D. Poly Covered (FT.)		20
	E	23 06 127	Bracket, Cutout, Single-Position		1
	F	23 17 411	Cover, Cutout, 100 Amp		1
8	G	54 07 208	Switch, Fused, 100 Amp		1
@	H		Link, Fuse – See Single-Phase Trans. Table in 10 00 01 01		1
	I	23 52 066	Bolt, Machine, 5/8" x 14" (w/nut)		2
	J	23 66 027	Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick		2
T	L	23 52 066	Bolt, Machine, 5/8" x 14" (w/nut) (50kVA & Below)		2
		23 52 219	Bolt, Machine, 3/4" x 14" (w/nut) (75 & 167kVA)		2
T	M	23 66 027	Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick (50kVA & Below)		2
		23 66 031	Washer, Square, 3/4", Curved (75 to 167kVA)		2
@	N		Transformer – See 13 00 01 02		1
T	O		Secondary Leads (FT.) (See 13 00 03 01)		12
T	P	PG*W	Connector, Lead Wire Connections (See 07 00 25 00)		3
@7	T	12 00 10 02	7#10 Grounding Unit With Ground Rod		1
	U	17 54 373	Connector, Split Bolt		1

NOTES:

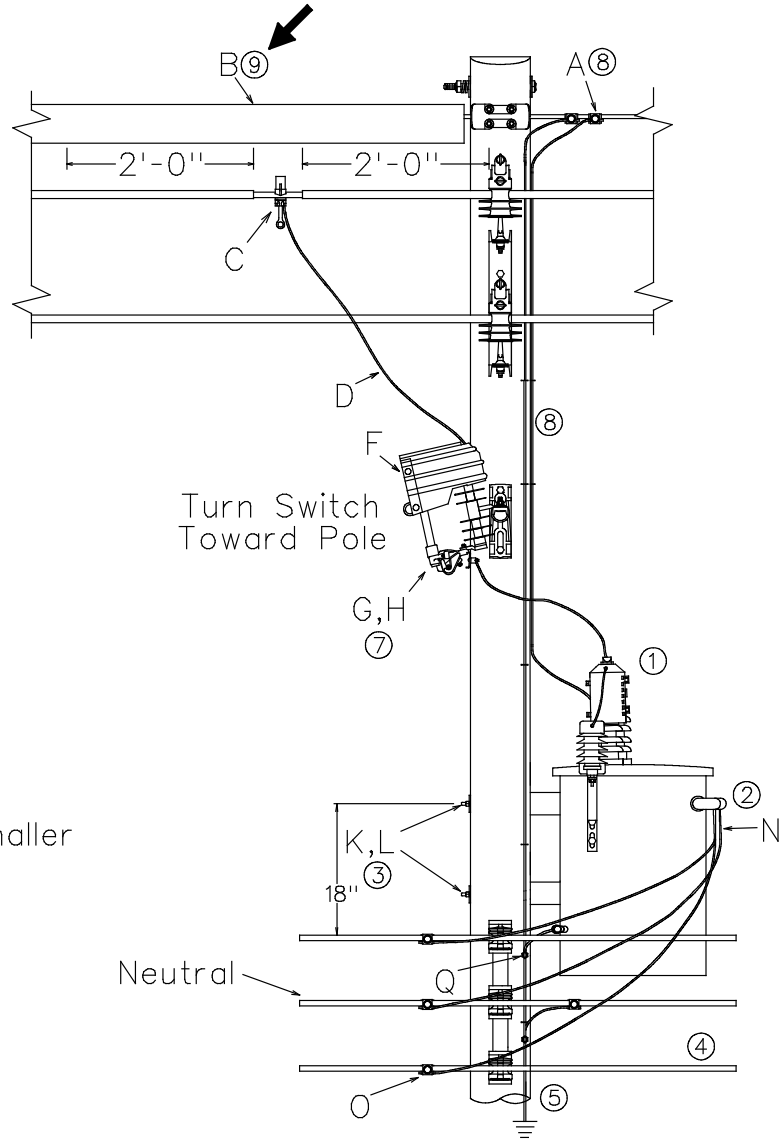
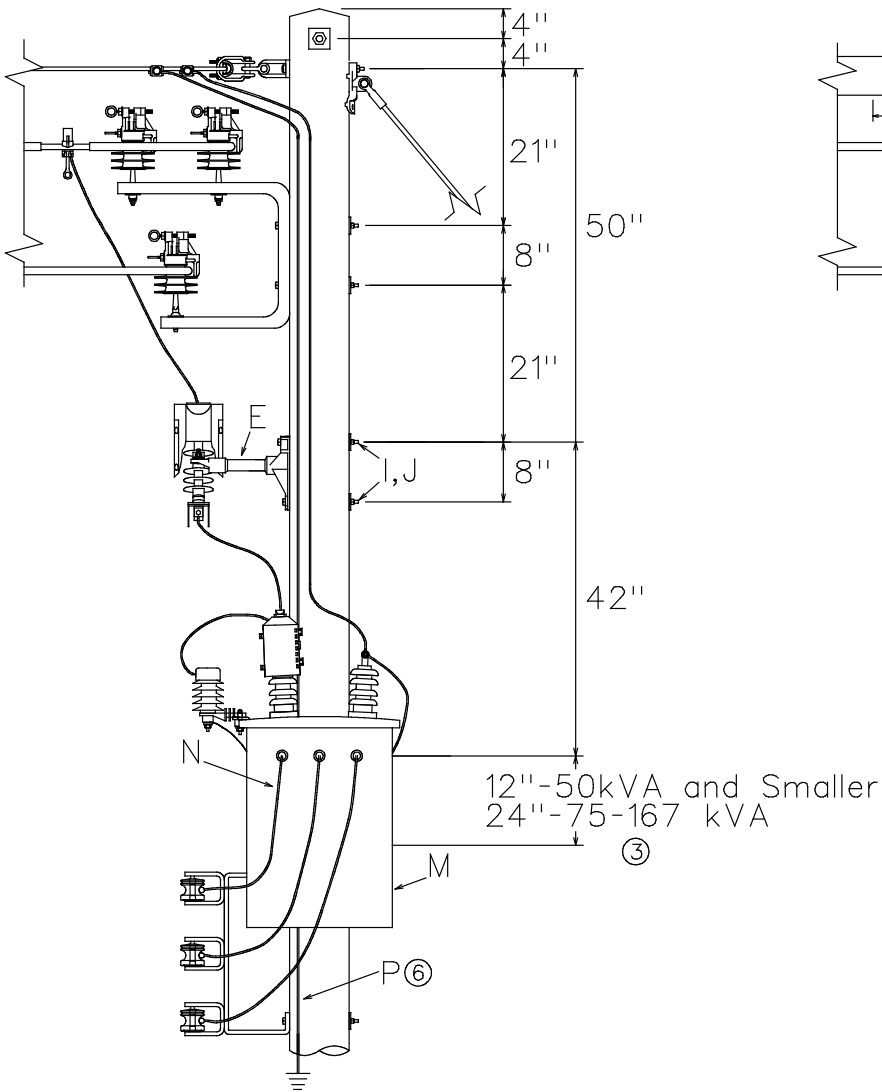
1. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.
2. Transformer may be received with the LA mounted beside either the H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of tank.
3. See DCS 13 00 06 02 for 120/240 or 240/480V 3-wire. See DCS 13 00 06 03 for 240 or 120V 2-wire.
4. Measure the distance between the mounting slots and drill so that the transformer rests evenly on both bolts. This distance is approximately 12 inches for transformers 50kVA and below, and 24 inches for 75kVA and above. The secondary rack position does not change.
5. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
6. If pole is NOT truck accessible, make secondary connections on the climbing side of the pole.
7. Install a pole ground if not already installed on pole.
8. If installing a CSP transformer, a fused switch shall be installed.
9. Note that the messenger also serves as the system neutral, so the transformer high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
10. If an existing transformer does not have the tapped lug holes for a tank mounted arrester, refer to DCS 12 12 05 **.

CONFIGURATIONS

13 20 03 01

15kV & Below - Spacer Cable - Grounded Wye Primary
1 to 167kVA - Single Phase - Protected - Angle Structure 7° - 60°

Sheet 1 of 2



CONFIGURATIONS**13 20 03 01**

15kV & Below – Spacer Cable – Grounded Wye Primary
 1 to 167kVA – Single Phase – Protected – Angle Structure 7°– 60°

Sheet 2 of 2

		Std. / Stk. No.	Description	13 20 03 01	01
@	A	17 51 137	Connector, PG		1
	B	69 58 293	Line Duc (Messenger Cover), Black, 8' Long (Each)		1
	C	17 62 088	Hot Line Clamp 1/0 through 477 Spacer Cable		1
		17 62 143	Hot Line Clamp 795 Spacer Cable		1
@	D	18 51 025	Wire, Trans. Riser #4, S.D. Poly Covered (Ft.)		20
	E	23 06 127	Bracket, Cutout, Single-Position		1
	F	23 17 411	Cover, Cutout, 100 Amp		1
	G	54 07 208	Switch, Fused, 100 Amp		1
T	H		Link, Fuse (See 10 00 01 01)		1
	I	23 52 066	Bolt, Machine, 5/8" x 14" (w/ nut)		2
	J	23 66 027	Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick		2
	K	23 52 066	Bolt, Machine, 5/8" x 14" (w/ nut) (50kVA & Below)		2
T		23 52 219	Bolt, Machine, 3/4" x 14" (w/ nut) (75 to 167kVA)		2
	L	23 66 027	Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16" Thick (50kVA & Below)		2
		23 66 031	Washer, Square, 3/4", Curved (75 to 167kVA)		2
	M		Transformer – See 13 00 01 02		1
T	N		Secondary Leads (FT.) (See 13 00 03 01)		12
	O	PG*W	Connector, Lead Wire Connections (See 07 00 25 00)		3
	P	12 00 10 02	7#10 Grounding Unit With Ground Rod		1
	Q	17 54 373	Connector, Split Bolt		1

NOTES

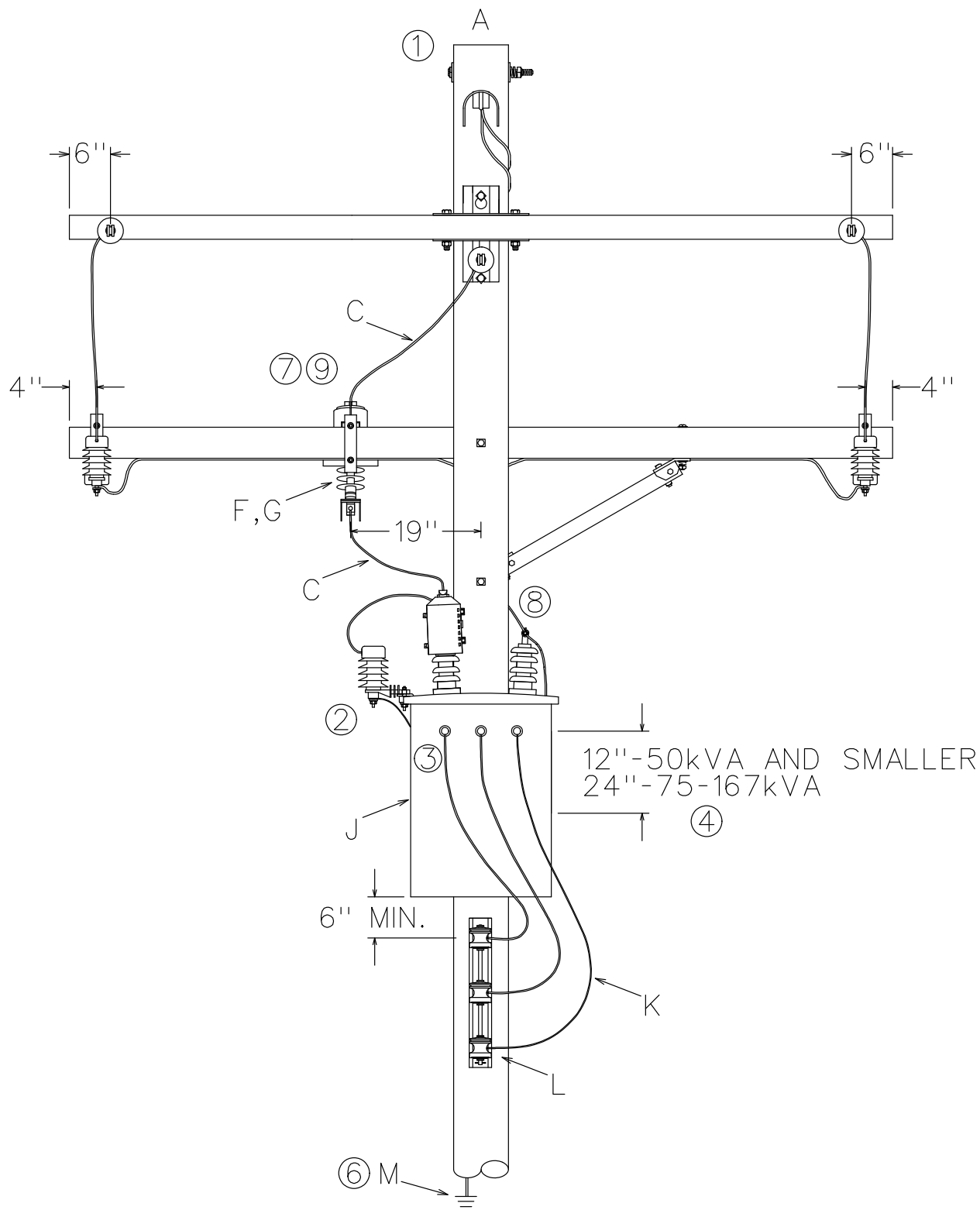
- Transformer may be received with the LA mounted beside either the H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of tank.
- See DCS 13 00 06 02 for 120/240 or 240/480V 3-wire. See DCS 13 00 06 03 for 240 or 120V 2-wire.
- Measure the distance between the mounting slots and drill so that transformer rests evenly on both bolts. This distance is approximately 12 inches for transformers 50kVA and below, and 24 inches for 75kVA and above. The secondary rack position does not change.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- If pole is NOT truck accessible, make secondary connections on the climbing side of the pole.
- Install a pole ground if not already installed on pole.
- If installing a CSP transformer, a fused switch shall be installed.
- Note that the messenger also serves as the system neutral, so the transformer high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

TRANSFORMERS

15kV & Below – Spacer Cable – 3 Phase Dead End Structure
1 to 167kVA – Single Phase – Protected

13 20 10 01

Sheet 1 of 3

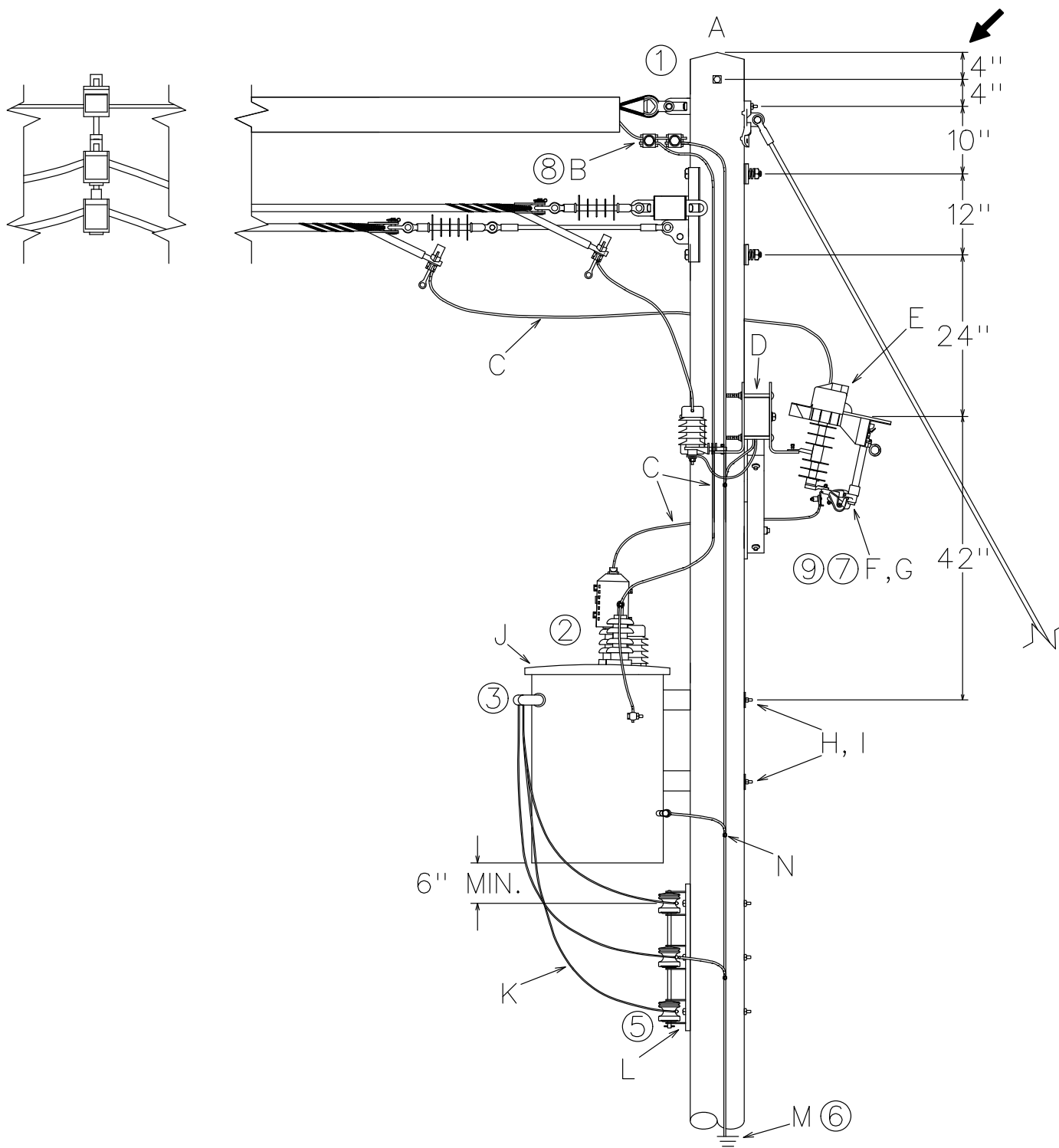


TRANSFORMERS

15kV & Below – Spacer Cable – 3 Phase Dead End Structure
1 to 167kVA – Single Phase – Protected

13 20 10 01

Sheet 2 of 3



TRANSFORMERS

15kV & Below – Spacer Cable – 3 Phase Dead End Structure
1 to 167kVA – Single Phase – Protected

13 20 10 01

Sheet 3 of 3

		Std./Stk. No.	Description	13 20 10 01
@1	A	03 20 10 01	15kV & Below – Spacer Cable Single Circuit – Dead End Structure	
8	B	17 51 137	Connector, PG	1
	C	18 51 025	Wire, Trans. Riser #4, S.D. Poly Covered (Ft.)	20
	D	17 58 054	Bracket, Crossarm, Cutout	1
	E	23 17 411	Cover, Cutout, 100 Amp	1
7, 9	F	54 07 208	Switch, Fused, 100 Amp	1
@	G		Link, Fuse – See Single Phase Transformer Table in 10 00 01 01	1
T	H	23 52 066	Bolt, Machine, 5/8" x 14" (w/ nut) (50kVA and Below)	2
		23 52 219	Bolt, Machine, 3/4" x 14" (w/ nut) (75 to 167kVA)	2
T	I	23 66 027	Washer, Square, 5/8", 2 1/4" x 2 1/4" x 3/16", Thick (50kVA and Below)	2
		23 66 031	Washer, Square, 3/4", Curved (75 to 167kVA)	2
@	J		Transformer – See 13 00 01 02	1
T	K		Secondary Leads (FT.) (See 13 00 03 01)	12
T	L	PG*W	Connector, Lead Wire Connections (See 07 00 25 00)	3
@6	M	12 00 10 **	7#10 Grounding Unit	1
	N	17 54 373	Connector, Split Bolt	1

NOTES:

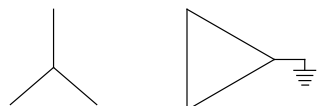
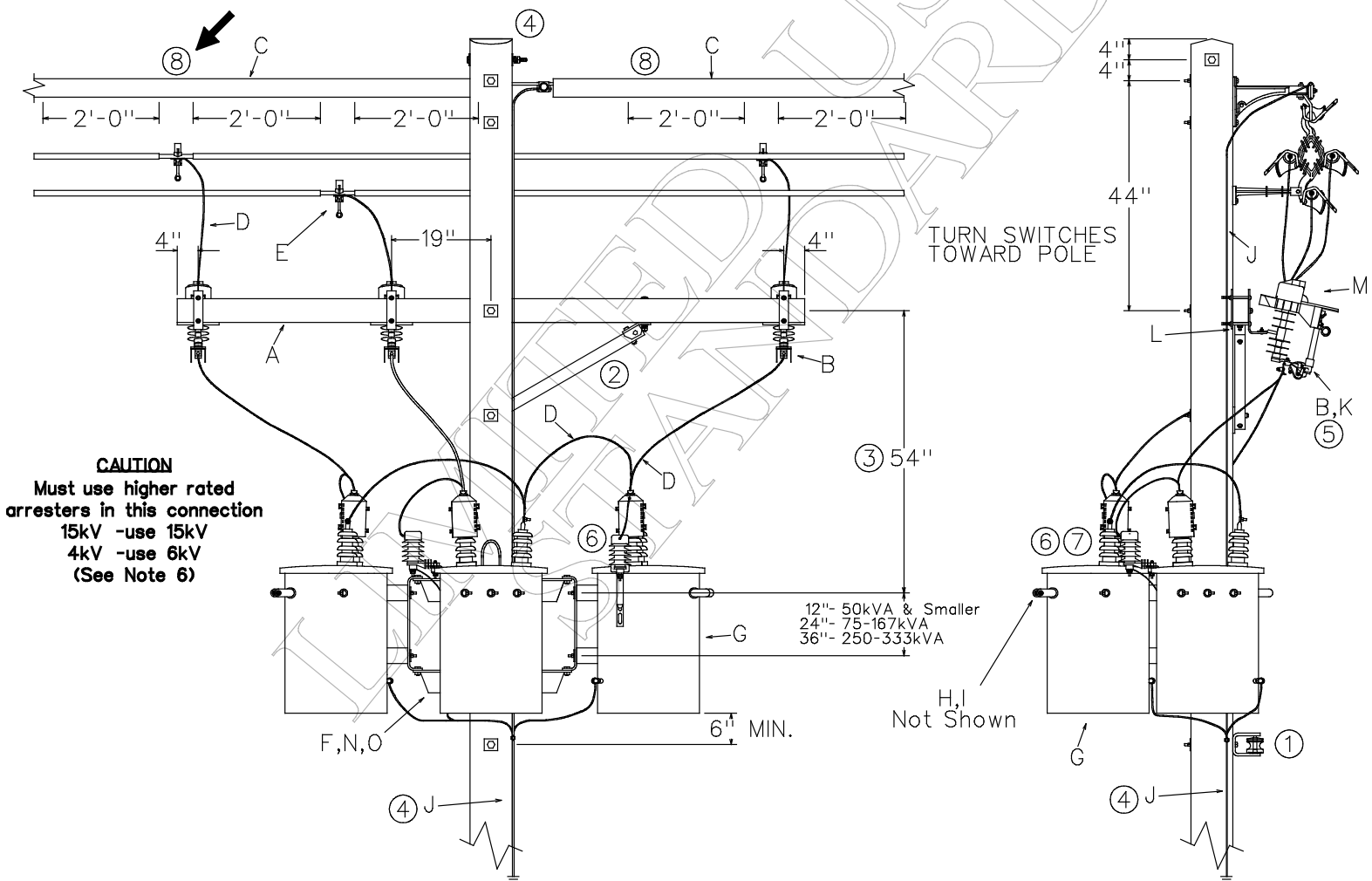
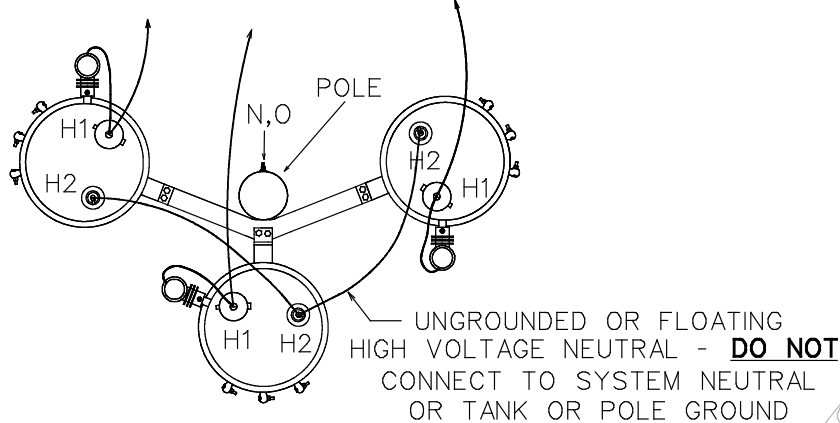
- Construct pole using 03 20 10 01. Mount the equipment arm on the guyed side of the pole as shown and omit one lightning arrester and replace with a switch as specified in this standard. Only two lightning arresters are required on the crossarm for the unprotected phases. The tank mounted arrester will be used to protect the phase that is tapped for the transformer.
- Transformer may be received with the LA mounted beside either the bushing H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of the tank.
- See DCS 13 00 06 02 for 120/240 or 240/480V 3-wire. See DCS 13 00 06 03 for 240 or 120V 2-wire.
- Measure the distance between the mounting slots and drill so that the transformer rests evenly on both bolts. This distance is approximately 12 inches for transformers 50kVA and below, and 24 inches for 75kVA and above. The secondary rack position does not change.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
- If installing a CSP transformer, a fused switch shall be installed.
- Note that the messenger also serves as the system neutral, so the transformer high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
- Switch may be mounted on any of the three positions on the LA arm depending on which phase is used.

TRANSFORMERS

15kV & Below - Spacer Cable - Three Single Phase Transformers Ungrounded-Wye Primary - Delta Secondary

13 20 80 **
Sheet 1 of 2

FLOATING WYE PRIMARY CONNECTION TO FUSED CUTOUTS



50kVA & Smaller - 13 20 80 01
75kVA - 167kVA - 13 20 80 02
250kVA- 333kVA- 13 20 80 03

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: DG
REV. NO: 1
REV. DATE: 06/19/18

TRANSFORMERS
15kV & Below – Spacer Cable – Three Single Phase
Transformers Ungrounded-Wye Primary – Delta Secondary

13 20 80 **
Sheet 2 of 2

		Std. / Stk. No.	Description	13 20 80 **	01	02	03
2	A	04 00 20 03	Crossarm 10' w/ 60" V Brace		1	1	1
5	B	54 07 208	Switch Fused 100A 15kV		3	3	3
	C	69 58 293	Line DUC (Messenger Cover), Black (ea.)		2	2	2
T	D	18 51 025	Primary Leads (ft.) (See 13 00 03 01)		40	40	40
@	E	17 62 088	Hot Line Clamp 1/0 through 477 Spacer Cable		3	3	3
		17 62 143	Hot Line Clamp 795 Spacer Cable		3	3	3
	F	23 17 209	Mounting Unit, 3 Pos. Light (Up To Three 50 KVA Trans.)		1		
		23 17 202	Mounting Unit, 3 Pos. Heavy (Three 75kVA to 167kVA Trans.)			1	
		23 17 354	Mounting Unit, 3 Pos. Xtra Hvy (Three 250kVA to 333kVA Trans.)				1
@	G		Transformer (See 13 00 01 02)		3	3	3
T	H		Secondary Leads (ft.) (See 13 00 03 01)				
T	I	PG*	Connector, Lead Wire Connections (See 07 00 25 00)				
@4	J	12 00 10 02	Grounding Unit, 7#10 Copperweld With Ground Rod		1	1	1
@	K		Link, Fuse – See Three-Phase Trans. Table in 10 00 01 01		3	3	3
	L	17 58 054	Bracket, Crossarm, Heavy Duty		3	3	3
	M	23 17 411	Cover – Cutout, 100 Amp		3	3	3
	N	23 52 219	Bolt, Mach., 3/4" x 14"		2	2	
	O	23 66 031	Washer, Curved, 3/4"		2	2	

NOTES:

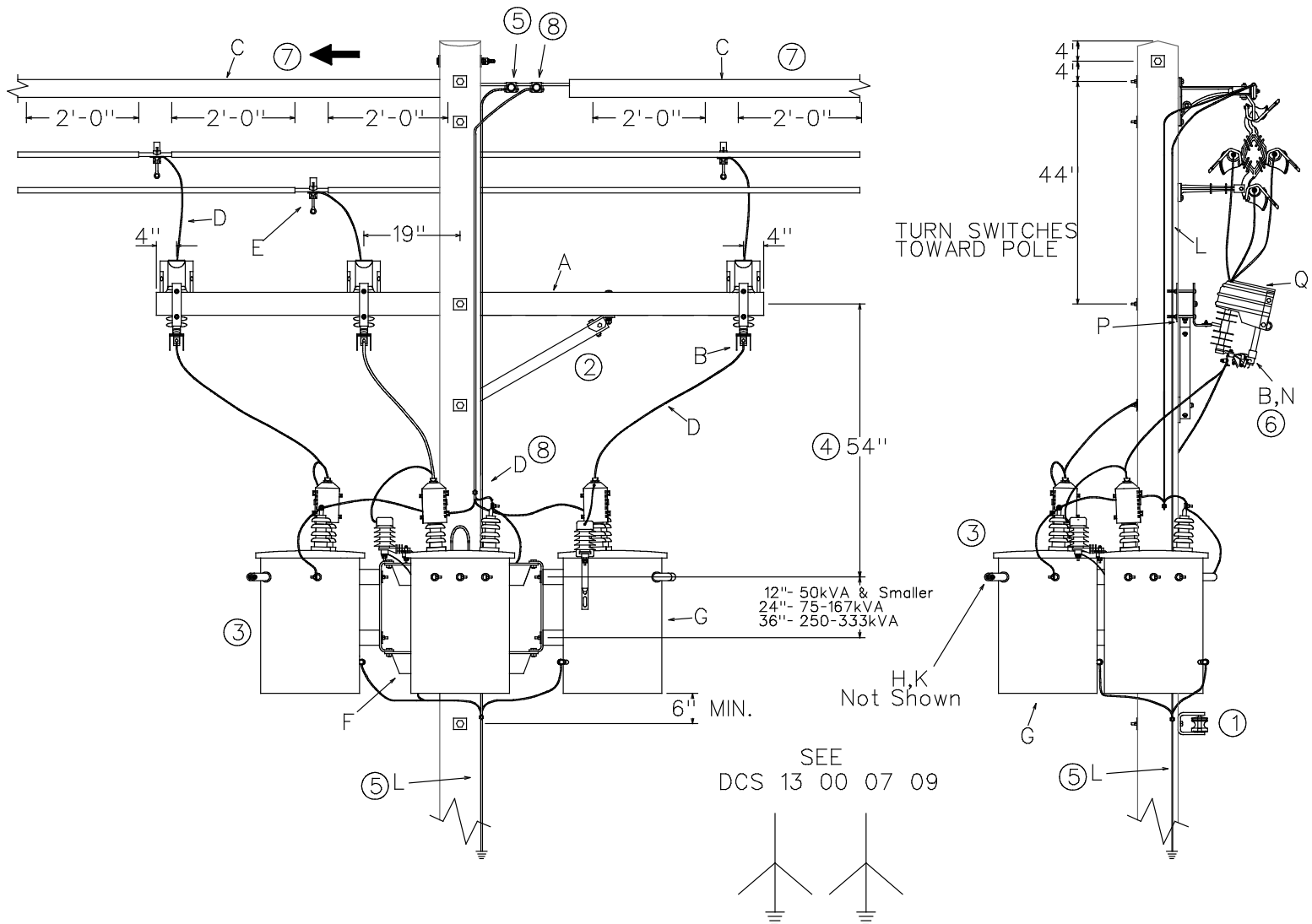
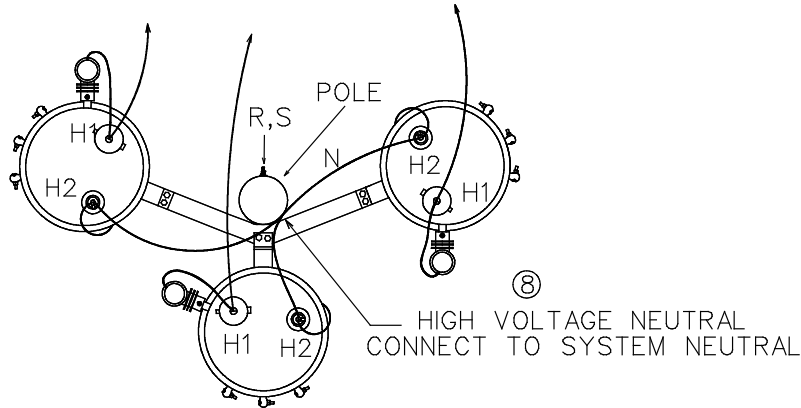
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Use only one V Brace. Keep the extra brace for future use.
- This dimension may be reduced to 48" for installation on existing pole.
- All poles with spacer cable should be installed with a pole ground. Add a pole ground if not already installed. Pole ground shall extend up to the messenger which is the system neutral and attached on the single switch side of the pole.
- Substitute 200A fused switches stock #54 07 209 for transformer banks greater than 500kVA on 4kV circuits.
- For 7.2, 7.62, and 7.97kV transformers use 15kV arrester stock #10 01 188. For 2.4kV transformers use 6kV arrester stock #10 01 184.
- 2400/4160 Y Transformers may have sidewall or cover mounted HV bushings. If sidewall mounted bushings:
 - Build according to the DCS except use 2.5 kV primary lead wire per Table 2.2 of DCS 13 00 03 01 or
 - If pole is congested, 2.5 kV primary lead wire in conduit similar to DCS 13 04 54 01.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

TRANSFORMERS

15kV & Below - Spacer Cable - Three Single Phase Transformers
Grounded - Wye Primary/Grounded - Wye Secondary

13 20 81 **
Sheet 1 of 2

GROUND WYE PRIMARY CONNECTION
TO FUSED CUTOUTS AND COMMON NEUTRAL



50kVA & Smaller - 13 20 81 01
75kVA - 167kVA - 13 20 81 02
250kVA- 333kVA- 13 20 81 03

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: DG
REV. NO: 2
REV. DATE: 06/19/18

TRANSFORMERS

15kV & Below - Spacer Cable - Three Single Phase Transformers
Grounded - Wye Primary/Grounded - Wye Secondary

13 20 81 **
Sheet 2 of 2

		Std. / Stk. No.	Description	13 20 81**	01	02	03
2	A	04 00 20 03	Crossarm 10' w/ 60" V Brace		1	1	1
6	B	54 07 208	Switch Fused 100A 15kV		3	3	3
	C	69 58 293	Line DUC (Messenger Cover), Black (ea.)		2	2	2
T	D	18 51 025	Primary Leads (ft.) (See 13 00 03 01)		40	40	40
@	E	17 62 088	Hot Line Clamp 1/0 through 477 Spacer Cable		3	3	3
		17 62 143	Hot Line Clamp 795 Spacer Cable		3	3	3
	F	23 17 209	Mounting Unit, 3 Pos. Light (Up To Three 50 KVA Trans.)		1		
		23 17 202	Mounting Unit, 3 Pos. Heavy (Three 75kVA to 167kVA Trans.)			1	
		23 17 354	Mounting Unit, 3 Pos. Xtra Hvy (Three 250kVA to 333kVA Trans.)				1
@	G		Transformer (See 13 00 01 02)		3	3	3
T	H		Secondary Leads (ft.) (See 13 00 03 01)				
T	K	PG*	Connector, Lead Wire Connections (See 07 00 25 00)				
@5	L	12 00 10 02	Grounding Unit		1	1	1
@	N		Link, Fuse - See Three-Phase Trans. Table in 10 00 01 01		3	3	3
@3	O	16 01 301	Tag, Banked Transformer		3	3	3
	P	17 58 054	Bracket, Crossarm, Heavy Duty		3	3	3
	Q	23 17 411	Cover - Cutout, 100 Amp		3	3	3
	R	23 52 219	Bolt, Mach., 3/4" x 14"		2	2	
	S	23 66 031	Washer, Curved, 3/4"		2	2	

NOTES:

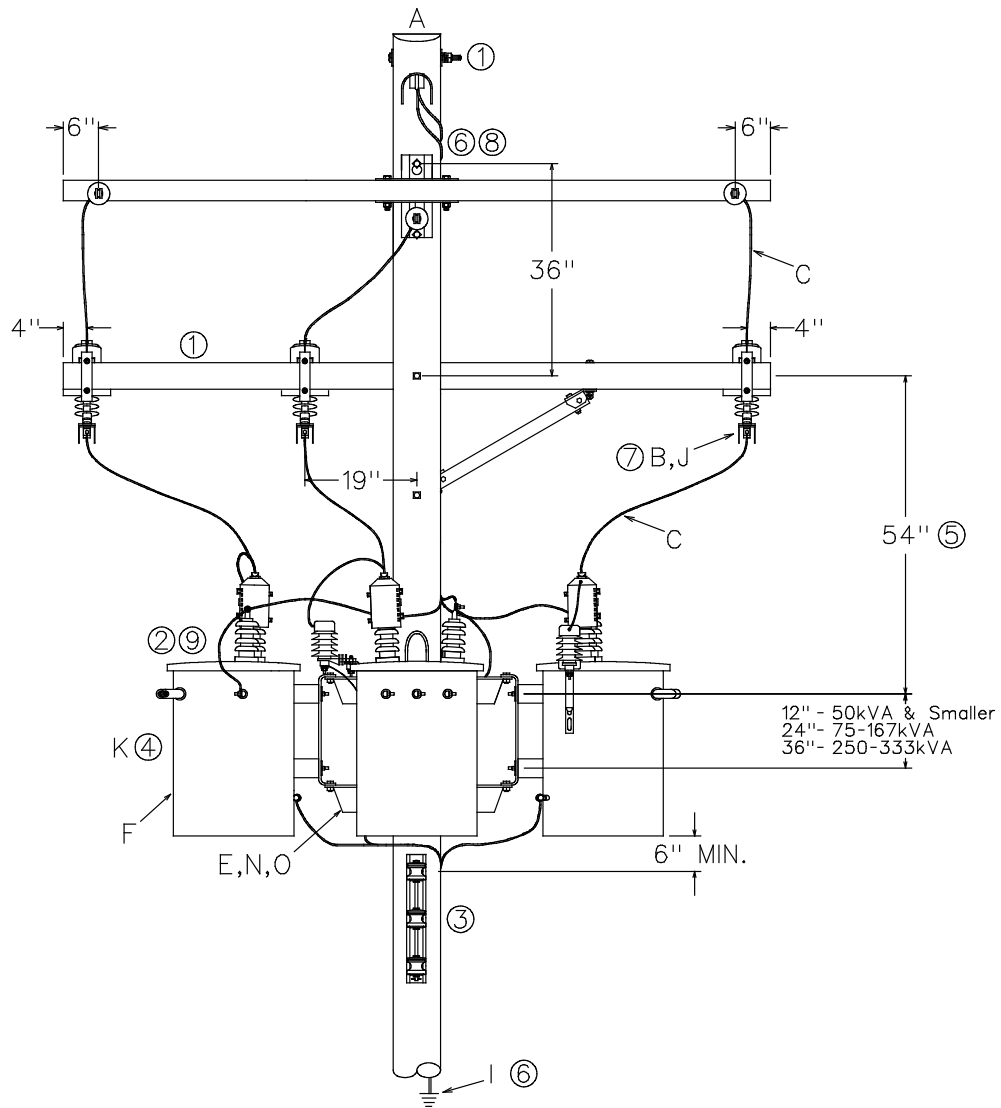
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Use only one V Brace. Keep the extra brace for future use.
- Install tag "Banked Transformer, 120/208Y" stock #16 01 301 to identify transformers that have been rewired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally. See DCS 13 00 07 09.
- This dimension may be reduced to 48" for installation on existing pole.
- All poles with spacer cable should be installed with a pole ground. Add a pole ground if not already installed. Pole ground shall extend up to the messenger which is the system neutral and attached on the single switch side of the pole.
- Substitute 200A fused switches stock #54 07 209 for transformer banks greater than 500kVA on 4kV circuits.
- Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation..
- Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushings up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.

TRANSFORMERS

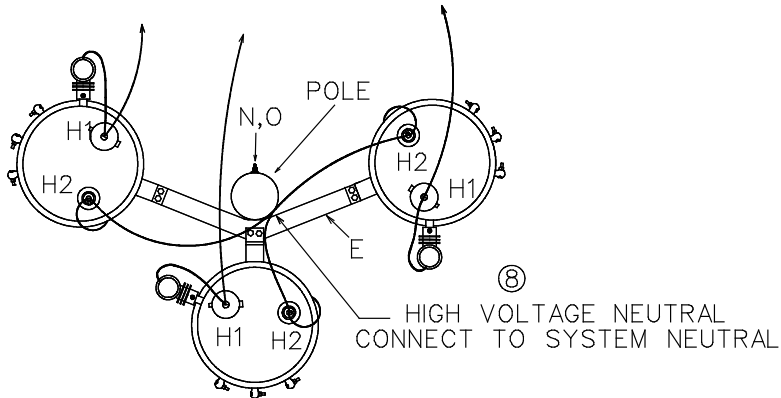
15 kV & Below - Spacer Cable - Dead End Structure
Three Single Phase Transformers - Grounded Wye Primary

13 20 85 **

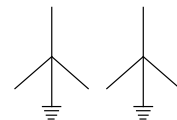
Sheet 1 of 3



GROUNDING WYE PRIMARY CONNECTION TO FUSED CUTOUTS AND COMMON NEUTRAL



SEE
DCS 13 00 07 09



50kVA & Smaller - 13 20 81 01
75kVA - 167kVA - 13 20 81 02
250kVA- 333kVA- 13 20 81 03

**DISTRIBUTION
CONSTRUCTION STANDARDS**



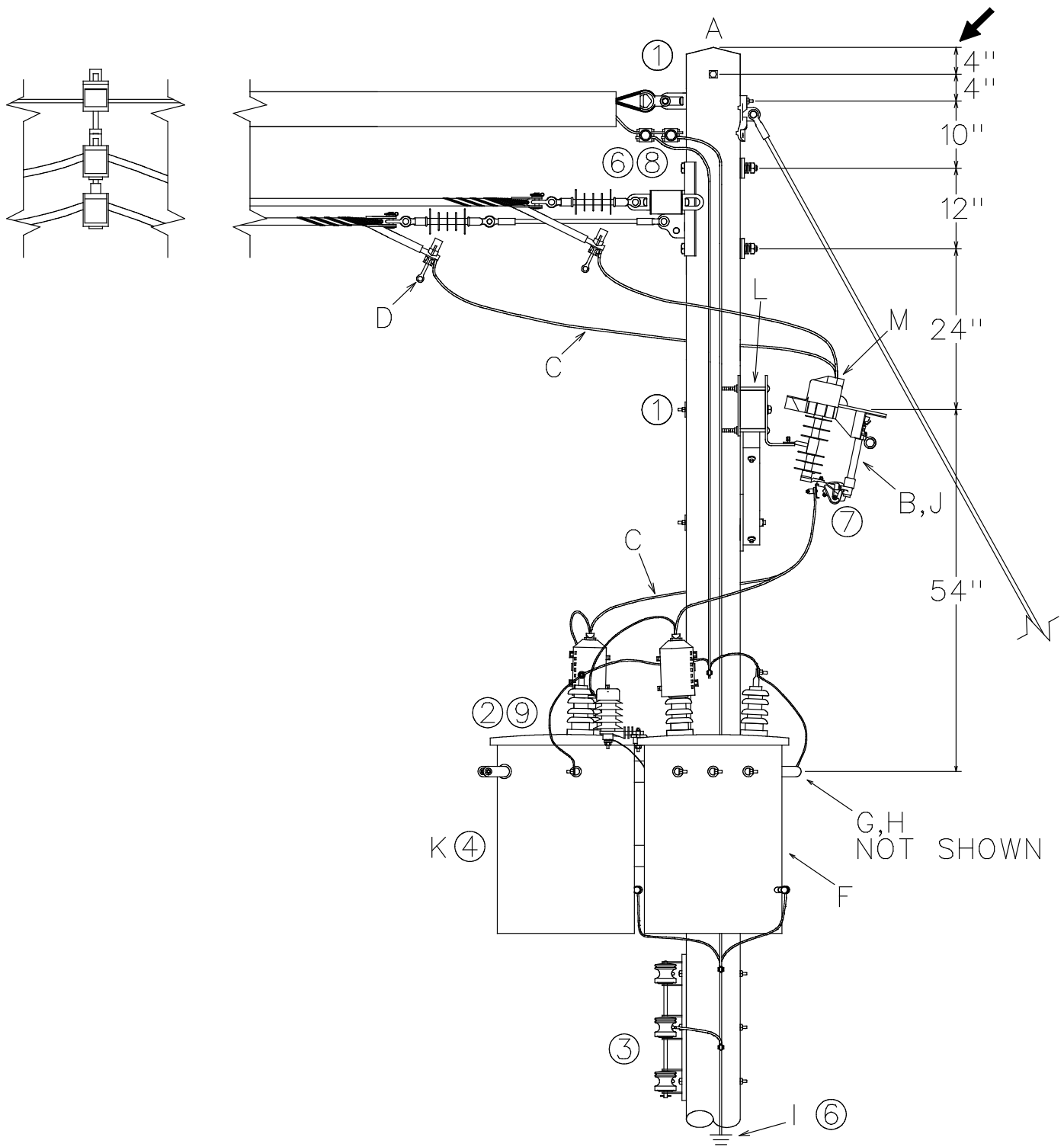
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REV. DATE: 07/02/18

TRANSFORMERS

15 kV & Below - Spacer Cable - Dead End Structure
Three Single Phase Transformers - Grounded Wye Primary

13 20 85 **

Sheet 2 of 3



TRANSFORMERS
15 kV & Below – Spacer Cable – Dead End Structure
Three Single Phase Transformers – Grounded Wye Primary

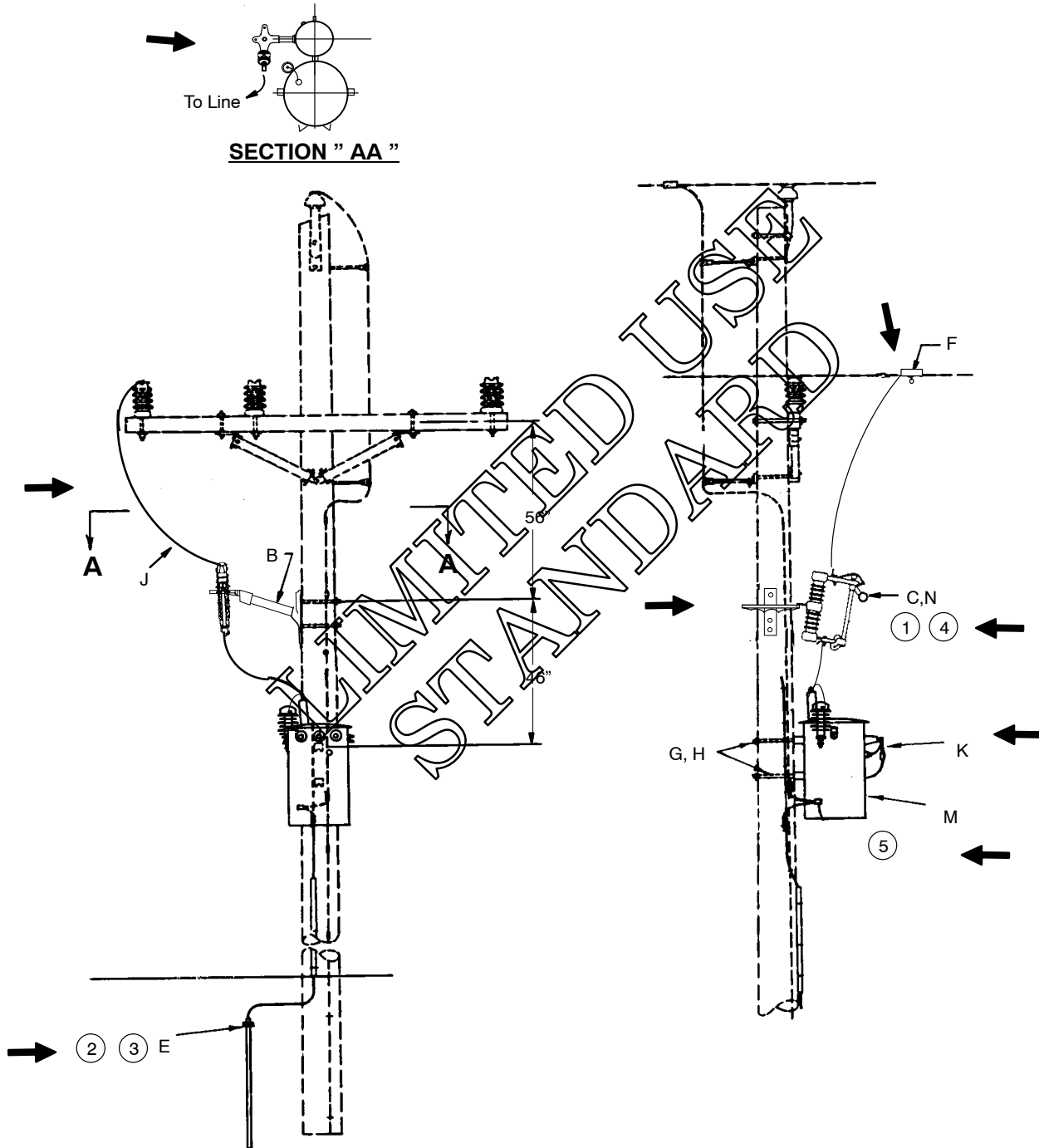
13 20 85 **
Sheet 3 of 3

		Std. / Stk. No.	Description	13 20 85 **	01	02	03
@1	A	03 20 10 01	15kV & Below – Spacer Cable Single Circuit – Dead End Structure		1	1	1
7	B	54 07 208	Switch, Fused, 100A 15kV		3	3	3
T	C	18 51 025	Primary Leads (ft.) (See 13 00 03 01)		40	40	40
@	D	17 62 088	Hot Line Clamp 1/0 through 477 Spacer Cable		3	3	3
		17 62 143	Hot Line Clamp 795 Spacer Cable		3	3	3
@	E	23 17 209	Mounting Unit, 3 Pos. Light (Up To Three 50 KVA Trans.)		1		
		23 17 202	Mounting Unit, 3 Pos. Heavy (Three 75kVA to 167kVA Trans.)			1	
		23 17 354	Mounting Unit, 3 Pos. Xtra Hvy (Three 250kVA to 333kVA Trans.)				1
@	F		Transformer (See 13 00 01 02)		3	3	3
T	G		Secondary Leads (ft.) (See 13 00 03 01)				
T	H	PG*W	Connector, Lead Wire Connections (See 07 00 25 00)				
@6	I	12 00 10 02	Grounding Unit, 7#10 Copperweld With Ground Rod		1	1	1
@	J		Link, Fuse, See Three Phase Trans. Table in 10 00 01 01		3	3	3
@4	K	16 01 301	Tag, Banked Transformer		3	3	3
@	L	17 58 054	Bracket, Crossarm, Heavy Duty		3	3	3
	M	23 17 411	Cover, Cutout, 100 Amp		3	3	3
	N	23 52 219	Bolt, Mach., 3/4" x 14"		2	2	
	O	23 66 031	Washer, Curved, 3/4"		2	2	

NOTES:

- Construct pole using 03 20 10 01. Mount the equipment arm on the guyed side of the pole as shown and omit the three lightning arresters and replace with switches as specified in this standard. The tank mounted arrester will be used to protect the phases that are tapped for the transformers.
- Transformer may be received with the LA mounted beside either the bushing H1 or H2 bushing. Both positions are acceptable. The arrester may be shifted to the most convenient side of the tank.
- See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
- Install tag "Banked Transformer, 120/208Y" stock #16 01 301 to identify transformers that have been rewired internally for 120/208Y service. The tag should be attached to the secondary bushing that is no longer connected internally. See DCS 13 00 07 09.
- This dimension may be reduced to 48" for installation on existing pole.
- All poles with spacer cable should be installed with a pole ground. Add a pole ground if not already installed. Pole ground shall extend up to the messenger which is the system neutral and attached on the single switch side of the pole.
- Substitute 200A fused switches stock #54 07 209 for transformer banks greater than 500kVA on 4kV circuits.
- Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushings up to the messenger separate from the pole ground. The transformer neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
- 2400/4160 Y Transformers may have sidewall or cover mounted HV bushings. If sidewall mounted bushings:
 - Build according to the DCS except use 2.5 kV primary lead wire per Table 2.2 of DCS 13 00 03 01 or
 - If pole is congested, 2.5 kV primary lead wire in conduit similar to DCS 13 04 54 01.

TO BE USED ON 34kV SYSTEM WITH A NEUTRAL



		Std. / Stk. No.	Description	13 34 01 **	01	02
1 @ 2,3 @ T T T T @ @4	B	23 56 063	Bracket, 3 Position Equipment Mount		1	1
	C	54 07 234	Switch Fused 100A 27kV		1	
		54 06 052	Switch, SMD-20, Overhead			1
	E	12 00 10 **	Grounding Unit		1	1
	F	HLC*W	Hot Line Clamp		1	1
	G	23 52 063	Bolt, Mach., 5/8" x 10" (50kVA & Smaller) OR		2	2
		23 52 095	Bolt, Mach., 3/4" x 10" (75 thru 167kVA)		2	2
	H	23 66 027	Washer, Square 5/8" (50kVA & Smaller) OR		2	2
		23 66 031	Washer Curved 3/4 (75 thru 167kVA)		2	2
	J	18 51 025	Primary Leads (Ft.)		15	15
	K		Secondary Leads (Ft.) (See 13 00 03 01)		12	12
	L	PG*	See 07 00 25 00		4	4
	M	VAXXXF	Transformer (34500 GRD.Y / 19920)		1	1
	N		Link, Fuse (See 10 00 01 01)		1	
			Refill, Fuse			1

NOTES:

1. If available fault current is less than 12 kA asymmetrical use 13 34 01 01. If available fault current is equal to or greater than 12 kA asymmetrical but less than 16 kA asymmetrical use 13 34 01 02. If asymmetrical fault current is greater than 16 kA, contact Distribution Standards.
2. On existing structure, the static wire ground may not be adequate to use as a transformer ground. Therefore, a separate ground (DCS 12 00 10 02) shall be installed for the transformer and it shall be bonded to the static ground.
3. On new structure, use grounding unit 12 00 10 09 as both the static and transformer ground.
4. If fuse refill is required, contact Distribution Standards for proper size to use.
5. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.

➔ 34kV – 120 or 120/240 Volt – Single Phase

Sheet 1 of 2

[illegible]



		Std. / Stk. No.	Description	13 34 02 **	01	02
3	A	10 01 235	Arrester 36kV, w/Transformer Mtg Brkt		2	
	B	04 00 20 02	Crossarm, 8' w / 60" V Brace		1	1
1	C	54 07 234	Switch Fused 100A 27kV		2	2
@4,5,6	E	12 00 10 **	Grounding Unit		1	1
@	F	HLC*W	Hot Line Clamp		2	2
T	G	23 52 063	Bolt, Mach., 5/8" x 10" (50kVA & smaller) OR		2	2
		23 52 095	Bolt, Mach., 3/4" x 10" (75 thru 250kVA)			2
T	H	23 66 027	Washer, Square 5/8" (50kVA & smaller) OR		2	2
		23 66 031	Washer, Curved, 3/4" (75 thru 250kVA)			2
T	J	18 51 025	Primary Leads (Ft.)		30	30
T	K		Secondary Leads (Ft.) (See 13 00 03 01)		12	12
T	L	PG*	See 07 00 25 00		4	4
@8	M	QK0010G	Transformer (34500–120)		1	
		QAXXXXF	Transformer (34500–120/240)			1
@2	N	20 53 197	Link, Fuse, 0.75X		2	
			Link, Fuse (See 10 00 01 01)			2

NOTES:

1. If available fault current is less than 12 kA asymmetrical use switch and fuse link shown. If available fault current is equal to or greater than 12 kA asymmetrical but less than 16 kA asymmetrical use SMD–20 switch (54–06–052). If asymmetrical fault current is greater than 16 kA. contact Distribution Standards.
2. If fuse refill is required, for QK0010G transformer use 1A fuse refill (stock # 20–04–361). For QAXXXXF transformer, contact Distribution Standards for proper size to use.
3. QAXXXXF transformer are purchased with arresters pre-installed. Arresters must be field installed on QK0010G transformer.
4. On an existing structure the static ground may not be adequate to use as a transformer ground. Therefore, a separate ground (DCS 12 00 10 02) shall be installed for the transformer and it shall be bonded to the static ground.
5. On a new structure with a static wire having a minimum of four grounds per mile, use grounding unit 12 00 10 09 as both the static and transformer ground.
6. If no static or common/primary neutral is present refer to DCS 13 00 06 06 for installation of grounds.
7. See DCS 13 01 01 ** for secondary support and DCS 03 01 20 ** for secondary configurations.
8. For QK0010G, use 13 34 02 01. For QAXXXXF use 13 34 02 02.

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69KV TERMINAL POLE 500 KCMIL – 1000 KCMIL

14-69-01-**



CABLE TERMINALS

Location & Placement of Risers

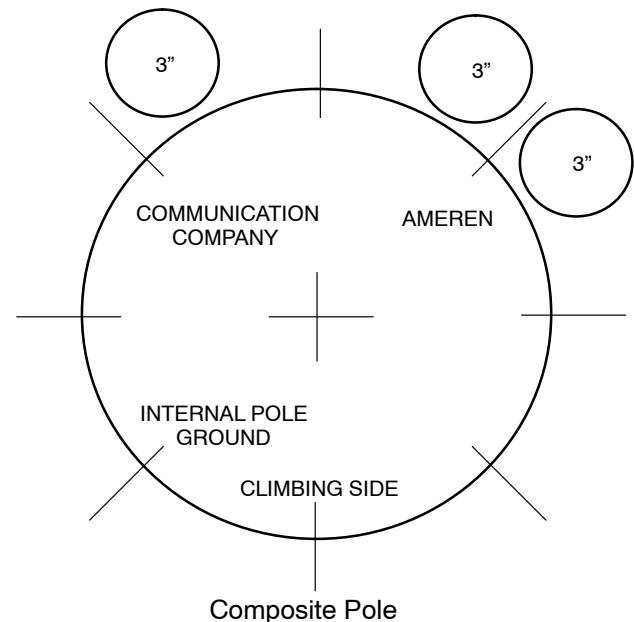
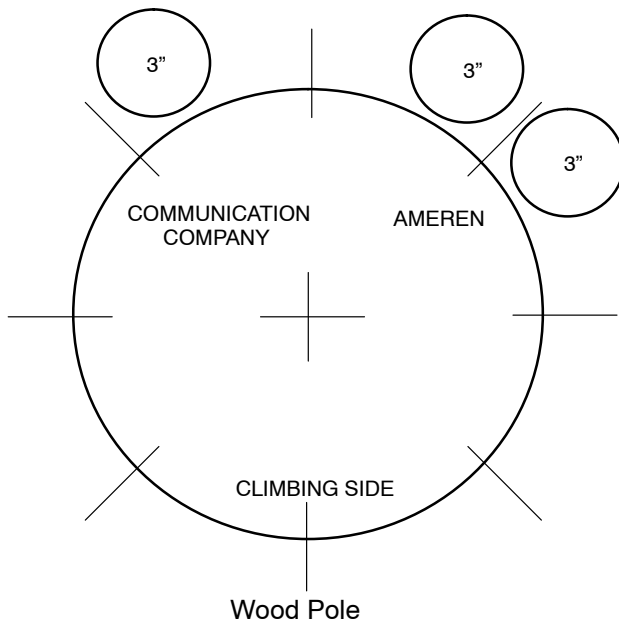
On Joint Use Poles

14 00 01 02

Sheet 1 of 1

Composite poles are a new addition to the Ameren distribution and sub-transmission systems. Below are the guidelines for communication companies using Ameren wood and composite poles.

1. Ameren and communication companies vertical runs shall not be placed on the same pole if it is practicable to place them on separate poles. If vertical runs must be placed on the same pole, the runs shall be placed in adjacent quadrants so that one-half of the pole is left open for climbing.
2. A riser should not be placed on a pole which by its addition exceeds the allotted quadrant or infringes on that portion of the pole considered as the climbing side.
3. Where an existing riser is in slotted circuit, an additional riser on the same pole should be placed in the same conduit, if possible, in order to conserve pole space. Primary and secondary risers may be placed in the same conduit.
4. Preferred construction will be Schedule 80 conduit for the first 10 foot section. If non-shielded cable operating above 2000 volts to ground is to be installed, a metal guard must be installed over the conduit.
5. Communication companies can be attached by pre-fabricated bolted option or by field assembly banded option on composite pole.



Ameren riser combinations which can be attached directly to the pole. This includes any ground wire lead which may be present on the pole.

Conduit	Conduit Riser								
	One Riser						Two Risers		
Diameter	2"	2-1/2"	3"	4"	5"	6"	2"	2-1/2"	3"

I. GENERAL INFORMATION

1. According to an NESC subcommittee's interpretation, metal brackets and straps used to support non-conductive conduits do not need to be grounded. However, conductive-material conduits that enclose electrical supply lines or are exposed to contact with open supply conductors must be effectively grounded.
2. Ideally, the first (lowest) standoff bracket will be positioned a minimum of 8' above ground to prevent anyone from walking into the bracket or using it to climb the pole. If the lowest bracket is less than 8' above the ground or any other accessible surface, there must be a minimum of 8' between the two lowest brackets.
3. If the conduit being supported is conductive (steel or iron) and the standoff bracket is less than 8' above ground the bracket must be bonded to the system neutral.
4. The bond will be made with #6 solid copper conductor.
5. The #6 solid copper conductor must be attached to the conduit support bracket and then trained along the DA bolt or bracket and attached to the system neutral or static wire.

ANY AND ALL BONDING MUST BE TO THE SYSTEM NEUTRAL OR STATIC WIRE

6. The #6 solid copper conductor that is trained along the DA bolt or bracket may be secured to the DA bolt or bracket with plastic wire ties.

II. BONDING METHOD #1 – CONDUIT STRAPS

This method is for bonding to conduit straps. Examples of the support brackets that may require this type of bonding are shown in Figures 1 & 2.

In addition to the general instructions shown in Section I, the following instructions will apply.

1. Remove a conduit strap bolt.
2. Install two washers on the strap bolt and replace the bolt.

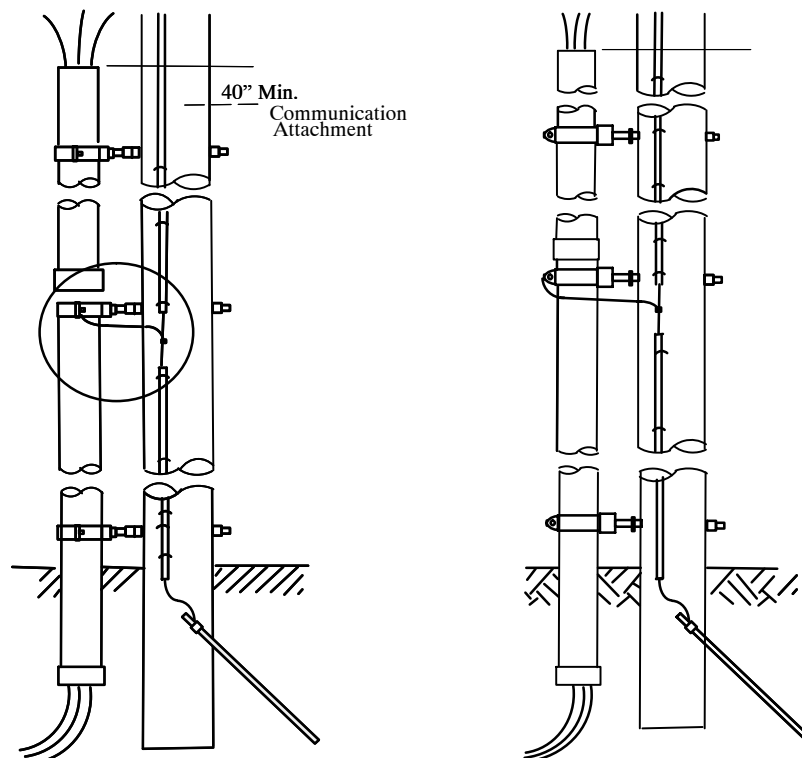


Figure 1

3. Wrap the #6 CU around the strap bolt between the two washers and tighten the bolt securely.

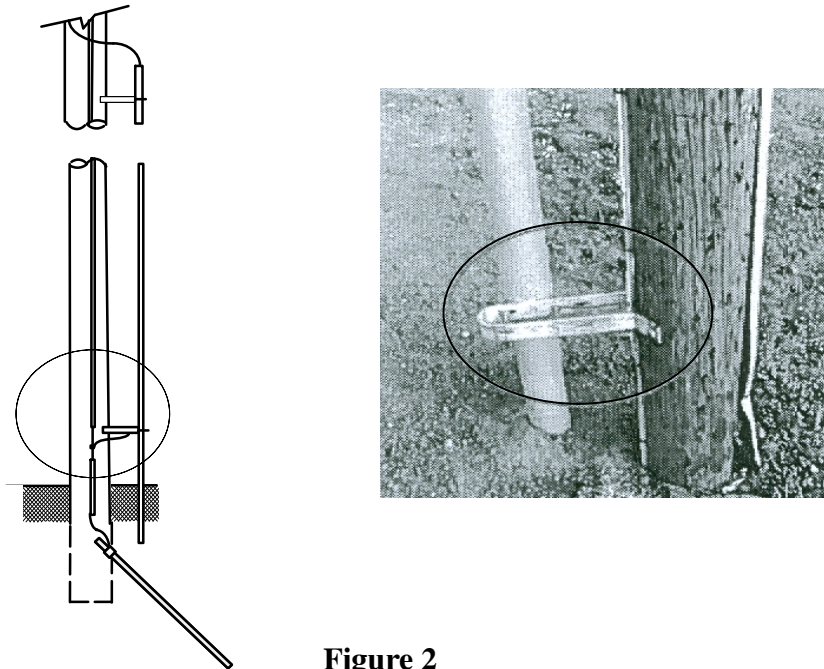


Figure 2

III. BONDING METHOD #2 – SLOTTED SUPPORT BRACKETS

This method is for bonding slotted conduit support bracket. Figure 3 shows the bonding on an H-slotted conduit support bracket. In addition to the general instructions shown above the following instructions will apply.

1. Use a transformer ground connector (Stk.#69-58-121) and M-F locknut (Stk.#23-65-053).
2. Place the M-F locknut on the transformer ground connector stud and then slide the nut into the small slot on the support bracket.
3. Tighten the transformer ground connector into the locknut.
4. Insert the #6 CU conductor into the transformer ground connector and securely tighten.

Note: Some slotted conduit support brackets may have pre-drilled holes. If the holes are of sufficient size, the transformer ground connector may be installed into one of the pre-drilled holes.

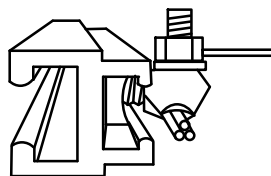
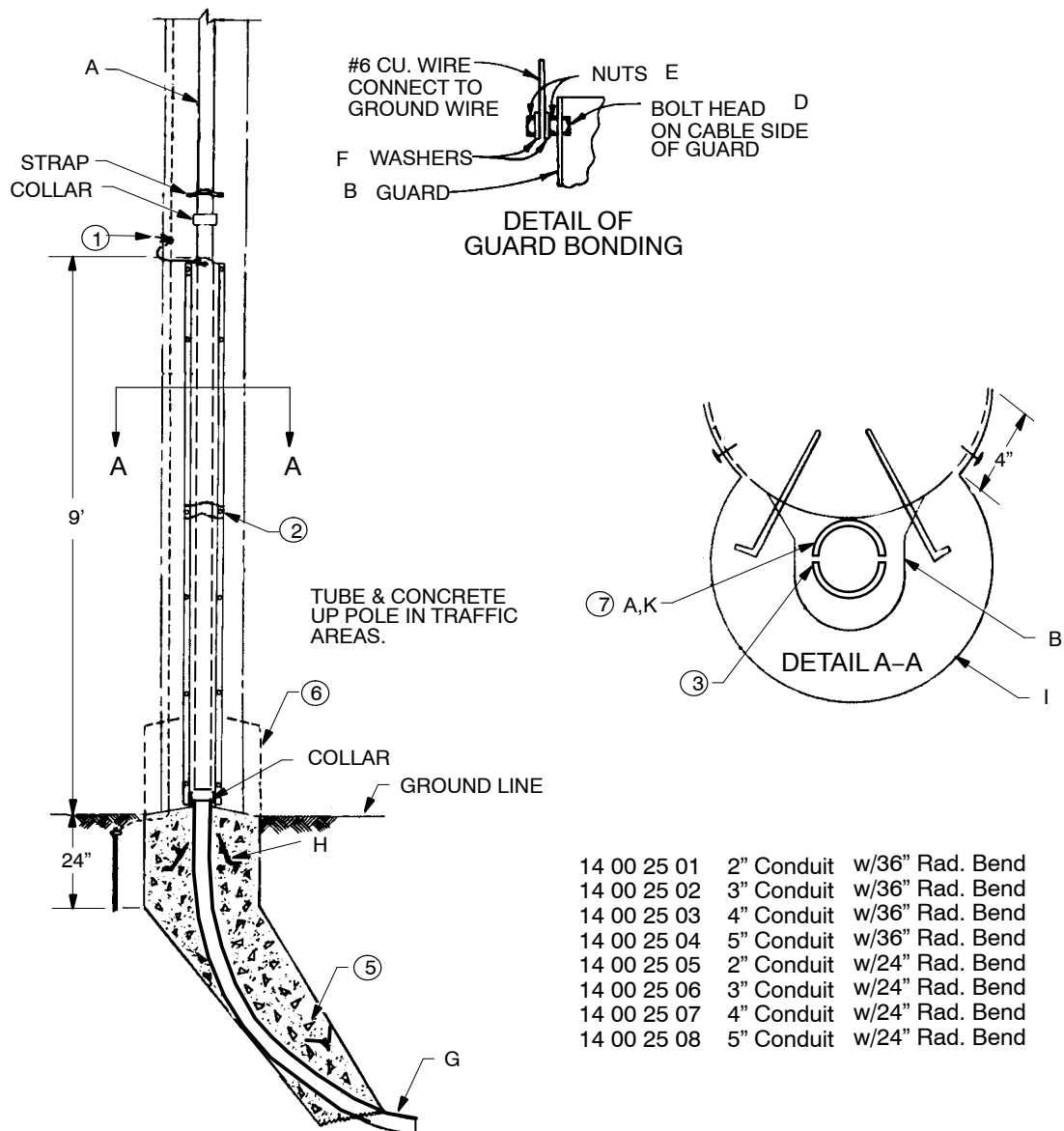


Figure 3

THIS STANDARD MUST BE USED FOR NON-SHIELDED CABLES ABOVE 2000V

THIS STANDARD MAY BE USED FOR REPAIRS TO EXISTING RISERS MOUNTED DIRECTLY TO THE POLE



NOTES:

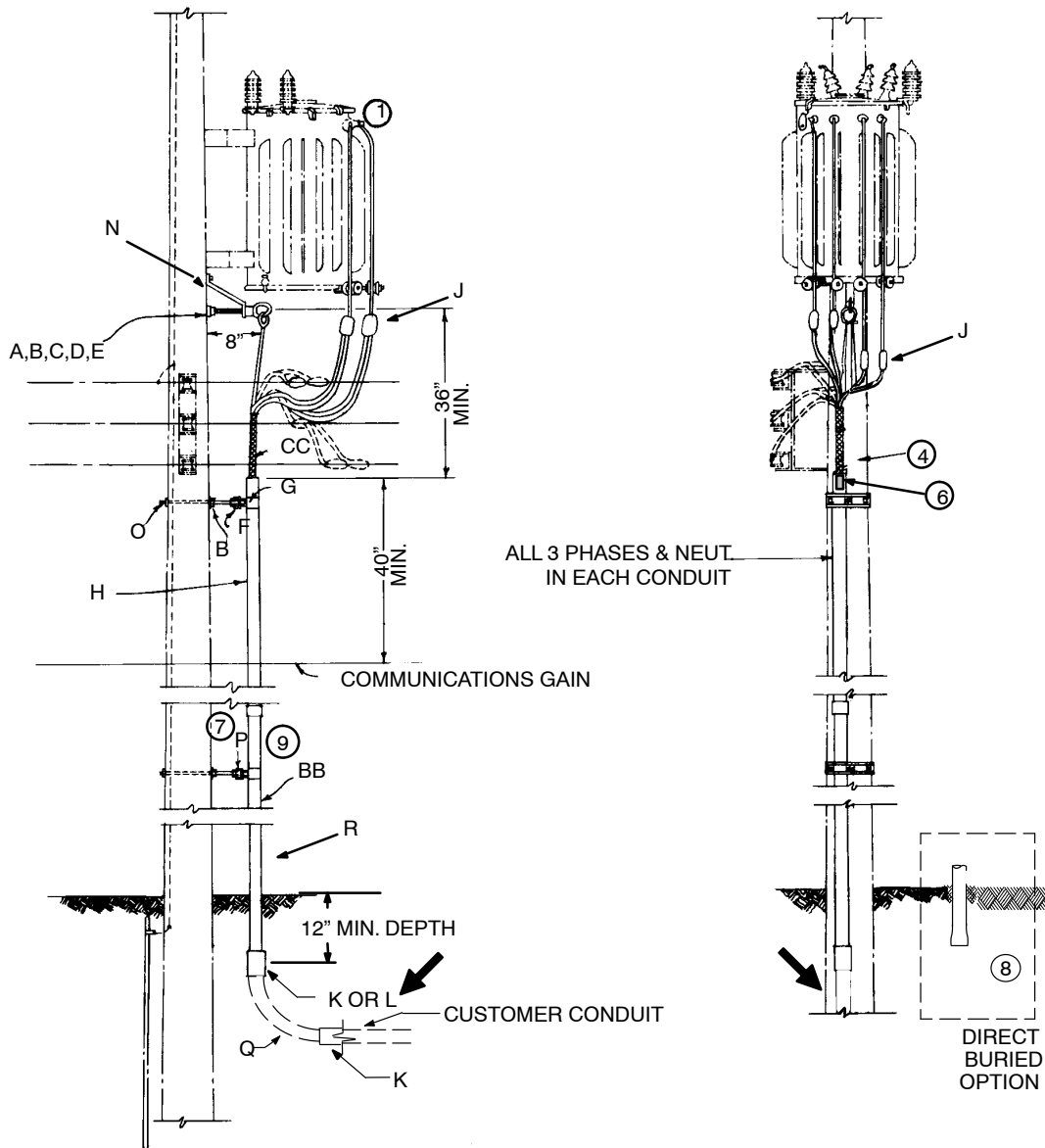
1. Bond guard to neutral conductor or to lightning arrester ground, if present.
2. 3" steel guards may be in 2-5' sections. If so, overlap lower section and align lag bolt holes.
3. Rotate split conduit so that splits are away from pole.
4. Cut the tube lengthwise: Bend back 4" tab for 10" dia. tube, 5" for 14" tube. See Detail A-A.
5. Additional Concrete on Bend ** - 03, 04, 07, 08. 6 to 8 cubic feet needed.
6. When located in possible traffic areas, the concrete cylinder protecting the conduit shall be extended up the pole. Bumper height - 18 inches to 2 ft.
7. Schedule 40 conduit may be substituted for the split conduit.

CABLE TERMINALS
One Riser w/ U Guard
2", 3", 4", & 5" Split Conduit or Schedule 40

14 00 25 **

Sheet 2 of 2

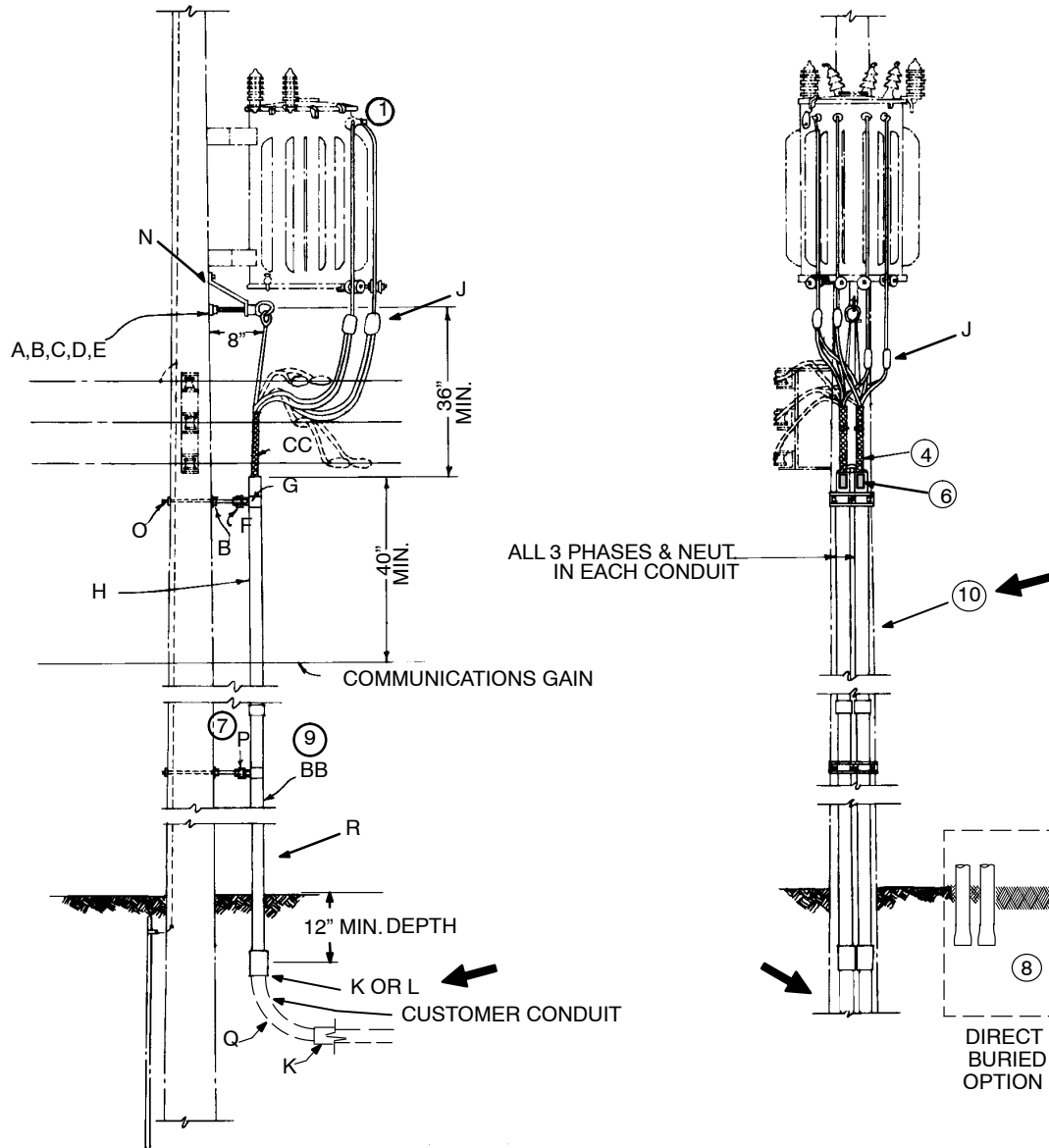
		Std. / Stk. No.	Description	14 00 25 **	01	02	03	04	05	06	07	08
@ @7	A	12 51 217	Cond. – Plas., 2" Split		10'				10'			
		12 51 218	Cond. – Plas. 3" Split			10'				10'		
		12 51 219	Cond. – Plas. 4" Split				10'				10'	
		12 51 220	Cond. – Plas. 5" Split					10'				10'
	B	23 18 237	Guard – Conduit 3"		1	1			1	1		
		23 18 202	Guard – Conduit 5"				1	1			1	1
	C	23 60 005	Screw – Lag 3/8" x 3"		10	10	6	6	10	10	6	6
	D	21 53 007	Bolt – Mach., 3/8" x 1-1/2"		1	1	1	1	1	1	1	1
	E	21 61 006	Nut – Hex., 3/8"		2	2	2	2	2	2	2	2
	F	23 66 016	Washer – 3/8" Galv.		2	2	2	2	2	2	2	2
	G	12 51 180	Bend – 2", 36" Rad		1							
		12 51 173	Bend – 3", 36" Rad			1						
		12 51 176	Bend – 4", 36" Rad				1					
		12 51 206	Bend – 5", 36" Rad					1				
		12 51 252	Bend – 2", 24" Rad						1			
		12 51 253	Bend – 3", 24" Rad							1		
		12 51 249	Bend – 4", 24" Rad								1	
		12 51 250	Bend – 5", 24" Rad									1
	H	23 67 036	Step – Pole 5/8 x 10"				2	2			2	2
	I	11 04 109	Tube – Concrete 10" Dia.		4	4			4	4		
		11 04 110	Tube – Concrete 14" Dia.				4	4			4	4
	J	98 00 001	Concrete 4 SK									
	K	12 01 280	Cond. – Plas. 2" Sch. 40		10				10			
		12 01 279	Cond. – Plas. 3" Sch. 40			10				10		
		12 01 278	Cond. – Plas. 4" Sch. 40				10				10	
		12 01 303	Cond. – Plas. 5" Sch. 40 or					10				10
		12 01 297	Cond. – Plas. 5" Sch. 40					10				10



1. Do not put aluminum conductors in transformer bushing connectors use copper secondary leads per Dist. Std. 13 00 03 01
2. Customer cable must be a type approved by the National Electrical Code and by Ameren. Cable must be suitable for exposure to sunlight and water. Cable should extend to the base of the pole or to a point designated by Ameren with sufficient additional cable provided for connection on pole as directed by an Ameren representative. The customer conduit shall extend to a nominal distance from the pole to accommodate the conduit bend. The location of the bend on the pole (quadrant) shall be specified by an Ameren representative.
3. It is recommended that the cable be installed in conduit under driveways and parking areas.
4. Apply two layers of tape to protect cable under the cable grips.
5. For alternate construction, call for split conduit – 3" (Stock #12-51-218), 4" (Stock #12-51-219), 5" (Stock #12-51-220).
6. Top of conduit may be sealed with polyurethane expanding foam, Stock #31 53 082. Expanding foam must be used with dispensing gun, Stock #85-20-073.

7. Some standoff brackets require that one of the nuts on the double arming bolt be replaced with a jam nut. The jam nut should then be inserted into the 5/8" slot on the standoff bracket. If the nut on the double arming bolt will fit into the 5/8" slot on the bracket – Do Not Use the jam nut.
8. In direct buried installations the conduit may have a coupling attached to the end or a duct shield inserted into the conduit to prevent cable damage.
9. See Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements.


		Std. / Stk. No.	Description Material	14 02 01**	01	02	03	04
9	A	23 52 069	Bolt – Machine 5/8" x 18" Sq Head w/Sq Nut		1	1	1	1
	B	23 66 031	Washer – Curved, 3 1/4" x 3 1/8"		7	7	7	7
	C	23 68 330	Link – Guy		1	1	1	1
	D	23 65 012	Eyenuit – 5/8"		1	1	1	1
	E	23 68 181	Shackle		1	1	1	1
	F	23 06 087	Bracket – Standoff, 12"		3	3	3	3
	G	23 67 189	Strap – Conduit 2-1/2"		3			
		23 67 182	Strap – Conduit 3"			3		
		23 67 183	Strap – Conduit 4"				3	
		23 67 184	Strap – Conduit 5"					3
	H	12 01 263	Conduit 2-1/2", SCH 40		20'			
		12 01 279	Conduit 3", SCH 40			20'		
		12 01 278	Conduit 4", SCH 40				20'	
		12 01 303	Conduit 5", SCH 40					20'
	J	31 53 055	Compound – Sealer (lb.)		1	1	1	1
	K	12 51 158	Coupling – 3" SCH 40			1		
		12 51 157	Coupling – 4" SCH 40				1	
		12 51 265	Coupling – 2-1/2" SCH 40		1			
		12 51 156	Coupling – 5" SCH 40					1
	L	40 53 666	Reducer – Conduit 3" x 2-1/2"		–		–	
	M	12 06 053	Solvent – Cement, PVC		1	1	1	1
	N	23 60 011	Screw – Lag, 5/8" x 5"		1	1	1	1
	O	23 53 003	Bolt – Arming Double 5/8" x 18" w/4 Sq Nuts		3	3	3	3
	P	23 65 053	Nut – 5/8" Jam		3	3	3	3
7	Q	12 51 264	Bend, 2-1/2", 24" Radius		1			
		12 51 253	Bend, 3", 24" Radius			1		
		12 51 249	Bend, 4", 24" Radius				1	
		12 51 206	Bend, 5", 36" Radius					1
	R	12 01 274	Conduit, 2-1/2" SCH 80		10'			
		12 01 276	Conduit, 3" SCH 80			10'		
		12 01 273	Conduit, 4" SCH 80				10'	
		12 01 272	Conduit, 5" SCH 80					10'
	BB		Cable		40	40	40	40
	CC	23 17 207	Grip – Cable 1-3/4", 2" Dia.		1	1	1	1
		23 17 220	Grip – Cable 3", 3-1/2" Dia.		1	1	1	1
		OP277 or OP279	Install Cable Up Pole		1	1	1	1



NOTES:

1. Do not put aluminum conductors in transformer bushing connectors use copper secondary leads per Dist. Std. 13 00 03 01
2. It is recommended that the cable be installed in conduit under driveways and parking areas.
3. Apply two layers of tape to protect cable under the cable grips.
4. For alternate construction, call for split conduit – 3" (Stock #12-51-218), 4" (Stock #12-51-219), 5" (Stock #12-51-220).
5. Top of conduit may be sealed with polyurethane expanding foam, Stock #31 53 082. Expanding foam must be used with dispensing gun, Stock #85-20-073.
6. Some standoff brackets require that one of the nuts on the double arming bolt be replaced with a jam nut. The jam nut should then be inserted into the 5/8" slot on the standoff bracket. If the nut on the double arming bolt will fit into the 5/8" slot on the bracket – Do Not Use the jam nut.

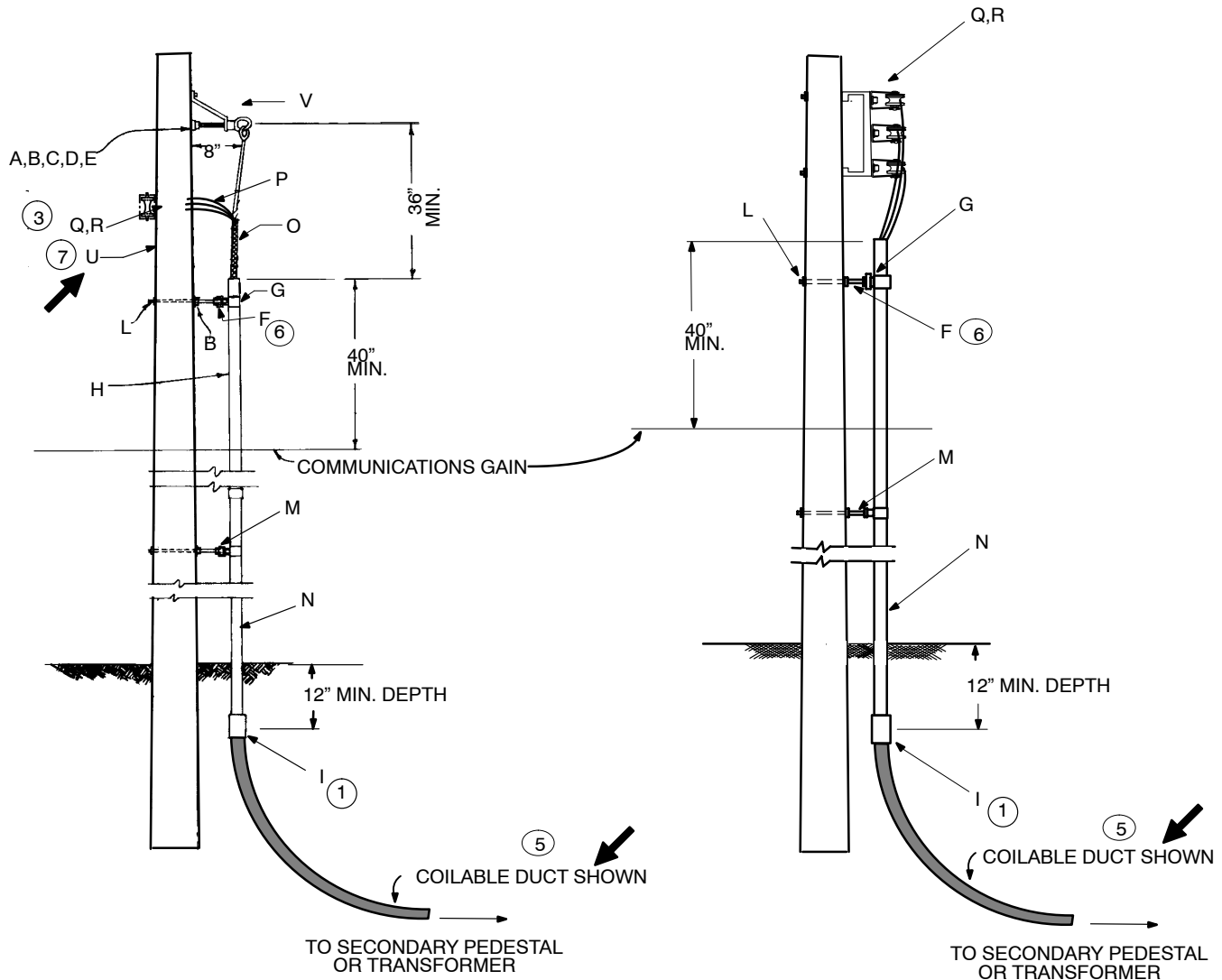
7. In direct buried installations the conduit may have a coupling attached to the end or a duct shield inserted into the conduit to prevent cable damage.
8. See Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements.
9. To reduce the amount of congestion on a pole, it may be possible to eliminate multiple service risers and use a secondary riser with cables feeding a pedestal (Stock# 12-05-049) or padmount secondary/service enclosure (Stock# 54-07-236).

		Std. / Stk. No.	Description Material	14 02 02 **	01	02	03	04
9	A	23 52 069	Bolt – Machine 5/8" x 18" Sq Head w/Sq Nut		1	1	1	1
	B	23 66 031	Washer – Curved, 3 1/4" x 3 1/8"		7	7	7	7
	C	23 68 330	Link – Guy		1	1	1	1
	D	23 65 012	Eyenuit – 5/8"		1	1	1	1
	E	23 68 181	Shackle		1	1	1	1
	F	23 06 087	Bracket – Standoff, 12"		3	3	3	3
	G	23 67 189	Strap – Conduit 2–1/2"		6			
		23 67 182	Strap – Conduit 3"			6		
		23 67 183	Strap – Conduit 4"				6	
		23 67 184	Strap – Conduit 5"					6
	H	12 01 263	Conduit 2–1/2", SCH 40		40			
		12 01 279	Conduit 3", SCH 40			40		
		12 01 278	Conduit 4", SCH 40				40	
		12 01 303	Conduit 5", SCH 40					40
	J	31 53 055	Compound – Sealer (lb.)		1	1	1	1
	K	12 51 158	Coupling – 3" SCH 40			1		
		12 51 157	Coupling – 4" SCH 40				1	
		12 51 156	Coupling – 5" SCH 40					1
L	40 53 666	Reducer – Conduit 3" x 2–1/2"		–		–		
M	12 06 053	Solvent – Cement, PVC		1	1	1	1	
7	 N	23 60 011	Screw – Lag, 5/8" x 5"		1	1	1	1
	O	23 53 003	Bolt – Arming Double 5/8" x 18" w/4 Sq Nuts		3	3	3	3
	P	23 65 053	Nut – 5/8" Jam		3	3	3	3
	Q	12 51 264	Bend, 2–1/2", 24" Radius		1			
		12 51 253	Bend, 3", 24" Radius			1		
		12 51 249	Bend, 4", 24" Radius				1	
		12 51 206	Bend, 5", 36" Radius					1
	R	12 01 274	Conduit, 2–1/2" SCH 80		10'			
		12 01 276	Conduit, 3" SCH 80			10'		
		12 01 273	Conduit, 4" SCH 80				10'	
12 01 272		Conduit, 5" SCH 80					10'	
BB		Cable		40	40	40	40	
CC	23 17 207	Grip – Cable 1–3/4", 2" Dia.		2	2	2	2	
	23 17 220	Grip – Cable 3", 3–1/2" Dia.		2	2	2	2	
	OP277 or OP279	Install Cable Up Pole		2	2	2	2	

CABLE – TERMINALS
0 – 600V
Underground to OH Service

14 02 03 **

Sheet 1 of 2



14 02 03 01

14 02 03 02

14 02 03 03

14 02 03 04

NOTES:

1. Attach the coupling to the coilable duct with epoxy cement – Stock #12-06-126.
2. If only one riser is being installed the bracket can be cut from Stock # 23-06-099 to accommodate a single conduit.
3. Connections between the underground cables and the overhead service wires should be sealed.
4. Quantities may be increased to allow for multiple risers.
5. Coilable duct shown. If conduit installed add item "T".
6. See Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements.
7. Attach a "Danger UG Feeds OH" sign below the secondary rack, and 5' above ground line.

**DISTRIBUTION
 CONSTRUCTION STANDARDS**



ENG. HLH
 REV. NO: 5
 REV. DATE: 11/18/15

CABLE – TERMINALS
0 – 600V
Underground to OH Service

14 02 03 **

Sheet 2 of 2

④

		Std. / Stk. No.	Description Material	14 02 03 **	01	02	03	04
2,6	A	23 52 069	Bolt – Machine 5/8" x 18" Sq Head w/Sq Nut		1	1		
	B	23 66 031	Washer – Curved, 3 1/4" x 2 1/8"		7	7		
	C	23 68 330	Link – Guy		1	1		
	D	23 65 012	Eyenuit – 5/8"		1	1		
	E	23 68 181	Shackle		1	1		
	F	23 06 087	Bracket – Standoff, 12"		3	3	3	3
1	G	23 67 189	Strap – Conduit 2-1/2"			3		3
		23 67 182	Strap – Conduit 3"		3		3	
	H	12 01 279	Conduit 3", SCH 40		20		20	
		12 01 263	Conduit 2-1/2", SCH 40			20		20
	I	12 51 265	Coupling – 2-1/2" SCH 40			1		1
		12 51 158	Coupling – 3" SCH 40		1		1	
@	J	12 56 099	Cement – Solvent, PVC		1	1	1	1
@	K	12 06 126	Cement – Epoxy HDPE Duct to PVC		1	1	1	1
3	L	23 53 003	Bolt – Double Arming 5/8" x 18" w4 Sq Nuts		3	3	3	3
	M	23 65 053	Nut – 5/8" Jam		3	3	3	3
	N	12 01 276	Conduit – 3" SCH 80		10		10	
		12 01 274	Conduit – 2-1/2" SCH 80			10		10
	O	23 17 220	Grip – Cable 3-1/2" Dia.		1	1		
	P	18 07 201	Cable – 600V 2-350 KCMIL x 1-4/0AWG		40		40	
3@		18 07 202	Cable – 600V 2-3/0 AWG x 1-1/0AWG			40		40
	Q	06 01 01 01	Secondary Clevis		1	1		
		06 01 03 01	3 Wire Extended Clevis Bracket				1	1
	R	09 01 10**	Multiple Service Cable Installation	@	@			
		09 01 28 00	Service Takeoff at Pole				1	1
	S	31 53 055	Compound – Sealer (lb.)		1	1	1	1
5@	T	12 51 264	Bend – 2 1/2", 24" Radius			1		1
		12 51 253	Bend – 3", 24" Radius		1		1	
	U	16 02 585	Sign, Danger UG Feed		1	1	1	1
	V	23 60 011	Screw – Lag, 5/8" x 5"		1	1		

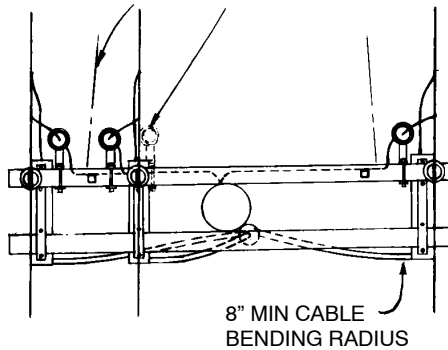
CABLE TERMINALS

4 kV Non Shielded Cable

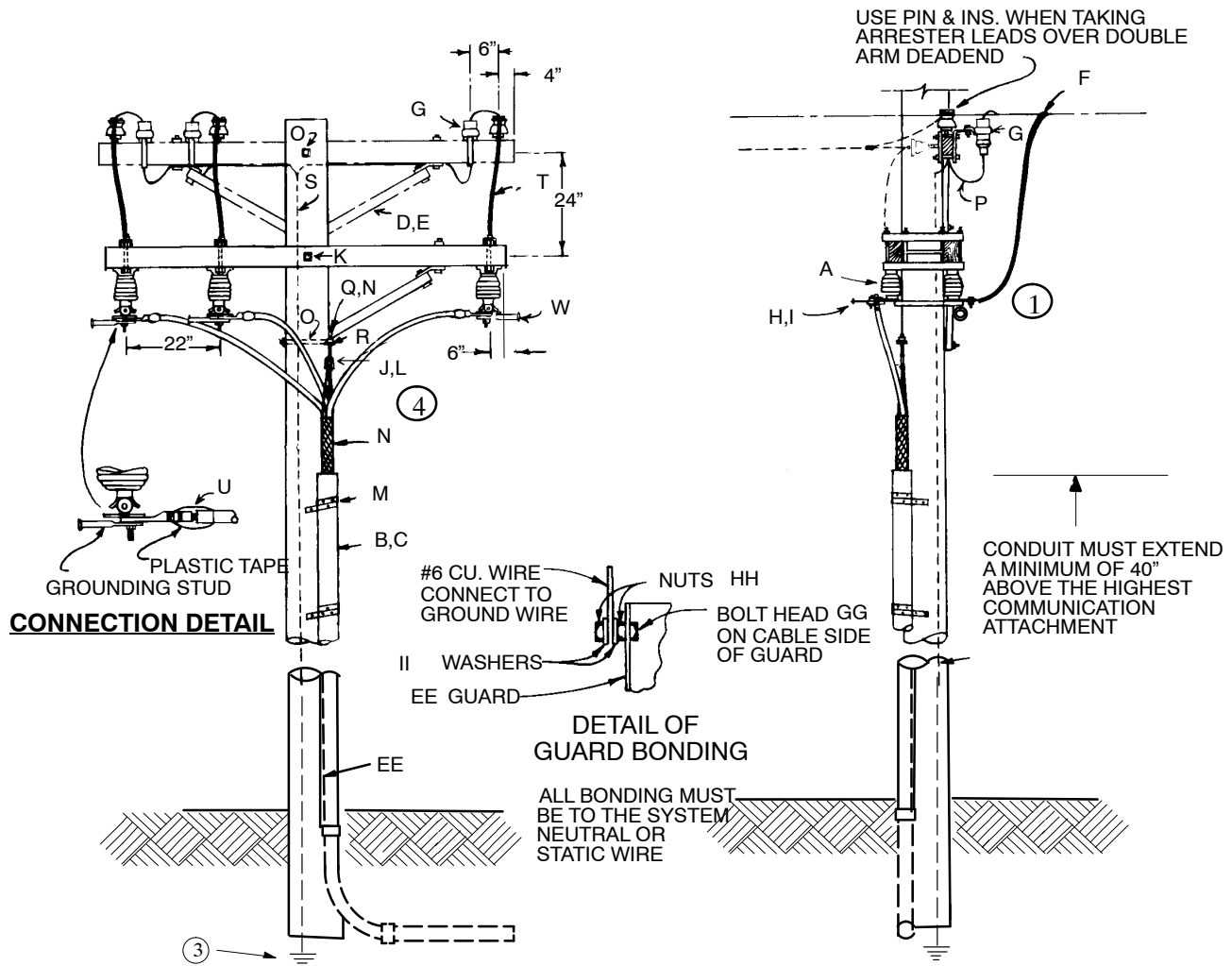
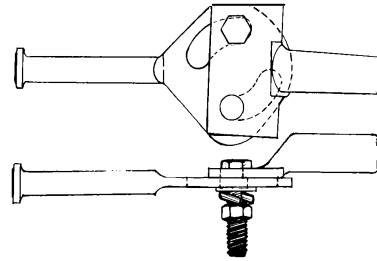
600 Amp Switch

14 04 07 **
Sheet 1 of 3

For Deadend Construction where Arm
Guys are Req'd. Spread Arresters
and Locate Guy between Them



DETAIL - GROUNDING STUD



CABLE TERMINALS
4 kV Non Shielded Cable
600 Amp Switch

14 04 07 **
Sheet 2 of 3

		Std. / Stk. No.	Description	14 04 07 **	01	02	03	04
@	A	54 07 204	Switch, S.B. 600A – 15 kV		3	3	3	3
	B	12 01 278	Conduit, Plastic, 4", SCH 40	20'			20'	
	C	12 01 182	Conduit, Plastic, 5", EB			20'		20'
	D	04 00 20 07	Crossarm & Brace, 8'	1	1			
	E	04 00 20 08	Crossarm & Brace, 10'				1	1
	F	PG*	See 07 00 25 00	3	3	3	3	3
	G	10 01 133	Arrester – Lightning, 3 kV	3	3	3	3	3
	H	17 55 275	Lug – 350 kcmil Copper, 90°, 2 Hole	3			3	
	I	17 55 274	Lug – 750 kcmil Copper, 90°, 2 Hole		3			3
	J	23 59 005	Eyelet – 5/8"	1	1	1	1	1
	K	23 66 027	Washer – Square, 5/8", 2-1/4" SQ	3	3	3	3	3
	L	23 68 181	Shackle	1	1	1	1	1
	M	27 60 035	Iron, Hanger	10	10	10	10	10
	N	23 17 220	Grip, Cable, 3" – 3-1/2" Cable Dia, 34" Long	1	1	1	1	1
	O	23 52 065	Bolt – Machine, 5/8" x 12" Galv, SQ Head w/ nut	2	2	2	2	2
	P	18 51 021	Wire – Cu., #6 S.D., Covered (Ft.)	10	10	10	10	10
	Q	23 52 061	Bolt – Machine, 5/8" x 8"	1	1	1	1	1
	R	23 65 012	Eyenuit for 5/8" Bolt	1	1	1	1	1
	S	12 00 10 04	Grounding Unit	1	1	1	1	1
2	T	18 53 102	Wire – 5 kV 350 kcmil	15	15	15	15	15
	U	25 53 055	Tape – Plastic	1	1	1	1	1
	W	23 64 037	Stud – Grounding, Univ.	3	3	3	3	3
	X	17 58 054	Bracket, Crossarm, Arrester	3	3	3	3	3
	AA	12 01 272	Conduit – 5" SCH 80			10'		10'
		12 01 273	Conduit – 4" SCH 80	10'			10'	
	BB	18 07 040	Cable – 5 kV, 350 kcmil	35			35	
		18 07 031	Cable – 5 kV, 750 kcmil			35		35
	CC	12 51 250	Bend – 5", 24" Rad.		1			1
		12 51 206	Bend – 5", 36" Rad.		1			1
3	DD	12 51 249	Bend – 4", 24" Rad.	1			1	
		12 51 176	Bend – 4", 36" Rad.	1			1	
	EE	23 18 202	Guard – Conduit 5"	1	1	1	1	1
	FF	23 60 005	Screw – Lag 3/4" x 3"	6	6	6	6	6
	GG	21 53 007	Bolt – Mach. 3/8" x 1-1/2"	1	1	1	1	1
	HH	21 61 006	Nut – Hex, 3/8"	2	2	2	2	2
	II	23 66 016	Washer – 3/8" Galv.	2	2	2	2	2
		OP 277	Install Cable Up Pole	1	1	1	1	1
@								
@								

NOTES:

- Switch blades should open towards the riser cables so the blades are de-energized when the cable is de-energized.
- Conduit straps may be substituted for iron hangers.

CABLE TERMINALS
4 kV Non Shielded Cable
600 Amp Switch

14 04 07 **
Sheet 3 of 3

-
3. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.

CABLE TERMINALS

15 kV & Below Single Phase

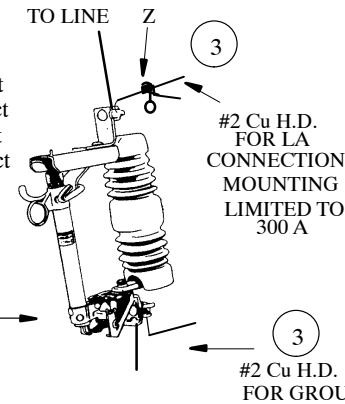
#2 Through 4/0

14 12 01 **

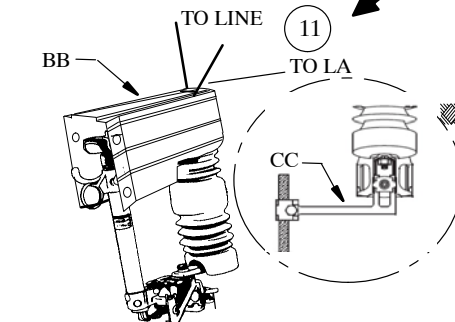
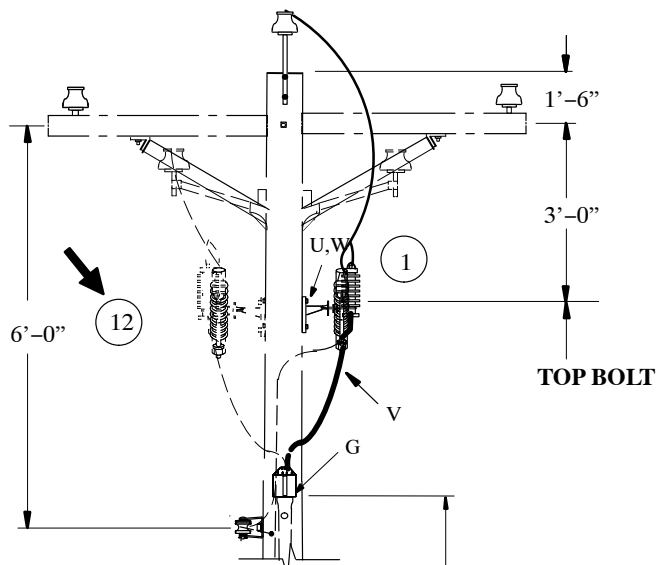
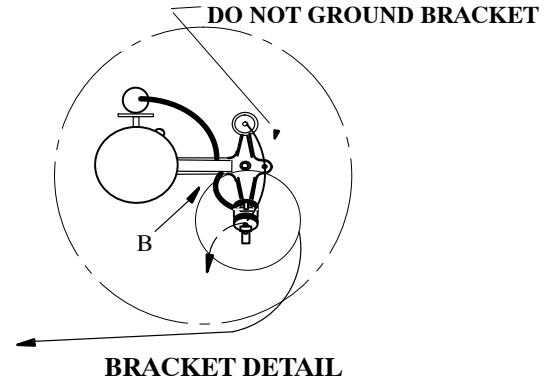
Sheet 1 of 3

- 01 - #2 Direct Buried or In 2" Conduit/Duct
- 02 - 4/0 Direct Buried or In 2" Conduit/Duct
- 03 - #2 Direct Buried or In 3" Conduit/Duct
- 04 - 4/0 Direct Buried or In 3" Conduit/Duct

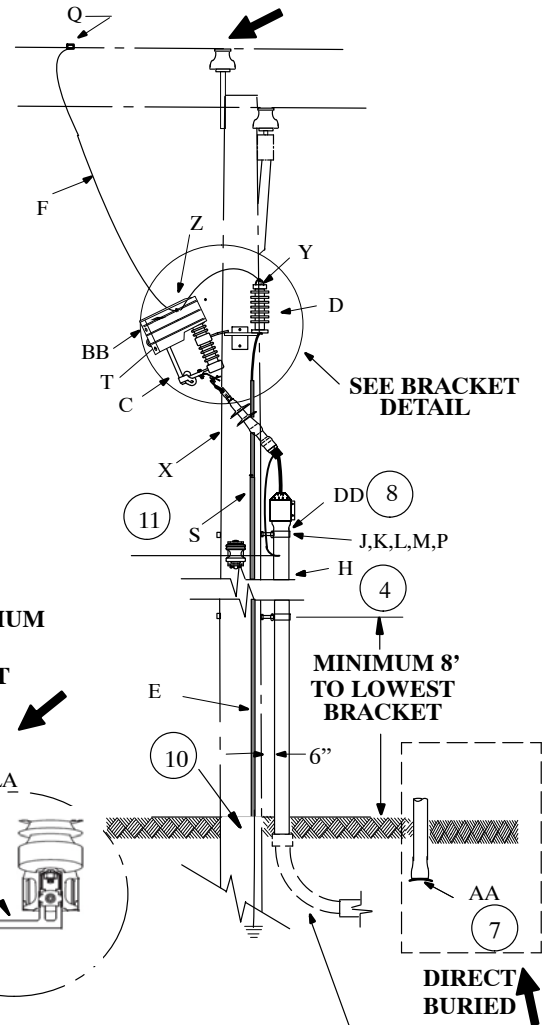
Use #4 Cu Line Lead w/ 100A Barrel
Use #1/0 Cu Line Lead w/ 200A Barrel
Use #1/0 Cu Line Lead w/ 300A Barrel



SWITCH DETAIL



SWITCH DETAIL W/COVER



SWEEP INSTALLED AS A PART OF CONDUIT INSTALLATION

CABLE TERMINALS
15 kV & Below Single Phase
#2 Through 4/0

14 12 01 **

Sheet 2 of 3

		Std. / Stk. No.	Description	14 12 01 **	01	02	03	04
2@	B	23 56 063	Bracket,Fiberglass, 3 Position Mounting		1	1	1	1
	C	54 07 208	Switch, Fused, 100A, 15kV		1	1	1	1
	D	10 01 129	Arrester, Lightning, 9kV		1	1	1	1
		10 01 133	Arrester, Lightning, 3kV		1	1	1	1
9		10 01 146	Arrester, Lightning, 10kV		1	1	1	1
	E	12 00 10 04	Grounding Unit		1	1	1	1
	F	18 51 025	Wire, Cu., #4 S.D. Covered		10		10	
		18 51 024	Wire, Cu., 1/0 S.D. Covered			10		10
4@	G	12 01 280	Conduit, Plastic, 2", SCH 40		20	20		
		12 01 279	Conduit, Plastic, 3", SCH 40				20	20
	H	12 01 275	Conduit, 2" SCH 80		10	10		
		12 01 276	Conduit, 3" SCH 80				10	10
	J	23 06 086	Bracket, Standoff 20"		3	3	3	3
		23 06 087	Bracket, Standoff 12"		3	3	3	3
	K	23 53 003	Bolt, Double Arming 5/8" x 18"		3	3	3	3
	M	23 67 190	Strap. Conduit 2"		3	3		
		23 67 182	Strap. Conduit 3"				3	3
	N	17 51 137	Clamp, PG, 1/0 – 350 kcmil		1	1	1	1
	P	23 65 053	Nut, Jam 5/8"		3	3	3	3
	Q	PG*	See 07 00 25 00		1	1	1	1
@		HLC*W	Clamp, Hot line		1	1	1	1
	S	17 51 032	Clamp, PG, 1/0 – #6		1	1	1	1
	T		Fuse Sized By Engineer		1	1	1	1
	U	23 52 066	Bolt, Mach., 5/8" x 14"		2	2	2	2
	V	18 07 238	Cable, 15kV, #2		35		35	
		18 07 239	Cable, 15kV, 4/0			35		35
	W	23 66 027	Washer, Square, 5/8"		8	8	8	8
	X	42 34 59 01	Termination, 15kV, #2 Al.		1		1	
		42 34 59 03	Termination, 15kV, 4/0			1		1
	Y	18 51 021	Wire, #6 Cu, S.D. Covered		2'	2'	2'	2'
	Z	23 78 394	Clamp, Hotline, #6 to 2/0		1	1	1	1
	AA	12 53 017	Shield, Duct, Cable		1	1	1	1
	BB	23 17 411	Cover – Cutout, 100A Fused		1	1	1	1
8	CC	17 55 828	Stirrup – Grounding, 1/2" x 7"		1	1	1	1
	DD	23 17 472	Cover – Conduit		1	1	1	1
		OP278	Install Cable Up Pole		1	1	1	1

CABLE TERMINALS
15 kV & Below Single Phase
#2 Through 4/0

14 12 01 **

Sheet 3 of 3

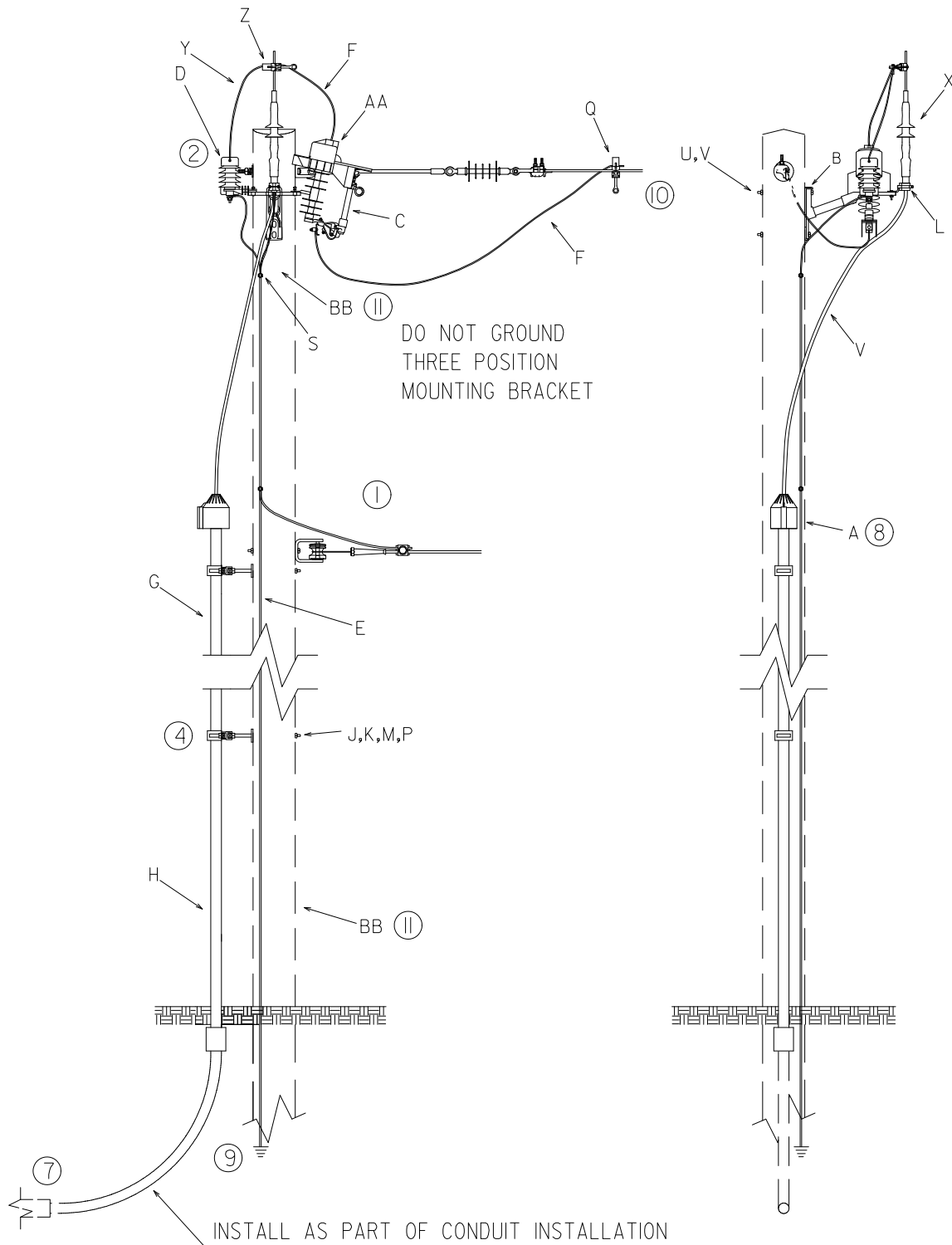
NOTES:

1. Keep arrester ground lead as short as possible.
2. On 13 kV terminal poles use 10 kV lightning arrester, Stock # 10-01-146.
3. Insert a piece of #2 H.D. Cu for LA and grounding attachments. See note 11 for avian protection requirements.
4. See DCS 14000103 for standoff bracket placement and grounding requirements.
5. Some standoff brackets require that one of the nuts on the double arming bolt be replaced with a jam nut. The jam nut should then be inserted into the 5/8" slot on the standoff bracket. If the nut on the double arming bolt will fit into the 5/8" slot on the bracket – Do Not Use the jam nut.
6. On the front of the 20" standoff bracket, the following conduits may be mounted: 4-2" conduits, 3-2-1/2" conduits, 3-3" conduits, 3-4" conduits, 2-5" conduits. Various combinations of conduits may also be mounted. On the front of the 12" standoff bracket, the following conduits may be mounted: 2-2" conduits, 2-2-1/2" conduits, 1-3" & 1-2" conduits, 1-3" and 1-2-1/2" conduit, 1-4" conduit, and 1-5" conduit.
7. To prevent damage to direct buried cables, install a cable shield (Stk# 12-53-017) at the conduit entry and increase the quantity of cable shields shown in the Materials List by "1".
8. Install a conduit cover at the top end of the conduit to prevent cable damage.
9. Use DCS 12 00 10 04 for ground coil application on new pole installation.
10. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
11. For all of Illinois and locations in Missouri where additional avian protection is needed, omit the piece of #2 bare copper wire and hot line clamp "Z". Connect the #6 copper poly covered arrester wire "Y" directly to the fused switch connector.
12. More than one single phase riser can be on a pole. Generally, installing three to four single phase risers on a pole will require the use of a crossarm. Refer to DCS 14 12 05 ** for proper spacing of cutouts.

CABLE TERMINALS
 15 kV & Below Single Phase, UG to OH Feed
 #2 Through 4/0

14 12 02 **

Sheet 1 of 3



CABLE TERMINALS
15 kV & Below Single Phase, UG to OH Feed
#2 Through 4/0

14 12 02 **

Sheet 2 of 3

		Std. / Stk. No.	Description	14 12 02 **	01	02	03	04
8	A	23 17 472	Cover, Conduit		1	1	1	1
	B	23 56 063	Bracket, Fiberglass, 3 Position Mounting		1	1	1	1
	C	54 07 208	Switch, Fused, 100A, 15kV		1	1	1	1
3 @	D	10 01 129	Arrester, Lightning, 9kV		1	1	1	1
		10 01 133	Arrester, Lightning, 3kV		1	1	1	1
		10 01 146	Arrester, Lightning, 10kV		1	1	1	1
1,9	E	12 00 10 04	Grounding Unit		1	1	1	1
	F	18 51 025	Wire, Cu., #4 S.D. Covered		10		10	
		18 51 024	Wire, Cu., 1/0 S.D. Covered			10		10
4, 6 @	G	12 01 280	Conduit, Plastic, 2", SCH 40		20	20		
		12 01 279	Conduit, Plastic, 3", SCH 40				20	20
	H	12 01 275	Conduit, Plastic, 2", SCH 80		10	10		
		12 01 276	Conduit, Plastic, 2" SCH 80				10	10
	J	23 06 086	Bracket, Standoff 20"		3	3	3	3
		23 06 087	Bracket, Standoff 12"		3	3	3	3
	K	23 53 003	Bolt, Double Arming 5/8" x 18"		3	3	3	3
	L	23 67 193	Bracket, Cable Positioner		1	1	1	1
	M	23 67 190	Strap, Conduit 2"		3	3		
		23 67 182	Strap, Conduit 3"				3	3
5 @	N	17 51 137	Clamp, PG, 1/0 – 350 kcmil		1	1	1	1
	P	23 65 053	Nut, Jam 5/8"		3	3	3	3
	Q	PG*	See 07 00 25 00		1	1	1	1
HLC*W		Clamp, Hot Line		1	1	1	1	
@	S	17 51 032	Clamp, PG, 1/0 – #6		1	1	1	1
	T		Fuse Sized By Engineer		1	1	1	1
	U	23 52 066	Bolt, Mach., 5/8" x 14"		2	2	2	2
	V	18 07 238	Cable, 15kV, #2		35		35	
		18 07 239	Cable, 15kV, 4/0			35		35
	W	23 66 027	Washer, Square, 5/8"		8	8	8	8
	X	42 34 59 01	Termination, 15kV, #2		1		1	
		42 34 59 03	Termination, 15kV, 4/0			1		1
	Y	18 51 021	Wire, #6 Cu., S.D. Covered		2'	2'	2'	2'
	Z	23 78 394	Clamp, Hotline, #6 to 2/0		1	1	1	1
AA	23 17 411	Cover, Cutout		1	1	1	1	
BB	16 02 585	Sign, Danger UG Feed		2	2	2	2	
		OP 279	Install Cable Up Pole		1	1	1	1

NOTES

1. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-stranded #10 copperweld ground wire may look like a stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: HLH
REV. NO: 3
REV. DATE: 03/09/16

CABLE TERMINALS
15 kV & Below Single Phase, UG to OH Feed
#2 Through 4/0

14 12 02 **

Sheet 3 of 3

2. Keep arrester ground lead as short as possible. Aerial tap it to concentrics close to the termination.
3. On 13 kV terminal poles use 10 kV lightning arrester, Stock # 10-01-146.
4. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.
5. Some standoff brackets require that one of the nuts on the double arming bolt be replaced with a jam nut. The jam nut should then be inserted into the 5/8" slot on the standoff bracket. If the nut on the double arming bolt will fit into the 5/8" slot on the bracket – Do Not Use the jam nut.
6. On the front of the 20" standoff bracket, the following conduits may be mounted: 4– 2" conduits, 3– 2-1/2" conduits, 3– 3" conduits, 3– 4" conduits, 2– 5" conduits. Various combinations of conduits may also be mounted. On the front of the 12" standoff bracket, the following conduits may be mounted: 2– 2" conduits, 2– 2-1/2" conduits, 1– 3" & 1– 2" conduits, 1– 3" and 1– 2-1/2" conduit, and 1– 5" conduit.
7. To prevent damage to direct buried cables, install a cable shield (Stk# 12-53-017) at the conduit entry.
8. Install a cable conduit cover at the top end of the conduit to prevent cable damage.
9. See DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
10. See DCS 03 12 01 ** for single phase deadend configuration.
11. Attach "Danger UG Feeds OH" sign approximately 5' above the ground line, and 3' below the cutout.

CABLE TERMINALS

15kV & Below Three-Phase

#2 Through 4/0

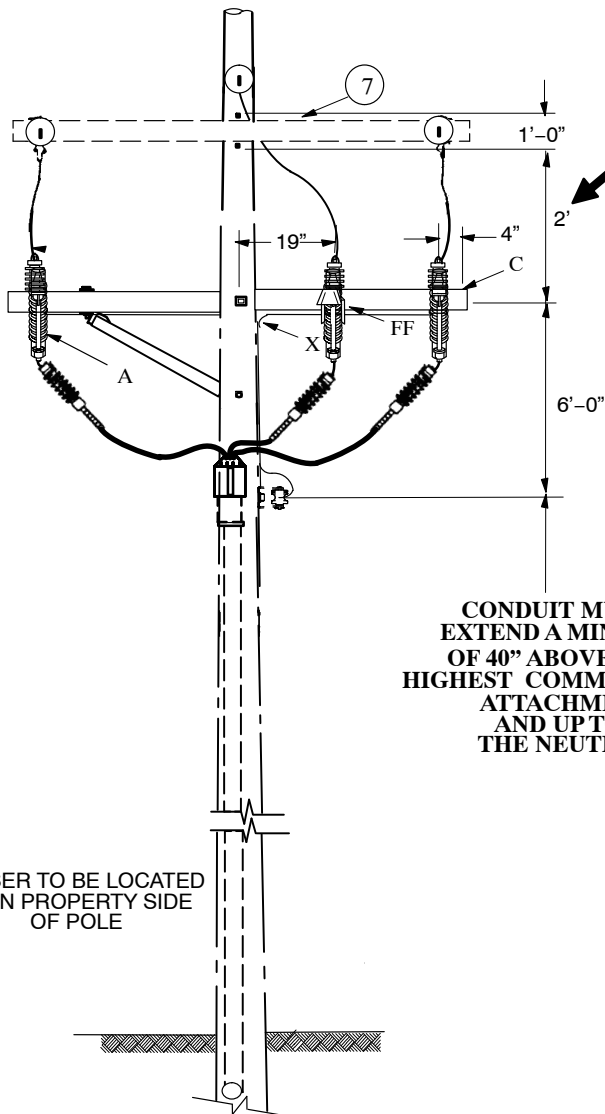
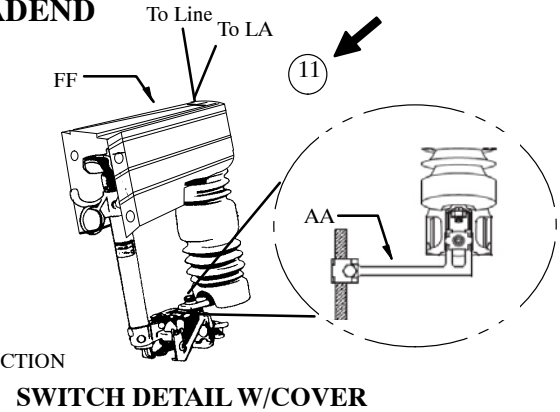
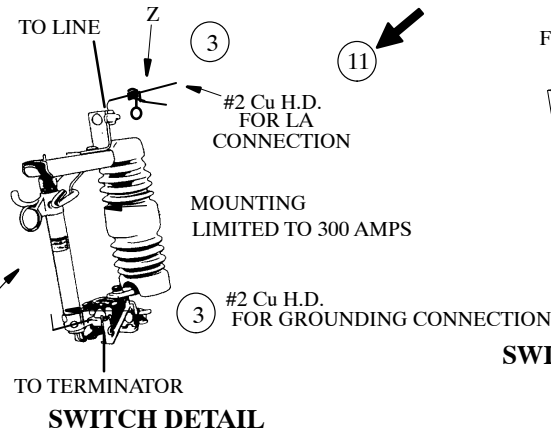
14 12 05 **

Sheet 1 of 3

THROUGH POLE OR DEADEND

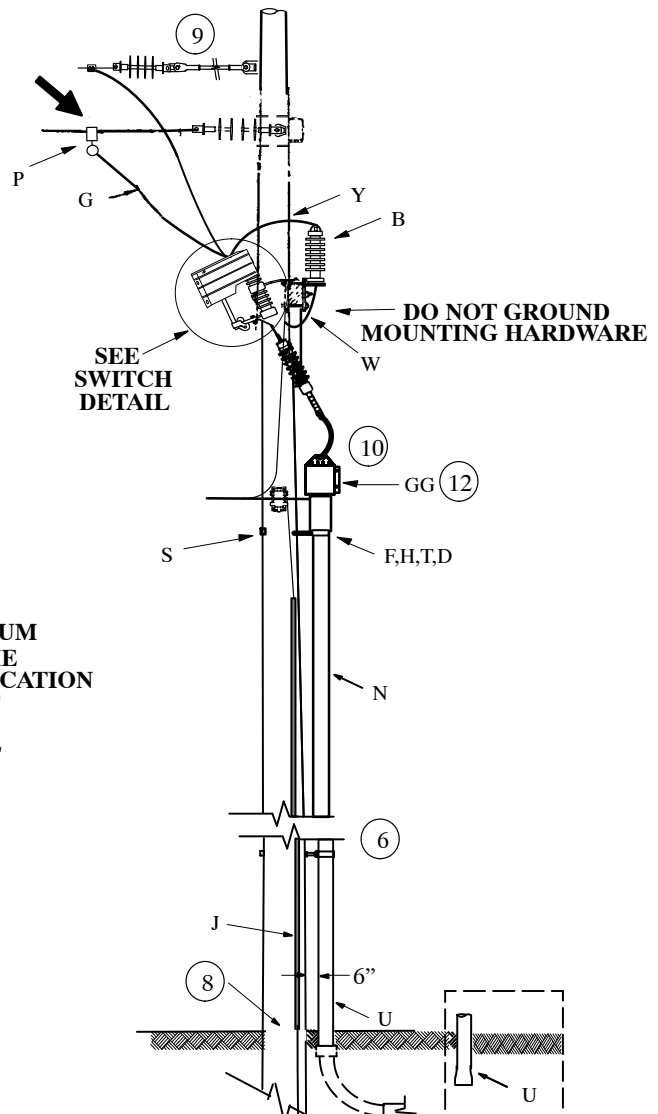
#2-3C 14 12 05 01
#2-1C 14 12 05 02
4/0-3C 14 12 05 03
4/1-1C 14 12 05 04

Use #4 Cu w/ 100A Barrel
Use #1/0 Cu w/ 200A Barrel
Use #1/0 Cu w/ 300A Barrel



RISER TO BE LOCATED
ON PROPERTY SIDE
OF POLE

CONDUIT MUST
EXTEND A MINIMUM
OF 40" ABOVE THE
HIGHEST COMMUNICATION
ATTACHMENT
AND UP TO THE
NEUTRAL



SWEEP INSTALLED AS A PART OF
CONDUIT INSTALLATION

DIRECT
BURIED

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: HLH
REV. NO: 17
REV. DATE: 11/24/15

CABLE TERMINALS
15kV & Below Three-Phase
#2 Through 4/0

14 12 05 **

Sheet 2 of 3

		Std. / Stk. No.	Description	14 12 05 **	01	02	03	04
@ 4	A	54 07 208	Switch, Fused, 100A, 15 kV		3	3	3	3
	B	10 01 129	Arrester, Lightning, 9 kV		3	3	3	3
		10 01 133	Arrester, Lightning, 3 kV		3	3	3	3
		10 01 146	Arrester, Lightning, 10 kV		3	3	3	3
C		04 00 20 02	Crossarm, Sgl, Wood, 8' on (use only 1/2 of V-brace)		1	1	1	1
		04 00 20 03	Crossarm, Sgl, Wood, 10' on (use only 1/2 of V-brace)		1	1	1	1
D		23 53 003	Bolt, Double Arming, 5/8" x 18"		3	3	3	3
		23 65 053	Nut, 5/8" Jam		3	3	3	3
G		18 51 025	Wire, Cu. , #4 S.D. Covered		15	15		
		18 51 024	Wire, Cu. , 1/0 S.D. Covered				15	15
H		23 06 087	Bracket, Conduit, Standoff, 12"		3	3	3	3
J		12 00 10 04	Grounding Unit		1	1	1	1
K		17 51 032	Clamp, PG, 1/0-6		3	3	3	3
L		17 51 137	Clamp, PG 1/0-350 kcmil		1	1	1	1
M			Fuse Sized by Engineer		3	3	3	3
N		12 01 278	Conduit, Plastic, 4", SCH 40		20	20	20	20
P		HLC*W	Line Clamp		3	3	3	3
		PG*	See 07 00 25 00		3	3	3	3
S		23 66 027	Washer, Square 5/8"		6	6	6	6
T		23 67 183	Strap, Conduit 4"		3	3	3	3
U		12 01 273	Conduit, 4" SCH 80		10'	10'	10'	10'
W		17 58 054	Bracket, Arrester/Cutout Mounting		6	6	6	6
X		18 52 019	Misc. #6 bare Cu SD (ft) for ground buss.		12'	12'	12'	12'
Y		18 51 021	Wire, #6 Cu. S.D. Covered		6'	6'	6'	6'
Z		23 78 394	Clamp, Hotline, #6 to 2/0		3	3	3	3
AA		17 55 828	Stirrup - Grounding 1/2" X 7"		3	3	3	3
BB		18 07 237	Cable, 15 kV, #2-3C Al.		35			
		18 07 238	Cable, 15 kV, #2-1C Al.			105		
		18 07 239	Cable, 15 kV, 4/0-1C Al.					105
		18 07 240	Cable, 15 kV, 4/0-3C Al.				35	
CC		42 34 59 01	Termination, 15 kV, #2		3	3		
		42 34 59 03	Termination, 15 kV, 4/0				3	3

CABLE TERMINALS
15kV & Below Three-Phase
#2 Through 4/0

14 12 05 **

Sheet 3 of 3

12	FF	23 17 411	Cover – Cutout, 100 Amp Fused	3	3	3	3
		OP 279	Install Cable Up Pole	1	1	1	1
	GG	23 17 472	Cover – Conduit	1	1	1	1

NOTES:

1. Keep arrester ground lead as short as possible. Keep arrester primary lead as short as possible.
2. 8' crossarm available, Ameren Mo only.
3. Insert a piece of #2 H.D. Cu for LA and grounding attachments. See note for avian protection requirement.
4. On 13 kV terminal poles use 10 kV lightning arrester, Stock # 10-01-146.
5. If a longer bracket is required, use Stock # 23-06-086 (20" long).
6. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.
7. See DCS 03 12 05 **, 03 12 06 ** or 03 12 09 ** for through pole or deadend configuration.
8. See DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
9. Underbuild construction requires deadend on pole w/FG extension, for deadend application.
10. Always connect the metallic shields on the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and / or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
11. For all of Illinois and locations in Missouri where additional avian protection is needed, omit the piece of #2 bare Cu, and hot line clamp "Z". Connect the #6 Cu poly covered arrester wire "Y" directly to the fused switch connector.
12. Install a conduit cover at the top end of the conduit to prevent cable damage.

CABLE TERMINALS

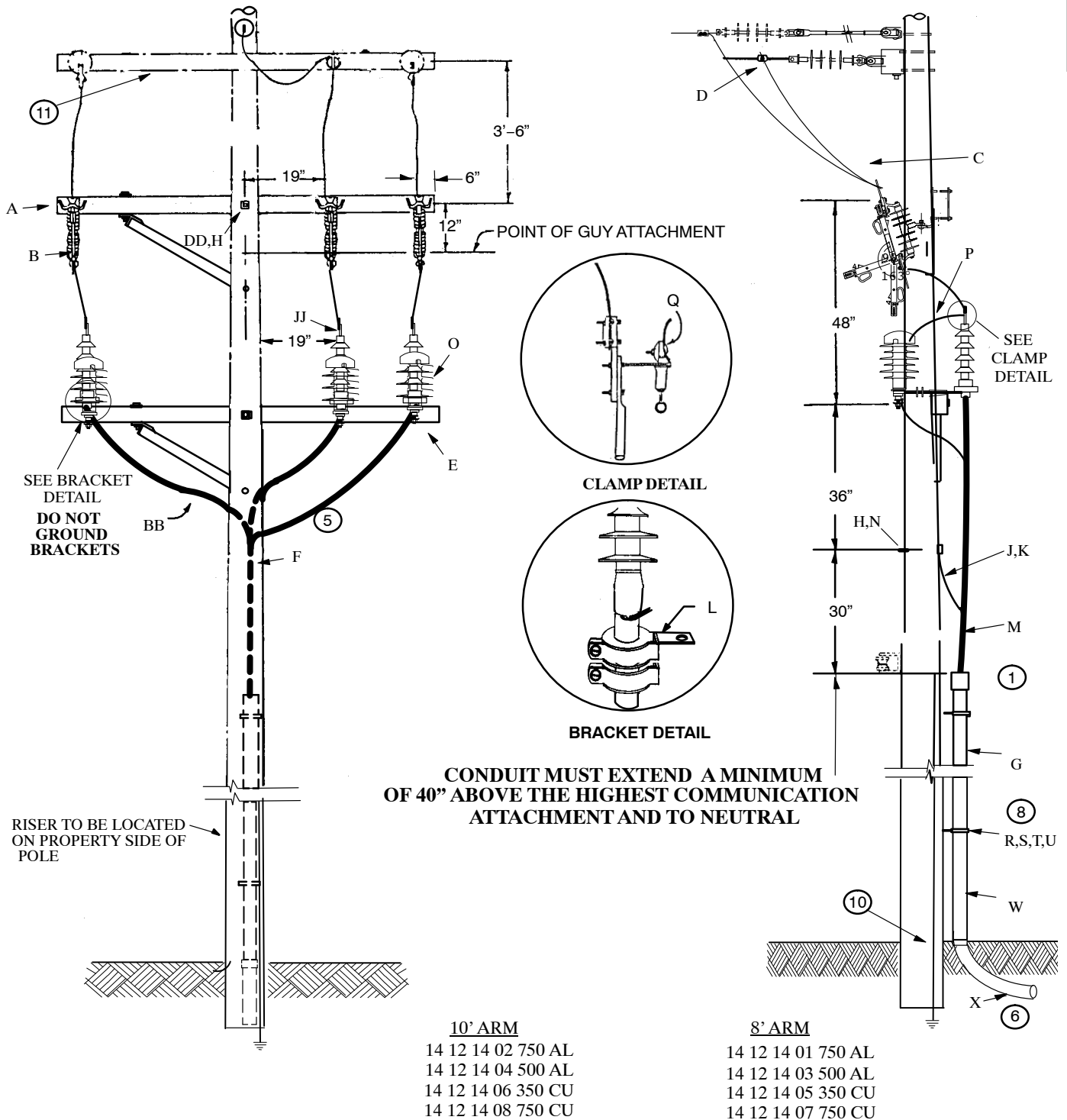
15 kV Below Three Phase 600 Amp Disconnect Switches Vertical Crossarm Mount 350 kcmil-750 kcmil

14 12 14 **

Sheet 1 of 3

THROUGH POLE OR DEADEND

THIS CONSTRUCTION SHALL NOT BE USED FOR NON-SHIELDED CABLES
OPERATING ABOVE 2000 VOLTS TO GROUND. CONDUIT MUST BE PLACED
AGAINST THE POLE AND COVERED WITH A BONDED GUARD.



CABLE TERMINALS
15 kV Below Three Phase 600 Amp Disconnect Switches
Vertical Crossarm Mount 350 kcmil–750 kcmil

14 12 14 **

Sheet 2 of 3

		Std. / Stk. No.	Description	14 12 14**	01	02	03	04	05	06	07	08
5	A	04 00 20 02	Crossarm, 8' w/60" V Brace	1		1			1		1	
		04 00 20 03	Crossarm, 10' w/60" V Brace		1			1		1		1
	B	54 07 296	Switch, Disc. 600A., 15kV	3	3	3	3	3	3	3	3	3
	C	18 51 052	Wire, Cu. 350 S.D. , Covered	35	35	35	35	35	35	35	35	35
	D	PG*	See 07 00 25 00	3	3	3	3	3	3	3	3	3
5,11	E	41 01 008	Crossarm, 10'		1			1		1		1
		41 01 014	Crossarm, 8'	1		1			1		1	
5,11												
9	F	12 00 10 04	Grounding Unit	1	1	1	1	1	1	1	1	1
		12 01 303	Conduit, 5" Plastic, SCH 40	20	20	20	20	20	20	20	20	20
	H	23 52 065	Bolt, Mach., 5/8" x 12"	3	3	3	3	3	3	3	3	3
		23 65 012	Eyebut, 5/8", Oval Eye	1	1	1	1	1	1	1	1	1
	K	23 68 181	Shackle	1	1	1	1	1	1	1	1	
		23 67 197	Bracket, Cable Support, 500–750 kcmil	3	3	3	3	3	3	3	3	3
	M	23 17 245	Grip, Cable Riser, 2"–2.5" Dia., Split	3	3	3	3	3	3	3	3	3
		23 66 027	Washer, Square, For 5/8" Bolt	9	9	9	9	9	9	9	9	9
7@	O	10 01 129	Arrester, Lightning, 9kV	3	3	3	3	3	3	3	3	3
		10 01 133	Arrester, Lightning, 3kV	3	3	3	3	3	3	3	3	3
		10 01 146	Arrester, Lightning, 10kV	3	3	3	3	3	3	3	3	3
	P	18 51 021	Wire, #6 Cu, S.D. Covered	6	6	6	6	6	6	6	6	6
		23 78 183	Clamp, Hot Line, #6–400 kcmil, Cu.	3	3	3	3	3	3	3	3	3
	R	23 53 003	Bolt, Double Arming, 5/8" x 18"	3	3	3	3	3	3	3	3	3
		23 65 053	Nut, Jam 5/8"	3	3	3	3	3	3	3	3	3
	T	23 67 184	Strap, Conduit, 5"	3	3	3	3	3	3	3	3	3
8	U	23 06 087	Bracket, Standoff, 12"	3	3	3	3	3	3	3	3	3
		12 01 272	Conduit, 5" SCH 80	10'	10'	10'	10'	10'	10'	10'	10'	10'
6@	X	12 51 206	Bend, 5", 36" Rad.	1	1	1	1	1	1	1	1	1
		23 52 038	Bolt, Machine 1/2" x 10"	2	2	2	2	2	2	2	2	2
	Z	23 66 017	Washer, Round 1/2"	2	2	2	2	2	2	2	2	2
@	AA	42 34 61 04	Termination, 15kV, 750 kcmil AL	3	3							
		42 34 61 10	Termination, 15kV, 500 kcmil AL			3	3					
		42 34 61 06	Termination, 15kV, 350 kcmil Cu					3	3			
		42 34 61 02	Termination, 15 kV, 750 kcmil Cu							3	3	
	BB	18 07 243	Cable, 750 kcmil Al	35	35							
		18 07 261	Cable, 500 Al kcmil (3 Cables, 35' Ea.)			105	105					
		18 07 245	Cable, 350 kcmil Cu					35	35			
		18 07 244	Cable, 750 kcmil Cu							35	35	
	DD	23 66 134	Washer, 5/8", Dbl. Coil	2	2	2	2	2	2	2	2	2

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: WYW
REV. NO: 14
REV. DATE: 11/03/16

CABLE TERMINALS
15 kV Below Three Phase 600 Amp Disconnect Switches
Vertical Crossarm Mount 350 kcmil–750 kcmil

14 12 14 **

Sheet 3 of 3

EE	23 66 133	Washer, 1/2", Dbl. Coil	2	2	2	2	2	2	2	2
FF	23 56 088	Bracket, Crossarm, Dbl. Sided	3	3	3	3	3	3	3	3
GG	23 52 063	Bolt, Machine 1/2" x 6"	2	2	2	2	2	2	2	2
JJ	23 17 415	Cover, wildlife, 2"x36"	1	1	1	1	1	1	1	1
	OP 277	Install Cable Up Pole	1	1	1	1	1	1	1	1

NOTES:

1. Wrap cable with friction tape prior to installation of cable grip.
2. When guy is required, use 45" fiberglass strain insulator and select links to obtain maximum clearance.
3. For alternate construction call for split conduit with steel guard.
4. Keep arrester primary lead as short as possible. Keep arrester ground lead short (attach it to concentric close to the terminator).
5. Use only one V brace on each crossarm.
6. Bend normally included in conduit instructions.
7. On 13 kV terminal poles use 10 kV lightning arrester.
8. See DCS 14 00 01 03 for standoff Bracket placement and grounding requirements.
9. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use DCS 12 00 10 03 for ground rod on existing pole.
10. See DCS 03 for through pole or deadend configuration.
11. Use 8' arm with DCS 14 12 14 01 where easement or horizontal clearances are concern.

CABLE TERMINALS

15kV & Below – Three Phase – 600A Disconnect Switches

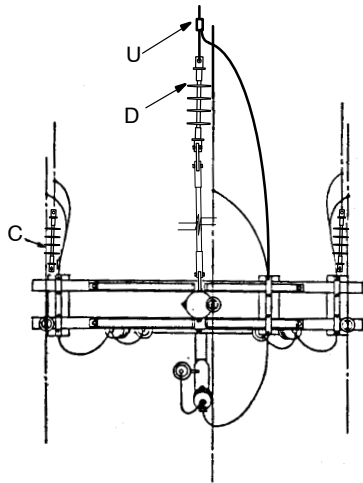
350 kcmil – 750 kcmil Shielded Cable

14 12 16 **

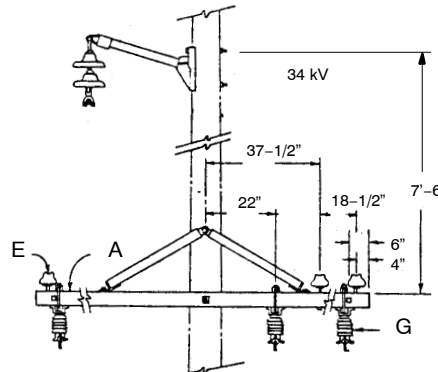
Sheet 1 of 3

SHIELDED CABLE THROUGH POLE OR DEADEND

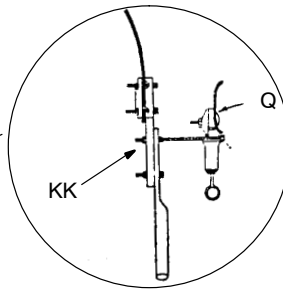
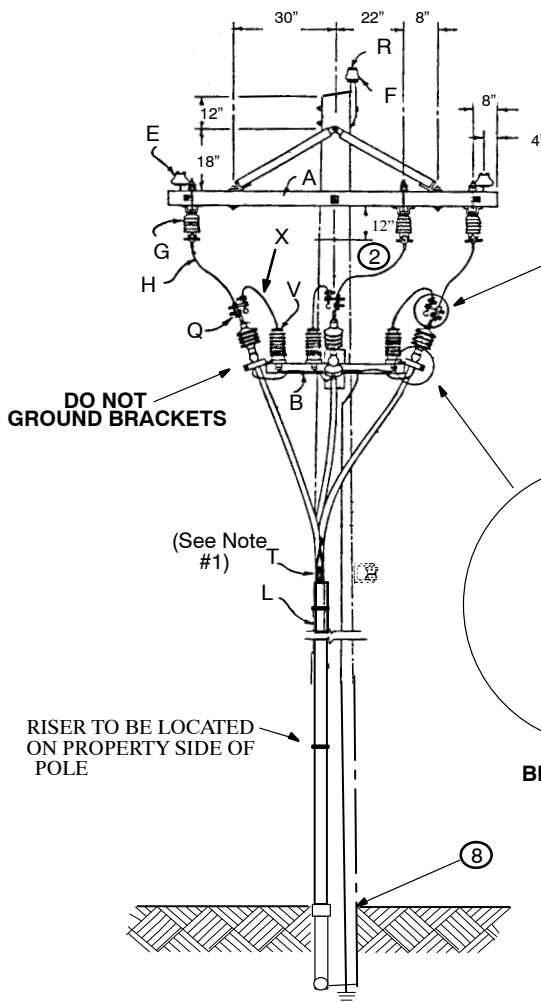
This construction shall not be used for non-shielded cables operating above 2000 volts to ground. Conduit must be placed against the pole and covered with a bonded guard.



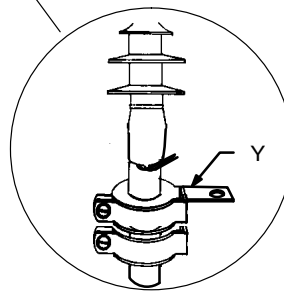
	Thru Circuit	Dead End
Overhead	14 12 16 05 14 12 16 01	14 12 16 06 14 12 16 02
Underbuild	14 12 16 03	14 12 16 04



UNDER BUILD DETAIL

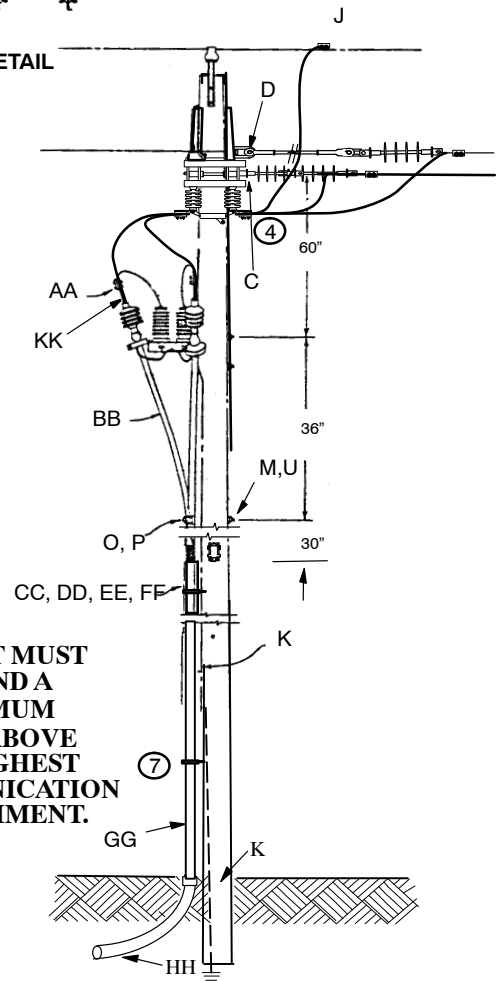


CLAMP DETAIL



BRACKET DETAIL

**CONDUIT MUST
EXTEND A
MINIMUM
OF 40" ABOVE
THE HIGHEST
COMMUNICATION
ATTACHMENT.**



CABLE TERMINALS
15kV & Below – Three Phase – 600A Disconnect Switches
350 kcmil – 750 kcmil Shielded Cable

14 12 16 **
Sheet 2 of 3

		Std. / Stk. No.	Description	14 12 16 **	01	02	03	04	05	06
9	A	04 00 20 07	Crossarm , Dble., 8'		1	1				
		04 00 20 08	Crossarm, Dble., 10'				1	1	1	1
	B	17 08 057	Bracket, Mounting, Terminator		1	1	1	1	1	1
	C	06 12 34 01	Deadend On Arm			2		2	3	3
	D	06 12 32 01	Deadend On Pole			1		1		
	E	06 12 01 01	Pin & Ins. On Arm		2		3			
	F	06 12 01 02	Pin & Ins. On Pole Top		1					
	G	54 07 204	Switch, Disc. 600A., 15kV		3	3	3	3	3	3
	H	18 51 052	Wire, Cu. 350 S.D., covered		25	25	25	25	25	25
@	J	PG*	See 07 00 25 00		3	3	3	3	3	3
8	K	12 00 10 04	Grounding Unit		1	1	1	1	1	1
	L	12 01 303	Conduit, 5", Plastic, SCH 40		20	20	20	20	20	20
	M	23 52 065	Bolt, Mach., 5/8" x 12"		3	3	3	3	3	3
	N	27 60 035	Iron, Hanger		2	2	2	2	2	2
	O	23 65 012	Eyenuit, 5/8", Oval Eye		1	1	1	1	1	1
	P	23 68 181	Shackle		1	1	1	1	1	1
	Q	23 78 183	Clamp, Hot Line, # 6-400 kcmil, Cu		3	3	3	3	3	3
@	R	TT*W	Top Tie		3		3			
@	S	DEC*W	Deadend Clamp			3		3	3	3
@	T	23 17 245	Grip, Cable Riser, 2"-2.5" OD		1	1	1	1	1	1
		23 17 254	Grip Cable Riser, 2.5"-3.00" OD		1	1	1	1	1	1
		23 17 220	Grip, Cable Riser, 3.0"-3.5" OD		1	1	1	1	1	1
		23 17 246	Grip, Cable Riser, 3.5"-4.0" OD		1	1	1	1	1	1
	U	23 66 027	Washer, Square, For 5/8" Bolt		3	3	3	3	3	3
6@	V	10 01 129	Arrester, Lightning, 9kV		3	3	3	3	3	3
		10 01 133	Arrester, Lightning, 3kV		3	3	3	3	3	3
		10 01 146	Arrester, Lightning, 10kV		3	3	3	3	3	3
	X	18 51 021	Wire, # 6 Cu, S.D. Covered		6	6	6	6	6	6
	Y	23 67 197	Bracket, Cable Support, 750 kcmil		3	3	3	3	3	3
@	AA	42 34 61 02	Termination, 15 kV, 750 kcmil Cu. CN		3	3	3	3	3	3
		42 34 61 04	Termination, 15 kV, 750 kcmil Al. CN		3	3	3	3	3	3
		42 34 61 06	Termination, 15 kV, 350 kcmil Cu. CN		3	3	3	3	3	3
		42 34 61 10	Termination, 15 kV, 500 kcmil Al. CN		3	3	3	3	3	3
@	BB	18 07 243	Cable – 750 kcmil Al. CN		35	35	35	35	35	35
		18 07 261	Cable – 500 kcmil Al. CN		105	105	105	105	105	105
		18 07 245	Cable – 350 kcmil Cu. CN		35	35	35	35	35	35
		18 07 244	Cable – 750 kcmil Cu. CN		35	35	35	35	35	35
	CC	25 53 003	Bolt, Double Arming, 5/8" x 18"		3	3	3	3	3	3
	DD	23 65 053	Nut, Jam, 5/8"		3	3	3	3	3	3
	EE	23 67 184	Strap, Conduit, 5"		3	3	3	3	3	3

CABLE TERMINALS
15kV & Below – Three Phase – 600A Disconnect Switches
350 kcmil – 750 kcmil Shielded Cable

14 12 16 **

Sheet 3 of 3

7 @	FF	23 06 087	Bracket, Standoff, 12"	3	3	3	3	3	3
	GG	12 01 272	Conduit, 5" SCH 80	10'	10'	10'	10'	10'	10'
	HH	12 51 206	Bend, 5" 36" Rad.	1	1	1	1	1	1
	KK	23 17 415	Tape, Fusion MV	1	1	1	1	1	1
		OP 277	Install Cable Up Pole	1	1	1	1	1	1

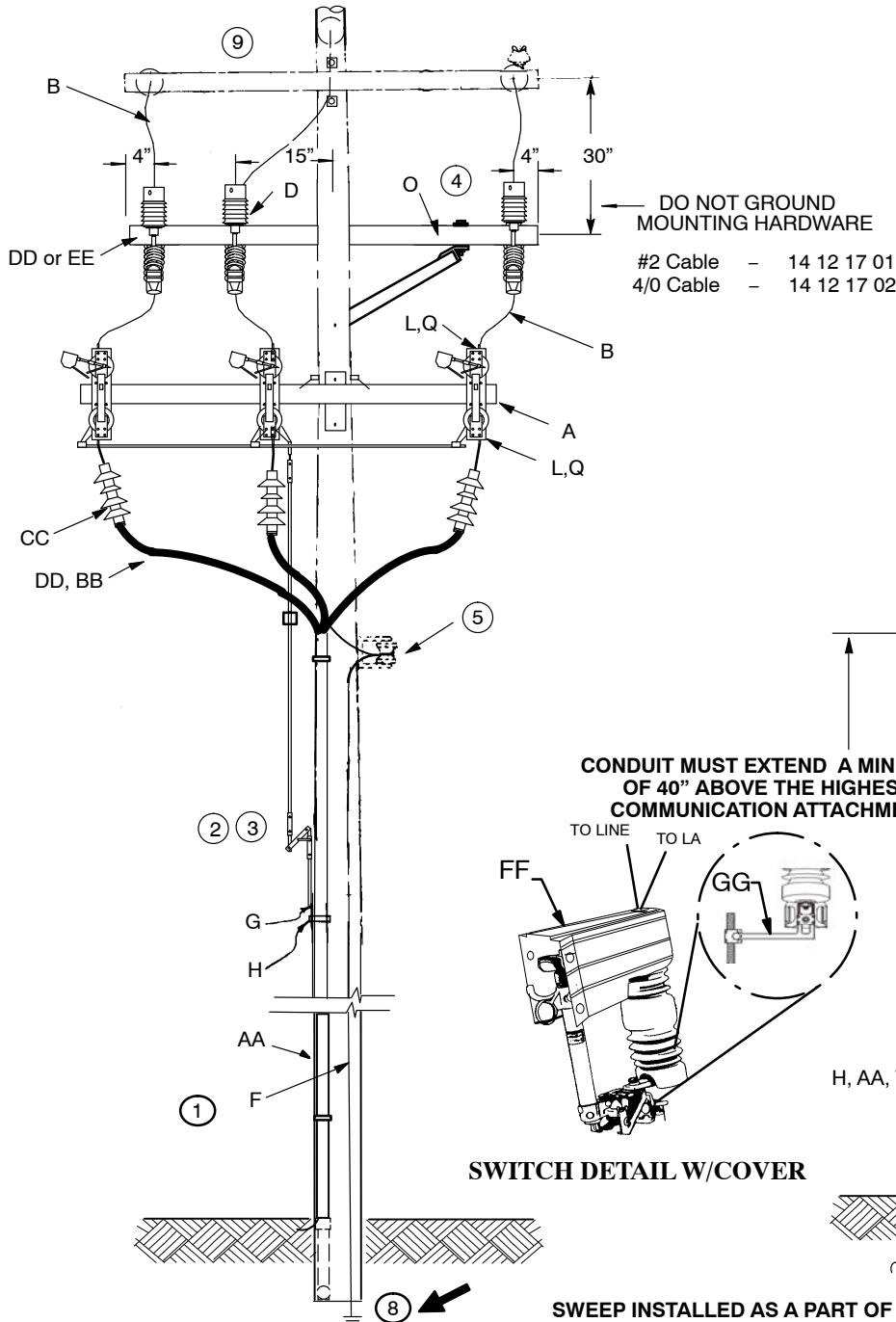
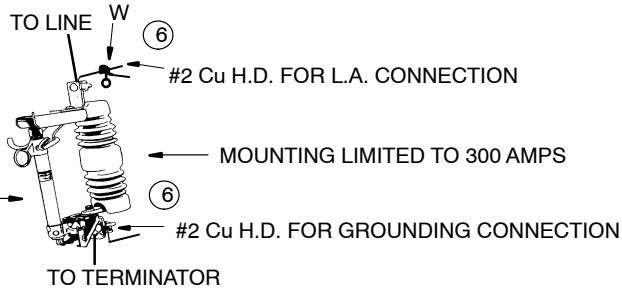
NOTES:

1. Wrap cable with friction tape prior to installation of cable grip.
2. When guy is required, use 45" fiberglass strain insulator and select links to obtain maximum clearance.
3. For alternate construction call for split conduit with steel guard.
4. Switch blades should open away from the terminators.
5. Keep arrester primary and ground leads as short as possible.
6. Use the 10 kV lightning arrester on 13 kV terminal poles.
7. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.
8. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
9. 8' crossarm available AmerenMO only.

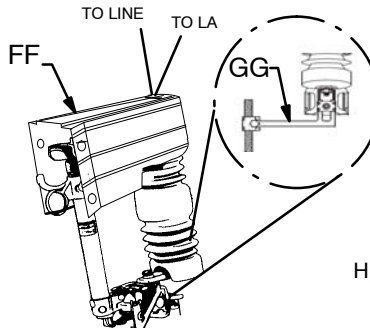
DEADEND OR THROUGH CIRCUIT

SWITCH DETAIL

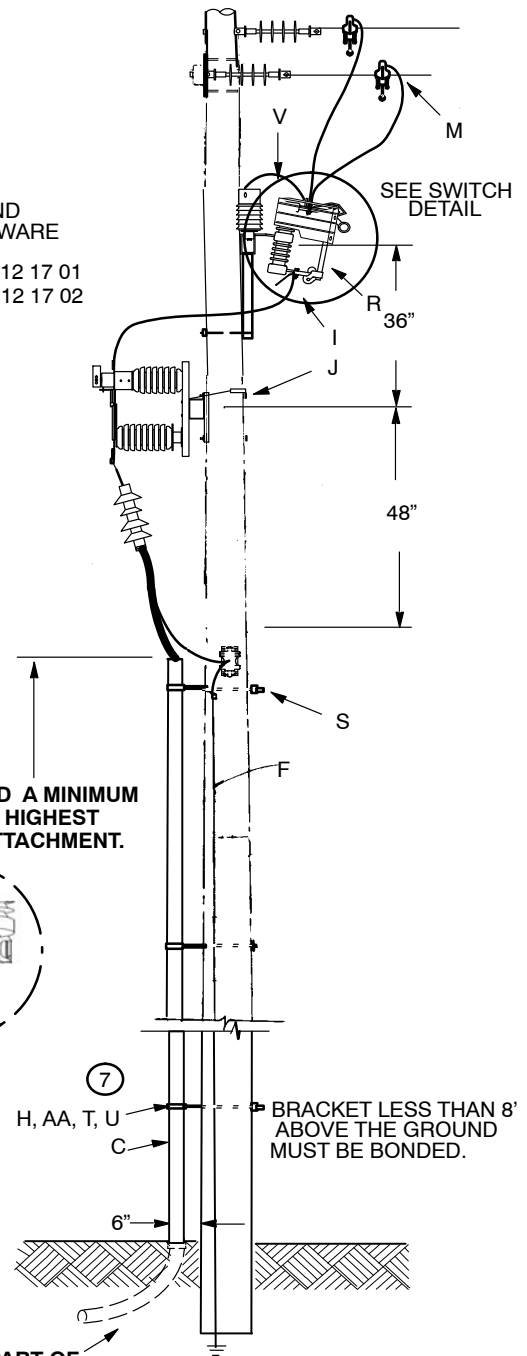
Use #4 Cu w/ 100A Barrel
 Use #1/0 Cu w/ 200A Barrel
 Use #1/0 Cu w/ 300A Barrel



CONDUIT MUST EXTEND A MINIMUM OF 40" ABOVE THE HIGHEST COMMUNICATION ATTACHMENT.



SWITCH DETAIL W/COVER



SWEEP INSTALLED AS A PART OF CONDUIT INSTALLATION

NOTES:

1. Locate ground opposite operating rod. Do not install pole ground where it would bypass the operating rod insulator.
2. Locate lever assembly half way between switch and operation handle or a little above halfway point.
3. Connect ground to switch handle mounting.
4. Use only one V brace. Keep extra brace for future use.
5. Always connect the metallic shields on the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and / or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
6. Insert a piece of #2 H.D. Cu. for LA and grounding attachments, Missouri only.
7. See DCS 14 00 00 03 for standoff bracket placement and grounding requirements.
8. Use DCS 12 00 10 04 for ground coil application on new pole installation.
Use 12 00 10 03 for ground rod on an existing pole.
9. See DCS 03 12 05 ** for through pole or deadend configuration.
10. For all of Illinois and locations in Missouri where additional avian protection is needed, omit the piece of #2 bare Cu, and hot line clamp "W". Connect the #6 Cu poly covered arrester wire "V" directly to the fused switch connector.

CABLE TERMINALS

14 12 17 **

15 kV & Below #2 thru 4/0 Three Phase – Group Operated Switch
For Ferroresonance Condition

Sheet 3 of 3

		Std. / Stk. No.	Description	14 12 17 **	01	02
	A	54 07 239	Switch, 15kV, Group Oper., 600A		1	1
	B	18 51 025	Wire, Cu., #4 S.D. Covered		40	
		18 51 024	Wire, Cu., 1/0 S.D. Covered			40
	C	12 01 273	Conduit, 4" Sch 80		10	10
@	D	10 01 129	Arrester, Lightning, 9kV		3	3
		10 01 133	Arrester, Lightning, 3kV		3	3
		10 01 146	Arrester, Lightning, 10kV		3	3
5,8	F	12 00 10 04	Grounding Unit		1	1
	G	12 01 278	Conduit, Plas. 4", Sch 40		20	20
7	H	23 06 087	Bracket, Conduit Standoff, 12"		3	3
	I	54 07 209	Switch, Fused, 200 A, 15kV			3
		54 07 208	Switch, Fused, 100 A, 15kV		3	
	J	23 52 065	Bolt Machine, 5/8" x 12"		2	2
	K	23 66 027	Washer, Square, For 5/8" Bolt		1	1
	L	17 05 215	Lug, Comp. Cu. #2		6	
		17 05 194	Lug, Comp. Cu 4/0			6
@	M	HLC*W	Hot Line Clamp		3	3
@	N	PG*	See 07 00 25 00		3	3
4@	O	04 00 20 02	Crossarm, Sgl, Wood, 8' (1/2 of V-brace)		1	1
		04 00 20 03	Crossarm, Sgl, Wood, 10' (1/2 of V-brace)		1	1
	Q	21 53 046	Bolts, Everdur, 1/2" x 2-1/2"		6	6
@	R		Fuse Sized By Engineer		3	3
	S	23 66 027	Washer, Square, 5/8"		6	6
	T	23 67 183	Strap, Conduit 4"		3	3
	U	23 65 053	Nut, 5/8" Jam		3	3
	V	18 51 021	Wire, #6 Cu S.D. Covered		6'	6'
	W	23 78 394	Clamp, Hotline, #6 to 2/0		3	3
	AA	23 53 003	Bolt, Double Arming, 5/8" x 18"		3	3
@	BB	18 07 237	Cable, 15kV, #2-3 C Al.		35	
		18 07 238	Cable, 15kV, #2-1 C Al.		105	
		18 07 239	Cable, 15kV, 4/0-1 C Al.			105
		18 07 240	Cable, 15kV, 4/0-3 C Al.			35
	CC	42 34 59 01	Termination, 15kV #2		3	
		42 34 59 03	Termination, 15kV, 4/0			3
	DD	23 56 088	Bracket, Crossarm Mounting, Double Sided		3	
	EE	17 58 054	Bracket, Crossarm Mounting			3
	FF	23 17 411	Cover, Cutout		3	3
@	GG	17 55 828	Stirrup – Grounding, 1/2" X 7"		1	1
		OP 279	Install Cable Up Pole		1	1

CABLE TERMINALS

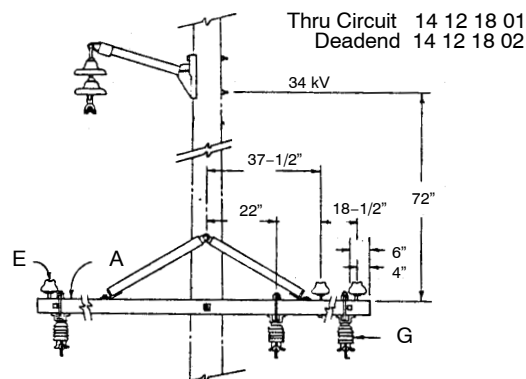
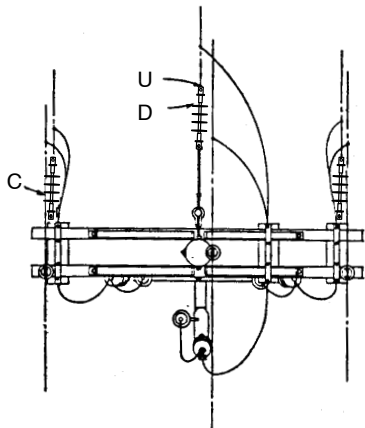
15kV & Below – Three Phase – 600A Disconnect Switches
& SM-5 Fuses

14 12 18 **

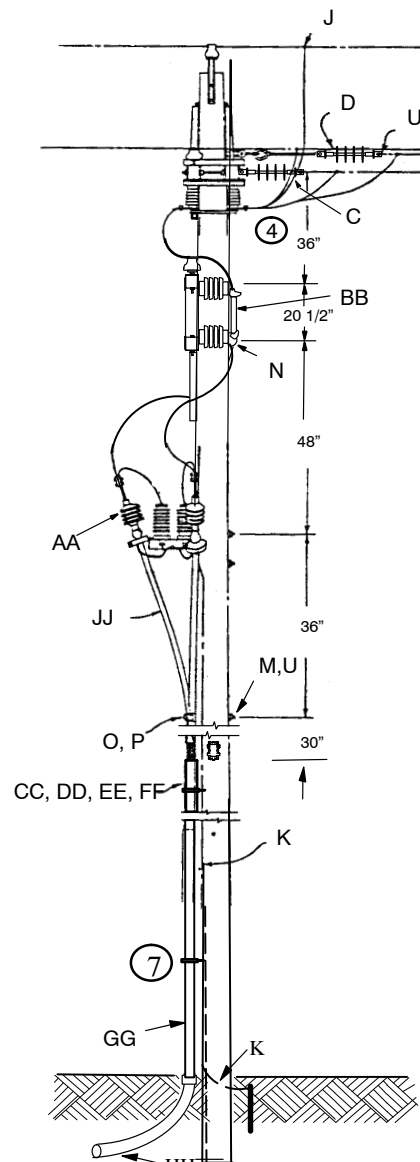
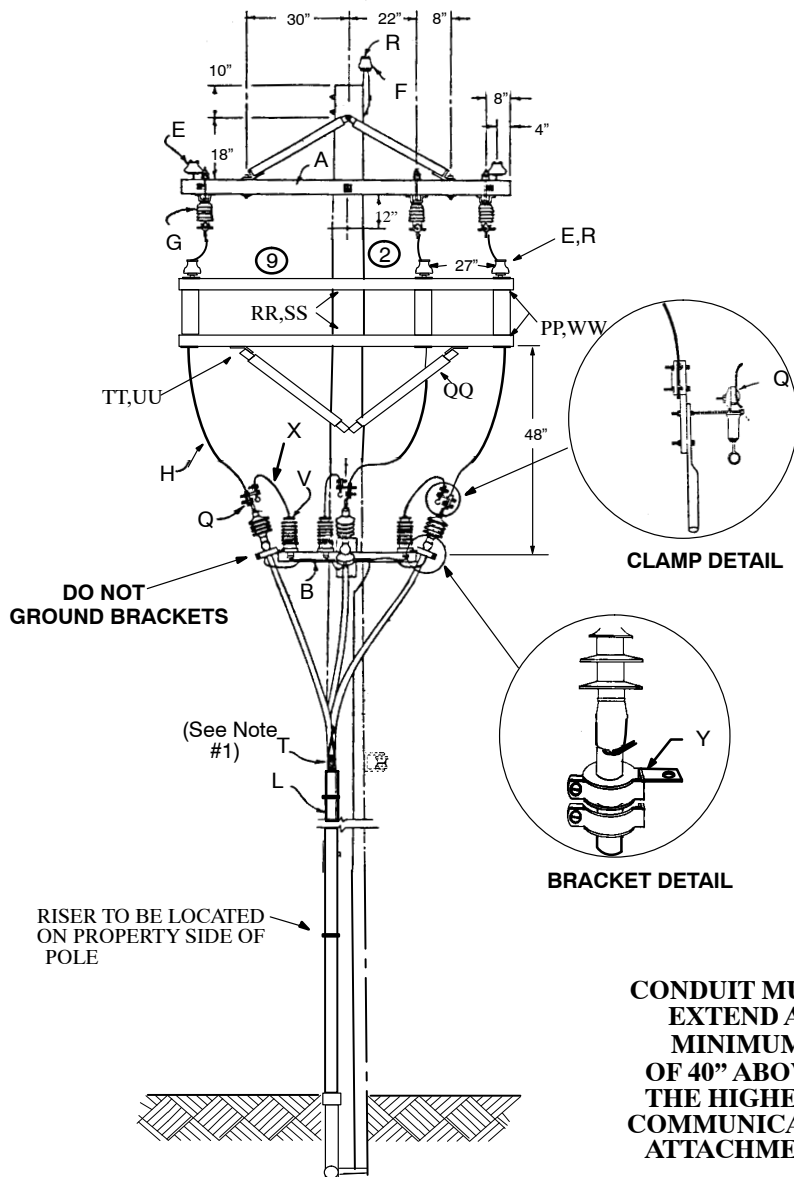
Sheet 1 of 3

SHIELDED CABLE THROUGH POLE OR DEADEND

This construction shall not be used for non-shielded cables operating above 2000 volts to ground.
Conduit must be placed against the pole and covered with a bonded guard.



UNDER BUILD DETAIL



CABLE TERMINALS

15kV & Below – Three Phase – 600A Disconnect Switches & SM-5 Fuses

14 12 18 **

Sheet 2 of 3

NOTES:

1. Wrap cable with friction tape prior to installation of cable grip.
2. When guy is required, use 45" fiberglass strain insulator and select links to obtain maximum clearance.
3. For alternate construction call for split conduit with steel guard.
4. Switch blades should open away from the terminators.
5. Keep arrester primary and ground leads as short as possible.
6. Use the 10 kV lightning arrester on 13 kV terminal poles.
7. See Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements.
8. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use DCS 12 00 10 03 for grounding rod on an existing pole.

		Std. / Stk. No.	Description	14 12 18 **	01	02
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">8</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">6@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> <div style="margin-bottom: 10px;">@</div> </div>	A	04 00 20 08	Crossarm , Dble., 10'		1	1
	B	17 08 057	Bracket, Mounting, Terminator		1	1
	C	06 12 34 01	Deadend On Arm			2
	D	06 12 32 01	Deadend On Pole			1
	E	06 12 01 01	Pin & Ins. On Arm		5	3
	F	06 12 01 02	Pin & Ins. On Pole Top		1	
	G	54 07 204	Switch, Disc. 600A., 15kV		3	3
	H	18 51 052	Wire, Cu. 350 S.D., Poly covered		40	40
	J	PG*	See 07 00 25 00		3	3
	K	12 00 10 04	Grounding Unit		1	1
	L	12 01 303	Conduit, 5", Plastic, SCH 40		20	20
	M	23 52 065	Bolt, Mach., 5/8" x 12"		1	1
	N	54 03 051	Mounting – Fuse SM5, 400A		3	3
	O	23 65 012	Eyenuit, 5/8", Oval Eye		1	1
	P	23 68 181	Shackle		1	1
	Q	23 78 183	Clamp, Hot Line,# 6–400 kcmil, Cu		3	3
	R	TT*W	Top Tie		6	3
	S	DEC*W	Deadend Clamp			3
	T	23 17 246	Grip, Cable Riser, 3.5"–4.0" Dia. Split		1	1
	U	23 66 027	Washer, Square, For 5/8" Bolt		3	3
	V	10 01 129	Arrester, Lightning, 9kV		3	3
		10 01 133	Arrester, Lightning, 3kV		3	3
		10 01 146	Arrester, Lightning, 10kV		3	3
	X	18 51 021	Wire, # 6 Cu, S.D. Covered		6	6
	Y	23 67 197	Bracket, Cable Support, 750 kcmil		3	3
	[@]	AA	42 34 61 02	Termination, 15 kV, 750 kcmil Cu. CN	3	3
			42 34 61 04	Termination, 15 kV, 750 kcmil Al. CN	3	3

CABLE TERMINALS
15kV & Below – Three Phase – 600A Disconnect Switches
& SM-5 Fuses

14 12 18 **

Sheet 3 of 3

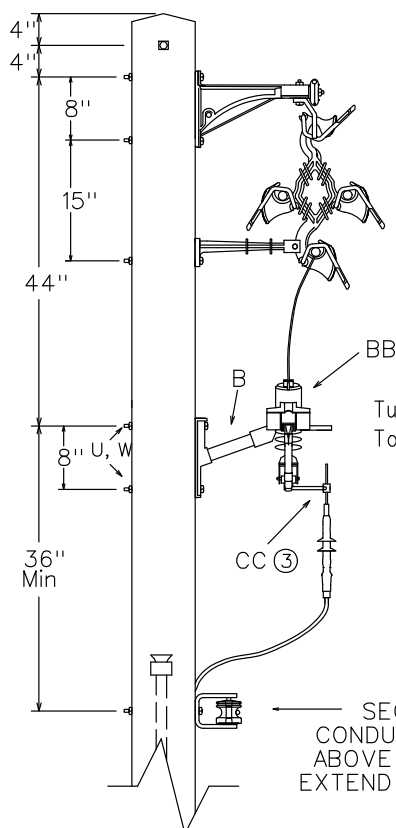
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	CC	23 53 003	Bolt, Double Arming, 5/8" x 18"	3	3
	DD	23 65 058	Nut, Jam, 5/8"	3	3
	EE	23 67 184	Strap, Conduit, 5"	3	3
	FF	23 06 087	Bracket, Standoff, 12"	3	3
	GG	12 01 272	Conduit, 5" SCH 80	10'	10'
	HH	12 51 206	Bend, 5" 36" Rad.	1	1
	JJ	18 07 243	Cable, 750 kcmil AL, CN	35	35
		18 07 244	Cable, 750 kcmil CU, CN	35	35
	PP	41 01 014	Crossarm, 3 1/2" x 4 1/2" x 8' 0"	2	2
		41 01 008	Crossarm, 3 1/2" x 4 1/2" x 10' 0"	2	2
	QQ	41 56 016	Brace, 60" V	1	1
	RR	23 52 065	Bolt, Machine, 5/8" x 12"	2	2
	SS	23 66 027	Washer, Square, 2 1/4"	6	6
	TT	23 52 038	Bolt, Machine, 1/2" x 6"	2	2
	UU	23 66 017	Washer, Round, 1/2"	2	2
	VV	23 52 063	Bolt, Machine, 5/8" x 10"	1	1
	WW	23 52 036	Bolt, Machine, 1/2" x 5"	12	12
		OP 277	Install Cable Up Pole	1	1

CABLE TERMINALS

15KV & Below – Spacer Cable #2 through 4/0 Single Phase Riser

14 20 01 **

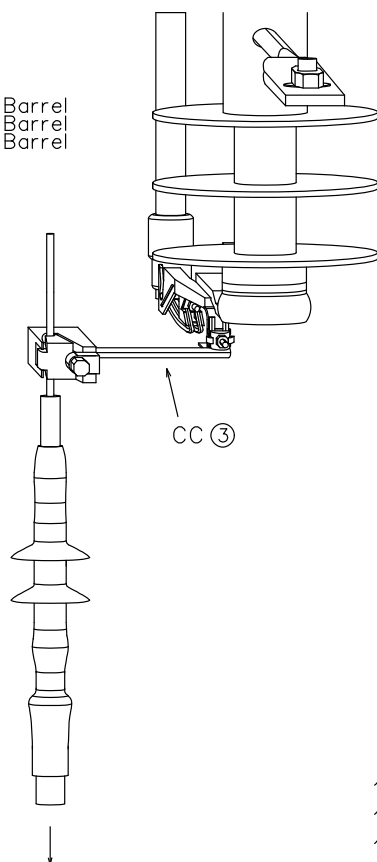
Sheet 1 of 3



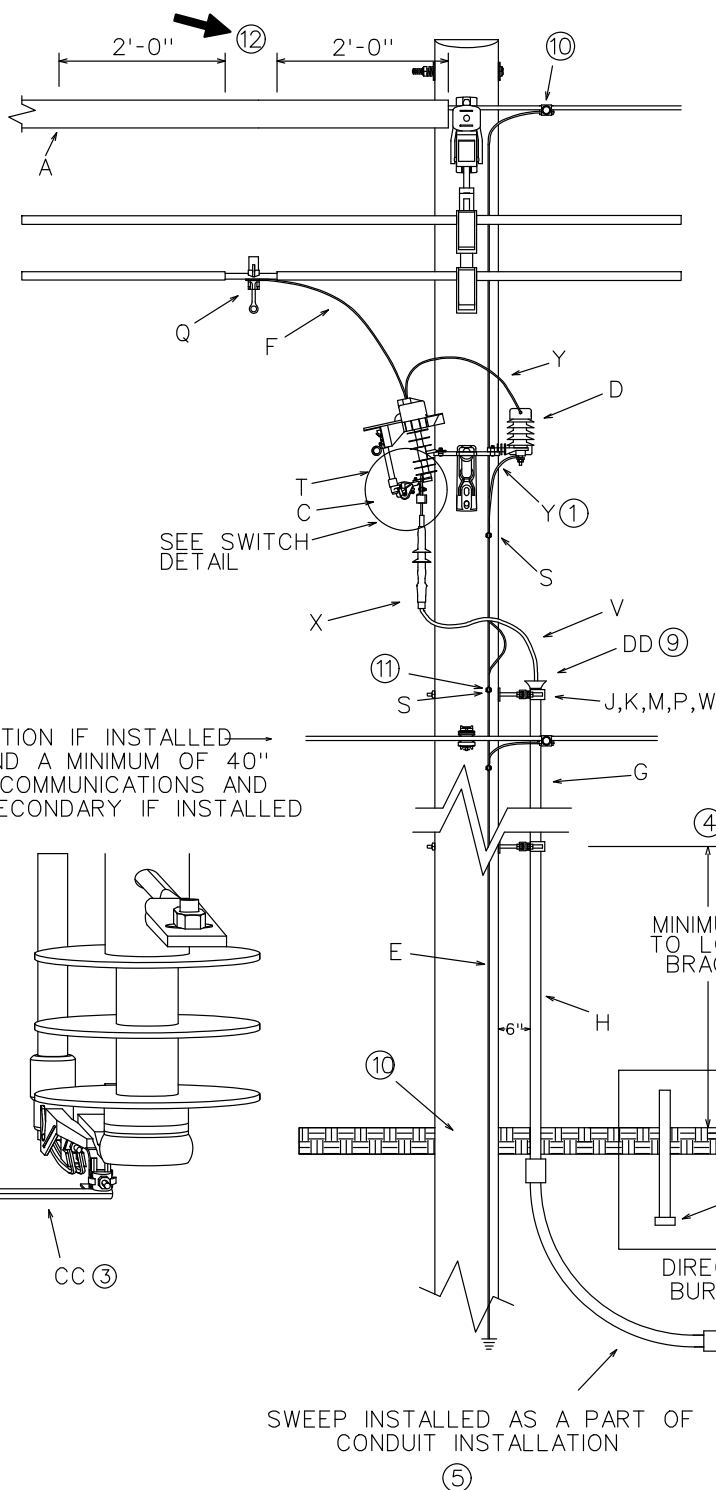
SECONDARY LOCATION IF INSTALLED
CONDUIT MUST EXTEND A MINIMUM OF 40"
ABOVE THE HIGHEST COMMUNICATIONS AND
EXTEND ABOVE THE SECONDARY IF INSTALLED

Use #4 Cu Line Lead w/ 100A Barrel
Use #1/0 Cu Line Lead w/ 200A Barrel
Use #1/0 Cu Line Lead w/ 300A Barrel

SWITCH DETAIL



TO TERMINATOR



14 20 01 01- #2 Direct Buried or In 2" Conduit/Duct
14 20 01 02- 4/0 Direct Buried or In 2" Conduit/Duct
14 20 01 03- #2 Direct Buried or In 3" Conduit/Duct
14 20 01 04- 4/0 Direct Buried or In 3" Conduit/Duct

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: JMW
REV. NO: 3
REV. DATE: 6/19/18

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Single Phase Riser

14 20 01 **

Sheet 2 of 3

		Std. / Stk. No.	Description	01	02	03	04	
2@	A	69 58 293	Line DUC (Messenger Cover), Black, 8' long (Each)	1	1	1	1	
	B	23 56 063	Bracket, Fiberglass, 3 Position Mounting	1	1	1	1	
	C	54 07 208	Switch, Fuse, 100A, 15KV	1	1	1	1	
10@	D	10 01 129	Arrester, Lightning, 9KV	1	1	1	1	
		10 01 133	Arrester, Lightning, 3KV	1	1	1	1	
		10 01 146	Arrester, Lightning, 10KV	1	1	1	1	
@	E	12 00 10 03	#2 Copper Ground Unit with ground rod	1	1	1	1	
	F	18 51 025	Wire, Cu., #4 S.D. Covered	10		10		
		18 51 024	Wire, Cu., 1/0 S.D. Covered		10		10	
4@	G	12 01 280	Conduit, Plastic, 2", SCH 40	20	20			
		12 01 279	Conduit, Plastic, 3", SCH 40			20	20	
	H	12 01 275	Conduit, Plastic, 2", SCH 80	10	10			
		12 01 276	Conduit, Plastic, 3", SCH 80			10	10	
	J	23 06 086	Bracket, Standoff 20"	3	3	3	3	
		23 06 087	Bracket, Standoff 12"	3	3	3	3	
@	K	23 53 003	Bolt, Double Arming 5/8' x 18"	3	3	3	3	
	M	23 67 190	Strap, Conduit 2"	3	3			
		23 67 182	Strap, Conduit 3"			3	3	
@	P	23 65 053	Nut, Jam 5/8"	3	3	3	3	
	Q	17 62 088	Hot Line Clamp, 1/0 through 477 Spacer Cable	1	1	1	1	
		17 62 143	Hot Line Clamp, 795 Spacer Cable	1	1	1	1	
@	S	17 54 373	Connector, Split Bolt, 2 AWA Stranded	2	2	2	2	
	T		Fuse Sized By Engineer	1	1	1	1	
	U	23 52 066	Bolt, Mach., 5/8" x 14"	2	2	2	2	
8@	V	18 07 238	Cable, 15 kv, #2	35		35		
		18 07 239	Cable, 15 kv, 4/0		35		35	
	W	23 66 027	Washer, Square, 5/8"	8	8	8	8	
	X	42 34 59 01	Termination, 15KV, #2 Al.	1		1		
		42 34 59 03	Termination, 15KV, 4/0		1		1	
	Y	18 51 021	Wire, #6 Cu., S.D. Covered (ft)	6	6	6	6	
	AA	12 53 017	Shield, Duct, Cable	1	1	1	1	
	BB	23 17 411	Cover, Cutout	1	1	1	1	
	3	CC	17 55 828	Stirrup – Grounding, 1/2" x 7"	1	1	1	1
	9	DD	40 83 491	Coupling, Bell End, 2"	1	1		
12 51 008			Coupling, Bell End, 3"			1	1	
		OP278	Install Cable Up Pole	1	1	1	1	

NOTES

1. Attached arrester ground lead to the pole ground keeping to lead as short as possible.
2. On 13kv terminal poles use 10 kv lightning arrester, Stock Number 10-01-146.
3. Insert a grounding stirrup Into the bottom of the cutout for a grounding attachment point.
4. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Single Phase Riser

14 20 01 **

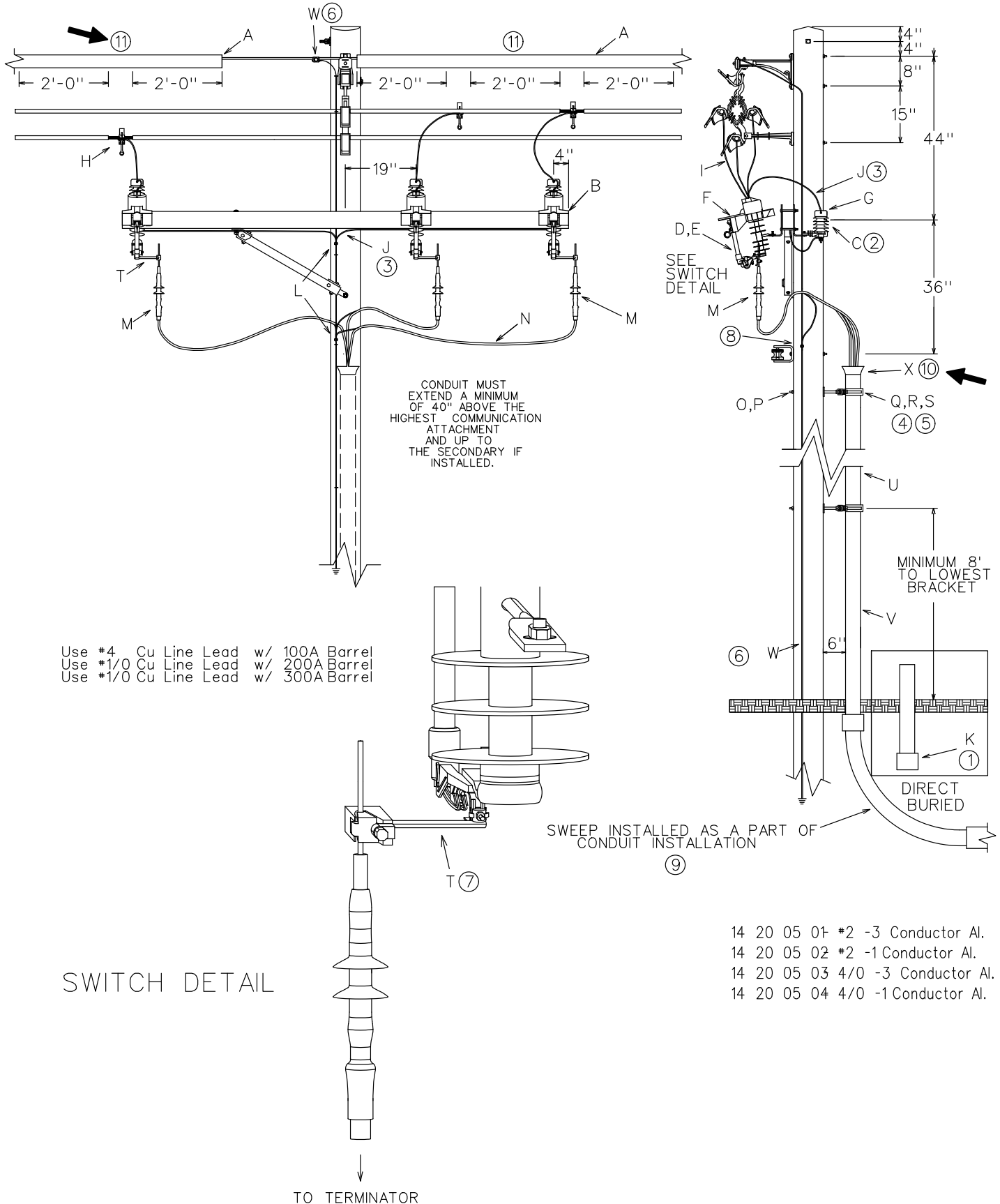
Sheet 3 of 3

5. See DCS 59 40 41 01 for information on making PVC to HDPE Duct connection at the end of the sweep if HDPE Duct is used.
6. Some standoff brackets require that one of the nuts on the double arming bolt be replaced with a jam nut, stock number 23-65-053. The jam nut should then be inserted into the 5/8" slot on the standoff bracket. If the nut on the double arming bolt will fit into the 5/8" slot on the bracket - Do Not use the jam nut.
7. On the front of the 20" standoff bracket, the following conduits may be mounted: 4-2" conduits, 3-2 1/2" conduits, 3-3" conduits, 3-4" conduits, 2-5" conduits. Various combinations of conduits may also be mounted. On the front of the 12" standoff bracket, the following conduits may be mounted: 2-2" conduits, 2-2 1/2" conduits 1-3" & 1-2" conduits, 1-3" and 1-2 1/2" conduits, and 1-5" conduit.
8. To prevent damage to direct buried cables, install a cable shield (Stk# 12-53-017) at the conduit entry.
9. If water entering the duct becomes a problem, the top of the duct can be sealed with polyurethane expanding foam, stock number 31-53-082. Expanding foam requires a dispensing gun, stock number 85-20-073.
10. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the non – switch side of the pole. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
11. Connect the metallic shields of the riser cable to the system neutral/ messenger by attaching to the #2 stranded copper pole ground that extends to the system neutral/messenger. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
12. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Three Phase Riser

14 20 05 **

Sheet 1 of 3



CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Three Phase Riser

14 20 05 **

Sheet 2 of 3

		Std. / Stk. No.	Description	01	02	03	04
1	A	69 58 293	Line DUC (Messenger Cover), Black, 8' long (Each)	2	2	2	2
	B	04 00 20 03	Crossarm, Single, Wood, 10' (Use only ½ of V-brace)	1	1	1	1
2	C	17 58 054	Bracket, Arrester/Cutout Mounting	6	6	6	6
	D	54 07 208	Switch, Fuse, 100A, 15KV	3	3	3	3
@	E		Fuse Sized by Engineer	3	3	3	3
@	F	23 17 411	Cover, Cutout	3	3	3	3
	G	10 01 129	Arrester, Lightning, 9KV	3	3	3	3
@		10 01 133	Arrester, Lightning, 3KV	3	3	3	3
		10 01 146	Arrester, Lightning, 10KV	3	3	3	3
	H	17 62 088	Hot Line Clamp, 1/0 through 477 Spacer Cable	3	3	3	3
@		17 62 143	Hot Line Clamp, 795 Spacer Cable	3	3	3	3
	I	18 51 025	Wire, Cu., #4 S.D. Covered(ft)	15		15	
3		18 51 024	Wire, Cu., 1/0 S.D. Covered(ft)		15		15
	J	18 51 021	Wire, #6 Cu., S.D. Covered (ft)	16	16	16	16
1@	K	12 53 017	Shield, Duct Cable	1	1	1	1
	L	17 54 373	Connector, Split Bolt, 2AWA Stranded	4	4	4	4
	M	42 34 59 01	Termination, 15KV, #2 Al.	3	3		
		42 34 59 03	Termination, 15KV, 4/0 Al.			3	3
	N	18 07 237	Cable, 15KV, #2-3C Al.	35			
		18 07 238	Cable, 15KV, #2-1C Al.		105		
		18 07 240	Cable, 15KV, 4/0-3C Al.			35	
		18 07 239	Cable, 15KV, 4/0-1C Al.				105
4,5	O	23 53 003	Bolt, Double Arming 5/8" x 18"	3	3	3	3
	P	23 66 027	Washer, Square, 5/8"	6	6	6	6
	Q	23 65 053	Nut, Jam 5/8"	3	3	3	3
	R	23 06 087	Bracket, Standoff 12"	3	3	3	3
7	S	23 67 183	Strap, Conduit 4"	3	3	3	3
	T	17 55 828	Stirrup – Grounding, 1/2" x 7"	3	3	3	3
	U	12 01 278	Conduit, Plastic, 4", SCH 40	20	20	20	20
	V	12 01 273	Conduit, Plastic, 4" SCH 80	10	10	10	10
6@	W	12 00 10 03	#2 Copper Ground Unit with ground rod	1	1	1	1
10	X	12 51 254	Coupling, Bell End, 4"	1	1	1	1
		OP279	Install Cable Up Pole	1	1	1	1

NOTES

1. To prevent damage to direct buried cables, install a cable shield (stk# 12 53 017) at the conduit entry.
2. Discard the backs of the brackets mounting them together with the cutout and arrester in the low position below the crossarm. Three double brackets stock number 23 56 088 may be substituted.
3. Route the arrester ground leads under the crossarm to attached to the pole ground keeping them as short as possible. Connect the arrester primary leads under the cutout cover to the arrester and keep them as short as possible.
4. Substitute the 20" standoff bracket, stock number 23 06 086 if a longer bracket is required.

CABLE TERMINALS
15KV & Below – Spacer Cable
#2 through 4/0 Three Phase Riser

14 20 05 **

Sheet 3 of 3

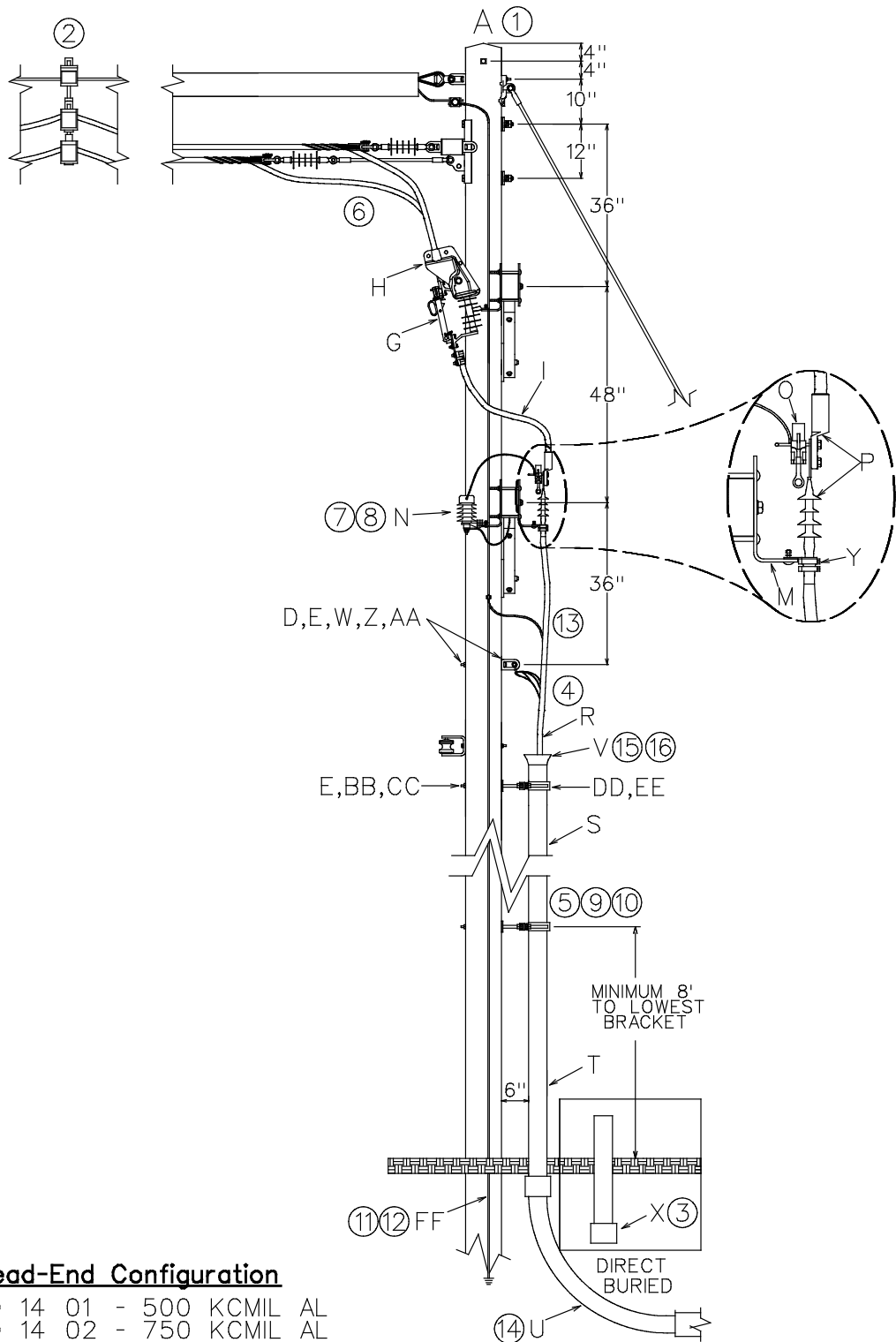
5. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.
6. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
7. Insert a grounding stirrup into the bottom of the cutout for a grounding attachment point.
8. Always connect the metallic shields of the riser cable to the system neutral/ messenger by attaching to the #2 stranded copper pole ground that extends to the system neutral/ messenger. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
9. See DCS 59 40 41 01 for information on making PVC to HDPE Duct connection at the end of the sweep if HDPE Duct is used.
10. If water entering the duct becomes a problem, the top of the duct can be sealed with polyurethane expanding foam, stock number 31-53-082. Expanding foam requires a dispensing gun, stock number 85-20-073.
11. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duct over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

CABLE TERMINALS

15kV & Below-Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **

Sheet 1 of 5

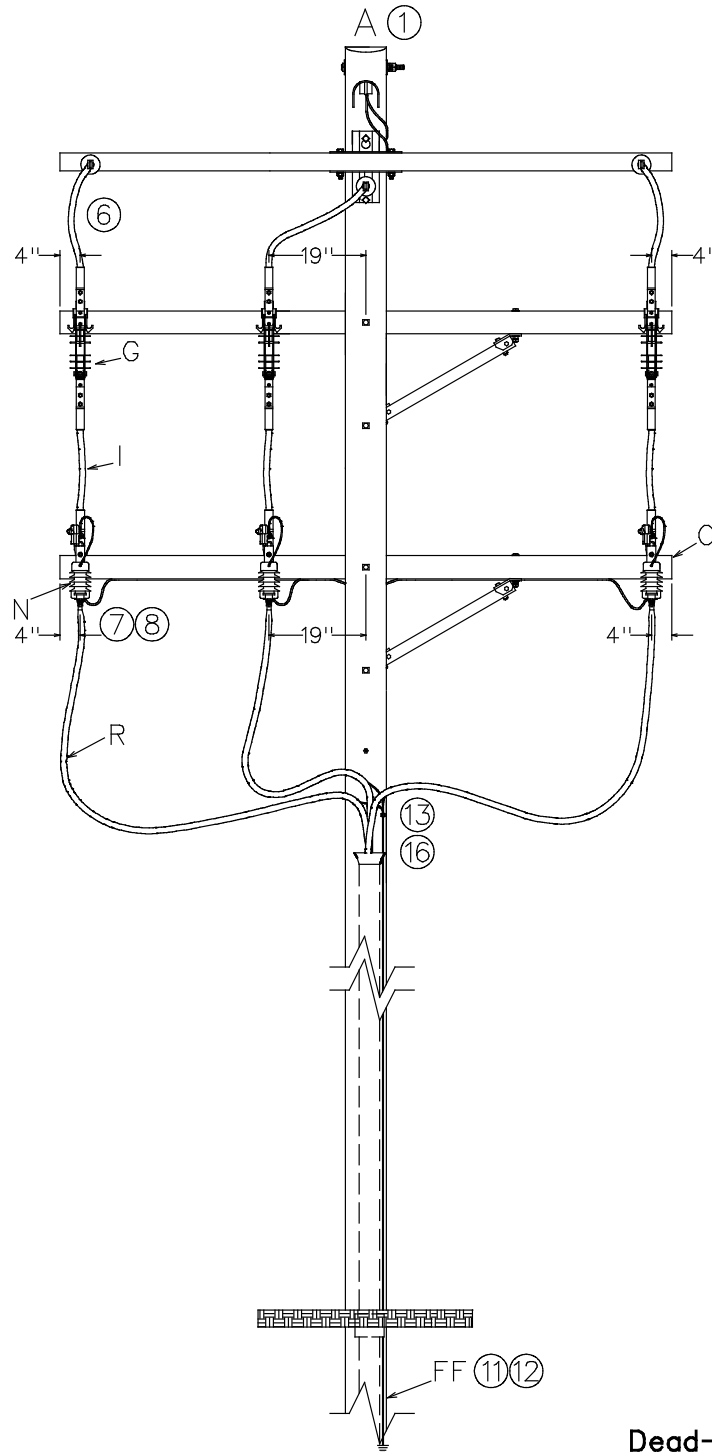


CABLE TERMINALS

15kV & Below-Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **

Sheet 2 of 5



Dead-End Configuration

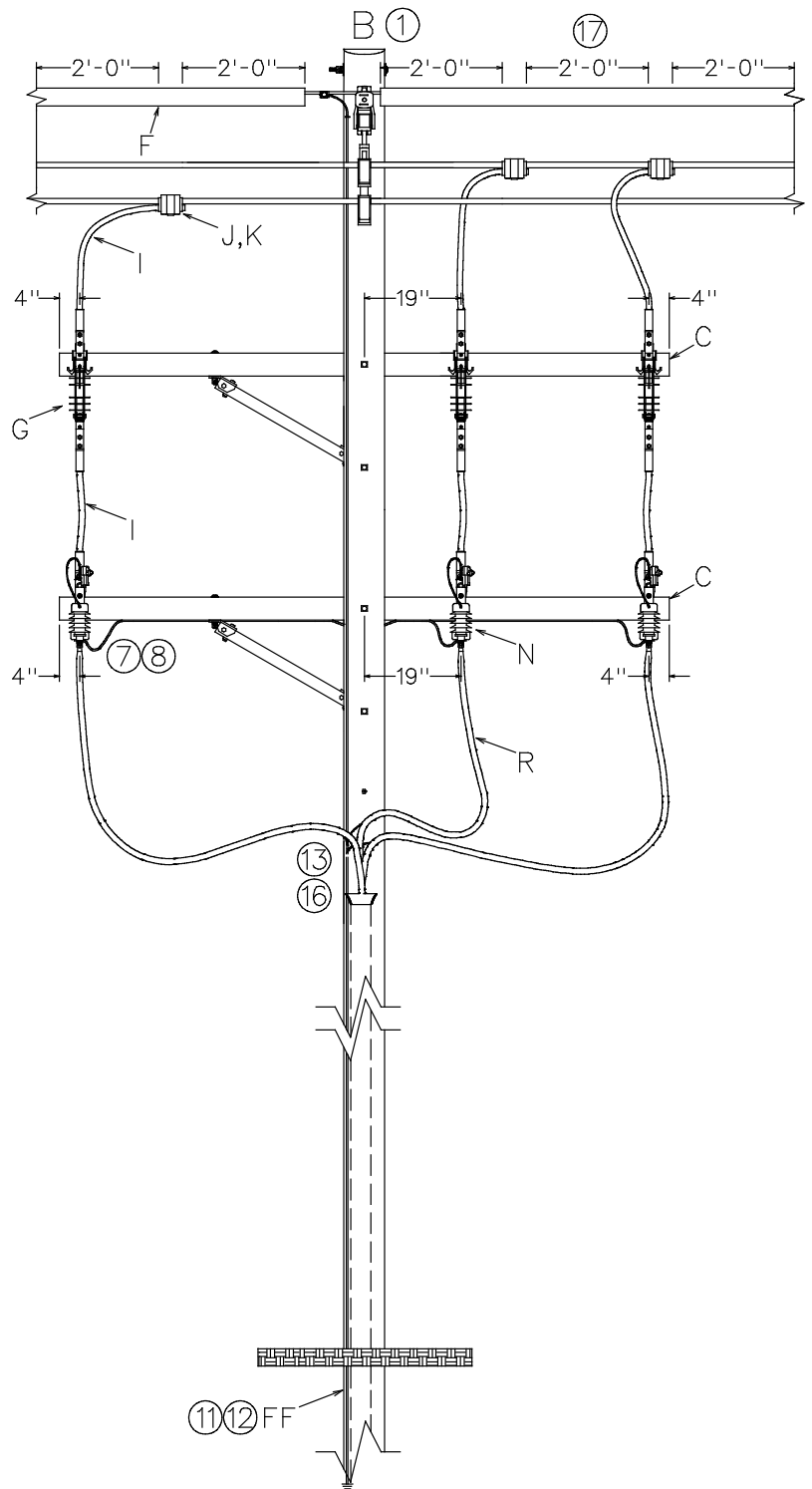
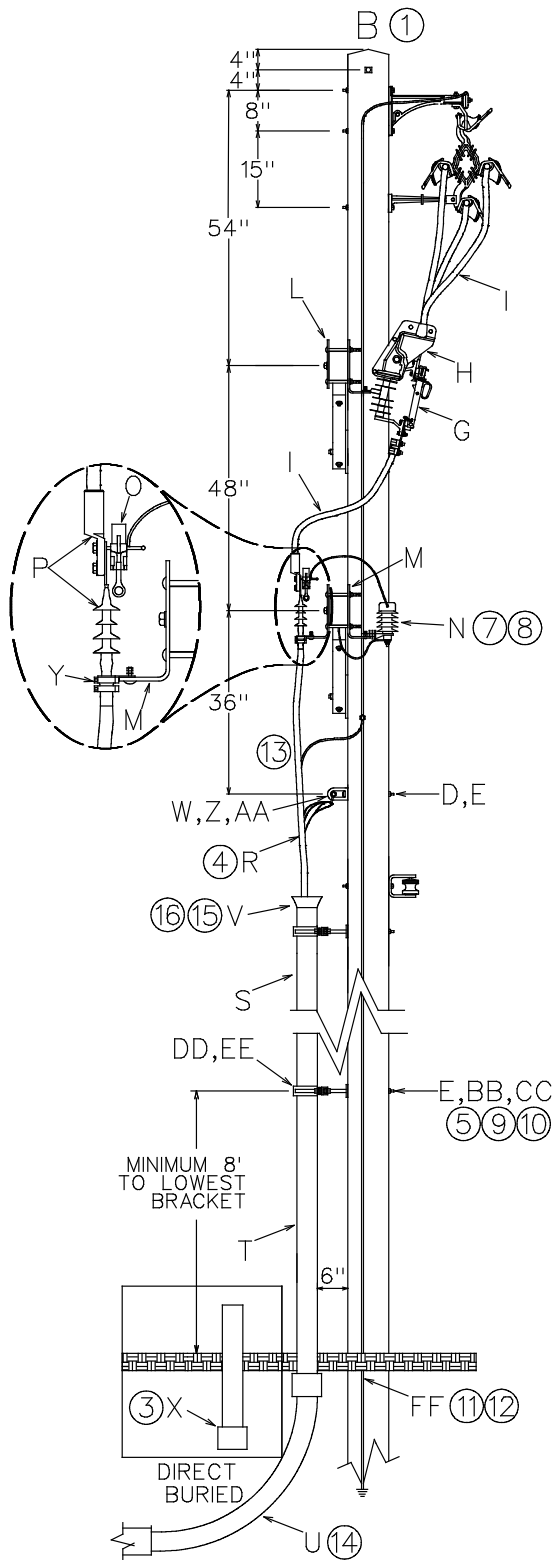
14	20	14	01	-	500	KCMIL	AL
14	20	14	02	-	750	KCMIL	AL
14	20	14	03	-	350	KCMIL	CU
14	20	14	04	-	750	KCMIL	CU

CABLE TERMINALS

15kV & Below-Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **

Sheet 3 of 5



Tangent Configuration

14	20	14	05	-	500	KCMIL	AL
14	20	14	06	-	750	KCMIL	AL
14	20	14	07	-	350	KCMIL	CU
14	20	14	08	-	750	KCMIL	CU

CABLE TERMINALS

15kV & Below-Spacer Cable-Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil-750 kcmil

14 20 14 **

Sheet 4 of 5

		Std./Stk. No.	Description	14 20 14 **	01	02	03	04	05	06	07	08
@1	A	03 20 10 01	15kV & Below-Spacer Cable Single Circuit-Dead End Structure		1	1	1	1				
@1	B	03 20 01 01	15kV & Below – Spacer Cable Single Circuit – Tangent Structure						1	1	1	1
	C	04 00 20 03	Crossarm, Sgl., Wood, 10' (Use only 1/2" of VBrace)		1	1	1	1	2	2	2	2
	D	23 52 066	Bolt, Mach., 5/8 x 14"		1	1	1	1	1	1	1	1
	E	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16"		7	7	7	7	7	7	7	7
	F	69 58 293	Line Duc Cover-(Messenger Cover), Black, 8' Long(Ea)						2	2	2	2
	G	54 07 296	Switch, Disc., 600A, Vertical, 15kV		3	3	3	3	3	3	3	3
	H	23 17 512	Cover, Vertical Switch, 600 Amp		3	3	3	3	3	3	3	3
	I	18 51 052	Wire, Cu. 350 S.D., Covered		15	15	15	15	35	35	35	35
@	J	PG*W	Clamp, Parallel Groove (See 07 00 25 00)						3	3	3	3
	K	38 51 608	Cover, Large, Vice Type Connectors						3	3	3	3
	L	17 58 054	Bracket, Switch, Arrester						3	3	3	3
	M	23 56 088	Bracket, Switch, Arrester, Double		3	3	3	3	3	3	3	3
@7,8	N	10 01 133	Arrester, Lighting, 3kV		3	3	3	3	3	3	3	3
		10 01 129	Arrester, Lighting, 9kV		3	3	3	3	3	3	3	3
		10 01 146	Arrester, Lighting, 10kV		3	3	3	3	3	3	3	3
	O	23 78 183	Clamp, Hot Line, #6-400 kcmil, CU.		3	3	3	3	3	3	3	3
@	P	42 34 61 10	Termination, 15kV, 500 kcmil AL.		3				3			
		42 34 61 04	Termination, 15kV, 750 kcmil AL.			3				3		
		42 34 61 06	Termination, 15kV, 350 kcmil CU.				3				3	
		42 34 61 02	Termination, 15kV, 750 kcmil CU.					3				3
	Q	23 17 415	Cover, Wildlife, 2" X 36 ft. Self-Fusing Tape		1	1	1	1	1	1	1	1
	R	18 07 261	Cable, 500 kcmil AL. (3 Cables, 35' Ea.)		105				105			
		18 07 243	Cable, 750 kcmil AL.			35				35		
		18 07 245	Cable, 350 kcmil CU.				35				35	
		18 07 244	Cable, 750 kcmil CU.					35				35
5	S	12 01 303	Conduit, 5" Plastic, SCH. 40		20	20	20	20	20	20	20	20
5	T	12 01 272	Conduit, 5" Plastic, SCH. 80		10	10	10	10	10	10	10	10
@	U	12 51 206	Bend, 5", 36" Radius		1	1	1	1	1	1	1	1
	V	12 51 233	Coupling, Bell End, 5"		1	1	1	1	1	1	1	1
	W	23 65 012	Nut, Eye, Oval, 5/8"		1	1	1	1	1	1	1	1
@3	X	12 53 017	Shield, Duct Cable		1	1	1	1	1	1	1	1
	Y	23 67 197	Bracket, Cable Support, 500-750 kcmil		3	3	3	3	3	3	3	3

CABLE TERMINALS

15kV & Below–Spacer Cable–Three Phase Tangent and DE
600A Vertical Disconnect Switches 350 kcmil–750 kcmil

14 20 14 **

Sheet 5 of 5

4 9,10 @11,12	Z	23 17 245	Grip, Cable Riser, 2"-2.5" Dia.	3	3	3	3	3	3	3	3
	AA	23 68 181	Shackle – Anchor, 9/16"	1	1	1	1	1	1	1	1
	BB	23 53 003	Bolt, Double Arming, 5/8"x18"	3	3	3	3	3	3	3	3
	CC	23 65 053	Nut, Jam, 5/8"	3	3	3	3	3	3	3	3
	DD	23 67 184	Strap, Conduit, 5"	3	3	3	3	3	3	3	3
	EE	23 06 087	Bracket, Standoff, 12"	3	3	3	3	3	3	3	3
	FF	12 00 10 **	Grounding Unit #2 Cu.	1	1	1	1	1	1	1	1
		OP277	Install Cable Up Pole	1	1	1	1	1	1	1	1

NOTES:

1. Refer to DCS 03 20 10 01 for dead end material. Refer to DCS 03 20 01 01 for the tangent material.
2. Install the first spacer, stock # 23 67 334, about 40' from the pole as to not stress the cable. Normal spacing is 25' to 33'.
3. To prevent damage to direct buried cables, install a cable shield (stk# 12 53 017) at the conduit entry.
4. Wrap cable with friction tape prior to installation of cable grip.
5. For alternate construction, call for split conduit with steel guard.
6. Extend spacer cable conductor with covering intact through the preform into the switch.
7. On 13kV terminal poles, a 10kV arrester shall be used.
8. Route the arrester ground leads under the crossarm and attach to the pole ground keeping them as short as possible. Connect the arrester primary leads under the cutout cover to the arrester and keep them as short as possible.
9. Substitute the 20" standoff bracket, stock number 23 06 086 if a longer bracket is required.
10. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.
11. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
12. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use DCS 12 00 10 03 for ground rod on existing pole.
13. Always connect the metallic shields of the riser cable to the system neutral/ messenger by attaching to the #2 stranded copper pole ground that extends to the system neutral/ messenger. Be aware that the bare and/or covered 7#10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
14. See DCS 59 40 41 01 for information on making PVC to HDPE Duct connection at the end of the sweep if HDPE duct is used.
15. If water entering the duct becomes a problem, the top of the duct can be sealed with polyurethane expanding foam, stock number 31 53 082. Expanding foam requires a dispensing gun, stock number 85 20 073.
16. Conduit must extend a minimum of 40" above the highest communication attachment and up to the secondary, if installed.
17. Stagger taps and other areas where the covering has been removed to provide a minimum 2'-0" horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2'-0" of horizontal separation.

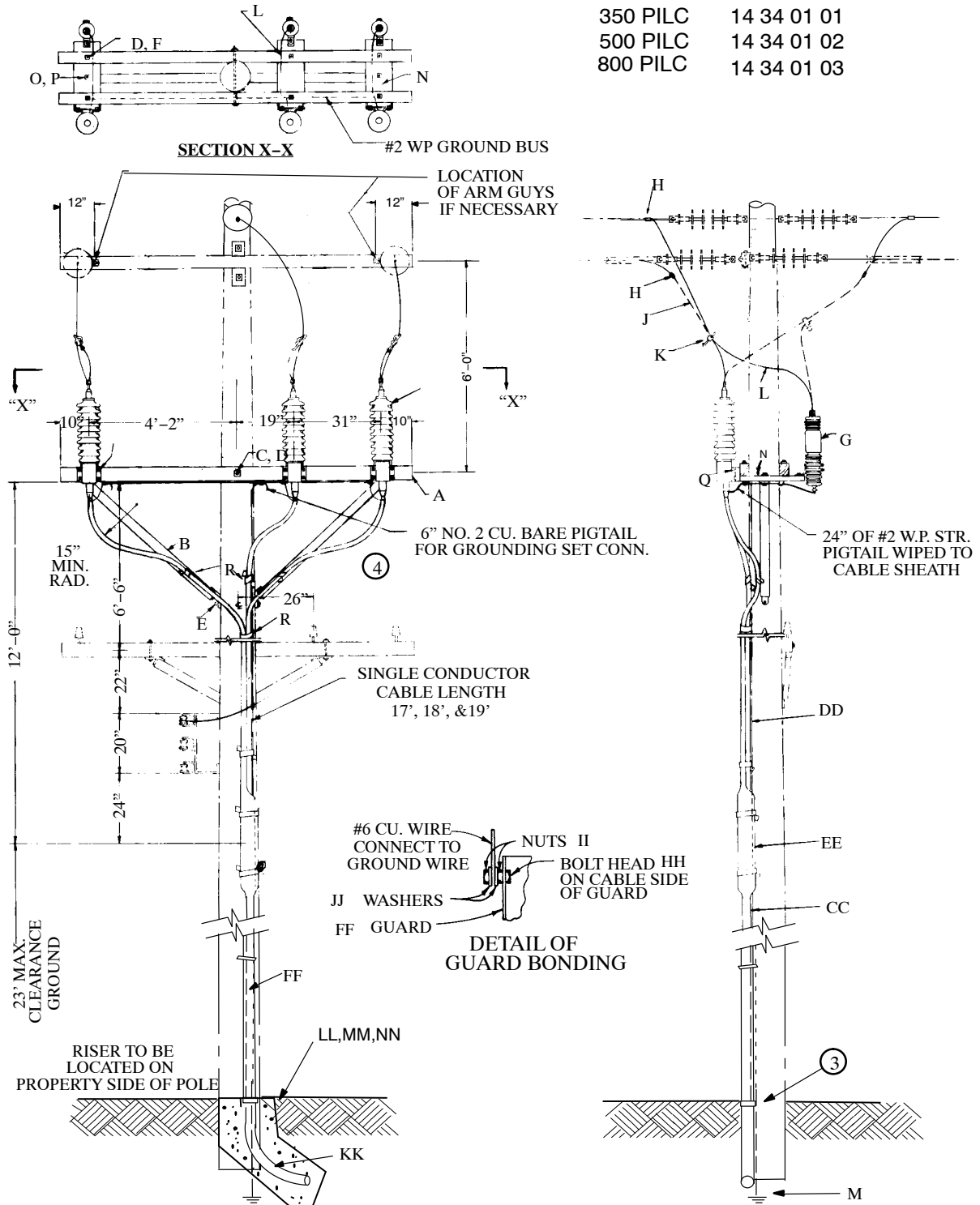
CABLE TERMINALS

34 kV Single Circuit – PILC Cable

Up to 600 Amp. Normal Rating

14 34 01 **

Sheet 1 of 3



CABLE TERMINALS
34 kV Single Circuit – PILC Cable
Up to 600 Amp. Normal Rating

14 34 01 **

Sheet 2 of 3

		Std. / Stk. No.	Description	14 34 01 **	01	02	03
@	A	41 01 022	Crossarm 10'		2	2	2
	B	41 56 021	Brace, Heel 5'		2	2	2
	C	23 52 070	Bolt, Mach., 5/8" x 20"		1	1	1
	D	23 66 027	Washer, Square 2-1/4"		8	8	8
	E	23 52 066	Bolt, Mach., 5/8" x 14"		1	1	1
	F	23 52 061	Bolt, Mach., 5/8" x 8"		6	6	6
	G	10 01 137	Arrester Lighting, 27 kV		3	3	3
	H	PG*	See 07 00 25 00		3	3	3
	J	18 52 024	Wire Cu. 4/0 S.D.		15'		
		18 52 023	Wire Cu. 350 S.D.			15'	15'
	K	23 78 183	Clamp Live Line		3	3	3
	L	18 51 021	Wire Cu #6 S.D. Covered		25'	25'	25'
	M	12 00 10 04	Grounding Unit		1	1	1
	N	23 06 065	Bracket LA & Pothead		3	3	3
	O	23 66 006	Washer, Lock 5/8"		2	2	2
	P	23 52 049	Bolt, Mach., 5/8" x 2"		2	2	2
	Q	21 53 021	Bolt, Mach 1/2" x 1-1/2"		12	12	12
	R	49 17 181	Strap, Poly		5	5	5
	AA	12 51 220	Conduit, Plastic, 5" Split		30	30	30
	BB	17 07 125	Pothead, 35kV 500 kcmil		3	3	
		17 07 097	Pothead, 35kV 750 kcmil				3
	CC	18 08 171	Cable, 35kV 350 3C. P		20		
		18 08 210	Cable, 35kV 500 3C. P			20	
		18 08 203	Cable, 35kV 800 3C. P				20
	DD	18 08 070	Cable, 35kV 350 1C.		55	55	
		18 08 180	Cable, 35kV 750 1C.				55
	EE	41 43 11 02	Joint, 35kV Trifurcating		1		
		41 43 11 01	Joint, 35kV Trifurcating			1	
		41 41 13 02	Joint, 35kV Trifurcating				1
	FF	23 18 202	Guard, Conduit 5"		1	1	1
	GG	23 60 005	Screws, Lag 3/8" x 3"		6	6	6
	HH	21 53 007	Bolt, Mach. 3/8" x 1 1/2"		1	1	1
	II	21 61 006	Nut, Hex, 3/8"		2	2	2
	JJ	23 66 016	Washer, 3/8" Galv.		2	2	2
	KK	12 51 206	Bend, 5", 36" Rad.		1	1	1
	LL	23 67 036	Step, Pole 5/8" x 10"		2	2	2
	MM	11 04 110	Tube, Concrete 14" Dia.		4	4	4
	NN	99 00 001	Concrete, 4 SK		-	-	-
		OP 281	Install Potheads		3	3	3

CABLE TERMINALS
34 kV Single Circuit – PILC Cable
Up to 600 Amp. Normal Rating

14 34 01 **

Sheet 3 of 3

NOTES:

1. Pothead 17-07-105, 46 kV for 350¹ leads to be used in locations where contamination is prevalent.
2. Grip – cable, stock #85-21-054 should be used when a down hill duct run exists away from the pole.
3. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for crowd rod on an existing pole.
4. Always connect the metallic shields on the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
5. If there is no system neutral or shield wire available install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.

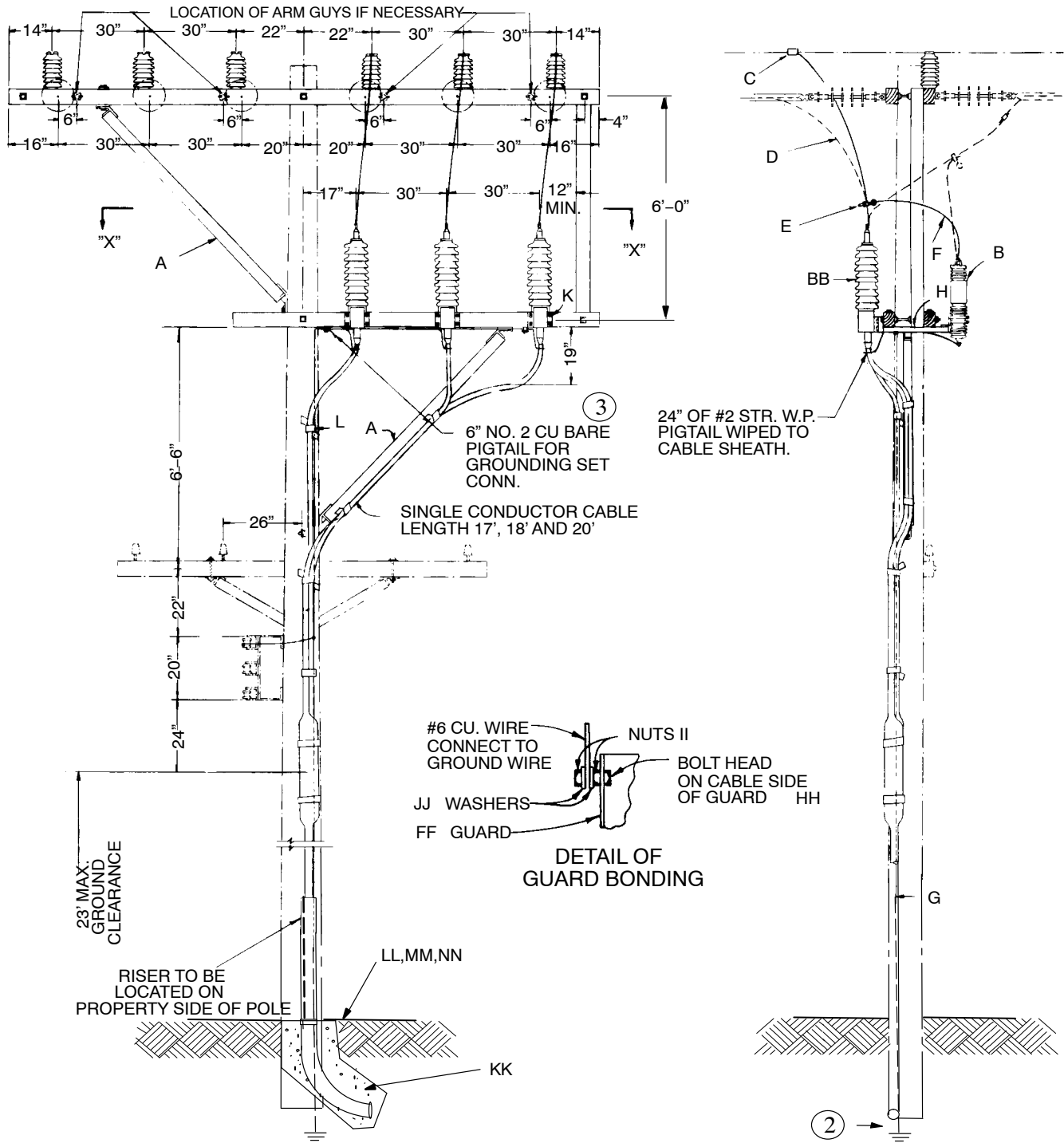
CABLE TERMINALS

34 kV Double Circuit – PILC Cable

Up to 600 Amp. Normal Rating

14 34 02 **

Sheet 1 of 2



CABLE TERMINALS
34 kV Double Circuit – PILC Cable
Up to 600 Amp. Normal Rating

14 34 02 **

Sheet 2 of 2

		Std. / Stk. No.	Description	14 34 02 **	01	02	03
@	A	14 34 03 01	Mounting Unit		1	1	1
	B	10 01 137	Arrester Lighting, 27 kV		3	3	3
	C	PG*	See 07 00 25 00		3	3	3
	D	18 51 023	Wire Cu. 4/0 S.D.	15'			
		18 51 052	Wire Cu. 350 S.D.		15'	15'	
	E	23 78 183	Clamp Live Line		3	3	3
	F	18 51 021	Wire Cu #6 S.D. Covered	25'	25'	25'	
	G	12 00 10 04	Grounding Unit		1	1	1
	H	23 06 065	Bracket LA & Pothead		3	3	3
	K	21 53 021	Bolt 1/2 x 1-1/2"		12	12	12
	L	49 17 181	Strap – Poly		5	5	5
	M	23 52 061	Bolt, Mach., 5/8" x 8"		6	6	6
	N	23 66 027	Washer – Square 2-1/4"		6	6	6
	AA	12 51 220	Conduit, Plastic 5" Split		10	10	10
	BB	17 07 125	Pothead, 35kV 500 kcmil		3	3	
		17 07 097	Pothead, 35kV 750 kcmil				3
	CC	18 08 171	Cable, 35kV 350 3C.,P	20			
		18 08 210	Cable, 35kV 500 3C.,P		20		
		18 08 203	Cable, 35kV 800 3C.,P				20
	DD	18 08 070	Cable, 35kV 350 1C.,P	55	55		
		18 08 180	Cable, 35kV 750 1C.,P				55
@	EE	41 43 11 02	Joint, 35kV Trifurcating	1			
		41 43 11 01	Joint, 35kV Trifurcating		1		
		41 41 13 02	Joint, 35kV Trifurcating				1
	FF	23 18 202	Guard, Conduit 5"		1	1	1
	HH	21 53 007	Bolt, Mach. 3/8" x 1 1/2"		1	1	1
	II	21 61 006	Nut, Hex 3/8"		2	2	2
	GG	23 60 005	Screw, Lag 3/8" x 3"		6	6	6
	JJ	23 66 016	Washer, 3/8" Galv.		2	2	2
	KK	12 51 206	Bend, 5", 36" Rad.		1	1	1
	LL	23 67 036	Step, Pole, 5/8" x 10"		2	2	2
	MM	11 04 110	Tube, Concrete 14" Dia.		4	4	4
	NN	98 00 001	Concrete 4 SK		–	–	–
		OP 281	Install Pothead		3	3	3

NOTES:

1. Grip – Cable, Stock #85–21–054, should be used when a down hill duct run exists away from the pole.
2. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
3. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7–strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
4. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.

**DISTRIBUTION
CONSTRUCTION STANDARDS**

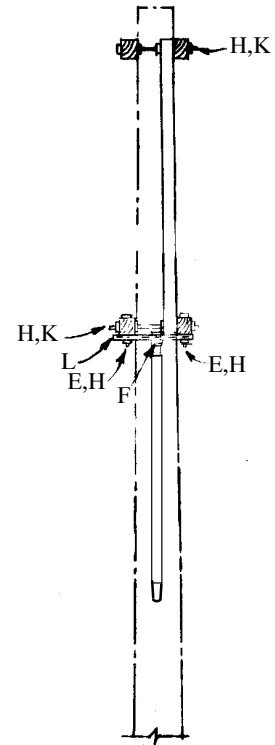
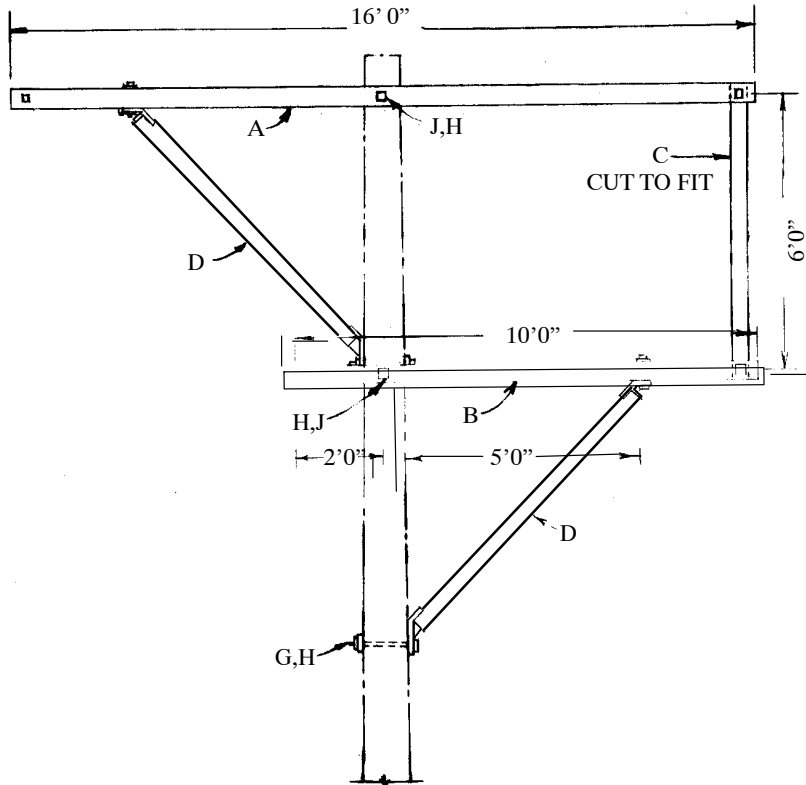
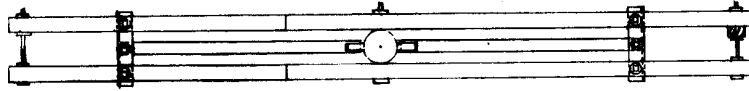


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REV. NO: 10
REV. DATE: 03/11/16

CABLE TERMINALS
34 kV Double Circuit
Mounting Unit

14 34 03 **

Sheet 1 of 1



		Std. / Stk. No.	Description	14 34 03 **	01	02
			O.H. MATERIALS			
→	A	41 01 010	Arm, Cross – 3-3/4" x 5-3/4" x 16' 0"	2	2	
	B	41 01 022	Arm, Cross – 3-3/4" x 4-3/4" x 10' 0"	2	2	
	C	41 01 020	Arm, Cross – 3-3/4" x 4-3/4" x 7' 0"	1	1	
→	D	41 56 022	Brace, Heel, Wood – 7' 0" Long	2	2	
→	E	23 52 256	Bolt, Mach. – 5/8" x 7" Galv., SQ Head w/nut	4	4	
→	F	23 52 049	Bolt, Mach. – 5/8" x 2" Galv., SQ Head w/nut	2	2	
→	G	23 52 066	Bolt, Mach. – 5/8" x 14" Galv., SQ Head w/nut	2	2	
→	H	23 66 027	Washer, Sq. – 5/8", 2-1/4" SQ	20	20	
→	J	23 52 070	Bolt, Mach. – 5/8" x 20" Galv., SQ Head w/nut	2	2	
→	K	23 53 004	Bolt, D.A. – 5/8" x 20" Galv., w/4 SQ Nuts	3	3	
→	L	23 77 212	Plate, Heel Brace – 8-3/4" to 13-3/8" Mount Centers	2		
		23 77 210	Plate, Heel Brace – 13-3/8" to 19" Mount Centers			2

CABLE TERMINALS

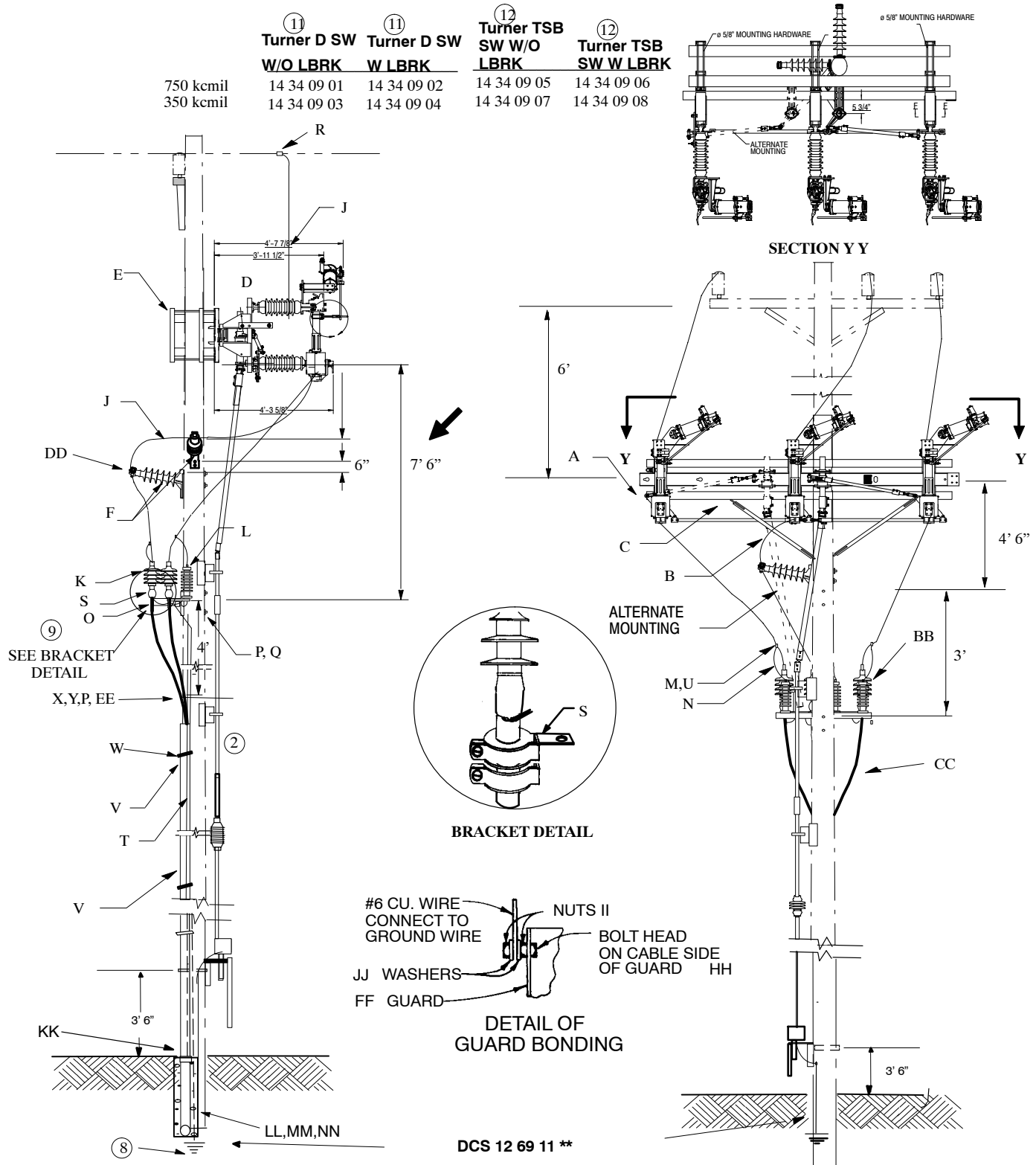
34 kV Single Circuit Cable Terminal With Airbreak Switch

750 kcmil and 350 kcmil

14 34 09 **

Sheet 1 of 3

SWITCHES & TERMINALS SHALL BE ON SEPARATE POLES WHENEVER POSSIBLE



CABLE TERMINALS
34 kV Single Circuit Cable Terminal With Airbreak Switch
750 kcmil and 350 kcmil

14 34 09 **

Sheet 2 of 3

		Std. / Stk. No.	Materials Description	14 34 09 **	01	02	03	04	05	06	07	08
	A	41 01 023	Crossarm, 3 3/4" x 5 3/4 x 12'		4	4	4	4	4	4	4	4
	B	41 56 023	Brace, Heel, 6'		2	2	2	2	2	2	2	2
	C	23 77 210	Plate, Heel Brace		2	2	2	2	2	2	2	2
	D	41 56 015	Brace, Xarm, Slab, 24"		2	2	2	2	2	2	2	2
	E	23 53 007	Bolt, 5/8", Double Arming, 24"		4	4	4	4	4	4	4	4
	F	06 34 03 04	Insulator, Linepost, Polymer		2	2	2	2	2	2	2	2
11	G	54 08 317	Turner D 34kV Switch w/LBRK			1		1				
11		54 08 314	Turner D 34kV Switch w/o LBRK		1		1					
12		54 08 438	Turner TSB 34kV Switch w/LBRK, Terminal Pole Mounting							1		1
12		54 08 440	Turner TSB 34kV Switch w/o LBRK, Terminal Pole Mounting						1		1	
	I	54 08 329	Kit, Vertical Mount Turner D Switch, 35kV		1	1	1	1				
13@	H	32 01 821	Pipe, Steel Galv. 2" x 10' w/ Coupling, Turner		1	1	1	1	1	1	1	1
	J	18 05 047	Wire, 556 AA (ft)		40	40	40	40	40	40	40	40
	K	17 55 192	Lug, Comp. 556 Al.		9	9	9	9	9	9	9	9
10@	L	10 01 137	Arrester, Lightning, 27kV Duty Cycle 22kV MCOV		3	3	3	3	3	3	3	3
		10 01 199	Arrester, Lightning, 27kV Duty Cycle 22kV MCOV Gaped		3	3	3	3	3	3	3	3
	M	23 78 394	Clamp, Hot Line		3	3	3	3	3	3	3	3
	N	18 51 021	Wire, Cu, #6 S.D. Covered		6	6	6	6	6	6	6	6
	O	17 08 058	Bracket, Terminator		1	1	1	1	1	1	1	1
	P	23 52 070	Bolt, Machine, 5/8" x 20"		3	3	3	3	3	3	3	3
	Q	23 66 027	Washer, Square 2-1/4"		2	2	2	2	2	2	2	2
@	R	PG*	See 07 00 25 00		3	3	3	3	3	3	3	3
	S	23 67 197	Bracket, Cable Support		1	1	1	1	1	1	1	1
8@	T	12 69 11 **	Grounding Unit for New Pole		1	1	1	1	1	1	1	1
		12 00 10 03	Grounding Unit for Existing Pole		1	1	1	1	1	1	1	1
	U	17 62 167	Clamp, Stirrup, Hot Line		3	3	3	3	3	3	3	3
4	V	12 51 220	Conduit, Plastic, 5" Split		40'	40'	40'	40'	40'	40'	40'	40'
6	W	27 60 035	Iron Hanger		8'	8'	8'	8'	8'	8'	8'	8'
	X	23 68 181	Shackle		1	1	1	1	1	1	1	1
	Y	23 65 012	Eyenuit, 5/8"		1	1	1	1	1	1	1	1
	BB	42 44 12 03	Termination, 35 kV, 750 kcmil		3	3			3	3		
		42 44 12 02	Termination, 35 kV, 350 kcmil				3	3			3	3
	CC	18 07 249	Cable, 35 kV, 750 kcmil		45'	45'			45'	45'		
		18 07 250	Cable, 35 kV, 350 kcmil				45'	45'			45'	45'
@	DD	TC*W	Trunnion Clamp		2	2	2	2	2	2	2	2
	EE	23 17 207	Grip, Cable Riser		3	3	3	3	3	3	3	3
	GG	23 60 005	Screw, Lag 3/8" x 3"		6	6	6	6	6	6	6	6

CABLE TERMINALS
34 kV Single Circuit Cable Terminal With Airbreak Switch
750 kcmil and 350 kcmil

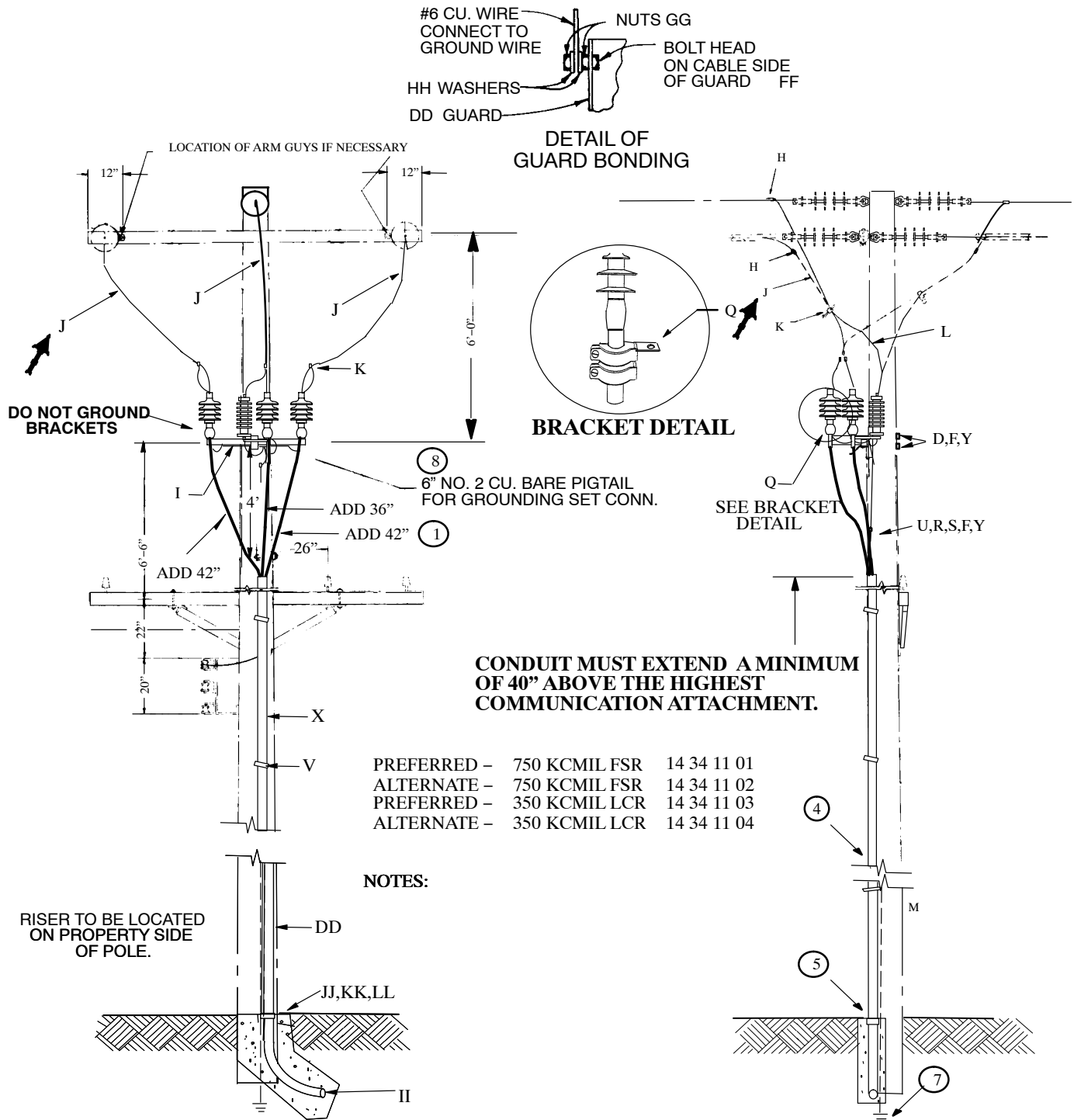
14 34 09 **
Sheet 3 of 3

5 @	HH	21 53 007	Bolt, Mach. 3/8" x 1 1/2"	1	1	1	1	1	1	1	1
	II	21 61 006	Nut, Hex. 3/8"	2	2	2	2	2	2	2	2
	JJ	23 66 016	Washer, 3/8" Galv.	2	2	2	2	2	2	2	2
	KK	12 51 206	Bend, 5" 36" Rad.	1	1	1	1	1	1	1	1
	LL	23 67 036	Step, Pole 5/8" x 10"	2	2	2	2	2	2	2	2
	MM	11 04 110	Tube, Concrete 14" Dia.	4	4	4	4	4	4	4	4
	NN	98 00 001	Concrete 4 SK	-	-	-	-	-	-	-	-
		OP 277	Install Cable Up Pole	3	3	3	3	3	3	3	3

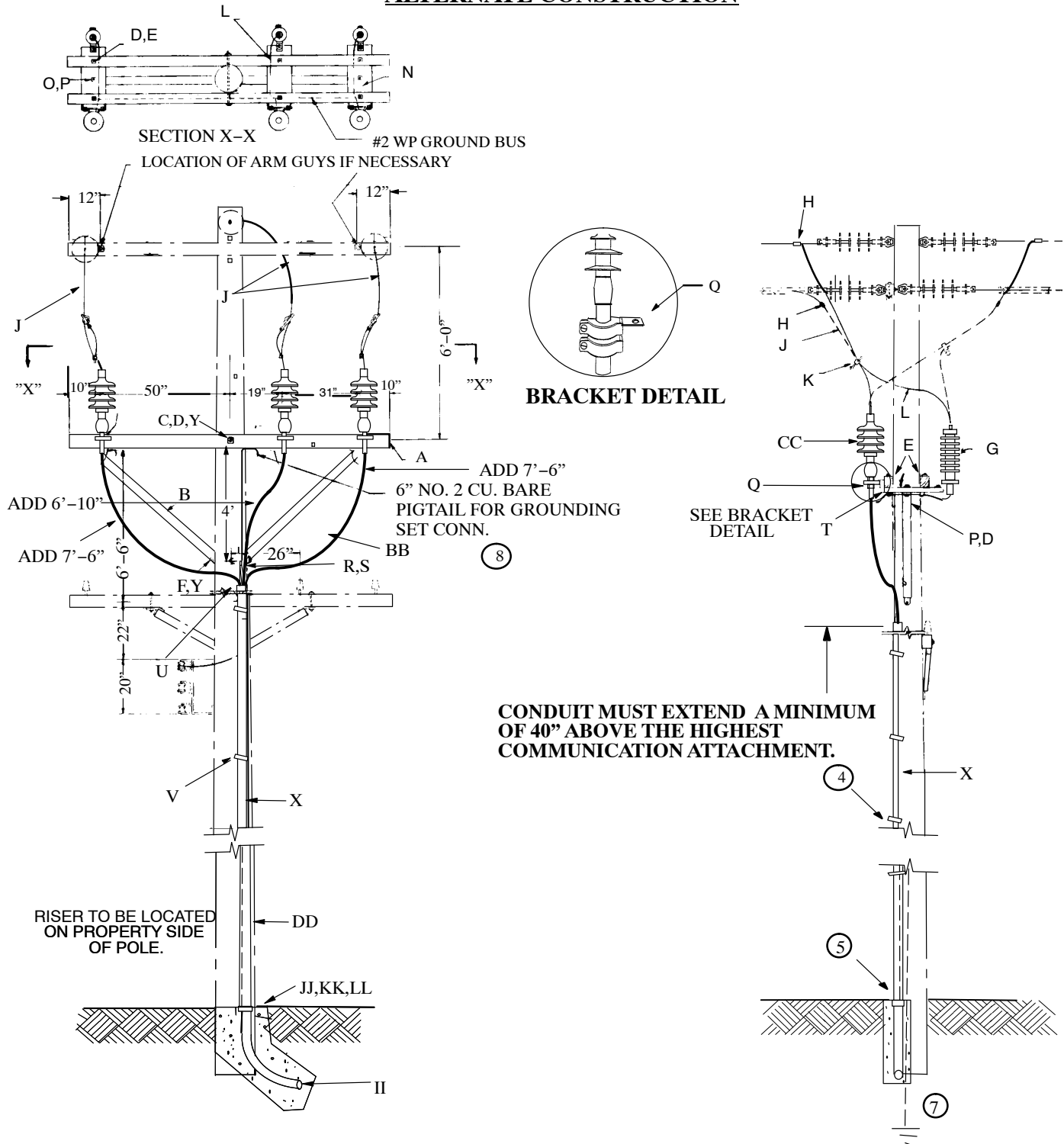
Notes:

1. Locate switch operating rod & cable as shown on Section Y-Y to leave one side of pole clear for climbing.
2. Extend plastic riser to 12" above operating rod insulator.
3. The minimum bending radius is 24" for both the 750 kcmil and 350 kcmil cables.
4. Schedule 80 conduit may be substituted for the split conduit and guard. Use Schedule 80 (12-01-272) for the first section of the riser if installed on standoff brackets.
5. Concrete encasement is also required if riser conduit is on standoff brackets.
6. Conduit straps may be substituted for iron hangers.
7. If it is necessary to stand the riser conduit off of the pole, see Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements. Use standoff brackets 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double arming bolts 23-53-003.
8. Use DCS 12 00 10 03 for ground rod application on existing pole and DCS 12 69 11 -for ground new pole installation.
9. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
10. Stock #10 01 137 - 27kV Duty Cycle 22kV MCOV Arrester for grounded system;
 Stock #10 01 199 - 27kV Duty Cycle 22kV MCOV Gaped Arrester for ungrounded system.
11. The switch is not for new installation.
12. The switch is for new installation.
13. Order additional vertical steel pipe only as needed.
14. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 Cu wire.

PREFERRED CONSTRUCTION



ALTERNATE CONSTRUCTION



PREFERRED - 750 KCMIL	14 34 11 01
ALTERNATE - 750 KCMIL	14 34 11 02
PREFERRED - 350 KCMIL	14 34 11 03
ALTERNATE - 350 KCMIL	14 34 11 04

CABLE TERMINALS
34 kV Single Circuit Up To 600 Amp Normal Rating
750 kcmil and 350 kcmil

14 34 11 **
Sheet 3 of 4

		Std. / Stk. No.	Description	14 34 11 **	01	02	03	04
9@	A	41 01 022	Crossarm-10'			2		2
	B	41 56 021	Brace-Heel 5'			2		2
	C	23 52 070	Bolt-Machine 5/8" x 20"			1		1
	D	23 66 027	Washer-Square 2 1/4" for 5/8" Bolt	2	8	2	8	
	E	23 52 061	Bolt-Machine 5/8" x 8"		6		6	
	F	23 52 066	Bolt-Machine 5/8" x 14"	2	1	2	1	
	G	10 01 137	Arrester-Lightning 27kV Duty Cycle, 22kV MCOV	3	3	3	3	
		10 01 199	Arrester-Lightning 27kV Duty Cycle, 22kV MCOV Gaped	3	3	3	3	
	H	PG*	See 07 00 25 00	3	3	3	3	
7@	I	17 08 058	Bracket-Terminator	1		1		
	J	18 51 022	Wire-Cu.,500, S.D., Covered	15'	15'			
		18 51 023	Wire- Cu. 4/0, S.D. Covered			15'	15'	
	K	23 78 183	Clamp-Hot Line, #6-400	3	3	3	3	
	L	18 51 021	Wire-Cu. # 6 S.D., Covered	25'	25'	25'	25'	
	M	12 00 10 04	Grounding Unit on New Poles	1	1	1	1	
		12 00 10 03	Grounding Unit on Existing Poles	1	1	1	1	
	N	23 06 065	Bracket L.A. & Pothead		3		3	
	O	23 66 006	Washer-Lock 5/8"		2		2	
6	P	23 52 049	Bolt-Machine 5/8" x 2"		2		2	
	Q	23 67 197	Bracket-Cable Support	3	3	3	3	
	R	23 68 181	Shackle	1	1	1	1	
	S	23 65 012	Eyenuit-5/8"	1	1	1	1	
	T	23 06 052	Bracket-Angle Clip		3		3	
	U	2317 207	Grip-Cable Riser	3	3	3	3	
	V	27 60 035	Iron Hanger	8'	8'	8'	8'	
	W	21 53 021	Bolt-Mach. 1/2" x 1 1/2"		9		9	
	X	12 51 220	Conduit - Plastic, 5" Split	40'	40'	40'	40'	
3	Y	23 66 134	Washer, Lock, 5/8" Dbl Coil Type	2	2	2	2	
	BB	18 07 249	Cable-35kV, 750 kcmil	45'	45'			
		18 07 250	Cable-35kV, 350 kcmil			45'	45'	
	CC	42 44 12 03	Termination, 35 kV, 750 kcmil	3	3			
		42 44 12 02	Termination, 35 kV, 350 kcmil			3	3	
	DD	23 18 202	Guard, Conduit 5"	1	1	1	1	
	EE	23 60 005	Screw, Lag 3/8" x 3"	6	6	6	6	
	FF	21 53 007	Bolt, Mach. 3/8" x 1 1/2"	1	1	1	1	
	GG	21 61 006	Nut, Hex, 3/8"	2	2	2	2	
5@	HH	23 66 016	Washer, 3/8" Galv.	2	2	2	2	
	II	12 51 206	Bend, 5" 36" Rad.	1	1	1	1	
	JJ	23 67 036	Step, Pole 5/8" x 10"	2	2	2	2	
	KK	11 04 110	Tube, Concrete 14" Dia.	4	4	4	4	
	LL	98 00 001	Concrete, 4SK	-	-	-	-	
		OP 277	Install Cable Up Pole	3	3	3	3	

CABLE TERMINALS
34 kV Single Circuit Up To 600 Amp Normal Rating
750 kcmil and 350 kcmil

14 34 11 **

Sheet 4 of 4

NOTES:

1. For cable lengths, measure the distance to the grip thru bolt located 4' below the terminator bracket or crossarm and add the amounts shown.
2. Cable minimum bending radius is 24" for both of the 750 kcmil and 350 kcmil cables.
3. Schedule 80 conduit may be substituted for the split conduit and guard. Use Schedule 80 conduit (12-01-272) for the first section of the riser if installed on standoff brackets.
4. If it is necessary to stand the riser conduit off of the pole, see DCS 14 00 01 03 for standoff bracket placement and grounding requirement. Use standoff brackets 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double arming bolts 23-53-003.
5. Concrete encasement is also required if riser conduit is on standoff brackets.
6. Conduit straps may be substituted for iron hangers.
7. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on existing poles.
8. Always connect the metallic shields on the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
9. Stock #10 01 137 for grounded system; Stock #10 01 199 for ungrounded system.
10. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper.

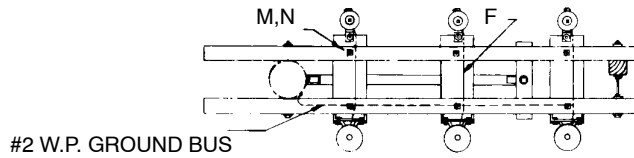
CABLE TERMINALS

34 kV Double Circuit

750 kcmil and 350 kcmil

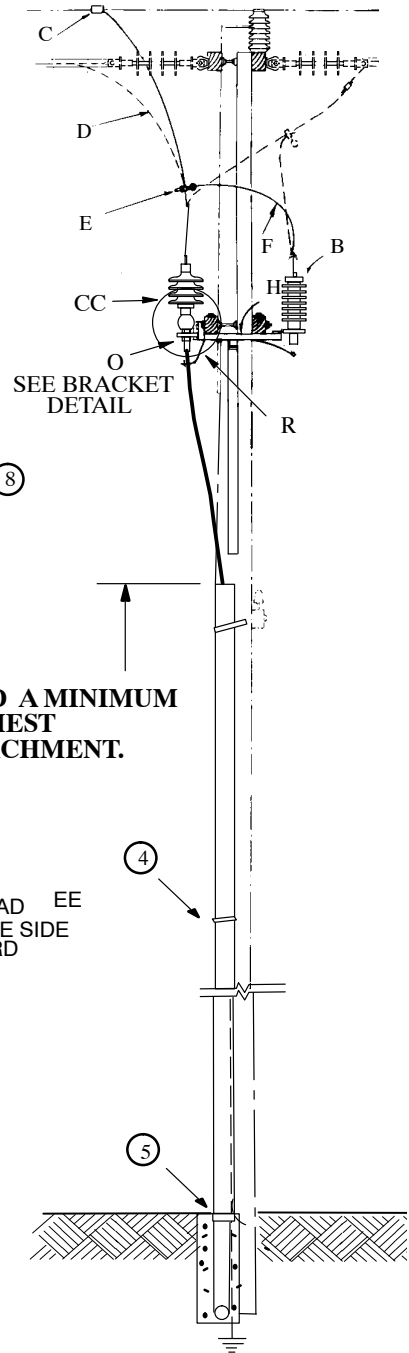
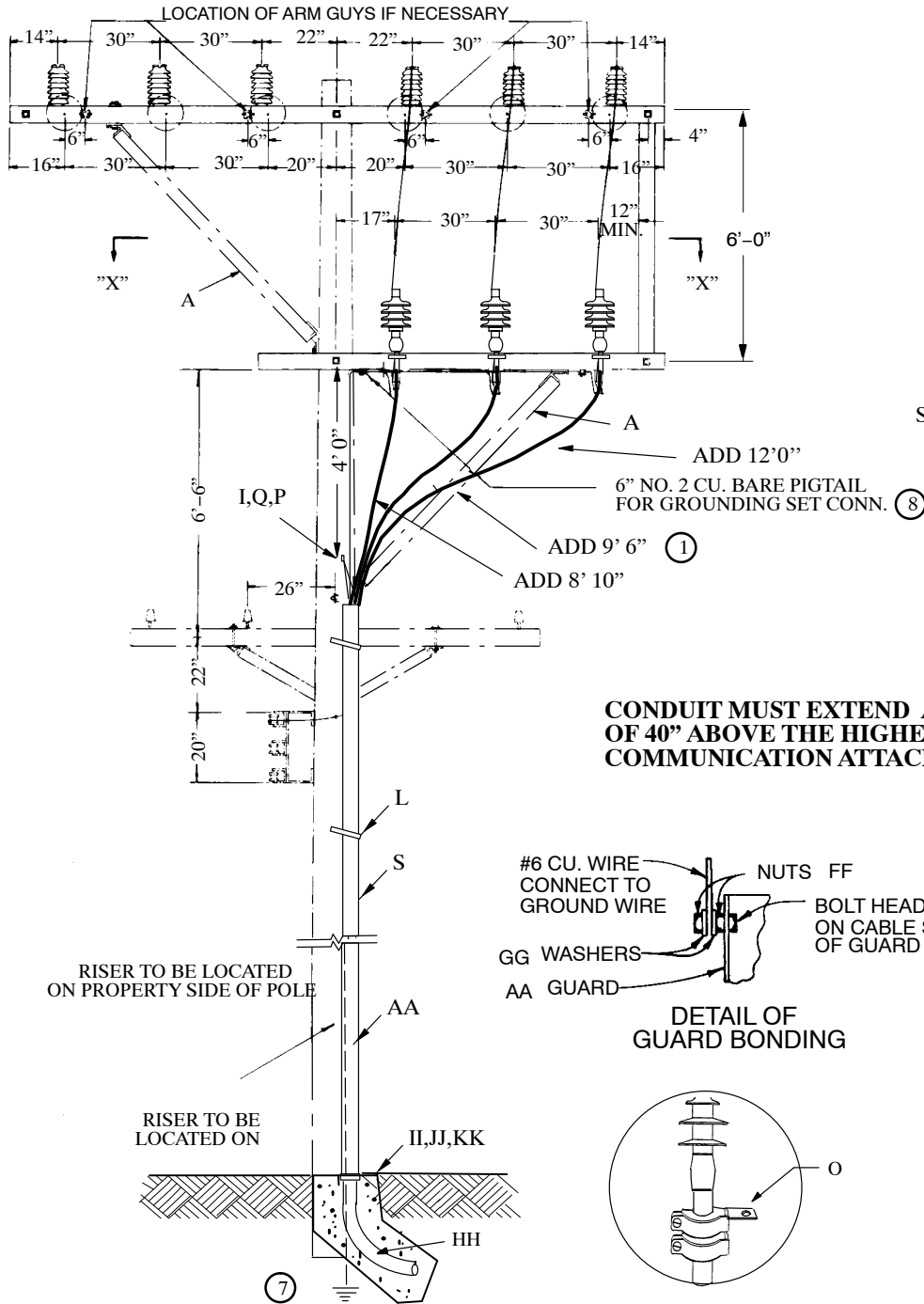
14 34 12 **

Sheet 1 of 3



750 KCMIL
350 KCMIL

14 34 12 01
14 34 12 02



CABLE TERMINALS
34 kV Double Circuit
750 kcmil and 350 kcmil

14 34 12 **
Sheet 2 of 3

		Std. / Stk. No.	Description	14 34 12 **	01	02
@	A	14 34 03 01	Mounting Unit		1	1
	B	10 01 137	Arrester, Lightning 27kV		3	3
	C	PG*	See 07 00 25 00		3	3
	D	18 52 023	Wire, Cu. 350, S.D. Bare		15'	
		18 52 024	Wire, Cu. 4/0, S.D. Bare			15'
	E	23 78 183	Clamp, Hotline, #6-400		3	3
	F	18 51 021	Wire, Cu. #6, S.D. Covered		25'	25'
	G	12 00 10 04	Grounding Unit		1	1
	H	23 06 065	Bracket, LA & Pothead		3	3
	I	23 52 070	Bolt, Machine 5/8" x 20"		1	1
	J	23 17 207	Grip, Cable Riser		3	3
	K	21 53 021	Bolt, Machine, 1/2" x 1-1/2"		9	9
	L	27 60 035	Iron Hanger		8'	8'
	M	23 52 061	Bolt, Machine 5/8" x 8"		6	6
	N	23 66 027	Washer, Square 2-1/4"		6	6
	O	23 67 197	Bracket, Cable Support		3	3
	P	23 68 181	Shackle		1	1
	Q	23 65 012	Eyebut, 5/8"		1	1
	R	23 06 052	Bracket, Angel Clip		3	3
	S	12 51 220	Conduit, Plastic, 5" Split		40'	40'
7	AA	23 18 202	Guard, Conduit, 5"		1	1
	BB	18 07 249	Cable, 35kV, 750 kcmil		55'	
		18 07 250	Cable, 35kV, 350 Kcmil			55'
	CC	42 44 12 03	Termination, 35kV, 750 kcmil		3	
		42 44 12 02	Termination, 35kV, 350 kcmil			3
	DD	23 60 005	Screw, Lag 3/8" x 3"		6	6
	EE	21 53 007	Bolt, Machine, 3/8" x 1 1/2"		1	1
	FF	21 61 006	Nut, Hex, 3/8"		2	2
	GG	23 66 016	Washer, 3/8" Galv.		2	2
	HH	12 51 206	Bend, 5", 36" Rad.		1	1
6	II	23 67 036	Step, Pole 5/8" x 10"		2	2
	JJ	11 04 110	Tub, Concrete 14" Dia.		4	4
	KK	98 00 001	Concrete 4SK			
		OP 277	Install Cable Up Pole		3	3
3						
5@						

NOTES:

- For cable lengths, measure the distance to the grip thru bolt located 4' below the crossarm and add amounts shown.
- Minimum bending radius is 24" for both the 750 kcmil and 350 kcmil cables.
- Schedule 80 conduit may be substituted for the split conduit and guard. Use Schedule 80 conduit (12-01-272) for the first section of the riser if installed on standoff brackets.

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: HLH
REV. NO: 14
REV. DATE: 07/08/15

4. If it is necessary to stand the riser conduit off of the pole, see Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements. Use standoff brackets 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double arming bolts 23-53-003.
5. Concrete encasement is also required if riser conduit is on standoff brackets.
6. Conduit straps may be substituted for iron hangers.
7. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
8. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
9. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.

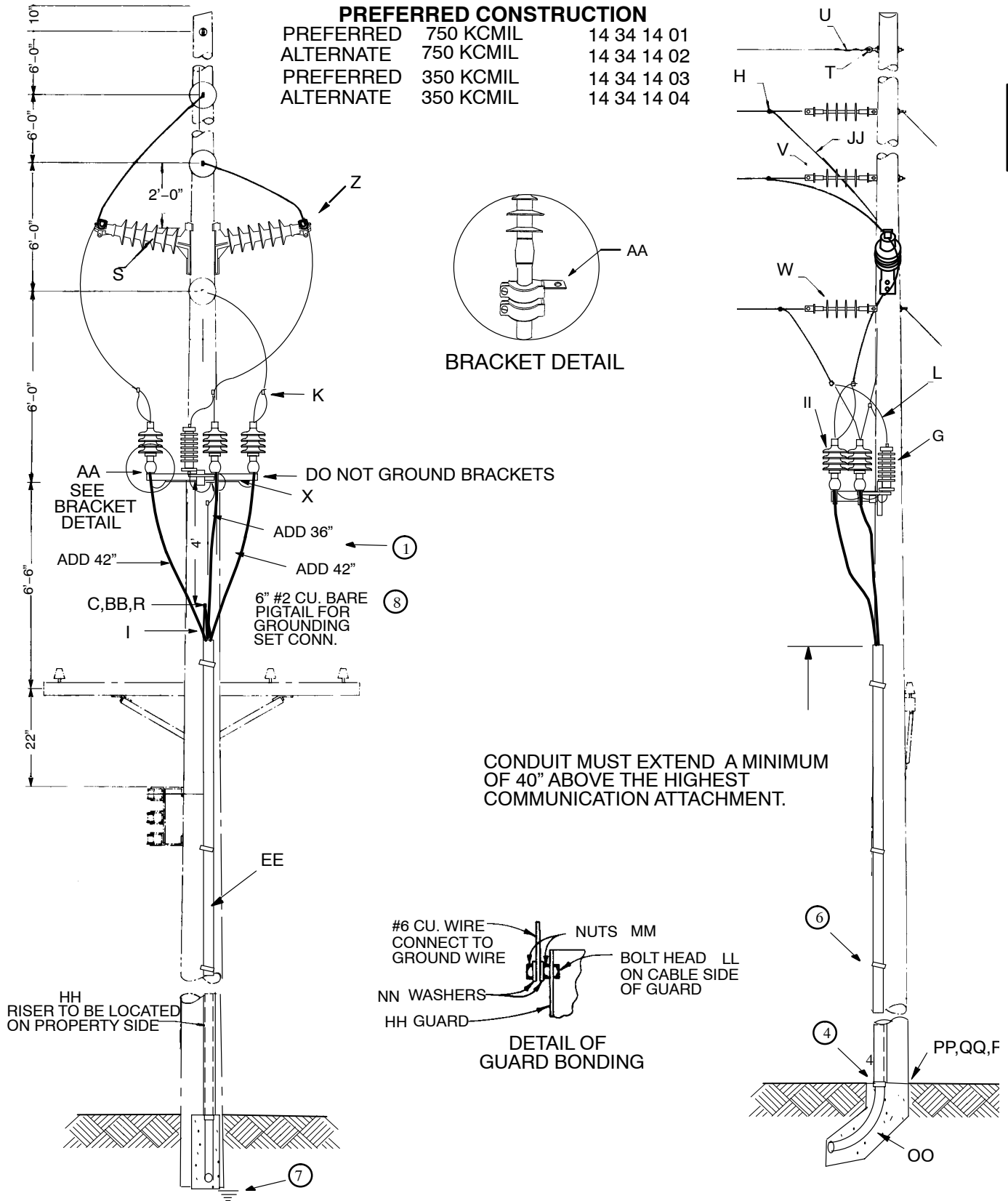
CABLE TERMINALS

34 kV Single Circuit Vertical Deadend

750 kcmil and 350 kcmil

14 34 14 **

Sheet 1 of 4



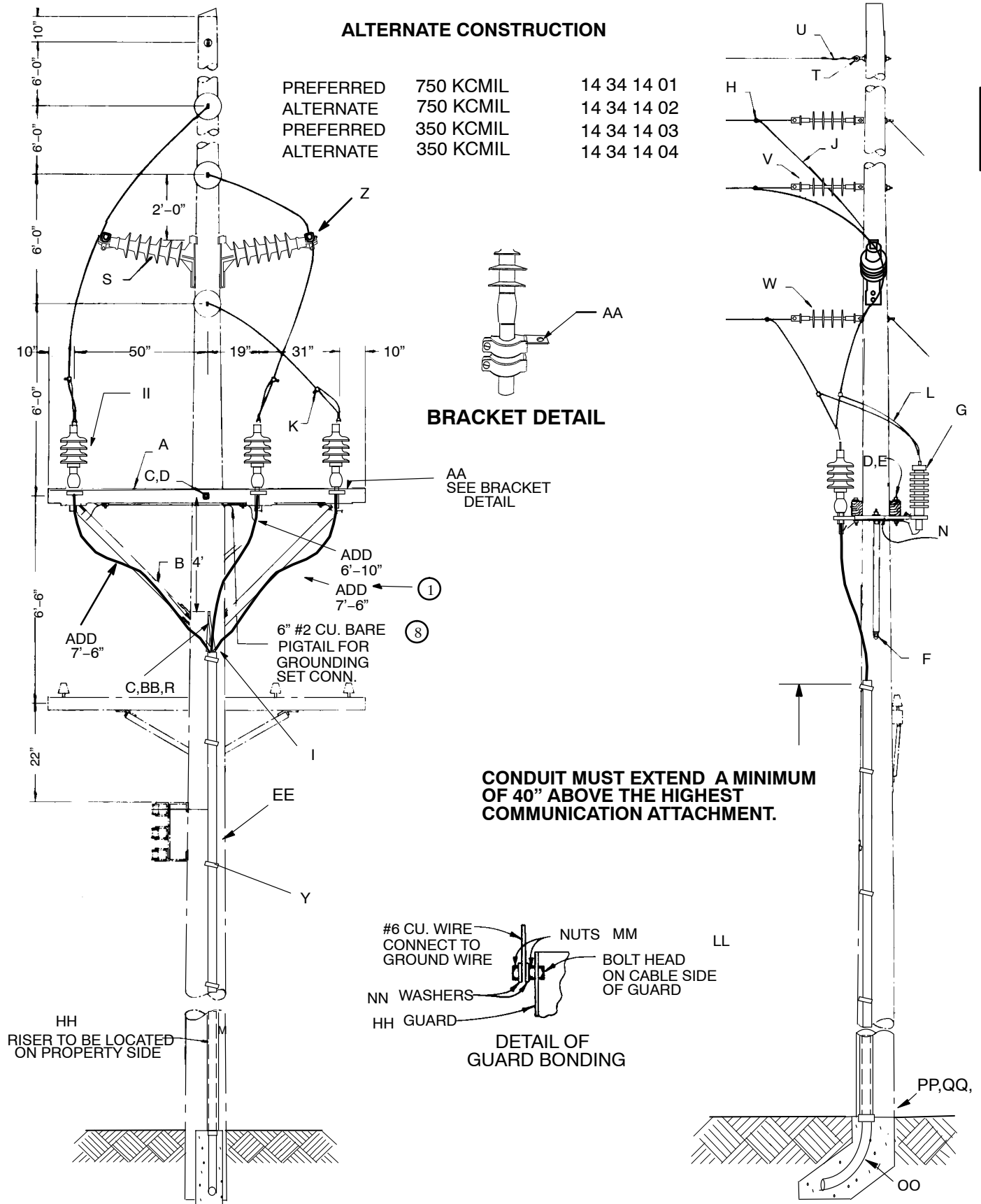
CABLE TERMINALS

34 kV Single Circuit Vertical Deadend

750 kcmil and 350 kcmil

14 34 14 **

Sheet 2 of 4



CABLE TERMINALS
34 kV Single Circuit Vertical Deadend
750 kcmil and 350 kcmil

14 34 14 **

Sheet 3 of 4

		Std. / Stk. No.	Description	14 34 14 **	01	02	03	04
@	A	41 01 022	Crossarm, 10'			2		2
	B	41 56 021	Brace, Heel 5'			2		2
	C	23 52 070	Bolt, Machine 5/8" x 20"	3	2	3	2	
	D	23 66 027	Washer, Square 2-1/4"	3	10	3	10	
	E	23 52 061	Bolt, Machine 5/8" x 8"		6		6	
	F	23 52 066	Bolt, Machine 5/8" x 14"		1		1	
	G	10 01 137	Arrester, Lightning 27kV	3	3	3	3	
	H	PG*	See 07 00 25 00	3	3	3	3	
	I	23 17 207	Grip, Cable Riser	3	3	3	3	
	J	18 52 023	Wire, Cu. 350, S.D. Bare	15'	15'			
		18 52 024	Wire, Cu. 4/0, S.D. Bare			15'	15'	
	K	23 78 183	Clamp, Hotline, #6-400	3	3	3	3	
	L	18 51 021	Wire, Cu. #6, S.D. Covered	25'	25'	25'	25'	
	M	12 00 10 04	Grounding Unit	1	1	1	1	
	N	23 06 065	Bracket, LA & Pothead		3		3	
	O	23 66 006	Washer, Lock, 5/8"		2		2	
	P	23 52 049	Bolt, Machine 5/8" x 2"		2		2	
	Q	21 53 021	Bolt, Machine, 1/2" x 1-1/2"		9		9	
	R	23 68 181	Shackle	1	1	1	1	
	S	06 34 03 07	Insul, Linepost, Polymer, Double, Trunnion	1	1	1	1	
	T	06 00 11 01	Deadend, Neutral	1	1	1	1	
@	U	DEC*W or DEA*W	Clamp, Deadend	1	1	1	1	
	V	06 34 60 02	Deadend, Pole	1	1	1	1	
	W	06 34 60 12	Deadend, H.D. Guy Hook	2	2	2	2	
	X	17 08 058	Bracket, Terminator	1		1		
	Y	27 60 035	Iron Hanger	8'	8'	8'	8'	
	Z	TCA*W	Clamp, Trunnion	2	2	2	2	
	AA	23 67 197	Bracket, Cable Support	3	3	3	3	
	BB	23 65 012	Eyenuit, 5/8"	1	1	1	1	
	CC	23 06 052	Bracket, Angle Clip		3		3	
	EE	12 51 220	Conduit, Plastic, 5" Split	40'	40'	40'	40'	
3	HH	23 18 202	Guard, Conduit 5"	1	1	1	1	
	II	42 44 12 03	Termination, 35kV, 750 kcmil	3	3			
		42 44 12 02	Termination, 35kV, 350 kcmil			3	3	
	JJ	18 07 249	Cable, 35kV, 750 kcmil	45'	45'			
		18 07 250	Cable, 35kV, 350 kcmil			45'	45'	
	KK	23 60 005	Screw, Lag 3/8" x 3"	6	6	6	6	
	LL	21 53 007	Bolt, Machine, 3/8" x 1 1/2"	1	1	1	1	
	MM	21 61 006	Nut, Hex, 3/8"	2	2	2	2	
	NN	23 66 016	Washer, 3/8" Galv.	2	2	2	2	
	OO	12 51 206	Bend, 5", 36" Rad.	1	1	1	1	
4	PP	23 67 036	Step, Pole 5/8" x 10"	2	2	2	2	
	QQ	11 04 110	Tube, Concrete 14" Dia.	4	4	4	4	
	RR	98 00 001	Concrete 45 SK					
		OP 277	Install Cable Up Pole	3	3	3	3	

NOTES:

1. For cable lengths, measure the distance to the grip thru bolt located 4' below the crossarm or bracket and add the amounts shown.
2. Minimum bending radius is 24" for both 750 kcmil and 350 kcmil cables.
3. Schedule 80 conduit may be substituted for the split conduit and guard. Use Schedule 80 conduit (12-01-272) for the first section if the riser is installed on standoff brackets.
4. Concrete encasement is also required if riser conduit is on standoff brackets.
5. Conduit straps may be substituted for iron hangers.
6. If it is necessary to stand the riser conduit off of the pole, see Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements. Use standoff bracket 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double arming bolts 23-53-003.
7. Use DCS 12 00 10 04 for ground coil application on new installation. Use 12 00 10 03 for ground rod on an existing pole.
8. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
9. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.

CABLE TERMINALS
34 kV Single Circuit Deadend
Parallel Assembly Unit¹ 750 kcmil and 350 kcmil

14 34 15 **

Sheet 2 of 3

		Std. / Stk. No.	Description	14 34 15 **	01	02
@	A	41 01 022	Crossarm, 10'		2	2
	B	23 77 212	Plate, Heel Brace, 8-3/4" to 13-3/8"		2	2
		23 77 210	Plate, Heel Brace, 13-3/8" to 19"		2	2
	C	23 52 070	Bolt, Machine, 5/8" x 20"		2	2
	D	23 66 027	Washer, Square, 2-1/4"		8	8
	E	23 52 066	Bolt, Machine, 5/8" x 14"		1	1
	F	23 52 256	Bolt, Machine, 5/8" x 7"		6	6
	G	10 01 137	Arrester, Lightning, 27 kV		3	3
	H	23 78 183	Clamp, Hot Line, #6 - 400		3	3
	I	23 66 031	Washer, Curved, 3/4"		2	2
	J	18 51 021	Wire, Cu, #6 S.D. Covered		20'	20'
	K	18 51 019	Wire, Cu, #2 S.D. Poly		15'	15'
	L	17 54 005	Connector, Solderless, #2 Cu.		7	7
	8 M	12 00 10 04	Grounding Unit		1	1
		N	23 06 078	Bracket, LA & Pothead	3	3
	O	23 66 006	Washer, Lock, 5/8"		2	2
	P	23 52 049	Bolt, Machine, 5/8" x 2"		2	2
	Q	41 56 021	Brace, Heel, 5'		2	2
	R	18 52 023	Wire, Cu, 350 S.D. Bare		30'	
		18 52 024	Wire, Cu, 4/0 S.D. Bare			30'
5@	S	17 54 132	Connector, 350		6	
		17 54 140	Connector, 4/0			6
	T	06 34 60 02	Deadend, Pole		1	1
	U	23 17 207	Grip, Cable Riser		6	6
	V	23 52 097	Bolt, Machine, 3/4" x 12"		1	1
	W	25 05 064	Insulator, Line Post		3	3
	X	18 52 009	Tie for Bare Copper Cond.		3	3
	Y	04 00 41 04	Crossarm - Dbl., D.E., F/G, 4-Wire, 10'		1	1
	Z	06 34 66 02	Deadend on Crossarm		2	2
	AA	23 18 202	Guard, Conduit, 5"		2	2
	BB	18 07 249	Cable, 35 kV 750 kcmil		95	
		18 07 250	Cable, 35 kV 350 kcmil			95
	CC	42 44 12 03	Termination, 35 kV, 750 kcmil		6	
		42 44 12 02	Termination, 35 kV, 350 kcmil			6
	DD	23 60 005	Screw, Lag 3/8" x 3"		12	12
	EE	21 53 007	Bolt, Machine 3/8" x 1 1/2"		2	2
	FF	21 61 006	Nut, Hex, 3/8"		4	4
	GG	23 66 016	Washer, 3/8" Galv.		4	4
	HH	12 51 206	Bend, 5", 36" Rad.		2	2
	II	23 67 036	Step, Pole 5/8" x 10"		4	4
	JJ	11 04 110	Tube, Concrete 14" Dia.		8	8
	5@ KK	98 00 001	Concrete 4 SK		-	-
		MM	23 65 012	Eyenuit, 5/8"	2	2
		NN	23 68 181	Shackle	2	2
		OO	23 67 197	Bracket, Cable Support	6	6
		PP	23 06 052	Bracket, Angle Clip	6	6

CABLE TERMINALS
34 kV Single Circuit Deadend
Parallel Assembly Unit¹ 750 kcmil and 350 kcmil

14 34 15 **

Sheet 3 of 3

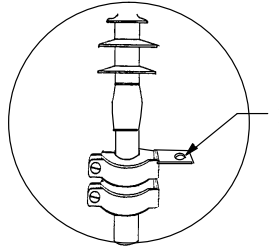
@		Std. / Stk. No.	Description	14 34 15 **	01	02
	QQ	21 53 021	Bolt, 1/2" x 1-1/2"		18	18
	RR	27 60 035	Iron Hanger		8'	8'
	SS	PG*	See 07 00 25 00		3	3
	TT	12 51 220	Conduit, Plastic, 5" Split		80'	80'
		OP 277	Install Cable up Pole		6	6

NOTES:

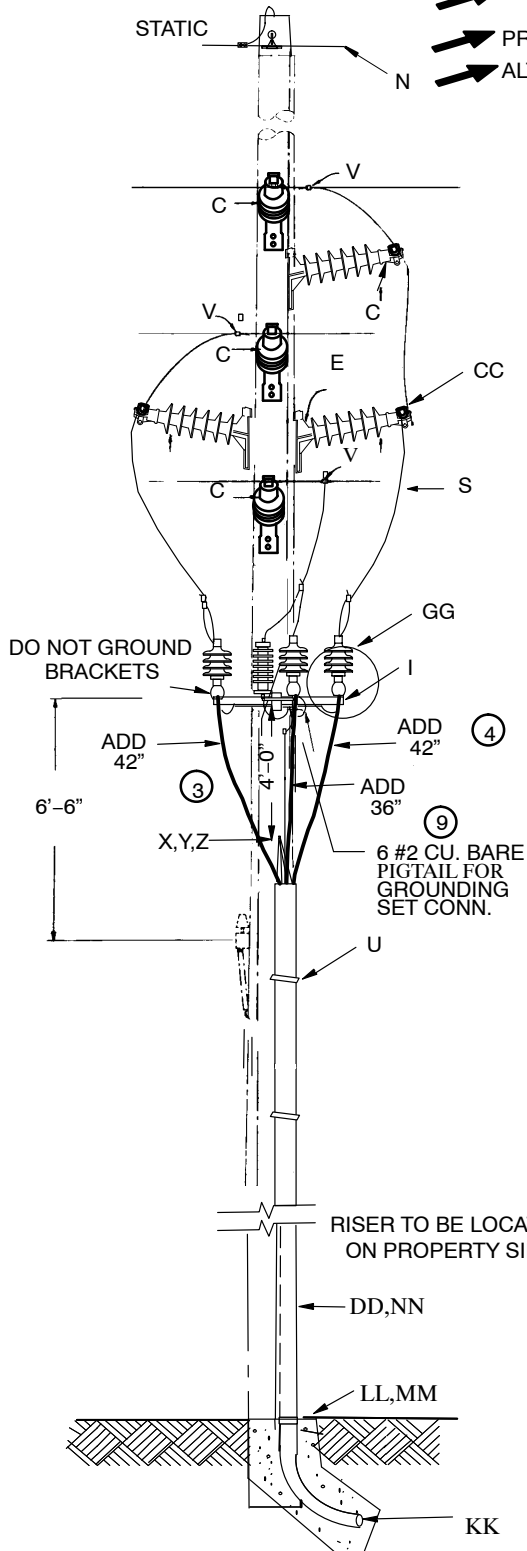
1. This standard to be used only when cables are operated in parallel as a single circuit to serve a single customer.
2. For cable lengths, measure distance to the thru bolt located 4' below the crossarm and add amounts shown.
3. Minimum bending radius is 24" for both the 750 kcmil and 350 kcmil cables.
4. Schedule 80 conduit may be substituted for the split conduit and guard. Use Schedule 80 conduit (12-01-272) for the first section of the riser if installed on standoff brackets.
5. Concrete encasement is also required if riser conduit is on standoff brackets.
6. Conduit straps may be substituted for iron hangers.
7. If it is necessary to stand the riser conduit off of the pole, see Distribution Standard 14 00 01 03 for standoff bracket placement and grounding requirements. Use standoff bracket 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double arming bolts 23-53-003.
8. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on the existing pole.
9. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
10. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.

PREFERRED CONSTRUCTION

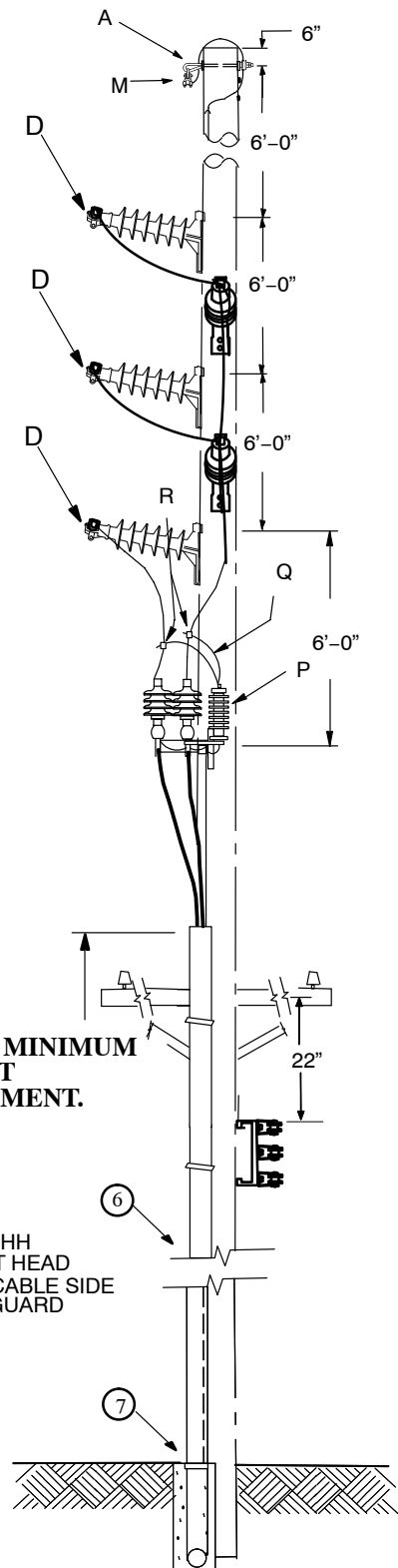
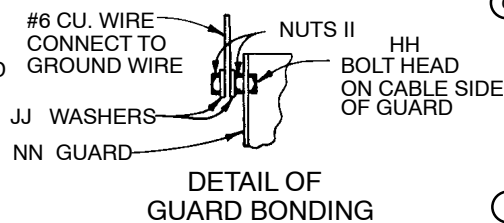
	PREFERRED 750 KCMIL	14 34 16 01
	ALTERNATE 750 KCMIL	14 34 16 02
	PREFERRED 350 KCMIL	14 34 16 03
	ALTERNATE 350 KCMIL	14 34 16 04



BRACKET DETAIL

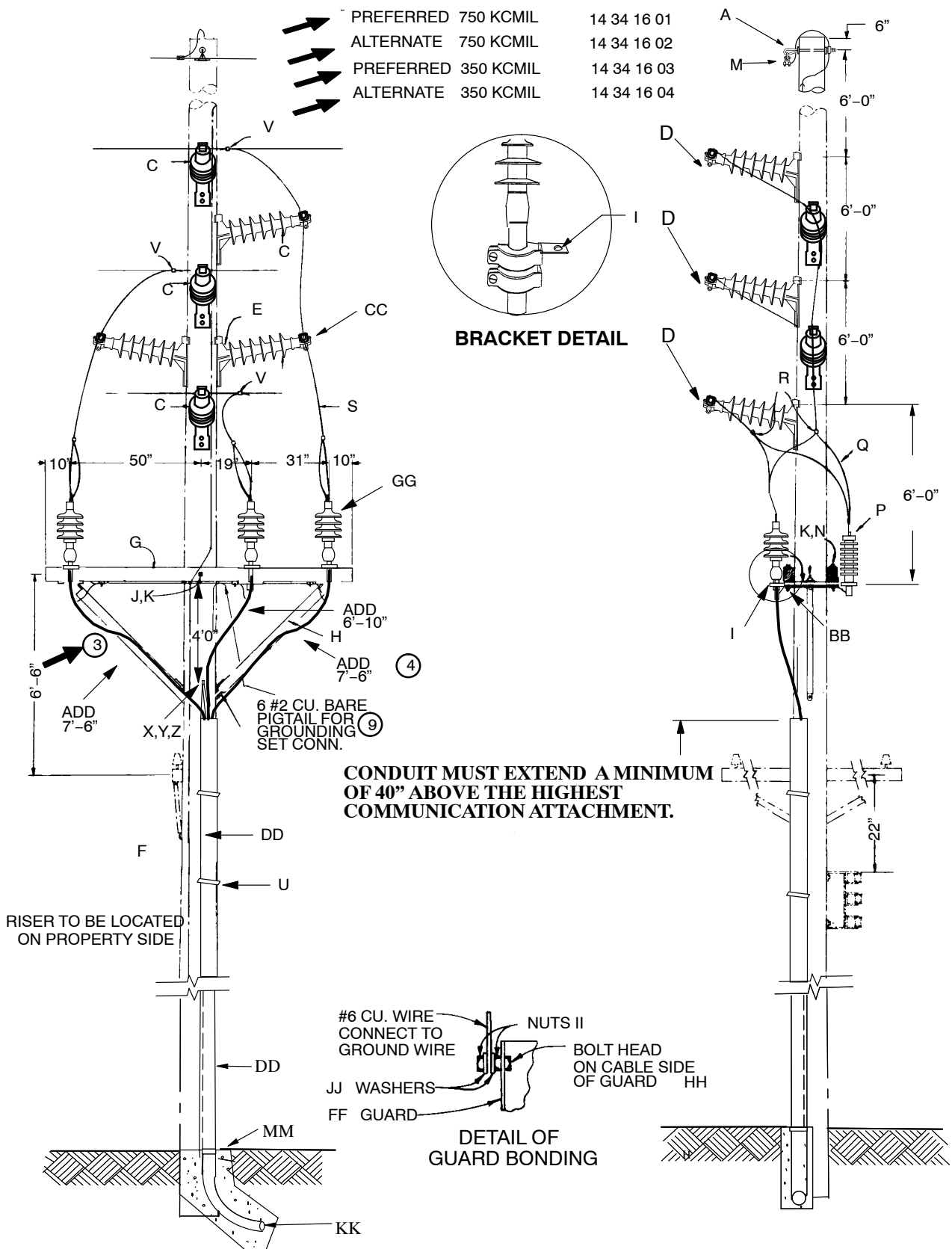


**CONDUIT MUST EXTEND A MINIMUM
 OF 40" ABOVE THE HIGHEST
 COMMUNICATION ATTACHMENT.**



ALTERNATE CONSTRUCTION

PREFERRED 750 KCMIL	14 34 16 01
ALTERNATE 750 KCMIL	14 34 16 02
PREFERRED 350 KCMIL	14 34 16 03
ALTERNATE 350 KCMIL	14 34 16 04



		Std. / Stk. No.	Description	14 34 16 **	01	02	03	04
@	A	06 00 11 04	Static Support w/ Suspension Clamp		1	1	1	1
	B	17 51 032	Clamp, PG		1	1	1	1
	C	06 34 03 04	Insulator, Linepost, Polymer, Single Trunnion Clamp		4	4	4	4
	D	TCA*W	Clamp, Trunion		3	3	3	3
	E	06 34 03 07	Insulator, Linepost, Polymer, Double Trunnion Clamp		2	2	2	2
	F	12 00 10 04	Grounding Unit		1	1	1	1
	G	41 01 022	Crossarm, 10'			2		2
	H	41 56 021	Brace, Heel 5'			2		2
@	I	23 67 197	Bracket, Cable Support		3	3	3	3
	K	23 66 027	Washer, Sq. 2 1/4"		8	6	8	6
	J	23 52 070	Bolt, Machine, 5/8" x 20"		3	2	3	2
	L	23 52 066	Bolt, Machine, 5/8" x 14"			1		1
	M	SC*W	Clamp, Suspension		1	1	1	1
	N	23 52 061	Bolt, Machine 5/8" x 8"			4		4
	O	23 52 049	Bolt, Machine 5/8" x 2"			2		2
	P	10 01 137	Arrester, Lightning 27 kV		3	3	3	3
@	Q	18 51 021	Wire, Cu. #6 S.D., Covered		10'	10'	10'	10'
	R	23 78 183	Clamp, Hotline, #6-400		3	3	3	3
	S	18 52 024	Wire, Cu. 4/0 S.D. Bare				50'	50'
		18 52 023	Wire, Cu. 350 S.D. Bare		50'	50'		
	T	23 06 065	Bracket, L.A. & Pothead			3		3
	U	27 60 035	Iron Hanger		8'	8'	8'	8'
	V	PG*	See 07 00 25 00		3	3	3	3
	W	21 53 021	Bolt, Machine 1/2" x 1 1/2"			9		9
1	X	23 17 207	Grip, Cable Riser		3	3	3	3
	Y	23 68 181	Shackle		1	1	1	1
	Z	23 65 012	Eyebolt 5/8"		1	1	1	1
	AA	17 08 058	Bracket, Terminator		1		1	
	BB	23 06 052	Bracket, Angle Clip			3		3
	CC	23 78 331	Clamp, Susp., 1/2" - 1" Cond.		3	3	3	3
	DD	12 51 220	Conduit, Plastic, 5" Split		40	40	40	40
	EE	23 60 005	Screw, Lag, 3/8" x 3"		6	6	6	6
	FF	18 07 249	Cable, 35 kV 750 kcmil		45'	45'		
		18 07 250	Cable, 35 kV 350 kcmil				45'	45'
	GG	42 44 12 03	Termination, 35 kV, 750 kcmil		3	3		
		42 44 12 02	Termination, 35 kV, 350 kcmil				3	3
	HH	21 53 007	Bolt, Machine 3/8" x 1 1/2"		1	1	1	1
	II	21 61 006	Nut, Hex, 3/8"		2	2	2	2
	JJ	23 66 016	Washer, 3/8" Galv.		2	2	2	2
	KK	12 51 206	Bend, 5", 36" Rad.		1	1	1	1

LL	23 67 036	Step, Pole 5/8" x 10"	2	2	2	2
MM	11 04 110	Tube, Concrete 5"	4	4	4	4

		Std. / Stk. No.	Description	14 34 16 **	01	02	03	04
1	NN	23 18 202	Guard, Conduit 5"		1	1	1	1
7 @	PP	98 00 001	Concrete, 4 SK		-	-	-	-
	OP	277	Install Cable Up Pole		3	3	3	3

NOTES:

- Schedule 80 conduit may be substituted for the split conduit and guard. Use Schedule 80 conduit (12-01-272) for the first section of the riser if installed on standoff brackets.
- Conduit straps may be substituted for iron hangers.
- Identify phases.
- For cable lengths, measure the distance to the grip thru bolt located 4' below the terminator bracket or crossarm and add the amounts shown.
- Minimum bending radius is 24" for both the 750 kcmil and 350 kcmil cables.
- If it is necessary to stand the riser conduit off the pole, see DCS 14 00 01 03 for standoff bracket placement and grounding requirements. Use standoff brackets 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double arming bolts 23-53-003.
- Concrete encasement is also required if riser conduit is on standoff brackets.
- Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 10 03 for ground rod on an existing pole.
- Always connect the metallic shields on the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and / or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
- If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.

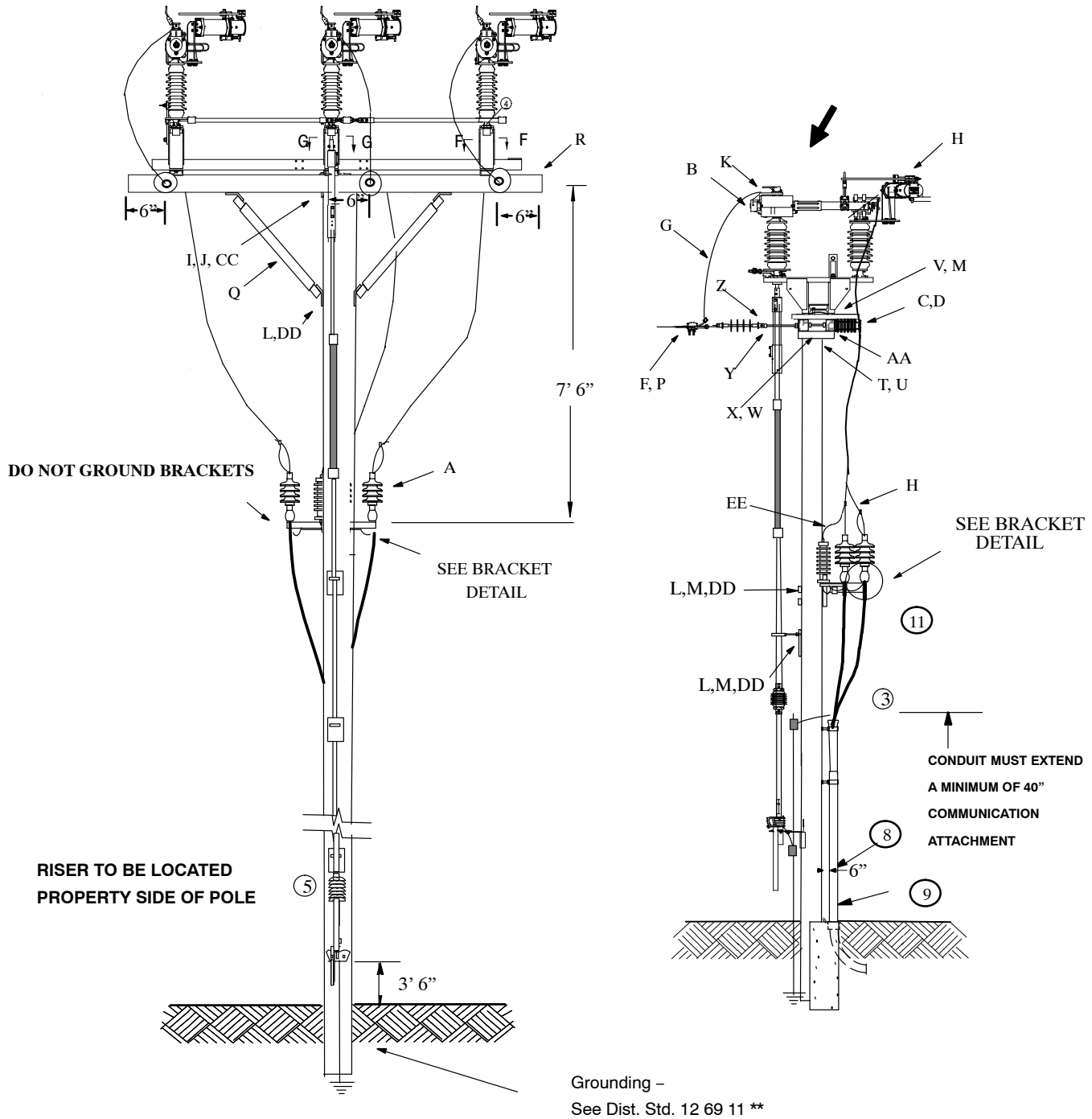
CABLE TERMINALS

34 kV Single Circuit – Deadend – Cable Terminal With Airbreak Switch – 750 kcmil and 350 kcmil

14 34 17 **

Sheet 1 of 6

PREFERRED CONSTRUCTION



Sheet 2 of 6

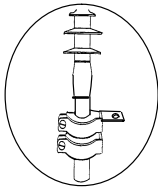
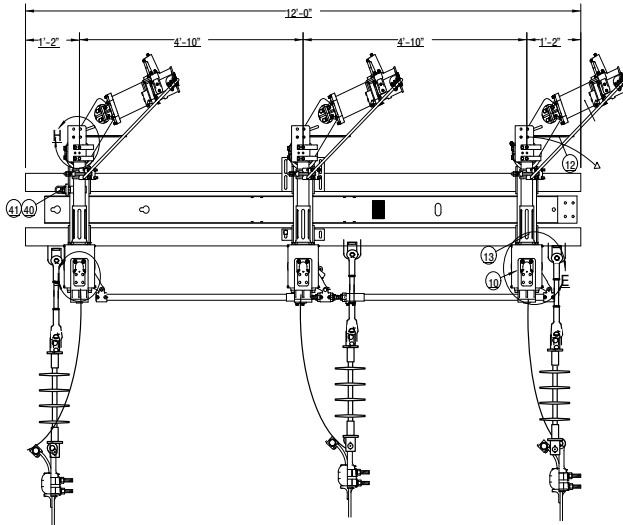
Grounding –
See Dist. Std. 12 69 11**

CABLE TERMINALS

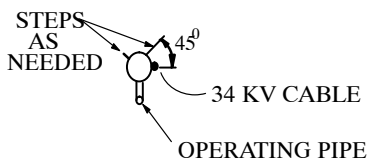
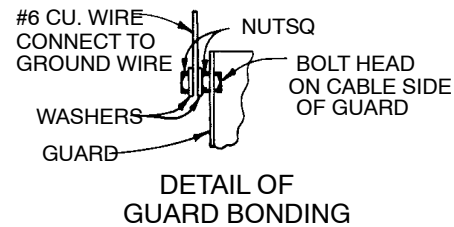
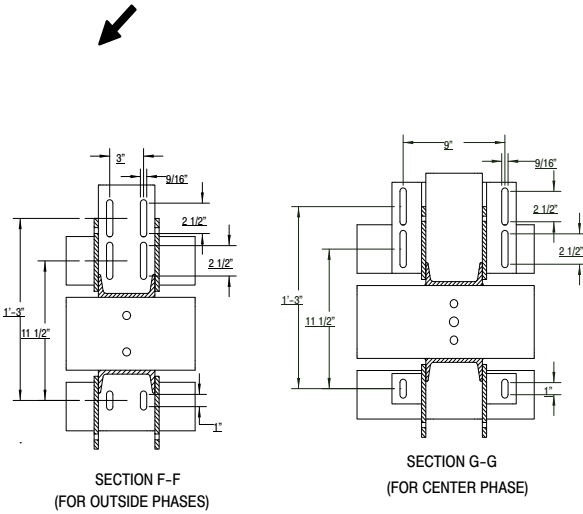
34 kV Single Circuit – Deadend – Cable Terminal With Airbreak Switch – 750 kcmil and 350 kcmil

14 34 17 **

Sheet 3 of 6



BRACKET DETAIL



TURNER D SW W/O LBRK	TURNER D SW W/ LBRK	TURNER TSB SW W/O LBRK	TURNER TSB SW W/ LBRK
----------------------------	---------------------------	------------------------------	-----------------------------

PREFERRED	750 KCMIL	14 34 17 02	14 34 17 01	14 34 17 10	14 34 17 09
ALTERNATE	750 KCMIL	14 34 17 04	14 34 17 03	14 34 17 12	14 34 17 11
PREFERRED	350 KCMIL	14 34 17 06	14 34 17 05	14 34 17 14	14 34 17 13
ALTERNATE	350 KCMIL	14 34 17 08	14 34 17 07	14 34 17 16	14 34 17 15

CABLE TERMINALS
34 kV Single Circuit – Deadend – Cable Terminal
With Airbreak Switch – 750 kcmil and 350 kcmil

14 34 17 **
Sheet 4 of 6

Turner 34kV D Switch – Not for New Installation after the inventory is depleted												
		Std. / Stk. No.	Description	14 34 17 **	01	02	03	04	05	06	07	08
@	4	A	14 34 11 01	Cable Terminal – 750 kcmil on bracket	1	1						
			14 34 11 02	Cable Terminal – 750 kcmil on crossarm			1	1				
			14 34 11 03	Cable Terminal – 350 kcmil on bracket					1	1		
			14 34 11 04	Cable Terminal – 350 kcmil on crossarm							1	1
12	12	B	54 08 317	Turner 34kV D Switch w LBRK.	1		1		1		1	
		54 08 314	Turner 34kV D Switch w/o LBRK		1		1		1		1	
		C	25 05 064	Insulator–Line Post	3	3	3	3	3	3	3	3
		D	18 52 009	Tie, Hand For Cu	3	3	3	3	3	3	3	3
		F	17 51 135	Clamp, PG. 450–1000 kcmil	3	3	3	3	3	3	3	3
		G	18 05 047	Wire, 556 AA.(ft)	45	45	45	45	45	45	45	45
		H	17 55 296	Lug, Comp, 350 cu.	6	6	6	6	6	6	6	6
		I	23 52 041	Bolt, 1/2” x 8”	12	12	12	12	12	12	12	12
		J	23 66 017	Washer–Round 9/16”	12	12	12	12	12	12	12	12
		K	17 55 192	Lug, Comp. 556 Al.	3	3	3	3	3	3	3	3
		L	23 52 065	Bolt, 5/8” x 12”	7	7	7	7	7	7	7	7
		M	23 66 027	Washer, Square , 11/16”	24	24	24	24	24	24	24	24
		N	54 08 328	Kit, 34.5 kV Switch	1	1	1	1	1	1	1	1
14@		O	32 01 821	Pipe, Steel Galv. 2” x 10’ w/Coupling	1	1	1	1	1	1	1	1
@		P	DEC*W	Deadend Clamp	3	3	3	3	3	3	3	3
		Q	41 56 021	Heel Brace, 5’–0” Wood	2	2	2	2	2	2	2	2
		R	41 01 023	Crossarm, 3–3/4” x 5–3/4” x 12	2	2	2	2	2	2	2	2
		S	23 52 069	Bolt, 5/8” x 18”	1	1	1	1	1	1	1	1
		T	23 52 049	Bolt, 5/8” x 2”	2	2	2	2	2	2	2	2
		U	23 66 006	Washer, Lock, 5/8”	2	2	2	2	2	2	2	2
		V	23 52 256	Bolt, 5/8” x 7”	4	4	4	4	4	4	4	4
		W	23 53 004	Bolt, Spacer, 5/8” x 20”	3	3	3	3	3	3	3	3
		X	23 65 012	EyenuT, 5/8”	3	3	3	3	3	3	3	3
		Y	23 51 015	Bolt, Clevis, 3/4” x 10”	3	3	3	3	3	3	3	3
		Z	23 65 018	EyenuT, 3/4”	3	3	3	3	3	3	3	3
		AA	23 77 210	Plate, Heel Brace, 13–3/8” to 19”	2	2	2	2	2	2	2	2
		BB	25 06 053	Insulator, Susp., 34 kV	3	3	3	3	3	3	3	3
		CC	23 66 133	Washer, Lock, 1/2”, Dbl. Coil	12	12	12	12	12	12	12	12
		DD	23 66 134	Washer, Lock, 5/8”, Dbl. Coil	7	7	7	7	7	7	7	7
		EE	18 51 021	Wire, Cu. #6 SD Covered	12	12	12	12	12	12	12	12
10 @	FF	12 69 11**	Grounding Unit on New Poles	1	1	1	1	1	1	1	1	1
		12 00 10 03	Grounding Unit on Existing Pole	1	1	1	1	1	1	1	1	1

CABLE TERMINALS
34 kV Single Circuit – Deadend – Cable Terminal
With Airbreak Switch – 750 kcmil and 350 kcmil

14 34 17 **

Sheet 5 of 6

Turner 34kV TSB Switch – New Installation

		Std. / Stk. No.	Materials Description	14 34 17 **	09	10	11	12	13	14	15	16
4	A	14 34 11 01	Cable Terminal – 750 kcmil on bracket	1	1							
		14 34 11 02	Cable Terminal – 750 kcmil on crossarm			1	1					
		14 34 11 03	Cable Terminal – 350 kcmil on bracket					1	1			
		14 34 11 04	Cable Terminal – 350 kcmil on crossarm							1	1	
13	B	54 08 437	Turner 34kV TSB Switch w/LBRK, Flat Top Mounting	1		1		1		1		
13		54 08 439	Turner 34kV TSB Switch w/o LBRK, Flat Top Mounting		1		1		1		1	
14 @	C	25 05 064	Insulator–Line Post	3	3	3	3	3	3	3	3	3
	D	18 52 009	Tie, Hand For Cu	3	3	3	3	3	3	3	3	3
	F	17 51 135	Clamp, PG. 450–1000 kcmil	3	3	3	3	3	3	3	3	3
	G	18 05 047	Wire, 556 AA. (ft)	45	45	45	45	45	45	45	45	45
	H	17 55 296	Lug, Comp, 350 cu.	6	6	6	6	6	6	6	6	6
	I	23 52 041	Bolt, 1/2" x 8"	12	12	12	12	12	12	12	12	12
	J	23 66 017	Washer–Round 9/16"	12	12	12	12	12	12	12	12	12
	K	17 55 192	Lug, Comp. 556 Al.	3	3	3	3	3	3	3	3	3
	L	23 52 065	Bolt, 5/8" x 12"	7	7	7	7	7	7	7	7	7
	M	23 66 027	Washer, Square , 11/16"	24	24	24	24	24	24	24	24	24
	N	32 01 821	Pipe, Steel, Galv. 2" x 10' w/Coupling	1	1	1	1	1	1	1	1	1
	P	DEC*W	Deadend Clamp	3	3	3	3	3	3	3	3	3
	Q	41 56 021	Heel Brace, 5'–0" Wood	2	2	2	2	2	2	2	2	2
	R	41 01 023	Crossarm, 3–3/4" x 5–3/4" x 12	2	2	2	2	2	2	2	2	2
	S	23 52 069	Bolt, 5/8" x 18"	1	1	1	1	1	1	1	1	1
	T	23 52 049	Bolt, 5/8" x 2"	2	2	2	2	2	2	2	2	2
	U	23 66 006	Washer, Lock, 5/8"	2	2	2	2	2	2	2	2	2
	V	23 52 256	Bolt, 5/8" x 7"	4	4	4	4	4	4	4	4	4
	W	23 53 004	Bolt, Spacer, 5/8" x 20"	3	3	3	3	3	3	3	3	3
	X	23 65 012	EyenuT, 5/8"	3	3	3	3	3	3	3	3	3
10 @	Y	23 51 015	Bolt, Clevis, 3/4" x 10"	3	3	3	3	3	3	3	3	3
	Z	23 65 018	EyenuT, 3/4"	3	3	3	3	3	3	3	3	3
	AA	23 77 210	Plate, Heel Brace, 13–3/8" to 19"	2	2	2	2	2	2	2	2	2
	BB	25 06 053	Insulator, Susp., 34 kV	3	3	3	3	3	3	3	3	3
	CC	23 66 133	Washer, Lock, 1/2", Dbl. Coil	12	12	12	12	12	12	12	12	12
	DD	23 66 134	Washer, Lock, 5/8", Dbl. Coil	7	7	7	7	7	7	7	7	7
	EE	18 51 021	Wire, Cu. #6 SD Covered	12	12	12	12	12	12	12	12	12
	FF	12 69 11**	Grounding Unit on New Pole	1	1	1	1	1	1	1	1	1
		12 00 10 03	Grounding Unit on Existing Pole	1	1	1	1	1	1	1	1	1

NOTES:

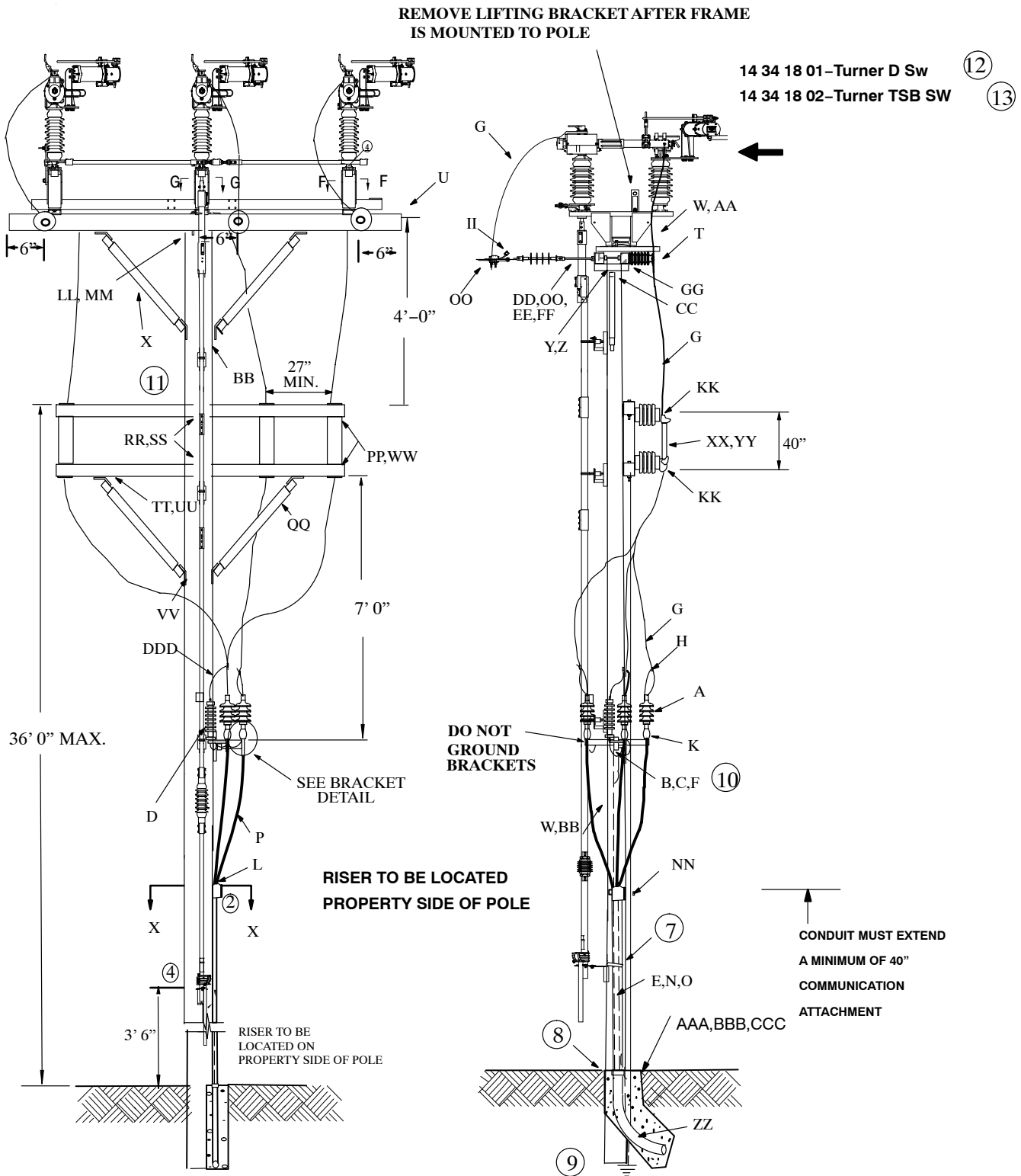
1. Switches & terminals shall be on separate poles whenever possible.
2. Locate switch operating rod & cable as shown on section XX to leave one side of pole clear for climbing. Install rod after terminators are placed.
3. Extend plastic riser to 12" above operating rod insulator.,
4. Maximum pole length 50 feet, otherwise check with construction. Conduit lengths may vary from those shown.
5. Do not install ground lead on terminator bracket or where it would bypass the operating rod insulator.
6. See DCS 14 34 11 ** for additional details.
7. Minimum bending radius is 24" for both the 750 kcmil and 350 kcmil cables.
8. If it is necessary to stand the riser conduit off of the pole, see DCS 14 00 01 03 for standoff bracket grounding requirements. Use standoff brackets 23 06 087, conduit straps 23 67 184, jam nuts 23 65 053, and double arm-ing bolts 23 53 003.
9. Concrete encasement is also required if riser conduit is on standoff brackets.
10. Use DCS 12 00 10 03 for ground rod application on existing pole and DCS 12 69 11 for ground new pole installation.
11. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
12. The switch is not for new installation.
13. The switch is for new installation.
14. Order additional vertical steel pipe only as needed.
15. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 Cu wire.

CABLE TERMINALS

34 kV Single Circuit – Deadend – Cable Terminal With Loadbreak Switch – 1/0

14 34 18 **

Sheet 1 of 4

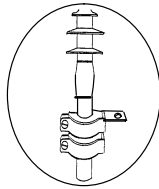
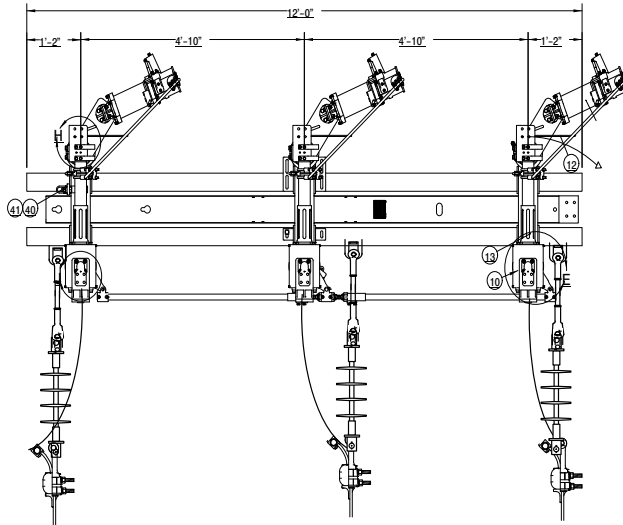


CABLE TERMINALS

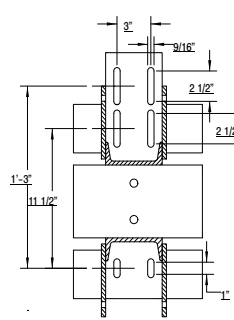
34 kV Single Circuit – Deadend – Cable Terminal With Loadbreak Switch – 1/0

14 34 18 **

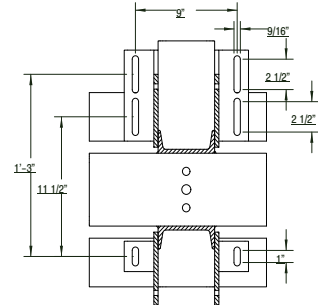
Sheet 2 of 4



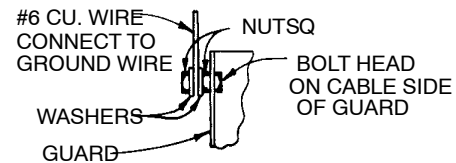
BRACKET DETAIL



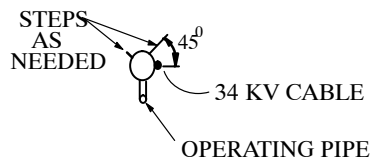
SECTION F-F
(FOR OUTSIDE PHASES)



SECTION G-G
(FOR CENTER PHASE)



DETAIL OF
GUARD BONDING



SECTION XX

CABLE TERMINALS
34 kV Single Circuit – Deadend – Cable Terminal
With Loadbreak Switch – 1/0

14 34 18 **

Sheet 3 of 4

		Std. / Stk. No.	Materials Description	14 34 18 **	01	02
	A	42 44 12 05	Termination, 35 kV, 1/0–750 kcmil		3	3
	B	23 52 070	Bolt, Machine 5/8" x 20"		3	3
	C	23 66 027	Washer, Square, 2 1/4"		3	3
	D	10 01 137	Arrester, Lightning, 27 kV		3	3
	E	23 60 005	Screw, Lag 3/8" X 3"		6	6
	F	17 08 058	Bracket, Terminator		1	1
	G	18 52 026	Wire, Cu. 1/0 Str., Bare		50'	50'
	H	23 78 183	Clamp, Hot Line, #6–400		1	1
	I	21 53 007	Bolt, Machine, 3/8" x 1 1/2"		1	1
9@	J	12 69 11	Grounding Unit on New Pole		1	1
		12 00 10 03	Grounding Unit on Existing Pole		1	1
	K	23 67 193	Bracket, Cable Support		3	3
	L	49 17 181	Strap, Poly., 2" x 36"		1	1
6	M	27 60 035	Iron Hanger		8'	8'
5	N	12 51 220	Conduit, Plastic, 5" Split		30'	30'
5	O	23 18 202	Guard, Conduit 5"		1	1
	P	18 07 291	Cable, 35 kV, 3–1/0 AL		35'	35'
	Q	21 61 006	Nut, Hex, 3/8"		2	2
	R	277	Install Cable Up Pole		1	1
12	S	54 08 317	Turner 34kV D Switch LBRK		1	
13		54 08 437	Turner 34kV TSB Switch LBRK–Flat Top			1
	NN	54 08 328	Kit, Mount Turner D Switch on Terminal Pole		1	1
	T	25 05 064	Insulator, Line Post		3	3
	U	41 01 023	Crossarm, 4" x 6" x 12'–0"		2	2
	V	23 52 069	Bolt, Machine, 5/8" x 18"		1	1
	W	23 66 027	Washer, Square, 2 1/4"		24	24
	X	41 56 021	Brace, Wood Heel, 5'–0"		2	2
	Y	23 52 049	Bolt, Machine, 5/8" x 2"		2	2
	Z	23 66 006	Washer, Lock, 5/8" Galv.		2	2
	AA	23 52 256	Bolt, Machine, 5/8" x 7"		4	4
	BB	23 52 065	Bolt, Machine, 5/8" x 12"		7	7
	CC	23 53 004	Bolt, Spacer, 5/8" x 20"		3	3
	DD	23 65 012	Eyenuit, 5/8"		3	3
	EE	23 51 015	Bolt, Clevis, 3/4" x 10"		3	3
	FF	23 65 018	Eyenuit, 3/4"		3	3
	GG	23 77 210	Plate, Heel Brace, 13 3/8" to 19"		2	2
	HH	25 06 053	Insulator, Susp., 34 kV		3	3
	II	17 51 032	Clamp, P.G., #6–1/0		3	3
	JJ	23 66 016	Washer, 3/8" Galv.		2	2
	KK	17 55 297	Lug, Comp., 1/0 Cu.		12	12
	LL	23 52 041	Bolt, Machine, 1/2" x 8"		12	12
	MM	23 66 017	Washer, Round, 1/2"		12	12

CABLE TERMINALS

34 kV Single Circuit – Deadend – Cable Terminal With Loadbreak Switch – 1/0

14 34 18 **

Sheet 4 of 4

		Std. / Stk. No.	Materials Description	14 34 18 **	01	02
@	OO	DEC*W	Clamp, Deadend – DCS 07 00 30 00		3	3
	NN	23 17 472	Cover, Riser Conduit for 2" – 4"		1	1
11@	PP	41 01 014	Crossarm, 3 1/2" X 4 1/2" X 8' 0"		2	2
		41 01 008	Crossarm, 3 1/2" X 4 1/2" X 10' 0"		2	2
	QQ	41 56 016	Brace, 60" V		1	1
	RR	23 52 065	Bolt, Machine, 5/8" x 12"		2	2
	SS	23 66 027	Washer, Square, 2 1/4"		6	6
	TT	23 52 038	Bolt, Machine, 1/2" x 6"		2	2
	UU	23 66 017	Washer, Round, 1/2"		2	2
	VV	23 52 063	Bolt, Machine, 5/8" x 10"		1	1
	WW	23 52 036	Bolt, Machine, 1/2" x 5"		12	12
	XX	54 03 048	Mounting, Fuse, 300A, SM-5		3	3
	YY		SM-5 Refill (Sized By Engr.)		3	3
	ZZ	12 51 206	Bend, 5", 36" Rad.		1	1
	AAA	23 67 036	Step, Pole 5/8" x 10"		2	2
8	BBB	11 04 110	Tube, Concrete 14" Dia.		4	4
8@	CCC	98 00 001	Concrete, 4SK		–	–
	DDD	18 51 021	Wire, Cu #6 SD Covered		12	12
3@	EEE	32 01 821	Pipe, Steel Galv. 2" x 10' w/Coupling		1	1

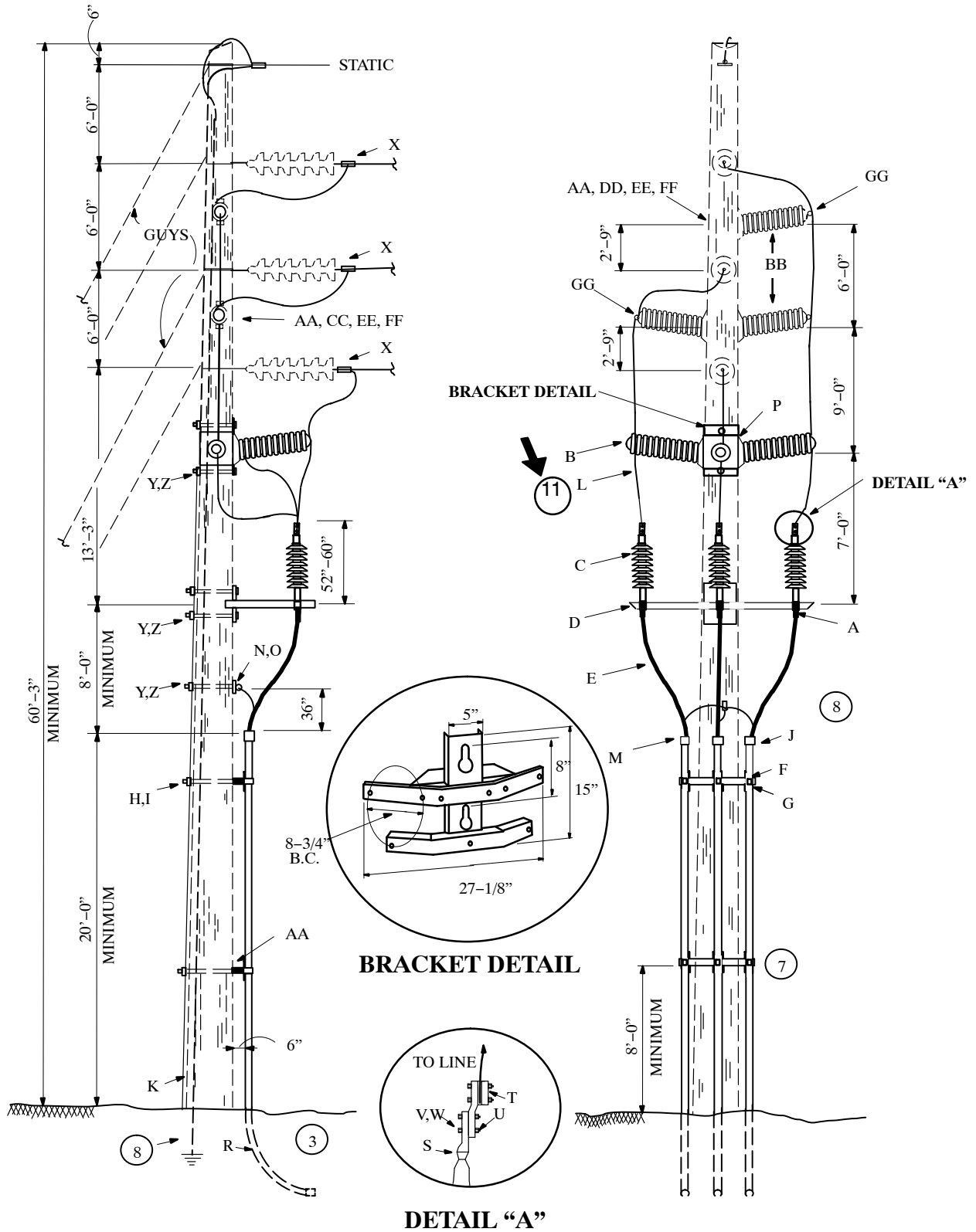
NOTES:

1. Locate switch operating rod & cable as shown on section XX to leave one side of pole clear for climbing.
2. Extend plastic riser to 12" above operating rod insulator.
3. Vertical steel pipe shipped with the switch is for maximum pole length of 50 feet, order additional vertical steel pipe as needed. Conduit lengths may vary from those shown.
4. Do not install ground lead on terminator bracket or where it would bypass the operating rod insulator.
5. Schedule 80 conduit may be substituted for the split conduit and guard. Use schedule 80 conduit (12-01-272) for the first section of the riser if installed on standoff brackets.
6. Conduit straps may be substituted for iron hangers.
7. If it is necessary to stand the riser conduit off of the pole, see DCS 14 00 01 03 for standoff bracket placement and grounding requirements. Use standoff brackets 23-06-087, conduit straps 23-67-184, jam nuts 23-65-053, and double aiming bolts 23-53-003.
8. Concrete encasement is also required if riser conduit is on standoff brackets.
9. Use DCS 12 00 10 03 for ground rod application on existing pole and DCS 12 69 11 for ground new pole installation.
10. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld ground wire for the #2 stranded copper wire when constructing the primary neutral buss.
11. 8' crossarm available AmerenMO only.
12. The switch is not for new installation.
13. The switch is for new installation.
14. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 Cu wire.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



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NOTES:

1. Wrap cable with tape prior to installing the grip.
2. Positioner is used to secure the terminator to the bracket. The weight of the cable is supported by the cable grip.
3. Bends should be encased in concrete.
4. Minimum pole height 70'.
5. See DCS 59 52 00 43 for Belleville Washer installation procedures.
6. Cut bracket to required mounting length.
7. See DCS 14 00 01 03 for standoff bracket placement and grounding requirements.
8. Use DCS 12 00 10 04 for ground coil application on new pole installation. Use 12 00 1003 for ground rod on an existing pole.
9. Always connect the metallic shields of the riser cables to the system neutral with at least a #2 stranded copper wire. Be aware that the bare and/or covered 7-strand #10 copperweld ground wire may look like stranded #2 copper wire. Never substitute the copperweld wire for the #2 stranded copper wire when constructing the primary neutral buss.
10. If there is no system neutral or shield wire available, install a pole ground per DCS 12 00 10 03 and bond all shields and ground wires to the #2 copper wire.
11. If avian protection is required, covered wire may be substituted for the bare 350 kcmil and 500 kcmil wire. If covered wire is needed, replace the bare 350 kcmil wire with Stock #1851052 and replace the bare 500 kcmil wire with stock #1851022.
Caution: The covered wire incorporates a XLP covering that has a maximum temperature rating of 90° C. If the circuit is expected to operate above 90° C, the bare wire should be used.

		Std. / Stk. No.	Materials Description	14 69 01	01	02	03
	A	23 67 185	Positioner, Cable		3	3	3
	B	71 10 002	Arrester, Lightning, Intermediate, 60kV		3	3	3
	C	17 07 179	Terminator, 69kV		3	3	3
	D	17 08 058	Bracket, 60"		1	1	1
	E	18 07 283	Cable, 69kV, 500 kcmil, Al.		105		
		18 07 292	Cable, 69kV, 750 kcmil, Al.			105	
		18 07 408	Cable, 69kV, 1000 kcmil, Cu.				105
6,7	F	23 06 099	Bracket, Standoff, 10'		1	1	1
	G	23 67 184	Straps, Conduit 5"		6	6	6
	H	23 53 046	Bolt, DA 5/8" x 36"		2	2	2
	I	23 65 053	Nuts, Jam		2	2	2
	J	12 01 272	Conduit, Sch. 80, 5"		60'	60'	60'
8	K	12 00 10 04	Grounding Unit		1	1	1
11	L	18 52 023	Wire, 350 Bare Cu.		60'	60'	
		18 52 021	Wire, 500 Bare Cu.				60'
1	M	23 17 220	Grip, Cable Riser, 3"-3.49" Dia., Split			3	3
		23 17 254	Grip, Cable Riser, 2.50"-2.99" Dia., Split		3		
	N	23 65 012	Eyebut, 5/8", Oval Eye		1	1	1
	O	23 68 181	Shackle		1	1	1
	P	23 06 119	Bracket, 3 Phase Intermediate Arrester		1	1	1
3	R	12 51 206	Bend, 5", 36" Rad.		3	3	3
	S	17 55 324	Lug, Compression, 500 Al., 2 Hole		3		
		17 55 260	Lug, Compression, 750 Al., 2 Hole			3	
		17 05 236	Lug, Compression, 1000 Cu., 2 Hole				3

CABLE TERMINALS

69 kV Terminal Pole

14 69 01 **

→500 kcmil–1000 kcmil Cables

Sheet 3 of 3

5 @	T	17 54 177	Connector, Cable to Flat, Bronze, 1/0–500 kcmil	3	3	3
	U	21 56 078	Bolt, Machine, 1/2" x 2", SS	6	6	6
	V	12 56 052	Washer, Belleville Spring, 1/2", SS	6	6	6
	W	12 56 053	Washer, Flat, 1/2", SS	12	12	12
	X	PG*	See 07 00 25 00	3	3	3
	Y	23 52 069	Bolt, Machine, 5/8" x 18"	5	5	5
	Z	23 66 027	Washer, Square, For 5/8" Bolt	5	5	5
	AA	23 66 031	Washer, Curved, 3/4"	6	6	6
	BB	25 05 098	Ins., Porc., N–Neck Tie Top, Stud Mount 69kV	3	3	3
	CC	23 52 219	Bolt, DA 3/4" x 14"	1	1	1
	DD	23 52 097	Bolt, DA 3/4" x 12"	1	1	1
	EE	23 65 042	Nut, Lock Type M–F	3	3	3
	FF	23 66 135	Washer, Double Coil Spring, 3/4"	3	3	3
	GG	18 52 009	Wire, Hand Tie, 6 AWG Bare CU, SD	3	3	3

OUTDOOR LIGHTING

15

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1.0 General

General information concerning outdoor lighting installations is covered in this section.

2.0 Standard Luminaires**2.1 Bracket Mount (Area) Luminaires**

All new installations will be made using Light Emitting Diode (LED) equivalent bracket mount luminaires. The existing High Pressure Sodium (HPS), Pulse-start Metal Halide (PMH), probe-start Metal Halide (MH) and Mercury Vapor (MV) luminaires are no longer available, and may remain in-service until the Luminaire, Lamp or Photocontrol failure.

2.1 Directional (Flood) Luminaires

All new installations will be made using LED equivalent directional (flood) luminaires. The existing HPS, PMH, MH and MV luminaires are no longer available, and may remain in-service until the Luminaire, Lamp or Photocontrol failure.

2.2 Decorative (Post-Top) Luminaires

In Missouri all new lighting installations will be made using LED luminaires. The existing HPS, PMH, MH and MV luminaires are no longer available, and may remain in-service until the Luminaire failure.

Illinois all new lighting installations will be made using HPS and PMH luminaires. The existing MH and MV luminaires are no longer available, and may remain in-service until the Luminaire failure.

The list of available Luminaires:

TABLE 1. AVAILABLE LUMINAIRES											
STOCK NUMBER	STYLE	STATE	LAMP	WATTS	IES LIGHT PATTERN	VOLTS	CORRAL. COLOR TEMP. ⁽³⁾ (KELVIN)	LUMENS	START/ OP AMPS	VOLTAGE INPUT RANGE	PF %
LED 100 W EQUIVALENT BRACKET MOUNT LUMINAIRE											
38 51 619	Bracket Mount	MO	LED	39	II, FIG. 1	120V/208V/ 240V/277V	4000	4,850	0.400	±5%	99%
38 51 641	Bracket Mount	MO	LED	39	V, FIG. 3	120V/208V/ 240V/277V	4000	4,850	0.400	±5%	99%
38 51 643	Bracket Mount	IL	LED	39	II, FIG. 1	120V/208V/ 240V/277V	3000	4,470	0.400	±5%	99%
38 51 644	Bracket Mount	IL	LED	39	V, FIG. 3	120V/208V/ 240V/277V	3000	4,470	0.400	±5%	99%
LED 250 W EQUIVALENT BRACKET MOUNT LUMINAIRE											
38 51 618	Bracket Mount	MO	LED	137	III, FIG. 2	120V/208V/ 240V/277V	4000	12,000	1.170	±5%	99%
38 51 617	Bracket Mount	MO	LED	137	III, FIG. 2	347-480V	4000	12,000	1.170	±5%	99%
38 51 645	Bracket Mount	IL	LED	107	III, FIG. 2	120V/208V/ 240V/277V	3000	11,960	1.170	±5%	99%
38 51 646	Bracket Mount	IL	LED	107	III, FIG. 2	347-480V	3000	11,960	1.170	±5%	99%
LED 400 W EQUIVALENT BRACKET MOUNT LUMINAIRE											
38 51 616	Bracket Mount	MO	LED	195	III, FIG. 2	120V/208V/ 240V/277V	4000	19,800	1.600	±5%	100%
38 51 615	Bracket Mount	MO	LED	195	III, FIG. 2	347-480V	4000	19,800	1.600	±5%	100%

TABLE 1. AVAILABLE LUMINAIRES (CONTINUED)

STOCK NUMBER	STYLE	STATE	LAMP	WATTS	IES LIGHT PATTERN	VOLTS	CORRAL. COLOR TEMP. ⁽³⁾ (KELVIN)	LUMENS	START/ OP AMPS	VOLTAGE INPUT RANGE	PF %
38 51 647	Bracket Mount	IL	LED	190	III, FIG. 2	120V/208V/ 240V/277V	3000	20,400	1.600	±5%	100%
38 51 648	Bracket Mount	IL	LED	190	III, FIG. 2	347-480V	3000	20,400	1.600	±5%	100%
LED 250W EQUIVALENT DIRECTIONAL/FLOOD LUMINAIRE											
38 51 626	Directional	MO	LED	98	6X6	120/208/ 240/277V	4000	13,400	0.475	±10%	90%
38 51 625	Directional	MO	LED	98	6X6	347-480V	4000	13,400	0.475	±10%	90%
38 51 649	Directional	IL	LED	98	6X6	120/208/ 240/277V	3000	12,600	0.475	±10%	90%
38 51 650	Directional	IL	LED	98	6X6	347-480V	3000	12,600	0.475	±10%	90%
LED 400W EQUIVALENT DIRECTIONAL/FLOOD LUMINAIRE											
38 51 624	Directional	MO	LED	150	6X6	120/208/ 240/277V	4000	18,600	0.875	±10%	90%
38 51 627	Directional	MO	LED	150	6X6	347-480V	4000	18,600	0.875	±10%	90%
38 51 651	Directional	IL	LED	150	6X6	120/208/ 240/277V	3000	18,200	0.875	±10%	90%
38 51 652	Directional	IL	LED	150	6X6	347-480V	3000	18,200	0.875	±10%	90%
LED 1000W EQUIVALENT DIRECTIONAL/FLOOD LUMINAIRE											
38 51 628	Directional	MO	LED	297	6X6	120/208/ 240/277V	4000	37,400	0.875	±10%	90%
LED 100W EQUIVALENT RECTANGULAR (SHOEBOX) LUMINAIRE											
3851637	Rectangular	IL	LED	44	III, FIG. 2	120/208/ 240/277V	3000	4,600	0.475	±10%	90%
LED 250W EQUIVALENT RECTANGULAR (SHOEBOX) LUMINAIRE											
3851640	Rectangular	IL	LED	136	III, FIG. 2	120/208/ 240/277V	3000	16,000	0.610	±10%	90%
LED 400W EQUIVALENT RECTANGULAR (SHOEBOX) LUMINAIRE											
3851638	Rectangular	IL	LED	183	III, FIG. 2	120/208/ 240/277V	3000	21,300	0.610	±10%	90%
3851639	Rectangular	IL	LED	183	III, FIG. 2	347-480V	3000	21,300	0.610	±10%	90%
HID DECORATIVE/POST-TOP LUMINAIRE											
3801517	Early American	IL / MO	HPS	100	III, FIG. 2	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801518	Early American	IL / MO	HPS	100	V, FIG. 3	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801942 ^(1,2)	Early American	IL	MH	175	III, FIG. 2	120V	4,100K	14,400	1.0/1.75	±10%	45%
3801961 ⁽²⁾	Early American	IL	PMH	150	III, FIG. 2	120V	4,100K	12,900	-	±10%	45%
3801624	Acorn	IL	HPS	100	V, FIG. 3	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801625 ^(1,2)	Acorn	IL	MH	175	V, FIG. 3	120V	4,100K	14,400	1.0/1.75	±10%	45%
3801960 ⁽²⁾	Acorn	IL	PMH	150	V, FIG. 3	120V	4,100K	12,900	1.9/0.9	±10%	45%

TABLE 1. AVAILABLE LUMINAIRES (CONTINUED)

STOCK NUMBER	STYLE	STATE	LAMP	WATTS	IES LIGHT PATTERN	VOLTS	CORRAL. COLOR TEMP. ⁽³⁾ (KELVIN)	LUMENS	START/ OP AMPS	VOLTAGE INPUT RANGE	PF %
3801524	Colonial	MO	HPS	100	III, FIG. 2	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801525	Colonial	MO	HPS	100	V, FIG. 3	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801513	Contemporary or Traditional	MO	HPS	100	III, FIG. 2	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801514	Contemporary or Traditional	MO	HPS	100	V, FIG. 3	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801584	Aspen	MO	HPS	100	III, FIG. 2	120V	1,900K	9,500	3.2/2.1	±5%	45%
3801585	Aspen	MO	HPS	100	V, FIG. 3	120V	1,900K	9,500	3.2/2.1	±5%	45%
LED 100W EQUIVALENT DECORATIVE/POST-TOP LUMINAIRE											
3851620	Early American	MO	LED	52	III, FIG. 2	120/208/240/277V	3000	5,290	0.700	±10%	88%
3851622	Early American	MO	LED	52	V, FIG. 3	120/208/240/277V	3000	4,939	0.700	±10%	88%
3851632	Colonial	MO	LED	44	III, FIG. 2	120/208/240/277V	3000	3,023	0.700	±10%	88%
3851631	Colonial	MO	LED	44	V, FIG. 3	120/208/240/277V	3000	3,210	0.700	±10%	88%
3851621	Contemporary or Traditional	MO	LED	50	III, FIG. 2	120/208/240/277V	3000	4,511	0.350	±10%	94%
3851623	Contemporary or Traditional	MO	LED	50	V, FIG. 3	120/208/240/277V	3000	4,511	0.350	±10%	94%
3851633	Aspen	MO	LED	39	III, FIG. 2	120/208/240/277V	3000	4,990	1.000	±10%	96%
3851634	Aspen	MO	LED	39	V, FIG. 3	120/208/240/277V	3000	4,988	1.000	±10%	96%

NOTES:

1. Probe-start Metal Halide (MH) luminaires with solid red identification tag are obsolete. These luminaires require MH lamp and may remain in service until Luminaire failure.
2. Pulse-start Metal halide (PMH) Lamps are NOT interchangeable with probe-start Metal Halide (MH) Lamps. If a PMH lamp is installed in the MH luminaire, the lamp will not ignite or will not start. If a MH lamp is installed in the PMH luminaire, the lamp will ignite or start very quickly. The MH lamp is not designed to run on the PMH ballast and will experience a very short lamp life. Because of the high startup voltage that is delivered across the ballast by the ignitor to the lamp, the lamp is subject to a non-passive end of life and could rupture the lamp arch tube. It is very important to always close the luminaire optical before testing the lamp or starting the MH/PMH luminaire.
3. Correlated Color Temperature (CCT) is the measure of light source color appearance in degrees Kelvin.

3.0 Lighting Patterns

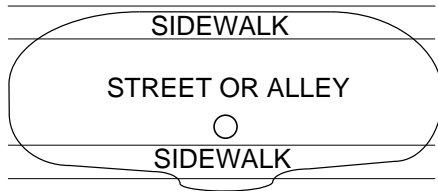


FIGURE 1

Type II - The type II distribution is used for lighting alleys and smaller streets. The light beam is narrow and long.

LED 100W EQUIVALENT BRACKET MOUNT
TYPE II LUMINAIRE

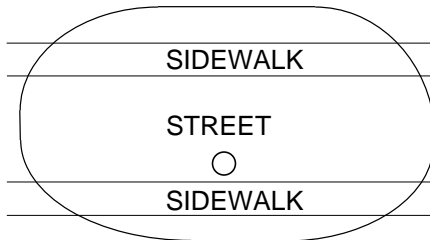


FIGURE 2

Type III - The type III distribution is used for lighting the larger roadways, general parking areas and other areas where a larger area of lighting is required.

LED 250W & 400W EQUIVALENT
BRACKET MOUNT
TYPE III LUMINAIRE

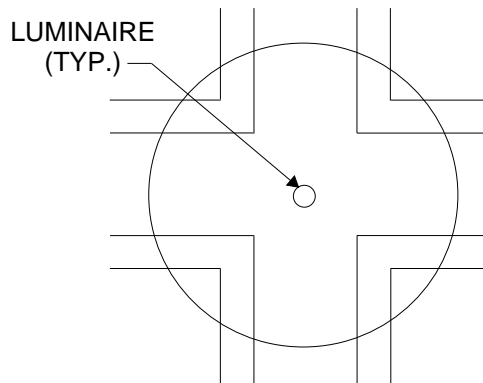


FIGURE 3

Type V - The type V distribution is used for lighting intersections, center islands of parkway, cul-de-sacs, and fields. The light beam has even intensity at all angles.

LED 100W EQUIVALENT
BRACKET MOUNT
TYPE V LUMINAIRE

4.0 Identification

All luminaires are shipped with the appropriate NEMA identification decal. If the decal is not installed it should be re-applied on the fixture so that it can be seen from the ground.

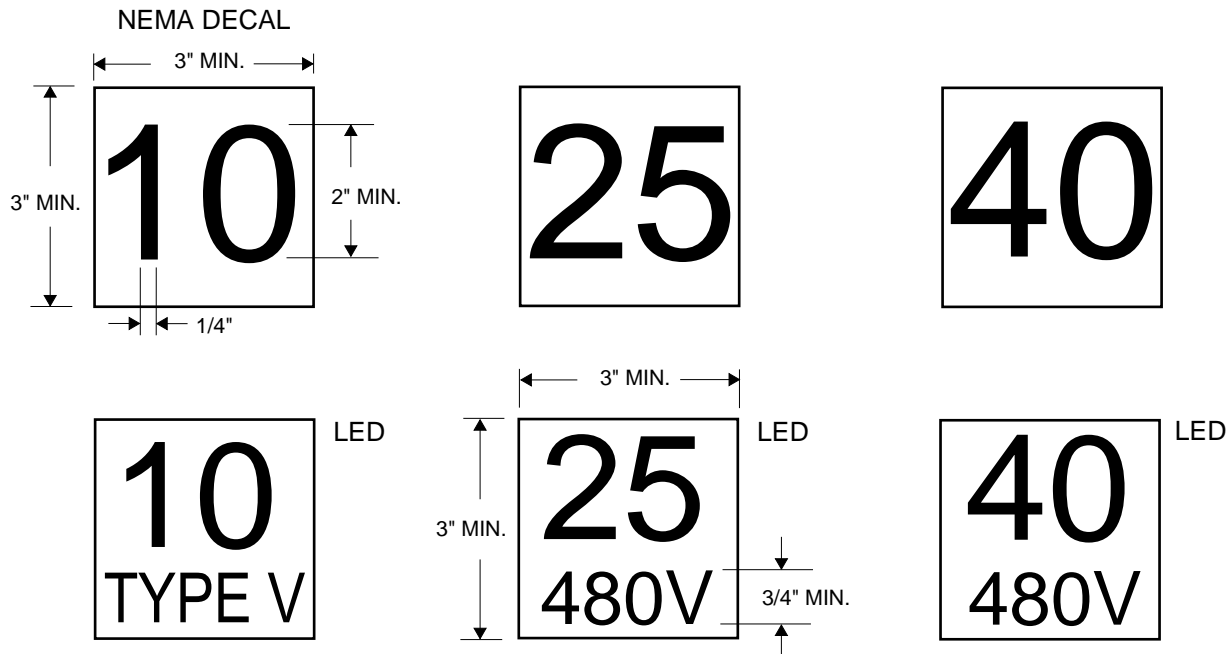


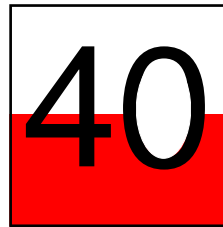
TABLE 2. IDENTIFYING CODE

IDENTIFYING NUMERAL	LAMP WATTAGE AND LED EQUIVALENT	BACKGROUND COLOR	LAMP TYPE
10	100 W	GOLD	HIGH PRESSURE SODIUM (HPS)
15	150 W	*HALF RED/HALF WHITE	PULSE-START METAL HALIDE (PMH)
17	175 W	BLUE	MERCURY VAPOR (MV)
25	250W	RED	PROBE-START METAL HALIDE (MH)
40	400 W	GOLD	HIGH PRESSURE SODIUM (HPS)
X1	1000 W	RED	PROBE-START METAL HALIDE (MH)
10	100 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)
10 TYPE V	100 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)
25	250 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)
25 480 V	250 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)
40	400 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)
40 480 V	400 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)
X1	1000 W EQV.	WHITE	LIGHT EMITTING DIODE (LED)

PROBE START
METAL HALIDE
MH



*HORIZONTAL BURN
PULSE START
METAL HALIDE
PMH



*VERTICAL BURN
PULSE START
METAL HALIDE
PMH



* PMH Luminaires label with wattage identification code.

The first label on the left is horizontal burn PMH luminaire such as horizontal non-cutoff, horizontal cutoff, and directional flood luminaires. The label on the right is for vertical burn PMH luminaire such as post-top luminaires.

5.0 Luminaire Mounting Heights

Post-top luminaires shall be mounted only on fiberglass poles purchased specifically for that purpose.

All other types of luminaires shall be mounted in accordance with the following table. The preferred height should be maintained whenever possible but the minimum heights may be used if this avoids a pole replacement.

Mounting height is defined as the height from ground to the bottom of the refractor (glassware) on glass enclosed reflectors and to the bottom of the lamp on open type reflectors.

TABLE 3. LUMINAIRE MOUNTING HEIGHTS

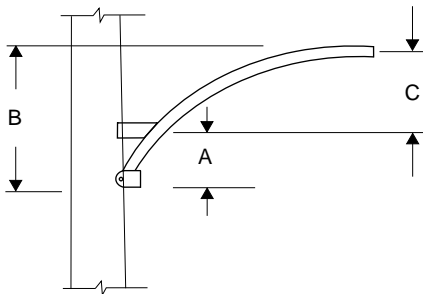
LIGHT EMITTING DIODE (LED)	HIGH PRESSURE SODIUM (HPS)	PROBE-START (MH) AND PULSE-START (PMH) METAL HALIDE	MIN. MTG. HEIGHT [FT.]	PREF. MTG. HEIGHT [FT.]
-	100 W HPS POST-TOP	150 W PMH POST-TOP 175 W MH POST-TOP	14	14
LED 100 W EQUIVALENT BRACKET MOUNT	100 W HPS OPEN BOTTOM 100 W HPS HORIZ. COBRA HEAD	-	20	20
LED 250 W EQUIV. DIRECT. LED 400 W EQUIV. DIRECT.	250 W HPS DIRECTIONAL 400 W HPS DIRECTIONAL	250 W MH & PMH DIRECTIONAL 400 W MH & PMH DIRECTIONAL	25	30
LED 250 W EQUIVALENT BRACKET MOUNT	-	250 W MH & PMH HORIZONTAL COBRA HEAD	30	30
LED 250 W EQUIVALENT BRACKET MOUNT	250 W HPS HORIZONTAL COBRA HEAD	-	35	35
LED 400 W EQUIVALENT BRACKET MOUNT	400 W HPS HORIZONTAL COBRA HEAD	-	30	35
LED 400 W EQUIVALENT BRACKET MOUNT	-	400 W MH & PMH HORIZONTAL COBRA HEAD	30	35
LED 1000 W EQUIV. DIRECT.	-	1000 W MH DIRECTIONAL		

6.0 Brackets

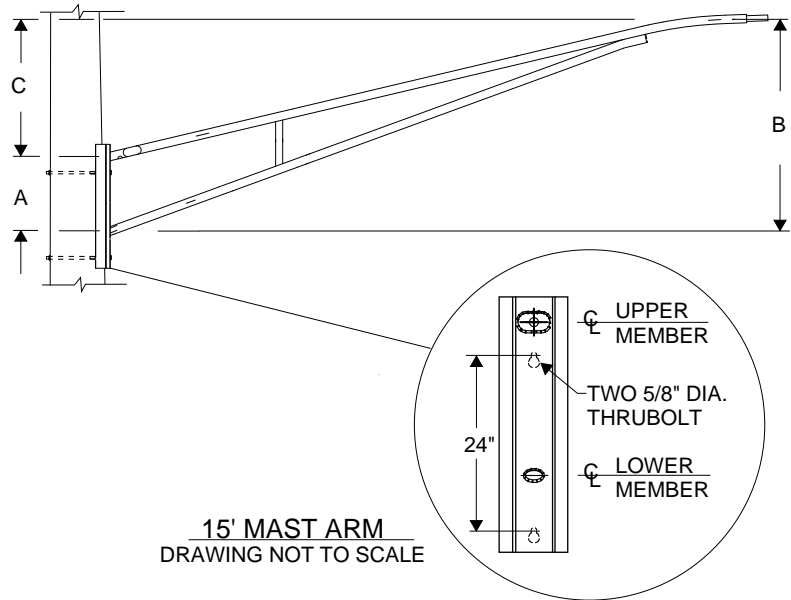
Standard installations for area lights shall use the 30" bracket. Standard installations for street lights shall use the 6' bracket. Brackets must be ordered as a separate item along with the luminaire and all other components and hardware.

For special applications, other brackets are available but their usage should be limited as much as possible.

The following data is for use in determining bracket locations to provide luminaire mounting heights as specified in the proceeding section. All upsweep brackets and mast arms are equipped for 1-1/4" slip-fitter mounting of luminaires.



30" AND 6' BRACKETS
DRAWING NOT TO SCALE



15' MAST ARM
DRAWING NOT TO SCALE

TABLE 4. BRACKET AND MAST ARM LENGTH/DIMENSIONS

BRACKET LENGTH	A	B	C
30"	11"	18"	7"
6'	11"	30"	19"
15'	21"	60"	39"

6.1 Ornamental concrete pole are no longer Ameren's standards and they are replaced with fiberglass poles for maintenance. Ornamental concrete pole have a set bracket mounting point. For these concrete poles the height above ground level at the luminaire end of the bracket is per following table:

TABLE 5. LUMINAIRE HEIGHT ABOVE GROUND LEVEL - CONCRETE POLES

CONCRETE POLES STOCK NUMBER	POLE HIGHT ABOVE THE GROUND	LUMINAIRE HEIGHT AT THE END OF THE 6 FT. BRACKETS
EXISTING - MAINTENANCE ONLY	23'	25'-3"
EXISTING - MAINTENANCE ONLY	28'	30'-3"

6.2 For both horizontal and vertical burning luminaires, the distance from the mounting point to the bottom of the luminaire is approximately 12". For fiberglass mast arm poles per material spec 2.1.264, the height above ground level, at the luminaire end of the bracket is per following table:

TABLE 6. LUMINAIRE HEIGHT ABOVE GROUND LEVEL - FIBERGLASS POLES

FIBERGLASS POLES STOCK NUMBER	POLE HIGHT ABOVE THE GROUND	LUMINAIRE HEIGHT AT THE END OF THE 6 FT. BRACKETS
38 01 555	30'	26'-3"
38 01 916	33'	28'-3"
38 01 554	35'	31'-3"
38 01 917	38'	33'-3"

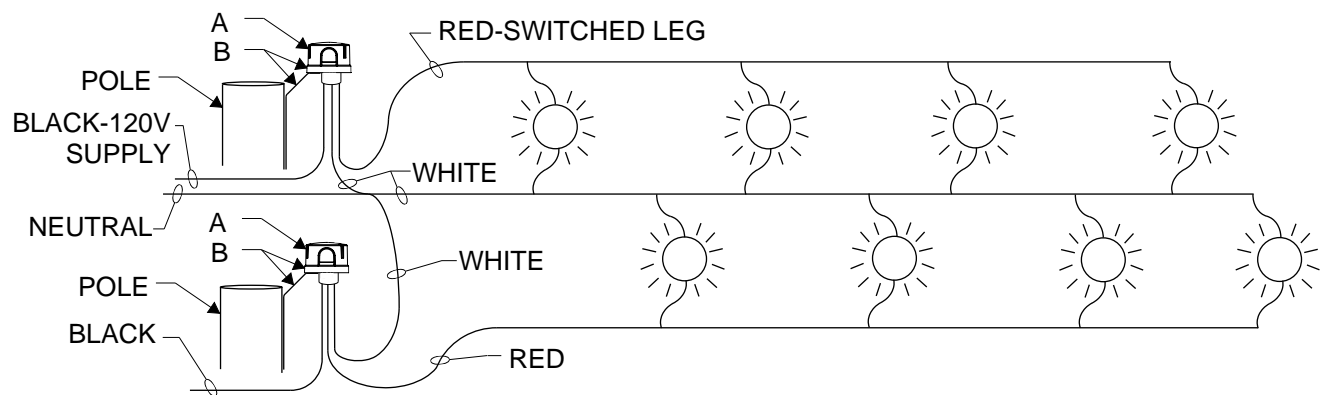
7.0 Remote Operated and Multiple Light Control

Periodically, light from one luminaire will activate the photocell and shut off another light. For these circumstances, when simply re-aiming the photocell does not resolve the problem, a remote photocell mounting bracket is used.

In some circumstances, it is beneficial to operate multiple luminaires from one control. For these circumstances a remote photocell mounting bracket or relay is used.

In both of the above situations, the photocell on the luminaire is replaced with a shorting plug. The photocell is rated at 15A while the relay is rated at 30A. See Table 1 of this document, for current draw information in order to determine how many luminaires can be controlled by either the photocell or the relay.

If multiple luminaires are used on 3-wire, single phase circuits, care should be taken to balance the load between the two phases in order to have the lights operated at the same time.



MULTIPLE LIGHT CONTROL DIAGRAM

TABLE 7. MULTIPLE LIGHT CONTROL MATERIAL

	STOCK NUMBER	STATE	DESCRIPTION
A*	38 51 630	MO/IL	PHOTOCELL, 120-277 V, 1000 W FAIL ON, BLACK, NORTH ORIENTED, HEAVY DUTY (LONG LIFE, 20+ YEARS)
	38 01 394	MO/IL	PLUG, SHORTING, PHOTOELECTRIC CELL
B	38 01 376	MO/IL	PHOTOCELL BRACKET AND PHOTOCELL RECEPTACLE ASSEMBLY MOUNTING ON POLE OR CROSSARM W/RECEPTACLE
	38 01 275	MO/IL	RELAY, 120 V, 30 A MULTIPLE STREETLIGHTS

*For more information on photocontrol see DCS 15 00 01 01.

8.0. References Chart Missouri

TABLE 8. LUMINAIRE EQUIVALENT WATTAGES - BRACKET MOUNT LUMINAIRES - MISSOURI							
STOCK NUMBER LED LUMINAIRE		LUMINAIRE I.D.	LIGHT EMITTING DIODE (LED)	HID FIXTURE WATTAGE			VOLTAGE
				MERCURY VAPOR (MV)	METAL HALIDE (MH) PULSE-START (PMH)	HIGH PRESS. SODIUM (HPS)	
38 51 619	MO	10	39 W	100/150/175/250 W	150 W & 175 W	70 W & 100 W	120/208/240/277 V
38 51 641	MO	10 TYPE V	39 W	100/150/175/250 W	150 W & 175 W	70 W & 100 W	120/208/240/277 V
38 51 618	MO	25	140 W	400 W	250 W	250 W	120/208/240/277 V
38 51 617	MO	25 480 V	140 W	400 W	250 W	250 W	480 V
38 51 616	MO	40	195 W	1000 W	400 W	400 W	120/208/240/277 V
38 51 615	MO	40 480 V	195 W	1000 W	400 W	400 W	480 V

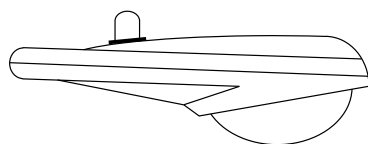
TABLE 9. LUMINAIRE EQUIVALENT WATTAGES - DIRECTIONAL (FLOOD) LUMINAIRES - MISSOURI							
STOCK NUMBER LED LUMINAIRE		LUMINAIRE I.D.	WATTAGE LIGHT EMITTING DIODE (LED)	HID FIXTURE WATTAGE			VOLTAGE
				MERCURY VAPOR (MV)	METAL HALIDE (MH) PULSE-START (PMH)	HIGH PRESS. SODIUM (HPS)	
38 51 626	MO	25	98 W	400 W	250 W & 400 W ⁽¹⁾	250 W	120/208/240/277 V
38 51 625	MO	25 480 V	98 W	400 W	250 W & 400 W ⁽¹⁾	250 W	480 V
38 51 624	MO	40	150 W	1000 W	- ⁽¹⁾	400 W	120/208/240/277 V
38 51 627	MO	40 480 V	150 W	1000 W	- ⁽¹⁾	400 W	480 V
38 51 628	MO	X1	300 W	-	1000 W	1000 W	120/208/240/277 V

NOTES:

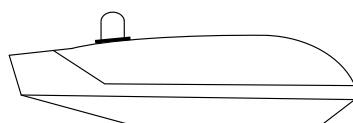
1. In Missouri only the 400 W Pulse Start Metal Halide (PMH) and probe start Metal Halide (MH) directional (flood) luminaires will be replaced with the LED 250 W equivalent luminaire.

9.0. References Chart Illinois

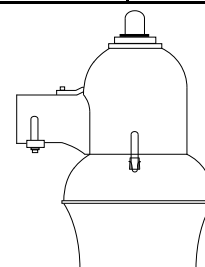
TABLE 10. LUMINAIRE EQUIVALENT WATTAGES - BRACKET MOUNT LUMINAIRES - ILLINOIS							
STOCK NUMBER LED LUMINAIRE		LUMINAIRE I.D.	LIGHT EMITTING DIODE (LED)	HID FIXTURE WATTAGE			VOLTAGE
				MERCURY VAPOR (MV)	METAL HALIDE (MH) PULSE-START (PMH)	HIGH PRESS. SODIUM (HPS)	
38 51 643	IL	10	39 W	100/150/175/250 W	150 W & 175 W	70 W & 100 W	120/208/240/277 V
38 51 644	IL	10 TYPE V	39 W	100/150/175/250 W	150 W & 175 W	70 W & 100 W	120/208/240/277 V
38 51 645	IL	25	107 W	400 W	250 W	250 W	120/208/240/277 V
38 51 646	IL	25 480 V	107 W	400 W	250 W	250 W	480 V
38 51 647	IL	40	190 W	1000 W	400 W	400 W	120/208/240/277 V
38 51 648	IL	40 480 V	190 W	1000 W	400 W	400 W	480 V



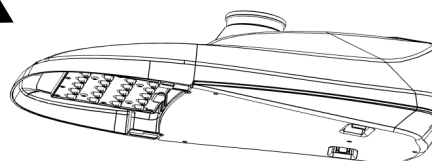
ENCLOSED
COBRA HEAD, SEMI CUTOFF
120 V, 120-277 V AND 480 V



ENCLOSED
COBRA HEAD, CUTOFF
120 V, 120-277 V AND 480 V



OPEN BOTTOM/NEMA HEAD
120 V



LED 100 W, 250 W AND 400 W EQUIVALENT
BRACKET MOUNT LUMINAIRE

TABLE 11. LUMINAIRE EQUIVALENT WATTAGES - DIRECTIONAL (FLOOD) LUMINAIRES - ILLINOIS							
STOCK NUMBER LED LUMINAIRE		LUMINAIRE I.D.	WATTAGE LIGHT EMITTING DIODE (LED)	HID FIXTURE WATTAGE			VOLTAGE
				MERCURY VAPOR (MV)	METAL HALIDE (MH) PULSE-START (PMH)	HIGH PRESS. SODIUM (HPS)	
38 51 649	IL	25	98 W	400 W	250 W	250 W	120/208/240/277 V
38 51 650	IL	25 480 V	98 W	400 W	250 W	250 W	480 V
38 51 651	IL	40	150 W	1000 W	400 W	400 W	120/208/240/277 V
38 51 652	IL	40 480 V	150 W	1000 W	400 W	400 W	480 V

OUTDOOR LIGHTING

HID LAMPS

15 00 02 01

Sheet 1 of 2

1. High Pressure Sodium (HPS) Lamps – CLEAR

HPS lamps must be used only in luminaires with ballasts designed for HPS lamps. HPS lamps require at least 1 minute to restrike after a power interruption.

Standard lamp sizes and types are as follows:

Stock No.	Lamp Watts	Lamp Type	Avg. Rated Life (HRS)	Approx. Initial Lumens	Lamp Base
26-06-257	70	HPS	24,000+	6,300	Mogul
26-55-260	100	HPS	24,000+	9,500	Mogul
26-06-740	150	HPS	24,000+	16,000	Mogul
26-55-067	250	HPS	24,000+	29,000	Mogul
26-55-061	400	HPS	24,000+	50,000	Mogul
26-55-072	1000	HPS	24,000+	130,000	Mogul

2. Probe-Start Metal Halide (MH) Lamps (Replacement for the existing probe-start metal halide (MH) luminaires)

MH lamps must be used only in luminaires ballasts designed for MH lamps. MH lamps require approximately 7 to 12 minutes to restrike after a power interruption.

Standard lamp sizes and types are as follows:

Stock No.	Lamp Watts	Lamp Type	Avg. Rated Life (HRS)	Approx. Initial Lumens	Lamp Base
26-56-260	175	MH	10,000	14,400	Mogul
26-56-251	250	MH	7,500	20,000	Mogul
26-56-261	400	MH	15,000	32,000	Mogul
26-56-244	1000	MH	12,000	107,800	Mogul

3. Pulse-Start Metal Halide Lamps (PMH) (Use in Pulse-start metal halide (PMH) luminaire)

PMH lamps must be used only in luminaires ballasts designed for PMH lamps. PMH lamps require approximately 5 to 7 minutes to restrike after a power interruption.

Standard lamp sizes and types are as follows:

Stock No.	Lamp Watts	Lamp Type	Avg. Rated Life (HRS)	Approx. Initial Lumens	Lamp Base
26-06-418	100	PMH	16,000	9,000	Medium
26-05-087	150	PMH	12,000	12,900	Medium
26-55-277	250	PMH	12,000	19,000	Mogul
26-55-278	400	PMH	20,000	40,000	Mogul

OUTDOOR LIGHTING

HID LAMPS

15 00 02 01

Sheet 2 of 2

4. Mercury Vapor (MV) Lamps (Replacement for existing mercury vapor luminaires only)

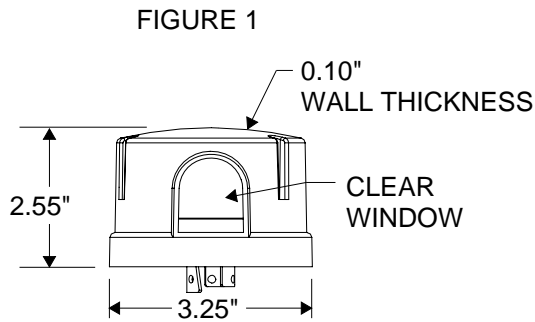
MV lamps must be used only in luminaires with ballasts designed for MV lamps. MV lamps require at least 6 minutes to restrike after a power interruption.

Standard lamp sizes and types are as follows:

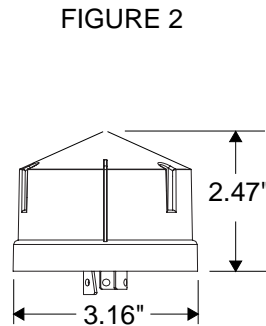
Stock No.	Lamp Watts	Lamp Type	Avg. Rated Life (HRS)	Approx Initial Lumens	Lamp Base
26-55-045	175	MV	24,000+	8,500	Mogul
26-55-066	250	MV	24,000+	13,000	Mogul
26-55-060	400	MV	24,000+	22,000	Mogul
26-55-048	1000	MV	24,000+	61,000	Mogul

IMPORTANT

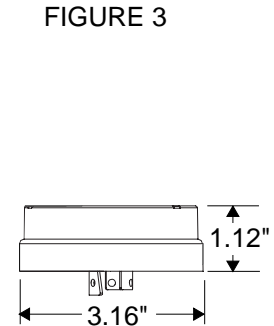
1. PMH lamps are not interchangeable with MH lamps.
2. If a PMH lamp is placed inside of a MH luminaire, the lamp will not ignite or will not start.
3. If a MH lamp is placed inside of a PMH luminaire, the lamp will ignite or start very quickly. The MH lamp is not designed to run on the PMH ballast and will experience a very short lamp life. Because of the high start up voltage that is delivered across the ballast by the ignitor to the lamp, the lamp is subject to a non passive end of life and could rupture the lamp arc tube. It is very important to always close the fixture optical before testing the lamp or starting the MH/PMH luminaire.
4. MV and MH/PMH lamps may continue to operate for some time even though the out glass envelope is missing. These lamps should be removed from service as soon as possible since they are a source of ultraviolet radiation when operating in this condition.
5. All PMH lamps and HPS lamps (not LU/plus) cycle at end of life.



**HEAVY DUTY
LONG LIFE**



**STANDARD DUTY
UPWARD LOOKING
ILLINOIS ONLY**



SHORTING COVER

TABLE 1. LIGHT CONTROL MATERIAL

STOCK NUMBER	STATE	VOLTAGE	DESCRIPTION	HOUSING COLOR	WINDOW	TYPE	HOUSING STYLE FIG. NO.
38 51 630 ^(1,3,4)	MO/IL	120-277V	PHOTOCELL, 1000W; FAIL ON	BLACK	NORTH ORIENTED	HEAVY DUTY (LONG LIFE, 20+ YEARS)	FIG. 1
38 51 629 ^(1,3,4)	MO/IL	480V	PHOTOCELL, 1000W; FAIL ON	YELLOW	NORTH ORIENTED	HEAVY DUTY (LONG LIFE, 20+ YEARS)	FIG. 1
54 14 312 ^(2,3,4)	IL	120V	PHOTOCELL, UPWARD LOOKING, 1000W; FAIL ON	CLEAR	UPWARD	STANDARD DUTY (10+ YEARS)	FIG. 2
38 01 394	MO/IL	-	PLUG, SHORTING, PHOTOELECTRIC CELL	-	-	TWISTLOCK RECEPTACLE	FIG. 3

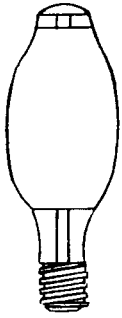
NOTES:

1. Long life-heavy duty photocell must be used with Light Emitting Diode (LED) luminaire.
2. Upward looking photocontrol to be used **ONLY** when necessary to prevent mis-operation due to a point source of ambient light entering the photocontrol window. May be needed in area with a large number of lights where the light from one luminaire causes another to turn off.
3. Photocontrol must have instantaneous turn on and 3-5 second turn off delay.
4. See Material Specification 2.1.298 for more information.

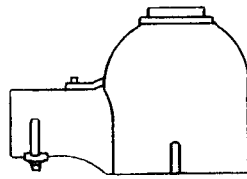
OUTDOOR LIGHTING
Luminaire Components,
NEMA Head

15 70 10 **

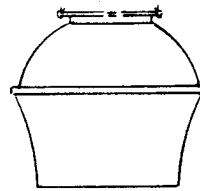
Sheet 1 of 1



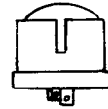
A



B



C



D

	Std. / Stk. No.	Description	157010	01	02	09	10
A	26 06 257	Lamp HPS 70W		1	1		
	26 55 260	Lamp HPS 100W				1	1
B	38 01 710	Hood HPS 70W		1	1		
	38 01 534	Hood HPS 100W				1	1
C	38 01 883	Refl. W/OB Acrylic (III)		1		1	
	38 51 368	Refl. W/OB Acrylic (V)			1		1
D	38 51 366	Switch 100W PE Cell		1	1	1	1

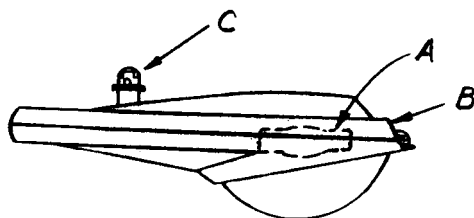
OUTDOOR LIGHTING

Luminaire Components

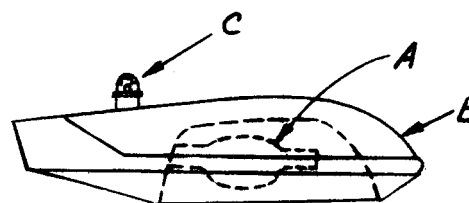
Horizontal

15 70 12 **

Sheet 1 of 3



NON-CUTOFF



CUTOFF

HPS

100W, 120V, Type III, Non-Cutoff

100W, 120V, Type III, Cutoff

250W, 120V, Type III, Non-Cutoff

250W, 120V, Type III, Cutoff

400W, 120V, Type III, Non-Cutoff

400W, 120V, Type III, Cutoff

Metal Halide Probe-Start (MH) (1) (4)

250W, 120V, Type III, Cutoff

250W, 120V, Type III, Non-Cutoff

400W, 120V, Type III, Cutoff

400W, 120V, Type III, Non-Cutoff

Standard

15 70 12 01

15 70 12 02

15 70 12 03

15 70 12 04

15 70 12 05

15 70 12 06

Standard

15 70 12 07

15 70 12 08

15 70 12 09

15 70 12 10

		Std. / Stk. No.	Description	15 70 12 **	01	02	03	04	05	06	07	08	09	10
1,4	A	26 55 260	Lamp HPS 100W		1	1								
		26 55 067	Lamp, HPS, 250W				1	1						
		26 56 251	Lamp, MH, 250W								1	1		
		26 55 061	Lamp, HPS, 400W						1	1				
		26 56 261	Lamp, MH, 400W										1	1
	B	38 01 531	Luminaire, 100W, 120V, HPS, NCO		1									
		38 01 528	Luminaire, 100W, 120V, HPS, CO			1								
		38 01 532	Luminaire, 250W, 120V, HPS, NCO				1							
		38 01 495	Luminaire, 250W, 120V, HPS, CO					1						
		38 01 628	Luminaire, 250W, 120V, MH, CO								1			
		38 01 627	Luminaire, 250W, 120V, MH, NCO									1		
		38 01 530	Luminaire, 400W, 120V, HPS, NCO						1					
		38 01 496	Luminaire, 400W, 120V, HPS, CO							1				
		38 01 630	Luminaire, 400W, 120V, MH, CO										1	
		38 01 629	Luminaire, 400W, 120V, MH, NCO											1
	C	38 51 366	Switch, St. Lt., 1000W, 120/240/277V, P.E.		1	1	1	1	1	1	1	1	1	1

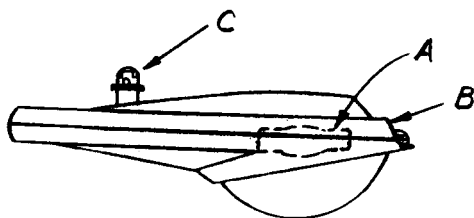
OUTDOOR LIGHTING

Luminaire Components

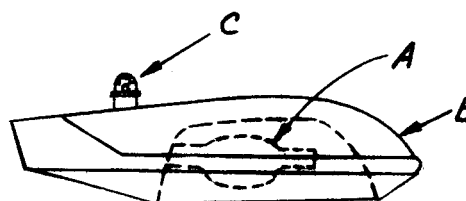
Horizontal

15 70 12 **

Sheet 2 of 3



NON-CUTOFF



CUTOFF

HPS (4)

250W, 480V, Type III, Cutoff

250W, 480V, Type III, Non-Cutoff

250W, 120/208/240/277, Non-Cutoff

400W, 480V, Type III, Non-Cutoff

400W, 480V, Type III, Cutoff

400W, 120/208/240/277V, Type III, Type III, Non-Cutoff

Standard

15 70 12 11

15 70 12 12

15 70 12 13

15 70 12 14

15 70 12 15

15 70 12 16

Metal Halide Pulse Start (PMH) (2) (4)

250W, 120V, Type III, Cutoff

250W, 120V, Type III, Non-Cutoff

400W, 120V, Type III, Cutoff

400W, 120V, Type III, Non-Cutoff

Standard

15 70 12 17

15 70 12 18

15 70 12 19

15 70 12 20

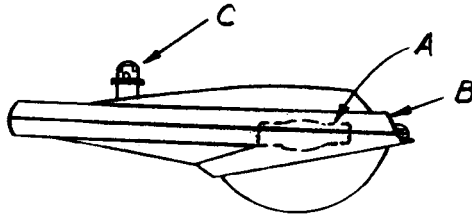
		Std. / Stk. No.	Description	15 70 12 **	11	12	13	14	15	16	17	18	19	20
4	A	26 55 067	Lamp HPS 250W		1	1	1							
		26 55 061	Lamp, HPS, 400W					1	1	1				
		26 55 277	Lamp PMH 250W								1	1		
		26 55 278	Lamp PMH 400W										1	1
4	B	38 01 828	Luminaire, 250W, 480V,HPS, CO		1									
4		38 01 578	Luminaire, 250W, 480V,HPS, NCO			1								
		38 01 574	Luminaire, 250W, 120/208/240/277V, HPS, NCO				1							
4		38 01 577	Luminaire, 400W, HPS, SCO, 480V					1						
4		38 01 830	Luminaire, 400W, HPS, CO, 480V						1					
		38 01 573	Luminaire, 400W, 120/208/240/277V, HPS, NCO							1				
2,4		38 01 963	Luminaire, 250W, 120V, PMH, CO								1			
2,4		38 01 958	Luminaire, 250W, 120V, PMH, NCO									1		
2,4	C	38 01 965	Luminaire, 400W, 120V, PMH, CO										1	
2,4		38 01 959	Luminaire, 400W, 120V, PMH, NCO											1
4		38 51 366	Switch, St. Lt., 1000W, 120/240/277V, P.E.				1			1	1	1	1	1
		54 14 313	Switch, St. Lt., 1000W, 480V, P.E.		1	1		1	1					

OUTDOOR LIGHTING

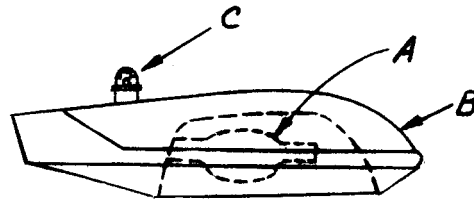
Luminaire Components

Horizontal

15 70 12 **
Sheet 3 of 3



NON CUTOFF



CUTOFF

HPS (Black) (3)

250W, 120V, Type III, Cutoff

250W, 120V, Type III, Non-Cutoff

Standard

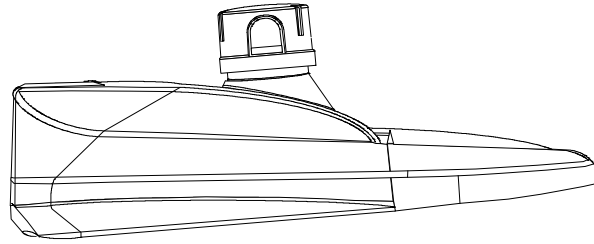
15 70 12 21

15 70 12 22

		Std. / Stk. No.	Description	15 70 12 **	21	22
3	A	26 55 067	Lamp HPS 250W		1	1
		26 55 061	Lamp, HPS, 400W			
3	B	38 01 969	Luminaire, 250, 120V,HPS, CO		1	
		38 01 971	Luminaire, 250, 120V,HPS, NCO			1
	C	38 51 366	Switch, St. Lt., 1000W, 120/240/277V, P.E.		1	1

Notes:

1. Metal Halide–Probe start (MH) Luminaires are no longer available from supplier.
2. Metal Halide–Pulse start (PMH) Luminaires are to replace the obsolete MH Luminaires.
3. Stock items are available in MO only.
4. Stock item is available in IL only.



LED 100W, 250W AND 400W
EQUIVALENT BRACKET MOUNT LUMINAIRE

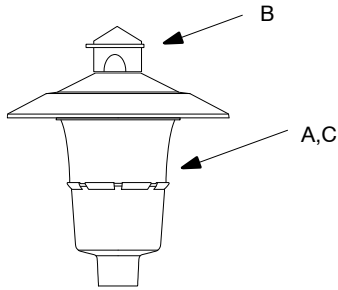
DESCRIPTION: AMEREN MO, 4000K	STANDARD	DESCRIPTION: AMEREN IL, 3000K	STANDARD
LED 100W EQ., 120V-277V, TYPE II	15 70 13 01	LED 100W EQ., 120V-277V, TYPE II	15 70 13 07
LED 100W EQ., 120V-277V, TYPE V	15 70 13 02	LED 100W EQ., 120V-277V, TYPE V	15 70 13 08
LED 250W EQ., 120V-277V, TYPE III	15 70 13 03	LED 250W EQ., 120V-277V, TYPE III	15 70 13 09
LED 250W EQ., 480V, TYPE III	15 70 13 04	LED 250W EQ., 480V, TYPE III	15 70 13 10
LED 400W EQ., 120V-277V, TYPE III	15 70 13 05	LED 400W EQ., 120V-277V, TYPE III	15 70 13 11
LED 400W EQ., 480V, TYPE III	15 70 13 06	LED 400W EQ., 480V, TYPE III	15 70 13 12

	STOCK NUMBER	STATE	DESCRIPTION	15 70 13	01	02	03	04	05	06	07	08	09	10	11	12
A	38 51 619	MO	LUMINAIRE, LED 100W EQUIV., 120V-277V, TYPE II, 4000K	1												
	38 51 641	MO	LUMINAIRE, LED 100W EQUIV., 120V-277V, TYPE V, 4000K		1											
	38 51 618	MO	LUMINAIRE, LED 250W EQUIV., 120V-277V, TYPE III, 4000K				1									
	38 51 617	MO	LUMINAIRE, LED 250W EQUIV., 480V, TYPE III, 4000K					1								
	38 51 616	MO	LUMINAIRE, LED 400W EQUIV., 120V-277V, TYPE III, 4000K						1							
	38 51 615	MO	LUMINAIRE, LED 400W EQUIV., 480V, TYPE III, 4000K							1						
	38 51 643	IL	LUMINAIRE, LED 100W EQUIV., 120V-277V, TYPE II, 3000K								1					
	38 51 644	IL	LUMINAIRE, LED 100W EQUIV., 120V-277V, TYPE V, 3000K									1				
	38 51 645	IL	LUMINAIRE, LED 250W EQUIV., 120V-277V, TYPE III, 3000K										1			
	38 51 646	IL	LUMINAIRE, LED 250W EQUIV., 480V, TYPE III, 3000K											1		
	38 51 647	IL	LUMINAIRE, LED 400W EQUIV., 120V-277V, TYPE III, 3000K												1	
B	38 51 648	IL	LUMINAIRE, LED 400W EQUIV., 480V, TYPE III, 3000K													1
	38 51 630	MO/IL	SWITCH, LOAD RATING 1000W, 120V-277V, BLACK, PE	1	1	1			1		1	1	1		1	
	38 51 629	MO/IL	SWITCH, LOAD RATING 1000W, 480V, YELLOW, PE					1		1				1		1

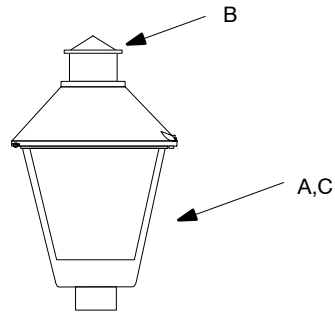
@C	38 51 675	MO/IL	Light Shield (J Series) – Back and Side (CUL DE SAC)	1	1	2	2	4	4	1	1	2	2	4	4
	38 51 676	MO/IL	Light Shield (J Series) – Back Side (House Side)	1	1	2	2	4	4	1	1	2	2	4	4
	38 51 635	MO/IL	Light Shield (G Series) – Back and Side (CUL DE SAC)	1	1	2	2	4	4	1	1	2	2	4	4
	38 51 636	MO/IL	Light Shield (G Series) – Back Side (House Side)	1	1	2	2	4	4	1	1	2	2	4	4

NOTE:

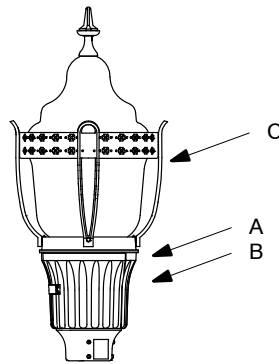
1. Order Light shield if there is a complaint of light trespass. Stock #3851675 (Block Back and Side) and Stock #3851676 (Block Back Light) are setup for the “J” series LED. The “J” series LED is labeled with additional identification decal “J” next to the wattage identification decal.
2. Stock #3851635 and stock #3851636 work only on the LED without identification decal “J”.



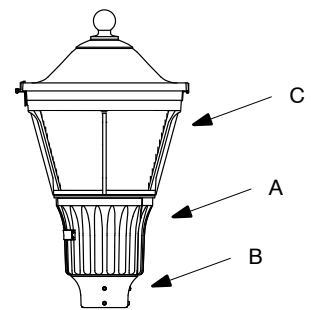
COLONIAL



EARLY AMERICAN



ASPEN



CONTEMPORARY

Notes:

1. Stk # 38 01 942 is no longer available from supplier
2. Stk # 38 01 961 is to replace Stk # 38 01 942.
3. Stock item is available in MO only.
4. Stock item is available in IL only.
5. Position luminaire to facilitate service from the street.
6. Type III, align refractor with street side.
7. Face eye of photo-electric cell north.

OUTDOOR LIGHTING

Luminaire Components – Post Top Installation

15 70 14 **

Sheet 2 of 2

		Std. / Stk. No.	Description	15 70 14 **	01	02	03	04	05	06	07	08	09	10
3	A	38 01 524	Colonial, 100W, HPS, Type III	(MO)	1									
3		38 01 525	Colonial, 100W, HPS, Type V	(MO)		1								
		38 01 517	Early American, 100W, HPS, Type III	(ALL)			1							
3		38 01 518	Early American, 100W, HPS, Type V	(MO)				1						
1,4		38 01 942	Early American, 175W, MH, Type III	(IL)									1	
2,4		38 01 961	Early American, 150W, PMH, Type II	(IL)										1
3		38 01 513	Contemporary, 100W, HPS, Type III	(MO)					1					
3		38 01 514	Contemporary, 100W, HPS, Type V	(MO)						1				
3		38 01 584	Aspen, 100W, HPS, Type III	(MO)							1			
3		38 01 585	Aspen, 100W, HPS, Type V	(MO)								1		
	B	38 51 630	Switch, Photo Electric Cell		1	1	1	1	1	1	1	1	1	1
	C	26 55 260	Lamp, 100W, HPS		1	1	1	1	1	1	1	1		
		26 56 260	Lamp, 175W, MH										1	
		26 05 087	Lamp, 150W, PMH											1

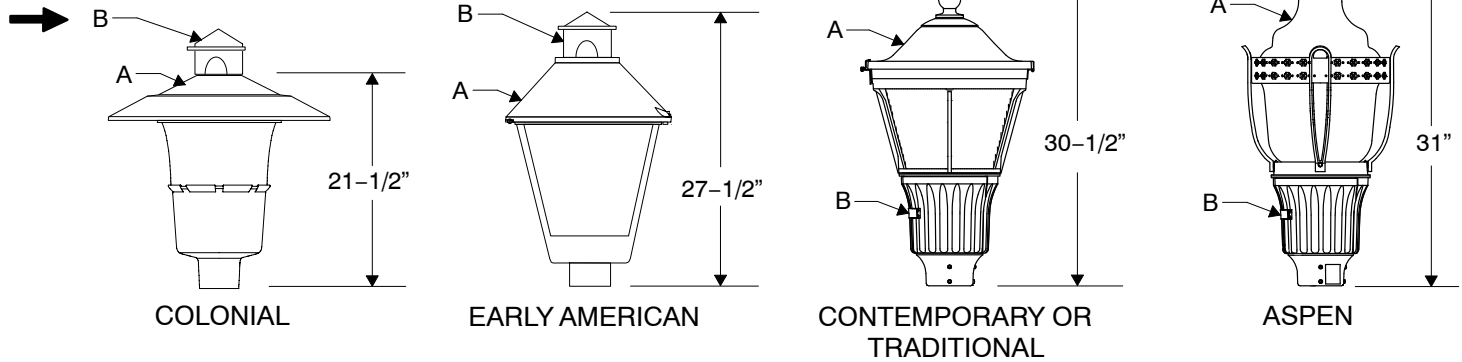
OUTDOOR LIGHTING

Luminaire Components – LED Decorative (Post Top) Luminaires

15 70 15 **

Sheet 1 of 1

MISSOURI ONLY AND NEW CONSTRUCTION ONLY



LED 100W EQUIVALENT DECORATIVE (POST TOP) LUMINAIRES

DESCRIPTION	STANDARD
LED 100W EQUIVALENT EARLY AMERICAN, 120V-277V, TYPE III, 3000K	15 70 15 01
LED 100W EQUIVALENT EARLY AMERICAN, 120V-277V, TYPE V, 3000K	15 70 15 02
LED 100W EQUIVALENT COLONIAL, 120V-277V, TYPE III, 3000K	15 70 15 03
LED 100W EQUIVALENT COLONIAL, 120V-277V, TYPE V, 3000K	15 70 15 04
LED 100W EQUIVALENT CONTEMPO/TRADITIONAL, 120-277V, TYPE III, 3000K	15 70 15 05
LED 100W EQUIVALENT CONTEMPO/TRADITIONAL, 120-277V, TYPE V, 3000K	15 70 15 06
LED 100W EQUIVALENT ASPEN, 120V-277V, TYPE III, 3000K	15 70 15 07
LED 100W EQUIVALENT ASPEN, 120V-277V, TYPE V, 3000K	15 70 15 08

	STOCK NUMBER	STATE	DESCRIPTION	15 70 15	01	02	03	04	05	06	07	08
A	3851620 ⁽¹⁾	MO	EARLY AMERICAN, LED 100W EQUIV., 120V-277V, TYPE III, 3000K		1							
	3851622	MO	EARLY AMERICAN, LED 100W EQUIV., 120V-277V, TYPE V, 3000K			1						
	3851632 ⁽¹⁾	MO	COLONIAL, LED 100W EQUIVALENT, 120V-277V, TYPE III, 3000K				1					
	3851631	MO	COLONIAL, LED 100W EQUIVALENT, 120V-277V, TYPE V, 3000K					1				
	3851621 ⁽¹⁾	MO	CONTEMPORARY OR TRADITIONAL, LED 100W EQUIV., 120V-277V, TYPE III, 3000K						1			
	3851623	MO	CONTEMPORARY OR TRADITIONAL, LED 100W EQUIV., 120V-277V, TYPE V, 3000K							1		
	3851633 ⁽¹⁾	MO	ASPEN, LED 100W EQUIVALENT, 120-277V, TYPE III, 3000K								1	
	3851634	MO	ASPEN, LED 100W EQUIVALENT, 120-277V, TYPE V, 3000K									1
B	38 51 630 ⁽²⁾	MO/IL	PHOTOCONTROL / SWITCH, LOAD RATING 1000W, 120V-277V, BLACK, PE		1	1	1	1	1	1	1	1

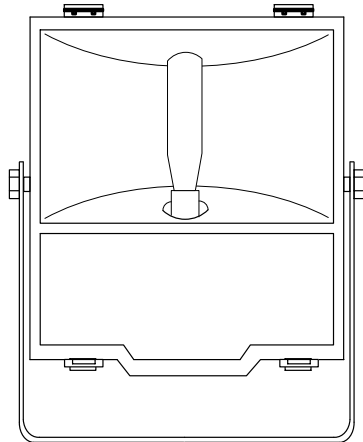
NOTES:

- Align distribution light pattern TYPE III refractor with street side.
- Face the eye of the photocell to the north.

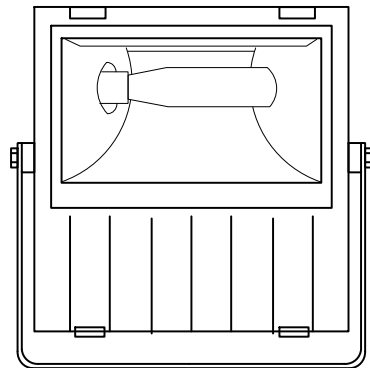
**DISTRIBUTION
CONSTRUCTION STANDARDS**



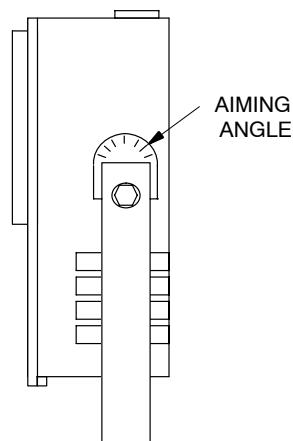
ENG:WYW
REV. NO: 1
REV. DATE: 09/29/17



1000 WATT



250 - 400 WATT



PROFILE

HPS

250W, 120V, 6x6 Directional
 400W, 120V, 7x6 Directional
 250W, 480V, 6x6 Directional
 400W, 480V, 7x6 Directional

Standard

15 70 16 01
 15 70 16 02
 15 70 16 06
 15 70 16 08

MH(1)

250W, 120V, 6x6 Directional
 400W, 120V, 6x5 Directional
 400W, 480V, 6x5 Directional
 1000W, 120V, 7x6 Directional

15 70 16 03
 15 70 16 04
 15 70 16 07
 15 70 16 05

PMH(2)

250W, 120V, 6x6 Directional
 400W, 120V, 6x5 Directional
 400W, 480V, 6x5 Directional

15 70 16 09
 15 70 16 11
 15 70 16 10

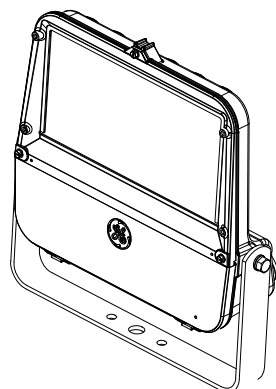
OUTDOOR LIGHTING
Luminaire Components
Directional Flood

15 70 16 **
Sheet 2 of 2

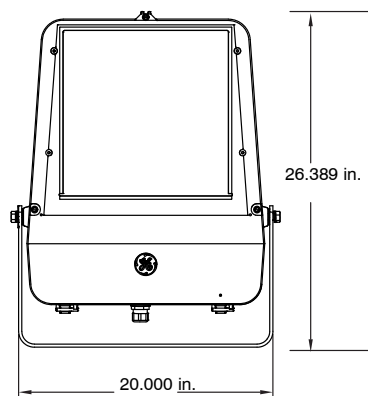
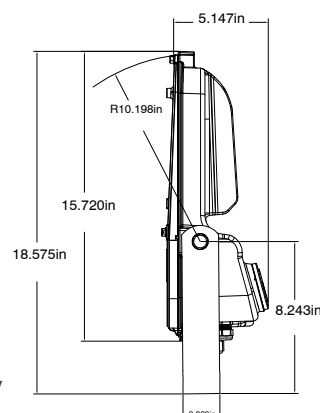
		Std. / Stk. No.	Description 16 **	15 70	01	02	03	04	05	06	07	08	09	10	11
	A	38 01 521	Floodlight, HPS 250W, 120V	All	1										
	B	38 01 522	Floodlight, HPS 400W, 120V	All		1									
1, 4	C	38 01 626	Floodlight, MH, 250W, 120V	IL			1								
1	D	38 01 542	Floodlight, MH, 400W, 120V	All				1							
2, 4	E	38 01 964	Floodlight, PMH, 250W, multi	IL									1		
2	F	38 01 962	Floodlight, PMH, 400W, 120V	All											1
3	G	38 01 541	Floodlight,MH, 1000W, 120V	(MO ONLY)					1						
	H	26 55 067	Lamp, HPS, 250W		1										
	I	26 55 061	Lamp, HPS, 400W			1						1			
	J	26 56 251	Lamp, MH, 250W				1			1					
	K	26 56 261	Lamp, MH, 400W					1			1				
	L	26 55 277	Lamp, PMH 250W										1		
	M	26 55 278	Lamp, PMH 400W											1	1
	N	26 56 244	Lamp, MH, 1000W						1						
	O	38 51 366	Switch, Photoelet- ric,120/240/277V		1	1	1	1	1				1		1
4	P	38 01 755	Floodlight, HPS 250W, 480V	IL						1					
1, 4	Q	38 01 768	Floodlight, MH 400W, 480V	IL							1				
2, 4	R	38 01 966	Floodlight, PMH, 400W, 480V	IL										1	
4	S	38 01 759	Floodlight, HPS 400W, 480V	IL								1			
	T	54 14 313	Switch, Photoelectric, 480V							1	1	1		1	

Notes:

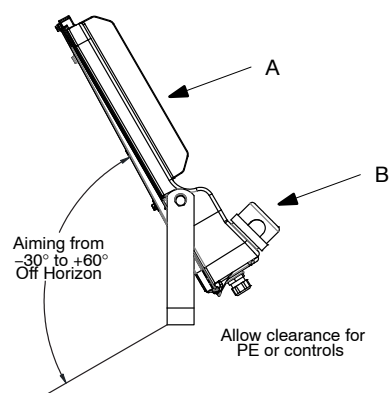
1. Metal Halide–Probe start (MH) Luminaires are no longer available from supplier.
2. Metal Halide–Pulse start (PMH) Luminaires are to replace the obsolete MH Luminaires with equal wattage.
3. Stock No. 3801541 is available for new installation in MO only.
4. Stock item is available in IL only.



LED 250W & 400W Equiv



LED 1000W Equiv



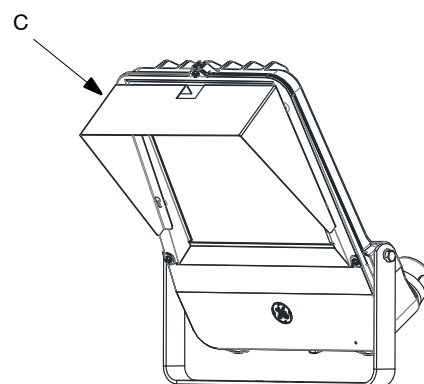
Trunnion Mount

Description: Ameren MO 4000KCCT
 LED 250W Equiv, 120–277V
 LED 250W Equiv, 480V
 LED 400W Equiv, 120–277V
 LED 400W Equiv, 480V
 LED 1000W Equiv, 120–277V

Standards
 15 70 17 01
 15 70 17 02
 15 70 17 03
 15 70 17 04
 15 70 17 05

Description: Ameren IL 3000KCCT
 LED 250W Equiv, 120–277V
 LED 250W Equiv, 480V
 LED 400W Equiv, 120–277V
 LED 400W Equiv, 480V
 LED 1000W Equiv, 120–277V
 LED 1000W Equiv, 480V

Standards
 15 70 17 06
 15 70 17 07
 15 70 17 08
 15 70 17 09
 15 70 17 10
 15 70 17 11



Light Shield is needed
 based on request

OUTDOOR LIGHTING
Luminaire Components
LED Directional (Flood)

15 70 17 **

Sheet 2 of 2

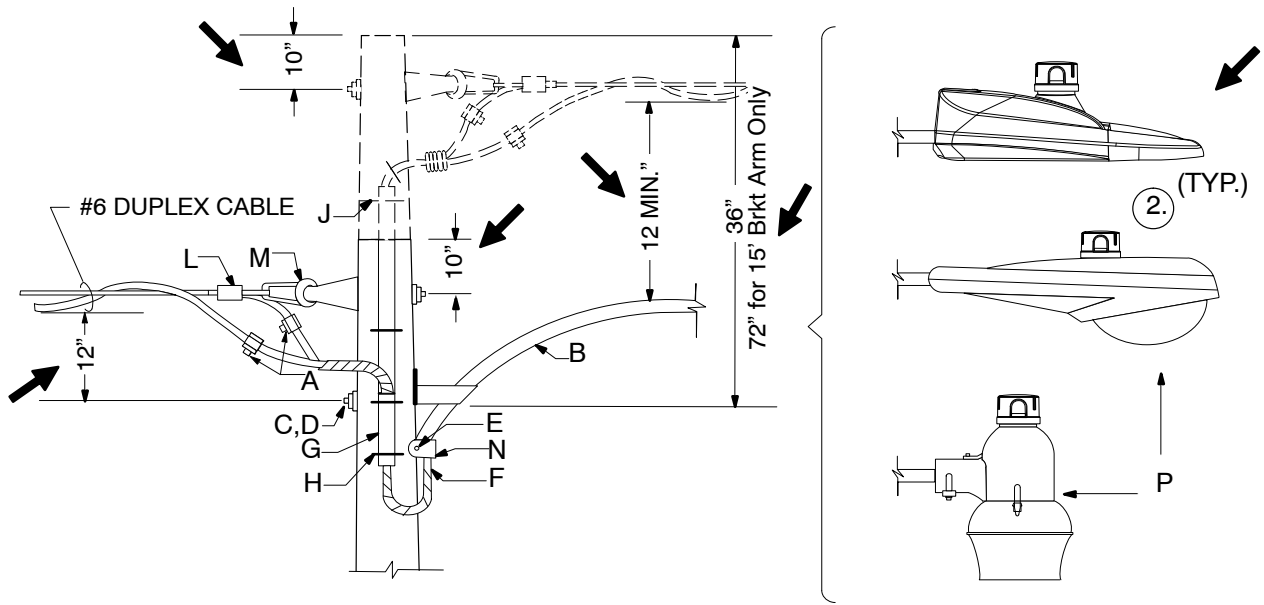
	STOCK NUMBER	STATE	DESCRIPTION	15	70	17	01	02	03	04	05	06	07	08	09	10	11
A	38 51 626	MO	LUMINAIRE, LED 250W EQUIVALENT, 120V-277V, 6X6, 4000K CCT	1													
	38 51 625	MO	LUMINAIRE, LED 250W EQUIVALENT, 480V, 6X6, 4000K CCT		1												
	38 51 624	MO	LUMINAIRE, LED 400W EQUIVALENT, 120V-277V, 6X6, 4000K CCT			1											
	38 51 627	MO	LUMINAIRE, LED 400W EQUIVALENT, 480V, 6X6, 4000K CCT				1										
	38 51 628	MO	LUMINAIRE, LED 1000W EQUIVALENT, 120V-277V, 6X6, 4000K CCT					1									
	38 51 649	IL	LUMINAIRE, LED 250W EQUIVALENT, 120V-277V, 6X6, 3000K CCT							1							
	38 51 650	IL	LUMINAIRE, LED 250W EQUIVALENT, 480V, 6X6, 3000K CCT									1					
	38 51 651	IL	LUMINAIRE, LED 400W EQUIVALENT, 120V-277V, 6X6, 3000K CCT											1			
	38 51 652	IL	LUMINAIRE, LED 400W EQUIVALENT, 480V, 6X6, 3000K CCT												1		
	38 51 653	IL	LUMINAIRE, LED 1000W EQUIVALENT, 120-277V, 6X6, 3000K CCT													1	
	38 51 669	IL	LUMINAIRE, LED 1000W EQUIVALENT, 480V, 6x6, 3000K CCT														1
B	38 51 630	MO/IL	PHOTOCONTROL / SWITCH, LOAD RATING 1000W, 120V-277V, BLACK, PE	1			1			1	1			1		1	
	38 51 629	MO/IL	PHOTOCONTROL / SWITCH, LOAD RATING 1000W, 480V, YELLOW, PE			1			1				1		1		1
@C	38 51 656	MO/IL	Light Shield GE 1000W LED EQUV							1						1	1
	38 51 657	MO/IL	Light Shield WORKS ONLY ON GE EFM Model 250W or 400W LED EQUV	1	1	1	1				1	1	1	1			

OUTDOOR LIGHTING

Multiple Installation On Wood Pole

15 74 01 **

Sheet 1 of 1



DRAWING NOT TO SCALE

1-1/4" x 30"	Brkt.	15 74 01 01
1-1/4" x 6"	Brkt.	15 74 01 02
1-1/4" x 15"	Brkt.	15 74 01 03

Notes:

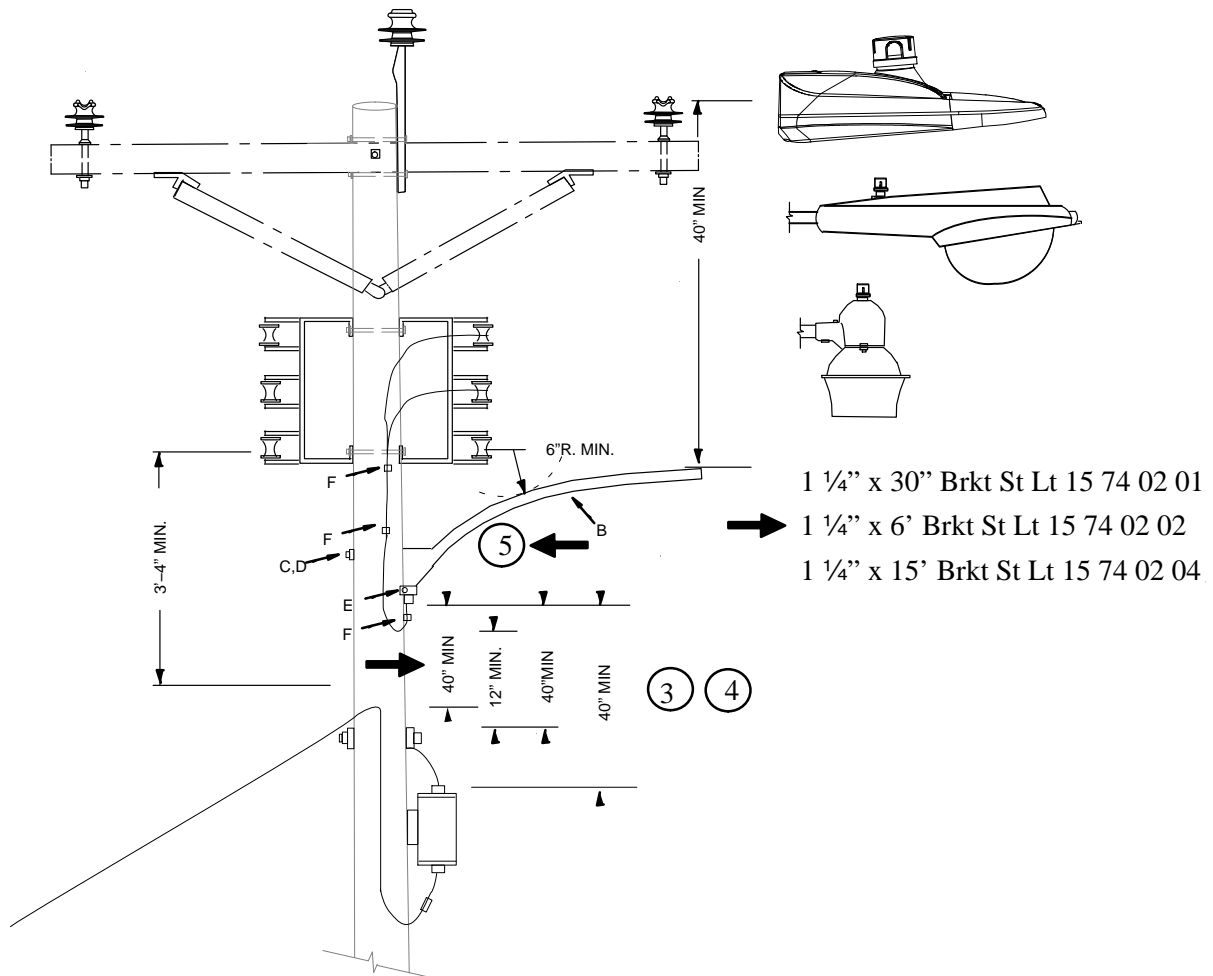
1. See DCS 15 00 01 01 for correct bracket use.
2. Face photocontrol north.

@		Std. / Stk. No.	Description	15 74 01 **	01	02	03
@	A	17 51 146	Connector, PG, #6-#10 AWG Main/Tap		2	2	2
		15 54 373	Connector, Split, #6 AWG Al Main/#14 AWG Cu Tap		2	2	2
	B	38 01 417	Brkt., St. Lt., 1-1/4" x 30"		1		
		38 01 249	Brkt., St. Lt., 1-1/4" x 6'-0"			1	
		38 01 705	Brkt., St. Lt., 1-1/4" x 15'-0"				1
	C	23 52 063	Bolt, Mach., 5/8" x 10"		1	1	2
	D	23 66 027	Washer, Square - 2-1/4"		1	1	2
	E	23 60 007	Screw, Lag 1/2" x 4"		2	2	0
	F	18 57 104	Cable, St. Lt., Twisted (ft.)		6	12	22
	G	41 56 106	Moulding, 1/2"		1	1	1
	H	23 64 027	Staple, 5/8" x 2"		3	3	3
	J	23 64 001	Staple, 3/8" x 1-3/4" C.W.		1	1	1
	L	17 51 123	Clamp, D.E., Wedge Type		1	1	1
	M	06 01 01 01	Clevis, Secondary		1	1	1
	N	25 54 074	Guard, Cable, 1/2" Poly			1	1
@	P	15 70 ** **	St. Lt. Assembly		1	1	1

OUTDOOR LIGHTING
Multiple Installation
On Wood Line Pole Above Communications

15 74 02 **

Sheet 1 of 2



Notes:

1. Refer to DCS 15 00 01 01 for correct bracket to use.
2. Face eye of photocell north.
3. If street light bracket is grounded, the vertical spacing between the bracket and communication attachments can be reduced to 20". However, street light brackets may be grounded ONLY IF:
 - A. When adding a light to a pole where none previously exists, there is no space available to install the light with the 40" bracket-to-communications attachment spacing without replacing the pole, or
 - B. When replacing a pole with an existing light on it, there is no space available to install the light with the 40" bracket-to-communications attachment clearance and installing a taller pole would create up-lift on adjacent poles.
4. The 40" bracket-to-communications attachment clearance applies to all new lighting installations, all new communication attachments where lighting already exists, AND ON ALL POLES REPLACED FOR ANY REASON THAT HAVE EXISTING LIGHTING AND COMMUNICATION ATTACHMENTS. This is per NESC Rules 13A1 and 13B2 Exception 2.
5. If the light bracket needs to be grounded but the bracket is without ground provision, the ground clamp, stock #40 59 318 needs to be ordered.

OUTDOOR LIGHTING
Multiple Installation
On Wood Line Pole Above Communications

15 74 02 **

Sheet 2 of 2

		Std. / Stk. No.	Description	15 74 02 **	01	02	04
@	B	38 01 417	Bracket, St. Lt., 1-1/4" x 30"	1			
		38 01 249	Bracket, St. Lt., 1-1/4" x 6'-0"		1		
		38 01 705	Bracket, St. Lt., 1-1/4" x 15'-0".				1
	C	23 52 063	Bolt, Mach., 5/8" x 10"	1	1	1	1
	D	23 66 027	Washer, Square - 2-1/4"	1	1	1	1
	E	23 60 007	Screw, Lag 1/2" x 4"	2	2	4	4
	F	23 68 746	Clip, Street Light Wire	3	3	3	3
	L	15 70 ** **	St. Lt. Assembly	1	1	1	1

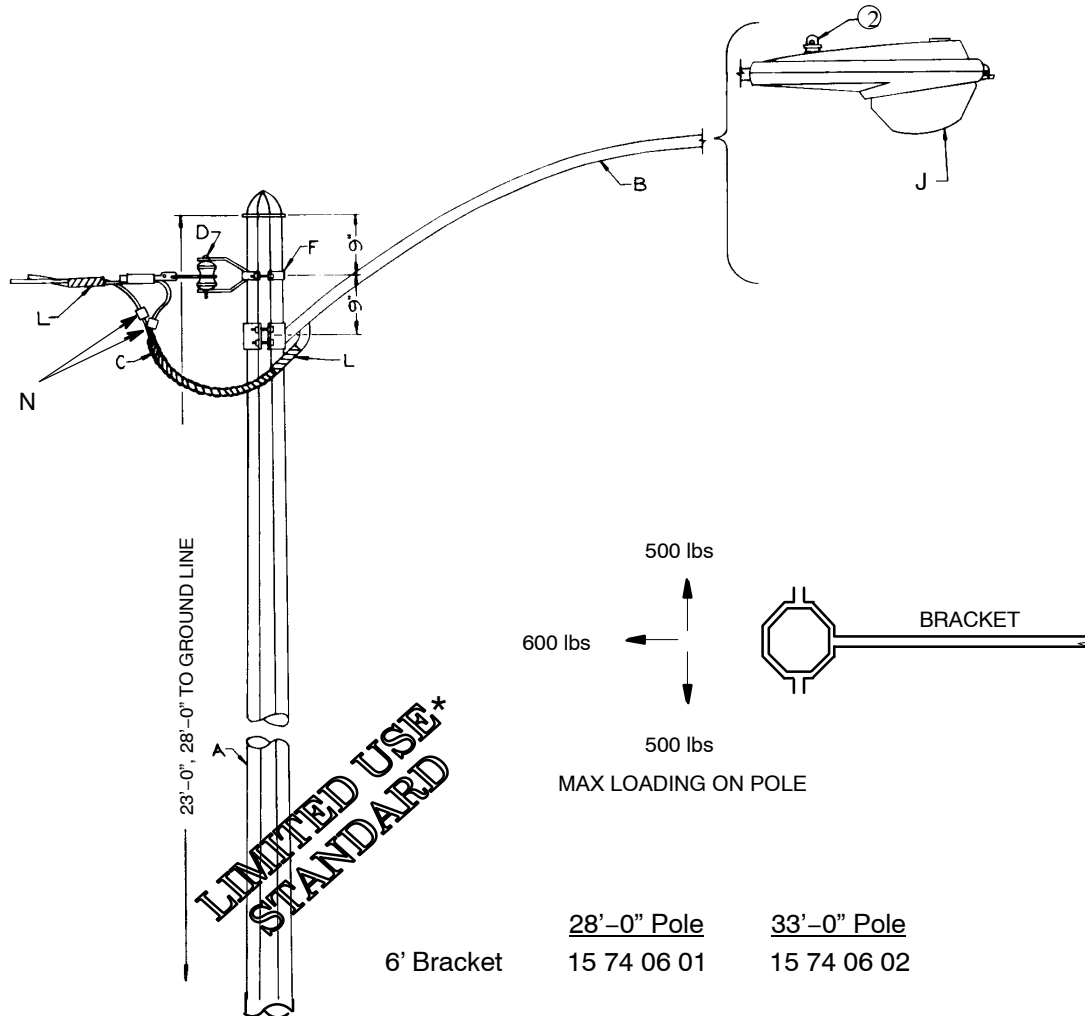
OUTDOOR LIGHTING

Multiple Installation

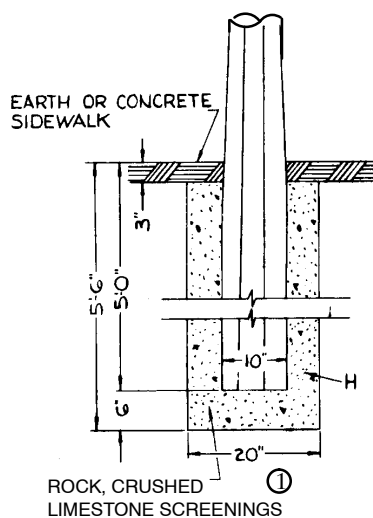
Ornamental Concrete Pole – Overhead Circuit – Deadend

15 74 06 **

Sheet 1 of 2



REINFORCED POLE



NOTE:

*Not standard for new installations and replace with a fiberglass pole for maintenance if applicable.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:WYW
REV. NO: 9
REV. DATE: 07/29/14

OUTDOOR LIGHTING
Multiple Installation
Ornamental Concrete Pole – Overhead Circuit – Deadend

15 74 06 **

Sheet 2 of 2

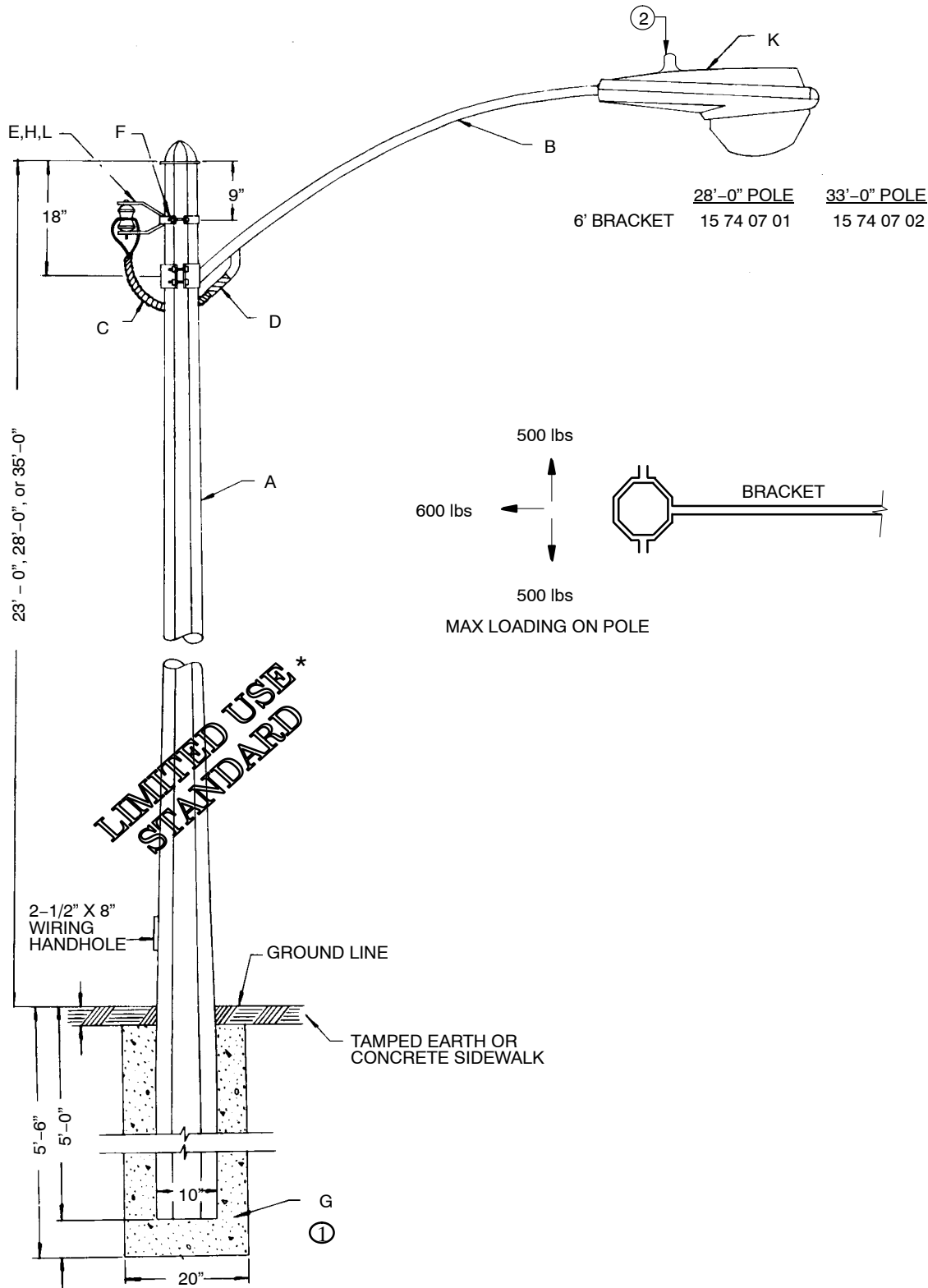
NOTES:

1. Limestone screenings to be wetted and thoroughly tamped to provide solid compaction around pole.
2. Face eye of photo-electric switch north.

	Std. / Stk. No.	Description	15 74 06 **	01	02
@	A 38 01 598*	Pole, St. Lt., Con., 28' 0" O.H./23' M.H.		1	
	38 01 599*	Pole, St. Lt., Con., 33' 0" O.H./28' M.H.			1
	B 38 01 404	Bracket, St. Lt., 2" x 6'		1	1
	C 18 57 104	Cable, St. Lt., Twisted		12	12
	D 23 06 040	Clevis, Secondary		1	1
	E 17 51 123	Clamp, D.E., Wedge Type		1	1
	F 23 67 154	Band, Pole, Steel, Galv.		1	1
	H	Rock, Crushed Limestone Screnning Lbs		850	1000
	J 15 70 ** **	St. Lt. Assembly		1	1
	L 25 54 074	Guard, Cable, 1/2", Poly		2	2
	M 25 59 044	Insulator, Spool		1	1
	N 17 51 146	Connector, PG #6-1/0 AWG Main/Tap		2	2
	17 54 373	Connector, Split, #6 AWG AL Main/#14 AWG Cu Tap		2	2

LIMITED USE STANDARD*

Ornamental Concrete Pole – Overhead Circuit – Tangent or Angle



NOTE:

*Not standards for new installations and replace with a fiberglass pole for maintenance if applicable.

Ornamental Concrete Pole – Overhead Circuit – Tangent or Angle

NOTES:

1. Limestone screenings to be wetted and thoroughly tamped to provide solid compaction around pole.
2. Face eye of photocontrol switch north.
3. Connect twisted pair street light cable to supply line using connector, Stock No. 17-51-146.

		Std. / Stk. No.	Description	15 74 07 **	01	02
@	A	38 01 598*	Pole, St. Lt., Con., 28' 0" O.H./23' M.H.		1	
		38 01 599*	Pole, St. Lt., Con., 33' 0" O.H./28' M.H.			1
	B	38 01 404	Bracket, St. Lt., 2" x 6'		1	1
	C	18 57 104	Cable, St. Lt., Twisted		12	12
	D	25 54 074	Guard – Cable, 1/2", Poly		1	1
	E	23 06 040	Clevis, Secondary		1	1
	F	23 67 154	Band, Pole, Steel, Galv.		1	1
	G		Rock, Crushed Limestone Screening Lbs		850	1000
	H	18 55 040	Wire – Tie, #4 Al. Poly. 42"		1	1
	I	25 59 044	Insulator, Spool		1	1
	K	15 70 ** **	St. Lt. Assembly		1	1

LIMITED USE STANDARD*

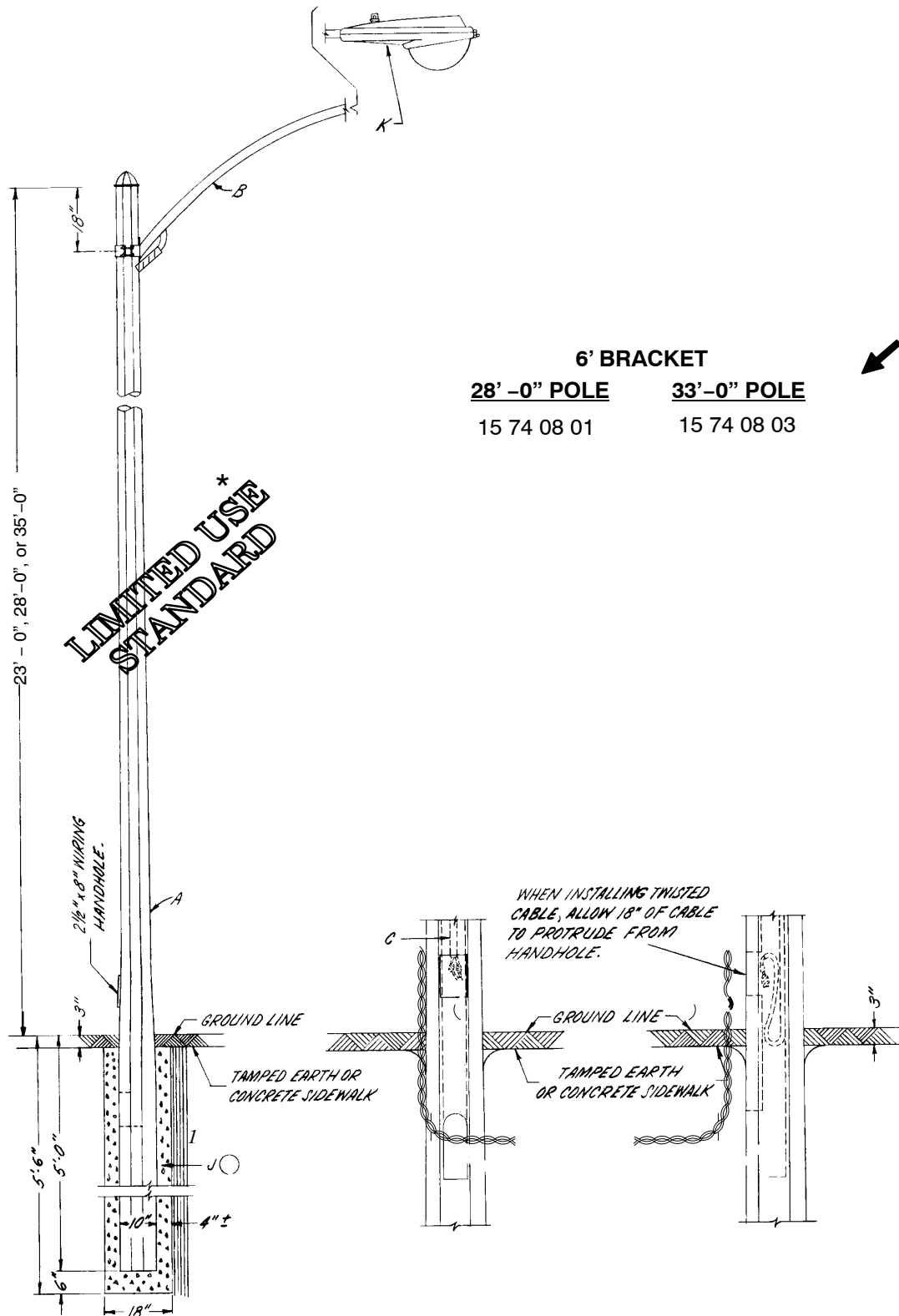
OUTDOOR LIGHTING

Multiple Installation

Ornamental Concrete Pole – Underground Circuit

15 74 08 **

Sheet 1 of 2



NOTE:

*Not standard for new installations and Replace with a fiberglass pole for maintenance if applicable.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:WYW
REV. NO: 7
REV. DATE: 12/11/09

OUTDOOR LIGHTING
Multiple Installation
Ornamental Concrete Pole – Underground Circuit

15 74 08 **

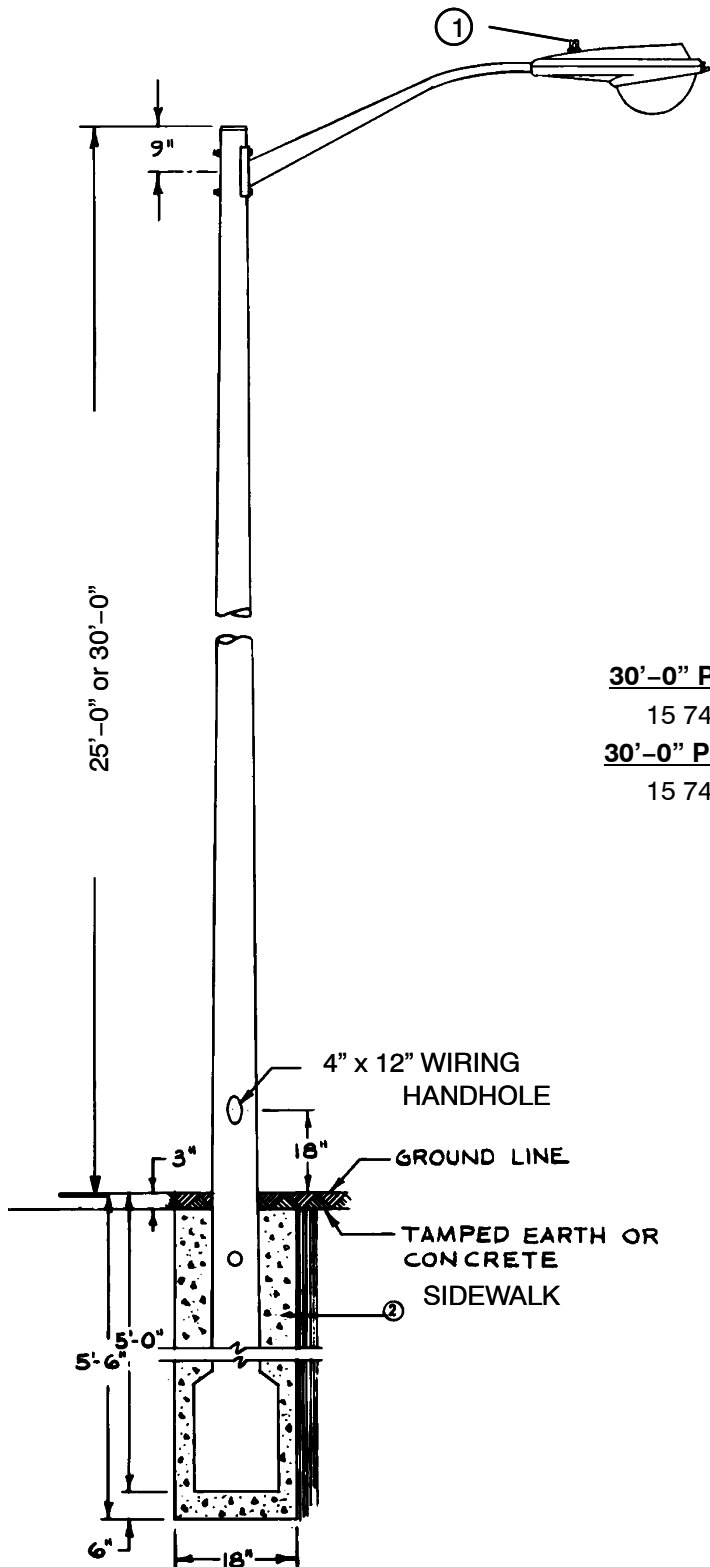
Sheet 2 of 2

NOTES:

1. Limestone screenings shall be wetted and thoroughly tamped as installed.
2. Face eye of photoelectric switch north.

		Std. / Stk. No.	Description	15 74 08 **	01	02
@	A	38 01 598*	Pole, St. Lt., Con., 28' 0" O.H./23' M.H.		1	
		38 01 599*	Pole, St. Lt., Con., 33' 0" O.H./28' M.H.			1
	B	38 01 404	Bracket, St. Lt., 2" x 6'		1	1
	C	18 57 104	Cable, St. Lt., Twisted (ft.)		30	36
	D	30 52 010	Sealer, Red Pedigree (pint)		1	1
	F	17 01 116	Connector, Bolted/Set Screw #14-2/0, 3 Pos.		2	2
	J		Limestone Screenings (lb.)		850	1000
	K	15 70 ** **	St. Lt. Assembly		1	1

LIMITED USE STANDARD*



6' Bracket

30'-0" Pole (Gray)

15 74 09 01

30'-0" Pole (Black)

15 74 09 03

35'-0" Pole (Gray)

15 74 09 02

35'-0" Pole (Black)

15 74 09 04

OUTDOOR LIGHTING
Fiberglass Pole 30' and 35' – U.G. Circuit

15 74 09**
Sheet 2 of 2

Notes:

1. Face photocontrol north.
2. Limestone screenings to be wetted and thoroughly tamped to provide solid compaction around pole
3. OK to install second bracket at 180° if required.
4. * For MO only.



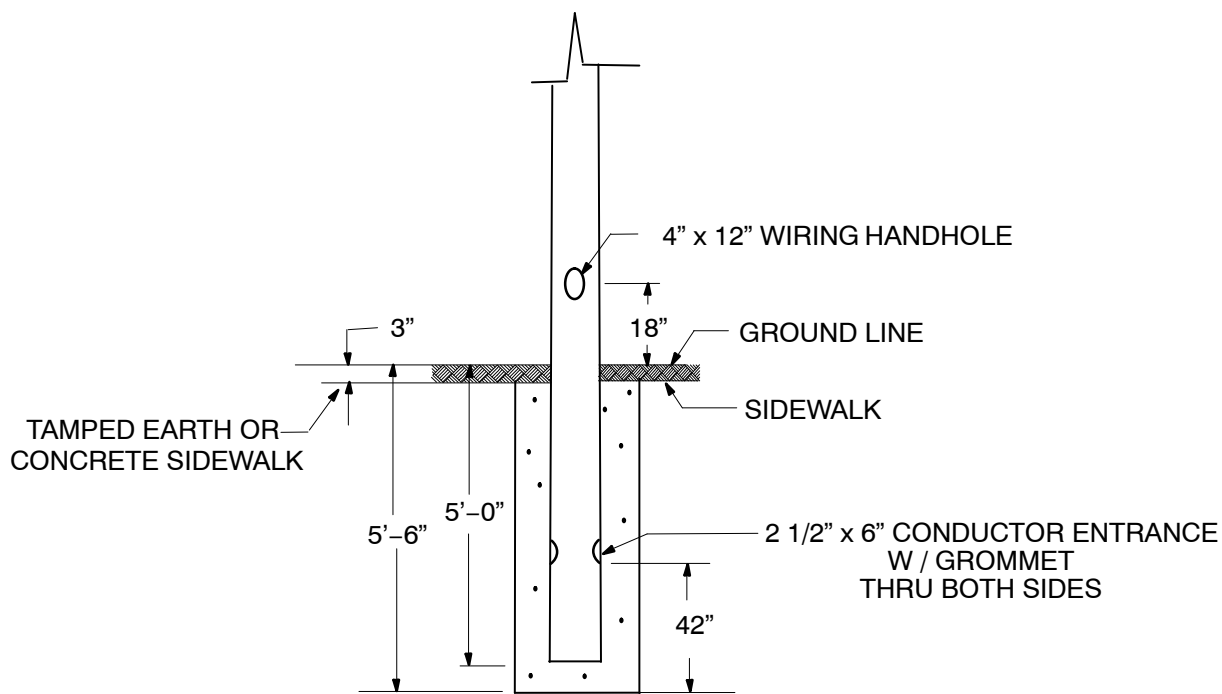
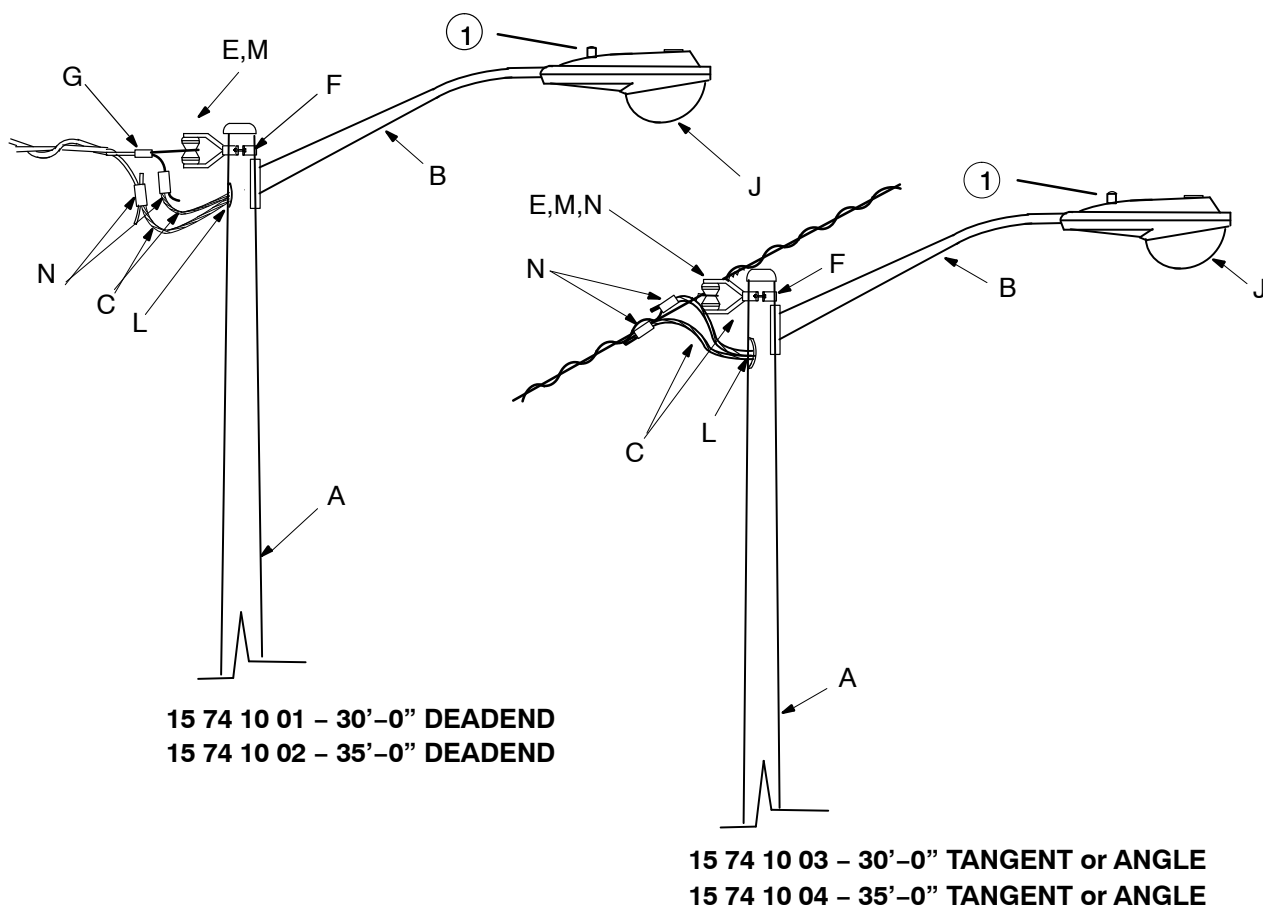
	Std. / Stk. No.	Description	15 74 09 **	01	02	03	04
A	38 01 555	Pole, St. Lt., Fiberglass, 30' O.H.		1			
	38 01 554	Pole, St. Lt., Fiberglass, 35' O.H.			1		
	38 01 970*	Pole, St. Lt., Fiberglass, Black, 30' O.H.				1	
	38 01 967*	Pole, St. Lt., Fiberglass, Black, 35' O.H.					1
B	38 01 556	Bracket, AL. 6'		1	1		
	38 01 968*	Bracket, AL. Black, 6'				1	1
C	18 57 104	Cable, St. Lt., #10-2 Conductor – Ft.		35	40	35	40
E	17 01 116	Connector, Bolted/Set Screw #14-2/0. 3 Pos		2	2	2	2
F	25 53 053	Tape, Rubber 3/4"		1	1	1	1
G		Rock, crushed, limestone screenings		850		850	
H	15 70 ** **	Street light assembly		1	1	1	1

OUTDOOR LIGHTING

Fiberglass Pole 30' and 35' – O.H. Circuit
Tangent, Angle, or Deadend

15 74 10**

Sheet 1 of 2



OUTDOOR LIGHTING
Fiberglass Pole 30' and 35' – O.H. Circuit
Tangent, Angle, or Deadend

15 74 10**

Sheet 2 of 2

Notes:

1. Face photocontrol north.
2. Limestone screenings to be wetted and thoroughly tamped to provide solid compaction around pole
3. OK to install second bracket at 180 degree if required.

		Std. / Stk. No.	Description	15 74 10 **	01	02	03	04
@	A	38 01 916	Pole, St. Lt., Fiberglass, 33'		1		1	
		38 01 917	Pole, St. Lt., Fiberglass, 38'			1		1
	B	38 01 556	Bracket, AL 6'		1	1	1	1
	C	18 57 104	Cable, St. Lt #10-2 Conductor – ft		12	12	12	12
	E	23 06 040	Clevis, Secondary		1	1	1	1
	F	23 67 154	Band, Pole, Steel, Galv		1	1	1	1
	G	17 51 123	Clamp, DE Wedge Type		1	1		
	N	17 51 146	Connector, PG, #6-#10AWG Main/Tap		2	2	2	2
		17 54 382	Connector, Split, #2-#6AWG AL Main/#14 AWG Cu Tap		2	2	2	2
	L	25 54 074	Guard, Cable, 1/2", Poly		2	2	2	2
	M	25 59 044	Insulator, Spool		1	1	1	1
	J	15 70 ** **	St. Lt. Assembly		1	1	1	1
	H		Rock, Crushed Limestone Screening lbs		850	850	850	850
	O	18 55 040	Wire-Tie, #4Al. Poly 42"				1	1

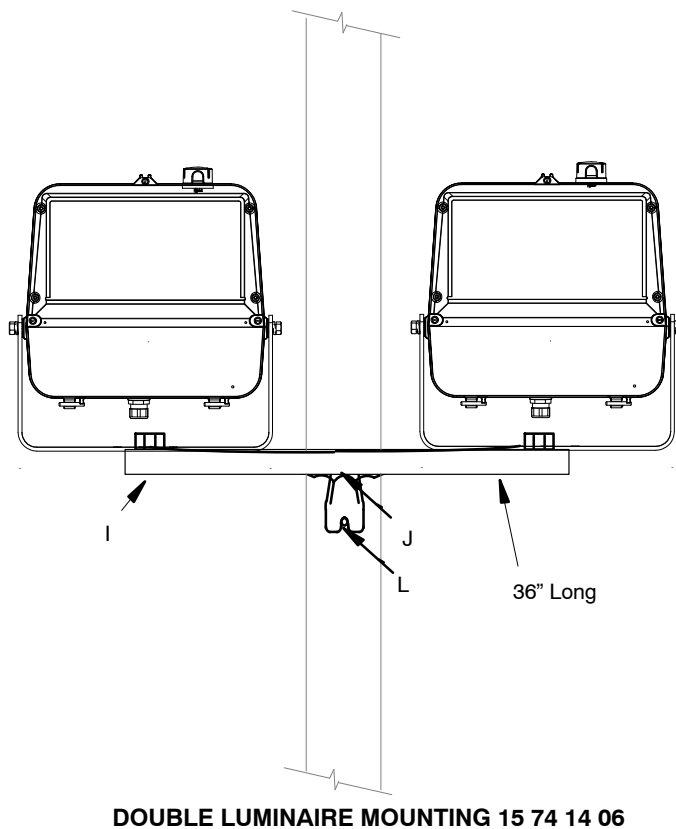
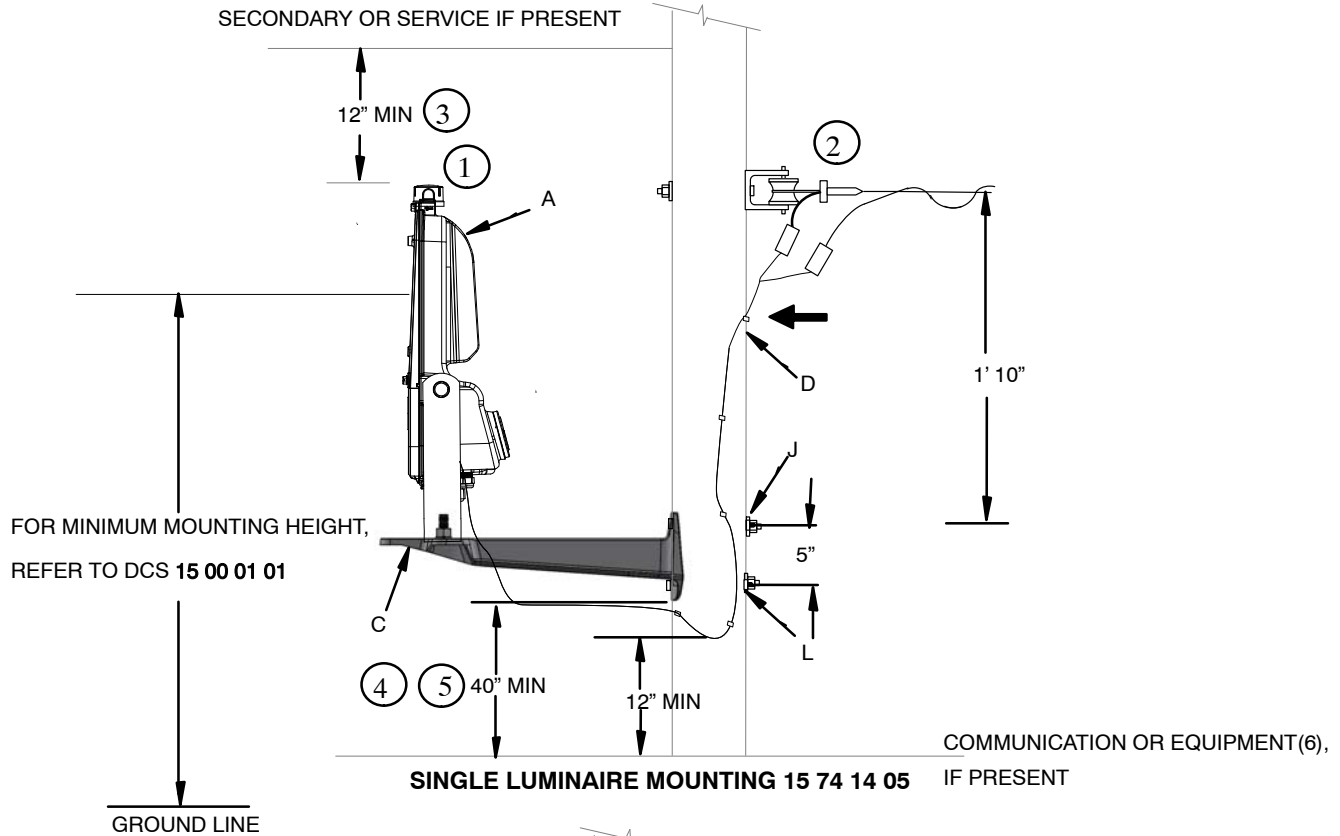
DIRECTIONAL OUTDOOR LIGHTING

On Wood Pole

Directional Flood

15 74 14 **

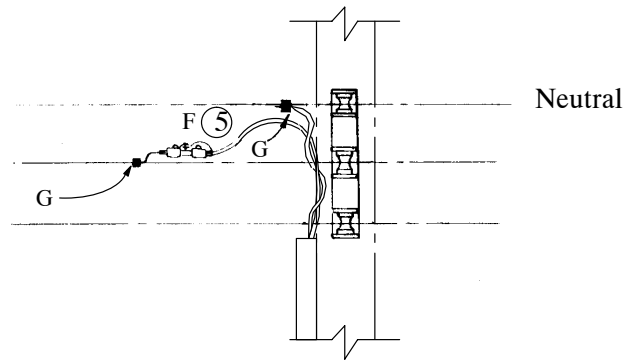
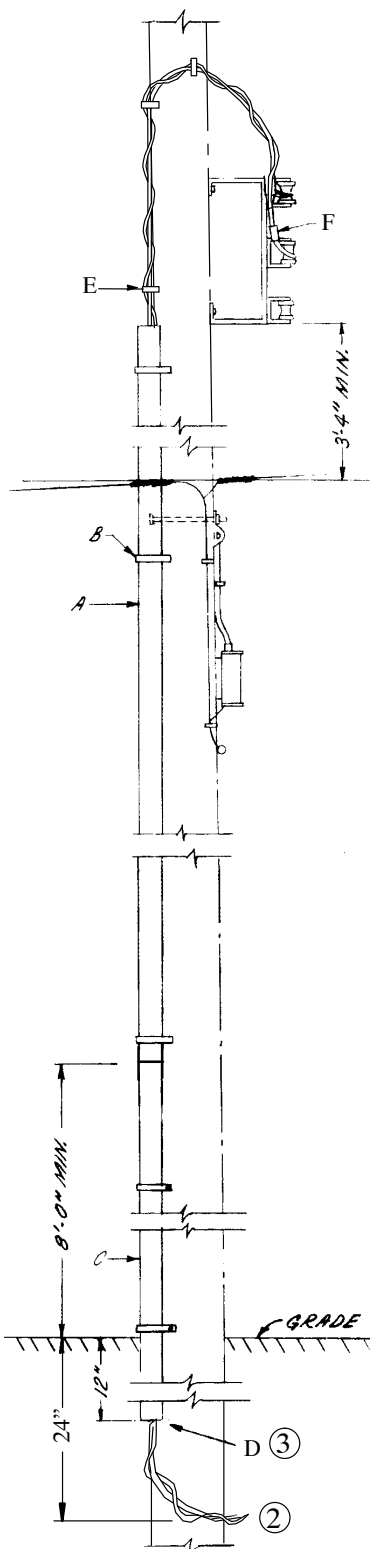
Sheet 1 of 2



NOTES:

1. Face photocontrol north, but multiple luminaires at the same location, adjust photocell socket to face control away from nearby light sources.
2. Connect the phase and neutral correctly to the terminal inside of the luminaires.
3. Increase this dimension by 4" if open service wires extend directly out over photocell.
4. If street light bracket is grounded, the vertical spacing between the bracket and communication attachments can be reduced to 20". However, street light brackets may be grounded ONLY IF:
 - A. When adding a light to a pole where none previously exists, there is no space available to install the light with the 40" bracket-to-communications attachment spacing without replacing the pole, or
 - B. When replacing a pole with an existing light on it, there is no space available to install the light with the 40" bracket-to-communications attachment clearance and installing a taller pole would create up-lift on adjacent poles.
5. The 40" bracket-to-communications attachment clearance applies to all new lighting installations, all new communication attachments where lighting already exists, AND ON ALL POLES REPLACED FOR ANY REASON THAT HAVE EXISTING LIGHTING AND COMMUNICATION ATTACHMENTS. This is per NESC Rules 13A1 and 13B2 Exception 2.
6. Equipment means non current-carrying metal parts of equipment, including metal supports for cables or conductors, metal support braces that are attached to metal supports or are less than 1 inch from transformer cases or hangers that are not effectively grounded, and metal or nonmetallic supports or braces associated with communication cables or conductors. Antennas, photovoltaic panels, power supplies, loading coils, etc., shall also be considered equipment for the purpose of measuring clearances under this rule.

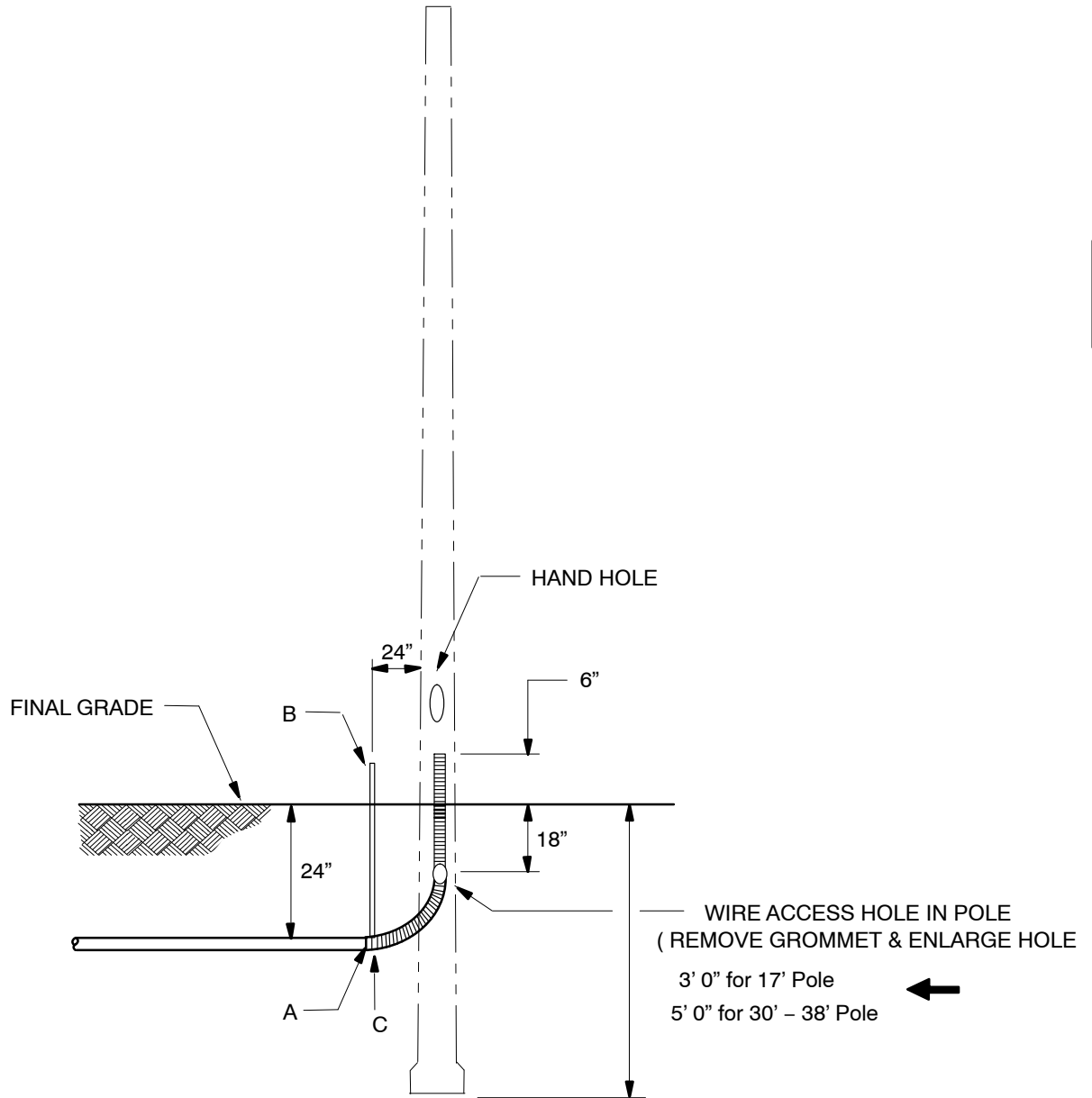
		Std. / Stk. No.	Description	15 74 14 **	05	06
@	A	15 70 16 **	Luminaire, Directional Flood	1	2	
	C	38 01 683	Bracket, Floodlight, 18"	1		
	D	23 64 027	Staple - 5/8" x 2"	5	5	
	I	38 01 726	Bracket, Double Flood Mounting			1
	J	23 52 063	Bolt, Mach. 5/8" x 10", Galv.	1	1	
	L	23 60 011	Screw, Lag 5/8" x 5"	1	1	



NOTES:

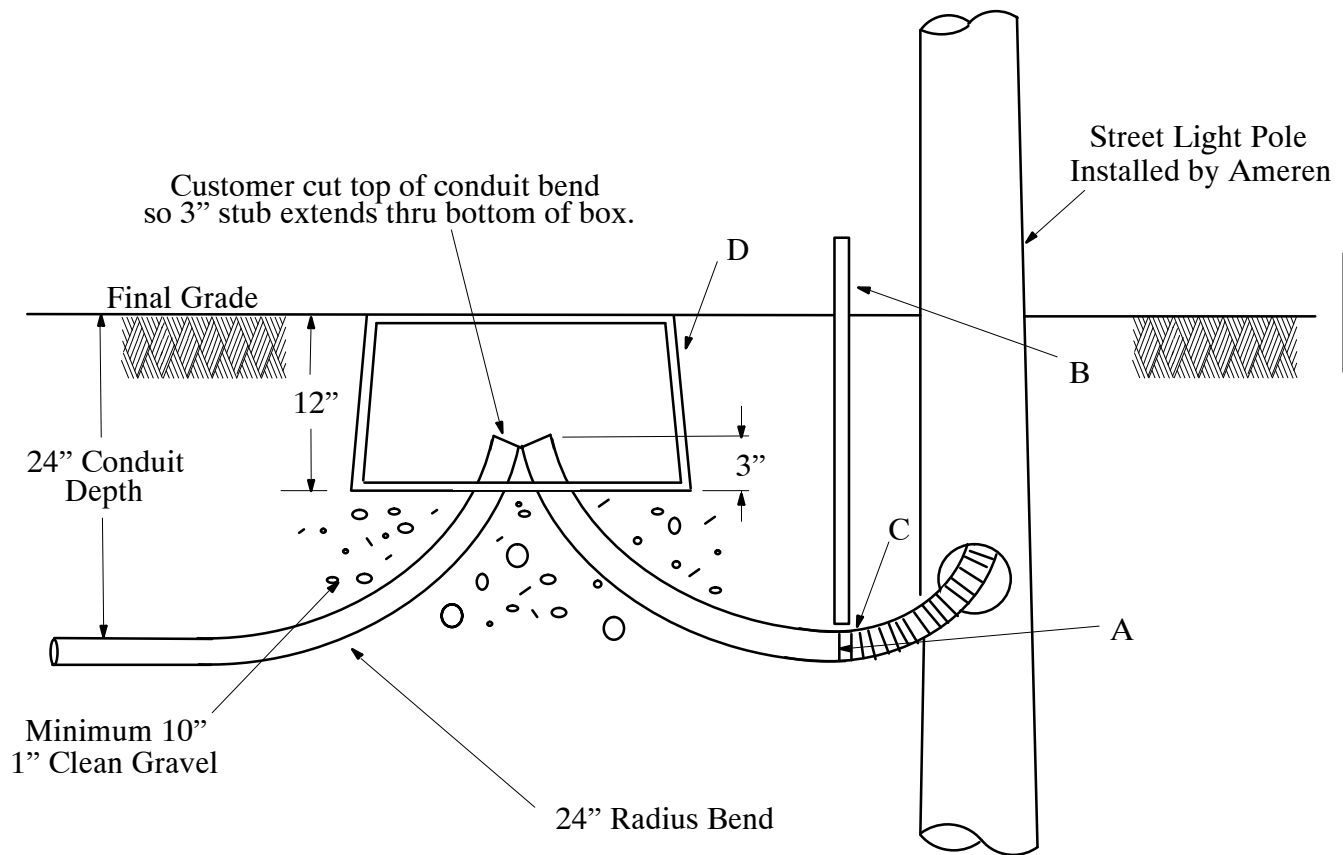
1. If the customer furnishes the cable, it must be approved by the National Electric Code for direct burial and exposure to sunlight. The customer cable should extend to the base of the pole or to a point designated by Ameren. (normally 2'-0" inside the customer's property line). The customer must provide enough cable to allow the connections to be made on the pole.
2. It is recommended that direct buried cable be installed in conduit under driveways and parking areas.
3. Drive the lag screw into the pole so that the schedule 80 conduit will rest on the head; thus preventing the conduit from sliding down.
4. If triplex cable is used, two fuses are required.
Additional fuse sizes are available:
15 AMP Stock #20 76 138
60 AMP Stock #20 76 142
100 AMP Stock #20 76 143
5. Install the fuse parallel to the wire so that the spring loaded indicator can flip open to show that the fuse has blown.
6. Cut the poly strap into one foot lengths. Wrap each section of the strap around the cable and secure the ends to the pole.

		Std. / Stk. No.	Description	15 74 50 01	Quantity
3 6 4,5 --► @	A	12 01 178	Conduit - Plastic, 2"		15 Ft.
	B	27 60 035	Iron - Hanger		10 Ft.
	C	12 01 275	Conduit - Plastic, Sch 80, 2"		10 Ft.
	D	23 60 007	Screw - Lag, 1/2" x 4"		1
	E	49 17 181	Strap - Poly, 2" x 36"		1
	F	20 76 139	Fuse - Secondary, 30 Amp		1
	G	PG*	See Std. 07 00 25 00		3
			Operation Code 278		1



MATERIAL INSTALLED BY CONTRACTOR

	Std. / Stk. No.	Description	15 75 05 02	Qty.
A	12 51 330	Plug - Conduit 1-1/2"		1
B	49 55 520	Marker - Buried Conduit		1
C	12 51 329	Conduit Reducer 2" to 1-1/2"		1



NOTES:

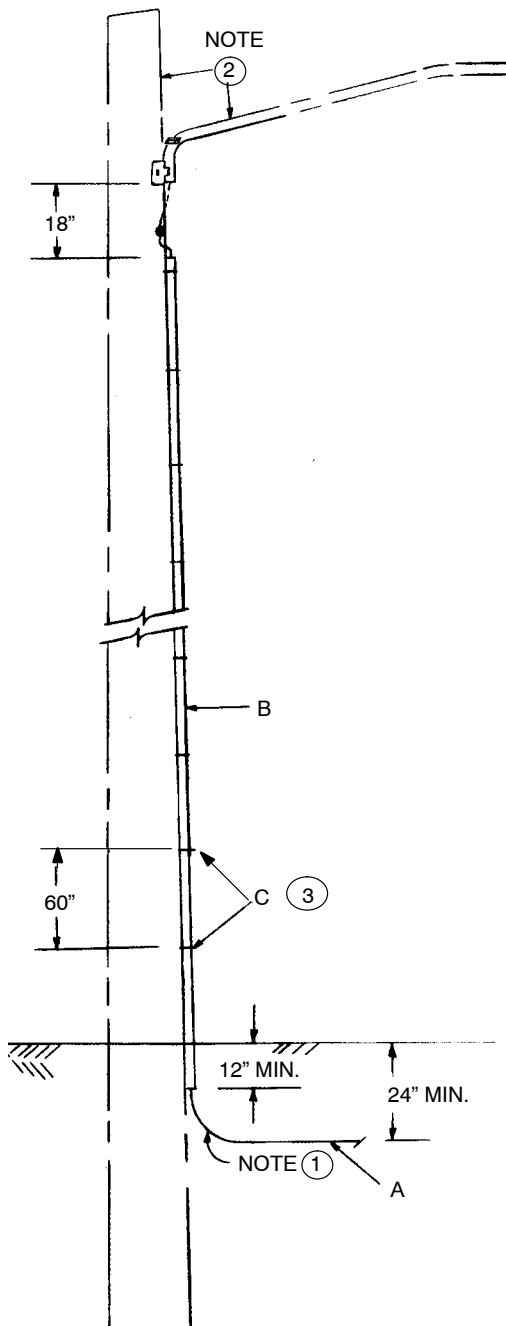
- Customer installs Ameren supplied box.

		Std. / Stk. No.	Description	15 75 05 03	Qty.
	A	12 51 330	Plug – Conduit, 1 1/2"		1
	B	49 55 520	Marker – Buried Conduit		1
	C	12 51 329	Conduit Reducer – 2" to 1 1/2"		1
1	D	12 06 106	Poly Splice Box 9 3/4" (W) x 14" (L) x 12" (D)		1

OUTDOOR LIGHTING
Installation of Underground Street Light
Cable on a Wood Pole

15 77 01 **

Sheet 1 of 2

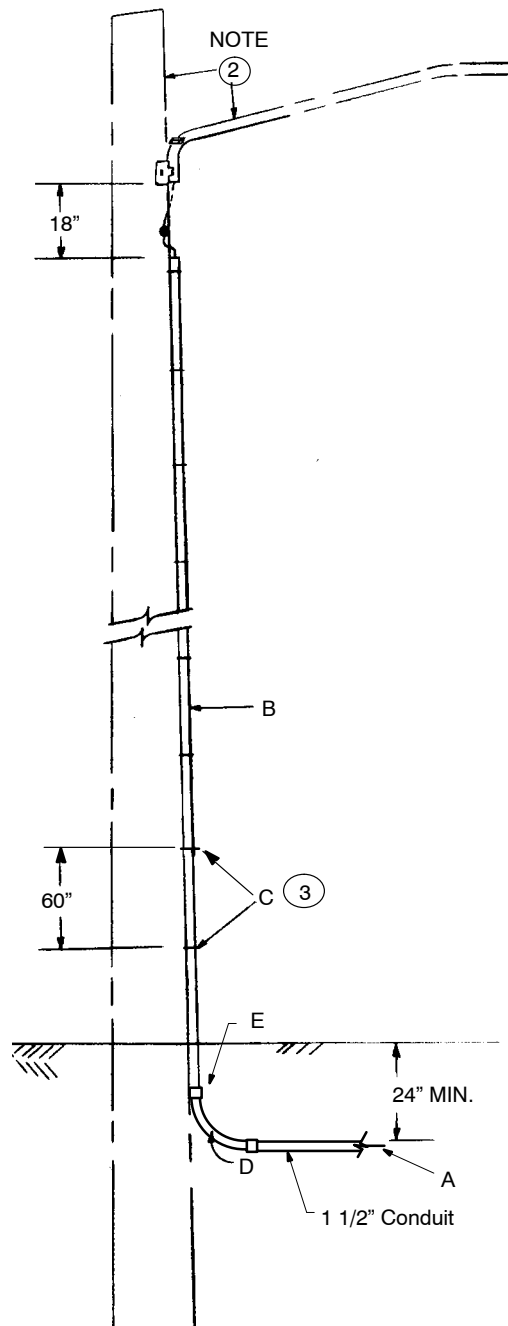


Direct Buried

15 77 01 01

Direct Buried (subject to physical damage)

15 77 01 03



In Conduit

15 77 01 02

In Conduit (subject to physical damage)

15 77 01 04

OUTDOOR LIGHTING
Installation of Underground Street Light
Cable on a Wood Pole

15 77 01 **

Sheet 2 of 2

NOTES:

1. As an underground alternative, where multiple lights are being installed direct bury a "T" splice per Dist. Std. 41 15 31 00 to avoid running the cable up and down the pole.
2. Pole, bracket, and luminaire must be listed separately.
3. If pole is subject to physical damage, use schedule 80 conduit for the first 10 ft. section up to the pole.

		Std./Stk. No.	Description	15 77 01 **	01	02	03	04
@	A	18 07 252	Cable – URD, St. Lt. #6 Duplex, Al.		As Req.	As Req.	As Req.	As Req.
@	B	12 51 197	Conduit – Plastic, 1" Sch. 40		As Req.	As Req.		
		12 01 332	Conduit – Plastic, 1" Sch. 80				As Req.	As Req.
@	C	23 67 490	Strap Conduit, 1-1/2 in. 2 Hole		As Req.	As Req.	As Req.	As Req.
	D	12 51 331	Bend 1-1/2", 24" Rad.			1		1
	E	40 83 425	Reducer 1-1/2" to 1"			1		1

OUTDOOR LIGHTING
Multiple Installation
30' Breakaway Pole – Underground Circuit

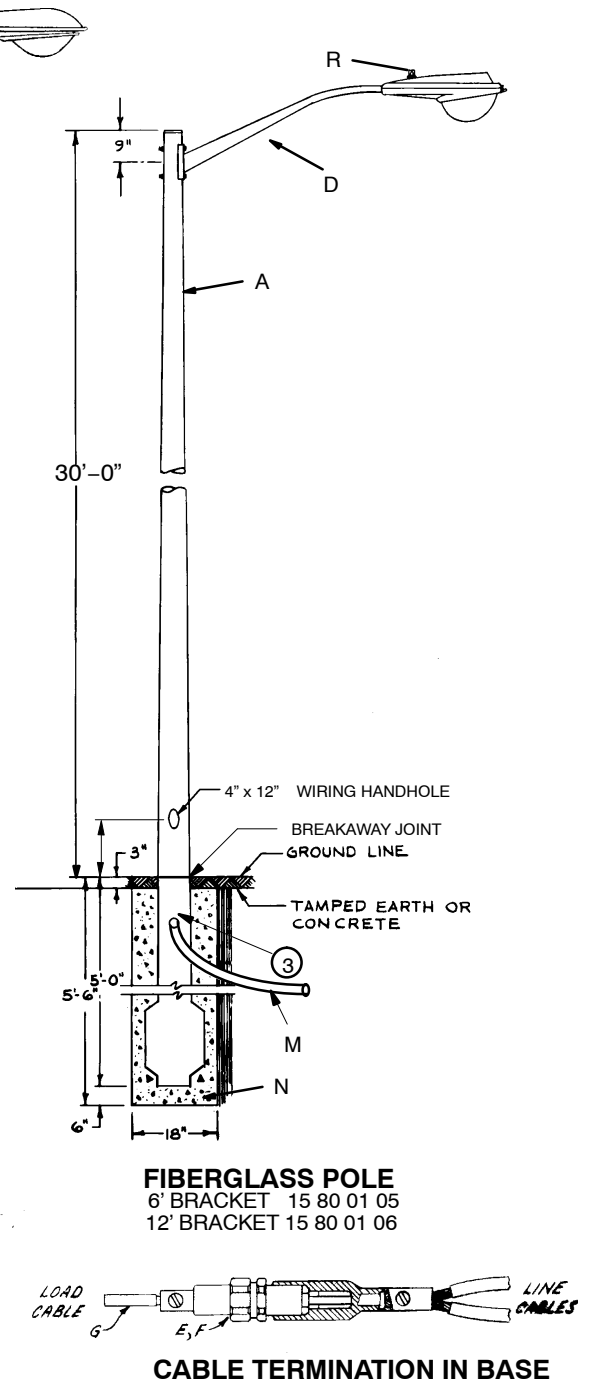
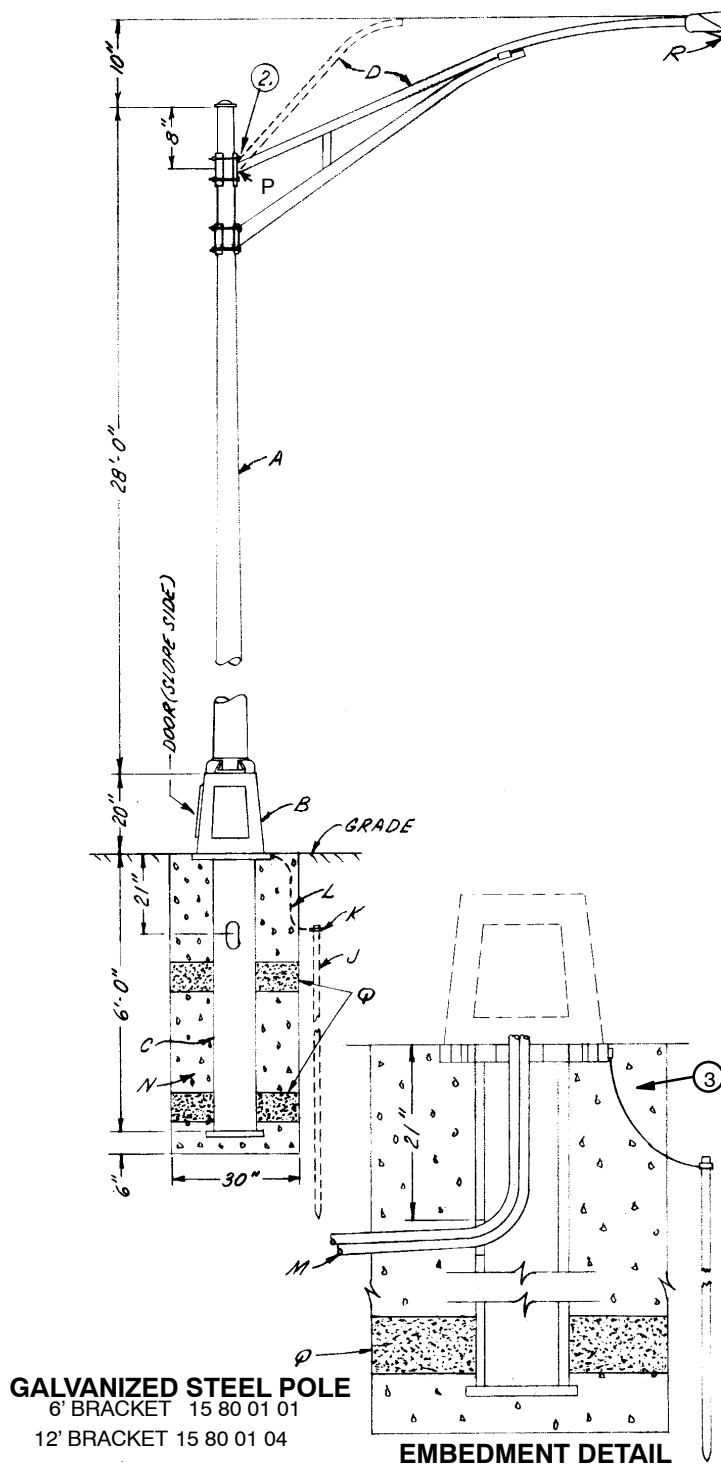
15 80 01 **

Sheet 1 of 2

MO ONLY

MO ONLY

MO ONLY



OUTDOOR LIGHTING
Multiple Installation
30' Breakaway Pole – Underground Circuit

15 80 01 **

Sheet 2 of 2

NOTES:

1. For U.E. 120 Volt circuit use one fuse in energized line and one fuse slug (#38 01 507) in neutral.
2. Wrap plastic tie around wires where they enter bracket.
3. Screenings to be wetted and thoroughly tamped.

MO ONLY

		Std. / Stk. No.	Description	15 80 01 **	01	04	05	06
@	A	38 01 506	Pole, Steel, Galv. – 28' – 0"	1	1			
		38 01 686	Pole, Fiberglass, Breakaway, 35'			1	1	
	B	38 01 499	Base, Transf. – Al.	1	1			
	C	38 01 505	Foundation, Steel Pile	1	1			
	D	38 01 500	Brkt., St. Lt. – 2" x 6' – 0"	1				
		38 01 503	Brkt., St. Lt. – 2" x 12' – 0"		1			
		38 01 556	Brkt., St. Lt. – Fbrgl. Mtg., 6'			1		
		38 01 690	Brkt. St. Lt. – Fbrgl. Mtg., 12'					1
	E	38 01 504	Connector, Fusible	2	2	2	2	
	F	38 01 509	Fusetron – Cart., 10 Amp	2	2	2	2	
	G	18 57 104	Cable, St. Lt. – #10 (ft.)	38	44	38	44	
	J	23 13 069	Rod, Ground – 5/8" x 8' – 0"	1	1			
	K	17 52 032	Clamp, Ground Rod – 5/8"	1	1			
	L	18 52 019	Wire, S.D., #6 B.C. (ft.)	10	10			
	M	12 51 148	Conduit, Poly. – 1" (ft.)	10	10	2	2	
	N		Rock, Crushed, Limestone, 1/2", Clean (lb)		2430	850	850	
	P	25 54 074	Tie, Cable – 1/2" x 6" Poly.	2	2			
	Q	11 04 105	Concrete Premix 90#	2	2			
	R	15 70 ** **	St. Lt. Assembly	1	1	1	1	

1.0 General

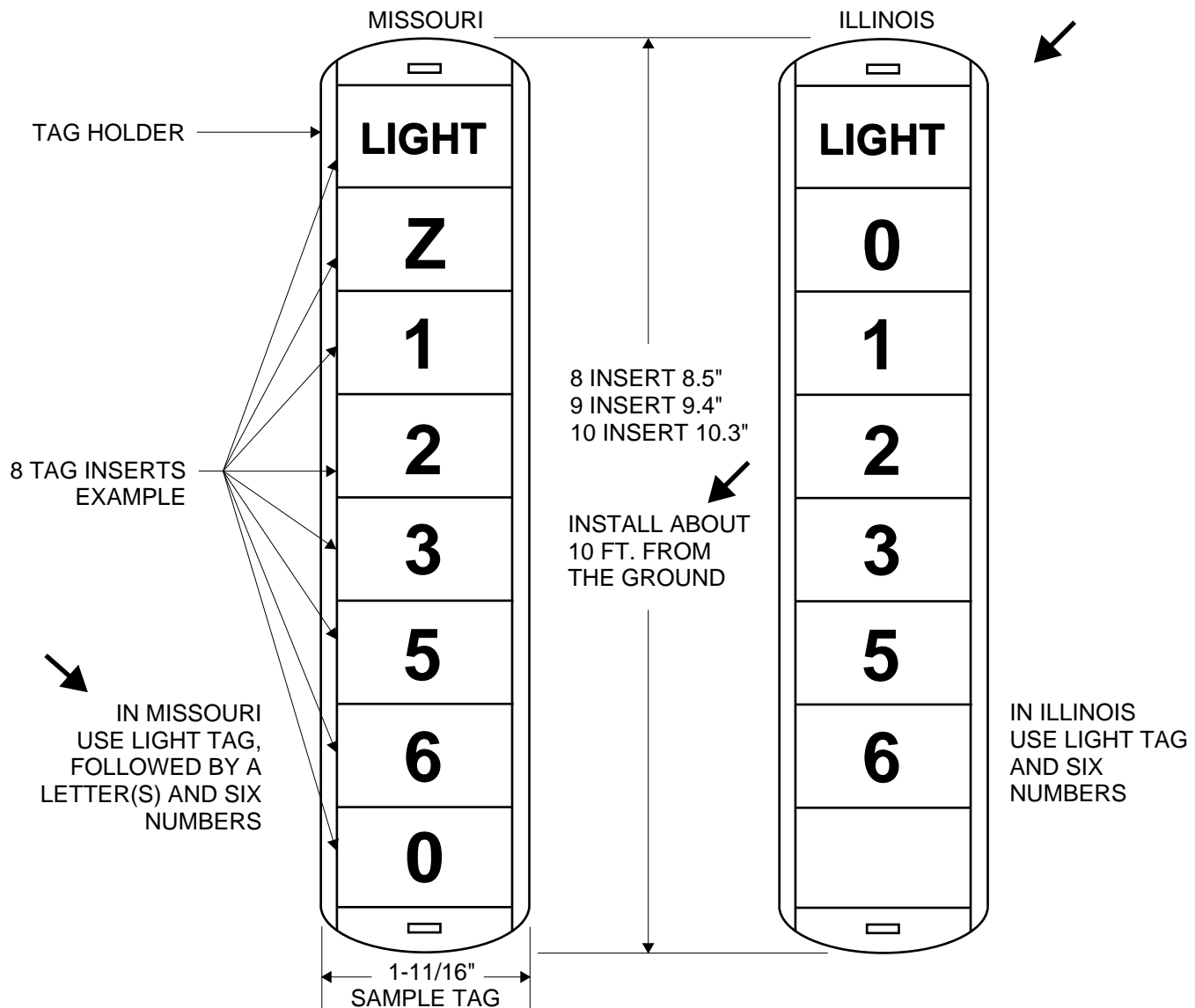
This specification covers the basic information and materials required to produce tags for street lighting poles. The street lighting tags will be produced by construction district personnel after obtaining the proper designation and abbreviation from the appropriate authority.

2.0 Street Lighting Tag Construction

The street lighting tags will consist of a holder and various inserts. The holder will accommodate a maximum of eight, nine, and ten inserts. It is necessary to crimp each end of the holder to prevent the number from sliding out. A sample tag with eight inserts is shown.

3.0 Typical Tag Locations

Install a street light number about 10 ft. from the ground, so that is visible for general public, but still out of reach. Generally only one tag per street light shall be installed. If more than one street light is installed on the same street lighting pole, one tag per street light is required, and each tag should be installed on the same quadrant as the light. The tag should be installed visibly from the ground level but not reachable from public.



4.0 Tag Attachment Methods**4.1 Tie Wire - Stock Number 40-59-197**

Whenever a tag is attached directly to a non-wood street lighting pole, tie wire shall be used for the attachment.

4.2 Galvanized Nails - Stock Number 21-57-047

Whenever a tag is attached directly to a wood pole; two galvanized nails shall be used for the attachment.

5.0 Tag Holder and Inserts

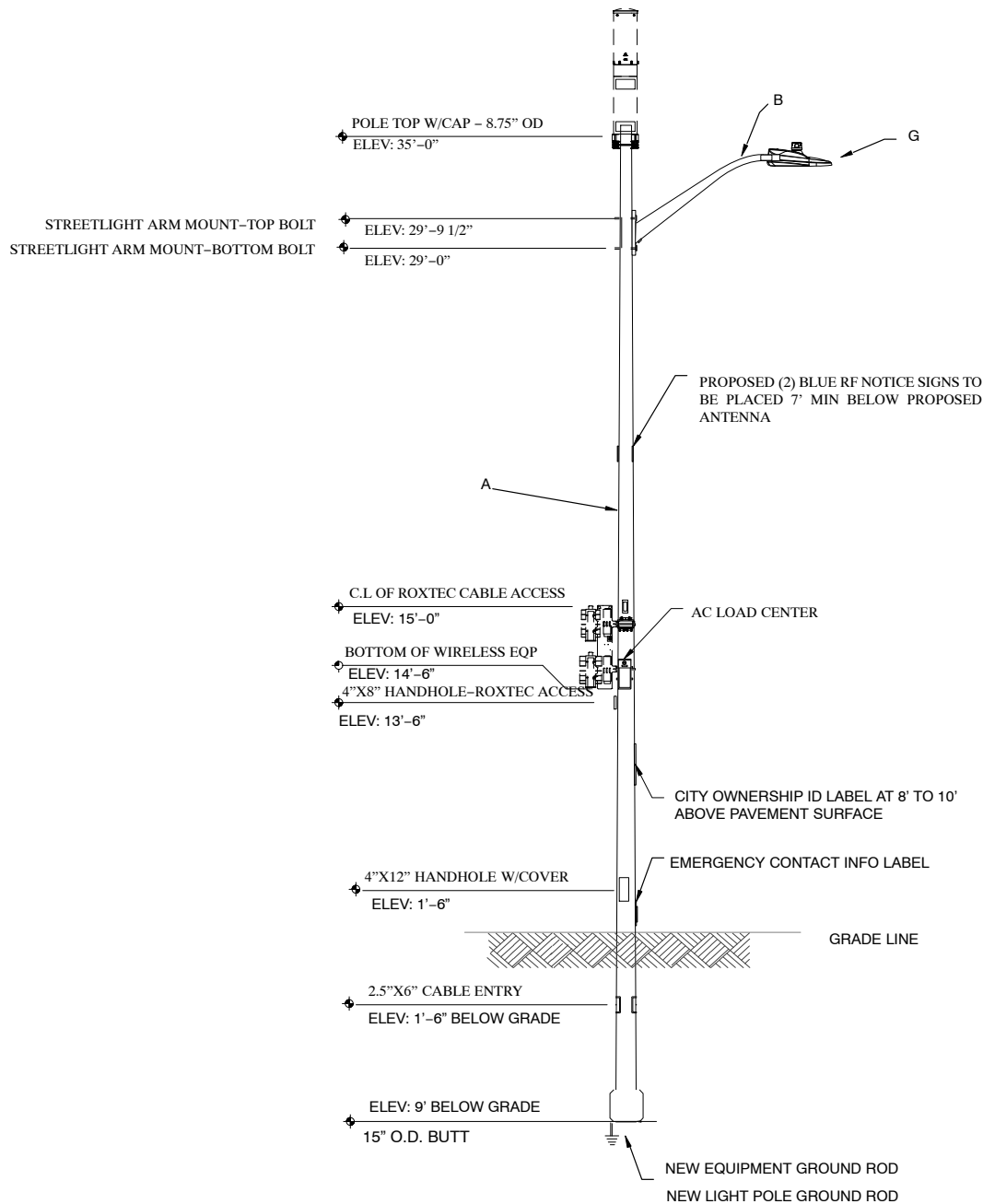
Street lighting tags will be produced using the following stock items.

<u>Stock Number</u>	<u>Description</u>	<u>Stock Number</u>	<u>Description</u>
16-16-047	Holder, Tag, Aluminum, 8 inserts	16-01-211	Tag, "H"
16-16-048	Holder, Tag, Aluminum, 9 inserts	16-01-303	Tag, "I"
16-16-049	Holder, Tag Aluminum, 10 inserts	16-01-304	Tag, "J"
16-16-050	Tag, "LIGHT"	16-01-305	Tag, "K"
16-01-195	Tag, "0" *	16-01-306	Tag, "L"
16-01-196	Tag, "1"	16-01-307	Tag, "M"
16-01-197	Tag, "2"	16-01-308	Tag, "N"
16-01-198	Tag, "3"	16-01-309	Tag, "O"
16-01-199	Tag, "4"	16-01-212	Tag, "P"
16-01-200	Tag, "5"	16-01-310	Tag, "Q"
16-01-201	Tag, "6 or 9"	16-01-311	Tag, "R"
16-01-202	Tag, "7"	16-01-213	Tag, "S"
16-01-203	Tag, "8"	16-01-214	Tag, "T"
16-01-204	Tag, "A"	16-01-312	Tag, "U"
16-01-205	Tag, "B"	16-01-313	Tag, "V"
16-01-206	Tag, "C"	16-01-314	Tag, "W"
16-01-207	Tag, "D"	16-01-215	Tag, "X"
16-01-208	Tag, "E"	16-01-216	Tag, "Y"
16-01-209	Tag, "F"	16-01-217	Tag, "Z"
16-01-210	Tag, "G"		

* The zero tag is a phase symbol that has been rotated 90 deg. to appear as a zero with a line through it. This is to help distinguish between "zero" and the letter "O".

OUTDOOR LIGHTING
4G/5G ATTACHMENT
FG STLT POLE DIRECT BURIAL- 44FT OH/35FT MH

15 91 00
Sheet 1 of 2



OUTDOOR LIGHTING
4G/5G ATTACHMENT
FG STLT POLE DIRECT BURIAL- 44FT OH/35FT MH

15 91 00
Sheet 2 of 2

NOTES:

1. Limestone or native soil backfill must be tamped to provide solid compaction around the pole.
2. Generally only one tag per streetlight shall be installed. If more than one streetlight installed on the same pole, one tag per streetlight is required, and each tag shall be installed on the same quadrant of the light. The tag shall be installed visibly from the ground level but not reachable from public. See DCS 15 90 01 01 for more details.
3. Fusing underground streetlight cable is at padmount transformer or pedestal. See DCS 52 00 01**.

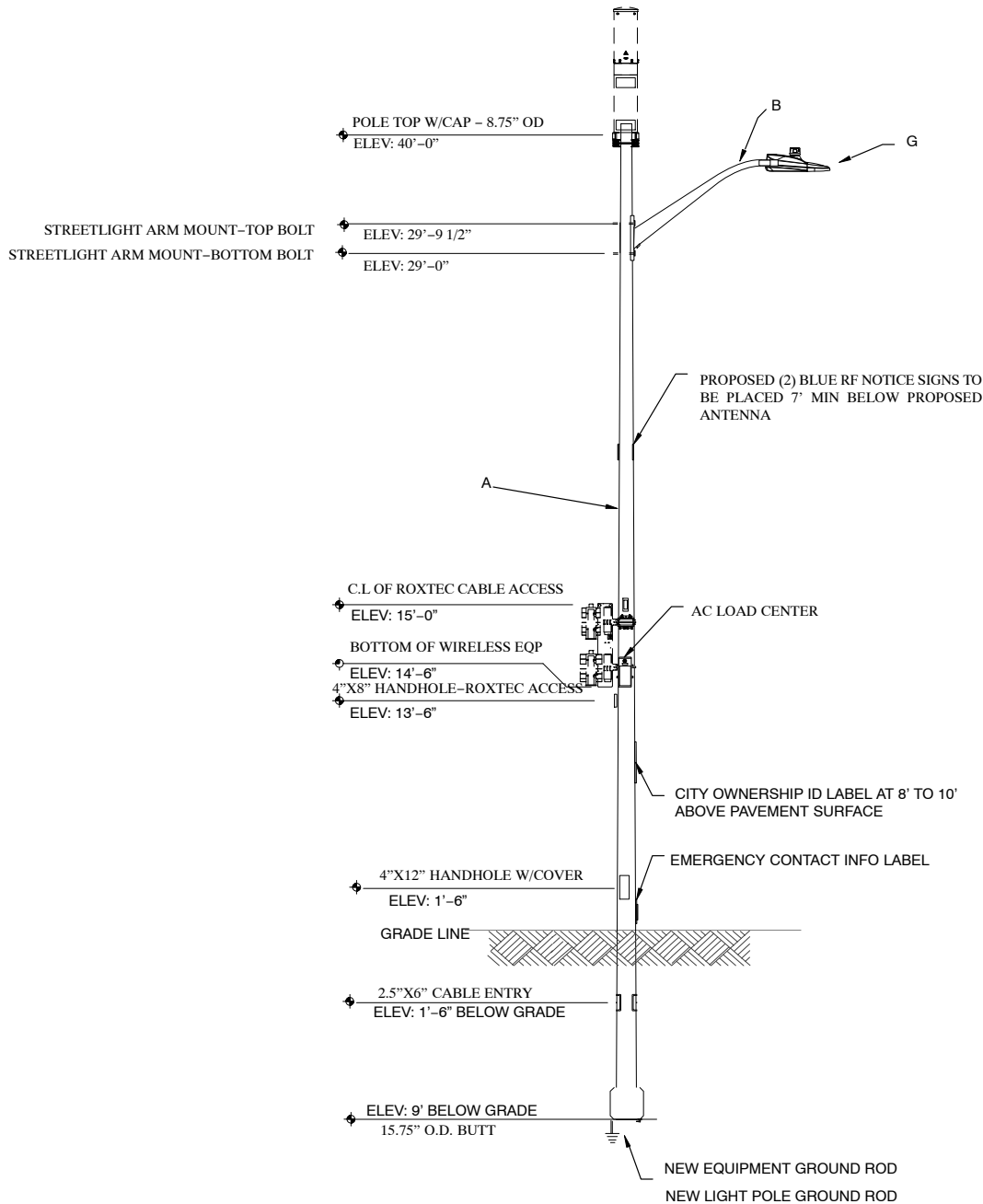
		Std. / Stk. No.	Description	15 91 00	QTY
	A	38 51 678	Pole, St. Lt., Con., 44' 0" O.H./ 35' M.H., Limited to 40 EPA		1
	B	38 01 556	Bracket, St. Lt., 2" x 6'		1
	C	18 57 104	Cable, St. Lt., Twisted - FT		40
	D	25 53 053	Tape, Rubber 3/4"		1
	E	17 01 116	Connector, Bolted/Set Screw #14-2/0, 3 Pos.		2
@	F		Rock, Crushed, Limestone - LB		As Req
@	G	15 70 ** **	St. Lt. Assembly		1

OUTDOOR LIGHTING

4G/5G ATTACHMENT

FG STLT POLE DIRECT BURIAL – 49FT OH/40FT MH

15 91 01
Sheet 1 of 2



NOTES:

1. Limestone or native soil backfill must be tamped to provide solid compaction around the pole.
2. Generally only one tag per streetlight shall be installed. If more than one streetlight installed on the same pole, one tag per streetlight is required, and each tag shall be installed on the same quadrant of the light. The tag shall be installed visibly from the ground level but not reachable from public. See DCS 15 90 01 01 for more details.
3. Fusing underground streetlight cable is at padmount transformer or pedestal. See DCS 52 00 01**. Limestone screenings shall be wetted and thoroughly tamped as installed.

OUTDOOR LIGHTING
4G/5G ATTACHMENT
FG STLT POLE DIRECT BURIAL – 49FT OH/40FT MH

15 91 01
Sheet 2 of 2

@ @		Std. / Stk. No.	Description	15 91 01	QTY
	A	38 51 679	Pole, St. Lt., Con., 49' O.H. / 40' M.H. Limited 40 EPA		1
	B	38 01 556	Bracket, St. Lt., 2" x 6'		1
	C	18 57 104	Cable, St. Lt., Twisted – Ft		45
	D	17 01 116	Connector, Bolted/Set Screw #14-2/0 3 Pos		2
	E	25 53 053	Tape, Rubber 3/4"		1
	F		Rock, Crushed, Limestone –LB		As Req
	G	15 70 ** **	St. Lt. Assembly		1



NOTES

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SINGLE PHASE, FIXED 2.4, 7.2, & 7.96 KV 16-00-02-00

THREE PHASE, SWITCHED AND FIXED 2.4 – 14.4KV 16-00-05-00

Controls and Wiring Diagrams

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CURRENT OR VAR, NON-COMMUNICATING FOR 2.4 – 34.5 KV BANKS 16-00-20-**

TIME, TEMP, VOLTAGE, COMMUNICATING FOR 2.4 – 34.5 KV BANKS 16-00-24-**

TIME, TEMP, VOLTAGE, COMMUNICATING FOR 2.4 – 34.5 KV BANKS 16-00-26-**

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2.4, 7.2 & 7.96KV SINGLE PHASE 16-15-01-**

2.4 – 14.4KV THREE PHASE 16-15-02-**

Switched Capacitor Installations

2.4 – 14.4KV FOR TIME, TEMP, VOLTAGE, COMMUNICATING CONTROLS 16-15-03-**

2.4 – 14.4KV FOR CURRENT CONTROLS, NON-COMMUNICATING CONTROLS 16-15-04-**

INSTALLATION OF 1KVA TRANSFORMER ON CAPACITOR BANK 16-15-05-01

SWITCHED CAPACITOR INSTALLATION 2.4-13.8KV THREE PHASE NON-COMMUNICATING CURRENT OR VAR
TYPE CONTROLS 16-20-01-**15KV & BELOW – SPACERCABLE – 300KVAR to 1200KVAR, FOR TIME, TEMP., VOLTAGE OR COMMUNICATING
TYPE CONTROLS 16-20-05-**SWITCHED CAPACITOR INSTALLATION 2.4-13.8KV THREE PHASE NON-COMMUNICATING CURRENT OR VAR
TYPE CONTROLS 16-20-10-**

REGULATOR – SPACER CABLE POLE MOUNTED, THREE PHASE 4KV & 12 KV 16-20-15-01

34.5KV FOR MULTI FUNCTION CONTROLS 16-34-02-**

Regulators

POLE MOUNTED, SINGLE PHASE 4 & 12KV 16-80-01-**

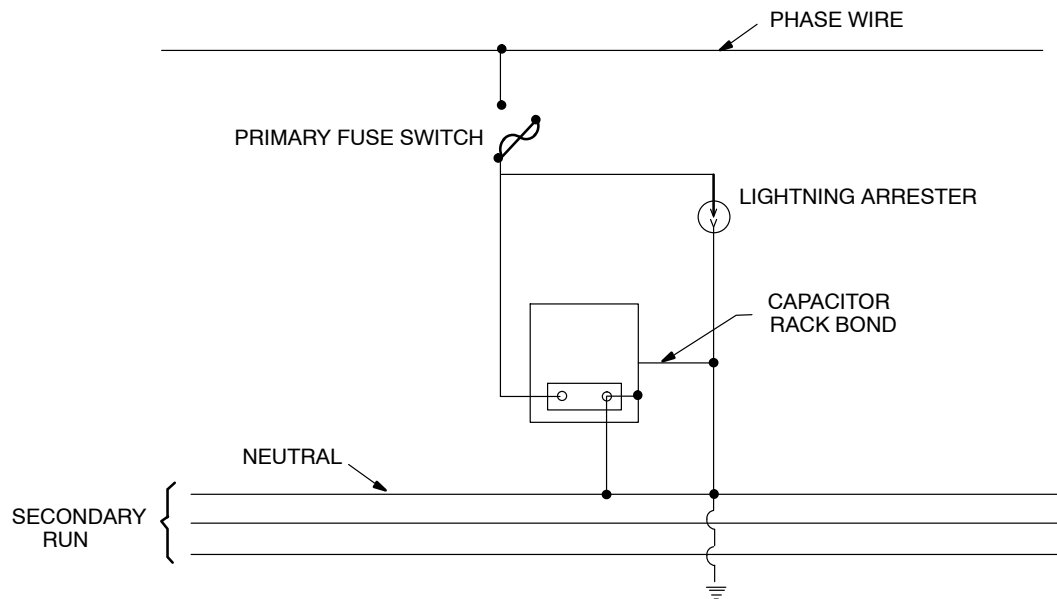
PLATFORM MOUNTED, THREE PHASE 4 & 12KV 16-80-02-**

POLE MOUNTED, THREE PHASE 4KV & 12KV 16-80-03-01

CAPACITORS AND REGULATORS
Capacitor Bank Wiring Diagram
Single Phase, Fixed 2.4, 7.2, and 7.96kV

16 00 02 00

Sheet 1 of 1

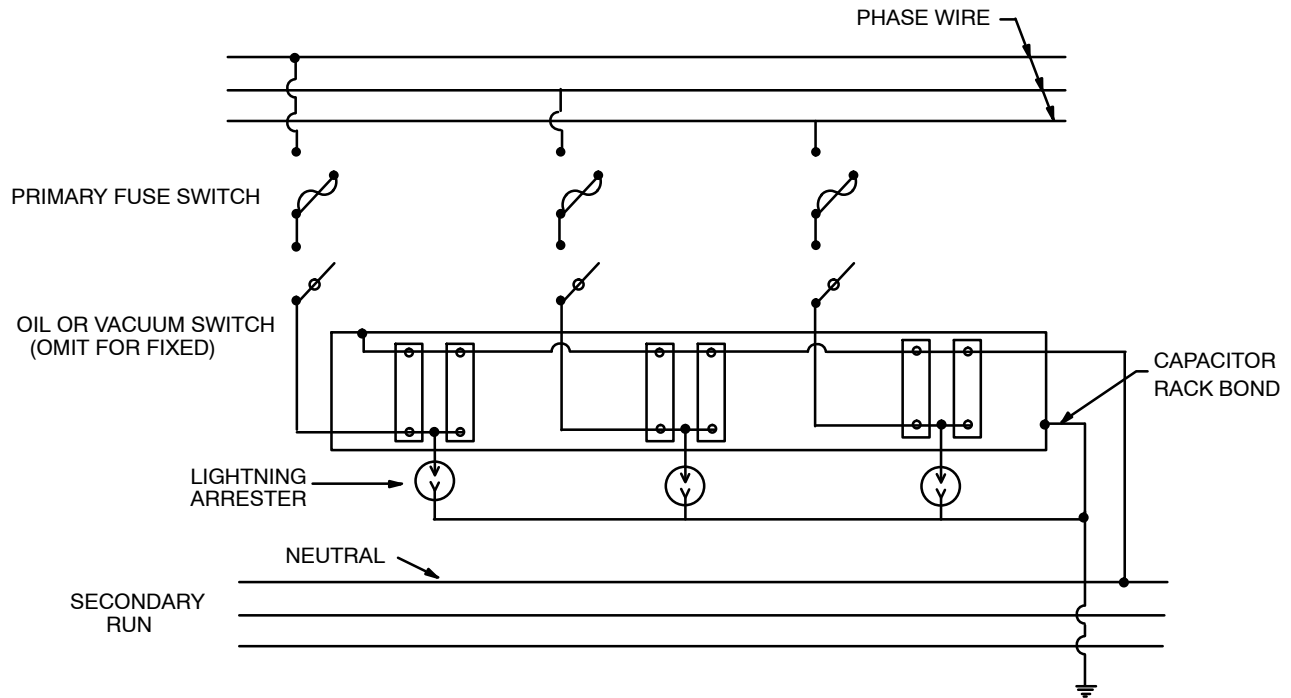


CAPACITORS AND REGULATORS
Capacitor Bank Wiring Diagram
Three Phase, Switched and Fixed – 2.4 – 14.4 kV

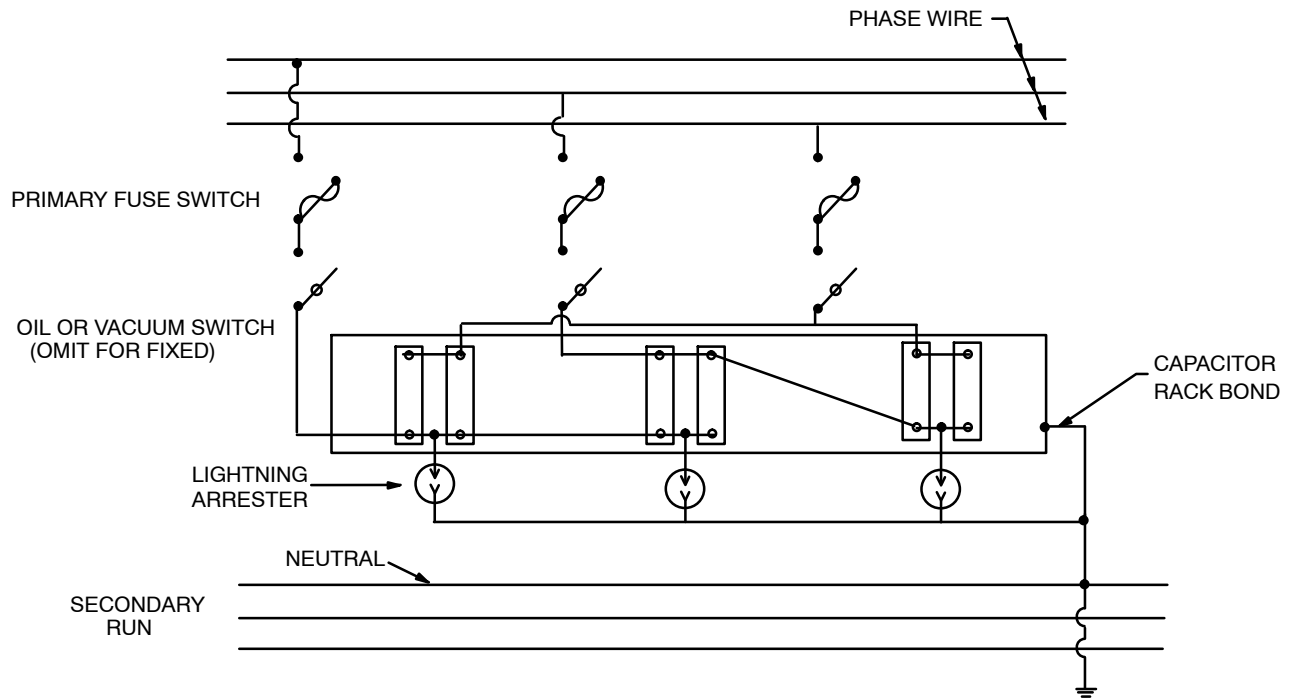
16 00 05 00

Sheet 1 of 1

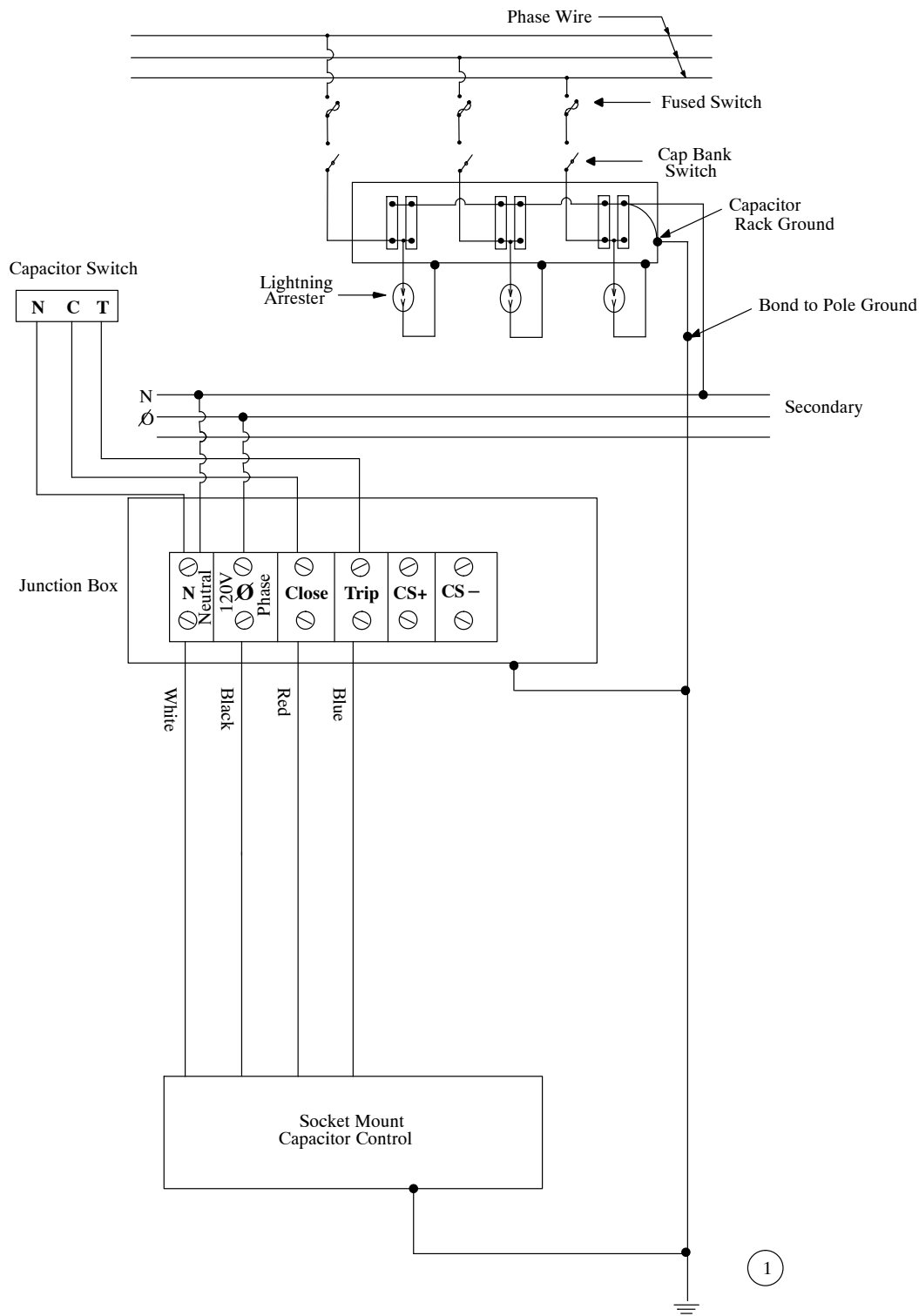
Wye Connected

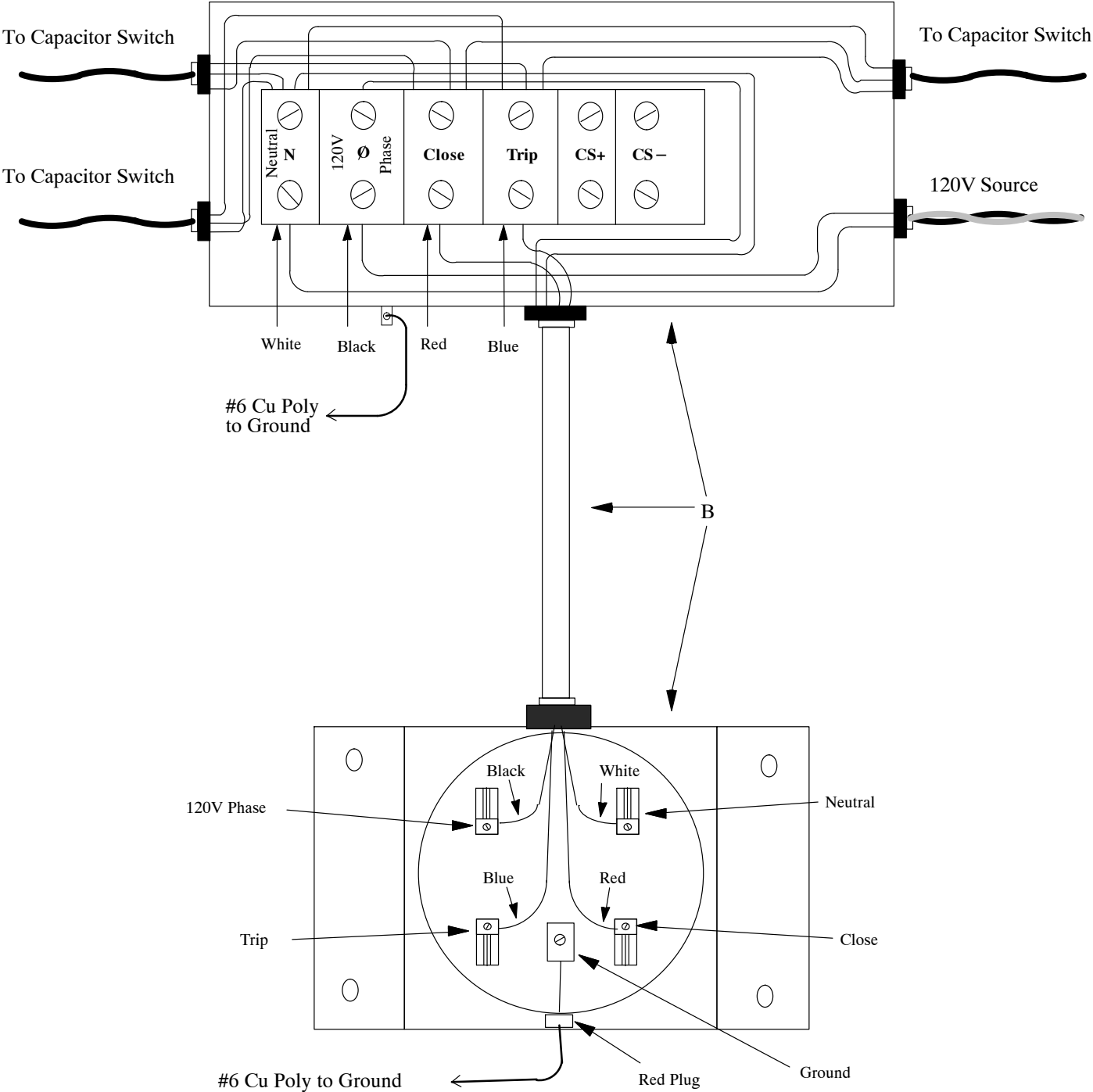


Delta Connected



Control and Wiring– Non Communicating
Time, Temp and Voltage for 14.4kV Systems and Below





CAPACITORS AND REGULATORS

16 00 18 01

Control and Wiring– Non Communicating

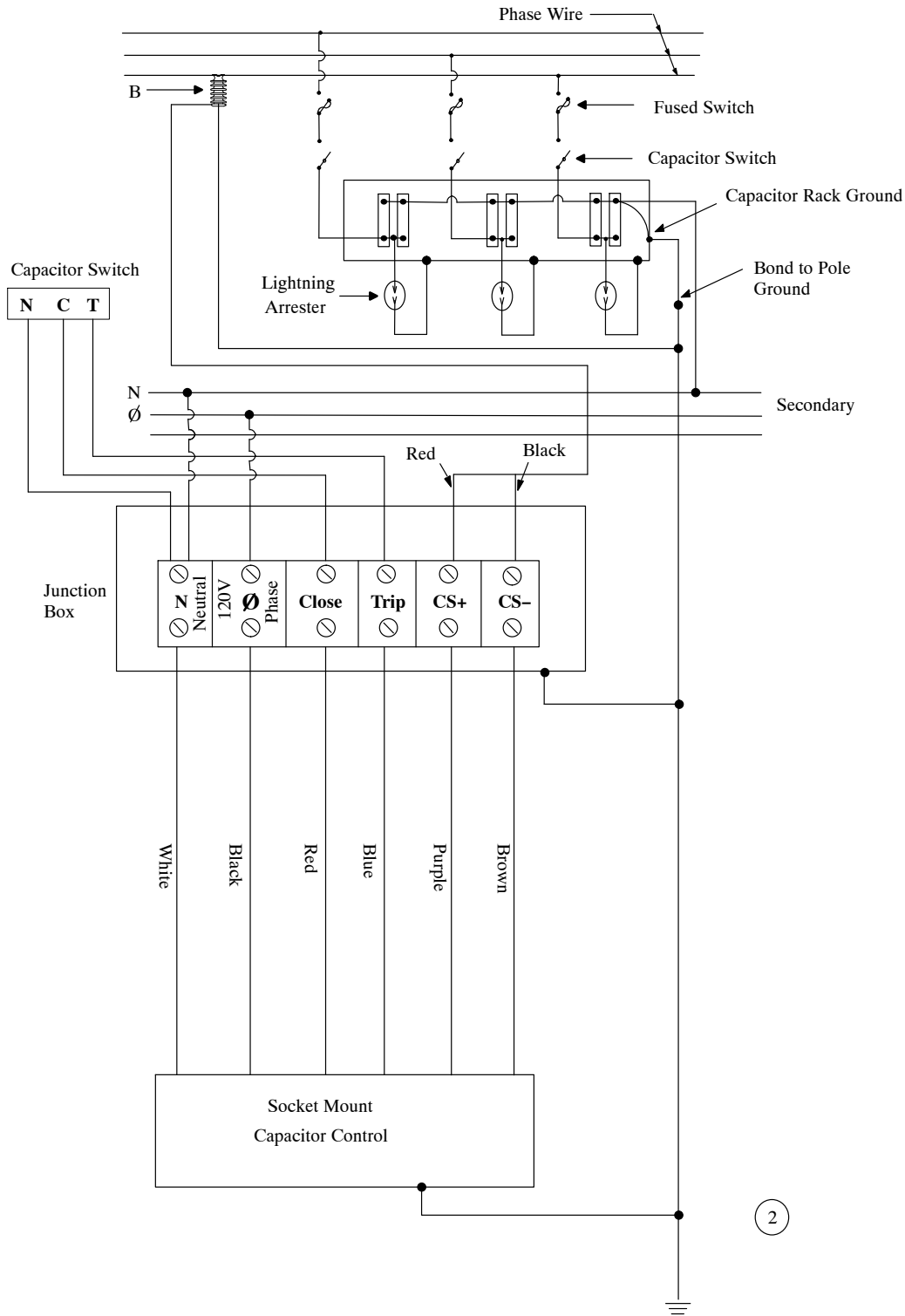
Sheet 3 of 3

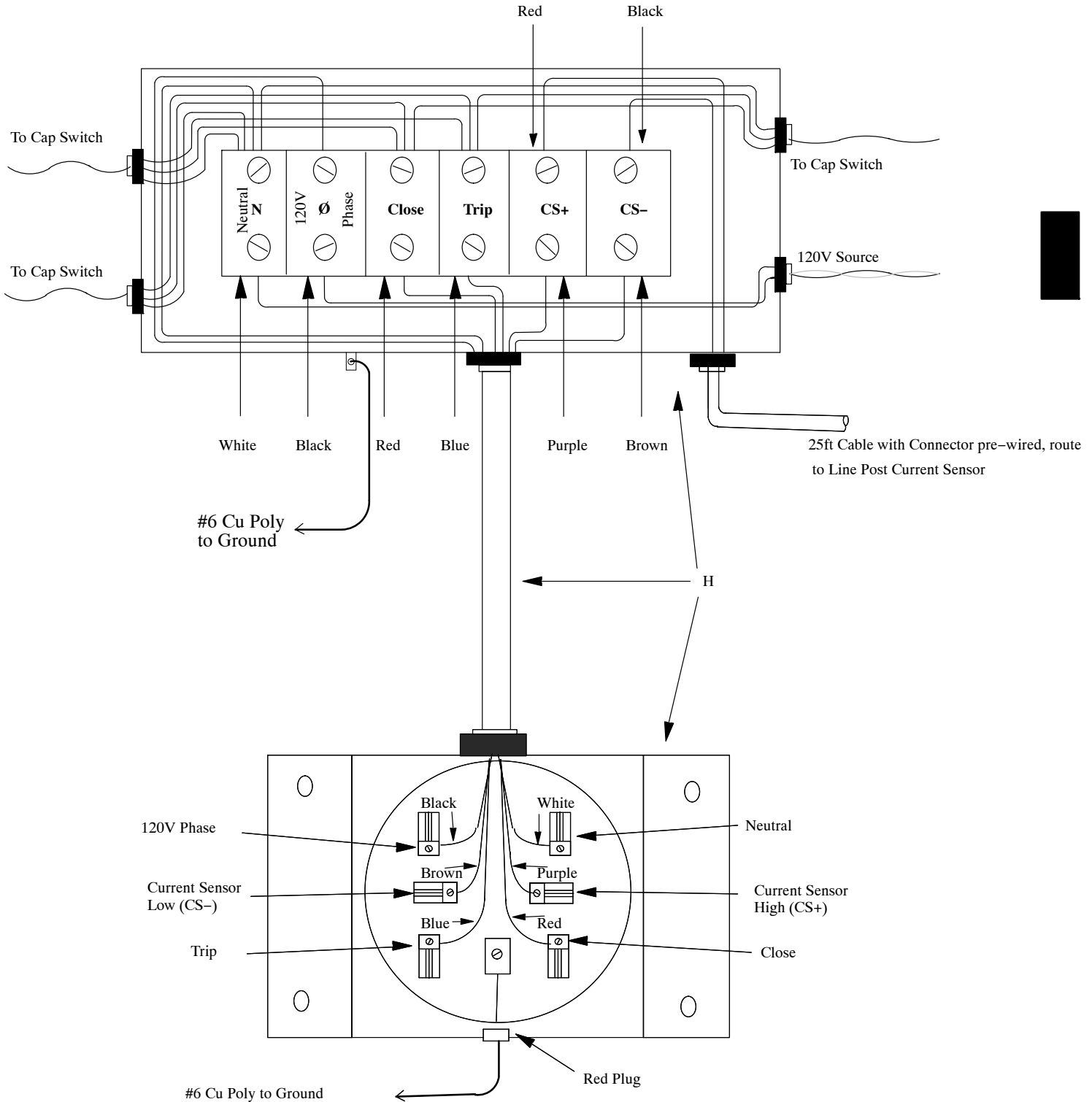
Time, Temp and Voltage for 14.4kV Systems and Below

		Stnd. / Stk. No.	Description	16 00 18	01
A	69 11 311		Control, Time, Temp, Volt – S&C Intellicap		1
B	54 17 510		Junction/Socket Meter, 4 Jaw, Pre – wired with 25' Liquidtight Conduit		1
C	17 54 003		Connector, Split Bolt		4

NOTES:

1. The junction box, meter socket, capacitor rack and capacitor control shall be bonded to the pole ground.
2. See DCS 16 15 04 ** for capacitor bank installation.

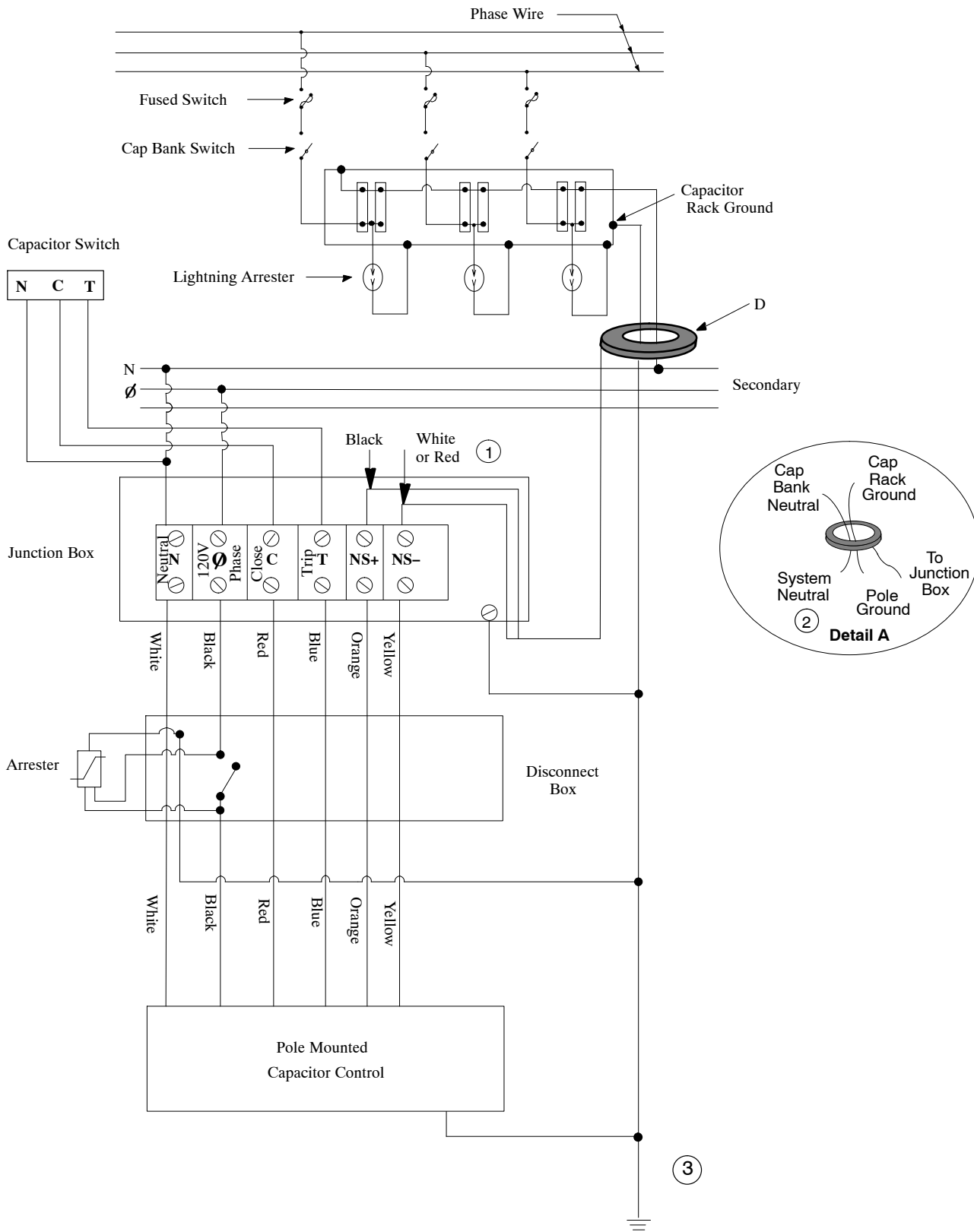




		Std. / Stk. No.	Description	16 00 20	01
	A	69 11 215	Control, Current or VAR – S&C Intellicap		1
	B	69 11 297	Sensor, Current, Line Post Type, 15 kV		1
	C	23 64 034	Stud, 5/8" X 7"		1
	F	17 54 003	Connector, Split Bolt		5
	H	54 17 511	Junction Box/Meter Socket 6-Jaw, Pre-wired with 25' Liquidtight Cable		1

NOTES:

1. Contact Standards Engineer for the replacement line post current sensor cable.
2. The junction box, meter socket, capacitor rack, capacitor control, and current sensor must be bonded to pole ground.
3. See DCS 16 15 04 ** for capacitor bank installation.

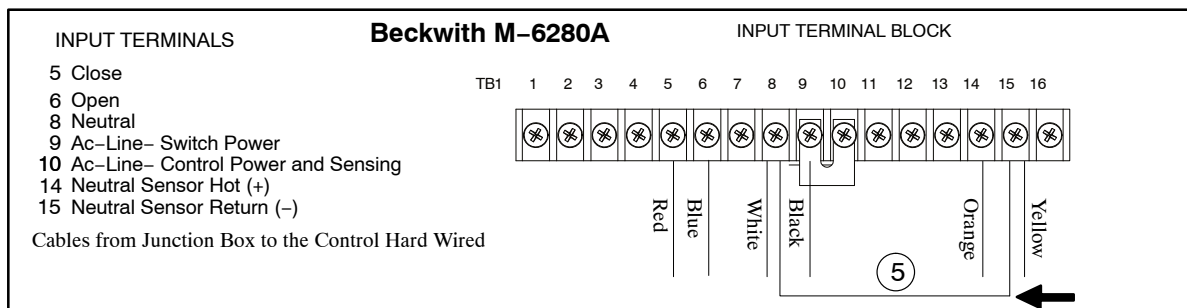
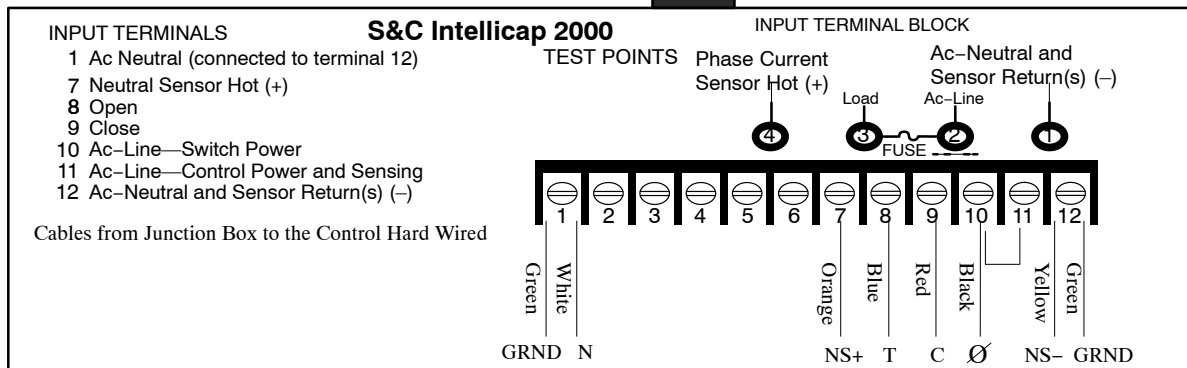
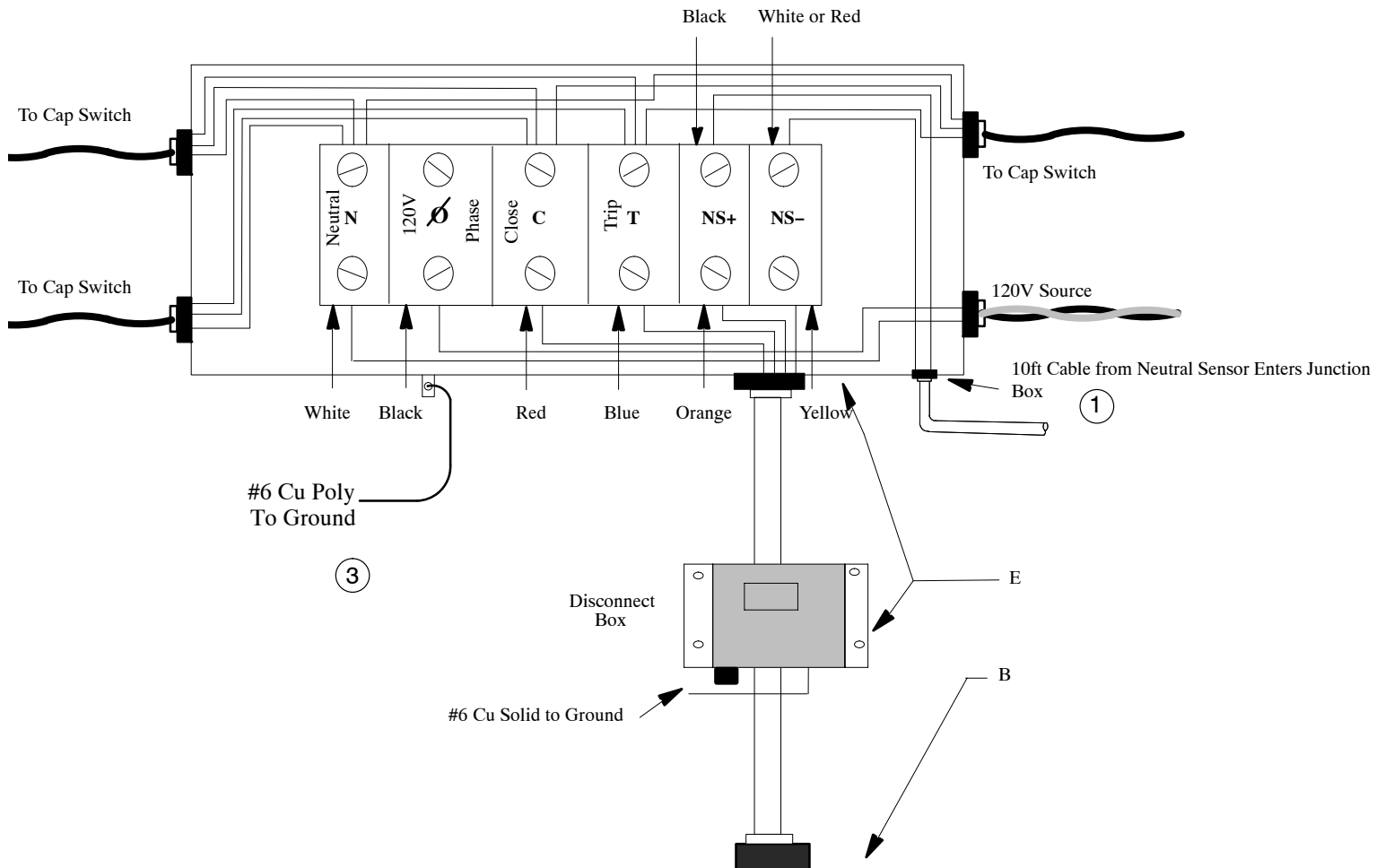


CAPACITORS AND REGULATORS

Control and Wiring – Communicating

Time, Temp and Voltage for 34.5kV Systems and Below

16 00 24 **
Sheet 2 of 3



CAPACITORS AND REGULATORS
Control and Wiring – Communicating
Time, Temp and Voltage for 34.5kV Systems and Below

16 00 24 **
Sheet 3 of 3

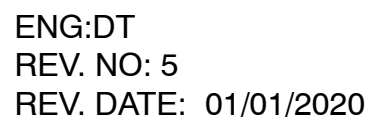
16 00 24 01 Time, Temp, Voltage sensing for 34 kV and below with Beckwith controller
16 00 24 02 Time, Temp, Voltage sensing for 34 kV and below with S&C Intellicap 2000 controller

		Std. / Stk. No.	Description	16 00 24	01	02
@6	B	69 11 306	Control, Communicating, Time, Temp, Volt – S&C Intellicap 2000			1
		69 11 307	Control, Communicating, Time, Temp, Volt – Beckwith	1		
	D	69 11 305	Neutral Current Sensor – S&C Intellicap Plus, with 10' cable W/O Connector			1
		69 11 304	Neutral Current Sensor – Beckwith, with 10' cable W/O Connector	1		
	E	54 17 498	Junction Box (6-terminal)/Disconnect Box, Pre-wired with 35' Liquidtight Cable	1		1
	L	17 54 003	Connector, Split Bolt	4		4
	M	69 59 001	Communications Kit, Coax and Antenna (VO only)	1		1
	N	69 59 003	GE Orbit ECR Cell Modem (VO only)	1		1
		16 08 298	GE Orbit ECR Cell Modem	1		1
	O	16 16 078	Low Profile Omnidirectional Antenna	1		1
@6	P	16 16 181	Coax. Cable, 2 ft jumper with SMA (male) to N (male)	1		1

NOTES:

- Neutral current sensor output can reach 40V if sensor wires are not terminated when current is present on wires routed through sensor.** Terminate the **neutral sensor wires** in the junction box. The **black** neutral sensor wire connects to the **NS+** terminal and the **white or red** neutral sensor wire connects to the **NS-** terminal.
- See Detail A.** The neutral current sensor shall be mounted below the bank. **Only the capacitor rack ground wire and the cap bank neutral wire from the bank should pass through the center of the sensor.** The sensor shall be located on the wires between the capacitor rack and their connections to pole ground and the distribution system neutral (thereby capturing all of the neutral current in the wires from the bank), and secured with a staple above and below to the wires passing through the sensor. If a 1kVA transformer is installed on the cap bank frame, the neutral and ground wires from the transformer must also pass through the neutral current sensor. If transformer is mounted on pole, the transformer neutral and ground wires do not need to be routed through sensor unless it's ground connection is made between sensor and cap bank frame. The sensor cable should be routed to the junction box.
- The junction box, disconnect box, capacitor rack and capacitor control shall be connected to pole ground.
- See DCS 16 15 03 ** for capacitor bank installation.
- Illinois uses 69 59 001 and 69 59 003 for VO only. Missouri and Illinois uses 16 08 298, 16 16 078 and 16 16 181 if SCADA control is needed (not for Illinois VO).
- For VO circuits, 120 V controller supply shall be no more than 1 span away from a lightly loaded transformer.

16 00 26 **
Sheet 1 of 3

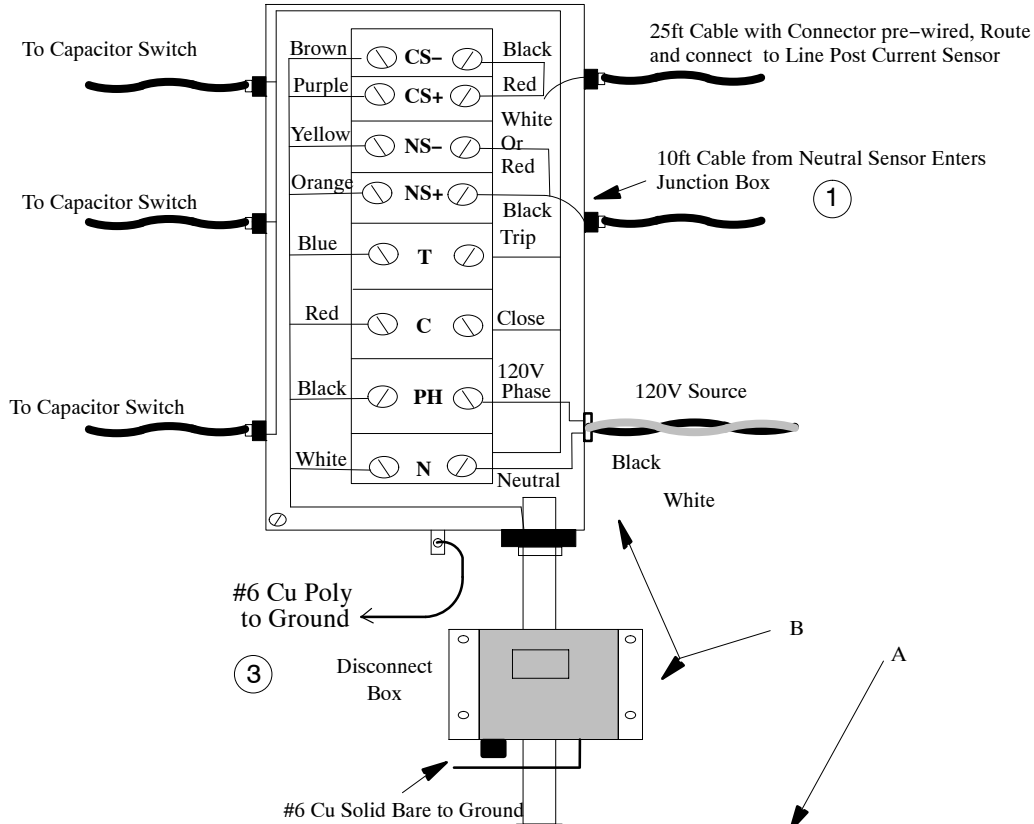


CAPACITORS AND REGULATORS

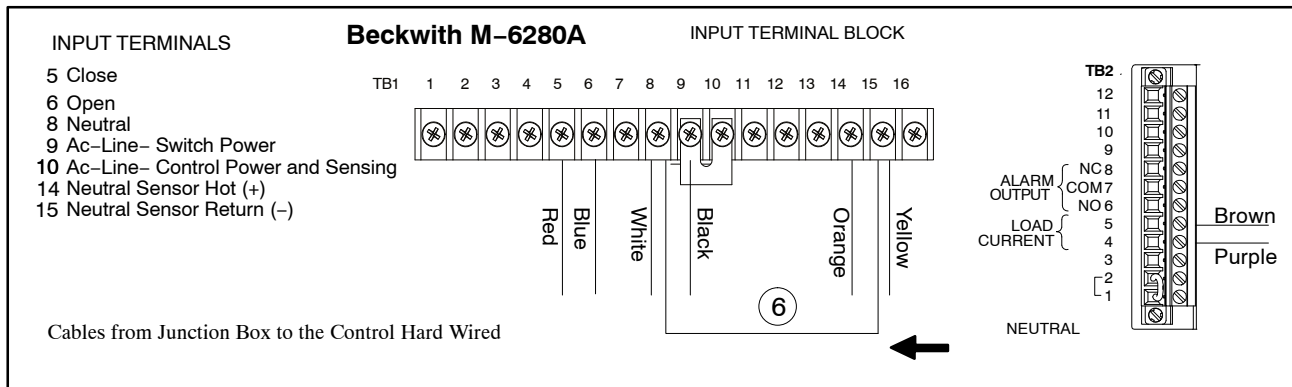
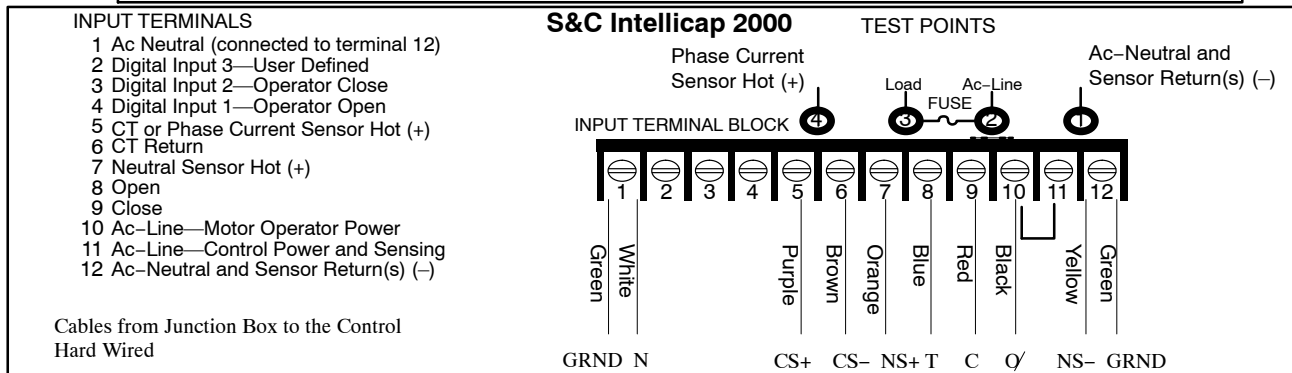
Control and Wiring – Communicating

Time, Temp, Voltage and VAR for 34.5kV Systems and Below

16 00 26 **
Sheet 2 of 3



Terminal Strip Configuration—For Wall or Pole Mounting Bracket



CAPACITORS AND REGULATORS

Control and Wiring – Communicating

Time, Temp, Voltage and VAR for 34.5kV Systems and Below

16 00 26 **
Sheet 3 of 3

16 00 26 01	Current and VAR Sensing for 15kV and below with S&C Intellicap 2000 controller
16 00 26 02	Current and VAR Sensing for 34kV with S&C Intellicap 2000 controller
16 00 26 03	Current and VAR Sensing for 15kV and below with Beckwith controller
16 00 26 04	Current and VAR Sensing for 34kV with Beckwith controller

		Std. / Stk. No.	Description	16 00 26 **	01	02	03	04
@7	A	69 11 201	Control, Time, Temp, Volt, Current or VAR – S&C Intellicap 2000		1	1	0	0
		69 11 316	Control, Time, Temp, Volt, Current or VAR – Beckwith		0	0	1	1
	B	54 17 512	Junction Box (8–terminal) and Disconnect Box, Pre-wired with 35' Liquid–tight Conduit		1	1	1	1
	C	69 11 305	Sensor, Neutral Current with 10' Cable– S&C		1	1	0	0
		69 11 304	Sensor, Neutral Current with 10' Cable– Beckwith		0	0	1	1
	D	69 11 297	Sensor, Current, Line Post Type, 15kV		1	0	1	0
		69 11 202	Sensor, Current, Line Post Type, 35kV		0	1	0	1
	E	23 64 034	Stud, 5/8" x 7"		1	1	1	1
	F	21 75 008	Washer, Flat, 5/8"		2	2	2	2
	N	17 54 003	Connector, Split Bolt		5	5	5	5
	S	18 51 021	Wire, #6 Cu., S.D. Poly Covered		7	7	7	7
	T	69 59 001	Communications Kit, Coax and Antenna (VO only)		1	1	1	1
	U	69 59 003	GE Orbit ECR Cell modem (VO only)		1	1	1	1
		16 08 298	GE Orbit ECR Cell Modem		1	1	1	1
	V	16 16 078	Low Profile Omnidirectional Antenna		1	1	1	1
	W	16 16 181	Coax Cable, 2 ft jumper with SMA (male) to N (male)		1	1	1	1

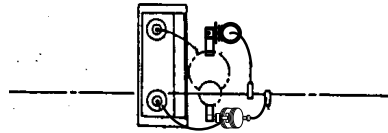
NOTES:

- Neutral current sensor output can reach 40V if sensor wires are not terminated when current is present on wires routed through sensor.** Terminate the **neutral sensor wires** in the junction box. The **black** neutral sensor wire connects to the **NS+** terminal and the **white or red** neutral sensor wire connects to the **NS–** terminal.
- See Detail A.** The neutral current sensor shall be mounted below the bank. Only the capacitor rack ground wire and the cap bank neutral wire from the bank should pass through the center of the sensor. The sensor shall be located on the wires between the capacitor rack and their connections to pole ground and the distribution system neutral (thereby capturing all of the neutral current in the wires from the bank), and secured with a staple above and below to the wires passing through the sensor. If a 1kVA transformer is installed on the cap bank frame, the neutral and ground wires from the transformer must also pass through the neutral current sensor. If transformer is mounted on pole, the transformer neutral and ground wires do not need to be routed through sensor unless it's ground connection is made between sensor and cap bank frame. The sensor cable should be routed to the junction box.
- The junction box, disconnect box, capacitor rack, capacitor control, and current sensor must be bonded to pole ground.
- Contact Standards Engineer for the replacement line post current sensor cable.
- See DCS 16 15 03 ** for capacitor bank installation.
- For Beckwith controllers, connect jumper wire from TB1–8 to TB1–15 when neutral sensor is used. When neutral current sensor is not used, connect jumper wire from TB2–4 to the ground stud to the right of TB–1.
- Illinois uses 69 59 001 and 69 59 003 for VO only. Missouri and Illinois uses 16 08 298, 16 16 078 and 16 16 181 if SCADA control is needed (not for Illinois VO).
- For VO circuits, 120 V controller supply shall be no more than 1 span away from a lightly loaded transformer.

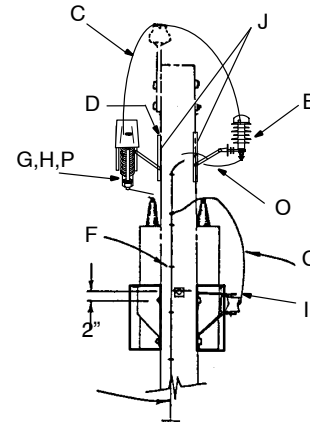
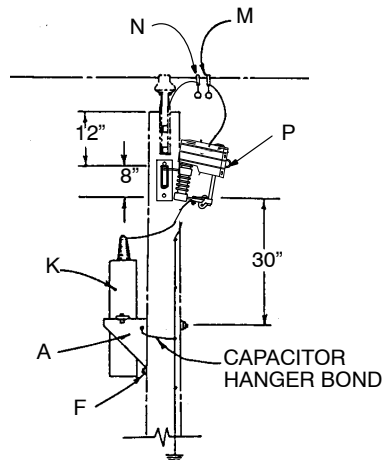
**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:DT
REV. NO: 5
REV. DATE: 01/01/2020



	<u>2.4kV</u>	<u>7.2kV</u>	<u>7.96kV</u>
50KVAR	01	03	
100KVAR	02	04	05



NOTES:

- Minimum clearance from the ground to the **bottom of the capacitor rack** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
- Connect wires to terminal strips in the junction box and capacitor control according to the color code chart in the schematic. Wiring colors may vary, and connect in junction box by its function (trip, close, 120V, neutral)
- Capacitor bank locations should be bucket truck accessible. If an exception is made and they are not, the control cable may be placed in conduit on standoff brackets if necessary. See DCS 14 02 02 ** for material.

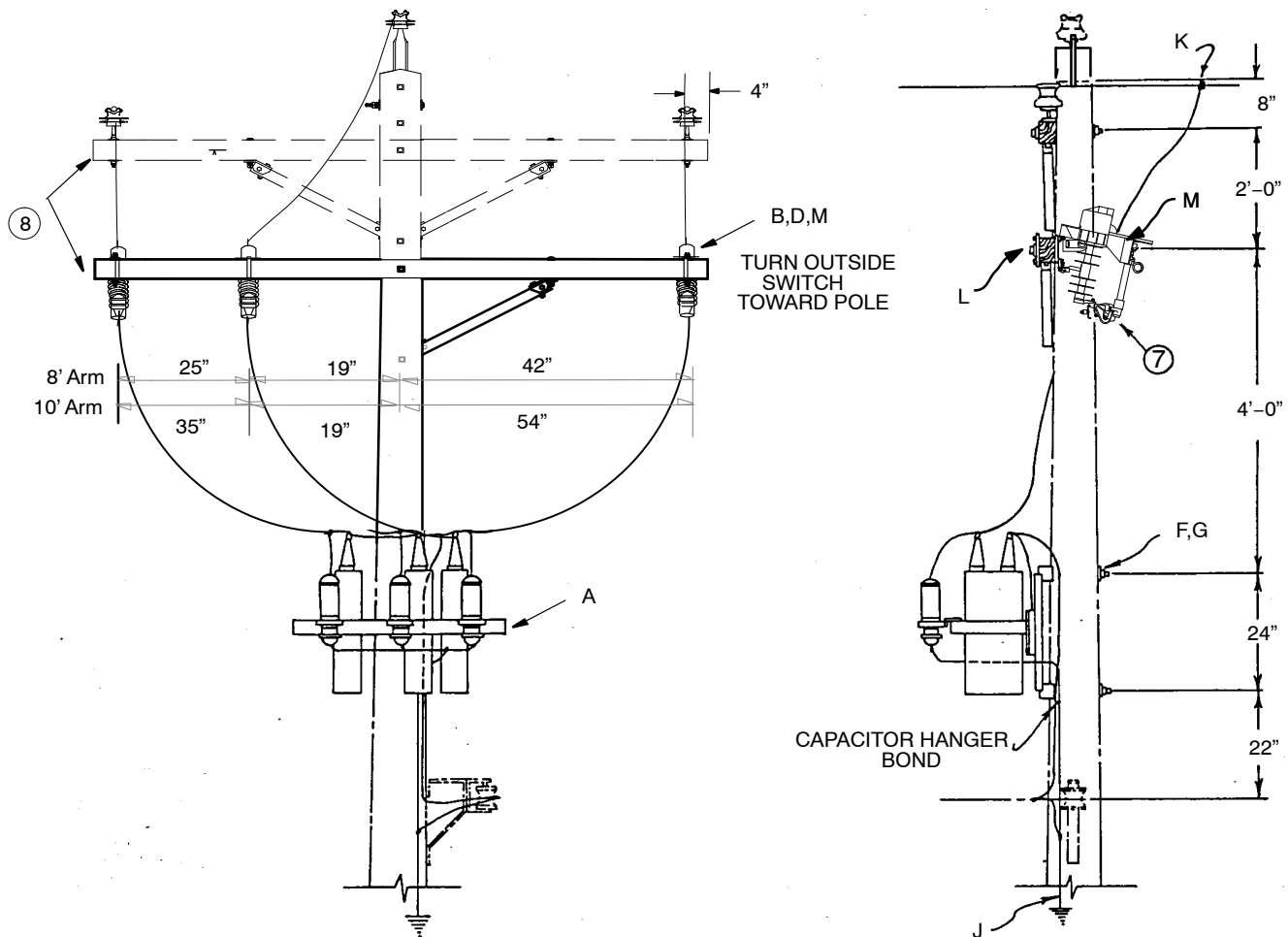
CAPACITORS AND REGULATORS

Fixed Capacitor Installation
One Phase 2.4, 7.2, & 7.96 kV

16 15 01 **

Sheet 2 of 2

		Std. / Stk. No.	Description	16 15 01 **	01	02	03	04	05
	A	69 11 002	Capacitor, Hanger		1	1	1	1	1
	B	10 01 133	Arrester, Lightning, 3kV		1	1			
		10 01 144	Arrester, Lightning, 10kV				1	1	1
	C	18 51 025	#4 Wire, Riser, Poly Covered		10	10	10	10	10
	D	23 52 065	5/8" x 12" Machine Bolt		3	3	3	3	3
	E	23 66 027	Washer, Galv, 11/16" Square		3	3	3	3	3
	F	23 60 011	5/8" x 5" Lag Screw		1	1	1	1	1
	G	54 07 208	Switch, Fuse 100A, 15kV		1	1	1	1	1
	H	20 53 089	Link, Fuse 25T		1				
		20 53 097	Link, Fuse 50K			1			
		20 53 084	Link, Fuse 12T				1		
		20 53 085	Link, Fuse 15T					1	1
	I	06 01 01 03	Clevis Extension Bracket		1	1	1	1	1
	J	23 06 127	Bracket, Switch, Fiberglass		2	2	2	2	2
		69 11 030	Cap, 2.4kV, 50 KVAR		1				
		69 11 044	Cap. 2.4kV, 100KVAR			1			
	K	69 11 029	Cap. 7.2 kV, 50 KVAR				1		
		69 11 043	Cap. 7.2kV, 100 KVAR					1	
		69 11 069	Cap. 7.96 kV, 100 KVAR						1
7@	L	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1
		12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1
@	M	HLC*W	Clamp, Hot Line		1	1	1	1	1
@	N	PG*	Clamp, Parallel Groove See Std. 07 00 25 00		1	1	1	1	1
		HLC*W	Clamp, Hot Line		1	1	1	1	1
	O	18 51 021	Wire, Cu, #6 SD., Poly Covered		2	2	2	2	2
	P	05 15 10 01	Cover – Cutout		1	1	1	1	1



CAPACITORS AND REGULATORS

Fixed Capacitor Installation

2.4 – 14.4kV Three Phase

16 15 02 **

Sheet 2 of 2

	Std. / Stk. No.	Description	16 15 02 **							
			4kV		12kV		13.8kV		14.4kV	
			01	02	03	04	05	06	07	08
A	69 11 055	Cap. Fix, 300 kVAR 4kV	1							
	69 11 057	Cap. Fix, 600 kVAR 4kV		1						
	69 11 061	Cap. Fix, 300 kVAR 12kV			1					
	69 11 062	Cap. Fix, 600 kVAR 12kV				1				
	69 11 073	Cap. Fix, 300 kVAR 13.8kV					1			
	69 11 072	Cap. Fix, 600 kVAR 13.8kV						1		
	69 11 085	Cap Fix 300 kVAR 14.4kV							1	
	69 11 083	Cap Fix 600 kVAR 14.4kV								1
B	54 07 208	Switch, Fuse 100A, 15kV	3	3	3	3	3	3	3	3
C	18 51 025	Wire, #4 Riser	24	24	24	24	24	24	24	24
D	20 53 088	Link, Fuse 40T	3							
	20 53 200	Link, Fuse 80T		3						
	20 53 085	Link, Fuse 15T			3					
	20 53 087	Link, Fuse 30T				3				
	20 53 089	Link, Fuse 25T						3		3
	20 53 084	Link, Fuse 12T					3		3	
E	23 60 007	Screw, Lag 1/2" x 4"	2	2	2	2	2	2	2	2
F	23 52 095	Bolt, Mach. 3/4" x 10"	2	2	2	2	2	2	2	2
G	23 66 031	Washer, Curved 3/4"	2	2	2	2	2	2	2	2
H	04 00 20 02	Crossarm w/Brace, 8'	1	1	1	1	1	1	1	1
	04 00 20 03	Crossarm w/Brace, 10'	1	1	1	1	1	1	1	1
J	12 00 10 02	Grounding Unit – Ground Rod	1	1	1	1	1	1	1	1
	12 00 10 01	Grounding Unit – Ground Coil	1	1	1	1	1	1	1	1
K	PG*	Clamp, Parallel Groove – See 07 00 25 00	3	3	3	3	3	3	3	3
	HLC*W	Clamp, Hot Line	3	3	3	3	3	3	3	3
L	17 58 054	Bracket, Switch, Arrester	3	3	3	3	3	3	3	3

NOTES:

- Minimum clearance from the ground to the **bottom of the capacitor rack** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
- Connect wires to terminal strips in the junction box and capacitor control according to the color code chart in the schematic. Wiring colors may vary, Connect in junction box by its function (trip, close, 120V, neutral)
- Capacitor bank locations should be bucket truck accessible. If an exception is made and they are not, the control cable may be placed in conduit on standoff brackets if necessary. See DCS 14 02 02 ** for material.
- Loadbreak tool, Stock No. 87 38 045, must be used to operate switches.
- Ameren IL must use 2 – 10" crossarms.

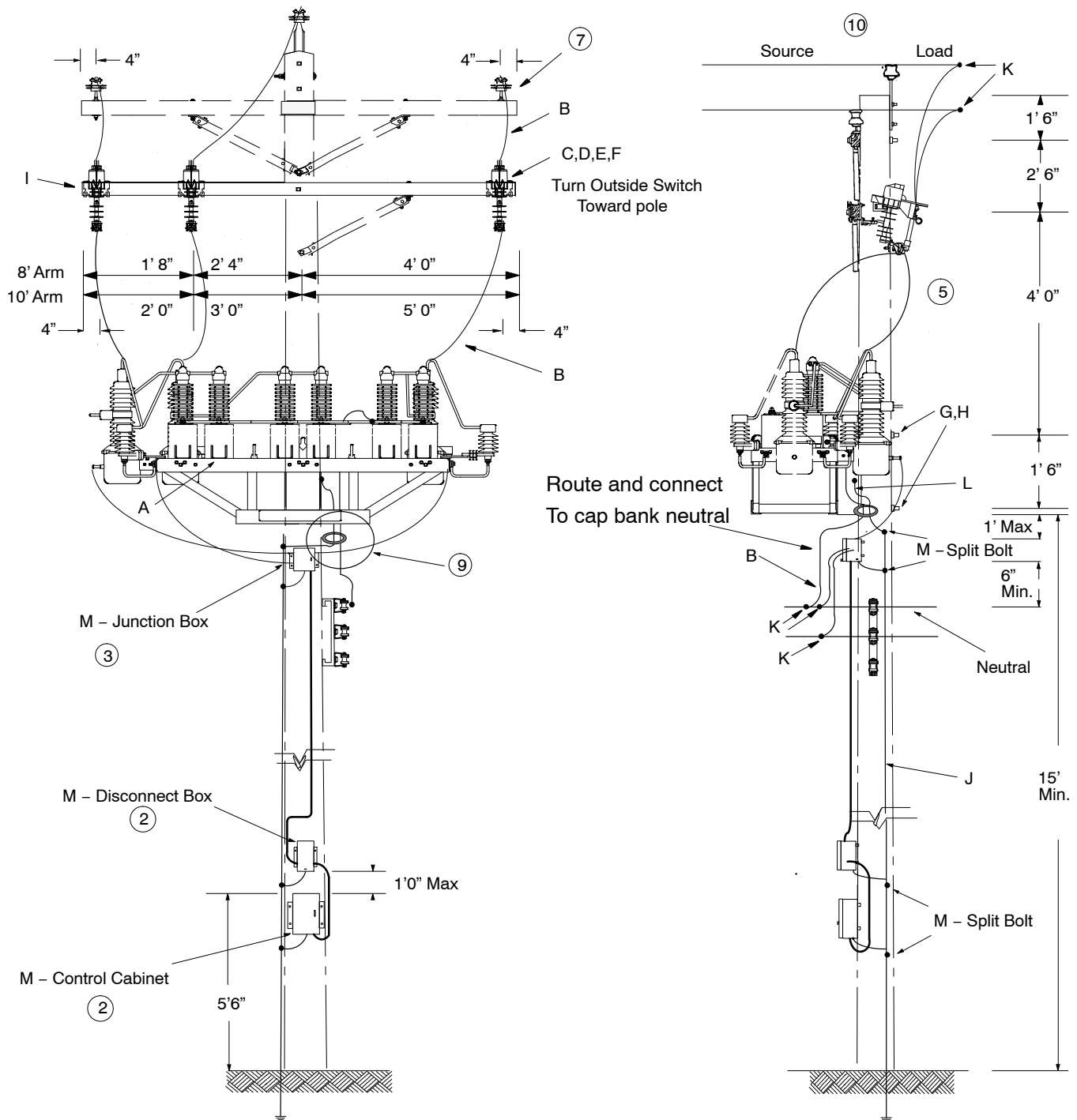
CAPACITORS AND REGULATORS

Switched Capacitor Installation – Communicating

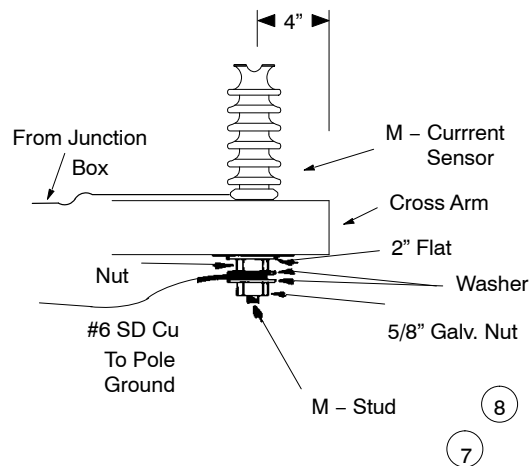
For 14.4 kV Systems and Below

16 15 03 **

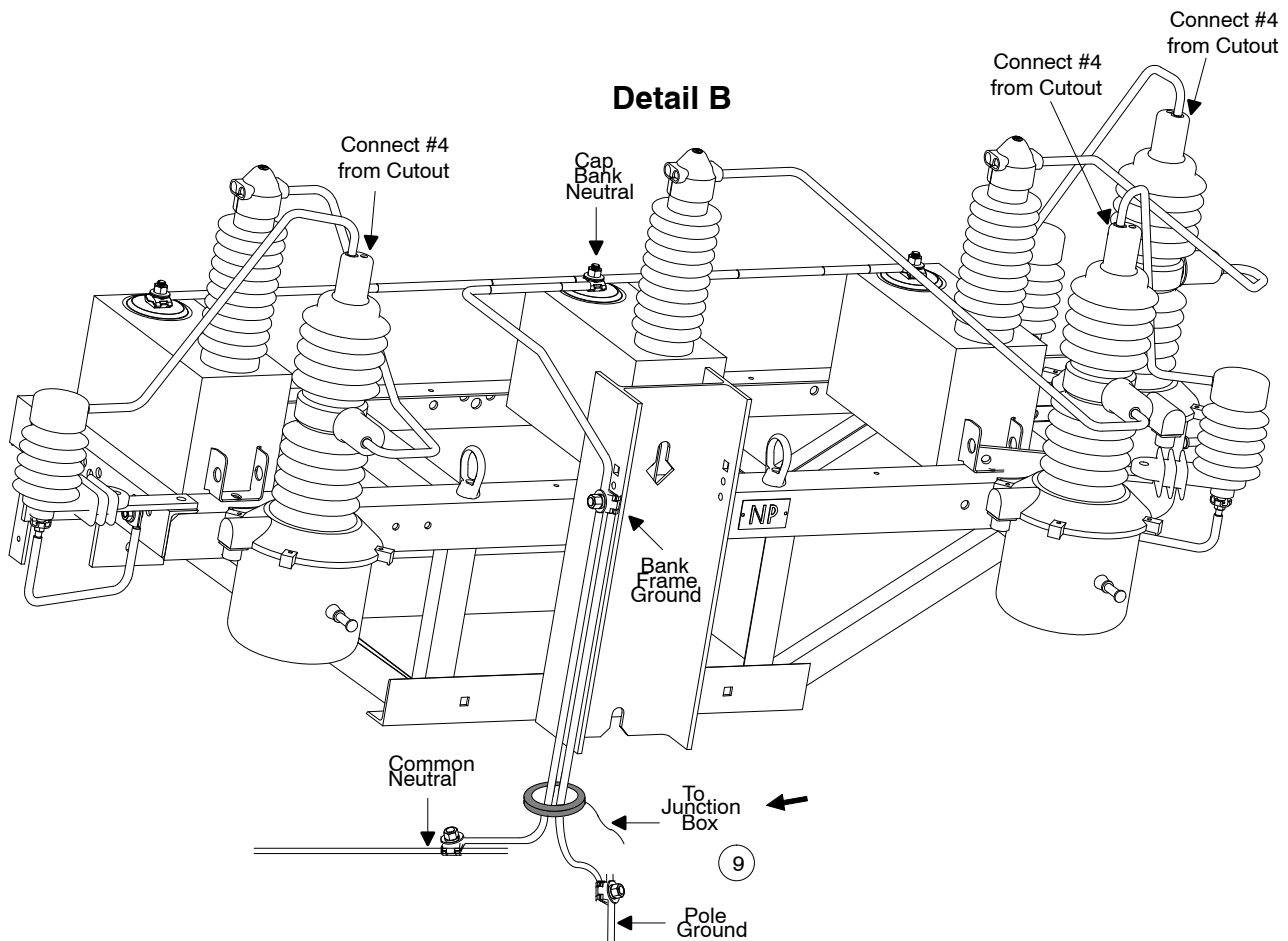
Sheet 1 of 4



Detail A



Detail B



CAPACITORS AND REGULATORS
Switched Capacitor Installation – Communicating
For 14.4 kV Systems and Below

16 15 03 **

Sheet 3 of 4

	Std. / Stk. No.	Description	16 15 03 **	4kV		12kV			13.8kV			13.2kV		14.4kV	
				01	02	03	04	05	06	07	08	11	12	09	10
A	69 11 031	Cap. Sw. 300 kVAR 4kV		1											
	69 11 036	Cap. Sw. 600 kVAR 4kV			1										
	69 11 019	Cap. Sw. 300 kVAR 12kV				1									
	69 11 032	Cap. Sw. 600 kVAR 12kV					1								
	69 11 058	Cap. Sw. 1200 kVAR 12kV						1							
	69 11 086	Cap. Sw. 300 kVAR 13.8kV							1						
	69 11 071	Cap. Sw. 600kVAR 13.8kV								1					
	69 11 074	Cap. Sw. 1200kVAR 13.8kV									1				
	69 11 084	Cap. Sw. 300 kVAR 14.4kV												1	
	69 11 077	Cap. Sw. 600kVAR 14.4kV													1
	69 11 226	Cap. Sw. 600 kVAR 13.2kV										1			
	69 11 225	Cap. Sw. 1200 kVAR 13.2kV											1		
B	18 51 025	Wire, #4 Cu Poly,Riser		24	24	24	24	24	24	24	24	24	24	24	24
C	54 07 208	Switch, Fuse, 100A, 15kV		3	3	3	3	3	3	3	3	3	3	3	3
D	17 58 054	Bracket, Switch, Arrester		3	3	3	3	3	3	3	3	3	3	3	3
E	05 15 10 01	Cover – Cutout		3	3	3	3	3	3	3	3	3	3	3	3
F	20 53 088	Link, Fuse 40T		3							3				
	20 53 200	Link, Fuse 80T			3										
	20 53 085	Link, Fuse 15T				3									
	20 53 087	Link, Fuse 30T					3					3			
	20 53 090	Link, Fuse 65T						3					3		
	20 53 084	Link, Fuse 12T							3					3	
	20 53 089	Link, Fuse 25T								3					3
G	23 52 095	Bolt, Mach. 3/4" x 10"		2	2	2	2	2	2	2	2	2	2	2	2
H	23 66 031	Washer, Curved 3/4"		2	2	2	2	2	2	2	2	2	2	2	2
@	I 04 00 20 02	Crossarm, w/ Brace 8'		1	1	1	1	1	1	1	1	1	1	1	1
	04 00 20 03	Crossarm, w/ Brace 10'		1	1	1	1	1	1	1	1	1	1	1	1
@6	J 12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1	1	1	1	1	1	1	1
	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1	1	1	1	1	1	1	1
@	K PG*	Clamp, Parallel Groove See 07 00 25 00		6	6	6	6	6	6	6	6	6	6	6	6
	HLC*W	Clamp, Hot Line		3	3	3	3	3	3	3	3	3	3	3	3
L	18 51 021	Wire, Cu, #6 S.D., Poly Covered		10	10	10	10	10	10	10	10	10	10	10	10
@	M 16 00 24 **	Control, Capacitor, Time, Temp Volt-age		1	1	1	1	1	1	1	1	1	1	1	1
	16 00 26 **	Control, Capacitor, Current or VAR		1	1	1	1	1	1	1	1	1	1	1	1

NOTES:

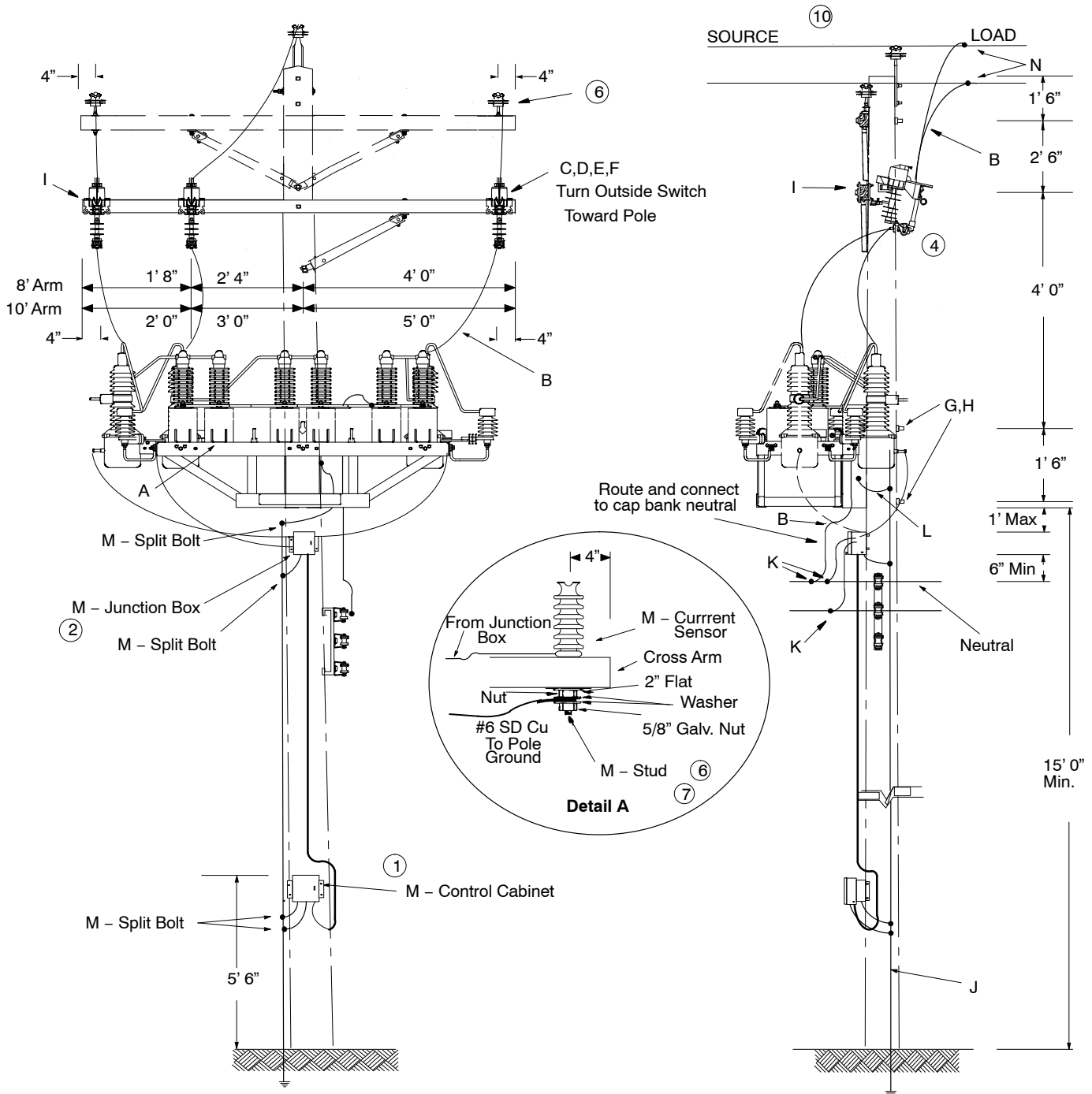
- 1..Minimum clearance from the ground to the **bottom of the capacitor rack** shall be 15 feet.
- 2..Clearance from the ground to the **top of the control cabinet** should be 5' 6" from the ground. The bottom of disconnect box shall be installed 1' max above the top of control cabinet. The next hand or foot hold shall be 8' or greater above the top of the disconnect box.
- 3..The top of the junction box shall be mounted a maximum of 1' below the capacitor bank frame. Leads to the capacitor switches shall be secured to the frame of the bank with wire ties. The junction box/meter socket kit includes 35' of pre-wired liquid-tight conduit. The liquid-tight must be stapled every 2'. Excess liquid-tight shall be coiled and secured to the pole between the junction box and the disconnect box.
- 4..For capacitor bank wiring diagram, refer to DCS 16 00 05 00. For capacitor control wiring diagram with current sensor, refer to DCS 16 00 26 **. For capacitor control wiring diagram without current sensor, refer to DCS 16 00 24 **.
- 5..Loadbreak tool, Stock No. 83 38 028, must be used to open cutout switches. Capacitor bank oil/vacuum switches should be primary method used to operate bank.
- 6..With new pole installation, refer to DCS 12 00 10 01 with ground coil.
- 7..For installations with a current sensor, the current sensor will be installed in place of an insulator, the current sensor stud shall be bonded to pole ground and the sensor cable shall be secured with a staple, refer to **detail A**.
- 8..Low voltage wires from line post current sensor should be connected in the junction box on the bank before the primary wire is energized on the sensor. However, if the primary on the sensor is energized, the sensor wires are safe to connect (low output current and voltage).
- 9..**Neutral current sensor output can reach 40V if sensor wires are not terminated when current is present on wires routed through sensor.** Neutral current sensors are not required on all cap banks. (ie. delta wired banks) For material and connection in the junction box; for installations without current sensor refer to DCS 16 00 24 **, with current sensor refer to DCS 16 00 26 **. The neutral current sensor, if equipped, shall be mounted between the bank and the connections between system neutral and pole ground and secured with a staple above and below to the ground wires passing through the sensor. The wire between the capacitor bank neutral and system neutral and the capacitor bank frame ground wire must pass through the center of the sensor (thereby capturing all of the ground current in the wires from the bank). If a 1kVA transformer is installed on the cap bank frame, the ground and neutral wires from the transformer must also pass through the neutral current sensor. If transformer is mounted on pole, the transformer neutral and ground wires do not need to be routed through sensor unless it's ground connection is made between sensor and cap bank frame. Run sensor cable and terminate to the junction box. **See Detail B.**
- 10..Capacitor control settings or SCADA may require source and load to be reversed from configuration shown for current or VAR controlled schemes.
- 11..The junction box, disconnect box, capacitor rack, capacitor control, and current sensor, if equipped, must be connected to pole ground.
- 12..If a 120V voltage source for the controller is not available from the circuit the capacitor bank is being installed on, refer to DCS 16 15 05 01 for 1 kVA transformer installation.

CAPACITORS AND REGULATORS

Switched Capacitor Installation– Non Communicating

14.4 kV Systems and Below

16 15 04 **
Sheet 1 of 3



CAPACITORS AND REGULATORS
Switched Capacitor Installation– Non Communicating
14.4 kV Systems and Below

16 15 04 **
Sheet 2 of 3

	Std. / Stk. No.	Description	16 15 04 **	4kV		12kV			13.2kV		13.8kV			14.4kV	
				01	02	03	04	05	11	12	06	07	08	09	10
A	69 11 031	Cap. Sw. 300 kVAR 4kV		1											
	69 11 036	Cap. Sw. 600 kVAR 4kV			1										
	69 11 019	Cap. Sw. 300 kVAR 12kV				1									
	69 11 032	Cap. Sw. 600 kVAR 12kV					1								
	69 11 058	Cap. Sw.1200 kVAR 12kV						1							
	69 11 086	Cap. Sw. 300 kVAR 13.8kV									1				
	69 11 071	Cap. Sw. 600 kVAR 13.8kV										1			
	69 11 074	Cap. Sw.1200 kVAR 13.8kV											1		
	69 11 084	Cap. Sw. 300 kVAR 14.4kV												1	
	69 11 077	Cap. Sw. 600 kVAR 14.4kV													1
	69 11 226	Cap. Sw. 600 kVAR 13.2kV							1						
	69 11 225	CAP. Sw.1200 kVAR 13.2kV								1					
B	18 51 025	Wire, #4 Riser, Poly Covered		24	24	24	24	24	24	24	24	24	24	24	24
C	54 07 208	Switch, Fuse 100A, 15kV		3	3	3	3	3	3	3	3	3	3	3	3
D	17 58 054	Bracket, Switch		3	3	3	3	3	3	3	3	3	3	3	3
E	05 15 10 01	Cover, Cutout		3	3	3	3	3	3	3	3	3	3	3	3
F	20 53 088	Link, Fuse, 40T		3									3		
	20 53 200	Link, Fuse 80T			3										
	20 53 085	Link, Fuse 15T				3									
	20 53 087	Link, Fuse 30T					3		3						
	20 53 090	Link, Fuse 65T						3		3					
	20 53 084	Link, Fuse 12T									3			3	
	20 53 089	Link, Fuse 25T										3			3
G	23 52 095	Bolt, Mach., 3/4" x 10"		2	2	2	2	2	2	2	2	2	2	2	2
H	23 66 031	Washer, Curved 3/4"		2	2	2	2	2	2	2	2	2	2	2	2
I	04 00 20 02	Crossarm, w / Brace 8'		1	1	1	1	1	1	1	1	1	1	1	1
	04 00 20 03	Crossarm, w / Brace 10'		1	1	1	1	1	1	1	1	1	1	1	1
J	12 00 10 02	Grounding Unit – Ground Rod		1	1	1	1	1	1	1	1	1	1	1	1
	12 00 10 01	Grounding Unit – Ground Coil		1	1	1	1	1	1	1	1	1	1	1	1
K	PG*	Clamp, Parallel Groove (See 07 00 25 00)		3	3	3	3	3	3	3	3	3	3	3	3
L	18 51 021	Wire, Cu., #6 S.D., Ploy Covered		25	25	25	25	25	25	25	25	25	25	25	25
M	16 00 20 01	Control, Capacitor, Current or Var for Non –Comm		1	1	1	1	1	1	1	1	1	1	1	1
	16 00 18 01	Control, Capacitor, Time, Temp or Voltage for Non– Comm		1	1	1	1	1	1	1	1	1	1	1	1
N	PG*	Clamp, Parallel Groove (See 07 00 25 00)		3	3	3	3	3	3	3	3	3	3	3	3
	HLC*W	Clamp, Hot Line – DCS 07 00 21 00		3	3	3	3	3	3	3	3	3	3	3	3

NOTES:

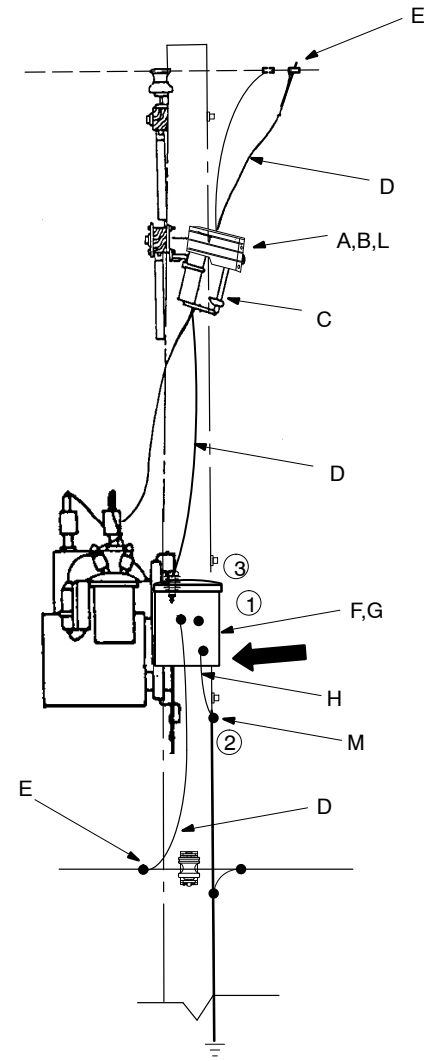
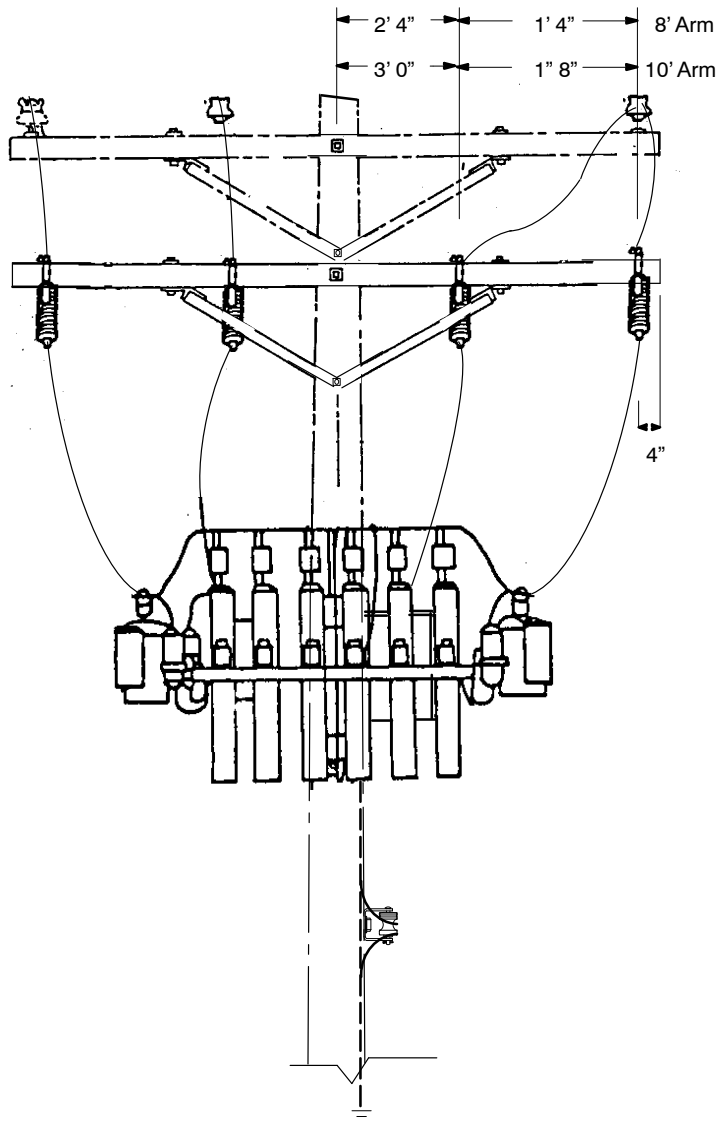
1. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground. The next hand or foot hold shall be 8' or greater above the control cabinet.
2. The top of the junction box shall be mounted a maximum 1' below the capacitor bank frame. Leads to the capacitor switches shall be secured to the frame of the bank with wire ties. The junction box/meter socket kit includes 25' of pre-wired liquid-tight conduit. The liquid-tight must be stapled every 2'. Excess liquid-tight shall be coiled and secured to the pole between the junction box and the control cabinet.
3. For capacitor bank wiring diagram, refer to DCS 16 00 05 00. For capacitor control wiring diagram with current sensor, refer to DCS 16 00 20 01. For capacitor control wiring diagram without current sensor, refer to DCS 16 00 18 01.
4. Loadbreak tool, Stock No. 83 38 028, must be used to operate switches. Capacitor bank oil/vacuum switches should be primary method used to operate bank.
5. With new pole installation, refer to DCS 12 00 10 01 with ground coil.
6. For installations with current sensors, the current sensor will be installed in place of an insulator, the current sensor stud shall be bonded to pole ground and the sensor cable shall be secured with a staple, refer to **detail A**.
7. Low voltage wires from sensor should be connected in the junction box on the bank before the primary wire is energized on the sensor. However, if the primary on the sensor is energized, the sensor wires are safe to connect (low output current and voltage).
8. The capacitor control, meter socket, junction box, capacitor rack and current sensor, if equipped, shall be bonded to pole ground.
9. If a 120V voltage source for the controller is not available from the circuit the capacitor bank is being installed on, refer to DCS 16 15 05 01 for 1 kVA transformer installation.
10. When equipped with a line post current sensor, settings may require the source and load to be reverse from what is shown. VAR controlled schemes normally require the current sensor to be on the source side of the bank (as shown) while current controlled schemes normally require the current sensor to be on the load side of the bank.

CAPACITORS AND REGULATORS

Installation of 1kVA Transformer On Capacitor Bank

16 15 05 01

Sheet 1 of 2



CAPACITORS AND REGULATORS
Installation of 1kVA Transformer
On Capacitor Bank

16 15 05 01

Sheet 2 of 2

		Std. / Stk. No.	Description	16 15 05	01
@ @	A	54 07 208	Switch, Fuse, 100A, 15kV		1
	B	17 58 054	Bracket, Switch, Arrester		1
	C	20 53 197	Link, Fuse, ¾ Amp type X		1
	D	18 51 025	Wire, #4 Riser (ft)		16
	E	PG*	Clamp, Parallel Groove see 07 00 25 00		2
	F	MK0001F	Transformer, 7200V, 1kVA		1
		SK0001F	Transformer, 7620V, 1kVA		1
	G	23 52 049	Bolt, Mach., 5/8"x2"		2
	H	18 52 019	Wire, #6 CU., Bare, SD, (ft)		6
	K	40 59 156	Tie, Nylon, Black		3
	L	05 15 10 01	Cover, Cutout		1
	M	17 54 003	Connector, Split Bolt		1

NOTES:

1. Typical mounting location is shown. Transformer may be mounted in other positions where mounting holes are provided..
2. The transformer shall have two ground connections; one ground connection should be between the transformer ground and pole ground and one should be between X2 and the system neutral. The transformer shall have a ground strap between X2 and transformer ground. The capacitor bank shall have a ground between the capacitor rack and pole ground, the capacitor bank neutral should connect to the system neutral.
3. 120V wiring goes from transformer to junction box mounted on pole below bank. Connect to transformer secondary bushing with minimum conductor size of #6 copper. Secure wire to frame of capacitor bank.

Sheet 1 of 2

CAPACITORS AND REGULATORS
 Spacer Cable – Fixed Capacitor Installation
 2.4 – 13.8kV Three Phase

16 20 01 **
 Sheet 2 of 2

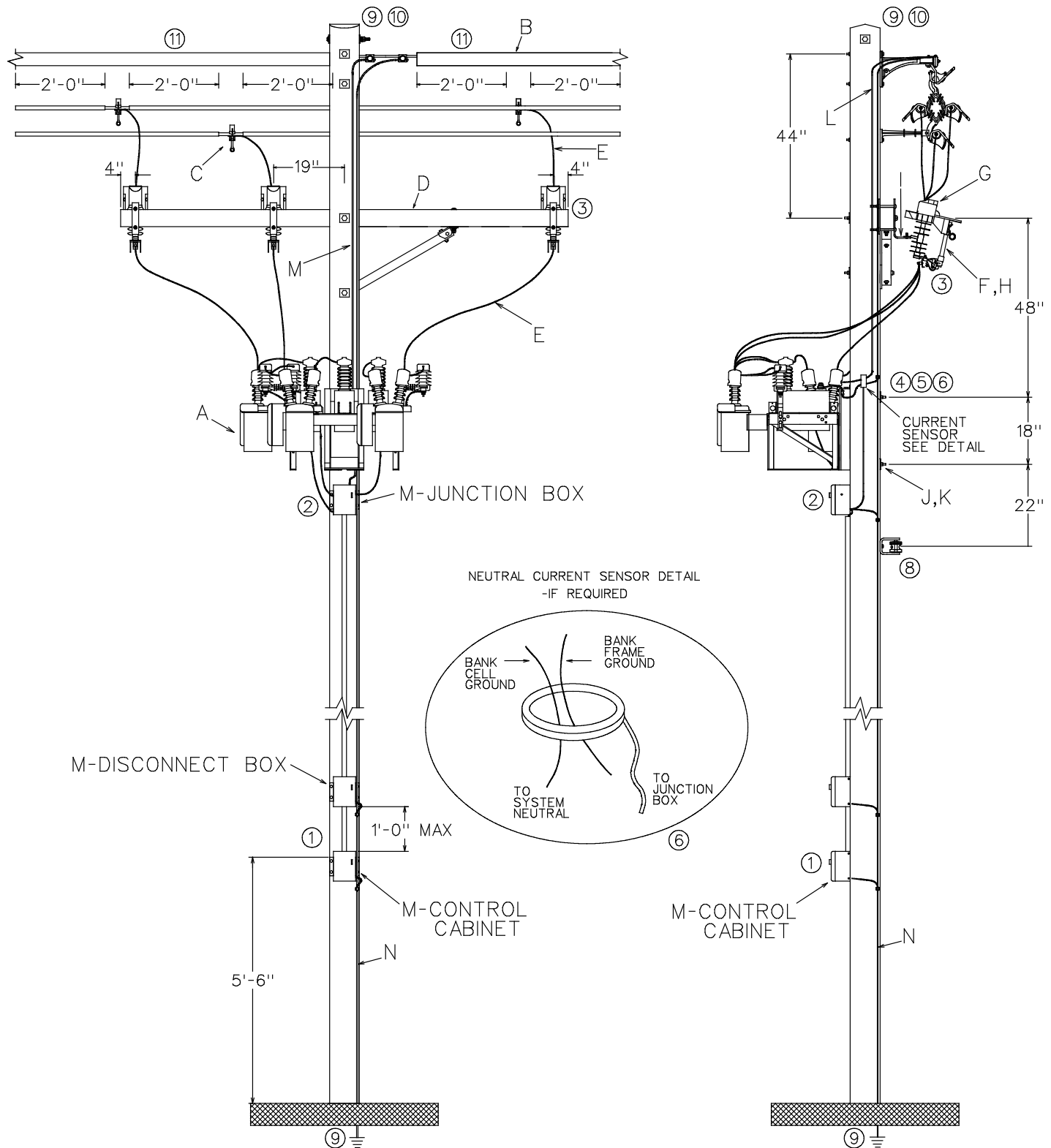
		Std./ Stk. No.	Description	16 20 01 **		4kV		12kV		13.8kV	
						01	02	03	04	05	06
1	A	69 11 055	Cap, Fix, 300 KVAR, 4KV			1					
		69 11 057	Cap, Fix, 600 KVAR, 4KV				1				
		69 11 061	Cap, Fix, 300 KVAR, 12KV					1			
		69 11 062	Cap, Fix, 600 KVAR, 12KV						1		
		69 11 073	Cap, Fix, 300 KVAR, 13.8KV							1	
		69 11 072	Cap, Fix, 600 KVAR, 13.8KV								1
6	B	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)			2	2	2	2	2	2
@	C	17 62 088	Clamp, Hot Line 1/0 Through 477 Spacer Cable			3	3	3	3	3	3
		17 62 143	Clamp, Hot Line, 795 Spacer Cable			3	3	3	3	3	3
	D	04 00 20 03	Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace)			1	1	1	1	1	1
2	E	54 07 208	Switch, Fuse, 100A, 15kV			3	3	3	3	3	3
	F	05 15 10 01	Cover – Cutout			3	3	3	3	3	3
	G	20 53 088	Link, Fuse, 40T			3					
		20 53 200	Link, Fuse, 80T				3				
		20 53 085	Link, Fuse, 15T					3			
		20 53 087	Link, Fuse, 30T						3		
		20 53 084	Link, Fuse, 12T							3	
		20 53 089	Link, Fuse, 25T								3
	H	17 58 054	Bracket, Switch, Arrester			3	3	3	3	3	3
	I	23 52 219	Bolt, Machine, 3/4" x 14"			2	2	2	2	2	2
	J	23 66 031	Washer, NM, Curved, 3/4"			2	2	2	2	2	2
@, 3	K	12 00 10 02	Grounding Unit, 7#10 Copperweld With Ground Rod			1	1	1	1	1	1
5	L	18 51 025	Wire, #4 Cu. Poly			34	34	34	34	34	34
@, 4	M	03 01 01 **	Neutral Configuration								

CAPACITORS AND REGULATORS

15kV & Below - Spacer Cable - 300 kVAR to 1200 kVAR
For Time, Temp., Voltage or Communicating Type Controls

16 20 05 **

Sheet 1 of 3



CAPACITORS AND REGULATORS
15kV & Below – Spacer Cable – 300 kVAR to 1200 kVAR
For Time, Temp., Voltage or Communicating Type Controls

16 20 05 **

Sheet 2 of 3

		Std./ Stk. No.	Description	16 20 05 **	4kV		12kV			13.8kV		
					01	02	03	04	05	06	07	08
7	A	69 11 031	Cap, Switched, 300 kVAR, 4kV		1							
		69 11 036	Cap, Switched, 600 kVAR, 4kV			1						
		69 11 019	Cap, Switched, 300 kVAR, 12kV				1					
		69 11 032	Cap, Switched, 600 kVAR, 12kV					1				
		69 11 058	Cap, Switched, 1200 kVAR, 12kV						1			
		69 11 086	Cap, Switched, 300 kVAR, 13.8kV							1		
		69 11 071	Cap, Switched, 600 kVAR, 13.8kV								1	
		69 11 074	Cap, Switched, 1200 kVAR, 13.8kV									1
11	B	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		2	2	2	2	2	2	2	2
@	C	17 62 088	Clamp, Hot Line 1/0 Through 477 Spacer Cable		3	3	3	3	3	3	3	3
		17 62 143	Clamp, Hot Line, 795 Spacer Cable		3	3	3	3	3	3	3	3
	D	04 00 20 03	Crossarm, Sgl., Wood, 10' (use only ½ of V-Brace)		1	1	1	1	1	1	1	1
	E	18 51 025	Wire, #4 Cu. Poly		24	24	24	24	24	24	24	24
	F	54 07 208	Switch, Fuse, 100A, 15kV		3	3	3	3	3	3	3	3
	G	05 15 10 01	Cover – Cutout		3	3	3	3	3	3	3	3
	H	20 53 088	Link, Fuse, 40T		3							3
		20 53 200	Link, Fuse, 80T			3						
		20 53 085	Link, Fuse, 15T				3					
		20 53 087	Link, Fuse, 30T					3				
		20 53 090	Link, Fuse, 65T						3			
		20 53 089	Link, Fuse, 12T							3		
		20 53 084	Link, Fuse, 25T								3	
	I	17 58 054	Bracket, Switch, Arrester		3	3	3	3	3	3	3	3
	J	23 52 219	Bolt, Machine, 3/4" x 14"		2	2	2	2	2	2	2	2
	K	23 66 031	Washer, NM, Curved, 3/4"		2	2	2	2	2	2	2	2
	L	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)		15	15	15	15	15	15	15	15
@ 5,6,7	M	16 00 24 **	Control, Capacitor		1	1	1	1	1	1	1	1
@ 9	N	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1	1	1	1	1	1	1

NOTES:

1. Clearance from ground to the top of the control cabinet shall be 5'-6" from the ground, and the bottom of the disconnect box has to be installed 1'-0" max above the top of the control cabinet, but the next hand or foot hold shall be 8' or greater above the disconnect box.
2. The junction box shall be mounted either on the capacitor bank frame or 1' to 2' below the capacitor bank frame. Leads to the bank switches shall be secured to the frame of the bank with wire ties.
3. Loadbreak tool, Stock No. 87 38 045 must be used to open switches.
4. Connect neutral ground to the bus of the neutral bushings of the capacitor and extend up the pole to the messenger / system neutral.
5. For wiring diagram, see DCS 16 00 05 00.

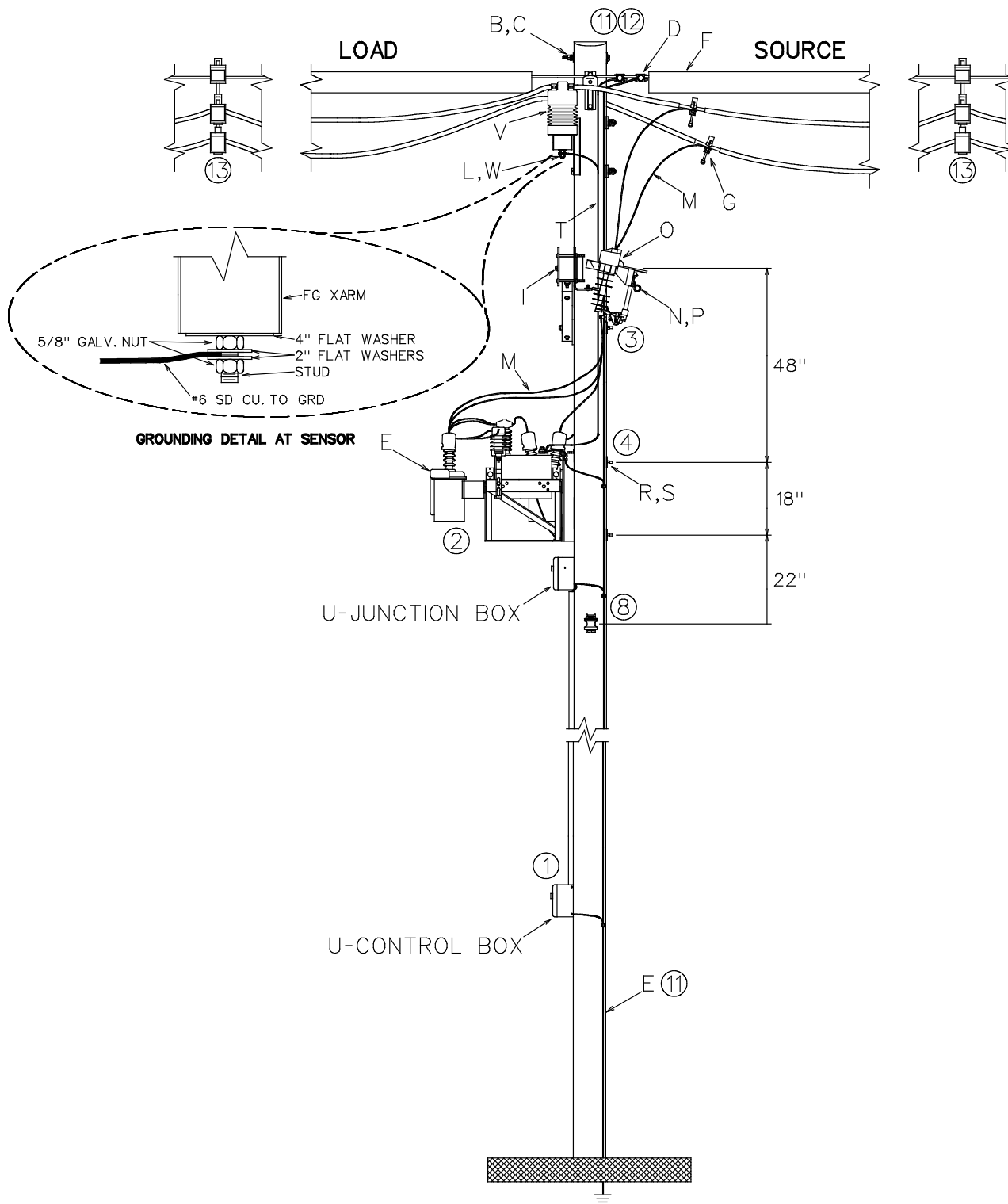
6. Neutral current sensor is not included on all models. Refer to DCS 16 00 24 ** for material and connection in the junction box. The neutral current sensor shall be mounted as shown on the drawing above. Both ground wires from the bank must pass through the center of the sensor. The sensor shall be located on the ground wires between the bank and their connection to the distribution system neutral (thereby capturing all of the ground current in the wires from the bank), and secured with a staple above and below to the ground wires passing through the sensor. (If a 1kVA transformer is installed on the bank, the two ground wires from the transformer must also pass through the neutral current sensor). Run sensor cable and terminate to the junction box.
7. Capacitor banks have a “C” order point, and have at least 16 weeks lead time.
8. Secondary location if present. Connect secondary neutral to pole ground.
9. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
10. Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground using #2 poly covered ground wire (18 51 019). The capacitor neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.
11. Stagger taps and other areas where the covering has been removed to provide a minimum 2’-0” horizontal separation between the opening and another opening or ground point. Install line duc over the messenger anywhere the cable covering is stripped to maintain the required 2’-0” of horizontal separation.

CAPACITORS AND REGULATORS

Switched Capacitor Installation 2.4-13.8kV Three Phase
Non-Communicating Current or VAR Type Controls

16 20 10 **

Sheet 1 of 4



Switched Capacitor Installation 2.4-13.8kV Three Phase Non-Communicating Current or VAR Type Controls

Sheet 2 of 4



ENG: JWC
REV. NO: 1
REV. DATE: 07/02/18

CAPACITORS AND REGULATORS

Switched Capacitor Installation 2.4-13.8kV Three Phase
Non-Communicating Current or VAR Type Controls

16 20 10 **

Sheet 3 of 4

		Std./ Stk. No.	Description	16 20 10 **	4kV		12kV			13.8kV		
					01	02	03	04	05	06	07	08
5,7,10	A	23 56 075	Bracket, Messenger		1	1	1	1	1	1	1	1
	B	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		3	3	3	3	3	3	3	3
	C	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick		4	4	4	4	4	4	4	4
	D	17 51 137	Connector, PG, Pole Ground to Messenger		2	2	2	2	2	2	2	2
	E	69 11 031	Cap, Switched, 300 kVAR, 4kV		1							
		69 11 036	Cap, Switched, 600 kVAR, 4kV			1						
		69 11 019	Cap, Switched, 300 kVAR, 12kV				1					
		69 11 032	Cap, Switched, 600 kVAR, 12kV					1				
		69 11 058	Cap, Switched, 1200 kVAR, 12kV						1			
		69 11 086	Cap, Switched, 300 kVAR, 13.8kV							1		
		69 11 071	Cap, Switched, 600 kVAR, 13.8kV								1	
		69 11 074	Cap, Switched, 1200 kVAR, 13.8kV									1
	F	69 58 293	Line Duc (Messenger Cover), Black. 8' Long (Each)		2	2	2	2	2	2	2	2
	G	17 62 088	Clamp, Hot Line 1/0 Through 477 Spacer Cable		3	3	3	3	3	3	3	3
		17 62 143	Clamp, Hot Line, 795 Spacer Cable		3	3	3	3	3	3	3	3
	H	04 00 41 16	Crossarm, Tangent, F/G, 10'		1	1	1	1	1	1	1	1
	I	04 00 20 03	Crossarm, Sgl., Wood, 10' (use only 1/2 of V-Brace)		1	1	1	1	1	1	1	1
	J	25 05 143	Insulator, Pin, 15kV, Vice-Top		2	2	2	2	2	2	2	2
	K	23 62 028	Pin, Insulator, Long Shank		2	2	2	2	2	2	2	2
	L	23 66 132	Washer, Flat, Sq., 4" x 4", with 13/16" hole		3	3	3	3	3	3	3	3
	M	18 51 025	Wire, #4 Cu. Poly		24	24	24	24	24	24	24	24
	N	54 07 208	Switch, Fuse, 100A, 15kV		3	3	3	3	3	3	3	3
	O	05 15 10 01	Cover - Cutout		3	3	3	3	3	3	3	3
	P	20 53 088	Link, Fuse, 40T		3							3
		20 53 200	Link, Fuse, 80T			3						
		20 53 085	Link, Fuse, 15T				3					
		20 53 087	Link, Fuse, 30T					3				
		20 53 090	Link, Fuse, 65T						3			
		20 53 084	Link, Fuse, 12T							3		
		20 53 089	Link, Fuse, 25T								3	
	Q	17 58 054	Bracket, Switch, Arrester		3	3	3	3	3	3	3	3
	R	23 52 219	Bolt, Machine, 3/4" x 14"		2	2	2	2	2	2	2	2
	S	23 66 031	Washer, NM, Curved, 3/4"		2	2	2	2	2	2	2	2
	T	18 51 019	Wire, #2 Cu. Poly Covered (Ft.)		15	15	15	15	15	15	15	15
9	U	16 00 20 01	Control, Capacitor		1	1	1	1	1	1	1	1
	V	69 11 297	Sensor, Current, 15kV w/o Control Cable		1	1	1	1	1	1	1	1
	W	23 64 034	Stud, Insulator, Line Post, 5/8" x 7"		1	1	1	1	1	1	1	1
@,11	X	12 00 10 **	Grounding Unit, 7#10 Copperweld		1	1	1	1	1	1	1	1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: JWC
REV. NO: 1
REV. DATE: 07/02/18

NOTES:

1. Minimum clearance from ground to the **top of the control cabinet** shall be minimum 5'6" from the ground, with the next hand or foot hold 8' or greater above the control cabinet.
2. The junction box shall be mounted either on the capacitor bank frame of 1' to 2' below the capacitor bank frame. Leads to the bank switches shall be secured to the frame of the bank with wire ties.
3. Loadbreak tool, Stock No. 87 38 045 must be used to operate switches
4. Connect neutral ground to the bus of the neutral bushings of the capacitor and extend up the pole to the messenger / system neutral.
5. For wiring diagram, see DCS 16 00 05 00.
6. Current sensor is not included on all models. Refer to DCS 16 00 20 ** for material and wire connections in the Junction box.
7. Capacitor banks have a "C" order point, and have at least 16 weeks lead time.
8. Secondary location if present. Connect secondary neutral to pole ground.
9. See grounding diagram for sensor. Low voltage wires from sensor should be connected in the junction box on the bank before the primary wire is energized on the sensor. However, if the primary on the sensor is energized, the sensor wires are safe to connect (low output current and voltage). Hand tie primary to sensor.
10. For VAR controlled banks, the source and load should be reversed from what is shown.
11. All poles with spacer cable should be installed with a properly sized pole ground for the equipment being installed. Add a pole ground if not already installed or not properly sized. Pole ground shall be extended up to the messenger which is system neutral and attached on the single switch side of the pole.
12. Note that the messenger also serves as the system neutral, so the high voltage neutral must extend from the neutral bushing up to the messenger separate from the pole ground using #2 poly covered ground wire (18 51 019). The capacitor neutral connection to the messenger shall be the furthest from the pole and separated from the pole ground connection as far as practical.

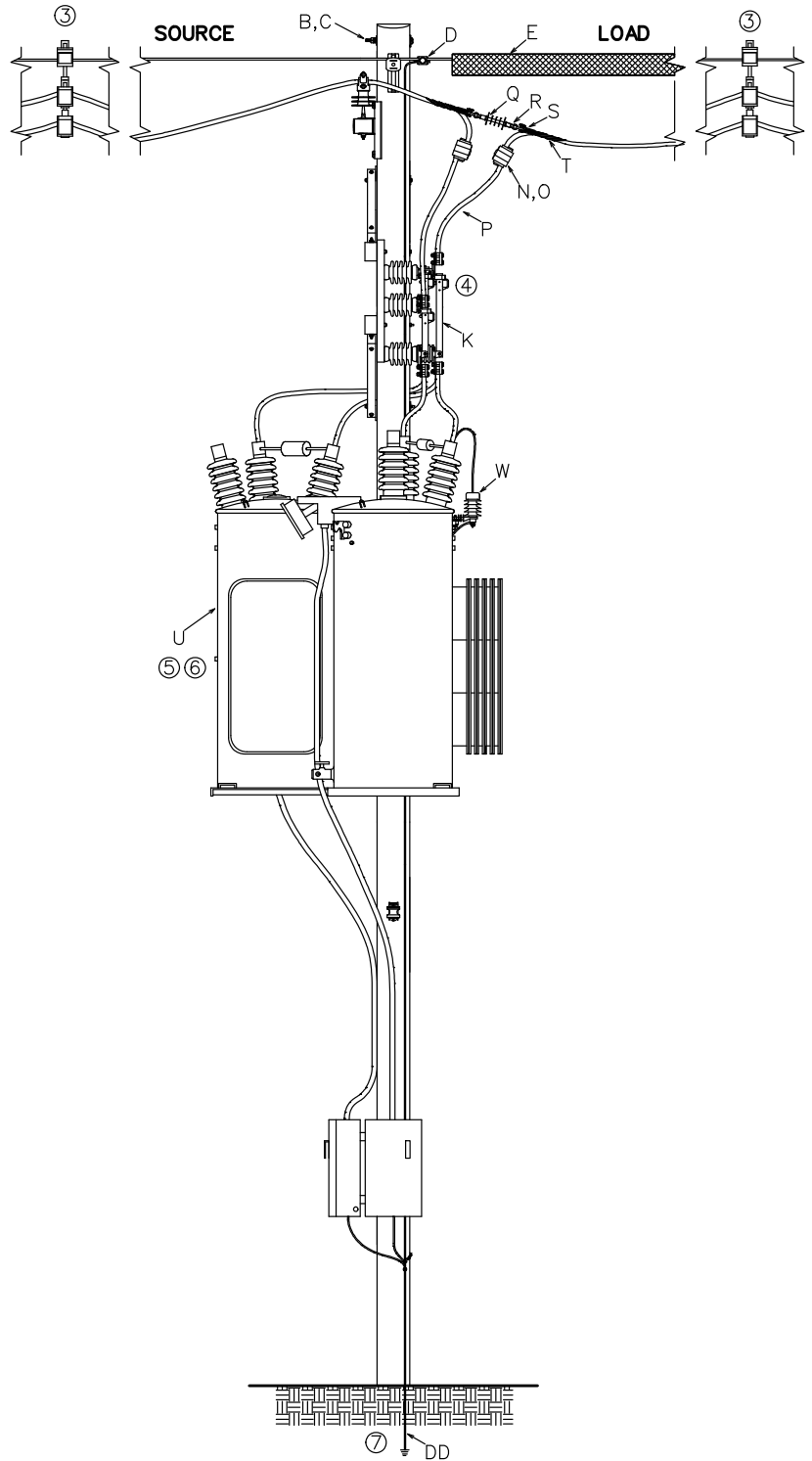
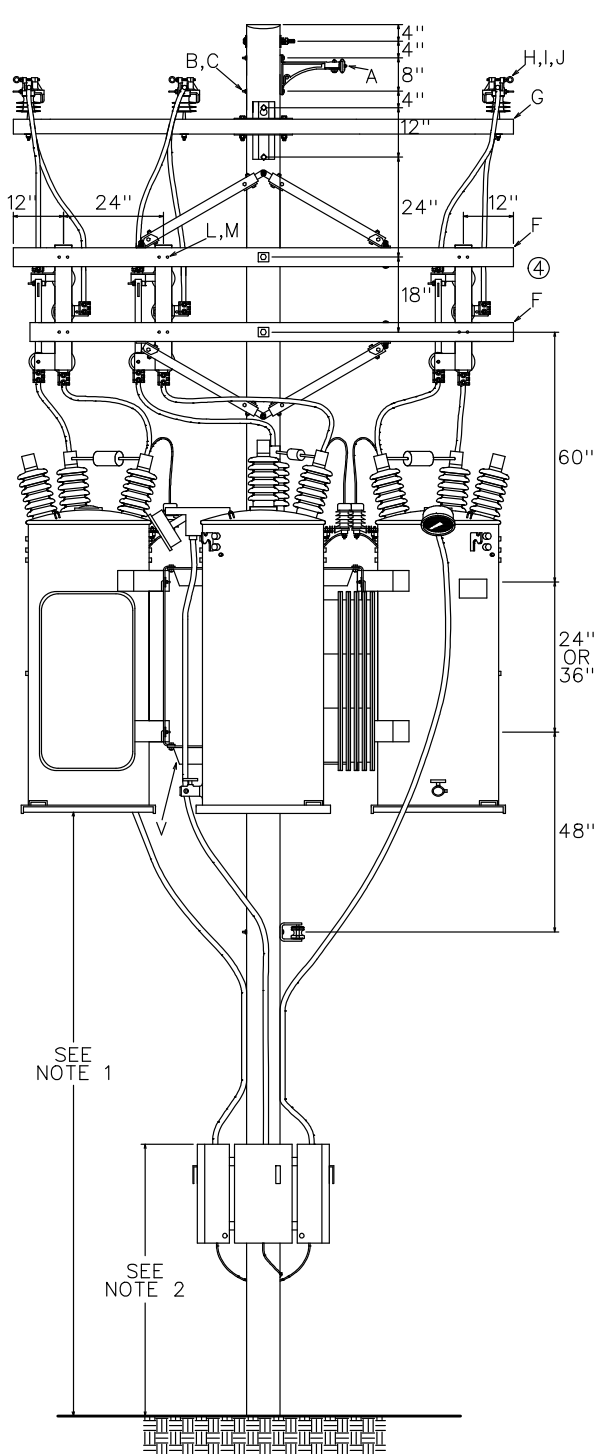
CAPACITORS AND REGULATORS

Regulator – Spacer Cable

Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01

Sheet 1 of 4



CAPACITORS AND REGULATORS

Regulator – Spacer Cable
Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01

Sheet 2 of 4

Regulator-Line	Voltage	Amps	KVA	Weight (lbs) Per Unit		
				Siemens	Cooper/Eaton	GE
69 09 078	2500	200	50		1200	1230
69 09 125	2500	400	100	2064	2526	1830
69 09 126	2500	665	167	2410	2509	2100
69 09 005	7620	100	76.2	1431	1270	1430
69 09 007	7620	150	114.3	1902	1585	1902
69 09 006	7620	219	167	2100	1975	2100

		Std./Stk. No.	Description	16 20 15 01	
	A	23 56 075	Bracket, Messenger		1
	B	23 52 065	Bolt, Machine, 5/8" x 12" (w/ nut)		3
	C	23 66 027	Washer, Square, 2-1/4" x 2-1/4" x 3/16" Thick		4
	D	17 51 137	Connector, PG, Pole Ground to Messenger		1
	E	69 58 293	Line Duc (Messenger Cover), Black, 8' Long (Each)		1
	F	04 00 20 03	Crossarm, Sgl., Wood, 10'		2
	G	04 00 41 16	Crossarm, Tangent, F/G, 10'		1
	H	25 05 143	Insulator, Pin, 15kV, Vice-Top		3
	I	23 62 028	Pin, Insulator, Long Shank		3
	J	23 66 132	Washer, Flat, Sq., 4"x4", with 13/16" hole		3
4	K	54 07 455	Switch, By-Pass, 600A		3
	L	23 52 038	Bolt, Machine, 1/2" x 6"		12
	M	23 66 118	Washer, Square, 1/2"		15
@	N	PG*W	Clamp, Parallel Groove (See 07 00 25 00)		6
	O	38 51 608	Cover, Large, Vice Type Connectors		6
	P	18 51 052	Wire, Poly, SD, 350 Cu. (Ft.)		60
	Q	25 06 052	Insulator, Suspension, 15kV, Poly		3
	R	23 68 181	Shackle – Anchor, 9/16"		6
	S	23 58 122	Clevis, Thimble, 7/8" opening, Galvanized Steel		6
@	T	17 69 063	Grip, Conductor Deadend, 15kV, New 477 Spacer Cable		6
		17 69 ***	Size Grip per Existing Spacer Cable Conductor		6
@5	U	Regulator (See Above)	Regulator		3
	V	23 17 202	Mounting Unit, 3 Position		1
@	W	10 01 133	Arrester, 3kV w/ Protective Cap		6
		10 01 145	Arrester, 10kV w/ Protective Cap		6

CAPACITORS AND REGULATORS
Regulator – Spacer Cable
Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01

Sheet 3 of 4

		Std./Stk. No.	Description	16 20 15 01	
@6	X	69 58 127	Galv. Channel for Adapting some 219A Reg. from 36" to 24" Spacing		1
	Y	23 52 219	Bolt, Mach., 3/4" x 14"		2
	Z	23 66 031	Washer, Square, 3/4"		2
	AA	23 64 028	Staple		48
	BB	23 52 309	Bolt, Mach., 1/2" x 18"		6
	CC	17 54 005	Connector, Split Bolt		7
@7	DD	12 00 10 **	Grounding Unit, 7#10 Copperweld		1

NOTES:

- Minimum clearance from the ground to the **bottom of the regulator tank** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrians – 11 feet.
- Minimum clearance from ground to the **top of the control cabinet** shall be minimum 5'6" from the ground, with the next hand or foot hold 8' or greater above the control cabinet. In addition, the minimum clearance from ground to the **bottom of the control cabinet** shall be:
 - Over shoulder of roadway – 15 feet.
 - In areas subject to vandalism – 15 feet.
 - Over walkways where unduly obstructing the walkway – 10 feet.
- Install the first spacer (23 67 334) about 40 feet from the pole as to not stress the cable. Normal spacing is 25' to 33'. See 07 20 01 01 for space installation between poles.
- See by-pass switch details on Sheet 4, follow instructions for operating.
- 7620V regulators can be applied at 2400V. However, the amperage limit remains the same, so the kVA rating will be lower. Also, in most cases, this will require moving a wire underneath the hand hole. Cover on the top of the regulator and changing a few parameters on the control.
- Some 219A regulators may require an adapter plate (69 58 127) for mounting.
- Use DCS 12 00 10 01 ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.

CAPACITORS AND REGULATORS
Regulator – Spacer Cable
Pole Mounted, Three Phase 4kV & 12kV

16 20 15 01

Sheet 4 of 4

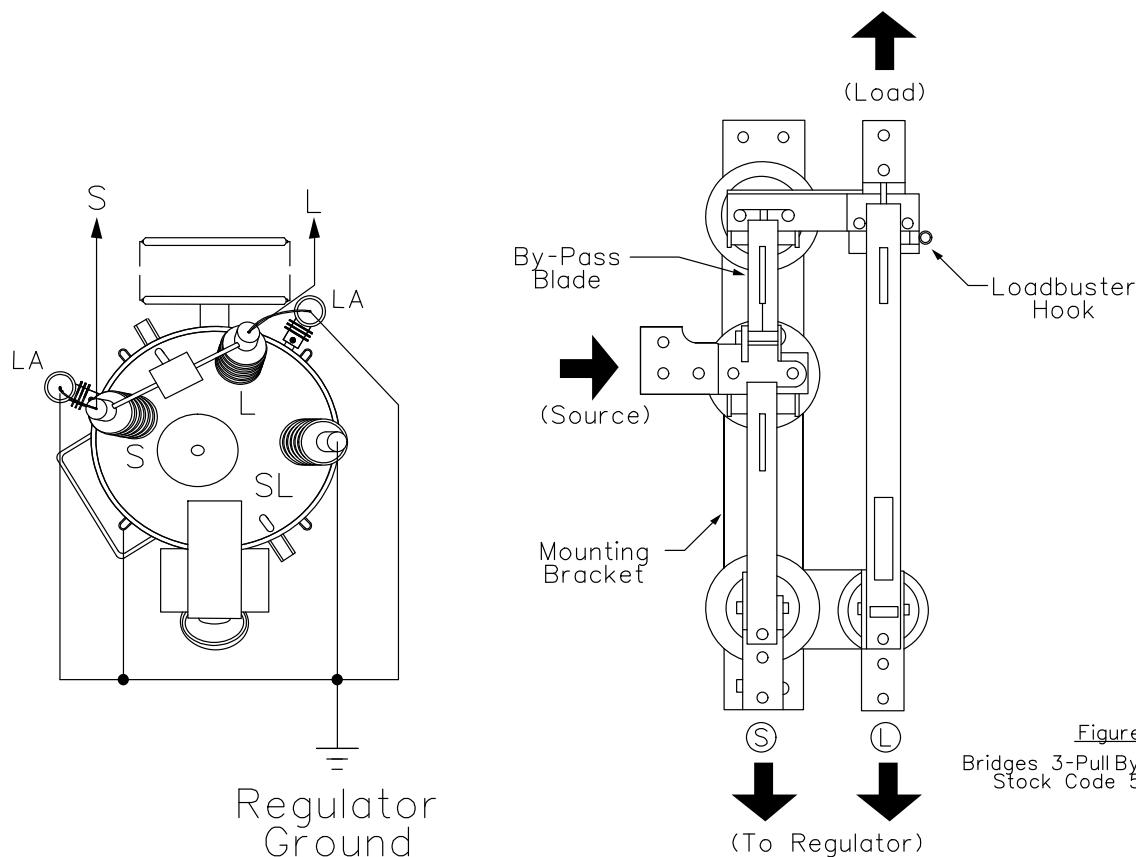


Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455

REGULATOR WIRING SCHEMATIC

BY-PASS SWITCH DETAIL

TO BY-PASS REGULATOR

1. Set regulator on neutral position. (Follow appropriate procedures to verify regulator is on neutral.)
2. Close the short by-pass blade.
3. Use load-buster tool and open the load blade.
4. Open the source blade.

TO RE-ENERGIZE REGULATOR

1. With by-pass blade closed, set regulator on neutral position.
2. Close the source side blade only to test the regulator.
3. Close the source and load blades to the regulator.
4. Open the short by-pass blade to the regulator.
5. Place regulator in service.

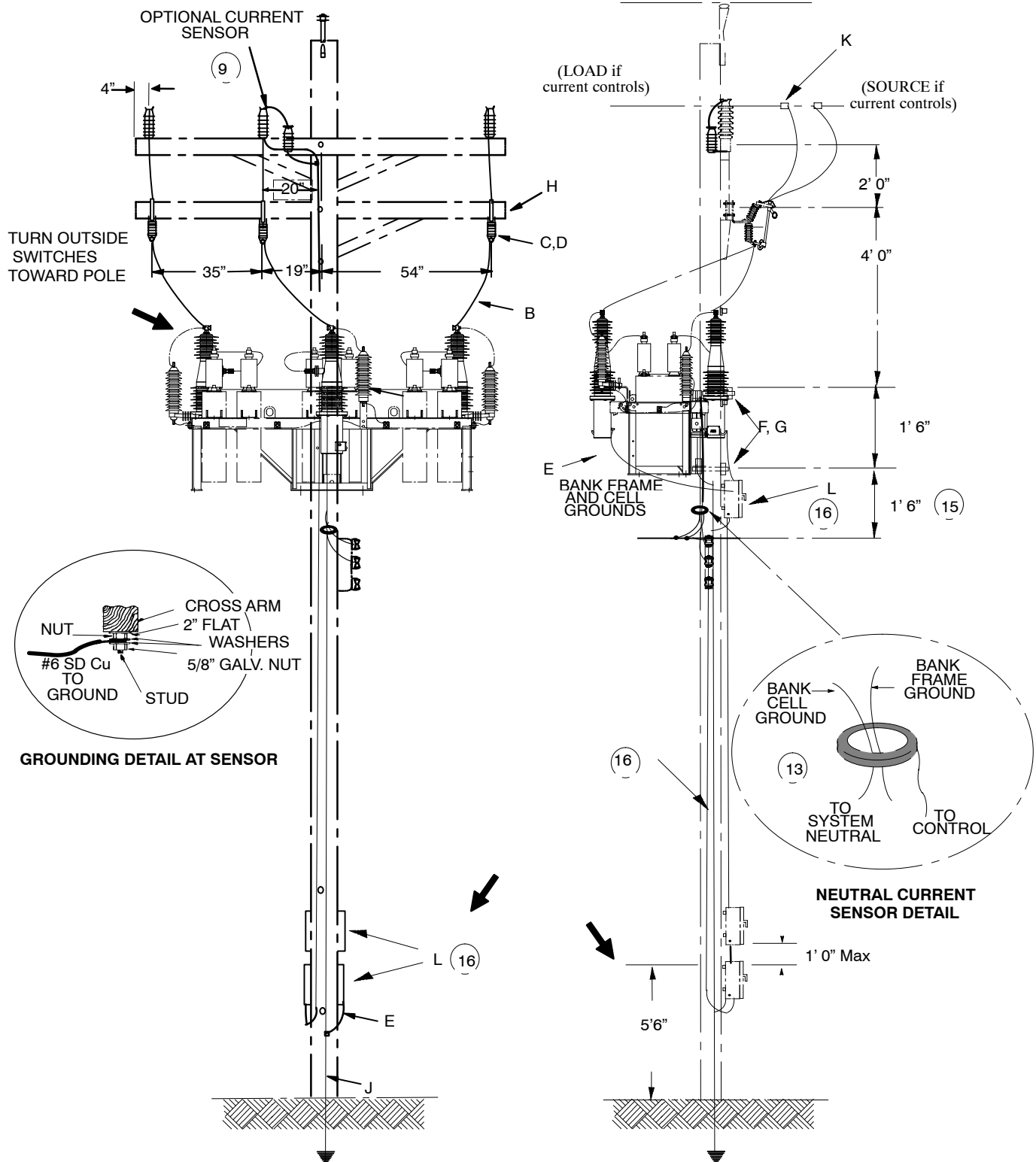
CAPACITORS AND REGULATORS

Switched Capacitor Installation

2400 or 4500 kVAR Banks – 34.5 kV

16 34 02 **

Sheet 1 of 3

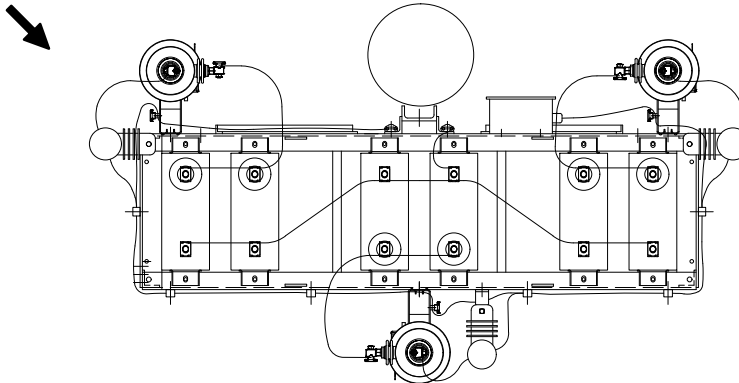


CAPACITORS AND REGULATORS
Switched Capacitor Installation
2400 or 4500 kVAR Banks – 34.5 kV

16 34 02 **

Sheet 2 of 3

34kV Capacitor Bank Top View



2400kVAR 16 34 02 02

4500kVAR 16 34 02 04

		Std./Stk. No.	Description	16 34 02 **	02	04
2.	A	69 11 302	Capacitor, Switched, 2400 kVAR		1	
		69 11 301	Capacitor, Switched, 4500 kVAR			1
1.	B	18 52 025	Wire, #4 Cu, Poly Covered		25	25
	C	54 06 052	Switch, Fused, SMD-20, 34kV		3	3
	D	20 04 343	Refill, Fuse, SMU 50K		3	
		20 04 355	Refill, Fuse, SMU 80E Slow			3
	E	18 51 021	Wire, Cu, #6 S.D., Poly Covered		20	20
	F	23 52 095	Bolt, Mach. 3/4" x 10"		2	2
	G	23 66 031	Washer, Curved, 3/4"		2	2
3@	H	04 00 20 03	X-Arm, 10'		1	1
	J	12 00 10 02	Grounding Unit – Ground Rod		1	1
		12 00 10 01	Grounding Unit – Ground Coil		1	1
@	K	PG*	Clamp, Parallel Groove – See 07 00 25 00		3	3
		HLC*W	Clamp, Hot Line – See 07 00 21 00		3	3
7.@	L	16 00 26 **	Control, multi function with NCS input		1	1

NOTES:

1. Minimum clearance from the ground to the **bottom of the capacitor rack** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
2. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground, and the bottom of disconnect box has to be installed 1' max above the top of control cabinet, but the next hand or foot hold shall be 8' or greater above the disconnect box.
3. The junction box shall be mounted either on the capacitor bank frame or 1' to 2' below the capacitor bank frame. Leads to the bank switches shall be secured to the frame of the bank with wire ties.
4. Minimum clearance from ground to the top of the control cabinet shall be:
 - Over shoulder of roadway – 15 feet
 - In areas subject to vandalism – 15 feet
 - Over walkways where unduly obstructing the walkway – 10 feet
5. Ameren IL must use 2–10' crossarms.
6. For wiring diagram, refer to DCS 16 00 05 00.
7. Loadbreak tool, Stock #87 38 045, must be used to operate switches.
8. With new pole installation, use Standard 12 10 00 01 with ground coil.
9. Neutral current sensor is not included on all models. See Standard 16 00 26 ** for material. The neutral current sensor should be secured with a staple above and below to the ground wires passing through the sensor.
10. Refer to DCS 10 00 01 01 for fusing selection.
11. Capacitor banks have a "C" order point.
12. With new pole installations, use DCS 12 10 00 01 with ground coil.
13. Wire from bank ground and cell ground must both pass through center of sensor before connecting to neutral or ground bus.
14. Connect bank ground(s) to static lead and distribution system neutral if present.
15. The minimum distance from the capacitor bank frame to the secondary line conductor is 1' 6". If underbuild on pole, bank lower mounting bolt must be 24" or more above the underbuild line conductor.
16. Refer to DCS 16 00 26 ** for control, neutral current sensor, cables, U-Guard and optional current sensor. Control requires 120V.

CAPACITORS AND REGULATORS

Regulator

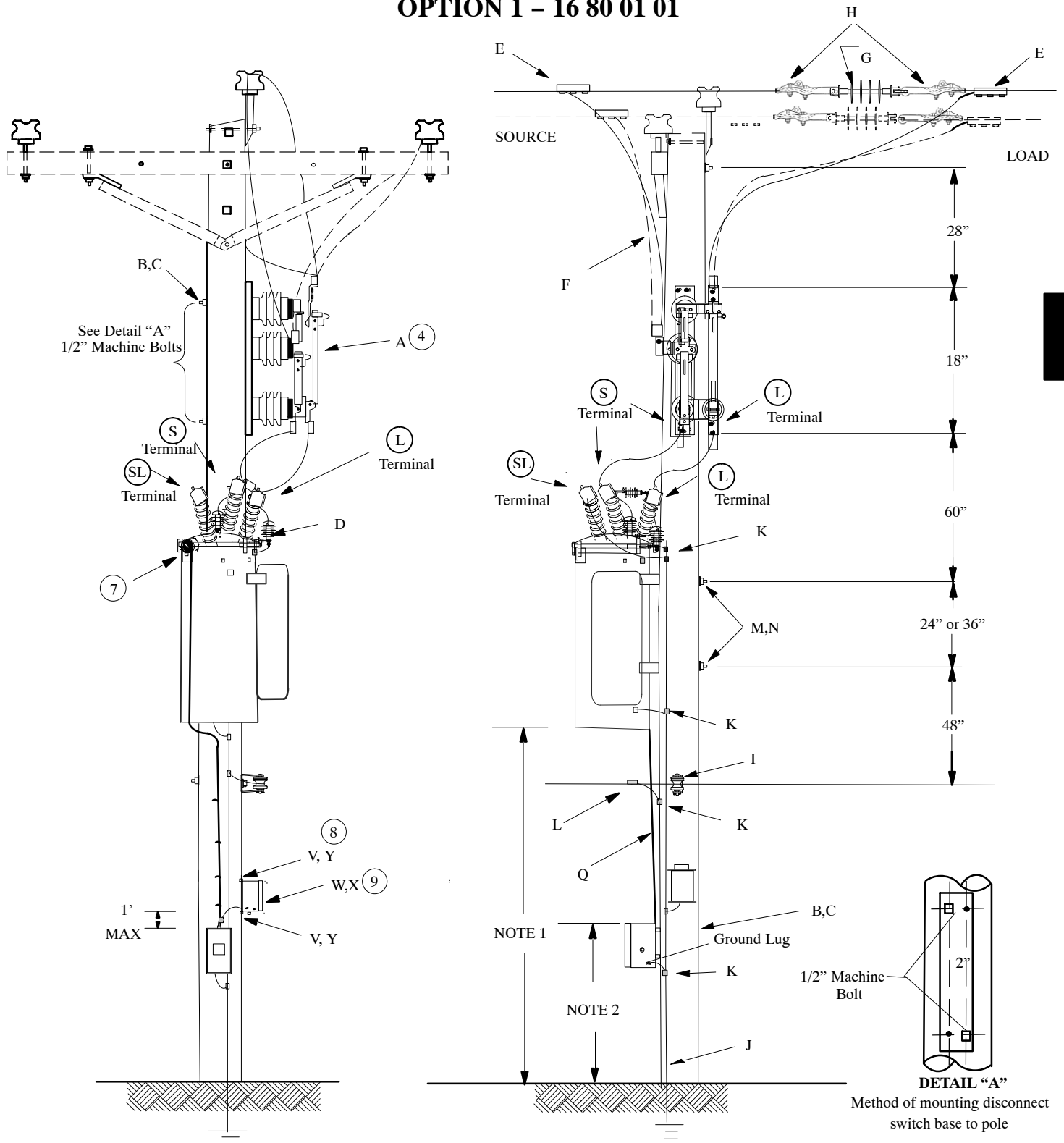
Pole Mounted Single Phase, 4 & 12kV

16 80 01**

Sheet 1 of 5

Use Option 1 or 2 that places the switch in the most favorable position to operate (road side if no other preference).

OPTION 1 - 16 80 01 01



CAPACITORS AND REGULATORS

Regulator

Pole Mounted Single Phase, 4 & 12kV

16 80 01**

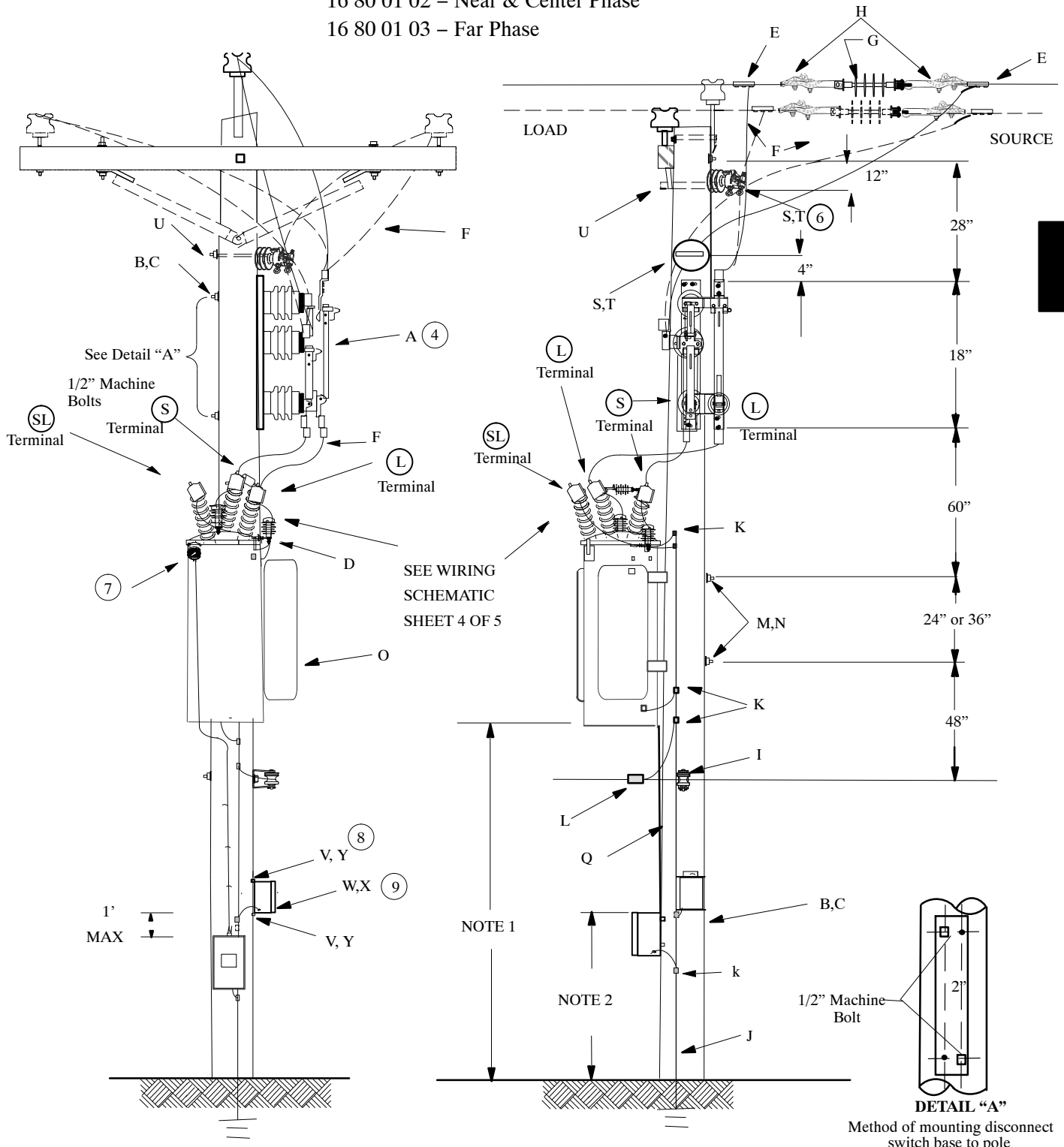
Sheet 2 of 5

Use Option 1 or 2 that places the switch in the most favorable position to operate (road side if no other preference).

OPTION 2

16 80 01 02 – Near & Center Phase

16 80 01 03 – Far Phase



CAPACITORS AND REGULATORS
Regulator
Pole Mounted Single Phase, 4 & 12kV

16 80 01**

Sheet 3 of 5

Regulator

Stock Number – Regulator Line	Voltage	Amps	kVA	Weigh in lbs.		
				Siemens	Cooper	GE
69 09 078	2500	200	50		1200	1230
69 09 125	2500	400	100	2064	2526	1830
69 09 126	2500	668	167	2410	2509	2100
69 09 005	7620	100	76.2	1431	1270	1280
69 09 007	7620	150	114.3	1902	1585	1600
69 09 006	7620	219	167	2100	1975	1900

		Std. / Stk. No.	Description	16 80 01	01	02	03
@	A	54 07 455	Switch, By-Pass, 600A		1	1	1
	B	23 52 309	Bolt, Mach., 1/2" x 16"		4	4	4
	C	23 66 118	Washer, Square, 1/2"		4	4	4
	D	10 01 145	Arrester, Lightning, 10kV Duty Cycle, 8.4kV MCOV with L-Shaped Bracket		2	2	2
		10 01 122	Arrester, Lightning, 3kV Duty Cycle, 2.55kV MCOV with L-Shaped Bracket		2	2	2
@	E	PG*	Clamp, Parallel Grove (See Std. 07 00 25 00)		2	2	2
@	F	LW*W	Wire, Poly, S.D. (ft.), DCS 07 00 01 01		50	50	50
@	G	25 06 052	Insulator, Susp. 15kV		1	1	1
	H	DEC*W	Clamp, Deadend, DCS 07 00 11 00		2	2	2
	I	06 01 01 **	Secondary Clevis		1	1	1
	J	12 00 10 01	Grounding Unit, 7#10CW, Ground Coil		1	1	1
		12 00 10 02	Grounding Unit, 7#10CW, Ground Rod		1	1	1
@	K	17 54 005	Connector, Split Bolt		4	4	4
	L	17 51 032	Clamp, Parallel Grove		1	1	1
	M	23 52 219	Bolt, Mach, 3/4" x14"		2	2	2
	N	23 66 031	Washer, Square, 3/4"		2	2	2
	O	Regulator (see above)	Regulator		1	1	1
6	Q	23 64 001	Staple – Ground Wire, Serrated Cu Clad		16	16	16
	S	25 05 143	Vice Top Insulator 15kV			1	2
	T	23 62 128	Adaptor Pin 1"			1	2
	U	23 52 065	Bolts 5/8" 12"			1	2
	V	62 51 563	Bracket, H Bar (VO only)		2	2	2
@9	W	69 59 004	Kit, Communications, (VO only)		1	1	1
@9	X	69 59 003	Radio, GE Orbitz, ECR, Single Port (VO only)		1	1	1
@9	Y	23 52 068	Bolt, mach., 5/8" x 16"		2	2	2

CAPACITORS AND REGULATORS
Regulator
Pole Mounted Single Phase, 4 & 12kV

16 80 01**

Sheet 4 of 5

NOTES:

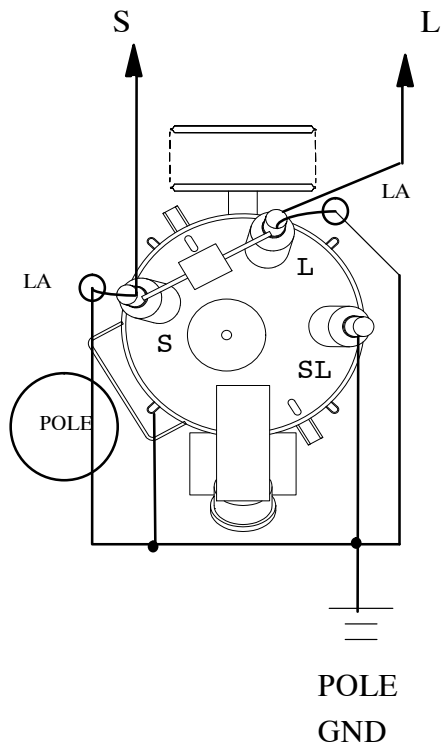
1. Minimum clearance from the ground to the **bottom of the regulator tank** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
2. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground unless additional clearance is needed for locations described in note 3. The next hand or foot hold shall be 8' or greater above the control cabinet.
3. Clearance from ground to the top of the control cabinet may be increased to the clearance provided for locations listed below:
 - Over shoulder of roadway – 15 feet
 - In areas subject to vandalism – 15 feet
 - Over walkways where unduly obstructing the walkway – 10 feet
4. See By-Pass Switch details below. Follow instructions for operating.
5. 7620V regulators can be applied at 2400V. However, the amperage limit remains the same, so the kVA rating will be lower. Also, in most cases, this will require moving a wire underneath the hand hole cover on the top of the regulator and changing a few parameters on the control.
6. Install a vice top insulator to train the wire from the right side of the switch to the far phase.
7. Tap Change Position Indicator needs to be located at street side.
8. For Illinois VO only. If required, the communications box shall be mounted to the pole by bolting an H bar bracket to the pole with a 5/8" bolt for the top and bottom of the cabinet. 3/8" bolts shall be used to mount the cabinet to the T slot of the H bar. The maximum vertical separation between regulator control cabinet and communication box shall be 12". The communications box shall be bonded to pole ground.
9. Items V, W, X and Y are only for Illinois VO project.

TO BY-PASS REGULATOR

1. Set regulator on neutral position. (Follow appropriate procedures to verify regulator is on neutral.)
2. Close the short by-pass blade.
4. Open the source blade.

TO RE-ENERGIZE REGULATOR

1. With by-pass blade closed, set regulator on neutral position.
2. Close the source side blade only to test the regulator.
3. Close the source and load blades to the regulator.
4. Open the short by-pass blade.
5. Place regulator in service.



REGULATOR WIRING SCHEMATIC

BY-PASS SWITCH DETAILS

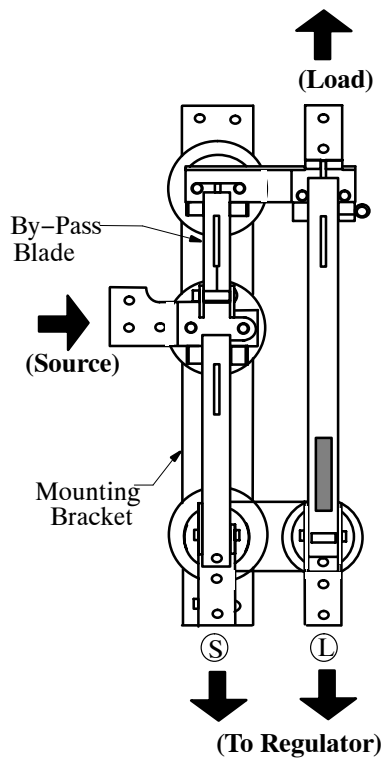


Figure 1
 Bridges 3-Pull By-Pass Switch
 Stock Code 54-07-455

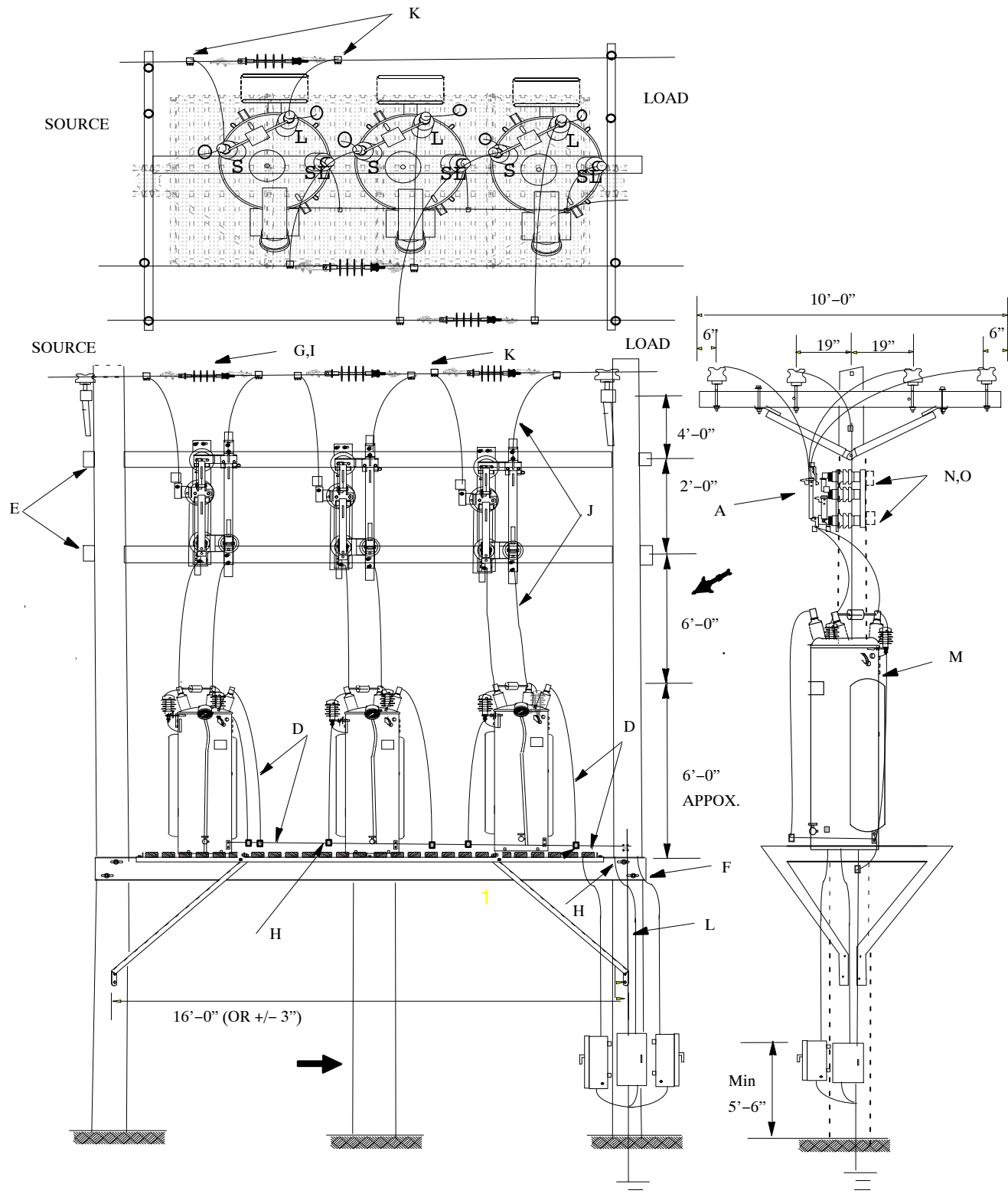
CAPACITORS AND REGULATORS

Regulator – Line

Platform Mounted, Three Phase 4kV & 12kV

16 80 02 **

Sheet 1 of 4



CAPACITORS AND REGULATORS
Regulator – Line
Platform Mounted, Three Phase 4kV & 12kV

16 80 02 **

Sheet 2 of 4

Stock No.	Voltage	Amps	kVA	Weight in lbs.		
				Siemens	Cooper	GE
69 09 006	7620	219	167	2100	1975	1900
69 09 091	7620	328	250	2985	2750	2620
69 09 127	7620	438	333	3950	3252	2980

		Std. / Stk. No.	Description	16 80 02 **	01	02	03
@	A	54 07 455	Switch, By-Pass, 600A.		3	3	3
	C	HLC*W	Clamp, Hot Line		6	6	6
	D	18 51 025	Wire, S.D., #4 Cu., Poly (Ft.)		30	30	30
	E	41 01 152	Cross Arm, 21'		2	2	2
	F	23 17 107	Platform		1	1	1
	G	25 06 052	Insulator, Suspension		3	3	3
@	H	17 54 005	Connector, Split Bolt, #2 Sol thru #6 Sol		3	3	3
	I	DEC*W	Clamp, Deadend		6	6	6
	J	LW*W	Wire, Ploy Covered (Ft., DCS 07 00 80 00)		50	50	50
	K	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		6	6	6
	L	12 00 10 01	Grounding Unit		2	2	2
	M	69 09 006	Regulator, 219A		3		
@		69 09 091	Regulator, 328A			3	
		69 09 127	Regulator, 438A				3
	N	23 52 309	Bolt, Machine, 1/2" x 16"		6	6	6
	O	23 66 118	Washer, Square, 1/2"		12	12	12
	P	10 01 145	Arrester, 10kV 8.4kV MCOV L-Bracket		3	3	3
		10 01 122	Arrester, 3kV 2.55kV MCOV L-Bracket		3	3	3

NOTES:

1. Install the regulator on the side of pole for easier access to the indicator.
2. Minimum clearance from the ground to the bottom of the regulator tank shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
3. Minimum clearance from ground to the top of the Control cabinet shall be:
 - Minimum 5'6" from the ground, but the next hand or foot hold is 8' or greater above the control cabinet.
4. Exception to Note 2, Minimum clearance from ground to the bottom of the control cabinet shall be:
 - Over shoulder of roadway – 15 feet
 - In areas subject to vandalism – 15 feet
 - Over walkways where unduly obstructing the walkway – 10 feet
5. See by-pass switch details below. Follow instructions for operating.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:WYW
REV. NO: 10
REV. DATE: 02/03/17

-
6. 7620V regulators can be applied at 2400V. However, the amperage limit remains the same, so the kVA rating will be lower. Also, in most cases, this will require moving a wire underneath the hand hole cover on the top of the regulator and changing a few parameters on the control.

TO BY-PASS REGULATOR

1. Set regulator on neutral position. (Follow appropriate procedures to verify regulator is on neutral.)
2. Close the short by-pass blade.
3. Open the source blade.

TO RE-ENERGIZE REGULATOR

1. With by-pass blade closed, set regulator on neutral position.
2. Close the source side blade only to test the regulator.
3. Close the source and load blades to the regulator.
4. Open the short by-pass blade.
5. Place regulator in service.

BY-PASS SWITCH DETAILS

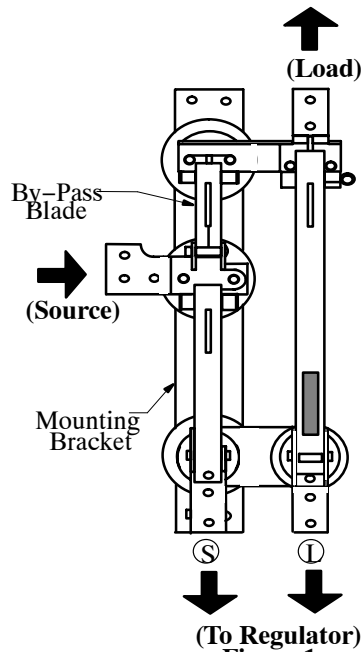
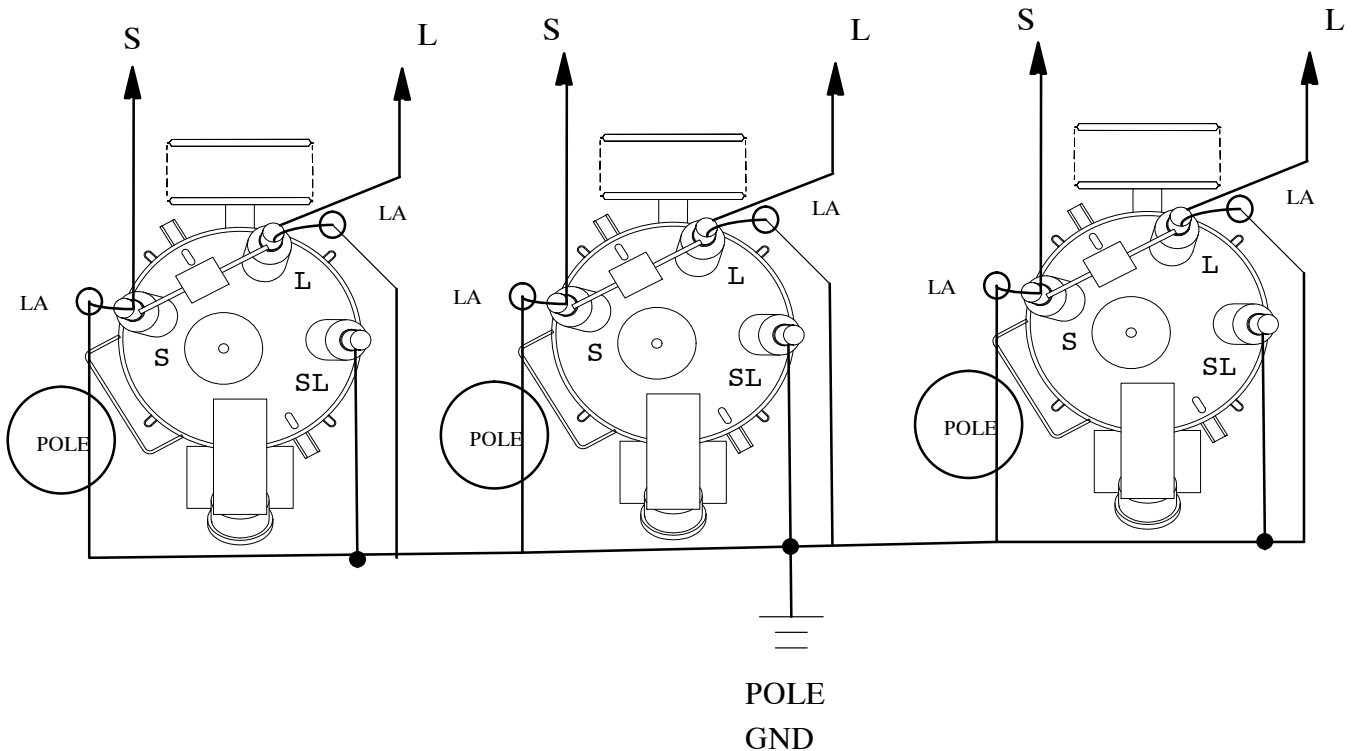
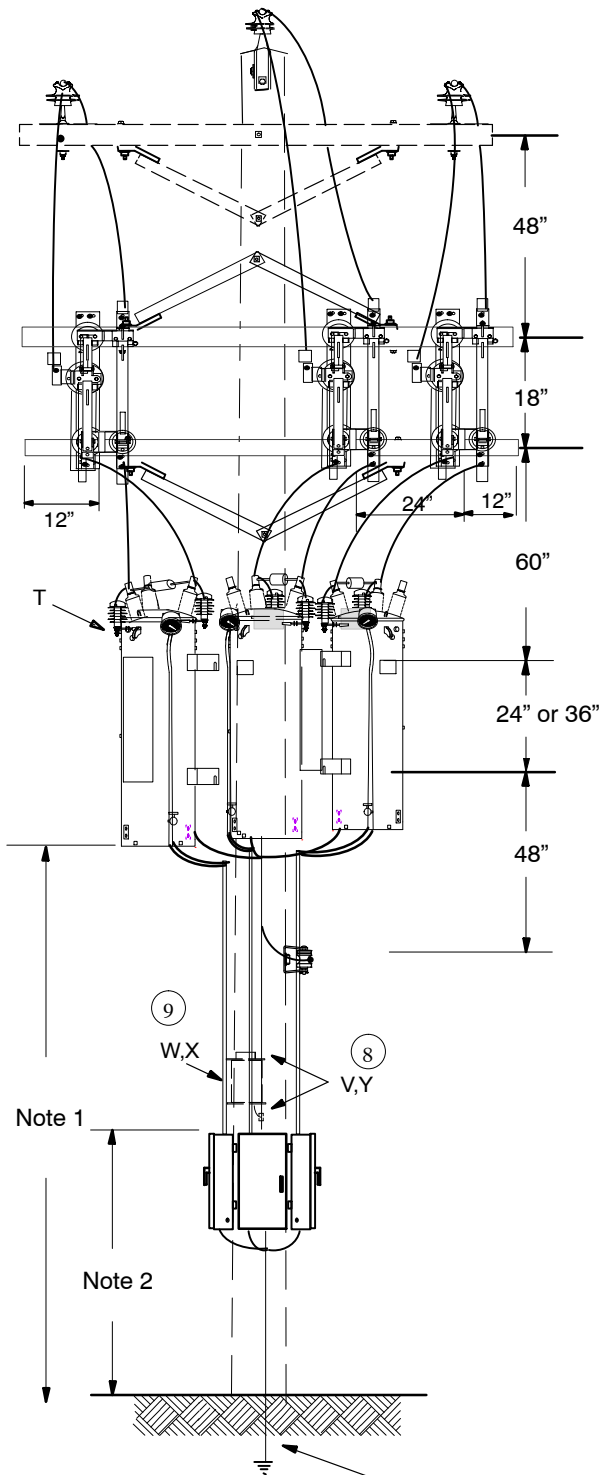


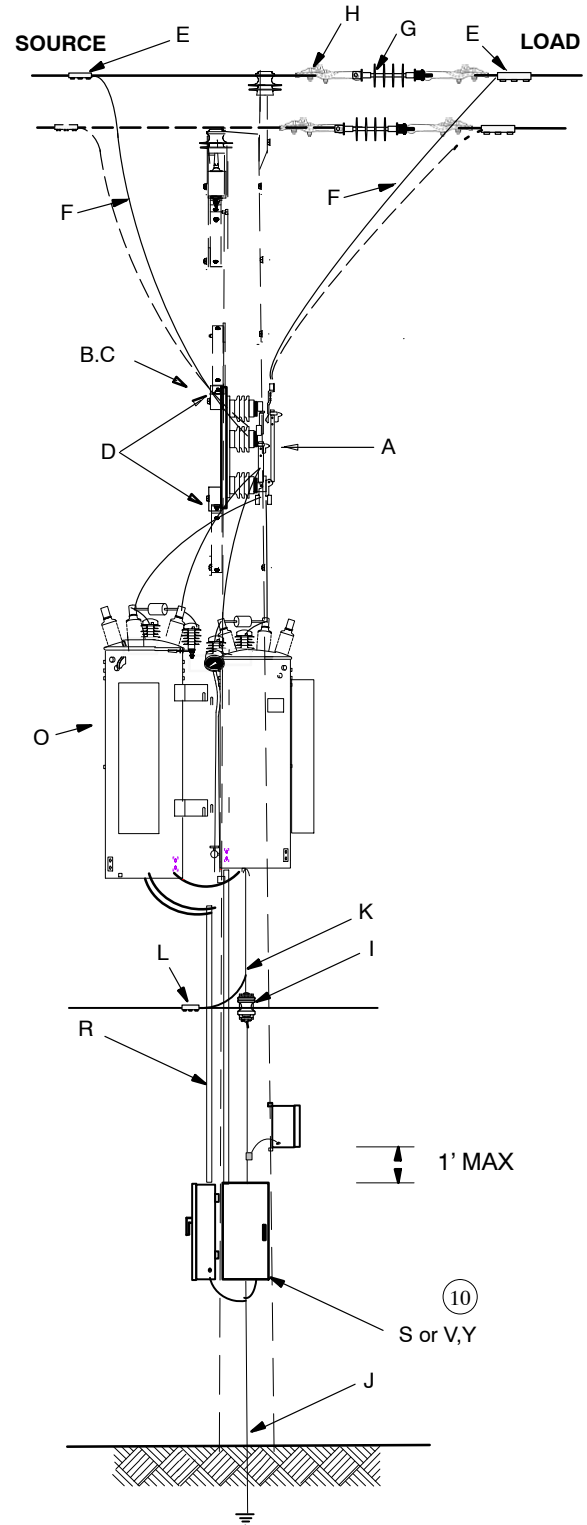
Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455



REGULATOR WIRING SCHEMATIC



Grounding, DCS 12 00 10 01



CAPACITORS AND REGULATORS

Regulator

Pole Mounted, Three Phase 4 & 12kV

16 80 03 01

Sheet 2 of 5

Regulator-Line	Voltage	Amps	KVA	Weight (lbs) Per Unit		
				Siemens	Cooper	GE
69 09 078	2500	200	50		1200	1230
69 09 125	2500	400	100	2064	2526	1830
69 09 126	2500	665	167	2410	2509	2100
69 09 005	7620	100	76.2	1431	1270	1431
69 09 007	7620	150	114.3	1902	1585	1902
69 09 006	7620	219	167	2100	1975	2100

	Std. / Stk. No.	Description	16 80 03 01
	A 54 07 455	Switch, By-Pass, 600 A.	3
	B 23 52 038	Bolt, Mach, 1/2" x 6"	12
	C 23 66 118	Washer, Square, 1/2"	15
	D 04 00 20 03	Crossarm, w/ Brace 10'	2
@	E PG*	Clamp, Parallel Grove, DSC 07 00 25 00	6
@	F LW*W	Wire, Poly, S.D. (ft.), DSC 07 00 01 01	150
	G 25 06 052	Insulator, Susp. 15kV	3
@	H DEC*W	Clamp, Deadend, DSC 07 00 17 00	6
@	I 06 01 01 **	Clevis, Secondary	1
7@	J 12 00 10 02	Grounding Unit – Ground Rod	1
	12 00 10 01	Grounding Unit – Ground Coil	1
	K 17 54 005	Connector, Split Bolt	7
	L 17 51 032	Clamp, Parallel Groove	1
	M 23 52 219	Bolt, Mach, 3/4" x 14"	2
	N 23 66 031	Washer, Square, 3/4"	2
5@	O Regulator (See Above)	Regulator	3
	P 23 17 202	Bracket, Cluster, Reg. and Trans.	1
	R 23 64 028	Staple	48
@	S 23 52 309	Bolt, Mach, 1/2" x 18"	6
@	T 10 01 133	Arrester, Lightning, 3kV Duty Cycle, 2.55kV MCOV with L-Shape Bracket	6
	10 01 145	Arrester, Lightning, 10kV duty Cycle, 8.4kV MCOV with L-Shape Bracket	6
6@	U 69 58 127	Adapter, Mounting Plate 36" to 24" Lug Spacing	1
8,10 @	V 62 51 563	Bracket, H Bar	8
@	W 69 59 004	Kit, Communications, (VO only)	1
@	X 69 59 002	Radio, GE Orbitz, MCR, 4 Port (VO only)	1
8,10 @	Y 23 52 068	Bolt, Mach., 5 /8" x 16"	8

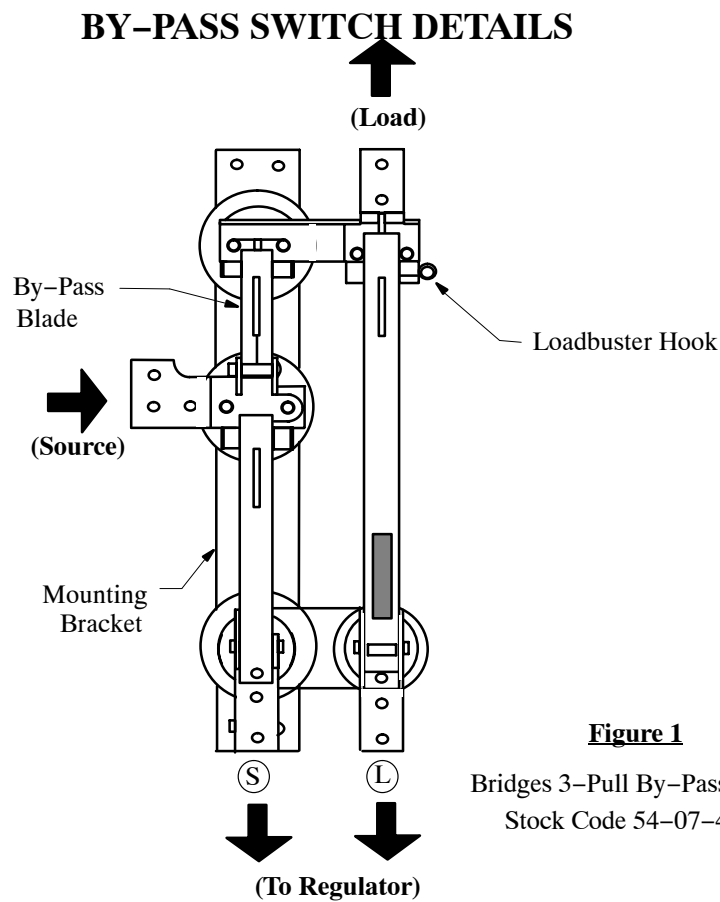
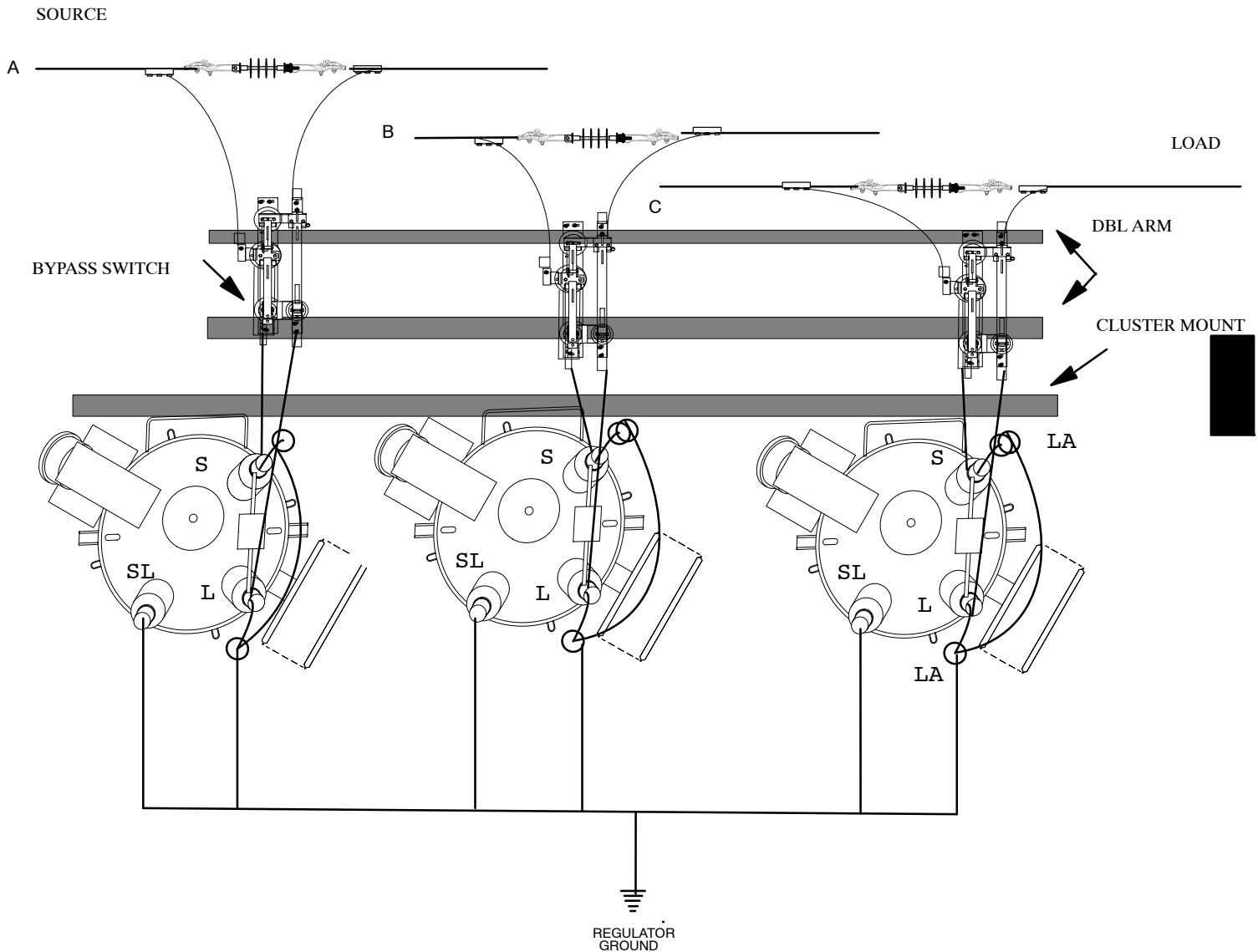


Figure 1
Bridges 3-Pull By-Pass Switch
Stock Code 54-07-455



REGULATOR WIRING SCHEMATIC

NOTES:

1. Minimum clearance from the ground to the **bottom of the regulator tank** shall be:
 - Areas accessible to vehicles – 15 feet.
 - Areas accessible to pedestrian only – 11 feet.
2. Clearance from ground to the **top of the control cabinet** shall be 5' 6" from the ground unless additional clearance is needed for locations described in note 3. The next hand or foot hold shall be 8' or greater above the control cabinet.
3. Clearance from ground to the top of the control cabinet may be increased to the clearance provided for locations listed below:
 - Over shoulder of roadway – 15 feet
 - In areas subject to vandalism – 15 feet
 - Over walkways where unduly obstructing the walkway – 10 feet
4. See by-pass switch details below, follow instructions for operating.
5. 7620V regulators can be applied at 2400V. However, the amperage limit remains the same, so the kVA rating will be lower. Also, in most cases, this will require moving a wire underneath the hand hole. Cover on the top of the regularor and changing a few parameters on the control.
6. Some 219A regulators may require an adapter plate (69 58 127) for mounting.
7. Existing pole installations, DCS 12 10 00 02 – ground rod.
8. For Illinois VO only. If required, the communications box shall be mounted to the pole by bolting an H bar bracket to the pole with a 5/8" bolt for the top and bottom of the cabinet. 3/8" bolts shall be used to mount the cabinet to the T slot of the H bar, two 5/8" bolts and two H bars are required. The maximum vertical separation between regulator control cabinet and communication box shall be 12". The communications box shall be bonded to pole ground.
9. Items W and X are only for Illinois VO project.
10. For installations without enough space to mount control cabinets directly to pole with 1/2" bolts, control cabinet may be mounted to the pole by bolting an H bar bracket to the pole with a 5/8" bolt for the top and bottom of the cabinet. 3/8" bolts would then be used to mount the cabinet to the T slot of the H bar. A total of six 5/8" bolts and six H bars would be required.

TO BY-PASS REGULATOR

1. Set regulator on neutral position. (Follow appropriate procedures to verify regulator is on neutral.)
2. Close the short by-pass blade.
3. use load-buster tool and open the load blade.
4. Open the source blade.

TO RE-ENERGIZE REGULATOR

1. With by-pass blade closed, set regulator on neutral position.
2. Close the source side blade only to test the regulator.
3. Close the source and load blades to the regulator.
4. Place regulator in service.

NOTES

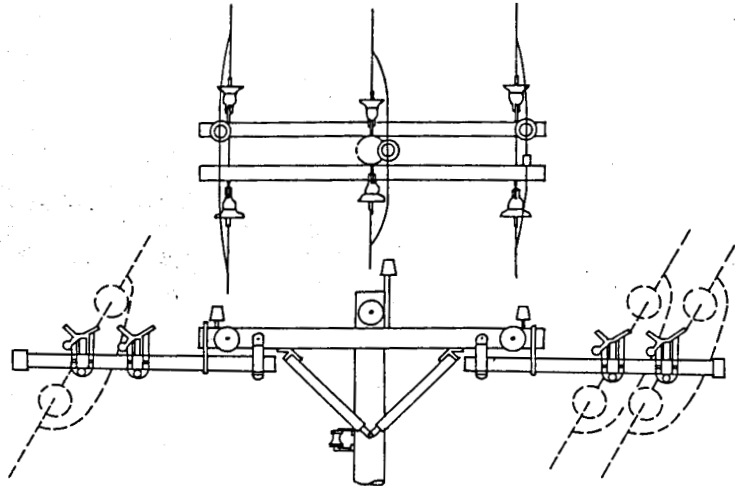
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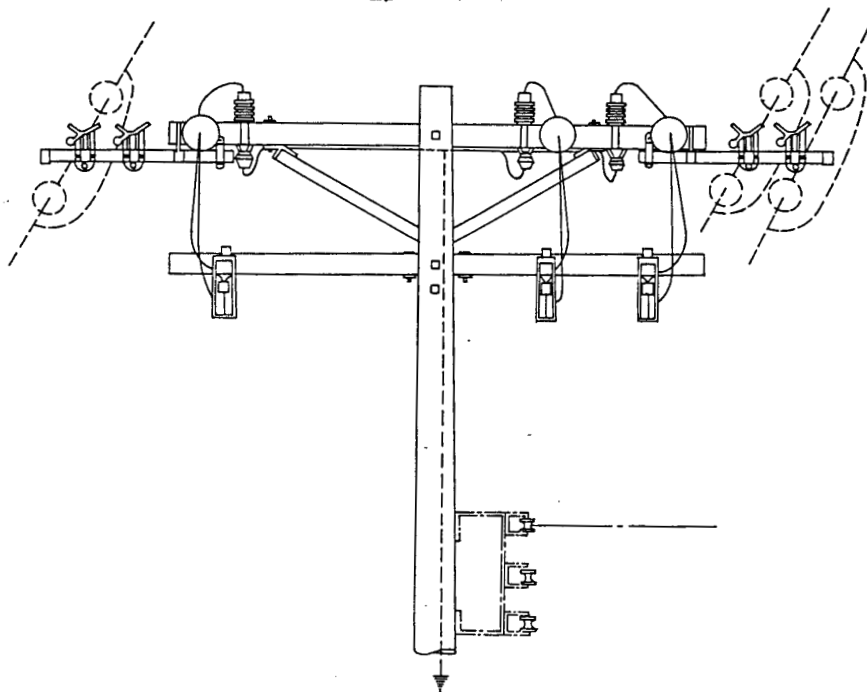
LABOR OPERATIONS
Reconductoring
4kV Loopover and Switch Pole

17 21 40 **

Sheet 1 of 1



3Ø 17 21 40 01
2Ø 17 21 40 02



3Ø 17 21 40 03
2Ø 17 21 40 04

1. Above quantities assume that new switches will be installed.
2. If switch is not replaced or R&R'd, Estimate 4 additional Code 260s per switch.

		Description	17 21 40 **	01	02	03	04
1 2	996	Epoxi Arms		4	4	4	4
	912	R & R Disc Insulators		6	4	6	4
	260	Jumper		12	8	6	4

**DISTRIBUTION
CONSTRUCTION STANDARDS**

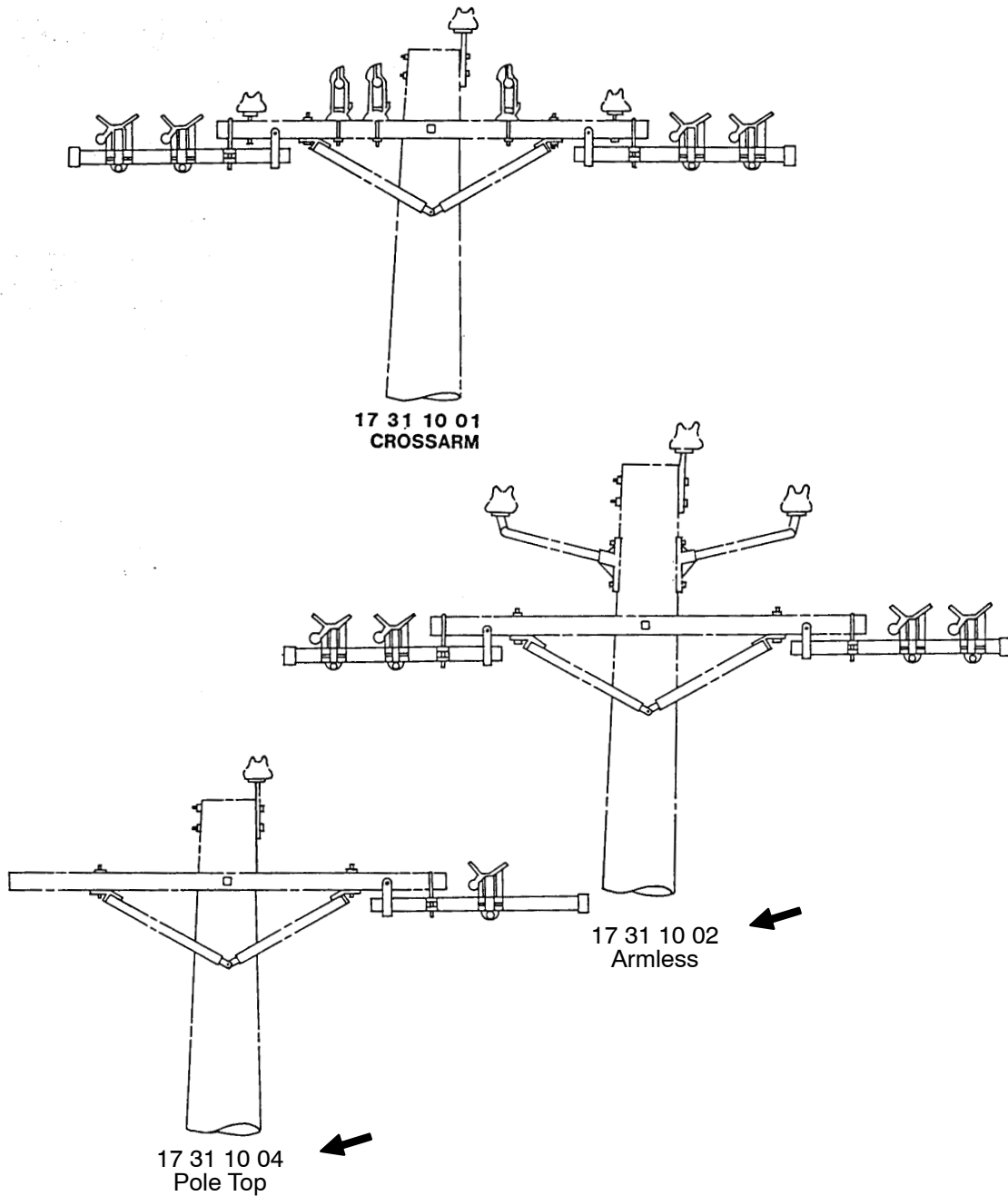


ENG:JMW
REV. NO: 0
REV. DATE: 8/08/95

LABOR OPERATIONS
Reconductoring
Crossarm or Armless – 1, 2, & 3 Phase

17 31 10 **

Sheet 1 of 1



Std. / Stk. No.	Description	17 31 10 **	01	02	04
996	Epoxi Arms		4	4	2
TARM	Crossarm Single, 6 Ft.			2	2

**DISTRIBUTION
CONSTRUCTION STANDARDS**



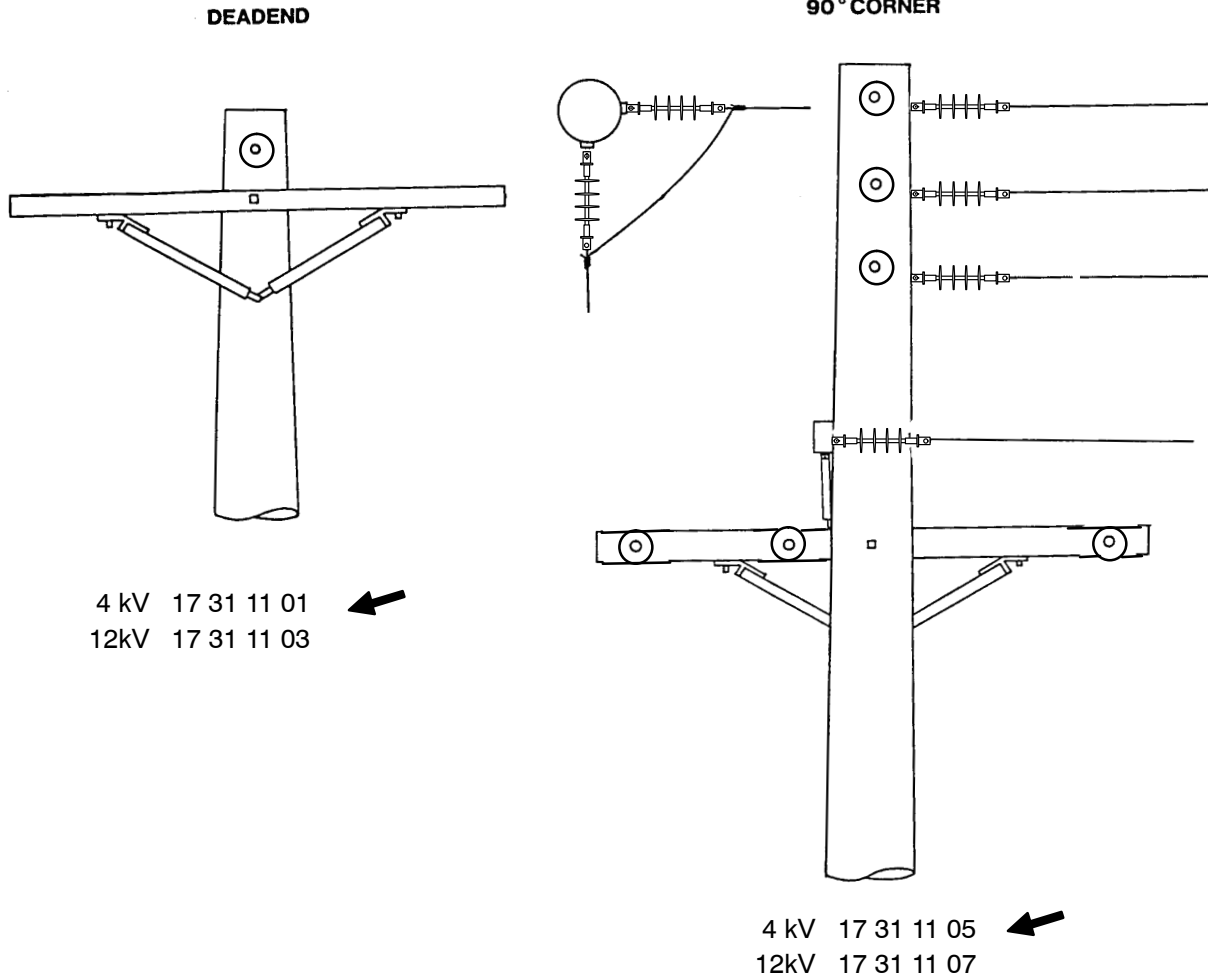
ENG:JMW
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REV. DATE: 9/08/99

LABOR OPERATIONS

Reconductoring Angle or Deadend

17 31 11 **

Sheet 1 of 1



1. Minus out each 255 jumper on which a 252 connector is installed.

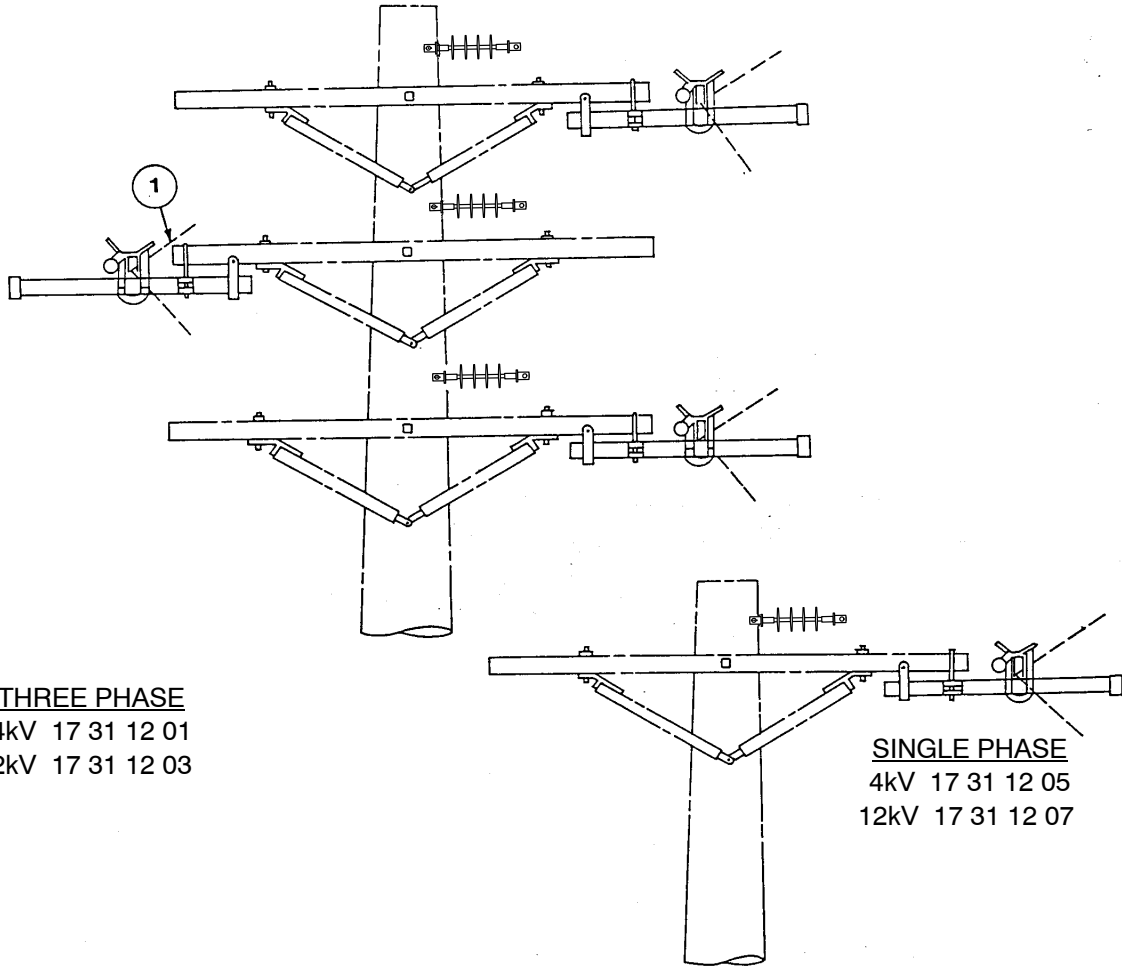
	Std. / Stk. No.	H/C	Description	17 31 11 **	01	03	05	07
	TARM		Crossarm Sgle, 6 Ft.		2	2		
	TARM		Crossarm Sgle, 8 Ft.				4	4
	912		R&R Insulator		1		6	
	912	H	R&R Insulator			1		6
	260		Jumper Inst & REM				12	6
	255		Jumper Inst & REM					6
@	252		Connector Energized Ea		@	@	@	@

LABOR OPERATIONS

Reconductoring Floating Angle

17 31 12 **

Sheet 1 of 1



THREE PHASE
4kV 17 31 12 01
12kV 17 31 12 03

SINGLE PHASE
4kV 17 31 12 05
12kV 17 31 12 07

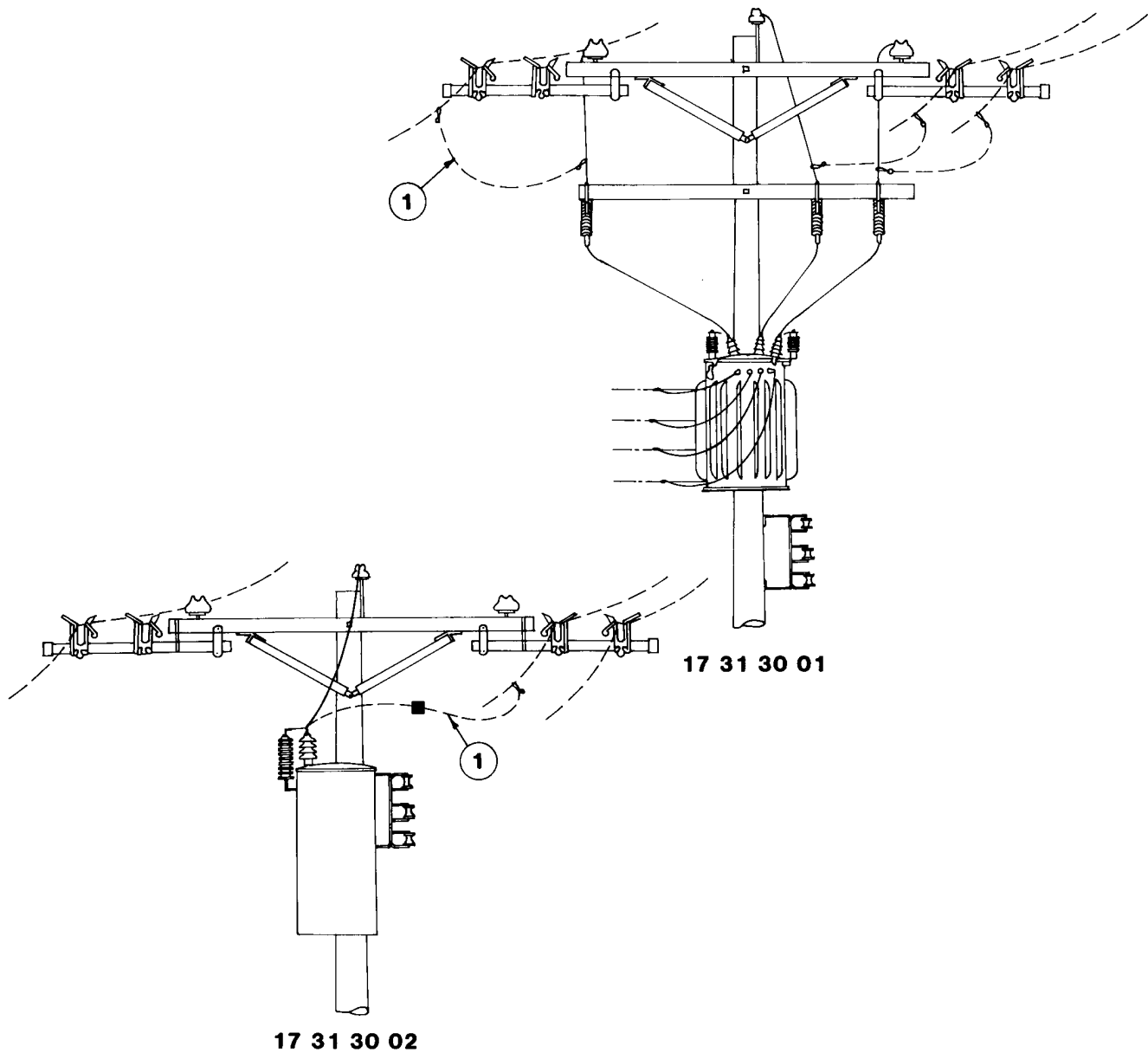
1. Splice – Add approx. 6" length of wire
2. 270 – De energized wire, #6–4/0 is spliced under tension.
3. 275 – De energized wire. 336 or larger is spliced under tension.
4. H 270 – Energized, 12 kV or above, wire, #6–4/0 is spliced.
5. H 275 – Energized, 12 kV or above, wire, 336 or larger is spliced.

	Std. / Stk. No.	H/C	Description 17 31 12 **	01	03	05	07
	TARM		Crossarm Single 6 Ft.	6	6	2	2
2 @	996		Epoxi Arm	6	6	2	2
3 @	270		Splice 6 Thru 4/0	2			
4 @	275		Splice 336 & Above	2			
5 @	270	H	SP 6 Thru 4/0 12kV		2		
	275	H	SP 336 & Above 12kV		2		
	260		Jumper	2			
	255		Jumper		2		

LABOR OPERATIONS
Reconductoring
12kV Transformers with or without Switches

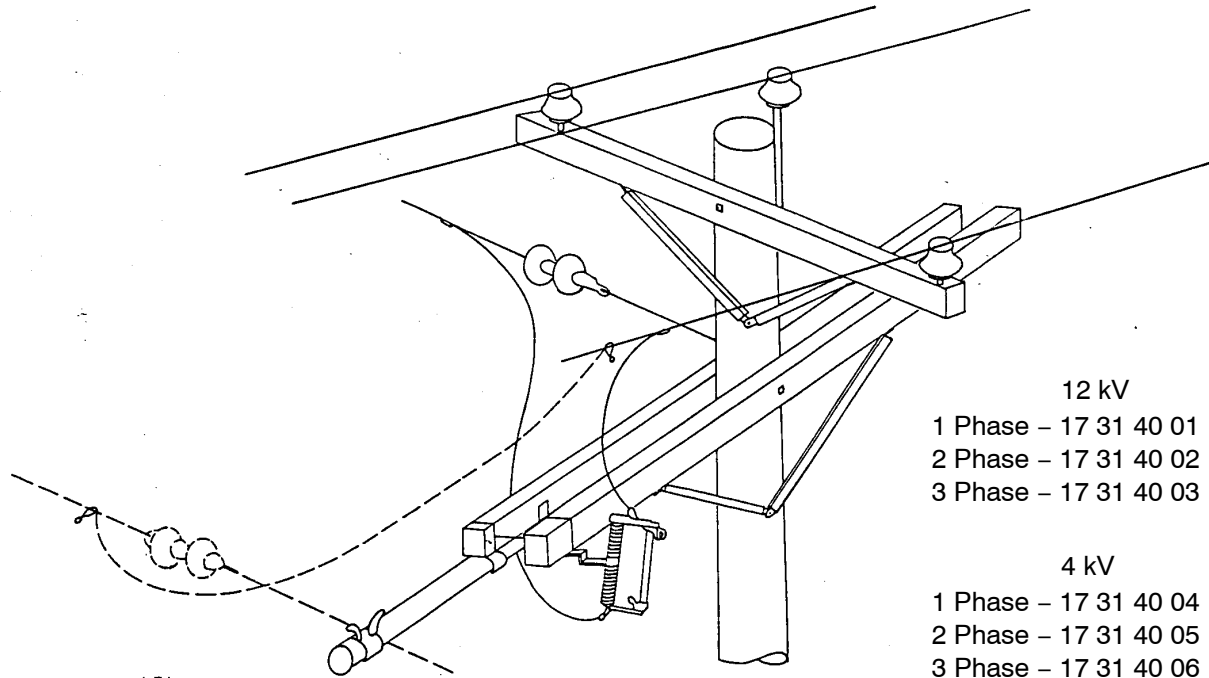
17 31 30 **

Sheet 1 of 1



1. If transformer outage can be obtained, use Code 260.

		Description	17 31 30 **	01	02
@	996	Epoxi Arms		4	4
@	255	Jumper		12	4
@	260	Jumper		12	4



1. Group for 12kV #6 thru 1/0 existing switch is refused or converted to solid blade.
2. Group for 12kV 336 thru 556 complete switch may be replaced.
3. Where P.G. connections are installed using rubber gloves, estimate a Code 255 and minus out one corresponding Code 252. 252 energized connectors (each). Minus out one 255 for each jumper on which a 252 connector is installed.

LABOR OPERATIONS
Reconductoring
Switch Pole – Breakoffs

17 31 40 **

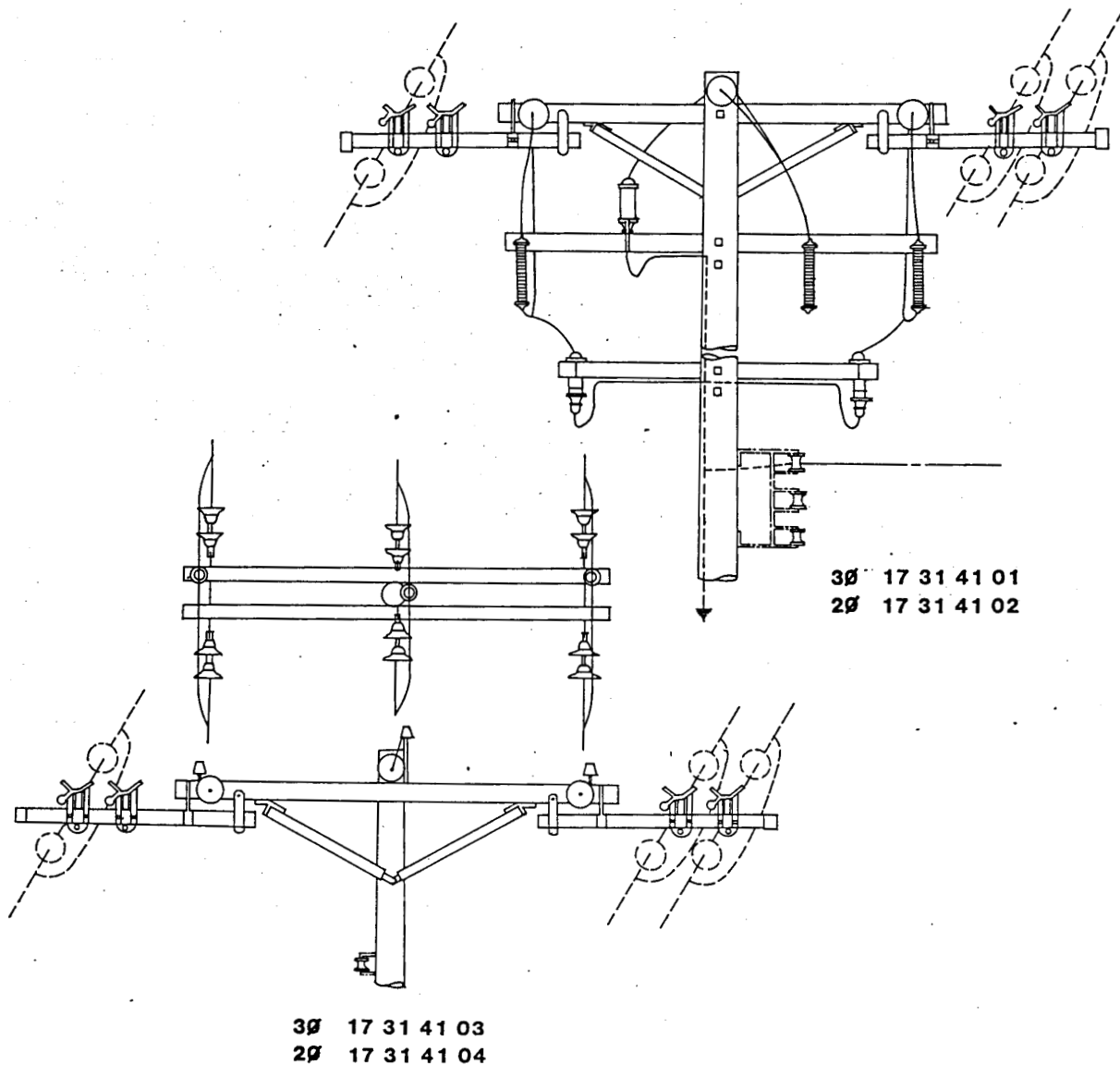
Sheet 2 of 2

		H/C	Description	17 31 40	01	02	03	04	05	06
5 @	996		Epoxi Arms		2	4	4	2	4	4
	912		R&R Insulators					1	2	3
	912	H	R&R Insulators		1	2	3			
			Breakoff Description		Quantities Estimated/Reported					
			Existing Breakoff	New Breakoff						
3 @	260		Switched	Switched	5	10	15	6	12	18
	255				1	2	3	0	0	0
	260		Not Switched	Not Switched	2	4	6	4	8	12
4 @	255				2	4	6			
5 @	260		Not Switched	Switched	1	2	3	3	6	9
	255				2	4	6			
	260		Switched	Not Switched	2	4	6	3	6	9
	255				1	2	3	0	0	0
			New Wire 336 or Larger							
@2	260		100 Amp Switch	600 Amp Switch	1	2	3	2	4	6
@3	255		200 Switch		1	2	3	0	0	0
@2	252				1	2	3			
@3	260		Not Switched	Not Switched	2	4	6	4	8	12
@2	255				2	4	6			
@3	252				@	@	@			
@2	260		Not Switched	600 Amp Switch	1	2	3	3	6	9
@3	255				2	4	6			
@2	252				1	2	3			
@3	260		Switched	Not Switched	2	4	6	3	6	9
@2	255				1	2	3			
@3	252				@	@	@			

LABOR OPERATIONS
Reconductoring
12 kV Switch Poles – Loopovers

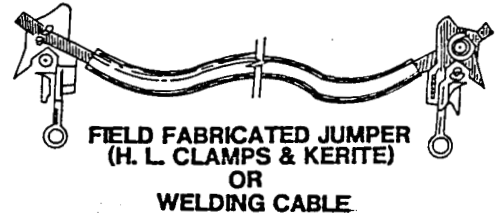
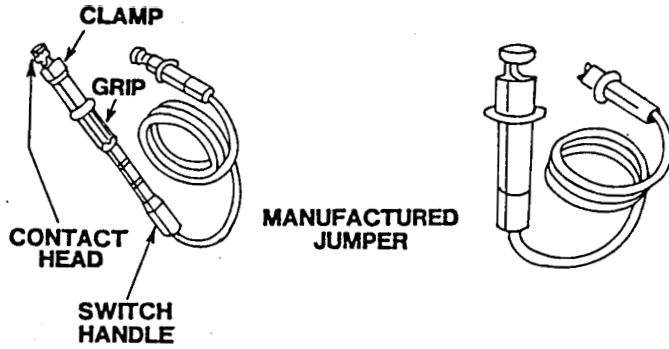
17 31 41 **

Sheet 1 of 1

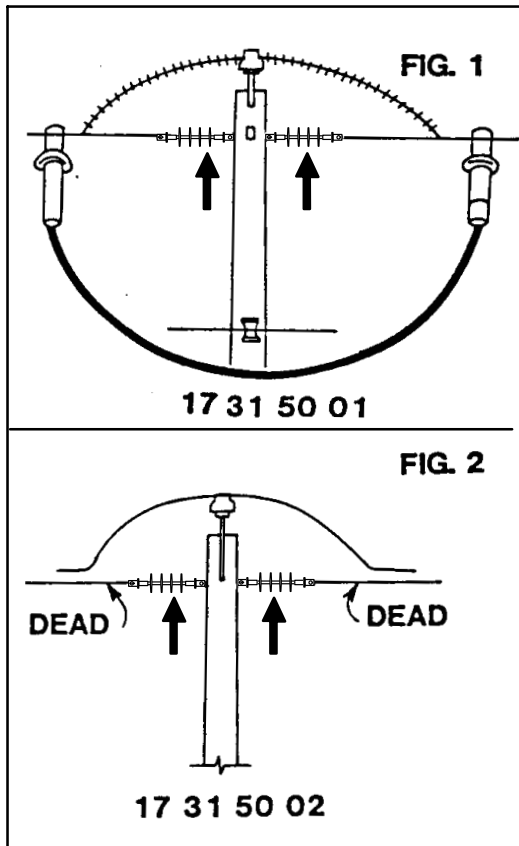


1. Above quantities assume that new switches will be installed.
2. If switch is not replaced or R&R'd, Estimate 4 additional Code 260s per switch.

	Stk. No or Code	H/C	Description	17 31 41 **	01	02	03	04
1 1 2	996		Epoxi Arms		4	4	4	4
	912	H	R&R Insulators		6	4	6	4
	255		Jumper		3	2	6	4
	260		Jumper		3	2	6	4



Std. / Stk. No.	Description	17 31 50 **	01	02	03	04	05	06
260	Inst. & REM. 5kV, Jumpers, Loopovers	2						
260	5 & 12kV, Dead Loopovers		1					
260	1st, Conn. REM. De-energizes jumper Loopover				1			
260	Secondary Split					2		
260	Inst. or REM. Primary Taps – Phase Cuts Etc.						1	
260	Open Loop & Reconnect to Itself Hot							1

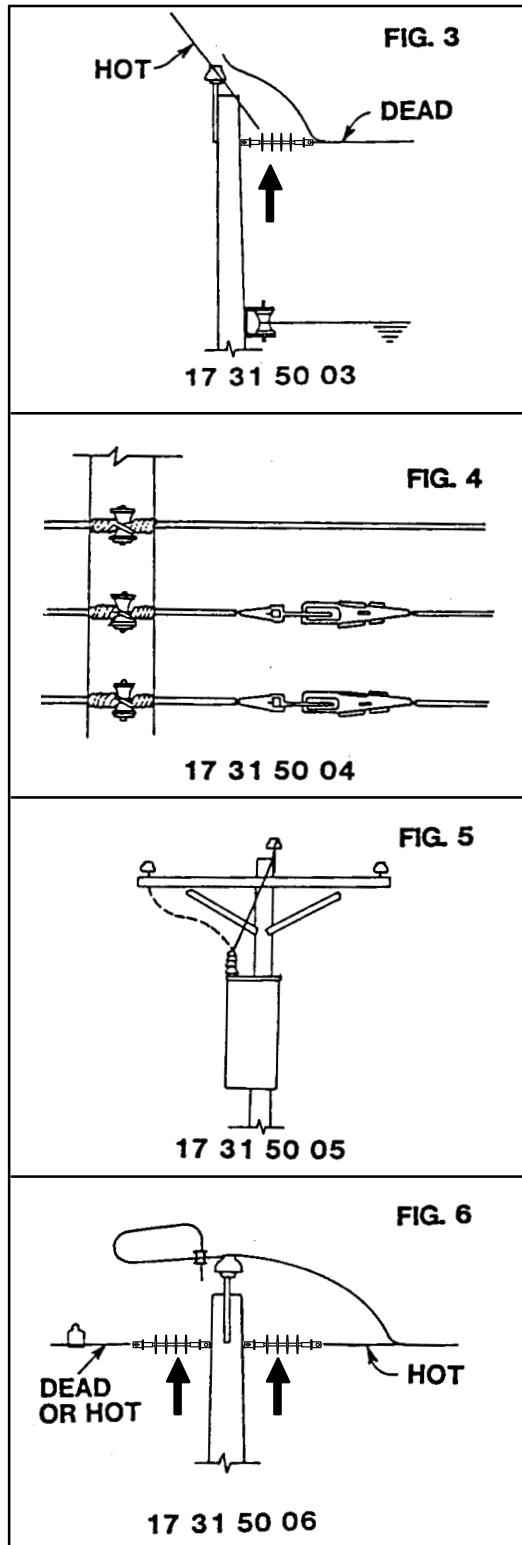


INSTALL OR REMOVE JUMPERS

This operation code is to be estimated in the following cases. Do not report with Code 255 or 252.

Installing or removing 5kV jumpers, loopovers, or looparounds. (Fig. 1)

Installing 12kV jumpers, loopovers, or looparounds and the first connection is to de-energized primary. (Figs. 2 & 3)



The first connection (connector or clamp) removed de-energizes the jumper, loopover or looparound. (Fig. 3)

Opening or closing secondary splits (Fig. 4), grounding single phase primary (Fig. 3), installing or removing temporary jumpers (Fig. 1), or as a supplemental ground from the neutral to the ground rod on a three phase cluster grounding set.

Installing or removing energized primary taps (hot line clamps) and no major items are reported. (Figs. 3 & 5)

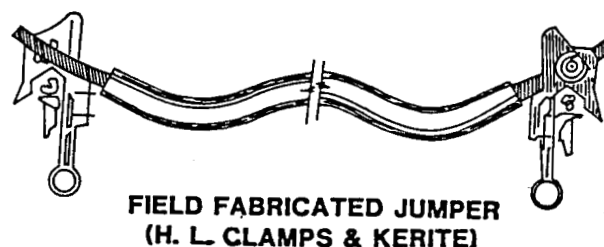
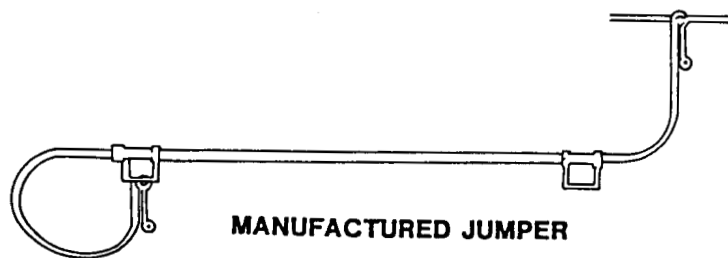
If an energized jumper is disconnected, remains energized and is reconnected to itself or the same energized phase (using hot line clamps or stirrups), estimate Code 260. (Fig. 6)

Installing or removing energized primary connections on existing reclosers and sectionalizers.

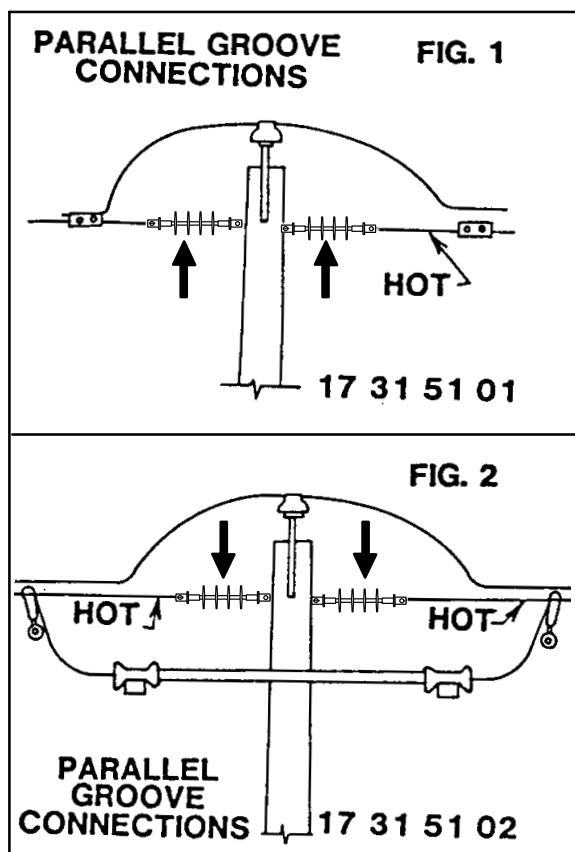
Do not estimate Code 260 when estimated major material items, such as switches, are connected or disconnected.

Do not estimate with stirrup clamps or with hot line clamps that are not already connected to a loopover, looparound, or loopunder. Not to be used for permanent connections on secondary or neutral.

Estimate only a quantity of one "each" for the installation or removal of a jumper, loopover, loopunder, or looparound.



Std. / Stk. No.	Description	17 31 51 **	01	02	03	04	05	06
252	Install Hot Connection (Parallel Groove)		1					
255	Inst. Jumper & Loopovers (Parallel Groove)			3				
255	Remove Connection – Tap Remains Hot				1			
255	Inst. or REM. Hot Taps & Jumpers					6		
255	Inst. or REM. Hot Taps & Jumpers						2	
255	Install Temporary Jumpers							3

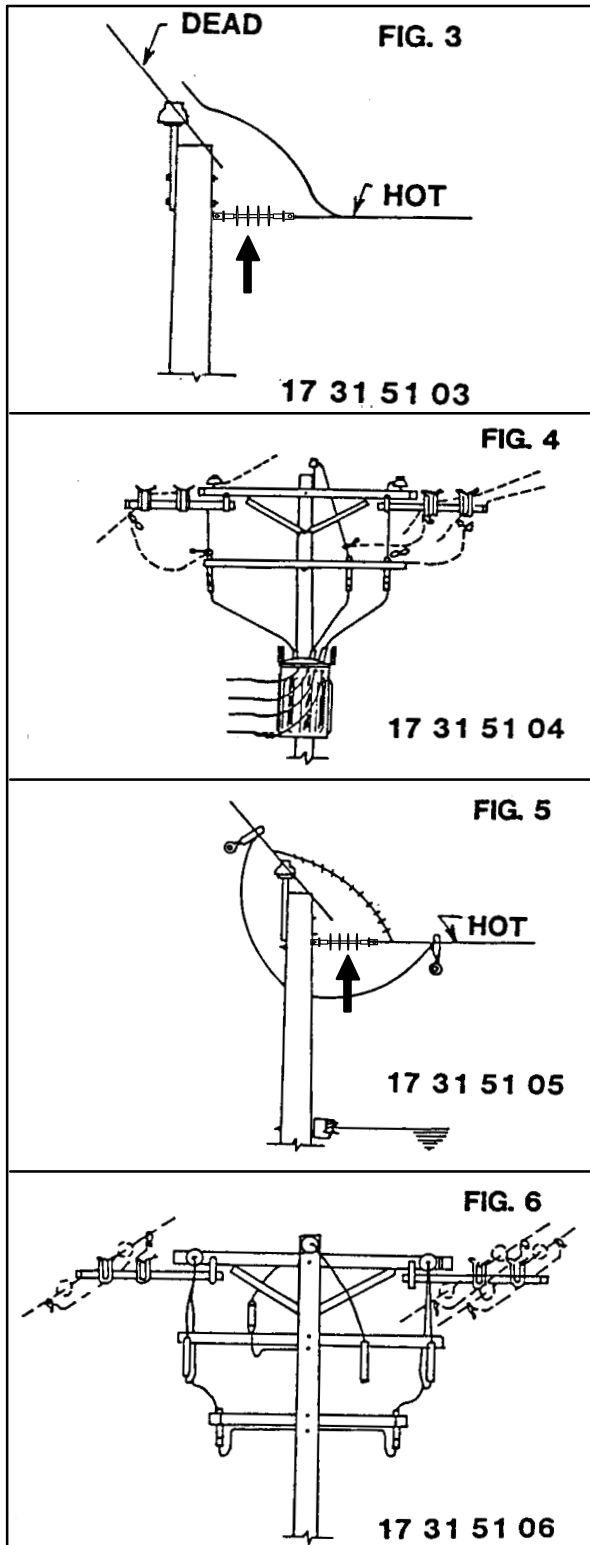


252
INSTALL OR REMOVE ENERGIZED (12KV OR ABOVE) PRIMARY CONNECTIONS

Estimate this operation code in the following cases:

Installing connector, such as a parallel groove clamp, on energized primary using hot sticks. (12kV or above) (Fig. 1)

Only a quantity of one Code 252 should be estimated unless two connectors (such as parallel groove clamps) on the same jumper are installed hot. In this case, a quantity of 2 Code 252s should be estimated. (Figs. 2 & 5) If the above is installed using rubber gloves, replace Code 252 with Code 255. If energized P.G. clamp is removed using hot sticks or gloves, report as Code 255.



255

Installing loopovers, looparounds, or jumpers and the first end connected (Hot Line Clamp) is to energized primary. (12kV or above) (Fig. 2, 4, & 5)

If an energized jumper is disconnected, remains energized, and is reconnected to itself or the same energized phase using hot line clamps or stirrups, estimate Code 260 (Fig. 6)

Do NOT estimate Code 255 with Code 260 or when major material, such as switches, are connected or disconnected when working on 5kV. Do NOT estimate Code 255, 260, or 252 on the same jumper.

Do NOT estimate Codes 255 or 260 for closing or opening a switch.

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FIBER SPLICING AND TESTING	18-00-01-02
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OPGW TANGENT OR CORNER $\geq 30^\circ \leq 60^\circ$	18-05-11-**
OPGW 90° CONTINUOUS CORNER NO SPLICE	18-05-12-**
OPGW 90° CORNER WITH SPLICE	18-05-13-**
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OPGW TO UNDERGROUND TRANSITION	18-05-15-**
OPGW DEAD END WITH SPLICE	18-05-16-**
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ADSS FORMED WIRE DEAD END $\geq 30^\circ \leq 90^\circ$ WITHOUT SPLICE	18-10-02-**
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STEEL POLE OPGW TO UNDERGROUND FIBER	18-30-01-**
STEEL POLE ADSS TO UNDERGROUND FIBER	18-30-02-**
LATTICE TOWER OPGW TO UNDERGROUND FIBER	18-40-01-**
LATTICE TOWER ADSS TO UNDERGROUND FIBER	18-40-02-**

1) GENERAL

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

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

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

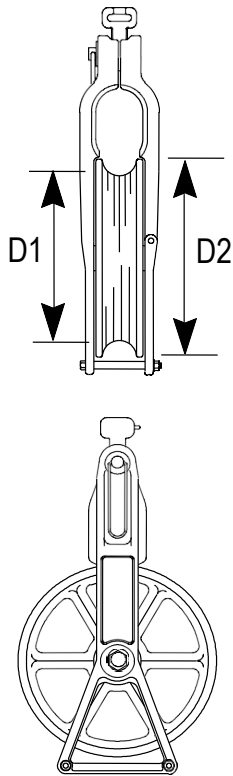
2) PRECAUTIONS

- a) Care must be taken to avoid damaging the OPGW during handling and stringing operations. Avoid sharp bends to the cable and take precautions to prevent crushing the OPGW during placement. The transmission quality of the optical fibers can potentially be degraded if the OPGW is subjected to excessive pulling tensions or excessively small bend diameters.
- b) Following values shall be considered to help prevent damage to the OPGW
 - i) Maximum Stringing Tensions listed in DCS **07-00-07-06**
 - ii) Minimum Bend Radius as follows:
 - During Installation (Dynamic): 20 x Diameter
 - After Installation (Static): 15 x Diameter
 - iii) Pulling Speed:
 - 60 meters per minute, or
 - 195 feet per minute, or
 - 3.6 km per hour, or
 - 2.2 miles per hour.
 - iv) Minimum distance from puller and tensioner to the stringing block:
 - 3:1 Ratio

3) INSTALLATION

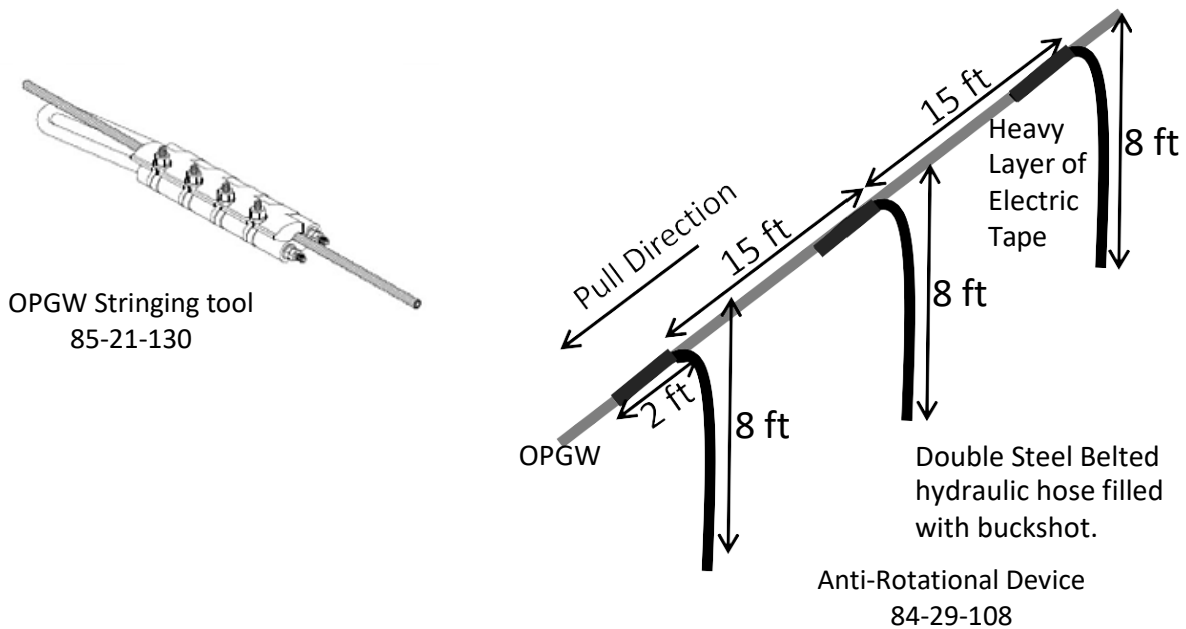
- a)** The contractor shall provide mechanical protection to the cable where it runs along the surface or edge of a structure or pulling devices.
- b)** At the locations where a splice is required, additional cable length must be provided to physically accommodate the splicing process.
 - i)** The length of each cable end shall be not less than 115 feet from the base of the structure (ground level), or as otherwise noted on the Drawings, remembering that about 20 feet of cable shall be cut off to assure no damaged fiber is used.
 - ii)** If additional length is required, due to limited access for splicing vehicles, it shall be included, as required, and with the approval of the Ameren Construction Services or Ameren Engineering.
- c)** The fiber shall be neatly coiled and securely attached to the structure on bracketing of the splice enclosure, as specified on the Drawings referenced in the Appendices. The diameter of the coil shall be a minimum of three feet or as required based on the minimum allowed bending radii.
- d)** The Contractor shall handle all fiber optic cable in strict accordance with the cable manufacturer's specifications and procedures.
- e)** If any Owner-provided materials appear to be damaged or defective, the Contractor shall immediately report the details to the Construction Manager, who shall provide written directions regarding the corrective actions, storage, or disposal of these materials.
- f)** If the cable must be temporarily stored overnight while in the process of splicing, the cable ends shall be sealed to prevent water migration and the cable coils stored out of the reach of vandals. It is unacceptable to temporarily store cable at the base of the pole, unless the structure is in a safe and secured location.
- g)** All cables splice boxes, and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.
- h)** Fiber shall be segregated by tray, conduit, innerduct, or other innerduct methods for protection.
 - i)** Where ADSS fiber is placed underground, it shall have its own conduit and be designated as such, or be segregated by using innerduct within the conduit or trench system.
 - ii)** Innerduct will also be used in the main cable tray application within the control house.
 - iii)** Within the confines of an enclosure, fiber jumpers should be segregated by a separate tray system, to ensure bend radii and cable weight concerns are mitigated.
- i)** Contractor shall mark conduits leaving Ameren Property with approved marking methods that should be prescribed in project documentation.

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

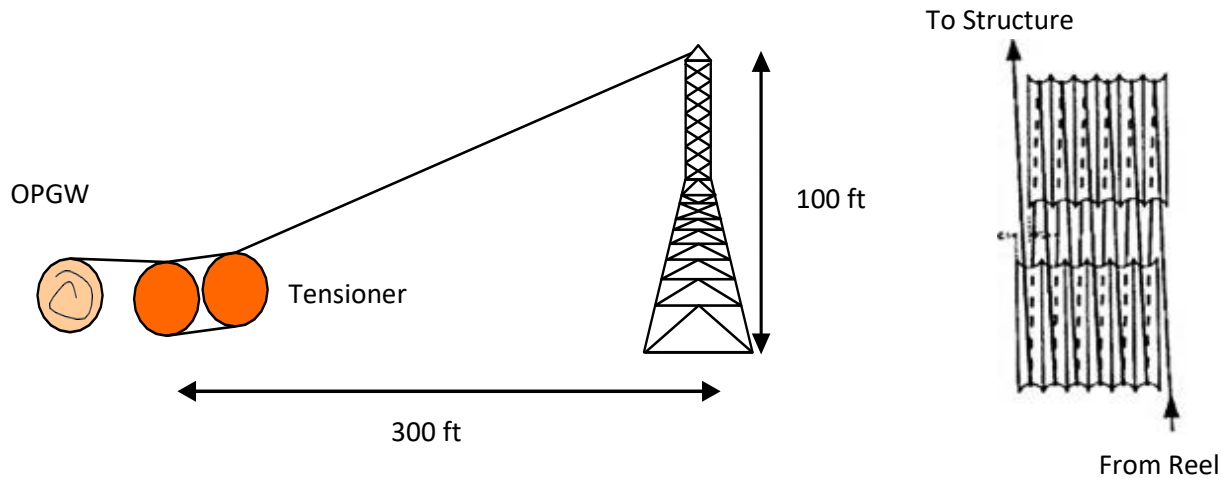


Structure Angle (θ)	Bottom Groove Diameter (D1)	Typical Stringing Block (minimum) (D2)
First and Last Structures	21"	28"
Tangent Structures $\theta < 20$	16"	20"
Tangent Structures $20 < \theta < 45$	21"	28"
Tangent Structures $45 < \theta < 60$	26"	35"
Tangent Structures $60 < \theta < 90$	31"	
Bull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

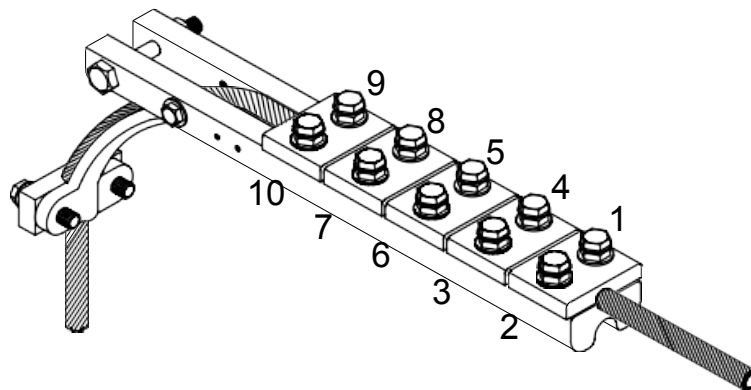
- k) Use Anti-Rotational Device (Stk No: 84-29-108) and OPGW stringing tool (Stk No: 85-21-130):



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



- m) Prior to pulling, tighten bolts and loosen inner tail of OPGW Reel.
- n) Pulling speed shall not exceed 200 ft/minute. Pulling tension shall not exceed 3,967 lbs (20% RBS). Do not exceed 48 hours in blocks prior to clipping in.
- o) Deadend bolts shall be torqued to 40 ft-lbs and tightened in sequence at 5 ft-lbs increments.



1) GENERAL

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

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

2) SPLICING

- a) Splicing shall be performed as per provided documentation and reference drawings.
- b) Standard optical cable color codes and fiber types shall be observed when fusion splicing two fiber optic cables together unless otherwise directed by the Ameren Representative. For instance, when butt splicing OPGW fibers to All Dielectric Self Supporting (ADSS) fiber optic cable, G.652 standard single mode fibers shall be spliced to G.652 standard single mode fibers, and G.655 fibers shall be spliced to G.655 fibers in order based on the TIA/EIA-598 color code scheme. G.655 fibers shall be spliced as the last group in the fiber cable count.
- c) OPGW and ADSS shall be prepared for splicing as per manufacturer's installation procedures. The installation procedures shall be read and fully understood prior to field installation. The manufacturer's recommended maximum bend radii and tensions shall be observed at all times so not to exceed these values.
- d) All fiber optic splicing shall be fusion type. Splicing shall be performed in an environmentally protected enclosure to ensure high quality splice performance. Splicing shall be accomplished on the ground and not in an aerial bucket. The excess cable at splice points shall be properly secured and mounted in/on the appropriate location. Fusion Splicing shall use Single Mode Fiber Active Core Alignment and LID (Light Injection and Detection) splicing methods per Telcordia GR-765-CORE.
- e) Splice equipment must meet or exceed minimum performance standards as described within Rural Development Utilities Program (RDUP, formerly RUS – Rural Utilities Service) Bulletin 1753F-401 RUS Standard for Splicing Copper and Fiber Optic Cables.
- f) All spliced fibers shall be protected by a fiber optic heat shrink sleeve. Tyco/Raychem SMOUV heat shrink

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

- g)** Visual inspection of each splice shall be performed by Ameren personnel or Ameren approved Contractor. The visual inspection requires that the splicing technician inspect the splice for abnormalities such as a narrowing, thickening, or bubble at the splice point. If abnormalities exist, the splice shall be broken and re-spliced. After passing visual inspection and profile alignment qualifications, the splice shall be subject to a tension test to ensure the fiber splice and adjacent fiber are of proper quality.
- h)** Final acceptance of a splice will be determined by the Ameren or Ameren Representative, as per 'ACCEPTANCE' paragraph below, upon successful completion of the bi-directional OTDR testing phase.
- i)** Prior to any work being performed on Ameren structures, approval from Ameren Supervision shall be obtained.

3) TESTING

- a)** All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.
- b)** Fiber end-faces shall be inspected at 250x or 400x magnification. Magnification of 250x is suitable for inspecting multimode and single-mode fibers. Magnification of 400X magnification should be used for detailed examination of single-mode fibers.
- c)** Scratched, pitted or dirty connectors shall be diagnosed and corrected. If the problem cannot be completed by cleaning, it should be reported to Ameren or Ameren Representative.
- d)** It is recommended that the end-face images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.
- e)** Testing shall be performed on each cabling segment (connector to connector). An "end-to-end" test is required. For example, splice box A to splice box B, cable run structure 100 to 110, substation X to substation Y, etc. or per scope required by Project Engineer.
- f)** Single mode fiber tests at wavelengths of 1310 nm, 1383 nm, 1550 nm, and 1625 nm at a distance range up to 80km shall be completed using OLTS – Optical Loss Test Set per standards ANSI/TIA/EIA-526-7 Method A.1; and
- g)** Single mode fiber tests at wavelengths of 1310 nm, 1383 nm, 1550 nm, and 1625 nm at a distance range up to 80km shall be completed using OTDR – Optical Time Domain Reflectometer Test per standards IEC 60793-1-40 or IEC 61300-3-7 with broadband light sources and spectrum analyzer on the receiving end of the fiber.

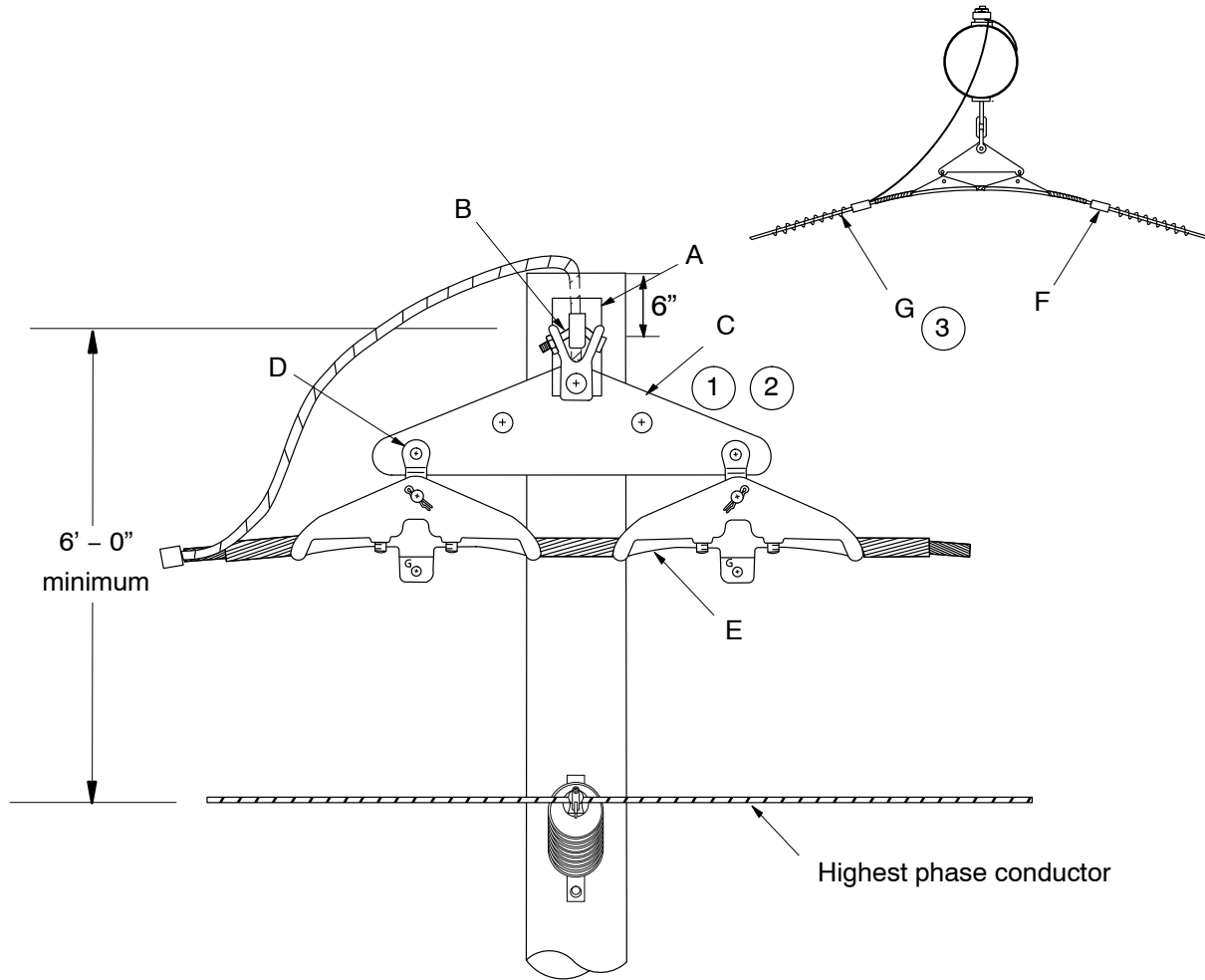
- h) Optical length shall be measured using an OLTS and OTDR. OLTS fiber calculated length measurements will be used as a reference for all the budget loss calculations.
- i) Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with ANSI/TIA/EIA-568-C.1. The polarity of the paired duplex fibers shall be verified using an OLTS.
- j) Each fiber segment of the fiber shall be tested at the wavelengths listed above, unless otherwise noted by Ameren Personnel.
- k) A final end-to-end test shall be done (substation patch box to substation patch box) with a loss budget less than 5% over the calculated total loss under ideal conditions per manufacturer's published values for the frequencies listed above, after each section of splicing is completed.
 - i) Patch box, splice enclosure, patch panel, all refer to the same box that is installed into the fiber distribution panel.

4) ACCEPTANCE

- a) Changes to the acceptance criteria can only be obtained with approval from Ameren Personnel or those he/she designates.
- b) Cabled fiber loss shall be a maximum of:
 - 0.35 dB/km at 1310 nm
 - 0.35 dB/km at 1383 nm
 - 0.20 dB/km at 1550 nm
 - 0.23 dB/km at 1625 nm
- c) Maximum fusion splice loss for any single splice shall be less than 0.10 dB.
- d) A factory terminated connector (type LC) shall not exceed loss of 0.75 dB end to end.

5) LABELING

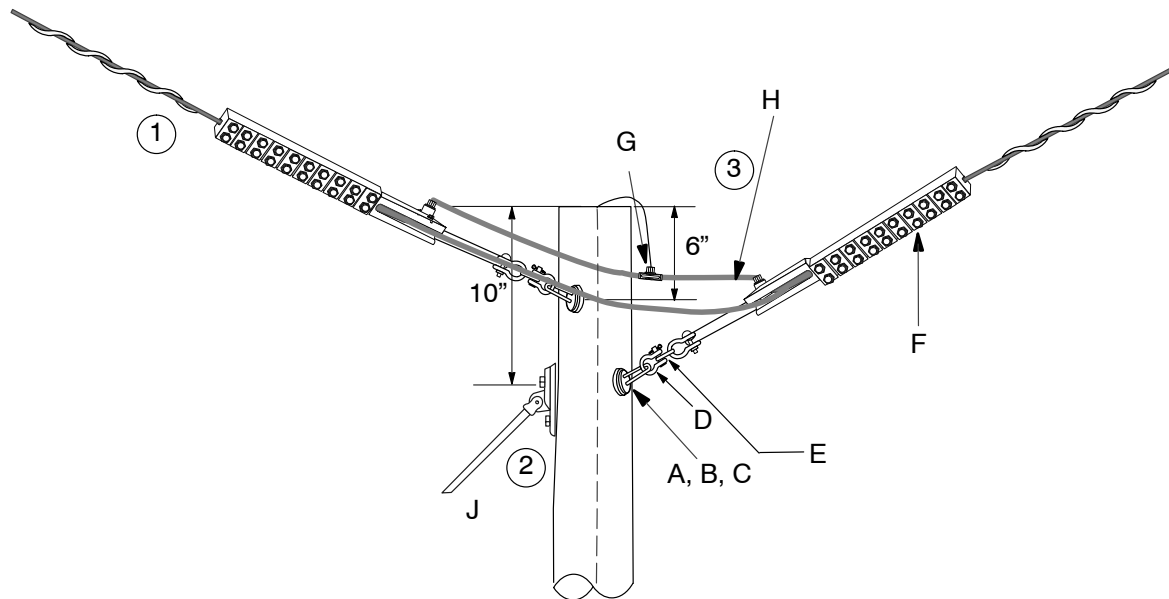
- a) Labeling shall conform to the requirements specified within ANSI/TIA/EIA-606-A or to the requirements specified by an Ameren Representative;
- b) Shall meet the legibility, defacement, exposure and adhesion requirements of Marking and Labeling Systems - UL 969. Handwritten labels are not acceptable.
- c) Labeling shall be done per Ameren guidance and standardization from the Ameren Fiber mapping system and conform to proper formats.
- d) As-builts shall have properly labeled end points of both OPGW and ADSS.



NOTES:

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

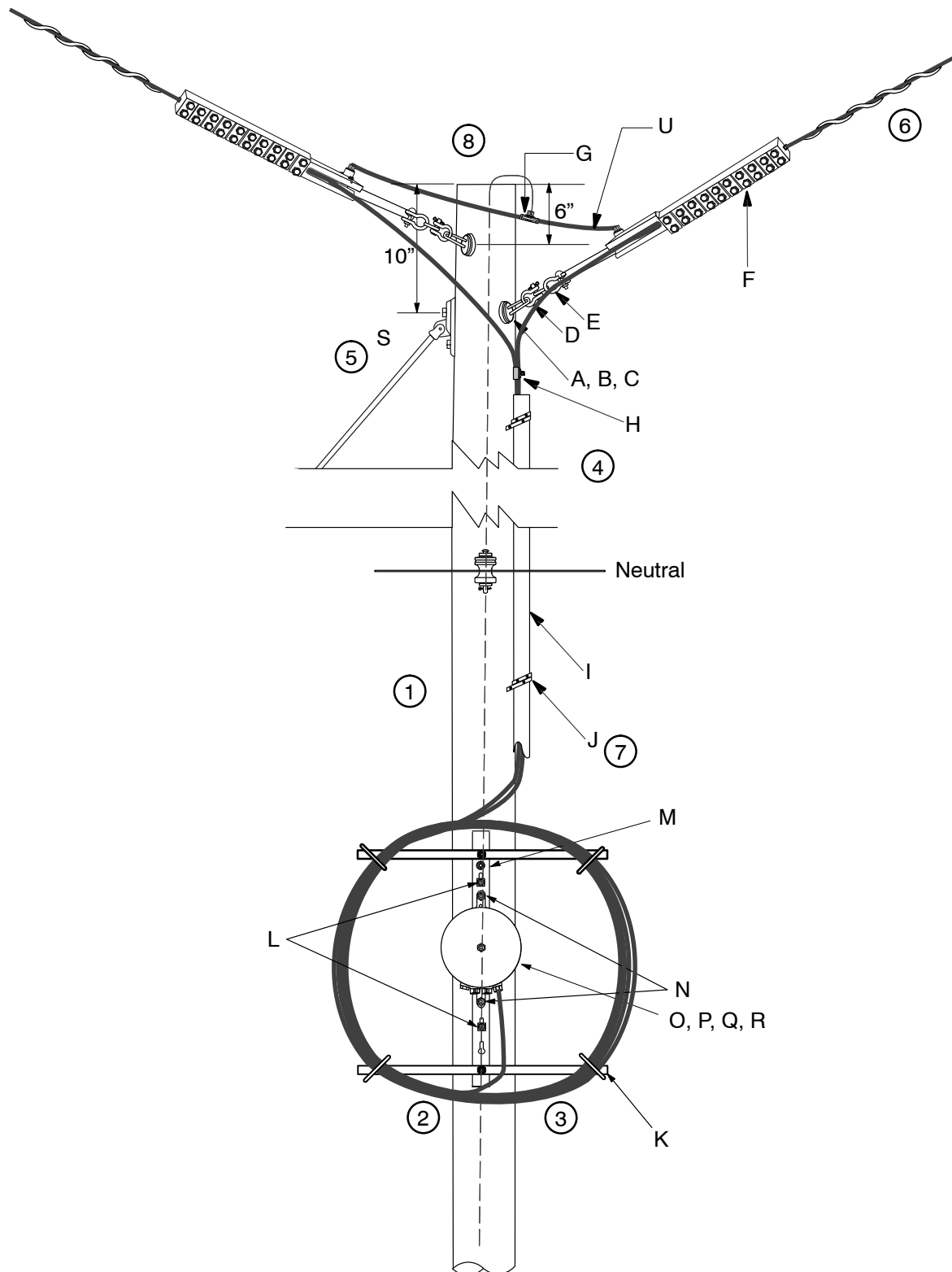
		Std. / Stk. No	Description	18 05 11	01
3@ @	A	23 68 458	Static Support Bracket $\frac{3}{4}$ " x 14"		1
	B	23 68 368	Anchor shackle		1
	C	23 17 437	Yoke Plate		1
	D	23 58 127	Clevis Eye		2
	E	23 67 501	OPGW Suspension Clamp w/ Armor Rods		2
	F	17 52 217	Clamp For Bonding OPGW Static to Pole Ground		1
	G	23 67 319	Spiral Vibration Damper		2
	H	12 00 10 **	Grounding Unit		1



NOTES:

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

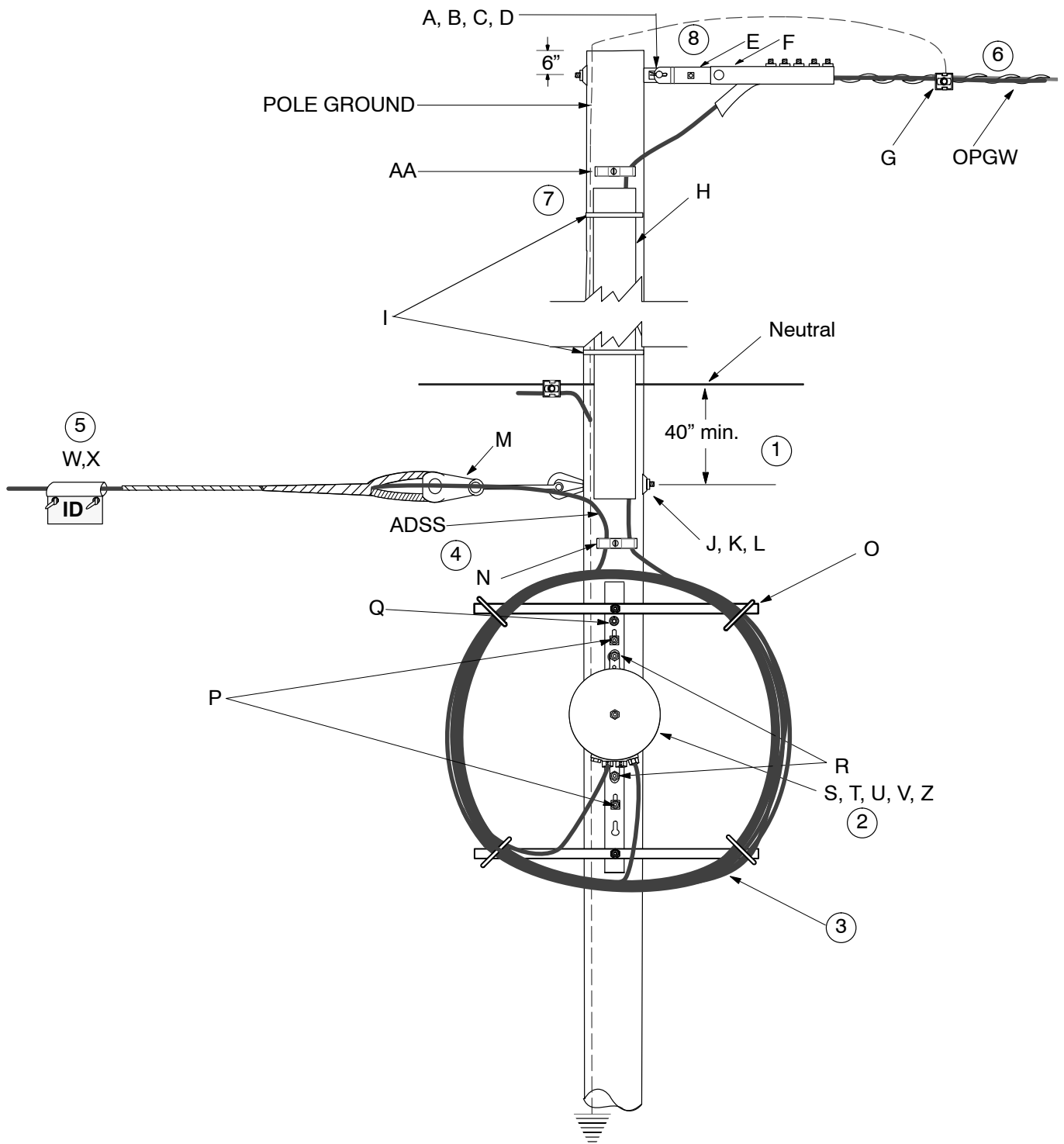
		Std./Stk. No.	Description	18-05-12	01
@ @2	A	23 66 135	Washer, Lock, Double Coil 3/4"		2
	B	23 66 031	Washer, Square for 3/4" bolt		2
	C	23 52 254	Machine Bolt 3/4" x 16"		2
	D	23 59 095	Eyelet, for 3/4" bolt		2
	E	23 59 042	Extension Link 6"		2
	F	23 68 732	Bolted Deadend		2
	G	17 51 137	Clamp, Parallel Groove		1
	H	18 66 678	Bonding Wire , 60"		1
	I	12 00 10 **	Grounding Unit		1
	J	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)		2



NOTES:

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

		Std./Stk. No.	Description	18-05-13	01
@5 @	A	23 66 135	Washer, Lock, Double Coil 3/4"		1
	B	23 66 031	Washer, Square for 3/4" bolt		1
	C	23 52 254	Machine Bolt 3/4" x 16"		1
	D	23 59 095	Eyelet, for 3/4" bolt		1
	E	23 59 042	Extension Link 6"		1
	F	23 68 732	Bolted Deadend		1
	G	17 51 137	Clamp, Parallel Groove		4
	H	17 52 220	Downlead Clamp, OPGW		1
	I	12 01 230	Conduit, 1 1/2"		1
	J	27 60 035	Strap, Iron Hanger		2
	K	40 54 480	Coil Bracket		1
	L	23 60 011	Lag Screw, 5/8" x 5" galvanized		2
	M	40 59 318	Pipe grounding clamp		1
	N	23 52 031	Bolt 1/2" x 3" with Galv. Nut		2
	O	40 54 478	Splice Enclosure		1
	P	17 60 734	Splice Protector Sleeve		10
	Q	40 54 481	Connector Kit, OPGW		1
	R	40 54 479	Furcation Kit (for OPGW)		2
	S	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)		2
	T	12 00 10 **	Grounding Unit		1
	U	18 66 678	Bonding Wire, 60"		1



FIBER OPTIC COMMUNICATION

OPGW to ADSS Transition

18 05 14**

Sheet 2 of 2

NOTES:

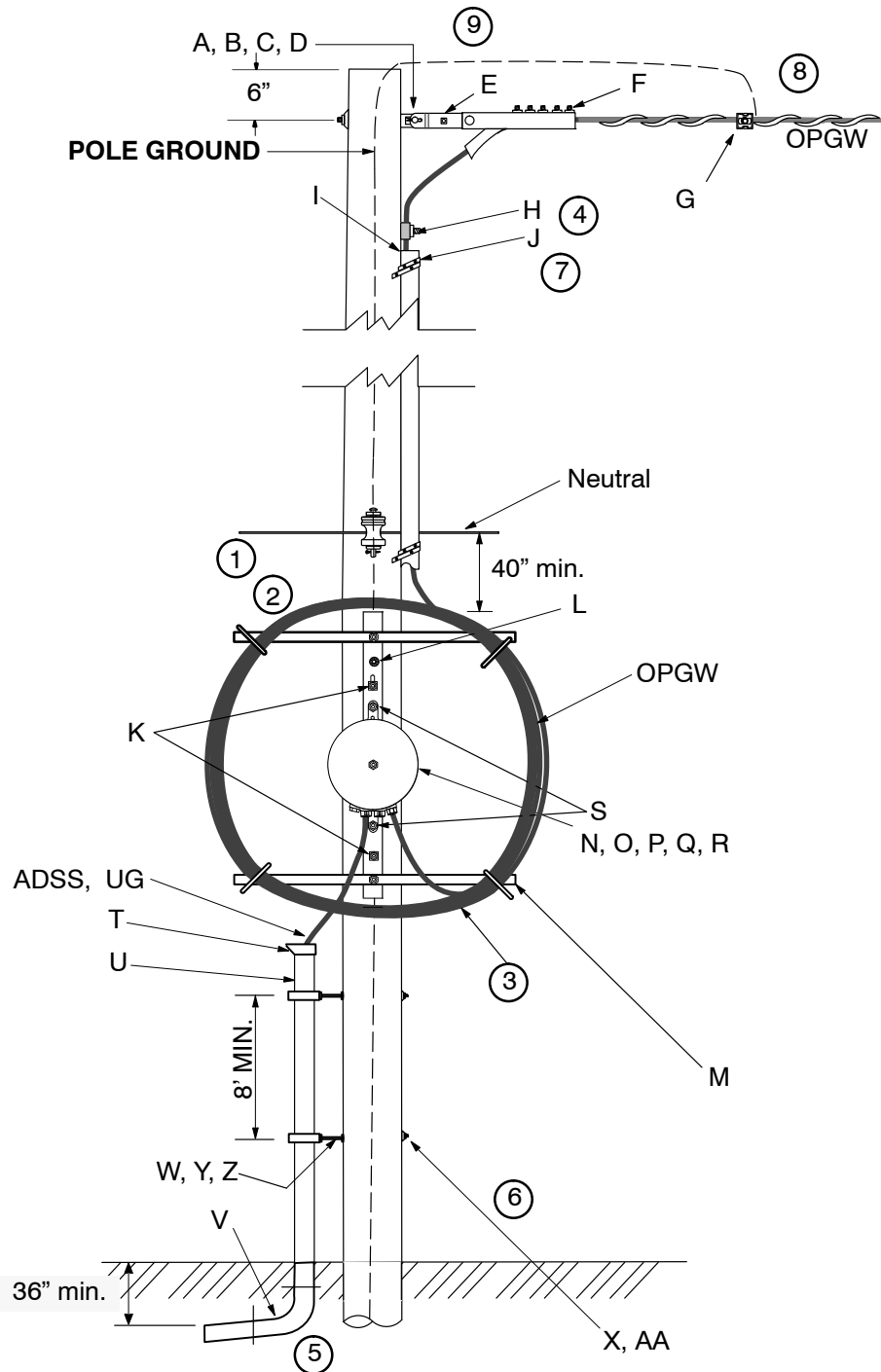
1. ADSS must be installed 40" or greater from Neutral or closest conductor.
2. Coil 100' of extra fiber optic cable around coil bracket.
3. Bottom loop of coiled fiber optic cable shall be located minimum of 15' above ground.
4. Install download clamps every 10'.
5. ADSS Tags should be attached with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

		Std. / Stk. No.	Description	18 05 14	01	02
@	A	23 66 135	Washer, Lock, Double Coil 3/4"		1	1
	B	23 66 031	Washer, Square for 3/4" bolt		1	1
	C	23 52 254	Machine Bolt 3/4" x 16"		1	1
	D	23 59 095	Eyelet, for 3/4" bolt		1	1
	E	23 59 042	Extension Link 6"		1	1
	F	23 68 732	Bolted Deadend		1	1
	G	17 52 217	Clamp for bonding OPGW Static to Pole Ground		1	1
	H	12 01 230	Conduit, 1 1/2"		1	1
	I	27 60 035	Strap, Iron Hanger		2	2
	J	23 66 134	Washer Lock, Double Coil 5/8"		1	1
	K	23 66 027	Washer, Square, for 5/8" machine bolt		2	2
	L	23 52 069	Machine Bolt 5/8" x 18'		1	1
	M	23 68 747	Formed Wire Deadend, 48-ct ADSS		1	
		23 68 778	Formed Wire Deadend, 72-ct ADSS			1
	N	17 02 177	Download Clamp, for 48-ct and 72ct ADSS		1	1
	O	40 54 480	Coil Bracket		1	1
	P	23 60 011	Lag Screw, 5/8" x 5" galvanized		2	2
	Q	40 59 318	Pipe grounding clamp		1	1
	R	23 52 031	Bolt 1/2" x 3" with Galv. Nut		2	2
	S	40 54 478	Splice Enclosure		1	1
	T	17 60 734	Splice Protector Sleeve		10	10
	U	17 62 293	Connector Kit, 48-ct ADSS		1	
		17 62 296	Connector Kit, 72-ct ADSS			1
	V	40 54 479	Furcation Kit (for OPGW)		2	2
	W	16 01 647	ID Tag, ADSS		1	1
	X	40 89 494	Nylon Zip Tie		2	2
	Y	12 00 10 **	Grounding Unit		1	1
	Z	40 54 481	Connector Kit, OPGW		1	1
	AA	17 52 220	Download Clamp, for OPGW		1	1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: KR
REV. NO: 1
REV. DATE: 07/01/2020



NOTES:

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



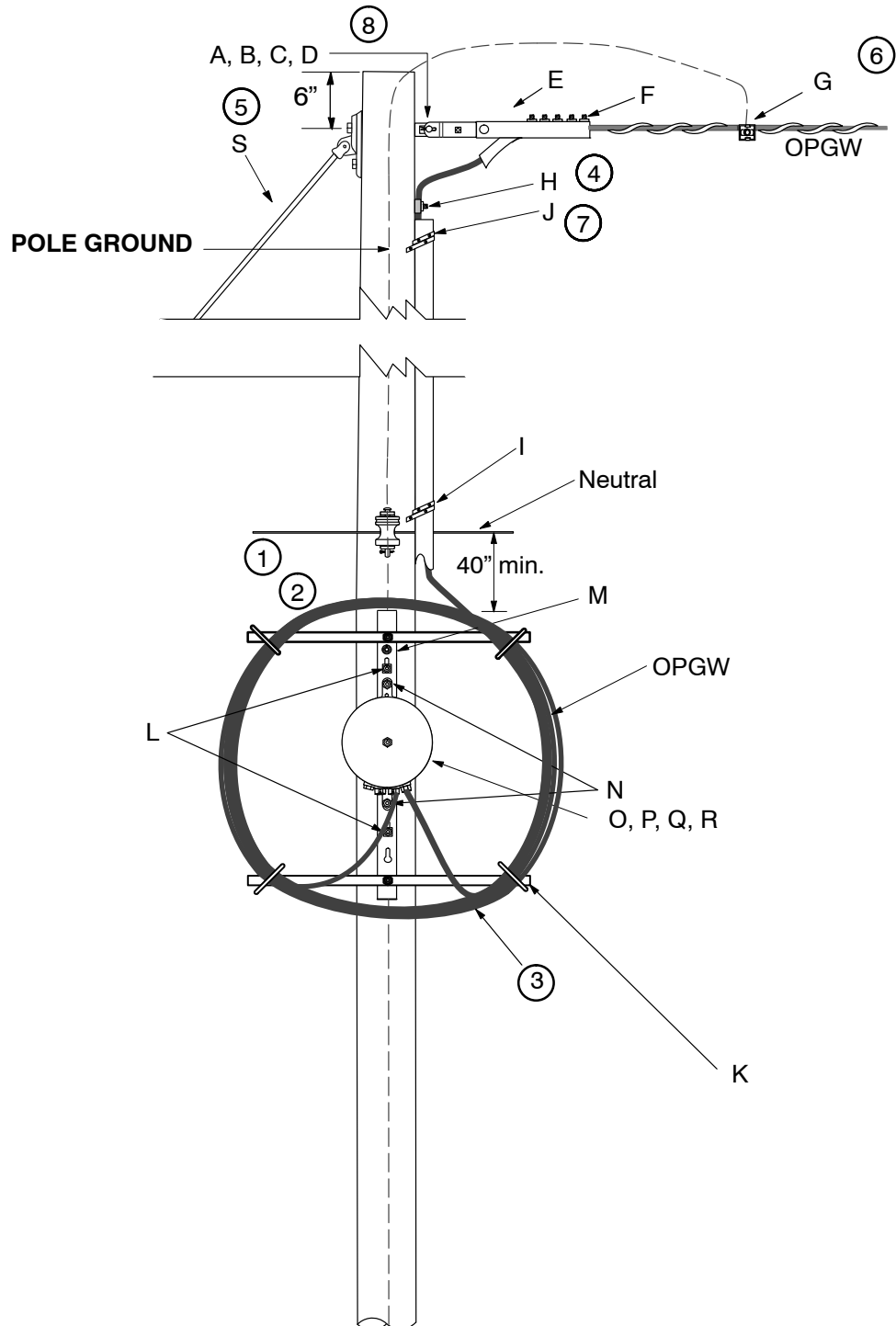
FIBER OPTIC COMMUNICATION

OPGW OH to UG Fiber Transition

18 05 15 **

Sheet 3 of 3

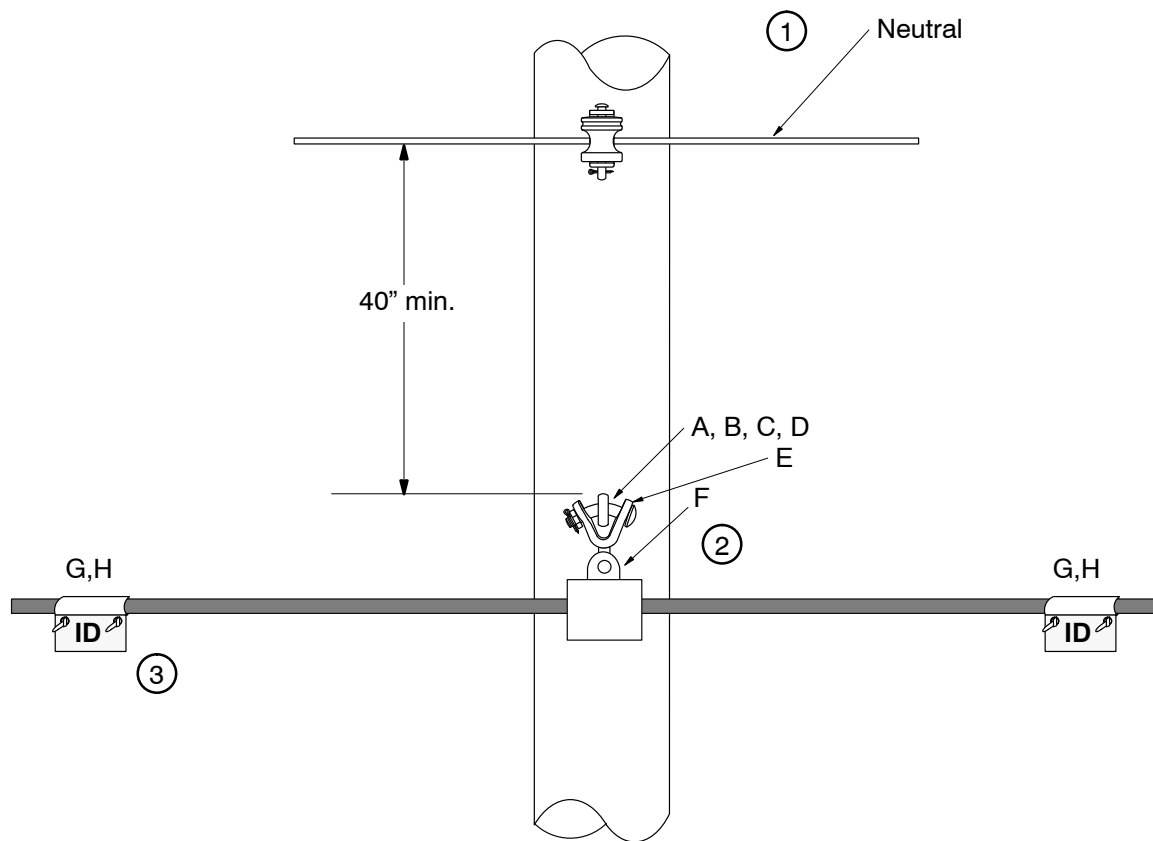
	Std./Stk. No.	Description	18 05 15	01
A	23 66 135	Washer, Lock, Double Coil ¾"		1
B	23 66 031	Washer, Square for ¾" bolt		1
C	23 52 254	Machine Bolt ¾" x 16"		1
D	23 59 095	Eyelet, for ¾" bolt		1
E	23 59 042	Extension Link 6"		1
F	23 68 732	Bolted Deadend, OPGW		1
G	17 52 217	Clamp for bonding OPGW Static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



NOTES:

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

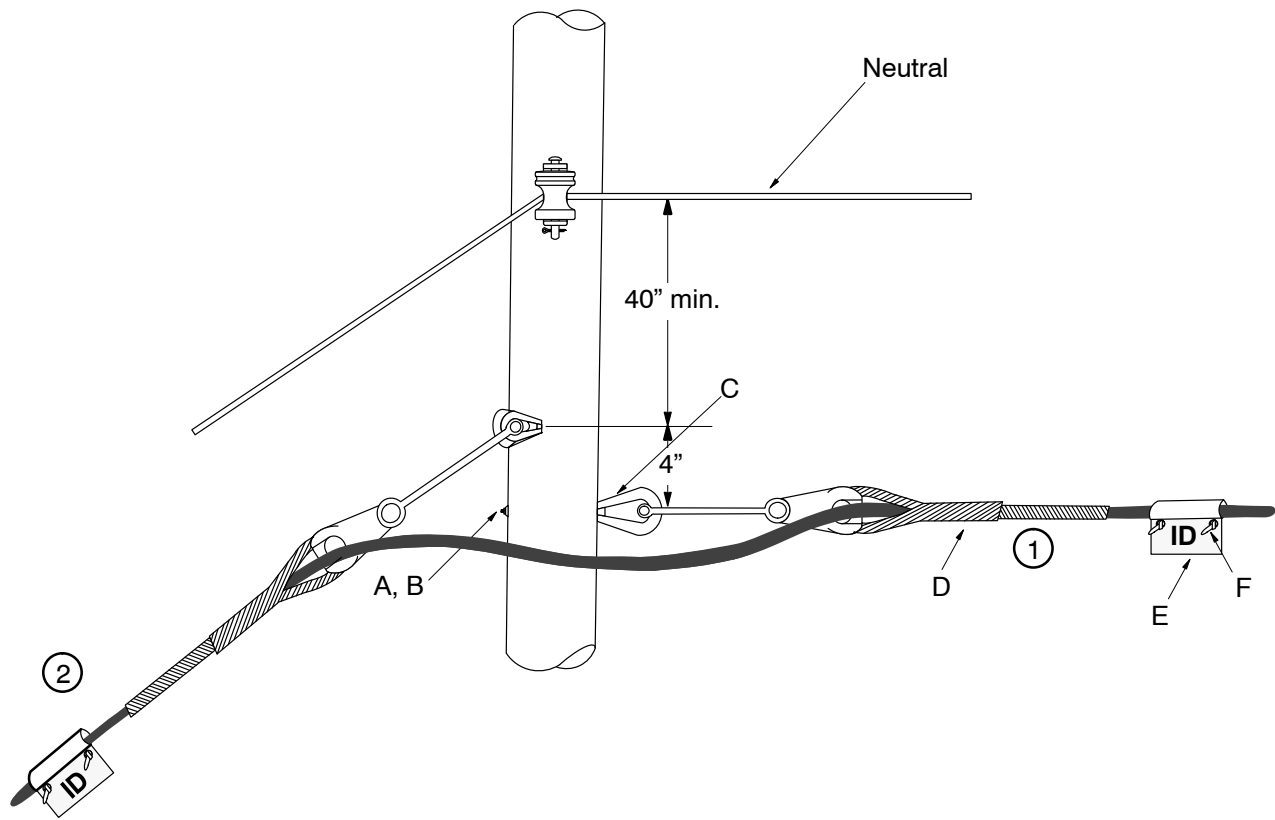
	Std. / Stk. No.	Description	18 05 16	01
A	23 66 135	Washer, Lock, Double Coil 3/4"		1
B	23 66 031	Washer, Square for 3/4" bolt		1
C	23 52 254	Machine Bolt 3/4" x 16"		1
D	23 59 095	Eyelet, for 3/4" bolt		1
E	23 59 042	Extension Link 6"		1
F	23 68 732	Bolted Deadend		1
G	17 52 217	Clamp for bonding OPGW Static to Pole Ground		1
H	17 52 220	Downlead Clamp, OPGW		1
I	12 01 230	Conduit 1 1/2"		1
J	27 60 035	Strap, Iron Hanger		2
K	40 54 480	Coil Bracket		1
L	23 60 011	Lag Screw, 5/8" x 5" galvanized		2
M	40 59 318	Pipe grounding clamp		1
N	23 52 031	Bolt 1/2" x 3" with Galv. Nut		2
O	40 54 478	Splice Enclosure		1
P	17 60 734	Splice Protector Sleeve		10
Q	40 54 481	Connector Kit, OPGW		1
R	40 54 479	Furcation Kit, OPGW		2
@5	S	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)	1
@	T	12 00 10 **	Grounding Unit	1



NOTES:

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

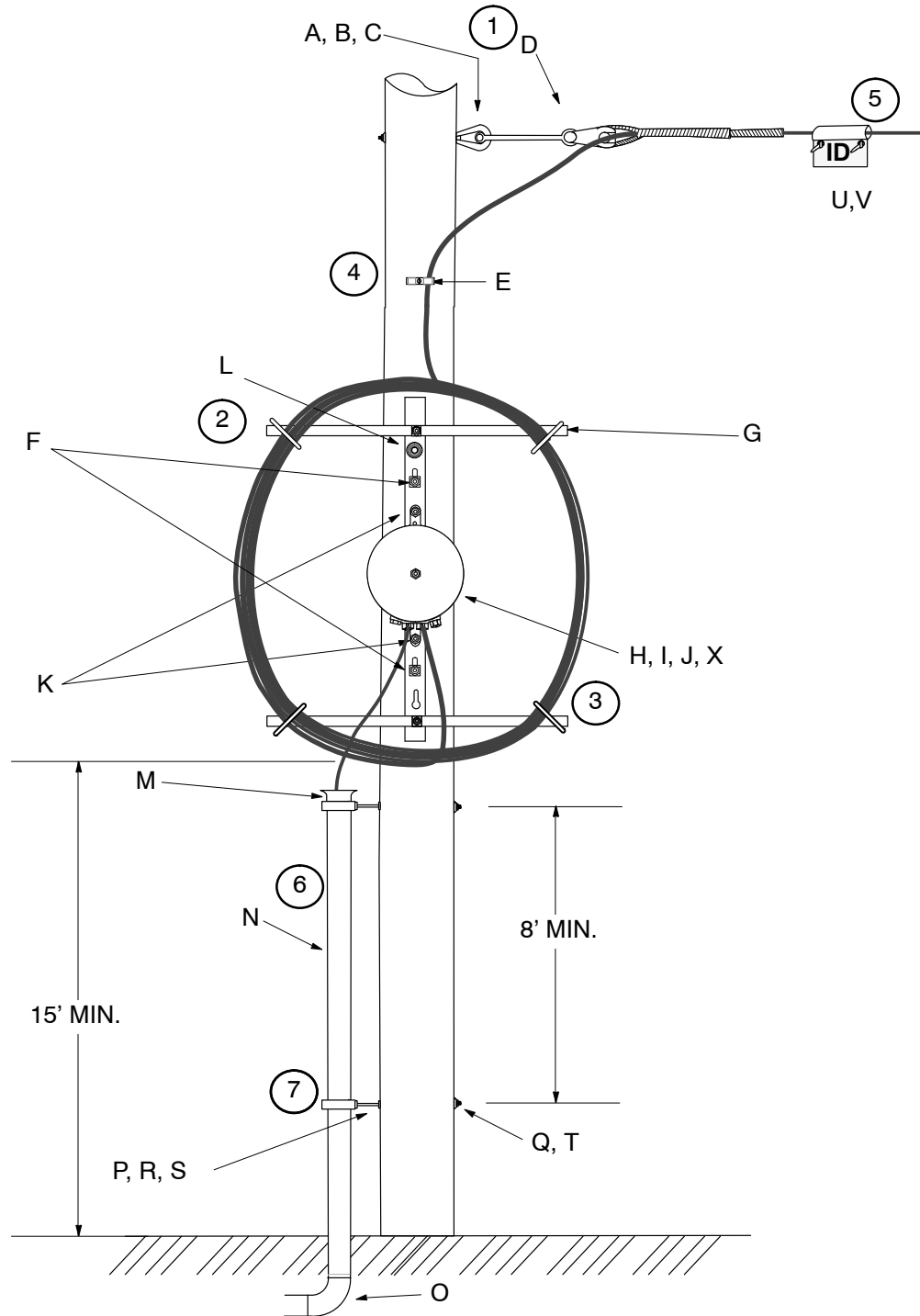
		Std. / Stk. No	Description	01
2	A	23 66 135	Washer, Lock, Double Coil 3/4"	1
	B	23 66 031	Washer, Square for 3/4" Bolt	1
	C	23 52 103	Machine Bolt 3/4" X 18"	1
	D	23 65 018	Eyelet for 3/4" bolt	1
	E	23 58 127	Clevis Eye	1
	F	17 01 119	Formed Wire Suspension, ADSS	1
	G	16 01 647	ID Tag, ADSS	2
	H	40 89 494	Nylon Zip Tie	4



NOTES:

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

		Std. / Stk. No.	Description	18 10 02	01	02
2	A	23 66 135	Washer, Lock, Double Coil $\frac{5}{8}$ "		2	2
	B	23 66 027	Washer, Square for $\frac{5}{8}$ " bolt		2	2
	C	23 52 069	Machine Bolt $\frac{5}{8}$ " x 18"		2	2
	D	23 68 747	Formed Wire Deadend, ADSS 48 ct. Fiber		2	
		23 68 778	Formed Wire Deadend, ADSS 72 ct. Fiber			2
	E	16 01 647	ADSS Identification Tag		2	2
	F	40 89 494	Zip Tie		4	4



FIBER OPTIC COMMUNICATION

ADSS Deadend Transition to Underground

18 10 03 **
Sheet 2 of 2

NOTES:

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

	Std. / Stk. No.	Description	18 10 03	01	02
A	23 66 135	Washer, Lock, Double Coil 3/4"		1	1
B	23 66 031	Washer, Square for 3/4" bolt		1	1
C	23 52 069	Machine bolt 3/4" x 18"		1	1
D	23 68 747	Formed wire Deadend, 48-ct ADSS		1	
	23 68 778	Formed wire Deadend, 72-ct ADSS			1
E	17 02 177	Download Clamp, 48-ct and 72-ct ADSS		1	1
F	23 60 011	LAG Screw, 5/8" x 5" galvanized.		2	2
G	40 54 480	Coil Bracket		1	1
H	17 60 734	Splice Protector Sleeve		10	10
I	40 54 478	Splice Enclosure		1	1
J	17 62 293	Connector kit, 48-ct ADSS		1	
	17 62 296	Connector kit, 72-ct ADSS			1
K	23 52 031	Bolt, 1/2" x 3" with Galv. Nut		2	2
L	40 59 318	Pipe grounding clamp		1	1
M	12 51 254	Bell end fitting		1	1
N	12 01 278	4" Sch. 80 PVC 10' LGH		1	1
O	12 51 176	4" Sch. 40 Bend 36" Radius		1	1
P	23 53 003	Bolt, double arming, 5/8" x 18" with 4 sq. nuts		2	2
Q	23 65 053	Nut, Jam, 5/8"		2	2
R	23 06 087	Bracket, Standoff 12"		2	2
S	69 58 121	Transformer Ground Connector		3	3
T	23 66 027	Washer, square, for 5/8" bolt		2	2
U	16 01 647	ID Tag, ADSS		1	1
V	40 89 494	Nylon Zip Tie		2	2
@ W	11 00 4* **	Guying Unit (Down, Span, or Sidewalk)		1	1
X	17 04 247	Connector Kit, ADSS UG		1	1

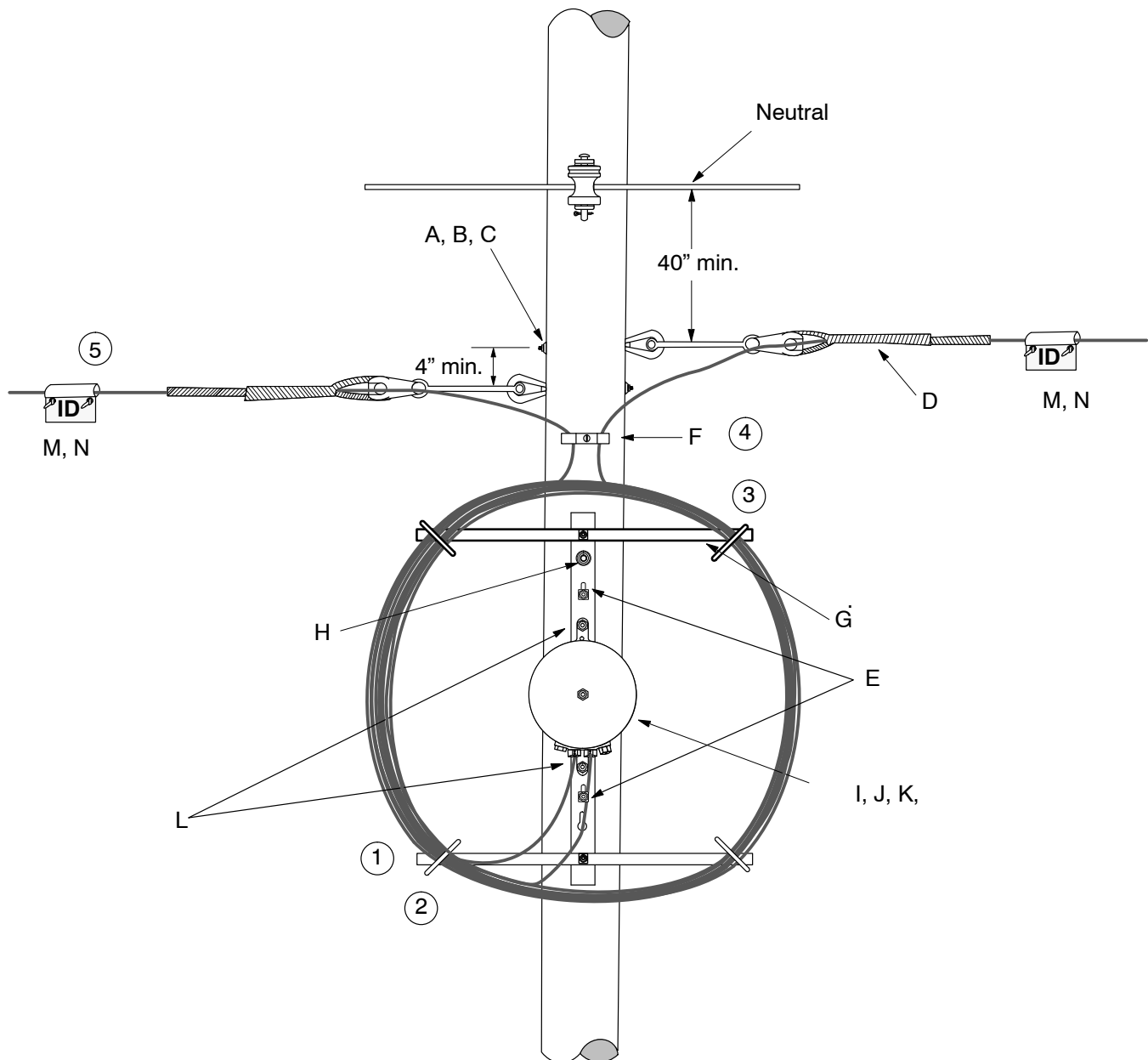
**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: KR
REV. NO: 1
REV. DATE: 07/01/2020

FIBER OPTIC COMMUNICATION
ADSS Deadend or Corner > 30° with Splice

18 10 04 **
Sheet 1 of 2



FIBER OPTIC COMMUNICATION

ADSS Deadend or Corner > 30° with Splice

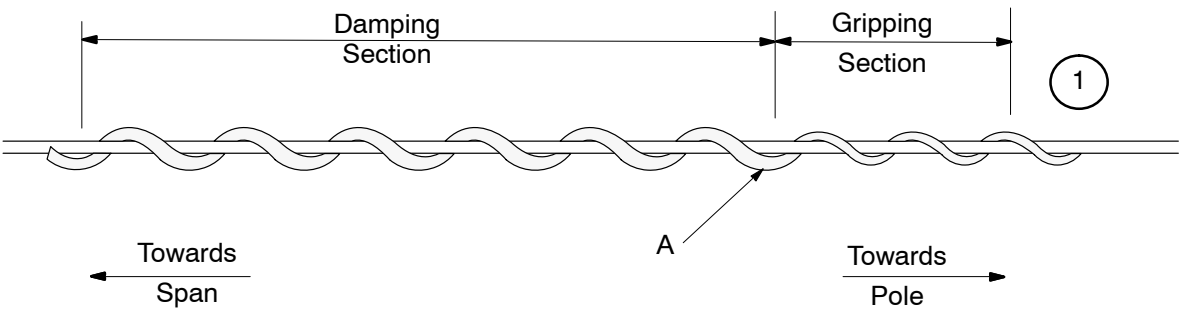
18 10 04 **

Sheet 2 of 2

NOTES:

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

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



NOTES:

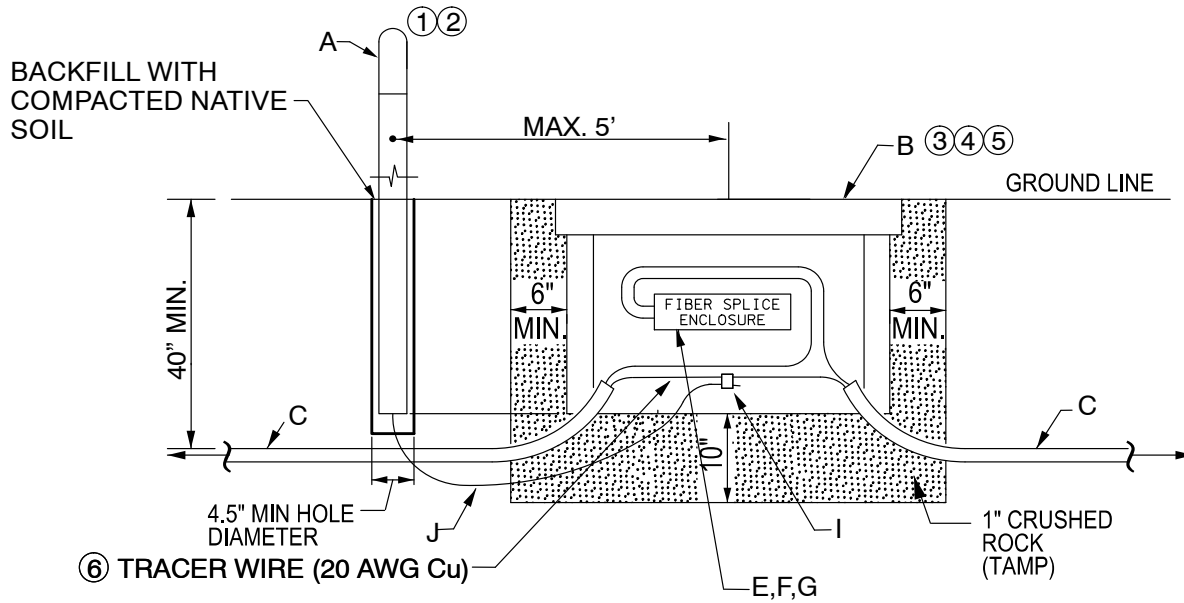
- 1. Gripping section features smaller helix than damping section.
- 2. Dampers shall be used when cable spans exceed 350' and/or tension exceeds 15% of the rated cable breaking strength.

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

Underground Fiber with Splice

18 20 01 **

Sheet 1 of 2



NOTES:

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

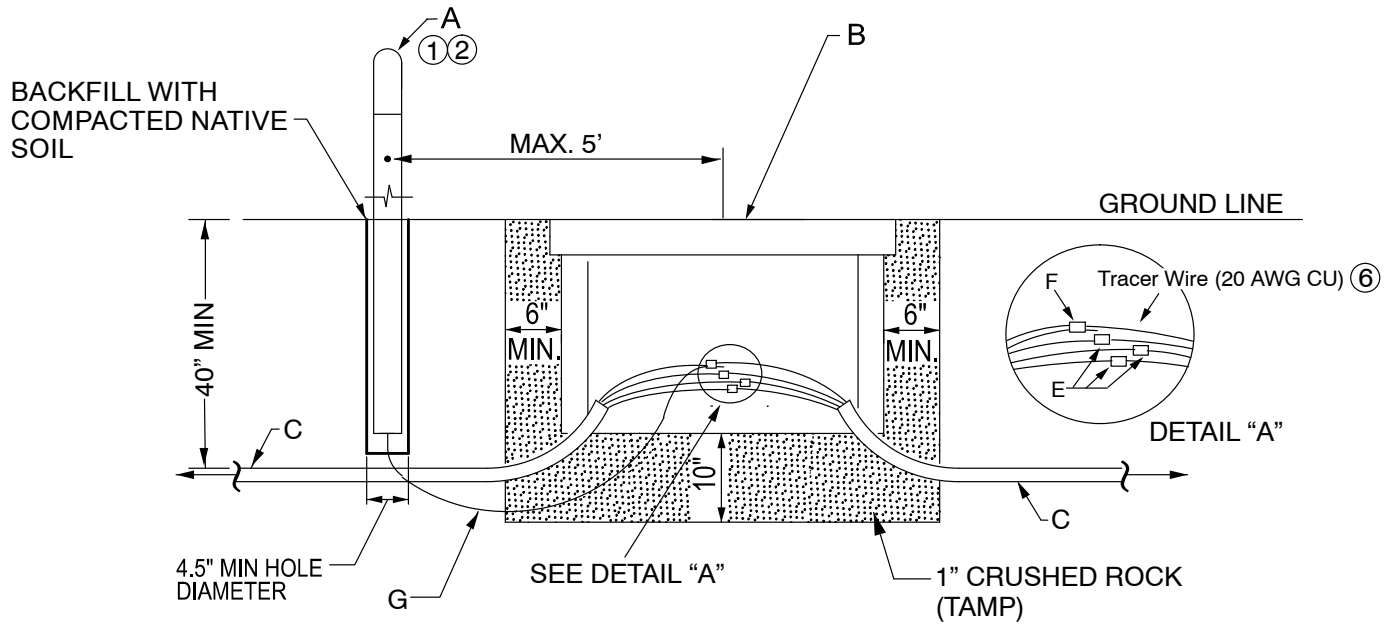


FIBER OPTIC COMMUNICATION

Underground Fiber with Splice

18 20 01 **
Sheet 2 of 2

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

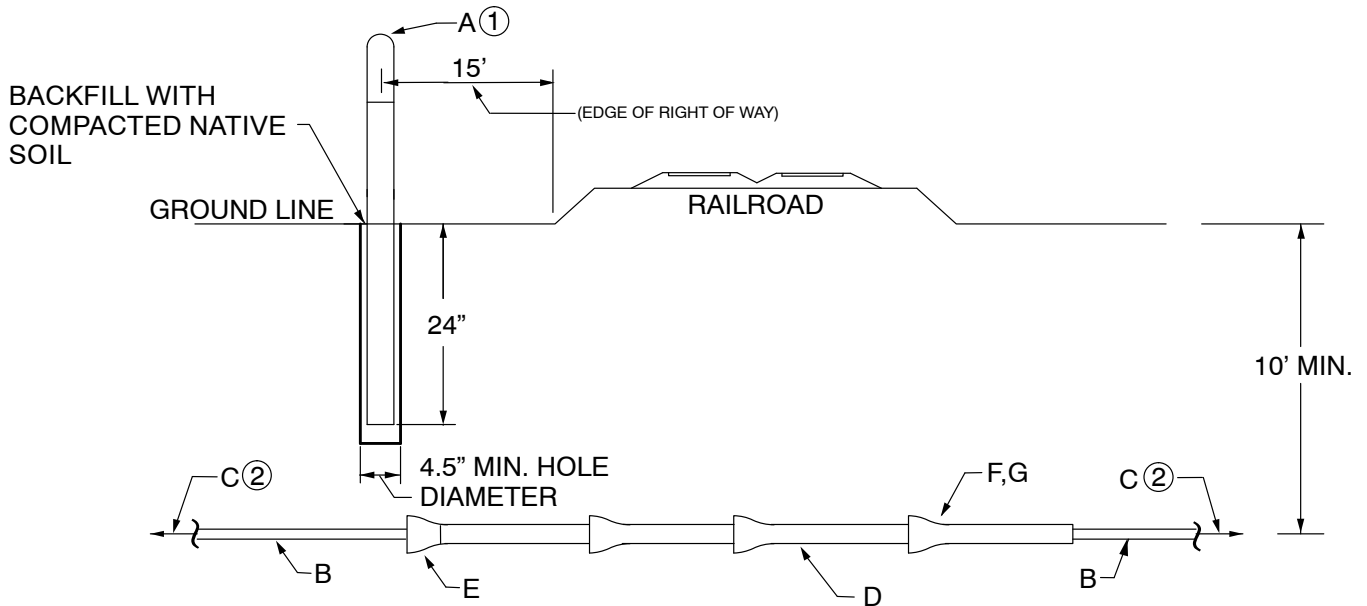


NOTES:

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

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

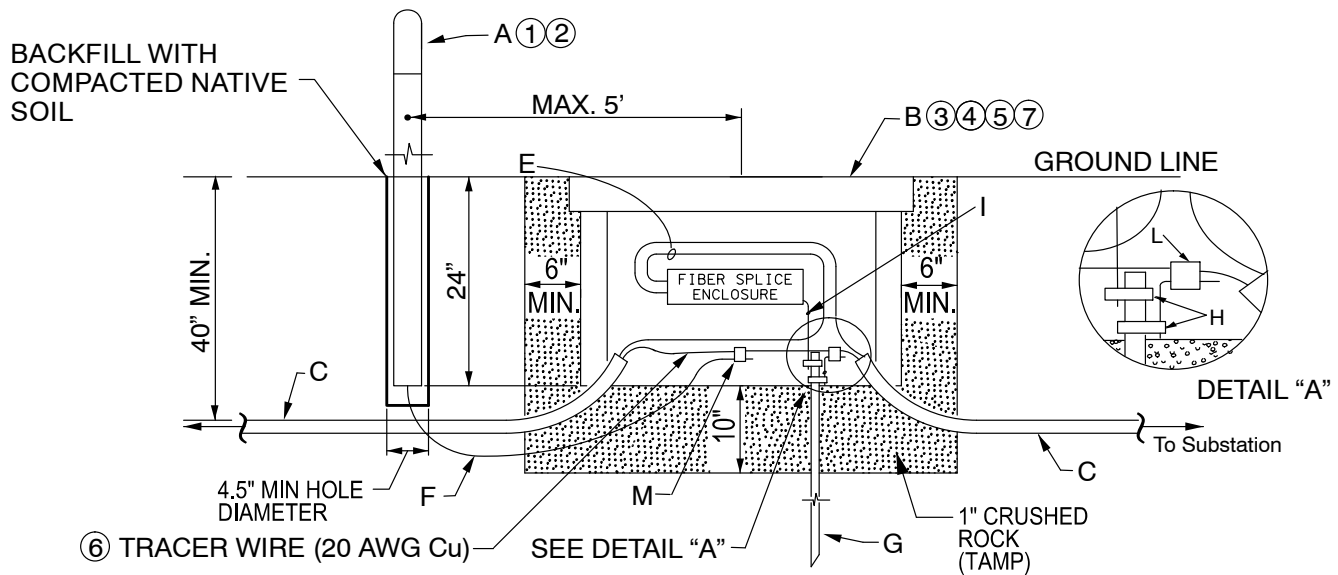
18 20 03 **
Sheet 1 of 1



NOTES:

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

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



NOTES:

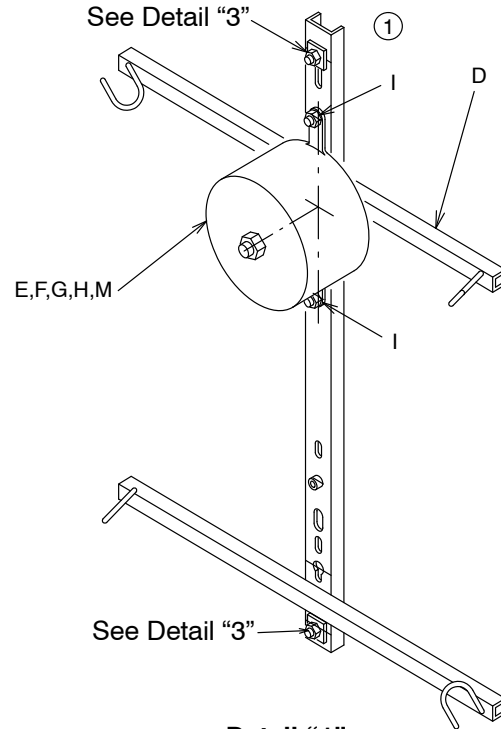
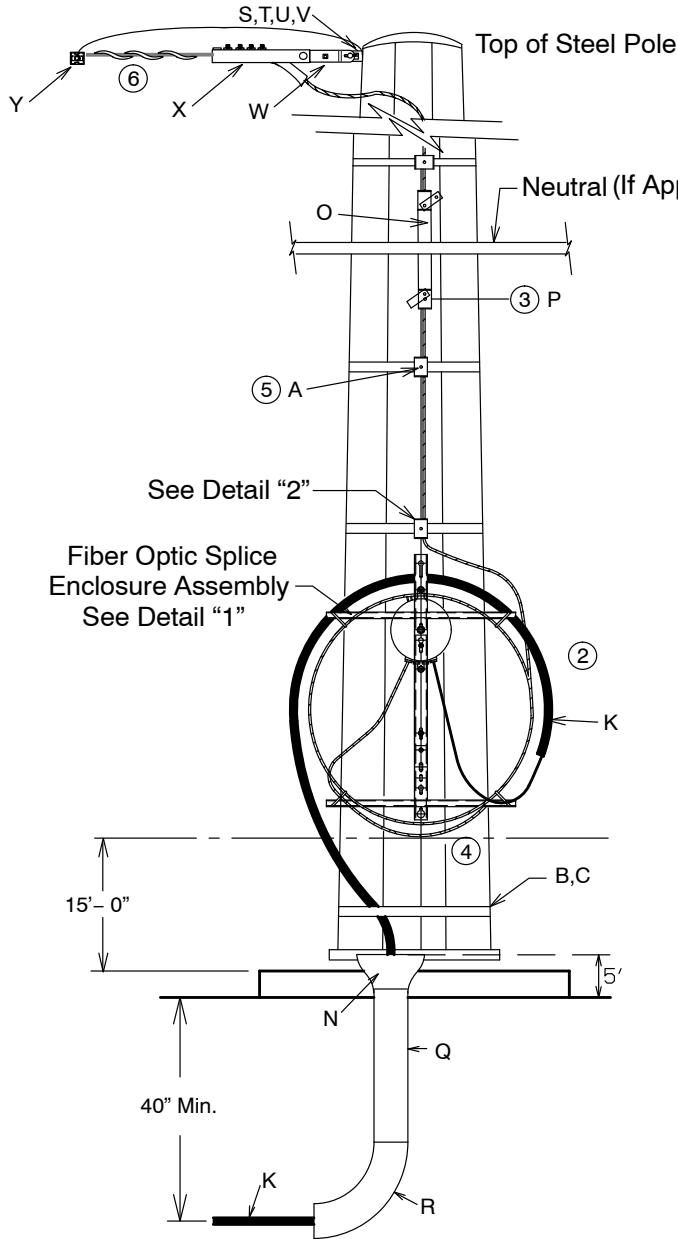
1. Install fiber markers with test paddle (16-16-283) max. 5' North of center of hand-hole and at beginning and end of each run.
2. Install buried fiber markers without test paddle (16-16-292) directly over buried fiber midway between hand-holes or no more than 1000' in rural areas.
3. Hand-holes shall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

FIBER OPTIC COMMUNICATION

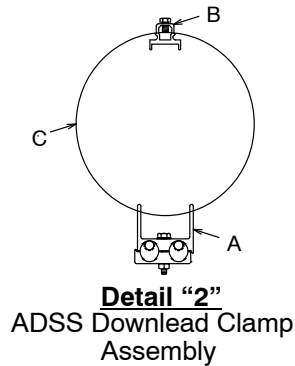
Underground Fiber at Substation

18 20 05 **
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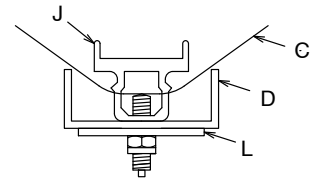
		Std. / Stk. No.	Description	18 20 05 **	01
@1	A	16 16 283	Orange Fiber Cable Marker w/Test Paddle		Ea.
	B	12 56 129	Hand-Hole		1
@	C	12 01 341	HDPE Microduct, 4-Way, w/ 20 AWG Cu Tracer Wire		Ft.
@4	D	83 36 251	Pulling Tape		Ft.
	E	40 89 742	Splice Tray, 24ct.		3
@6	F	18 66 689	#12 Orange Tracer Wire		Ft.
	G	23 13 069	Ground Rod 5/8"x8' Copperweld		1
@	H	17 52 032	Grounding Clamp		2
	I	18 52 025	#2 solid CU Ground Wire		Ft.
	J	40 54 494	Splice Box		1
	K	40 54 495	Splice Box Hand-Hole Stand		1
	L	12 01 342	Straight-thru connectors for microducts		3
	M	40 89 744	Connector, tracer wire		1



Detail "1"
Fiber Optic Splice Enclosure
Detail



Detail "2"
ADSS Downlead Clamp
Assembly



Detail "3"
Splice Enclosure Attachment
Without Bracket

FIBER OPTIC COMMUNICATION

Steel Pole OPGW to Underground Fiber

18 30 01 **

Sheet 2 of 2

NOTES:

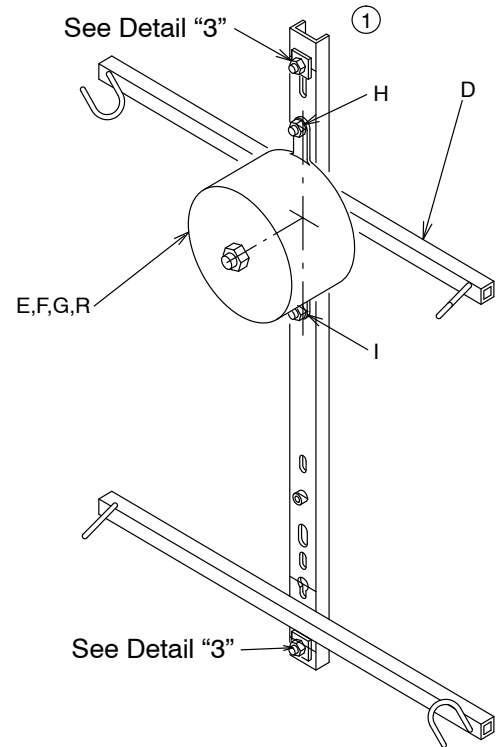
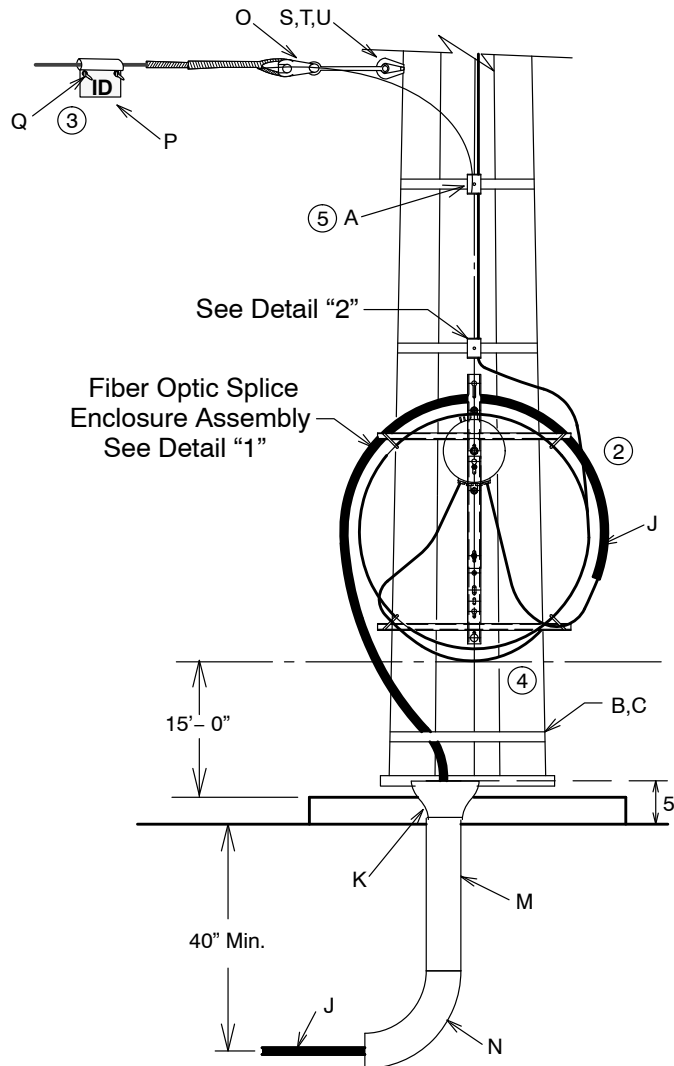
1. Top of coil bracket must be installed 40" or greater from Neutral or closest conductor.
2. Coil 100' of extra fiber optic cable around coil bracket. Wrap HDPE conduit 3/4 turn (opening points down) around coil bracket.
3. To attach iron hanger to pole use #10 self tapping screws.
4. Bottom loop of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

		Std. / Stk. No.	Description	18 30 01 **	01
5	A	17 52 219	Downlead Clamp		10
	B	23 67 500	Banding Clamp, w/ 5/8" Bolt		10
@	C	22 12 084	Banding, Stainless Steel		Ft.
1	D	40 54 480	Coil Bracket		1
	E	17 60 734	Splice Protector Sleeve		10
	F	40 54 478	Splice Enclosure		1
	G	40 54 479	Furcation Kit (for OPGW)		1
	H	40 54 481	Connector Kit, OPGW		1
	I	23 52 024	Machine Bolt, Galv., 1/2" x 1 1/4", w/Nut		2
	J	23 67 499	Banding Clamp, with 5/8" Stud and Nut		2
@	K	12 01 341	HDPE Microduct, 4-Way, w/ 20 AWG Cu Tracer Wire		Ft.
	L	23 66 027	Washer, Square, for 5/8" bolt		2
	M	17 04 247	Connector Kit , UG Fiber Optic Cable		1
	N	12 51 254	Bell end fitting		1
@	O	12 01 230	Conduit, 1 1/2" PVC, Schedule 40, 10'		Ft.
3	P	27 60 035	Strap, Iron Hanger, 50'Coil		1
	Q	12 01 278	4" Sch. 80 PVC, 10' Length		1
	R	12 51 176	4" Sch. 40 Bend, 36" Radius		1
	S	23 66 135	Washer, Lock, Double Coil, 3/4"		1
	T	23 66 031	Washer, Square for 3/4" bolt		1
	U	23 52 254	Mach. Bolt, Galv., 3/4" x 16"		1
	V	23 59 095	Eyelet, for 3/4" Bolt		1
	W	23 59 042	Extension Link,6"		1
	X	23 68 732	Bolted Deadend		1
	Y	17 52 217	Clamp for bonding OPGW Static to Pole Ground		1

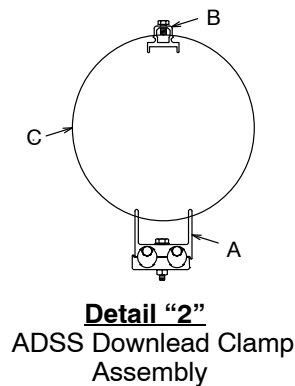
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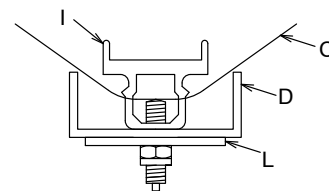
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REV. DATE: 07/01/2020



Detail "1"
Fiber Optic Splice Enclosure
Detail



Detail "2"
ADSS Download Clamp
Assembly



Detail "3"
Splice Enclosure Attachment
Without Bracket

FIBER OPTIC COMMUNICATION

Steel Pole ADSS to Underground Fiber

18 30 02 **

Sheet 2 of 2

NOTES:

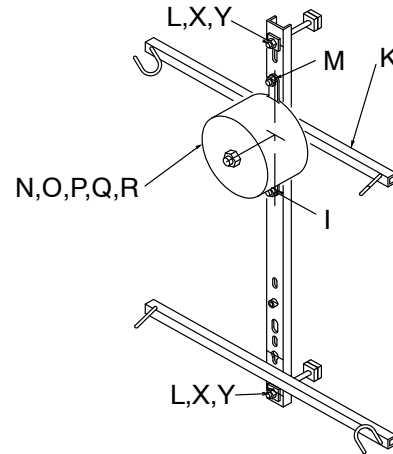
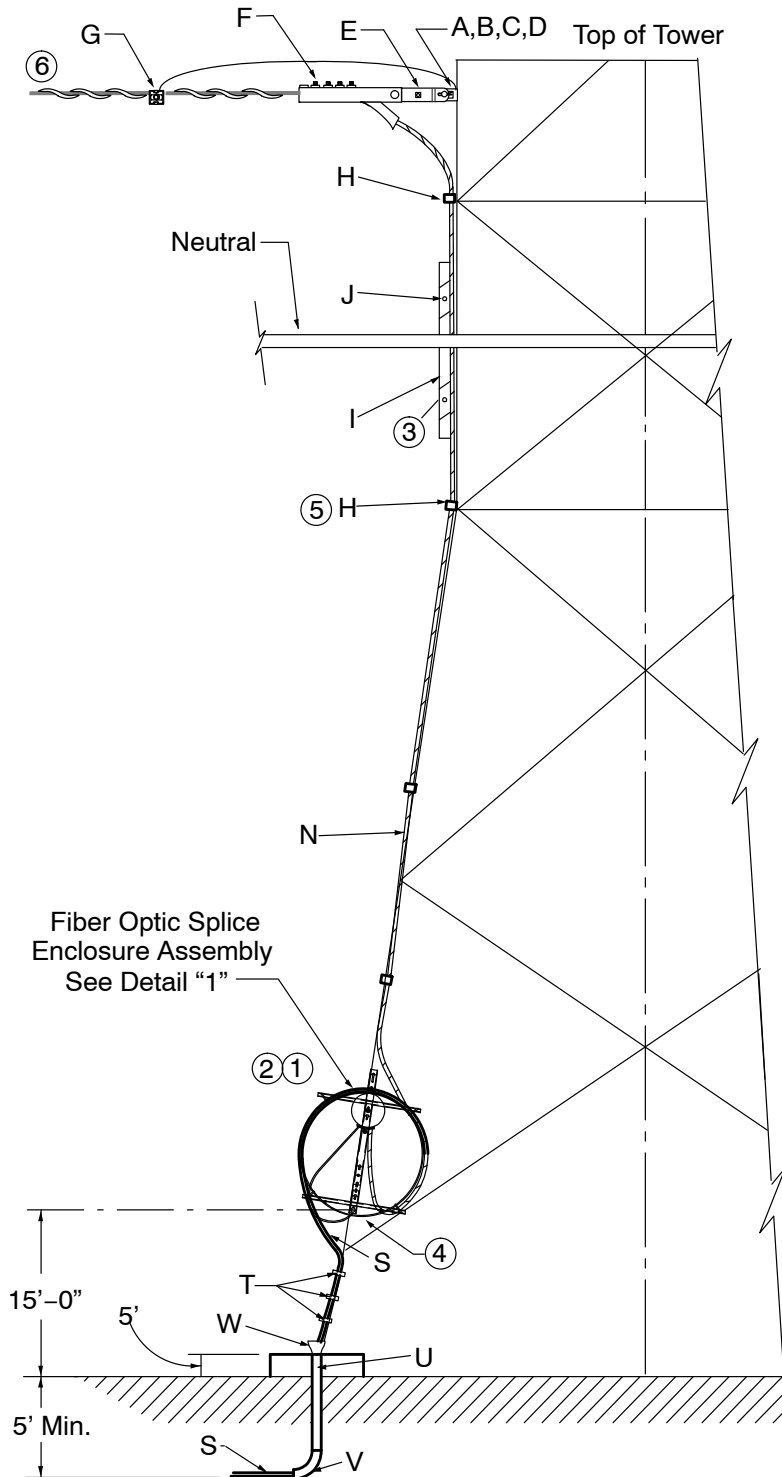
1. Top of coil bracket must be installed 40" or greater from Neutral or closest conductor.
2. Coil 100' of extra fiber optic cable around coil bracket. Wrap HDPE conduit 3/4 turn (opening points down) around coil bracket.
3. ADSS Tags should be attached with zip ties on overhead ADSS fiber optic cable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

		Std. / Stk. No.	Description	18 30 02 **	01	02
4	A	17 52 219	Downlead Clamp		10	10
	B	23 67 500	Banding Clamp, with 5/8" Bolt		10	10
@	C	22 12 084	Banding, Stainless Steel		Ft.	Ft.
	D	40 54 480	Coil Bracket		1	1
1	E	17 60 734	Splice Protector Sleeve		10	10
	F	40 54 478	Splice Enclosure		1	1
	G	17 62 293	Connector Kit, 48-ct ADSS		1	
		17 62 296	Connector Kit, 72-ct ADSS			1
	H	23 52 024	Machine Bolt, Galv., 1/2" x 1 1/4", w/Nut		2	2
	I	23 67 499	Banding Clamp, with 5/8" Stud and Nut		2	2
@	J	12 01 341	HDPE Microduct, 4-Way, w/ 20 AWG Cu Tracer Wire		Ft.	Ft.
	K	12 51 254	Bell end fitting		1	1
	L	23 66 027	Washer, Square, for 5/8" bolt		2	2
	M	12 01 278	4" Sch. 80 PVC, 10' Length		1	1
	N	12 51 176	4" Sch. 40 Bend, 36" Radius		1	1
	O	23 68 747	Formed Wire Deadend, 48-ct ADSS		1	
		23 68 778	Formed Wire Deadend, 72-ct ADSS			1
	P	16 01 647	ID Tag, ADSS		1	1
	Q	40 89 494	Nylon Zip Tie		2	2
	R	17 04 247	Connector Kit, UG Fiber Optic Cable		1	1
	S	23 66 135	Washer, Lock, Double Coil, 3/4"		1	1
	T	23 66 031	Washer, Square for 3/4" bolt		1	1
	U	23 52 069	Machine Bolt 3/4" x 18"		1	1

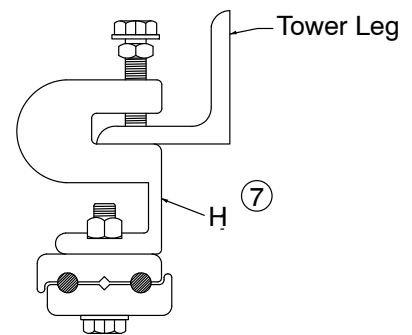
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Detail "1"
Fiber Optic Splice Enclosure
Detail



Detail "2"
OPGW Download Clamp
Detail

NOTES:

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

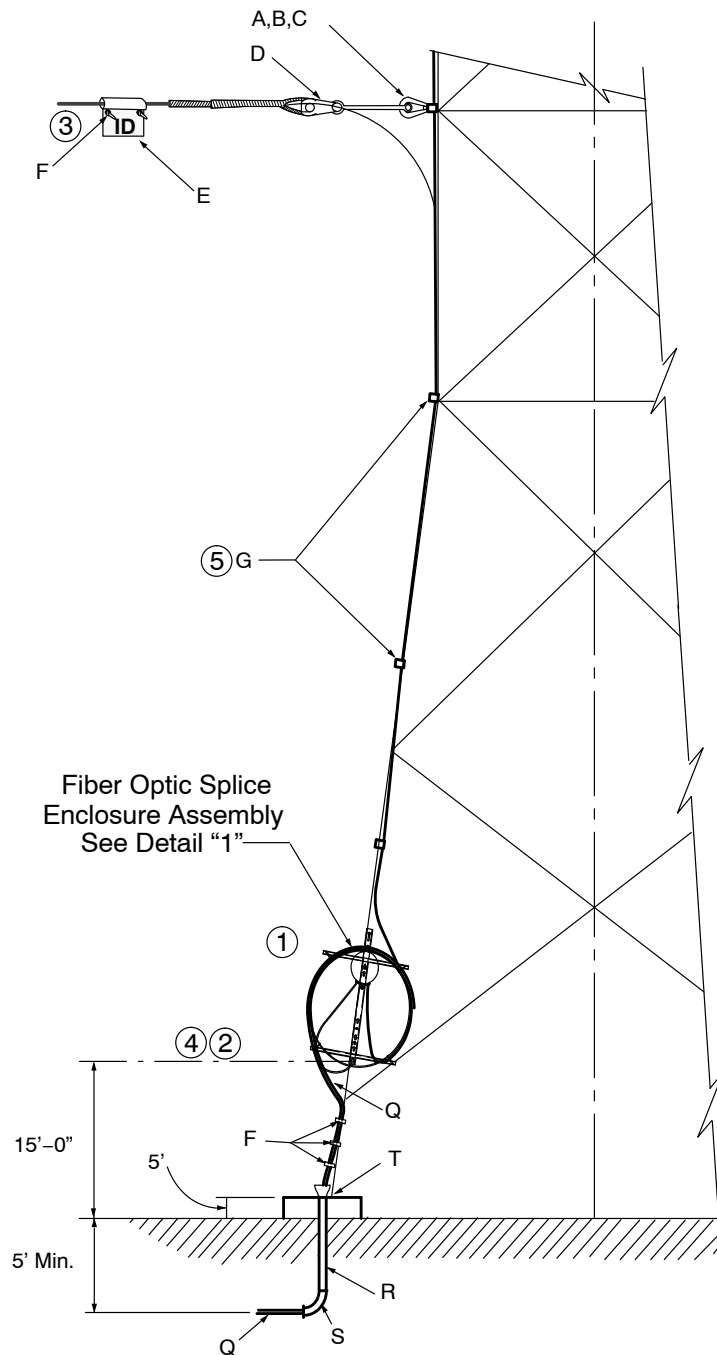


FIBER OPTIC COMMUNICATION
Lattice Tower OPGW to Underground Fiber

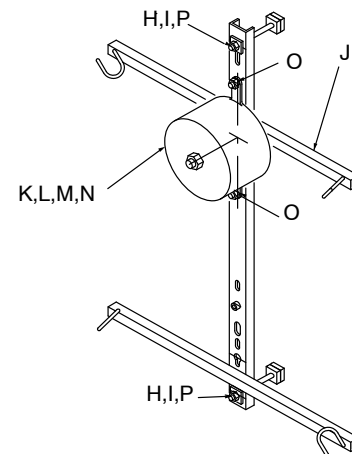
18 40 01 **

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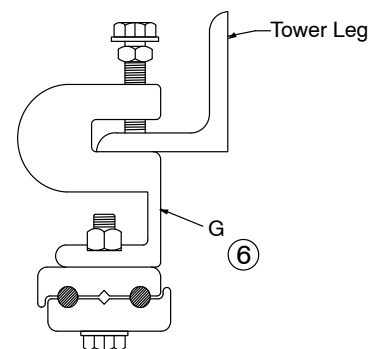
		Std./Stk No.	Description	18 40 01 **	01
1	@5,7	A	23 66 135 Washer, Lock, Double Coil, 3/4"		1
		B	23 66 031 Washer, Square for 3/4" bolt		1
		C	23 52 254 Mach. Bolt, Galv., 3/4" x 16"		1
		D	23 59 095 Eyelet, for 3/4" Bolt		1
		E	23 59 042 Extension Link, 6"		1
		F	23 68 732 Bolted Deadend		1
		G	17 52 217 Clamp for bonding OPGW Static to Pole Ground		1
		H	17 52 228 Downlead Clamp		10
			17 52 221 Downlead Clamp		10
		I	12 01 230 Conduit, 1 1/2" PVC, Schedule 40, 10'		Ft.
	@	J	27 60 035 Strap, Iron Hanger		2
		K	40 54 480 Coil Bracket		1
		L	23 52 200 Machine bolt, Galv., 5/8" x 4", w/Nut		2
		M	23 52 031 Mach. Bolt, Galv., 1/2" x 3", w/Nut		2
		N	40 54 478 Splice Enclosure		1
		O	17 60 734 Splice Protector Sleeve		10
		P	17 04 247 Connector Kit, Underground Fiber Optic		1
		Q	40 54 481 Connector Kit, OPGW		1
		R	40 54 479 Furcation Kit (for OPGW)		2
		S	12 01 341 HDPE Microduct, 4-Way, w/ 20 AWG Cu Tracer Wire		Ft.
		T	40 89 494 Tie, Nylon, Self Locking, UV Protected		3
		U	12 01 278 4" Sch. 80 PVC 10' Length		1
		V	12 51 176 4" Sch. 40 Bend, 36" Radius		1
		W	12 51 254 Bell end fitting		1
		X	23 66 027 Washer, Square for 5/8" bolt		2
		Y	23 65 043 Nut, Lock for 5/8" bolt, Galv.		2



Fiber Optic Splice
 Enclosure Assembly
 See Detail "1"



Detail "1"
 Fiber Optic Splice Enclosure
 Detail



Detail "2"
 ADSS Download Clamp
 Detail

FIBER OPTIC COMMUNICATION

Lattice Tower ADSS to Underground Fiber

18 40 02 **

Sheet 2 of 2

NOTES:

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

		Std. / Stk. No.	Description	18 40 02 **	01	02
@5,7	A	23 66 135	Washer, Lock, Double Coil 3/4 "		1	1
	B	23 66 031	Washer, Square for 3/4 " bolt		1	1
	C	23 52 254	Mach. Bolt, Galv., 3/4 " x 16"		1	1
	D	23 68 747	Formed Wire Deadend, 48-ct ADSS		1	
		23 68 778	Formed Wire Deadend, 72-ct ADSS			1
	E	16 01 647	ID Tag, ADSS		1	1
	F	40 89 494	Nylon Zip Tie		5	5
	G	17 52 228	Download Clamp		10	10
		17 52 221	Download Clamp		10	10
	H	23 65 043	Nut, Lock, for 5/8 " Bolt, Galv.		2	2
	I	23 66 027	Washer, Square, for 5/8" Bolt		2	2
1	J	40 54 480	Coil Bracket		1	1
	K	17 60 734	Splice Protector Sleeve		10	10
	L	40 54 478	Splice Enclosure		1	1
	M	17 62 293	Connector Kit, 48-ct ADSS		1	
		17 62 296	Connector Kit, 72-ct ADSS			1
	N	17 04 247	Connector Kit , UG Fiber Optic Cable		1	
	O	23 52 024	Machine Bolt, Galv., 1/2 " x 1 1/4 ", w/ Nut		2	2
	P	23 52 200	Machine Bolt, Galv., 5/8 " x 4", w/ Nut		2	2
	Q	12 01 341	HDPE Microduct, 4-Way, w/ 20 AWG Cu Tracer Wire		Ft.	Ft.
	R	12 01 278	4" Sch. 80 PVC, 10' Length		1	1
@	S	12 51 176	4" Sch. 40 Bend, 36" Radius		1	1
	T	12 51 254	Bell end fitting		1	1

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GENERAL

Standard installations of secondary and primary pole mounted metering installations are specified in this section.

1. Secondary Installations

Secondary pole mounted metering installations are normally customer owned. This type of installation is particularly applicable to farm distribution centers.

2. Primary Installations

Primary pole mounted metering installations may be either Company owned or customer owned. These installations are generally applicable to large light and power loads.

A. Company Owned

If the station being primary metered is to be owned by Ameren, all necessary equipment will be furnished and installed by Ameren.

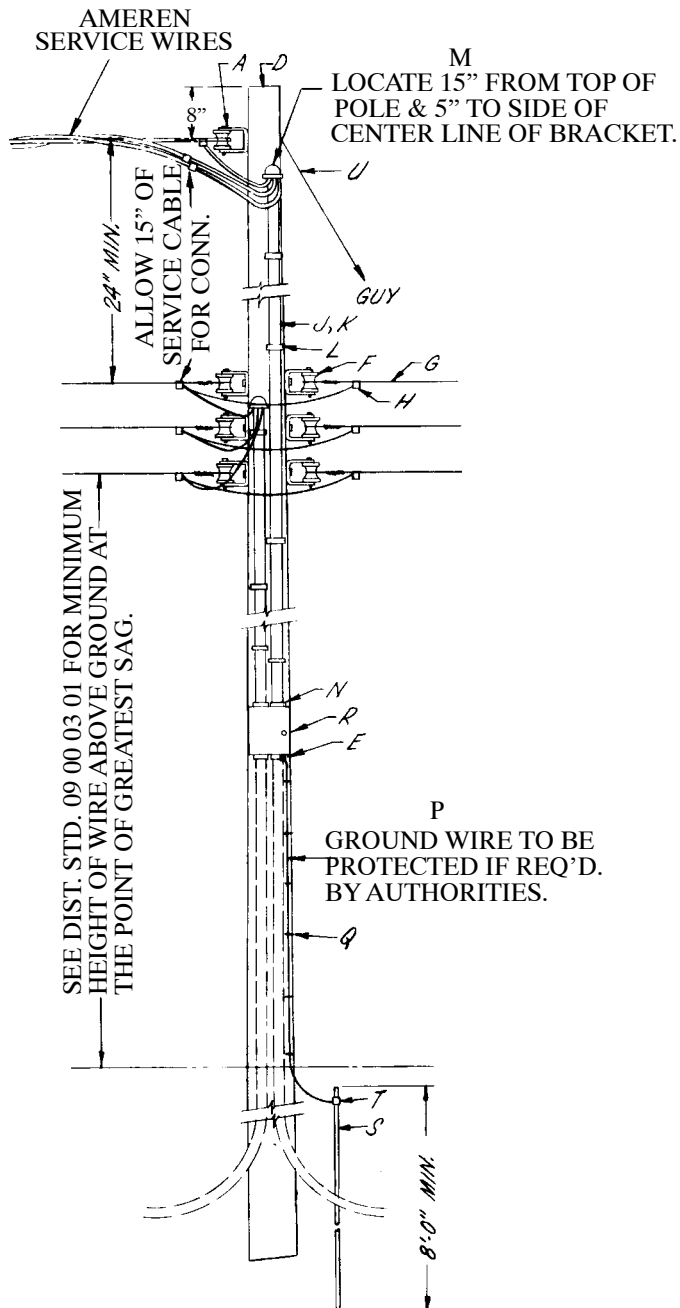
■ B. Customer Owned (For Missouri)

1. If the station being primary metered is to be owned by the customer, the customer must furnish and install the following equipment. This equipment shall be installed in accordance with appropriate Ameren Primary Metering Standards.
 - a. Pole.
 - b. Pole framing and steps.
 - c. Switches.
 - d. Lightning arresters.
 - e. All primary wiring including fiber conduit when required, except that Ameren will connect the customer's primary leads to the supply conductors and to the current and potential transformers. The customer must leave sufficient lengths of wire for making these connections.
 - f. Secondary wiring when required; Ameren will make connections to Secondary Supply. The customer must leave sufficient lengths of wire for making these connections.
2. Ameren will furnish and install the following equipment, and will complete metering connections.
 - a. Primary or secondary supply conductors with deadend devices.
 - b. Devices to connect customer's primary or secondary leads to the supply conductors.
 - c. Current, potential transformers, and bracket.
 - d. Devices to connect customer's primary wiring to current and potential transformers.
 - e. Meter enclosure, meter, and mounting framework.
 - f. All metering wiring including conduit to connect current and potential transformers to the meter.
- C. Ameren's Meter Department must be notified of job as early as possible to insure availability of equipment to be provided; includes metering enclosures and transformers – cluster mounts or units, are shop wired.

METER INSTALLATIONS
Customer Owned
Unmetered D/D Light Installation

25 01 05 00

Sheet 1 of 2



NOTES:

1. Customer to notify company of location of service pole, size of lighting load, and if overhead conductor, size of wire and length of span to next pole. Company will then determine pole size and guying requirements and notify customer. Guying to be avoided by using self sustained poles where possible. If guying is required, customer will supply guy and anchor in traffic free location.
2. Customer to provide a fused disconnect switch in a suitable watertight enclosure. This device shall meet all requirements of the National Electrical Code and National Electrical Safety Code and be approved by local inspection authorities. The enclosure is to be provided with a provision for locking. The enclosure shall be grounded.
3. All construction to comply with the National Electrical Code or National Electrical Safety Code as applicable.
4. If customer installs a light on this pole, such light shall clear Ameren service wires by not less than 24 inches.

METER INSTALLATIONS
Customer Owned
Unmetered D/D Light Installation

25 01 05 00

Sheet 2 of 2

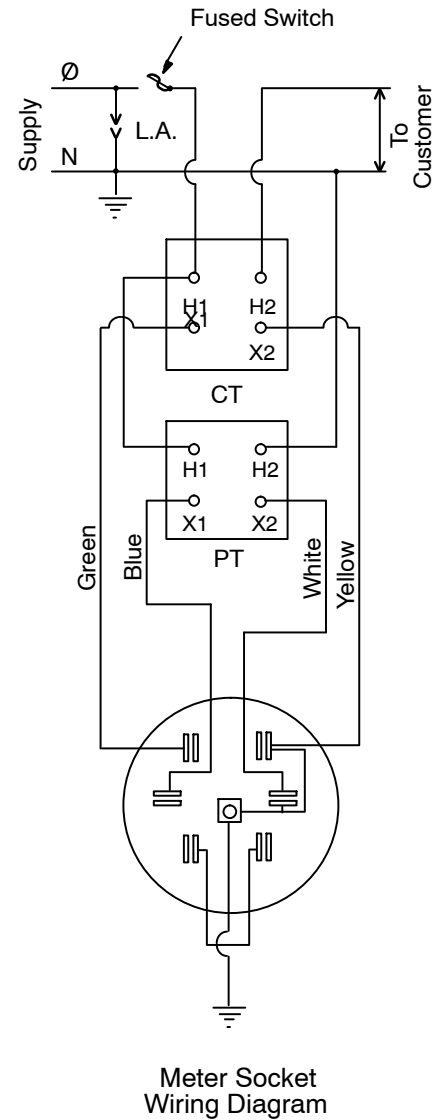
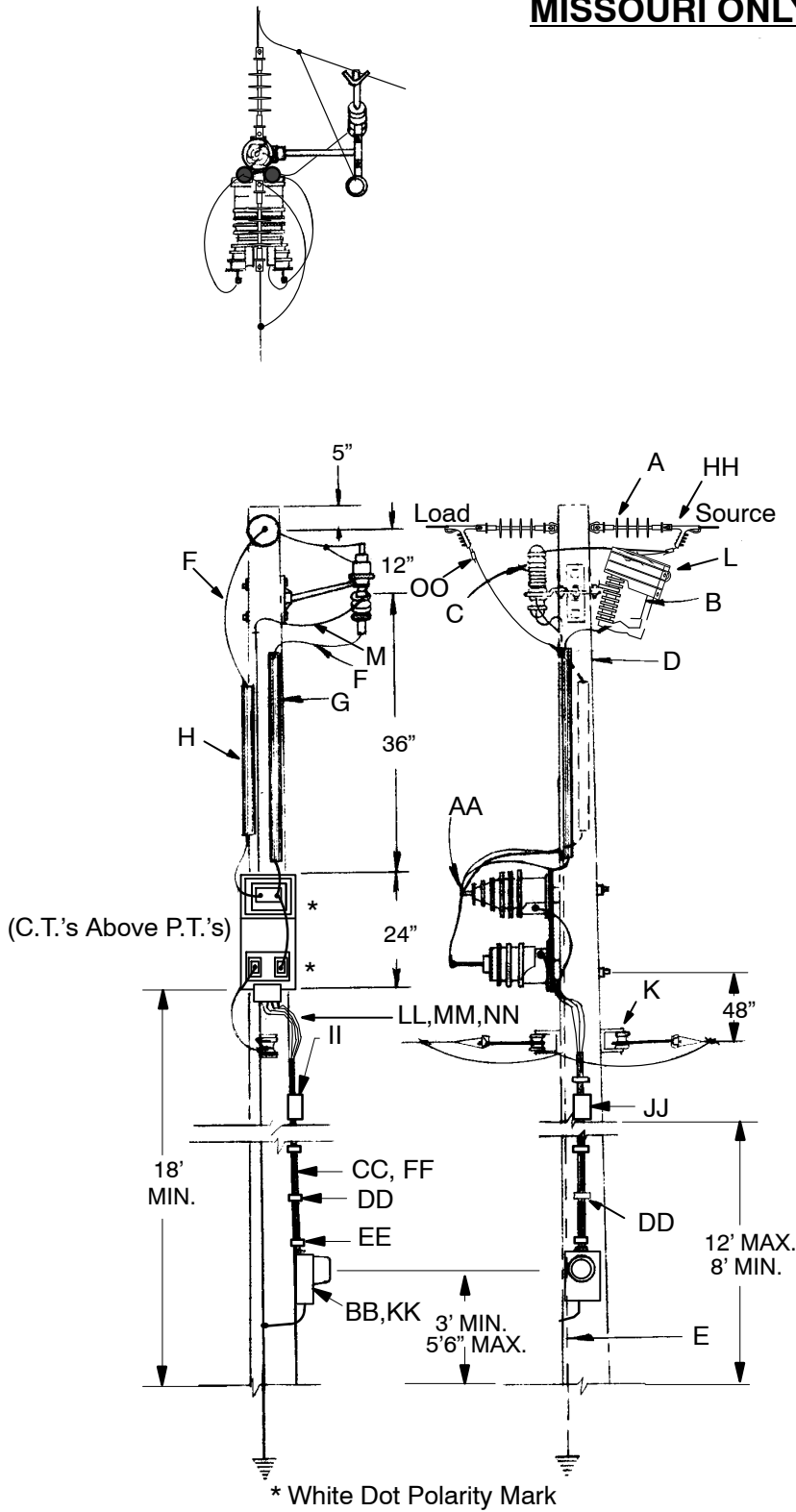
MATERIAL PROVIDED IN PLACE AND OWNED BY AMEREN

		Stnd. / Stk. No.	Description	
	A	06 01 01 01	Secondary Clevis	1

MATERIAL PROVIDED IN PLACE AND OWNED BY CUSTOMER

1		Stnd. / Stk. No.	Description	
	D		Pole	1
	E		Grounding Lug	1
	F		Secondary Clevis	6
	G		Distribution Wire	
	H		Solderless Connector	6
	J		Metallic Conduit	
	K		Service Entrance Cable	
	L		Conduit Straps	
	M		Entrance Caps	2
	N		Connectors (Water Tight)	2
2	P		Ground Wire	
	Q		Staples	
	R		Fused Disconnect SW. Raintight	1
	S		Ground Rod	1
1	T		Ground Rod Lug	1
	U	11 00 ** **	Guy & Anchor (If Req'd.)	1

MISSOURI ONLY



METER INSTALLATIONS
Primary Metering
2400 Volts Single Phase

25 04 01 00

Sheet 2 of 2

MISSOURI ONLY

NOTES:

1. Ground instrument transformer cases.
2. Metering equipment should be within reach of a 29' extension ladder.
3. If metered primary exceeds 2 spans, additional arresters must be installed on first pole beyond meter pole.
4. When meter pole is on customer property, a disconnect switch shall be provided one span before.
5. Secondary wire lead on meter cluster is 15ft. standard length. For taller poles, special order meter cluster with longer lead to meet max. height requirement for connection box.

NORMALLY FURNISHED BY CUSTOMER

	Std. / Stk. No.	Description	
A	06 12 30 03	Double D.E. on Pole	1
B	10 12 01 01	Switch Ass'y (Fuse size by Engr.)	1
C	10 01 133	Arrester 3kV	1
D	41 02 ***	Pole	1
E	12 00 10 01	Grounding Unit	1
F	18 51 019	Wire, #2 Cu Covered, S.D. (Ft.)	20'
G	12 01 178	Conduit 2"	8'
H	27 60 035	Iron Hanger (ft.)	5'
J	23 64 033	Staple	8
K	23 06 040	Clevis, Secondary	2
L	05 15 10 01	Cover – Cutout	1
M	18 52 019	Wire, #6 Cu., Bare S.D.	35'

NORMALLY FURNISHED BY AMEREN

	Std. / Stk. No.	Description	
AA		Metering Ass'y.	1
BB	40 04 210	Meter Socket	1
CC	40 02 054	Conduit 1", Flex	20
DD	23 64 033	Staple, 1 1/2"	3
EE	40 53 612	Fitting	2
FF	18 66 082	Wire #12 Cu. 600V Type TW Blue	30'
	18 66 084	Wire #12 Cu. 600V Type TW Green	30'
	18 66 088	Wire #12 Cu. 600V Type TW Yellow	30'
	18 66 087	Wire #12 Cu. 600V Type TW White	30'
GG	285	Inst Primary Metering	1
@ HH	DEC*W	Clamp – Deadend	2
II	40 01 120	Box, Secondary connection	1
JJ	21 66 039	Screw, Hex Head Cap, 3/8"x2"	2
KK	21 71 037	Screw, Wood, #14, 3", Rnd.	4
LL	18 11 065	Cord – Hrd Srv 14/2 Cu 600V	20
MM	12 51 217	Conduit – PVC Split 2"x10'	1
NN	27 60 035	Iron, Hanger, Galv., 3/4" wide	2
OO	PG*	Clamp, P.G. (Std. 07 00 25 00)	4

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
REV. NO: 8
REV. DATE: 09/23/11

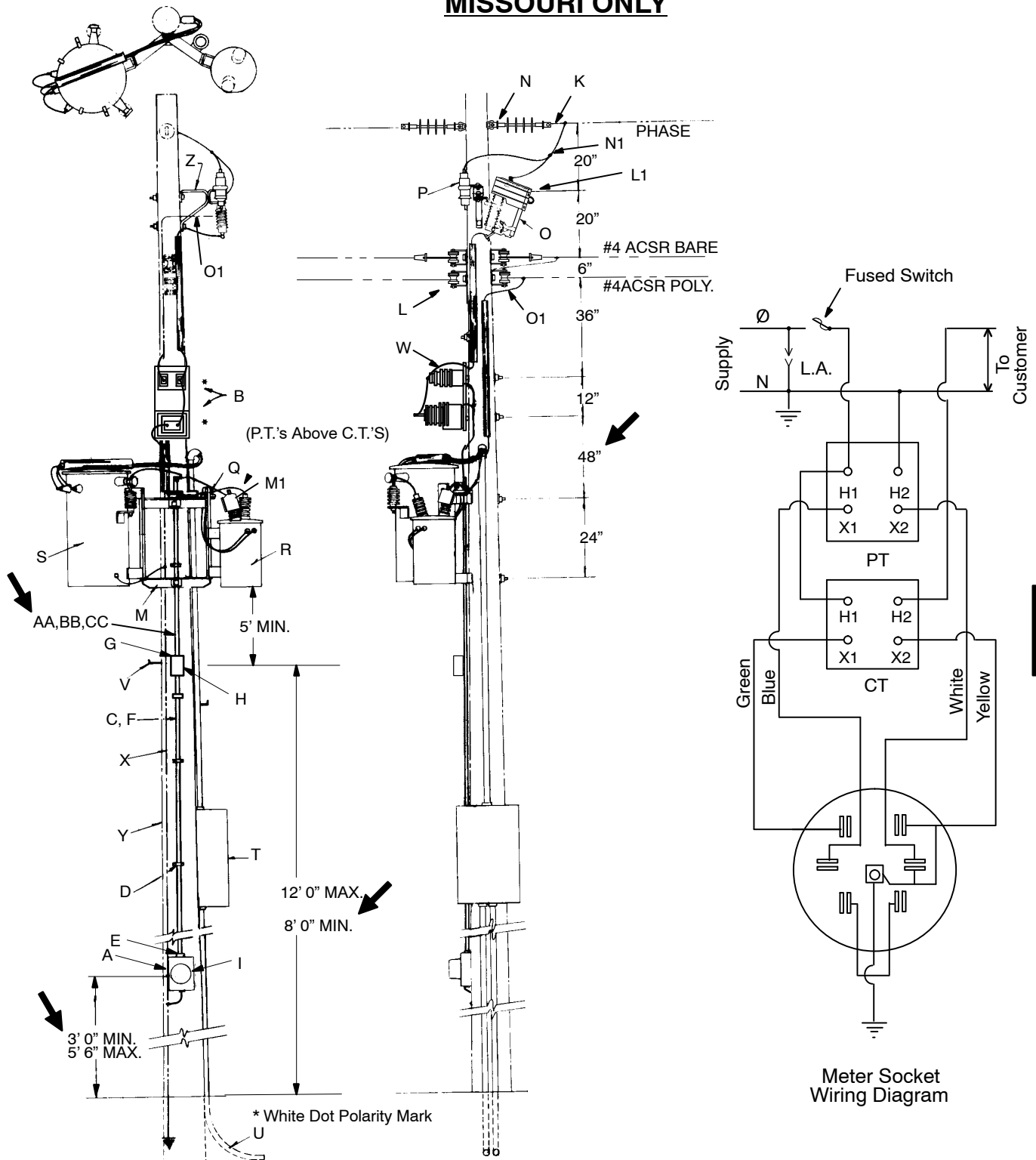
METER INSTALLATIONS

Primary Metering 2400 Volt Single Phase
With Customer Street Lighting Substation

25 04 03 00

Sheet 1 of 3

MISSOURI ONLY



METER INSTALLATIONS
Primary Metering 2400 Volt Single Phase
With Customer Street Lighting Substation

25 04 03 00

Sheet 2 of 3

MISSOURI ONLY

NOTES:

1. This standard shows the typical equipment arrangement for a pole mounted streetlighting substation. For installations where this arrangement cannot be used, the following requirements must be considered in arranging the equipment in order that adequate climbing space is provided for Ameren Personnel who must make attachments and operate switch on the substation poles.
 - a. One side of the pole must be clear of equipment, conduit, and cables.
 - b. Bolts extending thru the pole into the climbing space should be cut off so that they are not a hazard in climbing the pole.
 - c. Pole steps should be installed as outlined in Ameren Distribution Std. **02 00 32**, Sheets 1 & 2.
2. Ground instrument transformer cases.
3. Ameren shall install a fused switch on take-off pole for sectionalizing or disconnecting. This switch will be left open until customer requests Ameren to close it.
4. Ameren shall connect customer's transformer primary neutral lead to common neutral. Ameren shall also connect customer's driven ground to common neutral.
5. Fuse sized by Ameren Engineer.

NORMALLY FURNISHED BY AMEREN

@		Std. / Stk. No.	Description	
	A	40 04 210	Meter Enclosure	1
@	B	--	Metering Cluster Ass'y.	1
	C	40 02 054	Conduit 1", Flex.	20'
	D	23 64 033	Staple, 1 1/2"	3
	E	40 53 612	Fitting	2
	F	18 66 082	Wire, #12 Cu. 600V Type TW Blue	30'
		18 66 084	Wire, #12 Cu. 600V Type TW Green	30'
		18 66 088	Wire, #12 Cu. 600V Type TW Yellow	30'
		18 66 087	Wire, #12 Cu. 600V Type TW White	30'
	G	40 01 120	Box, Secondary connection	1
	K	DEC*W	Clamp - Deadend	2
		285	Install Pri. Metering	1
	H	21 66 039	Screw, Hex Head Cap, 3/8"x2"	2
	I	21 71 037	Screw, Wood, #14, 3", Rnd.	4
	AA	18 11 065	Cord, Hrd Srv, 14/2 Cu, 600V	15
	BB	12 51 217	Conduit, PVC Split	1
	CC	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)	2

MISSOURI ONLY

NORMALLY FURNISHED BY CUSTOMER

		Std. / Stk. No.	Description	
5	L	23 06 040	Clevis, Sec., Insulator	2
	M	23 17 208	Mounting Unit, Transf. C	1
	N	06 12 30 03	Double Deadend on Pole	1
	O	54 07 208	Switch, Fused, 15kV, 100A	1
	P	10 01 133	Lightning Arrester, 3kV	1
	Q		P.E. Cell Control Unit, KW	1
	R		Primary Oil Switch	1
	S		Transformer	1
	T		Control Cabinet	1
	U		Street Light Cable (Ft.)	
	V	02 00 32	Pole Step	9
	X	12 00 10 01	Grounding Unit	1
	Y		Pole	1
	Z	23 06 067	Brkt., Sgl. Ext., w/Clevis	1
	L1	05 15 10 01	Cover – Cutout	1
	M1	69 58 181	Guard– Clam shell Wildlife	1
	N1	18 51 019	Wire, #2 Cu., Covered S.D.	35
	O1	18 52 019	Wire, #6 Cu., Bare S.D.	35

Sheet 1 of 3

ENG: WYW
REV. NO: 13
REV. DATE: 09/23/11

METER INSTALLATIONS
Primary Metering For Customer U.G., 3 Phase 3W & 4W
2400 / 4160 V, SM-5 FUSING

25 04 08 **
Sheet 2 of 3

MISSOURI ONLY

NOTE:

1. When meter pole is on customer property, switch shall be provided one span before.
2. Secondary wire lead on meter cluster is 15ft. standard length. For tall poles, special order meter cluster with longer lead to meet max. height requirement for connection box.
3. Terminator mounting bracket is either Aluma Form (TB-EMB-1-6-PA-35-UE) or Hubbell (CTB-EMB-1-6PS-35-UE). It is no longer stocked by Ameren.

NORMALLY PROVIDED BY CUSTOMER

	Std. / Stk. No.	Description	25 04 08 **	01	02
A	54 07 239	Switch, 15 kV, Group Operated		1	1
B	18 51 023	Wire, 4/0 Cu, Covered S.D. (ft.)		25	20
C	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		3	3
D	04 00 20 02	Crossarm, 8'		2	2
E	54 03 051	Mounting, Fuse, 400 A		3	3
F	17 05 194	Lug, Compression, 4/0 Cu.		6	6
G	21 53 046	Bolt, Everdur, 1/2" x 2 1/2"		12	12
H		Bracket, Mounting, Terminator		1	1
I	23 52 036	Bolt, Machine, 1/2" x 5"		12	12
J	23 52 065	Bolt, Machine, 5/8" x 12"		8	8
K	23 66 027	Washer, Square		7	7
L	10 01 133	Arrester, Lightning, 3 kV, Riser Pole		6	6
M	23 78 394	Clamp, Hot Line		6	6
N	12 01 272	Conduit, Sch. 80, 5"		10	10
O	17 58 054	Bracket, Crossarm Mounting		3	3
P	23 67 197	Bracket, Cable		3	3
Q	12 51 206	Bend - 5", 36" Rad.		1	1
R	18 07 243	Cable, 15 kV, 750 Al. (ft.)		35	35
S	42 34 61 04	Terminator, 15 kV, 750 Al.		3	3
T	12 00 10 03	Grounding Unit		1	1
U		Refill (Sized by Engineering)		3	3
V	17 54 140	Connector, 2 Bolt, 4/0		3	3
W	04 00 20 07	Crossarm, 8', Double		1	1
X	06 12 34 01	Deadend, 12 kV		4	3
Y	ILW*W	Wire, 5 kV		30	25
Z	02	Pole		1	1
A1	12 01 297	Conduit, Sch. 40, 5"		20	20
B1	27 60 035	Iron - Hanger (ft.)		6'	6'
C1	23 06 087	Bracket - Standoff, 12"		4	4
D1	25 53 003	Bolt - Double Arming, 5/8" x 18"		4	4
E1	23 65 053	Nut - 5/8" Jam		4	4
F1	23 66 031	Washer - Curved, 3/4"		8	8
G1	23 67 184	Strap - Conduit, 5"		4	4
H1	18 52 019	Wire, #6 Cu., Bare S.D. (ft.)		35	35

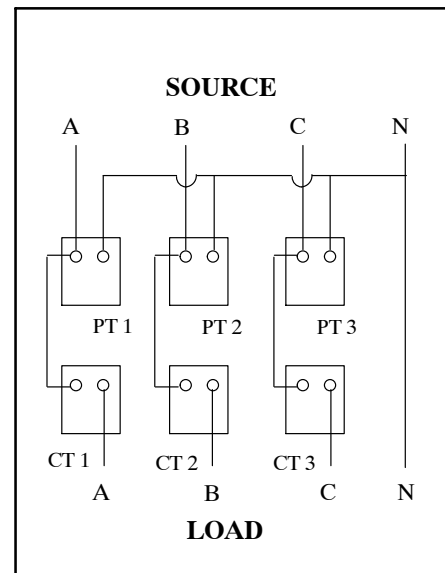
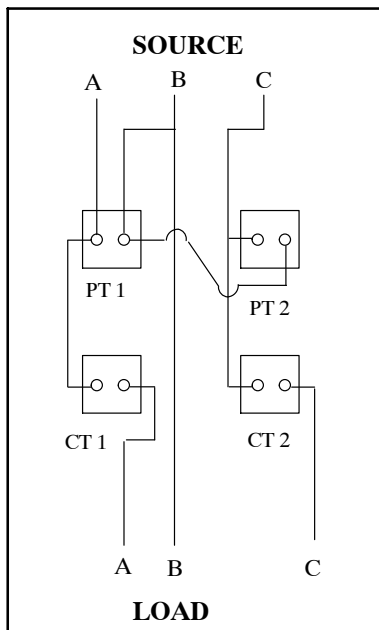
METER INSTALLATIONS
Primary Metering For Customer U.G., 3 Phase 3W & 4W
2400 / 4160 V, SM-5 FUSING

25 04 08 **

Sheet 3 of 3

MISSOURI ONLY
NORMALLY PROVIDED BY AMEREN

		Std. / Stk. No.	Description	25 04 08 **	01	02
@ @	AA	23 17 294	Mounting, Primary Metering		1	1
	BB	40 01 120	Box, Secondary Connection		1	1
	CC	21 66 039	Screw, Cap, 3/8" x 2"		2	2
	DD	40 02 054	Conduit, Flex 1"		20	20
	EE	23 64 033	Staple		3	3
	FF	MTR SHOP	Wire Pack of 10 # 12, Color Coded (ft.)		25	25
	GG	40 53 612	Fitting		2	2
	HH	40 04 245	Socket, Meter, 600 V, 3 Phase, 4 wire		1	
		40 04 246	Socket, Meter, 600 V, 3 Phase, 3 wire			1
	II	21 71 037	Screw, Wood #14, 3", Rnd		4	4
	LL	DEC*W	Clamp, D.E.		4	3
	MM	PG*	Clamp, P.G. (Neutral) (See Std. 07 00 25 00)		1	
	NN	18 11 065	Cord, Hrd Srv, 14/2; 600V. Cu		15	15
	OO	12 51 217	Conduit, PVC Split, 2"x10'		1	1
	PP	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)		2	2
	QQ	69 58 181	Guard, Clam-shell, Wildlife		3	4
		286	Install Primary Metering		1	1

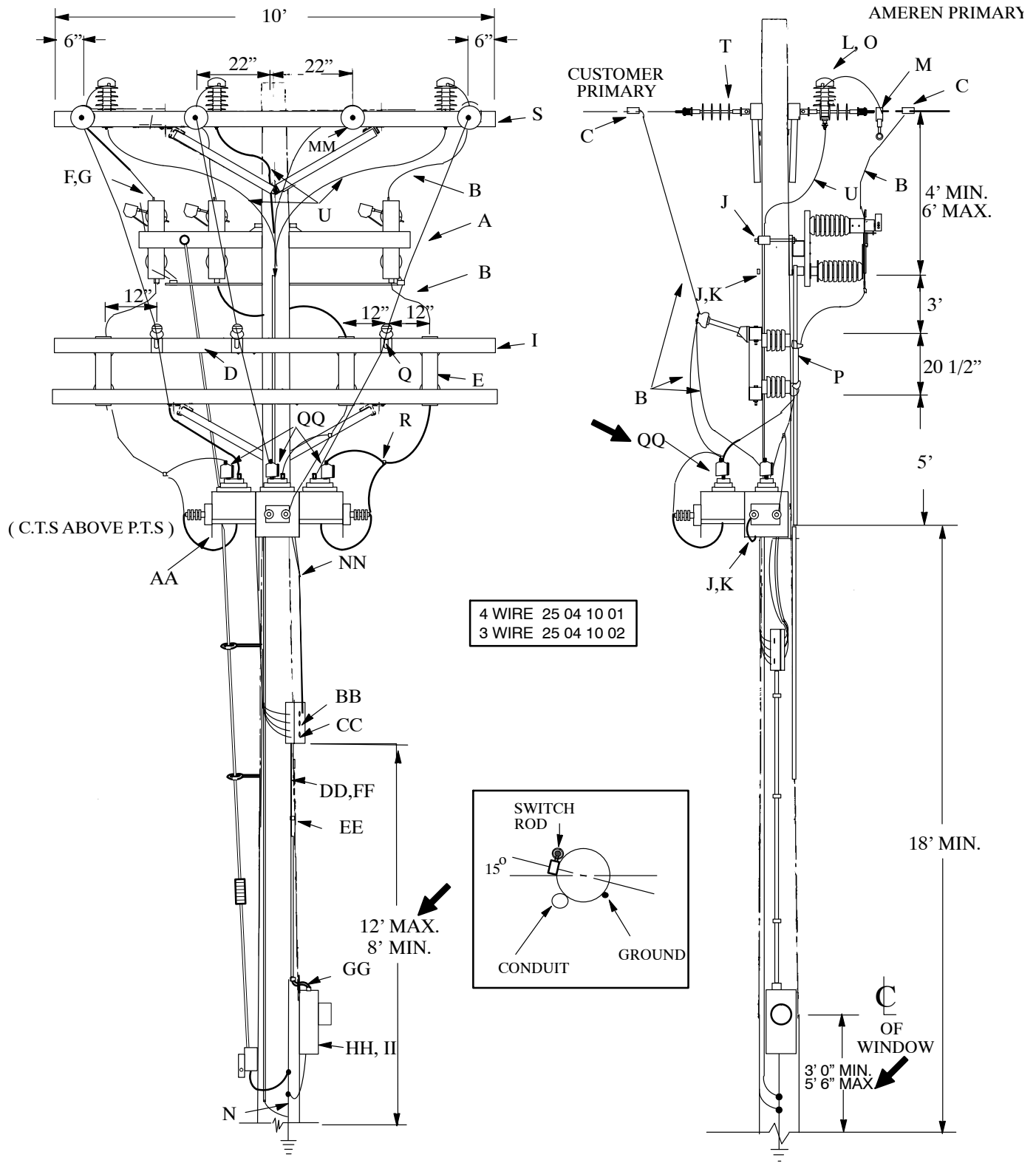


METER INSTALLATIONS
 Primary Metering, 3 Phase 3 W & 4 W
 2400 / 4160 V, SM-5 FUSING

25 04 10 **

Sheet 1 of 3

MISSOURI ONLY



METER INSTALLATIONS
Primary Metering, 3 Phase 3 W & 4 W
2400 / 4160 V, SM-5 FUSING

25 04 10 **

Sheet 2 of 3

MISSOURI ONLY

NOTE :

1. When meter pole is on customer property, switch shall be provided one span before.
2. Secondary wire lead on meter cluster is 15 ft. standard length. For tall poles, special order meter cluster with longer lead to meet maximum height requirement for connection box.

NORMALLY PROVIDED BY CUSTOMER

	Std. / Stk. No.	Description	25 04 10 **	01	02
A	54 07 239	Switch, 15 kV, Group Operated		1	1
B	18 51 019	Wire, #2 Cu, Covered S.D. (ft.)		50	50
C	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		6	6
D	04 00 20 03	Crossarm, 10'		2	2
E	54 03 051	Mounting, Fuse, 400 A		3	3
F	17 05 194	Lug, Compression, 4/0 Cu.		6	6
G	21 53 046	Bolt, Everdur, 1/2" x 2 1/2"		12	12
I	23 52 036	Bolt, Machine, 1/2" x 5"		12	12
J	23 52 065	Bolt, Machine, 5/8" x 12"		6	6
K	23 66 027	Washer, Square		5	5
L	10 01 133	Arrester, Lightning, 3 kV		3	3
M	23 78 394	Clamp, Hot Line		3	3
N	12 00 10 03	Grounding Unit		1	1
O	17 58 054	Bracket, Crossarm Mounting		3	3
P		Refill (Sized by Engineering)		3	3
Q	06 12 20 04	Arm, Training, Fiberglass, 18"		3	3
R	17 54 140	Connector, 2 Bolt, 4/0		3	2
S	04 00 20 08	Crossarm, 10' Double		1	1
T	06 12 34 04	Deadend, 12 kV, Double		8	6
U	18 52 019	Wire, #6 Cu Bare S.D. (ft.)		35	35
		Pole		1	1

METER INSTALLATIONS
Primary Metering, 3 Phase 3 W & 4 W
2400 / 4160 V, SM-5 FUSING

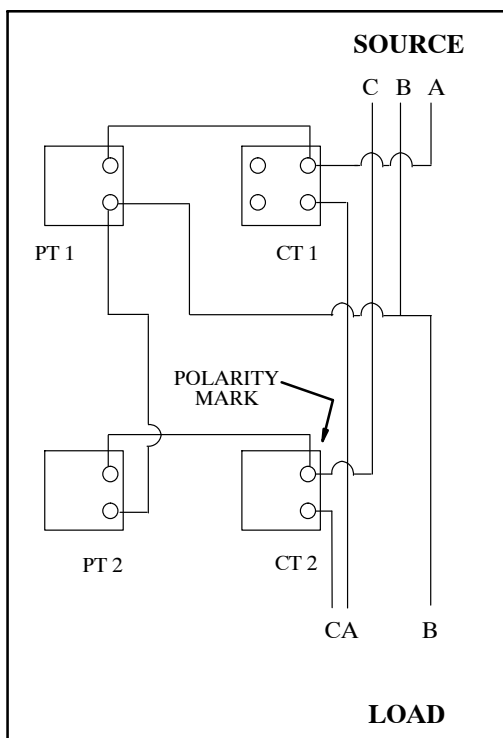
25 04 10 **

Sheet 3 of 3

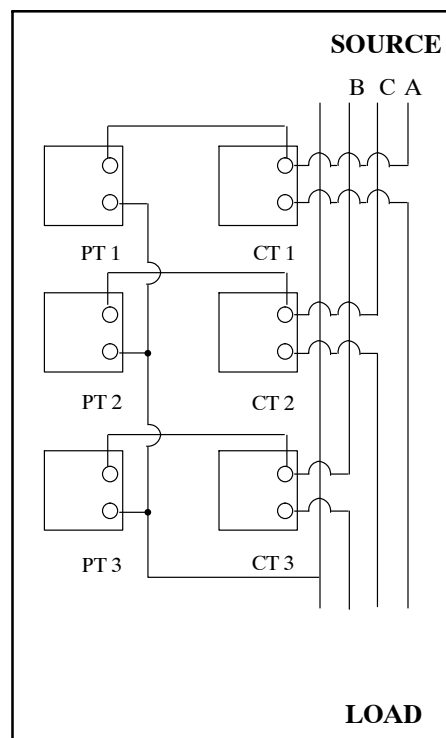
NORMALLY PROVIDED BY AMEREN

		Std. / Stk. No.	Description	25 04 10 **	01	02
@ @	AA	23 17 294	Mounting, Primary Metering		1	1
	BB	40 01 120	Box, Secondary Connection		1	1
	CC	21 66 039	Screw, Cap, 3/8" x 2"		2	2
	DD	40 02 054	Conduit, Flex, 1"		20	20
	EE	23 64 033	Staple		3	3
	FF	MTR SHOP	Wire Pack of 10 # 12, Color Coded (ft.)		25	25
	GG	40 53 612	Fitting		2	2
	HH	40 04 245	Socket, Meter, 600V, 3 Phase, 4 Wire		1	
		40 04 246	Socket, Meter, 600V, 3 Phase, 3 Wire			1
	II	21 71 037	Screw, Wood, # 14, 3", Rnd.		4	4
	LL	DEC*W	Clamp, D.E.		8	6
	MM	PG*	Clamp, P.G. (Neutral) (See Std. 07 00 25 00)		1	
	NN	18 11 065	Cord, Hrd Srv, 14/2 Cu, 600V		20	20
	OO	12 51 217	Conduit, PVC Split		1	1
	PP	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)		2	2
	QQ	69 58 181	Guard, Clam-shell, Wildlife		3	4
		286	Install Primary Metering		1	1

MISSOURI ONLY



3 WIRE 25 04 10 02



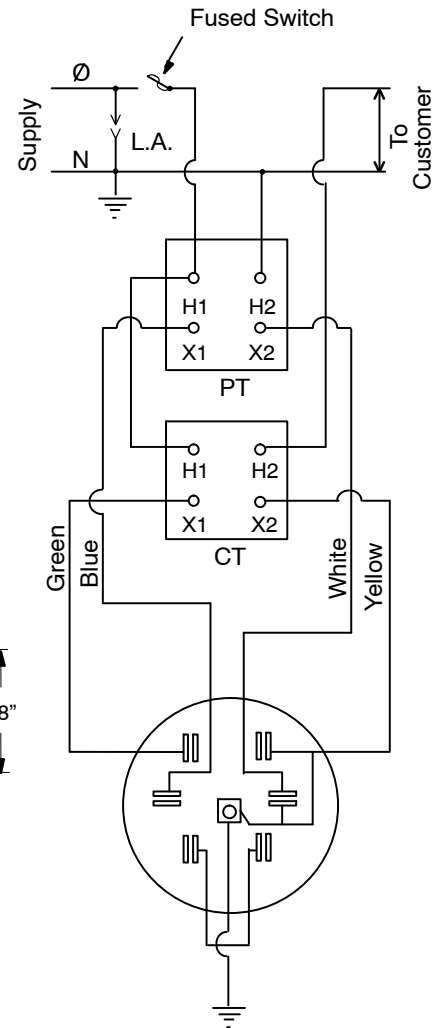
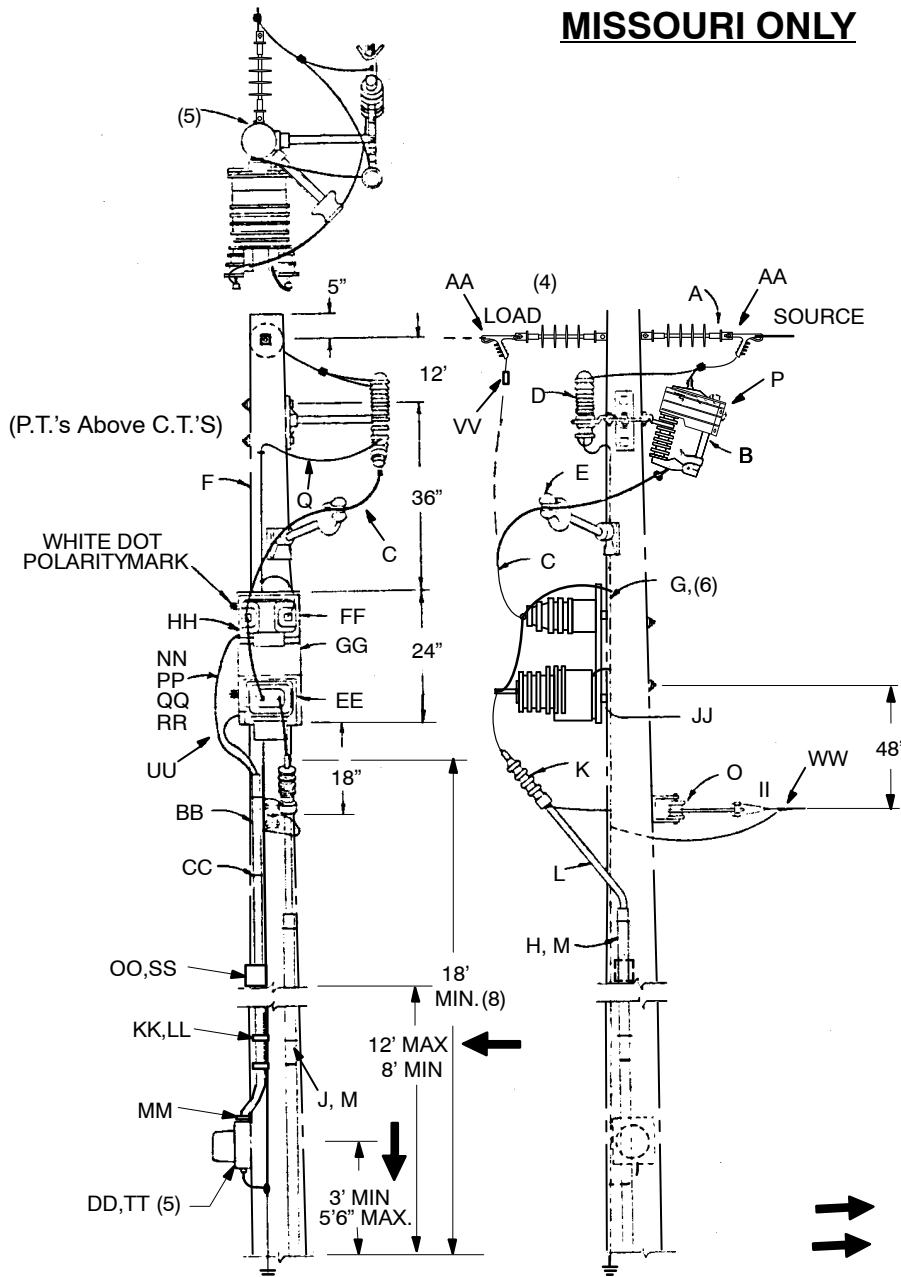
4 WIRE 25 24 10 01

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
 REV. NO: 11
 REV. DATE: 05/01/12

MISSOURI ONLY



Meter Socket
Wiring Diagram

➔ 25 12 01 01 - Double Deadend
➔ 25 12 01 02 - Single Deadend

NOTES:

1. Ground all instrument transformers.
2. If metered primary exceeds two spans, additional pole arresters must be installed on first pole beyond meter pole.
3. Ground clearance 4'. Barriers shall be installed for protection against vehicular traffic if necessary.
4. Overhead service shown by broken line.
5. Rotate G & DD to give best clearance and climbing space.
6. When meter pole is located on customer property, disconnect switches shall be provided one span before.
7. Secondary wire lead on meter cluster is 15ft. standard length. For tall poles, special order meter cluster with longer lead to meet max. height requirement for connection box.
8. Primary connections shall be 18ft. min. above the ground.

METER INSTALLATIONS
Primary Metering
7200 Volt Single Phase

25 12 01 **

Sheet 2 of 2

	Std. / Stk. No.	Description	25 12 01 **	01	02
NORMALLY FURNISHED BY CUST.					
A	06 12 30 03	Double D.E. on Pole		1	
	06 12 30 01	D.E. on Pole			1
B	10 12 01 01	SW, Ass'y., (Fuse Sized By Engr.)		1	1
C	18 51 019	Wire, #2 Cu Covered, SD, (ft.)		25	15
D	10 01 129	Lightning Arr., 9kV		1	1
E	06 12 20 04	Ins., Standoff, 18"		1	1
F	02	Pole		1	1
G	12 00 10 01	Grounding Unit		1	1
H	12 51 217	Conduit, 2" Pl., Slotted			20
J	23 18 237	Guard, 3" Metal Cable			1
K	42 34 59 01	Termination, 15kV			1
L	18 07 238	Cable, 15kV #2 CN., Ft.			30
M	27 60 035	Iron, Hanger			10
O	06 01 01 01	Insulator, Clevis		1	1
P	05 15 10 01	Cover-Cutout		1	1
Q	18 52 019	Wire, #6 Cu Bare S.D. (ft.)		35	35
NORMALLY FURNISHED BY AMEREN					
@	AA	DEC*W	Clamp – Deadend	2	1
	BB	12 51 217	Conduit-PVC, Split 2"x10'	1	1
	CC	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)	2	2
	DD	40 04 210	Meter Enclosure	1	1
@	EE	---	Transformer, Current	1	1
@	FF	---	Transformer, Potential	1	1
	GG	69 04 112	Bracket, Trfrmr. Mtg.	1	1
	HH	40 59 010	Connector, Cable #8	2	2
@	II	SDEA*W	Clamp – Secondary Deadend Automatic	1	1
	JJ	23 66 031	Washer, 3" Curved (Nested)	4	4
	KK	40 02 054	Conduit 1", Flex.	20'	20'
	LL	23 64 033	Staple, 1 1/2"	3	3
	MM	40 53 612	Fitting	2	2
	NN	18 66 082	Wire #12 Cu 600V Type TW Blue	30'	30'
	OO	40 01 120	Box, Secondary connection	1	1
	PP	18 66 084	Wire #12 Cu 600V Type TW Green	30'	30'
	QQ	18 66 088	Wire #12 Cu 600V Type TW Yellow	30'	30'
	RR	18 66 087	Wire #12 Cu 600V Type TW White	30'	30'
	SS	21 66 039	Screw, Hex Head Cap, 3/8"x2"	2	2
	TT	21 71 037	Screw, Wood, #14, 3", Rnd,	4	4
	UU	18 11 065	Cord – Hrd Srv 14/2 Cu 600V	20	20
@	VV	PG*	Clamp, P.G. (Std. 07 00 25 00)	2	2
@	WW	PG*	Clamp, P.G., Neutral (Std. 07 00 25 00)	1	1
		285	Install Pri. Metering	1	1

METER INSTALLATIONS
Primary Metering For Customer U.G., 3 Phase 3W & 4W
4 or 12 kV

25 12 07 **
Sheet 2 of 3

MISSOURI ONLY

NOTES:

1. When meter pole is on customer property, switch shall be provided one span before.
2. Secondary wire lead on meter cluster is 15ft. standard length. For tall poles, special order meter cluster with longer lead to meet max. height requirement for connection box.
3. Terminator mounting bracket is either Aluma Form (TB-EMB-1-6-PA-35-UE) or Hubbell (CTB-EMB-1-6-PA-35-UE). It is no longer stocked by Ameren.

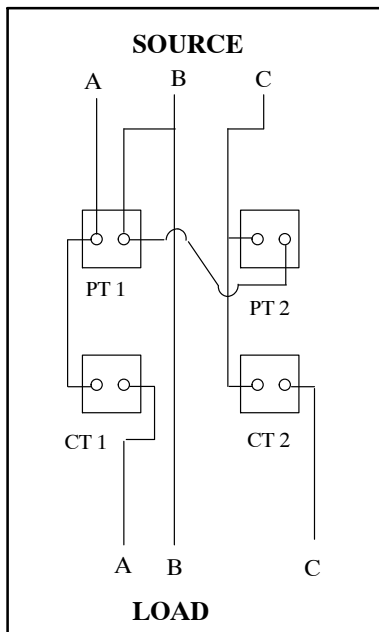
NORMALLY PROVIDED BY CUSTOMER

		Std. / Stk. No.	Description	25 12 07 **	01	02	03	04
③	A	54 07 239	Switch, 15 kV, Group Operated		1	1	1	1
	B	18 51 019	Wire, #2 Cu, Covered, S.D. (ft.)		50	50	50	50
	C	HLC*W	Clamp, Hot line		3	3	3	3
		PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		3	3	3	3
	D	04 00 20 03	Crossarm, 10'		1	1	1	1
	E	54 07 208	Switch, 15 kV, 100A		3		3	
		54 07 209	Switch, 15 kV, 200A			3		3
	F	17 05 215	Lug, Compression, # 2 Cu.		6	6	6	6
	G	21 53 046	Bolt, Everdur, 1/2" x 2 1/2"		12	12	12	12
	H		Bracket, Mounting, Terminator		1	1	1	1
	J	23 52 065	Bolt, Machine, 5/8" x 12"		8	8	8	8
	K	23 66 027	Washer, Square		7	7	7	7
	L	12 00 01 01	Arrester, Lightning, (3 or 10 kV)		6	6	6	6
	M	23 78 394	Clamp, Hot Line		6	6	6	6
	N	12 01 273	Conduit, Sch 80, 4"		10	10	10	10
	O	17 58 054	Bracket, Crossarm Mounting		6	6	6	6
	P	23 67 193	Bracket, Cable		3	3	3	3
	Q	12 01 278	Conduit, Sch 40, 4"		20	20	20	20
	R	18 07 237	Cable, 15 kV #2		35		35	
		18 07 240	Cable, 15 kV 4/0			35		35
	S	42 34 59 01	Terminator, 15 kV, #2		3		3	
		42 34 59 03	Terminator, 15 kV, 4/0			3		3
	T	12 00 10 03	Grounding Unit		1	1	1	1
	U	17 54 005	Connector, Split Bolt, # 2 Cu.		3	3	3	3
	V	04 00 20 08	Crossarm, Double 10'		1	1	1	1
	W	06 12 34 01	Deadend, 12kV		4	4	3	3
	Y	02	Pole		1	1	1	1
	Z	17 54 303	Connector, Cable to Flat, #6-2/0		6	6	4	4
	A1	12 51 176	Bend - 4", 36" Rad.		1	1	1	1
	B1	27 60 035	Iron - Hanger (Ft.)		6'	6'	6'	6'
	C1	23 06 087	Bracket - Standoff, 12"		4	4	4	4
	D1	23 53 003	Bolt - Double Arming, 5/8" x 18"		4	4	4	4
	E1	23 65 053	Nut - 5/8" Jam		4	4	4	4
	F1	23 66 031	Washer - Curved, 3/4"		8	8	8	8
	G1	23 67 183	Strap - Conduit, 4"		4	4	4	4
	H1	23 17 411	Cover - Cutout		3	3	3	3
	I1	18 52 019	Wire, #6 Cu Bare, S.D. (ft)		35	35	35	35

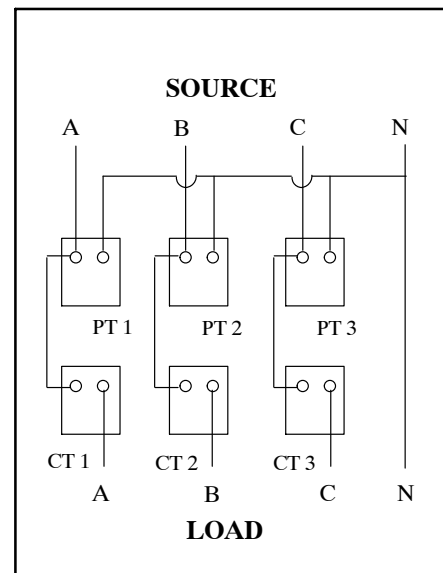
MISSOURI ONLY

NORMALLY PROVIDED BY AMEREN

		Std. / Stk. No.	Description	25 12 07 **	01	02	03	04
@ @	AA	23 17 294	Mounting, Primary Metering		1	1	1	1
	BB	40 01 120	Box, Secondary Connection		1	1	1	1
	CC	21 66 039	Screw, Cap, 3/8" x 2"		2	2	2	2
	DD	40 02 054	Conduit, Flex, 1"		20	20	20	20
	EE	23 64 033	Staple		3	3	3	3
	FF	MTR SHOP	Wire Pack of 10 # 12, Color Coded (ft.)		25	25	25	25
	GG	40 53 612	Fitting		2	2	2	2
	HH	40 04 245	Socket, Meter, 600V, 3 Phase, 4 Wire		1	1		
		40 04 246	Socket, Meter, 600V, 3 Phase, 3 Wire				1	1
	II	21 71 037	Screw, Wood, # 14, 3", Rnd.		4	4	4	4
	LL	DEC*W	Clamp D.E.		4	4	3	3
	MM	PG*	Clamp, P. G. (Neutral) (See Std. 07 00 25 00)		1	1		
		286	Install Primary Metering		1	1	1	1
	NN	18 11 065	Cord, Hrd Srv, 14/2; 600V. Cu		20	20	20	20
	OO	12 51 217	Conduit, PVC Split, 2"x10'		1	1	1	1
	PP	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)		2	2	2	2
	QQ	69 58 181	Guard, Clam-Shell, Wildlife		3	3	4	4



3 WIRE



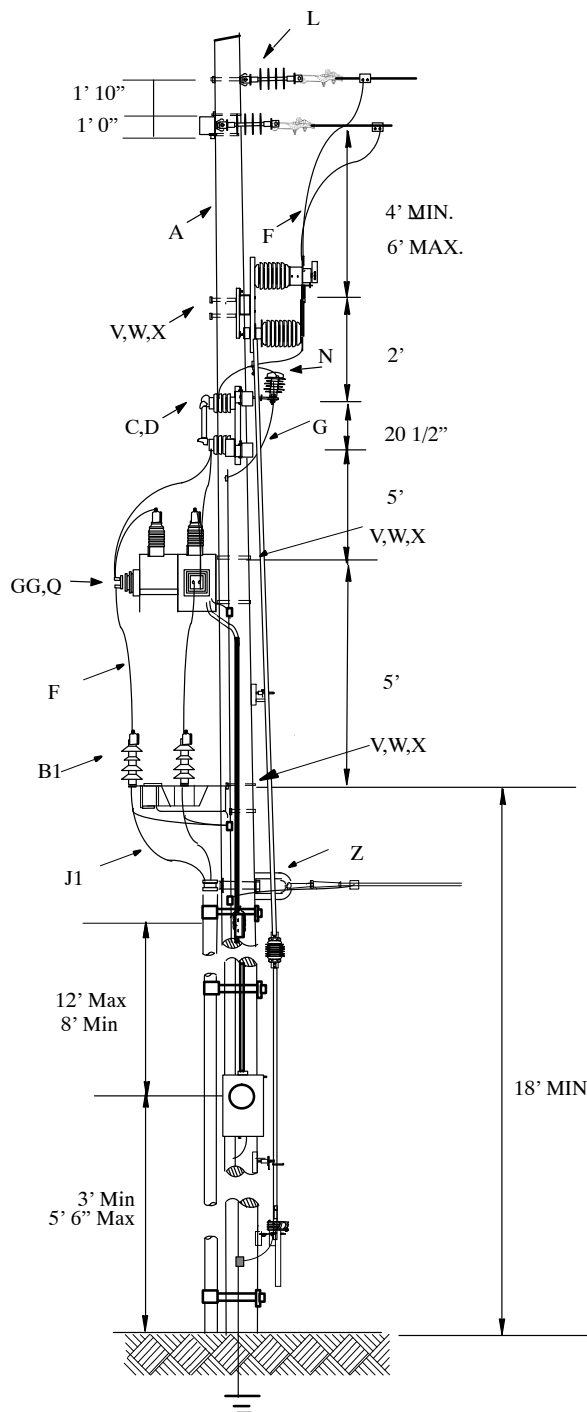
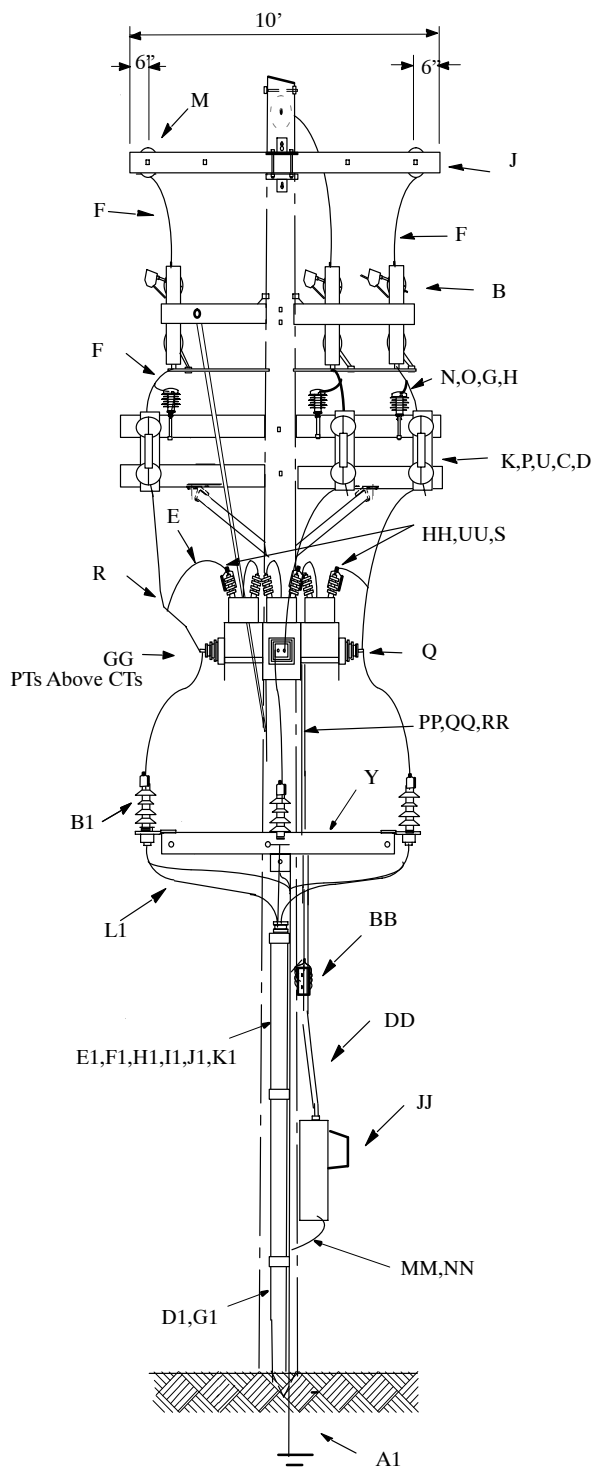
4 WIRE

METER INSTALLATIONS
 Primary Metering For Customer U.G., 3 Phase 4W
 4 or 12 kV, SM-5 Fusing, 400 Amp

25 12 08 01

Sheet 1 of 4

MISSOURI ONLY



MISSOURI ONLY

NOTES:

1. When meter pole is on customer property, switch shall be provided one span before.
2. Secondary wire lead on meter cluster is 15ft. standard length. For tall poles, special order meter cluster with longer lead to meet max. height requirement for connection box.
3. Terminator mounting bracket is either Aluma Form (TB-EMB-1-6-PA-35-UE) or Hubbell (CTB-EMB-1-6-PA-35-UE). It is no longer stocked by Ameren.
4. Fuse sized by Ameren Engineer.
5. Ground all instrument transformers, arresters, and mounting assembly to the grounding unit.
6. Install barriers for protection against vehicular traffic where necessary.
7. Maintain a minimum of 15" clearance between 15kV phases or phase to ground.
8. Maintain minimum of 5' clearance between the aluminum mounting platform and the crossarm.
9. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non climbing side of the pole. Reference from NESC, Rule 239E.
10. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12 kV underbuild.
11. For wire color coding on PT and CT secondaries, refer to system meter drawings.
12. If metering structure is located within a substation, the metering and L.A. ground wires must be connected to the substation ground mat.
13. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance.

METER INSTALLATIONS
 Primary Metering For Customer U.G., 3 Phase 4W
 4 or 12 kV, SM-5 Fusing, 400 Amp

25 12 08 01

Sheet 3 of 4

NORMALLY PROVIDED BY CUSTOMER

		Std. / Stk. No.	Description	25 12 08 01
@	A	02	Pole	
	B	54 07 239	Switch, 15kV, Group Operated	1
	C	54 03 051	Switch, 15kV, SM-5 Fuse Mounting, 400A	3
	D		Fuse Refill – 400	3
	E	18 51 019	Wire, #2 Cu, Covered, S.D. (ft.)	20
	F	18 51 022	Wire, 500 Cu, Covered, S.D. (ft)	30
	G	18 51 025	Wire, #4 Cu, Covered, S.D. (ft)	15
	H	17 02 175	Clamp, Hot line 500kCMIL Cu Main/#4 Cu Tap	3
	I	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)	3
	J	04 00 41 04	Crossarm, Fiberglass, 10'	1
	K	04 00 20 11	Crossarm, Dble Wood, 10', Vertically Mount	1
	L	06 12 30 11	Single Deadend on Pole, 12kV	1
	M	06 12 35 01	Deadend on F/G Arm, 10'	1
	N	10 01 129	Arrester, Terminal Pole, 9kV	3
	O	17 58 054	NEMA Bracket – Arrester	3
	P	21 53 046	Bolt, Everdur/Bronze, 1/2" x 2 1/2"	12
	Q	17 05 193	Lug, Compression, 500 Cu	18
	R	17 54 141	PG Connector, 2-Bolt Type, 500 Cu	3
	S	17 54 844	Connector, Cable to Flat, #8 Sol – 2/0 Str, One Eyebolt Type, Bronze	6
	T	17 54 005	Connector, Split Bolt, #2 Cu	3
	U	23 52 065	Bolt, Machine, 1/2" x 5"	12
	V	23 52 097	Bolt Machine, 3/4" x 12"	8
	W	23 66 131	Washer, 3/4", SQ	8
	X	23 66 135	Washer, 3/4" Double Coil	8
	Y	17 08 057	Bracket, Mounting, Terminator	1
	Z	03 01 01 03	Neutral Deadend	1
	A1	12 00 10 04	Grounding Unit – #2 Cu	1
	B1	42 34 61 02	Terminator, 15kV, 750 Cu	3
	C1	23 67 197	Bracket, Cable, 750 Cu	3
	D1	12 01 272	Conduit, 5", Sch80	10
	E1	12 01 303	Conduit, 5", Sch40	20
	F1	23 06 087	Bracket, Standoff, 12"	3
	G1	12 51 206	Bend, 5", 36" Rad	1
	H1	27 60 035	Iron – Hanger (ft)	6
	I1	25 53 003	Bolt, Dble Aiming, 5/8" x 18"	3
	J1	23 65 053	Nut Jam, 5/8"	3
	K1	23 67 184	Strap, Conduit, 5"	3
	L1	18 07 243	Cable, UG, 15kV 3–750 kcmil Cu	35

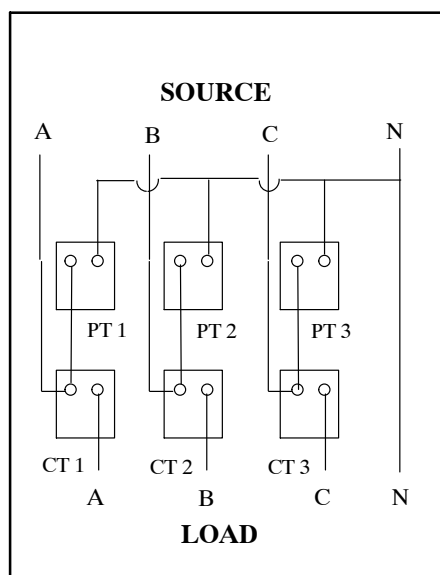
METER INSTALLATIONS
 Primary Metering For Customer U.G., 3 Phase 4W
 4 or 12 kV, SM-5 Fusing, 400 Amp

25 12 08 01

Sheet 4 of 4

NORMALLY PROVIDED BY AMEREN

		Std. / Stk. No.	Description	25 12 08 01	
@ @ @	AA	23 17 294	Mounting, Primary Metering		1
	BB	40 01 120	Box, Secondary Connection		1
	CC	21 66 039	Screw, Cap, 3/8" x 2"		2
	DD	40 02 054	Conduit, Flex, 1"		20
	EE	23 64 033	Staple		3
	FF	MTR SHOP	Wire Pack of 10 # 12, Color Coded (ft.)		25
	GG	MTR SHOP	Instrument Current Transformer		3
	HH	MTR SHOP	Instrument Potential Transformer		3
	II	40 53 612	Fitting		2
	JJ	40 04 245	Socket, Meter, 600V, 3 Phase, 4 Wire		1
	KK	21 71 037	Screw, Wood, #14, 3", Rnd.		4
	MM	17 54 373	Connector, Split Bolt, Bronze, #2 or #4Cu		1
	NN	18 01 012	Wire, #6 Cu Poly Covered		5
	OO	286	Install Primary Metering		1
	PP	18 11 065	Cord, Hrd Srv, 14/2 Cu, 600V		20
	QQ	12 51 217	Conduit, PVC Split, 2"x10'		1
	RR	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)		2
	UU	69 58 181	Guard, Clam-Shell, Wildlife		3



4 WIRE

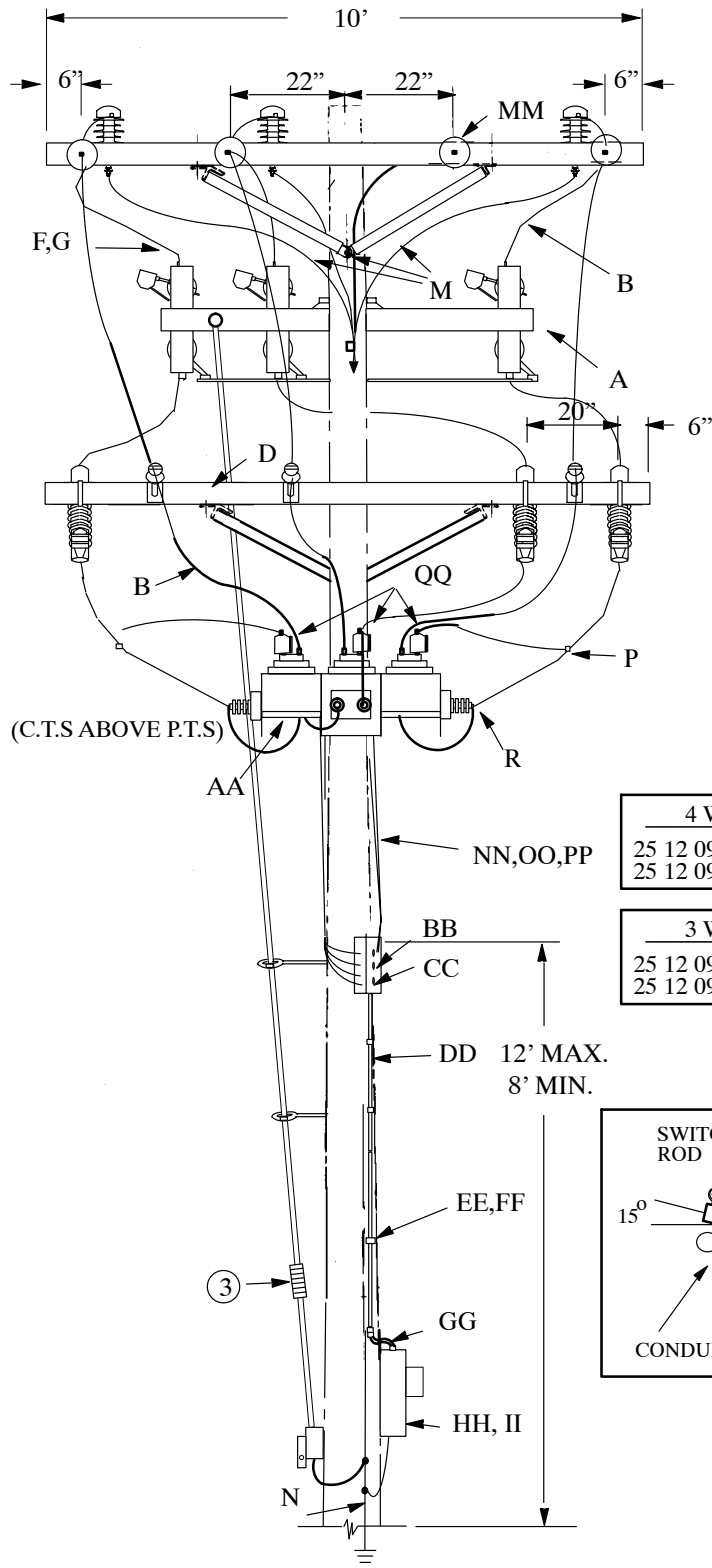
METER INSTALLATIONS

Primary Metering, 3 Phase 3W & 4W 4 or 12 kV

25 12 09 **

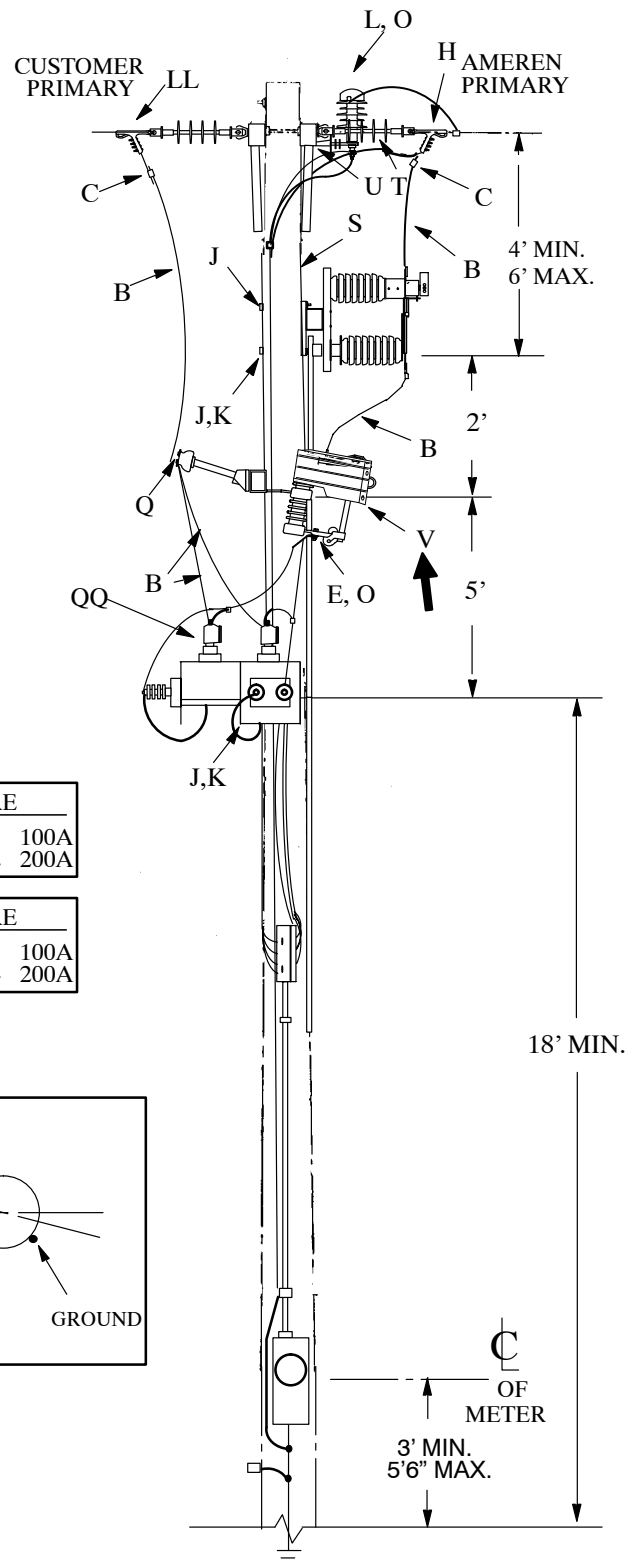
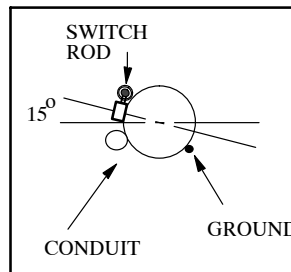
Sheet 1 of 4

MISSOURI ONLY



4 WIRE			
25 12 09 01	100A		
25 12 09 02	200A		

3 WIRE			
25 12 09 03	100A		
25 12 09 04	200A		



METER INSTALLATIONS
Primary Metering, 3 Phase 3W & 4W
4 or 12 kV

25 12 09 **

Sheet 2 of 4

MISSOURI ONLY

1. When meter pole is on customer property, switch shall be provided one span before.
2. Secondary wire lead on meter cluster is 15 ft. standard length. For tall poles, special order meter cluster with longer lead to meet maximum height requirement for connection box.
3. Switch is to be operated with rotating or reciprocating control rod accessible from ground level. Control rod to be furnished with insulating section above handle.

NORMALLY PROVIDED BY CUSTOMER

	Std. /Stk. No.	Description	25 12 09 **	01	02	03	04
A	54 07 239	Switch, 15 kV, Group Operated		1	1	1	1
B	18 51 019	Wire, #2 Cu, Covered, S.D. (ft.)		50	50	50	50
C	PG*	Clamp, Parallel Groove (See Std. 07 00 25 00)		6	6	6	6
D	04 00 20 03	Crossarm, 10'		1	1	1	1
E	54 07 208	Switch, 15 kV, 100A Fused		3		3	
	54 07 209	Switch, 15 kV, 200 Amp. Fused			3		3
F	17 05 215	Lug, Compression, # 2 Cu.		6	6	6	6
G	21 53 046	Bolt, Everdur, 1/2" x 2 1/2"		12	12	12	12
H	23 78 394	Clamp, Hot Line		3	3	3	3
J	23 52 065	Bolt, Machine, 5/8" x 12" Galv.		6	6	6	6
K	23 66 027	Washer, Square Galv.		5	5	5	5
L	12 00 01 01	Arrester, Lightning, (3kV or 10kV)		3	3	3	3
M	18 52 019	Wire, #6 Cu, Bare, S.D. (ft.)		35	35	35	35
N	12 00 10 03	Grounding Unit		1	1	1	1
O	17 58 054	Bracket, Crossarm Mounting		6	6	6	6
P	17 54 005	Connector, Split Bolt, # 2 Cu.		3	3	2	2
Q	06 12 20 04	Arm, Training, Fiberglass 18"		3	3	3	3
R	17 54 303	Connector, Cable to Flat, #6-2/0		6	6	4	4
S	41 02 XXX	Pole (Size & Class T.B.D.)		1	1	1	1
T	06 12 34 04	Deadend, Double, 12kV		4	4	3	3
U	04 00 20 08	Crossarm, 10' Double		1	1	1	1
V	23 17 411	Cover, Cutout, 100 Amp		3		3	
	23 17 412	Cover, Cutout, 200 Amp			3		3

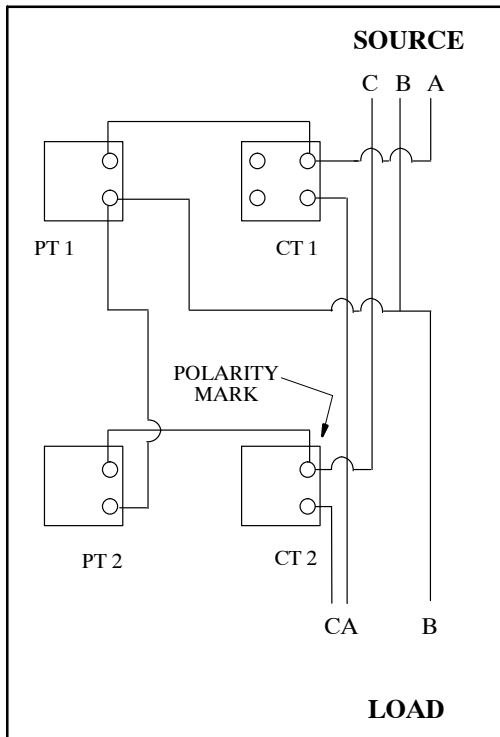
METER INSTALLATIONS
Primary Metering, 3 Phase 3W & 4W
4 or 12 kV

25 12 09 **

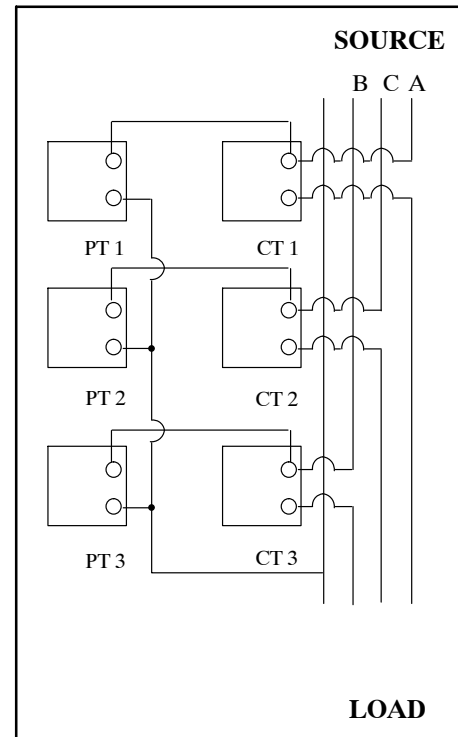
Sheet 3 of 4

NORMALLY PROVIDED BY AMEREN

		Std. / Stk. No.	Description	25 12 09 **	01	02	03	04
	AA	23 17 294	Mounting, Primary Metering		1	1	1	1
	BB	40 01 120	Box, Secondary Connection		1	1	1	1
	CC	21 66 039	Screw, Cap, 3/8" x 2"		2	2	2	2
	DD	40 02 054	Conduit, Flex, 1"		20	20	20	20
	EE	23 64 033	Staple		3	3	3	3
	FF	MTR SHOP	Wire Pack of 10 # 12, Color Coded (ft.)		25	25	25	25
	GG	40 53 612	Fitting		2	2	2	2
	HH	40 04 245	Socket, Meter, 600V, 3 Phase, 4 Wire		1	1		
		40 04 246	Socket, Meter, 600V, 3 Phase, 3 Wire				1	1
	II	21 71 037	Screw, Wood, #14, 3", Rnd.		4	4	4	4
@	LL	DEC*W	Clamp D.E.		8	8	6	6
@	MM	PG*	Clamp P.G. (Neutral) (See Std. 07 00 25 00)		1	1		
	NN	18 11 065	Cord – Hrd Srv 14/2 Cu 600V		20	20	20	20
	OO	12 51 217	Conduit – PVC Split 2"x10'		1	1	1	1
	PP	27 60 035	Iron, Hanger, Galv., 3/4" wide (ft)		2	2	2	2
	QQ	69 58 181	Guard, Clam-shell, Wildlife		3	3	4	4
		286	Install Primary Metering		1	1	1	1

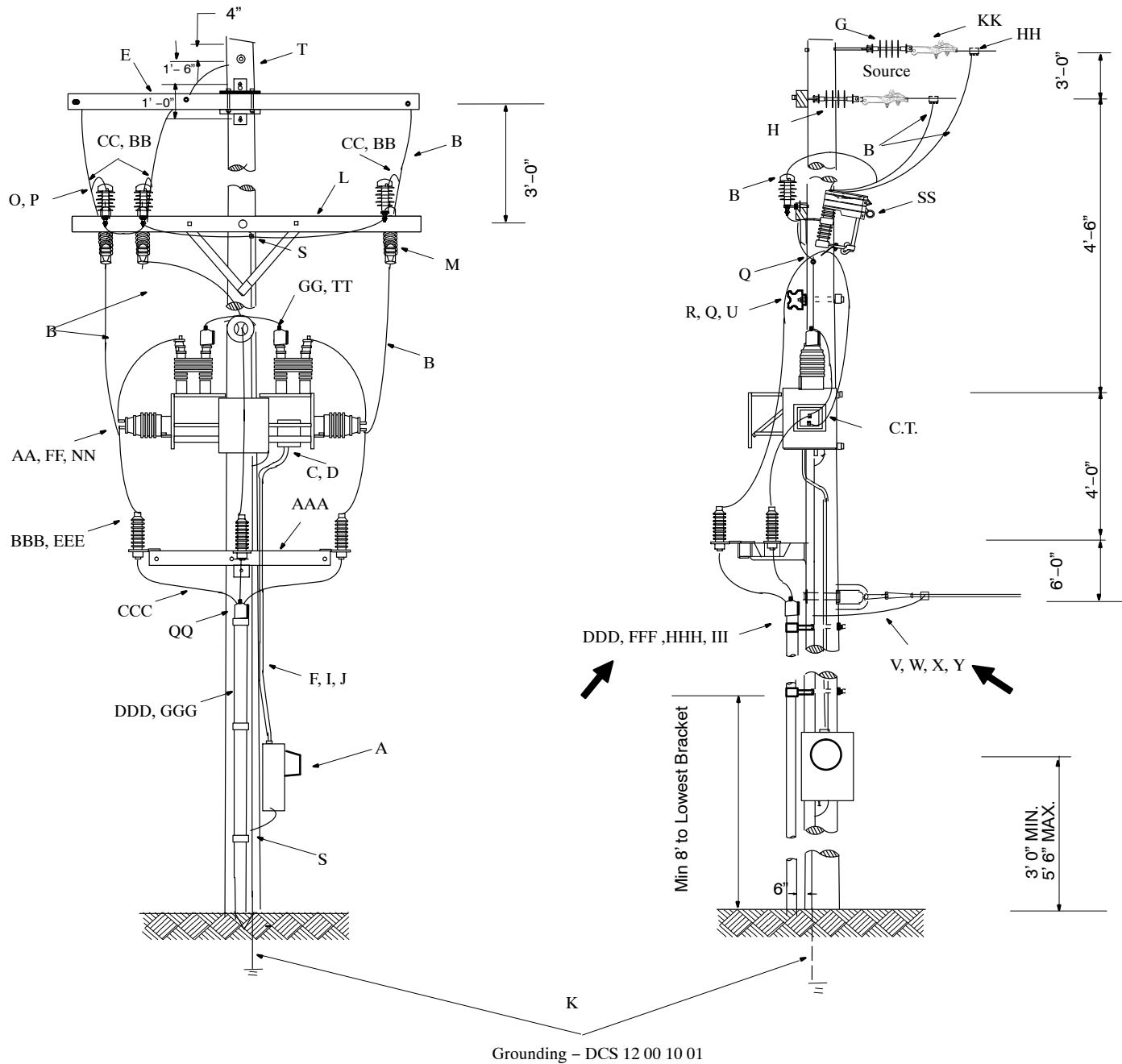


3 WIRE



4 WIRE

ILLINOIS ONLY



METER INSTALLATIONS

Primary Metering For Customer UG 3 Phase 3 Wire 4 thru 15 kV

25 12 10 **

Sheet 2 of 4

NOTES:

ILLINOIS ONLY

1. Grounding all instrument transformers, arresters, and mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole as per DCS **29 00 18 01**; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non-climbing side of the pole as per DCS **29 00 17 12**.
4. If disconnect switches are required, the switch may be installed on adjacent poles.
5. For wire color coding on PT and CT secondaries, refer to system metering drawings.
6. If metering structure is located within a substation, the metering and arresters ground wires must be connected to the substation ground mat.
7. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and arresters may be installed on adjacent poles.
8. Riser conduit cover is for 2" – 4" conduit.

		Std. / Stk. No.	Description(Provided and Installed by Ameren IL) 25 12 10 **	01	02
	A	40 54 378	Meter Socket, 600V, Pre-wired 8-Terminal Instrument Rated	1	1
	B	18 51 019	Wire, #2 Cu, Covered, S.D.	50	50
	C	40 01 120	Box, Secondary Connection	1	1
	D	21 66 039	Screw, Cap, 3/8" x 2"	2	2
	F	40 02 054	Conduit, Flex, 1"	20	20
	I	23 64 033	Staple	3	3
	J	40 53 612	Fitting	2	2
	K	12 00 10 01	Ground Unit – Ground Coil	1	1
	E	04 00 41 04	10' FG Dead Arm	1	1
	G	06 12 30 03	Dbl Deadend on Pole with FG Extension	1	1
	H	06 12 30 14	Dbl Deadend on FG Arm without FG Extension	2	2
	L	04 00 20 03	Single Wood Arm 10' with Braces	1	1
	M	54 07 208	Switch, 15kV, 100 Amp	3	
		54 07 209	Switch, 15kV, 200 Amp		3
@	O	10 01 133	Arrester, Lightning 3kV/2.55kV MCOV	3	3
		10 01 129	Arrester, Lightning 9kV/7.65kV MCOV	3	3
	P	23 56 088	Bracket, DBL Sided NEMA Crossarm Mounting, Arrester and Fuse Cutout	3	3
	Q	25 05 143	12kV Vice Top Insulator	1	1
	R	23 62 128	Adapter Pin for Vice Top Insulator	1	1
	U	23 52 070	Mach Bolt 20" x 5/8"	1	1
	S	17 54 373	Split Bolt #6 & 7#10 CW	4	4
@	T	02	Pole	1	1
	V	23 59 095	Eyelet, 3/4"	1	1
@	W	SDEA*W	Deadend, Automatic, Secondary, DCS 08 01 10 00	1	1
	X	23 52 097	Bolt, Machine 3/4" x 12"	1	1
	Y	23 66 031	Washer, SQ, 3/4"	1	1

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
REV. NO: 7
REV. DATE: 12/15/15

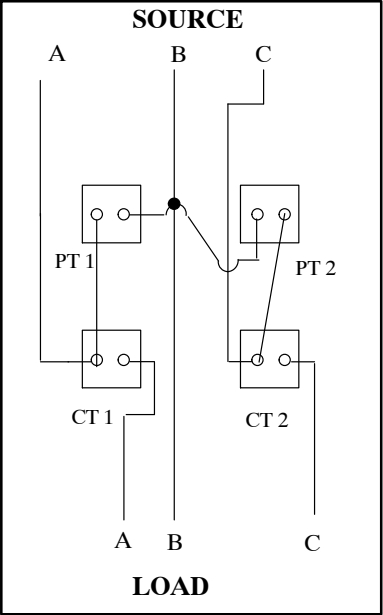
METER INSTALLATIONS
Primary Metering For Customer UG 3 Phase 3 Wire
4 thru 15 kV

25 12 10 **
Sheet 3 of 4

ILLINOIS ONLY

		Std. / Stk. No.	Description (Provided and Installed by Ameren IL) 25 12 10 **	01	02
@ @ @ @ @ @	AA	23 17 294	Mounting, Primary Metering	1	1
	BB	18 51 021	Wire, #6 Cu, Covered, S.D. (Ft.)	10	10
	CC	23 78 394	Clamp, Hot Line	3	3
	DD	MTR SHOP	Wire Pack of 10 #12, Color Coded (Ft.)	25	25
	FF	MTR SHOP	Current Transformer, 4 kV or 12 kV	2	2
	GG	MTR SHOP	Potential Transformer, 4 kV or 12 kV	2	2
	HH	PG*	Clamp, Parallel Groove (See DCS 07 00 25 00)	6	6
	JJ	PG*	Clamp, Parallel Groove (Neutral) (See DCS 07 00 25 00)	2	2
	KK	DEC*W	Clamp, D.E. – DCS 07 00 20 00	6	6
	MM	17 54 303	Connector, Cable to Flat, #6 – 2/0	4	4
	NN	17 05 215	Lug, Compression, #2 Cu.	6	6
	QQ	23 17 472	Cover, riser Conduit for 2" to 4"	1	1
	SS	23 17 411	Cover Cutout, 100A	3	
		23 17 412	Cover Cutout, 200A		3
	TT	69 58 181	Guard, Clam–Shell, Wildlife	3	3
	AAA	17 08 057	Bracket, 36", Mounting Terminators & Lightning Arresters	3	3
	BBB	23 67 193	Bracket, Cable	3	3
	CCC	18 07 237	Cable, 15kV #2	35	
		18 07 240	Cable, 15kV 4/0		35
	DDD	23 06 087	Bracket, Conduit Standoff, 12"	3	3
	EEE	42 34 59 01	Terminator, 15kV, #2	3	
		42 34 59 03	Terminator. 15kV. 4/0		3
	FFF	23 65 053	Nut 5/8" Jam	3	3
	GGG	12 01 273	Conduit, 4" Sch 80 (ft)	20	20
	HHH	23 67 183	Strap Conduit 4"	3	3
	III	23 53 003	Bolt, Double, Arming 5/8" x 18"	3	3
		286	Install Primary Metering	1	1

METER INSTALLATIONS
Primary Metering For Customer UG 3 Phase 3 Wire
4 thru 15 kV



25 12 10 01	100A
25 12 10 02	200A

3 WIRE

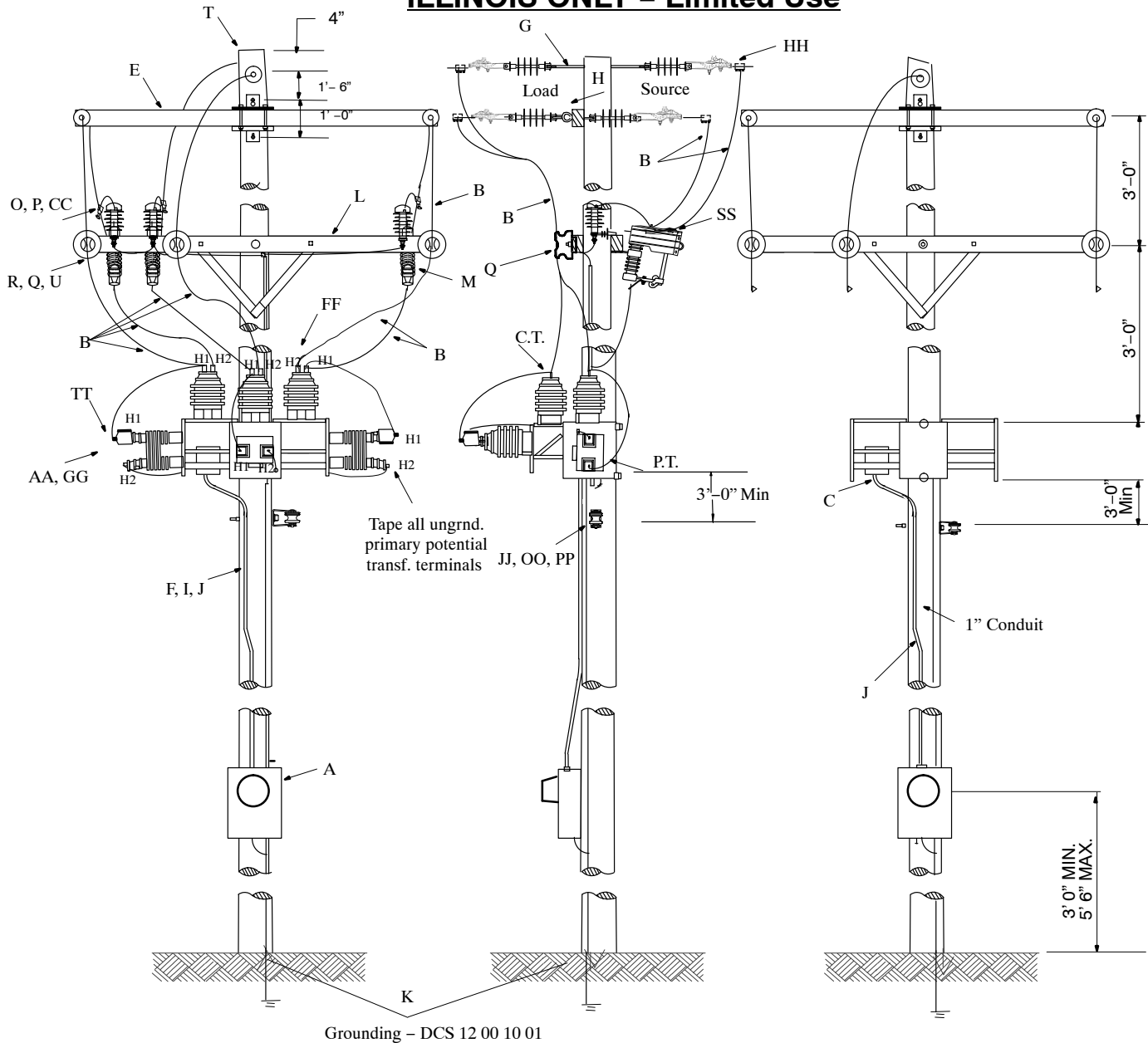
METER INSTALLATIONS

Primary Metering, 3 Phase 4 Wire 4 thru 15 kV

25 12 11 **

Sheet 1 of 3

ILLINOIS ONLY – Limited Use



1. When possible, use preferred DCS 25 12 20 01. (Refer to DCS 25 12 30 00 and DCS 25 12 30 01 for typical customer owned primary group operated switch and overcurrent protection).
2. Grounding all instrument transformers, arresters, and mounting assembly to the grounding unit.
3. Install barriers for protection against vehicular traffic where necessary.
4. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole as per DCS 29 00 18 01; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non-climbing side of the pole as per DCS 29 00 17 12.
5. If disconnect switches are required, the switch may be installed on adjacent poles.
6. For wire color coding on PT and CT secondaries, refer to system metering drawings.
7. If metering structure is located within a substation, the metering and arresters ground wires must be connected to the substation ground mat.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: WYW
REV. NO: 8
REV. DATE: 07/01/2020

METER INSTALLATIONS
 Primary Metering, 3 Phase 4 Wire
 4 thru 15 kV

25 12 11 **

Sheet 2 of 3

ILLINOIS ONLY – Limited Use

8. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and arresters may be installed on adjacent poles.

		Std. / Stk. No.	Description(Provided and Installed by Ameren IL) 25 12 11 **	01	02
@	A	40 54 353	Meter Socket, 600V, Pre-wired 13-Terminal Instrument Rated	1	1
	B	18 51 019	Wire, #2 Cu, Covered, S.D.	50	50
	C	40 01 120	Box, Secondary Connection	1	1
	D	21 66 039	Screw, Cap, 3/8" x 2"	2	2
	F	40 02 054	Conduit, Flex, 1"	20	20
	I	23 64 033	Staple	3	3
	J	40 53 612	Fitting	2	2
	K	12 00 10 01	Ground Unit	1	1
	E	04 00 41 04	10' FG Dead Arm	1	1
	G	06 12 30 03	Dbl Deadend on Pole with FG Extension	1	1
	H	06 12 30 14	Dbl Deadend on FG Arm without FG Extension	2	2
	L	04 00 20 03	Single Wood Arm 10' with Braces	1	1
	M	54 07 208	Switch, 15kV, 100 Amp	3	
		54 07 209	Switch, 15kV, 200 Amp		3
	N	PG*	Clamp, Parallel Groove – DCS 07 00 25 00	4	4
	O	10 01 133	Arrester, Lightning 3kV/2.55kV MCOV	3	3
		10 01 146	Arrester, Lightning 10kV/8.4kV MCOV	3	3
	P	23 56 088	Bracket, DBL Sided NEMA Crossarm Mounting, Arrester and Fuse Cutout	3	3
	Q	25 05 143	12kV Vice Top Insulator	3	3
	R	23 62 128	Adapter Pin for Vice Top Insulator	3	3
@	U	23 52 065	Mach Bolt 12" x 5/8"	3	3
	T	02	Pole	1	1

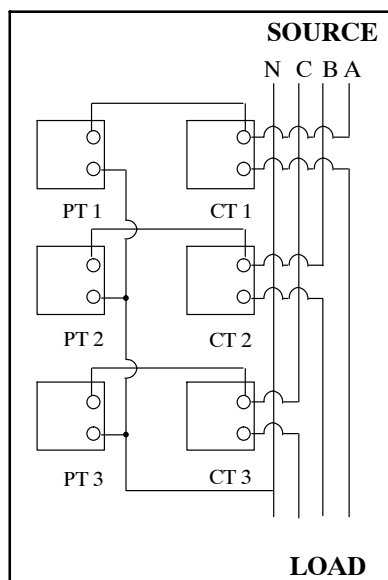
METER INSTALLATIONS
Primary Metering, 3 Phase 4 Wire
4 thru 15 kV

25 12 11 **

Sheet 3 of 3

ILLINOIS ONLY – Limited Use

		Std. / Stk. No.	Description (Provided and Installed by Ameren IL) 25 12 11 **	01	02
@ @ @ @ @ @ @ @	AA	23 17 294	Mounting, Primary Metering	1	1
	BB	18 51 021	Wire, #6 Cu, Covered, S.D. (Ft.)	10	10
	CC	23 78 394	Clamp, Hot Line	3	3
	DD	MTR SHOP	Wire Pack of 10 #12, Color Coded (Ft.)	25	25
	FF	MTR SHOP	Current Transformer, 4 kV or 12 kV	3	3
	GG	MTR SHOP	Potential Transformer, 4 kV or 12 kV	3	3
	HH	PG*	Clamp, Parallel Groove (See DCS 07 00 25 00)	6	6
	JJ	PG*	Clamp, Parallel Groove (Neutral) (See DCS 07 00 25 00)	2	2
	KK	DEC*W	Clamp, D.E. – DCS 07 00 20 00	6	6
	LL	08 01 10 00	Deadend, Preformed Sec. Spool	1	1
	MM	17 54 303	Connector, Cable to Flat, #6 – 2/0	6	6
	NN	17 05 215	Lug, Compression, #2 Cu.	6	6
	OO	06 12 01 01	Secondary Clevis		
	PP	ST**	Performed Tie, Side Ties DCS 07 00 41 00	1	1
	SS	23 17 411	Cover, Cutout, 100A	3	
		23 17 412	Cover, Cutout, 200A		3
@	TT	69 58 181	Guard, Clam-Shell, Wildlife	3	3
		286	Install Primary Metering	1	1



4 WIRE

**25 12 11 01 100A
25 12 11 02 200A**

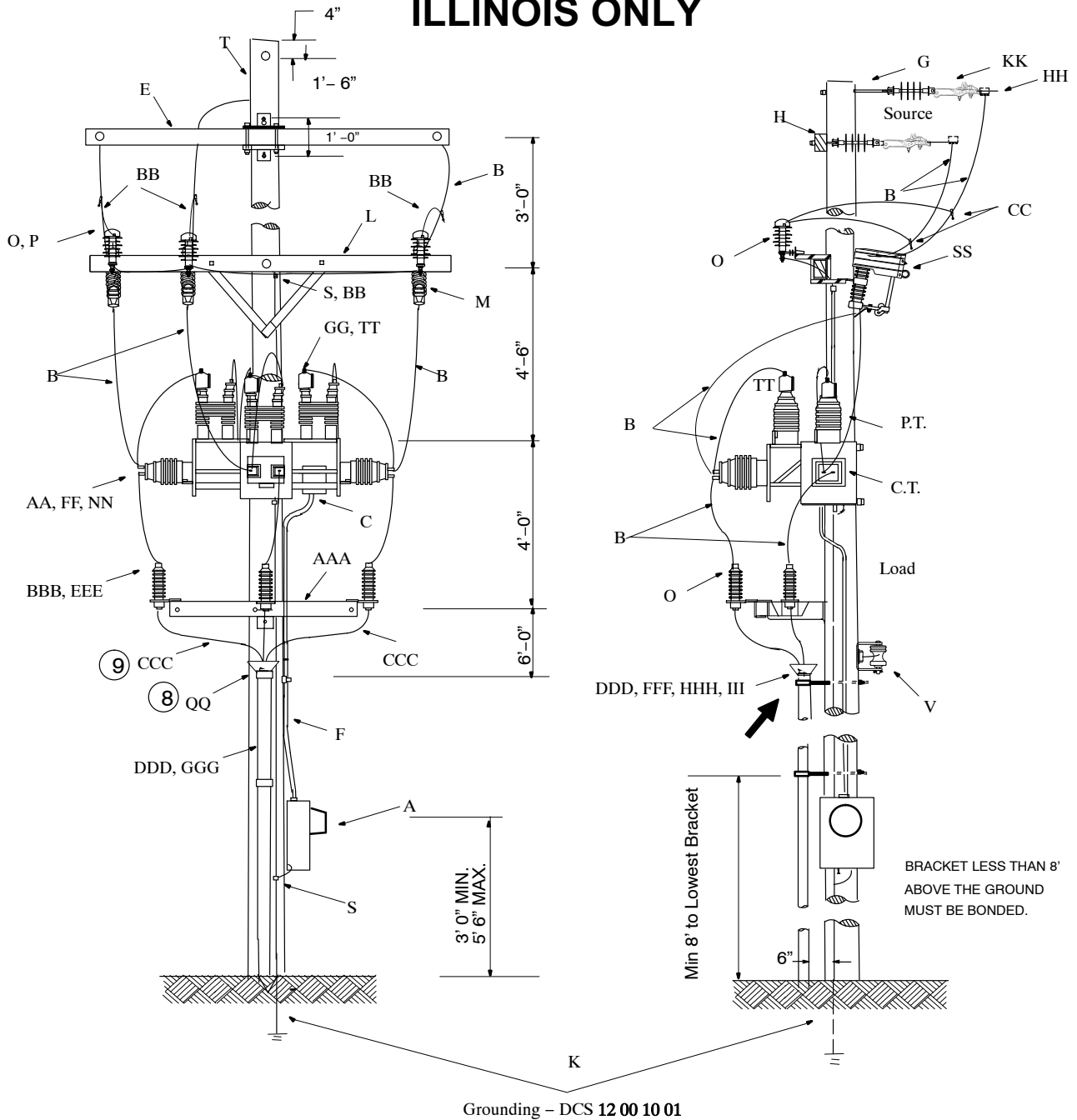
METER INSTALLATIONS

Primary Metering For Customer UG 3 Phase 4 Wire 4 thru 15 kV

25 12 12 **

Sheet 1 of 4

ILLINOIS ONLY



METER INSTALLATIONS
Primary Metering For Customer UG 3 Phase 4 Wire
4 thru 15 kV

25 12 12 **

Sheet 2 of 4

ILLINOIS ONLY

1. Grounding all instrument transformers, arresters, and mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole as per DCS **29 00 18 01**; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non-climbing side of the pole as per DCS **29 00 17 12**.
4. If disconnect switches are required, the switch may be installed on adjacent poles.
5. For wire color coding on PT and CT secondaries, refer to system metering drawings.
6. If metering structure is located within a substation, the metering and arresters ground wires must be connected to the substation ground mat.
7. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and arresters may be installed on adjacent poles.
8. If water entering the duct becomes a problem, the top of duct can be sealed with polyurethane expanding form, stock #31 53 082. Expanding form requires a dispensing gun, stock # 85 20 073.
9. Material is provided by customer.

		Std. / Stk. No.	Description(Provided and Installed by Ameren IL) 25 12 12 **	01	02
@	A	40 54 353	Meter Socket, 600V, Pre-wired 13-Terminal Instru- ment Rated	1	1
	B	18 51 019	Wire, #2 Cu, Covered, S.D.	50	50
	C	40 01 120	Box, Secondary Connection	1	1
	D	21 66 039	Screw, Cap, 3/8" x 2"	2	2
	F	40 02 054	Conduit, Flex, 1"	20	20
	I	23 64 033	Staple	3	3
	J	40 53 612	Fitting	2	2
	K	12 00 10 01	Ground Unit, 7#10 CW, Ground Coil	1	1
	E	04 00 41 04	10' FG Dead Arm	1	1
	G	06 12 30 01	Deadend on Pole with FG Extension	1	1
	H	06 12 35 01	Deadend without FG Extension on FG Arm	2	2
	L	04 00 20 03	Single Wood Arm 10' with Braces	1	1
	M	54 07 208	Switch, 15kV, 100 Amp	3	
		54 07 209	Switch, 15kV, 200 Amp		3
	O	10 01 133	Arrester, Lightning 3kV/2.55kV MCOV	3	3
		10 01 129	Arrester, Lightning 9kV/7.65kV MCOV	3	3
	P	23 56 088	Bracket, DBL Sided NEMA Crossarm Mounting, Ar- rester and Fuse Cutout	3	3
@	S	17 54 373	Split Bolt	4	4
@	T	02	Pole	1	1
@	V	03 01 01 03	Neutral Deadend	1	1

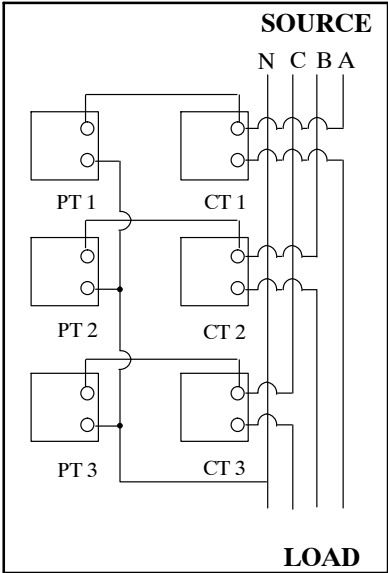
METER INSTALLATIONS
 Primary Metering For Customer UG 3 Phase 4 Wire
 4 thru 15 kV

25 12 12 **
 Sheet 3 of 4

ILLINOIS ONLY

		Std. / Stk. No.	Description (Provided and Installed by Ameren IL) 25 12 12 **	01	02
@	AA	23 17 294	Mounting, Primary Metering	1	1
	BB	18 51 021	Wire, #6 Cu, Covered, S.D. (Ft.)	10	10
	CC	23 78 394	Clamp, Hot Line	3	3
	DD	MTR SHOP	Wire Pack of 10 #12, Color Coded (Ft.)	25	25
	EE	17 54 005	Connector, Split Bolt, #2 Cu	2	2
	FF	MTR SHOP	Current Transformer, 4 kV or 12 kV	3	3
	GG	MTR SHOP	Potential Transformer, 4 kV or 12 kV	3	3
	HH	PG*	Clamp, Parallel Groove (See DCS 07 00 25 00)	6	6
	JJ	PG*	Clamp, Parallel Groove (Neutral) (See DCS 07 00 25 00)	2	2
	KK	DEC*W	Clamp, D.E. – DCS 07 00 20 00	3	3
	MM	17 54 303	Connector, Cable to Flat, #6 – 2/0	6	6
	NN	17 05 215	Lug, Compression, #2 Cu.	6	6
	OO	06 12 01 01	Secondary Clevis	1	1
	PP	ST**	Performed Tie, Side Ties DCS 07 00 41 00	1	1
	QQ	12 51 254	Coupling, Bell End, 4"	1	1
	SS	23 17 411	Cover, Cutout, 100A	3	
		23 17 412	Cover, Cutout, 200A		3
	TT	69 58 181	Guard, Clam-Shell, Wildlife	6	6
9 @	AAA	17 08 057	Bracket, 36", Mounting Terminators & Lightning Arresters	3	3
	BBB	23 67 193	Bracket, Cable	3	3
	CCC		UG Cable, Provided by Customer per NEC	35	
			UG Cable, Provided by Customer per NEC		35
9 @	DDD	23 06 087	Bracket, Conduit Standoff, 12"	3	3
	EEE		Terminator, Provided and installed by Customer	3	
			Terminator. Provided and installed by Customer		3
9 @	FFF	23 65 053	Nut 5/8" Jam	3	3
	GGG		Conduit, 4" Sch 80 (ft)	20	20
9 @	HHH		Strap Conduit 4"	3	3
	III	23 53 003	Bolt, Double, Arming 5/8" x 18"	3	3
		286	Install Primary Metering	1	1

METER INSTALLATIONS
Primary Metering For Customer UG 3 Phase 4 Wire
4 thru 15 kV

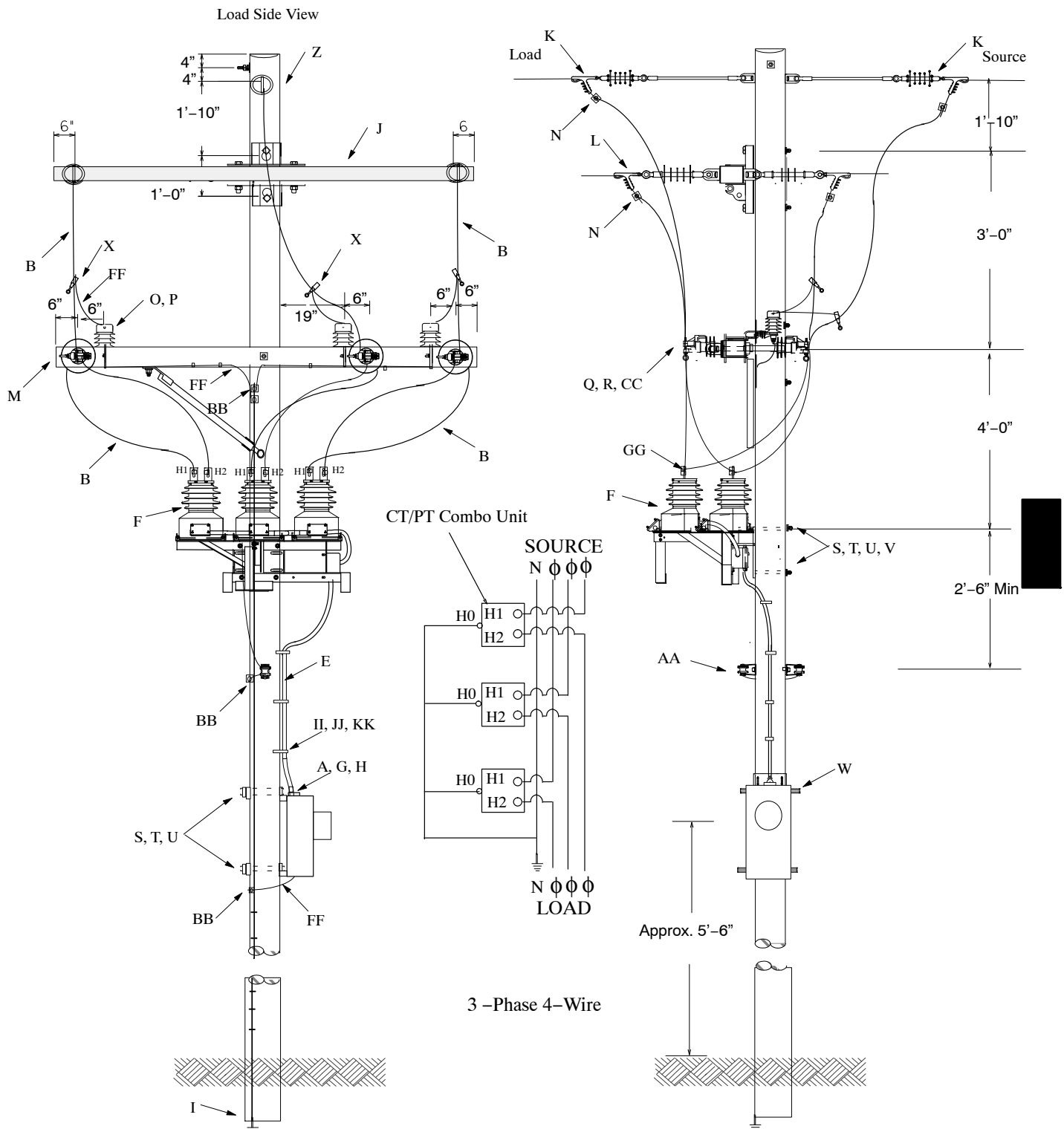


4 WIRE

25 12 11 01	100A
25 12 11 02	200A

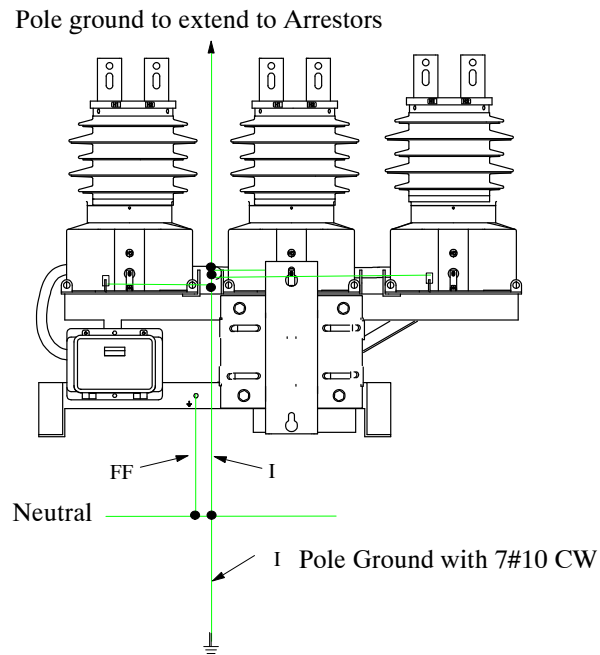
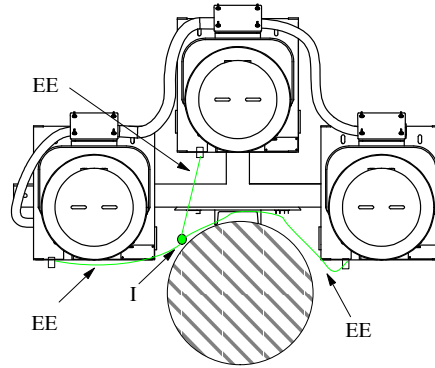
PRIMARY METER INSTALLATIONS
3-Phase 4-Wire Preferred
CT/PT Combo Unit (Illinois Only)

25 12 20 01
4 – 15KV
Sheet 1 of 4



PRIMARY METER INSTALLATIONS
3-Phase 4-Wire Preferred
CT/PT Combo Unit (Illinois Only)

25 12 20 01
4 – 15KV
Sheet 2 of 4



PRIMARY METER INSTALLATIONS
3-Phase 4-Wire Preferred
CT/PT Combo Unit (Illinois Only)

25 12 20 01
4 – 15KV
Sheet 3 of 4

		Stk/DCS#	Description (The list material is installed by Ameren Illinois)	25 12 20 01 Qty
9	A	40 54 353	Meter Socket, 600V, Pre-wired 13-Terminal Instrument Rated	1
	B	18 51 019	Wire, #2 Cu, Covered, S.D. (ft)	50
	C	40 01 120	Box, Secondary Connection	1
	D	21 66 039	Screw, Cap, 3/8" x 2"	2
	E	40 52 468	Conduit Liquid-tight, Flex, 1-1/2", Non-Metallic	20
	F	CT/PT Combo	Meter Shop provide instrument pre-mounted on rack	1
	G	40 52 467	Hub, 1-1/2"	1
	H	40 52 072	Conduit Fitting, Liquid-tight, Flex, 1-1/2"	2
	I	12 00 10 01	Ground Unit	1
6 @	J	04 00 41 04	10' FG Dead Arm	1
	K	06 12 30 03	Dbl Deadend on Pole with FG Extension	1
	L	06 12 30 14	Dbl Deadend on FG Arm without FG Extension	2
	M	04 00 20 03	Single Wood Arm 10' with Braces	1
	N	PG*	Clamp, Parallel Groove – DCS 07 00 25 00	4
	O	10 01 133	Arrestor, Lightning 3kV/2.55kV MCOV	3
		10 01 144	Arrestor, Lightning 10kV/8.4kV MCOV	3
		10 01 008	Arrestor, Lightning 12kV/10.2kV MCOV	3
	P	17 58 054	Bracket, NEMA Crossarm Mounting, Arrestors	3
@	Q	25 05 143	12kV Vice Top Insulator	6
	R	23 62 128	Adapter Pin for Vice Top Insulator	6
	S	23 52 068	Bolt, Mach 16" x 5/8"	4
	T	23 66 027	Washer, SQ 5/8"	4
	U	23 65 043	Lock Nut, 5/8"	4
	V	23 66 134	DBL Coil, 5/8"	2
	W	62 51 563	Bracket, Meter Socket Hanging	2
	X	23 78 394	Clamp, Hotline, #2 Cu Bare	3
	Z	02	Pole	1
@	AA	06 01 01 01	Secondary Clevis	1
	BB	17 54 373	Split Bolt, #14 to #2	5
	CC	23 53 009	Bolt, DA, 5/8" x 14"	3
	DD	23 66 027	Washer, SQ, 5/8"	6
	EE	18 51 025	Wire, Cu, #4, S.D., Covered (ft)	15
	FF	18 51 021	Wire, Cu, #6, S.D., Covered (ft)	30
	GG	17 51 114	Single Eyebolt, Bronze, #8 sol – 2/0 Str	6
	HH	23 64 033	Staple	12
	II	23 67 490	Strap, Conduit, 2 Hole, 1-1/2" Galv.	4
@	JJ	23 60 032	Screw, Lag, 1/4" x 1-1/2"	8
	KK	21 75 104	Washer, Round, 1/4", Stainless Steel	8

PRIMARY METER INSTALLATIONS
3-Phase 4-Wire Preferred
CT/PT Combo Unit (Illinois Only)

25 12 20 01
4 – 15KV
Sheet 4 of 4

CONSTRUCTIONS NOTE(s):

1. Ground each CT/PT combo instrument, arrestors, and mounting assembly to the pole ground.
2. If meter structure is located within a substation, the pole ground riser must be connected to the substation ground grid.
3. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole as per DCS 29 00 18 01; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non-climbing side of the pole as per DCS 29 00 17 12.

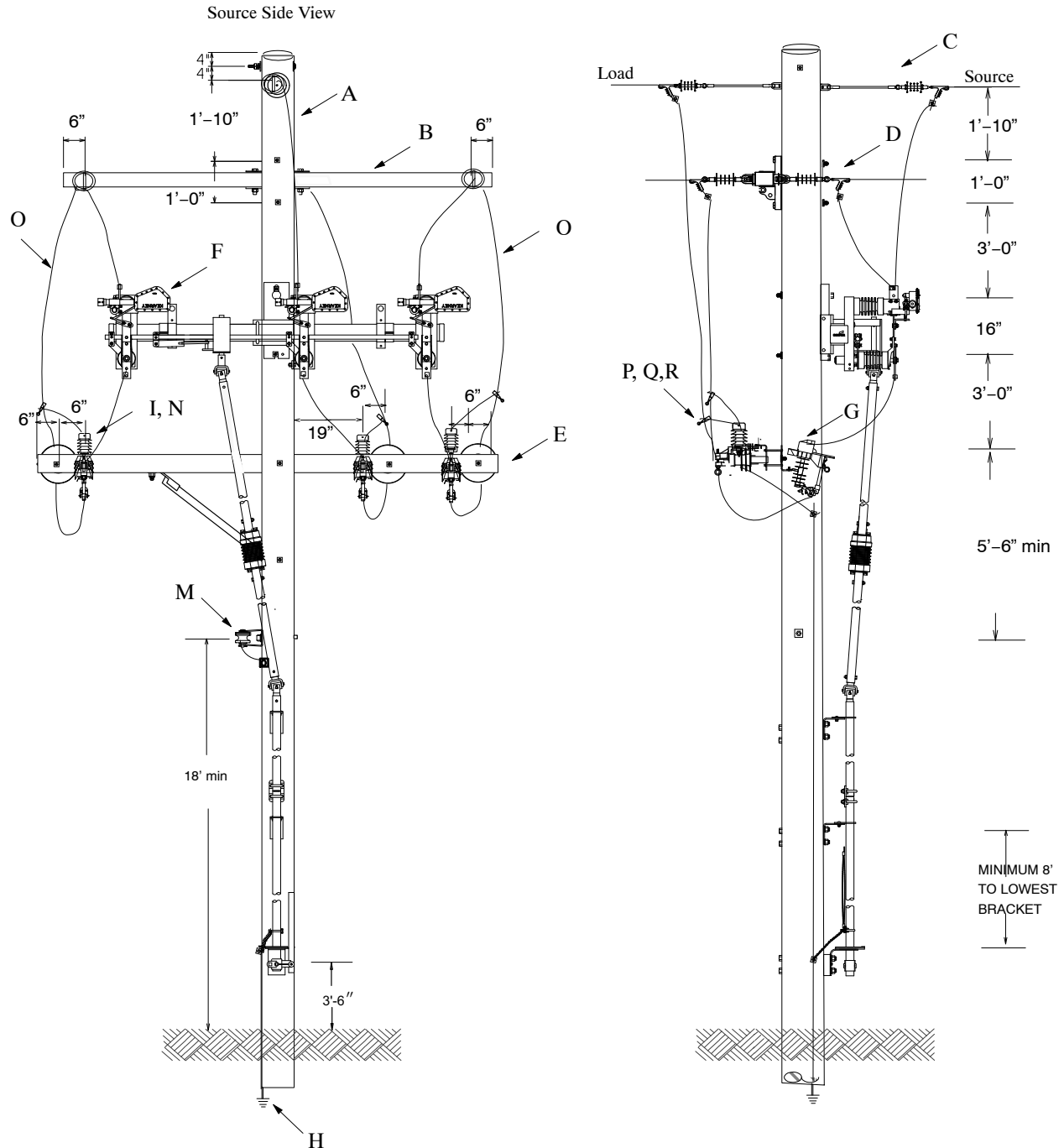
DESIGN NOTE(s):

4. Ameren overcurrent protection is required on source side, preferable on adjacent upstream pole.
5. Customer must install a group operated switch and overcurrent protection immediately after the primary meter structure. (Refer to DCS 25 12 30 00 and DCS 25 12 30 01 for typical customer owned primary group operated switch and overcurrent protection).
6. Lightning arrestor selection:
4kV grounded system – stock #10 01 133,
12.47 grounded and 13.2kV grounded system – 10 01 144,
13.8kV grounded system – stock #10 01 008.
(Refer to DCS 12 00 01 01 for other system ratings).
7. Install barriers for protection of the pole from vehicular traffic where necessary.
8. For wire color coding on PT and CT secondaries, **contact System Metering**.
9. If the meter pole is located within a substation or immediate outside fence, the 7 #10 ground riser needs to be upgraded to #2 copper for high fault currents and tie to substation grid. (Refer to DCS 12 00 10 04).

METER INSTALLATIONS

TYPICAL PRIMARY RATED CUSTOMER OWNED STRUCTURE
W/MAIN DISCONNECT/OVERHEAD PROTECTION

Up to 200 Amp Fuses



METER INSTALLATIONS

TYPICAL PRIMARY RATED CUSTOMER OWNED STRUCTURE
W/MAIN DISCONNECT/OVERHEAD PROTECTION

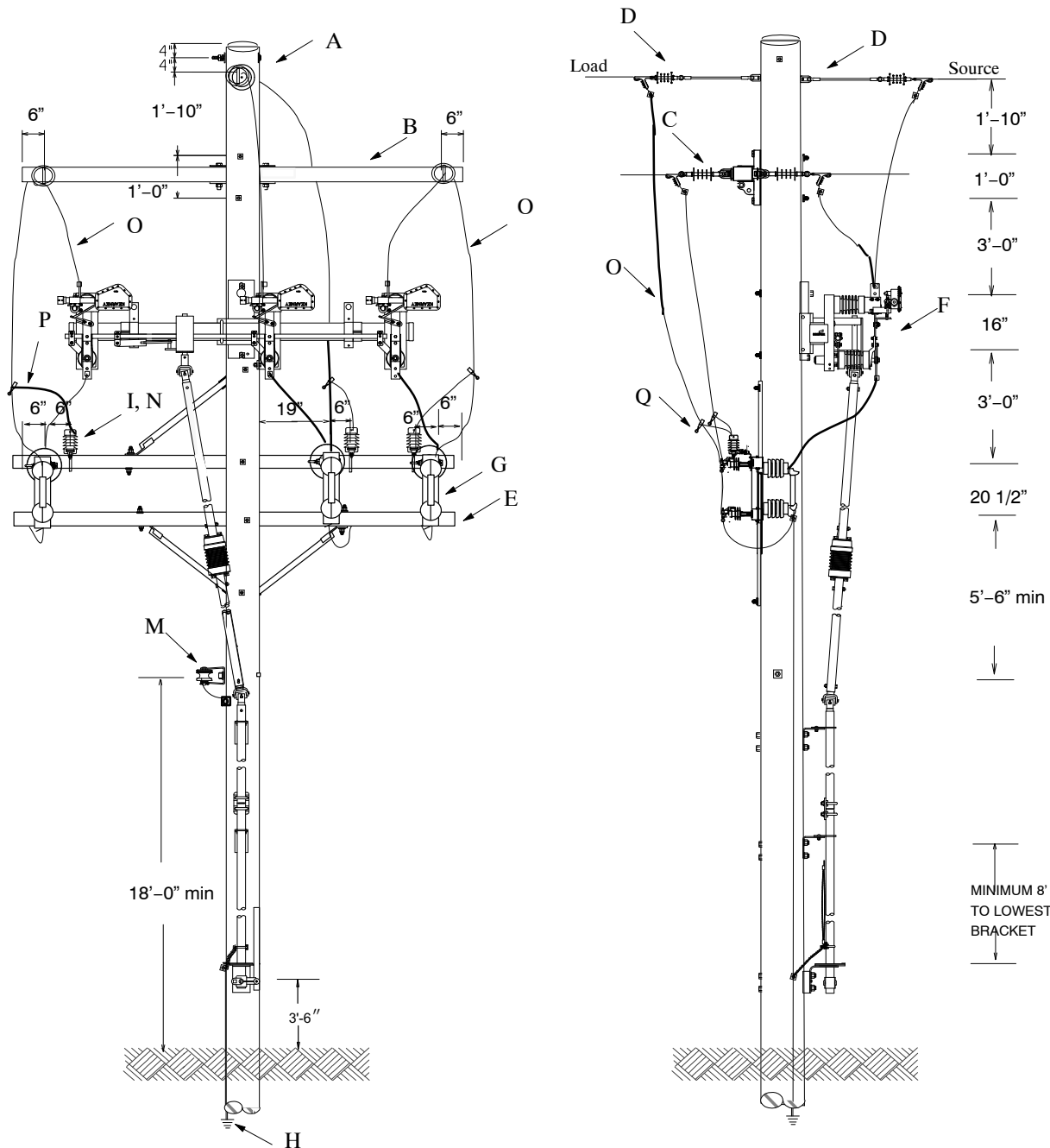
25 12 30 00

4 & 15KV

Sheet 2 of 3

201 to 400 Amp Fuses

Source Side View



METER INSTALLATIONS
TYPICAL PRIMARY RATED CUSTOMER OWNED STRUCTURE
W/MAIN DISCONNECT/OVERHEAD PROTECTION

25 12 30 00
4 & 15KV
Sheet 3 of 3

Notes:

1. A 15kV group operated switch rated 600 amp and associated overcurrent protection are required immediately after the Ameren meter pole.
2. Customer may choose to install lightning arrestors and overcurrent protection on structure immediately following the group operated switch structure.
3. For location fused at 200 amp or less, open type cutout, polymer insulator with load break hook is required.
4. SM5 fuse device is used on 4kV system requiring for 201 to 400 amp overcurrent protection.
5. If lightning arrestors are installed on the group operated switch structure, a ground mat is required.
6. If the pole ground riser is attached to the system neutral, a ground mat is required.
7. If group operated switch structure does not have overcurrent or lightning protection on structure, and there is vertical pipe insulation, a driven rod needs to be installed and bonded to the switch handle without pole ground riser extended to neutral (ground mat is not required).
8. Customer's group operated switch may be operated with hook stick, no handle is located at the ground line. In this case, no ground mat is required.
9. Lightning arrestor selection:
4kV grounded system – 3kV/2.55kV MCOV,
12.47 grounded and 13.2kV grounded system – 10kV/8.4kV MCOV
13.8kV grounded system – 12kV/10.2kV MCOV
10. 45 ft pole height with proposed framing ensures minimum NEC/NESC clearances are maintained.

		Description	25 12 30 00	Qty
3@ 4@ 3@ 4@ 7 9@	A	Pole (45 ft and Class 3 min)		1
	B	10' FG Deadend Arm		1
	C	Dbl Deadend on Pole with FG Extension		2
	D	Dbl Deadend on FG Arm without FG Extension		4
	E	Wood Arm 10' with Braces – 0 to 200 Amp Fuse		1
		Wood Arm 10" with Braces – SM 5 Fuse Holder		2
	F	15kV Group Operated Switch, Load Break, 600 Amp, Lockable is required if using handle		1
	G	Cutout 0– 200 Amp		3
		SM5 Fuse and Fuse Mounting		3
	H	Ground Unit as required		1
	I	Arrestor, Lightning 3kV/2.55kV MCOV		3
		Arrestor, Lightning 10kV/8.4kV MCOV		3
		Arrestor, Lightning 12kV/10.2kV MCOV		3
	J	Secondary Clevis		1
	K	12kV Vice Top Insulator		6
	L	Adapter Pin for Vice Top Insulator		6
	M	Secondary Clevis		1
	N	Bracket, NEMA Crossarm Mounting, Arrestors		3
	O	Wire, Cu, #2 S. D. Covered (ft)		50
	P	Wire, Cu, #6 S. D. Covered (ft)		30
	Q	Hotline Clamp		3
	R	Avian Cover, Cutout		3

DISTRIBUTION
CONSTRUCTION STANDARDS



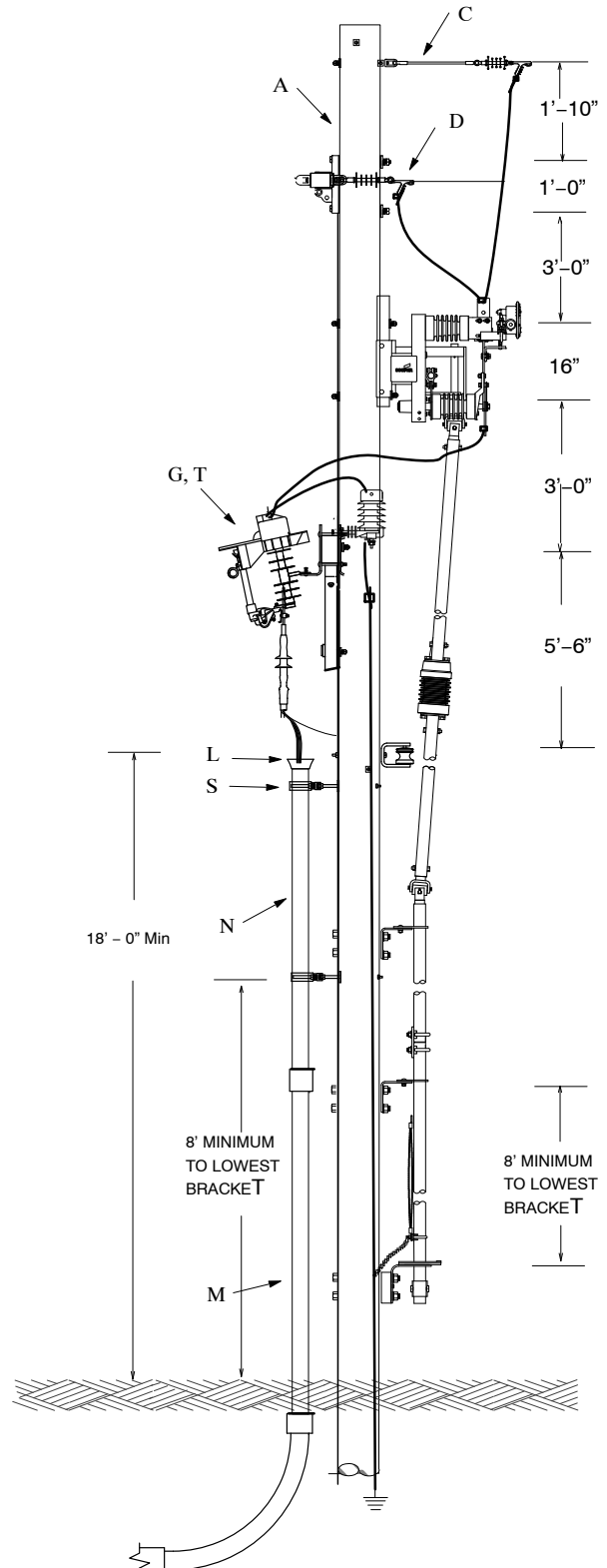
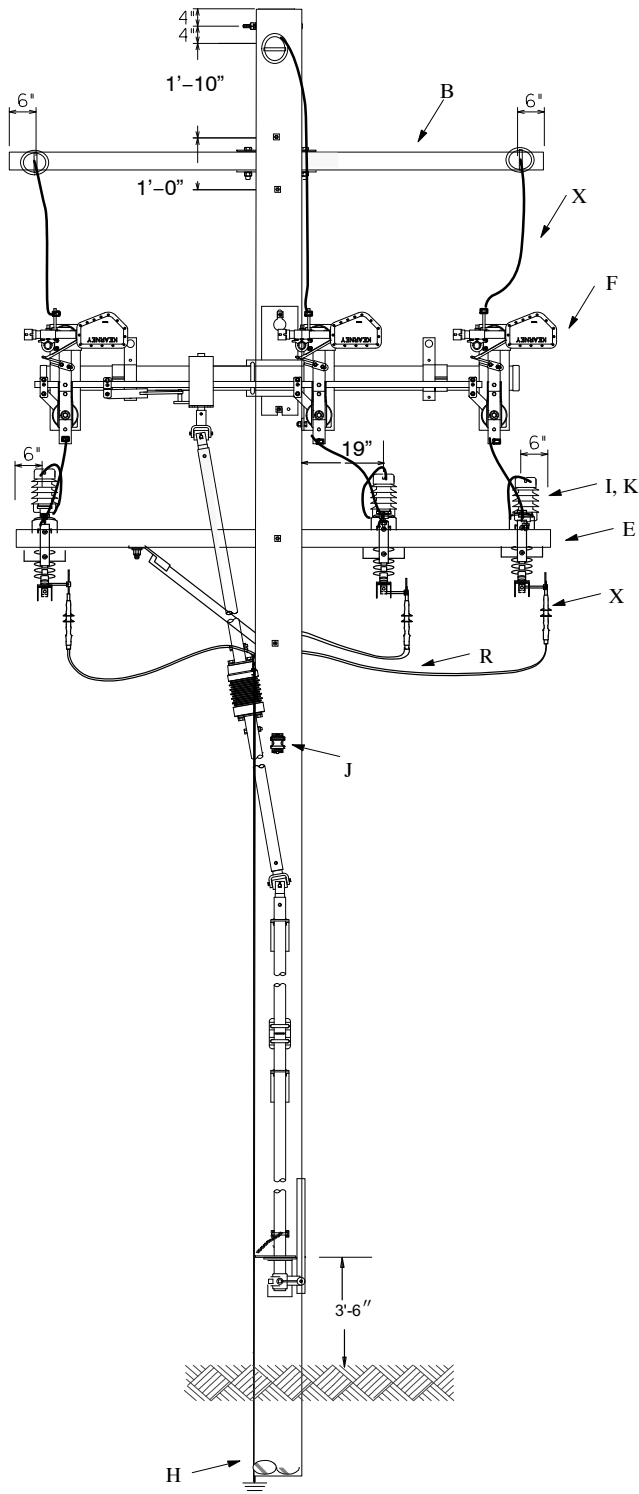
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METER INSTALLATIONS

25 12 30 01
4 OR 12KV

TYPICAL PRIMARY RATED CUSTOMER OWNED STRUCTURE Sheet 1 of 4
W/MAIN DISCONNECT/UNDERGROUND PROTECTION

Up to 200 Amp Fuses



DISTRIBUTION
CONSTRUCTION STANDARDS



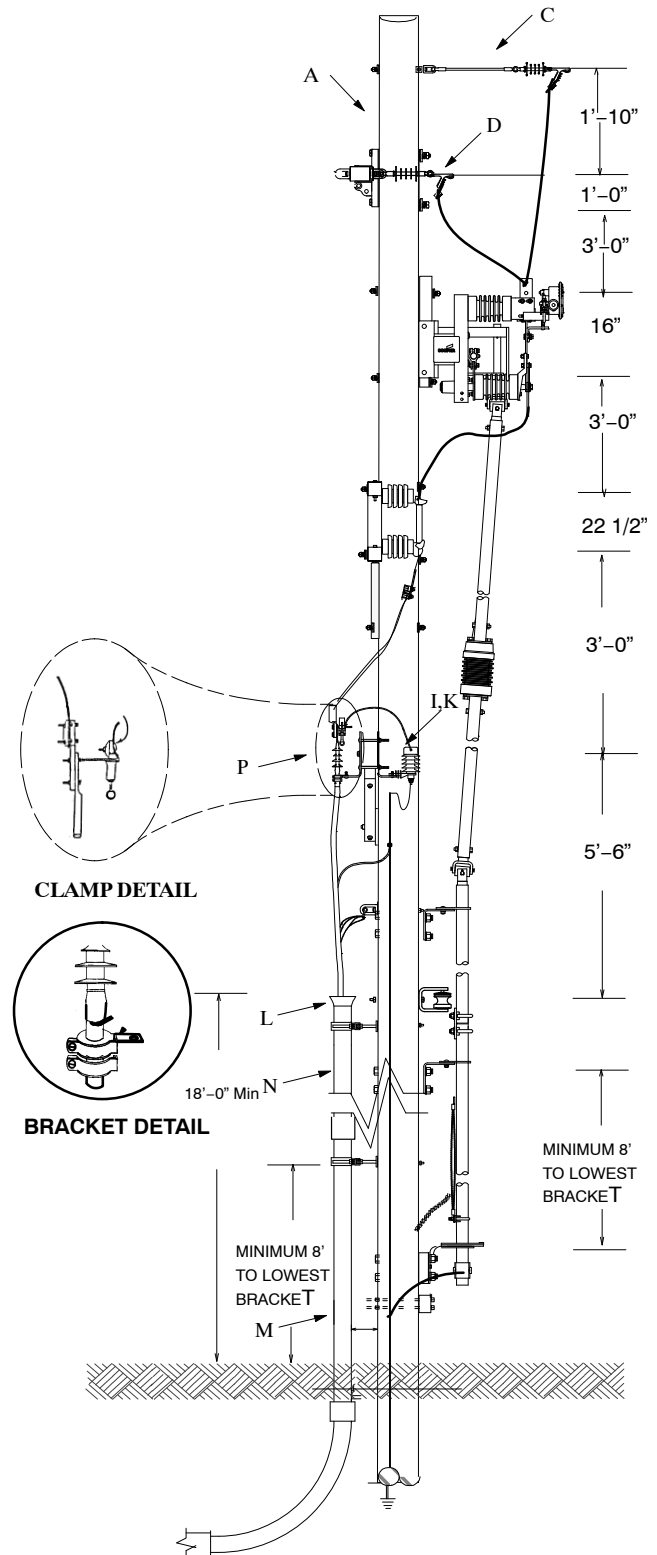
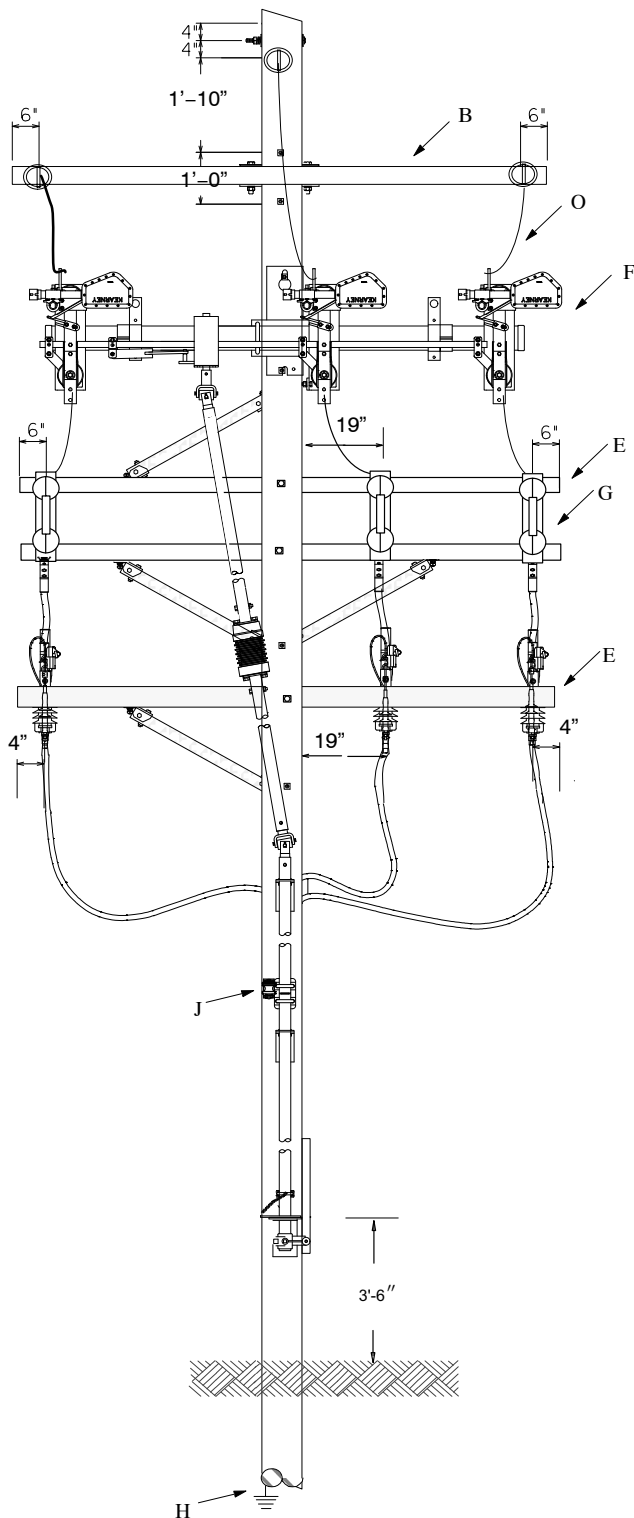
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METER INSTALLATIONS

25 12 30 01
4 OR 12KV

TYPICAL PRIMARY RATED CUSTOMER OWNED STRUCTURE Sheet 2 of 4
W/MAIN DISCONNECT/UNDERGROUND PROTECTION

201 to 400 Amp Fuses



Notes:

1. A 15kV group operated switch rated 600 amp and associated overcurrent protection are required immediately after the Ameren meter pole.
2. Customer may choose to install lightning arrestors and overcurrent protection, and UG riser on structure immediately following the group operated switch structure.
3. For location fused at 200 amp or less, open type cutout, polymer insulator with load break hook is required.
4. SM5 fuse device is used on 4kV system requiring for 201 to 400 amp overcurrent protection.
5. If lightning arrestors are installed on the group operated switch structure, a ground mat is required.
6. If the pole ground riser is attached to the system neutral, a ground mat is required.
7. If group operated switch structure does not have overcurrent or lightning protection on structure, and there is vertical pipe insulation, a driven rod needs to be installed and bonded to the switch handle without pole ground riser extended to neutral (ground mat is not required).
8. Customer's group operated switch may be operated with hook stick, no handle is located at the ground line. In this case, no ground mat is required.
9. Lightning arrestor selection:
4kV grounded system – 3kV/2.55kV MCOV,
12.47 grounded and 13.2kV grounded system – 10kV/8.4kV MCOV
13.8kV grounded system – 12kV/10.2kV MCOV
10. 45 ft pole height (0 – 200 Amp fuses) and 50 ft pole height (201 – 400 Amp fuses) with proposed framing ensures minimum NEC/NESC clearances are maintained at termination pole.
11. Another option is for customer to install underground termination pole immediately after Ameren meter pole. Customer provided group operated switch and overcurrent protection could be located in customer's padmount switchgear provided distance between termination pole and switchgear is less than 50ft.

METER INSTALLATIONS

25 12 30 01
4 OR 12KV

TYPICAL PRIMARY RATED CUSTOMER OWNED STRUCTURE Sheet 4 of 4
W/MAIN DISCONNECT/UNDERGROUND PROTECTION

		Description	25 12 30 01	Qty
@	A	Pole (45 ft and Class 3 min) (0 – 200 Amp Fuses)		1
		Pole (50 ft and Class 3 min) (201 – 400 Amp Fuses)		1
	B	10' FG Deadend Arm		1
	C	Dbl Deadend on Pole with FG Extension		2
@	D	Dbl Deadend on FG Arm without FG Extension		4
	E	Wood Arm 10' with Braces – 0 to 200 Amp Fuse		1
		Wood Arm 10" with Braces – SM 5 Fuse Holder		2
	F	15kV Group Operated Switch, Load Break, 600 Amp, Lockable is required if using handle		1
7	G	Cutout & Fuses		3
	H	Ground Unit as required		1
	I	Arrestor, Lightning 3kV/2.55kV MCOV		3
		Arrestor, Lightning 10kV/8.4kV MCOV		
Arrestor, Lightning 12kV/10.2kV MCOV				
9	J	Secondary Clevis		1
	K	Bracket, NEMA Crossarm Mounting, Arrestors/Cutouts Insulator		6
	L	Coupling, Bell End, 4"		1
	M	Conduit, 4", Schedule 80 (Lower 10ft)		10
	N	Conduit, 4", Schedule 40 (Upper Conduit)		25
	O	Wire, Cu, #2 S. D. Covered (ft)		50
	P	Termination, 15kV Cable		3
	Q	Wire, Cu, #6 S. D. Covered (ft)		30
	R	Cable, 15kV, Size per load		As Req
	S	Bracket, Standoff 12"		3
	T	Avian Cover, Cutout		3

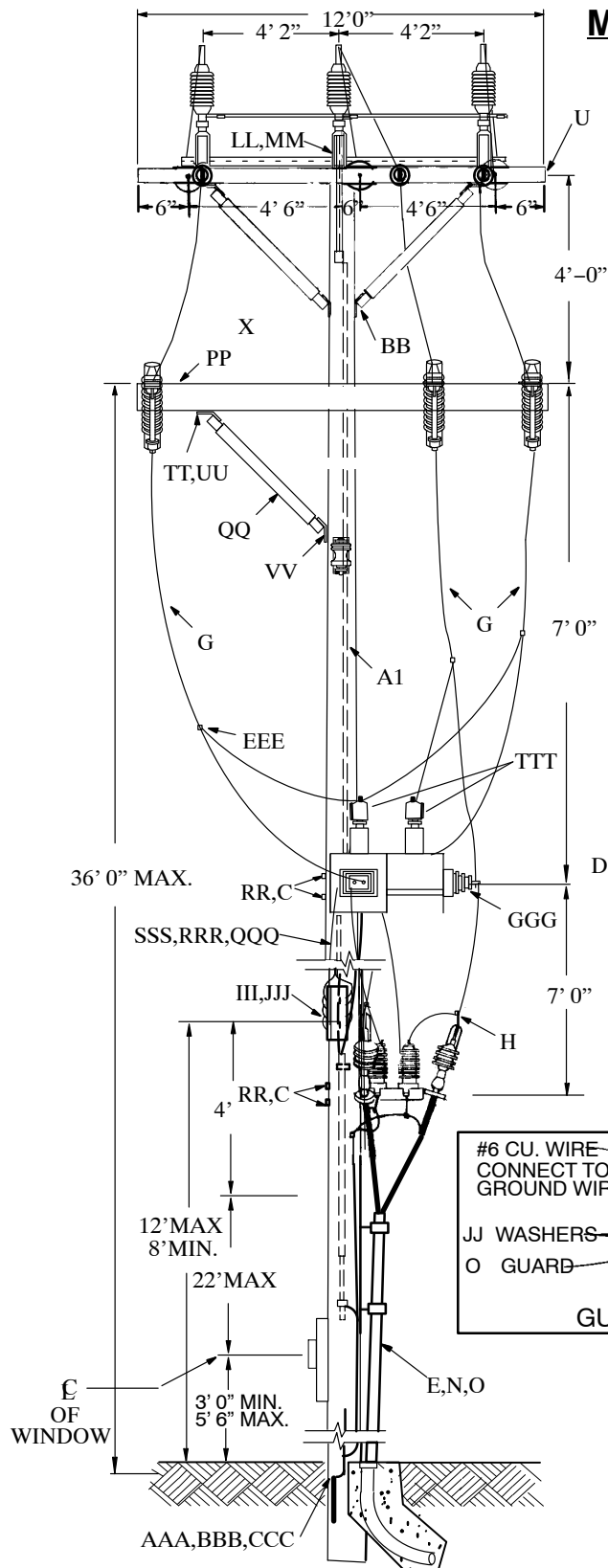
METER INSTALLATIONS

Primary Metering for Customer U.G. 3 Phase 4 Wire

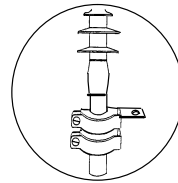
25kV

25 25 01 01

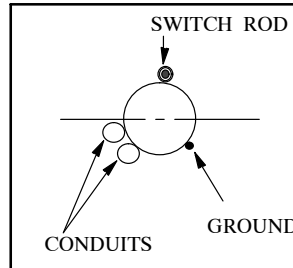
Sheet 1 of 4



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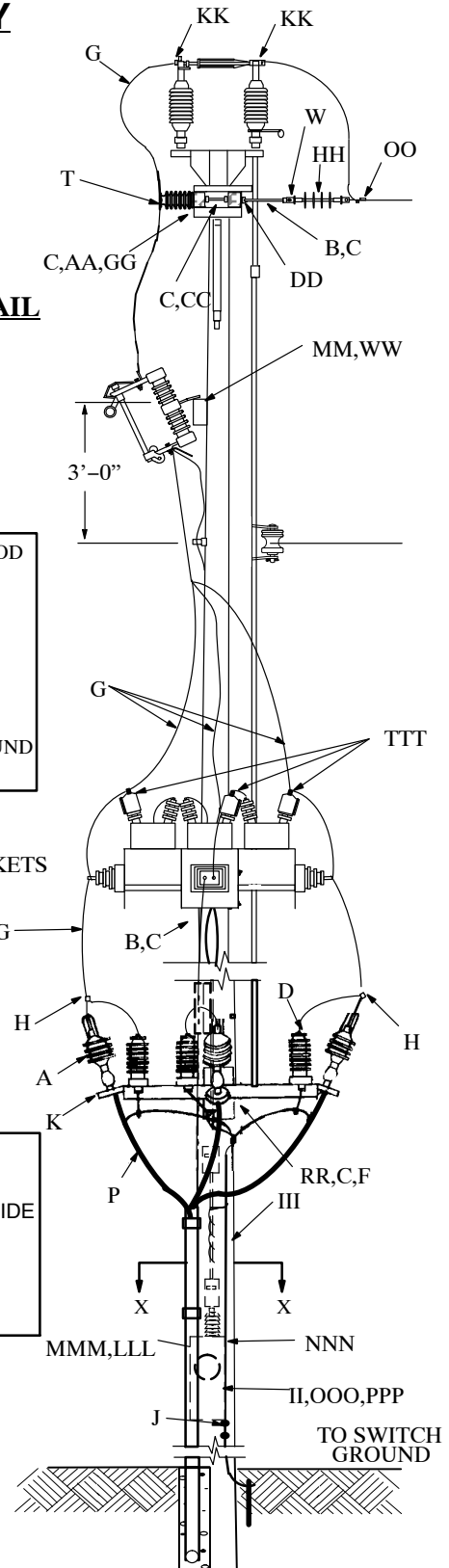
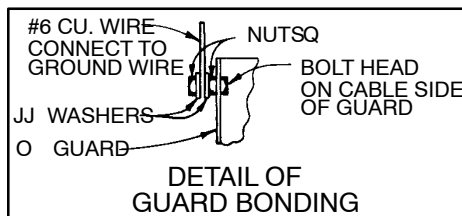


BRACKET DETAIL



SECTION XX

DO NOT GROUND BRACKETS



METER INSTALLATIONS

Primary Metering for Customer U.G. 3 Phase 4 Wire 25kV

25 25 01 01

Sheet 2 of 4

NOTES:

1. When meter pole is on customer property, a group operate switch shall be provided one span before.
2. Secondary wire lead on meter cluster is 15ft. standard length. For tall poles, special order meter cluster with longer lead to meet max. height requirement for connection box.
3. Terminator mounting bracket is Aluma Form (T3CA-60-CHL).

NORMALLY PROVIDED BY CUSTOMER				
	Stnd. / Stk. No.	Materials Description	25 25 01 01	
A	42 44 12 05	Termination, 35kV, 1/0-750 kcmil		3
B	23 52 070	Bolt, Machine 5/8" x 20"		3
C	23 66 027	Washer, Square, 5/8" x 2 1/4"		23
D	10 01 137	Arrester, Lightning, 27 kV		3
E	23 60 005	Screw, Lag 3/8" x 3"		6
F	17 08 058	Bracket, Terminator		1
G	18 51 019	Wire, Cu. #2., Covered S.D. (ft)		50'
H	23 78 183	Clamp, Hot Line, #6-400		3
I	21 53 007	Bolt, Machine, 3/8" x 1 1/2"		1
J	12 00 10 01	Grounding Unit		1
K	23 67 197	Bracket, Cable Support		3
L	49 17 181	Strap, Poly., 2" x 36"		1
M	27 60 035	Iron Hanger		8'
N	12 51 220	Conduit, Plastic, 5" Split		30'
O	23 18 202	Guard, Conduit 5"		1
P	18 07 291	Cable, 35 kV, 3-1/0 AL		35'
Q	21 61 006	Nut, Hex, 3/8"		2
R	277	Install Cable Up Pole		1
S	54 08 317	Switch, 35 kV, 3-1/0 AL		1
T	25 05 064	Insulator, Line Post		3
U	41 01 023	Crossarm, 4" x 6" x 12' - 0"		2
W	23 59 005	Eyelet' 5/8"		2
X	41 01 023	Brace, Wood Heel, 5" - 0"		2
Y	23 52 049	Bolt, Machine, 5/8" x 2"		2
Z	23 66 006	Washer, Lock, 5/8"		2
AA	23 52 061	Bolt, Machine, 5/8" x 8"		4
BB	23 52 063	Bolt, Machine, 5/8" x 10"		1
CC	23 53 004	Bolt, Spacer, 5/8" x 20"		2
DD	23 65 012	Eyenuit, 5/8"		3
FF	23 65 018	Eyenuit, 3/4"		3
GG	23 77 210	Plate, Heel Brace, 13 3/8" to 19"		2
HH	25 06 053	Insulator, Susp., 34 kV		3

METER INSTALLATIONS
 Primary Metering for Customer U.G. 3 Phase 4 Wire
 25kV

25 25 01 01

Sheet 3 of 4

		Std./Stk. No.	Materials Description 25 25 01 01	
	JJ	23 66 016	Washer, 3/8" Galv.	2
	KK	17 55 297	Lug, Comp., 1/0 Cu.	12
	LL	23 52 041	Bolt, Machine, 1/2" x 8"	12
	MM	23 66 017	Washer, Round, 1/2"	14
	NN	54 08 328	Kit	1
	OO	DEC*W	Deadend	3
	PP	41 01 014	Crossarm, 3 1/2" x 4 1/2" x 8' 0"	2
	QQ	41 56 016	Brace, 60" V	1
	RR	23 52 066	Bolt, Machine, 5/8" x 14"	6
	TT	23 52 038	Bolt, Machine, 1/2" x 6"	2
	UU	23 66 017	Washer, Round, 1/2"	1
	VV	23 52 065	Bolt, Machine, 5/8" x 12"	1
	WW	23 52 036	Bolt, Machine, 1/2" x 5"	12
	XX	54 03 048	Mounting, Fuse, 30A, SM-5	3
	YY		SM-5 Refill (Sized by Engr.)	3
	ZZ	12 51 206	Bend, 5", 36" Rad.	1
	A1	18 52 019	Wire, #6 Cu., Bare S.D. (ft.)	40

NORMALLY PROVIDED BY AMEREN

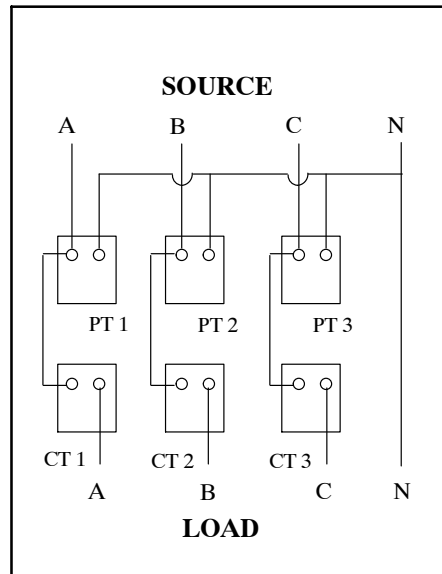
		Std./Stk. No.	Materials Description 25 25 01 01	
	AAA	23 67 036	Step, Pole 5/8" x 10"	2
	BBB	11 04 110	Tube, Concrete 14" Dia.	4
@	CCC	98 00 001	Concrete, 4SK	-
	EEE	17 54 390	Connector, Split Bolt #4 - 4/0 Str.	3
	FFF	23 78 394	Clamp, Hot Line	6
	GGG	17 54 303	Connector, Cable to Flat, #6 - 2/0	6
	HHH	23 17 402	Mounting, 25 kV Pri Metering Cluster	1
	III	40 01 120	Box, Secondary Connection	1
	JJJ	21 66 039	Screw, Cap, 3/8" x 2"	2
	KKK	23 64 033	Staple	3
	LLL	MTR SHOP	Wire Pack of 10 #12, Color Coded (ft.)	25
	MMM	40 02 054	Conduit, Flex, 1"	20
	NNN	40 53 612	Fitting	2
	OOO	40 04 245	Socket, Meter, 600V, 3 Phase, 4 Wire	1
	PPP	21 71 037	Screw, Wood, #14, 3", Rnd	4
	QQQ	18 11 065	Cord, Hrd Srv, 14/2 Cu, 600V	20
	RRR	12 51 217	Conduit, PVC Split	1
	SSS	27 60 035	Iron Hanger, Galv., 3/4" wide (ft.)	2

METER INSTALLATIONS
Primary Metering for Customer U.G. 3 Phase 4 Wire
25kV

25 25 01 01

Sheet 4 of 4

*	TTT	69 58 181	Guard, Clam-shell, Wildlife	3
		286	Install Primary Metering	1

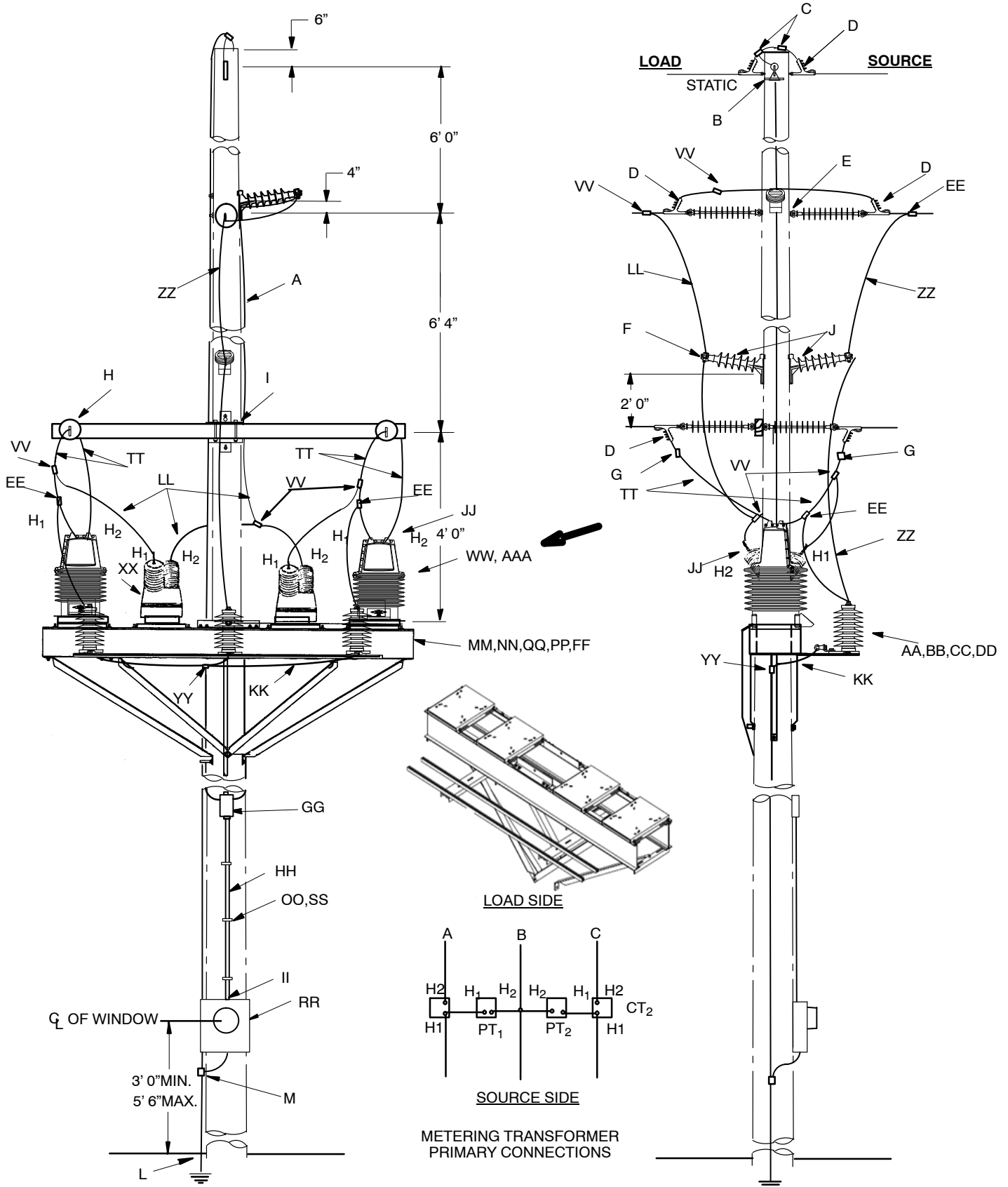


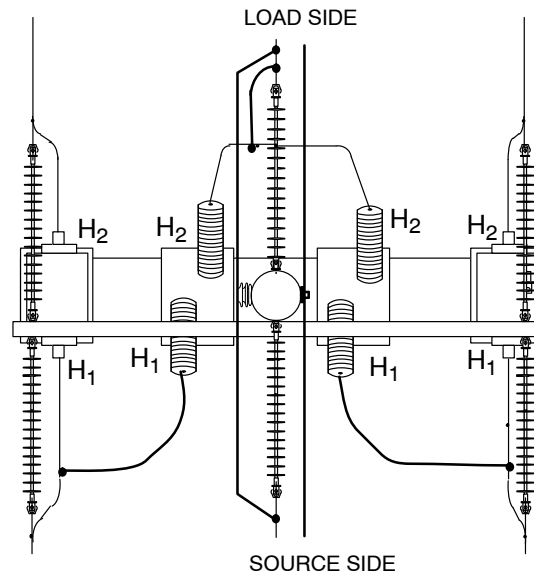
4 WIRE

METER INSTALLATIONS
 Primary Metering
 34.5kV, 3 Phase, 3 Wire – Missouri Only

25 34 01 00

Sheet 1 of 3





NOTES:

1. Ground all instrument transformers, arresters, and aluminum mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 23" clearance between 34kV phases or phase to ground.
4. Maintain minimum of 4' clearances between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 30" between the energized lateral and vertical conductors and the pole on non-climbing side of the pole. Reference from NESC, rule 239E.
6. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12kV underbuilds.
7. If disconnect switches are required, the switches may be installed on adjacent poles.
8. For wire color coding on PT and CT secondary's, refer to system meter drawings.
9. If metering structure is located within a substation, the metering and LA ground wires must be connected to the substation ground mat.
10. To enhance the protection of the metering equipment ensure that the tap from the phase conductor to the arrester is as short as possible in distance and use only intermediate class lightning arresters. In stall arresters to load side if multiple span exposure on the load side exists and the arresters may be installed on adjacent poles.

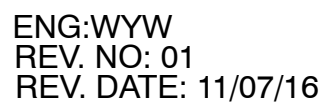
METER INSTALLATIONS
Primary Metering
34.5kV, 3 Phase, 3 Wire – Missouri Only

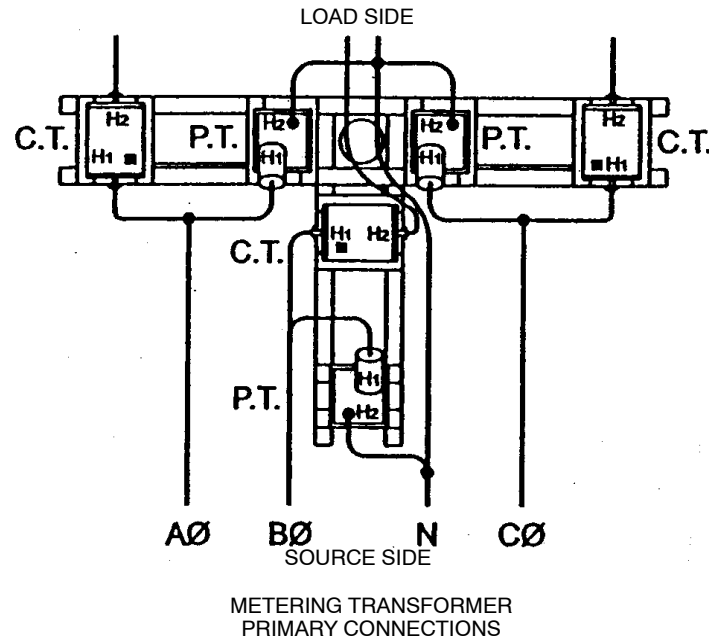
25 34 01 00

Sheet 3 of 3

		Std. / Stk. No.	Description – Provided and Installed By Customer	Qty.
@	A		Pole	1
	B	06 00 11 06	Static Wire Attachment	1
	C	23 68 234	Clamp, Guy Wire, ½" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2
	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 05	Double Deadend Loop 34kV Top Phase	1
	F	TCA*W	Clamp, Trunnion – DCS 07 00 20 00	3
	G	PG**	Clamp, Parallel Grove – DCS 07 00 25 00	7
	H	06 34 72 08	Double Deadend Loop 34kV on Fiberglass Arm	2
	I	04 00 41 04	Crossarm, Deadend, F/G 10'	1
	J	06 34 03 06	34kV Horizontal Line Post, Polymer, Double Insulators	1
	K	23 53 058	Bolt, DA, ¾" x 16"	2
		23 53 059	Bolt, DA, ¾" x 18"	2
	L	12 00 10 09	Grounding Unit New Pole	1
	M	17 51 032	Clamp, PG, #6 – 1/0 to #6 – 1/0	2
		Std. / Stk. No.	Description – Provided and Installed by Ameren Missouri	Qty.
@	AA	10 01 240	Arrester, 24.4kv MCOV, 30kV Duty Cycle, Intermediate, Base Mount	3
	BB	23 52 427	Bolt Mach ½" Dia x 2 ½" L	9
	CC	23 66 017	Washer RD ½"	18
	DD	23 66 133	Washer, Lock DBL Coil, ½"	9
	EE	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	FF	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set ⅝" x 3" Stainless	16
	GG	40 01 120	Junction Box	1
	HH	12 51 303	Conduit, Flex, 1", Non–Metallic ft	20
	II	40 53 612	Connector, 1" Conduit	2
	JJ	17 54 331	Connector, 2–Bolt, 2AWG Sol – 350 MCM Str. Bronze	8
	KK	18 51 021	Wire, #6 Cu Covered SD ft	20
	LL	18 51 019	Wire #2 Cu Covered (ft)	20
	MM	23 17 349	Mounting Assembly for 2CT's & 2PT's	1
	NN	23 52 105	Bolt, Mach, ¾" x 26"	5
	OO	40 83 093	Clamp, Conduit, 1" Two Hole Steel Strap	5
	PP	23 66 031	Washer Curved ¾"	10
	QQ	23 66 135	Washer Lock DBL Coil ¾"	5
	RR	40 04 246	Meter Socket, Pre–Wired 8–Terminal, Instrument Rated, Missouri	1
	SS	23 60 033	Screw, Lag, ¼" x 2" Galv.	10
	TT	PLW*W	Lead Wire, PH (ft) – DCS 07 00 80 00	30
	UU	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Color	@
	VV	PG**	Clamp, Parallel Grove – Std. 07 00 25 00	4
	WW		Current Transformer, 34kV	2
	XX		Potential Transformer, 34kV	2
	YY	17 51 032	Clamp, PG, #6 – 1/0 to #6 – 1/0	2
	ZZ	18 51 025	Wire, #4 Cu Covered (ft)	12
	AAA	69 56 039	Wildlife Cover for Ritz 34kV CT	2
		286	Install Primary Metering	1

Sheet 1 of 3





NOTES:

1. Ground all instrument transformers, arrestors, and aluminum mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 23" clearance between 34kV phases or phase to ground.
4. Maintain minimum of 4' clearance between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non climbing side of the pole. Reference from NESC, Rule 239E.
6. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12 kV underbuild.
7. If disconnect switches are required, they may be installed on adjacent poles.
8. For wire color coding on PT and CT secondaries, refer to system meter drawings.
9. If metering structure is located within a substation, the metering and L.A. ground wires must be connected to the substation ground mat.
10. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance and use only intermediate class lightning arresters. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and arresters may be installed on adjacent poles.

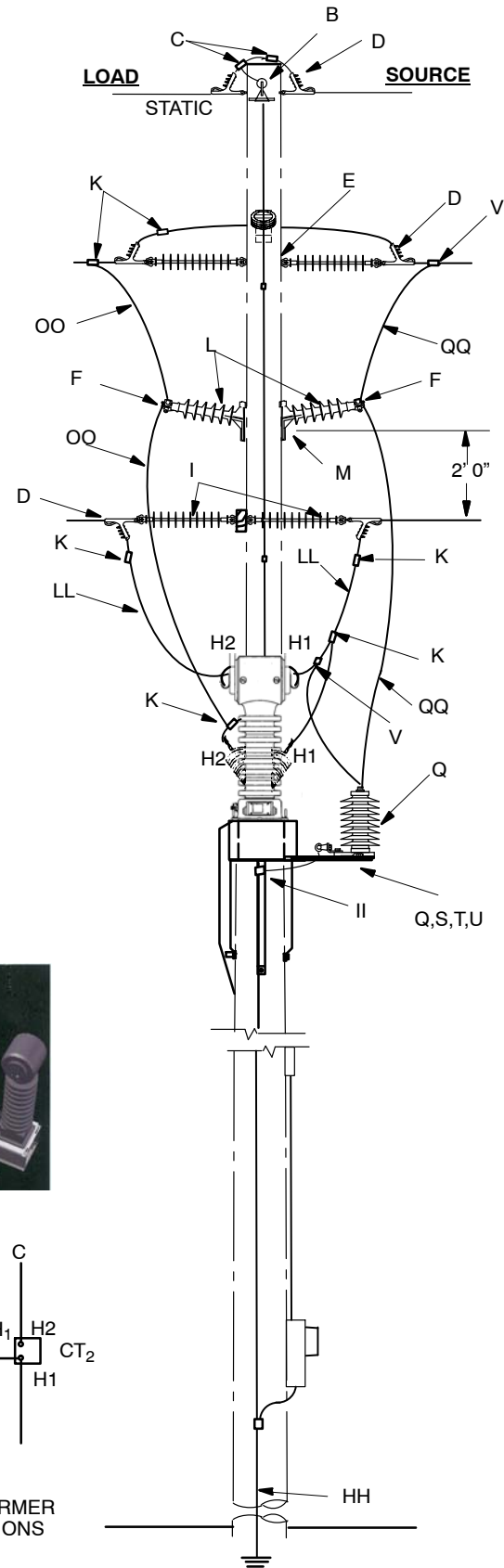
METER INSTALLATIONS
Primary Metering
34.5kV, 3 Phase, 4 Wire – Missouri Only (Limited Use)

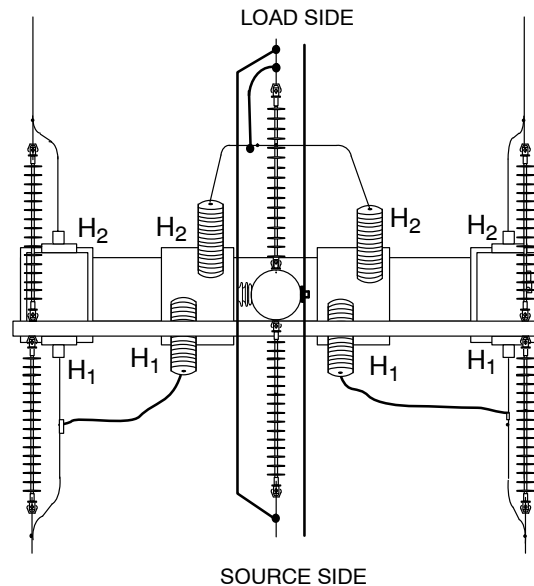
25 34 01 01

Sheet 3 of 3

		Std. / Stk. No.	Description – Installed and Provided By AmerenMissouri	QTY.
@	A		Pole	1
	B	06 00 11 06	Static Wire Attachment	1
@	C	23 68 234	Clamp, Guy Wire, ½" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2
@	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 05	Double Deadend Loop 34kV Top Phase	1
@	F	TC*W	Clamp, Trunnion – DCS 07 00 20 00	4
@	G	PG**	Clamp, Parallel Grove – DCS 07 00 25 00	9
	H	06 34 72 08	Double Deadend 34kV on Fiberglass Arm	2
	I	06 34 03 03	Horizontal Single Post Insulator,34kV	1
@	J	23 52 219	Bolt Mach ¾" x 14"	2
		23 52 254	Bolt Mach ¾" x 16"	2
	K	06 34 03 06	Horizontal Double Post Insulators,34kV	1
@	L	23 53 056	Bolt Mach ¾" x 16"	2
		23 53 059	Bolt Mach ¾" x 18"	2
	M	04 00 41 04	Crossarm, Deadend, F/G 10',	2
	N	10 01 241	Arrester, 24.4kV MCOV, 30kV Duty Cycle, NEMA Bracket Mount	3
	O	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	P	23 17 419	Mounting Assembly, 3CT's & 3 PT's	1
	Q	23 52 105	Bolt, Mach, ¾" x 26"	5
	R	23 66 031	Washer Curved ¾"	10
	S	23 66 135	Washer Lock DBL, Coil, ¾"	5
	T	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set ⅝" x 3" Stainless	24
	U	40 01 120	Junction Box	1
	V	40 53 612	Connector, 1" Conduit	2
	W	12 51 303	Conduit, Flex, 1" Non-Metallic (ft)	20
	X	40 83 093	Clamp, Conduit, 1" Two Hole Steel Strap	5
@	Y	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Colors	–
	Z	40 04 245	Meter Socket, 600V, Pre-Wired 13-Terminal, Instrument Rated, Missouri	1
	AA	12 00 10 09	Grounding Unit New Pole	1
	BB	17 51 032	Clamp, PG, #6–1/0 to #6–1/0	5
@	CC		Current Transformer 69kV	3
@	DD		Potential Transformer 69kV	3
@	EE	PLW*W	Lead Wire, PH (ft) – DCS 07 00 80 00	40
	GG	17 54 331	Connector, 2-Bolt, 2 Awg SD–350 MCM Str. Bronze	9
	HH	18 51 019	Wire #2 Cu Covered (ft)	30
	II	18 51 021	Wire #6 Cu Covered (ft)	15
	JJ	23 60 033	Screw, lag, ¼" x 2" Galv.	10
	KK	69 56 039	Wildlife Cover for Ritz 34kV CT	3
		286	Install Primary Metering	1

Sheet 1 of 3





NOTES:

1. Ground all instrument transformers, arresters, and mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 23" clearance between 34kV phases or phase to ground.
4. Maintain minimum of 6' clearance between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 30" between the energized lateral and vertical conductors and the pole on non-climbing side of the pole. Reference from NESC, Rule 239E.
6. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12 kV underbuilt.
7. If disconnect switches are required, they may be installed on adjacent poles.
8. For wire color coding on PT and CT secondaries, refer to system meter drawings.
9. If metering structure is located within a substation, the metering and L.A. ground wires must be connected to the substation ground mat.
10. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance and use only intermediate class lightning arresters. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and arresters may be installed on adjacent poles.

METER INSTALLATIONS
Primary Metering
34.5kV, 3 Phase, 3 Wire – Illinois Only

25 34 02 00

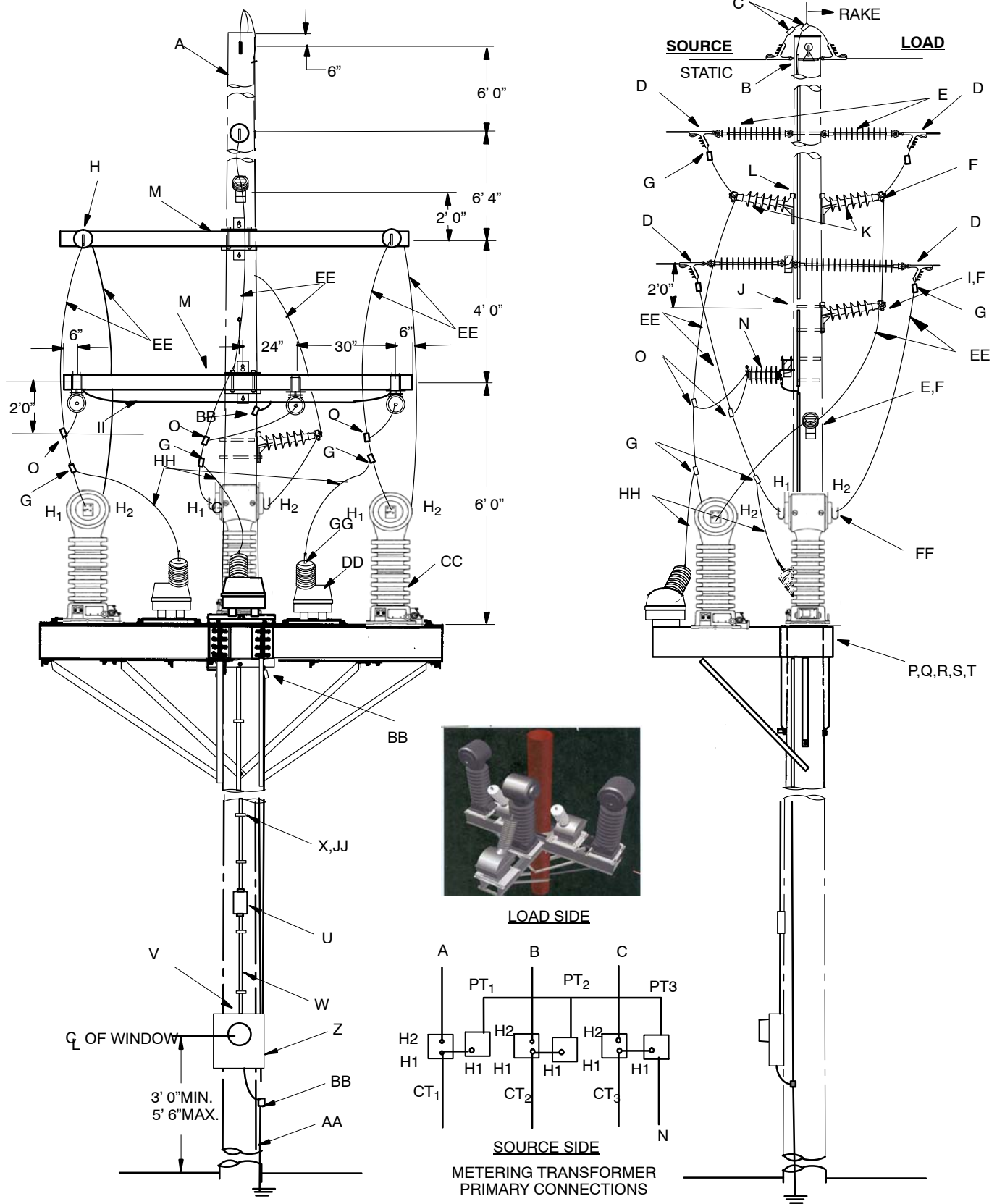
Sheet 3 of 3

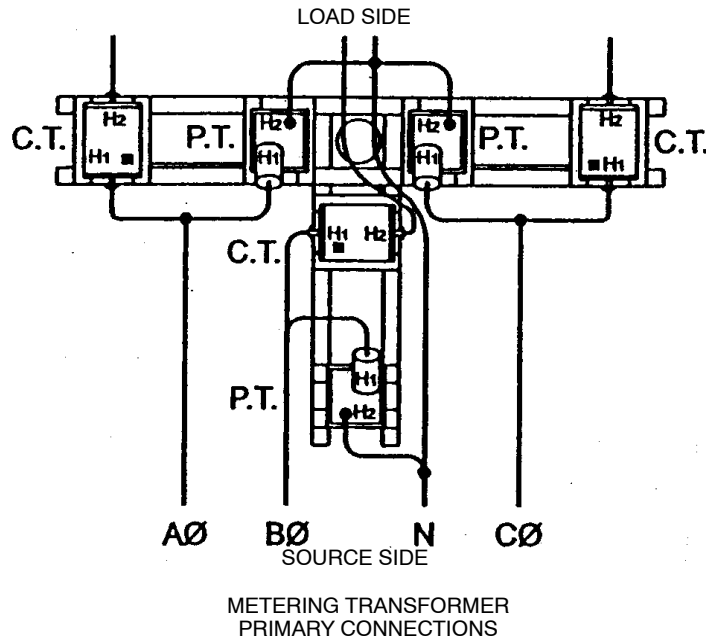
		Std. / Stk. No.	Description – Provided and Installed By AmerenIllinois	Qty.
@	A		Pole	1
	B	06 00 11 06	Static, Wire Attachment	1
@	C	23 68 234	Clamp, Guy Wire, ½" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2
@	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 05	Double Deadend Loop 34kV Top Phase	1
@	F	TCA*W	Clamp, Trunnion	3
	I	06 34 72 08	Double Deadend Loop 34kV on Fiberglass Arm	2
@	K	PG**	Clamp, Parallel Groove – DCS 07 00 25 00	11
	N	04 00 41 04	Crossarm, Deadend, F/G 10'	1
	L	06 69 03 04	34kV Horizontal Line Post, Polymer, Double Insulator	1
@	M	23 53 058	Bolt, DA, ¾" x 16"	2
		23 53 059	Bolt, DA, ¾" x 18"	2
	Q	10 01 240	Arrester, 24.4kv MCOV, 30kV Duty Cycle, Intermediate, Base Mount	3
	S	23 52 427	Bolt Mach ½" Dia x 2 ½" L	9
	T	23 66 017	Washer RD ½"	18
	U	23 66 133	Washer, Lock DBL Coil, ½"	9
@	V	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	W	23 17 349	Mounting Assembly, 2CT's & 2PT's	1
	X	23 52 105	Bolt, Mach, ¾" x 26"	5
	Y	23 66 031	Washer Curved ¾"	10
	Z	23 66 135	Washer Lock DBL, Coil, ¾"	5
	AA	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set ⅝" x 3" Stainless	16
	BB	40 01 120	Junction Box	1
	CC	40 53 612	Connector, 1" Conduit	2
	DD	12 51 303	Conduit, Flex, 1" Non-Metallic (ft)	20
	EE	40 83 093	Clamp, Conduit, 1" Two-Hole Steel Strap	5
@	FF	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Colors – Contact Metering Department	–
	GG	40 54 378	Meter Socket, Pre-Wired, 8-Terminal, Instrument Rated, Illinois	1
	HH	12 00 10 09	Grounding Unit New Pole	1
	II	17 51 032	Clamp, PG, #6–1/0 to #6–1/0	3
@	JJ		Current Transformer 34kV – Contact Metering Dept.	2
@	KK		Potential Transformer 34kV – Contact Metering Dept.	2
@	LL	PLW*W	Lead Wire, PH (ft) – DCS 07 00 80 00	30
@	MM	CL*W	Lug, Connector 4-Hole – DCS 07 00 30 00	4
	NN	17 54 331	Connector, 2-Bolt, 2 Awg SD–350 MCM Str. Bronze	4
	OO	18 51 019	Wire #2 Cu Covered (ft)	20
	PP	18 51 021	Wire #6 Cu Covered (ft)	20
	QQ	18 51 025	Wire, #4 Cu Covered (ft)	12
	RR	23 60 033	Screw, lag, ¼" x 2" Galv.	10
		286	Install Primary Metering	1

METER INSTALLATIONS
Primary Metering
34.5kV, 3 Phase, 4 Wire – Illinois Only

25 34 02 01

Sheet 1 of 3





NOTES:

1. Ground all instrument transformers, arresters, and mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 23" clearance between 34kV phases or phase to ground.
4. Maintain minimum of 6' clearance between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 40" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 19" between the energized lateral and vertical conductors and the pole on non climbing side of the pole. Reference from NESC, Rule 239E.
6. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12 kV underbuild.
7. If disconnect switches are required, they may be installed on adjacent poles.
8. For wire color coding on PT and CT secondaries, refer to system meter drawings.
9. If metering structure is located within a substation, the metering and L.A. ground wires must be connected to the substation ground mat.
10. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance and use only intermediate class lightning arresters. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and arresters may be installed on adjacent poles.

METER INSTALLATIONS
Primary Metering
34.5kV, 3 Phase, 4 Wire – Illinois Only

25 34 02 01

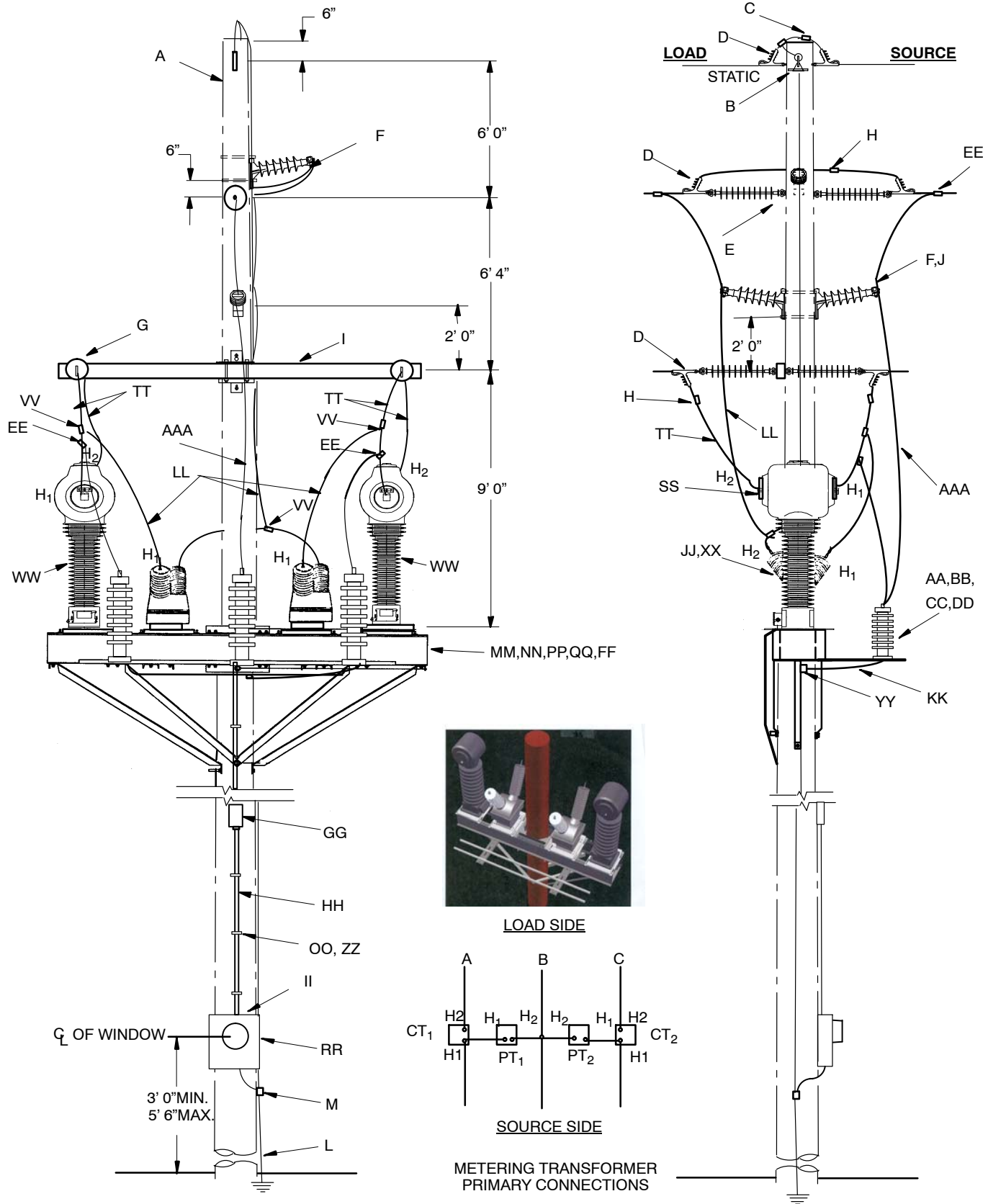
Sheet 3 of 3

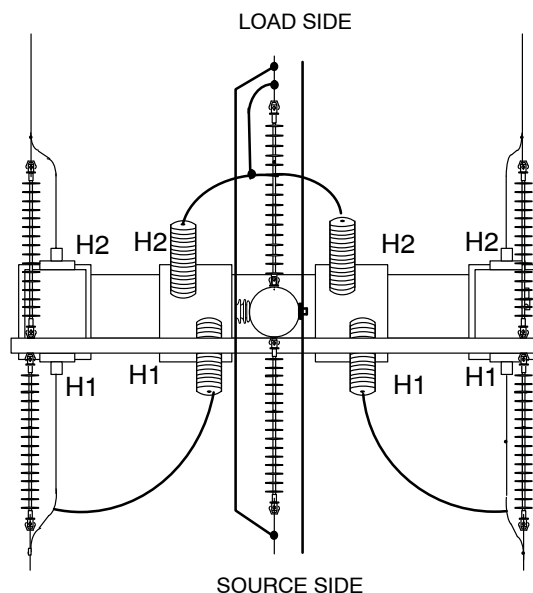
		Std. / Stk. No.	Description – Provided and Install By AmerenIllinois	QTY
@	A		Pole	1
	B	06 00 11 06	Static Wire Attachment	1
@	C	23 68 234	Clamp, Guy Wire, ½" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2
@	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 05	Double Deadend Loop 34kV Top Phase	1
@	F	TC*W	Clamp, Trunnion – DCS 07 00 20 00	4
@	G	PG**	Clamp, Parallel Grove – DCS 07 00 25 00	9
	H	06 34 72 08	Double Deadend 34kV on Fiberglass Arm	2
	I	06 34 03 03	Horizontal Single Post Insulator, 34kV	1
@	J	23 52 219	Bolt Mach ¾" x 14"	2
		23 52 254	Bolt Mach ¾" x 16"	2
	K	06 34 03 06	Horizontal Double Post Insulators, 34kV	1
@	L	23 53 056	Bolt Mach ¾" x 16"	2
		23 53 059	Bolt Mach ¾" x 18"	2
	M	04 00 41 04	Crossarm, Deadend, F/G 10',	2
	N	10 01 241	Arrester, 24.4kV MCOV, 30kV Duty Cycle, NEMA Bracket Mount	3
	O	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	P	23 17 419	Mounting Assembly, 3CT's & 3 PT's	1
	Q	23 52 105	Bolt, Mach, ¾" x 26"	5
	R	23 66 031	Washer Curved ¾"	10
	S	23 66 135	Washer Lock DBL, Coil, ¾"	5
	T	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set ⅝" x 3" Stainless	24
	U	40 01 120	Junction Box	1
	V	40 53 612	Connector, 1" Conduit	2
	W	12 51 303	Conduit, Flex, 1" Non-Metallic (ft)	20
	X	40 83 093	Clamp, Conduit, 1" Two Hole Steel Strap	5
@	Y	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Colors	–
	Z	40 54 353	Meter Socket, 600V, Pre-Wired 13-Terminal, Instrument Rated, Illinois	1
	AA	12 00 10 09	Grounding Unit New Pole	1
	BB	17 51 032	Clamp, PG, #6–1/0 to #6–1/0	5
@	CC		Current Transformer 69kV	3
@	DD		Potential Transformer 69kV	3
@	EE	PLW*W	Lead Wire, PH (ft) – DCS 07 00 80 00	40
@	FF	CL*W	Lug, Connector 4-Hole – DCS 07 00 30 00	6
	GG	17 54 331	Connector, 2-Bolt, 2 Awg SD–350 MCM Str. Bronze	3
	HH	18 51 019	Wire #2 Cu Covered (ft)	30
	II	18 51 021	Wire #6 Cu Covered (ft)	15
	JJ	23 60 033	Screw, lag, ¼" x 2" Galv	10
		286	Install Primary Metering	1

METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 3 Wire (Missouri Only)

25 69 01 00

Sheet 1 of 4





NOTES:

1. Ground all instrument transformers, arresters, and aluminum mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 38" clearance between 69kV phases or phase to ground.
4. Maintain minimum of 7 ½' clearance between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 54" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 18" between the energized conductors and the pole on non-climbing side of the pole. Reference from NESC, rule 239E.
6. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12kV underbuilds.
7. If disconnect switches are required, the switches may be installed on adjacent poles.
8. For wire color coding on PT and CT secondary's, refer to system meter drawings.
9. If metering structure is located with a substation, the metering and LA ground wires must be connected to the substation ground mat.
10. To enhance the protection of the metering equipment ensure that the tap from the phase conductor to the arrester is as short as possible in distance and use only intermediate class lightning arresters. Install arresters to load side if multiple span exposure on the load side exists and the arresters may be installed on adjacent poles.

METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 3 Wire (Missouri Only)

25 69 01 00

Sheet 3 of 4

		Std. / Stk. No.	Description – Normally Provided and Installed By Customer	Qty.
@	A		Pole	1
	B	06 00 11 06	Static, Wire Attachment	1
@	C	23 68 234	Clamp, Guy Wire, ½" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2
@	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 01	Double Deadend Loop 69kV Top Phase	1
@	F	TCA*W	Clamp, Trunnion – DCS 07 00 20 00	3
	G	06 34 72 04	Double Deadend Loop 69kV on Fiberglass Arm	1
@	H	PG**	Clamp, Parallel Grove – DCS 07 00 25 00	7
	I	04 00 41 04	Crossarm, Deadend, F/G 10'	1
	J	06 69 03 02	69kV Horizontal Line Post, Polymer, Double Insulators	1
@	K	23 53 058	Bolt, DA, ¾" x 16"	2
		23 53 059	Bolt, DA, ¾" x 18"	2
	L	12 00 10 09	Grounding Unit New Pole	1
	M	17 51 032	Clamp, PG, #6 – 1/0 to #6 – 1/0	2
		Std. / Stk. No.	Description – Provided and Installed By Ameren	Qty.
	AA	10 01 245	Arrester, 48kV MCOV, 60kV Duty Cycle, Intermediate, Base Mount	3
	BB	23 52 427	Bolt Mach ½" Dia x 2 ½" L w/Nut	9
	CC	23 66 017	Washer RD ½"	18
	DD	23 66 133	Washer, Lock DBL Coil, ½"	9
@	EE	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	FF	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set ⅝" x 3" Stainless	16
	GG	40 01 120	Junction Box	1
	HH	12 51 303	Conduit, Flex, 1", Non-Metallic (Ft)	20
	II	40 53 612	Connector, 1" Conduit	2
	JJ	17 54 331	Connector, 2-Bolt, 2AWG Sol – 350 MCM Str. Bronze	4
	KK	18 51 021	Wire, #6 Cu Covered SD (Ft)	20
	LL	18 51 019	Wire #2 Cu Covered (Ft)	20
	AAA	18 51 025	Wire #4 Cu Covered SD (Ft)	12
	MM	23 17 349	Mounting Assembly for 2CT's & 2PT's	1
	NN	23 52 105	Bolt, Mach, ¾" x 26"	5
	OO	40 83 093	Clamp, Conduit, 1" Two Hole Steel Strap	5
	ZZ	23 60 033	Screw, Lag, ¼" x 2" Galv.	10
	PP	23 66 031	Washer Curved ¾"	10
	QQ	23 66 135	Washer Lock DBL Coil ¾"	5
	RR	40 04 246	Meter Socket, Pre-Wired 8-Terminal, Instrument Rated, Missouri	1
@	SS	CL*W	Lug, Connector 4 Hole – Std 07 00 30 00	4

METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 3 Wire (Missouri Only)

25 69 01 00

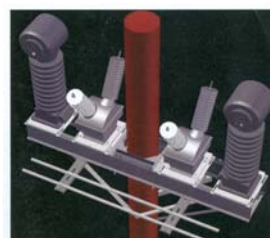
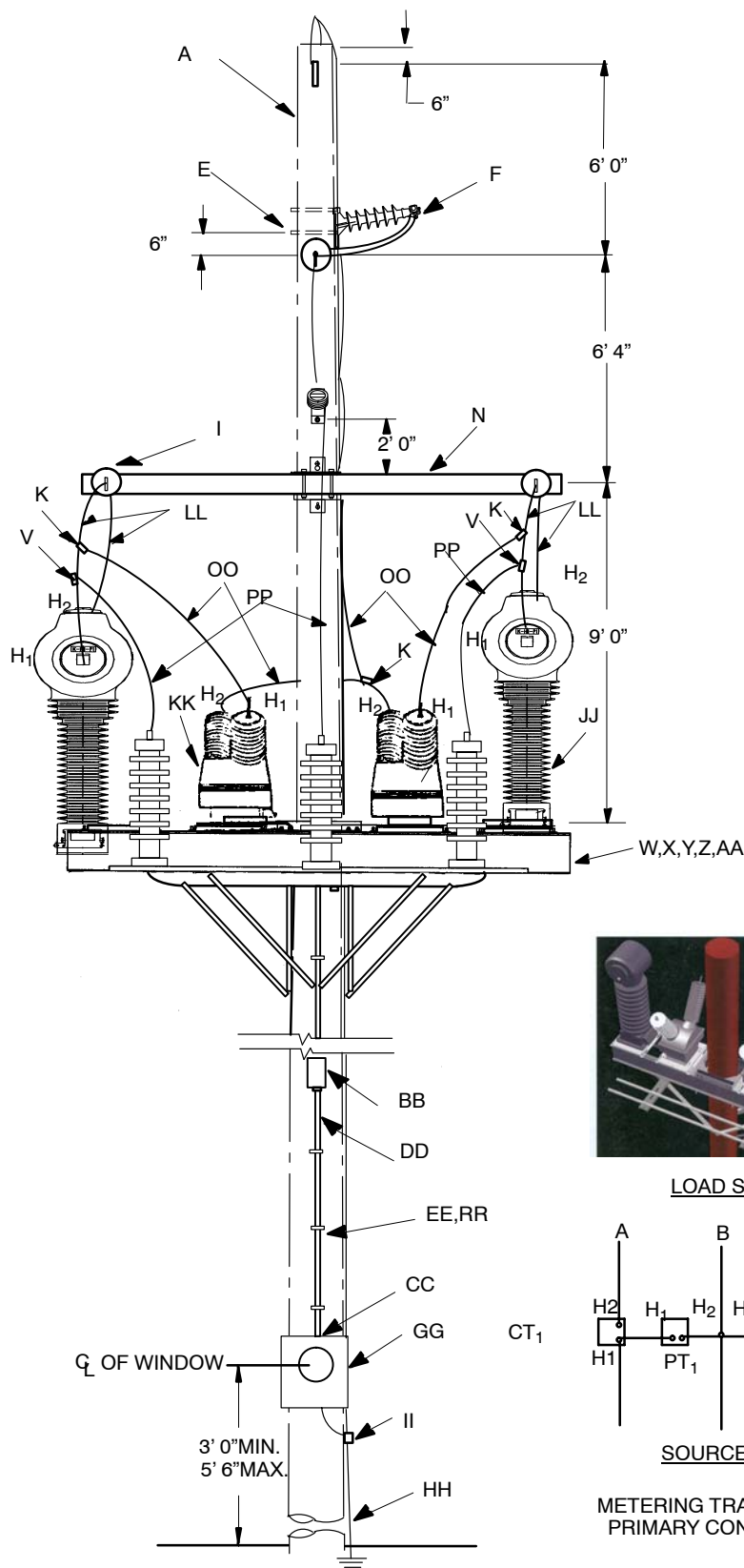
Sheet 4 of 4

@	TT	PLW*W	Lead Wire, PH (Ft) – DCS 07 00 80 00	30
@	UU	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Color	@
@	VV	PG**	Clamp, Parallel Grove – See Std. 07 00 25 00	8
@	WW		Current Transformer, 69kV	2
@	XX		Potential Transformer, 69kV	2
	YY	17 51 032	Clamp, PG, #6 – 1/0 to #6 – 1/0	2
		286	Install Primary Metering	1

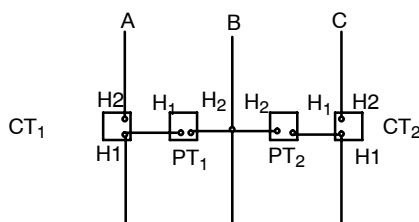
METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 3 Wire (Illinois Only)

25 69 02 00

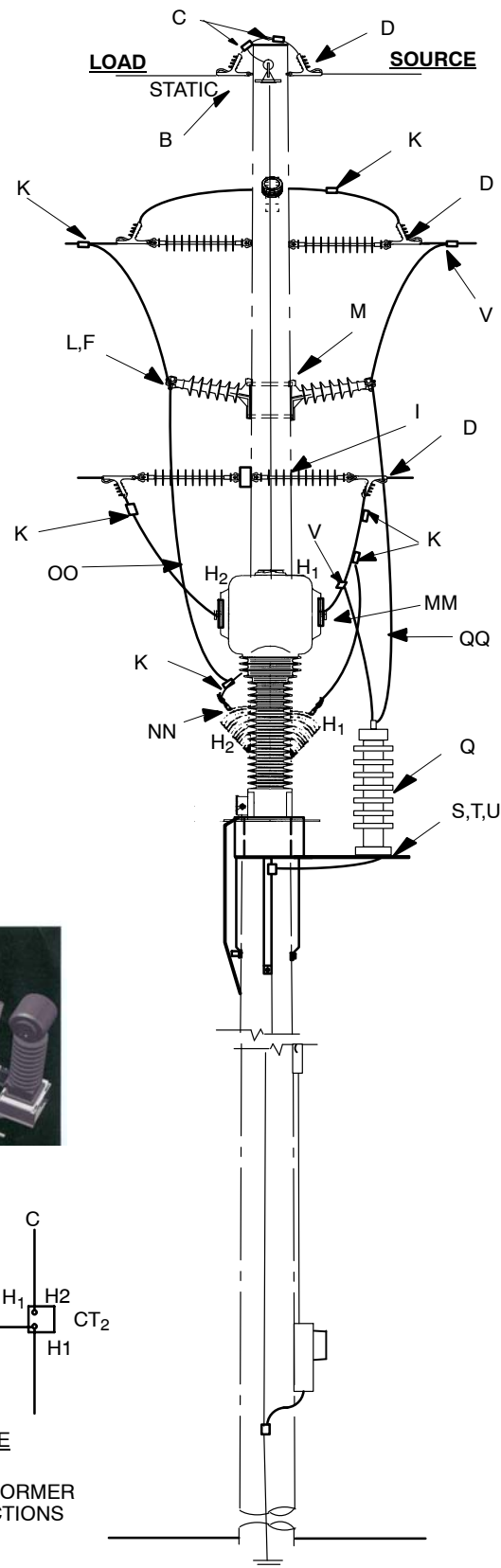
Sheet 1 of 3

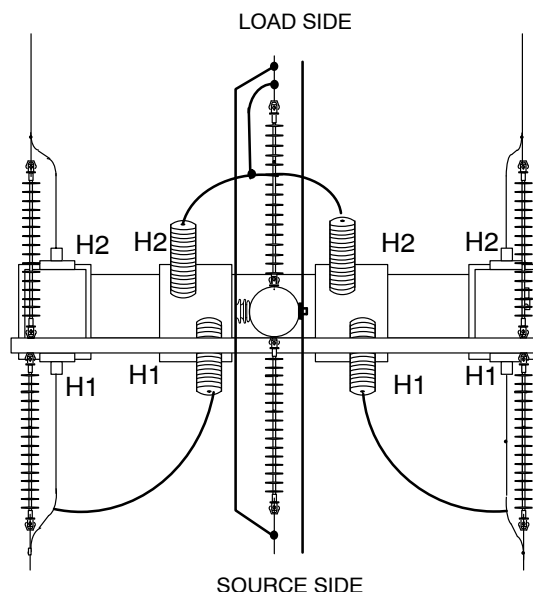


LOAD SIDE



**METERING TRANSFORMER
 PRIMARY CONNECTIONS**





NOTES:

1. Ground all instrument transformers, arrestors, and aluminum mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain minimum of 38" clearance between 69kV phases or phase to ground.
4. Maintain minimum of 7 1/2' clearance between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 54" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 18" between the energized conductors and the pole on non-climbing side of the pole. Reference from NESC, Rule 239E.
6. Maintain minimum of 40" clearance from any part of aluminum mounting unit to conductors of 12kV or 4kV under-builds.
7. If there is any problem maintaining clearances between transformer leads and static wire ground, omit static wire ground at this pole.
8. Due to variations in 34kV configurations each primary metering installation should be individually designed. But this standard will serve as a general guide.
9. If disconnect switches are required, they may be installed on an adjacent pole.
10. For wire color coding on PT and CT secondaries refer to system meter drawings.

		Std. / Stk. No.	Description – Provided and Installed By Ameren	Qty.
@	A		Pole	1
	B	06 00 11 06	Static, Wire Attachment	1
@	C	23 68 234	Clamp, Guy Wire, 1/2" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2
@	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 01	Double Deadend Loop 69kV Top Phase	1
@	F	TCA*W	Clamp, Trunnion	3

METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 3 Wire (Illinois Only)

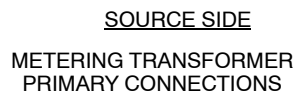
25 69 02 00

Sheet 3 of 3

@	I	06 34 72 04	Double Deadend Loop 69kV on Fiberglass Arm	2
	K	PG**	Clamp, Parallel Grove – DCS 07 00 25 00	7
	N	04 00 41 04	Crossarm, Deadend, F/G 10'	1
@	L	06 69 03 04	69kV Horizontal Line Post, Polymer, Double Insulator	1
	M	23 53 058	Bolt, DA, ¾" x 16"	2
@		23 53 059	Bolt, DA, ¾" x 18"	2
	Q	10 01 245	Arrester, 48kV MCOV, 60kV Duty Cycle, Interm (Grd WYE System)	3
@		71 10 117	Arrester, 57kV MCOV, 72kV Duty Cycle, Interm (Delta System)	3
	S	23 52 427	Bolt Mach ½" Dia x 2 ½" L	9
@	T	23 66 017	Washer RD ½"	18
	U	23 66 133	Washer, Lock DBL Coil, ½"	9
@	V	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	W	23 17 349	Mounting Assembly, 2CT's & 2PT's	1
@	X	23 52 105	Bolt, Mach, ¾" x 26"	5
	Y	23 66 031	Washer Curved ¾"	10
@	Z	23 66 135	Washer Lock DBL, Coil, ¾"	5
	AA	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set ⅝" x 3" Stainless	16
@	BB	40 01 120	Junction Box	1
	CC	40 53 612	Connector, 1" Conduit	2
@	DD	12 51 303	Conduit, Flex, 1" Non-Metallic (ft)	20
	EE	40 83 093	Clamp, Conduit, 1" Two Hole Steel Strap	5
@	RR	23 60 033	Screw, Lag, ¼" x 2" Galv.	10
	FF	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Colors – Contact Metering Department	–
@	GG	40 54 378	Meter Socket, Pre-Wired, 8-Terminal, Instrument Rated, Illinois	1
	HH	12 00 10 09	Grounding Unit – Ground Coil	1
@		12 00 10 10	Grounding Unit – Ground Rod	1
	II	17 51 032	Clamp, PG, #6–1/0 to #6–1/0	3
@	JJ		Current Transformer 69kV – Contact Metering Dept.	2
	KK		Potential Transformer 69kV – Contact Metering Dept.	2
@	LL	PLW*W	Lead Wire, PH (ft) – DCS 07 00 80 00	30
	MM	CL*W	Lug, Connector 4-Hole – DCS 07 00 30 00	4
@	NN	17 54 331	Connector, 2-Bolt, 2 Awg SD–350 MCM Str. Bronze	4
	OO	18 51 019	Wire #2 Cu Covered (ft)	20
@	PP	18 51 021	Wire #6 Cu Covered (ft)	20
	QQ	18 51 025	Wire #4 Cu Covered (ft)	12
@		286	Install Primary Metering	1

69kV, 3 Phase, 4 Wire (Illinois Only)

Sheet 1 of 3

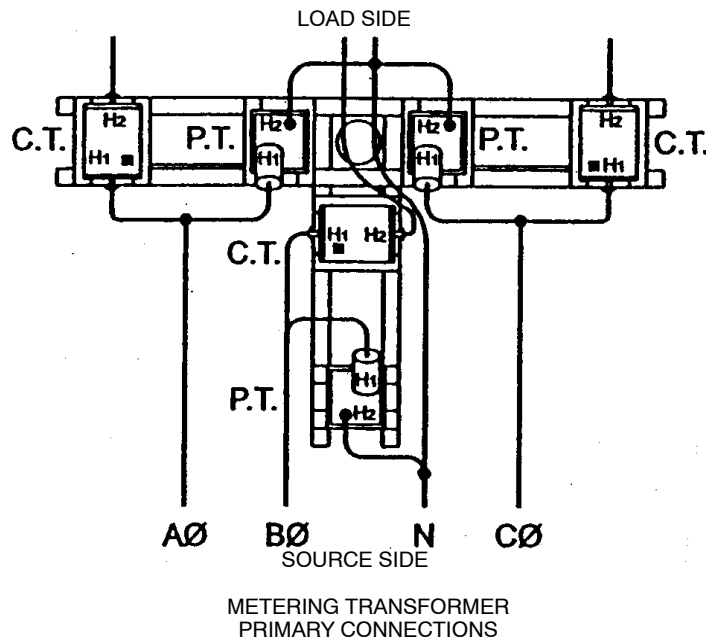


ENG:WYW
REV. NEW
REV. DATE: 08/14/14

METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 4 Wire (Illinois Only)

25 69 02 01

Sheet 2 of 3



NOTES:

1. Ground all instrument transformers, arrestors, and aluminum mounting assembly to the grounding unit.
2. Install barriers for protection against vehicular traffic where necessary.
3. Maintain a minimum of 38" clearance between 69kV phases.
4. Maintain minimum of 7 ½' clearance between the aluminum mounting platform and the crossarm.
5. Maintain a minimum of 54" between the energized conductors and the pole on climbing side of the pole; maintain a minimum of 18" between the energized conductors and the pole on non-climbing side of the pole. Reference from NESC, Rule 239E.
6. Maintain a minimum of 40" between any part of the aluminum mounting platform and conductors of 4 or 12 kV underbuild.
7. If disconnect switches are required, they may be installed on adjacent poles.
8. For wire color coding on PT and CT secondaries, refer to system meter drawings.
9. If metering structure is located within a substation, the metering and L.A. ground wires must be connected to the substation ground mat.
10. To enhance the protection of the metering equipment ensure that the tap for the phase conductor to the arrester is as short as possible in distance and use only intermediate class lightning arresters. Install arresters to load side on the adjacent pole if multiple span exposure on the load side exists and the arresters may be installed on adjacent poles.

		Std. / Stk. No.	Description – 25 69 02 01 Provided By Ameren	QTY.
@	A		Pole	1
	B	06 00 11 06	Static Wire Attachment	1
@	C	23 68 234	Clamp, Guy Wire, ½" (used with 12/7 ACSR Static)	2
		17 51 032	Clamp, Parallel Groove (used with 1/0 AAAC Static)	2

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:WYW
REV. NEW
REV. DATE: 08/14/14

METER INSTALLATIONS
Primary Metering
69kV, 3 Phase, 4 Wire (Illinois Only)

25 69 02 01

Sheet 3 of 3

@	D	DEC*W	Clamp, Deadend – DCS 07 00 20 00	8
	E	06 34 72 01	Double Deadend Loop 69kV Top Phase	1
@	F	TCA*W	Clamp, Trunnion – DCS 07 00 20 00	1
@	G	STC*W	Clamp, Stirrup – DCS 07 00 21 00	3
	H	PG**	Clamp, Parallel Grove – DCS 07 00 25 00	9
@	I	06 34 72 04	Double Deadend Loop 69kV on Fiberglass Arm	2
	L	06 34 01 04	Vertical Line Post Insulator 69kV	1
@	M	Hand Tie	Tie, Conductor 69kV – DCS 07 00 41 00	1
	N	04 00 41 04	Crossarm, Deadend, F/G 10',	3
@	O	23 53 003	Bolt, Dbl, Arm, 5/8" x 18"	2
	P	23 66 027	Washer, Square, 5/8"	4
	Q	10 01 245	Arrester, 48kV MCOV, 60kV Duty Cycle, Base Mount	3
	R	27 06 355	Plate for DBL Arm (Mount 48kV MCOV Arrester) W/ Mounting Hardware on the Crossarm	3
	S	23 52 427	Bolt Mach 1/2" Dia x 2 1/2" L	9
	T	23 66 017	Washer RD 1/2"	18
	U	23 66 133	Washer, Lock DBL Coil, 1/2"	9
	W	23 17 419	Mounting Assembly, 3CT's & 3 PT's	1
	X	23 52 105	Bolt, Mach, 3/4" x 26"	5
	Y	23 66 031	Washer Curved 3/4"	10
	Z	23 66 135	Washer Lock DBL, Coil, 3/4"	5
	AA	21 96 231	Bolt/RD Washer/Lock Washer/Nuts Set 5/8" x 3" Stainless	24
	BB	40 01 120	Junction Box	1
	CC	40 53 612	Connector, 1" Conduit	2
	DD	12 51 303	Conduit, Flex, 1" Non-Metallic (ft)	20
	EE	40 83 093	Clamp, conduit, 1" Two Hole Steel Strap	5
	QQ	23 60 033	Screw, Lag, 1/4" x 2" Galv.	10
	FF	Meter Shop	Wire Pack of 10 ea. #12 Solid Cu Wires of Individual Colors	-
	GG	40 54 353	Meter Socket, 600V, Pre-Wired 13-Terminal, Instrument Rated	1
	HH	12 00 10 09	Grounding Unit New Pole	1
@	II	17 51 032	Clamp, PG, #6-1/0 to #6-1/0	5
	JJ		Current Transformer 69kV	3
@	KK		Potential Transformer 69kV	3
@	LL	PLW*W	Lead Wire, PH (ft) – DCS 07 00 80 00	40
@	MM	CL*W	Lug, Connector 4-Hole – DCS 07 00 30 00	6
@	NN	17 54 331	Connector, 2-Bolt, 2 Awg SD-350 MCM Str. Bronze	3
	OO	18 51 019	Wire #2 Cu Covered (ft)	30
	PP	18 51 021	Wire #6 Cu Covered (ft)	15
		286	Install Primary Metering	1

A. ANTENNAS & AMI/AMR DEVICES LOCATED IN THE SUPPLY SPACE

1. General

Communication antennas located in the supply space shall be installed and maintained only by personnel authorized and qualified to work in the supply space. These are typically antennas on Routers and Collectors installed for Ameren's Advanced Metering Infrastructure (AMI) system, or Micro Cell Controllers (MCCs) installed for Ameren's Automated Meter Reading (AMR).

2. Vertical and Lateral AMI/AMR Device Power Conductors and Cables Attached to a Communication Antenna

Vertical and lateral device power conductors or antenna cables should be attached to the surface of the structure enclosed in non-metallic conduit or U-guard. They shall be located so that they do not obstruct climbing spaces or lateral working spaces between line conductors at different levels, or interfere with the safe use of pole steps.

3. Communication Equipment and Antennas

The radial clearance between a communication antenna and its associated conductive mounting hardware and a supply line conductor shall be not less than the values given in the following Table:

(All voltages are phase-to-ground unless otherwise indicated)

Clearance of Line Conductor From:	0 to 600V	>600V to 69kV
Antenna ^{2,3,5}	12 in.	48 in.
Equipment case that supports or is adjacent to a communication antenna ⁴	6 in.	48 in.

NOTES:

Reference: NESC, 2017 Edition, Rule 235 I (Similar to)¹

1. These Ameren required clearances exceed NESC allowed minimum clearances.
2. Wide Area Network (WAN) antennas are located on the top of the AMI or AMR devices.
3. Local Area Network (LAN) antennas located on the bottom of the AMI or AMR devices shall have at least 40 inches vertical clearance to communication conductors.
4. Additional requirements for AMI or AMR devices:
 - a. The bottom of an ungrounded AMI or AMR device case shall have at least 40 inches vertical clearance to communication conductors. If the AMI or AMR device case is grounded and there is no downward oriented antenna, the vertical clearance to communication conductors may be reduced to 30 inches.
 - b. The top and bottom of the AMI or AMR device should be maintained a minimum of 4 inches from bolted connection points on the pole that are in the same plane as the AMI or AMR device. This is to allow access by Ameren personnel to the bolted connection.
 - c. AMI or AMR device cases shall be at least 6 inches from conductors 0 to 600V. AMI or AMR devices may be installed at any angle from secondary rack or clevis necessary to achieve required clearance.
 - d. Ameren requires a minimum of 30 inches from center of cross-arm to top of the AMI or AMR device or its antenna whichever is closer. Greater separation may be required to achieve required clearance from line conductors.
5. This DCS is applicable to antennas operated at a radio frequency of 3 kHz to 300 GHz.
6. Collectors (AMI) and MCCs (AMR) shall be effectively grounded.
7. Routers (AMI) are NOT effectively grounded.
8. AMI or AMR devices may be installed on transformer poles where there are no communication (telephone or CATV) attachments, and where clearance requirements to communications (if present) can be met.
9. AMI or AMR devices should not be installed on terminal poles, gang operated switch poles, capacitor poles, or voltage regulator poles. They may be installed on solid blade or fused switch poles as long as the AMI or AMR device does not interfere with safe operation of the switches.

Figures 1 thru 3 demonstrate most of the clearances described above.

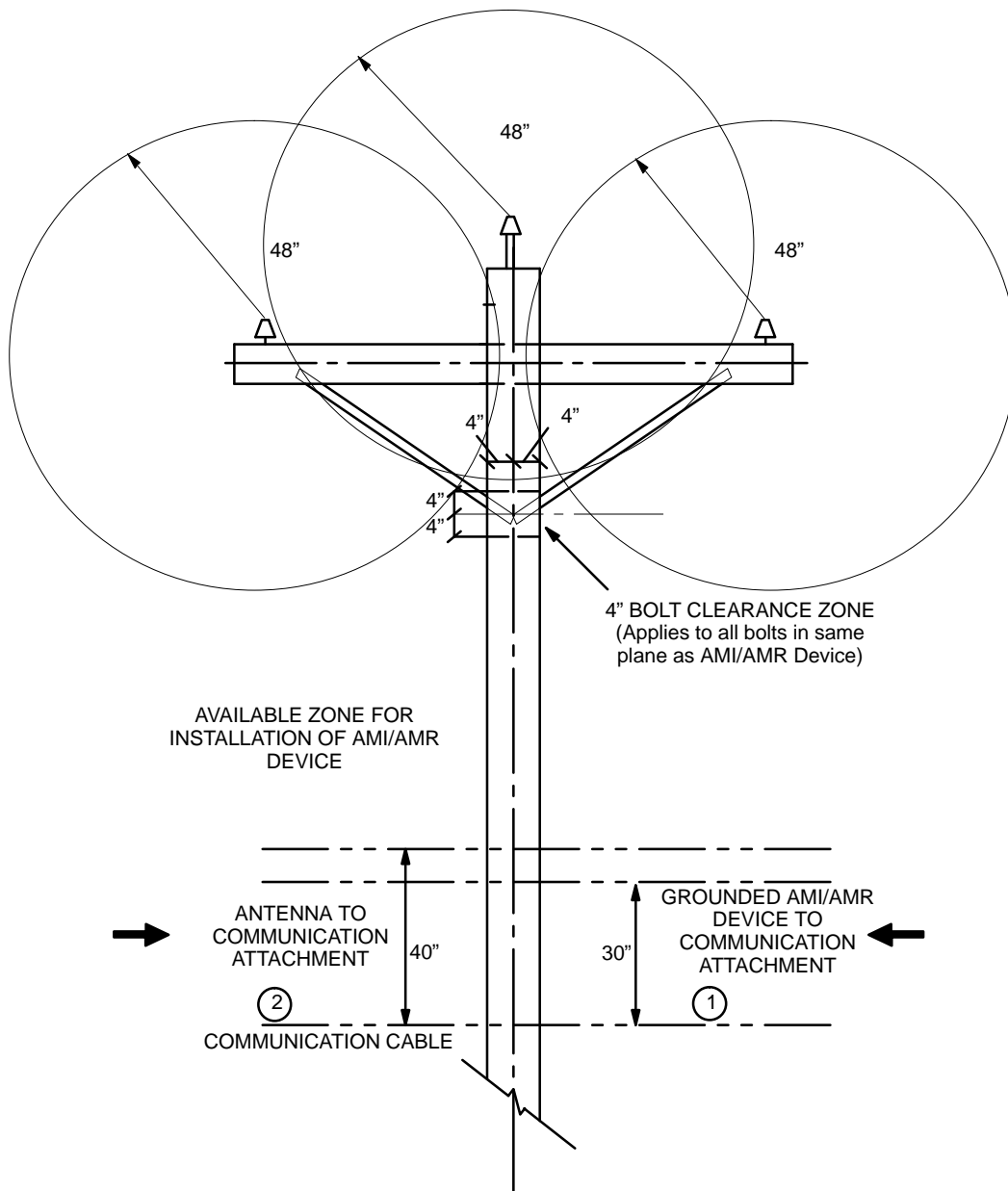


Figure 1: Antenna & AMI/AMR Device Supply Space Installation/Clearance Zone

FIGURE 1 NOTES:

1. If the AMI/AMR device case is NOT grounded, 40" minimum clearance to communication cable below must be provided to the device case.
2. Antennas located on the bottom of the AMI or AMR device shall have at least 40" vertical clearance to communication conductors.

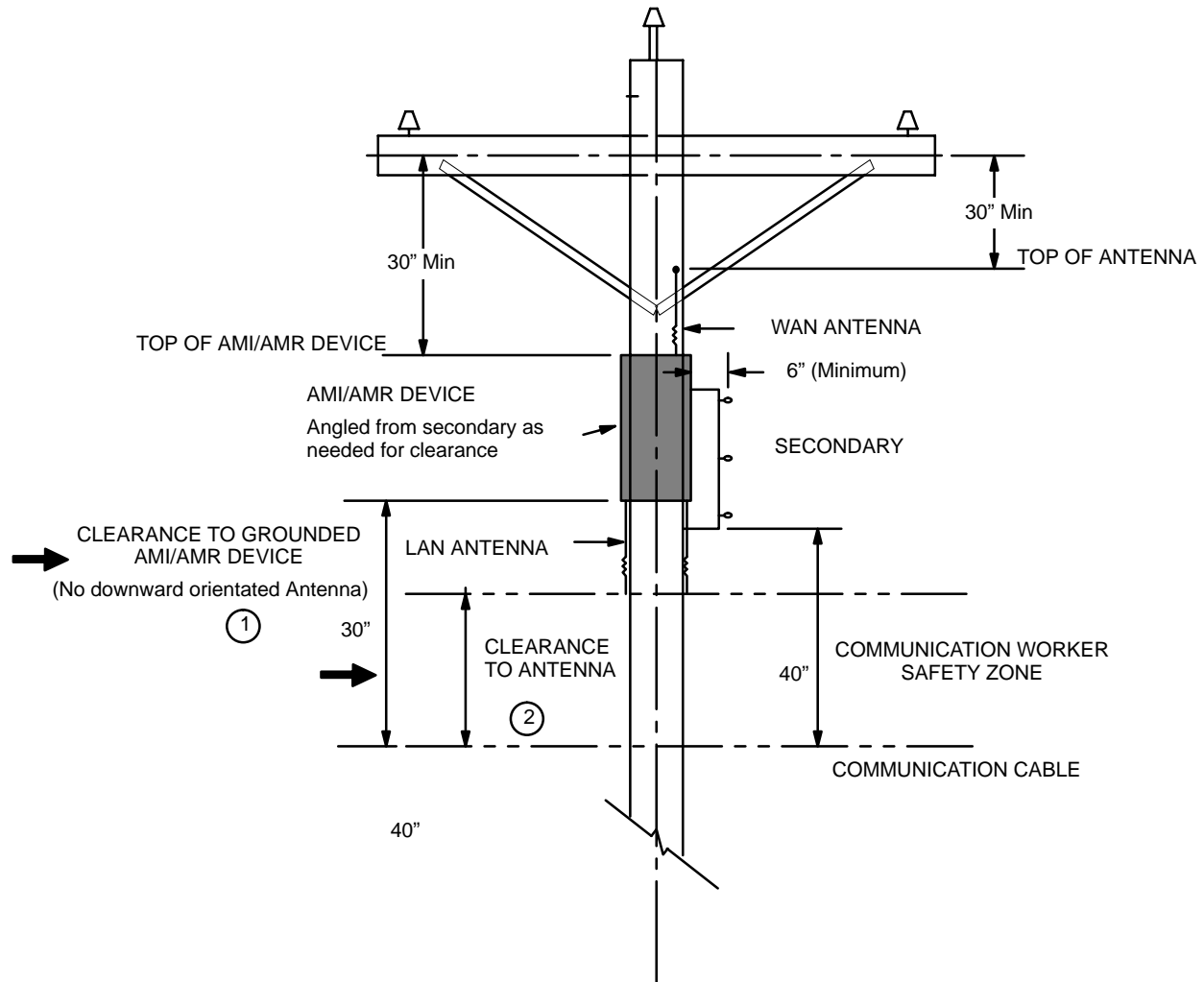


Figure 2: Antenna & AMI/AMR Device Clearances in 3-Phase Supply Space

FIGURE 2 NOTES:

1. If the AMI/AMR device case is NOT grounded, 40" minimum clearance to communication cable is required.
2. Antennas located on the bottom of the AMI or AMR device shall have at least 40" vertical clearance to communication conductors.

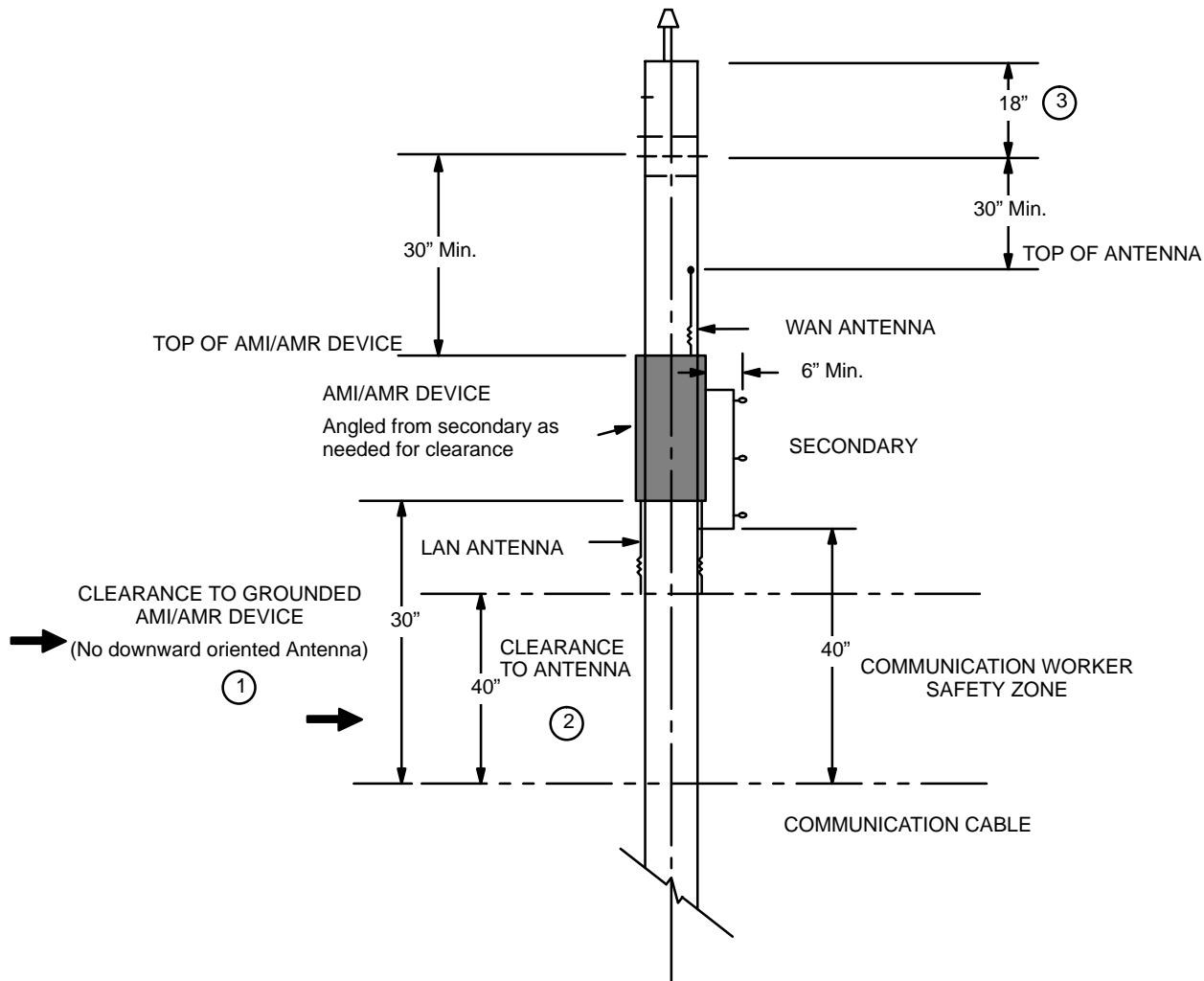


Figure 3: Antenna & AMI/AMR Device Clearances in 1-Phase Supply Space

FIGURE 3 NOTES:

1. If the AMI/AMR device case is NOT grounded, 40" minimum clearance to communication cable is required.
2. Antennas located on the bottom of the AMI or AMR device shall have at least 40" vertical clearance to communication conductors.
3. On single-phase pole lines where future addition of crossarm for adding additional phases is not reasonably expected, this dimension can be reduced to 6" (i.e., total of 36" from the pole top to the top of the antenna).

B. ANTENNAS LOCATED IN THE COMMUNICATION SPACE

Antennas located in the communication space shall be considered equipment for the purpose of determining minimum clearance requirements. See Figure 4. Also see DCS 29 00 17 11.

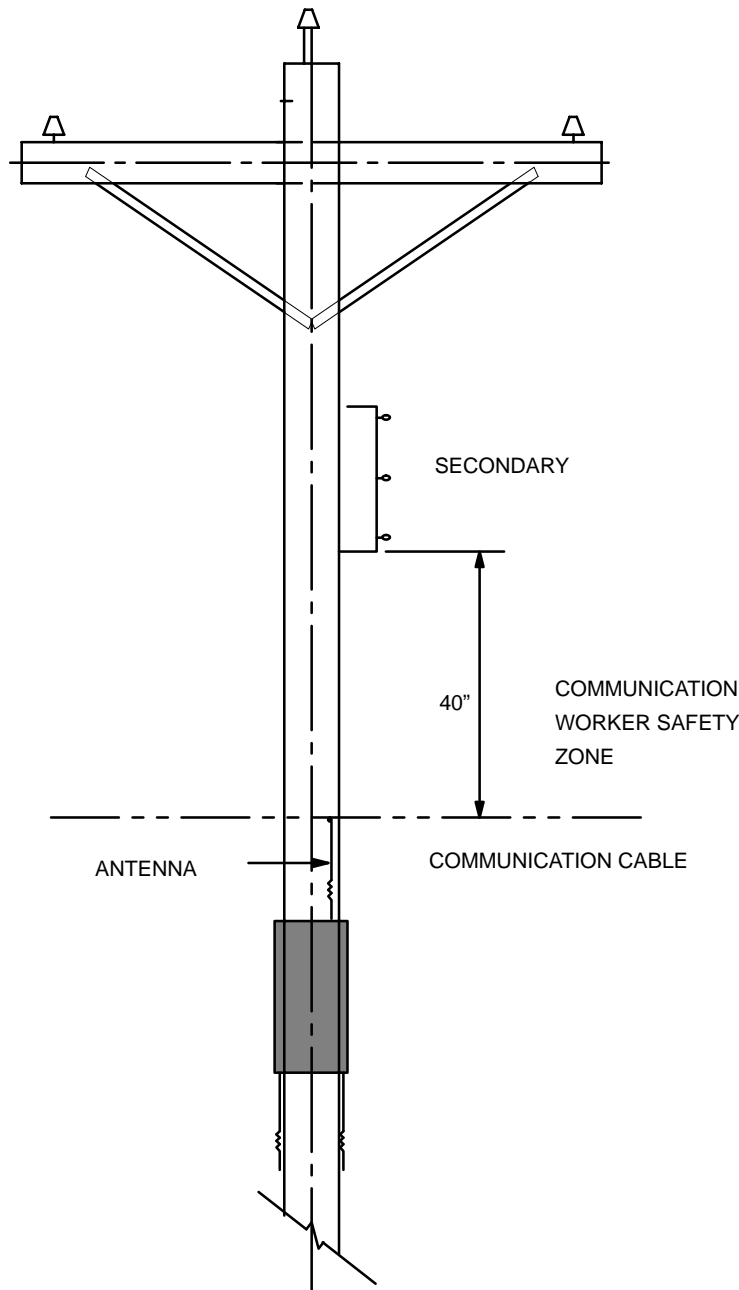
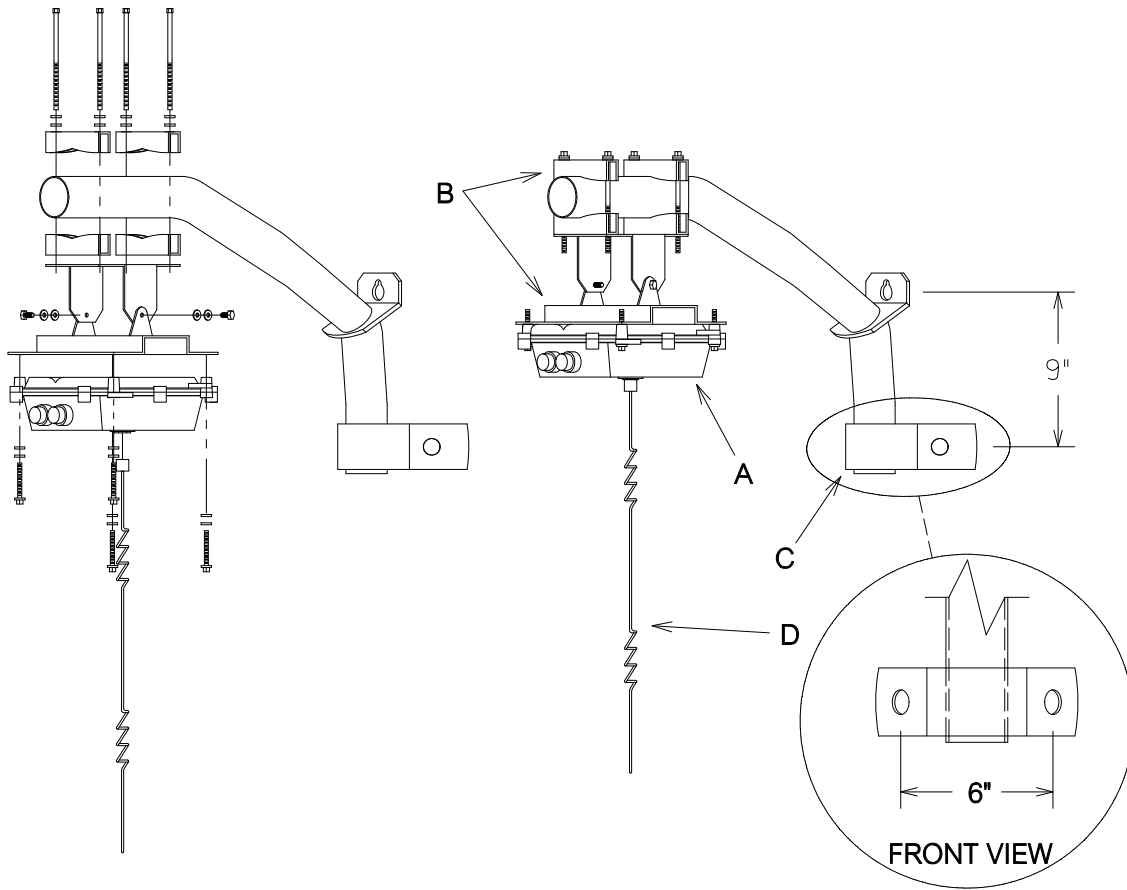


Figure 4: Antenna Clearance in Communication Space

FIGURE 4 NOTES:

- Reference: NESC, 2017 Edition, Rule 238



		Std./Stk. No.	Description	Qty.
1 @1,2,3 @1,3 @4	A	16 16 117	Router, Series, R6500, L&G #26-1730	1
	B	23 67 509	Mounting Kit, Router, Wood Pole Bracket, L&G#45-1081 rev AD	1
	C	38 01 417	Bracket, Wood Pole, 1-1/4" x 30"	1
	D	16 16 105	Antenna, 22" Whip, L&G #K1-6119-000	1

NOTES:

14. Initial deployment will be done using L&G Router Mounting Kit #45-1163 rev AB. This mounting kit includes the power cable assembly, wood pole bracket, and hardware for mounting the Router to the wood pole bracket. The antenna is provided with the Router.
15. The Router mounting kit may be preassembled for ease of installation on the wood pole bracket.
16. Assembly Instructions:
 - a. Slide a lock washer and a flat washer onto each of the two 3/8"-16 bolts and attach the swivel bracket to the mounting plate by threading these bolts into press nuts on the mounting plate.
 - b. Slide a lock washer and a flat washer onto each of the four 7" x 3/8"-16 bolts and thread these bolts through the clamps that go around the wood pole bracket mast. NOTE: To install the swivel bracket to the mast, open one side of the bracket to permit mast entry.
 - c. Hang the Router mount assembly off the mast and re-install the mast clamp bolts, taking care to keep the flat washer and lock washer on the mast clamp bolts with the lock washer closer to the head of the bolt.

AMI/AMR INSTALLATIONS
AMI Router Installations
AMI Router and Wood Pole Mounting Bracket

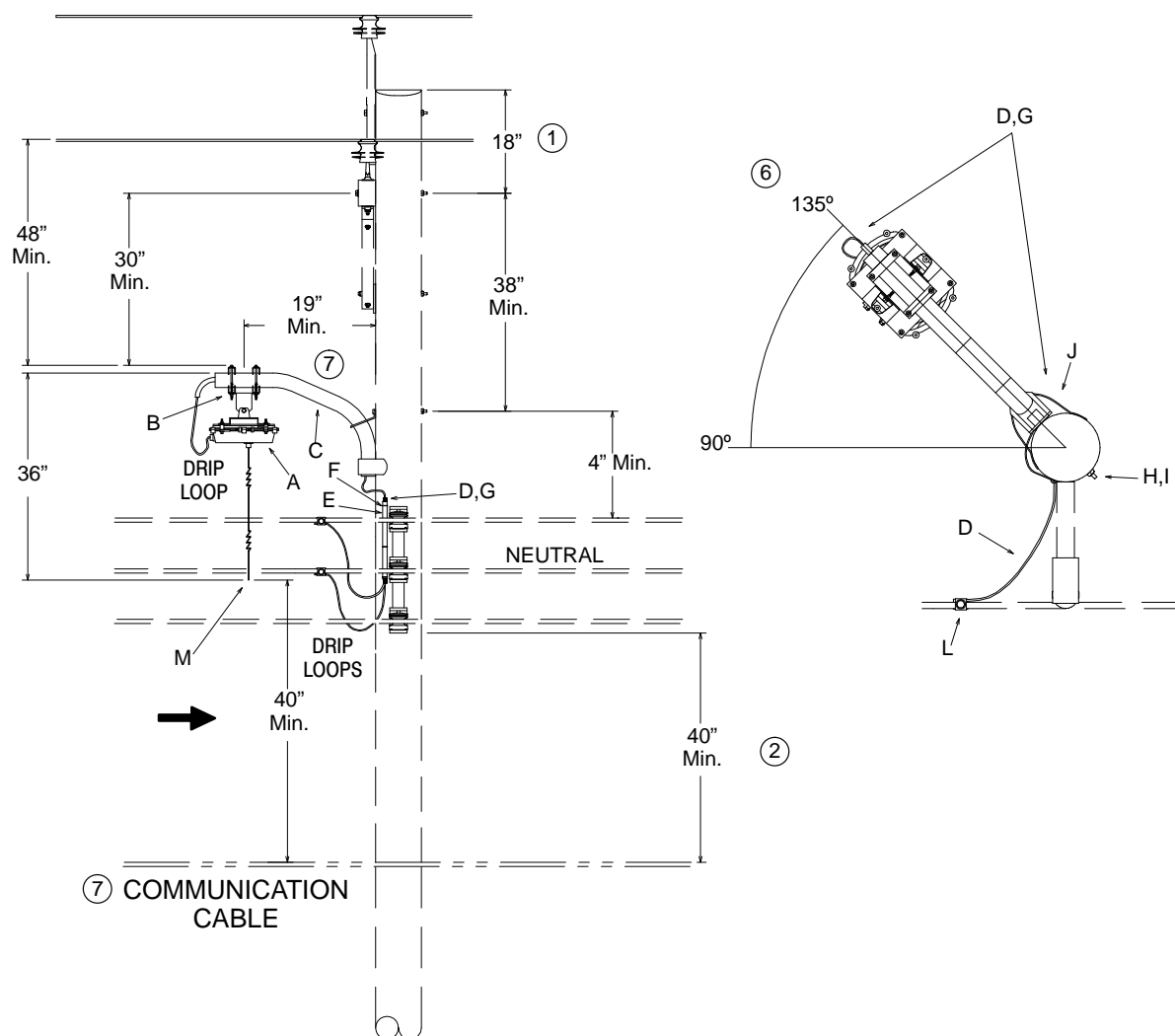
25 91 10 00

Sheet 2 of 2

- d. Install the antenna. Connect the terminated end of the Power Cable Assembly to the Router. The un-terminated end of the Power Cable Assembly is connected directly to the 120 Volt secondary.
 - e. As the mast clamps are tightened, align the Router so that the antenna does not exceed 5 degree off perpendicular to the ground.
 - f. Secure the power supply cable to the wood pole bracket using UV resistant cable ties and trim the excess length for a clean installation.
17. Antenna stock # 16 16 105 is for maintenance replacement if the antenna provided with the Router is damaged.

Wood Pole Mounting with Secondary Only

Sheet 1 of 2



AMI/AMR INSTALLATIONS
AMI Router Installations
Wood Pole Mounting with Secondary Only

25 91 10 01

Sheet 2 of 2

		Std./ Stk. No.	Description	Qty.
3 3 3 4	A	16 16 117	Router, Series R6500, L&G #26-1730	1
	B	23 67 509	Mounting Kit, Router, Wood Pole Bracket, L&G #45-1081 rev AD	1
	C	38 01 417	Bracket, Wood Pole, 1-1/4" x 30"	1
	D	18 57 111	Cable Assy., Router Power, 10 ft., L&G #105627-0000 rev AG	1
	E	41 56 041	Molding, 3/4" plastic	1
	F	23 64 028	Staple, for 3/4" plastic molding, Zn plated steel	7
	G	25 54 074	Guard, Cable, 1/2" Poly (ft)	5
	H	23 52 065	Bolt, Mach., 5/8" x 12"	1
	I	23 66 027	Washer, Square, 2-1/4"	1
	J	23 60 007	Screw, Lag, 1/2" x 4"	2
	L	17 51 032	Clamp, PG, 6-1/0 Main to 6-1/0 Tap	2
	M	16 16 105	Antenna, 22" Whip, L&G #K1-6119-000	1
@5,3				

NOTES

1. On single-phase pole lines where future addition of crossarm for adding additional phases is not reasonably expected, this dimension can be reduced to 6" (i.e., total of 44" from the pole top to the top mounting bracket bolt).
2. The 40" minimum applies to the secondary bracket or the Router cable drip loops whichever is lowest.
3. Initial deployment will be done using L&G Router Mounting Kit #45-1163 rev AB. This mounting kit includes the power cable assembly, wood pole bracket. The antenna is provided with the Router.
4. Cut Router cable molding to required length.
5. Antenna stock # 16 16 105 is for maintenance replacement if the antenna provided with the Router is damaged.
6. Mounting bracket is shown at 135 degrees from secondary rack but may be installed at any angle necessary to achieve required clearances as per DCS 25 90 00 00.
7. If there are no communications attachments on the pole, the mounting bracket may be installed below the secondary provided clearance requirements of DCS 25 90 00 00 and DCS 29 00 17 03 are met.

AMI/AMR INSTALLATIONS

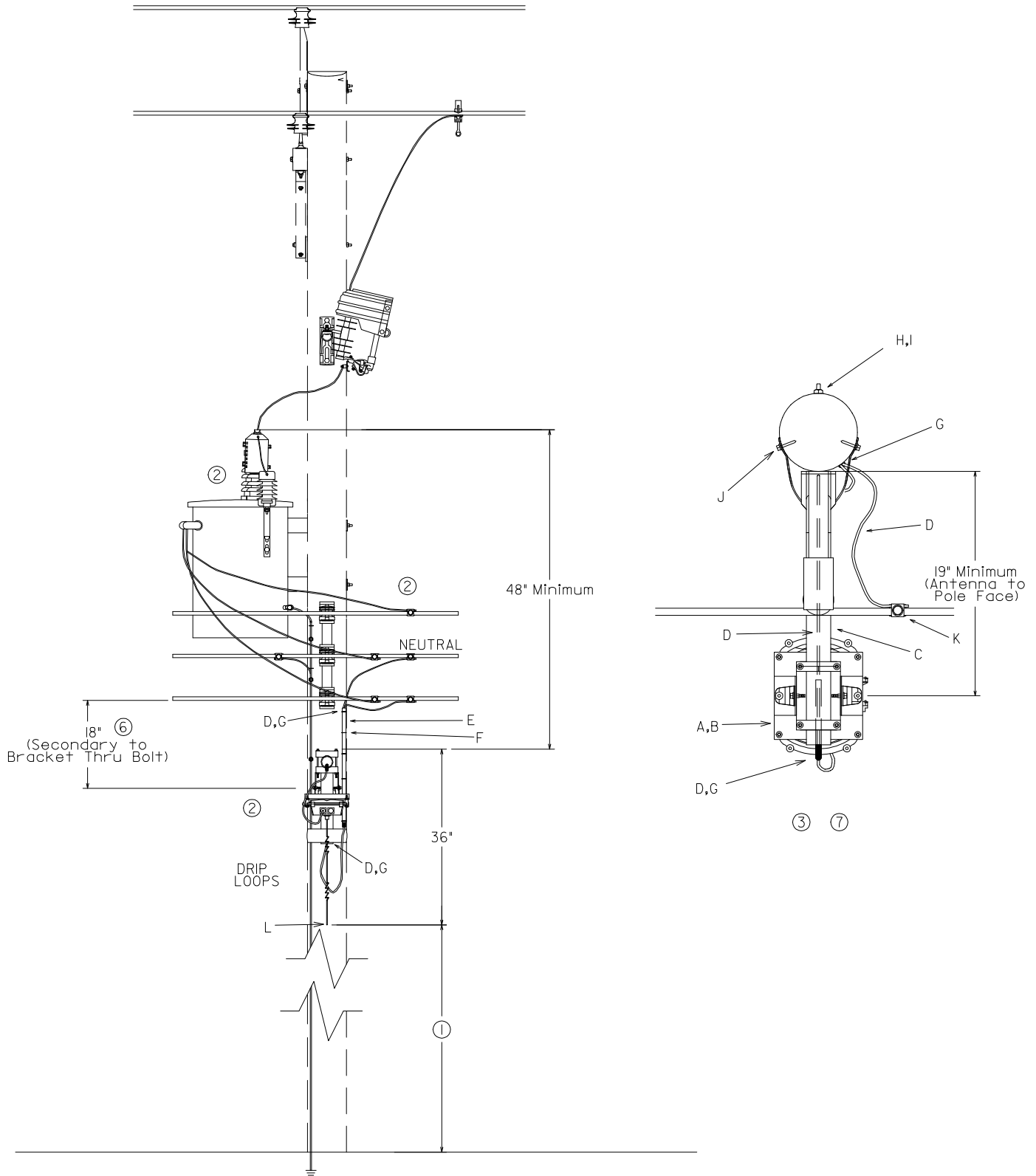
AMI Router Installations

Wood Pole Mounting with Transformer

25 91 10 02

Sheet 1 of 2

Routers may be installed on transformer poles where there are no communication (telephone or CATV) attachments, and where clearance requirements to communications (if present) can be met.



AMI/AMR INSTALLATIONS
AMI Router Installations
Wood Pole Mounting with Transformer

25 91 10 02

Sheet 2 of 2

		Std. / Stk. No.	Description	Qty.
3	A	16 16 117	Router, Series R6500, L&G #26-1730	1
	B	23 67 509	Mounting Kit, Router, Wood Pole Bracket, L&G #45-1081 rev AD	1
	C	38 01 417	Bracket, Wood Pole, 1-1/4" x 30"	1
3	D	18 57 111	Cable Assy., Router Power, 10 ft., L&G #105627-0000 rev AG	1
4	E	41 56 041	Molding, 3/4" plastic	1
	F	23 64 028	Staple, for 3/4" plastic molding, Zn plated steel	7
	G	25 54 074	Guard, Cable, 1/2" Poly (ft)	5
	H	23 52 065	Bolt, Mach., 5/8" x 12"	1
	I	23 66 027	Washer, Square, 2-1/4"	1
	J	23 60 007	Screw, Lag, 1/2" x 4"	2
	K	17 51 032	Clamp, PG, 6-1/0 Main to 6-1/0 Tap	2
	L	16 16 105	Antenna, 22" Whip, L&G #K1-6119-000	1
@3,5				

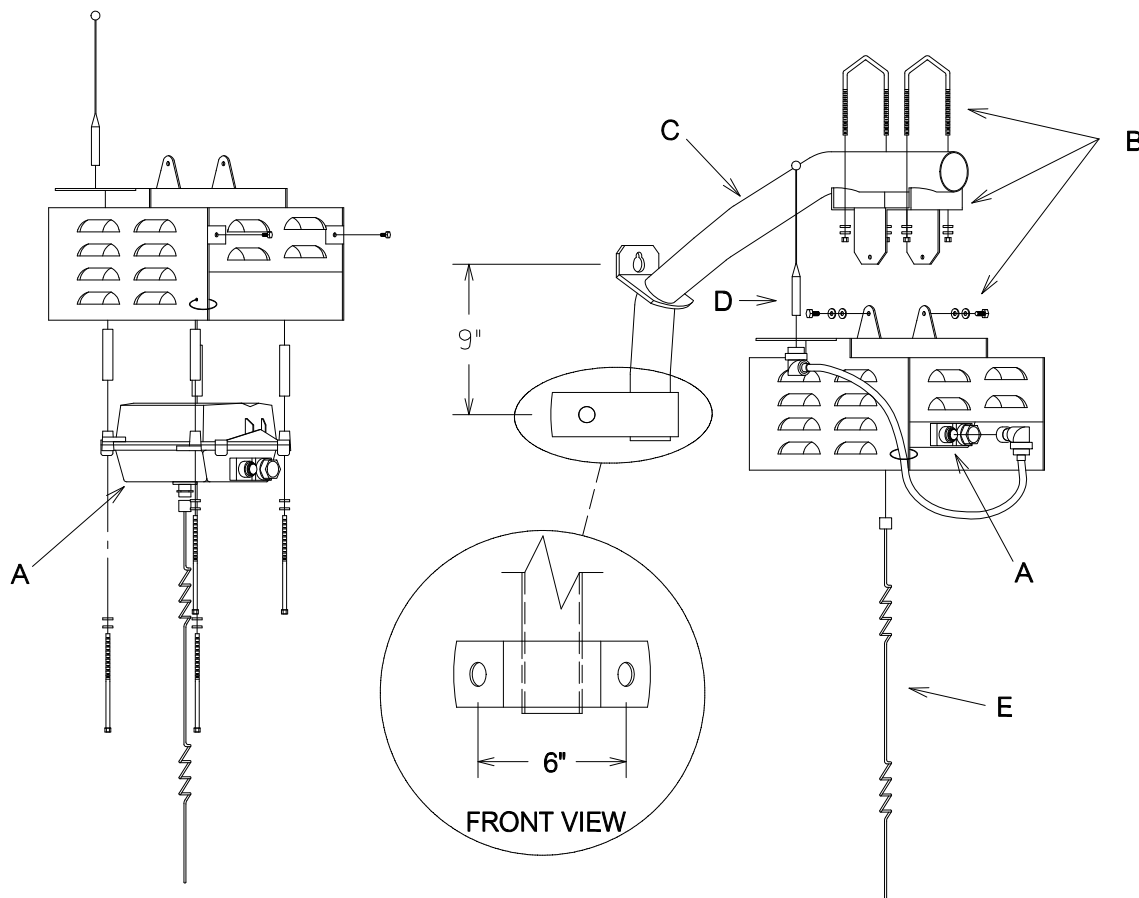
NOTES

1. See DCS **29 00 17 02** for minimum required ground clearance to bottom of antenna. Use clearances for 'Secondary & Service Conductors 0 to 750 Volts'.
2. If transformer is installed just to serve the Router and no secondary exists, the Router bracket can be mounted higher provided that a minimum of 48" radial clearance to any part of the Router (including antenna) is maintained from the transformer primary bushings and all other primary conductors.
3. Initial deployment will be done using L&G Router Mounting Kit #45-1163 rev AB. This mounting kit includes the power cable assembly and wood pole bracket. The antenna is provided with the Router.
4. Cut Router cable molding to required length.
5. Antenna stock # 16 16 105 is for maintenance replacement if the antenna provided with the Router is damaged.
6. 18" is recommended, but may be varied provided that the 6" minimum clearance from the secondary to the router mounting bracket is met and minimum ground clearance per note 1 is met.
7. Mounting bracket is shown at 0 degree from the secondary rack but may be installed at any angle necessary provided clearances in DCS **25 90 00 00** are met.

AMI/AMR INSTALLATIONS
AMI Collector Installations
AMI Collector and Wood Pole Mounting Bracket

25 91 20 00

Sheet 1 of 2



		Std. / Stk. No.	Description	Qty.
@1,5	A	16 13 877	Collector, C6500 Series, AT&T FAN, L&G #26-1676	1
		16 13 878	Collector, C6500 Series, Verizon FAN, L&G #26-1678	1
@1,2,3	B	23 67 508	Mounting Kit, Collector, Wood Pole Bracket, L&G #45-1264 rev AA	1
@1,3	C	38 01 417	Bracket, Wood Pole, 1-1/4" x 30"	1
@4	D	16 16 112	Antenna, Collector Modem, Gap: L&G Part #01-1311 rev AA	1
@4	E	16 16 105	Antenna, 22" Whip, L&G #K1-6119-000	1

NOTES:

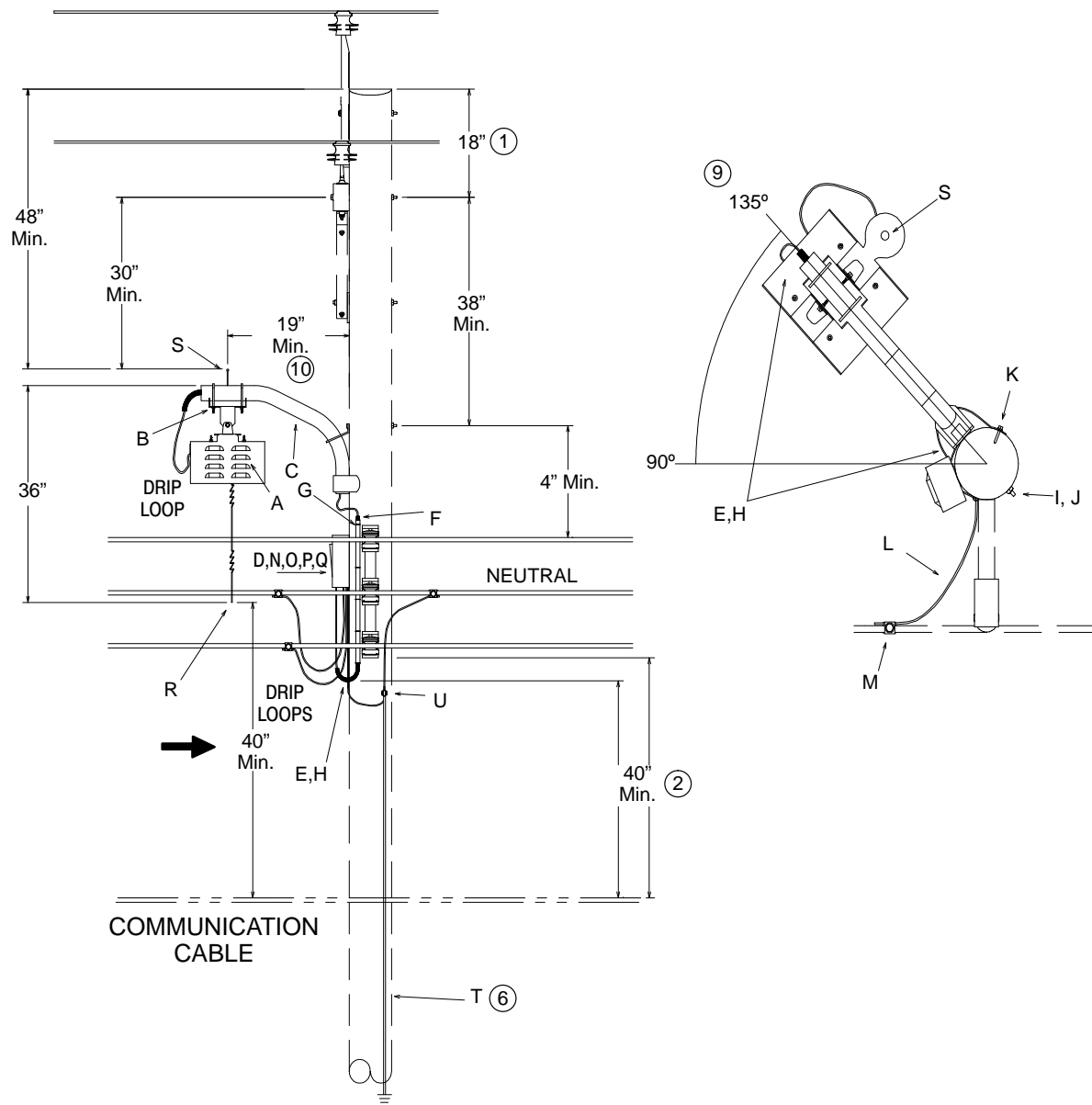
14. Initial deployment will be done using L&G Collector Mounting Kit #45-1144 rev AA. This mounting kit includes the power cable assembly, Collector enclosure, wood pole bracket, and hardware for mounting the router to the wood pole bracket. The antenna modem, modem cable, and antennas are provided with the Collector.

AMI/AMR INSTALLATIONS
AMI Collector Installations
AMI Collector and Wood Pole Mounting Bracket

25 91 20 00

Sheet 2 of 2

15. The Collector mounting kit may be preassembled for ease of installation on the wood pole bracket.
16. Assembly Instructions:
 - a. Attach the Collector to the Collector Enclosure using the bolts, spacers, washers, and lock washers included in the kit.
 - b. Insert two screws into the front of the bracket.
 - c. Attach Mounting Kit Bracket to the wood pole bracket using the V-bolts, washers, lock washers, and nuts included in the kit.
 - d. Attach the Collector Enclosure (containing the Collector) to the Mounting Kit Bracket using the hex head bolts, washers, and lock washers included in the kit.
 - e. Attach the Modem Cable Assembly directly to the Collector and the enclosure mounted antenna as follows:
 - i. Remove the hardware from the N-bulkhead connector of the modem cable.
 - ii. Secure the connector to the enclosure bracket with the hex nut provided in the kit.
 - iii. Attach the modem antenna to the N-bulkhead connector.
 - iv. Secure the modem cable to the enclosure with the cable tie provided in the kit.
 - f. Connect the terminated end of the Power Cable Assembly to the Collector. The un-terminated end of the Power Cable Assembly is connected in the junction/disconnect box on the pole (see DCS **25 91 50 02**).
17. Antenna stock #s 16 16 105 and 16 16 112 are for maintenance replacement if the antennas provided with the Collector are damaged.
18. Select Collector based on wireless communication network used in that area (AT&T or Verizon).



AMI/AMR INSTALLATIONS
AMI Collector Installations
Wood Pole Mounting with Secondary Only

25 91 20 01

Sheet 2 of 2

		Std. / Stk. No.	Description	Qty.
@8	A	16 13 877	Collector, C6500 Series, AT&T FAN, L&G #26-1676	1
		16 13 878	Collector, C6500 Series, Verizon FAN, L&G #26-1678	1
3	B	23 67 508	Mounting Kit, Collector, Wood Pole Bracket, L&G #45-1264 rev AA	1
3	C	38 01 417	Bracket, Wood Pole, 1-1/4" x 30"	1
5	D	40 78 038	Switch, 30A, Fused, Plug Type	1
3	E	18 57 113	Cable Assy., Collector Power, L&G #19-1332 rev AB	1
4	F	41 56 041	Molding, 3/4", Plastic	1
	G	23 64 028	Staple, 3/4" Plastic Molding, Zn Plated Steel	9
	H	25 54 074	Guard, Cable, 1/2" Poly (ft.)	5
	I	23 52 065	Bolt, Mach., 5/8" x 12"	1
	J	23 66 027	Washer, Square, 2-1/4"	1
	K	23 60 007	Screw, Lag, 1/2" x 4"	2
	L	18 57 104	Cable, St. Lt., #10, 2C, 1 - Black, 1 - White (ft.)	5
	M	17 51 032	Clamp, PG, 6-1/0 Main to 6-1/0 Tap	3
	N	16 08 301	Connector, Strain Relief (for St. Lt. Cable), 3 Wire	1
	O	16 08 303	Connector, Strain Relief (for Collector Cable)	1
	P	20 51 012	Fuse, 30A, 250V, Cartridge Type	1
	Q	40 59 039	Cartridge, Solid Neutral Fuse Slug, 30A, 250V	1
@7	R	16 16 105	Antenna, 22" Whip, L&G #K1-6119-000	1
@7	S	16 16 112	Antenna, Collector Modem, Gap: L&G Part #01-1311 rev AA	1
@6	T	12 00 10 **	Grounding Unit	1
	U	17 54 004	Connector, Elect., Split-Bolt, #4 Sol CU thru #8 Sol CU	1

NOTES

- On single-phase pole lines where future addition of crossarm for adding additional phases is not reasonably expected, this dimension can be reduced to 6" (i.e., total of 44" from the pole top to the top mounting bracket bolt).
- The 40" minimum applies to the secondary bracket or the Collector cable drip loops whichever is lowest.
- Initial deployment will be done using L&G Collector Mounting Kit #45-1144 rev AA. This mounting kit includes the power cable assembly, Collector enclosure, wood pole bracket, and hardware for mounting the router to the wood pole bracket. The antenna modem, modem cable and antennas are provided with the Collector
- Cut Collector cable molding to required length.
- See DCS **25 91 50 02** for Collector safety switch connection details.
- Use DCS **12 00 10 01** for ground coil application on new pole installation. Use DCS **12 00 10 02** for ground rod application on existing pole installation.
- Antenna stock #s 16 16 105 and 16 16 112 are for maintenance replacement if the antennas provided with the collector are damaged.
- Select Collector based on wireless communication network used in that area (AT&T or Verizon).
- Mounting bracket is shown at 135 degrees from secondary rack but may be installed at any angle necessary to achieve required clearances as per DCS **25 90 00 00**.
- If there are no communication attachments on the pole, the mounting bracket may be installed below the secondary provided clearance requirements of DCS **25 90 00 00** and DCS **29 00 17 03** are met.

AMI/AMR INSTALLATIONS

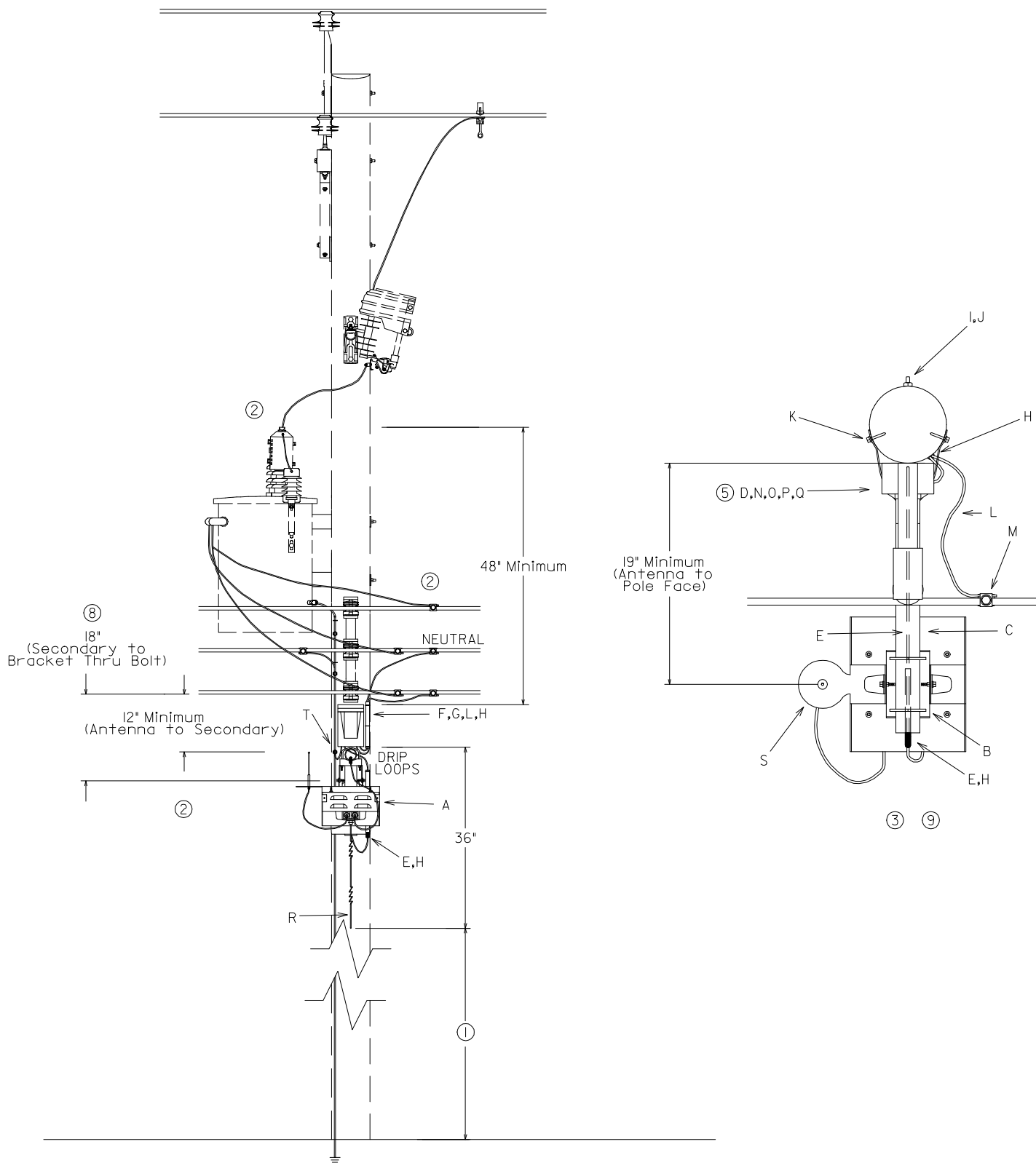
AMI Collector Installations

Wood Pole Mounting with Transformer

25 91 20 02

Sheet 1 of 2

C6500 Collectors may be installed on transformer poles where there are no communication (telephone or CATV) attachments, and where clearance requirements to communications (if present) can be met.



AMI/AMR INSTALLATIONS
AMI Collector Installations
Wood Pole Mounting with Transformer

25 91 20 02

Sheet 2 of 2

		Std. / Stk. No.	Description	Qty.
@7	A	16 13 877	Collector, C6500 Series, AT&T FAN, L&G #26-1676	1
		16 13 878	Collector, C6500 Series, Verizon FAN, L&G #26-1678	1
3	B	23 67 508	Mounting Kit, Collector, Wood Pole Bracket, L&G #45-1264 rev AA	1
3	C	38 01 417	Bracket, Wood Pole, 1-1/4" x 30"	1
5	D	40 78 038	Switch, 30A, Fused, Plug Type	1
3	E	18 57 113	Cable Assy., Collector Power, L&G #19-1332 rev AB	1
4	F	41 56 041	Molding, 3/4", Plastic	1
	G	23 64 028	Staple, for 3/4" Plastic Molding, Zn Plated Steel	3
	H	25 54 074	Guard, Cable, 1/2" Poly (ft.)	5
	I	23 52 065	Bolt, Mach., 5/8" x 12"	1
	J	23 66 027	Washer, Square, 2-1/4"	1
	K	23 60 007	Screw, Lag, 1/2" x 4"	2
	L	18 57 104	Cable, St. Lt., #10, 2C, 1 - Black, 1 - White (ft.)	5
	M	17 51 032	Clamp, PG, 6-1/0 Main to 6-1/0 Tap	3
	N	16 08 301	Connector, Strain Relief (for St. Lt. Cable), 3 Wire	1
	O	16 08 303	Connector, Strain Relief (for Collector Cable)	1
	P	20 51 012	Fuse, 30A, 250V, Cartridge Type	1
	Q	40 59 039	Cartridge, Solid Neutral Fuse Slug, 30A, 250V	1
@6	R	16 16 105	Antenna, 22" Whip, L&G #K1-6119-000	1
@6	S	16 16 112	Antenna, Collector Modem, Gap: L&G Part #01-1311 rev AA	1
	T	17 54 004	Connector, Elect., Split Bolt, #4 Sol CU thru #8 Sol CU	1

NOTES

1. See DCS 29 00 17 02 for minimum required ground clearance to bottom of antenna. Use clearances for Secondary & Service Conductors 0 to 750 Volts.
2. If transformer is installed just to serve the Collector and no secondary exists, the Collector bracket can be mounted higher provided that a minimum of 48" radial clearance to any part of the Collector (including the antennas) is maintained from the transformer primary bushings and all other primary conductors.
3. Initial deployment will be done using L&G Collector Mounting Kit #45-1144 rev AA. This mounting kit includes the power cable assembly, Collector enclosure, wood pole bracket, and hardware for mounting the router to the wood pole bracket. The antenna modem, modem cable, and antennas are provided with the collector.
4. Cut Collector cable molding to required length.
5. See DCS 25 91 50 02 for Collector safety switch connection details.
6. Antenna stock #s 16 16 105 and 16 16 112 are for maintenance replacement if the antennas provided with the Collector are damaged.
7. Select Collector based on wireless communication network used in that area (AT&T or Verizon).
8. 18" is recommended but may be varied provided that the 6" minimum clearance from the secondary to the Collector mounting bracket is met and minimum ground clearance per note 1 is met.
9. Mounting bracket and switch box are shown at 0 degrees from secondary rack but may be installed at any angle necessary to achieve required clearances as per DCS 25 90 00 00.

AMI/AMR INSTALLATIONS

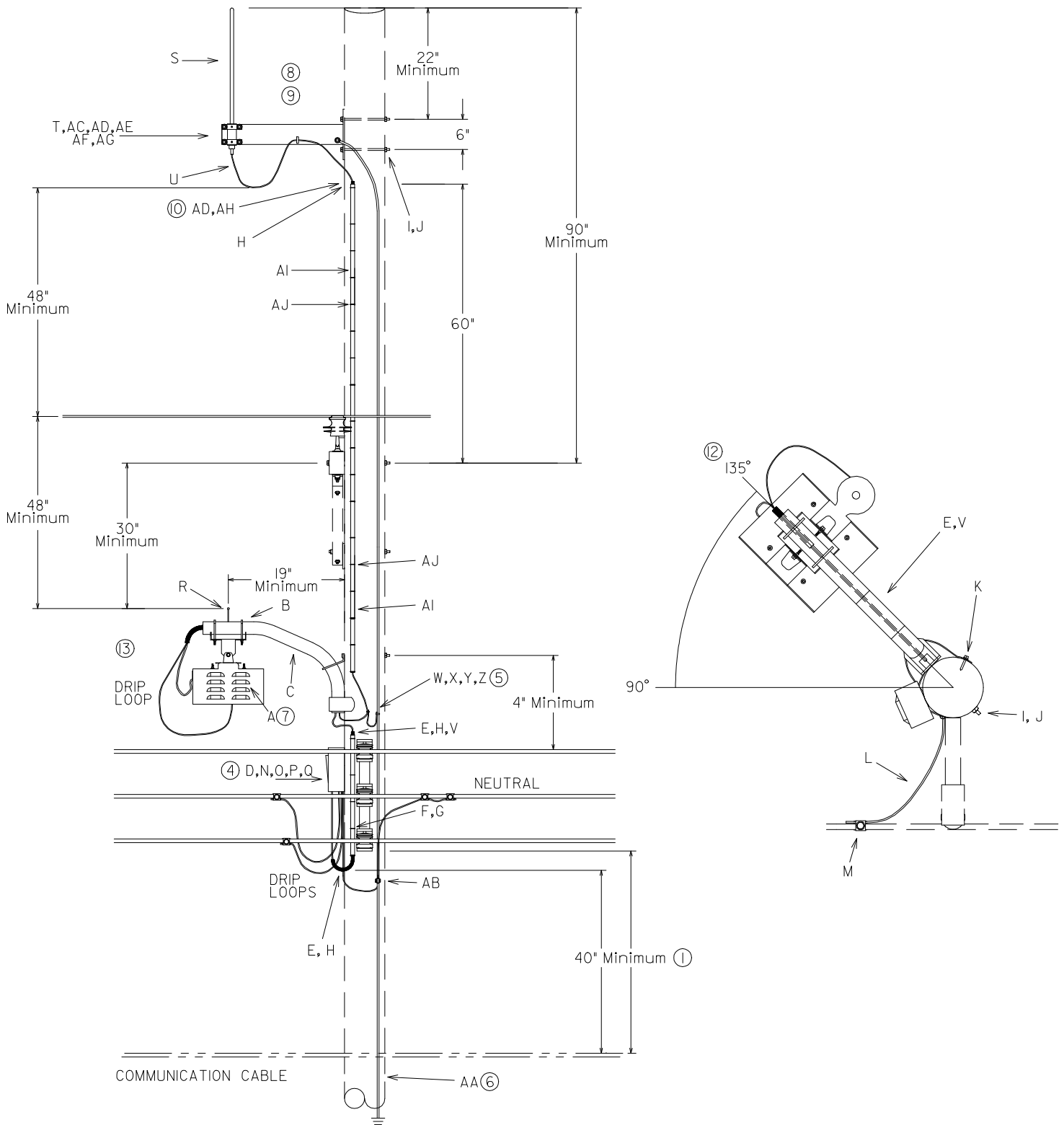
AMI Collector Installations

Single Pole-Top Antenna – Wood Pole Mounting

25 91 20 10

Sheet 1 of 3

C6500 Collector with WAN Antenna installed above Ameren primary conductors.



AMI/AMR INSTALLATIONS
AMI Collector Installations
Single Pole–Top Antenna – Wood Pole Mounting

25 91 20 10

Sheet 2 of 3

		Std. / Stk. No.	Description	Qty.
@7	A	16 13 877	Collector, C6500 Series, AT&T FAN, L&G #26–1676	1
		16 13 878	Collector, C6500 Series, Verizon FAN, L&G #26–1678	1
2	B	23 67 508	Mounting Kit, Collector, Wood Pole Bracket, L&G #45–1264 rev AA	1
2	C	38 01 417	Bracket, Wood Pole, 1–1/4" x 30"	1
4	D	40 78 038	Switch, 30A, Fused, Plug Type	1
2	E	18 57 113	Cable Assy., Collector Power, L&G #19–1332 rev AB	1
3	F	41 56 041	Molding, 3/4", Plastic	1
	G	23 64 028	Staple, for 3/4" Plastic Molding, Zn Plated Steel	4
	H	40 59 163	Guard, Cable, 1/2" Poly (ft.)	6
	I	23 52 065	Bolt, Mach., 5/8" x 12"	3
	J	23 66 027	Washer, Square, 2–1/4"	3
	K	23 60 007	Screw, Lag, 1/2" x 4"	2
	L	18 57 104	Cable, St. Lt., #10, 2C, 1–Black, 1–White (ft.)	5
	M	17 51 032	Clamp, PG, 6–1/0 Main to 6–1/0 Tap	3
	N	16 08 301	Connector, Strain Relief (for St. Lt. Cable), 3 wire	1
	O	16 08 303	Connector, Strain Relief (for Collector Cable)	1
	P	20 51 012	Fuse, 30A, 250V, Cartridge Type	1
	Q	40 59 039	Cartridge, Solid Neutral Fuse Slug, 30A, 250V	1
@11	R	16 16 112	Antenna, Collector Modem, Gap: L&G Part #01–1311 rev AA	1
	S	16 16 063	Antenna, Pole Top, 25 in. Tall, Laird Technology FG9023	1
	T	23 56 109	Bracket, Antenna, Pole Top, L&G #28–1315 rev AC	1
	U	16 16 120	Cable Assembly, Coax, 25' of LMR–400 Cable with Male Type N connectors on Both Ends	1
	V	16 16 119	Cable Assembly, Coax, 12' of LMR–400 Cable with Type N Connectors, Male On One End & Female on the Other End	1
5	W	10 01 250	Arrester, Antenna Coax Cable, Andrew Corp APT–NFM–DB	1
	X	18 66 375	Wire, #10, 7 Str., THHN, White (ft.)	4
	Y	17 55 834	Terminal Lug, Ring Type, #10 AWG to 1–Hole Flat	1
5	Z	25 54 053	Tape, Moisture Proofing, 3/4" x 30' x 0.03"	–
@6	AA	12 00 10 **	Grounding Unit	1
	AB	17 54 004	Connector, Elect., Split–Bolt, #4 Sol CU thru #8 Sol CU	2
	AC	17 51 032	Clamp, PG, #6 AWG–1/0 AWG	1
8,10	AD	23 67 510	Cleat, Cable, 3/8" Opening, Galvanized Steel with EDPM Cushion	4
8	AE	23 52 452	Bolt, Hex Head, 1/4" x 1–1/2", with Nut	1
8	AF	21 75 104	Washer, Round, 1/4", 0.260" ID x 11/16" OD	1
8	AG	21 75 021	Washer, Lock, 1/4"	1
10	AH	23 60 033	Screw, Lag, 1/4" x 2", w/ Preamsembled Washer & Gasket	3
3	AI	12 01 332	Conduit, Sch 80 PVC, 1" x 10'	2
	AJ	40 83 384	Strap, Conduit, 1–1/8", 2 Hole for 1/4" Bolt	11

NOTES

1. The 40" Minimum applies to the secondary bracket or the Collector cable loops whichever is lowest.

AMI/AMR INSTALLATIONS
AMI Collector Installations
Single Pole–Top Antenna – Wood Pole Mounting

25 91 20 10

Sheet 3 of 3

2. Initial deployment will be done using L&G Collector Mounting Kit #45–1144 rev AA. This mounting kit includes the power cable assembly, Collector enclosure, wood pole bracket, and hardware for mounting the router to the wood pole bracket. The antenna modem, modem cable, and antennas are provided with the Collector.
3. Cut cable molding and conduit to required length.
4. See DCS **25 91 50 02** for Collector safety switch connection details.
5. See DCS **25 91 50 03** for antenna arrester connection details. Cover arrester and arrester connections with as-needed length of moisture proofing tape stock # 25 54 053 and electrical tape stock # 25 53 055.
6. Use DCS **12 00 10 01** for ground coil application except increase the quantity of the 7#10 Copperweld poly covered ground wire by 5 feet.
7. Select Collector based on wireless communication network used in that area (AT&T or Verizon)
8. Add 3/8" cleat/cushion clamp to the antenna bracket to support the antenna cable. Drill hole in antenna bracket and install cleat/cushion clamp using a 1/4" x 1–1/2" bolt with 2 washers, a lock-washer, and nut.
9. Add PG clamp to the antenna bracket for grounding the bracket to the pole ground. Drill hole in antenna bracket and install the PG clamp using the 3/8" stud bolt of the connector.
10. Fasten the antenna cable to the pole at the entrances/exits of the protective U-guard using 3/8" cleat/cushion clamps and 1/4" x 2" lag screws.
11. Antenna stock # 16 16 112 is for maintenance replacement if the antenna provided with the Collector is damaged.
12. Mounting bracket is shown at 135 degrees from the secondary rack but may be installed at any angle necessary to achieve required clearances as per DCS **25 90 00 00**.
13. If there are no communications attachments on the pole, the mounting bracket may be installed below the secondary provided clearance requirements of DCS **25 90 00 00** and **29 00 17 03** are met.

AMI/AMR INSTALLATIONS

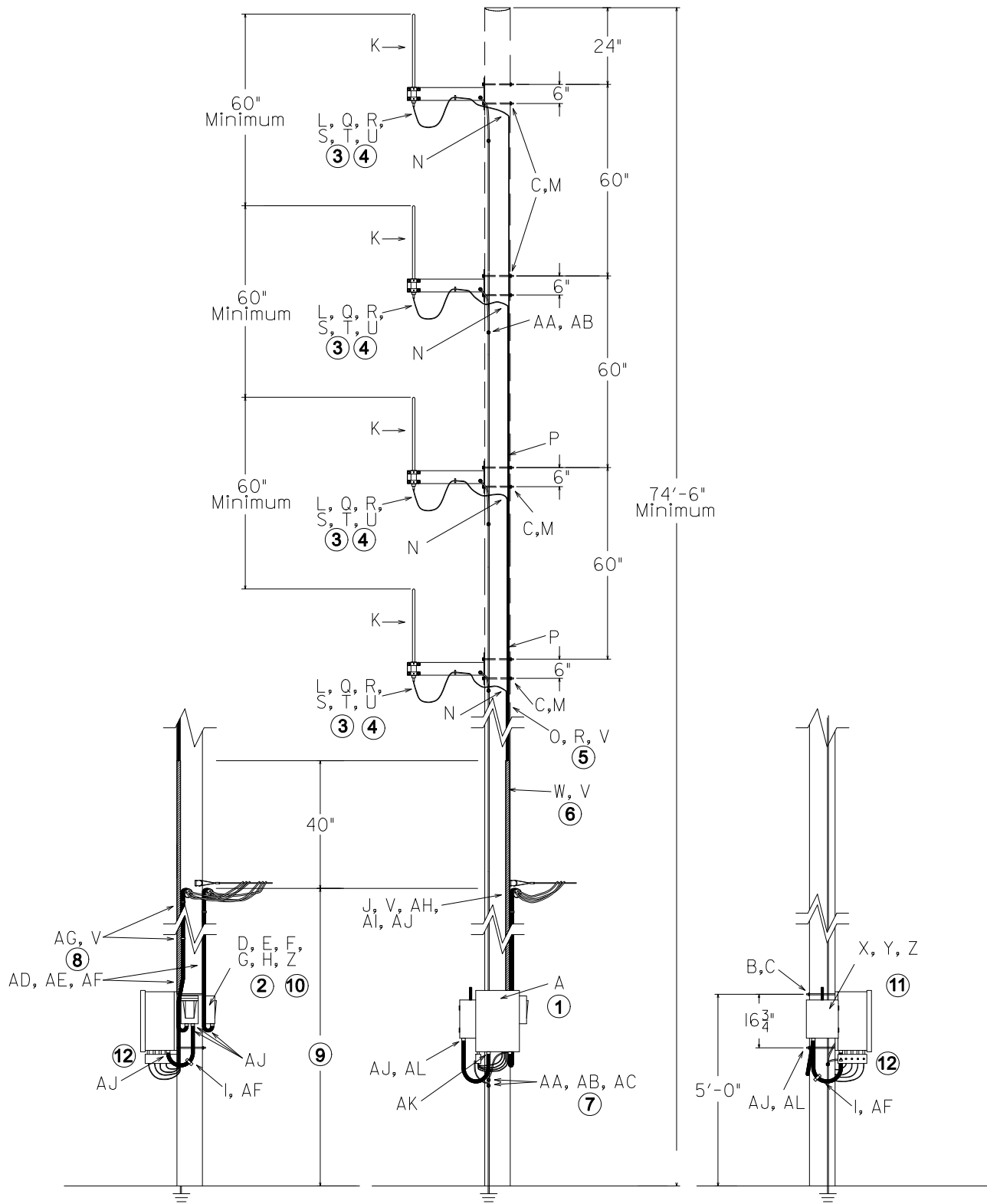
AMI Collector Installations

Four Pole-Top Antennas – Wood Pole Mounting

25 91 20 15

Sheet 1 of 3

C7500 Collector and WAN antennas installed on minimum 85 foot pole.



AMI/AMR INSTALLATIONS
AMI Collector Installations
Four Pole–Top Antennas – Wood Pole Mounting

25 91 20 15

Sheet 2 of 3

		Std. / Stk. No.	Description	Qty.
1,11	A	16 13 879	Collector, L&G C7500 Series	1
	B	23 52 069	Bolt, Mach., 5/8" x 18" (with Nut)	2
	C	23 66 027	Washer, Square, 5/8", 2–1/4" x 2–1/4" x 3/16" Thick	12
2,10	D	40 78 038	Switch, 30A, Fused, Plug Type	2
	E	20 51 012	Fuse, 30A, 250V, Cartridge Type	2
	F	40 59 039	Cartridge, Solid Neutral Fuse Slug, 30A, 250V	2
	G	16 08 301	Connector, Strain Relief, (for #10), 3 Wire	2
	H	16 08 303	Connector, Strain Relief, (for Collector Cable)	2
	I	18 57 113	Cable Assy., Collector Power, L&G #19–1332 rev AB	2
3,4	J	17 51 032	Clamp, PG, 6–1/0 Main to 6–1/0 Tap	6
	K	16 16 063	Antenna, Pole Top, 25 in. Tall, Laird Technology FG9023	4
	L	23 56 109	Bracket, Antenna, Pole Top, L&G #28–1315 rev AC	4
	M	23 52 065	Bolt, Mach., 5/8" x 12" (with Nut)	8
	N	16 16 119	Cable Assembly, Coax, 12' of LMR–400 Cable with Type N connectors, Male on One End & Female on the Other End	4
	O	16 13 849	Cable, Helix Coax Cable, CommScope FSJ4–50B (ft.)	210
4	P	16 16 015	Connector, Coax Cable, 1/2", N Male, CommScope F4PNMV2–HC	8
	Q	17 51 032	Clamp, PG, #6 AWG–1/0 AWG	4
	R	23 67 510	Cleat, Cable, 3/8" Opening, Galvanized Steel with EDPM Cushion	128
3,5	S	23 52 452	Bolt, Hex Head, 1/4" x 1–1/2", with Nut	4
	T	21 75 104	Washer, Round, 1/4", 0.260" ID x 11/16" OD	8
	U	21 75 021	Washer, Lock, 1/4"	4
	V	23 60 033	Screw, Lag, 1/4" x 2", w/ Preassembled Washer & Gasket	138
	W	17 59 112	U–Guard, 1–1/8" WD x 10' LGH x 13/16" DP 3/4" Flange	1
	X	40 54 484	Enclosure, Modem, 6" x 10" x 12"	1
6	Y	16 08 304	Modem, Vanguard 3000, CalAmp140–7230–000–A	1
	Z	22 13 197	Lock, Pad, Combination, 5/16" Diam x 1" WD x 2–1/4" Tall	3
	AA	18 51 021	Wire, Copper, #6 SD Poly Covered (ft)	9
10	AB	17 54 004	Connector, Elect., Split–Bolt, #4 Sol CU thru #8 Sol CU	7
	AC	12 00 10 **	Grounding Unit	1
	AD	18 66 374	Wire, Copper, #10 THHN, Black (ft)	100
@7	AE	18 66 375	Wire, Copper, #10 THHN, White (ft)	50
	AF	40 52 398	Conduit, 1", Type EF, Liquidtight Metal (ft)	70
	AG	40 83 093	Clamp, Conduit Support, 1", 2–Hole	18
8	AH	40 53 621	Clamp, Conduit Support, 1–1/4", 2–Hole	2
8	AI	40 53 950	Cap, Service Entrance, 1", Threaded	2
	AJ	40 52 104	Fitting, Conduit, 1", Straight	9
	AK	40 52 105	Fitting, Conduit, 1", 90 Degree	1
	AL	40 73 353	Knockout Reducing Washer, 1–1/4" x 1"	2

NOTES

1. C7500 Collector comes with 4 radios, controller/communication interface, power supply, batteries, RF filters, modem, modem housing, coaxial cable and cable connectors, flex conduit for coaxial, power, & telco cables,

DISTRIBUTION
CONSTRUCTION STANDARDS



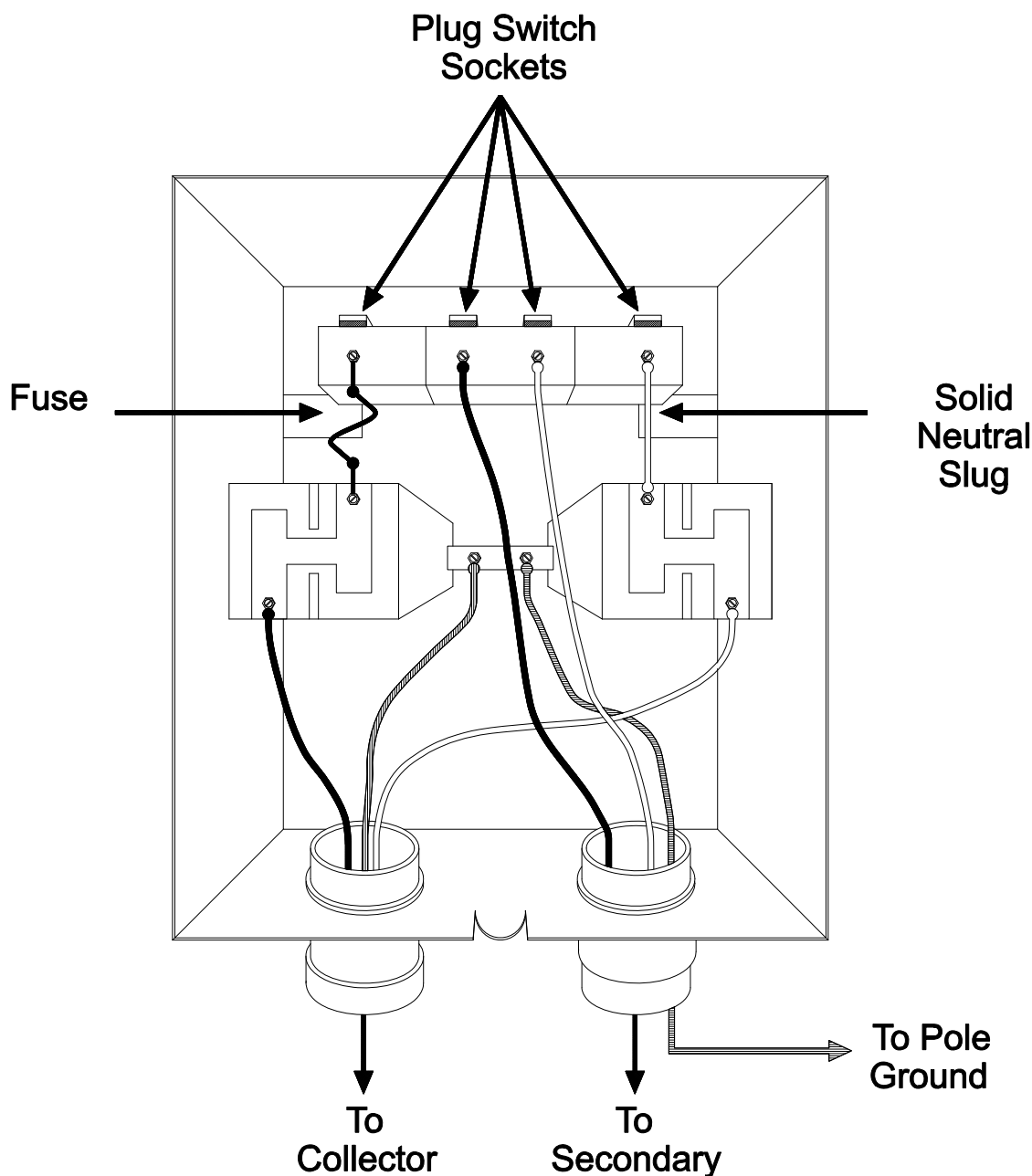
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REV. DATE: 11/06/15

AMI/AMR INSTALLATIONS
AMI Collector Installations
Four Pole–Top Antennas – Wood Pole Mounting

25 91 20 15

Sheet 3 of 3

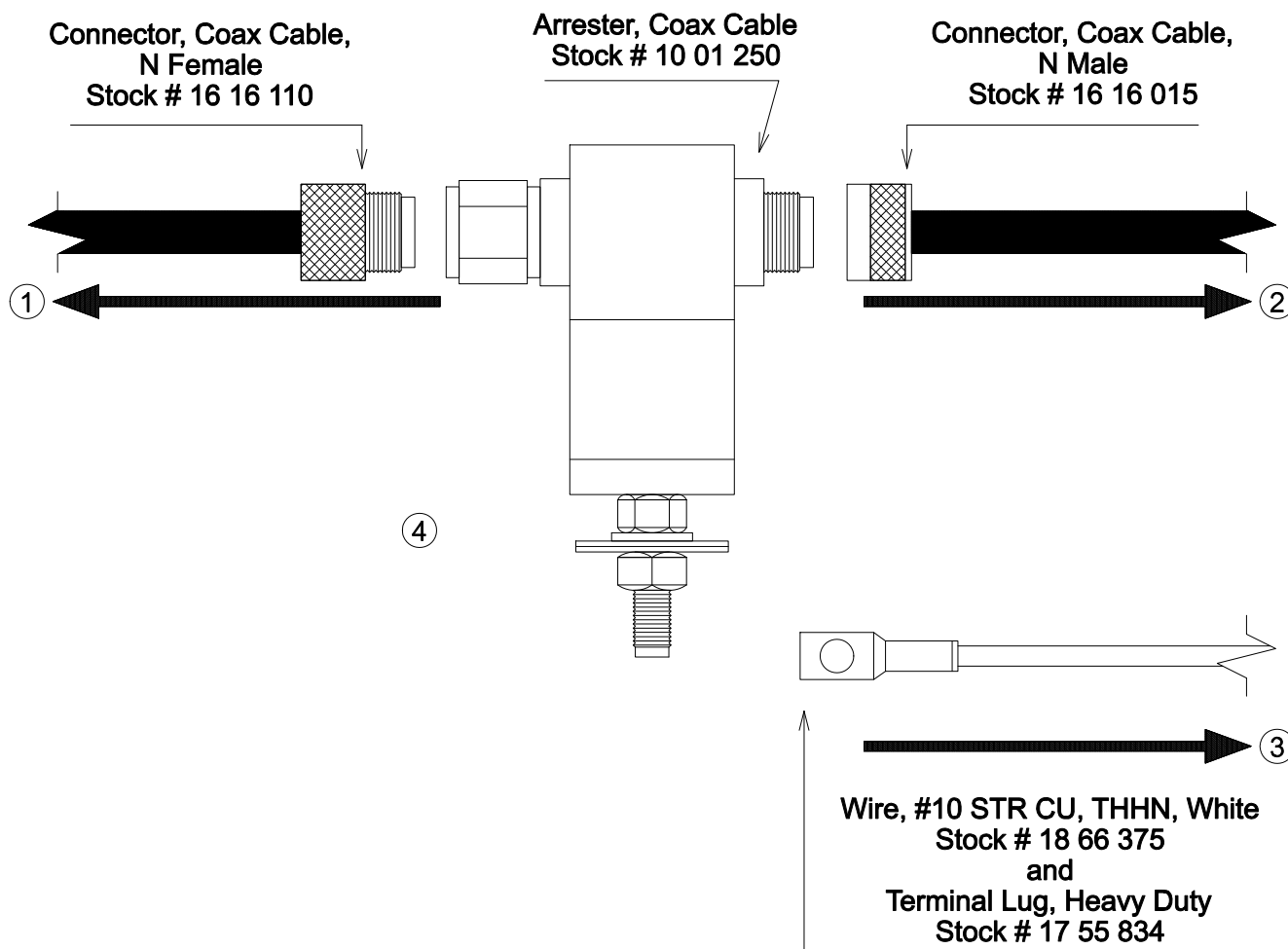
- conduit fittings, power disconnect, miscellaneous tape, wraps, etc., NEMA enclosure, lag bolts or adjustable enclosure mounting bands, and 4 antenna surge arresters with copper grounding plate.
2. See DCS **25 91 50 02** for Collector safety switch connection details.
 3. Add 3/8" cleat/cushion clamp to each antenna bracket to support the antenna cable. Drill hole in antenna bracket and install cleat/cushion clamp using a 1/4" x 1-1/2" bolt with 2 washers, a lock-washer, and nut.
 4. Add PG clamp to each antenna bracket for grounding the bracket to the pole ground using #6 copper wire. Drill hole in antenna bracket and install the PG clamp using the 3/8" stud bolt of the connector.
 5. Fasten the antenna cable to the pole approximately every 2 feet using 3/8" cleat/cushion clamps and 1/4" x 2" lag screws.
 6. U-guard must extend 40" minimum above the service entrance conductor.
 7. Use DCS **12 00 10 09** for ground coil application except increase the quantity of the 7#10 Copperweld poly covered ground wire by 5 feet.
 8. Install 1-1/4" conduit support clamps at each weatherhead. Install 1" cable clamps 1' from each cable entrance and exit and then one every 3'.
 9. Height of service attachment and weatherheads must meet clearance requirements given in DCS **29 00 17 02**.
 10. Drill out lock-holes of the two disconnect switch boxes to accept shank of the Ameren standard telecommunication device security pad lock.
 11. Use a nylon tie to secure the C7500 enclosure key inside the cell box enclosure.
 12. See DCS **25 91 50 03** for antenna arrester connections, with exception in this installation that the arrester grounds are connected directly to the bare copper ground bar provided with the C7500 Collector. Coat the C7500 arrester ground bar and any ground level bare copper ground wires with gray paint (stock # 30 51 520) to deter theft.



Switch, 30A, Fused, Plug Type - C6500/C7500 Collector Wiring
Switch Stock # 40 78 038

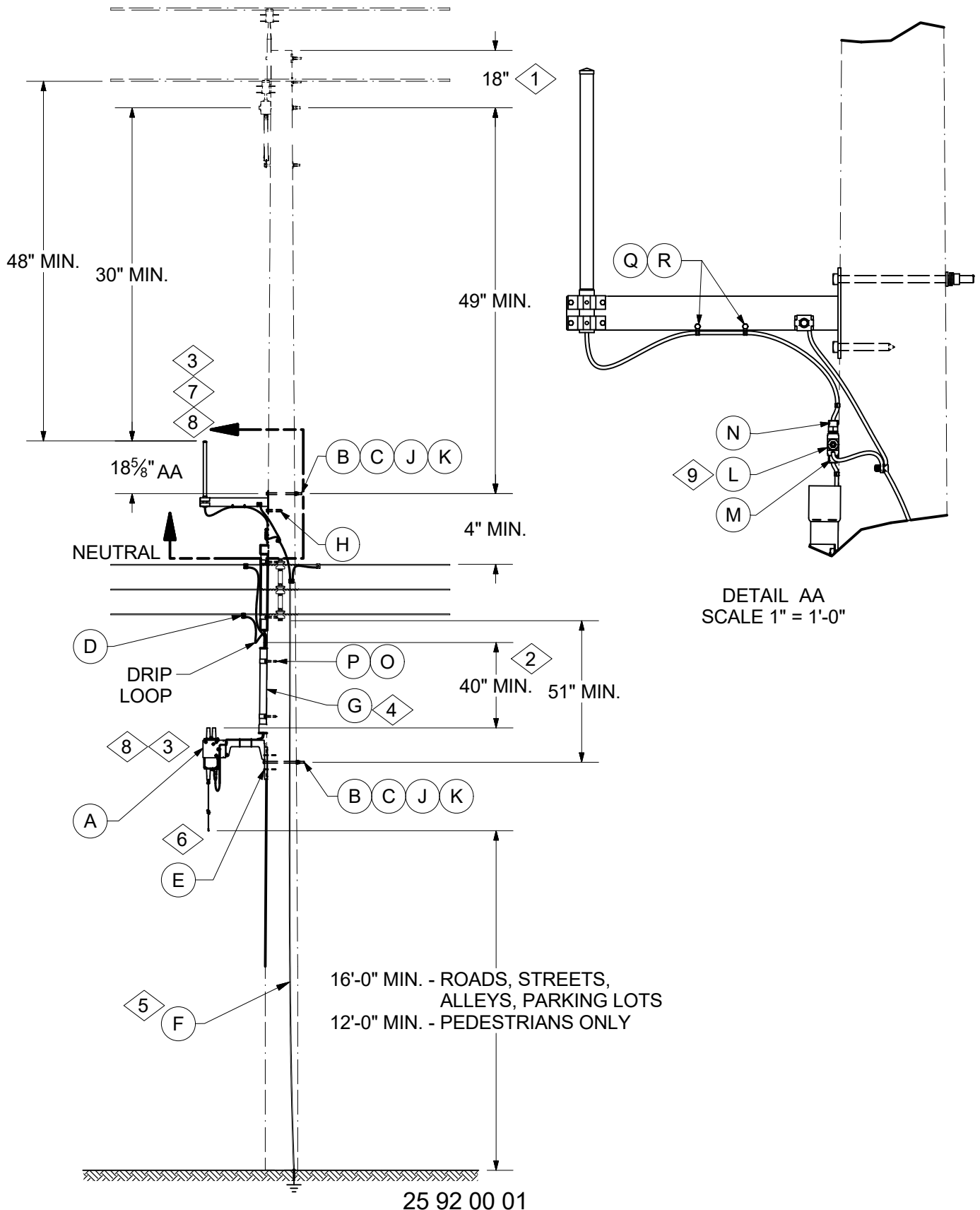
NOTES

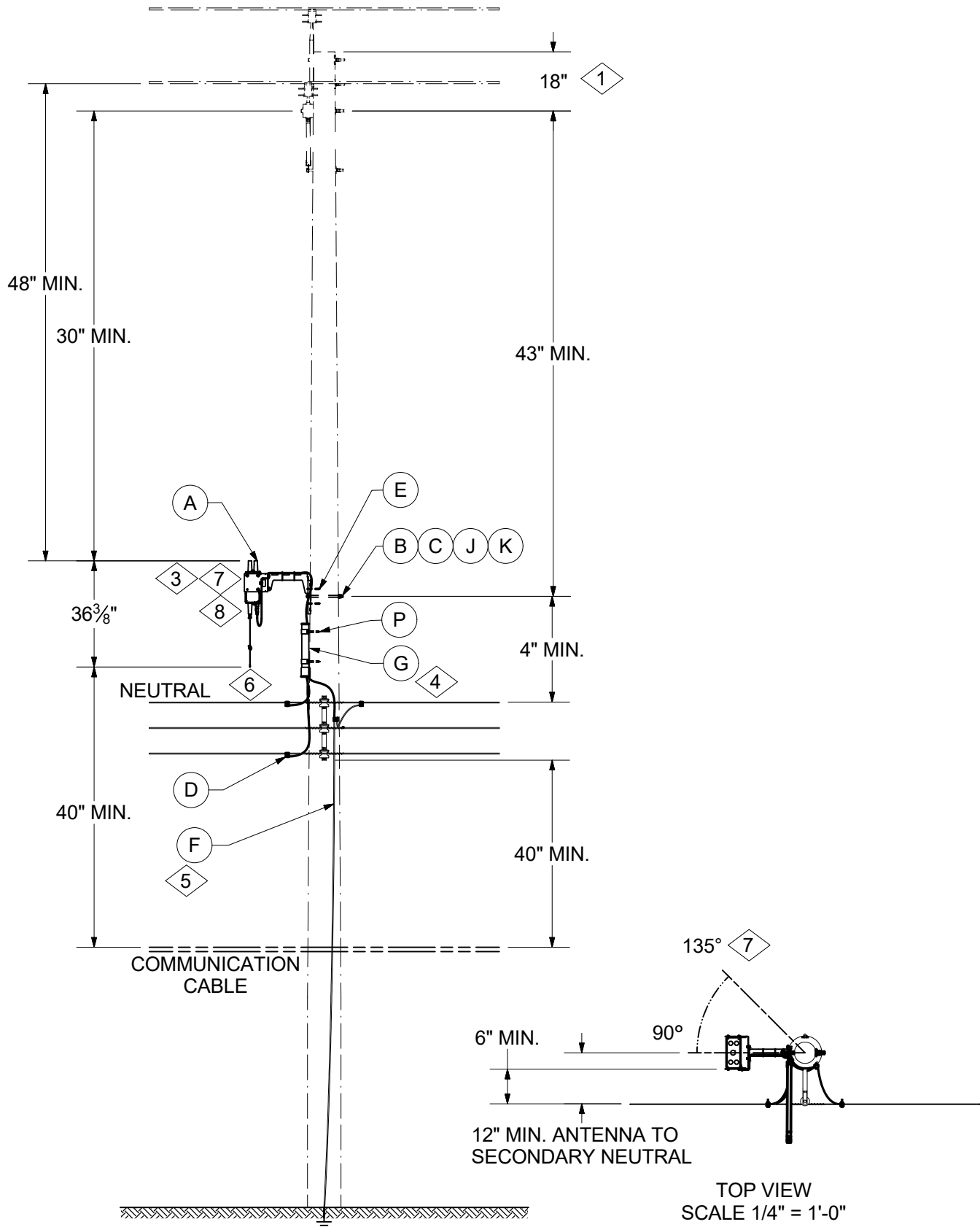
1. Use #6 SD CU (stock # 18 51 021) to bond safety switch box to pole ground. There must be a pole ground on poles where Collectors are installed.
2. Collector and secondary wire entrances can be reversed as needed for best wire/conduit arrangement on the pole.



NOTES

1. This end of the coax cable goes to the collector where it is terminated on that end with a male N connector stock # 16 16 015. If 12' coax cable assembly stock # 16 16 119 is used, connectors are pre-installed on both ends.
2. This end of the coax cable goes to the pole-top antenna where it is terminated on that end with a male N connector stock # 16 16 015. If 25' coax cable assembly stock # 16 16 120 is used, connectors are pre-installed on both ends.
3. Arrester ground wire connects to the pole ground. There must be a pole ground on poles where collectors are installed.
4. Cover the arrester and arrester connections with moisture proofing tape stock # 25 54 053 with overwrapping of electrical tape stock # 25 53 055.





25 92 00 02



SMART METER INSTALLATIONS

Smart Meter Network Gateway Installations
Wood Pole Mounting with Secondary Only

25 92 00 **

3 of 3

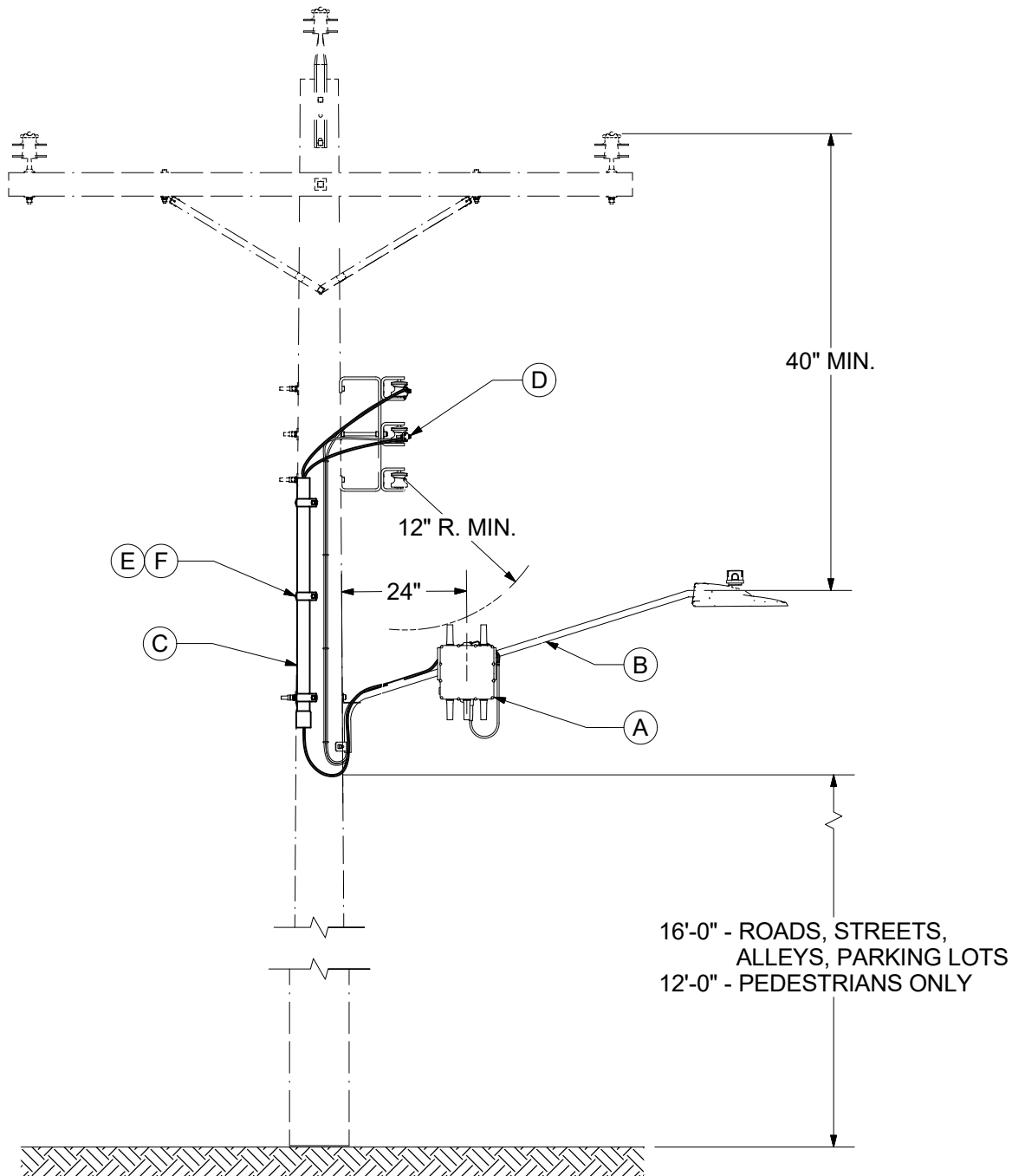
CONSTRUCTION NOTE(s):

1. On single-phase pole lines where future addition of crossarm for adding additional phases is not reasonably expected, this dimension can be reduced to 6" (e.g., total of 55" from the pole top to the top antenna mounting bracket bolt for 25 92 00 01).
2. The 40" minimum applies to the secondary bracket or the Gateway cable drip loops whichever is lowest.
3. Initial deployment will be done using L&G Gateway Mounting Kit. This mounting kit includes the power cable assembly, Gateway device, wood pole bracket, and hardware for mounting the Gateway device to the wood pole bracket. It also includes the antenna, antenna cable, and antenna mounting bracket.
4. Cut Gateway device and antenna cable molding to required length.
5. Use DCS 12 00 10 01 for ground coil application on new pole installation. Use DCS 12 00 10 02 for ground rod application on existing pole installation.
6. Antenna stock #16 16 105 is for maintenance replacement if the whip antenna provided with the Gateway device is damaged.
7. Mounting bracket may be installed at any angle necessary to achieve required clearances as per DCS 25 90 00 00.
8. Every antennae and Gateway needs to be installed at the minimum height as specified by the AMI designer for that location. Install replacement at as found height.
9. Gateway Device will be grounded to the neutral wire. The primary method to ground the remote antennae is through the lightning arrestor which will be attached to the ground wire (if damaged or not present on the pole, the device will be grounded by attaching to the neutral).

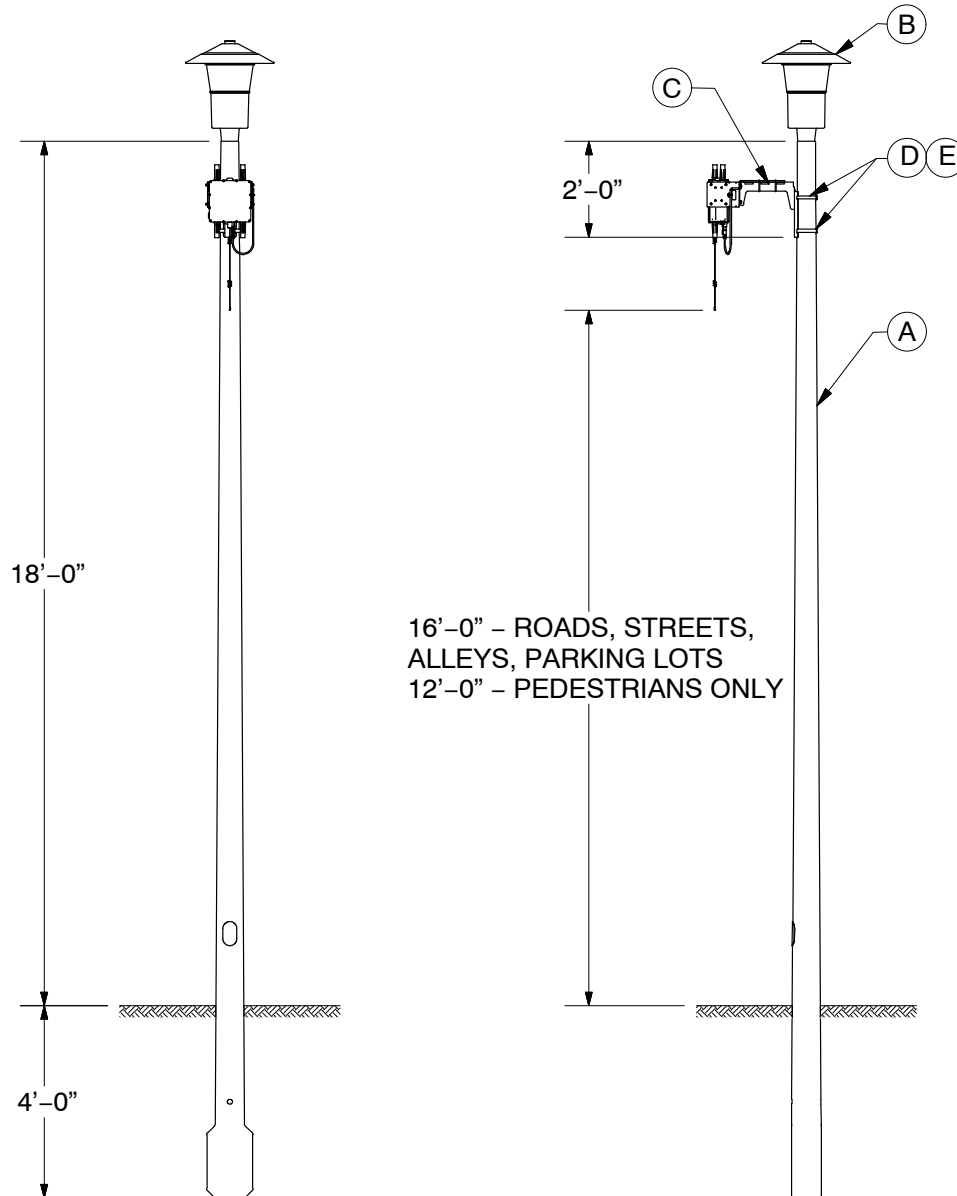
ITEM	STK / DCS #	DESCRIPTION	25 92 00 **	01	02
A	16 16 317	Network Gateway - Utility Pole Mount		1	1
B	23 52 068	Bolt - 5/8" Square 16"		2	1
C	23 66 046	Washer - 5/8" Round		2	1
D	17 51 032	Clamp - Parallel Grove 1/0 #6		5	5
E	23 60 002	Lag Screw - 1/4" x 4"		2	2
F	12 00 10 **	Grounding Unit		1	1
G	12 01 280	Conduit - 2" Schedule 40 (ft.)		2	2
H	23 60 011	Lag Screw - 5/8" x 5"		1	
I	23 64 049	Staple - 2"		2	2
J	23 65 043	Lock Nut - 5/8" Square		2	1
K	23 66 134	Lock Washer - 5/8" Double Coil		2	1
L	10 01 250	Arrestor - Antenna Coax Cable		1	
M	16 16 015	Connector - Coax Cable N Male		1	
N	16 16 110	Connector - Coax Cable N Female		1	
O	23 67 190	Strap - Conduit 2" w/2" Bolts		4	2
P	23 60 007	Lag Screw - 1/2" x 4"		8	4
Q	23 67 510	Cleat - Cable Clamp 3/8"		2	
R	21 53 001	Bolt - 1/4" Hex 3/4"		2	

DISTRIBUTION CONSTRUCTION STANDARDS

REV	DATE	ENG	DESCRIPTION
2	10/01/20	WYW	Conduit Size Change



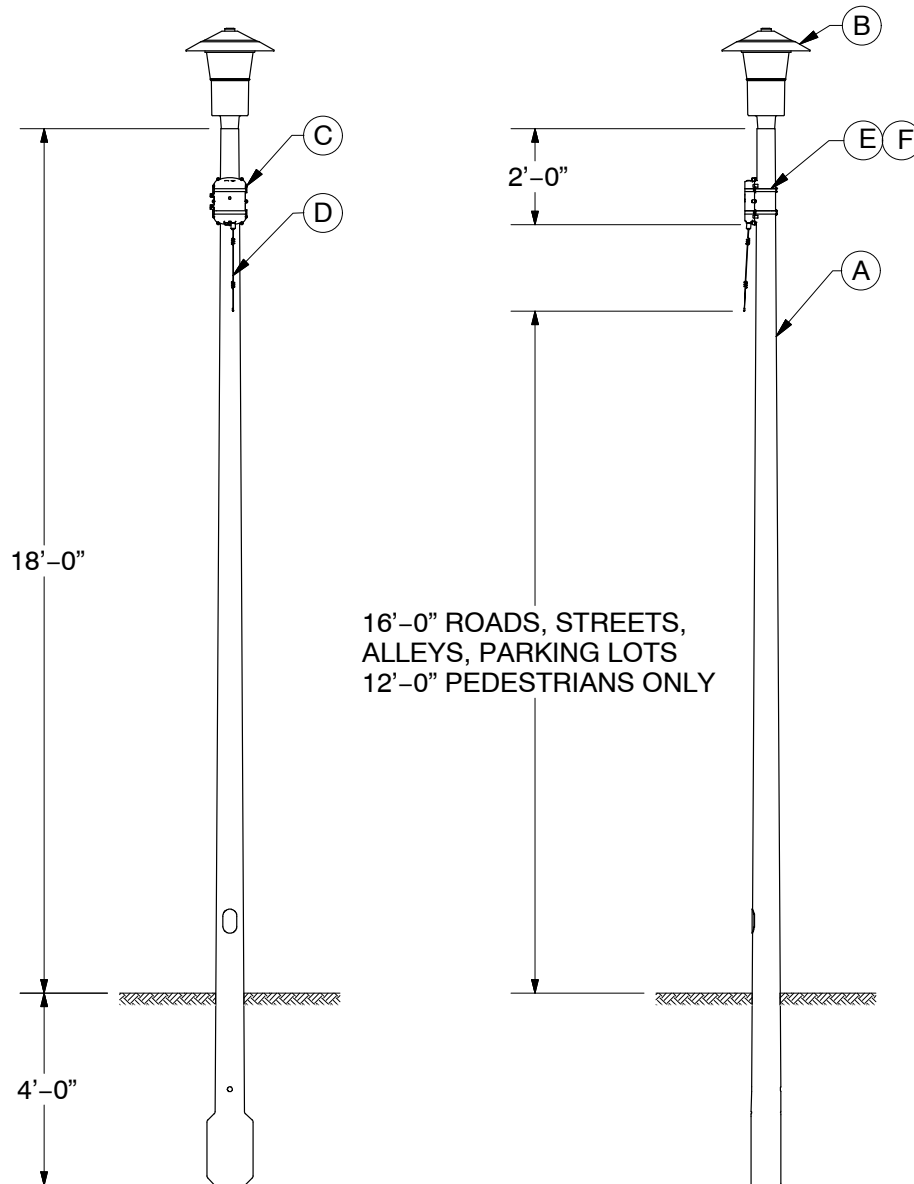
ITEM	STK / DCS #	DESCRIPTION	25 92 01 01	01
A	16 16 318	Network Gateway - Streetlight Mount		1
B	38 01 249	Streetlight Bracket - 6' x 1-1/4"		-
C	12 01 280	Conduit - 2" Schedule 40 (ft.)		1
D	17 51 032	Clamp - Parallel Grove 1/0 #6		4
E	23 67 190	Strap - Conduit 2" w/2" Bolts		3
F	23 60 007	Lag Screw - 1/2" x 4"		6



ITEM	STK / DCS #	DESCRIPTION	01
A	38 51 677	Pole – FG 22' OH 18' MH	1
B	15 70 15**	Luminaire	1
C	16 16 317	Network Gateway – Utility Pole Mount	1
D	23 67 528	Band – 3/4in	2
E	23 67 529	Band Buckle – 3/4in	2

Construction Note(s):

- Native soil back fill must be tamped to provide solid compaction around the pole.
- Generally only one street light tag per street light shall be installed. The tag should be installed visibly from the ground level but not reachable by the public. Refer to DCS 15 90 01 01.
- In Missouri; residential developments, the contractor will install 1-1/2" conduit to within 18" of the pole. Ameren will install the pole and the cable.
- See DCS 29 00 17 02 for minimum required ground clearance to bottom of antenna. Use clearances for "Secondary & Service Conductors 0 to 750 Volts".



ITEM	STK / DCS #	DESCRIPTION	01
A	38 51 677	Pole – FG 22' OH 18' MH	1
B	15 70 15**	Luminaire	1
D	16 16 105	Antenna – 22" Whip	1
C	16 16 117	Router – Series 6500	1
E	23 67 528	Band – 3/4in	2
F	23 67 529	Band Buckle – 3/4in	2

Construction Note(s):

1. Native soil back fill must be tamped to provide solid compaction around the pole.
2. Generally only one street light tag per street light shall be installed. The tag should be installed visibly from the ground level but not reachable by the public. Refer to DCS 15 90 01 01.
3. In Missouri; residential developments, the contractor will install 1-1/2" conduit to within 18" of the pole. Ameren will install the pole and the cable.
4. See DCS 29 00 17 02 for minimum required ground clearance to bottom of antenna. Use clearances for "Secondary & Service Conductors 0 to 750 Volts".

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1. General

Wherever practicable it is intended that poles be jointly used with other utilities. To effectively do this some of the more important provisions in the National Electric Safety Code (NESC) pertaining to Joint Use are outlined below.

2. Scope

Communication company (Communication Co.) circuits in this DCS include Telephone, Telegraph, CATV, Railroad Signal, Messenger Call, Clock, Control, Fire and Police, and other alarm circuits.

3. NESC Requirements

The National Electric Safety Code forms the basis for construction specifications under our joint use agreements.

All new construction shall conform to the NESC in effect at the time of construction. Where conductors or equipment are added, altered, or replaced on an existing structure, the installation should be brought into conformance with the NESC in effect at that time except as mutually agreed not to do so. This mutual agreement is allowed provided that the resulting installation will be in compliance with either (a) the NESC rules in effect at original installation, or (b) NESC rules in effect in a subsequent edition to which the structure has been previously brought into compliance. Exception: On these existing structures, clearances between luminaire brackets and communications equipment must comply with the NESC rules in effect at the time the structure is replaced. These provisions shall not be so applied as to require any then existing cables carried on one side of a joint pole to be rearranged to occupy the other side of the pole.

3.1 Setting Depth of Poles

Ameren poles shall be set in accordance with DCS 02 20 03 01. Variations in depth setting for self-sustaining shall be considered in arriving at the height of pole required for joint use.

3.2 Minimum "Clearance Space to Ground" Requirements

The "Clearance Space to Ground" for a conductor is the NESC minimum clearance between ground or rail and the conductor. For equipment such as transformers hung low on a pole it is the minimum clearance between ground and the bottom of the transformer case or hanger.

In Table 1 are listed the clearances for Communications Co. conductors (usually the lowest on the pole).

TABLE 1

Clearance to Ground or Rail of Communications Co. Cables or Conductors

Nature of Object Crossed Over or Along	Clearance Above Ground or Rail
Communications Co. Cables or Conductors Crossing Over:	
Track Rails of Railroads	23.5 ft.
Public streets or roads	15.5 ft.
Public alleys	15.5 ft.
Driveways to residence garages (No vehicles greater than 8 ft. anticipated)	11.5 ft.
Spaces or ways accessible to pedestrians only	9.5 ft.
Communications Co. Cables Running Along and Within Limits of:	
Public Streets, Roads or Alleys	15.5 ft.
Where no part of line overhangs any part of the highway and where it is unlikely loaded vehicles will cross under the line	13.5 ft.
Spaces or ways accessible to pedestrians only	9.5 ft.

NOTE: The clearances given are for the lowest point in the span. The point of attachment on the pole must, therefore, be higher to compensate for conductor sag or ground irregularities. Clearances are per the 2017 NESC.

3.3 Neutral Space

The neutral space shall be an equipment free vertical space (except as noted below) between Ameren attachments and equipment and Communications Co. attachments and equipment. It shall measure not less than 40" for Ameren attachments and equipment of circuits up to 600 volts to ground and 72" for circuits exceeding 600 volts to ground.

Exceptions

1. Where non-current carrying parts of equipment are effectively grounded consistently throughout well-defined areas, and where communications circuits are at lower levels, the neutral space may be reduced to 30".
2. For street light span wires and brackets, see Section 3.5, and for vertical runs, see Section 3.6.

3.4 Ground Connections

On all structures where a pole ground is installed by either Ameren or the Communication Co., the electric supply neutral and communication metallic messengers shall be bonded together with a minimum #6 covered copper or equivalent bond wire.

The same grounding wire or artificial ground may be used for Ameren and Communications Co. attachments, where mutually agreed upon. If separate Ameren and communication grounds are installed on the same pole, they must be bonded together with a minimum #6 covered copper or equivalent bond wire to the same ground rod or at the base of the pole, and at the Communication Co. attachment level.

3.5 Minimum Clearances between Street Light Equipment and Communications Equipment

Table 2 gives the minimum clearances that shall be maintained between Ameren and Communications Co. facilities under various conditions.

TABLE 2

Vertical Clearance of Luminaire Brackets and Span Wires to Communication Lines

Location of Luminaire Bracket or Span Wire Supporting Luminaire	Minimum Vertical Clearance (in)
Above communication support arms (not allowed by Ameren)	40 ¹
Below communication support arms (not allowed by Ameren)	40 ²
Above messengers carrying communication cables	40 ³
Below messengers carrying communication cables	40 ³
From terminal box of communication cable	40 ³
From communication brackets, bridle wire rings, or drive hooks	40 ³

NOTES:

Ref. 2017 NESC Section 23 Table 238-2

(1) This may be reduced to 20 inches for grounded luminaire brackets, or 12 inches for either span wires or metal parts of brackets at points 40 inches or more from the pole surface.

(2) This may be reduced to 24 inches for grounded luminaire brackets.

(3) This may be reduced to 20 inches for grounded luminaire brackets. (Note that this is greater than the NESC allowed 4".)

3.6 Vertical Runs on Pole Surface

In general Ameren and Communications Co. vertical runs shall not be placed on the same pole if it is practicable to place them on separate poles.

If vertical runs of both companies must be placed on the same pole, the runs shall be placed in adjacent quadrants, or on standoff brackets if more than half the pole surface is needed.

3.6.1 Clearance Between Vertical Runs and Pole Equipment

Vertical runs, risers, ground wires and hardware supporting such runs belonging to Ameren shall have a clearance of 1/8 the pole circumference but in no case less than 2" from communications equipment.

Vertical runs, risers, ground wires and hardware supporting such runs shall be so located that they do not interfere with the free use of pole steps.

3.6.2 Coverings for Vertical Runs on Poles

Ameren ground wires fastened directly to the pole shall in general only be covered with plastic moulding where within 8 feet of the ground.

Ameren non-leaded cables shall be covered with plastic conduit from the ground to a point not less than 40 inches above the highest Communications Co. attachments.

3.6.3 Vertical Runs Supported Between Crossarms

Lamp leads for street lights may be run from an Ameren crossarm directly to the lamp bracket provided the luminaire bracket is 40 inches or more above all communication attachments.

3.7 Other Attachments

3.7.1 Longitudinal Cable

All attachments in the communication space by a third party shall be bolted directly to the pole. In order to maintain climbing space, extension arms for means of attaching are prohibited.

3.7.2 Aerial Supply Service Cables

The point where such cables leave the pole shall be not less than 40 inches above the highest or 40 inches below the lowest Communication Co. attachments.

3.7.3 Requirements for Joint Use/Third Party Power Supply Equipment on Ameren Poles

All power supply equipment and associated facilities attachments (including but not limited to wires, conduits, brackets, and ground wires) are subject to Ameren approval.

Climbing space on any Ameren pole will be maintained at all times. This requires one side of the pole (180 degrees /the same face of the pole) to be open from the ground to the top of the communication space. Any power supplies or similar facilities shall be mounted on the same side of the pole as any risers and cables. Under no circumstances is power supply equipment allowed above the communications space.

Risers and cables shall be installed in accordance with Ameren Standard 14 00 01 02. No exceptions allowed.

Ameren's wireless antenna location policy addresses the proper placement of any risers and cables above the communications space.

If climbing space cannot be maintained, the cabinet equipment shall be installed on the ground and shall be a minimum of 5' horizontally, in any direction, from the base of the pole.

3.8 Guys & Anchors

In Tables 3 and 4 are listed minimum clearances that shall be maintained between guys of either the Ameren or the Communications Co. to the equipment listed and under the particular circumstances shown.

TABLE 3

Clearance to Grounded Guys when Crossing Over or Under Cables,
Conductors or Guys of Another Line

Equipment Guy Crosses over or under	Clearance Required
Communications Co. cable or conductors	2 feet
Ameren triplex or quad cables	2 feet
Ameren open conductors up to 750 volts	(3) 2 feet
Ameren open conductors above 750 volts	(2) (4) 2 feet
Other guys or street light span wires	(1) 2 feet

NOTE: Ref. 2017 NESC, Section 23, Table 233-1.

(1) This clearance may be reduced where both guys are electrically interconnected.

(2) For voltages above 22,000 volts consult the Standards Group.

(3) 4 feet is required to communication guy.

(4) 5 feet is required to communication guy.

TABLE 4

Clearance in Any Direction between Guys and Line Conductors or Cables
Attached to the Same Structure

Equipment Guy Shall Clear	Parallel to Line	Not Parallel to Line
Communications Co. cables or conductors	(1) 6 Inch	(1) 6 Inch
Ameren conductors up to 8700 volts phase to phase	(1) 12 Inch	6 Inch
Ameren conductors (7.2/12.47 kV to 14.4 kV)	15 Inch	9 Inch
Ameren 34.5 kV conductors	30 Inch	30 Inch

NOTE: Ref. 2017 NESC, Section 23, Table 235-6.

(1) If guy passes within 12 inches of Ameren conductors and also passes within 12 inches of communication cables, the guy must be insulated with a strain insulator at a point below the lowest supply conductor and above the highest communication cable.

Anchors shall have a minimum of 5 foot separation from the pole face and to other anchors. Communication guys shall not be attached to Ameren anchors (see DCS 29 00 01 01 sheet 10).

3.9 Miscellaneous Requirements

Street lamp span wires shall not encircle the pole but shall be attached by means of a through bolt.

Street lamp brackets and their metal parts shall be confined to the half of the pole circumference nearest the lamp, except that where attachment by means of lag screws is impracticable the metal parts may be secured with through bolts. Lamp leads supported along a span wire or lamp bracket shall be so attached that insulation will not be injured.

Span wires shall have at least one strain insulator of specified flash-over value.

3.10 Communication Co. Antennas

General

Communication Co. Antennas shall not be installed on any jointly used poles until reviewed by and approval is granted by Ameren. Communication Co. antennas shall not be installed on Ameren transformer poles, terminal poles, switch poles, capacitor poles, voltage regulator poles, recloser poles, deadend poles, or corner poles.

Exception: An installation on a transformer pole may be considered by Ameren to provide power to antenna where secondary does not exist.

Sections 3.3, 3.4, 3.5, 3.6, and 3.7 of this DCS shall also apply to Communication Co. Antennas except where the clearances in this Section are more stringent.

3.10.1 Communication Co. Antennas Located in the Communication Space

Communication Co. Antennas located in the communication space are considered equipment for the purpose of determining minimum clearance requirements.

Clearance from Communication Co. Antennas to Ameren secondary shall be 40" (see DCS 29 00 01 01 sheet 14). See Section 3.3 of this DCS for minimum required clearance to higher voltage conductors when Ameren secondary is not present.

3.10.2 Communication Co. Antennas Located in the Supply Space

Communication Co. Antennas located in the supply space shall be installed on the pole top only, and maintained only by personnel authorized and qualified to work in the supply space. Pole-top antennas shall only be allowed on poles that are truck accessible.

Minimum required clearances for Communication Co. Antennas installed in the supply space above Ameren conductors shall be as shown in DCS 29 00 01 01 sheet 15.

Pole top extensions are not permitted for providing antenna clearance above Ameren conductors.

All exposed Communication Co. Cable or wiring shall be covered or insulated. Antenna brackets shall be non-metallic or ungrounded.

Communication Co. Antenna cable must extend down the pole in non-metallic conduit or U-guard from the antenna to below the communication worker safety zone. The non-metallic conduit or U-guard shall be located so that it does not obstruct climbing spaces or lateral working spaces between line conductors at different levels, or interfere with the safe use of pole steps.

3.10.3 Antenna Disconnect

Communication Co. shall provide a disconnect switch accessible to Ameren so that the antenna can be de-energized to prevent exposure to radiation at any time work is required in or near the space (Supply or Communication) where the antenna is installed.

3.11 Overhead Aerial Construction

DCS 29 00 01 01 sheets 7 thru 13 include drawings for compliance to NESC joint construction requirements.

DCS 29 00 01 01 sheets 14 thru 16 include drawings showing Ameren requirements for location of communication antennas.

4. Communication Attachments to Poles

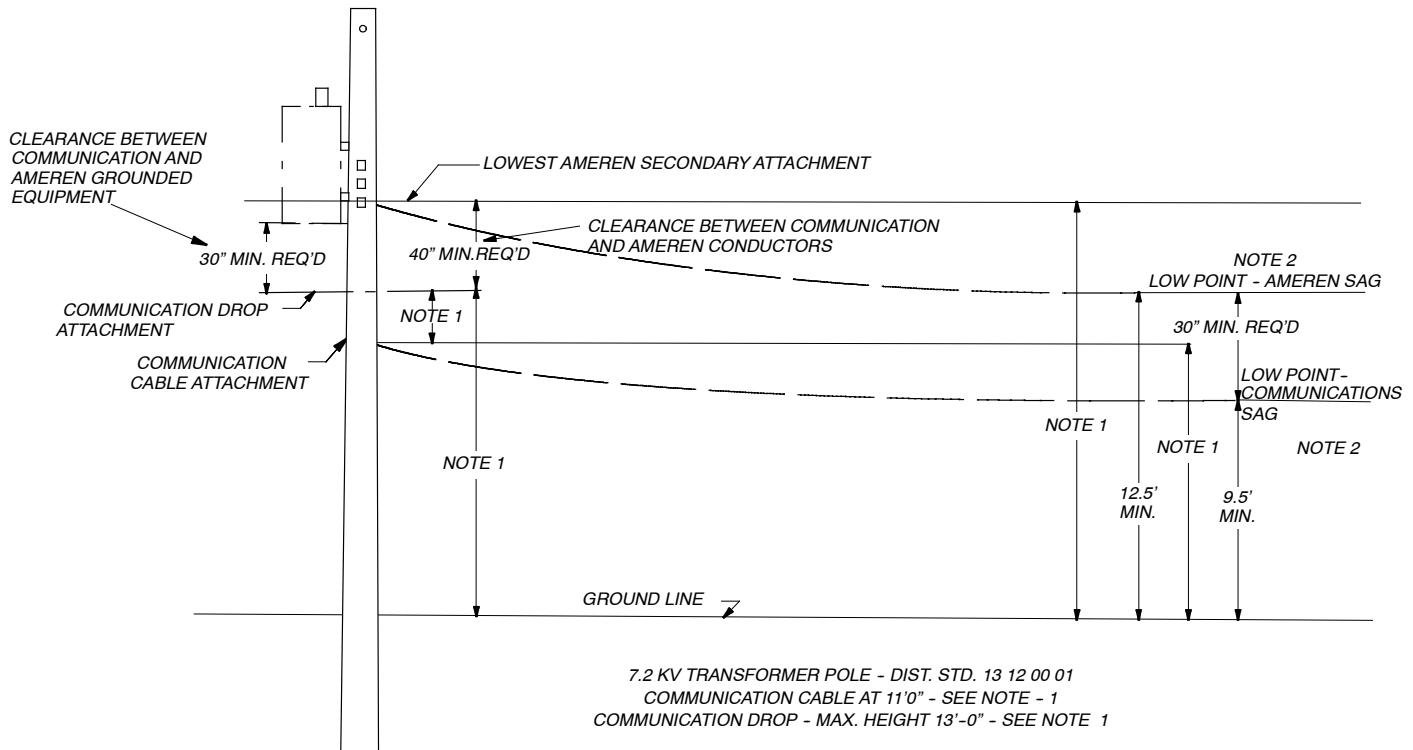
4.1 Wood Poles

Holes for through-bolts shall be no closer than 4" apart to avoid compromising pole strength.

4.2 Composite Poles

All communication attachments to Ameren composite poles shall be made using pole-band attachment hardware. Drilling holes in Ameren composite poles shall not be allowed for any communication facilities attachment. All attachment hardware shall be free of any cleats or protrusions that will compress into the pole. Ameren has approved the use of an Aluma-Form pole-band kit rated for 3,000lbs of vertical load for this purpose. This kit consists of a 60" stainless steel pole-band, a mounting block for the Communication Co. attachment, and fastening hardware for tensioning the band. The Aluma-Form part number is 3-CSO-3HB. Any alternate hardware must be approved by Ameren prior to use.

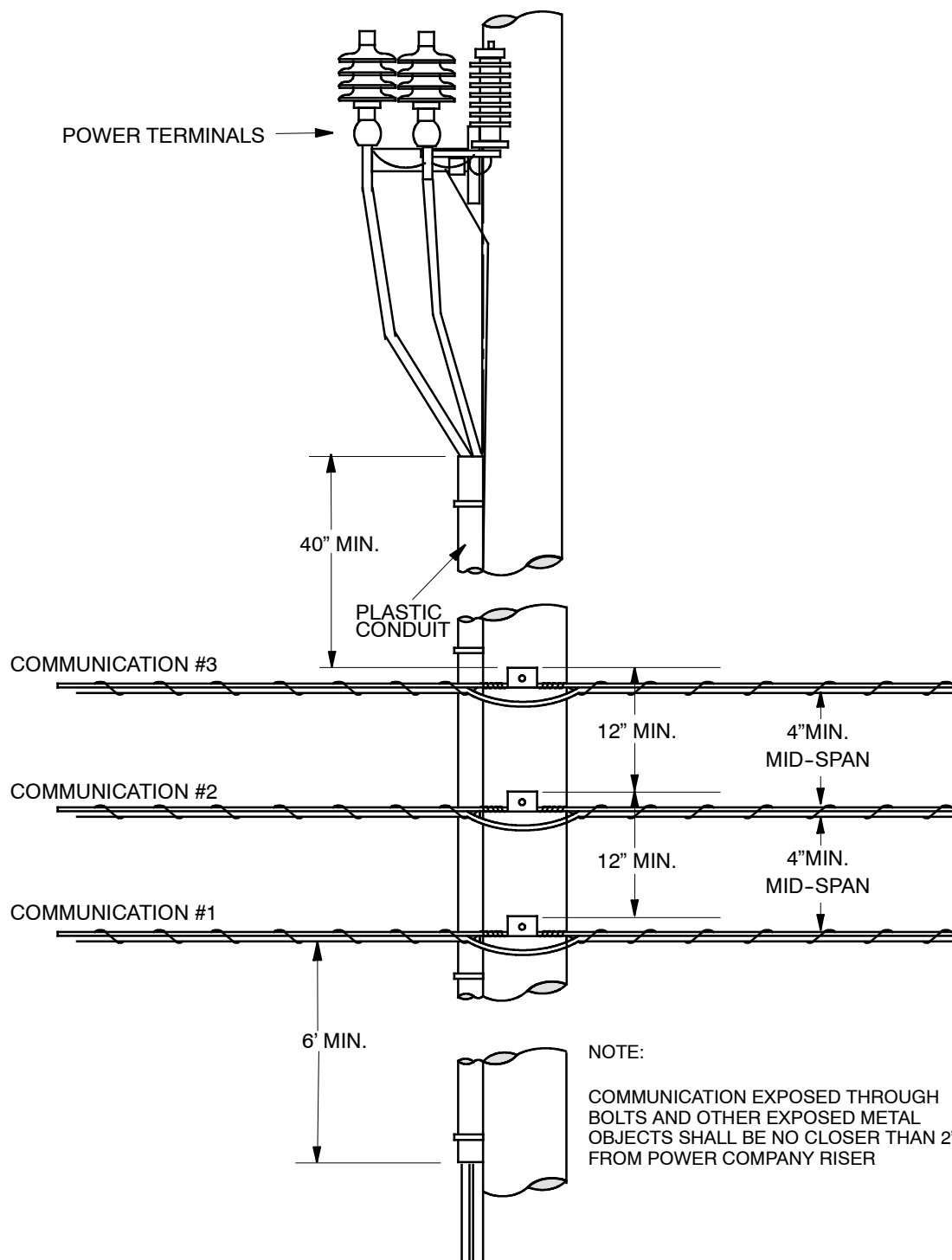
Typical Pole Set on Private Property



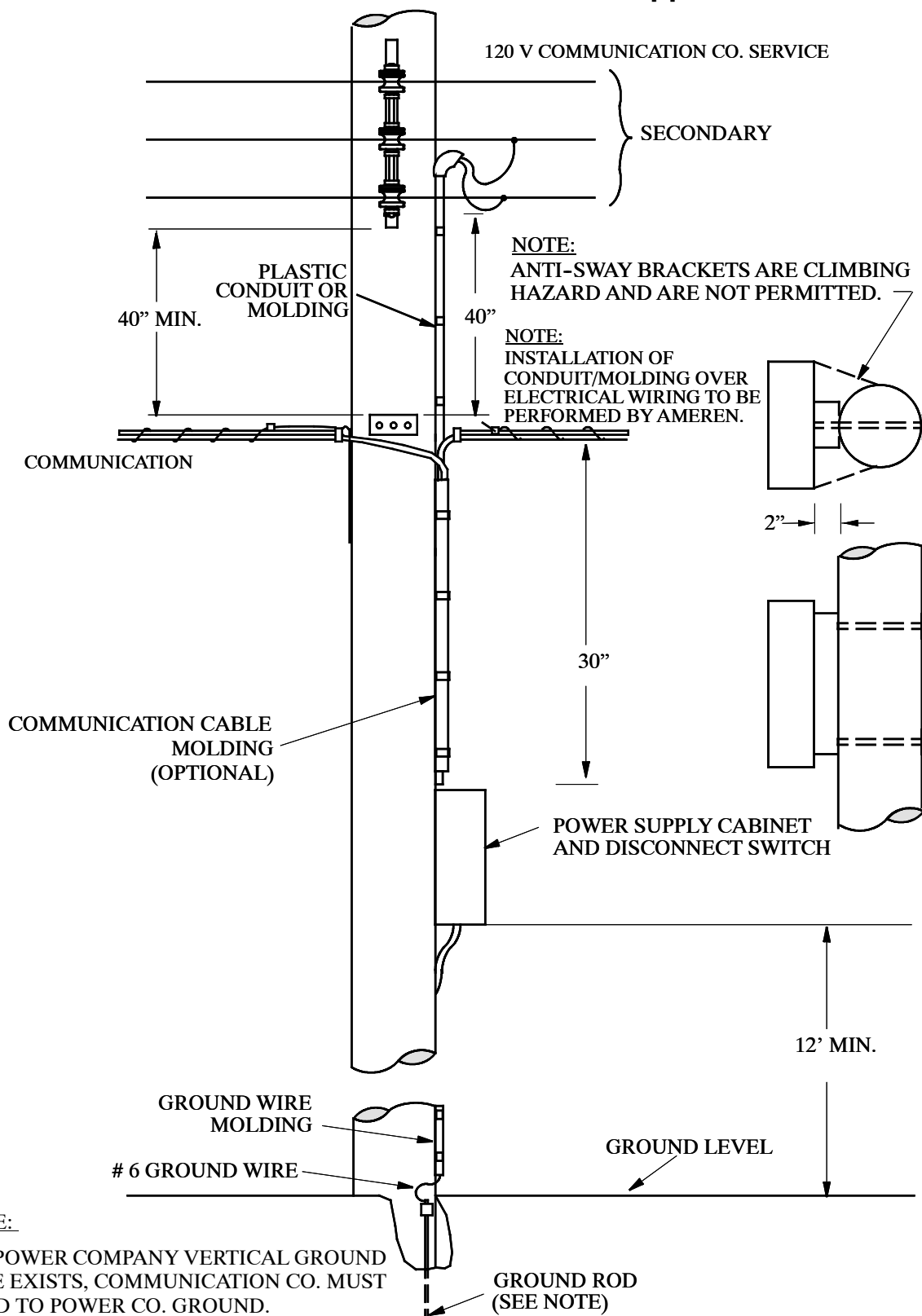
NOTE:

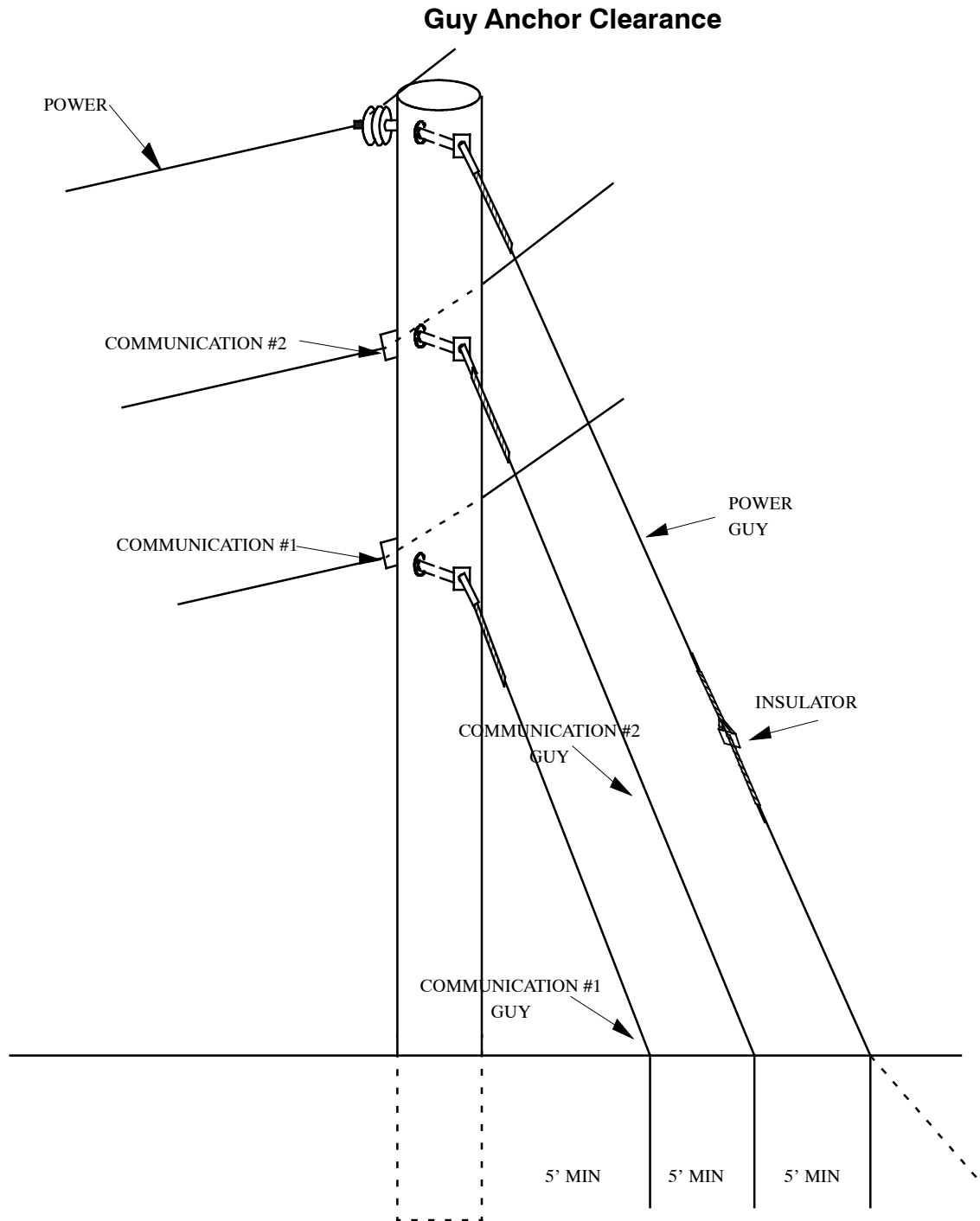
1. These mounting heights will vary in individual cases according to span lengths, conductor size, terrain and mounting height of customer drop attachment.
2. These minimum ground clearances are applicable in spaces or ways accessible to pedestrians only.

Vertical Clearance to Power Lines



Communication Co. Power Supplies

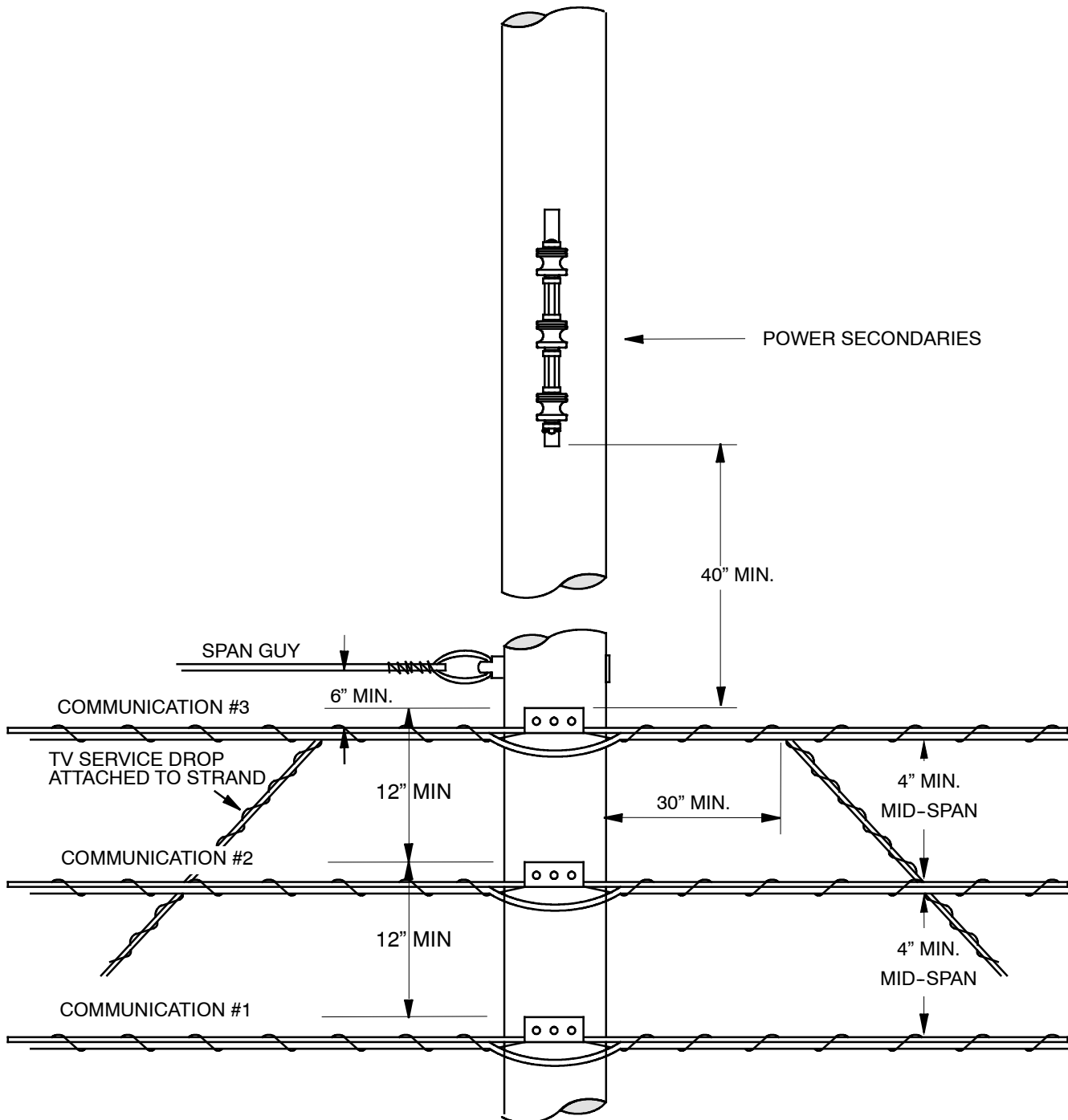




NOTES:

1. This guide is applicable to new guys only.
2. This guide is only to show minimum anchor separation at the ground.
3. Communication guys shall not be attached to Power (Ameren) anchors.

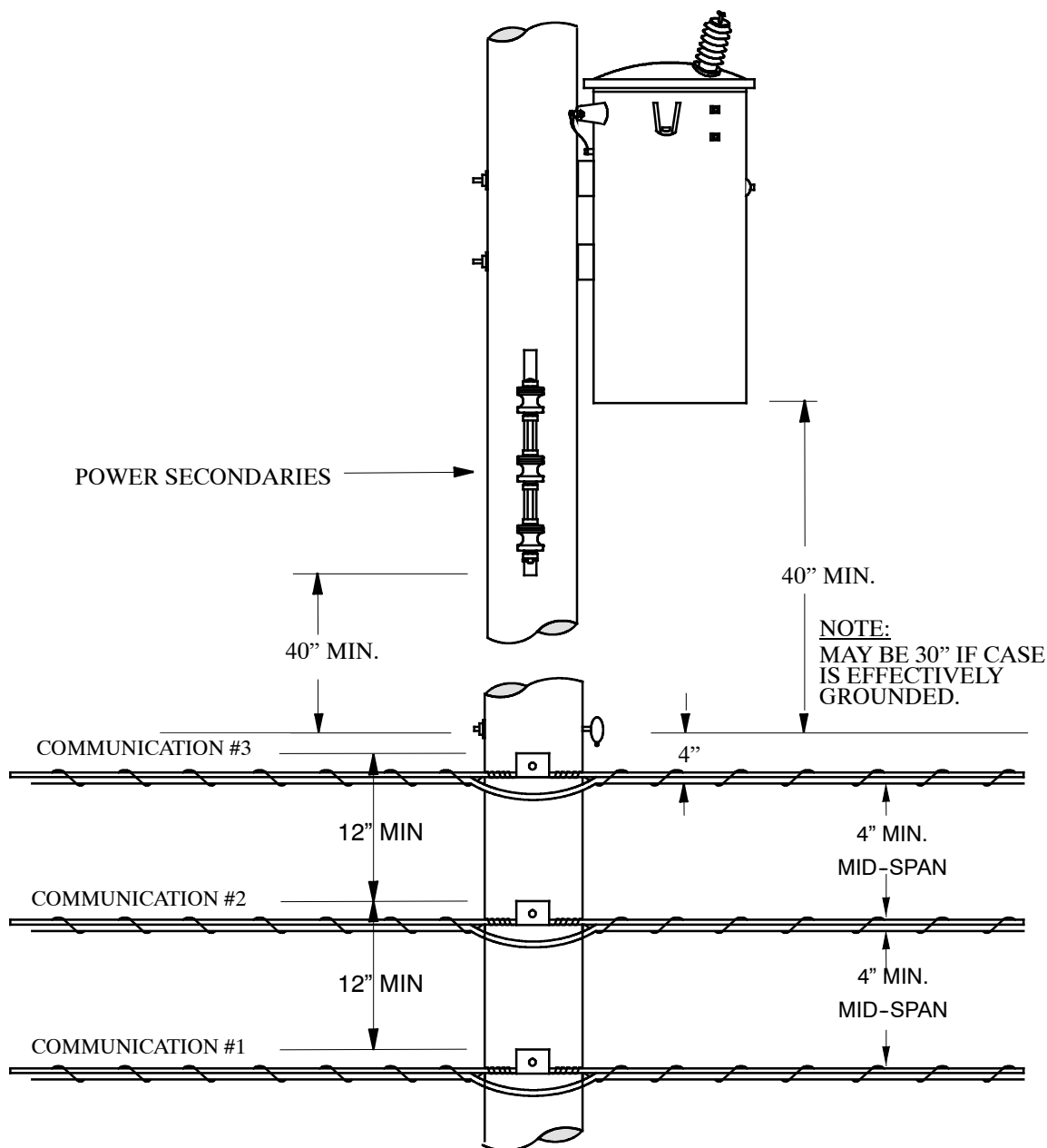
Vertical Clearance at the Pole



NOTE:

- ① ANY ADDITIONAL LICENSEE'S MUST ADHERE TO CLEARANCES SHOWN.
- ② SPACING BETWEEN ATTACHMENT LICENSEES AND JOINT USERS MUST CONSIDER EQUIPMENT WHICH MAY BE BELOW STRAND AND CABLE. SEPERATION IS DEFINED BY NESC AND OPERATING REQUIREMENTS.

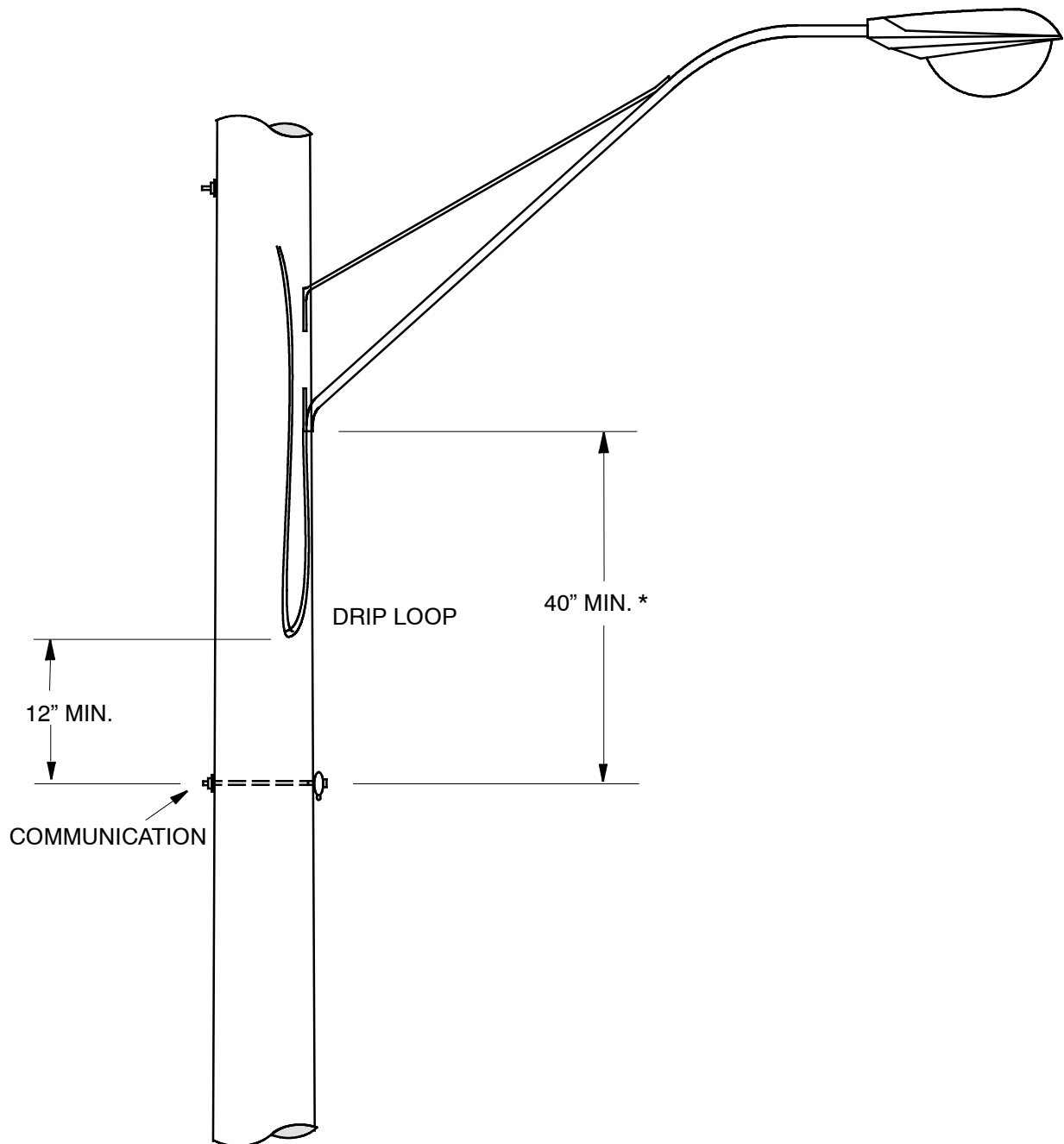
Vertical Clearance to Power Equipment



NOTE:

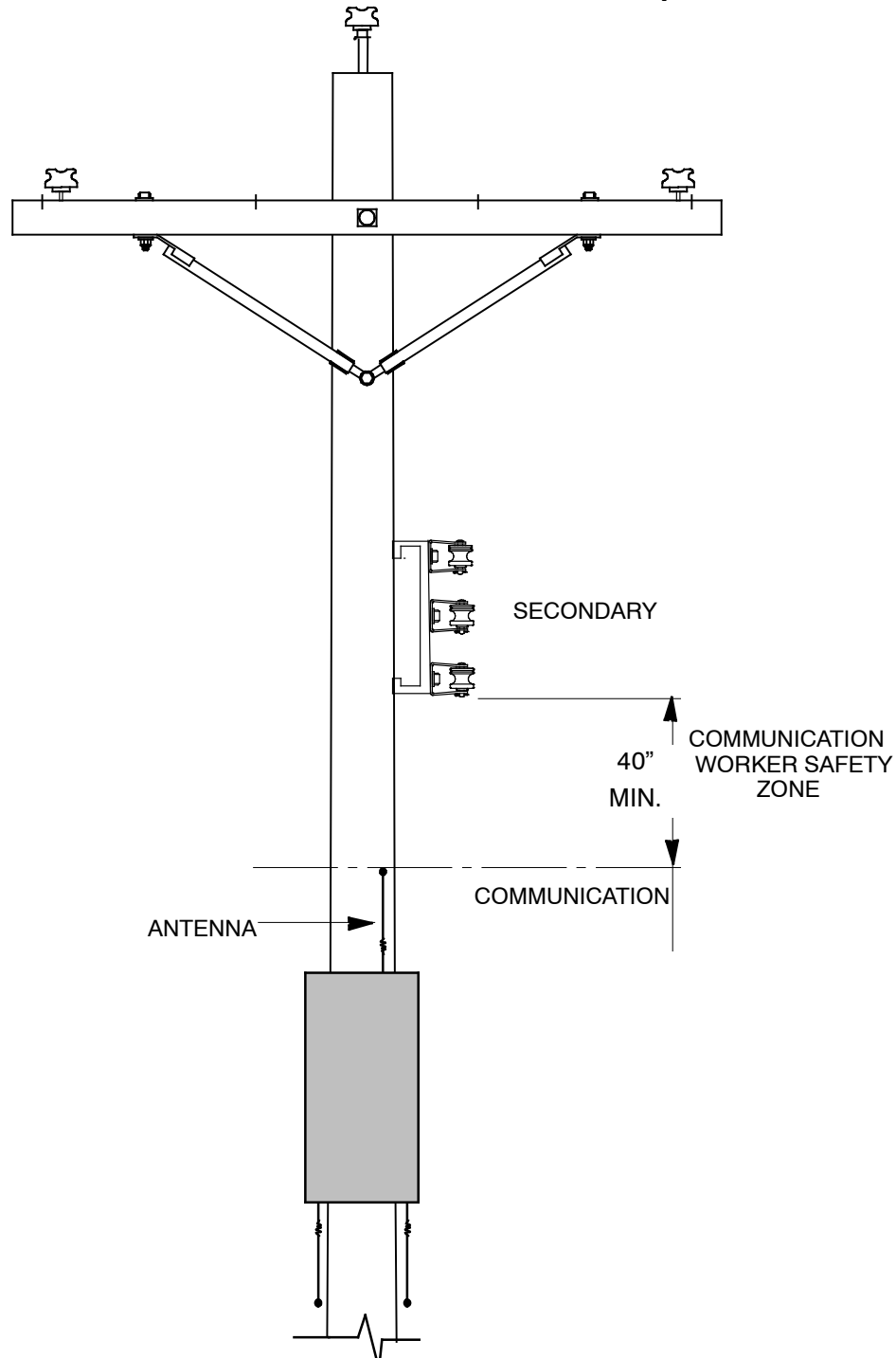
- ① NO COMMUNICATION EQUIPMENT IN CABINET SHALL BE INSTALLED ON A TRANSFORMER POLE.

Vertical Clearance to Streetlights



- ➡ * 40" MINIMUM FROM BOTTOM OF UNGROUNDED BRACKET
- ➡ * 20" MINIMUM FROM BOTTOM OF GROUNDED BRACKET

Antenna Clearance in Communication Space

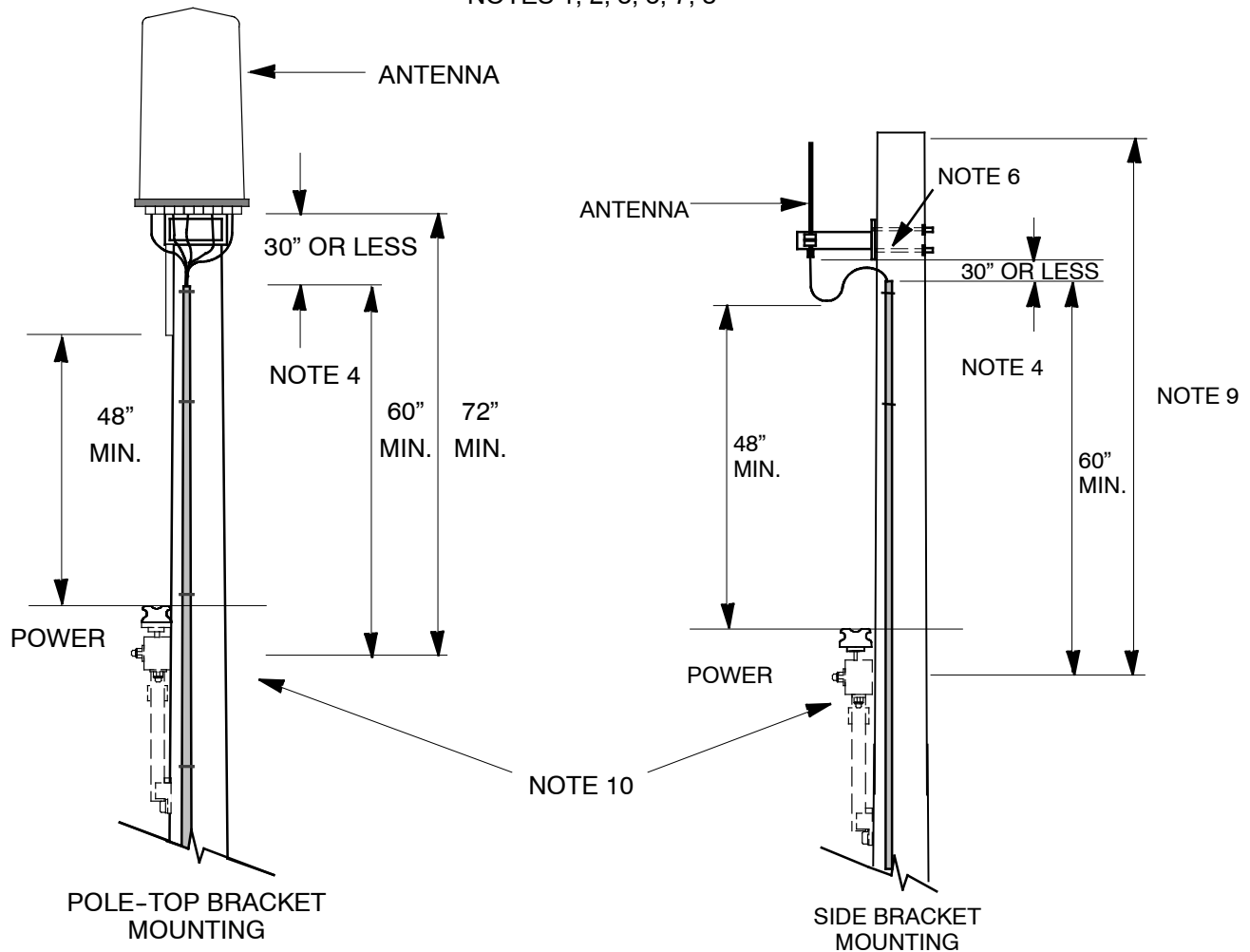


NOTES:

1. Refer to sections 3.7, 3.10 General, 3.10.1, 3.10.3, and 4 for specific requirements.

Antenna Clearance Above Ameren Conductors

NOTES 1, 2, 3, 5, 7, 8



NOTES:

1. Pole-top antennas shall only be allowed on poles that are truck accessible. Refer to sections 3.7, 3.10 General, 3.10.2, 3.10.3, and 4 for other specific requirements.
2. Communication Co. Antenna and Antenna cable must be installed and maintained by Ameren approved persons qualified to work in the electric supply space.
3. Pole top extensions are not permitted for providing antenna clearance above Ameren conductors.
4. Communication Co. Antenna cable must extend down the pole in non-metallic conduit or U-Guard from the antenna to below the communication worker safety zone. Length of antenna cable antenna to top of conduit or U-Guard opening, must be 30" or less.
5. All Communication Co. Wiring must be covered or insulated.
6. Antenna brackets must be non-metallic or ungrounded.
7. Ameren configuration changes required to accommodate the Communication Co. Antenna must meet Ameren avian design standard requirements. Conductor cover must be installed on center phase.
8. Ameren configuration changes required to accommodate the Communication Co. Antenna may require modification to adjacent poles to prevent conductor contact during galloping conditions.
9. 72" minimum from the crossarm mounting bolt (or center of the crossarm) to the top of the pole is required for antennas mounted on the pole top. For antennas mounted on side-brackets as shown in this drawing, the top of the pole must extend above the top of the antenna.

-
10. Tangent cross-arm construction is shown. For other single- or three-phase configurations, a minimum of 48" must be maintained from the lowest portion of the Communication Co. antenna mounting bracket or antenna cable drip-loop to the highest Ameren Power conductor.

General

Working clearances, electrical insulation levels and mechanical strength have been coordinated in the crossarm standards, Dist. Stds. 04 00 20 thru 04 00 41. To utilize properly these designs requires data on the strength of the configuration to withstand Vertical (V), Horizontal (H), and Transverse (T) loads during "Continuous" and "Intermittent" conditions.

Type of Loadings

"Continuous" loading, normally the 60°F loadings, are those applied day in and day out for years at a time. This compares to the "Intermittent" loadings or short time loadings as experienced during NESC Heavy Loading conditions due to ice, winds, plus at times, a lineman's weight on the extremity of the crossarm.

Due to the inherent characteristics of wood, it behaves differently under the various types of loads. With a continuous load applied to the arm, deflection will occur and in time, a permanent set takes place. The degree of set is dependent upon the amount of applied load. It is from this condition, that as intermittent loads are applied, further arm deflections or bending take place. However, as the intermittent loads reduce and return to the normal continuous loading the arm deflections also return to normal.

Both of these conditions must be checked and this instruction has been prepared to simplify this task. To illustrate the use of the tables in this standard, the following problems have been worked out.

Problem 1 – Vertical ("V") Loadings

Given a straight and level (4.16kV) line with 150 ft. spans and 3–556.5 kcmil bare AA conductors carried on crossarms in the top pole gain. Neutral is attached on body of pole.

The bare weight of the conductor (without ice) is .5224 lbs. per ft. The load on the pin is 78 lbs. Assume the conductors are placed on two end pins and a pin 29 inches in from one of the end pins. On an 8'–0" arm, the Equivalent Continuous Vertical Load "VCont" located 4 inches in from the end of the arm is obtained by taking moments about the crossarm through bolt for the heavier loaded half of the crossarm.

$$\begin{aligned} VCont \times 44" &= 78 \text{ lbs.} \times 44 \text{ inches} + 78 \text{ lbs.} \times 15 \text{ inches} \\ VCont &= 105 \text{ lbs.} \end{aligned}$$

The portion of NESC "Heavy Loading" contributed by the conductor (with ice) is 1.366 lbs. per ft. or 205 lbs. per pin. This gives a partial Equivalent Intermittent Loading (VPint).

$$\begin{aligned} VPint \times 44" &= 205 \text{ lbs.} \times 44 \text{ inches} + 205 \text{ lbs.} \times 15 \text{ inches} \\ VPint &= 275 \text{ lbs.} \end{aligned}$$

All braced crossarms except for the top gain arms shall be capable of supporting a vertical load of 300 pounds (Lineman's weight, plus harness, tools, and equipment supported by the lineman) at either extremity in addition to the weight of the conductor. Thus, the total Equivalent Intermittent Vertical Load (VInt) is:

$$VInt = 275 \text{ lbs.} + 300 \text{ lbs.} = 575 \text{ lbs.}$$

From Table 1 of this construction standard, an 8'–0" single arm, Std. 04 00 20 02, is good for 300 lbs. "Continuous Loading" and 900 lbs. "Intermittent Loading" which is adequate for the calculated loads in both conditions. Overload capacity factors are built into the loading tables in this standard.

Problem 2 – Horizontal ("H") Loadings

Given a 12.47 kV, 3 wire, 336 ACSR conductor, with 150 ft. spans strung to the Short Span sag table, grade "C" construction, to be deadended directly on the crossarm unit.

For "Continuous Loading" the initial 60°F tension found in Dist. Std. 07 00 07 03 should be used. The initial tension for 336 ACSR, using the Short Span Sag table is 392 lbs. per conductor.

For "Intermittent Loading" the deadend tension found in Dist. Std. 07 00 07 03 should be used. The actual conductor deadend tension for 336 ACSR, using the Short Span Final Sag table is 1800 lbs. per conductor.

Assume that the line is to be deadended on 8'-0" double arms, Std. 04 00 20 07. Two conductors will be in deadend on one side and one conductor on the other side of the 8'-0" arms. The Equivalent Horizontal "Continuous Load" (HCont) is located 6" from the end of the arm and is obtained by taking moments about the through bolt of the cross-arm for the heaviest loaded half of the arm.

$$\begin{aligned} \text{HCont} \times 42" &= 392 \times 42" + 392 \times 19" \\ \text{HCont} &= 570 \text{ lbs.} \end{aligned}$$

The Equivalent Horizontal Intermittent Load is:

$$\begin{aligned} \text{HInt} \times 42" &= 1800 \times 42" + 1800 \times 19" \\ \text{HInt} &= 2615 \text{ lbs.} \end{aligned}$$

The strength of unit 04 00 20 07 from Table 1 is 800 lbs. continuous load and 1600 lbs. intermittent load. Therefore, because the calculated intermittent load is too high and because of unbalance, arm guys would be necessary.

Even if one of the conductors were deadended at the pole, the equivalent intermittent loading "HInt" would be 1800 lbs. Under these conditions, unit 04 00 20 07 would still not be strong enough. The 8' fiberglass deadend arm with B-phase deadended on the pole would be needed.

Problem 3 – Transverse ("T") Loadings

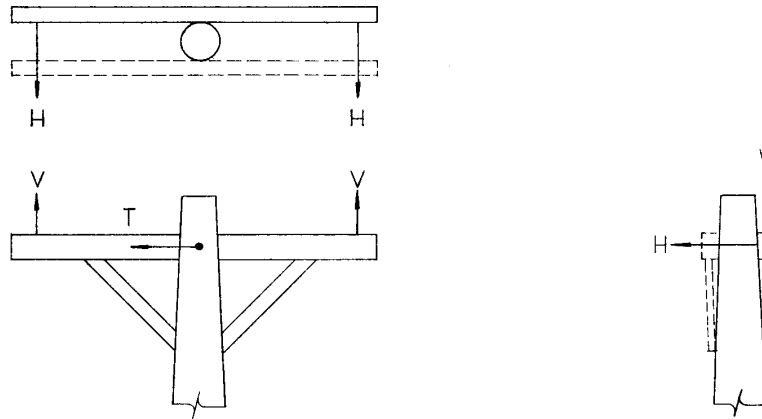
Given a pole with a 12.47kV, 3 wire 556.5 AA bare circuit strung to the Medium Span sag table turning a line angle of 15°. Determine if crossarms can be used for this construction.

Going to Dist. Std. 03 00 03 00, an 18° line angle can be turned using a double crossarm assembly with grid gains, provided the conductors are deadended on the arms. (See Note 5 Dist. Std. 03 00 03 00 Sh. 3.)

However, if one conductor can be carried on double pole top pins, the other two conductors could be carried on pins using double crossarms without grid gains. With this combination, a line angle of 17° can be turned.

NOTES FOR TABLE 1 (ON NEXT SHEET):

1. The "Allowable Continuous Loading" for one insulator pin is 170 lbs. with 500 lbs. the "Allowable Intermittent Loading". These values to be doubled for two pins (340 lbs. and 1000 lbs.) as on a double arm.
2. The loadings shown are based on arm strength. Where more than two conductors are used per arm the total of pin loadings must not exceed the loadings given.
3. The loadings shown are based on double arm strength with grid gains.



V = Equivalent Vertical Load on Crossarm 4" From End of Arm
H = Equivalent Horizontal Load on Crossarm 6" From End of Arm
T = Transverse Load on Crossarm Due to Line Angles or Wind Loads

TABLE 1

TABLE 1												
Dist. Std. No.	Cross-arm Length	Crossarm Section	No. of Arms	Type Braces (Wood)	Allowable Continuous (60°F Initial)Loadings				Allowable Intermittent (NESC Heavy Final)Loadings			
					V	H(1)	T(2)	T(3)	V	H(1)	T(2)	T(3)
Crossarm Units – 13.8 kV and Below												
04002001	6'–0"	3–1/2x4–1/2	Single	V	300	400	400	–	900	800	1200	–
04002006	6'–0"	3–1/2x4–1/2	Double	V	600	1050	800	1400	1800	2100	2400	4000
04002002	8'–0"	3–1/2x4–1/2	Single	V	300	310	400	-	900	620	1200	-
04002007	8'–0"	3–1/2x4–1/2	Double	V	600	800	800	1400	1800	1600	2400	4000
04002003	10'–0"	3–1/2x4–1/2	Single	V	225	250	400	-	675	500	1200	-
04002008	10'–0"	3–1/2x4–1/2	Double	V	450	625	800	1400	1350	1250	2400	4000
Side Arm Units 7.2/12.47 kV and Below												
04002401	6'–0"	3–1/2x4–1/2	Single	Heel	350	-	400	-	1050	-	1200	-
04002403	6'–0"	3–1/2x4–1/2	Double	Heel	350	-	800	1400	1050	-	2400	4000
04002601	6'–0"	3–1/2x4–1/2	Single	Heel	350	-	400	-	1050	-	1200	-
04002603	6'–0"	3–1/2x4–1/2	Double	Heel	350	-	800	1400	1050	-	2400	4000
04002402	8'–0"	3–1/2x4–1/2	Single	Heel	250	-	400	-	750	-	1200	-
04002405	8'–0"	3–1/2x4–1/2	Double	Heel	250	-	800	1400	750	-	2400	4000
Crossarm Units – 34kV												
04002010	10'–0"	3–3/4x4–3/4	Double	V	500	900	750	1400	1500	1800	2250	4000

1. General

This instruction covers the type, care, and use of pneumatic tools carried on each portable air compressor of the Overhead Construction Division.

2. Standard Compressor Tools

Each compressor shall be equipped with the following tools:

- a. Two paving breakers, heavy duty, 70 lb. class, 1-1/8" x 6" hex chuck, with the following accessories:

2 Ea.	Digging chisel with 3" x 12" blade 2'-0" Overall	Stock #85 07 055
3 Ea.	3" Chisel edge with round shank 5'-6" Overall	Stock #85 07 056
3 Ea.	Moil Point with hex shank 3'-6" Overall	Stock #86 02 123
3 Ea.	Moil Point with hex shank 6'-6" Overall	Stock #86 02 128

- b. One rock drill, heavy duty, 55 lb. class, 7/8" x 3-1/4" hex chuck, blower type, with the following accessories:

2 Ea.	2' Drill Steel For detachable bit	Stock #85 32 135
2 Ea.	4' Drill Steel For detachable bit	Stock #85 32 136
2 Ea.	6' Drill Steel For detachable bit	Stock #85 32 137
3 Ea.	2" Drill bit, 4 Point	Stock #85 04 105
3 Ea.	1-1/2" Drill bit, 4 Point	Stock #85 04 156

- c. One backfill tamper, 35lb. class, with 5" diameter butt.

- d. Hoses and Fittings:

4 Ea.	50' length 3/4" heavy duty air hose complete with Thor #2072 fittings.
2 Ea.	12-1/2' length 3/4" heavy duty air hose complete with Thor #2072 fittings.
2 Ea.	25' length 1/2" air hose complete with Thor #2071 fittings (for backfill tamper).

3. Use

The paving breaker with its accessories is normally used for the following work:

<u>Use</u>	<u>Accessory</u>
Cutting through asphalt	Digging chisel
Breaking concrete	Moil point or chisel edge
Digging in rock or boulders	Moil point or chisel edge
Digging in hard-pan	Digging chisel or chisel edge
Starting rock anchor holes	Digging chisel or chisel edge

The rock drill with drill rod and either 2-1/4" or 1-1/2" detachable bit is normally used as follows:

<u>Use</u>	<u>Bit Size</u>
Drilling holes for rock anchor	2"
All other drilling	2" or 1-1/2"*

*1-1/2" drill cuts much faster and should be used in most cases.

The backfill tamper is normally used for backfilling either dirt or rock.

Either the rock drill or the paving breaker may be operated separately from each compressor but not simultaneously.

The backfill tamper may be used separately or with the paving breaker.

Excessive air hose length reduces the operating efficiency of air tools, therefore, where practicable the compressor should be located so that only one section of the hose is necessary for the operation of a tool.

The 1/2" air hose should be used only on the backfill tamper.

4. Care

a. Lubrication

Pneumatic Air Tools require a special type of lubricating oil. This oil is available in one gallon cans under Stock #3159051.

Each compressor is equipped with a line oiler and this oiler should be full at the beginning of each shift. The oil chamber on each tool should also be full at the beginning of each shift. When the line oiler is functioning properly no oil will be required from the chamber on the tool. The chamber will remain full, adding insurance of proper lubrication.

b. Hose

The air hose should be kept on the reel when not in use. Each 50' section should have its turn at regular use and not be left on the reel for long intervals.

c. Sharpening

The paving breaker steels should be sent in to the Utility Shop for sharpening.

All broken steels should be sent to the Salvage shop.

d. Bits

The detachable bits should be sent to the Salvage Shop when broken or dulled beyond their usefulness.

1. General

This instruction specifies procedures, care and precautions to be used in handling and installing 5000 volt insulated wire. This type of wire is used for primary voltage installations on the 4160 and 4800 volt systems where open wire would be hazardous. These installations include primary transformer leads, switch leads and primary taps.

2. Care In Handling And Installing

It is essential that the utmost care and precaution be exercised in handling and installing 5000 volt insulated wire. A flexible insulation is inherently weak to mechanical damage. Even the best insulated wires or cables presently available have certain limitations and require care during handling and installation. The care exercised in storing and handling 5000 volt wire should be similar to that which is given to the storage, handling and use of rubber protective equipment.

2.1 Handling Before Installation

Care shall be taken to avoid cutting and abrading the insulation on 5000 volt wire before installation. The wire shall be supported in the truck on a smooth flat surface and shall be kept free of dirt, grease or other foreign substances. It shall not be thrown into the truck or onto the ground at any time. Throwing the wire on sharp objects will result in possible damage to the insulation. Similarly, objects shall not be thrown on the wire. Dragging the wire from the truck or along the ground will result in abrasion of the wire and shall be avoided.

2.2 Care And Precautions While Installing

2.2.1 Clearance

5000 volt wire shall be installed in such a manner that the insulation will not be damaged by rubbing against other objects nor be pressed against any projection which will cause an indentation in the insulation.

2.2.2 Bending

5000 volt insulated wire shall never be bent at a radius less than 10 times the outside diameter of the wire. (Diameter includes the insulation.) Excessive stretching by too sharp a bend will weaken the insulation.

2.2.3 Corona

5000 volt insulated wire shall be installed as far as possible from grounded objects or other conducting surfaces. Objects with sharp edges, such as bolts, brackets and transformer tanks, when in contact with the insulation cause a concentration of the corona at these edges and will accelerate the destruction of the insulation.

2.2.4 Splices

5000 volt insulated wire shall not be spliced where the splice will be inside conduit or within 6 inches of the point of entry of the insulated wire into the conduit. All splices shall be insulated with two layers of H.V. rubber tape (Stock #25 53 070) half lapped, two layers of friction tape (Stock #25 53 003) half lapped and the splice completed with a single layer of vinyl plastic tape (Stock #25 53 055) half lapped. See Dist. Std. 41 24 30 ** for a cold-shrinkable 5kV splice.

2.2.5 Taps

Joints where 5000 volt insulated wire tap a second 5000 volt insulated wire shall be insulated in the same manner as a splice. The joint shall be insulated with two layers of H.V. rubber tape half lapped, two layers of friction tape half lapped and the joint completed with a single layer of vinyl plastic tape half lapped.

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1. General

This instruction covers the inspection, testing, care and maintenance of all live line tools used in construction and maintenance of overhead lines.

2. Scope

The tools covered by this instruction include all live line tools as well as rope and other associated equipment used with these tools.

3. Storage

All live line tools shall be kept dry when not in use. When carried on a truck, they shall be placed in canvas bags and stored in assigned compartments. If special compartments and canvas bags are not available, the tools shall be transported in such a manner as to reduce to a minimum the possibility of damage and exposure to weather.

When live line tools are stored in a storeroom or at a works headquarters, they shall be placed in a well ventilated cabinet or trailer designed for this purpose. All precautions should be taken to insure that live line equipment is not subject to moisture or dampness while being stored.

4. Care of Live Line Equipment on the Job

Live line tools shall be wiped clean with silicone treated wiping clothes and visually inspected before being used. The inspection should include such items as condition of finish, cracks or gouges in the fiberglass and condition of hardware. The surface of the tool should be smooth, free of dust and have a shiny finish. If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live line tool is present the tool should be removed from service and returned to the Stores Department.

When live line tools are temporarily laid aside on the job, they should be laid on waterproof canvas drop clothes to keep them clean and free of moisture.

All rope used in live line work shall be the standard treated rope used for other line work, but the lengths when required shall be issued from new rope and kept separate for this purpose only. Special care shall be exercised to keep this rope clean and dry and stored on the truck so that it will not be subject to moisture, dirt, oil, or grease.

5. Two Year Inspection

Live line tools used for primary employee protection shall be cleaned waxed and inspected every two years. All live line tools which satisfactorily pass the two year inspection shall be marked with the date of the inspection. All live line tools having any defects or contamination that could adversely affect the insulating qualities or mechanical integrity of the live line tool shall be returned to the Stores Department.

6. Return of Live Line Equipment

All surplus live line equipment and live line equipment which is defective in any manner shall be returned to the Stores Department. All wood hot sticks should be retired and returned to the Stores Department. All live line equipment which is returned to the Stores Department for any reason shall have a Tool Repair Ticket, Form #5074, firmly attached. These tags shall be filled out in detail and the specific reason the tool is being returned shall be carefully noted on the tag.

7. Inspection and Maintenance by Meter Department

All live line equipment which is returned to the Stores Department from the field shall be sent to the Meter Shop for inspection. All returned equipment shall be carefully cleaned, inspected, and tested for current leakage by personnel of the Meter Shop and Meter Laboratory before being returned to stock. The inspection procedure will be as follows:

- a. Thoroughly clean the equipment using an approved hot stick cleaner.
- b. Check each tool for indications that the tool may have been mechanically over stressed. This type of damage is evidenced by bent or cracked parts, bent rivets or bolts, signs that ferrules have been pulled away from their original positions and obviously damaged fiberglass members. Check metal parts of the tool for excessive wear and other visible damage and repair or replace as needed.



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- c. Minor parts such as end caps, tool hangers, tie wire assistants, hand guards, and machine screws shall be replaced by the Meter Shop.
- d. Hot Sticks which have been cleaned and inspected shall then be tested for current leakage with an approved Hot Stick Tester. Detailed instructions for use of the Hot Stick Tester are contained in Standard Work Practice Section IX-C-1-1 through IX-C-1-8. All live line tools which fail to pass the current leakage test shall be dried out in a drying cabinet. After drying out, the tools shall be retested for current leakage with the Hot Stick Tester.
- e. All hot line equipment which satisfactorily passes the inspection and testing by the Meter Shop and Laboratory shall be marked with the date of the test, appropriately packaged, marked with an identifying U.E. stock number and returned to the storeroom to be placed in stock.
- f. Non-stock live line tools which pass inspection and testing by the Meter Shop and Laboratory shall be returned directly to the original user, if known. Otherwise, these tools shall be accumulated by the T&D Meter Shop and listed in T&E Newsletter as available live line tools.



1. General

This instruction prescribes procedures to be followed on group operated airbreak and load-break switches on 13.8kV thru 69kV lines and in customer substations. It does not apply to switches installed in company substations.

2. Procedure

- a. The switch should be disconnected from all electric power sources before service.
Ground leads or their equivalent should be attached to both sides of the switch. Local and applicable OSHA regulations, including all safety precautions should be followed. Switch leads that may have been removed shall be re-connected and all switch terminals shall be checked for tightness before the switch is released for normal service.
- b. Look for evidence of burning, pitting or overheating of the blade and stationary contacts. Inspect all live parts for scarring, gouging, or sharp points that could contribute to excessive radio noise and corona. Check corona balls and rings for damage that could impair their effectiveness.
- c. Inspect the flexible braids or slip-ring contacts used for grounding the operating handle. Replace braids showing signs of corrosion, wear, or having broken strands.
- d. Switches having silver contacts shall be cleaned and those having copper contacts may be lightly dressed with sandpaper.
- e. A preliminary check on the operation of all moving parts shall be made to determine if any bushings, bearings, pins, etc., are missing or worn and replacement shall be made as required.
- f. The mounting bolts that fasten the base of each switch to the crossarms shall be checked for tightness and tightened as needed. Also, the mounting bolts and lag screws that fasten all guide bearings and the operating handle assembly to the pole shall be checked and tightened. All other supporting members of the switch structure that may become loose through weathering should also be checked and tightened.
- g. After all necessary repairs have been made and all mounting bolts, hardware, etc., has been tightened, the overall operation of the switch shall be carefully checked and adjusted.
- h. Inspect interphase linkages, operating rods, levers, bearings, etc., to assure that adjustments are correct, all joints are tight, and pipes are not bent. Clean and lubricate the switch parts only when recommended by the manufacturer. The length of the interphase rods should be adjusted as needed so that all units open and close simultaneously. It is important that all switches operate to the fully closed position. The shortening or lengthening of the interphase rods may have to be repeated several times to assure proper operation. The travel of the operating handle should be set so that a slight effort is required to lock it in either the open or closed position. Check gear boxes for moisture that could cause damage due to corrosion or ice formation.
- i. Inspect the insulators for breaks, cracks, burns, or cement deterioration. Clean the insulators particularly where abnormal conditions such as salt deposits, cement dust, or acid fumes exist. This is important to minimize the possibility of flashover as a result of the accumulation of foreign substances on the insulator surfaces.
- j. Check the switch for alignment, contact pressure, eroded contacts, corrosion, and mechanical malfunction. Replace damaged or badly eroded components. If contact pitting is of a minor nature, smooth the surface with clean, fine sandpaper (not emery) or as the manufacturer recommends. If recommended by the manufacturer, lubricate the contacts. Inspect arcing horns for signs of excessive arc damage and replace if necessary.
- k. Power-operating mechanisms for switches are usually of the motor-driven, spring, hydraulic, or pneumatic type. The particular manufacturer's instructions for each mechanism should be followed. Check the limit switch adjustment and associated relay equipment for poor contacts, burned out coils, adequacy of supply voltage, and any other conditions that might prevent the proper functioning of the complete switch assembly.

- I. Inspect and check all safety interlocks while testing for proper operation for Turner D Switch.

3. Interrupters

Vacuum interrupters (bottles) shall be checked for proper operation. Check the fiberglass housing. If there is evidence of burning from the inside showing or if there are cracks which appear to go through the housing, replace the bottle.

The bottle is designed to interrupt 2000 amps of load current (1200A capacitive). It is not able to carry load current for more than a few seconds.

The actuating arm on the bottle trips the vacuum interrupter internally. Check that the arm operates smoothly and there is a click for tripping and for resetting (when the arm is released). Be sure the actuating arm springs back to its reset or rest position. Check electrical continuity in the reset position and for open in the trip position.

3.1 Turner D Switches:

Check for proper switch blade -- actuating arm operating. The actuating arm on the bottle should be contacted by the opening switch blade pick up hardware before the quick whips separate from the stationary contact. As the blade keeps moving the current is carried through the actuating arm until it trips. As the blade keeps moving it clears the bottle actuating arm (minimum 3/4"). The actuating arm then springs back to reset. When the switch is closed again, momentary contact will be made with the bottle actuating arm.

3.2 SEECO Switches:

Switches supplied with high-speed, snap-out arcing horns for the interruption of limited amounts of line charging and transforming magnetizing currents. Horn shall be tapered design to provide maximum tip speed and shall include a mechanical stop (snubber) to prevent return/rebound of the horn and possible re-strike.

Inspect the arcing horn assemblies to insure that no whips are burned and that no snubber rubbers are broken. Insure that the arcing horn whips engage the hooks and are held as the switch opens. Insure that all jaw assemblies open completely, so that the blade closing in will hit inside the jaw rather than on the outside. Insure that the blade closing in will hit the center of the jaw contact finger assemblies equally.

The switch has vacuum interrupters installed, inspect to insure that interrupter operating arm is engaged correctly by the opening blade and visually inspect the auxiliary contacts to insure that they are not burned and they engage in the proper sequence.

4. Application of Silicone Compound

Silicone compound shall be applied to 13.8kV and 34.5kV airbreak switches to minimize the adhesion of ice to switches and operating mechanisms.

4.1 Areas of Application

Silicone compound shall be applied to the following switch parts.

- a. All bearings, pivot points and pins.
- b. Contact Areas
 1. The stationary contact assembly.
 2. The switch contact area.
 3. Arcing horns.
- c. Any location where ice may form between a moving part and a stationary member. For example: On interphase rods where the clearance between the interphase rods and switch base is small.

4.2 Method of Application

Stock No. 31 51 048 – "Compound – Insulating, Silicone, in 12 oz. Pressurized Cans" – This silicone compound is combined with a solvent in a liquid form and is packaged in an aerosol bomb. Upon application the solvent quickly evaporates leaving the silicone compound. A sufficient amount of spray should be applied to leave a thin film of silicone compound on the area sprayed.

CAUTION: The solvent will attack rubber; do not spray on rubber equipment.



OVERHEAD LINES INSTRUCTION
Clearances of Supporting
Structures from Other Objects

29 00 17 01

Sheet 1 of 1

1. General

This standard and the Clearance Standards that follow cover minimum clearances to be used in the design and construction of overhead lines on the Ameren System. The clearances specified meet or exceed the NESC requirements as required by the amended 83 IL. Admin. Code 305 and the MO 4CSR 240-18.010 Safety Standards.

These clearances also meet the requirements of the 2017 Edition of the NESC.

2. Horizontal Clearances of Supporting Structures

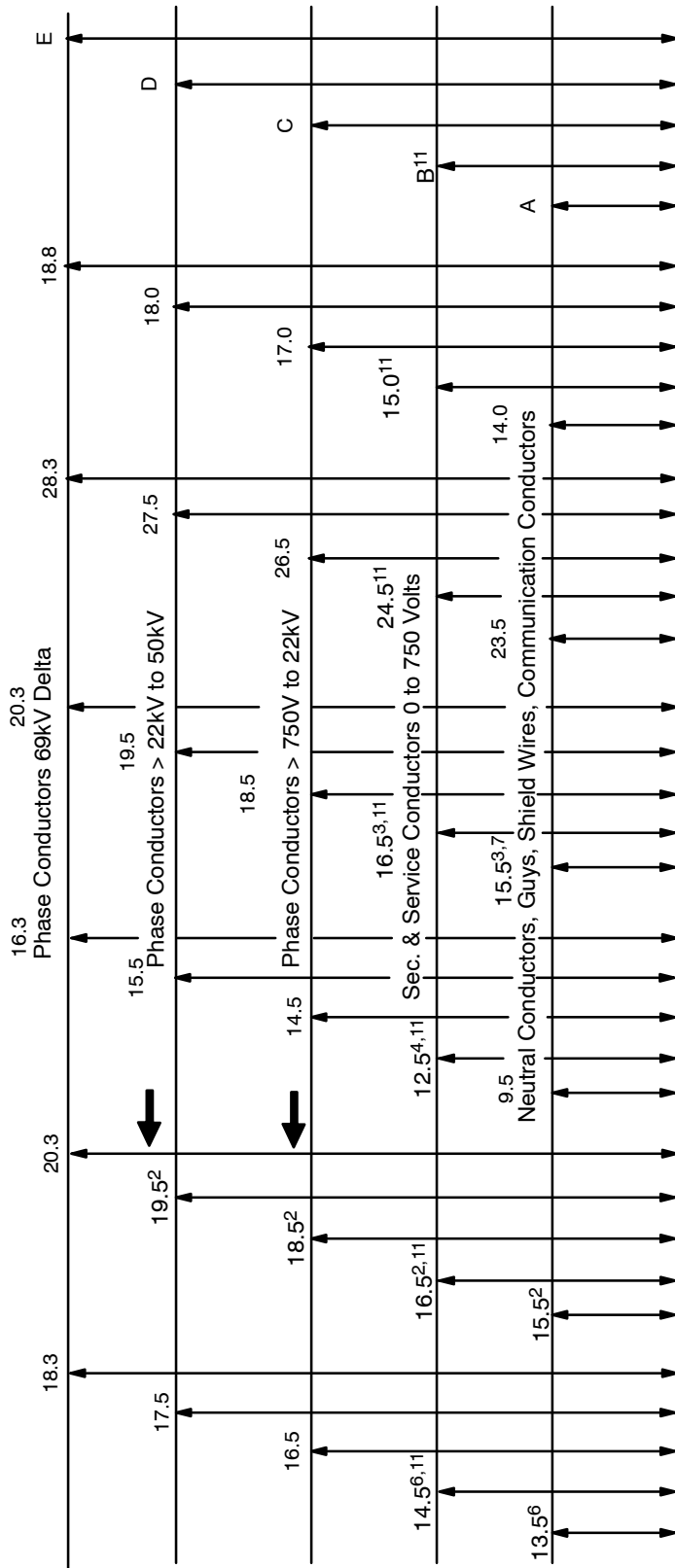
Supporting structures, support arms, anchor guys, and attached equipment shall have the following minimum clearances, measured between the nearest parts of the objects concerned:

OBJECTS	MINIMUM	RECOMMENDED
A. Fire Hydrants	3 ft. ³	4 ft.
B. Streets, Roads, & Highways ⁴	Horizontal Clearance for First 15 Ft. Above Ground ⁵	
1. With street curbs (clearance measured from street side of the curb).	See Note 1. ⁴	2 ft. ^{1,4}
2. With no curbs.		As close as practical to R.O.W. Line ⁴
C. All Railroad Tracks	Horizontal Clearance for First 22 ft. Above the Nearest Track Rail	
	12 ft. ²	12 ft.

NOTES:

Reference: 2017 NESC, Rule 231.

- Supporting structures should be placed as far as practical behind the curb within the road right-of-way and shall be located a sufficient distance behind the curb to avoid contact by ordinary vehicles using and located on the traveled way. Some ordinary trucks and delivery vehicles overhang the curb by more than 6 in. Superelevated curves and heavily crowned roads further increase this overhang.
- This may be reduced to 7 feet where the supporting structure is not the controlling obstruction, provided sufficient space for a driveway is left where the cars are loaded and unloaded.
- 3 feet is allowed only if conditions do not allow 4 feet clearance.
- For Illinois and Missouri State and Federal highways, location of structures shall be as required by each individual permit. In Illinois, 92 IL Admin. Code 530 provides requirements for location of support structures. In Missouri, MO 7CSR 10-3.010 provides requirements for location of support structures.
- Specified clearance is to the support structure or the closest support arm, anchor guy, or attached equipment on that structure up to 15 feet above the road surface.



Along roads in rural areas where conductors run within the limits of road ROW, but DO NOT overhang the roadway and where it is unlikely that vehicles will be crossing under the line.

Along or across streets, subject to truck traffic. Other land traversed by vehicles such as cultivated, grazing forest and orchard lands, industrial areas, commercial areas, etc.¹²

Spaces or ways accessible to pedestrians only.⁵

Across, driveways, alleys and parking lots.

Track rails of railroads.

Water areas not suitable for sailboating or where sailing or boating is prohibited.¹⁰

Water areas suitable for sailboating. Including lakes, ponds, reservoirs, rivers, streams & canals with unobstructed surface areas.

Reference Height ⁹	All Distance in Feet				
	A	B ¹¹	C	D	E
16	17.5	18.5	20.5	21.5	22.3
24	25.5	26.5	28.5	29.5	30.3
30	31.5	32.5	34.5	35.5	36.3
36	37.5	38.5	40.5	41.5	42.3

Water Areas^{8,9,10,13}

NOTES:

(Based on maximum calculated sag for span; see Note 1.)

(All voltages are phase-to-ground unless otherwise indicated.)

Reference: 2017 NESC, Rule 232, Table 232-1

1. The vertical clearances apply under the following conductor temperature and loading conditions, whichever produces the largest final sag.
 - a. 120°F (50°C), no wind displacement.
 - b. The maximum conductor temperature for which the line is designed to operate, if greater than 120°F (50°C), with no wind displacement.
 - c. 32°F (0°C), no wind displacement with 1/2 inch of ice.
2. Where this construction crosses over state and federal commercial highways, this clearance shall be no less than 18 ft. per MO Title 7 CSR 10-3.010 and 92 Il. Admin. Code 530. For Illinois limited access highway crossings, this clearance shall be no less than 20 ft.
3. Where vehicles exceeding 8 ft in height are not normally encountered nor reasonably anticipated, service drop(s) clearances over residential driveways only may be reduced to the following:

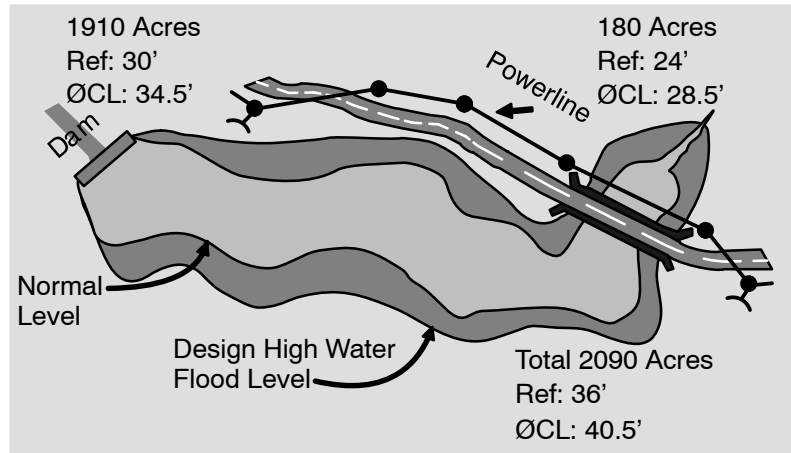
a. Insulated supply service drops limited to 300V to ground	12.5 ft.
b. Insulated drip loops of supply service drops limited to 300 V to ground	10.5 ft.
c. Triplex supply service drops limited to 150V to ground	12.0 ft.
d. Drip loops only of triplex service drops limited to 150V to ground	10.0 ft.
e. Insulated communication service drops	11.5 ft.
4. Clearance values for service drops to residential buildings only may be reduced to the following:

a. Insulated supply service drops limited to 300V to ground	10.5 ft.
b. Insulated drip loops of supply service drops limited to 300V to ground	10.5 ft.
c. Triplex supply service drops limited to 150V to ground	10.0 ft.
d. Drip loops only of triplex supply service drops limited to 150V to ground	10.0 ft.
5. Spaces and ways subject to pedestrians or restricted traffic only are those areas where riders on horseback or other large animals, vehicles, or other mobile units exceeding 8 ft in height, are prohibited by regulation or permanent terrain configurations or are otherwise not normally encountered nor reasonably anticipated.
6. Where a line along a road is located relative to fences, ditches, embankments, etc. so that the ground under the line would not be expected to be traveled except by, pedestrians, this clearance may be reduced to the following values:

a. Triplex and quadruplex 120V to ground	10.0 ft.
b. Insulated conductors 0 to 300V to ground	12.5 ft.
c. Guys, neutrals, insulated communication cables	9.5 ft.
7. Where this construction crosses over and runs along alleys, driveways, or parking lots not subject to truck traffic, this clearance may be reduced to 15 ft.
8. The surface area and corresponding clearance shall be based upon the normal flood level or, for controlled impoundments, upon the design high water level. The clearance over rivers, streams, and canals shall be based upon the largest surface of any one-mile long segment which includes the crossing. The clearance over a canal or similar waterway providing access for sailboats to a larger body of water shall be the same as that required for the larger body of water.
9. Where an over water obstruction restricts vessel height, the required clearance may be reduced by the difference between the Reference Height from the 'Water Areas' table above (for the overall area of the body water that the line crosses), and the over water obstruction height. Exception: The reduced clearance shall not be less than that required for the water surface area on the line-crossing side of the obstruction.

Example: A 12.47 kV line will cross over a portion of a 2090 acre lake adjacent to a bridge. For this size lake, the normally required clearance for a 12.47 kV line is 40.5 ft. (the Reference Height = 36 ft.). The area of the lake on one side of the bridge is 1910 acres. For a 1910 acre lake, the normally required clearance for a 12.47kV line is 34.5ft. The area of the lake on the other side of the bridge is 180 acres. For a 180 acre lake, the normally

required clearance for a 12.47 kV line is 28.5 ft. The height of the bridge above the water is 25 ft. The Reference Height for the overall area of the lake minus the bridge height is 11ft. (36 ft. – 25 ft.).



If the 12.47 kV line is installed on the 1910 acre side of the bridge, an 11 ft. reduction in the clearance over the 2090 acre lake would be 29.5 ft. (40.5ft. – 11ft.). However, 29.5 ft. is less than the 34.5 ft. required for a 12.47 kV line over a 1910 acre lake. Therefore, if the 12.47 kV line crossing is done over the 1910 acre side of the bridge, the full 34.5 ft. clearance of the 12.47 kV line over the lake must be maintained.

If the 12.47 kV line is installed on the 180 acre side of the bridge, an 11 ft. reduction in the clearance over the 2090 acre lake would be 29.5 ft. (40.5 ft. – 11 ft.). 29.5 ft. is more than the 28.5 ft. required for a 12.47 kV line over a 180 acre lake. Therefore, if the 12.47 kV line crossing is done over the 180 acre side of the bridge, the clearance of the 12.47 kV line over the lake can be reduced to 29.5 ft.

10. Where the US Army Corps of Engineers, or the State, or surrogate thereof has issued a crossing permit, clearances of that permit shall govern.
11. Clearance can be reduced by 6 inches for triplex and quadruplex conductor.
12. When designing to accommodate oversized vehicles, these clearance values shall be increased by the difference in the known height of the oversized vehicle and 14 ft.
13. Add 5 ft to the water area clearance values for ground clearance at established boat ramp and rigging areas, or areas posted with sign(s) for rigging or launching sail boats.

OVERHEAD LINES INSTRUCTION

Vertical Clearance To Equipment Mounted On Structures

29 00 17 03

Sheet 1 of 2

General

These vertical clearances above ground are for unguarded rigid live parts such as potheads, transformer bushings, lightning arresters, and short lengths of connecting supply conductors which are not subject to variations in sag and effectively grounded equipment cases.

(All voltages are phase-to-ground unless otherwise indicated)

NATURE OF SURFACE BELOW LIVE PARTS	MINIMUM VERTICAL CLEARANCE IN FEET				
	Effectively Grounded Cases	0 to 750 Volts	Over 750V to 22kV	Over 22 kV to 50kV	69kV Delta
1. Where live parts overhang:					
a. Roads, streets, alleys; nonresidential driveways; parking lots and other areas subject to truck traffic ³	15.0	16.0	18.0	19.0	19.8
b. Residential driveways; commercial areas not subject to truck traffic.	15.0	16.0 ¹	18.0	19.0	19.8
c. Other land traversed by oversized vehicles such as cultivated land, grazing land, forest, orchard, industrial commercial etc. ⁷	15.0 ⁵	16.0	18.0	19.0	19.8
d. Spaces and ways accessible to pedestrians only. ⁴	9.0 ⁵	12.0 ^{1b}	14.0	15.0	15.8
2. Where live parts are along and within the limits of high ways or other road rights-of-way but do not overhang the roadway:					
a. Roads, streets, and alleys.	15.0 ⁵	16.0	18.0	19.0	19.8
b. Roads where it is unlikely that vehicles will be crossing under the line.	13.0 ⁵	14.0 ²	16.0	17.0	17.8
3. Water areas not suitable for sailboating or where sailboating is prohibited. ⁶	13.5	14.5	16.5	17.5	18.3
4. Water areas suitable for sail boating including lakes, ponds, reservoirs, tidal waters, rivers, streams, and canals with an unobstructed surface area.	Use clearances over Water Areas in DCS 29 00 17 02 reduced by 6 inches.				

Reference: NESC, 2017 Edition, Rule 232, Table 232-2

NOTES:

1. This clearance may be reduced to the following values(feet):
 - a. Insulated live parts limited to 300V to ground 12
 - b. Insulated live parts limited to 150V to ground 10
2. Where a supply line along a road is limited to 300V to ground and is located relative to fences, ditches, embankments, etc., so that the ground under the line would not be expected to be traveled except by pedestrians, this clearance may be reduced to 12 ft.
3. For the purpose of this rule, trucks are defined as any vehicle exceeding 8 ft. in height. Areas not subject to truck traffic are areas where truck traffic is not normally encountered nor reasonably anticipated.
4. Spaces and ways subject to pedestrians or restricted traffic only are those areas where riders on horseback, vehicles, or other mobile units exceeding 8 ft. in height, are prohibited by regulation or permanent terrain configurations or are otherwise not normally encountered nor reasonably anticipated.

**DISTRIBUTION
CONSTRUCTION STANDARDS**

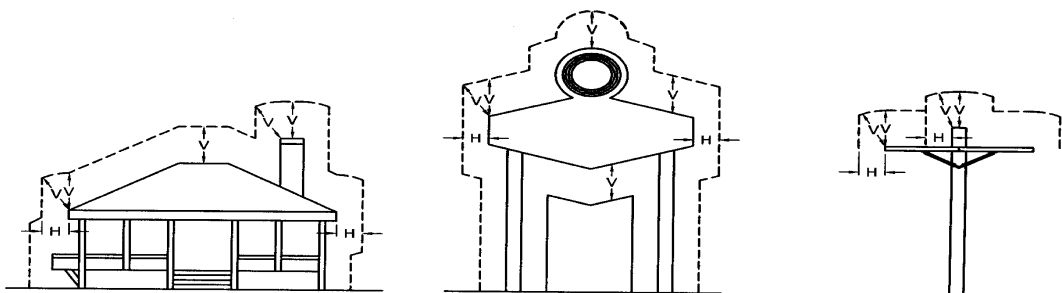


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5. Effectively grounded switch handles and supply or communication equipment cases (such as fire alarm boxes, control boxes, communication terminals, meters, or similar equipment cases) may be mounted at a lower level for accessibility, provided such cases do not unduly obstruct a walkway.
6. Where the US Army Corps of Engineers, or the state, or surrogate thereof has issued a crossing permit, clearances of that permit shall govern.
7. These clearances shall be increased by the difference between the known height of the oversized vehicle and 14ft.

OVERHEAD LINES INSTRUCTION

Clearances of Wires from Buildings and Other Installations



Clearance in Feet

Voltages Are Phase-to- Ground Unless Otherwise Indicated

STRUCTURES	SHIELD WIRES; NEUTRAL CONDUCTORS; GUYS ¹⁰	TRIPLEX OR QUAD CABLES	UNGUARDED RIGID LIVE PARTS 0 TO 750V	PHASE CONDUCTORS 0 TO 750V; SHIELDED & NON-SHIELDED CABLES W/ MESSENGER OVER 750V ¹⁸	UNGUARDED RIGID LIVE PARTS OVER 750V TO 22kV	PHASE CONDUCTORS AT XX KV (PHASE TO PHASE)			
						2.4 12	34	69Y	69Δ
Buildings ^{2,3,19}									
1. Horizontal Clearances, with wind ²⁰	--	--	--	3.5	--	4.5	5.0	5.2	6.2
2. Horizontal Clearances, no wind ²⁰									
a. To walls, projections and guarded windows	4.5 ^{5,11}	5.0 ⁵	5.0 ⁵	5.5 ⁵	7.0 ⁵	7.5 ⁵	8.0 ⁵	8.2	9.2
b. To unguarded windows ¹³	4.5	5.0	5.0	5.5	7.0	7.5	8.0	8.2	9.2
c. To balconies and areas accessible to pedestrians ⁷	4.5	5.0	5.0	5.5	7.0	7.5	8.0	8.2	9.2
3. Vertical Clearances ⁸									
a. Above or below roofs or projections NOT accessible to pedestrians	3.0	3.5 ¹²	10.0	10.5 ¹²	12.0	12.5	13.0	13.2	14.2
b. Above or below balconies or roofs accessible to pedestrians ⁷	10.5	11.0 ¹²	11.0	11.5 ¹²	13.0	13.5	14.0	14.2	15.2
c. Above roofs accessible to vehicles but NOT subject to truck traffic ¹⁶	10.5	11.0	11.0	11.5	13.0	13.5	14.0	14.2	15.2
d. Above roofs accessible to truck traffic ¹⁶	15.5	16.0	16.0	16.5	18.0	18.5	19.0	19.2	20.2
Signs, chimneys, radio and T.V. antennas, tanks and other installations NOT classified as buildings or bridges ^{6,9,19}									
1. Horizontal clearances, with wind ²⁰	--	--	--	3.5	--	4.5	5.0	5.2	6.2
2. Horizontal clearances, no wind ²⁰									
a. To portions that are NOT readily accessible to pedestrians	3.0	3.5	5.0 ⁵	5.5 ⁵	7.0 ⁵	7.5 ⁵	8.0	8.2	9.2
b. To portions that ARE readily accessible to pedestrians ⁷	4.5	5.0	5.0 ⁵	5.5	7.0 ⁵	7.5	8.0	8.2	9.2
3. Vertical Clearances									
a. Over or under catwalks and other surfaces upon which personnel walk	10.5	11.0	11.0	11.5	13.0	13.5	14.0	14.2	15.2
b. Over or under other portions of such installations	3.0	3.5	5.5	6.0	7.5	8.0	8.5	8.7	9.7
Support Structures ^{14, 19}	Guys, messengers, neutrals, triplex 0-300V			Phase conductors & cables 0-750V					
1. Horizontal clearances, with wind ²⁰			--	3.5	--	4.5	5.0	5.2	6.2
2. Horizontal clearances, no wind ²⁰	3.0	3.0	--	5.0	--	5.0	5.5	5.7	6.7
3. Vertical Clearances ¹⁵	2.0	2.0	--	4.5	--	4.5	5.0	5.2	6.2
Crane, derricks, etc. ¹⁷									
1. Vertical clearances	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	15.0
Storage facilities for hazardous materials (oxygen, hydrogen, gasoline, etc.)	Contact the Electric Distribution Standards group before locating any electric line within 50 feet of such a storage facility (Reference is OSHA, 1910 Subpart H)								

OVERHEAD LINES INSTRUCTION

Clearances of Wires from Buildings and Other Installations

NOTES:

Reference: NESC, 2017 Edition, Rules 234 A,B,C, and G.

1. Not used in this revision.
2. The construction of electric distribution primary lines over buildings is to be avoided whenever possible. When avoidance is not practical, these clearances shall be provided.
3. Where buildings or other installations exceed three stories (or 50 feet) in height, overhead lines should be arranged, where practical, so that a clear space or zone at least 6 feet wide will be left either adjacent to the building or beginning not over 8 feet from the building, to facilitate the raising of ladders where necessary for fire fighting.
4. Not used in this revision.
5. Where available space will not permit this value, it may be reduced by 2 feet if the conductors, including splices and taps, have covering which provides sufficient insulation to prevent a short circuit in case of a momentary contact with a structure or building.
6. Clearance to flags and banners shall assume no deflection of the flag pole but maximum displacement of the flag or banner towards the at rest (no displacement) utility facility.
7. A roof, balcony, or similar structure is considered readily accessible to pedestrians if it can be casually accessed through a doorway, window, ramp, stairway, or permanently mounted ladder by a person on foot who neither exerts extra ordinary physical effort nor employs tools or devices to gain entry. A permanently mounted ladder is not considered a means of access if its bottom rung is 8 ft. or more from the ground or other permanently installed accessible surface, or is otherwise equipped with barriers to inhibit climbing by unauthorized persons.
8. For clearances above railings, walls, or parapets around balconies, decks, or roofs, use the clearances required for roofs not accessible to pedestrians.
9. The required clearance shall be increased to allow for the movement of motorized signs and other moveable attachments to any installation covered by this table.
10. Ungrounded guys and ungrounded portion of guys between guy insulators shall have clearances based on the highest voltage to which they may be exposed to a slack conductor or guy.
11. This clearance may be reduced to 3 in. for the effectively grounded portion of guys.
12. Service Conductors Attached to Installation for Service Entrance:
 - a. Service drop conductors including drip loops not in excess of 750 volts, shall have a clearance of not less than 10 ft. from the highest point of roofs over which they pass with the following exceptions.

Exception 1: Where the voltage between open-wire conductors does not exceed 300 volts or the voltage between triplex or quadruplex conductors does not exceed 750 volts and the roof or balcony is not readily accessible, the clearance may be not less than 3 feet.

Exception 2: Where service-drop conductors of 0 to 300V, or triplex or quadruplex cable 0 to 750V pass over a roof or a balcony that is not readily accessible to terminate at a (through the roof) raceway or approved support located not more than 4 feet horizontally from the nearest edge of the roof, it may be maintained at a minimum of 18 inches for a horizontal distance of 6 ft. from the raceway or support, and may be maintained at a minimum of 3 feet for the remainder of the horizontal distance that the conductor or cable passes over the roof.
 - b. Service drop conductors not in excess of 750 volts shall have a clearance of not less than 3 ft. in any direction from windows designed to open.

Exception 1: This does not apply to triplex or quadruplex conductors above the top level of a window.
 - c. Service drop conductors of 300 volts or less may be run along side the installation provided the clearance from the surface of the installation is not less than 3 inches.
 - d. Service drop conductors not in excess of 750 volts shall have a clearance of not less than 5 ft. horizontally from porches, decks, fire escapes, or other similarly attached structures.
 - e. Service drop conductors not in excess of 750 volts shall have a clearance of not less than 3 ft. vertically below porches, decks, fire escapes, or other similarly attached structures.

OVERHEAD LINES INSTRUCTION

Clearances of Wires from Buildings and Other Installations

13. Windows not designed to open may have the clearance permitted for walls and projections.
 14. Support structures include those to which the conductor is not attached, such as a lighting support, a traffic signal support, and a supporting structure of another line.
 15. These clearances may be reduced by 2 ft. (with 2 ft. as minimum) if both of the following conditions are met:
 - a. The wires, conductors, or cables above and the supporting structure of another line below are operated and maintained by the same utility.
 - b. Employees do not work above the top of the supporting structure unless:
 1. The upper circuit is de-energized and grounded, or temporarily insulated or repositioned, or
 2. Other equivalent measures are taken.
 16. For purpose of these clearances, trucks are defined as any vehicle exceeding 8.0 ft. in height. When designing for oversized vehicles, increase clearances by the difference between the known height of the oversized vehicle and 14 ft.
 17. The clearances specified in the table are minimum clearances allowed between any part of the equipment, load line, or load and the energized conductors if the 20ft zone of clearance cannot be maintained. THE CRANE, DER-RICK, ETC. OPERATOR MUST COMPLY WITH OSHA 1926.1408 WHICH SPECIFIES SAFETY REQUIREMENTS IF ANY PART OF THE EQUIPMENT, LOAD LINE, OR LOAD COULD GET CLOSER THAN 20FT TO A POWER LINE.
 18. "Shielded & Non-Shielded Cables w/Messenger Over 750V" does NOT include spacer type cable. Spacer cable clearances are the same as open phase conductors in this DCS.
 19. The clearances specified in the table are NESC minimum clearances. If workers must access these structures for installation or maintenance when the conductors are energized, then minimum approach distances (MAD) for unqualified workers as specified by OSHA in section 1910.333 (c) (3) (i) must be maintained (10 feet for 69kVY and below and 11 feet for 69kVΔ). These MADs are to the longest conductive tool or object the worker may contact.
 20. The following table lists NESC wind displacement for some of Ameren's higher use conductors. These values are added to the 'Horizontal Clearances with wind' values in the clearance table. If this sum is greater than the 'no wind' clearance, the 'no wind' clearance must be increased to this value.
- Example: 12kv, 1/0 AAAC Long Span - Wind displacement is 3.9 ft. The 'with wind' value from clearance table is 4.5 ft. The sum of the two is 8.4 ft. The 'no wind' value from clearance table is 7.5 ft. which is less than the 'with wind' sum. Therefore, the 'no wind' clearance must be increased to 8.4 ft.

HORIZONTAL LINE DISPLACEMENT

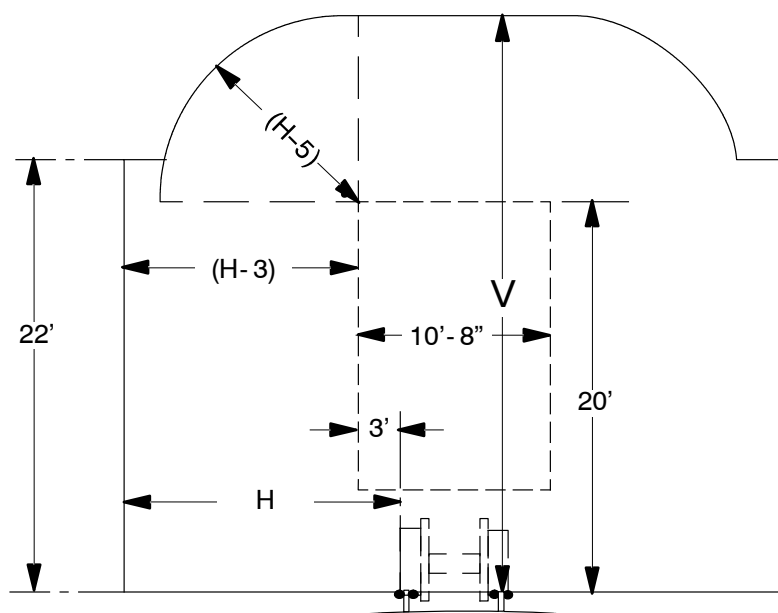
60F, 6psf of WIND, FINAL SAG*

(In Feet)

TABLE 1
SAG TABLE

CONDUCTOR	Short Span	Medium Span	Long Span	Extra Long Span
1/0 AAAC	2.2	3.2	3.9	4.8
110.8 (12/7) ACSR	2.5	3.0	3.3	3.5
336.4 (18/1) ACSR	2.9	3.7	4.5	5.0
556.5 (19) AAC	2.7	3.2	4.2	5.1
954 (45/7) ACSR	3.1	4.1	5.0	5.9
1272 (45/7) ACSR	3.5	4.3	5.0	5.8
4/0 (6/1) ACSR T2	3.2	3.6	4.0	4.1
336.4 (18/1) ACSR T2	2.8	3.5	4.1	4.6
556.5 (19) AAC T2	2.8	3.8	4.8	5.7
954 (45/7) ACSR T2	3.6	4.7	5.8	6.6

*Per NESC Rule 234 A2



Overhead Wires, Conductors, or Cables	Minimum Clearance in Feet ¹	
	V ⁴	H ³
Phase Conductors 69 kV Δ^2	28.3	13.3
Phase Conductors > 22 kV to 50 kV	27.5	12.5
Phase Conductors 751 V to 22 kV	26.5	11.5
Phase Conductors 0- 750V, Unshielded Cables with messenger over 750V	24.5	9.5
Triplex, Quad, Unshielded Cable with Messenger 0- 750V	24.0	9.0
Grounded Guys, Neutrals, Shielded Cables With Messenger	23.5	8.5

NOTES:

■ Reference: NESC, 2017 Edition, Rules 234A and I.

- Clearances shown are NESC minimums. Where the railroad authority issues a crossing permit, clearances of that permit shall govern.
- This voltage is phase-to-phase. All others are phase-to-ground.
- Where conductors run along mine, logging, and similar railways that handle only cars smaller than standard freight cars, the value of H may be reduced by one-half the difference between the width of a standard rail car (10 ft. 8 in.) and the width of the narrower car.
- The vertical clearance V is per DCS 29 00 17 02 (NESC Rule 232).

- P = Probe clearance (18 ft.) ①
H = Horizontal clearance (15 ft.) ①
T = Transition clearance
V₁ = Vertical clearance above a building, see 29 00 17 04
V₂ = Vertical clearance above land, see 29 00 17 02

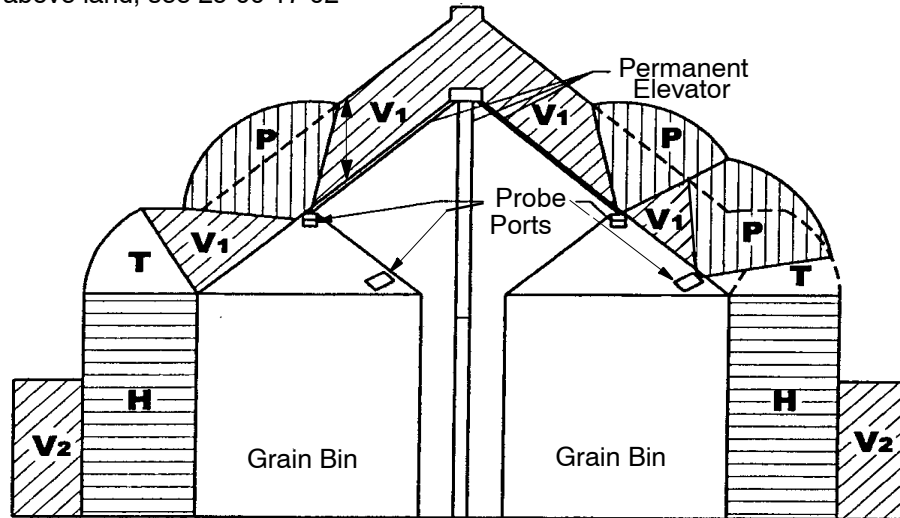


Figure 1 - Clearance Envelope for Grain Bins Filled by Permanently Installed Augers, Conveyors or Elevators

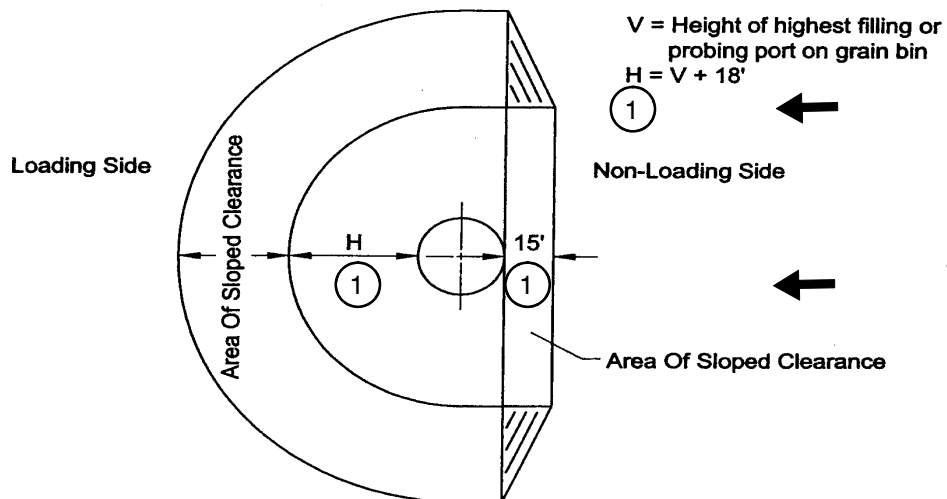
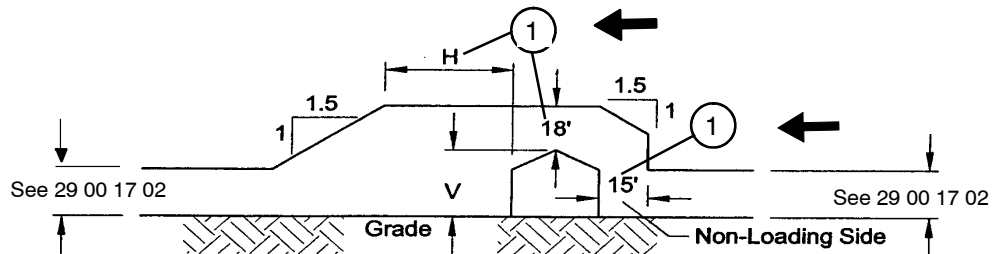


Figure 2 - Clearance Envelope for Grain Bins Filled by Portable Augers, Conveyors, or Elevators

NOTES:

References: NESC 2017 Edition, Rules 234A, F, and G.

1. The clearances on this page are the minimums permitted for up to 34.5kV- Y. Increase dimensions by 0.5 ft. for 34.5 kV- Delta, 0.7 ft. for 69 kV- Y, and 1.7 ft. for 69 kV- Delta.
2. All portions of grain bins that are expected to be loaded by use of a permanently installed auger, conveyer, or elevator system shall be considered as a building or other installation for the purpose of determining clearances, except that for voltages of 0 to 34.5 kV- Y a radial clearance above the bin of not less than 18 ft. shall be maintained above each port and a horizontal clearance of not less than 15 ft. shall be maintained between an open supply conductor and a grain bin.
3. The clearance on the non- loading side of grain bins may be reduced to those required for buildings (see DCS 29 00 17 04) if the cable or equipment is in one of the following categories:
 - (a) Support arms and effectively grounded equipment cases
 - (b) Messengers, guys, neutrals, and shielded cables
 - (c) Triplex and quadruplex unshielded cable with messenger 0- 750 volts
4. Any side of a grain bin is considered to be a non- loading side if it is so designated, or if it is so closely abutting another structure or obstruction, or so close to a public road or other right of way that a portable auger, conveyer, or elevator is not reasonably anticipated to be used over that side or portion to fill the grain bin.
5. Where an agreement excludes the use of portable augers, conveyers, or elevators from a designated portion of a grain bin, such portion is considered to be a non- loading side.

OVERHEAD LINES INSTRUCTION

Clearances of Wires to Bridges

29 00 17 07

Sheet 1 of 1



Clearance in Feet^{1,9}

Voltages Are Phase- to- Ground Unless Otherwise Indicated

	Unguarded rigid live parts and ungrounded equipment cases 0- 750V, triplex, quad, shielded & non- shielded cables with messenger 0- 750V; ungrounded guys ⁸	Unshielded Cable with Messenger Over 750V Phase Conductors 0- 750V	Unguarded rigid live parts and ungrounded equipment cases over 750V to 22kV	Phase Conductors at XX kV (Phase- to- Phase)			
				2.4 12	34	69Y	69Δ
1. Over Bridges ^{2,4}							
a. Attached ³	3.0	3.5	5.0	5.5	6.0	6.2	7.2
b. Not attached	10.0	10.5	12.0	12.5	13.0	13.2	14.2
2. Clearances beside, under or within bridge structure ⁴							
a. Readily accessible portions of any bridge including wing wall and bridge attachments ²							
1. Attached ³	3.0	3.5	5.0	5.5	6.0	6.2	7.2
2. Not attached, no wind	5.0	5.5	7.0	7.5	8.0	8.2	9.2
3. Not attached, with wind ⁷	--	3.5	--	4.5	5.0	5.2	6.2
b. Ordinarily inaccessible portions of bridges (other than brick, concrete or masonry) and from abutments ⁵							
1. Attached ^{3,6}	3.0	3.5	5.0	5.5	6.0	6.2	7.2
2. Not attached, no wind ^{6,8}	4.0	4.5	6.0	6.5	7.0	7.2	8.2
3. Not attached, with wind ^{6,7,8}	--	3.5	--	4.5	5.0	5.2	6.2



NOTES:

Reference: NESC 2017 Edition, Rules 234A, D, and G.

- The clearances on this page are the minimums permitted. No clearances are specified for effectively grounded neutral conductors.
- Where over traveled ways on or near bridges, the clearances specified in 29 00 17 02 also apply.
- Clearances from supply conductors to supporting arms and brackets attached to bridges shall be the same as specified in 29 00 17 09 if the supporting arms and brackets are owned, operated, or maintained by the same utility.
- Where the bridge has moving parts, such as a lift bridge, the required clearances shall be maintained throughout the full range of movement of the bridge or its attachments.
- Bridge seats of steel bridges carried on masonry, brick, or concrete abutments that require frequent access for inspection shall be considered as readily accessible portions.
- Where conductors passing under bridges are adequately guarded against contact by unauthorized persons and can be de- energized and grounded for maintenance of the bridge, clearances of the conductor from the bridge at any point may have clearances specified in 29 00 17 09 for clearances from surfaces of support arms plus one-half the final sag at 60 degrees F no wind of the conductor at that point.
- Clearances with wind shall be determined with the conductor or cable displaced by a 6 lb. per sq. ft. wind at final sag at 60 degrees F. The wind may be reduced to 4 lbs. per sq. ft. in areas sheltered by buildings, terrain or other obstacles. The displacement shall include the deflection of suspension insulators and flexible structures.
- Ungrounded guys and ungrounded portions of guys between guy insulators shall have clearances based on the highest voltage to which they may be exposed due to a slack conductor or guy.
- Where permitted by the bridge owner, supply cables may be run in rigid conduit attached directly to the bridge.

**DISTRIBUTION
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→ Clearances Over Swimming Pools^{1,2}
And Waterways Restricted to Swimming^{1,3}
Voltages Are Phase- to- Ground Unless Other wise Indicated

Open Supply Conductors 69kVΔ

Open Supply Conductors > 22kV - 50kV

Open Supply Conductors > 750V - 22kV, Unguarded rigid live parts (>750V - 22kV)

Open Supply Conductors 0- 750V

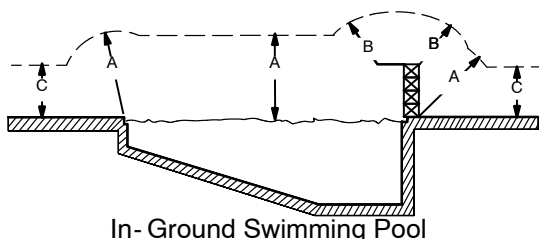
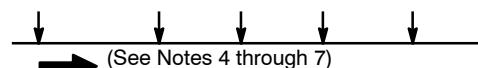
Triplex, Quadruplex, Unguarded Rigid Live Parts (0- 750V), Guys Exposed to >300V - 750V

Neutral Conductors, Guys Exposed to 0- 300V

A = 22.0' 22.5' 23.0' 25.0' 26.0' 26.7'

B = 14.0' 14.5' 15.0' 17.0' 18.0' 18.7'

C = See DCS 29 00 17 02

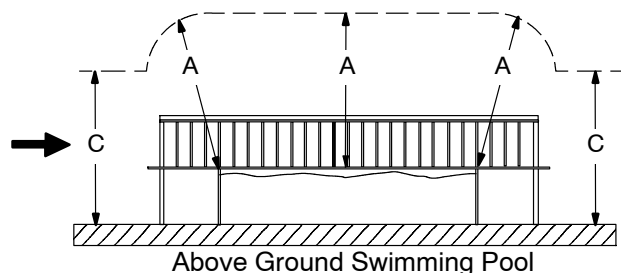


In-Ground Swimming Pool

A = Clearance in any direction to the water level, edge of water surface, base of diving platform or permanently anchored raft.

B = Clearance in any direction to the diving platform, tower, slide, or other fixed pool structure.

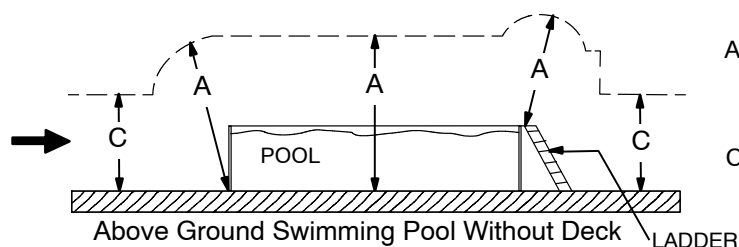
C = Vertical clearance over adjacent land as specified by DCS 29 00 17 02



Above Ground Swimming Pool

A = Clearance in any direction from the highest point of the installation upon which people can stand (typically the pool deck).

C = Vertical clearance over adjacent land as specified by DCS 29 00 17 02.



Above Ground Swimming Pool Without Deck LADDER

A = Clearance in any direction from the highest point of the installation upon which people can stand (typically the pool deck).

C = Vertical clearance over adjacent land as specified by DCS 29 00 17 02.

NOTES:

Reference: NESC, 2017 Edition, Rule 234A, E, and G.

1. Although the NESC allows conductors to be installed over swimming areas, this practice is discouraged and should only be done if there is no other practical alternative.
2. Where wires conductors or cables cross over a swimming pool or the surrounding area, the clearances in any direction shall be as shown in the diagrams above. This rule does not apply to a pool fully enclosed by a solid or screened permanent structure.
3. If rescue poles are not used by lifeguards in supervised swimming beaches, the clearances specified in DCS 29 00 17 02 for the appropriate water body shall be used.
4. Vertical clearances are determined with conductor at final sag, maximum design operating temperature, no wind.
5. This rule does not apply to neutrals, guys, triplex, and quadruplex (0 to 750 V) when these are 10 ft. or more horizontally from the edge of the pool, diving platform, diving tower, slide, or other fixed pool related structures.
6. For hot- tubs, jacuzzis, spas, etc. not suitable for swimming, vertical clearance is from the highest point of the installation upon which a person can stand. See DCS 29 00 17 04 for this clearance.
7. For wading pools, see DCS 29 00 17 02, "space or ways accessible to pedestrians only".

A. MINIMUM VERTICAL CLEARANCE BETWEEN LINE CONDUCTORS (INCHES) ¹

(All voltages are phase-to-ground unless otherwise indicated)

<div style="text-align: center;"> <div style="transform: rotate(-45deg); display: inline-block;"> Conductors Usually at Upper Levels Conductors Usually at Lower Levels </div> </div>		Open Supply Line Conductors									
		Neutral Conductors: Triplex & Quadruplex		0 to 8.7 kV		> 8.7 to 22 kV		> 22 to 50 kV		69 kVΔ	
		At Pole	Mid Span	At Pole	Mid Span	At Pole	Mid Span	At Pole	Mid Span	At Pole	Mid Span
Communication Conductors		40 ⁶	30	40	30	46	35	57	43	66	52
Neutral Conductors; Phase Conductors 0- 750 Volts; Triplex & Quadruplex		16 ⁷	12 ⁷	16 ^{4,9}	12 ^{4,9}	22 ⁸	17 ⁸	33 ⁸	25 ⁸	42 ⁸	34 ⁸
> 750 V to 8.7 kV		-	-	16 ⁴	12 ⁴	25 ⁸	19 ⁸	36 ⁸	27 ⁸	45 ⁸	37 ⁸
> 8.7 to 22 kV		-	-	-	-	31 ⁸	24 ⁸	42 ⁸	32 ⁸	51 ⁸	43 ⁸
> 22 to 50 kV		-	-	-	-	-	-	53 ⁸	40 ⁸	62 ⁸	54 ⁸



NOTES:

Reference: NESC, 2017 Edition, Rule 235 A,C, and G

- In Illinois, where conductors are mounted on crossarms, IL Adm Code 305 Table A takes precedent (See Sheet 2 of this DCS).
- The minimum vertical clearance at any point in the span shall be not less than the mid- span values in the table above with the upper conductor at its maximum design operating temperature or 32° F with ½ inch of ice (whichever produces the greatest final sag) and the lower conductor at its final sag at the same ambient temperature. The clearance "At Pole" means the clearance at the support on the supporting structure.
- Communication service drops, crossing under neutral conductors on a common crossing structure, may have a minimum clearance of 4 inches to the neutral conductor.
- Where conductors are operated by different utilities, the minimum vertical clearance of 40 inches at the pole and 30 inches mid- span are recommended.
- Triplex and quadruplex cables, 0- 480 volts, running above and parallel to communication service drops, may have a minimum spacing of 12 inches at any point in the span, including the point of and at their attachment to a building, provided that a clearance of 40 inches is maintained between the two services at the pole.
- May be reduced to 30 inches for effectively grounded supply neutrals where the communication messenger is bonded to the neutral.
- No clearance is required between neutral conductors and triplex or quadruplex cables if owned by the same utility.
- Where conductors are operated by different utilities, add 24 inches to the "At Pole" clearance. The new "Mid Span" clearance is then 75% of this new "At Pole" clearance.
- Secondary conductors (0- 750V) on vertical racks are allowed to have only 8 inches separation at the pole for span lengths up to 250 feet and 12 inches separation up to 300 feet.

B. VERTICAL SEPARATION BETWEEN CROSSARMS

Reference: 83 IL. Adm. Code 305 Table A; **Applicable only to service area in Illinois**

(All voltages are nominal circuit voltages)

Conductors Usually at Lower Levels \ Conductors Usually at Upper Levels	Neutral Conductors; Phase Conductors 0 to 480 Volts; Shielded & Non- Shielded Cables With Messenger	Phase Conductors				
		2.4 to 4 kV	7.2 to 13.8 kV	14.4 to 34 kV	69 kV Y	69 kV Δ
Communication Conductors	48 in.	48 in.	48 in.	72 in.	72 in.	81 in.
Communication Conductors Used in Operation of Power Lines	24	24	24	48 ¹	48 ¹	57 ¹
Neutral Conductors; Phase Conductors 0 to 480 Volts; Shielded & Non- Shielded Cables with Messenger	24	24 ¹	24 ¹	48 ¹	48 ¹	57 ¹
Phase Conductors						
2.4 to 4kV	-	24 ¹	24 ¹	48 ¹	48 ¹	57 ¹
7.2 to 13.8kV	-	-	24 ¹	48 ¹	48 ¹	57 ¹
14.4 to 34kV	-	-	-	48 ^{1,2}	48 ^{1,2}	57 ^{1,2}
69 kV Y	-	-	-	-	48 ^{1,2}	62 ^{1,2,3}
69 kV Δ	-	-	-	-	-	71 ^{1,2,3}

NOTES:

- Where conductors are operated by different utilities, the minimum vertical clearance shall be increased by 24 inches.
- These values do not apply to adjacent crossarms carrying phases of the same circuit or circuits.
- These values are calculated from the NESC. They exceed the 83 IL. Adm. Code 305 Table A values.

C. HORIZONTAL CLEARANCE BETWEEN LINE CONDUCTORS

Line conductors attached to fixed supports shall have horizontal clearances from each other not less than the larger value required by the following table or as calculated based on the sag of the conductors. For long spans, horizontal clearance requirements will in most cases be driven by the conductor sag calculation method.

(Voltage is between the two conductors for which the clearance is being determined)

Class of Circuit	Clearance (inches) ^{1,2,3}					
	0 to 8.7 kV	> 8.7 to 14.4 kV	> 14.4 to 22 kV	> 22 to 34.5 kV	> 34.5 to 50 kV	69 kV ⁴
Supply Conductors of the Same or Different Circuit	12	15	18	23	29	38

Horizontal clearance based on conductor sag is calculated as follows:

- a. For line conductors smaller than #2 -
Clearance (inches) = $0.3 \times kV + 4.04 \times \text{sq rt } (S - 24)$
- b. For #2 or larger line conductors -
Clearance (inches) = $0.3 \times kV + 8 \times \text{sq rt } (S/12)$

S = the sag in inches of the conductor having the greater sag
(60 degree F, final sag, no wind)

kV = the voltage between the conductors

Example: 69kV, 954 ACSR, 260 ft.spans.

S = 64 inches per DCS 07 00 07 03

kV = $69 \times 1.05 = 72.45$ kV

(Switching surge factor of 1.05 is applied because above 50 kV, the maximum possible operating voltage must be used instead of the nominal voltage)

Clearance = $0.3 \times 72.45 + 8 \times \text{sq rt } (64/12)$
= 41 inches

Therefore; for this example, 41 inches of horizontal spacing at the support is required instead of the 38 inches as indicated in table.

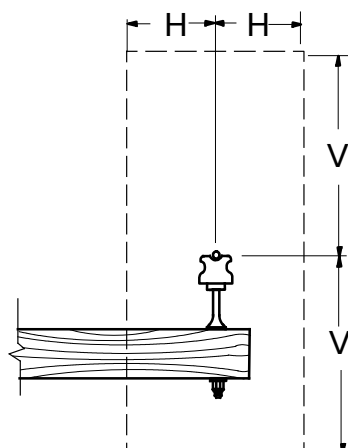
NOTES:

References: NESC, 2017 Edition, Rule 235 A and B

1. The pin spacing on buck-arm construction may be reduced to 7.25 inches for conductors 15 kV line-to-line and below provided that the span lengths do not exceed 150 feet; the 60 degree F sag does not exceed 15 inches (#2 or larger), or 30 inches(smaller than #2); each conductor on the end of every arm is tied to the same side of its insulator; and spacing on the next pole is not less than 14.5 inches.
2. These clearances do not apply to covered or insulated cables.
3. Where suspension insulators are used and not restrained from movement, the horizontal spacing shall be increased so that the clearances above will be maintained with one string of insulators at maximum swing angle with 6 lb/sq ft wind at 60 degree F final sag. This may be reduced to 4 lb/sq ft wind in sheltered areas.
4. For 69 kV conductors of the same circuit, no horizontal clearance is specified in the NESC.

D. DIAGONAL CLEARANCE BETWEEN LINE WIRES, CONDUCTORS, AND CABLES LOCATED AT DIFFERENT LEVELS ON THE SAME SUPPORTING STRUCTURE

No wire, conductor, or cable may be closer to any other wire, conductor, or cable than defined by the dashed line in the figure below. V is determined by section A of this DCS and H is determined by section C of this DCS.



V = Vertical clearance

H = Horizontal clearance

E. CLEARANCES IN ANY DIRECTION FROM LINE CONDUCTORS TO SUPPORTS, AND TO VERTICAL OR LATERAL CONDUCTORS, SPAN OR GUY WIRES ATTACHED TO SAME SUPPORT.

a. Fixed Supports

Clearances shall not be less than those in Table below.

b. Suspension Insulators

Where suspension insulators are used and are not restrained from movement, the clearance shall be increased so that the clearances in the following table are maintained with the string of insulators at maximum design swing angle with 6 lb/sq. ft. wind at 60 degree F final sag. This may be reduced to a 4 lb/sq. ft. wind in sheltered areas. The displacement of wires, conductors, and cables shall include deflections of flexible structures and fittings where such deflection would reduce the clearances.

(All voltages are phase- to- phase)

Clearance of Line Conductors From ¹	0 to 4.16kV	> 4.16kV - 14.4kV	>14.4kV - 34.5kV	69kV
Vertical and lateral conductors: ^{2,3} Of the same ckt. Of other ckts. ¹¹	3 in. 6 in. ⁷	5 in. 9 in.	10 in. 17 in.	19 in. 32 in.
Span or guy wires attached to same structure: ⁹ Span guy parallel to line All other	12 in. ^{5,8} 6 in. ⁵	15 in. 9 in. ⁵	30 in. ¹⁰ 30 in. ¹⁰	38 in. 32 in.
Surface of support arms	3 in. ^{4,6}	5 in.	9 in.	16 in.
Surface of structures	5 in. ^{4,6}	7 in.	11 in.	18 in.

NOTES:

Reference: NESC, 2017 Edition, Rule 235E

- A line conductor is a wire or cable intended to carry electric currents between structures along the route of the line.
- A lateral conductor is a wire or cable entirely supported on one structure and extending in a general horizontal, vertical, or diagonal direction to make connections to line conductors, service drops, equipment, or other facilities on the same structure. Lateral conductors may be attached directly to the structure or supported away from the structure.
- A vertical conductor is either a wire or cable riser (not in non-metallic conduit or u-guard) attached to a pole, or the vertical portion of a lateral conductor.
- A neutral conductor which is effectively grounded throughout its length and associated with circuits 0 to 22 kV to ground may be attached directly to the structure surface.
- If a guy passes within 12 inches of Ameren's conductors and also passes within 12 inches of communication cables, the guy must be insulated with a strain insulator at a point below the lowest supply conductor and above the highest communication cable.
- For supply circuits of 0 to 750V., this clearance may be reduced to 1 in.
- For neutrals and supply circuits of 0 to 750V., this clearance may be reduced to 3 in.
- For neutrals, this clearance may be reduced to 6 inches.
- "Parallel" means in the same general direction as the line conductors. "All other" includes down guys and span guys that cross over or under line conductors. See DCS 11 00 02 03 for reduced clearances allowed to guy insulators.
- 30" is based on Ameren's use of 500 kV BIL and is greater than NESC requirements.

11. These dimensions are based on the voltage of the vertical or lateral conductor being 8.7 kV or less. If voltage of vertical or lateral conductor is greater than 8.7 kV, then these dimensions need to be increased based on assumption that line and vertical or lateral conductor voltages are 180° out of phase.

OVERHEAD LINES INSTRUCTION

VERTICAL CLEARANCES BETWEEN CONDUCTORS AND NON-CURRENT-CARRYING METAL PARTS OF EQUIPMENT

29 00 17 11

Sheet 1 of 1

Equipment here means non-current-carrying metal parts of equipment mounted on the same structure. Non-Current-Carrying metal parts of equipment include metal supports for cables or conductors, metal support braces which are attached to metal supports or are less than 1 inch from transformer cases or hangers which are not effectively grounded, and metal or non-metallic supports or braces associated with communication cables or conductors. Antennas, solar panels, power supplies, etc., are considered equipment for applying these clearances.

(All voltages are phase to ground unless otherwise indicated)

Vertical Clearance of Conductors to Non-Current-carrying metal parts of Equipment ²		Vertical Clearance of span wires and luminaire brackets from communication lines		
Supply Voltage (kV)	Vertical Clearance (in)	Location of Span Wires and luminaire brackets	Not effectively grounded (in)	Effectively Grounded (in)
Grounded conductor and messenger hardware and supports	30	Above communication support arms	40	20 ³
0 to 8.7kV	40 ¹	Above messengers carrying communication cables	40	4
>8.7 to 22kV	46 ¹	From terminal box of communication cable	40	4
>22 to 50kV	57 ¹	From communication brackets, bridle wire rings, or drive hooks	40	4
69kV DELTA	66 ¹	Drip loop of conductor entering luminaire bracket above communication cable, through-bolt, or other equipment	12 ⁴	12 ⁴

NOTES:

Reference: NESC, 2017 Edition, Rule 238

- Where non-current-carrying parts of supply equipment are effectively grounded, communication messenger is bonded to the neutral four times per mile, and communication lines are at lower levels, clearances may be reduced to 30 inches.
- For vertical clearances which are between supply conductors and communication equipment, communication conductors and supply equipment, and supply and communication equipment.
- Clearance may be reduced to 12 inches for span wires or metal parts of brackets which are 40 inches or more from the structure surface.
- May be reduced to 3 inches if the loop is covered by a suitable non-metallic covering that extends at least 2 inches beyond the loop.

Table 1 Clearances of Open Vertical and Lateral Conductors (inches) ^{1,2}				
Phase-to-Phase Voltages (kV)	0 to 8.7 kV	> 8.7 to 22 kV	> 22kV to 50 kV	69kV
From surfaces of supports ⁴	3 ³	6	12	16
From span guy and messenger wires	6 ⁷	12	23	32
Anchor Guys	6 ⁷	10	17	29

Table 2 ⁴ Clearances Between Open Vertical Conductors and Pole Surface (Fig.1,2)		
Phase-to-Ground Voltages (kV) Unless otherwise indicated)	A. Zones Above and Below Conductor Where Clearances Apply (ft.) ⁵	B. Min. Clearance Between Vertical Cond. & Pole Surface (in.)
0 to 22kV	6	19
>22 to 30kV	6	22
>30 to 50kV	6	30
69kVΔ	Note 6	Note 6

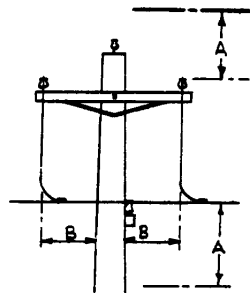


FIG. 1

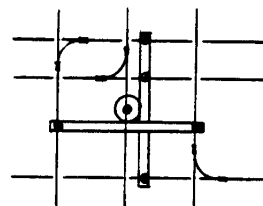


FIG. 2

NOTES:

Reference: NESC, 2017 Edition, Rule 239E.

1. A lateral conductor is a wire or cable entirely supported on one structure and extending in a general horizontal, vertical, or diagonal direction to make connections to line conductors, service drops, equipment, or other facilities on the same structure. Lateral conductors may be attached directly to the structure or supported away from the structure.
2. A vertical conductor is either a wire or cable riser (not in non-metallic conduit or u-guard) attached to a pole, or the vertical portion of a lateral conductor.
3. Clearance may be reduced to 1 inch for supply circuits of 0 to 750 volts. A neutral conductor may be attached directly to the structure surface.
4. If open wire conductors are within 4 feet of the pole, vertical conductors must conform to the zones and clearances in Table 2.

5. Within this zone above and below open supply conductors, vertical and lateral conductors may be enclosed in non-metallic conduit or protected by a non-metallic covering and may be run on the pole surface.
6. These distances are not specified in the NESC for voltages above 50kV phase-to-ground.
7. For effectively grounded neutrals, this clearance can be reduced to 3 inches.

Additional Requirements (per NESC, 2017 Edition, Rule 239)

1. **CONDUCTORS ATTACHED DIRECTLY TO SUPPORTING STRUCTURES.**
Grounding and neutral conductors or conductors physically protected by conduit may be run directly on the support.
2. **CLIMBING SPACE**
Location of vertical or lateral conductors shall not obstruct climbing spaces or lateral working spaces between line conductors at different levels.
3. **CONDUCTORS NOT IN CONDUIT**
All conductors which are not enclosed in a conduit must maintain the same clearances from conduits as from other structure surfaces.
4. **MECHANICAL PROTECTION NEAR GROUND**
All vertical conductors, cables, and grounding wires shall have a suitable mechanical protective covering when within 8 feet of the ground. This protective covering may be omitted from grounding conductors used to ground multi-grounded circuits.
5. **SUPPLY GROUNDING CONDUCTORS**
Supply grounding conductors may be run bare through communication spaces provided no supply equipment is located between the ground rod and the neutral and the grounding conductor is bonded to grounded communication facilities at that structure. All other grounding conductors must be protected by a non-metallic covering for a distance of 40 inches above the highest communication attachment and 6 feet below the lowest communication attachment.
6. **CLEARANCE FROM METAL PARTS**
Vertical runs of supply cables must have a clearance of at least 2 inches from through bolts or other metal parts associated with communication line equipment. Exception: Vertical runs of effectively grounded supply conductors may have a clearance of 1 inch.

A. General

Crossings should be made on a common supporting structure, where practical. When this is not practical, the clearance between any two crossing or adjacent wires, conductors, or cables carried on different supporting structures shall be not less than that required in this DCS.

B. Conductor Movement Envelope

The relevant positions of the conductors or cables on or within their respective conductor movement envelopes must be considered. The conductor movement envelope for each must be determined under the following general conditions, See Figure 1.

- a. Both are simultaneously subjected to the same ambient air temperature and wind loading conditions, and
- b. Each is subjected individually to the full range of its icing conditions and applicable design electrical loading.

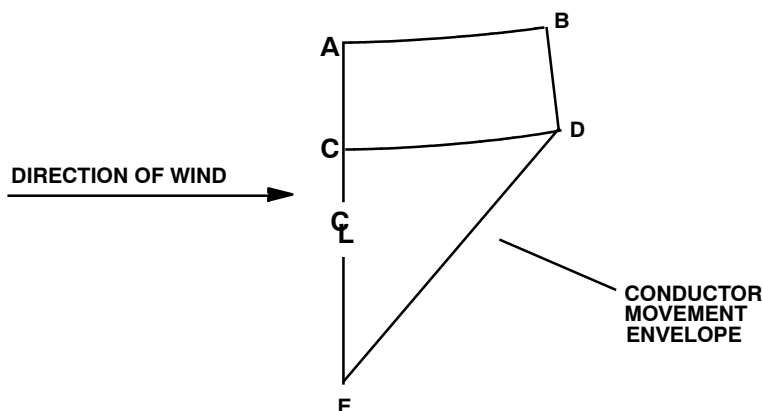
C. Conductor Clearance Envelope

The vertical and horizontal clearances in Table 1 are used to define a clearance envelope as shown in Figure 2. The clearance envelope defines the minimum required clearance to any other conductor or cable.

D. Use of the Conductor Clearance and Conductor Movement Envelopes

The “conductor 1” clearance envelope is drawn with its center located at any point on the “conductor 1” movement envelope. At any point on its movement envelope, the “conductor 1” clearance envelope shall not contact “conductor 2” within its movement envelope with the same horizontal displacement. See Figure 3.

Figure 1 - Conductor Movement Envelope



Point	Conductor Temperature	Sag	Ice Loading	Wind Displacement ¹
A	60° F ⁴	Initial	None	None
B	60° F ⁴	Initial	None	6 psf
C	60° F ⁴	Final	None	None
D	60° F ⁴	Final	None	6 psf
E1 ³	The greater of 120° F or maximum operating temperature	Final	None	None
E2 ³	32° F	Final	½ in.	None

Figure 1 Notes:

1. The direction of the wind shall be that which produces the minimum distance between conductors including the deflection of suspension insulators and flexible structures.
2. Not used in this revision.
3. Point E shall be determined by whichever of the conditions described under E1 and E2 produces the greater sag.
4. When one conductor movement envelope is lower than that of the other conductor, the lower conductor envelope shall be developed with points A, B, C, and D at a conductor temperature equal to the ambient temperature used in determining E of the upper conductor movement envelope.

Figure 2 - Conductor Clearance Envelope

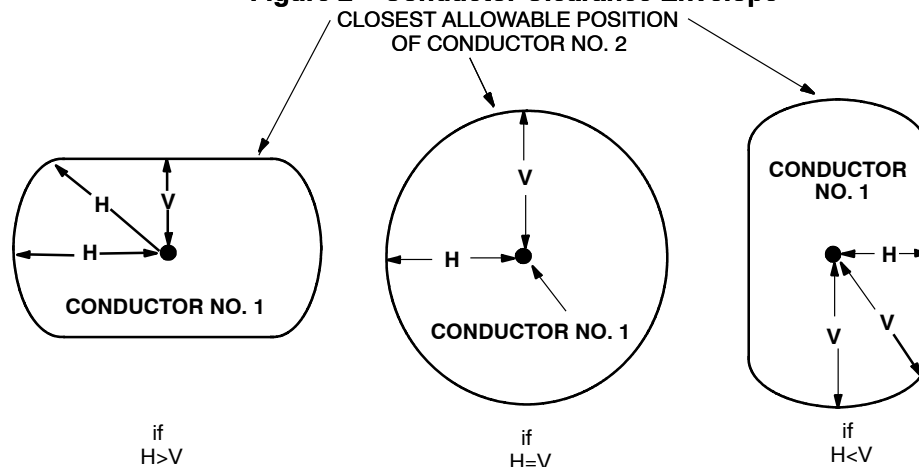


Table 1 - Vertical and Horizontal Clearances for Clearance Envelope

(All voltages are phase- to- ground unless otherwise indicated)

Vertical Clearances V in Feet - Used for Drawing Conductor Clearance Envelope						
<div>Conductors at Upper Levels</div> <div>Conductors at Lower Levels</div>	Shield/Stat- ic Wire, Neutral, Guys ³	Shielded Cables with Messenger; Triplex & Quadruplex	Phase Conductors			
			0 to 750V	>750V to 22kV	>22kV to 50kV	69kvΔ
Shield/static Wire, Neutral, Guys ³	2.0 ¹	2.0	2.0	2.0	3.0	3.7
Communication Conductors	2.0	2.0	4.0 ⁴	5.0 ²	6.0	6.7
Shielded Cables with Messen- ger; Triplex & Quadruplex	2.0	2.0	2.0	2.0	3.0	3.7
Phase Conductors 0 to 750Volts	2.0	2.0	2.0	2.0	3.0	3.7
Phase Conductors > 750 V to 22kV	2.0			3.0	3.7	5.0
Phase conductors > 22 kV to 50kV	3.0				4.6	5.4
Phase Conductors 69kVΔ	4.0					6.1

OVERHEAD LINES INSTRUCTION

Clearances Between Conductors & Cables Carried on Different Support Structures

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Sheet 3 of 3

Horizontal Clearance H Used for Drawing the Clearance Envelope	
Vector Difference Between Voltage of Wires (kV) ⁵	Horizontal Clearance H (ft.)
0 to 22 kV	5.0 ⁶
Over 22 kV	5.0 plus 0.4 inches / kV over 22 kV

Table 1 Notes:

Reference: NESC, 2017 Edition, Rule 233

1. No clearance is specified between guys or span wires that are electrically interconnected.
2. This clearance may be reduced to 4 feet where supply conductors of 750 V to 8.7 kV cross a communication line more than 6 feet horizontally from a communication structure.
3. These clearances may be reduced by not more than 25% to a guy insulator, provided that full clearance is maintained to its metallic end fittings and the guy wires. The clearance to an insulated section of a guy between two insulators may be reduced by not more than 25% provided that full clearance is maintained to the uninsulated portion of the guy.
4. This clearance may be reduced to 2 feet for supply service drops.
5. Vector Difference Between Voltage of Wires is equal to:
 $1.05 \times (\text{kV } \emptyset - \emptyset \text{ (Line1)}) / \sqrt{3} + 1.05 \times (\text{kV } \emptyset - \emptyset \text{ (Line 2)}) / \sqrt{3}$
 The Factor of 1.05 is only applied if the kV $\emptyset - \emptyset$ is greater than 50kV.
6. The horizontal clearance H between anchor guys of different supporting structures may be reduced to 6 inches and may be reduced to 2 feet between other guys and neutral conductors.

Figure 3 - Use of Conductor Movement and Clearance Envelopes

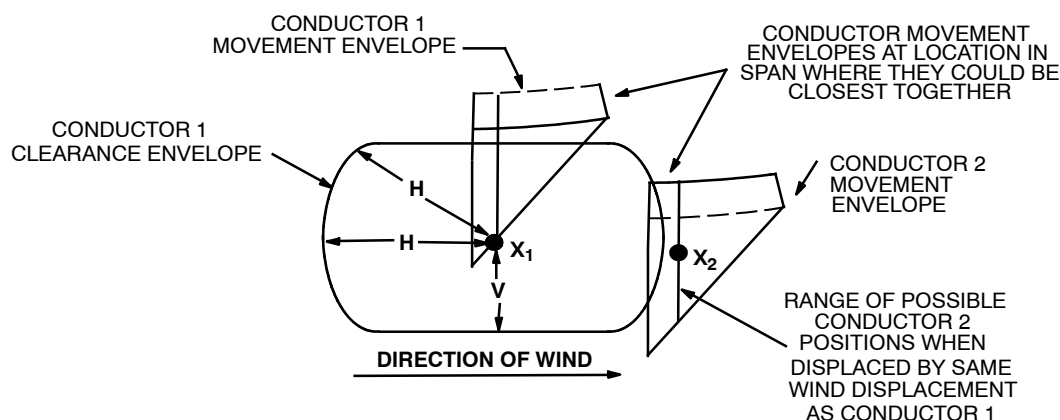


Figure 3 Notes:

1. In this illustration, Conductor 2 is closest at position X2 to Conductor 1 when Conductor 1 is at position X1.
2. Vertical lines intersecting X1 and X2 represent the equivalent horizontal wind displacements.

1. General

Climbing space shall be provided on poles past any conductors, crossarms, equipment or other parts. In addition, working space shall be provided on the climbing face of the pole at each side of the climbing space.

2. Climbing Space – Location and Dimensions (Reference NESC, 2017 Edition, Rule 236)

The climbing space need only be provided on one side or corner of the pole and shall extend vertically not less than 40 inches above or below the limiting conductors or other part, but may otherwise be shifted from any side or corner of the pole to any other side or corner per Figure 1.

TABLE 1
Minimum Horizontal Dimensions of Climbing Space
(All voltages are phase-to-phase)

Character of Conductors Adjacent to Climbing Space	Horizontal Dimension of Climbing Space
Communications Conductors	30" x 30"
Ameren Circuits	40" x 40" preferred generally but in no case less than 30" x 30" for 4.16kV; in no case less than 36" x 36" for 15kV; in no case less than 40" x 40" for 34.5kV; and in no case less than 54" x 54" for 69kV

a. Portions of Pole and Equipment in Climbing space

Portions of the pole or structure, including crossarms, when included in one side or corner of the climbing space, are not considered to obstruct the climbing space.

Longitudinal runs, such as secondaries on racks or brackets, are not considered as obstructing the climbing space if all wires concerned are covered by rubber protective equipment or otherwise guarded.

Where longitudinal runs such as secondaries on racks or brackets are not covered up, the climbing space shall be measured from the longitudinal run concerned and shall extend 40 inches above and below the limiting conductors. The normal method of meeting this requirement where there is less than 40 inches between limiting conductors and conductors are carried on arms, is to eliminate the conductor from the pole pin on the opposite side of the pole to which the longitudinal run is attached. This also includes buckarm construction.

Vertical runs encased in suitable conduit or other protective covering and securely attached to the pole surface are not considered to obstruct the climbing space.

With pole top pin construction, the climbing space shall be provided above the top crossarm to the pole top pin conductor but need not be carried past it.

Supply and communication apparatus including but not limited to transformers, regulators, capacitors, cable terminals (potheads), lightning arresters, antennas, and switches when located below conductors or other attachments shall be mounted outside the climbing space.

3. Working Space – Dimensions (Reference NESC, 2017 Edition, Rule 237)

The working space shall extend along the crossarm on each side of the climbing space to the outmost pin position on the crossarm.

At right angles to the crossarm, the working space shall preferably extend 40 inches but in no case less than the distances shown in Table 1 when measured from the face of the crossarm.

Vertically the working space shall have a height not less than shown in Table 2.

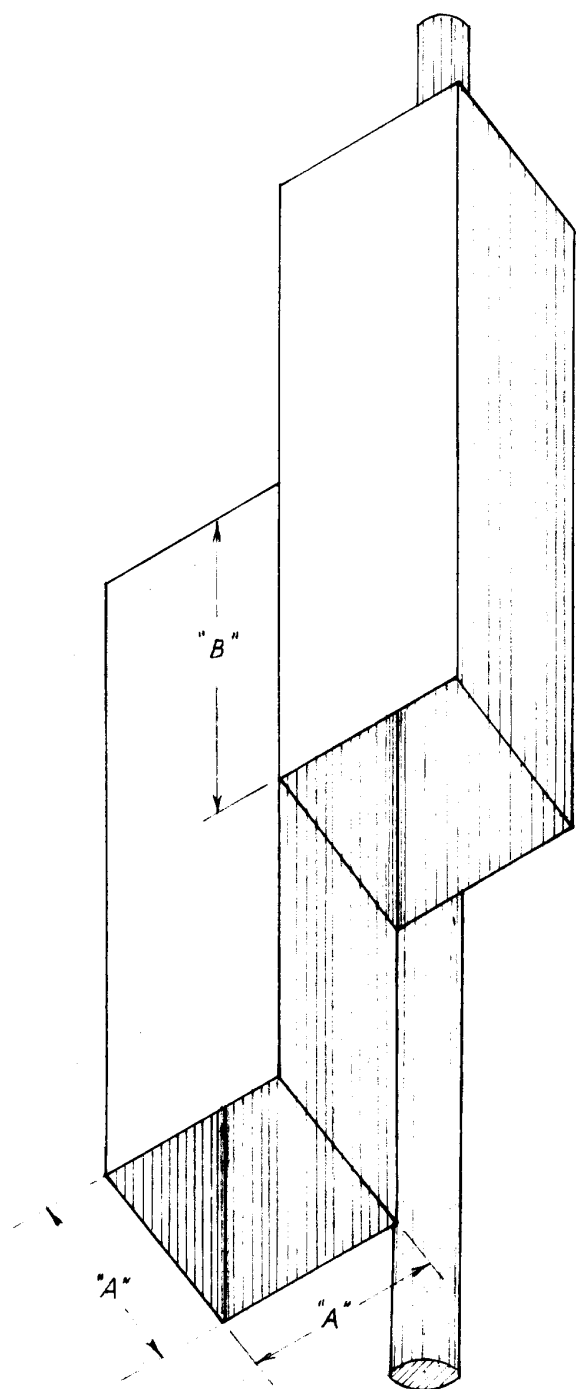
The working space shall not be obstructed by vertical or lateral conductors. Such conductors shall be located on the opposite side of the pole from the climbing side or on the climbing side of the pole at a distance from the crossarms at least as great as the width of the climbing space required for the highest voltage conductor concerned. See Table 1.

TABLE 2
Minimum Vertical Height of Working Space between Conductors on
Different Levels on The Same Pole or Structure

Voltage of Wire, Cable, or Conductor Concerned	Other Wire, Cable, or Conductor Concerned		
	A	B	C
	Secondaries 0–750 Volts Between Phases and Multi-grounded Neutral	2400 Volt 4160 Volt 4800 Volt Circuits	7.2/12.47 kV 13.2 kV 34.5 kV Circuits
Secondaries 0–750 Volts between phases and multi-grounded neutral	16 Inches ¹	24 Inches ²	60 Inches ²
2400 Volt, 4160 Volt 4800 Volt Circuits		24 Inches ²	60 Inches ²
7.2/12.47 kV, 13.2 kV and 34.5kV Circuits			60 Inches ²

NOTES:

1. This applies to secondaries on crossarms. The clearance between secondary conductors on racks or clevises are allowed to have 8 inches separation for span lengths up to 250 feet and 12 inches up to 300 feet.
2. These clearances exceed NESC required minimums. For reduced clearances refer to NESC Table 235–5.



Climbing space shaft may be shifted from one side or corner of pole to another side or corner as required but shall in such instances provide the minimum vertical overlap shown by dimension "B".

Figure 1

	DIMENSION "A"					DIMENSION "B"
	AMEREN CIRCUIT VOLTAGE					
	0 to 300V	300V to 4800V	11kV to 15kV	34.5kV	69kV	
Min. Climbing Space	30"	30"	36"	40"	54"	40"

1. General

Sub Transmission- All sub transmission lines shall be numbered at each **1st structure** coming out of the substation with the circuit number at the top of the pole, on both sides. The **5th structure** shall be numbered with #5 then each 5th structure will be numbered in sequence starting at the normal source end of the line. Poles should be numbered on both sides at major road crossings

In the event a new pole or poles are added between any of the AP numbers, (Example between 301 and 302), add pole number designation 301A, 301B, 301C, etc.

Aerial Patrol Numbering – All sub transmission lines numbered for aerial patrolling shall be numbered in consecutive sequence on **both sides** of each structure that has a number divisible evenly by 5.

When sub transmission poles are either repaired or replaced a new AP number should be installed if the sequence is as mentioned in the above paragraph. If an AP number already exists on the pole, front and back side, no action would be required.

Note: When a structure that should be numbered is located at a major angle in the line and cannot be numbered, either of the adjacent structures shall be numbered with its own structure number. Example, if the major angle is on pole 95, the structure in front would be 94 and the structure behind would be 96; keeping in consecutive order with the other numbered poles.

Numbering shall be continuous from one major switching station to another.

Tap lines shall be numbered with number one on the first structure from the junction with the main line.

Aerial patrol numbers shall be located on structures as indicated by drawings in this bulletin. Typically numbers shall be installed below the first set of insulators (between 1st and 2nd set), if the pole is unshielded. If the pole is shielded, then the numbers can be installed at top of the top or as stated above, below the first set of insulators.

2. Installation

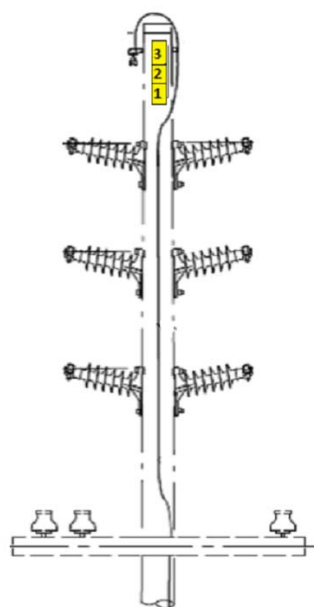
Wood Poles - The vertical holder shall be installed using two lag screws, 2" long with ¼" diameter (Stock # 23 60 027). An alternative to the vertical holder for a wood pole is to securely nail the plates directly to the pole (four holes in each plate).

Composite Poles / Fiberglass Poles - Composite / Fiberglass Poles - Use #10 hex head 3/4" long self-tapping screws (Stock # 21 76 679) in predrilled holes. If pole is not predrilled, use Stock # 86 04 289 to drill pilot hole. This length will work on all composite poles.

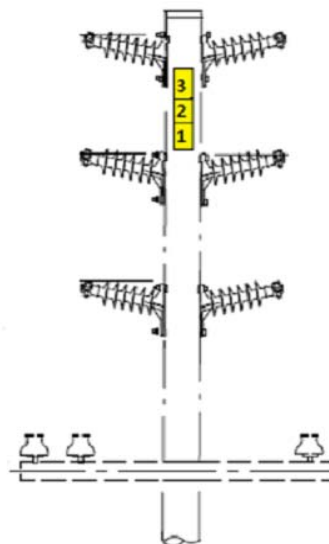
3.Tag Holder and Inserts

Material used in numbering sub transmission lines shall be Black on Yellow, Aluminum 5"W x 7"H w/6" Number Embossed with a Vertical Aluminum Number Plate 29" H x 5 ¼" W. Tags will be produced from following stock numbers.

<u>Stock Number</u>	<u>Description</u>
16 04 627	Numeral "0"
16 04 628	Numeral "1"
16 04 629	Numeral "2"
16 04 630	Numeral "3"
16 04 631	Numeral "4"
16 04 632	Numeral "5"
16 04 633	Numeral "6" or "9"
16 04 634	Numeral "7"
16 04 635	Numeral "8"
16 02 691	Letter "A"
16 02 689	Letter "B"
16 02 690	Letter "C"
16 06 272	Holder-Vertical



SHIELDED 34KV OR 69 KV



UNSHIELDED 34 KV OR 69 KV

Numbers shown on the following examples are NOT to scale

ILLINOIS ONLY ←

1. Conductors and electrical apparatus shall be treated as energized unless they are properly grounded.
2. Any circuit de-energized for work clearance shall be tested prior to grounding to ascertain whether the circuit is actually de-energized.
3. Protective grounding cables shall be installed and connected to ground at one or more points as illustrated in pages 3–5.
4. The ground end of grounding cables shall always be connected first.
5. The grounding cables shall be installed and removed by means of hot sticks. If self-cleaning clamps are used, they should be installed in such a manner as to insure the effectiveness of the self-cleaning action. If self-cleaning clamps are not used, clamp jaws and conductors shall be wire brushed immediately before attachment. After the ground-end connection is secured, the grounding cables shall be applied in turn to the nearest conductor first, proceeding outward and upward until all phases have been connected. They shall be removed in reverse order, with the farthest ground removed first.
6. The cables shall be as short as possible, and shall be installed with minimum slack by placing the clamps as far out from the structure as possible in order to reduce violent mechanical reaction in the event of a fault.
7. Grounds shall be installed at the structure upon which the work is being performed. If it is not possible to place the grounds on the same structure, the work shall be done between two sets of visible grounds, preferably placed on the first structure either side of the work structure or span. When ground sets are not placed at the work structure, a personal ground shall be used as the work structure. The personal ground shall consist of a grounding cable connecting the phase upon which work is being performed to a grounding-cluster assembly located on the pole below the lineman's feet.
8. The grounding-cluster assembly shall always be placed on the structure just below the lineman's feet. When a system neutral is not present and a pole ground is present, the grounding-cluster assembly must be bonded to the pole ground. This may be accomplished by connecting a grounding jumper to the connection bar on the assembly and the pole ground. On metal structures, the grounding clamps may be attached to the structure below the lineman's feet in lieu of the grounding-cluster assembly.
9. All phase conductors to be worked on must be electrically bonded together and connected to ground. Bonding one conductor of each bundled conductor assembly is adequate. To maintain continuity, a bonding jumper must be installed before opening a grounded conductor for any purpose.
10. Where feasible, groundmen should not approach within ten feet of ground wires while protective grounds are installed. They should avoid ground wires and grounding cables except where it is necessary to work on or near them while the grounding cables are in place.

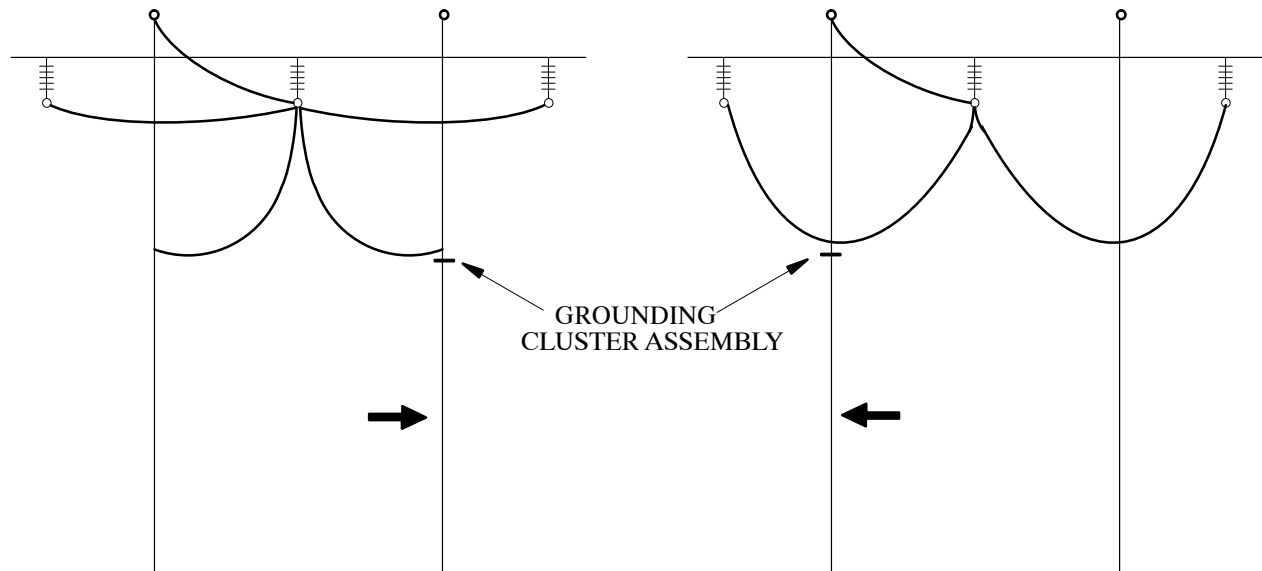
ILLINOIS ONLY

FIG. A
UNACCEPTABLE FOR 138KV–345KV

FIG. B
APPROPRIATE GROUNDING FOR 138KV–345KV

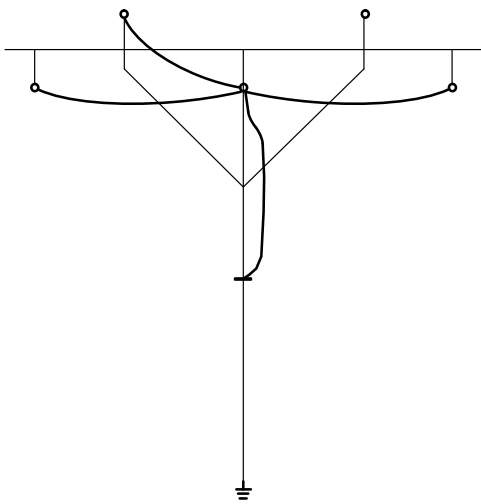
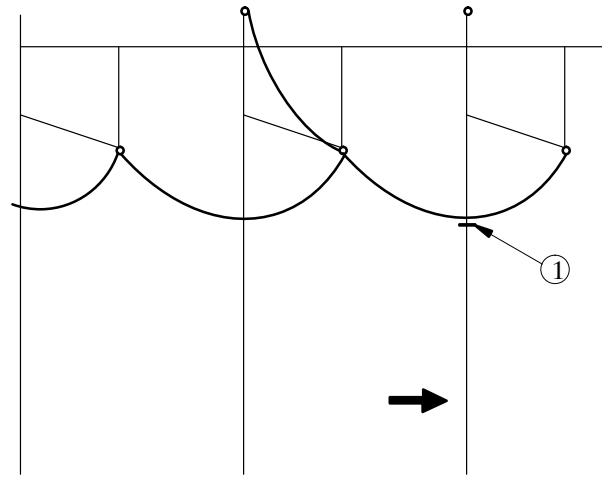
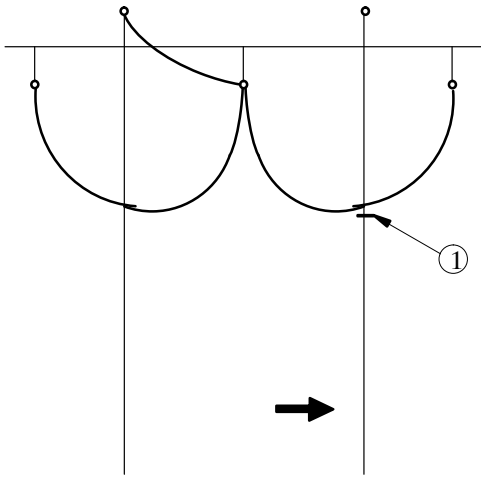
The following sheets show application of ground sets at various voltages.

Application of Ground Sets

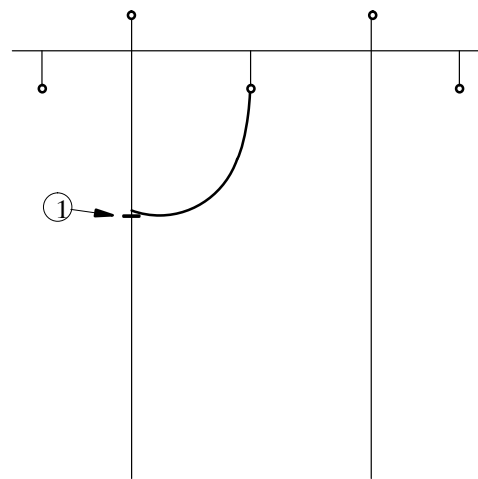
Figures A and B above show two examples of the application of ground sets. In Figure A, jumpers are connected between phases and a single jumper is connected to the grounding cluster assembly below the lineman's feet on each structure. This allows less conductors below the lineman to congest the area; however, when working on an outside phase, his body is parallel with two jumpers in series, thus increasing the resistance and the voltage impressed across the lineman in case of a fault. Because of the lesser spacings and shorter jumper lengths on voltages 69 kV and below, this method will be used where possible on single pole structures at these voltages. At voltages of 138 kV to 345kV, the phase spacing requires longer jumpers than acceptable, thus impressing hazardous voltages across the lineman if a fault should occur while working on one of the outside phases. Therefore, the ground sets shall be applied as shown in Figure B on these voltages.

ILLINOIS ONLY

138 kV – 345 kV



METAL TOWER



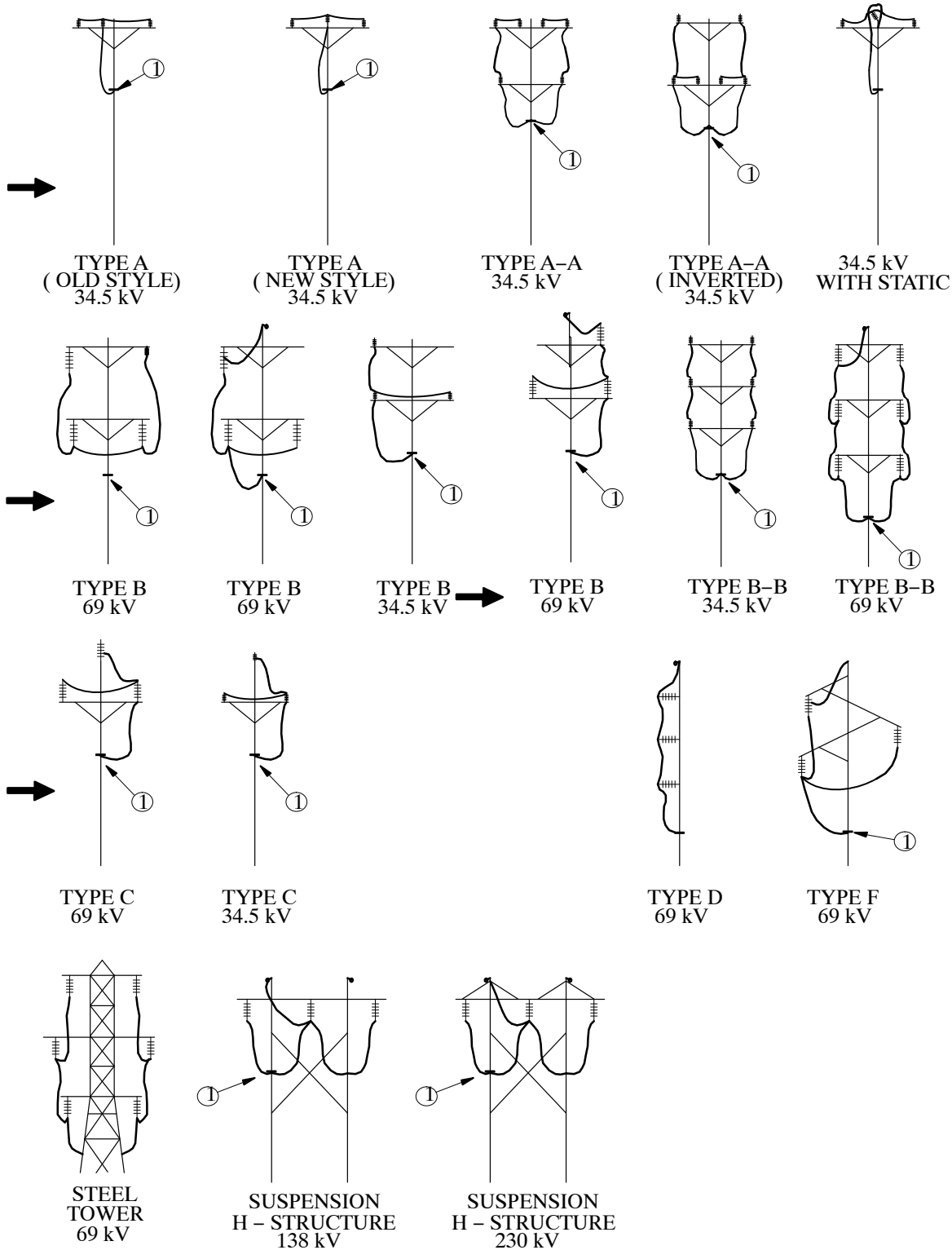
Personal ground – To be used when ground sets are placed as near as possible in all directions from structure being worked on. Apply to phase which is being worked.

NOTE:

1. Grounding cluster assembly.

ILLINOIS ONLY

34.5kV – 69 kV



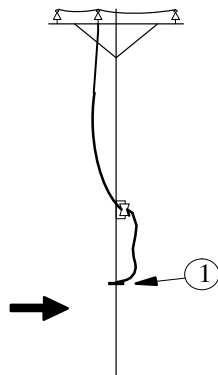
NOTE:

1. Grounding cluster assembly.

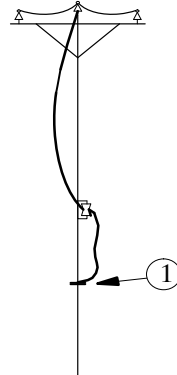
2. Where a low voltage system neutral is present, jumper should be installed from the system neutral to the temporary grounding system.

ILLINOIS ONLY

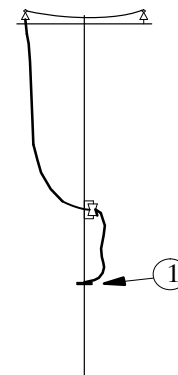
2.4 kV – 12.5 kV



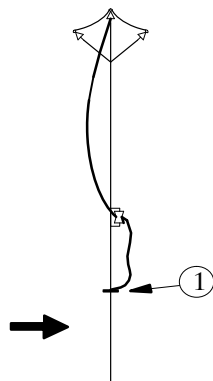
3Ø UNDERBUILD



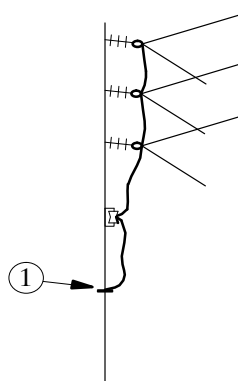
3Ø TANGENT



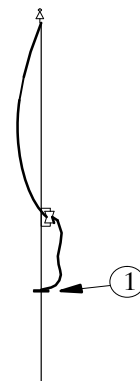
2Ø TANGENT



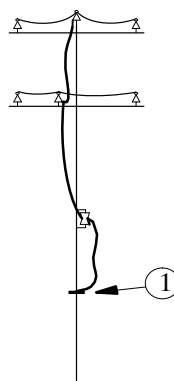
3Ø ARMLESS



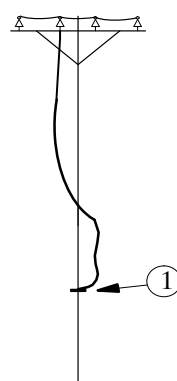
3Ø ANGLE OR
CORNER



1Ø POLE TOP PIN



DOUBLE CIRCUIT
BOTH CKTS. GROUNDED



3Ø WITH NEUTRAL
ON ARM

NOTE:

1. Grounding cluster assembly.
2. When system neutral is shield wire on underbuild circuit, a jumper is required from underbuild phase to the shield wire or pole ground.

Purpose -

This DCS is for use by Ameren Illinois for EZRR corrective action projects. This DCS provides materials for:

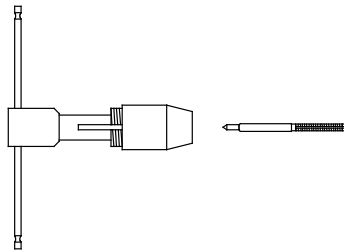
- 1) Moving the arrester from the energize zone above the transformer to the transformer tank,
- 2) Replacing porcelain cutout with polymer cutout,
- 3) Lowering cutout from phase conductor crossarm to FG cutout bracket (refer to DCS 13 12 00 01), and
- 4) Conforming the transformer H2 grounding to current Ameren Standards (refer to DCS 13 00 06 02).

The variations in each standard within this DCS are as described below:

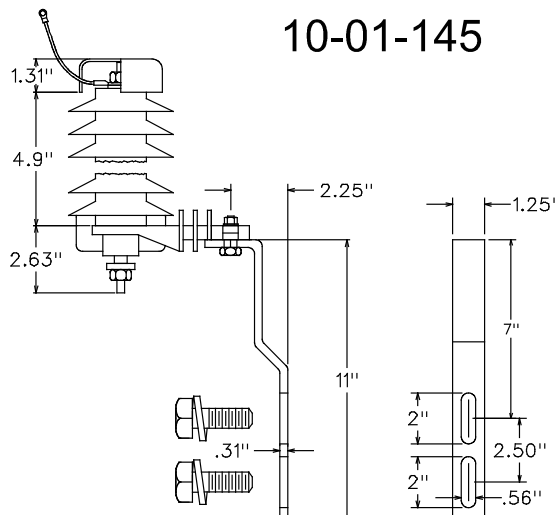
- 29 12 00 01 – Tank Mounting of Arrester, 7.2 kV thru 7.97 kV Transformer
- 29 12 00 02 – Tank Mounting of Arrester, 2.4 kV Transformer w/ Cover Mounted Primary Bushings
- 29 12 00 03 – Tank Mounting of Arrester, 2.4 kV Transformer w/ Side-Wall Mounted Primary Bushings
- 29 12 00 04 – Hanger Bracket Mounting of Arrester, 7.2 kV thru 7.97 kV Transformer
- 29 12 00 05 – Hanger Bracket Mounting of Arrester, 2.4 kV Transformer w/ Cover Mounted Primary Bushings

If transformer has existing lugs for mounting arresters adjacent to the H1 bushings:

1. **Clean the threads in the arrester mounting lugs.** Thread Tap stock number **85-37-166** with T-Wrench stock number **85-41-336** can be used to 'chase' the threads.

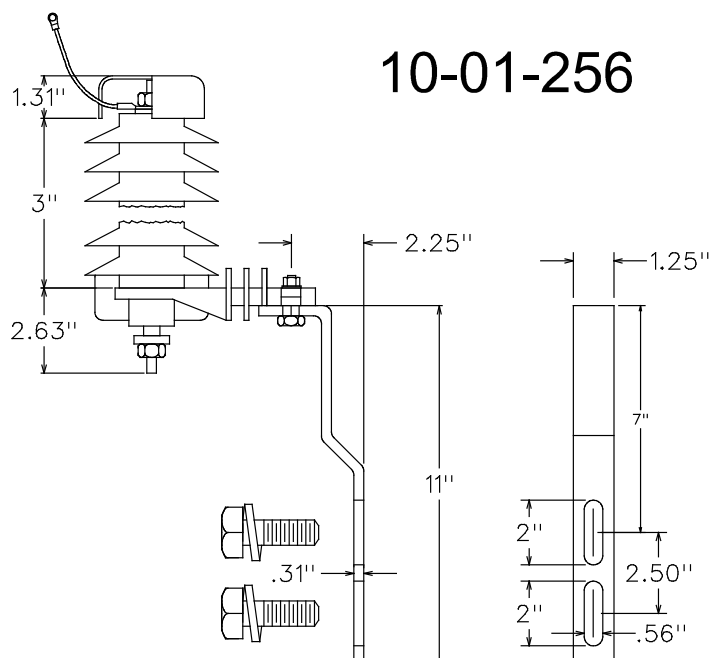
**2. Install arrester on transformer tank-****a. If transformer is rated 7.2kV thru 7.97kV-29 12 00 01**

Use arrester kit stock number 10-01-145. This kit includes a 10kV arrester with cap, 600V insulated arrester lead-wire, L-shaped mounting bracket, copper ground strap, and two 1/2" bolts for mounting to the transformer tank.



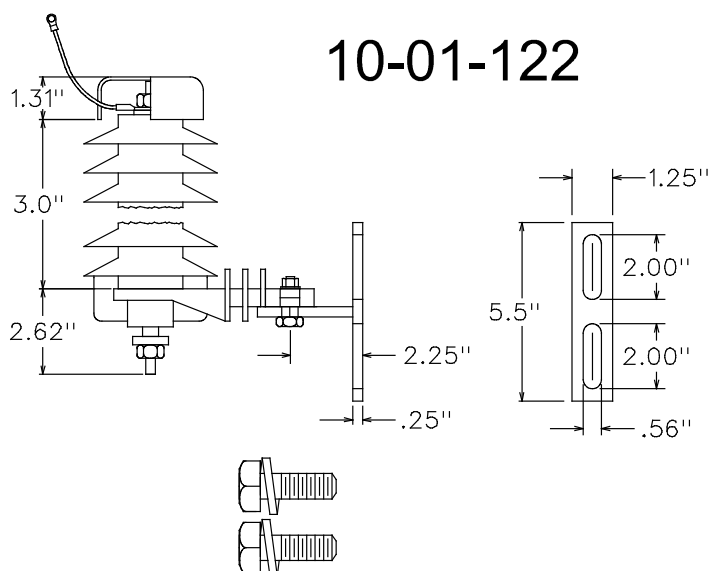
b. If transformer is rated 2.4kV with cover mounted bushings-29 12 00 02

Use arrester kit stock number 10-01-256. This kit includes a 3kV arrester with cap, 600V insulated arrester lead-wire, L-shaped mounting bracket, copper ground strap, and two 1/2" bolts for mounting to the transformer tank.



c. If transformer is rated 2.4kV with side-wall mounted primary bushings-29 12 00 03

Use arrester kit stock number 10-01-122. This kit includes a 3kV arrester with cap, 600V insulated arrester lead-wire, T-shaped mounting bracket, copper ground strap, and two 1/2" bolts for mounting to the transformer tank.



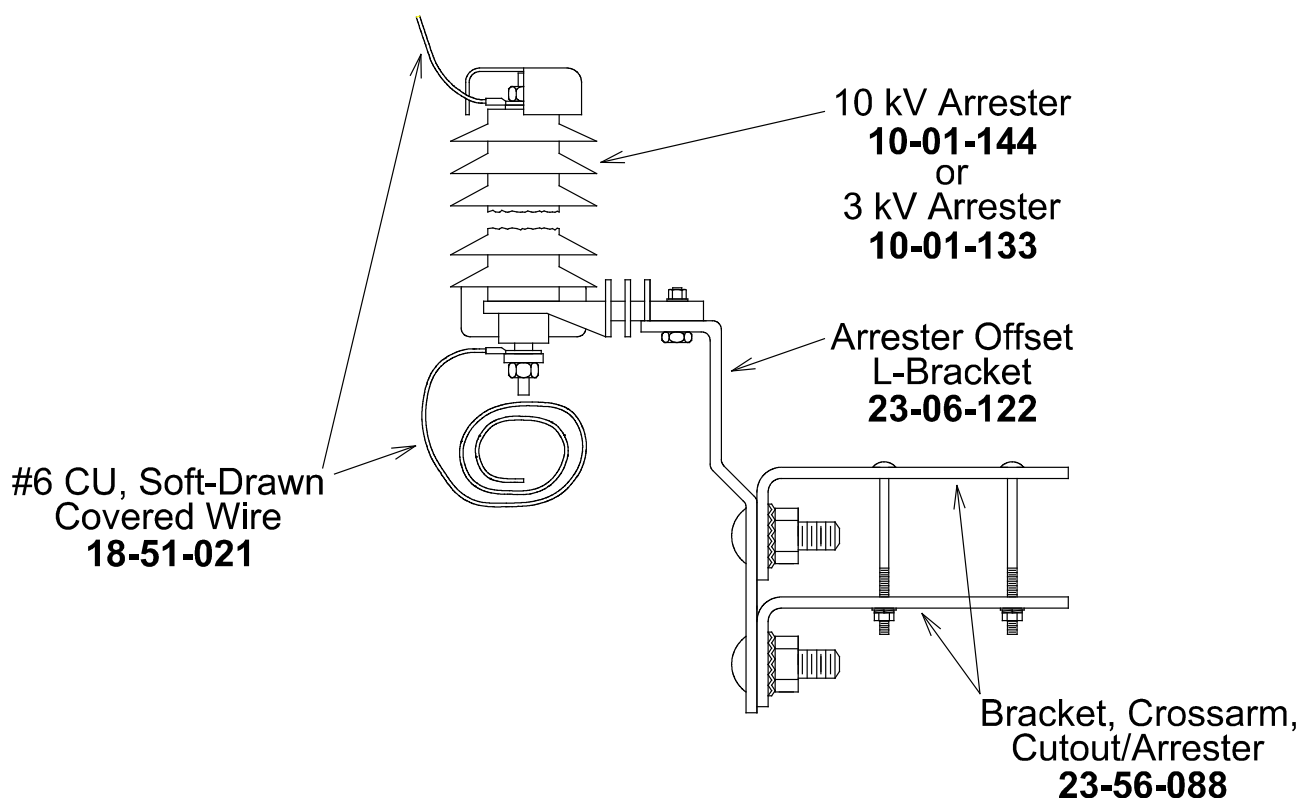
If transformer does NOT have existing lugs for mounting adjacent to the H1 bushing:**1. Transformer with Cover Mounted Primary Bushings-**

29 12 00 04 – Hanger Bracket Mounting of Arrester, 7.2kV thru 7.97kV Transformer

29 12 00 05 – Hanger Bracket Mounting of Arrester, 2.4kV Transformer w/ cover mounted primary Bushings

Mount hardware and arrester to upper transformer hanger bracket as per DCS 12 12 05 **. DCS 12 12 05 ** contains the following materials needed for a transformer with cover mounted primary bushings:

- i. Cutout/Arrester Crossarm Bracket 23-56-088.
- ii. Arrester Offset L-Bracket 23-06-122.
- iii. 10kV Arrester 10-01-144 (for 7.2kV thru 7.97kV transformers) Or
3kV Arrester 10-01-133 (for 2.4kV transformers).
- iv. #6 CU, Soft-Drawn, Covered Wire 18-51-021.

**2. 2.4kV Transformer with Side-Wall Mounted Primary Bushings-**

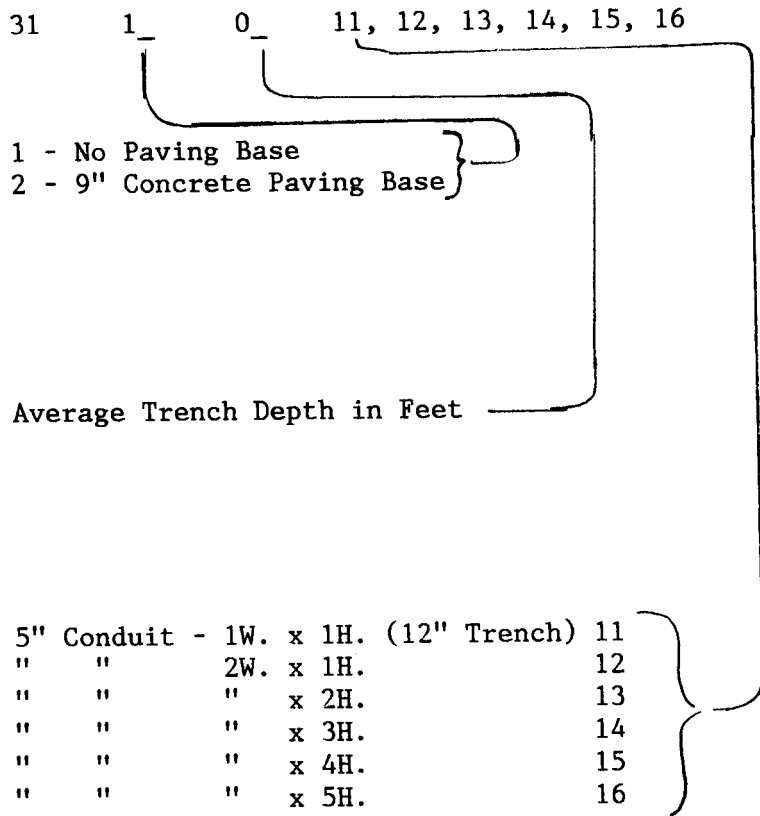
Replace with new transformer that is pre-kitted with tank mounted arrester.

@		Std./Stk No	Description	29 12 00 **	01	02	03	04	05
	A	23 06 127	Bracket, Cutout		1	1	1	1	1
	B	23 52 065	Bolt, Mach, 5/8" x 12"		2	2	2	2	2
	C	23 66 027	Washer, Square, 5/8"		2	2	2	2	2
	D	54 07 208	Switch, Fused, Open Type		1	1	1	1	1
	E		Link, Fuse (see DCS 10 00 01 01)		1	1	1	1	1
	F	18 51 025	Wire, Trans. Riser, #4, S.D. Poly covered (FT.)		15	15	15	15	15
	G	23 17 411	Cover-Cutout		1	1	1	1	1
	H	10 01 145	Arrester Kit, 10kV, w/ "L" Transformer Mtg. Brkt.		1				
		10 01 256	Arrester Kit, 3kV, w/ "L" Transformer Mtg. Brkt.			1			
		10 01 122	Arrester Kit, 3kV, w/ "T" Transformer Mtg. Brkt.				1		
	I	12 12 05 01	Arrester, 10kV					1	
		12 12 05 02	Arrester, 3kV						1
	M	23 64 001	Staple, Ground Wire, Serrated, CU Clad					3	3
	N	17 51 032	Clamp, PG. #6-1/0		1	1	1	2	2
	O	69 58 296	Guard, Wildlife, Clam-Shell, Short		1	1	1	1	1
	P	69 58 121	Ground, Transformer Tank, #8 Sol. To #2 Str. Cu.		1	1	1	1	1

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STRAIGHT – PRECAST 6' – 0" X 12' – 0" (TYPE 38Y-A)	ILLINOIS ONLY	32-21-04-**
STRAIGHT – PRECAST 6' – 0" X 12' – 0" (TYPE 38Y-J4 ROOF A)	ILLINOIS ONLY	32-21-05-**
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NOTES:

1. For construction details for standard and reinforced ducts, refer to Dist. Std. 31 10 01 00 and 31 10 02 00.

* Key Sheet for Dist. Std. 31 11 ** ** and 31 12 ** **.



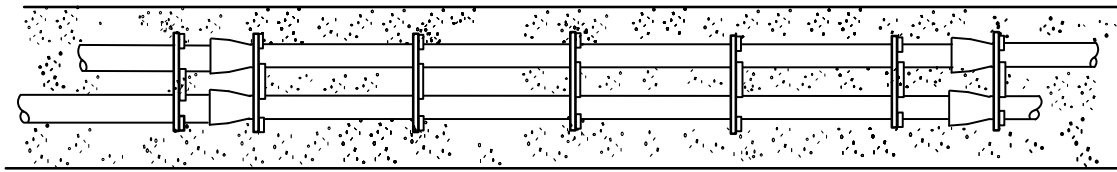
STRUCTURES – CONDUIT

Standard Duct Construction

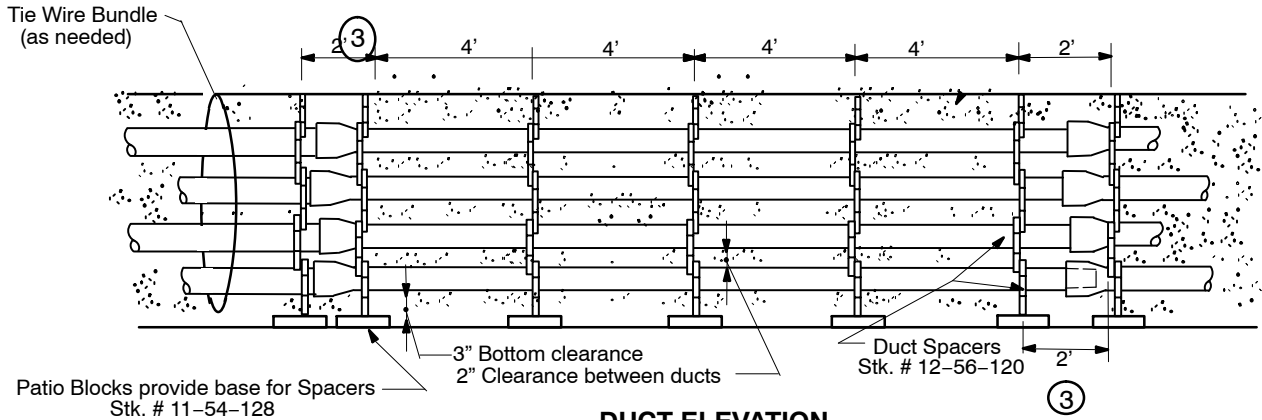
5" EB35 CONDUIT

31 10 01 **

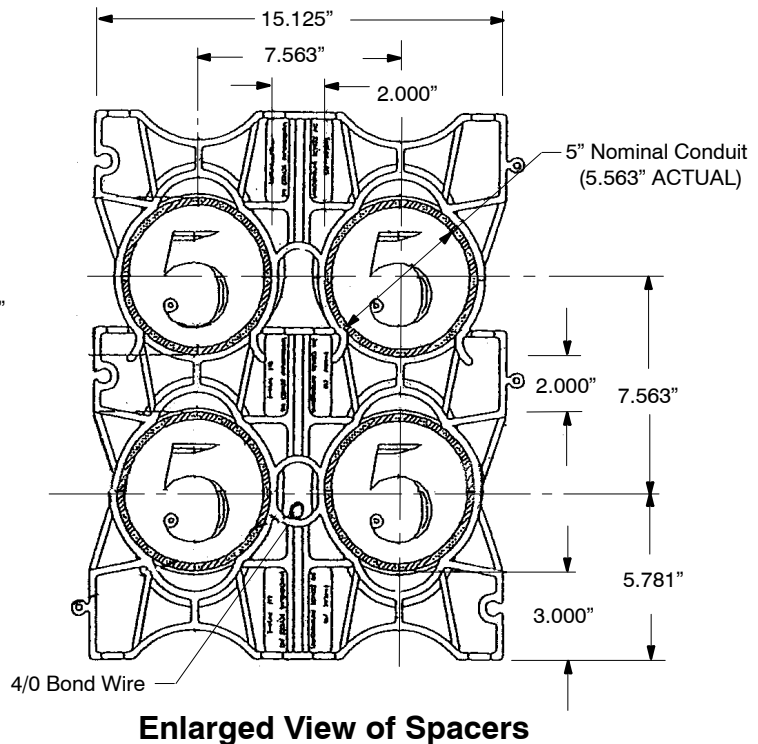
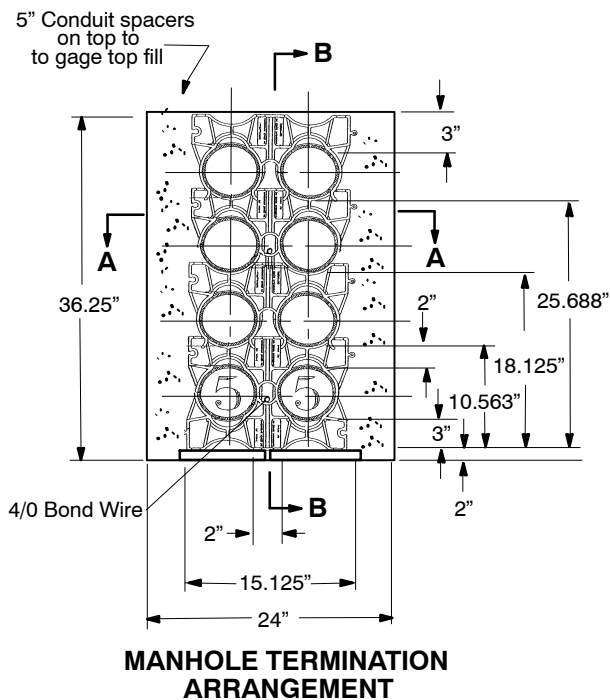
Sheet 1 of 4



Section A A



DUCT ELEVATION
Section B B



NOTES:

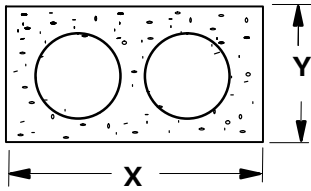
1. Conduit standards will not explode. See Dist. Std. 31 10 00 00 through 31 12 08 ** for construction by appropriate material and non-material operators.
2. If in level terrain a minimum fall of 6" per 100" shall be provided.
3. Reduce this dimension to 1 ft. on each end when using 10 ft. conduit. 4 ft. spacing stays the same.

**DISTRIBUTION
CONSTRUCTION STANDARDS**

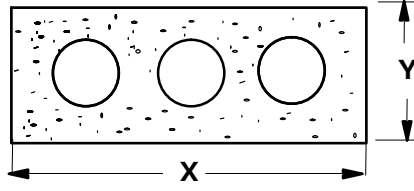


ENG: EJB
REV. NO: 7
REV. DATE: 07/04/15

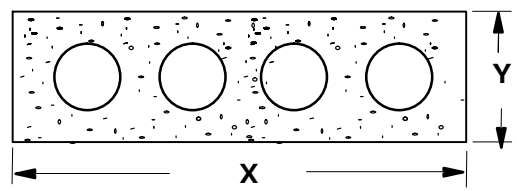
5" EB35 CONDUIT



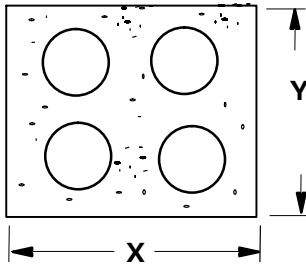
1. 2-DUCTS



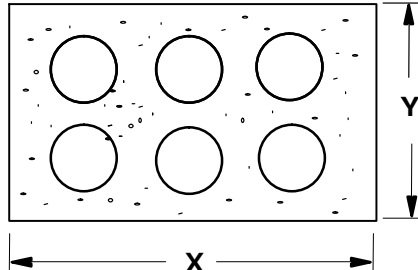
2. 3-DUCTS



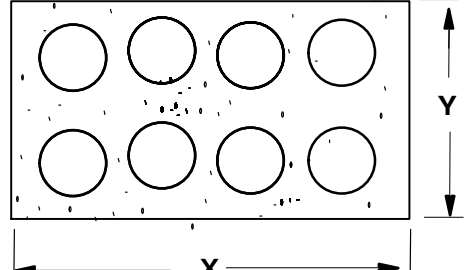
3. 4-DUCTS



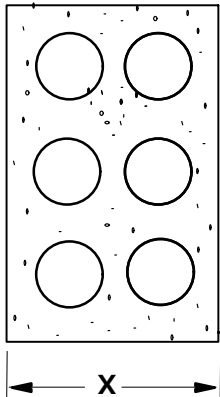
4. 4-DUCTS



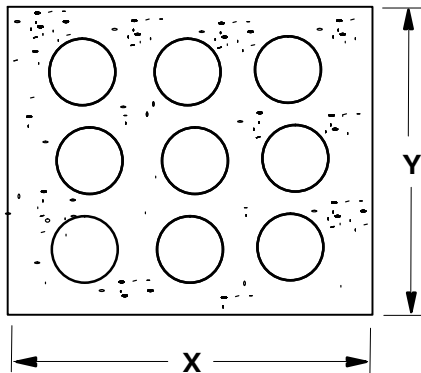
5. 6-DUCTS



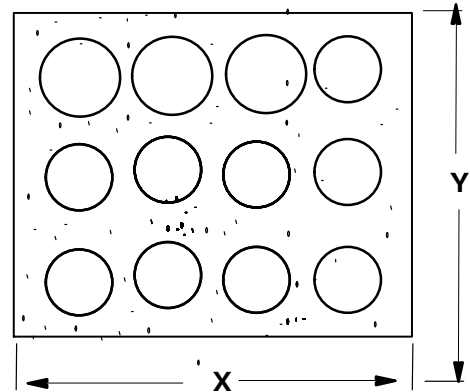
6. 8-DUCTS



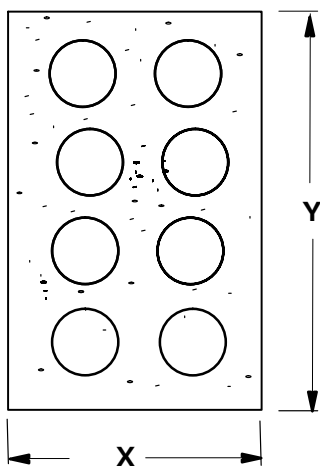
7. 6-DUCTS



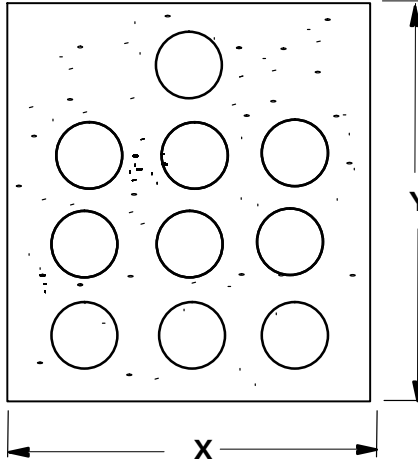
8. 9-DUCTS



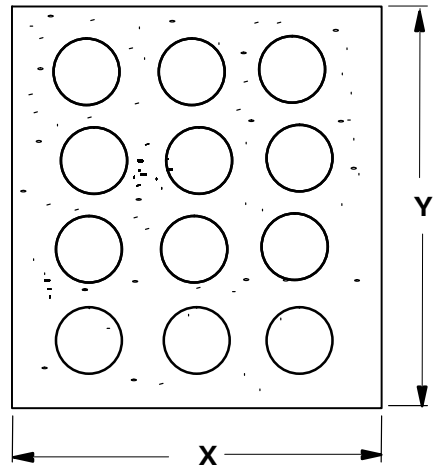
9. 12-DUCTS



10. 8-DUCTS



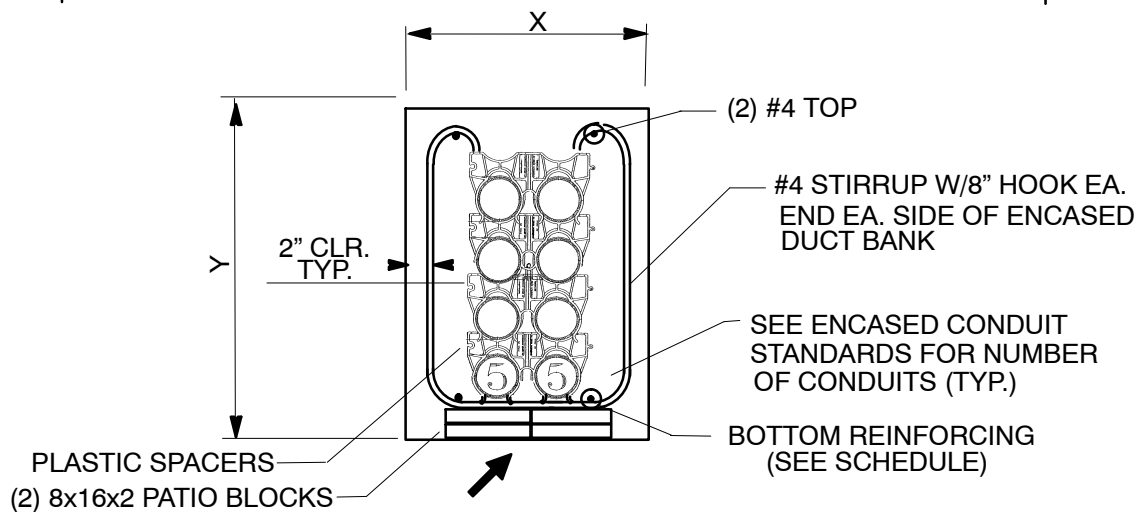
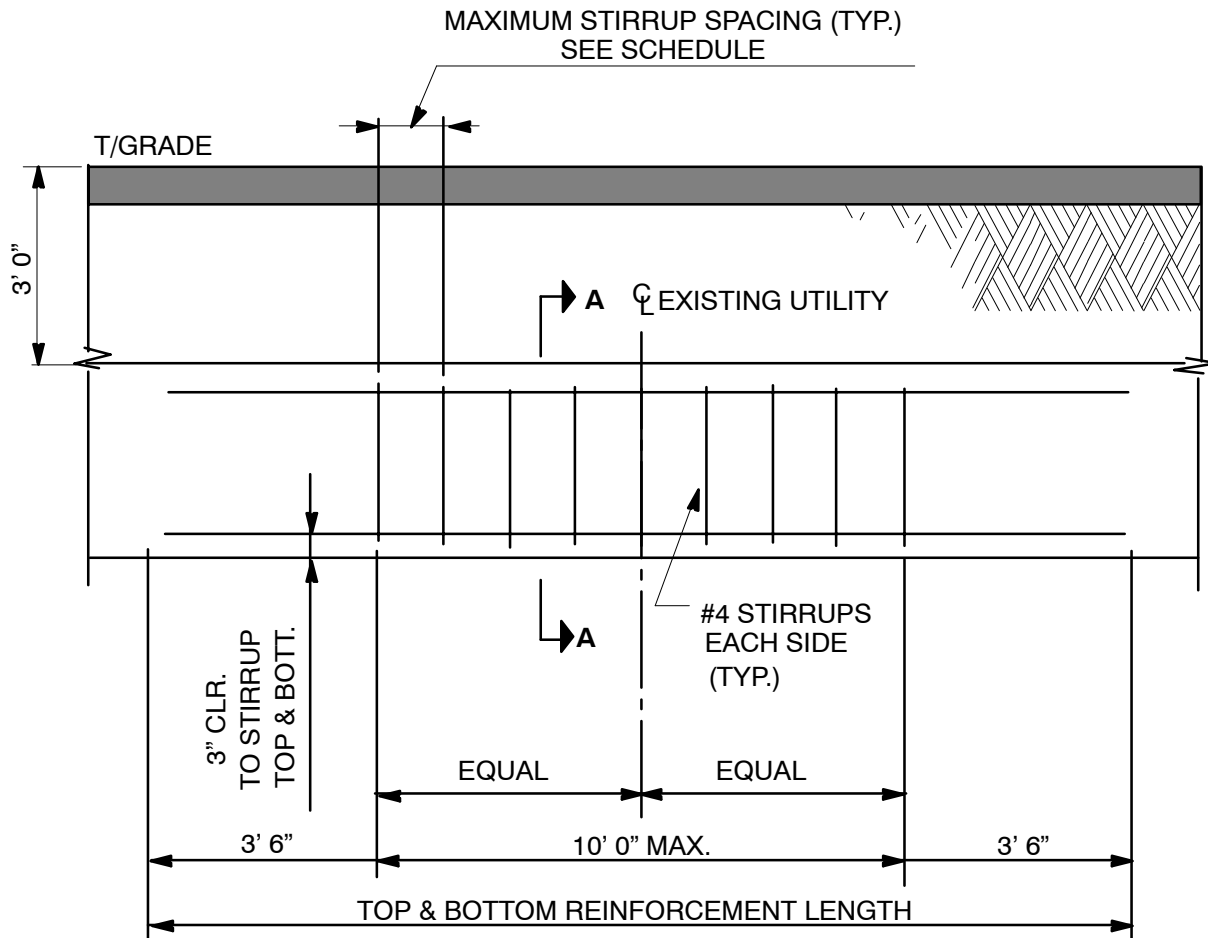
11. 10-DUCTS



12. 12-DUCTS

ENCASED DUCT BANK OVER EXISTING UTILITY

SCALE: $\frac{3}{8}" = 1' 0"$



SECTION A-A

SCALE: $\frac{3}{4}" = 1' 0"$

NOTES:

1. DESIGN BASED ON HS20 TRUCK LOADING.
2. $f_c = 2,500$ PSI $f_y = 60,000$ PSI

STRUCTURES – CONDUIT
Standard Duct Construction
5" EB35 CONDUIT

31 10 01 **

Sheet 4 of 4

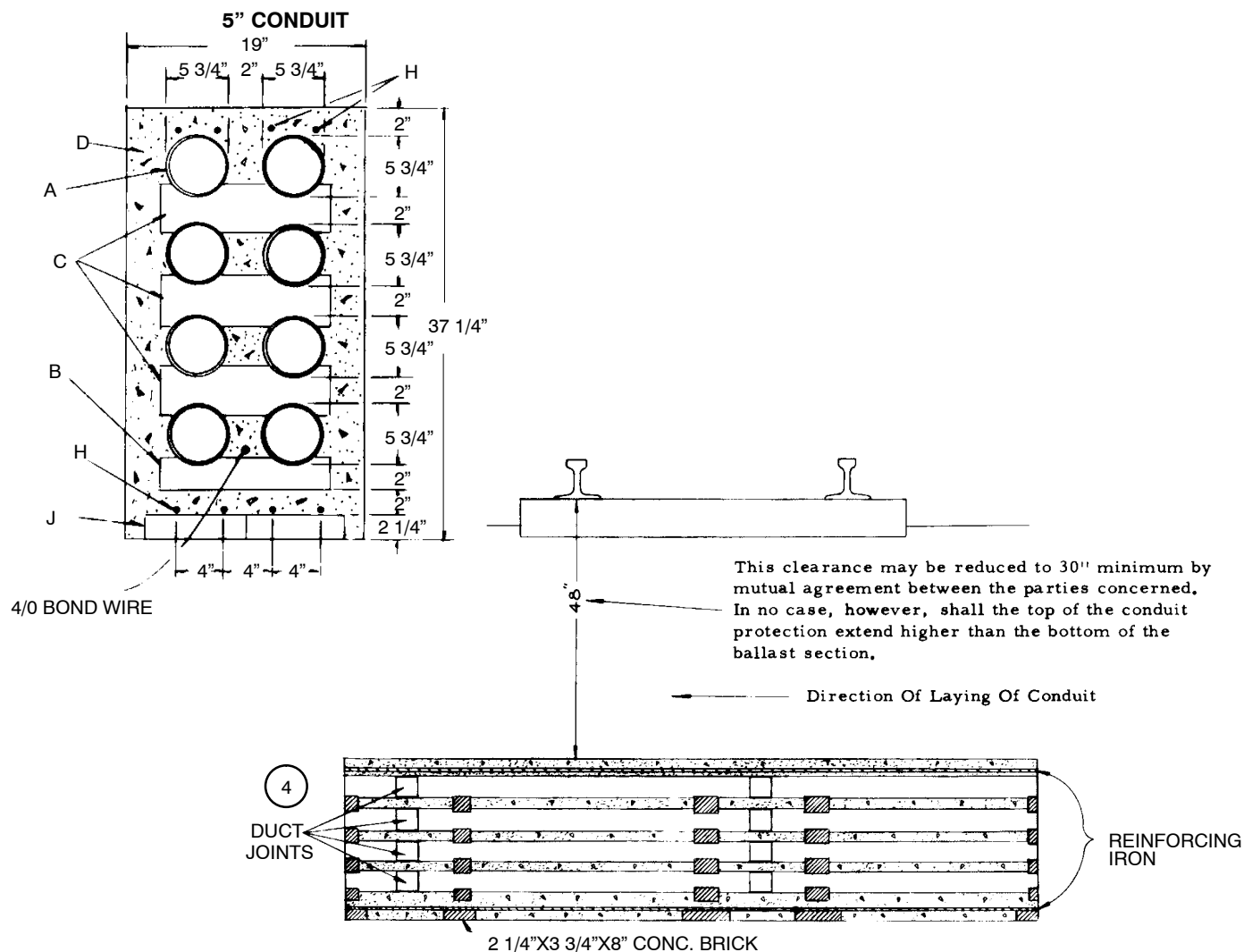
FIG.	STANDARD NUMBER	NUMBER OF DUCTS	DIMENSIONS			CROSSING EXISTING UTILITY STIRRUP REINFORCING	
			X MIN	* X	Y	BOTTOM REINFORCING	STIRRUP SPACING
1.	31 10 01 01	2	18"	24"	13"	3-#7	3 ½"
2.	31 10 01 02	3	25"	30"	13"	4-#7	3 ½"
3.	31 10 01 03	4	33"	36"	13"	5-#7	3 ½"
4.	31 10 01 04	4	18"	24"	21"	3-#7	6"
5.	31 10 01 05	6	25"	30"	21"	4-#7	6"
6.	31 10 01 06	8	33"	36"	21"	3-#7	9"
7.	31 10 01 07	6	18"	24"	28"	5-#7	6"
8.	31 10 01 08	9	25"	30"	28"	3-#7	12"
9.	31 10 01 09	12	33"	36"	28"	4-#7	9"
10.	31 10 01 10	8	18"	24"	36"	4-#7	12"
11.	31 10 01 11	10	25"	30"	36"	5-#7	9"
12.	31 10 01 12	12	25"	30"	36"	4-#7	12"

* Based on standard 24" or 36" bucket size used to dig trench.

NOTES:

- Each standard includes material for a 20 ft. duct formation.
- Spacers should be installed every 4 ft. for straight runs.
- Call for extra spacers to use on large sweeps in a duct run. Sweeps need more spacers placed closer together.
- If floatation is a concern, install restraint as necessary per installers' direction. Wood is not an acceptable material for restraint.
- For duct banks stacked higher than 4 conduits, must be built with multiple concrete pours to prevent ducts from collapsing.
- Upon completion of duct bank, the integrity of each duct must be verified by pulling a mandrel through each duct.
- In situations where the duct bank crosses sewers greater than 2 ft. Diameter, reinforcing the duct bank will be required per Ameren's direction.

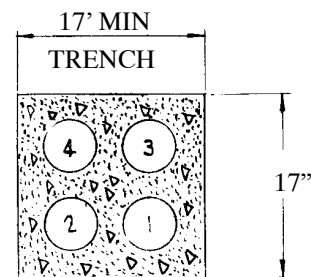
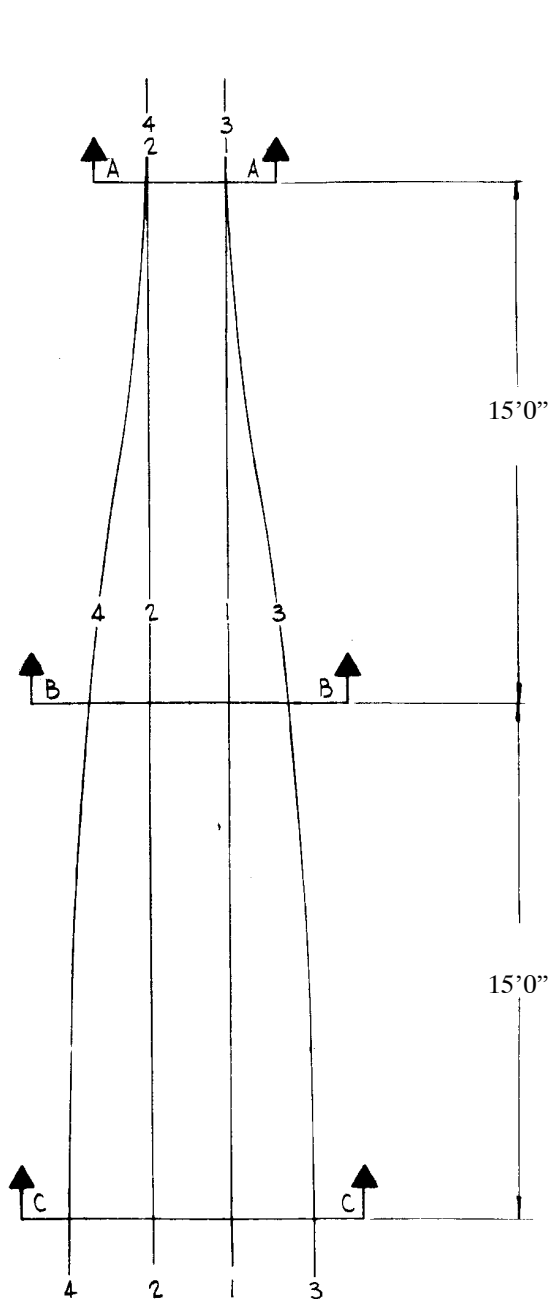
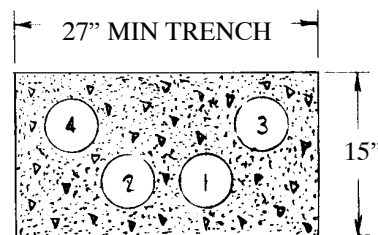
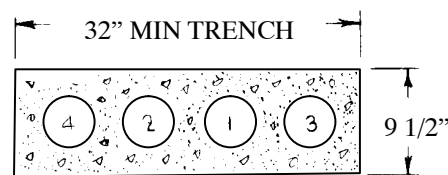
	Std. / Stk. No.	Description	31 10 01 **	01	02	03	04	05	06	07	08	09	10	11	12
A	12 01 335	Conduit – Plastic, 5", EB (ft.)		40	60	80	80	120	160	120	180	240	160	200	240
B	12 56 120	Spacer – Conduit		10	20	20	15	30	30	20	40	40	25	45	50
C	98 00 007	Concrete-Conduit (Cu. Yd.)		1	2	2	2	3	3	3	4	4	3	5	5



NOTES:

- Reinforcing rods shall be set parallel to duct run as shown. Cross rods shall not be used due to heating from induced currents
- A 2" concrete pad shall be poured on top of the concrete block to hold reinforcing rods in place. Base block is to rest on concrete pad.
- Conduit standards will not explode. See Dist. Std. 31 10 00 00 through 31 12 08 ** for construction by appropriate material and non-material operators.
- Reinforcing under railroad tracks shall extend the full width of the railroad right-of-way.

		Std. / Stk. No.	Description	Req'd
→	A	12 01 182	Conduit–Plastic 5"	As Req'd.
	B	12 56 042	Block–Base, 5"	As Req'd.
	C	12 56 043	Spacer–Conduit, 5"	As Req'd.
	D	99 00 007	Concrete–Conduit (C.Y.)	As Req'd.
	H	27 02 101	Iron–Reinforcing– 1/2"	As Req'd.
→	J	11 01 006	Brick–10 Hole, 2–1/4" x 3–1/4" x 8–1/4"	As Req'd.

SECTION AASECTION BBSECTION CC

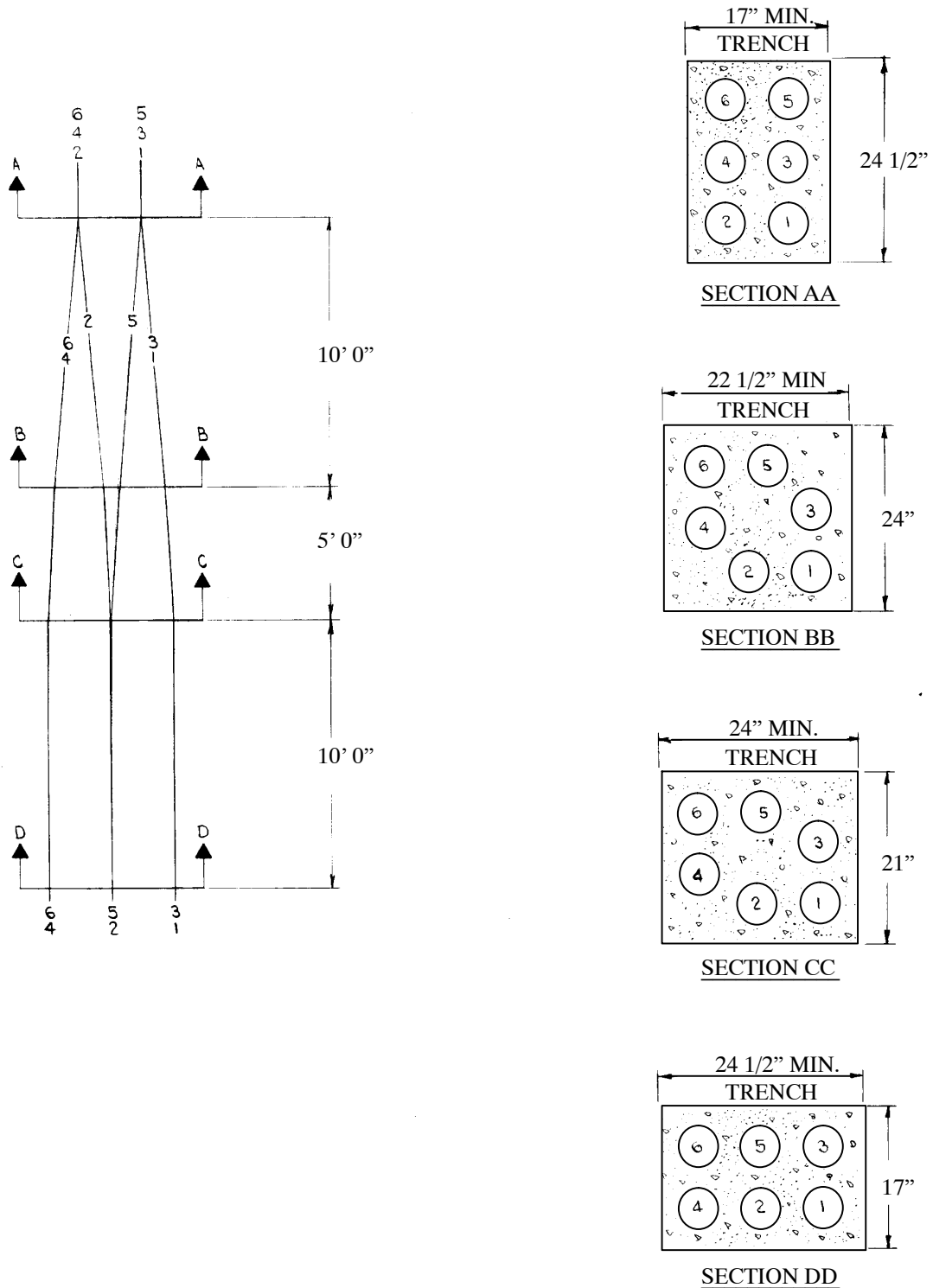
NOTES:

1. Dimensions based on 5" conduit, 5' lengths.
2. Spacer blocks shall be used to maintain conduit spacing during transposition.

STRUCTURES – CONDUIT
6 Duct Transposition
Standard to Horizontal Position

31 10 04 00

Sheet 1 of 1



NOTES:

1. Dimensions based on 5" conduit, 5' lengths.
2. Spacer blocks shall be used to maintain conduit spacing during transposition.

**DISTRIBUTION
CONSTRUCTION STANDARDS**

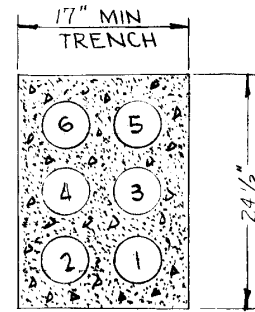
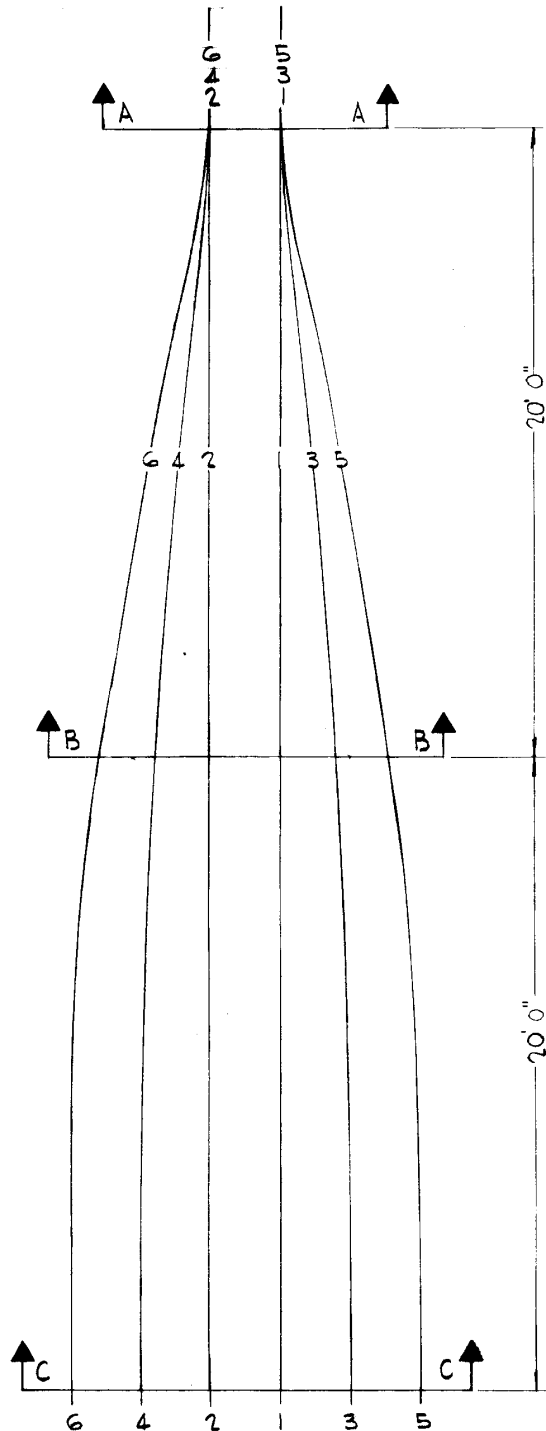


ENG: DDG
REV. NO: 0
REV. DATE: 05/03/94
REAFFIRMED DATE: 03/13/09

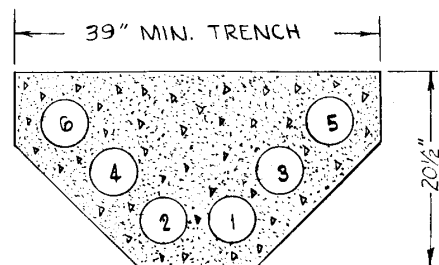
STRUCTURES – CONDUIT
6 Duct Transposition
Standard to Flat Position

31 10 05 00

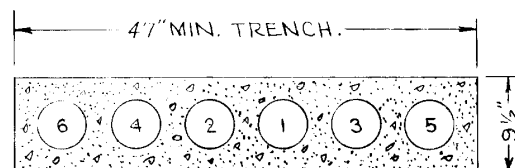
Sheet 1 of 1



SECTION A-A



SECTION B-B



SECTION C-C

NOTES:

1. Dimensions based on 5" conduit, 5' lengths.
2. Spacer blocks shall be used to maintain conduit spacing during transposition.

**DISTRIBUTION
CONSTRUCTION STANDARDS**

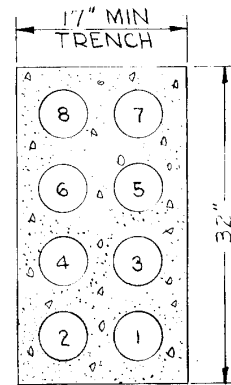
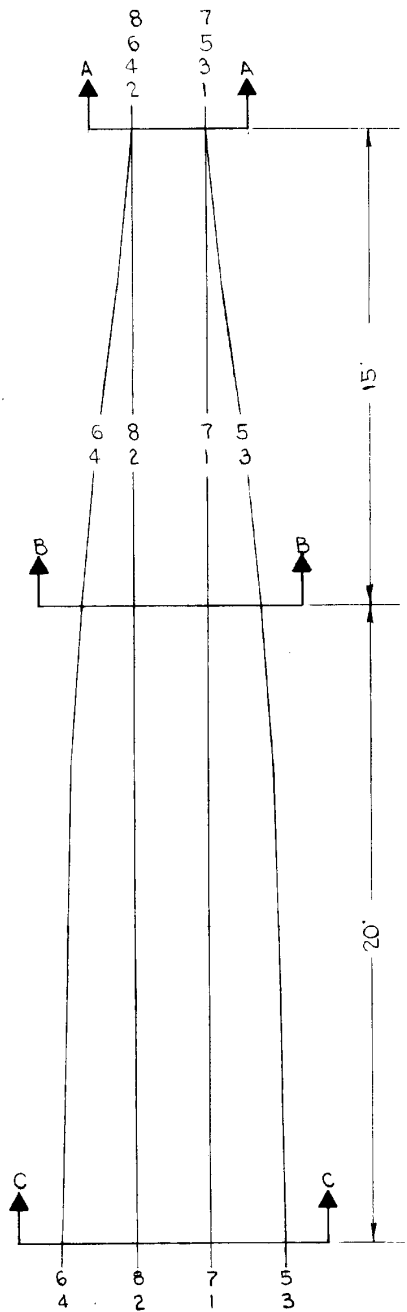


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REV. NO: 0
REV. DATE: 05/03/94
REAFFIRMED DATE: 03/13/09

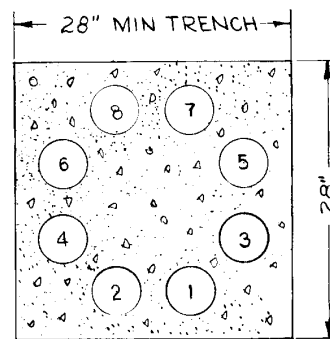
STRUCTURES – CONDUIT
8 Duct Transposition
Standard to Horizontal Position

31 10 06 00

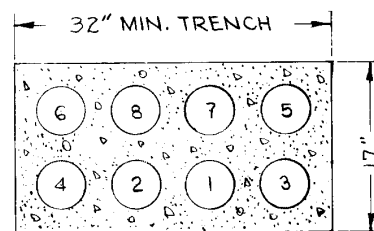
Sheet 1 of 1



SECTION A-A



SECTION B-B



SECTION C-C

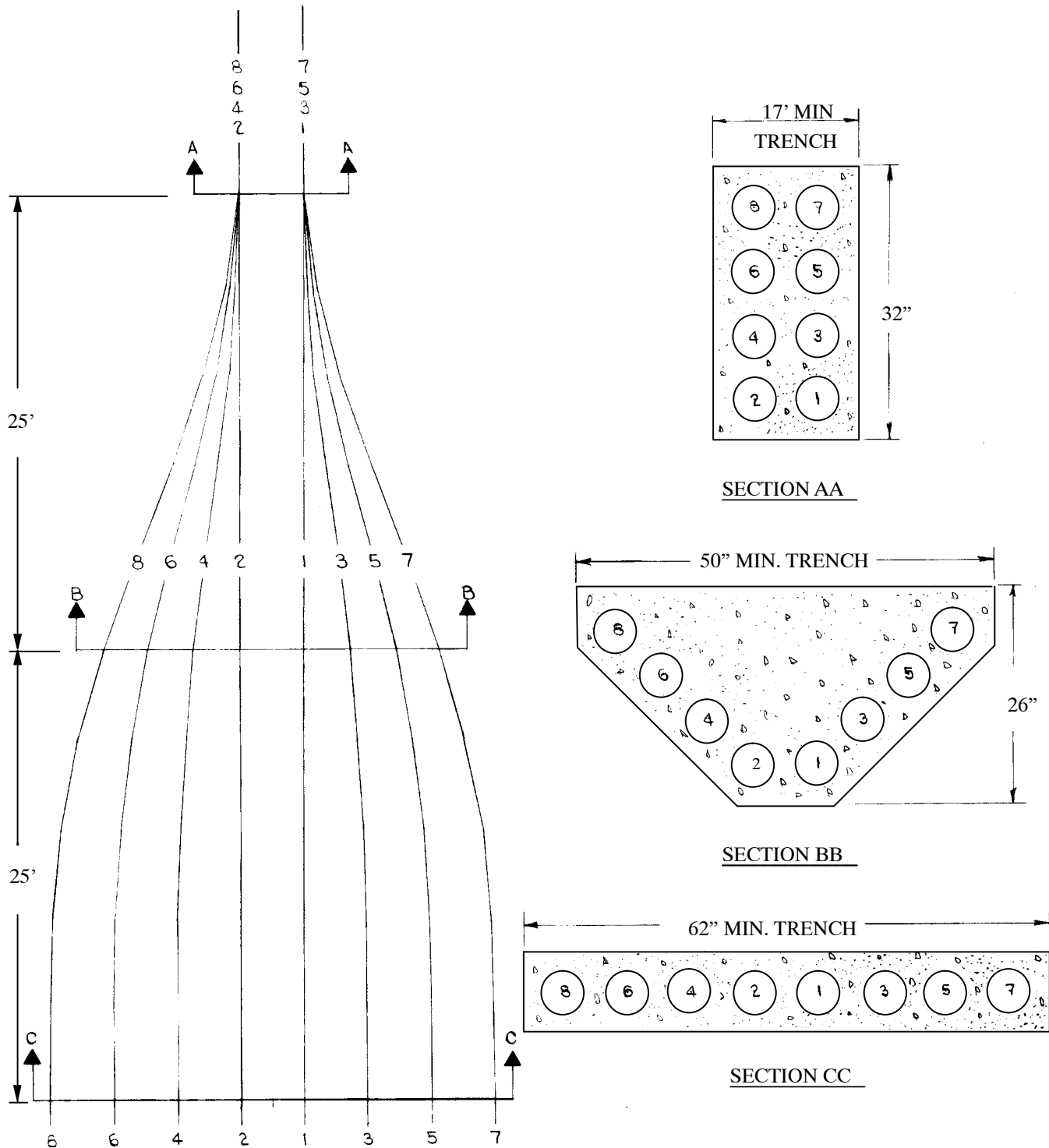
NOTES:

1. Dimensions based on 5" conduit, 5' lengths.
2. Spacer blocks shall be used to maintain conduit spacing during transposition.

STRUCTURES – CONDUIT
8 Duct Transposition
Standard to Flat Position

31 10 07 00

Sheet 1 of 1



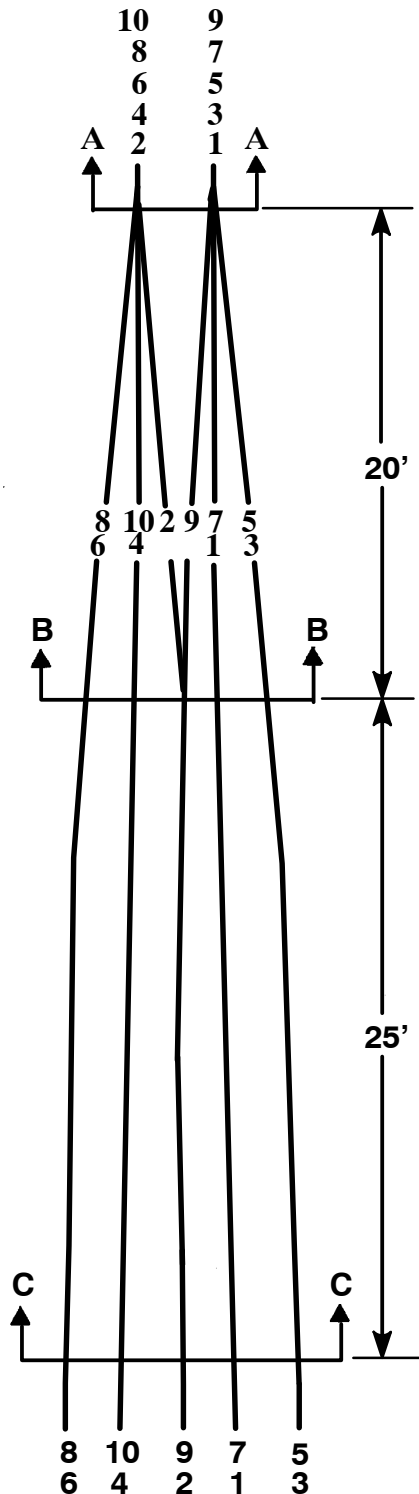
NOTES:

1. Dimensions based on 5" conduit, 5' lengths.
2. Spacer blocks shall be used to maintain conduit spacing during transposition.

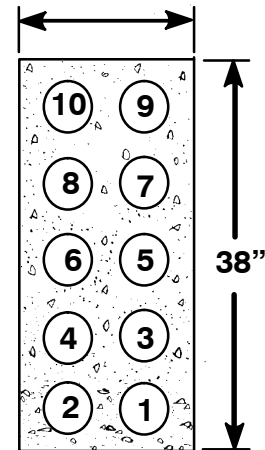
STRUCTURES – CONDUIT
10 Duct Transposition
Standard to Horizontal Position

31 10 08 00

Sheet 1 of 1

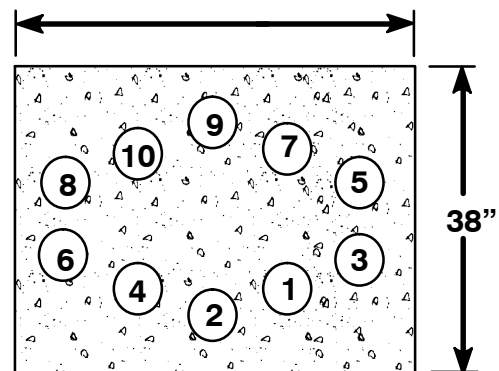


17" MIN TRENCH



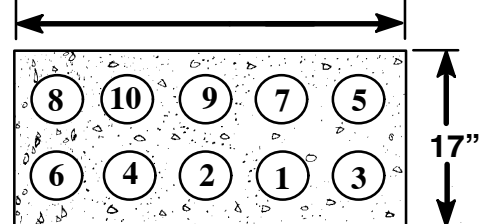
SECTION A-A

38" MIN TRENCH



SECTION B-B

38" MIN TRENCH



SECTION C-C

NOTES:

1. Dimensions based on 5" conduit, 5' lengths.
2. Spacer blocks shall be used to maintain conduit spacing during transposition.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DDG
REV. NO: 0
REV. DATE: 05/03/94
REAFFIRMED DATE: 03/13/09

STRUCTURES – CONDUIT
3 Ft. Average Trench Depth
No Paving Base

31 11 03 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Std. / Stk. No.	Description	31 11 03 **			
			11	12	13	14
			5"			
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600
B	11 54 128	Block – Concrete Patio	25	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100
D	98 00 014	Crushed Limestone	16	33	24	14
E	98 00 007	Concrete – Conduit (C.Y.)	3	4	6	9
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	100	160	160	160
@		Surface Removal (S.F.)	200	260	260	260
	36 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100
	835	Hauling Spoil	2	4	4	4
	ATMP	Tamping (S.F.)	200	320	320	320
@		Surface Replacement (S.F.)	200	260	260	260
	831	Rodding (Duct Feet)	100	200	400	600

STRUCTURES – CONDUIT
4 Ft. Average Trench Depth
No Paving Base

31 11 04 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Std. / Stk. No.	Description	31 11 04 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	24	48	38	28	19	10
E	98 00 007	Concrete – Conduit (C.Y.)	3	4	6	9	11	14
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	100	160	160	160	160	160
@		Surface Removal (S.F.)	200	260	260	260	260	260
	48 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	3	6	6	6	6	6
	ATMP	Air Tamping (S.F.)	200	320	320	320	320	320
@		Surface Replacement (S.F.)	200	260	260	260	260	260
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
5 Ft. Average Trench Depth
No Paving Base

31 11 05 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Std. / Stk. No.	Description	31 11 05 **	11	12	13	14	15	16
				5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35		100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio		25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"		50	50	75	100	125	150
D	98 00 014	Crushed Limestone		31	62	52	43	33	24
E	98 00 007	Concrete – Conduit (C.Y.)		3	5	8	11	14	17
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)		100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)		100	185	185	185	185	185
@		Surface Removal (S.F.)		200	285	285	285	285	285
	60 CBTRN	Backhoe Trenching (L.F.)		100	100	100	100	100	100
	835	Hauling Spoil		4	7	7	7	7	7
	ATMP	Tamping (S.F.)		200	370	370	370	370	370
@		Surface Replacement (S.F.)		200	285	285	285	285	285
	831	Rodding (Duct Feet)		100	200	400	600	800	1000

STRUCTURES – CONDUIT
6 Ft. Average Trench Depth
No Paving Base

31 11 06 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Std. / Stk. No.	Description	31 11 06 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	38	76	66	56	47	38
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	100	185	185	185	185	185
@		Surface Removal (S.F.)	200	285	285	285	285	285
	72 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	5	9	9	9	9	9
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
@		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
7 Ft. Average Trench Depth
No Paving Base

31 11 07 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Stnd. / Stk. No.	Description	31 11 07 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	45	90	81	71	62	52
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	100	185	185	185	185	185
@		Surface Removal (S.F.)	200	285	285	285	285	285
	84 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	5	10	10	10	10	10
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
@		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
8 Ft. Average Trench Depth
No Paving Base

31 11 08 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Std. / Stk. No.	Description	31 11 08 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	52	105	95	86	76	67
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	100	185	185	185	185	185
@		Surface Removal (S.F.)	200	285	285	285	285	285
	96 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	6	12	12	12	12	12
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
@		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
3 Ft. Average Trench Depth
With Paving Base (9" Concrete)

31 12 03 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Stnd. / Stk. No.	Description	31 12 03 **		
			11	12	13
			5"		
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400
B	11 54 128	Block – Concrete Patio	25	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75
D	98 00 014	Crushed Limestone	10	19	10
E	98 00 007	Concrete – Conduit (C.Y.)	3	4	6
F	98 00 001	Concrete–Paving Base	3	5	5
G	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	200	320	320
@		Surface Removal (S.F.)	200	260	260
	36 CBTRN	Backhoe Trenching (L.F.)	100	100	100
	835	Hauling Spoil	2	4	4
	ATMP	Tamping (S.F.)	200	320	320
@		Surface Replacement (S.F.)	200	260	260
	831	Rodding (Duct Feet)	100	200	400

STRUCTURES – CONDUIT
4 Ft. Average Trench Depth
With Paving Base (9" Concrete)

31 12 04 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Std. / Stk. No.	Description	31 12 04 **	11	12	13	14	15
				5"				
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35		100	200	400	600	800
B	11 54 128	Block – Concrete Patio		25	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"		50	50	75	100	125
	98 00 014	Crushed Limestone		17	33	24	14	4
D	98 00 007	Concrete – Conduit (C.Y.)		3	4	6	9	11
E	98 00 001	Concrete–Paving Base		3	5	5	5	5
F	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)		100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)		200	320	320	320	320
@		Surface Removal (S.F.)		200	260	260	260	260
	48 CBTRN	Backhoe Trenching (L.F.)		100	100	100	100	100
	ATMP	Tamping (S.F.)		200	320	320	320	320
@		Surface Replacement (S.F.)		200	260	260	260	260
	831	Rodding (Duct Feet)		100	200	400	600	800
	835	Hauling Dirt		3	6	6	6	6

STRUCTURES – CONDUIT
5 Ft. Average Trench Depth
With Paving Base (9" Concrete)

31 12 05 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired result.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Stnd. / Stk. No.	Description	31 12 05 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	24	48	38	29	19	10
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	98 00 001	Concrete–Paving Base	3	6	6	6	6	6
G	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	200	370	370	370	370	370
		Surface Removal (S.F.)	200	285	285	285	285	285
	60 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	4	7	7	7	7	7
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
6 Ft. Average Trench Depth
With Paving Base (9" Concrete)

31 12 06 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Stnd. / Stk. No.	Description	31 12 06 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	31	62	52	43	33	24
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	98 00 001	Concrete–Paving Base	3	6	6	6	6	6
G	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	200	370	370	370	370	370
@		Surface Removal (S.F.)	200	285	285	285	285	285
	72 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	5	9	9	9	9	9
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
@		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
7 Ft. Average Trench Depth
With Paving Base (9" Concrete)

31 12 07 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

Quantity Per 100' of Duct Run

	Stnd. / Stk. No.	Description	31 12 07 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	38	76	67	57	48	38
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	98 00 001	Concrete–Paving Base	3	6	6	6	6	6
G	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	200	370	370	370	370	370
@		Surface Removal (S.F.)	200	285	285	285	285	285
	84 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	5	10	10	10	10	10
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
@		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
8 Ft. Average Trench Depth
With Paving Base (9" Concrete)

31 12 08 **

Sheet 1 of 1

NOTE:

1. Estimator to show duct construction in units of "Feet", i.e., 180 Ft. duct run, should be shown as 180 in quan. column. Computer will interpret 180 as 180% and multiply units listed above by 1.8 to obtain desired results.
2. The quantity shown in the adder item is for a duct run of 100'. For a duct run other than 100', the quantity of the adder item (@) must be adjusted by the estimator.
3. For a complete listing of adder items (@), refer to the underground conduit estimating (Operation Codes) sheets.
4. For duct construction (stacking) refer to key sheet standard 31 10 00 00.

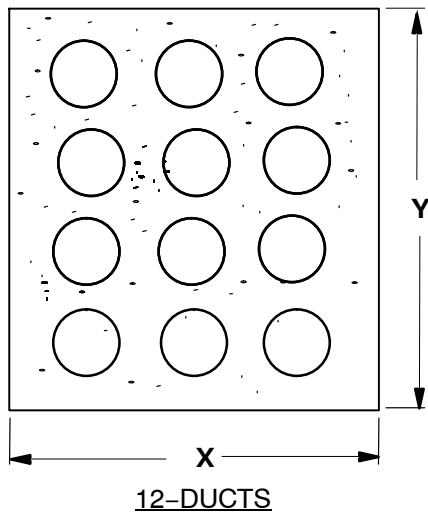
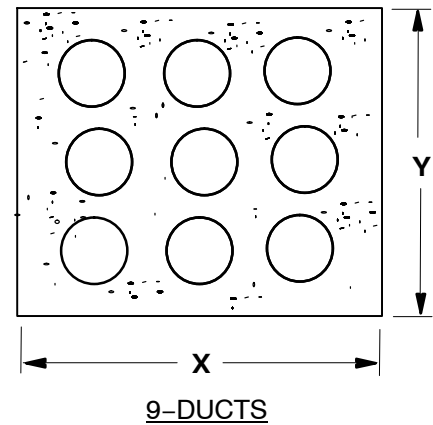
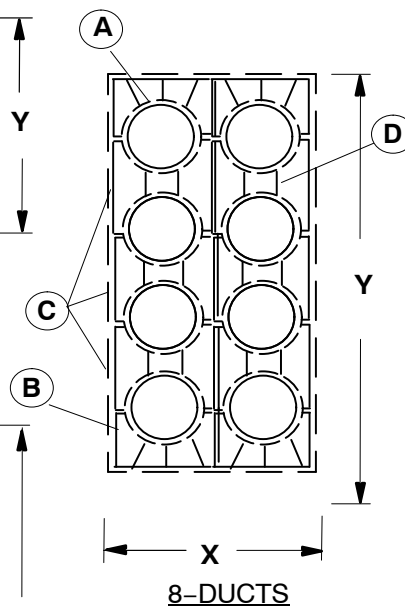
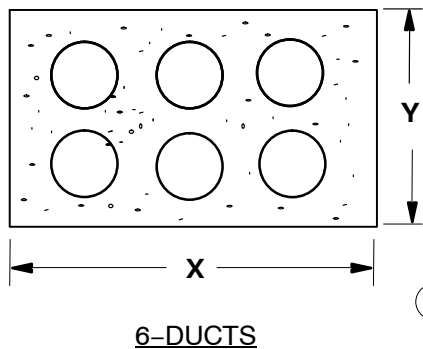
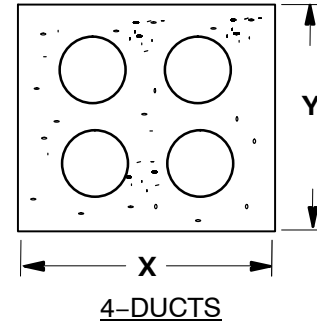
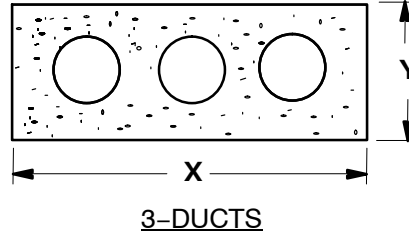
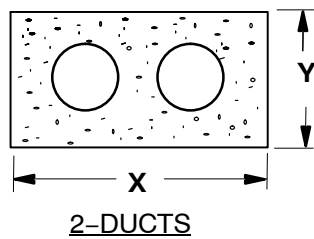
Quantity Per 100' of Duct Run

	Stnd. / Stk. No.	Description	31 12 08 **					
			11	12	13	14	15	16
			5"					
A	12 01 335	Conduit – Plastic, 5" x 20', EB 35	100	200	400	600	800	1000
B	11 54 128	Block – Concrete Patio	25	50	50	50	50	50
C	12 56 120	Plastic Spacer – Conduit, 5"	50	50	75	100	125	150
D	98 00 014	Crushed Limestone	46	90	81	72	60	52
E	98 00 007	Concrete – Conduit (C.Y.)	3	5	8	11	14	17
F	98 00 001	Concrete–Paving Base	3	6	6	6	6	6
G	18 52 030	Wire – 4/0 Tinned S.D. (Ft.)	100	100	100	100	100	100
	RFIN	Rough Finish Concrete (s.f.)	200	370	370	370	370	370
@		Surface Removal (S.F.)	200	285	285	285	285	285
	96 CBTRN	Backhoe Trenching (L.F.)	100	100	100	100	100	100
	835	Hauling Spoil	6	12	12	12	12	12
	ATMP	Tamping (S.F.)	200	370	370	370	370	370
@		Surface Replacement (S.F.)	200	285	285	285	285	285
	831	Rodding (Duct Feet)	100	200	400	600	800	1000

STRUCTURES – CONDUIT
Encased Conduit Formations
5" EB Conduit (ILLINOIS)

31 13 01 **

Sheet 1 of 2



STANDARD NUMBER	NUMBER OF DUCTS	DIMENSIONS	
		X	Y
31 13 01 02	2	17 3/4"	10 3/4"
31 13 01 03	3	24 3/4"	10 3/4"
31 13 01 04	4	17 1/4"	17 3/4"
31 13 01 06	6	24 3/4"	17 3/4"
31 13 01 08	8	17 1/4"	31 3/4"
31 13 01 09	9	24 3/4"	24 3/4"
31 13 01 12	12	24 3/4"	31 3/4"

STRUCTURES – CONDUIT
Encased Conduit Formations
5" EB Conduit (ILLINOIS)

31 13 01 **

Sheet 2 of 2

NOTE:

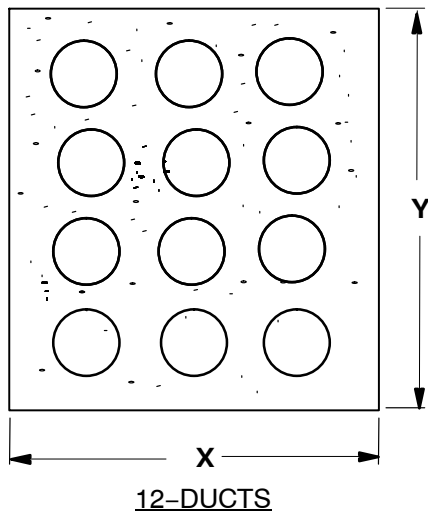
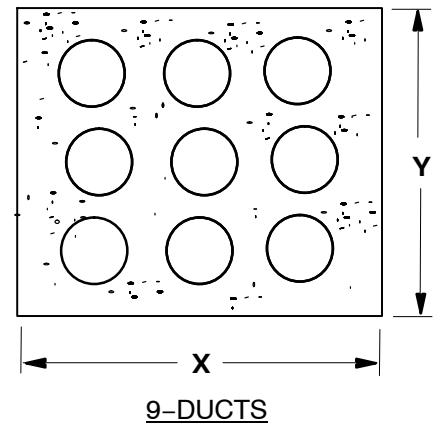
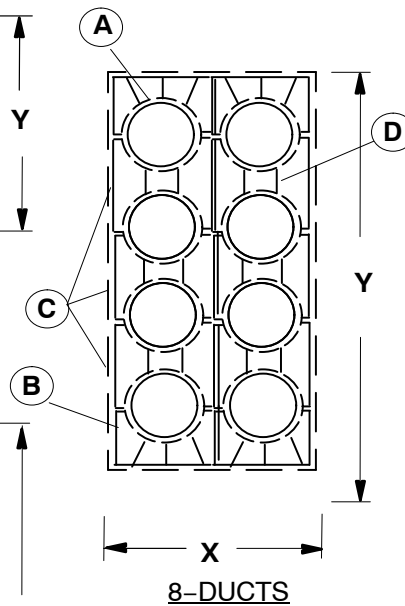
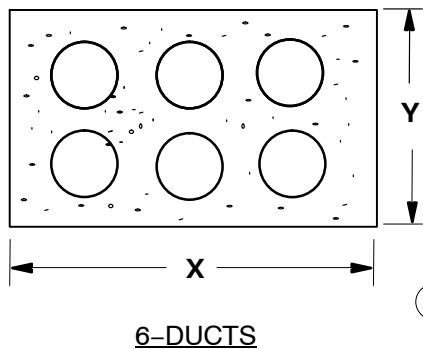
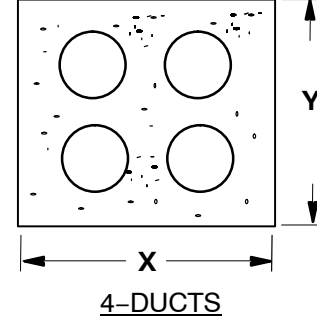
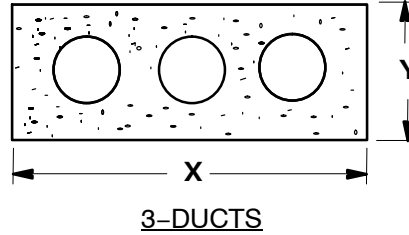
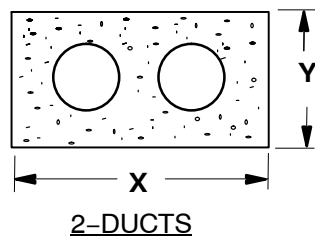
1. Each standard includes material for a 20 ft. duct formation.
2. Spacers should be installed every 10 ft. for straight runs.
3. Call for extra spacers to use on large sweeps in a duct run. Sweeps need more spacers placed closer together.
4. To keep conduits from floating when the concrete is poured, attach the duct bank to rebar stakes with rebar tie wire. Contractors usually supply the rebar and tie wire.

		Std. / Stk. No.	Description	31 13 01 **	02	03	04	06	08	09	12
	A	12 01 335	Conduit – Plastic, 5" x 20', EB 35		40	60	80	120	160	180	240
	B	40 83 015	Spacer – Conduit, 5", Base		4	6	4	6	4	6	6
	C	40 83 016	Spacer – Conduit, 5", Intermediate				4	6	12	12	18
	D	98 00 007	Concrete–Conduit (Cu. Yd.)		.740	1.01	1.10	1.53	1.85	2.05	2.58

STRUCTURES – CONDUIT
Encased Conduit Formations
4" EB Conduit (ILLINOIS)

31 13 02 **

Sheet 1 of 2



STANDARD NUMBER	NUMBER OF DUCTS	DIMENSIONS	
		X	Y
31 13 02 02	2	15"	9 1/2"
31 13 02 03	3	21 1/2"	9 1/2"
31 13 02 04	4	15"	15 1/2"
31 13 02 06	6	21 1/2"	15 1/2"
31 13 02 08	8	15"	27 1/2"
31 13 02 09	9	21 1/2"	21 1/2"
31 13 02 12	12	21 1/2"	27 1/2"

STRUCTURES – CONDUIT
Encased Conduit Formations
4" EB Conduit (ILLINOIS)

31 13 02 **

Sheet 2 of 2

NOTE:

1. Each standard includes material for a 20 ft. duct formation.
2. Spacers should be installed every 10 ft. for straight runs.
3. Call for extra spacers to use on large sweeps in a duct run. Sweeps need more spacers placed closer together.
4. To keep conduits from floating when the concrete is poured, attach the duct bank to rebar stakes with rebar tie wire. Contractors usually supply the rebar and tie wire.

		Std. / Stk. No.	Description	31 13 02 **	02	03	04	06	08	09	12
	A	12 01 337	Conduit – Plastic, 4" x 20', EB 35	40	60	80	120	160	180	240	
	B	40 83 014	Spacer – Conduit, 4", Base	4	6	4	6	4	6	6	
	C	40 83 013	Spacer – Conduit, 4", Intermediate			4	6	12	12	18	
	D	98 00 007	Concrete-Conduit (Cu. Yd.)	.570	.810	.870	1.22	1.47	1.65	2.06	

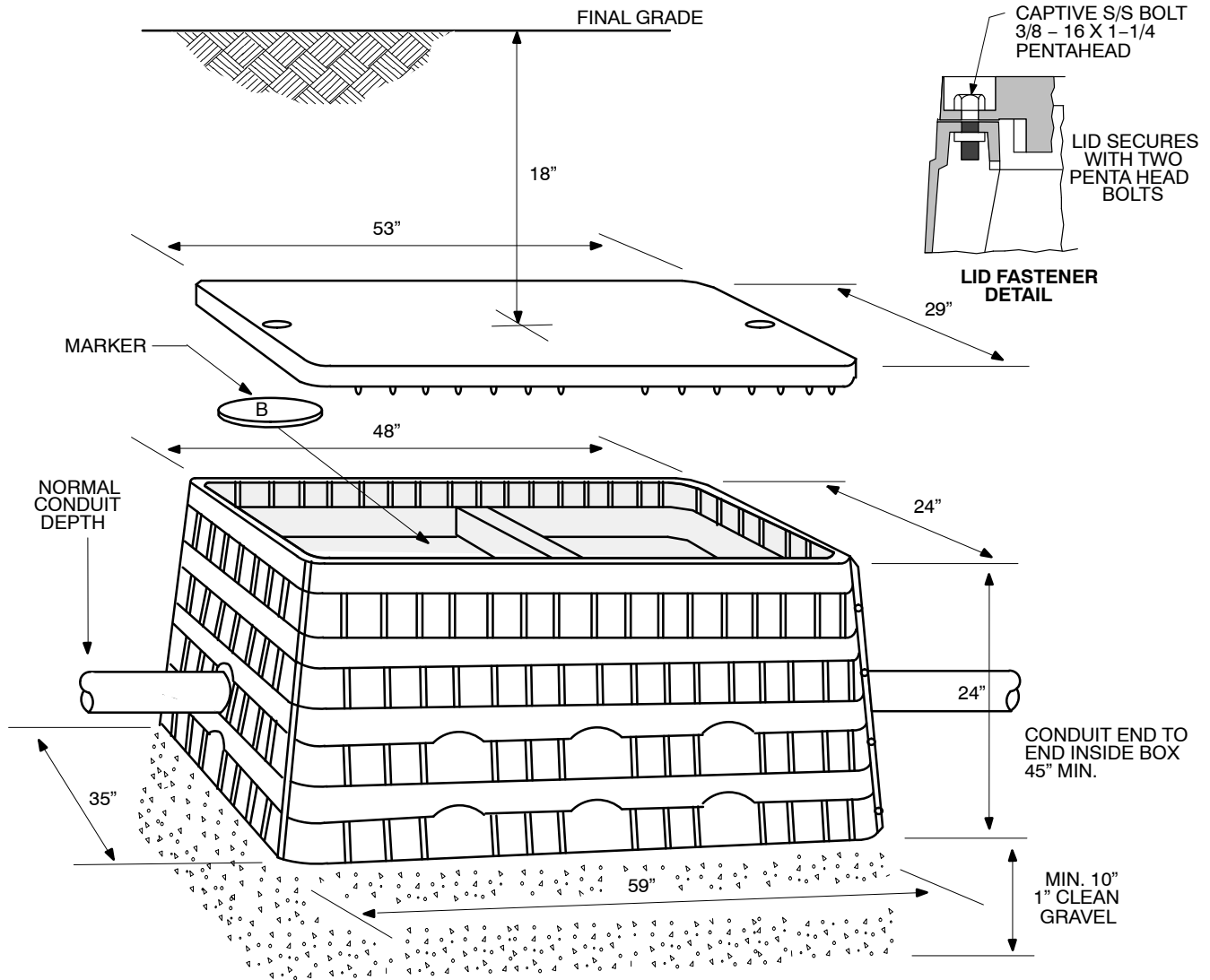
STRUCTURES

Splice – Box

2' X 4' X 2' Deep

31 21 02 01

Sheet 1 of 1



BOX – SPLICE
24" X 24" X 48"
FOR USE IN NON-TRAFFIC AREAS

INSTRUCTIONS :

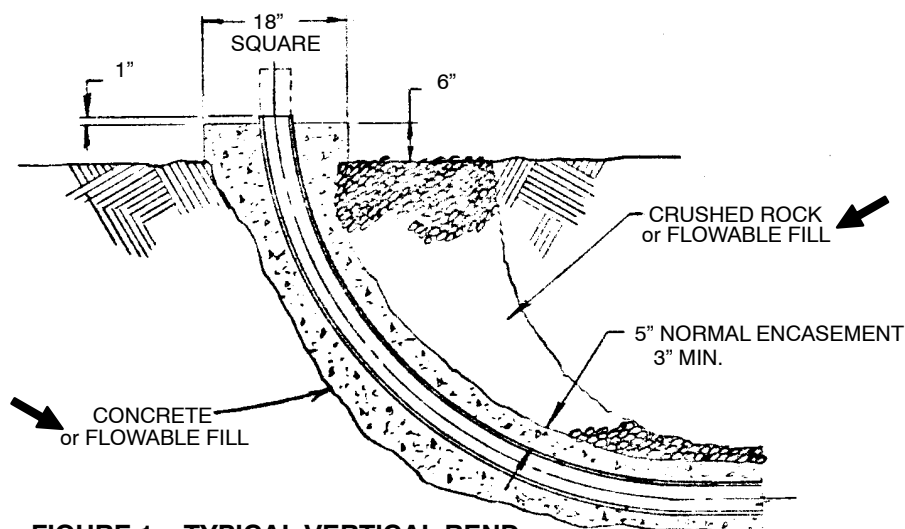
1. Excavate and install box at standard conduit depths on 10 inch base of 1 inch gravel. Box lid located approx. 18" below grade
2. Install conduits thru knockouts, or bore holes in the box. Seal conduits at box interface.
3. After installing cable, place lid on box, partially backfill and tamp soil.
4. Place electronic marker at the center inside of the box and complete backfill. **IMPORTANT:** Marker must be laid flat.
5. In Missouri residential developments, the contractor will install the splice box and conduit.

	Std. / Stk. No.	Description	31 21 02	01
	12 06 105	Box, Cable, 2' x 4' x 2' Deep		1
	49 05 519	Marker, Electronic		1
@	98 00 014	Rock Crushed		As Req'd
@	701	Drill Hole In Box		@

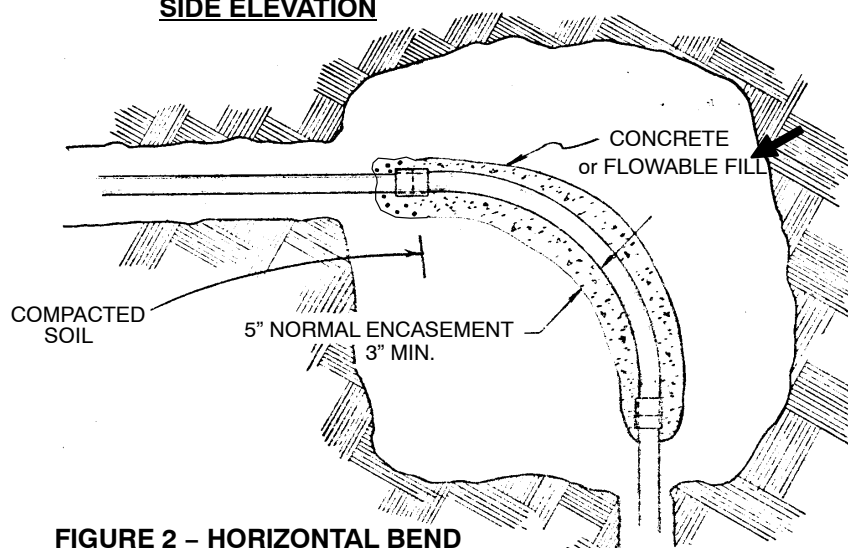
DISTRIBUTION
CONSTRUCTION STANDARDS



ENG:EJB
REV. NO: 8
REV. DATE: 06/06/08

RESTRAINT-SWITCHGEAR & TERMINAL POLE BEND

**FIGURE 1 – TYPICAL VERTICAL BEND
SIDE ELEVATION**



**FIGURE 2 – HORIZONTAL BEND
PLAN VIEW**

	Std. / Stk. No.	31 47 01 **	Horizontal				Vertical			
			01	02	03	04	05	06	07	08
	12 51 180	Bend 2" x 36" Rad.	1				1			
	12 51 173	Bend 3" x 36" Rad.		1				1		
	12 51 176	Bend 4" x 36" Rad.			1				1	
	12 51 206	Bend 5" x 36" Rad.				1				1
	11 04 105	Concrete or Flowable Fill- Cu. Ft.	4	5	6	7	6	7	8	9
	98 00 014	Crushed Rock Cu. Yd.					1/2	1/2	1/2	1/2
	BTRN	Backhoe trn 36" x Ft.	4	4	4	4	4	4	4	4

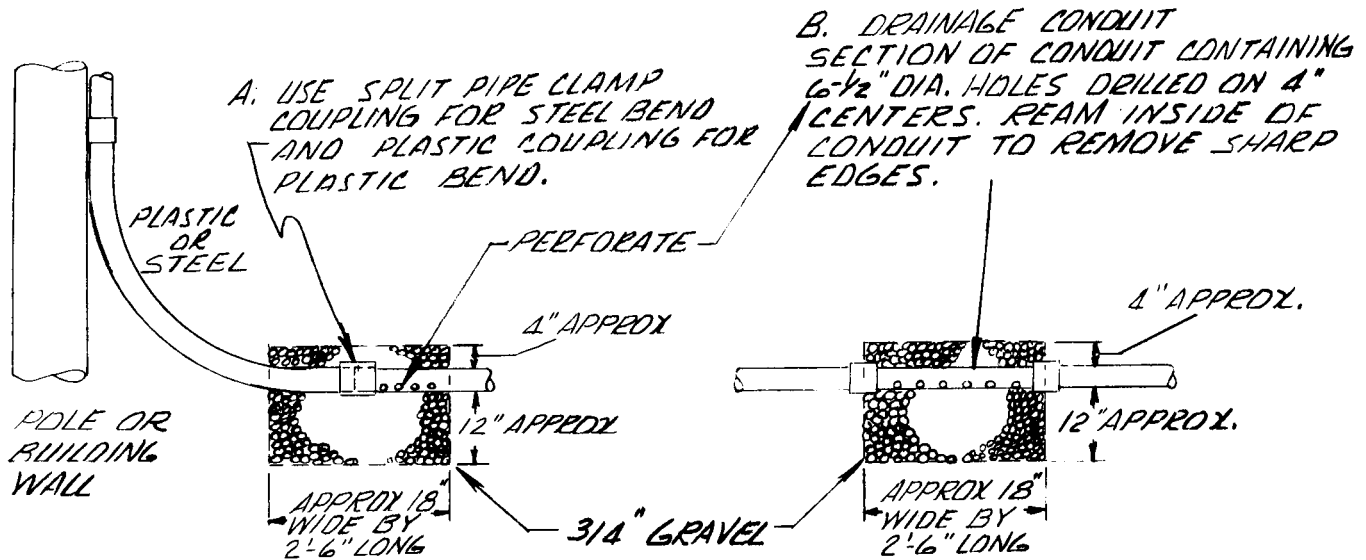


FIG. 1

FOR BURIED ELECTRICAL STEEL
OR PLASTIC CONDUIT

FIG. 2

FOR BURIED NON-METALLIC
CONDUIT

BUILDING PAPER ABOVE CONDUIT
TO PREVENT UPPER CONCRETE
SHEATHING FROM FILLING
CONDUIT HOLES & GRAVEL

DRAINAGE CONDUIT
SECTION OF CONDUIT CONTAINING
6-1/2" DIA HOLES DRILLED ON 4"
CENTERS. REAM INSIDE OF CONDUIT
TO REMOVE SHARP EDGES.

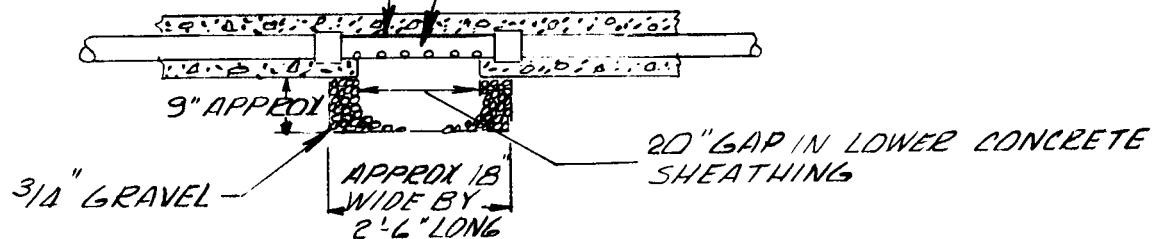


FIG. 3

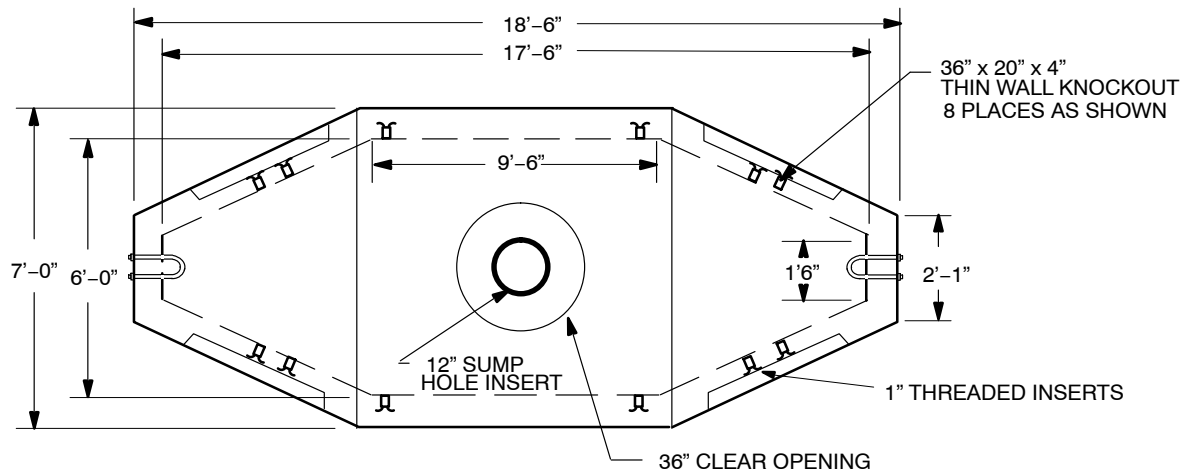
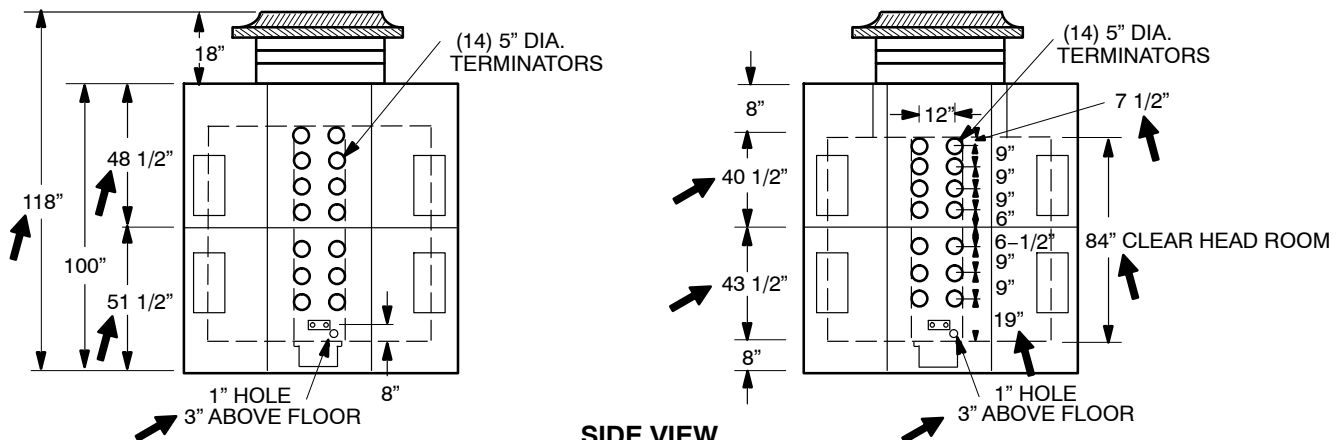
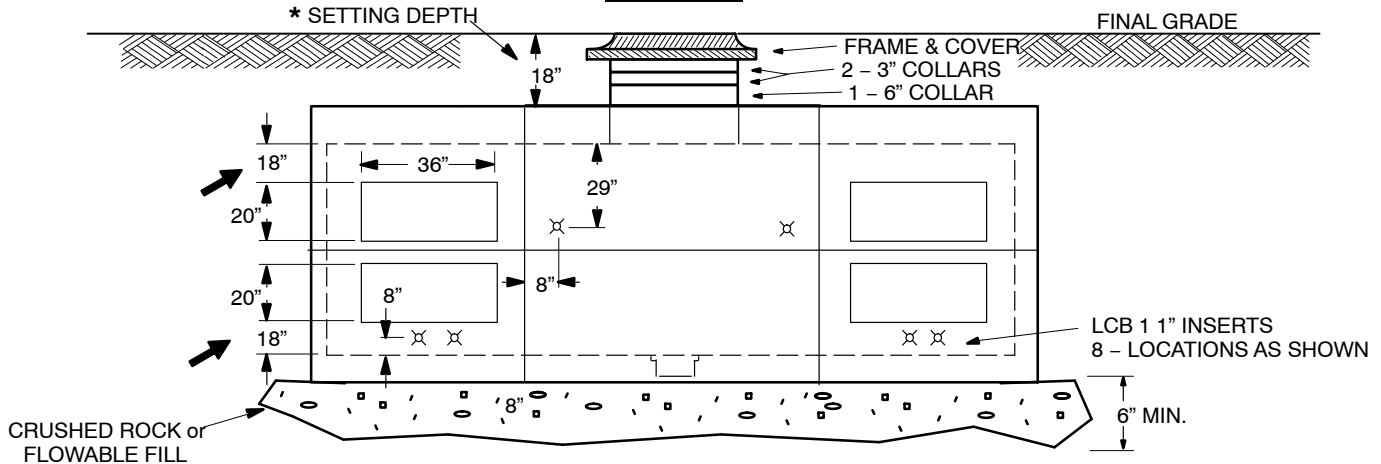
FOR CONCRETE ENCASED
NON-METALLIC CONDUIT

		Std. / Stk. No.	Description	31 47 02 **	2"	3"	4"	5"
					01	02	03	04
	@	by shop	Conduit Perforated 30" long		1 Ea	1 Ea	1 Ea	1 Ea
	@	BTRN	Backhoe 42" in ft.		3'	3'	3'	3'
→	@	98 00 014	Rock Crushed		As Req'd	As Req'd	As Req'd	As Req'd

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: DDG
REV. NO: 1
REV. DATE: 2/08/95
REAFFIRMED DATE: 3/16/09

TOP VIEW**END VIEWS****SIDE VIEW****COLLAR CONFIGURATION**

PREFERRED – 1-6" & 2-3"
3" NECKS ARE REQUIRED ON ALL MANHOLES
AND SHALL BE TOP COLLARS

*** SETTING DEPTHS**

COORDINATE W/AMEREN REP.
PREFERRED – 18" (AS SHOWN)
MINIMUM – 12" TO FINAL GRADE
MAXIMUM – 60" TO FINAL GRADE

WEIGHTS

TOP SECTION 20,980 lbs.
BASE SECTION 21,599 lbs.
TOTAL 42,579 lbs.

TRAFFIC RATED DESIGN

NECK STYLE

36" Round – 32 21 01 01

36" Round x 5' Deep – 32 21 01 02

NOTE

1. 5.32 Cubic yards of dirt removed per foot of excavation.
2. Add the required number of 6" concrete (Stk. # 12 06 063) and 3" concrete (Stk. # 12 06 062) necks so that the frame and cover are at final grade.
3. Manholes are equipped with the cable mounting racks. Add the required number of cable mounting arms to suspend the installed cables.
4. Set the manhole at the "Preferred Depth" or contact company rep. if not achievable.

		Stock. No.	Description	01	02
	A	12 06 235	Manhole – Top, Precast Conc.	1	1
		12 06 236	Manhole – Bottom, Precast Conc.	1	1
	B	98 00 006	Concrete – 2 Sack (c.y.)	8	8
	C	33 12 01 01	Neck & Frame – 36" Rd.	1	
		33 12 01 02	Neck & Frame – 3' x 5' Deep		1
	D	19 04 327	Grate – 14"	1	1
		MEXC	Excavation (Mach.) (c.y.)	52	70
		MBF	Backfilling (Mach.) (c.y.)	12	31
		ATMP	Tamping (s.f.)	130	130
			Surface Removal (s.f.)	130	130
			Surface Replacement (s.f.)	130	130
	E	33 11 ** **	Wingwall Bays	A/R	A/R
		819	Loading Out (c.y.)	A/R	A/R
	F	98 00 014	Crushed Rock (c.y.)	1.33	1.33
	G	12 53 017	Shield – Duct, 3" thru 6"	12	12
3	H	12 56 113	Arm–Cable Mounting 14"	A/R	A/R
3	I	12 56 112	Arm–Cable Mounting 18"	A/R	A/R
3	J	12 56 114	Arm–Cable Mounting, 7 1/2"	A/R	A/R

A/R = As Required

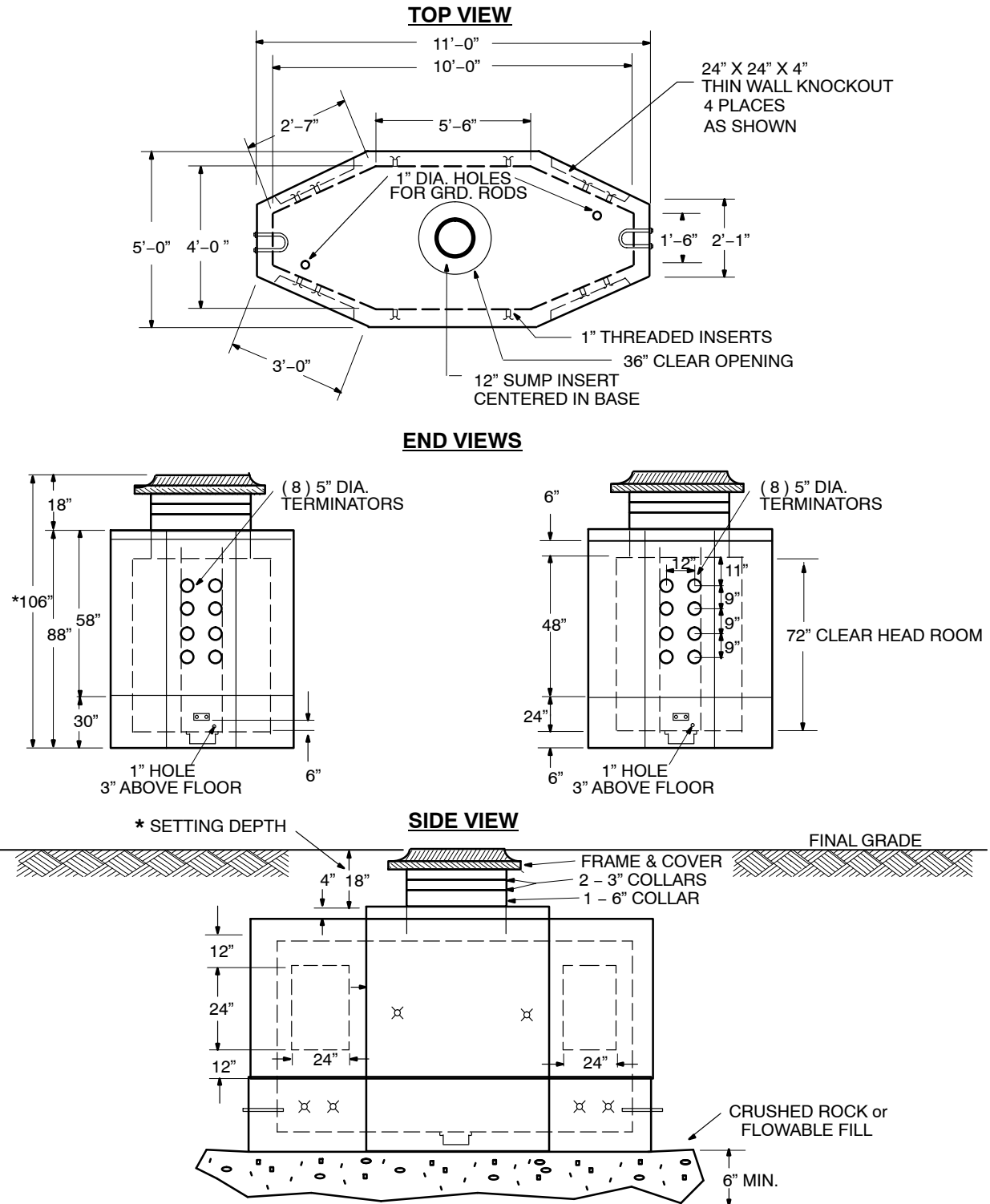
STRUCTURES – MANHOLES

Straight – Precast

4'-0" x 10'-0" x 6'-0"

32 21 02 **

Sheet 1 of 2



COLLAR CONFIGURATION

PREFERRED – 1-6" & 2-3"
3" NECKS ARE REQUIRED ON ALL MANHOLES
AND SHALL BE TOP COLLARS

* SETTING DEPTHS

COORDINATE W/AMEREN REP.
PREFERRED – 18" (AS SHOWN)
MINIMUM – 12" TO FINAL GRADE
MAXIMUM – 60" TO FINAL GRADE

WEIGHTS

TOP SECTION	13,200 lbs.
BASE SECTION	7,350 lbs.
TOTAL	20,550 lbs.

TRAFFIC RATED DESIGN

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG:DDG
REV. NO: 7
REV. DATE: 12/12/12

NECK STYLE

36" Round – 32 21 02 01

36" Round x 5' Deep – 32 21 02 02

NOTE

1. 2.45 Cubic yards of dirt removed per foot of excavation.
2. Add the required number of 6" concrete (Stk. # 12 06 063) and 3" concrete (Stk. # 12 06 062) necks so that the frame and cover are at final grade.
3. Manholes are equipped with the cable mounting racks. Add the required number of cable mounting arms to suspend the installed cables.
4. Set the manhole at the "Preferred Depth" or contact company rep. if not achievable.

		Std. / Stk. No.	Description	32 21 02 **	01	02
@ @ @ @	A	12 06 231	Manhole – Top, Precast Conc.		1	1
		12 06 232	Manhole – Bottom, Precast Conc.		1	1
	B	98 00 006	Concrete – 2 Sack (c.y.)		4	4
	C	33 12 01 01	Neck & Frame – 36" Rd.		1	
		33 12 01 02	Neck & Frame – 3'x5' Deep			1
	D	19 04 327	Grate – 14"		1	1
		MEXC	Excavation (Mach.) (c.y.)		18	27
		MBF	Backfilling (Mach.) (c.y.)		4	11
		ATMP	Tamping (s.f.)		70	70
			Surface Removal (s.f.)		70	70
			Surface Replacement (s.f.)		70	70
	E	33 11 ** **	Wingwall Bays		A/R	A/R
		819	Loading Out (c.y.)		A/R	A/R
	F	98 00 014\	Crushed Rock (c.y.)		2/3	2/3
	G	12 53 017	Shield – Duct, 3" thru 6"		4	4
	H	12 56 113	Arm – Cable Mounting, 14"		A/R	A/R
	I	12 56 112	Arm – Cable Mounting, 18"		A/R	A/R
	J	12 56 114	Arm–Cable Mounting, 7 1/2"		A/R	A/R

A/R=As Required

STRUCTURES – MANHOLES

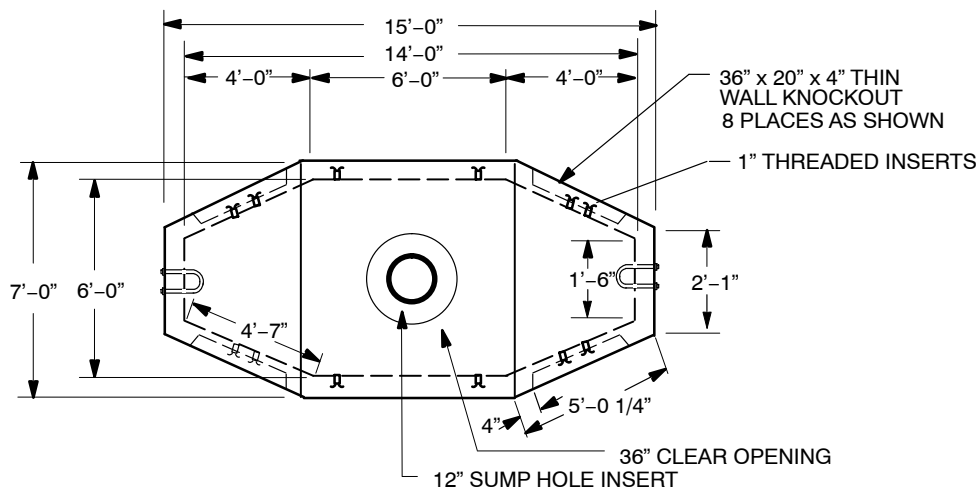
Straight – Precast

6'-0" x 14'-0" x 7'-0" ←

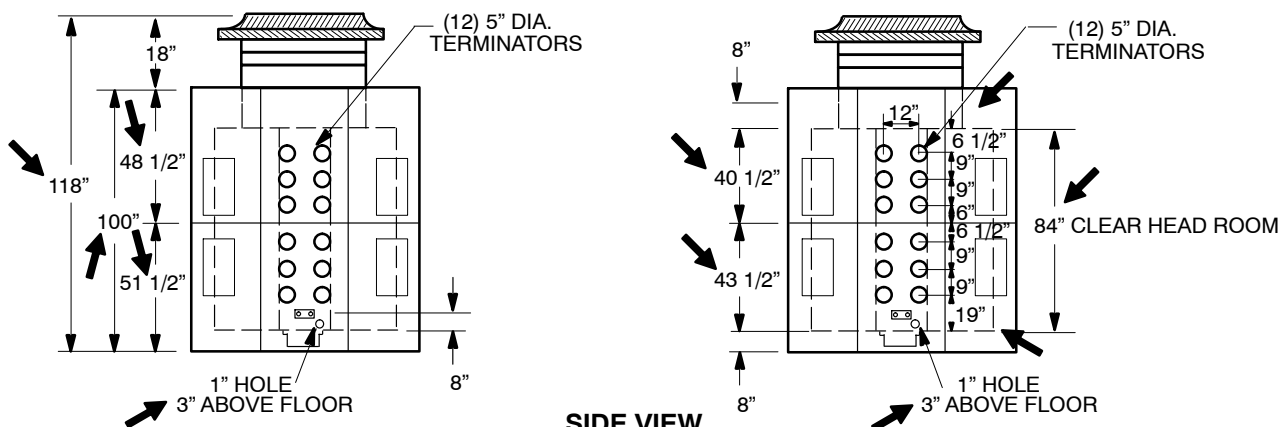
32 21 03 **

Sheet 1 of 2

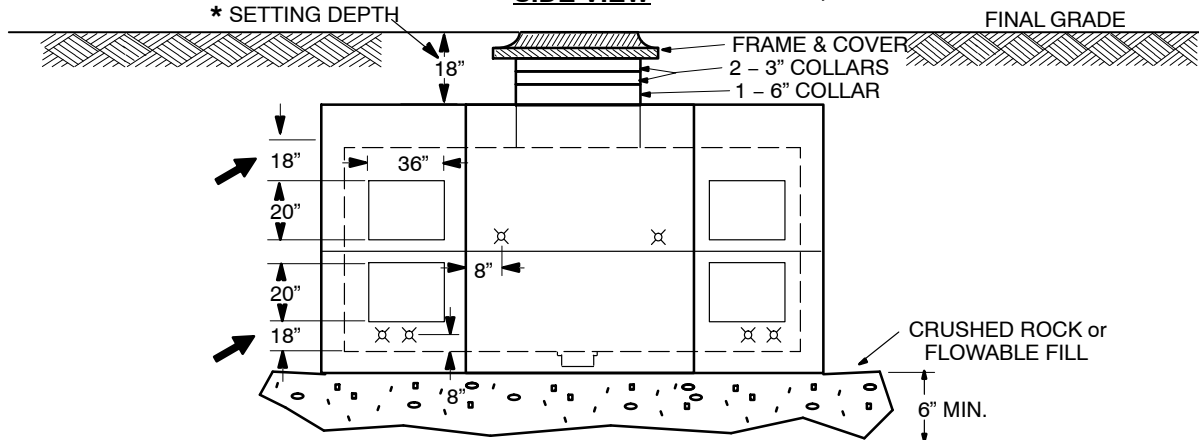
TOP VIEW



END VIEWS



SIDE VIEW



COLLAR CONFIGURATION

PREFERRED – 1-6" & 2-3"
3" NECKS ARE REQUIRED ON ALL MANHOLES
AND SHALL BE TOP COLLARS

* SETTING DEPTHS

COORDINATE W/AMEREN REP.
PREFERRED – 18" (AS SHOWN)
MINIMUM – 12" TO FINAL GRADE
MAXIMUM – 60" TO FINAL GRADE

WEIGHTS

TOP SECTION 19,798 lbs.
BASE SECTION 20,526 lbs.
TOTAL 40,324 lbs.

TRAFFIC RATED DESIGN

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG:EJB
REV. NO: 10
REV. DATE: 04/23/14

NECK STYLE

36" Round – 32 21 03 01

36" Round x 5' Deep – 32 21 03 02

NOTE

1. 3.536 Cubic yards of dirt removed per foot of excavation.
2. Add the required number of 6" concrete (Stk. # 12 06 063) and 3" concrete (Stk. # 12 06 062) necks so that the frame and cover are at final grade.
3. Manholes are equipped with the cable mounting racks. Add the required number of cable mounting arms to suspend the installed cables.
4. Set the manhole at the "Preferred Depth" or contact company rep. if not achievable.

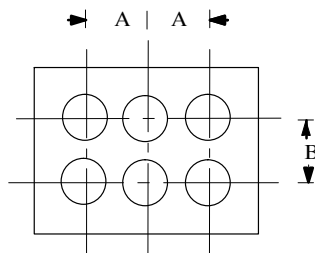
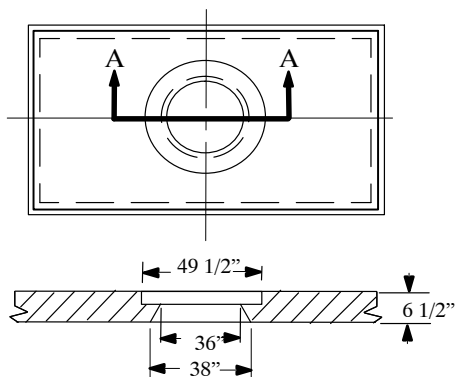
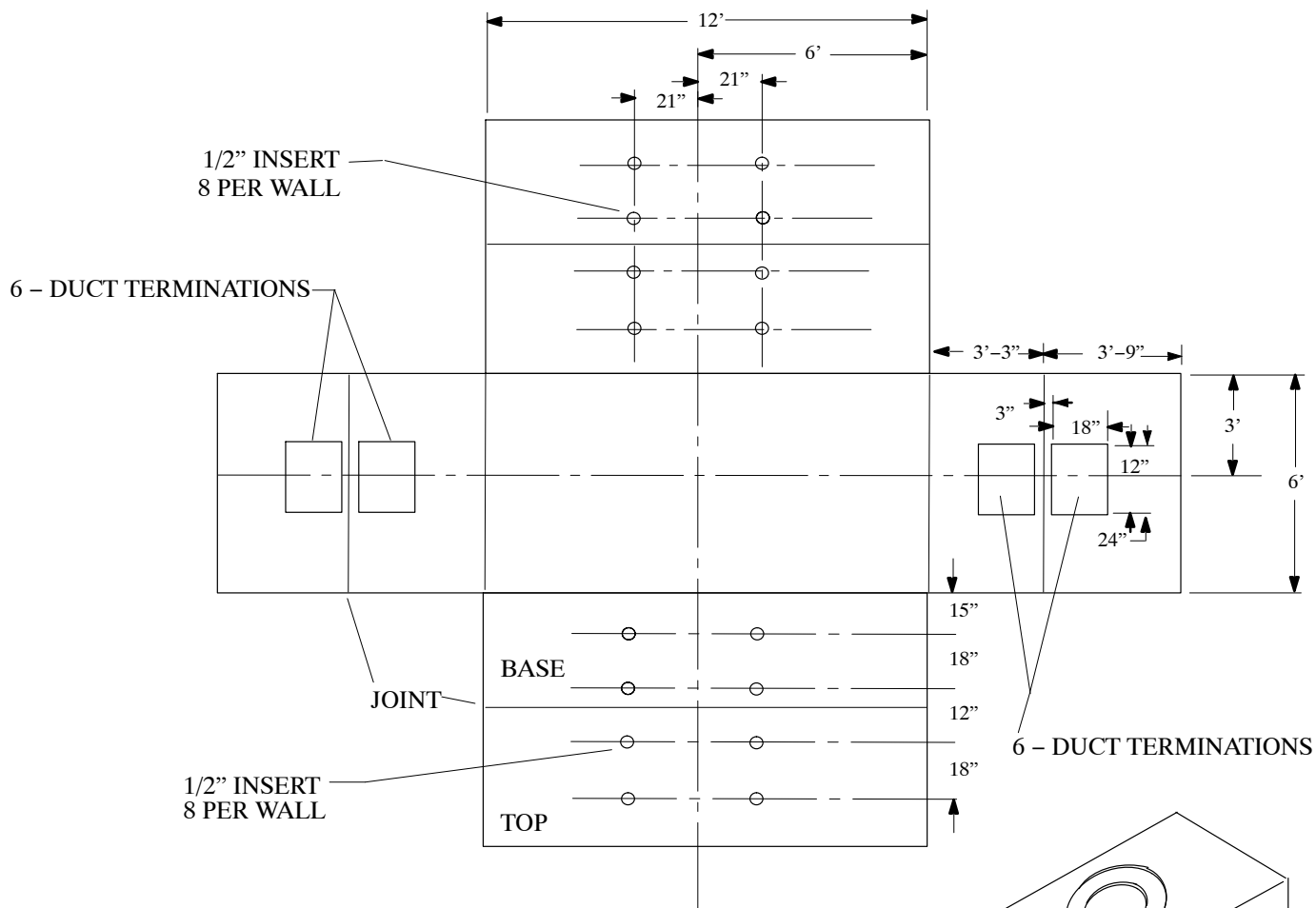
		Std. / Stk. No.	Description	32 21 03 **	01	02
@ @ @ @ 3 3 3	A	12 06 233	Manhole – Top, Precast Conc.		1	1
		12 06 234	Manhole – Bottom, Precast Conc.		1	1
	B	98 00 006	Concrete – 2 Sac (c.y.)		8	8
	C	33 12 01 01	Neck & Frame – 36" Rd.		1	
		33 12 01 02	Neck & Frame – 3'x5' Deep			1
	D	19 04 327	Grate – 14"		1	1
		MEXC	Excavation (Mach.) (c.y.)		40	53
		MBF	Backfilling (Mach.) (c.y.)		9	24
		ATMP	Tamping (s.f.)		99	99
			Surface Removal (s.f.)		99	99
			Surface Replacement (s.f.)		99	99
	E	33 11 ** **	Wingwall Bays		A/R	A/R
		819	Loading Out (c.y.)		A/R	A/R
	F	98 00 014*	Crushed Rock (c.y.)		1.0	1.0
	G	12 53 017	Shield – Duct, 3" thru 6"		12	12
	H	12 56 113	Arm–Cable Mounting, 14"		A/R	A/R
	I	12 56 112	Arm–Cable Mounting, 18"		A/R	A/R
	J	12 56 114	Arm–Cable Mounting, 7 1/2"		A/R	A/R

A/R = As Required

STRUCTURES-MANHOLES
 Straight-Precast
 6'-0" x 12'-0" (Type 38Y-A) (ILLINOIS)

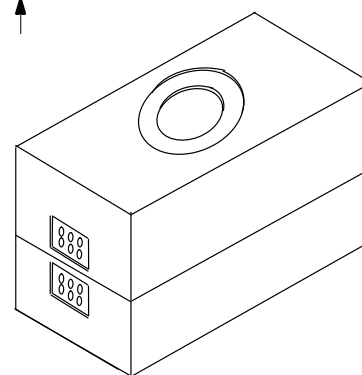
32 21 04 **

Sheet 1 of 2



DIM	MAX	MIN
A	7 5/8"	6 5/8"
B	7 5/8"	6 5/8"

DUCT TERMINATORS
 (5" TYPE EB PVC CONDUIT)



DESCRIPTION

	LENGTH	WIDTH	HEIGHT
INSIDE	12'	6'	7'
OUTSIDE	13'-1"	7'-1"	8'

WEIGHT
 14,000 Lb. MAX.
 EACH SECTION.
 TRAFFIC RATED DESIGN

STRUCTURES-MANHOLES
Straight-Precast
6'-0" x 12'-0" (Type 38Y-A) (ILLINOIS)

32 21 04 **

Sheet 2 of 2

NECK STYLE

32" Round x 5-5/8" Deep 32 21 04 01

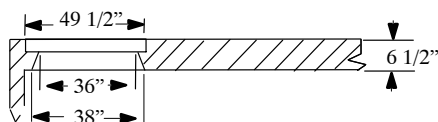
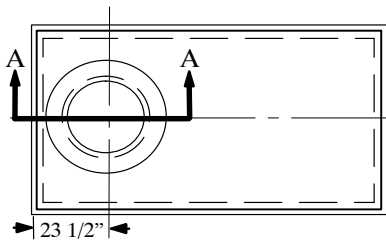
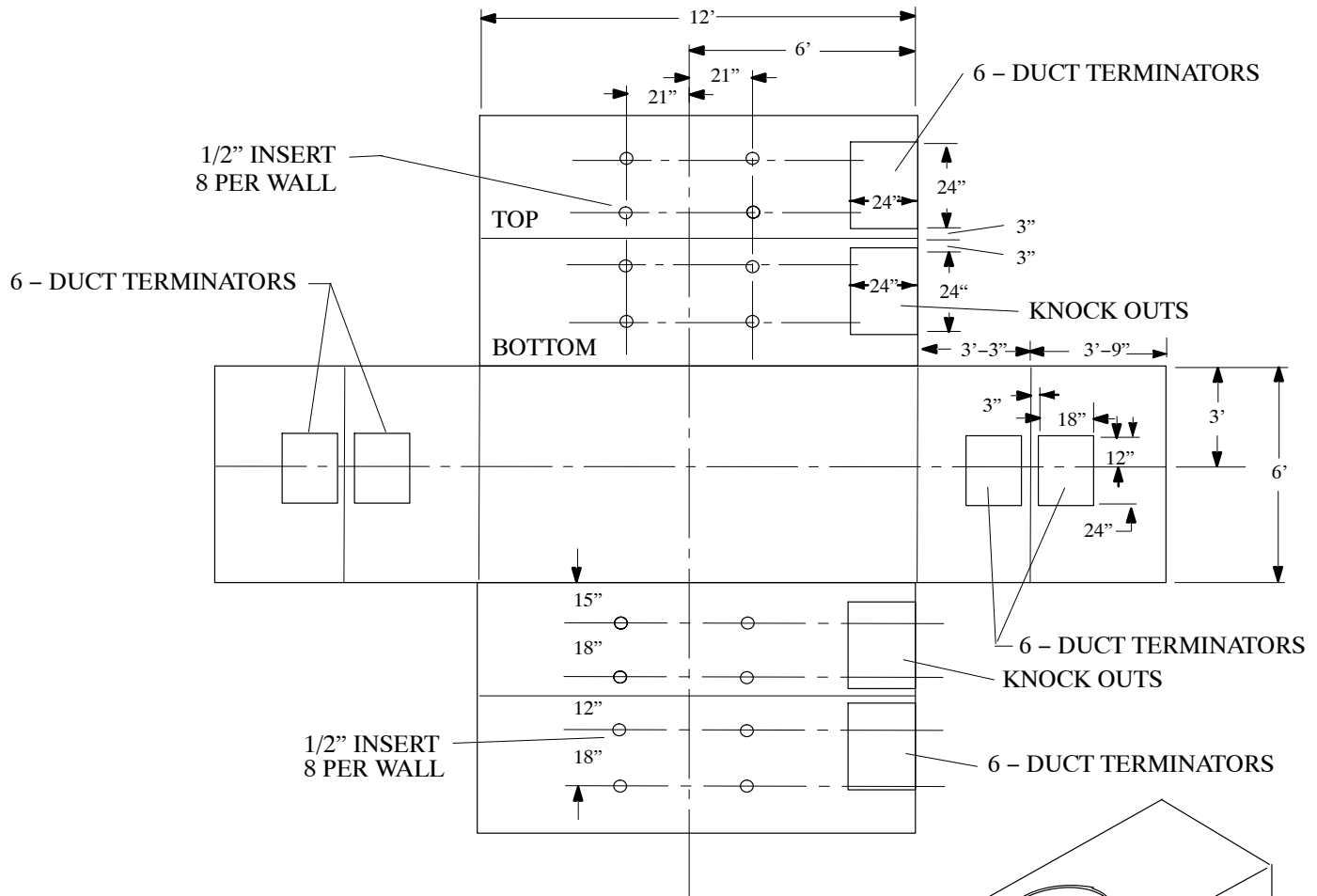
32" Round x 10" Deep 32 21 04 02

		Std. / Stk. No.	Description	01	02
	A	12 06 223	Manhole - Top, Precast Conc. (Type 38Y-A)	1	1
		12 06 224	Manhole - Bottom, Precast Conc. (Type 38Y-A)	1	1
	B	33 12 02 01	Manhole Frame and Cover - Shallow	1	
		33 12 02 02	Manhole Frame & Cover - Standard		1

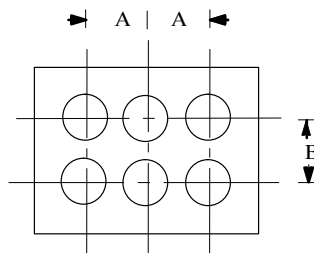
STRUCTURES-MANHOLES
 Straight-Precast
 6'-0" x 12'-0" (Type 38Y-J4 Roof A) (ILLINOIS)

32 21 05 **

Sheet 1 of 2

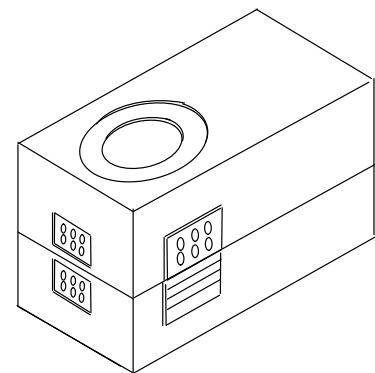


SECTION A-A



DIM	MAX	MIN
A	7 5/8"	6 5/8"
B	7 5/8"	6 5/8"

DUCT TERMINATORS
 (5" TYPE EB PVC CONDUIT)



WEIGHT
 14,800 Lb. MAX.
 EACH SECTION.
 TRAFFIC RATED DESIGN

STRUCTURES-MANHOLES
Straight-Precast
6'-0" x 12'-0" (Type 38Y-J4 Roof A) (ILLINOIS)

32 21 05 **

Sheet 2 of 2

NECK STYLE

32" Round x 5-5/8" Deep 32 21 05 01

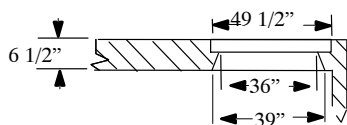
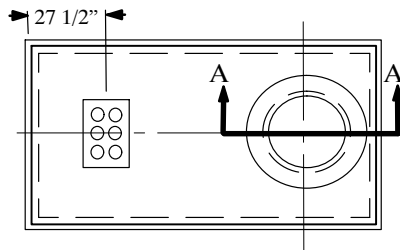
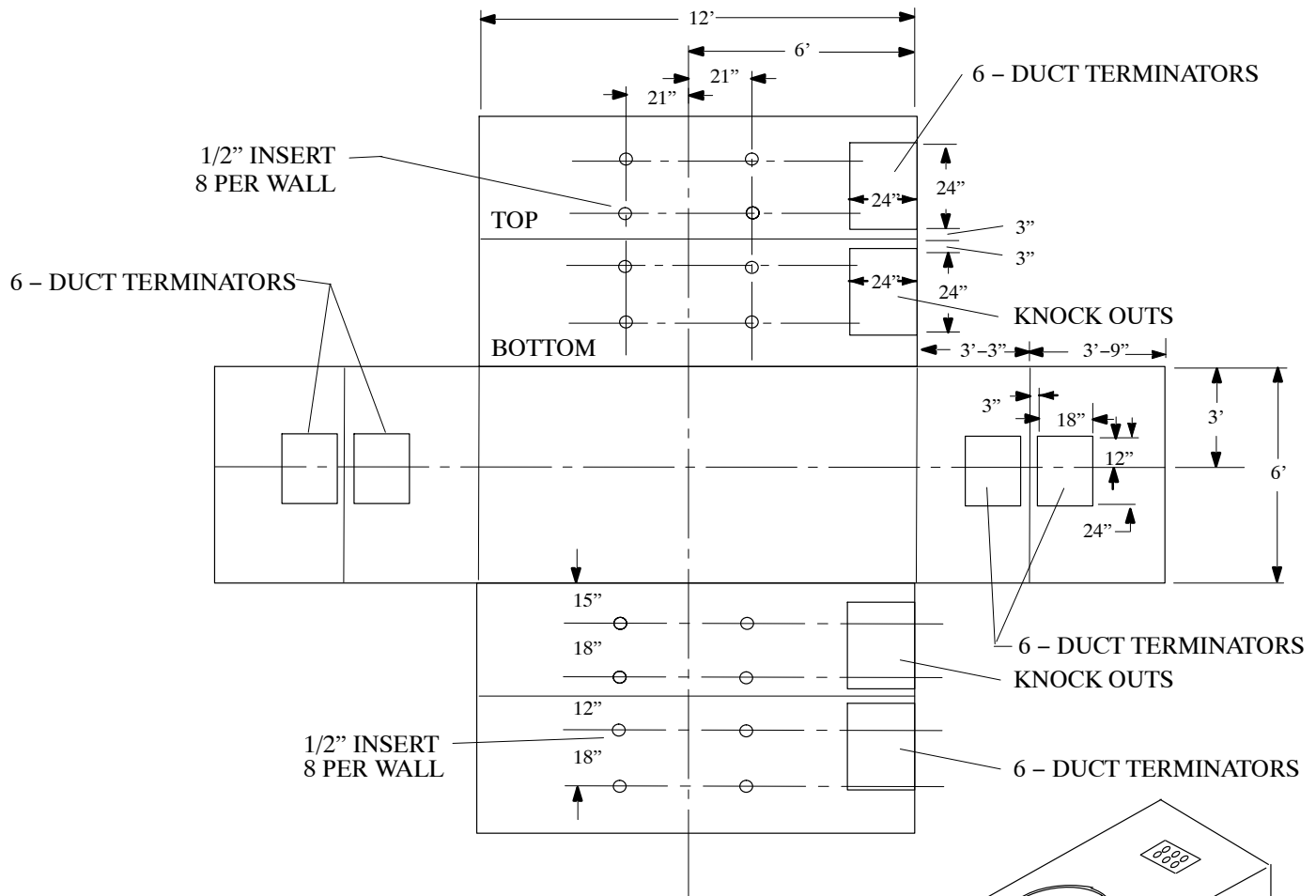
32" Round x 10" Deep 32 21 05 02

		Std. / Stk. No.	Description	01	02
	A	12 06 225	Manhole - Top, Precast Conc. (Type 38Y-J4 Roof A)	1	1
		12 06 226	Manhole - Bottom, Precast Conc. (Type 38Y-J4 Roof A)	1	1
	B	33 12 02 01	Manhole Frame and Cover - Shallow	1	
		33 12 02 02	Manhole Frame & Cover - Standard		1

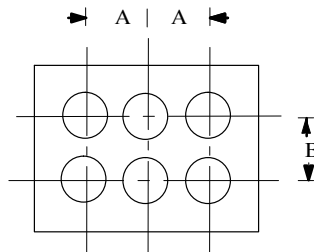
STRUCTURES-MANHOLES
 Straight-Precast
 6'-0" x 12'-0" (Type 38Y-J4 Roof D) (ILLINOIS)

32 21 06 **

Sheet 1 of 2

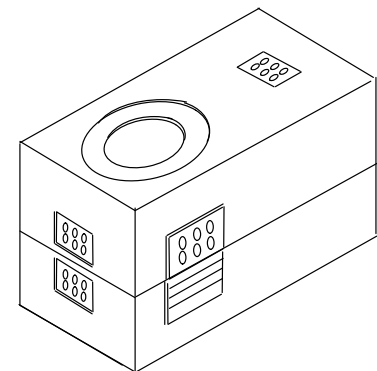


SECTION A-A



DIM	MAX	MIN
A	7 5/8"	6 5/8"
B	7 5/8"	6 5/8"

DUCT TERMINATORS
 (5" TYPE EB PVC CONDUIT)



WEIGHT
 14,800 Lb. MAX.
 EACH SECTION.
 TRAFFIC RATED DESIGN

STRUCTURES-MANHOLES
Straight-Precast
6'-0" x 12'-0" (Type 38Y-J4 Roof D) (ILLINOIS)

32 21 06 **

Sheet 2 of 2

NECK STYLE

32" Round x 5-5/8" Deep 32 21 06 01

32" Round x 10" Deep 32 21 06 02

		Std. / Stk. No.	Description	01	02
	A	12 06 227	Manhole - Top, Precast Conc. (Type 38Y - J4 Roof D)	1	1
		12 06 228	Manhole - Bottom, Precast Conc (Type 38Y-J4 Roof D)	1	1
	B	33 12 02 01	Manhole Frame and Cover - Shallow	1	
		33 12 02 02	Manhole Frame & Cover - Standard		1

STRUCTURES – MANHOLES

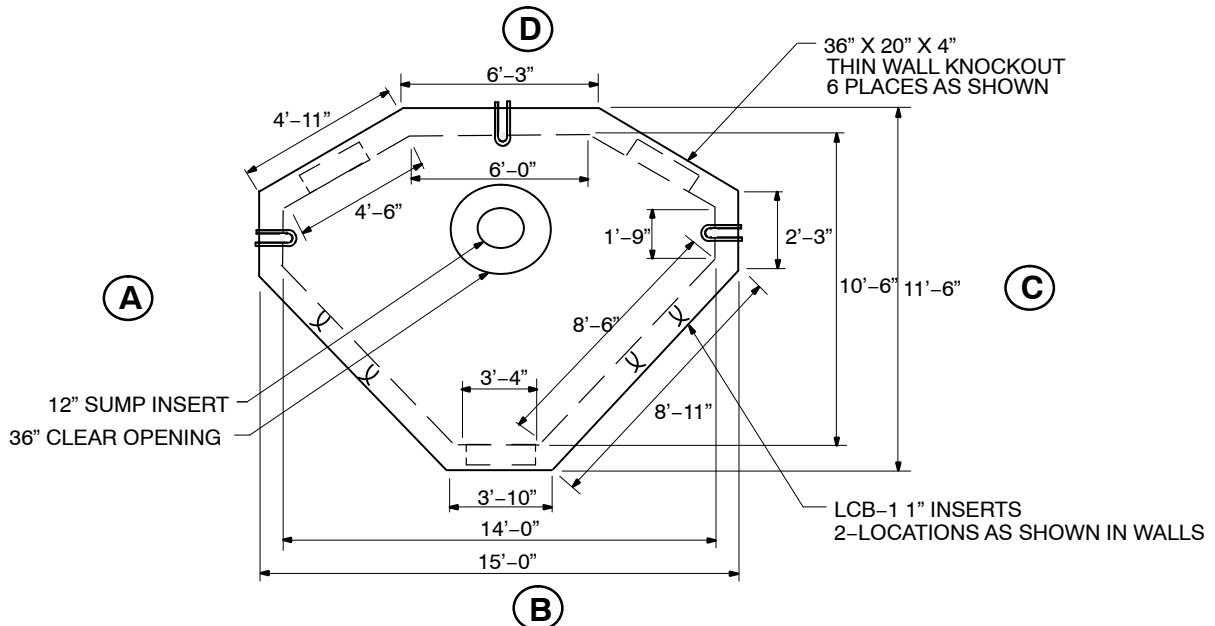
3 – Way – Precast

10'-6" x 14'-0" x 7'-0" ←

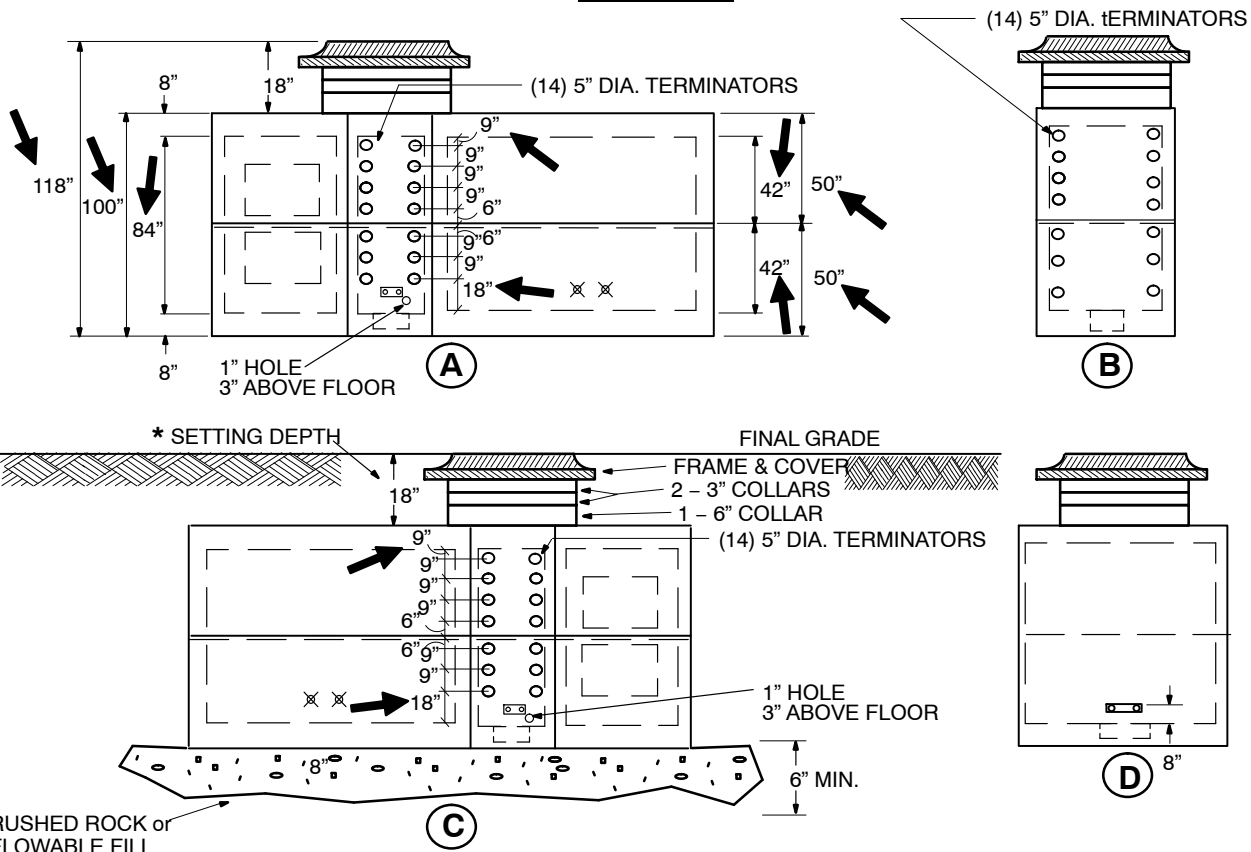
32 22 01 **

Sheet 1 of 2

TOP VIEW



SIDE VIEWS



COLLAR CONFIGURATION

PREFERRED – 1-6" & 2-3"
3" NECKS ARE REQUIRED ON ALL MANHOLES
AND SHALL BE TOP COLLARS

* SETTING DEPTHS

COORDINATE W/AMEREN REP.
PREFERRED – 18" (AS SHOWN)
MINIMUM – 12" TO FINAL GRADE
MAXIMUM – 60" TO FINAL GRADE

WEIGHTS

TOP SECTION 21,609 lbs.
BASE SECTION 22,305 lbs.
TOTAL 43,914 lbs.

TRAFFIC RATED DESIGN

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG:EJB
REV. NO: 9
REV. DATE: 04/23/14

NECK STYLE

36" Round – 32 22 01 01

36" Round x 5' Deep – 32 22 01 02

NOTE

1. 4.586 Cubic yards of dirt removed per foot of excavation.
2. Add the required number of 6" concrete (Stk. # 12 06 063) and 3" concrete (Stk. # 12 06 062) necks so that the frame and cover are at final grade.
3. Manholes are equipped with the cable mounting racks. Add the required number of cable mounting arms to suspend the installed cables.
4. Set the manhole at the "Preferred Depth" or contact company rep. if not achievable.

		Std. / Stk. No.	Description	32 22 01 **	01	02
@	A	12 06 237	Manhole – Top, Precast Conc.		1	1
		12 06 238	Manhole – Bottom, Precast Conc.		1	1
	B	98 00 006	Concrete – 2 Sack (c.y.)		14	14
	C	12 51 156	Coupling – Conduit, 5” Plastic (avg.)		26	26
	D	19 04 327	Grate – 14”		1	1
	E	33 11 ** **	Wingwall Bays		1	1
	F	33 12 01 01	Neck & Frame – 36” Rd.		1	
		33 12 01 02	Neck & Frame – 3’ x 5’ Deep			1
@		MEXC	Excavation (Mach.) (c.y.)		46	65
		MBF	Backfilling (Mach.) (c.y.)		12	28
		ATMP	Tamping (s.f.)		124	124
			Surface Removal (s.f.)		124	124
			Surface Replacement (s.f.)		124	124
		819	Loading Out (c.y.)		A/R	A/R
3	G	98 00 014	Crushed Rock (c.y.)		2	2
	H	12 53 017	Shield – Duct, 3” thru 6”		26	26
	I	12 56 113	Arm–Cable Mounting 14”		A/R	A/R
	J	12 56 112	Arm–Cable Mounting 18”		A/R	A/R
	K	12 56 114	Arm–Cable Mounting 7 1/2”		A/R	A/R
	L	12 06 062	Neck – Manhole, 36” ID x 52” OD x 3” Thick		A/R	A/R
	M	12 06 063	Neck – Manhole, 36” ID x 52” OD x 6” Thick		A/R	A/R

A/R =As Required

UNDERGROUND STRUCTURES

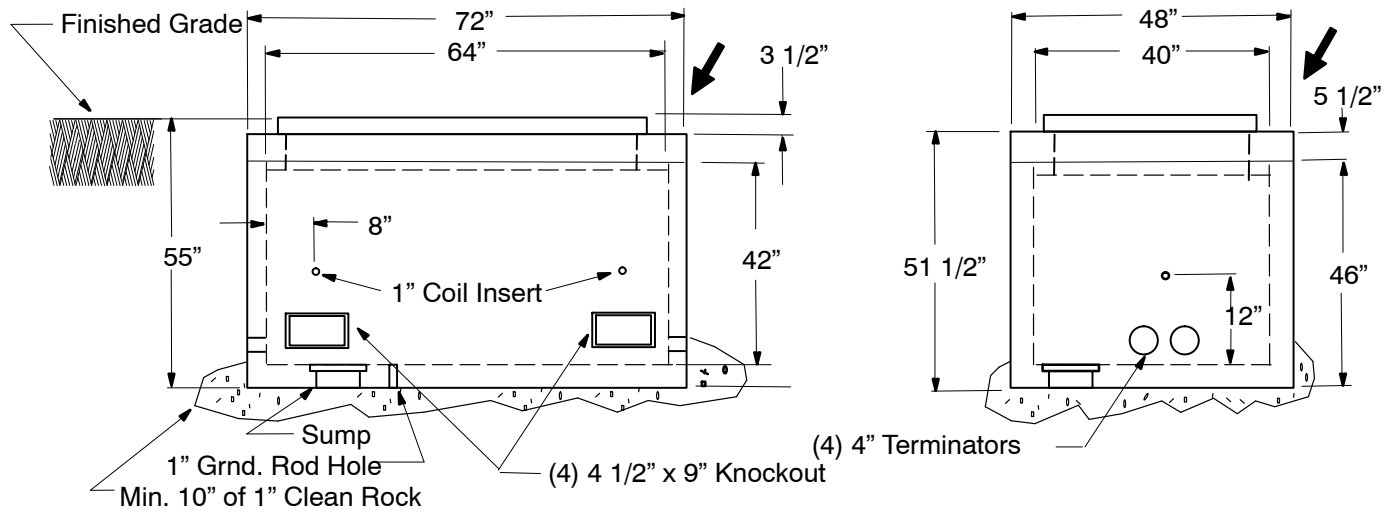
Vault – Precast 3' x 5' – 42" deep

For #2 & 4/0 Al, CNR, 15kV 2–4" PVC Couplings Each End

32 24 01 **

Sheet 1 of 1

****THIS VAULT DOES NOT HAVE A TRAFFIC RATING.****



Grade adjustments shall be made using the riser to meet the existing slope. The vault floor shall always be installed level.

1. Locate this vault out of the way of vehicular traffic.
2. Excavate a 5' x 7' pit to a depth necessary to obtain minimum cover for the conduits. Outside dimensions are L-72"; W-48"; H-55"; Riser 6" tall. NOTE: RISER MUST BE USED.
3. Fill with crushed rock leveling the rock and tamping to firm wherever the earth has been disturbed.
4. Use swivel plates mounted to the Richmond inserts with lag bolts that "Firmly" fasten the plate against the wall.
5. Place conduits into ducts or Knockouts as required. Grout or mortar around ducts entering thru Knockouts.
6. FILL & TAMP – Replace and stabilize the earth around the vault and riser tamping to compaction.
7. Brick and mortar between riser and keyway in manhole to accommodate the grade slope. Seal the cover frame to the riser with aquaseal. Install pulling eyes firmly into wall above conduits.
8. WEIGHTS: Vault = 4200 lbs, Riser = 665 lbs, Cover = 500 lbs.
9. Sod or resurface grade as necessary.
10. In Missouri residential developments, the contractor will install the vault and conduit. See Stds. 32 24 01 03 and 32 24 01 04.
11. Install 3" to 6" duct shields (12–53–017) as required.

	Std. / Stk. No.	Description	UNIT	LEVEL 01	SLOPED 02	LEVEL 03	SLOPED 04
	12 06 097	Vault – Precast 3' x 5'	Ea	1	1		
	12 02 100	Cover – Vault Galv. Stl. 42" x 66"	Ea	1	1		
	98 00 014	Rock – Crushed	Cy	1	1		
	23 59 076	Eye – Pulling	Ea	2	2	2	2
	MEXC	Mechanical Excavation	Cy	11	13		
	MBF	Mechanical Backfill	Cy	2	3		
	ATMP	Air Tamping	S.F.	32	40		
	25 54 053	Compound – Sealer Aqua	Rq'd	1	1		
	19 04 352	Grate – Sewer 10" Round		1	1	1	1
	2399	Install Conduit	MH/10	50	60		
@	701	Knockout – Conduit preparation	--	--	--		
@	849	Resurfacing	--	--	--		

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 10
REV. DATE: 01/12/16

UNDERGROUND STRUCTURES

Vault – Precast 4' x 8' – 4 Ft. deep

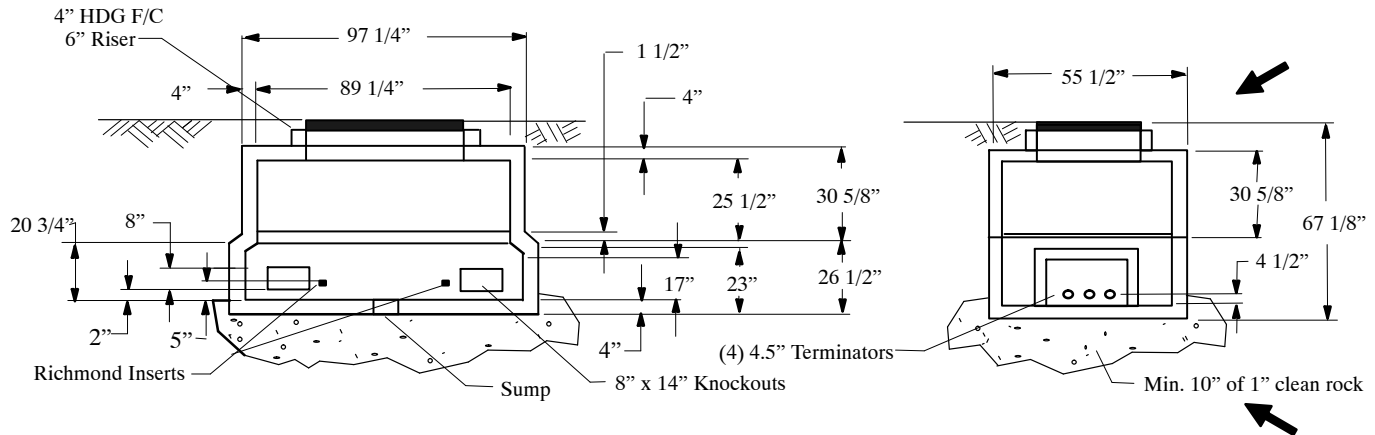
For 750 kcmil Al, Cu, 15kV 3–5" PVC Couplings Each End

32 24 02 **

Sheet 1 of 1

Grade adjustments shall be made using the riser to meet the existing slope. The vault floor shall always be installed level.

**** THIS VAULT DOES NOT HAVE A TRAFFIC RATING****



NOTES:

1. Locate this vault out of the way of vehicular traffic.
2. Excavate a 6' x 11' pit to a depth necessary to obtain minimum cover for the conduits. Outside vault dimensions: L-8'10"; W-5'6"; H-5'-10"; Riser 6" tall. NOTE: RISER MUST BE USED.
3. Fill any overdig with crushed rock leveling the rock and tamping to firm wherever the earth has been disturbed.
4. Use swivel plates mounted to the Richmond inserts with lag bolts that "Firmly" fasten the plate against the wall.
5. Place conduits into ducts or Knockouts as required. Grout or mortar around ducts entering thru Knockouts.
6. FILL & TAMP – Replace and stabilize the earth around the vault and riser tamping to compaction.
7. Brick and mortar between riser and keyway in manhole to accommodate the grade slope. Seal the cover frame to the riser with aquaseal. Install pulling eyes firmly into wall above conduits.
8. WEIGHTS: Bottom = 4560 lbs., Top = 4420 lbs., Riser = 365 lbs., Cover = 500 lbs.
9. Sod or resurface grade as necessary.
10. In Missouri residential developments, the contractor will install the vault and conduits. See Stds. 32 24 02 03 and 32 24 02 04.
11. install 3" to 6" duct shields (12-53-017) as required.

Std./Stk. No.	Description	UNIT	LEVEL 01	SLOPED 02	LEVEL 03	SLOPED 04
12 06 096	Vault – Precast 4' x 8'	Ea	1	1		
12 06 192	Riser – Neck 6" Extension	Ea	1	1		
12 02 100	Cover – Vault Galv. Stl. 42" x 66"	Ea	1	1		
98 00 014	Rock – Crushed	Cy	2	2		
23 59 076	Eye – Pulling	Ea	2	2	2	2
MEXC	Mechanical Excavation	Cy	20	23		
MBF	Mechanical Backfill	S.F.	4	6		
ATMP	Air Tamping	MH/10	50	60		
19 04 352	Grate – Cast iron 10" x 3/4	Ea	1	1	1	1
25 54 053	Comp'd – Sealer Aqua	Req'd.	1	1		
2399	Install Conduit	Ea	50	60		
@ 701	Knockout – Conduit preparation	--	--	--		
@ 849	Resurfacing	--	--	--		

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG:DDG
REV. NO: 9
REV. DATE: 1/26/11

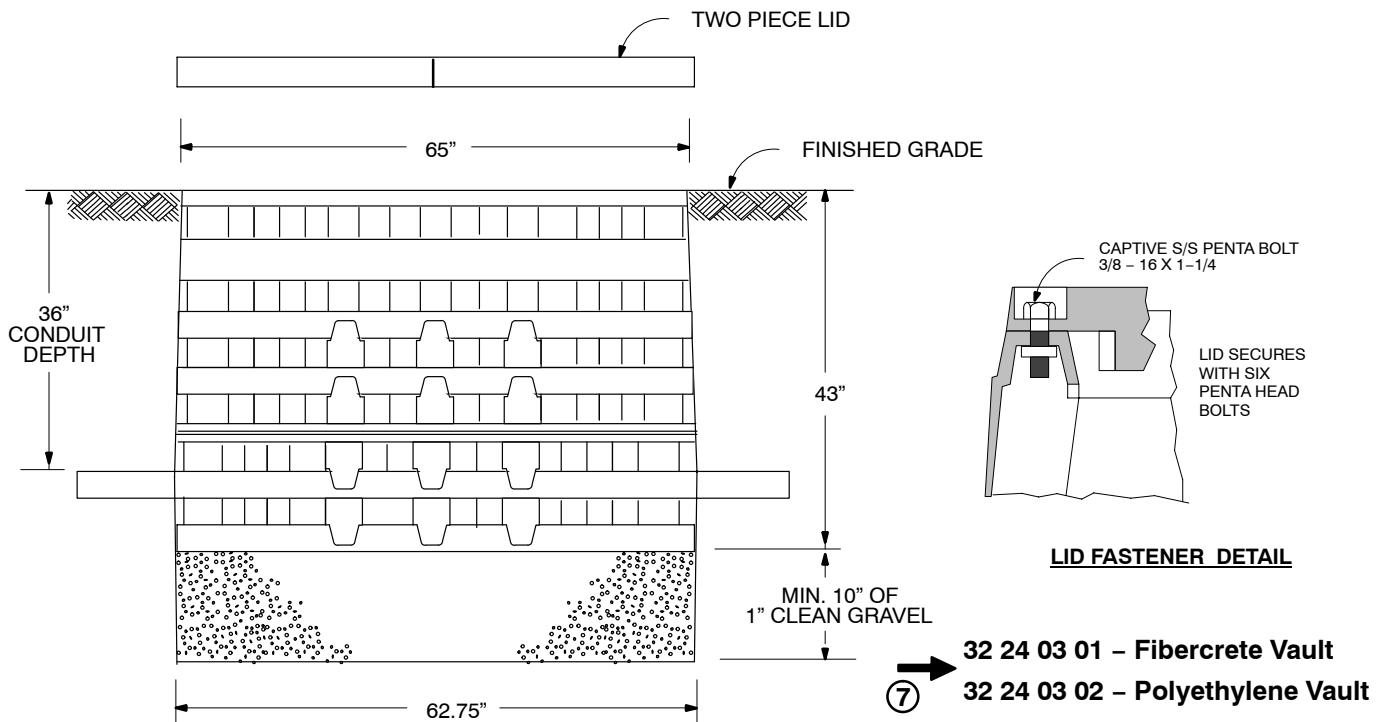
UNDERGROUND STRUCTURES

Vault – Polyethylene/Fibercrete 3' x 5' – 42"
For #2 & 4/0 Al, CNR, 15 kV 2 – 4" Couplings Each End

32 24 03 **

Sheet 1 of 1

**** THIS VAULT DOES NOT HAVE A TRAFFIC RATING ****



Instructions :

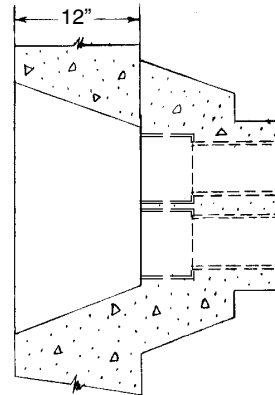
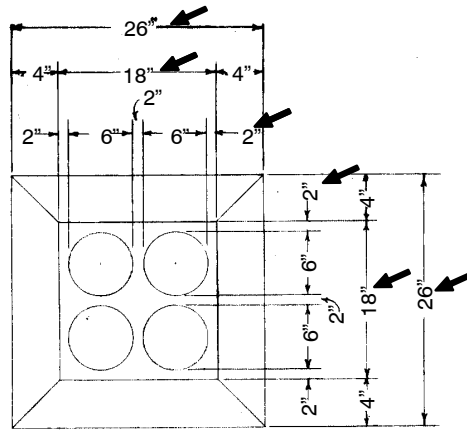
1. Locate this vault out of the way of vehicular traffic.
2. Excavate and install vault at standard conduit depths on 10" base of 1" gravel.
3. Fill any overdig with crushed rock levelling the rock and tamping firm.
4. Install conduits in couplings or drill holes in desired conduit locations.
5. FILL & TAMP – Replace and stabilize the earth around the vault tamping to compaction.
6. Sod or resurface grade as necessary.
7. Only use Polyethylene vault when Fibercrete vault is too heavy to transport – such as on private property.
8. Install 3" to 6" duct shields (12-53-017) as required.

Std. / Stk. No.	Description	32 24 03 **	Unit	01	02	Weight
12 06 122	Vault – 3' x 5' – Fibercrete		Ea.	1		1136 lbs.
12 06 259	Vault – 3' x 5' – Polyethylene		Ea.		1	420 lbs.
98 0014	Rock – Crushed		Cy	1	1	
MEXC	Mechanical Excavation		Cy	11	11	
MBF	Mechanical Backfill		Cy	2	2	
ATMP	Air Tamping		S.F.	32	32	
19 04 352	Grate – Sewer 10" Round		Ea.	1	1	
2399	Install Conduit		MH/10	50	50	
@ 701	Drill Hole in Vault		–	–	–	
@ 849	Resurfacing		–	–	–	

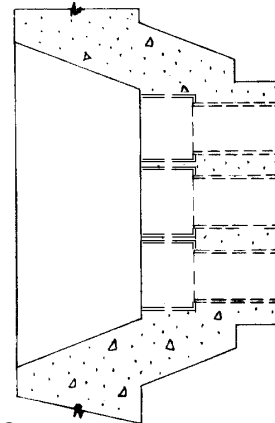
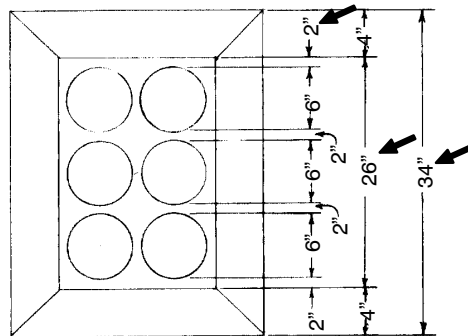
**DISTRIBUTION
CONSTRUCTION STANDARDS**



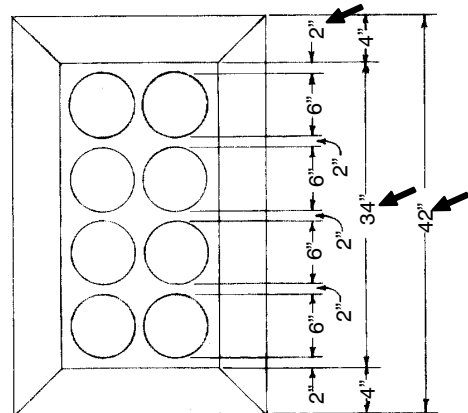
ENG:JMW
REV. NO: 4
REV. DATE: 06/26/2018



33 11 01 01
4 DUCT RECESS



33 11 01 02
6 DUCT RECESS



33 11 01 03
8 DUCT RECESS

Two or more ducts may be omitted if not required.

STRUCTURES – ACCESSORIES

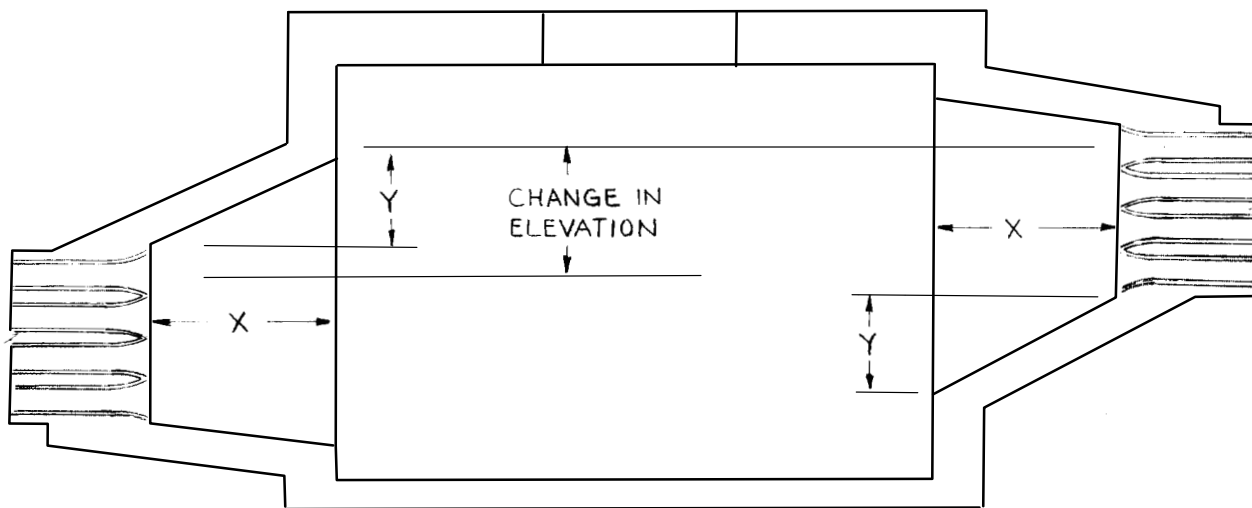
12" Recess Construction

33 11 01 **

Sheet 2 of 2

33 11 01 01 4 Duct Recess
 33 11 01 02 6 Duct Recess
 33 11 01 03 8 Duct Recess

		Std. / Stk. No.	Description	33 11 01 **	01	02	03
	A	98 00 005	Concrete – M.H. (c.y.)		1	1	1
	B	12 51 156	Coupling – 5", PVC		4	6	8
		MEXC	Excavation (Mach.) (c.y.)		3	3	3
		WFOR	Installing and Removing Forms (S.F.)		11	13	14
		MBF	Backfilling (Mach.) (c.y.)		1	1	1
		ATMP	Tamping (s.f.)		7	7	8
@			Surface Removal (s.f.)		7	7	8
@			Surface Replacement (s.f.)		7	7	8



Difference In Elevation (Ft.)	Dimension "X"	Dimension "Y"	Standard No.
3 to 4	24"	12"	33 11 02 01
4 to 5	30"	24"	33 11 02 02

NOTES:

- 6'-0" x 17'-6" manholes do not require end-wall bays or recesses.
- 12" recesses are adequate for changes in duct elevation up to 3 ft.
- Bay mouth width shall be 30 inches.
- When horizontal angle of conduit entering end-wall bay exceeds 15° from long axis of manhole, build bay 30" deep regardless of change in elevation (except 6'-0" x 17'-6" manholes).

	Std. / Stk. No.	Description	33 11 02 **	01	02
→	A 98 00 005	Concrete – M.H. (c.y.)		1	1
	MEXC	Excavation (Mach.) (c.y.)		4	5
	WFOR	Installing and Removing Forms (S.F.)		20	25
	MBF	Backfilling (Mach.) (c.y.)		1	1
→	ATMP	Air Tamping (s.f.)		12	14
@		Surface Removal (s.f.)		12	14
@		Surface Replacement (s.f.)		12	14

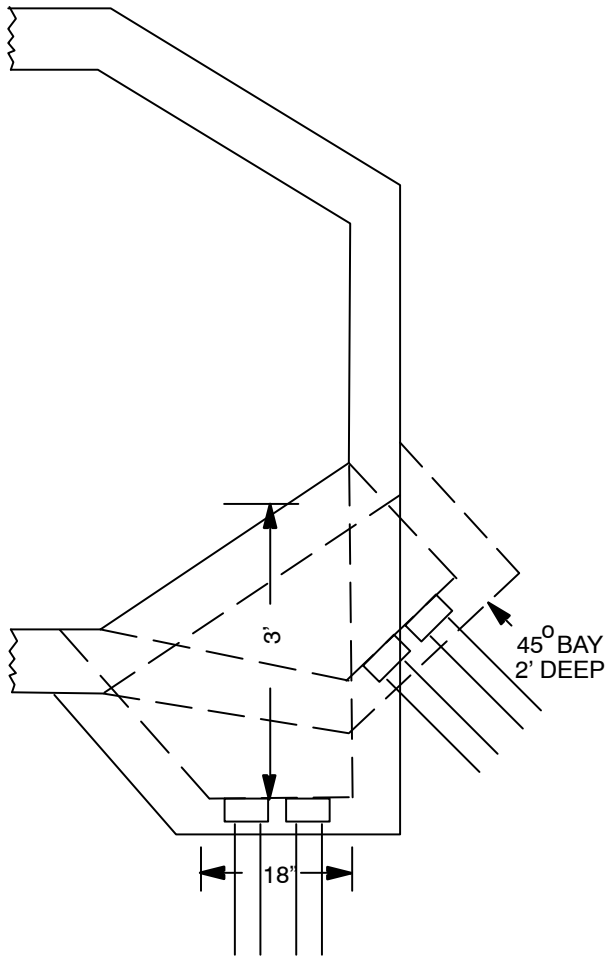
STRUCTURES – ACCESSORIES

Standard Bay Construction

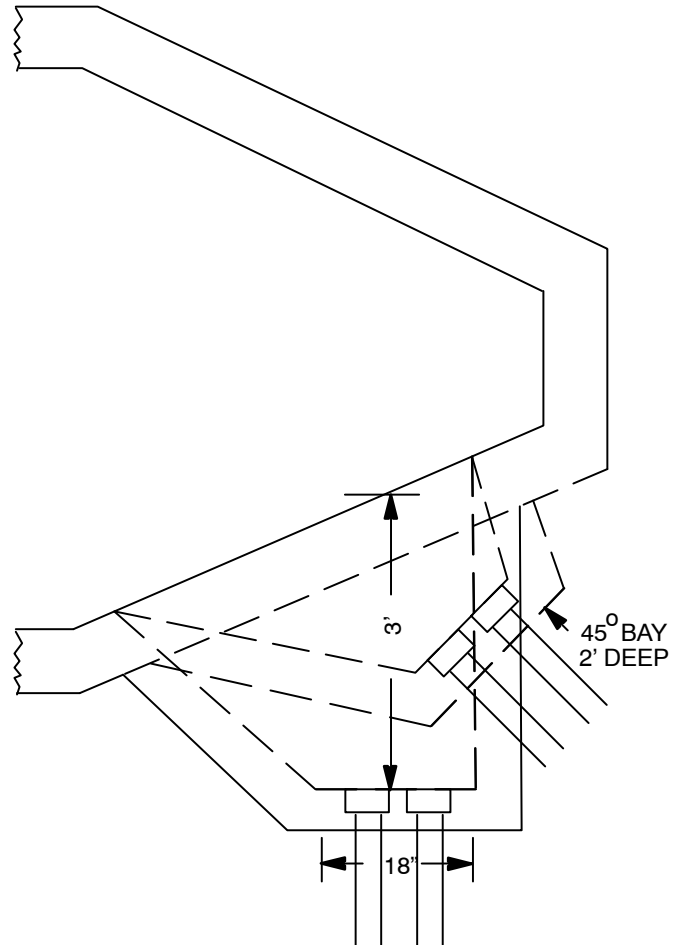
Wing Wall

33 11 03 **

Sheet 1 of 1



➔ 45° – 90° WINGWALL BAY FOR
10'–0" & 14'–0" LONG MANHOLES
33 11 03 01



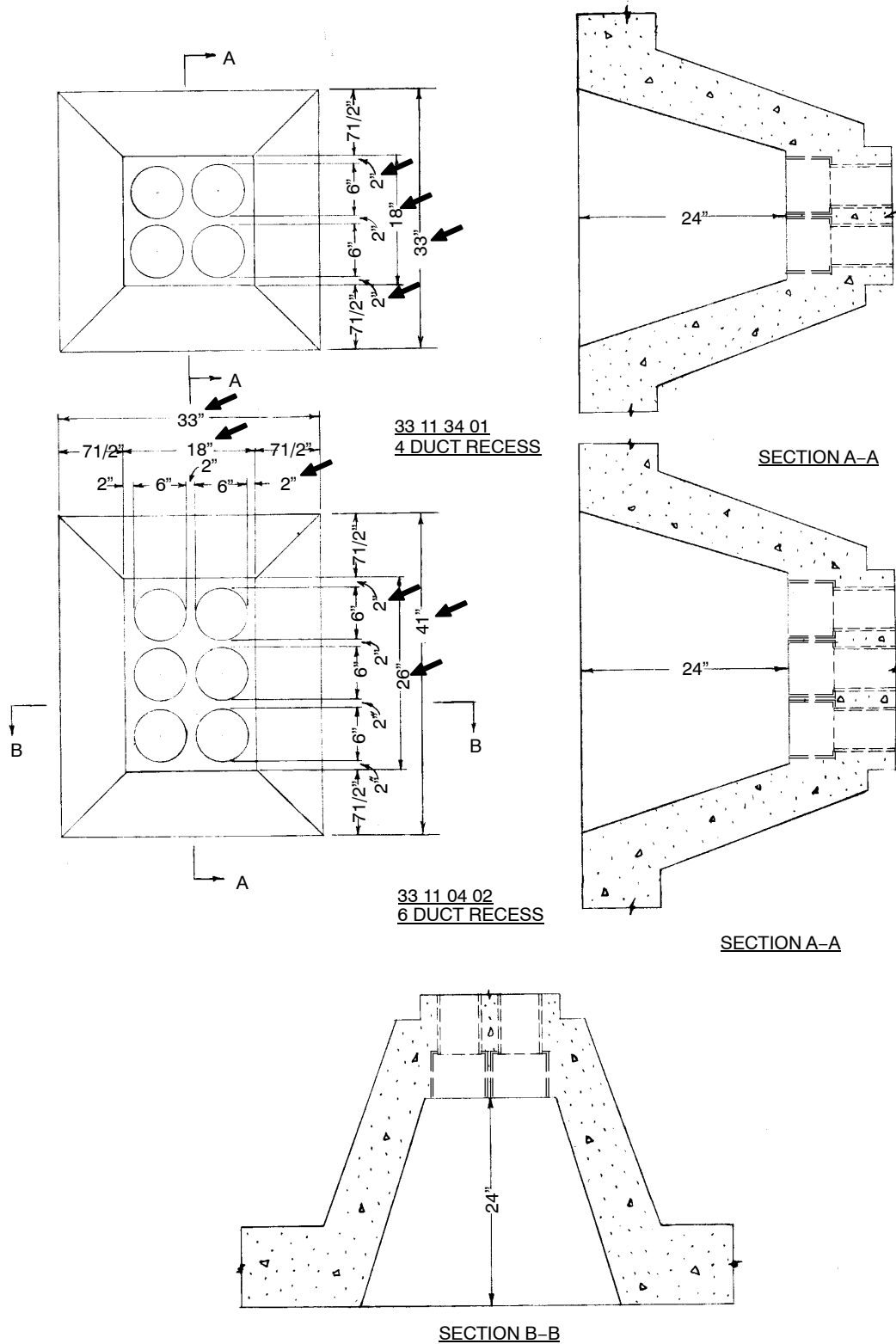
45° – 90° WINGWALL BAY FOR
17'–6" LONG MANHOLES
33 11 03 02

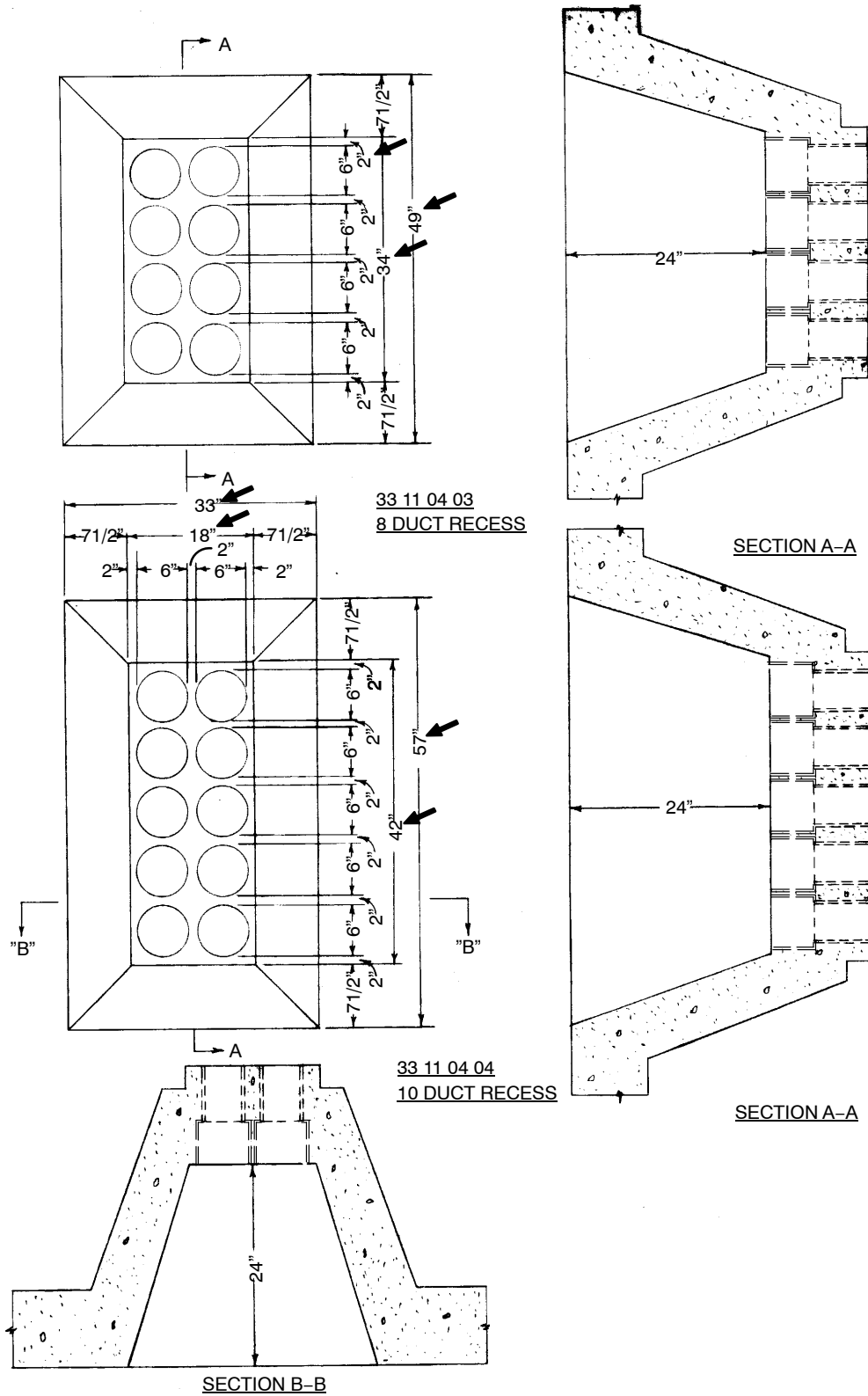
		Std. / Stk. No.	Description	33 11 03 **	01	02
@ @	A	98 00 005	Concrete – M.H. (c.y.)		1	1
		MEXC	Excavation (Mach.) (c.y.)		8	8
		WFOR	Installing and Removing Forms (S.F.)		43	43
		MBF	Backfilling (Mach.) (c.y.)		1	1
		ATMP	Tamping (s.f.)		22	22
			Surface Removal (s.f.)		22	22
			Surface Replacement (s.f.)		22	22

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DDG
REV. NO: 4
REV. DATE: 1/3/03
REAFFIRMED DATE: 3/16/09





STRUCTURES – ACCESSORIES

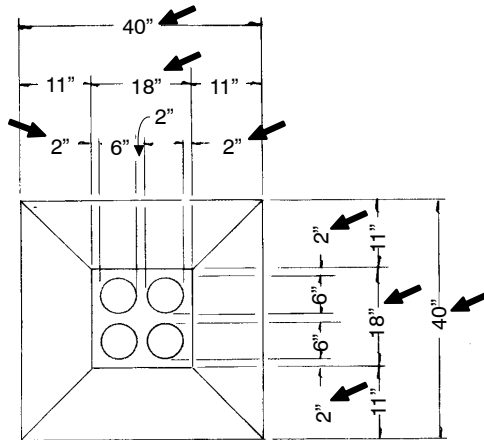
24" Recess Construction

33 11 04 **

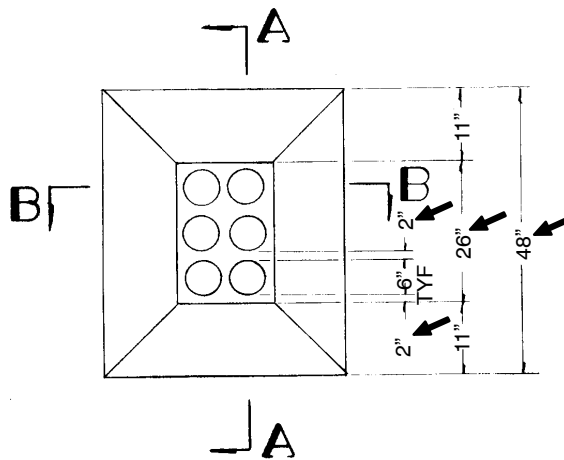
Sheet 3 of 3

33 11 04 01	4 Duct Recess
33 11 04 02	6 Duct Recess
33 11 04 03	8 Duct Recess
33 11 04 04	10 Duct Recess

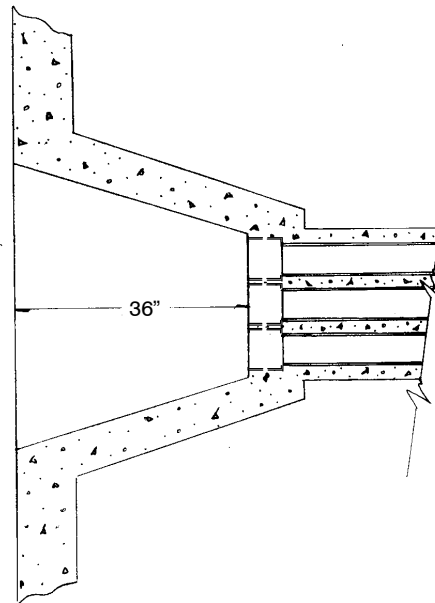
		Std. / Stk. No.	Description	33 11 04 **	01	02	03	04
	A	98 00 005	Concrete – M.H. (c.y.)		1	1	2	2
	B	12 51 156	Coupling – 5", PVC		4	6	8	10
		MEXC	Excavation (Mach.) (c.y.)		4	4	4	14
		WFOR	Installing and Removing Forms (S.F.)		20	23	26	29
		MBF	Backfilling (c.y.)		1	1	1	1
		ATMP	Tamping (s.f.)		12	12	12	12
@			Surface Removal (s.f.)		12	12	12	12
@			Surface Replacement (s.f.)		12	12	12	12
@			Demolition (s.f.)		7	8	10	11



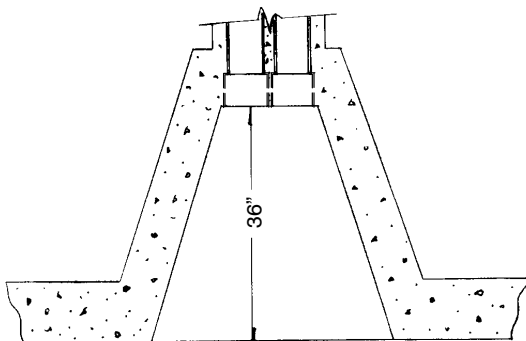
33 11 05 01
4 DUCT BAY



33 11 05 02
6 DUCT BAY



TYPICAL SECTION A-A
(3 DUCT HIGH SHOWN)

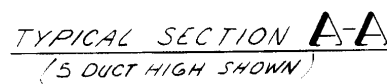
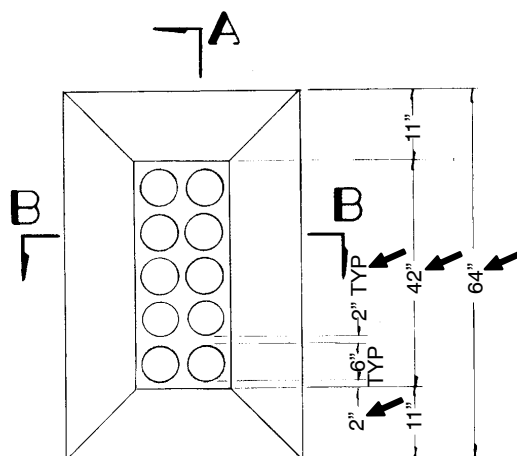


TYPICAL SECTION B-B

STRUCTURES – ACCESSORIES

33 11 05 **

Sheet 2 of 3



DISTRIBUTION CONSTRUCTION STANDARDS



ENG: DDG
REV. NO: 3
REV. DATE: 1/16/03
REAFFIRMED DATE: 3/16/09

STRUCTURES – ACCESSORIES

36" Bay Construction

33 11 05 **

Sheet 3 of 3

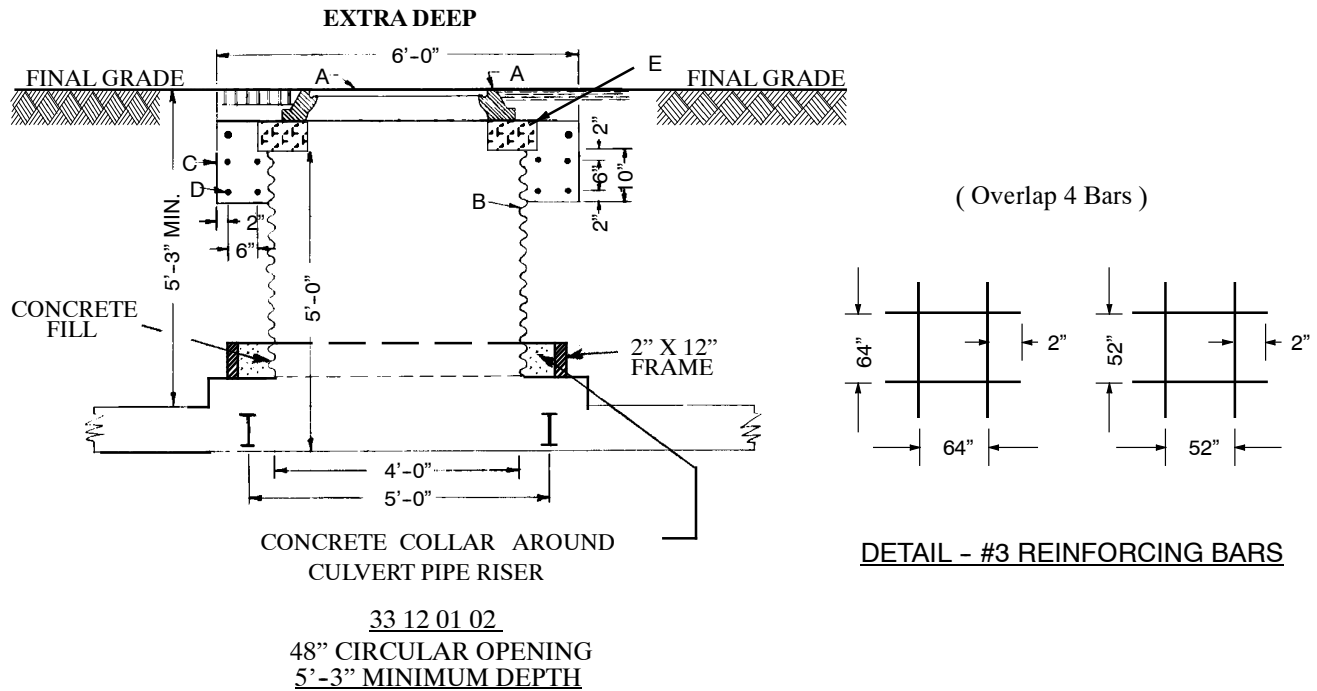
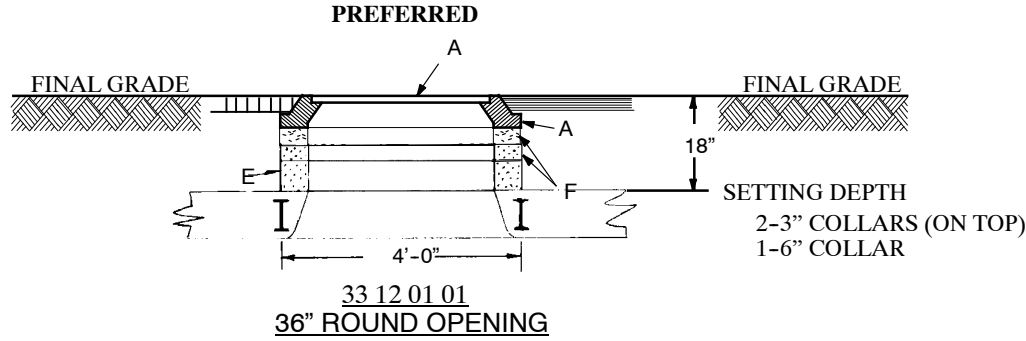
33 11 05 01	4 Duct Bay
33 11 05 02	6 Duct Bay
33 11 05 03	8 Duct Bay
33 11 05 04	10 Duct Bay

	Std. / Stk. No.	Description	33 11 05 **	01	02	03	04
	A	98 00 005	Concrete – M.H. (c.y.)	2	2	3	3
	B	12 51 156	Coupling – 5", PVC	4	6	8	10
		MEXC	Excavation (Mach.) (c.y.)	5	5	5	5
		WFOR	Installing and Removing Forms	36	39	42	45
		MBF	Backfilling (c.y.)	2	2	2	2
		ATMP	Tamping (s.f.)	18	18	18	18
@			Surface Removal (s.f.)	18	18	18	18
@			Surface Replacement (s.f.)	18	18	18	18
@			Demolition (s.f.)	8	10	11	12

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: DDG
REV. NO: 3
REV. DATE: 1/16/03
REAFFIRMED DATE: 3/16/09



		Std. / Stk. No.	Description	33 12 01 **	Req'd	
					01	02
	A	12 02 085	Frame and Cover		1	1
	B	12 02 076	Pipe, Culvert - 48" x 5'-0"			1
**@		12 02 077	Pipe, Culvert - 48" x 4'-0"			
	C	98 00 005	Concrete, 4000 PSI Cu Yrds			1
*	D	27 02 062	Bar, Reinforcing, #3 16 Ft.			6
	E	12 06 063	Neck - Section, 6" Thk. Conc		1	1
	F	12 06 062	Neck - Section, 3" Thk. Conc		2	

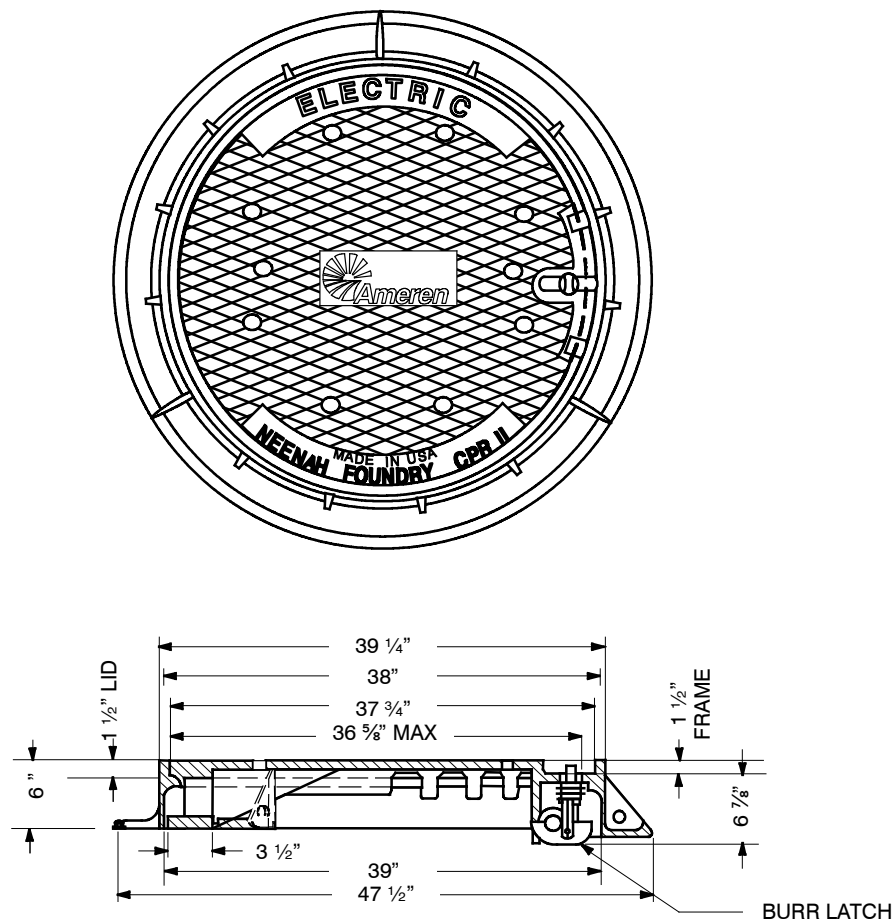
* See Detail

** 4' Length is available

NOTE: Manhole frame extension rings are used to raise the lid.

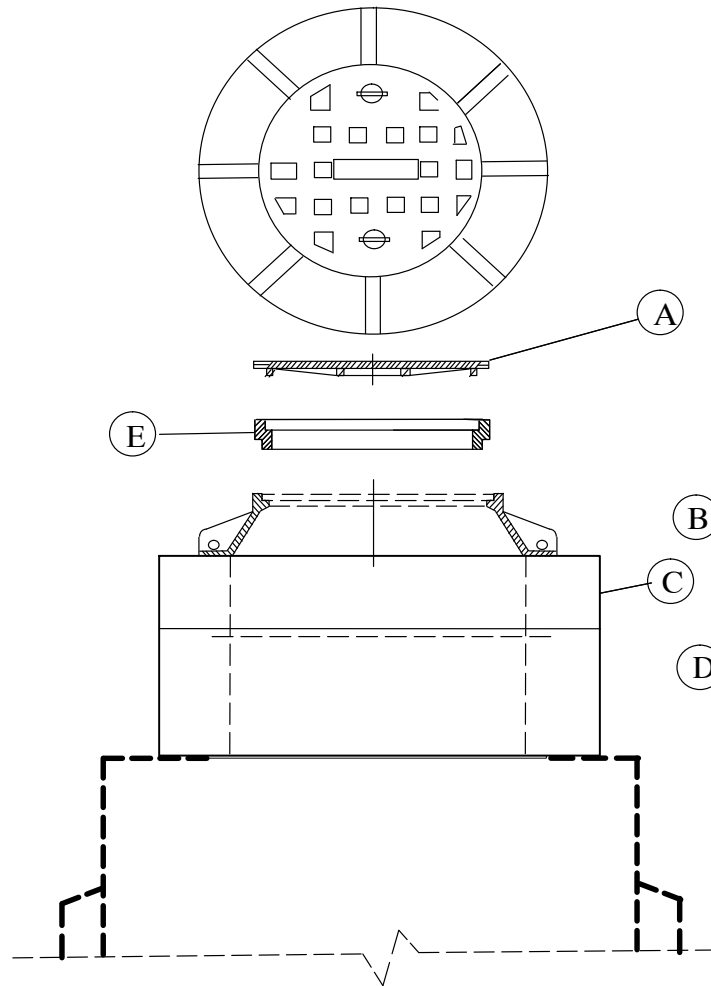
Stk.# 12 52 003 = 1.75" rise and Stk. # 12 52 004 = 2.25" rise.

SwiveLoc Type

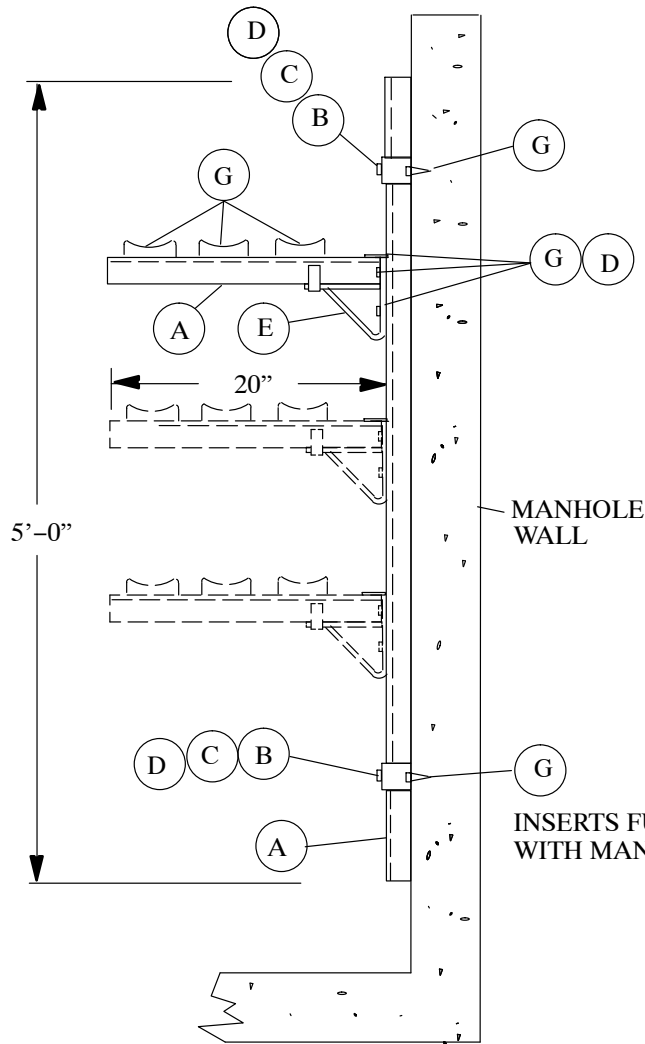


		Dist. Stnd./ Stk. No.	Description	33 12 01 **	03	04
	A	12 02 108	Frame and Cover - Explosion Mitigation Type		1	1
++@	B	12 02 076	Pipe, Culvert - 48" x 5' -0"			1
		12 02 077	Pipe, Culvert - 48" x 4' -0"			
	C	98 00 005	Concrete, 4000 PSI Cu Yards			1
*	D	27 02 062	Bar Reinforcing, #3 16 ft			6
	E	12 06 063	Neck - Section, 6" Thick Concrete		1	1
	F	12 06 062	Neck - Section, 3" Thick Concrete		2	
@	G	12 02 107	Cover Only - Explosion Mitigation Type		-	-

*See Detail (Sheet 1)

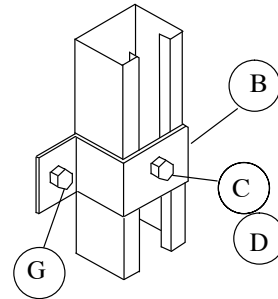


	Std. / Stk. No.	Description	01	02	03	04	05	06
A	12 02 088	Cover – Manhole, Electric	1	1				
B	12 06 143	Ring – Manhole, Shallow (H = 5-5/8")	1					
	12 06 144	Ring – Manhole, Standard (H = 10")		1				
C	12 56 085	Collar – Precast Concrete, 6"			1			
D	12 56 086	Collar – Precast Concrete, 12"				1		
E	12 52 089	Ring – Manhole Adjusting, 2"					1	
	12 52 091	Ring – Manhole Adjusting, 3"						1



- 33 20 01 01 – Cable Rack – 1 Circuit
- 33 20 01 02 – Cable Rack – 2 Circuits
- 33 20 01 03 – Cable Rack – 3 Circuits
- 33 20 01 04 – Cable Rack – Add'l Circuit

INSERTS FURNISHED
WITH MANHOLE

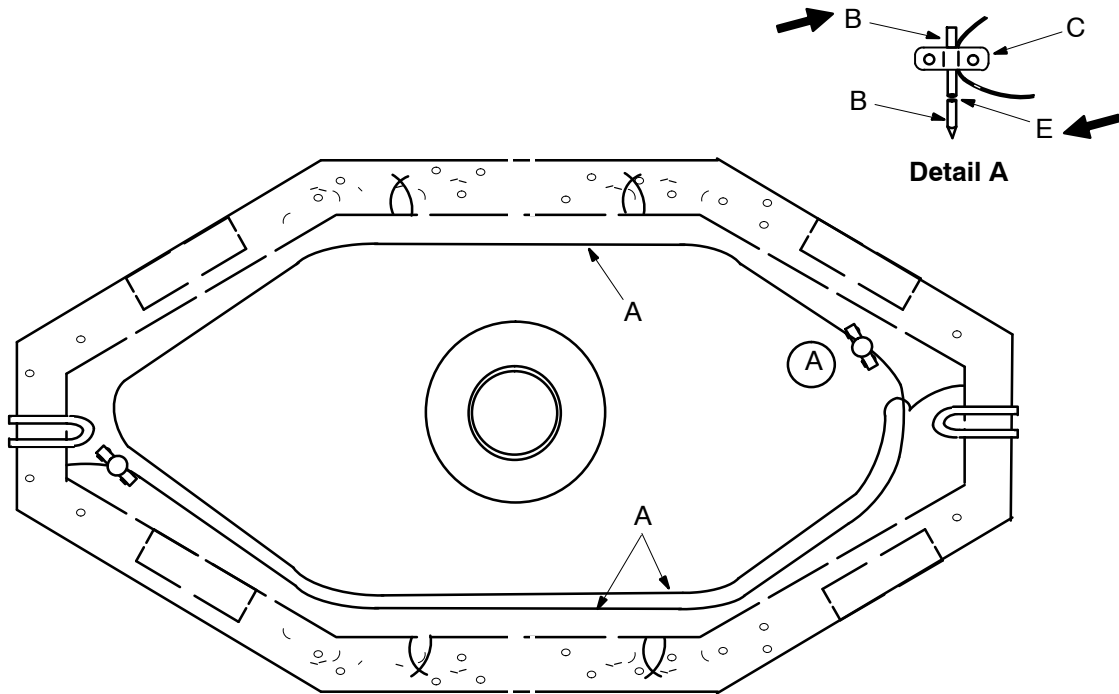


	Std. / Stk. No.	Description	01	02	03	04
A	40 79 781	Channel – Single, Galv, 1-5/8" x 1-5/8" x 10', (Ft.)	7	9	10	2
B	40 79 764	Support – Zee, Unistrut	2	2	2	
C	23 52 436	Screw – Cap, 1/2" x 1" Hex	2	2	2	
D	40 09 231	Nut – Channel, 1/2"	5	8	11	3
E	40 79 759	Brace – Bracket, Unistrut	1	2	3	1
F	40 79 761	Insulator – Cable Rack	3	6	9	3
G	40 79 763	Screw – Cap, 1/2" x 1-1/2" Hex	5	8	11	3

STRUCTURES-MANHOLES
STRAIGHT PRECAST
Grounding System

33 20 02 **

Sheet 1 of 1



		Std. / Stk. No.	Description	33 20 02 **	01	02	03
3	A	18 52 024	Wire-4/0 AWG, Copper, Bare, Soft Drawn		43	54	65
	B	23 63 143	Rod-Ground, 5/8" x 4'		4	4	4
	C	17 54 132	Connector-Wire, 8-350 kcmil, CU		2	2	2
2	D	12 56 123	Hook - Plastic, 2 1/2" Diameter, Bond Wire Support		10	10	10
5	E	23 13 070	Coupling-CU Alloy, 5/8", Threaded		2	2	2
			Operation Code 308		1	1	1

NOTES:

1. All splice ground and drain wires are connected to the grounding system using a two bolt connector.
2. The Bond Wire is to be fastened 6 inches above the manhole floor using plastic hooks (D) attached to the cable mounting brackets.
3. If the manhole is the first one in the substation do not drive the ground rods. Connect the end of the bond wire at two points to the substation ground grid.
4. When making grounding attachments to the bond wire, clean the bond wire at the attachment point.
5. Join two ground rods together with a coupling.

33 20 02 01

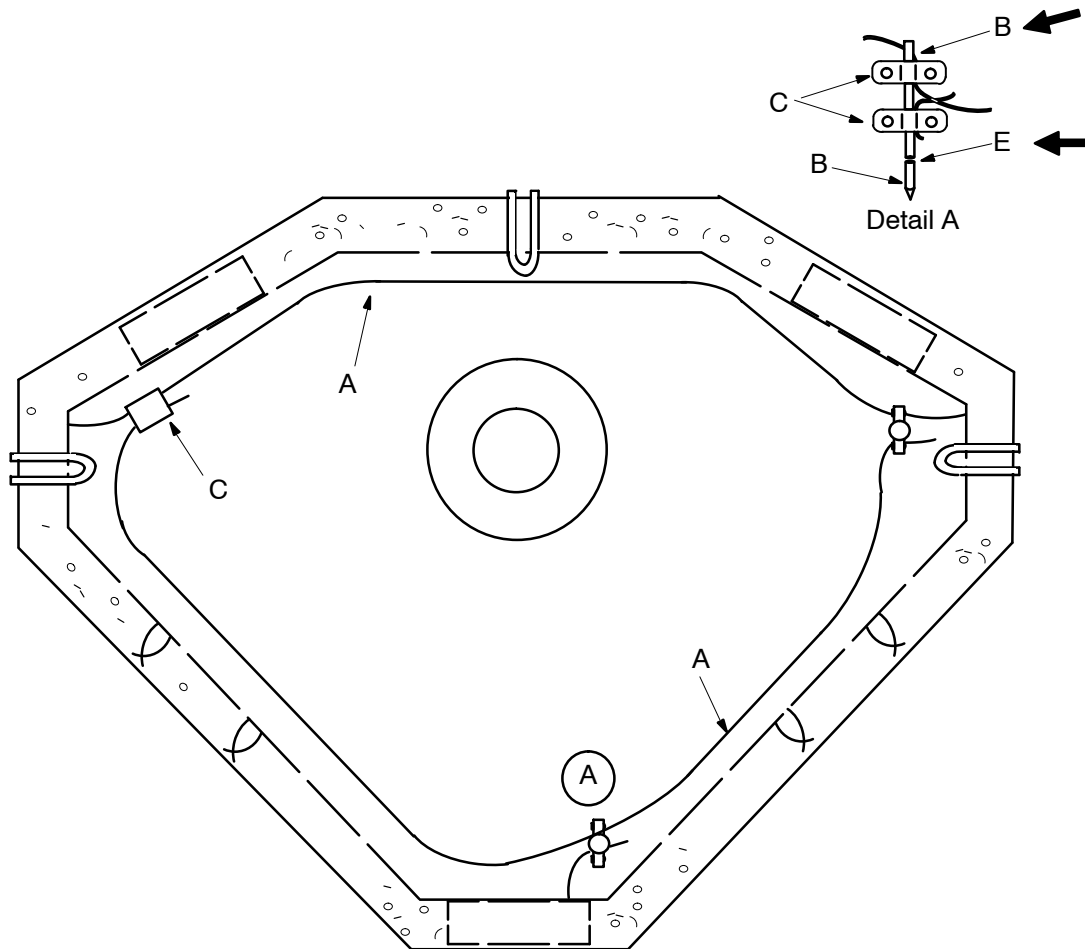
4' x10' Manhole

33 20 02 02

6' x 14' Manhole

33 20 02 03

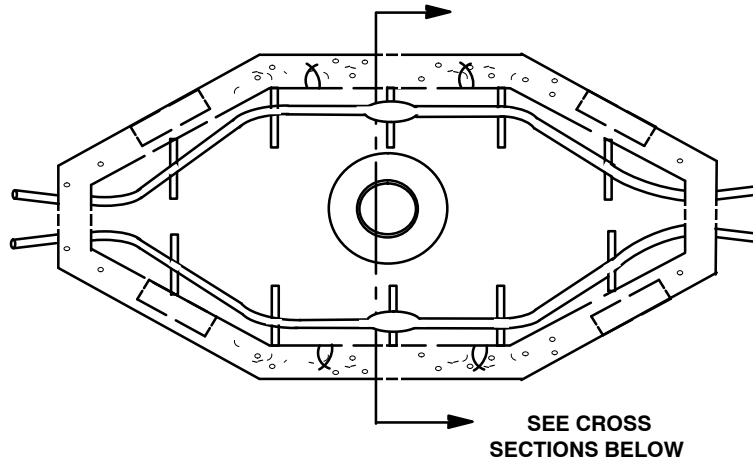
6' x 17" Manhole



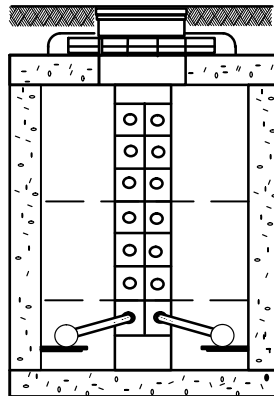
		Std. / Stk. No.	Description	33 20 03 01	
3	A	18 52 024	Wire-4/0 AWG, Copper, Bare, Soft Drawn		50
	B	23 63 143	Rod-Ground, 5/8" x 4'		4
	C	17 54 132	Connector-Wire, 8-350 kcmil, CU		5
2	D	12 56 123	Hook - Plastic, 2 1/2" Diameter, Bond Wire Support		8
5	E	23 13 070	Coupling - CU Alloy, 5/8", Threaded		2
			Operation Code 308		1

NOTES:

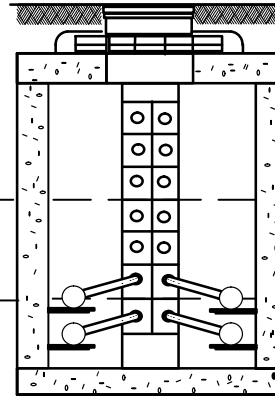
1. All splice ground and drain wires are connected to the grounding system using a two bolt connector.
2. The Bond Wire is to be fastened 6 inches above the manhole floor using plastic hooks (D) attached to the cable mounting brackets.
3. If the manhole is the first one in the substation do not drive the ground rods. Connect the end of the bond wire at two points to the substation ground grid.
4. When making grounding attachments to the bond wire, clean the bond wire at the attachment point.
5. Join two ground rods together with a coupling.



TWO DUCTS



FOUR DUCTS

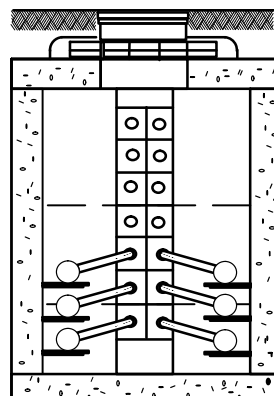


600 V Network Operating
Cable Zone
(If Necessary)

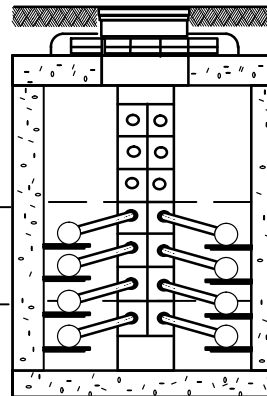
4-15 kV Operating
Cable Zone

34 kV Operating
Cable Zone
(If Necessary)

SIX DUCTS



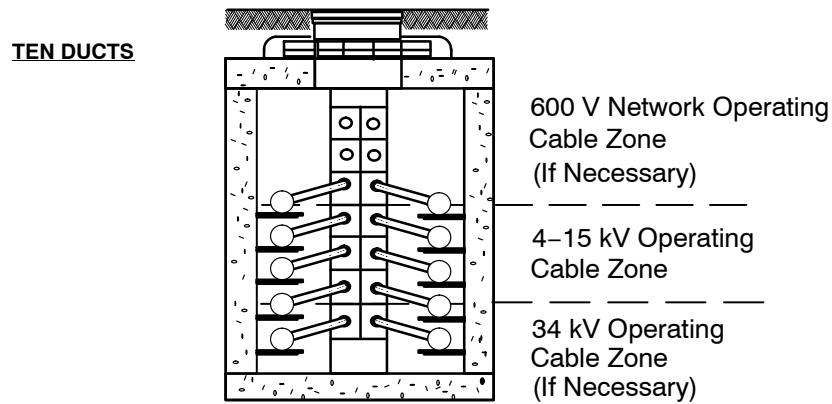
EIGHT DUCTS



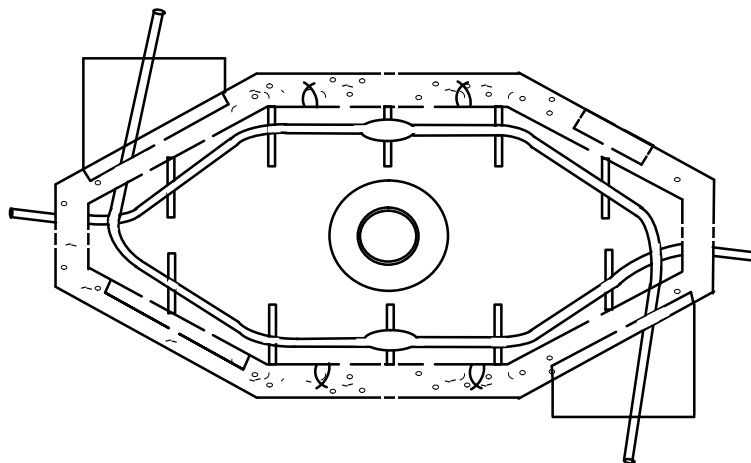
600 V Network Operating
Cable Zone
(If Necessary)

4-15 kV Operating
Cable Zone

34 kV Operating
Cable Zone
(If Necessary)

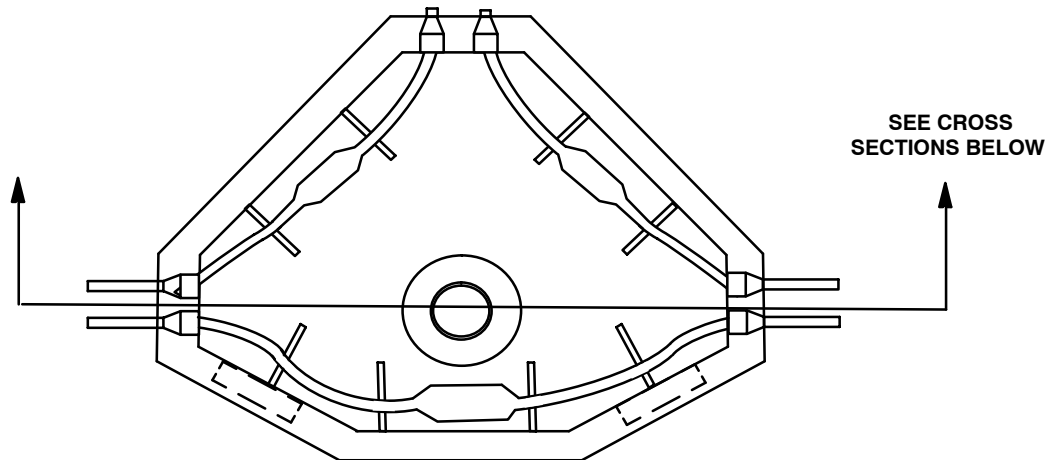


**CABLE TRAINING IN MANHOLE
WITH WINGWALL**

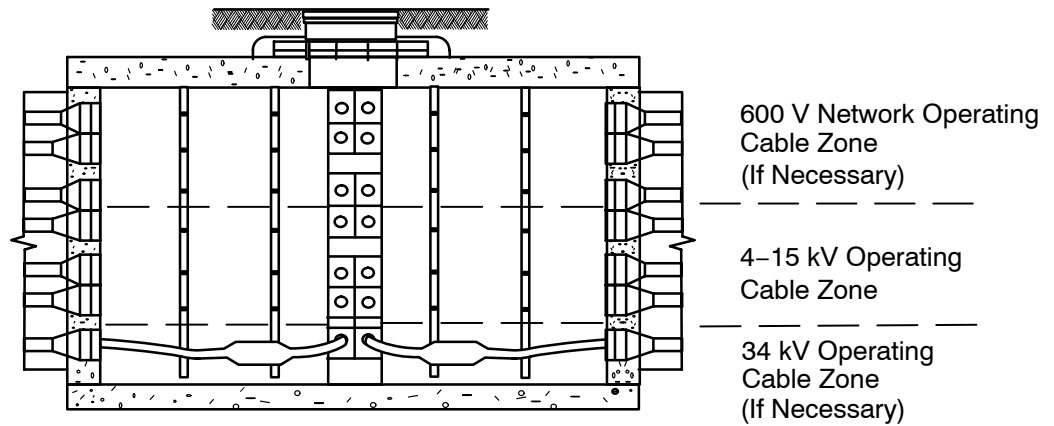


NOTES:

1. Cable and splice positions reflect either one conductor PILC cable and joint or three single conductor cables and three splices.
2. The maximum number of ducts occupied by energized power cables shall be ten.

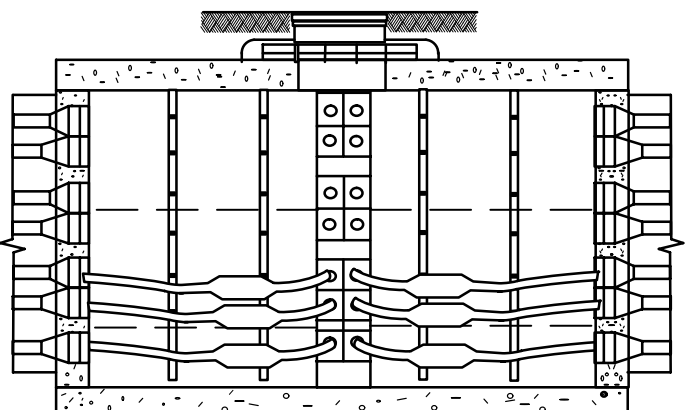
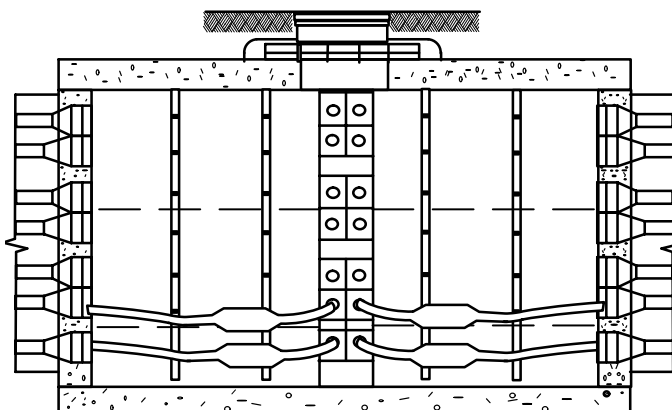


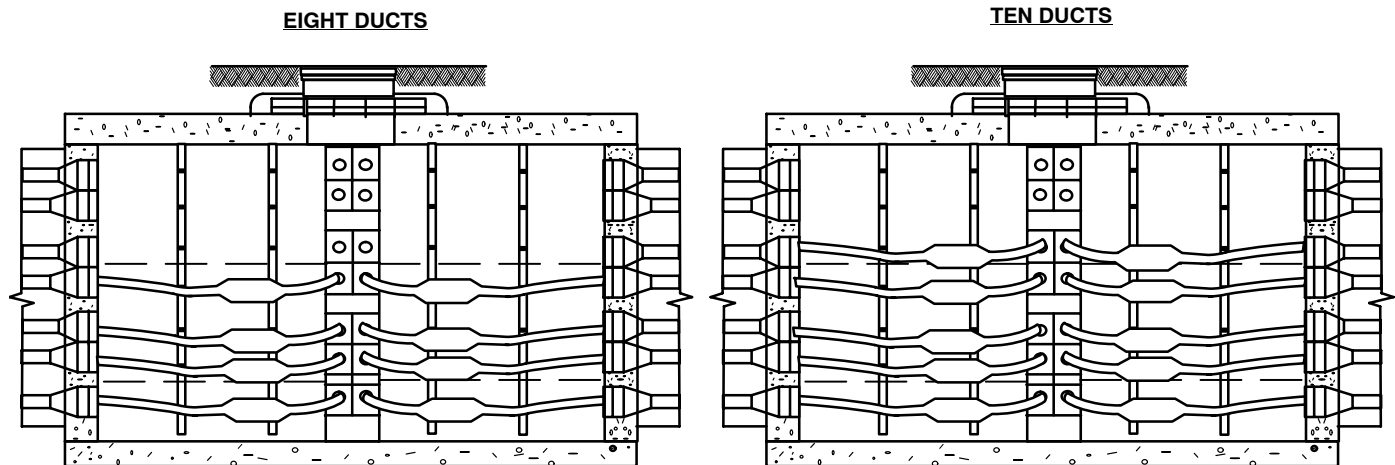
TWO DUCTS



FOUR DUCTS

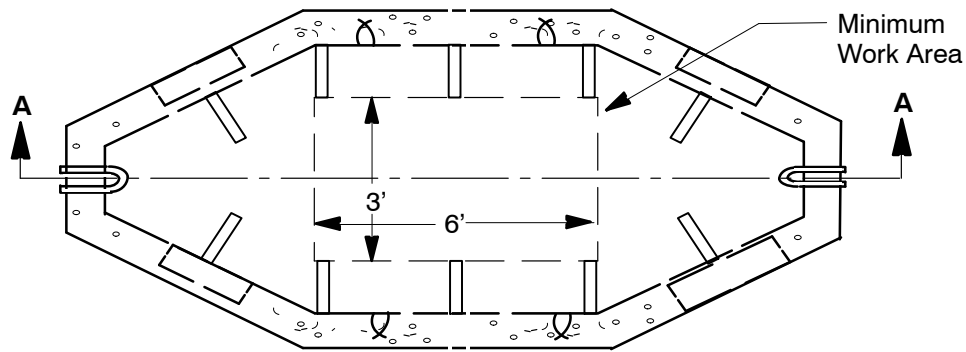
SIX DUCTS



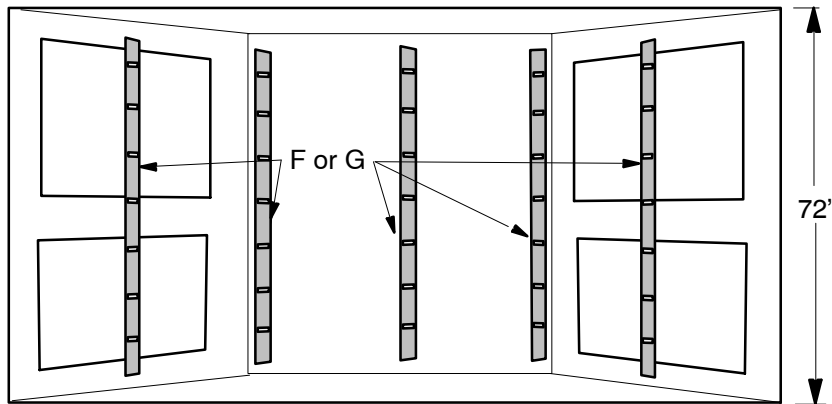


NOTES:

1. Cable and splice positions reflect either one 3 conductor PILC cable and joint or three single conductor cables and three splices.
2. The maximum number of ducts occupied by energized power cables shall be ten.



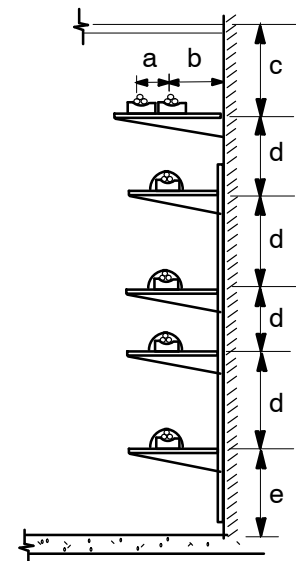
Cable Rack Spacing in Manhole



SECTION AA
Side View of Cable Racks in Manhole

Standard Manhole (1 to 10 Ducts Used)
 Maximum of 10 Network Cables on One Side
 Maximum of 5 Primary Cables on Each Side
 7 Brackets Maximum on Each Cable Rack

Cable Bracket Spacing



Dimension in Table

SPACING REQUIREMENTS FOR CABLE BRACKETS
Standard Precast Manhole

	a	b	c	d	e
Network & 600V	6"	6"	12"	12"	12"
5 & 15 kV		6"	12"	12"	12"
35 kV		6"	12"	12"	15"

STRUCTURES-MANHOLES
STRAIGHT PRECAST
Cable Racking

33 20 05 **

Sheet 2 of 3

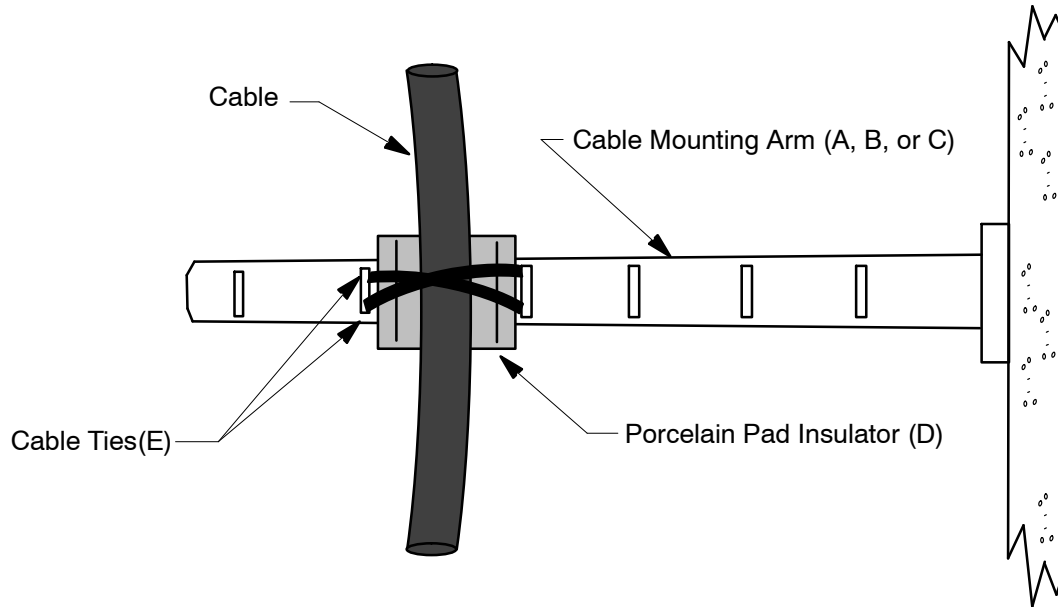
		Std. / Stk. No.	Description	33 20 05 **	01	02	03
	A	12 56 121	Arm – Cable Mounting 10"		5		
	B	12 56 113	Arm – Cable Mounting 14"			20	
	C	12 56 112	Arm – Cable Mounting 18"				20
	D	12 56 122	Insulator – Porcelain Pad		@	@	@
3	E	40 59 196	Tie – Cable, Black, 13 ½" Dia.		10	40	200
4	F	12 56 115	Rack – Cable, Galv. Steel, 30" Long, 18 Holes		@	@	@
4	G	12 56 116	Rack – Cable, Galv. Steel, 55" Long, 37 Holes		@	@	@

- 33 20 05 01 Single Installation of 5 kV or 15 kV Primary Cable and Splice or a 35 kV Sub-transmission Cable and a Splice
- 33 20 05 02 Installation of One or Two 600 V Network Cables and Straight Splices or 2–3 Network Cables and a 3–way Crab Connector
- 33 20 05 03 4–7 600 V Network Cables and Either a 5 or 7 way Crab Connector

NOTES:

1. In combined Network & Primary manholes the Network cables should be located on the top 1–4 brackets and the Primary cables should be located on the next 1–3 brackets below the Network cables. The Sub-transmission cables (if needed) should be located below the Primary cables on the bottom bracket(s).
2. Use the Cable Training Standard 33 20 04 01 to determine the duct position of new cable installations. When training and racking cables avoid situations whenever possible where cables will cross each other.
3. At each cable mounting arm, tie the cable/splice down to the porcelain insulator pad and mounting arm using two cable ties in a cross pattern (see Detail on Sheet 3).
4. New precast manholes will be supplied with the cable racks already installed in them.

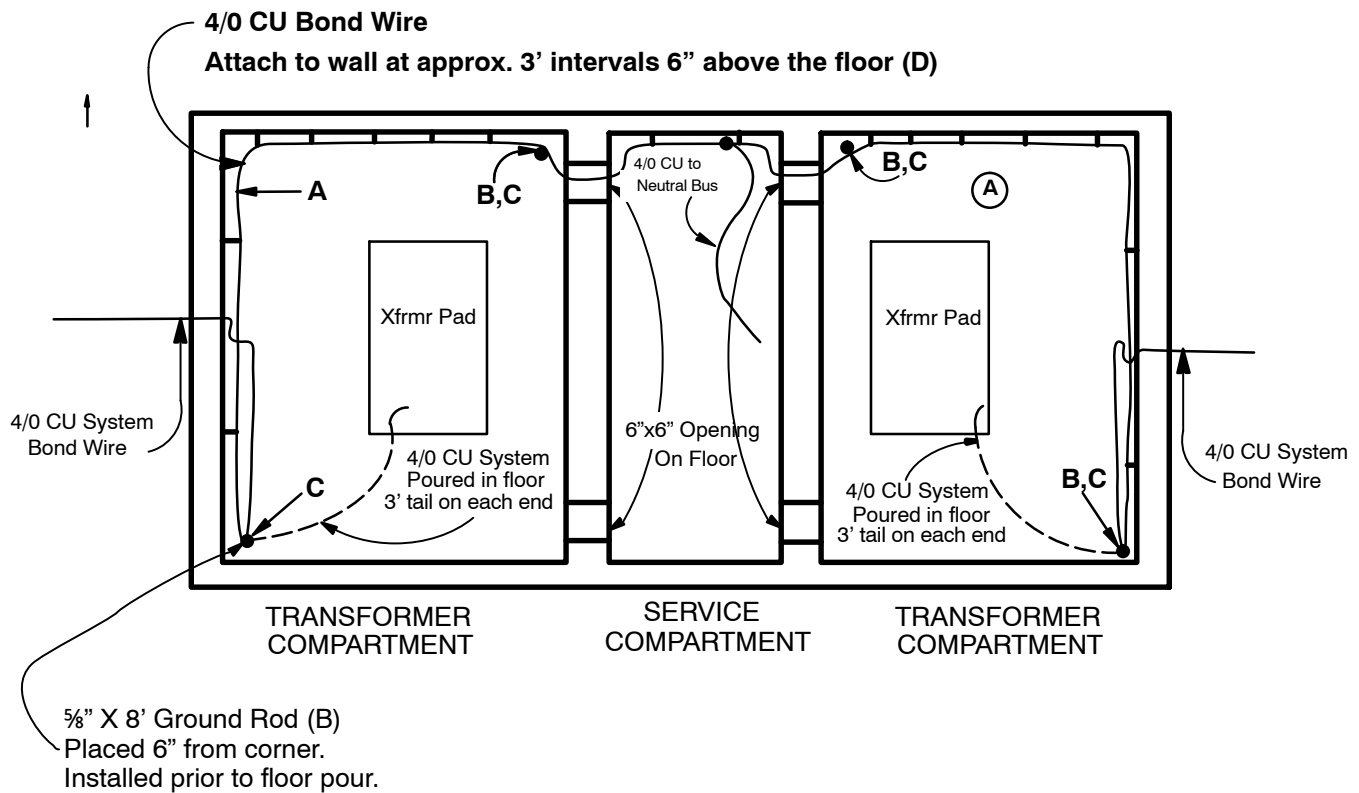
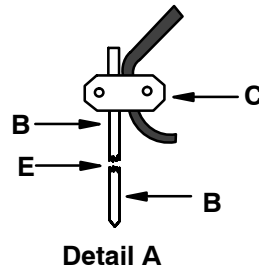
Cable / Splice Cross Tie Down Detail



STRUCTURES– NETWORK VAULT GROUNDING SYSTEM

33 20 06 01

Sheet 1 OF 2



		Dist. Std. /Stk. No.	Description	33 20 06 01
1	A	18 52 024	Wire – 4/0 AWG, Copper, Bare, Soft Drawn	95
4	B	23 63 143	Rod – Ground, 5/8" x 4'	8
	C	17 54 132	Connector – Wire, 8–350 kcmil, CU	11
1	D	40 59 196	Tie – Cable, Black, 13 1/2" Dia.	20
6	E	23 13 070	Coupling – CU Alloy, 5/8", Threaded	4

NOTES:

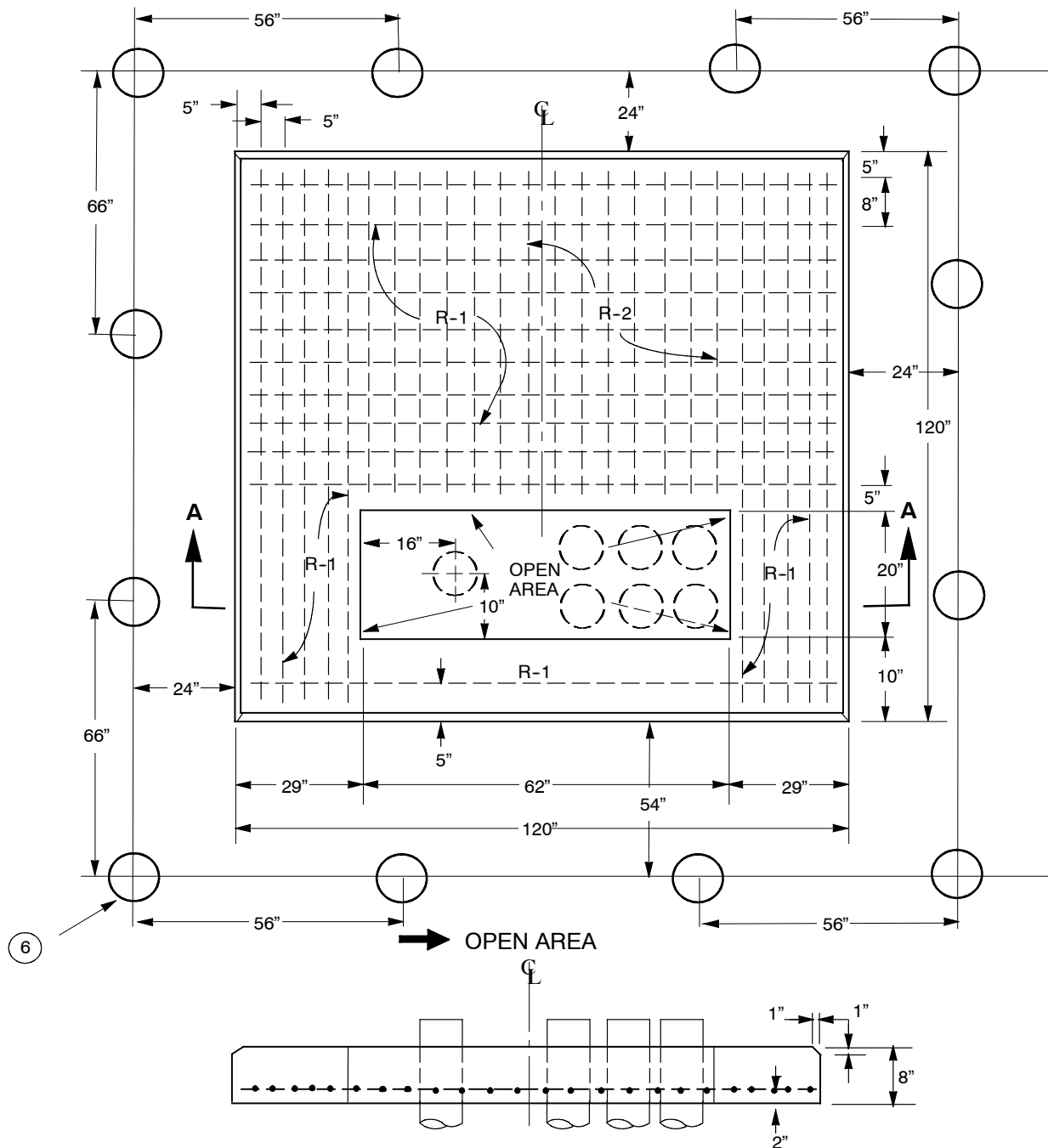
1. The Bond Wire (A) is to be fastened with cable ties (D) 6 inches above the manhole floor after the vault is poured. The Bond wire will be tied to 1/2" minimum diameter mounting eyes which are to be cast into the vault walls at intervals of 3 ft. maximum. The 4/0 AWG bond wire will run from the primary duct banks in to the vaults.
2. Each transformer compartment will have a 4/0 AWG copper bond wire extension from the wall to the transformer pad. The extension is to be poured into the vault floor and have two 3 foot tails exposed at each end. One end will connect to the bond wire system while the other end connects to the transformer ground. Connect the extension with two bolt connectors (C).
3. The service compartment will have a 4/0 AWG bond wire, clean the bond wire extension from the bond wire system to the neutral bus bar. Connect the extension with two bolt connectors (C).
4. Ground Rods (B) are to be driven in 6 feet prior to pouring the floor of the vault.
5. When making grounding attachments to the bond wire, clean the bond wire at the attachment point.
6. Join two ground rods together with a coupling.
7. All access ladders are to be individually connected to the grounding system.



STRUCTURES-PADS
Three Phase Padmount Transformers
34.5kV (Poured-In-Place)

34 11 00 00
 Sheet 1 of 3

RADIAL-FEED ONLY
1500 kVA THRU 3000 kVA



SECTION AA

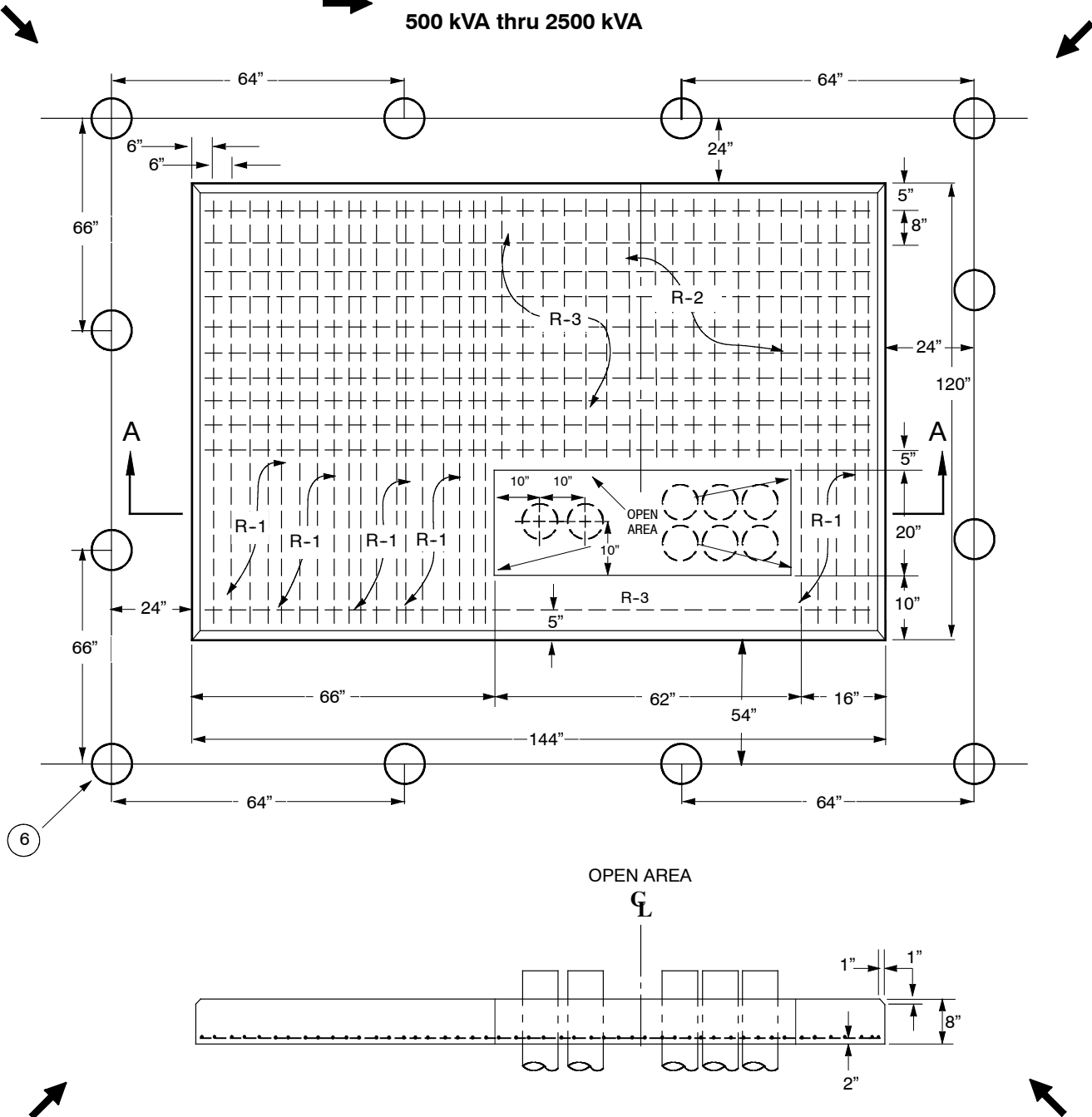
REINFORCING SCHEDULE			
MARK	NO REQ'D	SIZE	LENGTH
R-1	22	#4	114"
R-2	13	#4	84"

STRUCTURES-PADS

Three Phase Padmount Transformers
34.5kV (Poured-In-Place)

34 11 00 00
Sheet 2 of 3

LOOP-FEED ONLY
500 kVA thru 2500 kVA



SECTION AA

REINFORCING SCHEDULE			
MARK	NO REQ'D	SIZE	LENGTH
R-1	12	#4	114"
R-2	11	#4	84"
R-3	12	#4	138"

1. CONCRETE MIX

Concrete mix shall be either Type I or Type III portland. Mix concrete in accordance with ASTM C94. Water shall be clear and drinkable. Ultimate strength at 28 days shall be 4,000 psi, 6 sacks minimum of cement per cubic yard. Maximum slump 4". Water to cement ratio shall not exceed 5.0 by weight, including free moisture on aggregate. Aggregate shall be white limestone rock, maximum size 3/4". Use air entraining admixture (3% to 6% air by volume.) **The use of calcium chloride is prohibited.**

2. PLACEMENT

All concrete shall be well vibrated, dense and smooth. No honeycombs, fins or cold joints shall be present. Placement and vibration of concrete shall not disturb the reinforcement.

3. REINFORCEMENT

Reinforcement shall consist of #4 reinforcing bars meeting the requirements of ASTM A615, minimum grade 40. All reinforcing bars shall be tied to prevent displacement during concrete placement.

4. DIMENSIONS

Dimensions shall be in accordance with the drawings shown in this standard. The top surface shall be true and free of mounds or depressions. A four foot level shall be placed at any location on the top surface and at no location may a #14 (American Wire Gauge) bare wire fit between the level and the surface. The finished pad shall be free of voids and crumbling edges. No protrusion or flashing shall exceed 1/4" in length from the finished surface. **Pads not conforming to any dimension or specification contained herein will not be accepted.**

5. CONDUITS

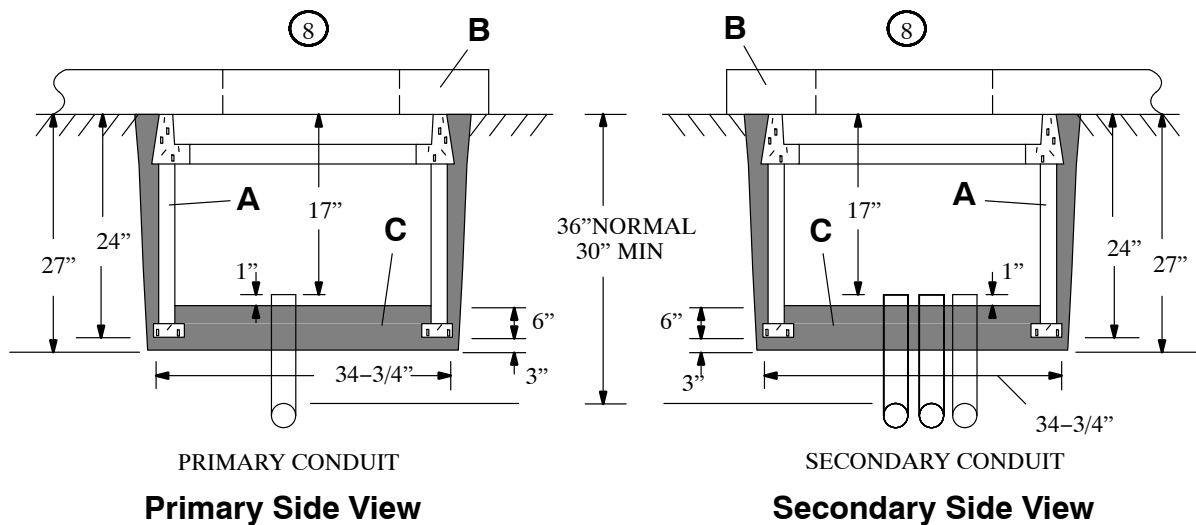
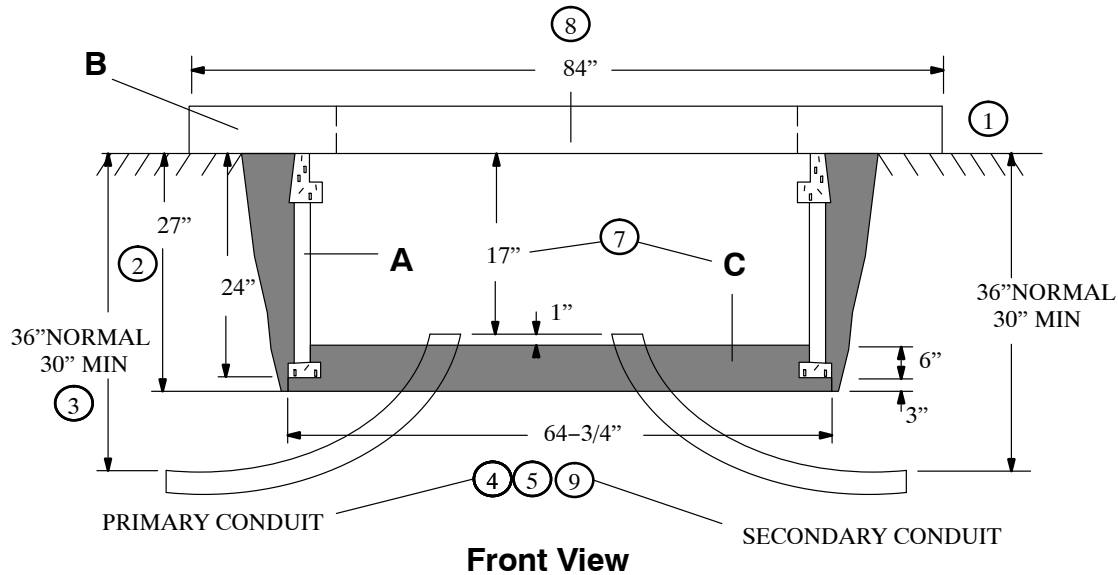
Secondary conduits shall be symmetrically located within a 20" x 24" area. Primary conduit shall be positioned as shown.

6. PROTECTIVE BARRIER RAILS

- Barrier iron to be railroad rails, 8'6" long, 50-100 lbs. per yard. An acceptable alternative is 4" iron pipe 8'6" long, concrete filled or see Dist. Std. 34 22 01 00 for power installed bumper posts.
- Barriers on sides not accessible to vehicles may be omitted.
- All Materials and labor for protective barrier rail installation shall be provided by the customer.
- Customer is encouraged to paint barrier rails with yellow street marking lacquer.

Caution: Installation of barrier rails must be coordinated with the conduit installation to avoid mutual interference.

Note: If circumstances are such that Ameren crews must install barriers the following materials may be used: Barrier Rail (Stk. # 68-05-024), Concrete (Stk. # 11-04-105), Yellow Lacquer (Stk. # 30-57-025).



STRUCTURES – COMPOSITE BOX VAULT

Three Phase Padmounted Transformers

15kV & Below

34 21 04 05

Sheet 3 of 3

1, 3, 7		Std./Stk. No.	Description	
	A	12 06 241	Box Vault, Composite, 60" x 30" x 24"	1
	B	12 06 124	Pad, Composite, 84" x 72"	1
			Pad, Poured-in-Place, 84" x 72"	
	C		Screenings, Crushed Stone	As Req'd.

NOTES:

1. The areas of excavation that bear the box vault and the flat pad shall be tamped and leveled. Proper compaction prior to setting the box vault and the flat pad is important to prevent settling. Back filling with crushed stone screenings is recommended.
2. An initial depth of 27" shall be excavated for the box vault.
3. To install the 36" radius bends, an increase in the initial excavation depth will be required. After the bends have been installed, crushed stone screenings shall be placed and tamped to the level shown in the drawings.
4. The primary and secondary conduits may enter the box vault from the sides (as shown in drawings), from the front, or from the back.
5. All conduits shall be rigid PVC Schedule 40 or approved PVC flexible conduit. If bends are cut off, apply a bell end coupling over the end of each conduit.
6. See DCS 34 21 05 **, sheet 4 of 4, for conduit layout in the primary and secondary compartment areas of the pad vault.
7. Stabilize the box vault over the conduits before backfilling so that there will be no shifting. To further stabilize the conduit bends, place additional screenings inside the pad vault and hand tamp in place. Conduit openings should be 17" below the load bearing surface (top) of the box vault. See drawings.
8. The opening of the flat pad should be centered over the box vault. Note that the box vault opening is 57-5/8" x 27-5/8" and the flat pad opening is slightly smaller at 52" x 20".
9. If pulling tension through the conduit elbows will exceed 400 lbs., restrain the bends as per DCS 31 47 01 **.
10. Box vault cover stock #12 06 245 can be used on this vault box to temporarily cover the opening. Note however, this cover cannot be installed or removed with the flat pad in place over the box vault.

Sheet 1 of 2

STRUCTURES – FIBERGLASS BOX VAULT

Single Phase Padmounted Transformers

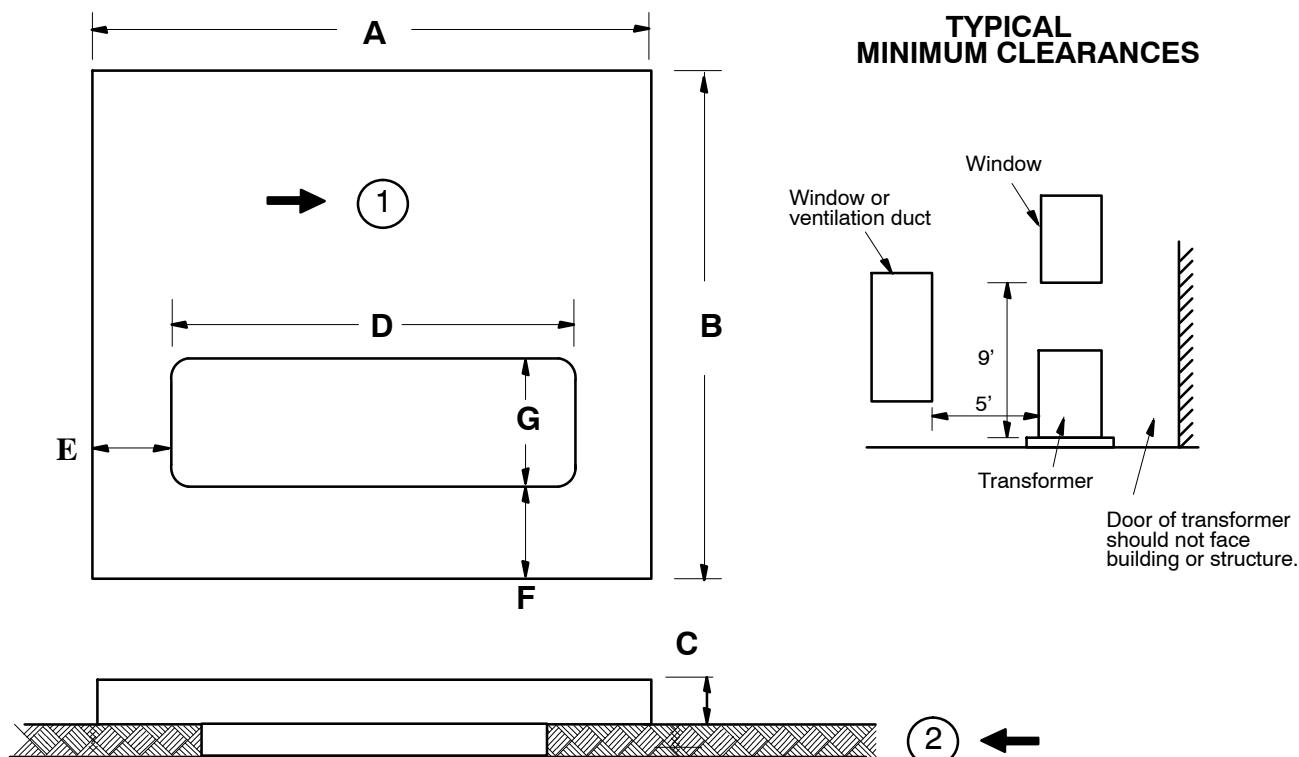
34 21 04 **

Sheet 2 of 2

Stock Number	Description	Dimensions (inches)							Approx. Weight
		Top		Height	Opening		Base		
		WT	LT	H	WO	LO	WB	LB	
12 06 215	42"Wx48"Lx32"H	42	48	32	25	24	54	60	144
12 06 163	42"Wx48"Lx18"H	42	48	18	25	24	50.5	56.5	90
12 06 218	37"Wx48"Lx18"H	37	43	18	22	23.5	47.5	54.5	80



		Std./Stk No.	Description	34 21 04 **	01	02	03
9,10,11	A	12 06 215	Vault – Transformer, Fiberglass, 42"x48"x32"		1	–	–
		12 06 163	Vault – Transformer, Fiberglass, 42"x48"x18"		–	1	–
		12 06 218	Vault – Transformer, Fiberglass, 37"x43"x18"		–	–	1
@	B	12 51 173	Bend – Plastic, 3", 36" Rad. (Secondary & 400 A Service)		As Req'd	As Req'd	As Req'd
@	C	12 51 331	Bend – Plastic, 1-1/2", 24" Rad. (Streetlight)		As Req'd	As Req'd	As Req'd
@	D	12 51 264	Bend – Plastic, 2-1/2", 24" Rad. (200 A Service)		As Req'd	As Req'd	As Req'd



	STOCK CODE	INTENDED USE	DIMENSIONS							APPROX. WEIGHTS
			A	B	C	D	E	F	G	
4	12 06 164	1 Phase, Lightweight	42	47	4	25	8.5	6	12	50lbs
4	12 06 198	1 Phase, Heavy	42	47	4	25	8.5	7	12	300lbs
3	12 06 123	3 Phase 750 kVA & under Radial Feed	72	65	4	48	12	6	15	600lbs
3	12 06 124	3 Phase over 750 kVA Radial Feed & all 3 Phase Loop Feed	84	72	5	52	16	10	20	800lbs

CONSTRUCTION NOTES:

- When possible, do not install cable under this portion of pad.
- Pad shall be installed on 4" of level, well compacted, 1" minus rock extending 12" outside the pad. Dirt under the rock must first be well compacted. Avoid filling pad opening before cable or conduit is installed. Refer to sheets 2 thru 5 for details.

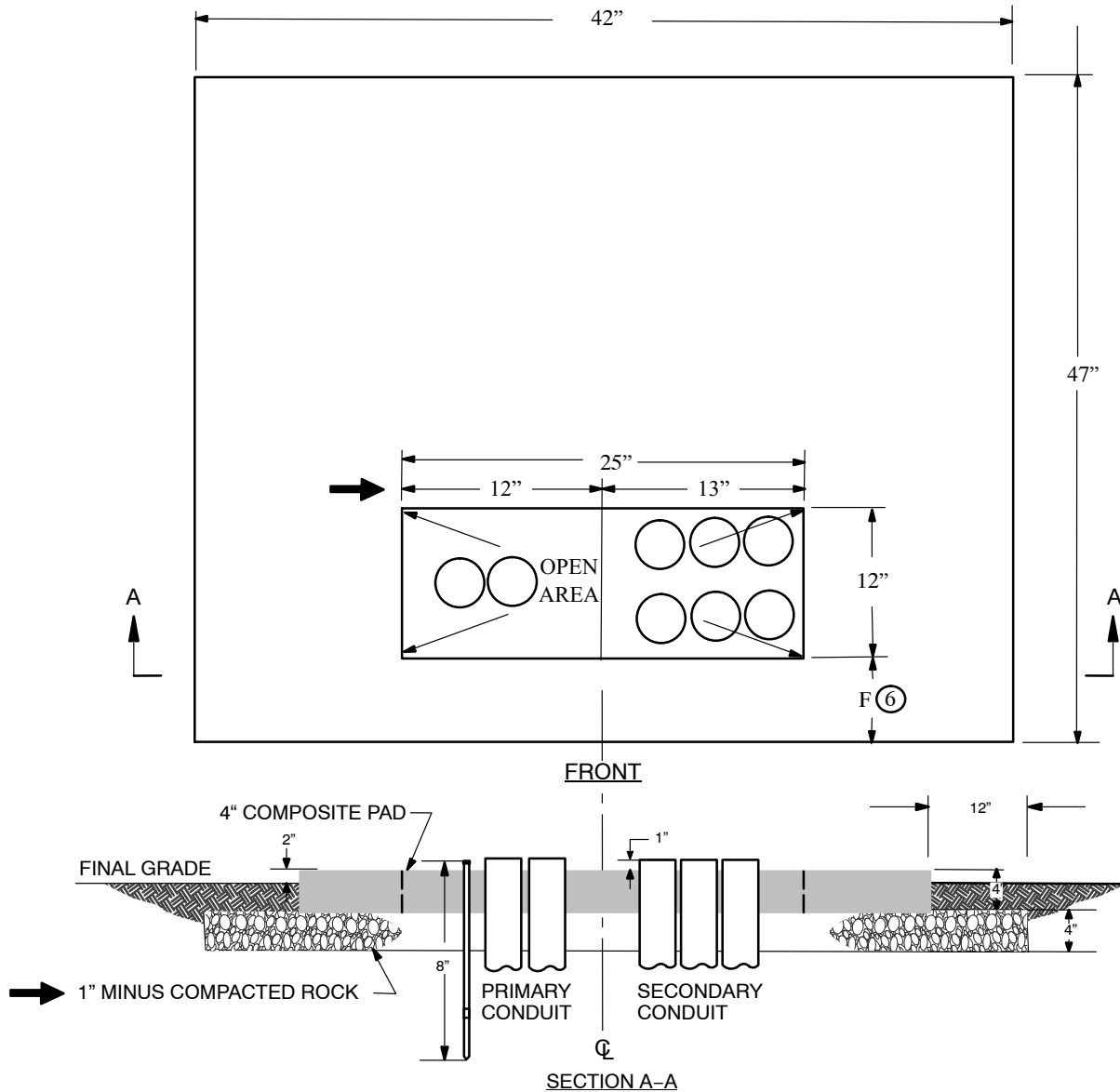
ENGINEERING NOTES:

- Ameren transformers 1999 or newer will fit on these pads. Transformer dimensions should be verified by construction personnel prior to using these pads with older transformers.
- Heavy pad for conduit systems where pad is installed by customer contractor and for "dummy" transformers. Lightweight pad is for installations where pad is installed by Ameren personnel.

Std./Stk.No.	Description	34 21 05 **	01	02	04	05
12 06 164	Pad – Xfrmr, Composite, 1 Phase, Lightweight	1				
12 06 198	Pad – Xfrmr, Composite, 1 Phase, Heavy		1			
12 06 123	Pad – Xfrmr, Composite, 3 Phase, 72" x 65"			1		
12 06 124	Pad – Xfrmr, Composite, 3 Phase, 84" x 72"				1	

Stock # 12 06 198 or 12 06 164

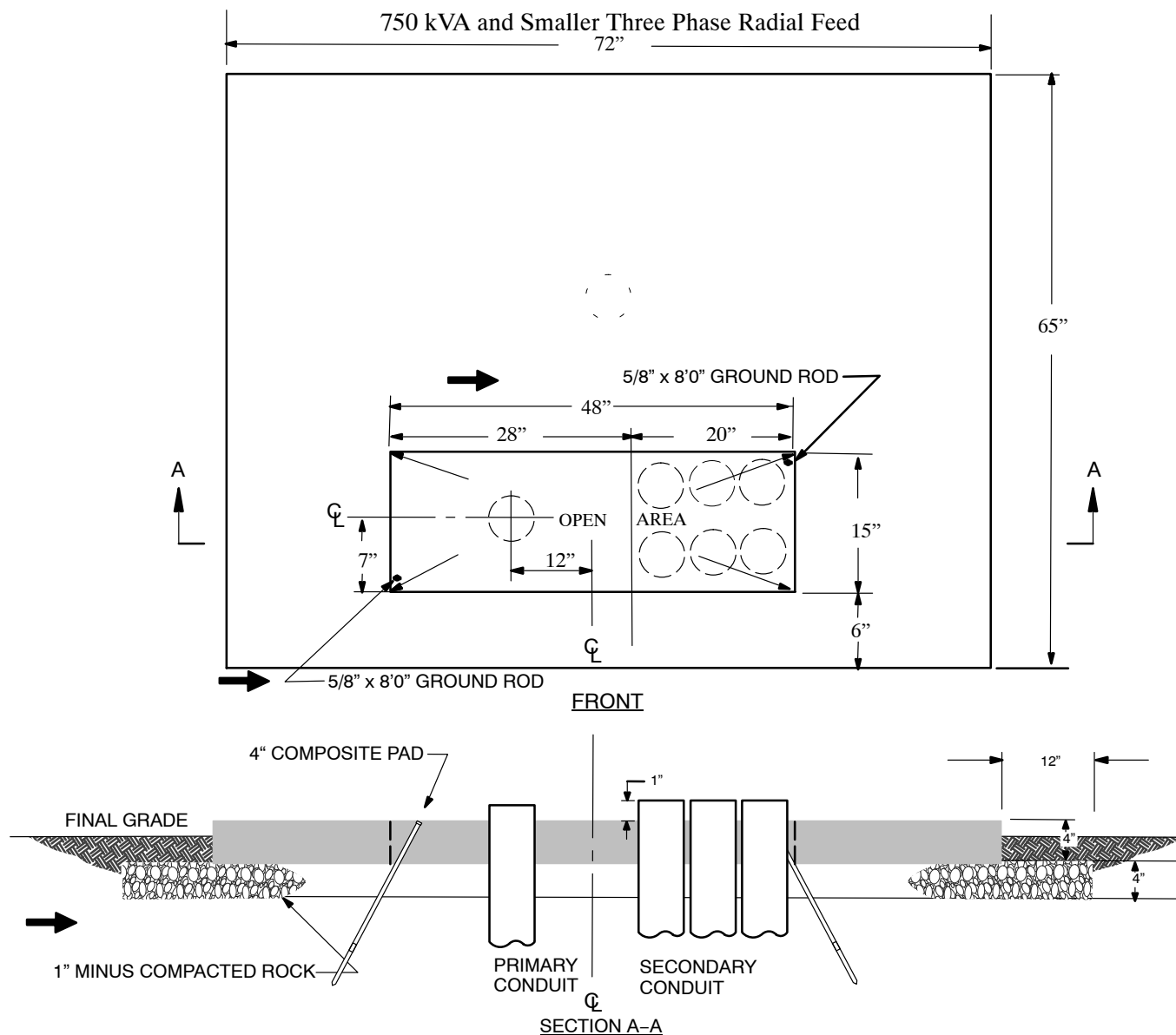
➔ 25 kVA thru 250 kVA Single Phase Loop Feed



CONSTRUCTION NOTES:

1. The number of secondary cables shall not exceed 8 per phase.
2. Secondary conduit shall be symmetrically located within 12" x 13" area.
3. The maximum number of conduits is 6 – 3" for the secondary.
4. Two – 2" Conduits shall be installed on the primary side – minimum size 2".
5. In Missouri residential developments, the contractor will install the pad and conduits.
6. See sheet 1 for this dimension depending on pad stock number used.
7. Pad shall be installed on 4" of level, well compacted, 1" minus rock extending 12" outside the pad. Dirt under rock must first be well compacted. Avoid filling opening before cable or conduit is installed. Unless situated in a paved area, the rest of the exterior shall be backfilled with the excavated material and foot tamped.

#12 06 123

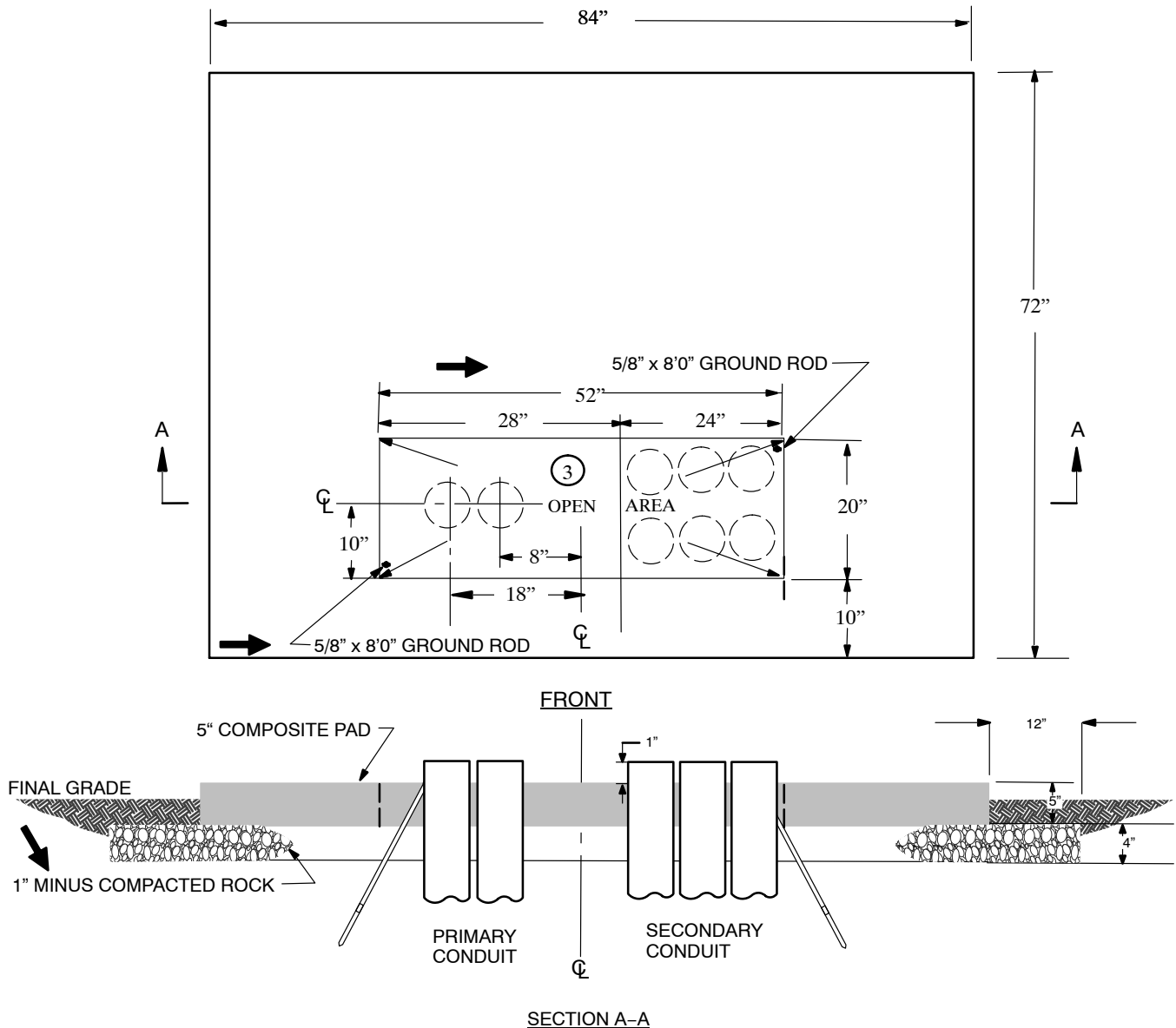


CONSTRUCTION NOTES

1. Ameren Engineering to determine final location and orientation of transformer pad.
2. All Conduit shall be rigid PVC Schedule 40 or approved PVC flexible conduit.
3. Secondary conduit shall be symmetrically located within a 15" x 20" area as shown above.
4. The number of primary and secondary conduits may vary. The number of secondary cables shall not exceed 12 per phase. Ameren Engineering will determine if the number of conduits is acceptable or if a vault will be required.
5. Two 5/8" x 8'0" ground rods shall be installed on opposite sides of the pad opening to provide maximum possible separation between rods. Ends of ground rods should be angled away from each other 45° +/- 15°.
6. Pad shall be installed on 4" of level, well compacted, 1" minus rock extending 12" outside the pad. Dirt under rock must first be well compacted. Avoid filling opening before cable or conduit is installed. Unless situated in a paved area, the rest of the exterior shall be backfilled with the excavated material and foot tamped.

Stock # 12 06 124

75 kVA thru 1000 kVA Three Phase Loop Feed
1000 kVA thru 2500 kVA Three Phase Radial Feed



CONSTRUCTION NOTES:

1. Ameren Engineering to determine final location and orientation of transformer pad.
2. All conduit shall be rigid PVC Schedule 40 or approved PVC flexible conduit.
3. Secondary conduits shall be symmetrically located within a 20" x 24" area as shown above.
4. The number of primary and secondary conduits may vary. The number of secondary cables shall not exceed 12 per phase. Ameren Engineering will determine if the number of conduits is acceptable or if a vault will be required.
5. Two 5/8" x 8'0" ground rods shall be installed on opposite sides of the pad opening to provide maximum possible separation between the rods. Ends of ground rods should be angled away from each other 45° +/- 15°.



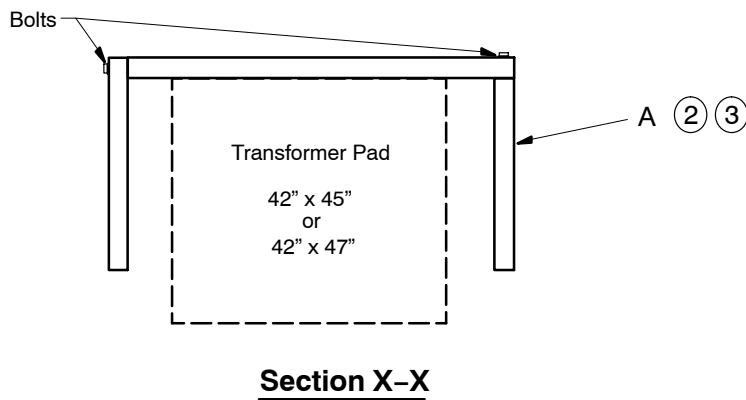
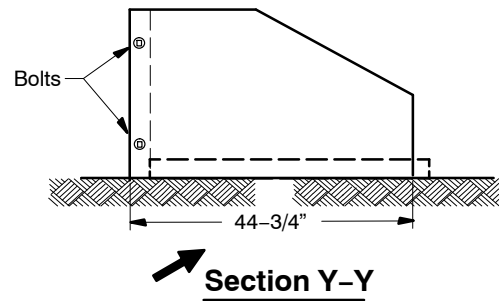
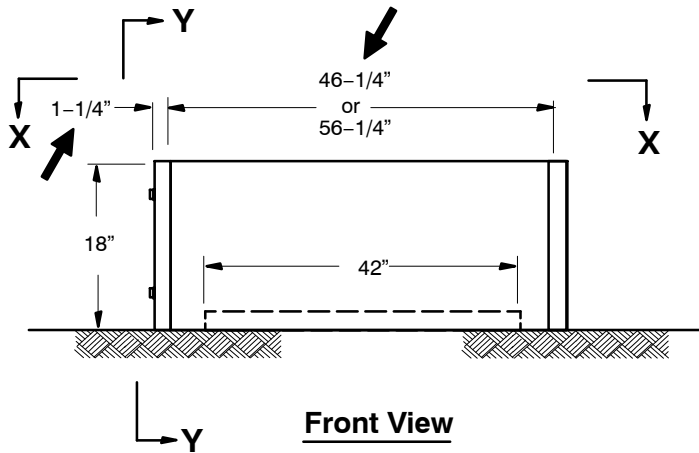
-
6. Pad shall be installed on 4" of level, well compacted, 1" minus rock extending 12" outside the pad. Dirt under rock must first be well compacted. Avoid filling opening before cable or conduit is installed. Unless situated in a paved area, the rest of the exterior shall be backfilled with the excavated material and foot tamped.

STRUCTURES – RETAINING WALL SET

For Single Phase Padmount Transformers
or Secondary Pedestals

34 21 06 **

Sheet 1 of 1



NOTES

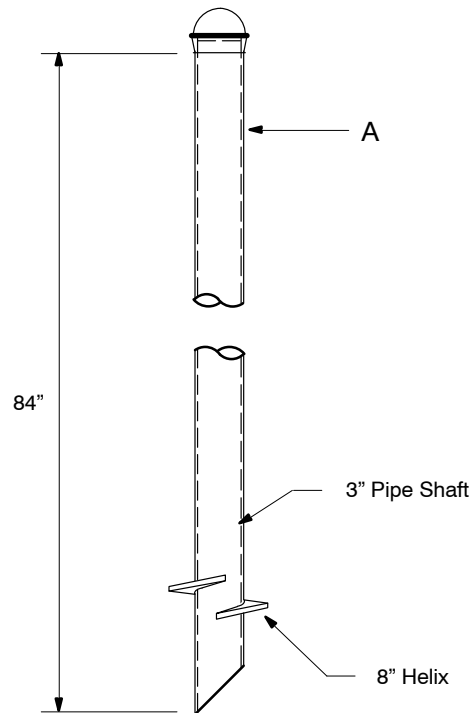
1. Use where grade has changed and transformer or pedestal has been partially buried. Can also be used in new installations where slight grade exists and erosion or landscaping is reasonably expected.
2. Retaining wall set includes 1– back wall, 1–right (short) wall, 1–left (long) wall, and 4–galvanized steel bolts with washers and nuts.
3. In some instances, only two of the three sides will be required. This will leave some wall set components “stranded” in stock. To make use of these stranded components, replacement components can be ordered as follows:
 Left (long) Wall – 12 06 210
 Right (short) Wall – 12 06 212
 46–1/4” Back Wall – 12 06 211
 56–1/4” Back Wall – 12 06 213

	Std./Stk.No.	Description	34 21 06 **	01	02
A	12 06 208	Wall, Retaining, 56–1/4” Wide		1	–
	12 06 209	Wall, Retaining, 46–1/4” Wide		–	1

STRUCTURES – BUMPER POST
Power Installed
To Protect Padmount Switchgear & Transformer

34 22 01 00

Sheet 1 of 1



NOTES

1. Cap should be driven on after bumper post is installed.
2. Install the base 4 feet into the ground in order to leave 3 feet projecting above ground line.
3. See Dist. Std. 59 81 51 10 for placement positions of bumper posts around padmounted transformers and switchgear.

	Std./Stk.No.	Description	34 22 01 00	
A	21 51 127	Bumper–Power Installed, Screw Type, Steel	1	
		Operation Code 203	1	

NOTES

UNDERGROUND CABLE

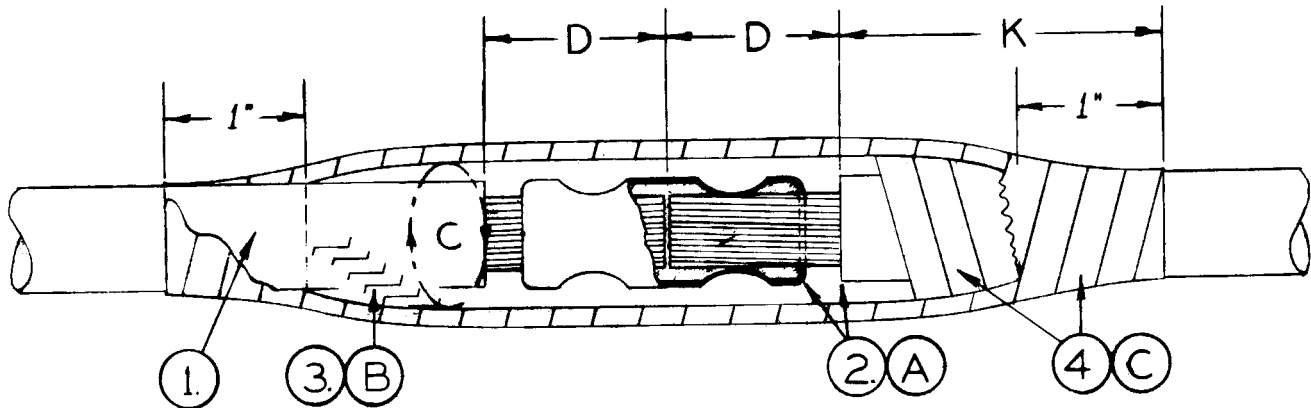
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OPERATIONS

1. Jackets over the insulation are considered a part of the insulation and are not to be removed.
2. Remove insulation back the required length (D) and install crimp sleeve and, if necessary, reducers.
3. Apply tape half lapped to circ. (c) taping gradual slopes at each end. Stretch tape to only 3/4 of its original width.
CAUTION: When splicing aluminum cable, wipe off all excess inhibitor.
4. Apply two half-lapped layers of plastic tape extending one inch beyond the original taping.

Copper Cables

Dimensions					Ins. (mils)
	Size	D	K	c	
#2	01	1-1/2"	3"	2.7"	180
1/0	02	2"	3"	3.6"	180
4/0	03	2"	3"	3.6"	180
500	04	2-1/2"	4"	4.2"	180

Aluminum Cables

Dimensions					Ins. (mils)
	Size	D	K	c	
1/0	05	1-1/4"	3"	2.7"	180
3/0	06	1-3/4"	3"	3.2"	180
350	07	2"	4"	4.2"	180

		Dist. Std. Or Stk. No.	Description	41 14 31 **	01	02	03	04	05	06	07
					Copper			Alum.			
1	A	17 63 127	Sleeve-Compression, #2, Cu.	1							
		17 54 219	Reducer-#4/0 to #1/0		2						
		17 63 030	Sleeve-Compression, 4/0 Cu.		1	1					
		17 63 032	Sleeve-Compression, 500 kcmil, Cu.				1				
		17 63 133	Sleeve-Compression, 1/0, Al					1			
		17 63 125	Sleeve-Compression, 3/0, Al						1		
		17 63 124	Sleeve-Compression, 350 kcmil, Al								1
	B	25 53 080	Tape-Rubber, 3/4"	1	1	1	1	1	1	1	1
	C	25 53 055	Tape-Plastic	1	1	1	1	1	1	1	1
		413	Operation Code	1	1	1	1	1	1	1	1

¹ Sleeves – Splicing, #2 Cu. (Stk. #17 60 273) may be substituted for this sleeve. Apply with Nicopress XPJ Tool.

If #8 CNP cable is to be joined to either a #6 Cu/Al cable or a #8 CNP cable, refer to additional instructions on Sheet 3.

See Sheet 2 for Special Instructions (Splicing Bare Copper Conductor To Aluminum Cable).

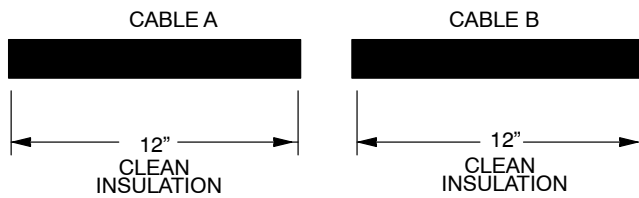


FIGURE 1

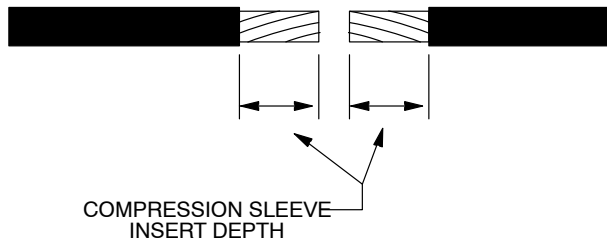


FIGURE 2

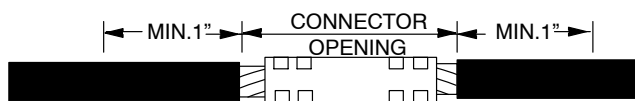


FIGURE 3

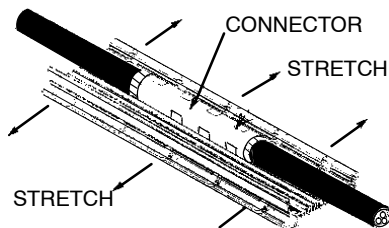


FIGURE 4

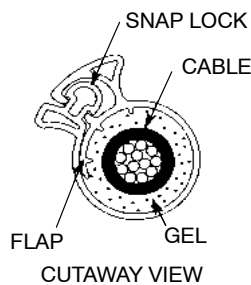


FIGURE 5

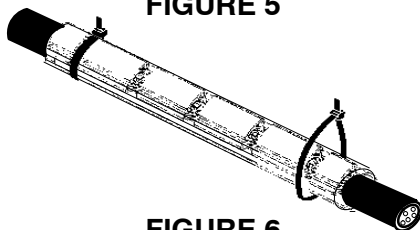


FIGURE 6

1. Thoroughly clean the cable insulation. Clean 12" of insulation on Cable "A" and 12" of insulation on Cable "B". See Figure 1.

2. Check the insert depth of the compression sleeve being used. Remove the length of cable insulation on each cable that corresponds to the insert depth of the compression sleeve. See Figure 2.

3. Install the compression sleeve. Make as many crimps as possible without overlap. Use the dies shown in the table. Remove the excess flash and inhibitor. See Figure 3.

4. Prestretch gel wrap sleeve as shown in Figure 4.

NOTE: Warming the sleeve will make it easier to install in cold weather.

5. Center the connector in the sleeve, then wrap the sleeve around the cable and connector. Start at one end, compress the snap locks over the entire length of the sleeve. Ensure that flaps seat under snap locks as shown in Figure 5.

6. Install cable ties at outer most notches of the snap locks. Splice is complete and ready for use. See Figure 6.

CABLE – JOINT – 1 C
#6 Cu./Al., 1/0, 3/0, 4/0, 350 , 750 Al. & 500 – 750 Cu.
600V

41 14 36 **
Sheet 2 of 3



	Std. / Stk. No.	Description 41 14 36 **	01	02	03	04	05	06	07	08	09	10	11	12	13	14	Die Size
	1763133	Sleeve–Compression, 1/0 Al.	1														U249
	1763138	Sleeve–Compression, 1/0 to 3/0 Al.		1													or
	1763125	Sleeve–Compression, 3/0 Al.			1												B49EA
	1763124	Sleeve–Compression, 350 Al.				1											U31ART
	1763144	Sleeve–Compression, 4/0 Al.					1										U249 U28ART
	1763143	Sleeve–Compression, 1/0 to 4/0 Al.						1									or
	1763145	Sleeve – Compression, 3/0 to 4/0 Al.							1								B49EA
	1763141	Sleeve–Compression, 3/0 to 350 Al.								1							U31ART
	1760362	Sleeve–Compression, 6 Al./Cu.									1						PEACH
	1763142	Sleeve–Compression, 750 kcmil Al										1					L39ART
	1763032	Sleeve–Compression, 500 kcmil Cu											1				U34RT
	1760360	Sleeve–Compression, 750 kcmil Cu												1			P39RT
	1760102	Sleeve–Compression, #8 Cu													1		53XPJ "J"
	1760363	Sleeve–Compression, #8 Cu to #6 Al/Cu														2	PEACH
	1754003	Connector–Split Bolt													1	1	
	1762215	Wrap – Gel, 10" Long	1	1	1	1	1	1	1	1							
→	1762217	Wrap – Gel, 8" Long									1				1	1	
	1762282	Wrap – Gel, 12" Long										1	1	1			
		Operation Code 405	1	1	1	1	1	1	1	1	1						
		Operation Code 406										1	1	1	1	1	

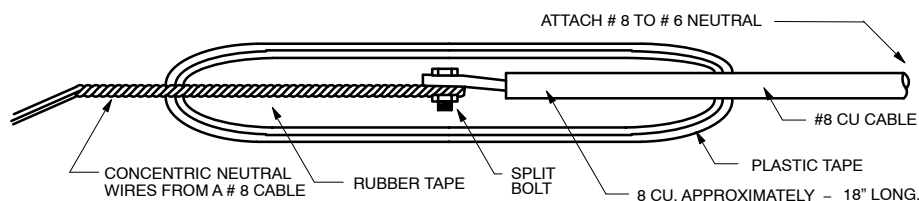
INSTRUCTIONS FOR #8 CNP TO #8 CNP (If voltage is greater than 600V, refer to Dist. Std. 41 24 33 00.)

NOTE: In addition to the instructions shown on Sheet 1, the following shall apply.

1. Unwind the concentric neutral wires from each cable. Remove enough cable to provide a sufficient length of concentric neutral wires for connecting across the splice.
2. Clean the cables.
3. Check the insert depth of the compression sleeve being used. Remove the installation from each cable that corresponds to the insert depth of the compression sleeve.
4. Install the compression sleeve using the "J" groove on the Nicopress 53-XPJ tool. Apply three crimps per end.
5. Install gel wrap sleeve as shown on Sheet 1.
6. Connect concentric neutral wires together across the splice with a split bolt.

INSTRUCTIONS FOR #8 CNP TO #6 AL/CU.

1. Follow instructions above.
2. Install the #8 to #6 compression sleeve (Stock #1760355) using the Nicopress Peach Tool. Apply two crimps per end.
3. Attach the concentric neutral wires to the #6 Al/Cu neutral cables as follows:
 - a. Unwind concentric neutral from the end of the #8 cable and twist the ends of the concentric together. Obtain a 18" piece of #8 cable with the concentrics removed. Strip approximately 2" of insulation from one end of the short piece of #8 cable.
 - b. Using Stock #17-54-003, join the concentrics to the short piece of #8 cable. After covering this connection with 2 layers of 1/2 lapped rubber tape, apply 3 layers of 1/2 lapped plastic tape.
 - c. Attach the other end of the short piece of #8 cable to the #6 neutral cable. This connection shall be made according to the instructions shown above. The #6 neutral will be identified by yellow insulation, yellow stirpes or ribs.



Inline Set Screw Connector Insulated with Gel Wrap Sleeve

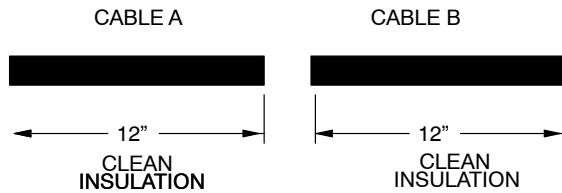


FIGURE 1

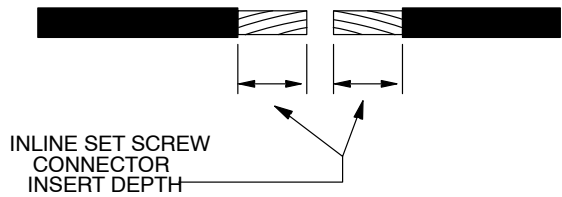


FIGURE 2

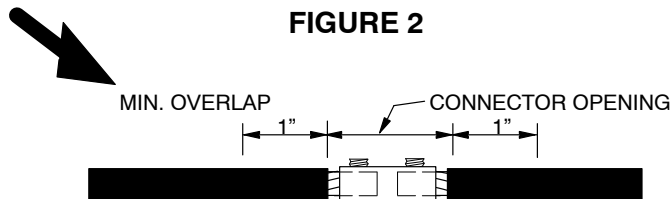


FIGURE 3

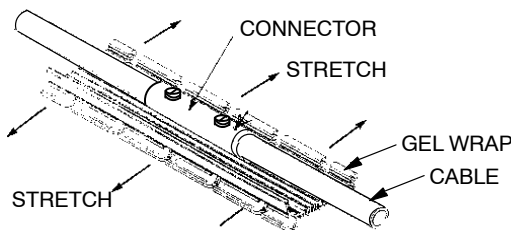


FIGURE 4

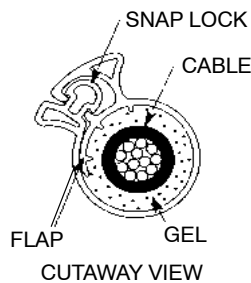


FIGURE 5

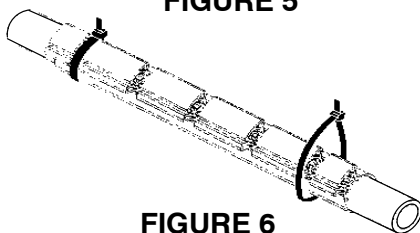


FIGURE 6

1. Thoroughly clean the cable insulation. Clean 12" of insulation on Cable "A" and 12" of insulation on Cable "B". See Figure 1.
2. Check the insert depth of the inline set screw connector (Stk # 17 64 204). Remove the length of cable insulation on each cable that corresponds to the insert depth of the connector. See Figure 2. Remove surface oxides from the exposed conductors with a wire brush. Coat the cleaned conductors with oxide inhibitor (31 59 058).
3. Insert cables into the connector. Tighten the set screws using a 5/16" allen wrench. NOTE: To obtain sufficient torque it may be necessary to hold the connector with a large crescent wrench.
4. Prestretch the Gel Wrap sleeve as shown in Figure 4.

NOTE: Warming the sleeve will make it easier to

install in cold weather.

5. Center the connector in the sleeve then wrap the sleeve around the cable and connector. Start at one end. Compress the snap locks over the entire length of the sleeve. Ensure that flaps seat under snap locks as shown in Figure 5.
6. Install cable ties at outermost notches of snap locks. Splice is complete and ready for use. See Figure 6.

Std. / Stk. No.	Description	41 14 37 01	
17 64 204	Connector – Inline Set Screw 1/0 – 350 kcmil		1
17 62 215	Wrap – Gel, 10" Long		1
	Operation Code 405		1

NOTE: INSTRUCTIONS AND FIGURES ARE FOR A “Y” SPLICE. FOR A STRAIGHT SPLICE OMIT THE GEL PAD AND WIRE TIE REFERENCED IN STEPS 3 & 4.

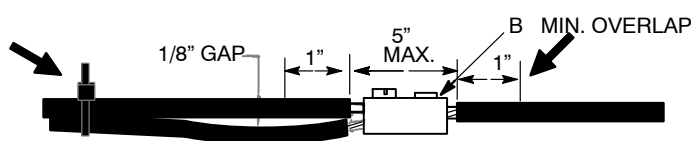


FIGURE 1

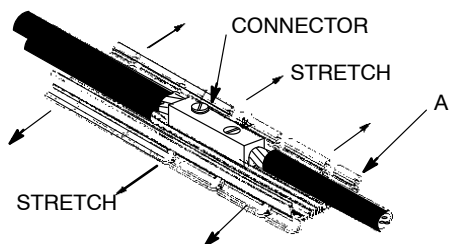


FIGURE 2

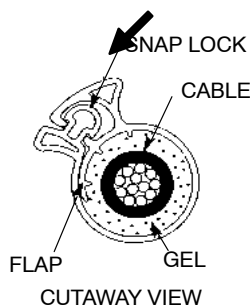


FIGURE 3

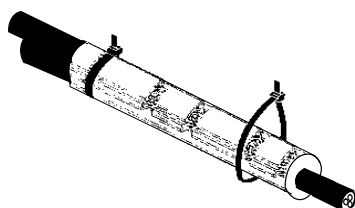
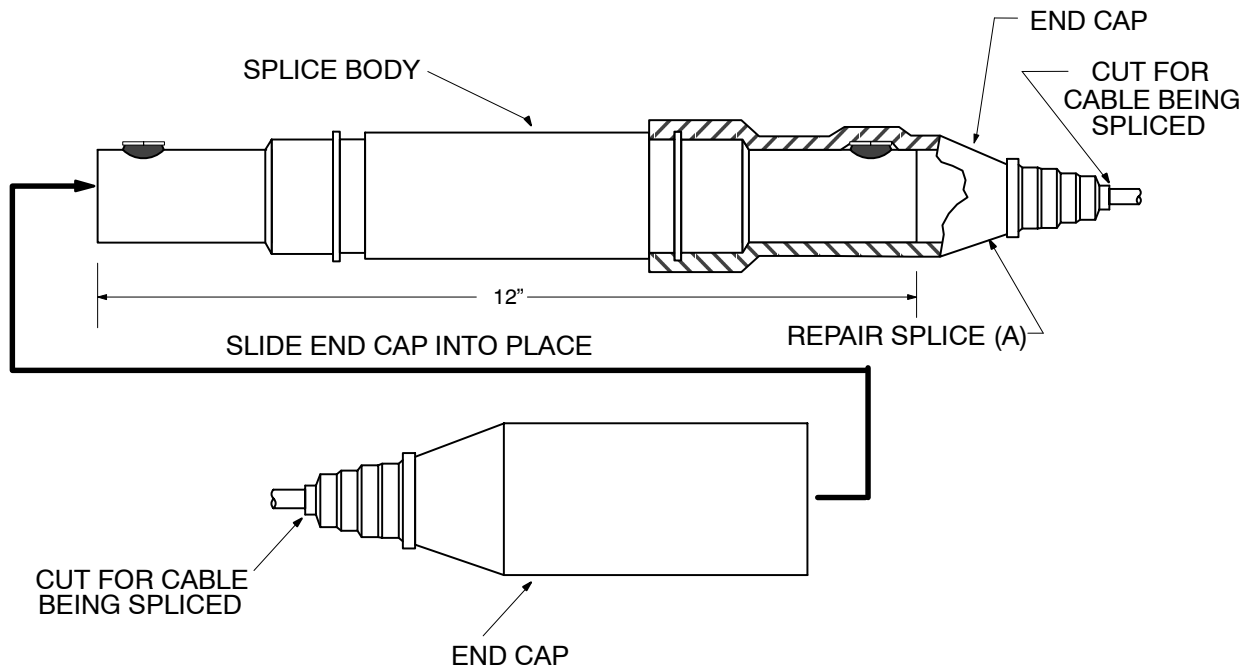


FIGURE 4

1. Remove 1 inch of insulation from each of the cables. Clean the conductors.
2. Install the connector and wipe off any excess inhibitor.
3. Clean the cables as required, and apply a small piece of gel pad around one of the cable of the “Y”. Omit this step if making a straight splice.
4. Position a wire tie around the two cables as shown in Figure 1. Omit this step if making a straight splice.
5. Pre stretch the gel wrap sleeve and position it around the cables with the connector centered.
6. Starting at one end of the gel wrap sleeve compress the snap locks over the entire length of the sleeve. Ensure that flaps seat under snap locks as shown in Figure 3.
7. Install the two wire ties in the notches of the snap locks. Splice is complete and ready for use. See Figure 4.

NOTE: Warming the gel wrap sleeve will make it easier to install in cold weather.

		Std. / Stk. No.	Description	41 15 31 00	
@	A	17 62 217	Wrap – Gel, 8” long		1
	B	17 51 233	Connector, Wire, St. Lt.		1
	C	17 62 216	Gel Wrap Pad, 2” x 8”		1
			Operation Code 405		1



INSTRUCTIONS:

1. Check insert depth of connector and remove required cable insulation. **DO NOT NICK THE CONDUCTOR.**
2. Cut appropriate steps on the end caps to match the conductor size.
3. Install silicone grease on the cables and slide the end caps onto the cables.
4. Remove surface oxides from the exposed conductors with a wire brush.
5. Coat the exposed conductors with oxide inhibitor (31 59 058).
6. Insert cables into the connector ports until they hit the stops.
7. Tighten the set screws using a 5/16" allen wrench.
8. Complete the splice by sliding the splice end caps onto the splice body.

	Std. / Stk. No.	Description	41 15 32 01
A	17 62 193	Splice – Repair, #6-350 kcmil AL. or CU.	1
		Operation Code 405	1

CABLE JOINT – TRIFURCATING TRANSITION SPLICE

5 kV, Non-Shielded, 3/C PILC To 3 1/C Solid Dielectric

800³ to 3-750 and 350³ to 3-350 and 4/0³ to 3-1/0

41 23 23 **

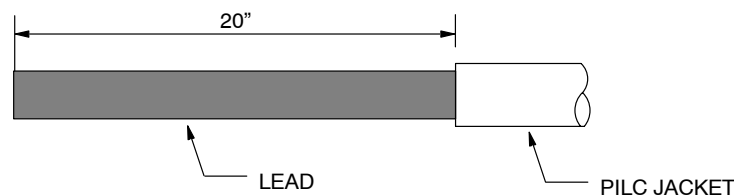
Sheet 1 of 6

GENERAL INSTRUCTIONS:

1. Adjust the flame so that it is an overall 12 inch bushy flame.
2. Apply the outer 3 to 4 inch tip of the flame to the heat shrink material with a rapid brushing motion.
3. Unless otherwise instructed, start shrinking the tubes at the center working the flame around all sides of the tubes to apply uniform heat.
4. Concentrate on heating the back of the tubes as well as the front of the tubes.
5. If it is necessary to interrupt the shrinking process and the tubes cool, you must reheat prior to shrinking the next tube.
6. Inspect all installed tubes. Reheat any flat spots or wrinkles, paying particular attention to the back of the splice.

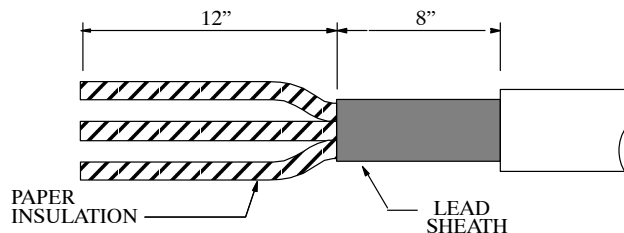
I PREPARE PILC CABLE

Remove 20" of outer jacket from PILC cable.



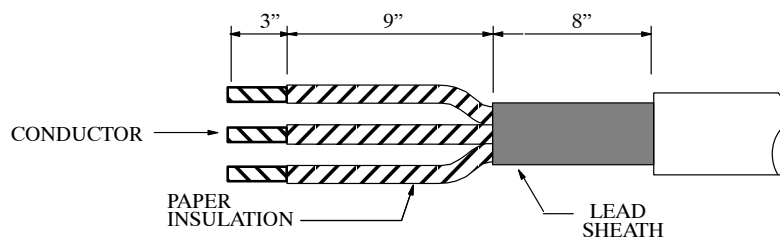
II PREPARE AND REMOVE LEAD SHEATH

Remove lead oxide from the lead sheath and clean sheath with solvent. Remove 12" of lead sheath and remove all belting and bedding tapes spreading phase legs back to the lead sheath cutback.



III CUTBACK PAPER INSULATION

Remove 3" of paper insulation from each phase of the PILC cable.



CABLE JOINT – TRIFURCATING TRANSITION SPLICE

5 kV, Non-Shielded, 3/C PILC To 3 1/C Solid Dielectric

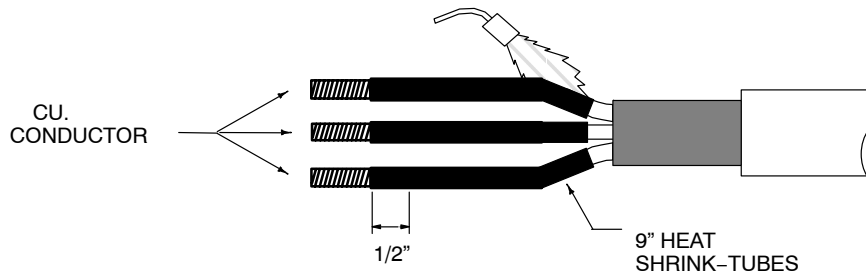
800³ to 3-750 and 350³ to 3-350 and 4/0³ to 3-1/0

41 23 23 **

Sheet 2 of 6

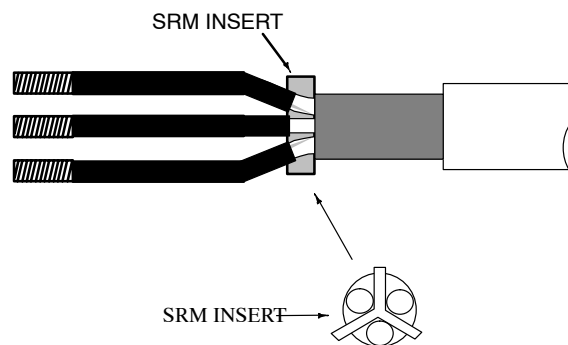
IV SHRINK 9" TUBES

Shrink a 9" tube onto each phase. The tube should be pushed up to the lead sheath cutoff as far as possible. The other end should overlap the conductor by 1/2 inch.



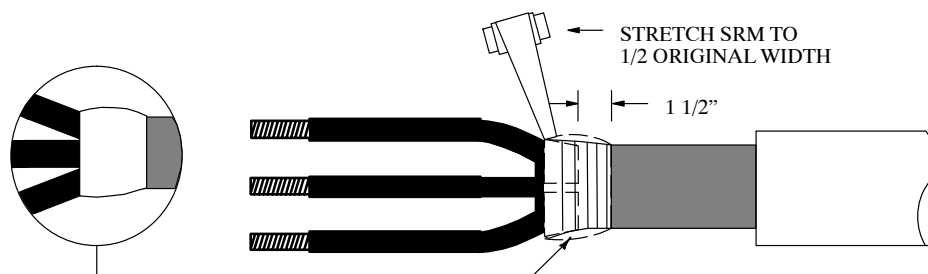
V ASSEMBLE SRM INSERT

Using two 3" strips of SRM, fold into "Y" insert as shown. Stuff this insert between phase legs as shown.



VI INSTALL OIL SEAL

Using 3 to 4 SRM strips fill in the area between the 9 inch sleeves and the lead sheath cutoff. Overlap the 9 inch sleeves by 1/2" and the lead sheath by 1-1/2". Stretch the SRM while applying.



CABLE JOINT – TRIFURCATING TRANSITION SPLICE

5 kV, Non-Shielded, 3/C PILC To 3 1/C Solid Dielectric

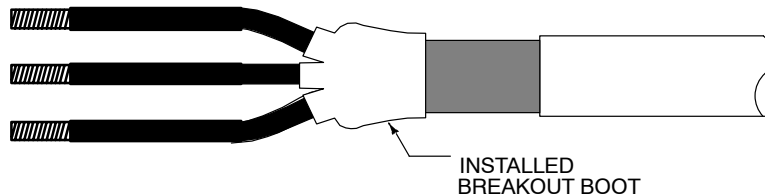
800³ to 3-750 and 350³ to 3-350 and 4/0³ to 3-1/0

41 23 23 **

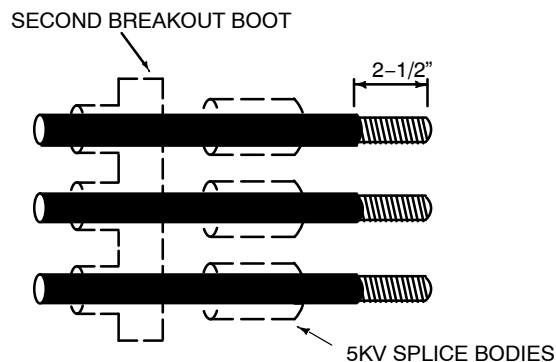
Sheet 3 of 6

VII POSITION OUTER BREAKOUT BOOT

Slide breakout boot down the legs and over the lead sheath cutoff. The breakout boot should butt up hard against the applied SRM. Shrink the breakout boot in place starting at the fingers and working toward the other end.



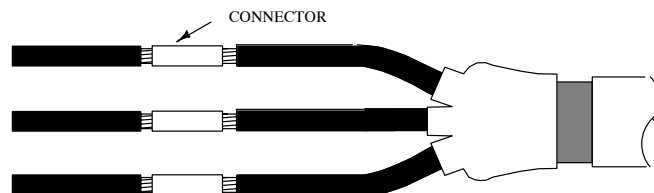
VIII PREPARE THE SOLID DIELECTRIC CABLE SIDE



Remove 2-1/2" of jacket and insulation from each phase of solid dielectric cable. Slide the second cable breakout boot down the cable with the fingers facing outward. Slide one 5kV splice body down each phase cable.

IX INSTALL CONNECTORS

Install the connectors using the rounding tool to round the sectored PILC cable. If soldering, protect the insulation and oil barrier tubes by wrapping the area with cotton material or glass tape. Make sure that the connectors are smooth.



X APPLY SRM OVER CONNECTOR

NOTE: COMPLETE STEP X WORKING ON ONE PHASE AT A TIME.

Remove backing from one side of a long strip of SRM, roll the SRM and remaining backing strip into a convenient size.

While removing the remaining backing strip, tightly wrap the SRM around the connector and exposed conductor. Be sure to fill the gaps and low spots around the connector.

Continue to wrap the SRM onto the insulation as shown.

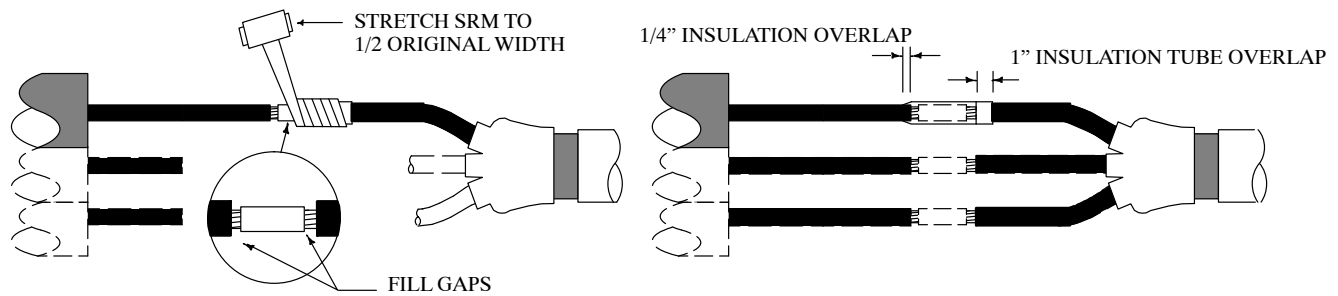
CABLE JOINT – TRIFURCATING TRANSITION SPLICE

5 kV, Non-Shielded, 3/C PILC To 3 1/C Solid Dielectric

800³ to 3-750 and 350³ to 3-350 and 4/0³ to 3-1/0

41 23 23 **

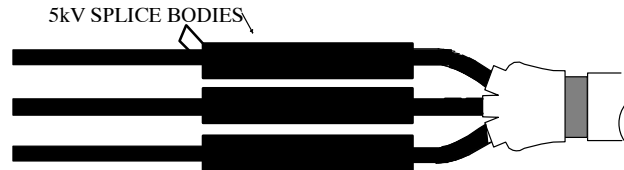
Sheet 4 of 6



Cover SRM on each phase with 1 layer of plastic tape.

XI APPLY 5 kV COLD SHRINK SPLICE BODY TO EACH PHASE

Center each 5kV splice body over phase connectors. Pull the core out counter-clockwise. Shrink down each tube one at a time.



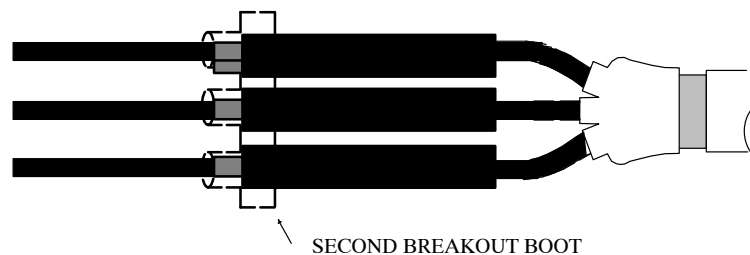
XII APPLY SEALANT TO SOLID DIELECTRIC CABLES

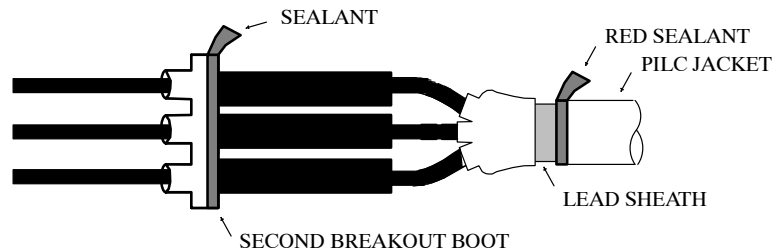
Wrap one layer of sealing mastic around each solid dielectric phase cable. Sealant is to be placed at the end of each 5kV splice body.



XIII PLACE SECOND BREAKOUT BOOT AND SHRINK

Slide second breakout boot toward the splices stopping where the breakout "fingers" meet the 5kV splice bodies. Shrink breakout starting at the fingers and working toward splice center.



XIV APPLY SEALANT AT END OF SECOND BREAKOUT AND AT PILC JACKET CUTOFF

Apply one layer of sealant over the breakout body as shown. Allow breakout to cool before applying sealant. Wrap another layer of sealant around the PILC cable at the jacket cutoff.

XV POSITION AND SHRINK WRAPAROUND SLEEVE

1. Cut the 48" wraparound sleeve down to 30". The sleeve may be reduced to a minimum 24" where a shorter overall splice is necessary.
2. Remove the backing from the wraparound sleeve and center sleeve over splice.
3. Slide the metal retention clip onto the butted rails. Connect the channels by overlapping the retention clip as shown below.
4. Channel(s) must overlap sleeve edges by 1/4" minimum.
5. Preheat evenly along both sides of the rail/channel area until this area begins to shrink. (Critical step)
6. Begin shrinking at the center of the sleeve and work all the way around the sleeve and toward each end.
7. Apply heat until the sleeve is completely shrunk and the green paint is completely converted to black.
8. Post heat the entire length, concentrating on the metal channel area. The post heat should be for 30 seconds after the sleeve is completely shrunk. A white line should be visible in the channel gaps indicating sufficient heating.
9. Look for adhesive flow at both ends of the sleeve.
10. The sleeve to cool before moving or placing in service.

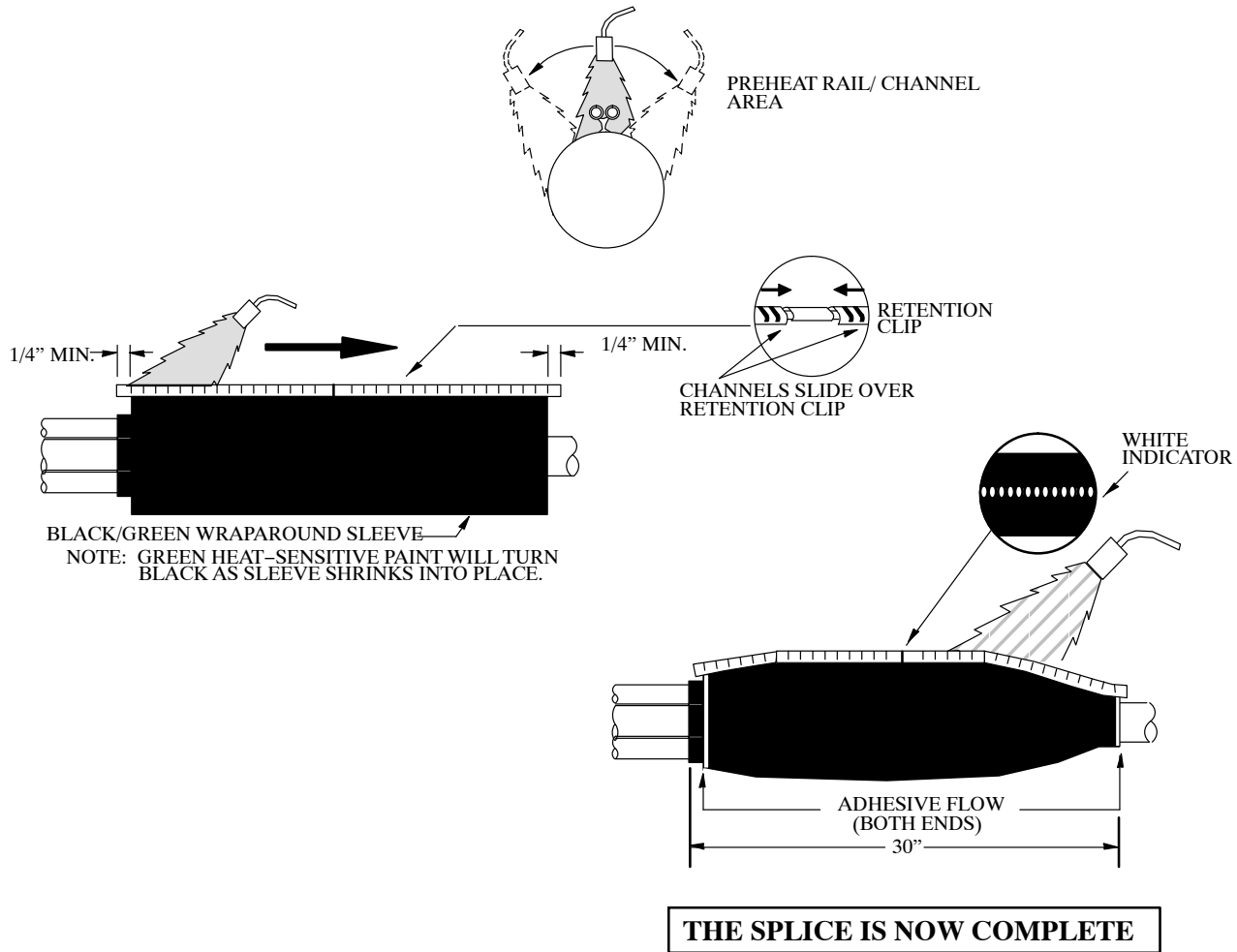
CABLE JOINT – TRIFURCATING TRANSITION SPLICE

5 kV, Non-Shielded, 3/C PILC To 3 1/C Solid Dielectric

800³ to 3-750 and 350³ to 3-350 and 4/0³ to 3-1/0

41 23 23 **

Sheet 6 of 6



	Std. / Stk. No.	Description	41 23 23 **	01	02	03
A	12 53 018	Tubing-H.S., 2.0" I.D. x 9" Long		3		
	12 53 078	Tubing-H.S., 1.5" I.D. x 9" Long			3	3
B	12 53 082	Tubing-H.S., 2.15" – 7.10" Range x 48" Long, Split Sleeve		1	1	1
C	17 55 300	Splice-Straight, 5kV, 350-750 kcmil		1	1	
	17 55 301	Splice-Straight, 5kV, #2-300 kcmil				1
D	12 53 080	Breakout Boot, 4.90-2.32" Cable, 2.00-1.00" Legs		2		
	12 53 081	Breakout Boot, 3.20-2.00" Cable, 1.45-0.75" Legs			2	2
E		Yellow SRM Strips		10	10	10
F		Sealant Strips		8	8	8
G	17 60 504	Sleeve-Compression 800 kcmil to 750 kcmil		3		
	17 60 359	Sleeve-Compression 350 kcmil			3	
	17 63 143	Sleeve-Compression 4/0 AWG to 1/0 AWG				3
		Operation Code 719		1	1	1

41 23 23 01 800 kcmil, 3C, PILC to 3-750 NSR

41 23 23 03 4/0 AWG, 3C, PILC to 3-1/0 NSR

41 23 23 02 350 kcmil, 3C, PILC to 3-350 NSR

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 3
REV. DATE: 06/29/10

CABLE JOINT-1C

Cold-Shrinkable Rubber Splice

1/0-750 Cu, Non-Shielded, 5kV

41 24 30 **

Sheet 1 of 1

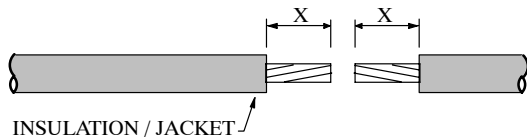


FIGURE 1

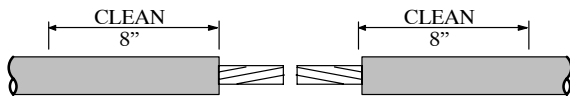


FIGURE 2

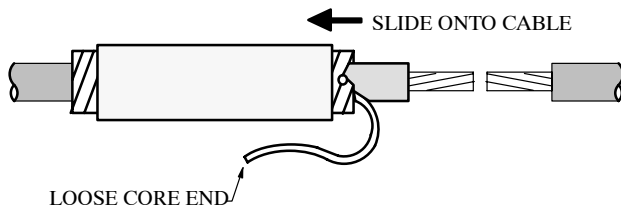


FIGURE 3

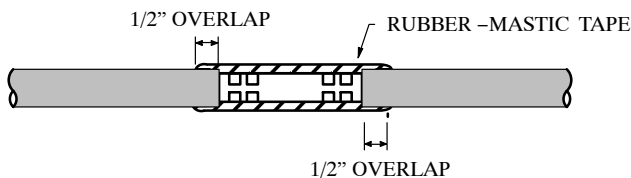


FIGURE 4

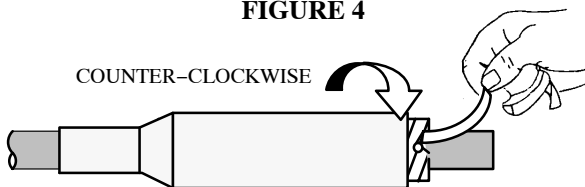


FIGURE 5

1. Remove the insulation/jacket as shown in Figure 1. "X" dimension is the insert depth of the connector being used.

NOTE: The connectors, used on 350 kcmil and 750 kcmil cables, shall not exceed a length of 6-1/4". The connector, used on 1/0 cable, shall not exceed a length of 4-1/2".

2. Clean the cable insulation/jacket with the cleaning pads provided. See Figure 2.
3. Slide cold shrink splice onto one of the cables. See Figure 3.
4. Install the 1/0 connector with a U-25RT die, install the 350 kcmil connector with a U-31RT die, and install the 750 kcmil connector with a P-39RT die. Make as many crimps as possible on each side of the connector. Do not overlap crimps.
5. Overwrap the installed connector with the rubber-mastic tape provided. Apply the tape with the mastic side in towards the connector. Use the tape to build up the thickness to the level of the cable insulation then overlap the tape 1/2" onto the insulation. **DO NOT** apply an excess amount of the rubber-mastic tape. See Figure 4.

NOTE: The rubber-mastic tape should be stretched during installation, so that its width is reduced to approximately 1-1/2" or less.

6. Center the splice over the connector area. Remove the core by unwinding counter-clockwise, starting with the loose core end. An occasional tug of the core strand while unwinding will aid in core removal. Splice is complete after the core is removed.

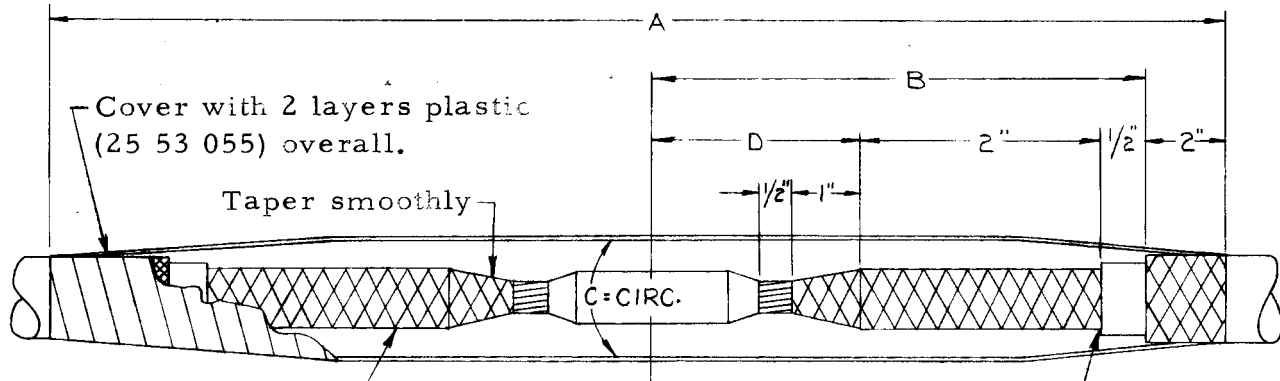
Std. / Stk. No.	Description	41 24 30 **	01	02	03
17 55 301	Splice, Straight, 5 kV, #2-300 kcmil (Kt)		1		
17 55 300	Splice, Straight, 5 kV, 350 kcmil-750 kcmil (Kt)			1	1
17 60 357	Sleeve, Compression, 1/0 (Ea)		3		
17 60 359	Sleeve, Compression, 350 kcmil (Ea)			3	
17 60 360	Sleeve, Compression, 750 kcmil (Ea)				3
	Operation Code 422		3	3	3

NOTE: QUANTITIES SHOWN ARE FOR MAKING THREE JOINTS.

CABLE - JOINTS
5kV 1/0 - 750 Single Cond.
Unshielded (N.S.) Jacketed

41 24 31 **

Sheet 1 of 1



Sand hatched areas so insulation is free of braid markings and jacket is free of glaze. Apply cement (49 01 066) to **sanded area**. Allow to dry before taping.

**When present
Step T.P. barrier.
Do not nick insulation.**

Conductor	Dimensions				Insulation Over Connector
	A	B	C	D	
1/0	14	5	3-3/4	2-1/2	.346 Mils
350	14-1/2	5-1/4	5	2-3/4	.370 Mils
750	15-1/2	5-3/4	6-1/2	3-1/4	.341 Mils

MATERIALS FOR THREE JOINTS		Size	1/0	350	750	Unit
Stk. No.	Description	41 24 31 **	01	02	03	
17 60 022	Connector - 1/0		3			Ea
17 60 045	Connector - 350			3		Ea
17 60 054	Connector - 750				3	Ea
22 02 273	Solder - 50-50		3	3	3	Lbs
49 01 066	Cement - Rubber		1	1	1	Cn
25 53 070	Tape - Rubber, HV		3	2	3	Roll
25 53 074	Tape - High Volt., 1-1/2" Wide			2	3	Roll
25 53 055	Tape - Plastic		1	2	2	Roll
22 05 213	Cloth - Sand		8	8	8	Ft.
22 02 255	Paste - Soldering		1	1	1	Cn.
418	Operation Code		3	3	3	

NOTE:

Kerite cable shown. Overall dimensions are the same for other cables without T.P. barriers.

CABLE – JOINTS

5kV Bare Neutral Rubber Concentric – Type Cable

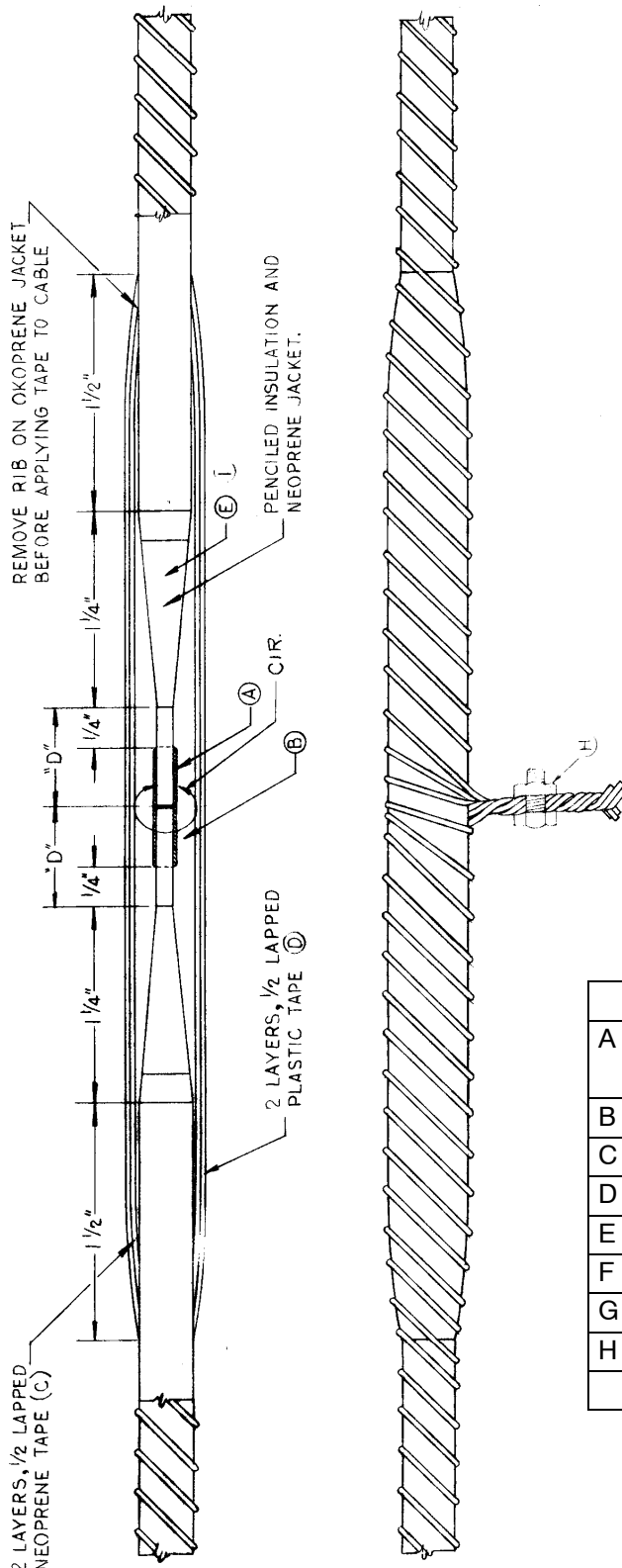
#6 Or #2 Single Conductor

41 24 32 **

Sheet 1 of 1

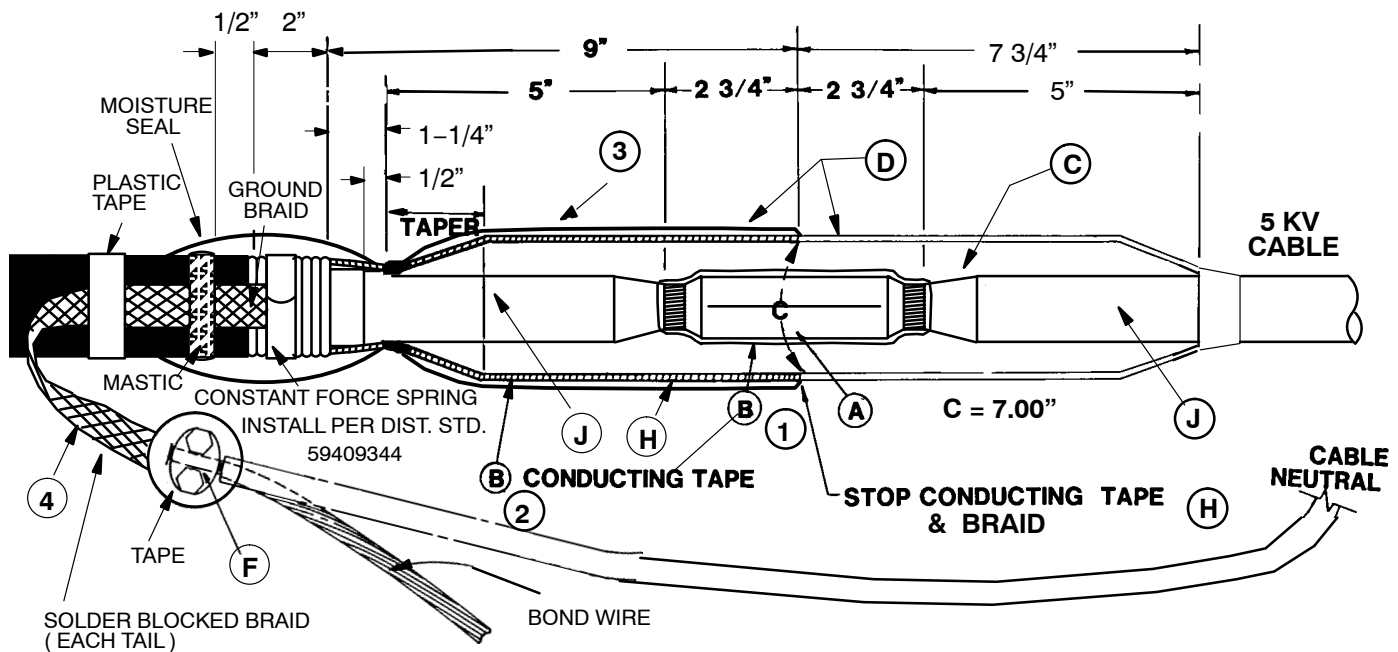
NOTE:

1. Rubber cement over connector, conductor, and surrounding insulation.



	Size Conductor	"D"	Circum.
41 24 32 01	#6	1"	3"
41 24 32 02	#2	1-1/4"	3-3/4"

	Stk. No.	Description	41 24 32 **	01	02
A	17 60 006	Sleeve – #6		1	
	17 60 273	Sleeve – #2			1
B	25 53 070	Tape – H.V. Rubber (RI.)		2	2
C	25 53 053	Tape – Neoprene (RI.)		1	1
D	25 53 055	Tape – Plastic		1	1
E	49 01 066	Cement – Rubber		1	1
F	22 02 275	Solder – String (Lb.)		1/10	1/10
G	22 05 213	Cloth – Sanding (Ft.)		1	1
H	17 54 182	Connector – #2		1	1
	417	Joint – Straight R.		1	1

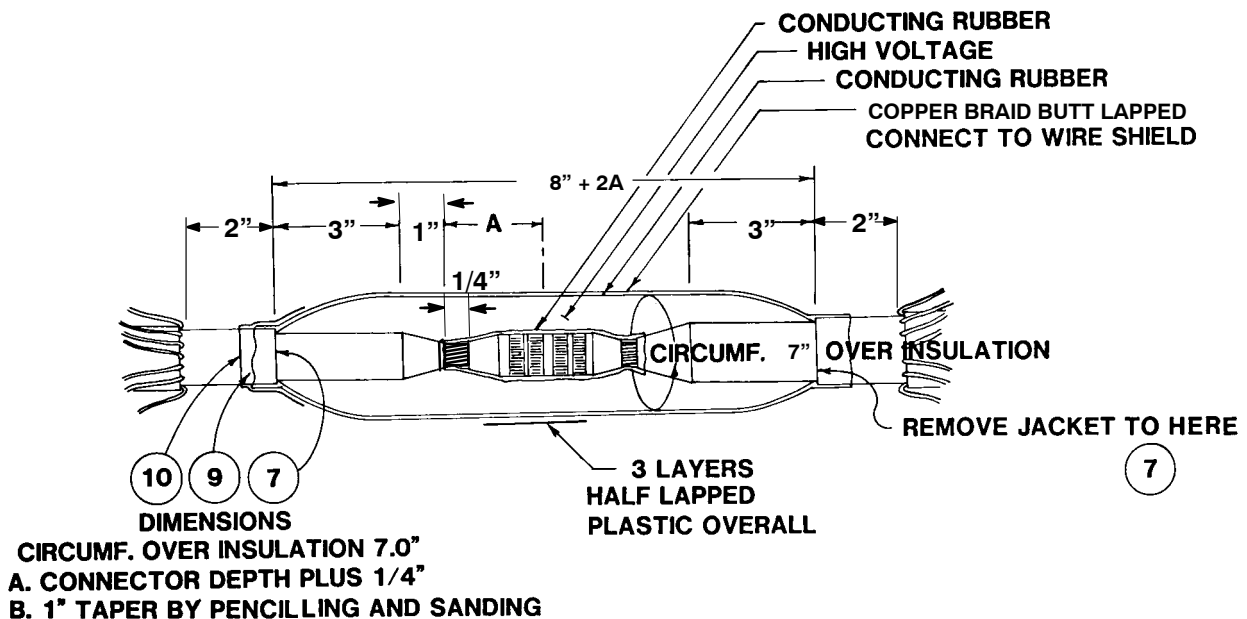


- ① Cover connector & bare copper strands with one half lapped layer of conducting rubber tape.
- ② Extend one half lapped layer of conducting rubber from the factory shielding halfway across the joint.
- ③ Prior to sealing, tape one layer of butt lapped copper braid from the metal LC shield to the center of the splice.
- ④ Exposed braid must be solder blocked or covered with a heat-shrinkable sleeve (Stk.# 12 53 079).

NOTES:

1. All taping half lapped.

	Std. / Stk. No.	Description	Qty.	
@	A	17 60 054	Connector - Split 750	3
	B	25 53 076	Tape - Rubber Conducting	1
	C	25 53 070	Tape - Rubber High Volt	4
	D	25 53 055	Tape - Plastic	2
	E	17 54 306	Connector - Cable Grounding, Constant Force Spring	1
	F	17 54 140	Connector - Two Bolt	1
	G	31 53 055	Compound - Sealer	As Req'd.
	H	18 66 101	Braid - Copper	1
	J	49 01 066	Cement - Adhesive	1
		418	Operation Code	1
				Solder Block Half Lapped 3 Layers Min.



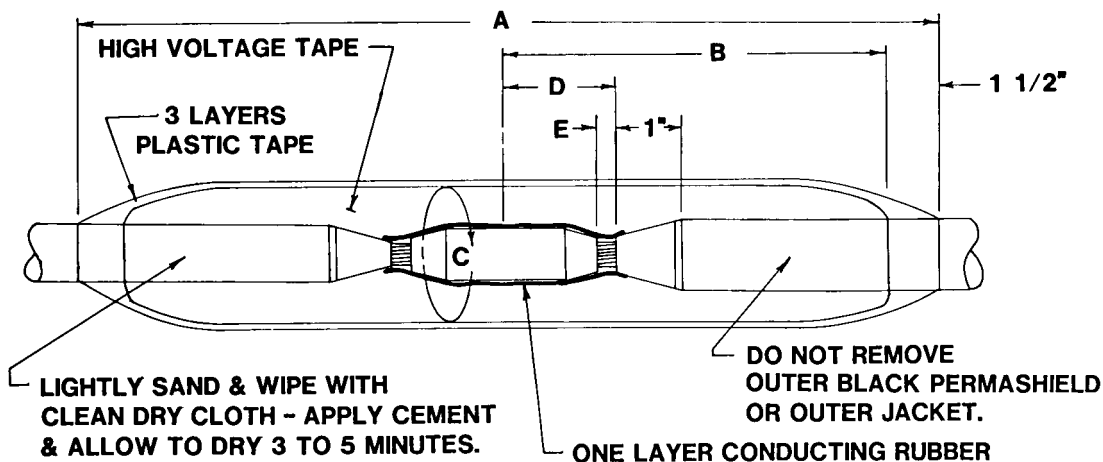
1. Pull drain wires thru the cable jacket 6" plus dimension A.
2. Strip each side to remove semi-con for 4 1/4" plus the depth of the connector.
3. Remove all of insulation from a length equal to the connector depth plus 1/4 inch. (Dimension "A")
4. For Dimension "B", taper the insulation to the conductor. Shave with a knife and sand to produce a smooth surface with sand cloth. Insure insulation is clean and free of contamination.
5. Crimp on connector. File out any excessive flashing. Prior to installing the connector, clean the exposed conductor with stainless steel wire brush. Use one of the stocked stainless steel wire brushes.
6. Cover connector, and bare strands with one layer of conducting rubber tape, half lap.
7. Fill in low spots with high voltage rubber tape (25 53 070) to produce a smooth area from the top of one pencil to the other.
8. Tape high voltage rubber tape in continuous half lapped passes from the edge of one stripped jacket completely across to the other. Shorten each pass to produce taper effect.
9. Tape to 7.0 inch circumference.
10. Tape one layer of conducting tape completely across splice (See No. 9 on sketch).
11. Cover joint with one layer butt lapped copper braid.
12. Cover entire splice with 3 layers of plastic tape, half lapped.
13. Connect wire shield across splice with copper connector (split bolt).
14. Seal jacket cut offs per Dist. Std. 59 40 90 14.

	Std. / Stk. No.	Description		
	17 60 055	Connector – 1000 kcmil	1	Ea
	25 53 076	Tape – Conducting	3	Rls
	25 53 070	Tape – Insul. High Volt	6	Rls
	18 66 101	Braid – Copper	2	Rls
	25 53 055	Tape – Plastic	2	Rls
	22 05 213	Cloth – Sanding	4	Ft
	17 54 182	Connector – Split Bolt	1	Ea
		Operation Code 418	1	

CABLE - JOINT
5 kV 1/0 - 1000 Single Cond.
Non - Shielded Cable

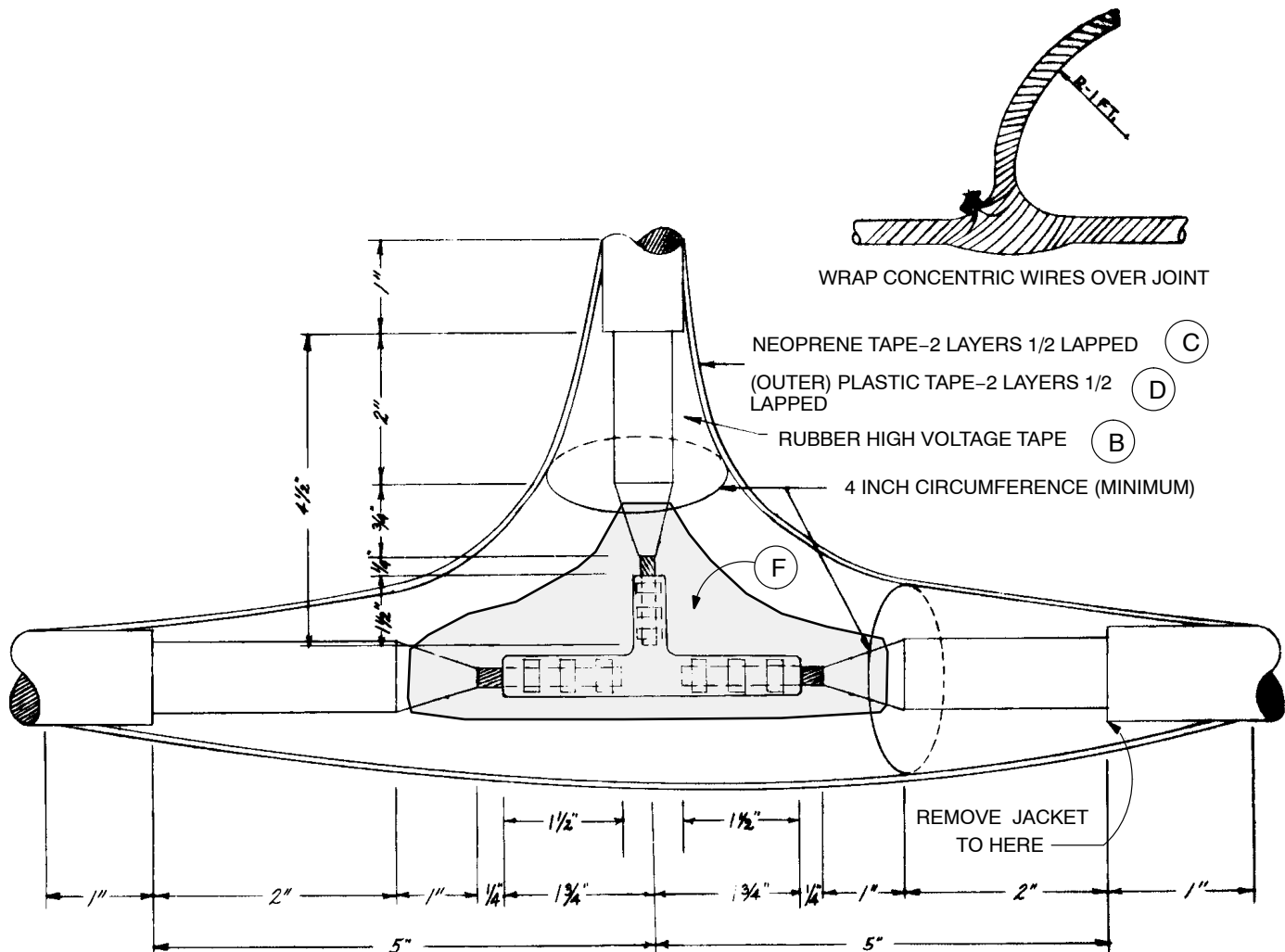
41 24 35 **

Sheet 1 of 1



DIMENSIONS IN INCHES						INSULATION OVER CON- NECTOR SHIELD
Conductor	A	B	C	D	E	
1/0 AWG	14	5-1/2	4	2	1/2	.346" +.040
4/0 AWG	14	5-1/2	4-3/4	1-3/4	1/2	.360" +.040
350 kcmil	14-1/2	5-3/4	5-1/2	1-3/4	1/2	.375" +.040
500 kcmil	15	6	6-1/4	2	1/2	.345" +.040
750 kcmil	15-1/2	6-1/4	6-1/2	2-1/2	3/4	.341" +.040
1000 kcmil	17	7	7-1/2	3	3/4	.367" +.040

Std. / Stk. No.	Description	41 24 35 **	01	02	04	05	06	07	
17 60 022	Connector - 1/0		3						EA
17 60 036	Connector - 4/0			3					EA
17 60 045	Connector - 350				3				EA
17 60 052	Connector - 500					3			EA
17 60 054	Connector - 750						3		EA
17 60 055	Connector - 1000							3	EA
49 01 066	Cement - Rubber		1	1	1	1	1	1	CN
25 53 070	Tape - Rub. High Volt1"		3	3	2	3	4	4	RL
25 53 074	Tape - Rub., High Volt 1-1/2"				2	2	4	4	RL
22 05 213	Cloth - Sanding		6	6	8	8	8	8	FT
22 02 255	Paste - Soldering		1	1	1	1	2	2	CN
25 53 076	Tape - Rub, Conducting		1	1	1	1	1	1	RL
25 53 055	Tape - Plastic		1	1	2	2	3	3	RL
418	Operation Code		3	3	3	3	3	3	



INSTRUCTIONS FOR "T" JOINT

1. Cut each cable one foot longer than needed to obtain proper training.
2. Measure 13-1/2" back and apply several wraps of friction tape around cable and concentric wires. Untwist strands and train out of the way. To be re-wrapped later.
3. Cut 12" off the end of each of the cables. The cables should be trained so that the "T" tap cable trains down from above the joint at no less than one foot radius bend.
4. Remove insulation and jacketing to the dimensions shown.* (Pencil after installing connector).
5. Install connector using the J groove for #6 and the X groove for #2 Nicopress sleeves.
6. Pencil the insulation and roughen jacket and insulation with sanding cloth. Wipe clean with approved solvent.
7. Apply rubber cement over the entire joint and allow to dry. Apply sealing compound as shown. Tape with high voltage rubber tape obtaining a uniform covering of the desired thickness.
8. Apply two half lapped layers of neoprene tape over the joint and cover this with two half lapped layers of plastic.
9. Twist concentric wires back over the joint connecting the ends with a split bolt connector. Protect this connector with air seal and plastic tape.

NOTE:

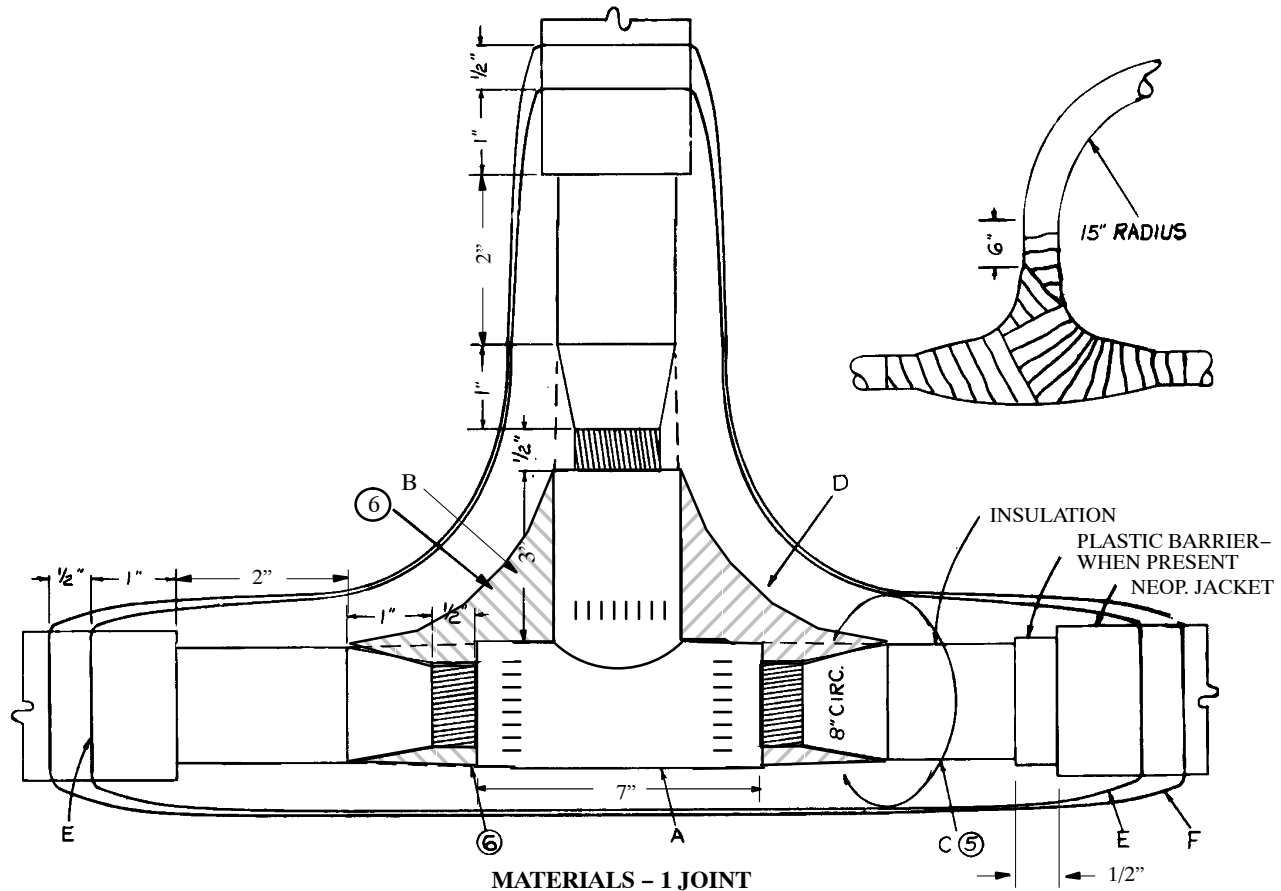
In constructing joints on the other phases, stagger as necessary to obtain proper training. * If jacket is tight on the insulation, it may be treated as a part of the insulation; however, any indentations made by the concentric neutral must be sanded out.

CABLE-JOINTS
5 kV
T – #2 With #6 or #2 Tap

41 25 31 **

Sheet 2 of 2

		Std. / Stk. No.	Description	41 25 31 **		01	02
						Qty.	
	A	17 54 223	Connector – #2 to #2	1			
		17 54 222	Connector – #2 to #6			1	
	B	25 53 070	Tape – H.V. Rubber	2		2	
	C	25 53 053	Tape – Rubber, Moisture Proofing	1		1	
	D	25 53 055	Tape – Plastic	1		1	
	E	49 01 066	Cement – Rubber	1		1	
	F	31 53 055	Compound – Sealing, Cable	1		1	
		419	Operation Code	1		1	



INSTRUCTIONS

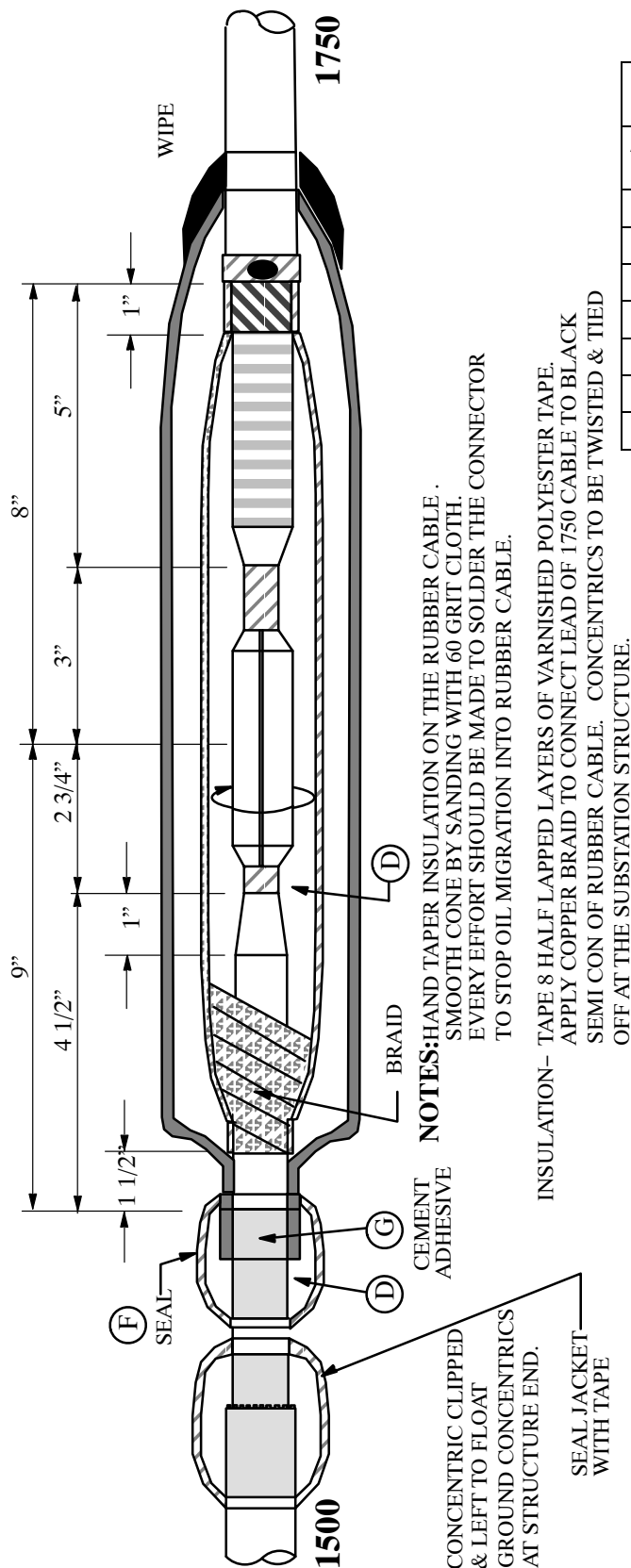
1. Train cables into position maintaining bending radius and cut cable.
2. Strip off 6 1/2" of neoprene jacket on the mains and 5 1/2" of the neo jacket on the tap cable. Do not disturb plastic barrier. Strip down to the conductor 3 1/2" on the mains & 2 1/2" on the tap cable.
3. Pencil off 1" of insulation and remove plastic barrier as shown.
4. Crimp on connector smoothing with sanding cloth and roughen jacket, poly barrier and rubber insulation.
5. Wipe clean and paint exposed plastic, rubber and jacket with cement.
6. Tape pencilled slopes to level and work sealing compound into crotches.
7. Tape to circumference with high voltage tape. Apply first layers with limited tension. Remaining layers tightly stretched.
8. Cover joint with one layer of halflapped neoprene tape.
9. Finish joint with two layers of plastic tape, tightly stretched, & finish with one moderately stretched layer.

	Std. / Stk. No.	Description	Qty.
A	17 54 239	Connector-Cable, T	1
B	31 53 055	Compound - Sealing, Cable	1
C	49 01 066	Cement, Rubber	1
D	25 53 074	Tape-Rubber, H.V.	4
E	25 53 053	Tape-Rubber, Moisture Proofing, 3/4"	2
F	25 53 055	Tape-Plastic, 3/4"	2
	743	Operation Code	1

CABLE – JOINT
5kV
1750 PILC to 1500 Rubber

41 27 01 00

Sheet 1 of 1



	Std. / Stk. No.	Description Materials – 1 – Joint		
A	17 60 057	Connector–1500 kcmil, Split, Sol- dered	1	Ea
B	12 53 062	Sleeve–Lead 3–1/2 x 20” Long	1	EA
C	25 53 063	Tape–Varnish Polyester	1	CN
D	25 53 070	Tape–Rubber High Voltage	1	RL
E	18 66 101	Braid–Copper, 1” Wide	1	RL
F	25 53 055	Tape–Plastic, PVC	1	RL
G	49 01 066	Cement–Adhesive Rubber & Poly	1	CN
H	31 51 049	Compound–Insulating, Joint	1	CN

			JOINT STANDARD NUMBERS					
Std. No.	Description OPERATION CODE	41 31 **	11 00	12 01	12 02	12 03	12 04	12 05
			759	724				
12 53 062	Sleeve–Lead, 3–1/2” x 20”			1				
12 53 063	Sleeve–Lead, 4” x 21”				1			
12 53 064	Sleeve–Lead, 4–1/2” x 22”					1	1	
12 53 065	Sleeve–Lead, 5” x 24”							1
12 53 052	Sleeve–Lead, 5–1/2” x 28”		1					
12 53 061	Sleeve–Lead, 7–1/2” x 36”							
17 60 022	Connector–Copper, 1/0 AWG			3				
17 60 036	Connector–Copper, 4/0 AWG				3			
17 60 045	Connector–Copper, 350 kcmil					3	3	
17 60 052	Connector–Copper, 500 kcmil							3
17 60 054	Connector–Copper, 750 kcmil							
17 60 069	Connector–Copper, 800 kcmil		3					
17 60 057	Connector–Copper, 1500 (1750) kcmil							
22 02 282	Solder–Wiping (Lb.)		12	12*	12*	12*	12*	12*
22 02 273	Solder–50–50 (Lb.)		3	3*	3*	3*	3*	3*
22 02 276	Solder–String, 1/4” (Lb.)		1	1*	1*	1*	1*	1*
22 02 255	Solder–Paste (Cn.)		1	1*	1*	1*	1*	1*
25 53 022	Tape–V.P., 1” x 8 Yd. (Rl.)		1			1*	2*	2*
25 53 053	Tape–Neoprene, 3/4” x 30’ Rl.							
25 53 071	Tape–Silicone Rubber (Rl.)							
25 53 076	Tape–Rubber, Conducting 3/4” x 15’							
31 53 007	Stearine (Pk.)		1	1*	1*	1*	1*	1*
22 05 213	Cloth–Sanding, 1–1/2” W(Ft.)		4	2*	2*	2*	2*	2*
31 51 062	Petrolatum – 3 Lb. Pkg. (Pk.)		3	3	3	3	3	3
18 66 101	Braid–Copper Mesh, 1” x 15’ Rl.		3	3*	3*	3*	3*	3*
17 63 129	Disc–Tinned Copper, 1/32” x .75” dia. ¹							
12 53 071	Plate–End, 5.5” I.D. x 1.75” ¹							
UNIT SPLICE STOCK NO. 17–62–			None	022 ⁵	022 ⁵	022 ⁵	022 ⁵	022 ⁵

CABLE – JOINTS

15kV

Joint Materials – Lead Covered Cable**41 30 00 00**

Sheet 2 of 3

		JOINT STANDARD NUMBERS				
Std. No.	Description OPERATION CODE	41 32 **	11 01	11 02	11 03	12 00
			725			726
12 53 062	Sleeve–Lead, 3–1/2" x 20"					
12 53 063	Sleeve–Lead, 4" x 21"		1			
12 53 064	Sleeve–Lead, 4–1/2" x 22"					
12 53 065	Sleeve–Lead, 5" x 24"			1		
12 53 052	Sleeve–Lead, 5–1/2" x 28"		1		1	
12 53 061	Sleeve–Lead, 7–1/2" x 36"					1
17 60 022	Connector–Copper, 1/0 AWG		3			
17 60 036	Connector–Copper, 4/0 AWG		3	3		
17 60 045	Connector–Copper, 350 kcmil			5	3	
17 60 052	Connector–Copper, 500 kcmil					3
17 60 054	Connector–Copper, 750 kcmil				3	
17 60 069	Connector–Copper, 800 kcmil					1
17 60 057	Connector–Copper, 1500 (1750) kcmil					3
22 02 282	Solder–Wiping (Lb.)		12*	12*	12*	12
22 02 273	Solder–50–50 (Lb.)		3*	3*	3*	3
22 02 276	Solder–String, 1/4" (Lb.)		1*	1*	1*	1
22 02 255	Solder–Paste (Cn.)		1*	1*	1*	1
25 53 022	Tape–V.P., 1" x 8 Yd. (Rl.)		1*	2*	2*	2
25 53 053	Tape–Neoprene, 3/4" x 30' Rl.					
25 53 071	Tape–Silicone Rubber (Rl.)					
25 53 076	Tape–Rubber, Conducting 3/4" x 15'					
31 53 007	Stearine (Ea.)		1*	1*	1*	1
22 05 213	Cloth–Sanding, 1–1/2" W(Ft.)		2*	2*	2*	2
31 53 028	Compound–Insul. Oil Insol.		1	1	1	2
18 66 101	Braid–Copper Mesh, 1" x 15' Rl.		3*	3*	3*	2
17 63 129	Disc–Tinned Copper, 1/32" x .75" dia. ¹					
12 53 071	Plate–End, 5.5" I.D. x 1.75" ¹					
UNIT SPLICE STOCK NO. 17–62–			022 ⁵	022 ⁵	022 ⁵	None

		JOINT STANDARD NUMBERS							
Std. No.	Description OPERATION CODE	41 36 **	11 01	11 02	11 03	11 04	11 05	11 06	11 07
		435							
12 53 062	Sleeve–Lead, 3–1/2” x 20”		1						
12 53 063	Sleeve–Lead, 4” x 21”			1					
12 53 064	Sleeve–Lead, 4–1/2” x 22”				1	1	1		
12 53 065	Sleeve–Lead, 5” x 24”							1	
12 53 052	Sleeve–Lead, 5–1/2” x 28”								1
12 53 061	Sleeve–Lead, 7–1/2” x 36”								
17 60 022	Connector–Copper, 1/0 AWG								
17 60 036	Connector–Copper, 4/0 AWG								
17 60 045	Connector–Copper, 350 kcmil								
17 60 052	Connector–Copper, 500 kcmil								
17 60 054	Connector–Copper, 750 kcmil								
17 60 069	Connector–Copper, 800 kcmil								
17 60 057	Connector–Copper, 1500 (1750) kcmil								
22 02 282	Solder–Wiping (Lb.)		12	12	12	12	12	12	12
22 02 273	Solder–50–50 (Lb.)		2	2	2	2	2	2	2
22 02 276	Solder–String, 1/4” (Lb.)		1	1	1	1	1	1	1
22 02 255	Solder–Paste (Cn.)		1	1	1	1	1	1	1
25 53 022	Tape–V.P., 1” x 8 Yd. (Rl.)		1	1	1	1	1	1	1
25 53 053	Tape–Neoprene, 3/4” x 30’ Rl.								
25 53 071	Tape–Silicone Rubber (Rl.)								
25 53 076	Tape–Rubber, Conducting 3/4” x 15’								
31 53 007	Stearine (Ea.)		1	1	1	1	1	1	1
22 05 213	Cloth–Sanding, 1–1/2” W(Ft.)		2	2	2	2	2	2	2
31 51 062	Petrolatum – 3 Lb. Pkg. (Pk.)		1	1	1	1	1	1	1
18 66 101	Braid–Copper Mesh, 1” x 15’ Rl.		3	3	3	3	3	3	3
17 63 129	Disc–Tinned Copper, 1/32” x .75” dia. ¹								
12 53 071	Plate–End, 5.5” I.D. x 1.75” ¹								
UNIT SPLICE STOCK NO.		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE

Notes:

** means material included in unit splice shown at bottom of column.

¹ Made by Utility Shop.

⁵ Stocked at Storeroom 75.

Unless otherwise noted, Petrolatum is referred to as "Compound" and "Oil Insoluble Compound" or "Insulating Compound" in the standard drawings.

CABLE JOINT – TRIFURCATING TRANSITION SPLICE

15 kV, 3/C PILC To 3 1/C Extruded Solid Dielectric

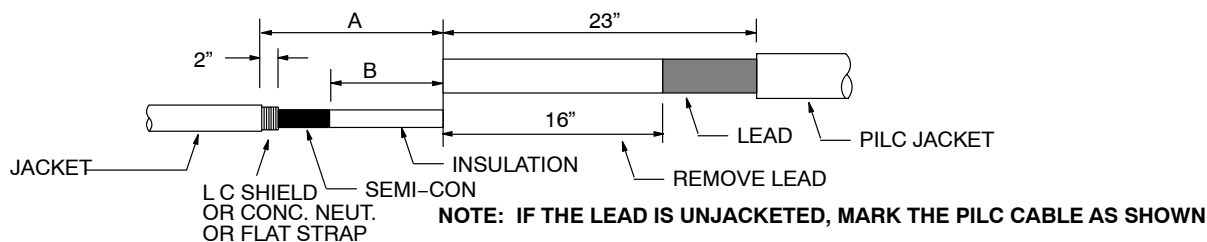
Raychem Heat-Shrinkable

41 33 22 **
Sheet 1 of 10

I GENERAL INSTRUCTIONS

1. Adjust the flame so that it is an overall 12-inch bushy flame.
2. Apply outer 3- to 4- inch tip of the flame to heat-shrinkable material with a rapid brushing motion.
3. Unless otherwise instructed start shrinking tubes at the center working the flame around all sides of the tubes to apply uniform heat.
4. Concentrate on heating the back of the tubes as well as the front of the tubes.
5. If it is necessary to interrupt the shrinking process and the tubes cool, you must reheat prior to shrinking the next tube.
6. Inspect all installed tubes. Reheat any flat spots or wrinkles, paying particular attention to the back of the splice.

II PREPARE CABLES

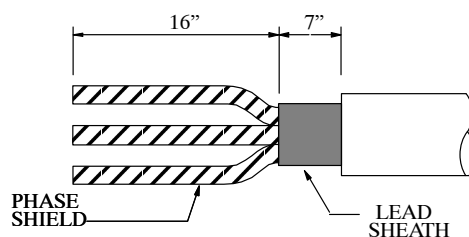


CABLE SIZES	A	B
1/0 ³ – 4/0 ³ PILC TO 3-#2, 3-1/0, OR 3-4/0	10"	5"
350 ³ PILC TO 3-350, OR 3-4/0	12"	5-1/2"
800 ³ PILC TO 3-750	12"	5-1/2"

SECURE END OF FLAT STRAP, CONCENTRIC NEUTRAL, OR LC SHIELD WITH A LENGTH OF COPPER FOIL TAPE OR MINIMAL WIDTH WRAP OF PLASTIC TAPE.

III PREPARE AND REMOVE LEAD SHEATH

Remove lead oxide from the lead sheath and clean with an approved solvent. Remove the lead sheath as shown.



NOTE: FOR PHASE HOLDING

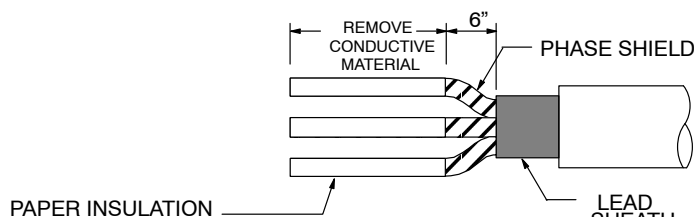
If an existing 3/C PILC cable is being cut and spliced to three new single conductor cables, "Phase Holding" may be required. After opening the lead sheath to expose the shielded phase conductors, place several wraps of colored tape around each phase before cutting the conductors. Use "white" to signify the "Held Phase A", blue to signify the "Held Phase B" and "red" to signify the "Held Phase C". The phase colors do not identify the actual phases but they represent the "Held Phase" of the system.

Due to the covering of the phases during the preparation of the splice, it will be necessary to move the markers several times throughout the splicing process. Each time the "Phase Holding" tape is to be moved to a new location, "Phase Holding" will be noted in the installation instructions.

If "Phase Holding" is not a requirement for this splice, then the "Phase Holding" comments should be ignored.

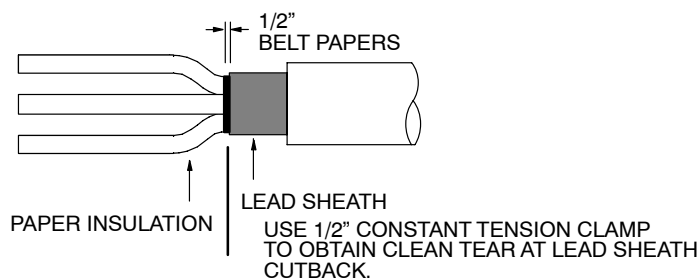
IV REMOVE SHIELD

1. Cut back any bedding and/or shield tapes over all three phases to the lead sheath cutback.
2. Cut back phase shields and remove any conductive material from paper insulation as shown.



NOTE: TAPE PHASE SHIELDS AT EDGE TO PREVENT UNWRAPPING. DO NOT USE STRING.
USE ONE WRAP OF COLORED "PHASE HOLDING" TAPE OR PLASTIC TAPE.

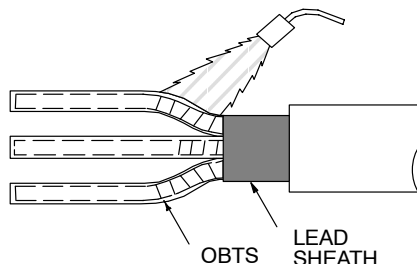
IF BELTED PILC CABLE
REMOVE BELT PAPERS AS SHOWN



V POSITION AND SHRINK OIL BARRIER TUBES (OBT)

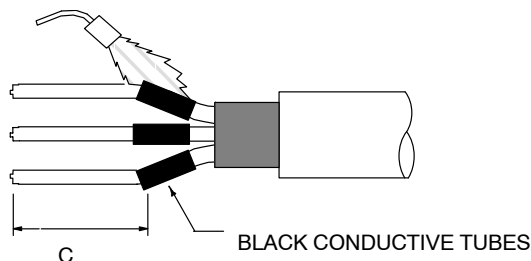
1. Place an oil barrier tube over each phase, butted to the lead sheath cutback.
2. Shrink the OBT's in the crotch area first. After the crotch is done, shrink one tube at a time.
3. Inspect the installed OBT's. The OBT's should have a smooth, wrinkle-free surface after shrinking. Reheat to smooth any wrinkled areas.

NOTES:
(A) OBT MAY SHRINK 1/4 – 1/2" AWAY FROM LEAD SHEATH CUTBACK. THIS IS OK.
(B) TO ACHIEVE A SMOOTH, WRINKLE-FREE INSTALLATION, USE A REDUCED FLAME TO INSTALL THE THIN-WALLED OBT'S.



Phase Holding: Wrap a layer of "Phase Holding" tape to the connection end of the OBT before positioning and shrinking the Black Conductive Tubes.

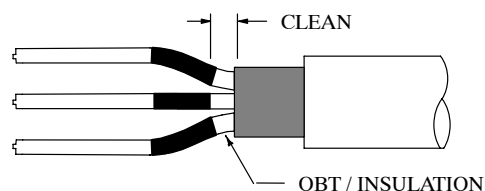
VI POSITION AND SHRINK BLACK CONDUCTIVE TUBES



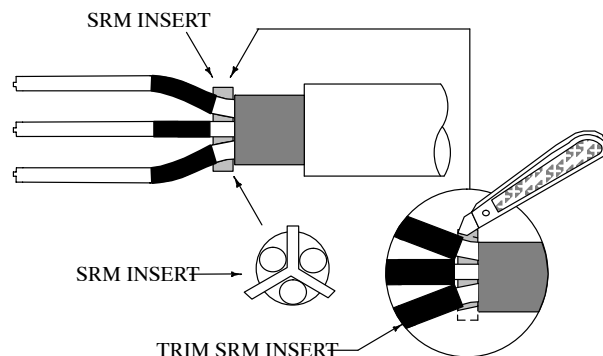
1. Place a black conductive tube over each phase and position as shown.
2. Shrink the tubes in place starting at the end nearest to the center of the splice.

CABLE SIZES	C
1/0 ³ and 4/0 ³ PILC	6"
350 ³ and 800 ³ PILC	6-1/2"

VII CLEAN OBTS AND INSTALL SRM INSERT



1. Using an approved solvent, clean the OBT/in-sulation, as shown.

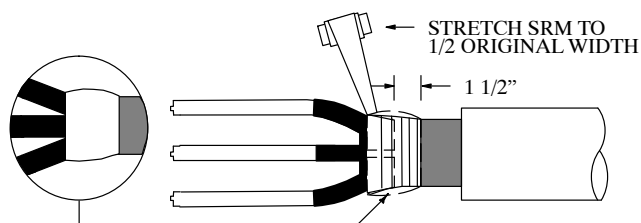


2. Assemble SRM insert per box instructions.
3. Spread the phases and position the SRM insert as shown

NOTE: THE SRM INSERT IS PACKAGED INSIDE THE CONDUCTIVE BREAKOUT.

4. Trim SRM insert to extend 1/8" beyond each phase.
5. Reclean the lead sheath using an approved solvent.

VIII INSTALL OIL SEAL

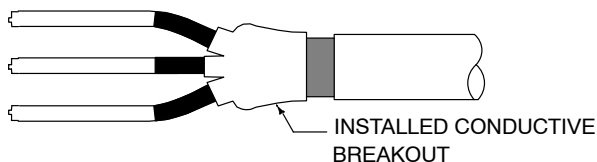


NOTES: (A) THE SRM WILL STICK BETTER IF THE LEAD SHEATH IS PRE-HEATED.

(B) DO NOT OVER APPLY SRM, THE FINISHED DIAMETER MUST NOT EXCEED THAT OF THE BREAKOUT BOOT.

1. Mark the lead sheath 1-1/2" from the end.
2. Remove the backing from one side of a long strip of SRM. Roll the SRM and remaining backing strip into a convenient size.
3. While removing the remaining backing strip, tightly wrap the SRM from the mark on the lead sheath to the outer edge of the SRM insert.
4. Four to six strips of SRM should be used to build the SRM to the shape shown.

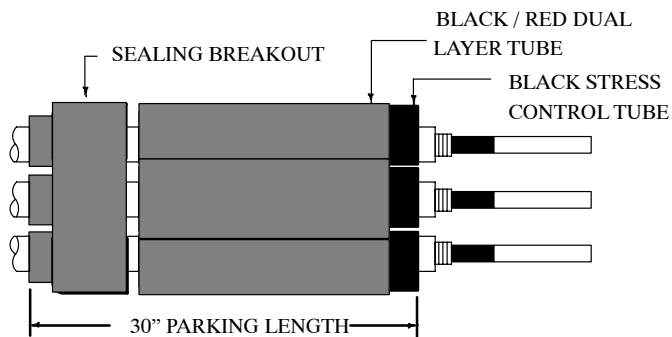
IX POSITION AND SHRINK CONDUCTIVE BREAKOUT



1. Position the conductive breakout over the SRM so that the inside butts up hard against the SRM.
2. Shrink the conductive breakout in place starting at the fingers and working toward the other end.
3. After the breakout has shrunk continue to apply heat until the breakout has a smooth, uniform surface.

Phase Holding: After breakout is cool, apply "Phase Holding" tape to the fingers of the cable breakout (last and final location for "Phase Holding" tape).

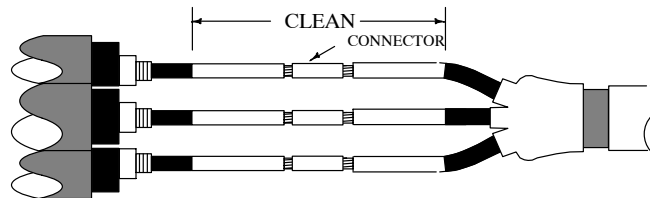
X POSITION SPLICE COMPONENTS ON SOLID DIELECTRIC CABLES



1. Clean 30" of cable jacket.
2. Place sealing breakout over the cables with the fingers pointing away from the splice center.
3. Place one set of nested tubes over each clean cable.

XI REMOVE INSULATION AND INSTALL CONNECTORS

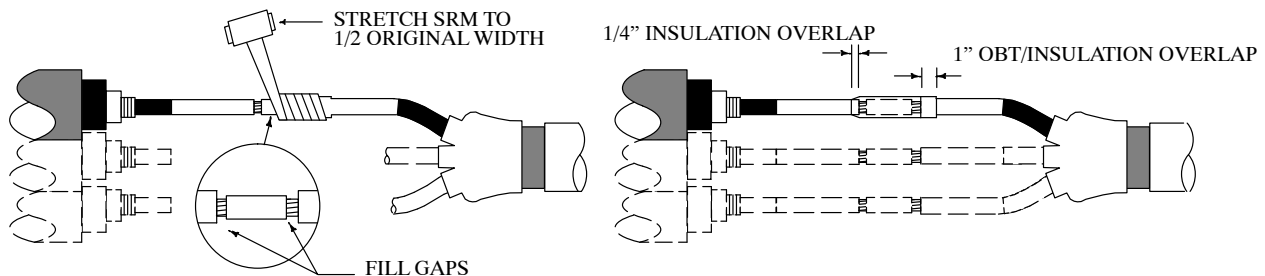
1. Determine the insert depth of the connector.
2. The insulation cutback should equal the connector insert depth plus 1/4".
3. Install the connectors. Protect the OBTS, if using soldered connector by wrapping them with cotton or glass fiber tape.
4. Make sure connections are smooth.
5. Using an approved solvent, clean the insulation as shown. Pay particular attention to the OBT/insulation surface.



XII APPLY SRM OVER CONNECTOR

NOTE: Complete Steps XII and XIII working on one phase at a time.

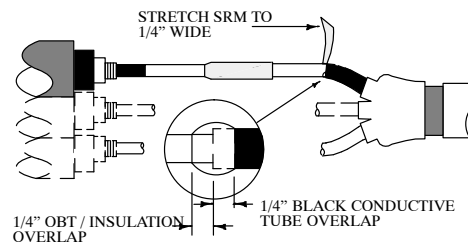
1. Remove backing from one side of a long strip of SRM, roll the SRM and remaining backing strip into a convenient size.
2. While removing the remaining backing strip, tightly wrap the SRM around the connector and exposed conductor. Be sure to fill the gaps and low spots around the connector.
3. Continue to wrap the SRM onto the insulation as shown.



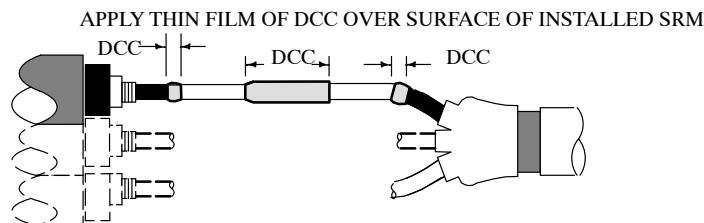
NOTE: IF THE CONNECTOR DIAMETER IS LARGER THAN THE INSULATION DIAMETER, APPLY TWO HALF-LAPPED LAYERS OF SRM OVER THE ENTIRE CONNECTION.

XIII APPLY SRM AT BLACK CONDUCTIVE TUBE AND SEMI-CON STEPS, APPLY DISCHARGE CONTROL COMPOUND, AND THEN POSITION BLACK STRESS CONTROL TUBE

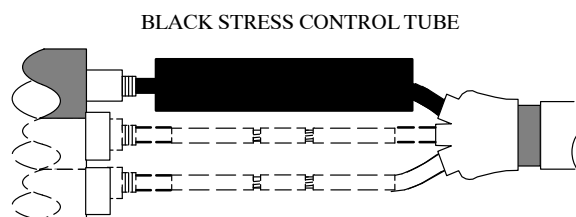
1. Remove the backing from the short angle-cut piece of SRM. Place the tip of SRM at the black conductive tube step and tightly wrap to fill the step. Overlap black conductive tube and OBT/insulation and taper as shown.
2. Repeat the above procedure for the semi-con step.



3. Snip open the end of the DCC tube and apply a thin film of compound on the SRM over the connector and semi-con steps.



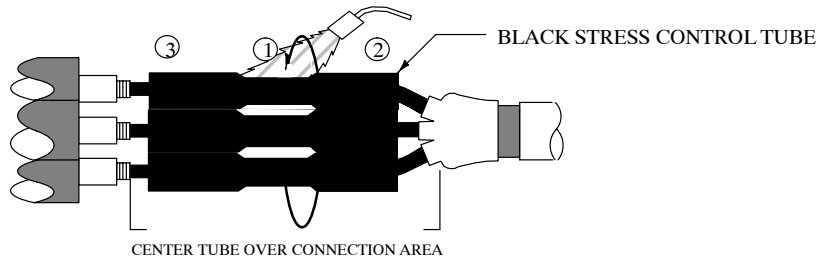
4. Center the black stress control tube over the completed connector area. Be sure to equally overlap the semi-con and the black conductive tube.



COMPLETE STEPS XII AND XIII FOR THE REMAINING TWO PHASES BEFORE PROCEEDING TO STEP XIV.

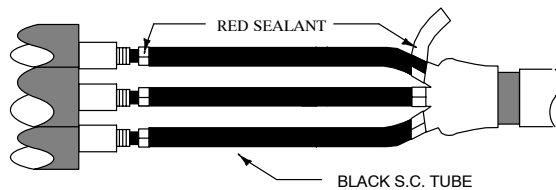
XIV SHRINK BLACK STRESS CONTROL TUBES

1. Make sure that each tube is centered over the connection area, equally overlapping the semi-con and black conductive tube.
2. Shrink all three tubes in place at the same time.
3. Begin shrinking at center of tubes (1), working torch with a smooth brushing motion around the tubes.
4. After center portions shrink, work torch toward one end (2), then to opposite end (3). Post heat all tubes.
5. Apply sufficient heat to ensure softening of the SRM, indicated by a smooth surface profile.



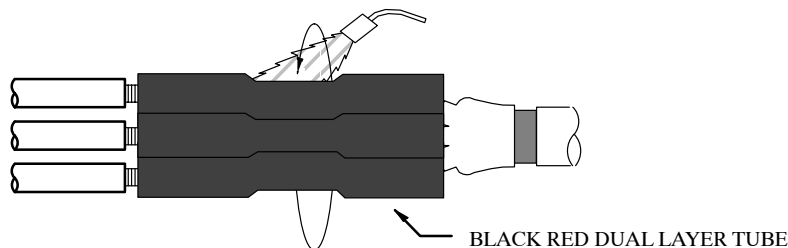
XV APPLY RED SEALANT

1. Remove backing from red sealant.
2. Using light tension, wrap sealant over the cable and butt against the black stress control tube as shown.
3. Build the sealant to the level of the black stress control tube.

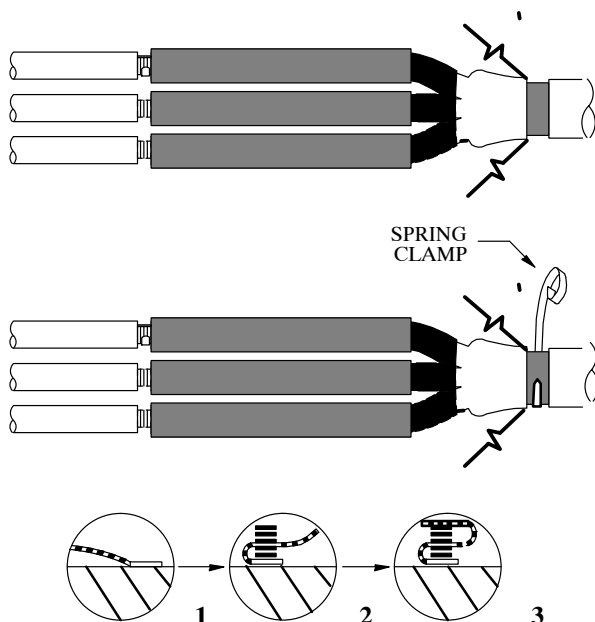


XVI POSITION AND SHRINK BLACK/RED DUAL LAYER TUBES

1. Center the tubes over the black stress control tubes.
2. Shrink in place using the method described in XIV except stop shrinking 5" from each end. Then shrink each end.
3. After initial shrinking, heat the entire tubes for approximately 1 minute. The raised ridges should disappear. Absence of ridges can be observed by visual inspection and by feeling the surface with a gloved hand.



XVII INSTALL GROUND LEADS TO PILC CABLE

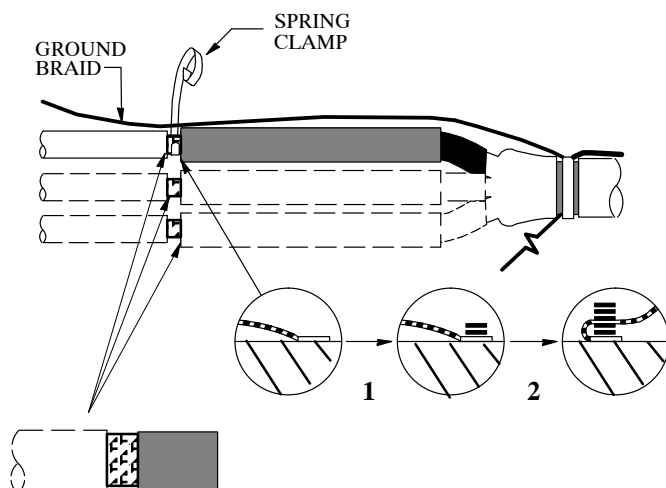


NOTE:

There are three (3) long braids provided with this kit. One end of the braid has a short length of heat shrink tube installed next to a 2" wide solder block. This is the end of the braid which will be positioned over the jacket for external grounding.

1. Wrap three layers of 2" wide copper mesh around the cleaned lead sheath on the 3/C PILC side of the joint. Tie off with a half hitch or equivalent knot.
2. Lay the three (3) braids across the joint evenly spaced around the joint circumference so that the braids overlap the mesh and the solder block is positioned over the jacket and aligned with the cable jacket cutback. Temporarily tape the braids into position.
3. (1) Wrap two turns of the LARGE spring clamp OVER the three (3) braids and mesh. (2) Fold the long end of the braid back over the spring clamp and wrap two additional turns. (3) Fold long end one more time over the spring clamp and complete wrapping the spring clamp over the braid. (The long end of the braid should be going across the splice at this time.)

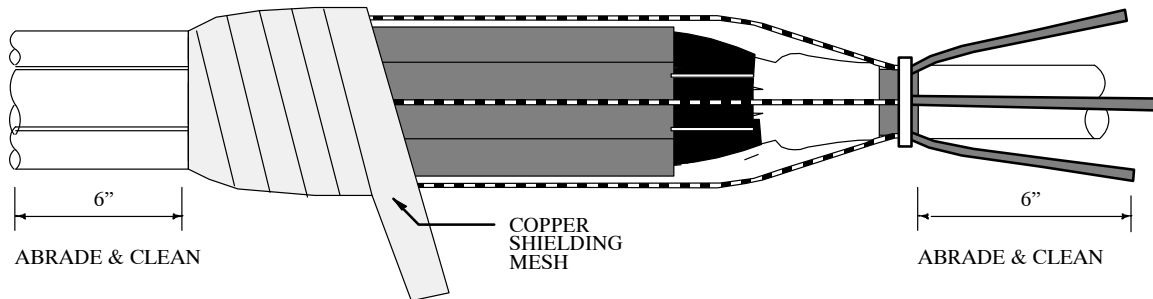
XVIII INSTALL GROUND LEADS TO METALLIC SHIELDS



1. Wrap three layers of 2" wide copper mesh around the metallic shields of the solid dielectric cable and tie off with a half hitch or equivalent knot. (Wrap around flat strap, concentric wires or LC Shield.)
2. (1) Lay braid directly over the mesh. (2) Wrap two turns of the SMALL spring clamp OVER the braid and mesh. (3) Fold back the braid over the spring clamp and complete wrapping the spring clamp over the braid. (Excess braid should be going across the splice at this time.) Excess braid may be cut off or left over the splice.
3. Repeat this step for remaining phases until all three phases are completed.

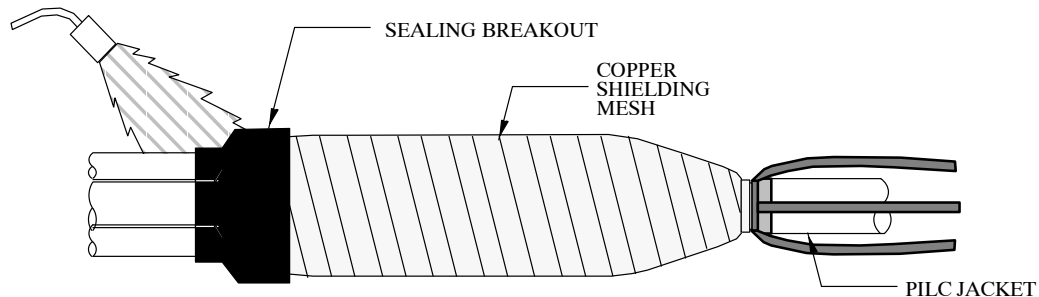
XIX APPLY SHIELDING MESH

1. Starting over the ground connections on the extruded solid dielectric cable side of the splice, wrap one half-lapped layer of 2" wide shielding mesh across the splice and tie off to the PILC cable lead sheath.
2. Abrade and solvent clean the cable jackets (or lead sheath) as shown.



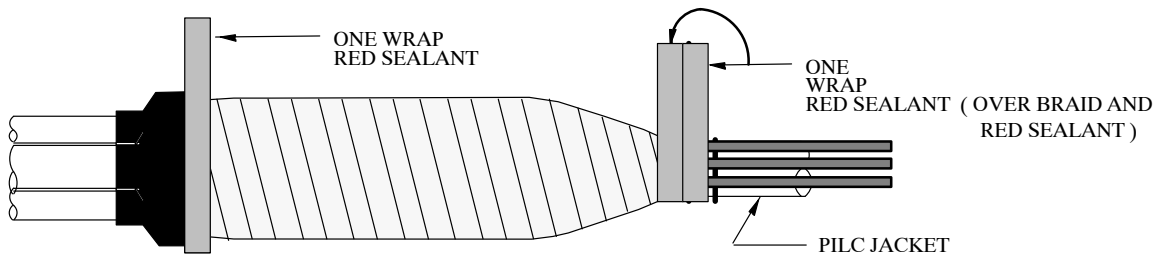
XX POSITION AND SHRINK NON-CONDUCTIVE SEALING BREAKOUT

1. Slide the breakout into position. Make sure that the full length of the fingers of the breakout are over the cable jackets and the body is extending over the splice.
2. Shrink in place starting at the fingers and working toward the splice center.



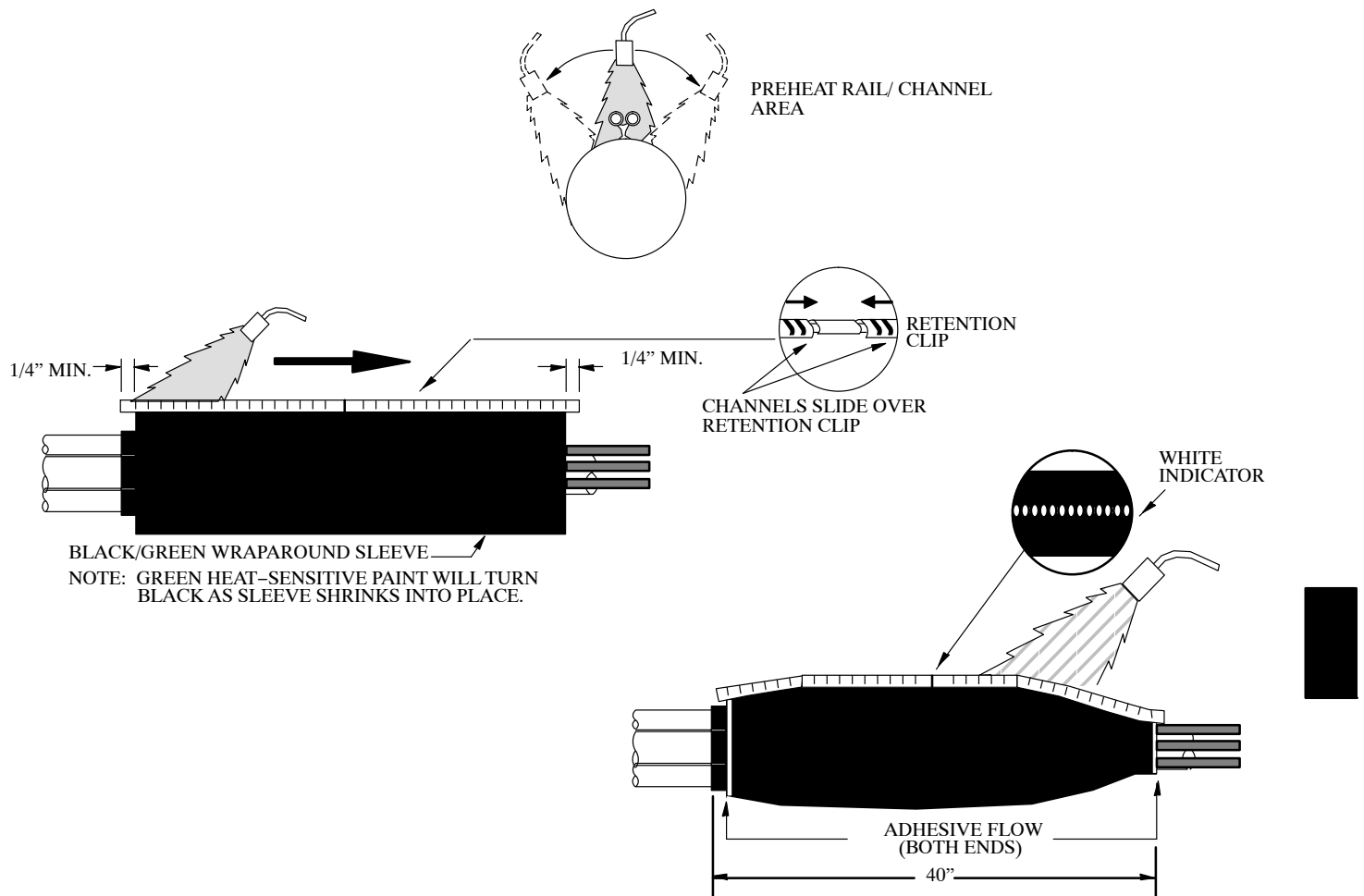
XXI APPLY RED SEALANT

1. Allow the breakout to cool sufficiently to touch before proceeding.
2. Apply two single wraps of red sealant under the ground braids on the PILC cable side. Wraps should be side by side and butted up to the cable jacket cutback.
3. Lay the braids down and press the solder blocked portion and the end of the heat shrink tubing into the red sealant.
4. Apply two additional single wraps of red sealant over the braids and the first layers of red sealant.
5. Apply one wrap of red sealant over the body of the breakout as shown.



XXII POSITION AND SHRINK WRAPAROUND SLEEVE

1. Remove or tape over all sharp points to prevent puncture of wraparound sleeve.
2. Remove the backing from the wraparound sleeve and center sleeve over splice.
3. Slide the metal retention clip onto the butted rails. Connect the channels by overlapping the retention clip as shown below.
4. Channel(s) must overlap sleeve edges by 1/4" minimum.
5. Preheat evenly along both sides of the rail/channel area until this area begins to shrink. (Critical Step)
6. Begin shrinking at the center of the sleeve and work all the way around the sleeve and toward each end.
7. Apply heat until the sleeve is completely shrunk and the green paint is completely converted to black.
8. Post heat the entire length, concentrating on the metal channel area. The post heat should be for 30 seconds after the sleeve is completely shrunk. A white line should be visible in the channel gaps indicating sufficient heating.
9. Look for adhesive flow at both ends of the sleeve.
10. The sleeve to cool before moving or placing in service.



THE SPLICE IS NOW COMPLETE

CABLE JOINT – TRIFURCATING TRANSITION SPLICE

15 kV, 3/C PILC To 3 1/C Extruded Solid Dielectric

Raychem Heat-Shrinkable

41 33 22 **

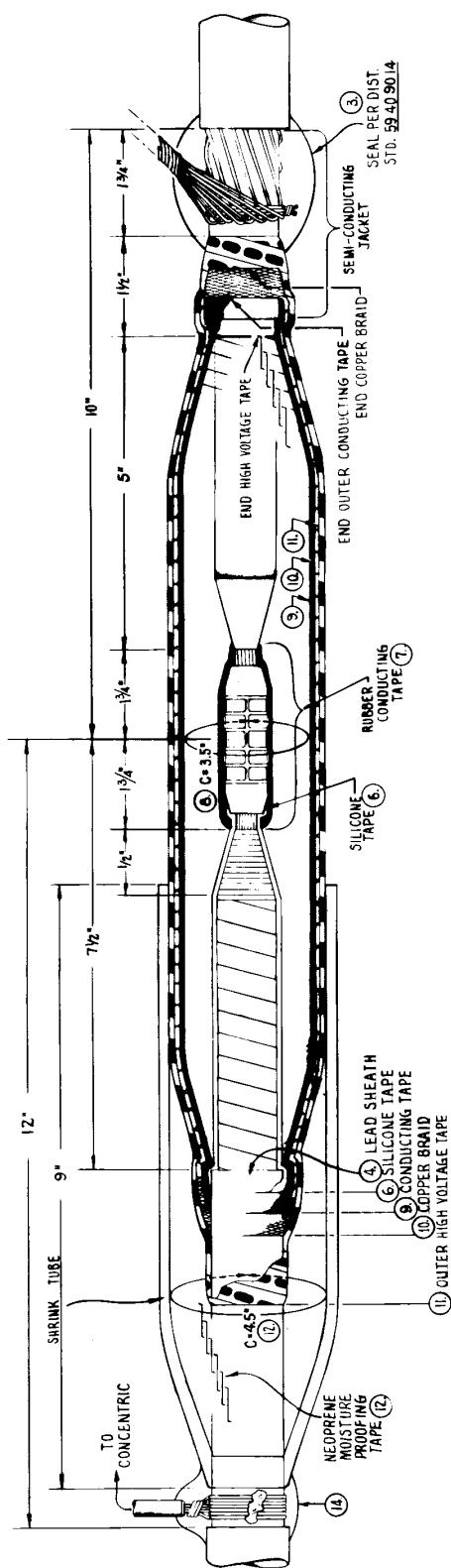
Sheet 10 of 10

	Std. / Stk. No.	Description	41 33 22 **	01	02	03	04	05	06	07
A	17 05 308	Splice-Cond., Trif., H.S., 1/0-4/0 AWG		1	1	1	1			
	17 05 307	Splice-Cond., Trif., H.S., 350 kcmil						1	1	
	17 05 306	Splice-Cond., Trif., H.S., 750-800 kcmil								1
B	17 60 357	Sleeve-Cmpsn., 1/0 Cu	3							
	17 60 344	Sleeve-Cmpsn., 1/0 - #2 Al.		3						
	17 63 143	Sleeve-Cmpsn., 1/0 - 4/0 Al.			3					
	17 60 317	Sleeve-Cmpsn., 4/0 Al.				3				
	17 63 201	Sleeve-Cmpsn., 350 - 4/0 Al.					3			
	17 60 359	Sleeve-Cmpsn., 350 kcmil Cu.						3		
	17 60 504	Sleeve-Cmpsn., 800 kcmil to 750 kcmil Cu.								3
C	25 53 055	Tape-Plastic (RL)	1	1	1	1	1	1	1	1
		Operation Code 729	1	1	1	1	1	1	1	1

**HEAT SHRINK SPLICE STANDARDS
FOR COMMON CABLE SPLICES**

<u>PILC CABLE</u>	<u>TO</u>	<u>SOLID DIELECTRIC CABLE</u>	<u>STANDARD</u>
1/0 ³		3-1/0 CNRP	41 33 22 01
1/0 ³		3-#2 ALCNRP	41 33 22 02
1/0 ³		3-4/0 ALCNRP	41 33 22 03
4/0 ³		3-4/0 ALCNRP	41 33 22 04
350 ³		3-4/0 ALCNRP	41 33 22 05
350 ³		3-350 CNRP	41 33 22 06
350 ³		3-350 FSRP, RW	41 33 22 06
800 ³		3-750 LCRP	41 33 22 07
800 ³		3-750 FSRP, RW	41 33 22 07
800 ³		3-1000 TSRP	41 33 22 07*

*800 kcmil to 1000 kcmil connector is not included in the standard.

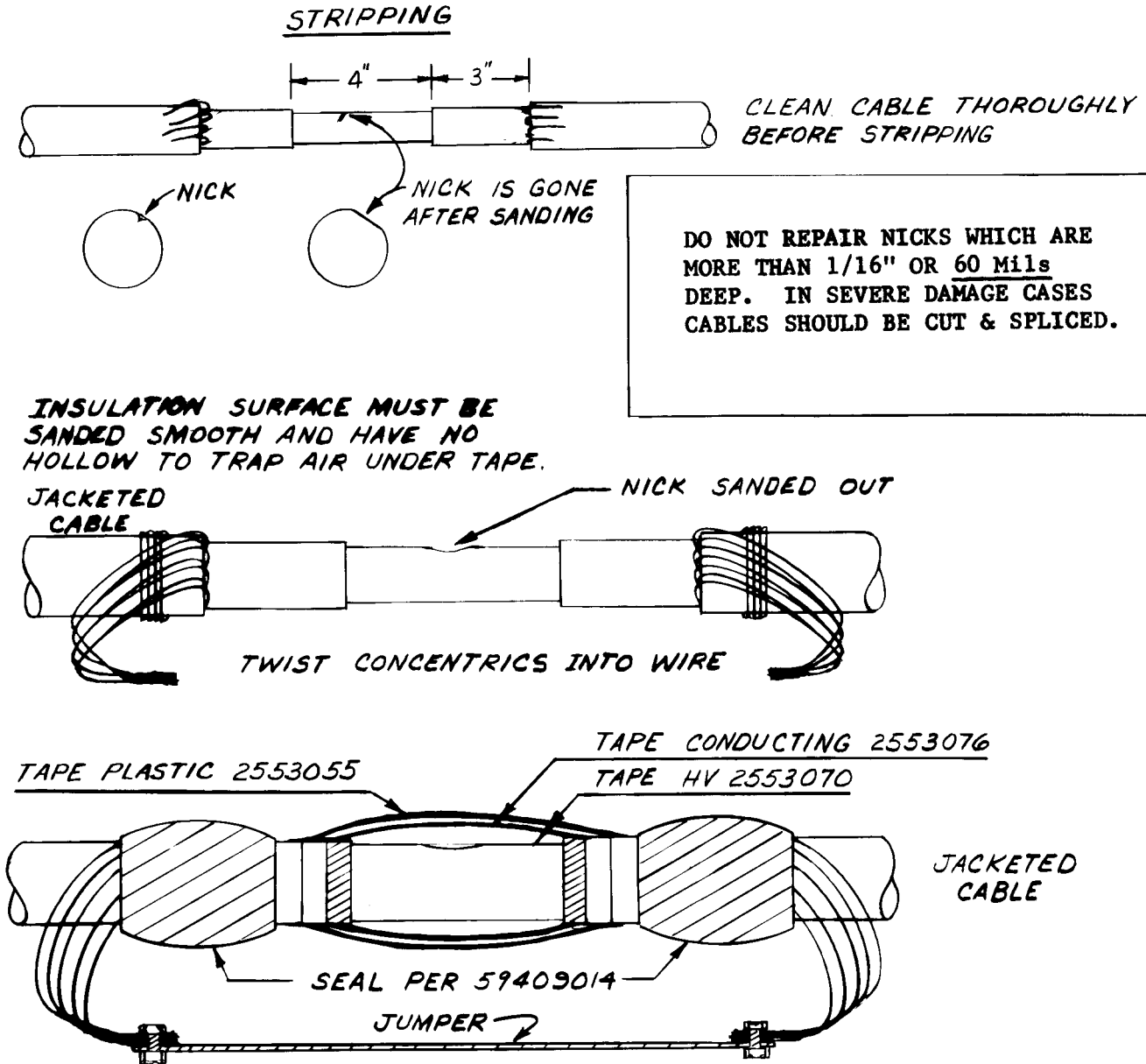


1. Cut cable at center of joint.
2. Remove 12" of jacket from the lead cable side.
3. Remove 10" of overall jacket from the poly side. The off concentrics in the manner indicated per Dist. Std. 59 40 90 14.
4. Strip both cables to dimensions shown. Place 9 inch heat shrink tube over the lead cable side.
5. Install #2 to #4 Cu. connector. Use X groove of XPJ Nicopress. Three crimps per side.
6. Start 1/2 inch onto the lead and tape one half-lapped layer of silicone tape to cover as shown.
7. Cover the connector with one layer of conducting tape.
8. Insulate the entire joint with high voltage rubber tape to a circumference of 3.5 inches.
9. Cover with one half-lapped layer of conducting tape.
10. Cover with one layer of butt-lapped copper braid.
11. Cover with 3 layers of half-lapped high voltage rubber tape as shown.
12. Tape the lead end of joint with Neoprene moisture proofing tape to a 4.5 inch circumference.
13. Using a propane torch carefully shrink the protective 9 inch sleeve over the lead side. Apply heat until the mastic oozes out of both sides.
14. Tin a #4 covered wire onto the lead sheath. Seal the bond with Kearney air seal covering with plastic tape. Connect to the concentric with a #2 split bolt.

NOTE: 1) Sealing on the lead side is very important to the life of this joint.

- 2) Remove top layer of silverized paper or black paper to the lead sheath.

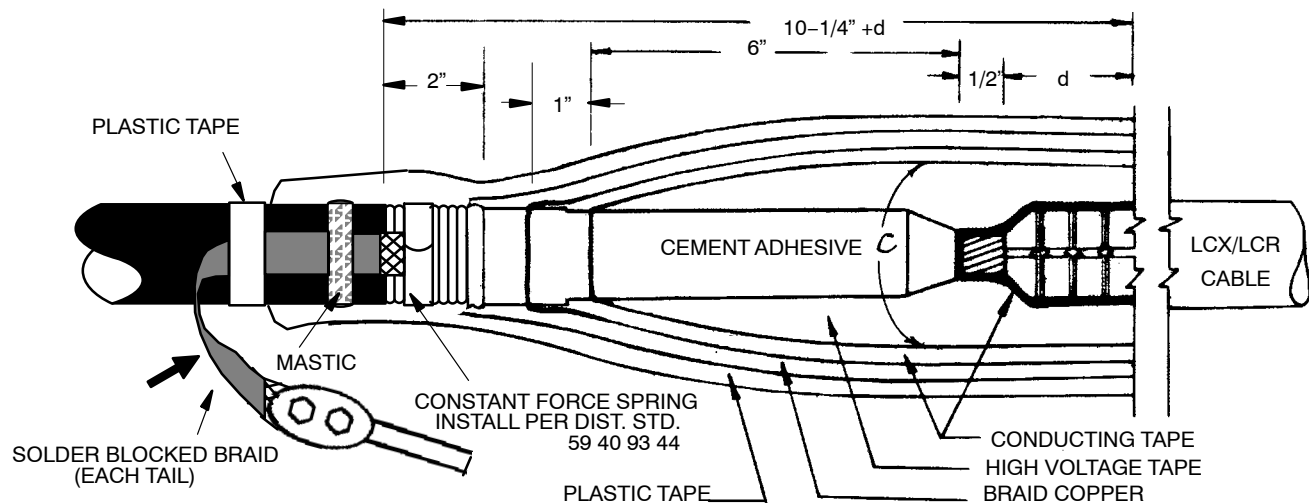
Std. / Stk. No.	Description	Qty.	Unit
17 60 318	Sleeve #4 – #2	1	EA
25 53 071	Tape – Silicone Rubber	1	RL
25 53 070	Tape – High Voltage	4	RL
25 53 076	Tape – Rubber Conducting	1	RL
18 66 101	Braid – Copper	1	RI
25 53 055	Tape, Plastic 3/4"	1	RL
31 53 055	Compound – Sealer	1	LB
12 53 018	Sleeve–Plastic 2.0" x 9"	1	EA
25 53 053	Tape – Neoprene, Moistureproof	As Reqd	RL
18 54 026	Wire #4 Covered	2	FT
17 54 182	Connector Split Bolt #2	1	EA
723	Operation Code	1	



NOTES:

1. The nick must be completely sanded out. #60 axolite cloth (22 05 213).
2. Tape high voltage tape tightly a minimum of 5 half lapped layers – to 7–dependent on severity of damage.
3. Seal jacketed cables per 59 40 90 14.
4. Use jumper size as noted.

Cable	Jumper	Connector	Stk. No.
all #2	#4 AWG	#4 Split Bolt	17 54 004
1–4/0	#2 AWG	2 Bolt	17 54 145
3–4/0	#2 AWG	#2 Split Bolt	17 54 182
3–750	#2 AWG	2 Bolt	17 54 139



Cir. (In)	"d" (In.)	d – Dimension	Stk. No.
7.0	1–3/4	Connector – Copper, 750 kcmil, Split Sleeve	17 60 054
7.0	2–1/4	Sleeve – Copper, 750 kcmil, H.V. Oil Stop	17 60 360
8.0	3	Sleeve – Al. 750 kcmil, H.V.	17 60 316

1. Train cables and clean-up 3 ft. either side of the center of the splice.
2. Remove the outer jacket for 10–1/4" inches plus the dimension "d" in the table.
3. Remove the corrugated copper shield to leave 2" of shield.
4. Remove the insulation shield by carefully scoring and peeling to leave 1–3/4" of extruded shield beyond the copper shield.
5. Taper the insulation to the conductor using the tapering tool, baring the conductor for length "d" in table plus 1/2 inch.
6. Apply the connector/ sleeve.
 - a. Tin per Standard 59 40 91 46, if Stk # 17–60–054 is used.
 - b. Crimp using Y46 tool, U39RT die, and adapter (Stock #86–04–168), if Stock #17–60–360 is used. Apply as many crimps as possible without overlap.
 - c. Crimp using Y46 tool, U39ART die, and adapter (Stock #86–04–168), if Stock #17–60–316 is used. Apply as many crimps as possible without overlap.
7. Clean up connector and surrounding bare insulation using approved cleaner.
8. Install ground connectors per Dist. Std. 59 40 93 44. **DO NOT SEAL NOW.** ◀ --
9. Item Step Taping
 - A a Cover bare metal in connector area—one half lapped layer.
 - G b Apply cement to bare insulation. Allow to dry
 - B c Tape to circumference with high voltage tape.
 - A d Tape one half lapped layer of conducting tape. Cover joint and 1 inch of factory extruded shield.
 - C e Tape one butt lapped layer of copper braid, across the splice making metal to metal contact on each side.
 - E f Seal ground connection per Dist Std. 59 40 93 44.

D g Seal joint and ground connection with 3 layers of half lapped plastic tape.

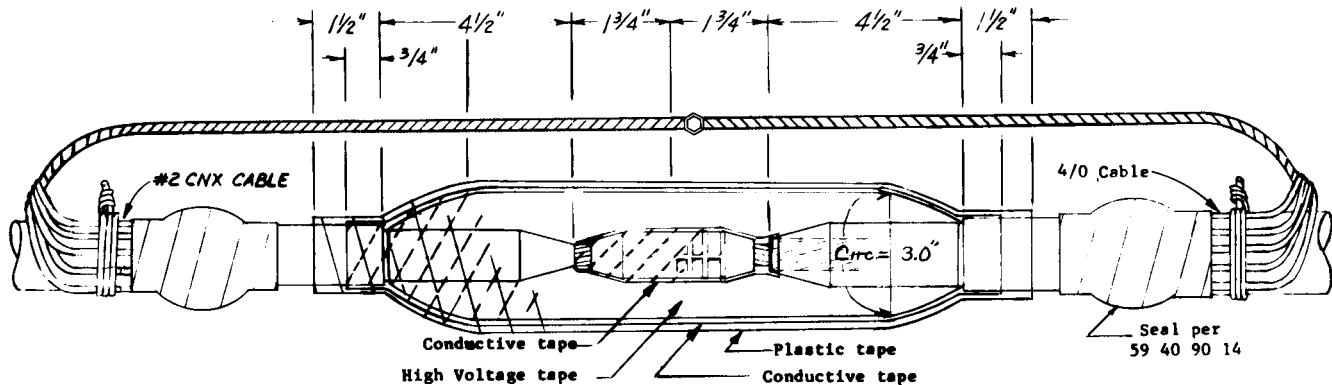
10. Connect ground leads across joint and to the bonding system, using a two-bolt connector and #2 copper wire.

@		Std. / Stk. No.	Description	Qty.
	A	25 53 076	Tape – Rubber Conducting	1
	B	25 53 070	Tape – High Voltage	6
	C	18 66 101	Braid – Copper	2
	D	25 53 055	Tape – Plastic	2
	E	17 54 306	Connector – Cable Grounding, W/Constant Force Spring	2
	F	17 54 140	Connector – Wire, 2-Bolt	1
	G	49 01 066	Cement Adhesive	1
	H	18 54 027	Wire – #2 Copper	As Req'd
			Operation Code 721	

CABLE – JOINT
15 kV
#2 CNX or CNR to 4/0

41 34 33 03

Sheet 1 of 1



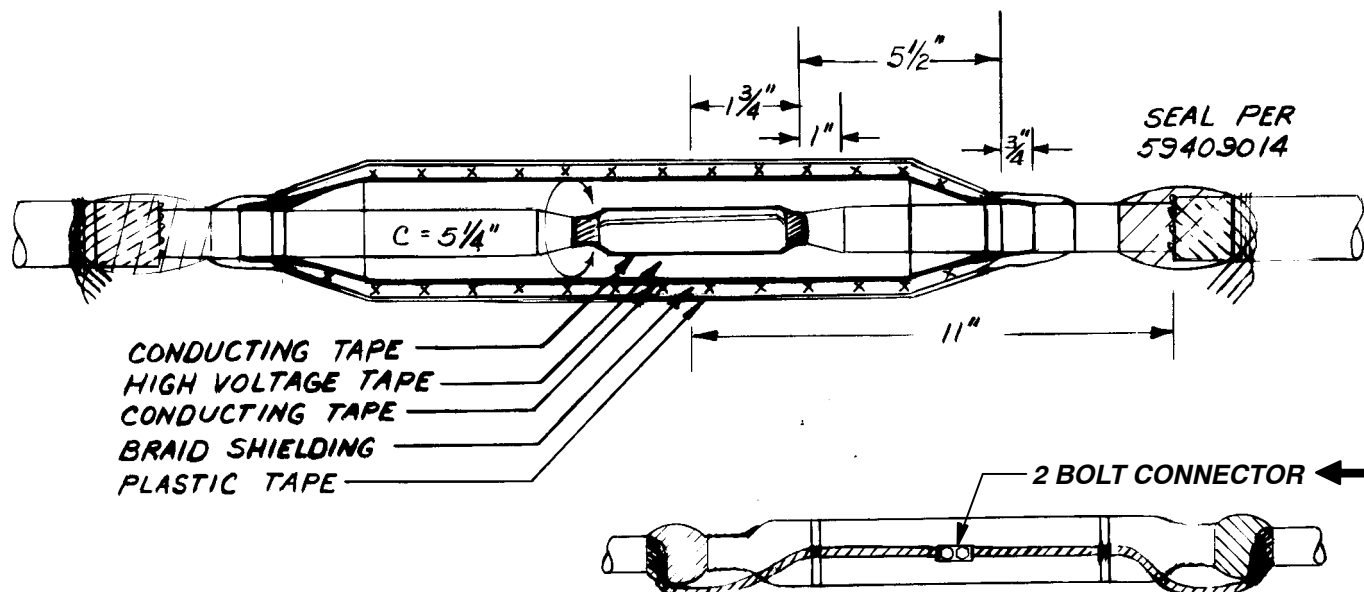
1. Train cables to final joint location and cut to length with a hacksaw.
 2. Remove 10 inches of the outer jacketing when present. Install jacket seals per Dist. Std. 59 40 90 14.
 3. Strip outer shield and insulation to the dimensions indicated above. The insulation must be pencilled to smooth conical tapers. (6-1/4 inches of shield – 1-3/4 inches of bare conductor.)
- NOTE: When pencilling tools are not available, sand tapers smooth with #60 grit axolite cloth–sanding 22–05–213. This operation may be accomplished after sleeve compression.
4. Knick the top layer of strands – bend and break off at the edge of the cable insulation of the 4/0 cable.
 5. Install #2 aluminum tapered high voltage sleeve with the X groove of the XPJ tool with a minimum of two crimps per end.
 6. Complete the tapering of the cable insulation with sand cloth. Clean splice insulation with a cloth dampened with Chlorothene.
 7. Apply one half lapped layer of conducting rubber taper to cover all exposed metal of connector and cable strands.
 8. Tape with high voltage tape over the connector area filling in the low place between the cable insulations until a smooth transition between the #2 and 4/0 insulations is present.
 9. Continue to tape with high voltage tape beginning 1/8 inch from the edge of the cables extruded conducting shield across the joint to within 1/8 inch of the shielding on the opposite side.
 10. Shorten up taping passes forming tapers at both ends. Full insulation thickness is required over the connector and insulation tapers. Tape to 3 inch circumference.
 11. Cover the taped insulation and 3/4 inch of factory shield with one half lapped layer of conducting rubber tape.
 12. Cover the entire splice with three half lapped layers of plastic tape.
 13. Connect concentric wires with a split bolt as shown. Tape concentrics against splice body taking care the connector is not hard against the joint puncturing the insulation.

Std. / Stk. No.	Description	Qty.	Unit
17 60 313	Sleeve, #2 Aluminum	1	Ea
25 53 070	Tape, Rubber, High Voltage	3	RI
25 53 076	Tape, Rubber, Conductive	1	RI
25 53 055	Tape, Plastic PVC	1	RI
17 54 182	Connector – #2 Split Bolt	1	Ea
31 53 055	Compound Sealer, Poly.	1	Lb
721	Operation Code		

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 0
REV. DATE: 12/15/94
REAFFIRMED DATE: 7/27/10



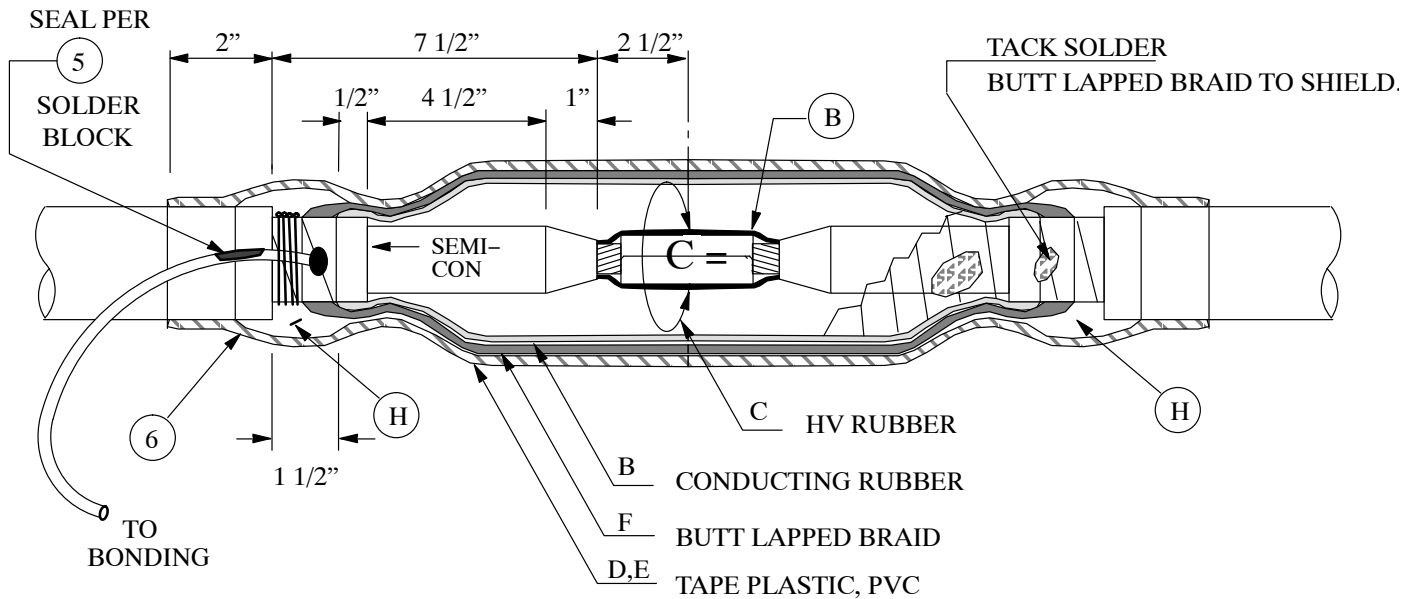
NOTES:

1. Overlap cables and strip out concentric to connect across joint.
2. Strip per dimensions shown. Poly insulation must be smooth – 1 pencilled finishing with #60 grit axolite sanding cloth. Clean insulation.
3. Cover insulation with glass cloth during connector tinning. Finger wipe and sand connector smooth.
4. Cover bare conductor and connector with one layer half lapped conducting tape.
5. Tape with high voltage tape filling in over the connector first. Tape to a 5–1/4 inch circumference tapering down in a 2 to 3 in long taper at each end.
6. Cover with one half lapped layer of conducting rubber tape.
7. Cover the conducting tape with one butt lapped layer of copper shielding braid.
8. Cover the joint taping with two half lapped layers of plastic tape.
9. Construction the jacket seals as indicated per Dist. Standard 59 40 90 14.
10. Connect concentrics across the joint taping them to the body of the splice as shown.

Std. / Stk. No.	Description	Qty.	Unit
17 60 045	Connection–350 kcmil – Soldered type	1	Ea
25 53 076	Tape, Rubber, Conductive	1	RI
25 53 070	Tape, Rubber, High Voltage	2	RI
25 53 055	Tape, Plastic PVC	2	RI
18 66 101	Braid – Copper, 1" x 15'	2	RI
31 53 055	Compound Sealer, Poly.	1	Lb
17 54 140	Connector–Wire, #8–4/0 Cu, 2 Bolt	1	Ea
721	Operation Code		

CABLE – JOINT
15 kV Tape Shield
1000 kcmil Rubber Insulated

➔ **41 34 33 05**
Sheet 1 of 1



HACKSAW CUT TO POSITION CENTER OF SPLICE BETWEEN SUPPORTS.

NOTES:

1. Strip 10 inches of jacket and succeeding cable elements as shown. Taper insulation one inch to conductor.
2. Protect tapers with glass tape and tin connector.
3. One layer of conducting rubber (1/4" lap tightly) taper to taper over connector.
4. Butt lapp shielding braid factory tape to factory tape.
5. Solder tack at each end with one #7 conductivity copper braid shield to shield (not shown in drawing) solder block braid in seal area.
6. In water holes tape extra water seal over end of factory shield and jacket (several layers of HV rubber).
7. Cover entire splice with 3 half lapped layers of plastic tape – 1-1/2 or 3/4 inch wide tape.

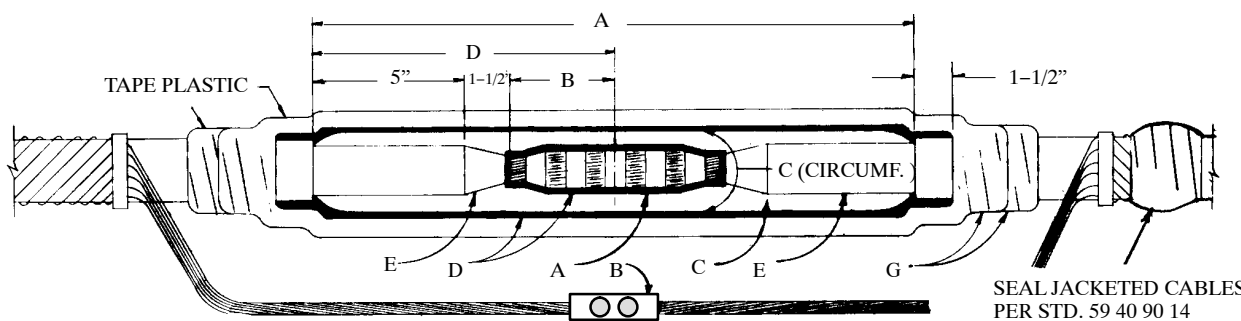
C = Circumference = 6-1/8" – 335 Mils

		Std. / Stk. No.	Description	Qty.
	A	17 60 055	Connector–1000 kcmil, Soldered	1
	B	25 53 076	Tape, Rubber, Conducting	3
	C	25 53 070	Tape, Rubber, High Voltage 1"	8
	D	25 53 055	Tape, Plastic PVC 3/4 inch	1
	E	25 53 077	Tape, Plastic PVC 1-1/2 inch	1
	F	18 66 101	Braid – Copper 1 inch Wde	2
@	G	22 02 282	Solder – As Required	–
	H	18 66 189	Braid – Grounding 3/4"	2
	I	31 53 055	Compound Sealer	As Req'd
		OP Code 418		1

CABLE – JOINT
15 kV
4/0, 750 Straight Al.

41 34 33 **

Sheet 1 of 1



Dimensions (Inches)	a	b	Circ.	d	Tooling Die	Crimps Per End	Insulation Over Conn.
Cable Size 4/0	17	2	5-1/2	8-1/2	U249	1	360 Mils.
Cable Size 750	20	3-1/2	8	10	L39 ART	2	410 Mils.

NOTES:

1. Cut the cable with 20" overlap to provide sufficient length of concentric wires.
2. Measure 24 inches from each end, secure the concentrics with tape and unwind concentric wires.
3. Mark and cut cables at center of overlap.
4. Ring the conductive jacket "d" inches from the end and remove. Do not nick the cable insulation.
5. Pencil the insulation to bare "b" inches of conductor.
6. Install the connector sleeve with the die indicated in the table.
7. Wipe off excess inhibitor.
8. Cover the connector and bare strands with 1 layer of conducting tape. (Half lap item "D").
9. Paint exposed insulation with cement, item "E".
10. Apply high voltage tape, first filling in level at the connector and then taping across the joint just to the conducting jacket sloping in until circumference "C" is obtained.
11. Cover joint and 1-1/2 inches of jacket with one layer of conducting tape "D".
12. a) Butt lap one layer of copper braid covering the conducting rubber tape.
b) Cover the copper braid plus 2 inches of cable with two layers of half lapped plastic tape.

41 34 34 06 – 4/0 Splice

41 34 34 07 – 750 Splice

	Std. / Stk. No.	Description	41 34 33 **	06	07
A	17 60 317	Sleeve – Splicing 4/0		1	
	17 60 316	Sleeve – Splicing, 750			1
B	17 54 140	Connector – Two Bolt, 4/0 Cu.		1	1
C	25 53 070	Tape – Poly, HV, 1" x 30" (rl.)		2	6
D	25 53 076	Tape – Cond., Rubber (rl.)		1	3
E	49 01 066	Cement – Rubber		1	1
F	18 66 101	Braid – Cu. 1" x 15'		1	3
G	25 53 055	Tape – Plastic		1	2
	721	Operation Code		1	1

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG:EJB
REV. NO: NEW
REV. DATE: 6/16/99
REAFFIRMED DATE: 7/28/10

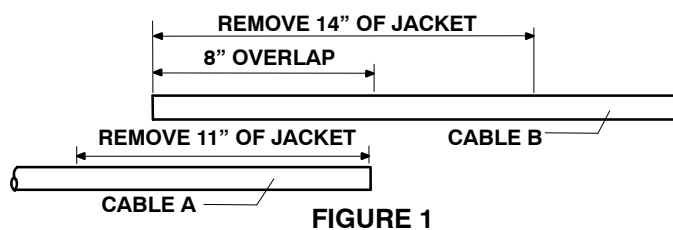
THIS SHEET FOR INSTALLATION OF 3M CABLE SPLICES STANDARD SPLICE

NOTES:

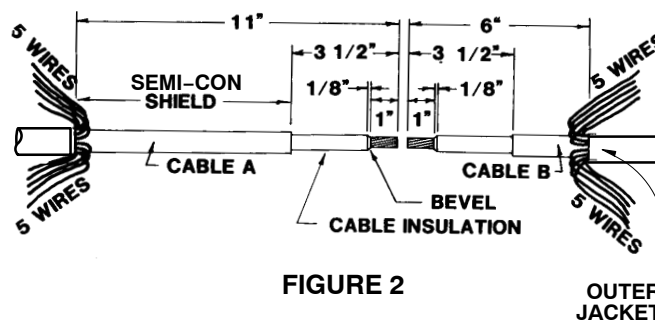
- When a cold-shrinkable sleeve or no sleeve is used, connect one or two concentric wires on each end to the grounding eyes.
- When splicing a nonjacketed cable to a long length of jacketed cable seal the jacketed side per 59 40 90 14.

Read the cautionary statement on Sheet 8 before starting.

- There must be an 8 inch overlap of the cables, Figure 1. Wipe clean 2 feet each side.



- Place the shrinkable sleeve on either cable.
- Remove 14 inches of jacket Cable B, 11 inches of jacket Cable A.
- For single phase cables train the concentric wires in two bundles each side, 5 wires per bundle. See Figure 2. For three phase cables train concentric wires in one 6 wire bundle.



- Cut 8 inches off Cable B. Cut cables with a hack saw so that the cable ends butt together at the splice center.
- Strip cables for splicing per Figure 2, clean cables – DO NOT USE SILICONE SPRAY ON CABLES OR SPLICE BODY.
- Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.
- Lubricate insulation and semi-con shield of Cable A with silicone grease. Install splice body onto Cable A, leaving conductor exposed for the connector. NOTE: Lubricate bore with silicone grease to aid installation.
- Install connector using the Y-35 handpress with the U25ART die. Make as many crimps per end as possible without overlap. File flashing down. Remove excess inhibitor.

10. Lubricate insulation and semi-con shield of Cable B with silicone grease. Slide splice body onto Cable B and into final position over the connector. Use the bumps formed on the splice ends as guides for centering. See Figure 3.
11. Connect concentrics with two sleeves on Side A. For single phase cables place 5 wires per side into each sleeve. For three phase cables place all 6 wires into one sleeve. Crimp using the "P" or "J" groove of the XPJ Nicopress tool as shown on sleeve. Snug sleeves and wires tightly against splice and cable. See Figure 3.

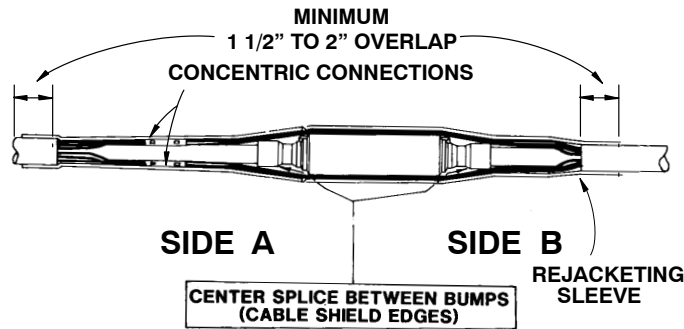


FIGURE 3

12. Slide shrinkable sleeve over the splice and shrink it down. To install cold-shrinkable sleeves, follow the manufacturers' instructions.

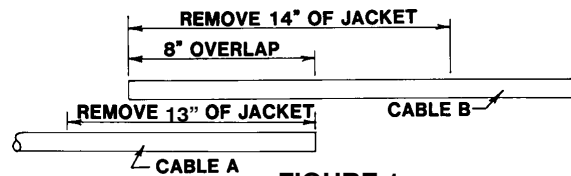
THIS SHEET FOR INSTALLATION OF ELASTIMOLD CABLE SPLICES STANDARD SPLICE

NOTES:

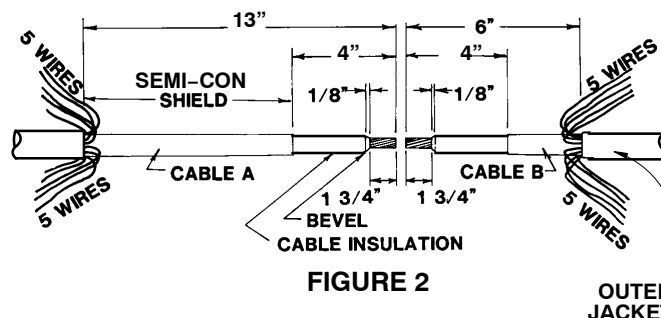
- When a cold-shrinkable sleeve or no sleeve is used, connect one or two concentric wires on each end to the grounding eyes.
- When splicing a nonjacketed cable to a long length of jacketed cable seal the jacketed side per 59 40 90 14.

Read the cautionary statement on Sheet 8 before starting.

- There must be an 8 inch overlap of the cables, Figure 1. Wipe clean 2 feet each side.



- Place the shrinkable sleeve on either cable.
- Remove 14 inches of jacket Cable B, 13 inches of jacket Cable A.
- For single phase cables, train the concentric wires in two bundles each side, 5 wires per bundle. See Figure 2. For three phase cables, train the concentric wires in one 6 wire bundle.
- Cut 8 inches off Cable B. Cut cables with a hacksaw so that the cable ends butt together at the splice center.
- Strip cables for splicing per Figure 2, clean cables – DO NOT USE SILICONE SPRAY ON CABLES OR SPLICE BODY.



- Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.
- Lubricate insulation and semi-con shield of Cable A with silicone grease. Install splice body onto Cable A, leaving conductor exposed for the connector. NOTE: Lubricate bore with silicone grease to aid installation.

9. Install connector using Y-35 handpress with U25ART die. Make as many crimps per end as possible without overlap. File flashing down. Remove excess inhibitor.
10. Lubricate insulation and semi-con shield of Cable B with silicone grease. Slide body onto Cable B and into final position over the connector. Use the bumps formed on the splice ends as guides for centering. See Figure 3.
11. Connect concentrics with two sleeves on Side A. For single phase cables place 5 wires per side into each sleeve. For three phase cables place all 6 wires into one sleeve. Crimp using the "P" or "J" groove of the XPJ Nicopress tool as shown on sleeve. Snug sleeves and wires tightly against splice and cable. See Figure 3.

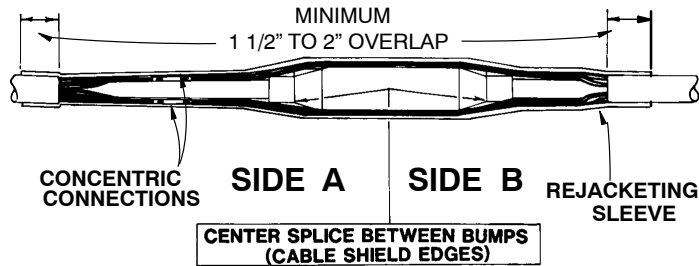


FIGURE 3

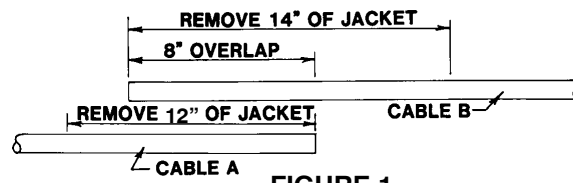
12. Slide shrinkable sleeve over the splice and shrink it down. To install cold-shrinkable sleeves, follow the manufacturers' instructions.

THIS SHEET FOR INSTALLATION OF COOPER CABLE SPLICES STANDARD SPLICE

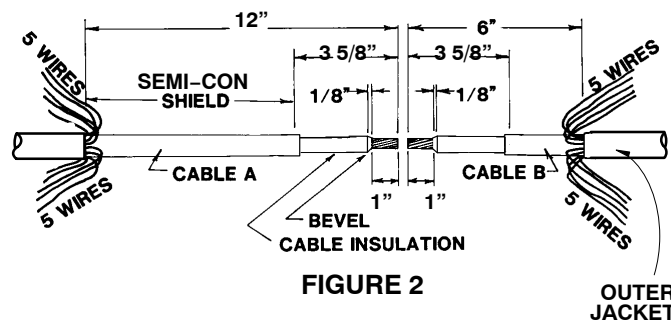
- NOTES: a. When a cold-shrinkable sleeve or no sleeve is used, connect one or two concentric wires on each end to the grounding eyes.
- b. When splicing a nonjacketed cable to a long length of jacketed cable, seal the jacketed side per 59 40 90 14.

Read the cautionary statement on Sheet 8 before starting.

1. There must be an 8 inch overlap of the cables, Figure 1. Wipe clean 2 feet each side.



2. Place the shrinkable sleeve on either cable.
3. Remove 14 inches of jacket Cable B, 12 inches of jacket Cable A.
4. For single phase cables train the concentric wires in two bundles each side, 5 wires per bundle. See Figure 2. For three phase cables train concentric wires in one 6 wire bundle.
5. Cut 8 inches off Cable B. Cut cables with a hacksaw so that the cable ends butt together at the splice center.
6. Strip cables for splicing per Figure 2, clean cables – DO NOT USE SILICONE SPRAY ON CABLES OR SPLICE BODY. Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.



7. Lubricate insulation and semi-con shield of Cable A with silicone grease. Apply one wrap of tape to the end of the conductor on Cable A. Install splice body onto Cable A, leaving conductor exposed for the connector. NOTE: Lubricate bore with silicone grease to aid installation.
8. Remove tape from the conductor on Cable A. Clean bare conductors with a wire brush prior to installing the connector.

9. Install connector using the Y-35 handpress with the U25ART die. Make as many crimps per end as possible without overlap. Leave the center 1/4" of the connector uncrimped. File flashing down. Remove excess inhibitor.
10. Lubricate insulation and semi-con shield of Cable B with silicone grease. Slide splice body onto Cable B and into final position over the connector. Use the bumps formed on the splice ends as guides for centering. See Figure 3.
11. Connect concentrics with two sleeves on Side A. Place 5 wires per side into each sleeve. Crimp using the "P" or "J" groove of the XPJ Nicopress tool. Snug sleeves and wires tightly against splice and cable. See Figure 3.

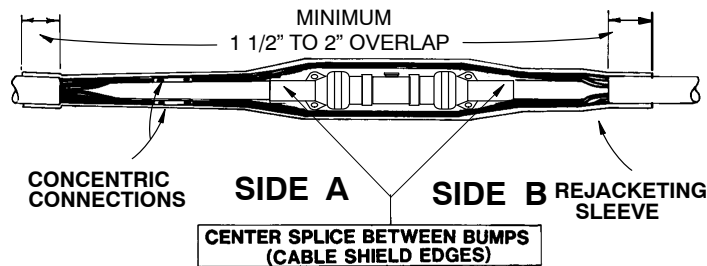


FIGURE 3

12. Slide shrinkable sleeve over the splice and shrink it down. To install cold-shrinkable sleeves, follow the manufacturers' instructions.

3M LONG REPAIR SPLICE

1. Cut out damaged cable section, do not exceed 6.0 inches. Retain neutral wires from damaged section. Use a hack saw to get clean cuts.
2. Prepare cables as shown in Figure 1. If cable is jacketed, remove jacket to expose neutral wires. For single phase cables train the concentric wires in two bundles each. For three phase cables train the concentric wires in one 6 wire bundle. Place the shrinkable sleeve on one of the cables.

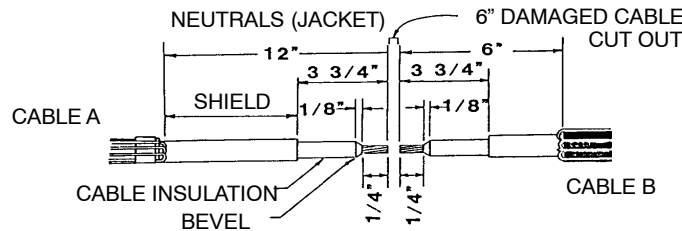


FIGURE 1

3. Fold neutrals back and clean dirt off of the semi-con shield and the insulation. Use a dry cloth. Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.
4. Install the connector on Cable A only and crimp using Y-35 handpress with U-25 ART die or B24EA die as shown in Figure 2. Wipe off excess inhibitor and file flashing down.

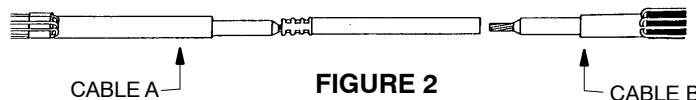


FIGURE 2

5. Lubricate connector, insulation, semi-con, and splice bore with silicone grease. Install splice body onto connector and Cable A until un-crimped connector end is exposed approximately 2 inches. Do Not Use Spray Silicone.
6. Install Cable B into connector and crimp. Clean off excess inhibitor and file flashing down.
7. Lubricate insulation and semi-con of Cable B and the exposed connector and bore area of the splice body with silicone grease. Slide splice body only onto Cable B. Use bumps formed on splice ends as guides for centering.
8. Tape down concentric strands at ends of splice.
9. Attach one concentric from cable through its splice grounding eye and back to the concentric neutral wires. (Cold-shrinkable sleeved and Non-jacketed cables only.)
10. Twist the strands together and jumper across the splice using cable neutral wires and retained neutral wires. For single phase cables connect each bundle using 2 sleeves and the "P" or "J" groove of the XPJ Nicopress tool as shown on sleeve. (See Figure 3.) For three phase cables connect the bundle using 1 sleeve. Make sure that the neutral wires are against the splice body.

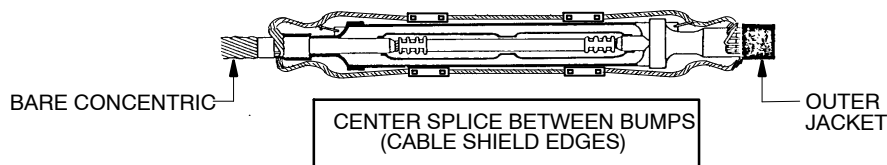


FIGURE 3

NOTES:

- a. Slide shrinkable sleeve over splice and shrink down.
Install cold-shrinkable sleeves per manufacturer's instructions.
- b. When splicing a non jacketed cable to a long length of jacketed cable, seal the jacketed side per 59 40 90 14.

Notes	Stnd. / Stk. No.	Description	41 34 34 **	05	07	08	09	10	11	14	15	16
	17 55 283	Splice – #2 Al Str. 15kV		1	1	1	1	1	1			
	17 55 288	Splice – Long Repair, #2 Al. Str. 15kV								1		1
	17 60 506	Sleeve – #2 Solid Al		1								
	17 60 505	Sleeve – 1/0 Str. Al		1								
	17 60 501	Sleeve – Transition #2 Str. to #2 Solid Al, or #4 Cu Str.						1				
	17 60 502	Sleeve – Transition #2 Str. to 1/0 Str. Al					1					
	17 60 408	Sleeve – Transition #2 Solid to 1/0 Str. Al				1						
	17 60 409	Sleeve – Long Repair, #2 Al, Solid, or #4 Str. Cu, 15kV								1		
	17 62 250	Splice – Long Repair, 1/0 Al Str. 15kV									1	
	17 60 103	Sleeve – #4 Str. Cu.		2	2	2	2	2	2	4	4	4
	17 55 371	Sleeve Cold-Shrinkable		1	1	1	1	1	1	1	1	1
		Operation Code 404		1	1	1	1	1	1	1	1	1

15kV Splice	Dist. Std.
#2 Al Stranded, 15kV	41 34 34 11
#2 Al Solid, 15kV	41 34 34 07
1/0 Al Stranded, 15kV	41 34 34 05
Transition #2 Str. to #2 Solid Al, or #4 Str. Cu	41 34 34 10
Transition #2 Stranded to 1/0 Stranded Al	41 34 34 09
Transition #2 Solid to 1/0 Stranded Al	41 34 34 08
Long Repair #2 Al, Stranded, 15kV	41 34 34 16
Long Repair #2 Al, Solid or #4 Str. Cu, 15kV	41 34 34 14
Long Repair #1/0 Stranded, 15kV	41 34 34 15

CAUTIONARY STATEMENT

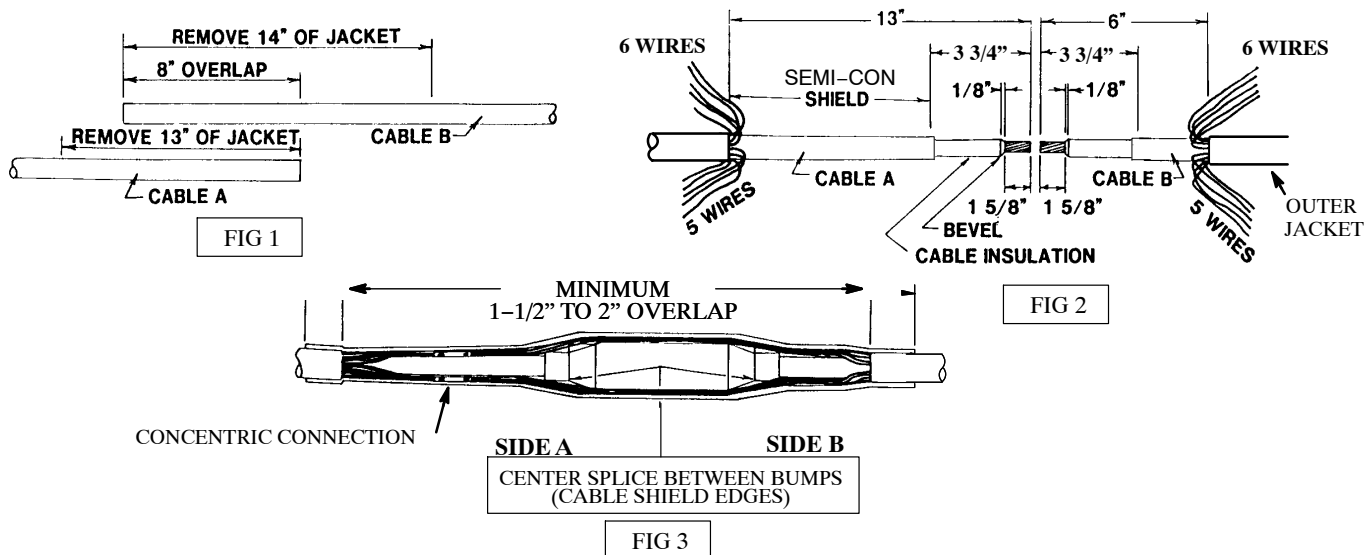
The standard splice (Stk. #17-55-283) is for #2 stranded aluminum cables (Stk. #18-07-238 and Stk. #18-07-237). If any cables other than the standard #2 stranded aluminum cables are to be spliced together, the compression sleeve in the standard splice must be discarded and replaced by one of the compression sleeves shown in the materials list.

DO NOT CHANGE THE CABLE PREPARATION DIMENSIONS SHOWN FOR EACH APPROVED SUPPLIER'S SPLICE WHEN SUBSTITUTING A COMPRESSION SLEEVE FOR THE STANDARD #2 COMPRESSION SLEEVE. THIS IS ESPECIALLY IMPORTANT WHEN SUBSTITUTING A 2" LONG COMPRESSION SLEEVE FOR THE 3" LONG COMPRESSION SLEEVE IN THE ELASTIMOLD SPLICE. IF THE DIMENSIONAL REQUIREMENTS SHOWN ARE NOT MAINTAINED – THE SPLICE WILL FAIL.

THIS SHEET FOR INSTALLATION OF 3M CABLE JOINTS.

NOTES:

- For cold shrink sleeves or no re-jacketing sleeves, connect one or two concentric wires on each end to the grounding eyes.
- When splicing a non-jacketed cable to a long length of jacketed cable seal the jacketed side per 59 40 90 14.
- When splicing in manholes an external ground connection is required – see sheet 4 for instructions.

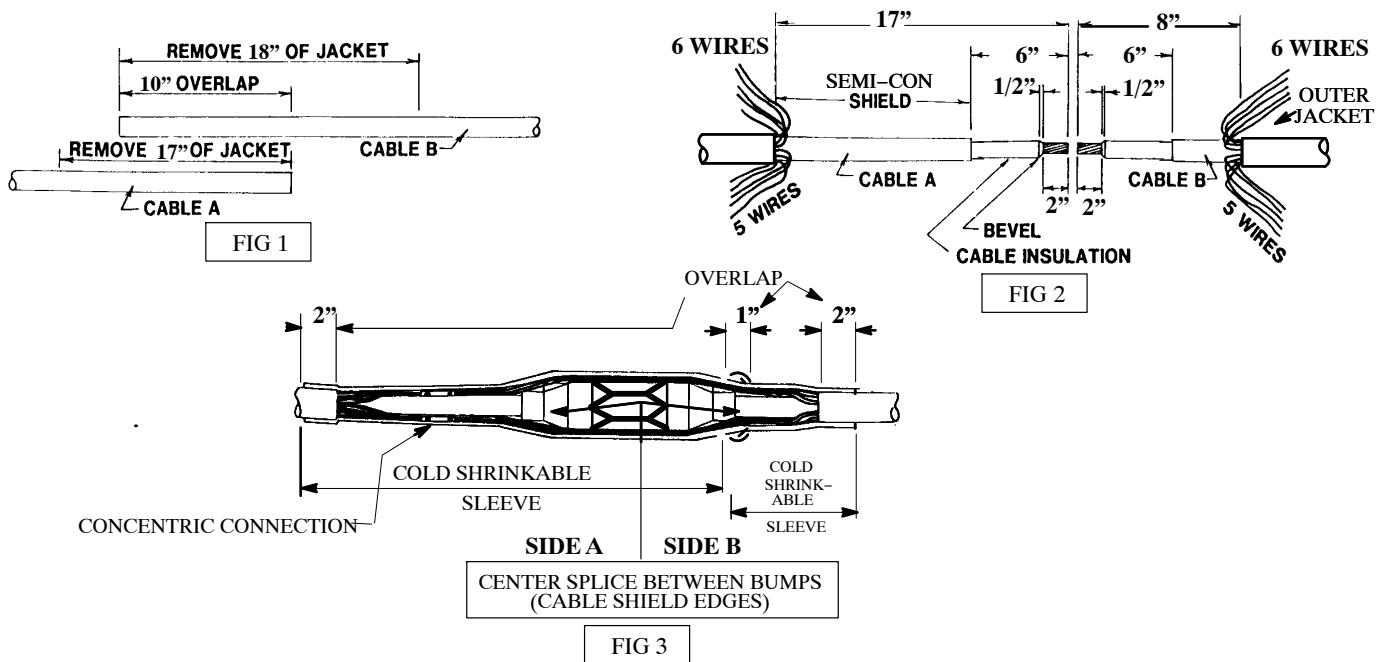


- There must be an 8 inch overlap of the cables. Fig. 1. Wipe clean 2 feet each side.
- Remove 14 inches of jacket from Cable B, 13 inches of jacket from Cable A.
- Place the shrinkable sleeve(s) on either cable.
- Train the concentric wires in two bundles each side, 5 and 6 wires per bundle. See Fig. 2.
- Cut 8 inches off Cable B. Cut cables with a hacksaw so that the cable ends butt together at the splice center.
- Strip cables for splicing per Fig. 2, clean cables – **DO NOT USE SILICONE SPRAY ON CABLE OR JOINT.**
- Clean the bare conductors with a stainless steel wire brush prior to installing the connector. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.**
- Lubricate insulation and semi-con shield of Cable A with silicone grease. Install splice body onto Cable A, leaving conductor exposed for the connector. NOTE: Lubricate bore with silicone grease to aid installation.
- Install connector using Y-35 handpress with U249 or U28ART die. Make one crimp per side with the U249 or two crimps per side with the U28ART die. File the flashing down.
- Lubricate insulation and semi-con shield of Cable B with silicone grease. Slide splice body onto Cable B and into final position over the connector. Use the bumps formed on the splice ends as guides for centering. See Fig. 3.
- Connect concentric with two sleeves on Side A. Place 5 and 6 wire bundles into connectors. Crimp using the P or J groove of XPJ Nicopress tool as shown on sleeve. Snug sleeves and wires tightly against splice and cable. See Fig. 3. NOTE: 4/0 single phase cables with twenty #12 concentrics require three wire bundles and three #2 sleeves.
- For the cold shrink sleeve, place a layer of mastic around the end of each cable jacket. Slide the first cold shrink sleeve over the splice with the end of the sleeve overlapping the opposite cable jacket cut off (or mastic strip) by 2 inches. Shrink the sleeve down.
Wrap one layer of mastic at the inner end of the shrunken sleeve. Slide the second sleeve over the splice and overlap the first sleeve by 2 inches. Shrink the second sleeve down.

THIS SHEET FOR INSTALLATION OF ELASTIMOLD CABLE JOINTS.

NOTES:

- For cold shrink sleeves or no re-jacketing sleeves, connect one or two concentric wires on each end to the grounding eyes.
- When splicing a non-jacketed cable to a long length of jacketed cable seal the jacketed side per 59 40 90 14.
- When splicing in manholes an external ground connection is required – see sheet 4 for instructions.



- There must be a 10 inch overlap of the cables, Fig. 1. Wipe clean 2 feet each side.
- Remove 18 inches of jacket from Cable B, 17 inches of jacket from Cable A.
- Cut a 6 inch piece of heat-shrinkable sleeve from Stock #12-53-076. Place the 6 inch heat-shrinkable sleeve and a 24 inch heat-shrinkable sleeve on the cables. Cold shrink-install the cold-shrinkable sleeves on the cable.
- Train the concentric wires in two bundles each side, 5 and 6 wires per bundle. See Fig. 2.
- Cut 10 inches off Cable B. Cut cables with a hacksaw so that the cable ends butt together at the splice center.
- Strip cables for splicing per Fig. 2, clean cables – DO NOT USE SILICONE SPRAY ON CABLES OR JOINT.
- Clean the bare conductors with a stainless steel wire brush prior to installing the connector. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.
- Lubricate insulation and semi-con shield of Cable A with silicone grease. Install splice body onto Cable A, leaving conductor exposed for the connector. NOTE: Lubricate bore with silicone grease to aid installation.
- Install connector using Y-35 handpress with the U249 or U28ART die. Make one crimp per side with the U249 or two crimps per side with the U28ART die. File the flashing down.
- Lubricate insulation and semi-con shield of Cable B with silicone grease. Slide splice body onto Cable B and into final position over the connector. Use the bumps formed on the splice ends as guides for centering. See Fig. 3.
- Connect concentrics with two sleeves on Side A. Place 5 and 6 wire bundles into separate sleeves. Crimp using the P or J groove of the XPJ Nicopress tool as shown on sleeve. Snug sleeves and wires tightly against splice and cable. See Fig. 3. NOTE: 4/0 single phase cables with twenty #12 concentrics require three wire bundles and three #2 sleeves.

12. For the cold shrink sleeve, place a layer of mastic around the end of each cable jacket. Slide the first cold shrink sleeve over the splice with the end of the sleeve overlapping the opposite cable jacket cut off (or mastic strip) by 2 inches. Shrink the sleeve down.
Wrap one layer of mastic at the inner end of the shrunken sleeve. Slide the second sleeve over the splice and overlap the first sleeve by 2 inches. Shrink the second sleeve down.

CAUTIONARY STATEMENT FOR 3/0 TO 4/0 SPLICING

The standard splice (Stk. #17-55-285) is for 4/0 stranded aluminum cables (Stk. #18-07-240 and Stk. #18-07-239). If any cables other than the standard 4/0 stranded aluminum cables are to be spliced together, the compression sleeve in the standard splice must be discarded and replaced by the transition sleeve shown in the materials list.

DO NOT CHANGE THE CABLE PREPARATION DIMENSIONS SHOWN FOR EACH APPROVED SUPPLIER'S SPLICE WHEN SUBSTITUTING A COMPRESSION SLEEVE FOR THE STANDARD 4/0 COMPRESSION SLEEVE. THIS IS ESPECIALLY IMPORTANT WHEN SUBSTITUTING A 2" LONG COMPRESSION SLEEVE FOR THE 3" LONG COMPRESSION SLEEVE IN THE ELASTIMOLD SPLICE. IF THE DIMENSIONAL REQUIREMENTS SHOWN ARE NOT MAINTAINED – THE SPLICE WILL FAIL.



Ground Connection for Splices Installed in Manholes

(Dist. Standards 41 34 35 08 & 09)

1. Prior to installing the cold shrink sleeves, wrap 6 layers of shielding
2. Attach a ground braid and a constant force spring over the shielding braid on Cable A. Install the ground braid and spring per Dist. Std. 59 40 93 44. Wrap two layers of plastic tape over the spring connector (no sealer is needed as shown in the standard). Position the tails of the ground braid away from the splice body.
3. Apply two mastic strips from the cold shrink jacket kit at the end of the cable jacket cutoffs on each cable. Wrap one layer of mastic at each cutoff. Apply the mastic over the ground braid on Cable A.
4. Slide the first cold shrink sleeve over the splice with the end of the sleeve overlapping the opposite cable jacket cutoff (or mastic strip) by two inches. Shrink the sleeve down.
5. Wrap one layer of mastic at the inner end of the shrunken sleeve.
6. Slide the second sleeve over the splice and overlap the first cold shrink sleeve by ½ inch minimum. Shrink the second sleeve down.
7. Attach the ground braid tails to a piece of #2 CU bond wire using a two bolt clamp (17-54-140). Seal the two bolt connector, the bond wire, and the ground braid connections using sealer compound (31-53-055) and two layers of plastic tape (25-53-055) wrapped over the outside. Connect the #2 CU bond wire to the 4/0 CU bond wire in the manhole (system ground) using a two bolt clamp.

	Std. / Stk. No.	Description	41 34 35 **	03	05	06	07	08	09
				3Ø	1Ø	3Ø	1Ø	3Ø	1Ø
A	17 55 285	Splice, Straight, 4/0 Al., 15 kV		1	1	1	1	1	1
B	17 63 127	Sleeve, Compression, # 2 Copper			3		3		3
C	17 60 103	Sleeve, Compression, # 4 Copper		2		2		2	
D	17 55 443	Sleeve, Cold Shrinkable		1	1	1	1	1	1
E	17 60 720	Sleeve, Transition, 3/0 to 4/0 Al.				1	1		
F	17 54 306	Connector – Cable Ground w/ Constant Force Spring						1	1
G	18 66 101	Braid – Copper, 1" x 15'						1	1
H	17 54 140	Connector – Wire, #8-4/0 Cu, 2 Bolt						2	2
		Operation Code 415		1	1	1	1	1	1

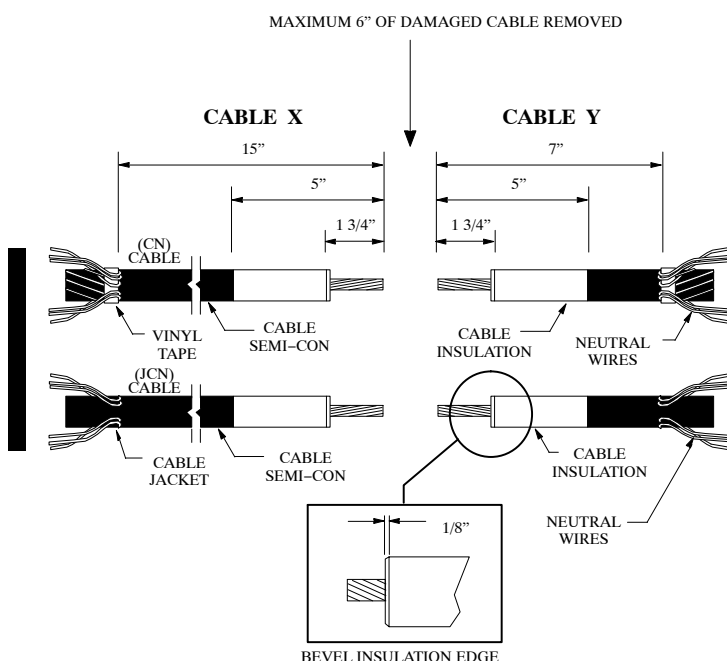


FIGURE 1

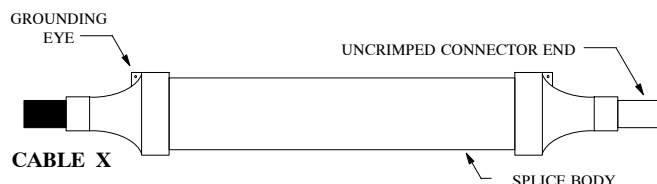


FIGURE 2

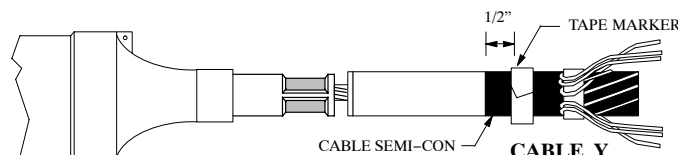


FIGURE 3

NOTE:

BARE CONCENTRIC SHOWN ON CABLE "Y" COULD HAVE BEEN JACKETED CABLE.

1. Cut out the damaged section of cable, but do not exceed 6". Retain the neutral wires from the damaged section. Use a hacksaw to get a clean square cut.
2. Prepare the cables as shown in Figure 1. If the cable is non-jacketed, bind the neutrals with wire or vinyl tape at the jacket cut back dimensions shown in Figure 1. Check the dimensions using templates provided.
3. Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes.
4. Install the connector onto the "X" cable only, – using the Y-35 tool and U249 die. Make one crimp, wipe off excess inhibitor and file sharp flashing.
5. Lubricate the connector, cable "X", and both ends of splice body with the silicone grease provided or Stk # 31 51 050.
6. Slide the splice body onto connector and cable "X" until the uncrimped connector end is exposed. See Figure 2.
7. If jacketed cable is being repaired, store the cold-shrinkable sleeves on the cables at this time.
8. Connect the exposed connector end to cable "Y" using the Y-35 tool and U249 or U28ART die. Make one crimp, wipe off excess inhibitor and file sharp flashing.
9. Place a tape marker on cable "Y" semi-con, 1/2" from the end of the cable semi-con. See Figure 3.
10. Lubricate the exposed connector and cable "Y" with silicone grease.
11. Center splice body over the connector so that the leading edge aligns with the marker tape. Remove the marker tape.

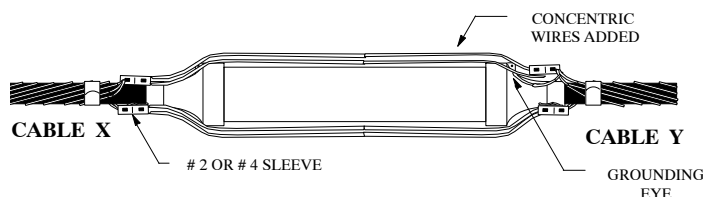


FIGURE 4

NOTE:

BARE CONCENTRIC CABLES SHOWN. COULD BE JACKETED OR A COMBINATION OF JACKETED AND NON-JACKETED.

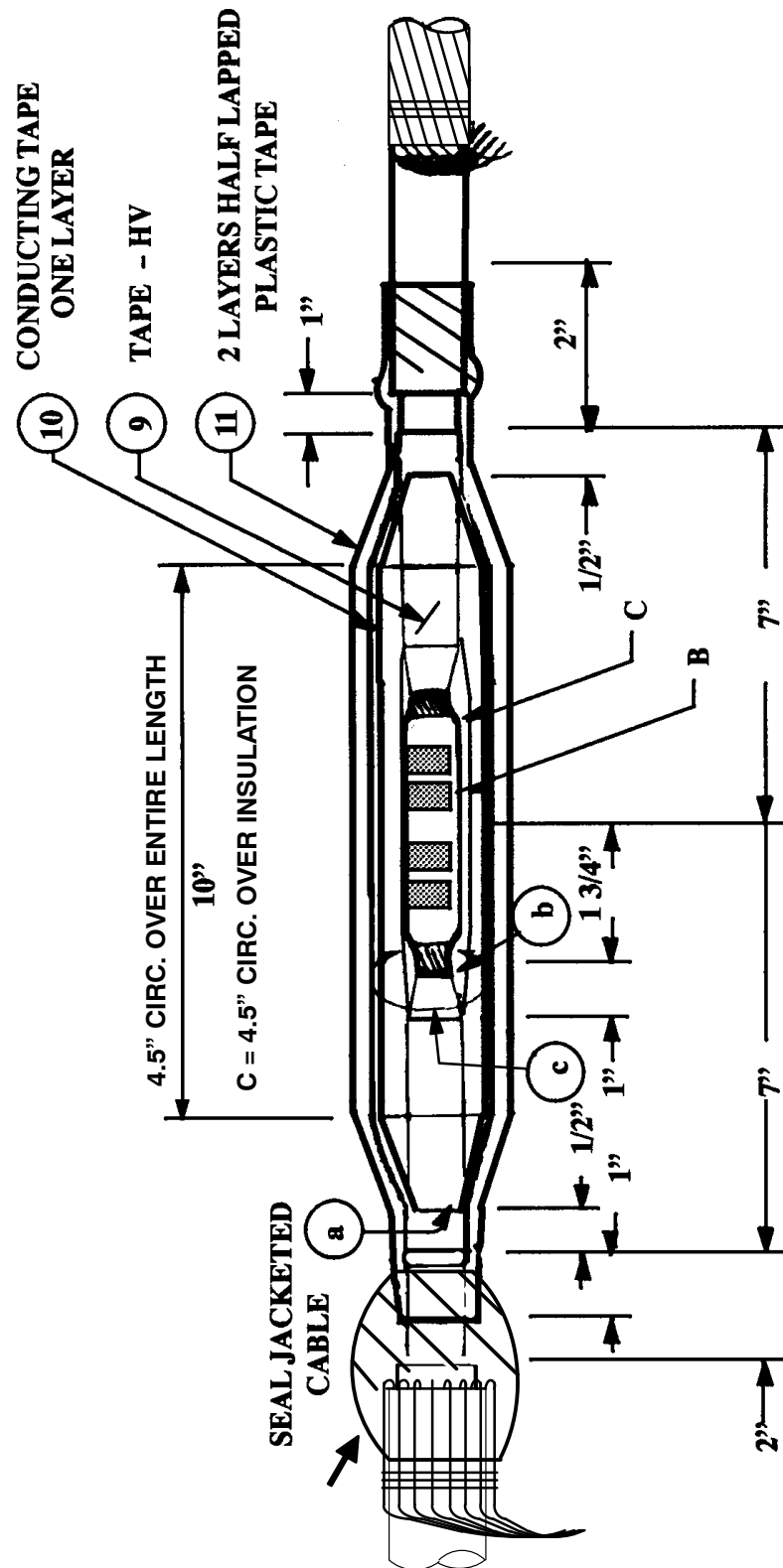
12. Connect the concentric neutral wires back over the cable and splice body as follows: 4/0 cable with 11 #14 AWG concentric wires (3 ph) make two bundles of wires (one with 5 wires and one with 6 wires) and place them into the #4 copper sleeves. Crimp the sleeves using the "P" or "J" groove of the XPJ tool as shown on sleeve. 4/0 cable with 20 #12 AWG concentric wires, (1 ph), make three bundles of wires (two with 7 wires and one with 6 wires), and place them into the #2 copper sleeves. Crimp the sleeves using the "P" or "J" groove of the XPJ tool as shown on sleeve. It may be necessary to add concentric wires in order to jumper across the splice. See Figure 4. Make sure that the neutral wires are against the splice body.

NOTE: Connect one concentric wire on each side to its respective grounding eye and return it back to the wire bundle.

13. If cold shrinkable covers are used, place a layer of mastic around the end of each cable jacket. Slide the first cold shrink sleeve over the splice with the end of the sleeve overlapping the opposite cable jacket cut off (or mastic strip) by two inches. Shrink the sleeve down. Wrap one layer of mastic at the inner end of the shrunken sleeve. Slide the second sleeve over the splice and overlap the first sleeve by at least 2 inches. Shrink the second sleeve down.

14. When splicing a non-jacketed cable to a jacketed cable or whenever jacketed cables are joined and shrinkable covers are not used, the jackets must be sealed per Dist. Std. 59 40 90 14.

			1 PH	3 PH
	Std. / Stk. No.	Description	03	04
	17 55 298	Splice – Long Repair Unit, 4/0 Al. 15 kV	1	1
	17 63 127	Sleeve – #2 Copper	6	
	17 60 103	Sleeve – #4 Copper		4
	17 55 443	Sleeve – Cold – Shrinkable	1	1
@	415	Operation Code	1	1



NOTES:

Train cables into position (unwind concentrics to reach across splice) cut cable.

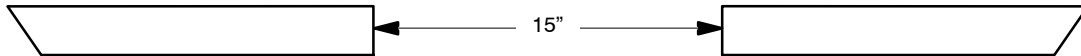
1. Strip 9" of jacket and 7" of semi-conducting shield.
2. Remove 1-3/4 inches of insulation off both sides of cable.
3. Pencil shoulder with pencilling tool.
4. Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Use one of the stocked stainless steel wire brushes. Crimp connector – using 5/8 tool or U-die.
5. Tape one half lapped layer of conducting tape to cover connector and exposed conductor.
6. Tape over connector with high voltage tape to fill in connector area level over the stripped area level with factory insulation.
7. Begin taping across splice with H.V. tape beginning 1/2 inch short of the conducting factory shield.
8. Tape over splice running 1/2 lapped layers side to side maintaining full circumference over mid splice to well over the factor insulation – then begin to taper to the cable insulation.
9. Apply one half lapped layer of conducting tape over insulation to cover one inch of factory shield on each side of splice.
10. Cover splice with two or more layers of plastic tape half lapped.
11. Seal concentrics onto jacketed cable where cable is jacketed See U.E. Standard 59-40-90-14.
12. Connect concentrics across splice.

	Std. / Stk. No.	Materials/ Splice	41 34 39 04	Qty.
A	17 54 145	Connector Two Bolt		1 Each
B	25 53 076	Tape, Conducting Rubber		2 Rolls
C	25 53 070	Tape, Rubber High Voltage		3 Rolls
D	25 53 055	Tape, Plastic		2 Rolls
E	31 53 055	Sealer, Compound		As Req'd.
G	17 60 344	Sleeve HV #2 to 1/0 AWG		1 Each
	718	Operation Code		1 Each

CONCENTRIC NEUTRAL WIRES OR FLAT STRAPS SHIELDED CABLES

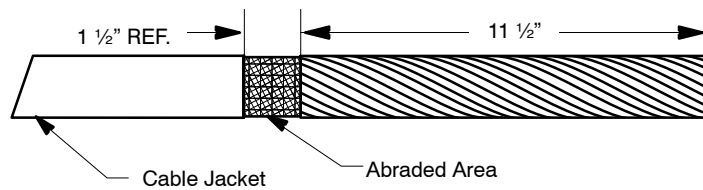
XIII. Positioning the Cables:

- Straighten and train the cable ends.
- Cut the cables with 15" between them to allow space for the bus.
- Clean the cable jacket up to 36" from the end of the cable.



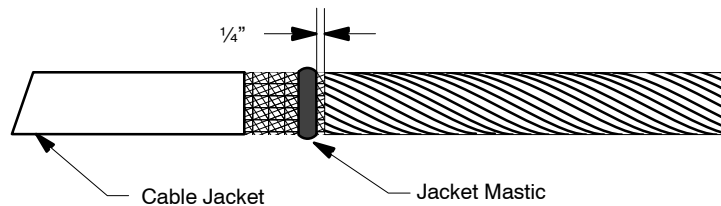
XIV. Exposing the Metallic Shield:

- Remove the cable jacket 11 1/2" as shown below.
- Abrade the area as shown.



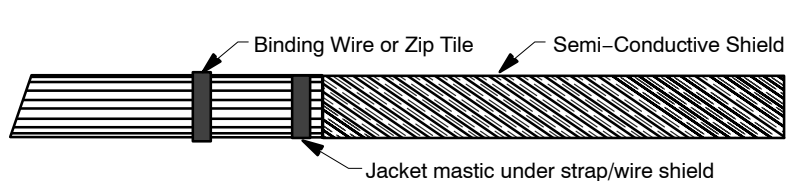
XV. Applying the Jacket Mastic:

- Apply one piece of jacket mastic at the position shown below by stretching and wrapping with light tension fully around the outer jacket.



XVI. Exposing the Cable Semi-Conductive Shield:

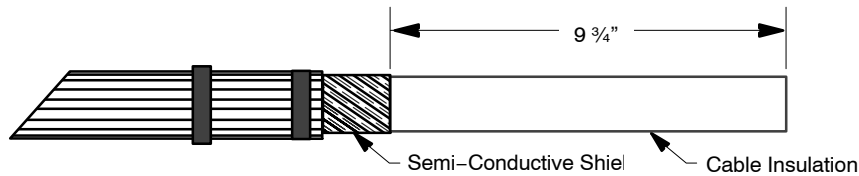
- Fold back the wire / flat strap shields and press firmly into the jacket mastic.
- Secure the wires / flat straps 3" back from the jacket mastic with a binding wire or zip tie as shown below.



CABLE – JOINT – PREMOLDED **15/35 kV “I”, “Y”, and “H” Splice** **#2 Through 750 kcmil Cu or Al**

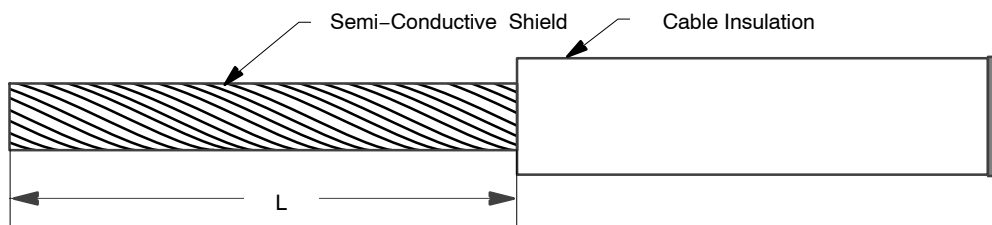
41 35 31 **
Sheet 2 of 13

XVII. Remove the semi-conductive shield 9 ¾” as shown below. (do not nick or cut the cable insulation).



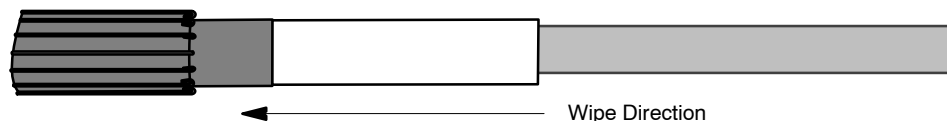
XVIII. Remove the cable insulation for the length (L) in inches per each dis-con kit as shown below:

<u>Kit Stock #</u>	<u>Length (L) in Inches</u>
17-05-522	2
17-05-525	2 3/4
17-05-523	2 3/4
17-05-524	3 3/8



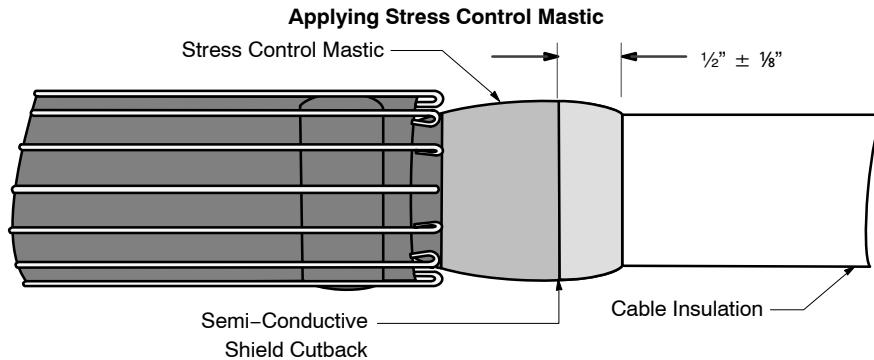
XIX. Repeat Steps I to VI for the other cable(s).

XX. Clean the insulation with the cleaning wipes by wiping from the lug to the shielding.



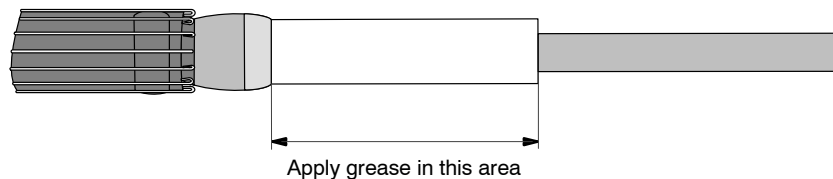
XXI. Applying the Stress Control Mastic

- a. Apply the stress control mastic on top of the exposed semi-con shield cut back and overlapping the cable insulation by $\frac{1}{2}$ " as shown below. Apply the mastic with light tension so that it slightly stretches and completely wraps the cable.



XXII. Applying Grease

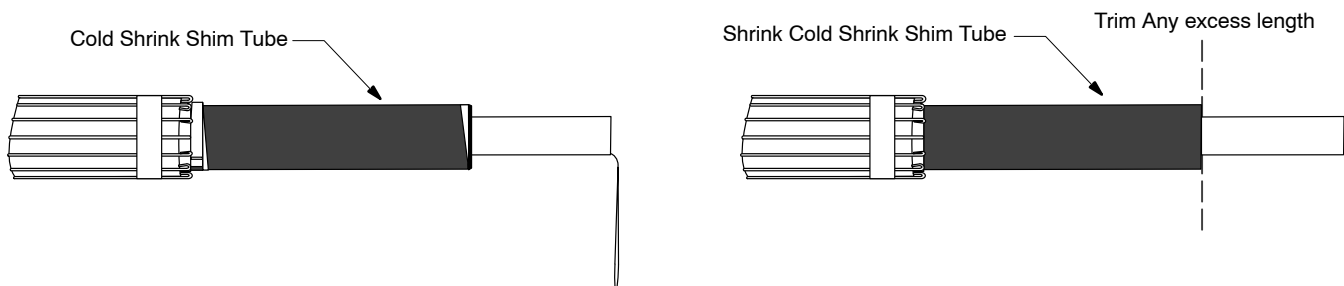
- a. Apply grease over the cable insulation as shown below. Use only the grease supplied in the kit. Avoid applying any grease on the stress control mastic as it may prevent adhesion to the sealing mastic applied later on.



XXIII. NOTE: FOR STOCK # 17-05-522 (15kV #2 AWG DIS-CON Kit) ONLY:

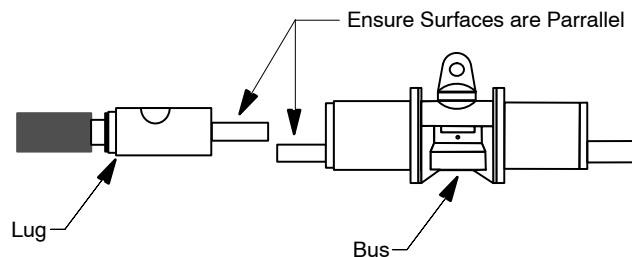
Installing the Shim Tube

- a. Align the cold shrink shim tube over the cable end so that the tube will land over the applied stress control mastic, butted up to the concentric wire / flat strap fold back.
- b. Unwind the spiral holdout to shrink the sleeve in place.
- c. Trim the extra length of the tube so that it is even with the cable insulation cut back.



XXIV. Installing the Lug

- Clean the conductor. For aluminum conductor, wire brush and immediately insert the lug onto the conductor. Slide the lug until the conductor is fully seated within the lug barrel.
- Rotate the lug so that the spade is parallel to the contact face of the bus as shown.
- Snug all of the bolts starting with the bolt closest to the cable insulation and moving towards the lug pad.
- Shear off all of the bolts in the same order.
- The 1/0–350 kcmil lugs have shear bolts that take a 6mm Allen hex socket (stk. #86–44–455). The #2 lug (stk. # 17–55–842) and the #2 dis-con kit (stk. # 17–05–522) shear bolts take a 5 mm Allen hex socket (stk. 86–44–454). The 750 kcmil lug (stk. # 17–55–844) and the 750 kcmil dis-con kit (stk. # 17–05–524) shear bolts take an 8 mm Allen hex socket (stk. # 85–32–776).



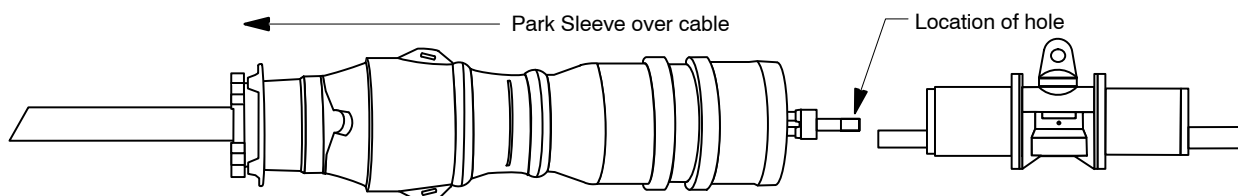
XXV. Checking the Lug

- Confirm that the distance after installing the lug does not exceed the 7 1/8" dimension shown below.



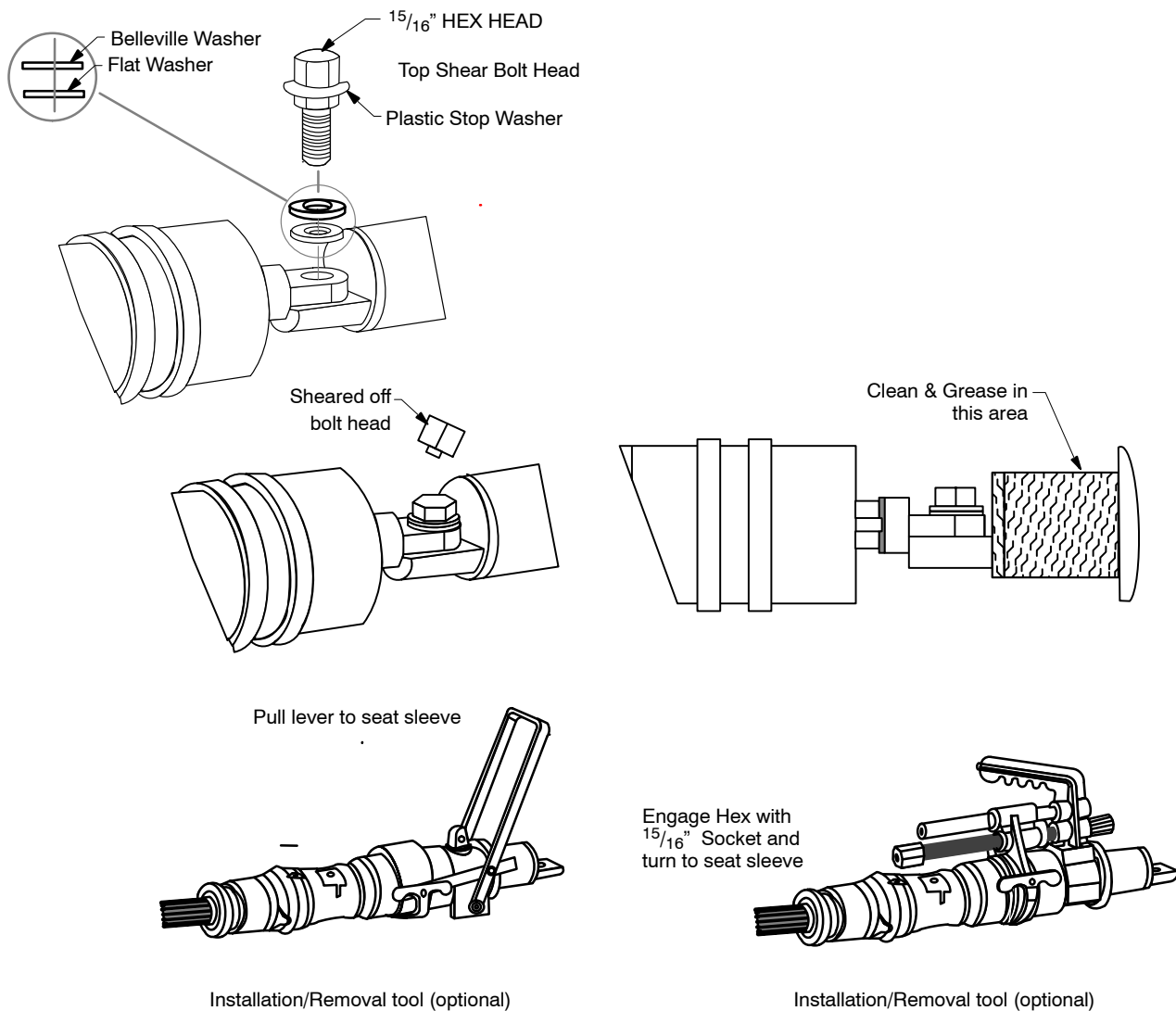
XXVI. Parking the Sleeve

- Slide the sleeve body over the cable so that the hole in the lug is visible as shown below.



XXVII. Installing the Sleeve

- a. Position the Belleville washer and the flat washer as shown.
- b. Insert the bolt through the lug and hand-tighten the bolt to ensure that all of the cables fit on the bus.
- c. Tighten the top $1\frac{5}{16}$ " shear bolt head until it shears off.
- d. Clean the splice interface as shown.
- e. Apply grease over the bus interface as shown. Use only the grease supplied in the kit.
- f. Slide the sleeve body over the lug and push it onto the bus. This can be accomplished by hand or by use of an installation tool as shown below.

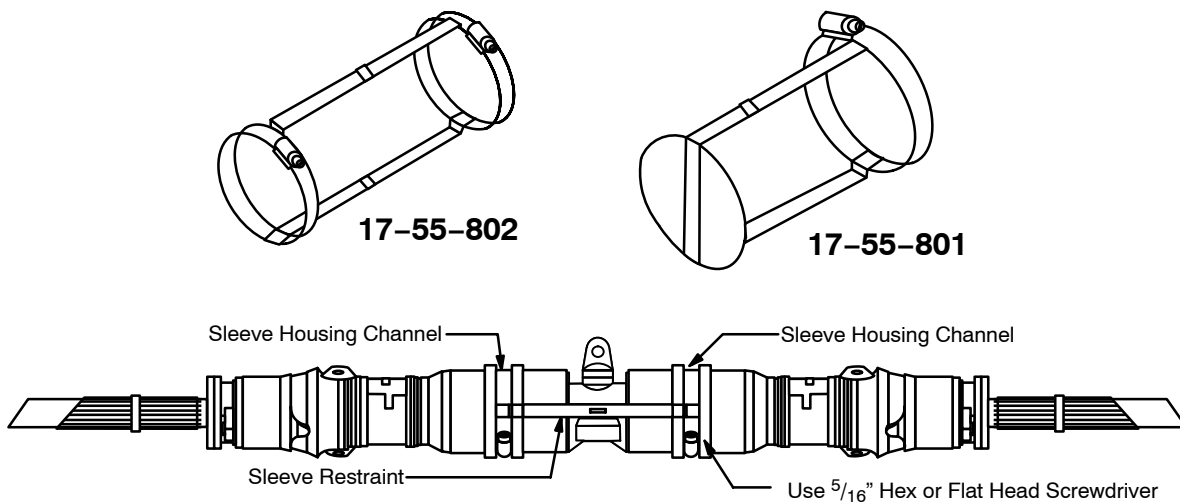


XXVIII. Repeat Steps VIII to XV for the other cables.

XXIX. Sleeve Restraints

- a. Apply sleeve restraints in the sleeve housing channels.
- b. The hose clamp can be tightened with a $\frac{5}{16}$ " hex or flat headed screwdriver. Fully tighten the hose clamp on the sleeve restraint until the screw “clicks”. It is designed to click when fully tightened and cannot be over-tightened.
- c. Apply the sleeve restraints as follows:
 - i. I Splice: one stock # 17-55-802 double end.
 - ii. Y Splice: one stock # 17-55-802 double end and one # 17-55-801 single end.
 - iii. H Splice: two stock # 17-55-802 double ends.

Note: If sleeves are not fully seated onto the splice, the sleeve restraints cannot be installed.



XXX. Removing the Core From the Sleeve

- a. Grasp the removal ring. Push the ring against the core flange and twist so that the cutting teeth break the tape on both sides. Check that the tape is broken.
- b. Completely remove the core from the rubber housing by hand. DO NOT twist the core while removing it.



XXXI. Applying the Sealing Mastic

- Apply sealing mastic to overlap the stress control mastic and completely overlap the jacket mastic as shown below.
- Compress the sealing mastic to create a smooth transition to the stress control mastic. This will assist during jacket seal application.



XXXII. Applying the Jacket Seal

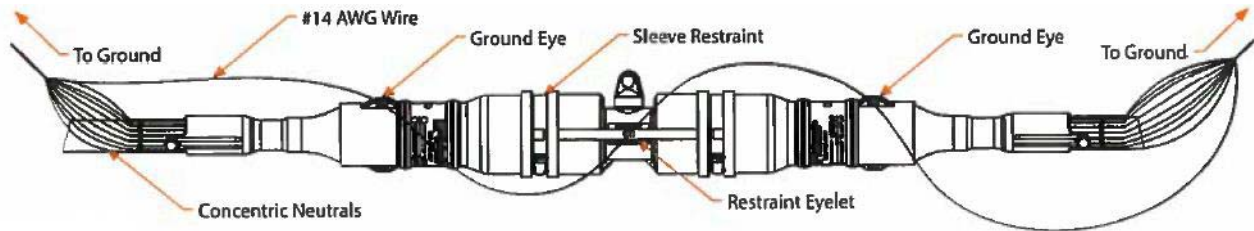
- Apply grease over the area as shown. Only use the silicone grease supplied with the kit.
- Hold onto both of the tabs and pull out to completely cover the sealing mastic as shown below.
NOTE: Ensure that the sealing mastic is not dislodged when unfolding the seal.



XXXIII. Repeat Steps XVII to XX for the other cable(s)

XXXIV. Connecting the Splice To Ground

- For each cable, insert one end of a #14 wire through the restraint eyelet and twist to make a small loop.
- Wrap the other end through the sleeve eyelet and connect to the shield wires with two bolt clamps.
- Connect the neutral wires to ground wiring 600 V #2 AWG copper covered wire.



XXXV. THE INSTALLATION IS COMPLETE.

LC SHIELDED CABLES

I. Positioning the Cables:

- Straighten and train the cable ends.
- Cut the cables with 15" between them to allow space for the bus.
- Clean the Cable jacket up to 36" from the end of the cable.



II. Exposing the Metallic Sheath

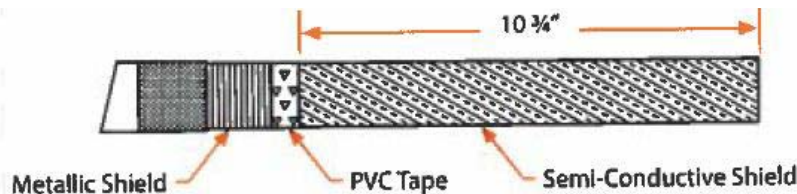
- Remove the cable jacket to the dimensions shown below
- Abrade the area as shown below.



III. NOTE: The Jacket Mastic Will Be Applied in Step XIII.

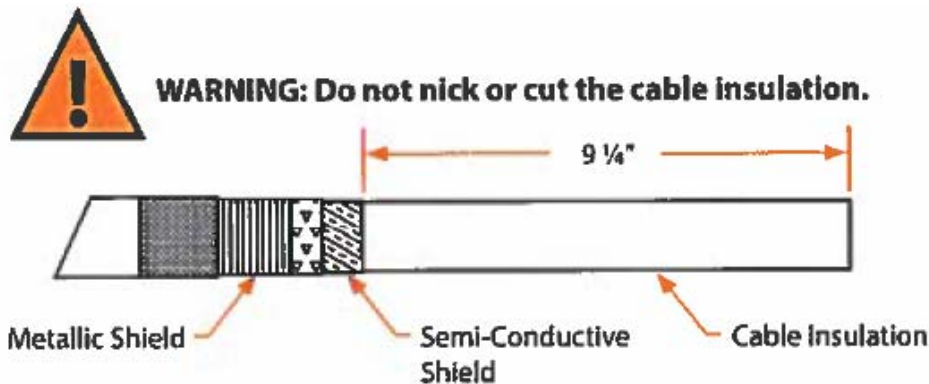
IV. Exposing the Semi-Conductive Shield.

- Wrap two layers of plastic tape at the dimension shown below to secure the metallic shield.
- Remove the metallic shield up to the plastic tape as shown below.



V. Exposing the Cable Insulation

- Remove the semi-conductive shield to the dimension shown below.



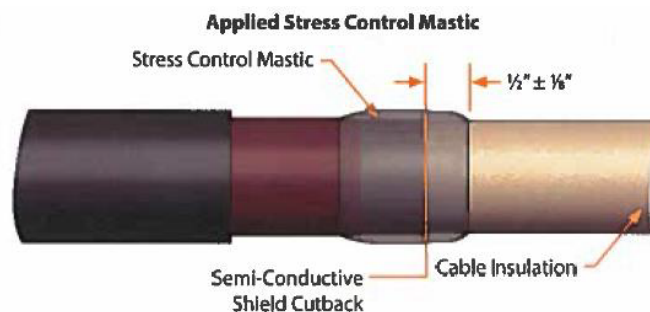
VI. Exposing the Conductor

- Remove the cable insulation based on the cable kit stock number shown in Step VI for the wire shielded cable.
- Do not cut or nick the cable strands.

VII. Repeat Steps I through VI for the other cable(s)

VIII. Applying the Stress Control Mastic

- Remove the plastic tape from Step VI.
- Apply the stress control mastic on tip of the exposed semi-con shield cutback and overlapping the cable insulation by 1/2" as shown below. Allow the mastic with light tension so that it slightly stretches and completely wraps the cable.



IX. Applying Grease

- a. Apply grease over the exposed cable insulation as shown. Use only the grease supplied in the kit. Avoid applying any grease on the stress control mastic as it may prevent adhesion to the sealing mastic applied later on.

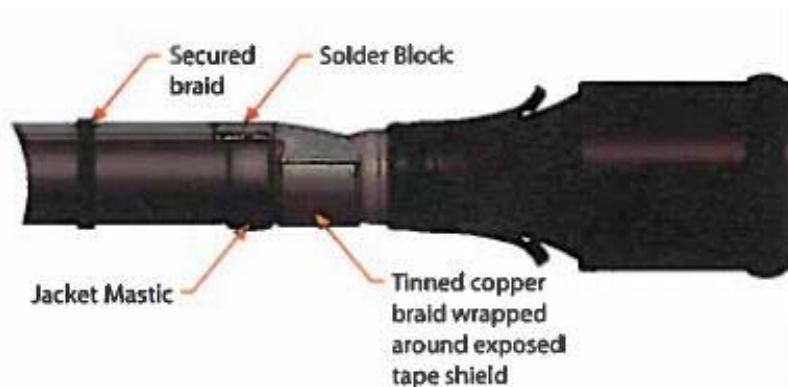
X. Install and check the Lug Dimension and Park and Install the Sleeves in the Same Manner as the Wire Shielded Cable. Repeat Steps VIII through X for the Other Cable(s).

XI. Add Sleeve Restraints to all Cables. See Instructions for Wire Shielded Cables.

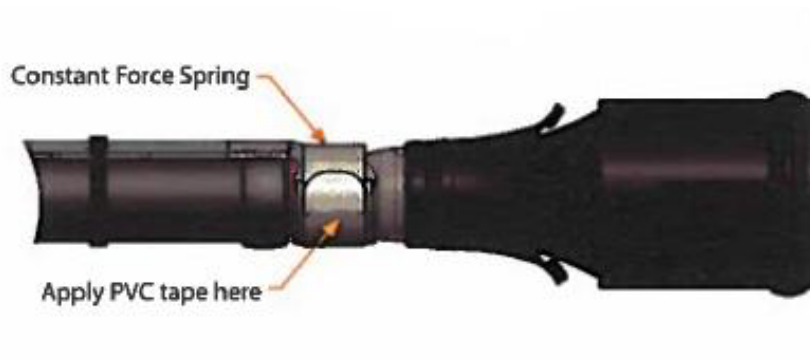
XII. Remove the Core on Each Cable. See the Instructions for Wire Shielded Cable.

XIII. Preparing the Metallic Shield

- a. Install the jacket seal mastic on the cable jacket aligned with the jacket cutback.
- b. Wrap tinned copper braid around the exposed LC shield.
- c. Align the edge of the solder block with the jacket cutback.
- d. Secure the copper braid 3" back from the end of the jacket mastic with zip tie or binding wire.



- e. Install the constant force spring over the wrapped copper braid.
- f. Wrap two layers of plastic tape over the constant force spring.
- g. Press the solder block into the jacket mastic.



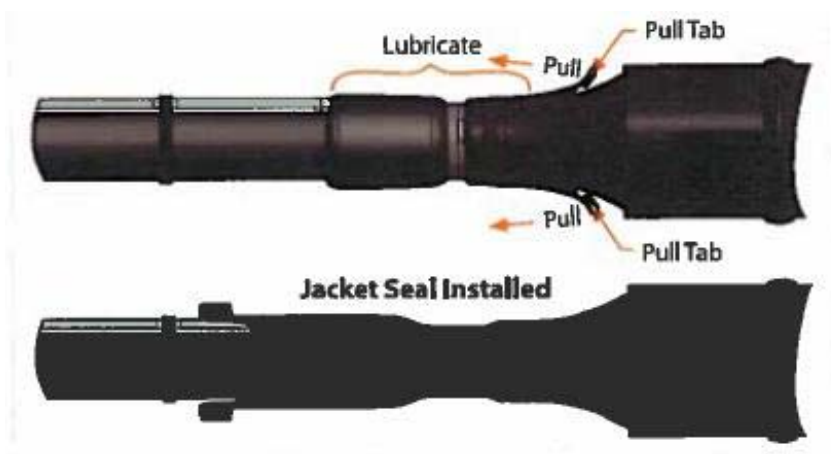
XIV. Applying the Sealing Mastic

- a. Align the sealing mastic to completely overlap the jacket mastic as shown below.
- B. Compress the sealing mastic to create a smooth transition to the stress control mastic; this will assist during the jacket application.



XV. Applying the Jacket Seal

- a. Apply grease over the area shown below. Only use grease supplied with the kit.
 - b. Hold onto both tabs and pull out to completely cover the sealing mastics as shown below.
- Note:** Ensure that the sealing mastic is not dislodged when unfolding the seal.



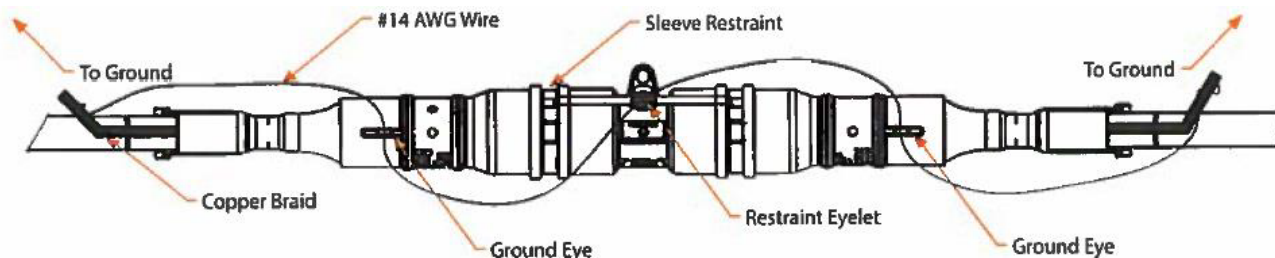
XVI. Repeat Steps XII to XV for the other cables.

CABLE – JOINT – PREMOLDED
15/35 kV “I”, “Y”, and “H” Splice
#2 Through 750 kcmil Cu or Al

41 35 31 **
Sheet 12 of 13

XVII. Connecting the Splice to Ground

- a. For each cable insert one end of a #14 wire through the restraint eyelet and twist to make a small loop.
- b. Wrap the other end through the sleeve eyelet and connect to the copper braids with two bolt clamps.
- c. Connect the copper braids to ground using 600 V #2 AWG copper covered wire.



XVIII. THE INSTALLATION IS COMPLETE

		Dist. Stnd. /Stk. No.	Description	41 35 31 **	01	02	03
	A	17 05 530	Bus Bar, I Splice, 15/35 kV		1		
		17 05 372	Bus Bar, Y Splice, 15/35 kV			1	
		17 05 529	Bus Bar, H Splice, 15/35 kV				1
@	B	17 05 522	Dis-con Kit, #2 AWG 15 kV Only				
		17 05 525	Dis-con Kit, 1/0 – 350 KCMIL RW 15 kV				
		17 05 523	Dis-con Kit 350 kcmil 15 kV & 1/0 – 350 kcmil 35 kV				
		17 05 524	Dis-con Kit 750 kcmil 5 / 15 / 35 kV				
	C	18 54 027	Wire – #2 Copper, 600 V Cov.		12	12	20
	D	18 52 018	Wire – #14 Copper, Binding, Bare		5	8	10
@	E	17 54 306	Connector Cable Grounding, 15–35kV				
@	F	17 05 315	Cap – Insulating End				
	G	17 55 801	Restraint – Splice, Single Housing End			1	
	H	17 55 802	Restraint – Splice, Double Housing End		1	1	2
5 @	I	17 05 526	Sleeve Only, #2 – 350 kcmil RW 15kV, with Shim Tube				
5 @	J	17 05 527	Sleeve Only, 350 kcmil RW 15kV, and 1/0 350 kcmil 35kV				
5 @	K	17 05 528	Sleeve only, 750 kcmil 5 / 15 / 35 kV				
6 @	L	17 55 842	Lug Only, #2 AWG 15 kV, AL / CU				
6 @	M	17 55 843	Lug Only, 1/0 –500 kcmil, AL / CU				
6 @	N	17 55 844	Lug Only, 350 –750 kcmil, AL / CU				
	O	17 54 140	Connector – Wire, #8–4/0 CU, 2 Bolt		2	2	2

CABLE – JOINT – PREMOLDED
15/35 kV “I”, “Y”, and “H” Splice
#2 Through 750 kcmil Cu or Al

41 35 31 **
Sheet 13 of 13

<u>Cable Size</u>	<u>Dis-con Kit Stock#</u>
750 NSR, 5 kV	17-05-524
#2 AL, CNR, P, 15 kV	17-05-522
4/0 AL, CNR, P, 15 kV	17-05-525
350 FSR, P, RW, 15 kV	17-05-525
350 CNR, P, 15 kV	17-05-523
750 AL, CNR, P, 15 kV	17-05-524
750 CNR, P, 15 kV	17-05-524
750 FSR, P, RW, 15 kV	17-05-524
1/0 AL, CNR, P, 35 kV	17-05-523
350 CNR, P, 35 kV	17-05-523
750 FSR, P, 35 kV	17-05-524

NOTES:

- 1) For each “I” Splice (Item A) choose a combination of two Dis-con kits (Item B) or a Dis-con kit and an End Cap (Item F).
- 2) For each “Y” Splice (Item A) choose a combination of three Dis-con kits (Item B) or Dis-con kits(s) and End Cap(s) (Item F).
- 3) For each “H” Splice (Item A) choose a combination of four Dis-con kits (Item B) or Dis-con kits(s) and End Cap(s) (Item F).
- 4) For a three phase cable splice installation the selected bus, Dis-con kits and grounding materials should be multiplied by three.
- 5) When reconnecting cables to the splice, use the Sleeve Only Items (I, J, and K).
- 6) When replacing a shear bolt lug, use the Lug Only Items (L, M, and N).
- 7) A Test Point Indicator (Stk.# 17-05-483) may be applied to the bus to show that the splice is energized. However, a non-indication of the Test Point indicator should not be used to prove that the splice is de-energized.
- 8) A Test Box (Stk. # 85-36-355) can be used to verify proper operation of the Test Point Indicator.

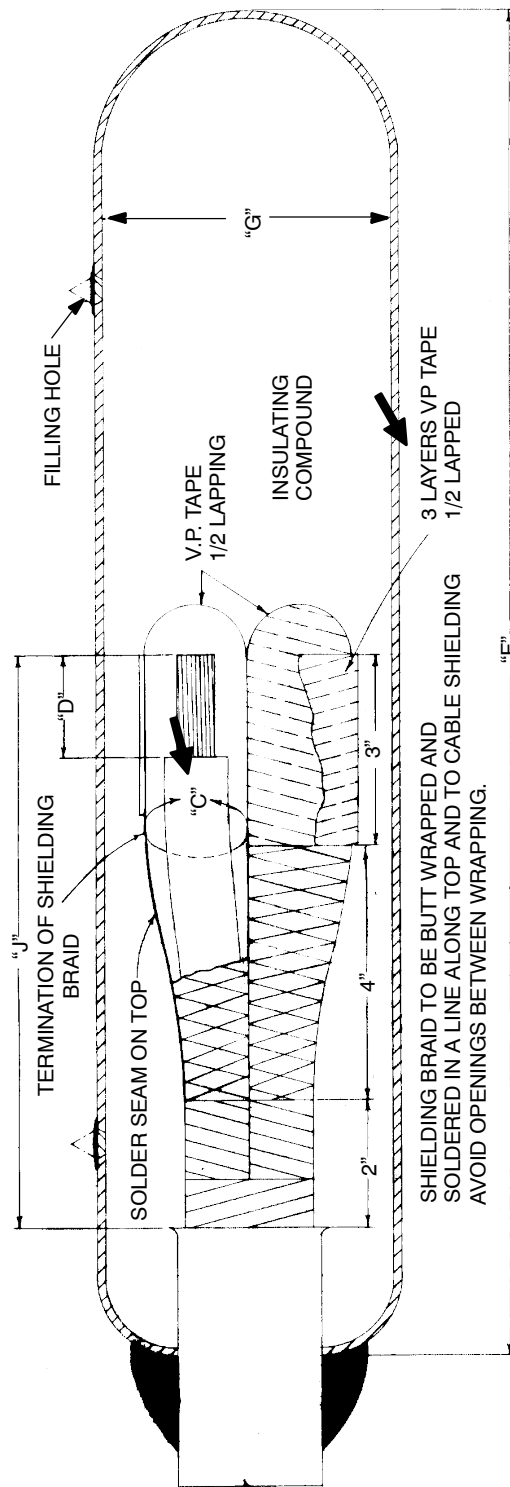
CABLE - JOINT
 5 kV to 15kV Test Cap
 1/0 Thru 800 kcmil 3 Cond. Lead Cable (Belted or Shielded)

41 36 11 **

Sheet 1 of 2

NOTES:

1. Shielded joint shown for belted joint, omit shielding braid.
2. See Dist. Std. 41 30 00 00 for materials and operation code.



CABLE – JOINT
5 kV to 15kV Test Cap
1/0 Thru 800 kcmil 3 Cond. Lead Cable (Belted or Shielded)

41 36 11 **

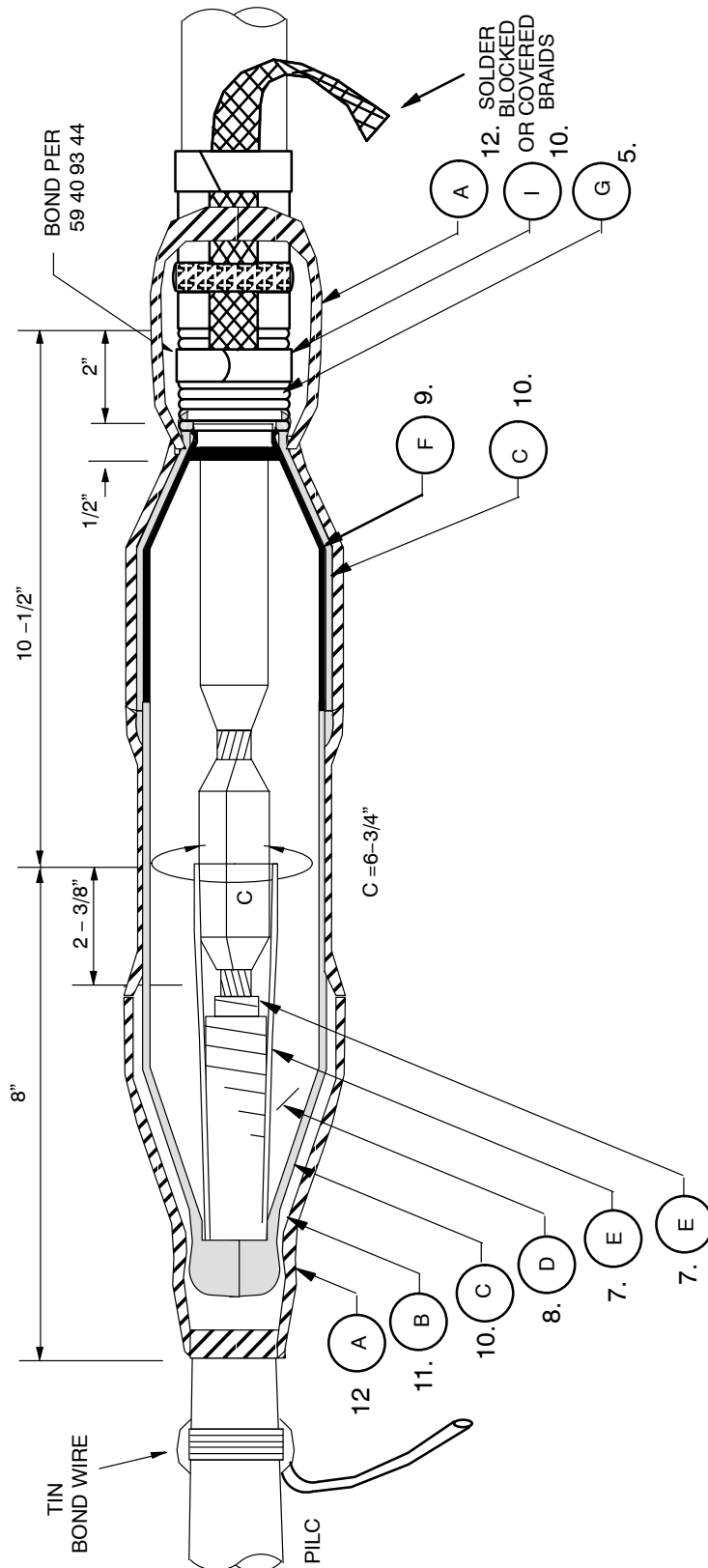
Sheet 2 of 2

Dist. Std. No.	Size of Cable	Circumference Over Insulation "C"		Length of Bare Copper "D"	Lead Sleeve		Length Lead Removed "J"	
		5000V	15000V		Length "F"	I.D. "G"	5kV	15kV
41 36 11 01	1/0	3"	3-7/8"	1-3/8"	20"	3-1/2"	9"	11"
41 36 11 02	4/0	3-5/8"	4-5/8"	1-5/8"	21"	4"	9"	11"
41 36 11 03	300 kcmil	4-1/4"	5"	1-5/8"	22"	4-1/2"	9"	11"
41 36 11 04	350 kcmil	4-3/8"	5-1/4"	1-5/8"	22"	4-1/2"	9"	11"
41 36 11 05	500 kcmil	5-1/4"		2"	22"	4-1/2"	9"	
41 36 11 06	800 kcmil	5-7/8"		2-5/8"	24"	5"	10"	
41 36 11 07	800 kcmil		6-7/8"	2-5/8"	24"	5-1/2"		13"

CABLE JOINTS
15 kV
750 CU,1C, PILC-LCR/LCX

41 37 21 11

Sheet 1 of 2



NOTE: THIS SPLICE MUST BE PLACED ABOVE THE WATER LINE WHEN INSTALLED IN MANHOLE .

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 1
REV. DATE: 11/12/96
REAFFIRMED DATE: 9/21/10

NOTE:

1. Train cables into their final position, mark the center of the splice and cut the cables with a hacksaw.
2. Clean the cables. Strip as shown in the figure. Strip the extruded cable first.
3. Remove any black or metalized paper tapes on the PILC insulating surface all the way back to the lead sheath. Protect the paper insulation with a covering while preparing the extruded cable.
4. Taper the insulation on the extruded cable side with a pencilling tool. Do not use solvents on the cable unless absolutely necessary. If solvents are used, they must be dried off with the aid of a clean dry cloth.
5. Install the L.C. grounding connector per Dist. Std. 59 40 93 44, Sheet 2.
6. Cover both of the insulations while tinning the connector. Tin the connector and finish using standard sanding and smoothing techniques.
7. Tape to the height of the connector shoulder with V.P. tape on the PILC side of the connector. Tape two layers half lapped V.P. tape over the paper insulation to the middle of the soldered connector.
8. Insulate the splice with high voltage rubber tape stopping just short of the sheath on the lead side to just short of the extruded insulation shield on the extruded cable side. Tape to a 6-3/4" circumference.
9. Tape one layer of conducting tape to cover the extruded insulation and the extruded cable's insulation shield.
10. Cover the joint with shielding braid to 1/2" over the metal on both sides. Seal the L.C. grounding connector with sealing compound.
11. Waterproof the paper side by applying a layer of moisture proofing tape over the lead cable, as shown.
12. Tape three layers of PVC tape over the entire joint.
13. Apply the bond to the lead sheath. Connect this lead to the L.C. grounding connector leads and to the bonding system.

		Std. / Stk. No.	Description	41 37 21 11	
	A	25 53 055	Tape, Plastic		2
	B	25 53 053	Tape, Moisture Proof		1
	C	18 66 101	Braid, CopperTinned		2
	D	25 53 070	Tape, High Volt. Rubber		3
	E	25 53 022	Tape, Varnished Polyester		2
	F	25 53 076	Tape, Rubber, Conducting		1
--▶	G	17 54 306	Connector, Cable Grounding		1
	H	17 60 054	Connector, 750 Kcmil		1
--▶	I	31 53 055	Compound, Sealer, Poly		1
			Operation Code 721		1

CABLE – JOINTS
35kV
Joint Materials

41 40 00 00
Sheet 1 of 3

Std. No.	Description OPERATION CODE	JOINT STANDARD NUMBERS					
		11 01	11 02	12 01	12 02	12 03	13 02
		732				733	739
17 60 138	Sleeve–Copper, 7" x 36"	1	1	1	1	1	
17 60 139	Sleeve–Copper, 7" x 36"						1
17 60 045	Connector–Copper, 350 kcmil	3			3		
17 60 052	Connector–Copper, 500 kcmil		3	3			
17 60 069	Connector–Copper, 800 kcmil					3	3
22 02 282	Solder–Wiping (Lb.)	12	12	12	12	12	12
22 02 273	Solder–50–50	3	3	3	3	3	3
22 02 276	Solder–String, 1/4"	1	1	1	1	1	1
22 02 255	Solder–Paste	1	1	1	1	1	1
25 53 063	Tape–V.P., 1" x 4 Yd., RI. (Cn)	1	1	1	1	1	1
19 11 094	Bushing–1/8" x 1/2"	2	2	2	2	2	2
19 11 015	Plug–Pipe, 1/8"	2	2	2	2	2	2
18 66 101	Braid–Copper Mesh RI.	3	4	4	3	4	4
31 53 028	Compound–Insul. Oil Insol. (Cn.)						2
31 51 003	Compound–Insul. Oil (GE219)						
31 51 020	Oil–Insul. (GE5314) (Gal.)						
31 51 062	Petrolatum – 3 Lb. Pkg. (Pk.)	5	5	5	5	5	
28 03 061	Wedge–Lead (Ft.)					2	2
31 53 007	Stearine (Ea.)	1	1	1	1	1	1
25 53 103	Tape–4" Plastic x 160' RI.	1	1	1	1	1	1
22 05 213	Cloth–Sanding, 1–1/2" W(Ft.)	2	2	2	2	2	2

CABLE – JOINTS
35kV
Joint Materials

41 40 00 00
Sheet 2 of 3

Std. No.	Description OPERATION CODE	JOINT STANDARD NUMBERS			
		41 42 11 01	41 42 11 02	41 43 11 01	41 43 11 02
		734	735	738	
12 53 025	Sleeve–Lead, 6" x 34"			1	1
12 53 028	Sleeve–Lead, 9" x 40"	1	1		
17 60 045	Connector–Copper, 350 kcmil	3			3
17 60 052	Connector–Copper, 500 kcmil			3	
17 60 054	Connector–Copper, 750 kcmil	3			
17 60 069	Connector–Copper, 800 kcmil		3		
22 02 282	Solder–Wiping (Lb.)	12	12	12	12
22 02 273	Solder–50–50	3	3	3	3
22 02 276	Solder–String, 1/4"	1	1	1	1
22 02 255	Solder–Paste	1	1	1	1
25 53 063	Tape–V.P., 1" x 4 Yd., RI. (Cn)	1	1	1	1
19 11 094	Bushing–1/8" x 1/2"	2	2	2	2
19 11 015	Plug–Pipe, 1/8"	2	2	2	2
18 66 101	Braid–Copper Mesh RI.	3	4	4	3
31 53 028	Compound–Insul. Oil Insol. (Cn.)			2	2
31 51 003	Compound–Insul. Oil (GE219)				
31 51 020	Oil–Insul. (GE5314) (Gal.)	8	8		
31 51 062	Petrolatum – 3 Lb. Pkg. (Pk.)	1	1		
28 03 061	Wedge–Lead (Ft.)		2		
31 53 007	Stearine (Ea.)	1	1	1	1
25 53 103	Tape–4" Plastic x 160' RI.	1	1	1	1
22 05 213	Cloth–Sanding, 1–1/2" W(Ft.)	2	2	2	2

CABLE – JOINTS
35kV
Joint Materials

41 40 00 00
Sheet 3 of 3

Std. No.	Description OPERATION CODE	JOINT STANDARD NUMBERS			
		41 44 11 01	41 44 11 02	41 46 11 01	41 46 11 02
		730		731	
12 53 056	Sleeve–Lead, 3–1/2" x 28"	1			
12 53 053	Sleeve–Lead, 4–1/2" x 28"		1		
12 53 025	Sleeve–Lead, 6" x 34"			1	1
12 53 055	Sleeve–Lead, Insul., 4–1/2" x 28"				
17 60 045	Connector–Copper, 350 kcmil	1			
17 60 054	Connector–Copper, 750 kcmil		1		
22 02 282	Solder–Wiping (Lb.)	6	6	12	12
22 02 273	Solder–50–50	2	2	3	3
22 02 276	Solder–String, 1/4"	1	1	1	1
22 02 255	Solder–Paste	1	1	1	1
25 53 063	Tape–V.P., 1" x 4 Yd., RI. (Cn)	1	1	1	1
19 11 094	Bushing–1/8" x 1/2"			2	2
19 11 015	Plug–Pipe, 1/8"			2	2
18 66 101	Braid–Copper Mesh RI.	3	4	3	3
31 53 028	Compound–Insul. Oil Insol. (Cn.)				
31 51 003	Compound–Insul. Oil (GE219)			4	4
31 51 020	Oil–Insul. (GE5314) (Gal.)				
31 51 062	Petrolatum – 3 Lb. Pkg. (Pk.)	1	1		
25 52 055	Tube–Fiber, 3/4" I.D. x 9"			3	
25 52 056	Tube–Fiber, 1" I.D. x 9"				3
31 53 007	Stearine (Ea.)	1	1	1	1
25 53 103	Tape–4" Plastic x 160' RI.	1	1	1	1
22 05 213	Cloth–Sanding, 1–1/2" W(Ft.)	2	2	2	2

CABLE JOINT – TRIFURCATING TRANSITION SPLICE

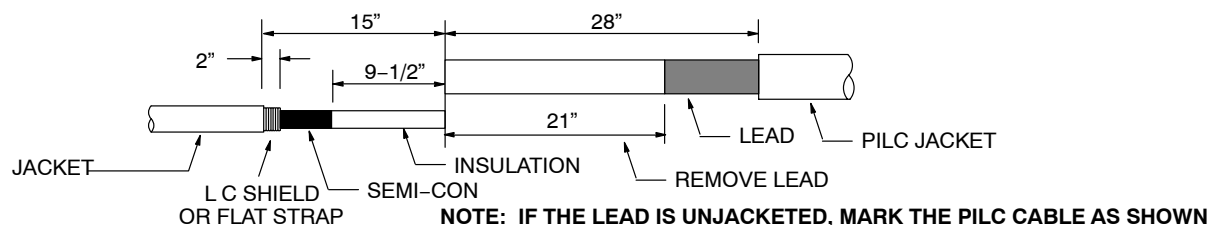
35 kV, 3/C PILC To 3 1/C Extruded Solid Dielectric
Raychem Heat-Shrinkable

41 43 22 **
Sheet 1 of 11

I GENERAL INSTRUCTIONS

1. Adjust the flame so that it is an overall 12-inch bushy flame.
2. Apply outer 3- to 4- inch tip of the flame to heat-shrinkable material with a rapid brushing motion.
3. Unless otherwise instructed start shrinking tubes at the center working the flame around all sides of the tubes to apply uniform heat.
4. Concentrate on heating the back of the tubes as well as the front of the tubes.
5. If it is necessary to interrupt the shrinking process and the tubes cool, you must reheat prior to shrinking the next tube.
6. Inspect all installed tubes. Reheat any flat spots or wrinkles, paying particular attention to the back of the splice.

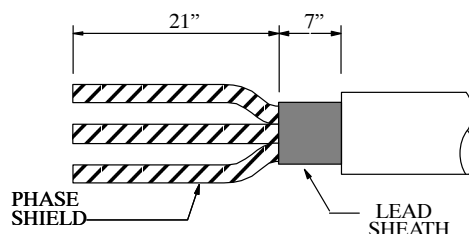
II PREPARE CABLES



SECURE END OF FLAT STRAP OR LC SHIELD WITH A LENGTH OF COPPER FOIL TAPE OR MINIMAL WIDTH WRAP OF PLASTIC TAPE.

III PREPARE AND REMOVE LEAD SHEATH

Remove lead oxide from the lead sheath and clean with an approved solvent. Remove the lead sheath as shown.



NOTE: FOR PHASE HOLDING

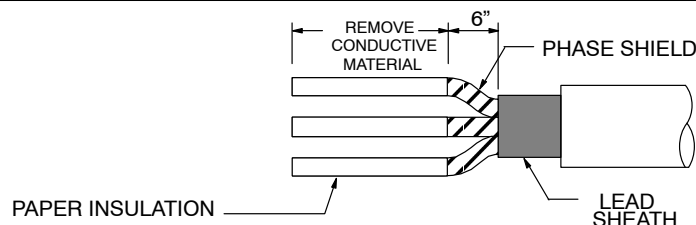
If an existing 3/C PILC cable is being cut and spliced to three new single conductor cables, "Phase Holding" may be required. After opening the lead sheath to expose the shielded phase conductors, place several wraps of colored tape around each phase before cutting the conductors. Use "white" to signify the "Held Phase A", blue to signify the "Held Phase B" and "red" to signify the "Held Phase C". The phase colors do not identify the actual phases but they represent the "Held Phase" of the system.

Due to the covering of the phases during the preparation of the splice, it will be necessary to move the markers several times throughout the splicing process. Each time the "Phase Holding" tape is to be moved to a new location, "Phase Holding" will be noted in the installation instructions.

If "Phase Holding" is not a requirement for this splice, then the "Phase Holding" comments should be ignored.

IV REMOVE SHIELD

1. Cut back any bedding and/or shield tapes over all three phases to the lead sheath cutback.
2. Cut back phase shields and remove any conductive material from paper insulation as shown.

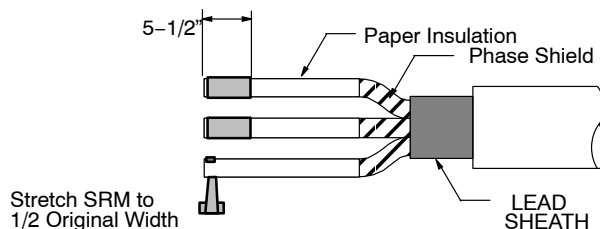


NOTE: TAPE PHASE SHIELDS AT EDGE TO PREVENT UNWRAPPING. DO NOT USE STRING.

USE ONE WRAP OF COLORED "PHASE HOLDING" TAPE OR PLASTIC TAPE.

V. APPLY STRESS RELIEF MATERIAL (SRM)

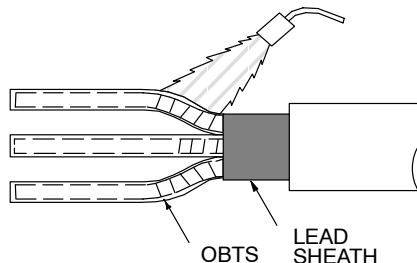
1. Mark the insulation 5-1/2" from the end of the PILC cable.
2. Remove the backing strip from one side of a long strip of SRM.
3. Roll up the SRM and remaining backing strip into a convenient size.
4. Removing the remaining backing strip, tightly wrap one, half-lapped layer of SRM around each phase from the cable end to the mark. Wrap the SRM in the same direction as the insulating papers on the cable.



VI POSITION AND SHRINK OIL BARRIER TUBES (OBT)

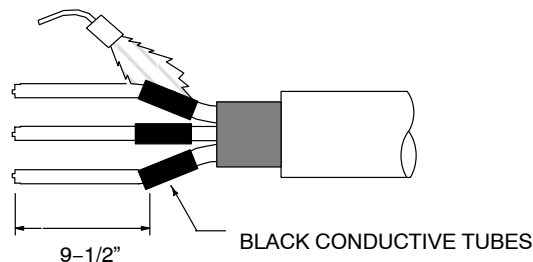
1. Place an oil barrier tube over each phase, butted to the lead sheath cutback.
2. Shrink the OBT's in the crotch area first. After the crotch is done, shrink one tube at a time.
3. Inspect the installed OBT's. The OBT's should have a smooth, wrinkle-free surface after shrinking. Reheat to smooth any wrinkled areas.

- NOTES:**
- (A)** OBT MAY SHRINK 1/4 - 1/2" AWAY FROM LEAD SHEATH CUTBACK. THIS IS OK.
 - (B)** TO ACHIEVE A SMOOTH, WRINKLE-FREE INSTALLATION, USE A REDUCED FLAME TO INSTALL THE THIN-WALLED OBT'S.



Phase Holding: Wrap a layer of "Phase Holding" tape to the connection end of the OBT before positioning and shrinking the Black Conductive Tubes.

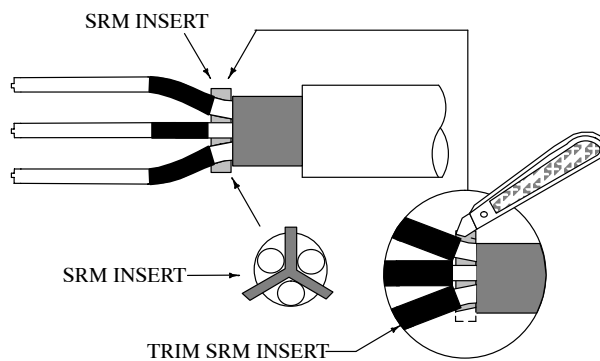
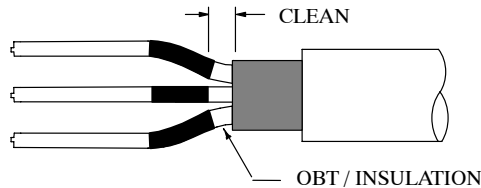
VII POSITION AND SHRINK BLACK CONDUCTIVE TUBES



1. Place a black conductive tube over each phase and position as shown.
2. Shrink the tubes in place starting at the end nearest to the center of the splice.

VIII CLEAN OBTS AND INSTALL SRM INSERT

1. Using an approved solvent, clean the OBT/in-sulation, as shown.

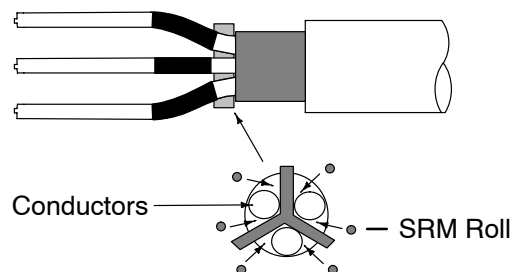


**NOTE: THE SRM INSERT IS PACKAGED
INSIDE THE CONDUCTIVE BREAKOUT.**

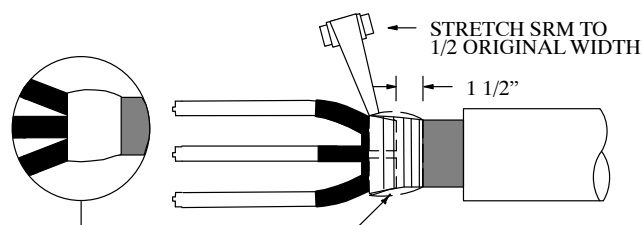
2. Assemble SRM insert per box instructions.
3. Spread the phases and position the SRM insert as shown
4. Trim SRM insert to extend 1/8" beyond each phase.
5. Reclean the lead sheath using an approved solvent.

IX FILL GAPS BETWEEN SRM INSERT AND CONDUCTORS

1. Cut a 6" piece of SRM into 6-1" strips.
2. Remove the backings and rollup each 1" piece.
3. Place two of the SRM rolls on each side of the SRM insert to fill the gaps between the insert and the conductors as shown.



X INSTALL OIL SEAL

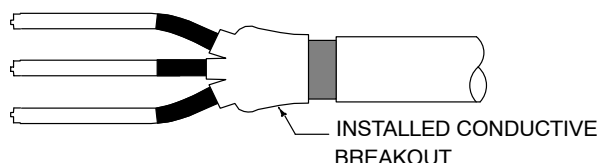


NOTES: (A) THE SRM WILL STICK BETTER IF THE LEAD SHEATH IS PRE-HEATED.

(B) DO NOT OVER APPLY SRM, THE FINISHED DIAMETER MUST NOT EXCEED THAT OF THE BREAKOUT BOOT.

1. Mark the lead sheath 1-1/2" from the end.
2. Remove the backing from one side of a long strip of SRM. Roll the SRM and remaining backing strip into a convenient size.
3. While removing the remaining backing strip, tightly wrap the SRM from the mark on the lead sheath to the outer edge of the SRM insert.
4. Four to six strips of SRM should be used to build the SRM to the shape shown.

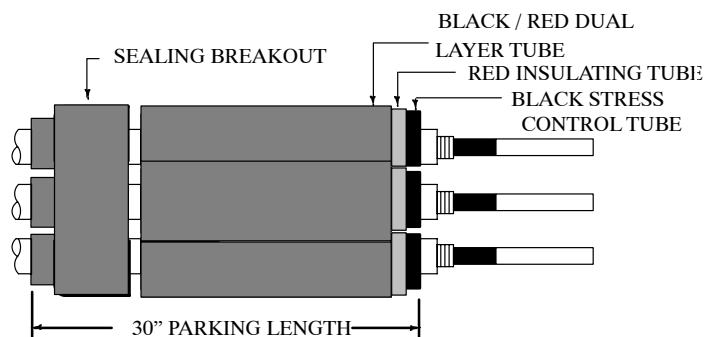
XI POSITION AND SHRINK CONDUCTIVE BREAKOUT



1. Position the conductive breakout over the SRM so that the inside butts up hard against the SRM.
2. Shrink the conductive breakout in place starting at the fingers and working toward the other end.
3. After the breakout has shrunk continue to apply heat until the breakout has a smooth, uniform surface.

Phase Holding: After breakout is cool, apply "Phase Holding" tape to the fingers of the cable breakout (last and final location for "Phase Holding" tape).

XII POSITION SPLICE COMPONENTS ON SOLID DIELECTRIC CABLES

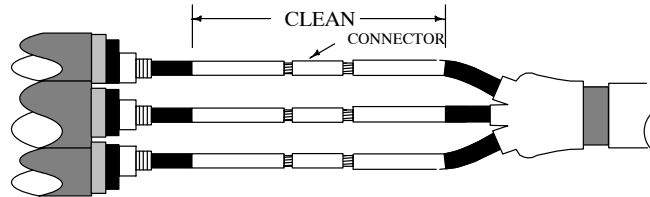


1. Clean 30" of cable jacket.
2. Place sealing breakout over the cables with the fingers pointing away from the splice center.
3. Place one set of nested tubes over each clean cable.

XIII REMOVE INSULATION AND INSTALL CONNECTORS

1. Determine the insert depth of the connector.
2. The insulation cutback should equal the connector insert depth plus 1/4".

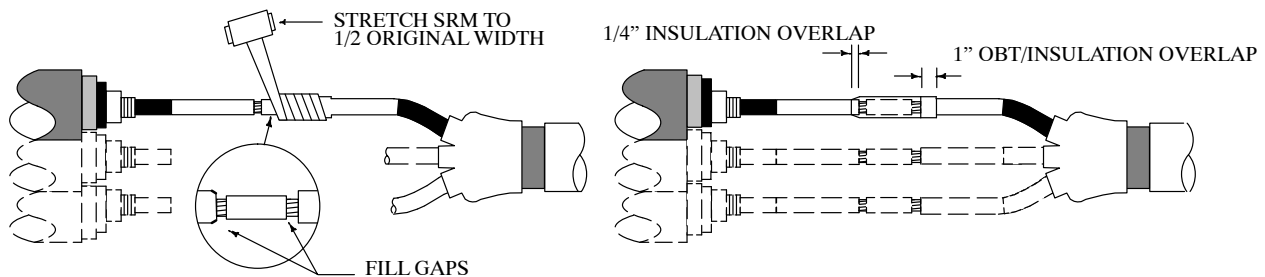
3. Chamfer or cut the sharp edge off of the EPR insulation for 1/4".
4. Install the connectors. Protect the OBTS, if using soldered connector by wrapping them with cotton or glass fiber tape.
5. Make sure connections are smooth.
6. Using an approved solvent, clean the insulation as shown. Pay particular attention to the OBT/insulation surface.



XIV APPLY SRM OVER CONNECTOR

NOTE: Complete Steps XIV and XV working on one phase at a time.

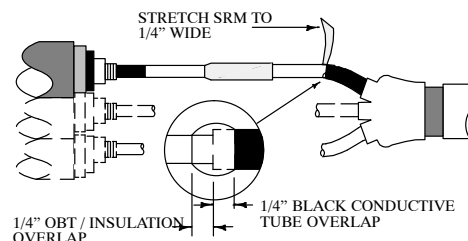
1. Remove backing from one side of a long strip of SRM, roll the SRM and remaining backing strip into a convenient size.
2. While removing the remaining backing strip, tightly wrap the SRM around the connector and exposed conductor. Be sure to fill the gaps and low spots around the connector.
3. Continue to wrap the SRM onto the insulation as shown.



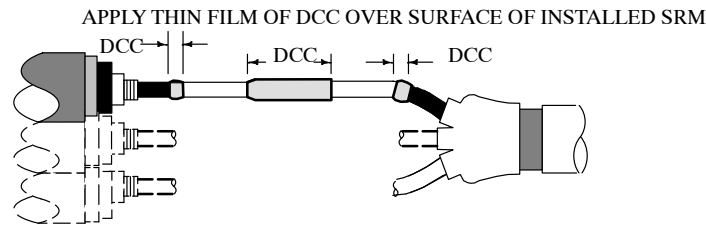
NOTE: IF THE CONNECTOR DIAMETER IS LARGER THAN THE INSULATION DIAMETER, APPLY TWO HALF-LAPPED LAYERS OF SRM OVER THE ENTIRE CONNECTION.

XV APPLY SRM AT BLACK CONDUCTIVE TUBE AND SEMI-CON STEPS, APPLY DISCHARGE CONTROL COMPOUND, AND THEN POSITION BLACK STRESS CONTROL TUBE

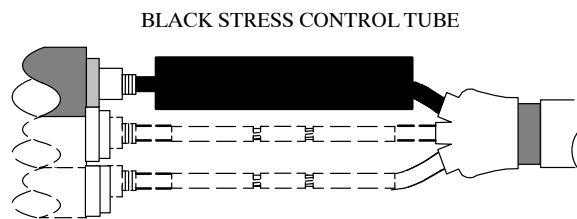
1. Remove the backing from the short angle-cut piece of SRM. Place the tip of SRM at the black conductive tube step and tightly wrap to fill the step. Overlap black conductive tube and OBT/insulation and taper as shown.
2. Repeat the above procedure for the semi-con step.



3. Snip open the end of the DCC tube and apply a thin film of compound on the SRM over the connector and semi-con steps.



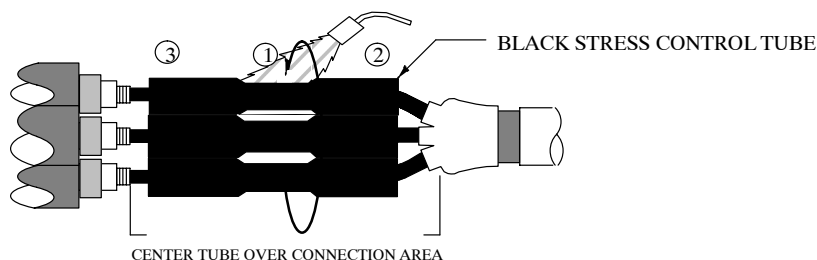
4. Center the black stress control tube over the completed connector area. Be sure to equally overlap the semi-con and the black conductive tube.



COMPLETE STEPS XII AND XIII FOR THE REMAINING TWO PHASES BEFORE PROCEEDING TO STEP XIV.

XVI SHRINK BLACK STRESS CONTROL TUBES

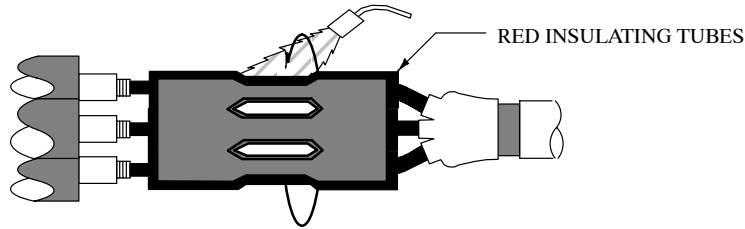
1. Make sure that each tube is centered over the connection area, equally overlapping the semi-con and black conductive tube.
2. Shrink all three tubes in place at the same time.
3. Begin shrinking at center of tubes (1), working torch with a smooth brushing motion around the tubes.
4. After center portions shrink, work torch toward one end (2), then to opposite end (3). Post heat all tubes.
5. Apply sufficient heat to ensure softening of the SRM, indicated by a smooth surface profile.



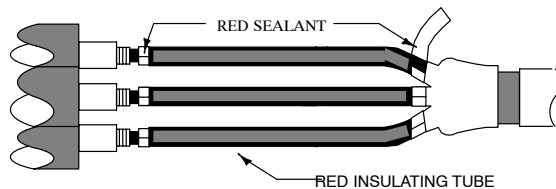
XVII POSITION AND SHRINK RED INSULATING TUBES

1. Center red insulating tubes over the black stress control tubes.
2. Shrink in place using the same method as XVI.

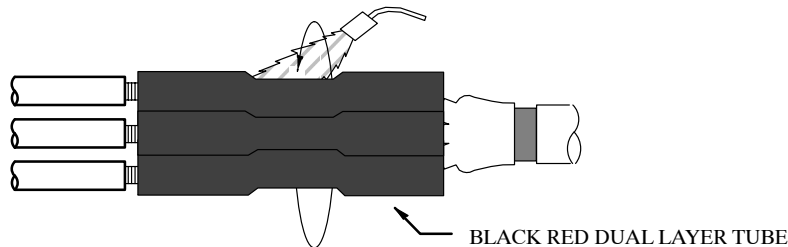
NOTE: Do not allow the red insulating tubes to cool before applying red sealant and installing the black/red dual layer tubes.

**XVIII APPLY RED SEALANT**

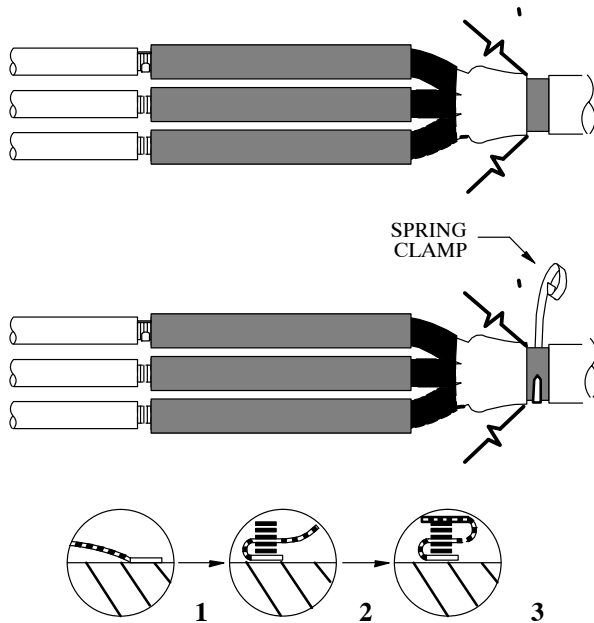
1. Remove backing from red sealant.
2. Using light tension, wrap sealant over the cable and butt against the red insulating tube as shown.
3. Build the sealant to the level of the red insulating tube.

**XIX POSITION AND SHRINK BLACK/RED DUAL LAYER TUBES**

1. Center the tubes over the red insulating tubes.
2. Shrink in place using the method described in XVI except stop shrinking 4" from each end. Then shrink each end.
3. After initial shrinking, heat the entire tubes for approximately 1 minute. The raised ridges should disappear. Absence of ridges can be observed by visual inspection and by feeling the surface with a gloved hand.



XX INSTALL GROUND LEADS TO PILC CABLE

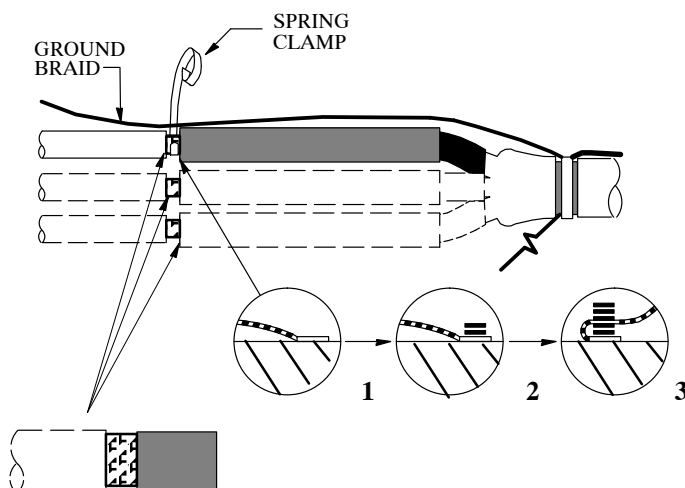


NOTE:

There are three (3) long braids provided with this kit. One end of the braid has a short length of heat shrink tube installed next to a 2" wide solder block. This is the end of the braid which will be positioned over the jacket for external grounding.

1. Wrap three layers of 2" wide copper mesh around the cleaned lead sheath on the 3/C PILC side of the joint. Tie off with a half hitch or equivalent knot.
2. Lay the three (3) braids across the joint evenly spaced around the joint circumference so that the braids overlap the mesh and the solder block is positioned over the jacket and aligned with the cable jacket cutback. Temporarily tape the braids into position.
3. (1) Wrap two turns of the LARGE spring clamp OVER the three (3) braids and mesh. (2) Fold the long end of the braid back over the spring clamp and wrap two additional turns. (3) Fold long end one more time over the spring clamp and complete wrapping the spring clamp over the braid. (The long end of the braid should be going across the splice at this time.)

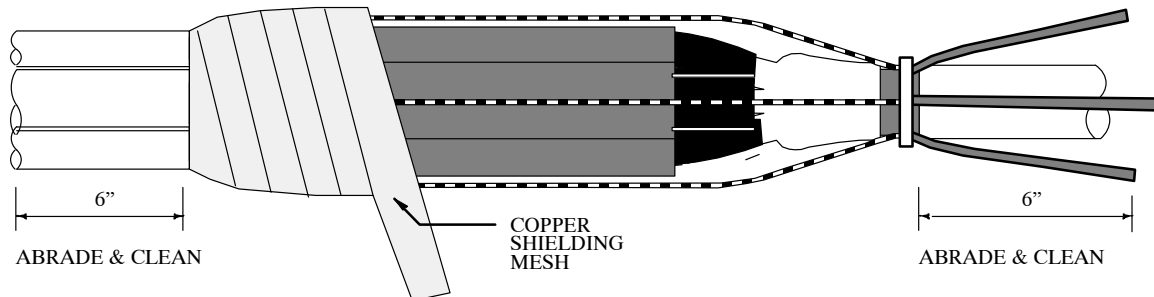
XXI INSTALL GROUND LEADS TO METALLIC SHIELDS



1. Wrap three layers of 2" wide copper mesh around the metallic shields of the solid dielectric cable and tie off with a half hitch or equivalent knot. (Wrap around flat strap, concentric wires or LC Shield.)
2. (1) Lay braid directly over the mesh. (2) Wrap two turns of the SMALL spring clamp OVER the braid and mesh. (3) Fold back the braid over the spring clamp and complete wrapping the spring clamp over the braid. (Excess braid should be going across the splice at this time.) Excess braid may be cut off or left over the splice.
3. Repeat this step for remaining phases until all three phases are completed.

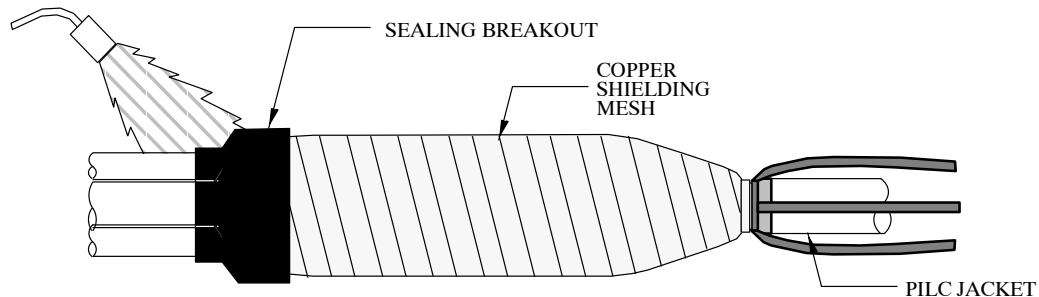
XXII APPLY SHIELDING MESH

1. Starting over the ground connections on the extruded solid dielectric cable side of the splice, wrap one half-lapped layer of 2" wide shielding mesh across the splice and tie off to the PILC cable lead sheath.
2. Abrade and solvent clean the cable jackets (or lead sheath) as shown.



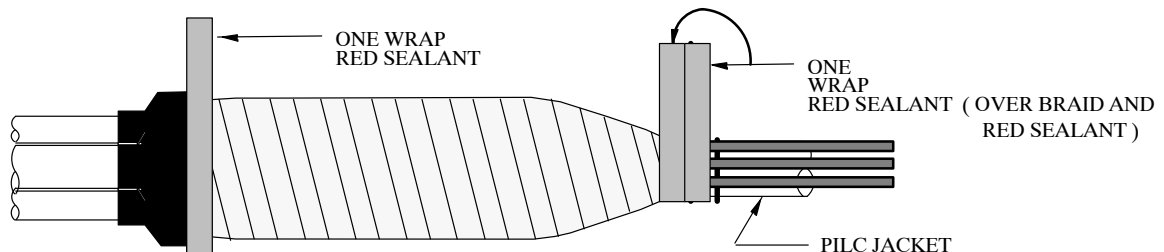
XXIII POSITION AND SHRINK NON-CONDUCTIVE SEALING BREAKOUT

1. Slide the breakout into position. Make sure that the full length of the fingers of the breakout are over the cable jackets and the body is extending over the splice.
2. Shrink in place starting at the fingers and working toward the splice center.



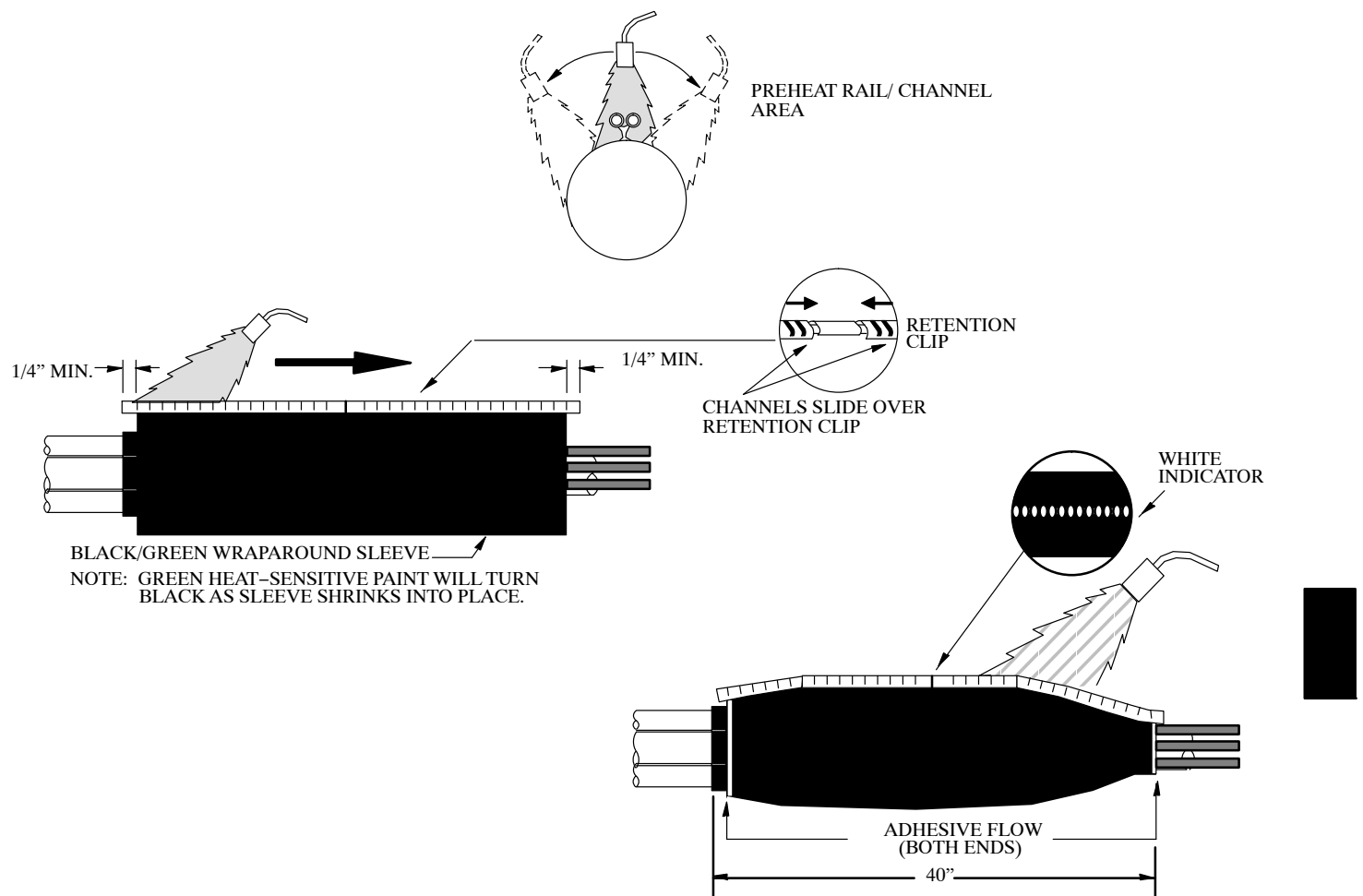
XXIV APPLY RED SEALANT

1. Allow the breakout to cool sufficiently to touch before proceeding.
2. Apply two single wraps of red sealant under the ground braids on the PILC cable side. Wraps should be side by side and butted up to the cable jacket cutback.
3. Lay the braids down and press the solder blocked portion and the end of the heat shrink tubing into the red sealant.
4. Apply two additional single wraps of red sealant over the braids and the first layers of red sealant.
5. Apply one wrap of red sealant over the body of the breakout as shown.



XXV POSITION AND SHRINK WRAPAROUND SLEEVE

1. Remove or tape over all sharp points to prevent puncture of wraparound sleeve.
2. Remove the backing from the wraparound sleeve and center sleeve over splice.
3. Slide the metal retention clip onto the butted rails. Connect the channels by overlapping the retention clip as shown below.
4. Channel(s) must overlap sleeve edges by 1/4" minimum.
5. Preheat evenly along both sides of the rail/channel area until this area begins to shrink. (Critical Step)
6. Begin shrinking at the center of the sleeve and work all the way around the sleeve and toward each end.
7. Apply heat until the sleeve is completely shrunk and the green paint is completely converted to black.
8. Post heat the entire length, concentrating on the metal channel area. The post heat should be for 30 seconds after the sleeve is completely shrunk. A white line should be visible in the channel gaps indicating sufficient heating.
9. Look for adhesive flow at both ends of the sleeve.
10. The sleeve to cool before moving or placing in service.

**THE SPLICE IS NOW COMPLETE**

CABLE JOINT – TRIFURCATING TRANSITION SPLICE

35 kV, 3/C PILC To 3 1/C Extruded Solid Dielectric

Raychem Heat-Shrinkable

41 43 22 **

Sheet 11 of 11

	Std. / Stk. No.	Description	41 43 22 **	01	02
A	17 05 317	Splice-Cond., Trif., H.S., 350 kcmil & 750-800 kcmil		1	1
B	17 60 359	Sleeve-Cmpsn., 350 kcmil Cu.		3	
	17 60 504	Sleeve-Cmpsn., 800 kcmil to 750 kcmil Cu.			3
C	25 53 055	Tape-Plastic (RL)		1	1
		Operation Code 745		1	1

**HEAT SHRINK SPLICE STANDARDS
FOR COMMON CABLE SPLICES**

<u>PILC CABLE</u>	TO	<u>SOLID DIELECTRIC CABLE</u>	<u>STANDARD</u>
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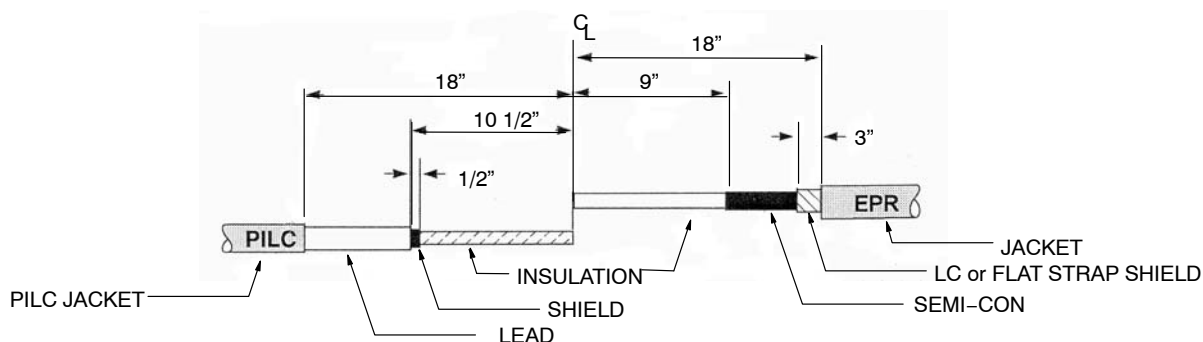
350 ³		3-350 LCRP	41 43 22 01
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800 ³		3-750 FSRP	41 43 22 02
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I GENERAL INSTRUCTIONS

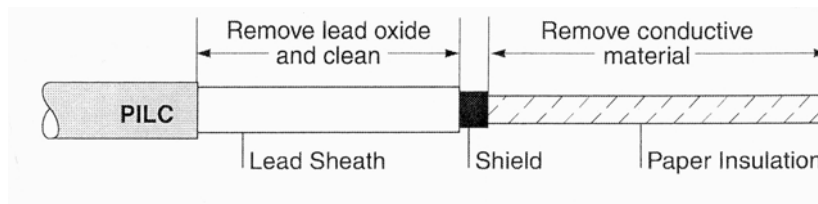
1. Adjust the flame so that it is an overall 12-inch bushy flame.
2. Apply outer 3- to 4- inch tip of the flame to heat-shrinkable material with a rapid brushing motion.
3. Unless otherwise instructed start shrinking tubes at the center working the flame around all sides of the tubes to apply uniform heat.
4. Concentrate on heating the back of the tubes as well as the front of the tubes.
5. If it is necessary to interrupt the shrinking process and the tubes cool, you must reheat prior to shrinking the next tube.
6. Inspect all installed tubes. Reheat any flat spots or wrinkles, paying particular attention to the back of the splice.

II PREPARE CABLES

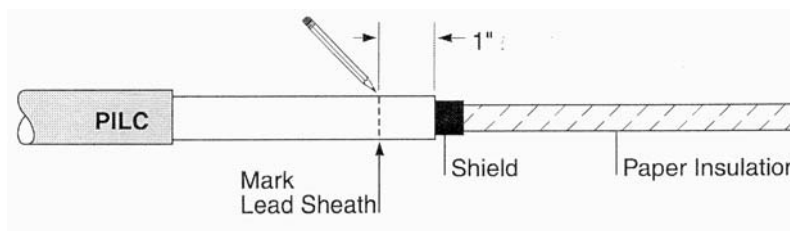


III PREPARE LEAD SHEATH AND PAPER INSULATION

1. Remove lead oxide from the lead sheath and clean with oil-free solvent.
 2. Remove conductive material from the paper insulation.
- Remove lead oxide from the lead sheath and clean with an approved solvent. Remove the lead sheath as shown.



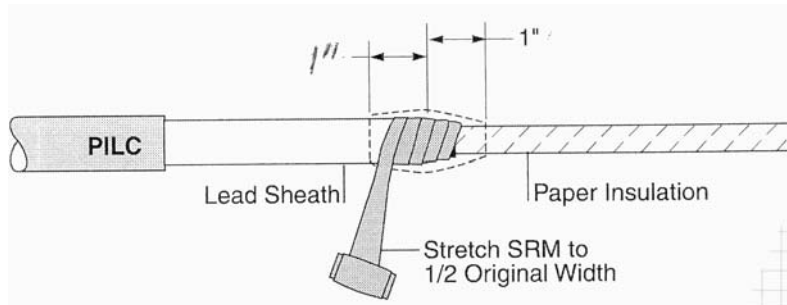
IV MARK LEAD SHEATH



V. APPLY STRESS RELIEF MATERIAL (SRM) AT LEAD SHEATH CUTBACK

1. Remove backing from one side of a long strip of SRM. Roll the SRM and remaining backing strip into a convenient size.
2. Remove the remaining backing strip and tightly wrap SRM around the shield. Continue wrapping to the mark on the lead sheath, then back across the shield onto the paper insulation as shown.

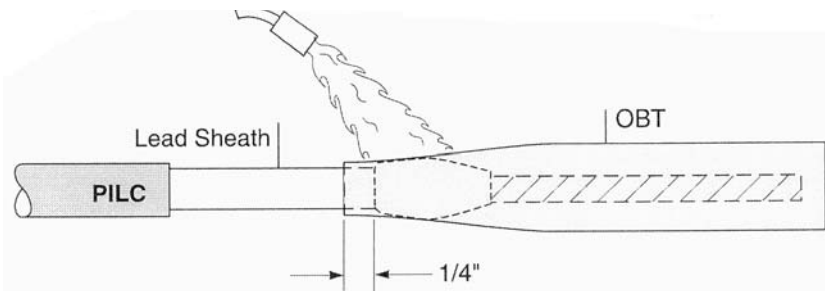
Note: Apply a maximum thickness of 1/8" of SRM over the lead sheath to prevent excessive diameter build-up. Save the remaining SRM.



VI POSITION AND SHRINK OIL BARRIER TUBES (OBT)

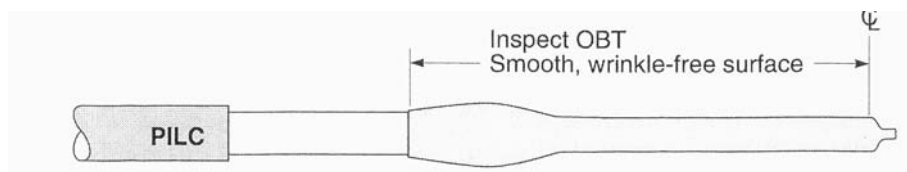
1. Place the OBT over the PILC cable as shown.
2. Shrink in place starting at the SRM. Work around the tube with a smooth brushing motion.

Note: To achieve a smooth wrinkle-free installation, use a reduced flame to install the thin-walled OBT.



VII INSPECT THE OBT

1. The OBT should have a smooth, wrinkle-free surface after shrinking.
2. Reheat to smooth out any wrinkle areas.
3. Discard the second OBT.

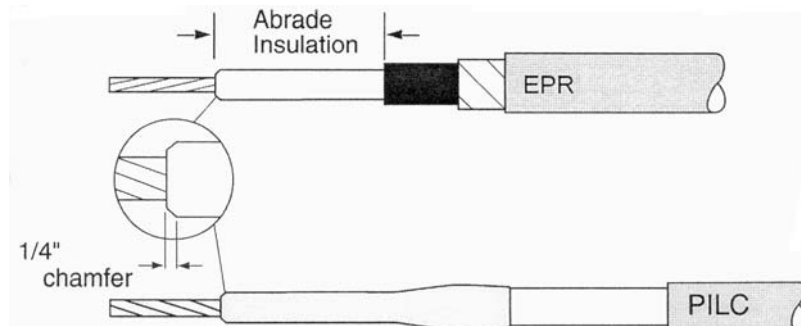


VIII REMOVE INSULATION FROM PILC AND EPR CABLES

1. Mark the insulation 1/2 the length of the connector plus 1/2" from the end of each cable.
2. Cut off the insulation to the mark on each cable.

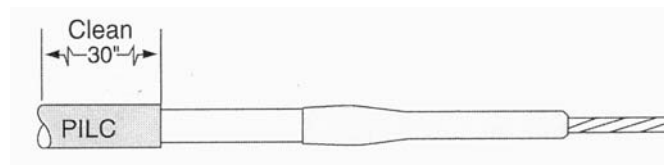
IX ABRADE THE EPR INSULATION

1. Chamfer the insulations for 1/4".
2. Clean the EPR insulation.



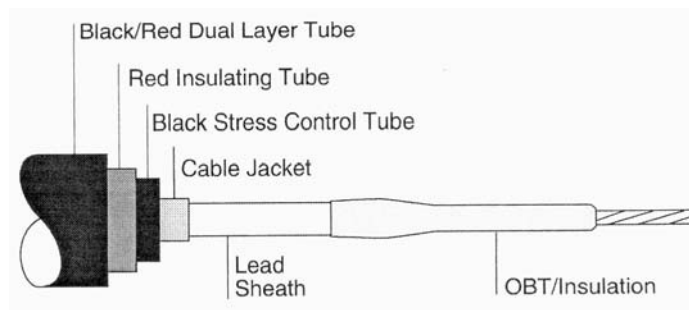
X CLEAN THE PILC CABLE

1. Clean the PILC cable for the length of the nested tubes.



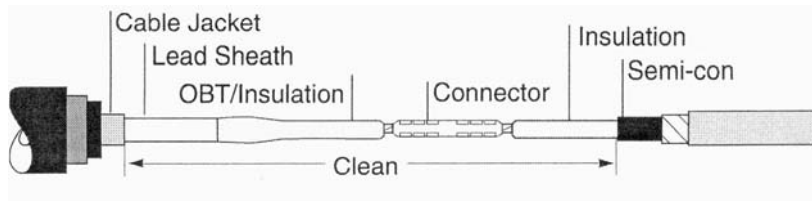
XI PLACE THE NESTED TUBES OVER THE PILC CABLE

1. Place nested tubes over PILC cables as shown.
2. Protect tubes from end of conductor as they are placed over cable end.



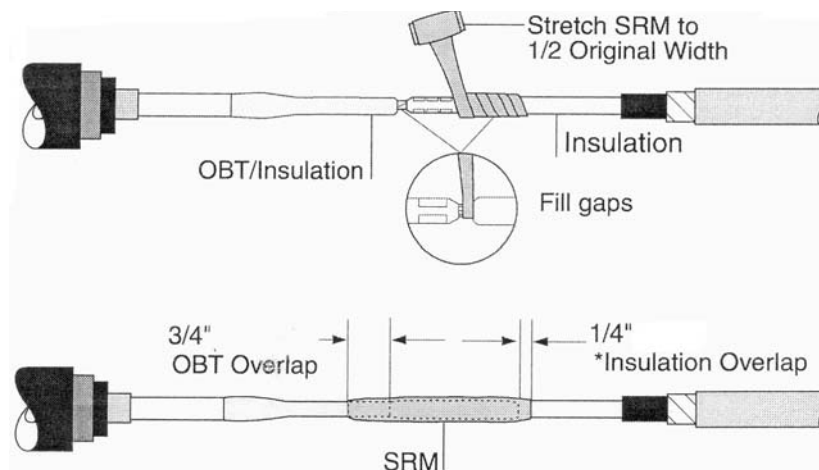
XII INSTALL THE CONNECTOR

1. Slide the cables into the connector and crimp the connector.
2. Make sure that the crimps are smooth. Deburr the connector if necessary.
3. Clean the insulation and OBT's.



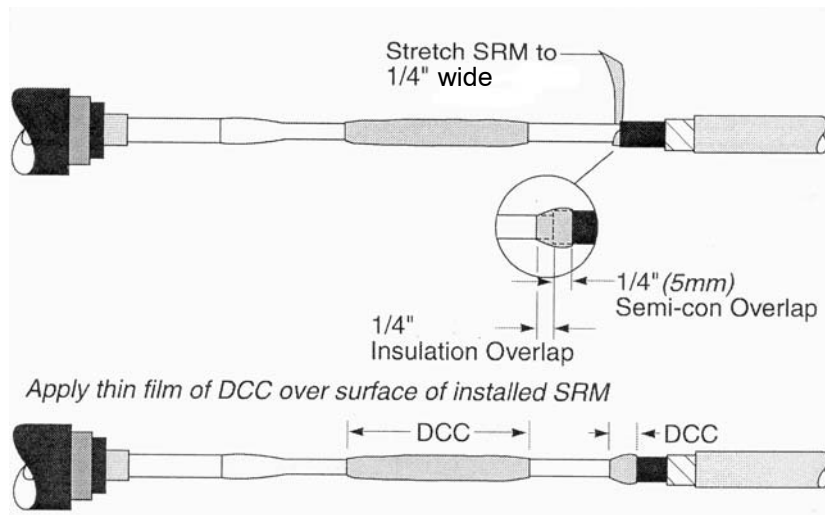
XIII APPLY SRM OVER CONNECTOR

1. Remove backing from one side of a long strip of SRM, roll the SRM and remaining backing strip into a convenient size.
2. While removing the remaining backing strip, tightly wrap the SRM around the connector and exposed conductor. Be sure to fill the gaps and low spots around the connector.
3. Continue to wrap the SRM onto the insulation as shown.



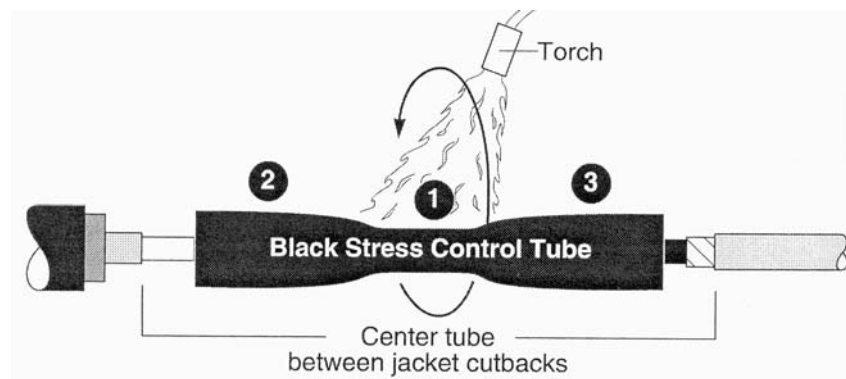
XIV APPLY SRM AND DISCHARGE CONTROL COMPOUND (DCC) AT SEMI-CON CUTBACK

1. Remove the backing from the short angle-cut piece of SRM.
2. Place the tip of the SRM at the semi-con cutback and tightly wrap to fill the semi-con step.
3. Overlap the semi-con and the insulation as shown. Taper the SRM down to meet the insulation.
4. Snip open the end of the DCC ampule and apply a thin film of compound on the SRM over the connector and the semi-con step.



XV POSITION AND SHRINK THE BLACK STRESS CONTROL TUBE

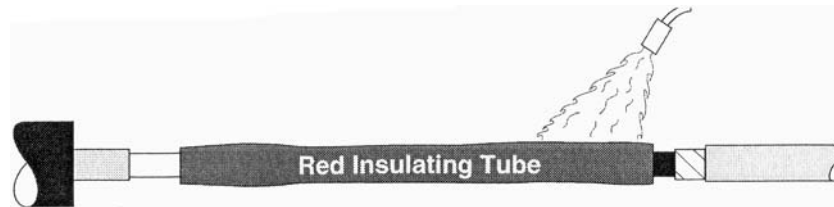
1. Center the tube over the splice.
2. Begin shrinking at the center (1) of the tube, working the torch around all sides of the tube.
3. After the center portion shrinks, work towards one end (2) and then to the opposite end (3).
4. Do not point the flame at the cable semi-con.
5. The rings of the SRM wraps may be visible as the tubing is shrunk.
6. Post heat the connector area until the tube surface is smooth.



XVI POSITION AND SHRINK THE RED INSULATING TUBE

1. Center red insulating tube over black stress control tube.
2. Shrink in place using the same method as XV.

Note: Do not allow the red insulating tube to cool before applying red sealant and installing the black/red dual layer tube.



XVII APPLY RED SEALANT

1. Remove backing from sealant.
2. Using light tension, wrap sealant over the cable and butt against the red insulating tube as shown.
3. Build the sealant to the level of the red insulating tube.



XVIII POSITION AND SHRINK THE BLACK/RED DUAL LAYER TUBE

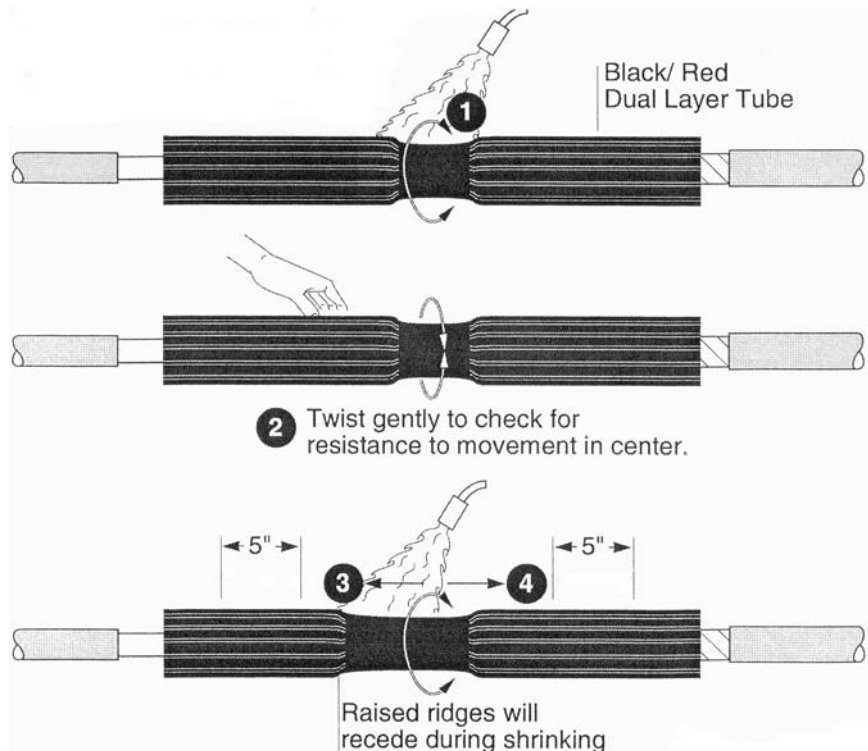
CENTER TUBE OVER JOINT

1. Begin shrinking in center of tube, working torch around all sides of the tube. *Pay particular attention to the back and underside of the tube.*
2. Before continuing, gently twist the unshrunk end of the tube to feel for resistance to movement in center indicating the center is shrunk.

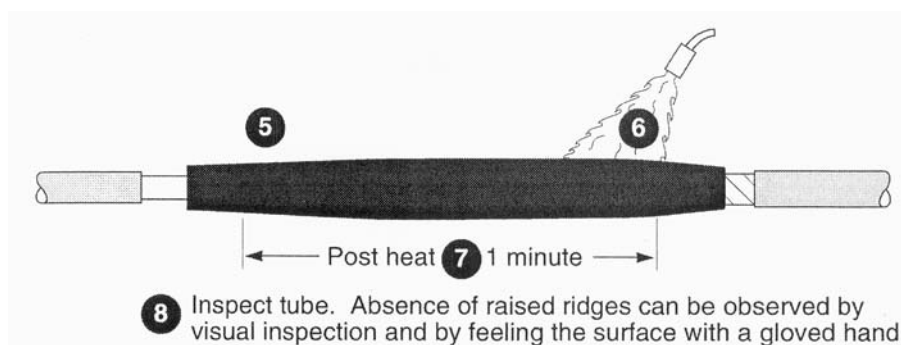
CABLE JOINT
35 kV – 1C PILC To Extruded Solid Dielectric
Raychem Heat-Shrinkable

41 44 21 **
Sheet 7 of 11

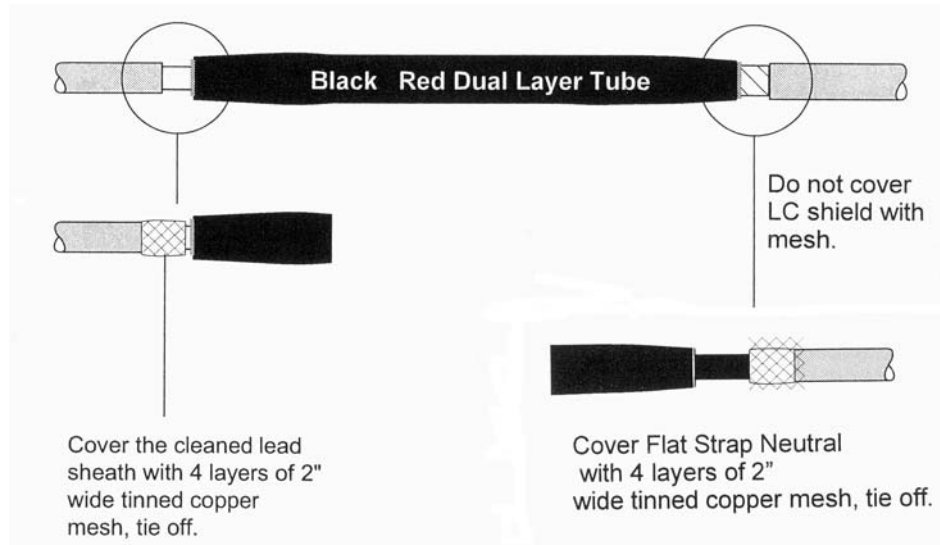
3. Shrink from the center toward one end and stop about 5" from the end of the tube.
4. Return to the center and shrink toward the other end, again stopping about 5" from the tube end.



5. Go back to first end and shrink the remaining 5" of tube.
6. Go back to second end and shrink the remaining 5" of tube.
7. After completing these steps, heat the entire tube for approximately 1 minute.
8. When completely shrunk down, the raised ridges should disappear.

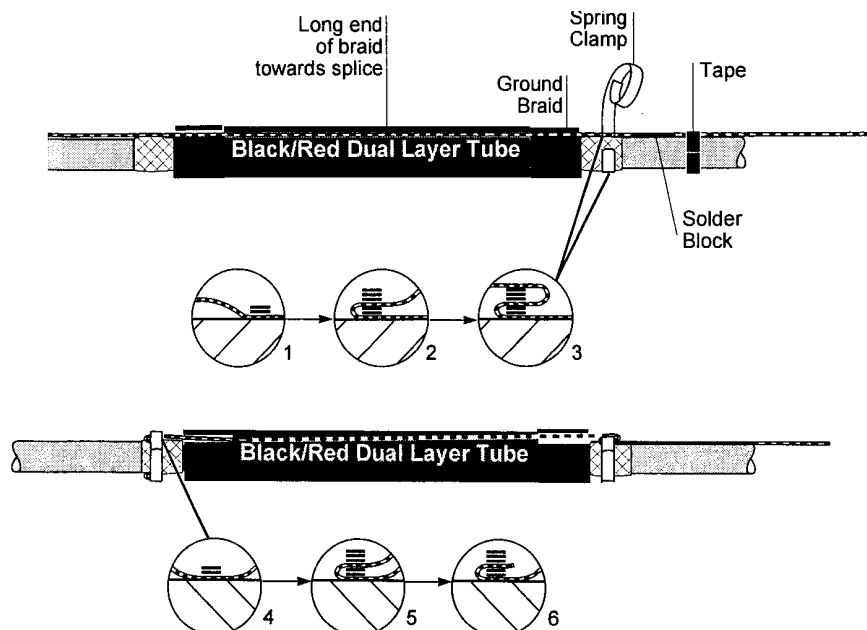


XIX INSTALL MESH ON THE CABLES



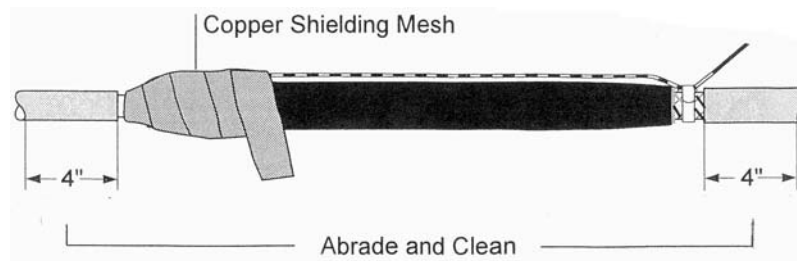
XX INSTALL THE GROUND BRAID AND THE GROUND SPRINGS

1. Lay the braid across the splice with the inner edge of the solder block aligned with the cable jacket cutback.
2. The shortest length of braid from the solder block should extend away from the splice. Tape the braid to the cable jacket to temporarily keep it in place.
3. Starting at the solder-blocked end, wrap two turns of the spring clamp over the braid and mesh or metallic shield.
4. Fold the long side of the braid back over the spring clamp and wrap the remainder of the clamp over the braid.
5. Fold the braid back over the clamp and route across the splice.
6. Wrap two turns of the second spring clamp over the braid and the mesh covered lead sheath.
7. Fold the braid back over the clamp and wrap the remainder of the clamp over the braid.
8. If no external ground connection, cut off the short length of braid at the solder block.
9. Remove the temporary tape.



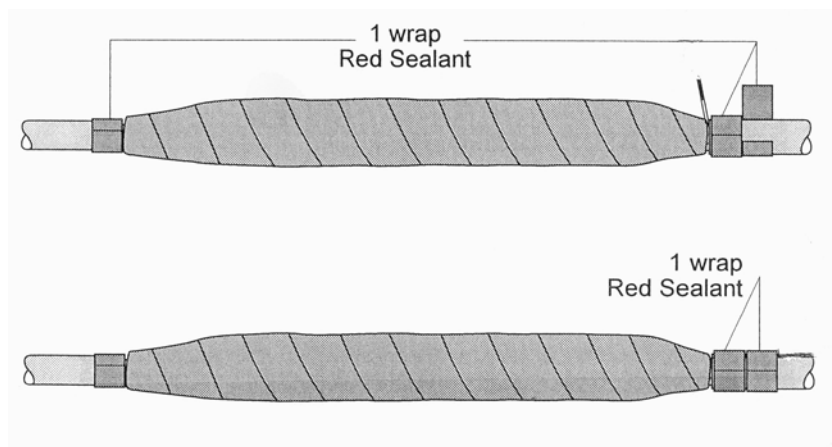
XXI INSTALL THE SHIELDING MESH

1. Wrap a half-lapped layer of the copper mesh across the entire splice from the PILC cable lead sheath to the opposite cable jacket and tie off.
2. Abrade and solvent clean the cable jacket and lead sheath to provide an oil-free surface.



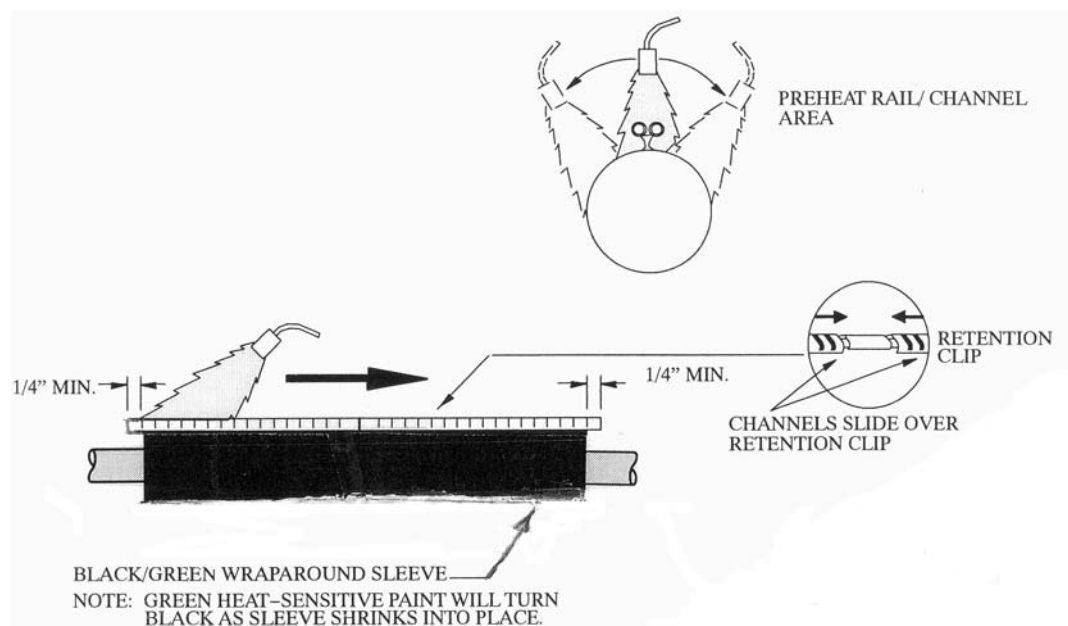
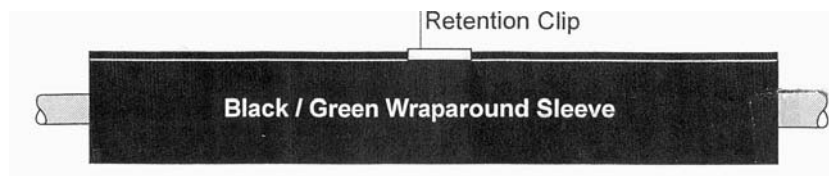
XXII APPLY THE RED SEALANT

1. Apply 1 layer of red sealant on the PILC cable at the jacket cutback.
2. Lift the solder-block braid end and make two single wraps of sealant, side by side, butted up to the EPR cable jacket cutback.
3. Lay the solder-block braid end down and press it into the red sealant.
4. Apply two single wraps of sealant, side by side, over the solder-blocked braid end and directly over the first layer of red sealant.



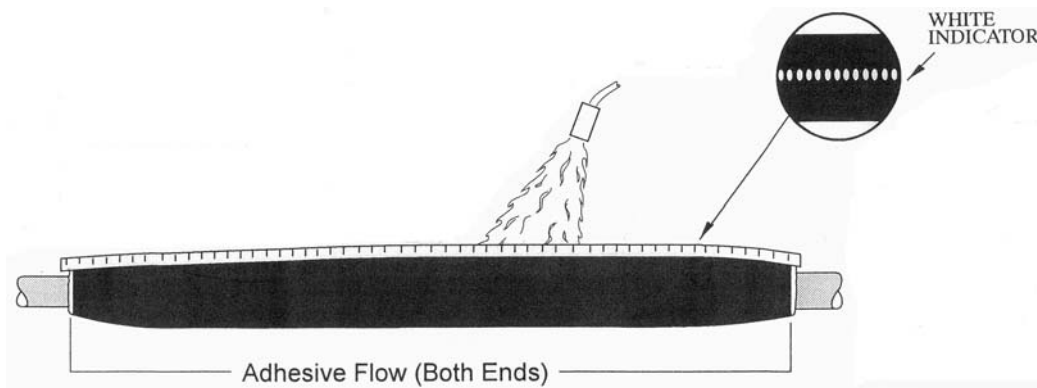
XXIII POSITION AND SHRINK WRAPAROUND SLEEVE

1. Remove or tape over all sharp points to prevent puncture of wraparound sleeve.
2. Remove the backing from the wraparound sleeve and center sleeve over splice.
3. Slide the metal retention clip onto the butted rails. Connect the channels by overlapping the retention clip as shown below.
4. Channel(s) must overlap sleeve edges by 1/4" minimum.
5. Preheat evenly along both sides of the rail/channel area until this area begins to shrink. (Critical Step)
6. Begin shrinking at the center of the sleeve and work all the way around the sleeve and toward each end.
7. Apply heat until the sleeve is completely shrunk and the green paint is completely converted to black.
8. Post heat the entire length, concentrating on the metal channel area. The post heat should be for 30 seconds after the sleeve is completely shrunk. A white line should be visible in the channel gaps indicating sufficient heating.
9. Look for adhesive flow at both ends of the sleeve.
10. Allow the sleeve to cool before moving or placing in service.



CABLE JOINT
35 kV – 1C PILC To Extruded Solid Dielectric
Raychem Heat-Shrinkable

41 44 21 **
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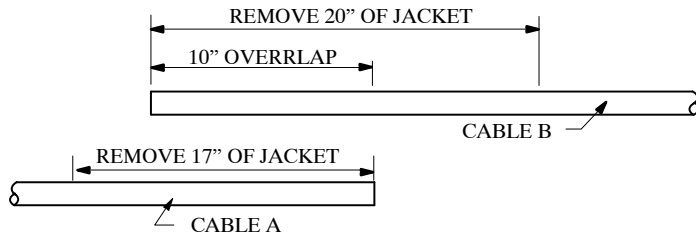
THE SPLICE IS NOW COMPLETE

	Std. / Stk. No.	Description	41 44 21 **	01	02
A	17 05 481	Splice-Cond., CIC., H.S., 350 kcmil & 750-800 kcmil		1	1
B	17 60 359	Sleeve-Cmps., 350 kcmil Cu.		1	
	17 60 360	Sleeve-Cmps., 750 kcmil Cu.			1
C	25 53 055	Tape-Plastic (RL)		1	1
		Operation Code 425		1	1

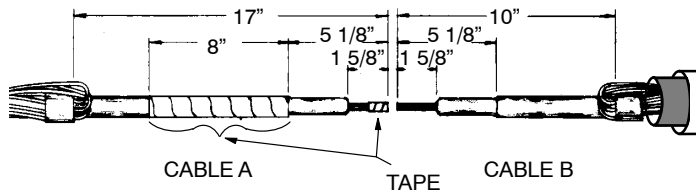
**HEAT SHRINK SPLICE STANDARDS
FOR COMMON CABLE SPLICES**

<u>PILC CABLE</u>	<u>TO</u>	<u>SOLID DIELECTRIC CABLE</u>	<u>STANDARD</u>
350 ¹		1-350 LCRP	41 44 21 01
750 ¹		1-750 FSRP	41 44 21 02

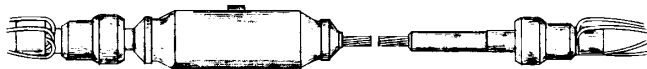
3M CABLE JOINT



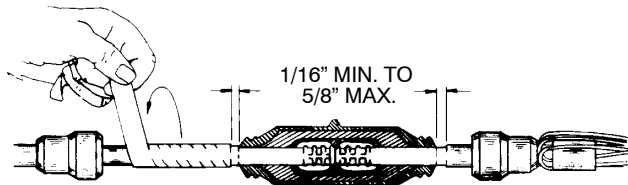
STEP 1



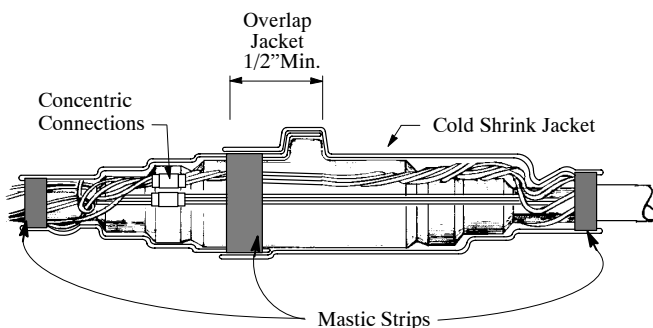
STEP 2-4



STEP 5-6



STEP 7-11



STEP 12-15

NOTE: Keep the cable clean at all times, but do not use solvent on the semi-conductive jacket.

1. There must be a 10 inch overlap of the cables. Wipe the cable clean 2 feet on each side.
2. Saw cut and prepare both cables according to the dimensions shown. Bevel the edge of the cable insulation at 45° angle. Do not exceed 1/8". NOTE: Cable "A" dimensions are different from cable "B" dimensions.
3. If both cables are jacketed, slide the cold shrink sleeve(s) over one of the cables.
4. Apply one-half lapped layer of brightly colored vinyl tape for the distance shown over the semi-conductive jacket of cable A. Begin tape 1/4" on the insulation of the cable. Apply 2 layers of brightly colored vinyl tape on the end of the conductor of cable A.
5. Apply silicone grease over the cable insulation and vinyl tape.
6. Slide the splice end caps onto each cable until butted against the concentric neutral wires.
7. Slide the splice body onto cable A. Do not slide past the end of the vinyl tape.
8. Remove the previously applied vinyl tape from the end of conductor of cable A.
9. Prior to installing the connector, clean the exposed conductor with a stainless steel wire brush. Some splice kits may contain a small disposable stainless steel wire brush, if so, it should be used. If there is no wire brush in the kit use one of the stocked stainless steel wire brushes. Crimp the connector onto the cable using the 12-ton press and the U26ART die. The connector should have three crimps per end.
10. Slide the splice body into final position over connector. NOTE: A small area of insulation should be left exposed at the ends of splice body as shown.
11. Remove the remaining vinyl tape from cable A.
12. Slide end caps onto the splice body. Two locking grooves exist on the splice body. NOTE: Insure that end caps are fully seated. There should be no visible gap between the cap and splice body.
13. Connect the concentrics with three #4 sleeves on cable "A" side. Place 5 and 6 wire bundles into separate sleeves. Snug the sleeves and wires tightly against the splice and the cable. NOTE: In manholes, bring the remaining concentric neutral strands outside of the splice cover. Attach a #2 copper bond wire to the neutral

wires using a two bolt clamp (17-54-140). Attach the other end of the bond wire to the system ground.

14. For jacketed cable(s), wrap a layer of mastic at the end of each cable jacket. Slide the first cold shrink sleeve over the splice with the end of the sleeve overlapping the opposite cable jacket cut off (or mastic strip) by two inches. Shrink the sleeve down.
15. Wrap one layer of mastic at the inner end of the shrunken sleeve. Slide the second sleeve over the splice and overlap the first sleeve by 1/2 inch minimum. Shrink the second sleeve down.

@	Std. / Stk. No	Description	41 44 30 03	
	17 05 230	Joint – Unit, 1/0 Al. 35 kV		1 Ea.
	17 60 103	Sleeve–Compression, #4 Copper		3 Ea.
	17 55 443	Sleeve–Cold Shrink, Sealing, 2 Pieces		1 Ea.

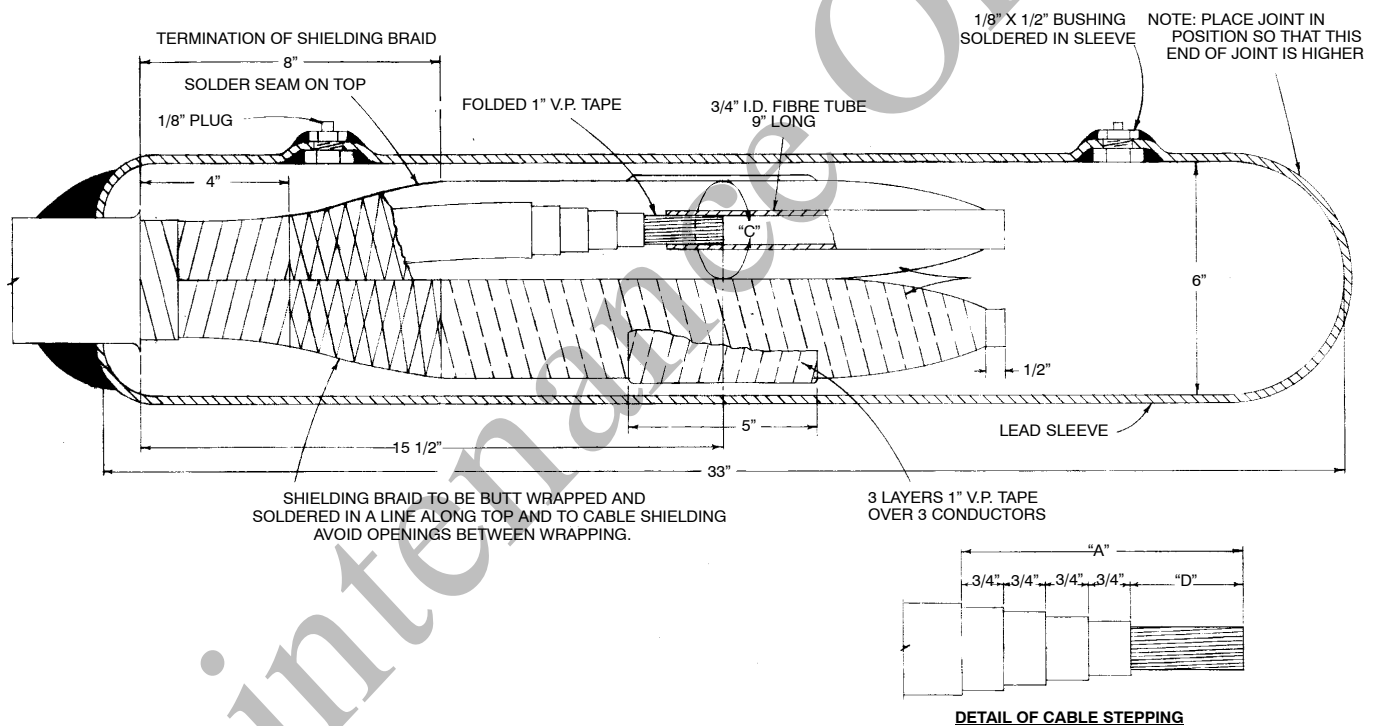
CABLE - JOINT

35kV Hot Test Cap

350 kcmil or 500 kcmil 3 Cond. Lead Cable (Belted or Shielded)

41 46 11 **

Sheet 1 of 1



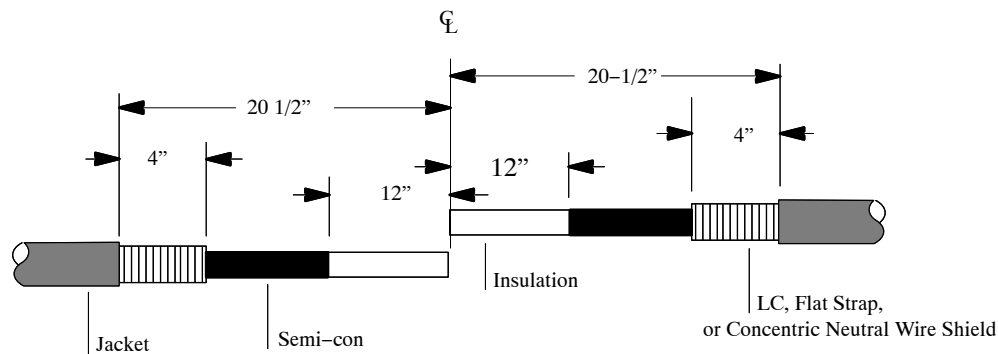
NOTE:

1. Shielding joint shown. For belted joint, omit shielding braid.
2. See Dist. Std. 41 40 00 00 for materials and operation codes.

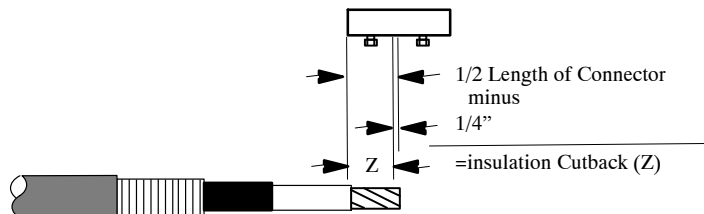
Dist. Std. No.	Cable Size	L Joint to Stepping A	Circumference Over Insulation "C"	Length of Bare Copper D
41 46 11 01	350 kcmil	4-3/4"	7-1/2"	1-3/4"
41 46 11 02	500 kcmil	5"	8"	2"

I. GENERAL INSTRUCTIONS

1. Adjust the flame so that it is an overall 12-inch bushy flame.
2. Apply outer 3- to 4-inch tip of the flame to heat-shrinkable material with a rapid brushing motion.
3. Unless otherwise instructed, start shrinking tubes at the center, working the flame around all sides of the tubes to apply uniform heat.
4. Concentrate on heating the back of the tubes as well as the front of the tubes.
5. If it is necessary to interrupt the shrinking process and the tubes cool, you must reheat prior to shrinking the next tube.
6. Inspect all installed tubes. Reheat any flat spots or wrinkles, paying particular attention to the back of the splice.
7. A 2 inch diameter torch head (Stk. #85 36 326) is recommended to properly shrink the splice.

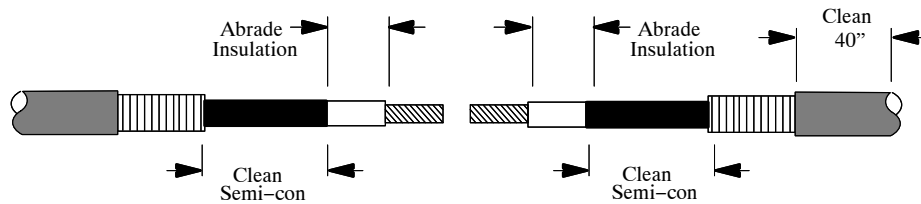
II. PREPARE CABLES

1. Make sure that the cables to be joined are straight and level.
2. Overlap the two cables 8" and cut at the centerline.
3. Remove the cable jacket and metallic shield as shown above.
4. Secure end of metallic shield with copper foil tape provided.
5. Remove semi-con as shown above.
 - Carefully score the semi-con with a straight, fixed blade. Do not nick or cut the insulation!
 - Apply heat to the semi-con while removing strips with a pliers. Keep the semi-con hot for a clean separation between the semi-con and the insulation.
 - Use a round file to smooth out the semi-con cut off.



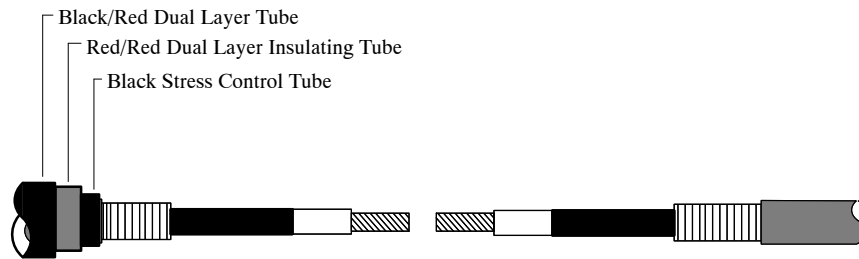
6. Remove insulation as shown above. The insulation cut backs should equal 1/2 the connector length minus 1/4".

III. ABRABE THE INSULATION AND CLEAN THE CABLES



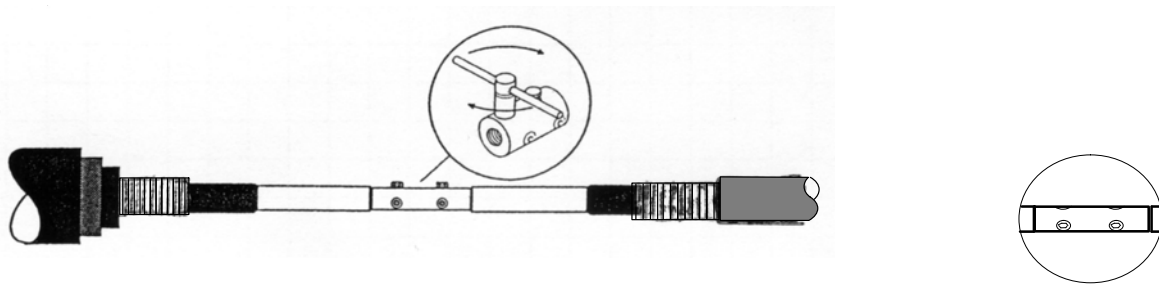
1. Abrade and clean insulation (120 Grit non-conductive sanding tape works well) to remove imbedded semi-con and smooth out the surface.
2. Clean cable jacket as shown.
3. It is very important that the cable insulation is clean, smooth, and free of nicks and cuts. Damaged or dirty insulation will cause the splice to fail!

IV. PLACE NESTED TUBES OVER THE CABLE



1. Protect the tubes from the end of the conductor by placing a plastic tube storage bag over one of the cable ends.
2. Slide the tubes over the plastic bag.

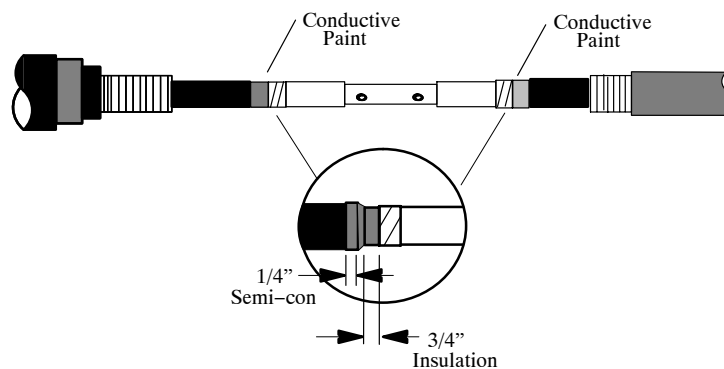
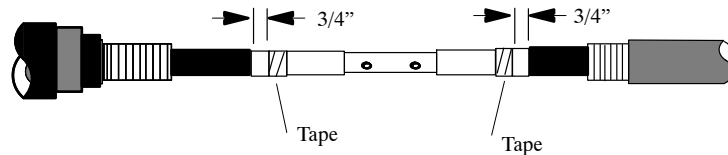
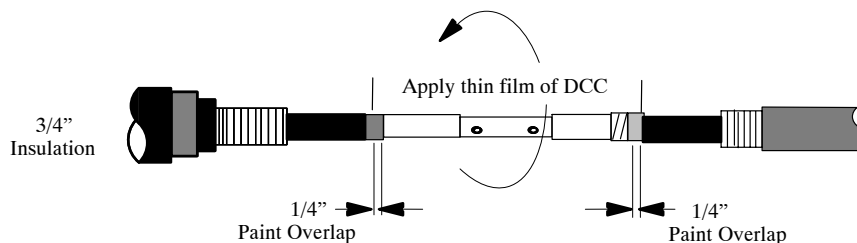
V. INSTALL CONNECTOR & APPLY FILLER



1. Fit conductors into connector so that connector ends line up with the insulation.
2. Make sure that no gaps are left between the connector and insulation.
3. "Hand tighten" each bolt. Then, using a wrench, tighten each bolt an additional 1/2 turn.
4. Continue to tighten each bolt until the head shears off.
5. Apply filler over the sheared bolts to obtain a smooth finish.

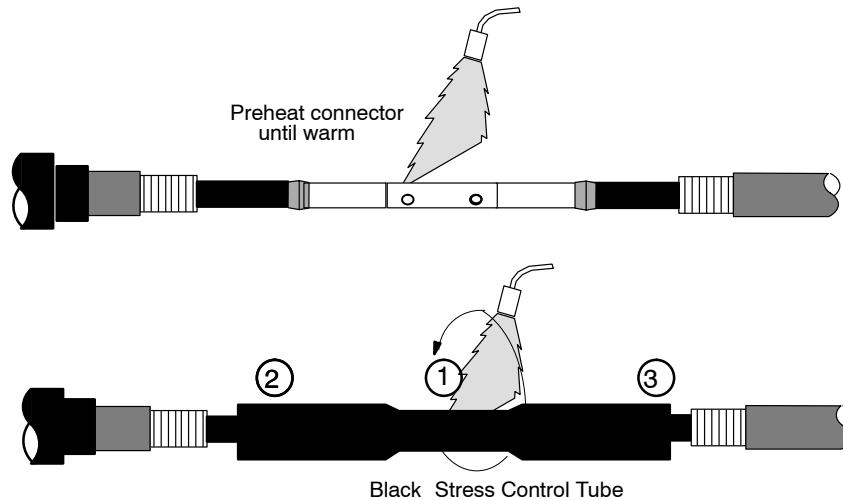
VI. APPLY TAPE AND CONDUCTIVE PAINT

1. Apply tape (adhesive side up) on the insulation 3/4" from the semi-con cutback. Repeat on the other cable.
2. Shake the conductive paint bottle for 30 seconds. Apply the paint onto the 3/4" of insulation and overlap the semi-con shield by 1/4". Repeat on the other cable.

**VII. APPLY THE DISCHARGE CONTROL COMPOUND (DCC)**

1. Apply a thin layer of DCC to the surface of the insulation and the connector. Overlap the conductive paint by 1/4".

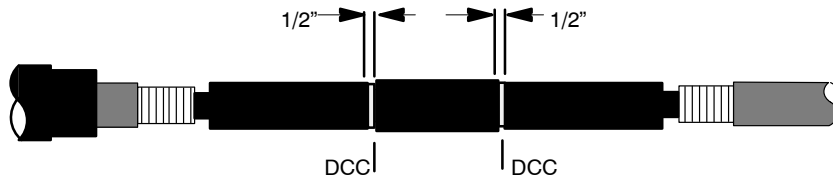
VIII. PREHEAT CONNECTOR; POSITION AND SHRINK BLACK STRESS CONTROL TUBE



1. Preheat the connector for approximately 1 minute or until warm.
2. Center the black stress control tube over the splice.
3. Begin shrinking at the center of the tube (1). Work the torch with a smooth brushing motion around the tube.
4. After the center portion shrinks, work the torch toward one end (2) and then to the other end (3). Apply sufficient heat to ensure complete shrinkage as indicated by a smooth profile.

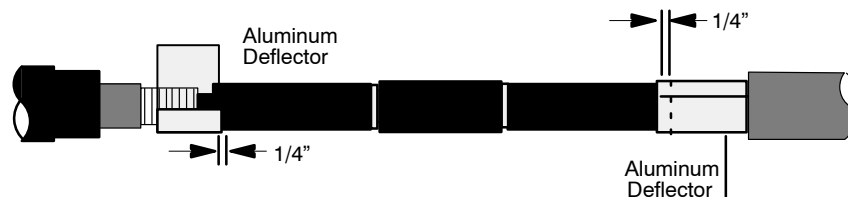
Note: Do not point the flame directly at the semi-con layer.

IX. APPLY DCC TO MATTE SURFACE



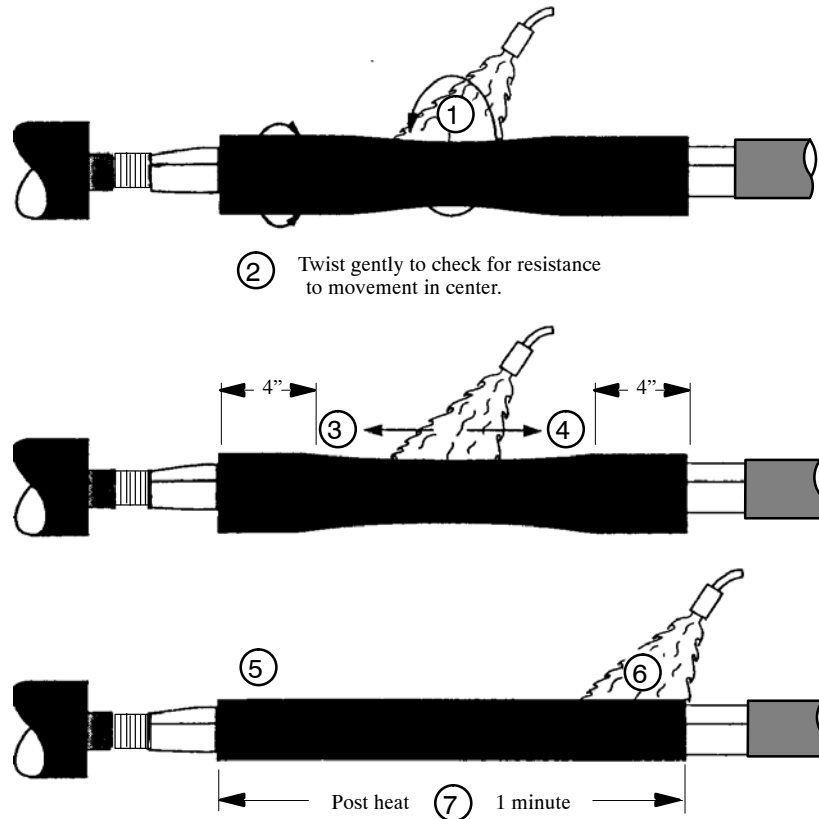
1. Apply a thin film of DCC approximately 1/2" width around the edges of the matte surface in the center of the stress control tube.

X. INSTALL ALUMINUM DEFLECTORS



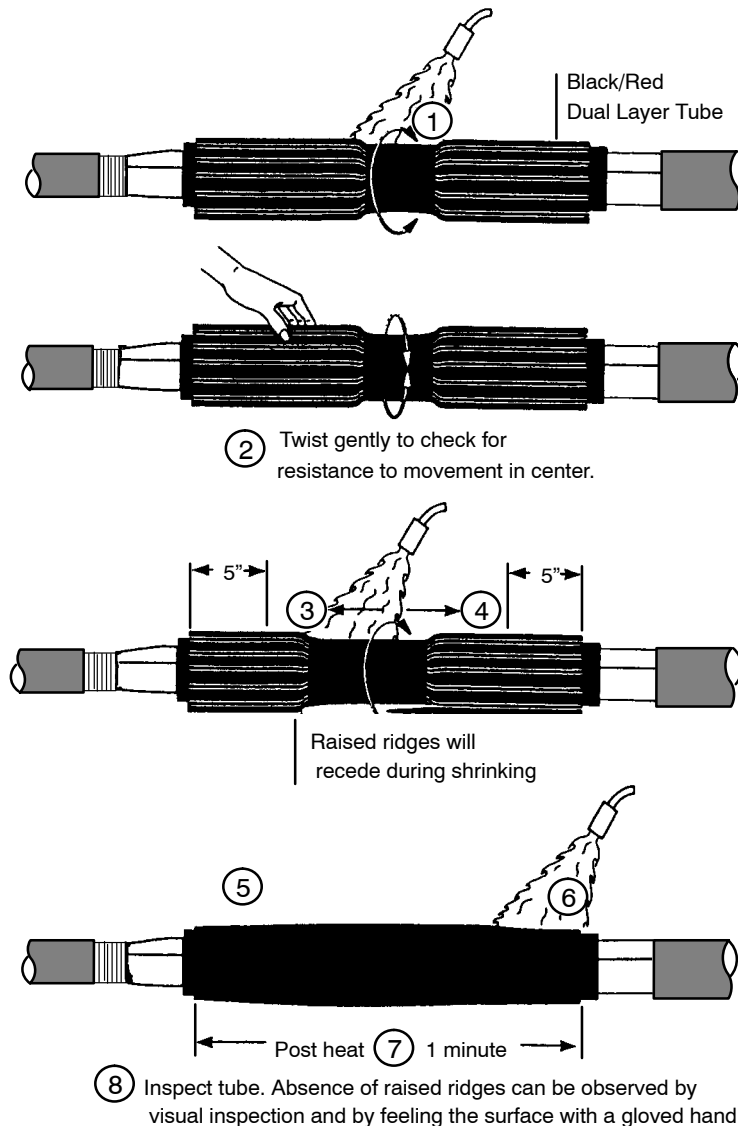
1. Remove the backing and wrap the aluminum deflectors 1/4" onto the black stress control tube and over the shielding as shown.

XI. POSITION THE RED/RED DUAL LAYER INSULATING TUBE AND SHRINK IN PLACE



1. Center the tube over the joint. Begin shrinking in the center of the tube. Work the torch around all sides particularly the back and underside of the tube.
2. Before continuing, gently twist the unshrunk end of the tube. Feel for resistance to movement in the center which would indicate that the center is shrunk.
3. Shrink from the center toward one end and stop about 4" from the end of the tube.
4. Return to the center and shrink toward the other end of the tube stopping 4" from the end.
5. Go back to the first end and shrink the remaining 4" of tube.
6. Go back to the second end and shrink the remaining 4" of tube.
7. After completion of these steps, heat the entire tube for 1 minute.
8. Inspect the tube. Look for absence of raised ridges. A gloved hand may also be used to feel the surface of the tube for raised ridges. Absence of these ridges indicates a complete shrink down.

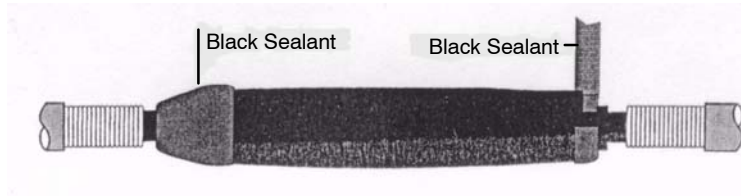
XII. POSITION THE BLACK/RED DUAL LAYER TUBE AND SHRINK IN PLACE



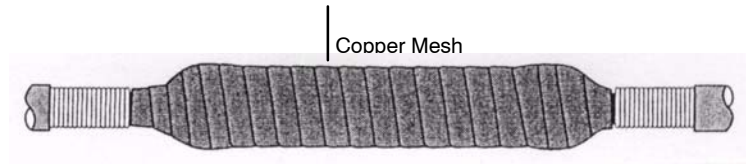
Note: The dual layer insulating/shielding tube takes longer to shrink than previous tubes.

- Center tube over joint. Begin shrinking in the center of the tube, working the torch around all sides of the tube. Pay particular attention to the back and underside of the tube.
- Before continuing, gently twist the unshrunk end of the tube to feel for resistance to movement in the center indicating that the center is shrunk.
- Shrink from the center toward one end and stop about 3" from the end of the tube.
- Return to the center and shrink toward the other end, once again stopping about 3" from the tube end.
- Go back to the first end and shrink the remaining 3" of the tube.
- Go back to the second end and shrink the remaining 3" of the tube.
- After completing these steps, heat the entire tube for about 1 minute.
- Inspect the tube. Look for the absence of raised ridges. A gloved hand may also be used to feel the surface of the tube for raised ridges. Absence of these ridges indicates a complete shrink down.
- Remove the aluminum deflectors from the cables.

XIII. INSTALL SEALANT AND MESH



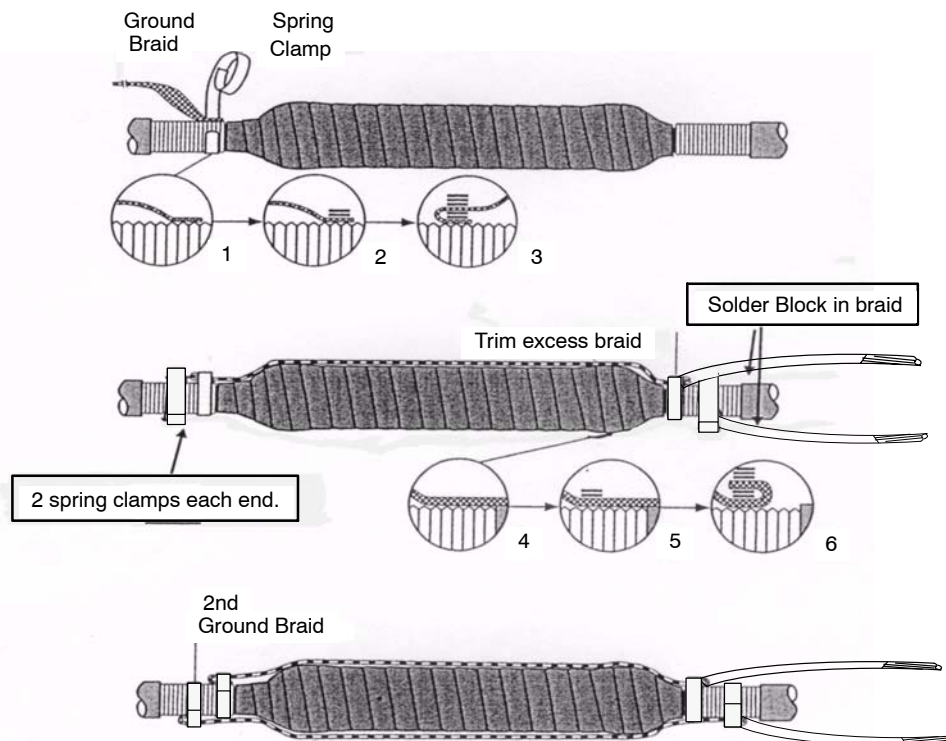
1. Remove the backing strips from the black sealant.
2. Apply the sealant to smooth out the steps at the sleeve ends as shown above.
3. Apply the sealant onto the semi-con being careful not to overlap onto the metallic shields.



4. Wrap a half-lapped layer of copper mesh across the splice butted up to the metallic shield on both sides and tie off.

XIV. INSTALL AND CONNECT GROUNDING

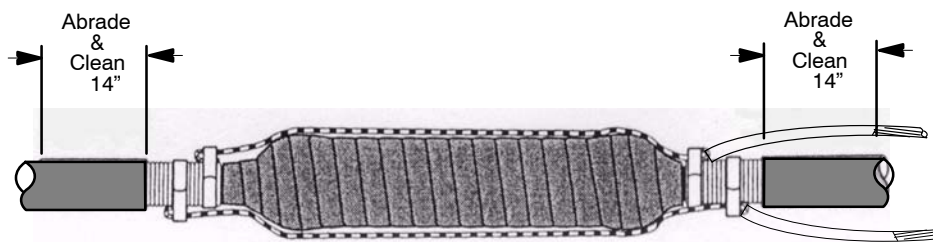
(External Grounding with 2-#2 AWG Solder Blocked Braids, Without Shield Break)



1. Position the solder blocked portion of the braid at the end of the jacket on either side of the splice with the short covered portion positioned away from the splice. Repeat with the second braid. Use tape to hold the braids in place.

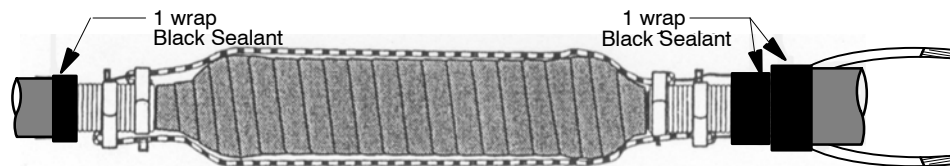
2. Use the heavy duty constant tension clamps to attach the 2 braids to the metallic shield. Make two wraps of spring clamp over the braid.
3. Fold the braids back over the spring clamps. Continue to wrap the remaining clamp over the braid. Tighten the clamp by twisting it in the direction it is wrapped and secure with copper foil tape.
4. Lay the braids across the splice tube and onto the metal shield on the other side of the splice.
5. For each braid, make two wraps of each clamp over the braid.
6. Fold the braids back toward the splice and finish wrapping the clamp. Tighten and secure each braid. Cut off excess braid. The second ground braid should be placed opposite the first ground braid and the second set of spring clamps installed outside of the first set of spring clamps and over the metallic shield.

XV. CLEAN AND ABRASE CABLE JACKETS



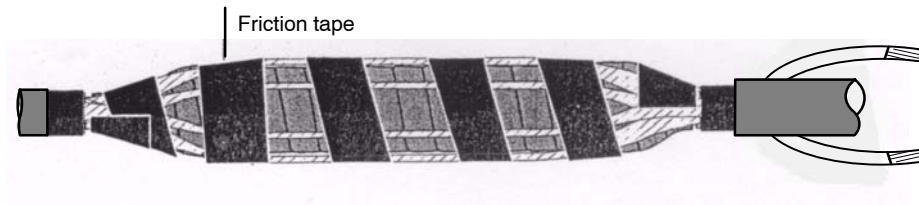
1. Abrade the cable jackets and clean with an approved solvent.

XVI. APPLY THE BLACK SEALANT



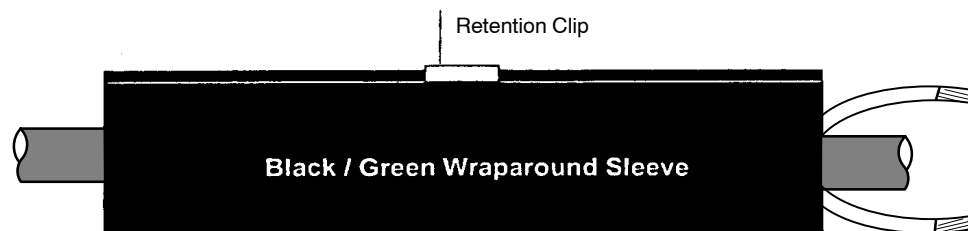
1. Apply one wrap of black sealant starting at the jacket cutbacks around both cable jackets.
2. On the external braid end apply a second one wrap layer of sealant next to the first one on the cable jacket. Push the solder blocks and covered braid ends into the sealant.
3. Wrap one more layer of black sealant over the top of the first two layers to encapsulate the solder blocks and the covered external braid ends.

XVII. APPLY FRICTION TAPE



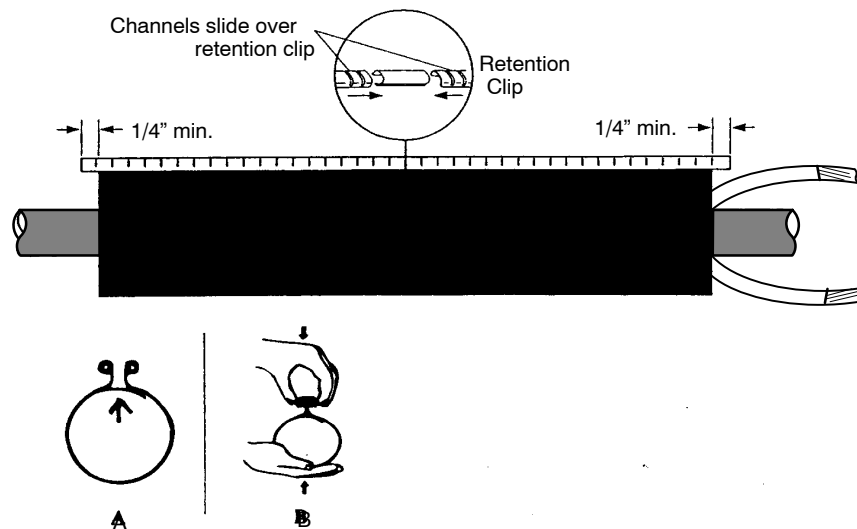
1. Apply a wrap of friction tape to hold the ground braids in position.
2. Tape down external braid ends.
3. Tape over all sharp points.

XVIII. POSITION OUTER WRAP AROUND SLEEVE



1. Remove the backing from the wrap around sealing sleeve and center the sleeve over the splice.
2. Slide the metal retention clip onto the butted rails and position in the center of the sleeve.

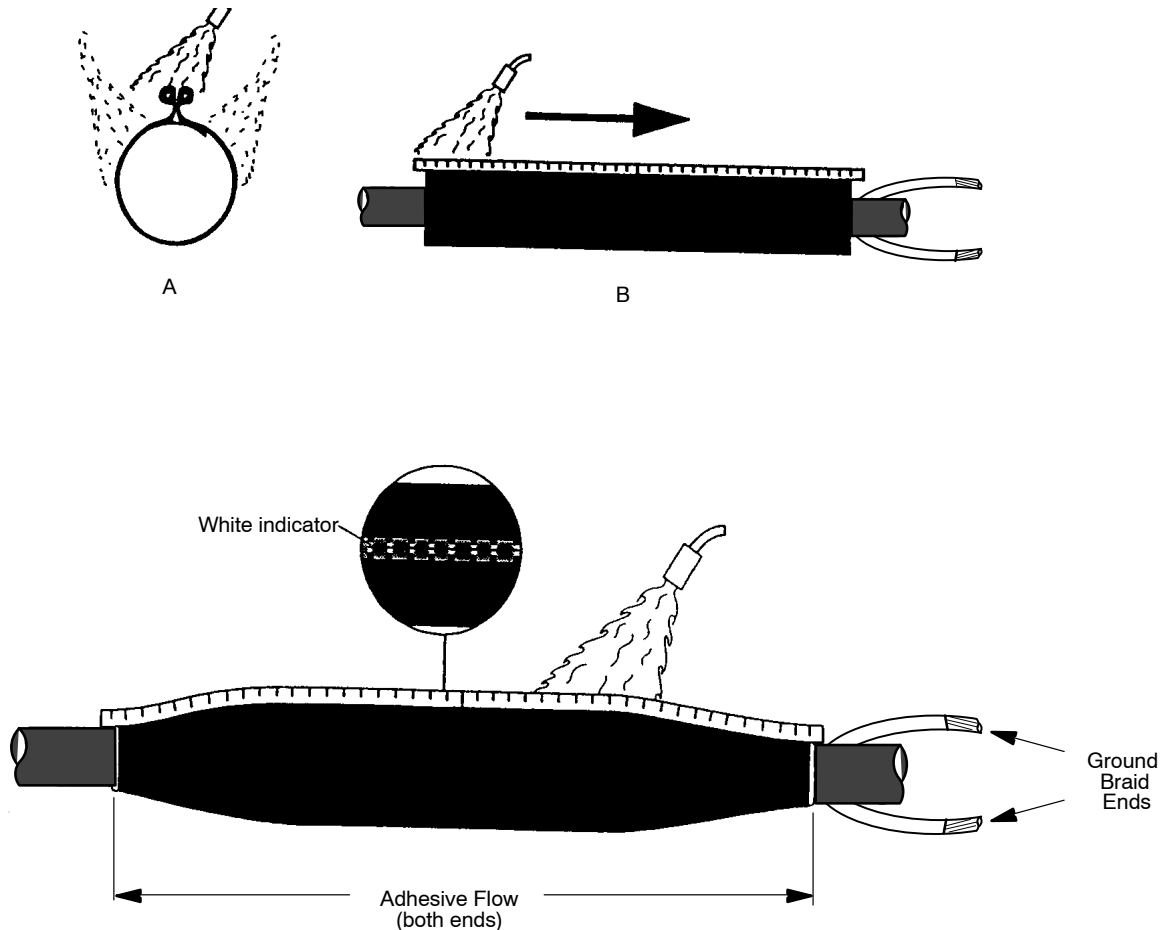
XIX. INSTALL THE CHANNELS



1. Slide the channels onto the rail.
2. Connect the channels by having them overlap the retention clip as shown. (Channels must overlap the edge of the wrap around sleeve by 1/4" minimum.)

3. If the channels fit tight make sure that the sleeve flap is not pinched between the rails (A).
4. Push the sleeve up from the bottom and down from the top while sliding the channels onto the sleeve (B). This keeps the channels from binding.

XX. SHRINK THE WRAP AROUND SLEEVE



1. Preheat evenly along both sides of the rail/channel area until this area begins to shrink.
2. In order to achieve a uniform heating, move the flame back and forth from one side of the channel to the other (A) while also moving the flame along the entire length of the channel (B) until the sleeve starts to shrink.
3. Begin shrinking at the center of the sleeve and work toward each end.
4. Apply heat until the sleeve is fully shrunk and the heat sensitive green paint is completely converted to black.
5. Continue heating the rail/channel area for another 5 seconds per foot. A white line should be visible in the channel gaps indicating sufficient heating.
6. This completes the splice.
7. Connect external ground braid ends into ground rods or ground bond wire using ground clamps or two bolt clamps and covering the connections with plastic tape.
8. Allow the splice to cool before moving it or placing it in service.

CABLE – JOINT, HEAT SHRINKABLE

69 kV

500 kcmil – 1000 kcmil

41 54 30 **

Sheet 11 of 11



		Std. / Stk. No.	Description	41 54 30	01	02	03
@ @ @	A	17 05 313	Splice – 500 – 750 kcmil, 69kV		1	1	
		17 05 538	Splice – 1000 kcmil, 69 kV				1
	B	17 54 378	Connector – Cable, Shearing Screw, 750 kcmil AL		1		
		17 54 379	Connector – Cable, Shearing Screw, 500 kcmil AL			1	
		17 54 971	Connector – Cable, Shearing Screw, 1000 kcmil CU				1
	C	17 54 140	Connector – Two bolt		2	2	2
	D	17 52 032	Clamp–Ground Rod, Cast Bronze		2	2	2
	E	18 54 027	Wire – #2 Cu.		As Req'd	As Req'd	As Req'd
	F	25 53 055	Tape – Plastic (RL)		1	1	1
	G	25 53 027	Tape – Friction, 1–1/2" Wide (RL)		2	2	2

41 54 30 01**750 kcmil, AL, 69kV Cable****41 54 30 02****500 kcmil, AL, 69kV Cable****41 54 30 03****1000 kcmil, CU, 69kV Cable**

1. Prepare the Cables and Apply the Copper Mesh as Shown in Figure 1.

The copper mesh installation requirements, for each jacketed cable type, are shown in Figure 1. If bare concentric neutral cable must be spliced, go to Step1A for cable preparation instructions.

Wrap the copper mesh around the cable so that it is located in the 1-1/2" metallic shield area as shown. The copper mesh should be pulled tight around the cable and tied off. After tying off the copper mesh, cut it so that only a very short tail remains.

Use Stock #22-05-213 or the aluminum oxide strip included in the splice kit to abrade/scuff the cable jacket, see Figure 1.

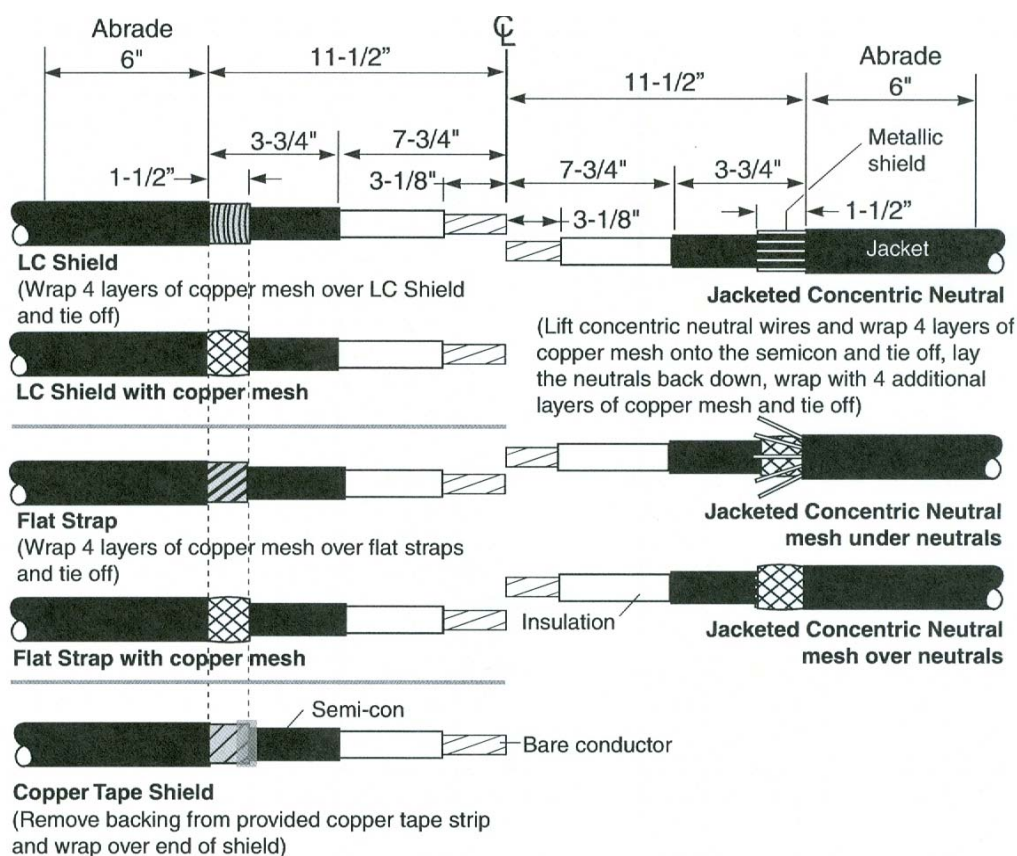


Figure 1

Initial when Step 1 is complete. _____

1A. Prepare Bare Concentric Neutral Cables

Bare concentric neutral cable will be prepared using the dimensions shown in Figure 2.

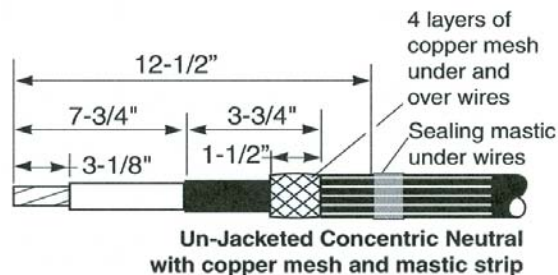


Figure 2

After preparing the BCN cable as shown in Figure 2, carefully lift the bare concentric neutral wires and clean the underlying semi-con.

Wrap a strip of the gray sealing mastic under the concentric neutral wires. Place the mastic strip 12-1/2" from the end of the cable.

While the concentric neutral wires are still lifted, wrap four layers of copper mesh around the cable and tie off the end. The copper mesh wrap must start 10" from the end of the cable and end 11-1/2" from the end of the cable.

Lay the concentric neutral wires back down over the semi-con, making sure the ends of the concentric neutral wires align with the edge of the copper mesh. Press the concentric neutral wires into the sealing mastic.

Apply four additional wraps of copper mesh over the concentric neutral wires and tie off. Verify that the installed copper mesh provides a 1-1/2" connection area at the ends of the concentric neutral wires.

Initial when Step 1A is complete. _____

2. Place Splice Body Over Cleaned Cable

Clean 30" of cable jacket on the cable where the splice body will be placed or stored prior to making the shearbolt connection.

Slide the splice body over the cable end so that the holdout core release strip points toward the cable end.

Figure 3 shows the placement of the splice body on the cable. Also shown in Figure 3 is the optional use of the plastic bag supplied with the splice body to cover the cable to maintain cleanliness.

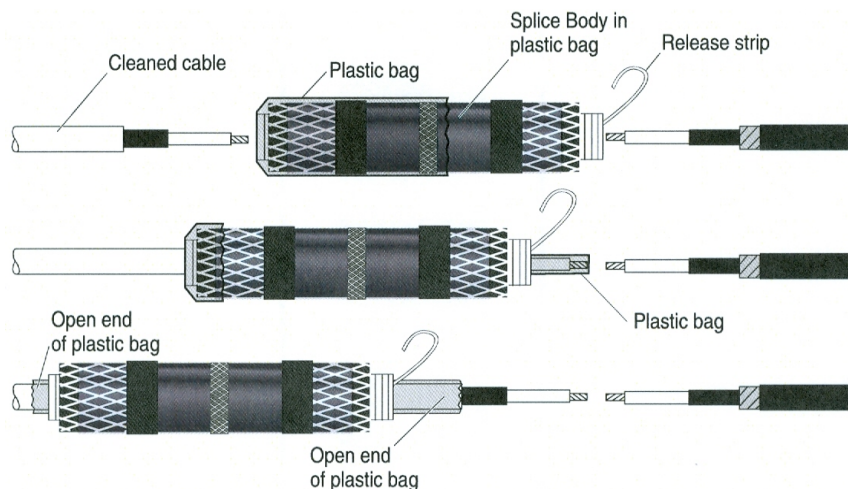


Figure 3

Initial when Step 2 is complete. _____

3. Install Shearbolt Connector

Before shearing bolts, confirm that the dimension between semi-con cutbacks is between 15 1/2" and 16 1/4" for proper placement of the splice body. See Figure 4.

Use the small wire brush included in the kit to clean the surface of the aluminum conductor before placing the conductor into the connector.

If the conductor is larger than 600 kcmil, remove the inserts in the connector.

Insert the cable conductor into the connector until it butts up with the center-stop of the connector.

Tighten the shear bolts by hand until they are snug against the conductor. Complete the installation by tightening and shearing the bolts in the sequence shown in Figure 4.

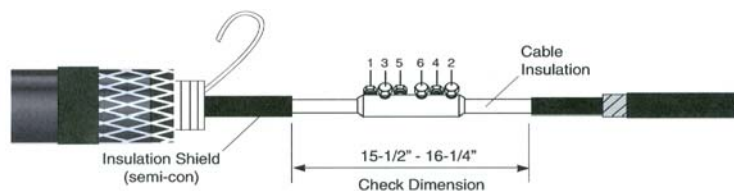


Figure 4

Initial when Step 3 is complete. _____

4. Clean Cable and Install Marking Tape

CLEAN AND DEGREASE THE CONNECTOR AREA (REMOVE ALL EXCESS INHIBITOR).

CLEAN THE CABLE INSULATION. WHEN CLEANING THE INSULATION, ALWAYS WIPE TOWARD THE SEMI-CON.

Install several turns of marking tape onto the cable semi-con 9 1/4" from the center of the connector as shown in Figure 5. This tape will be used as a guide for positioning the splice body. The marking tape is to be installed on the same cable that the splice body is on.



Figure 5

Initial when Step 4 is complete. _____

5. Lubrication

Put on the glove provided in the kit and then use the gloved hand to lubricate the cable insulation up to the semi-con cutback and marking tape with the supplied DISCHARGE CONTROL COMPOUND (DCC). Be sure to use extra DCC to form a bead around the semi-con cutbacks on each cable. See Figure 6 for areas to lubricate.

USE ALL OF THE DCC SUPPLIED IN THE KIT TO HELP FILL VOIDS. DO NOT USE STANDARD SILICONE GREASE.

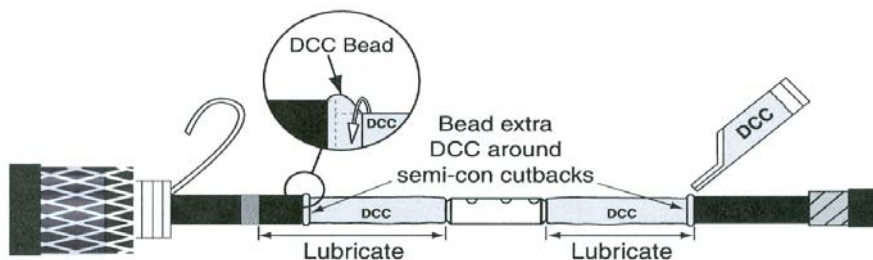


Figure 6

Initial when Step 5 is complete. _____

6. Installation of Splice Body

If the optional plastic bag was used in Step 2 to maintain cleanliness, it should now be removed.

Position the splice body so that the silicone splice body's transparent edge is aligned with the edge of the marking tape. It is important that the splice body remain aligned with the marking tape while the spiral holdout is removed.

Remove the spiral holdout (core) by pulling the release strip counterclockwise while holding the splice body in place. The spiral holdout cannot be pulled out all at once. Slowly pull the spiral holdout on top of the cable and then pass it around and underneath the cable until the spiral holdout has been completely removed. Once the splice is partially shrunk adjacent to the marking tape, there is no need to hold the splice. Use two hands at this point to remove the remaining spiral holdout.

Remove the marking tape.

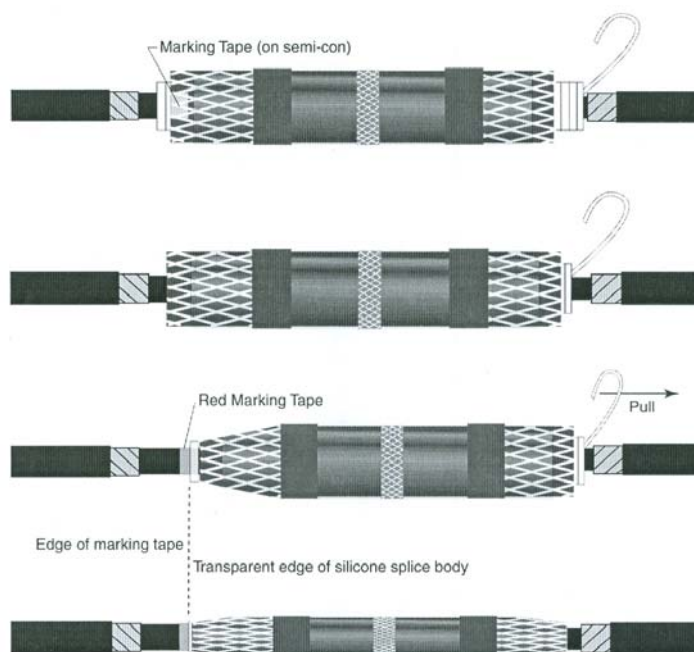


Figure 7

Initial when Step 6 is complete. _____

7. Straighten Out Mesh Sock Wires, Install Spring Clamps & Tape

IF AN EXTERNAL GROUND CONNECTION IS REQUIRED, PROCEED TO STEP 8.

USE THE SMALL SPRING CLAMP “F” FOR 15 KV CABLES UP TO AND INCLUDING 500 KCMIL AND 1/0 35 KV. FOR ALL OTHERS, USE THE LARGE SPRING CLAMP “G”.

Remove the black tape holding the ends of the mesh sock wires on the splice body. If a knife is used to cut the tape, take care not to damage the underlying re-jacketing material.

Straighten the mesh sock wires out over the previously installed copper mesh tape. Install two turns of the spring clamp over the mesh sock and the mesh tape covering the cable metallic shield. After two turns are installed, fold the mesh sock back over the spring clamp and continue to install the remaining turns on the spring clamp over the mesh sock.

Secure the spring clamp with three wraps of vinyl tape (Stk. # 25-53-055) wrapped in the same direction as the spring clamp. Continue taping over the ends of the mesh to cover all sharp points.

Follow the above steps to complete the other side.

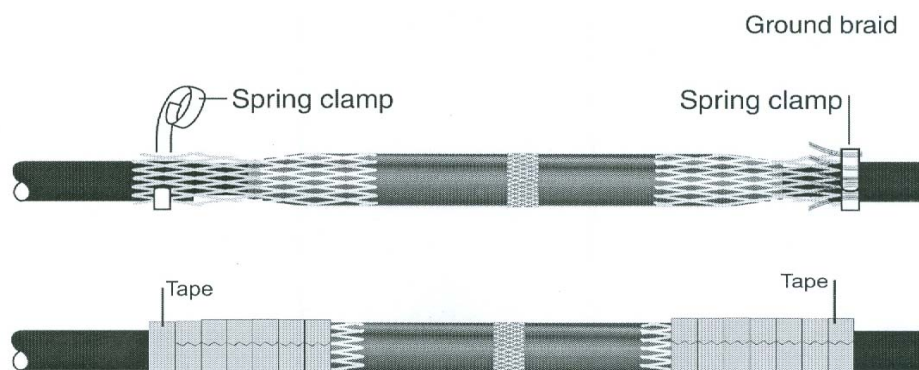


Figure 8

Initial when Step 7 is complete. _____

8. Installation of Wraparound Ground Braid Used for External Ground Connection–Optional

Straighten the mesh sock wires out over the previously installed copper mesh. Fold the edges of the mesh sock back toward the center of the splice end where the ground braid will be installed. If the edges of the mesh sock are very long, they may be secured with vinyl tape.

Select one of the three mastic strips from the grounding kit (Stk. # 17-54-306). Remove liners and wrap the mastic around the cable jacket, $\frac{1}{2}$ " from the cut edge. Discard any excess mastic from the piece.

Position the twin pre-formed ground braid over the folded back mesh sock with one tail along the cable jacket. Verify that the ground braid is positioned over the $1\frac{1}{2}$ " area where the cable metallic shield and copper mesh tape are located. Press one tail of the preformed ground braid into the previously applied mastic and secure the tail to the cable jacket with vinyl tape, $1\frac{1}{2}$ " from the edge of the jacket. Additional wraps of vinyl tape can be used along the length of the tail to hold it into place.

Wrap the braid around the mesh sock and metallic shield of the cable. Secure the ground braid with a spring clamp from the splice kit. **Use the small spring clamp "F" for 15 kV cable up to and including 500 kcmil and 1/0 35 kV. For all others, use the large spring clamp "G".** Wrap the spring in the same direction as the braid and tighten the final lap.

Position the second tail of the preformed ground braid along the cable and secure the tail to the cable with vinyl tape. Press the second tail into the previously applied mastic strip.

Apply a second mastic strip layer over the braid tails. The second mastic strip must be positioned so that it overlays the previously installed mastic strip. Press the two mastic strips together to form a water tight seal around the ground braid tails.

Secure the spring clamp with three wraps of vinyl tape (Stk. # 25-53-055) wrapped in the same direction as the spring clamp. Continue taping over the ends of the mesh to cover all sharp points.

Connect the other end of the mesh sock as detailed in Step 7.

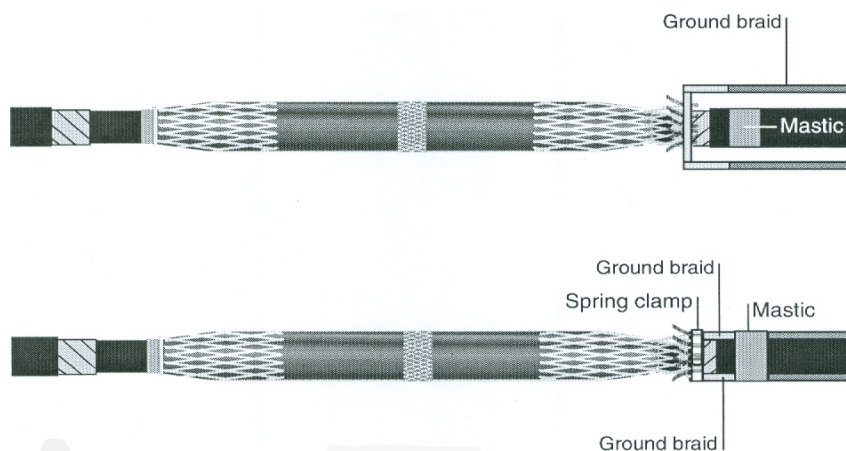


Figure 9

Initial when Step 8 is complete. _____

9. Expand Re-Jacketing Sleeve

Install a strip of gray sealing mastic at each jacket cutback. Be sure that mastic has been applied under and over the tails of the external ground braid if one is installed. If Bare Concentric Neutral cable is being spliced, be sure to apply a strip of gray sealing mastic over the strip that was applied under the concentric neutral wires in Step 1A.

Wipe off the black re-jacketing sleeve to allow for a positive grip on the sleeve. Twist the black re-jacketing sleeve from side to side to release the lubricating grease. Slide one side of the re-jacketing sleeve over the mesh sock and spring clamp connector and onto the cable jacket. Repeat this step on the other side.

Cut off the red mesh sleeve, being careful not to damage the re-jacketing sleeve or the splice body.

Using approved solvent, clean the surface to the re-jacketing sleeve to remove excess grease.

Wrap four layers of vinyl tape (Stk. # 25-53-055) over each end of the re-jacketing sleeve.

Note: The tape is not being applied to seal the re-jacketing sleeve. The vinyl tape is being applied to finish the ends of the re-jacketing sleeve.

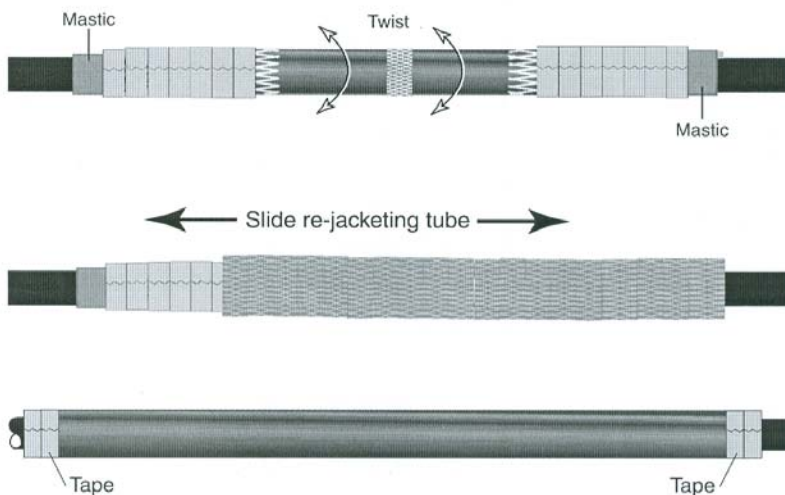


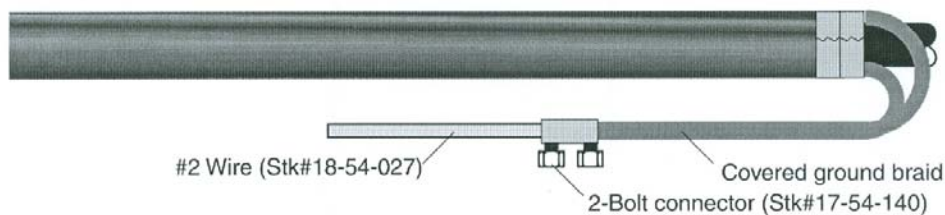
Figure 10

Initial when Step 9 is complete. _____

10. Connect Ground Braid to System Ground (Only if External Ground Braid was Installed in Step 8)

Connect the external ground braid ends to the system ground with a 2-bolt connector(Stk. # 17-54-140) and a #2 copper wire (Stk. # 18-54-027).

Seal the 2-bolt connection with poly sealer (Stk. # 31-53-055). Tape over poly sealer with vinyl tape (Stk. #25-53-055).

**Figure 11**

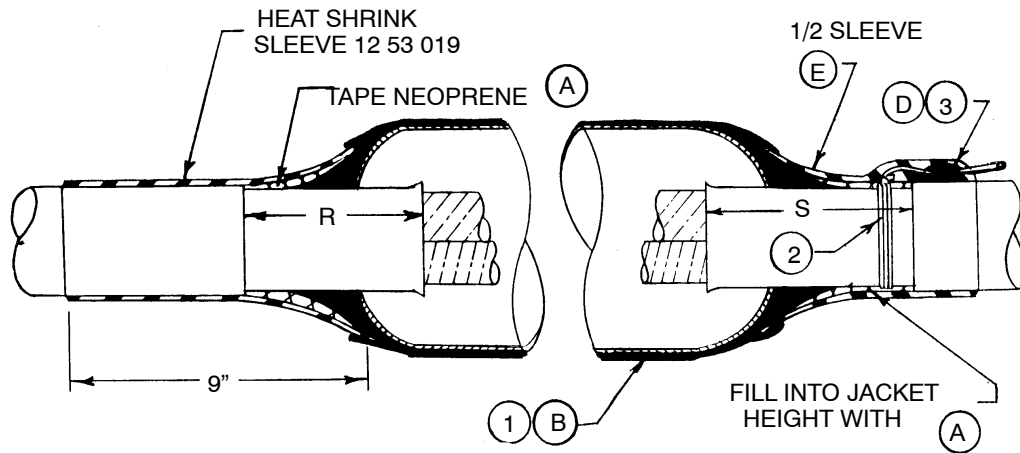
Initial when Step 10 is complete. _____

	Std. / Stk. No.	Description	41 64 30 00	QTY
@	17 05 500	Splice – 350–750 Cu/Al, 15/35kV		1
	17 54 306	Connector – Cable Ground w/Constant Force Spring		1
	25 53 055	Tape – Vinyl		1
@	17 54 140	Connector – Wire, #8 – 4/0 Cu, 2-Bolt		1
@	31 53 055	Compound – Sealer		1

CABLE – JOINT
5kV – 15kV – 35kV
Sheath Reinforced & Corrosion Protected

41 90 02 00

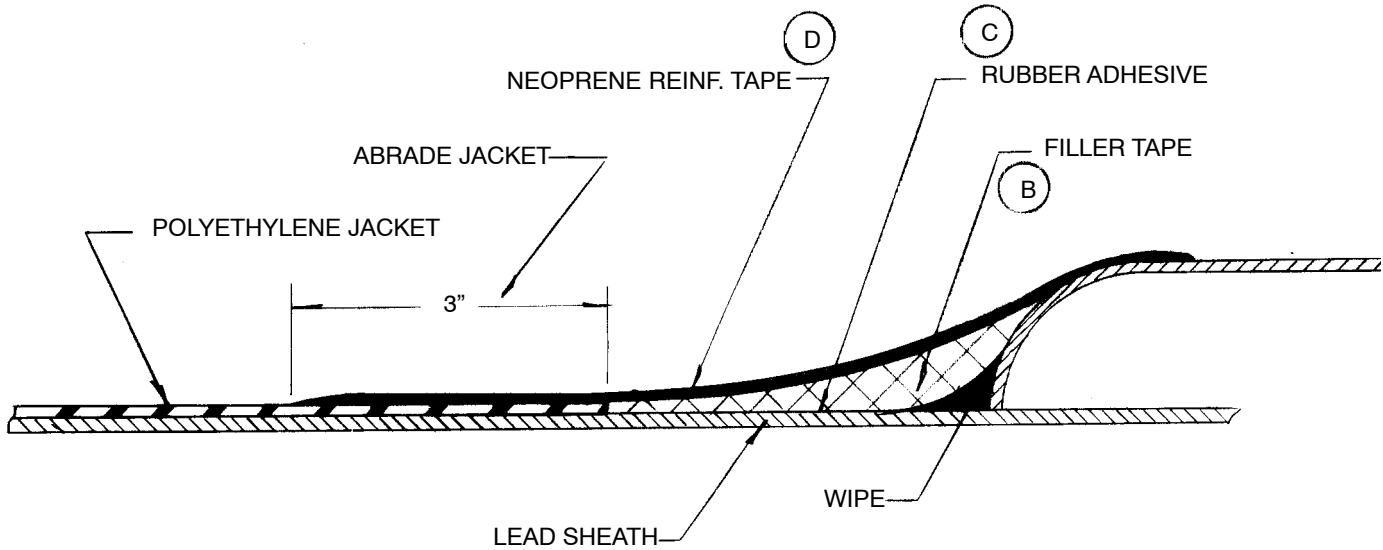
Sheet 1 of 1



NOTES:

1. A protective layer of 1–1/2" wide plastic tape shall be applied overall when installed in holes where frequent lengthy submersion occurs.
2. Bond per Std. 41 90 91 00.
3. Fill in around bond wire (Item D) before shrinking Sleeve E.

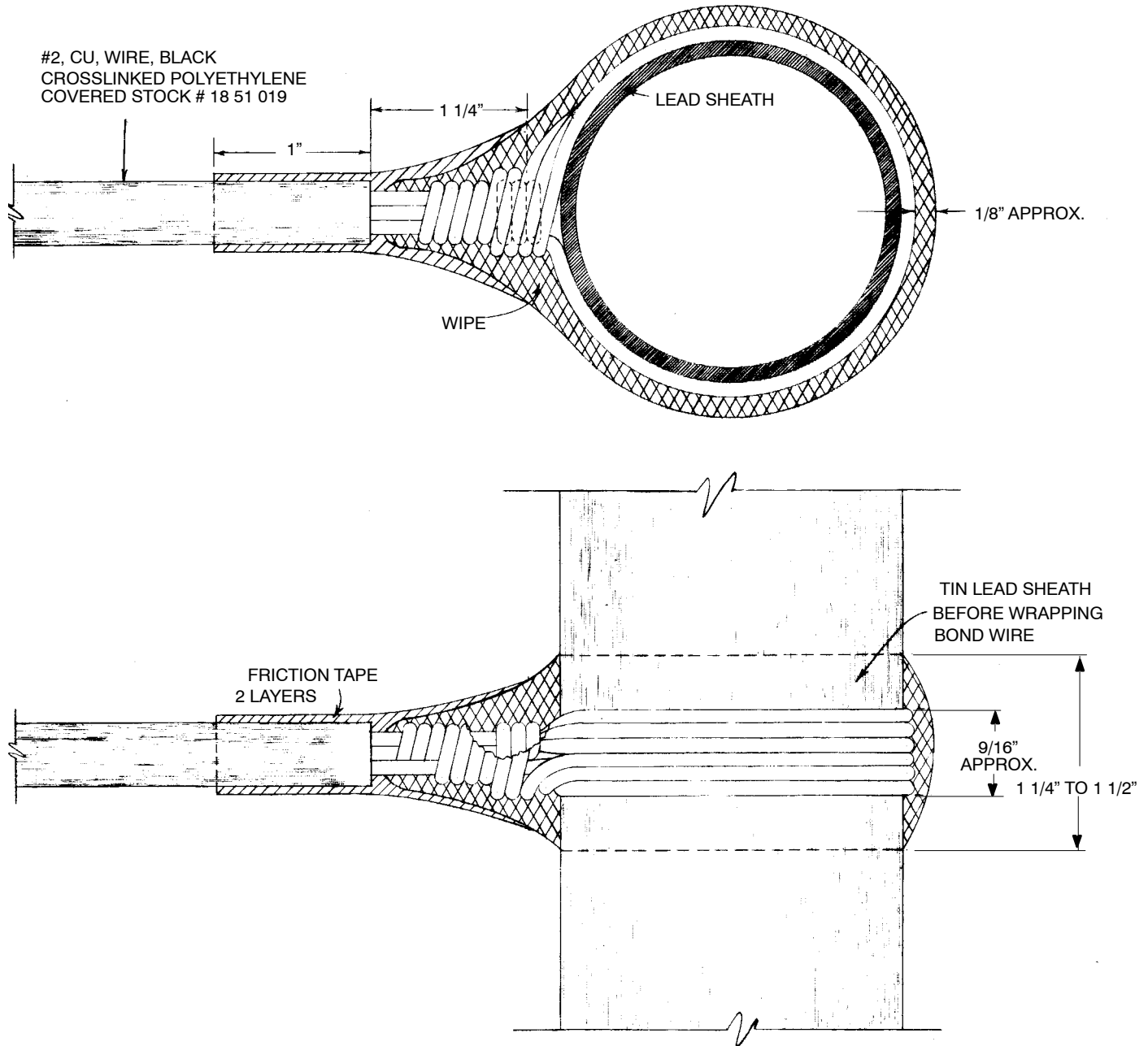
		Std. / Stk. No.	Description	41 90 02 00	
@	A	25 53 078	Tape, Neoprene Reinf.	As Req'd	
@	B	25 53 077	Tape, Plastic, 1 1/2"	As Req'd	
	C	41 90 91 00	Cable, Bonding	1	
@	D	31 53 055	Compound, Sealer	As Req'd	
	E	12 53 019	Sleeve, Prot. H.S.	1	
				Length to Remove Jacket	
				R	S
@	F	41 21 11 00	800 kcmil – 5kV	3–1/2"	4–1/2"
		41 21 12 00	500 kcmil 5kV	4"	5"
		41 31 11 **	800 kcmil – 15kV	3–1/2"	4–1/2"
		41 31 12 **	1/0 – 15kV	3–1/2"	4–1/2"
		41 31 12 **	4/0–300–500 kcmil–15kV	4"	5"
		41 41 12 **	350–500–800 kcmil–35kV	3–7/8"	4–7/8"
		41 41 11 **	350–500 kcmil–35kV	3–7/8"	4–7/8"



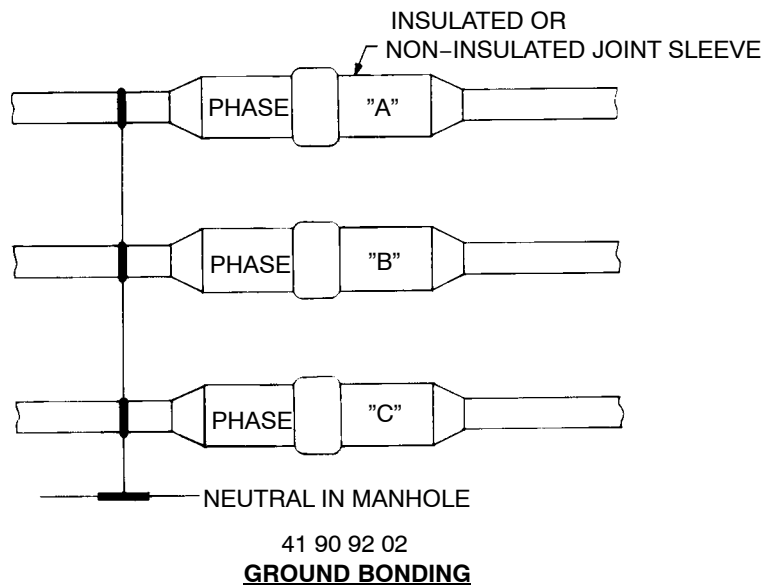
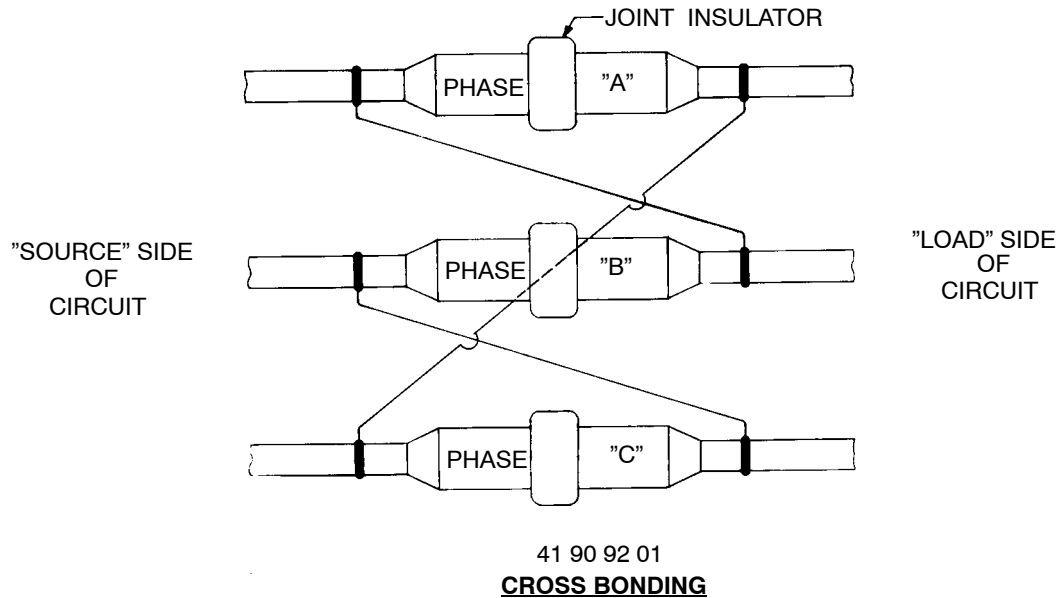
NOTES:

1. Prepare the jacket, lead sheath and wipe by wiping clean, using solvents where necessary.
2. Abrade the jacket by sanding with 1-1/2" wide #60 grit sanding cloth.
3. Paint the jacket, wipe, sheath and joint sleeve with rubber cement.
4. Fill in the sharp contours with neoprene tape, 25-53-053.
5. Tape 3 inches of jacket and continue up over the wipe just onto the lead sleeve with two half-lapped layers of neoprene reinforcing tape.

Materials For One Side of 5-1/2" x 28" Sleeve			
	Dist. Std. or Stock No.	Description	Qty.
A	22 05 213	Cloth – Sanding, 1-1/2" Wide (Ft.)	2
B	25 53 053	Tape – Neoprene (RI.)	2
C	49 01 066	Cement – Rubber (Cn.)	1
D	25 53 078	Tape – Reinforcing Neoprene (RI.)	2



1. Wrap 1 strand twice around conductor.
2. Wrap 3 strands of the bonding conductor in one direction around the cable and the other 3 strands in the opposite direction.
3. Move the two sections in the same direction around the bonding conductor without crossing strands.



NOTES:

1. See Dist. Std. 41 90 91 00 for method of attaching bond to PILC cable.
2. When one of the three cables is trained to the manhole wall opposite the other two, train the bond wire along the cables and cross the manhole near the duct mouth.
3. In applying cross bonding, note the phase markings on the cables and also note the "Source" and the "Load" side of the circuit. Make certain that the cable on the "Source" side of the joint is connected to the cable on the "Load" side of another, such as "Source" side of "A" phase to the "Load" side of "B" phase, etc. (see drawing).

CABLE TERMINATION

15 kV #2 – 4/0 XLP/EPR Cable Indoor – Outdoor

42 34 59 **

Sheet 1 of 3

1. Train the cable into position and cut to required length. For all installations allow sufficient neutral wire length beyond the finished cable end for proper grounding connection.
2. Prepare the cable using the dimensions shown in Figure 1. Be sure to check the lug or pin terminal connector being used to determine the insert depth "X". Provide an additional 1/4" of exposed conductor to allow for growth of the aluminum lug or connector during crimping.

All measurements should be made from the jacket cutback.

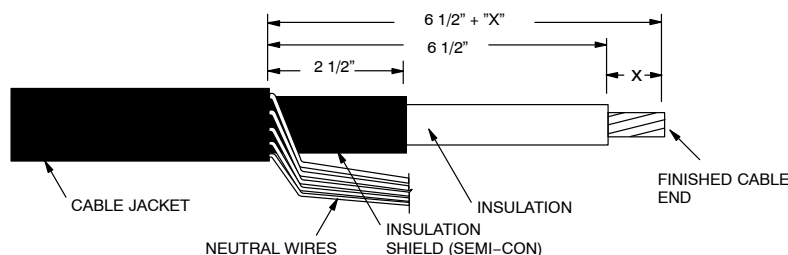


FIGURE 1

3. Select one of the mastic strips from the kit and remove the white release liners. Using light tension apply a single wrap of mastic around the cable jacket 1/4" from the edge. Cut off excess mastic. See Figure 2.

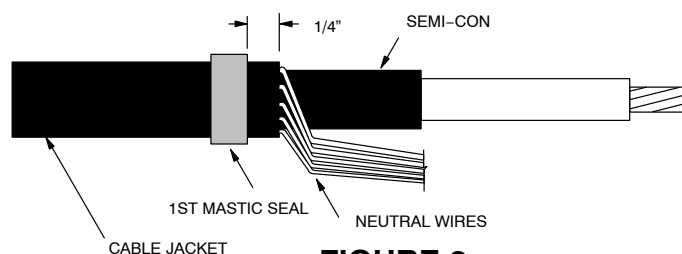


FIGURE 2

4. Bend neutral wires back over applied mastic, secure the wires to the cable jacket with vinyl tape. The tape should be placed a distance of 4–1/2" from the edge of the semi-con. See Figure 3. NOTE: The vinyl tape serves as a marker tape, so position carefully.
5. Select a second mastic strip from the kit and remove the white release liners. Apply a second single wrap of mastic over the neutral wires and the previously applied mastic. Cut off excess. See Figure 3.
6. Compress the neutral wires into the mastic. Over-wrap the mastic strips with two highly stretched layers of vinyl tape. Be sure that all exposed mastic is covered. See Figure 3.

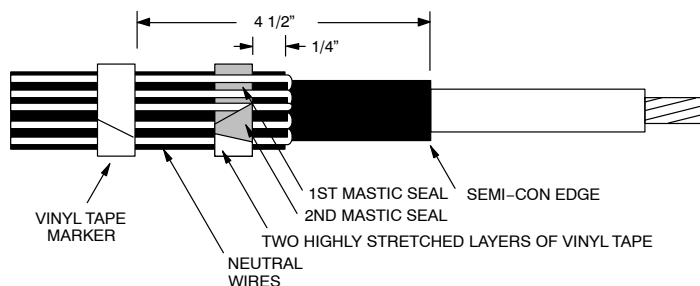


FIGURE 3

CABLE TERMINATION
15 kV #2 – 4/0 XLP/EPR Cable
Indoor – Outdoor

42 34 59 **

Sheet 2 of 3

7. Clean the cable insulation.
8. Remove the red support core from the terminator and slide the terminator onto the cable. The terminator must be positioned beyond the exposed conductor to allow installation of the lug or pin connector. See Figure 4.

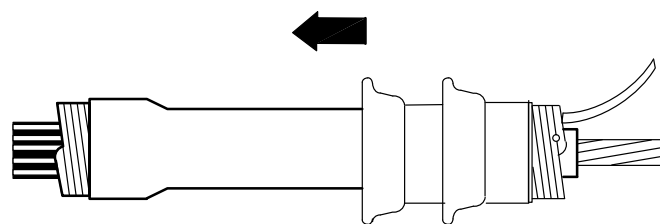


FIGURE 4

9. Install either the lug or pin terminal connector using the Y-35 tool with a U25ART die for #2 or 1/0 and a U249 or U28ART die for 4/0. Crimp as many times as possible without overlap. Remove excess oxide inhibitor and sharp crimp flashing. See Figure 5.

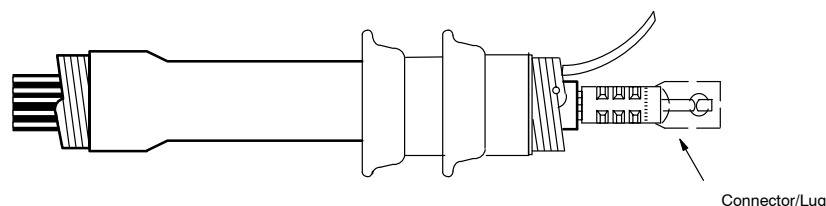


FIGURE 5

10. Re-position the terminator body on the cable and remove the core. Make sure the terminator body (not the core) is butted up to the edge of the vinyl marker tape. While removing the core, unwind it in a counter-clockwise direction. See Figure 6.

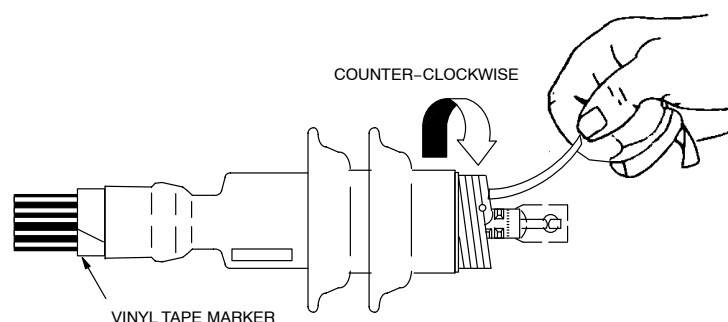


FIGURE 6

NOTE: Once the terminator has made contact over the mastic seal area, there is no need to continue supporting the assembly. Do not push or pull on the terminator while unwinding the core.

11. When using a short barrel lug/connector on small cable, it may be necessary to trim excess terminator insulation from the lug or connector.
12. Collect all neutral wires together and connect to system ground.

CABLE TERMINATION

15 kV #2 – 4/0 XLP/EPR Cable
Indoor – Outdoor

42 34 59 **

Sheet 3 of 3

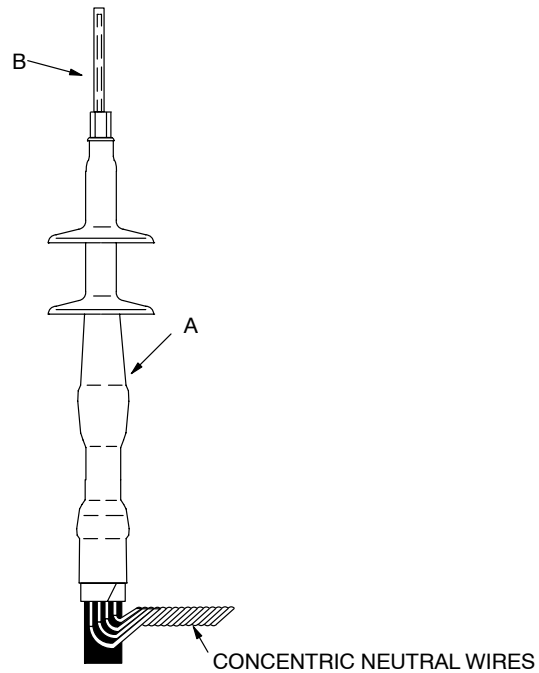


FIGURE 7

		Std. / Stk. No.	Description	42 34 59 **	01	02	03	04	05	06
	A	17 07 145	Termination, Cable, 15kV, Indoor or Outdoor, #2 – 4/0		1	1	1	1	1	1
	B	17 54 232	Connector, Cable Pin Terminal #2		1					
		17 55 257	Lug, Compression, #2			1				
		17 54 357	Connector, Cable Pin Terminal 1/0						1	
		17 55 456	Lug, Compression 1/0							1
		17 54 233	Connector, Cable Pin Terminal 4/0				1			
		17 55 256	Lug, Compression, 4/0					1		

Cable With Concentric Neutral Wires or Flat Strap Neutral

1. Train cable into position and cut to required length. Strip the cable to the dimensions shown in Figure 1. Check the lug being used to determine insert depth "X". Provide an additional 1/2" of exposed conductor on 500 kcmil and smaller cables and 3/4" of exposed conductor on 750 kcmil cables. This will accommodate growth during crimping of aluminum lugs. If a shearhead bolt lug is used, additional exposed conductor is not required.
2. Allow sufficient neutral wire length to make ground connections.

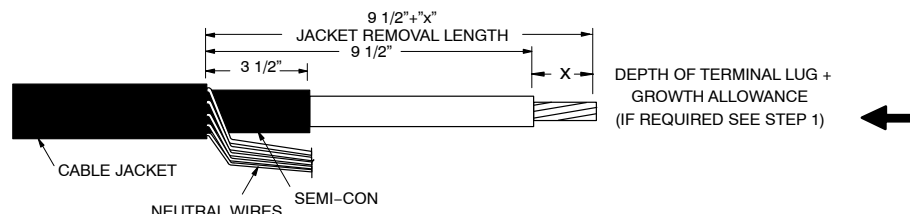


FIGURE 1

3. Select one of the two mastic strips from the kit and remove white release liners. Using light tension apply a single wrap of mastic around the cable jacket 1/4" from the cut edge. Cut off excess mastic. See Figure 2.

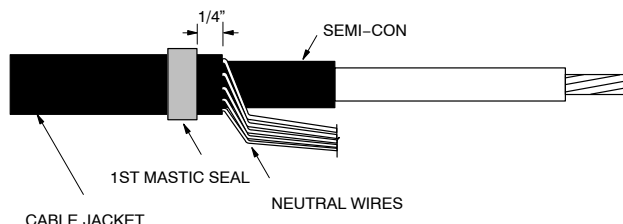


FIGURE 2

4. Bend neutral wires back over applied mastic and secure to cable jacket 4–1/2" from the edge of the semi-con. Use vinyl tape to secure the wires. This tape will also be used to position the terminator, so the location is critical. See Figure 3.

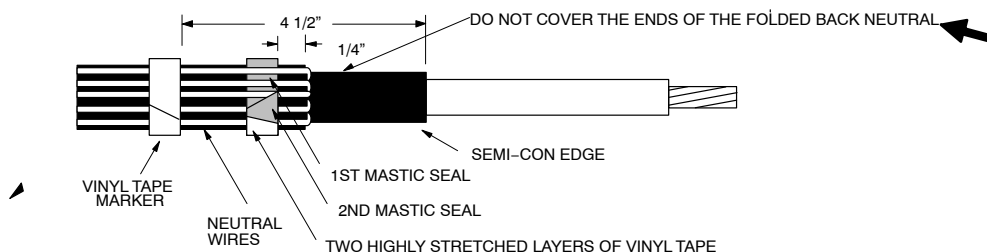


FIGURE 3

5. Select the second mastic strip from the kit and remove the white release liners. Apply a second mastic band over the neutral wires and the previously applied mastic strip. Cut off excess. See Figure 3. Compress the neutral wires into the mastic by over-wrapping the strips with two highly stretched layers of vinyl tape. Be sure to cover all exposed mastic. See Figure 3.
6. Remove the red support core from the terminator. Verify that the terminator body will fit over the lug being used. If the lug will not fit through the core, clean the insulation and slide the terminator onto the cable before installing the lug. Do not remove the core at this time.

7. Use a stainless steel wire brush to clean the exposed aluminum conductor. Position and install 750 kcmil copper lugs, using a L39RT die. For 750 kcmil aluminum lugs, use a U608 die. For 500 kcmil aluminum lugs, use a U34ART die. For 350 kcmil copper lugs, use a U31RT die. For 1000 kcmil copper lugs, use a P44RT die. After the lug is installed remove excess oxide inhibitor and all sharp crimp flashing. The shearhead bolt lug (Stk #17-55-804) may be used instead of the 350 kcmil through 750 kcmil copper and aluminum compression lugs.

Shearhead Bolt Lug Installation Instructions.

- A. Battery powered impact wrench with a $\frac{7}{8}$ " hexagonal socket should be used to install shearhead bolt lugs.
- B. Remove the insert from the lug body if the conductor to be installed is greater than 600 kcmil compact stranded.
- C. Back out all bolts to give clearance for the conductor – DO NOT completely remove the bolts from the connector body.
- D. Insert the cleaned conductor into the lug. There should be no gap between the insulation and lug body.
- E. Hand tighten the bolts to firmly grip the conductor. Use the tightening sequence shown in Figure E to tighten the bolts one-and-a-half turns. Bolts should remain un-sheared.

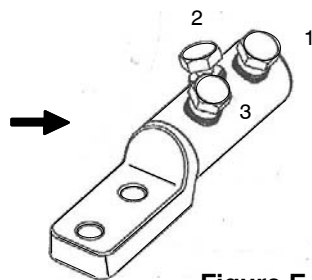


Figure E

- F. Repeat the sequence in step “E” tightening each bolt until the head shears off. DO NOT bend the conductor while shearing the bolts.
 - G. Smooth any sharp edges of protruding bolts with the abrasive provided. Clean the connector to remove particles and excess inhibitor.
8. Position the terminator body on the cable. The base of the terminator body (not the core), must be butted up to the edge of the vinyl marker tape. Remove the core while unwinding in a counter-clockwise direction. Once the terminator body has made contact over the mastic seal area, there is no need to continue supporting the assembly. DO NOT push or pull the terminator while unwinding the core. See Figure 5.

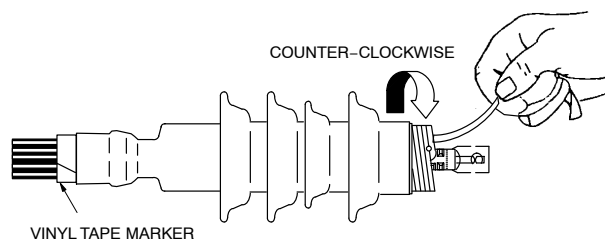


FIGURE 5

CABLE TERMINATION
15 kV 350 kcmil–1000 kcmil
AL/CU Jacketed or Non-Jacketed (Indoor–Outdoor)

42 34 61 **
Sheet 3 of 8

9. For outdoor installations, attach a bronze four bolt lug to the compression lug or shearhead bolt lug using a ground stud in the upper hole and a 1/2" x 2" bolt in the lower hole. See Figure 6.

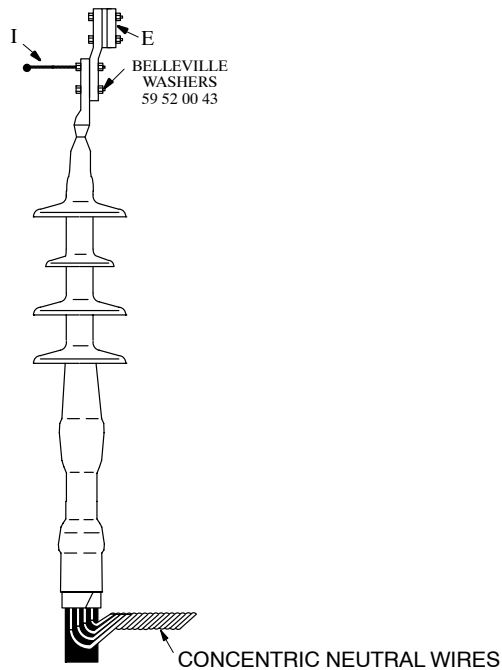


FIGURE 6

10. Collect all concentric neutral wires (straps) together and connect to system ground.
11. If a shearhead bolt lug is used, verify that the terminator body covers all bolt positions to prevent moisture ingress. If a bolt position is not covered with the termination body, cover the bolt position with mastic and silicone tape.

Cables With Metallic Shields (LC or Tape)

LC Shield Shown

1. Train cable into position and cut to required length. Strip the cable to the dimensions shown in Figure 1A. Check the lug being used to determine insert depth "X". Note A: Special shears (Stk. #85–32–240) should be used to cut the LC shield. Note B: To prevent a taped shield from unrolling, hold down the edge with a single wrap of semi-conducting tape (Stk. #25–53–076). Note C: Provide an additional 1/2" of exposed conductor on 500 kcmil aluminum cables and provide an additional 3/4" of exposed conductor on 750 kcmil aluminum cables to accommodate growth during crimping of aluminum lugs. If a shearhead bolt lug is used, additional exposed conductor is not required.

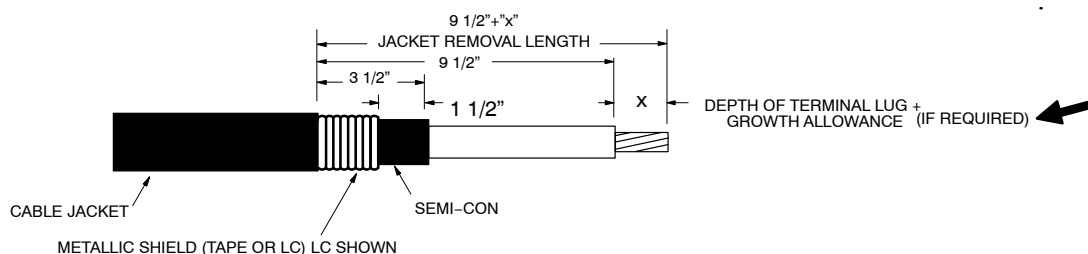


FIGURE 1A

2. Select one of the two mastic strips from the kit and remove white release liners. Using light tension apply a single wrap of mastic around the cable jacket 1/4" from the cut edge. Cut off excess mastic. See Figure 2A.

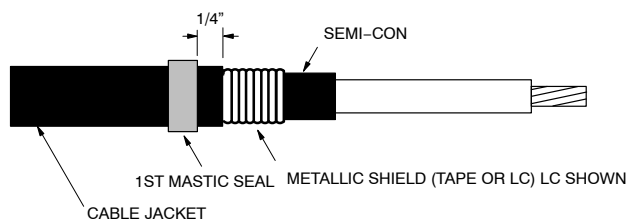
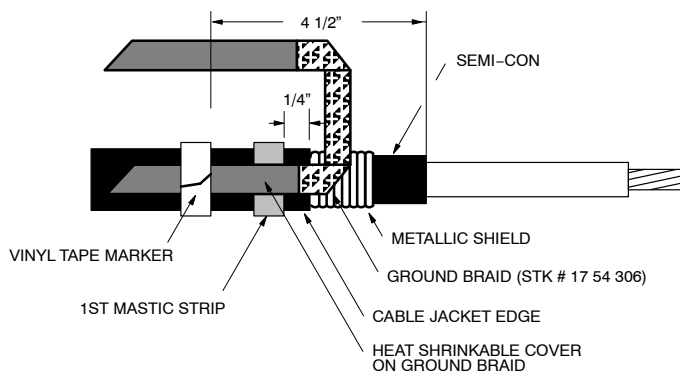


FIGURE 2A

3. Position a pre-formed ground braid (Stk. #17–54–306) with the "U" section over the metallic shield directly adjacent to the cable jacket cut edge. Position one tail of the ground braid over the cable jacket with the heat-shrinkable covering in contact with the mastic strip. Secure the tail to the cable jacket 4–1/2" from the edge of the semi-con using vinyl tape. NOTE: Position the vinyl tape with care since it also serves as a marker for positioning the terminator. See Figure 3A.



4. Wrap the ground braid around the metallic shield and secure in place with the constant force spring. Tighten the spring after wrapping the final turn. Position the finish ground braid tail over the cable jacket. NOTE: The finish tail of the ground braid does not have to be on top of the first tail. See Figure 4A.
5. Select the second mastic strip from the kit and remove the white release liners. Apply the second mastic strip over the previously applied mastic. If ground braids overlap on cable jacket be sure to apply mastic between the braids. Secure ground braids to cable jacket 4–1/2" from cable semi-con edge using vinyl tape. Apply tape directly over previously applied marker tape. See Figure 4A.

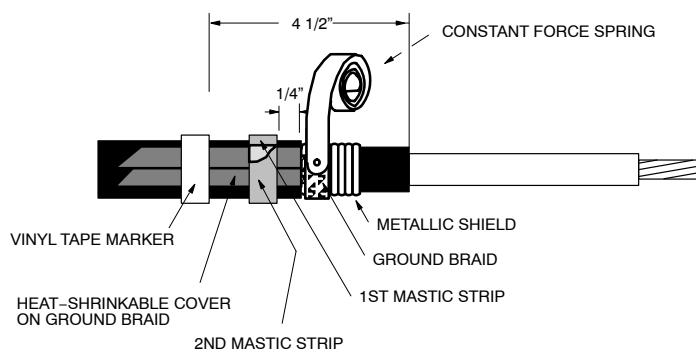


FIGURE 4A

6. Wrap two half-lapped layers of vinyl tape around the mastic seal. Apply two half-lapped layers of semi-conducting tape over the constant force spring, and exposed metallic shield. Do not cover the exposed semi-con insulation shield. See Figure 5A.

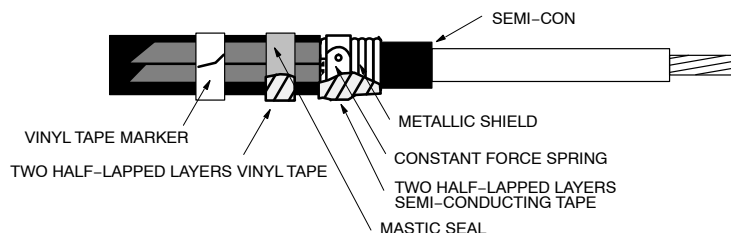


FIGURE 5A

7. Remove the red support core from the terminator. Verify that the terminator body will fit over the lug being used. If the lug will not fit through the core, clean the insulation and slide the terminator onto the cable before installing the lug.
8. Use a stainless steel wire brush to clean the exposed aluminum conductor. Position and install 750 kcmil copper lugs, using a L39RT die. For 750 kcmil aluminum lugs, use a U608 die. For 500 kcmil aluminum lugs, use a U34ART die. For 350 kcmil copper lugs, use a U31RT die. For 1000 kcmil copper lugs, use a P44RT die. After the lug is installed remove excess oxide inhibitor and all sharp crimp flashing. The shearhead bolt lug (Stk #17-55-804) may be used instead of the 350 kcmil through 750 kcmil copper and aluminum compression lugs. See shearhead bolt lug installation instructions on Sheet 2.

CABLE TERMINATION
15 kV 350 kcmil–1000 kcmil
AL/CU Jacketed or Non-Jacketed (Indoor–Outdoor)

42 34 61 **
Sheet 6 of 8

9. Position the terminator body on the cable. The base of the terminator body (not the core), must be butted up to the edge of the vinyl marker tape. Remove the core while unwinding in a counter-clockwise direction. Once the terminator body has made contact over the mastic seal area, there is no need to continue supporting the assembly. DO NOT push or pull the terminator while unwinding the core. See Figure 6A.

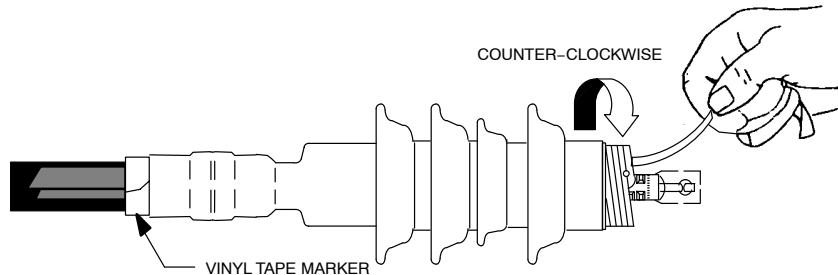


FIGURE 6A

10. For outdoor installations, attach a bronze four bolt lug to the compression lug or shearhead bolt lug using a ground stud in the upper hole and a 1/2" x 2" bolt in the lower hole. See Figure 7A.

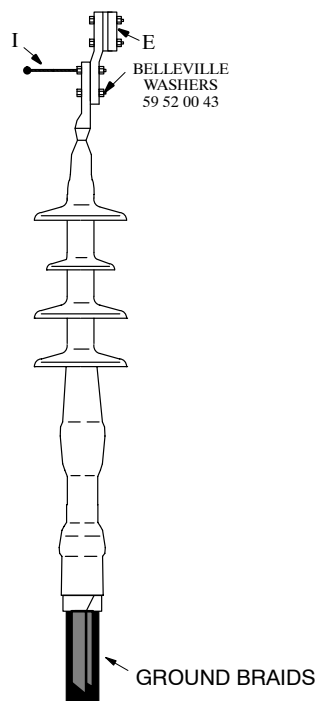


FIGURE 7A

CABLE TERMINATION
15 kV 350 kcmil–1000 kcmil
AL/CU Jacketed or Non-Jacketed (Indoor–Outdoor)

42 34 61 **

Sheet 7 of 8

11. Connect ground braids to system ground using a two-bolt connector (Stk. #17–54–140).
12. If a shearhead bolt lug is used, verify that the terminator body covers all bolt positions to prevent moisture ingress. If a bolt position is not covered with the terminator body, cover the bolt position with mastic and silicone tape.

		Std. / Stk. No.	Description	42 34 61 **	01	02	03	04	05	06	07	08	09	10
@	A	17 07 142	Terminator – Cable, 15kV, 350–1000 kcmil		1	1	1	1	1	1	1	1	1	1
	B	17 55 260	Lug – Compression, 750 Al, 2 Hole				1	1						
		17 05 214	Lug – Compression, 750 Cu., 2 Hole		1	1								
		17 55 296	Lug – Compression, 350 Cu., 2 Hole						1	1				
		17 55 324	Lug – Compression, 500 Al, 2 Hole										1	1
		17 05 236	Lug – Compression, 1000 Cu., 2 Hole								1	1		
		17 55 804	Lug – Shearhead Bolt, 350–750 Cu/Al, 2 Hole		1	1	1	1	1	1			1	1
	C	21 56 078	Bolt – Machine 1/2" x 2" SS		2	1	2	1	2	1	2	1	2	1
	D	12 56 052	Washer–Belleville–Spring, 1/2", SS		2	2	2	2	2	2	2	2	2	2
		12 56 053	Washer–Flat, 1/2", SS		4	4	4	4	4	4	4	4	4	4
@	E	17 54 177	Connector–Cable to Flat Bronze			1		1		1		1		1
	F	17 54 306	Connector–Cable Ground Braid		1	1					1	1		
	G	25 53 055	Tape–Vinyl Plastic, 3/4" x 66'		1	1	1	1	1	1	1	1	1	1
	H	17 54 140	Connector–Wire, #8–4/0, 2– Bolt		1	1					1	1		1
	I	23 64 051	Stud – Grounding, 7" Long, Ball End			1		1		1		1		1

750 kcmil	Copper LC/CN Shield (Indoor)	42 34 61 01
750 kcmil	Copper LC/CN Shield (Outdoor)	42 34 61 02
750 kcmil	Aluminum CN (Indoor)	42 34 61 03
750 kcmil	Aluminum CN (Outdoor)	42 34 61 04
350 kcmil	Copper CN (Indoor)	42 34 61 05
350 kcmil	Copper CN (Outdoor)	42 34 61 06
1000 kcmil	Copper Tape Shield (Indoor)	42 34 61 07
1000 kcmil	Copper Tape Shield (Outdoor)	42 34 61 08
500 kcmil	Aluminum CN (Indoor)	42 34 61 09
500 kcmil	Aluminum CN (Outdoor)	42 34 61 10

CABLE TERMINATION
15 kV 350 kcmil–1000 kcmil
AL/CU Jacketed or Non-Jacketed (Indoor–Outdoor)

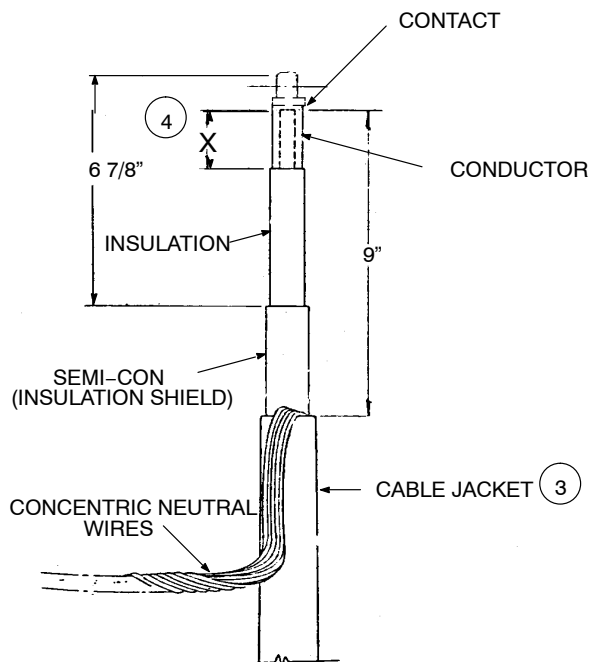
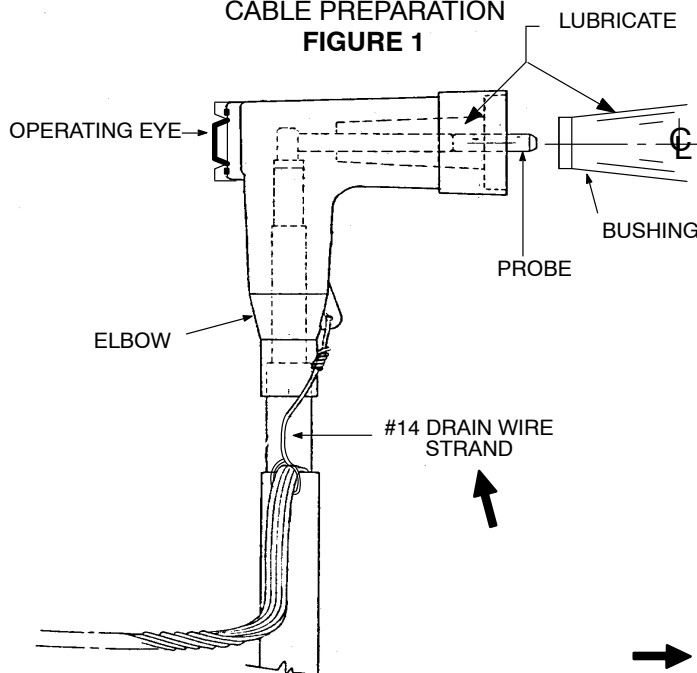
42 34 61 **

Sheet 8 of 8

		Std. / Stk. No.	Description	42 34 61 **	11	12	13	14	15	16
@	A	17 07 142	Terminator – Cable, 15kV, 350–1000 kcmil		1	1	1	1	1	1
		17 05 214	Lug – Compression, 750 Cu., 2 Hole		1	1				
	B	17 55 296	Lug – Compression, 350 Cu., 2 Hole				1	1		
		17 55 792	Lug – Compression, 500 Cu., 2 Hole						1	1
		17 55 804	Lug – Shearhead Bolt, 350–750 Cu/AL, 2 Hole		1	1	1	1	1	1
@	C	21 56 078	Bolt – Machine 1/2" x 2" SS		2	1	2	1	2	1
		12 56 052	Washer–Belleville–Spring, 1/2", SS		2	2	2	2	2	2
	D	12 56 053	Washer–Flat, 1/2", SS		4	4	4	4	4	4
		17 54 177	Connector–Cable to Flat Bronze			1		1		1
	E	17 54 306	Connector–Cable Ground Braid							
		25 53 055	Tape–Vinyl Plastic, 3/4" x 66'		1	1	1	1	1	1
	F	17 54 140	Connector–Wire, #8–4/0, 2– Bolt		1	1	1	1	1	1
		23 64 051	Stud – Grounding, 7" Long, Ball End			1		1		1
	G									

750 kcmil	Reduced Wall Copper FS Shield (Indoor)	42 34 61 11
750 kcmil	Reduced Wall Copper FS Shield (Outdoor)	42 34 61 12
350 kcmil	Reduced Wall Copper FS Shield (Indoor)	42 34 61 13
350 kcmil	Reduced Wall Copper FS Shield (Outdoor)	42 34 61 14
500 kcmil	Reduced Wall Copper FS Shield (Indoor)	42 34 61 15
500 kcmil	Reduced Wall Copper FS Shield (Outdoor)	42 34 61 16

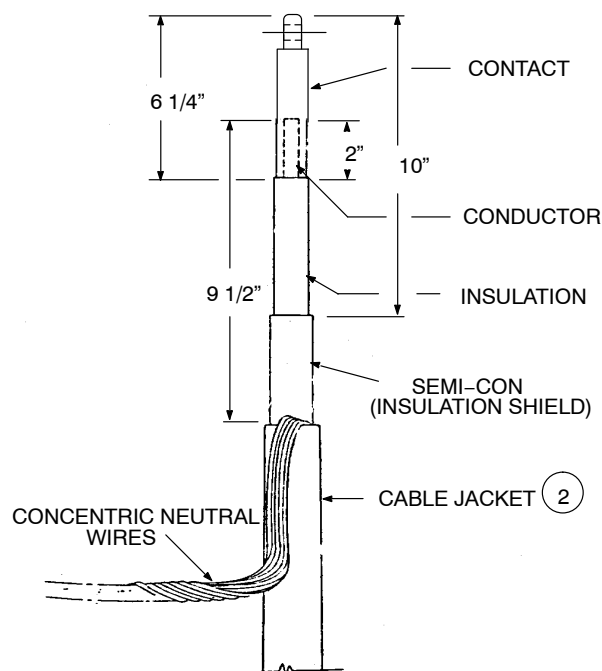
STANDARD ELBOW

CABLE PREPARATION
FIGURE 1ASSEMBLED VIEW
FIGURE 2

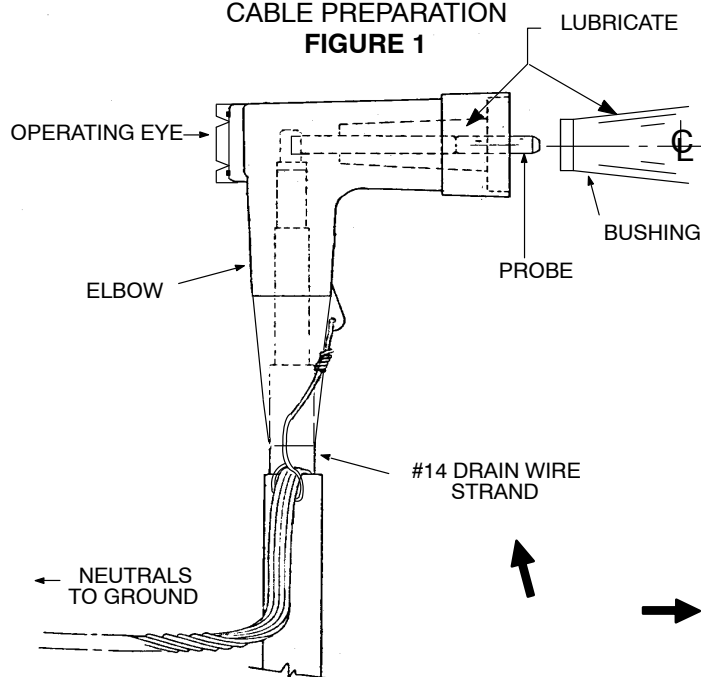
1. Train the cable into position (at the center line of the bushing) and cut excess cable off squarely.
2. Remove 4 feet of cable jacket and bend back 4 feet of concentric neutral wires. Twist the strands together.
3. Unwrap and bind the concentric wires 9 inches from the end of the cable. The cable jacket may be removed to 1 inch above the transformer pad, but the concentrics must be in place 9" from the end of the cable.
4. Check the insert depth "X" of the contact being used. Remove the semi-con and insulation from the cable end.
5. Wire brush the exposed aluminum conductor and install the contact. Position the contact so that the threaded hole aligns with the bushing bore. Crimp the #2 and 1/0 contacts with the Nicropress "Peach" tool. Crimp the 4/0 contact with a U27ART die in a Y35 press. Start crimping at the crimp mark on the contact and rotate each successive crimp 180°. Make as many crimps as possible without overlap. Wipe off excess inhibitor.
6. Remove the semi-con to a point 6-7/8 inches from the end of the contact. The edge of the semi-con should be straight, smooth, and squared. Do not cut the insulation while removing the semi-con.
7. Clean the cable insulation.
8. Lubricate the cable insulation and inside of the elbow housing with the silicone grease provided or Stk. # 31 51 050.
9. Slide the elbow onto the cable. Use a back and forth twisting motion. After the elbow is seated, align the elbow with the contact's threaded hole. Wipe off all excess silicone grease.
10. Thread the probe into the contact by hand, taking care not to cross-thread. Finish tightening the probe, with the wrench, until the wrench bends 90°.
11. Retain a scrap piece of concentric neutral wire or use #14 copper wire (Stk. #18 52 018). Insert one end of the wire through the grounding eye on the elbow and carefully twist it so as to not damage the eye. Wrap the other end of the wire around the neutral wire bundle and twist it. Connect the neutral wire bundle to ground.
12. Lubricate the interface of the elbow with silicone grease. Lubricate the mating bushing only if the bushing is known to be de-energized. Use Stk. # 31 51 050.
13. The elbow is now ready to install.

REPAIR ELBOW

NOTE: DAMAGED CABLE CUT OUT SECTION (INCLUDING CONTACT LENGTH) NOT TO EXCEED 3 1/2".



CABLE PREPARATION
FIGURE 1



ASSEMBLED VIEW
FIGURE 2

1. Remove the old elbow, damaged contact, and damaged cable section – **REMOVED CABLE SECTION AND CONTACT LENGTH SHALL NOT EXCEED 3 1/2"**. If more than 3 1/2" has to be removed, do not use the repair elbow. Use a hacksaw to obtain a clean square cut when removing the damaged cable. Retain all neutral wires.
2. Unwrap and bind the concentric wires 9–1/2" from the end of the cable. If jacketed cable is used, the jacket may be removed to 1" above the transformer pad. Twist the wires together.
3. Remove 2" of insulation shield (semi-con) and insulation from the cable end.
4. Wire brush the exposed aluminum conductor and install the contact. Position the contact so that the threaded hole aligns with the bushing bore. Crimp the #2 and 1/0 contacts with the Micropress "Peach" tool. Crimp the 4/0 contact with a U27ART Die in a Y35 press. Start crimping at the crimp mark on the contact and rotate each successive crimp 180°. Make as many crimps as possible without overlap. Wipe off excess inhibitor.
5. Remove the semi-con to a point 10" from the end of the contact. The edge of the semi-con should be straight, smooth, and squared. Do not cut the insulation while removing the semi-con.
6. Clean the cable insulation.
7. Lubricate the cable insulation and inside of the elbow housing with silicone grease.
8. Slide the elbow onto the cable. Use a back and forth twisting motion. After the elbow is seated properly, align the elbow with the contact's threaded hole. Wipe off all excess silicone grease.
9. Thread the probe into the contact by hand, taking care not to cross-thread. Finish tightening the probe, with the wrench, until the wrench bends 90°.
10. Retain a scrap piece of concentric neutral wire or use #14 copper wire (Stk. #18 52 018). Insert one end of the wire through the grounding eye on the elbow and carefully twist it so as to not damage the eye. Wrap the other end of the wire around the neutral wire bundle and twist it. Connect the neutral wire bundle to ground.
11. Lubricate the interface of the elbow with silicone grease. Lubricate the mating bushing only if the bushing is known to be de-energized.

CABLE TERMINATIONS

15 kV

42 34 62 **

#2, 1/0 and 4/0 AWG Standard, Repair, and Fused Loadbreak Elbow

Sheet 3 of 7

12. The elbow is now ready to install.

		Std./ Stk. No.	Description	42 34 62 **	01	02	03	04	05	06	07	08
A		17 05 183	Elbow-Loadbreak, #2 Al, Stranded	1								
		17 05 203	Elbow-Loadbreak, 4/0 Al, Stranded		1							
		17 05 253	Elbow-Loadbreak, #2 Al, Solid					1				
		17 05 254	Elbow-Loadbreak, 1/0 Al, Stranded						1			
		17 05 250	Elbow-Loadbreak, #2 Al, Stranded, Long Repair				1					
		17 05 303	Elbow-Loadbreak, #2 Al, Solid, Long Repair							1		
		17 05 304	Elbow-Loadbreak, 1/0 Al, Stranded, Long Repair								1	
		17 05 305	Elbow-Loadbreak, 4/0 Al, Stranded, Long Repair									1

15kV Elbow	Dist. Std.
#2 Al, Stranded 175 or 220 Mil	42 34 62 01
#2 Al, Solid 175 Mil	42 34 62 04
1/0 Al, Stranded 175 Mil	42 34 62 05
4/0 Al, Stranded 175 Mil	42 34 62 02
#2 Al, Stranded 175 or 220 Mil (Long Repair)	42 34 62 03
#2 Al, Solid 175 Mil (Long Repair)	42 34 62 06
1/0 Al, Stranded 175 Mil (Long Repair)	42 34 62 07
4/0 Al, Stranded 175 Mil (Long Repair)	42 34 62 08

#2 FUSIBLE ELBOW JUMPER – Approved for use in Illinois ONLY

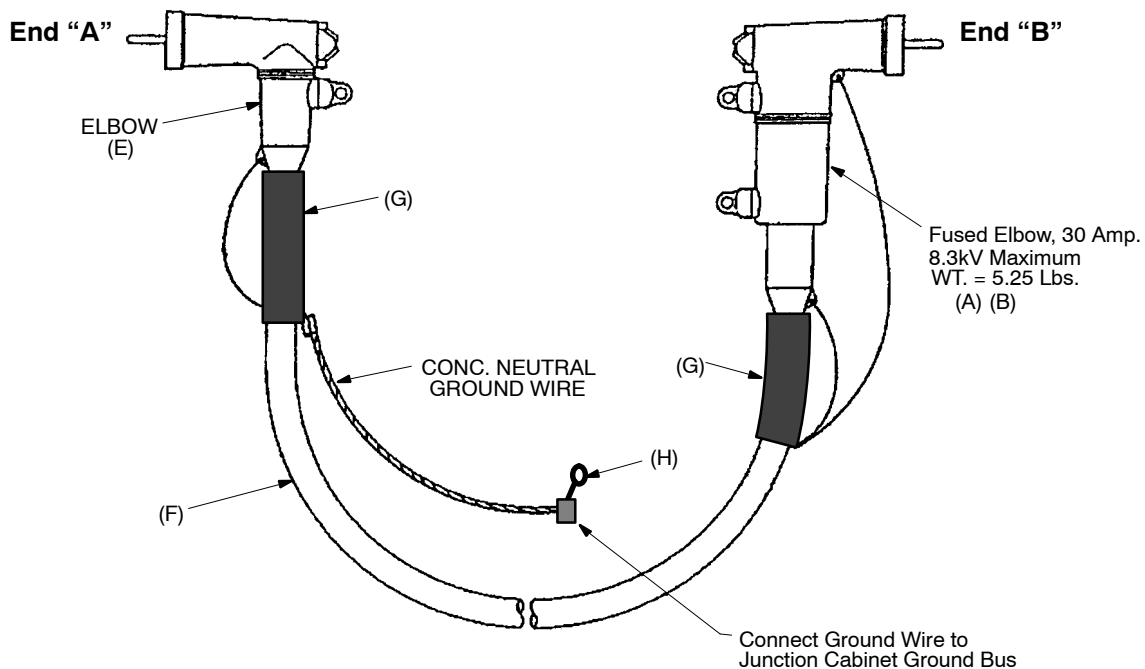
(Dist. Std. 42 34 62 09)

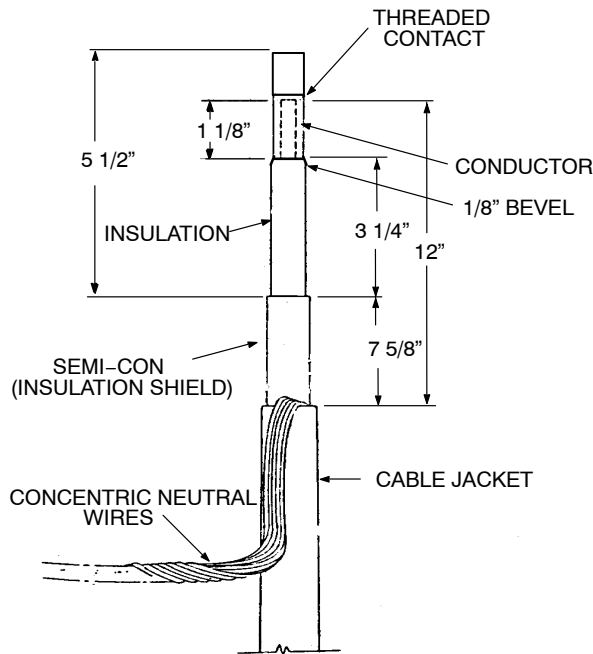
I Obtain a 12 ft. length of #2 AWG, 15kV cable (Stk. # 18-07-238)**II Assemble end “A”:**

1. Remove 4 ft. of cable jacket and bend back the concentric neutral wires. Cut off the stripped back conductor.
2. Slide a heat shrink sleeve down the cable.
3. Separate one neutral wire from the others. Twist the other neutral wires together.
4. Continue the elbow assembly from step #4 of Dist. Std. 42 34 62 01.
5. When the elbow assembly is complete, place the heat shrink sleeve over the elbow neck approx. 1–1/2 inches and shrink the sleeve completely down over the elbow and cable jacket.

III Assemble end “B”:

1. Assemble the fused elbow per the instructions on sheet 5.
2. When the fused elbow assembly is complete, place the heat shrink sleeve over the fused elbow neck approx. 1–1/2 inches and shrink the sleeve completely down over the fused elbow and the cable jacket.

IV Add a hot line clamp to the end of the twisted concentric neutral wires.

FUSED ELBOW – Approved for use in Illinois ONLY

**CABLE PREPARATION
FIGURE 1**

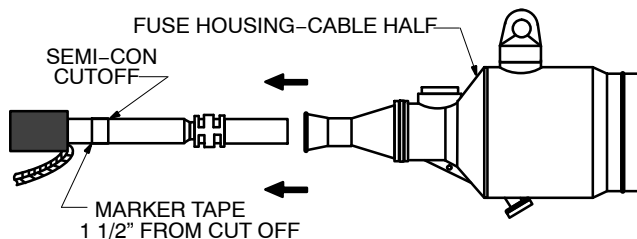


FIGURE 2

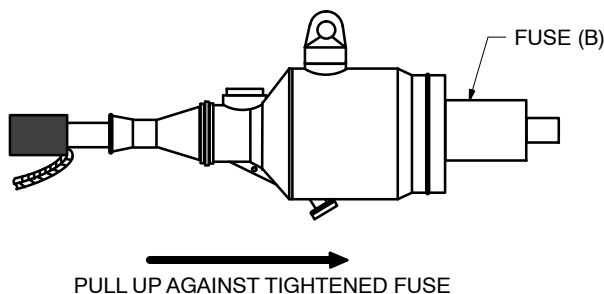


FIGURE 3

1. Remove 4 feet of the cable jacket and bend back 4 feet of concentric neutral wires. Keep 2 strands of concentric neutral wires separated from the others. Cut off 3 feet of excess cable squarely. Cut off remaining neutral wires at the cable jacket cut back.
2. Slide a heat shrink sleeve down the cable.
3. Remove 4 3/8 inches of semi-con and 1-1/8 inches of insulation from the end of the cable. Wire brush the exposed aluminum conductor and install the threaded contact. Crimp the #2 contact with the Nicopress "Peach" tool. Start crimping at the crimp mark and rotate each successive crimp 180 degrees. Make as many crimps as possible and wipe off excess inhibitor.
4. Clean the cable insulation and apply a tape marker on the semi-con 1 1/2 inches from the cut off.
5. Apply silicone grease to the outside of the threaded contact, cable insulation and semi-con and the cable half of the fuse housing. Slide the housing onto the cable up to the marker tape on the semi-con. Remove the marker tape.
6. Insert the threaded end of the fuse into cable half of the fuse housing and thread into the contact. **HAND TIGHTEN ONLY!** Pull the fuse housing up against the bottom of the tightened fuse.
7. Assemble the probe connector to the fuse terminal. Rotate the probe connector so that the flats are perpendicular to the mating bushing. Lock the probe connector in position by tightening the set screws with the allen wrench supplied.
8. Apply silicone grease to the elbow half of the fuse housing and push it onto the cable half of the fuse housing. The rubber surfaces should butt and the probe connector should face the opening of the elbow half of the fuse housing. The two test points should be in line with each other.

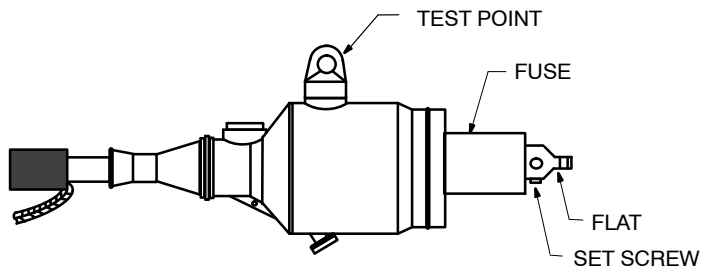


FIGURE 4

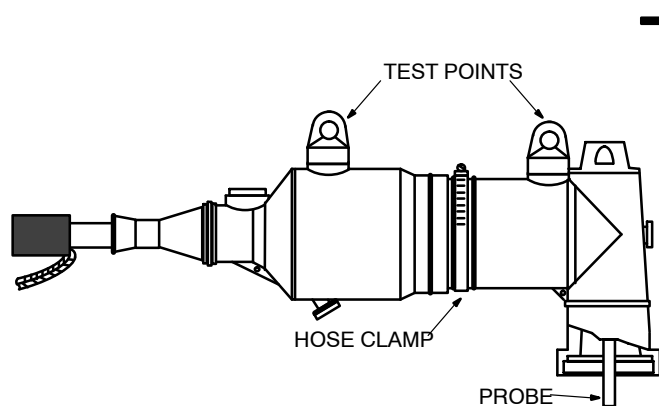
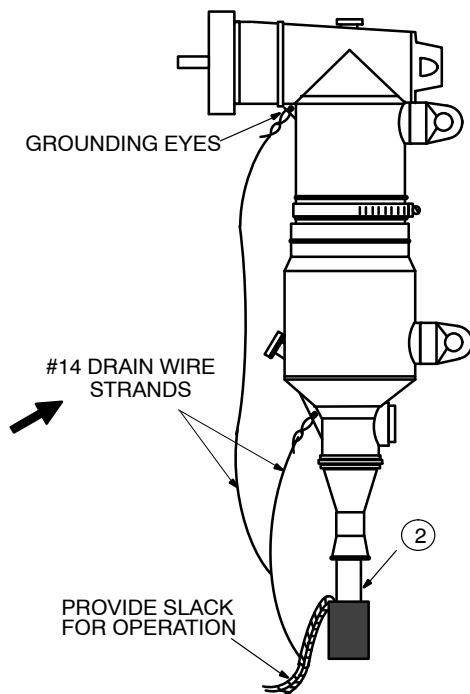


FIGURE 5



COMPLETED FUSED ELBOW (A)

FIGURE 6

9. Insert the probe into the probe connector and start the threads by hand. Tighten using the torque limiting wrench supplied. Tighten the probe with the wrench until the wrench bends 90 degrees.

10. Position the hose clamp as shown and tighten snug. DO NOT OVERTIGHTEN THE HOSE CLAMP.

11. Retain two scrap pieces of concentric neutral wire or use #14 copper wire (Stk. #18 52 018). Insert one end of each wire through a grounding eye on the fused elbow and carefully twist them so as to not damage the eyes. Wrap the other end of each wire around the neutral wire bundle and twist it. Connect the neutral wire bundle to ground. Provide slack in the drain wires for elbow operation.

12. Lubricate the interface of the elbow with silicone grease. If de-energized, the mating bushing should also be lubricated. Use Stk.# 31 51 050.

13. The fused elbow is complete.

CABLE TERMINATIONS

15 kV

42 34 62 **

#2, 1/0 and 4/0 AWG Standard, Repair, and Fused Loadbreak Elbow

Sheet 7 of 7

NOTES:

1. Fused elbow jumpers are to be installed only in the single phase junction box.
2. Install a fault indicator on the heat shrink sleeve below the fused elbow. The fault indicator will aide in determining the condition of the fuse.
3. Order 1 spare fuse (20-04-859) for each junction cabinet.

3 2		Std./Stk. No.	Description	42 34 62 **	09
	A	17 05 476	Elbow-Loadbreak, Fused, #2Al. Strand		1
	B	20 04 859	Fuse-8.3 kV, 30A, Current Limiting		2
	D	60 55 034	Indicator-Fault, Fast Response		1
	E	17 05 183	Elbow-Loadbreak, #2Al. Stranded		1
	F	18 07 238	Cable-#2Al, 15kV, Stranded (ft.)		12
	G	12 53 078	Tube-Heat Shrink, 1.5" ID x 9" Long		2
	H	23 78 394	Clamp-Hotline, #6-2/0, CU		1

1. Train the cable into position and cut to required length. For all installations allow sufficient neutral wire length beyond the finished cable end for proper grounding connection.
2. Prepare the cable using the dimensions shown in Figure 1. Be sure to check the lug or pin terminal connector being used to determine the insert depth "X". Provide an additional 1/4" of exposed conductor to allow for growth of the aluminum lug or connector during crimping.

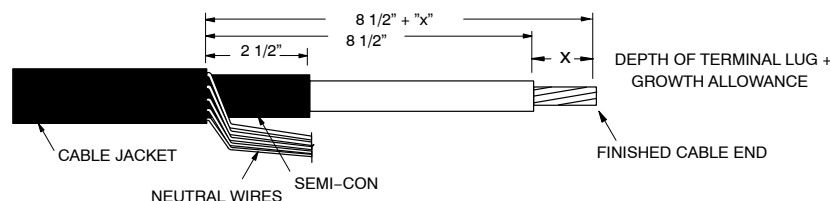


FIGURE 1

3. Select one of the mastic strips from the kit and remove the white release liners. Using light tension apply a single wrap of mastic around the cable jacket 1/4" from the edge. Cut off excess mastic. See Figure 2.

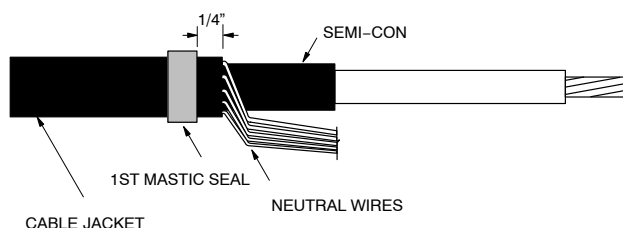


FIGURE 2

4. Bend neutral wires back over applied mastic. Secure the wires to the cable jacket with vinyl tape. The tape should be placed a distance of 4-1/2" from the edge of the semi-con. See Figure 3.

NOTE: The vinyl tape serves as a marker tape, so position carefully.

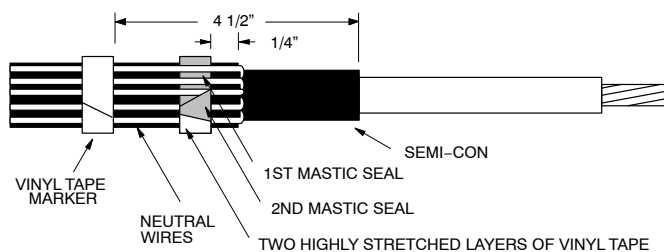


FIGURE 3

5. Select a second mastic strip from the kit and remove the white release liners. Apply a second mastic band over the neutral wires and the previously applied mastic. Cut off excess. See Figure 3.
6. Compress the neutral wires into the mastic. Over-wrap the mastic strips with two highly stretched layers of vinyl tape. Be sure that all exposed mastic is covered. See Figure 3.
7. Remove the red support core from the terminator and check to insure the terminator will fit over the lug or pin terminal connector being used. If the lug or pin terminal connector will not fit through the termination core, clean the insulation and slide the terminator on the cable before installing the lug/connector. Do Not remove the core at this time. Position terminator beyond the exposed conductor to allow installation of the lug/connector.
8. Install either the lug or pin terminal connector using the Y-35 tool with a U25ART die for #2 or 1/0 and a U249 or U28ART die for 4/0. Crimp as many times as possible without overlap. Remove excess oxide inhibitor and sharp crimp flashing. If the insulation has not been cleaned, clean at this time.

CABLE TERMINATION

15kV #2 & 4/0 XLP/EPR Cable

Indoor Use Only

42 34 63 **

Sheet 2 of 2

9. Re-position the terminator body on the cable and remove the core. Make sure the terminator body (not the core) is butted up to the edge of the vinyl marker tape. While removing the core, unwind it in a counter-clockwise direction. See Figure 4.

NOTE: Once the terminator has made contact over the mastic seal area, there is no need to continue supporting the assembly. Do not push or pull on the terminator while unwinding the core.

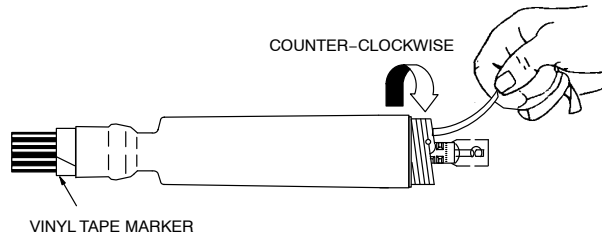


FIGURE 4

10. When using a short barrel lug/connector on small cable, it may be necessary to trim excess terminator insulation from the lug or connector.
11. Collect all neutral wires together and connect to system ground. See Figure 5.

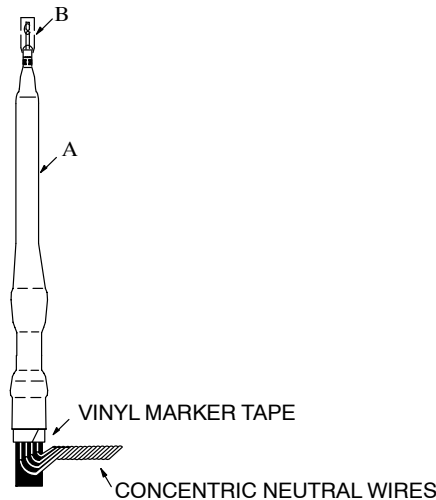


FIGURE 5

		Std. / Stk. No.	Description	42 34 63 **	01	02	03	04	05	06
	A	17 07150	Termination, Cable, 15 kV Indoor #2-4/0		1	1	1	1	1	1
	B	17 54 232	Connector, Cable Pin Terminal #2		1					
		17 55 257	Lug, Compression, #2			1				
		17 54 357	Connector, Cable Pin Terminal 1/0						1	
		17 55 307	Lug, Compression, 1 Hole 1/0							1
		17 54 233	Connector, Cable Pin Terminal 4/0				1			
		17 55 256	Lug, Compression, 4/0					1		

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 3
REV. DATE: 11/6/02
REAFFIRMED DATE: 3/22/11

CABLE TERMINATION
15kV 4/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow

42 34 64 **

Sheet 1 of 8

COOPER T-OP II

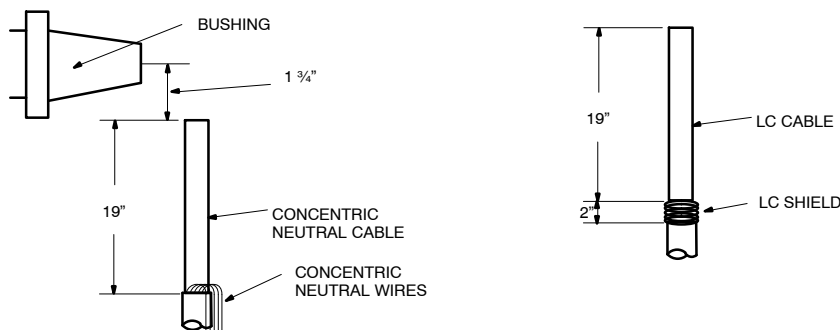
I TRAIN THE CABLE

1. Center the cable between the apparatus bushing and the parking stand pocket. The cable should be located 7 inches from the apparatus front plate.
2. Provide adequate slack for cable movement between the apparatus bushing and the standoff bushing.
3. Cut the cable $1 \frac{3}{4}$ inches from the centerline of the bushing. Clean 24 inches of the outer cable jacket.

II CUT BACK THE CABLE

Cable with LC Shield

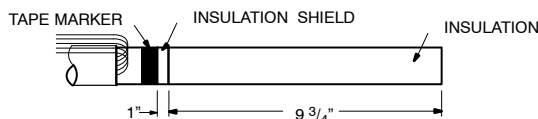
1. Remove 21 inches of cable jacket
2. Remove 19 inches of LC shield. Cover the sharp end of the LC shield with a wrap of plastic tape. Go to step #3.



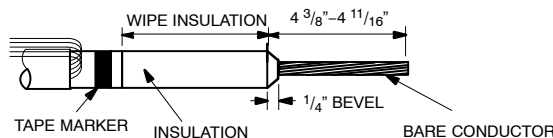
Cable/shield cutback dimensions have been increased 6 inches to allow for installation of fault indicators.

Cable with Concentric Neutral Wires

1. Remove 19 inches of cable jacket
2. Allow enough extra concentric neutral wires to connect to ground and allow movement to the standoff bushing.
3. Remove $9 \frac{3}{4}$ inches of insulation shield.
4. Place a tape marker 1 inch from the end of the insulation shield.

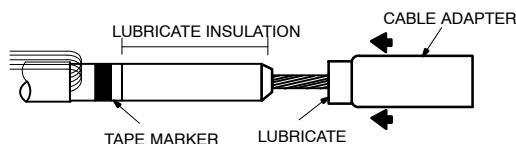


5. Remove $4 \frac{3}{8}$ - $4 \frac{11}{16}$ inches of insulation.
6. Bevel the insulation edge $\frac{1}{4}$ inch at a 45 degree angle.
7. Thoroughly clean the insulation.



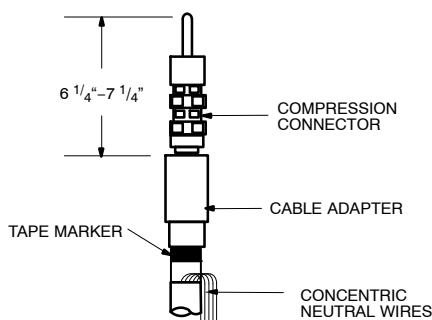
III INSTALL THE CABLE ADAPTER

1. Lubricate the exposed insulation and the inside of the cable adapter.
2. Slide the small end of the cable adapter over the cable using a twisting motion until the small end is flush with the tape marker.

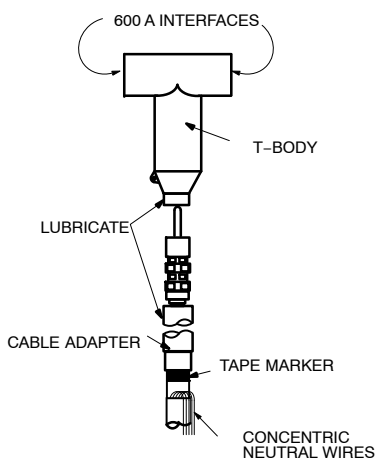


**15kV 4/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow****IV INSTALL THE COMPRESSION CONNECTOR**

1. Wire brush the aluminum conductor.
2. Insert the conductor into the compression connector and rotate until the flats of the compression connector and the apparatus bushing are aligned.
3. Make 5 crimps using the U34ART die (for 500 kcmil cable) or L39ART die (for 750 kcmil cable) or U31ART die (for 350 AWG cable and for 4/0 AWG cable). Make the first crimp at the first line below the shoulder of the connector. Rotate each crimp 90 degrees and allow $\frac{1}{8}$ inch between crimps.
4. Wipe off excess inhibitor.
5. Check connector length as shown.

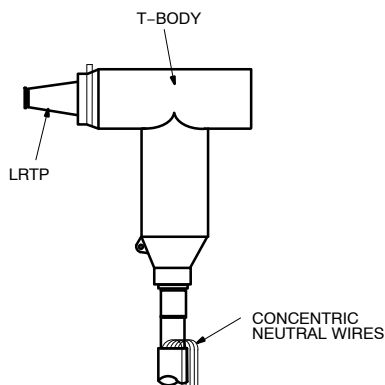
**V INSTALL T-BODY**

1. Clean and lubricate the outside of the cable adapter.
2. Clean and lubricate the inside of the T-body.
3. Slide the T-body onto the cable until the compression connector eye is centered in the 600 Amp interfaces.
4. Remove the tape marker.

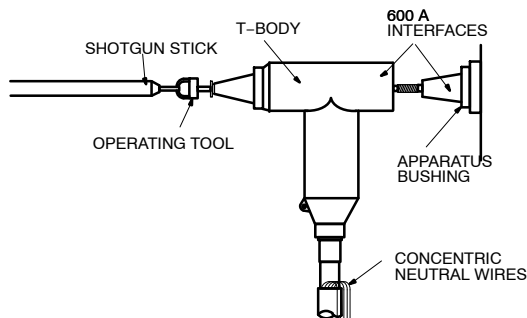


VI INSTALL THE LRTP INTO THE T-BODY

1. Clean and lubricate the mating 600 Amp interface of the LRTP (Load Reducing Tap Plug) and the T-body.
2. Remove the shipping cap from the 200 Amp interface of the LRTP and the thread protector on the threaded end.
3. Insert the T-wrench (Stk. #85-41-370) into the throat of the LRTP and thru the rotating nut and engage the alignment segment.
4. Insert the threaded ferrule end of the LRTP into the side of the T-body opposite the apparatus bushing.
5. Thread the alignment segment into the threads of the compression connector by turning the T-wrench until a positive stop is felt.
6. Continue applying clockwise force to the T-wrench until the pin shears and the alignment segment rotates freely.
7. Remove the alignment segment by applying pressure to the T-wrench until the segment separates. Discard the segment.

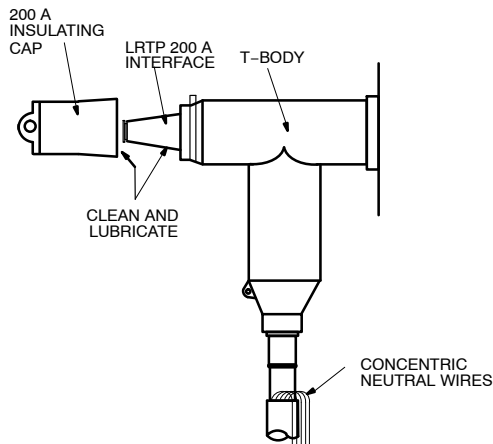
**VII INSTALL THE 600 AMP ELBOW ONTO THE APPARATUS BUSHING**

1. Screw the short end of the stud into the threaded hole in the apparatus bushing.
2. Clean and lubricate the mating interfaces of the apparatus bushing and the T-body.
3. Grasp the eye of the operating tool (Stk. #83-28-045) with a shotgun stick and pull the eye fully into it.
4. Using the shotgun stick, insert the operating tool into the LRTP throat and engage the rotating nut.
5. While pushing the T-body onto the apparatus bushing, turn the operating tool clockwise to make a threaded connection. Turn until the torque head rachets. An audible click will be heard.
6. Remove the operating tool.



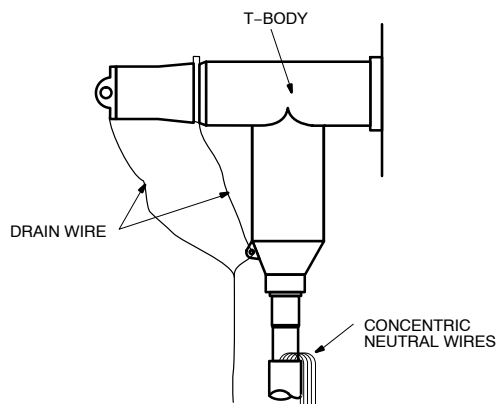
VIII CAP THE 200 AMP INTERFACE

1. Clean and lubricate the 200 Amp interface on the LRTP and the inside of an insulating cap (Stk. #17-55-227).
2. Cover the interface with the cap.



IX GROUND THE ELBOW

1. Connect the tie off tabs of the LRTP and the T-body with a strand of drain wire (concentric neutral wire) and connect the drain wire to ground.
2. Connect the insulating cap drain wire to ground.
3. Connect the cable concentric neutral wires or flatstraps to ground. For LC Shield Cables use Dist. Std. 59 40 93 44.
4. See Dist. Std. 59 40 60 01 for additional 600 Amp accessories.



		Std. / Stk. No.	Description	42 34 64 **	01	02	03	04	05	06
@	A	17 05 255	Elbow – Deadbreak, 500 kcmil Al, Stranded	1						
		17 05 224	Elbow – Deadbreak, 750 kcmil Al or Cu, Stranded		1	1				
		17 05 374	Elbow – Deadbreak, 4/0 AWG Al, Stranded					1		
		17 05 326	Elbow – Deadbreak, 350 kcmil Cu, RW, Compact Str.						1	
		17 05 492	Elbow – Deadbreak, 350 kcmil Cu, Stranded							1
	B	17 55 227	Cap – Insulating, 15kV, with Drain Wire	1	1	1	1	1	1	1
	C	17 54 306	Connector – Cable Ground Braid				1			

42 34 64 01 500 kcmil AL CN Cable

42 34 64 02 750 kcmil AL/CU CN Cable

42 34 64 03 750 kcmil LC Cable

42 34 64 04 4/0 AWG AL CN Cable

42 34 64 05 350 kcmil FS, Reduced Wall Cable

42 34 64 06 350 kcmil CN Cable

CABLE TERMINATION
15kV 4/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow

42 34 64 **

Sheet 5 of 8

RICHARDS R800

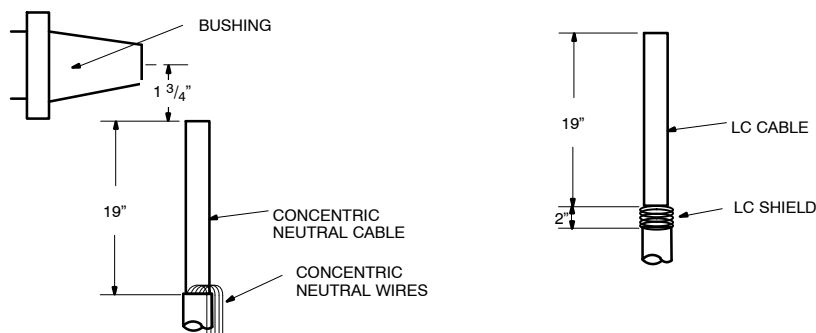
I TRAIN THE CABLE

1. Center the cable between the apparatus bushing and the parking stand pocket. The cable should be located 7 inches from the apparatus front plate.
2. Provide adequate slack for cable movement between the apparatus bushing and the standoff bushing.
3. Cut the cable $1\frac{3}{4}$ inches from the centerline of the bushing. Clean 24 inches of the outer cable jacket.

II CUT BACK THE CABLE

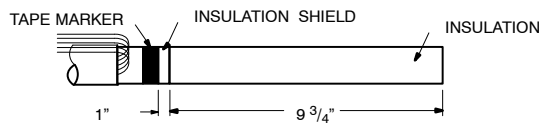
Cable with LC Shield

1. Remove 21 inches of cable jacket.
2. Remove 19 inches of LC shield. Cover the sharp end of the LC shield with a wrap of plastic tape. Go to step #3.

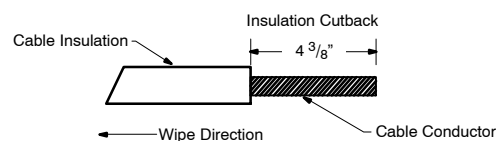


Cable with Concentric Neutral Wires

1. Remove 19 inches of cable jacket.
2. Allow enough extra concentric neutral wires to connect to ground and allow movement to the standoff bushing.
3. Remove $9\frac{3}{4}$ inches of insulation shield.
4. Place a tape marker 1 inch from the end of the insulation shield.

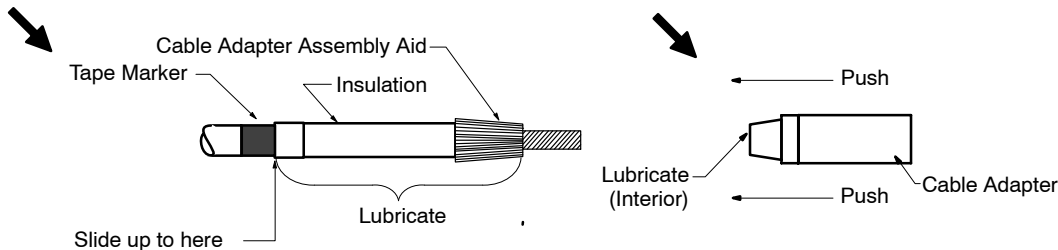


5. Remove $4\frac{3}{8}$ inches of insulation.
6. Thoroughly clean the insulation.

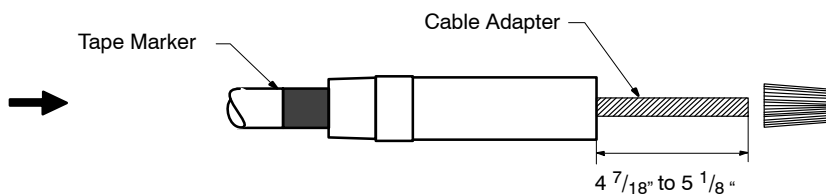


III. INSTALL THE CABLE ADAPTER

1. Slide cable adapter aid up to insulation.
2. Apply silicone lubricant to cable insulation, cable adapter assembly aid, and inside of cable adapter as shown.
3. Slide cable adapter onto cable until the cable adapter sits flush with the leading edge of the tape marker as shown.



4. Remove cable adapter assembly aid.
5. Confirm cable adapter is positioned as shown below.

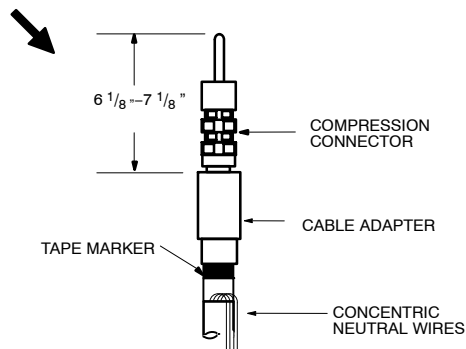


Check: Confirm that edge of tape marker is flush with end of cable adapter as shown.

Check: Confirm that exposed conductor dimension satisfies criteria shown above.

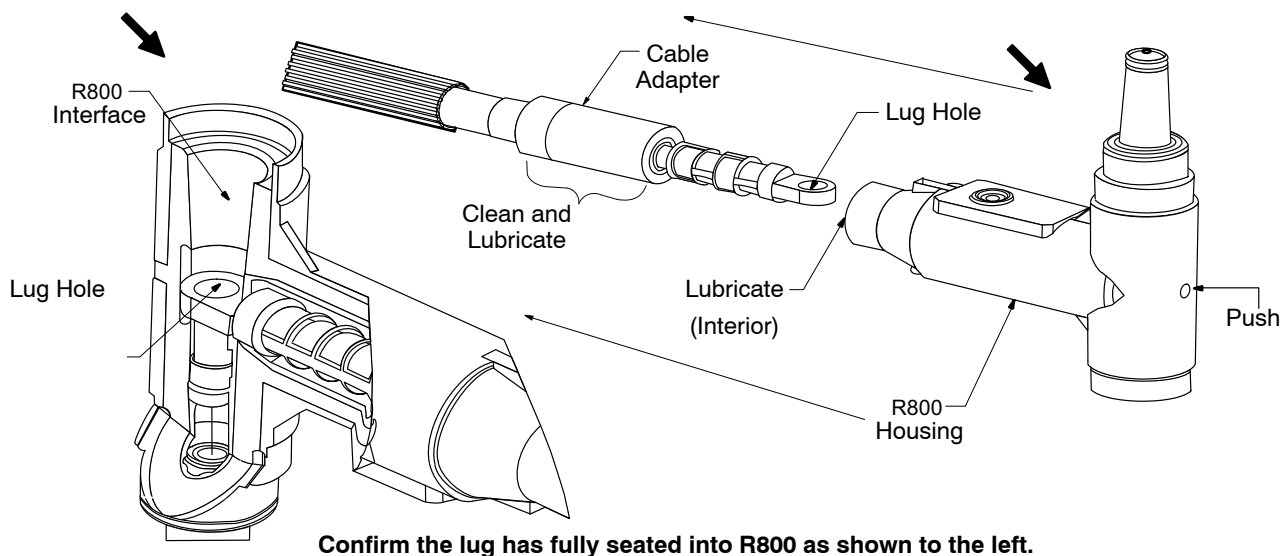
IV INSTALL THE COMPRESSION CONNECTOR

1. Wire brush the aluminum conductor.
2. Insert the conductor into the compression connector and rotate until the flats of the compression connector and the apparatus bushing are aligned.
3. Make 5 crimps using the U34ART die (for 500 kcmil cable) or L39ART die (for 750 kcmil cable) or U31ART die (for 350 AWG cable and for 4/0 AWG cable). Make the first crimp at the first line below the shoulder of the connector. Rotate each crimp 90 degrees and allow 1/8 inch between crimps.
4. Wipe off excess inhibitor.
5. Check connector length as shown.



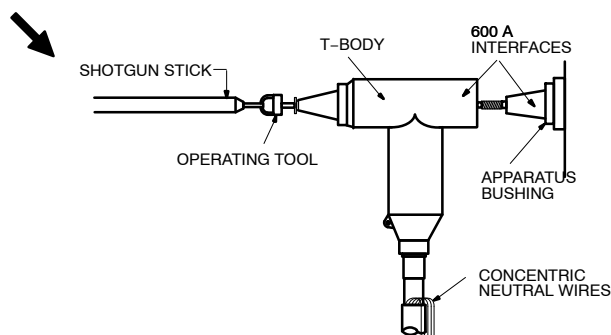
V INSTALL R800 HOUSING

1. Clean the outside of the cable adapter.
2. Lubricate the entire surface of cable adapter and cable entrance of the R800.
3. Install R800 onto the cable adapter and push until the lug is fully inside the R800. Remove the tape marker.



VI INSTALL THE 600 AMP ELBOW ONTO THE APPARATUS BUSHING

1. Screw the short end of the stud into the threaded hole in the apparatus bushing.
2. Clean and lubricate the mating interfaces of the apparatus bushing and the T-body.
3. Grasp the eye of the operating tool (Stk. #83-28-045) with a shotgun stick and pull the eye fully into it.
4. Using the shotgun stick, insert the operating tool into the LRTP throat and engage the fastener.
5. Slide the fastener into forward position through the lug hole.
6. While pushing the T-body onto the apparatus bushing, turn the operating tool clockwise to make a threaded connection. Turn until the torque head ratchets. An audible click will be heard.
7. Remove the operation tool.



CABLE TERMINATION

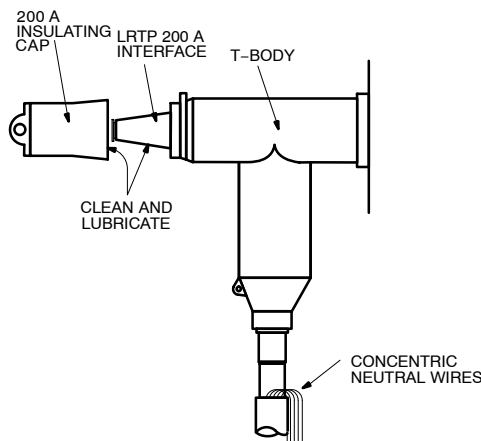
15kV 4/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow

42 34 64 **

Sheet 8 of 8

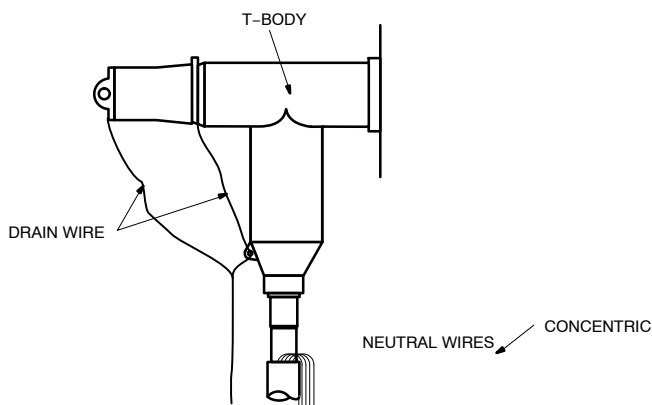
VII CAP THE 200 AMP INTERFACE

1. Clean and lubricate the 200 Amp interface on the LRTP and the inside of an insulating cap (Stk. #17-55-227).
2. Cover the interface with the cap.



VIII GROUND THE ELBOW

1. Connect the tie off tabs of the LRTP and the T-body with a strand of drain wire (concentric neutral wire) and connect the drain wire to ground.
2. Connect the insulating cap drain wire to ground.
3. Connect the cable concentric neutral wires or flatstraps to ground. For LC Shield Cables use Dist. Std. 59 40 93 44.
4. See Dist. Std. 59 40 60 01 for additional 600 Amp accessories.



	Std./Stk. No	Description	42 34 64**	01	02	03	04	05	06
A	17 05 255	Elbow – Deadbreak, 500 kcmil Al, Stranded		1					
	17 05 224	Elbow – Deadbreak, 750 kcmil Al or Cu, Stranded			1	1			
	17 05 374	Elbow – Deadbreak, 4/0 AWG Al, Stranded					1		
	17 05 326	Elbow – Deadbreak, 350 kcmil Cu, RW, Compact Str.						1	
	17 05 492	Elbow – Deadbreak, 350 kcmil Cu, Stranded							1
B	17 55 227	Cap – Insulating, 15kV, with Drain Wire		1	1	1	1	1	1
@	C	17 54 306	Connector – Cable Ground Braid			1			

42 34 64 01 500 kcmil AL CN Cable

42 34 64 02 750 kcmil AL/CU CN Cable

42 34 64 03 750 kcmil LC Cable

42 34 64 04 4/0 AWG AL CN Cable

42 34 64 05 350 kcmil FS, Reduced Wall Cable

42 34 64 06 350 kcmil CN Cable

**DISTRIBUTION
CONSTRUCTION STANDARDS**

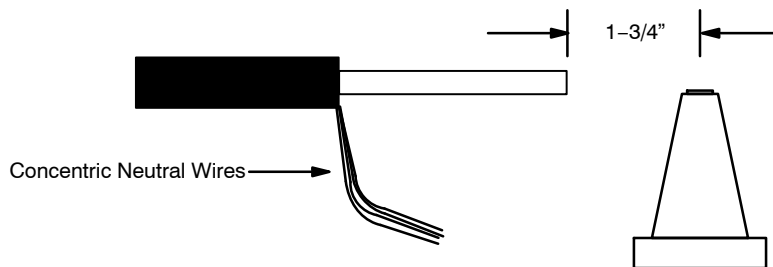


ENG: EJB
REV. NO: 12
REV. DATE: 10/14/16

CONCENTRIC NEUTRAL WIRES OR FLAT STRAP SHIELDED CABLES

IV. Train the Cable

Position the cable between the apparatus bushing and the parking stand pocket. It should be located in the final assembled position with enough slack to provide adequate clearance for removing the elbows. Cut back the jacket and unwind the concentric neutral wires to allow enough length to make a connection to ground. Cut the cable $1 - \frac{3}{4}$ " from the center line of the mating bushing.

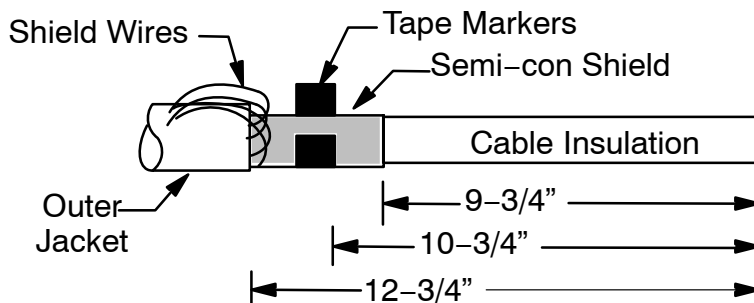


V. Clean the Cable

- a. Clean the outer jacket of the cable for 24 inches.

VI. Cable Preparation

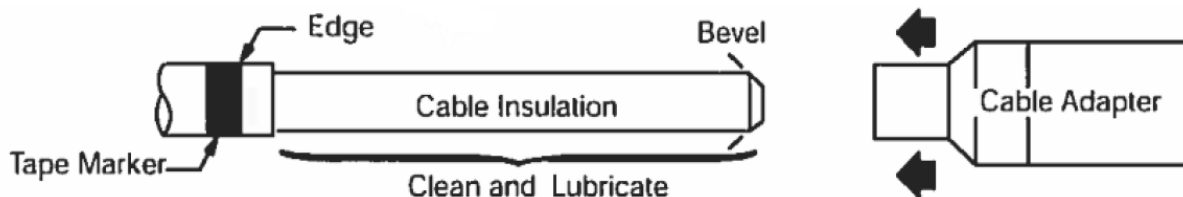
- a. Follow the cable cut backs for jacketed concentric neutral wires shown below:



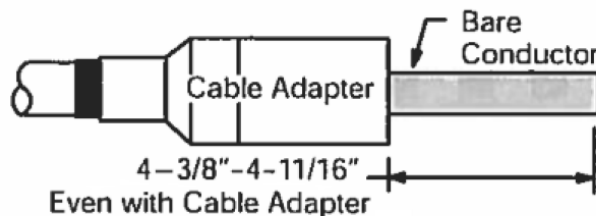
600 Amp Dead-break Elbow with Ball Ground

VII. Install the Cable Adapter:

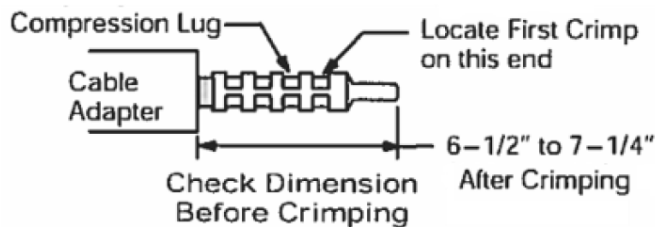
- Bevel the end of the cable insulation at 45 degree angle, approximately $\frac{1}{4}$ " back.
- Thoroughly clean, then lubricate the cable insulation always working toward the semi-con shield.
- Install the cable adapter, small end first, until it is flush with the edge of the tape marker.

**VIII. Expose the Conductor**

- Remove the protruding cable insulation by cutting it even with the cable adapter.
- Do not cut or nick the cable adapter or the conductor.
- The length of exposed conductor should be between $4 \frac{3}{8}$ " to $4 \frac{11}{16}$ ".
- Otherwise, redo the assembly.

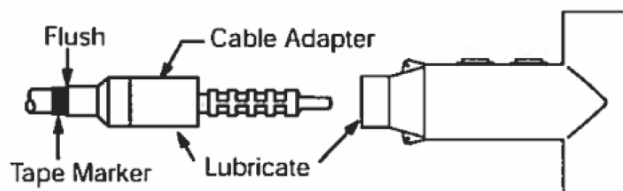
**IX. Install the Compression Lug:**

- Fully insert the conductor into the compression lug.
- Measure the "Check Dimension" before crimping. This dimension should be less than $6 \frac{1}{2}$ ". Otherwise, redo the assembly.
- Crimp the compression lug using the U31ART die.
- Rotate each crimp 90 degrees and allow $\frac{1}{8}$ " between crimps.
- Wipe off excess inhibitor.
- The distance from the end of the compression lug to the cable adapter after crimping should be between $6 \frac{1}{2}$ " and $7 \frac{1}{4}$ ". Otherwise, redo the assembly.



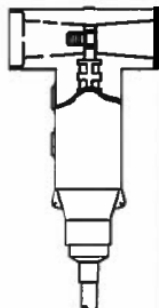
X. Install the T Elbow Body to the Cable

- Lubricate the cable adapter and the inside of the elbow cable entrance.
- Install the elbow on to the cable adapter until the elbow cannot advance further.
- Make sure that the cable adapter is still flush with the tape marker.
- If not, reposition the cable adapter.
- Remove the tape marker.



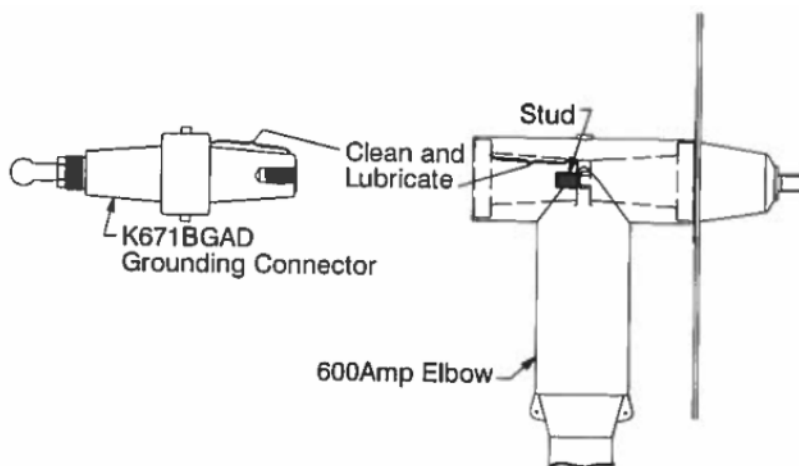
XI. Install the T Elbow to the 600 Amp Bushing.

- Remove the protective caps from both ends of the T elbow and from the 600 amp bushing.
- Hand tighten the threaded stud supplied with the T elbow into the 600 amp bushing.
- Clean and lubricate both the T elbow and the 600 amp bushing with the lubricant supplied.
- Push the T elbow onto the 600 amp bushing, lining up the hole in the compression lug with the stud on the mating part.



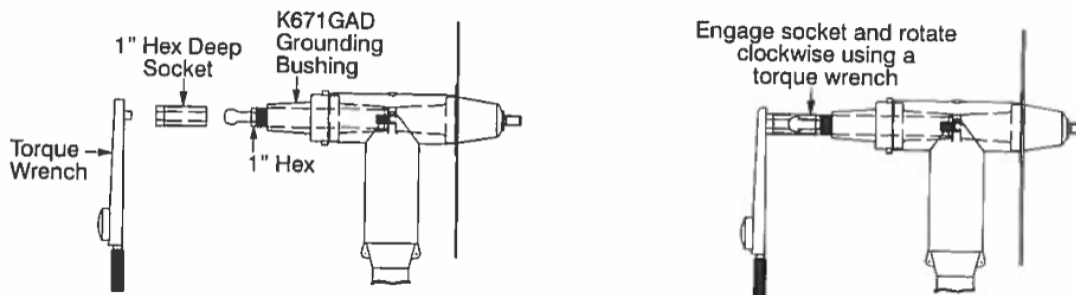
XII. Install the Ball Ground Connector to the T Elbow

- The Ball Ground Connector (K671BGAD) is installed on the rear position of the T-elbow instead of the insulating plug and cap which is included in the T-elbow kit.
- Clean and lubricate the Ball Ground Connector interface and the 600 amp T-elbow interface with the lubricant supplied.
- Insert the Ball Ground Connector into the T elbow and rotate clockwise to engage the stud.



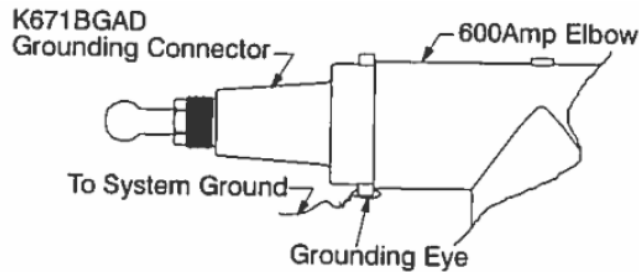
XIII. Tighten the Ball Ground Connector to the T Elbow

- Engage a 1" deep socket (stk.# 86-14-400) onto the ball ground connector by placing it over the ball ground. Attach a torque wrench (stk.# 85-40-005) to the socket and continue rotating.
- When the Ball Ground Connector stops rotating, tighten it to 55/60 foot-pounds torque.
- Remove the wrench and socket from the Ball Ground Connector.



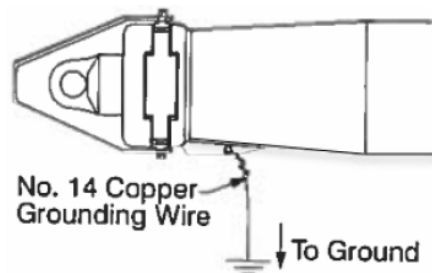
XIV. Install the Drain Wires and Ground Drain wires and Neutral Wires

- a. Using a separate #14 copper wire, insert one end through the grounding eye on the Ball Ground Connector. Twist lightly taking care not to damage the eye. The other end of the wire must be connected to system ground.
- b. Repeat step "a" to connect a drain wire from a tab on the T-elbow to system ground
- c. Twist the neutral wires of the cable together and connect them to system ground.

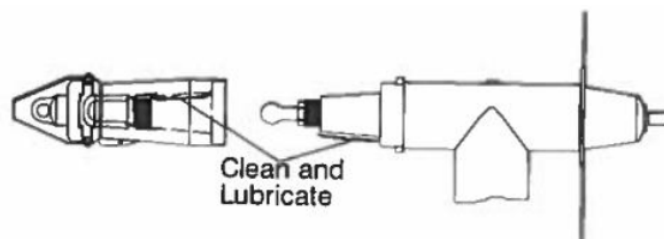


XV. Installing the Insulating Cap

- a. Insert a length of #14 copper wire through the grounding eye of the Insulating Cap (K676BGADDR).
- b. Make a small loop and twist lightly, taking care not to damage the grounding eye.
- c. Connect the free end of the grounding wire to the system ground. The length of the grounding wire should be sufficient for the distance from the grounding point to the grounding eye of the Insulated Cap plus enough wire to wrap round the Insulated Cap 10 times (90") during assembly.

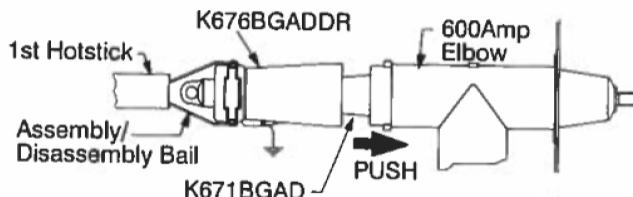


- d. Clean and lubricate the Insulated Cap and the Ball Ground Connector with lubricant supplied.

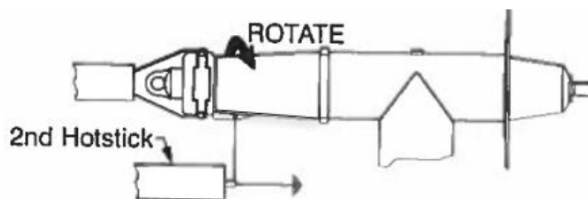


600 Amp Dead-break Elbow with Ball Ground

- e. Two hot sticks are required for installation of the Insulating Cap. During installation of the Insulating Cap, the grounding wire will be wrapped around the body of the Insulating Cap.
- f. Attach the first hot stick tool to the Insulating Cap assembly / disassembly bail and push the cap onto the bushing interface as far as it will go.



- g. With the second hot stick, engage the grounding wire and establish slight tension (see the figure below).

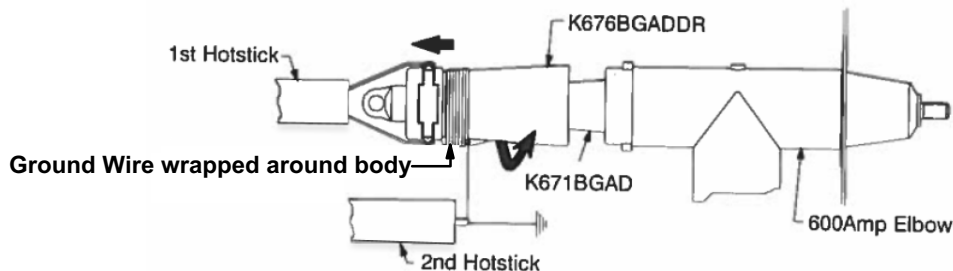


- h. With the first hot stick, while pushing against the bushing surface, rotate the cap clockwise until the threads between the stud mounted on the bushing and the Insulating Cap engage; continue turning without pushing until resistance is felt. **DO NOT OVERTIGHTEN.**
- i. Remove the second hot stick.

XVI. Removing the Insulating Cap

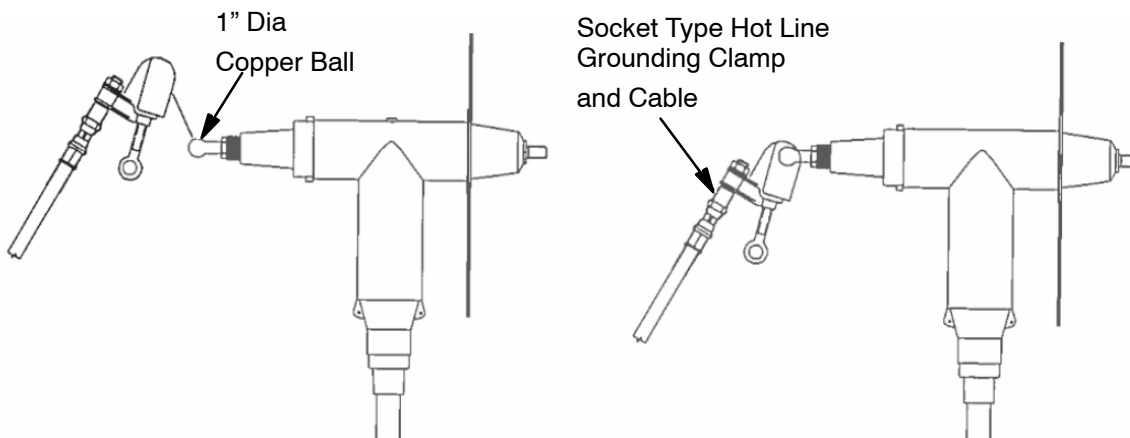
WARNING: DO NOT DISCONNECT THE INSULATING CAP WHILE THE ELBOW IS ENERGIZED!

- a. After the circuit is known to be de-energized, securely fasten a hot stick to the assembly / disassembly bail.
- b. Without exerting any pulling force, rotate the Insulating Cap counter-clockwise eight or nine turns.
- c. With a second hot stick tool, control the unwound ground wire so that the wire will not interfere with adjacent devices or entangle itself with the first hot stick tool.
- d. Exert a pulling force to remove the Insulating Cap from the Ball Ground Connector interface.



XVII. Installing the Ball Ground Clamp

- The Ball Ground Connector (K671BGAD) has a 1" copper ball extending out from the interface end so that a socket type hot line grounding clamp can be attached.
- FOLLOW AMEREN OPERATING PROCEDURES FOR GROUNDING THIS CONNECTION.**



XVIII. Removing the Ball Ground Clamp and Installing the Insulating Cap

- When repairs have been completed, remove the hot line ball ground clamp.
- Install the Insulating Cap (K676BGADDR) as shown in Step XII.

CABLE TERMINATION**42 34 65 01**

15kV 350 kcmil EPR Cable

Sheet 8 of 8

600 Amp Dead-break Elbow with Ball Ground

		Std. / Stk. No.	Description	42 34 65 01
	A	17 05 535	Elbow – Dead-break, 15 kV, 600 A, T Body, 350 kcmil	1
	B	17 05 536	Connector – Ball Ground Stud, 15 kV, 600 A	1
	C	17 55 849	Cap – Insulating, 15 kV, 600 A, Ball Ground Stud Cover	1
	D	18 52 018	Wire – #4 Copper, Binder, Bare	15
2	E	17 54 435	Connector – Grounding, #8 to 2/0	1
2	F	21 61 007	Nut – Hex, ½", 13 TPI, Everdur	1

NOTES:

- 1) Each 15 kV vault mounted switchgear will require from 3–9 15kV 600 amp elbow terminations.
- 2) Use the Grounding Connector (Item E) and the Hex Nut (Item F) to connect the drain wires of the T-body and the 600A Insulating Cap to the ground bus bar of the vault mounted switchgear.

Cable With Concentric Neutral Wires or Flat Strap Neutrals

1. Train cable into position and cut to required length. Strip the cable to the dimensions shown in Figure 1. Check the lug being used to determine insert depth "X". Provide an additional 1/4" of exposed conductor on 1/0 – 350 kcmil aluminum cables and an additional 3/4" of exposed conductor on 750 kcmil cables. This will accommodate growth during crimping of aluminum lugs. If a shearhead bolt lug is used, additional exposed conductor is not required.
2. Allow a sufficient length of concentric wires or flat straps to make the ground connections.

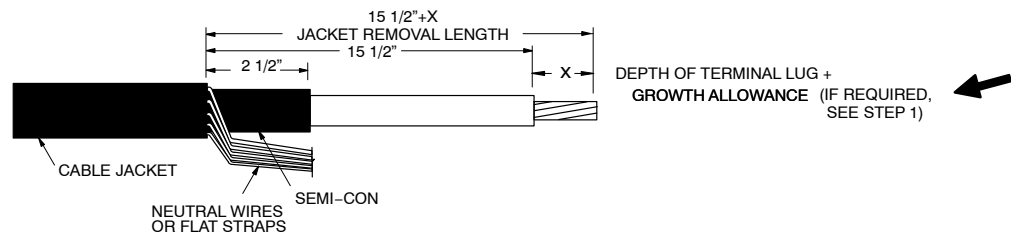


FIGURE 1

3. Select one of the two mastic strips from the kit and remove white release liners. Using light tension apply a single wrap of mastic around the cable jacket 1/4" from the cut edge. Cut off excess mastic See Figure 2.

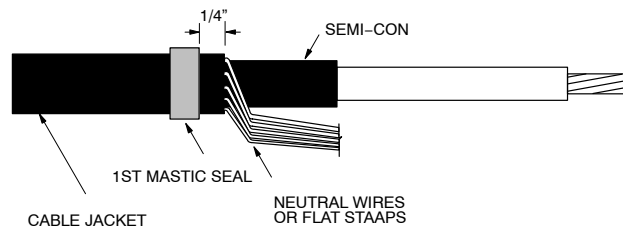


FIGURE 2

4. Bend the neutral wires (flat straps) back over applied mastic and secure to cable jacket 4-1/2" from the edge of the semi-con. Use vinyl tape to secure the wires (straps). This tape will be used to position the terminator, so the location is critical. See Figure 3.

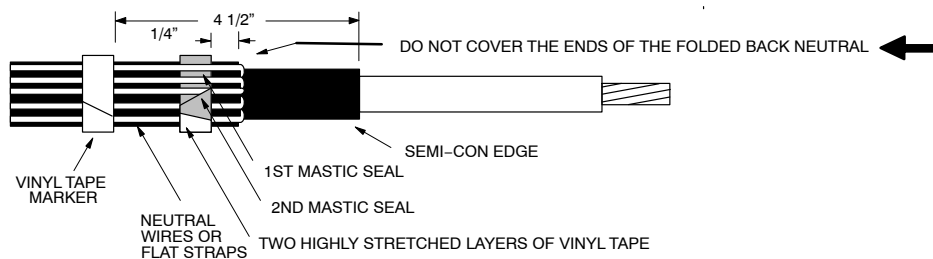


FIGURE 3

5. Select the second mastic strip from the kit and remove the white release liners. Apply a second single wrap of mastic over the neutral wires (straps) and the previously applied mastic strip. Cut off excess. See Figure 3.

Compress the neutral wires (straps) into the mastic by over-wrapping the strips with two highly stretched layers of vinyl tape. Be sure to cover all exposed mastic. See Figure 3.

6. Remove the red support core from the terminator. Verify that the terminator body will fit over the lug being used. If the lug will not fit through the core, clean the insulation and slide the terminator onto the cable before installing the lug. **DO NOT** remove the core at this time.
7. Use a stainless steel wire brush to clean the exposed aluminum conductor. Position and install the 4/0 aluminum lug using a U249 die. For the 350 kcmil copper lug, use a U31RT die. For the 750 kcmil aluminum lug, use a U608 die. For the 750 kcmil copper lug, use a L39RT die. For the 1/0 aluminum pin terminal, use a U25ART die. Make as many crimps as possible without overlap. After the lug is installed remove excess oxide inhibitor and all sharp crimp flashing.

The shearhead bolt lug (Stk #17-55-804) may be used instead of the 350 kcmil through 750 kcmil copper and aluminum compression lugs.

Shearhead Bolt Lug Installation Instructions.

- H. Battery powered impact wrench with a $\frac{7}{8}$ " hexagonal socket should be used to install shearhead bolt lugs.
- I. Remove the insert from the lug body if the conductor to be installed is greater than 600 kcmil compact stranded.
- J. Back out all bolts to give clearance for the conductor – DO NOT completely remove the bolts from the connector body.
- K. Insert the cleaned conductor into the lug. There should be no gap between the insulation and lug body.
- L. Hand tighten the bolts to firmly grip the conductor. Use the tightening sequence shown in Figure E to tighten the bolts one-and-a-half turns. Bolts should remain un-sheared.

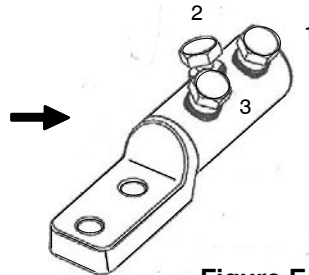


Figure E

- M. Repeat the sequence in step “E” tightening each bolt until the head shears off. DO NOT bend the conductor while shearing the bolts.
 - N. Smooth any sharp edges of protruding bolts with the abrasive provided. Clean the connector to remove particles and excess inhibitor.
8. Position the terminator body on the cable. The base of the terminator body (not the core) must be butted up to the edge of the vinyl marker tape. Remove the core while unwinding in a counter-clockwise direction. Once the terminator body has made contact over the mastic seal area, there is no need to continue supporting the assembly. **DO NOT** push or pull the terminator while unwinding the core. See Figure 5.

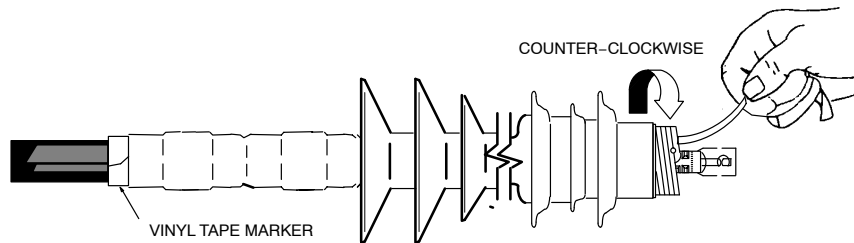


FIGURE 5

9. For 1/0–750 kcmil outdoor installations, attach a bronze four bolt lug to the compression lug or shearhead bolt lug using a ground stud in the upper hole and a 1/2" x 2" bolt in the lower hole. See Figure 6.

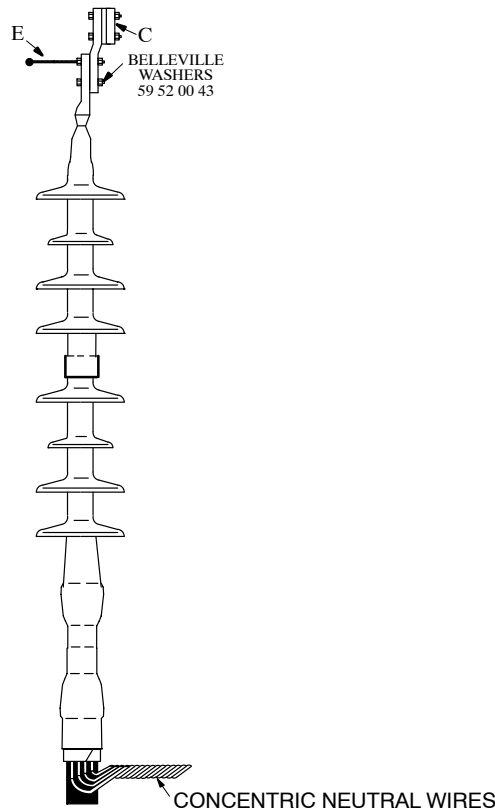


FIGURE 6

10. Collect all concentric neutral wires (straps) together and connect to system ground.
11. If a shearhead bolt lug is used, verify that the terminator body covers all bolt positions to prevent moisture ingress. If a bolt position is not covered with the terminator body, cover the bolt position with mastic and silicone tape.

Cables With Metallic Shields (LC or Tape) Tape Shield Shown

1. Train cable into position and cut to required length. Strip the cable to the dimensions shown in Figure 1A. Check the lug being used to determine insert depth "X". Note A: Special shears (Stk. #85-32-240) should be used to cut the LC shield. Note B: To prevent a taped shield from unrolling, hold down the edges with a single wrap of semi-conducting tape (Stk. #25-53-076). Note C: Provide an additional 1/4" of exposed conductor on 1/0-350 kcmil cables and an additional 3/4" of exposed conductor on 750 kcmil cables. This will accommodate growth during crimping of aluminum lugs. If a shearhead bolt lug is used, additional exposed conductor is not required.

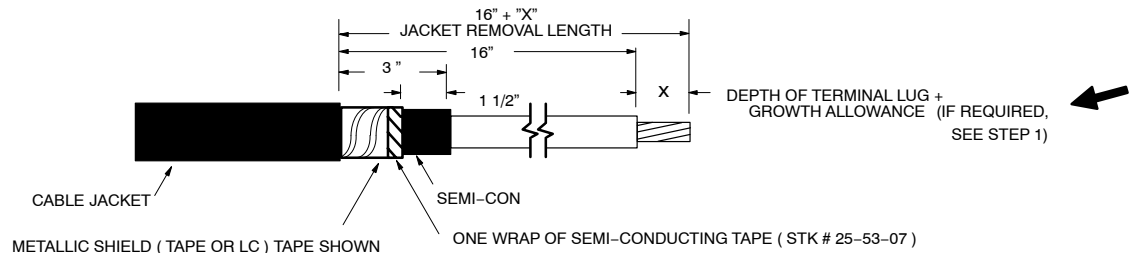


FIGURE 1A

2. Select one of the two mastic strips from the kit and remove white release liners. Using light tension apply a single wrap of mastic around the cable jacket 1/4" from the cut edge. Cut off excess mastic. See Figure 2A.

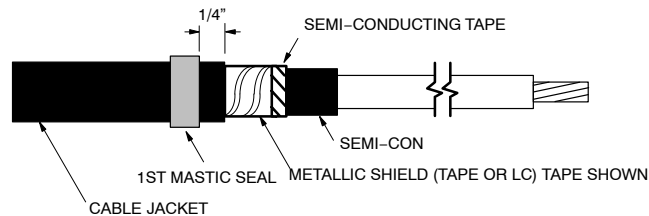


FIGURE 2A

3. Position a preformed ground braid (Stk. #17-54-306) with the "U" section over the metallic shield directly adjacent to the cable jacket cut edge. Position one tail of the ground braid over the cable jacket with the heat-shrinkable covering in contact with the mastic strip. Secure the tail to the cable jacket 4-1/2" from the edge of the semi-con using vinyl tape. Note: Position the vinyl tape with care since it also serves as a marker for positioning the terminator. See Figure 3A.

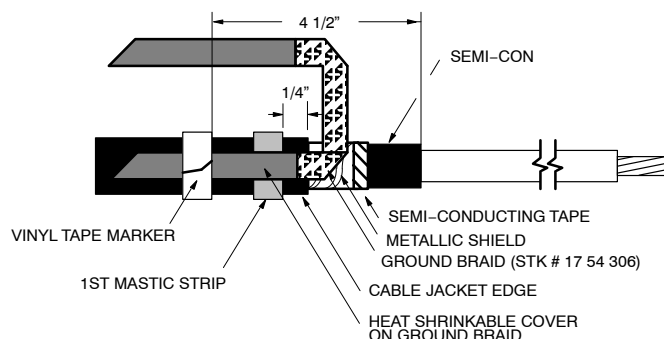


FIGURE 3A

4. Wrap the ground braid around the metallic shield and secure in place with the constant force spring. Tighten the spring after wrapping the final turn. Position the ground braid tails over the cable jacket. Note: The tails of the ground braid do not have to be on top of each other. See Figure 4A.
5. Select the second mastic strip from the kit and remove the white release liners. Apply a single wrap of the second mastic strip over the previously applied mastic. If ground braids overlap on cable jacket be sure to apply mastic between the braids. Secure ground braids to cable jacket 4–1/2" from cable semi-con edge using vinyl tape. Apply tape directly over previously applied marker tape. See Figure 4A.

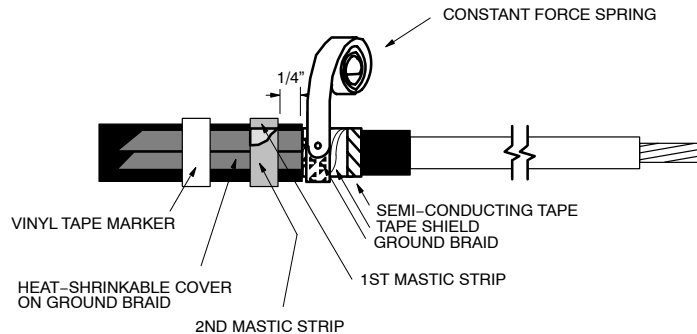


FIGURE 4A

6. Wrap two half-lapped layers of vinyl tape around the mastic seal. Apply two half-lapped layers of semi-conducting tape over the constant force spring and exposed metallic shield. Do not cover the exposed semi-con insulation shield. See Figure 5A.

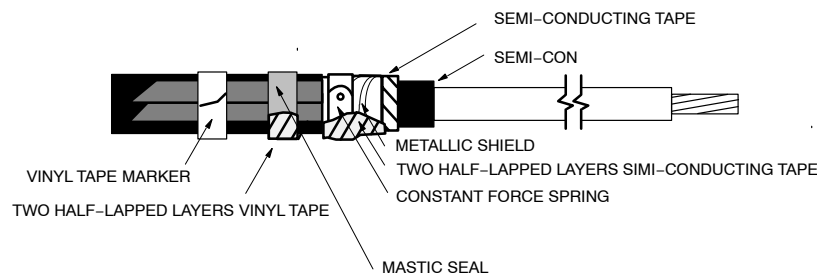


FIGURE 5A

7. Remove the red support core from the terminator. Verify that the terminator body will fit over the lug being used. If the lug will not fit through the core, clean the insulation and slide the terminator onto the cable before installing the lug. Do not remove the core at this time.
8. Use a stainless steel wire brush to clean the exposed aluminum conductor. Position and install the 4/0 aluminum lug using a U249 die. For the 350 kcmil copper lug, use a U31RT die. For the 750 kcmil aluminum lug, use a U608 die. For the 750 kcmil copper lug, use a L39RT die. Make as many crimps as possible without overlap. After the lug is installed remove excess oxide inhibitor and all sharp crimp flashing.

The shearhead bolt lug (Stk. #17-55-804) may be used instead of the 350 kcmil through 750 kcmil copper and aluminum compression lugs. See shearhead bolt lug installation on Sheet 2.

9. Position the terminator body on the cable. The base of the terminator body (not the core) must be butted up to the edge of the vinyl marker tape. Remove the core while unwinding in a counter-clockwise direction. Once the terminator body has made contact over the mastic seal area, there is no need to continue supporting the assembly. **DO NOT** push or pull the terminator while unwinding the core. See Figure 6A.

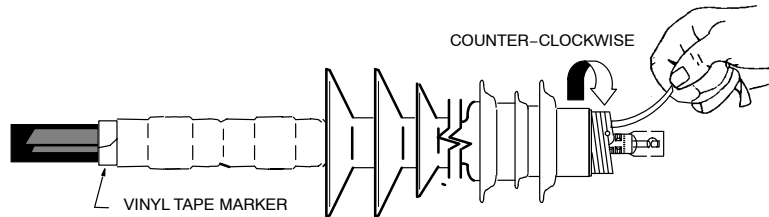


FIGURE 6A

10. For outdoor installations, attach a bronze four bolt lug to the compression lug or shearhead bolt lug using a ground stud in the upper hole and a 1/2" x 2" bolt in the lower hole. See Figure 7A.

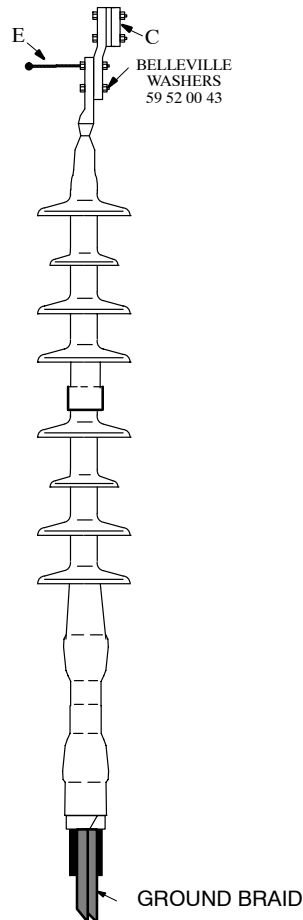


FIGURE 7A

11. Connect ground braids to system ground using a two-bolt connector (Stk. #17-54-140).

CABLE TERMINATION

35 kV 1/0 – 750 kcmil

42 44 12 **

AL/CU Jacketed or Non-Jacketed (Indoor-Outdoor)

Sheet 7 of 7

12. If a shear head bolt lug is used, verify that the terminator body covers all bolt positions to prevent moisture ingress. If a bolt position is not covered with the terminator body, cover the bolt position with mastic and silicone tape.

		Std./Stk. No.	Description	42 44 12 **	01	02	03	04	05
A A A @	A	17 07 151	Termination – Cable, 34kV, 1/0 – 750 kcmil		1	1	1	1	1
	B	17 55 456	Lug – Compression, 1/0, 2-Hole, al						1
		17 55 256	Lug – Compression, 4/0, 2-Hole, Al	1					
		17 55 296	Lug – Compression, 350, 2-Hole, Cu		1				
		17 05 214	Lug – Compression, 750, 2-Hole, Cu				1		
		17 55 260	Lug – Compression, 750, 2-Hole, Al					1	
		17 55 804	Lug – Shear Head Bolt, 350–750 Cu/Al, 2 Hole			1	1	1	
	C	17 54 177	Connector – Cable to Flat, Bronze	1	1	1	1	1	1
	D	21 56 078	Bolt – Machine, 1/2" x 2" SS	1	1	1	1	1	1
	E	23 64 051	Stud – Grounding, 7" Long, Ball End	1	1	1	1	1	1
	F	12 56 052	Washer – Belleville – Spring, 1/2" SS	2	2	2	2	2	2
		12 56 053	Washer – Flat, 1/2", SS	4	4	4	4	4	4
	G	17 54 306	Connector – Cable Ground Braid w/ Spring			1	1	1	
	H	17 54 140	Connector – Wire, #8 –4/0, 2-Bolt	1	1	1	1	1	1
			Operation Code 720	1	1	1	1	1	1

Note:

A. For indoor installations omit items "C" and "E" and increase the quantity of item "D" by one.

42 44 12 01**4/0 AL Lug****42 44 12 02****350 CU Compression Lug/Shearhead Bolt Lug****42 44 12 03****750 CU Compression Lug/Shearhead Bolt Lug****42 44 12 04****750 AL Compression Lug/Shearhead Bolt Lug****42 44 12 05****1/0 AL Lug**

CABLE TERMINATION
35 kV 1/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow

42 44 13 **

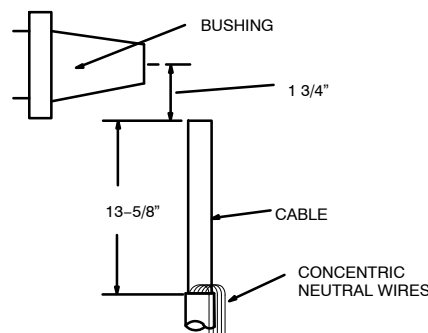
Sheet 1 of 4

I TRAIN THE CABLE

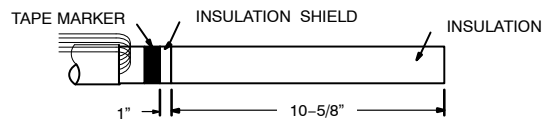
1. Center the cable between the apparatus bushing and the parking stand pocket. The cable should be located 7 inches from the apparatus front plate.
2. Provide adequate slack for cable movement between the apparatus bushing and the standoff bushing.
3. Cut the cable 1–3/4 inches from the centerline of the bushing.
4. Clean 24 inches of the outer cable jacket.

II CUT BACK THE CABLE

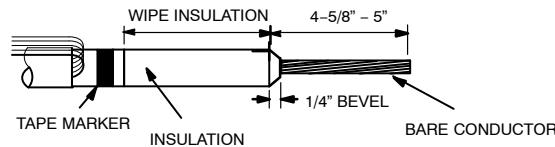
1. Remove 13–5/8 inches of cable jacket.
2. Allow enough extra concentric neutral wires to connect to ground and allow movement to the standoff bushing.



3. Remove 10–5/8 inches of insulation shield.
4. Place a tape marker 1 inch from the end of the insulation shield.

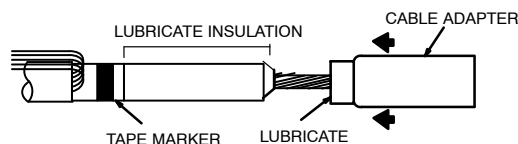


5. Remove 4 5/8 – 5 inches of insulation.
6. Bevel the insulation edge 1/4 inch at a 45 degree angle.
7. Thoroughly clean the insulation.



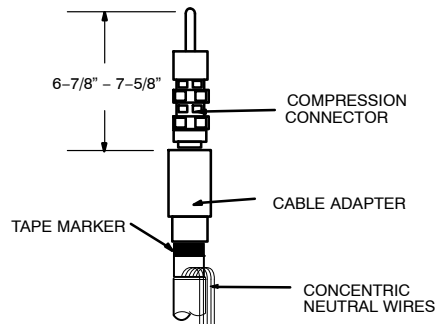
III INSTALL THE CABLE ADAPTER

1. Lubricate the exposed insulation and the inside of the cable adapter.
2. Slide the small end of the cable adapter over the cable using a twisting motion until the small end is flush with the tape marker.



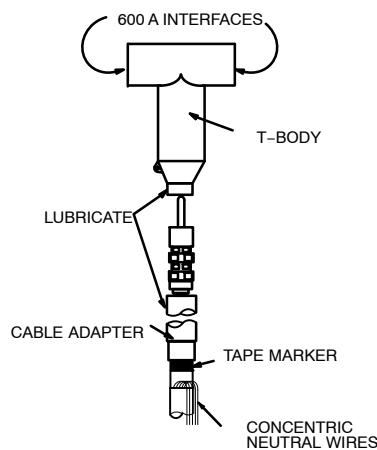
IV INSTALL THE COMPRESSION CONNECTOR

1. Wire brush the aluminum conductor.
2. Insert the conductor into the compression connector and rotate until the flats of the compression connector and the apparatus bushing are aligned.
3. Make 3 crimps using the U28ART die for 1/0 AWG AL cable, or U31 ART die for 350 kcmil cable. Make the first crimp at the first line below the shoulder of the connector. Rotate each crimp 90 degrees and allow 1/8 inch between crimps.
4. Wipe off excess inhibitor.
5. Check connector length as shown.



V INSTALL T-BODY

1. Clean and lubricate the outside of the cable adapter. Remove the protective caps from the T-body.
2. Clean and lubricate the inside of the T-body.
3. Slide the T-body onto the cable until the compression connector eye is centered in the 600 Amp interfaces.
4. Remove the tape marker.



VI INSTALL THE 600 AMP ELBOW ONTO THE APPARATUS BUSHING

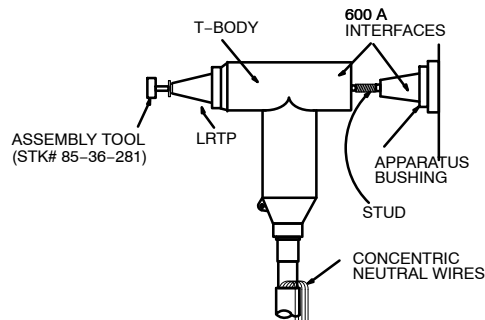
1. Screw the threaded stud into the threaded hole in the LRTP if a stud is not already installed on the apparatus bushing.
2. Clean and lubricate the mating interfaces of the apparatus bushing, the LRTP, and the T-body.
3. Push the T-body onto the apparatus bushing.

CABLE TERMINATION
35 kV 1/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow

42 44 13 **

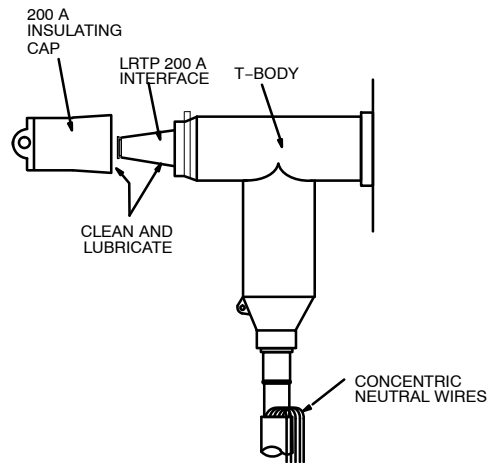
Sheet 3 of 4

4. Insert the LRTP into the back of the T-body and engage the stud by turning the LRTP by hand.
5. Insert the assembly tool into the LRTP throat and engage the internal nut.
6. Turn and tighten the LRTP using the assembly tool to a torque of 50–60 ft-lbs.
7. Remove the assembly tool.



VII CAP THE 200 AMP INTERFACE

1. Clean and lubricate the 200 Amp interface on the LRTP and the inside of an insulating cap.
2. Cover the interface with the cap.



Note:

A 35 kV elbow arrester may be inserted onto the LRTP in lieu of the 200 A insulating cap.

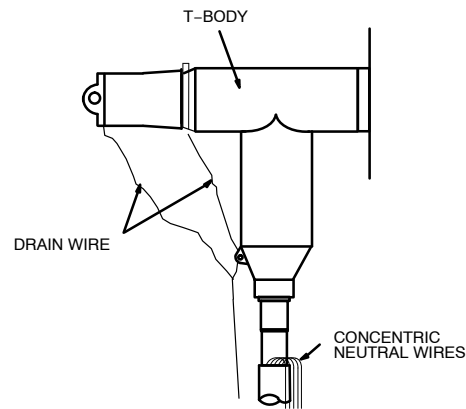
CABLE TERMINATION
35 kV 1/0 AWG – 750 kcmil XLP/EPR Cable
600 Amp Deadbreak Elbow

42 44 13 **

Sheet 4 of 4

VIII GROUND THE ELBOW

1. Connect the tie off tabs of the LRTP and the T-body with a strand of drain wire (concentric neutral wire) and connect the drain wire to ground.
2. Connect the insulating cap drain wire to ground.
3. Connect the cable concentric neutral wires to ground.
4. For LC shield cables use Dist. Std. 59 40 93 44.



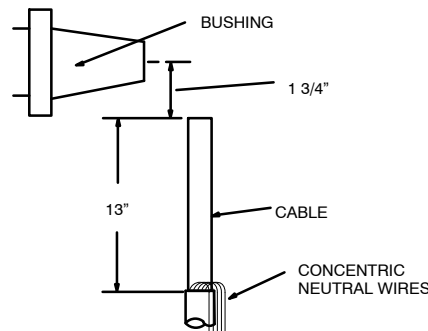
		Std. / Stk. No.	Description	42 44 13 **			01	02	03
	A	17 05 321	Elbow – Deadbreak, 35kV, 1/0 AWG, Stranded				1		
		17 05 472	Elbow – Deadbreak, 35kV, 350 kcmil, Stranded					1	
		17 05 542	Elbow – Deadbreak, 35kV, 750 kcmil, Stranded						1
	B	10 01 163	Arrester – Elbow, 35kV				1	1	1
@	C	17 54 306	Connector – Cable Ground Braid					1	

I TRAIN THE CABLE

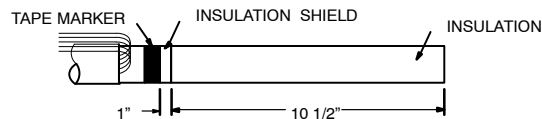
1. Center the cable between the apparatus bushing and the parking stand pocket. The cable should be located 7 inches from the apparatus front plate.
2. Provide adequate slack for cable movement between the apparatus bushing and the standoff bushing.
3. Cut the cable 1–3/4 inches from the centerline of the bushing.
4. Clean 24 inches of the outer cable jacket.

II CUT BACK THE CABLE

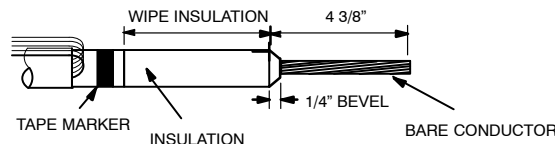
1. Remove 13 inches of cable jacket.
2. Allow enough extra concentric neutral wires to connect to ground and allow movement to the standoff bushing.



3. Remove 10 1/2 inches of insulation shield.
4. Place a tape marker 1 inch from the end of the insulation shield.

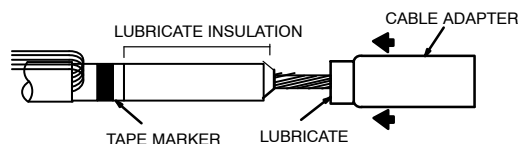


5. Remove 4 3/8 inches of insulation.
6. Bevel the insulation edge 1/4 inch at a 45 degree angle.
7. Thoroughly clean the insulation.



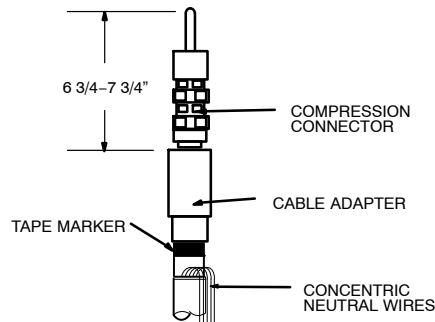
III INSTALL THE CABLE ADAPTER

1. Lubricate the exposed insulation and the inside of the cable adapter.
2. Slide the small end of the cable adapter over the cable using a twisting motion until the small end is flush with the tape marker.



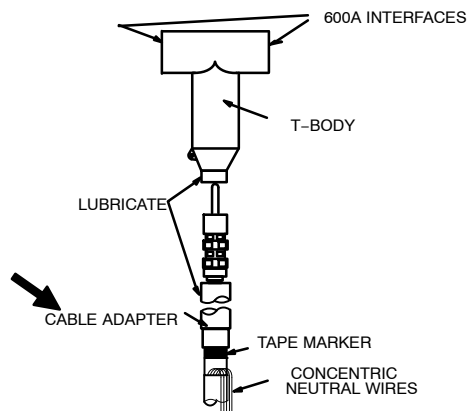
IV INSTALL THE COMPRESSION CONNECTOR

1. Insert the conductor into the compression connector and rotate until the flats of the compression connector and the apparatus bushing are aligned.
2. Make 5 crimps using the L39ART die (for 750 kcmil cable). Make the first crimp at the first line below the shoulder of the connector. Rotate each crimp 90 degrees and allow 1/8 inch between crimps.
3. Wipe off excess inhibitor.
4. Check connector length as shown.



V INSTALL T-BODY

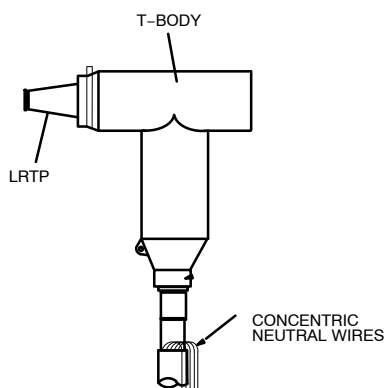
1. Clean and lubricate the outside of the cable adapter.
2. Clean and lubricate the inside of the T-body.
3. Slide the T-body onto the cable until the compression connector eye is centered in the 600 Amp interfaces.
4. Remove the tape marker.



VI INSTALL THE LRTP INTO THE T-BODY

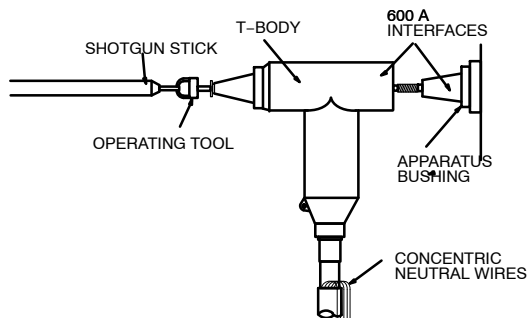
1. Clean and lubricate the mating 600 Amp interface of the LRTP (Load Reducing Tap Plug) and the T-body.
2. Remove the shipping cap from the 200 Amp interface of the LRTP and the thread protector on the threaded end.
3. Insert the T-wrench (Stk. #85-41-370) into the throat of the LRTP and thru the rotating nut and engage the alignment segment.
4. Insert the threaded ferrule end of the LRTP into the side of the T-body opposite the apparatus bushing.
5. Thread the alignment segment into the threads of the compression connector by turning the T-wrench until a positive stop is felt.

6. Continue applying clockwise force to the T-wrench until the pin shears and the alignment segment rotates freely.
7. Remove the alignment segment by applying pressure to the T-wrench until the segment separates. Discard the segment.



VII INSTALL THE 600 AMP ELBOW ONTO THE APPARATUS BUSHING

1. Screw the short end of the copper stud into the threaded hole in the apparatus bushing.
2. Clean and lubricate the mating interfaces of the apparatus bushing and the T-body.
3. Grasp the eye of the operating tool (Stk. #83-28-049) with a shotgun stick and pull the eye fully into it.
4. Using the shotgun stick, insert the operating tool into the L RTP throat and engage the rotating nut.
5. While pushing the T-body onto the apparatus bushing, turn the operating tool clockwise to make a threaded connection. Turn until the torque head ratchets. An audible click will be heard.
6. Remove the operating tool.



VIII CAP THE 200 AMP INTERFACE

1. Clean and lubricate the 200 Amp interface on the L RTP and the inside of an insulating cap.
2. Cover the interface with the cap.

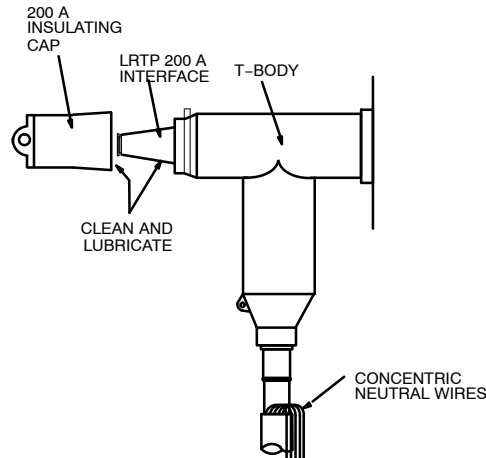
CABLE TERMINATION

35kV 750 kcmil XLP/EPR Cable

600 Amp Deadbreak Elbow

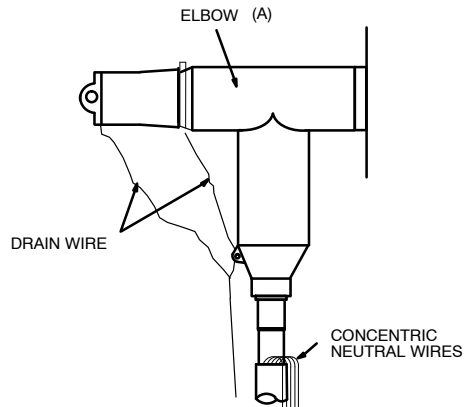
42 44 14 01

Sheet 4 of 4



XI GROUND THE ELBOW

1. Connect the tie off tabs of the LRTP and the T-body with a strand of drain wire (concentric neutral wire) and connect the drain wire to ground.
2. Connect the insulating cap drain wire to ground.
3. Connect the cable concentric neutral wires to ground.
4. See Dist. Std. 59 40 60 01 for additional 600 Amp accessories.



		Std. / Stk. No.	Description	42 44 14 01	
@	A	17 05 330	Elbow – Deadbreak, 750 kcmil, Stranded	1	
	B	10 01 177	Arrester – Elbow, 35kV	1	

CABLE TERMINATION
69kV 350kcmil – 1000kcmil CN
COLD – SHRINKABLE

42 54 11 **

Sheet 1 of 8

Sixty-nine kV terminators have numerous installation steps and it is critical that each step be completed in the correct order and as detailed in the following instructions. To help ensure that the installation instructions are followed and completed in order, a sign-off/check-off line has been added at the end of each step. After the work outlined in a specific step has been completed, the sign-off/check-off line is to be initialed by the individual completing the step.

By using the sign-off/check-off lines there will be no errors associated with skipped or overlooked instructions. Additionally, there will never be a question about where one is in the installation process.

1. Prepare cable using dimensions shown in Figure 1. **Be sure to allow for depth of terminal lug plus 0.5" plus crimp growth allowance. If a shear head bolt lug is used, additional exposed conductor is not required.**

Conductor Size	350	400–650	750–1000
Crimp Growth Allowance	0.25"	0.5"	0.75

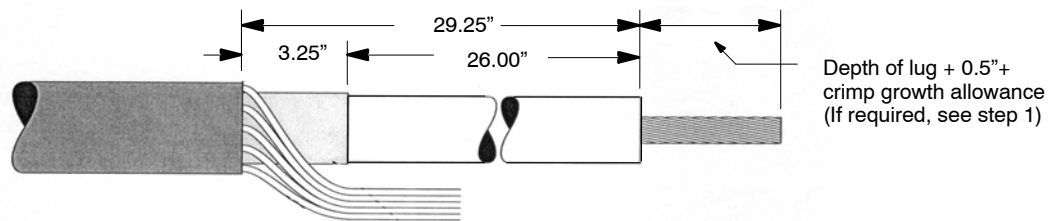


Figure 1

Initial when Step 1 is complete. _____

2. Select the roll of 1" wide Scotch Sealing Mastic 2229 from the kit. Cut a length of the mastic long enough to wrap around the cable jacket. Remove the release liner from the mastic and, using a light tension, apply a single wrap of mastic around the cable jacket 1" from the edge. (Figure 2)

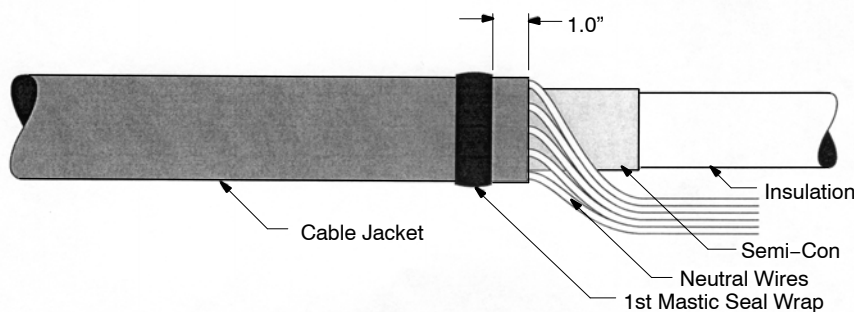


Figure 2

Initial when Step 2 is complete. _____

CABLE TERMINATION
69kV 350kcmil – 1000kcmil CN
COLD – SHRINKABLE

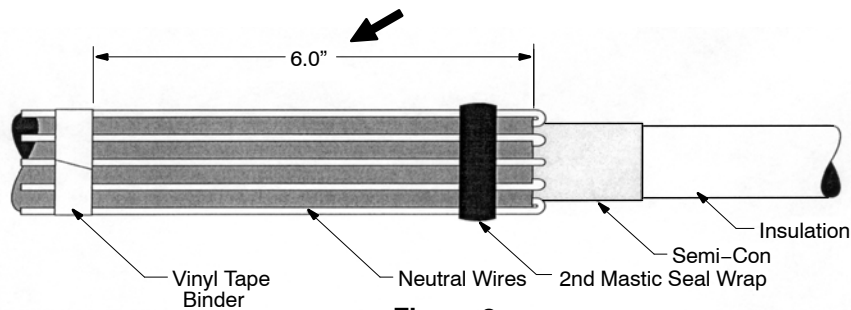
42 54 11 **

Sheet 2 of 8

3. Bend neutral wires back over applied sealing mastic and secure to cable jacket with vinyl tape 6" below jacket cutback. (Figure 3)

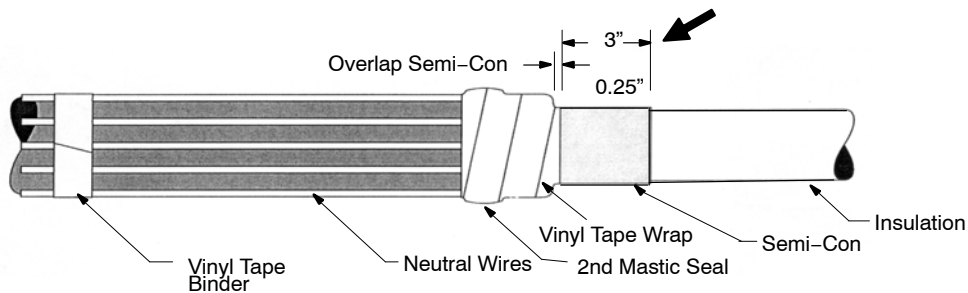
Initial when Step 3 is complete. _____

4. Select the roll of 1" wide Scotch Sealing Mastic 2229 from the kit and cut a length of the mastic long enough to wrap around the cable jacket and neutral wires. Remove the release liner and, using a light tension, apply a single wrap of mastic around the cable jacket over the neutral wires and previously applied mastic. (Figure 3)



Initial when Step 4 is complete. _____

5. Compress neutral wires into mastic by over-wrapping seal strips with two half-lapped layers of highly-tensioned Scotch Vinyl Electrical Tape Super 88. Cover all exposed mastic and neutral wires, overlapping 0.25" onto the exposed cable semi-con. (Figure 4) Take care to leave 3" of exposed semi-con.



Initial when Step 5 is complete. _____

6. Wipe the cable insulation clean with an approved solvent. **Do not allow the solvent to touch the semi-con insulation shield.**

NOTE: If an abrasive is required.

Use only aluminum oxide abrasive to finish and polish insulation surface.

Use abrasive only on cable insulation. **Do not use on semi-con.**

When using abrasive, do not reduce the cable insulation diameter below that allowed by kit.

Initial when Step 6 is complete. _____

- 7. Slide the ground seal assembly onto the cable jacket, loose core end first. (Figure 5)

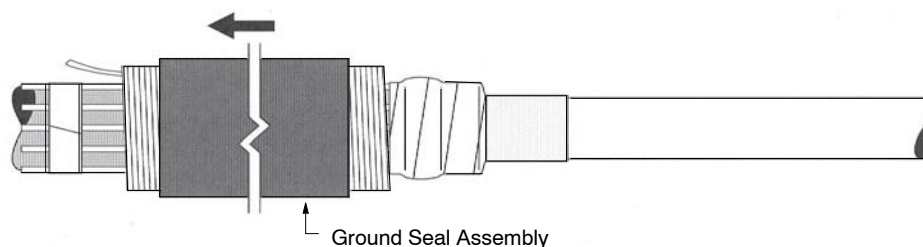


Figure 5

Initial when Step 7 is complete. _____

- 8. Place a marker tape on the cable semi-con located 1.75" from the end of the semi-con. (Figure 6)

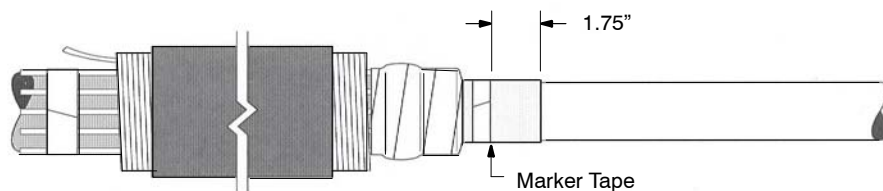


Figure 6

Initial when Step 8 is complete. _____

9. Apply 1 tube 3M Red Dielectric Compound P55/R starting at marker tape and continuing onto the cable insulation for approximately 8" (Figure 7)

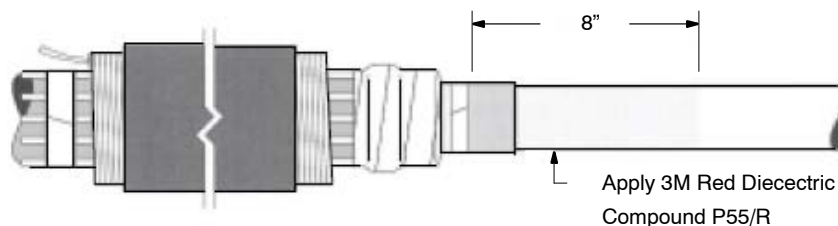


Figure 7

Initial when Step 9 is complete. _____

10. Select the Stress Control Assembly (medium length tubular assembly on white core) from the kit. Slide the Stress Control Assembly over the cable with the loose core end toward the cable end. Align the Stress Control Assembly Tube (not the core) with the marker tape, and remove the core by pulling the loose end while unwinding counter-clockwise. (Figure 8)

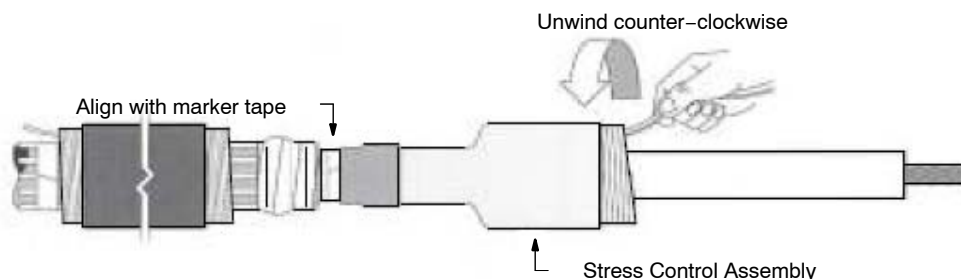


Figure 8

Initial when Step 10 is complete. _____

11. Apply 2 tubes 3M Red Dielectric Compound P55/R to the exposed insulation and stress control adapter. Fill the top edge of the stress control tube and the semi-con step with the 3M Red Dielectric Compound P55/R. (Figure 9)

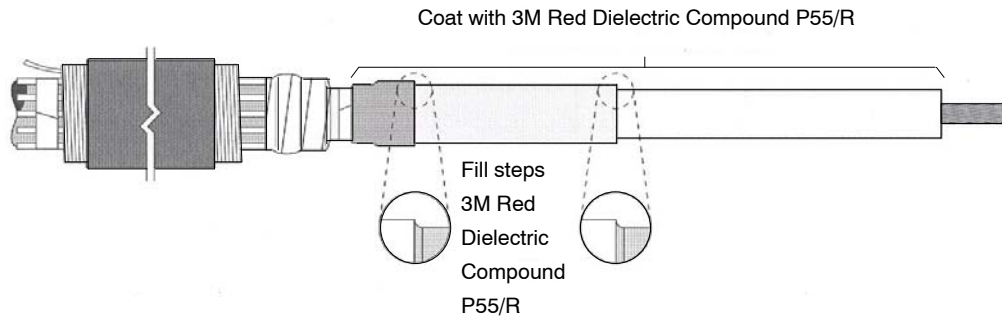


Figure 9

Initial when Step 11 is complete. _____

12. Slide the Silicone Rubber Skirted Insulator Assembly onto the cable. Align the assembly tube (not the core) with the sealing mastic/wire cover tape located 3.0" from the end of the cable semi-con, and remove the core by pulling the loose end while unwinding counter-clockwise. (Figure 10)

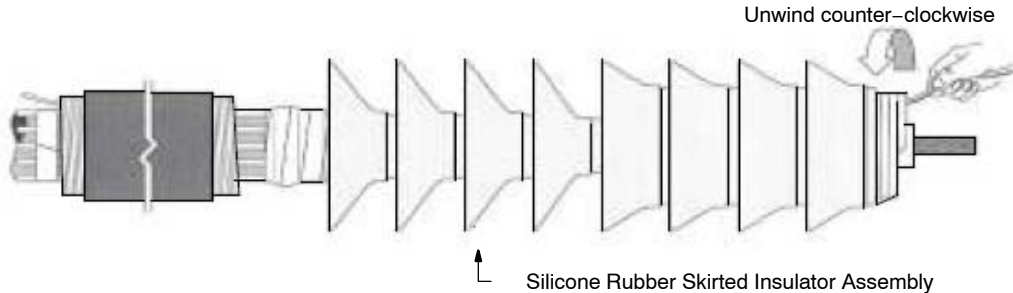


Figure 10

Initial when Step 12 is complete. _____

13. Use a stainless steel wire brush to clean the aluminum conductor. Position and install the 500 kcmil lug using a U34ART die. For the 750 kcmil lug use a U608 die. For the 1000 kcmil copper lug use a P44RT die. Make as many crimps as possible without overlap. Remove excess oxide inhibitor and sharp crimp flashing.

A shear head bolt lug (STK #17-55-804) may be used instead of the aluminum compression lugs.

Shearhead Bolt Lug Installation Instructions.

- O. Battery powered impact wrench with a $\frac{7}{8}$ " hexagonal socket should be used to install shearhead bolt lugs.
- P. Remove the insert from the lug body if the conductor to be installed is greater than 600 kcmil compact stranded.
- Q. Back out all bolts to give clearance for the conductor – DO NOT completely remove the bolts from the connector body.
- R. Insert the cleaned conductor into the lug. There should be no gap between the insulation and lug body.
- S. Hand tighten the bolts to firmly grip the conductor. Use the tightening sequence shown in Figure E to tighten the bolts one-and-a-half turns. Bolts should remain un-sheared.

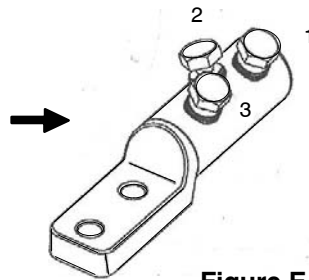


Figure E

- T. Repeat the sequence in step "E" tightening each bolt until the head shears off. DO NOT bend the conductor while shearing the bolts.
- U. Smooth any sharp edges of protruding bolts with the abrasive provided. Clean the connector to remove particles and excess inhibitor.

Initial when Step 13 is complete. _____

- 14. Wrap Scotch Rubber Mastic Tape 2228 half-lapped around the exposed conductor between the cable insulation and lug. Build the mastic up to the insulation O.D. Cover 2 inches of the lug barrel. (Figure 11)

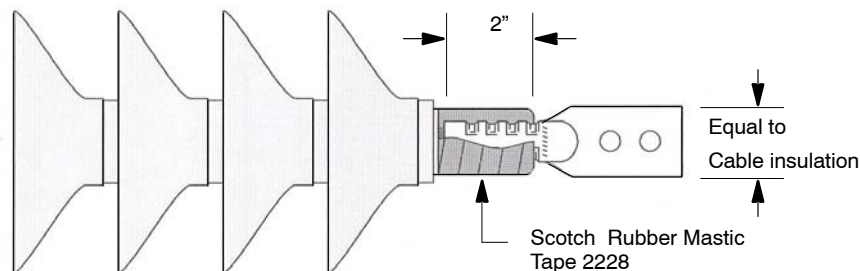


Figure 11

Initial when Step 14 is complete. _____

15. Slide the parked ground seal assembly onto the termination. Start to shrink underneath the first skirt. Remove the core by pulling the loose end while unwinding counter-clockwise. (Figure 12)

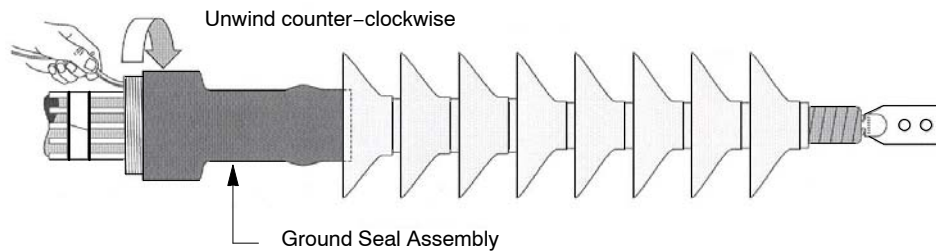


Figure 12

Initial when Step 15 is complete. _____

16. Slide the lug sealing tube onto the lug/termination, as shown. Start to shrink the tube near the top of the last skirt and onto the lug barrel. If the tube overlaps the lug pad or is not tight to the lug barrel, carefully trim the tube just past (1/4") the Scotch Rubber Mastic Tape 2228 sealing tape. A roll of Scotch Self-fusing Silicone Rubber Tape 70 is provided to cover the edge of the trimmed tube, apply with moderate tension, stretching only enough to conform to the lug barrel and tube. (Figure 13)

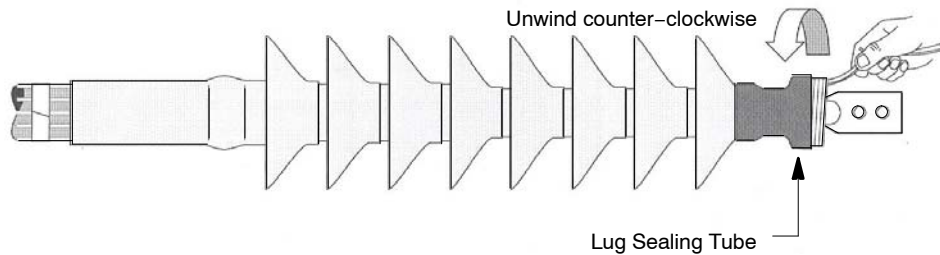


Figure 13

Initial when Step 16 is complete. _____

CABLE TERMINATION
69kV 350kcmil – 1000kcmil CN
COLD – SHRINKABLE

42 54 11 **

Sheet 8 of 8

17. Attach the bronze four bolt lug to the compression or shear head bolt lug. Note: If the terminator lug is being attached directly to a flat surface the bronze connector may be omitted. (Figure 14)

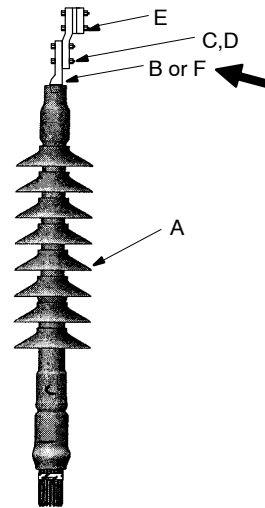


Figure 14

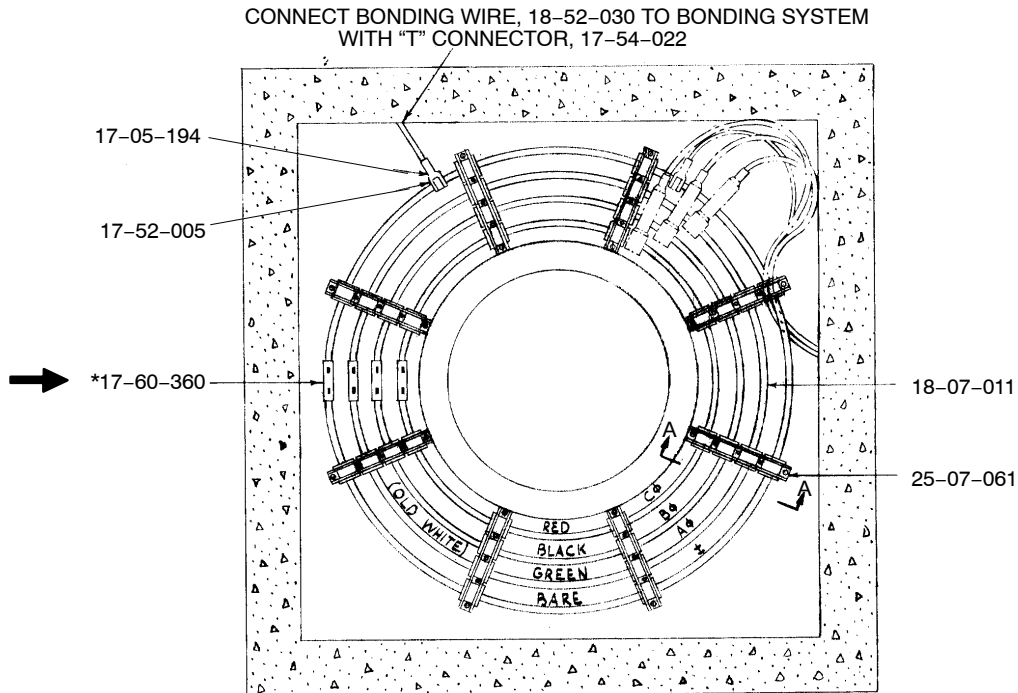
Initial when Step 17 is complete. _____

18. Connect the concentric neutral wires to system ground using a two-bolt connector.

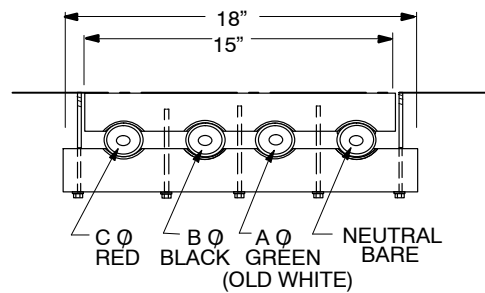
Initial when Step 18 is complete. _____



@		Std. / Stk. No.	Description	42 54 11 **	01	02	03
	A	17 07 249	Termination-Cable, 69kV , 350 kcmil-1000 kcmil		1	1	1
	B	17 55 324	Lug-Compression, 500Al., 2 Hole		1		
		17 55 260	Lug-Compression, 750Al., 2 Hole			1	
		17 55 804	Lug-Shear Head Bolt, 350-750 CU/AL, 2 Hole		1	1	
	C	21 56 078	Bolt, Machine 1/2" x 2" SS		2	2	2
	D	12 56 052	Washer-Belleville Spring 1/2" SS		2	2	2
		12 56 053	Washer-Flat 1/2" SS		2	2	2
	E	17 54 177	Connector-Cable to Flat Bronze		1	1	2
	F	17 05 236	Lug-Compression, 1000 Cu, 2 Hole				1



VIEWED FROM MANHOLE FLOOR



DETAIL OF RING BUS INSULATOR CLAMP
SECTION A-A

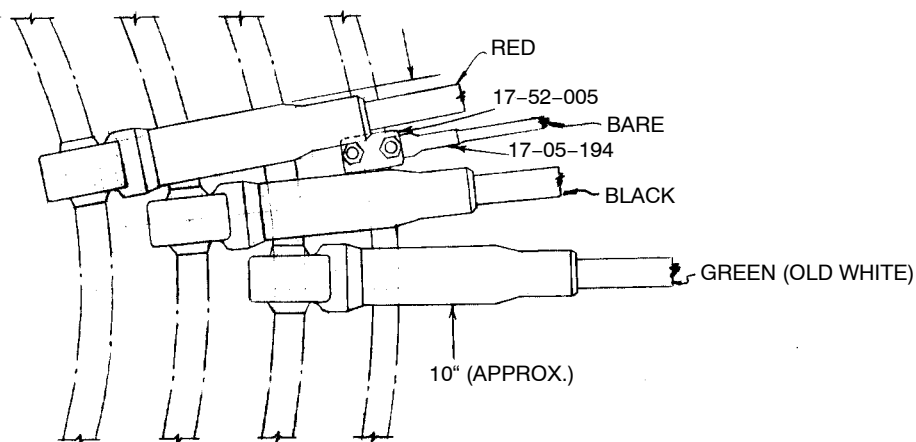
NOTE: Length of Cable Req'd.

AØ 18' Long

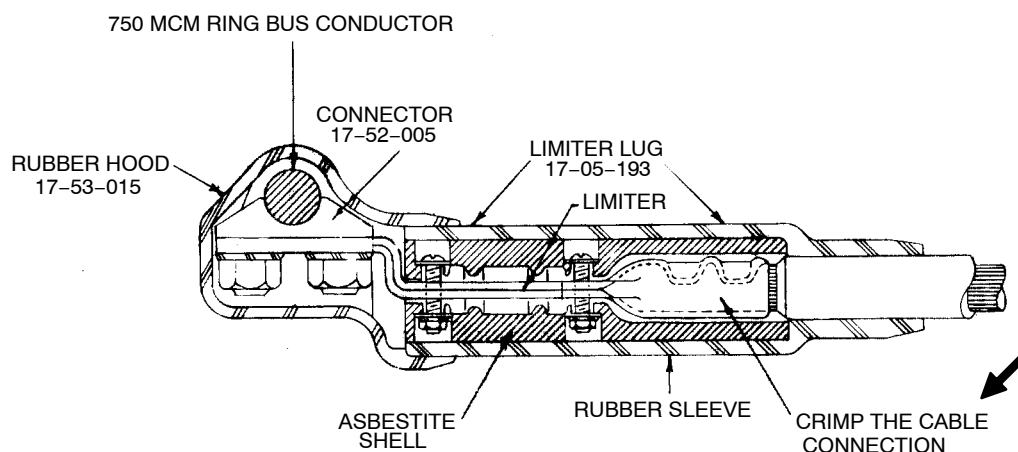
BØ 16' Long

CØ 14' Long

Std. / Stk. No.	Description	Req'd.
25 07 061	Insulator – Ring Bus 4 Cond.	8
17 60 360	Sleeve – Compression, 750 kcmil, Cu	4
18 07 011	Cable – NW 750 kcmil	See Note
18 52 022	Wire – 750 kcmil Bare	20'
17 52 005	Connector – Cable to Lug	1
17 05 194	Lug – Hypress 4/0	1
17 54 022	Connector – T-4/0	1
18 52 030	Wire – 4/0 Tinned Copper	10'
753	Ring Bus	1



VIEWED FROM MANHOLE FLOOR



DETAIL OF LIMITER LUG AND CONNECTION TO RING BUS

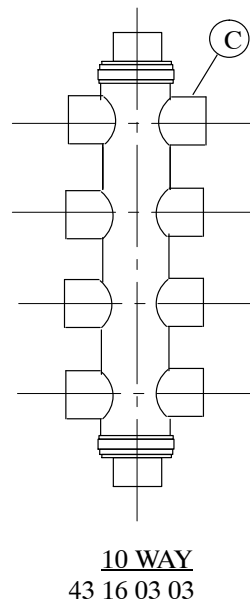
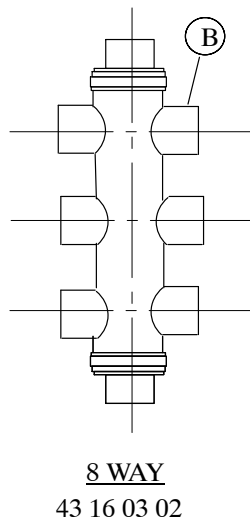
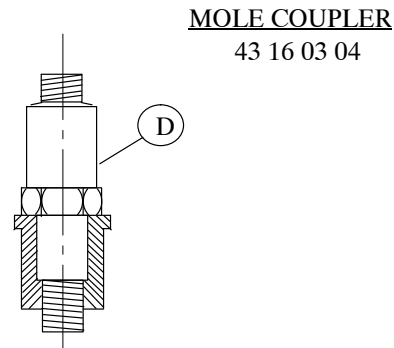
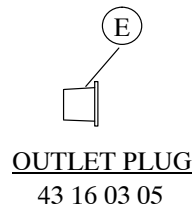
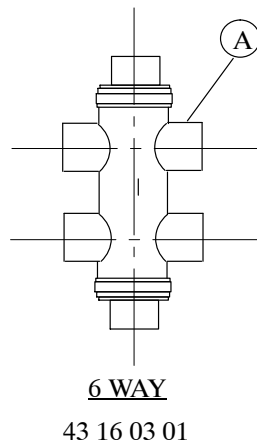
NOTE: Limiter lug consists of limiter, asbestos shell, and rubber sleeve.

*Use 500 kcmil hypress lug (Stock No. 17-05-195) on direct runs from transformer to ring bus.

	Stock No.	Description	Req'd.
	17 52 005	Connector – Cable to Lug	4
	17 53 015	Hood – Rubber Insulating	3
	17 05 193	Lug – Limiter	3
*	17 05 194	Lug – Hypress 4/0	1

→ **AMEREN ILLINOIS ONLY**

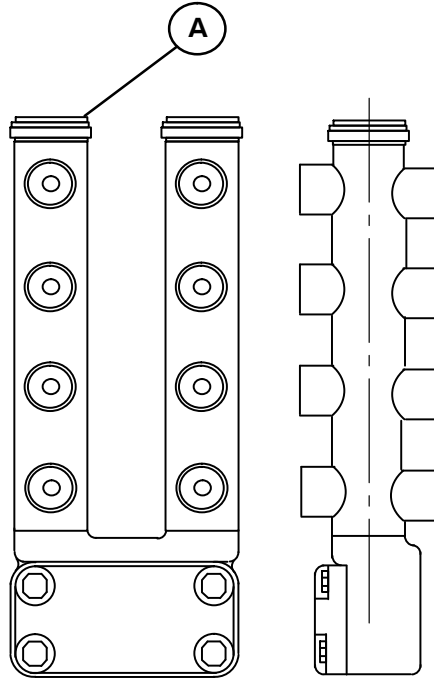
AMEREN ILLINOIS ONLY



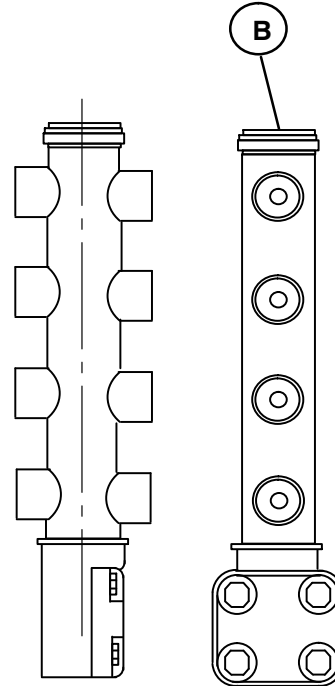
		Std. / Stk. No.	Description	01	02	03	04	05
	A	17 62 207	Connector-Mole, 6 Way, 1500A	1				
	B	17 62 208	Connector-Mole, 8 Way, 1500A		1			
	C	17 62 209	Connector-Mole, 10 Way, 1500A			1		
	D	17 62 213	Coupler – Mole				1	
	E	17 62 182	Plug – Mole, Diatex					1

➔ **AMEREN ILLINOIS ONLY**

AMEREN ILLINOIS ONLY



16 WAY – 3000 AMP
43 16 04 01



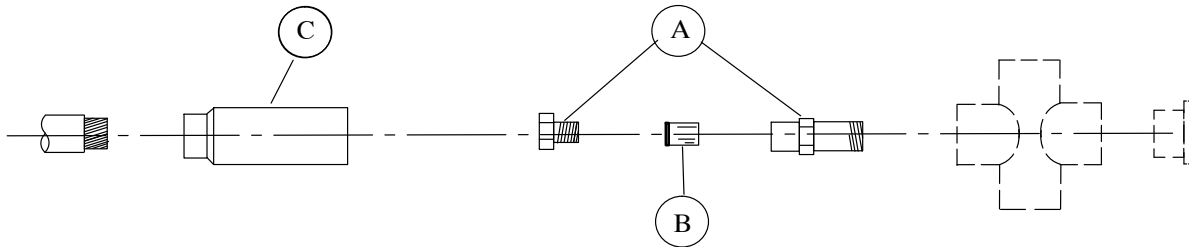
8 WAY – 2500 AMP
43 16 04 02

8 WAY – 3000 AMP
43 16 04 03

	Std. / Stk. No.	Description	01	02	03
	17 62 212	Connector–Mole, Stud, 16 Way, 3000A	1		
	17 62 210	Connector–Mole, Stud, 8 Way, 2500A		1	
	17 62 211	Connector–Mole, Stud, 8 Way, 3000A			1

➔ **AMEREN ILLINOIS ONLY**

AMEREN ILLINOIS ONLY



DESCRIPTION

1/0 CABLE/MOLE CONN.

4/0 CABLE/MOLE CONN.

300KCMIL CABLE/MOLE CONN.

350KCMIL CABLE/MOLE CONN.

500KCMIL CABLE/MOLE CONN.

STANDARD #

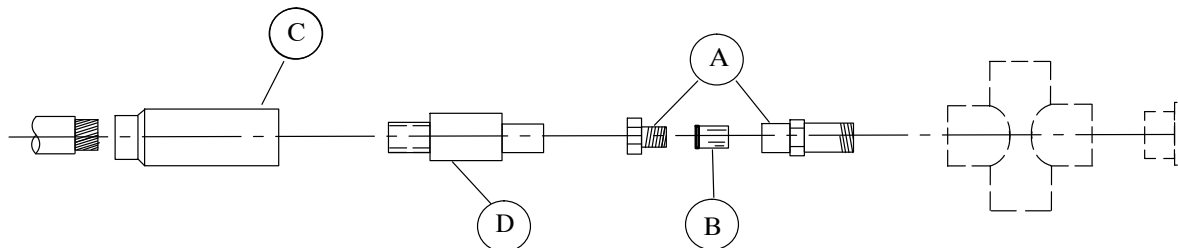
43 16 05 01

43 16 05 02

43 16 05 03

43 16 05 04

43 16 05 05

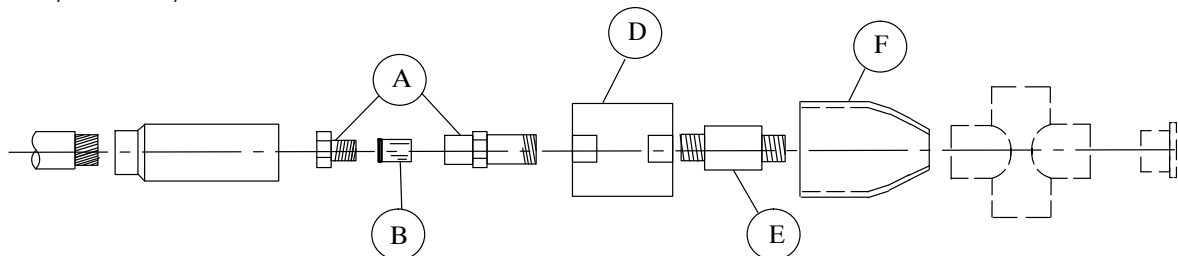


DESCRIPTION

4/0 CABLE/MOLE CONN. WITH LIMITER

STANDARD #

43 16 05 06

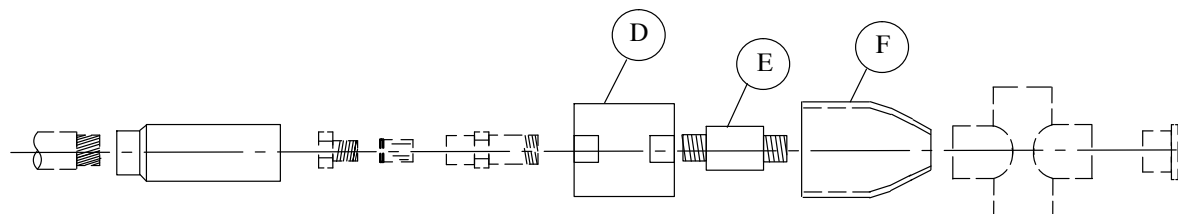


DESCRIPTION

500 KCMIL CABLE/MOLE CONN. WITH LIMITER

STANDARD #

43 16 05 07



DESCRIPTION

500 KCMIL LIMITER ADDED TO CABLE

STANDARD #

43 16 05 08

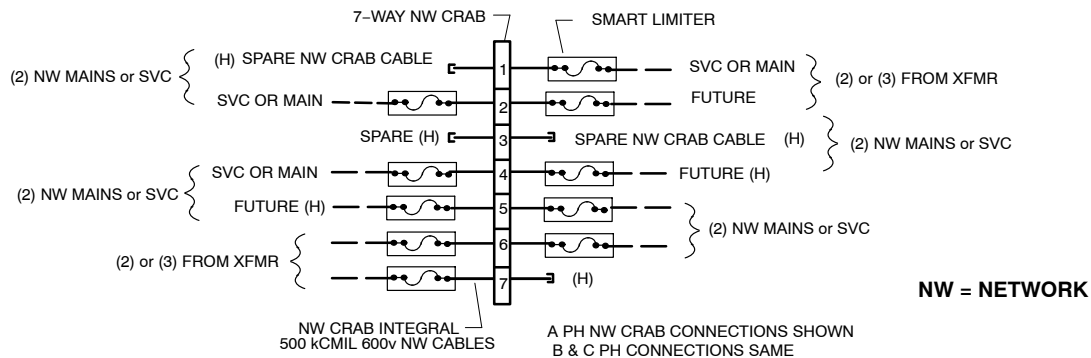


AMEREN ILLINOIS ONLY

AMEREN ILLINOIS ONLY

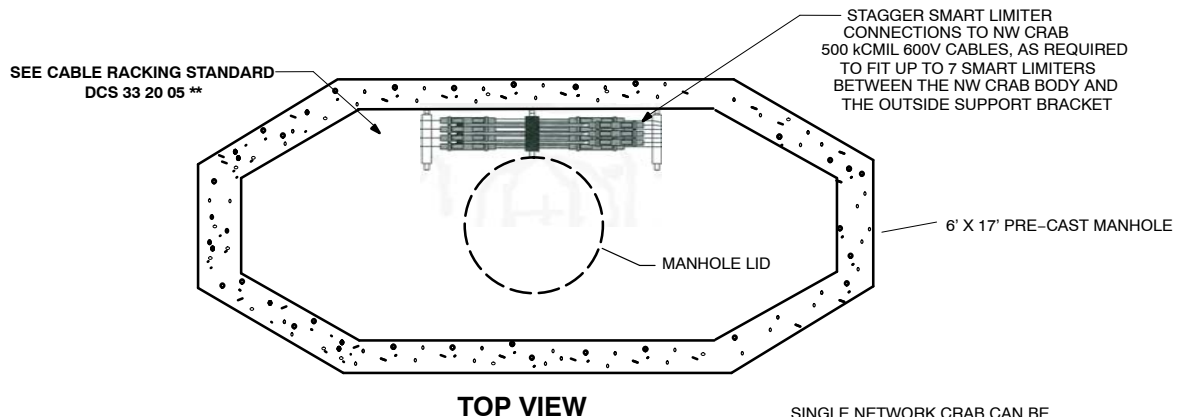
	Std. / Stk. No.	Description	01	02	03	04	05	06	07	08
A	17 62 214	Termination – Socket & Nut, 4/0	1	1				1		
	17 62 175	Termination – Socket & Nut, 500 kcmil			1	1	1		1	
B	17 62 205	Connector – Cone, Cmpr., 1/0	1							
	17 62 178	Connector – Cone, Cmpr., 4/0		1				1		
	17 62 206	Connector – Cone, Cmpr., 300 kcmil			1					
	17 62 202	Connector – Cone, Cmpr., 350 kcmil				1				
	17 62 177	Connector – Cone, Cmpr., 500 kcmil					1		1	
C	17 60 618	Sleeve – Insulating, 4/0 Limiter	1	1				1		
	17 62 181	Sleeve – Insulating, 500 kcmil			1	1	1			
D	17 05 327	Fuse – Limiter, 4/0, 480V						1		
	17 05 328	Fuse – Limiter, 500 kcmil, 480V							1	1
E	17 63 230	Coupling – Limiter							1	1
F	17 60 619	Sleeve – Insulating, for Limiter							1	1

MANHOLE – SINGLE CRAB



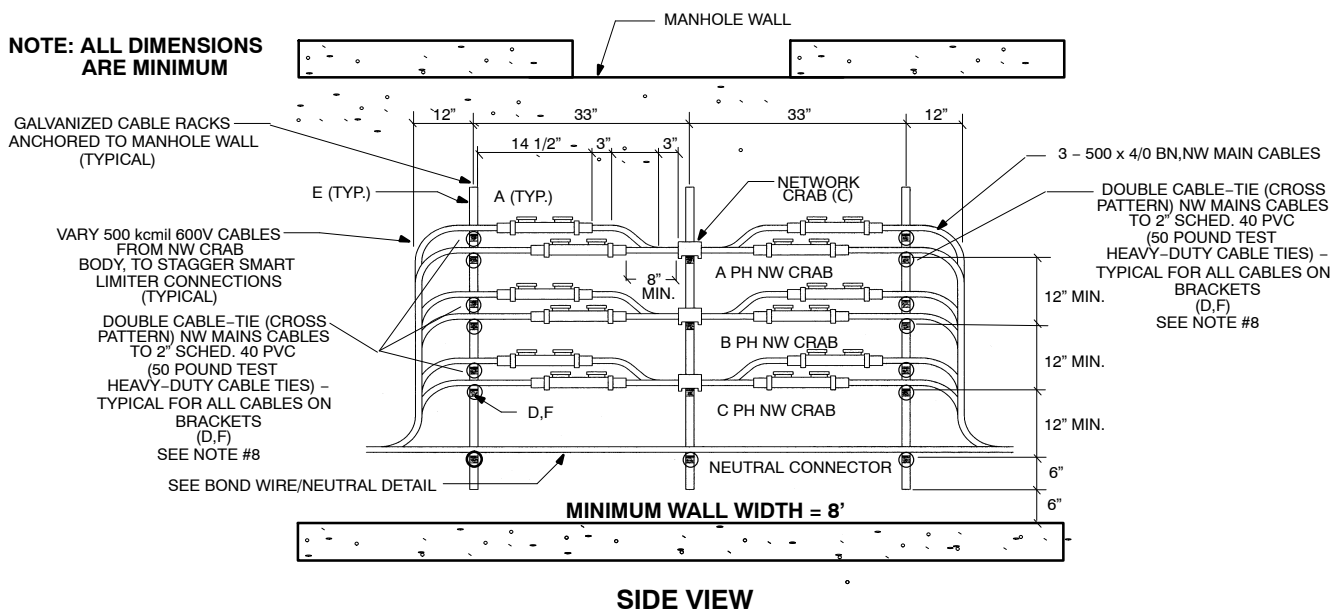
TYPICAL ONE LINE W/7-WAY NW CRAB

(CONSULT UD DIVISION ENGINEERING FOR SPECIFIC NETWORK CONNECTION CONFIGURATION, AS REQUIRED)



SINGLE NETWORK CRAB CAN BE
INSTALLED WITHIN A MANHOLE, VAULT,
OR SERVICE COMPARTMENT.

**NOTE: ALL DIMENSIONS
ARE MINIMUM**



CABLE - NETWORK

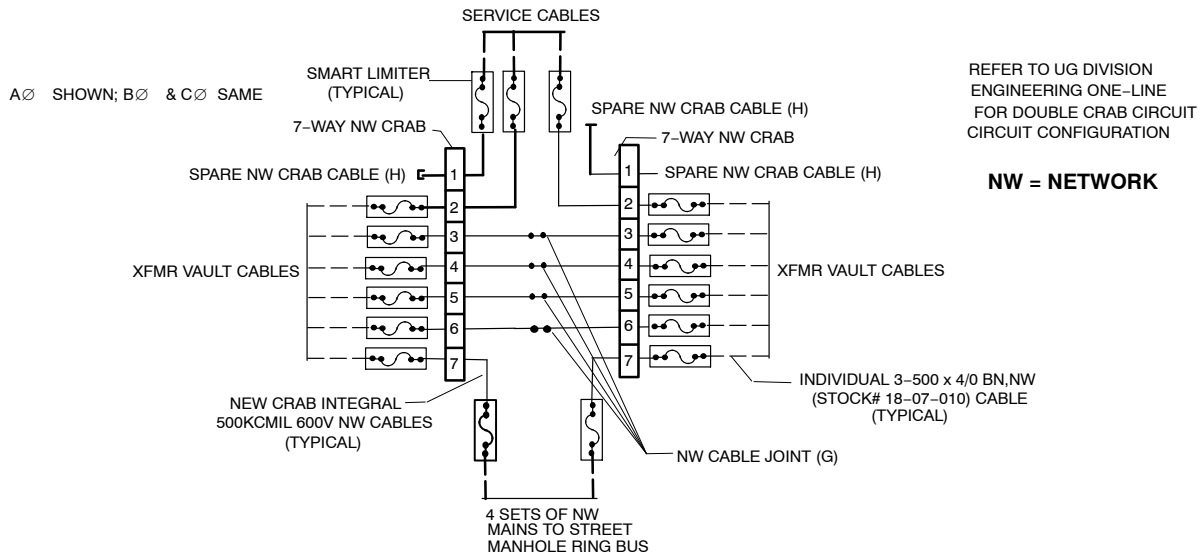
Crab Connector/Smart Limiter Installation

→120/208V ONLY

43 16 06 **

Sheet 2 of 4

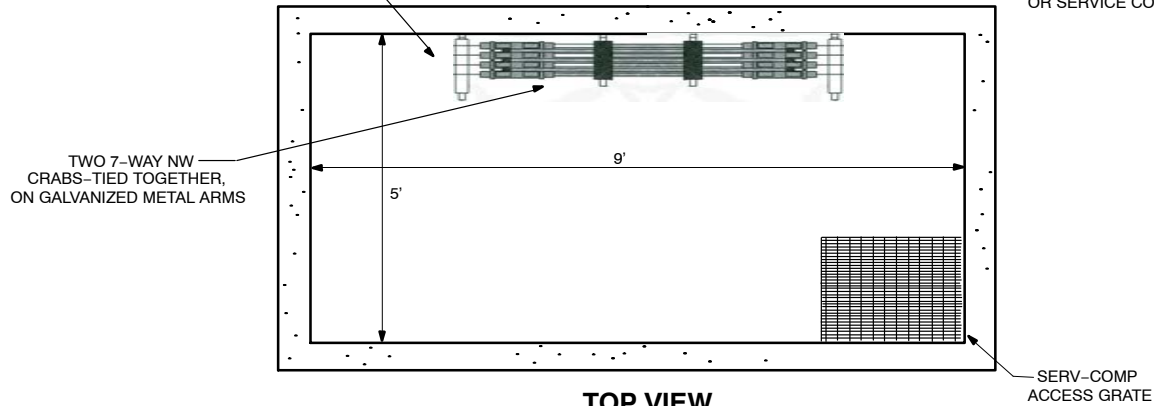
SERVICE COMPARTMENT - DOUBLE CRAB



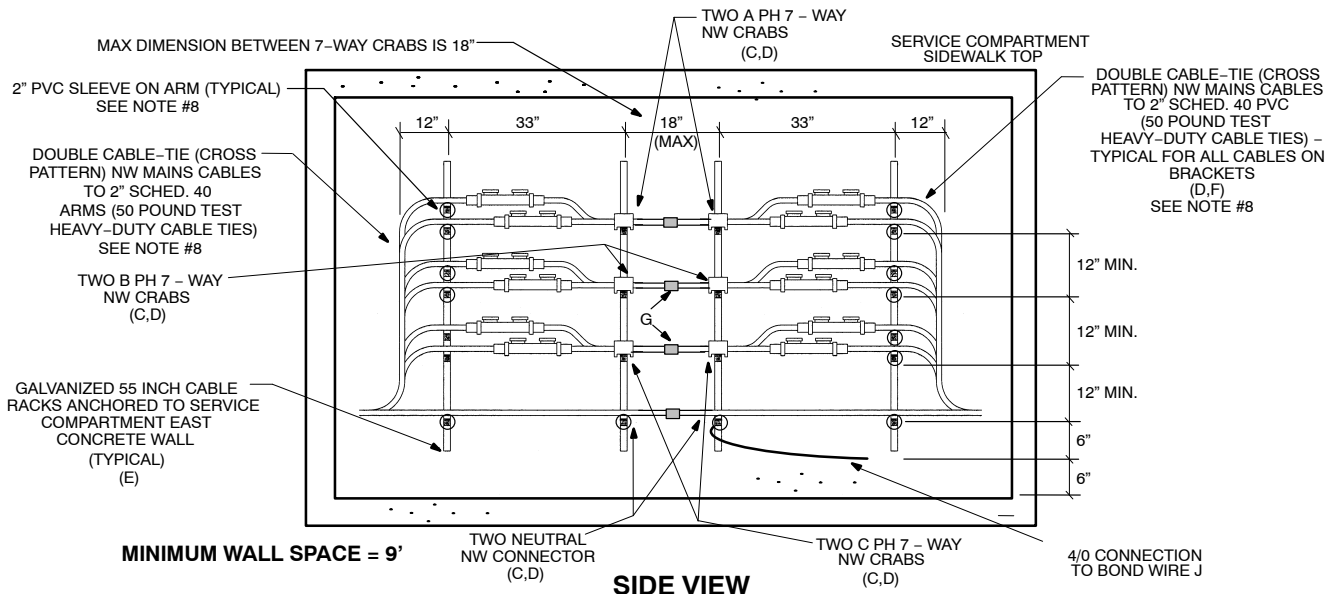
TYPICAL ONE LINE W/7-WAY DOUBLE NW CRABS

SEE CABLE RACKING STANDARD
DCS 33 20 05 **

DOUBLE NETWORK CRAB CAN BE
INSTALLED WITHIN A MANHOLE, VAULT,
OR SERVICE COMPARTMENT.



TOP VIEW



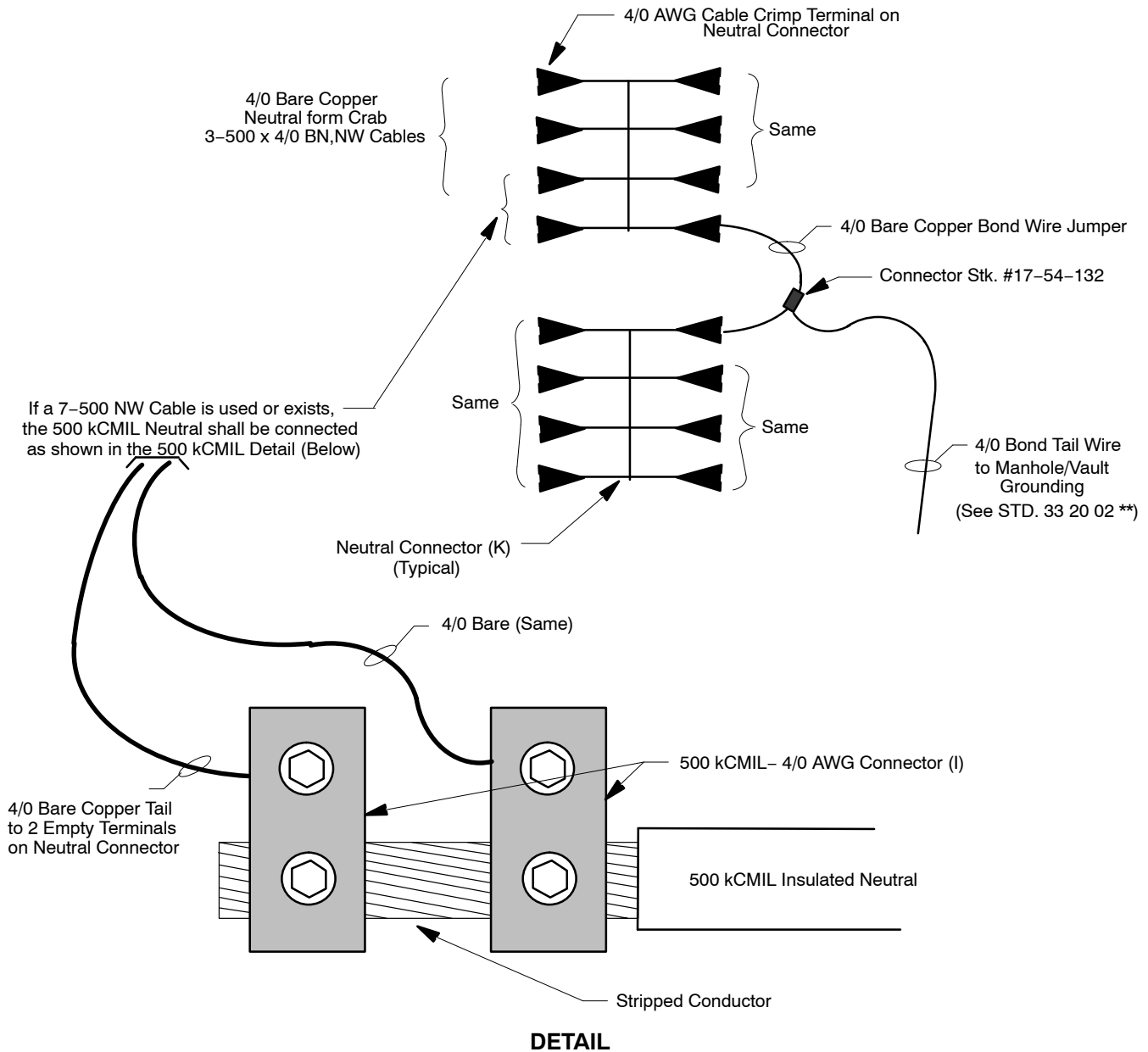
SIDE VIEW

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 3
REV. DATE: 03/30/15

NEUTRAL CONNECTOR



CABLE – NETWORK
Crab Connector/Smart Limiter Installation
→120/208V ONLY

43 16 06 **

Sheet 4 of 4

NOTES:

1. Add smart limiters as directed by one-line or UG engineering to network main or service to crab connector.
2. Utilize 600V–500kCMIL cable straight splice to join crab connectors.
3. Cable mounting rack is included in new precast manholes. Add rack as necessary to existing network installations.
4. Add approved 600V cable cap to the ends of any spare crab connector cables.
- 5. Add connectors as necessary to connect neutrals/bond wire to crab connector.
6. For all 4/0 neutrals use the 4/0 bare crab connection. For 500 kCMIL neutrals use the 500 kCMIL crab reducing sleeves (I) as needed for 4/0 neutrals. See neutral detail or connector.
7. Neutral connections can be made using either the neutral connector or crab (see item K) based on field conditions. The neutral connector is the preferred connection method as it saves space for cable training.
8. For cable mount arm (14" or "16), when using 2" dia. PVC sleeve, the PVC sleeve shall be anchored to the arm by 50 pound test cable tie-strap prior to installing crabs. The cables shall be cross tie-strapped to the 2" PVC sleeve – to prevent movement.

		Std. / Stk. No.	Description	43 16 06 **	01	02	03	04	05	06
1@	A	17 05 486	Limiter – 500 kCMIL, 120V, Fused		–	–	–	–	–	–
	C	17 05 488	Crab – 500 kCMIL, 600V, NW, 3-Way		3			6		
		17 05 485	Crab – 500 kCMIL, 600V, NW, 5-Way			3			6	
		17 05 484	Crab – 500 kCMIL, 600V, NW, 7-Way				3			6
3@	D	12 56 113	Arm – Cable Mounting, 14"		9			12		
		12 56 112	Arm – Cable Mounting, 18"			9	9		12	12
	E	12 56 116	Rack – Cable Mounting, 55", 37 Holes		3	3	3	4	4	4
		12 56 115	Rack – Cable Mounting, 30", 18 Holes		3	3	3	4	4	4
	F	40 59 715	Tie – Cable, Black, 10" Dia.		48	80	112	64	112	160
2@	G	41 14 36 11	Splice – 600V, 500 kCMIL, Str					6	9	12
4@	H	40 59 166	Cap–Cable End – 500 kCMIL NW. (600V)		–	–	–	–	–	–
5@	I	17 54 141	Connector – Wire, 2–500 kCMIL, CU (Neut.)		–	–	–	–	–	–
	J	18 52 024	Wire – 4/0 AWG, Cu, Bare Soft Drawn (ft)		10	10	10	10	10	10
6@	K	17 05 501	Neutral Connection – 4/0 AWG, 600V, NW, 4-Way, Bare Crimp (Neut.) (8 total connections–4 per side)		1	2	2	3	3	3
		17 05 485	Crab – 500 kCMIL, 600V, NW, 5-Way (Neut.)		1	1	1	1	1	1

43 16 06 01	3-Way Single NW Crab
43 16 06 02	5-Way Single NW Crab
43 16 06 03	7-Way Single NW Crab
43 16 06 04	3-Way Double NW Crab
43 16 06 05	5-Way Double NW Crab
43 16 06 06	7-Way Double NW Crab

IMPORTANT: The cable insulation cut back dimension of 2 ½" is critical for maintaining a water seal and for proper operation of the smart limiters.

**DISTRIBUTION
CONSTRUCTION STANDARDS**

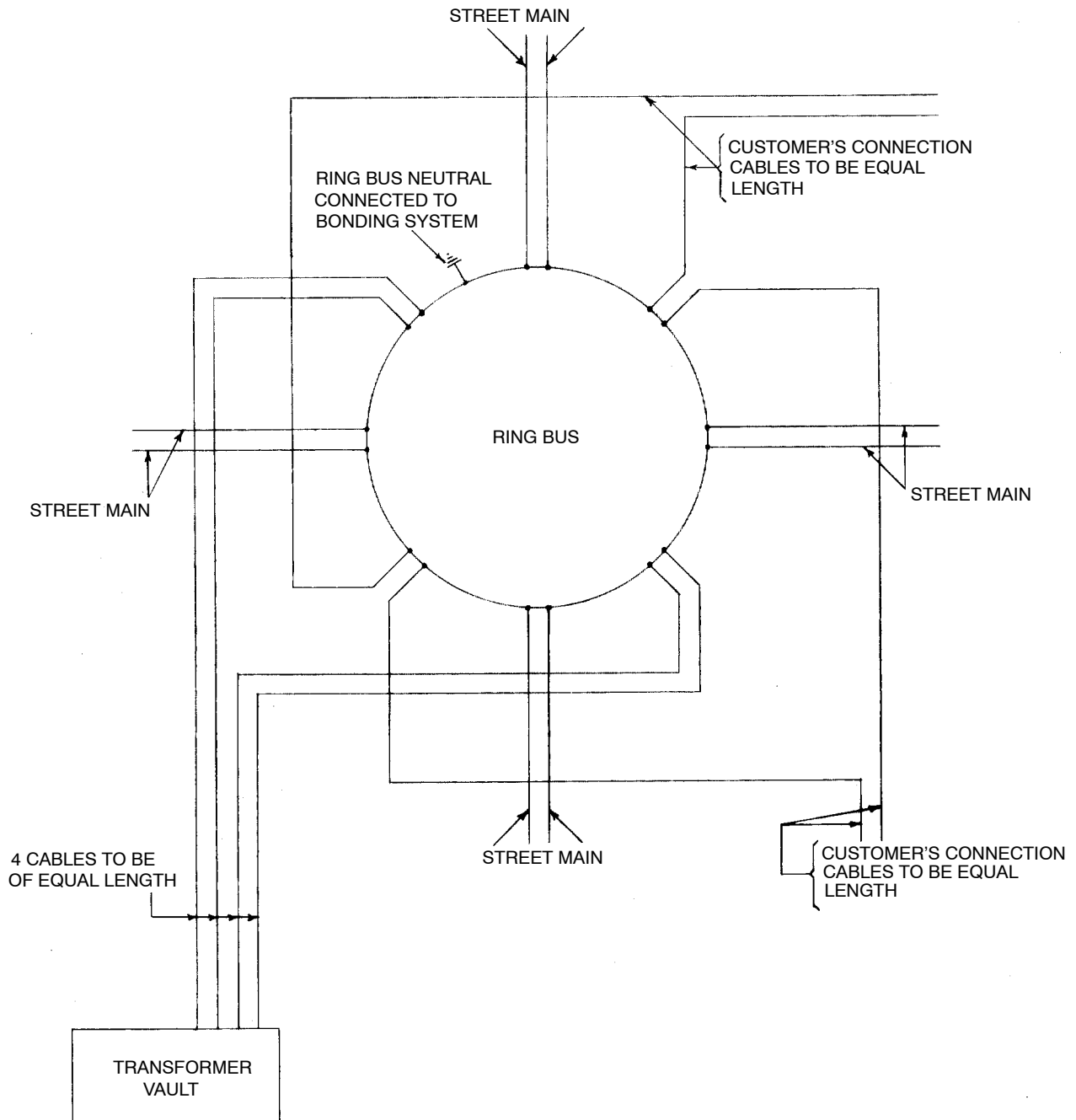


ENG: EJB
REV. NO: 3
REV. DATE: 03/30/15

CABLE – NETWORK
System Network Transformer and Ring Bus
Typical One Line Diagram

43 16 96 00

Sheet 1 of 1



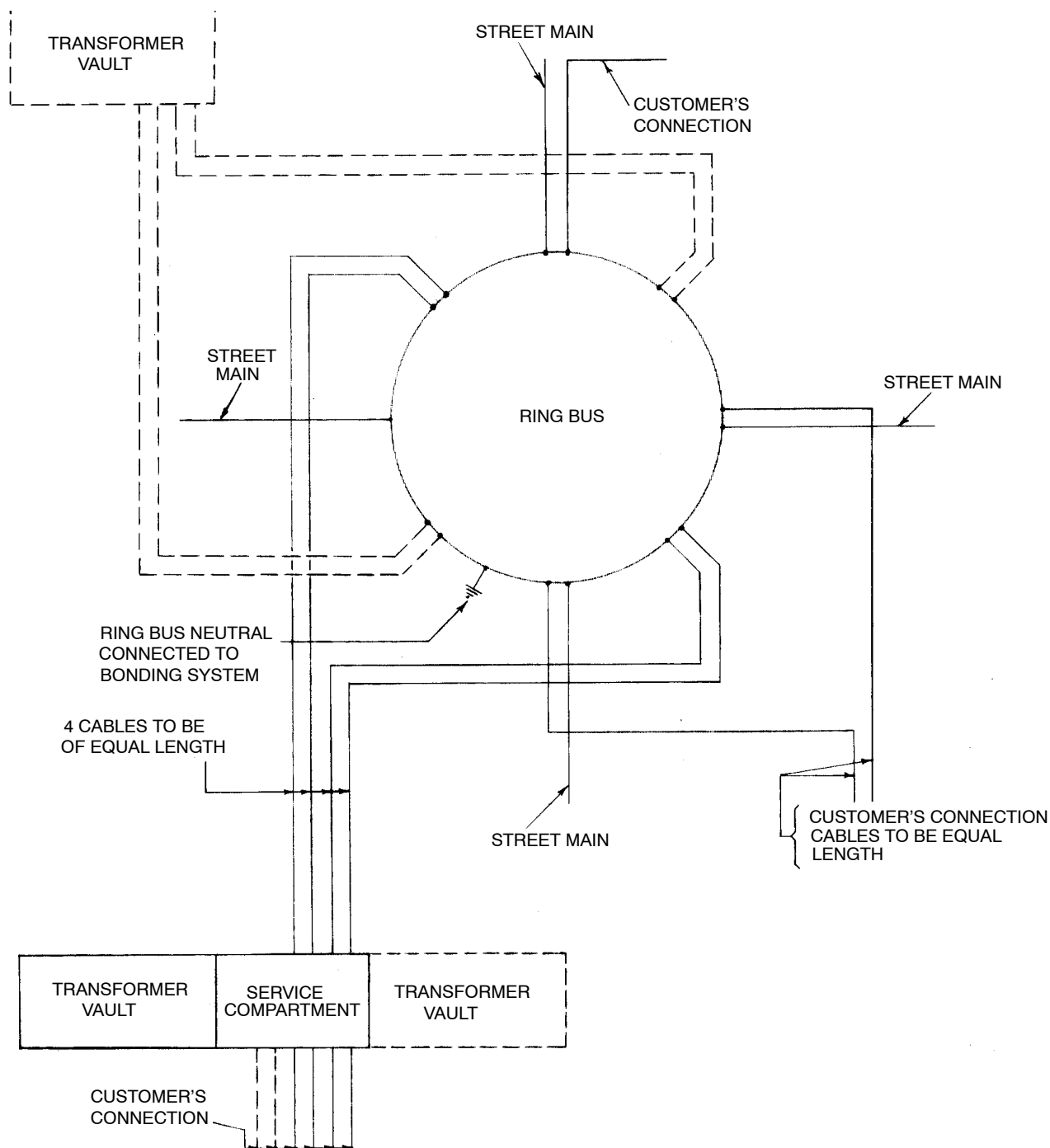
NOTE:

Connections to ring bus shall be arranged to maintain balanced loading of the ring bus under various operating conditions. Variations in this arrangement of connections may be made as required to meet specific conditions. The number of street mains and customers' connections depends on requirements at each location.

CABLE – NETWORK
A.C. Network Service Compartment and Ring Bus
Typical One Line Diagram

43 16 97 00

Sheet 1 of 1



NOTE:

Connections to ring bus shall be arranged to maintain balanced loading of the ring bus under various operating conditions. Variations in this arrangement of connections may be made as required to meet specific conditions. The number of street mains and customers' connections depends on requirements at each location.

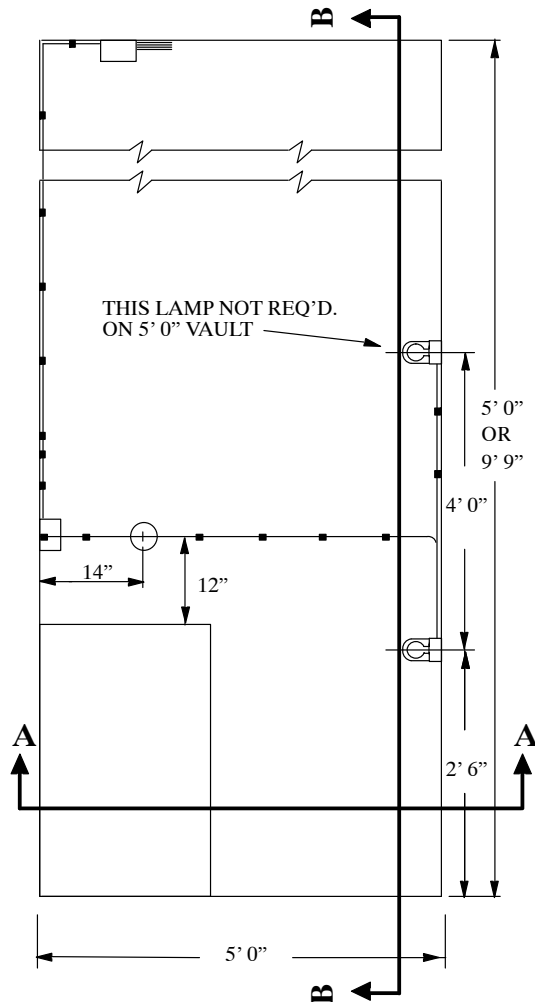
CABLE – NETWORK

System Vault (Service Compartment)

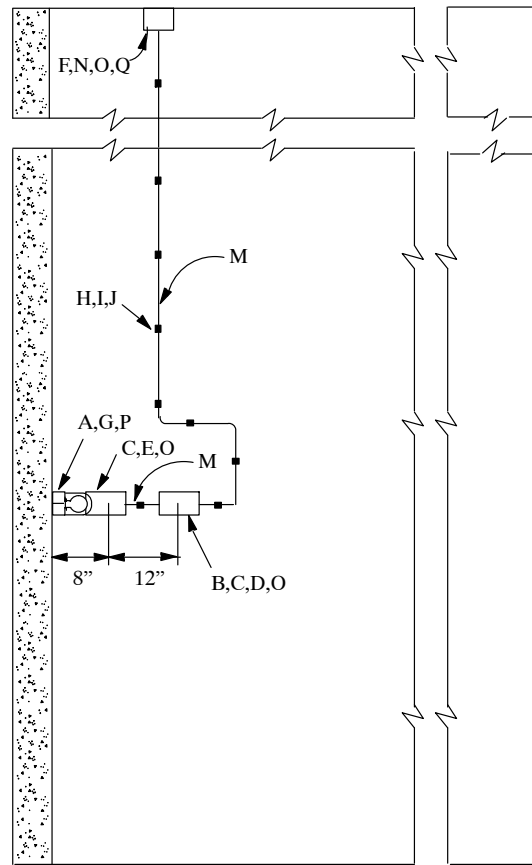
Detail of Lighting Layout

43 17 01 00

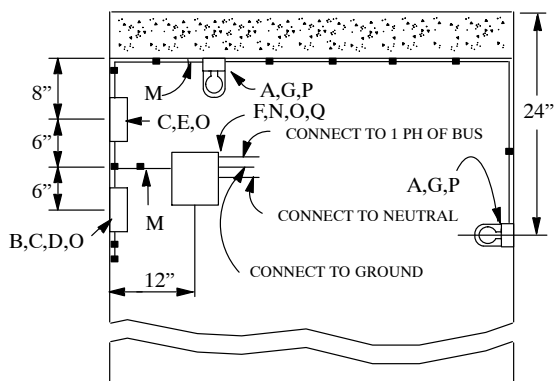
Sheet 1 of 2



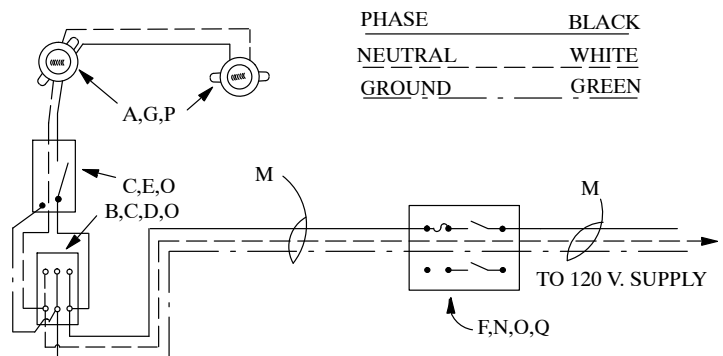
PLAN VIEW



SECTION B B



SECTION A A



WIRING DIAGRAM

NOTE:

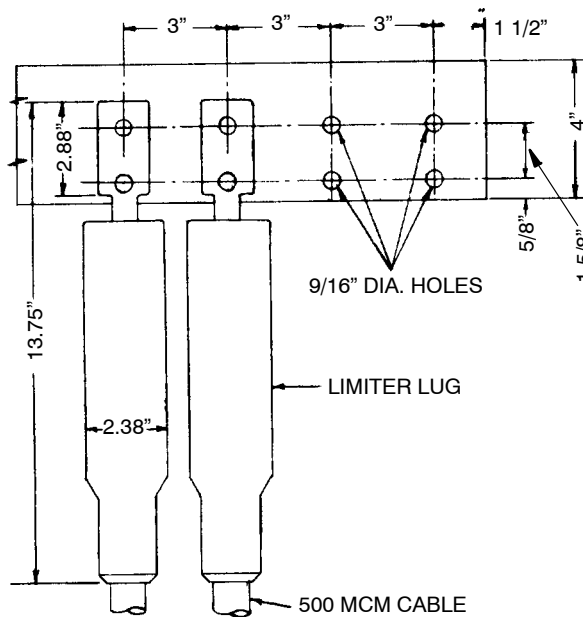
For extra lamp req'd on 9'-9" service compartment vault, requisition one receptacle #40-55-925 and one lamp #26-03-012.

CABLE – NETWORK
System Vault (Service Compartment)
Detail of Lighting Layout

43 17 01 00

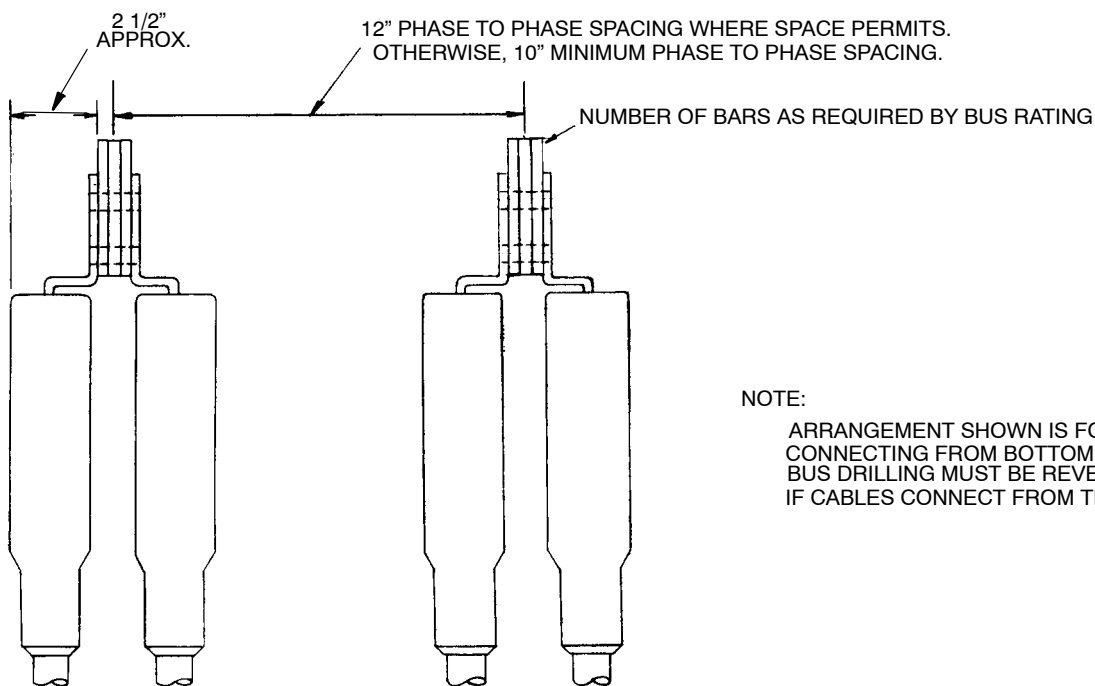
Sheet 2 of 2

		Dist. Std. Or Stk. No.	Description	
	A	40 55 925	Fixture – Incandescent Lighting 150W with Globe	2
	B	40 56 505	Receptacle – Duplex,GFI, 15A	1
	C	40 01 105	Box – Surface Wiring, Outdoor	2
	D	40 56 506	Plate Receptacle Cover, Outdoor	1
	E	40 58 509	Switch – Toggle Outdoor, 10A, with Cover	1
	F	20 52 041	Fuse–15A., Cartridge, Type FRN	1
	G	26 03 012	Lamp – General Purpose, 60 W Med. Screw Base	2
	H	21 51 001	Anchor – Expansion 8–32	24
	I	21 68 036	Screw – Rd. Hd. Brass 8–32 3/4” Long	24
	J	23 67 128	Cleat – Cable, Plastic	24
	M	18 61 113	Cord–Electrical, 600V, #14–3, Wet Rated	55’
	N	40 08 226	Switch–Safety, 30A Fusible, Outdoor	1
	O	40 52 053	Connector–Cord, 3/4” Hub	6
	P	40 52 065	Connector–Cord, 1/2” Hub	2
	Q	40 53 189	Nut– Conduit Lock, 3/4”	2
	R	21 51 005	Anchor – Expansion 1/4”–20	12
	S	21 68 034	Screw – Rd. Hd. Brass 1/4”–20 1” Long	12
		1399	Lighting, Vault & Ser. Comp.	2



DRILLING PLAN FOR CABLE LIMITER LUGS

2000 AMP BUS	4 LUGS PER PHASE
3000 AMP BUS	6 LUGS PER PHASE
4000 AMP BUS	8 LUGS PER PHASE



END VIEW SHOWING SPACING

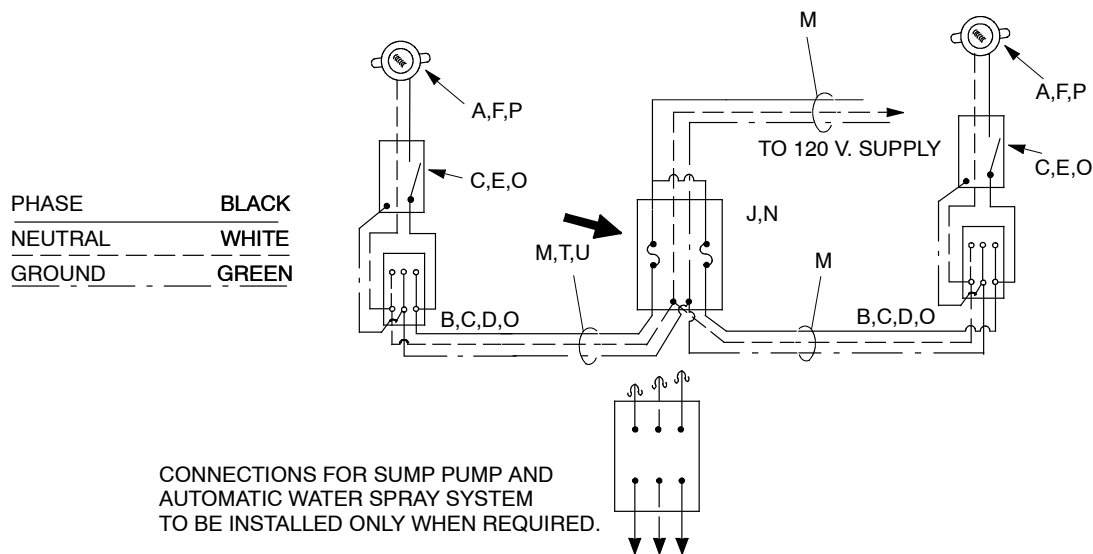
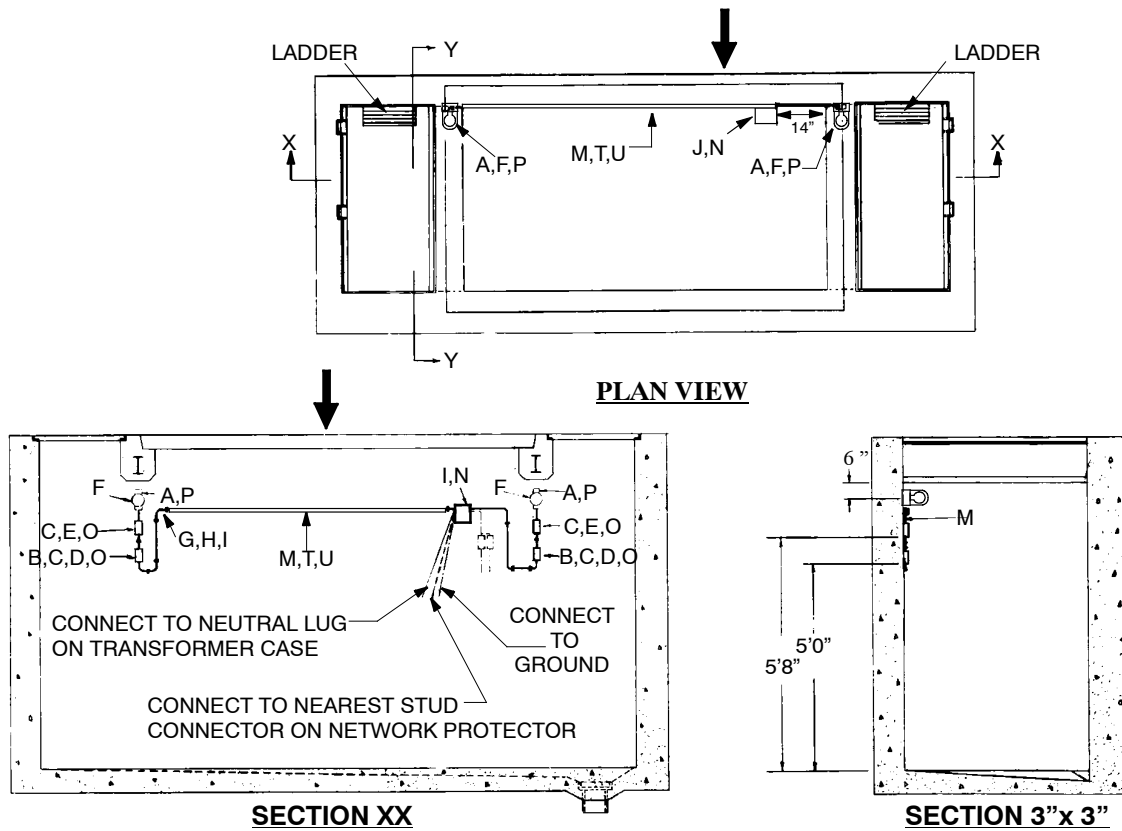
NOTE:

ARRANGEMENT SHOWN IS FOR CABLES
CONNECTING FROM BOTTOM OF BUS
BUS DRILLING MUST BE REVERSED
IF CABLES CONNECT FROM THE TOP

CABLE - NETWORK System Vault Detail of Lighting Layout

43 18 01 **

Sheet 1 of 2



CABLE - NETWORK
System Vault
Detail of Lighting Layout

43 18 01 **

Sheet 2 of 2

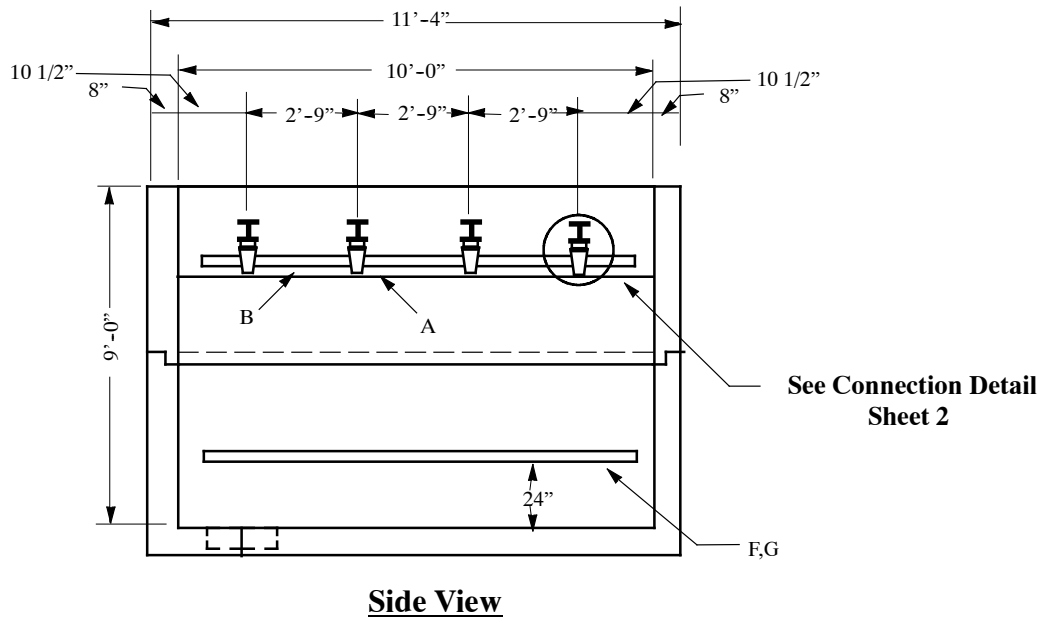
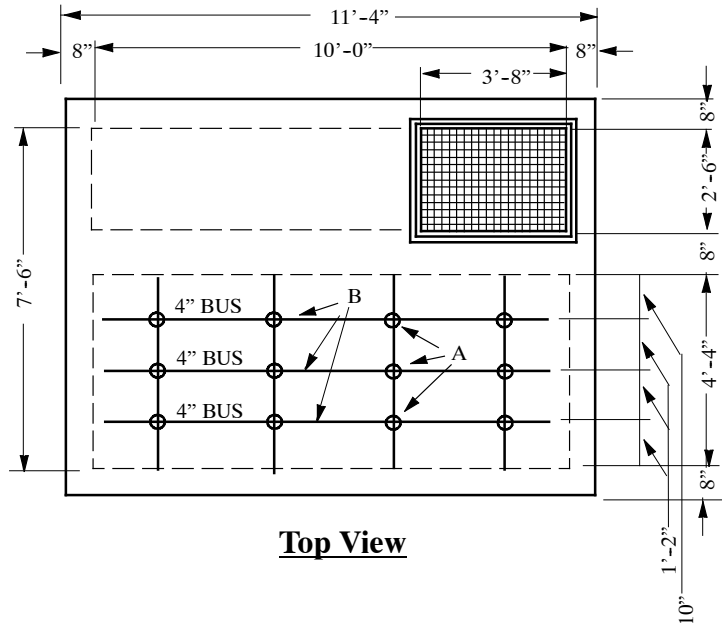


	Dist. Std. / Stk. No.	Description	43 18 01 **	01	02
A	40 55 925	Fixture - Lighting, 150W, w/ Globe		2	2
B	40 56 505	Receptacle - Duplex, GFI, 15A		2	2
C	40 51 653	Box - Surface Wiring, PVC, Outdoor		4	4
D	40 56 687	Cover - Receptacle- Outdoor		2	2
E	40 58 509	Switch - Toggle, Outdoor, 10A, w/ Cover		2	2
F	26 06 856	Lamp - LED, 120V, 8.5W (60 W Eq.), Medium Base		2	2
G	21 51 001	Anchor - Expansion 8-32		24	24
H	21 68 036	Screw - Round Head Brass 8-32, 3/4" Long		24	24
I	23 67 128	Cleat - Cable, Plastic		24	24
J	20 52 041	Fuse - 15 A, 600V, Cartridge, Type CC		2	2
M	18 61 130	Cord - Electrical, 600V, #12-3, Wet Rated		55'	55'
N	40 51 644	Box - Fuse, 600V, 30A, 10" Wide x 8" High X 4" Deep		1	
	40 51 652	Box - Fuse, 600V, 30A, 6" Wide x 6" High X 4" Deep			1
O	40 52 053	Connector - Cord, 3/4" Hub		8	8
P	40 52 065	Connector - Cord, 1/2" Hub		2	2
R	21 51 005	Anchor - Expansion 1/4"-20		24	24
S	21 68 034	Screw - Round Head, Brass 1/4"-20, 1" Long		24	24
T	12 51 197	Conduit - PVC, 5ch. 40, 1" x 10'		1	1
U	40 52 455	Clamp - Conduit, 1", PVC		4	4
	1399	Lighting, Vault & Service Compartment		2	2

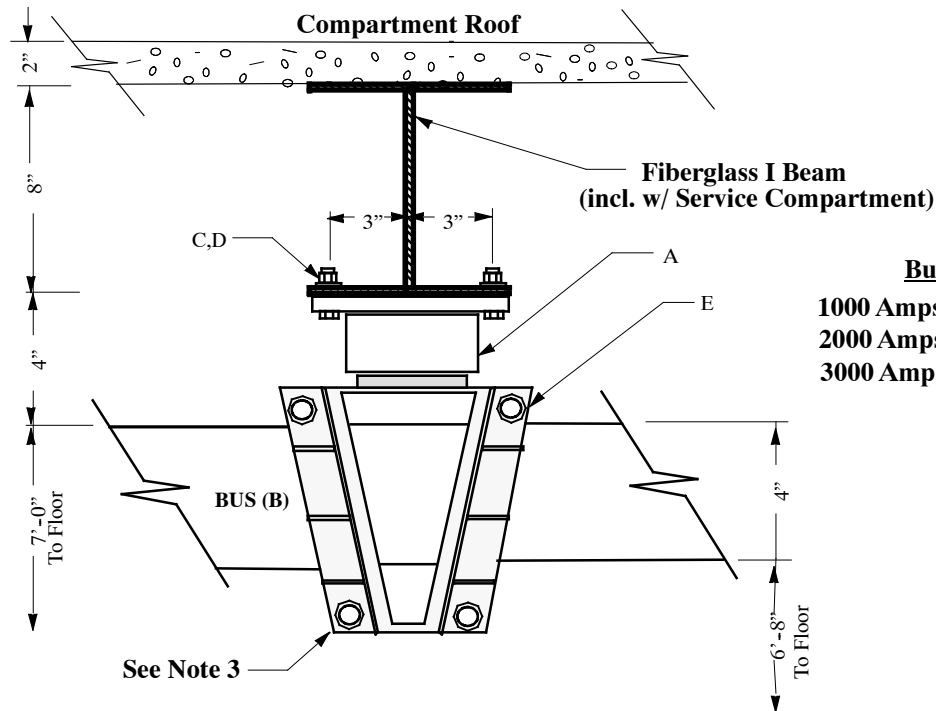
NOTES:

1. Installation of the large fuse box (Std. 43 18 01 01) is preferred in vaults where space allows.
2. A fuse puller tool Stock # 85-29-163 is available to remove the fuse from the carriage.

Precast Network Service Compartment



This standard covers new pre-cast network service compartment installations, custom scratch built service compartments, and rebuilt existing service compartments. Consult the project one-line and drawings for additional connection and circuit information. All other standard requirements are contained herein.



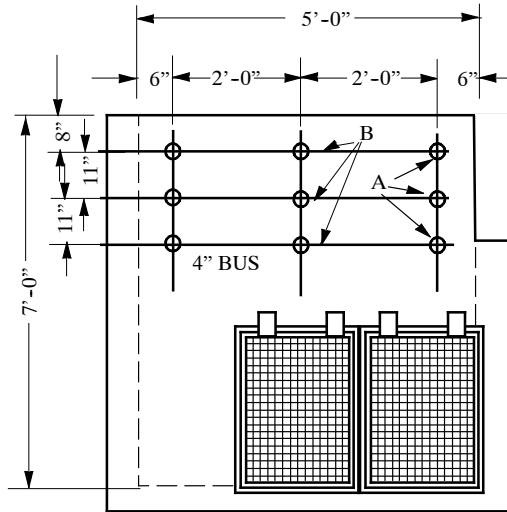
Buss Ampacity

1000 Amps	Std. 43 19 01 01
2000 Amps	Std. 43 19 01 02
3000 Amps	Std. 43 19 01 03

Detail of Bus Bar Connection

		Dist. Std. Or Stk. No.	Description	43 19 01	01	02	03
1	A	25 07 024	Support-Network Bus, Vertical, Heavy Duty		12	12	12
	B	18 12 126	Bar-Bus, Copper, 1/4" x 4" x 9', Predrilled		3	6	9
	C	21 56 078	Bolt-Machine, SS, 1/2" x 2", Hex Head w/Hex Nut		24	24	24
	D	23 66 005	Washer-Lock, Galv. Steel, 1/2"		24	24	24
	E	17 55 810	Spacer, Bus Support, 1/4" x 4" x 4", Copper			12	24
	F	18-12-125	Bar-Bus, Neutral/Ground Kit, 1/4" x 4" x 9', w/Mounts		1	1	1
	G	21-53-049	Bolt-Machine, Everdur, 3/8" x 6", Hex Head w/Nut		8	8	8

Small Network Service Compartment - Top View



Buss Ampacity

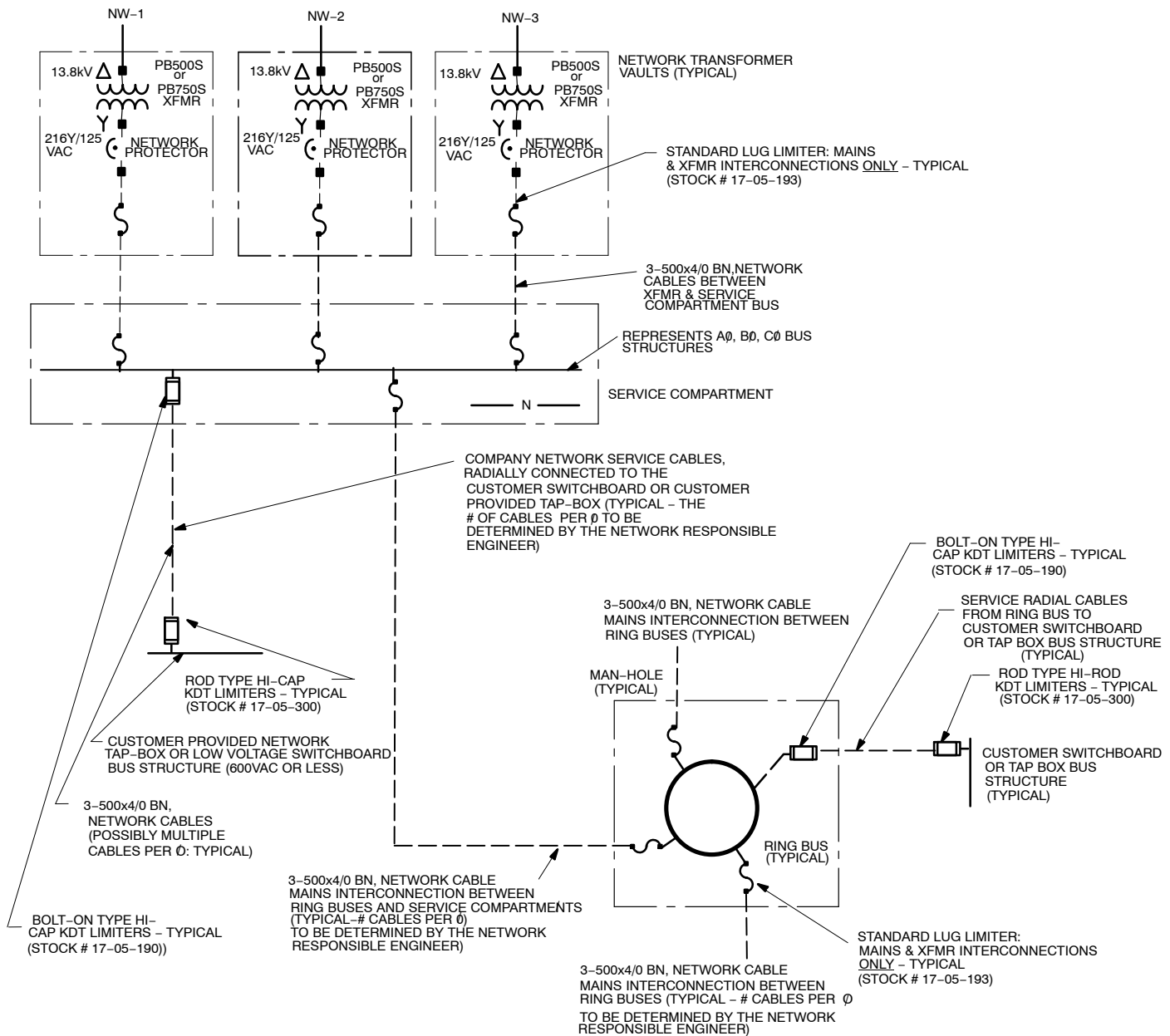
1000 Amps	Std. 43 19 01 04
2000 Amps	Std. 43 19 01 05
3000 Amps	Std. 43 19 01 06

		Dist. Std. Or Stk. No.	Description	43 19 01	04	05	06
1	A	25 07 024	Support-Network Bus, Vertical, Heavy Duty		9	9	9
	B	18 12 124	Bar-Bus, Copper, 1/4" x 4" x 53", Predrilled		3	6	9
	C	21 56 078	Bolt-Machine, SS, 1/2" x 2", Hex Head w/Hex Nut		18	18	18
	D	23 66 005	Washer-Lock, Galv. Steel, 1/2"		18	18	18
	E	17 55 810	Spacer, Bus Support, 1/4" x 4" x 4", Copper			9	18
	F	18-12-127	Bar-Bus, Neutral/Ground Kit, 1/4" x 4" x 4', w/Mounts		1	1	1
	G	21-53-049	Bolt-Machine, Everdur, 3/8" x 6", Hex Head w/Nut		6	6	6

NOTES:

1. Insert the copper spacers (E) between the bus bars (A) at each network bus support (B) as necessary.
2. Attach the Neutral/Ground Bus to the bond wire using 4/0 copper wire (18-52-024) and a two bolt connector (17-54-132) and a copper lug (17-05-194).
3. For all bus bar connections tighten bolts to a torque value of 20 ft-lbs.

AMEREN MISSOURI ONLY



NOTES:

1. Hi-cap KDT limiters shall be used only on 480Y/277V spot network connections and for 216Y/125V radial secondary network taps to customer equipment from a ring bus or service compartment.
2. The hi-cap KDT limiter's interrupting rating is 200,000 amps, symmetrical, and the standard lug limiter's interrupting rating is 14,000 amperes, symmetrical.
3. Neutral connections not shown on this drawing (limiters not used on neutral conductors).
4. PB500S transformer interconnections: (4) 3-500x4/0 BN, Network Cable
 PB 750S transformer interconnections: (6) 3-500x4/0 BN, Network Cable
5. Unless otherwise noted, all devices exist in all three phases.
6. This standard is complimentary to STD 43-16-96-00 & 43-16-97-00.

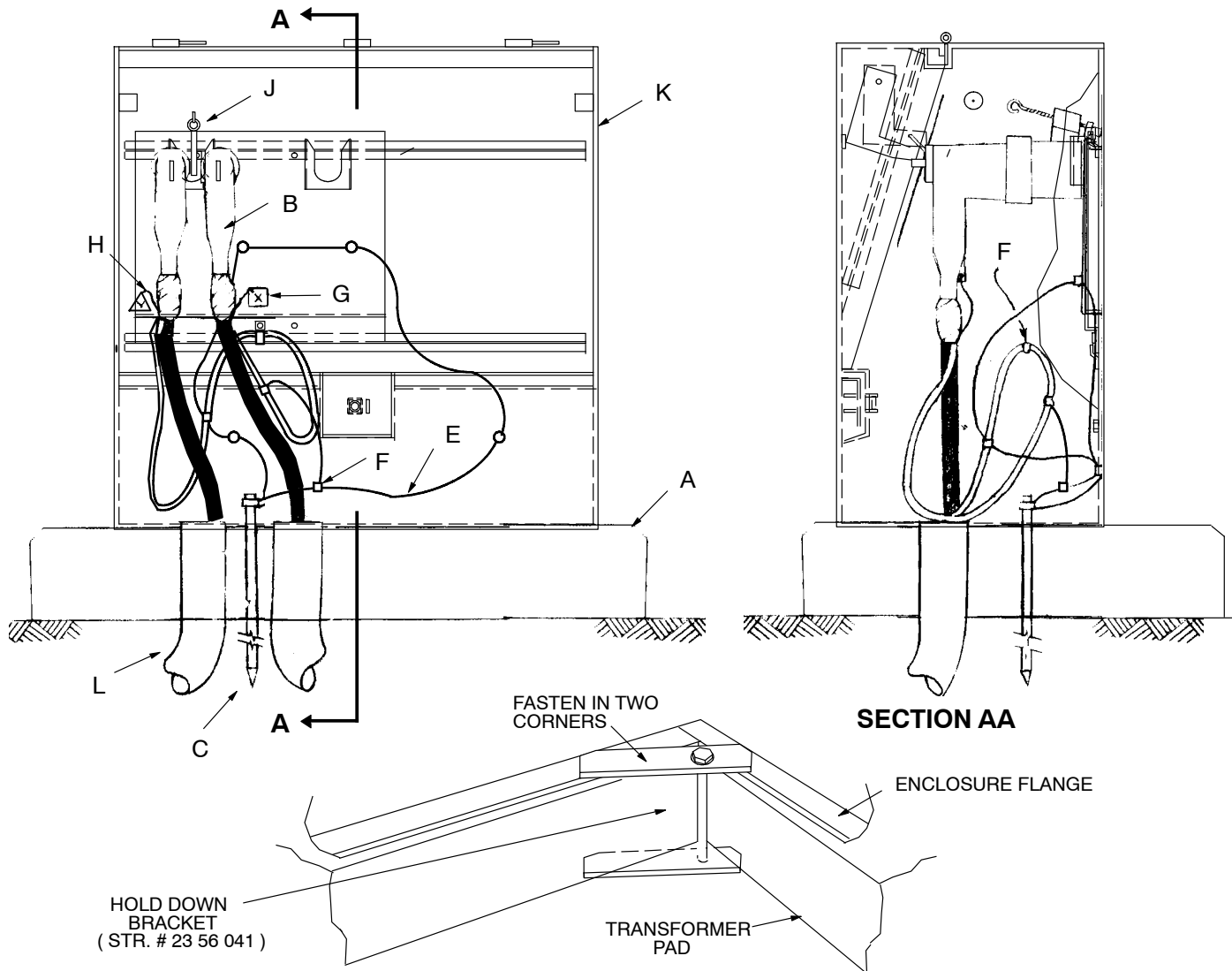
NOTES

UNDERGROUND EQUIPMENT

50

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HOLD DOWN BRACKET DETAIL

NOTES:

1. Secure compartment to pad using hold down plates and hold down brackets. Hold down plates will be furnished with the composite pads and hold down brackets will be furnished with the compartments. If hold down brackets are missing or if additional brackets are required they may be ordered (Stock #23-56-041).
2. See Dist. Std. **34 21 05 **** for the location of conduits.
3. Train cables so that elbows can be operated safely and easily. Ground as shown.
4. Remove the shipping caps from a feed thru bushing and wipe the surfaces clean. Apply silicone grease (Stock #31-51-050) before installing a loadbreak elbow, insulating cap, or elbow lightning arrester. Place the feed thru bushing into one of the parking stands provided. If more than two cable positions are required, use Dist. Std. **51-11-06 ****.
5. DO NOT ENERGIZE a feed thru bushing with a shipping cover in place. Covers are only intended to keep the bushing interfaces clean during shipping and handling. Use a high voltage insulating cap (Stock #17-55-227) to cover an unused position on the feed thru bushing.

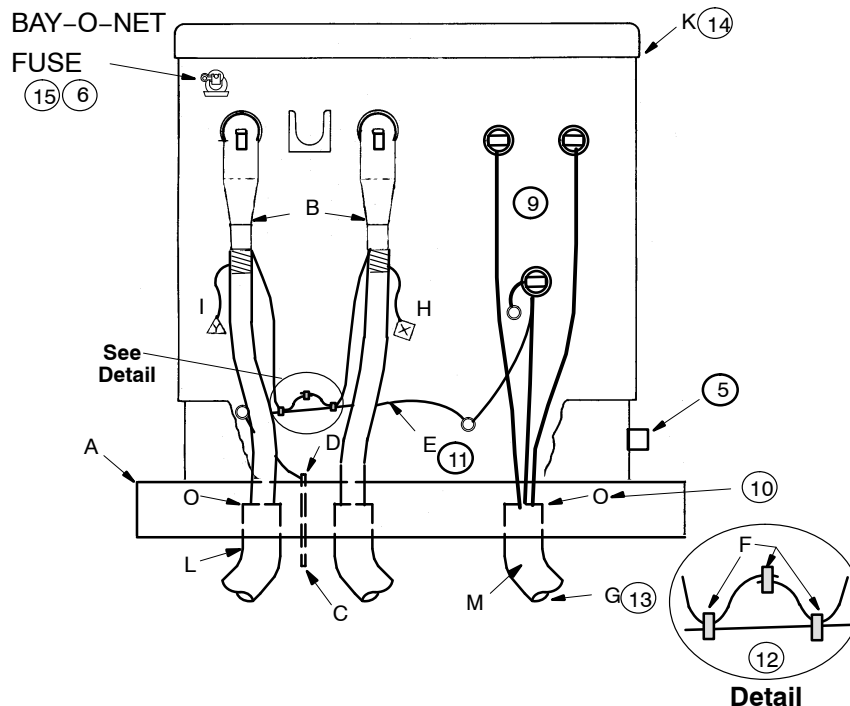
EQUIPMENT - COMPARTMENT
Padmounted – Dead Front – Single Phase Dummy Transformer
For # 2 Al 15 kV Cable Only

51 11 02 **
Sheet 2 of 2

6. In Missouri residential developments, the contractor will install the pad and bends. Use Standard 51 11 02 02.
7. A minimum clearance of 10' shall be provided at the front of the compartment.
8. Faulted circuit indicators (Stock #60-55-001) may be installed on the out-going cables.

		Std. / Stk. No.	Description	51 11 02 **	01	02*
6	A	12 06 198	Pad – Transf. 42" x 42" x 4", Composite		1	
	B	42 34 62 01	Termination – Elbow, #2		2	2
	C	23 63 069	Rod – Grd. 5/8" x 8'		1	1
	D	17 52 032	Clamp – Grd. Rod. 5/8" for #8 – 1/0		1	1
	E	18 52 025	Wire – Cu., # 2 S.D. (ft.)		10	10
	F	17 54 373	Connector – Split Bolt		3	3
	@ G	16 51 079	Tag – Letter X, Red Sq.		1	1
	@ H	16 51 080	Tag – Letter Y, Blue Tri.		1	1
	J	17 55 228	Bushing – Feed Thru		1	1
	K	54 07 235	Enclosure – Primary Pedestal		1	1
6	L	12 51 173	Bend – Plastic, 3", 36" Rad		2	
		12 51 176	Bend – Plastic 4", 36" Rad			
	M	23 56 041	Bracket – Hold Down		4	4

*See Note 6



Construction Note(s):

1. Train cables and provide enough concentric neutral length to allow movement of the elbows from the bushings to the parking stand.
2. Bolts and hold down plates for securing the transformer to the pad are provided with the pad.
3. See DCS **34 21 05 **** for pad installation.
4. For 4/0 cable, substitute elbow termination with DCS **42 34 62 02**.
5. External provision for grounding – for use by communication companies.
6. Positions of bay-o-net fuses may vary.
7. For most Illinois transformer installations, Ameren will install the pad and bends–see DCS **51 11 04 04**. For Missouri residential and commercial developments the contractor will install the pad and bends – see DCS **51 11 04 02**. For some Missouri individual transformer installations, Ameren will install the pad and bends–see DCS **51 11 04 03**.
8. Elbow arresters should be installed at all open points including the last transformer in a radial feed – see DCS **54 11 01 01**.
9. Transformers are delivered with slip-fit set screw type lugs on each secondary bushing stud. The lugs have eight positions and will accommodate cables up to 500 kcmil. If larger cables are used, the lugs can be replaced with five position lugs that will accommodate cables up to 750 kcmil. For 75kVA and smaller transformers use Stock #17-55-230. For 100kVA and larger transformers use Stock #17-55-229.
10. If bends are cut off, apply a bell end coupling (O) over the end of each conduit.
11. Run continuous length of #2 bare CU ground wire to connect an open port of the X2 connector, to the two lower tank grounds, and to the ground rod
12. Grounding practices are different in Missouri and Illinois.
 In Missouri – Connect cable concentric neutrals to the #2 bare CU ground and then end--to--end using 3 split bolt connectors as shown in this detail.
 In Illinois – Cable Concentric neutrals may be single-point connected to the #2 bare CU ground using hot-line clamps or split bolt connectors.

UG EQUIPMENT TRANSFORMERS
 Padmounted–Single–Phase 2400, 7200, 7620, 7970 Volts
 25 KVA And Above

51 11 04 **

Sheet 2 of 2

51 11 04 01	Ameren Installed With Lightweight Pad
51 11 04 02	Contractor Installed With Heavy Pad
51 11 04 03	Ameren Installed With Heavy Pad
51 11 04 04	Ameren Installed With Lightweight Pad and Conduit (See note 13)

		Std. / Stk. No.	Description	51 11 04 **	01	02	03	04
7	A	34 21 05 01	Pad, Transformer, Lightweight		1	–	–	1
		34 21 05 02	Pad, Transformer, Heavy		–	C	1	–
4	B	42 34 62 01	Elbow, Termination, #2 Al.		2	2	2	2
	C	23 63 069	Rod, Ground, 5/8" x 8'		1	1	1	1
	D	17 52 032	Clamp, Ground Rod, 5/8" For #8 – 1/0		1	1	1	1
	E	18 52 025	Wire, Cu., #2 S.D. (ft.)		5	5	5	5
	F	17 54 373	Connector, Split Bolt		3	3	3	3
	G	12 01 263	Conduit, 2–1/2", SCH 40 PVC, 10' Length		–	–	–	2
13 @	H	16 51 079	Tag, Letter "X", Red Sq.		1	1	1	1
	I	16 51 080	Tag, Letter "Y", Blue Tri.		1	1	1	1
14 @	K	MR – – – X	Transformer, 7200V or		1	1	1	1
		MZ – – – X	Transformer, 7200V or		1	1	1	1
		TR – – – X	Transformer, 7970V or		1	1	1	1
		WR – – – X	Transformer, 2400V x 7200V or		1	1	1	1
		SR – – – X	Transformer, 7620V or		1	1	1	1
		SZ – – – X	Transformer, 7620V or		1	1	1	1
		ZR – – – X	Transformer, 2400V x 7200V x 7620V or		1	1	1	1
		ZZ – – – X	Transformer, 2400V x 7200V x 7620V		1	1	1	1
13 @	L	12 51 173	Bend, Conduit, PVC, 3", 36" Rad. (Primary)		2	C	2	2
		12 51 173	Bend, Conduit, PVC, 3", 36" Rad. (Secondary & 400A Service)		–	C	–	–
8 @	M	12 51 331	Bend, Conduit, PVC, 1 1/2", 24" Rad. (Streetlight)		–	C	–	–
		12 51 264	Bend, Conduit, PVC, 2 1/2", 24" Rad. (200 A Service)		–	–	–	2
10 @	N	54 11 01 01	Arrester, 10kV Elbow or		2	–	2	2
		54 11 01 03	Arrester, 10kV Parking Stand		1		1	1
	O	40 83 492	Coupling–Conduit, PVC, Bell End, 1 1/2"		–	C	–	–
		12 51 398	Coupling–Conduit, PVC, Bell End, 2 1/2"		–	–	–	–
		12 51 008	Coupling–Conduit, PVC, Bell End, 3"		2	C	2	2
	P	49 55 520	Marker, Buried conduit, Red		–	–	–	2

"C" = Contractor Installed Materials (Missouri Only)

Engineering Note(s):

13. DCS 51 11 04 04 is required in Illinois for residential subdivision developments when the transformer is placed on the property line. It includes Item M (12 51 264), Item G (12 01 263) and item P (49 55 520) for future use.

14. See DCS **13 00 01 02** for single–phase padmount transformer selection.
 See DCS **13 00 04 01** for typical transformer dimensions, weight, and oil volumes.

Operating Note(s):

15. See DCS **59 51 53 40** for bay–o–net fuse operation and replacement.

**DISTRIBUTION
 CONSTRUCTION STANDARDS**

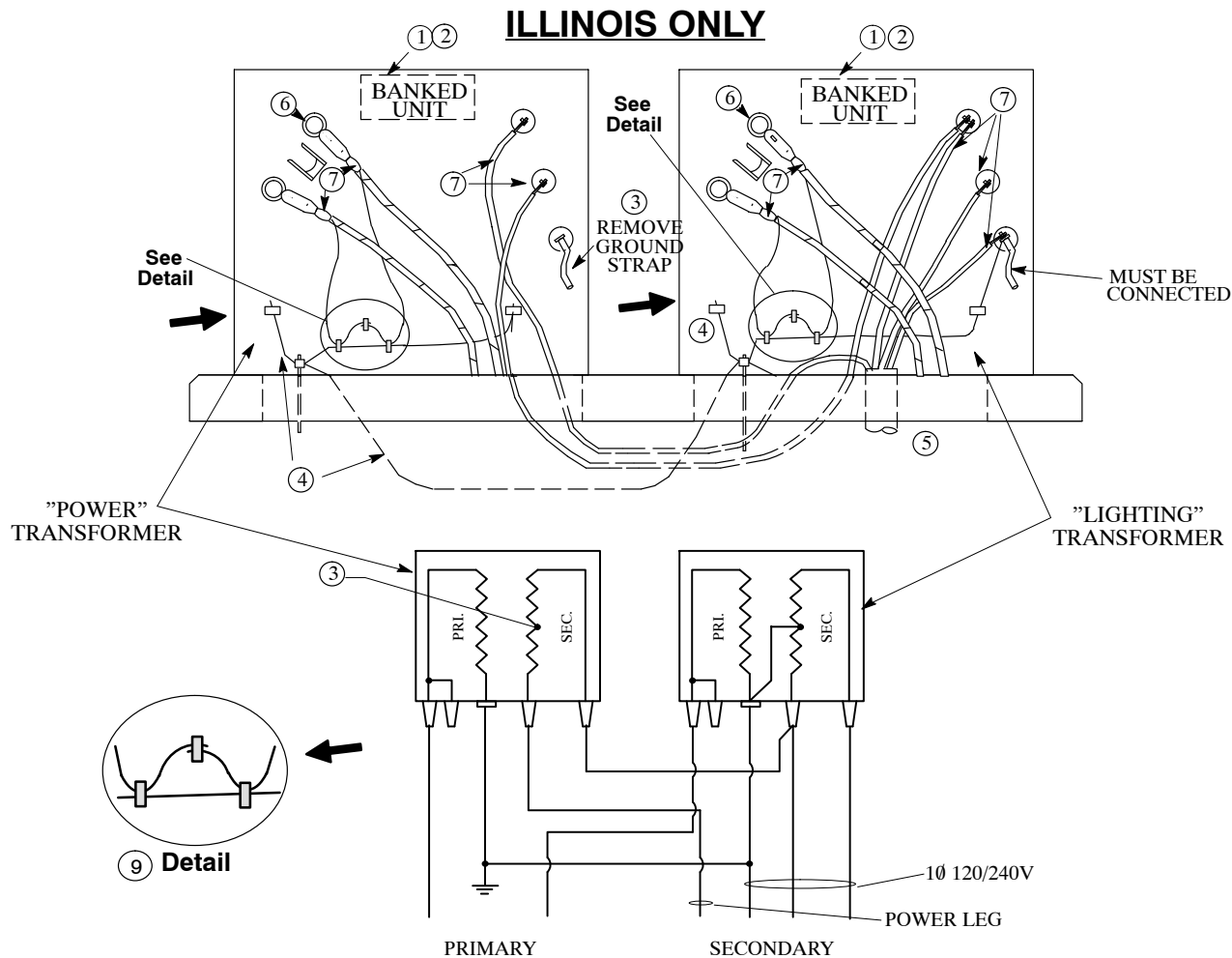


ENG: DG
 REV. NO: 21
 REV. DATE: 07/01/20

EQUIPMENT – TRANSFORMERS
Open WYE Primary
Two Single Phase Padmount Transformers

51 11 05 01

Sheet 1 of 1

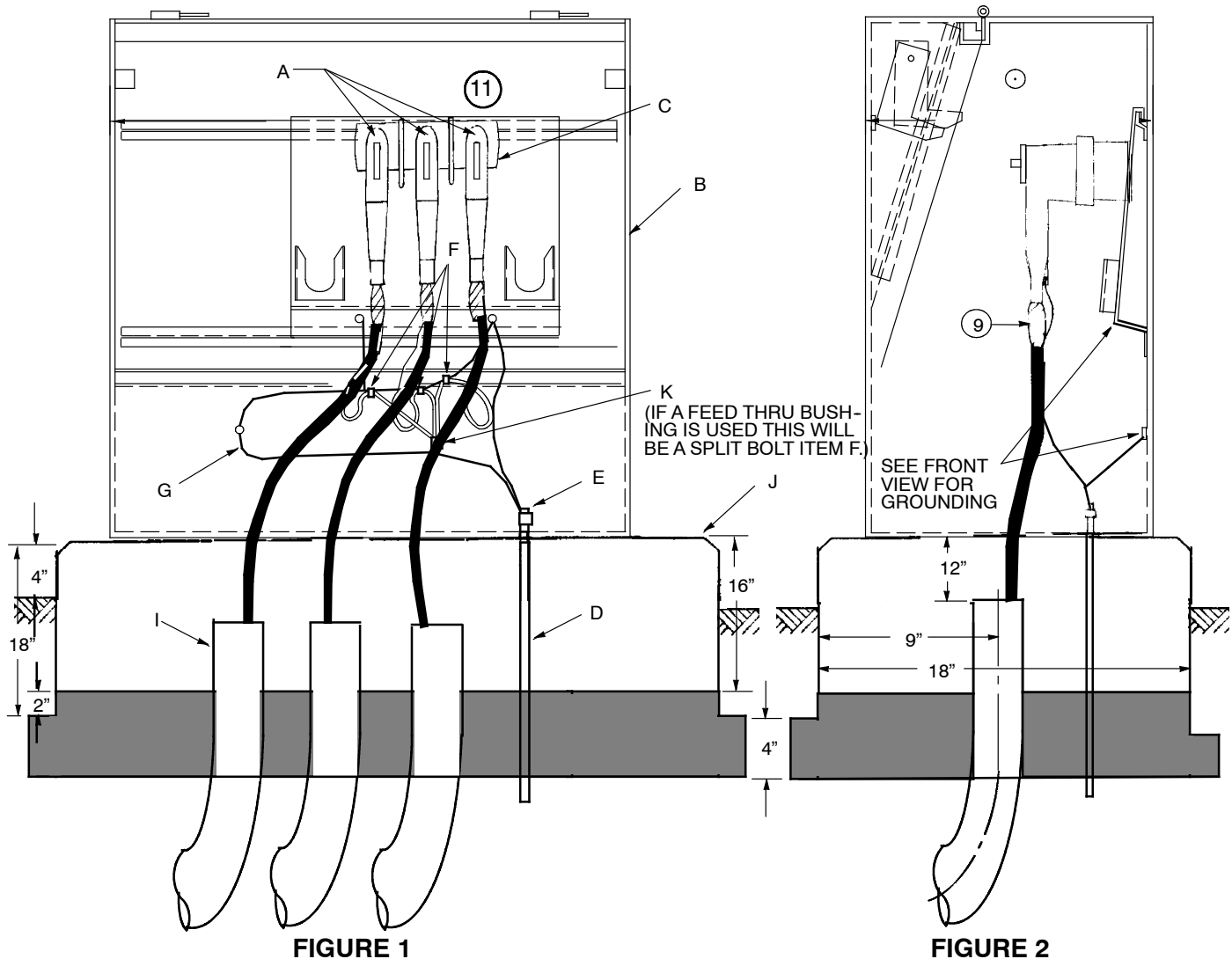


NOTES:

1. This installation should only be used where three primary phases are not available. 120/240 volt, 3-phase, 4-wire, open delta service is provided with this connection.
2. Apply "BANKED UNIT" label in secondary compartment of both transformers. Use label stock #16-04-979.
3. REMOVE THE GROUND STRAP FROM THE SECONDARY NEUTRAL LUG OF THE POWER TRANSFORMER AND INSULATE THE NEUTRAL TERMINAL LUG WITH TAPE. If the transformer does not have an insulated secondary neutral terminal (no bushing), do not use as power transformer because this would require getting inside the transformer and disconnecting the secondary neutral winding.
4. Primary concentric neutral shall be grounded to ground rod and transformer case.

CAUTION: The transformer cases and ground rods must be interconnected before the transformers are energized.

5. The customer must supply wire of sufficient length to extend from the lighting to the power transformer.
6. When primary loop is normally left open, use a parking stand arrester (Stk.# 10-01-151) in the parking stand and install an elbow arrester (Stk. # 10-01-138) on the unused transformer bushing.
7. Install transformer identification numbers and cable identifiers.
8. Primary cable risers and terminators should originate from the same pole. Cables should run along the same route and in the same trench if possible.
9. Connect cable concentric neutrals to the #2 bare CU ground and then end-to-end using 3 split bolts.



NOTES:

1. An initial depth of 18" shall be excavated and all loose soil shall be removed or tamped. The length and width of the hole should be sized to allow a minimum of 6" of clearance on all sides.
2. To install the 36" radius bends, an increase in the initial excavation depth will be required. After the bends have been installed, crushed stone screening shall be placed and tamped to the level shown in Figure 1.
3. The final depth should be adjusted to provide 4" of exposed ground sleeve pad at final grade.
4. Stabilize the ground sleeve pad over the conduits before backfilling so that there will be no shifting. Provide 12" of space between the load bearing surface of the ground sleeve pad and the end of each conduits. See Figure 2.
5. To further stabilize the ground sleeve pad and the bends, place additional screening inside the ground sleeve pad and hand tamp in place.
6. Backfill with loose material, DO NOT backfill next to the ground sleeve pad with chunks of material or rocks. Pack loose backfill by foot tamping and do not tamp excessively close to the ground sleeve pad sides. NOTE: Hydraulic tamping is not recommended.
7. To install 3-way or 4-way junctions, remove the mounting plate from the enclosure. Mount 3-way junctions using the two "U" straps and bolts furnished with the junctions. Mount 4-way junctions using the three "U" straps and bolts furnished with the junction. Mount the junctions so that the center line is approximately 24" from the top of the pad. After the junction is installed, replace the mounting plate. Secure the plate in a convenient location.

EQUIPMENT - ENCLOSURE
2-Way, 3-Way, 4-Way Primary Pedestal
15kV, 200 Amp Loadbreak, Single Phase (For #2Al 15 kV Only)

51 11 06 **

Sheet 2 of 2

NOTE: If only two cables will be installed, use a feed thru bushing. Place the feed thru bushing into one of the parking stands. If the installation is to be a dummy transformer, see Dist. Std. **51 11 02 01**.

8. Train cables so that elbows can be operated safely and easily. Ground as shown.
9. Remove the shipping covers from the junctions and wipe the surfaces clean. Apply silicone grease (Stock #31-51-050) before installing a loadbreak elbow, insulating cap, or lightning arrester.
10. **CAUTION:** If all junction positions are not used, a high voltage insulating cap (Stock #17-55-227) must be installed on the unused positions.
DO NOT ENERGIZE a junction with a shipping cover in place. Covers are only intended to keep the bushing interfaces clean during shipping and handling.
11. 10' minimum clearance shall be provided at the front of the primary pedestal.
12. Faulted circuit indicators should be installed on the elbows at the cable entrance. All concentric neutral wires must be outside of the faulted circuit indicator closed core CT. Faulted circuit indicators should be installed on the out-going cables.
13. In Missouri residential developments, the contractor will install the sleeve and bends. See Stds. 51 11 06 04 thru 06.
14. Lightning protection should be installed at open points. See Dist. Std. **54 11 01 ****.
15. If bends are cut off apply a bell end coupling (M) over the end of each conduit.

		Std./ Stk. No.	Description	51 11 06 **	01	02	03	04*	05*	06*
	A	42 34 62 01	Termination - Elbow, #2		2	3	4	2	3	4
	B	54 07 235	Enclosure - Primary Pedestal		1	1	1	1	1	1
	C	17 07 137	Junction - Load Break 3-way			1			1	
		17 07 138	Junction - Load Break 4-way				1			1
	D	23 63 069	Rod - Grd. 5/8" x 8'		1	1	1	1	1	1
	E	17 52 032	Clamp - Grd Rod 5/8" For #8 - 1/0		1	1	1	1	1	1
	F	17 54 373	Conector - Split Bolt		3	3	4	3	3	4
	G	18 52 025	Wire - Cu. #2 S.D. (ft.)		12	12	12	12	12	12
	H	17 55 228	Bushing - Feed Thru		1			1		
	I	12 51 173	Bend - Plastic, 3" 36" Rad		2	3	4			
		12 51 176	Bend - Plastic, 4" 36" Rad							
@	J	12 06 134	Pad - Ground Sleeve		1	1	1			
	K	17 54 140	Connector - 2 Bolt			1	1		1	1
@	L	60 55 001	Indicator - Faulted Circuit		1	2	3	1	2	3
@	M	12 51 008	Coupling - Conduit, Plastic, Bell End, 3"		2	3	4			
		12 51 254	Coupling - Conduit, Plastic, Bell End, 4"		2	3	4			

*See Note 13.

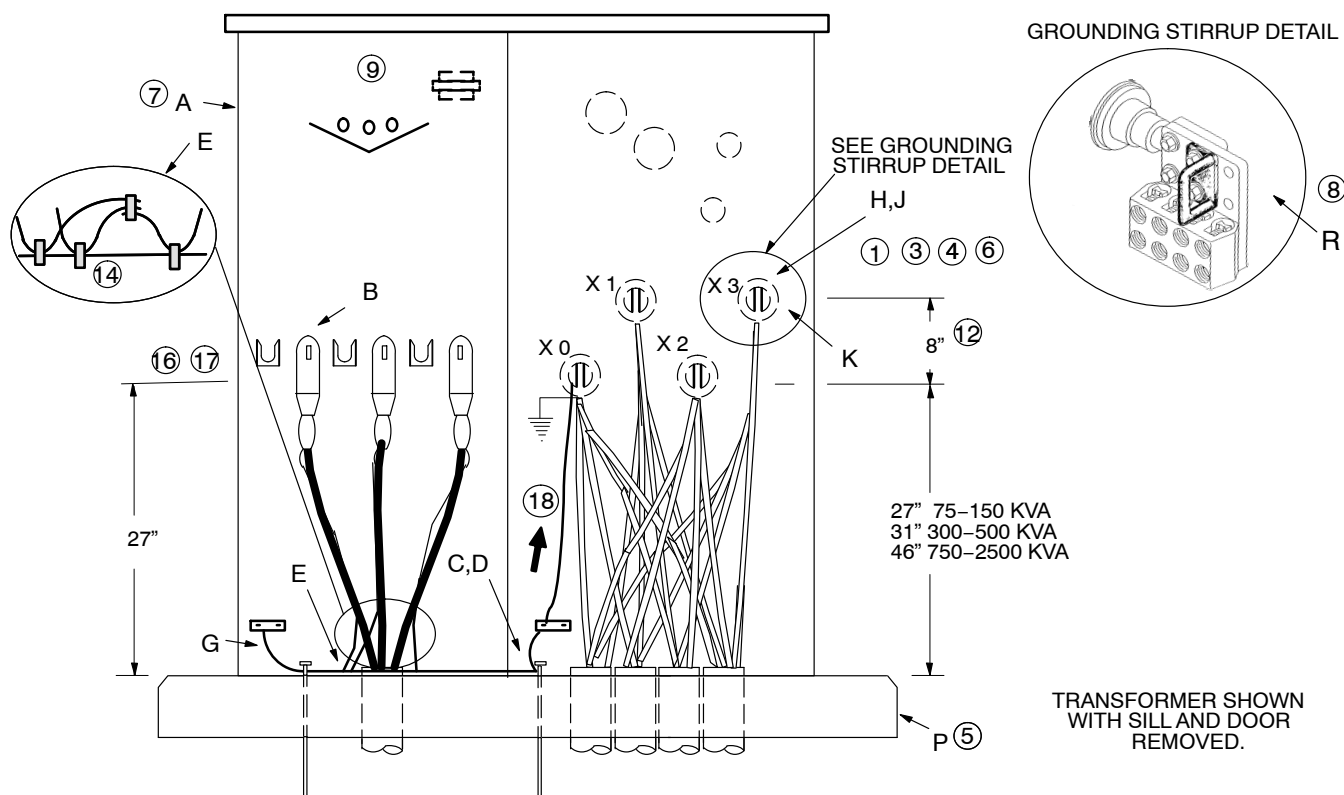
EQUIPMENT – TRANSFORMERS

Padmounted – Dead Front – Three Phase

Radial Feed 75 Through 2500 KVA – 15kV and Below

51 12 00 **

Sheet 1 of 3



NOTES:

1. When installing secondary lugs use the maximum number of mounting holes that will align with the spade holes.
2. Provide enough concentric neutral length to attach to ground and also allow movement of the elbow from the bushing to the parking stand.
3. Stainless steel machine bolts and belleville spring washers are required for bolting aluminum lugs to secondary terminals. Clean the lugs and terminals and apply inhibitor to the mating interfaces. See DCS 59 52 00 43 for Belleville washer installation instructions. Everdur bolts and brass washers are to be used for bolting copper lugs to secondary terminals.
4. Preferred number of secondary cables per terminal is six or less. In no case shall the number of cables per terminal exceed twelve.
5. See DCS 34 21 05 04 or 34 21 05 05 for pad installations. See also DCS 34 21 04 05 if vault is needed for cable training.
6. Verify that lugs are available for specific operating company.
7. See DCS 13 00 04 01 for typical dimensions, weights, and gallons of oil.
8. If the grounding stirrup is installed, longer bolts may be required.
9. Some transformers may have Bay-O-Net fuses. See DCS 59 51 53 40.
10. Install ground rod clamp 3" below top of rod to provide space for attaching ground set.
11. 480 Volt Three Wire Service From 480Y/277 Volt Four Wire Transformer

CAUTION: DO NOT MAKE THIS CONVERSION ON WYE-WYE TRANSFORMERS WITH INTERNALLY CONNECTED PRIMARY AND SECONDARY NEUTRALS.

a. If 480 volt three-wire grounded is required, follow these steps to convert a 480Y/277 volt four-wire transformer.

- Remove the secondary neutral ground strap.
- Tape the secondary neutral terminal to prevent accidental contact and any misunderstanding as to which terminals are being used and the type service being provided.

- Run a #2 copper lead from the "A" phase secondary terminal to the tank ground connector. Ground the transformer tank to a driven ground rod and to the common system neutral (if present).

CAUTION: AFTER THE "A" SECONDARY TERMINAL IS ENERGIZED, THE TAPED NEUTRAL TERMINAL IS ENERGIZED.

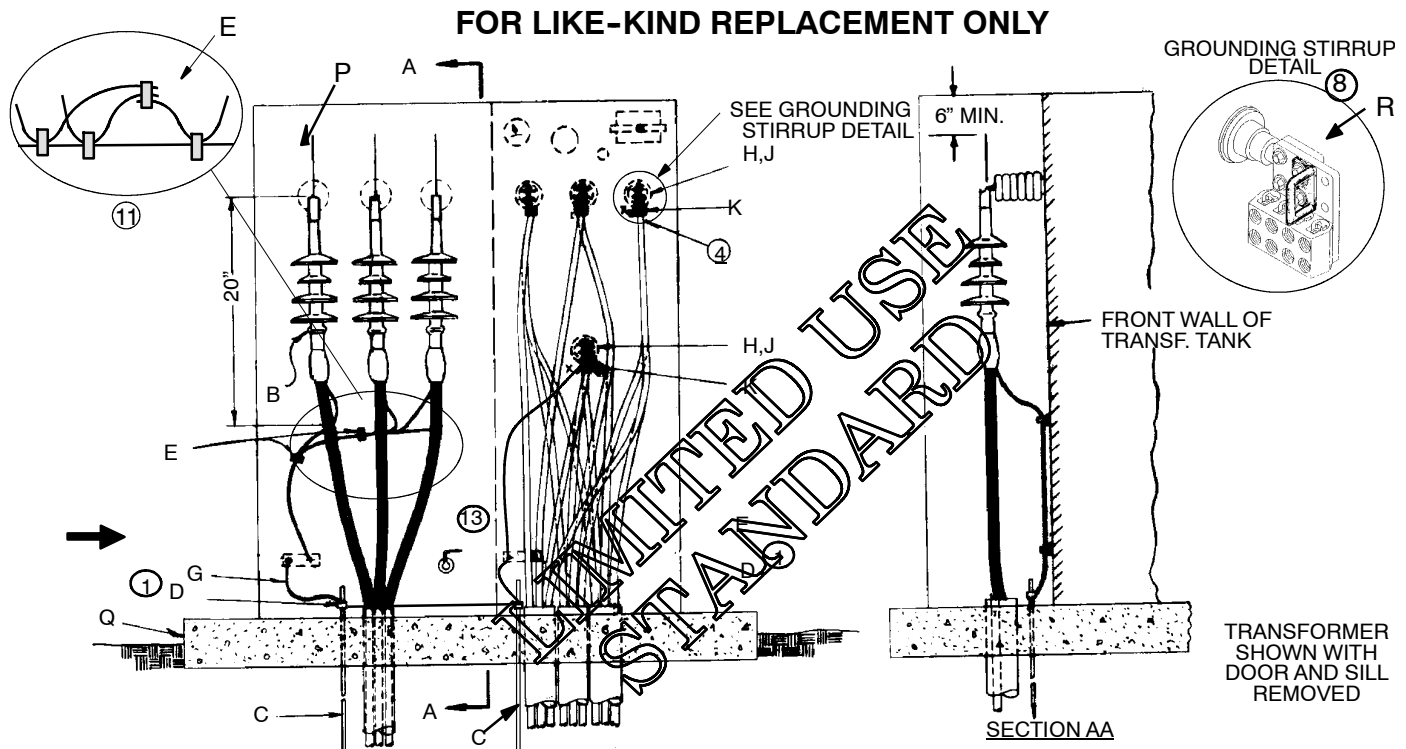
- Before connecting the customer's cable, determine which cable the customer has grounded (if any) and connect that cable to the now grounded "A" phase secondary terminal.
- b. If 480 volt three-wire ungrounded service is required, follow these steps to convert a 480Y/277 volt four-wire transformer:
- Remove the secondary neutral ground strap.
 - Ground the transformer tank to the driven ground rod and to the common system neutral (if present).
12. 150kVA and smaller transformers manufactured prior to mid-2010 will have 6" vertical spacing between secondary bushings.
 13. For non-standard primary cable sizes, see DCS **42 34 62 **** for proper elbow termination. 4kV transformers 1500kVA and larger require 600 amp non-load break terminations (DCS **42 34 64 ****).
 14. Connect cable concentric neutrals to the #2 bare CU ground, then end-to-end using 4 split bolt connectors.
 15. The Aluminum lugs can be used for Aluminum or Copper conductors.
 16. Three-phase radial-feed padmount transformers connected to EPR insulated primary cable do not need arresters. If connected to XLPE insulated primary cable, replace the single-bushing inserts with double-bushing inserts and install elbow lightning arresters.
 17. Fault current indicators can be installed to aid in determining if a fault has occurred in the transformer or the cable feeding the transformer.
 18. Run continuous length of #2 bare CU ground wire to connect an open port of the X0 connector to the two lower tank grounds and to the ground rods.

EQUIPMENT – TRANSFORMERS
 Padmounted – Dead Front – Three Phase
 Radial Feed 75 Through 2500 KVA – 15kV and Below

51 12 00 **

Sheet 3 of 3

		Stnd. / Stk. No.	Description	51 12 00 **	
				02	04
@7,9	A		Transformer, Three-Phase, Dead Front	1	1
13	B	42 34 62 01	Termination, 15kV, #2 Elbow	3	
		42 34 62 02	Termination, 15kV, #4/0 Elbow		3
	C	23 63 027	Rod, Ground, 5/8" x 8'	2	2
	D	17 52 032	Clamp, Ground Rod, 5/8" For #8 – 1/0	2	2
14	E	17 54 373	Connector, Split Bolt, #2 Str. CU.	3	3
14	E	17 54 182	Connector, Split Bolt, #3 Str. CU.	1	1
18	G	18 52 025	Wire, Copper, #2 Solid, Soft Drawn	15	15
@3,8	H	21 56 078	Bolt, Machine, 1/2" x 2" Stainless	–	–
		21 53 022	Bolt, Machine, 1/2" x 1-3/4", Everdur	–	–
		21 54 316	Bolt, Machine, 1/2" x 2-1/2", Stainless	–	–
		21 56 075	Bolt, Machine, 1/2" x 1-1/2", Stainless	–	–
@3	J	21 75 042	Washer, Round, 9/16", Brass	–	–
		12 56 052	Washer, Belleville Spring, 1/2", S.S.	–	–
		12 56 053	Washer, Flat, 1/2", S.S. (2 ea. per Belleville)	–	–
@4,6,15	K	17 55 177	Lug, CU., 2 – #4/0 to 500 kcmil	–	–
		17 55 176	Lug, CU., 3 – #4/0 to 500 kcmil	–	–
		17 55 180	Lug, CU., 3 – 500 – 1000 kcmil	–	–
		17 55 190	Lug, Alum 1 – 1/0 to 1000 kcmil, Lay-In	–	–
		17 55 289	Lug, Alum 2 – 1/0 to 1000 kcmil, Lay-In	–	–
		17 55 209	Lug, Alum 3 – 1/0 to 1000 kcmil, Lay-In	–	–
		17 55 233	Lug, Alum 6 – 1/0 to 500 kcmil, Lay-In	–	–
		17 55 232	Lug, Alum 6 – 1/0 to 1000 kcmil, Lay-In	–	–
		17 55 343	Lug, Alum 1-1/0-750 kcmil	–	–
		17 55 344	Lug, Alum 2-1/0-750 kcmil	–	–
		17 55 345	Lug, Alum 4-1/0-750 kcmil	–	–
		17 55 346	Lug, Alum 5-1/0-750 kcmil	–	–
		17 55 349	Lug, Alum 6-1/0-750 kcmil	–	–
		17 55 350	Lug, Alum 8-1/0-750 kcmil	–	–
@5	P	12 06 123 12 06 124	Pad, Composite, 75-750 KVA OR Pad, Composite, 1000-2500 KVA	1	1
@8	R	17 55 510	Stirrup, Grounding, Bolted	3	3
@16	S	17 55 265	15kV Bushing Insert, 200A Feed-Thru	3	3
@16	T	10 01 138	10 kV Elbow Arrester	3	3
@16		10 01 244	10kV Bushing Well Arrester	3	3
@17	U	60 55 001	Indicator, Fault Current, 1 Phase	3	3



CAUTION:

YOU MUST MAINTAIN A 6" CLEARANCE FROM THE TOP OF THE STINGER TO THE CABLE COMPARTMENT ROOF. ON SOME SMALLER SIZE TRANSFORMERS, IT MAY BE NECESSARY TO CUT OFF ABOUT 1" OF THE STINGER TO ACCOMPLISH THIS. THE STINGER SHOULD EXTEND ABOVE THE EYEBOLT, NOT BELOW, TO REDUCE STRAIN ON THE AL. CABLE.

NOTES:

1. Install ground rod clamp 3" below top of rod to provide space for attaching ground set.
2. Stainless steel machine bolts and Belleville spring washers required for bolting aluminum lugs to secondary terminals. Clean lugs, terminals and use inhibitor. See DCS **59 52 00 43** for Belleville washer installation instructions. Everdur bolt and brass washer to be used for bolting copper lugs to secondary terminals.
3. Preferred number of secondary cables per terminal is six or less. In no case shall the number of cables per terminal exceed twelve.
4. Secondary connections as shown are for 208Y/120 or 480Y/277. For 480 volt three wire service, see the instructions below.
5. If 750 kcmil Al. cable is used on 1500-2500 KVA 4160 volt transformers, use terminator Stock #17-07-142 and pin terminal Stock #17-54-248.
6. See DCS **13 00 04 01** for typical dimensions, weights, and gallons of oil.
7. See DCS **34 21 05 04**, or **34 21 05 05** for pad installation.
8. If the grounding stirrup is installed, longer bolts may be required.
9. When installing secondary lugs use the maximum number of mounting holes that align with the spade holes.
10. Verify that lugs are available for specific operating company.G

480 VOLT THREE WIRE SERVICE FROM 480Y/277 VOLT FOUR WIRE TRANSFORMER

CAUTION: DO NOT MAKE THIS CONVERSION ON TRANSFORMERS CONNECTED WYE-WYE.

- If an external ground strap is connected to the secondary neutral (Xo) terminal, it must be removed.
- Tape the secondary neutral terminal to prevent accidental contact and any misunderstanding as to which terminals are being used and the type service being provided.
- Run a #2 copper lead from the "A" phase secondary terminal to the tank ground connector. Ground the transformer tank to a driven ground rod and to the common system neutral (if present).

EQUIPMENT - TRANSFORMERS
Padmounted – Live Front – Three Phase
Radial Feed – 15kV and Below

51 12 01 **

Sheet 2 of 3

- Before connecting the customer's cable, determine which cable the customer has grounded (if any) and connect that cable to the now grounded "A" phase secondary terminal.

CAUTION: After the "A" phase secondary terminal is energized, the taped neutral terminal is energized.

11. Connect cable concentric neutrals to the #2 bare CU ground, then connect end-to-end using 4 split bolt connectors.
12. The Aluminum lugs can be used for Aluminum or Copper conductors.
13. Run continuous length of #2 bare CU ground wire to connect an open port of the X0 connector to the two lower tank grounds and to the ground rods.

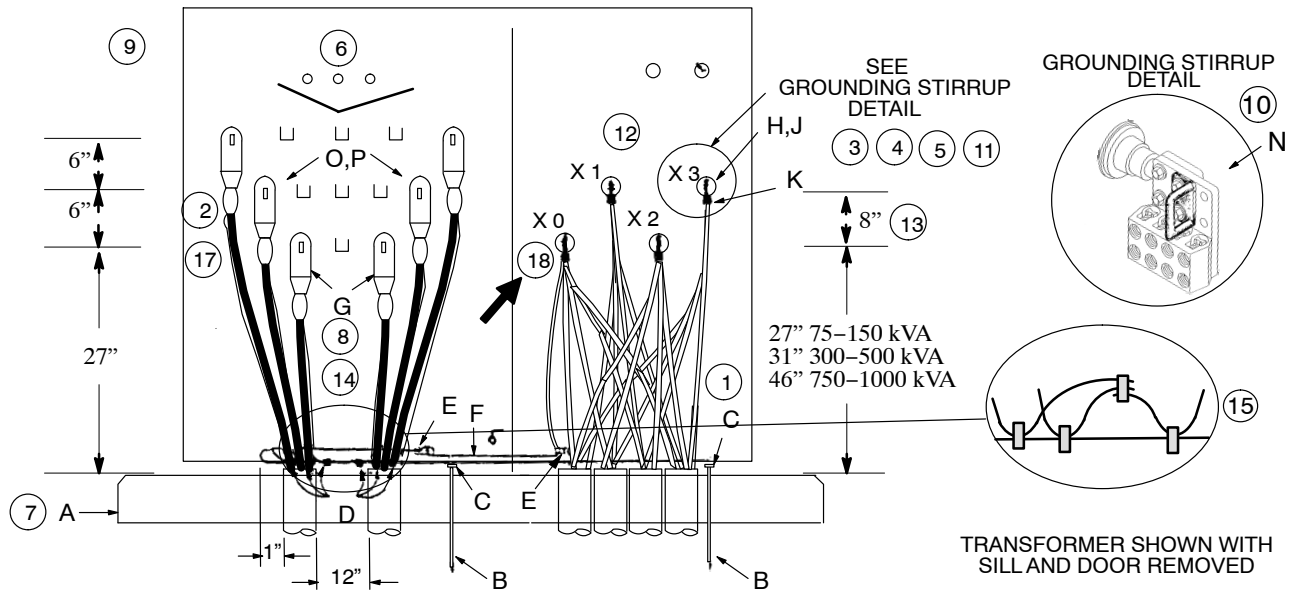
EQUIPMENT - TRANSFORMERS
 Padmounted - Live Front - Three Phase
 Radial Feed - 15kV and Below

51 12 01 **

Sheet 3 of 3

		Std. / Stk. No.	Description	51 12 01 **	02	04
@			Transformer, Three Phase		1	1
	B	17 07 145	Termination, 15kV, #2-4/0		3	3
	C	23 63 069	Rod, Ground, 5/8" x 8'		2	2
	D	17 52 032	Clamp, Ground Rod, 5/8" For #8 - 1/0		2	2
	E	17 54 373	Connector, Split Bolt, #2 Str. CU.		3	3
		17 54 182	Connector, Split Bolt, 3-#2 Str. CU		1	1
	G	18 52 025	Wire, Copper, #2 Solid, Soft Drawn		15	15
	H	21 56 078	Bolt, Machine, 1/2" x 2" Stainless		-	-
		21 53 022	Bolt, Machine, 1/2" x 1-3/4", Everdur		-	-
		21 54 316	Bolt, Machine, 1/2" x 2-1/2", Stainless		-	-
		21 56 075	Bolt, Machine, 1/2" x 1-1/2", Stainless		-	-
	J	21 75 042	Washer, Round, 9/16", Brass		-	-
		12 56 052	Washer, Belleville Spring, 1/2", S.S.		-	-
		12 56 053	Washer, Flat, 1/2", S.S. (2 ea. per Belleville)		-	-
	K	17 55 177	Lug, CU., 2 - #4/0 to 500 kcmil		-	-
		17 55 176	Lug, CU., 3 - #4/0 to 500 kcmil		-	-
		17 55 180	Lug, CU., 3 - 500 to 1000 kcmil		-	-
		17 55 190	Lug, Alum., 1 - 1/0 to 1000 kcmil, Lay-In		-	-
		17 55 289	Lug, Alum., 2 - 1/0-1000 kcmil, Lay-In		-	-
		17 55 209	Lug, Alum 3-1/0 to 1000 kcmil, Lay-In		-	-
		17 55 232	Lug, Alum., 6-1/0 to 1000 kcmil, Lay-In		-	-
		17 55 233	Lug, Alum., 6 - 1/0 to 500 kcmil, Lay-In		-	-
		17 55 343	Lug, Alum 1-1/0 to 750 kcmil		-	-
		17 55 344	Lug, Alum 2-1/0 to 750 kcmil		-	-
		17 55 345	Lug, Alum 4-1/0 to 750 kcmil		-	-
		17 55 346	Lug, Alum 5-1/0 to 750 kcmil		-	-
		17 55 349	Lug, Alum 6-1/0 to 750 kcmil		-	-
		17 55 350	Lug, Alum 8-1/0 to 750 kcmil		-	-
	P	17 54 232	Connector, Pin Terminal #2		3	
		17 54 233	Connector, Pin Terminal 4/0			3
	Q	12 06 123	Pad, Composite, 75-750 kVA OR		1	1
		12 06 124	Pad, Composite, 1000-2500 kVA			
	R	17 55 510	Stirrup, Grounding, Bolted		3	3

Padmounted – Three-Phase – Loopfeed
75 Thru 1000 kVA



NOTES:

1. Install ground rod clamp 3" below top of rod to provide space for attaching ground set.
2. Ensure concentric is long enough to allow movement of elbow from bushing to center parking stand.
3. Stainless steel machine bolts and Belleville spring washers required for bolting aluminum lugs to secondary terminals. Clean lugs, terminals, and use inhibitor. See DCS 59 52 00 43 for Belleville washer installation instructions.
4. Preferred number of secondary cables per bushing is six or less. In no case shall the number of cables per bushing exceed twelve.
5. When installing secondary lugs use the maximum number of mounting holes that align with the spade holes.
6. See DCS 59 51 53 40 for bay-o-net fuse information.
7. See DCS 34 21 05 05 for pad installation. See also DCS 34 21 04 05 if vault is needed for cable training.
8. Elbow arresters should be installed at all open points. DCS 54 11 01 ** shows a single-phase elbow arrester installation. Make adjustments for three-phase use.
9. See DCS 13 00 04 01 for typical transformer dimensions, weights and oil volumes.
10. If the grounding stirrup is installed, longer bolts may be required.
11. Verify that lugs are available for specific operating company.
12. 480 Volt Three Wire Service From 480Y/277 Volt Four Wire Transformer
CAUTION: WYE-WYE TRANSFORMERS WITH INTERNALLY CONNECTED PRIMARY AND SECONDARY NEUTRALS CANNOT BE USED FOR THREE-WIRE SERVICE.

- a. If 480 volt three-wire grounded service is required, follow these steps to convert a 480Y/277 volt four-wire transformer:
 - Remove the secondary neutral ground strap.
 - Tape the secondary neutral terminal to prevent accidental contact and any misunderstanding as to which terminals are being used and the type service being provided.
 - Run a #2 copper lead from the "A" phase secondary terminal to the tank ground connector. Ground the transformer tank to a driven ground rod and to the common system neutral (if present).

CAUTION: After the “A” phase secondary terminal is energized, the taped neutral terminal is energized.

- Before connecting the customer’s cable, determine which cable the customer has grounded (if any) and connect that cable to the now grounded “A” phase secondary terminal.
- b. For ungrounded 480 volt three–wire service:
 - Remove the secondary neutral ground strap.
 - Ground the transformer tank to a driven ground rod and to the common system neutral (if present).
- 13. 150kVA and smaller transformers manufactured prior to mid–2010 will have 6” vertical spacing between secondary bushings.
- 14. For non–standard primary cable sizes, see DCS **42 34 62 **** for proper elbow termination.
- 15. Connect cable concentric neutrals to the #2 bare CU ground, then connect end–to–end using 4 split bolt connect-ors.
- 16. The Aluminum lugs can be used for Aluminum or Copper conductors.
- 17. Fault current indicators can be installed to aid in determining if fault has occurred in the transformer or the cable feeding the transformer.
- 18. Run continuous length of #2 bare CU ground wire to connect an open port of the X0 connector to the two lower tank grounds and to the ground rods.

EQUIPMENT – TRANSFORMERS

51 12 02 **

Padmounted – Three-Phase – Loopfeed
75 Thru 1000 kVA

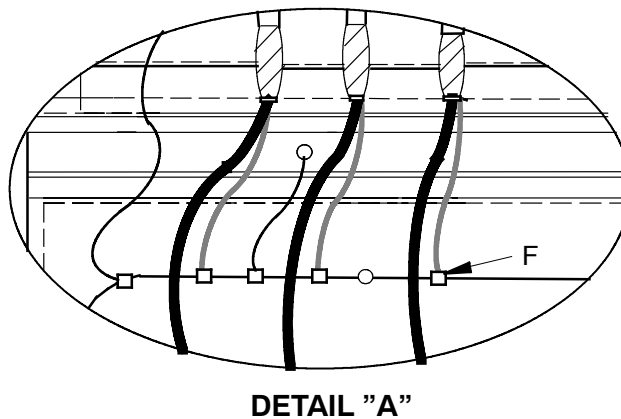
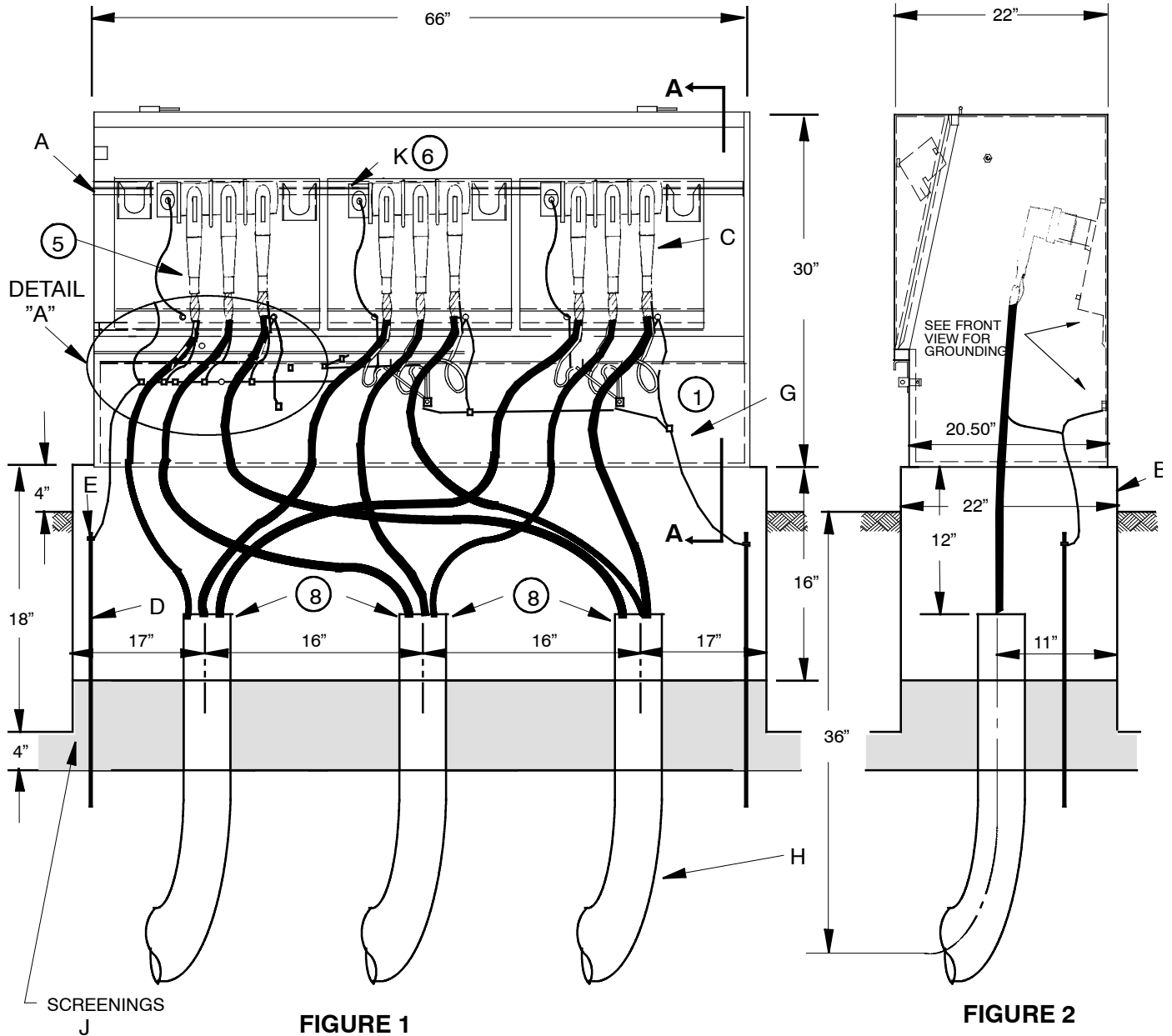
Sheet 3 of 3

		Std. / Stk. No.	Description	51 12 02 **	01	02
@9			Transformer, 3Ø Loopfeed		1	1
@7	A	12 06 124	Pad, Composite, 1000 kVA & below		1	1
	B	23 63 027	Rod, Ground, 5/8" x 8'		2	2
	C	17 52 032	Clamp, Ground Rod, 5/8" For #8 – 1/0		2	2
15	D	17 54 373	Connector, Split Bolt, #2 Str. CU		6	6
		17 54 182	Connector, Split Bolt, 3-#2 Str. CU		2	2
	E	69 58 121	Connector, Ground, Trans. Tank		3	3
18	F	18 52 025	Wire, Copper, #2 Solid S.D.		15	15
14	G	42 34 62 01	Termination, Elbow #2		6	
		42 34 62 02	Termination, Elbow 4/0			6
	H	21 56 075	Bolt, Machine 1/2" x 1-1/2" Stainless		-	-
@3,10		21 56 078	Bolt, Machine 1/2" x 2" Stainless		-	-
		21 54 316	Bolt, Machine 1/2" x 2-1/2" Stainless		-	-
@3	J	12 56 052	Washer, Belleville Spring, 1/2", S.S.		-	-
		12 56 053	Washer, Flat, 1/2", S.S. (2 ea. per Belleville)		-	-
@4,5,11,16	K	17 55 190	Lug, Alum 1-1/0-1000, Lay-In		-	-
		17 55 289	Lug, Alum 2-1/0-1000, Lay-In		-	-
		17 55 209	Lug, Alum 3-1/0-1000 kcmil, Lay-In		-	-
		17 55 233	Lug, Alum 6 – 1/0 to 500 kcmil, Lay-In		-	-
		17 55 232	Lug, Alum 6 – 1/0 to 1000 kcmil, Lay-In		-	-
		17 55 343	Lug, Alum 1-1/0-750 kcmil		-	-
		17 55 344	Lug, Alum 2-1/0 – 750 kcmil		-	-
		17 55 345	Lug, Alum 4-1/0-750 kcmil		-	-
		17 55 346	Lug, Alum 5-1/0-750 kcmil		-	-
		17 55 349	Lug, Alum 6-1/0-750 kcmil		-	-
		17 55 350	Lug, Alum 8-1/0-750 kcmil		-	-
@8	L	54 11 01 01	Arrester, 10kV Elbow		-	-
@10	N	17 55 510	Stirrup, Grounding, Bolted		3	3
@	O	16 51 079	Tag, Letter "X", Red Sq.		3	3
@	P	16 51 080	Tag, Letter "Y", Red Sq.		3	3
@17	Q	60 55 001	Indicator, Fault Current, 1 Phase		3	3

EQUIPMENT - ENCLOSURE
4-Way Primary Pedestal
15kV, 200 AMP Loadbreak, Three Phase

51 12 03 **

Sheet 1 of 2



EQUIPMENT - ENCLOSURE
4-Way Primary Pedestal
15kV, 200 AMP Loadbreak, Three Phase

51 12 03 **

Sheet 2 of 2

INSTRUCTION FOR EXCAVATION AND PLACEMENT OF FIBERGLASS GROUND SLEEVE PAD- STK. NO. 12-06-120

1. An initial depth of 18" shall be excavated and all loose soil shall be removed or tamped. The length and width of the hole should be sized to allow a minimum of 6" of clearance on all sides.
2. To install the 36" radius bends, an increase in the initial excavation depth will be required. After the bends have been installed, crushed stone screenings shall be placed and tamped to the level shown in Figure 1.
3. The final depth should be adjusted to provide 4" of exposed ground sleeve pad at final grade.
4. Stabilize the ground sleeve pad over the conduits before backfilling so that there will be no shifting. Provide 12" of space between the load bearing surface of the ground sleeve pad and the end of each conduit. See Figure 2.
5. To further stabilize the ground sleeve pad and the bends, place additional screenings inside the ground sleeve pad and hand tamp in place.
6. Backfill with loose material, DO NOT backfill next to the ground sleeve pad with chunks of material or rocks. Pack loose backfill by foot tamping and do not tamp excessively close to the ground sleeve pad sides. NOTE: Hydraulic tamping is not recommended
7. Reduce center to center conduit spacing to 13 inches for 4-way installation.
8. If bends are cut off apply a bell end coupling (L) over the end of each conduit.

This installation will not withstand pulling long cable lengths through the bends. If restrained bends are needed, refer to Dist. Std. **31 47 01 ****.

ACCESSORY INSTALLATION

1. Connect concentric neutral wires from each cable to the #2 copper wire connected to the ground rods. Also attach the #2 copper wire to each ground connector in the primary pedestal.
2. Install elbows as required.
3. All exposed bushings must be covered with insulating caps, elbows, or elbow arresters.
4. 10' minimum clearance shall be provided at the front of the primary pedestal.
5. Faulted circuit indicators should be installed at the elbows below the cable entrance. All concentric neutral wires must be outside of the faulted circuit indicator closed core CT. Faulted circuit indicators should be installed on the out-going cables.
6. Cover any open positions with an insulating cap.

		Std. / Stk. No.	Description	51 12 03 **	01
@	A	54 07 297	Enclosure - Primary Pedestal 3 Ø		1
	B	12 06 120	Pad-Ground Sleeve		1
	C	42 34 62 01	Termination - #2 Elbow		As Req'd.
		42 34 62 02	Termination - 4/0 Elbow		As Req'd.
		42 34 62 05	Termination - 1/0 Elbow		As Req'd.
	D	23 63 069	Rod - Ground, 5/8" x 8'		2
	E	17 52 032	Clamp - Ground Rod, 5/8" For #8 - 1/0		2
	F	17 54 373	Connector - Split Bolt		15
	G	18 52 025	Wire - Cu, #2 S. D. (Ft.)		12
@	H	12 51 176	Bend - Plastic, 4" 36" Rad.		3
5@	I	60 55 001	Indicator - Faulted Circuit		As Req'd.
	J		Screenings		As Req'd.
6@	K	17 55 227	Cap - Insulating, 15kV		1
8@	L	12 51 254	Coupling - Conduit, Plastic, Bell End, 4"		3

**DISTRIBUTION
CONSTRUCTION STANDARDS**

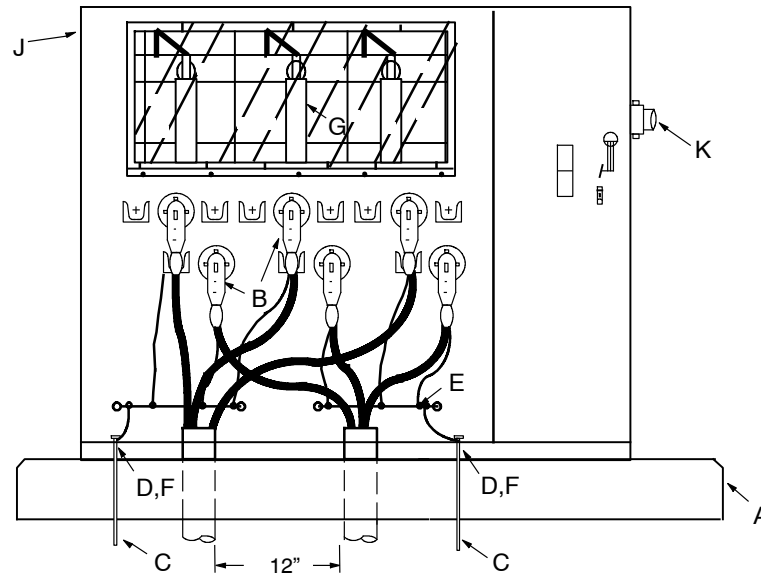


ENG: JMW
REV. NO: 13
REV. DATE: 09/07/17

EQUIPMENT - CAPACITOR BANK - SWITCHED
 Padmounted - 3 Phase - Loop or Radial Feed
 12kV, 600 thru 1800 kVAR

51 12 04 **

Sheet 1 of 1



NOTES:

1. Insure that the concentric neutral wires and the cable is long enough to allow movement of the elbow from bushing to parking stand. Some of the elbows must be raised to the level of the parking stands.
2. OPEN CAPACITOR BANK BEFORE REMOVING ELBOWS.
3. Per the Spec. all padmounted capacitors are supplied with the required fusing plus a set of refills. Fuses listed in this standard are for replacement only. Check the nameplate of the unit to determine the proper fusing.

		Std./Stk. No	Description	51 12 04 **	02	04	06
@	A	12 06 124	Pad - Composite, 7'x 6'x 5"		1	1	1
	B	42 34 62 01	Termination, 15kV, #2 Elbow		6	6	6
		42 34 62 02	Termination, 15kV, 4/0 Elbow		6	6	6
	C	23 63 069	Rod - Ground, 5/8" x 8'		2	2	2
	D	17 52 032	Clamp - Ground Rod, 5/8" For #8 - 1/0		2	2	2
	E	17 54 132	Connector - Two Bolt, #8-350 kcmil		8	8	8
	F	18 52 025	Wire - Copper, #2 Solid S.D.		10	10	10
@ 3	G	20 04 527	Fuse - 65A, Type NX		-	-	-
		20 04 852	Fuse - 1.5A, Type NX		-	-	-
		20 04 853	Fuse - 50A, Type NX		-	-	-
@ 3	H	20 04 480	Fuse - 65A, Type NXC		-	-	-
@ 3	I	20 04 486	Fuse - 40A, Type NXC		-	-	-
	J	69 11 198	Capacitor - 12kV, 600 kVAR, Padmount		1		
		69 11 200	Capacitor - 12kV, 1200 kVAR, Padmount			1	
		69 11 199	Capacitor - 12kV, 1800 kVAR, Padmount				1
@	K	69 11 300	Control, Capacitor, Meter Mount		1	1	1
@	L	69 11 296	Sensor - Neutral Current (Used With Control)		1	1	1

600 kVAR
51 12 04 02

1200 kVAR
51 12 04 04

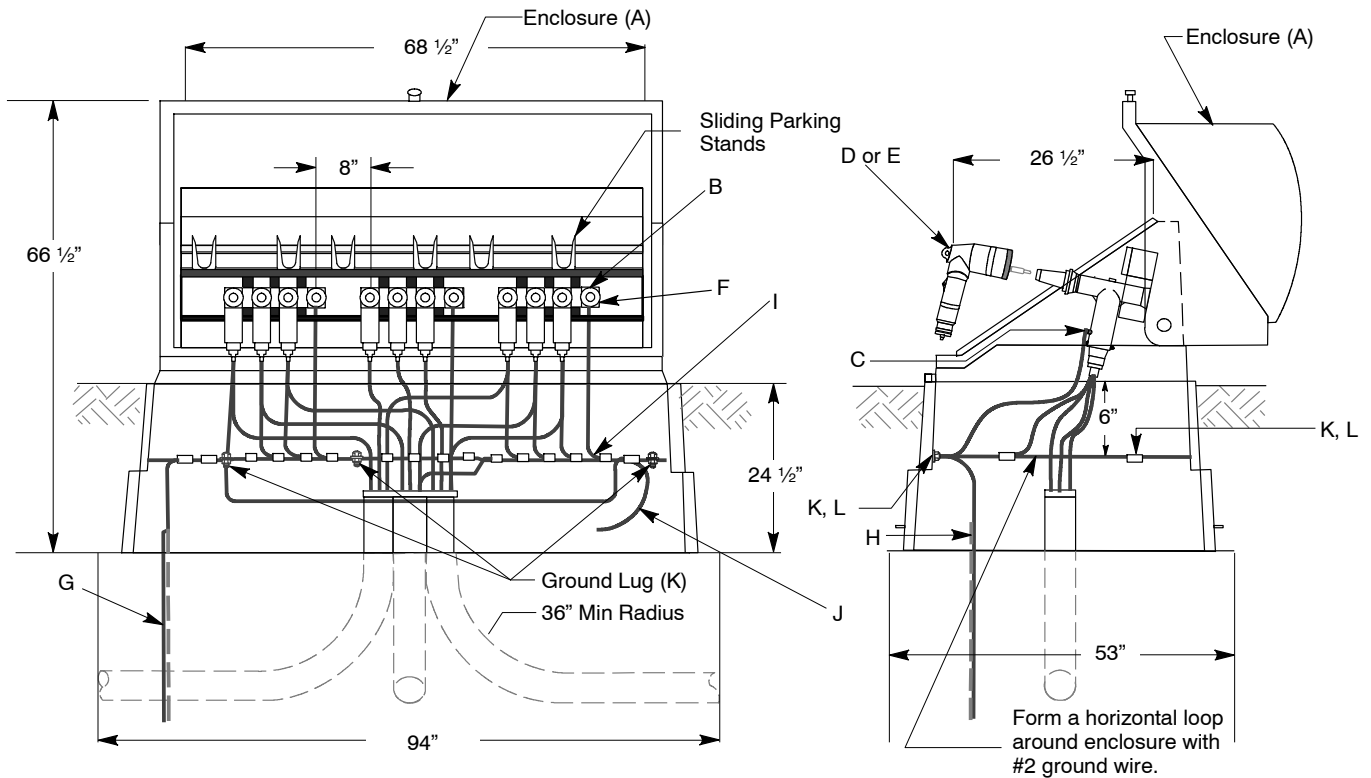
1800 kVAR
51 12 04 06

EQUIPMENT - ENCLOSURE
Primary Pedestal
15kV 600 Amp, Dead-break, Three Phase

51 12 05 **

Sheet 1 of 2

3-Way or 4-Way Dead-break Junction



			Dist. Std. /Stk. No.	Description	51 12 05 **	01	02
		A	54 07 498	Enclosure-Primary Cable Junction, 15 kV, 600 A, 3ph		1	1
		B	17 07 239	Junction - 15 kV, 600 Amp, Bolted, 3-Way w/U Straps		3	
			17 07 242	Junction - 15 kV, 600 Amp, Bolted, 4-Way w/U Straps			3
1	@	C	42 34 64 **	Termination - 15 kV, 600 Amp, 4/0 AWG-750 kcmil		-	-
2	@	D	10 01 138	Arrester - Lighting, Elbow, 10 kV		-	-
2	@	E	17 55 227	Cap - Insulating, 15 kV, 200 Amp		-	-
1	@	F	17 55 386	Cap - Insulating, 15 kV, 600 Amp		-	-
		G	23 63 027	Rod - Ground, 5/8" x 8'		2	2
		H	17 52 032	Clamp - Ground Rod, 5/8", For #8 to 1/0		2	2
		I	17 54 132	Connector - Wire, 8-350 kcmil, CU		11	14
		J	18 52 025	Wire - #2, S.D. (Ft.)		9	9
		K	17 54 435	Connector - Grounding, #8 to 2/0		8	8
		L	21 61 007	Nut - Hex, 1/2", 13 TPI, Everdur		8	8

Notes:

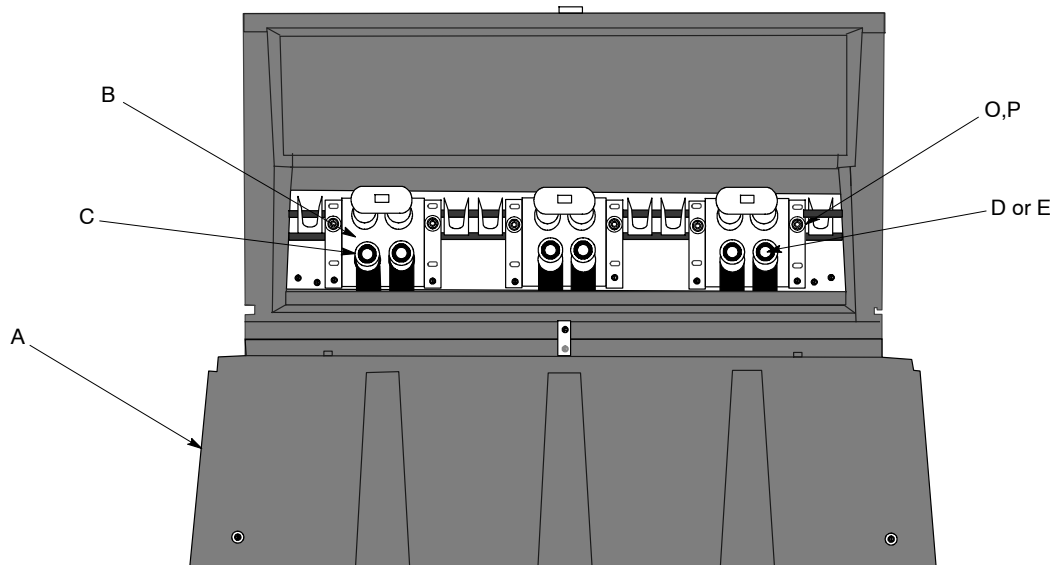
- Each junction position will be covered with either a T-body cable termination or a 600 amp cap.
- Each T-body cable termination will have the rear 200 amp tap covered with either an elbow arrester or a 200 amp cap.

EQUIPMENT - ENCLOSURE
Primary Pedestal
15kV 600 Amp, Dead-break, Three Phase

51 12 05 **

Sheet 2 of 2

CLEER 600 Amp Load-break Connector



			Dist. Std. / Stk. No.	Description	51 12 05 **	03
		A	54 07 498	Enclosure - Primary Cable Junction, 15 kV, 600 A, 3ph		1
		B	17 07 256	Junction - 15 kV, 600 Amp, Load-break, 2 Position Square		3
1	@	C	42 34 64 **	Termination - 15 kV, 600 Amp, 4/0 AWG - 750 kcmil		6
2	@	D	10 01 138	Arrester - Lighting, Elbow, 10 kV		-
2	@	E	17 55 227	Cap - Insulating, 15 kV, 200 Amp, Load-break		-
1	@	F	17 55 386	Cap - Insulating, 15 kV, 600 Amp, Load-break		-
		G	23 63 027	Rod - Ground, 5/8" x 8'		2
		H	17 52 032	Clamp - Ground Rod, 5/8", For #8 to 1/0		2
		I	17 54 132	Connector - Wire, 8-350 kcmil, CU		11
		J	18 52 025	Wire- #2, S. D. (Ft.)		9
3		K	17 05 513	Bushing - Standoff, Double, 15 kV, 600 Amp,		3
3		L	17 55 835	Cap - Insulating, 15 kV, 600 Amp, Load-break		6
		M	17 54 435	Connector - Grounding, #8 to 2/0		8
		N	21 61 007	Nut - Hex, 1/2", 13 TPI, Everdur		8
		O	21 56 078	Bolt - Hex, 1/2", Stainless, w / Nut		6
		P	21 75 105	Washer - 1/2", Stainless, 1 1/4" OD		6

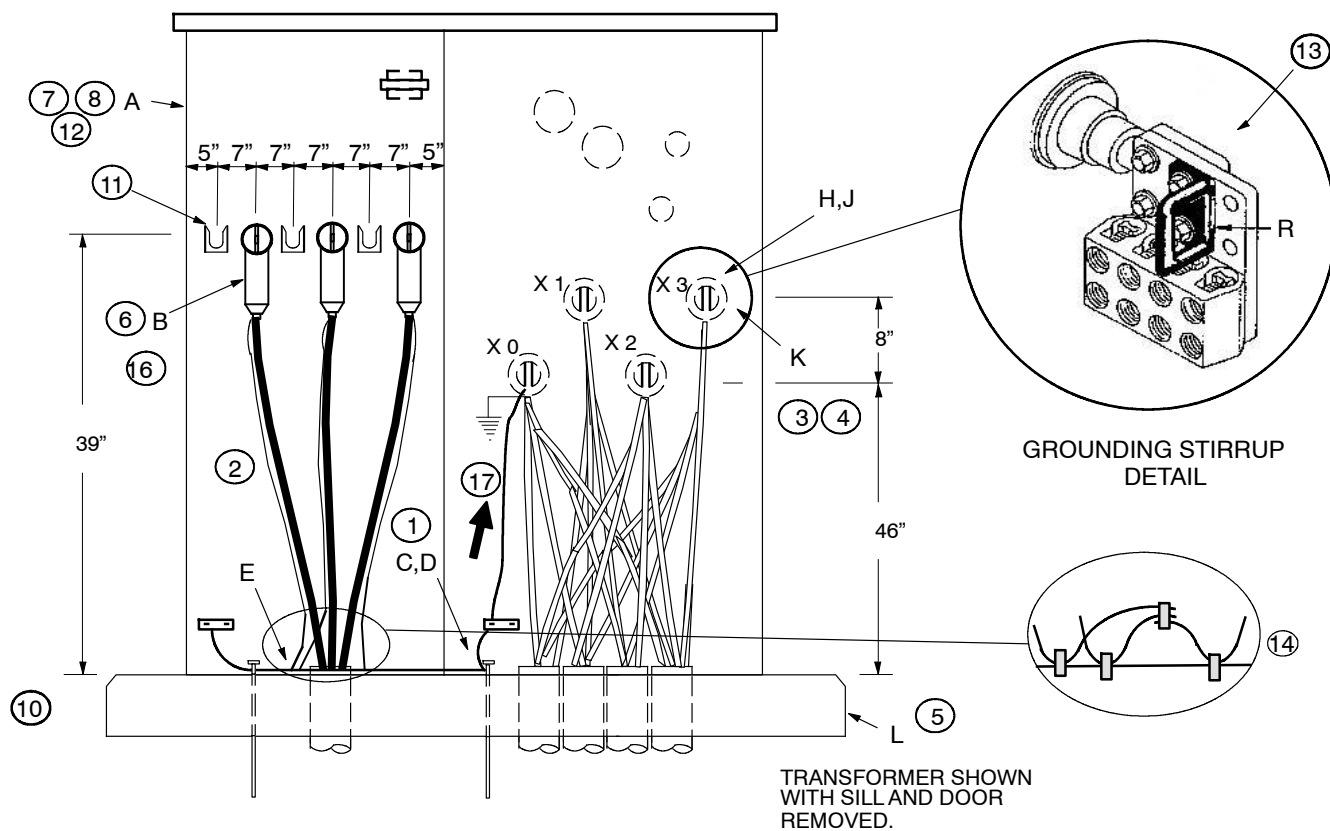
Notes:

- Each junction position will be covered with either a T-body cable termination or a 600 amp dead-break cap.
- Each T-body cable termination will have the rear 200 amp tap covered with either an elbow arrester or a 200 amp cap.
- Three double standoff bushings will be left in each junction for resting the 600 amp link when pulled open. These double standoff bushings shall be covered with six load-break caps when the 600 amp link is closed in.

EQUIPMENT - TRANSFORMERS
Padmounted - Dead Front - Three-Phase
Radial Feed 1500 Through 3000 KVA - 35kV

51 12 34 01

Sheet 1 of 2



NOTES:

1. Install ground rod clamp 3" below top of rod to provide space for attaching ground set.
2. Provide enough concentric neutral length to attach to ground and also allow movement of the elbow from the bushing to the parking stand.
3. Stainless steel machine bolts and belleville spring washers are required for bolting aluminum lugs to secondary terminals. Clean the lugs and terminals and apply inhibitor to the mating interfaces. See Dist. Std. **59 52 00 43**. Everdur bolts and brass washers are to be used for bolting copper lugs to secondary terminals.
4. Preferred number of secondary cables per terminal is six or less. In no case shall the number of cables per terminal exceed twelve.
5. See DCS **34 11 00 00**, for poured-in-place pad instructions.
6. The 200A loadbreak reducing tap plug on the end of the 600A nonloadbreak elbow will be covered with a 35kV elbow arrester (Stk.#10-01-163). Construction personnel are to install an elbow arrester on each elbow.
7. Transformer will be equipped with a storage rack inside the primary cable compartment for storing grounding elbows. Construction personnel are to leave three grounding elbows on the storage rack. Coil the leads and leave the interfaces covered.
8. Transformers will be equipped with a storage pocket on the inside of the primary cable compartment door for storing fuse refills. Construction personnel are to leave three extra refills in the pocket.
9. See DCS **13 00 04 01** for typical transformer weights and dimensions.
10. Protective barriers/fences or other obstructions should be at least 3' from the edge of the transformer pad with a minimum unobstructed work area of 10' in front of the transformer.
11. If the 600A nonloadbreak elbows are removed from the transformer bushings, they must be placed on 35kV, 600A standoff bushings (Stk.#17-05-323). Construction personnel are to install a standoff bushing in each parking stand.
12. Construction personnel are to leave an elbow installation tool (Stk.#85-36-281) in the storage pocket.
13. Grounding stirrups may be added. Longer bolts may be required when grounding stirrups are used.E

DISTRIBUTION
CONSTRUCTION STANDARDS



ENG: JMW
 REV. NO: 6
 REV. DATE: 09/07/17

EQUIPMENT - TRANSFORMERS
Padmounted – Dead Front – Three-Phase
Radial Feed 1500 Through 3000 KVA – 35kV

51 12 34 01

Sheet 2 of 2

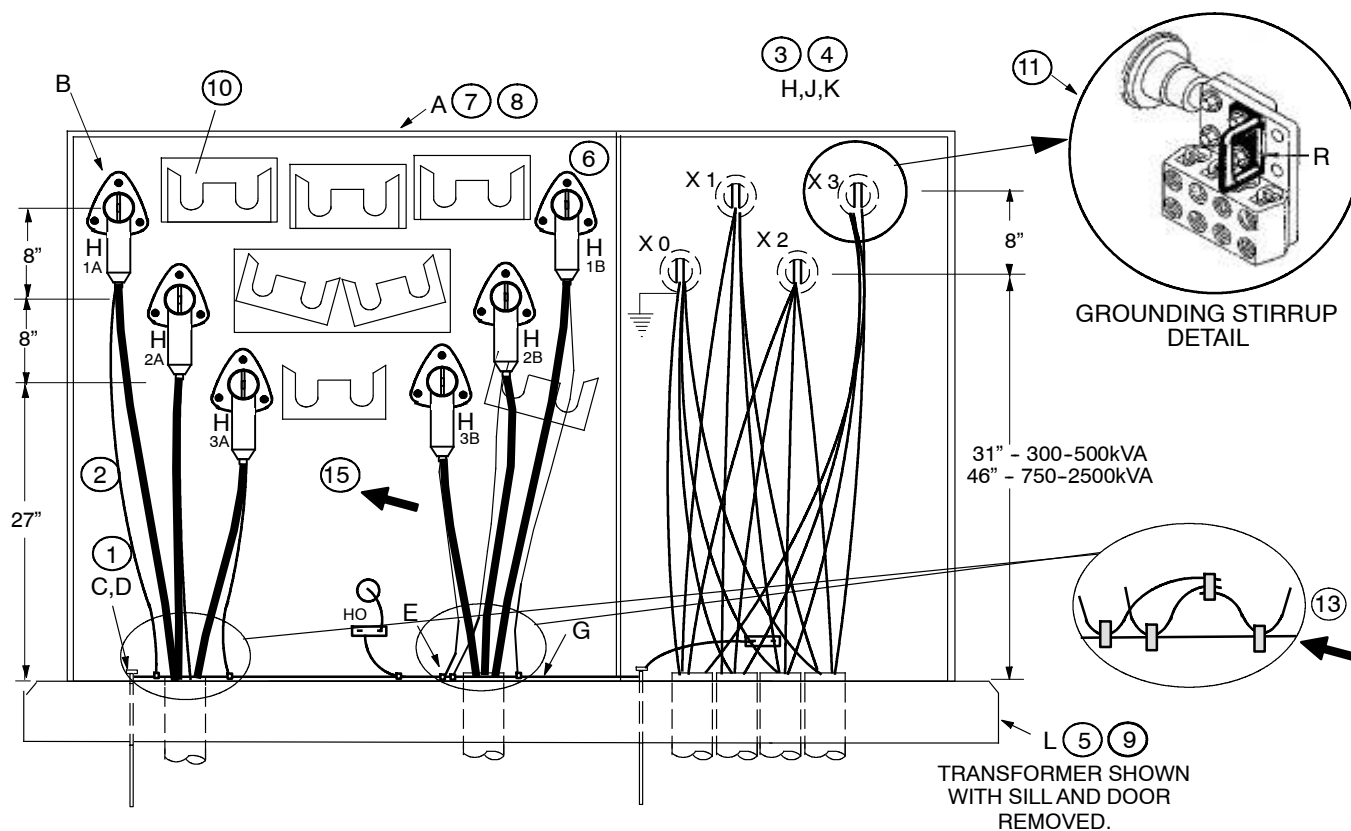
14. Connect cable concentric neutrals to the #2 bare CU ground, then end-to-end using 4 split bolt connectors.
15. The Aluminum lugs can be used for Aluminum or Copper conductors.
16. Fault current indicators can be installed to aid in determining if fault has occurred in the transformer or the cable feeding the transformer.
17. Run continuous length of #2 bare CU ground wire to connect an open port of the X0 connector to the two lower tank grounds and to the ground rods.

		Std. / Stk. No.	Description	51 12 34 01
@9 2,6	A	QF____M	Transformer, Three-Phase, Dead Front	1
	B	42 44 13 01	Termination, 35kV, 600A Deadbreak Elbow	3
	C	23 63 069	Rod, Ground, 5/8" x 8'	2
	D	17 52 032	Clamp, Ground Rod, 5/8" For #8 - 1/0	2
14	E	17 54 373	Connector, Split Bolt, #2 Str. CU.	3
		17 54 182	Connector, Split Bolt, 3-#2 Str. CU.	1
17	G	18 52 025	Wire, Copper, #2 Solid, Soft Drawn	15
		21 56 078	Bolt, Machine, 1/2" x 2" Stainless	-
@3	H	21 53 022	Bolt, Machine, 1/2" x 1-3/4", Everdur	-
		21 54 316	Bolt, Machine, 1/2" x 2-1/2", Stainless	-
		21 56 075	Bolt, Machine, 1/2" x 1-1/2", Stainless	-
@3	J	21 75 042	Washer, Round, 9/16", Brass	-
		12 56 052	Washer, Belleville Spring, 1/2", S.S.	-
		12 56 053	Washer, Flat, 1/2", S.S. (2 ea. per Belleville)	-
@4,15	K	17 55 177	Lug, CU, 2-#4/0-500 kcmil	-
		17 55 176	Lug, CU, 3-#4/0-500 kcmil	-
		17 55 180	Lug, CU, 3-500-1000 kcmil	-
		17 55 190	Lug, Alum, 1-1/0-1000 kcmil, Lay-In	-
		17 55 289	Lug, Alum, 2-1/0-1000 kcmil, Lay-In	-
		17 55 209	Lug, Alum, 3-1/0-1000 kcmil, Lay-In	-
		17 55 233	Lug, Alum, 6-1/0-500 kcmil, Lay-In	-
		17 55 232	Lug, Alum, 6-1/0-1000 kcmil, Lay-In	-
		17 55 343	Lug, Alum, 1-1/0-750 kcmil	-
		17 55 344	Lug, Alum, 2-1/0-750 kcmil	-
		17 55 345	Lug, Alum, 4-1/0-750 kcmil	-
		17 55 346	Lug, Alum, 5-1/0-750 kcmil	-
		17 55 349	Lug, Alum, 6-1/0-750 kcmil	-
		17 55 350	Lug, Alum, 8-1/0-750 kcmil	-
5	L	34 11 00 00	Pad, Concrete, 1500-2500 KVA	1
@8	M		Refill, Fuse (Sized by Engineer)	3
7	N	17 63 295	Ground, Elbow, 35kV	3
6	O	10 01 163	Arrester, Lightning, 35kV	3
11	P	17 05 323	Bushing, Standoff, 35kV	3
12	Q	85 36 281	Tool – Elbow Installation (Elastimold)	1
@13	R	17 55 510	Stirrup, Grounding	3
@16	S	60 55 001	Indicator, Fault Current, 1 Phase	3

EQUIPMENT - TRANSFORMERS
Padmounted - Dead Front - Three-Phase
Loop Feed 300 Through 2500 kVA - 35kV

51 12 34 02

Sheet 1 of 3



NOTES:

1. Install ground rod clamp 3" below top of rod to provide space for attaching ground set.
2. Provide enough concentric neutral length to attach to ground and also allow movement of the elbow from the bushing to the parking stand.
3. Stainless steel machine bolts and belleville spring washers are required for bolting aluminum lugs to secondary terminals. Clean the lugs and terminals and apply inhibitor to the mating interfaces. See DCS. 59 52 00 43. Everdur bolts and brass washers are to be used for bolting copper lugs to secondary terminals.
4. Preferred number of secondary cables per terminal is six or less. In no case shall the number of cables per terminal exceed twelve.
5. Use legacy company poured-in-place pad or contact Distribution Standards. Pad should have minimum dimensions of 12' wide x 9' deep x 8" thick.
6. If transformer is used as open point in the cable loop, install elbow arresters (stock # 10-01-177) in the open bushings and install feed-thru bushing stand-offs (stock # 17-63-245) with elbow arresters for the open cable termination.
7. Transformer will be equipped with a storage rack inside the primary cable compartment for storing grounding elbows. Construction personnel are to leave three grounding elbows on the storage rack. Coil the leads and leave the interfaces covered.
8. See DCS 13 00 04 01 for typical transformer weights and dimensions.
9. Protective barriers/fences or other obstructions should be at least 3' from the edge of the transformer pad with a minimum unobstructed work area of 10' in front of the transformer.
10. If the 200A loadbreak elbows are removed from the transformer bushings, they must be placed on 35kV, 200A standoff bushings (Stk.#17-63-246). Construction personnel are to install three standoff bushings in each transformer.
11. Grounding stirrups may be added. Longer bolts may be required when grounding stirrups are used.G

EQUIPMENT - TRANSFORMERS
Padmounted - Dead Front - Three-Phase
Loop Feed 300 Through 2500 kVA - 35kV

51 12 34 02

Sheet 2 of 3

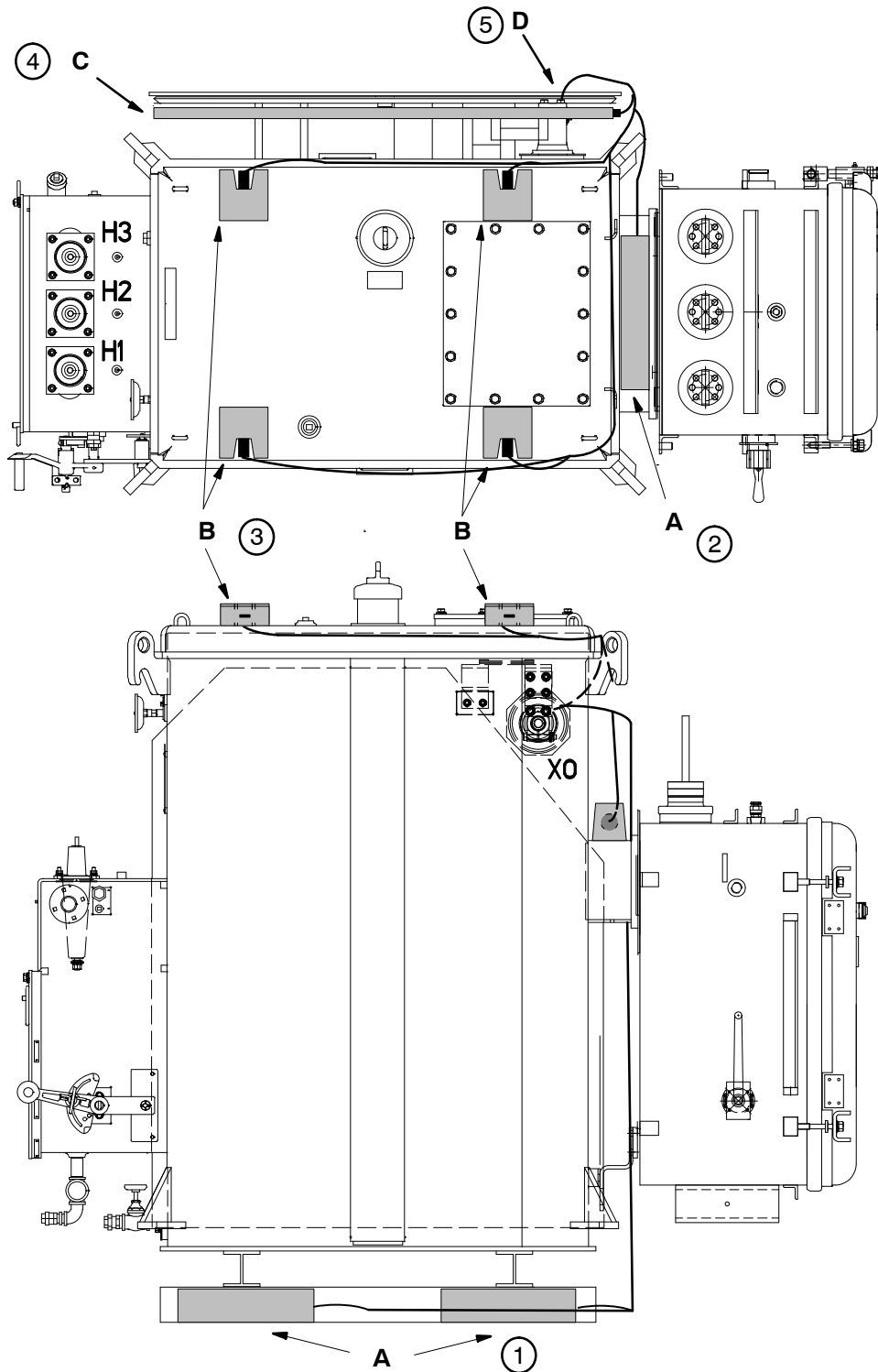
-
12. Contact Distribution Standards for replacement fuse stock #.
 13. Connect cable concentric neutrals to the #2 bare CU ground, then end-to-end using 4 split bolt connectors.
 14. The Aluminum lugs can be used for Aluminum or Copper conductors.
 15. Fault current indicators can be installed to aid in determining if fault has occurred in the transformer or the cable feeding the transformer.
 16. Run continuous length of #2 bare CU ground wire to connect an open port of the XO connector to the two lower tank grounds and to the ground rods.

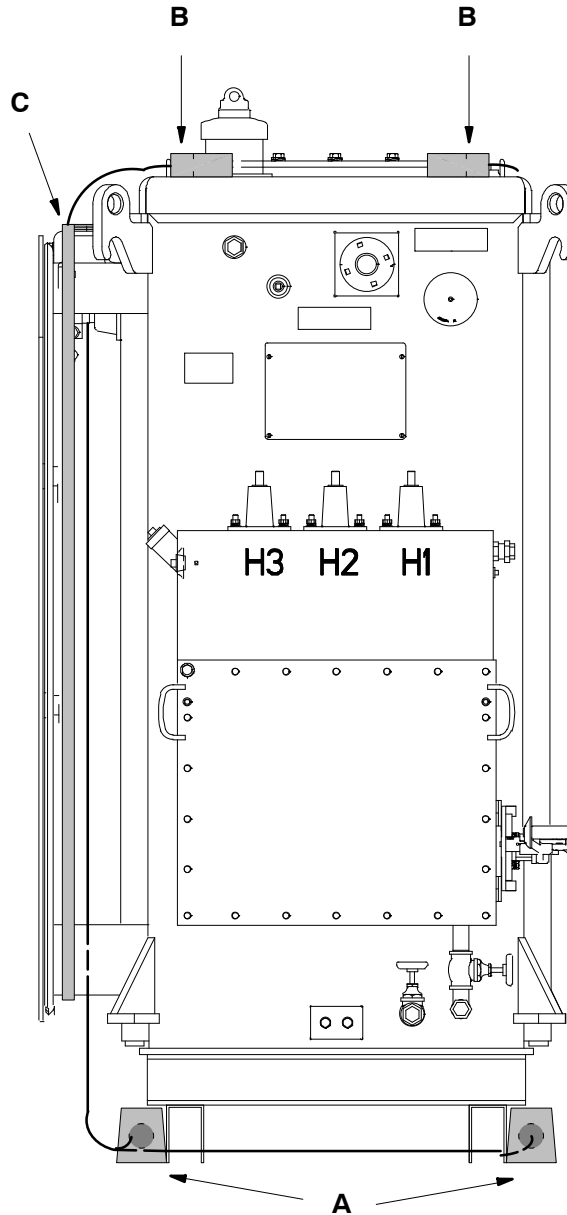
EQUIPMENT - TRANSFORMERS
Padmounted - Dead Front - Three-Phase
Loop Feed 300 Through 2500 kVA - 35kV

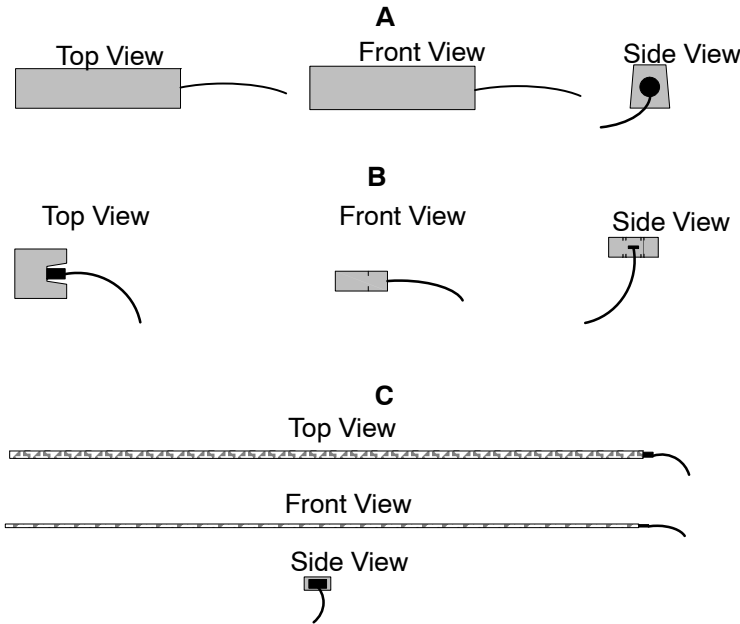
51 12 34 02

Sheet 3 of 3

		Std. / Stk. No.	Description	51 12 34 02
@8	A	QC____L	Xfmr, 3-Phase, 35kVΔ-208Y/120, Loopfeed	1
		QF____L	Xfmr, 3-Phase, 35kVΔ-480Y/277, Loopfeed	1
		VC____L	Xfmr, 3-Phase, 35kV Grd Y-208Y/120, Loopfeed	1
		VF____L	Xfmr, 3-Phase, 35kV Grd Y-480Y/277, Loopfeed	1
2,6	B	17 05 228	Termination, 35kV, 200A Loadbreak Elbow	6
		23 63 069	Rod, Ground, 5/8" x 8'	2
		17 52 032	Clamp, Ground Rod, 5/8" For #8 - 1/0	2
13	E	17 54 373	Connector, Split Bolt, #2 Str. CU.	8
		17 54 182	Connector, Split Bolt, 3-#2 Str. CU.	2
16	G	18 52 025	Wire, Copper, #2 Solid, Soft Drawn	10
@3,11	H	21 56 078	Bolt, Machine, 1/2" x 2" Stainless	-
		21 53 022	Bolt, Machine, 1/2" x 1-3/4", Everdur	-
		21 54 316	Bolt, Machine, 1/2" x 2-1/2", Stainless	-
		21 56 075	Bolt, Machine, 1/2" x 1-1/2", Stainless	-
@3	J	21 75 042	Washer, Round, 9/16", Brass	-
		12 56 052	Washer, Belleville Spring, 1/2", S.S.	-
		12 56 053	Washer, Flat, 1/2", S.S. (2 ea. per Belleville)	-
@4,11,14	K	17 55 177	Lug, CU 2 - #4/0 to 500 kcmil	-
		17 55 176	Lug, CU 3 - #4/0 to 500 kcmil	-
		17 55 180	Lug, CU 3 - 500 - 1000 kcmil	-
		17 55 190	Lug, Alum 1 - 1/0 to 1000 kcmil, Lay-In	-
		17 55 209	Lug, Alum 3-1/0-1000 kcmil, Lay-In	-
		17 55 289	Lug, Alum 2-1/0-1000 kcmil, Lay-In	-
		17 55 233	Lug, Alum 6 - 1/0 to 500 kcmil, Lay-In	-
		17 55 232	Lug, Alum 6-1/0 to 1000 kcmil, Lay-In	-
		17 55 343	Lug, Alum 1-1/0-750 kcmil	-
		17 55 344	Lug, Alum 2-1/0-750 kcmil	-
		17 55 345	Lug, Alum 4-1/0-750 kcmil	-
		17 55 346	Lug, Alum 5-1/0-750 kcmil	-
		17 55 349	Lug, Alum 6-1/0-750 kcmil	-
		17 55 350	Lug, Alum 8-1/0-750 kcmil	-
5	L		Pad, Concrete, Poured-in-Place	1
T12	M		Fuse, Current Limiting	3
7	N	17 63 296	Ground, Elbow, 35kV, Large Interface	3
@6	O	10 01 177	Arrester, Lightning, 35kV, Large Interface	-
10	P	17 63 246	Bushing, Standoff, 35kV, Large Interface	3
@11	R	17 55 510	Stirrup, Grounding	3
@6	S	17 63 245	Bushing, Standoff, Feed-Thru, 35kV	-
@15	T	60 55 001	Indicator, Fault Current, 1 Phase	3







		Std. / Stk. No.	Description	51 13 02 01	Qty
	A	40 54 490	17 Lb. Magnesium anode with 20' #10 CU		5
	B	40 54 491	3 Lb. Magnesium anode with 15' #10 CU		4
	C	40 54 492	7' Ribbon Magnesium anode with 13.5' #10 CU		1
	D	17 51 114	Lug, Bolted, #8-2/0		1

NOTES:

- Four 17 lb. magnesium anodes shall be placed on the floor next to U-channel under the transformer.
- One 17 lb. magnesium anode shall be placed on the network protector throat. The anode shall be secured with a small bead of silicone caulk, approximately one inch long, on both ends of the anode. A continuous bead of silicone shall not be applied around the base of the anode and no silicone shall be applied to the mating surface of the anode.
- Four 3 lb. magnesium anodes shall be placed on the top surface of the transformer. The anode shall be secured to the transformer with 4 small beads of silicone caulk at the corners of the anode. Each bead shall be approximately one inch long. Do not use a continuous bead of caulk around the anode or apply any silicone caulk to the mating surface of the anode.
- One 7 ft. long magnesium anode ribbon shall be shaped and positioned on the transformer cooling panel brackets. The anode shall be secured with a small bead of silicone caulk that shall be applied on the side of the anode where it contacts to cooling panel bracket. Do not use a continuous bead of caulk around the anode or apply any silicone caulk to the mating surface of the anode.
- Each individual wire for all ten anodes shall be routed and bonded to the transformer X0 bushing with connector.

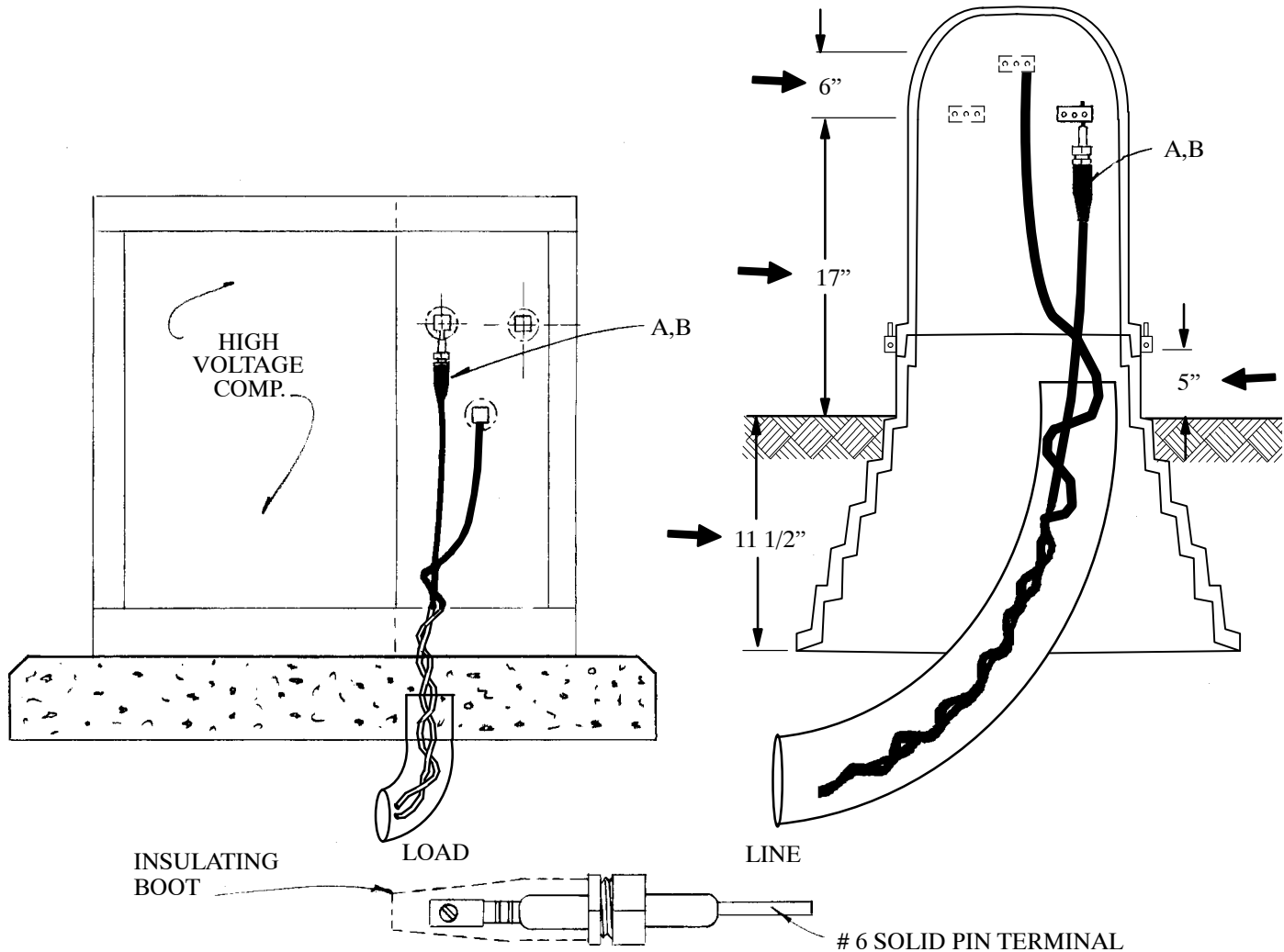
EQUIPMENT – CONNECTIONS

Fused Multiple Streetlight Cable Connections

Connection at Pad Mtd. Transformer or Pedestal

52 00 01 **

Sheet 1 of 1



FUSEHOLDER W/COPPER TERMINAL

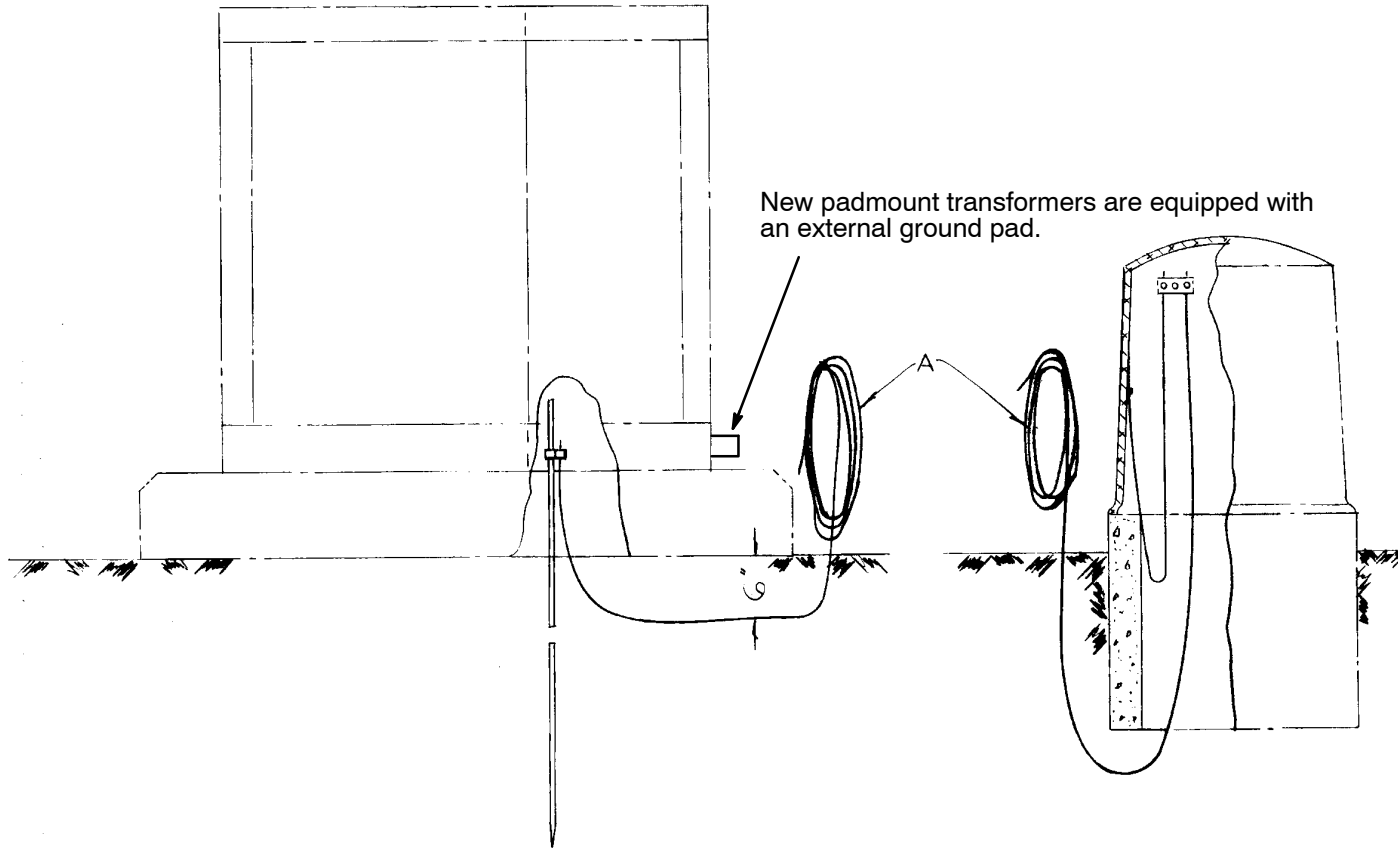
See Note 2		Std. / Stk. No.	Description	52 00 01 **	01	02
	A	20 76 141	Fuseholder-InLine, with Copper Pin Terminal		1	
		20 76 144	Fuseholder-InLine, with Two Screw Terminals			1
	B	20 76 140	Fuse-Cartridge, 30 Amp.		1	1

NOTES;

1. To fuse underground streetlight cable on overhead secondaries, see Dist. Std. **15 74 50 01**.
2. Fuseholder, Stock No. 20 76 144, is stocked with a cable connector on each end. This fuseholder should be used whenever connectors are too full of cables to readily use fuseholder, Stk. No. 20 76 141 or if the connectors are covered with a PVC insulated cover that prevents the pin terminal from being inserted.

52 00 02 01 Ameren connects ground wire at time of transformer or pedestal installation and leaves wire coiled for Telephone Co.

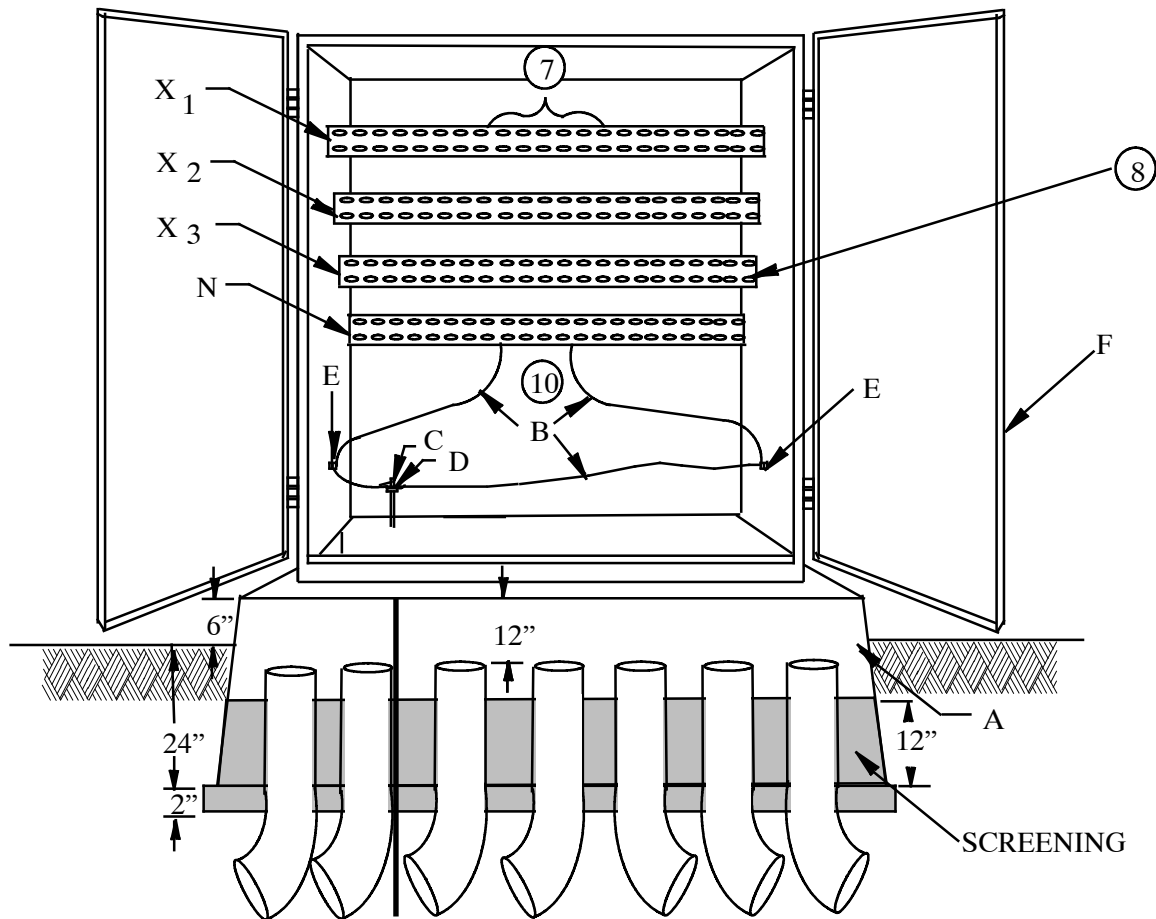
52 00 02 02 Ameren connects ground wire left by Telephone Co. after transformer or pedestal have been installed.



NOTES:

1. Operation Codes include labor units for hand trenching and other operations necessary for connection of grd. wire.
2. Estimator shall prepare Form U-307 listing each ground wire connection.

	Std. / Stk. No.	Description	52 00 02 **	01	02
A	18 51 021	Wire - Cu., #6 Poly Cov. Ft.		18	
B	17 52 032	Clamp - Grd. Rod. 5/8" For #8 - 1/0		1	1
C	712	Operation Code		1	
	713	Operation Code			1



NOTES:

1. An initial depth of 26" shall be excavated and all loose soil shall be removed or tamped. The length + width of the hole shall be sized to allow a minimum of 6" of clearance on all sides.
2. Add 2" of screening, compact, and set box pad.¹
3. Final depth should be adjusted to provide 6" of exposed ground pad at final grade.
4. Provide 12" of space between the top of the box pad and the end of the conduits.
5. Stabilize the box pad and conduits by placing 12" of crushed stone screening inside the box pad and tamp in place.
6. Backfill with loose material, DO NOT backfill next to the ground sleeve pad with chinks of material or rocks. Pack loose backfill by foot tamping and do not tamp excessively close to the ground sleeve pad sides. NOTE: Hydraulic tamping is not recommended.
7. Center positions of each bus are reserved for Ameren feed cables.
8. Bus has lay-in style connectors. Clean the contact surfaces of connectors and cables then coat them with inhibitor.
9. Secure the enclosure to the pad.
10. Be sure that the enclosure is grounded by attaching ground wires to the ground rod and to the neutral bus.

EQUIPMENT CONNECTIONS
Three Phase Multiple Secondary/Service
Termination Cabinet

52 10 01 00

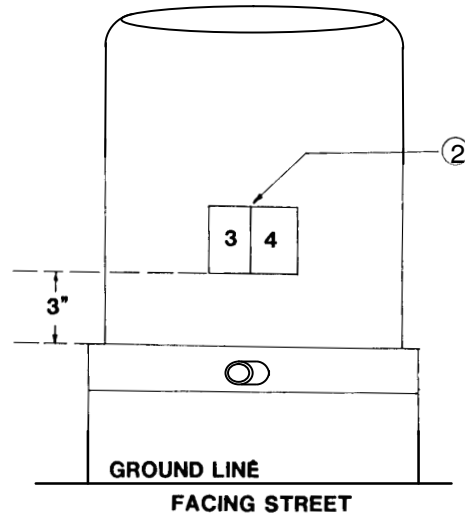
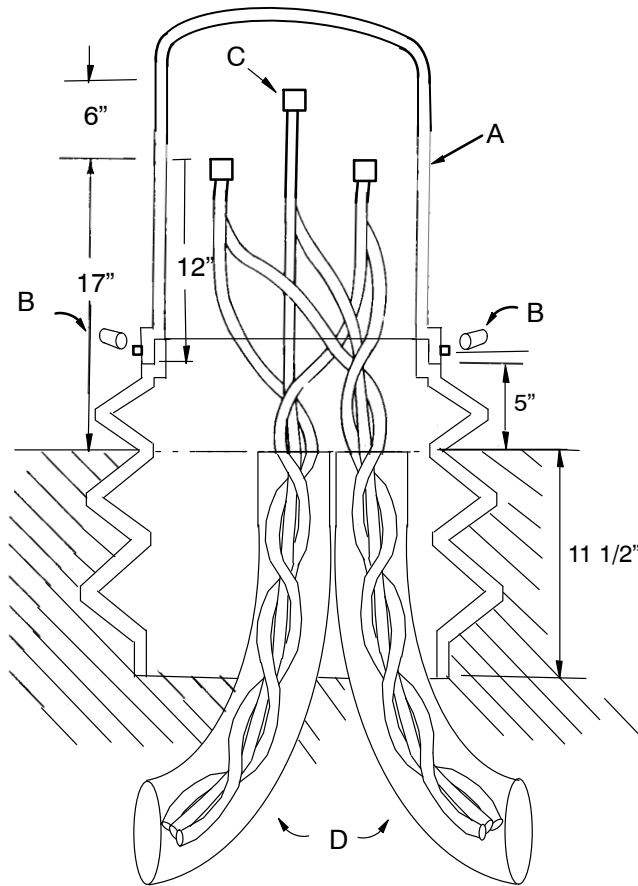
Sheet 2 of 2

		Std. / Stk. No.	Description	.52 10 01 00	
	A	12 06 196	Pad - Fiberglass 49" x 24" x 30"		1
	B	18 52 025	Wire - Copper, #2 Solid, Soft Drawn		12
	C	23 63 069	Rod - Ground, 5/8" x 8'		1
	D	17 52 032	Clamp - Ground Rod, 5/8" #8 - 1/0		1
	E	69 58 121	Connector - Ground		2
	F	54 07 236	Enclosure - Padmount, 3 Ph Secondary		1

EQUIPMENT – CONNECTIONS
Secondary Power Pedestal
Above Grade – Polyethylene

52 11 01 **

Sheet 1 of 2



Three (3) ft. minimum clearance
required from obstructions such
as buildings, street light poles,
bell or catv pedestals, etc.

Construction Note(s):

1. When used for 3 phase applications, the dome should be marked "3 PH " using reflective numbers and letters.
2. Use reflective numbers (Stock Numbers 16 04 108 thru 16 04 116) to show the LAST 2 DIGITS of the source pad transformer.
3. See Dist. Std. **59 40 00 10** for conduit/cable burial depths.

EQUIPMENT – CONNECTIONS
Secondary Power Pedestal
Above Grade – Polyethylene

52 11 01 **

Sheet 2 of 2

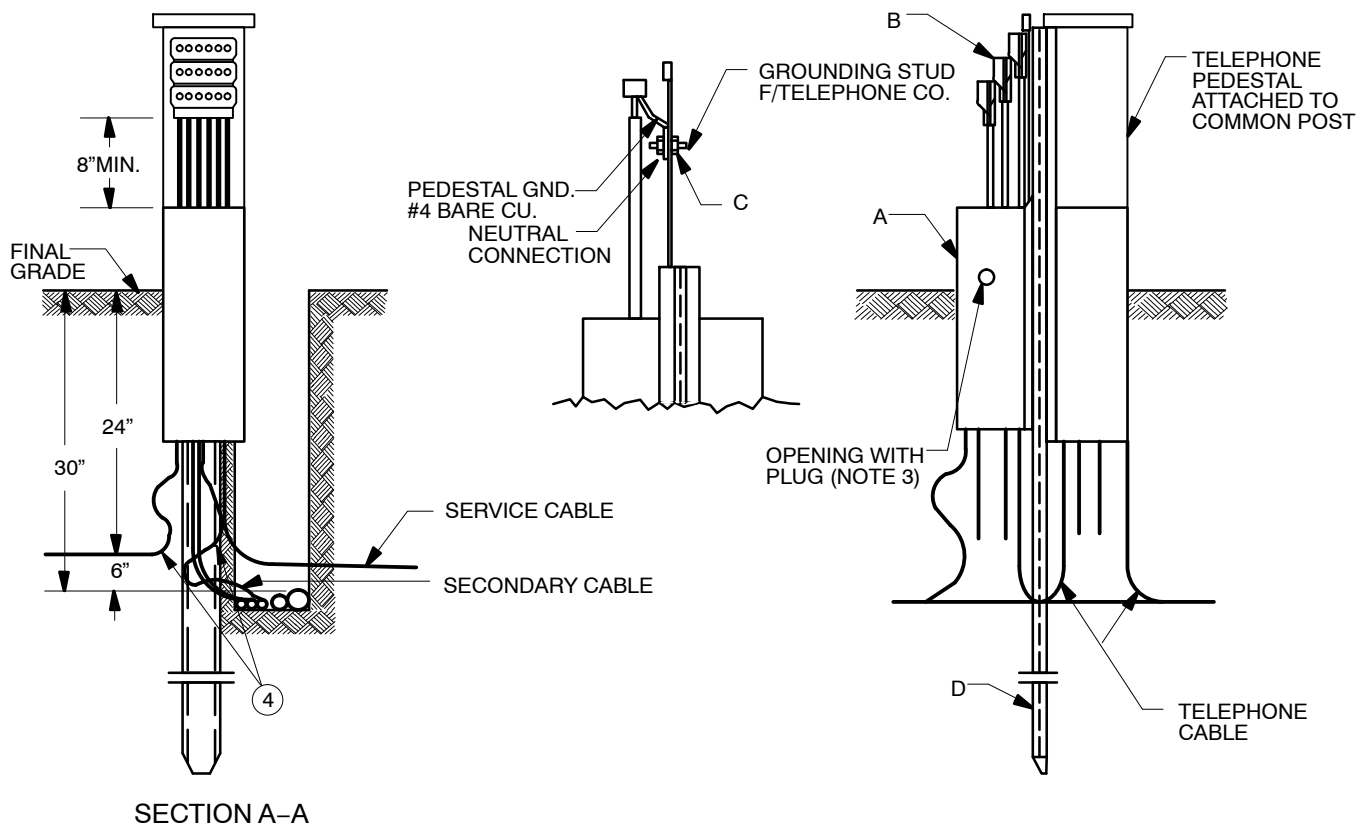
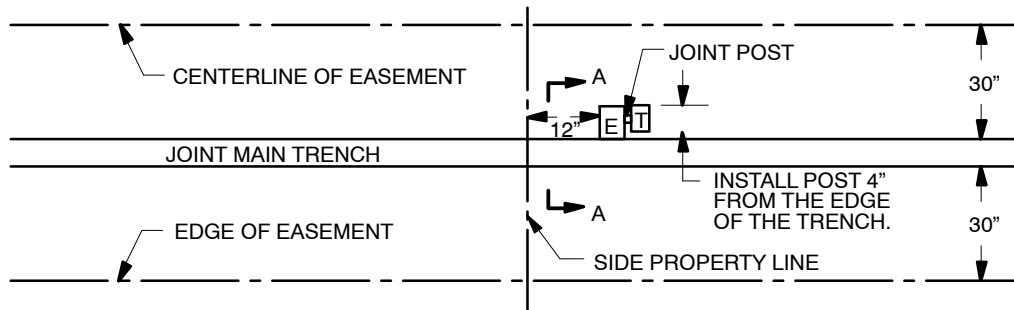
52 11 01 01 & 06
52 11 01 02
52 11 01 03 – 05
52 11 01 07

Ameren Installed 1 Phase
Contractor Installed 1 Phase
Ameren Installed 3 Phase
Ameren III Installed 1 Phase

	Stk. No.	Description	01	02	03	04	05	06	07
5@	A	12 05 049 Pedestal – Above Ground, Polyethylene	1		1	1	1	1	1
	B	12 55 034 Cap, Pedestal Latch, 1.5", Dark Green	2		2	2	2	2	2
	C	17 64 218 Connector – Ped, 6 Pos., 6–500 kcmil, Insulated	3	3	4				3
		17 64 219 Connector – 4 Pos., 1/0–750 kcmil, w/cover				4			
		17 64 220 Connector – 6 Pos., 1/0–750 kcmil, w/cover					4		
		17 64 238 Connector – Ped, 4 Pos., 6–500 kcmil, Insulated						3	
	D	12 51 252 Bend–Plastic, 2", 24" Rad. (Streetlight)	As Req'd						
		12 51 173 Bend–Plastic, 3', 36" Rad. (Secondary & 400 A Service)	As Req'd						
		12 51 264 Bend–Plastic, 2 1/2", 24" Rad. (200 A Service)	As Req'd						2
	E	12 01 263 Conduit, 2 1/2", Sch 40, 10'							2
	F	49 55 520 Marker, Buried Conduit, Red							2

Engineering Note(s):

- For Missouri residential developments the contractor will install the pedestal, pedestal caps, and bends. See Std. 52 11 01 02.
- DCS 52 11 01 07 is required in Illinois for residential subdivision developments when the pedestal is placed on the property line. It includes Item D (12 51 264) and Item E (12 01 263), for future use.

AMEREN ILLINOISAMEREN ILLINOISAMEREN ILLINOIS**RANDOM LAY OR NON-JOINT CONSTRUCTION**

NOTES:

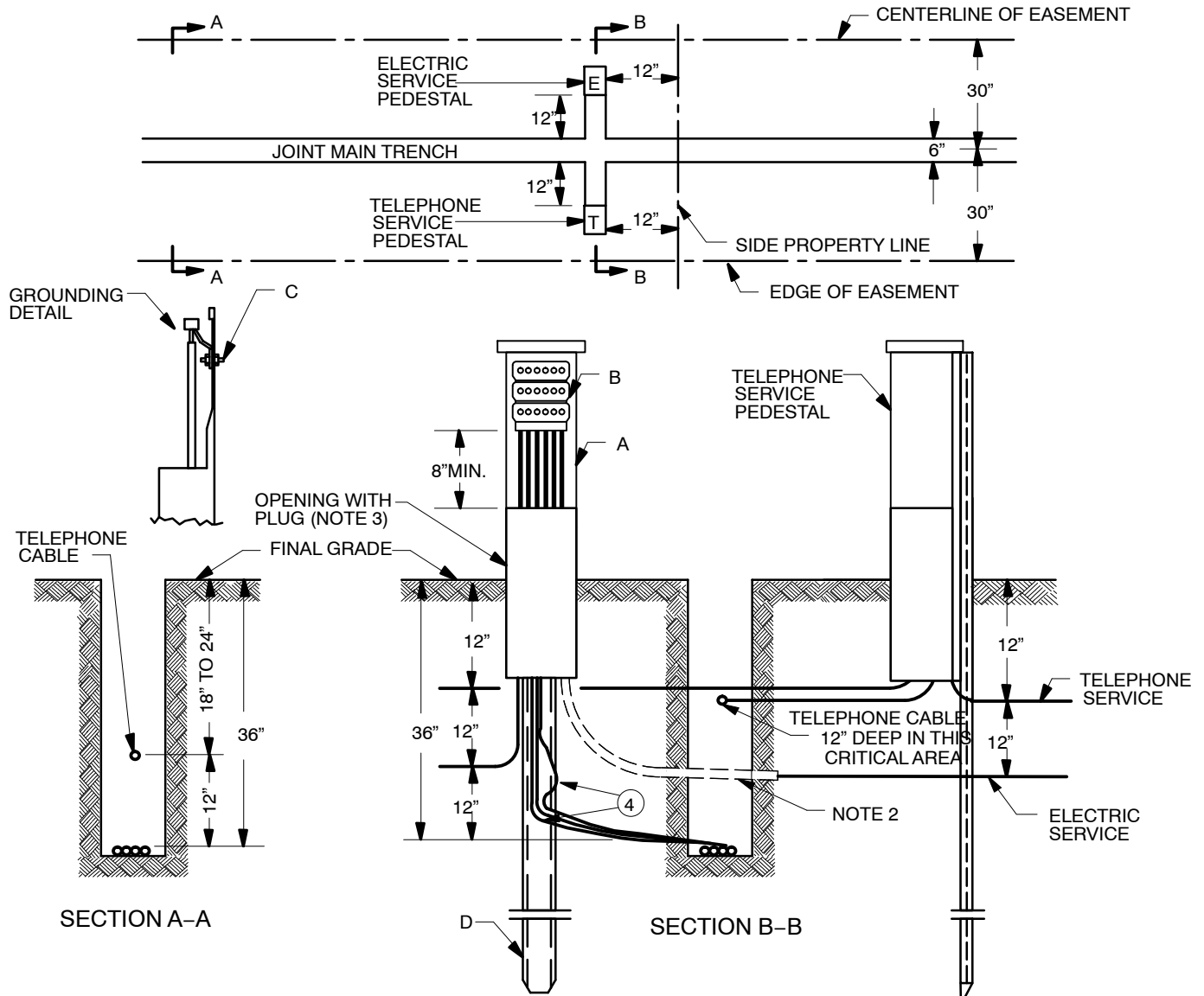
1. Upper portion of post shall be 22" above final grade.
2. Flexible conduit (12 51 238) shall be placed on all secondary and service cables as they are installed. Conduit to extend three feet beyond pedestal.
3. This temporary entrance is to be used to restore service or when ground conditions prevent trenching. Leave plug inside pedestal when removed.
4. Install secondary and service conductors with "S" curve slack to allow for settling

AMEREN ILLINOIS

AMEREN ILLINOIS

AMEREN ILLINOIS

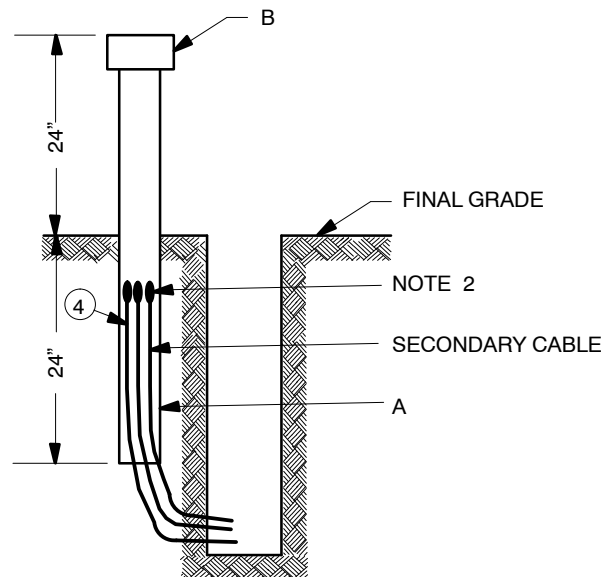
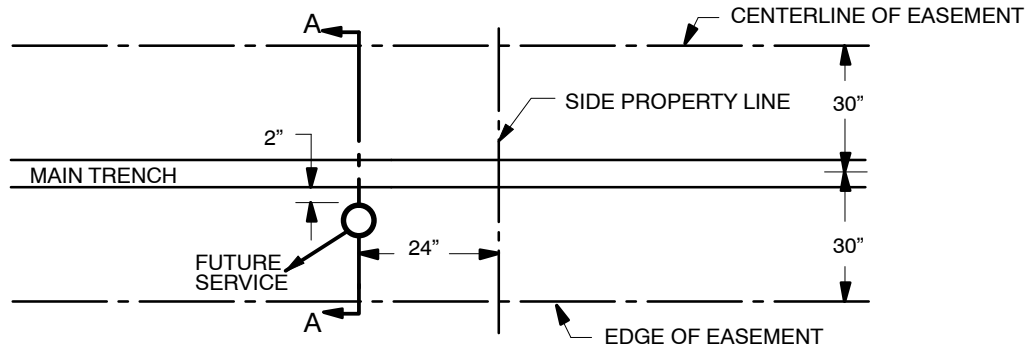
JOINT CONSTRUCTION WITH A 12" FIXED SEPARATION



NOTES ON PREVIOUS PAGE

	Stk. No.	Description	52 11 03 00
A	12 05 052	Pedestal – Above Ground – Steel	1
B	17 64 218	Conn – Ped, 6C, 6–500 kcmil, Insulated	3
C	17 64 208	Conn – Post Type, 3/8", #2 AWG.	1
D	12 55 035	Post – Ped, 6', Stl.	1

AMEREN ILLINOIS ONLY **AMEREN ILLINOIS ONLY** **AMEREN ILLINOIS ONLY**



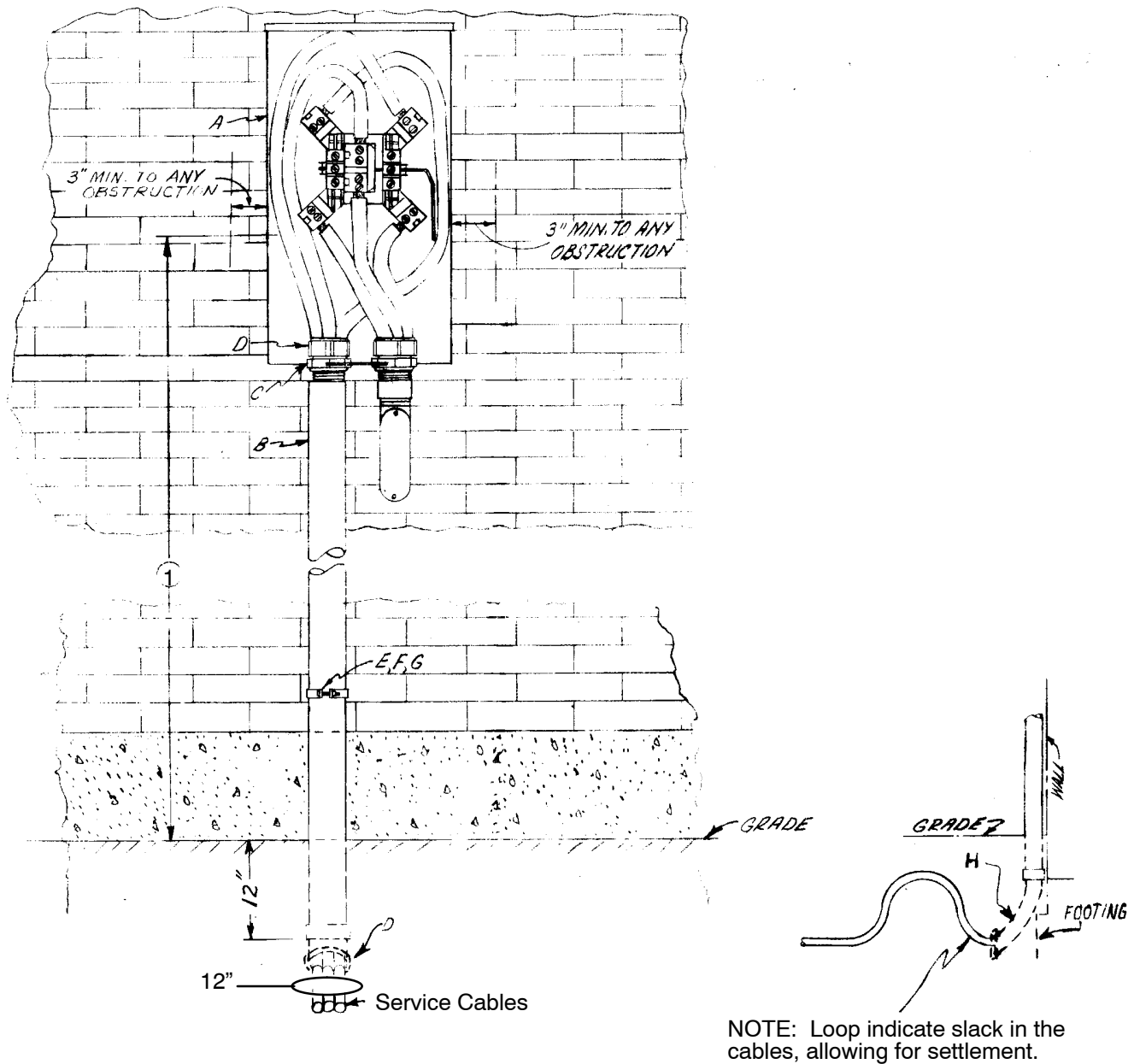
SECTION A-A
CONDUIT PEDESTAL

NOTES

1. Install conduit pedestal on the side of the trench that is adjacent to future service. Pedestal to be made of 3" plastic conduit with an end cap.
2. Seal the ends of the secondary cable with plastic tape and cover with "Scotchkote".
3. When the future service is to be installed, removed the temporary pedestal and make a direct buried splice.
4. Install cable identifier.

	Stk. No.	Description	52 11 04 00	
A	12 01 279	Conduit – 3", Sch. 40, 10" Length		1
B	12 51 312	Cap – 3", Conduit End		1

DIRECT BURIED SERVICE



NOTES:

1. See Page D-4 of the Service Manual for mounting height.
2. All materials except supply cables shall be furnished, installed and connected by customer.
3. Service cable shall have a minimum of 24" of cover. See National Electric Code Article 300, Part A, Section 5.

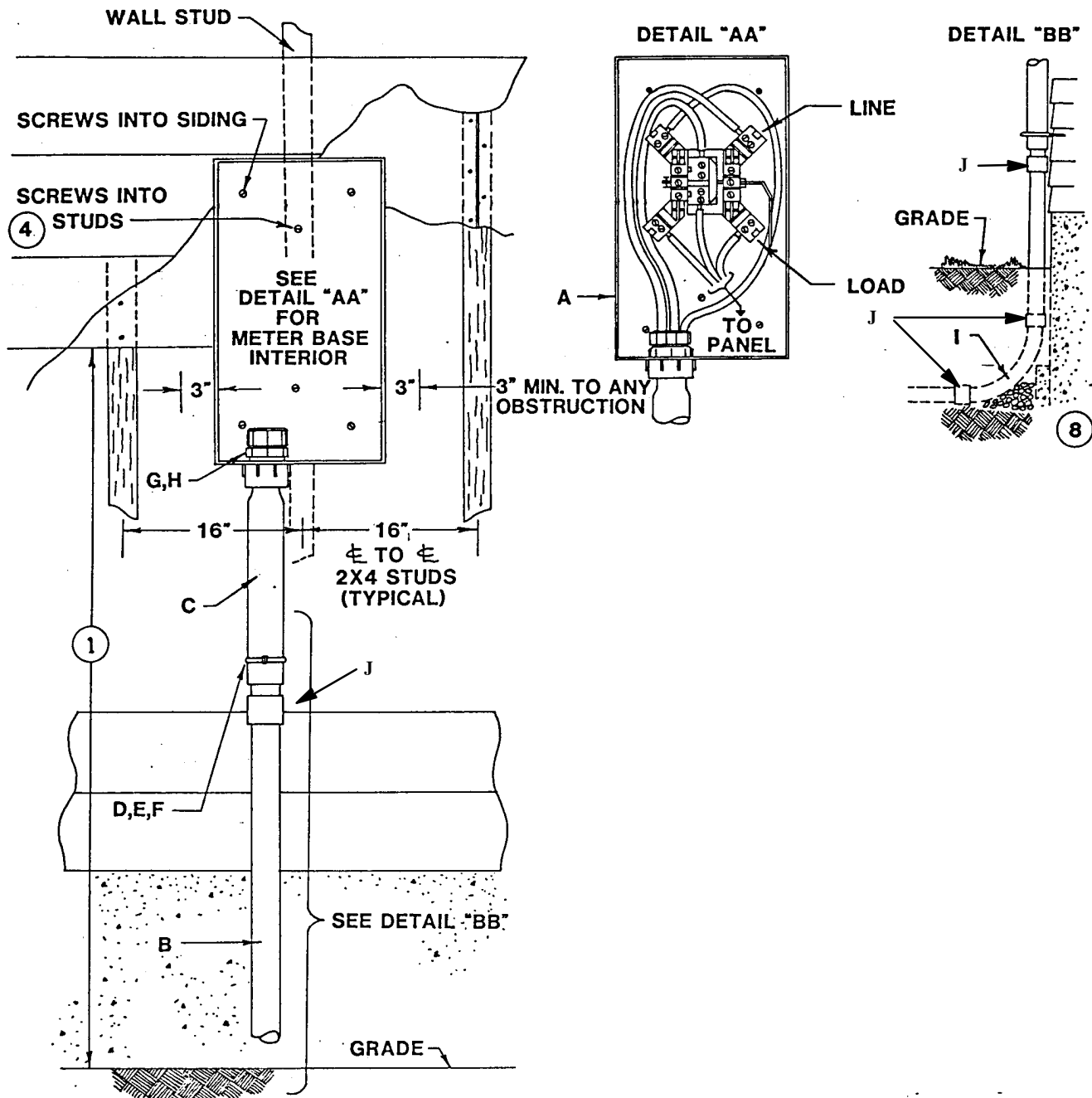
DIRECT BURIED SERVICE

	MATERIAL FURNISHED, INSTALLED, AND OWNED BY CUSTOMER	0 – 200 Amp	201 Thru 400 Amp
A	Socket, Meter, 200 Amp, I.D. 228	1	1
	Socket Meter, 400 Amp, (Class 320), I.D. 235		1
B	Conduit, Sch. 40, PVC, 2-1/2"	*	
	Conduit, Sch. 40, PVC, 3"		*
C	Nut, Lock, 2-1/2"	1	
	Nut, Lock, 3"		1
D	Bushing, Conduit, 2-1/2"	1	
	Bushing, Conduit, 3"		1
E	Hanger, Conduit	*	*
F	Screw, Lag	*	*
G	Shield, Expansion	*	*
H	Bend, Conduit, 2-1/2", 45°	1	
	Bend, Conduit, 3", 45°		1

* As Required



CONDUIT SERVICE



NOTES:

1. See page D-4 of the Service Manual for mounting height.
2. All materials except the supply cables shall be furnished, installed and connected by customer.
3. Where subject to mechanical damage provide protection.
4. To properly secure the meter socket, use #14 x 3" wood screws. In brick, use expansion shields and lag screws.
5. See 59 81 40 40 2 of 2 for additional serv. cond. instructions and materials.
6. The conduit hanger shall be secured by a lag screw into the floor joist. If attached to the foundation a lead expansion shield shall be used. An alternative to the expansion shield is a stud shot into the foundation.

CONDUIT SERVICE

7. When backfilled, expansion coupling "C" shall be fully closed.
8. The area underneath the bend shall consist of good quality fill material and dirt free of debris. The area shall be compacted to a density in excess of 90% of the soil density outside the disturbed area around the foundation wall. Acceptable fill materials: Sand, limestone screenings, concrete slurry, concrete.
9. See 59 81 40 41 for additional service conduit instructions and materials.

	MATERIAL FURNISHED AND INSTALLED BY CUSTOMER	0 to 200 Amp	201 to 400 Amp
A	Socket, Meter 200 Amp, I.D. 228	1	
	Socket, Meter 400 Amp (Class 320), I.D. 235		1
B	Conduit, Schedule 40, PVC, 2-1/2"	As Req'd	As Req'd
	Conduit, Schedule 40, PVC, 3"		
C	Coupling-Conduit, Expansion Sch 40, 2-1/2", PVC, (Allows 8" tall)	1	
	Coupling-Conduit, Expansion Sch 40, 3", PVC, (Allows 8" tall)		1
D	Hanger, Conduit	1	1
E	Screw, Lag		
F	Shield, Expansion		
G	Nut, Lock, 2-1/2"	1	
	Nut, Lock, 3"		1
H	Bushing – Conduit 2-1/2"	1	
	Bushing – Conduit, 3"		1
I	Bend – Conduit, Sch 40 PVC 2-1/2" 90, 24" Radius	*	
	Bend – Conduit, Sch 40 PVC 3" 90, 36" Radius		*
J	Coupling – Conduit, Sch 40 PVC 2-1/2"	1	
	Coupling – Conduit, Sch 40 PVC, 3"		1

* Minimum radius, 24" for 2-1/2" conduits and 36" for 3" conduits.

MOBILE HOME METER
Pedestal Installation
Single or Dual Meter Posts

52 18 04 00

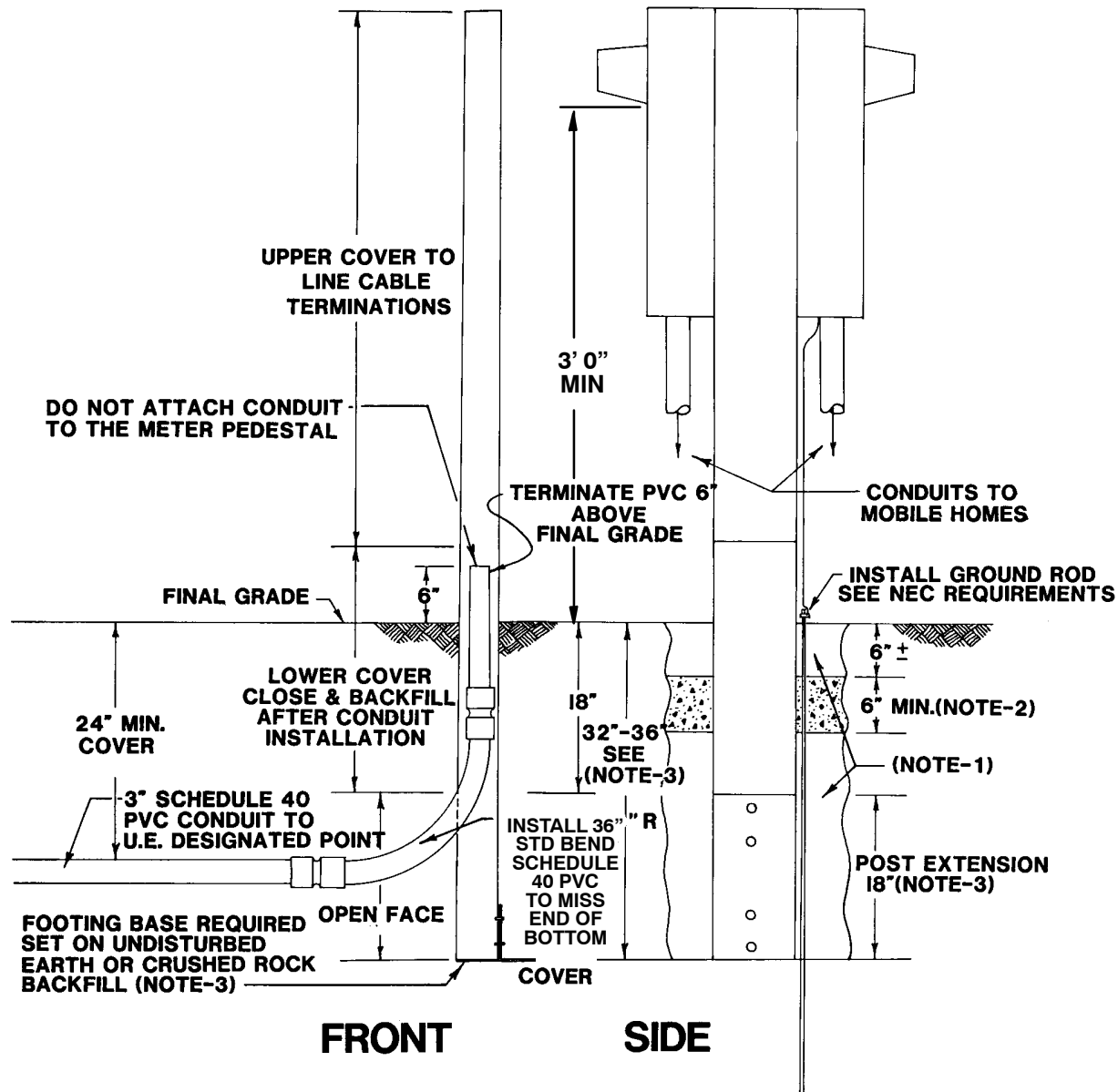
Sheet 1 of 1

➔ **AMEREN MISSOURI ONLY**

REQUIREMENTS:

All materials except supply cables shall be furnished and installed by customer.

■ Pedestals shall be labeled for service equipment by U.L. and approved by Ameren Missouri.



NOTES:

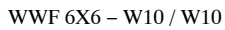
1. Backfill with tamped crushed rock screening including entire conduit elbow.
2. Place concrete collar 6" thick, min., 6" below grade to firm earth as shown.
3. 32" to 36" pedestal embedment required. Order post extension and footing base with meter post as shown.
4. Owner shall be responsible to see that pedestal is firmly embedded in ground, and plumb to within 1" in 12" vertical.
5. Conduit shown 3" for dual pedestal, use 2-1/2" conduit and 24" radius bend for single pedestal.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



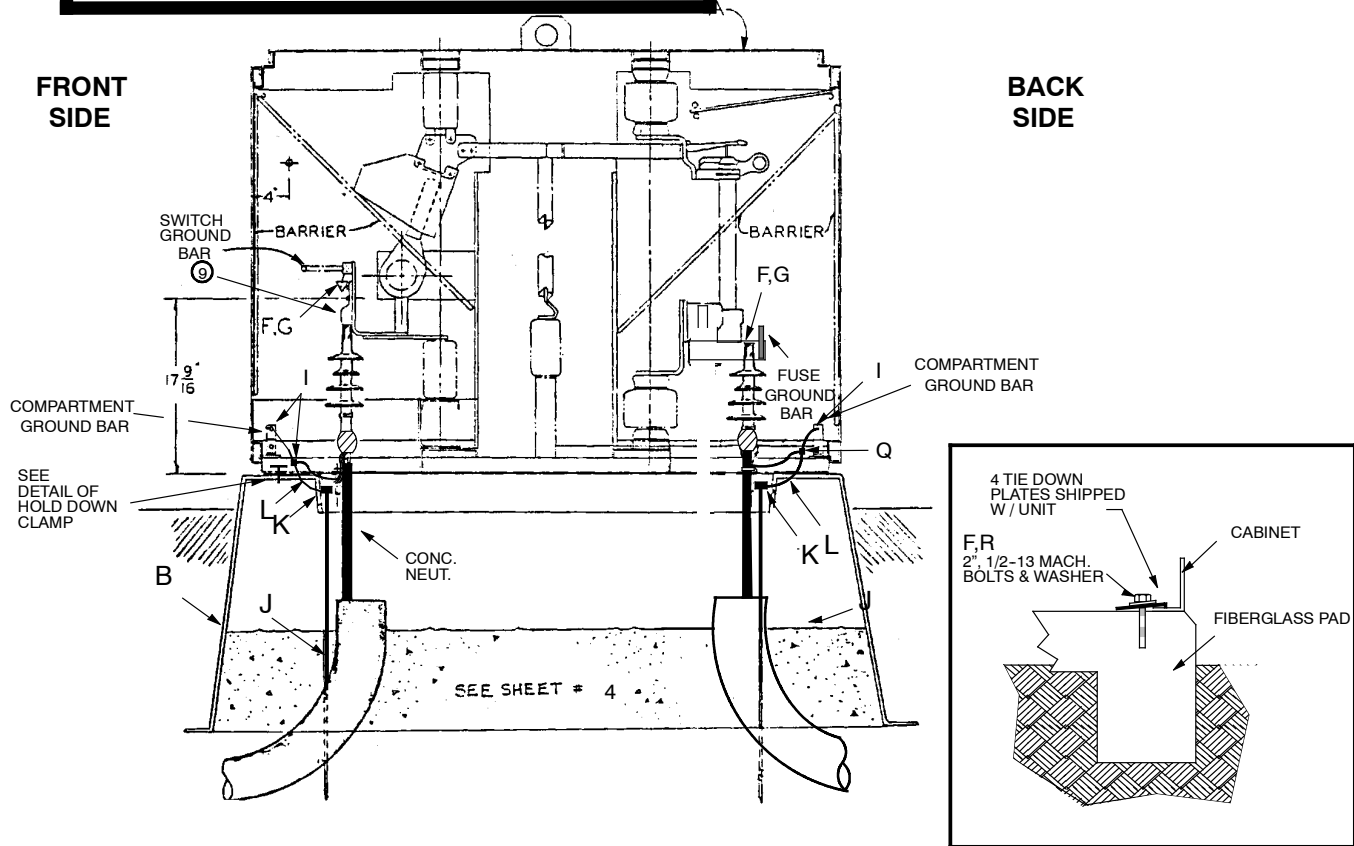
ENG: EJB
REV. NO: 3
REV. DATE: 01/30/12

Sheet 1 of 1



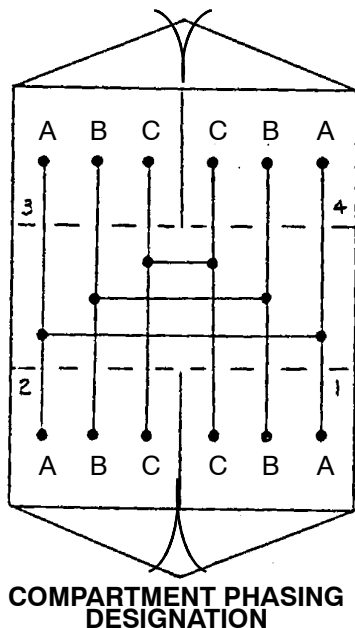
1001

LIMITED USE STANDARD



SECTION RIGHT-HAND SIDE SWITCH GEAR & PAD

HOLD DOWN CLAMP DETAIL



NOTES:

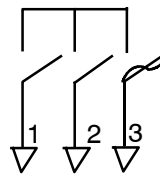
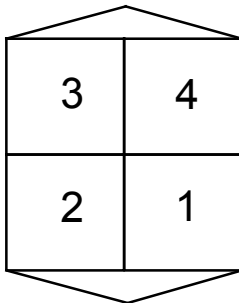
1. Connect conc. neutral from each cable to #2 Cu. wire connected to grd. rod and compartment grd. bar SIMILAR CONNECTIONS TO BE MADE IN EACH EQUIPPED COMPARTMENT.
2. 10' min. clearance shall be provided at front and back of switchgear for operation. 4' min. clearance shall be provided at sides of switchgear.
3. Typical installations will require 3 terminations per compartment sized according to the particular cable being used.
4. Install a label on the switchgear where it can be seen from the street with the proper Pad number. Use the appropriate Reflective Numbers 16-04-1XX.
5. Install a label on each compartment door with the letters LAT____ or DIP. Use Reflective Letters 16-04-320, 16-04-317, 16-04-321 or 16-04-418, 16-04-419, 16-04-737 and the appropriate Reflective Numbers 16-04-1XX.

LIMITED USE STANDARD

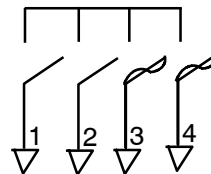
6. Install a label by each switch handle with the letter D _____. Use Reflective Letter 16-04-418 and the appropriate Reflective Numbers 16-04-1XX.
7. See Dist. Std. **59 52 00 43** for procedures on installation of belleville washers.
8. See sheets 3 & 4 for composite pad installation instructions.
9. Mount all cables in the lower two hole positions so that fault indicators may be installed.
10. Install Faulted Circuit Indicator on the lug barrel.
11. Place spare fuse refills in fuse compartment door fuse holders.
12. In Missouri residential developments, the contractor will install the box pad and bends.
13. Stock items 54 07 433 and 54 07 435 are for maintenance only.W
14. For duct banks terminating in padmounted switchgear, retain approximately 5 ft. of 4/0 copper bond wire and connect it to a ground rod using a 2 bolt clamp (17-54-132).

ONE LINE DIAGRAMS OF AVAILABLE UNITS WITH COMPARTMENT LOCATION

COMPARTMENT NUMBER
DESIGNATION



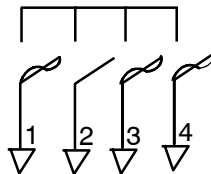
TYPE 6
53 11 04 01
53 11 04 09**



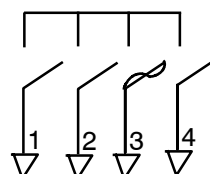
TYPE 9
53 11 04 02
53 11 04 08 (PMS)*
53 11 04 10**



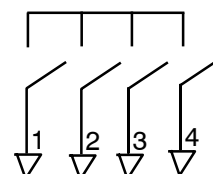
TYPE 4
53 11 04 07



TYPE 12
53 11 04 04
53 11 04 11**



TYPE 11
53 11 04 05
53 11 04 12**



TYPE 10
53 11 04 06

*200A Switching and Fusing Only.
** Peoria Only

LIMITED USE STANDARD

SMU -20 Fusing

		Dist Stnd. / Stk No.	Material Description	53 11 04 **	01	02	04	05	06	07	08
13	A	54 07 212	Switchgear - 2 Sw, 3 Fuses	1							
		54 07 213	Switchgear - 2 Sw, 6 Fuses		1						
		54 07 216	Switchgear - 1 Sw, 9 Fuses			1					
		54 07 217	Switchgear - 3 Sw, 3 Fuses				1				
		54 07 218	Switchgear - 4 Sw					1			
		54 07 433	Switchgear - 3 Fuses							1	
		54 07 435	Switchgear - 2 Sw, 6 Fuses (All 200 Amp)								1
8	B	12 06 109	Pad - Switchgear, Composite	1	1	1	1	1			
@	C	42 34 61 **	Termination - 750 Al.								
@	D	42 34 59 02	Termination - #2 Al.								
@	E	42 34 59 04	Termination - 4/0 Al.								
7	F	21 56 078	Bolt - Mach., S.S., Hex, 1/2" x 2"	22	28	28	28	28	10		
	G	12 56 052	Washers - Belleville Spring, 1/2", S.S.	18	24	24	24	24	6		
		12 56 053	Washers - Flat, 1/2", S.S.	36	48	48	48	48	12		
	I	17 54 132	Connector - Wire, 8-350 kcmil Cu.	9	10	7	13	16	3		
	J	23 63 069	Rod - Ground, 5/8" x 8'	3	4	4	4	4	2		
	K	17 52 032	Clamp - Ground Rod, 5/8" For #8 - 1/0	3	4	4	4	4	2		
	L	18 52 025	Wire - Cu. #2, S.D. (Ft.)	27	36	36	36	36	9		
@	N	16 51 079	Tag - Square, Red "X"	3	3	-	-	-	-		
@	P	16 51 080	Tag - Triangle, Blue, "Y"	3	3	3	-	-	-		
	Q	17 54 373	Connector-Wire, 2 Cu, Split Bolt	3	6	9	3	-	3		
	R	21 75 105	Washer - Rnd, 1/2", S.S.	4	4	4	4	4	4		
@	S		Refill - Fuse 14.4 kV	6	12	18	6	-	6		
10 @	V	60 55 001	Indicator - Faulted Circuit, 1 PH, Auto Reset								

LIMITED USE STANDARD

SM -4 Fusing (Peoria Only)

		Dist Stnd. / Stk No.	Material Description	53 11 04 **	09	10	11	12	06
	A	54 07 566	Switchgear - 2 Sw, 3 Fuses		1				
		54 07 563	Switchgear - 2 Sw, 6 Fuses			1			
		54 07 565	Switchgear - 1 Sw, 9 Fuses				1		
		54 07 564	Switchgear - 3 Sw, 3 Fuses					1	
		54 07 218	Switchgear - 4 Sw						1
8	B	12 06 109	Pad - Switchgear, Composite		1	1	1	1	1
@	C	42 34 61 **	Termination - 750 Al.						
@	D	42 34 59 02	Termination - #2 Al.						
@	E	42 34 59 04	Termination - 4/0 Al.						
	F	21 56 078	Bolt - Mach., S.S, Hex, 1/2" x 2"		22	28	28	28	28
7	G	12 56 052	Washers - Bellville Spring, 1/2", S.S.		18	24	24	24	24
		12 56 053	Washers - Flat, 1/2", S.S.		36	48	48	48	48
	I	17 54 132	Connector - Wire, 8*-350 Kcmil Cu.		9	10	7	13	16
	J	23 63 069	Rod - Ground, 5/8" x 8"		3	4	4	4	4
	K	17 52 032	Clamp - Ground Rod, 5/8" for #8 - 1/0		3	4	4	4	4
	L	18 52 025	Wire - Cu. #2, S.D. (Ft.)		27	36	36	36	36
@	N	16 51 079	Tag - Triangle, Red, "X"		3	3	-	-	-
@	P	16 51 080	Tag - Triangle, Blue, "Y"		3	3	3	-	-
	Q	17 54 373	Connector - Wire, 2 Cu, Split Bolt		3	6	9	3	-
	R	21 75 105	Washer - Rnd, 1/2", S.S.		4	4	4	4	4
@	S		Refill - Fuse 14.4kV		6	12	18	6	-
10@	V	60 55 001	Indicator - Faulted Circuit, 1 PH, Auto Reset						

LIMITED USE STANDARD

INSTRUCTIONS FOR EXCAVATION AND PLACEMENT OF SWITCHGEAR BOXPAD STOCK NO. 12 06 109

Placing The Bends

Place the bends as described in Figure 1. Note that a 36 inch radius bend on the lateral side at a 36 inch depth will almost touch the side of the box when it is placed at depth. An increase of final burial depth or angling of the conduit may be necessary to clear the box flange.

Excavation And Final Depth

An initial depth of 33 inches shall be excavated removing or tamping all loose soil. The length and width of the hole should be 85" by 79". This allows 5" of side clearance. The longer dimension is the door side of the gear.

Crushed stone screenings shall be placed and tamped to a final level depth of 30 inches. The area bearing the pad-box shall be leveled with a carpenter's level. The final depth of 30 inches will leave the required 6 inches of box exposed at final grade.

Place The Box

Place the box with the longer side where the doors will be, as described on the Engineering Layout.

Backfilling

Stabilize the box before backfilling the outside of the box to prevent shifting. A 3" base must be prepared and thoroughly tamped. Level the box pad and place 1 - 2" of soil on the flange to keep the box pad in place.

Stabilizing

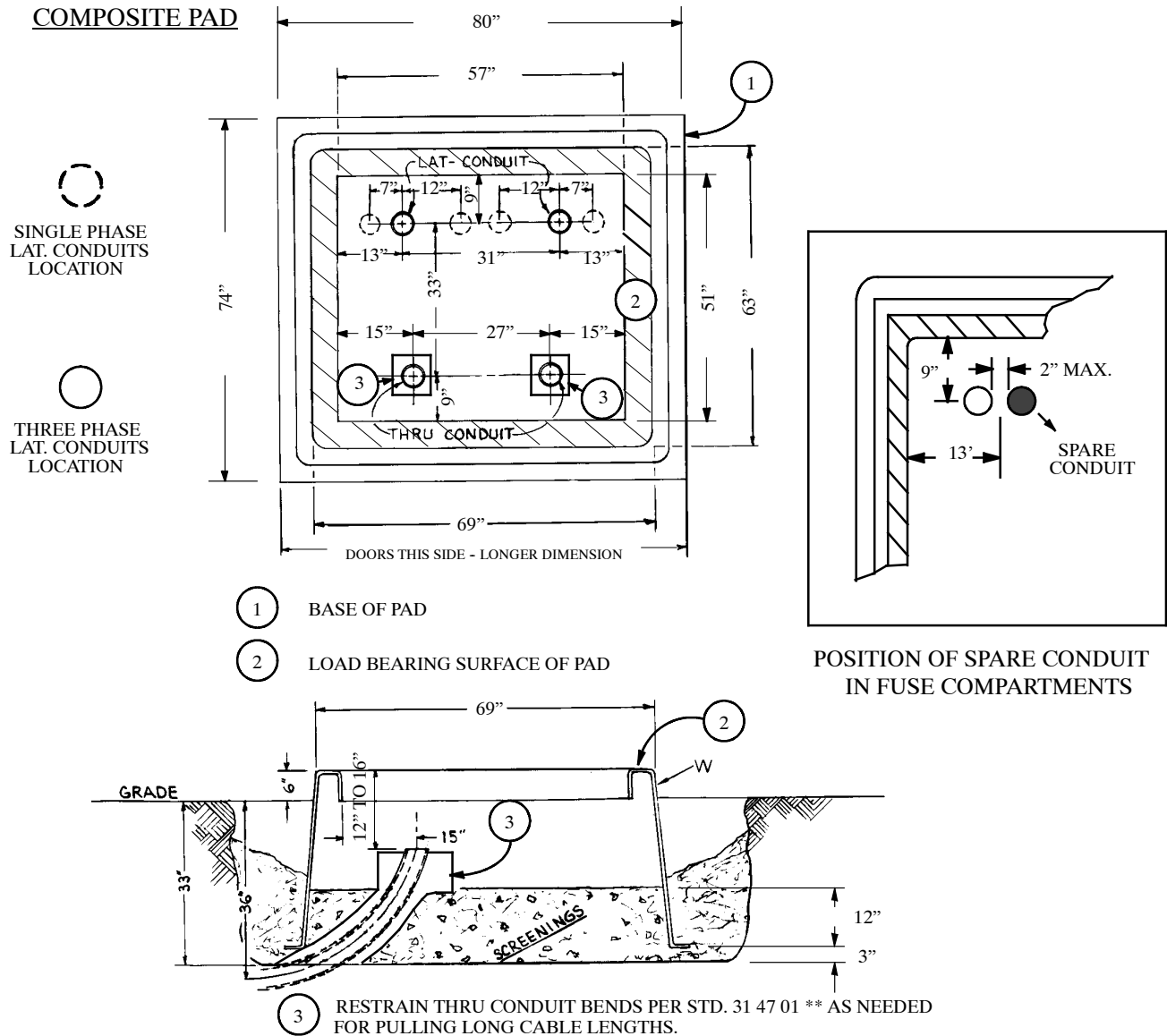
To further stabilize the box and conduit bends, place 12 inches of screenings inside the box and tamp in place.

Bend - Final Preparation

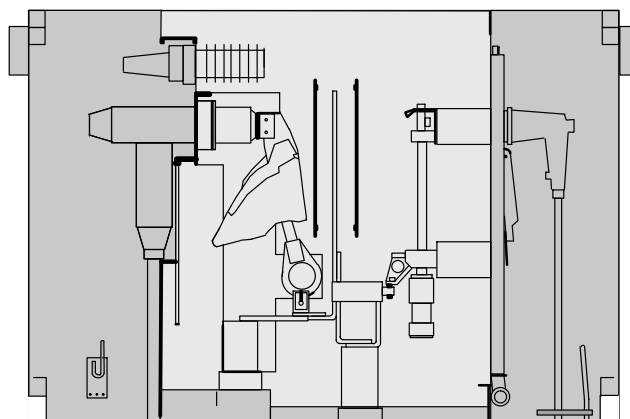
The conduit bend should be cut off below the box's switchgear mounting flange. The rule is as follows: 5 inch diameter bend shall be cut a minimum of 16 inches below the flange. A 4 inch conduit cut a minimum of 12 inches below.

NOTE: This installation will not withstand pulling long cable lengths through the bends at the switchgear. Install restrained bends per Dist. Standard 31 47 01 **. Recommended for pulling 750 Al or Cu cables more than 250 ft. See composite pad drawing.

LIMITED USE STANDARD



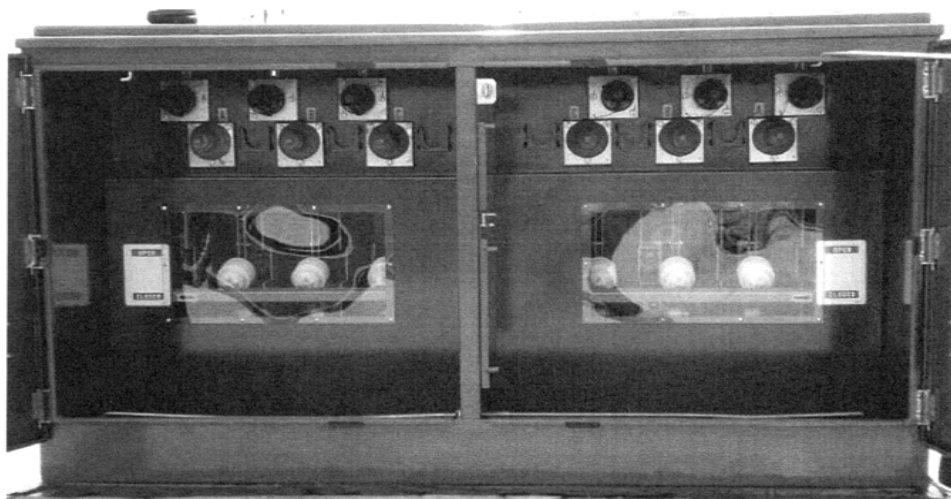
600 Amp
Switch Side



200 Amp
Fuse Side

Side View of a Deadfront Switchgear

600 Amp Switch Side Operation:



Front View of 600 Amp Switch Side

1. Confirm the visible break through the windows. This eliminates the need to move the 600 amp elbow connectors.
2. The operating sequence is similar to that of a live front switch.
3. See Dist. Std. **42 34 64 **** and **59 40 60 01** for 600 amp elbow terminator details.
4. 200 Amp loadbreak elbows with #2 AWG cables may be installed in the switch compartments when necessary. Install a 200 amp to 600 amp bushing adaptor (Stk.# 17-05-256) on each 600 amp bushing. See Dist. Std. **59 40 60 01**.
5. 200 Amp bushings are for grounding elbows.
6. For duct banks terminating in padmounted switchgear, retain approximately 5ft of 4/0 copper bond wire and connect it to a ground rod using a 2 bolt clamp (17-54-132).

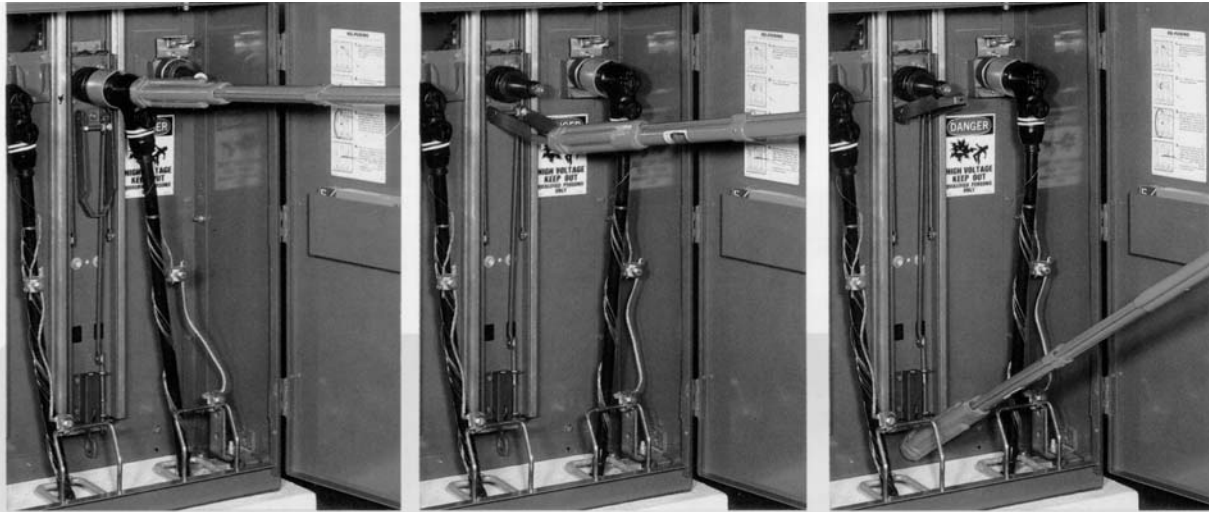
CAUTION: 600 amp elbows are non-loadbreak and can only be removed from a de-energized bushing.

EQUIPMENT-SWITCHING
Padmounted-3 Phase, 15 kV
Deadfront

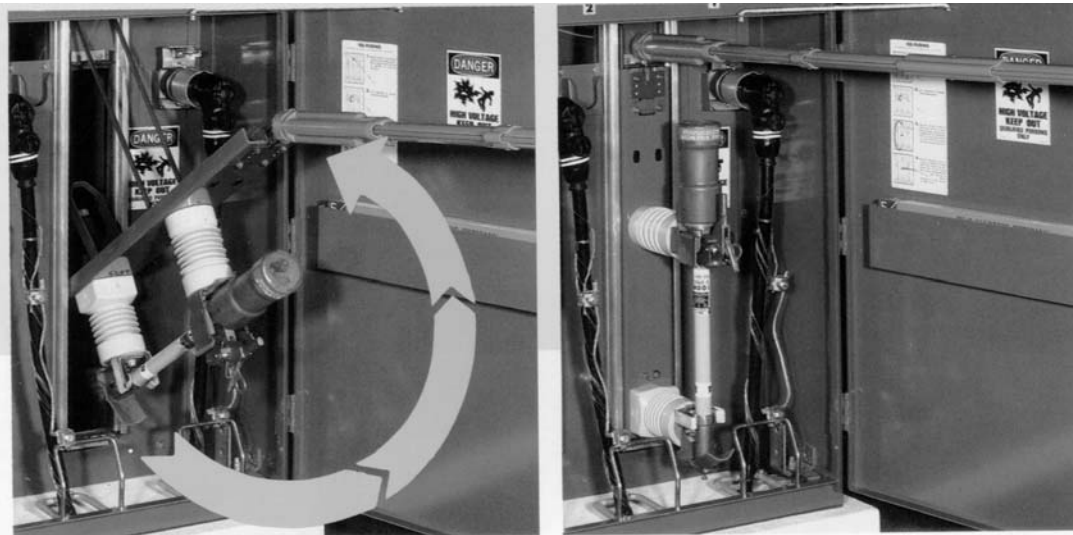
53 11 05 **
Sheet 2 of 14

-
7. Install a label on the switchgear where it can be seen from the street with the proper pad number. Use the appropriate reflective numbers 16-04-108 to 16-04-116.
 8. Install a label on each compartment door with the letters LAT _____ or DIP _____. Use reflective letters 16-04-320, 16-04-317, 16-04-321 or 16-04-148, 16-04-419, 16-04-737 and the appropriate reflective numbers 16-04-108 to 16-04-116.
 9. Install a label by each switch handle with the letter D _____. Use reflective letter 16-04-418 and the appropriate reflective numbers 16-04-108 to 16-04-116.

200 Amp Fuse Side Operation (S&C):



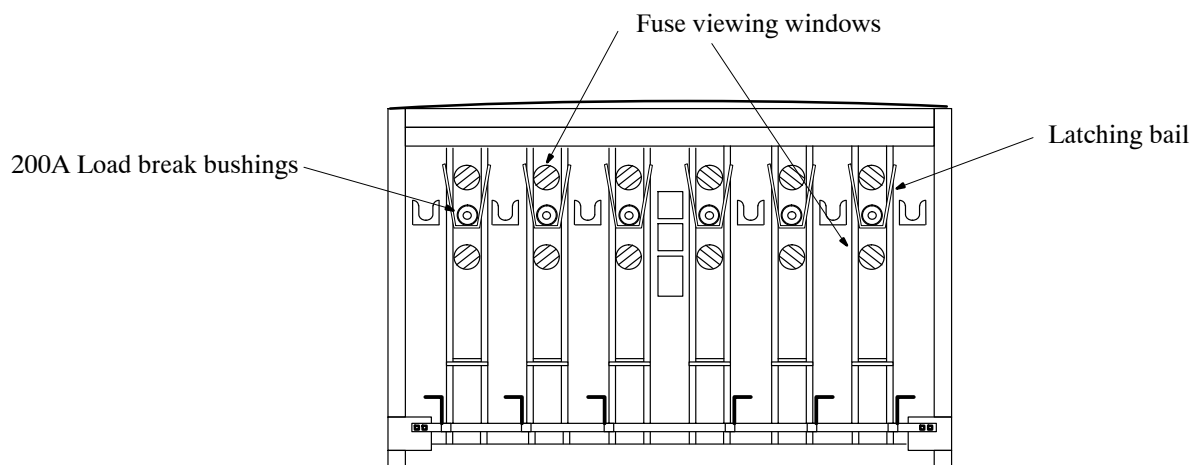
1. The operator moves the loadbreak elbow to a feedthru or standoff insulator on the parking stand, interrupting any fuse load.
2. This allows the mechanical interlock to be raised, unlocking the TransFuser Mounting.
3. A slight pull unlatches the TransFuser Mounting.



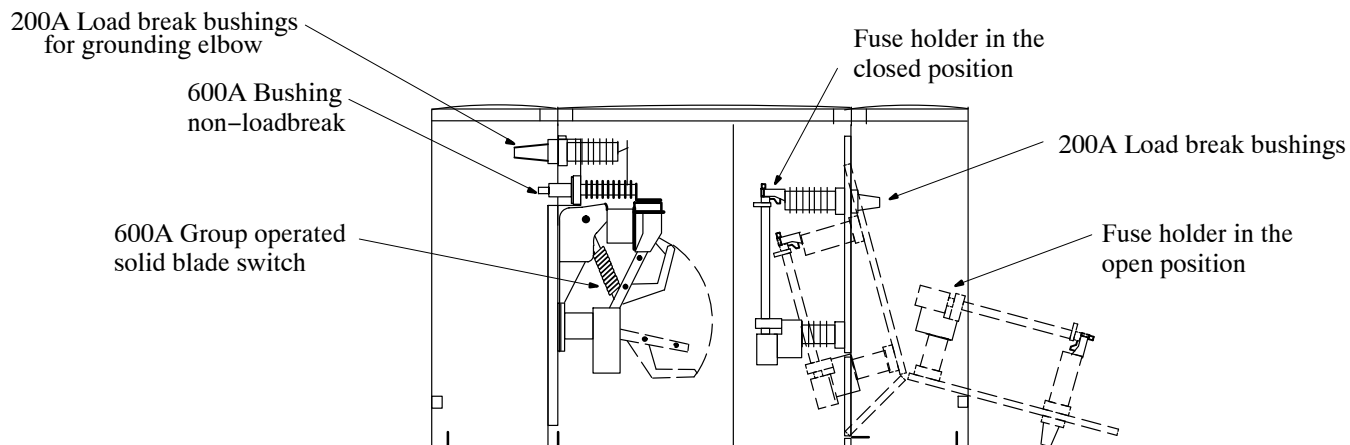
4. The balanced mounting virtually self-pivots to its open position and latches in place – its a swift, controlled action that guards against exposure to energized live parts.
5. In the open position, the de-energized and isolated fuse is accessible to the operator for replacement.

1. Always use hotline tools when replacing fuses.
2. The fuse installation procedure is a reverse of fuse removal.
3. S & C SMU – 20 fuses and fuse mountings are standard. S&C Deadfront Switchgear uses SME-20 fuse end fittings (20-04-498).

200 Amp Fuse Side Operation (Federal Pacific & A.B. Chance):



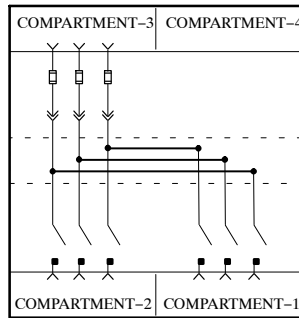
Front View of 200 Amp Fuse Side



Side View of Switchgear

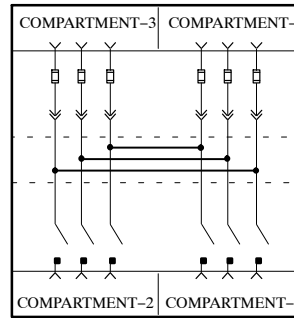
1. Always use hotline tools when replacing fuses.
2. Loadbreak elbow must be placed on a parking stand before the latching bail can be raised.
3. After the elbow has been parked, the latching bail on the fuse door can be raised with a shotgun stick and the fuse door lowered into position.
4. The fuse can then be removed from the holder with the shotgun stick.
5. These units require S&C SMU-20 fuses, and S&C SML-20 fuse end fittings stock number 20-04-499.

Switchgear Configurations:



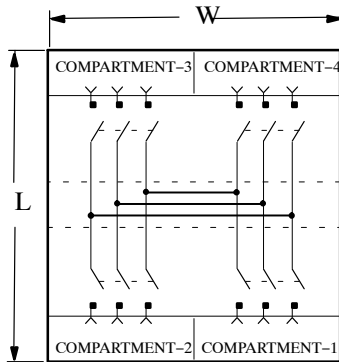
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53 11 05 05



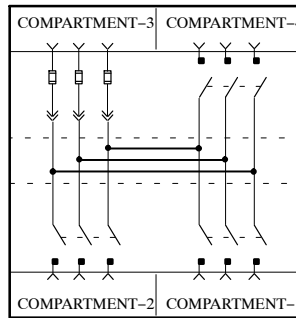
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53 11 05 01



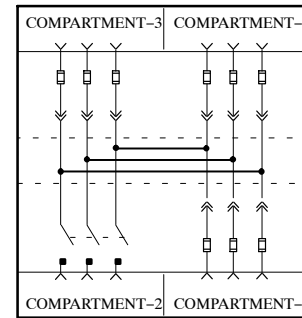
Type: 10

53 11 05 02



Type: 11

53 11 05 03



Type: 12

53 11 05 04

Switchgear Dimensions:

Height = 45 1/8" + 6" Base Adapter (All Types)

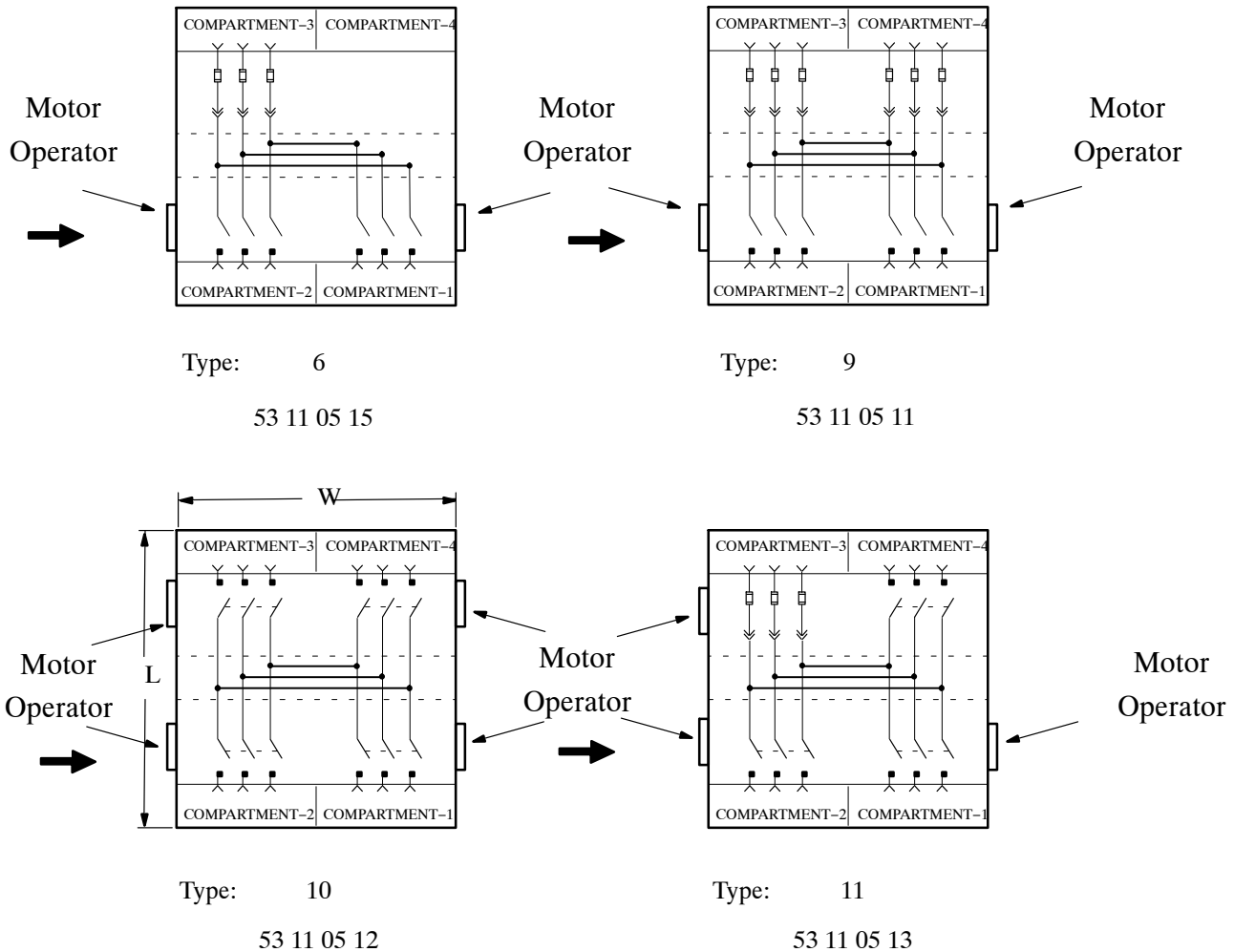
Width(W) = 75" (All Types)

Length(L) = 69 3/4" (Types 6, 9, and 12)

= 72 3/4" (Types 10 and 11)



Automated Switchgear Configurations:



Switchgear Dimensions:

Height = 45 1/8" + 6" Base Adapter (All Types)
 Width(W) = 75" (All Types) *
 Length(L) = 69 3/4" (Types 6, and 9)
 = 72 3/4" (Types 10 and 11)

➔ * Each motor operator extends 14" beyond the cabinet width

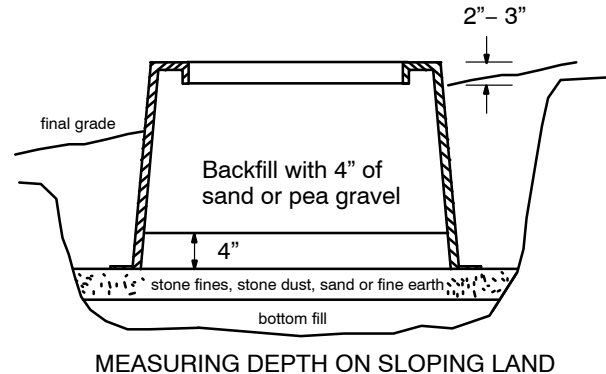
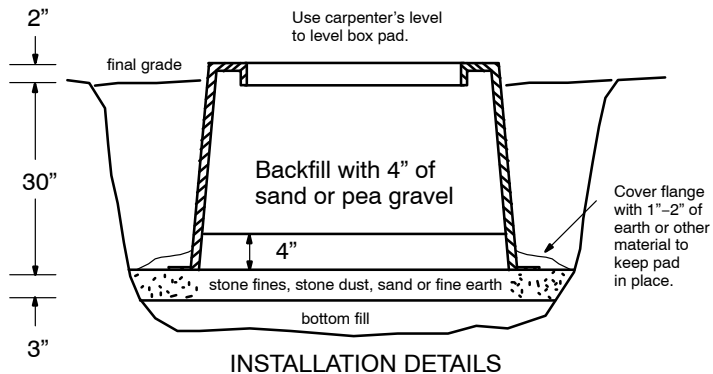
Composite Box Pad Installation for Direct Buried Cables:

Base Preparation

The bottom flange must rest on a firm foundation, and a 3" base must be prepared and thoroughly tamped. After the box pad has been placed in position and levelled, 1"-2" of soil should be placed on the flange to keep the box pad in place. Place 4" of sand inside the box pad to hold it in place.

Backfilling

Make sure no large boulders are resting against the sides of the box, because they produce high pressure points. Sand is not a good back fill material since it provides very little resistance to surface loads.



Composite Box Pad Installation for Conduit Systems:

Backfilling

Stabilize the box before backfilling the outside of the box to prevent shifting. A 3" base must be prepared and thoroughly tamped. Level the box pad and place 1 – 2" of soil on the flange to keep the box pad in place.

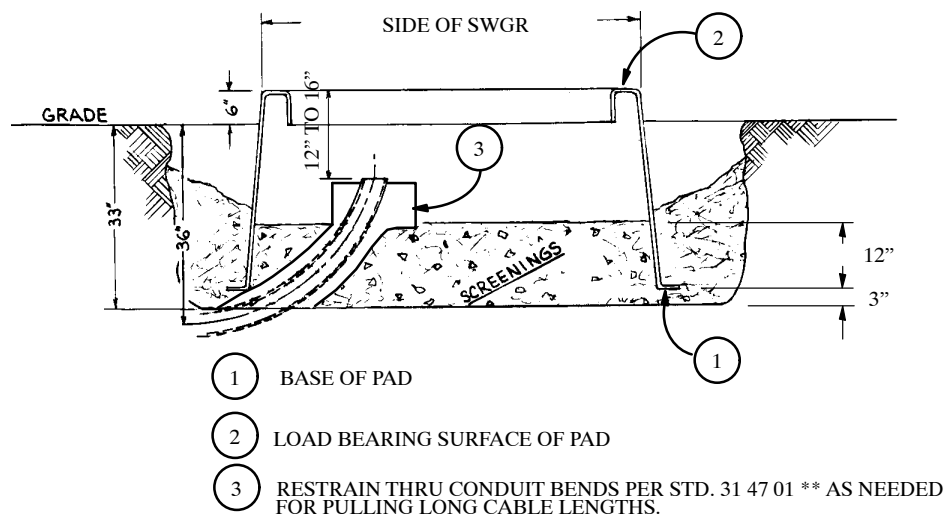
Stabilizing

To further stabilize the box and conduit bends, place 12 inches of screenings inside the box and tamp in place.

Bend – Final Preparation

The conduit bend should be cut off below the box's switchgear mounting flange. The rule is as follows: 5 inch diameter bend shall be cut a minimum of 16 inches below the flange. A 4 inch conduit cut a minimum of 12 inches below.

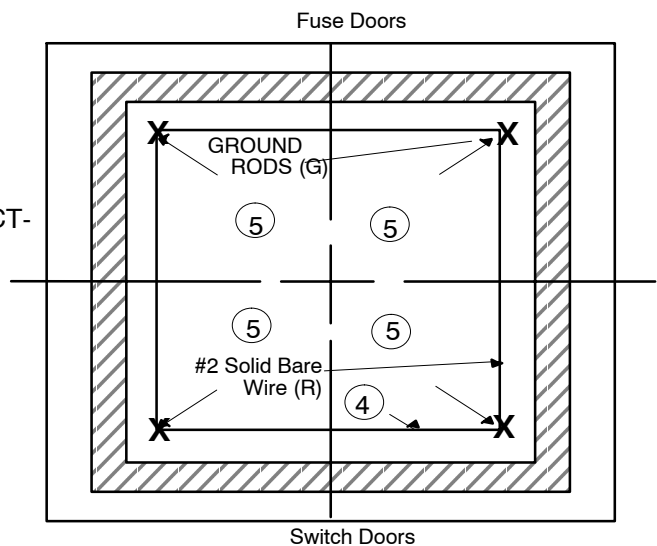
NOTE: The installation will not withstand pulling long cable lengths through the bends at the switchgear. Install restrained bends per Dist. Standard 31 47 01 **. Recommended for pulling 750 Al or Cu cables more than 250 ft.



Grounding Systems

④. PLACE GROUND RODS AT CORNERS (x) AND LOOP #2 BARE WIRE AROUND THE PAD CONNECTING TO THE RODS WITH GROUND ROD CLAMPS

⑤. CONNECT THE GROUND RODS TO THE SWITCHGEAR GROUND BARS.



EQUIPMENT-SWITCHING

Padmounted-3 Phase, 15 kV

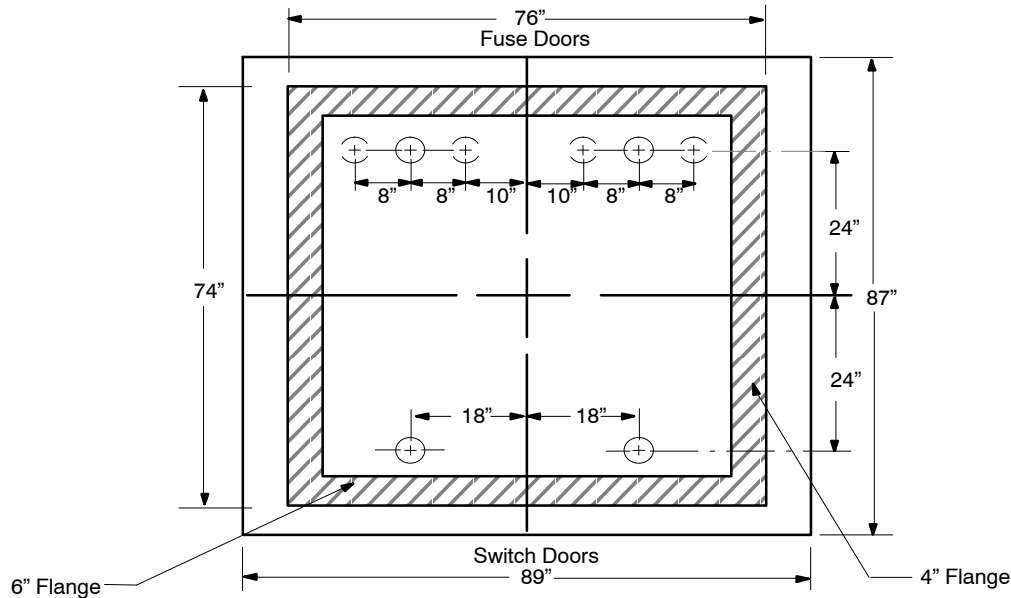
Deadfront

53 11 05 **

Sheet 9 of 14

Conduit Locations – Deadfront Pad (12-06-165):

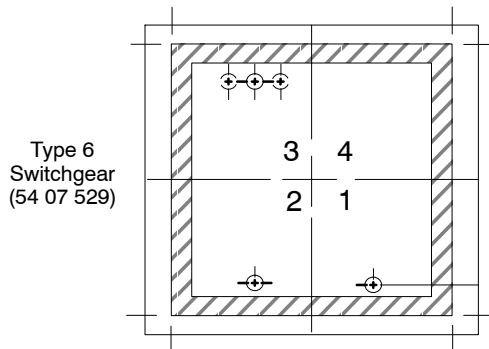
This is the preferred pad for deadfront switchgear.



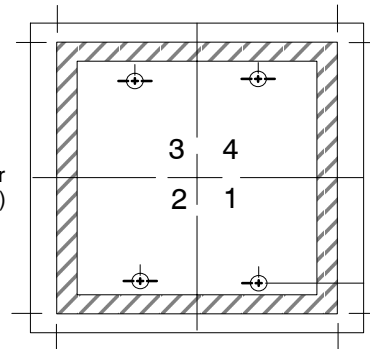
Type 9 Switchgear (54 07 287)

- Single Phase Lateral Conduit Location
- ⊕ Three Phase Lateral Conduit Location

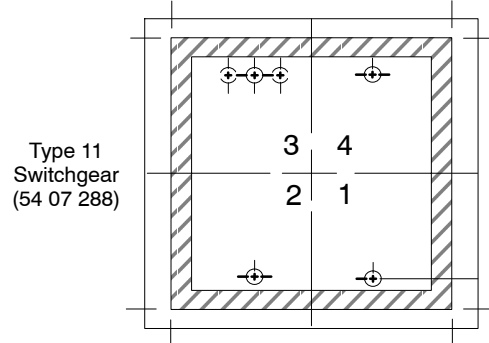
For the following switchgear conduit layouts, use the appropriate dimensions from the Type 9 conduit layout drawing above.



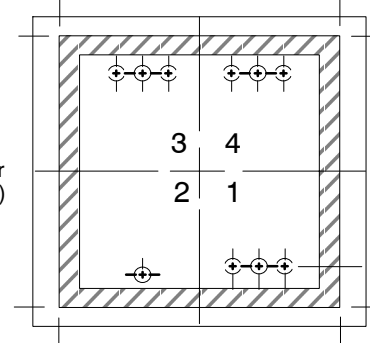
Type 6
Switchgear
(54 07 529)



Type 10
Switchgear
(54 07 300)



Type 11
Switchgear
(54 07 288)



Type 12
Switchgear
(54 07 290)

EQUIPMENT-SWITCHING

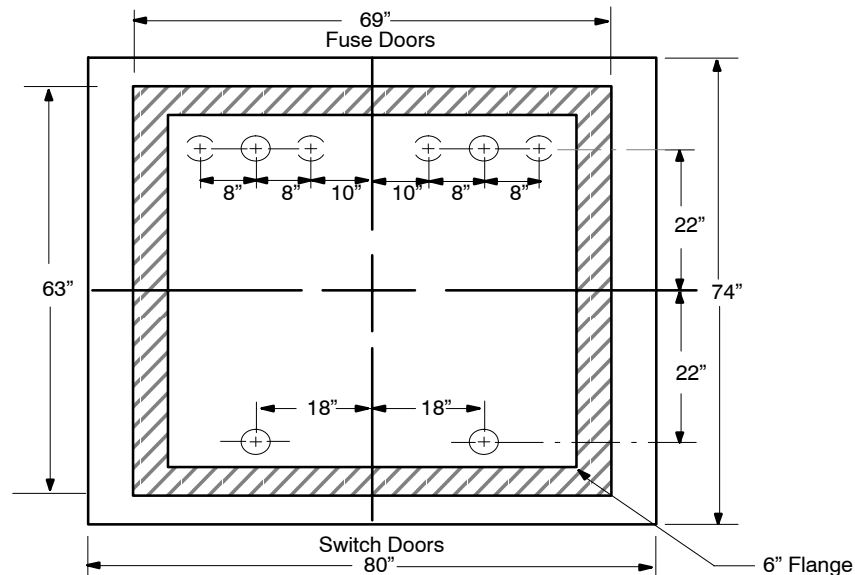
Padmounted-3 Phase, 15 kV

Deadfront

53 11 05 **
Sheet 10 of 14

Conduit Locations – Livefront Pad (12-06-109):

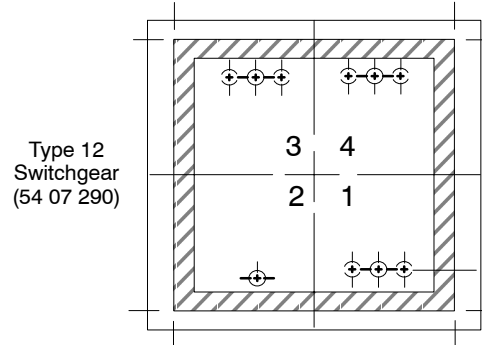
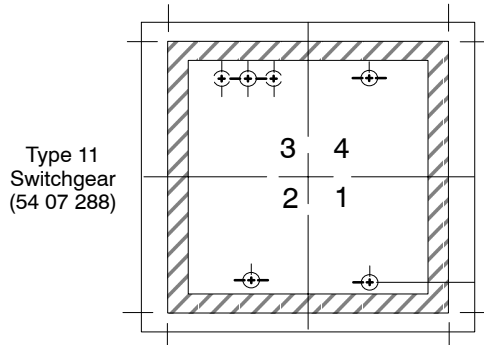
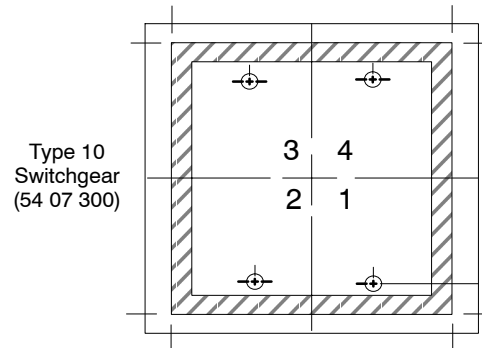
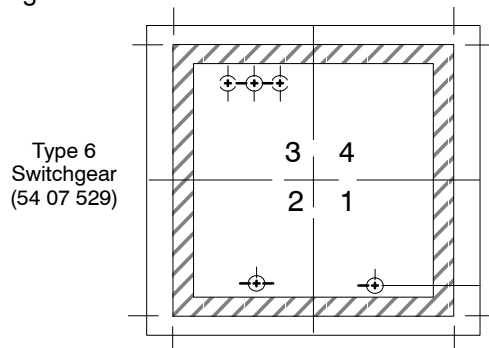
This pad is for deadfront switchgear with a base-spacer-adapter.



Type 9 Switchgear (54 07 287)

- Single Phase Lateral Conduit Location
- Three Phase Lateral Conduit Location

For the following switchgear conduit layouts, use the appropriate dimensions from the Type 9 conduit layout drawing above.



DEADBREAK CONNECTIONS IN SWITCHED COMPARTMENTS (600A)

		Dist Std. / Stk No.	Material Description	53 11 05 **	01	02	03	04	05
<div> <div>@</div> <div>@ 1</div> <div>@</div> <div>@ 2</div> <div>@</div> <div>@ 7</div> <div>@</div> <div>4</div> <div>@ 6</div> </div>	A	54 07 287	Switchgear – Type 9, 2 Sw, 6 Fuses		1				
		54 07 300	Switchgear – Type 10, 4 Sw			1			
		54 07 288	Switchgear – Type 11, 3 Sw, 3 Fuses				1		
		54 07 290	Switchgear – Type 12, 1 Sw, 9 Fuses					1	
		54 07 529	Switchgear – Type 6, 2 Sw, 3 Fuses						1
	B	12 06 165	Pad Composite– Deadfront Switchgear,		1	1	1	1	1
		12 06 109	Pad – Livefront Switchgear, Composite		1	1	1	1	1
	C	42 34 64 **	Terminator – Elbow, Deadbreak 600A		6	12	9	3	6
	D	42 34 62 01	Elbow – Loadbreak, 200A, #2 AWG		6	–	3	9	3
		42 34 62 02	Elbow – Loadbreak, 200A, 4/0 AWG		6	–	3	9	3
		42 34 62 03	Elbow – Loadbreak, 200A, 1/0 AWG		6	–	3	9	3
	G	23 13 069	Rod – Ground 5/8” x 8’		4	4	4	4	3
	H	17 52 032	Clamp – Ground Rod, 5/8” For #8 – 1/0		8	8	8	8	6
	I	17 54 132	Connector – Wire, 8–350 kcmil Cu.		10	16	13	7	10
	J	17 54 373	Connector – Wire, #2 Cu, Split Bolt		6	–	3	9	3
	K	16 06 276	Holder – Tag, Black, 5 Position						
		16 06 277	Holder – Tag, Black, 7 Position						
	L		Refill – Fuse, 14.4 kV, SMU – 20		6	–	3	9	3
	M	60 55 001	Indicator – Faulted Circuit, 1 PH						
	N	54 11 01 01	Arrester – Elbow, 10 kV						
	O	17 55 227	Cap – Insulating, 15 kV, 200 A		12	24	18	6	12
	P	18 52 025	Wire – Cu., #2 S.D. (ft)		48	48	48	48	39
	Q	12 06 195	Base Adapter – Type 6, 9, and 12						
		12 06 194	Base Adapter – Type 10 and 11						

Notes:

- Cover all 200 amp load reducing tap plugs on 600 amp elbows with an insulated cap (17–55–227) or an elbow arrester (10–01–138).
- Add appropriate letters and numbers (stock #'s 16–01–195 through 16–01–225) to tag holders.
- 600 amp insulated cap (17–55–386) or a 200 amp to 600 amp bushing adapter (17–05–256) can be used to cover an open 600 amp bushing.
- Cover all open 200 amp bushings with insulated caps (17–55–227). Cover all grounding bushings with insulated caps.
- 600 amp elbows are installed on bushings in the switchgear using a “T” wrench (stock # 85–41–370) or an “OAT” Operating Tool (stock# 83–28–045).
- For Federal Pacific switchgear installed on livefront pad 12–06–109, order base adapter 12–06–195 for type 6, 9, 12, or base adapter 12–06–194 for type 10 or 11.
- A fiber optic cable (18–66–658) can be added to each fault indicator installed for remote viewing on the door.

LOADBREAK CONNECTIONS IN SWITCHED COMPARTMENTS (200A)

		Dist Std. / Stk No.	Material Description	53 11 05 **	06	07	08	09	10
	A	54 07 287	Switchgear – Type 9, 2 Sw, 6 Fuses		1				
		54 07 300	Switchgear – Type 10, 4 Sw			1			
		54 07 288	Switchgear – Type 11, 3 Sw, 3 Fuses				1		
		54 07 290	Switchgear – Type 12, 1 Sw, 9 Fuses					1	
		54 07 529	Switchgear – Type 6, 2 Sw, 3 Fuses						1
@	B	12 06 165	Pad – Deadfront Switchgear, Composite		1	1	1	1	1
		12 06 109	Pad – Livefront Switchgear, Composite		1	1	1	1	1
@	C	17 05 256	Bushing Adapter – 200A to 600A		6	12	9	3	6
	D	42 34 62 01	Elbow – Loadbreak, 200A, #2 AWG		12	12	12	12	9
		42 34 62 02	Elbow – Loadbreak, 200A, 4/0 AWG		12	12	12	12	9
		42 34 62 03	Elbow – Loadbreak, 200A, 1/0 AWG		12	12	12	12	9
	G	23 13 069	Rod – Ground 5/8" x 8'		4	4	4	4	3
	H	17 52 032	Clamp – Ground Rod, 5/8" For #8 – 1/0		8	8	8	8	6
	I	17 54 132	Connector – Wire, 8–350 kcmil Cu.		10	16	13	7	10
@1	J	17 54 373	Connector – Wire, #2 Cu, Split Bolt		6	–	3	9	3
	K	16 06 276	Holder – Tag, Black, 5 Position						
		16 06 277	Holder – Tag, Black, 7 Position						
@	L		Refill – Fuse, 14.4 kV, SMU – 20		6	–	3	9	3
@ 4	M	60 55 001	Indicator – Faulted Circuit, 1 PH						
@	N	54 11 01 01	Arrester – Elbow, 10 kV						
2	O	17 55 227	Cap – Insulating, 15 kV, 200 A		6	12	9	3	6
	P	18 52 025	Wire – Cu., #2 S.D. (ft)		48	48	48	48	39
	@ 3	12 06 195	Base Adapter – Type 6, 9, and 12						
		12 06 194	Base Adapter – Type 10 and 11						

Notes:

1. Add appropriate letters and numbers (stock #'s 16–01–195 through 16–01–225) to tag holders.
2. Cover all open 200 amp bushings with insulated caps (17–55–227). Cover all grounding bushings with insulated caps.
3. For Federal Pacific switchgear installed on livefront pad 12–06–109, order base adapter 12–06–195 for type 6, 9, 12, or base adapter 12–06–194 for type 10 or 11.
4. A fiber optic cable (18–66–658) can be added to each fault indicator installed for remote viewing on the door.

AUTOMATED SWITCHGEAR
DEADBREAK CONNECTIONS IN SWITCHED COMPARTMENTS (600A)

		Dist Std. / Stk No.	Material Description	53 11 05 **	11	12	13	15
8	A	54 07 547	Switchgear – Type 9, 2 Sw, 6 Fuses, M.O. on 1 & 2	1				
		54 07 546	Switchgear – Type 10, 4 Sw, M.O. on 1,2,3 & 4		1			
		54 07 567	Switchgear – Type 11, 3 Sw, 3 Fuses, M.O. on 1,2 & 3			1		
		54 07 570	Switchgear – Type 6, 2 Sw, 3 Fuses, M.O. on 1 & 2				1	
@	B	12 06 165	Pad – Deadfront Switchgear, Composite	1	1	1	1	
		12 06 109	Pad – Livefront Switchgear, Composite	1	1	1	1	
@1	C	42 34 64 **	Terminator – Elbow, Deadbreak 600A	6	12	9	6	
@	D	42 34 62 01	Elbow – Loadbreak, 200A, #2 AWG	6	–	3	3	
		42 34 62 02	Elbow – Loadbreak, 200A, 4/0 AWG	6	–	3	3	
		42 34 62 03	Elbow – Loadbreak, 200A, 1/0 AWG	6	–	3	3	
	G	23 13 069	Rod – Ground Rod 5/8" x 8'	4	4	4	3	
	H	17 52 032	Clamp – Ground Rod, 5/8" for #8 - 1/0	8	8	8	6	
	I	17 54 132	Connector – Wire, 8–350 kcmil Cu.	10	16	13	10	
	J	17 54 373	Connector – Wire, #2 Cu, Split Bolt	6	–	3	3	
@2	K	16 06 276	Holder – Tag, Black, 5 Position					
		16 06 277	Holder – Tag, Black, 7 Position					
@	L		Refill – Fuse, 14.4 kV, SMU – 20	6	–	3	3	
@7	M	60 55 001	Indicator – Faulted Circuit, 1 PH					
@	N	54 11 01 01	Arrestor – Elbow, 10 kV					
4	O	17 55 227	Cap – Insulating, 15 kV, 200 A	12	24	18	12	
	P	18 52 025	Wire – Cu., #2 S.D. (ft)	48	48	48	39	
@6	Q	12 06 195	Base Adapter – Type 6, 9, and 12					
		12 06 194	Base Adapter – Type 10 and 11					

Notes:

- Cover all 200 amp load reducing tap plugs on 600 amp elbows with an insulated cap (17–55–227) or an elbow arrester (10–01–138).
- Add appropriate letters and numbers (stock #'s 16–01–195 through 16–01–225) to tag holders.
- 600 amp insulated cap (17–55–386) or a 200 amp to 600 amp bushing adapter (17–05–256) can be used to cover an open 600 amp bushing.
- Cover all open 200 amp bushings with insulated caps (17–55–227). Cover all grounding bushings with insulated caps.
- 600 amp elbows are installed on bushings in the switchgear using a "T" wrench (stock # 85–41–370) or an "OAT" Operating Tool (stock# 83–28–045).
- For Federal Pacific switchgear installed on livefront pad 12–06–109, order base adapter 12–06–195 for type 6, 9, or base adapter 12–06–194 for type 10 or 11.
- A fiber optic cable (18–66–658) can be added to each fault indicator installed for remote viewing on the door.
- Motor Operator (M.O.'s) are on switched compartments.

AUTOMATED SWITCHGEAR

LOADBREAK CONNECTIONS IN SWITCHED COMPARTMENTS (200A)

		Dist Std. / Stk No.	Material Description	53 11 05 **	16	17	18	20
8	A	54 07 547	Switchgear – Type 9, 2 Sw, 6 Fuses, M.O. on 1 & 2		1			
		54 07 546	Switchgear – Type 10, 4 Sw, M.O. on 1, 2, 3 & 4			1		
		54 07 567	Switchgear – Type 11, 3 Sw, 3 Fuses, M.O. on 1, 2 & 3				1	
		54 07 570	Switchgear – Type 6, 2 Sw, 3 Fuses, M.O. on 1 & 2					1
@	B	12 06 165	Pad – Deadfront Switchgear, Composite		1	1	1	1
		12 06 109	Pad – Livefront Switchgear, Composite		1	1	1	1
@	C	17 05 256	Bushing Adapter – 200A to 600A		6	12	9	6
		42 34 62 01	Elbow – Loadbreak, 200A, #2 AWG		12	12	12	9
		42 34 62 02	Elbow – Loadbreak, 200A, 4/0 AWG		12	12	12	9
		42 34 62 03	Elbow – Loadbreak, 200A, 1/0 AWG		12	12	12	9
@1	G	23 13 069	Rod – Ground 5/8" x 8'		4	4	4	3
		17 52 032	Clamp – Ground Rod, 5/8" for #8 – 1/0		8	8	8	6
		17 54 132	Connector – Wire, 8–350 kcmil Cu.		10	16	13	10
		17 54 373	Connector – Wire, #2 Cu, Split Bolt		6	–	3	3
@	K	16 06 276	Holder – Tag, Black, 5 Position					
		16 06 277	Holder – Tag, Black, 7 Position					
@4	L		Refill – Fuse, 14.4 kV, SMU – 20		6	–	3	3
@	M	60 55 001	Indicator – Faulted Circuit, 1 PH					
@	N	54 11 01 01	Arrester – Elbow, 10 kV					
2	O	17 55 227	Cap – Insulating, 15 kV, 200A		6	12	9	6
	P	18 52 025	Wire – Cu., #2 S.D. (ft)		48	48	48	39
@3	Q	12 06 195	Base Adapter – Type 6, 9, and 12					
		12 06 194	Base Adapter – Type 10 and 11					

Notes:

1. Add appropriate letters and numbers (stock #'s 16–01–195 through 16–01–225) to tag holders.
2. Cover all open 200 amp bushings with insulated caps (17–55–227). Cover all grounding bushings with insulated caps.
3. For Federal Pacific switchgear installed on livefront pad 12–06–109, order base adapter 12–06–195 for type 6, 9, 12, or base adapter 12–06–194 for type 10 or 11.
4. A fiber optic cable (18–66–658) can be added to each fault indicator installed for remote viewing on the door.
5. Motor Operators (M.O.'s) are on switched compartments.

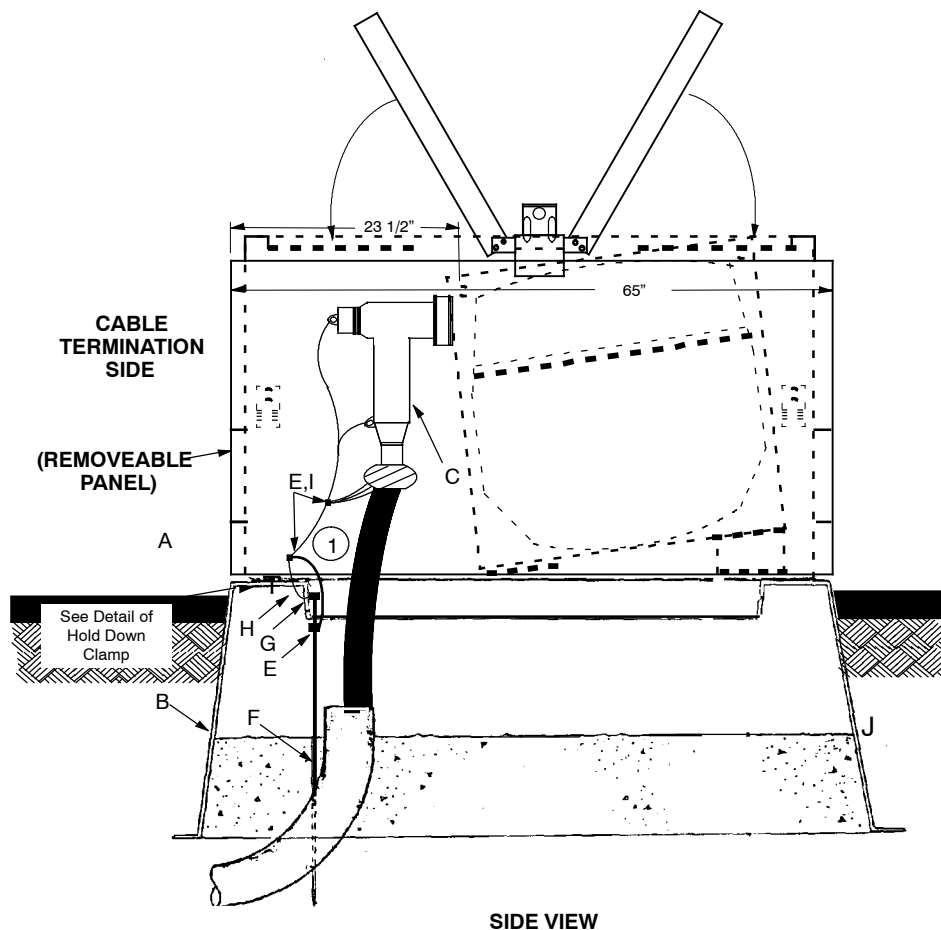
EQUIPMENT-SWITCHING

Padmounted-3 Phase, 35 kV

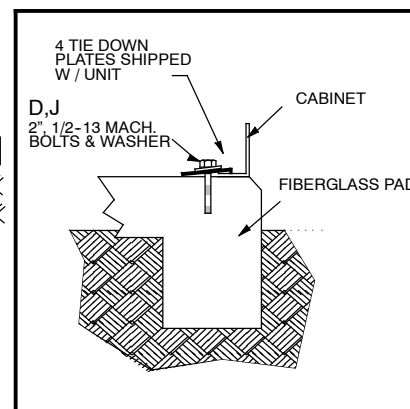
Vacuum Type

53 11 06 **

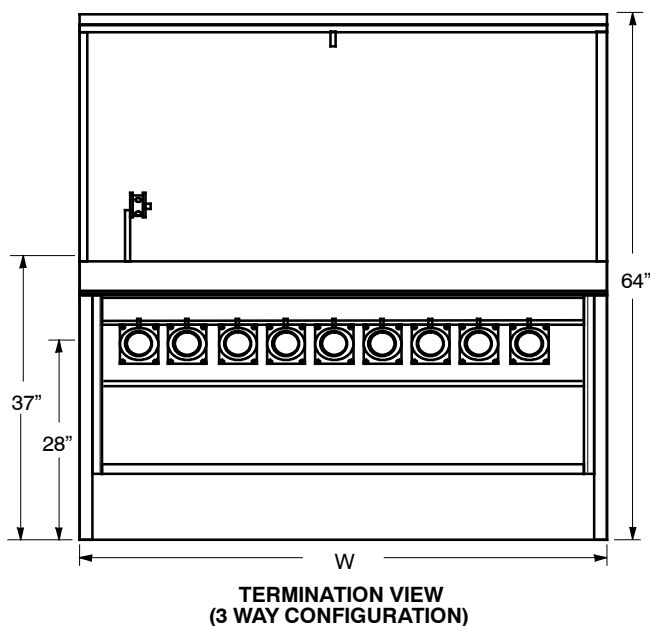
Sheet 1 of 6



SWITCH / INTERRUPTER
CONTROL SIDE



HOLD DOWN CLAMP DETAIL



NOTES:

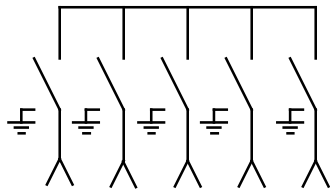
1. Connect neutral wires from each cable to #2 Cu. wire connected to grd. rod and compartment grd. bar. Construct compartment ground bar using 3 ground rods and 2 bolt connectors.
2. For Stk. # 54-07-438 : W=113"
For Stk. # 54-07-437 and 54-07-445: W=79"
For Stk. # 54-07-534: W=79"
3. Install a label on the switchgear where it can be seen from the street with the proper Pad number. Use the appropriate Reflective Numbers 16-04-1XX.
4. Install a label on the inside of the compartment lid (both termination and control side) with the letters LAT____ or DIP____. Use Reflective Letters 16-04-320, 16-04-317, 16-04-321 or 16-04-148, 16-04-419, 16-04-737 and the appropriate Reflective Numbers 16-04-108 to 16-04-116. Also install "35kV" below each LAT or DIP label using Reflective Numbers 16-04-111 and 16-04-113 and Reflective Letters 16-04-420 and 16-14-041.

EQUIPMENT-SWITCHING
Padmounted-3 Phase, 35 kV
Vacuum Type

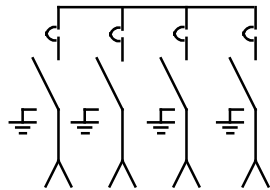
53 11 06 **

Sheet 2 of 6

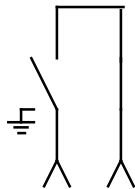
5. Install a label by each switch handle with the letter D____. Use Reflective Letter 16-04-418 and the appropriate Reflective Numbers 16-04-1XX.
6. See sheets 3 & 4 for fiberglass pad installation instructions.
7. Install Faulted Circuit Indicator above the cable jacket cut off.
8. Cover over unused bushings with 35kV insulated caps (stk.# 17 55 509).
9. The 200A tap on the back of each 600A termination can be covered with an elbow arrester (stk.# 10 01 163 or stk.# 10 01 177) instead of an insulated cap.
10. Add at least 3 grounding elbows per switchgear. Choose type(s) of grounding elbows depending on cable size(s).



5 Load Interrupter Switches
Stk.#: 54-07-438

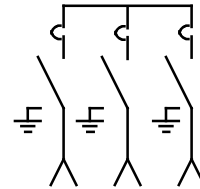


4 Fault Interrupter Switches
Stk.#: 54-07-527

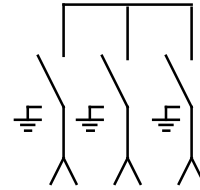


1 Load Interrupter Switch
Stk.#: 54-07-534

**Switchgear
Configurations**



3 Fault Interrupter Switches
Stk.#: 54-07-437



3 Load Interrupter Switches
Stk.#: 54-07-445

EQUIPMENT-SWITCHING
Padmounted-3 Phase, 35 kV
Vacuum Type

53 11 06 **

Sheet 3 of 6

		Dist Std. / Stk No.	Material Description	53 11 06 **	01	02	03	04	05
@	A	54 07 438	Switchgear - 5 L.I. Sw.		1				
		54 07 437	Switchgear - 3 F.I. Sw.			1			
		54 07 445	Switchgear - 3 L.I. Sw.				1		
		54 07 527	Switchgear - 4 F.I. Sw.					1	
		54 07 534	Switchgear - 1 L.I. Sw.						1
	B	12 06 154	Pad - Switchgear, Fiberglass, 74" x 118" x 36"		1				
		12 06 155	Pad - Switchgear, Fiberglass, 66" x 84" x 36"			1	1	1	1
	C	42 44 14 01	Termination - 750 Cu., 35kV	-	-	-	-	-	-
		42 44 13 **	Termination - 1/0 Al. and 350 Cu., 35kV	-	-	-	-	-	-
	D	21 56 078	Bolt - Mach., S.S., Hex, 1/2" x 2"		8	8	8	8	8
	E	17 54 132	Connector - Wire, 8-350 kcmil Cu.		17	11	11	14	8
	F	23 63 069	Rod - Ground, 5/8" x 8'		3	3	3	3	3
	G	17 52 032	Clamp - Ground Rod, 5/8" For #8 - 1/0		2	2	2	2	2
	H	18 52 025	Wire - Cu. #2, S.D. (ft.)		65	47	47	56	38
	I	17 54 182	Connector - Wire, #2 Cu., Split Bolt		30	18	18	24	12
	J	21 75 105	Washers - Rnd., 1/2", S.S.		8	8	8	8	8
	8 @	K	17 55 509	Cap - Protective, 600A, 35kV Bushing	-	-	-	-	-
	@	L	60 55 024	Indicator - Fault, CRNT Reset, Vari. Trip	-	-	-	-	-
	9 @	M	10 01 163	Arrester - 34kV Elbow, 200A (for 1/0 AWG)	-	-	-	-	-
			10 01 177	Arrester - 34kV Elbow, 200A (for 750 kcmil)	-	-	-	-	-
	10@	N	17 63 296	Elbow - Grounding, 35kV, 750 kcmil	3	3	3	3	3
			17 63 295	Elbow - Grounding, 35kV, 1/0 AWG and 350 kcmil	3	3	3	3	3

INSTRUCTIONS FOR EXCAVATION AND PLACEMENT OF SWITCHGEAR BOXPAD

Placing The Bends

Place the bends as described in the figure. Note that a 36 inch radius bend on the lateral side at a 36 inch depth will almost touch the side of the box when it is placed at depth. An increase of final burial depth or angling of the conduit may be necessary to clear the box flange.

Excavation And Final Depth

An initial depth of 33 inches shall be excavated removing or tamping all loose soil. The length and width of the hole is the maximum length and width of the box plus 5" of clearance on each side. The longer dimension is the door side of the gear.

Crushed stone screenings shall be placed and tamped to a final level depth of 30 inches. The area bearing the pad-box shall be leveled with a carpenter's level. The final depth of 30 inches will leave the required 6 inches of box exposed at final grade.

Place The Box

Place the box with the longer side where the doors will be, as described on the Engineering Layout.

Backfilling

Stabilize the box before backfilling the outside of the box to prevent shifting.

Stabilizing

To further stabilize the box and conduit bends, place 12 inches of screenings inside the box and tamp in place.

Bend - Final Preparation

The conduit bend should be cut off below the box's switchgear mounting flange. A 5 inch diameter bend shall be cut a minimum of 16 inches below the flange.

Do not tamp excessively close to the box because the side will tend to bow in.

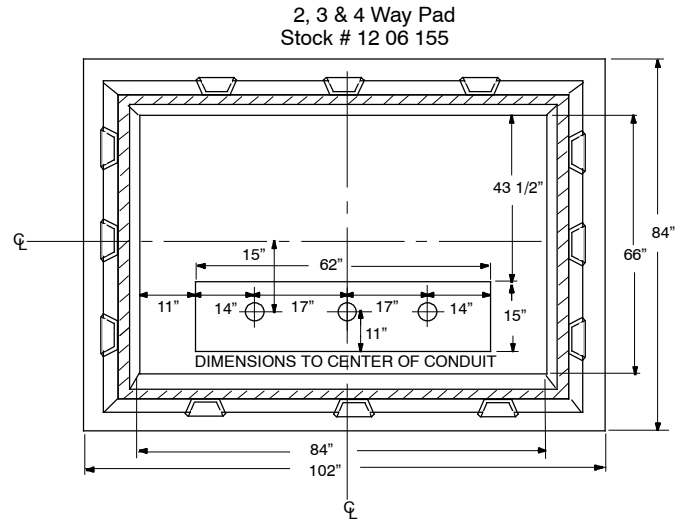
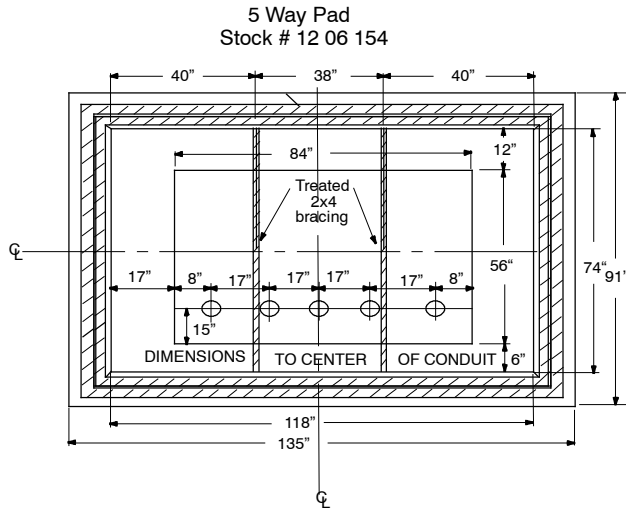
NOTE: This installation will not withstand pulling long cable lengths through the bends at the switchgear. Install re-strained bends per Dist. Standard **31 47 01 ****. Recommended for pulling 750 Al or Cu cables more than 250 ft. See fiberglass pad drawing.

CONCRETE OPERATING PAD

The switchgear box pad shall be surrounded by a concrete pad. The poured in place pad shall be a minimum of 4 inches thick. The pad shall be a minimum length of 16 feet on the cable termination side of the switchgear and a minimum of 6 feet on the switch/interrupter control side of the switchgear.

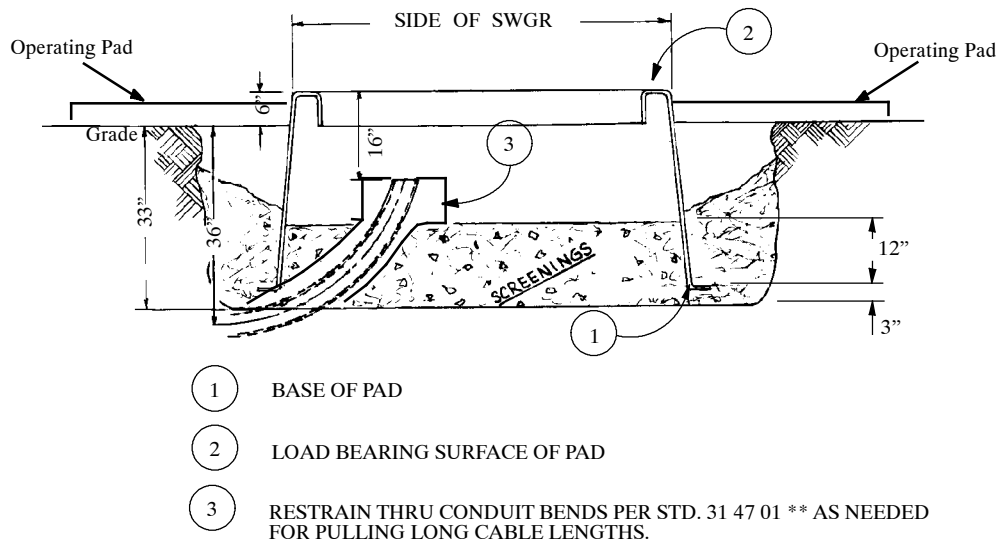
The operating pad shall have a minimum width of 5 feet on both sides of the switchgear mounting sleeve.

Fiberglass Pads with Conduit Bend Placements

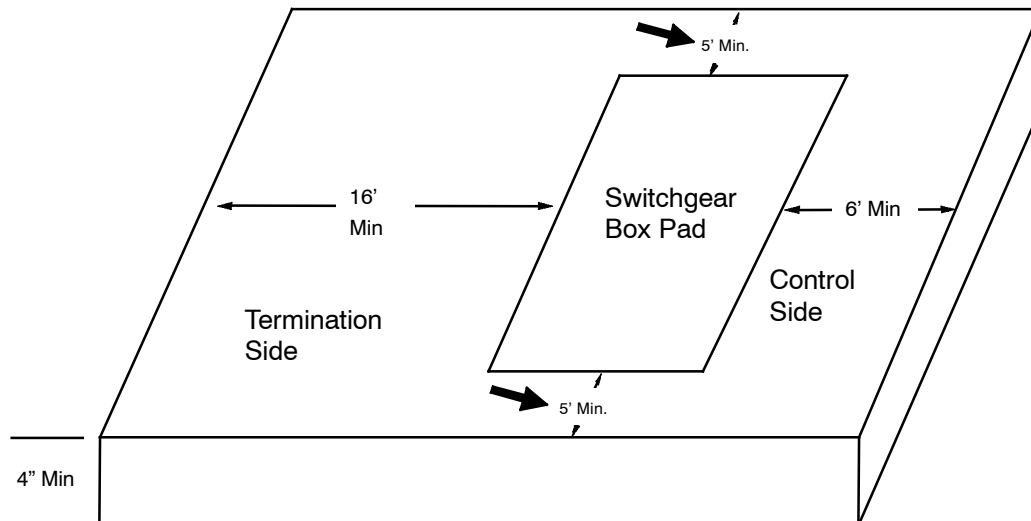


(Note: For 4-Way Swgr. add 1 conduit and reduce the end dimensions from 14" to 5.5". For 2-Way Swgr., install the center and left conduits as shown and install the vacuum tank at the left end of the cable pit.)

Fiberglass Pads - Placement Depth



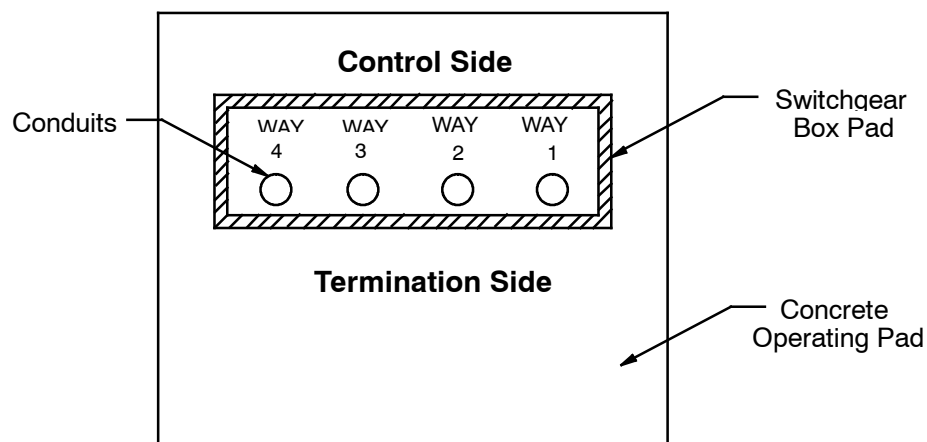
CONCRETE OPERATING PAD



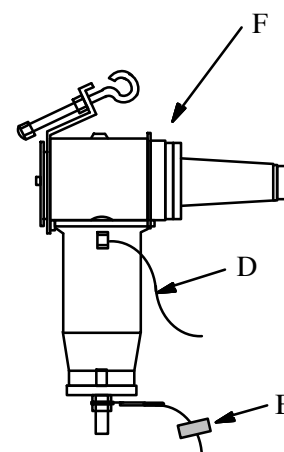
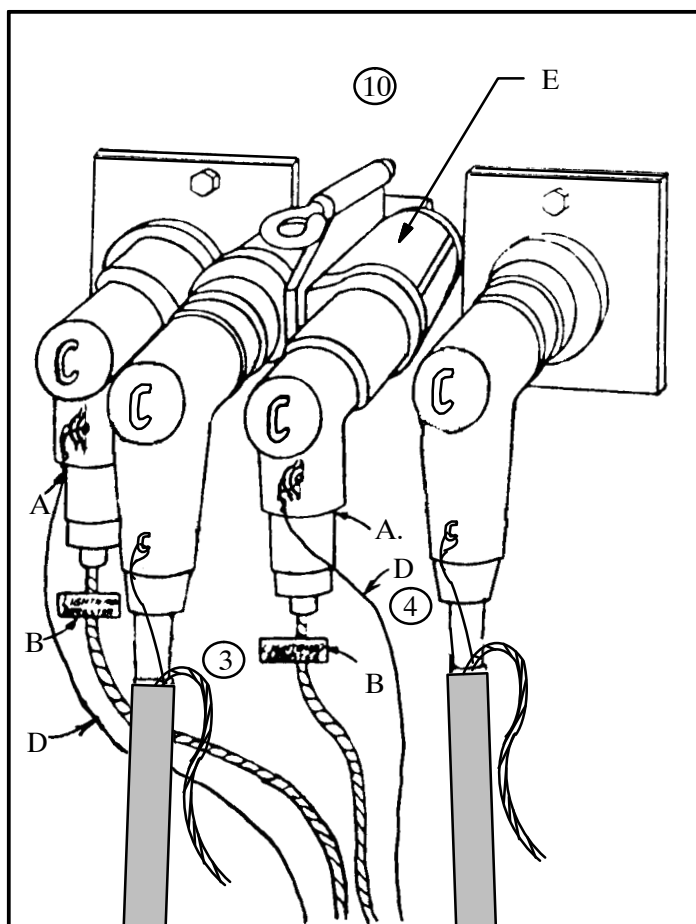
For 5-Way switchgear, approximately 6.14 cubic yards of concrete is needed to construct the operating pad.

For 2, 3, or 4-Way switchgear, approximately 5.26 cubic yards of concrete is needed to construct the operating pad.

DESIGNATION OF CONDUIT POSITIONS



SINGLE-PHASE INSTALLATION SHOWN. ADJUST QUANTITIES FOR THREE-PHASE APPLICATIONS.



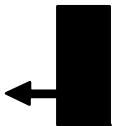
- 54 11 01 01 – Installation on transformer w/under oil arrester
- 54 11 01 01 – No under oil arrester increase items “A” & “B” to 2 each
- 54 11 01 02 – No under oil arrester and limited space between bushings
- 54 11 01 03 – Installation on transformer w/under oil arrester and limited space between bushings

		Std. / Stk. No.	Description	01	02	03
3	A	10 01 138	10 kV Elbow Arrester	1*	1	
	B	16 01 147	Plate, Name, 1-1/4 x 2, Red, "Lightning Arrester"	1*	2	1
	C	23 78 183	Hot Line Clamp	1	2	1
5	D	18 52 018	Wire, Copper, Binding, #14	4 ft.	8ft.	4ft.
@	E	17 55 228	Bushing – Feed Thru, 15kV	1		
6	F	10 01 151	10 kV Parking Stand Arrester		1	1

* If an elbow arrester is to be installed on both the stand-off bushing and the spare transformer/enclosure bushing, then enter a quantity of 2 when estimating this standard.

Notes:

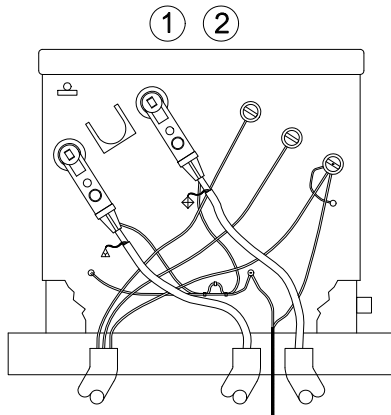
1. Arresters are for 4160 Grd. Y/2400V, 12470 Grd. Y/7200V, 13200 Grd. Y/7620 and 13800 Grd. Y/7970 volt pad-mounted transformers and padmounted junction enclosures. Elbow arresters are not installed on radial feed 3Ø padmount transformers.
2. Care must be taken to avoid confusing elbow arresters with grounding elbows. Grounding elbows are for grounding isolated URD primary cables and are generally either yellow or orange in color. Care must also be taken to avoid confusing a parking stand arrester with an insulating standoff bushing.
3. Elbow arresters and parking stand arresters should always be identified with the special "Lightning Arrester" nameplate. The nameplate should be attached to the ground lead prior to installing the arrester.
4. The arrester mating interface must be coated with a thin layer of silicone lubricant prior to installation.
5. When installing arresters, the ground lead must always be attached first. The ground lead must be attached to the transformer/enclosure ground using a hot line clamp. A #14 copper drain wire must be attached from the arrester body to the transformer/enclosure ground connection.
6. Install elbow arresters on feed thru bushings or equipment bushings in a manner similar to installing a loadbreak elbow. Due to space limitations in the Type II transformers it may be necessary to use a parking stand arrester instead of a feed thru bushing and elbow arrester. The parking stand arrester is installed in a manner similar to installing a feed thru bushing. The open point loadbreak elbow is installed on the parking stand arrester and an elbow arrester is installed on the open equipment bushing.
7. Elbow arresters are to be removed with an elbow pulling tool (Stk.#83-38-032). The pulling tool must be attached to the pull-ring on the back of the elbow arrester.
8. Whenever installing or removing arresters care must be taken to avoid bending or twisting the arrester. If arresters are subjected to excessive bending, twisting, or pounding or if the arresters appear to be defective they must not be used.
9. If open points are found while performing routine work, they should be retrofitted with arresters.
10. All transformers shall have an arrester installed at open points will be needed unless the transformer is equipped with an under oil lightning arrester. If the transformer has an under oil arrester, an arrester will not be placed on the open transformer bushing. Instead of an arrester an insulating cap (Stk.#17-55-227) will be placed on the open transformer bushing.



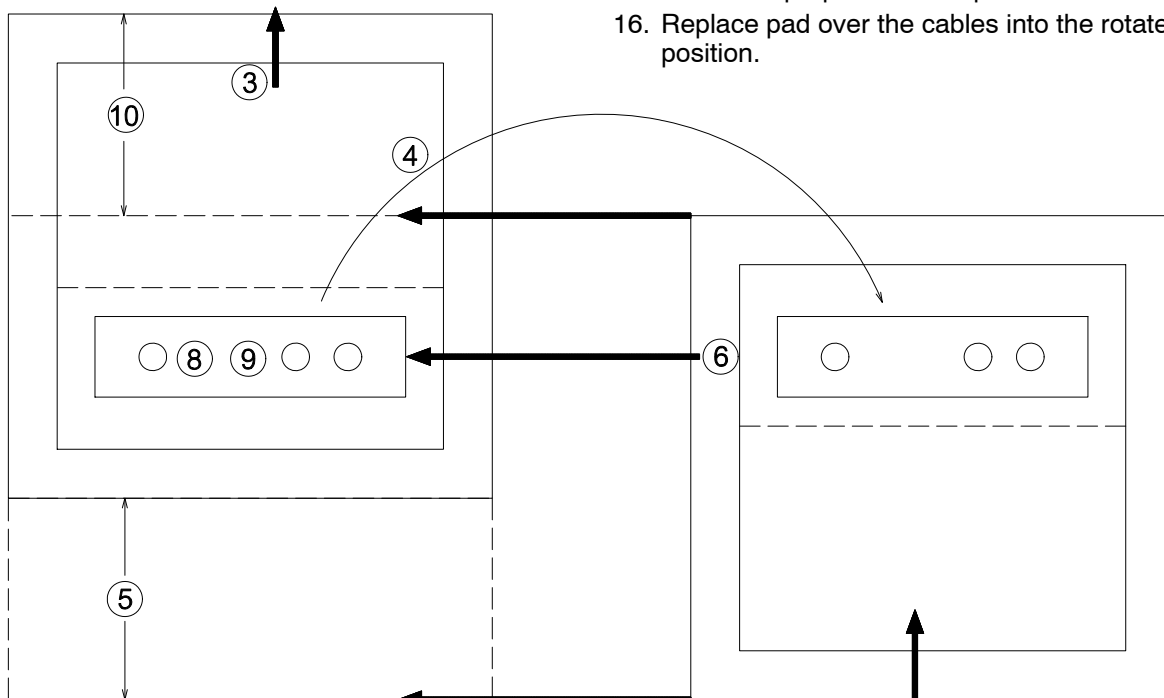
EQUIPMENT TRANSFORMERS
Padmounted, Single-Phase, 2400, 7200, 7620, 7970 Volts
Replacement of Low-Profile with High-Profile

54 12 01 **

Sheet 1 of 3



TYPE II - 24" HIGH

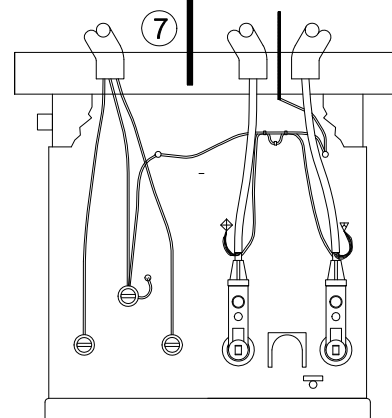


Option 1 - Rotate Pad 180 Degrees

The Transformer pad can be rotated 180 degrees if a) the easement allows, b) there are no obstructions in front of the rotated pad to prevent 10 FT. access, and c) primary cables and secondary wire were installed per low-profile standards.

11. De-energize the transformer and primary cables feeding into the transformer.
12. Disconnect and ground all cable and wire connections.
13. Remove the low-profile transformer from the pad.
14. Remove the pad.
15. Level and prepare rotated pad location.
16. Replace pad over the cables into the rotated position.

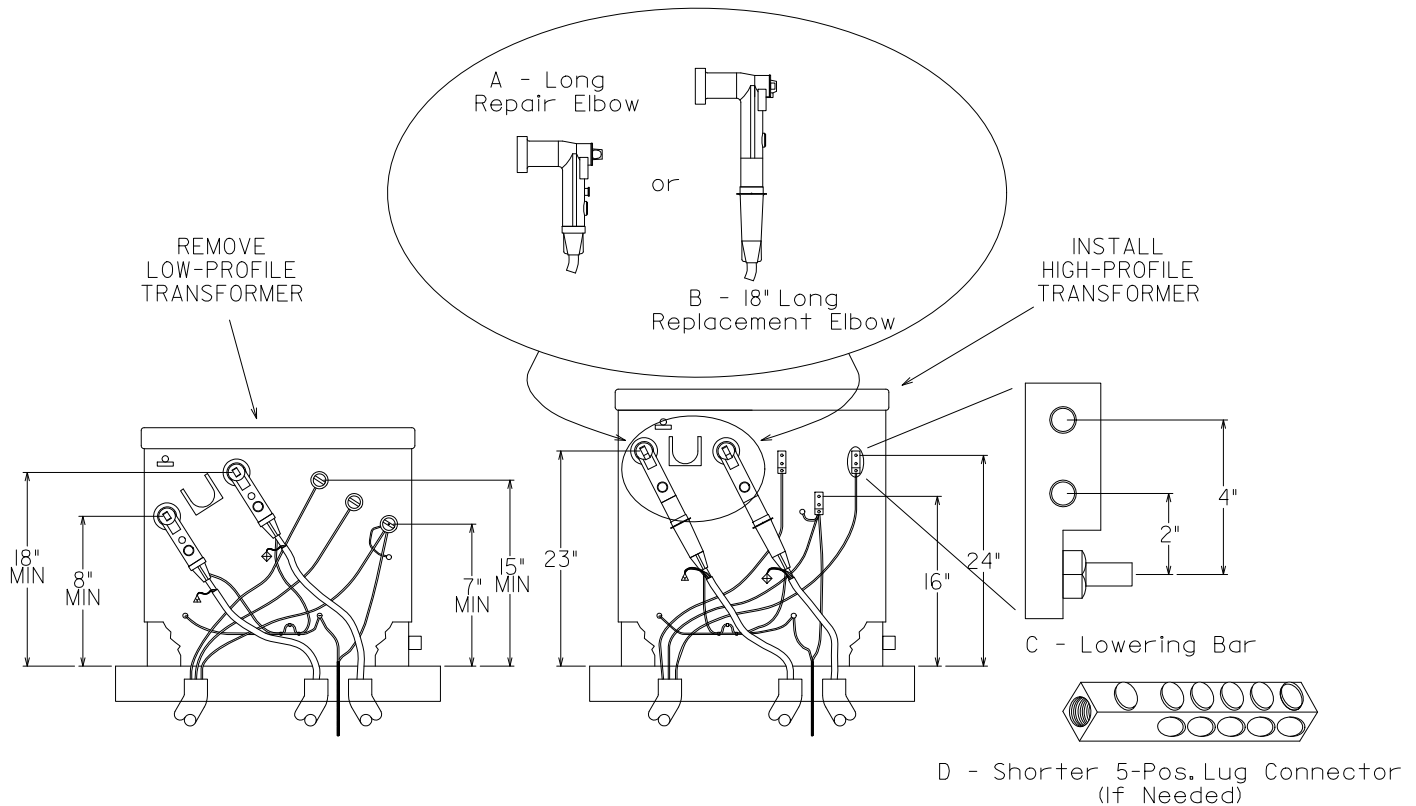
17. Place new high-profile transformer onto the rotated pad.
18. Reorient and reconnect all cables and wires to the new transformer.
19. Reenergize the primary cables and the new transformer.
20. Back-fill and restore remainder of the old pad location as needed.



TYPE I - 32" HIGH

Option 2 – Keep Pad Orientation and Re-Terminate Primary Cables and Secondary Wires

If the transformer pad cannot be rotated 180 degrees, the primary cables and secondary wires will likely not be long enough. The following materials can be used as needed to re-terminate the cable and wires to the new High-Profile transformer.

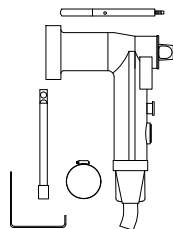


Load-Break Repair or Replacement Elbows

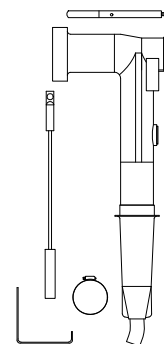
There are two versions of longer load-break elbows available that can be used to re-terminate the primary cables so they will reach the higher mounted primary bushings:

A – The “Long Repair” elbow has an extended length contact and elbow housing that results in a net gain of 3-1/4 inches in length.

B – The “18” Long Replacement” elbow has an extended length contact and elbow housing that results in a net gain of 8-7/8 inches in length.



A - Long Repair Elbow



B - 18" Long Replacement Elbow

EQUIPMENT TRANSFORMERS

Padmounted, Single-Phase, 2400, 7200, 7620, 7970 Volts
Replacement of Low-Profile with High-Profile

54 12 01 **

Sheet 3 of 3

C – Secondary Bushing Lowering Bar

The secondary connectors can be disconnected from the low-profile transformer and secondary lowering bars installed to provide lower conductor connection points on the replacement high-profile transformer. The existing connectors are then reinstalled onto the stud of the lowering bar. In many cases this may lower the connectors enough to allow connection of the secondary conductors without splicing.

There are two secondary bushing lowering bars. Both provide for lowering the connectors either 2" or 4".

- Stock # 18 12 052 has 5/8" slip-fit holes for connection to transformers up to 75 kVA.
- Stock # 18 12 051 has 1" slip-fit holes for connection to transformers from 100 to 167 kVA.

D – Shorter 5-Position Secondary Lug Connector

In some cases, the connectors on the transformer being replaced may be too long and when installed on the lowering bar, cause inadequate clearance to the door of the transformer. In these cases, the lug connectors will need to be replaced with shorter lug connectors. These shorter lug connectors are limited to 5 conductors with a range of 1/0 to 750 per conductor position.

- Stock # 17 55 230 has 5/8" slip-fit holes for connection to transformers up to 75 kVA.
- Stock # 17 55 229 has 1" slip-fit holes for connection to transformers from 100 to 167 kVA.

		Std. / Stk. No.	Description	41 12 01 **	1	2	3	4	5	6	7	8	9	10
@	A	17 05 250	#2 AWG Al, STR, 175 or 220 Mil (Long Repair)		2									
		17 05 303	#2 AWG Al, SOL, 175 Mil (Long Repair)			2								
		17 05 304	1/0 AWG Al, STR, 175 Mil (Long Repair)				2							
		17 05 514	3/0 AWG Al, CPR, 175 Mil (Long Repair)					2						
		17 05 305	4/0 AWG Al, STR, 175 Mil (Long Repair)						2					
	B	17 05 494	#2 AWG Al, STR, 175 or 220 Mil (18 Inch Long Replacement)							2				
		17 05 498	#2 AWG Al, SOL, 175 or 220 Mil (18 Inch Long Replacement)								2			
		17 05 499	1/0 AWG Al, STR, 175 Mil (18 Inch Long Replacement)									2		
		17 05 515	3/0 AWG Al, CPR, 175 Mil (18 Inch Long Replacement)										2	
		17 05 493	4/0 AWG Al, STR, 175 Mil (18 Inch Long Replacement)											2
@	C	18 12 052	Lowering Bar, 5/8" Slip-Fit for Up to 75 kVA		3	3	3	3	3	3	3	3	3	3
		18 12 051	Lowering Bar, 1" Slip-Fit for 100-167 kVA		3	3	3	3	3	3	3	3	3	3
@	D	17 55 230	Lug, 5-Pos., 5/8" Slip-Fit for Up to 75 kVA		3	3	3	3	3	3	3	3	3	3
		17 55 229	Lug, 5-Pos., 1" Slip-Fit for 100-167kVA		3	3	3	3	3	3	3	3	3	3

Option 3 – Splice or Replace Primary Cables and Secondary Conductors

If neither Options 1 or 2 allow the primary cables and secondary conductors to be reconnected to the replacement high-profile transformer, then splicing or replacement of primary and secondary cables/conductors will be required.

For the 600 V secondary, refer to DCS **41 14 36 **** or **41 14 37 01** for splicing materials and instructions.

For the 15 kV primary cable, refer to DCS **41 34 33 03**, **41 34 34 ****, or **41 34 35 **** for splicing materials and instructions. Refer to DCS **42 34 62 **** for loadbreak elbow materials and instructions.

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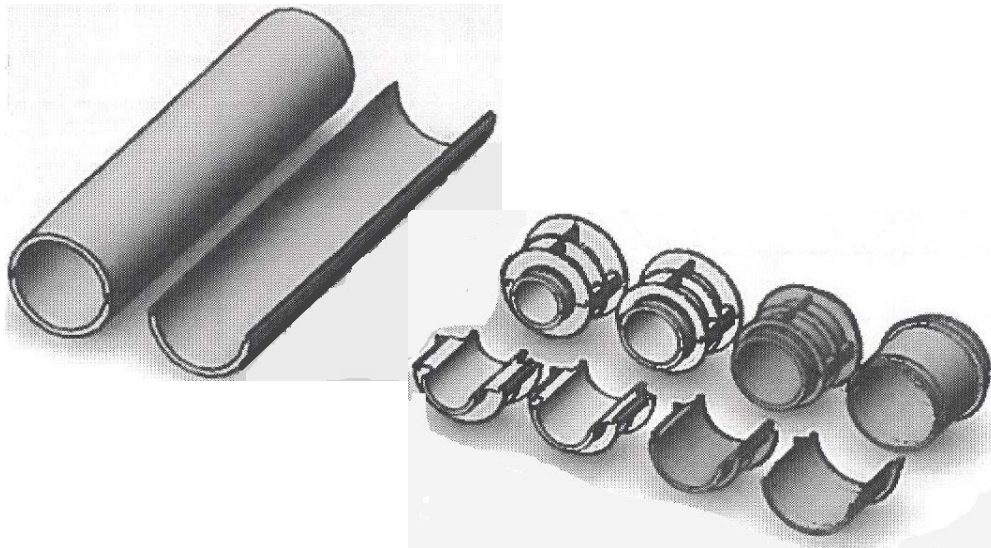
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GENERAL

The Broken Conduit Repair System (BCRS) will be used to repair broken PVC conduits installed on poles or in the ground. The BCRS will allow Ameren Linemen to make repairs to broken conduit without having to remove the installed cables and thereby reducing customers interruptions and the associated customers minutes out.

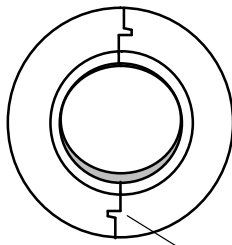
The BCRS will consist of five split couplings for the 2.0" to 4.0" conduits and a 10' length of split 5.0" schedule 80 PVC conduit. Note that the split conduit will encompass a 5.0" schedule 80 PVC conduit. The inside diameter of the split conduit is 5.563".

COMPONENTS OF THE BCRS

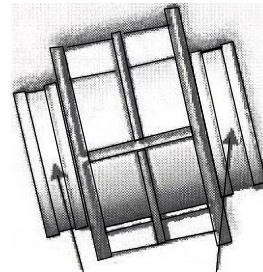


HALF VIEW AND ASSEMBLED VIEW

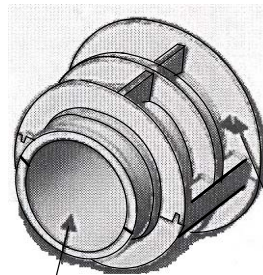
SPLIT CONDUIT DETAILS



INTERLOCKING DESIGN



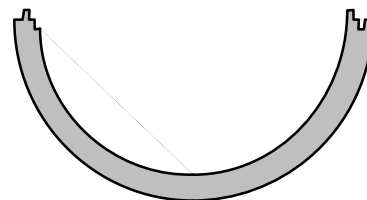
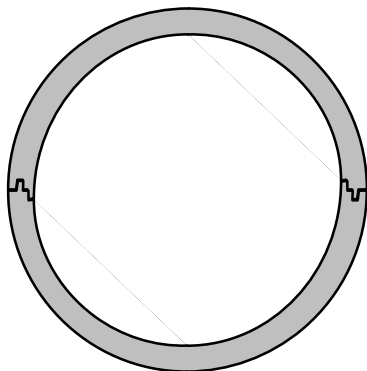
CABLE TIE AREA



SCHEDULE 80
ID DIMENSIONS FOR
CONDUITS 2.0" TO 4.0"

FLANGE TO SUPPORT
5.0" SPLIT CONDUIT

END VIEW OF SPLIT CONDUIT INTERLOCKING DESIGN



MATERIALS

Dist. Std. Or Stk. No.	Description	59 14 40 40
12 51 403	Conduit-Split, 10' Length, Schedule 80 PVC	
12 51 404	Conduit-Split, 2.0" to 5", PVC	
12 51 408	Conduit-Split, 2.5" to 5", PVC	
12 51 407	Conduit-Split, 3.0" to 5", PVC	
12 51 406	Conduit-Split, 4.0" to 5", PVC	
23 67 483	Strap-Kit, Standoff Bracket, 6" Conduit	
12 56 099	Cement-Solvent, PVC	
40 59 191	Tie-Wire, Black, 18" Reusable	
86 12 994	Blade-Saw, Reciprocating	

Note:

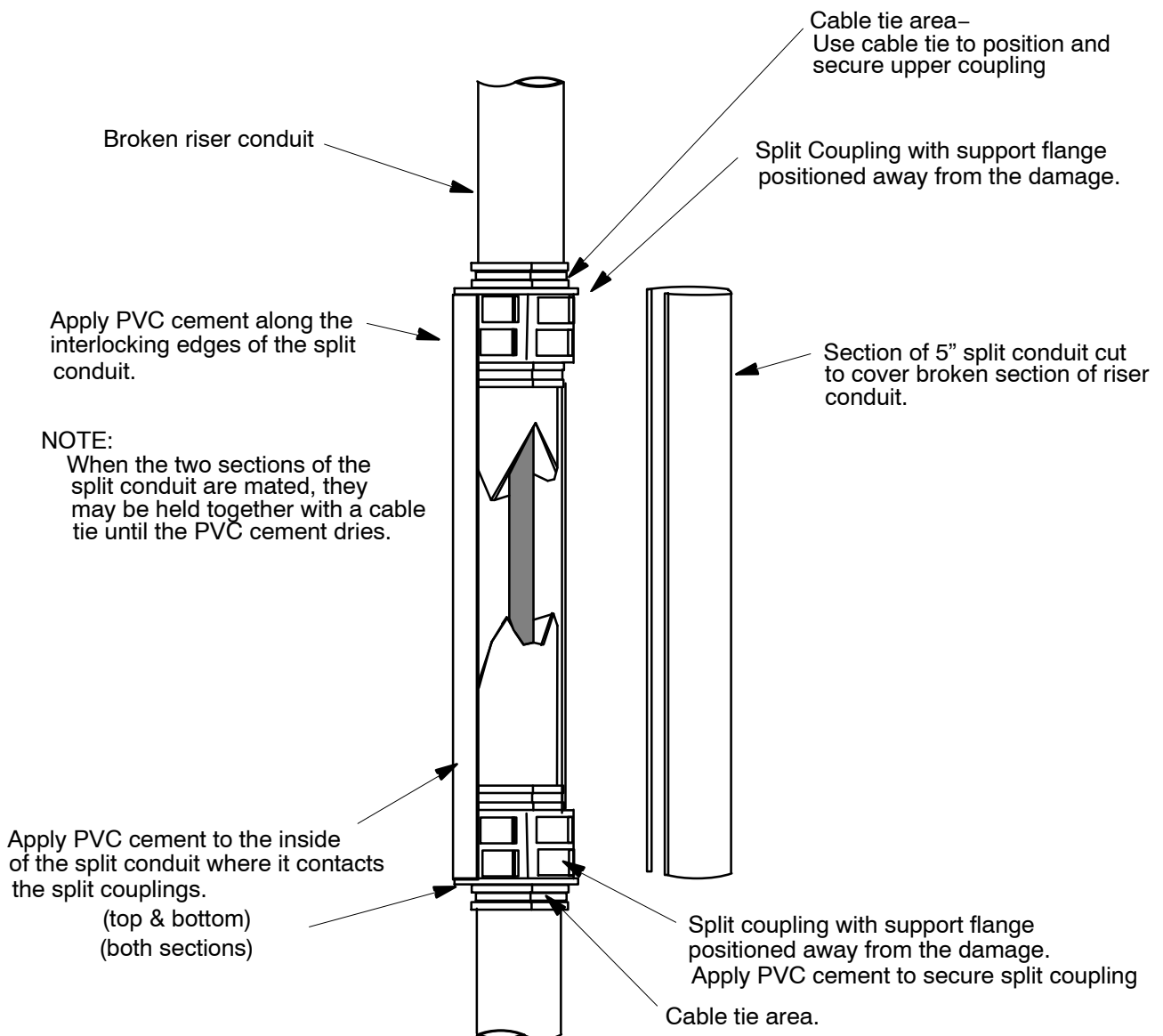
Reciprocating saw blade shown above (86 12 994) is the preferred blade for cutting split conduit. Split conduit should be assembled while cutting for best cut quality.

REPAIR INSTRUCTIONS

1. Determine the size of the broken conduit.
2. Remove the broken pieces of conduit.
3. Using PVC cement, attach the correctly sized split coupling to the bottom section of the broken riser conduit (below the break on the solid conduit). Position the split coupling so that the 5" split conduit support flange is away from the broken section. If necessary, a cable tie may be used to hold the split coupling in place.
4. Using a cable tie, attach a correctly sized split coupling to the top section of the broken riser conduit (above the break on the solid conduit). Position the split coupling so that the 5" split conduit support flange is away from the broken section.
5. Measure between the two split couplings to determine the length of the 5" split conduit needed to make the repair. Cut the required length of split conduit needed to make the repair.
6. Place one section of the cut split conduit on the support flange of the bottom split coupling. Slide the top split coupling down so that the section of split conduit contacts the support flange of the top split coupling. Tighten the cable tie to secure the split coupling into place.
7. Remove the section of split conduit. Apply PVC cement to the inner surface of the split conduit in the area where the conduit contacts the split coupling.
8. Re-insert the section of split conduit between the two split couplings. Apply PVC cement to the edges of the reinstalled section of split conduit. Insert the remaining section of split conduit between the top and bottom split couplings. Hold the two split conduit sections together until the PVC cement dries. The conduit sections may be held together with cable ties.

REPAIR INSTRUCTIONS

NOTE: Illustration shows a repair on a riser conduit. Rotate the illustration for a repair on an underground conduit.



Single weave cable grips should be laced with single strand lacing; double weave cable grips should be laced with double strand lacing. Lacing strands should be the same material as the grip. Appropriate lacing should be provided with each grip.

The split grips, used by Ameren to support cables on terminal poles, are as follows:

Stock #23-17-207 – 1.75" to 1.99" Cable Diameter, 25" Long

Stock #23-17-245 – 2.00" to 2.49" Cable Diameter, 27" Long

Stock #23-17-245 – 2.50" to 2.99" Cable Diameter, 29" Long

Stock #23-17-220 – 3.00" to 3.49" Cable Diameter, 34" Long

Stock #23-17-246 – 3.50" to 3.99" Cable Diameter, 36" Long

1. Start the lacing at the lead or anchoring end of the grip (where the eye is located). Thread the lacings through the first two loops of the split and pull through until the lacings are centered at this point. Lace as you would your shoe, crossing the lacings before lacing the next two loops.



2. Don't pull lacing too tight. Leave a space between adjoining loops approximately equal to the width of one diamond of the mesh grip.



3. At the very end of the mesh grip, twist the lacing ends tightly together. Wrap the ends tightly around the tail of the grip once or twice. Excess lace can be cut off.



4. Remove all slack from the mesh grip starting at the strand equalizers and working toward the tail end of the grip. Apply one or two cable ties (Stock #40-59-191) to the mesh grip approximately 1 to 2 inches from the tail end of the mesh grip. This may help keep the grip from moving or releasing. The tails of the cable ties should be cut off.
5. Attach the mesh grip eye to the anchoring hardware (generally a machine bolt, eyenut, and shackle) on the pole.



GENERAL

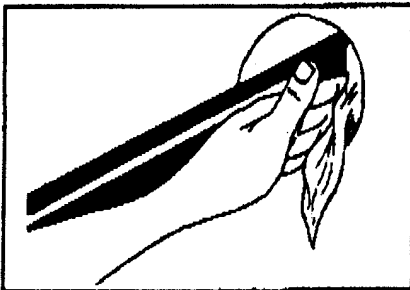
The Inflatable Duct System (DSS) may be used in conjunction with plastic, concrete, tile, fiberglass, or steel ducts to provide a weathertight duct seal. The IDSS consist of an inflatable sealed bladder, made of flexible metallic laminate material, which has pre-installed, high-temperature sealant strips on both sides. The bladder is inflated to approximately 45 psi internal pressure with an inflation tool equipped with a manometer, safety relief valve, and CO₂ cartridge. After the bladder is inflated, the fill tube is removed and a self-sealing gel material seals the filling hole.

The IDSS will seal ducts with or without cable(s). If three or more cables have to be sealed, sealing clips are used in combination with the inflatable bladder. To make installation easier, the metallic surfaces should be lubricated with an approved lubricant.

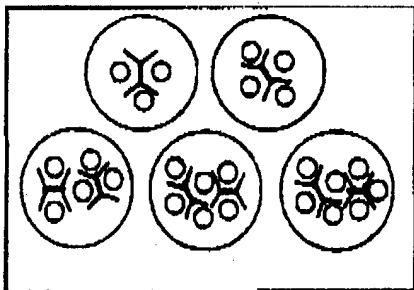
MATERIALS

- A. CO₂ cartridge – Stock # 86-08-020. Noet: One cartridge will fill multiple bladders.
- B. Bladder for conduit with 3.25-4.50" I.D. – Stock # 12-51-098.
- C. Clip for use with item B – Stock # 12-51-098.
- D. Bladder for conduit with 4.75"-5.00" I.D. – Stock # 12-51-296.
- E. Clip for use with item D – Stock # 12-51-099.
- F. Bladder
- G. Clip for use with item F – Stock # 12-51-100.

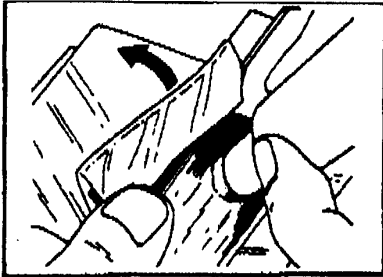
INSTALLATION INSTRUCTIONS



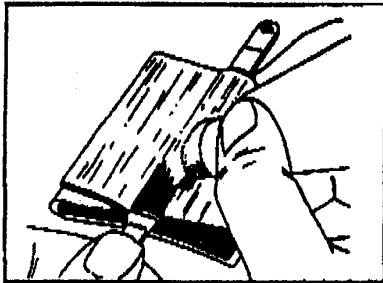
1. It is recommended to wet clean the duct and cable sheath. Remove as much dirt, crust, mud, etc. as possible. **For ducts with 3 or more cables, continue with step 2. For 0, 1, or 2 cables skip to step 9.**



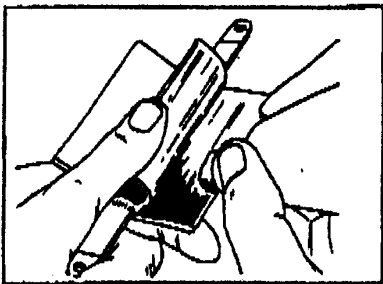
2. Examples for different multiple cable configuration. One RDSS-Clip can seal up to four cables. If more cables are to be sealed, use one extra clip per three additional cables.



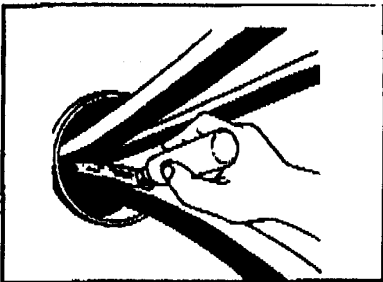
3. Open clip wings on one side. Lubricate the wings abundantly, to ensure that they don't stick together.



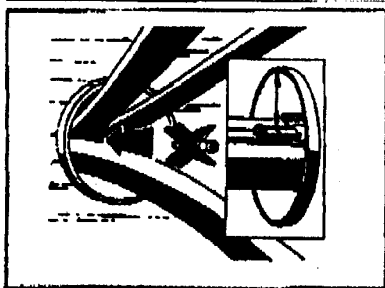
4. Remove one protection paper and lubricate abundantly the larger surface of the clip wing.



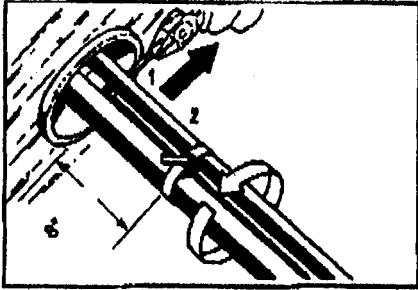
5. Repeat steps 3 & 4 for the other clip wings. Remove protection paper only after lubricating at least one wing side.



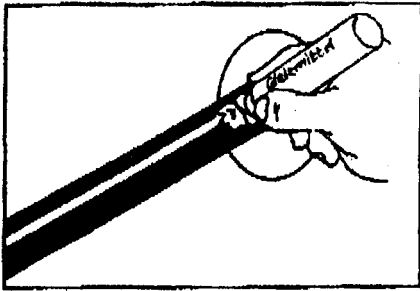
6. Abundantly lubricate the cables in the crotch area as much as possible.



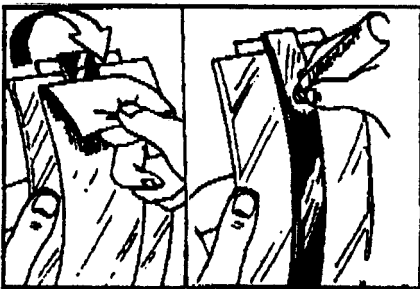
7. Insert the clip in between the cables, assuring that there is only one cable between each clip wing (see picture, step 2). Make sure that the central part of the clip is well positioned in the crotch area. The raised line on center stick should be flush with the end of the duct. Use the snort tie-wrap to hold the clip in place. Cut off the excess tie-wrap and position the locking part between the cables.



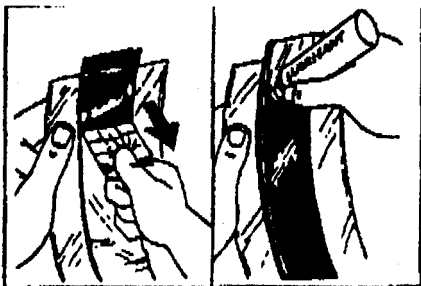
8. Install the long tie-wrap around the cable bundle at a distance of approx. 8" from the duct entrance.



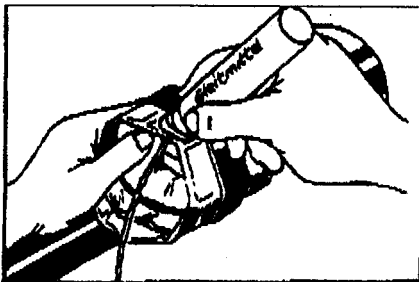
9. For ease of installation lubricate the cable.



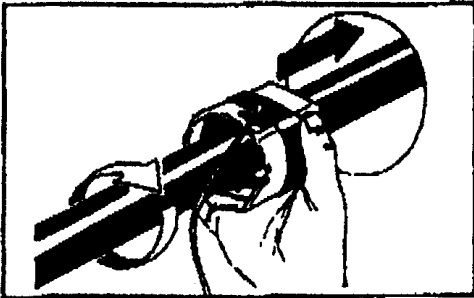
10. Remove the protective paper from the outside of the sealing strip and lubricate abundantly.



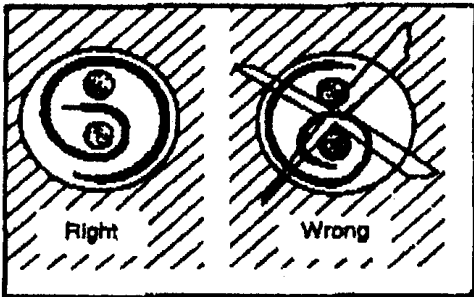
11. Continue with lubrication of the inside of the sealing strip.



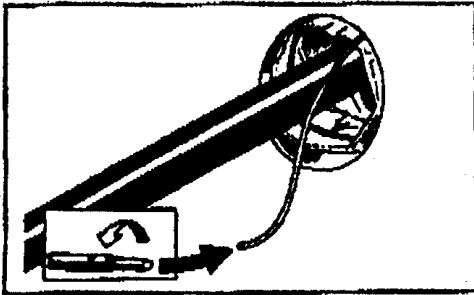
12. Lubricate the filling tube on the bladder section.



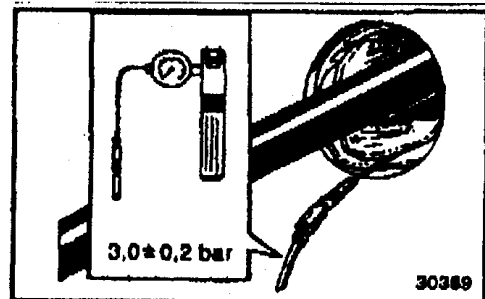
13. Wrap bladder around the cable (or cable bundle) and slide completely into the duct.



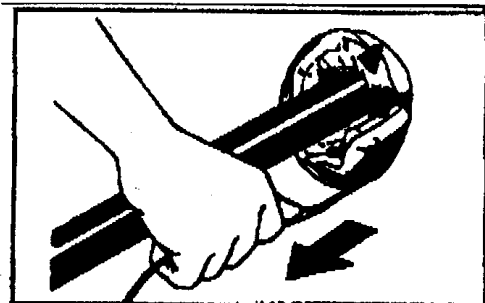
14. In case of two cables, wrap bladder around the cables as shown starting with the largest cable.



15. Connect the filling tube to the tube snap of the inflation tool. Gently insert the filling tube until it will not go any further. Tighten down the nozzle.

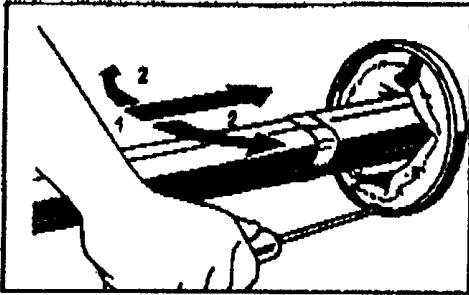


16. Inflate bladder up to the pressure of 3.0 bar (43.5 psi) and keep the pressure there for 30 seconds, after which the tool must be shut off.
Note: Refer to the operation manual for the specific inflation tooling being used.

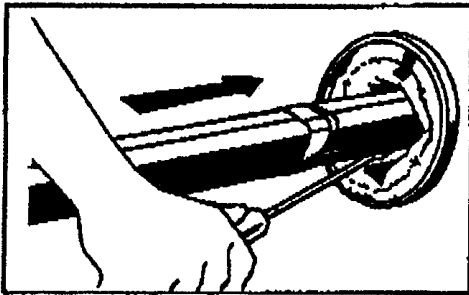


17. BEFORE removing the installation tool connection from the filling tube, pull out of the filling tube in one gentle move in the direction of the cable installation is complete

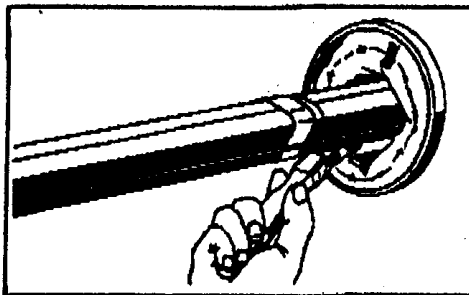
REMOVAL INSTRUCTIONS



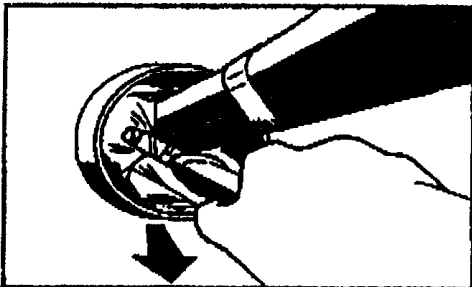
1. Deflate the bladder by piercing with a screw driver. Release the bladder from the duct wall by using a blunt tool.



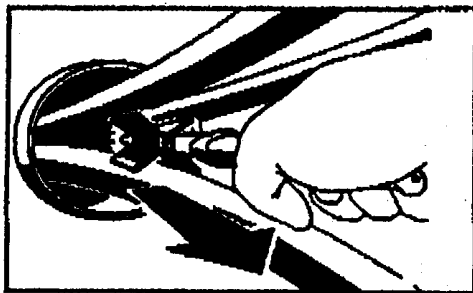
2. Release bladder from the cable or cable bundle.



3. Apply lubricant on the released areas.



4. Pull the bladder out of the duct with a pair of pliers.



5. If applicable: Remove tie wraps from the cable bundle. Spread cables. Remove clip core and sealant as much as possible with a pair of pliers.

UNDERGROUND LINES INSTRUCTION
Non-Lead Direct Buried Cable
Burial Information

59 40 00 10

Sheet 1 of 1

1. General

This instruction covers both normal installations and allowable deviations in burial depth of non-lead direct buried cables. New three phase primary cables shall be installed in conduit.

2. Non-Fused Primary Cable (Generally all 750 kcmil cable)

No new or replacement 750 kcmil cable direct buried installations shall be made.

For existing installations, the normal burial depth should be 48" in trenchable earth.

Existing installations in rock should be at a depth of no less than 24" and the cable should be installed in conduit and covered with 2 or more inches of protective concrete.

3. Fused Primary (Generally #2 or 4/0 cable)

In trenchable earth the normal burial depth shall be 36". The minimum depth shall be 30".

This may be reduced to 12" if the cable(s) are in conduit and covered with 2 or more inches of protective concrete.

4. Secondary

In trenchable earth the normal burial depth shall be 36". The minimum depth shall be 24".

This may be reduced to 12" if the cable(s) are in conduit.

5. Services

In trenchable earth the normal and minimum burial depth shall be 24".

This may be reduced to 12" if the cable(s) are in conduit.

6. Street Light Cable

In trenchable earth the normal depth shall be 24" and minimum burial depth shall be 18" where conflicts with other underground facilities exist.

In rock the depth may be reduced to 12" if the cable(s) are in conduit.

7. Special Cases

If depths other than those specified above are desired on specific jobs, the Standards Department shall be consulted.

8. Definitions

A. **Trenchable Earth** – Earth that can be excavated by use of a trenching machine.

B. **Rock** – Rock or Earth and rock that cannot be excavated by use of a trenching machine at the rate of 1.5 feet/minute.

C. **Burial Depth** – The amount of cover over the top of a cable or conduit.

D. **Suitable Backfill** – Dirt free of rock or debris; sand; or 1/4" limestone screening.

9. Other Conditions

A. Primary and secondary cables shall be installed random lay.

B. The first 6" of backfill over all cables not in conduit shall be of suitable backfill material.

C. The base of the trench on which the cable will lie shall be free of rock and/or debris. If rock and/or debris is present, backfill material can be put in the trench to form a 4" base for the cable to lie on or conduit may be used.

D. When the material excavated from a trench is not itself suitable backfill, a field decision by the Company Construction Supervisor or his representative will be made to either obtain suitable backfill, use conduit, or use cable-in-duct.

E. When cables or conduits are installed in areas that are congested (such as where we cross other underground facilities) and additional digging by others is highly likely to occur, "Caution Buried Cable" tape (stock number 49-16-061) may be used to mark the cable route. The caution tape should be installed 12"-18" below ground level and 12" directly above the buried cable or conduit.

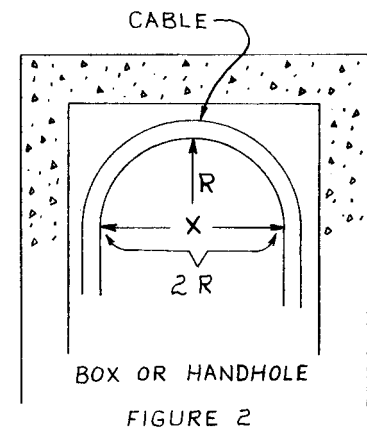
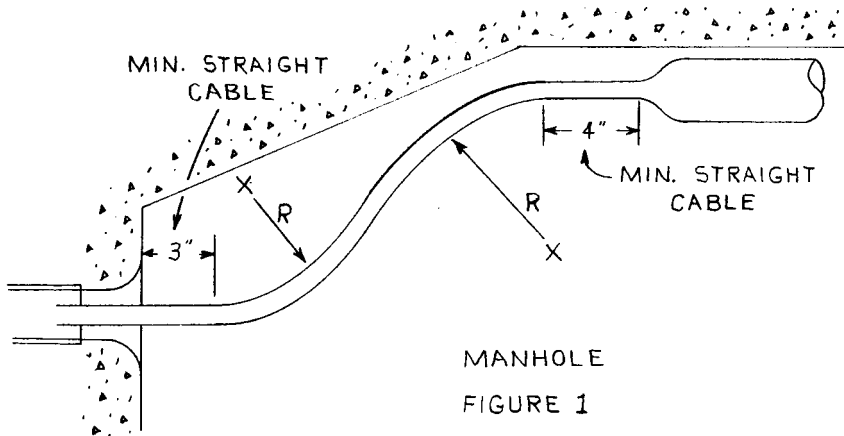
General

This standard covers minimum bending radii for training underground cables.

Bending Radii

The radii quoted in this instruction are minimum standards and should be exceeded where possible. Normal bending radii are ordinarily 12 times the cable diameter for non-armored paper lead cable. Minimum bending radii for solid dielectric cables vary widely. Secondary solid dielectric cable through 350 kcmil may be trained to a radius of 4 times the cable diameter. A no. 2 solid dielectric primary cable is properly trained at 5 times the cable diameter. A 750 kcmil as. 15kV cable is properly trained at 6 times and a 1500 kcmil cable at 8 times the cable diameter.

The information on this standard shall be used in obtaining minimum dimensions for construction of new underground facilities. Figures 1 and 2 below indicate normal measurements of typical bending radii for cables not direct buried.



ALL DIMENSIONS ARE IN INCHES.

<u>Size – Paper Lead Cable</u>	<u>Minimum Bending Radii</u>	<u>Normal Bending Radii</u>	<u>Cable O.D.*</u>
800–3C, 35kV	36	42	3.6
500–350–3C, 35kV	32	36	3.25
800–3C, 15kV	30	34	2.9
500–350–3C, 15kV	20	24	2.5
4/0–1/0–3C, 15kV	16	20	1.95
800–500–3C, 5kV	25	30	2.5
350–4/0–3C, 5kV	15	19	1.87
750–500–1C, 35kV	20	24	1.9
350–4/0 1C, 35kV	16	20	1.6
750–500–1C, 15kV	13	17	1.55
4/0–2–1C, 15kV	9	12	1.06

<u>Size – Solid Dielectric Cable</u>			
3–750R, 5kV	6.5	8	1.59
3–350 through 1/0R, 5kV	5	7	1.21
3–500 RL, 15kV	12	14	1.78
3–1500 AL., LCX, 15kV	24	28	2.35
3–4/0 through 1/0 AL. CNX or P, 15kV	8	10	0.98
3–2 through 1/0 CNR & P, 5kV	4	6	0.841
6 through 4 CNR & P, 5kV	4	6	0.73
3–350, FSR, P,RW 15kV	9.0	11	1.13
3–750, FSR,P,RW 15kV	11.0	14	1.43

<u>Size – 600V Solid Dielectric</u>			
4 through 2 R	1.5	3	0.476
10 through 6 R	1.0	2	
1/0 through 4/0 R	3.25	5	0.79
250 through 500 R	4.5	7	1.15
750 R	5.5	9	1.37

<u>Size – URD Cables</u>	<u>Minimum Bend- ing Radius</u>	<u>Normal Bending Radius</u>	<u>Cable O.D.*</u>	<u>Stock No.</u>
2-350 x 3/0 AL, X, 600V	3.5	5.0	0.869	18-07-201
2-350 x 3/0 AL, X, 600V C/D	20.0	24.0	–	18-07-248
2-3/0 x 1/0 AL, X, 600V	2.5	4.0	0.626	18-07-202
3-1/0 AL, X, 600V	2.0	3.0	0.529	18-07-203
3-750 x 1-350 AL, X, 600V	6.0	10.0	1.218	18-07-217
2 AL, CNRP, 15 kV	7.0	9.0	0.912	18-07-238
3-2 AL, CNRP, 15 kV	7.0	9.0	0.912	18-07-237
3-4/0 AL, CNRP, 15 kV	8.0	10.0	1.051	18-07-240
1-500 AL, CNRP, 15 kV	12.0	15.0	1.53	18-07-261
3-750 AL, CNR P, 15 kV	12.0	15.0	1.57	18-07-243
3-750, LCX, 15 kV	32.0	36.0	1.77	18-07-244
1-4/0 AL, LCR, 35 kV	32.0	36.0	1.74	18-07-219
1-750 AL, LCX, LCR, 35 kV	36.0	45.0	2.25	18-07-214
3-350 CU, LCR 35 kV	24.0	30.0	1.84	18-07-250
3-750 CU, FSR 35 kV	15.0	19.0	1.87	18-07-249
1-500 AL, CNRP, 69 kV	33.0	41.0	2.713	18-07-283
1-750 AL, CNRP, 69 kV	35.0	44.0	2.908	18-07-292
<u>CIC Primary</u>				
1-#2 CNRP 15kV in Conduit		18.0	–	18-07-242
1-#4/0 CNR P 15 kV in Conduit		24.0	–	18-07-241

1C	One Conductor	LC	Longitudinally Corrugated
3C	Three Conductor	CNP	Concentric Neutral Poly
X	Cross-Linked Poly	CNX	Concentric Neut. X-Linked Poly
R	Rubber	CNR	Concentric Neutral Rubber
RW	Reduced Wall (Insulation)	P	Protected (Jacketed)
L	Lead Sheath	FSR	Flat Strap, Rubber

*The outside diameter given for multiple conductor cable is the diameter of the largest conductor.

15 kV Cable Ratings in Amps										
One Circuit Only – Not for Multi-Circuit Installations										
Stock Number	Size AWG or kcmil	Insulation	Direct Burial				Buried Conduit*			
			Summer		Winter		Summer		Winter	
			Normal / Emergency		Normal / Emergency		Normal / Emergency		Normal / Emergency	
			Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase	Single Phase	Three Phase
1807238	1-2AL	XLP or EPR	226/260	165/190	249/286	182/209	176/202	150/173	194/222	165/190
1807260	1-1/0AL	XLP or EPR	297/342	214/246	327/376	235/271	232/267	182/209	255/294	200/230
1807240	3-4/0AL	XLP or EPR		316/363		348/400		293/337		322/371
1807261	1-500AL	XLP or EPR		513/590		564/649		402/462		442/508
1807237	3-2AL	XLP or EPR		165/190		182/209		150/173		165/190
1807239	1-4/0AL	XLP or EPR	447/514		492/566		349/401		384/441	
1807243	3-750AL	XLP or EPR		628/722		691/794		493/567		542/624
1807245	3-350	XLP or EPR		533/613		586/674		416/478		458/526
1807244	3-750	XLP or EPR		745/857		820/943		582/669		640/736

*This rating applies only when cables are enclosed completely in conduit from the terminal pole to the first termination. Use the direct burial rating for cable installed in a conduit only for the pole riser section.

600 Volt Cross-Linked Polyethylene Insulated Cable Ratings in Amps			
Stock Number	Cable Size	Direct Burial	Buried Conduit
1807252	#6 Al. Duplex	90	65
1807266	1/0-2-1/0 Al.	220	198
1807202	3/0-1/0-3/0 Al.	286	255
1807201	350-4/0-350 Al.	432	381

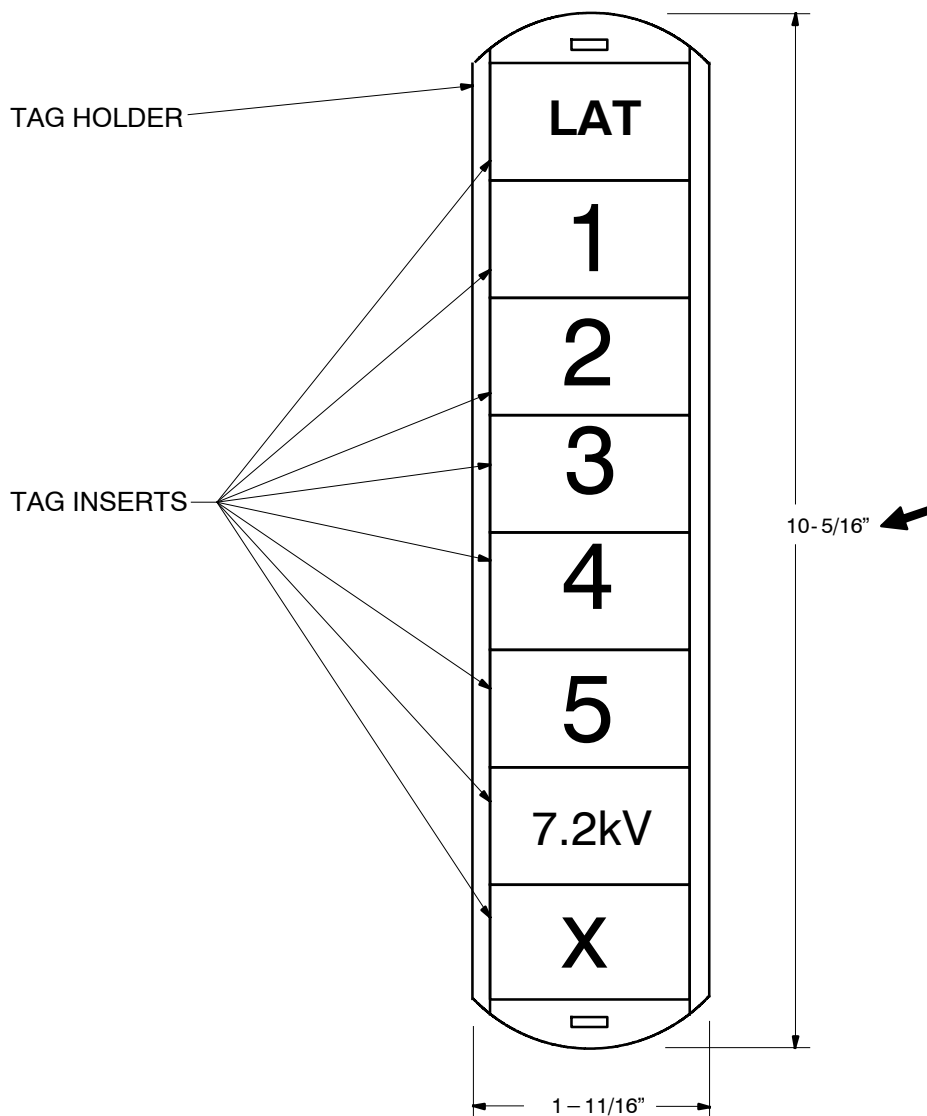
Quadruplexed 600 Volt Cross-Linked Polyethylene Cable Ratings in Amps (Three-Phase Service)		
Number of Conduits	Stk. # 18 07 288 3-350 x 1-4/0 Al	Stk. # 18 07 217 3-750 x 1 - 350 Al
1	335	509
3	278	421
6	228	346
9	208	316

1.0 General

This standard covers the basic information and materials required to produce cable tags for cables energized at 2.4 kV, 4 kV, 7.2 kV, 12 kV, or 34 kV. The cable tags will be produced by construction district personnel after obtaining the proper circuit designation and abbreviation from the appropriate authority. See DCS 59 40 00 41 for lead tag information and applications.

2.0 Cable Tag Construction

The cable tags will consist of a holder and various inserts. The holder will accommodate a maximum of ten inserts. A sample tag is shown.



SAMPLE CABLE TAG

3.0 Tag Use

These tags may be used as direct replacements for lead tags (Stk.# 16 – 01 – 099) and formica tags. However, it is not advisable to use these tags in locations where they may be damaged for long term submersion, petroleum products, etc.

4.0 Tag Attachment Methods

4.1 Copper Wire or Nylon Cable Tie

Whenever a tag is attached directly to a cable; a piece of concentric neutral, #14 binding wire (Stk #18 – 52 – 018), or appropriately sized nylon cable tie may be used.

Whenever a tag is attached to a conduit strap; a piece of concentric neutral, #14 binding wire (Stk # 18– 52 – 018), or nylon cable tie may be used. Only black nylon cable ties shall be for outdoor applications.

4.2 Galvanized Nails – Stk.# 21 – 57 – 047

Whenever a tag is attached directly to a pole; two galvanized nails shall be used for the attachment.

5.0 Typical Tag Locations

Generally only one tag will be installed on a cable.

5.1 Cables In Manholes

Tags shall be attached within two feet of the west or north side of the cable joint nearest the manhole entrance.

Tags shall face toward the manhole entrance.

Tags attached to cables in racks shall be staggered.

See Distribution Standard 59 50 00 41 for lead tags.

5.2 Cables In Network Vaults

Tags shall be attached within two feet of the duct entrance and face toward the vault entrance.

See Distribution Standard 59 50 00 41 for lead tags.

5.3 Cables On Terminal Poles

Tags may be attached directly to the pole where there is only one lateral. If the terminal pole has more than one lateral, the tags shall be attached to the appropriate cables.

Tags attached to the cables shall be positioned immediately below the terminators.

Tags attached to the poles shall be positioned approximately 8' – 10' above grade or immediately above the guard.

Tags may be attached to a conduit strap if one lateral is on stand– off brackets. The tags shall be positioned approximately 8' – 10' above grade.

6.0 Special Requirements

6.1 Cables Cut Dead

Cables cut dead are to be identified by a hole punched in the cable tag circuit voltage. Do not remove the cable tag and do not punch out any other information on the tag.

6.2 Customer Owned Cables

Tags shall be attached to all customer owned cables. If the customer's cables are on terminal poles or attached to overhead facilities a yellow "Customer Owned" tag (Stk # 16 – 01 – 159) shall be attached (with binding wire or a black nylon) near the ends of each cable.

If the customer's cable enters a padmount transformer, switchgear, or pedestal the cables shall be marked with the tag described above or a wire tie (Stk # 40 – 59 – 268) that is imprinted with "Customer Owned Cable".

Each customer owned cable shall be tagged.

Customer owned cables, that are inside meter enclosures, shall be marked with the wire tie described above.

See distribution standard 59 52 00 41 for additional information about customer owned cables and parallel cables.

7.0 Tag Holder and Inserts

Cable tags will be produced using the following stock items. The tags are shown are black on yellow measuring 7/8" H x 1 1/2 W"

<u>Stock Number</u>	<u>Description</u>	<u>Stock Number</u>	<u>Description</u>
16 – 06 – 277	Holder, Tag, Black Poly	16 – 01 – 209	Tag, Cable "F"
16 – 01 – 318	Tag, Cable, "LAT"	16 – 01 – 210	Tag, Cable "G"
16 – 01 – 329	Tag, Cable, Dash (–)	16 – 01 – 211	Tag, Cable "H"
16 – 01 – 330	Tag, Cable, "FDR"	16 – 01 – 303	Tag, Cable "I"
16 – 01 – 331	Tag, Cable, "DIP"	16 – 01 – 304	Tag, Cable "J"
16 – 01 – 319	Tag, Cable "12 kV"	16 – 01 – 305	Tag, Cable "K"
16 – 01 – 320	Tag, Cable "7.2 kV"	16 – 01 – 306	Tag, Cable "L"
16 – 01 – 321	Tag, Cable "2.4 kV"	16 – 01 – 307	Tag, Cable "M"
16 – 01 – 326	Tag, Cable "4 kV"	16 – 01 – 308	Tag, Cable "N"
16 – 01 – 327	Tag, Cable "34 kV"	16 – 01 – 309	Tag, Cable "O"
*16 – 01 – 195	Tag, Cable "0"	16 – 01 – 212	Tag, Cable "P"
16 – 01 – 196	Tag, Cable "1"	16 – 01 – 310	Tag, Cable "Q"
16 – 01 – 197	Tag, Cable "2"	16 – 01 – 311	Tag, Cable "R"
16 – 01 – 198	Tag, Cable "3"	16 – 01 – 213	Tag, Cable "S"
16 – 01 – 199	Tag, Cable "4"	16 – 01 – 214	Tag, Cable "T"
16 – 01 – 200	Tag, Cable "5"	16 – 01 – 312	Tag, Cable "U"
16 – 01 – 201	Tag, Cable "6" or "9"	16 – 01 – 313	Tag, Cable "V"
16 – 01 – 202	Tag, Cable "7"	16 – 01 – 314	Tag, Cable "W"
16 – 01 – 203	Tag, Cable "8"	16 – 01 – 215	Tag, Cable "X"
16 – 01 – 204	Tag, Cable "A"	16 – 01 – 216	Tag, Cable "Y"
16 – 01 – 205	Tag, Cable "B"	16 – 01 – 217	Tag, Cable "Z"
16 – 01 – 206	Tag, Cable "C"	16 – 01 – 221	Tag, Cable "CIPS"
16 – 01 – 207	Tag, Cable "D"	16 – 01 – 050	Tag, Cable "Light"
16 – 01 – 208	Tag, Cable "E"	16 – 01 – 224	Tag, Cable "Pedestal"
16 – 01 – 218	Tag, Cable "A – Phase"	16 – 01 – 322	Tag, Cable "Riser"
16 – 01 – 219	Tag, Cable "B – Phase"	16 – 01 – 225	Tag, Cable "Service"
16 – 01 – 220	Tag, Cable "C – Phase"	16 – 01 – 223	Tag, Cable "Streetlight"
		16 – 01 – 323	Tag, Cable "Switch"
		16 – 01 – 324	Tag, Cable "Trans."
		16 – 01 – 222	Tag, Cable "To"

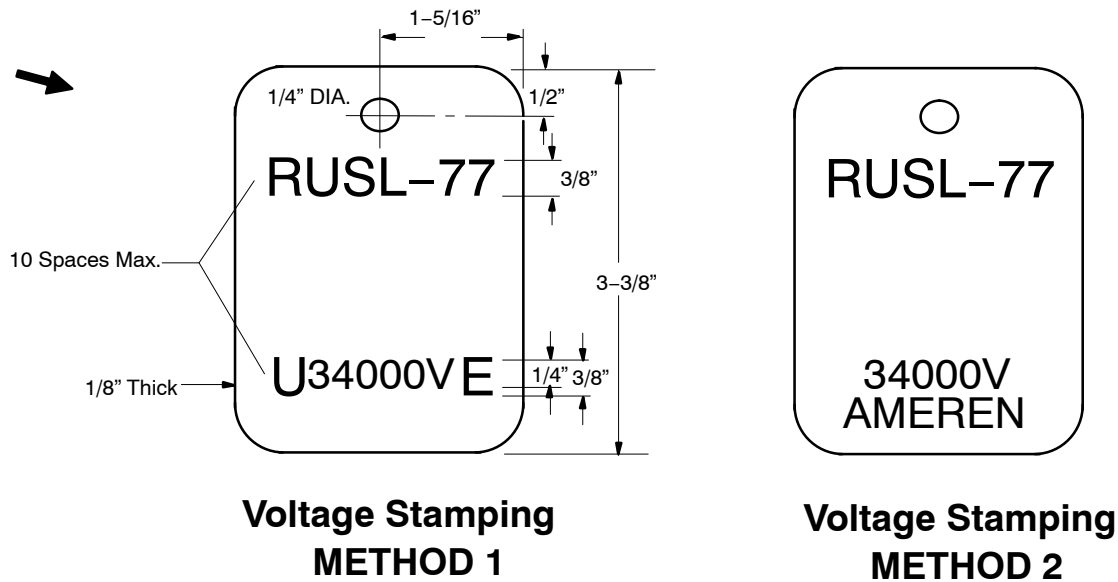
* THE ZERO TAG IS ACTUALLY A PHASE SYMBOL THAT HAS BEEN ROTATED 90° TO APPEAR AS A ZERO WITH A LINE THROUGH IT. THIS IS TO HELP DISTINGUISH BETWEEN "ZERO" AND THE LETTER "O"

1.0 General

This standard covers a method that may be used for tagging cables.

2.0 Tags

Lead cable tags are generally stamped in the field and are routinely used for marking cables in manholes. The blank lead tag is Stock #16-01-099. The voltage shall be as shown, not abbreviated. See DCS 59 40 00 40 for tags that may be used on terminal poles.



3.0 Method of Attachment

Tags are to be attached to cables with a No. 14 tinned copper binding wire, Stock #18-52-018.

The procedure of attachment outlined below shall be followed

- * Securely fasten tag to one end of wire.
- * Bring the free end of wire under cable and serve it on the tag end.
- * Bend served wire down on cable in such a manner that the tag can easily be seen.

4.0 Tag Placement

Only one tag per cable shall be installed in a given manhole. After repairs are completed, tags are to be returned to their original location.

Cable tags shall be located as outlined below.

4.1 Tagging Cables in Manholes

Tags shall be attached within two feet of the west or north side of the cable joint nearest the manhole entrance.

The attached tag shall face toward the manhole entrance.

Tags attached to cables in racks shall be staggered.

4.2 Tagging in Network Vaults

Tags shall be attached within two feet of the duct entrance and face toward the vault entrance.

4.3 Tagging on Terminal Poles

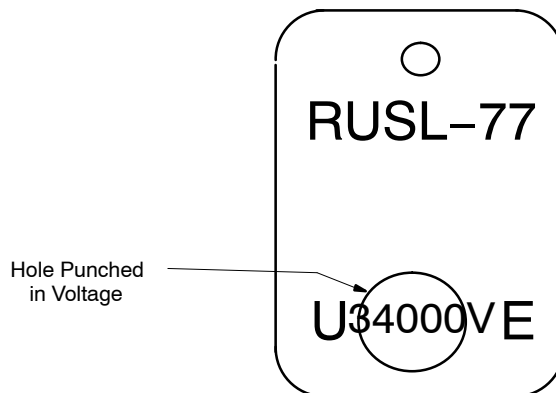
See DCS 59 40 00 40 for tags used on terminal poles.

4.4 Tagging Customer Owned Cables

Tags shall be placed on all customer owned cables. If the customer's cables are on terminal poles or attached to overhead facilities, a yellow "Customer Owned" tag (Stock #16-01-159) should be attached (with binding wire) near the end of each cable. If the Customer Owned cables enter a padmount transformer, switchgear, or pedestal, etc. they should be marked with either the tag described above, or a wire tie (Stock #40-59-268) imprinted with "Customer Owned Cable". Each cable should be tagged. Customer owned cables inside meter enclosures should be marked with wire ties, Stock #40-59-268. See DCS 59 52 00 41 for additional information about customer owned cables and parallel cables.

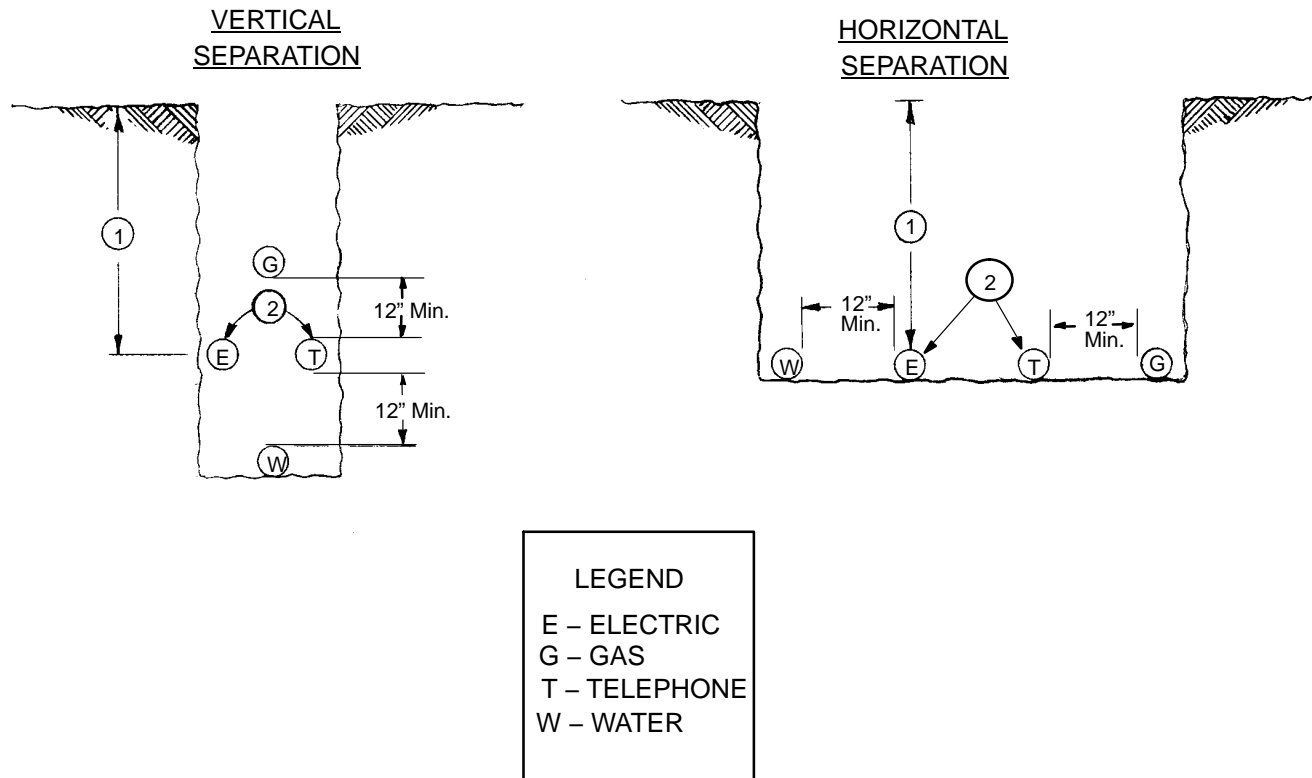
5.0 Tagging Cables Cut Dead

Cables cut dead are to be identified by a 3/4" hole punched in the cable tag circuit voltage as shown below. Do not punch out circuit name, cable number, or circuit number.



Method to Identify Dead Cables

1. Joint Trench Separation Requirements (NESC, 2017 Edition, Rules 320B and 353)
These minimum separations apply to direct buried cables and cables installed in conduit.



NOTES:

1. Burial depth per DCS. 59 40 00 10.
2. This dimension may be reduced to 6 inches minimum in Missouri providing all parties are in agreement to this reduction. (NESC, 2017 Edition, Rule 320B2 Exception)

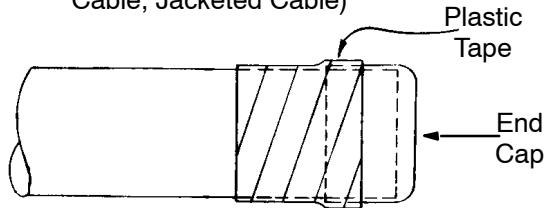
2. Swimming Pool Separation Requirements (NESC, 2017 Edition, Rule 351 C1 and C2)

- A. Direct buried supply cables should not be installed within 5 feet of a swimming pool or its auxiliary equipment. If 5 feet is not attainable, see B. below.
- B. Supply cables installed in conduit have no clearance requirement. Burying under a swimming pool, even in conduit, should be avoided.

ALL CABLES MUST BE SEALED.

Sealing With End Caps

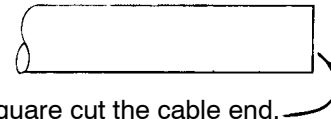
(Service, Non-Jacketed Cable, Jacketed Cable)



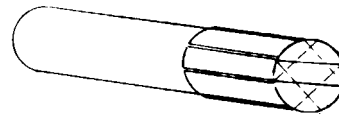
1. Choose the proper end cap for the cable being sealed.
2. Square cut the cable end.
3. Insert the cable into the end cap.
4. Secure the end cap with plastic tape (Stk. #25-53-055). Note: The heat shrinkable end cap requires no taping. Just shrink cap using an appropriate torch.

Sealing Without End Caps

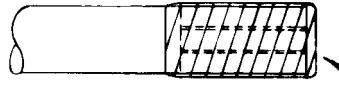
(To be used when end caps are not available)



1. Square cut the cable end.



2. Apply longitudinal strips of plastic tape. (Stk. #25 53 055)



3. Apply circumferential wraps of plastic tape over the longitudinally applied tape.

CABLE END CAPS			600 VOLT CABLE SIZE	5 KV NON- SHIELDED CABLE	15 KV JACKETED CABLE	34 KV EPR JACKETED
STOCK NO.	COLOR	I.D. (INCHES)				
40 59 144	RED	.437	1/0			
40 59 145	YELLOW	.562	3/0 4/0			
40 59 146	ORANGE	.813	350	1/0		
40 59 171	MAROON	1.00			#2 AL.	
40 59 166	BLACK	1.125	500 NW 750	350	350 Reduced Dia.	
40 59 194	BROWN	1.37	750 NW		4/0	
40 59 172	BLUE	1.50		750	350	1/0
40 59 193	BLACK	1.625			500	
40 59 173	GREEN	1.75			750	350
12 05 041	BLACK – HEATSHRINKABLE	4.5"			1000	750

A. General

This instruction lists the standard formats to be used in designating various types of cable assemblies on all Company documents and records

Standard abbreviations:

Description	Abbreviation	Description	Abbreviation
Conductor Size	kcmil (Formerly MCM)	Varnish Cambric	VC
		Rubber	R
Conductor Size	AWG (American Wire Gauge)	Polyethylene	P
		Cross-Linked Poly	X
Paper-Insulated-lead Covered	PILC	Series Light	SL
Concentric Neutral	CN	Multiple Light	ML
Bare Neutral	BN	Lead	L
Network Type Cable	NW	Kilovolts	kV
Aluminum	AL	Tape Shield	TS
Longitudinally - Corrugated	LC	Protected (Jacketed)	P
Aerial	A	Conductive Jacket	PC
Flat Strap	FS	Duct	D
Reduced Insulation Wall	RW	Cable in Conduit	C/D

General Rules:

- When copper conductors are used in a cable assembly, the conductor material is not specified in the cable description. If the conductor material is aluminum, AL is used.
- When the cable is of the paper-insulated lead-covered type, the insulating material and the lead sheath are not specified.
- When the letter "P" is used following PILC cable descriptions, it indicates a protective covering has been installed over the metal cable sheath. When the letter "P" follows a comma, as CNX, P, the "P" stands for a jacket over the shield or concentric.
- AWG conductor sizes below 1/0 should use the numeral sign (#) preceding the AWG wire size (Example #2).

B. Paper-Insulated Lead-Covered Cable (PILC)

All PILC cable designations follow one of the forms listed below. The conductor size is specified in kcmil or AWG, followed by the number of conductors under a common covering. The letter P is added if the sheath is jacketed and then the voltage is stated in kV.

Cable Description	Handwritten	Typed
800-3C, 35kV, PILC	800- ³ 35 kV	800-3C, 35kV
4/0-3C, 15kV, PILC Jacketed	4/0- ³ P, 15 kV	4/0-3C, P, 15kV
750-1C, 35kV, PILC	750- ¹ 35kV	750-1C, 35kV
Three 750-1C Jacketed Cables installed in the same duct	3-750 P, 35kV	3-750 P, 35kV

C. Lead-Covered Cables with Insulation Other Than Paper

These cables normally consist of one or three conductors under a lead sheath. The insulation is usually rubber (abbreviated "R") or Varnish cambric (abbreviated "VC"). The lead sheath is identified by the letter "L". These letters are added to the form specified in Section "B" in the position shown in the samples below.

Cable Description	Handwritten	Typed
Rubber-insulated lead-covered 500kcmil 15kV-3 cables triplexed (18-08-207). No longer stocked	3-500 RL, 15 kV	3-500 RL, 15kV
Varnish Cambric insulated lead-covered, 500 kcmil, 1C, 1000 Volt (18-08-019). No longer stocked	500- ¹ VCL, 1kV	500-1C, VCL, 1kV
Rubber Lead - 300 kcmil, 3C, 600 V (18-08-014). No longer stocked	300- ³ RL	300-3C, RL

D. Multi-Conductor Assemblies of Single Conductor Cables (Other than Concentric Neutral Type)

This cable is identified by stating the number and size of all conductors. When the neutral is the same size as the phase conductor, it is included with the phase conductors. If the neutral is bare, the abbreviation "BN" is added to the description following the conductor size. If the neutral is smaller than the phase conductors, it is specified following the phase conductor by adding the multiplication symbol "x" and the size. If more than one conductor is used for the neutral, the number of conductors must be specified.

Example: 3-500 kcmil phase conductors with a 4/0 bare neutral - 3-500 x 4/0 BN
 3-750 kcmil phase conductors with 3-#2 covered neutrals - 3-750 x 3-#2

To complete the description, the conductor metal must be shown if it is other than copper. Also, the insulation material and the rated voltage must be shown. If the rated voltage is 1000 volts or higher, the voltage is specified in kV (Example: 5kV). If the cable is rated at 600 volts, the voltage should not be shown. Any other cable assemblies designed for underground use, but not rated 600 volts should carry the rated voltage in volts (Example: 300V).

Several complete examples are given below.

<u>Cable Description</u>	<u>Written or Typed</u>
Pole Riser - Rubber Insulated 5kV consisting of 3-750 kcmil phase conductors and 3-#2 or 1-4/0 neutral conductors (18 07 031).	3-750 x 3-#2, R, 5kV 3-750 x 1-4/0, R, 5kV
URD Secondary - Cross-linked polyethylene insulated consisting of 2-350 kcmil aluminum phase conductors and a 3/0 AWG aluminum insulated cable triplexed together. Rated voltage 600 volts (18 07 201).	2-350 x 3/0 AL, X
URD Service - Cross-linked polyethylene insulated consisting of 2-3/0 AWG phase conductors and 1-1/0 AWG neutral conductor twisted together. All conductors are aluminum. Rated voltage is 600 volts. 18 07 202, or 2-350 kcmil with a 3/0 neutral in duct (18 07 248).	2-3/0 x 1/0 AL, X 2-350 x 3/0 AL, X, C/D

E. Network Type Cable - Rubber

Network cable (abbreviated NW) is a special construction of the cable specified in Section D. It consists of copper conductors covered with rubber insulation and a tough neoprene rubber jacket. It is rated 600 volts. This cable is identified by placing the abbreviation "NW" as a suffix to the description stated in Section D, Paragraph 1.

UNDERGROUND LINES INSTRUCTION

Designation of Underground Cables

59 40 00 70

Sheet 3 of 4

Cable Description

Network – 500 kcmil, 3C x 4/0 AWG

Bare Neutral – 600 V. (18 07 010)

Network – #2 AWG, 3C, 600 Volt

Bare Neutral (18 07 026)

Written or Typed

3–500 x 4/0 BN, NW

3–#2 BN, NW

F. Network Type Cable – Cross-Linked Poly

Another class of cables is crosslinked network. This cable has a copper conductor, is cross-link poly insulated, and is basically used as a duct cable was therefore designated as a network style cable with the NW description, rated 600 volts. See Ameren Material Spec. 2.2.206.

The usual description for item C which has a bare neutral would be: 3–2/0 NW, X, BN. Item D would be 3–1/0 NW, X because all three conductors are insulated.

Stock No.	Stock Description	Assembly of Insulated	Conductors Bare (AWG)	Record Description
18 07 011	NW, 1–750 kcmil	1–750 kcmil	–	1–750 NW, X
18 07 027	NW, 3–4/0 AWG (BN)	2–4/0 AWG	1–4/0	3–4/0 NW, X, BN
18 07 246	NW, 3–2/0 AWG (BN)	3–2/0 AWG	1–2/0	3–2/0 NW, X, BN
18 07 043	NW, 3–1/0 AWG	3–1/0 AWG	–	3–1/0 NW, X
18 07 026	NW, 3–#2 AWG (BN)	2–#2 AWG	1–#2	3–#2 NW, X, BN
18 07 001	NW, 4–#2 AWG (BN)	3–#2 AWG	1–#2	4–#2 NW, X, BN

G. Primary–Extruded Insulation Concentric, Tape, Longitudinal Corrugated, or Flat Strap Shield

To identify this type of cable, the number of insulated conductors making up the cable the size of the conductor, the conductor metal, the abbreviation "CN" indicating concentric neutral followed by the abbreviation for the style of insulation and construction. A comma and the rated voltage follow.

There are several types of extruded "High Voltage" cable insulations on the Ameren System. All types of rubber cable insulations use "R" to designate the rubber regardless of the style of rubber cable. X is used to designate cross-linked poly while P was used when Ameren purchased high molecular weight polyethylene which was not cross linked. While manufacturers used HMWP, Ameren used "P" (Poly) for the insulation description. For concentric neutral cables designated CN the X, P, or R should follow the CN immediately CNX, CNP, CNR. All cable currently purchased for URD primary will also have a P in the abbreviated description to indicate jacketed. Hence "CNR,P" is the modern URD cable now being used. It is important to cable operations that all cable be accurately posted with its proper abbreviated description and date of installation, month and year.

Cable Description	Posting
1–#2 AL, Rub, 15kV, Concentric Neutral, Jacketed	1–#2 AL, CNR, P (F) M/Yr.
3–#2 AL Rub, 15kV, Concentric, Triplexed, Jacketed	3–#2 AL, CNR, P (F) M/Yr.
3–750 AL, Rub, 15kV, Concentric, Triplexed, Jacketed	3–750 AL, CNR, P (F) M/Yr.
3–750 Rubber, 15kV, Longitudinal Corrugated Shield	3–750, LCR, P(F) M/Yr.
*3–350, Rub, 15kV, Flat Strap, Tripl., Jkt, Reduced Insul.	3–350, FSR, P, RW(F) M/Yr.
*3–750, Rub, 15kV, Flat Strap, Tripl., Jkt, Reduced Insul.	3–750, FSR, P, RW(F) M/Yr.
1–#2 AL, Rub, 15kV, Conc. Neutral, Jacketed in Conduit	1–#2 AL, CNR, P, C/D (F) M/Yr.

**DISTRIBUTION
CONSTRUCTION STANDARDS**



ENG: EJB
REV. NO: 2
REV. DATE: 1/31/12

1-1000 Rubber, 15kV, Tape Shielded, Jacketed	1-1000, TSR, P(F) M/Yr.
3-350 Rubber, 35kV, Longitudinal Corrugated Shield	3-350, LCR, P (H) M/Yr.
3-750 Rubber, 35kV Flat Strap Shielded Jacketed	3-750, FSR, P (H) M/Yr.

* Used by Heavy Underground Only.

H. Identification of Rated Voltage on Plat Book Records

In identifying rated voltage of cables on the plat book records, the following letters are used and the voltage used in the description above is eliminated.

A – 600 Volts or Less

D – 8.0 kV

G – 27 kV

B – 500 Volts d.c.

E – 6.6 kV

H – 35 kV

C – 5 kV

F – 15kV

J – 69 kV

In actual practice, the letters B, D, E, and G are no longer used.

When a cable is rated at a higher voltage than its operating voltage, it should carry the symbol corresponding to its rated voltage on all plat book records. The circuit name will show the operating voltage of the cable.

SCOPE: This standard provides for the joining, sealing placing and repair of plastic conduit.

MATERIALS

The conduits and fittings used shall be in accordance with Ameren Specifications and the conduit standards referenced therein. The male ends of all conduit shall be beveled on the inside 1/2" wide from edge. Pieces that are field cut shall be cut straight and beveled on the inside edge. This will provide a smooth internal transition between pieces avoiding damage to the cable.

INSTALLATION

1. Preparation of the materials shall include –
 - a. Cleaning surfaces to be joined
 - b. Eliminating cracked or defective parts or conduit
 - c. Make sure male ends of conduit have an inside beveled edge
 - d. Close tolerance shall be adhered to in the cutting and fitting
 - e. Fresh good solvent or cement shall be used
2. Continuity of size shall be maintained between manholes etc., where conduits end. Necessary changes in size due to adaptation to existing system shall use approved fittings and methods.
3. Proper support and transportation must be used to insure good materials. Do not drop conduit in cold weather.

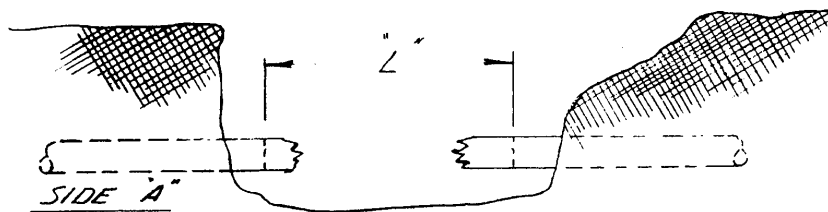
JOINTING

1. Cement the cleaned surfaces using a liberal amount of cement. Coat the entire length of the socket.
2. Work fast. If delays occur re-cement before joining.
3. Slip the conduit into the socket with a firm twist until bottoming is felt. Hold the joint motionless for 15 seconds longer when the weather is very cold. Do not drive or twist a completed joint.
4. Full curing takes one hour. Avoid transportation or unnecessary movement. Use care when adding additional sections. Stake bends to keep the stress off the joints.
5. All plastic conduit and fittings to be joined shall be exposed to the same temperature conditions for an hour prior to joining.
6. Precautions shall be taken to allow extra length where the conduit is at higher temperatures than the earth or the reverse, extra room, if the conduit is colder than the earth.
7. Backfilling shall be from the center of the ditch toward the ends or from one tie in point to the other.
8. Use only approved fittings and couplings. End bell or duct terminators shall be used at the terminations.
9. Free ends of conduit must be sealed when any work delay occurs. All completed ducts shall be wired and sealed.

Stock Numbers
Schedule 40 Couplings

Size	Standard	Repair Sleeve*
1"	12-51-237	--
1-1/4"	12-51-280	--
1-1/2"	12-51-278	--
2"	12-51-181	12-51-287
2-1/2"	12-51-265	12-51-288
3"	12-51-158	12-51-289
4"	12-51-157	12-51-290
5"	12-51-156	12-51-291

*No center stop.



"L"	
MIN. LENGTH OF REPAIR CONDUIT	
DIA.	LENGTH
2"	15"
3"	20"
4"	25"
5"	30"

SIDE "A"

EXPOSE CONDUIT AND CLEAR DEBRIS SQUARE CUT EDGES.
MEASURE & CUT REPAIR PIECE 1/2" SHORTER THAN "L".
CLEAN ALL EDGES TO BE FITTED.
CEMENT & INSTALL COUPLING ON REPAIR LENGTH
APPLY CEMENT TO SIDE "A".

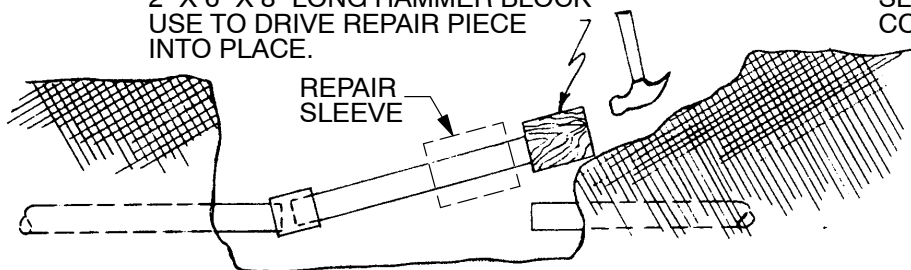
OPTION 1

2" X 6" X 8" LONG HAMMER BLOCK
USE TO DRIVE REPAIR PIECE
INTO PLACE.

OR

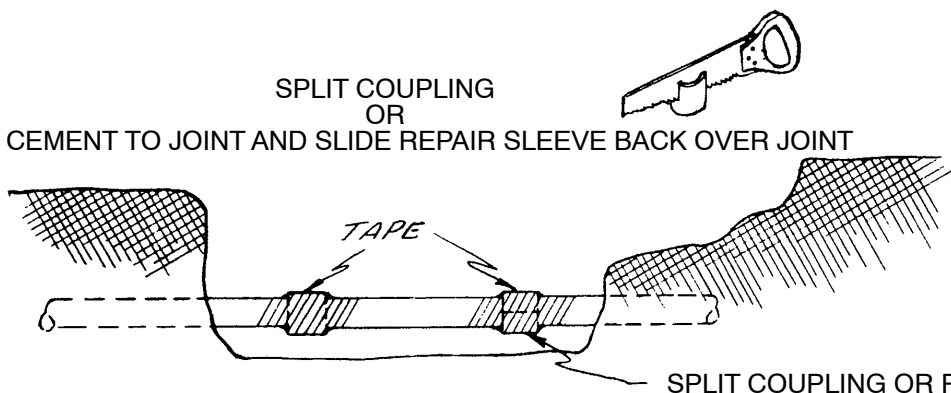
OPTION 2

SLIDE REPAIR SLEEVE ON
CONDUIT PAST JOINT.

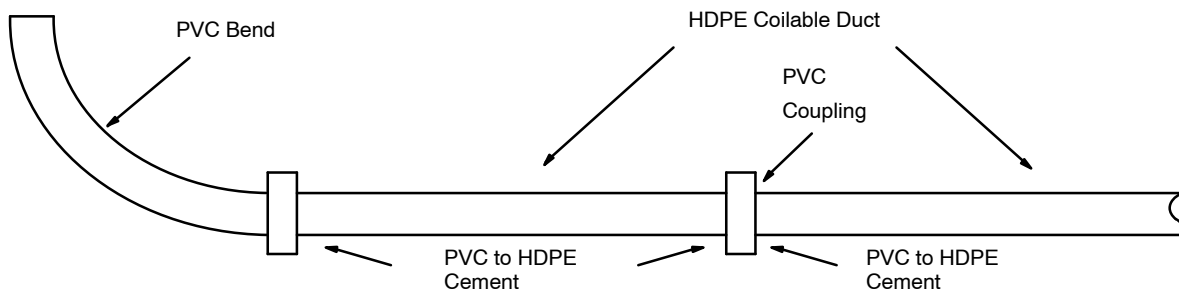


SPLIT COUPLING
OR

APPLY CEMENT TO JOINT AND SLIDE REPAIR SLEEVE BACK OVER JOINT



CEMENT COUPLING TO CONDUIT.
TAPE COMPLETELY SEALED WITH 1-1/2" WIDE PLASTIC TAPE.
ALLOW CEMENT TO SET - CAREFULLY BACKFILL.



Epoxy Cement Application Instructions

The stocked epoxy cement will effectively bond HDPE coilable duct to PVC bends and couplings if the following instructions are properly observed:

1. Cut the HDPE coilable duct to the desired length at a 90 degree angle. A straight cut will maximize adhesion.
2. For coilable duct over 3 inches, taper the end at a 45 degree angle using a knife.
3. Clean the coilable duct and the coupling or bend thoroughly to remove dirt and grime.
4. Using the abrasive cloth provided with the bonding kit, sand the outside of the coilable duct from the end to ½ inch beyond the depth of insertion into the coupling or bend. Using the same cloth, thoroughly sand the inside of the coupling or bell end of the bend. Be sure that all of the polish is removed.
5. Clean the adhesion surfaces again to remove loose material or water.
6. To avoid waste of the epoxy cement clean as many coilable duct ends, couplings, and bends as possible before opening the adhesive cartridge.
7. Place the epoxy cement cartridge into the dispensing tool and snap it into place.
8. Twist the cap off of the epoxy cement cartridge.
9. Place the mixing nozzle onto the cartridge and lock into place by twisting clockwise. Depress the handle on the dispensing tool until the epoxy cement comes out of the nozzle tip. Pump one or two more times to assure that the mixture is even (no streaking). Discard this excess cement.
10. Place the epoxy cement in a ⅛ to ¼ inch bead using a zigzag pattern the depth of the connector insert. The pattern should be about ½ inch in width and extend to the outer edge of the coilable duct. The end of the nozzle may be trimmed off up to the last notch to place a larger bead for larger diameter duct.
11. Twist the coupling immediately onto the coilable duct. It is important to twist the coupling to make sure that the epoxy cement is well mixed and spread evenly on the inside of the connection.
12. Smooth any excess epoxy cement. Use gloves to smooth out the cement.
13. Allow sufficient time for the epoxy cement to set:

Temp	Working Time	Set Time Before Movement
35 Deg. F	40 Minutes	7 Hours
52 Deg. F	20 Minutes	3 ½ Hours
60 Deg. F	10 Minutes	1 ½ Hours
70 Deg. F	6 Minutes	60 Minutes
88Deg. F	4 Minutes	40 Minutes

14. To store cartridge for later reuse, remove the mixing nozzle and replace the cap on the cartridge. Discard used mixing nozzles.

-
15. The working temperature for the epoxy cement is 35 Deg. F to 95 Deg. F.
 16. The following epoxy cement components are stocked by Ameren:
 - a. Starter Kit (Dispensing tool, 2 cartridges, and 10 nozzles) stk. #12-06-126
 - b. Case of 12 cartridges and 24 mixing nozzles stk #12-06-127
 - c. Mixing Nozzles (each) stk. #12-06-128

Guide for the use of insulating compounds (I semi fluid, II fluid, III resin based).

STOCK DESCRIPTION:

I. Compound – Insulating – – –

A. –Asphaltic – Semi-Fluid, Low Loss Stk. No. 31 53 074 (new) T&D Spec. 2.2.88

TEMP.

Min. Pour 280 Flash Pt. 430.

Max. Pour 400°F

FOR USE IN

1. All PILC potheads rated through 35kV

B. Petroleum Base – Petrolatum Stock No. 31 51 062

TEMP.

Min. Pour 250°F Flash Pt. 400°F

Max. Pour 350°F

FOR USE IN

1. All PILC joints rated through 35kV where factory paper insulation is used.

Exception: a. 35kV crotch joints Use Stk. No. 31 51 020

2. All paper lead transition splices where hand applied tapes are of the varnish cloth type (varnished polyester)

II. Compound Insulating-Fluids

A. – 219 – Oil Fluid – A. Stk. No. 31 51 003 (042) T&D Spec. 2.2.135 (55 Gallon Drum) ◀—

TEMP.

Pour 70/105°F Flash Pt. 445°F

1. All cable terminal chambers on the network system.

2. All hot test caps through 35kV. (31 51 003)

B. Polybutene – Fluid B

Compound Insulating, for poly and rubber joints and transition splices, where lead sleeves are used.

U.E. Stock No. 31 51 049 (Usually G&W Novoid 224)

III. Resin Base – Oil Insoluble Stk. No. 31 53 028

1. For use in special applications where migration could be a problem.

TEMP.

Minimum Pour 300°F Flash Point 450°F

Maximum Pour 375°F

IV. Gel – Cold Mix – Stk. No. 31 51 099 ◀—

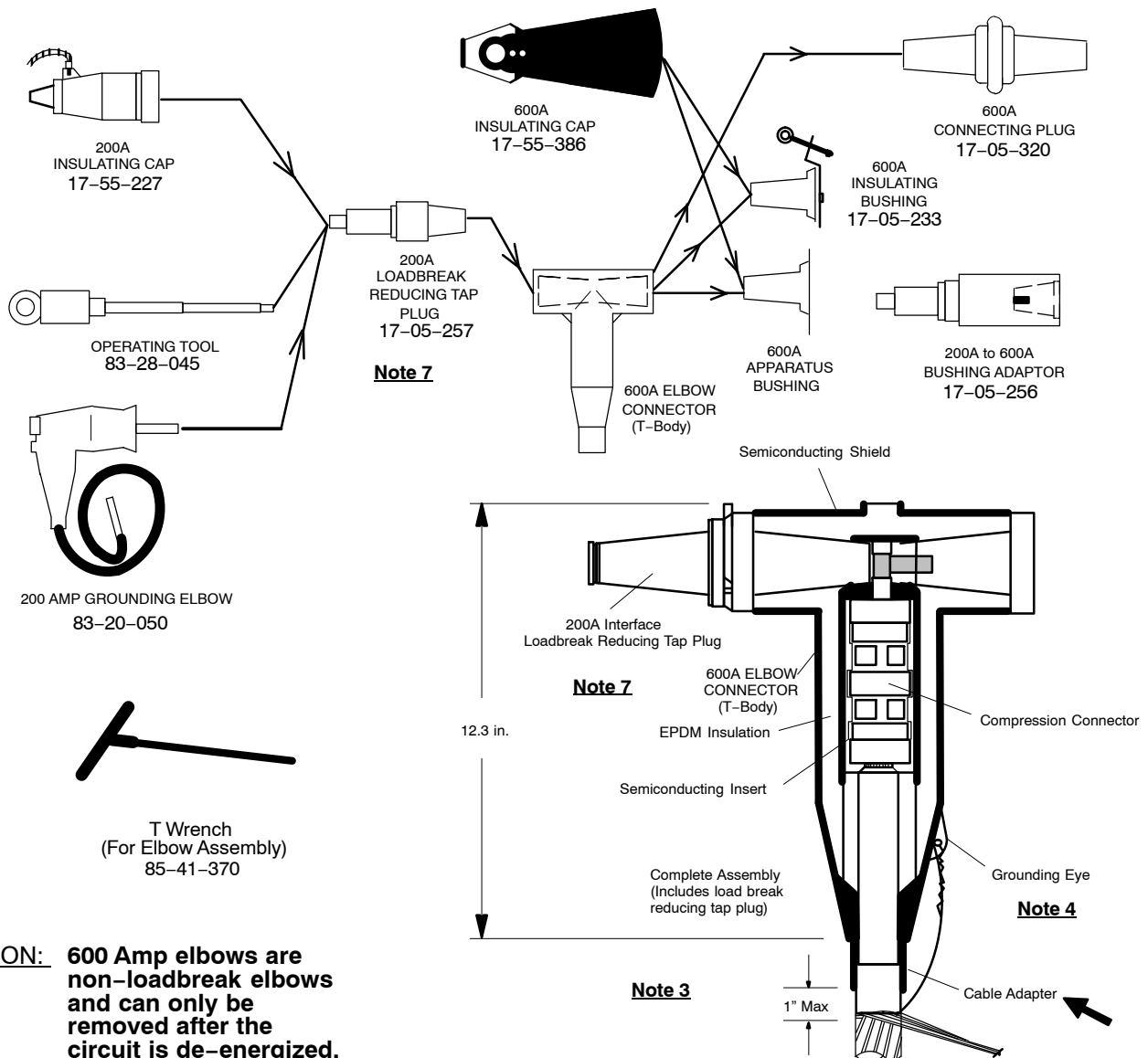
1. For use in PILC Joints and Potheads.

UNDERGROUND LINES INSTRUCTION

15kV, 600A T-Body Termination and Accessories

59 40 60 01

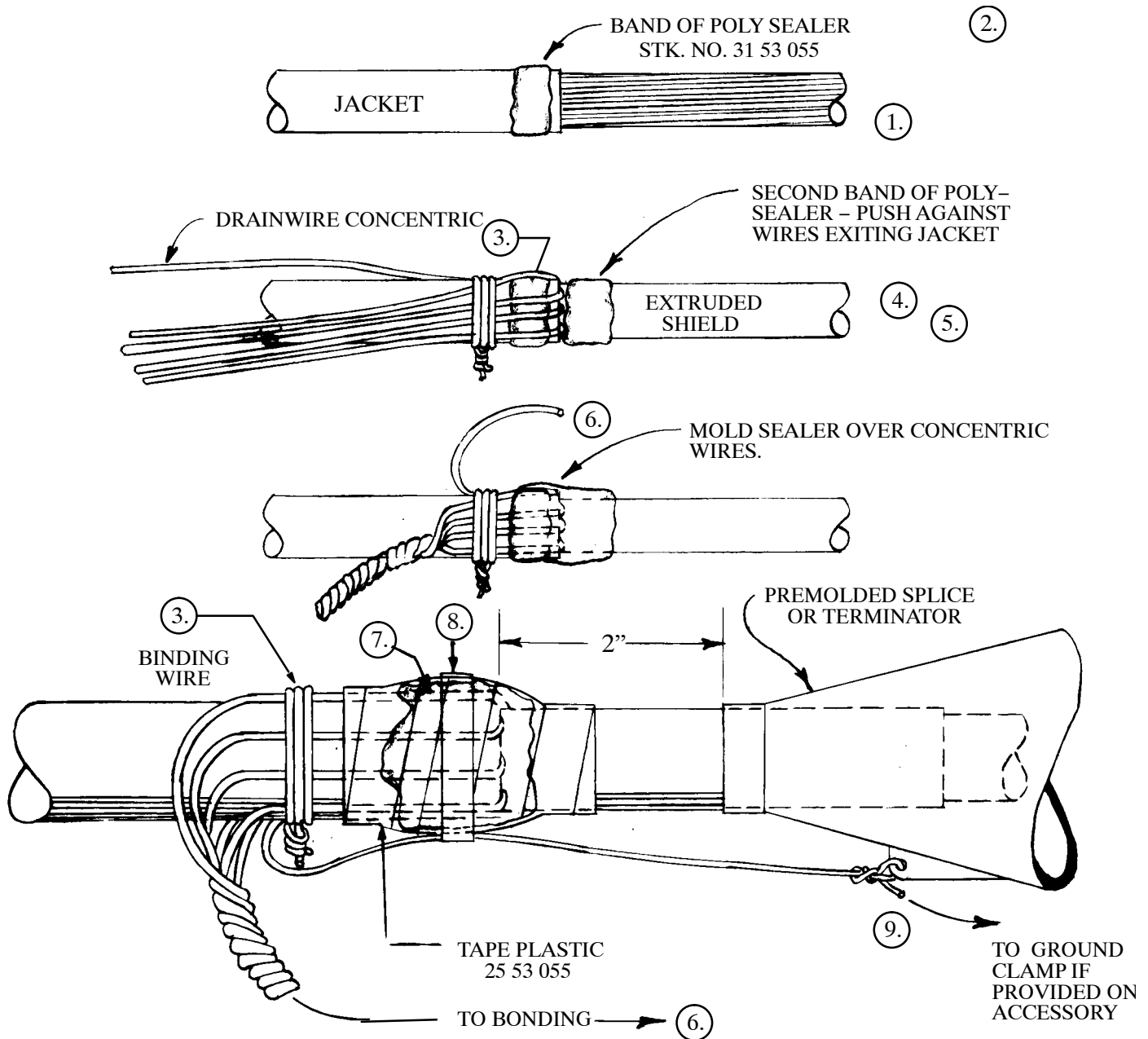
Sheet 1 of 1



CAUTION: 600 Amp elbows are non-loadbreak elbows and can only be removed after the circuit is de-energized.

Notes

1. Tools and hands shall be clean at all times to eliminate foreign particles in the elbow.
2. In cold weather, keep the elbow in your truck cab until you are ready to install it.
3. Install elbow per manufacturer's instructions and Dist. Std. 42 34 64 **.
4. Connect one concentric neutral strand in the grounding eye and twist tight. Reform the strands as nearly as possible to their original position and bind at this point with a scrap piece of concentric neutral strand. Twist the strands to form a single conductor for ground connection.
5. The apparatus bushing must be clean and silicone grease applied before the elbow is connected.
6. Remove all marking tape.
7. Replacement needed only if existing loadbreak reducing tap plug is damaged. Note: A Cooper (RTE) Loadbreak Reducing Tap Plug (LB RTP) will only fit a Cooper (RTE) elbow and an Elastimold LB RTP will only fit an Elastimold elbow.



1. Remove jacket sufficiently long to allow concentric length for neutral connections.
2. Place a band of sealer putty just 1/2" to 3/4" wide sufficient to bury concentrics into.
3. Bend concentrics back and bury them in the putty -- Bind concentrics into place with wire as shown.
4. Place a band of poly putty in front of the jacket on the extruded shield so that it seals against the concentric wires where they exit from under the jacket.
5. Mold against the jacket & over the concentric wires.
6. Leave one wire out of bunch – Twist the balance to form one stranded conductor to take to the neutral bond or connection.
7. Tape two layers of plastic tape stretched tightly over the molded putty seal.
8. Add a third layer of tape using less tension.
9. Take the bond wire to grounding eyelet of accessory, connect as shown.

SCOPE

This instruction covers the handling and use of Varnished polyester (glass) insulating tapes used in the hand insulating of paper lead cable.

STORAGE OF MATERIALS

The tapes shall be stored in closed polyethylene bags or sealed cans. Unstored bags left in the air shall not be used. Materials left unused in trucks or other equipment stored in poly bags shall not be used if the storage period exceeds 3 months.

Peeling

The mastic used to secure the end of the roll shall be cut off.

Heating

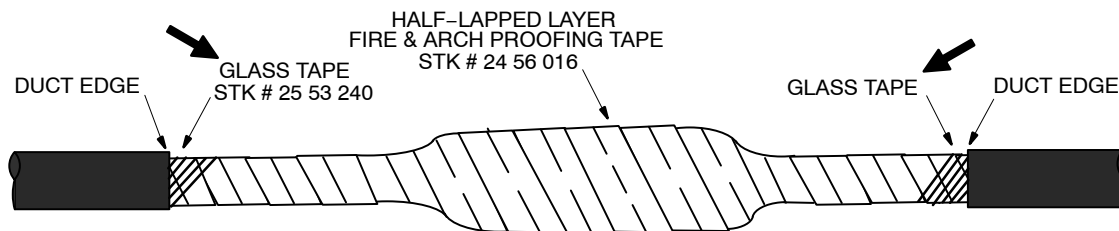
The peeled tapes shall be placed in the aluminum taping pot with sufficient 219 oil to cover the tapes. The pot and oil shall be heated to 150°F prior to taping. (Compound insulating 219 – Stock No. 31 51 003 in gallon cans.)

Taping

1. Start the tape application in the lowest spot usually next to the connector.
2. Fill in lower spot first, fill in level pulling the tapes tight to obtain a void free fill.
3. Care shall be taken that no sharp step is created that causes voids.
4. Pour or wipe oil over each half lapped layer as the tape is applied.
5. Each new pot of tapes shall be heated. No tapes shall be applied cold.

TEST each leg for firmness before going on or applying the shield.

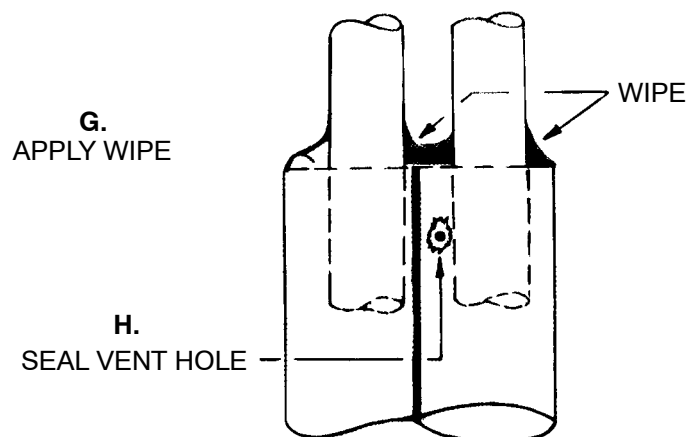
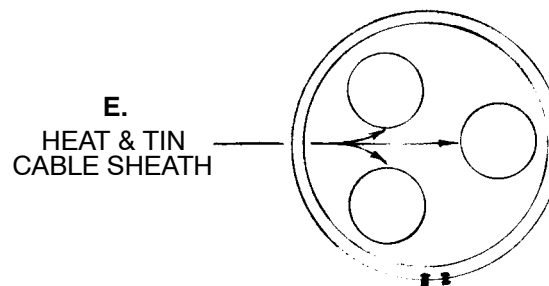
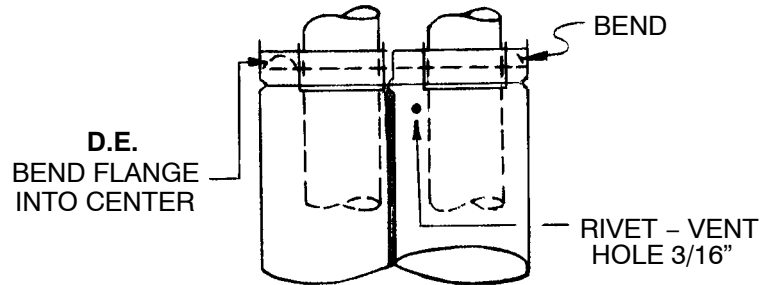
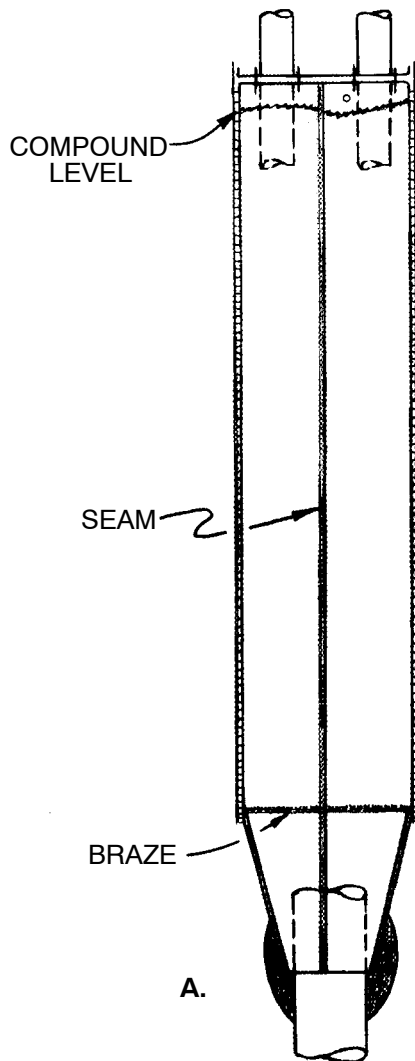
1. All cables in manholes and vaults, when personnel may be present, and the cables are operating at 2400 volts and above should be protected from fire and arcing. Note: Do not cover bond wires or bare neutral wires.
2. Apply fire and arc proofing tape to the cable with one half-lapped layer. The tape may be applied with either side toward the cable. The tape may be pulled tight to obtain a snug, wrinkle-free wrap which conforms to the cable (and splice). Overlap the last six (6) inches of protected cable when starting a new roll of tape.
3. Since fire and arc proofing tape may not be adhesive coated, it must be held in place after wrapping with glass tape. Secure the ends with several wraps of glass tape. (See Figure 1)
4. Fire and arc proofing tape shall be applied from duct edge to duct edge.
5. Triplexed cables shall be treated as a single cable except at locations where it is un-layed for splicing and then protect each leg and splice individually.



CABLE & SPLICE COVERED
FIGURE 1

SEALING TRIFURCATING SLEEVES

- A. The sleeve should be placed with the seam away from the pole or support structure.
- B. Apply the bottom wipe tinning the copper sleeve and sealing the cable to lead sheath.
- C. Fill the joint with compound leaving 1-3/4 to 2 inches of depth unfilled so that the compound does not run out of the brass riveted venting hole.
- D. Place the trifurcating end cover into the copper sleeve dished up until it sits tightly onto the rolled indent.



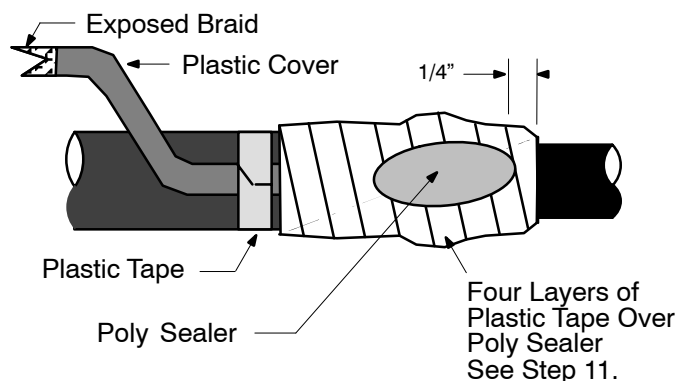
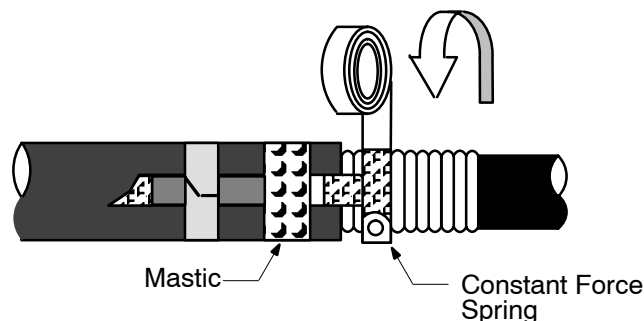
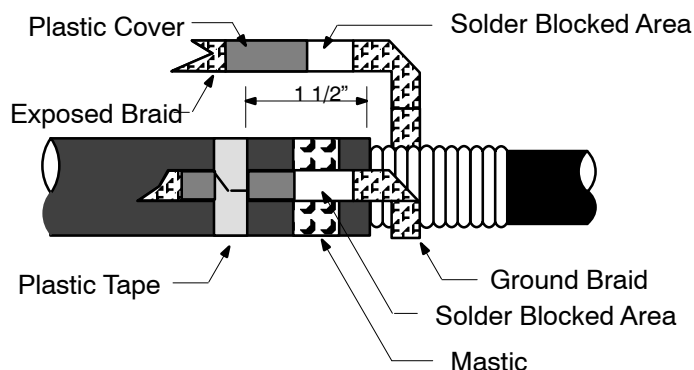
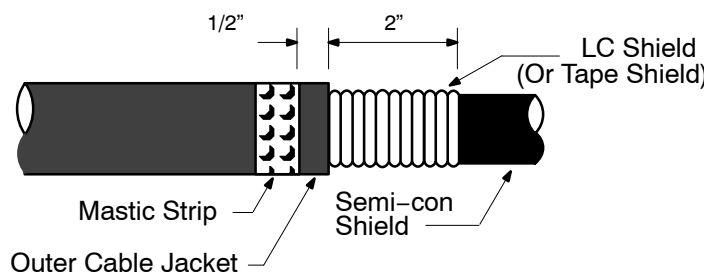
- E. Peen the "1" inch of copper sleeve above the indent so that it leans into the trifurcating end plate. See figure.
- F. Heat and tin the sheath of the single conductor cable where they will contact the wipe before placing the mass of lead which makes up the wipe.
- G. Apply the wiping solder while in the plastic state wiping and securing a tinned connection between the solder, sheath, and copper sleeve.
- H. As the last step, solder seal the brass rivet hole to the copper sleeve.

CONNECTOR TINNING

1. The conductors shall have been previously prepared by proper cutting with a hacksaw and stripped to the dimensions indicated per standard.
2. The insulation shall be protected by wrapping with several layers of glass tape 25 53 057 at the shoulder to prevent scorching during tinning.
3. The conductors must be well coated with paste flux, 22 02 255.
4. The connectors must be squeezed onto the conductors tightly but allowing the proper 1/8 inch slot opening to allow for proper tinning of the conductors.
5. The solder shall be tinning hot, 370°C (a cardboard or heavy paper quickly dipped into the solder shall turn brown but not burst into flames).
6. Starting at one end pour hot solder into the slot until the solder has heated the copper to the extent that molten solder runs through the connector. Then move the pouring back and forth along the slot.
7. Continue to pour solder into the slot using the cooling solder in the catch box. Pour and force mushy solder into slot until a solidly filled connector is obtained.
8. Use the gloved finger or wiping cloth to smooth the soft solder across and around the connectors.
9. After cooling, file and sand the connector to obtain a smooth finish removing any burrs or lead piles created during the tinning.
10. Remove the glass tape and dress up the shoulders of the insulation. Remove any burns or damaged insulation, and assure that no lead burrs remain.

CONSTANT FORCE SPRING CONNECTION WITH BRAID

NOTE: The constant force spring connector can be used on either LC shielded or tape shielded cables.



1. Strip jacket and semi-con shield to dimensions required.
2. Select one of three mastic strips from the grounding kit (Stk. #17-54-306). Remove liners and wrap mastic around the cable jacket, 1/2" from the cut edge. Discard any excess mastic from this piece.
3. Position twin pre-formed ground braid with one tail along the cable jacket. The mastic must be within the solder blocked area.
4. Secure the braid to the cable jacket with plastic tape, 1-1/2" from the cut edge of the jacket.
5. Wrap the braid around the metallic shield and secure it in place with the constant force spring.
6. Wrap the spring in the same direction as the braid and cinch (tighten) the final lap.
7. Position the tail of the preformed ground braid along the cable jacket. The mastic must be within the solder blocked area.
8. Secure the braid to the cable jacket with plastic tape, 1-1/2" from the cut edge of the jacket.
9. Apply a second mastic strip layer over the braid tail. The second mastic strip should be positioned so that it overlays the previously installed mastic strip. Press the two mastic strips together to form a water tight seal.
10. To seal the connection, apply poly sealer (Stk. #31-53-055) over the metallic shield, the constant force spring, and the mastic strips. Start sealing approximately 1/4" beyond the end of the metallic shield.
11. Tape over the poly sealer with two layers of plastic tape (Stk. #25-53-055) stretched very tightly. Add two more layers of plastic tape, half lapped, to complete the water seal.
12. Attach the two exposed braid tails to a #2 Cu. bond wire (Stk. #18-54-027) with a two bolt connector (Stk. #17-54-145). If an accessory drain wire is needed, include a #14 Cu. binding wire (Stk. #18-52-018) in the two bolt connection.
* Seal the two bolt connector using poly sealer and plastic tape.

I. General

The following instructions apply to all 35 kV joints shown in the 41 40 ** ** sections of the Dist. Const. Standards.

II. Precautions

1. Great care must be exercised to prevent moisture, dirt, or metal particles from getting into the insulation or the cable compound during construction of the cable joint.
2. During warm weather or in warm manholes the splicer shall keep his hands clean and free of perspiration by wiping them with rags and solvent degreaser while doing any work on the insulation.
3. All materials in direct contact with the insulation such as spacer blocks and wood chisels shall be boiled in oil until free of moisture and kept in oil until used.
4. All boiling out operations to be made with GE 219 taping oil (31-51-003) heated to 135° – 140° C during summer and 140° – 145° C in winter.
5. During the process of making the joint, the cable must not be bent or the conductors spread to such a degree that the insulation is damaged.

III. Preparation of the Manhole

1. A guard shall be placed around the manhole opening when necessary to prevent street dirt from blowing into the manhole.
2. Wipe all moisture and loose dirt from the roof, side wall, the cable to be worked on and other cables adjacent to the point where the joint is to be made.
3. In damp or wet manholes place a rubber blanket above the working area so that moisture cannot drop into the joint.

IV. Training

1. Train the cables into approximately their final position and support them on wood blocks and/or rollers on the iron pin cable supports.
2. Cables shall be trained so that a 6 inch section of straight cable extends from the duct mouth before beginning a bend.

V. Determining the Center of the Joint

1. Select a point, along the overlapping cable ends, for the center of the joint, so that there will be at least 21 inches of straight cable on each side of this center.
2. Wrap a marker tape around the cables just back of the center and cut the cables at right angles to their axes at this point.

VI. Removing the Lead Sheath and Belt or Binder Tape**1. General**

- a) Mark the lead sheath at the point where it is to be removed.
- b) At this point cut a groove around the cables halfway through the lead with the chipping knife.
- c) Clean with a wire brush or sand cloth and inspect the lead sheath for a distance of 4 inches back from the groove.

- d) Make a longitudinal cut in the section of lead between the groove and the end of the cable.
- e) Remove the lead sheath by tearing it off at the groove around the cable. This will leave a partial belling of the lead sheath.

2. Belted Cable

- a) Complete the belling of the lead sheath with a fibre belling tool, using care to avoid damaging the insulation.
- b) Tie a string around the belt insulation at a point 1 inch from the lead sheath.
- b) Remove the belt insulation by tearing against the binder string.
- c) Wrap 4 layers of V.P. tape over belt and tie off tightly.

3. Shielded Cable

- a) Unwind any binder tape and cut off as close as possible to the lead sheath.
- b) Bind the cable next to lead sheath with 4 layers of 1 inch V.P. tape.

VII. Preparing the Outer Sleeves

1. General

- a) Copper Sleeve
Carefully clean the sleeve.
- b) Lead Sleeve
Carefully clean the sleeve, wire brush and inspect the outside of the sleeve for a distance of 4 inches from each end.

2. For Oil-Filled Joints

- a) Insert brass bushings (for fitting) and solder them in place being careful not to get solder on the inside of the bushing (19-11-094).
- b) Remove any solder from the inside of the sleeve.
- c) Slip the lead sleeve back over the cleaned cable.

3. For Compound-Filled Joints

- a) Same as for VII-2 except at one end of the sleeve the bushing is to be soldered in place after filling the joint. This half is to be on the cable at the lower or filling end.

VIII. Preparing the Conductor Ends and Shaping Conductors

- 1. Remove the fillers to within 1/2 inch from the belt on belted cable or the lead on shielded cable.
- 2. On shielded cables, unwind the copper shielding tape on the conductors, overlap and tack solder. 4 inches from the sheath. Place spacer blocks.
- 3. Wrap plastic sheeting tightly around the three conductors from the lead to the spacer blocks.
- 4. Shape the conductors straight and parallel to the cable.

IX. Stepping Conductor Insulation

- 1. Tie a string around the conductor insulation at the furthest step.
-

2. Remove ten layers of paper, tearing each layer against the string leaving a rough tapered surface.
3. In succession at each step tie a string and remove ten layers. At the last step remove half of the layers, and with the last string tied remove the remaining layers.
4. Wrap the insulation with plastic sheeting before working on the other conductors.

X. Installing Copper Connectors

1. Spread the connectors uniformly, sufficient to allow them to be slipped over the conductors.
2. Apply soldering paste to the conductors and slip all the connectors on the cable by grasping the cable with both hands, one just back of either crotch and push the two cable ends out toward the wall of the manhole until the ends of the connectors just pass the other conductor ends. Adjust each conductor to fit into the copper sleeve. Pull the cables back in the same manner.
3. Press the copper connectors together shaping them to conform to the conductor leaving no open space between the conductor and the inside of the connectors. Tap down any sharp edges with a ballpeen hammer.

XI. Soldering Copper Connectors

1. Carefully protect the end of the insulation and part of the exposed copper with several layers of glass tape, leaving 1/8" exposed copper next to sleeve.
2. Apply more soldering paste and then pour hot 50–50% solder into the slot in the connector until the conductors are properly tinned.
3. Allow the solder to cool until a surplus of solder can be built up over the ends and along the slot in the connector, making as smooth a wipe as possible.
4. With a sharp knife cut off any rough spots and projections of solder and sand connector.
5. If the solder is not smooth or other imperfections are noted, resolder and repeat the operation.
6. Remove the glass tape.

XII. Preparation of V.P. Tape

1. Open the can of V.P. tape and pour out oil into stewing pan.
2. Heat oil to 135° C.
3. Remove a 2 foot sample of tape and test for moisture by placing it in the hot oil. If the tape bubbles the entire can of tape shall be tagged and returned to the Stores Department as wet tape.
4. Pour hot oil back into can over V.P. tape.

XIII. Applying the Tape

1. General
 - a) Remove the spacer blocks and remove plastic only from conductor to be worked on, also cut the strings holding the stepped paper insulation. On Anaconda's cable remove the semi-conducting (carbon black) tape to a point 4 inches from the lead sheath.
 - b) Boil out the conductor to be worked on, when conditions are very wet and legs may get wet.

- c) Pour cold #219 taping oil from a new can over the conductor.
- d) Remove the V.P. tape from the can and remove the strings or stickers. Place sufficient rolls of tape into stew pan filled with oil.
- e) With the V.P. tape folded lengthwise fill the gap between the connector and the first step, gradually building up evenly over the connector.
- f) Tape back and forth between steps until even with the conductor insulation.
- g) Continue taping between the limits of 4 inches from the lead sheath. Each successive layer to be stopped about 1/2 inch from the underlying layer thereby forming a long taper. The center portion of the taping should be built up to the required circumference.
- h) The V.P. tape should be drawn tight after each turn or tightened after not more than 4 turns by gripping the last turn and twisting it with the lay.
- i) Use the warm taping oil freely on every layer.

2. For Joining Shielded Cables

- a) At one end solder the shielding braid to the copper shielding tape.
- b) Butt wrap the shielding braid, covering the insulation across the entire joint and solder to the copper shielding tape on the opposite end of the joint.
- c) Solder the shielding braid across the entire joint with a soldering iron, touching the copper tape and braid lightly to prevent injury to the insulation or the expelling of any compound from under the tape.

3. For Joining Shielded and Belted Cable

- a) Build up the insulation at the crotch of the shielded cable after the conductors have been taped as in XIII-1. The taping must be in a cone shape starting in the crotch at the edge of the tack soldered factory shield and extending for 4 inches.
- b) Wrap the shielding braid around the built-up cone, stopping at the highest point.
- c) Solder the braid to prevent it from unraveling, tack soldering to the factory shield.

4. For Joining Three Conductor Shielding Cables

With Three Single Conductor Cables

- a) Apply the copper shielding braid over the entire length of each conductor and solder in place as in XIII 2C, and solder to the copper band on the single conductor side.
- b) Solder the copper band to the single conductor lead sheath.

XIV. Wrapping the Binder Belt

- 1. Wrap V.P. tape over all three conductors, covering the center of the joint with three layers of tape.
- 2. Boil out the complete joint with taping oil heated to 120°C.

XV. Wiping Outer Sleeve

- 1. Slip the sleeves in place and wipe the two halves together.
- 2. Center the sleeve.
- 3. Insert the lead wedges around the cable at each end of the sleeve and tap them in place.

4. Place markers around the cable sheath at each end at a distance of 1 1/2 inches from the sleeve.
5. Remove the fittings or plugs from the sleeve to permit the escape of air during the wiping operation.
6. Wipe the sleeve to the cable sheath. Do not use stearine to cool wipes.

XVI. Filling of the Joint**1. Type of Filling Compound**

- a) For completely shielded joints, connecting shielded to shielded cable, fill joint with (Molex) oil insoluble compound 31 53 028 (or Petrolatum 31 51 062).
- b) For all joints connecting to submarine cables, fill with GE 5314 oil 31 51 020.
- c) For belted cables where no reservoirs are available and on new cable where temporary joints are to be made, fill with GE 219 compound, 31 51 003 (or Petrolatum 31 51 062).

2. Heating of Compound

- a) Heat four gallons of oil, petrolatum, or compound to a minimum temperature of 145°C in winter and 135°C in summer.

3. Oil (or Petrolatum) Filled Joints

- a) Place a funnel in the hole at the low end of the joint. Pour the oil through the joint until bubbles have ceased flowing out at the high end.
- b) Insert the alemite fitting at one end and a plug at the other end.
- c) For reservoir connection remove alemite and insert Lunkenheimer "L" and connect flushed tubing.

4. Compound Filled Joints

- a) Place a funnel in the hole at the low end of the joint. Fill the joint with compound.
- b) Fill the joint with the approved filling compound. Fill with hot compound and seal, do not allow to cool and top off.
- c) Replace the bushing and plug and solder the entire assembly in place.

For Tape Shielded, Rubber Insulated Cables

Dist. Stds. 41 44 30 01, 41 44 20 **, 41 43 20 01

A. Jacket Removal

Remove the jacket by scoring with a sharp knife. This jacket is only 50 mils thick – 0.05 inches. A deep circumferential cut could go thru the jacket and then thru the copper shield tape, which is only .005 inches thick. A slanted blade cut or a perpendicular score will both do a good job for the long score, but the circumferential score is more tricky.

B. Removal of the Copper Shield Tape

Two wraps of 3/4 inch plastic tape (25 53 055) shall be used to mark the cut off dimension for the copper shield tape. The tape should be positioned on the keeper side of the cut off dimension so that it can be left in place to hold the shield tapes. Using the triangular file (85 19 036) to score the shield tape insures that no deep cut will be made into or thru the extruded shield. A file score mark on the extruded shield does not injure the cable. Removal of the copper tape by scoring leaves no sharp burrs or disfigured shield points to worry about. Since the tape is only 5 mils thick, not much of a file score is necessary. A deeper score will be needed where the shield tapes overlap, or the knife blade can be used as a ruler edge to tear the tape against at the overlay points. The plastic guide tape is left in place to secure the shield tape.

C. Semi-Con Shield Removal

Removal of the semi-con shield should be done with the bana-peeler-scoring tool (85-32-090). Using the bana-peeler to score the semi-con is the most controllable method to accomplish this task.

D. Repairs

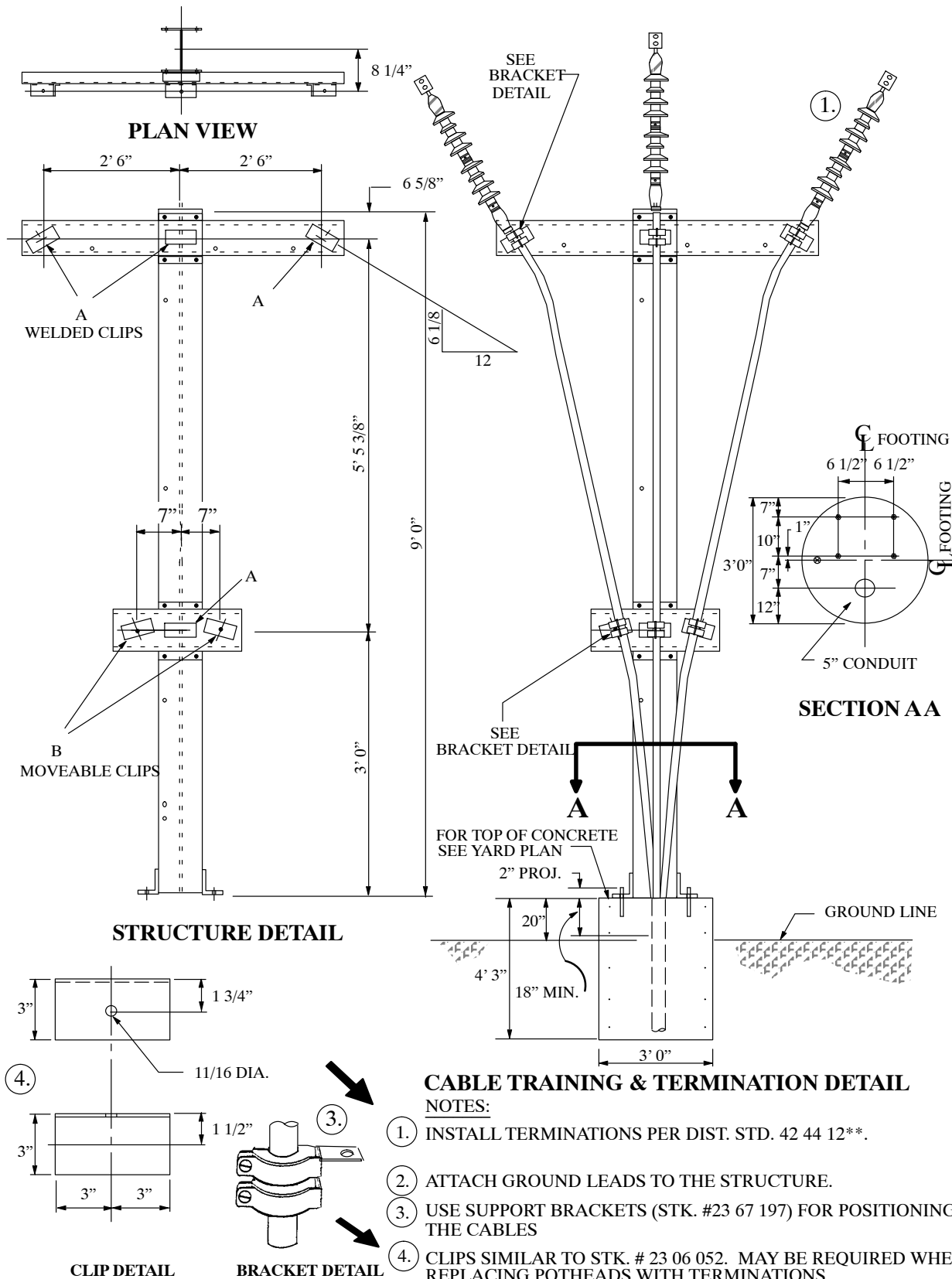
Any score which digs into the insulation must be sanded out using sanding cloth (22-05-213). A score in the insulation resulting from the circumferential scoring should be filled with silicone grease since it would be nearly impossible to sand out next to the semi-con shield.

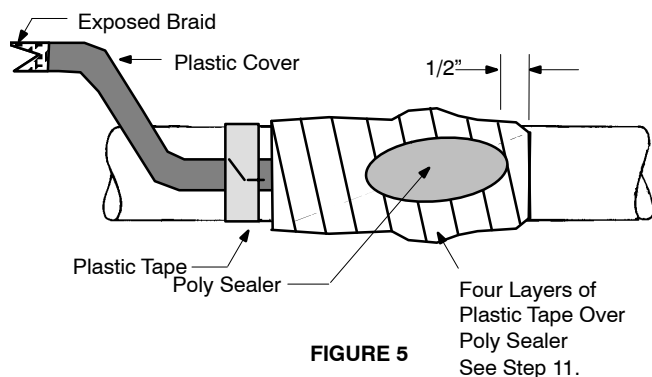
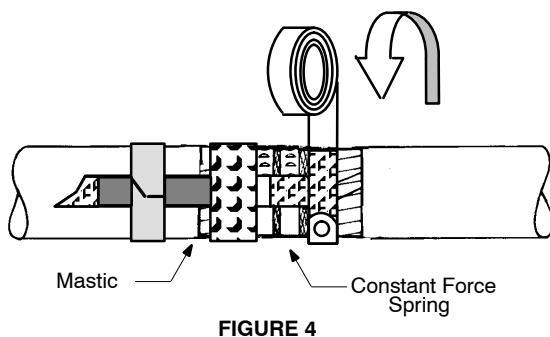
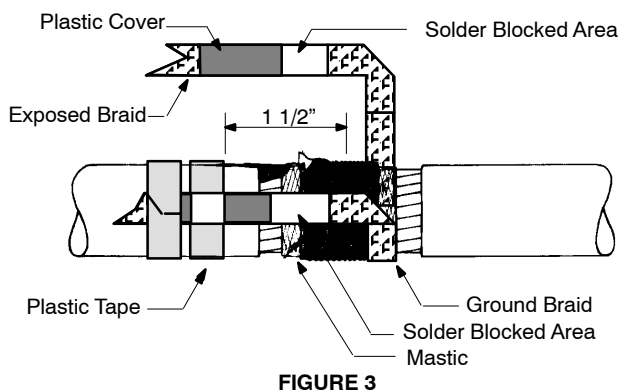
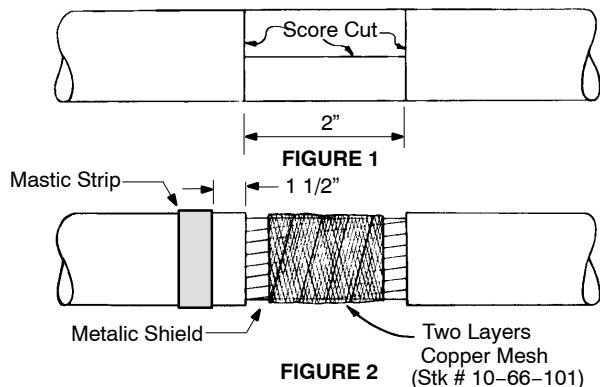
E. Insulation Removal

Insulation stripping for the lug is left to the splicers discretion and preference. An insulation stripping tool is available from stock. Ripley Co. Utility Tool WS-50 (83-36-031).

F. Pencilling Insulation

Use the WS-8 Pencilling Tool for 35kV, 750 kcmil insulation when splicing (85-29-250).





1. Score jacket carefully as shown. Do not cut through concentrics which are #18 AWG wires. Remove the jacket by prying and lifting along score. Cut.
2. Wrap two layers of half lapped copper mesh (Stk. # 10-66-101) over concentric wires as shown.
3. Select one of three mastic strips from the grounding kit (Stk. #17-54-306). Remove liners and wrap mastic around the cable 1/2" from the cut edge. Discard any excess mastic from this piece.
4. Position twin pre-formed ground braid with one tail along the cable. The mastic must be within the solder blocked area.
5. Secure the braid to the cable with plastic tape, 1-1/2" from the cut edge of the copper mesh.
6. Wrap the braid around the copper mesh and secure it in place with the constant force spring.
7. Wrap the spring in the same direction as the braid and cinch (tighten) the final lap.
8. Position the tail of the preformed ground braid along the cable. The mastic must be within the solder blocked area.
9. Secure the braid to the cable with plastic tape, 1-1/2" from the cut edge.
10. Apply a second mastic strip layer over the braid tail. The second mastic strip should be positioned so that it overlays the previously installed mastic strip. Press the two mastic strips together to form a water tight seal.
11. Seal the connection by applying poly sealer (Stk. #31-53-055). Start sealing approximately 1/2" beyond the cut edge and extend the seal to the plastic tape.
12. Tape over the poly sealer with two layers of plastic tape (Stk. #25-53-055) stretched very tightly. Add two more layers of plastic tape, half lapped, to complete the water seal.
13. Attach the two exposed braid tails to a #2 Cu. bond wire (Stk. #18-54-027) with a two bolt connector (Stk. #17-54-145).
14. Seal the two bolt connector using poly sealer and plastic tape.

This instruction provides a method for labeling cables, transformers or switch locations supplied by primary cable loops associated with underground distribution. This labeling is used to identify a particular switch, cable, padmount junction or padmount transformer for operating purposes.

The labeling method described here is used primarily in the former UE service areas. Labeling methods, different from those described here, are used by the other legacy companies. This instruction should not be interpreted as a requirement for the other legacy companies to change their current labeling methods.

1. The engineer responsible for the job's one line drawing shall show on the one line (or plat if there is no one line) the lateral name, and at each transformer or switching location, a location (or pad) number and an X and Y terminal of the primary cables.

Lateral naming shall be in accordance with the Operating Procedures followed by the reporting center located by district or division.

In the St. Louis area, the transformer or switch location (pad) number assignment will also be obtained from the Distribution Operating Department where these numbers are assigned and recorded. In other divisions or districts it will probably be convenient to use the transformer number for a location number. (All numbers must be different.)

Where cables loop up into a transformer or switch, the ends shall be marked with X and Y tags. One end of each cable shall be tagged with an X and the other end tagged with a Y in such a manner that when tracing along the path of the cable in one direction, the near ends of each cable segment will be tagged X and far ends Y. Each transformer or switch location will have a Y end of one cable segment and an X end of the next segment.

The X and Y designation will have nothing to do with the normal direction of supply or the normally open switch. They are to designate which of the two switches or connections at a location are being referenced. The X and Y are not to be considered part of the lateral/loop name.

The lateral should be marked according DCS 59 40 00 40.

Pad mounted switching and/or fusing compartments, usually associated with three phase supply, shall also be numbered for identification purposes. Cables in the switching and/or fusing compartments are to be tagged similar to terminal poles.

2. Construction Personnel will label each cable end and transformer location in accordance with the one line drawing or construction plat. The foreman or crew leader, after checking that the marking is in accord with the one line, will sign it and return it to the office for posting in the usual manner.

Pad mounted transformers will be numbered as shown on the one line by applying pressure sensitive numbers. These numbers shall be located on the outside of the transformers facing in the direction of most likely access so that they can be seen from the street or from as far away as possible by the troublemen. A duplicate set of numbers shall be located on the inside of the door in such a position that they can be readily seen by anyone operating the high voltage switch or disconnect.

Vault mounted transformers shall have the assigned numbers stamped in brass or copper identification plates. The plates shall be affixed to the vault grates.

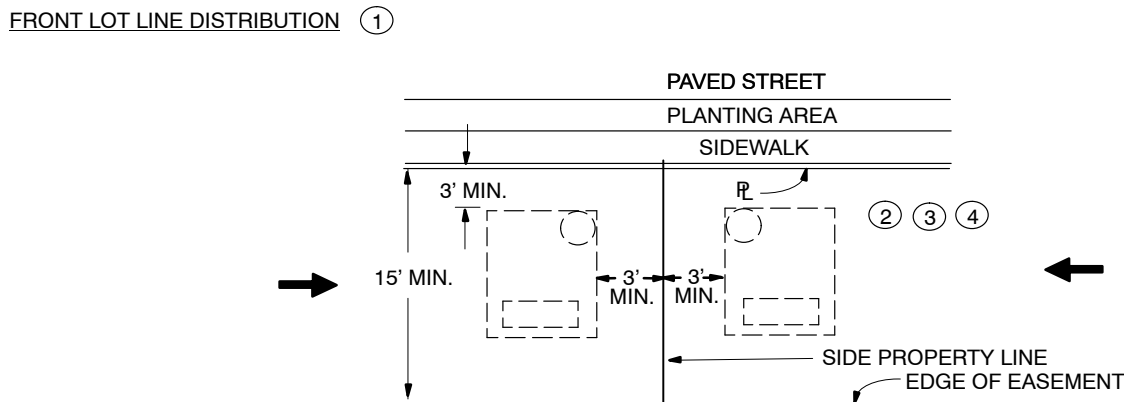
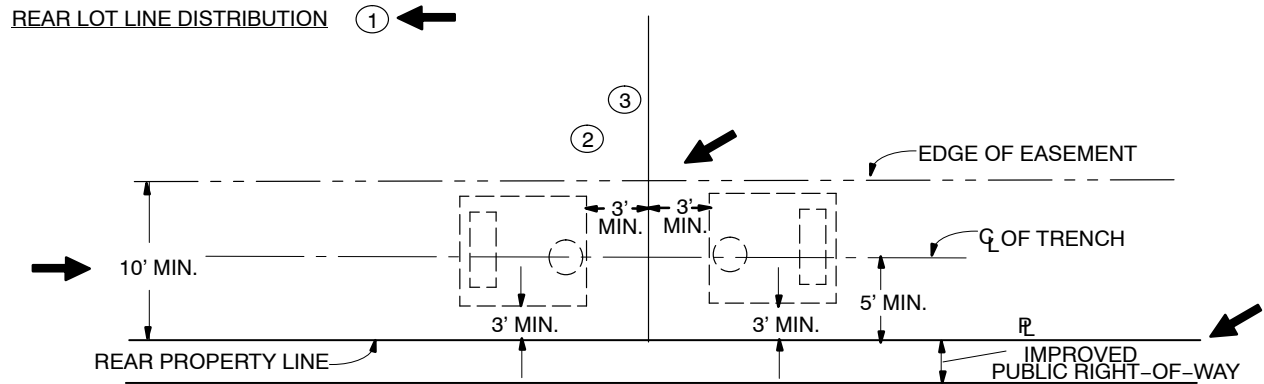
The cable ends will be marked X or Y as shown by the one line by applying a "tag – blue formica triangle – letter Y" (Stock No. 16-51-080) or "tag – orange formica square – letter X" (Stock No. 16-51-079), tied with a small copper wire to the cable at the end of the concentric neutral strands or just below the termination. To avoid confusion the cables should enter on the side of the pad from which they come and should not cross each other under the pad.

When a pad mounted transformer is replaced, the number should be removed from the old transformer and the same number used for the new transformer using new pressure sensitive high visability numbers. In the case of a vault mounted transformer, the plate shall remain attached to the grate.

3. Construction personnel shall number each pad mounted switching or fusing compartment by applying pressure sensitive high visability numbers. These numbers shall be located on the outside of the compartment facing in the direction of most likely access.

The cable ends shall be marked with a phase identification in each pad mounted switchgear, three phase transformer, and terminal pole with more than one phase. This will be done by applying a "tag – round formica, green A" (Stock No. 16-01-122), "tag – round formica, black B" (Stock No. 16-01-123), or "tag – round formica, red C" (Stock No. 16-01-124) tied with a small copper wire to the cable just below the cable termination.

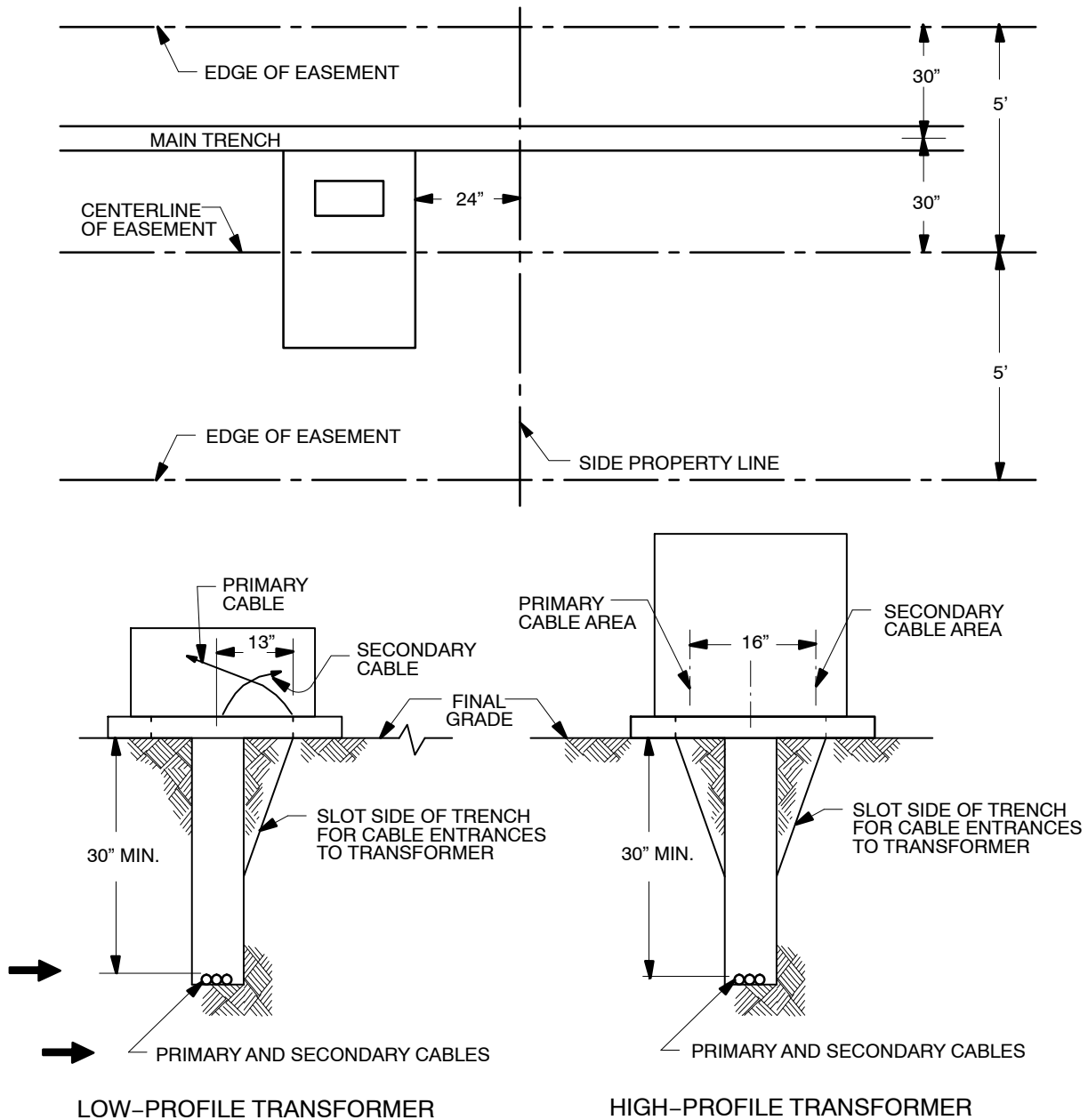
All other information, such as circuit names, shall be stenciled on the inside of the compartments.



NOTES:

1. Front lot line distribution is standard for all new construction. Where local ordinances require rear lot line distribution, unobstructed improved truck access via public right-of-way adjacent to our easement is required.
2. Location of transformer pad or above grade pedestal should be within area indicated. Where practicable, straddling the side property line should be avoided.
3. 10 feet minimum clearance is required in front (door side) of transformer. 3 feet minimum clearance is required for the other three sides.
4. On front lot line distribution, if terrain permits, locate transformer pad so the door of the transformer will face to the rear of the property.
5. When transformer is located adjacent to a driveway, it should, when possible, clear the driveway by at least 5 feet.
6. Thoroughly tamp earth underlying pad to prevent settling.
7. In multi-family developments, transformers should be located within 15 feet of a paved surface intended for vehicular traffic. Transformers should be oriented to maintain 10 feet minimum of clear working room on the front (door-side) and 3 feet minimum on the other three sides.

ILLINOIS ONLY



NOTES

- Bottom of trench shall be free from rocks or debris. Backfill shall be dirt, free from stones, broken glass, cans, or other debris that might damage the cables. The backfill must be tamped at transformer and pedestal locations.

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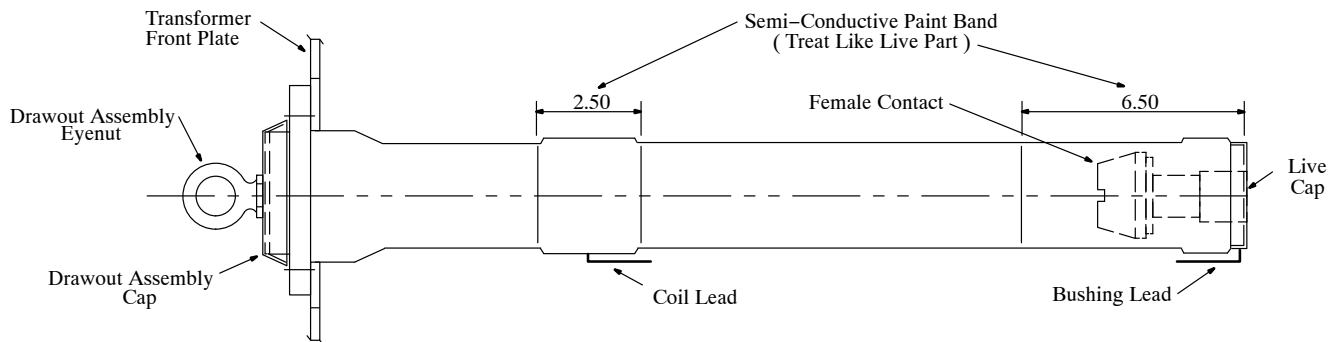
GENERAL

Many three-phase pad mounted transformers installed in legacy CIPS Districts are equipped with dry-well current-limiting fuses. Three-phase Commercial Subsurface Transformers (CST) installed in some legacy IP Districts are also equipped with dry-well current-limiting fuses.

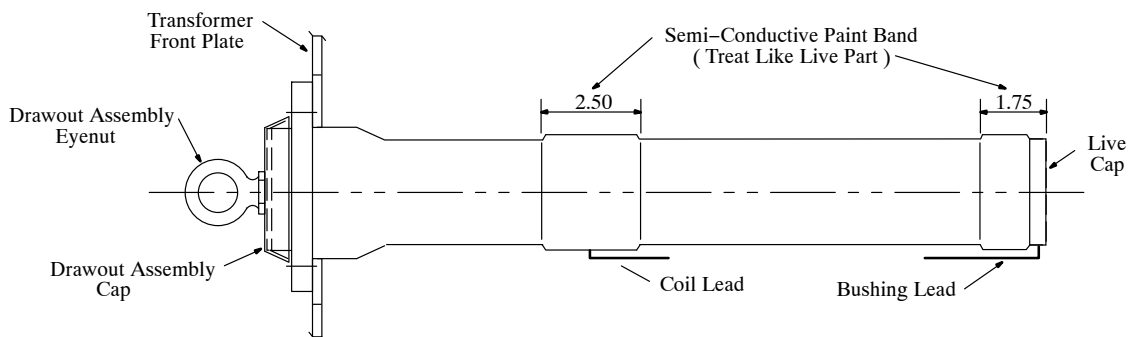
The instructions provided in this DCS are for de-energizing and re-energizing dry-well fused pad mounted transformers. The replacement fuse parts shown in the drawings are also for dry-well fuses in pad mounted transformers.

CST transformers are equipped with three-phase loadbreak switches that interlock with the fuse holders to prevent the removal or insertion of the current-limiting fuses unless the switch is in the open position. The replacement fuse parts for CST transformers are similar but different in that they are modified for submersible environments to prevent water ingress into the transformer. If such replacement parts are needed, contact Distribution Standards.

The current-limiting fuses listed at the end of this DCS can be used in either type of transformer.



Loadbreak Dry Well Fuseholder Housing



Non-Loadbreak Dry Well Fuseholder Housing

➔ **AMEREN ILLINOIS ONLY** **AMEREN ILLINOIS ONLY** **AMEREN ILLINOIS ONLY**

TO DE-ENERGIZE

CAUTION: Only Loadbreak Fuseholders And Loadbreak Fuse Assemblies Can Be Operated While Energized.

1. Attach live-line tool to the drawout assembly eyenut.
2. Rapidly withdraw the drawout assembly from the fuseholder housing.
3. Removal of the drawout assemblies will de-energize the transformer. However, the primary elbows are still energized and the remaining transformers are energized (if in a loop).

NOTE 1: Three-phase transformers, 500 kVA and below, are equipped with three loadbreak fuseholders and assemblies. Three-phase transformers, 750 kVA and above, are equipped with three loadbreak fuseholders and assemblies in parallel with three non-loadbreak fuseholders and assemblies.

NOTE 2: When loadbreak fuseholders are connected in parallel with non-loadbreak fuseholders, the transformers will be designed so that the non-loadbreak fuseholders cannot be accessed without first removing the drawout assemblies from the loadbreak fuseholders. The design will also prevent the drawout assemblies from non-loadbreak fuseholders from being inserted after the drawout assemblies for the loadbreak fuseholders have been inserted.

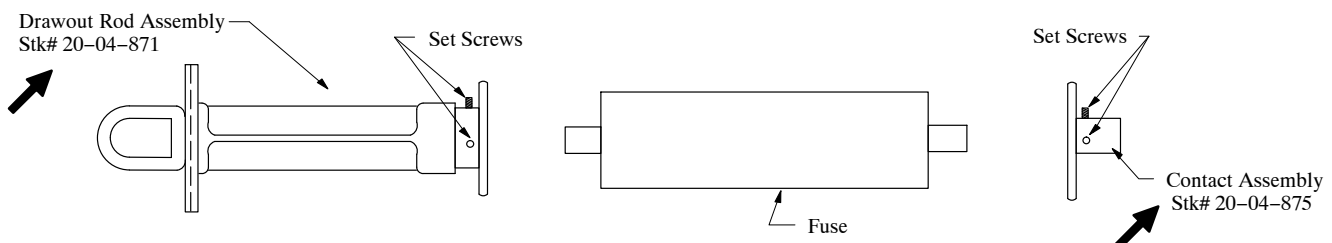
TO RE-ENERGIZE

1. Attach live-line tool to the drawout assembly eyenut.
2. Insert the drawout assembly into the fuseholder housing. The end of the drawout rod should be positioned just inside the fuseholder housing.
3. Rapidly push the drawout assembly into the fuseholder housing until the drawout assembly cap seats under the spring clips.

FUSE REPLACEMENT

Three different fuse assembly styles are in use. The styles are loadbreak, non-loadbreak and parallel loadbreak. Fuses listed can be used with all the fuse assembly styles.

1) Non-Loadbreak Fuse Assembly



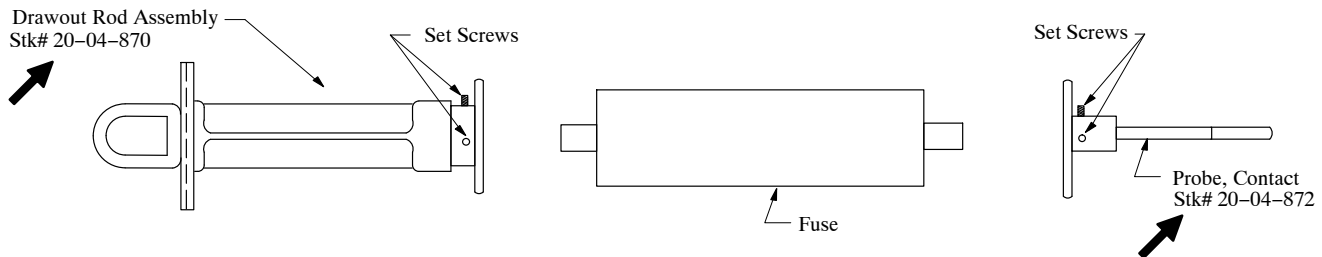
- * Disassemble by loosening the set screws.
- * Replace the blown fuse with a new fuse of the same rating.
- * Reassemble with the parts oriented as shown above.
- * Securely tighten the set screws.

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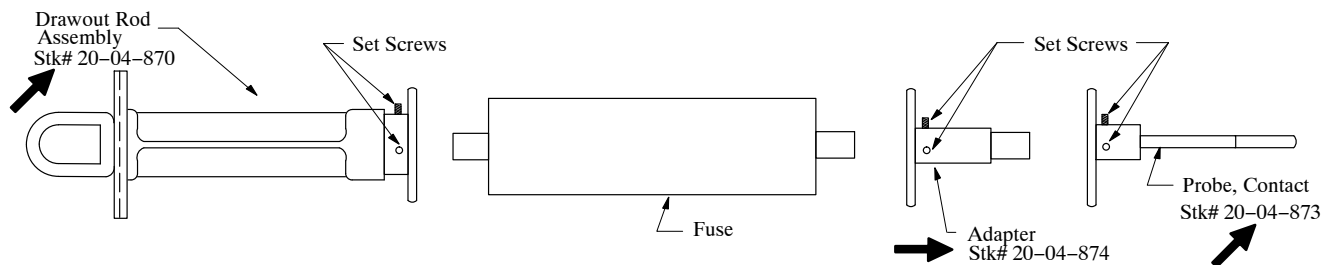
AMEREN ILLINOIS ONLY

2) Loadbreak Fuse Assembly



- * Disassemble by loosening the set screws.
- * Replace the blown fuse with a new fuse of the same rating.
- * Reassemble with the parts oriented as shown above.

3) Parallel Loadbreak Fuse Assembly



- * Securely tighten the set screws.
- * Disassemble by loosening the set screws in the drawout rod assembly and the adapter.
- * Replace the blown fuse with a new fuse of the same rating.
- * Reassemble with the parts oriented as shown above.
- * Securely tighten all set screws.

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FUSE TABLE

TRANSFORMER SIZE	4160 VOLTS		12470 VOLTS		
	FUSE RATING	AMEREN STOCK NO (4.3 kV) (Note 1)	FUSE RATING	AMEREN STOCK NO. (8.3 kV) (Note 2)	AMEREN STOCK NO (15.5 kV) (Note 3)
75 kVA	18C AMP.	20 04 370	8C AMP.	20 04 382	
150 kVA	35C AMP.	20 04 372	12C AMP.	20 04 384	20 04 646
225 kVA	50C AMP.	20 04 374	18C AMP.	20 04 386	20 04 647
300 kVA	75C AMP.	20 04 376	25C AMP.	20 04 388	20 04 648
500 kVA	100C AMP.	20 04 378	40C AMP.	20 04 391	20 04 663
750 kVA	*2-75C AMP.	20 04 376	*2-25C AMP.	20 04 388	20 04 648
1000 kVA	*2-100C AMP.	20 04 378	*2-40C AMP.	20 04 391	20 04 663

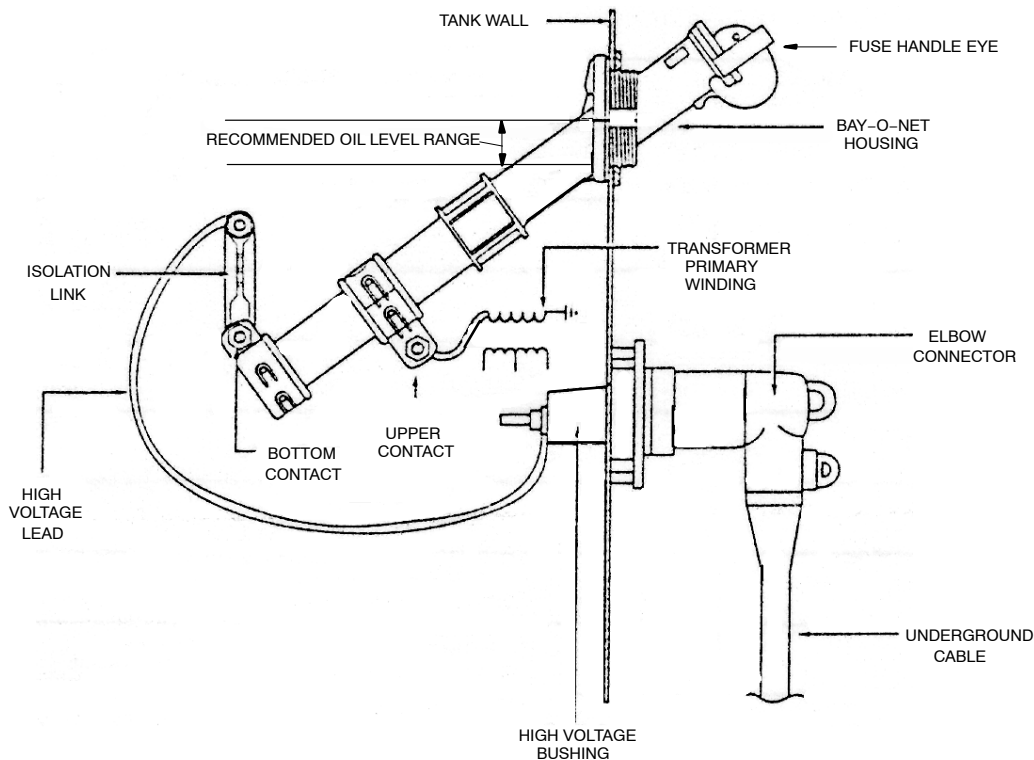
*** TWO FUSES IN PARALLEL**

- 4.3 kV rated fuses are clip style fuses, 10 inches long from tip-to-tip, and fit in code 4 fuse mountings or canisters. These fuses are not to be used on systems above 4.16 kV.
- 8.3 kV rated fuses are clip style fuses, 10 inches long from tip-to-tip, and fit in code 4 fuse mountings or canisters. These fuses are used in 2.47 kV transformers and switchgear with dry-well fusing (see note 3 for exceptions). These fuses are also to be used in dual rated (4.16 X 12.47 kV) dry-well fused transformers when operated at 12.47 kV. Note: Although not used by Ameren, 8.3 kV rated fuses larger than 40C Amps require code 5 fuse mountings or canisters.
- Some 12.47 kV dry-well fused transformers purchased by legacy company Illinois Power were purchased with 15.5 kV dry-wells. The 15.5 kV rated fuses are required for these transformers. They are clip style fuses, 14.4 inches long from tip-to-tip, and fit in code 5 fuse mountings or canisters.
- Fault current interrupting capability of these fuses is 50,000 Amps symmetrical.

GENERAL

Bay-O-Net fuses can be used to turn transformers off or on with primary load current 150 Amps or less up to 15kV and 50 Amps or less up to 35kV. This DCS provides instructions on the de-energizing and re-energizing of padmount transformers equipped with Bay-O-Net fuses. Fuse link replacement instructions are also provided.

NOTE: Bay-O-Net fuses **MUST** be latched at all times when the transformer is unattended.



LINE ILLUSTRATION OF BAY-O-NET ASSEMBLY WITH INTERNAL ISOLATION LINK

BEFORE OPERATING THE BAY-O-NET FUSE

1. Carefully assess the condition of the transformer. Check for any audible sounds of arcing occurring inside the tank. Check for bulging of the tank or any signs of oil leakage or spillage. Check the tank in the proximity of the pressure relief device for any signs of oil leakage, spillage, or for black carbon smudges. If any of these conditions are present, do not attempt to switch the transformer on or off with the Bay-O-Net fuse.
2. Inspect the area around the unit to make sure the ground is level and the footing is sound.

TO DE-ENERGIZE

1. Release transformer tank pressure.
 - a. Pull pressure relief valve open for 30 seconds or until pressurized air can no longer be heard evacuating audibly through the valve.
 - b. Close pressure relief valve and wait 30 seconds.
 - c. Pull pressure relief valve open again and keep it open until audible pressure (air flow) stops and hold it open for an additional 5 seconds.

NOTE: If the transformer does not have a pressure relief valve, loosen the 1/2" oil fill plug to relieve any built-up tank pressure.

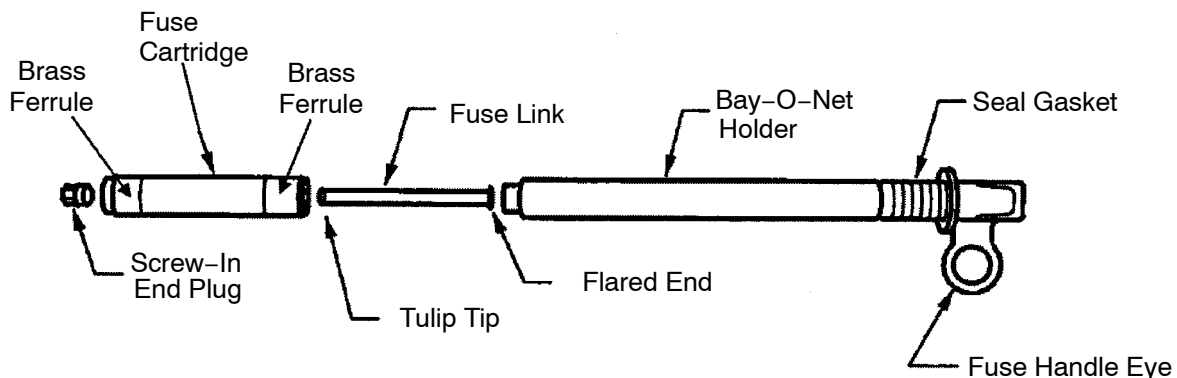
2. Standing to one side of the transformer, attach live-line tool to fuse handle eye and lift the handle to unlock the Bay-O-Net.
3. Push down and rotate the handle 90° to release additional pressure and to break the adhesion between the seal gasket and the Bay-O-Net housing.
4. Pull the Bay-O-Net fuse holder out rapidly in one motion 6 to 8 inches to interrupt the transformer load. Wait several seconds for oil to drain into tank.
NOTE: If any arcing is noticed or rumbling is heard, the fuse should be immediately slammed back into the transformer and latched. De-energize the transformer at a remote location before proceeding with fuse removal.
5. Remove fuse holder from the Bay-O-Net housing. If a drip is present, rest the Bay-O-Net holder on the drip guard for 30 seconds to 1 minute to minimize the potential of oil spillage onto the rubber terminations. Remove the Bay-O-Net and wipe off remaining oil.
6. The transformer is now de-energized. However, the primary elbows are still energized and the remaining transformers (if in a loop) are energized.

NOTE: On 3 phase transformers, there will be three Bay-O-Nets and the same procedure must be followed for each one.

TO RE-ENERGIZE

1. Check the oil level in the transformer. It should be approximately at the base of the protruding plastic threads of the Bay-O-Net housing at 25°C (77°F) with the transformer on a level surface.
2. Pull pressure relief valve, keeping it held open until audible pressure evacuation stops and then hold open for another 5 seconds.
3. Attach the live-line tool to the fuse handle eye of the Bay-O-Net.
4. Place the Bay-O-Net into the housing until it is about 5 inches from the closed position.
NOTE: This will prevent any damage to the contacts due to arcing.
5. Turn away from the transformer and slam the Bay-O-Net home.
6. When the Bay-O-Net is inserted as far as possible, push down and rotate the locking handle hooking it over the shoulder of the housing. When the handle is in the locked position, check to make sure the cover washer is seated against the shoulder of the housing.
7. The transformer is now energized.
NOTE: If the fuse blows upon re-energizing the transformer, find and correct the cause of the failure before attempting to re-energize the transformer again.

FUSE LINK REPLACEMENT INSTRUCTIONS



1. Unscrew and remove the fuse cartridge from the fuse holder.
2. Remove the plug from the end of the fuse cartridge.

3. Straighten the spread leaves of the tulip tip and push the fuse link out of the fuse cartridge.
4. Inspect the cartridge bore to make sure it is clean, then replace the fuse link with a new fuse link of the same size and rating. The new fuse link may be inserted from either end of the fuse cartridge (at times, a slight resistance may occur).
5. Be sure the contact flare end is secured in place between the fuse cartridge and the Bay-O-Net. Tighten the fuse cartridge against the Bay-O-Net. Do not overtighten. Hand tight is sufficient.
6. Spread the tulip tip of the fuse link and place the end plug on the end of the fuse cartridge. Tighten the end plug. Do not use wrench on brass ferrules of the cartridge. A wrench can be used on the end plug.
7. Remove the end plug and ensure the leaves of the tulip tip have spread uniformly. Failure to do so can cause malfunction.
8. Replace the end plug.

FUSE LINKS FOR THREE-PHASE PADMOUNT TRANSFORMERS (ALL FUSE LINKS ARE LOAD CURRENT AND TEMPERATURE SENSING)				
	Ameren Stock Nos.	Transformer KVA	Fuse Part Numbers	
			4160 Volts	12470 Volts & 13200 Volts
1	20-53-109	75	358C10 (25A)	
	20-53-110	150	358C12 (50A)	
	20-53-121	300	358C14 (65A)	
	20-53-119	75		358C05 (8A)
	20-53-108	150		358C08 (15A)
	20-53-109	300		358C10 (25A)
	20-53-110	500		358C12 (50A)
	20-53-121	750		358C14 (65A)
	20-53-121	1000		358C14 (65A)
	20-53-238	1500		38361C04CB (100A)
	20-53-239	2500		38361C05CB (125A)

FUSE LINKS FOR SINGLE-PHASE PADMOUNT TRANSFORMERS (ALL FUSE LINKS ARE LOAD CURRENT AND TEMPERATURE SENSING)				
	Ameren Stock Nos.	Transformer KVA	Fuse Part Numbers	
			2400 Volts	7200 Volts, 7620 Volts & 7970 Volts
1	20-53-109	25	358C10 (25A)	
	20-53-110	50	358C12 (50A)	
	20-53-121	75	358C14 (65A)	
	20-53-121	100	358C14 (65A)	
	20-53-120	167	358C18C (140A)	
	20-53-119	25		358C05 (8A)
	20-53-108	50		358C08 (15A)
	20-53-109	75		358C10 (25A)
	20-53-109	100		358C10 (25A)
	20-53-110	167		358C12 (50A)
	20-53-121	250		358C14 (65A)

NOTES:

1. This fuse comes pre-assembled as a unit with the fuse, the cartridge, and the end-plug. Replace the entire fuse and cartridge when the fuse operates.

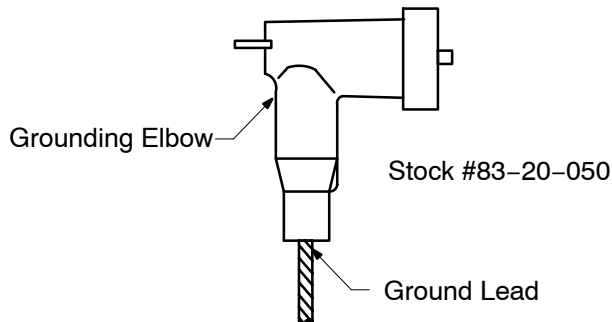


FIGURE 1

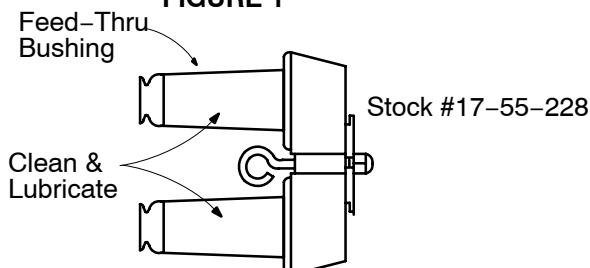


FIGURE 2

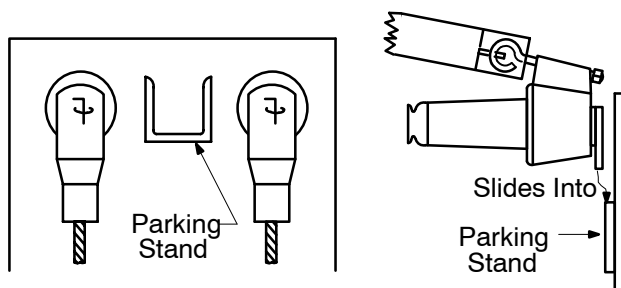


FIGURE 3

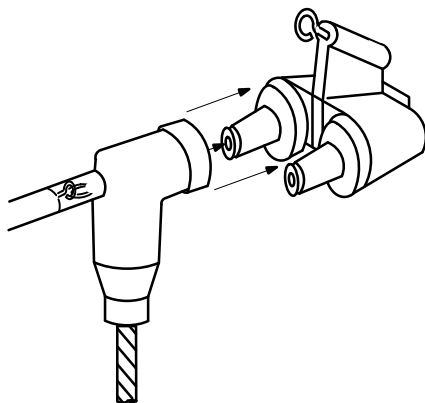


FIGURE 4

1. Connect lead on Grounding Elbow to Ground. **IMPORTANT: DO NOT INSERT GROUNDING ELBOW INTO FEED-THRU BUSHING UNTIL CIRCUIT HAS BEEN TESTED "DEAD".** Grounding elbow shown in Figure 1.
2. Remove protective covers from the feed-thru bushing. Clean and lubricate the surfaces of the feed-thru bushing with silicone grease. **ALWAYS REPLACE PROTECTIVE COVERS WHEN THE FEED-THRU BUSHING IS NOT IN USE.** Connect one #14 ground wire to grounding point of feed-thru bushing. Connect to ground, leaving enough slack to operate with a shotgun tool. Feed-thru bushing shown in Figure 2.
3. Attach the feed-thru bushing eye and crossbar firmly to shotgun tool. Slide the feed-thru bushing onto parking stand. Tighten down eye by rotating shotgun tool clockwise until snug. **DO NOT OVERTIGHTEN.** See Figure 3. **NOTE: #14 ground wire not shown.**
4. Remove the elbow from the equipment bushing following applicable loadbreak operating instructions. Insert the elbow into the nearest feed-thru plug and push until it is firmly in place and the internal locking ring is seated. See Figure 4.

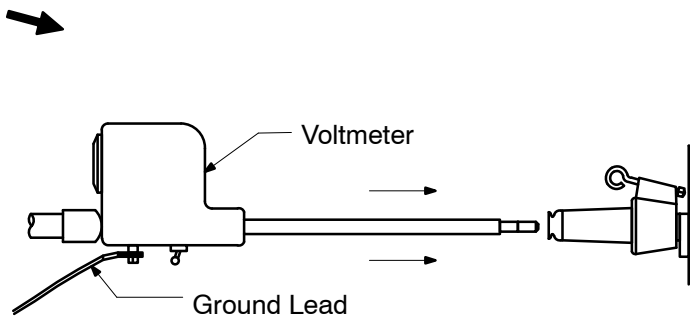


FIGURE 5

5. Attach voltmeter firmly to universal hot stick. Insert meter rod in second plug of feed-thru bushing. Check for voltage. **CAUTION:** Do not leave the meter attached to an energized line any longer than 1 minute. If attached longer, the instrument may overheat. See Figure 5. **NOTE:** Elbow not shown on the feed-thru bushing.

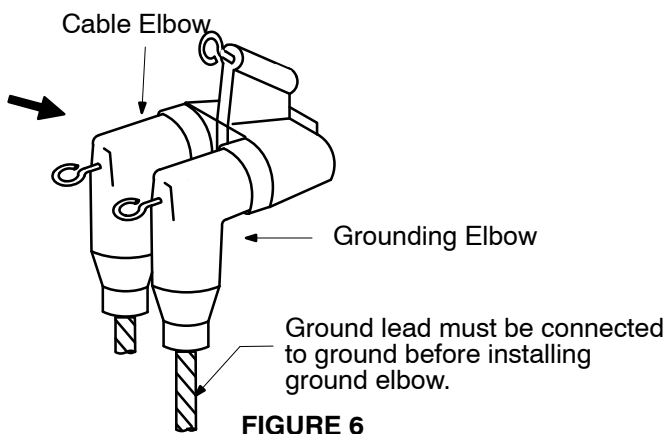


FIGURE 6

6. After circuit has been tested "Dead", remove test rod and using shotgun tool immediately insert the grounding elbow into the feed-thru bushing. See Figure 6.

UNDERGROUND LINES INSTRUCTION

Identification of Secondary and Service Cables

Underground Residential Subdivision

59 52 00 41

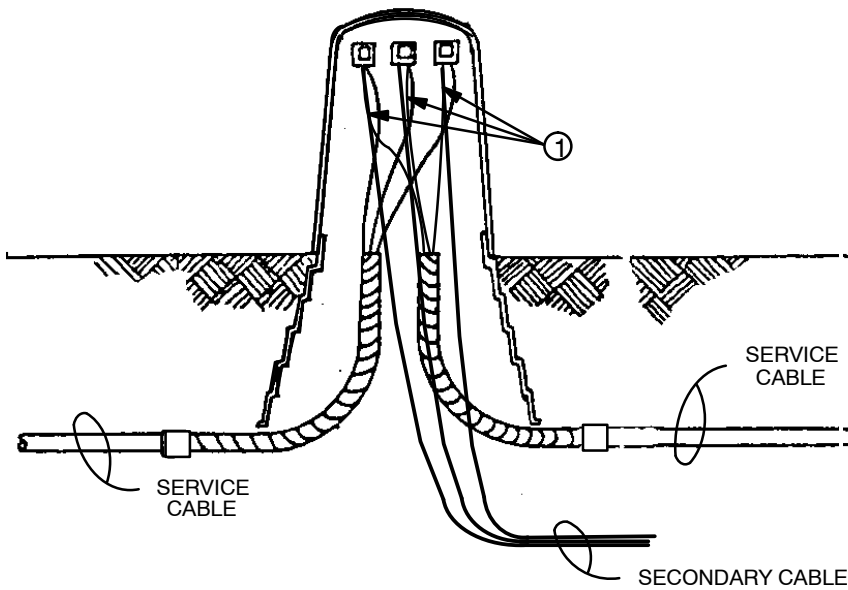
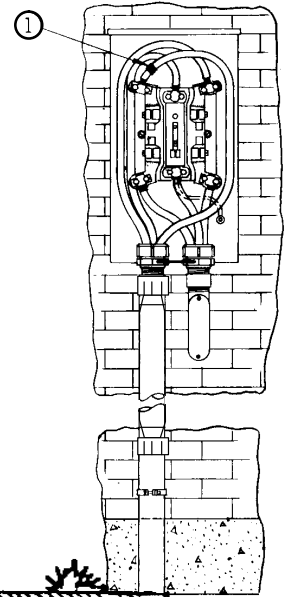
Sheet 1 of 2



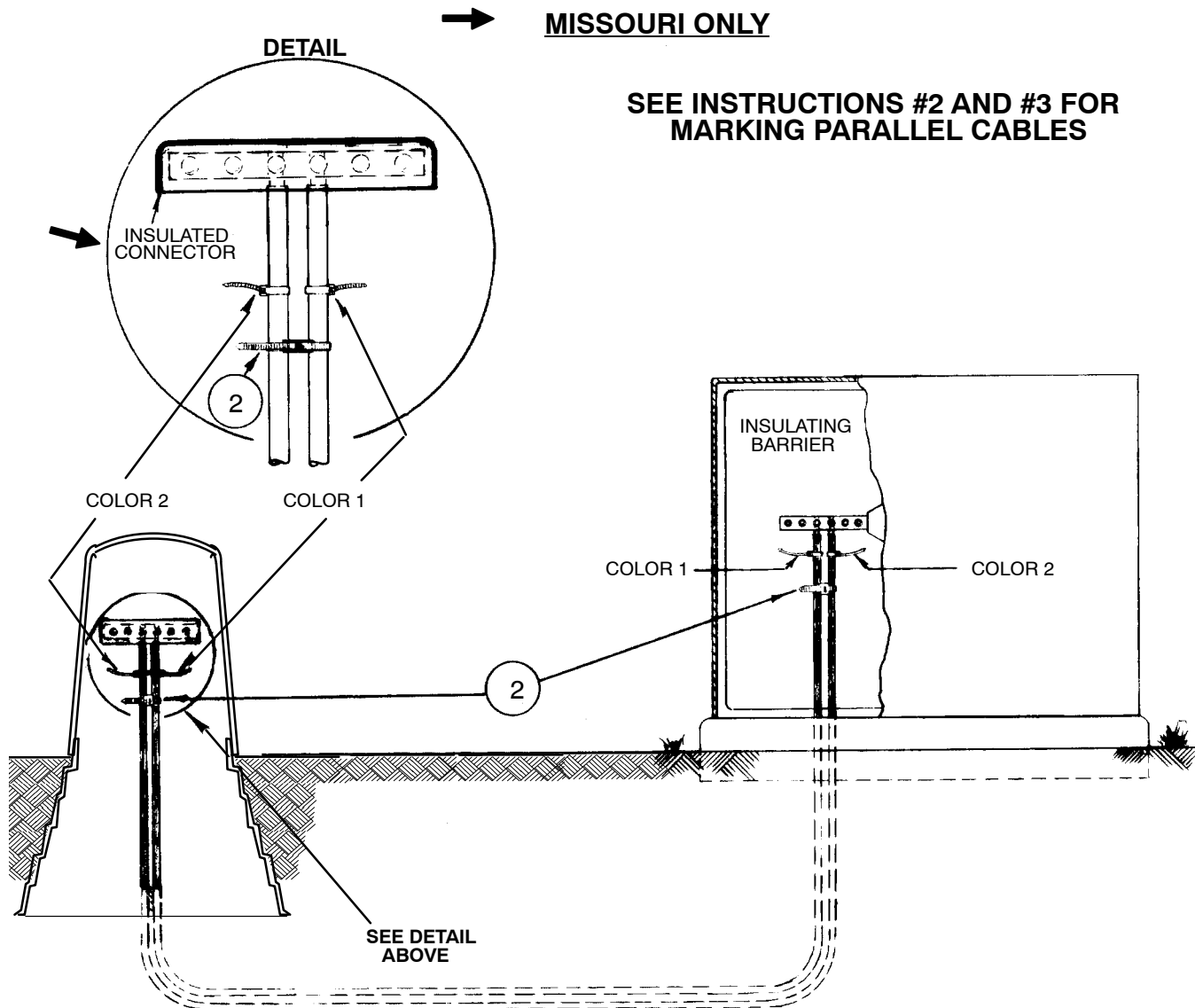
MISSOURI ONLY

When more than one service cable emanates from pedestals, handholes or transformers, it is desirable to identify the cables with respect to specific customers. Various wire ties are stocked for this purpose. See the instructions below for various marking requirements.

SEE INSTRUCTION # 4 FOR MARKING
"CUSTOMER OWNED CABLES."



		Std. / Stk. No.	Description
1	A	40 59 135	Tie-Wire, Identification, Red Color
	B	40 59 138	Tie-Wire, Identification, Green Color
	C	40 59 139	Tie-Wire, Identification, Blue Color
	D	40 59 137	Tie-Wire, Identification, Yellow Color
	E	40 59 136	Tie-Wire, Identification, Orange Color
	F	49 59 140	Tie-Wire, Identification, Purple Color
	G	40 59 162	Tie-Wire, Identification, Brown Color
	H	40 59 163	Tie-Wire, Identification, Gray Color
2	I	40 59 191	Tie-Wire, Identification for Parallel Cables
2	J	16 01 184	Tag - Parallel Cable
4	K	40 59 268	Tie - Wire, Identification, "Customer Owned Cable"
4	L	16 01 159	Tag - Customer Owned



INSTRUCTIONS:

1. With reference to the sketch, one identification tie of a particular color is installed on a conductor within the meter socket. At the supply end of the service cable, identification ties of the same color are installed on each of the three conductors. Thus, by using the different colored ties, as many as eight sets of service cables can be identified. Four ties of the same color required per service cable.
2. After identifying each cable with a different color tie, parallel cables are marked as a pair by using Stock # 40-59-191 around both cables. A tag (Stk # 16-01-184) engraved "Parallel Cable" may also be attached to the parallel cables. Parallel cables shall be marked on the plats.
3. Parallel cables fed from the overhead shall be tagged at the top of the conduit on the pole with a tag (Stock #16-01-184) engraved "Parallel Cable". These cables shall be marked on the plats.
4. If the cable is owned by the customer, attach a "Customer Owned Cable" wire tie (Stock #40-59-268) to each cable. These wire ties should be attached to each cable end and are in addition to any other ties required to identify the cables. A "Customer Owned" tag may also be used (Stk. # 16 01 159). Customer owned cable should be marked on the plats.

1. GENERAL

This instruction covers the special procedures required for making bolted aluminum connections, both aluminum-to-aluminum and aluminum-to-copper.

2. CONTACT SURFACE PREPARATION

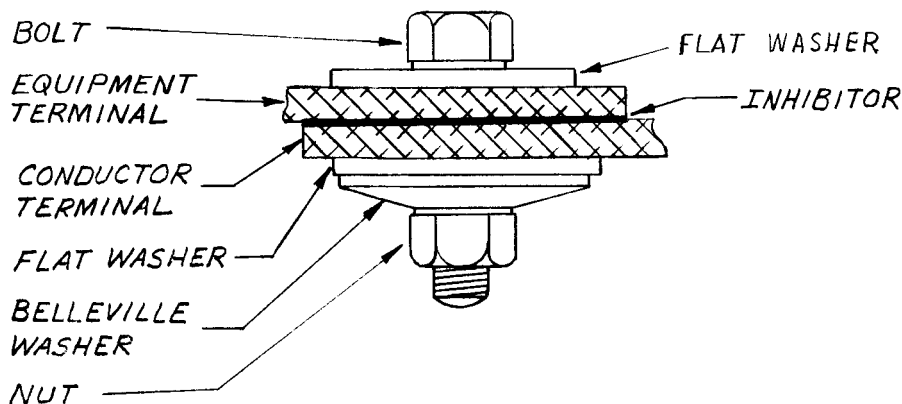
All aluminum contact surfaces that are not either silver plated or tin plated must be properly cleaned prior to making the electrical connection. Clean the contact surfaces with a wire brush to remove the oxide coating. Immediately coat the brushed contact surface with a liberal amount of corrosion inhibitor (Stock #31-59-058).

3. FLAT-TO-FLAT CONNECTIONS

The electric current will flow between the two mated surfaces at the points or areas of least resistance. Therefore, the distribution of forces at the contact surfaces must be given careful consideration.

To avoid concentrated paths of current flow and hot spots within the connection the clamping forces must be properly distributed. A flat washer of the same alloy as the bolt should be placed between the bolt head and one side of the connection. A steel Belleville washer with a matching steel flat washer should be placed on the opposite side of the connection under the nut. The Belleville washer must be installed with the convex side up (toward the nut).

Tighten the nut until a sudden increase in torque is felt. The Belleville washer is now flattened. Do not over tighten. And it is not necessary to "back off" the nut. The bolted assembly should be as shown in the figure below.



1. Drill three 5/16" holes in the lower (hinged) corner of the outgoing switch compartment door. The holes should be positioned as shown in Figure 1. Note: Changes have been made to the material specification for padmount switchgear to call for predrilled and plugged holes in each switch compartment door.
2. Directly beside each hole apply a high intensity reflective 1-3/4" x 2-7/8" letter for phase identification. The top hole will be marked with "A" (Stk. #1604317), the middle hole with "B" (Stk. #1604318), and the bottom hole with "C" (Stk. #1604319).
3. Install a faulted circuit indicator (Stk. #6055001) onto each outgoing cable/lug. Note: Faulted circuit indicator Stk. #6055024 may be used if the cable/lug OD is larger than 1.57".
4. Snap the fiber optic cable plastic end fitting into the cup around the LED on the faulted circuit indicator. The fiber optic cable (Stk. #1866658) is 6 foot long. Care must be taken not to kink the fiber optic cable. The fiber optic cables must be routed and secured to prevent damage associated with the operation of the door and other routine work.
5. Remove the bolt socket from the fiber optic cable barrel. The bolt socket will then be inserted through the 5/16" hole. See Figure 2.
6. Place the fiber optic cable lens into the bolt socket and securely screw the barrel onto the bolt socket. **BE SURE THAT THE FIBER OPTIC CABLES ARE POSITIONED BY THE CORRECT PHASE DESIGNATION.**

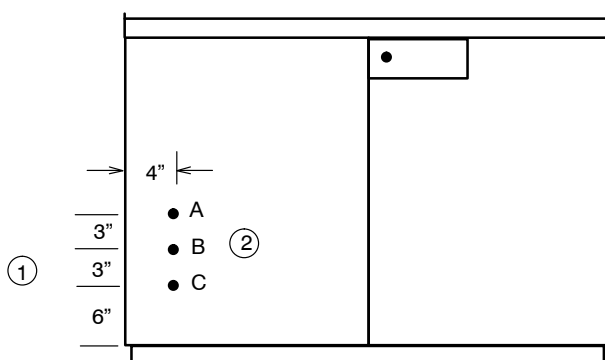


Figure 1

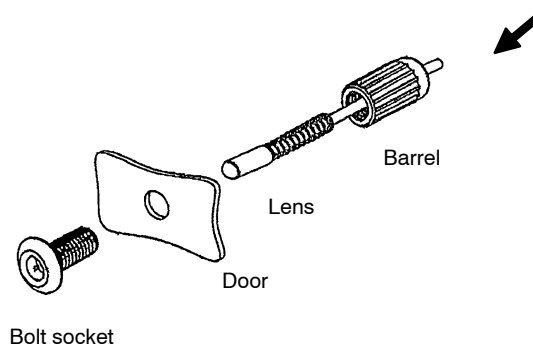


Figure 2

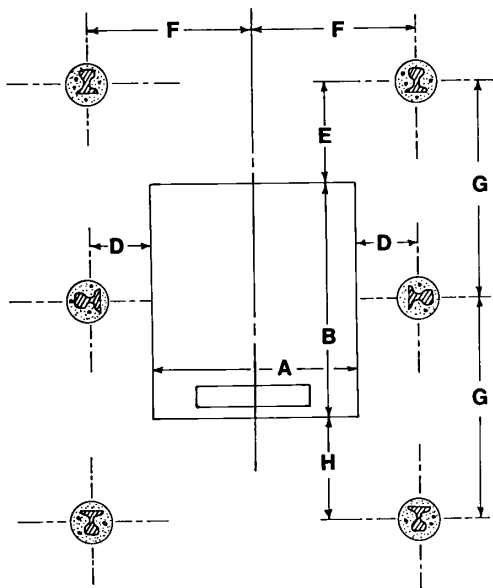


FIGURE 1

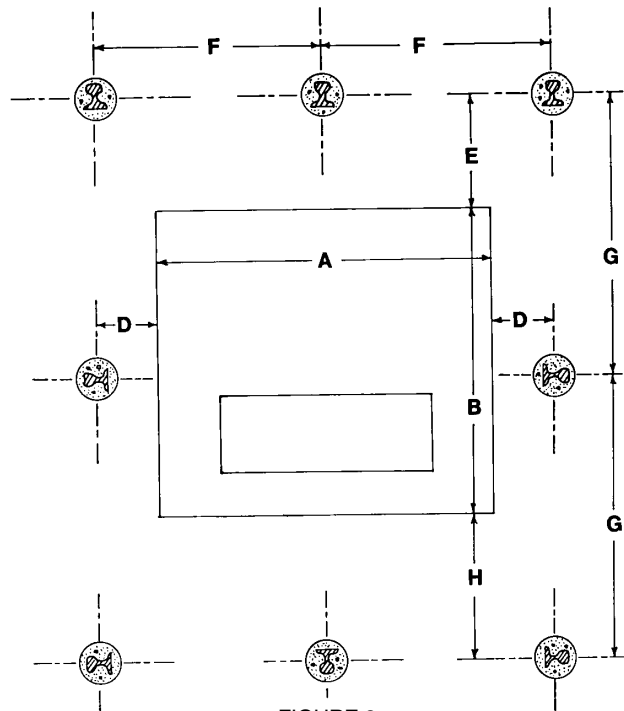


FIGURE 2

	PADMOUNT TRANSFORMERS	COMPOSITE PAD STOCK NO.	A	B	C	D	E	F	G	H
Figure 1	0-167 kVA, 1Ø, Lightweight Pad	12 06 164	42"	47"	4"	12"	15"	33"	40"	18"
Figure 1	0-167 kVA, 1Ø, Heavy Pad	12 06 198	42"	47"	4"	12"	15"	33"	40"	18"
Figure 2	75-750 kVA, 3Ø, Radial Feed	12 06 123	72"	65"	4"	32"	27"	68"	64"	36"
Figure 2	1000-2500 kVA, 3Ø, Radial Feed	12 06 124	84"	72"	5"	32"	38"	74"	73"	36"
Figure 2	75-1000 kVA, 3Ø, Loop Feed	12 06 124	84"	72"	5"	32"	38"	74"	73"	36"

COMPOSITE SWGR PAD STOCK NO.	FIGURE 3						
	A	B	C*	D	E	F	G
12 06 109	69"	63"	36"	24"	36"	58.5"	67.5"
12 06 165	76"	74"	36"	24"	36"	62"	73"
12 06 165(Auto)**	76"	74"	36"	49"	36"	62"	73"

*C = HEIGHT OR THICKNESS OF PAD

(Auto)** = AUTOMATED SWITCHGEARS REQUIRE LARGER SIDE CLEARANCE (D)
 TO OPEN THE DOORS ON CONTROL BOXES AND METER OPERATORS.

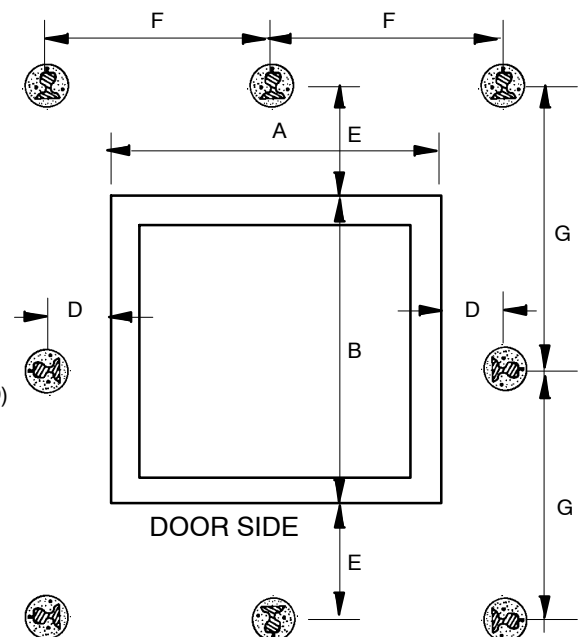
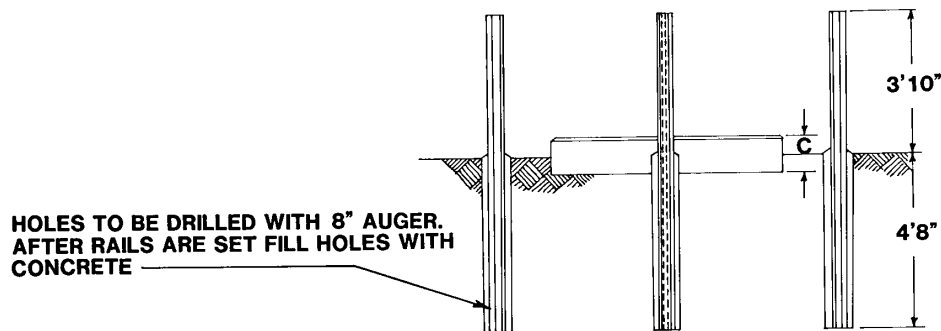


FIGURE 3



1. Barrier iron to be railroad rails, 8'6" long, 50–100 lbs. per yard. An acceptable alternate is 4" iron pipe, 8'6" long, concrete filled or see Dist. Std. 34 22 01 00 for a power installed bumper post.
2. Barriers on sides not accessible to vehicles may be omitted.
3. All materials and labor for protective barrier rail installation shall be provided by customer.
4. Customer is encouraged to paint barrier rails with yellow street marking lacquer.

NOTE: If circumstances are such that Ameren Crews are to install barriers, the following material is carried as stock items in AmerenUE storerooms only:

Stk No.	Description
68 05 024	Rail – Barrier, 8'6" (Ea)
11 04 105	Concrete – Premix (Sk)
30 57 025	Lacquer – Yellow (Gal)

CAUTION: Installation of barrier rails must be coordinated with electric conduit installation to avoid mutual interference.

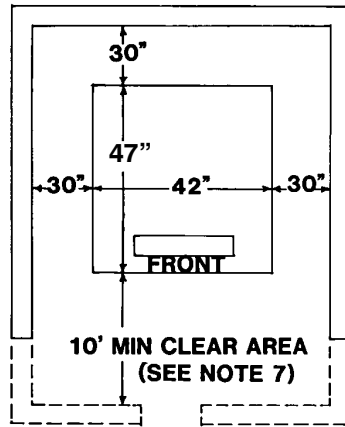
UNDERGROUND LINES INSTRUCTION

Customer Installed Pad Installations Required

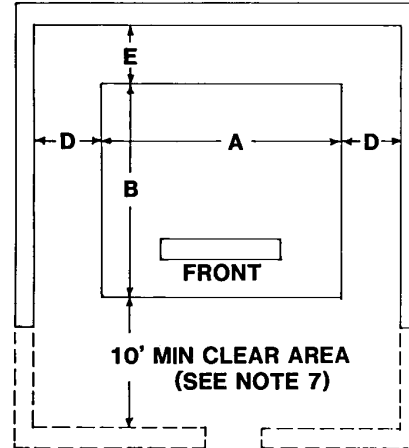
Clearances For Padmounted Transformers and Switchgear

59 81 51 11

Sheet 1 of 1



1 Ø INSTALLATIONS
25-167 KVA TRANSFORMERS



3 Ø INSTALLATIONS

Dimensions for 1Ø pads pertain to all Ameren Companies.

For 3Ø installations, dimensions A and B pertain to dimensions of AmerenUE equipment pads. Pad specifications for Ameren Illinois companies vary.

The critical dimensions for all padmounted equipment are the distances from the left, right, rear, and front of pads, not the equipment installed on the pad. These dimensions shall be maintained in all installations.

Verify pad dimensions with your local contacts.

3Ø INSTALLATIONS	A	B	D	E
75 Thru 300 kVA Radial Feed Transformers	72"	65"	30"	35"
500 & 750 kVA Radial Feed Transformers	72"	65"	45"	43"
75 Thru 1000 kVA Loop Feed Transformers	84"	72"	45"	44"
1000 Thru 2500 kVA Radial Feed Transformers	84"	72"	45"	56"
Switchgear (Live Front)	69"	63"	49"	120"
Switchgear (Dead Front)	76"	74"	49"	120"

NOTES:

- If pad mount is enclosed on all 4 sides, 10' minimum clearance from the front of transformer to inside of wall must be maintained for hot stick operations.
- If a 4 sided enclosure is used, an opening or doorway shall be provided. If a lock is required provisions shall be made to provide Ameren personnel access.
- Customer to provide drainage away from enclosed areas to prevent oil and/or water from standing.
- If a 4 sided enclosure is used, a minimum of 10 square feet of venting space in the form of 50% effective louvers or 5 square feet of opening shall be provided located along the bottom of each wall. If a 3 sided wall is used, wall venting space is desirable, but not required.
- Location must be accessible for installing or replacing transformer with crane.
- Developer to provide plastic conduit of size specified by Ameren to a point designated by Ameren outside the wall 36" to 42" below final grade.
- The 10' distance between the front of the pad and the wall may be reduced to 48" if an opening or gate is provided. The opening or gate should be centered on the front of the pad and should provide for a minimum opening of 3-1/2' for 1Ø and 9-1/2' for the 3Ø installation. A 10' clear area in front of the pad must still be available with the opening or when the gate is open for hot stick operations.
- To provide for transformer replacement, enclosed area is to be free of overhangs or overhead obstructions. Wall height not to exceed 8' unless the above mentioned gate or opening is provided or an easily removable wall is used.
- Should upgrading be required, the dimensions as shown provide adequate ventilation and space for 1 size larger transformer.
- Walls shown in drawing, but clearances are required for any obstruction, i.e. switchgear, dumpsters, etc.