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General Information 02

NHEC Naming Convention
Request for Standards change/addition
IN Non-Material Assembly Units and Adversity Factors



NHEC Naming Convention

DESIGNATED MEANING	PREFIX	DESCRIPTION
Hendrix	H	Space Cable construction
Information/Guides	I	Information Guide
24.9 / 14.4 kV Line Construction	V	25 kV construction
34.5/19.9 kV Line Construction	Z	35 kV construction only
Underground Distribution	U	For underground construction only
Transmission	T - Future	Transmission Line construction

CATEGORY DESCRIPTION (Function of Assembly Unit)	NHEC DESIGNATION	SUB- CATEGORY	DESCRIPTION
Single-Phase Primary	A, ZA	1	Single Support
		1-1	6 foot arm, small angle
		2	Double Support
		2-1	6 foot arm, medium angle
		2-2	Alley arm, double
		3	Suspension Angle, Vertical
		4	D.E. Angle, large angle
		5	D.E., Single
		5-1	D.E., Vertical, Tap
		5-2	D.E., Vertical, Tap w/ Extension
		5-3	Double Crossarm
		5-4, -5, -6	D.E., Tap
		6	D.E., Double
Two-Phase Primary	B	Not used at this time	

**NAMING
CONVENTION**

CATEGORY DESCRIPTION (Function of Assembly Unit)	NHEC DESIGNATION	SUB- CATEGORY	DESCRIPTION
Three-Phase Primary	C, HC, ZC, ZHC	1	Single Support
		1-1	Tangent, 4 position
		1-2	Tangent, 8 foot crossarm
		1-3	Tangent, Messenger DE
		2	Double Support
		2-1	4 position, Double Crossarm
		2-2	3 position, Double Crossarm
		2-3	Alley Arm, Double Crossarm
		3	Suspension Angle, Vertical
		4	D.E., Double, Large Angle
		5	D.E., Single
		5-1	D.E., Single, Double 5'7" Crossarm
		5-2	D.E., Single, Braceless
		6	D.E., Double, Double Crossarm
		6-1	D.E., Double, Unbalanced Load
		6-2	D.E., Double, 4 position
Double Circuit Primary	D	Future	
Guys	E, HE	1	Single Guy
		2	Double Guy
		3	Sidewalk Guy
		4	Overhead
		5	Push Brace
		9	Miscellaneous
Anchors	F	1	Anchor Screw Type
		2	Anchor Log Type
		4	Anchor Expanding Type
		5	Anchor Rock Type
		9	Miscellaneous
Transformers	G, UG, VG, ZG	1	CSP
		2	Conventional
		3	3-Phase (Underground Only)
		9	Miscellaneous



CONSTRUCTION STANDARDS

**NAMING
CONVENTION**

ISSUE DATE: 01/06

**NAMING
CONVENTION**

CATEGORY DESCRIPTION (Function of Assembly Unit)	NHEC DESIGNATION	SUB- CATEGORY	DESCRIPTION
Secondary Equipment	J, UJ	1	Deadend
		2	Angle
		3	Riser
		5	Pedestal
		9	Miscellaneous
		20	Mid span tap
Service	K, UK	1	Building Mounted
		2	Mast Type
		9	Miscellaneous
Lighting	L	1	Highway / Roadway (Fixture Only)
		2	Highway / Roadway (Pole Only)
		3	Area / Yard Light
		4	Wall Packs
		5	Light Brackets for Wood Poles
		6	Lamp Only
		7	Base
		9	Miscellaneous
Miscellaneous	M, VM, ZM	1	Bolts
		2	Grounding / Bonding
		4	Brackets
		5	Insulators
Non-Material	N	TRVCREW	Travel Crew/Hour
		TRVTRK	Travel Truck/Mile
		FLAG	Flagging/Hour
		TRIM	Trimming/Foot
		CUT	Clear Cut/Foot
		TRENCH	Trenching/Foot
		PAVE	Paving/Square Foot
		LEDGE	Ledge Hole/Each
		BARGE	Barge/Hour
		STAKE	Staking/Hour
		EASE	Easements/Hour
		TRANSFER	Transfer/Hour



CONSTRUCTION STANDARDS

**NAMING
CONVENTION**

ISSUE DATE: 01/06

**NAMING
CONVENTION**

CATEGORY DESCRIPTION (Function of Assembly Unit)	NHEC DESIGNATION	SUB- CATEGORY	DESCRIPTION
Poles/Wood Products	P	1	Poles
		2	Crossarms
		3	Braces
		9	Miscellaneous
Metering	Q, UQ	1	Single-Phase (secondary)
		3	Three-Phase (secondary)
		4	Three-Phase (primary)
		9	Miscellaneous
Recloser	R	1	Single-Phase
		3	Three-Phase
		9	Miscellaneous
Sectionalizing	S, ZS	1	Cutout
		2	Switch
		3	Power Fuse
		9	Miscellaneous
Underground	U, VU, ZU	1	Single-Phase Risers
		2	Loop Risers
		3	Three-Phase Risers
		4	Four-Phase Risers
		5	Vaults
		6	Pads
		7	Covers
		8	Conduit
		9	Miscellaneous
		10	Connectors
Voltage Devices/Regulators	V, UV, ZV	1	Voltage Regulators
		2	Autotransformers
		3	Capacitors
		4	Fault Indicators
		5	Voltage Blockers
		6	Line Arresters
		9	Miscellaneous
Wire	W, UW, ZW, ZUW	1	Primary
		2	Secondary
		3	Service
		5	Splices
		9	Miscellaneous



CONSTRUCTION STANDARDS

**NAMING
CONVENTION**

ISSUE DATE: 01/06

CONSTRUCTION STANDARDS

Request for Change/Addition to the Standards

These Construction Standards attempt to detail assemblies and methods that meet all applicable codes, are as safe as possible for New Hampshire Electric Cooperative personnel and the general public, are operable for the line crews, while ultimately trying to minimize bottom line costs. As a result of all these different drivers you will find things in the Standards that you think should be changed. **WE WANT YOUR INPUT IN ORDER TO CONTINUE WITH THE DEVELOPMENT OF THE STANDARDS.**

Each District has a designated Standards Representative that is an active member of the Standards Committee. This person is your best avenue for having a suggestion or idea reviewed by the committee. The steps to take are:

1. Fill out the form on this page.
2. Attach a copy if existing of the current Standard in question with written details of the change.
3. Submit this completed form to your local representative. (You can ask for help from the rep in filling out the form)
4. Your rep will forward the form to the Engineering Manager.
5. The Engineering Manager will respond to you personally that he has your request and will assign it a "Status" as follows.
 - a. Recommendation is accepted and will be included in the next Standards Release
 - b. The recommendation will be researched by Engineering (maximum of 60 working days from date submitted to Manager) and will then be reassigned a status of "a" or "c".
 - c. The Manager will present the recommendation to the Standards Committee at the next Standards meeting. (Minimum 2 times per year)
 - d. The recommendation, following "c" will be accepted or declined based on the consensus of the standards committee. Manager of Engineering will have the final authority.
6. Each recommendation will be returned to the originator, through their Standards Representative, with a final status of accepted or declined.

Fill out the following and submit to your Standards Representative

NAME _____ **DISTRICT** _____

DATE _____

Suggestion: (attach additional sheets if necessary)

Non-Material and Adversity Factors Information Guide

Non-Material Units

Non-Material units cover labor and other categories that require budgeting for time, mileage, and / or costs associated with a Work Request. Non-material units have been set up as the following:

Name	Description
TRVCREW	Travel Crew per hour
TRVTRK	Travel Truck per mile
FLAG	Flagging per hour
TRIM	Trimming per foot
CUT	Clear Cut per foot
TRENCH	Trenching (inclusive) per foot
PAVE	Paving per square foot
LEDGE	Ledge Hole per each
BARGE	Barge per hour
STAKE	Staking per hour
EASE	Easement Acquisition per hour
TRANSFER	Transfer per hour
CRANE	Crane per hour, 4 hours minimum

Assumptions for these units are:

1. All are based on a 2-man crew
2. Labor per hour is crew-hours not man-hours
3. Default per hour, foot, mile, etc. is "1"
4. Trimming applies to branch or limb removal only
5. Cutting applies to entire tree removal
6. Trenching includes all aspects involved, i.e. excavating, tamping, backfill, etc.



Adversity Factors

In addition, certain adversity factors may apply to a particular non-material unit. To account for these, the following Adversity Factors (AF) and corresponding percentage adders are as follows:

AF Name	Description	Percentage Adder
A	Winter Work	15%
B	Single Lane Road (setup and breakdown to allow cars to pass)	10%
C	Working on energized single-phase OH lines along a road	10%
D	Working on energized three-phase OH lines along a road	25%
E	Off road new OH	30%
F	Off road energized single-phase OH line	45%
G	Off road energized three-phase OH line	50%

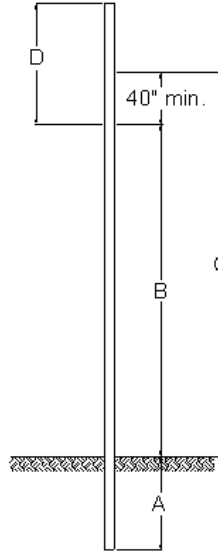
Combinations of the above Adversity Factors and respective percentage adders are as follows:

AB	25%
AC	25%
AD	40%
AE	45%
AF	60%
AG	65%
BC	20%
BD	35%
ABC	35%
ABD	50%

Clearances and Ownership 03

OH Clearances (future)
Tagging Guide
Pole Ownership (future)
OH Climbing Space (future)
UG Clearances (future)

TAGGING GUIDE



Pole Length (ft)	Pole Space Allocation NHEC / Telephone Note 1	A Normal Setting Depth Note 2	B Communications Maximum Height Note 3	C NHEC Minimum Height Note 4	D NHEC Tag Placement From Pole Top Notes 5,6,7
35'	35 / 35	6' - 0"	22' - 0"	25' - 4"	7' 0"
40'	40 / 40	6' - 0"	24' - 6"	27' - 10"	9' 6"
40'	40 / 35	6' - 0"	22' - 0"	25' - 4"	12' 0"
40'	35 / 40	6' - 0"	27' - 0"	30' - 4"	7' 0"
45'	45 / 45	6' - 6"	26' - 9"	30' - 1"	11' 9"
45'	45 / 40	6' - 6"	24' - 6"	27' - 10"	14' 0"
45'	45 / 35	6' - 6"	22' - 0"	25' - 4"	16' 6"
45'	40 / 45	6' - 6"	29' - 0"	32' - 4"	9' 6"
45'	35 / 45	6' - 6"	31' - 6"	34' - 10"	7' 0"
50'	50 / 50	7' - 0"	29' - 0"	32' - 4"	14' 0"
50'	50 / 45	7' - 0"	27' - 0"	30' - 4"	16' 0"
50'	50 / 40	7' - 0"	24' - 6"	27' - 10"	18' 6"
50'	45 / 50	7' - 0"	31' - 0"	34' - 4"	12' 0"
50'	40 / 50	7' - 0"	33' - 6"	36' - 10"	9' 6"
55'	55 / 55	7' - 6"	31' - 3"	34' - 7"	16' 3"
55'	55 / 50	7' - 6"	29' - 0"	32' - 4"	18' 6"
55'	55 / 45	7' - 6"	26' - 9"	30' - 1"	20' 9"
55'	55 / 40	7' - 6"	24' - 6"	27' - 10"	23' 0"
55'	50 / 55	7' - 6"	33' - 3"	36' - 7"	14' 3"
55'	45 / 55	7' - 6"	36' - 0"	39' - 4"	11' 6"
55'	40 / 55	7' - 6"	38' - 0"	41' - 4"	9' 6"

- 40/35 indicates a 40-foot pole where Telephone Company occupies space as if it was a 35-foot pole.
- Pole setting depth is the responsibility of the installing utility.
- Dimension B, C, or D, may be adjusted by mutual agreement between attachées to avoid a pole change out in the field if standards and codes permit.
- The 40" safety space may be reduced to 30" between effectively grounded non-current carrying equipment and communication conductors, as per NESC Table 238-1.
- Tag placement denotes the bottom of NESC Communication Worker's Safety Zone.
- For all standard transformer poles & junction poles, the spacing shown for a 40/35 pole space allocation shall apply.
- For all standard road crossing poles, the spacing shown for a 40/40 pole space allocation shall apply.
- If a conductor drip loop enters a luminaire bracket, the lowest point of the loop shall be at least 12 inches above a communications cable or through-bolt.

Secondary and Services 04

J1 Secondary attachment Dead End
J2 Secondary attachment angle
J20 Mid-span service take-off
K1 Overhead service to House Knob
K2 Overhead service to a mast
UJ3 Secondary Riser
UJ5 Secondary Pedestal, single phase
IU Secondary Trench

Construction and Design Notes:

J1

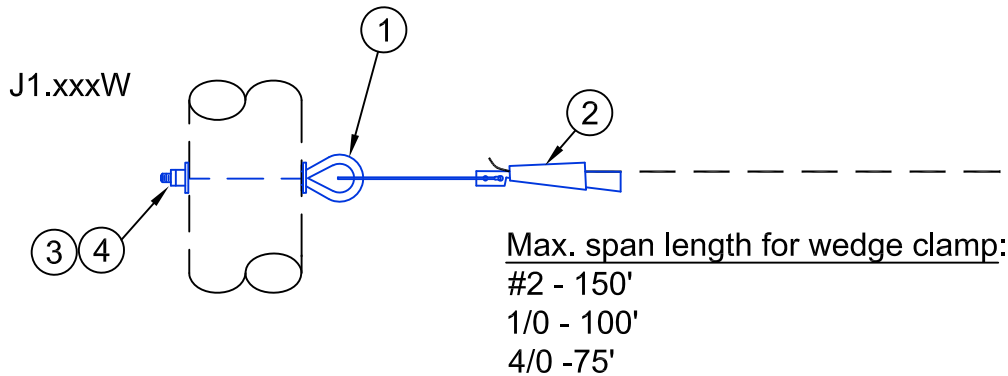
1. Wedge clamps and deadend shoes for 1/0 Triplex also fit 2 Triplex.
2. The J1.xxxS deadend shoe assembly is recommended for use with 1/0 or 4/0 Quadruplex or with 4/0 Triplex spans greater than 75 ft.
3. The wedge clamp can be used for all 6 Triplex deadends. Deadend shoes are not required.

DESCRIPTIONS

J1.006W... Secondary Attach, Deadend, Wedge, 6

J1.010W... Secondary Attach, Deadend, Wedge, 1/0

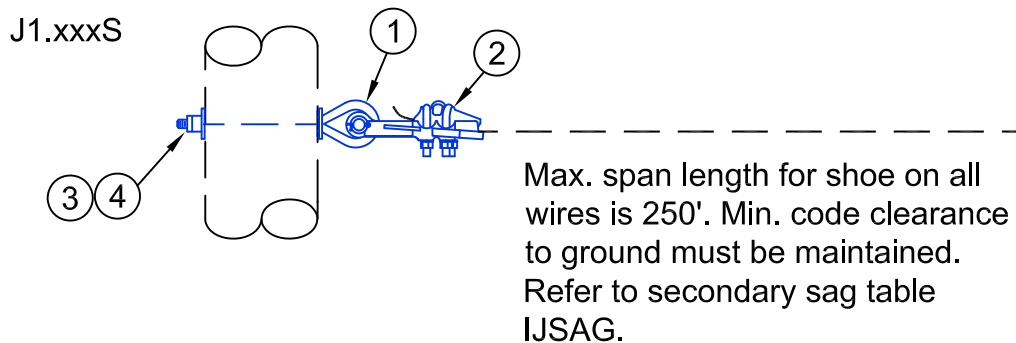
J1.040W... Secondary Attach, Deadend, Wedge, 4/0



DESCRIPTIONS

J1.010S... Secondary Attach, Deadend Shoe, 1/0

J1.040S... Secondary Attach, Deadend Shoe, 4/0



Ref. No.	Material #	Description	J1.006W	J1.010W	J1.040W	J1.010S	J1.040S
1	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1	1
2	11780023	Clamps, Wedge #6 ACSR	1				
2	11780025	Clamps, Wedge #1/0 ACSR		1			
2	11780029	Clamps, Wedge #4/0 ACSR			1		
2	11723025	Clamps, DE #4 - 2/0 ACSR				1	
2	11723040	Clamps, DE #4/0 - 336.4 ACSR					1
3	71053063	Washer, Spring 5/8"	1	1	1	1	1
4	71020451	Washer, Square, 2 1/4" x 13/16"	2	2	2	2	2



CONSTRUCTION STANDARDS

SECONDARY ATTACHMENT - DEADEND

J1

ISSUE DATE: 02/17

Construction and Design Notes:

J2

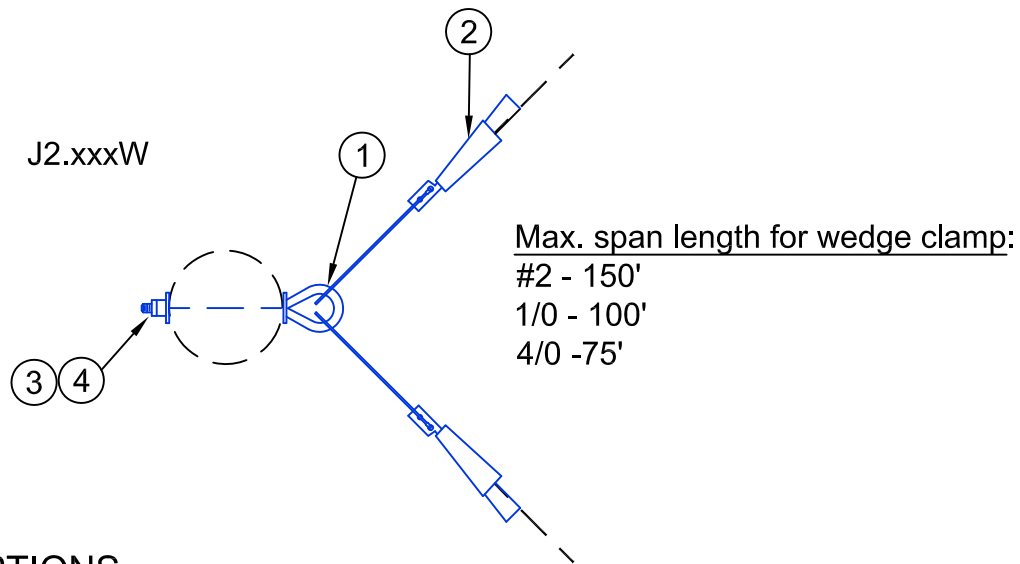
1. Not recommended for use with 1/0 or 4/0 Quadruplex or with 4/0 Triplex spans greater than 75 ft. In these situations, a J1 deadend assembly can be used.

DESCRIPTIONS

J2.006W... Secondary Attach, Angle, Wedge, 6

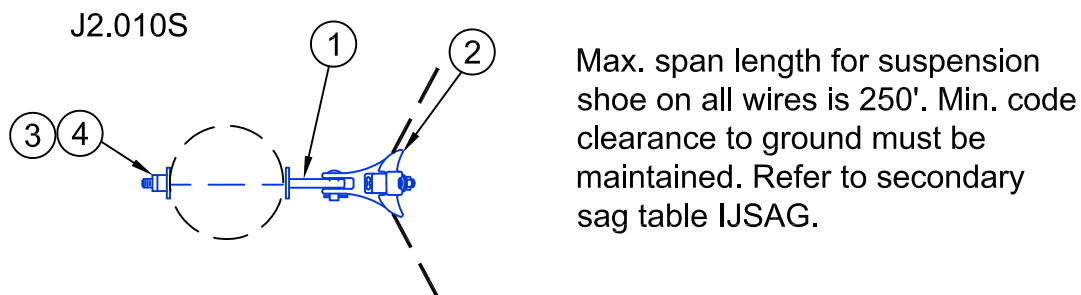
J2.010W... Secondary Attach, Angle, Wedge, 1/0

J2.040W... Secondary Attach, Angle, Wedge, 4/0



DESCRIPTIONS

J2.010S... Secondary Attach, Angle, Susp, 1/0



Ref. No.	Material #	Description	J2.006W	J2.010W	J2.040W	J2.010S
1	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1
2	11780023	Clamps, Wedge #6 ACSR	2			
2	11780025	Clamps, Wedge #1/0 ACSR		2		
2	11780029	Clamps, Wedge #4/0 ACSR			2	
2	11744000	Clamp, Susp. /Angle, Alum.				1
3	71053063	Washer, Spring 5/8"	1	1	1	1
4	71020451	Washer, Square, 2 1/4" x 13/16"	2	2	2	2



CONSTRUCTION STANDARDS
SECONDARY ATTACHMENT - ANGLE

J2

ISSUE DATE: 05/16

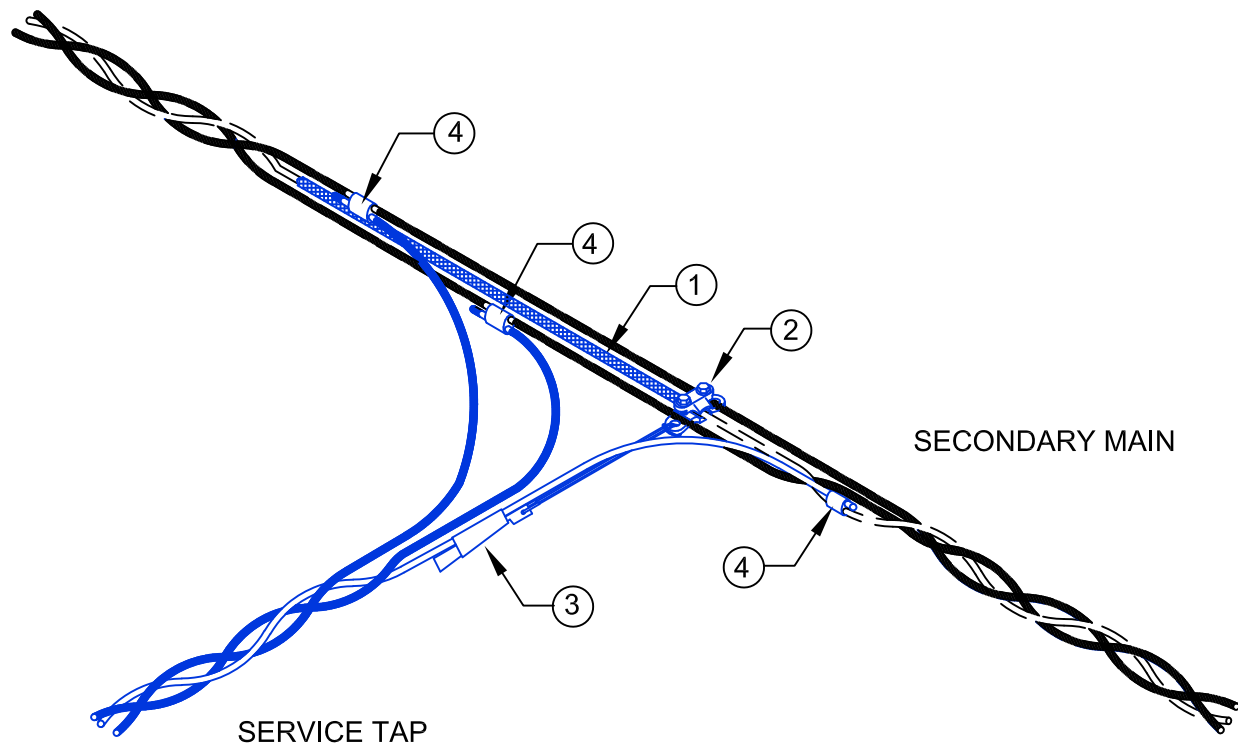
Construction and Design Notes:

1. This is non-standard construction requiring approval from Engineering prior to use.
2. Limit to one take-off per span. A second service may feed off the back side to balance side pull as necessary.
3. This mid-span service take-off is not to be tapped off a service drop.
4. Take-off is limited to 1/0 Triplex or smaller and should not exceed 75 feet in length.
5. Staking personnel are responsible for assuring secondary main is adequate size for additional service load.

Descriptions:

J20.002... Midspan Service Take-off, 2 TPLX

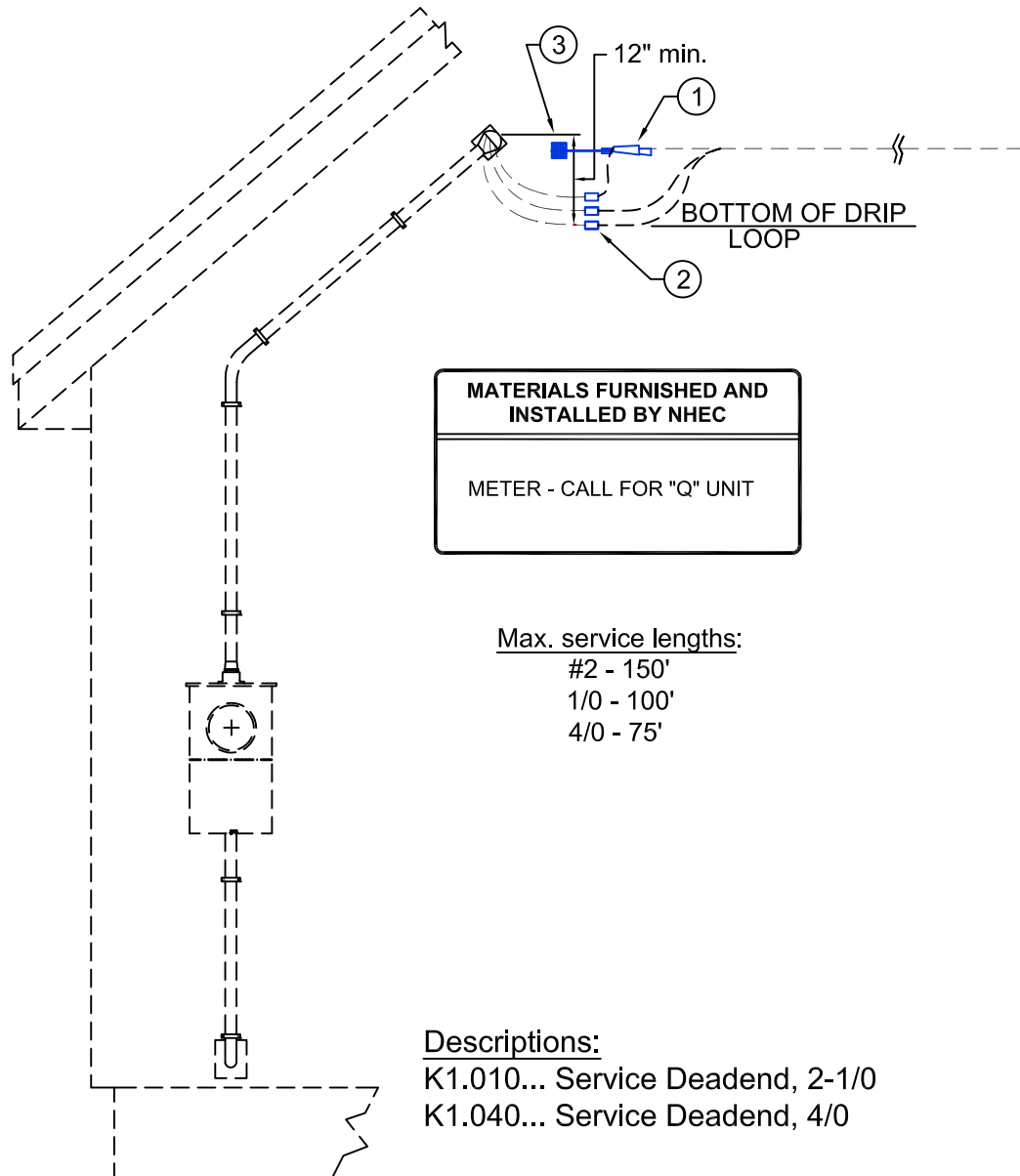
J20.010... Midspan Service Take-off, 1/0 TPLX



Ref. No.	Material #	Description	J20.002	J20.010
1	05358400	Clamp, Black plastic slide cover	1	1
2	11760000	Clamp, Midspan	1	1
3	11780025	Clamps, Wedge #2, 1/0	1	1
4	17010502	Con, Sicame TTD2710XFBTUNI	3	
4	17010502	Con, Sicame TTD2710XFBTUNI		3

Construction and Design Notes:

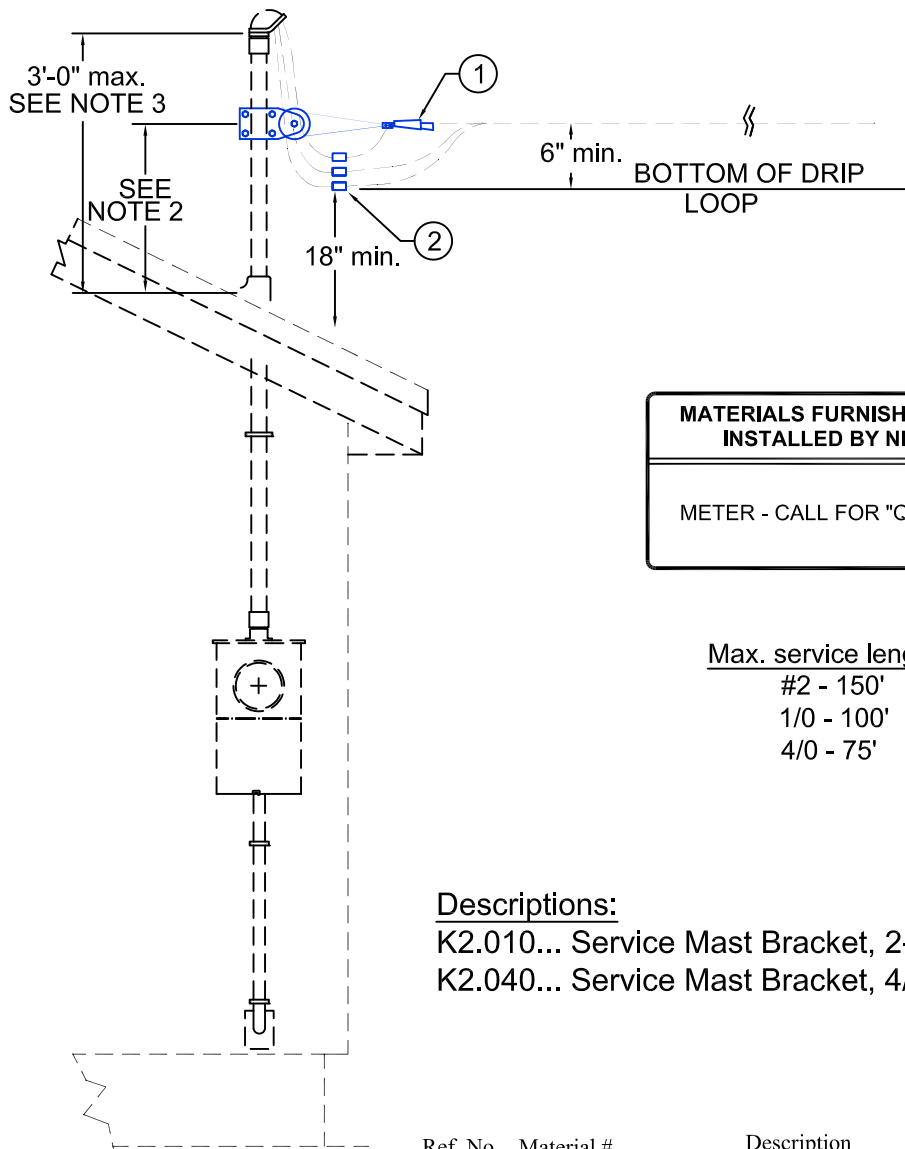
1. The point of attachment on the building to be determined by the required minimum ground clearances of service drop conductors.
2. Use K1.010 for #2 and 1/0 service.



Ref. No.	Material #	Description	K1.010	K1.040
1	11780025	Clamps, Wedge 1/0 ACSR	1	
1	11780029	Clamps, Wedge 4/0		1
2	17010502	Con, Sicame TTD2710XFBTUNI	3	
2	17010502	Con, Sicame TTD2710XFBTUNI		3
2	17010502	Con, Sicame TTD2710XFBTUNI	3	
3	75101022	Wireholder, House Knob	1	1

Construction and Design Notes:

1. The point of attachment on the building to be determined by the required minimum ground clearance of service drop conductors. Attachment heights in excess of 18 feet are subject to NHEC approval.
2. For the 2" conduit as shown, the maximum distance from the roof to the point of attachment is 26 inches for #2 triplex or 22 inches for #1/0 triplex.
3. The consumer assumes the responsibility that the service mast is of adequate strength (including support by braces or guys if required) to withstand strain imposed by the service drop conductors.
4. Use K2.010 for 1/0 and #2 service.

Max. service lengths:

#2 - 150'
1/0 - 100'
4/0 - 75'

Descriptions:

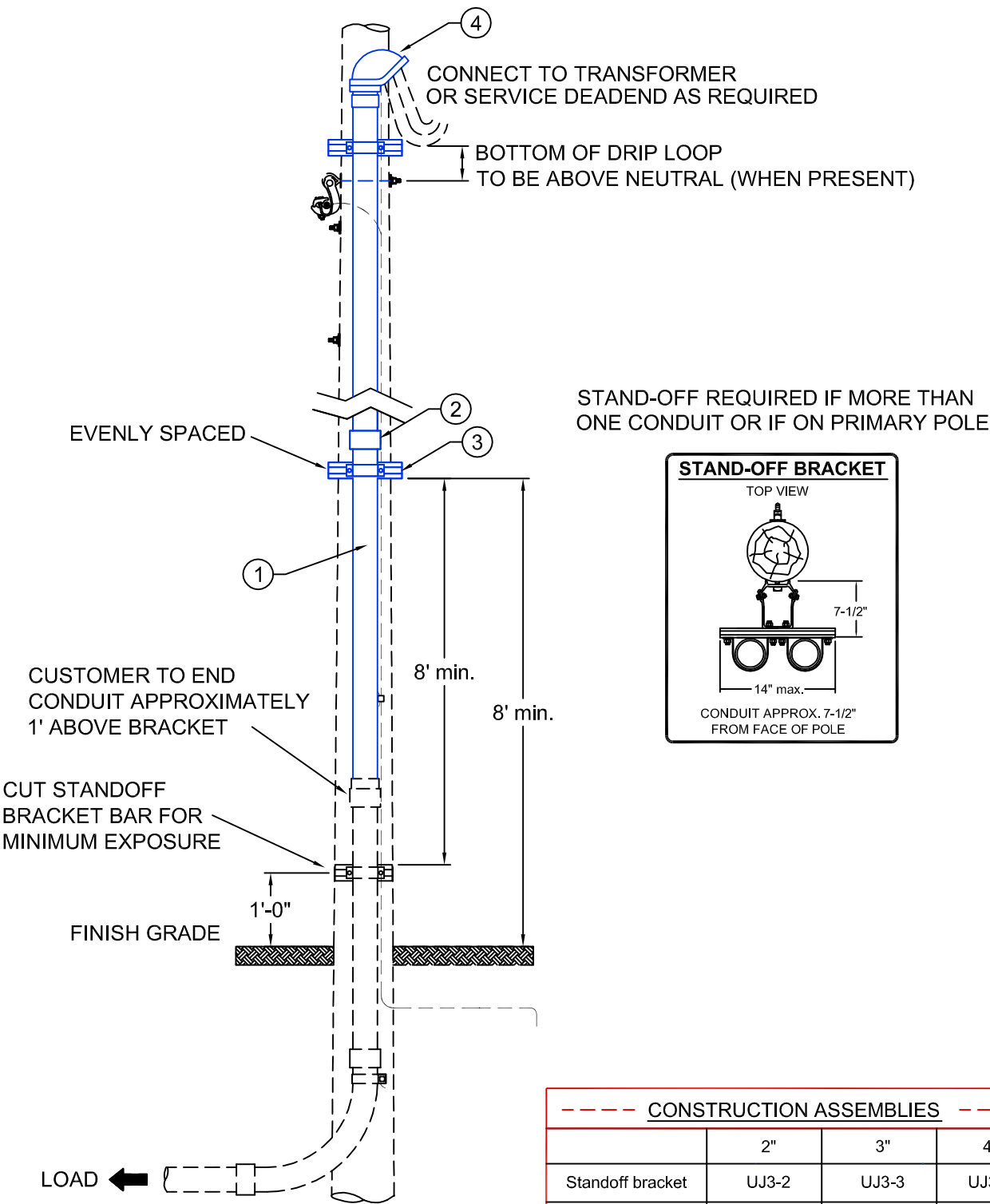
K2.010... Service Mast Bracket, 2-1/0

K2.040... Service Mast Bracket, 4/0

Ref. No.	Material #	Description	K2.010	K2.040
1	11780025	Clamps, Wedge 1/0 ACSR	1	
1	11780029	Clamps, Wedge 4/0		1
2	17010502	Con, Sicame TTD2710XFBTUNI	3	
2	17010502	Con, Sicame TTD2710XFBTUNI		3
2	17010502	Con, Sicame TTD2710XFBTUNI	3	

Construction and Design Notes:

- 1. Stand-off brackets are required when secondary riser is on a primary pole or when more than one conduit is required.
- 2. All conduit above grade to be schedule 80 PVC.



CONSTRUCTION ASSEMBLIES			
	2"	3"	4"
Standoff bracket	UJ3-2	UJ3-3	UJ3-4
Clips	UJ3-2C	UJ3-3C	UJ3-4C



CONSTRUCTION STANDARDS

SECONDARY RISER

Materials List for Assemblies

Descriptions

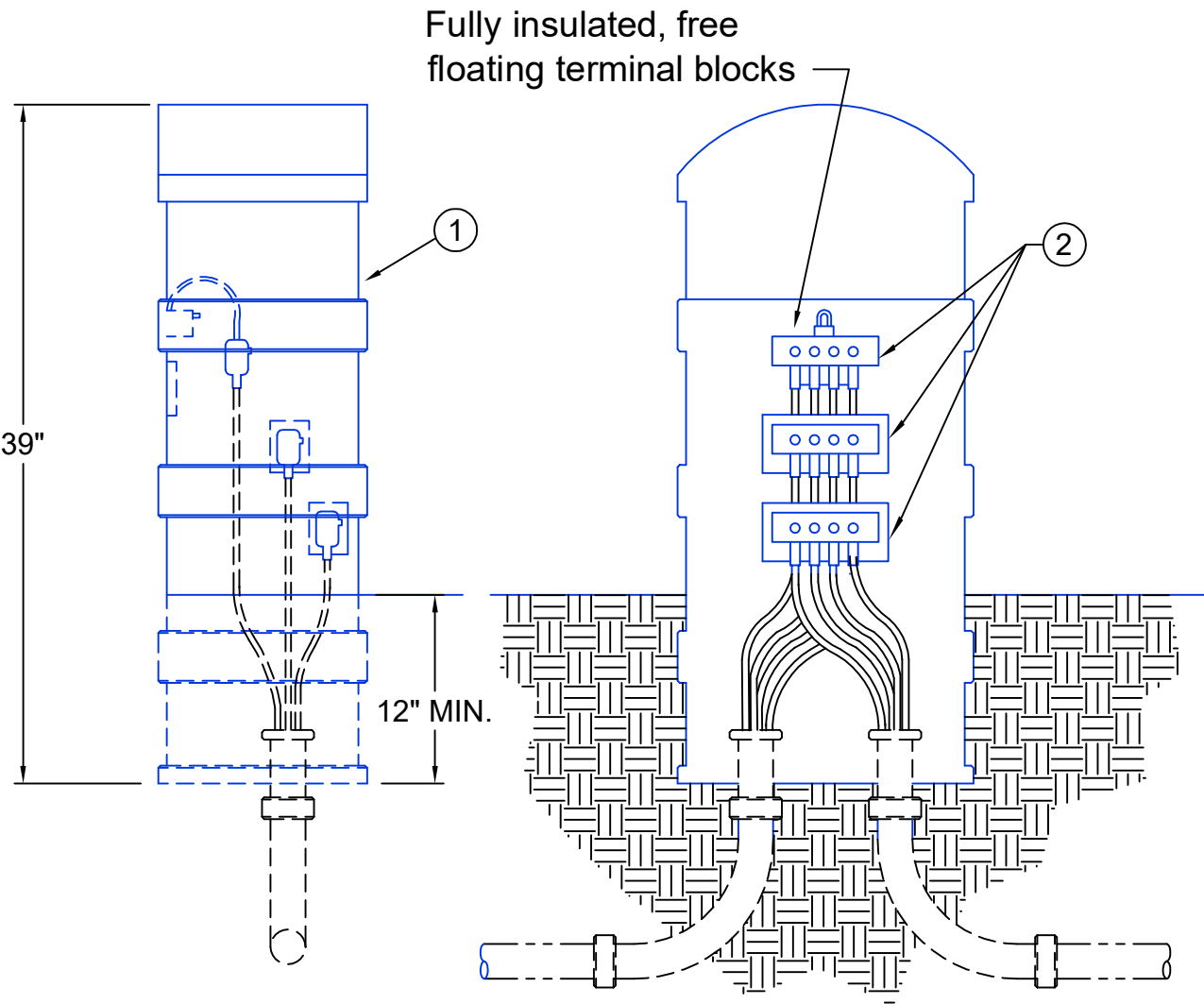
UJ3-2 Riser, Secondary, Stand-Off, 2"
 UJ3-2C Riser, Secondary, Clips, 2"
 UJ3-3 Riser, Secondary, Stand-Off, 3"
 UJ3-3C Riser, Secondary, Clips, 3"
 UJ3-4 Riser, Secondary, Stand-Off, 4"
 UJ3-4C Riser, Secondary, Clips, 4"

Ref	Material #	Description	UJ3-2	UJ3-2C	UJ3-3	UJ3-3C	UJ3-4	UJ3-4C
1	76010420	Conduit PVC Sch 80 2"	30	20				
1	76010430	Conduit PVC Sch 80 3"			30	20		
1	76010440	Conduit PVC Sch 80 4"					30	20
2	76010120	Conduit: Coupling PVC 2"	2	2				
2	76010130	Conduit: Coupling PVC 3"			2	2		
2	76010140	Conduit: Coupling PVC 4"					2	2
3	76100020	Conduit Clips 2 Hole 2"		3				
3	76100030	Conduit Clips 2 Hole 3"				3		
3	76100040	Conduit Clips 2 Hole 4"						3
3	10500024	Brkt, Standoff Conduit Riser	3		3		3	
3	10500002	Brkt, Clamp 2" Conduit Riser	3					
3	10500003	Brkt, Clamp 3" Conduit Riser			3			
3	10500004	Brkt, Clamp 4" Conduit Riser					3	
4	76010050	Conduit: Entrance Heads, 2" PVC	1	1				
4	76010060	Conduit: Entrance Heads, 3" PVC			1	1		
4	76010070	Conduit: Entrance Heads, 4" PVC					1	1

Construction and Design Notes:

UJ5

- 1. Ground rod not required with a fiberglass enclosure.
- 2. Electrical grade schedule 40 PVC sweeps with a minimum bending radius of 36" shall be used if runs are less than 150'. If runs exceed 150', then the sweeps must be galvanized steel.



Ref. No.	Material #	Description	Quantity
1	44400000	Pedestal, Secondary	1
2	17020000	Conn, Secondary Pedestal URD	3

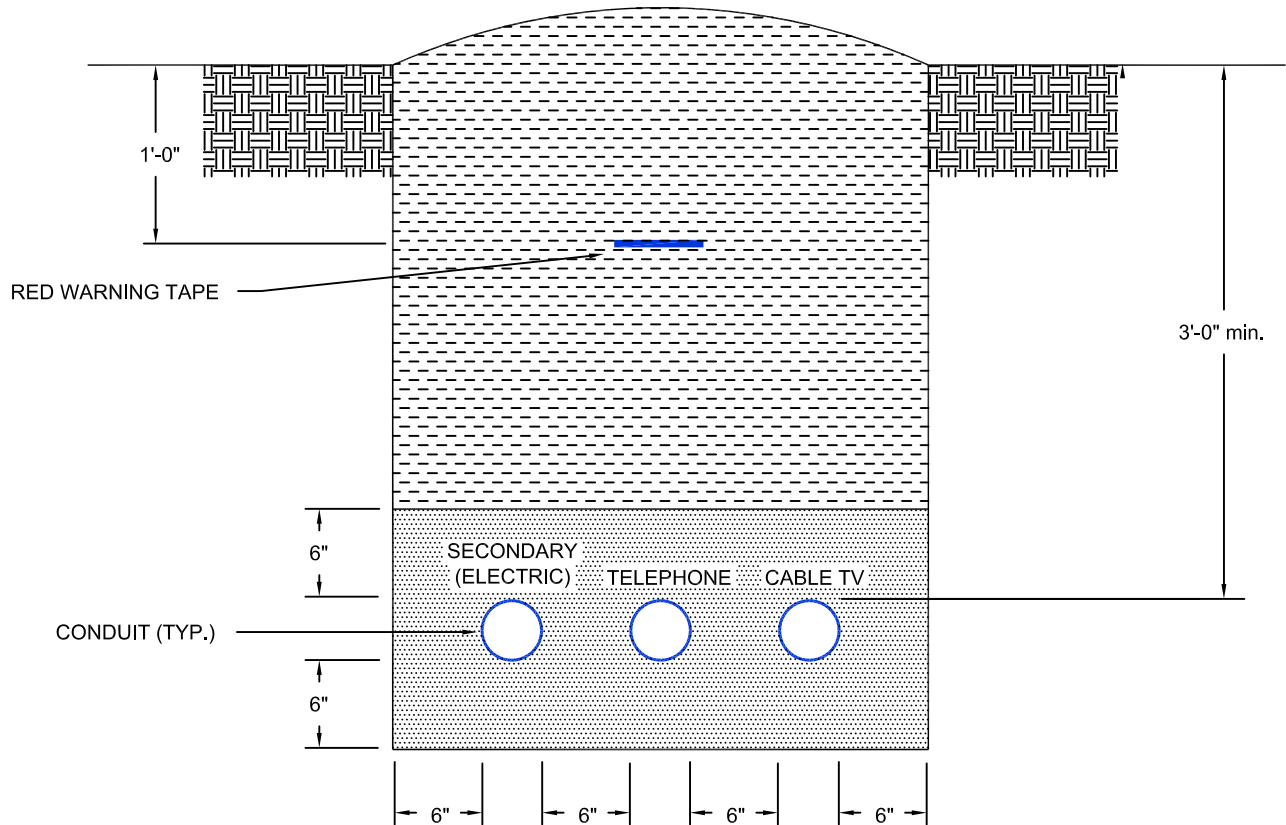


CONSTRUCTION STANDARDS

SECONDARY PEDESTAL, SINGLE-PHASE

UJ5

ONE OR MORE SECONDARY CIRCUITS WITH TELEPHONE AND/OR CABLE TV



NOTE:

1. TRENCH WIDTH AS REQUIRED TO MAINTAIN 6" MINIMUM SPACING BETWEEN ALL CONDUITS AND TRENCH SIDEWALLS.
2. TRENCH TO BE INSPECTED BY A REPRESENTATIVE OF NHEC PRIOR TO BACKFILLING.



WHEEL COMPACTED BACKFILL,
NO ROCKS LARGER THAN 6"
DIAMETER



SAND OR FINE BACKFILL,
NO ROCKS LARGER THAN 1"
DIAMETER



UNDISTURBED EARTH



CONSTRUCTION STANDARDS
TRENCH FOR JOINT ELECTRIC
AND COMMUNICATION FACILITIES

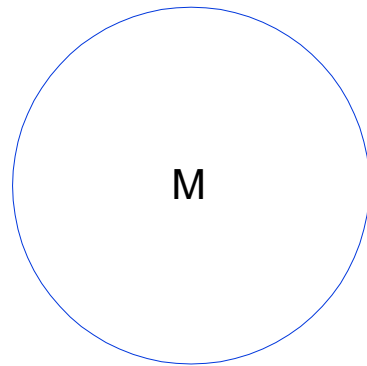
IU Secondary Trench

ISSUE DATE: 06/05

Metering 05

Q, Single Metered Account Q1, Q3
Q2, Single-Phase Primary Metering
Q4, Primary Metering

Q



Assembly Name	Description
Q1	Single Phase Metered Account
Q3	3 Phase Metered Account



CONSTRUCTION STANDARDS

METERING

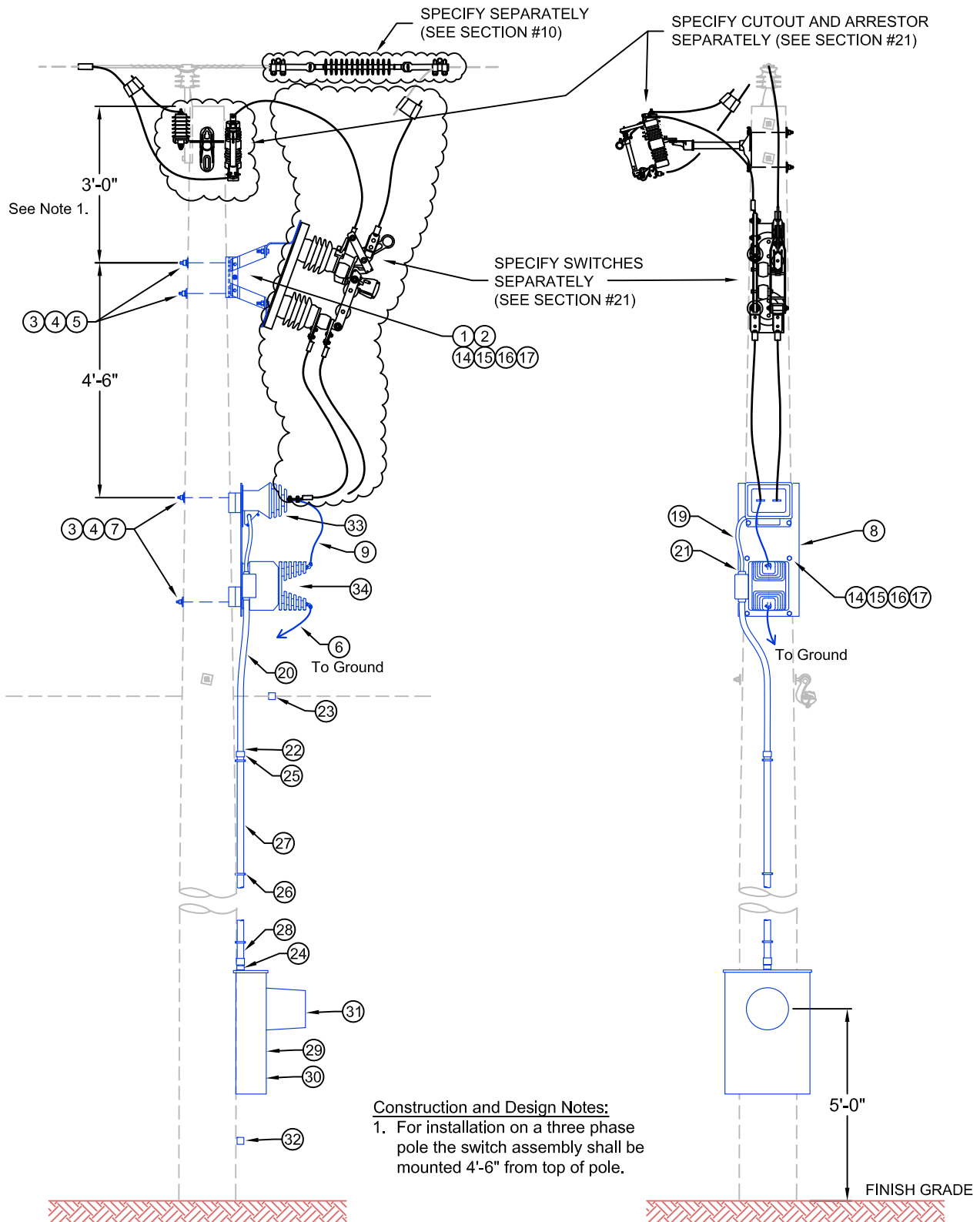
Q

ISSUE DATE: 01/06

Descriptions:

Q2 Primary Metering Mounting Hardware 15 & 25KV

Q2



Materials List for Assemblies

Descriptions

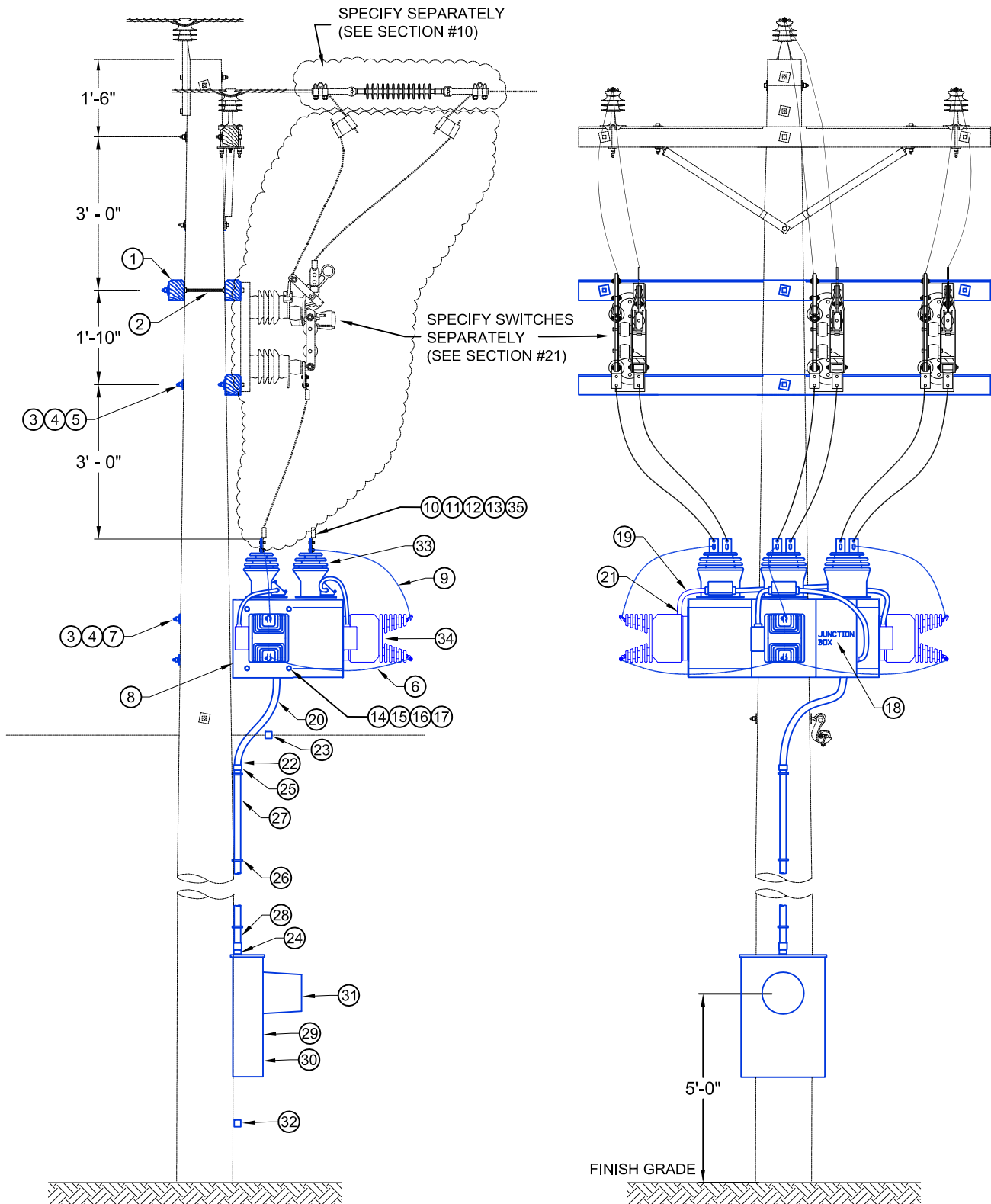
Q2 Primary Metering Mounting Hardware 15 & 25KV

Ref	Material #	Description	Q2
1	7806001	Bracket, Ext Recloser	1
2	7800718	Bracket, Bypass Switch	1
3	71020451	Washer, Square, 2 1/4" x 13/16"	4
4	71053063	Washer, Spring, 5/8"	4
5	6380512	Bolt, Machine 5/8" x 12"	2
6	15610401	Cond. 4 Sol Cu Soft Drawn	20
7	6380514	Bolt, Machine 5/8" x 14"	2
8	36705001	Bracket, Pri. Single Phase CT/PT	1
9	16510407	Cond. 4 Cu Poly Sd Str	4
14	17040121	Stainless Bolt 1 1/2 x 3/8"	8
15	17040122	Stainless Flat Washer 3/8"	16
16	17040123	Stainless Lock Washer 3/8"	8
17	17040124	Stainless Nut 3/8"	8
19	76010810	Conduit Liquid Tight 1"	5
20	76010812	Conduit Liquid Tight 1 1/4"	10
21	76010809	Liquid Tight Male Adpt 1"	2
22	76010811	Liquid Tight Male Adpt 1 1/4"	2
23	17010508	Conn, H Tap, YHD-150	1
24	76010166	Conduit, Fit M Adpt 1 1/4"	1
25	76010171	Conduit, Fit F Adpt 1 1/4"	1
26	76100014	Conduit Clips 2 Hole 1 1/4"	6
27	76010310	Conduit, Pvc Sch 40 1 1/4"	30
28	36705500	Metering Cable 12/10c	50
29	59100035	6 Terminal meter socket	1
30	36700001	7 Pole Test Switch	1
31	36605000	Protective Cove	1
32	17015004	Conn Gc5004 #4 Solid	4
33	69123031	Primary CT	1
34	69105135	P.T. Transformer	1

Descriptions:

Q4... Primary Metering Mounting Hardware 15 & 25KV

Q4



Materials List for Assemblies

Descriptions

Q4 Primary Metering Mounting Hardware 15 & 25KV

Ref	Material #	Description	Q4
1	18210311	Xarm 8' 3 3/4" x 4 3/4"	3
2	6330524	Bolt, DA. 5/8 x 24"	3
3	71020451	Washer, Square, 2 1/4" x 13/16"	14
4	71053063	Washer, Spring – 5/8"	9
5	6380518	Bolt, Machine 5/8" x 18"	1
6	15610401	Cond. 4 Sol Cu Soft Drawn	20
7	6380514	Bolt, Machine 5/8" x 14"	2
8	36705000	Mtr Primary CT/PT Rack	1
9	16510407	Cond. 4 Cu Poly Sd Str	12
10	17040100	Stainless Bolt 1 1/2"	3
11	17040115	Stainless Flat Washer 1/2"	6
12	17040120	Stainless Lock Washer 1/2"	3
13	17040125	Stainless Nut 1/2"	3
14	17040121	Stainless Bolt 1 1/2 x 3/8"	24
15	17040122	Stainless Flat Washer 3/8"	48
16	17040123	Stainless Lock Washer 3/8"	24
17	17040124	Stainless Nut 3/8"	24
18	34384033	Junction Box 12x12" & EB27B12S	1
19	76010810	Conduit Liquid Tight 1"	20
20	76010812	Conduit Liquid Tight 1 1/4"	10
21	76010809	Liquid Tight Male Adpt 1"	12
22	76010811	Liquid Tight Male Adpt 1 1/4"	2
23	17010508	Con H Tap YHD-150	1
24	76010166	Conduit, Fit M Adpt 1 1/4"	1
25	76010171	Conduit, Fit F Adpt 1 1/4"	1
26	76100014	Conduit Clips 2 Hole 1 1/4"	5
27	76010310	Conduit Pvc Sch 40 1 1/4"	30
28	36705500	Metering Cable 12/10c	50
29	59100110	Socket Meter 13 term 20 amp	1
30	36700000	Test Switch	1
31	36605000	Protective Cove	1
32	17015004	Conn Gc5004 #4 Solid	4
33	69100000	C.T. Transformer	3
34	69105135	P.T. Transformer	3
35	17019000	Conn: Terminal NEMA #4	3

OVHD Construction Guidelines 06

IW1 Covered Wire Construction Standard
Equipment Identification Practices (future)



Covered-Wired Construction Standards

NHEC's Reliability Guidelines state "tree-wire or spacer-cable shall be used for all primary construction unless prudent circumstances dictate otherwise" and that "the smallest primary conductor used for construction shall be 1/0 ACSR (both bare & tree-wire) and 1/0 AAC spacer-cable". #2 ACSR is no longer an approved primary conductor except for repairs and maintenance or for small line extensions when approved by Engineering.

Tree-wire is defined as covered 1/0 or 336.4 ACSR for use with vertical or horizontal (crossarm) open-wire construction. Only ACSR is approved for tree-wire construction. Spacer-cable or Hendrix (HNDX) is defined as covered 1/0 or 336.4 AAC phase conductors supported by a 052 AWA messenger with spacers. AAC is only to be used in spacer cable construction. Under no circumstances will either one be substituted for the other. They have totally different ratings & characteristics and improper use may effect sagging, clearances, guying, safety, etc.

If three-phase construction is required and ROW or easement restrictions dictate that construction be off-road or not accessible by line vehicles, then tree-wire will be the standard design, not spacer-cable. Spacer-cable is a stronger design, but if the messenger or poles break, resulting in an outage, restoration would be near impossible without vehicular equipment. Broken tree-wire can be repaired by hand.

Maximum Spans

The spans listed below are applicable for both single and three phase construction. Spans longer than those listed will require review and analysis by Engineering. Vertical clearance requirements may dictate the need for shorter spans when communications and secondary underbuilds exist.

Wire Type	Maximum Span Length
1/0 Tree-wire 15 kV	250 feet
1/0 Tree-wire 25 / 35 kV	225 feet
336 Tree-wire 15 kV	225 feet
336 Tree-wire 25 / 35 kV	200 feet
Spacer-Cable w/052 AWA Messenger	225 feet

Construction considerations

NHEC will use the Hendrix HPI-15 polyethylene pin-type tie-top insulators on all 15 kV construction, including bare wire, tree-wire, and spacer-cable. It will also be used on neutrals for all 15, 25, and 35 kV construction. The HPI-35 insulator will be used on all 25 and 35 kV construction. Covered conductors will be top or side tied using the Hendrix thermoplastic rubber covered #4 AL tie wire (see the appropriate Tie-Wire guides in the Conductor/Cable section). The neutral will be tied using standard issue soft-drawn bare aluminum tie wire.

All tree-wire neutral attachments (tangent and angle) will consist of an eyebolt and suspension clamp. The spool insulator and wide-base clevis will no longer be used.

All tree-wire suspension corners (A3, C3, etc.) will use 35 kV suspension insulators with the standard aluminum-body suspension shoe, clamped directly on the tree-wire, without having to skin away the insulation.

The weight per foot and diameter of 1/0 tree-wire is similar to that of bare 336.4 ACSR. The rated strength of the 1/0 tree-wire is 4,380 lbs. For these reasons, it will be treated like RUS heavy conductor, from a design standpoint. Therefore, only 60" wood braces are approved for new construction...28" braces are only approved for maintenance and repairs. Clamp-type cross-arm pins are required for all single and double conductor supports. Standard cross-arm pins are approved for jumper support only.

Poles

Standard Pole sizes and class are:

- 40 Class 3
- 45 Class 2
- 50 Class 1

The use of poles taller than 50 ft will require review/analysis by engineering.

1) Emergency Situations:

- a. An alternate class or height of a pole may be utilized based on availability.

2) Topography:

- a. Non standard sizes of poles may be utilized where required by terrain variations.

Pole Standardization

Wire Type	Phase	40/3	45/2	50/1
1/0 Tree 15 kV	1 Phase	X	X	X
1/0 Tree 25/35 kV	1 Phase	X	X	X
1/0 Tree 15 kV	3 Phase	X	X	X
1/0 Tree 25/35 kV	3 Phase		X	X
336 Tree 15 kV	3 Phase		X	X

The following telephone loads were assumed when developing structure designs:

Telephone Loads	
200 pr cable	Single-phase construction
400 pr cable	Three-phase construction

Structure Types and Tree-Wire Specifications

Tree-wire Specifications			Structure Types *				
COND	RATING	PHASE	TANGENT	ANGLE	DEADEND	EXCESSIVE LOADS	MAX SPAN
1/0 ACSR (6/1)	15 kV	1-ph	40-3 (4)	40-3 (5)	40-3 (5)	40-3 (4)	250
			45-2 (4)	45-2 (4)	45-2 (4)	45-2	
			50-1 (3)	50-1 (3)	50-1 (3)	50-1 (2)	
		3-ph	40-3	40-3	40-3	40-2	250
			45-2	45-2 (3)	45-2	45-2	
			50-1	50-1 (3)	50-1 (2)	50-1	
	25 & 35 kV	1-ph	40-3 (4)	40-3 (4)	40-3 (4)	40-3	225
			45-2 (4)	45-2 (4)	45-2 (4)	45-2 (3)	
			50-1 (3)	50-1 (3)	50-1 (3)	50-1 (2)	
		3-ph	40-2	40-2 (3)	40-2	40-2	225
			45-2	45-2 (3)	45-2	45-2	
			50-1 (2)	50-1 (3)	50-1 (2)	50-1 (2)	
336.4 ACSR (18/1)	15 kV	3-ph	40-2	40-2	40-2	40-2	225
			45-2	45-2	45-2	45-2	
			50-1 (2)	50-1 (2)	50-1	50-1	
	25 & 35 kV	3-ph	<i>CONTACT ENGINEERING</i>				200

* Poles classes listed in the table above in parenthesis are minimum class sizes for the given structure type and are not recommended for new construction, but would be acceptable to avoid changing out an existing pole, providing the pole is sound and less than 15 years old.

Design Criteria/Assumptions & Notes:

Design limits are based on NESC Heavy Loading District weather condition:

- 1/2" Ice
- 0°F
- 40 mph Wind

NESC Conductor Tension Limits

Loading Condition	Percentage of Ultimate Strength
Loaded, 0°F, 1/2" ice, 4 lbs per sq foot wind	60%
Initial unloaded, 0° F (initial sag)	35%
Final unloaded, 0° F (final sag)	25%

NHEC Conductor Design Tensions @ NESC "Heavy"

Wire Type	Design Tension (%)	Rated Strength (lbs)	Maximum Design Tension (lbs)
1/0 Tree-wire	40%	4,380	1,752
1/0 ACSR Bare ¹	36%	4,380	1,557
1/0 ACSR Bare ²	50%	4,380	2,190
336 ACSR (Bare & Tree-wire)	34.6%	8,680	3,000
4/0 ACSR ³	25%	8,350	2,088
052 AWA ⁴ Messenger	11.7%	17,120	2,000

¹ When used as a neutral conductor with tree-wire. The neutral tension matches the 1/0 Treewire sag @ 60° F.

² When used as a primary conductor.

³ When used as a neutral conductor for 336.4 ACSR.

⁴ Design tension for 052 AWA messenger is at @ 60° F, initial condition, with no physical loading from ice or wind.

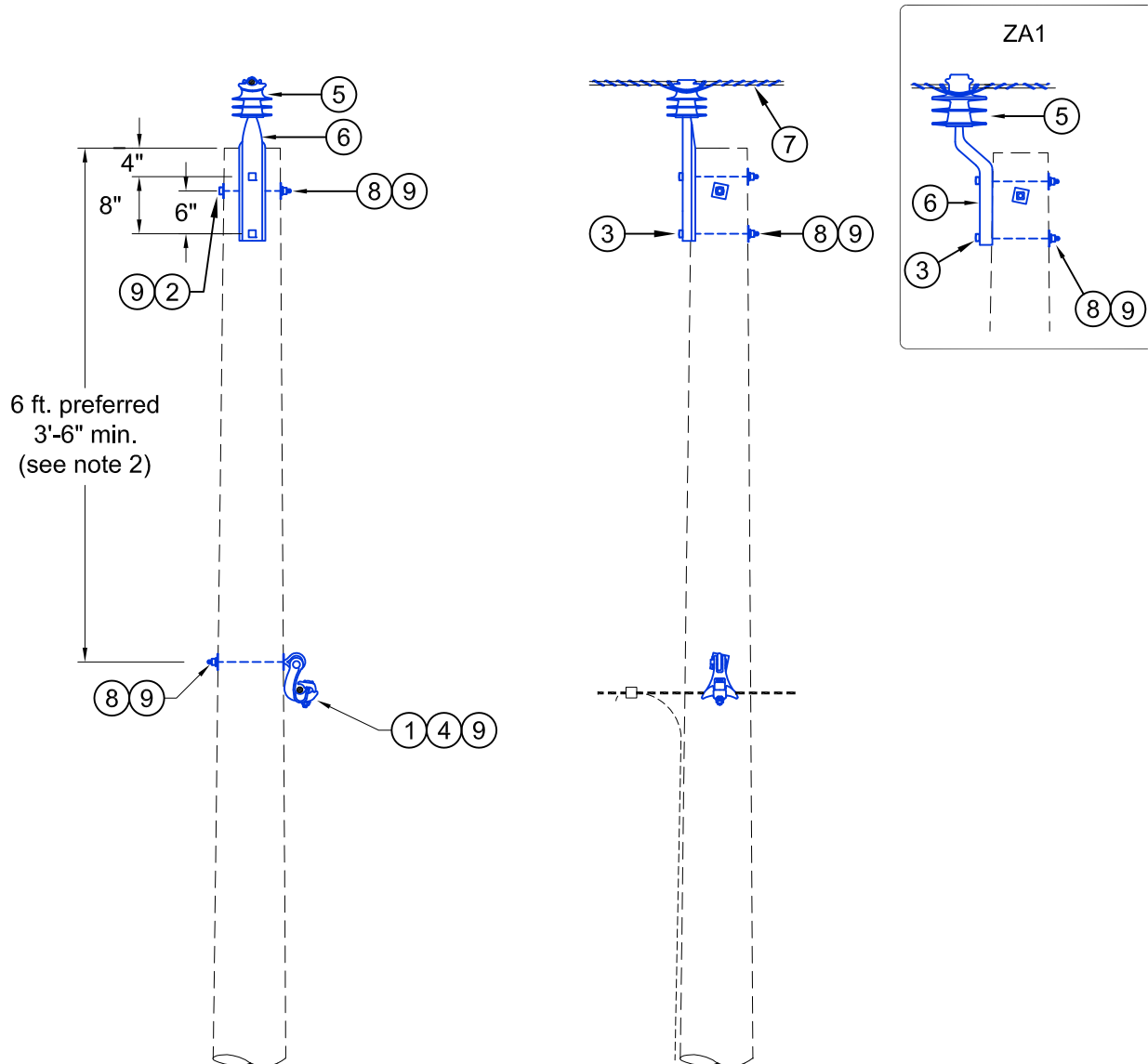
Generally, bare neutrals may be sagged to match their respective tree-wire sag, at any temperature, with minimal impact on tensions and clearances.

OVHD Single Phase 07

- A1 Vertical, Tangent, Single Support
- A1-1 Six ft Crossarm, Small Angle, Single Support (0-15°)
- A2 Vertical, Small Angle, Double Support (0-15°)
- A2-1 Six ft Double Crossarm, Medium Angle (0-35°)
- A2-2 Double Alley Arm, Medium Angle (0-35°)
- A3 Vertical, Suspension Insulators, Medium Angle (15-60°)
- A4 Vertical, Double DE, Large Angle (60-120°)
- A5 Vertical, Single DE
 - A5-1 Vertical Tap from Existing Single-Phase Line
 - A5-2 Vertical Tap with Extension, Off Three-Phase Line
 - A5-3 Six ft Double Crossarm, Single DE
 - A5-4 Vertical Tap, Pole Top Pin, from Existing DE Single-Phase Line
 - A5-5 single phase tap with Extension Bracket, Hendrix
 - A5-6 single phase tap with Extension Bracket, Open Wire
- A6 Six ft Double Crossarm, Double DE, Large Angle (0-60°)

Construction and Design Notes:

1. This assembly is approved only for tangent structures with bare wire.
2. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.



Design Limits:

Max. transverse load: 500 lbs. per conductor

Max. line angle: 1/0 ACSR (Bare): 2°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare)
15 kV	A1.1B
25/35 kV	ZA1.1B



CONSTRUCTION STANDARDS
SINGLE-PHASE VERTICAL CONSTRUCTION
SINGLE PRIMARY SUPPORT
TANGENT

Materials List for Assemblies

Descriptions

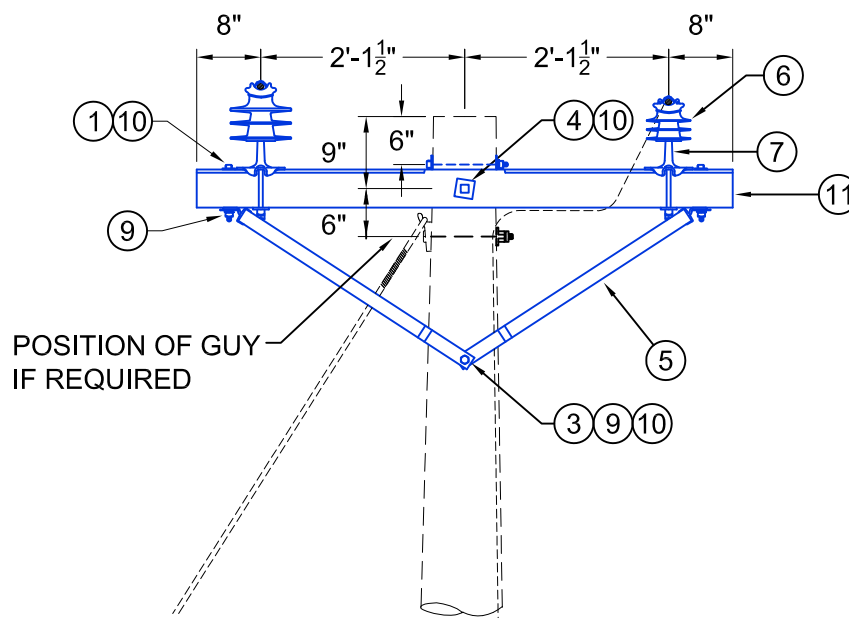
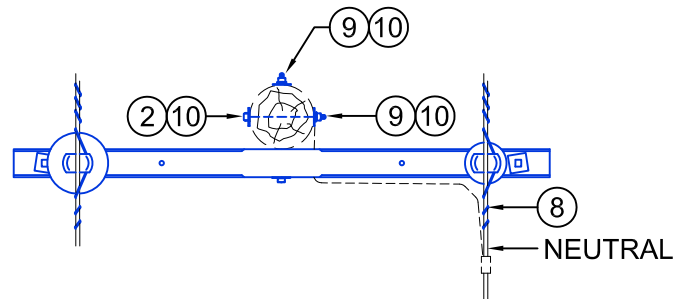
A1.1B Sgl Ph Tan 1 Sup 1/0 Bare 15 kV

ZA1.1B Sgl Ph Tan 1 Sup 1/0 Bare 35 kV

Ref	Material #	Description	A1.1B	ZA1.1B
1	6361514	Bolt, Eye 5/8" X 14"	1	1
2	6380512	Bolt, Machine 5/8" X 12"	1	1
3	6380514	Bolt, Machine 5/8" X 14"	2	2
4	11744000	Clamp, Susp/Angle Alum	1	1
5	32000901	HNDX Pin Ins Poly 15 kV	1	
5	32000903	HNDX Pin Ins Poly 35 kV		1
6	45612120	Pin Pole Top 20" X 1"	1	
6	45612520	Pin Pole Top 20" X 1 3/8" Offset		1
7	67100000	Tie Wire, Alum. No 4 Solid	8	8
8	71053063	Washer, Spring - 5/8"	4	4
9	71020451	Washer, Square, 2 1/4" X 13/16"	6	6

Construction and Design Notes:

1. This assembly is approved for bare wire construction only.
2. Install 5/8" brace bolt in outside pine hole on 5'-7" arm.
3. Phase conductors should be top-tied for line angles 2° or less.

Design Limits:

Max. transverse load: 1000 lbs. per conductor

Max. line angle: 1/0 ACSR (Bare): 15°

----- CONSTRUCTION ASSEMBLIES -----

System Voltage	1/0 ACSR (Bare)
15 kV	A1-1.1B
25/35 kV	ZA1-1.1B



CONSTRUCTION STANDARDS
SINGLE-PHASE CROSSARM CONSTRUCTION
6FT SINGLE ARM, SMALL ANGLE (0 - 15°)

A1-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

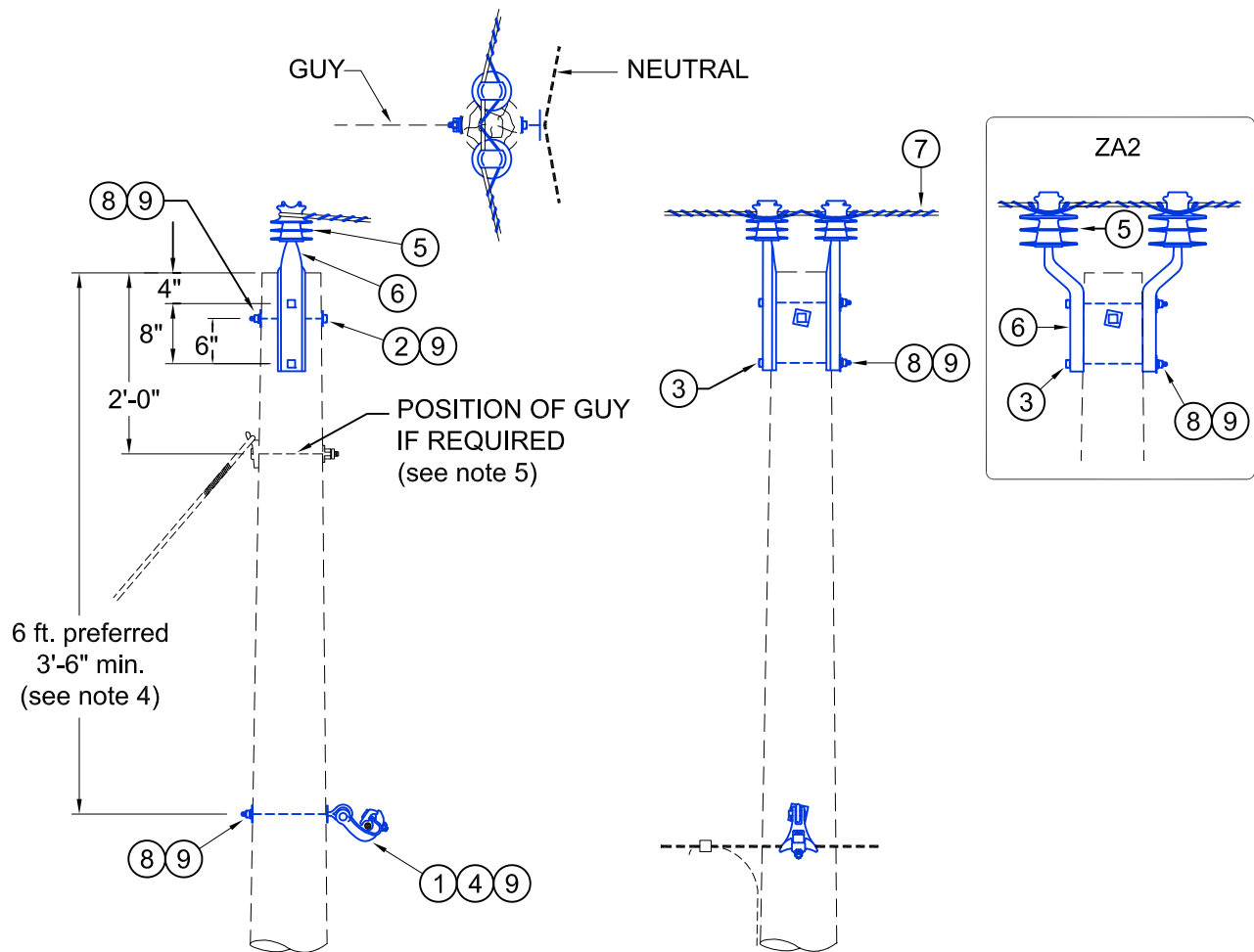
A1-1.1B Sgl Ph 6' Sgl Xarm, 1/0 Bare 15kV

ZA1-1.1B Sgl Ph 6' Sgl Xarm, 1/0 Bare 35kV

Ref	Material #	Description	A1-1.1B	ZA1-1.1B
1	6380507	Bolt, machine, 5/8" X 7"	2	2
2	6380512	Bolt, machine, 5/8" X 12"	1	1
3	6380514	Bolt, machine, 5/8" X 14"	1	1
4	6380516	Bolt, machine, 5/8" X 16"	1	1
5	7535168	Brace: Wood 60" (Pair)	1	1
6	32000901	HNDX Pin Ins Poly 15 kV	2	1
6	32000903	HNDX Pin Ins Poly 35 kV		1
7	45411155	Pins, Xarm Clamp Type 1"	2	2
8	67100000	Tie Wire, Alum No 4 Solid	16	16
8	67110000	Tie Wire, Alum Ins No 4 Solid		
9	71053063	Washer, Spring - 5/8"	5	5
10	71020451	Washer, Square, 2 1/4" X 13/16"	7	7
11	18210211	Xarm 5'7" 3 5/8" x 4 5/8"	1	1

Construction and Design Notes:

1. This assembly is approved for bare and tree wire construction for line angles up to 15°. It is also approved for tangent tree wire construction and road/railroad crossings where double-supports are desired.
2. The neutral should always be run on the inside of the line angle, regardless of the road location.
3. Phase conductor should be top-tied for line angles 2° or less.
4. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
5. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



Design Limits:

Max. transverse load: 1000 lbs. per conductor
 Max. line angle: 1/0 ACSR (Bare & Tree): 15°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A2.1B	A2.1T
25/35 kV	ZA2.1B	ZA2.1T



CONSTRUCTION STANDARDS
 SINGLE-PHASE VERTICAL CONSTRUCTION
 DOUBLE PRIMARY SUPPORT
 SMALL ANGLE (0 - 15°)

A2

ISSUE DATE: 05/16

Materials List for Assemblies

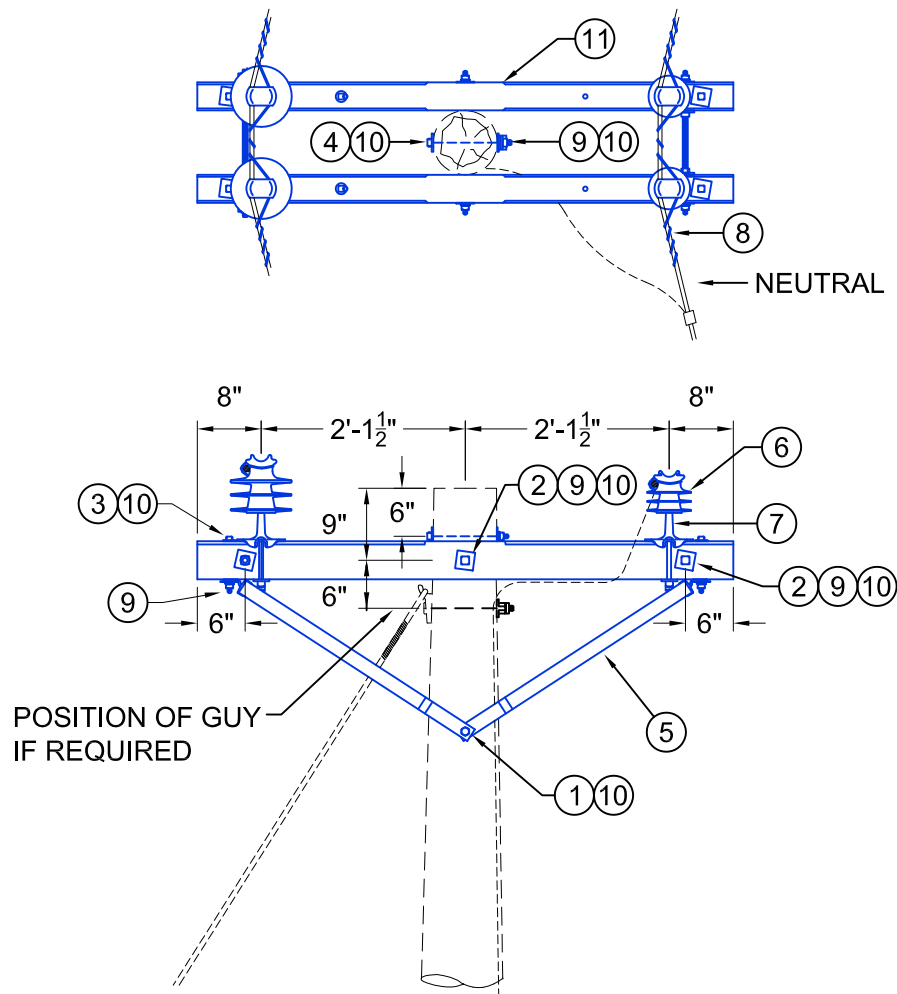
Descriptions

A2.1B Sgl Ph Angle 2 Sup 1/0 Bare 15 kV
 A2.1T Sgl Ph Angle 2 Sup 1/0 Tree 15 kV
 ZA2.1B Sgl Ph Angle 2 Sup 1/0 Bare 35 kV
 ZA2.1T Sgl Ph Angle 2 Sup 1/0 Tree 35 kV

Ref	Material #	Description	A2.1B	A2.1T	ZA2.1B	ZA2.1T
1	6361514	Bolt, Eye 5/8" X 14"	1	1	1	1
2	6380512	Bolt, Machine 5/8" X 12"	1	1	1	1
3	6380516	Bolt, Machine 5/8" X 16"	2	2	2	2
4	11744000	Clamp, Susp/Angle Alum	1	1	1	1
5	32000901	HNDX Pin Ins Poly 15 kV	2	2		
5	32000903	HNDX Pin Ins Poly 35 kV			2	2
6	45612120	Pin Pole Top 20" X 1"	2	2		
6	45612520	Pin Pole Top 20" X 1", Offset			2	2
7	67100000	Tie Wire, Alum No 4 Solid	16		16	
7	67110000	Tie Wire, Alum Ins No 4 Solid		16		16
8	71053063	Washer, Spring - 5/8"	4	4	4	4
9	71020451	Washer, Square, 2 1/4" X 13/16"	4	4	4	4

Construction and Design Notes:

1. Install 5/8" brace bolt in outside pin hole on 5'-7" arm.
2. Phase conductors should be top-tied for line angles 2° or less.

Design Limits:

Max. transverse load: 2000 lbs. per conductor

Max. line angle: 1/0 ACSR (Bare & Tree): 35°

----- CONSTRUCTION ASSEMBLIES -----

System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A2-1.1B	A2-1.1T
25/35 kV	ZA2-1.1B	ZA2-1.1T



CONSTRUCTION STANDARDS
SINGLE-PHASE CROSSARM CONSTRUCTION
6 FT DOUBLE ARM, HORIZONTAL CONFIGURATION
MEDIUM ANGLE (0 - 35°)

A2-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

A2-1.1B Sgl Ph 6' Dbl Xarm, 1/0 Bare 15 kV
 A2-1.1T Sgl Ph 6' Dbl Xarm, 1/0 Tree 15 kV
 ZA2-1.1B Sgl Ph 6' Dbl Xarm, 1/0 Bare 35 kV
 ZA2-1.1T Sgl Ph 6' Dbl Xarm, 1/0 Tree 35 kV

Ref	Material #	Description	A2-1.1B	A2-1.1T	ZA2-1.1B	ZA2-1.1T
1	6330516	Bolt, Da. 5/8" X 16"	1	1	1	1
2	6330524	Bolt, Da. 5/8" X 24"	3	3	3	3
3	6380507	Bolt, machine, 5/8" x 7"	4	4	4	4
4	6380512	Bolt, machine, 5/8" x 12"	1	1	1	1
5	7535168	Brace: Wood 60" (Pair)	2	2	2	2
6	32000901	HNDX Pin Ins Poly 15 kV	4	4	2	2
6	32000903	HNDX Pin Ins Poly 35 kV			2	2
7	45411155	Pin, Xarm Clamp Type 1"	4	4	4	4
8	67100000	Tie Wire, Alum No 4 Solid	32	16	32	16
8	67110000	Tie Wire, Alum Ins No 4 Solid		16		16
9	71053063	Washer, Spring - 5/8"	13	13	13	13
10	71020451	Washer, Square, 2 1/4" X 13/16"	16	16	16	16
11	18210211	Xarm 5'7" 3 5/8" x 4 5/8"	2	2	2	2

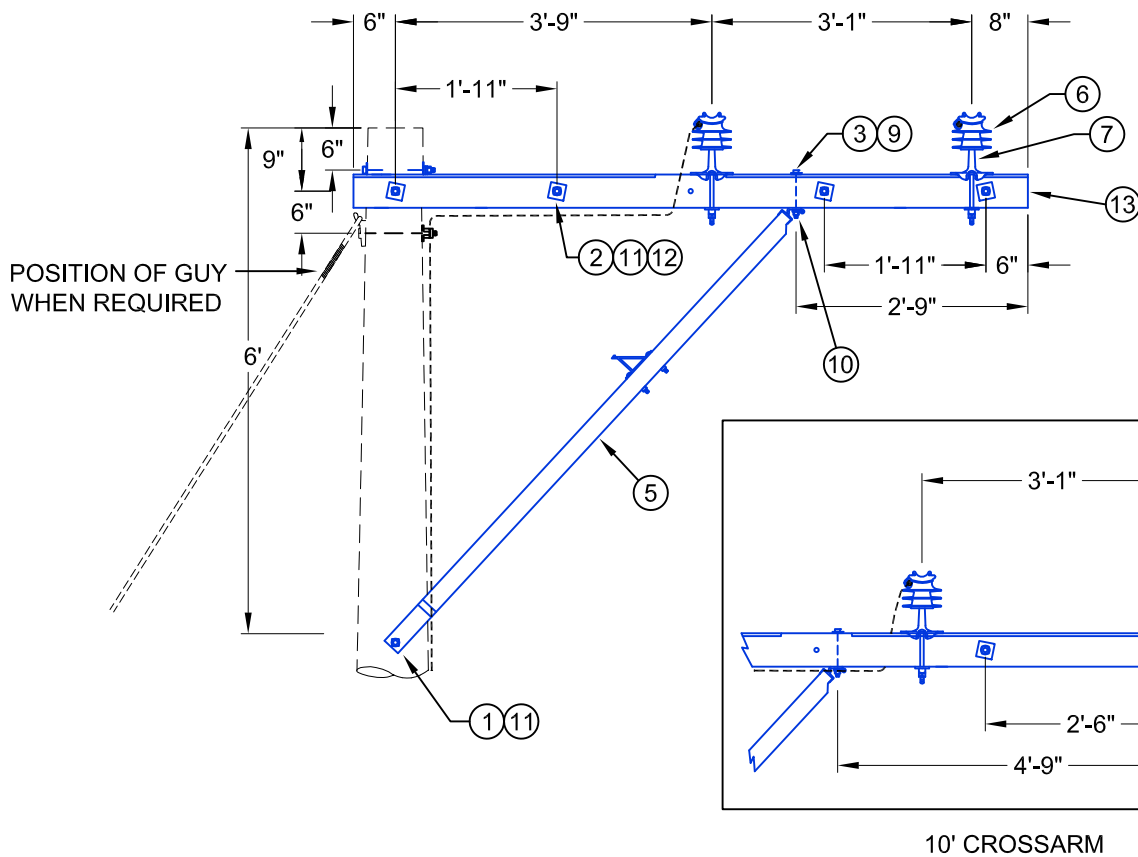
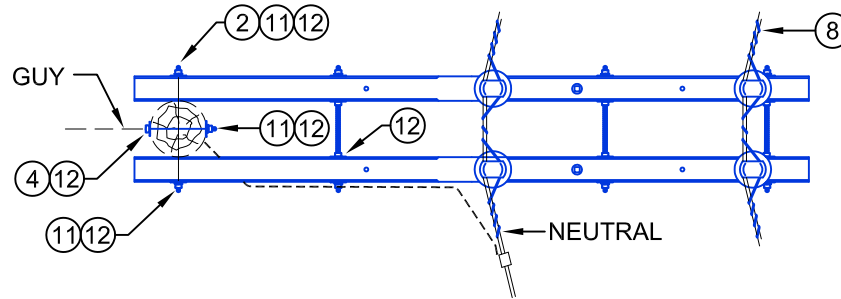


CONSTRUCTION STANDARDS
 SINGLE-PHASE CROSSARM CONSTRUCTION
 6 FT DOUBLE ARM, HORIZONTAL CONFIGURATION
 MEDIUM ANGLE (0-35°)

Construction and Design Notes:

1. Phase conductor should be top-tied for line angles 2° or less.

A2-2



Design Limits:

Max. transverse load: 2000 lbs. per conductor

Max. line angle:

1/0 ACSR (Bare & Tree): 35° (8 ft. arm)
 25° (10 ft. arm)

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A2-2.8.1B A2-2.10.1B	A2-2.8.1T A2-2.10.1T
25/35 kV	ZA2-2.8.1B ZA2-2.10.1B	ZA2-2.8.1T ZA2-2.10.1T



CONSTRUCTION STANDARDS
 SINGLE-PHASE CROSSARM CONSTRUCTION
 DOUBLE ALLEY ARM
 MEDIUM ANGLE

A2-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

A2-2.8.1B	Sgl Ph Dbl Alley 8' Xarm, Med Angle 1/0 Bare 15 kV
A2-2.8.1T	Sgl Ph Dbl Alley 8' Xarm, Med Angle 1/0 Tree 15 kV
ZA2-2.8.1B	Sgl Ph Dbl Alley 8' Xarm, Med Angle 1/0 Bare 35 kV
ZA2-2.8.1T	Sgl Ph Dbl Alley 8' Xarm, Med Angle 1/0 Tree 35 kV
A2-2.10.1B	Sgl Ph Dbl Alley 10' Xarm, Med Angle 1/0 Bare 15 kV
A2-2.10.1T	Sgl Ph Dbl Alley 10' Xarm, Med Angle 1/0 Tree 15 kV
ZA2-2.10.1B	Sgl Ph Dbl Alley 10' Xarm, Med Angle 1/0 Bare 35 kV
ZA2-2.10.1T	Sgl Ph Dbl Alley 10' Xarm, Med Angle 1/0 Tree 35 kV

Ref	Material #	Description	A2-2.8.1B	A2-2.8.1T	ZA2-2.8.1B	ZA2-2.8.1T	A2-2.10.1B	A2-2.10.1T	ZA2-2.10.1B	ZA2-2.10.1T
1	6330516	Bolt, Da. 5/8" X 16"	1	1	1	1	1	1	1	1
2	6330524	Bolt, Da. 5/8" X 24"	4	4	4	4	4	4	4	4
3	6380407	Bolt, machine, 1/2" X 7"	2	2	2	2	2	2	2	2
4	6380512	Bolt, machine, 5/8" x 12"	1	1	1	1	1	1	1	1
5	7553200	Brace: Wood Diagonal 7'	2	2	2	2	2	2	2	2
6	32000901	HNDX Pin Ins Poly 15 kV	4	4	2	2	4	4	2	2
6	32000903	HNDX Pin Ins Poly 35 kV			2	2			2	2
7	45411155	Pins, Xarm Clamp Type 1"	4	4	4	4	4	4	4	4
8	67110000	Tie Wire, Alum Ins No 4 Solid		16		16		16		16
8	67100000	Tie Wire, Alum No 4 Solid	32	16	32	16	32	16	32	16
9	71035931	Washer, Round - 5/8"	2	2	2	2	2	2	2	2
10	71053050	Washer, Spring - 1/2"	2	2	2	2	2	2	2	2
11	71053063	Washer, Spring - 5/8"	11	11	11	11	11	11	11	11
12	71020451	Washer, Square, 2 1/4" X 13/16"	16	16	16	16	16	16	16	16
13	18210311	Xarm 8' 3 3/4" X 4 3/4"	2	2	2	2				
13	18210511	Xarm 10' 3 3/4" X 4 3/4"					2	2	2	2



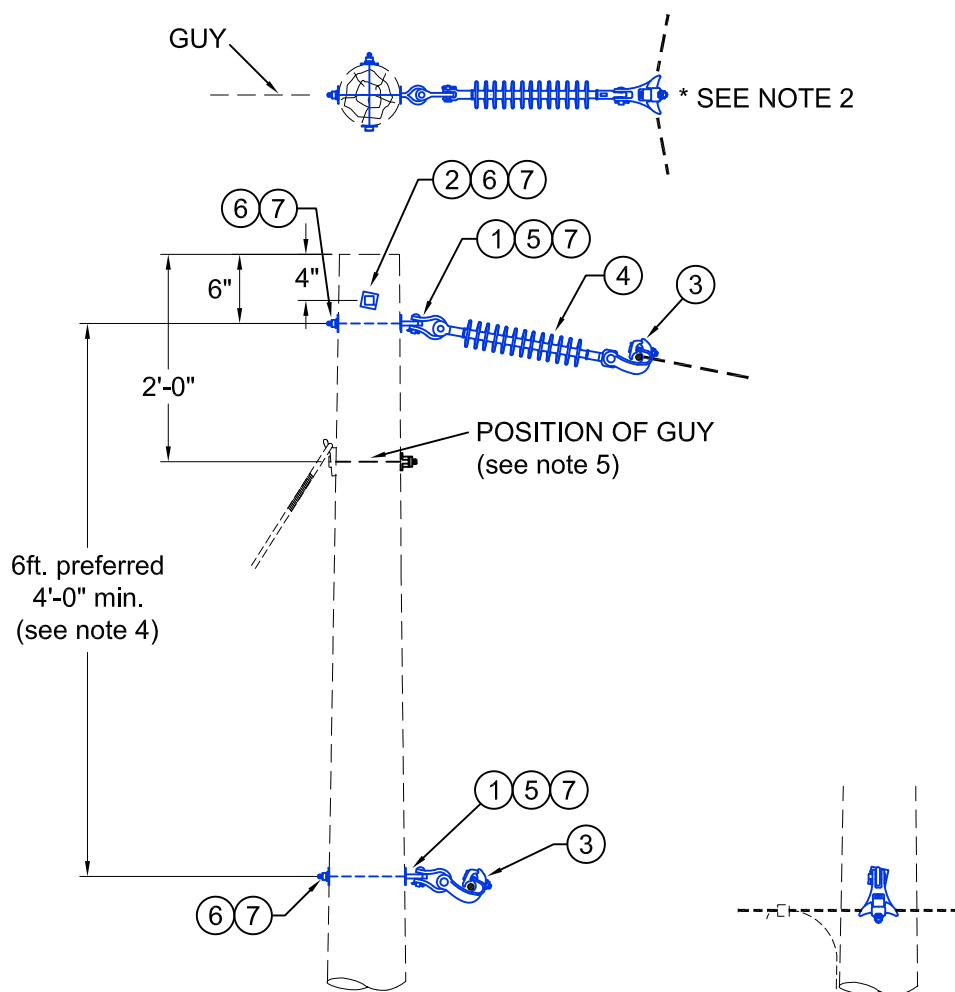
CONSTRUCTION STANDARDS
SINGLE-PHASE CROSSARM CONSTRUCTION
DOUBLE ALLEY ARM
MEDIUM ANGLE

A2-2

ISSUE DATE: 05/16

Construction and Design Notes:

1. This assembly is approved for line angles from 15° to 60° for both bare and tree wire construction at all voltages.
2. Do not strip insulation when clamping covered phase conductors.
3. The neutral should always be run on the inside of the line angle, regardless of the road location.
4. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
5. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.

Design Limits:

Max. transverse load: 4000 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare & Tree): 15 - 60°

----- CONSTRUCTION ASSEMBLIES -----

System Voltage	1/0 ACSR (Bare & Tree)
15 kV	A3.1
25/35 kV	



CONSTRUCTION STANDARDS

SINGLE-PHASE VERTICAL CONSTRUCTION
MEDIUM ANGLE (15 - 60°)

Materials List for Assemblies

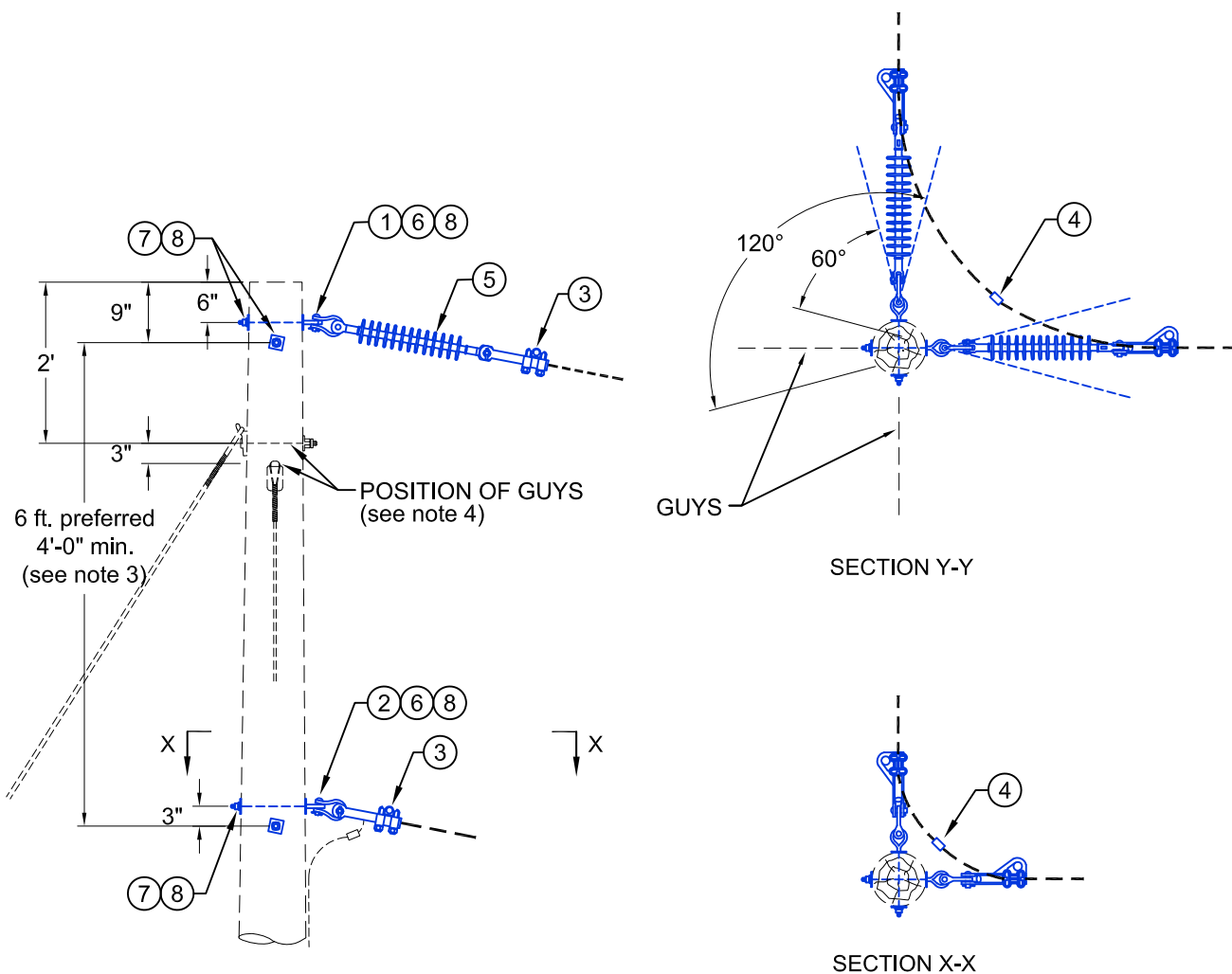
Descriptions

A3.1 Sgl Ph Vert Med Angle

Ref	Material #	Description	A3.1
1	6361514	Bolt, Eye 5/8" X 14"	2
2	6380512	Bolt, Machine 5/8" X 12"	1
3	11744000	Clamp, Susp/Angle Alum	2
4	34283544	Ins, Susp Epox 35kV	1
5	55570000	Shackle Anchor	2
6	71053063	Washer, Spring - 5/8"	3
7	71020451	Washer, Square, 2 1/4" X 13/16"	6

Construction and Design Notes:

1. This assembly is approved for line angles from 60° - 120° for both bare and tree wire construction at all voltages.
2. The insulation must be stripped when clamping covered phase conductors.
3. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
4. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A4.1	
25/35 kV		



CONSTRUCTION STANDARDS
SINGLE-PHASE VERTICAL CONSTRUCTION
DOUBLE DEADEND
LARGE ANGLE (60 - 120°)

Materials List for Assemblies

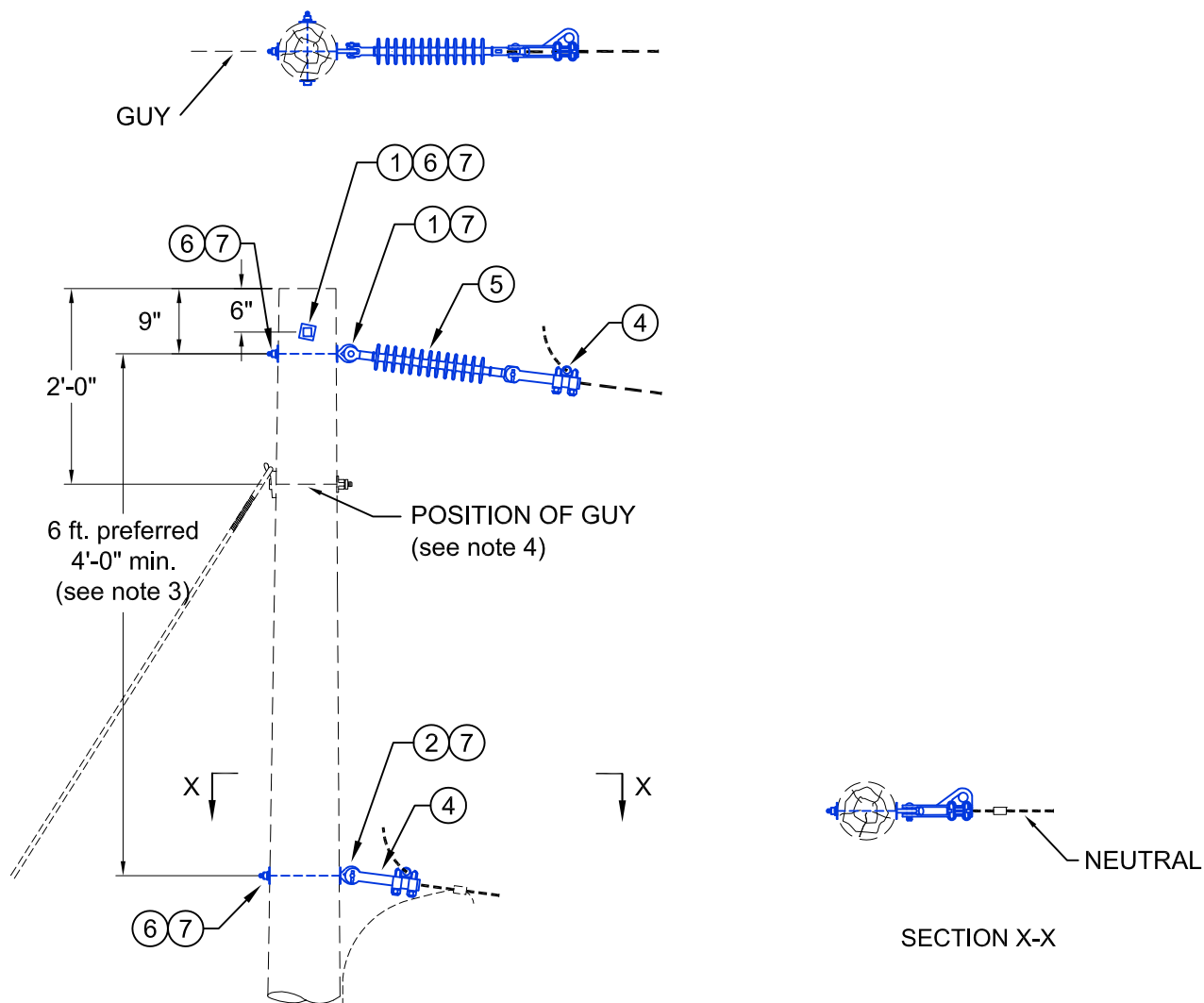
Descriptions

A4.1 Sgl Ph Vert Large Angle 1/0 35 kV

Ref	Material #	Description	A4.1
1	6361512	Bolt, Eye 5/8" X 12"	2
2	6361514	Bolt, Eye 5/8" X 14"	2
3	11723025	Clamp DE 4-2/0 ACSR	4
4	17010502	Con, Sicame TTD2710XFBTUNI	2
5	34283544	Ins, Susp Epox 35kV	2
6	55570000	Shackle Anchor	4
7	71053063	Washer, Spring - 5/8"	4
8	71020451	Washer, Square, 2 1/4" X 13/16"	8

Construction and Design Notes:

1. This assembly is approved for dead-ends for both bare and tree wire construction at all voltages.
2. The insulation must be stripped when clamping covered phase conductors.
3. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
4. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



CONSTRUCTION ASSEMBLIES	
System Voltage	1/0 ACSR (Bare & Tree)
15 kV	A5.1
25/35 kV	



CONSTRUCTION STANDARDS
SINGLE-PHASE VERTICAL CONSTRUCTION
SINGLE PRIMARY SUPPORT
DEADEND

Materials List for Assemblies

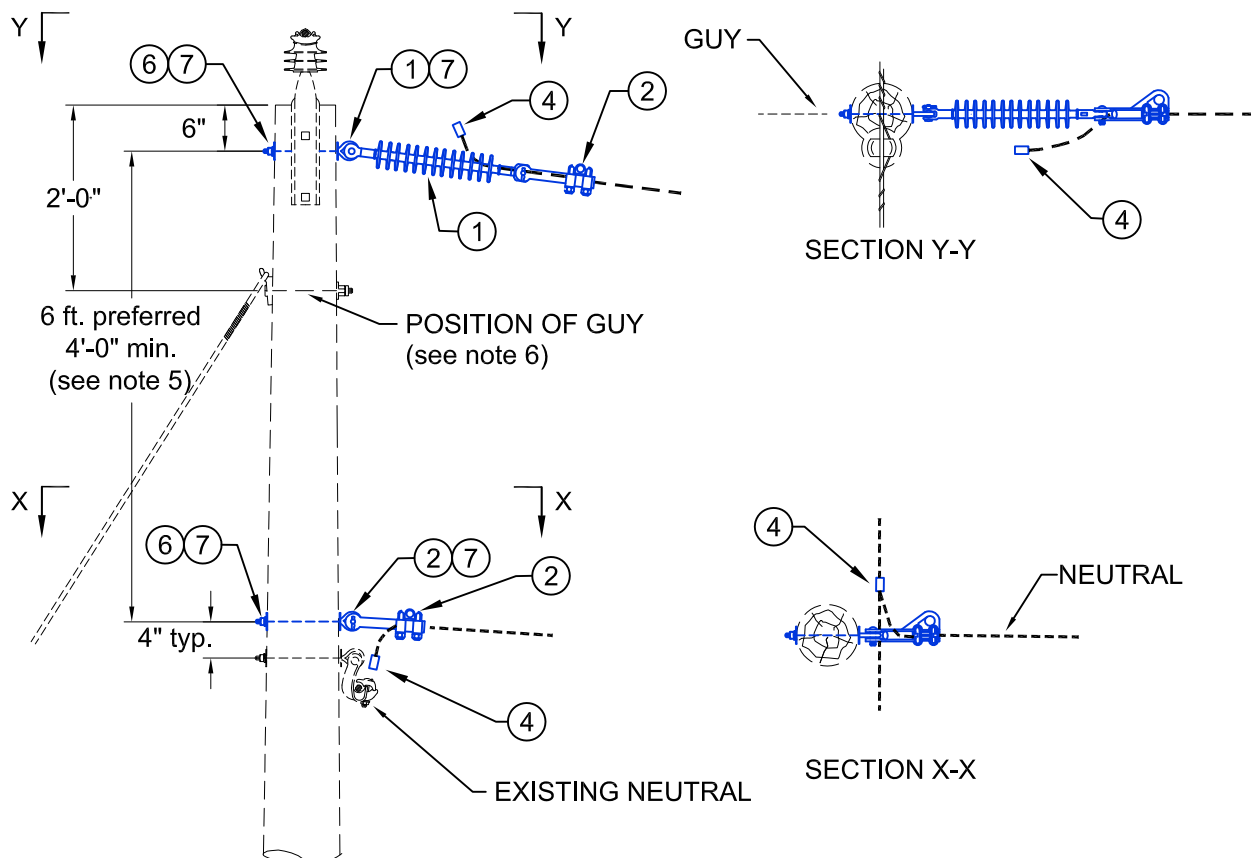
Descriptions

A5.1 Sgl Ph Vert DE 1/0 35 kV

Ref	Material #	Description	A5.1
1	6361512	Bolt, Eye 5/8" X 12"	1
2	6361514	Bolt, Eye 5/8" X 14"	1
3	6380512	Bolt, Machine 5/8" X 12"	1
4	11723025	Clamp DE 4-2/0 ACSR	2
5	34283544	Ins, Susp Epox 35kV	1
6	71053063	Washer, Spring - 5/8"	3
7	71020451	Washer, Square, 2 1/4" X 13/16"	6

Construction and Design Notes:

1. This assembly is approved for vertical taps for both bare and tree wire construction at all voltages.
2. The assembly is for taps off of existing single phase lines.
3. The insulation must be stripped when clamping covered phase conductors.
4. A sectionalizing device shall be specified separately as required per the NHEC Distribution Fusing Guidelines. Otherwise, connect the tap directly to the main line.
5. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
6. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare & Tree)
15 kV	A5-1.1
25/35 kV	



CONSTRUCTION STANDARDS
SINGLE-PHASE VERTICAL CONSTRUCTION
SINGLE PHASE TAP

A5-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

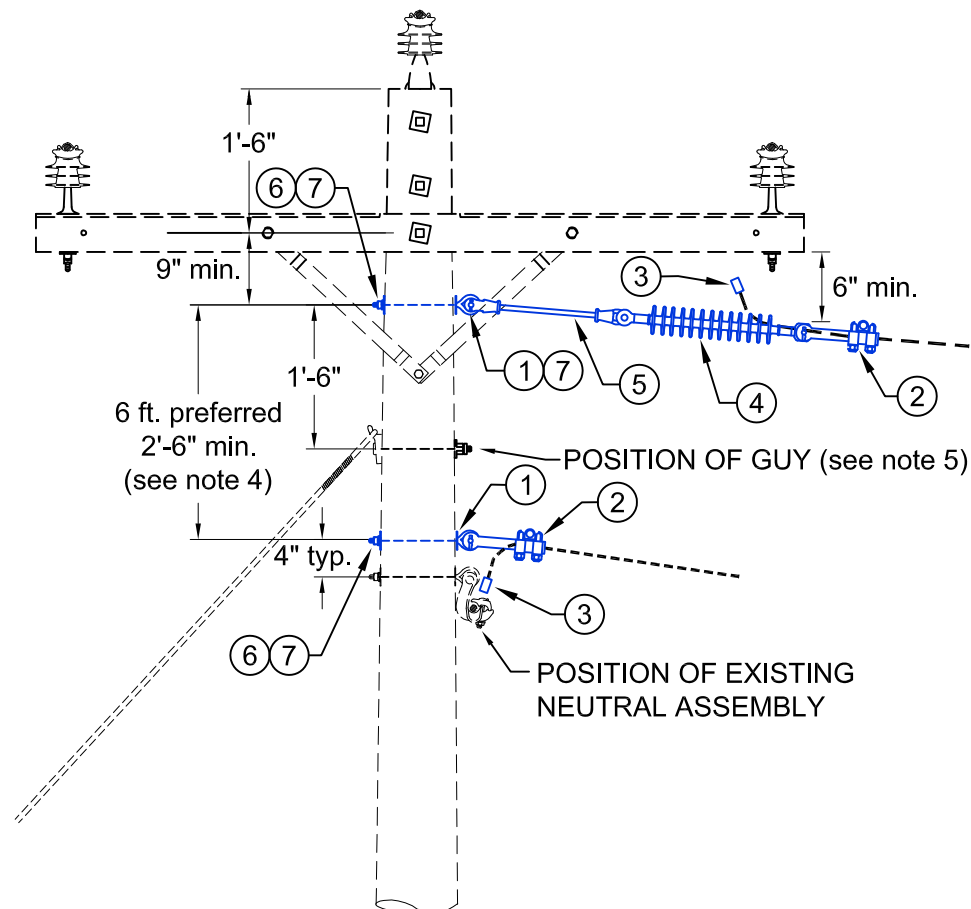
A5-1.1 Sgl Ph Vert Tap 1/0 35 kV

Ref	Material #	Description	A5-1.1
1	6361512	Bolt, Eye 5/8" X 12"	1
2	6361514	Bolt, Eye 5/8" X 14"	1
3	11723025	Clamp DE 4-2/0 ACSR	2
4	17010502	Con, Sicame TTD2710XFBTUNI	2
5	34283544	Ins, Susp Epox 35kV	1
6	71053063	Washer, Spring - 5/8"	2
7	71020451	Washer, Square, 2 1/4" X 13/16"	4

Construction and Design Notes:

A5-2

1. This assembly is approved for both bare and tree wire at all voltages.
2. The insulation must be stripped when clamping covered phase conductors.
3. A sectionalizing device shall be specified separately as required per the NHEC Distribution Fusing Guidelines. Otherwise, connect the tap directly to the main line.
4. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
5. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A5-2.1	
25/35 kV		



CONSTRUCTION STANDARDS
SINGLE-PHASE VERTICAL CONSTRUCTION
SINGLE PHASE TAP W/ EXTENSION

A5-2

ISSUE DATE: 05/16

Materials List for Assemblies

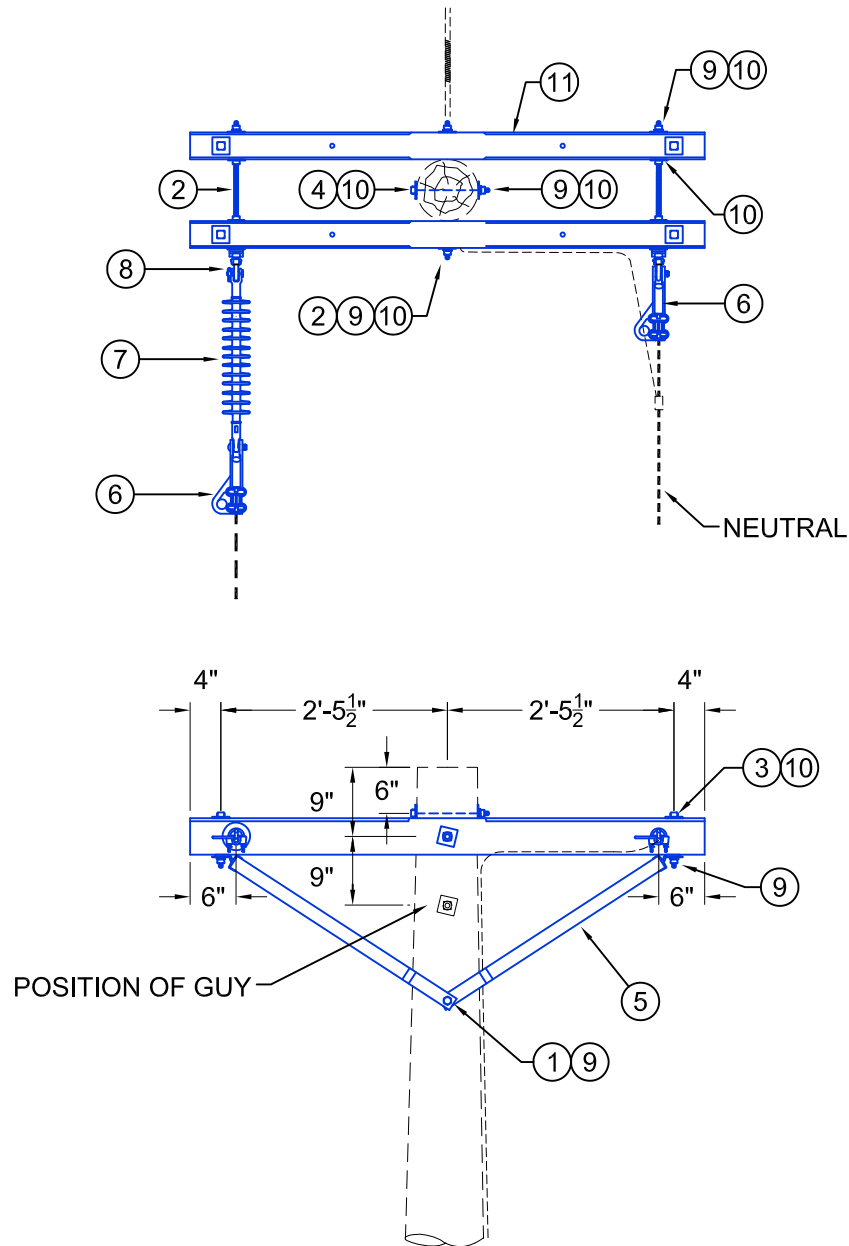
Descriptions

A5-2.1 Sgl Ph Vert Tap w/Extension

Ref	Material #	Description	A5-2.1
1	6361514	Bolt, Eye 5/8" X 14"	2
2	11723025	Clamp DE 4-2/0 ACSR	2
3	17010502	Con, Sicame TTD2710XFBTUNI	2
4	34283544	Ins, Susp Epox 35kV	1
5	37820000	Link ext pri 12" short	1
6	71053063	Washer, Spring - 5/8"	2
7	71020451	Washer, Square, 2 1/4" X 13/16"	4

Construction and Design Notes:

1. This assembly is approved for bare and tree wire construction at all voltages.



----- CONSTRUCTION ASSEMBLIES -----

System Voltage	1/0 ACSR (Bare & Tree)
15 kV	A5-3.1
25/35 kV	



CONSTRUCTION STANDARDS
SINGLE-PHASE CROSSARM CONSTRUCTION
SINGLE DEADEND, DOUBLE CROSSARM, 6FT

Materials List for Assemblies

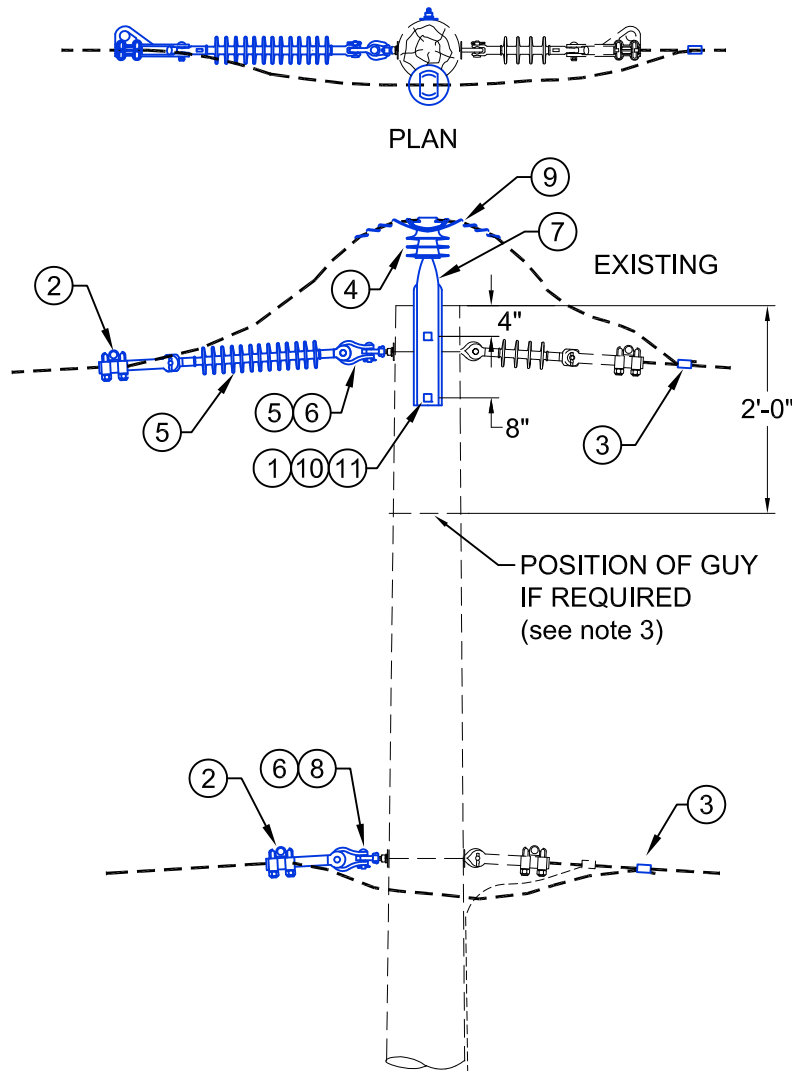
Descriptions

A5-3.1 Sgl Ph Dbl Xarm, Sgl DE 35 kV

Ref	Material #	Description	A5-3.1
1	6330516	Bolt, Da. 5/8" X 16"	1
2	6330524	Bolt, Da. 5/8" X 24"	3
3	6380507	Bolt, machine, 5/8" x 7"	4
4	6380512	Bolt, Machine 5/8" X 12"	1
5	7535168	Brace, Wood 60" (pair)	2
6	11723025	Clamp DE 4-2/0 ACSR	2
7	34283544	Ins, Susp Epox 35kV	1
8	42904063	Nut, Eye 5/8"	2
9	71053063	Washer, Spring - 5/8"	13
10	71020451	Washer, Square, 2 1/4" X 13/16"	16
11	18210211	Xarm 5' 7" 3 3/4" X 4 3/4"	2

Construction and Design Notes:

1. This assembly is approved for tangent construction for both bare and tree wire at all voltages.
2. If continuing line angle is greater than 10° , specify an A5-1 and the appropriate pole top pin assembly.
3. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



Design Limits:

Max. transverse load: 500 lbs. per conductor

Max. line angle:

1/0 ACSR (Bare & Tree): 10°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A5-4.1B	A5-4.1T
25/35 kV	ZA5-4.1B	ZA5-4.1T



CONSTRUCTION STANDARDS
SINGLE-PHASE VERTICAL CONSTRUCTION
SINGLE PHASE TAP, POLE TOP PIN

A5-4

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

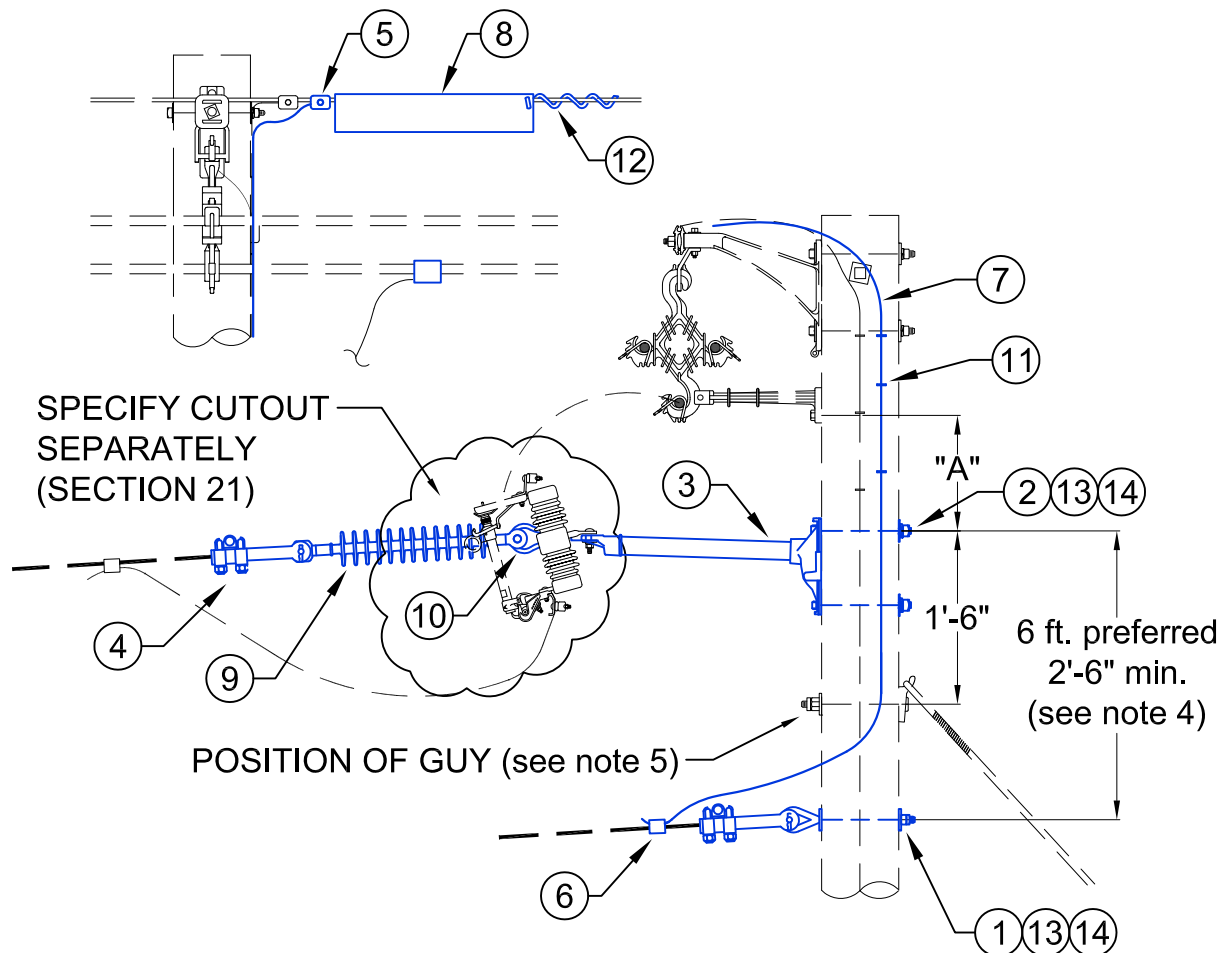
A5-4.1B Sgl Ph Tap w/Pin 1/0 Bare 15 kV
 A5-4.1T Sgl Ph Tap w/Pin 1/0 Tree 15 kV
 ZA5-4.1B Sgl Ph Tap w/Pin 1/0 Bare 35 kV
 ZA5-4.1T Sgl Ph Tap w/Pin 1/0 Tree 35 kV

Ref	Material #	Description	A5-4.1B	A5-4.1T	ZA5-4.1B	ZA5-4.1T
1	6380514	Bolt, Machine 5/8" X 14"	2	2	2	2
2	11723025	Clamp DE 4-2/0 ACSR	2	2	2	2
3	17010502	Con, Sicame TTD2710XFBTUNI	2	2	2	2
4	32000901	HNDX Pin Ins Poly 15 kV	1	1		
4	32000903	HNDX Pin Ins Poly 35 kV			1	1
5	34283544	Ins, Susp Epox 35kV	1	1	1	1
6	42904063	Nut, Eye 5/8"	2	2	2	2
7	45612120	Pin Pole Top 20" X 1"	1	1		
7	45612520	Pin Pole Top 20" X 1 3/8", Offset			1	1
8	55570000	Shackle Anchor	2	2	2	2
9	67100000	Tie Wire, Alum No 4 Solid	6		6	
9	67110000	Tie Wire, Alum Ins No 4 Solid		6		6
10	71053063	Washer, Spring - 5/8"	2	2	2	2
11	71020451	Washer, Square, 2 1/4" X 13/16"	2	2	2	2

Construction and Design Notes:

A5-5

1. This assembly is approved for both bare and tree wire at all voltages.
2. The insulation must be stripped when clamping covered phase conductors.
3. A sectionalizing device shall be specified separately as required per the NHEC Distribution Fusing Guidelines. Otherwise, connect the tap directly to the main line.
4. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
5. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



CONSTRUCTION DIMENSIONS

"A" ... 12" min. (tap directly beneath phases)
6" min. tap on back of pole)

CONSTRUCTION ASSEMBLIES		
System Voltage	12" Bracket	24" Bracket
15 kV	A5-5S	A5-5L
25/35 kV		



CONSTRUCTION STANDARDS
HENDRIX CONSTRUCTION
SINGLE PHASE TAP W/BACKET

A5-5

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

A5-5S Sgl Ph Vert Tap from Hndx 12" Brkt

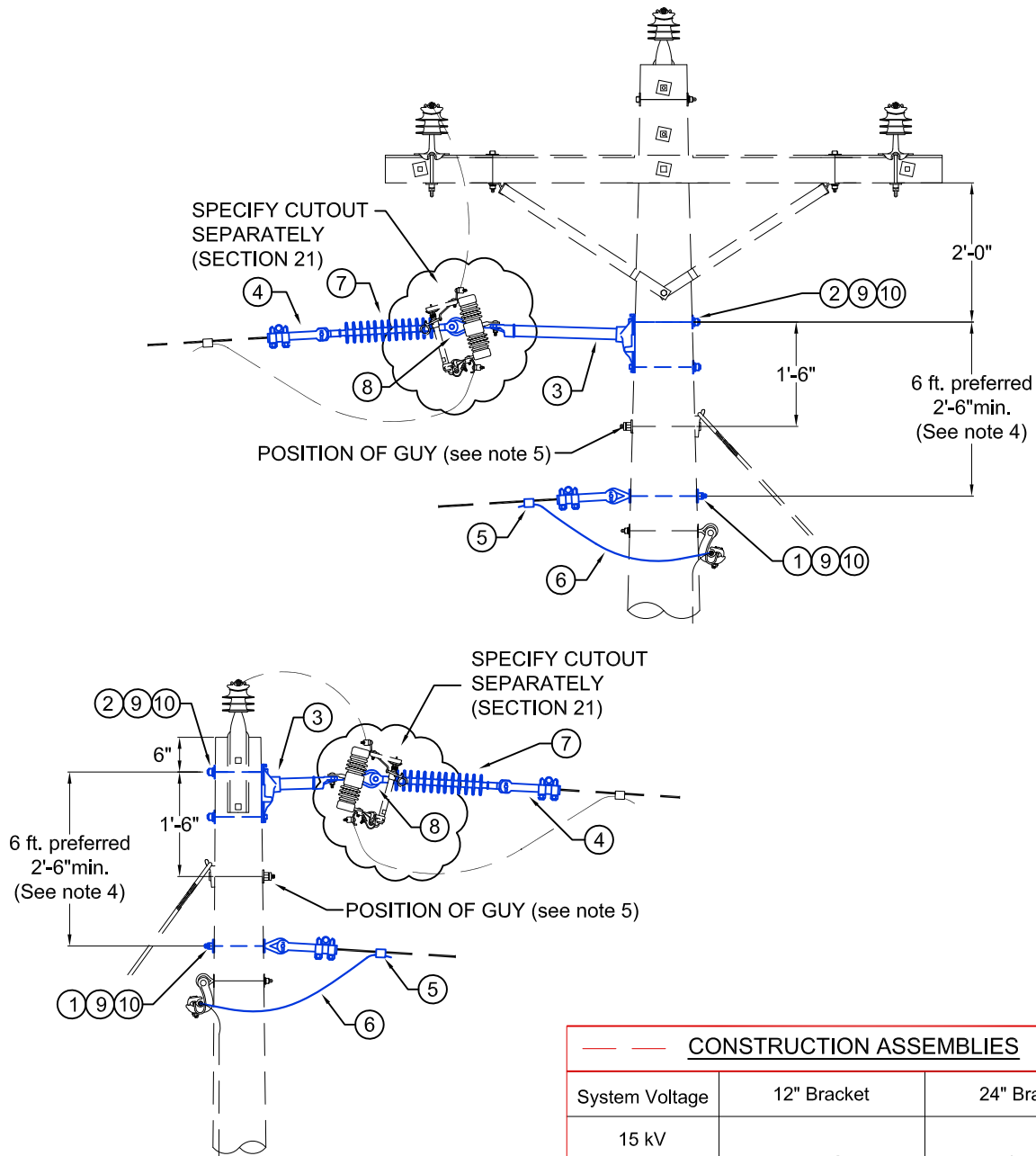
A5-5L Sgl Ph Vert Tap from Hndx 24" Brkt

Ref	Material #	Description	A5-5S	A5-5L
1	06361514	Bolt, Eye 5/8" x 14"	1	1
2	06380514	Bolt, Machine 5/8" x 14"	2	2
3	07800750	Brkt, Comb Arr/Cutout 12"	1	
3	07800725	Brkt, Comb Arr/Cutout 24"		1
4	11723025	Clamp DE 4-2/0 ACSR	2	2
5	17010502	Con, Sicame TTD2710XFBTUNI	1	1
6	17010502	Con, Sicame TTD2710XFBTUNI	1	1
7	15620203	Conductor, 2 Str CU	12'	12'
8	32000906	Hndx Clip-on Line Duc	3'	3'
9	34283544	Ins, Susp Epox 35kV	1	1
10	55570000	Shackle, Anchor	1	1
11	61801810	Staples, Ground Wire	6	6
12	67100000	Tie Wire, Alum No 4 Solid	2'	2'
13	71053063	Washer, Spring - 5/8"	3	3
14	71020451	Washer, Square, 2 1/4" X 13/16"	4	4

Construction and Design Notes:

A5-6

1. This assembly is approved for both bare and tree wire at all voltages.
2. The insulation must be stripped when clamping covered phase conductors.
3. A sectionalizing device shall be specified separately as required per the NHEC Distribution Fusing Guidelines. Otherwise, connect the tap directly to the main line.
4. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
5. A neutral guy is required on angle and tap structures if the un-guyed space between the guy and the neutral is greater than 6 ft.



CONSTRUCTION ASSEMBLIES		
System Voltage	12" Bracket	24" Bracket
15 kV	A5-6S	A5-6L
25/35 kV		



CONSTRUCTION STANDARDS

OPEN WIRE CONSTRUCTION

SINGLE PHASE TAP W/BACKET

A5-6

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

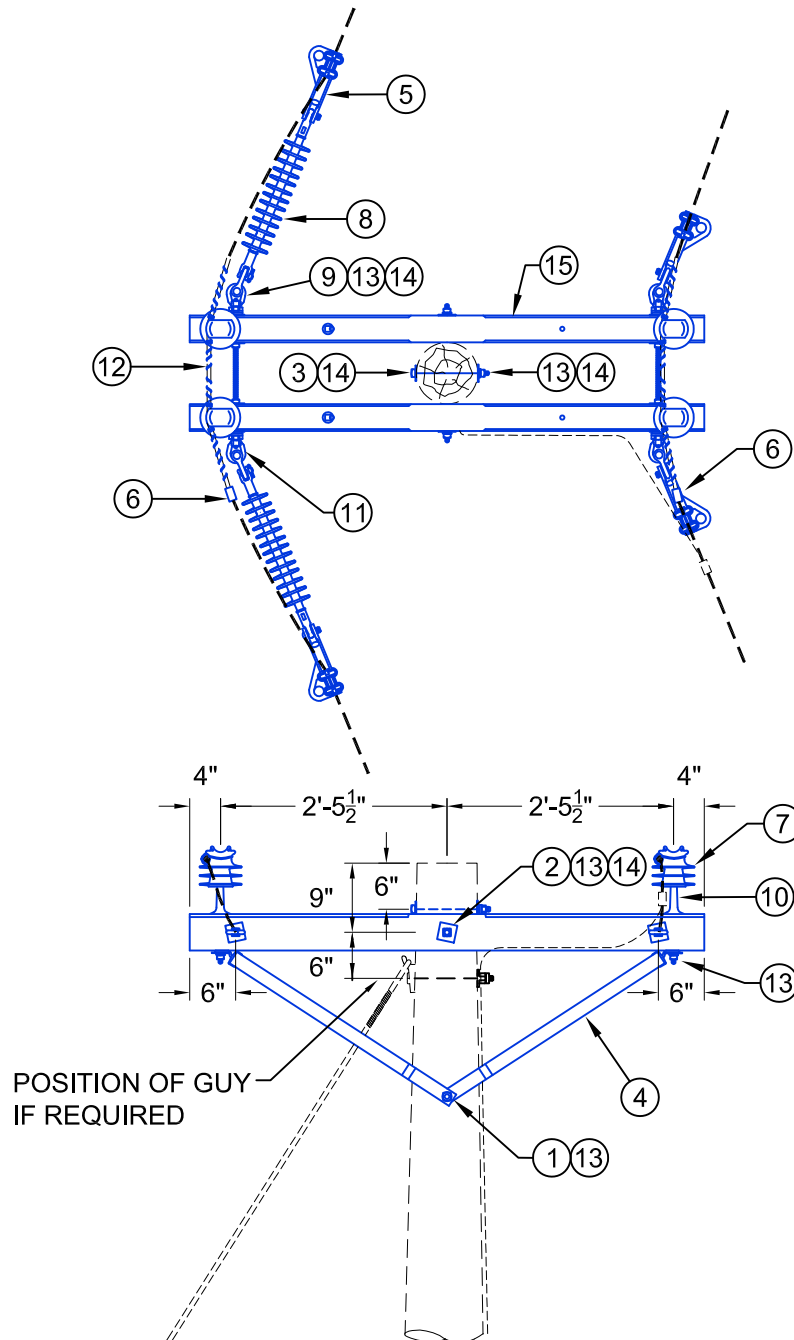
A5-6S Sgl Ph Tap w/ 12" Brkt Open Wire Vertical

A5-6L Sgl Ph Tap w/ 24" Brkt Open Wire Vertical

Ref	Material #	Description	A5-6S	A5-6L
1	06361514	Bolt, Eye 5/8" x 14"	1	1
2	06380514	Bolt, Machine 5/8" x 14"	2	2
3	07800750	Brkt, Comb Arr/Cutout 12"	1	
3	07800725	Brkt, Comb Arr/Cutout 24"		1
4	11723025	Clamp DE 4-2/0 ACSR	2	2
5	17010502	Con, Sicame TTD2710XFBTUNI	2	2
5	17010502	Con, Sicame TTD2710XFBTUNI	1	1
6	15620203	Conductor, 2 Str CU	4'	4'
7	34283544	Ins, Susp Epox 35kV	1	1
8	55570000	Shackle, Anchor	1	1
9	71053063	Washer, Spring - 5/8"	3	3
10	71020451	Washer, Square, 2 1/4" X 13/16"	4	4

Construction and Design Notes:

1. Install 5/8" insulator pin as the brace bolt in outside pin hole on 5'-7" arm.



----- CONSTRUCTION ASSEMBLIES -----		
System Voltage	1/0 ACSR (Bare)	1/0 ACSR (Tree)
15 kV	A6.1B	A6.1T
25/35 kV	ZA6.1B	ZA6.1T



CONSTRUCTION STANDARDS
SINGLE-PHASE CROSSARM CONSTRUCTION
DOUBLE DEADEND, 6 FT CROSSARM
LARGE ANGLE (0 - 60°)

Materials List for Assemblies

Descriptions

A6.1B Sgl Ph 6' Xarm, Dbl DE, Large Angle Bare 15 kV
 A6.1T Sgl Ph 6' Xarm, Dbl DE, Large Angle Tree 15 kV
 ZA6.1B Sgl Ph 6' Xarm, Dbl DE, Large Angle Bare 35 kV
 ZA6.1T Sgl Ph 6' Xarm, Dbl DE, Large Angle Tree 35 kV

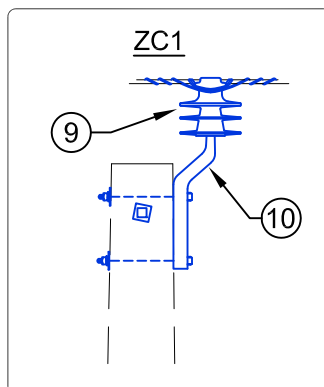
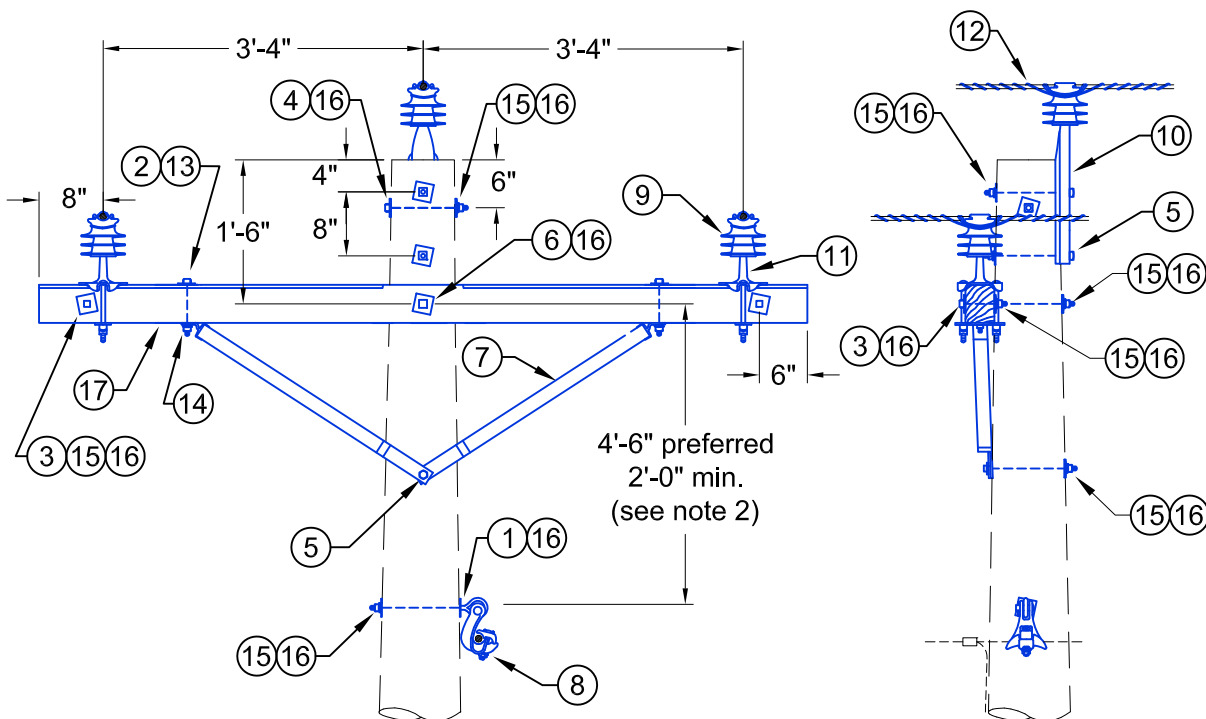
Ref	Material #	Description	A6.1B	A6.1T	ZA6.1B	ZA6.1T
1	6330516	Bolt, Da. 5/8" X 16"	1	1	1	1
2	6330524	Bolt, Da. 5/8" X 24"	3	3	3	3
3	6380512	Bolt, Machine 5/8" X 12"	1	1	1	1
4	7535168	Brace, Wood 60" (pair)	2	2	2	2
5	11723025	Clamp DE 4-2/0 ACSR	4	4	4	4
6	17010502	Con, Sicame TTD2710XFBTUNI	4	4	4	4
7	32000901	HNDX Pin Ins Poly 15 kV	4	4	2	2
7	32000903	HNDX Pin Ins Poly 35 kV			2	2
8	34283544	Ins, Susp Epox 35kV	2	2	2	2
9	42904063	Nut, Eye 5/8"	4	4	4	4
10	45412155	Pin Xarm 5/8" X 1"	4	4	4	4
11	55570000	Shackle Anchor	4	4	4	4
12	67110000	Tie Wire, Alum Ins No 4 Solid		16		16
12	67100000	Tie Wire, Alum No 4 Solid	32	16	32	16
13	71053063	Washer, Spring - 5/8"	8	8	8	8
14	71020451	Washer, Square, 2 1/4" X 13/16"	12	12	12	12
15	18210211	Xarm 5' 7" 3 3/4" X 4 3/4"	2	2	2	2

OVHD Three Phase Open Wire 08

- C1 Eight ft Crossarm, Tangent (Bare Wire Only)
- C1-1 Ten ft Crossarm, 4-position, Small Angle (0-15°) (Bare Wire Only)
- C2 Double Crossarm, Small Angle (0-15°)
- C2-1 Double Crossarm, 4-position, Medium Angle (0-35°)
- C2-2 Double Crossarm, 3-position, Medium Angle (0-35°)
- C2-3 Eight ft Double Alley Arm, Medium Angle (0-25°)
- C3 Vertical, Suspension Insulators, Medium Angle (20-60°)
- C4 Vertical, Double DE, Suspension Insulators, Large Angle (60-120°)
- C5 Braceless Crossarm, Single DE, 3-position
- C5-1 Three Phase Crossarm Construction Single DE, 4 position
Braceless Crossarm
- C6 Double Crossarm, Double DE, 3-position, Medium Angle (0-60°)
- C6-1 Braceless Crossarm, Double DE, Unbalanced Load, Medium
Angle (0-60°)
- C6-2 Ten ft Double Crossarm, Double DE, 4-position, Medium Angle
(0-45°)
- C6-3 Braceless Crossarm, Double DE, 10 ft. 4-position, Unbalanced
load, Medium Angle

Construction and Design Notes:

1. This assembly is approved for bare wire construction only.
2. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.

Design Limits:

Max. transverse load: 500 lbs. per conductor

Max. line angle:

1/0 & 336 ACSR (Bare): 2°

CONSTRUCTION ASSEMBLIES	
System Voltage	1/0 & 336 ACSR (Bare)
15 kV	C1.B
25/35 kV	ZC1.B



CONSTRUCTION STANDARDS

THREE-PHASE CROSSARM CONSTRUCTION
SINGLE 8 FT ARM, TANGENT (BARE WIRE ONLY)

Materials List for Assemblies

Descriptions

C1.B 3-Ph Tan Sgl 8' Xarm Bare Only 15 kV

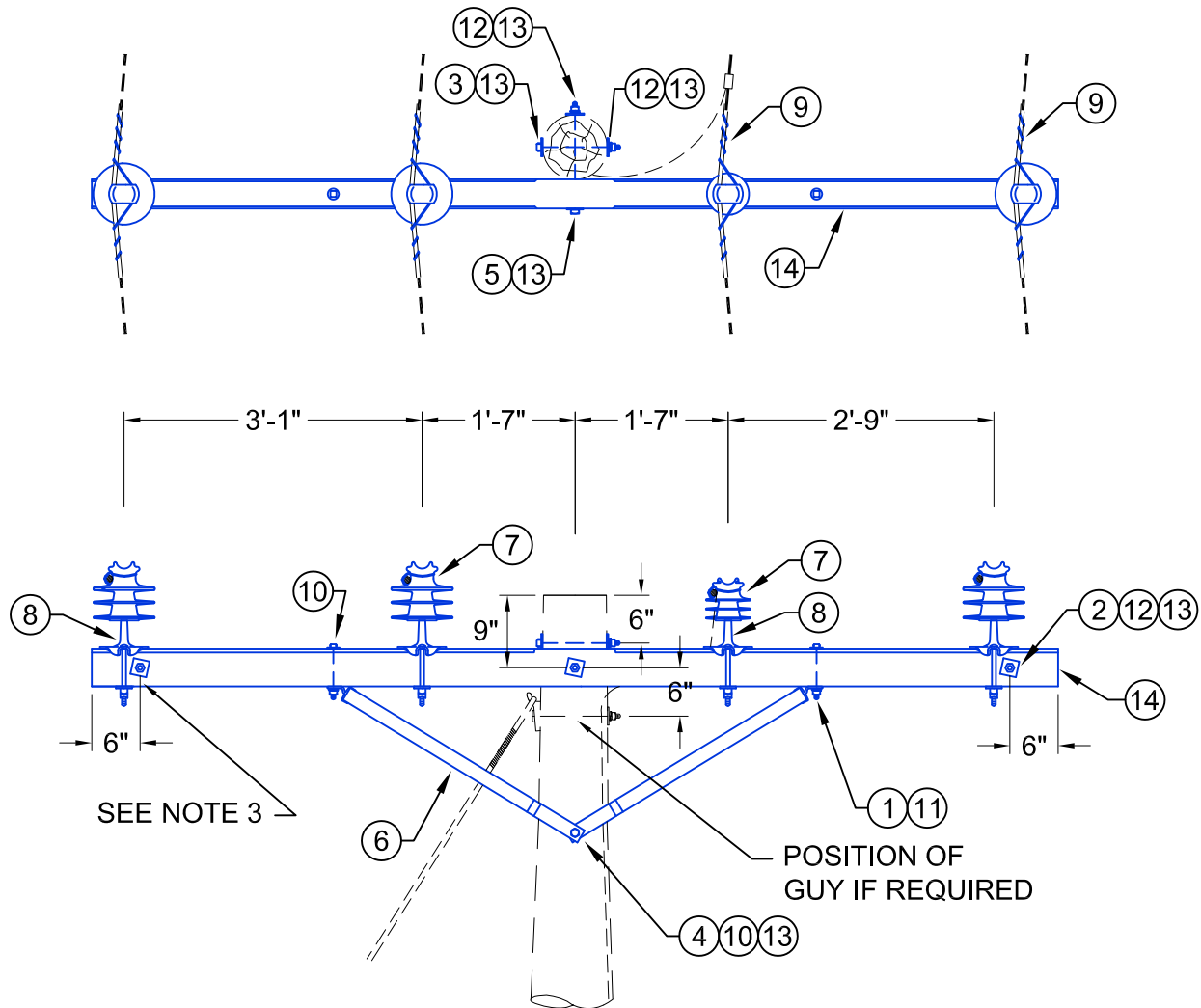
ZC1.B 3-Ph Tan Sgl 8' Xarm Bare Only 35 kV

Ref	Material #	Description	C1.B	ZC1.B
1	6361514	Bolt, Eye 5/8" x 14"	1	1
2	6380407	Bolt, Machine 1/2" x 7"	2	2
3	6380508	Bolt, Machine 5/8" x 8"	2	2
4	6380512	Bolt, Machine 5/8" x 12"	1	1
5	6380514	Bolt, Machine 5/8" x 14"	3	3
6	6380516	Bolt, Machine 5/8" x 16"	1	1
7	7535168	Brace: Wood 60" (Pair)	1	1
8	11744000	Clamp, Angle Suspension, Neutral	1	1
9	32000901	HNDX Pin Ins Poly 15 kV	3	
9	32000903	HNDX Pin Ins Poly 35 kV		3
10	45612120	Pin Pole Top 20" x 1"	1	
10	45612520	Pin Pole Top 20" Offset		1
11	45411155	Pins, Xarm Clamp Type 1"	2	2
12	67100000	Tie Wire, Alum. No 4 Solid	24	24
13	71035931	Washer, Round 5/8"	2	2
14	71053050	Washer, Spring - 1/2"	2	2
15	71053063	Washer, Spring - 5/8"	8	8
16	71020451	Washer, Square, 2 1/4" x 13/16"	13	13
17	18210311	Xarm 8' 3 3/4" x 4 3/4"	1	1

Construction and Design Notes:

1. This assembly is approved for bare wire construction only.
2. Phase conductors should be top-tied for line angles 2° or less.
3. On corners, position outer insulator pins 2" from split bolts on the outside of the line angle, as shown. On tangents, position outer insulator pins 2" inside of split bolts.

C1-1



Design Limits:

Max. transverse load: 1000 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare): $0 - 15^\circ$

336 ACSR (Bare): $0 - 10^\circ$

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 & 336 ACSR (Bare)
15 kV	C1-1.B
25/35 kV	ZC1-1.B



CONSTRUCTION STANDARDS
THREE PHASE CROSSARM CONSTRUCTION
SINGLE 10 FT ARM, 4-POSITION
SMALL ANGLE (BARE WIRE ONLY)

C1-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

C1-1.B 3-Ph Sgl 10' Xarm 4-Pos Bare 15 kV

ZC1-1.B 3-Ph Sgl 10' Xarm 4-Pos Bare 35 kV

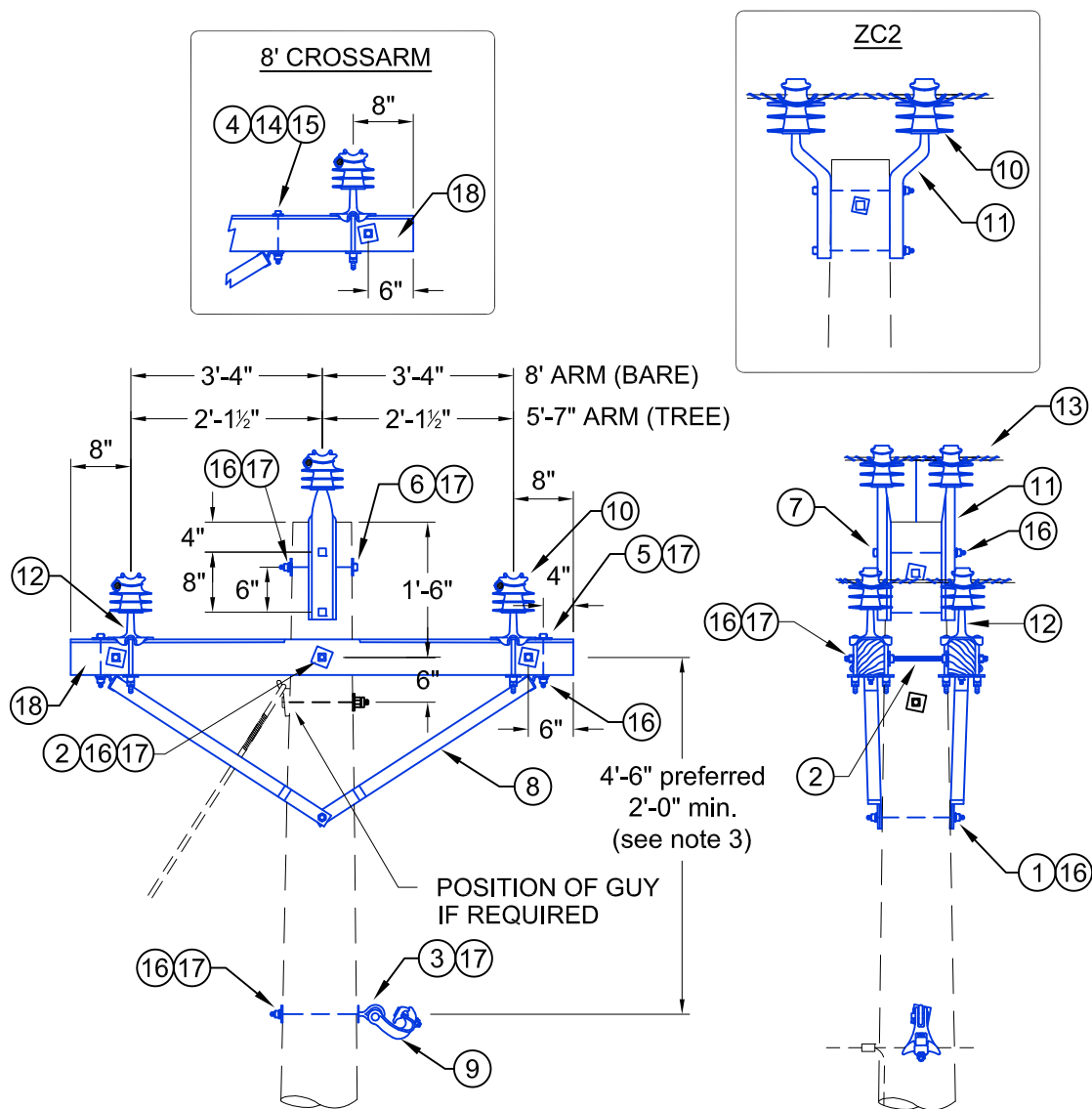
Ref	Material #	Description	C1-1.B	ZC1-1.B
1	6380407	Bolt, Machine 1/2" x 7"	2	2
2	6380508	Bolt, Machine 5/8" x 8"	2	2
3	6380512	Bolt, Machine 5/8" x 12"	1	1
4	6380514	Bolt, Machine 5/8" x 14"	1	1
5	6380516	Bolt, Machine 5/8" x 16"	1	1
6	7535168	Brace: Wood 60" (Pair)	1	1
7	32000901	HNDX Pin Ins Poly 15 kV	4	1
7	32000903	HNDX Pin Ins Poly 35 kV		3
8	45411155	Pins, Xarm Clamp Type 1"	4	4
9	67100000	Tie Wire Alum. Round	32	32
10	71035931	Washer, Round 5/8"	2	2
11	71053050	Washer, Spring - 1/2"	2	2
12	71053063	Washer, Spring - 5/8"	5	5
13	71020451	Washer, Square, 2 1/4" x 13/16"	9	9
14	18210511	Xarm 10' 3 3/4" x 4 3/4"	1	1



CONSTRUCTION STANDARDS
THREE-PHASE CROSSARM CONSTRUCTION
SINGLE 10 FT ARM, 4-POSITION, SMALL ANGLE
(BARE WIRE ONLY)

Construction and Design Notes:

1. This assembly is approved for all bare and tree wire construction.
2. Install 5/8" brace bolt in outside pin hole on 5'-7" arm.
3. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
4. Phase conductors should be top-tied for line angles 2° or less.

**Design Limits:**

Max. transverse load: 1000 lbs. per conductor

Max. line angle:

1/0 ACSR (Bare & Tree): 15°

336 ACSR (Bare & Tree): 10°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 & 336 ACSR (Bare)	1/0 & 336 ACSR (Tree)
15 kV	C2.8.B	C2.6.T
25/35 kV	ZC2.8.B	ZC2.6.T

**CONSTRUCTION STANDARDS**THREE-PHASE CROSSARM CONSTRUCTION
DOUBLE ARM, SMALL ANGLE**C2**

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

C2.6.T 3-Ph Dbl 6' Xarm, Sm Angle Tree 15 kV

C2.8.B 3-Ph Dbl 8' Xarm, Sm Angle Bare 15 kV

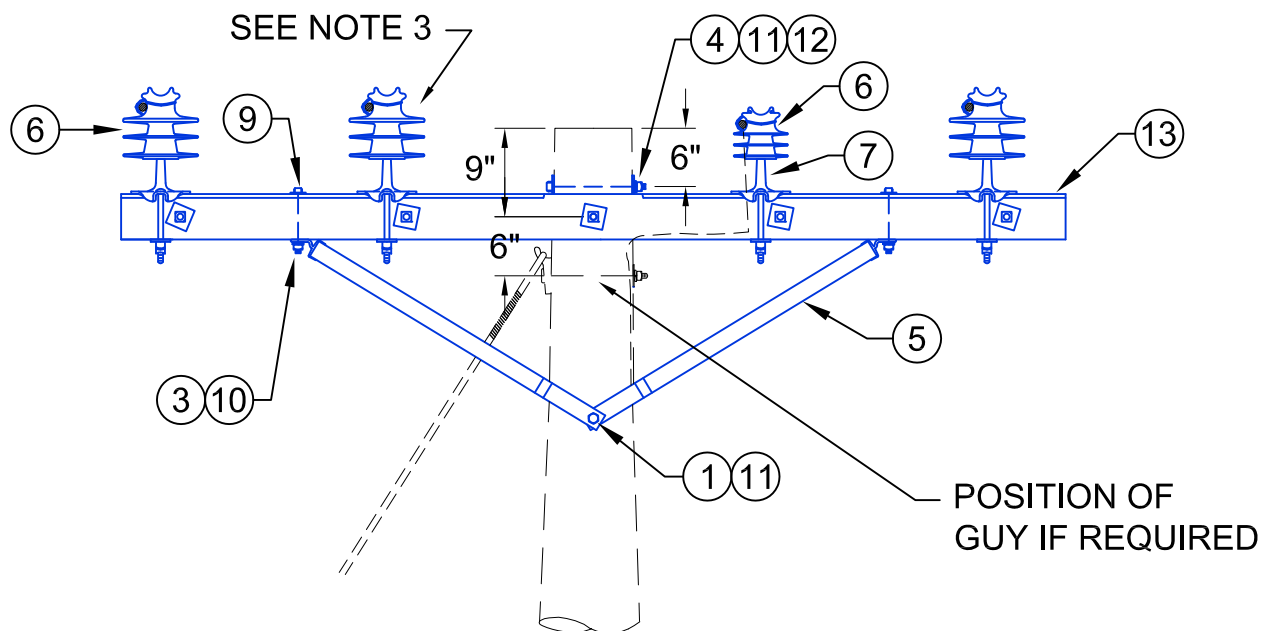
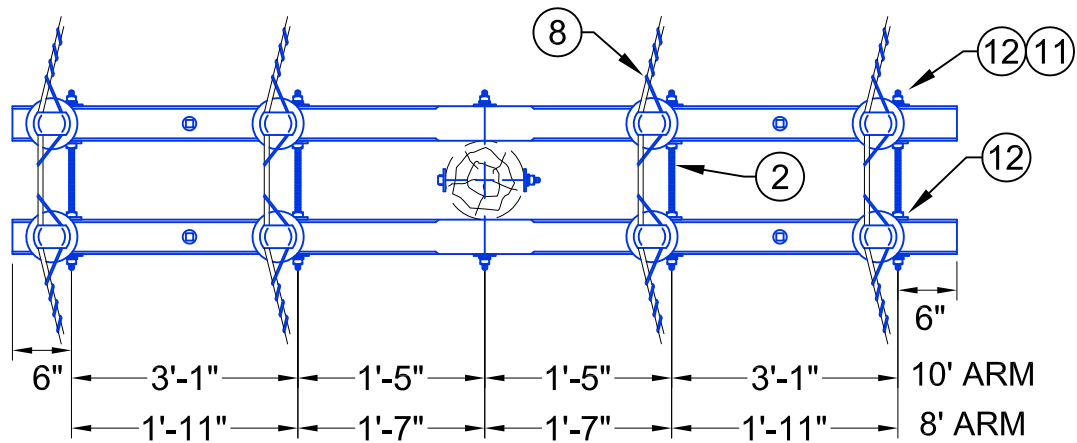
ZC2.6.T 3-Ph Dbl 6' Xarm, Sm Angle Tree 35 kV

ZC2.8.B 3-Ph Dbl 8' Xarm, Sm Angle Bare 35 kV

Ref	Material #	Description	C2.6.T	C2.8.B	ZC2.6.T	ZC2.8.B
1	6330516	Bolt, Da. 5/8" x 16"	1	1	1	1
2	6330524	Bolt, Da. 5/8" x 24"	3	3	3	3
3	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1
4	6380407	Bolt, Machine 1/2" x 7"		4		4
5	6380507	Bolt, Machine 5/8" x 7"	4		4	
6	6380512	Bolt, Machine 5/8" x 12"	1	1	1	1
7	6380514	Bolt, Machine 5/8" x 14"	2	2	2	2
8	7535168	Brace: Wood 60" (Pair)	2	2	2	2
9	11744000	Clamp, Susp/Angle Alum	1	1	1	1
10	32000901	HNDX Pin Ins Poly 15 kV	6	6		
10	32000903	HNDX Pin Ins Poly 35 kV			6	6
11	45612120	Pin Pole Top 20" x 1"	2	2		
11	45612520	Pin Pole Top 20" x 1" Offset			2	2
12	45411155	Pins, Xarm Clamp Type 1"	4	4	4	4
13	67100000	Tie Wire, Alum. No 4 Solid		48		48
13	67110000	Tie Wire, Alum. Ins No 4 Solid	48		48	
14	71035931	Washer, Round 5/8"		4		4
15	71053050	Washer, Spring - 1/2"		4		4
16	71053063	Washer, Spring - 5/8"	16	12	16	12
17	71020451	Washer, Square, 2 1/4" x 13/16"	18	14	18	14
18	18210211	Xarm 5' 7" 3 5/8" x 4 5/8"	2		2	
18	18210311	Xarm 8' 3 3/4" x 4 3/4"		2		2

Construction and Design Notes:

1. This assembly is not approved for off-road construction.
2. Phase conductors should be top-tied for line angles 2° or less.
3. On corners, position insulator pins 2" from D.A. bolts on the outside of the line angle, as shown. On tangents, position outer insulator pins 2" inside of D.A. bolts.

Design Limits:

Max. transverse load: 2000 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare & Tree): 0 - 35°

336 ACSR (Bare & Tree): 0 - 25°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 & 336 ACSR (Bare)	1/0 & 336 ACSR (Tree)
15 kV	C2-1.10.B	C2-1.8.T
25/35 kV	ZC2-1.10.B	ZC2-1.8.T



CONSTRUCTION STANDARDS

THREE PHASE CROSSARM CONSTRUCTION
DOUBLE ARM, 4-POSITION, MEDIUM ANGLE

C2-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

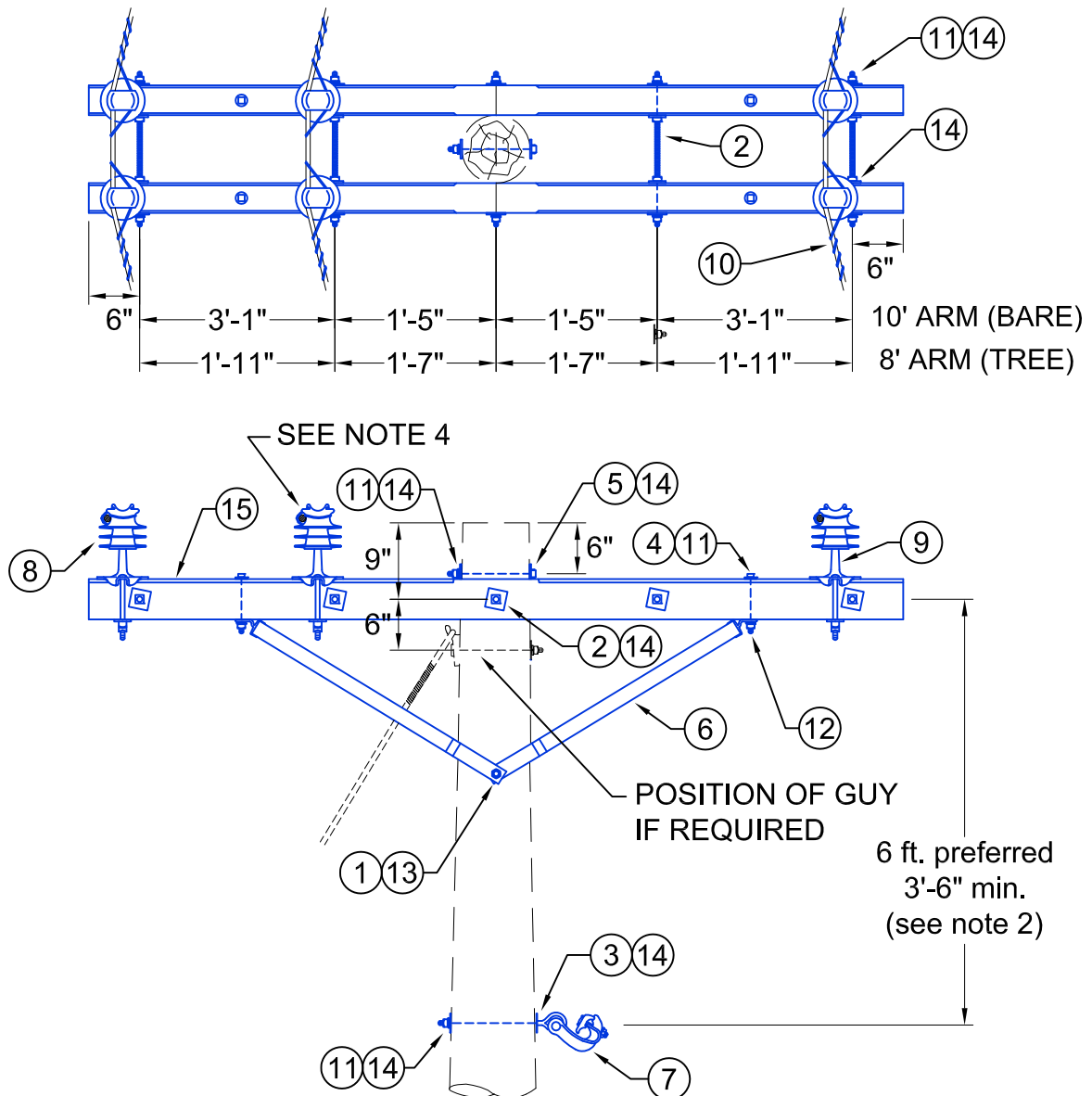
C2-1.10.B	3-Ph Dbl 10' Xarm 4-Pos Bare 15 kV
ZC2-1.10.B	3-Ph Dbl 10' Xarm 4-Pos Bare 35 kV
C2-1.8.T	3-Ph Dbl 8' Xarm 4-Pos Tree 15 kV
ZC2-1.8.T	3-Ph Dbl 8' Xarm 4-Pos Tree 35 kV

Ref	Material #	Description	C2-1.10.B	ZC2-1.10.B	C2-1.8.T	ZC2-1.8.T
1	6330516	Bolt, Da 5/8" x 16"	1	1	1	1
2	6330524	Bolt, Da. 5/8" x 24"	5	5	5	5
3	6380407	Bolt, Machine 1/2" x 7"	4	4	4	4
4	6380512	Bolt, Machine 5/8" x 12"	1	1	1	1
5	7535168	Brace: Wood 60" (Pair)	2	2	2	2
6	32000901	HNDX Pin Ins Poly 15 kV	8	2	8	2
6	32000903	HNDX Pin Ins Poly 35 kV		6		6
7	45411155	Pins, Xarm Clamp Type 1"	8	8	8	8
8	67100000	Tie Wire, Alum No 4 Solid	64	64	16	16
8	67110000	Tie Wire, Alum Ins No 4 Solid			48	48
9	71035931	Washer, Round 5/8"	4	4	4	4
10	71053050	Washer, Spring – 1/2"	4	4	4	4
11	71053063	Washer, Spring – 5/8"	13	13	13	13
12	71020451	Washer, Square, 2 1/4" x 13/16"	20	20	20	20
13	18210511	Xarm 10' 3 3/4" x 4 3/4"	2	2		
13	18210311	Xarm 8' 3 3/4" x 4 3/4"			2	2

Construction and Design Notes:

C2-2

1. This assembly is not approved for off-road construction.
2. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
3. Phase conductors should be top-tied for line angles 2° or less.
4. On corners, position insulator pins 2" from D.A. bolts on the outside of the line angle, as shown. On tangents, position outer insulator pins 2" inside of D.A. bolts.



Design Limits:

Max. transverse load: 2000 lbs. per conductor

Max. line angle:

1/0 ACSR (Bare & Tree): 35°

336 ACSR (Bare & Tree): 25°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 & 336 ACSR (Bare)	1/0 & 336 ACSR (Tree)
15 kV	C2-2.10.B	C2-2.8.T
25/35 kV	ZC2-2.10.B	ZC2-2.8.T



CONSTRUCTION STANDARDS

THREE-PHASE CROSSARM CONSTRUCTION
DOUBLE ARM, 3-POSITION, MEDIUM ANGLE

C2-2

ISSUE DATE: 05/16

Materials List for Assemblies

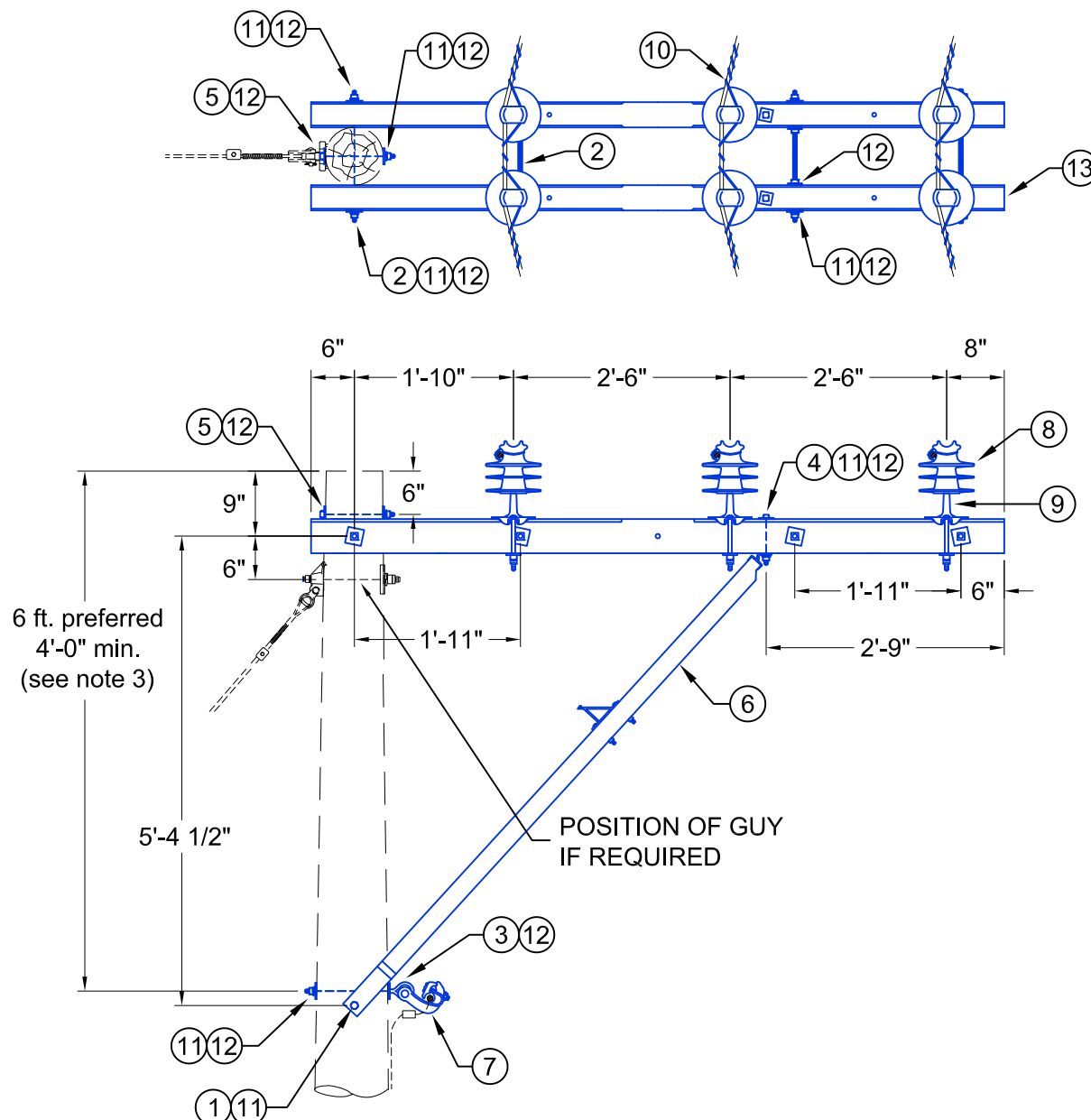
Descriptions

C2-2.8.T 3-Ph Dbl 8' Xarm, 3 Position Med Angle Tree 15 kV
 C2-2.10B 3-Ph Dbl 10' Xarm, 3 Position Med Angle Bare 15 kV
 ZC2-2.8.T 3-Ph Dbl 8' Xarm, 3 Position Med Angle Tree 35 kV
 ZC2-2.10B 3-Ph Dbl 10' Xarm, 3 Position Med Angle Bare 35 kV

Ref	Material #	Description	C2-2.8.T	C2-2.10.B	ZC2-2.8.T	ZC2-2.10.B
1	6330516	Bolt, Da 5/8" x 16"	1	1	1	1
2	6330524	Bolt, Da. 5/8" x 24"	5	5	5	5
3	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1
4	6380407	Bolt, Machine 1/2" x 7"	4	4	4	4
5	6380512	Bolt, Machine 5/8" x 12"	1	1	1	1
6	7535168	Brace, Wood 60" (Pair)	2	2	2	2
7	11744000	Clamp, Susp/Angle Alum	1	1	1	1
8	32000901	HNDX Pin Ins Poly 15 kV	6	6		
8	32000903	HNDX Pin Ins Poly 35 kV			6	6
9	45411155	Pins, Xarm Clamp Type 1"	6	6	6	6
10	67100000	Tie Wire, Alum. No 4 Solid		48		48
10	67110000	Tie Wire, Alum Ins No 4 Solid	48		48	
11	71035931	Washer, Round - 5/8"	4	4	4	4
12	71053050	Washer, Spring - 1/2"	4	4	4	4
13	71053063	Washer, Spring - 5/8"	14	14	14	14
14	71020451	Washer, Square, 2 1/4" x 13/16"	22	22	22	22
15	18210311	Xarm 8' 3 3/4" x 4 3/4"	2		2	
15	18210511	Xarm 10' 3 3/4" x 4 3/4"		2		2

Construction and Design Notes:

1. This assembly is not approved for off-road construction.
2. Phase conductors should be top-tied for line angles 2° or less.
3. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.

Design Limits:

Max. transverse load: 1500 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare & Tree): $0 - 25^\circ$

336 ACSR (Bare & Tree): $0 - 20^\circ$

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 & 336 ACSR (Bare)	1/0 & 336 ACSR (Tree)
15 kV	C2-3.B	C2-3.T
25/35 kV	ZC2-3.B	ZC2-3.T



CONSTRUCTION STANDARDS

THREE-PHASE CROSSARM CONSTRUCTION
DOUBLE ALLEYARM, 8 FT CROSSARM

Materials List for Assemblies

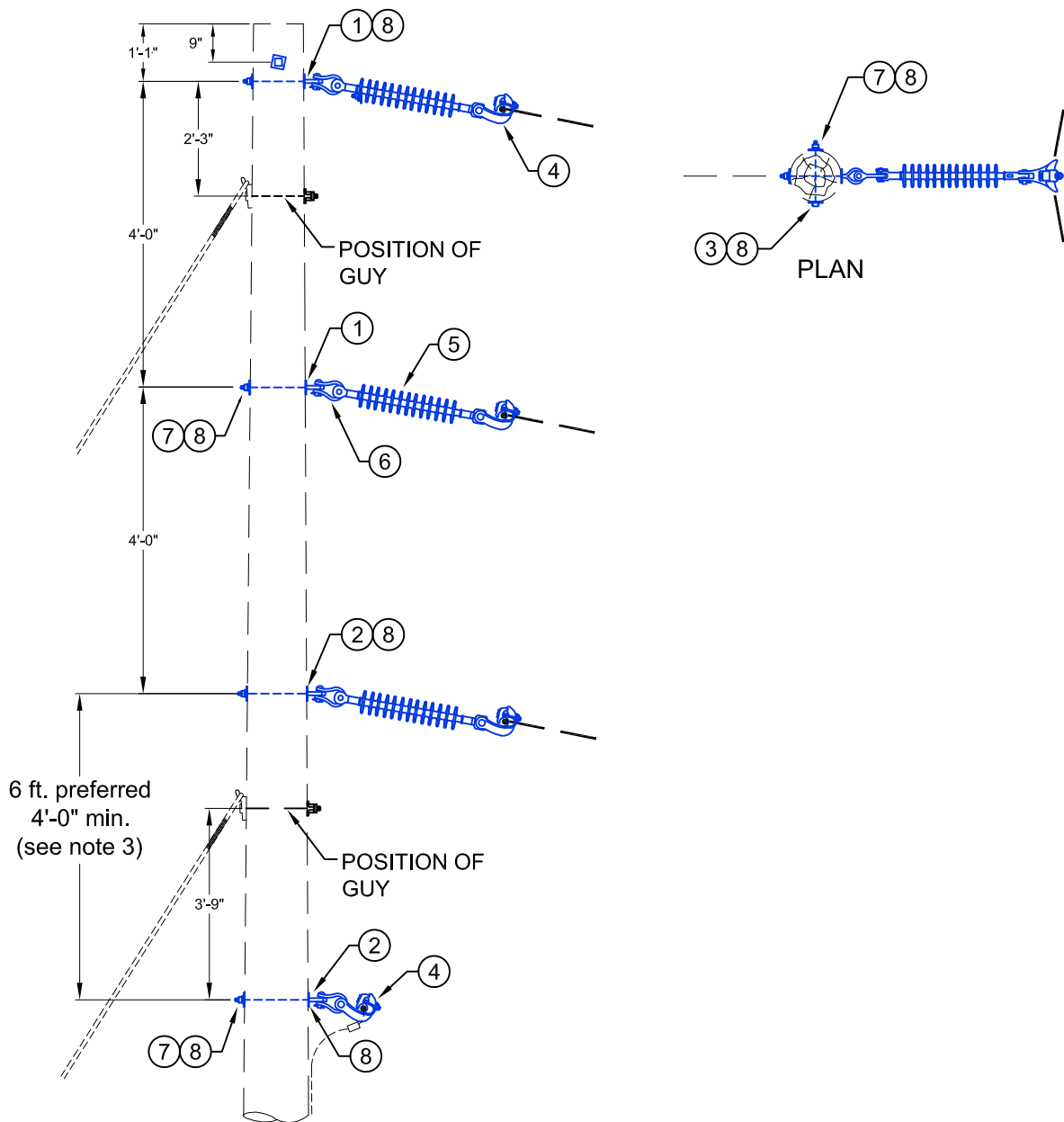
Descriptions

C2-3.B 3-Ph Dbl 8' Alley Arm Bare 15 kV
 ZC2-3.B 3-Ph Dbl 8' Alley Arm Bare 35 kV
 C2-3.T 3-Ph Dbl 8' Alley Arm Tree 15 kV
 ZC2-3.T 3-Ph Dbl 8' Alley Arm Tree 35 kV

Ref	Material #	Description	C2-3.B	ZC2-3.B	C2-3.T	ZC2-3.T
1	6330516	Bolt, DA. 5/8" x 16"	1	1	1	1
2	6330524	Bolt, DA. 5/8" x 24"	4	4	4	4
3	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1
4	6380507	Bolt, Machine 5/8" x 7"	2	2	2	2
5	6380512	Bolt, Machine 5/8" x 12"	1	1	1	1
6	7553200	Brace: Wood Diagonal 7'	2	2	2	2
7	11744000	Clamp, Susp/Angle Alum	1	1	1	1
8	32000901	HNDX Pin Ins Poly 15 kV	6		6	
8	32000903	HNDX Pin Ins Poly 35 kV		6		6
9	45411155	Pins, Xarm Clamp Type 1"	6	6	6	6
10	67100000	Tie Wire, Alum No 4 Solid	48	48		
10	67110000	Tie Wire, Alum Ins No 4 Solid			48	48
11	71053063	Washer, Spring – 5/8"	14	14	14	14
12	71020451	Washer, Square, 2 1/4" x 13/16"	20	20	20	20
13	18210311	Xarm 8' 3 3/4" x 4 3/4"	2	2	2	2

Construction and Design Notes:

- 1. This assembly is approved for line angles from 20° - 60° for both bare and tree wire construction at all voltages.
- 2. Do not strip insulation when clamping covered phase conductors.
- 3. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.



Design Limits:

Max. transverse load: 4000 lbs. per conductor
Max. line angle within load limits: 20°-60°

CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 ACSR(Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C3.0	
25/35 kV		



Materials List for Assemblies

Descriptions

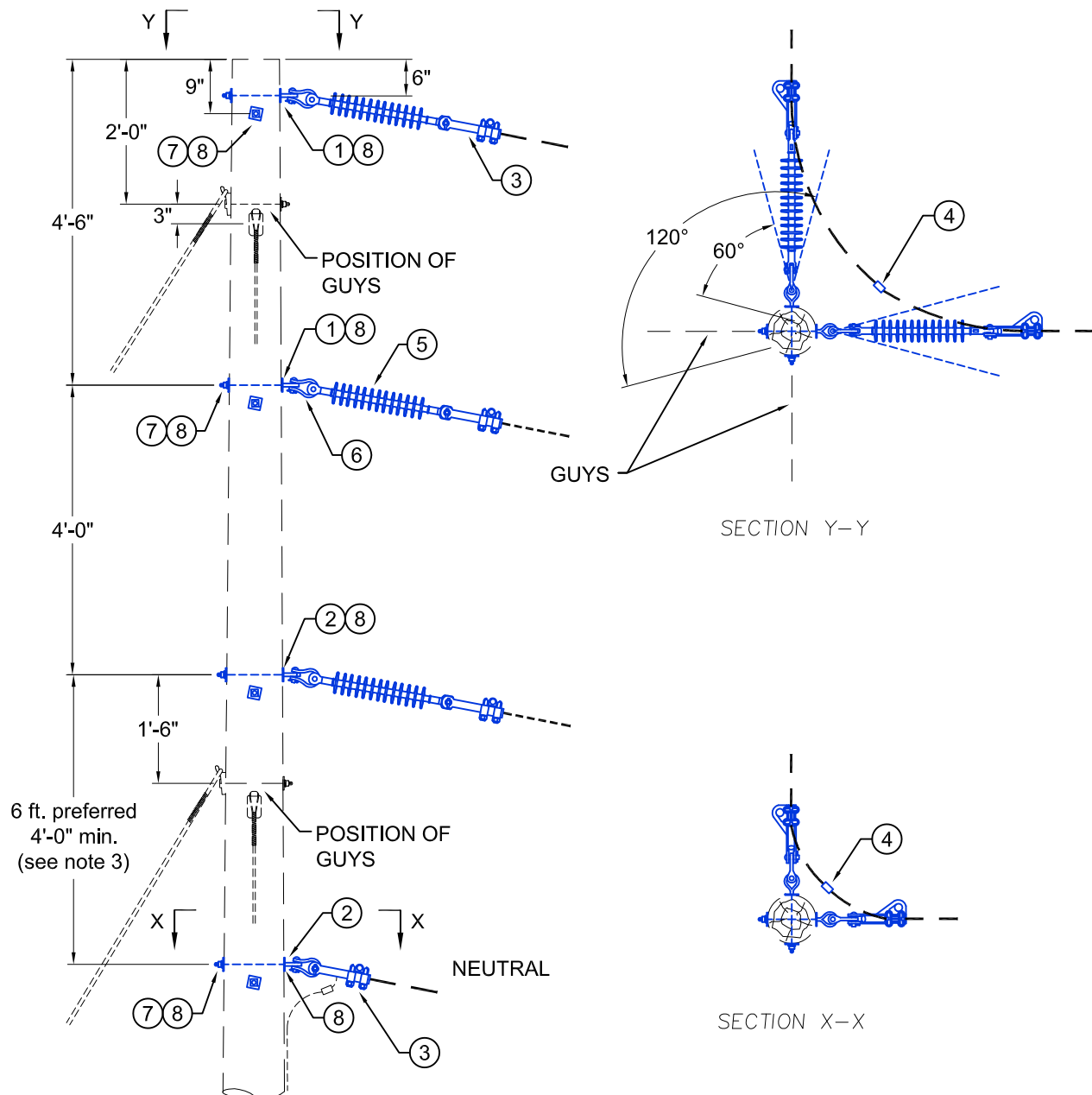
C3.0 3-Ph Vert Med Angle (20-60°)

Ref	Material #	Description	C3.0
1	6361512	Bolt, Eye 5/8" x 12"	2
2	6361514	Bolt, Eye 5/8" x 14"	2
3	6380512	Bolt, Machine 5/8" x 12"	1
4	11744000	Clamp, Susp/Angle Alum	4
5	34283544	Ins, Susp Epox 35kV	3
6	55570000	Shackle Anchor	4
7	71053063	Washer, Spring - 5/8"	5
8	71020451	Washer, Square, 2 1/4" x 13/16"	10

Construction and Design Notes:

C4

1. This assembly is approved for line angles from 60° - 120° for both bare and tree wire construction at all voltages.
2. The insulation must be stripped when clamping covered phase conductors.
3. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR(Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C4.1	C4.3
25/35 kV		



CONSTRUCTION STANDARDS

THREE PHASE VERTICAL CONSTRUCTION
DOUBLE DEADEND, LARGE ANGLE (60° - 120°)

C4

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

C4.1 3-Ph Vert Dbl DE, Large Angle (60-120°) 1/0

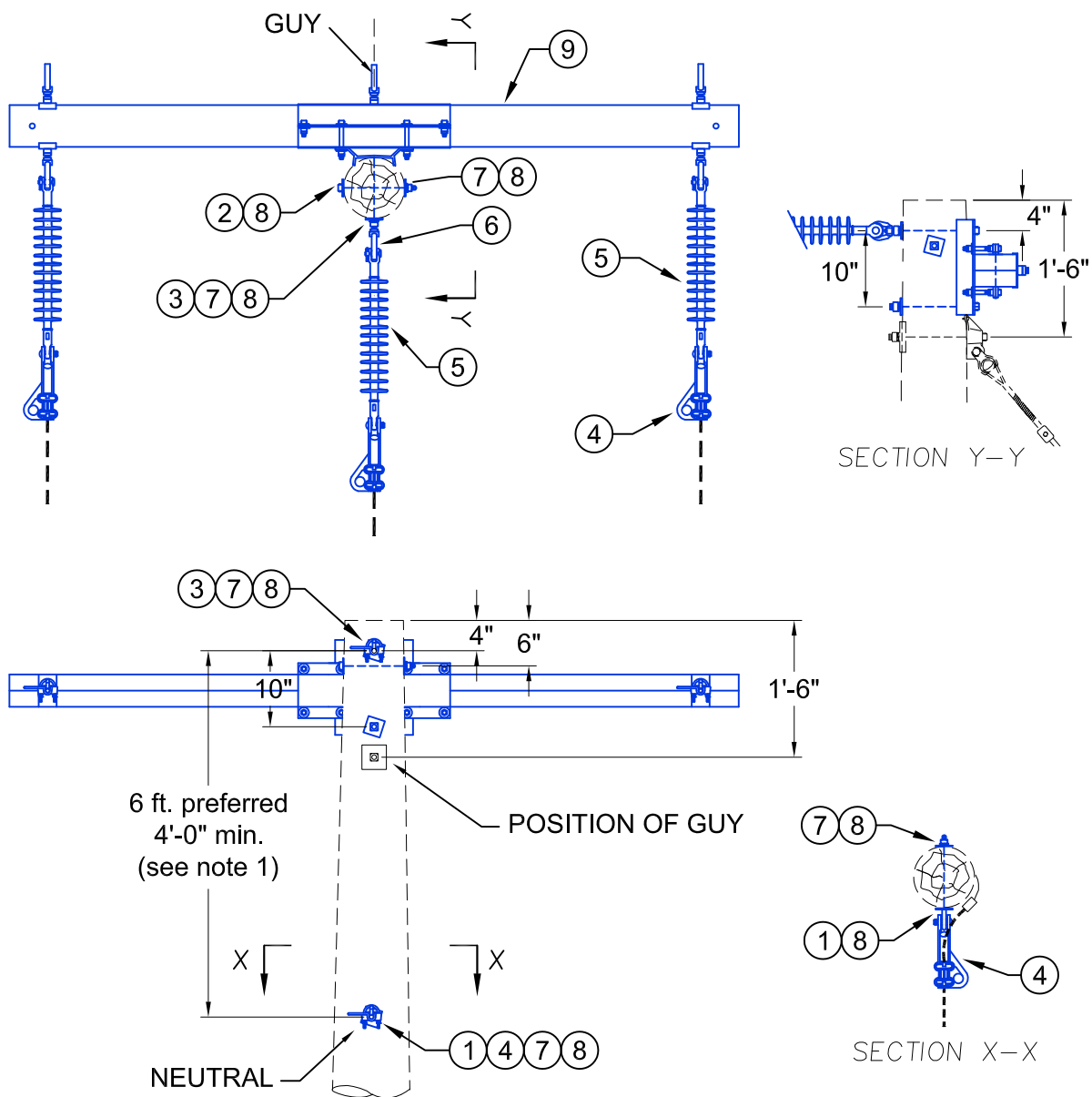
C4.3 3-Ph Vert Dbl DE, Large Angle (60-120°) 336

Ref	Material #	Description	C4.1	C4.3
1	6361512	Bolt, Eye 5/8" x 12"	4	4
2	6361514	Bolt, Eye 5/8" x 14"	4	4
3	11723025	Clamp DE 4-2/0 ACSR	8	
3	11723040	Clamp DE 3/0-477 ACSR		8
4	17010502	Con, Sicame TTD2710XFBTUNI	4	
4	17010502	Con, Sicame TTD2710XFBTUNI		1
4	17010520	Con, Sicame TTD4010XFBT		3
5	34283544	Ins, Susp Epox 35 kV	6	6
6	55570000	Shackle Anchor	8	8
7	71053063	Washer, Spring - 5/8"	8	8
8	71020451	Washer, Square, 2 1/4" x 13/16"	16	16

Construction and Design Notes:

C5

1. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C5.1	C5.3
25/35 kV		



CONSTRUCTION STANDARDS

THREE PHASE CROSSARM CONSTRUCTION
SINGLE DEADEND, BRACELESS CROSSARM

C5

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

C5.1 3-Ph Sgl DE Braceless 1/0

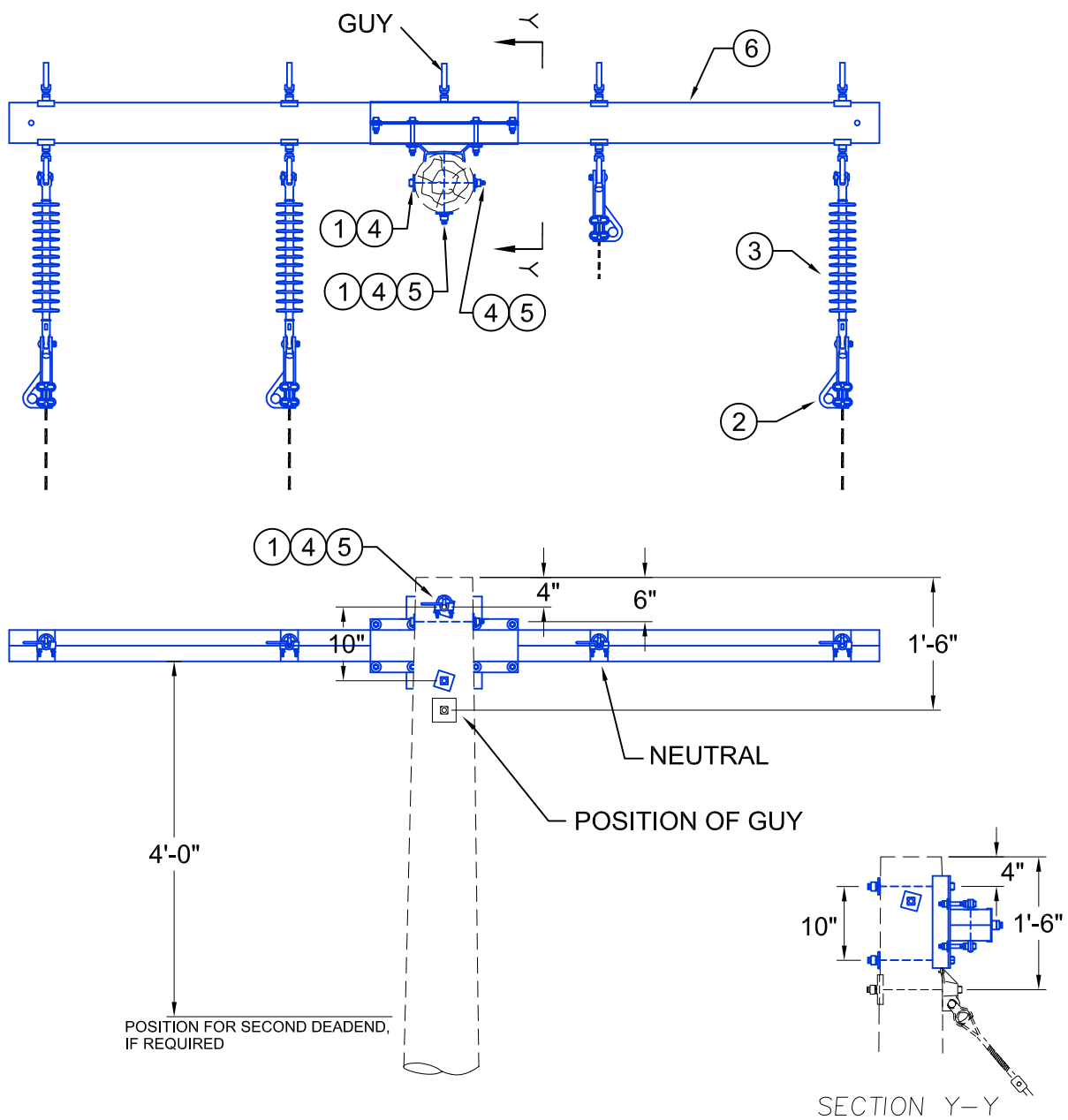
C5.3 3-Ph Sgl DE Braceless 336

Ref	Material #	Description	C5.1	C5.3
1	6361514	Bolt, Eye 5/8" x 14"	1	1
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	6380514	Bolt, Machine 5/8" x 14"	2	2
4	11723025	Clamp DE 4-2/0 ACSR	4	
4	11723033	Clamp DE 4/0-336.4 ACSR		4
5	34283544	Ins, Susp Epox 35kV	3	3
6	42904063	Nut, Eye 5/8"	1	1
7	71053063	Washer, Spring – 5/8"	4	4
8	71013040	Washer, Square Curved, 4"x4"x 3/16"	6	6
9	18217811	Xarm, Braceless Deadend 8'	1	1

Construction and Design Notes:

1. Not approved for Hendrix spacer cable.

C5-1



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C5-1.1	C5-1.3
25/35 kV		

CONSTRUCTION STANDARDS

THREE PHASE CROSSARM CONSTRUCTION
SINGLE DEADEND, 4 POSITION BRACELESS CROSSARM

C5-1

ISSUE DATE: 05/16



Materials List for Assemblies

Descriptions

C5-1.1 3-Ph Sgl DE 4 Position Braceless 1/0

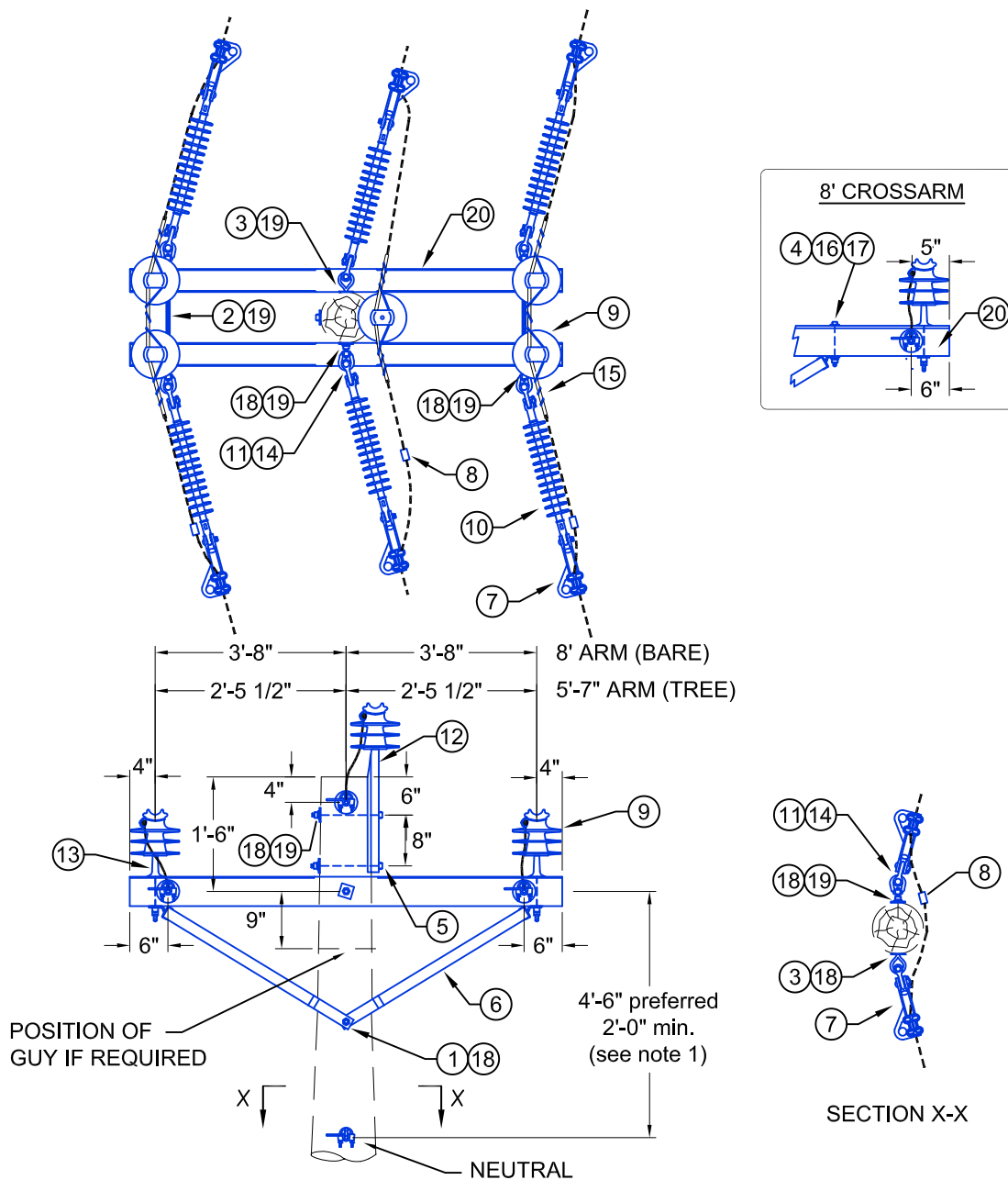
C5-1.3 3-Ph Sgl DE 4 Position Braceless 336

Ref	Material #	Description	C5-1.1	C5-1.3
1	6380616	Bolt, Machine 3/4" x 16"	3	3
2	11723025	Clamp DE 4-2/0 ACSR	4	
2	11723033	Clamp DE 4/0-336.4 ACSR		4
3	34283544	Ins, Susp Epox 35kV	3	3
4	71013040	Washer, Square Curved, 4"x4"x 3/16"	4	4
5	71053075	Washer, Spring – 3/4"	3	3
6	18200912	Xarm, Hughes Assy 10'	1	1

Construction and Design Notes:

C6

1. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.
2. Phase conductor should be top-tied for angles 2° or less.



Design Limits:

Max. transverse load: 3000 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare & Tree): 0 - 60°

336 ACSR (Bare & Tree): 0 - 50°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C6.8.1B C6.6.1T	C6.8.3B C6.6.3T
25/35 kV	ZC6.8.1B ZC6.6.1T	ZC6.8.3B ZC6.6.3T



CONSTRUCTION STANDARDS
THREE PHASE CROSSARM CONSTRUCTION
DOUBLE DEADEND, DOUBLE CROSSARM

C6

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

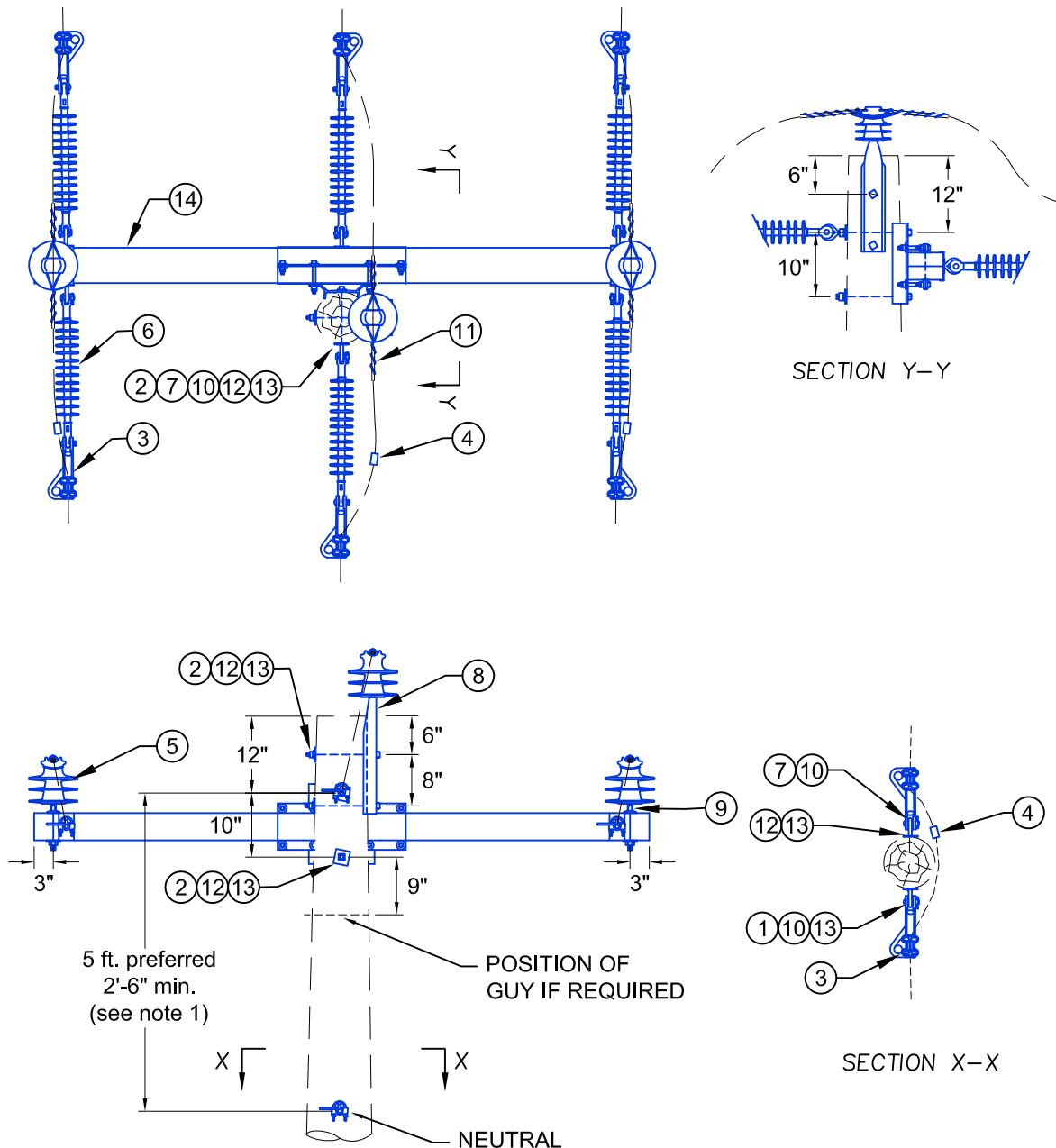
C6.6.1T	3-Ph Dbl DE 6' Xarm 1/0 Tree 15 kV
C6.6.3T	3-Ph Dbl DE 6' Xarm 336 Tree 15 kV
ZC6.6.1T	3-Ph Dbl DE 6' Xarm 1/0 Tree 35 kV
ZC6.6.3T	3-Ph Dbl DE 6' Xarm 336 Tree 35 kV
C6.8.1B	3-Ph Dbl DE 8' Xarm 1/0 Bare 15 kV
C6.8.3B	3-Ph Dbl DE 8' Xarm 336 Bare 15 kV
ZC6.8.1B	3-Ph Dbl DE 8' Xarm 1/0 Bare 35 kV
ZC6.8.3B	3-Ph Dbl DE 8' Xarm 336 Bare 35 kV

Ref	Material #	Description	C6.6.1T	C6.6.3T	ZC6.6.1T	ZC6.6.3T	C6.8.1B	C6.8.3B	ZC6.8.1B	ZC6.8.3B
1	6330516	Bolt, DA. 5/8" x 16"	1	1	1	1	1	1	1	1
2	6330524	Bolt, DA. 5/8" x 24"	3	3	3	3	3	3	3	3
3	6361514	Bolt, Eye 5/8" x 14"	2	2	2	2	2	2	2	2
4	6380407	Bolt, Machine 1/2" x 7"	4	4	4	4	4	4	4	4
5	6380514	Bolt, Machine 5/8" x 14"	2	2	2	2	2	2	2	2
6	7535168	Brace, Wood 60" (Pair)	2	2	2	2	2	2	2	2
7	11723025	Clamp DE 4-2/0 ACSR	8		8		8		8	
7	11723040	Clamp DE 4/0-336.4 ACSR		8		8		8		8
8	17010502	Con, Sicame TTD2710XFBTUNI	4		4		4		4	
8	17010502	Con, Sicame TTD2710XFBTUNI		1		1		1		1
8	17010520	Con, Sicame TTD4010XFBT		3		3		3		3
9	32000901	HNDX Pin Ins Poly 15 kV	5	5			5	5		
9	32000903	HNDX Pin Ins Poly 35 kV			5	5			5	5
10	34283544	Ins, Susp Epox 35kV	6	6	6	6	6	6	6	6
11	42904063	Nut, Eye 5/8"	6	6	6	6	6	6	6	6
12	45612120	Pin Pole Top 20" x 1"	1	1	1	1	1	1	1	1
13	45412155	Pins Xarm 5/8" x 1"	4	4	4	4	4	4	4	4
14	55570000	Shackle Anchor	8	8	8	8	8	8	8	8
15	67100000	Tie Wire, Alum No 4 Solid					60	60	60	60
15	67110000	Tie Wire, Alum Ins No 4 Solid	60	60	60	60				
16	71035931	Washer, Round 5/8"	4	4	4	4	4	4	4	4
17	71053050	Washer, Spring - 1/2"	4	4	4	4	4	4	4	4
18	71053063	Washer, Spring - 5/8"	12	12	12	12	12	12	12	12
19	71020451	Washer, Square, 2 1/4" x 13/16"	16	16	16	16	16	16	16	16
20	18210211	Xarm 5'7" 3 5/8" x 4 5/8"	2	2	2	2				
20	18210311	Xarm 8' 3 3/4" x 4 3/4"					2	2	2	2

Construction and Design Notes:

1. This assembly is approved for all unbalanced conductor loading only.
2. Construction on existing poles where the neutral spacing is less than the minimum shown shall require replacement with a taller pole.

C6-1



Design Limits:

Max. transverse load: 3000 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare & Tree): 0 - 60°

336 ACSR (Bare & Tree): 0 - 50°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C6-1.1B C6-1.1T	C6-1.3B C6-1.3T
25/35 kV	ZC6-1.1B ZC6-1.1T	ZC6-1.3B ZC6-1.3T



CONSTRUCTION STANDARDS

THREE PHASE CROSSARM CONSTRUCTION
DOUBLE DEADEND, UNBALANCED LOAD

C6-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

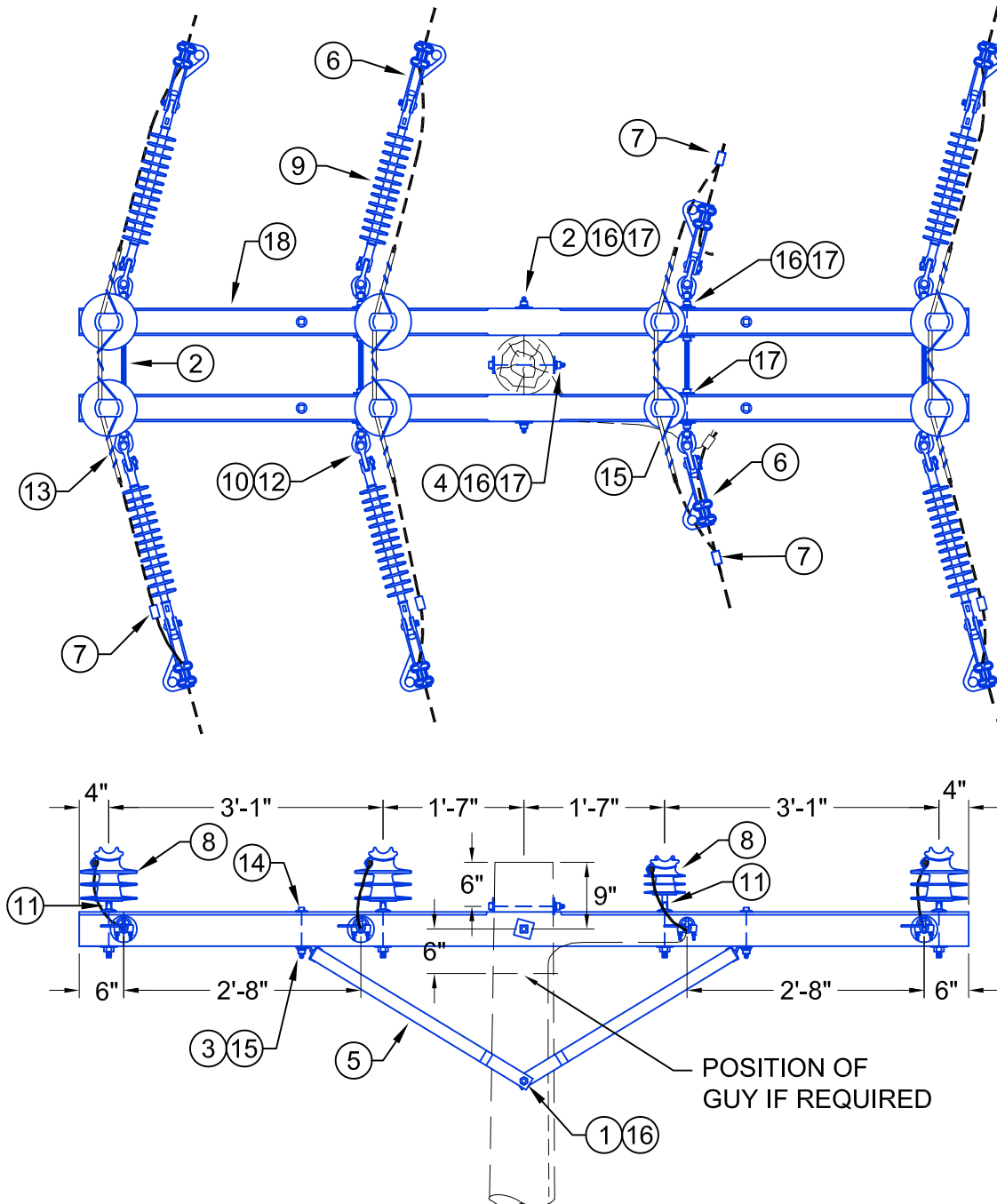
C6-1.1B	3-Ph Dbl DE w/Unbalanced Load 1/0 Bare 15 kV
C6-1.1T	3-Ph Dbl DE w/Unbalanced Load 1/0 Tree 15 kV
C6-1.3B	3-Ph Dbl DE w/Unbalanced Load 336 Bare 15 kV
C6-1.3T	3-Ph Dbl DE w/Unbalanced Load 336 Tree 15 kV
ZC6-1.1B	3-Ph Dbl DE w/Unbalanced Load 1/0 Bare 35 kV
ZC6-1.1T	3-Ph Dbl DE w/Unbalanced Load 1/0 Tree 35 kV
ZC6-1.3B	3-Ph Dbl DE w/Unbalanced Load 336 Bare 35 kV
ZC6-1.3T	3-Ph Dbl DE w/Unbalanced Load 336 Tree 35 kV

Ref	Material #	Description	C6-1.1B	C6-1.1T	C6-1.3B	C6-1.3T	ZC6-1.1B	ZC6-1.1T	ZC6-1.3B	ZC6-1.3T
1	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1	1	1	1	1
2	6380514	Bolt, Machine 5/8" x 14"	4	4	4	4	4	4	4	4
3	11723025	Clamp DE 4-2/0 ACSR	8	8			8	8		
3	11723040	Clamp, DE 3/0- 477 ACSR, Straight			8	8			8	8
4	17010502	Con, Sicame TTD2710XFBTUNI	4	4			4	4		
4	17010502	Con, Sicame TTD2710XFBTUNI			1	1			1	1
4	17010520	Con, Sicame TTD4010XFBT			3	3			3	3
5	32000901	HNDX Pin Ins Poly 15kV	3	3	3	3				
5	32000903	HNDX Pin Ins Poly 35kV					3	3	3	3
6	34283544	Ins, Susp Epox 35kV	6	6	6	6	6	6	6	6
7	42904063	Nut, Eye 5/8"	2	2	2	2	2	2	2	2
8	45612120	Pin Pole Top 20" x 1"	1	1	1	1	1	1	1	1
9	45412155	Pin Xarm 5/8" x 1"	2	2	2	2	2	2	2	2
10	55570000	Shackle Anchor	8	8	8	8	8	8	8	8
11	67100000	Tie Wire, Alum. No 4 Solid	24		24		24		24	
11	67110000	Tie Wire, Alum. Ins No 4 Solid		24		24		24		24
12	71053063	Washer, Spring – 5/8"	5	5	5	5	5	5	5	5
13	71013040	Washer, Square Curved, 4"x4"x 3/16"	6	6	6	6	6	6	6	6
14	18217811	Xarm, Braceless Deadend 8'	1	1	1	1	1	1	1	1

Construction and Design Notes:

1. This assembly is not approved for off-road construction or in areas not accessible by a bucket truck.
2. Phase conductor should be top-tied for angles 2° or less.

C6-2



Design Limits:

Max. transverse load: 2500 lbs. per conductor

Min - Max. line angle: $0 - 45^\circ$

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C6-2.1B C6-2.1T	C6-2.3B C6-2.3T
25/35 kV	ZC6-2.1B ZC6-2.1T	ZC6-2.3B ZC6-2.3T



CONSTRUCTION STANDARDS
THREE PHASE CROSSARM CONSTRUCTION
DOUBLE DEADEND, 10 FT DOUBLE CROSSARM, 4-POSITION

C6-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

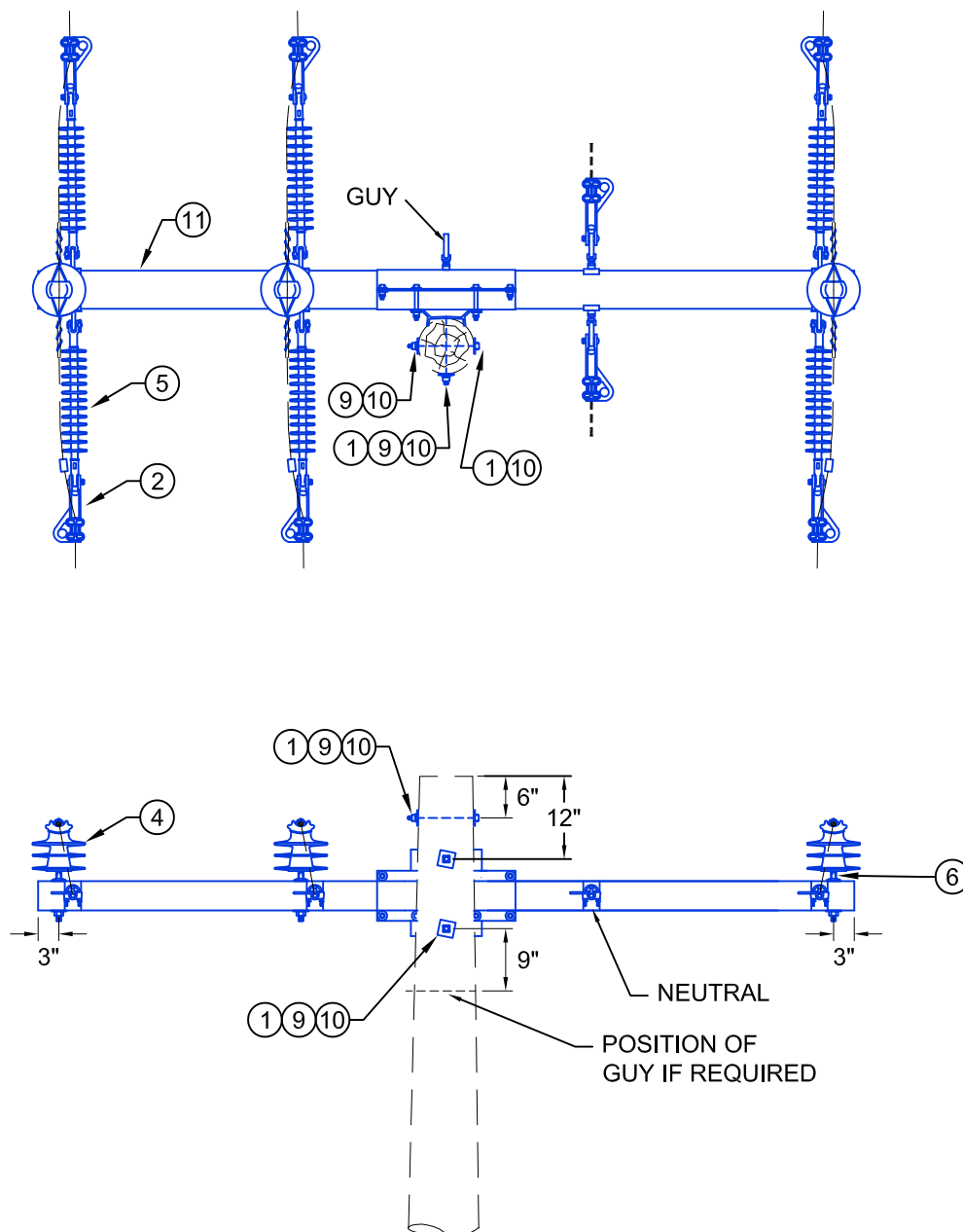
C6-2.1B	3-Ph Xarm Dbl DE 10' 4-Pos 1/0 Bare 15 kV
C6-2.1T	3-Ph Xarm Dbl DE 10' 4-Pos 1/0 Tree 15 kV
C6-2.3B	3-Ph Xarm Dbl DE 10' 4-Pos 336 Bare 15 kV
C6-2.3T	3-Ph Xarm Dbl DE 10' 4-Pos 336 Tree 15 kV
ZC6-2.1B	3-Ph Xarm Dbl DE 10' 4-Pos 1/0 Bare 35 kV
ZC6-2.1T	3-Ph Xarm Dbl DE 10' 4-Pos 1/0 Tree 35 kV
ZC6-2.3B	3-Ph Xarm Dbl DE 10' 4-Pos 336 Bare 35 kV
ZC6-2.3T	3-Ph Xarm Dbl DE 10' 4-Pos 336 Tree 35 kV

Ref	Material #	Description	C6-2.1B	C6-2.1T	C6-2.3B	C6-2.3T	ZC6-2.1B	ZC6-2.1T	ZC6-2.3B	ZC6-2.3T
1	6330516	Bolt, DA 5/8" x 16"	1	1	1	1	1	1	1	1
2	6330524	Bolt, DA 5/8" x 24"	5	5	5	5	5	5	5	5
3	6380407	Bolt, Machine 1/2" x 7"	4	4	4	4	4	4	4	4
4	6380512	Bolt, Machine 5/8" x 12"	1	1	1	1	1	1	1	1
5	7535168	Brace, Wood 60" (Pair)	2	2	2	2	2	2	2	2
6	11723025	Clamp DE 4-2/0 ACSR	8	8			8	8		
6	11723040	Clamp DE 4/0-336.4 ACSR			8	8			8	8
7	17010502	Con, Sicame TTD2710XFBTUNI	5	5			5	5		
7	17010502	Con, Sicame TTD2710XFBTUNI			1	1			1	1
7	17010520	Con, Sicame TTD4010XFBT			3	3			3	3
8	32000901	HNDX Pin Ins Poly 15kV	8	8	8	8	2	2	2	2
8	32000903	HNDX Pin Ins Poly 35kV					6	6	6	6
9	34283544	Ins, Susp Epox 35kV	6	6	6	6	6	6	6	6
10	42904063	Nut, Eye 5/8"	8	8	8	8	8	8	8	8
11	45412155	Pins Xarm 5/8" x 1"	8	8	8	8	8	8	8	8
12	55570000	Shackle Anchor	8	8	8	8	8	8	8	8
13	67100000	Tie Wire, Alum No 4 Solid	64	16	64	16	64	16	64	16
13	67110000	Tie Wire, Alum Ins No 4 Solid		48		48		48		48
14	71035931	Washer, Round 5/8"	4	4	4	4	4	4	4	4
15	71053050	Washer, Spring – 1/2"	4	4	4	4	4	4	4	4
16	71053063	Washer, Spring – 5/8"	13	13	13	13	13	13	13	13
17	71020451	Washer, Square, 2 1/4" x 13/16"	20	20	20	20	20	20	20	20
18	18210511	Xarm 10' 3 3/4" x 4 3/4"	2	2	2	2	2	2	2	2

Construction and Design Notes:

1. Not approved for Hendrix spacer cable.

C6-3



Design Limits:

Max. transverse load: 3000 lbs. per conductor

Min - Max. line angle:

1/0 ACSR (Bare & Tree): 0 - 55°

336 ACSR (Bare & Tree): 0 - 45°

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR (Bare/Tree)	336 ACSR (Bare/Tree)
15 kV	C6-3.1B C6-3.1T	C6-3.3B C6-3.3T
25/35 kV	ZC6-3.1B ZC6-1.1T	ZC6-3.3B ZC6-3.3T



CONSTRUCTION STANDARDS

THREE PHASE CROSSARM CONSTRUCTION
4-POSITION DOUBLE-DE, 10 FT XARM, UNBALANCED LOAD

C6-3

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

C6-3.1B 3-Ph Dbl DE 10' 4 Pos w/Unbl 1/0 Bare 15 kV
 C6-3.1T 3-Ph Dbl DE 10' 4 Pos w/Unbl 1/0 Tree 15 kV
 C6-3.3B 3-Ph Dbl DE 10' 4 Pos w/Unbl 336 Bare 15 kV
 C6-3.3T 3-Ph Dbl DE 10' 4 Pos w/Unbl 336 Tree 15 kV
 ZC6-3.1B 3-Ph Dbl DE 10' 4 Pos w/Unbl 1/0 Bare 35 kV
 ZC6-3.1T 3-Ph Dbl DE 10' 4 Pos w/Unbl 1/0 Tree 35 kV
 ZC6-3.3B 3-Ph Dbl DE 10' 4 Pos w/Unbl 336 Bare 35 kV
 ZC6-3.3T 3-Ph Dbl DE 10' 4 Pos w/Unbl 336 Tree 35 kV

Ref	Material #	Description	C6-3.1B	C6-3.1T	C6-3.3B	C6-3.3T	ZC6-3.1B	ZC6-3.1T	ZC6-3.3B	ZC6-3.3T
1	6380614	Bolt, Machine 3/4" x 14"	3	3	3	3	3	3	3	3
2	11723025	Clamp DE 4-2/0 ACSR	8	8			8	8		
2	11723040	Clamp, DE 3/0- 477 ACSR, Straight			8	8			8	8
3	17010502	Con, Sicame TTD2710XFBTUNI	4	4			4	4		
3	17010502	Con, Sicame TTD2710XFBTUNI			1	1			1	1
3	17010520	Con, Sicame TTD4010XFBT			3	3			3	3
4	32000901	HNDX Pin Ins Poly 15kV	3	3	3	3				
4	32000903	HNDX Pin Ins Poly 35kV					3	3	3	3
5	34283544	Ins, Susp Epox 35kV	6	6	6	6	6	6	6	6
6	45412155	Pin Xarm 5/8" x 1"	3	3	3	3	3	3	3	3
7	55570000	Shackle Anchor	8	8	8	8	8	8	8	8
8	67100000	Tie Wire, Alum. No 4 Solid	24		24		24		24	
8	67110000	Tie Wire, Alum. Ins No 4 Solid		24		24		24		24
9	71053075	Washer, Spring – 3/4"	3	3	3	3	3	3	3	3
10	71013040	Washer, Square Curved, 4"x4"x 3/16"	4	4	4	4	4	4	4	4
11	18200912	Xarm, Hughes Assy 10'	1	1	1	1	1	1	1	1

OVHD Three Phase Hendrix 09

HC1 Tangent

HC1-1 Tangent, Horizontal Bracket

HC1-2 Eight ft Crossarm, Sectionalizing

HC1-3 Tangent, Messenger DE For Long Spans

HC2 Outside, Medium Angle (0-60°)

HC2-1 Reverse Angle (0-45°)

HC2-2 Sectionalizing Double 8' Crossarm (0-60° Angle)

HC2-3 Alley Arm Construction (0-25°)

HC3 Outside, Double Pins, Large Angle (60-90°)

HC5 Single DE Bracket

HC5-1 Double Crossarm, Single DE

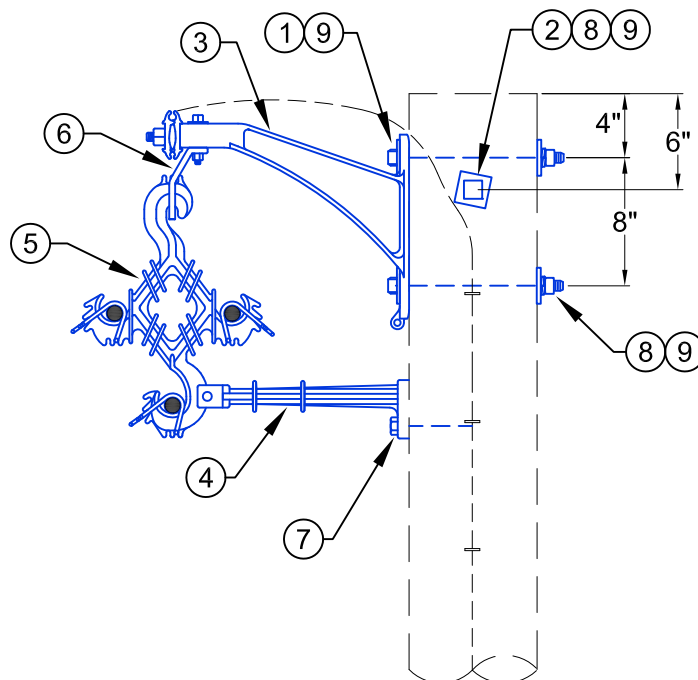
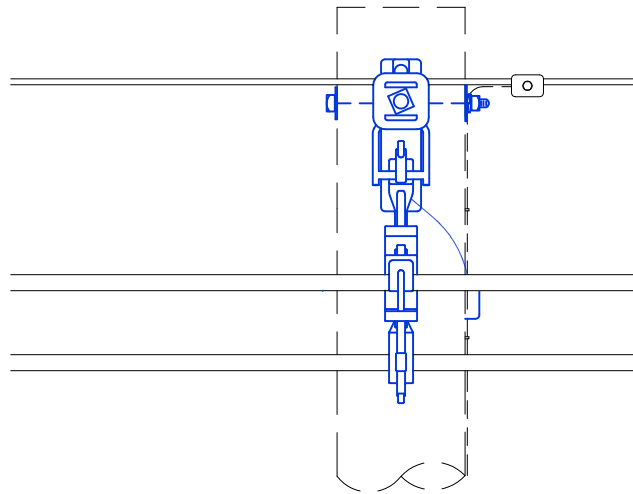
HC5-2 Five ft 7 in Braceless Crossarm. Single DE

HC6 Double DE Transition Spacer to Open Wire

HC6-1 Double DE Spacer Cable to Spacer Cable

Construction and Design Notes:

1. This assembly is approved for tangent structures for both 1/0 and 336 Hendrix spacer cable.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX & 336 HNDX
15 kV	HC1
25/35 kV	ZHC1



CONSTRUCTION STANDARDS

HENDRIX TANGENT

Materials List for Assemblies

Descriptions

HC1 Hndx Tan 15 kV

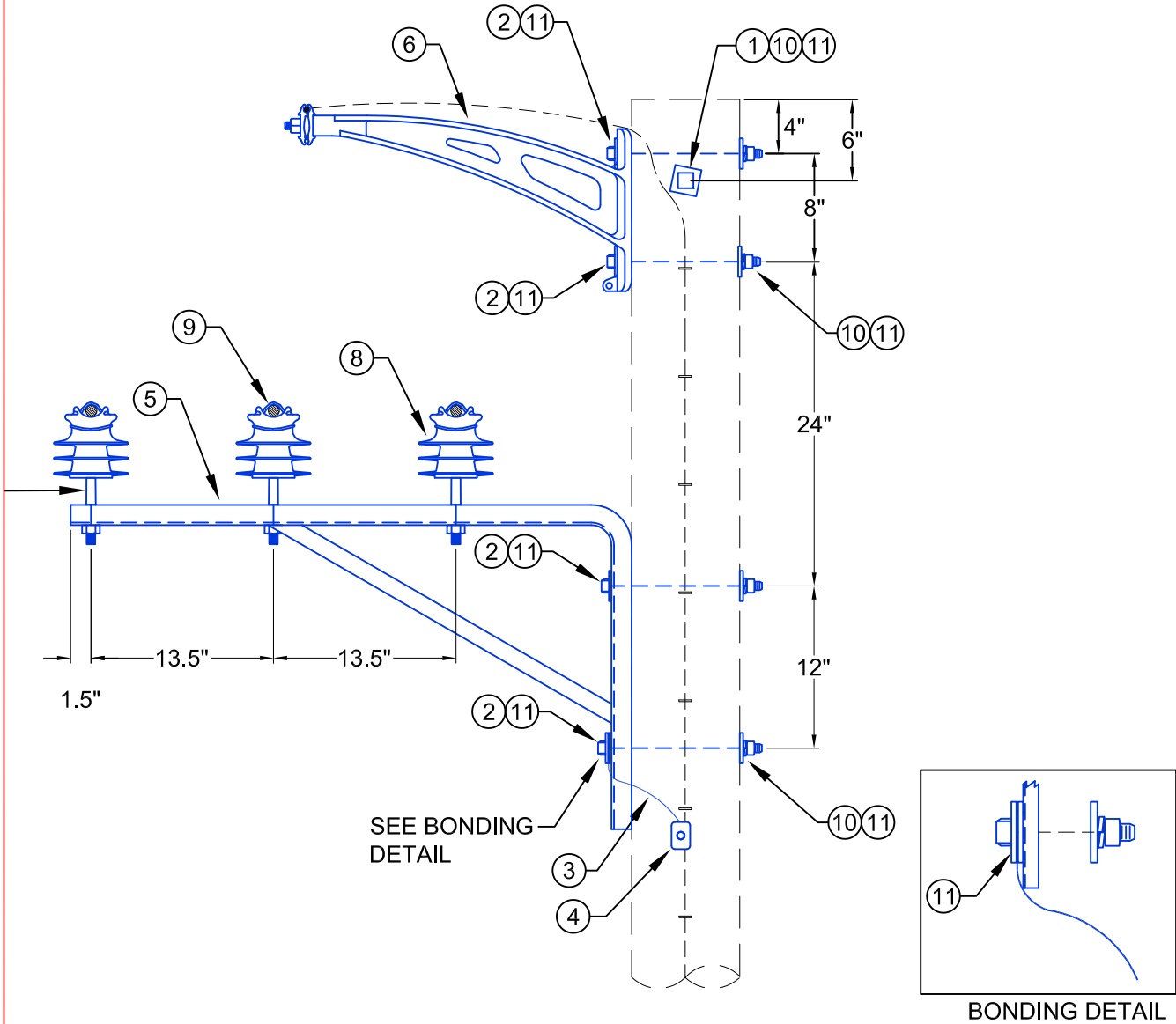
ZHC1 Hndx Tan 35 kV

Ref	Material #	Description	HC1	ZHC1
1	6380514	Bolt, Machine 5/8" x 14"	2	2
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	32000201	HNDX Brkt Tan BM-14 14"	1	
3	32000202	HNDX Brkt Tan BM-24 24"		1
4	32000214	HNDX Brkt Anti Sway 14"	1	
4	32000215	HNDX Brkt Anti Sway 24"		1
5	32000301	HNDX Spacer H-15D	1	
5	32000302	HNDX Spacer H-46D		1
6	32001302	HNDX, Stirrup-TS-1	1	1
7	55504440	Screw, Lag 1/2" x 4"	1	1
8	71053063	Washer, Spring - 5/8"	3	3
9	71020451	Washer, Square, 2 1/4" x 13/16"	6	6

Construction and Design Notes:

HC1-1

1. Assembly approved for equipment locations i.e. capacitor and transformer banks where additional phase spacing is desired for tapping jumpers.



CONSTRUCTION ASSEMBLIES	
System Voltage	1/0 HNDX & 336 HNDX
15 kV	HC1-1
25/35 kV	ZHC1-1



CONSTRUCTION STANDARDS
HENDRIX TANGENT
HORIZONTAL BRACKET

HC1-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

HC1-1 Hndx Tan Horizontal Brkt 15 kV

ZHC1-1 Hndx Tan Horizontal Brkt 35 kV

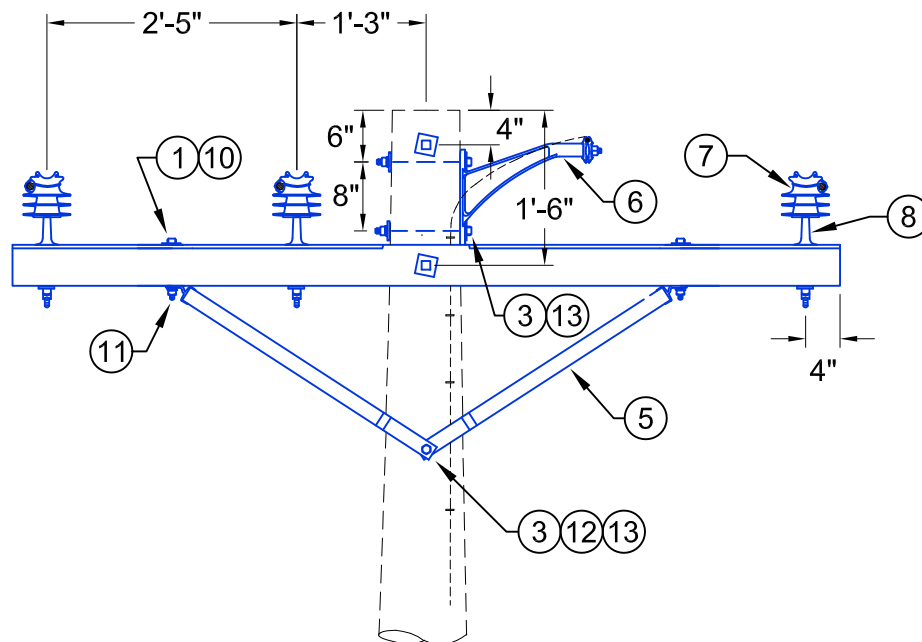
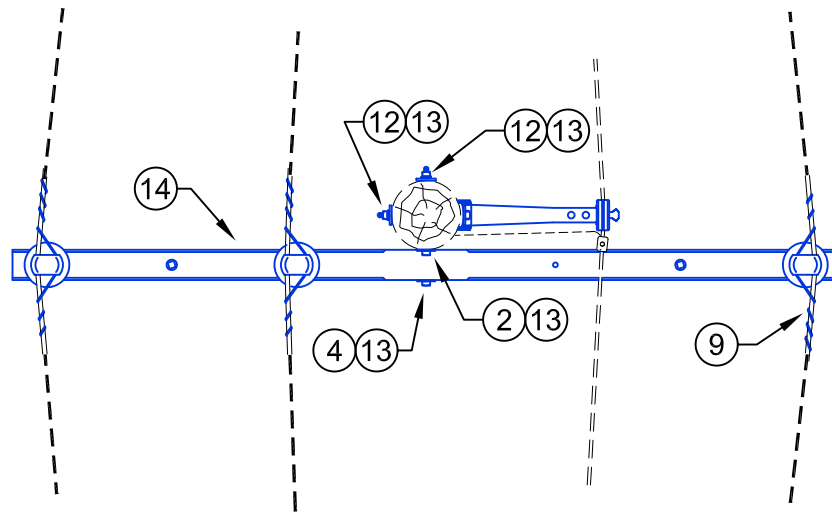
Ref	Material #	Description	HC1-1	ZHC1-1
1	6380512	Bolt, Machine 5/8" x 12"	1	1
2	6361514	Bolt, Machine 5/8" x 14"	4	4
3	15610601	Cond, 6 Sol Cu Soft Drawn	2	2
4	17015004	Connector, GC5004	1	1
5	32000216	HNDX Brkt BA-6 Horizontal 15-25-C	1	1
6	32000202	HNDX Brkt Tan BM-24 24" 35kV	1	1
7	32001601	HNDX Ins Pin Shrt Shnk SSP-2	3	3
8	32000903	HNDX Pin Ins Poly 35 kV		3
8	32000901	HNDX Pin Ins Poly 15 kV	3	
9	67110000	Tie Wire, Alum Ins No 4 Solid	24	24
10	71053063	Washer, Spring - 5/8"	5	5
11	71020451	Washer, Square, 2 1/4" x 13/16"	11	11

**NOTE: When installing 3-Phase equipment, transformer banks, capacitors, or UG risers, using an L-Bracket assembly is an option. **

Construction and Design Notes:

HC1-2

1. This assembly is approved for sectionalizing installations on Hendrix tangent construction. Specify the miscellaneous in-lines, bypass/disconnect switches or recloser assemblies separately as needed.



----- CONSTRUCTION ASSEMBLIES -----	
System Voltage	1/0 HNDX & 336 HNDX
15 kV	HC1-2
25/35 kV	ZHC1-2



CONSTRUCTION STANDARDS

HENDRIX SECTIONALIZING
SINGLE 8' CROSSARM

HC1-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

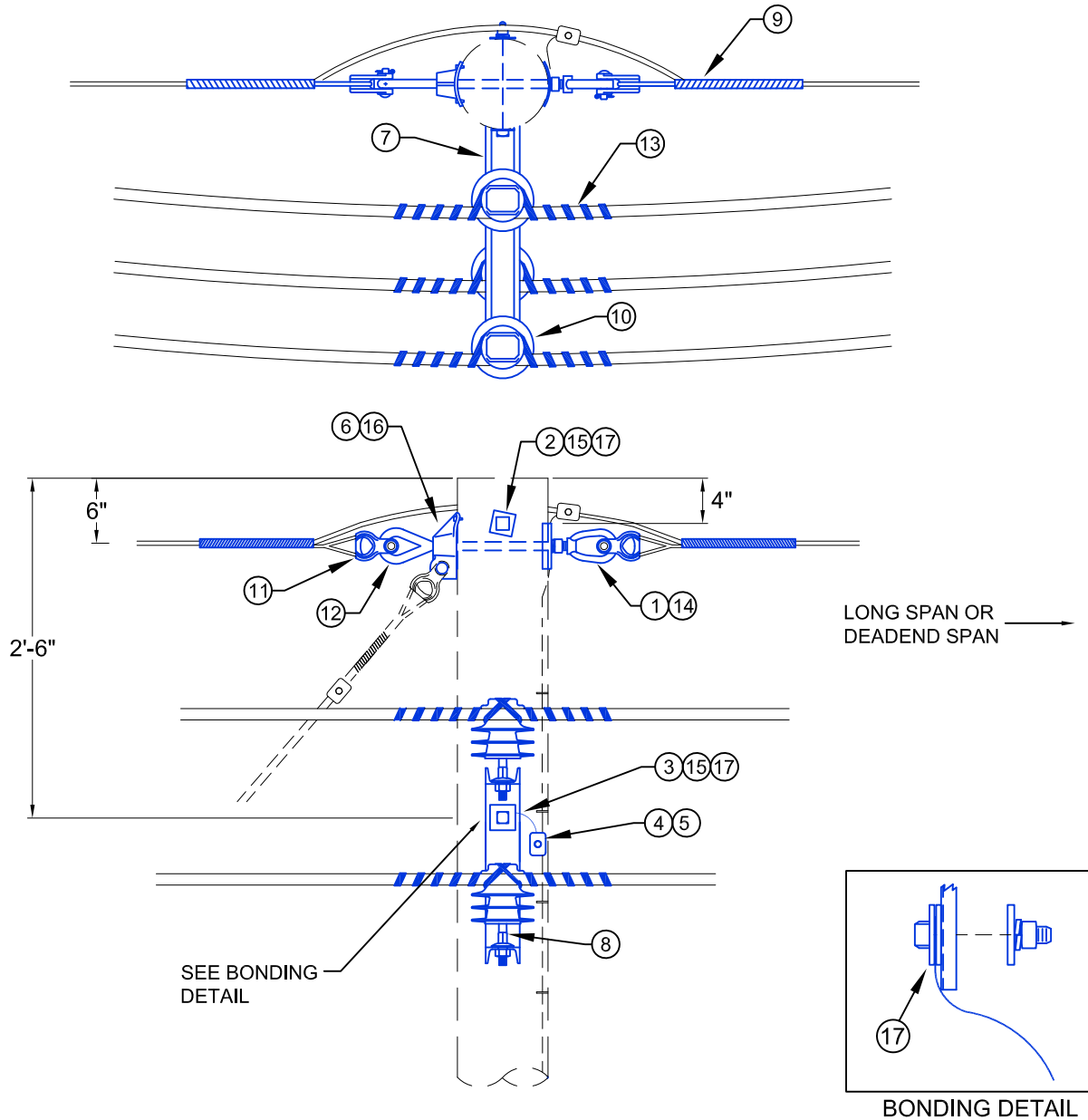
HC1-2 Hndx Sectionalizing Sgl 8' Xarm 15 kV

ZHC1-2 Hndx Sectionalizing Sgl 8' Xarm 35 kV

Ref	Material #	Description	HC1-2	ZHC1-2
1	6380407	Bolt, Machine 1/2" x 7"	2	2
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	6380514	Bolt, Machine 5/8" x 14"	3	3
4	6380518	Bolt, Machine 5/8" x 18"	1	1
5	7535168	Brace: Wood 60" (Pair)	1	1
6	32000201	HNDX Brkt Tan BM-14 14"	1	
6	32000202	HNDX Brkt Tan BM-24 24"		1
7	32000901	HNDX Pin Ins Poly 15 kV	3	
7	32000903	HNDX Pin Ins Poly 35 kV		3
8	45412155	Pins Xarm 5/8" x 1"	3	3
9	67110000	Tie Wire, Alum Ins No 4 Solid	24	24
10	71035931	Washer, Round 5/8"	2	2
11	71053050	Washer, Spring - 1/2"	2	2
12	71053063	Washer, Spring - 5/8"	5	5
13	71020451	Washer, Square, 2 1/4" x 13/16"	9	9
14	18210311	Xarm 8' 3 3/4" x 4 3/4"	1	1

Construction and Design Notes:

1. All messenger guying requires $\frac{3}{4}$ " bolts and hardware.
2. Assembly approved for dead-end long spans and highway/railroad crossings if desired.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX & 336 HNDX
15 kV	HC1-3
25/35 kV	ZHC1-3



CONSTRUCTION STANDARDS
HENDRIX TANGENT
LONG SPAN, MESSENGER DEADEND

HC1-3

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

HC1-3 Hndx Tan Long Span Msg DE 15 kV

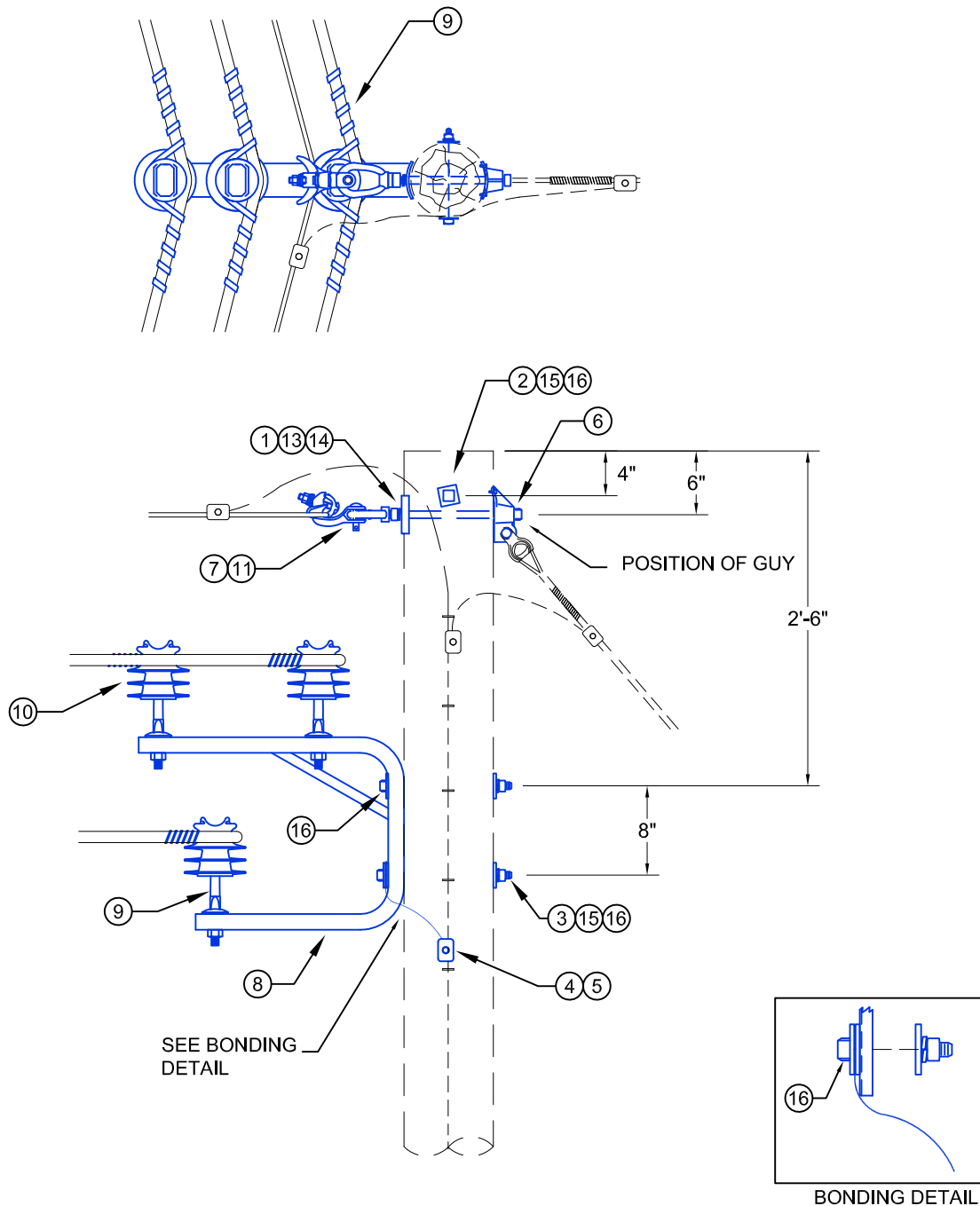
ZHC1-3 Hndx Tan Long Span Msg DE 35 kV

Ref	Material #	Description	HC1-3	ZHC1-3
1	6360616	Bolt, Eye 3/4" x 16"	1	1
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	6361514	Bolt, Machine 5/8" x 14"	2	2
4	15610601	Cond, 6 Sol Cu Soft Drawn	2	2
5	17015004	Connector, GC5004	1	1
6	29800000	Guy Plate/Single Bolt	1	1
7	32000208	HNDX Brkt, Agle-BA3-35 35kV	1	1
8	32001601	HNDX Ins Pin Shrt Shnk SSP-2	3	3
9	32000701	HNDX Preform-052 Messenger	2	2
10	32000901	HNDX Pin Ins Poly 15 kV	3	
10	32000903	HNDX Pin Ins Poly 35 kV		3
11	32001298	HNDX Thim Clevis For Messenger	2	2
12	42907563	Nut, Eye 3/4"	1	1
13	67110000	Tie Wire, Alum Ins No 4 Solid	24	24
14	71013041	Washer, Curved Guy 3/4"	1	1
15	71053063	Washer, Spring - 5/8"	3	3
16	71053075	Washer, Spring - 3/4"	1	1
17	71020451	Washer, Square, 2 1/4" x 13/16"	7	7

Construction and Design Notes:

1. All messenger guying requires $\frac{3}{4}$ " bolts and hardware.

HC2



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX & 336 HNDX
15 kV	HC2
25/35 kV	ZHC2



CONSTRUCTION STANDARDS

HENDRIX OUTSIDE ANGLE
(UP TO 60°)

HC2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

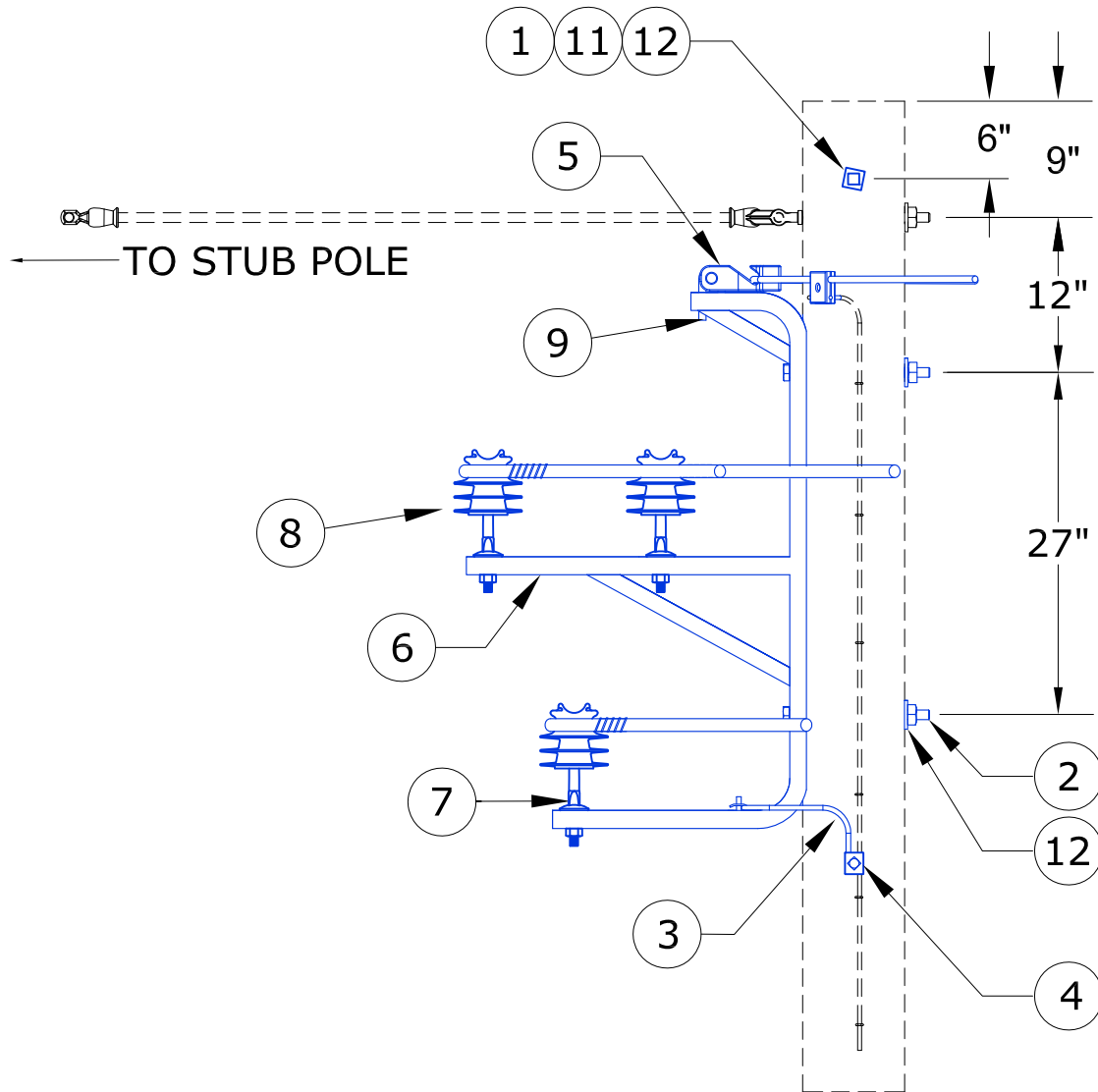
HC2 Hndx Angle Up To 60° 15 kV

ZHC2 Hndx Angle Up To 60° 35 kV

Ref	Material #	Description	HC2	ZHC2
1	06380616	Bolt, Machine 3/4" x 16"	1	1
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	6361514	Bolt, Machine 5/8" x 14"	2	2
4	15610601	Cond, 6 Sol Cu Soft Drawn	2	2
5	17015004	Connector, GC5004	1	1
6	29800000	Guy Plate/Single Bolt	1	1
7	32000303	HNDX Angle Clamp, Cma-1	1	1
8	32000208	HNDX Brkt, Agle-BA3-35 35kV	1	1
9	32001601	HNDX Ins Pin Shrt Shnk SSP-2	3	3
10	32000901	HNDX Pin Ins Poly 15 kV	3	
10	32000903	HNDX Pin Ins Poly 35 kV		3
11	42907563	Nut, Eye 3/4"	1	1
12	67110000	Tie Wire, Alum Ins No 4 Solid	24	24
13	71013041	Washer, Curved Guy 3/4"	1	1
14	71053075	Washer, Spring - 3/4"	1	1
15	71053063	Washer, Spring - 5/8"	3	3
16	71020451	Washer, Square, 2 1/4" x 13/16"	7	7

Construction and Design Notes:

1. All messenger guying requires $\frac{3}{4}$ " bolts and hardware.
2. Specify E4-20 and HE9-1 for guying.



Materials List for Assemblies

Descriptions

HC2-1 Hndx Reverse Angle Up To 45° 15 kV

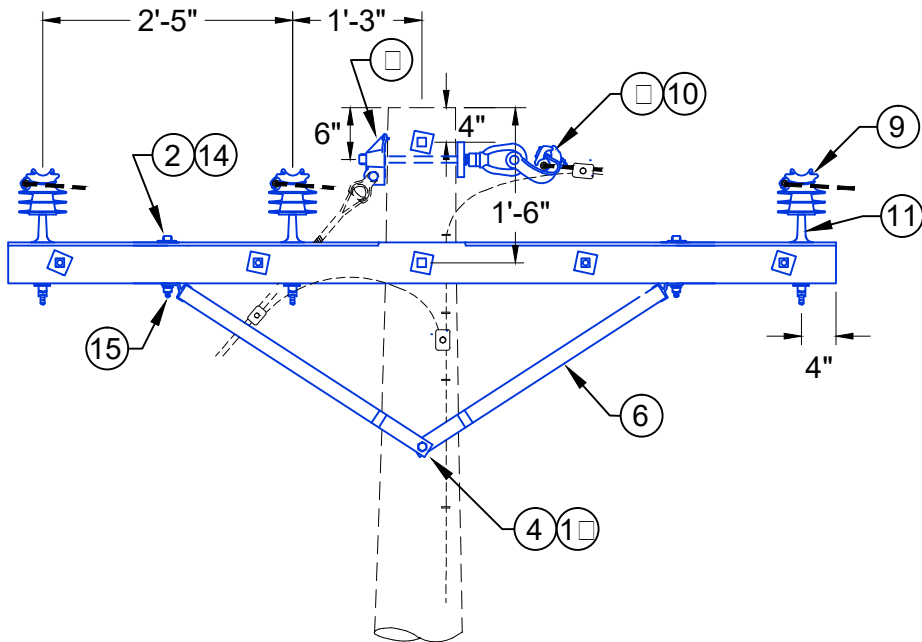
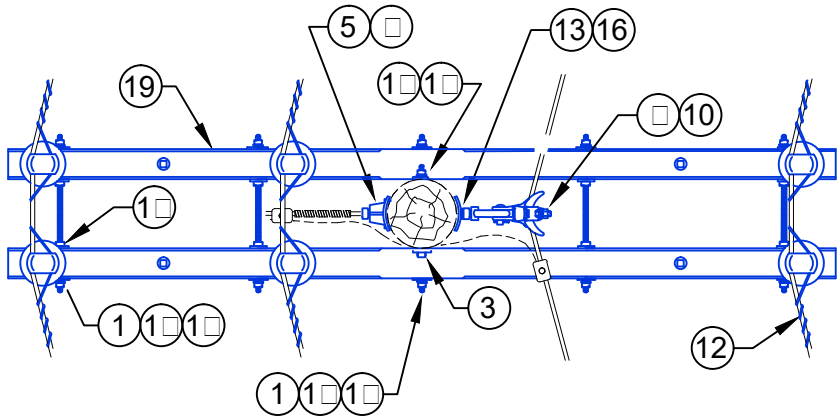
ZHC2-1 Hndx Reverse Angle Up To 45° 35 kV

Ref	Material #	Description	HC2-1	ZHC2-1
1	6380512	Bolt, Machine 5/8" x 12"	1	1
2	6380514	Bolt, Machine 5/8" x 14"	3	3
3	15610601	Cond, 6 Sol Cu Soft Drawn	2	2
4	17015004	Connector, GC5004	1	1
5	32000304	HNDX Angle Clamp, Cma-2	1	1
6	32000210	HNDX Brkt, Agle-BA4-35 35kV	1	1
7	32001601	HNDX Ins Pin Shrt Shnk SSP-2	3	3
8	32000901	HNDX Pin Ins Poly 15 kV	3	
8	32000903	HNDX Pin Ins Poly 35 kV		3
9	32001303	HNDX, U-Bolt - UB	1	1
10	67110000	Tie Wire, Alum Ins No 4 Solid	24	24
11	71053063	Washer, Spring - 5/8"	12	12
12	71020451	Washer, Square, 2 1/4" x 13/16"	20	20

Construction and Design Notes

HC2-2

1. The pole shall be drilled or sectioned in anticipation on Hendri
pole construction. See the pole section line, drilled/connect notch or
recorder pole line for details needed.



CONSTRUCTION ASSEMBLIES	
Site Voltage	1/0 HND or 336 HND
15 V	HC2-2
25/35 V	HC2-2



CONSTRUCTION STANDARDS
HENDRI SECTIONALIZING
DOUBLE 8' CROSSARM (0 - 60° ANGLE)

HC2-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

HC2-2 Hndx Sectionalizing Dbl 8' Xarm 15 kV

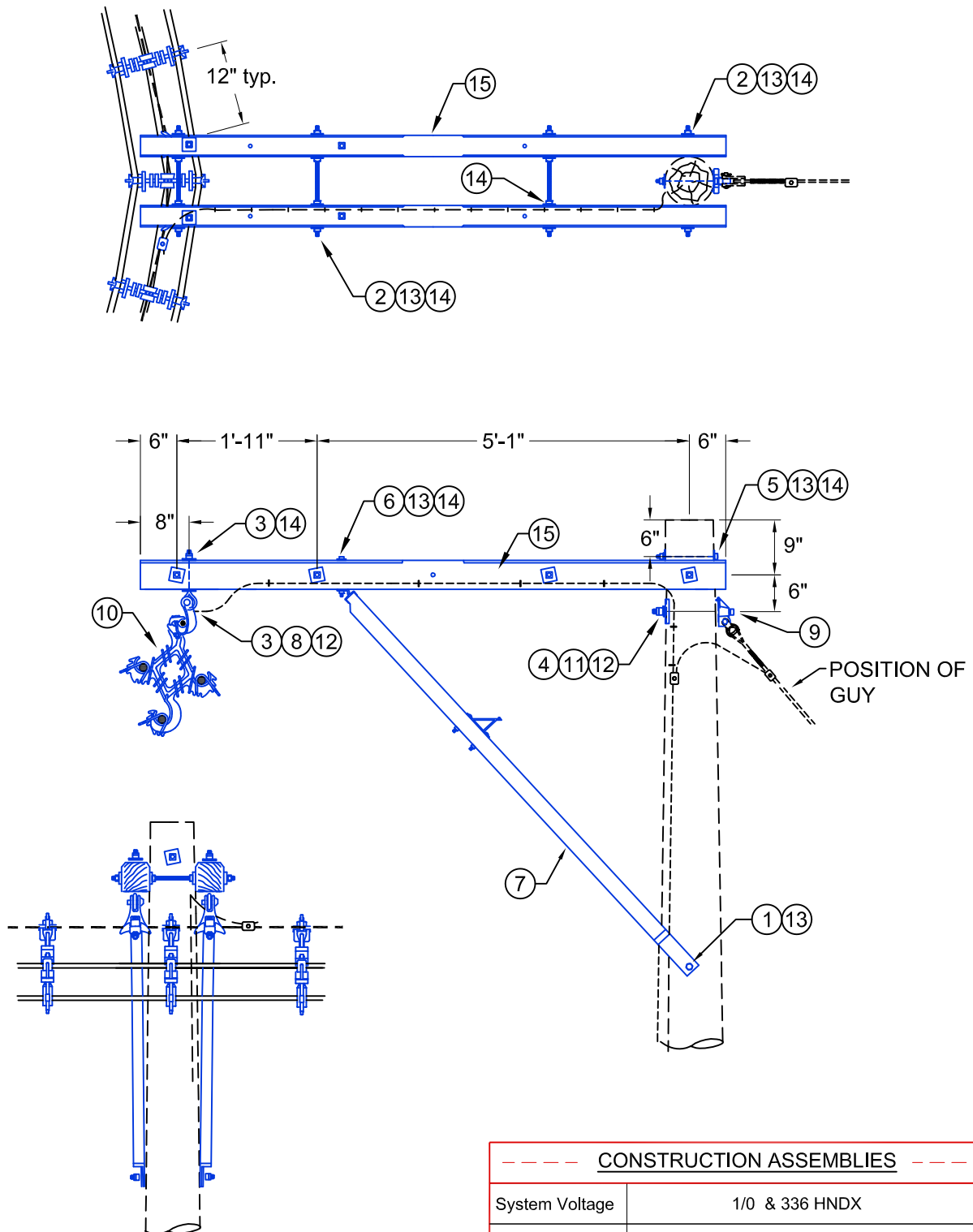
ZHC2-2 Hndx Sectionalizing Dbl 8' Xarm 35 kV

Ref	Material #	Description	HC2-2	ZHC2-2
1	6330524	Bolt, DA 5/8" x 24"	5	5
2	6380407	Bolt, Machine 1/2" x 7"	4	4
3	6380514	Bolt, Machine 5/8" x 14"	1	1
4	6380516	Bolt, Machine 5/8" x 16"	1	1
5	6380616	Bolt, Machine 3/4" x 16"	1	1
6	7535168	Brace: Wood 60" (Pair)	2	2
7	29800000	Guy Plate/Single Bolt	1	1
8	32000304	HNDX Angle Clamp, Cma-2	1	1
9	32000901	HNDX Pin Ins Poly 15 kV	6	
9	32000903	HNDX Pin Ins Poly 35 kV		6
10	42907563	Nut, Eye 3/4"	1	1
11	45412155	Pins Xarm 5/8" x 1"	6	6
12	67110000	Tie Wire, Alum Ins No 4 Solid	40	40
13	71013041	Washer, Curved Guy 3/4"	1	1
14	71035931	Washer, Round 5/8"	4	4
15	71053050	Washer, Spring – 1/2"	4	4
16	71053075	Washer, Spring - 3/4"	1	1
17	71053063	Washer, Spring - 5/8"	12	12
18	71020451	Washer, Square, 2 1/4" x 13/16"	20	20
19	18210311	Xarm 8' 3 3/4" x 4 3/4"	2	2

Construction and Design Notes:

1. This assembly approved for 15kV only.
2. This assembly to be used only with special Engineering Approval.

HC2-3



CONSTRUCTION ASSEMBLIES	
System Voltage	1/0 & 336 HNDX
15 kV	HC2-3



CONSTRUCTION STANDARDS
HENDRIX ALLEY-ARM CONSTRUCTION
0 - 25° ANGLE

HC2-3

ISSUE DATE: 05/16

Materials List for Assemblies

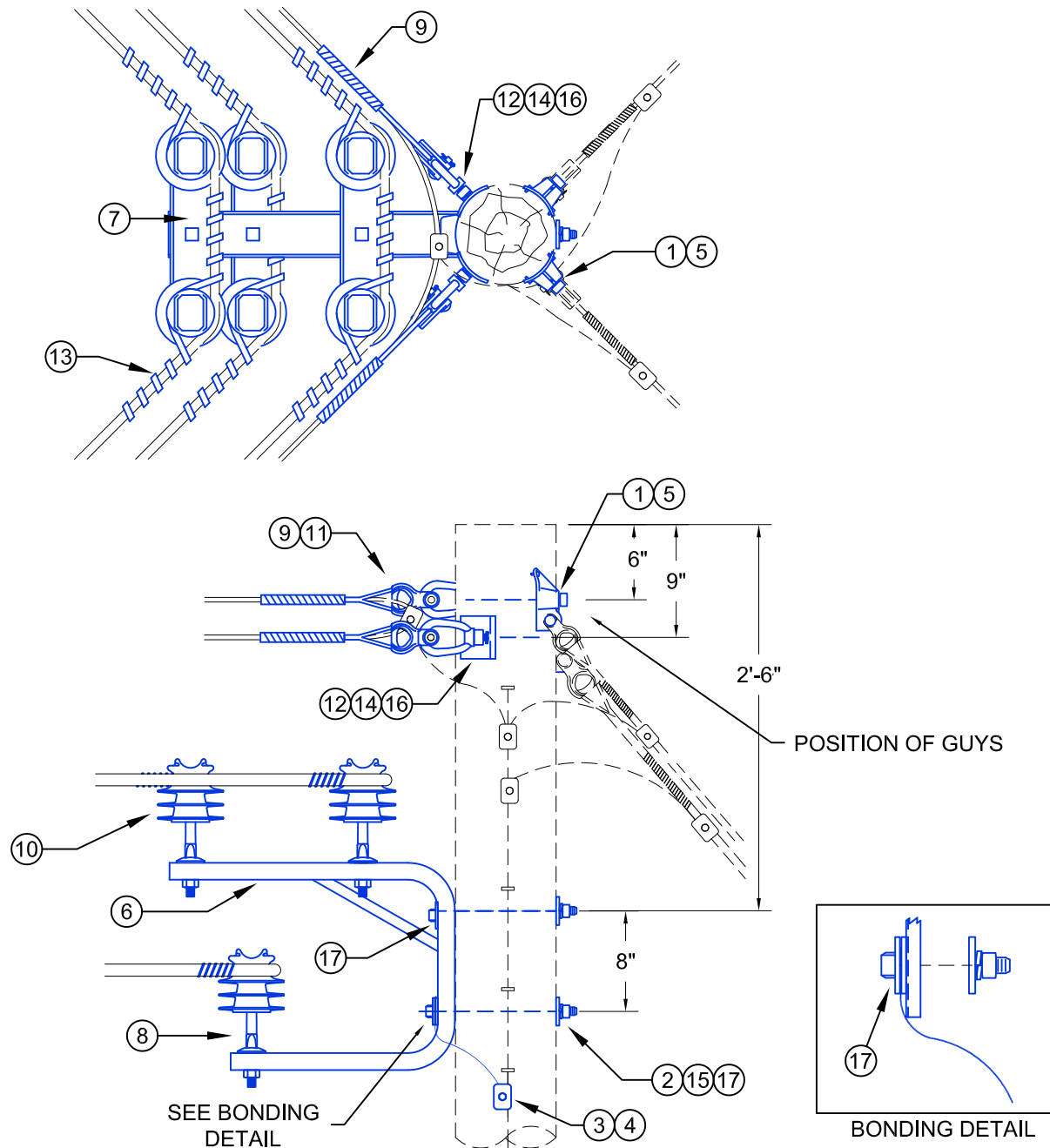
Descriptions

HC2-3 Hndx Dbl 8' Alley Xarm 0-25 Degree

Ref	Material #	Description	HC2-3
1	6330516	Bolt, DA 5/8" x 16"	1
2	6330524	Bolt, DA 5/8" x 24"	4
3	6361508	Bolt, Eye 5/8" x 8"	2
4	6380616	Bolt, Machine 3/4" x 16"	1
5	6380512	Bolt, Machine 5/8" x 12"	1
6	6380507	Bolt, Machine 5/8" x 7"	2
7	7553200	Brace: Wood Diagonal 7'	2
8	11744000	Clamp, Susp/Angle Alum	2
9	29800000	Guy Plate/Single Bolt	1
10	32000301	Hndx Spacer H-15D	3
11	71013041	Washer, Curved Guy 3/4"	5
12	71053075	Washer, Spring – 3/4"	1
13	71053063	Washer, Spring – 5/8"	13
14	71020451	Washer, Square, 2 1/4" x 13/16"	17
15	18210311	Xarm 8' x 3 3/4" x 4 3/4"	2

Construction and Design Notes:

1. All messenger guying requires $\frac{3}{4}$ " bolts and hardware.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX & 366 HNDX
15 kV	HC3
25/35 kV	ZHC3

Materials List for Assemblies

Descriptions

HC3 Hndx Angle Dbl Pins (60 To 90°) 15 kV

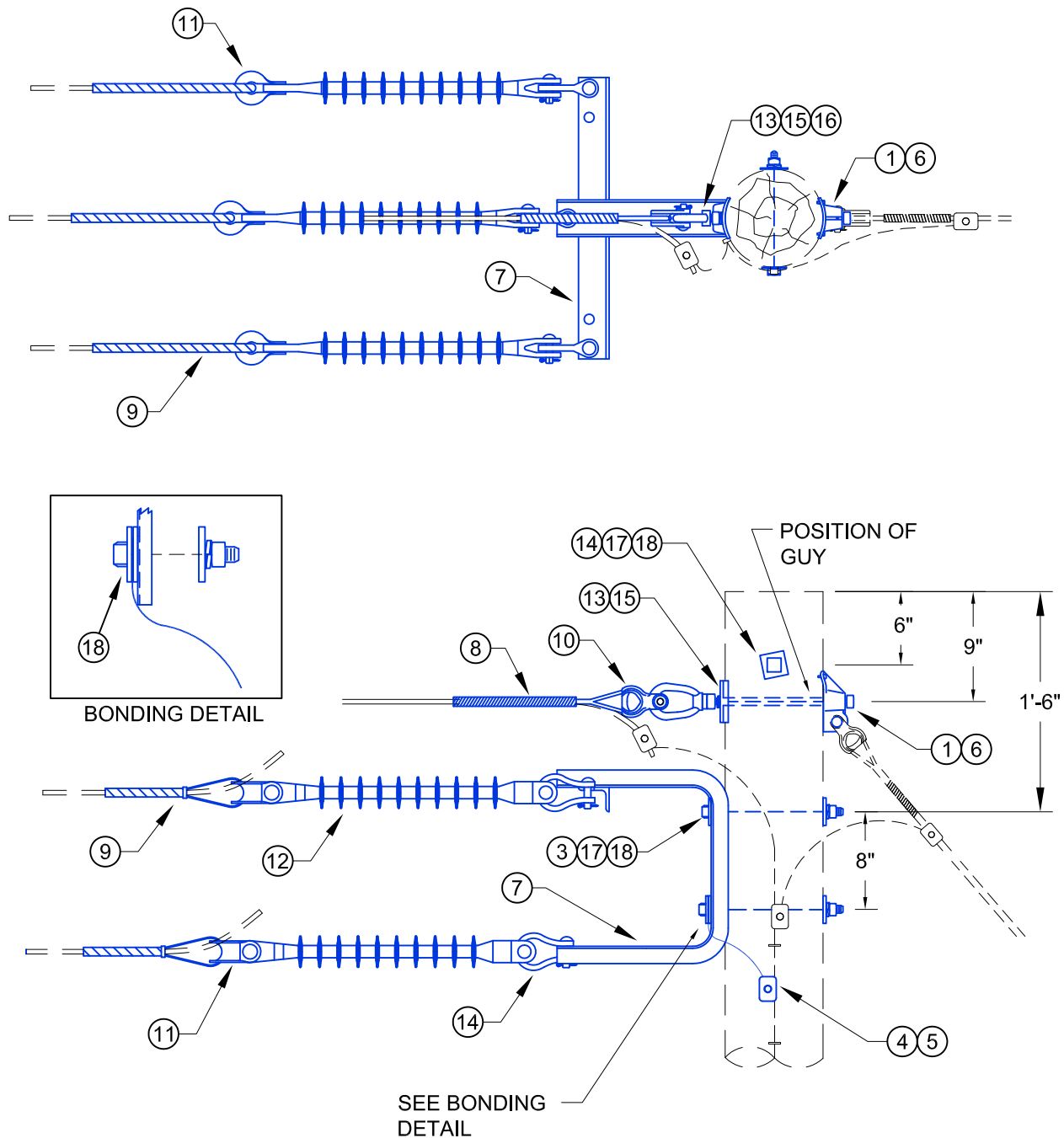
ZHC3 Hndx Angle Dbl Pins (60 To 90°) 35 kV

Ref	Material #	Description	HC3	ZHC3
1	6380616	Bolt, Machine 3/4" x 16"	2	2
2	6361514	Bolt, Machine 5/8" x 14"	2	2
3	15610601	Cond, 6 Sol Cu Soft Drawn	2	2
4	17015004	Connector, GC5004	1	1
5	29800000	Guy Plate/Single Bolt	2	2
6	32000208	HNDX Brkt, Agle-BA3-35 35kV	1	1
7	32001603	HNDX Dbl Ins Plate 21p	3	3
8	32001601	HNDX Ins Pin Shrt Shnk SSP-2	6	6
9	32000701	HNDX Preform-052 Messenger	2	2
10	32000901	HNDX Pin Ins Poly 15 kV	6	
10	32000903	HNDX Pin Ins Poly 35 kV		6
11	32001298	HNDX Thim Clevis For Messenger	2	2
12	42907563	Nut, Eye 3/4"	2	2
13	67110000	Tie Wire, Alum Ins No 4 Solid	48	48
14	71013041	Washer, Curved Guy 3/4"	2	2
15	71053063	Washer, Spring - 5/8"	2	2
16	71053075	Washer, Spring - 3/4"	2	2
17	71020451	Washer, Square, 2 1/4" x 13/16"	5	5

Construction and Design Notes:

1. All messenger guying requires 3/4" bolts and hardware.

HC5



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX	336 HNDX
15 kV	HC5.1	HC5.3
25/35 kV		

CONSTRUCTION STANDARDS

HENDRIX SINGLE DEADEND
BRACKET

HC5

ISSUE DATE: 05/16



Materials List for Assemblies

Descriptions

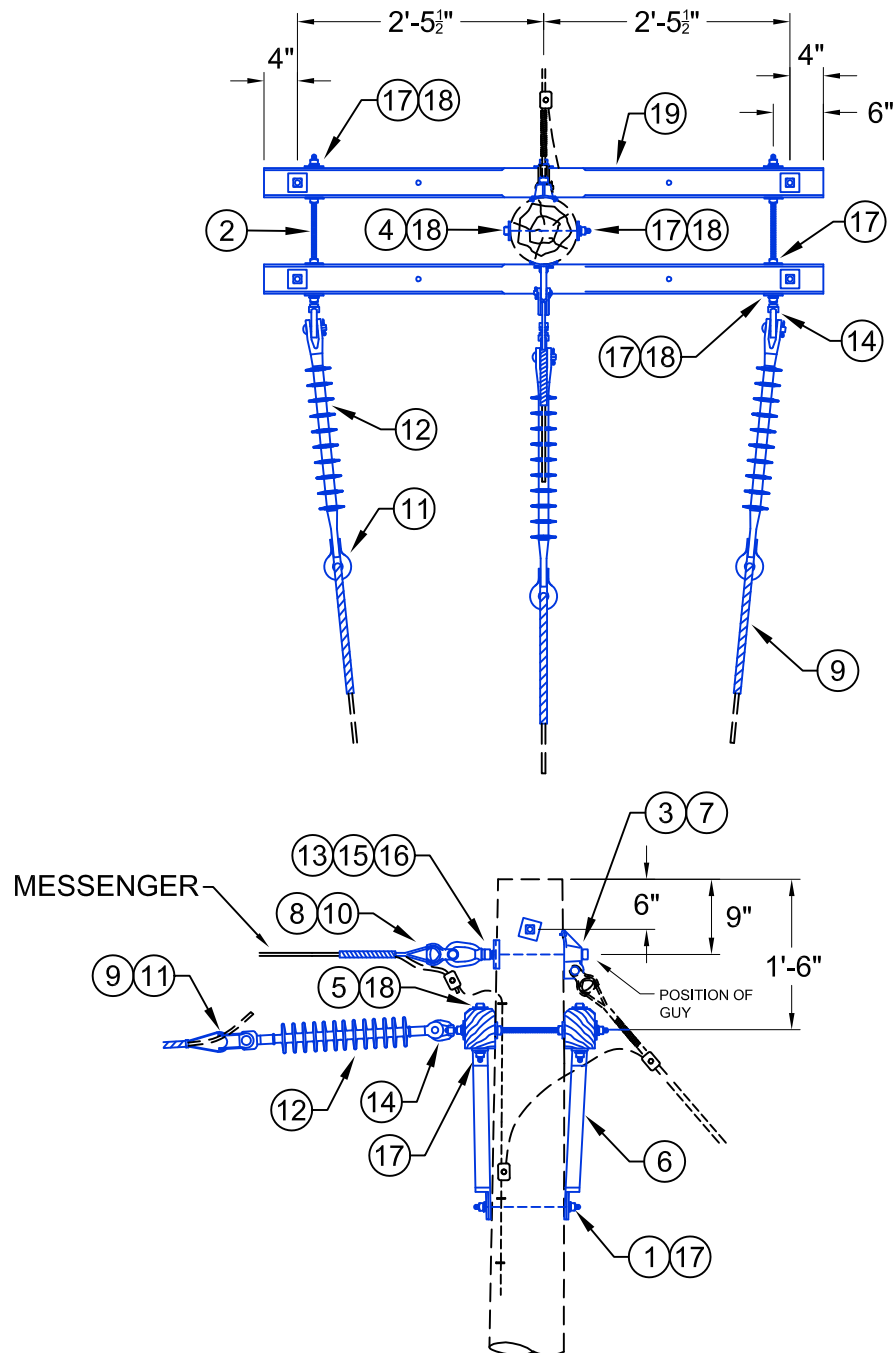
HC5.1 Hndx Single DE Small Conductor

HC5.3 Hndx Single DE Large Conductor

Ref	Material #	Description	HC5.1	HC5.3
1	6380616	Bolt, Machine 3/4" x 16"	1	1
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	6380514	Bolt, Machine 5/8" x 14"	2	2
4	15610601	Cond, 6 Sol Cu Soft Drawn	2	2
5	17015004	Connector, GC5004	1	1
6	29800000	Guy Plate/Single Bolt	1	1
7	32000205	HNDX Brkt, Agle-BD-35 35kV	1	1
8	32000701	HNDX Preform-052 Messenger	1	1
9	32000703	HNDX Preform-1/0 15kV size .668	3	
9	32000702	HNDX Preform-336 15kV size .933		3
10	32001298	HNDX Thim Clevis For Messenger	1	1
11	32001301	HNDX, Thim Clevis TC	3	3
12	34283544	Ins, Susp Epox 35kV	3	3
13	42907563	Nut, Eye 3/4"	1	1
14	55570000	Shackle Anchor	3	3
15	71013041	Washer, Curved Guy 3/4"	1	1
16	71053075	Washer, Spring - 3/4"	1	1
17	71053063	Washer, Spring - 5/8"	3	3
18	71020451	Washer, Square, 2 1/4" x 13/16"	7	7

Construction and Design Notes:

1. All messenger attachments where guying is required will utilize $\frac{3}{4}$ " bolts and hardware.



----- CONSTRUCTION ASSEMBLIES -----		
System Voltage	1/0 HNDX	336 HNDX
15 kV	HC5-1.1	HC5-1.3
25/35 kV		



CONSTRUCTION STANDARDS

HENDRIX SINGLE DEADEND
DOUBLE 5'-7" CROSSARM

HC5-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

HC5-1.1 Hndx Single DE Dbl Xarm Small Conductor

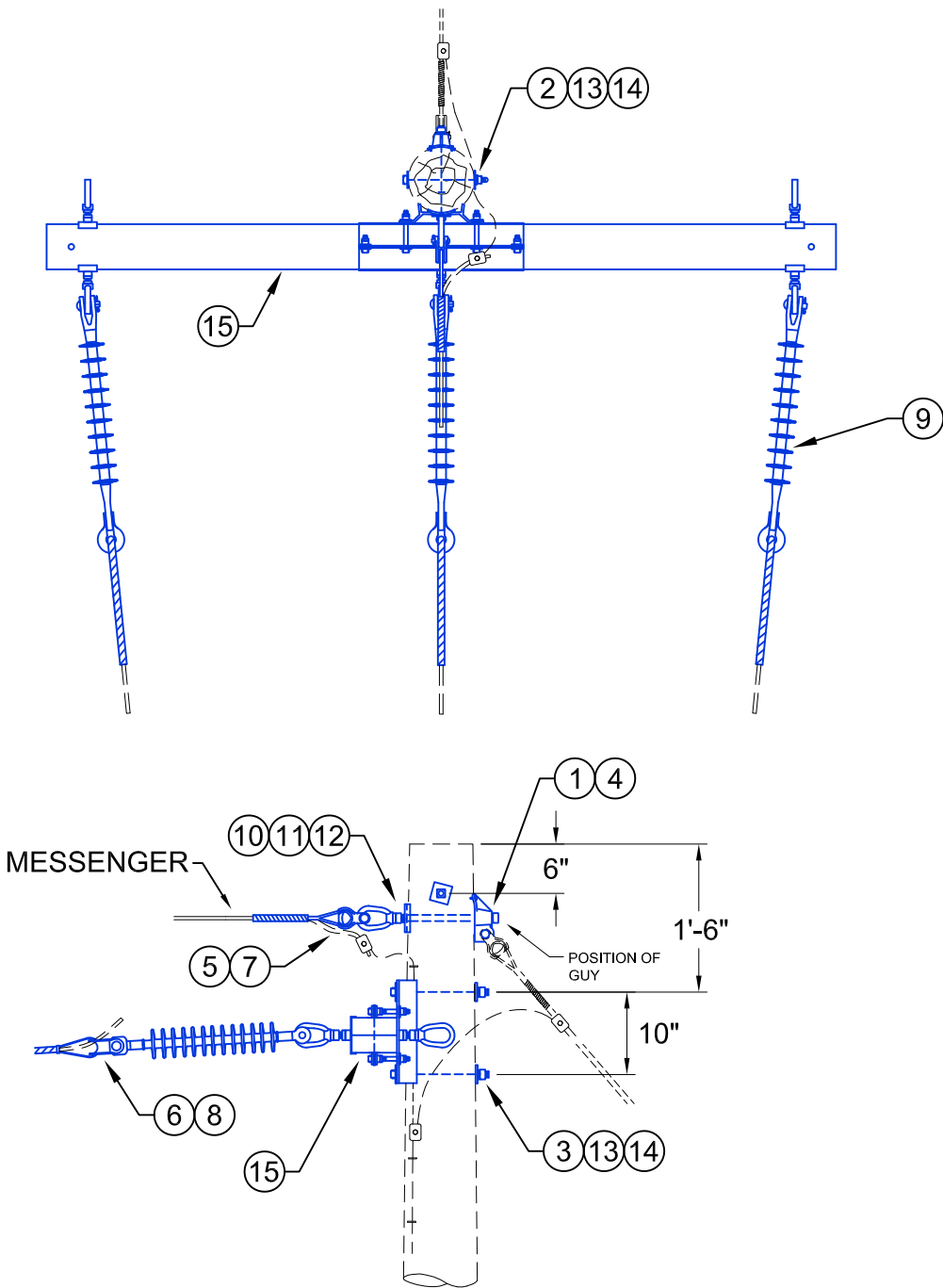
HC5-1.3 Hndx Single DE Dbl Xarm Large Conductor

Ref	Material #	Description	HC5-1.1	HC5-1.3
1	6330516	Bolt, Da. 5/8" x 16"	1	1
2	6330524	Bolt, Da. 5/8" x 24"	3	3
3	6380616	Bolt, Machine 3/4" x 16"	1	1
4	6380512	Bolt, Machine 5/8" x 12"	1	1
5	6380507	Bolt, Machine 5/8" x 7"	4	4
6	7535168	Brace, Wood 60"(pair)	2	2
7	29800000	Guy Plate/Single Bolt	1	1
8	32000701	HNDX Preform-052 Messenger	1	1
9	32000703	HNDX Preform-1/0 15kV size .668	3	
9	32000702	HNDX Preform-336.4 15kV size .933		3
10	32001298	HNDX Thim Clevis for Messenger	1	1
11	32001301	HNDX, Thim Clevis TC	3	3
12	34283544	Ins, Susp Epox 35kV	3	3
13	42907563	Nut, Eye 3/4 "	1	1
14	42904063	Nut, Eye 5/8"	3	3
15	71013041	Washer, Curved Guy 3/4"	1	1
16	71053075	Washer, Spring - 3/4"	1	1
17	71053063	Washer, Spring - 5/8"	13	13
18	71020451	Washer, Square, 2 1/4" x 13/16"	16	16
19	18210211	Xarm 5' 7" 3 3/4" x 4 3/4"	2	2

Construction and Design Notes:

1. All messenger guying requires 3/4" bolts and hardware.

HC5-2



CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 HNDX	336 HNDX
15 kV	HC5-2.1	HC5-2.3
25/35 kV		



CONSTRUCTION STANDARDS
HENDRIX SINGLE DEADEND
BRACELESS CROSSARM

HC5-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

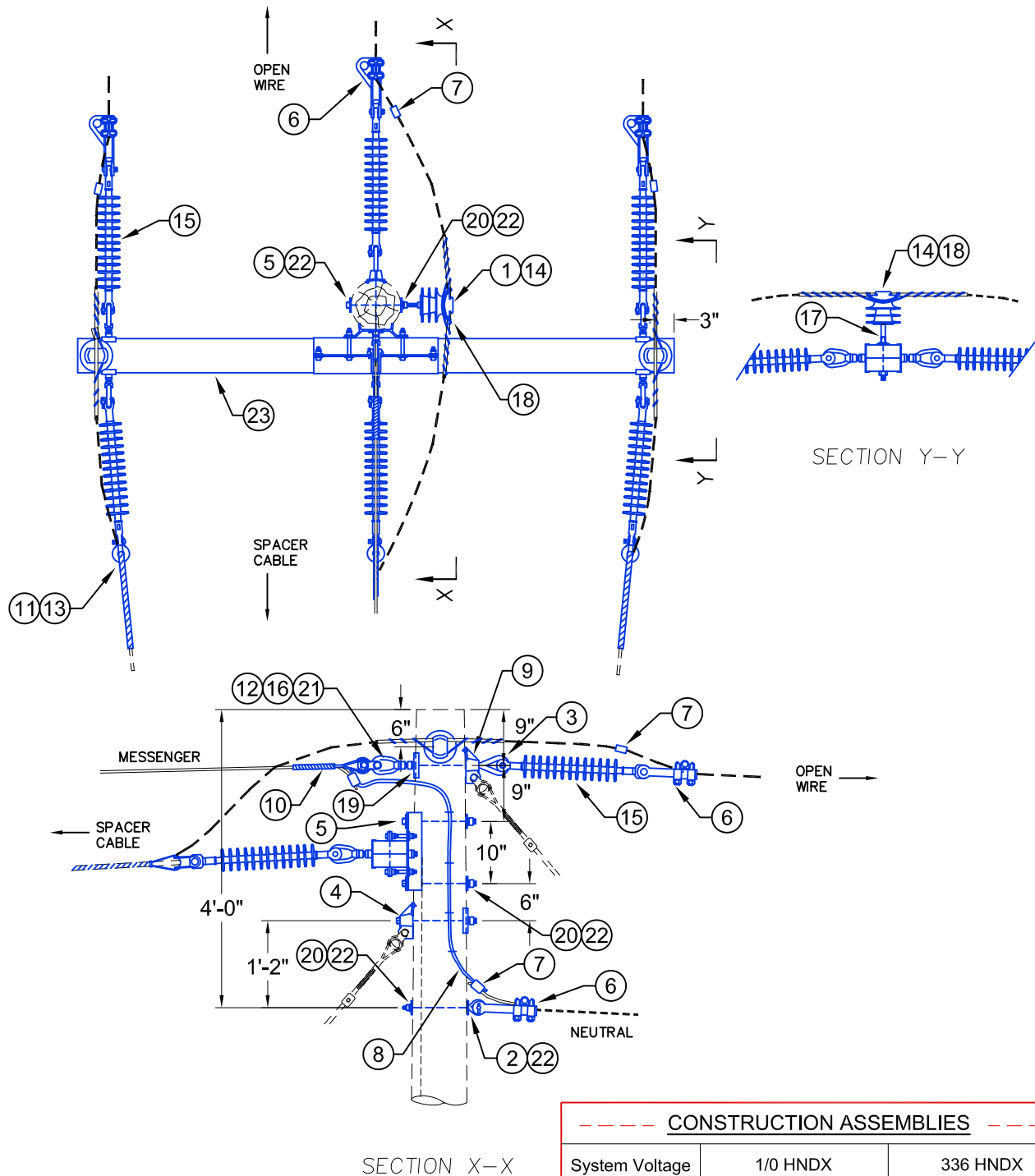
HC5-2.1 Hndx Single DE Braceless Small Conductor

HC5-2.3 Hndx Single DE Braceless Large Conductor

Ref	Material #	Description	HC5-2.1	HC5-2.3
1	6380616	Bolt, Machine 3/4" x 16"	1	1
2	6380512	Bolt, Machine 5/8" x 12"	1	1
3	6380514	Bolt, Machine 5/8" x 14"	2	2
4	29800000	Guy Plate/Single Bolt	1	1
5	32000701	HNDX Preform-052 Messenger	1	1
6	32000703	HNDX Preform-1/0 15kV size .668	3	
6	32000702	HNDX Preform-336.4 15kV size .933		3
7	32001298	HNDX Thim Clevis For Messenger	1	1
8	32001301	HNDX, Thim Clevis TC	3	3
9	34283544	Ins, Susp Epox 35kV	3	3
10	42907563	Nut, Eye 3/4"	1	1
11	71013041	Washer, Curved Guy 3/4"	1	1
12	71053075	Washer, Spring -3/4"	1	1
13	71053063	Washer, Spring - 5/8"	3	3
14	71013040	Washer, Square Curved, 4"x4"x 3/16"	4	4
15	18217811	Xarm Braceless Deadend 8'	1	1

Construction and Design Notes:

1. All messenger attachments where guying is required will utilize $\frac{3}{4}$ " bolts and hardware.
2. This assembly is for transitions of like-size conductors. When conductors are different size specify miscellaneous dead-end assemblies separately as needed.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX	336 HNDX
15 kV	HC6.1	HC6.3
25/35 kV	ZHC6.1	ZHC6.3



CONSTRUCTION ASSEMBLIES
HENDRIX DOUBLE DEADEND
TRANSITION, SPACER CABLE TO OPEN WIRE

HC6

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

HC6.1 Hndx Dbl DE Braceless Xarm Small Conductor 15kV
 HC6.3 Hndx Dbl DE Braceless Xarm Large Conductor 15kV
 ZHC6.1 Hndx Dbl DE Braceless Xarm Small Conductor 35kV
 ZHC6.3 Hndx Dbl DE Braceless Xarm Large Conductor 35kV

Ref	Material #	Description	HC6.1	HC6.3	ZHC6.1	ZHC6.3
1	340510	Adpt Ins 5/8" to 1"	1	1	1	1
2	6361514	Bolt, Eye 5/8" x 14"	1	1	1	1
3	6360616	Bolt, Eye 3/4" x 16"	1	1	1	1
4	6380614	Bolt, Machine 3/4" x 14"	1	1	1	1
5	6361512	Bolt, Machine 5/8" x 12"	1	1	1	1
6	11723025	Clamp DE 4-2/0 ACSR	3	3		
6	11723040	Clamp DE 4/0-336.4 ACSR			3	3
7	17010502	Con, Sicame TTD2710XFBTUNI	5	5		
7	17010502	Con, Sicame TTD2710XFBTUNI			2	2
7	17010520	Con, Sicame TTD4010XFBT			3	3
8	15620203	Cond #2 Str Cu	10	10		
8	15624007	Cond: #4/0 Str Cu			10	10
9	29800000	Guy Plate/Single Bolt	2	2	2	2
10	32000701	HNDX Preform-052 Messenger	1	1	1	1
11	32000702	HNDX Preform-336.4 15kV size .933		3		3
11	32000703	HNDX Preform-1/0 15kV size .668	3		3	
12	32001298	HNDX Thim Clevis For Messenger	3	1	1	3
13	32001301	HNDX, Thim Clevis Tc	3	3	3	3
14	32000901	HNDX Pin Ins Poly 15 kV	3	3		
14	32000903	HNDX Pin Ins Poly 35 kV			3	3
15	34283544	Ins, Susp Epox 35kV	6	6	6	6
16	42907563	Nut, Eye 3/4"	1	1	1	1
17	45412155	Pins Xarm 5/8" x 1"	2	2	2	2
18	67110000	Tie Wire, Alum Ins No 4 Solid	24	24	24	24
19	71013041	Washer, Curved Guy 3/4"	2	2	2	2
20	71053063	Washer, Spring - 5/8"	4	4	4	4
21	71053075	Washer, Spring -3/4"	2	2	2	2
22	71013040	Washer, Square Curved,4"x4"x 3/16"	6	6	6	6
23	18217811	Xarm Braceless Deadend 8'	1	1	1	1

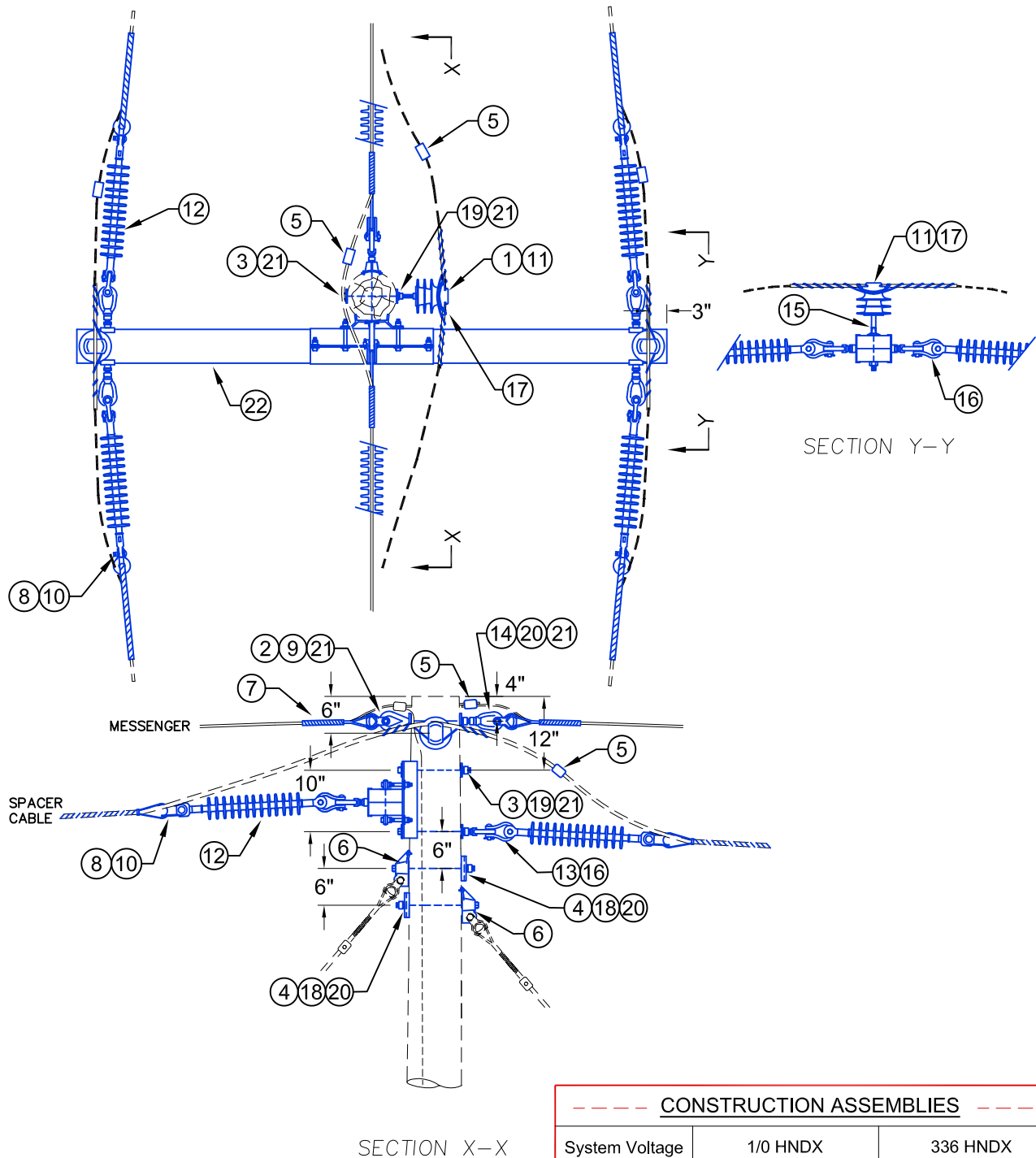


CONSTRUCTION STANDARDS

HENDRIX DOUBLE DEADEND
TRANSITION, SPACER CABLE TO OPEN WIRE

Construction and Design Notes:

1. All messenger attachments where guying is required will utilize $\frac{3}{4}$ " bolts and hardware.
2. This assembly is for double dead-end of like-size conductors. When conductors are different size specify miscellaneous dead-end assemblies separately as needed



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 HNDX	336 HNDX
15 kV	HC6-1.1	HC6-1.3
25/35 kV	ZHC6-1.1	ZHC6-1.3



CONSTRUCTION ASSEMBLIES
HENDRIX DOUBLE DEADEND
SPACER CABLE TO SPACER CABLE

HC6-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

HC6-1.1 Hndx DDE Spacer Cbl Braceless Xarm Sm Cond 15kV
 HC6-1.3 Hndx DDE Spacer Cbl Braceless Xarm Lg Cond 15kV
 ZHC6-1.1 Hndx DDE Spacer Cbl Braceless Xarm Sm Cond 35kV
 ZHC6-1.3 Hndx DDE Spacer Cbl Braceless Xarm Lg Cond 35kV

Ref	Material #	Description	HC6-1.1	HC6-1.3	ZHC6-1.1	ZHC6-1.3
1	0340510	Adpt Ins 5/8" to 1"	1	1	1	1
2	06360614	Bolt, Eye 3/4" x 14"	1	1	1	1
3	06380514	Bolt, Machine 5/8" x 14"	3	3	3	3
4	06380614	Bolt, Machine 3/4" x 14"	2	2	2	2
5	17010502	Con, Sicame TTD2710XFBTUNI	4		4	
5	17010502	Con, Sicame TTD2710XFBTUNI		1		1
5	17010520	Con, Sicame TTD4010XFBT		3		3
6	29800000	Guy Plate/Single Bolt	2	2	2	2
7	32000701	HNDX Preform-052 Messenger	2	2	2	2
8	32000702	HNDX Preform-336.4 15kV size .933		6		6
8	32000703	HNDX Preform-1/0 15kV size .668	6		6	
9	32001298	HNDX Thim Clevis For Messenger	2	2	2	2
10	32001301	HNDX, Thim Clevis Tc	6	6	6	6
11	32000901	HNDX Pin Ins Poly 15 kV	3	3		
11	32000903	HNDX Pin Ins Poly 35 kV			3	3
12	34283544	Ins, Susp Epox 35kV	6	6	6	6
13	42904063	Nut, Eye 5/8"	1	1	1	1
14	42907563	Nut, Eye 3/4"	1	1	1	1
15	45412155	Pins Xarm 5/8" x 1"	2	2	2	2
16	55570000	Shackle Anchor	6	6	6	6
17	67110000	Tie Wire, Alum Ins No 4 Solid	24	24	24	24
18	71013040	Washer, Square Curved, 4"x4"x 3/16"	2	2	2	2
19	71053063	Washer, Spring - 5/8"	4	4	4	4
20	71053075	Washer, Spring -3/4"	4	4	4	4
21	71020451	Washer, Square, 2 1/4" x 13/16"	6	6	6	6
22	18217811	Xarm Braceless Deadend 8'	1	1	1	1



CONSTRUCTION STANDARDS

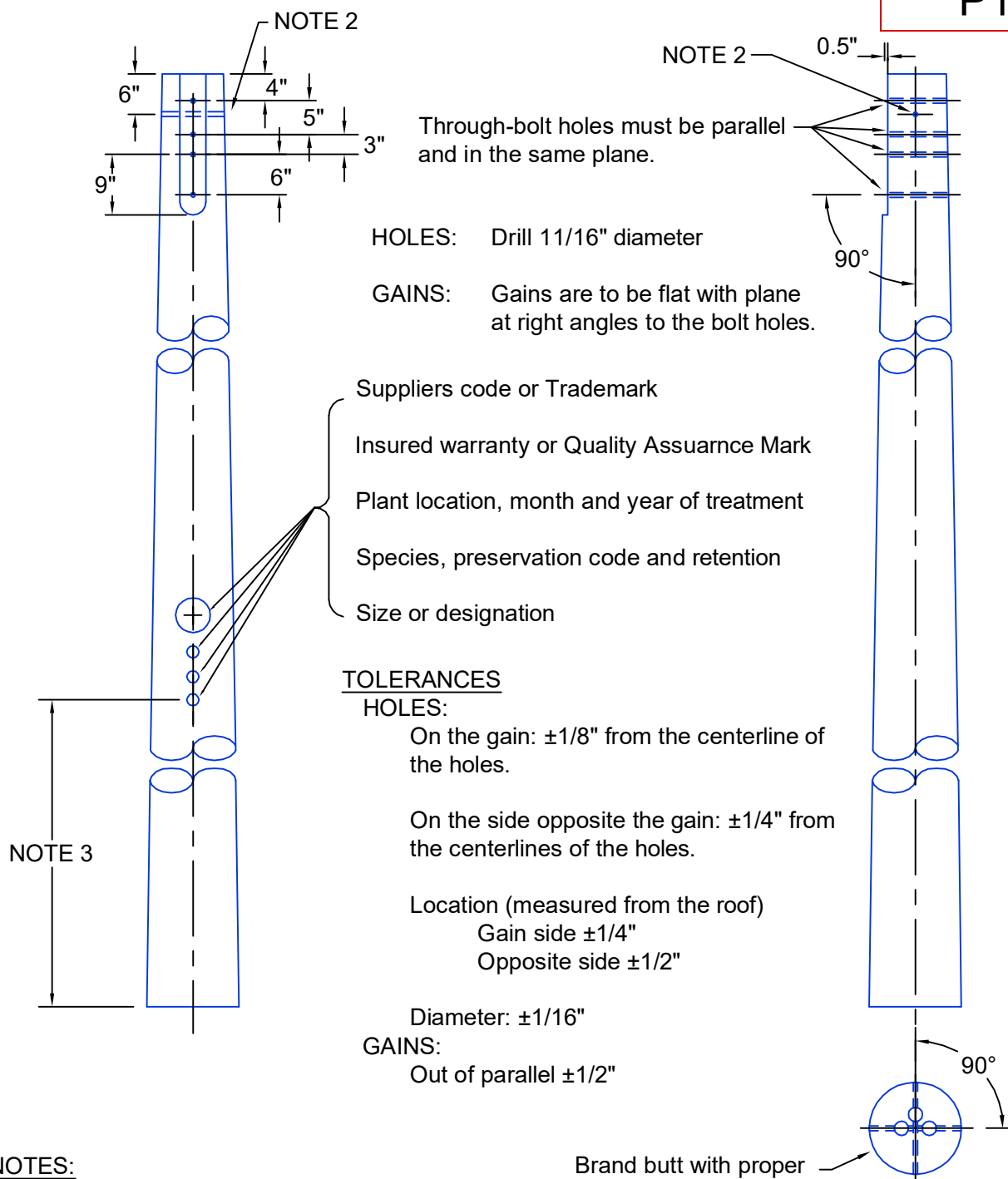
HENDRIX DOUBLE DEADEND
SPACER CABLE TO SPACER CABLE

HC6-1

ISSUE DATE: 01/22

Miscellaneous OH Assemblies 10

P1 Poles
P2 Crossarms
P3 Crossarm Braces
M4 Combo Bracket
HM4 Hendrix Brackets
HM5 (Page One) Hendrix Spacers
HM5 (Page Two) Hendrix Dead Ends
HM5 (Page Three) Hendrix Reverse Corner Clamp
M5 (Page One) Jumper Insulator, In-Line Open
M5 (Page Two) Pins and insulators
M2-51, M2-51A Pole Grounding
M10 Connectors



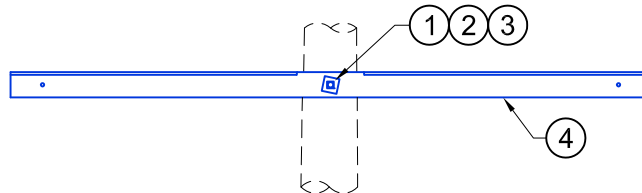
NOTES:

- 1.) All poles shorter than 50 feet must be bored, roofed and gained before treatment. Roofs may be flat or at a 15° angle at the producer's option.
- 2.) Anti-split bolt hole is to be drilled at 90° to through-bolt holes.
- 3.) Bottom of brand or center of metal disk shall be 10' $\pm 2"$ from the pole butt for poles less than 55' in length; 14' $\pm 2"$ for poles 55' and longer.

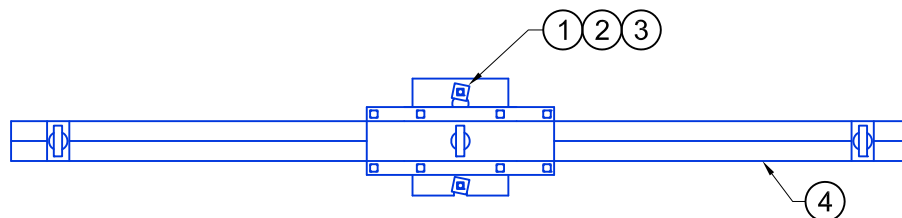
Brand butt with proper length and class

	Material #	Description
P1.30-5	48305000	Pole - 30' Class 5
P1.35-4	48354000	Pole - 35' Class 4
P1.40-3	48403000	Pole - 40' Class 3
P1.45-2	48452000	Pole - 45' Class 2
P1.50-1	48501000	Pole - 50' Class 1
P1.55-1	48551000	Pole - 55' Class 1
P1.60-1	48601000	Pole - 60' Class 1

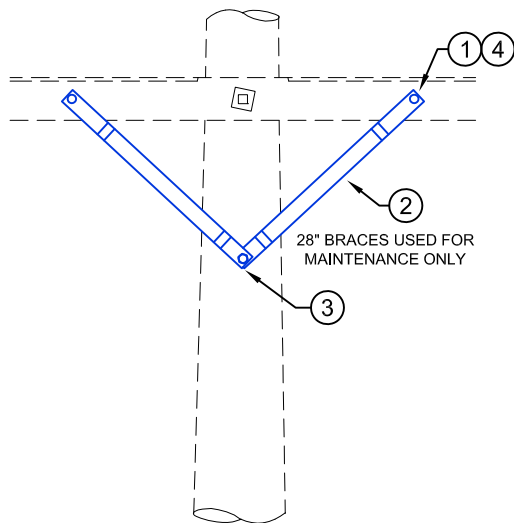




Ref. No.	Material #	Description					
			P2.10	P2.10H	P2.8	P2.8H	P2.6
1	6380516	Bolt, machine, 5/8" x 16"	1	1	1	1	1
2	71020451	Washer, square, 2-1/4"	2	2	2	2	2
3	71053063	Washer, spring lock, 5/8"	1	1	1	1	1
4	18210511	Crossarm, 3-3/4" x 4-3/4" x 10'-0"	1				
4	18211011	Crossarm, 4-3/4" x 5-3/4" x 10'-0"		1			
4	18210311	Crossarm, 3-3/4" x 4-3/4" x 8'-0"			1		
4	18210811	Crossarm, 4-3/4" x 5-3/4" x 8'-0"				1	
4	18210211	Crossarm, 3-3/4" x 4-3/4" x 5'-7"					1



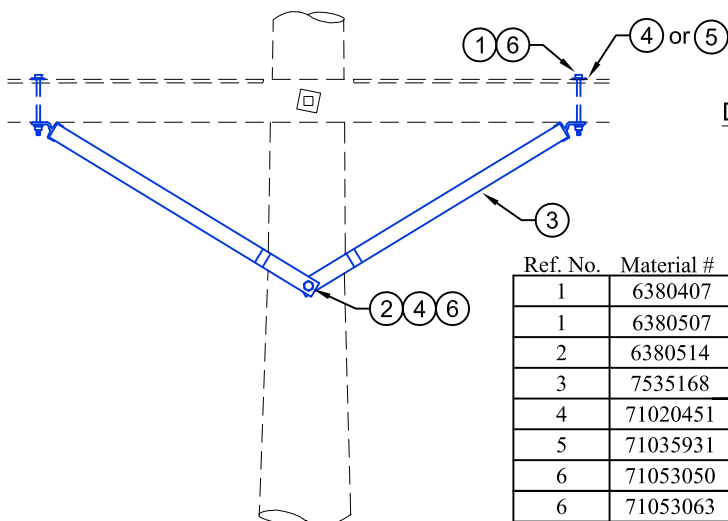
Ref. No.	Material #	Description		
			P2.8D1	P2.10D1
1	6380514	Bolt, machine, 5/8" x 14"	2	2
2	71020451	Washer, square, 2-1/4"	2	2
3	71053063	Washer, spring lock, 5/8"	2	2
4	18217811	Crossarm, Deadend Assembly 8'	1	
4	18200912	Crossarm, Deadend Assembly 10'		1



Description:

P3.28... Brace, Wood 28"

Ref. No.	Material #	Description	P3.28
1	6310305	Bolt, carriage, 3/8" x 5"	2
2	7535128	Brace (each), wood, 28"	2
3	55504440	Screw, lag, 1/2" x 4"	1
4	71050041	Washer, spring lock, 3/8"	2

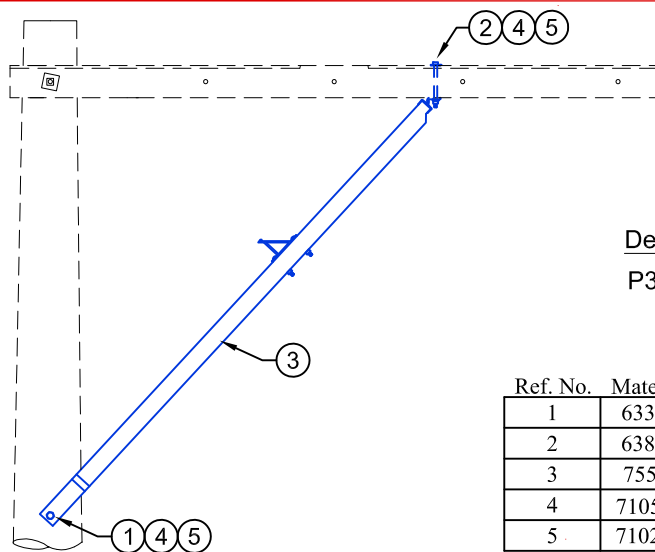


Description:

P3.60... Brace, Wood 60", Pair, 8 ft. Xarm

P3-1.60... Brace, Wood 60", Pair, 5'7" Xarm

Ref. No.	Material #	Description	P3.60	P3-1.60
1	6380407	Bolt, machine, 1/2" x 7"	2	
1	6380507	Bolt, machine, 5/8" x 7"		2
2	6380514	Bolt, machine, 5/8" x 14"	1	1
3	7535168	Brace (pair), wood, 60" span	1	1
4	71020451	Washer, square, 2-1/4"	1	3
5	71035931	Washer, round, 5/8"	2	
6	71053050	Washer, spring lock, 1/2"	2	
6	71053063	Washer, spring lock, 5/8"	1	3



Description:

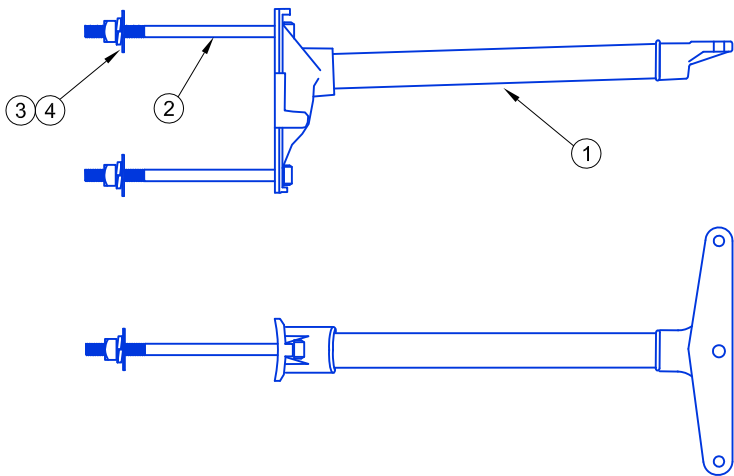
P3.7... Brace, Wood 7ft Alley arm

Ref. No.	Material #	Description	P3.7
1	6330516	Bolt, DA, 5/8" x 16"	1
2	6380507	Bolt, machine, 5/8" x 7"	1
3	7553200	Brace, wood, alley arm (each)	1
4	71053063	Washer, spring lock, 5/8"	2
5	71020451	Washer, square 2 1/4"	2

DESCRIPTIONS

M4

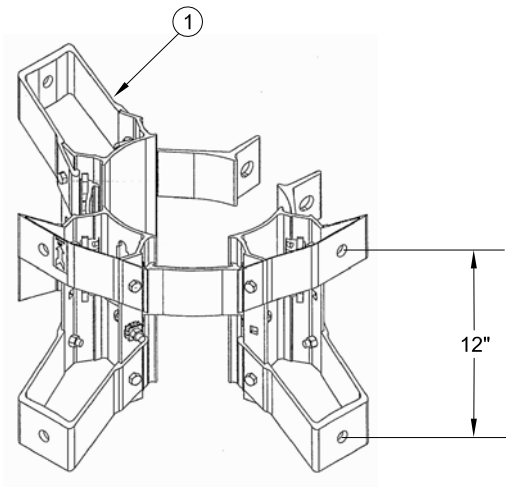
M4-12... Bracket, 12", Comb Arr/Cutout
M4-24... Bracket, 24", Comb Arr/Cutout



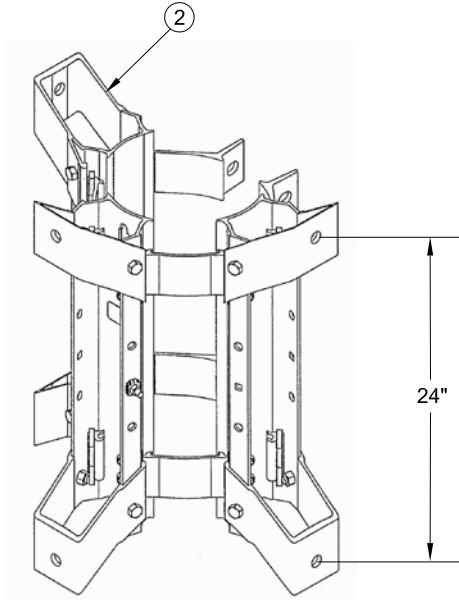
Ref. #	Material #	Description	M4	
			M4-12	M4-24
1	07800725	Bracket, Comb Arr/Cutout 24"		1
1	07800750	Bracket, Comb Arr/Cutout 12"	1	
2	6380514	Bolt, Machine 5/8" x 14"	2	2
3	71020451	Washer, Square, 2-1/4" x 13/16"	2	2
4	71053063	Washer, Spring 5/8"	2	2

DESCRIPTIONS

M4-25... Hanger, 3-Way, 0-25 kVA
M4-250... Hanger, 3-Way, 37-250 kVA



M4-25



M4-250

Ref. #	Material #	Description	M4	
			M4-25	M4-250
1	31002440	Hanger, 0-25 kVA	1	
2	31002490	Hanger, 37-250 kVA		1

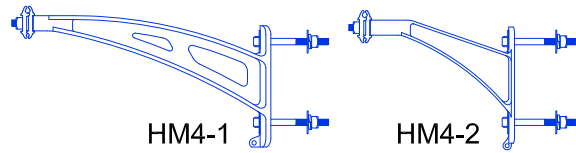


CONSTRUCTION STANDARDS
MISCELLANEOUS OVERHEAD
COMBINATION BRACKETS

M4

ISSUE DATE: 05/16

HM4



HM4-1

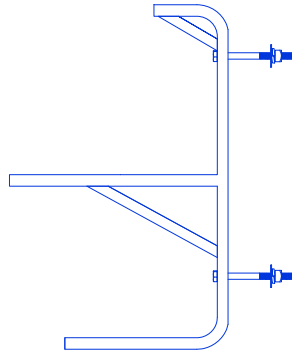
HM4-2



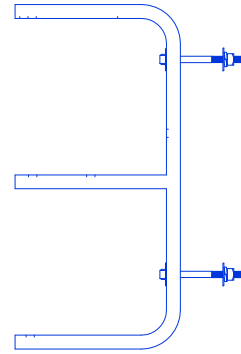
HM4-3



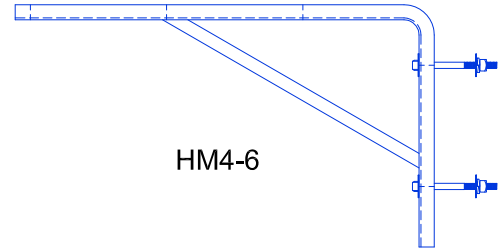
HM4-4



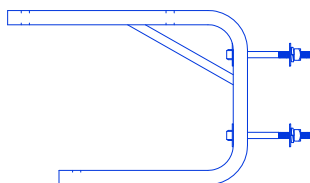
HM4-5



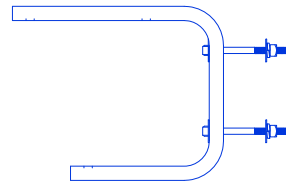
HM4-11



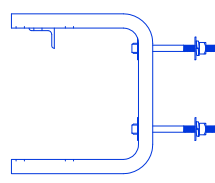
HM4-6



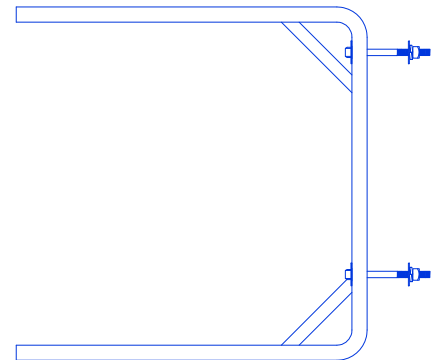
HM4-7



HM4-8



HM4-9



HM4-10

Material #	Description	HM4										
		HM4-1	HM4-2	HM4-3	HM4-4	HM4-5	HM4-6	HM4-7	HM4-8	HM4-9	HM4-10	HM4-11
32000202	Hndx Brkt Tan 24"	1										
32000201	Hndx Brkt Tan 14"		1									
32000214	Hndx Brkt Antisway 14"			1								
32000215	Hndx Brkt Antisway 24"				1							
32000210	Hndx Brkt, Angle, 35kV					1						
32000216	Hndx Brkt, Angle, 25kV						1					
32000208	Hndx Brkt, Angle, 35kV							1				
32000207	Hndx Brkt, Angle, 15kV								1			
32000205	Hndx Brkt, D.E., 35kV									1		
32000209	Hndx Brkt, Angle, 35kV										1	
32000213	Hndx Brkt, Vertical Tap											1
6380514	Bolt, Machine 5/8" x 14"	2	2			2	2	2	2	2	2	2
55504440	Screw, Lag 1/2" x 4"			2	2							
71053063	Washer, Spring 5/8"	2	2			2	2	2	2	2	2	2
71020451	Washer, Square, 2-1/4" x 13/16"	4	4			4	4	4	4	4	4	4



CONSTRUCTION STANDARDS

HARDWARE HENDRIX BRACKETS

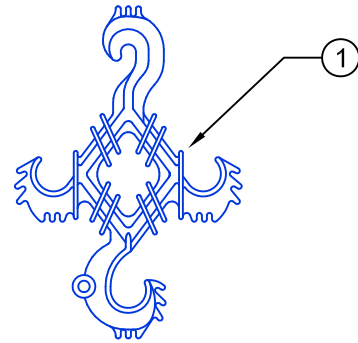
HM4

ISSUE DATE: 05/16

HM5

Description:

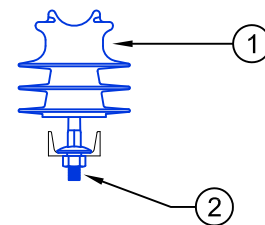
HM5-1... Hendrix Spacer H,15kV
ZHM5-1... Hendrix Spacer H, 46kV



Ref. No.	Material #	Description	HM5-1	ZHM5-1
1	32000301	HNDX Spacer H-15D	1	
1	32000302	HNDX Spacer H-46D		1

Description:

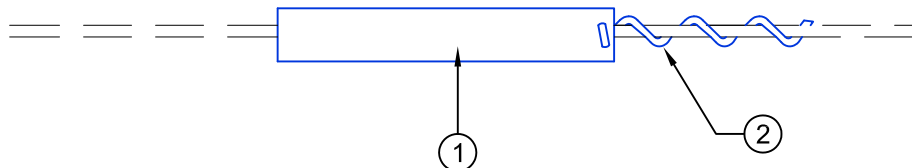
HM5-2... Hendrix Pin Insl, Poly,15kV
ZHM5-2... Hendrix Pin Insl, Poly,35kV



Ref. No.	Material #	Description	HM5-2	ZHM5-2
1	32000901	HNDX Pin Insl Poly 15kV	1	
1	32000903	HNDX Pin Insl Poly 35kV		1
2	32001601	HNDX Insl Pin, short shank SSP-2	1	1

Description:

HM5-3... Hendrix Clip-on Line Duc

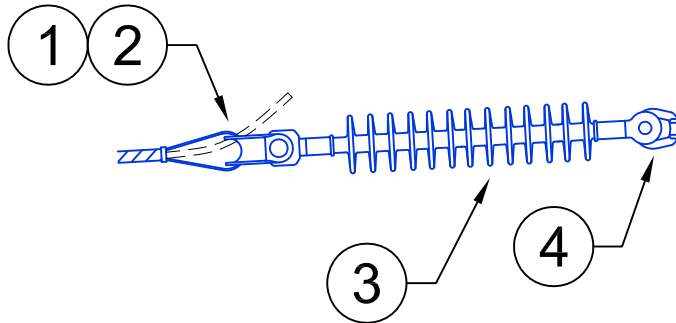


Ref. No.	Material #	Description	HM5-3
1	32000906	HNDX Clip-on Line Duc Std 8ft.	1'
2	67100000	Tie Wire Alum Round	2'



Description:

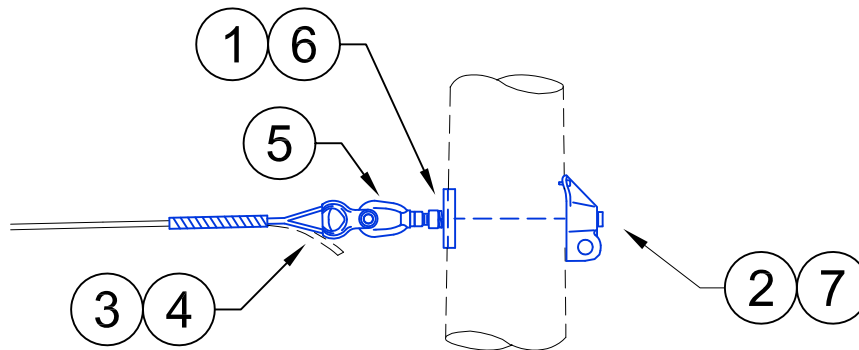
HM5-55.1... Hendrix Deadend, Epoxilator 1/0 Spacer
 HM5-55.3... Hendrix Deadend, Epoxilator 336 Spacer



Ref. No.	Material #	Description	HM5-55.1	HM5-55.3
1	32000702	HNDX PRFM 336.4 15KV .907		1
1	32000703	HNDX PRFM 1/0 15KV .638	1	
2	32000301	HNDX Thimble Clevis TC	1	1
3	34283544	Ins, Suspension, Epox 35kv	1	1
4	42904063	Nut, Eye 5/8"	1	1

Description:

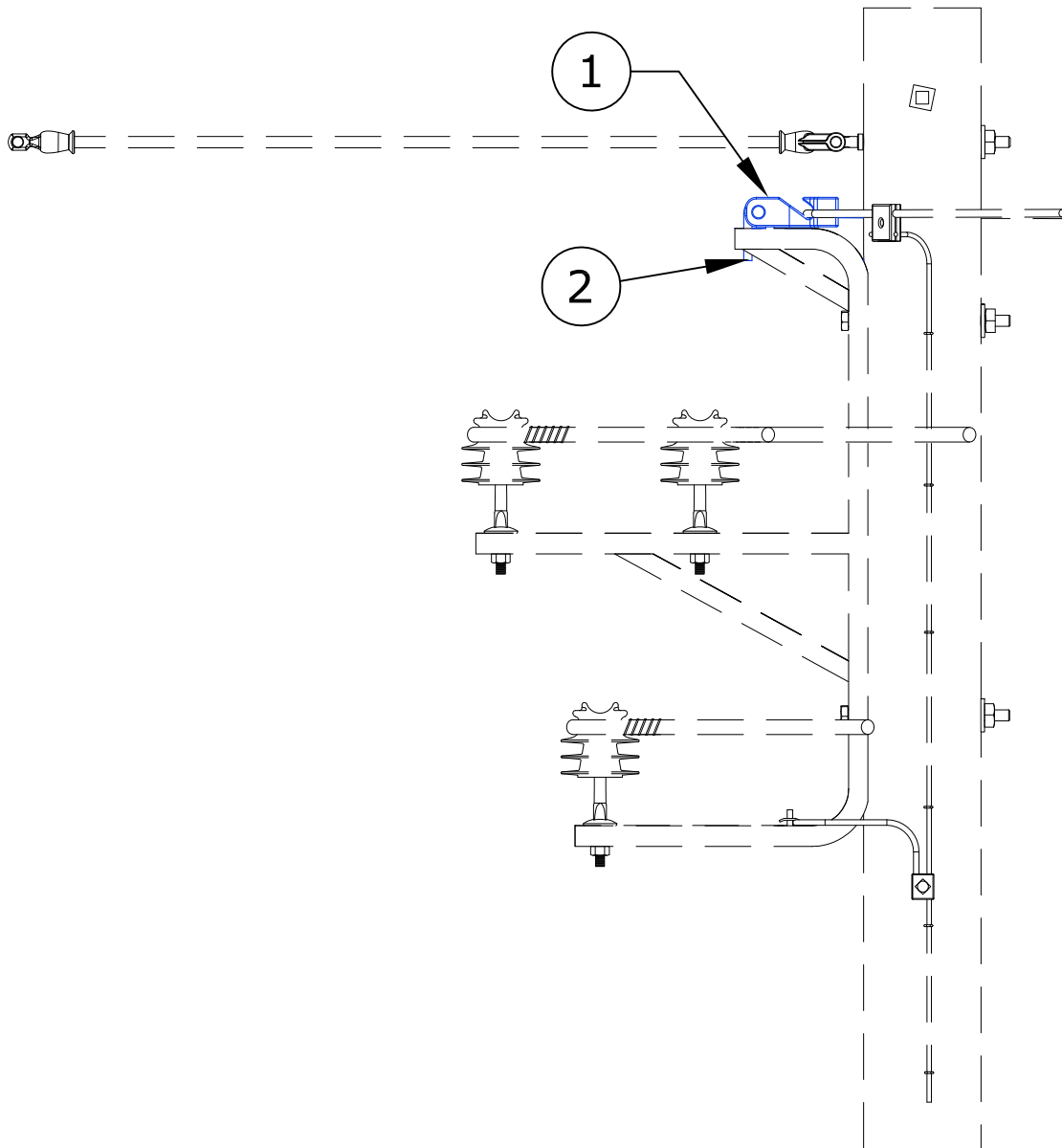
HM5-55.052... HNDX Deadend 052 Messenger



Ref. No.	Material #	Description	HM5-55.052
1	6380616	Bolt, Machine 3/4" x 16"	1
2	29800010	Guy Plate/Tie Trans	1
3	32000701	HNDX Preform 052 Messenger	1
4	32001298	HNDX Thimble Clevis for Messenger	1
5	42907563	Nut, Eye, 3/4"	1
6	71013041	Washer, Curved Guy 3/4"	1
7	71053075	Washer, Spring , 3/4"	2

Description:

HM5-56... Hendrix, Reverse Corner, messenger

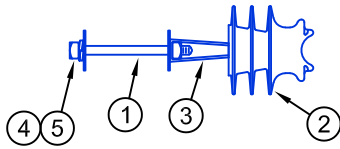


Ref. No.	Material #	Description	HM5-56
1	32000304	HNDX Angle Clamp, CMA-2	1
2	32001303	HNDX, U-Bolt - UB	1

DESCRIPTIONS

M5-50... Insulator, Pin, Stand Off 15kV

ZM5-50... Insulator, Pin, Stand Off 35kV

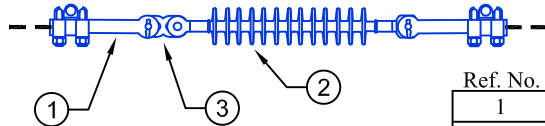


Ref. No.	Material #	Description	M5-50	ZM5-50
1	6380512	Bolt, machine, 5/8" x 12"	1	1
2	32000901	HNDX Pin Ins Poly 15kV	1	
2	32000903	HNDX Pin Ins Poly 35kV		1
3	00340510	Pin, adapter, 5/8" bolt, 1"	1	1
4	71053063	Washer, spring, 5/8"	1	1
5	71020451	Washer, square, 2-1/4"	2	2

DESCRIPTIONS

M5-51.1... Insulator, Susp w/Deadend Shoes, 1/0

M5-51.3... Insulator, Susp w/Deadend Shoes, 336



Ref. No.	Material #	Description	1/0 ACSR M5-51.1	336 ACSR M5-51.3
1	11723025	Clamp DE 4-2/0 ACSR	2	
1	11723040	Clamp DE 3/0-477 ACSR		2
2	34283544	Insulator, suspension, epoxilator, 35kV	1	1
3	35120000	Link, figure 8	1	1

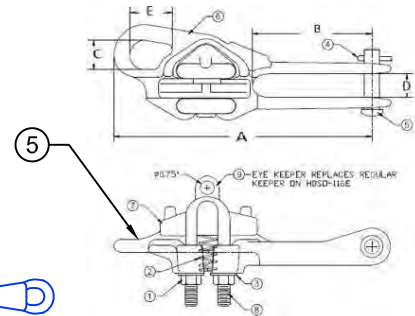
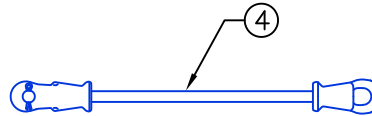
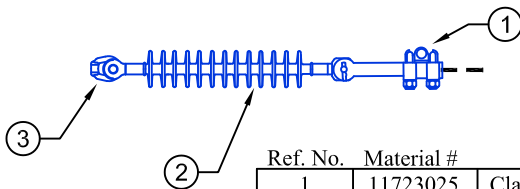
DESCRIPTIONS

M5-55.1... Deadend, Epoxilator 1/0 ACSR

M5-55.3... Deadend, Epoxilator 336 ACSR

M5-55C... Clamp, Deadend, Copper #6 - 4/0

M5-55L... Link, Insulated Extension 12"



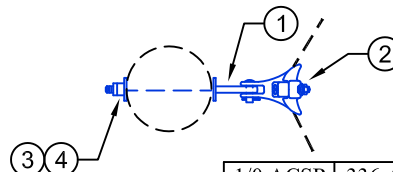
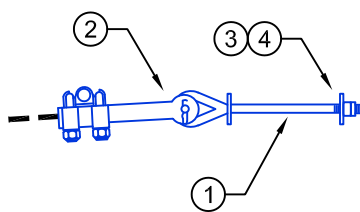
Ref. No.	Material #	Description	M5-55C	M5-55L	1/0 ACSR M5-55.1	336 ACSR M5-55.3
1	11723025	Clamp DE 4-2/0 ACSR			1	
1	11723040	Clamp DE 3/0-477 ACSR				1
2	34283544	Insulator, suspension, epoxilator, 35kV			1	1
3	42904063	Nut, Eye 5/8"			1	1
4	37820000	Link, Extension, Pri 12" short		1		
5	11723030	Clamp, Deadend, Copper #6 - 4/0	1			

DESCRIPTIONS

M5-55N.1... Neutral Deadend, 1/0 ACSR

M5-55N.3... Neutral Deadend, 336 ACSR

M5-55N.S... Neutral Attach, Angle Susp



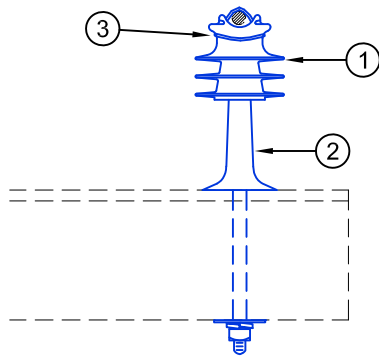
Ref. No.	Material #	Description	1/0 ACSR M5-55N.1	336 ACSR M5-55N.3	M5-55N.S
1	6361514	Bolt, Eye 5/8 x 14"	1	1	1
2	11723025	Clamp DE 4-2/0 ACSR	1		
2	11723040	Clamp DE 3/0-477 ACSR		1	
2	11744000	Clamp, Susp/Angle, Alum			1
3	71053063	Washer, Spring 5/8"	1	1	1
4	71020451	Washer, Square 2 1/4 x 13/16	2	2	2



CONSTRUCTION STANDARDS
MISCELLANEOUS OVERHEAD
INSULATORS
(PAGE ONE)

M5

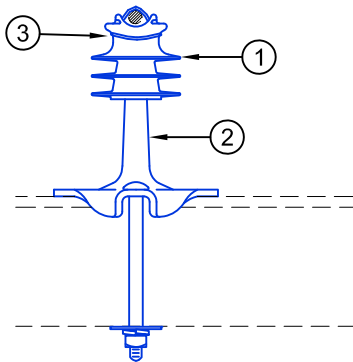
ISSUE DATE: 12/21



Description:

M5-54... Crossarm Pin Assembly 15kV
ZM5-54... Crossarm Pin Assembly 35kV

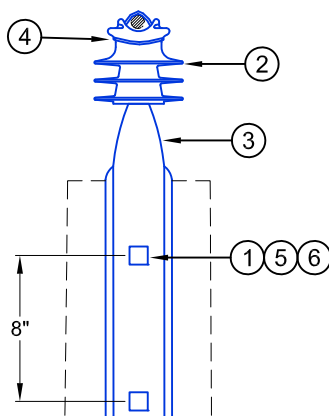
Ref. No.	Material #	Description	M5-54	ZM5-54
1	32000901	HNDX Pin Ins Poly 15kV	1	
1	32000903	HNDX Pin Ins Poly 35kV		1
2	45412155	Pin, crossarm, steel, 1"	1	1
3	67110000	Tie Wire, Alum Ins No 4 SOL	6	6



Description:

M5-53... Crossarm Pin Clamp-Type 15kV
ZM5-53... Crossarm Pin Clamp-Type 35kV

Ref. No.	Material #	Description	M5-53	ZM5-53
1	32000901	HNDX Pin Ins Poly 15kV	1	
1	32000903	HNDX Pin Ins Poly 35kV		1
2	45411155	Pin, crossarm, steel clamp type, 1"	1	1
3	67110000	Tie Wire, Alum Ins No 4 SOL	6	6



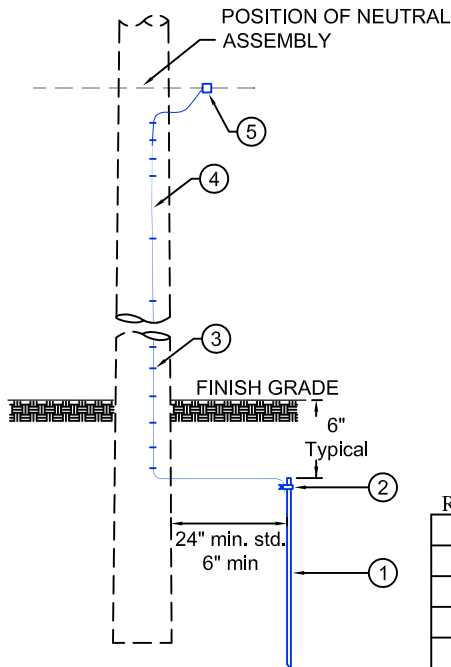
Description:

M5-52... Pole Top Pin Assembly 15kV
ZM5-52... Pole Top Pin Assembly 35kV

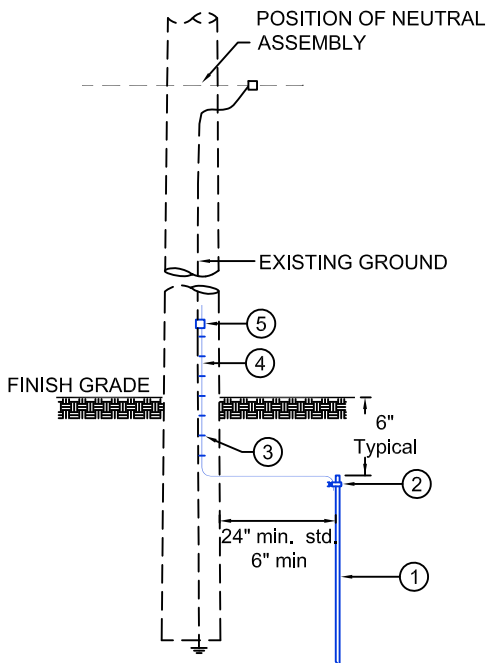
Ref. No.	Material #	Description	M5-52	ZM5-52
1	6380514	Bolt, machine, 5/8" x 14"	2	2
2	32000901	HNDX Pin Ins Poly 15kV	1	
2	32000903	HNDX Pin Ins Poly 35kV		1
3	45612120	Pin, pole top, 20" x 1"	1	
3	45612520	Pin, pole top, 20" x 1" offset		1
4	67110000	Tie Wire, Alum Ins No 4 SOL	6	6
5	71053063	Washer, spring, 5/8"	2	2
6	71020451	Washer, square, 2-1/4"	2	2

Construction and Design Notes:

1. Ground wire to be located on same side as Neutral Conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be approximately 2' apart, except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Ground wire to clear all hardware by 2" min. and shall be stapled to maintain this position.

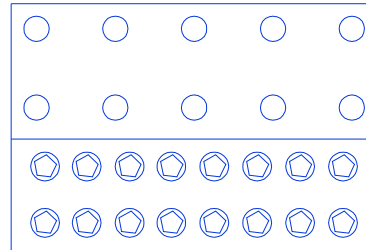
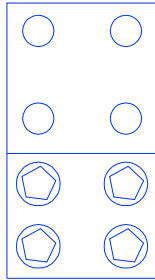


Ref. No.	Material #	Description	1/0 ACSR	336 ACSR
			M2-51.1	M2-51.3
1	53808508	Rod, ground, copper, 5/8" x 8'-0"	1	1
2	17311000	Clamp, ground rod, 5/8"	1	1
3	61801810	Staples, ground wire	1	1
4	15610601	Conductor, #6 solid copper	45	45
5	17018010	Conn: GC8010P 1/0 STR-8	1	
5	17018040	Conn: LC52CXB		1

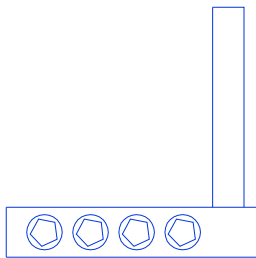


Ref. No.	Material #	Description	M2-51A
1	53808508	Rod, ground, copper, 5/8" x 8'-0"	1
2	17311000	Clamp, ground rod, 5/8"	1
3	61801810	Staples, ground wire	8
4	15610601	Conductor, #6 solid copper	6
5	17015004	Connector, GC5004 #4 Solid	1

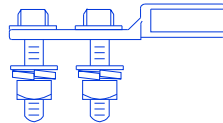
M10



Item No.	Material #	Description	M10-SPADE.2	M10-SPADE.4	M10-SPADE.6	M10-SPADE.8
1	17040000	Conn, Xfmr Sec Sp 4 Pos	1			
1	17040004	Conn, Xfmr Sec Sp 4 Pos		1		
1	17040006	Conn, Xfmr Sec Sp 6 Pos			1	
1	17040008	Conn, Xfmr Sec Sp 6 Pos				1
2	17040100	Conn, Xfmr Stainless bolts 1-1/2"	2	4	6	8
3	17040115	Conn, Xfmr Stainless washer flat	2	4	6	8
4	17040120	Conn, Xfmr Stainless washer lock	2	4	6	8
5	17040125	Conn, Xfmr Stainless nut	2	4	6	8
6	18000000	Cover, Live Sec Pad	1	4	1	1



Item No.	Material #	Description	M10-STUD.3	M10-STUD.4
1	17050000	Conn, Xfmr Sec Stud Al 3	1	
1	17050004	Conn, Xfmr Sec Stud Al 4		1



Item No.	Material #	Description	M10-CRIMP.				
			002	010	04	350	500
1	17019002	Conn, Comp Terminal NEMA #2	1				
1	17019010	Conn, Comp Terminal NEMA #1/0		1			
1	17019040	Conn, Comp Terminal NEMA #4/0			1		
1	17019350	Conn, Comp Terminal NEMA #350				1	
1	17019500	Conn, Comp Terminal NEMA #500					1
2	17040100	Conn, Xfmr Stainless bolts 1-1/2"	2	2	2	2	2
3	17040115	Conn, Xfmr Stainless washer flat	4	4	4	4	4
4	17040120	Conn, Xfmr Stainless washer lock	2	2	2	2	2
5	17040125	Conn, Xfmr Stainless nut	2	2	2	2	2



CONSTRUCTION STANDARDS

MISCELLANEOUS TRANSFORMER CONNECTORS

M10

ISSUE DATE: 01/06

Guys and Anchors 11

Guying / Anchor Guidelines

E1-10 Single Down Guy

E1-15 Single Down Guy HD 7/16"

HE1-10 Single Down Guy, Hendrix

E2-10 Double Down Guy, Spread

HE2-10 Double Down Guy, Hendrix, Spread

E2-20 Double Down Guy, In Line

HE2-20 Double Down Guy, Hendrix, In Line

E3-15 Sidewalk Guy

HE3-15 Sidewalk Guy, Hendrix

E4-10 Single Overhead Guy

HE4-10 Single Overhead Guy, Hendrix

E4-20 Double Overhead Guy

HE4-20 Double Overhead Guy, Hendrix

E5 Push Brace

E9-1 Guy Tee & Link, HE9-1 Guy Strain Link, E9-3 Guy Marker Plastic

Anchor

F1 Screw Anchor Assembly

F2 Log Anchor Assembly

F2-2 Log, Double Rod Anchor Assembly

F4 Expanding Anchor Assembly

F5 Rock Anchor Assembly

GUYING & ANCHOR TABLES

(Good for bare & 15-35 kV covered-wire construction)

New Hampshire Electric Co-op, Inc.

TOTAL HORIZONTAL PULL ON POLE AT ANGLE (lbs.)				
LINE ANGLE (deg)	1/0 ACSR Treewire (or Bare) (1/0 ACSR neut)		336.4 ACSR Treewire (or Bare) (4/0 ACSR neut)	1/0 & 336.4 SPACER (052 AWA neut)
	SINGLE-PHASE	THREE-PHASE	THREE-PHASE	THREE-PHASE
5	1,200	2,415	2,785	675
10	1,605	3,315	4,000	1,345
15	2,020	4,210	5,210	2,010
20	2,425	5,100	6,410	2,675
25	2,830	5,985	7,605	3,335
30	3,235	6,860	8,790	3,990
35	3,630	7,730	9,955	4,635
40	4,020	8,580	11,110	5,270
45	4,405	9,425	12,245	5,895
50	4,785	10,250	13,355	6,510
55	5,155	11,060	14,450	7,115
60	5,515	11,850	15,515	7,700
DEAD END	5,100	10,765	14,490	7,780

MAXIMUM HORIZONTAL PULL GUY WILL HOLD (lbs.)							
TABLE GIVES MINIMUM GUY LEADS (GRADE "C" CONSTRUCTION)	GUY LEAD (ft.)	SINGLE-GUY ASSEMBLY (3/8" GALVANIZED STEEL STRAND, 11,500 lbs. RBS)					
		30' POLE	35' POLE	40' POLE	45' POLE	50' POLE	55' POLE
	10	3,700					
	12	4,385	3,840				
	14	5,010	4,420	3,315			
	16	5,565	4,955	4,335	3,885		
	18	6,065	5,440	4,795	4,320	3,920	
	20	* 6,505	5,880	5,220	4,725	4,305	3,950
	25	7,395	* 6,805	6,145	5,630	5,180	4,785
	30	8,040	7,510	* 6,890	6,385	5,925	5,520
	35		8,045	7,480	* 7,000	6,555	6,150
	40			7,950	7,505	* 7,085	6,690
	45				7,920	7,525	* 7,150
	50					7,895	7,545
	55						7,875
<u>RULING SPAN (RS) EQUATION (approximate):</u>		* approx. 1:1 guy slope (recommended)					
RS = AVG. SPAN + 2/3 (MAX. SPAN – AVG. SPAN)							
<u>SAG EQUATION:</u>		NOTE: Guy leads shorter than those listed above for each pole size should be avoided.					
SAG = RS SAG (SPAN / RS) ²							

GUYING & ANCHOR TABLES

(Good for bare & 15-35 kV covered-wire construction)

New Hampshire Electric Co-op, Inc.

<u>SCREW ANCHORS</u>					
ANCHOR UNIT	ROD SIZE	ANCHOR DESCRIPTION	HOLDING CAPACITY (LBS)		
			SOIL CLASS		
			HARD	AVERAGE	SOFT
F1.8	1" x 7'-0"	8" SCREW	16,000	12,000	-
F1.10	1" x 7'-0"	10" SCREW	24,000	20,000	8,000
F1.14	1" x 7'-0"	14" SCREW	-	-	12,000

<u>LOG ANCHORS</u>					
ANCHOR UNIT	ROD SIZE	ANCHOR DESCRIPTION	HOLDING CAPACITY (LBS)		
			SOIL CLASS		
			HARD	AVERAGE	SOFT
F2.8	¾" x 8'-0"	9" dia. x 5'-0"	16,000	12,000	8,000
F2.10	1" x 10'-0"	12" dia. x 5'-0"	24,000	16,000	10,000
F2-2.10	1" x 10'-0" (2)	8" dia. x 8'-0"	32,000	24,000	16,000

<u>EXPANDING ANCHORS</u>					
ANCHOR UNIT	ROD SIZE	ANCHOR DESCRIPTION	HOLDING CAPACITY (LBS)		
			SOIL CLASS		
			HARD	AVERAGE	SOFT
F4.12	3/4" x 8'-0"	135 sq. in.	16,000	12,000	6,000
F4.16	1" x 10'-0"	300 sq. in.	26,000	20,000	10,000

Note: Rock anchors exceed the rating of the anchors listed above and have a 36,000 lb holding capacity regardless of soil.

SOIL CLASSIFICATIONS:

HARD soils: hardpan, dense sand, compact gravel or clay, shale, broken bedrock, etc.

AVERAGE soils: clay-silt, loose coarse sand, compact fine sand

SOFT soils: wet clay, loose fine sand, swamp, loose fill, etc.

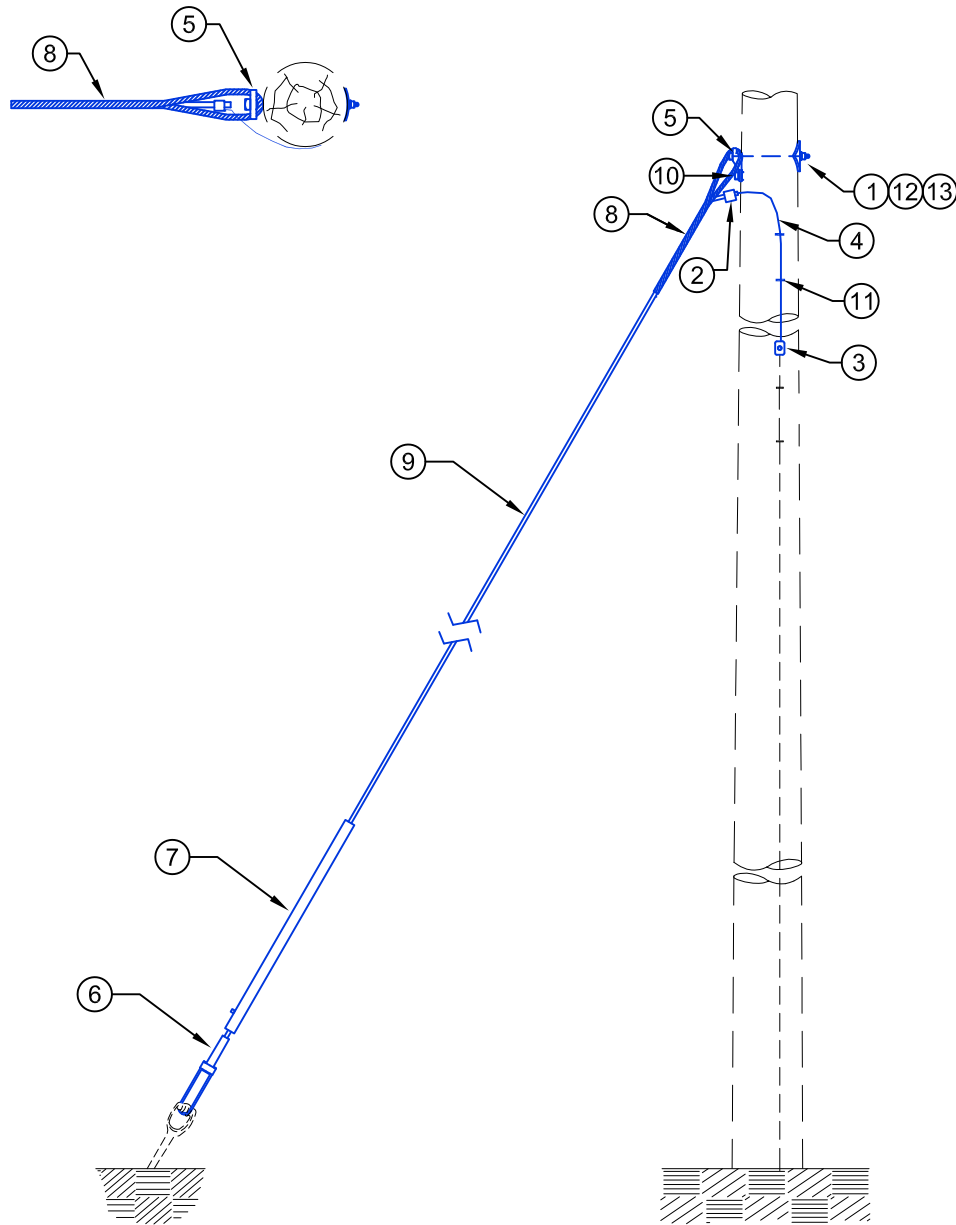
GUYING & ANCHOR TABLES

(Good for bare & 15-35 kV covered-wire construction)

New Hampshire Electric Co-op, Inc.

Clearance from Phase to Guy Wire/Link (from table 235-6)

Phase Voltage	No Guy Strain Link (bare guy wire)	w/ Guy Strain Link
Secondary (<750V)	3 in.	3 in.
4 kV and Neutral	6 in.	5 in.
12.5 kV	7 in.	6 in.
24.9 kV	11 in.	9 in.
35 kV	13 in.	10 in.
46 kV	16 in.	12 in.



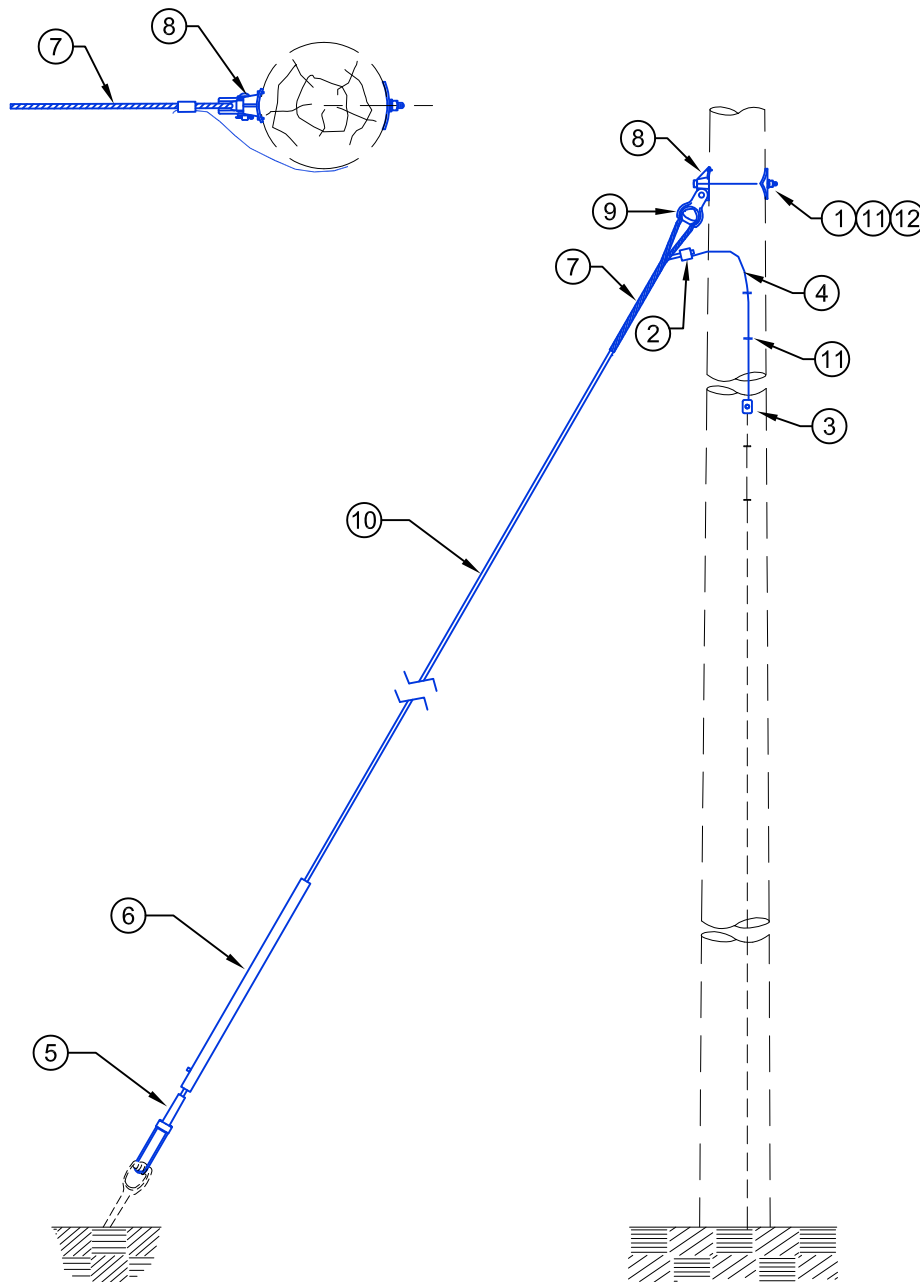
Design Limits:
9000 LBS.

Materials List for Assemblies

Descriptions

E1-10 Single Down Guy

Ref	Material #	Description	E1-10
1	6380514	Bolt, Machine 5/8" X 14"	1
2	17010502	Con, Sicame TTD2710XFBTUNI	1
3	17015004	Conn: GC5004 #4 solid	1
4	15610601	Cond. #6 Sol Cu Soft Drawn	6
5	2150200	Guy Attachment	1
6	11772038	Guy Auto De 3/8" Short	1
7	29300851	Guy Marker Plastic	1
8	11772085	Guy, Preformed Grip 3/8"	1
9	73818307	Guy Wire 3/8"	40
10	55504440	Screw, Lag 1/2" X 4"	1
11	61801810	Staples, Ground Wire	6
12	71013041	Washer, Curved Guy 5/8"	1
13	71053063	Washer, Spring - 5/8"	1



Design Limits:
18720 LBS.



CONSTRUCTION STANDARDS

SINGLE DOWN GUY HD 7/16"

E1-15

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

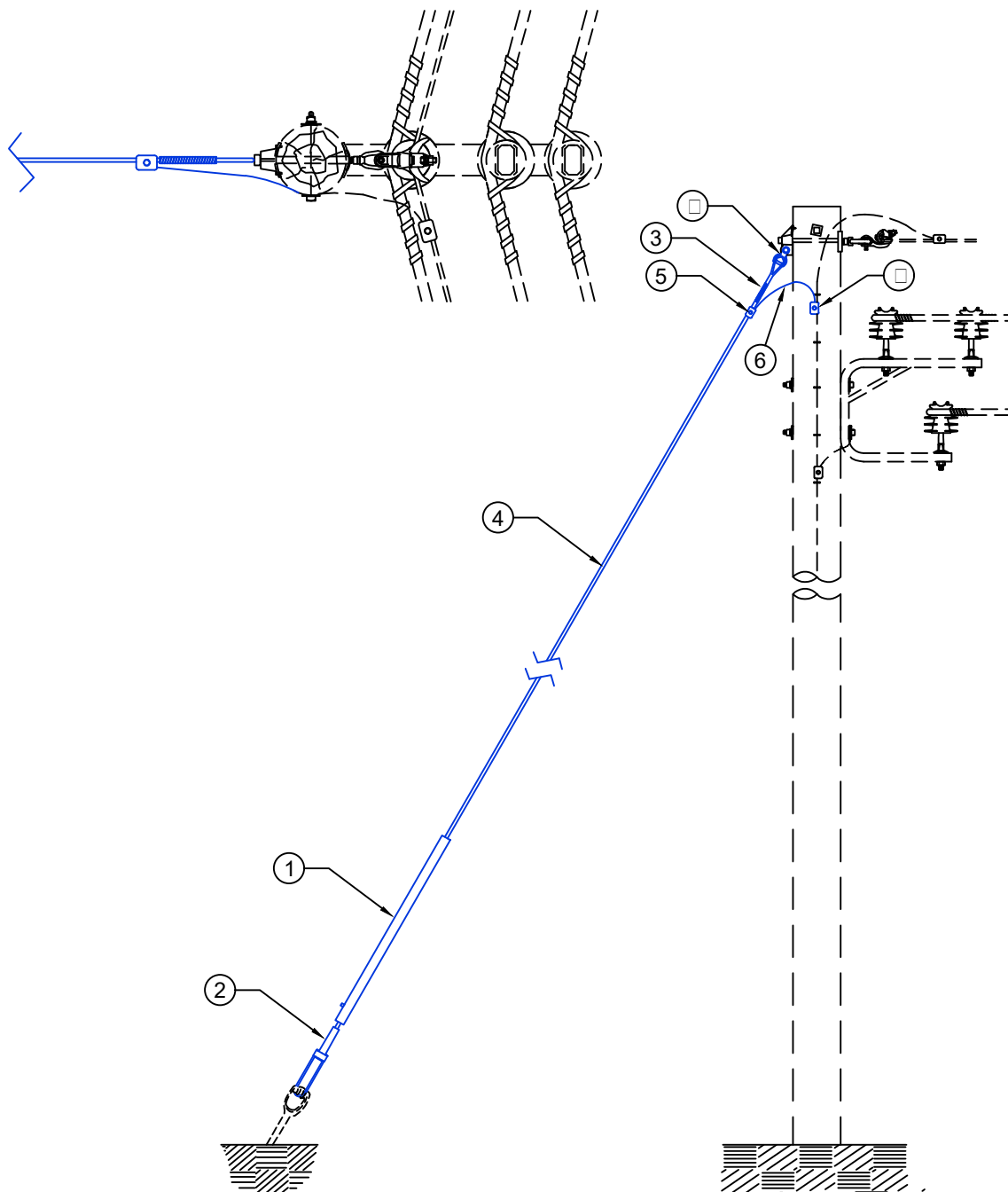
E1-15 Single Down Guy HD 7/16"

Ref	Material #	Description	E1-15
1	6380616	Bolt, Machine 3/4" X 16"	1
2	17010502	Con, Sicame TTD2710XFBTUNI	1
3	17015004	Conn: GC5004 #4 solid	1
4	15610601	Cond. #6 Sol Cu Soft Drawn	6
5	11772076	Guy Auto De 7/16"	1
6	29300851	Guy Marker Plastic	1
7	11772087	Guy, Preformed Grip 7/16"	1
8	29800000	Guy Plate/Single Bolt	1
9	29700000	Guy Thimble	1
10	73816707	Guy Wire 7/16"	50
11	61801810	Staples, Ground Wire	6
12	71013041	Washer, Curved	1
13	71053075	Washer, Spring – 3/4"	1

Construction and Design Notes

1. All Hendri anchor cable dependent rebar do not anchor.
2. All Hendri anchor rebar 3/4" hardwire.

HE1-10



Design Load:
9000 LBS.



CONSTRUCTION STANDARDS

SINGLE DOWN GUY HENDRI

HE1-10

REV. DATE: 07/2010

Materials List for Assemblies

Descriptions

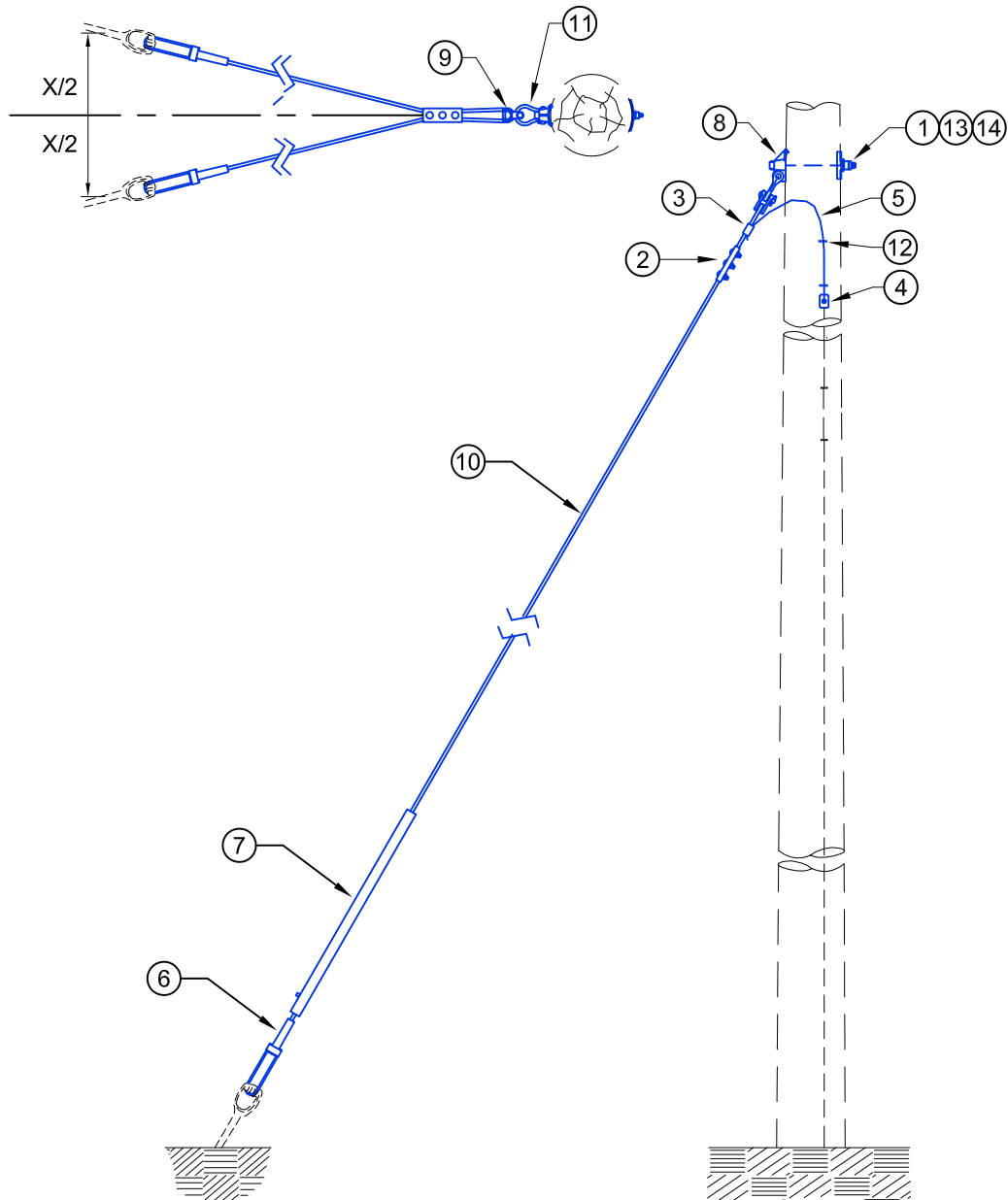
HE1-10 Single Down Guy, Hendrix

Ref	Material #	Description	HE1-10
1	29300851	Guy Marker Plastic	1
2	11772038	Guy Auto De 3/8" Short	1
3	1172085	Preformed Guy Grip	1
4	73818307	Guy Wire 3/8"	40
5	17010502	Con, Sicame TTD2710XFBTUNI	1
6	15610601	Cond, 6 Sol Cu Soft Drawn	3
7	2970000	Guy Thimble	1
8	17015004	Conn: GC5004 #4 solid	1

Construction and Design Notes:

X= 5' Spacing min. for screw/expansion anchors

X= 3' Spacing min. for double log anchors



Design Limits:
18000 LBS.

Materials List for Assemblies

Descriptions

E2-10 Double Down Guy, Spread

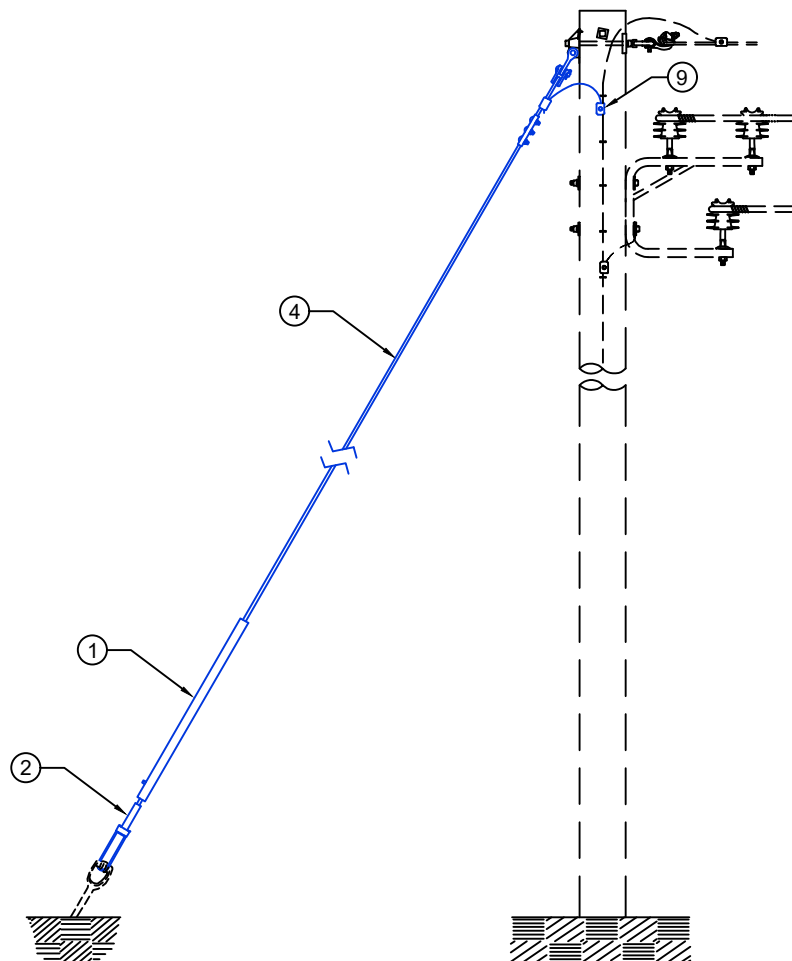
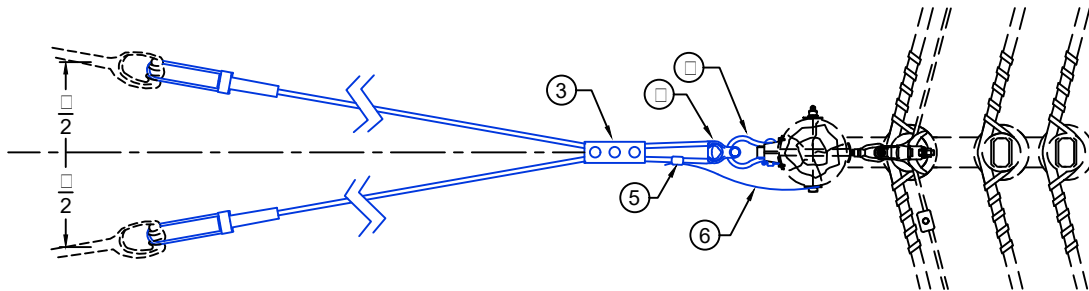
Ref	Material #	Description	E2-10
1	06380614	Bolt, Machine 3/4" x 14"	1
2	11732289	Clamp, 3-Bolt	1
3	17010502	Con, Sicame TTD2710XFBTUNI	1
4	17015004	Conn: GC5004 #4 solid	1
5	15610601	Cond, 6 Sol Cu Soft Drawn	6
6	11772038	Guy Auto De 3/8" Short	2
7	29300851	Guy Marker Plastic	2
8	29800000	Guy Plate/ Single Bolt	1
9	29700000	Guy Thimble	1
10	73818307	Guy Wire 3/8"	80
11	55570000	Shackle Anchor	1
12	61801810	Staples, Ground Wire	6
13	71013041	Washer, Curved 4" x 4" x 13/16"	1
14	71053075	Washer, Spring - 3/4"	1

Construction and Detail Note:

1. A Hendri member cable depends/requires double anchor.
2. A Hendri member requires 3/4" hardware.

5' Spacing in. for cret/election anchor

3' Spacing in. for double anchor



Detail Limit:
1000 LBS.

Materials List for Assemblies

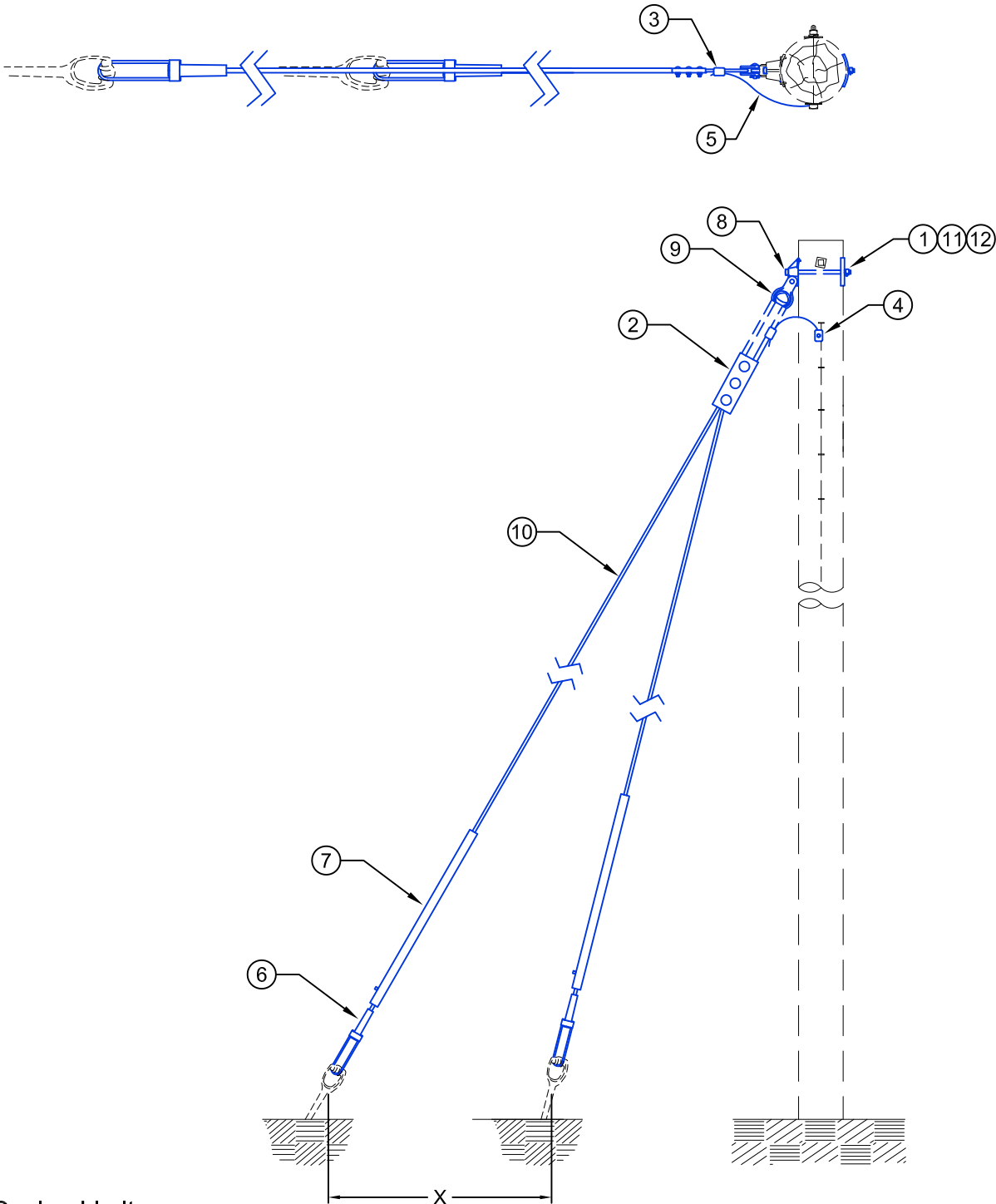
Descriptions

HE2-10 Double Down Guy, Hendrix, Spread

Ref	Material #	Description	HE2-10
1	29300851	Guy Marker Plastic	2
2	11772038	Guy Auto De 3/8" Short	2
3	11732289	Clamp, 3-Bolt	1
4	73818307	Guy Wire 3/8"	80
5	17010502	Con, Sicame TTD2710XFBTUNI	1
6	15610601	Cond, 6 Sol Cu Soft Drawn	3
7	55570000	Shackle Anchor	1
8	29700000	Guy Thimble	1
9	17015004	Conn: GC5004 #4 solid	1

Construction and Design Notes:
X= 5' Spacing min. for screw/expansion anchors

E2-20



Design Limits:
18000 LBS.



CONSTRUCTION STANDARDS

DOUBLE DOWN GUY - INLINE

E2-20

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

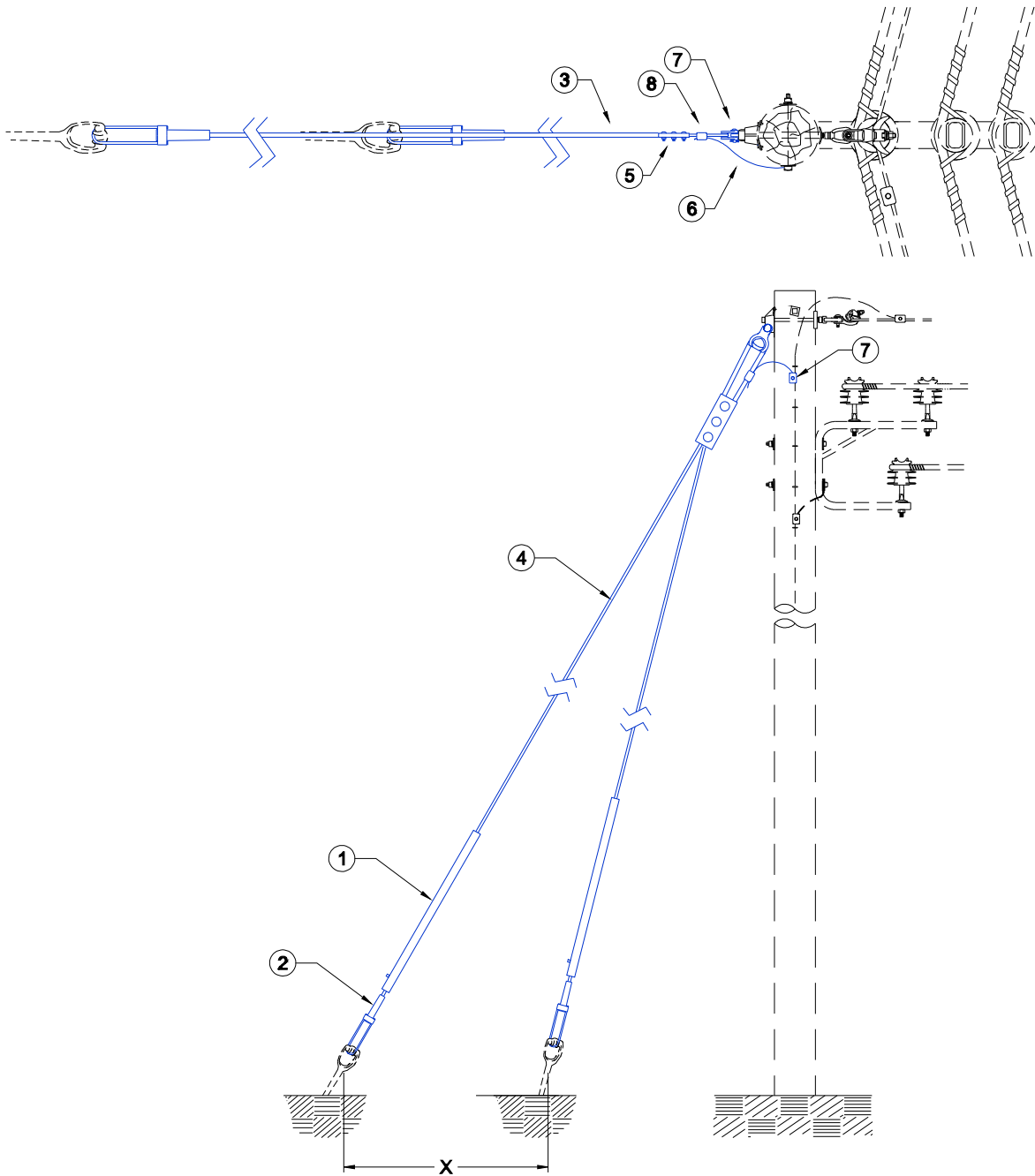
E2-20 Double Down Guy, In-Line

Ref	Material #	Description	E2-20
1	6380614	Bolt, Machine 3/4" x 14"	1
2	11732289	Clamp, 3-Bolt	1
3	170105002	Con, Sicame TTD2710XFBTUNI	1
4	17015004	Conn: GC5004 #4 solid	1
5	15610601	Cond, 6 Sol Cu Soft Drawn	6
6	11772038	Guy Auto De 3/8" Short	2
7	29300851	Guy Marker Plastic	2
8	29800000	Guy Plate/Single Bolt	1
9	29700000	Guy Thimble	1
10	73818307	Guy Wire 3/8"	80
11	71013041	Washer, Curved 4" x 4" x 13/16"	1
12	71053075	Washer, Spring - 3/4"	1

Construction and Design Notes:

1. All Hendrix spacer cable deadends require double guys/anchors.
 2. All Hendrix guying requires 3/4" hardware.
- X= 5' Spacing min. for screw/expansion anchors

HE2-20



Design Limits:
18000 LBS.

Materials List for Assemblies

Descriptions

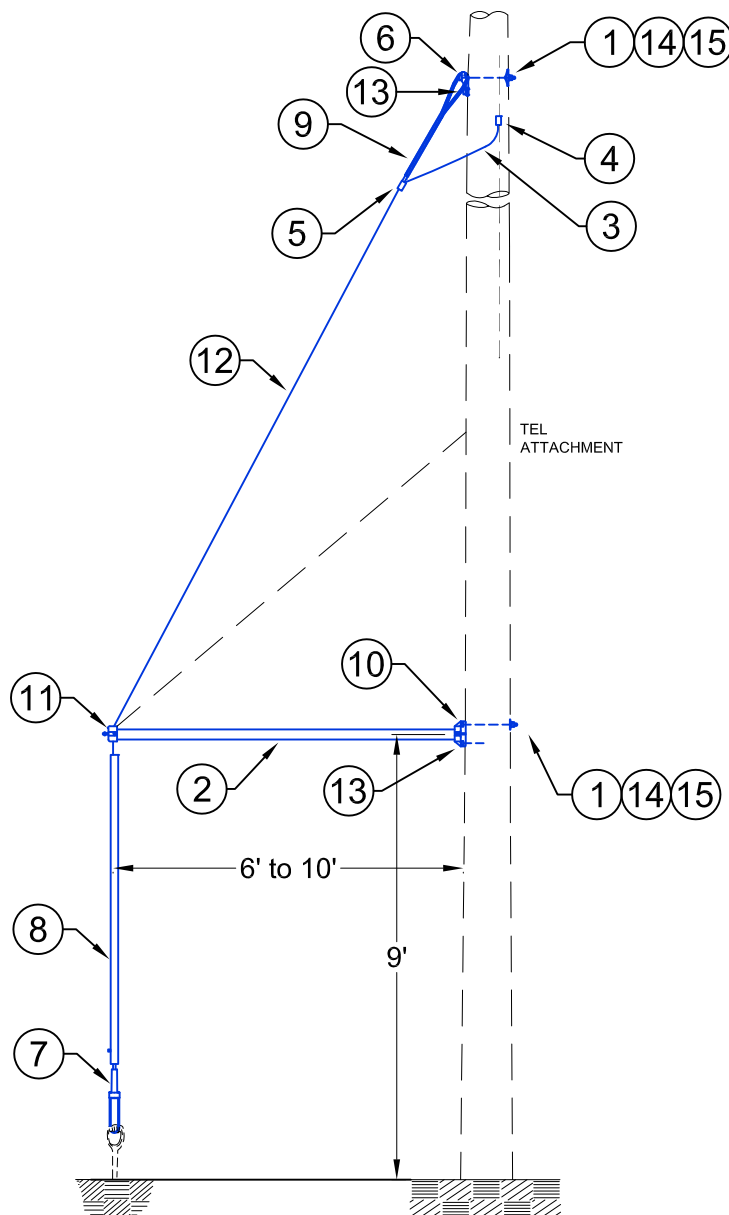
HE2-20 Double Down Guy, Hendrix, In-Line

Ref	Material #	Description	HE2-20
1	29300851	Guy Marker Plastic	2
2	11772038	Guy Auto De 3/8" Short	2
3	11732289	Clamp, 3-Bolt	1
4	73818307	Guy Wire 3/8"	80
5	17010508	Con, H-Tap, YHO-150	1
6	15610601	Cond, 6 Sol Cu Soft Drawn	6
7	17015004	Conn: GC5004 #4 solid	1
8	29700000	Guy Thimble	1

Construction and Design Notes:

1. Sidewalk guys to be use when no other type of guy can be installed.
2. Not approved for primary conductor deadends. May be used for dead ending secondary conductors when other guys can not be used.
3. Not approved for use with open wire construction for conductors larger than 1/0 ACSR.

E3-15



MAXIMUM LINE ANGLES		
1/0 ACSR (Bare or Tree)		336.4 ACSR (Bare or Tree)
1-PHASE	3-PHASE	
20	5	NOT APPROVED

Materials List for Assemblies

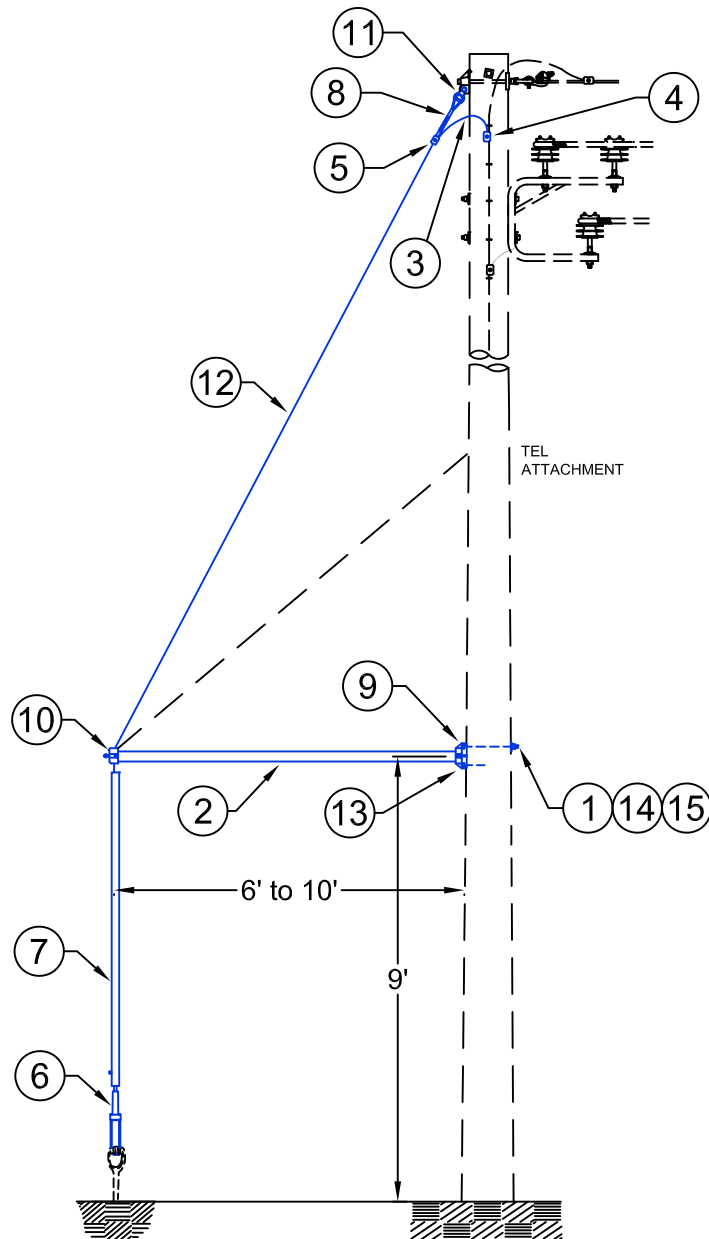
Descriptions

E3-15 Sidewalk Guy

Ref	Material #	Description	E3-15
1	6380514	Bolt, Machine 5/8" X 14"	2
2	76010725	Conduit Rigid Steel 2 1/2"	10
3	15610601	Cond, 6 Sol Cu Soft Drawn	6
4	17015004	Conn: GC5004 #4 solid	1
5	17010502	Con, Sicame TTD2710XFBTUNI	1
6	2150200	Guy Attachment	1
7	11772038	Guy Auto De 3/8" Short	1
8	29300851	Guy Marker, 10' Plastic	1
9	11772085	Guy, Preformed Grip 3/8"	1
10	2150600	Guy Sidewalk Brace Pole	1
11	2150800	Guy Sidewalk End Fitting	1
12	73818307	Guy Wire 3/8"	40
13	5550440	Screw, Lag, 1/2" x 4"	2
14	71013041	Washer, Curved, Guy 3/4"	2
15	71053063	Washer, Spring - 5/8"	2

Construction and Design Notes:

1. Sidewalk guys to be use when no other type of guy can be installed.
2. Not approved for primary conductor deadends. May be used for dead ending secondary conductors when other guys can not be used.
3. Not approved for use with open wire construction for conductors larger than 1/0 ACSR.

MAXIMUM LINE ANGLES

1/0 & 336.4 AAC
SPACER CABLE

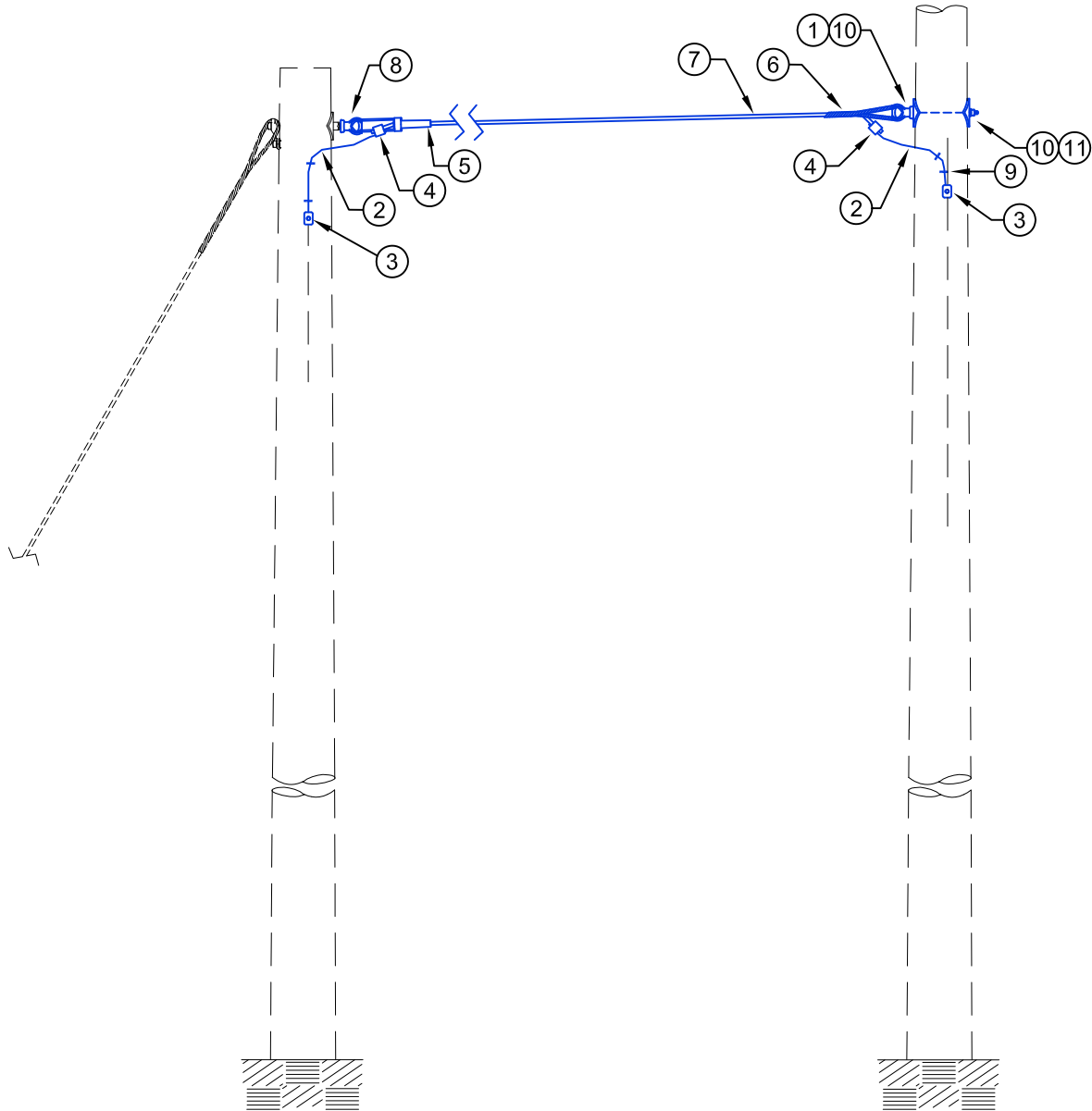
10

Materials List for Assemblies

Descriptions

HE3-15 Sidewalk Guy, Hendrix

Ref	Material #	Description	HE3-15
1	6380514	Bolt, Machine 5/8" X 14"	1
2	76010725	Conduit Rigid Steel 2 1/2"	10
3	15610601	Cond, 6 Sol Cu Soft Drawn	3
4	17015004	Conn: GC5004 #4 solid	1
5	17010502	Con, Sicame TTD2710XFBTUNI	1
6	11772038	Guy Auto De 3/8" Short	1
7	29300851	Guy Marker, 10' Plastic	1
8	11772085	Guy, Preformed Grip 3/8"	1
9	2150600	Guy Sidewalk Brace Pole	1
10	2150800	Guy Sidewalk End Fitting	1
11	29700000	Guy Thimble	1
12	73818307	Guy Wire 3/8"	40
13	5550440	Screw, Lag, 1/2" x 4"	1
14	71013041	Washer, Curved, Guy 3/4"	1
15	71053063	Washer, Spring - 5/8"	1



Design Limits:
9000 LBS.

Materials List for Assemblies

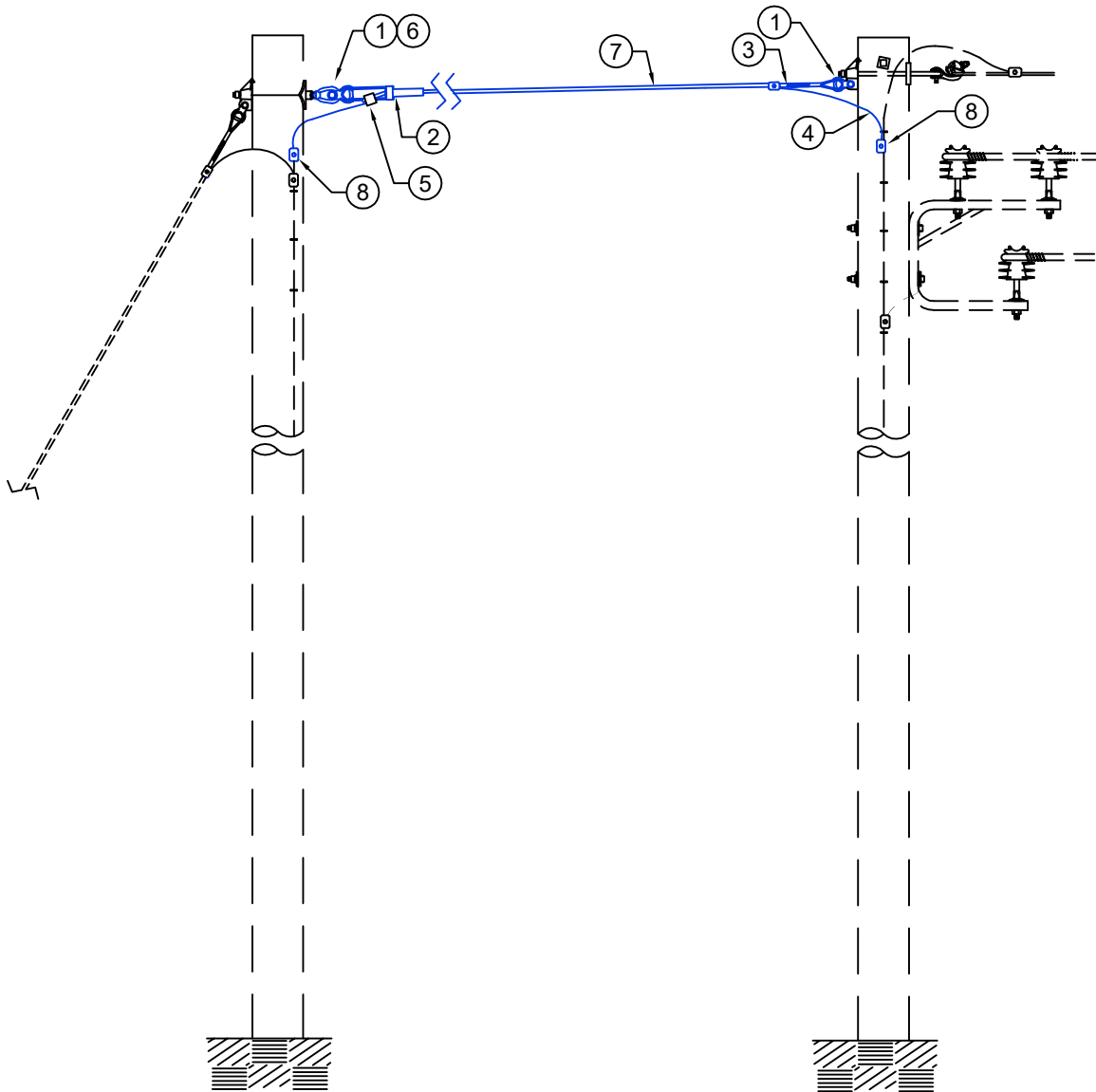
Descriptions

E4-10 Single Overhead Guy

Ref	Material #	Description	E4-10
1	6365514	Bolt, Thimbleye, 5/8" X 14"	1
2	15610601	Cond, 6 Sol CU Soft Drawn	10
3	17015004	Conn: GC5004 #4 solid	2
4	17010502	Con, Sicame TTD2710XFBTUNI	2
5	11772038	Guy, Auto DE 3/8" Short	1
6	11772085	Guy, Preformed Grip 3/8"	1
7	73818307	Guy Wire 3/8"	50
8	42906063	Nut, Thimbleye 5/8"	1
9	61801810	Staples, Ground Wire	6
10	71013041	Washer, Curved Guy 3/4"	2
11	71053063	Washer Spring 5/8"	1

Construction and Design Notes:

1. All Hendrix spacer cable deadends require double guys/anchors.
2. All Hendrix guying requires 3/4" hardware.



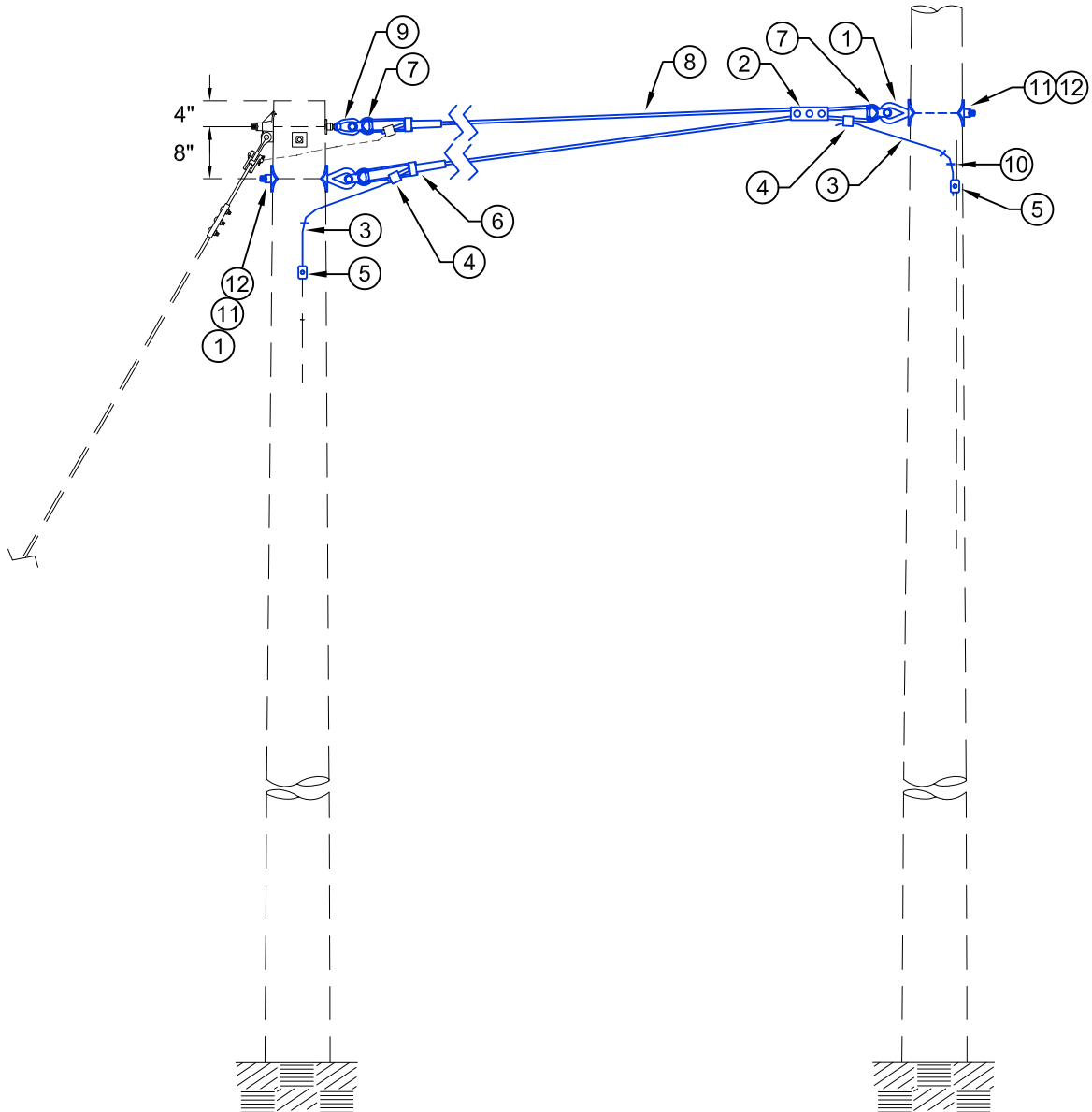
Design Limits:
9000 LBS.

Materials List for Assemblies

Descriptions

HE4-10 Single Overhead Guy, Hendrix

Ref	Material #	Description	HE4-10
1	29700000	Guy Thimble	2
2	11772038	Guy, Auto DE 3/8" Short	1
3	11772085	Guy, Preformed Grip 3/8"	1
4	15610601	Cond, 6 Sol CU Soft Drawn	6
5	17010502	Con, Sicame TTD2710XFBTUNI	2
6	42907563	Nut, Eye 3/4"	1
7	73818307	Guy Wire 3/8"	50
8	17015004	Conn: GC5004 #4 solid	2



Design Limits:
18,000 LBS.

Materials List for Assemblies

Descriptions

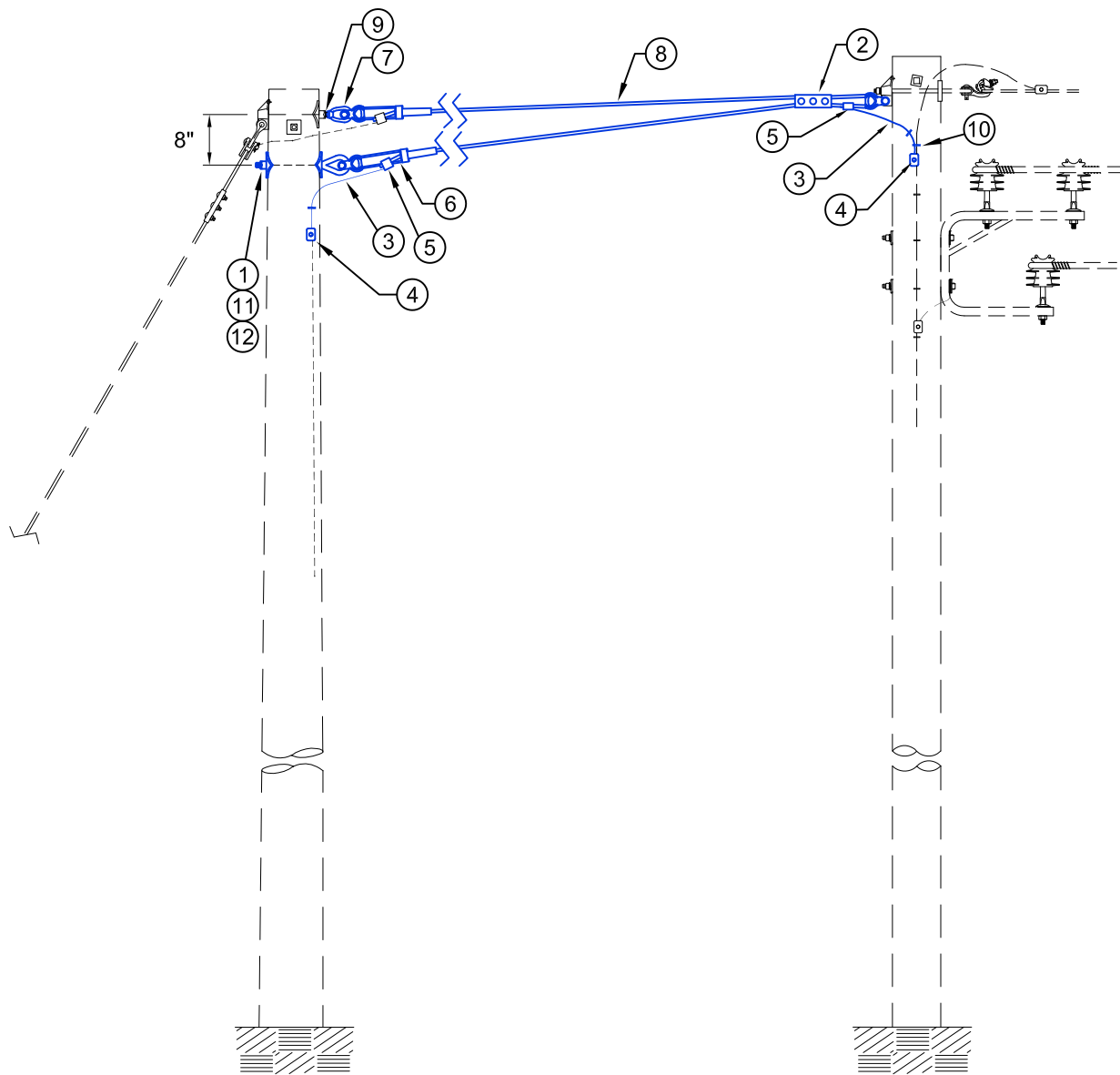
E4-20 Double Overhead Guy

Ref	Material #	Description	E4-20
1	6360614	Bolt, Eye, 3/4" X 14"	2
2	11732289	Clamp, 3-Bolt	1
3	15610601	Cond, 6 Sol CU Soft Drawn	9
4	17015004	Conn: GC5004 #4 solid	2
5	17010502	Con, Sicame TTD2710XFBTUNI	2
6	11772038	Guy, Auto DE 3/8" Short	2
7	29700000	Guy Thimble	3
8	73818307	Guy Wire 3/8"	100
9	42907563	Nut Eye 3/4"	1
10	61801810	Staples, Ground Wire	6
11	71013041	Washer, Curved Guy 3/4"	4
12	71053075	Washer Spring 3/4"	2

Construction and Design Notes:

1. All Hendrix spacer cable deadends require double guys/anchors.
2. All Hendrix guying requires 3/4" hardware.

HE4-20



Design Limits:
18,000 LBS.



CONSTRUCTION STANDARDS
DOUBLE OVERHEAD GUY, HENDRIX

HE4-20

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

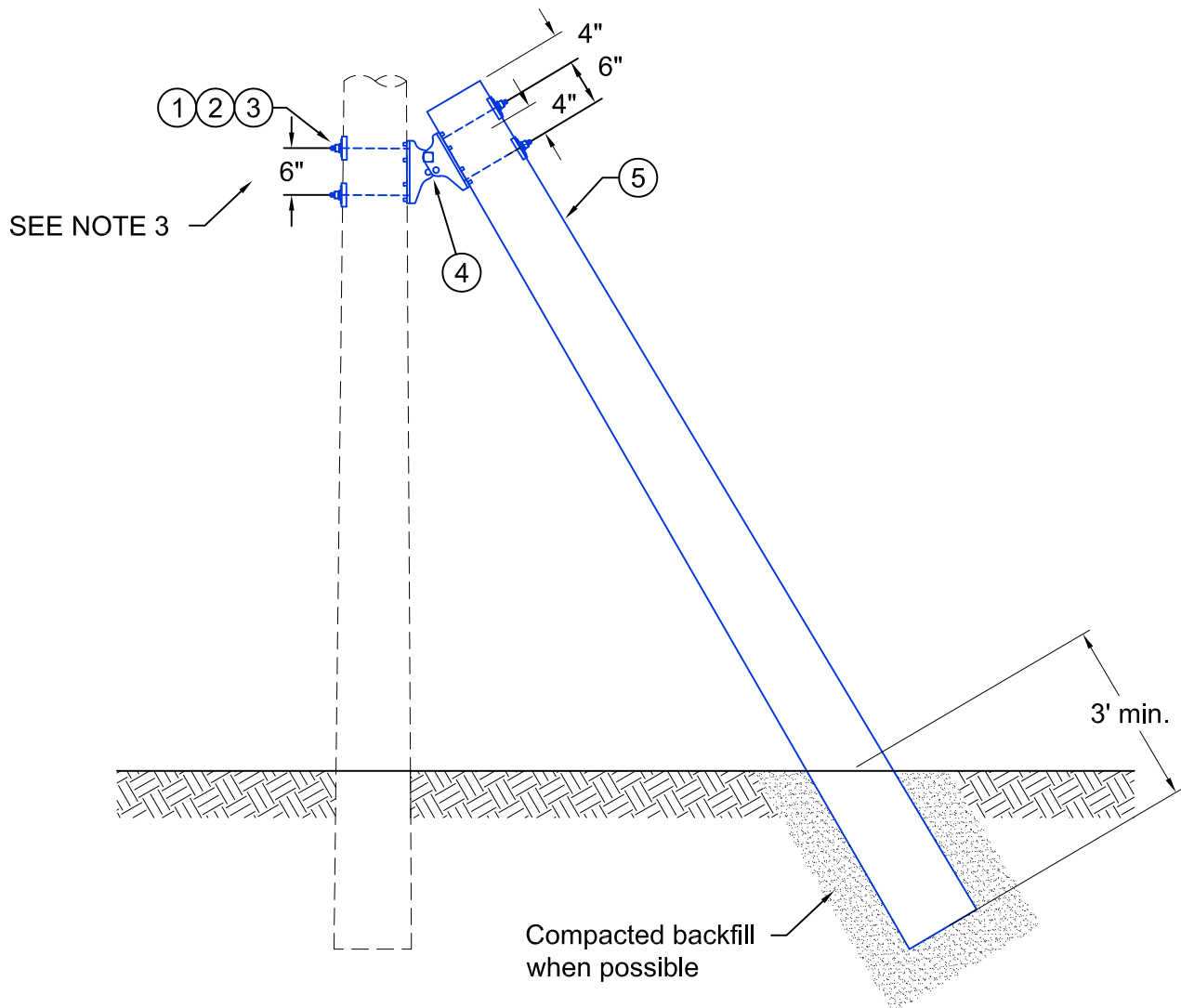
HE4-20 Double Overhead Guy, Hendrix

Ref	Material #	Description	HE4-20
1	6360614	Bolt, Eye, 3/4" x 14"	1
2	11732289	Clamp, 3-Bolt	1
3	15610601	Cond, 6 Sol CU Soft Drawn	6
4	17015004	Conn: GC5004 #4 solid	2
5	17010502	Con, Sicame TTD2710XFBTUNI	2
6	11772038	Guy, Auto DE 3/8" Short	2
7	29700000	Guy Thimble	3
8	73818307	Guy Wire 3/8"	100
9	42907563	Nut Eye 3/4"	1
10	61801810	Staples, Ground Wire	6
11	71013041	Washer, Curved Guy 3/4"	2
12	71053075	Washer Spring 3/4"	1

Construction and Design Notes:

E5

1. Push braces to be used only when no other type of guy can be installed.
2. Push braces are not approved for three-phase dead ends
3. Attach the push brace to the line pole at the normal guy location within practical limits of the available space.



Ref. No.	Material #	Description	E5.30-5	E5.35-4	E5.40-3	E5.45-2
1	6380514	Bolt, Machine 5/8" x 14"	4	4	4	4
2	71053063	Washer, Spring - 5/8"	4	4	4	4
3	71013041	Washer, Curved Guy 3/4"	4	4	4	4
4	7808000	Brkt, Push Brace	1	1	1	1
5	48305000	Pole 30' - Class 5	1			
5	48354000	Pole 35' - Class 4		1		
5	48403000	Pole 40' - Class 3			1	
5	48452000	Pole 45' - Class 2				1

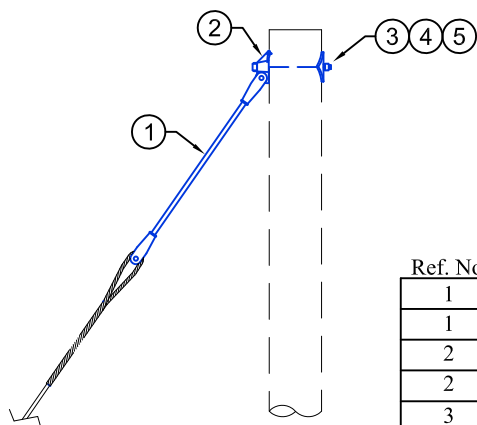


CONSTRUCTION STANDARDS

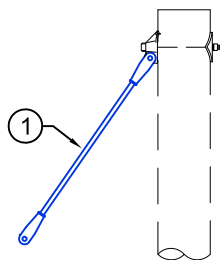
PUSH BRACE

E5

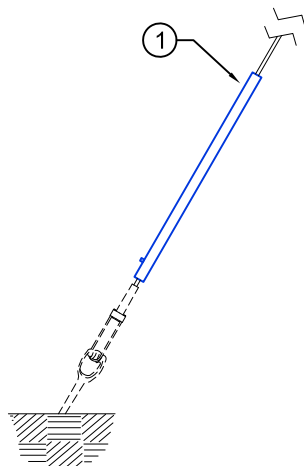
ISSUE DATE: 05/16



Ref. No.	Material #	Description	E9-1	E9-1H
1	21000000	Guy Strain Link 21000 lbs	1	
1	21000010	Guy Strain Link 36000lbs		1
2	29800000	Guy Plate, Single Bolt	1	
2	29800010	Guy Plate /Tie Trans		1
3	6380614	Bolt, Machine 3/4" x 14"	1	2
4	71013041	Washer, Curved 4x 4x 1/4x 11/16"	1	2
5	71053075	Washer, Spring 3/4"	1	2



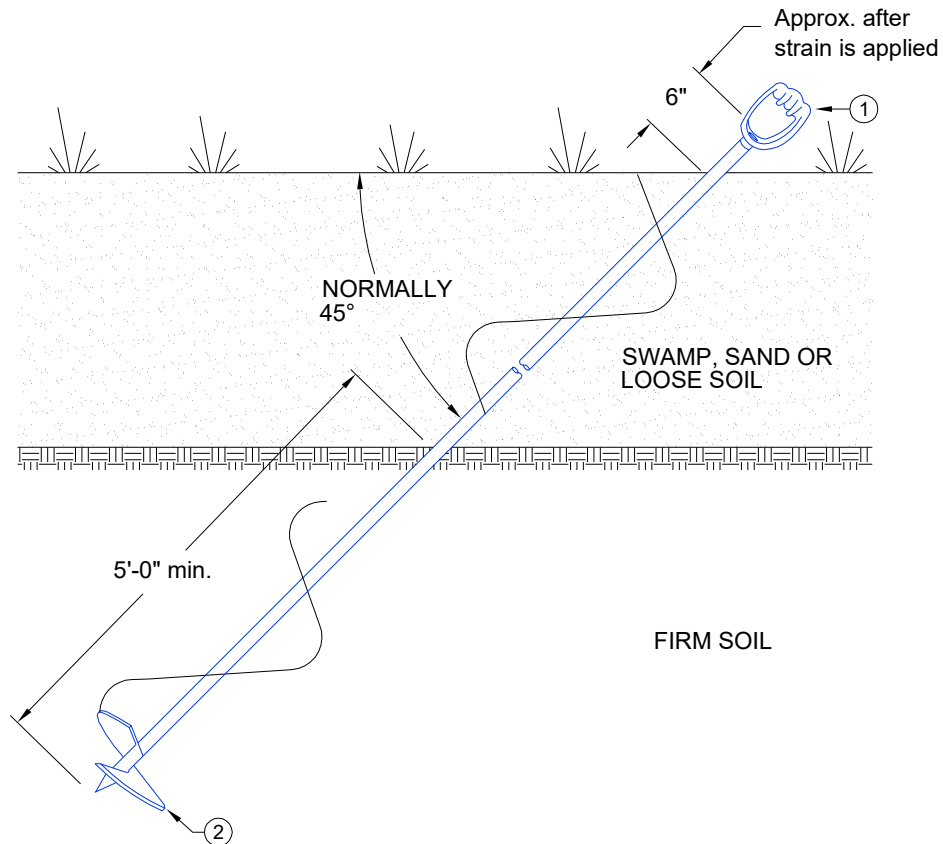
Ref. No.	Material #	Description	HE9-1	HE9-1H
1	21000000	Guy Strain Link 21000 lbs	1	
1	21000010	Guy Strain Link 36000 lbs		1



Ref. No.	Material #	Description	E9-3
1	29300851	Guy Marker, 10' Plastic	1

Construction and Design Notes:

- 1.) Projection of anchor rod above earth may be increased to a maximum of 12" in cultivated fields or other locations where necessary to prevent burying the rod eye.
- 2.) Assembly F1.EXT must be specified with one of the other screw anchor assemblies.



Ref. No.	Material #	Description	CONSTRUCTION ASSEMBLIES			
			F1.8	F1.10	F1.14	F1.EXT
1	53630107	Rod Anchor 1" x 7'	1	1	1	1
2	00971008	Anchor, Screw 8"	1			
2	00971010	Anchor, Screw 10"		1		
2	00971014	Anchor, Screw 14"			1	
-	00600000	Anchor Rod Coupling				1

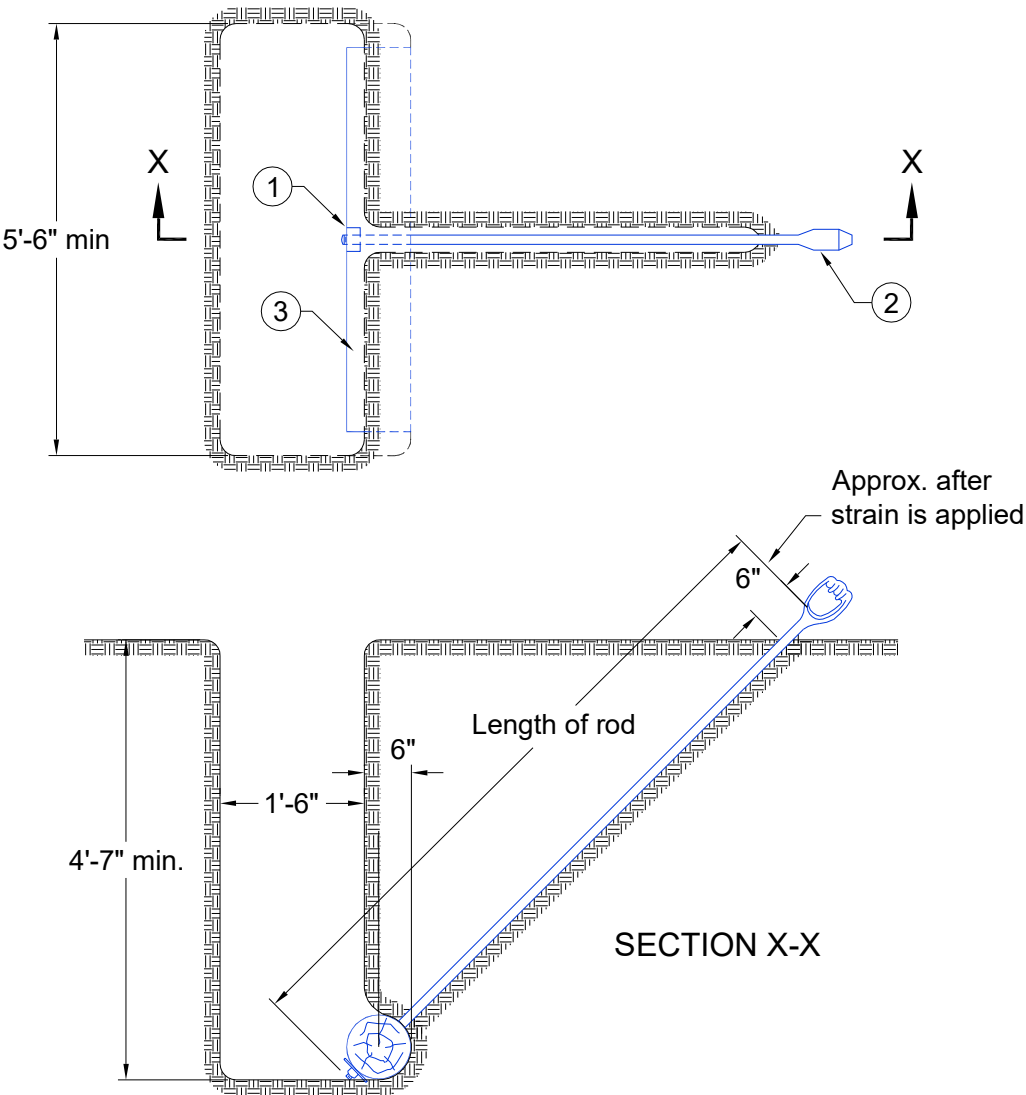


CONSTRUCTION STANDARDS

SCREW ANCHOR ASSEMBLY

Construction and Design Notes:

- 1.) Projection of anchor rod above earth may be increased to a maximum of 12" in cultivated fields or other locations where necessary to prevent burying the rod eye.

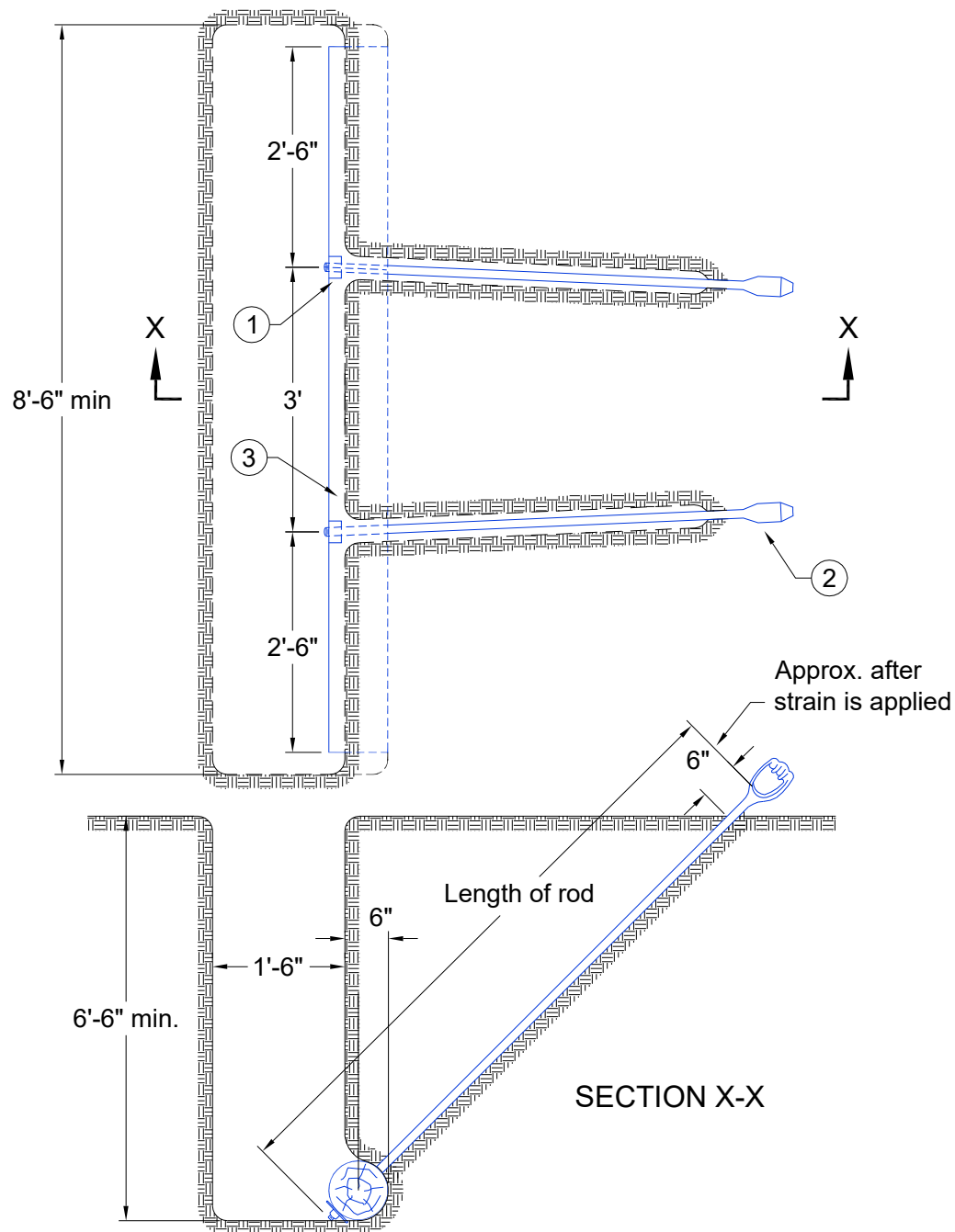


			CONSTRUCTION ASSEMBLIES	
Ref. No.	Material #	Description	F2.8	F2.10
1	71024371	Washer, Log Anchor 4" x 4"	1	1
2	53614308	Rod Anchor 3/4" x 8'	1	
2	53610110	Rod Anchor 1" x 10'		1
3	988010	Anchor Log 9" x 5'	1	
3	988016	Anchor Log 12" x 5'		1

Construction and Design Notes:

F2-2

- 1.) Projection of anchor rod above earth may be increased to a maximum of 12" in cultivated fields or other locations where necessary to prevent burying the rod eye.



CONSTRUCTION ASSEMBLIES			
Ref. No.	Material #	Description	F2-2.10
1	71024371	Washer, Log Anchor 4" x 4"	2
2	53610110	Rod Anchor 1" x 10'	2
3	00988088	Anchor Log 8" x 8'	1



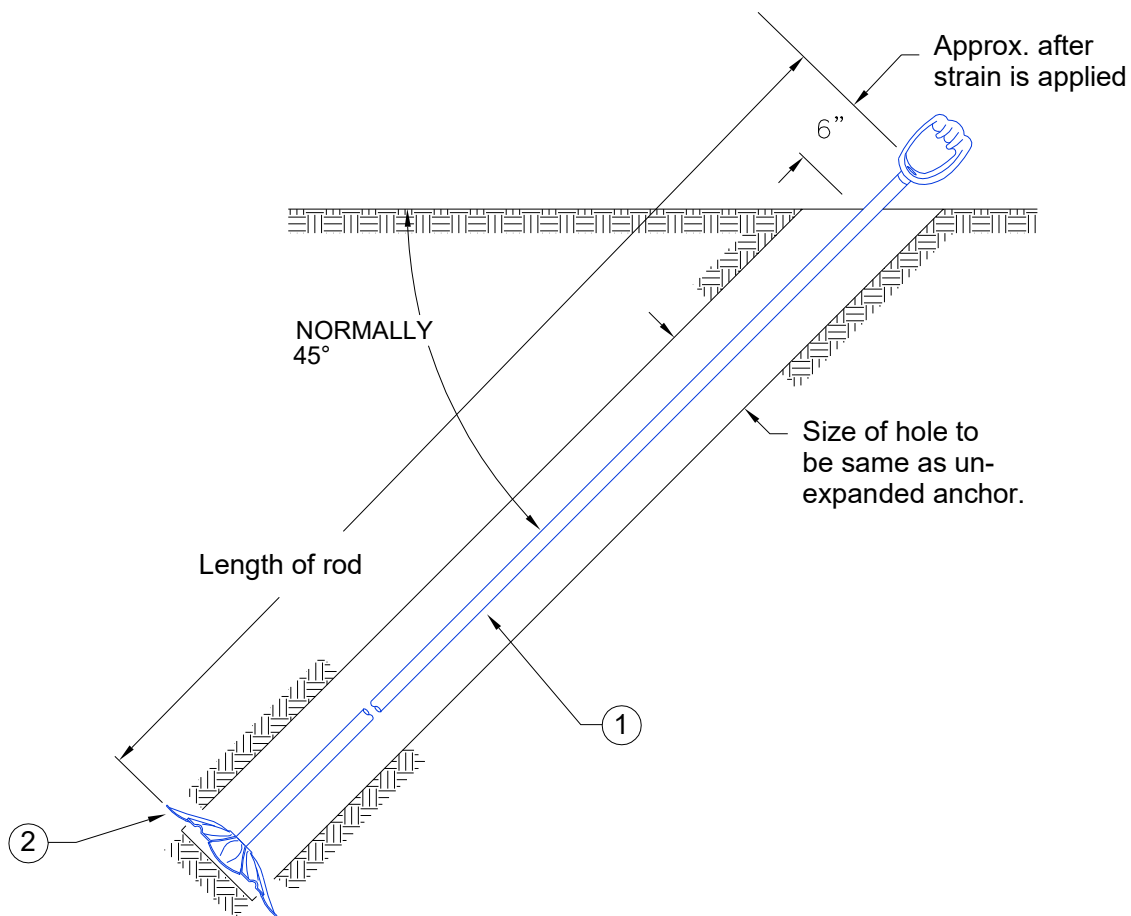
CONSTRUCTION STANDARDS
LOG ANCHOR ASSEMBLY, DOUBLE ROD

F2-2

ISSUE DATE: 01/06

Construction and Design Notes:

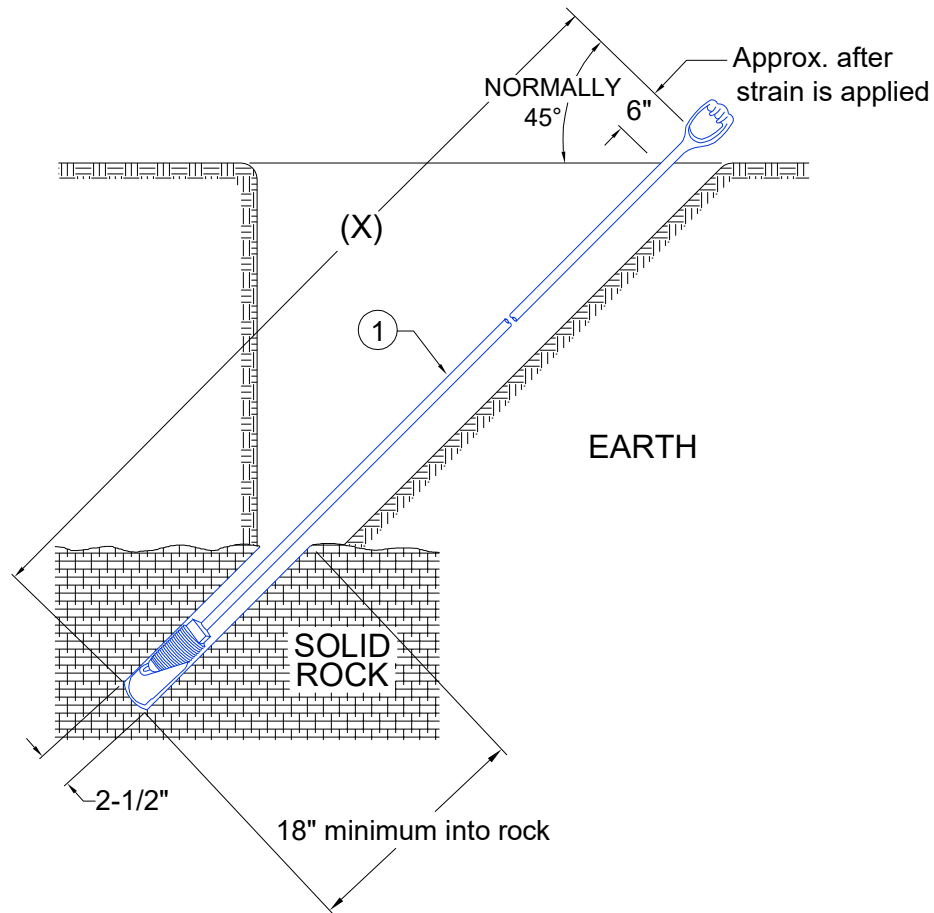
- 1.) Projection of anchor rod above earth may be increased to a maximum of 12" in cultivated fields or other locations where necessary to prevent burying the rod eye.



			CONSTRUCTION ASSEMBLIES	
Ref. No.	Material #	Description	F4.12	F4.16
1	53614308	Rod Anchor 3/4" x 8'	1	
1	53610110	Rod Anchor 1" x 10'		1
2	00932006	Anchor, Expanding 12000#	1	
2	00930300	Anchor, Expanding 16000#		1

Construction and Design Notes:

- 1.) Only one guy shall be attached to a rock anchor. Where more than one guy is required, space anchors 2 ft. minimum and where practical they shall be in direct line with pole.
- 2.) Do not anchor to any boulder measuring less than 5 ft. in two directions at right angles to each other.
- 3.) Projection of anchor rod above earth may be increased to a maximum of 12" in cultivated fields or other locations where necessary to prevent burying the rod eye.
- 4.) Grout hole after anchor installation.



Ref. No.	Material #	Description	CONSTRUCTION ASSEMBLIES			
			F5.30	F5.53	F5.72	F5.96
1	963082	Anchor, Rock 30" Long	1			
1	963083	Anchor, Rock 53" Long		1		
1	963085	Anchor, Rock 72" Long			1	
1	963096	Anchor, Rock 96" Long				1

**CONSTRUCTION STANDARDS****ROCK ANCHOR ASSEMBLY**

Underground Construction Guidelines 12

IU Primary Trenching Details

IU Concrete Capped Trenching Details

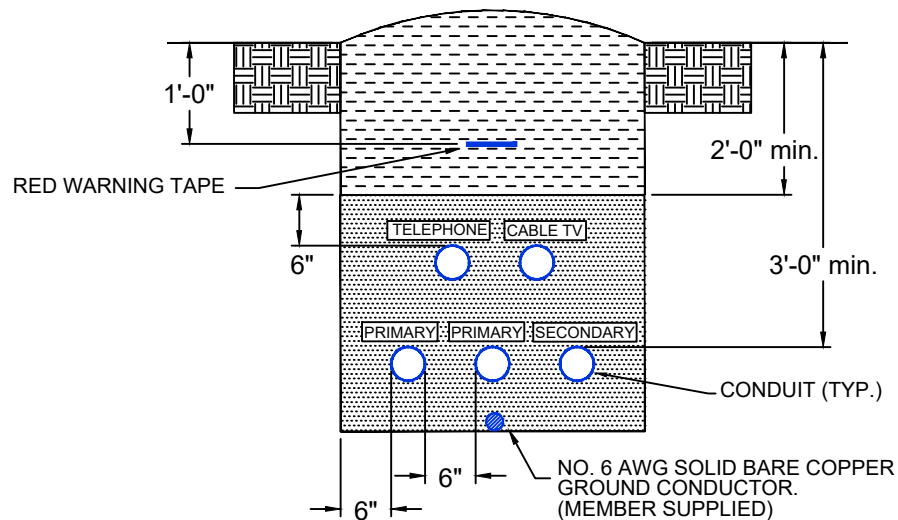
IUSUB Submarine Cable Riser Guideline

IUJ Secondary Trench

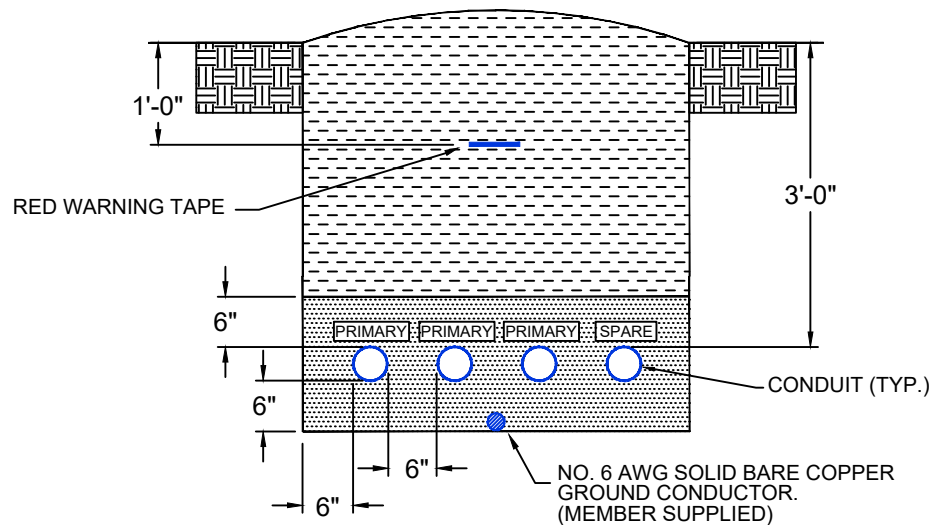
IUCOND Installation Requirements for Underground Conduit

Systems Equipment Identification Practices (future)

ONE OR MORE PRIMARY CIRCUITS WITH TELEPHONE AND/OR CABLE TV



PRIMARY CIRCUIT WITH SPARE



NOTE:

1. TRENCH WIDTH AS REQUIRED TO MAINTAIN 6" MINIMUM SPACING BETWEEN ALL CONDUITS AND TRENCH SIDEWALLS.
2. TRENCH TO BE INSPECTED BY A REPRESENTATIVE OF NHEC PRIOR TO BACKFILLING.
3. REFER TO MEMBER HANDBOOK UNDERGROUND INSTALLATION SECTION FOR FURTHER CLARIFICATION AND DETAILED DESCRIPTIONS FOR UNDERGROUND INSTALLATIONS.



WHEEL COMPACTED BACKFILL,
NO ROCKS LARGER THAN 6"
DIAMETER

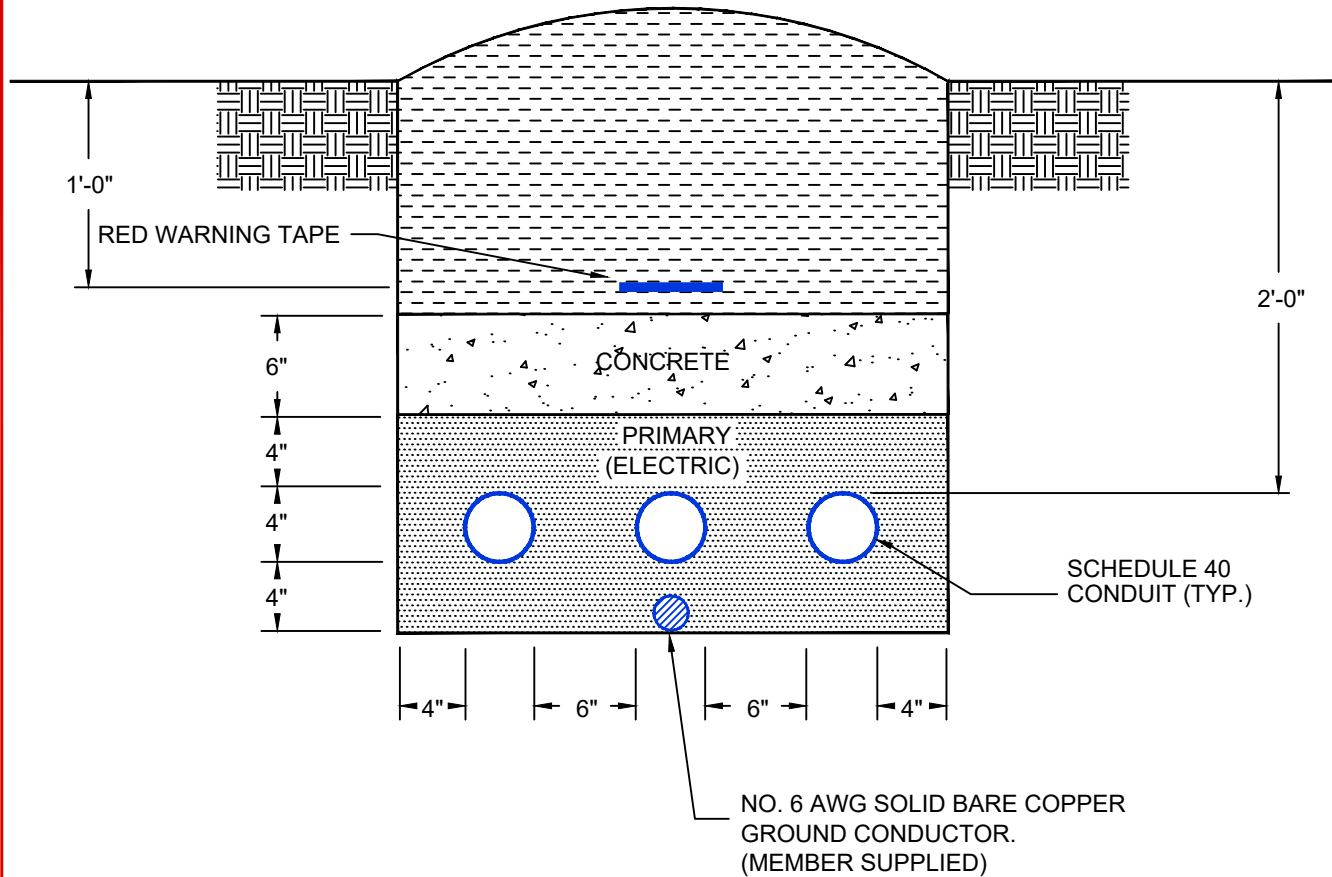


SAND OR FINE BACKFILL,
NO ROCKS LARGER THAN 1"
DIAMETER



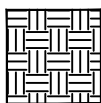
UNDISTURBED EARTH

CONCRETE CAPPED TRENCH

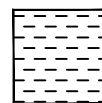


NOTE:

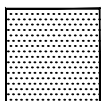
1. TRENCH WIDTH AS REQUIRED TO MAINTAIN 6" MINIMUM SPACING BETWEEN ALL CONDUITS AND 4" TO TRENCH SIDEWALLS.
2. CONCRETE TO BE 5000 PSI
3. TRENCH TO BE INSPECTED BY A REPRESENTATIVE OF NHEC PRIOR TO BACKFILLING.
4. REFER TO MEMBER HANDBOOK UNDERGROUND SERVICE INSTALLATION SECTION FOR FURTHER CLARIFICATION AND DETAILED DESCRIPTIONS FOR UNDERGROUND INSTALLATIONS.



UNDISTURBED EARTH



WHEEL COMPACTED BACKFILL,
NO ROCKS LARGER THAN 4"
DIAMETER



SAND OR FINE BACKFILL,
NO ROCKS LARGER THAN 1"
DIAMETER



5000 PSI CONCRETE ENCASEMENT

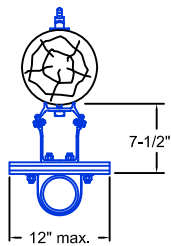
MATERIALS FURNISHED AND INSTALLED BY CONSUMER

- ① 4" CONDUIT
SCHEDULE 80 PVC
- ② 4" 90° SWEEP
GALVANIZED STEEL
- ③ 4" ADAPTER
(IF NEEDED)
- ④ CONDUIT END CAPS
- ⑤ 1/4" POLYPROPYLENE STRING
INSTALLED IN ALL CONDUITS WITH STRING
EXPOSED AND TIED OFF AT ENDS THRU
CAPS AT END OF CONDUIT.

MATERIALS FURNISHED AND INSTALLED BY NHEC

POLE
GROUND ROD AND CONNECTOR
ALUMA-FORM STANDOFF BRACKETS

STANDOFF BRACKET TOP VIEW

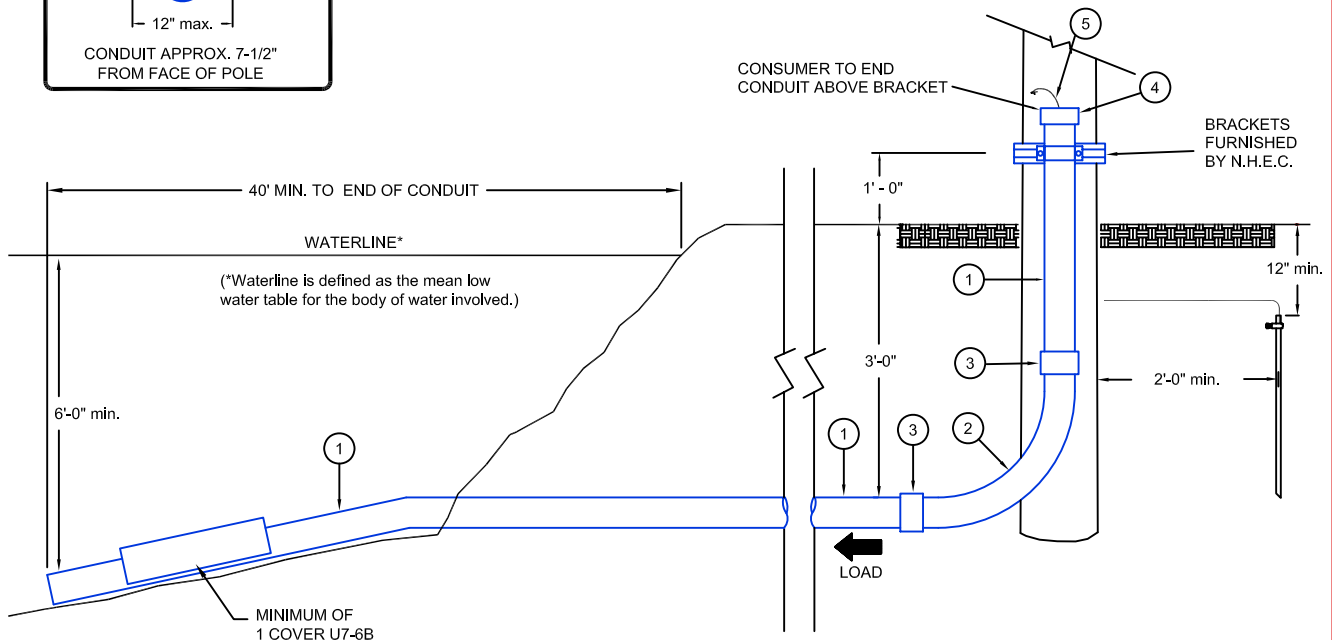


CONDUIT APPROX. 7-1/2"
FROM FACE OF POLE

STANDOFF BRACKET IMPORTANT NOTES:

CONTRACTOR SWEEPS CONDUIT TO 7-1/2" FROM FACE OF POLE.

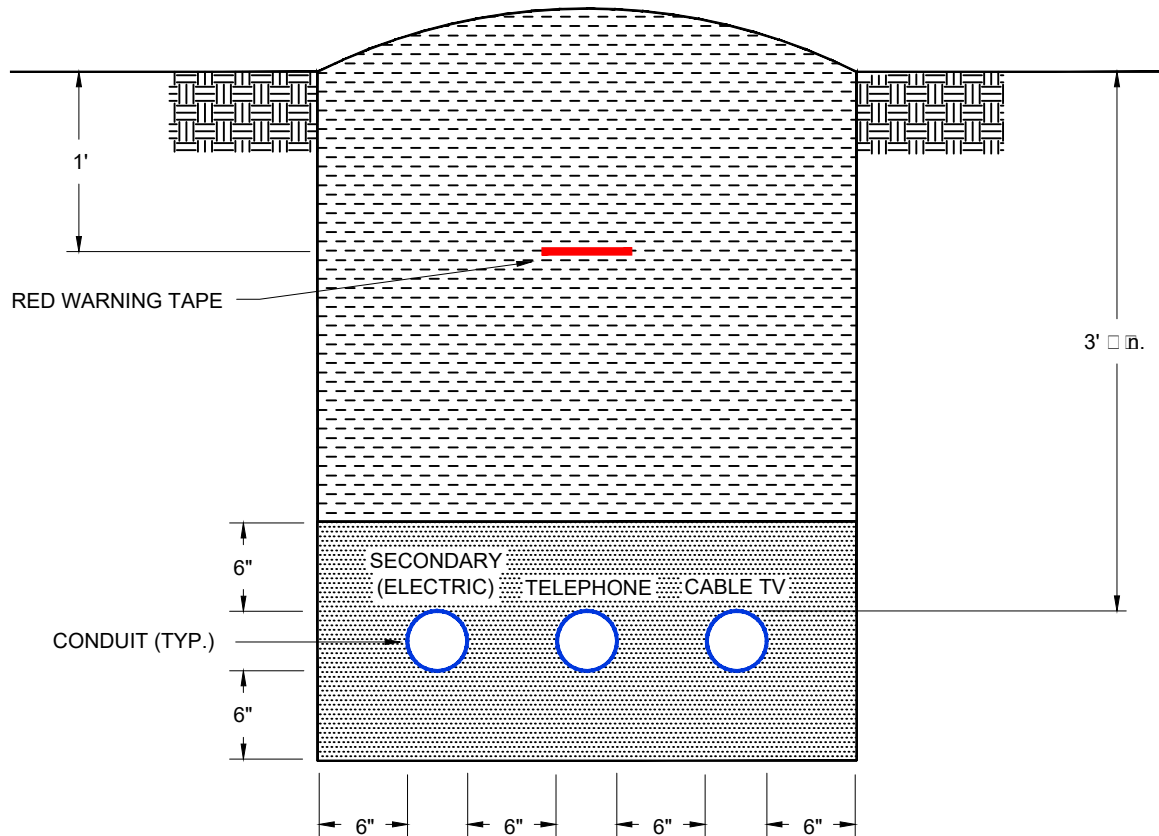
NHEC PERSONNEL WILL PROVIDE A STANDOFF BRACKET TO ASSIST
STEEL SWEEP DISTANCE TO THE POLE.



NOTES:

- 1.) ALL CONDUIT AND ACCESSORIES MUST MEET ELECTRICAL GRADE SPECIFICATIONS.
- 2.) ALL CONSUMER FURNISHED MATERIAL TO BE ON HAND, AND ALL NECESSARY EXCAVATION AND CONDUIT READY PRIOR TO TIME OF INSTALLATION OF EQUIPMENT ON POLE BY NHEC PERSONNEL.
- 3.) CONDUIT TO BE ON QUADRANT OF POLE OPPOSITE FLOW OF TRAFFIC.

SECONDARY CIRCUITS WITH TELEPHONE AND/OR CABLE TV



NOTE:

1. TRENCH WIDTH AS REQUIRED TO MAINTAIN 6" MINIMUM SPACING BETWEEN ALL CONDUITS AND TRENCH SIDEWALLS.
2. TRENCH TO BE INSPECTED BY A REPRESENTATIVE OF NHEC PRIOR TO BACKFILLING.
3. REFER TO MEMBER HANDBOOK SECTION 2 OR CONSTRUCTION STANDARDS TAB 12 FOR FURTHER CLARIFICATION AND DETAILED DESCRIPTIONS FOR UNDERGROUND INSTALLATIONS.



WHEEL COMPACTED BACKFILL,
NO ROCKS LARGER THAN 6"
DIAMETER



SAND OR FINE BACKFILL,
NO ROCKS LARGER THAN 1"
DIAMETER



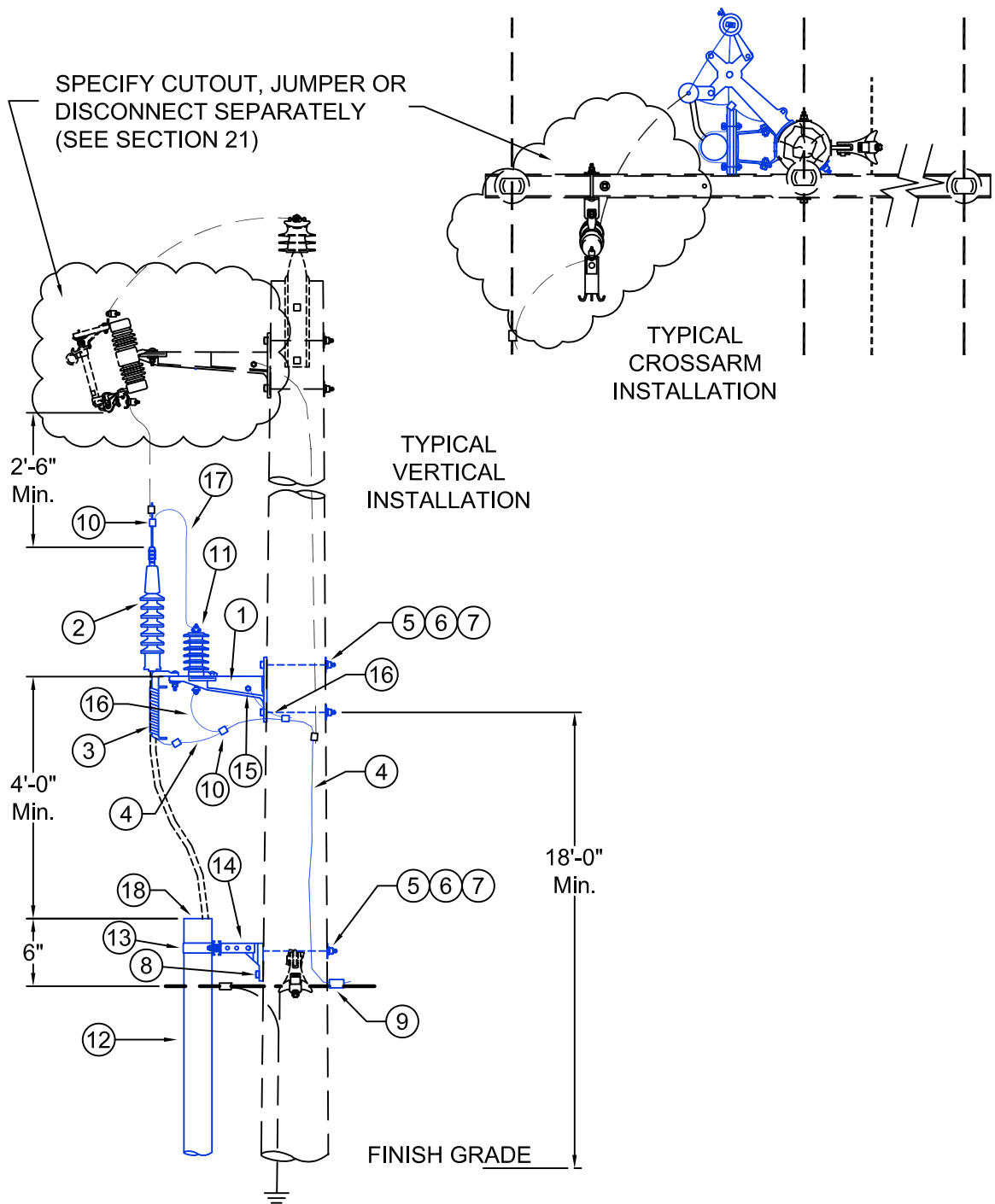
UNDISTURBED EARTH

1. Contractor shall call Member Solutions Department at 1-800-698-2007 of NH Electric Cooperative a minimum of 24 hours before trench is started to make arrangements for onsite inspection.
2. Underground (buried) conduit shall be Schedule 40 PVC or other corrosion resistant duct suitable for the intended environment as approved by the cooperative. All 90 degree bends shall be electrical grade, schedule 40 PVC or Rigid galvanized steel sweeps with minimum bending radius of 36 inches.
3. Minimum size for buried conduit shall be 3 inches for all conductor smaller than 500 MCM, and 4 inches for primary or conductor 500 MCM or larger.
4. Conduit minimum depth 36 inches. Any conduit crossing under a road shall be Schedule 80. Conduits installed less than 36 inches in depth require Cooperative engineering approval and shall be encased in concrete to Cooperative specs. Depths specified are to finished grade.
5. Trenches to be in as straight and direct a line as possible. Routes through unstable soil such as mud, shifting soils, or other hazards should be avoided.
6. Longitudinal runs of conduit should not be located directly over or under other underground facilities such as gas, water sewer lines and septic systems. Whenever possible the horizontal distance between these facilities should be a minimum of 6 feet to permit access and maintenance of either facility without damage to the other. Under special circumstances, controlled horizontal separation of down to 12 inches will be allowed providing all parties are in agreement as to the method.
7. Underground conduit systems shall not be installed within 15 feet of any building foundation, swimming pool, etc., except for where service conduit merges to intercept the service equipment.
8. Caution ribbon shall be installed above the conduit, a foot below finished grade. In trenches for primary cable, a continuous No. 6 AWG copper grounding conductor shall be directly buried in the bottom of the trench, prior to installation of any conduit, with adequate length at each end for connections by NHEC.
9. When electric facilities are installed in the same trench as communication facilities, a No. 6 AWG copper bonding conductor, readily accessible at both ends shall be installed at each vault, pad mounted equipment location between electric and communication facilities.
10. A pulling rope, 1/4 inch diameter polypropylene, shall be installed in each conduit.
11. The ends of the conduit shall be plugged during construction to prevent the entrance of foreign matter. The conduit shall be terminated as follows:
 - a) Conduit shall terminate not more than 3 inches inside a vault. Whenever possible the conduit should run straight into the vault without sweeps or bends. Where the conduit enters the vault, it shall be grouted to prevent water, soil and rock intrusion.
 - b) At meter locations, the conduit shall terminate as per appropriate meter installation specs. If the meter socket is at a lower grade than the pad mounted equipment location or part of the underground conduit system, provisions shall be made as necessary so that the conduit will not fill with water and run into the meter socket. If a slip coupling with O-rings removed is employed, a 6 inch deep, 1 foot wide and 2 foot long stone base will be set up underneath the slip joint for drainage.
 - c) If a reduction in the service conduit is required, it will occur at the top of the slip joint/expansion fitting utilizing a reducing bushing. The slip joint/expansions fitting will remain the same size as the conduit installed in the trench with the transition occurring above ground.

12. All ends, joints and internal finish of the conduit shall be free of sharp edges or burns which could damage the cable.
13. All buried joints shall be glued as recommended by the conduit manufacturer. Colored PVC cleaner shall be used before applying glue.
14. Any change in direction between lengths of straight rigid conduit greater than 5 degrees shall be made in electrical sweeps, or with a very gradual sweeping change of direction. Any single run of conduit will contain no more than two 90 degree sweeps. If the secondary runs of conduit are less than 150 feet in length then schedule 40, PVC sweeps are acceptable. For runs of conductor sized 500 MCM & larger that exceed 150 feet in length all sweeps shall be steel. For runs of conductor smaller than 500 MCM size & that exceed 200 feet in length all sweeps shall be steel.
15. The Member shall be responsible for having the conduit/vault system ready, prior to NHEC personnel installing the cable. Any changes, repairs or other work required to the underground conduit/vault system in order for NHEC personnel to pull the cable into the conduit shall be the responsibility of the Member.
16. A drainage system must be installed in all vaults and structures. In areas of high water table, vaults and conduit may need to be elevated to promote effective drainage. If the first vault from the riser pole is at a higher grade then the riser pole location, provisions shall be made necessary so the conduit will not fill with water and run up and into the riser. These provisions require engineering approval.

Primary Risers 13

- U1 Single Phase Riser
- U2 Single Phase Loop or 2 Phase Riser
- U3 Three Phase Riser, Bracket
- U3-1 Three-Phase Riser, Crossarm
- U3-2 Three Phase Riser, one 6 inch conduit
- U4 Three Phase Riser w/Spare on Crossarm



CONSTRUCTION ASSEMBLIES	
System Voltage	1/0
15 kV	U1.010
25 kV	VU1.010

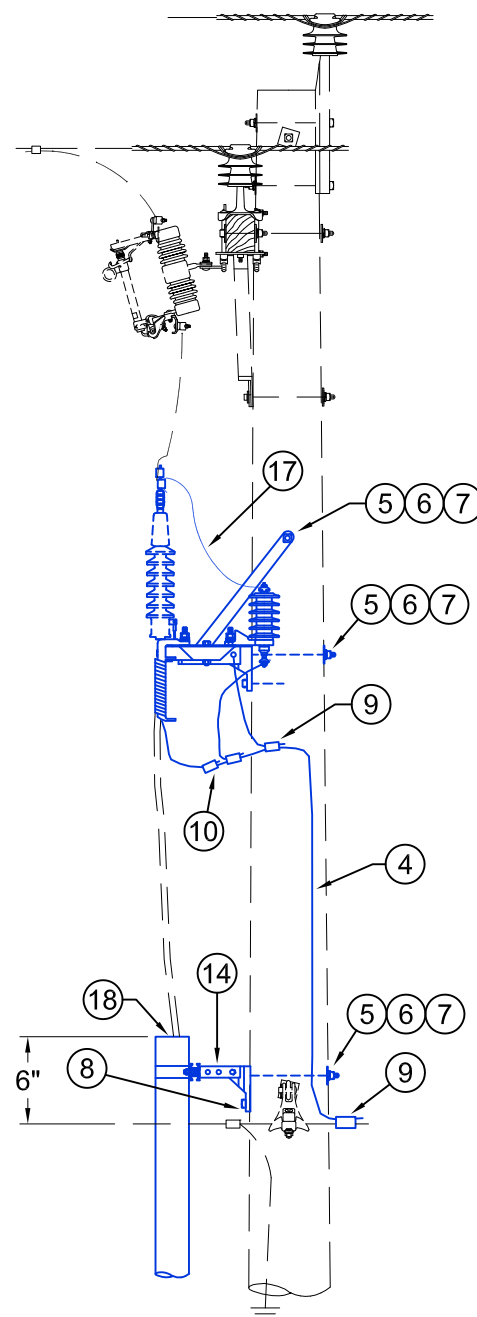
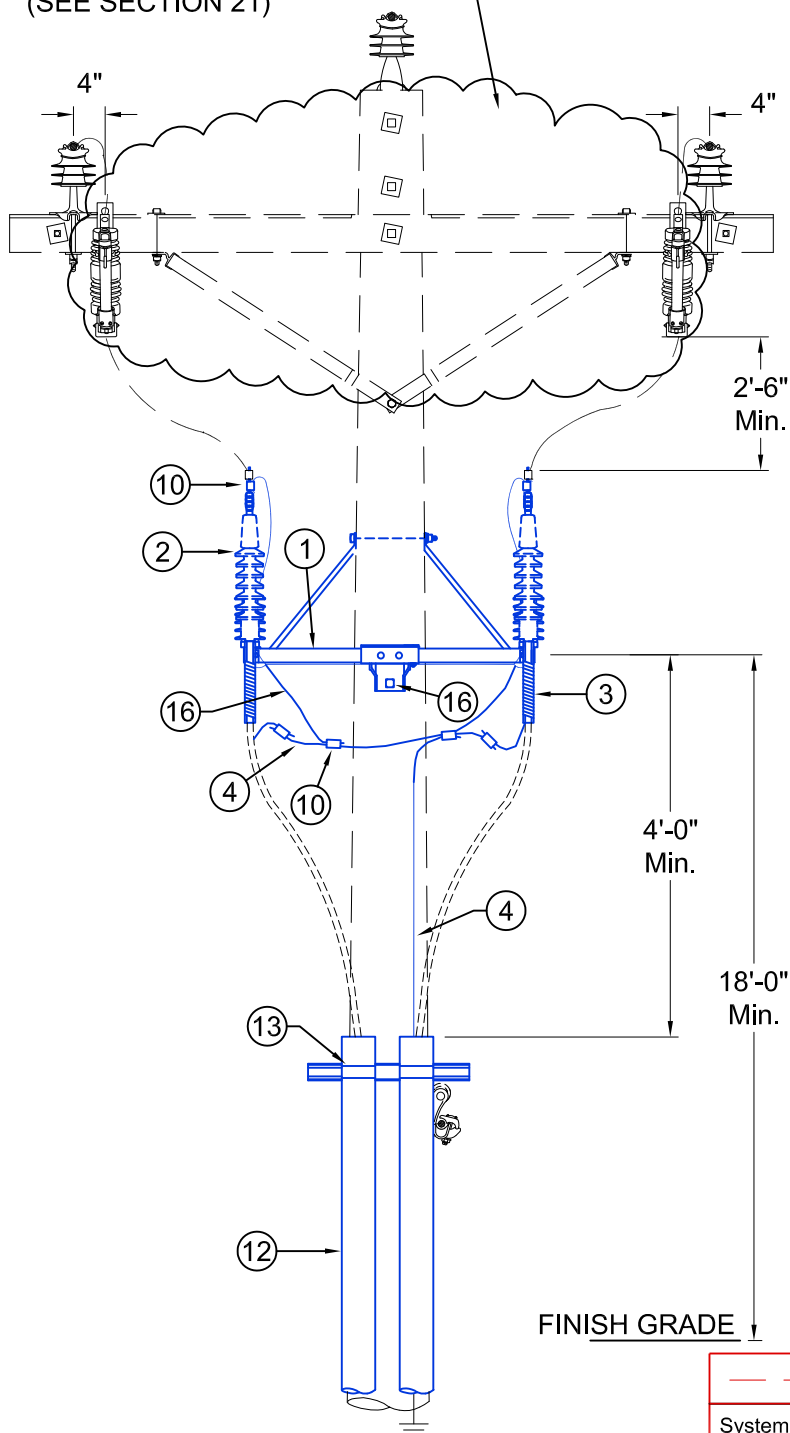
Materials List for Assemblies

Descriptions

U1.010 1-Ph, 15 kV Riser, Bracket Construction
 VU1.010 1-Ph, 25 kV Riser, Bracket Construction

Ref	Material #	Description	U1.010	VU1.010
1	7800725	Brkt, Comb Arr/Cutout 24"	1	1
2	66911252	Term: 1/0 15KV	1	
2	66911253	Term: 1/0 25KV/35		1
3	15010000	Cable Support CS-820	1	1
4	15620203	Cond 2 Str Cu	6	6
5	6380514	Bolt, Machine 5/8" x 14"	6	6
6	71020451	Washer, Square, 2 1/4" x 13/16"	6	6
7	71053063	Washer, Spring – 5/8"	6	6
8	55504440	Screw, Lag 1/2" x 4"	4	4
9	17010502	Con, Sicame TTD2710XFBTUNI	1	1
9	17010502	Con, Sicame TTD2710XFBTUNI	1	1
10	17015002	Conn, GC5002 #2 Str	4	4
11	1520900	Arrester, 9/10 kV	1	
11	1521800	Arrester, 18 kV		1
12	76010440	Conduit PVC Sch 80 4"	30	30
13	10500004	Brkt, Clamp 4" Conduit Riser	4	4
14	10500024	Brkt, Standoff Conduit Riser	4	4
15	17015004	Conn, GC5004 # 4 solid	1	1
16	15610401	Cond 4 solid cu sd	2	2
17	16510407	Cond, 4 cu poly	2	2
18	10693120	Conduit Sealing Foam	1	1

SPECIFY CUTOUTS, JUMPERS OR
DISCONNECTS SEPARATELY
(SEE SECTION 21)



CONSTRUCTION ASSEMBLIES

System Voltage	1/0
15 kV	U2.010
25 kV	VU2.010

Materials List for Assemblies

Descriptions

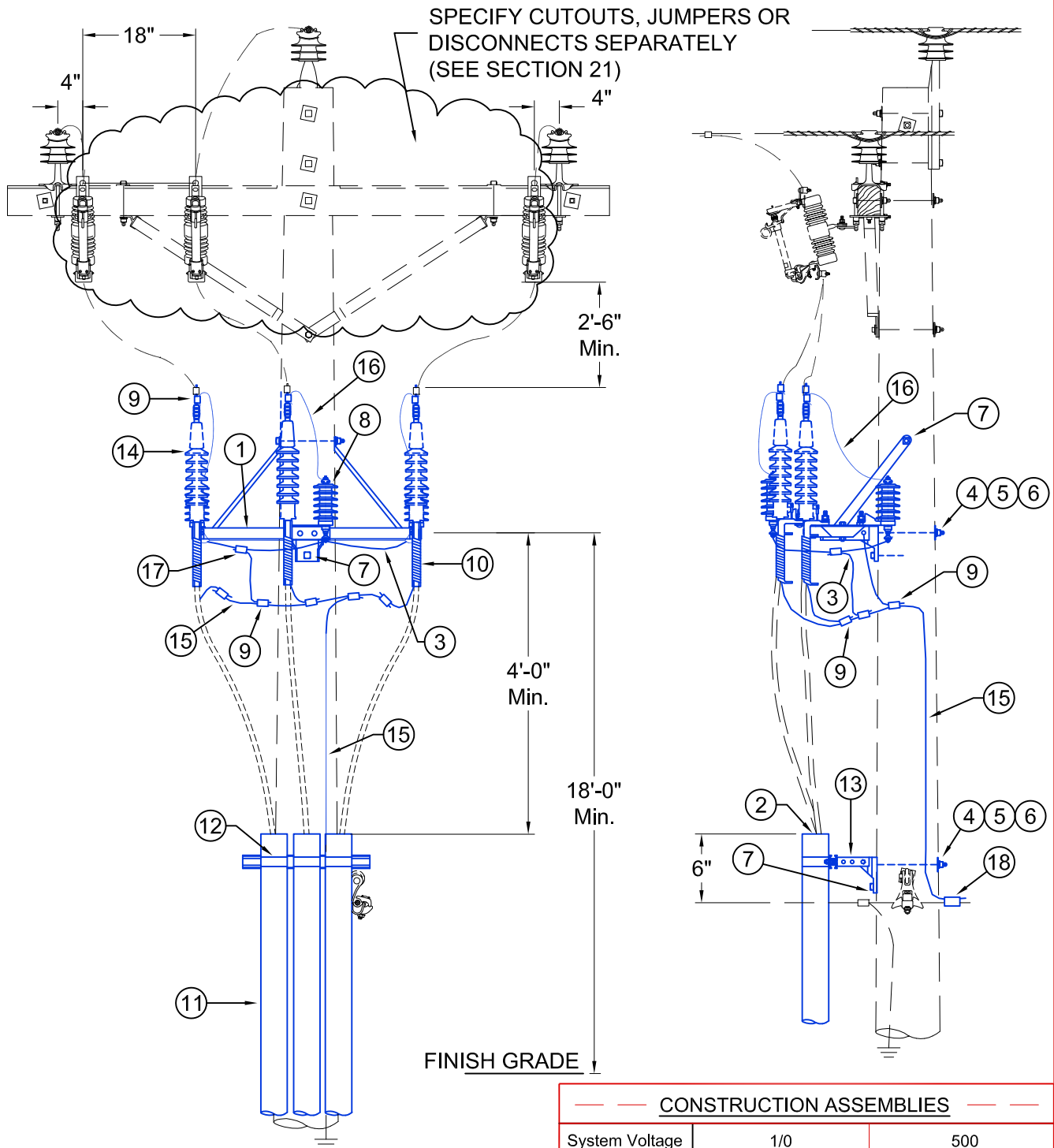
U2.010 1-Ph 15 kV Riser, Loop on Bracket
 VU2.010 1-Ph 25 kV Riser, Loop on Bracket

Ref	Material #	Description	U2.010	VU2.010
1	31001400	Hngr, Clustermount, Co/Arr/Term	1	1
2	66911252	Term: 1/0 15KV	2	
2	66911253	Term: 1/0 25KV/35		2
3	15010000	Cable Support CS-820	2	2
4	15620203	Cond 2 Str Cu	6	6
5	6380514	Bolt, Machine 5/8" x 14"	6	6
6	71020451	Washer, Square, 2 1/4" x 13/16"	6	6
7	71053063	Washer, Spring – 5/8"	8	8
8	55504440	Screw, Lag 1/2" x 4"	4	4
9	17010502	Con, Sicame TTD2710XFBTUNI	1	1
9	17010502	Con, Sicame TTD2710XFBTUNI	1	1
10	17015002	Conn, GC5002 #2 Str	8	8
11	1520900	Arrester, 9/10 kV	2	
11	1521800	Arrester, 18 kV		2
12	76010440	Conduit PVC Sch 80 4"	60	60
13	10500004	Brkt, Clamp 4" Conduit Riser	8	8
14	10500024	Brkt, Standoff Conduit Riser	4	4
15	17015004	Conn, GC5004 # 4 solid	2	2
16	15610401	Cond 4 solid cu sd	8	9
17	16510407	Cond, 4 cu poly	4	4
18	10693120	Conduit Sealing Foam	2	2

Construction and Design Notes:

1. This assembly is not approved for 35 kV construction.
2. When used on 25 kV construction, sectionalizing devices must be mounted on a separate work arm, not on the primary pole top assembly as shown.

U3



CONSTRUCTION ASSEMBLIES

System Voltage	1/0	500
15 kV	U3.010	U3.500
25 kV	VU3.010	VU3.500



CONSTRUCTION STANDARDS

THREE PHASE RISER
BRACKET CONSTRUCTION

U3

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

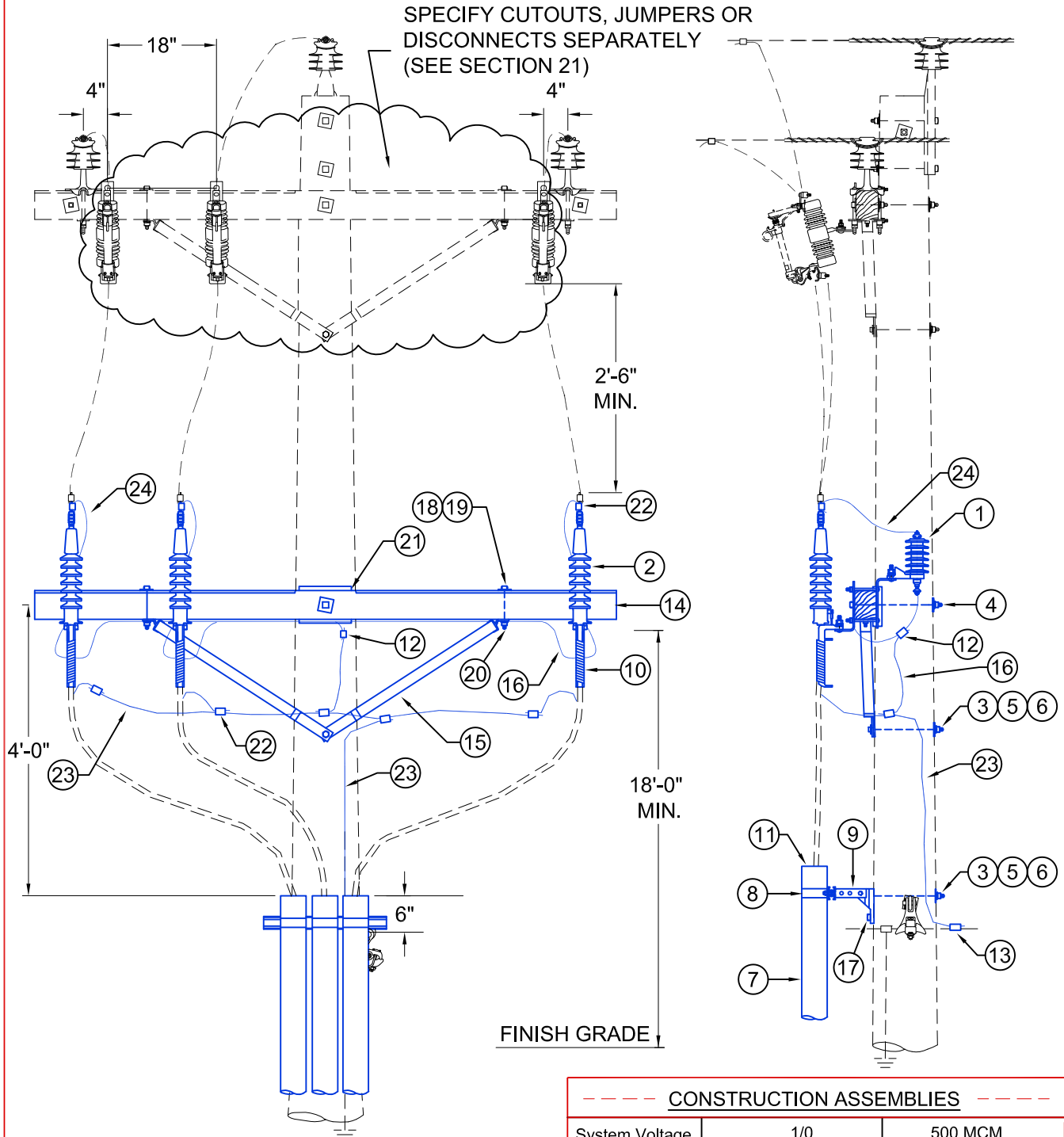
U3.010	3-Ph, 15 kV Riser, Brkt Construction 1/0
VU3.010	3-Ph, 25 kV Riser, Brkt Construction 1/0
U3.500	3-Ph, 15 kV Riser, Brkt Construction 500
VU3.500	3-Ph, 25 kV Riser, Brkt Construction 500

Ref	Material #	Description	U3.010	VU3.010	U3.500	VU3.500
1	31001400	Hngr, Clustermount, Co/Arr/Term	1	1	1	1
2	10693120	Conduit Plug Foam	1	1	1	1
3	15610401	Cond. 4 Sol Cu Soft Drawn	15	15	15	15
4	6380514	Bolt, Machine 5/8" x 14"	5	5	5	5
5	71020451	Washer, Square, 2 1/4" x 13/16"	5	5	5	5
6	71053063	Washer, Spring – 5/8"	5	5	5	5
7	55504440	Screw, Lag 1/2" x 4"	7	7	7	7
8	1520900	Arrester, 9/10 kV	3		3	
8	1521800	Arrester, 18 kV		3		3
9	17015002	Conn, GC5002 #2 Str	8	8		
9	17015040	Conn, GC5040 4/0 Str			8	8
10	15010000	Cable Support CS-820	3	3	3	3
11	76010440	Conduit PVC Sch 80 4"	90	90	90	90
12	10500004	Brkt, Clamp 4" Conduit Riser	12	12	12	12
13	10500024	Brkt, Standoff Conduit Riser	4	4	4	4
14	66911252	Term: 1/0 15KV	3			
14	66911260	Term: 350/500 15kv			3	
14	66911253	Term: 1/0 25KV/35		3		
14	66911255	Term: 350/500 25KV/35				3
15	15620203	Cond. 2 Str Cu	10	10		
15	15624007	Cond. 4/0 Str Cu			10	10
16	16510407	Cond. 4 Cu Poly SD Str	6	6	6	6
17	17015004	Conn, GC5004 #4 Solid	3	3	3	3
18	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1	1
18	17010502	Con, Sicame TTD2710XFBTUNI	1	1		

Construction and Design Notes:

- When used on 25 or 35 kV construction, sectionalizing devices must be mounted on a separate work arm, not on the primary pole top assembly as shown.

U3-1



CONSTRUCTION ASSEMBLIES

System Voltage	1/0	500 MCM
15 kV	U3-1.010	U3-1.500
25 kV	VU3-1.010	VU3-1.500
35 kV	ZU3-1.010	ZU3-1.500



CONSTRUCTION STANDARDS

THREE PHASE RISER
ON CROSSARM

U3-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

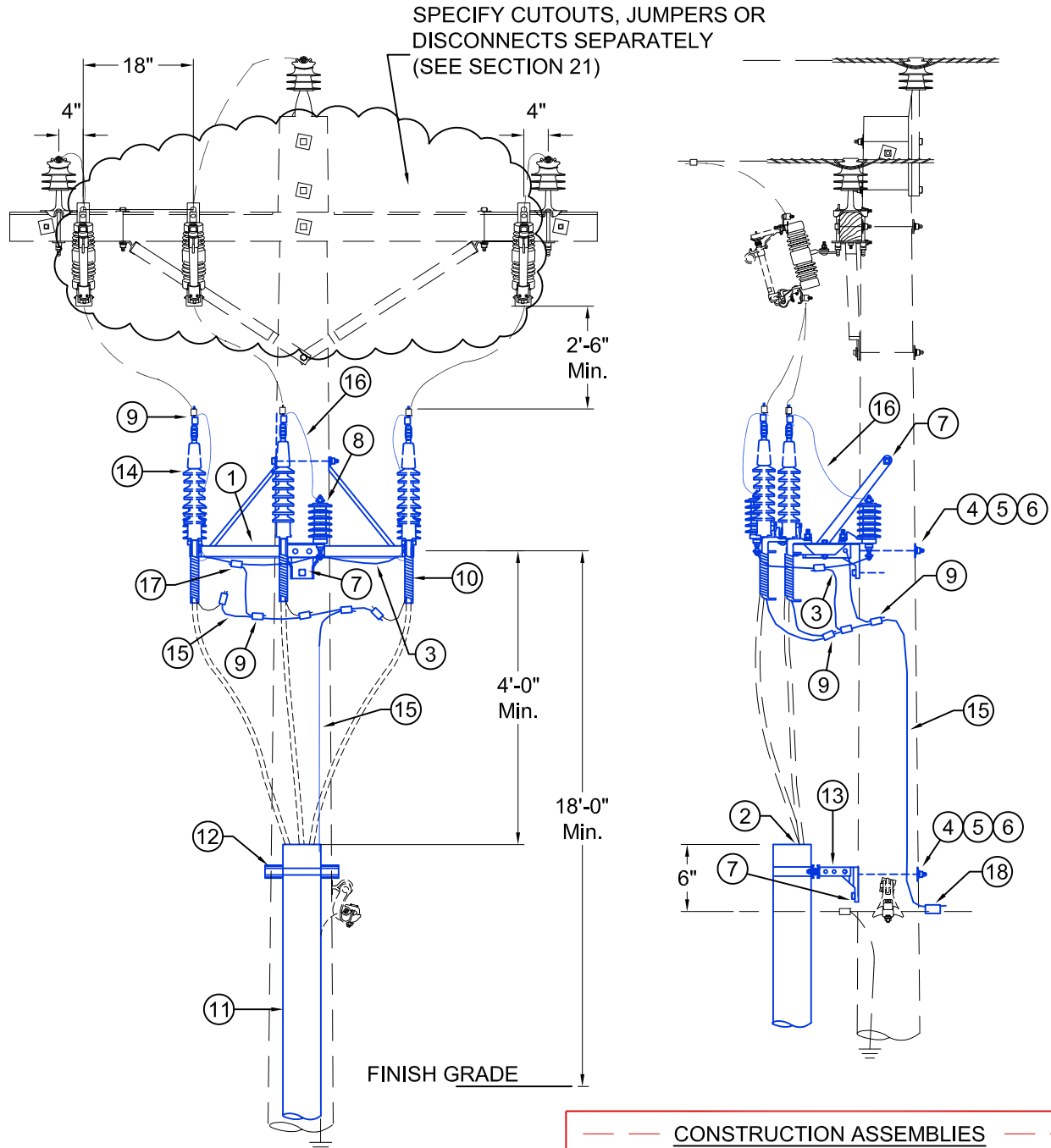
U3-1.010	3-Ph, 15kV Riser on Crossarms 1/0
VU3-1.010	3-Ph, 25kV Riser on Crossarms 1/0
ZU3-1.010	3-Ph, 35kV Riser on Crossarms 1/0
U3-1.500	3-Ph, 15kV Riser on Crossarms 500 MCM
VU3-1.500	3-Ph, 25kV Riser on Crossarms 500 MCM
ZU3-1.500	3-Ph, 35kV Riser on Crossarms 500 MCM

Ref	Material #	Description	U3-1.010	VU3-1.010	ZU3-1.010	U3-1.500	VU3-1.500	ZU3-1.500
1	1520900	Arrester 9/10 kV	3			3		
1	1521800	Arrester 18 kV		3			3	
1	1522700	Arrester 27 kV			3			3
2	66911252	Term 1/0 – 15 kV	3					
2	66911253	Term 1/0 - 25/35 kV		3	3			
2	66911260	Term 350/500 – 15 kV				3		
2	66911255	Term 350/500 – 25/35kV					3	3
3	6380514	Bolt, Machine 5/8" x 14"	5	5	5	5	5	5
4	6380518	Bolt, Machine 5/8" x 18"	1	1	1	1	1	1
5	71020451	Washer, Square 2 1/4" x 13/16"	7	7	7	7	7	7
6	71053063	Washer, Spring – 5/8"	6	6	6	6	6	6
7	76010440	Conduit PVC Sch 80 - 4"	90	90	90	90	90	90
8	10500004	Brkt Clamp 4" Conduit Riser	12	12	12	12	12	12
9	10500024	Brkt Standoff Conduit Riser	4	4	4	4	4	4
10	15010000	Cable Support CS-820	3	3	3	3	3	3
11	10693120	Conduit Foam	1	1	1	1	1	1
12	17015004	Conn, GC5004 #4 Solid	3	3	3	3	3	3
13	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1	1	1	1
13	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1			
14	18210311	Xarm 8' 3 3/4" x 4 3/4"	1	1	1	1	1	1
15	07535168	Brace: Wood 60" (Pair)	1	1	1	1	1	1
16	15610401	Cond, 4 Sol CU Soft Drawn	15'	15'	15'	15'	15'	15'
17	55504440	Screw, Lag 1/2" x 4"	4	4	4	4	4	4
18	71035931	Washer, Round 1/2"	2	2	2	2	2	2
19	71053050	Washer, Spring 1/2"	2	2	2	2	2	2
20	06310406	Bolt, Carriage 1/2" x 6"	2	2	2	2	2	2
21	29799999	Gain Plates	1	1	1	1	1	1
22	17015002	Conn, GC5002 #2 Str	8	8	8			
22	17015040	Conn, GC5040 4/0 Str				8	8	8
23	15620203	Cond, 2 Str Cu	15'	15'	15'			
23	15624007	Cond, 4/0 Str Cu				15'	15'	15'
24	16510407	Cond, 4 Cu Poly SD Str	8'	8'	8'	8'	8'	8'

U3-2

Construction and Design Notes:

1. This assembly is not approved for 35 kV construction.
2. When used on 25 kV construction, sectionalizing devices must be mounted on a separate work arm, not on the primary pole top assembly as shown.
3. This assembly is approved for use when a circuit can be back fed from alternate source or for short cable runs.



CONSTRUCTION ASSEMBLIES

System Voltage	1/0	500 MCM
15 kV	U3-2.010	U3-2.500
25 kV	VU3-2.010	VU3-2.500



CONSTRUCTION STANDARDS
THREE PHASE RISER
BRACKET CONSTRUCTION SINGLE 6" CONDUIT

U3-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

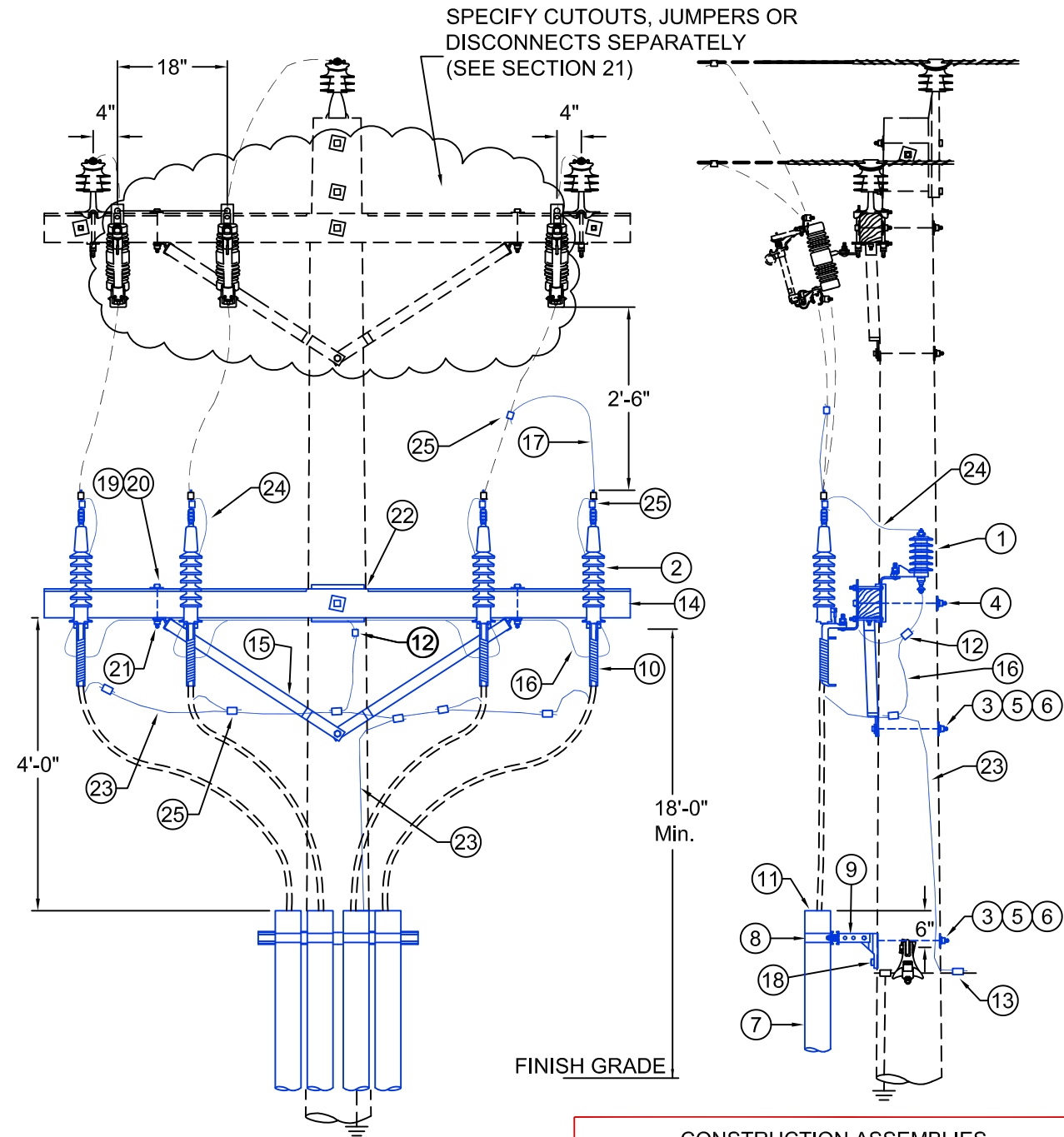
U3-2.010	3-Ph, 15 kV Riser, Brkt, 6" Conduit 1/0
VU3-2.010	3-Ph, 25 kV Riser, Brkt, 6" Conduit 1/0
U3-2.500	3-Ph, 15 kV Riser, Brkt, 6" Conduit 500
VU3-2.500	3-Ph, 25 kV Riser, Brkt, 6" Conduit 500

Ref	Material #	Description	U3-2.010	VU3-2.010	U3-2.500	VU3-2.500
1	31001400	Hngr, Clustermount, Co/Arr/Term	1	1	1	1
2	10693120	Conduit Plug Foam	1	1	1	1
3	15610401	Cond. 4 Sol Cu Soft Drawn	15	15	15	15
4	6380514	Bolt, Machine 5/8" x 14"	5	5	5	5
5	71020451	Washer, Square, 2 1/4" x 13/16"	5	5	5	5
6	71053063	Washer, Spring – 5/8"	5	5	5	5
7	55504440	Screw, Lag 1/2" x 4"	7	7	7	7
8	1520900	Arrester, 9/10 kV	3		3	
8	1521800	Arrester, 18 kV		3		3
9	17015002	Conn, GC5002 #2 Str	8	8		
9	17015040	Conn, GC5040 4/0 Str			8	8
10	15010000	Cable Support CS-820	3	3	3	3
11	76010460	Conduit PVC Sch 80 6"	30	30	30	30
12	10500006	Brkt, Clamp 6" Conduit Riser	4	4	4	4
13	10500024	Brkt, Standoff Conduit Riser	4	4	4	4
14	66911252	Term: 1/0 15KV	3			
14	66911260	Term: 350/500 15kv			3	
14	66911253	Term: 1/0 25KV/35		3		
14	66911255	Term: 350/500 25KV/35				3
15	15620203	Cond. 2 Str Cu	10	10		
15	15624007	Cond. 4/0 Str Cu			10	10
16	16510407	Cond. 4 Cu Poly SD Str	6	6	6	6
17	17015004	Conn, GC5004 #4 Solid	3	3	3	3
18	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1	1
18	17010502	Con, Sicame TTD2710XFBTUNI	1	1		

Construction and Design Notes:

U4

1. When used on 25 or 35 kV construction, sectionalizing devices must be mounted on a separate work arm, not on the primary pole top assembly as shown.



--- CONSTRUCTION ASSEMBLIES ---		
System Voltage	1/0	500 MCM
15 kV	U4.010	U4.500
25 kV	VU4.010	VU4.500
35 kV	ZU4.010	ZU4.500



CONSTRUCTION STANDARDS
THREE PHASE RISER W/SPARE
ON CROSSARM

U4

ISSUE DATE: 01/20

Materials List for Assemblies

Descriptions

U4.010	3-Ph 15kV Riser w/Spare on Crossarms 1/0
VU4.010	3-Ph 25kV Riser w/Spare on Crossarms 1/0
ZU4.010	3-Ph 35kV Riser w/Spare on Crossarms 1/0
U4.500	3-Ph 15kV Riser w/Spare on Crossarms 500 MCM
VU4.500	3-Ph 25kV Riser w/Spare on Crossarms 500 MCM
ZU4.500	3-Ph 35kV Riser w/Spare on Crossarms 500 MCM

Ref	Material #	Description	U4.010	VU4.010	ZU4.010	U4.500	VU4.500	ZU4.500
1	1520900	Arrester 9/10 kV	4			4		
1	1521800	Arrester 18 kV		4			4	
1	1522700	Arrester 27 kV			4			4
2	66911252	Term 1/0 – 15 kV	4					
2	66911253	Term 1/0 - 25/35 kV		4	4			
2	66911260	Term 350/500 – 15 kV				4		
2	66911255	Term 350/500 – 25/35kV					4	4
3	6380514	Bolt, Machine 5/8" x 14"	5	5	5	5	5	5
4	6380518	Bolt, Machine 5/8" x 18"	1	1	1	1	1	1
5	71020451	Washer, Square 2 1/4" x 13/16"	13	13	13	13	13	13
6	71053063	Washer, Spring – 5/8"	6	6	6	6	6	6
7	76010440	Conduit PVC Sch 80 - 4"	120	120	120	120	120	120
8	10500004	Brkt Clamp 4" Conduit Riser	16	16	16	16	16	16
9	10500036	Brkt Standoff Conduit Riser 36"	4	4	4	4	4	4
10	15010000	Cable Support CS-820	4	4	4	4	4	4
11	10693120	Conduit Foam	1	1	1	1	1	1
12	17015004	Conn, GC5004 #4 Solid	4	4	4	4	4	4
13	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1	1	1	1
13	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1			
14	18210311	Xarm 8' 3 3/4" x 4 3/4"	1	1	1	1	1	1
15	07535168	Brace: Wood 60" (Pair)	1	1	1	1	1	1
16	15610401	Cond, 4 Sol CU Soft Drawn	15'	15'	15'	15'	15'	15'
17	16510207	Cond, 2 CU Poly SD Str	2	2	2	2	2	2
18	55504440	Screw, Lag 1/2" x 4"	4	4	4	4	4	4
19	06380406	Bolt, Machine 1/2" x 6"	2	2	2	2	2	2
20	71035931	Washer, Round 1/2"	2	2	2	2	2	2
21	71053050	Washer, Spring 1/2"	2	2	2	2	2	2
22	29799999	Gain Plate	1	1	1	1	1	1
23	15620203	Cond, 2 Str Cu	15'	15'	15'			
23	15624007	Cond, 4/0 Str Cu				15'	15'	15'
24	16510407	Cond, 4 Cu Poly SD Str	8'	8'	8'	8'	8'	8'
25	17015002	Conn, GC5002 #2 Str	10	10	10			
25	17015040	Conn, GC5040 4/0 Str				10	10	10

Vaults, Pads and Covers 14

Vaults

U5-4 Vault Assembly, Individual Service Only
U5-5 Vault Assembly, Multiple Services & 1-Ph Loop Feed Transformers
U5-7 Vault assembly for 3 phase transformers
U5-7P Vault assembly for Pull Vault
U5-7S Vault assembly for 3 phase sectionalizer

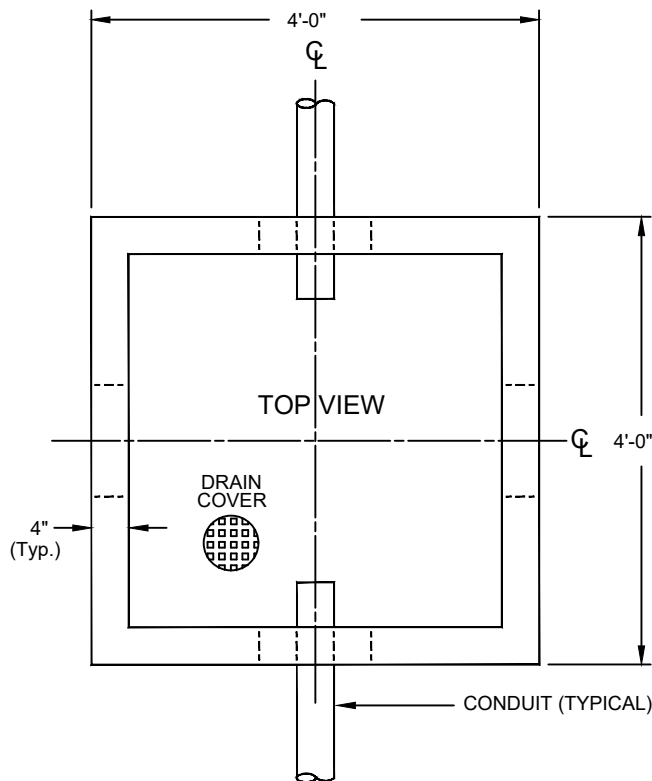
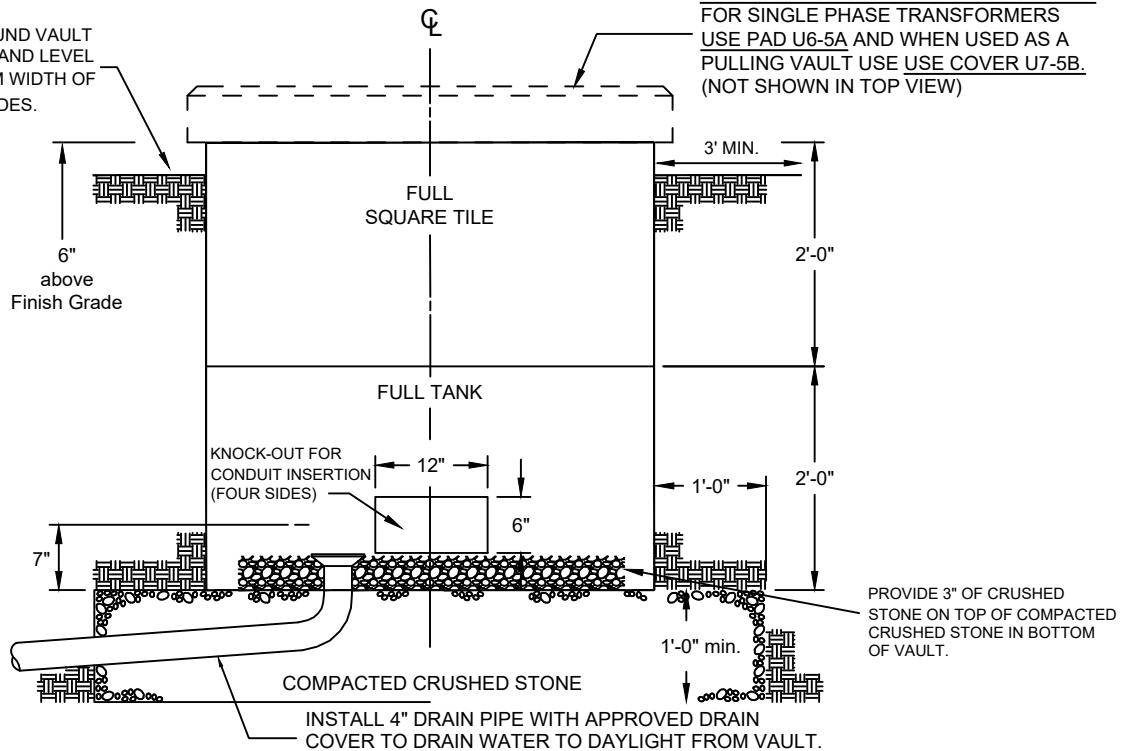
Pads

U6-5A Single-Ph Transformer Vault Pad for U5-5 & U5-4, Including Temporary Cable Opening Cover
U6-5B Single-Ph Sectionalizer Vault Pad for U5-5, Including Temporary Cable Opening Cover
U6-5C Vault Pad for 3-Ph Transformer on Existing U5-5, Including Temporary Cable Opening Cover
U6-5D Three-Ph Sectionalizer Vault Pad for U5-5, Including Temporary Cable Opening Cover
U6-5E Three-Ph Sectionalizer Vault Pad for Pad U5-5, Including Temporary Cable Opening Cover
U6-5G Vault Pad for 5000 kva Transformer

Covers

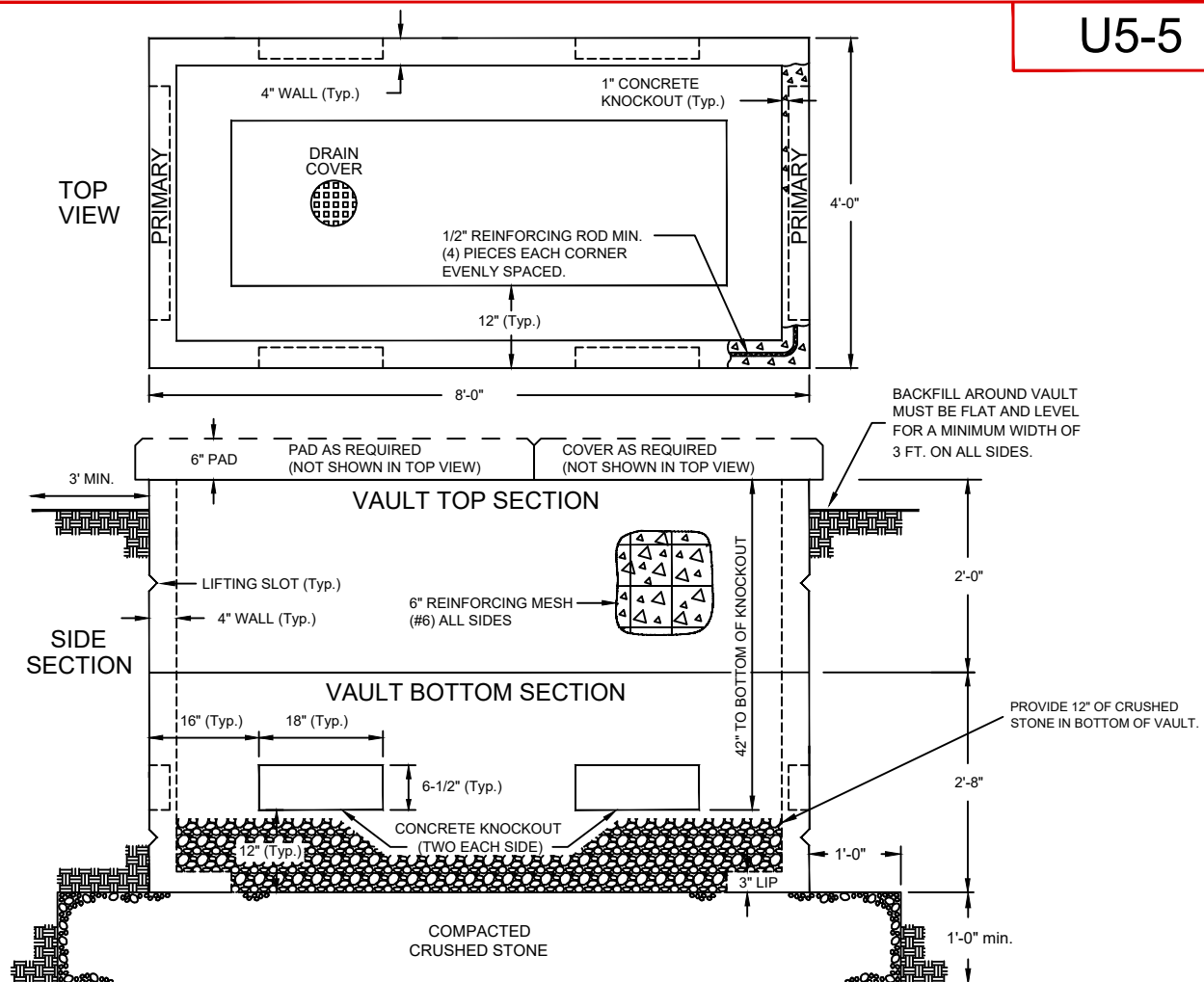
U7-5A Vault Cover for U5-5
U7-5B Vault Cover for U5-5 & U5-4
U7-6B Underwater Cable Cover
U7-6B.1 Underwater Cable Cover or Culvert Crossing Protector
U7-7C Vault Cover for U5-7 Series Vault Assemblies
U7-7E Vault Cover for U5-7 Series Vault Assemblies

BACKFILL AROUND VAULT MUST BE FLAT AND LEVEL FOR A MINIMUM WIDTH OF 3 FT. ON ALL SIDES.



INSTALLATION REQUIREMENTS

- 1.) If the vault is cut into an embankment, NHEC may require a retaining wall either in front or behind the vault to prevent material from spilling into or away from the vault.
- 2.) Top of vault shall be six inches above finished grade.
- 3.) All vaults will be constructed with a drainage system of approved pipe material to drain water that may penetrate the vault. The piping shall originate at the lowest point inside the vault and be routed to free air at an elevation below its origination that promotes drainage.
- 4.) If vault is located near the traveled way, NHEC may require a protective structure to prevent damage.
- 5.) Seal all knockouts after conduit is placed.
- 6.) Concrete shall have a compressive strength of 5000 P.S.I. after 28 days when tested in accordance with ASTM C-39-72 (Latest edition).
- 7.) Refer to Member Handbook Underground Service Installation Section for further clarification and detailed descriptions for underground installations.

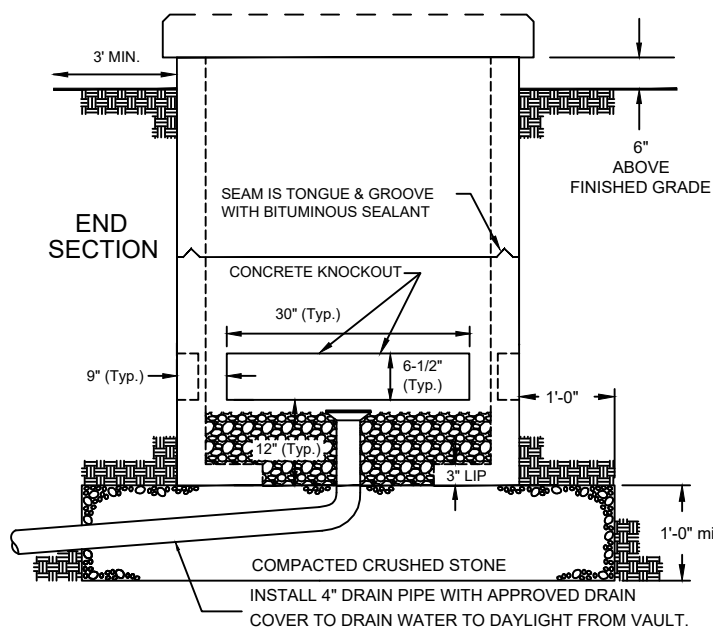


INSTALLATION REQUIREMENTS

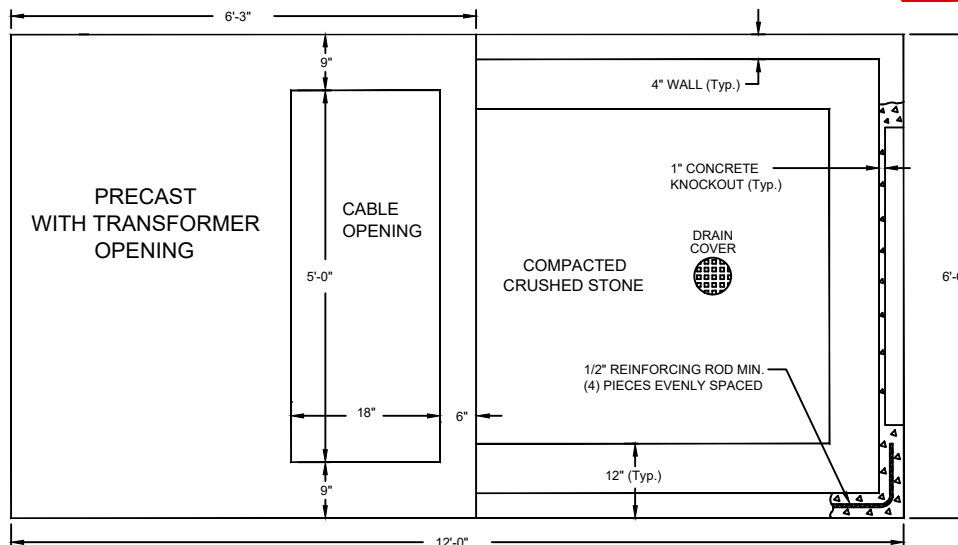
- 1.) If the vault is cut into an embankment, NHEC may require a retaining wall either in front or behind the vault to prevent material from spilling into or away from the vault.
- 2.) Top of vault shall be six inches above finished grade.
- 3.) All vaults will be constructed with a drainage system of approved pipe material to drain water that may penetrate the vault. The piping shall originate at the lowest point inside the vault and be routed to free air at an elevation below its origination that promotes drainage.
- 4.) If vault is located near the traveled way, NHEC may require a protective structure to prevent damage.
- 5.) Seal all knockouts after conduit is placed.
- 6.) Concrete shall have a compressive strength of 5000 P.S.I. after 28 days when tested in accordance with ASTM C-39-72 (Latest edition).
- 7.) Refer to Member Handbook Underground Service Installation Section for further clarification and detailed descriptions for underground installations.

PAD & COVER REQUIREMENTS

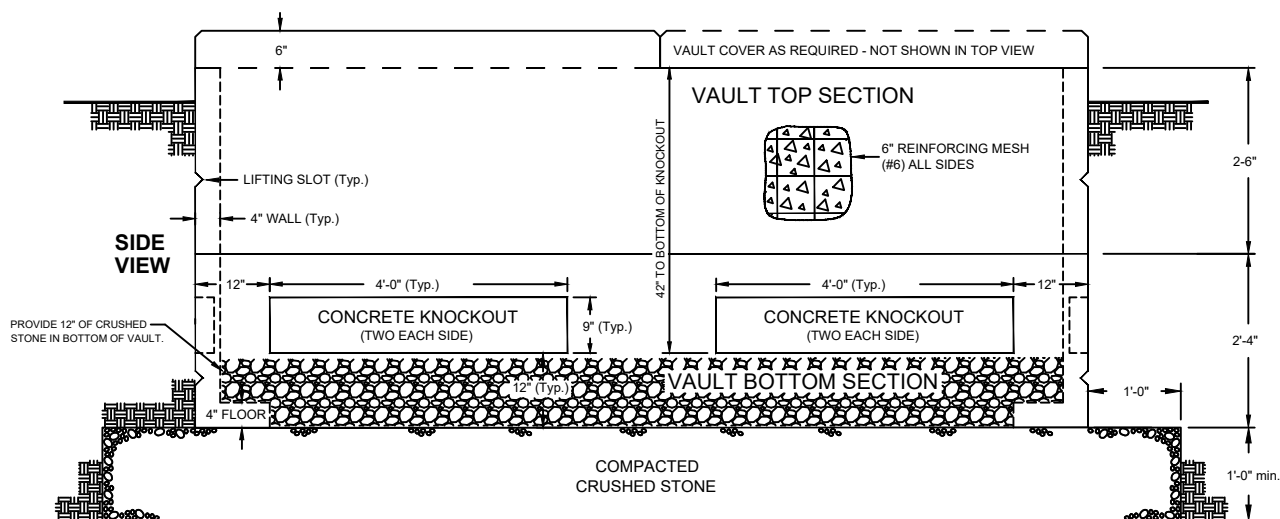
- 1.) For single phase 15 or 25kV transformer (15-167kVA), use Pad U6-5A & Cover U7-5B.
- 2.) For single phase 15 or 25kV 200 amp sectionalizing cabinet use Pad U6-5B & Cover U7-5B.
- 3.) For splicing or pulling vault use Cover U7-5A & Cover U7-5B.



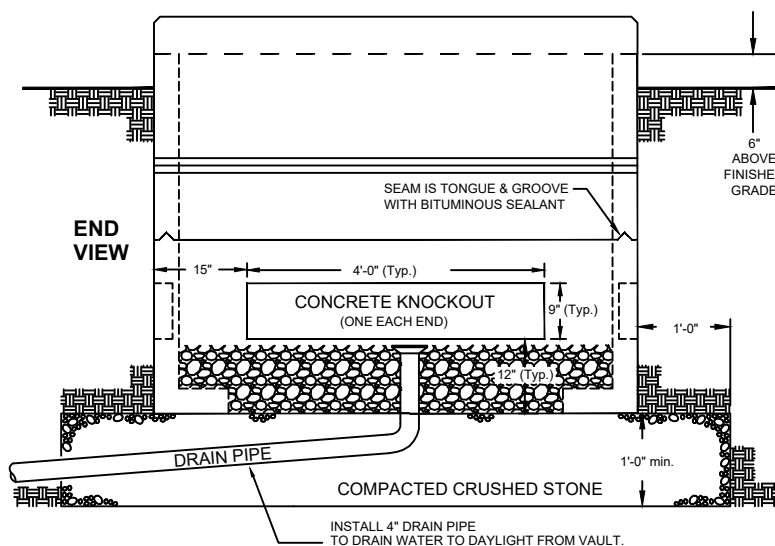
TOP VIEW



SIDE VIEW



END VIEW

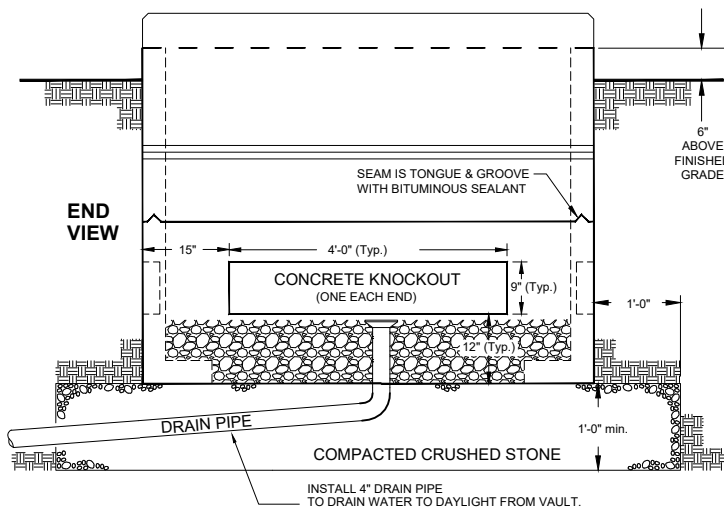
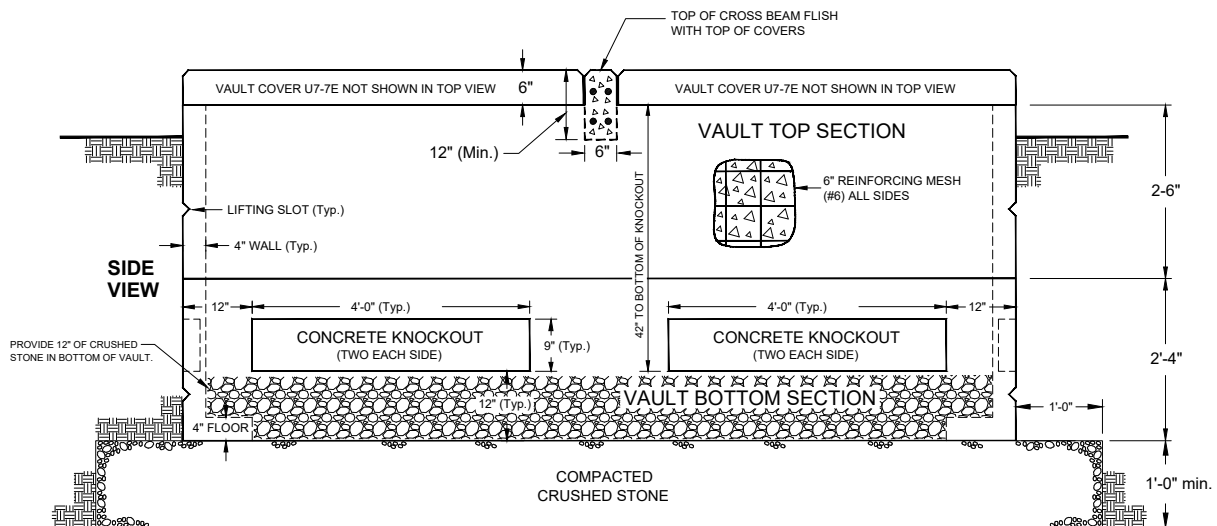
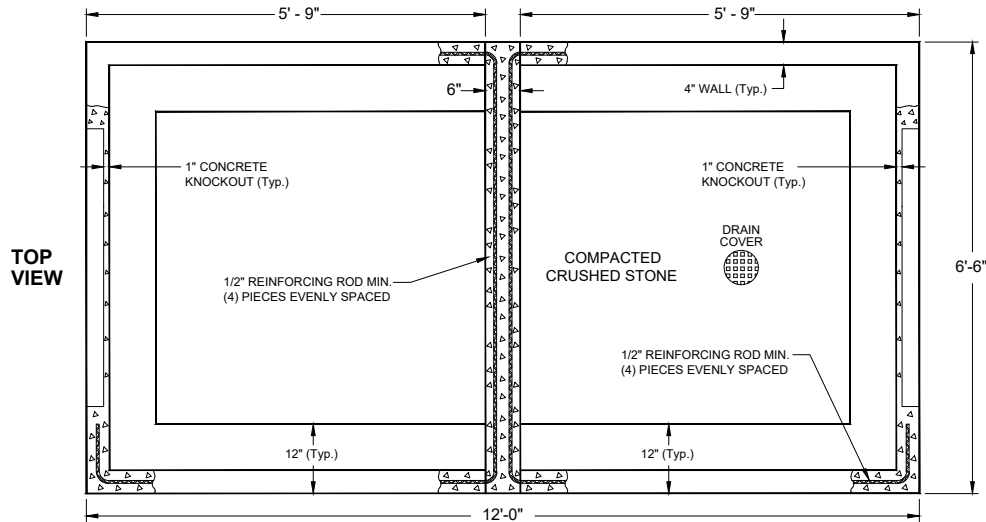


INSTALLATION REQUIREMENTS

- 1.) If the vault is cut into an embankment, NHEC may require a retaining wall either in front or behind the vault to prevent material from spilling into or away from the vault.
- 2.) Top of vault shall be six inches above finished grade.
- 3.) All vaults will be constructed with a drainage system of approved pipe material to drain water that may penetrate the vault. The piping shall originate at the lowest point inside the vault and be routed to free air at an elevation below its origination that promotes drainage.
- 4.) If vault is located near the traveled way, NHEC may require a protective structure to prevent damage.
- 5.) Seal all knockouts after conduit is placed.
- 6.) Concrete shall have a compressive strength of 5000 P.S.I. after 28 days when tested in accordance with ASTM C-39-72 (Latest edition).
- 7.) Refer to Member Handbook Underground Service Installation Section for further clarification and detailed descriptions for underground installations.

FURTHER REQUIREMENT INCLUDES:

- 1.) Vault cover U7-7E to enclose vault.
- 2.) Approximate weights:
 Vault top section 5600 Lbs.
 Vault bottom section 5300 Lbs.
 Vault cover U7-7E 2600 Lbs.



INSTALLATION REQUIREMENTS

- 1) IF THE VAULT IS CUT INTO AN EMBANKMENT, NHEC MAY REQUIRE A RETAINING WALL EITHER IN FRONT OR BEHIND THE VAULT TO PREVENT MATERIAL FROM SPILLING INTO OR AWAY FROM THE VAULT.
- 2) TOP OF UPPER SECTION OF VAULT SHALL BE SIX INCHES ABOVE FINISHED GRADE.
- 3) ALL VAULTS WILL BE CONSTRUCTED WITH A DRAINAGE SYSTEM OF APPROVED PIPE MATERIAL TO DRAIN WATER THAT MAY PENETRATE THE VAULT. THE PIPING SHALL ORIGINATE AT THE LOWEST POINT INSIDE THE VAULT AND BE ROUTED TO FREE AIR AT AN ELEVATION BELOW ITS ORIGIN THAT PROMOTES DRAINAGE.
- 4) IF VAULT IS LOCATED NEAR THE TRAVELED WAY, NHEC MAY REQUIRE A PROTECTIVE STRUCTURE TO PREVENT DAMAGE.
- 5) SEAL ALL KNOCKOUTS AFTER CONDUIT IS PLACED.
- 6) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C-39-72 (LATEST EDITION).
- 7) REFER TO MEMBER HANDBOOK SECTION 2 OR CONSTRUCTION STANDARDS TAB 12 FOR FURTHER CLARIFICATION AND DETAILED DESCRIPTIONS FOR UNDERGROUND INSTALLATIONS.

FURTHER REQUIREMENT INCLUDES:

- 1) VAULT COVER U7-7E TO ENCLOSE VAULT. (2 EACH)
- 2) APPROXIMATE WEIGHTS:
 VAULT TOP SECTION 5600 LBS.
 VAULT BOTTOM SECTION 5300 LBS.
 VAULT COVER U7-7E 2600 LBS.

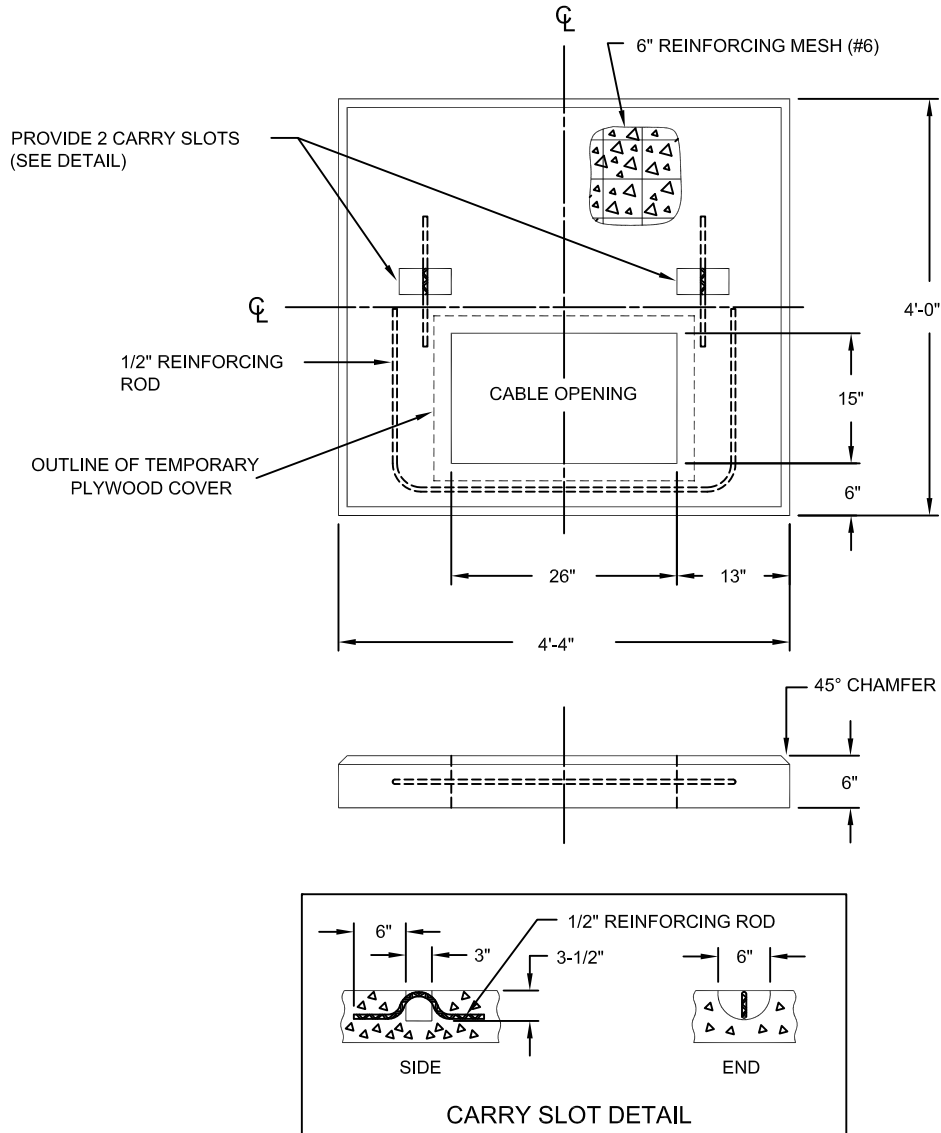
U5-7S



- 1.) If the vault is cut into an embankment, NHEC may require a retaining wall either in front or behind the vault to prevent material from spilling into or away from the vault.

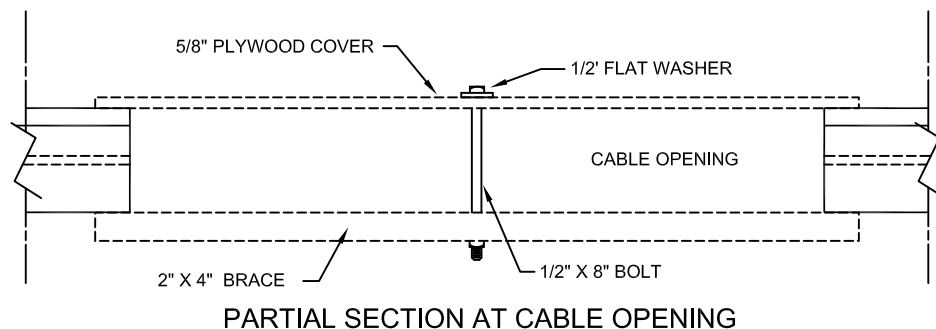
- FURTHER REQUIREMENT INCLUDES:

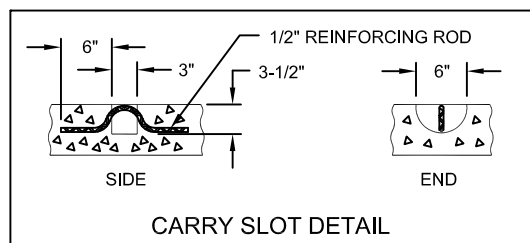
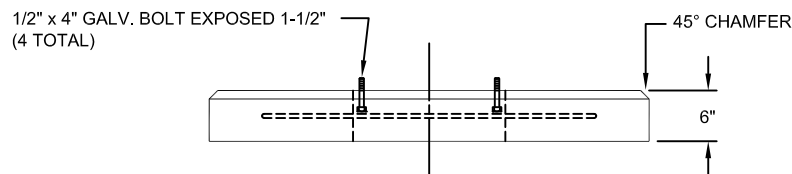
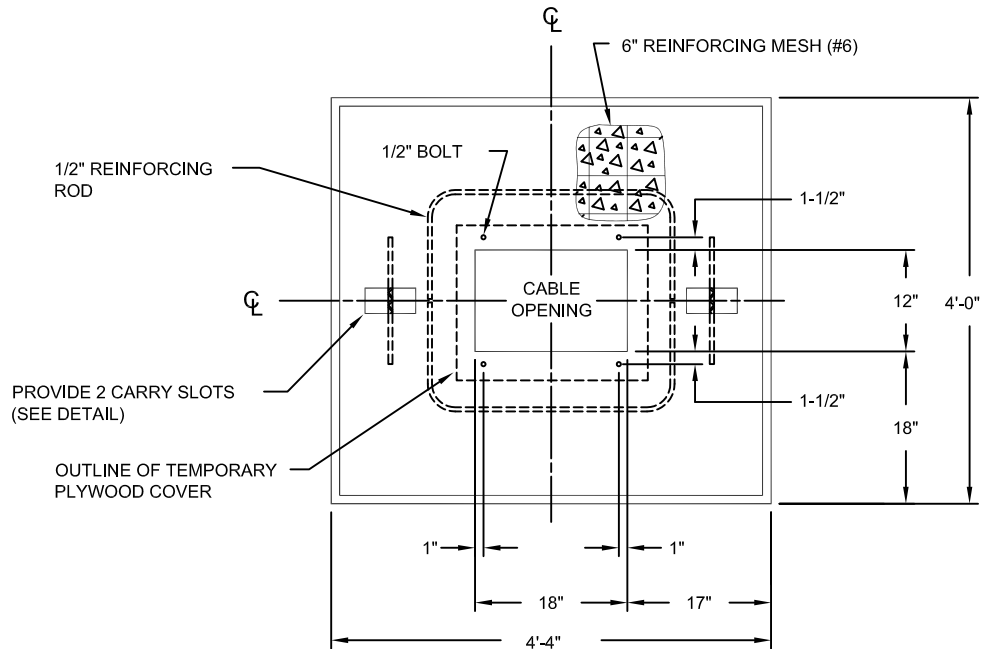
- 2.) Approximate weights:
- | | |
|----------------------|-----------|
| Vault top section | 5600 Lbs. |
| Vault bottom section | 5300 Lbs. |
| Vault cover U7-7E | 2600 Lbs. |



NOTE:

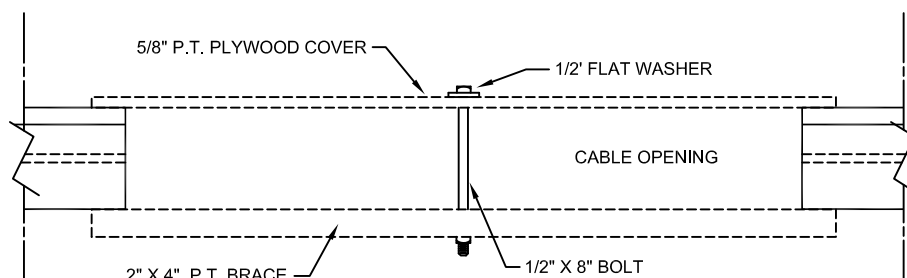
- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) USE COVER U7-5B WITH VAULT U5-5.
- 3.) CONTRACTOR IS RESPONSIBLE TO COVER CABLE OPENING UNTIL NHEC BEGINS WORK. SEE DRAWING BELOW FOR RECOMMENDED COVER ATTACHMENT.



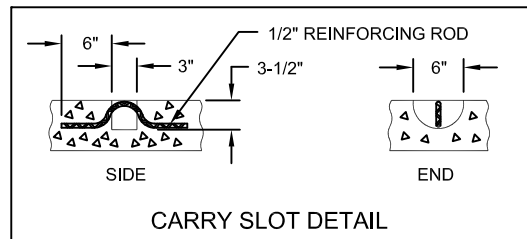
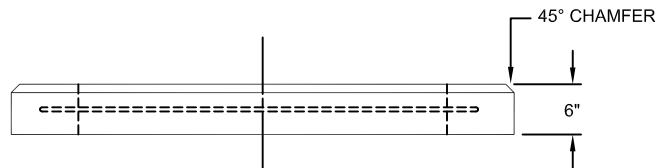
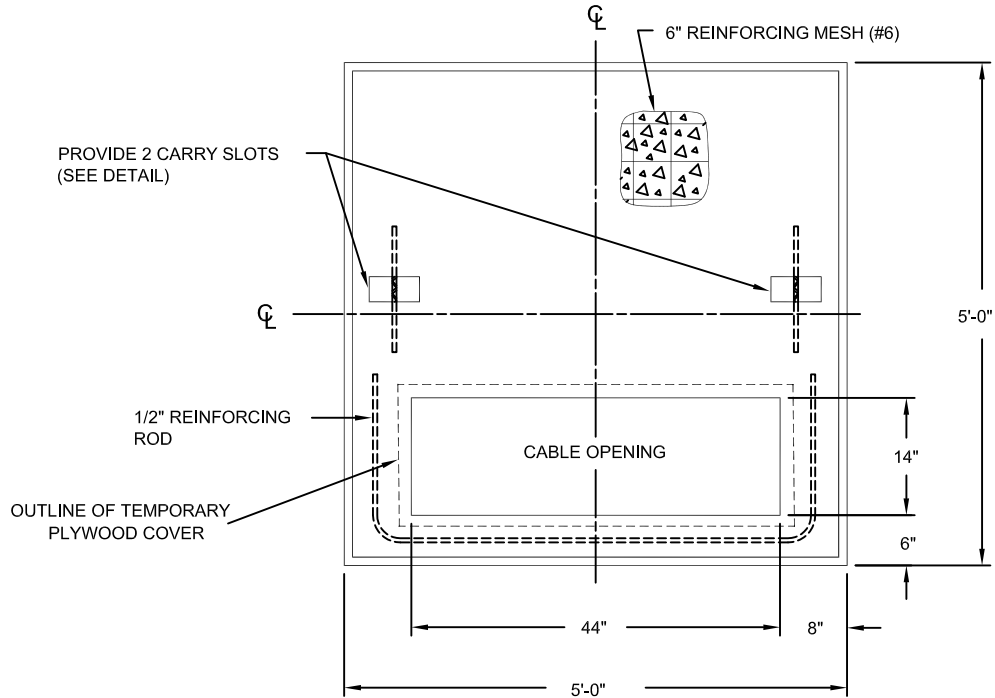


NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) USE WITH VAULT COVER U7-5B.
- 3.) CONTRACTOR SHALL SUPPLY MEANS TO SECURE CABLE OPENING FROM ENTRY.

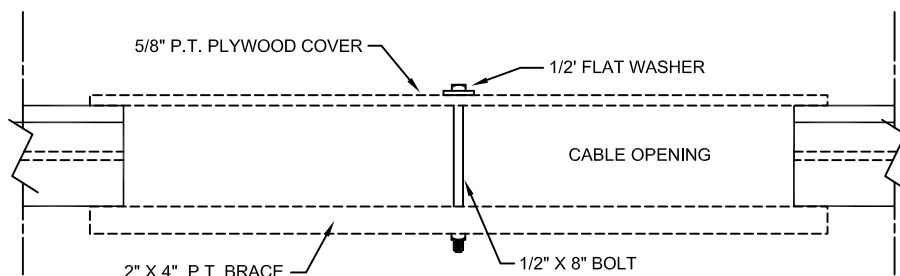


PARTIAL SECTION AT CABLE OPENING

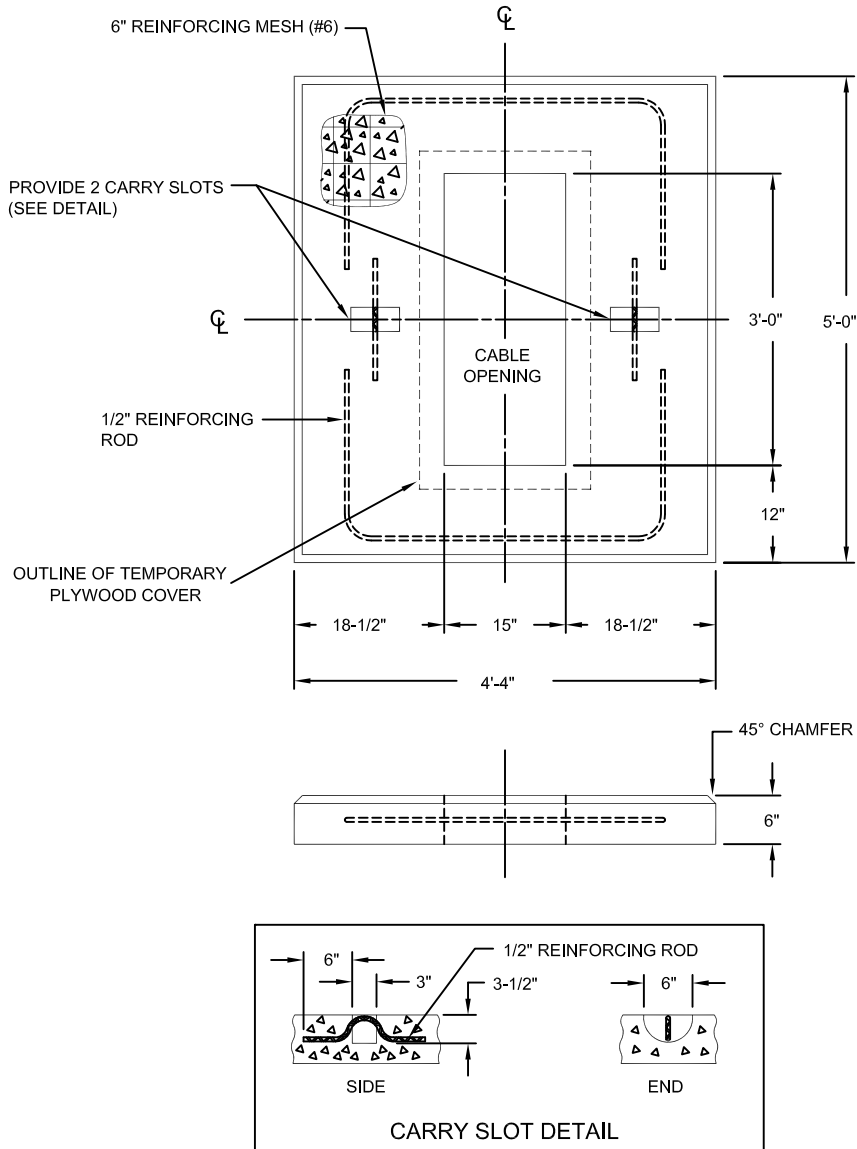


NOTE:

- 1.) TO BE USED ONLY WHEN U5-5 WITH ADEQUATE SPACE EXISTS IN THE FIELD AND A U5-7 SERIES VAULT IS NOT REQUIRED. TO BE USED WITH COVER U7-5A.
- 2.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 3.) CONTRACTOR SHALL SUPPLY MEANS TO SECURE CABLE OPENING FROM ENTRY.

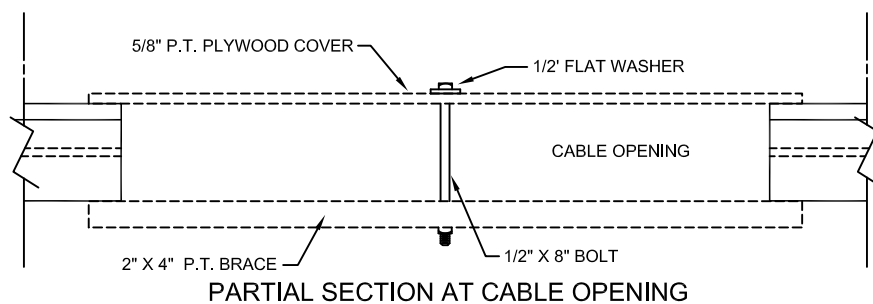


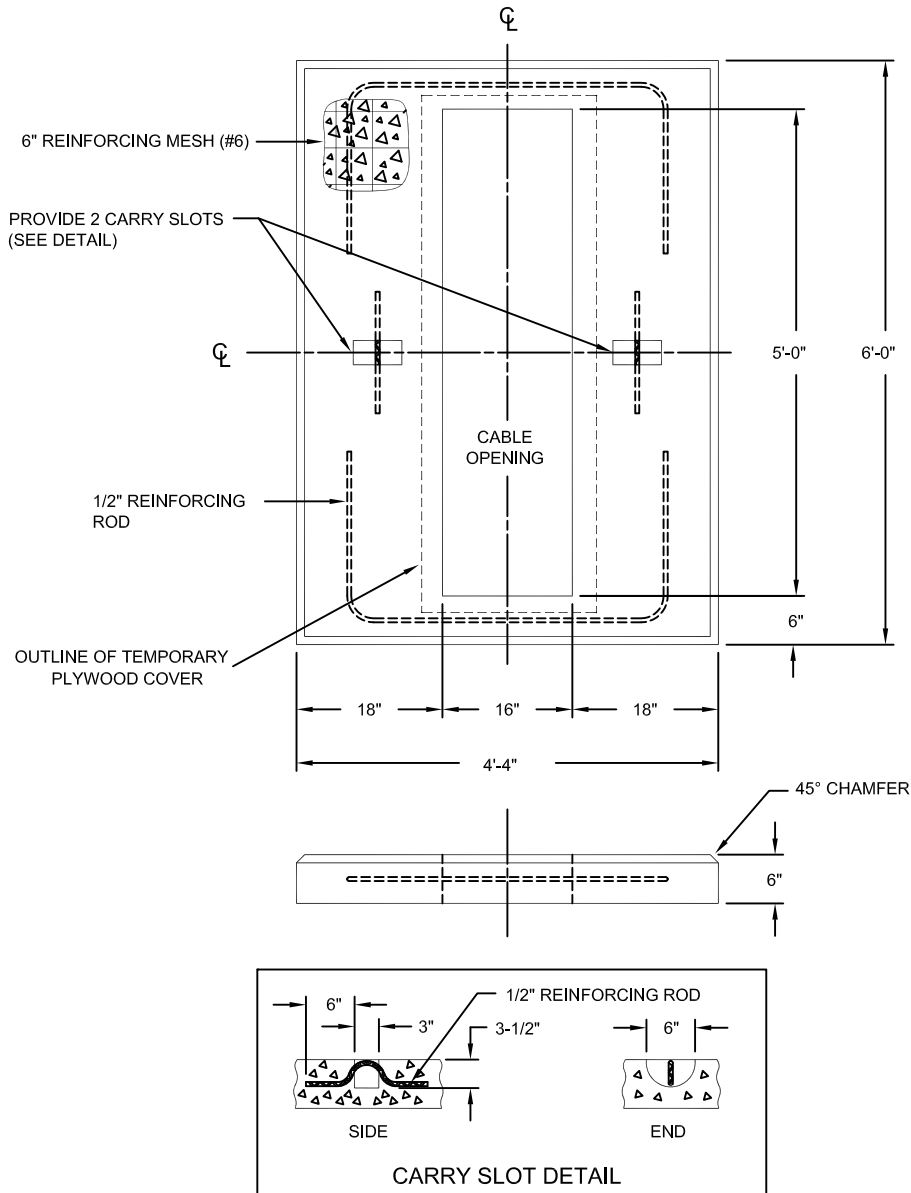
PARTIAL SECTION AT CABLE OPENING



NOTE:

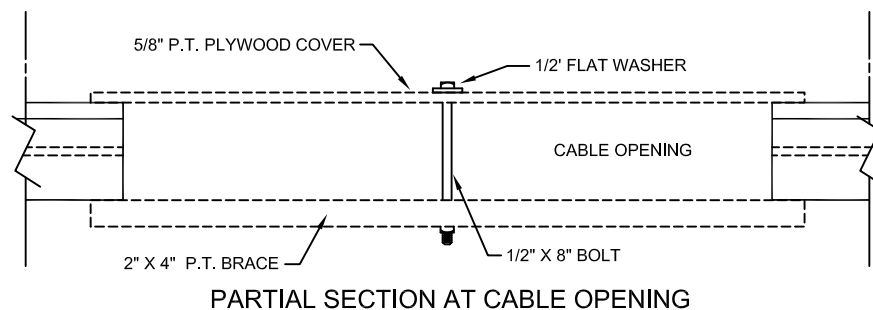
- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) USE WITH VAULT COVER U7-5A.
- 3.) CONTRACTOR SHALL SUPPLY MEANS TO SECURE CABLE OPENING FROM ENTRY.

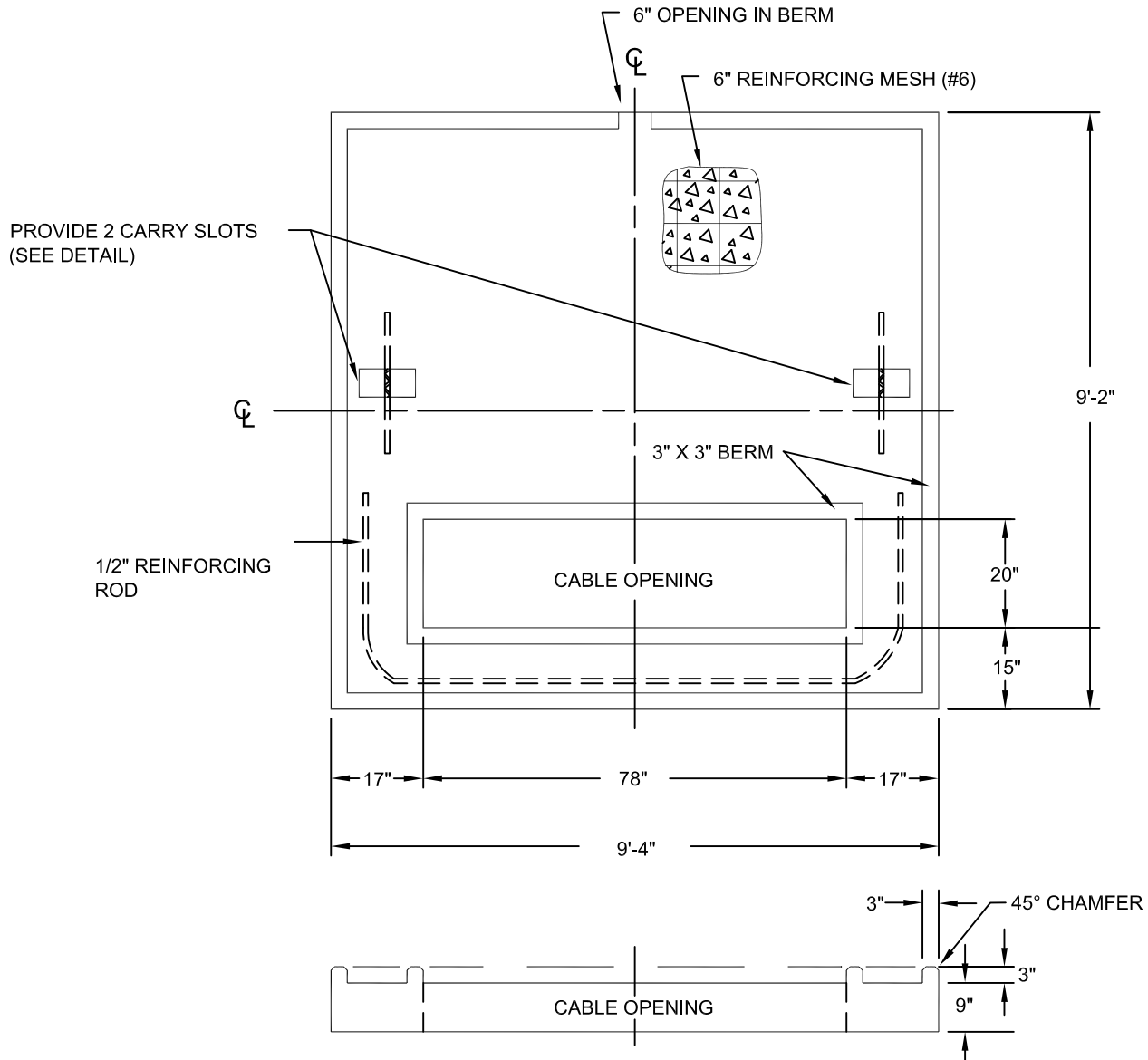




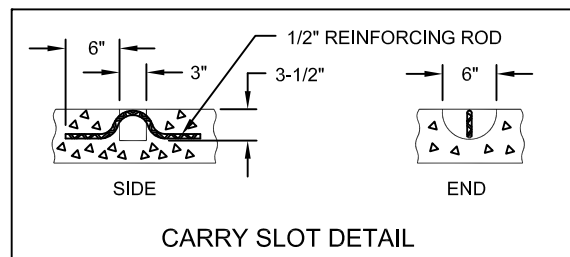
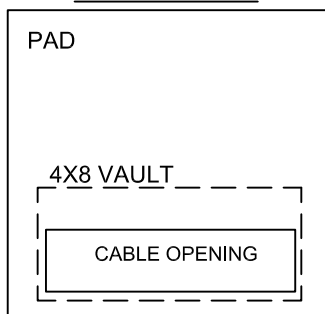
NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) USE WITH VAULT COVER U7-5A.
- 3.) CONTRACTOR SHALL SUPPLY MEANS TO SECURE CABLE OPENING FROM ENTRY.



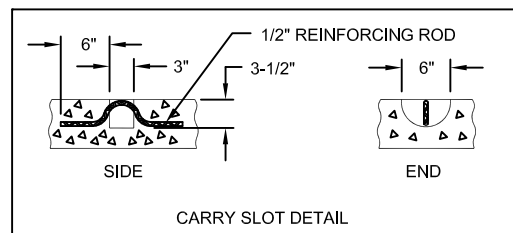
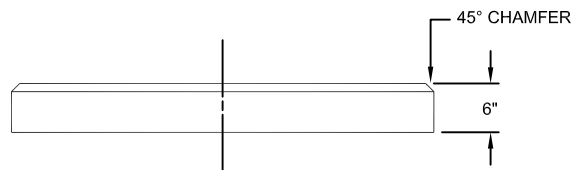
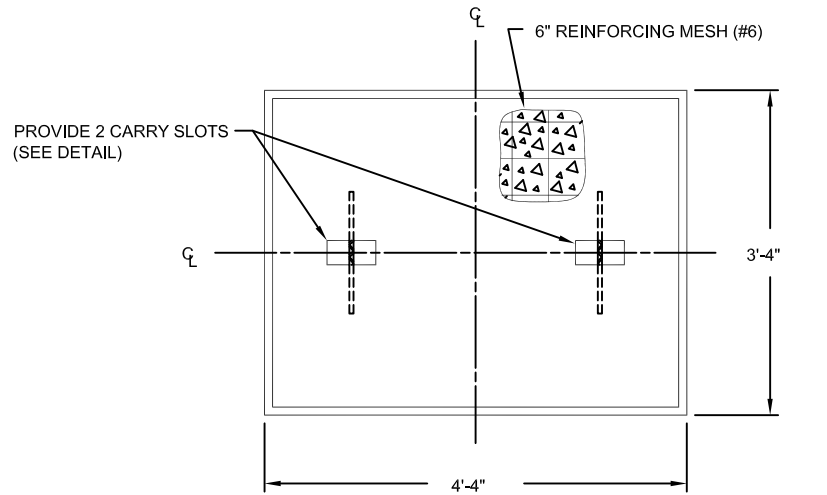


LAYOUT DETAIL



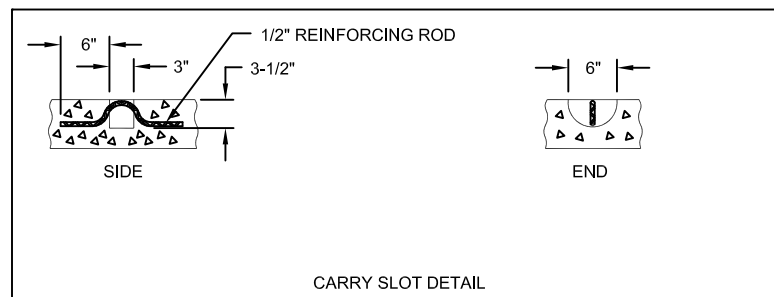
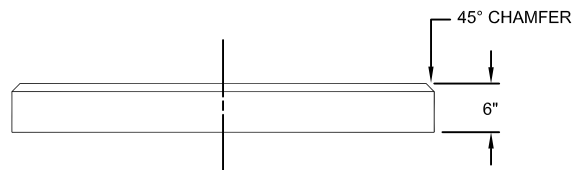
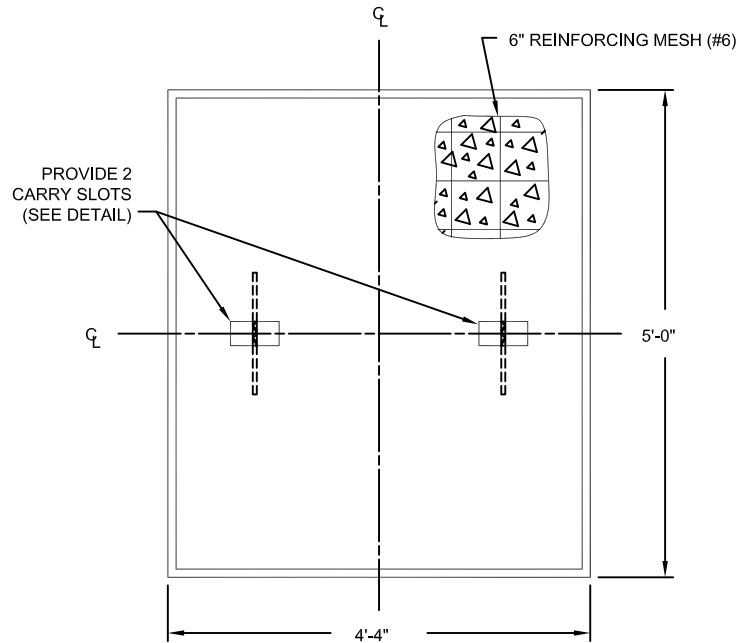
NOTES:

- 1) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2) USE WITH VAULT U5-5. SEE DETAIL FOR LAYOUT.



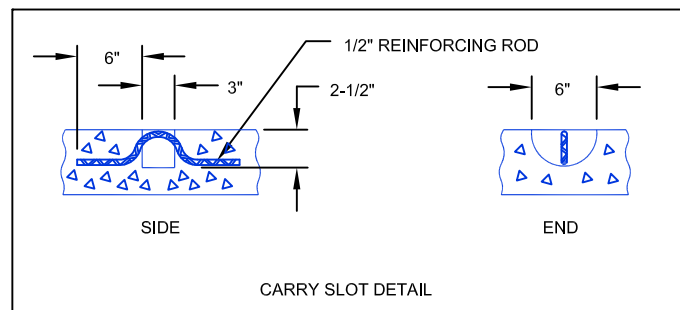
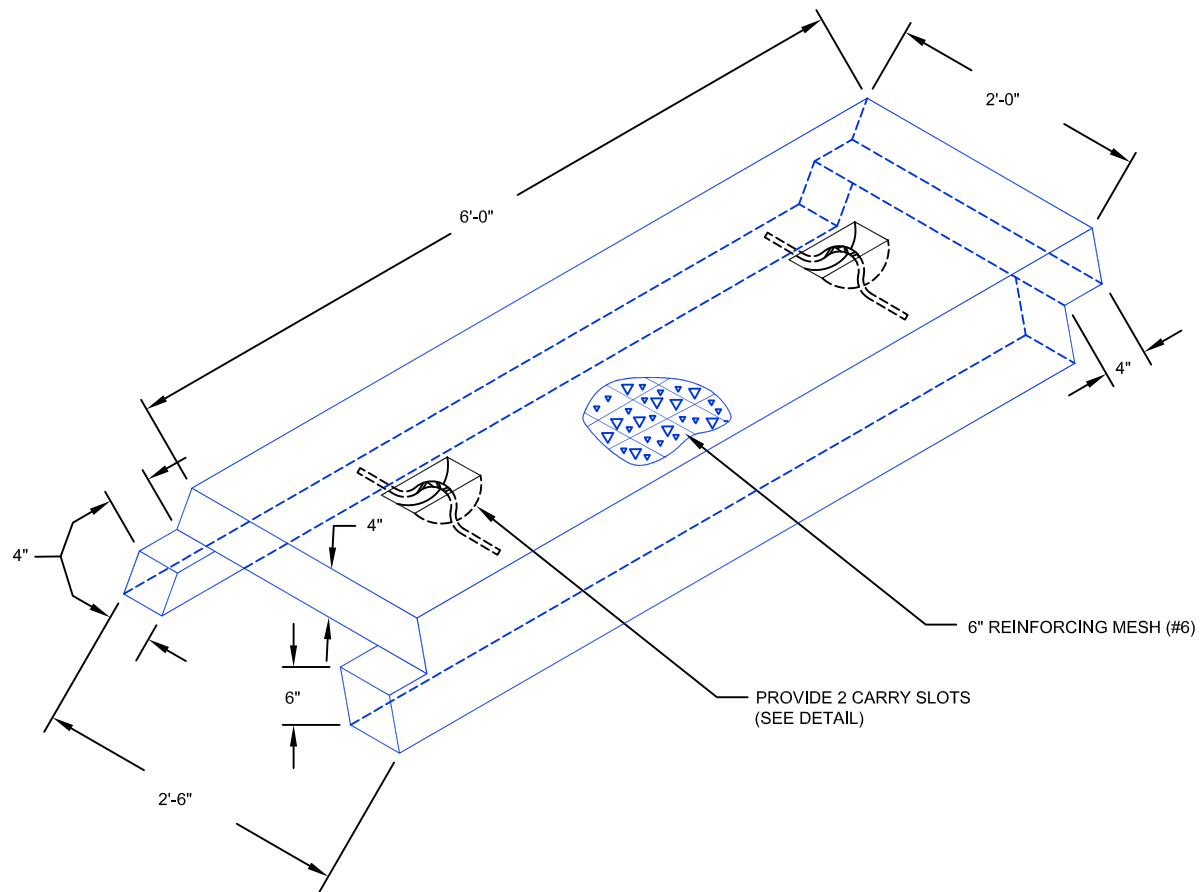
NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) APPROXIMATE WEIGHT: 1008 LBS.



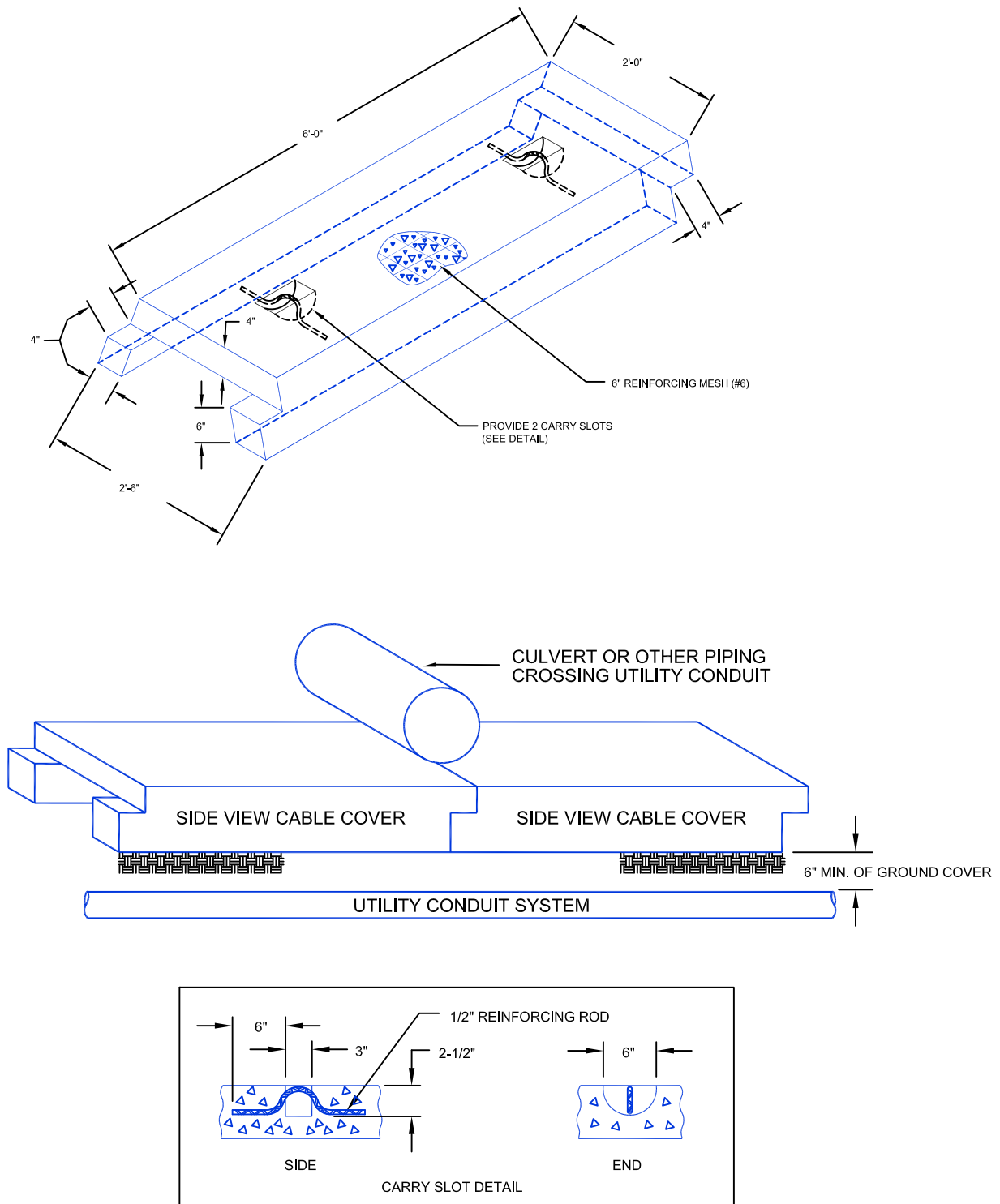
NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION)
- 2.) APPROXIMATE WEIGHT: 1515 LBS.



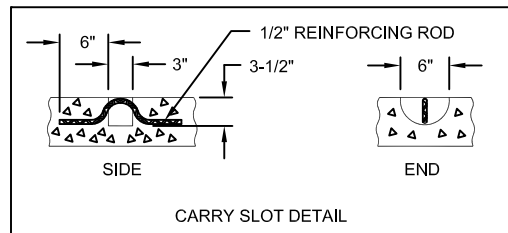
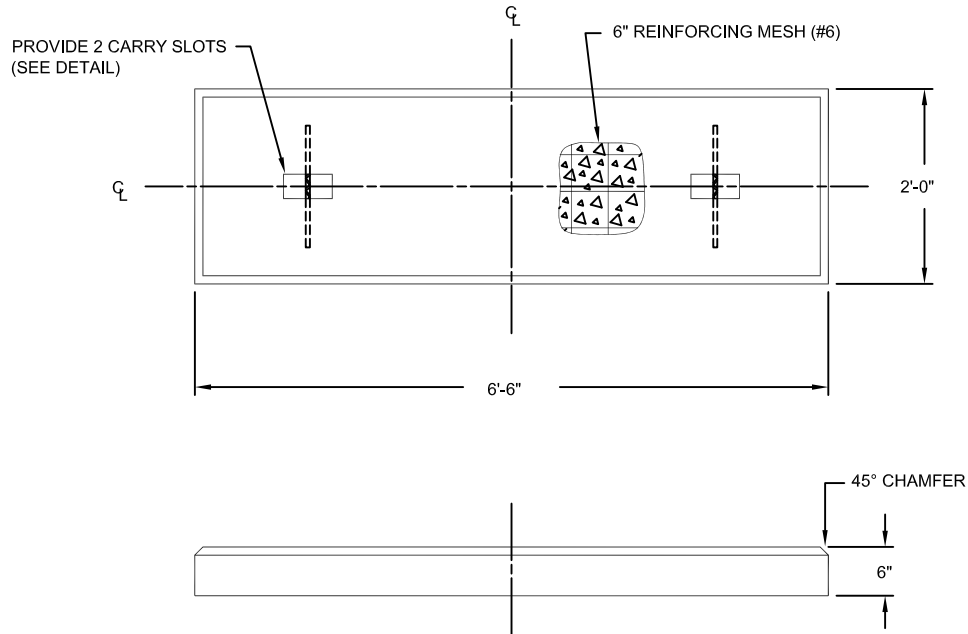
NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).



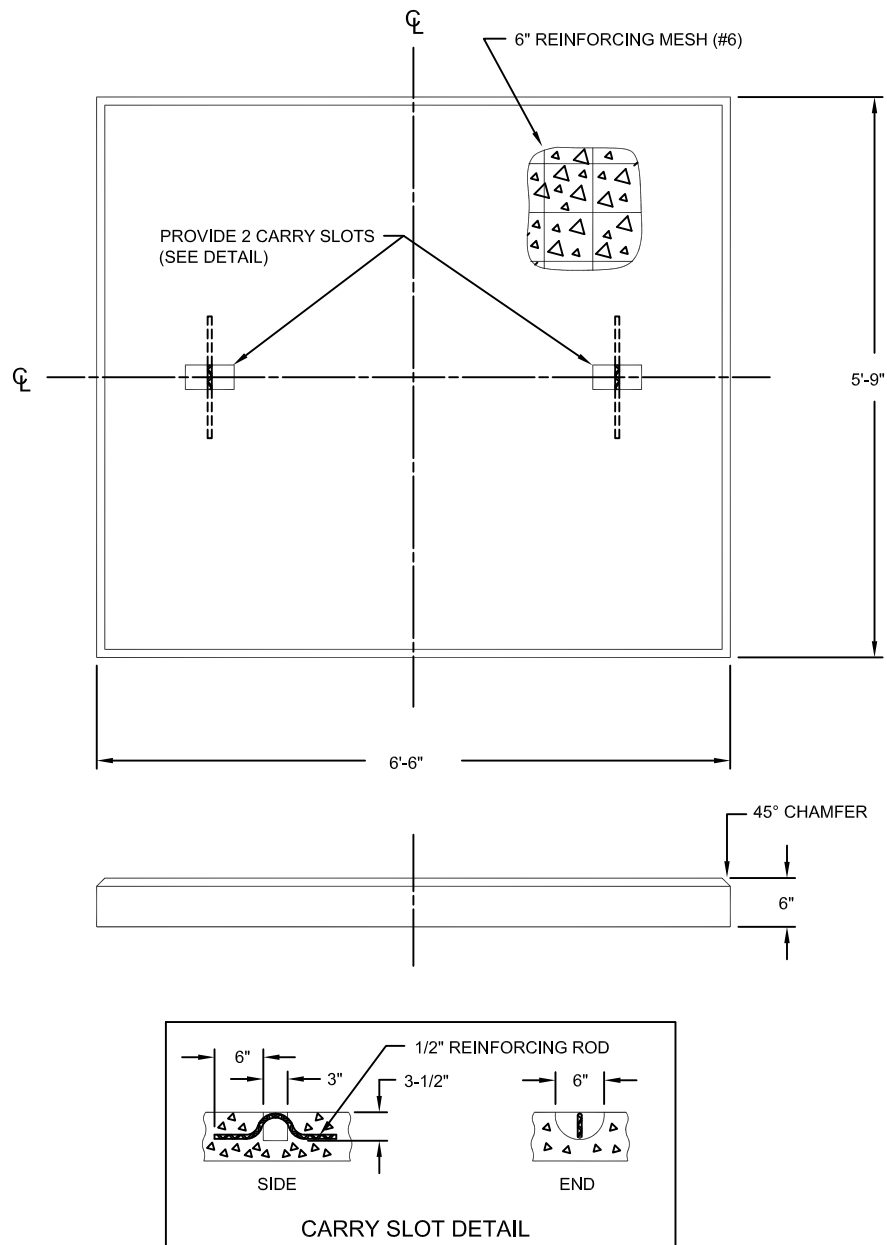
NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).



NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) CAN BE USED WITH ANY OF THE U5-7 SERIES VAULT ASSEMBLIES TO COVER XFMR OR SECTIONALIZING CABINET OPENINGS PRIOR TO EQUIPMENT PLACEMENT.
- 3.) CAN ALSO BE USED AS A COVER WITH THE U5-7 VAULT FOR ANY NON-STANDARD 3-PHASE CONSTRUCTION SUCH AS THE 2500 KVA PADMOUNT DELIVERY POINTS.
- 4.) APPROXIMATE WEIGHT: 900 LBS.



NOTE:

- 1.) CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 5000 P.S.I. AFTER 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C 39-72 (LATEST EDITION).
- 2.) APPROXIMATE WEIGHT: 2600 LBS.

Conduit and Accessories 15

Conduit

U8-C2.40P Two inch, sch 40 PVC
U8-C2.80P Two inch, sch 80 PVC
U8-C3.40P Three inch, sch 40 PVC
U8-C3.80P Three inch, sch 80 PVC
U8-C4.40P Four inch, sch 40 PVC
U8-C4.80P Four inch, sch 80 PVC
U8-C6.80P Six inch, sch 80 PVC

Sweeps

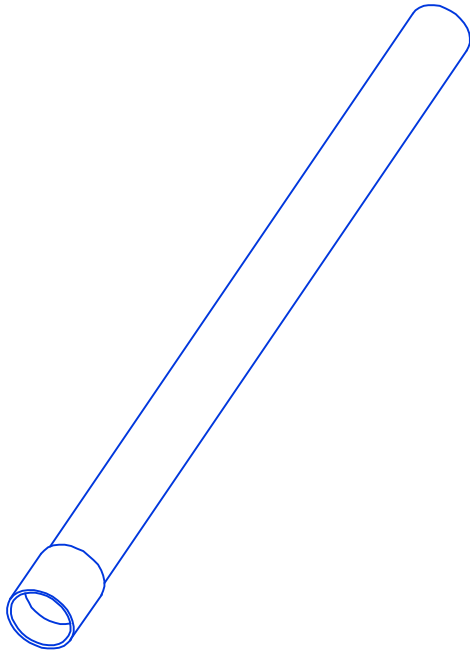
U8-S3.90P Three inch 90 PVC
U8-S3.90S Three inch 90 Steel
U8-S4.45S Four inch 45 Steel
U8-S4.90P Four inch 90 PVC
U8-S4.90S Four inch 90 steel
U8-S6.90S Six inch 90 steel

Couplings

U8-J2EXP Two inch expansion
U8-J3EXP Three inch expansion
U8-J4EXP Four inch expansion

U8

CONDUIT

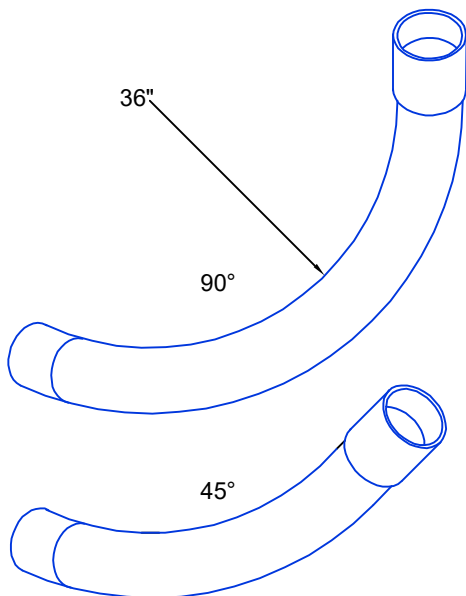


Descriptions:

U8-C2.40P...	Conduit, PVC, Sch 40, 2" by ft.
U8-C2.80P...	Conduit, PVC, Sch 80, 2" by ft.
U8-C3.40P...	Conduit, PVC, Sch 40, 3" by ft.
U8-C3.80P...	Conduit, PVC, Sch 80, 3" by ft.
U8-C4.40P...	Conduit, PVC, Sch 40, 4" by ft.
U8-C4.80P...	Conduit, PVC, Sch 80, 4" by ft.
U8-C6.80P...	Conduit, PVC, Sch 80, 6" by ft.

Construction Unit	Material #	Size	Schedule	Type
U8-C2.40P	76010320	2"	40	PVC
U8-C2.80P	76010420	2"	80	PVC
U8-C3.40P	76010330	3"	40	PVC
U8-C3.80P	76010430	3"	80	PVC
U8-C4.40P	76010340	4"	40	PVC
U8-C4.80P	76010440	4"	80	PVC
U8-C6.80P	76010460	6"	80	PVC

SWEEPS



Descriptions:

U8-S3.90P...	Sweep, PVC, 90-deg, 3"
U8-S3.90S...	Sweep, Steel, 90-deg, 3"
U8-S4.45S...	Sweep, Steel, 45-deg 4"
U8-S4.90P...	Sweep, PVC, 90-deg 4"
U8-S4.90S...	Sweep, Steel, 90-deg 4"
U8-S6.90S...	Sweep, Steel, 90-deg 6"

Construction Unit	Material #	Size	Angle	Type
U8-S3.90P	76050431	3"	90°	PVC
U8-S3.90S	76050730	3"	90°	Steel
U8-S4.45S	76060740	4"	45°	Steel
U8-S4.90P	76050441	4"	90°	PVC
U8-S4.90S	76050740	4"	90°	Steel
U8-S6.90S	76050760	6"	90°	Steel



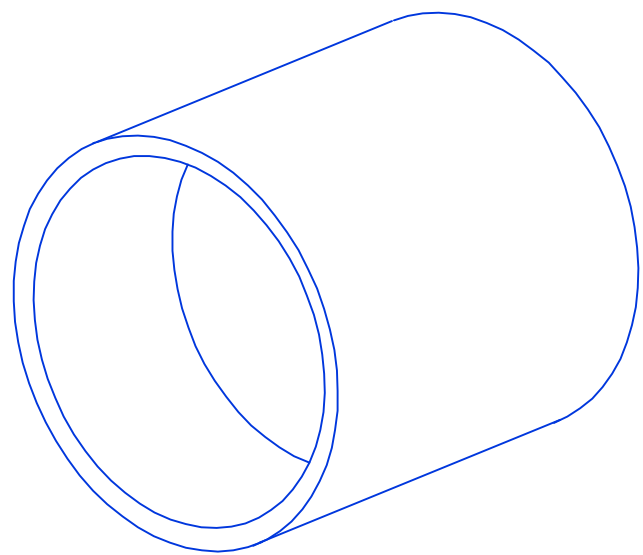
CONSTRUCTION STANDARDS

CONDUITS AND SWEEPS

U8

ISSUE DATE: 01/06

EXPANSIONS



Descriptions:

- U8-J2EXP... Expansion Joint PVC 2"
- U8-J3EXP... Expansion Joint PVC 3"
- U8-J4EXP... Expansion Joint PVC 4"

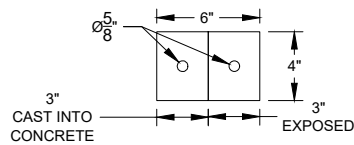
Construction Unit	Material #	Description
U8-J2EXP	76010002	Expansion Joint PVC 2"
U8-J3EXP	76010003	Expansion Joint PVC 3"
U8-J4EXP	76010004	Expansion Joint PVC 4"



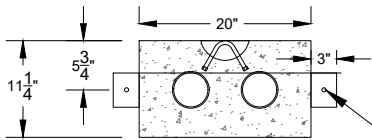
CONSTRUCTION STANDARDS

EXPANSION JOINTS

ENCASED CONDUIT PAD (2)X10' SCH 80



CONNECTION TAB
DETAIL

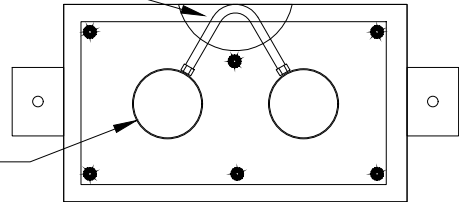


FRONT ELEVATION VIEW

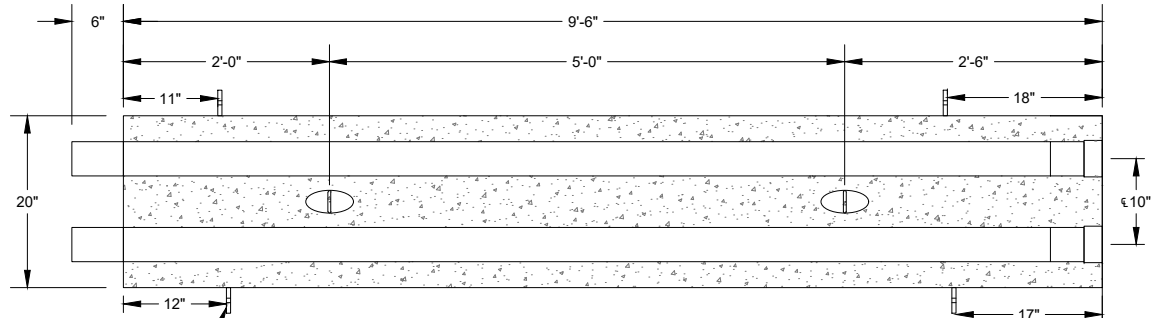
CONNECTION
TAB (4 PLACES)

RECESSED HANDLES
(2 PLACES)

4" SCH 80
PVC CONDUIT
SUPPLIED BY
CONTRACTOR

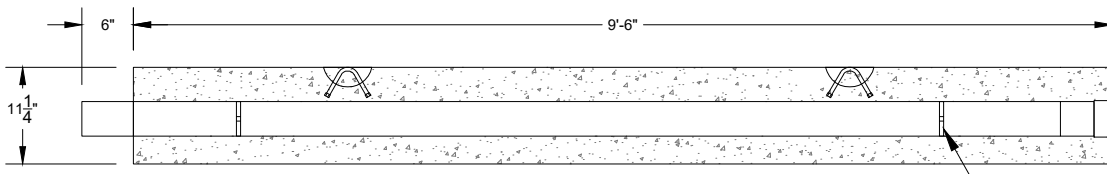


TYP REBAR PATTERN (NTS)
(6) #6 BARS LENGTHWISE
#3 HOOPS @ 12" O.C. 1 1/2" COVER TYP



CONNECTION
TAB (4 PLACES)

PLAN VIEW



SIDE ELEVATION VIEW

CONNECTION
TAB (4 PLACES)

DIMENSIONS	WEIGHT	PART#
PAD	2,350 LBS	U8-PAD.2C

NOTES

1. CONCRETE: 4000 PSI MINIMUM AFTER 28 DAYS
2. REINFORCED STEEL: CONFORMS TO ASTM-A615 GRADE 60
3. CONFORMS TO H2O LOADING



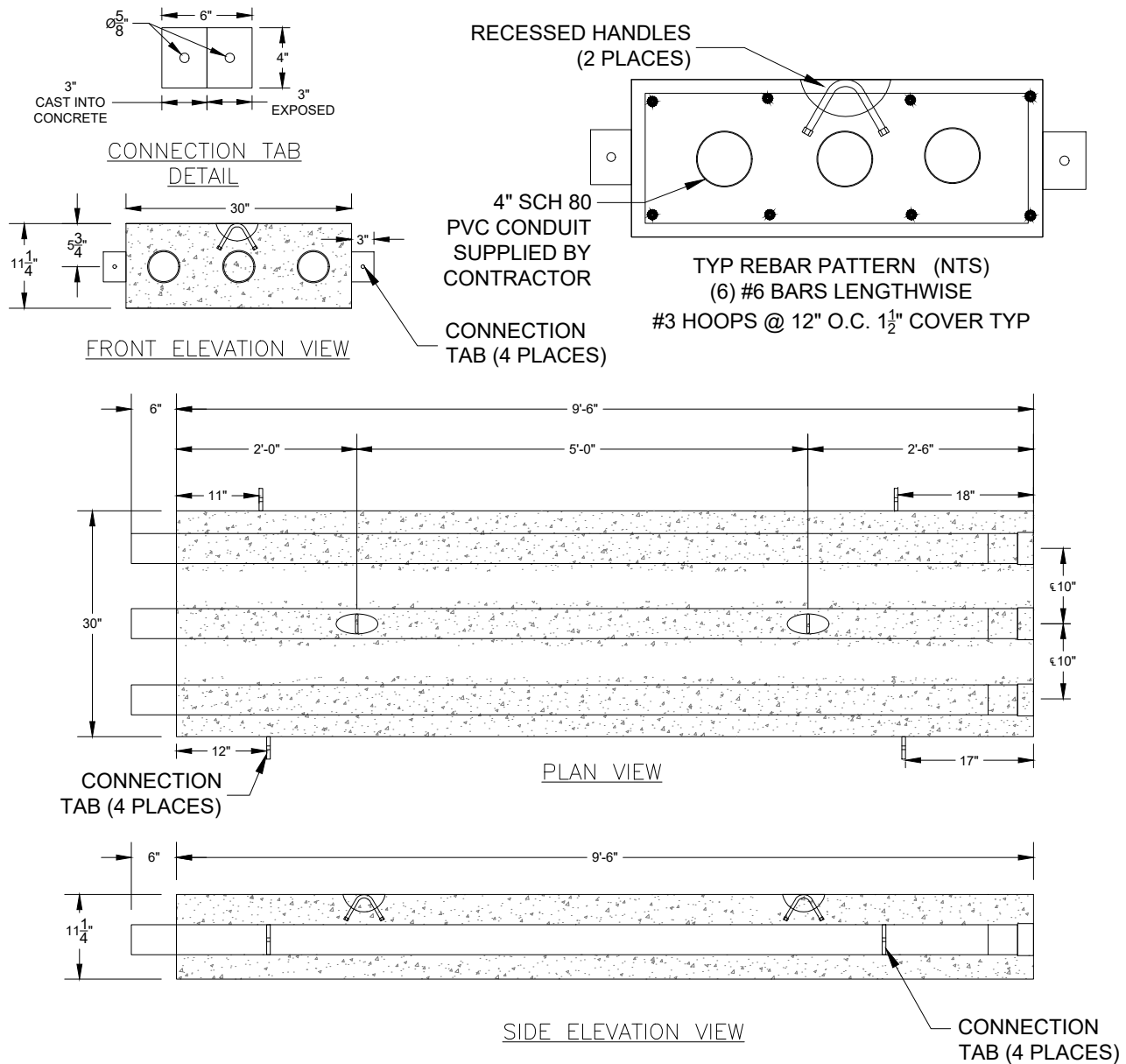
CONSTRUCTION STANDARDS

ENCASED CONDUIT PAD
(2)X10' SCH 80

U8-PAD.2C

ISSUE DATE: 06/19

ENCASED CONDUIT PAD (3)X10' SCH 80



DIMENSIONS	WEIGHT	PART#
PAD	3,500 LBS	U8-PAD.3C

NOTES

1. CONCRETE: 4000 PSI MINIMUM AFTER 28 DAYS
2. REINFORCED STEEL: CONFORMS TO ASTM-A615 GRADE 60
3. CONFORMS TO H20 LOADING



CONSTRUCTION STANDARDS

ENCASED CONDUIT PAD
(3)X10' SCH 80

U8-PAD.3C

ISSUE DATE: 08/19

Underground Miscellaneous 16

U9-STOFF Standoff Bracket

U9-1 PVC U-Guard

U9-11 Equipment Ground

U9-11A Cable Ground

U10 (Page One) Connectors

U10 (Page Two) Bushing well – plug, insert, feedthrough

U10 (Page Three) Protective cap, feedthrough busing, parking bushing

U10 (Page Four) Elbows

U10 (Page Five) Multipoint Terminals

U10.Push Ops

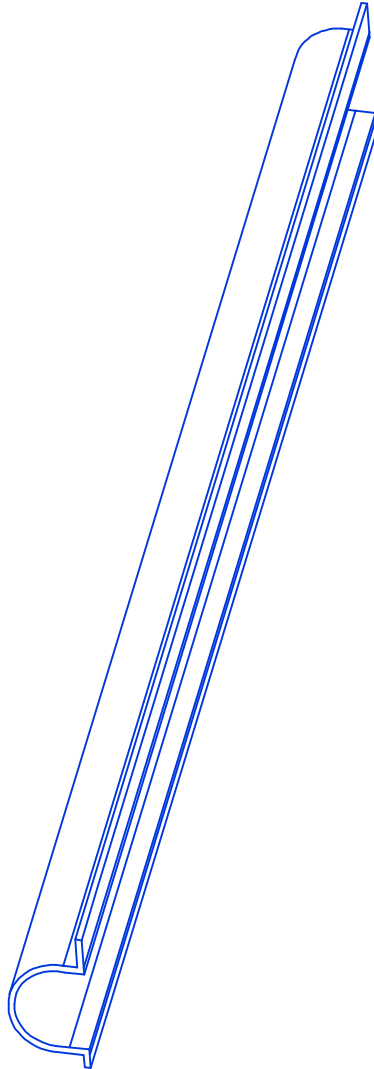
U10.SPLICE Primary splicing material

IU Bollard

U9-1

Descriptions:

- U9-1.2... PVC U-Guard 2"
- U9-1.4... PVC U-Guard 4"



Ref. No.	Material #	Description	U9-1.2	U9-1.4
1	68110005	PVC U-Guard 2"	10'	
1	68110010	PVC U-Guard 4"		10'
2	55504550	Screw, Lag 1/4" x 2"	10	10



CONSTRUCTION STANDARDS

PVC U-GUARD

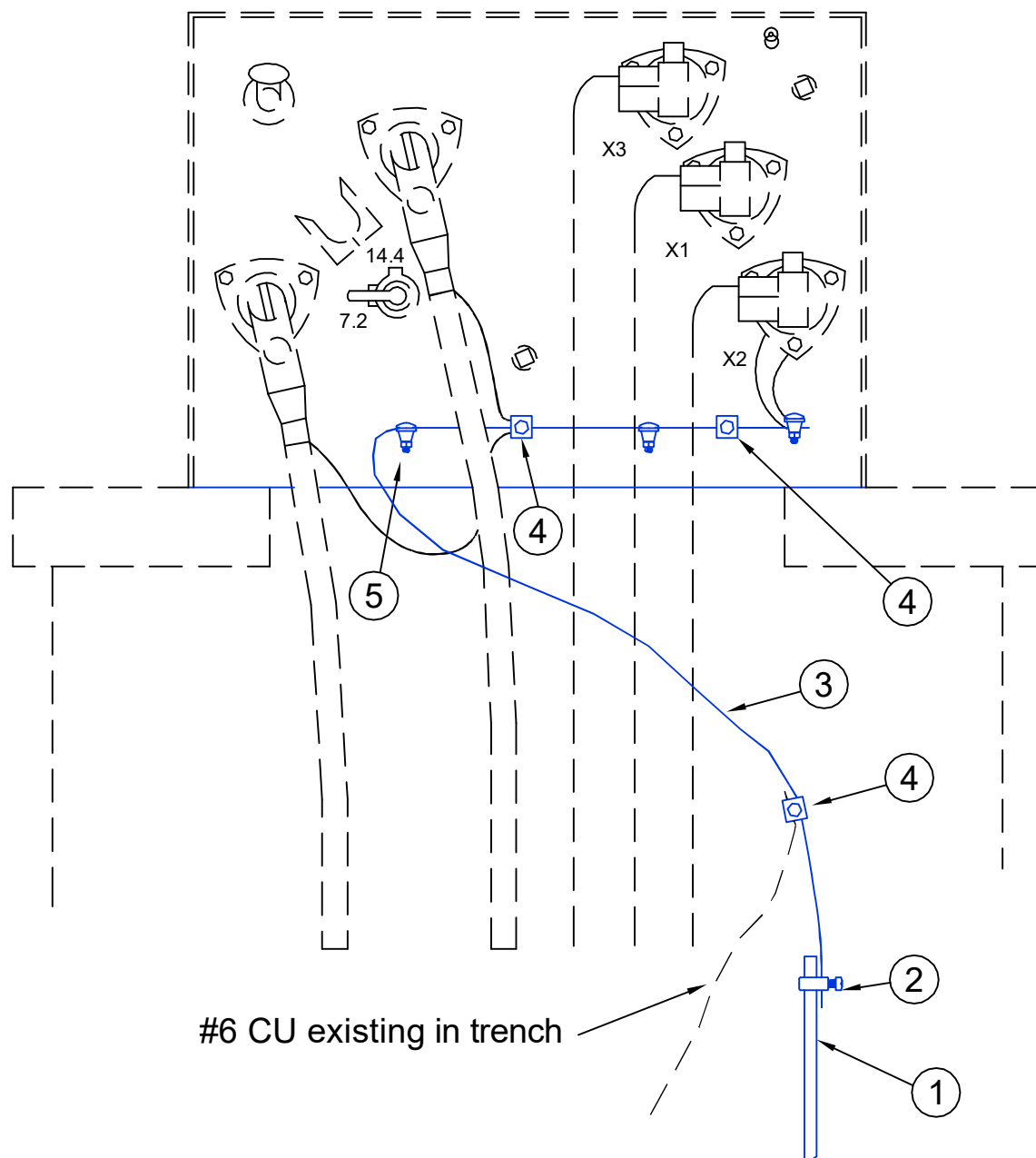
U9-1

ISSUE DATE: 01/06

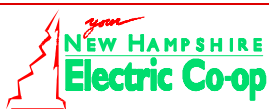
Descriptions:

U9-11... URD Equipment Ground

U9-11



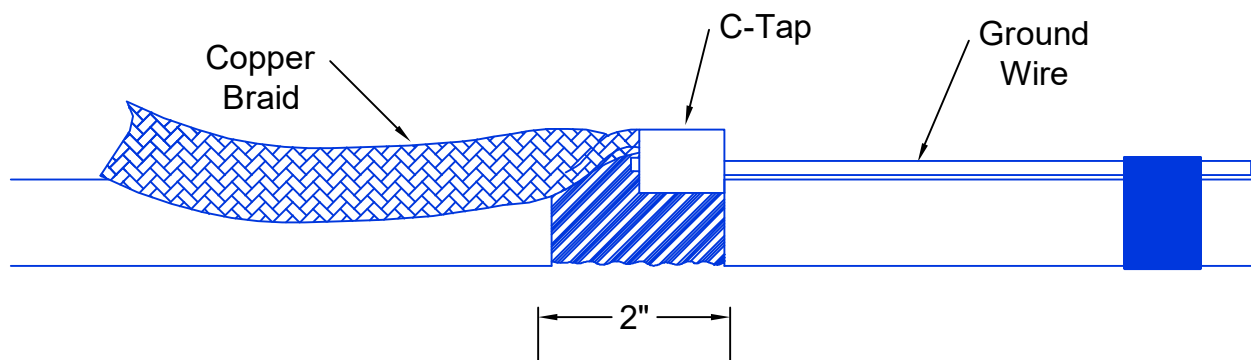
Ref. No.	Material #	Description	U9-11
1	53808508	Rod, ground, 5/8" min. dia.	1
2	17311000	Clamp, ground rod, 5/8"	1
3	15620203	Wire, #2 Stranded, Cu	15'
4	17015002	Conn: GC5002 #2 str	5
5	17010010	Con. Tran. Grd Lug #2 STR to 4/0	2



CONSTRUCTION STANDARDS
PAD MOUNT EQUIPMENT GROUND

U9-11

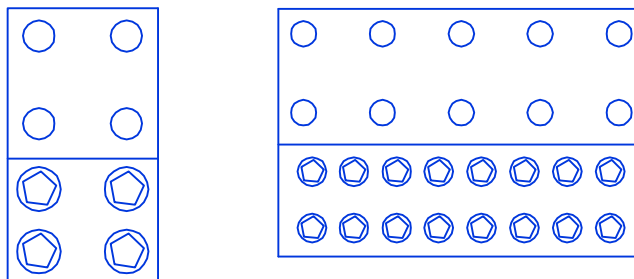
ISSUE DATE: 01/06



Material #	Description	U9-11A
10500050	Primary Cable Ground Kit for 1/0 to 4/0	1
53808508	Rod, ground, 5/8" min. dia.	1
17311000	Clamp, ground rod, 5/8"	1
15620203	Wire, #2 Stranded, Cu	1
17015002	Conn: GC5002 #2 str	1

U10

SPADES



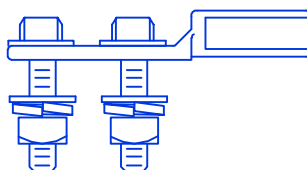
Item No.	Material #	Description	U10-SPADE.2	U10-SPADE.4	U10-SPADE.6	U10-SPADE.8
1	17040000	Conn, Xfmr Sec Sp 2 Pos	1			
1	17040004	Conn, Xfmr Sec Sp 4 Pos		1		
1	17040006	Conn, Xfmr Sec Sp 6 Pos			1	
1	17040008	Conn, Xfmr Sec Sp 8 Pos				1
2	17040100	Conn, Xfmr Stainless bolts 1-1/2"	2	4	6	8
3	17040115	Conn, Xfmr Stainless washer flat	2	4	6	8
4	17040120	Conn, Xfmr Stainless washer lock	2	4	6	8
5	17040125	Conn, Xfmr Stainless nut	2	4	6	8
6	18000000	Cover, Live Sec Pad	1	1	1	1

UTILCO



Item No.	Material #	Description	U10-UTIL.4	U10-UTIL.6	U10-UTIL.8
1	17060000	Conn, Xfmr Sec 4 Pos Utilco	1		
1	17060006	Conn, Xfmr Sec 6 Pos Utilco		1	
1	17060008	Conn, Xfmr Sec 8 Pos Utilco			1

CRIMP



Item No.	Material #	Description	U10-CRIMP				
			.002	.010	.040	.350	.500
1	17019002	Conn, Comp Terminal NEMA #2	1				
1	17019010	Conn, Comp Terminal NEMA #1/0		1			
1	17019040	Conn, Comp Terminal NEMA #4/0			1		
1	17019350	Conn, Comp Terminal NEMA #350				1	
1	17019500	Conn, Comp Terminal NEMA #500					1
2	17040100	Conn, Xfmr Stainless bolts 1-1/2"	2	2	2	2	2
3	17040115	Conn, Xfmr Stainless washer flat	4	4	4	4	4
4	17040120	Conn, Xfmr Stainless washer lock	2	2	2	2	2
5	17040125	Conn, Xfmr Stainless nut	2	2	2	2	2



CONSTRUCTION STANDARDS

MISCELLANEOUS PADMOUNT TRANSFORMER CONNECTORS

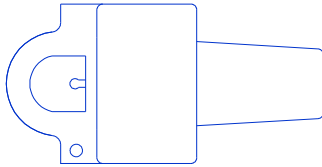
U10

ISSUE DATE: 01/06

PLUGS**Descriptions:**

U10-BWP...

BUSHING WELL PLUG 15/25 KV



Assembly Name	Material #	Description	Quantity
U10-BWP	66932000	Term: Bushing Well Plug 15/25 kV	1

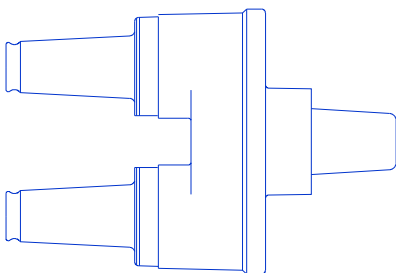
FEED-THROUGHS**Descriptions:**

U10-BWF...

BUSHING WELL FEEDTHROUGH 15KV

VU10-BWF...

BUSHING WELL FEEDTHROUGH 25KV



Assembly Name	Material #	Description	Quantity
U10-BWF	66936016	Term: Bushing Well Feedthrough 15kV	1
VU10-BWF	66936018	Term: Bushing Well Feedthrough 25kV	1

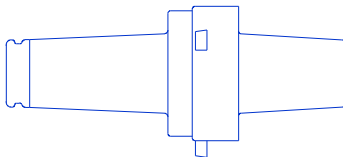
INSERTS**Descriptions:**

U10-BWI...

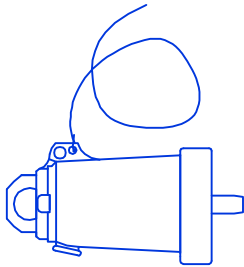
BUSHING WELL INSERT 15KV

VU10-BWI...

BUSHING WELL INSERT 25KV

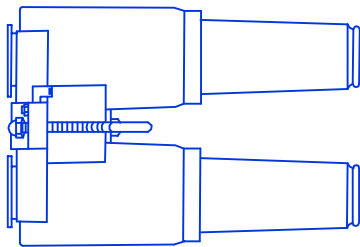


Assembly Name	Material #	Description	Quantity
U10-BWI	66936015	Term: Bushing Well Insert 15 kV	1
VU10-BWI	66936017	Term: Bushing Well Insert 25 kV	1

CAPSDescriptions:

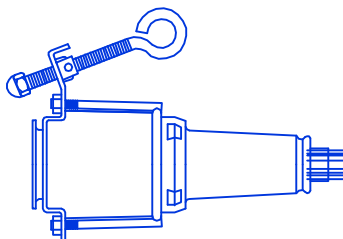
U10-CAP... PROTECTIVE CAP 15KV
 VU10-CAP... PROTECTIVE CAP 25KV
 ZU10-CAP... PROTECTIVE CAP 35KV

Assembly Name	Material #	Description	Quantity
U10-CAP	66931462	Term: Prot Cap 15 kV	1
VU10-CAP	66931471	Term: Prot Cap 25 kV	1
ZU10-CAP	66931476	Term: Prot Cap 35 kV	1

FEED-THROUGHSDescriptions:

U10-FTB... FEEDTHROUGH BUSHING 15KV
 VU10-FTB... FEEDTHROUGH BUSHING 25KV

Assembly Name	Material #	Description	Quantity
U10-FTB	66931564	Term: Feed Thru Bush 15 kV	1
VU10-FTB	66931565	Term: Feed Thru Bush 25 kV	1

PARKING STANDSDescriptions:

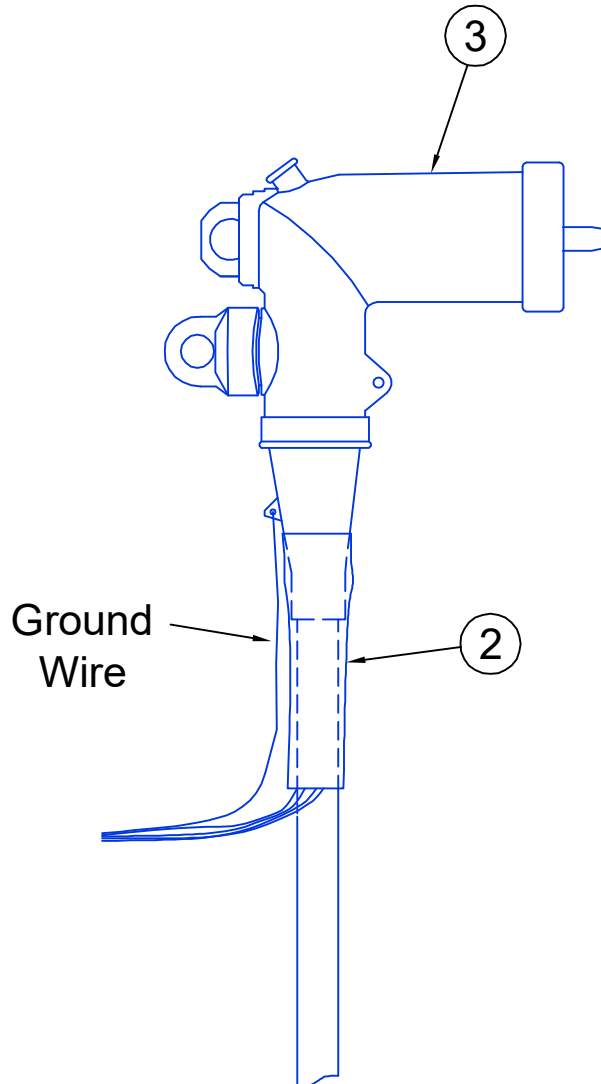
U10-PRK... PARKING STAND 15KV
 VU10-PRK... PARKING STAND 25KV
 ZU10-PRK... PARKING STAND 35KV

Assembly Name	Material #	Description	Quantity
U10-PRK	66950015	Term: Parking Stand 15kV	1
VU10-PRK	66950025	Term: Parking Stand 25kV	1
ZU10-PRK	66950035	Term: Parking Stand 35kV	1

ELBOWS

Descriptions:

U10-ELBOW.220 ... ELBOW, 15KV 220 MIL
 U10-ELBOW.345 ... ELBOW, 15KV 345 MIL
 VU10-ELBOW.345 ... ELBOW, 25KV 345 MIL
 ZU10-ELBOW.345... ELBOW, 35KV 345 MIL



Note: These are single phase assemblies.

Item. No.	Material #	Description	U10- ELBOW.220	U10- ELBOW.345	VU10- ELBOW.345	ZU10- ELBOW.345
1	10500150	Cable Preparation Kit	1	1	1	1
2	12341040	Cold Shrink Elbow 1/0 15/25/35 kV, 200 Amp	1	1	1	1
3	66931442	Term: Elbow 1/0 15 kV 175/220 MIL	1			
3	66931443	Term: Elbow 1/0 15 kV 345 MIL		1		
3	66931445	Term: Elbow 1/0 25 kV 345 MIL			1	
3	66930142	Term: Elbow 1/0 34 kV 345 MIL				1



CONSTRUCTION STANDARDS

1/0 ELBOW KITS

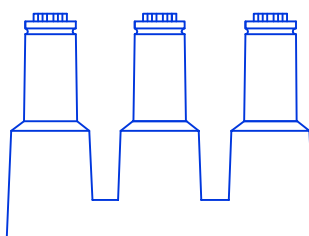
U10

ISSUE DATE: 01/06

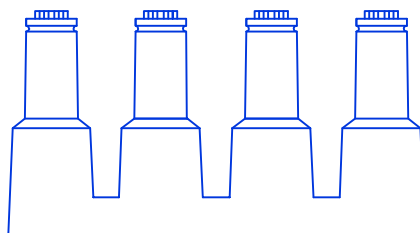
MULTIPOINTSDescriptions:

U10-MPT.3 ... MULTIPOINT 3 WAY 15KV
 U10-MPT.4 ... MULTIPOINT 4 WAY 15KV
 VU10-MPT.3 ... MULTIPOINT 3 WAY 25KV
 VU10-MPT.4 ... MULTIPOINT 4 WAY 25KV

3-WAY



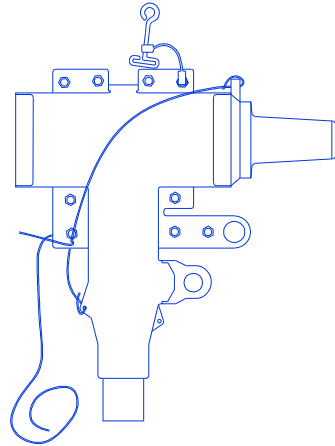
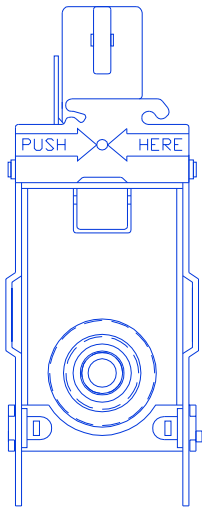
4-WAY



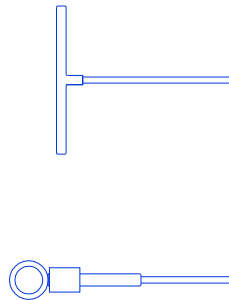
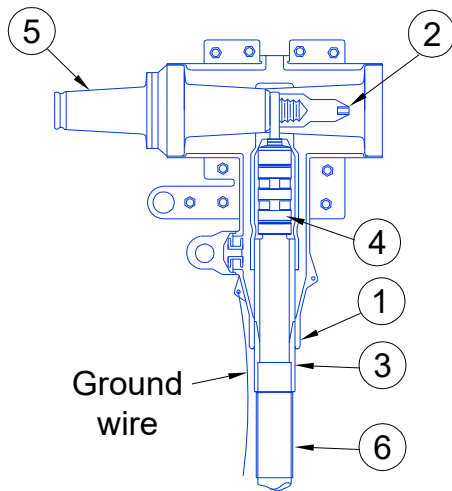
Note: These are single phase assemblies.

Item No.	Material #	Description	U10-MPT.3	U10-MPT.4	VU10-MPT.3	VU10-MPT.4
2	66940112	Term, Multipt 3 way 15 kV	1			
2	66940114	Term, Multipt 4 way 15 kV		1		
2	66940117	Term, Multipt 3 way 25 kV			1	
2	66940118	Term, Multipt 4 way 25 kV				1

U10-PushOp



Assembly Name	Material #	Description	Quantity
U10-Push.Prk	66950050	Term: Parking Stand Push-op	1
U10-Push.Cap	66931474	Term: Prot Cap Push-op	1



Required tools:

1. The T-Wrench is used to install the load break reducing tap plug into the compression connector and t-body.
2. The Torque Tool is required to assemble a 15/25 kV Class PUSH-OP Deadbreak Connector. It is precision calibrated and hotstick operable.

Item No.	Material #	Description	U10-Push.500	VU10-Push.500
1	66921100	Term: Elbow Push-op Body Only	1	1
2	66921115	Term: Probe for Push-op w/o stud	1	1
3	66931130	Term: Cable Adapter 15/25 kV	1	
3	66931120	Term: Cable Adapter 35 kV		1
4	66931115	Term: Comp Con 500 MCM CU	1	1
5	66921015	Term: Reducing Tap plug 15 kV	1	
5	66921025	Term: Reducing Tap plug 25 kV		1
6	12341050	Cold shrink 500 MCM	1	1



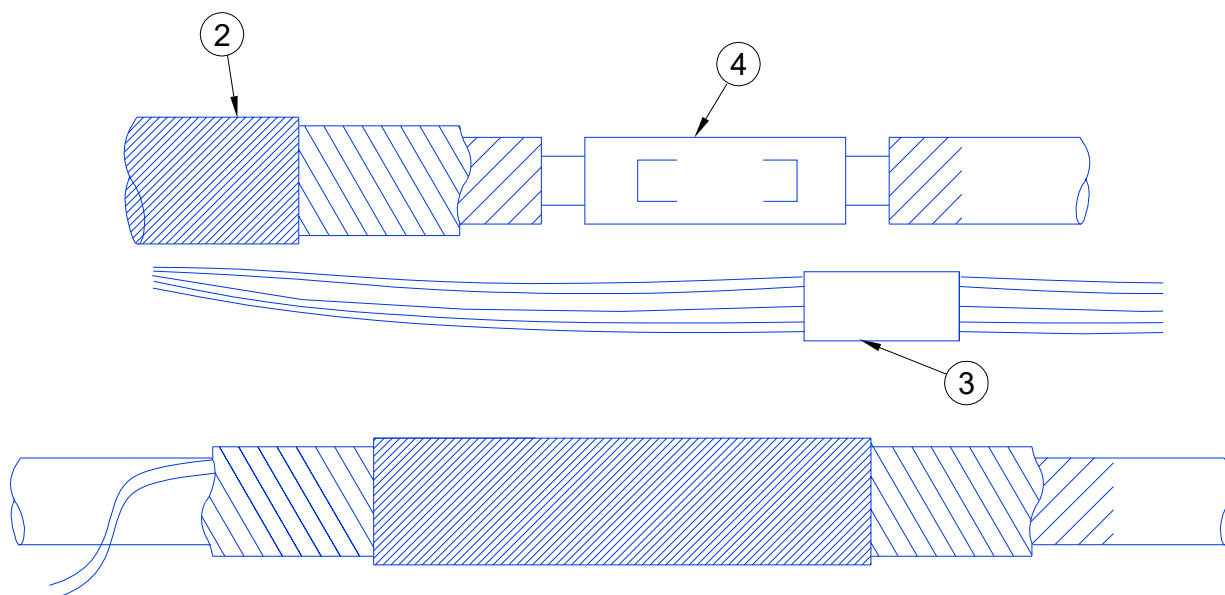
CONSTRUCTION STANDARDS

600 Amp PushOp

U10-PushOp

ISSUE DATE: 01/06

U10-SPLICE



Item No.	Material #	Description	U10-SPL.010.15	ZU10-SPL.010.35	U10-SPL.500.15	ZU10-SPL.500.35
1	10500150	Cable Preparation Kit	1	1	1	1
2	12341000	Cold Shrink Splice Jacket Kit 1/0 15 kV	1			
3	55714500	Sleeve URD Neu 1/0	1	1		
3	55714510	Sleeve URD Neu 2/0			1	1
4	60710142	Splice URD 1/0 200 Amp 15 kV	1			
4	60710141	Splice URD 1/0 200 Amp 35 kV		1		
4	60710148	Splice URD 500 600 Amp 15/25 kV 1.05"- 1.68"			1	
4	60710150	Splice URD 500 600 Amp 35 kV				1

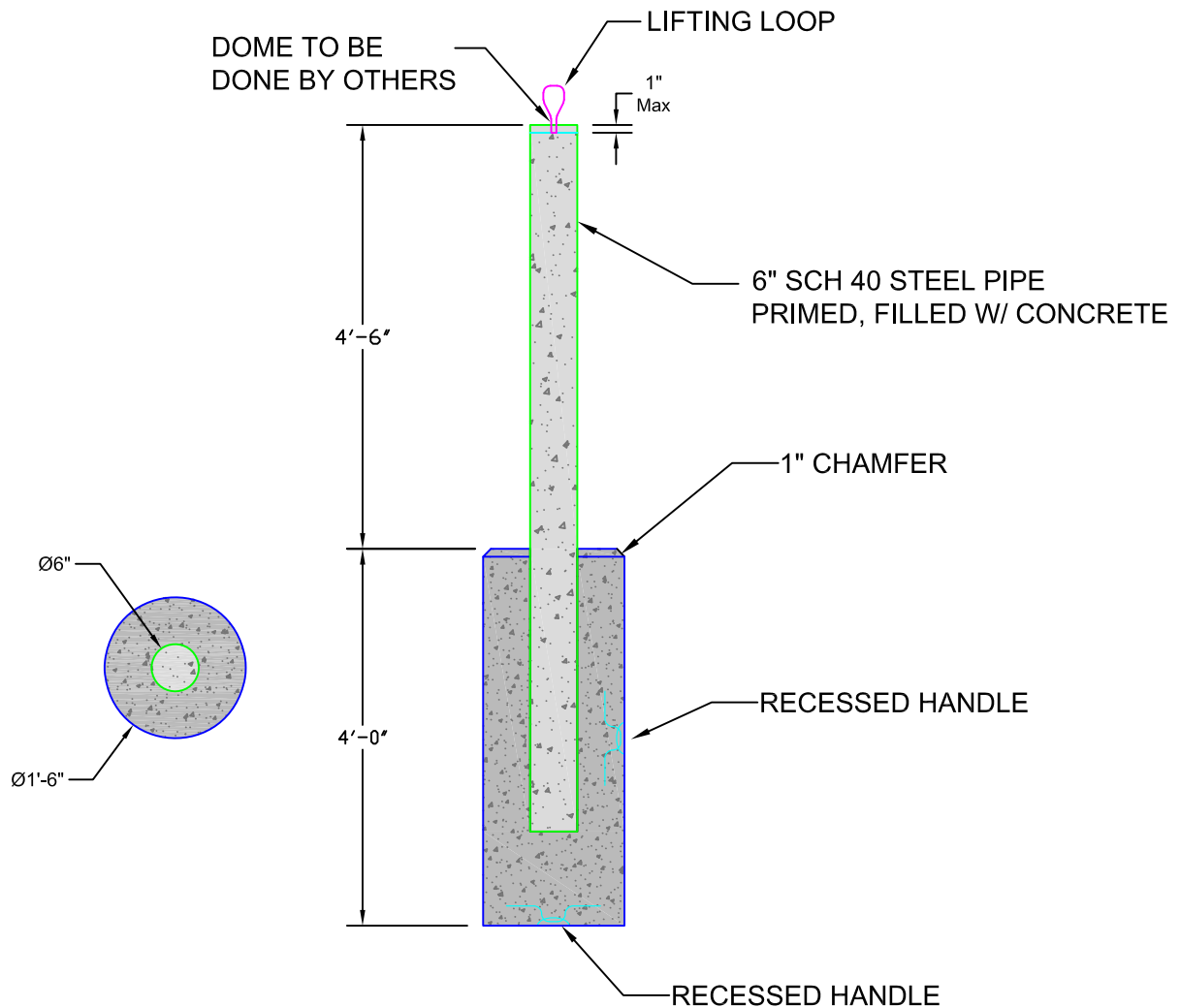


CONSTRUCTION STANDARDS

SPLICE KITS

U10-SPLICE

ISSUE DATE: 01/06



NOTES:

1. CONCRETE: 4,000 PSI MINIMUM AFTER 28 DAYS.
2. STEEL REINFORCEMENT CONFORMS TO LATEST ASTM SPECIFICATION: ASTM A-185 WELDED WIRE FABRIC
3. DECORATIVE POLYETHYLENE SLEEVES AVAILABLE
4. SPACING IS TO BE NO LESS THAN 3 FEET APART AND NO MORE THAN 5 FEET APART.

Overhead Conductors / Cables 17

W1 Overhead Primary Conductors

W2, W3 Overhead Secondary/Service Conductors

W9 Miscellaneous conductor, poly covered, bare stranded & solid

IW9-SAG General Information on Sagging Overhead Wire

Primary Conductor Sag Tables

IW-2ACSR #2ACSR Primary Conductors Initial Sags

IW-1/0ACSR #1/0 ACSR Primary Conductors Initial Sags

IW-336ACSR #336.4 ACSR Primary Conductors Initial Sags

IW-4/0ACSR #4/0 ACSR Neutral Conductor Initial Sags

IW-052AWA #052 AWA Messenger Cable Initial Sags

IW-15SPCRCBL 15KVSpacer Cable Final Sags

IW-SPCRCBL Cable between Blocks or Spacers Sags

Secondary and Service Sag Tables

IW-OHTRIP.SERV Triplex Service Drop Sag Tables

IW-OHTRIP.SEC Triplex Secondary Sag Tables

IW-OHTRIP.UB Triplex Underbuild Initial Sags

IW-1/0QUAD #1/0 ACSR Quad Initial Sags

IW-4/0QUAD #4/0 ACSR Quad Initial Sags

Conductor Characteristics Table (future)

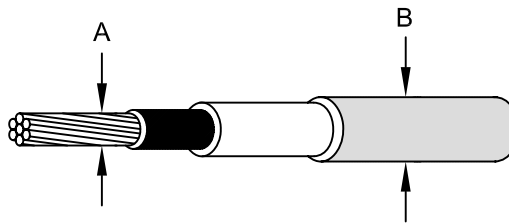
Wire Tie Procedure

IW-TIE WIRE.B Guide for tying Bare Conductor

IW-TIE WIRE.T Guide for tying Covered Conductor

SPACER CABLE

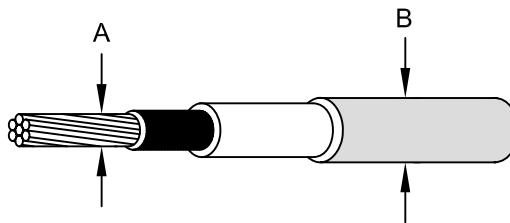
(Compact Round, AAC)



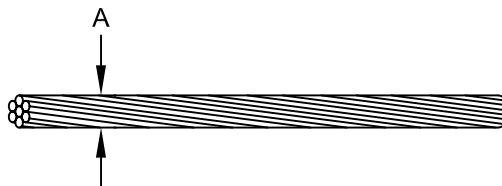
Construction Unit	Material #	Description	A(IN.)	B(IN.)
W1.010.SPACER	15101015	1/0 Hndx 15kV Spacer	.336	.666
W1.336.SPACER	15103315	336.4 Hndx 15kV Spacer	.603	.933
ZW1.010.SPACER	15101030	1/0 Hndx 35kV Spacer	.336	.968
ZW1.477.SPACER	15104770	477 Hndx 35kV Spacer	.722	1.362

TREEWIRE

(Concentric Round, ACSR)



Construction Unit	Material #	Description	A(IN.)	B(IN.)
W1.002.TREE	15100501	#2 Tree wire ACSR	.316	.646
W1.010.TREE	15101016	1/0 Tree wire ACSR	.398	.728
W1.336.TREE	15103316	336.4 Tree wire ACSR	.684	1.014
W1.477.TREE	15104700	477 Tree wire ACSR	.858	1.198

BARE WIRE

Construction Unit	Material #	Description	A(IN.)
W1.002.ACSR	15100261	Cond, #2 ACSR SPARROW	.316
W1.010.ACSR	15101061	Cond, 1/0 ACSR RAVEN	.398
W1.040.ACSR	15104061	Cond, 4/0 ACSR PENGUIN	.563
W1.052.AWA	15100052	052 AWA Hndx Messenger	.486
W1.336.ACSR	15103318	336 ACSR MERLIN	.684
W1.477.ACSR	15104726	477 ACSR HAWK	.858

SECONDARY & SERVICE WIRES

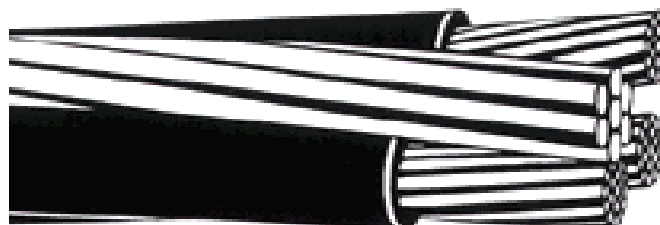
W2 = SECONDARY WIRE

W3 = SERVICE WIRE

TRIPLEX

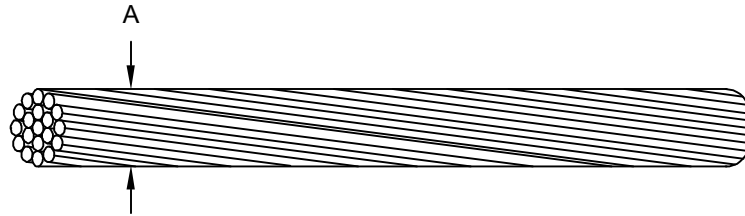


QUADRUPLEX



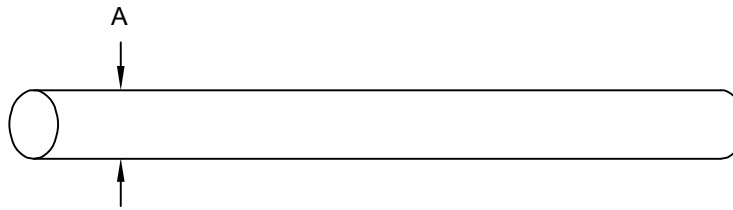
		Material #	Description
N/A	W2.006.TPLX	16130601	Cond #6 Triplex VOLUTA
W3.002.TPLX	W2.002.TPLX	16130201	Cond #2 Triplex CONCH
W3.010.TPLX	W2.010.TPLX	16131001	Cond 1/0 Triplex NERITINA
W3.010.QUAD	W2.010.QUAD	16141001	Cond 1/0 Quad COSTENA
W3.040.TPLX	W2.040.TPLX	16134001	Cond 4/0 Triplex ZUZARA
W3.040.QUAD	W2.040.QUAD	16144001	Cond 4/0 Quad APPALOOSA

STRANDED



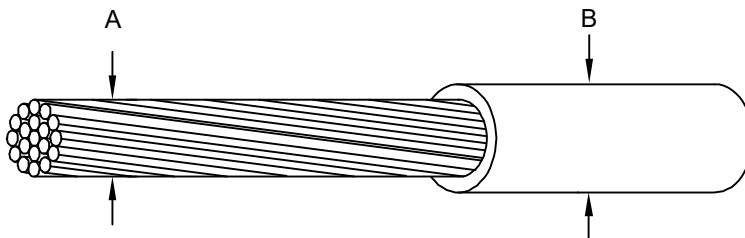
	Material #	Description	A(IN.)
W9.002.STRCU	15620203	#2 Stranded CU- Bare	
W9.020.STRCU	15622007	#2/0 Stranded CU- Bare	
W9.040.STRCU	15624007	#4/0 Stranded CU- Bare	

SOLID



	Material #	Description	A(IN.)
W9.006.SOLCU	15610601	#6 Sol Cu Soft Drawn	.168
W9.004.SOLCU	15610401	#4 Sol Cu Soft Drawn	.204

POLY-COVERED



	Material #	Description	A(IN.)	B(IN.)
W9.004.POLY	16510407	#4 Cu Poly, Soft Drawn	.204	.303
W9.002.POLY	16510207	#2 Cu Poly, Soft Drawn	.292	.391
W9.040.POLY	16514007	#4/0 Cu Poly, Soft Drawn	.528	.627

Overhead Conductor Sags

General

The conductor sag standards in this section have been developed to allow the longest possible span lengths while satisfying the requirements of the National Electric Safety Code (NESC) and maintaining reasonable conductor tensions.

Vertical clearance requirements may dictate the need for shorter spans and/or increased separation at supports when communications and secondary underbuilds exist. These vertical clearance requirements must be met with the conductors at the sag condition that results in the closest mid-span separation.

All NESC requirements referenced in this standard or used in the calculation of the sags and tensions in this section are based on the requirements of the latest edition of the NESC.

Definitions

- **Temperature**... when referring to sag-tension, it is the temperature of the conductor, and not necessarily the ambient air temperature. Conductor temperature can be affected by the sun, wind, and electrical loading. However, stringing temperatures are generally ambient air temperatures.
- **Stringing Section**... conductor strung on a series of spans between dead-ends
- **Ruling Span**... equivalent span length whose sag & tension characteristics, when applied to a stringing section, will minimize the difference in tension between the individual spans once they are tied in.
- **Sag-check span**... span(s) in a stringing section selected to measure/verify conductor sag. It should be level and similar in length to the ruling span.
- **Creep**... permanent elongation (stretch) of a conductor due to everyday tensions and unloaded weight of the conductor, occurring over time.
- **Initial Condition**... sag & tension of un-stretched conductor when first strung with no ice or wind load
- **Unloaded Condition**...conductor with no electrical load, or physical load due to ice, snow or wind
- **Final Condition (load)**... sag & tension of conductor after being subjected to assumed ice and wind loads and reaching permanent or inelastic stretch.
- **NESC Heavy District**... National Electric Safety Code conductor temperature, wind and ice loading requirements for our region, applied simultaneously (1/2" ice, 40 mph wind, 0°F).
- **Storm-Load Tension**...the initial conductor tension at 0 °F, ½" ice and 40 mph wind

Sag/Tension Conditions

The calculations performed to derive the sag and tension values shown in this section are based on the following NESC sag and tension limits:

Tension Limits

The initial conductor tension at 0°F, with ½” of radial ice, and 4 lbs of wind per foot (40 mph) shall not exceed 60% of the rated breaking strength of the conductor. This is defined as the storm-load tension. This tension is used to determine guying and pole class requirements. It is not in any way related to the tensions used when installing or re-sagging conductors.

In addition, the following tension limits are used:

- § The initial tension at 60°F with the conductor unloaded shall not exceed 35% of the conductor’s rated breaking strength.
- § The final tension at 60°F with the conductor unloaded shall not exceed 25% of the conductor’s rated breaking strength.

Sag/Clearance Limits

Clearance requirements must be satisfied for the tension limits given above. When examining vertical clearances between conductors, they must be calculated with the upper conductor at its worst sag condition and the lower conductor at its final unloaded sag at the same ambient temperature of the upper conductor at its worst sag condition.

The worst sag condition for the upper conductor will occur at one of the following conditions:

- § 32°F with ½” of radial ice and no wind displacement
- § 120°F conductor temperature , with no wind displacement

The sag conditions required for calculating vertical clearances are shown in the sag tables included in this section.

Conductor Installation

The proper installation of conductor is one of the most important aspects of distribution line construction. Improper conductor installation can impact system reliability and efficient line operation and may result in clearance issues and NESC code violations. Over time, increased conductor tensions from improper installation, can lead to premature conductor fatigue/damage and increase the probability of excessive loading on poles, guys, anchors, insulators, crossarms, and other line hardware.

The following guidelines for conductor installation are general in nature and not intended to replace or contradict specific instructions provided by any manufacturers of conductors.

Unloading and Storage

Care should be exercised when unloading/loading conductor reels. They should not be dropped or allowed to roll freely. Careless handling during unloading/loading, storage, transporting, and stringing may cause needless damage to the conductors while still on the reel.

Conductor Stringing

Whenever possible, conductors should be payed-out from reel trailers. This reduces the probability of conductor damage due to dragging over fences, rocks and other obstacles. When this is not practical or possible, the conductor can be pulled out if precautions are taken to prevent damage to the conductors caused by dragging.

Once the conductor is payed-out, it should be lifted to the supports and placed in or on freewheeling travelers (sheaves, blocks or rollers) before pulling tension in the conductors. In order to equalize/balance tensions in all spans during conductor sagging, it is necessary that the conductor be as free from friction as possible at the supports. The conductor should be pulled up far enough to clear ground obstructions; however, it should be left semi-slack until ready to start the final stringing operation.

The length of the section of line to be pulled up and sagged at one time is usually governed by the terrain, number of angles, deadends, road crossings, and other obstructions and finally by the length of conductor that can be uniformly sagged. Consideration should be given to the impact of long spans and inclined spans in determining the spans which will be sagged in one operation.

To sag the conductor properly, the sagging tension must be applied in all spans in the section of the line being sagged. It is therefore necessary to determine if the supporting travelers are running free. An inspection should be made along the line section to determine if the conductors are coming up even. If not, this may be an indication that a sheave is not running free. During stringing and sagging operations, there will always be some friction at every support. Therefore, there will be some tendency for the tension to be higher at the pulling end of the section being sagged and lower at the fixed end. It sometimes may be necessary to “ride” the conductor at one or more points in the section being pulled in order to equalize the tensions in all spans.

Selecting the Sag-Check Spans

For short stringing sections, it is usually acceptable to make one sag-check near the center of the stringing section. As the length of the stringing sections increase, additional sag-check spans may be required. The number and location of check points for a given stringing section may vary with factors such as conductor size, conductor tension, friction at the conductor supports, terrain, location of long spans, impact of inclined spans, etc.

The sag should be checked in spans with supports as nearly level as possible. Where possible, the sag-check span should be approximately equal to the ruling span of the pulling

section. It should not be less than the average span of the section, and at most, exceed the ruling span slightly. Sagging in spans shorter than the average span should be avoided.

If more than one sag-check span is being used in the stringing section, they should be as near the same length as possible, or it may be difficult to coordinate the sagging tolerance.

When to Sag Conductors

Conductors, particularly aluminum, stretch or creep rapidly when first brought to full or near full tension. It is therefore necessary to sag the conductor as soon as possible after it is brought to full sagging tension. Most initial stringing sag data is based on one hour of creep at the sagging tension. Delaying the sagging operation after the conductor has been brought to, or almost too stringing tension, will cause the final sags to be different than predicted.

Sag Check Preparation

The following should be checked prior to starting the sagging operation:

- § Make sure you have the correct sag table for the conductor being installed
- § Use the INITIAL stringing sag table for new conductor (final sag tables for re-sagging used conductor)
- § Measure the sag-check span(s)...don't rely on the staking sheet dimensions.

Checking Sag

When checking sag, it is best to determine the temperature by means of a certified etched glass thermometer. The corresponding sag for the measured temperature should be obtained from the appropriate sag table. The temperature used from the table should be as near as possible to the measured temperature.

When sagging new conductor, use INITIAL sag tables. When sagging used conductor, use FINAL sag tables.

When To Tie-In Conductor

After a conductor is pulled up to sag, it should be left one to four hours or more, depending on the length of the pull, to allow the conductor to “work”. Immediately after pulling, the tension is generally greater at the pulling end than at the fixed end. This is due to drag or friction in the rollers or other conductor supports used during sagging. Vibration of the conductors or supports resulting from wind or other causes will let the conductors “work” through the supports, thereby promoting the equalization of tensions between the spans.

Conductors should not be tied or clipped in until they have had time to “work” or an unbalanced strain will be placed on the poles, arms, pins, insulators, tie wires and conductors.

During this period of time “creep” will occur. This is the permanent stretch of the conductor due to the applied tension and the conductor’s own weight. If the sag of the conductor were to be rechecked at the end of the working period, it would be found that sag most likely had increased. The amount of increase will vary with the conductor type and design criteria. The conductor should not be re-sagged because of this... “creep” is a natural occurrence.

A visual inspection of the conductor sag throughout the line section should be made before tying-in. Sags of multi-phase conductors of the same type should be similar or even. If not, the cause could possibly be incorrect sagging or failure of one of the conductors to “work” because of a locked roller or similar cause. Remedial action should be taken before final clip-in. At this stage, if one of the conductors is sagged wrong, it should be re-sagged to match the other conductors, not to the original initial sag table sag or tension.

Conductor Sag Tables

General

This section contains initial sag tables for the most commonly used primary and secondary conductors at NHEC. These primary conductors include #2, 1/0, and 336.4 ACSR, both bare and 15 kV tree-wire, and 4/0 ACSR bare, as a neutral. They also include 052 AWA messenger used with both 1/0 and 336.4 AAC 15 kV spacer cable. Covered conductors rated 25 and 35 kV are not considered standard construction and are therefore not included in this standard.

The secondary conductors include #2, 1/0, and 4/0 ACSR Triplex as well as 1/0 and 4/0 ACSR Quadruplex. Separate sag tables are provided for each of these conductors when used for service drops (with house-knobs), as secondary (with wedge-clamps), and as underbuild (with dead-end shoes). In these situations, considerations for the strength of each of the support types were the controlling factor in the design tension.

These sag tables supercede all previous sag and tension tables. Contact engineering if final sag and tension data for the above standard conductors is needed for re-sagging or if sag and tension data is needed for any older, obsolete non-standard conductor on the NHEC system.

All of the tables provided are for initial sags, meaning they are only to be used when stringing/sagging new un-stretched conductor. Generally, each table also includes a column “Sag for Vertical Clearance”. These are the worst case sags that need to be used for checking vertical clearances to supply and communications underbuild and as well as objects on the ground.

Primary Conductor Sags

When using the primary conductor sag tables, it is important to note that the span lengths listed for each conductor are “ruling spans”. This means that the span(s) used to measure/check sag need to be similar in length to the ruling span. Using a sag value from a

different span will yield improper sag results. The following example will demonstrate this:

Example:

Lets assume that the ruling span for a particular stringing section of 1/0 ACSR 15 kV Tree Wire is 200 ft. From the sag table (not the ones below), for 200 ft. @ 60 deg F, the correct sag is 28". The span or spans used to check/measure this sag must be close to 200 ft in length. Now, let's assume that the span chosen to check the sag, for whatever reason, was only 150 ft. long. Again from the sag table (not the ones below), for 150 ft @ 60 deg F, the sag, instead of 28", is found to be only 11". Well, this may seem reasonable...a shorter span will have less sag! However, the actual sag for the 150 ft. span with a 200 ft ruling span should be 16", not 11 (see Table 1 below). The stringing tension should have been 617 lbs, not 862. This stringing section would have been sagged too tight.

Table 1

1/0 ACSR-15kV Tree Wire @ 40% NESC Heavy

Stringing Sag Table Using Initial Sag							Ruling Span: 200.0 Feet			
NESC Heavy Load Zone							Max Tension = 1752 Lb			
Design: 40.0 % Ult. @ 0. Deg F, .50 In Ice, 4.00 Psf Wind, Initial										
H Tens	952.	888.	827.	769.	714.	663.	617.	575.	537.	503.
(LBS)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Temp F>	0.	10.	20.	30.	40.	50.	60.	70.	80.	90.
Sag	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Span	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
100.0	4	5	5	6	6	6	7	7	8	8
125.0	7	7	8	9	9	10	11	12	12	13
150.0	10	11	12	12	13	14	16	17	18	19
175.0	14	15	16	17	18	20	21	23	24	26
200.0	18	19	21	22	24	26	28	30	32	34

Table 2

1/0 ACSR-15kV Tree Wire @ 40% NESC Heavy

Stringing Sag Table Using Initial Sag							Ruling Span: 150.0 Feet			
NESC Heavy Load Zone							Max Tension = 1752 Lb			
Design: 40.0 % Ult. @ 0. Deg F, .50 In Ice, 4.00 Psf Wind, Initial										
H Tens	1291.	1220.	1149.	1077.	1005.	933.	862.	792.	725.	662.
(LBS)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Temp F>	0.	10.	20.	30.	40.	50.	60.	70.	80.	90.
Sag	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Span	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
100.0	3	3	4	4	4	5	5	5	6	6
125.0	5	5	6	6	7	7	8	8	9	10
150.0	7	8	8	9	10	10	11	12	13	14
175.0	10	11	11	12	13	14	15	16	18	20
200.0	13	14	15	16	17	18	20	22	23	26

Conclusion: The sag data is only valid if the span where sag is being measured or sighted is approximately equal to the ruling span of the pulling section between deadends.

Ruling Span Calculation

The ruling span may be considered as an assumed “design-span” that assures the best average conductor tension throughout a line between dead-ends of non-uniform span lengths.

If all spans in a section of line between dead-ends are the same length, ice and wind loads will result in equal conductor tension in all spans. In practice, span lengths will usually vary in any section of line with the result that the applications of ice and wind loads will cause the conductor tension to become greater in the longer spans than in the shorter spans. Slight movement of the structures will tend to equalize this unequal tension. Unless the conductor is strung to limit this condition, over time, greater tensions than expected or desired could lead to premature conductor fatigue/damage and increase the probability of excessive loading on poles, guys, anchors, insulators, crossarms, and other line hardware.

Line Design or Engineering personnel may provide construction crews the ruling spans for various pulling sections. If ruling spans are not provided, they can be approximated by using the following method:

- § Find/determine the average span length of all spans in the pulling section
- § Add to the average span length two-thirds (2/3) of the difference between the longest span and the average span.

$$\text{Approximate Ruling Span} = \text{Average Span} + \frac{2}{3} \left(\text{Longest Span} - \text{Average Span} \right)$$

For example, assume there is a 5-span pulling section, with spans of 200, 175, 205, 185, and 205 feet. The total pulling span is 970 feet. The average span would be 194 feet (970 divided by 5). Two-thirds of the difference between the longest and average span would be 7.3 feet (2/3 of 11). Therefore, the approximate ruling span for this example would be 194 plus 7.3 feet, or approximately 201 feet. The sags for a 200 foot ruling span should be used for sagging this pulling section.

2 ACSR 15KV TREE WIRE											
Design Condition: 50% NESC Heavy				Rated Strength (lbs.): 2,850					Weight (lbs/ft): 0.207		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 1/2" Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	3	3	3	3	3	3	3	3	3	3	13
125	4	4	4	5	5	5	5	6	6	6	20
150	7	7	7	8	8	8	9	10	10	11	29
175	10	11	11	12	13	14	15	16	17	19	40
200	16	17	18	20	21	23	24	26	28	30	54
225	26	28	30	32	34	36	38	40	43	45	69
250	41	43	45	48	50	53	55	58	60	62	86
275	59	62	64	67	68	72	74	77	79	82	105
300	81	83	86	88	91	93	96	98	100	103	126

2 ACSR, BARE, 6/1 STRAND, "SPARROW"											
Design Condition: 50% NESC Heavy				Rated Strength (lbs.): 2,850					Weight (lbs/ft): 0.091		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 1/2" Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	1	1	1	1	1	1	1	1	2	2	9
125	2	2	2	2	2	2	2	2	2	3	14
150	3	3	3	3	3	3	3	3	4	4	20
175	4	4	4	4	4	5	5	5	6	6	27
200	5	6	6	6	6	7	7	8	9	9	36
225	7	8	8	9	10	10	11	12	14	15	47
250	11	11	12	13	14	16	17	19	22	24	60
275	16	17	19	21	23	25	28	31	34	38	74
300	24	27	29	32	36	39	43	47	51	54	89

Notes:

- 1) Use initial sags when installing new conductor. Final sags (not included in this table) are used when re-sagging older conductor.
- 2) Spans greater than 250 ft are not approved for standard construction. Contact Engineering for authorization. Vertical clearance requirements may dictate the need for shorter spans when communications and secondary underbuilds exist.
- 3) Refer to the IW9-SAG guideline at the beginning of this section for directions on use of these sag tables. The sag data is only valid if the span where the sag is being measured or sighted, is approximately equal to the ruling span of the pulling section between deadends.

1/0 ACSR 15KV TREE WIRE											
Design Condition: 40% NESC Heavy				Rated Strength (lbs.): 4,380					Weight (lbs/ft): 0.284		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 1/2" Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	3	3	3	3	3	4	4	4	4	5	12
125	5	5	5	5	6	6	7	7	8	9	19
150	7	8	8	9	10	10	11	12	13	14	27
175	12	12	13	14	15	17	18	19	21	23	37
200	18	19	21	22	24	26	28	30	32	34	49
225	27	29	31	33	36	38	40	42	45	47	63
250	41	43	45	48	50	53	55	57	60	62	78
275	57	59	62	64	67	69	72	74	77	79	95
300	75	78	80	83	85	88	90	93	95	97	113

1/0 ACSR, BARE, 6/1 STRAND, "RAVEN"											
Design Condition: 40% NESC Heavy				Rated Strength (lbs.): 4,380					Weight (lbs/ft): 0.145		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 1/2" Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	1	1	1	2	2	2	2	2	2	2	8
125	2	2	2	3	3	3	3	3	4	4	13
150	3	3	4	4	4	4	5	5	6	6	19
175	5	5	5	6	6	7	7	8	9	10	26
200	7	7	8	8	9	10	11	12	13	15	35
225	10	11	11	12	13	15	16	18	20	23	45
250	14	15	17	18	20	22	24	27	30	33	56
275	20	22	24	27	30	32	36	39	42	45	69
300	30	33	36	39	42	46	49	53	56	60	83

Notes:

- 1) Use initial sags when installing new conductor. Final sags (not included in this table) are used when re-sagging older conductor.
- 2) Spans greater than 250 ft are not approved for standard construction. Contact Engineering for authorization. Vertical clearance requirements may dictate the need for shorter spans when communications and secondary underbuilds exist.
- 3) Refer to the IW9-SAG guideline at the beginning of this section for directions on use of these sag tables. The sag data is only valid if the span where the sag is being measured or sighted, is approximately equal to the ruling span of the pulling section between deadends.

**CONSTRUCTION STANDARDS**

1/0 ACSR PRIMARY CONDUCTORS
INITIAL SAGS

IW-1/0ACSR

ISSUE DATE: 01/06

336.4 ACSR 15KV TREE WIRE											
Design Condition: 34.6% NESC Heavy				Rated Strength (lbs.): 8,680					Weight (lbs/ft): 0.578		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	3	4	4	4	5	6	7	8	9	11	20
125	5	6	7	7	8	10	11	13	15	17	27
150	8	9	10	12	13	15	17	19	22	24	35
175	13	14	16	18	20	22	24	27	29	32	44
200	19	21	23	25	28	31	33	36	39	41	54
225	26	29	32	35	38	41	43	46	49	52	65
250	36	39	43	46	49	52	55	58	61	64	77
275	48	52	55	58	61	65	68	71	74	77	91
300	62	65	69	72	75	79	82	85	88	91	105

336.4 ACSR, BARE, 6/1 STRAND, "MERLIN"											
Design Condition: 34.6% NESC Heavy				Rated Strength (lbs.): 8,680					Weight (lbs/ft): 0.365		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	2	2	2	3	3	3	4	5	6	8	18
125	3	3	4	4	5	6	7	8	10	13	24
150	5	5	6	7	8	9	11	13	15	18	31
175	7	8	9	10	11	13	16	18	21	24	38
200	10	11	12	14	16	19	22	25	28	31	46
225	14	15	17	20	23	26	29	33	36	40	55
250	19	21	24	27	31	34	38	42	45	49	65
275	26	29	32	36	40	44	48	52	55	59	75
300	34	38	42	46	50	55	59	62	66	70	87

Notes:

- 1) Use initial sags when installing new conductor. Final sags (not included in this table) are used when re-sagging older conductor.
- 2) Spans greater than 225 ft are not approved for standard construction. Contact Engineering for authorization. Vertical clearance requirements may dictate the need for shorter spans when communications and secondary underbuilds exist.
- 3) Refer to the IW9-SAG guideline at the beginning of this section for directions on use of these sag tables. The sag data is only valid if the span where the sag is being measured or sighted, is approximately equal to the ruling span of the pulling section between deadends.

4/0 ACSR, BARE, 6/1 STRAND, "PENGUIN" (NEUTRAL)											
Design Condition: 25% NESC Heavy				Rated Strength (lbs.): 8,350					Weight (lbs/ft): 0.291		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1										Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)										
	0	10	20	30	40	50	60	70	80	90	
100	2	3	3	3	4	4	5	6	8	9	15
125	4	5	5	6	7	8	9	11	13	15	21
150	7	7	8	10	11	13	15	17	19	22	29
175	11	12	14	15	18	20	22	25	27	30	38
200	16	19	21	23	26	29	31	34	37	39	48
225	25	27	30	33	36	39	42	44	47	50	59
250	36	39	42	45	48	51	53	56	59	61	71
275	48	51	55	58	61	64	66	69	72	75	84
300	63	66	69	72	75	78	81	84	86	89	99

Notes:

- 1) Use initial sags when installing new conductor. Final sags (not included in this table) are used when re-sagging older conductor.
- 2) Spans greater than 225 ft are not approved for standard construction. Contact Engineering for authorization. Vertical clearance requirements may dictate the need for shorter spans when communications and secondary underbuilds exist.
- 3) Refer to the IW9-SAG guideline at the beginning of this section for directions on use of these sag tables. The sag data is only valid if the span where the sag is being measured or sighted, is approximately equal to the ruling span of the pulling section between deadends.

**CONSTRUCTION STANDARDS**

4/0 ACSR NEUTRAL CONDUCTOR
INITIAL SAGS

IW-4/0ACSR

ISSUE DATE: 01/06

052 AWA, 5/2 STRAND, MESSENGER										
Design Condition: 2,000 lbs @ 60° F				Rated Strength (lbs.): 17,120				Weight (lbs/ft): 0.346		
Ruling Span (See Note 2) (feet)	Initial Mid-Span Sags (inches) See note 1									
	Ambient Air Temperature (Degree F)									
	0	10	20	30	40	50	60	70	80	90
100	2	2	2	2	2	2	3	3	3	4
125	3	3	3	3	3	4	4	4	5	6
150	4	4	4	5	5	5	6	6	7	8
175	5	5	6	6	7	7	8	9	10	11
200	7	7	8	8	9	10	10	11	12	14
225	9	9	10	10	11	12	13	14	16	17
250	11	11	12	13	14	15	16	18	19	21
275	13	14	15	16	17	18	20	21	23	25
300	16	17	18	19	20	22	23	25	27	30
All Span Lengths	Initial Sag-Tensions (lbs) See note 1									
	3,100	2,908	2,715	2,541	2,345	2,169	2,000	1,834	1,675	1,505

Notes:

- 1) Use initial sags and tensions when installing new conductor.
- 2) Spans greater than 225 ft are not approved for standard construction. Contact Engineering for authorization. Vertical clearance requirements may dictate the need for shorter spans when communications and secondary underbuilds exist.
- 3) Refer to the IW9-SAG guideline at the beginning of this section for directions on use of these sag tables. The sag data is only valid if the span where the sag is being measured or sighted, is approximately equal to the ruling span of the pulling section between deadends.

Final Sag & Tension Data											
1/0 AAC COMPACT 15KV SPACER CABLE (052 AWA MESSENGER)											
Load Condition			Span Length (feet)								
Weather Case (temp, ice, wind)	Weight (lbs/ft)	NESC Heavy Loading	100	125	150	175	200	225	250	275	300
0°F, 1/2", 4psf	4.785	Tension (lbs)	4,283	4,646	4,997	5,336	5,663	5,979	6,284	6,579	6,865
		Sag (in)	17	24	32	41	51	61	72	83	95
32°F, 1/2"	3.929	Sag (in)	17	24	32	40	50	59	70	80	92
0°F	1.074		6	9	12	17	22	28	34	41	48
30°F			7	11	15	20	26	32	39	46	54
60°F			9	13	18	24	30	37	44	52	60
90°F			12	16	22	28	35	42	50	58	66
120°F			14	20	26	32	40	47	55	63	72

Final Sag & Tension Data											
336.4 AAC COMPACT 15KV SPACER CABLE (052 AWA MESSENGER)											
Load Condition			Span Length (feet)								
Weather Case (temp, ice, wind)	Weight (lbs/ft)	NESC Heavy Loading	100	125	150	175	200	225	250	275	300
0°F, 1/2", 4psf	6.106	Tension (lbs)	4,693	5,142	5,572	5,984	6,379	6,759	7,125	7,478	7,821
		Sag (in)	20	28	37	47	58	69	81	93	106
32°F, 1/2"	5.274	Sag (in)	20	28	37	47	57	68	80	92	104
0°F	1.920		19	14	20	26	33	41	49	58	67
30°F			11	16	23	29	37	45	53	62	72
60°F			13	19	26	33	41	49	58	67	77
90°F			15	22	29	36	45	53	62	72	82
120°F			18	25	32	40	48	57	67	77	87

SAG BETWEEN "ROLL-BY" BLOCKS OR SPACERS	
Temperature Range (deg F)	Sag (inches)
10 - 20	3
30 - 40	4
50 - 60	5
70 - 80	6
90 - 100	7

SAG BETWEEN "THREE-SHEAVE" BLOCKS			
Span Between "Three-Sheave" Blocks (feet)	Temperature During Installation (deg F)		
	30	60	90
100	30	3	42
125	42	4	54
150	54	5	66
175	66	6	78
200	78	7	90
225	90	8	102
250	102	9	114

2 ACSR TRIPLEX, "CONCH" (SERVICE DROP)					
600 lbs NESC Heavy		Rated Strength (lbs.): 2,850		Weight (lbs/ft): 0.261	
Span Length (feet)	Sag (inches) See note 1				
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
	0-75	16	18	21	23
	100	33	35	37	39
125	54	56	59	61	
150	81	83	87	87	

1/0 ACSR TRIPLEX, "NERITINA" (SERVICE DROP)				
600 lbs NESC Heavy		Rated Strength (lbs.): 4,380		Weight (lbs/ft): 0.419
Span Length (feet)	Sag (inches) See note 1			
	Ambient Air Temperature (Degree F)			
	0	30	60	90
0-75	23	25	27	28
100	43	45	46	48
125	68	70	72	74
150	100	102	104	106

4/0 ACSR TRIPLEX, "ZUZARA" (SERVICE DROP)				
600 lbs NESC Heavy		Rated Strength (lbs.): 8,350		Weight (lbs/ft): 0.792
Span Length (feet)	Sag (inches) See note 1			
	Ambient Air Temperature (Degree F)			
	0	30	60	90
0-75	33	34	36	37
100	59	61	62	63
125	94	96	97	98
150	137	139	140	141

Notes:

- Greater sags may be used to reduce pull on supports if adequate clearance can be maintained.

2 ACSR TRIPLEX, "CONCH" (SECONDARY)					
1200 lbs NESC Heavy		Rated Strength (lbs.): 2,850		Weight (lbs/ft): 0.261	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance <small>(NESC 232A&B) 1/2 Ice @ 32 F (inches)</small>
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	2	3	4	7	10
100	5	7	10	13	18
125	11	14	19	23	28
150	21	26	31	36	41
175	36	42	47	51	56
200	54	59	64	69	74

1/0 ACSR TRIPLEX, "NERITINA" (SECONDARY)					
1200 lbs NESC Heavy		Rated Strength (lbs.): 4,380		Weight (lbs/ft): 0.419	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical <u>Clearance</u> (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	4	6	8	11	15
100	10	14	17	21	26
125	22	26	30	33	39
150	37	41	45	49	54
175	55	60	63	67	73
200	77	81	85	88	94

4/0 ACSR TRIPLEX, "ZUZARA" (SECONDARY)					
1200 lbs NESC Heavy		Rated Strength (lbs.): 8,350		Weight (lbs/ft): 0.792	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical <u>Clearance</u> (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	13	16	18	20	23
100	26	29	31	34	36
125	43	45	48	51	54
150	63	66	69	71	75
175	88	91	93	96	99
200	116	119	122	124	128

Notes:

- 1) Greater sags may be used to reduce pull on supports if adequate clearance can be maintained.

**CONSTRUCTION STANDARDS**

OVERHEAD TRIPLEX – SECONDARY
INITIAL SAGS

IW-OHTRIP.SEC

ISSUE DATE: 01/06

2 ACSR TRIPLEX, "CONCH" (UNDERBUILD)					
50% NESC Heavy		Rated Strength (lbs.): 2,850		Weight (lbs/ft): 0.261	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 1/2 Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	2	2	3	4	9
100	3	4	4	5	15
125	5	6	7	9	22
150	9	10	12	15	33
175	15	17	21	26	46
200	24	28	34	40	60
225	38	44	50	56	77
250	56	62	69	75	96

1/0 ACSR TRIPLEX, "NERITINA" (UNDERBUILD)					
50% NESC Heavy		Rated Strength (lbs.): 4,380		Weight (lbs/ft): 0.419	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 1/2 Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	2	2	3	4	7
100	3	4	4	5	12
125	5	6	6	7	18
150	8	9	10	12	26
175	11	13	15	17	36
200	16	19	22	26	47
225	23	27	31	36	60
250	33	38	43	49	74

4/0 ACSR TRIPLEX, "ZUZARA" (UNDERBUILD)					
40% NESC Heavy		Rated Strength (lbs.): 8,350		Weight (lbs/ft): 0.792	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	2	2	3	4	9
100	4	4	5	7	14
125	6	7	9	11	21
150	10	11	14	17	28
175	14	17	20	24	37
200	20	24	28	33	48
225	28	32	38	44	59
250	38	43	50	56	72

Notes:

- 1) Greater sags may be used to reduce pull on supports if adequate clearance can be maintained.

CONSTRUCTION STANDARDSOVERHEAD TRIPLEX – UNDERBUILD
INITIAL SAGS

IW-OHTRIP.UB

ISSUE DATE: 01/06

1/0 ACSR QUADRUPLX, "COSTENA" (SERVICE DROP)					
600 lbs NESC Heavy		Rated Strength (lbs.): 4,380		Weight (lbs/ft): 0.551	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	26	27	29	31	32
100	48	50	51	53	55
125	77	79	80	82	84
150	113	115	116	118	120

1/0 ACSR QUADRUPLX, "COSTENA" (SECONDARY)					
1200 lbs NESC Heavy		Rated Strength (lbs.): 4,380		Weight (lbs/ft): 0.551	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	6	8	10	13	17
100	15	18	21	24	29
125	28	32	35	38	44
150	46	49	52	56	61
175	66	70	73	76	82
200	90	94	97	100	106

1/0 ACSR QUADRUPLX, "COSTENA" (UNDERBUILD)					
50% NESC Heavy		Rated Strength (lbs.): 4,380		Weight (lbs/ft): 0.551	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 1/2" Ice @ 32 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	2	3	3	4	8
100	4	5	5	6	14
125	7	8	9	10	21
150	11	12	14	16	30
175	16	18	21	24	41
200	23	27	30	35	54
225	34	38	43	48	68
250	47	52	58	64	85

Notes:

- 1) Greater sags may be used to reduce pull on supports if adequated clearance can be maintained.

**CONSTRUCTION STANDARDS**

1/0 ACSR QUADRUPLX
INITIAL SAGS

IW-1/0QUAD

ISSUE DATE: 01/06

4/0 ACSR QUADRUPLIX, "APPALOOSA" (SERVICE DROP)					
600 lbs NESC Heavy		Rated Strength (lbs.): 8,350		Weight (lbs/ft): 1.038	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical <u>Clearance</u> <small>(NESC 232A&B) 120 F (inches)</small>
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
	0-75	38	39	40	
100	68	70	71	72	73
125	108	110	111	112	113
150	159	160	161	163	164

4/0 ACSR QUADRUPLIX, "APPALOOSA" (SECONDARY)					
1200 lbs NESC Heavy		Rated Strength (lbs.): 8,350		Weight (lbs/ft): 1.038	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	16	18	21	23	25
100	31	33	36	38	41
125	50	53	55	57	60
150	74	77	79	81	84
175	103	105	107	110	113
200	135	138	140	143	146

4/0 ACSR QUADRUPLIX, "APPALOOSA" (UNDERBUILD)					
45% NESC Heavy		Rated Strength (lbs.): 8,350		Weight (lbs/ft): 1.038	
Span Length (feet)	Initial Sag (inches) See note 1				Sag for Vertical Clearance (NESC 232A&B) 120 F (inches)
	Ambient Air Temperature (Degree F)				
	0	30	60	90	
0-75	2	3	3	4	9
100	4	5	6	7	14
125	7	8	9	11	21
150	11	12	14	17	28
175	16	18	21	24	37
200	22	25	29	33	47
225	30	34	39	44	59
250	40	45	50	56	72

Notes:

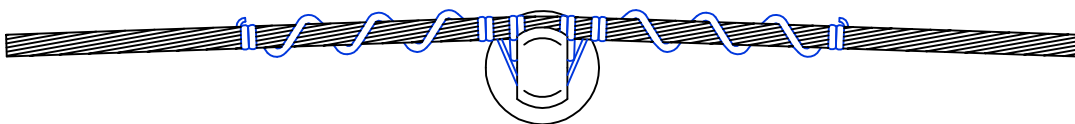
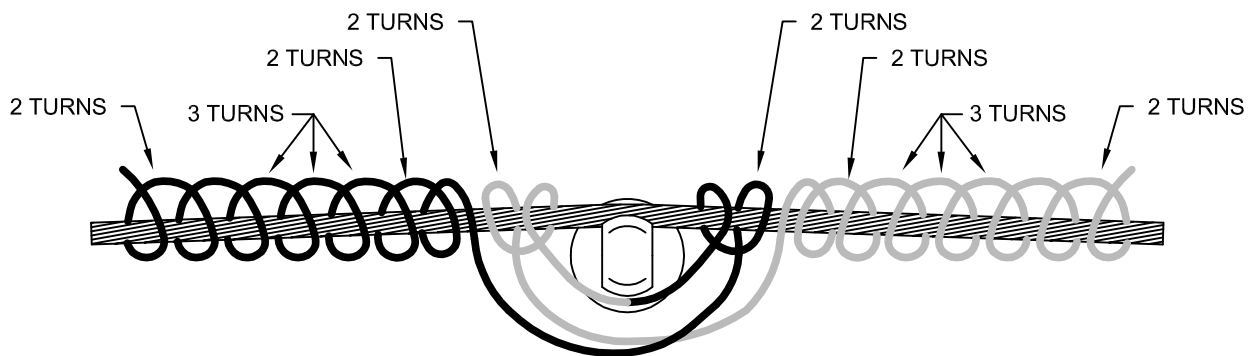
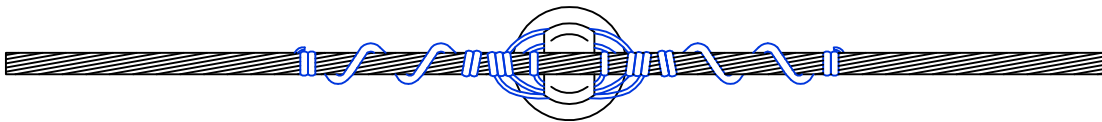
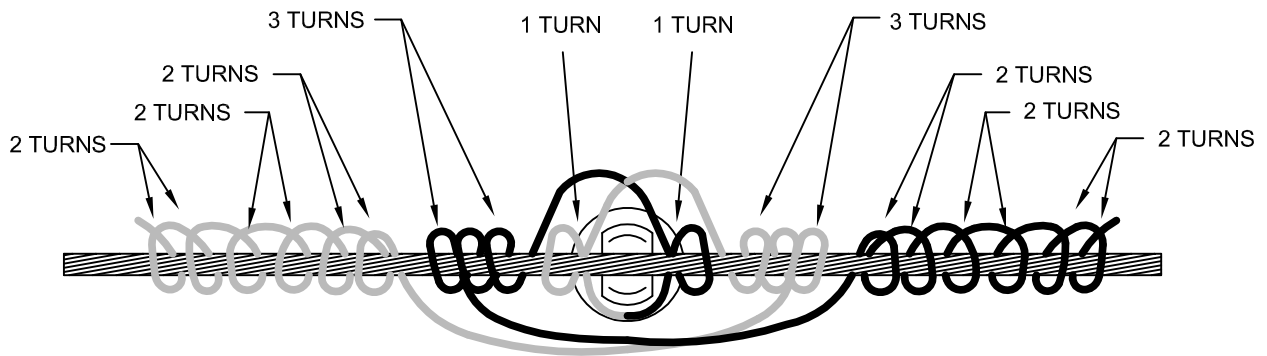
- 1) Greater sags may be used to reduce pull on supports if adequated clearance can be maintained.

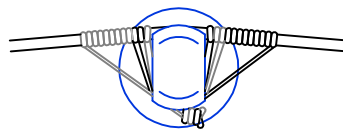
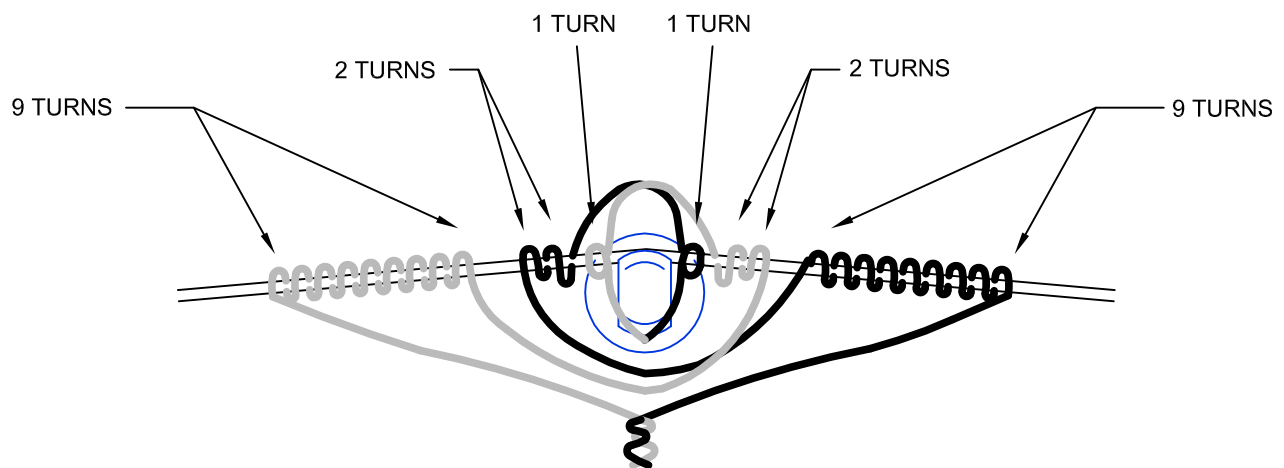
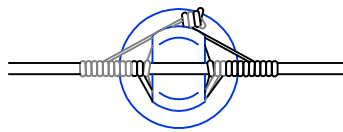
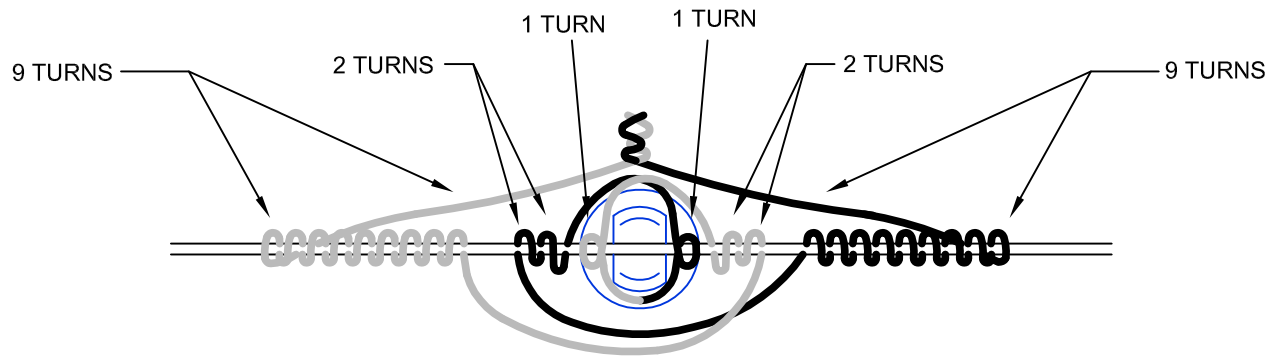
**CONSTRUCTION STANDARDS**

4/0 ACSR QUADRUPLIX
INITIAL SAGS

IW-4/0QUAD

ISSUE DATE: 01/06





Underground Conductors / Cables 18

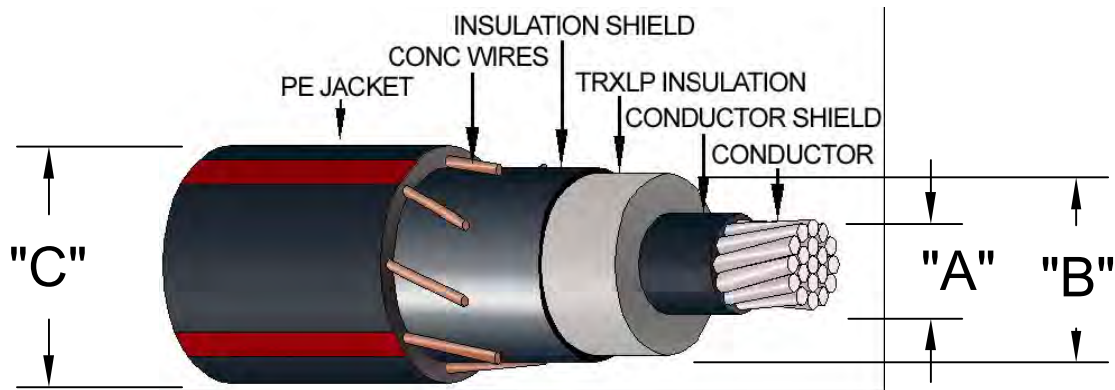
UW1 Underground Primary Conductors

UW2, UW3 Underground Secondary/Service Conductors

UG Cable pulling tension guidelines & procedures (future)

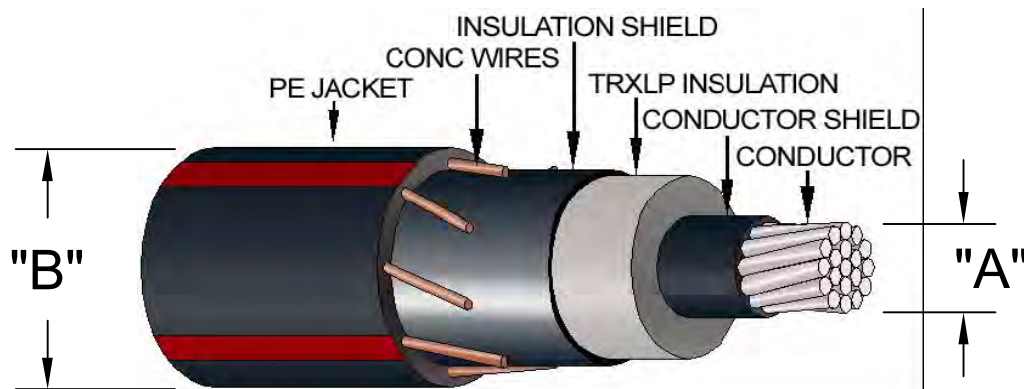
Cable Characteristics Table (future)

UNDERGROUND CABLE



	Material #	Description	A(IN.)	B(IN.)	C(IN.)
UW1.010.URD	09152213	CBL PRI 1/0 F Neut 15 kV 220 MIL	.362	.860	1.168
ZUW1.010.URD	09252219	CBL PRI 1/0 F Neut 34 kV 345 MIL	.362	1.110	1.458
UW1.500.URD	09342300	CBL PRI 500 1/3 15 kV 220 MIL	.789	1.300	1.742
ZUW1.500.URD	09342225	CBL PRI 500 1/3 34 kV 345 MIL	.789	1.565	2.047

SUBMARINE CABLE



	Material #	Description	A(IN.)	B(IN.)
UW1.010.SUB	15560005	Cond, Sub 1/0 AL 15 kV	.398	1.720
ZUW1.010.SUB	15560006	Cond, Sub 1/0 AL 35 kV	-	-

SECONDARY & SERVICE UNDERGROUND CABLES

UW2 = SECONDARY WIRE

UW3 = SERVICE WIRE



		Material #	Description
UW3.010.USE	UW2.010.USE	09722404	CBL, Sec 1/0-1/0-2 AL
UW3.040.USE	UW2.040.USE	09722407	CBL, Sec 4/0-4/0-2/0 AL
UW3.500.USE	UW2.500.USE	09722500	CBL, Sec 500-500-350 AL



CONSTRUCTION STANDARDS

SECONDARY/SERVICE UNDERGROUND CABLE

Underground Conductors / Cables 18

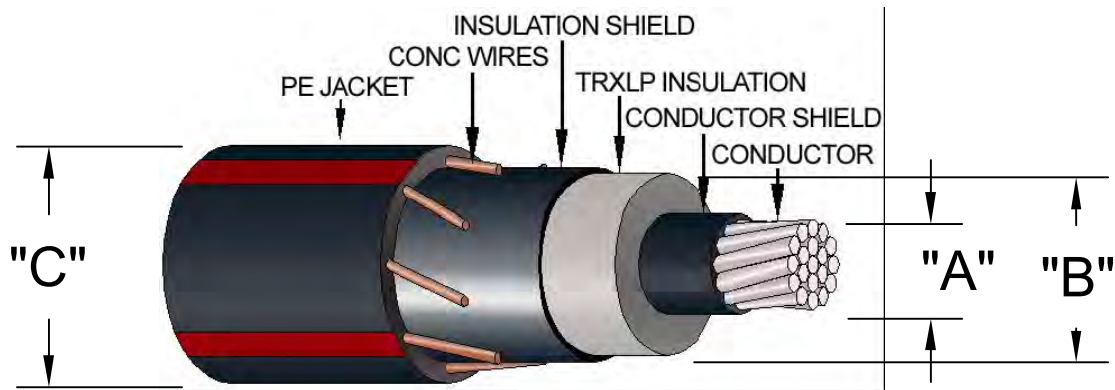
UW1 Underground Primary Conductors

UW2, UW3 Underground Secondary/Service Conductors

UG Cable pulling tension guidelines & procedures (future)

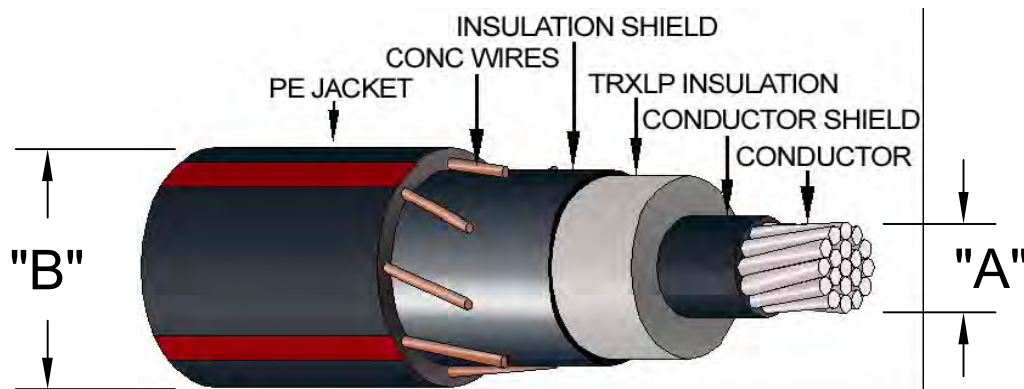
Cable Characteristics Table (future)

UNDERGROUND CABLE



	Material #	Description	A(IN.)	B(IN.)	C(IN.)
UW1.010.URD	09152213	CBL PRI 1/0 F Neut 15 kV 220 MIL	.362	.860	1.168
ZUW1.010.URD	09252219	CBL PRI 1/0 F Neut 34 kV 345 MIL	.362	1.110	1.458
UW1.500.URD	09342300	CBL PRI 500 1/3 15 kV 220 MIL	.789	1.300	1.742
ZUW1.500.URD	09342225	CBL PRI 500 1/3 34 kV 345 MIL	.789	1.565	2.047

SUBMARINE CABLE



	Material #	Description	A(IN.)	B(IN.)
UW1.010.SUB	15560005	Cond, Sub 1/0 AL 15 kV	.398	1.720
ZUW1.010.SUB	15560006	Cond, Sub 1/0 AL 35 kV	-	-

SECONDARY & SERVICE UNDERGROUND CABLES

UW2 = SECONDARY WIRE
UW3 = SERVICE WIRE



		Material #	Description
UW3.010.USE	UW2.010.USE	09722404	CBL, Sec 1/0-1/0-2 AL
UW3.040.USE	UW2.040.USE	09722407	CBL, Sec 4/0-4/0-2/0 AL
UW3.500.USE	UW2.500.USE	09722500	CBL, Sec 500-500-350 AL



CONSTRUCTION STANDARDS

SECONDARY/SERVICE UNDERGROUND CABLE

Overhead Transformers 19

Transformer Assemblies

G1 CSP

G2 Conventional

Transformer Mounting Assemblies

CSP

G91-1 Single-Ph, CSP Transformer, Vertical Construction

HG91-1 Single-Ph, CSP Transformer, Hendrix Construction

G91-2 Single-Ph, CSP Transformer, Crossarm Construction

Conventional

G92-1 Single-Ph, Conventional Transformer, Vertical Construction

HG92-1 Single-Ph, Conventional Transformer, Hendrix Construction

G92-2 Single-Ph, Conventional Transformer, Crossarm Construction

3-Phase

G93 Cluster Mount with c/o's on Crossarm

HG93 Hendrix Cluster Mount with c/o's on workarm

VG93 Cluster Mount with c/o's on workarm (preferred 25kv)

G9-1 Secondary support bracket

Guides

IG91/IHG91 Single Phase Grounding for CSP

IG92/IHG92 Single Phase Grounding for conventional

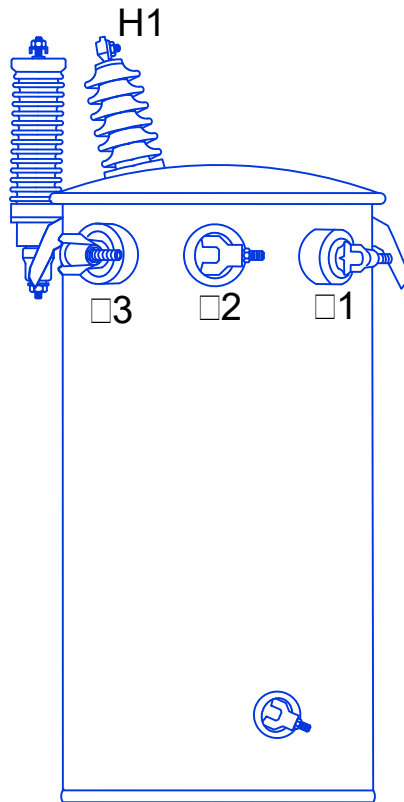
IG93/IHG93 Three phase grounding for Conventional Transformers

IG9-CONNECTION.3 Grounded wye-Grounded wye connections

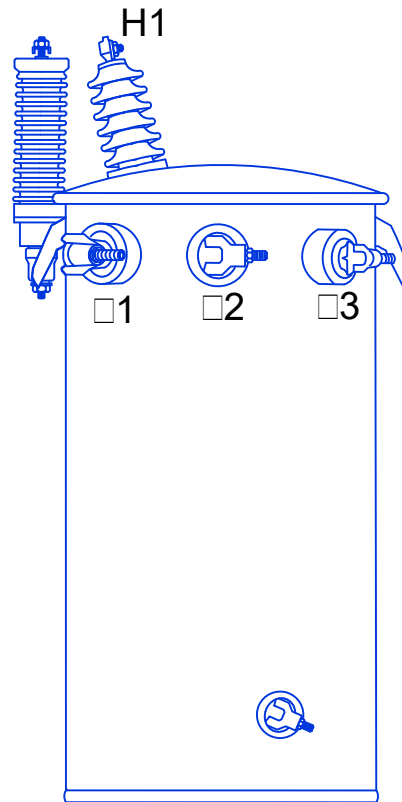
IG9-CONNECTION.1 Open wye-Open Delta connections

Construction and Design Note

1. All locations for terminals are shown on additive circuit, unless indicated otherwise.



ADDITIVE
POLARITY



SUBTRACTIVE
POLARITY

CSP TRANSFORMER

ASSEMBLY NAME	Material #	KVA	Single/Dual Voltage	Primary Voltage	Secondary Voltage
G1.001S.120	69311200	1.5	Single	7.2 kV	120/240 V
G1.010S.120	69311211	10	Single	7.2 kV	120/240 V
G1.010D.120	69381211	10	Dual	7.2 / 2.4 kV	120/240 V
VG1.010S.120 *	69331211	10	Single	14.4 kV	120/240 V
VG1.010D.120 *	69391211	10	Dual	14.4/ 7.2 kV	120/240 V
G1.015S.120	69311213	15	Single	7.2 kV	120/240 V
G1.015D.120	69381213	15	Dual	7.2 / 2.4 kV	120/240 V
VG1.015S.120 *	69331213	15	Single	14.4 kV	120/240 V
VG1.015D.120 *	69391213	15	Dual	14.4/ 7.2 kV	120/240 V
G1.025S.120	69311215	25	Single	7.2 kV	120/240 V
G1.025D.120	69381215	25	Dual	7.2 / 2.4 kV	120/240 V
VG1.025S.120 *	69331215	25	Single	14.4 kV	120/240 V
VG1.025D.120 *	69391215	25	Dual	14.4/ 7.2 kV	120/240 V

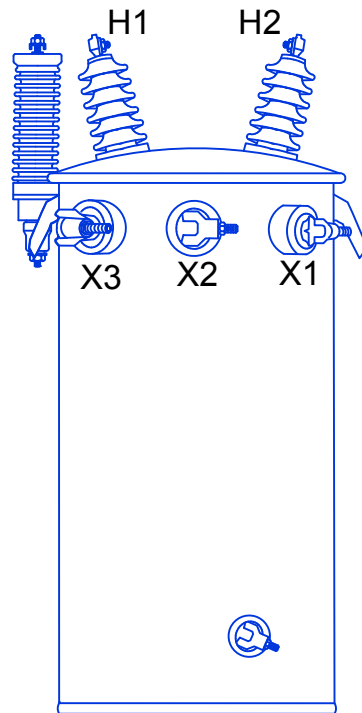
* Subtractive polarity

CONSTRUCTION STANDARDS

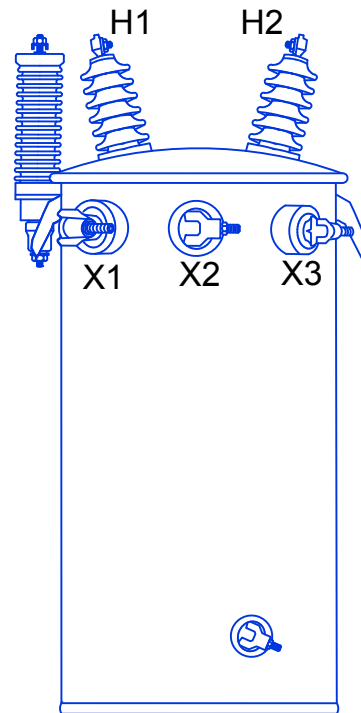
CSP TRANSFORMERS

Construction and Design Notes:

1. All associated transformers are shown as additive polarity, unless specified otherwise.



ADDITIVE
POLARITY



SUBTRACTIVE
POLARITY

CONVENTIONAL TRANSFORMER

Conventional transformers available in following configurations:

- Primary Voltage 7.2 kV
- Primary Voltage 14.4 kV *
- Primary Voltage 7.2/2.4 kV
- Primary Voltage 14.4/7.2 kV *
- Secondary Voltage 120/240 v
- Secondary Voltage 277/480 v

* Subtractive polarity

Transformer Size

ASSEMBLY NAME	KVA
G2.010	10
G2.015	15
G2.025	25
G2.037	37.5
G2.050	50
G2.075	75
G2.100	100
G2.167	167

Materials List for Assemblies

* Subtractive polarity

	Assembly Name	Material #	KVA	Single / Dual Voltage	Primary Voltage	Secondary Voltage
G2.010	G2.010S.120	69351111	10	Single	7.2 kV	120 / 240 V
	G2.010S.277	69356111	10	Single	7.2 kV	277 / 480 V
	G2.010D.120	69381111	10	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.010D.277	69386111	10	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.010S.120 *		10	Single	14.4 kV	120 / 240 V
	VG2.010S.277 *	69376111	10	Single	14.4 kV	277 / 480 V
	VG2.010D.120 *		10	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.010D.277 *		10	Dual	14.4 / 7.2 kV	277 / 480 V
G2.015	G2.015S.120	69351113	15	Single	7.2 kV	120 / 240 V
	G2.015S.277	69356113	15	Single	7.2 kV	277 / 480 V
	G2.015D.120	69381113	15	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.015D.277	69386113	15	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.015S.120 *	69371113	15	Single	14.4 kV	120 / 240 V
	VG2.015S.277 *	69376113	15	Single	14.4 kV	277 / 480 V
	VG2.015D.120 *	69391113	15	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.015D.277 *	69396113	15	Dual	14.4 / 7.2 kV	277 / 480 V
G2.025	G2.025S.120	69351115	25	Single	7.2 kV	120 / 240 V
	G2.025S.277	69356115	25	Single	7.2 kV	277 / 480 V
	G2.025D.120	69381115	25	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.025D.277	69386115	25	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.025S.120 *	69371115	25	Single	14.4 kV	120 / 240 V
	VG2.025S.277 *	69376115	25	Single	14.4 kV	277 / 480 V
	VG2.025D.120 *	69391115	25	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.025D.277 *	69396115	25	Dual	14.4 / 7.2 kV	277 / 480 V
G2.037	G2.037S.120	69351117	37.5	Single	7.2 kV	120 / 240 V
	G2.037S.277	69356117	37.5	Single	7.2 kV	277 / 480 V
	G2.037D.120	69381117	37.5	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.037D.277	69386117	37.5	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.037S.120 *	69371117	37.5	Single	14.4 kV	120 / 240 V
	VG2.037S.277 *	69376117	37.5	Single	14.4 kV	277 / 480 V
	VG2.037D.120 *	69391117	37.5	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.037D.277 *	69396117	37.5	Dual	14.4 / 7.2 kV	277 / 480 V
G2.050	G2.050S.120	69351119	50	Single	7.2 kV	120 / 240 V
	G2.050S.277	69356119	50	Single	7.2 kV	277 / 480 V
	G2.050D.120	69381119	50	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.050D.277	69386119	50	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.050S.120 *	69371119	50	Single	14.4 kV	120 / 240 V
	VG2.050S.277 *	69376119	50	Single	14.4 kV	277 / 480 V
	VG2.050D.120 *	69391119	50	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.050D.277 *	69396119	50	Dual	14.4 / 7.2 kV	277 / 480 V

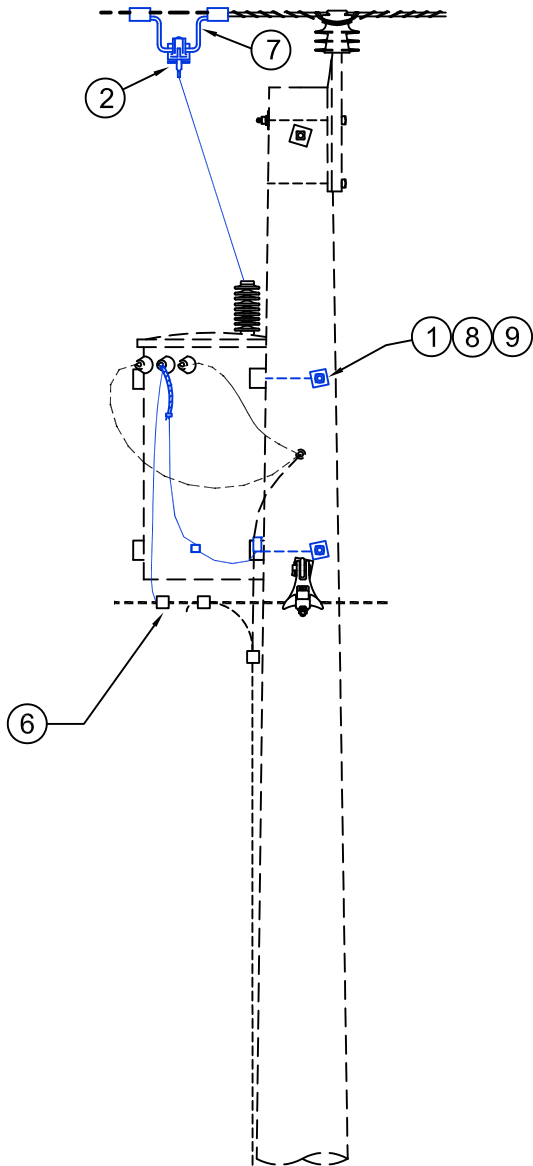
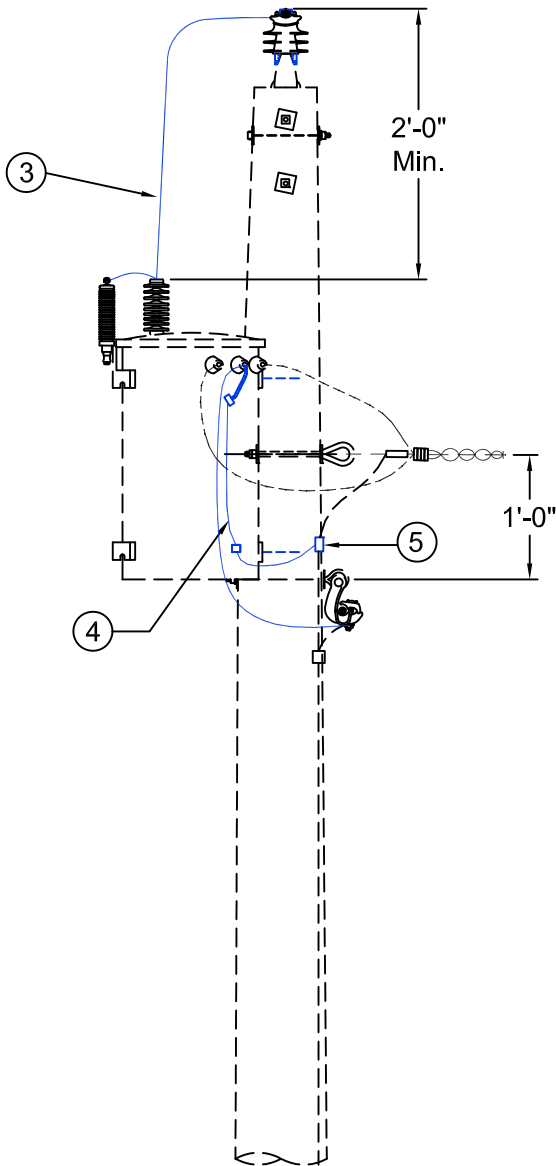
Materials List for Assemblies

	Assembly Name	Material #	KVA	Single / Dual Voltage	Primary Voltage	Secondary Voltage
G2.075	G2.075S.120	69351120	75	Single	7.2 kV	120 / 240 V
	G2.075S.277	69356120	75	Single	7.2 kV	277 / 480 V
	G2.075D.120	69381120	75	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.075D.277	69386120	75	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.075S.120 *	69371120	75	Single	14.4 kV	120 / 240 V
	VG2.075S.277 *	69376120	75	Single	14.4 kV	277 / 480 V
	VG2.075D.120 *	69391120	75	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.075D.277 *	69396120	75	Dual	14.4 / 7.2 kV	277 / 480 V
G2.100	G2.100S.120	69351121	100	Single	7.2 kV	120 / 240 V
	G2.100S.277	69356121	100	Single	7.2 kV	277 / 480 V
	G2.100D.120	69381121	100	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.100D.277	69386121	100	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.100S.120 *	69371121	100	Single	14.4 kV	120 / 240 V
	VG2.100S.277 *	69376121	100	Single	14.4 kV	277 / 480 V
	VG2.100D.120 *	69391121	100	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.100D.277 *	69396121	100	Dual	14.4 / 7.2 kV	277 / 480 V
G2.167	G2.167S.120	69351123	167	Single	7.2 kV	120 / 240 V
	G2.167S.277	69356123	167	Single	7.2 kV	277 / 480 V
	G2.167D.120	69381123	167	Dual	7.2 / 2.4 kV	120 / 240 V
	G2.167D.277	69386123	167	Dual	7.2 / 2.4 kV	277 / 480 V
	VG2.167S.120 *	69371123	167	Single	14.4 kV	120 / 240 V
	VG2.167S.277 *	69376123	167	Single	14.4 kV	277 / 480 V
	VG2.167D.120 *	69391123	167	Dual	14.4 / 7.2 kV	120 / 240 V
	VG2.167D.277 *	69396123	167	Dual	14.4 / 7.2 kV	277 / 480 V

* Subtractive polarity

Construction and Design Notes:
1. See IG91 for grounding.

G91-1



----- CONSTRUCTION ASSEMBLIES -----		
System Voltage	1/0 ACSR	336 ACSR
15 kV	G91-1.1	G91-1.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY FOR
SINGLE-PHASE CSP TRANSFORMER
VERTICAL CONSTRUCTION - RETIRE ONLY

G91-1

ISSUE DATE: 11/21

Materials List for Assemblies

Descriptions

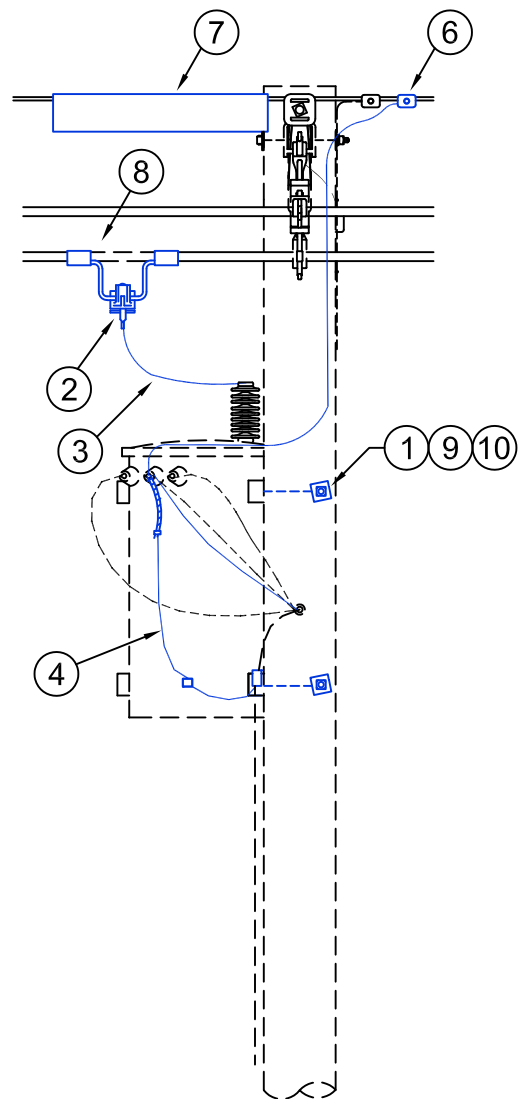
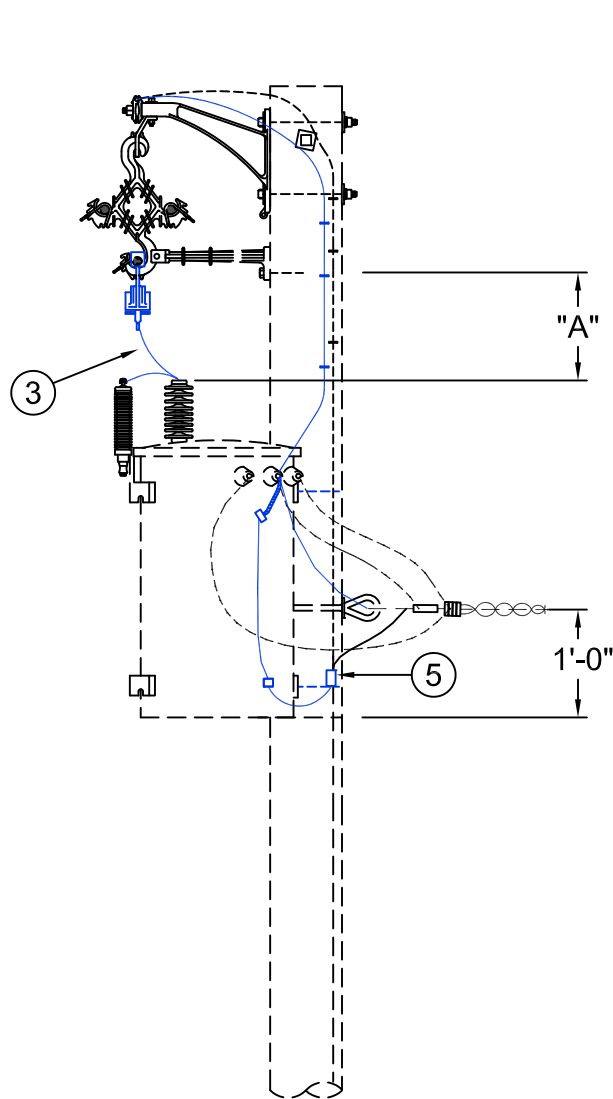
G91-1.1 1-Ph CSP Vertical 1/0

G91-1.3 1-Ph CSP Vertical 336

Ref	Material #	Description	G91-1.1	G91-1.3
1	6380514	Bolt, Machine 5/8" x 14"	2	2
2	17410000	Clamp, Hot Line 8 – 1/0	1	1
3	16510407	Cond, 4 CU Poly SD Str	8	8
4	15610401	Cond, 4 Sol CU Soft Drawn	10	10
5	17015004	Conn, GC5004 #4 Solid	1	1
6	17010502	Con, Sicame TTD2710XFBTUNI	1	
6	17010502	Con, Sicame TTD2710XFBTUNI		1
7	62000000	Stirrups, Comp 1/0	1	
7	62000336	Stirrups, Comp 336.4		1
8	71053063	Washer, Spring – 5/8"	2	2
9	71020451	Washer, Square 2 1/4" x 13/16"	2	2

Construction and Design Notes:
1. See IHG91 for grounding.

HG91-1



CONSTRUCTION DIMENSIONS

"A" ...12" min. (transformer directly beneath phases)
6" min. (transformer on back of pole)

CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 HNDX	336 HNDX
15 kV	HG91-1.1	HG91-1.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY FOR
SINGLE-PHASE CSP TRANSFORMER
HENDRIX CONSTRUCTION - RETIRE ONLY

HG91-1

ISSUE DATE: 11/21

Materials List for Assemblies

Descriptions

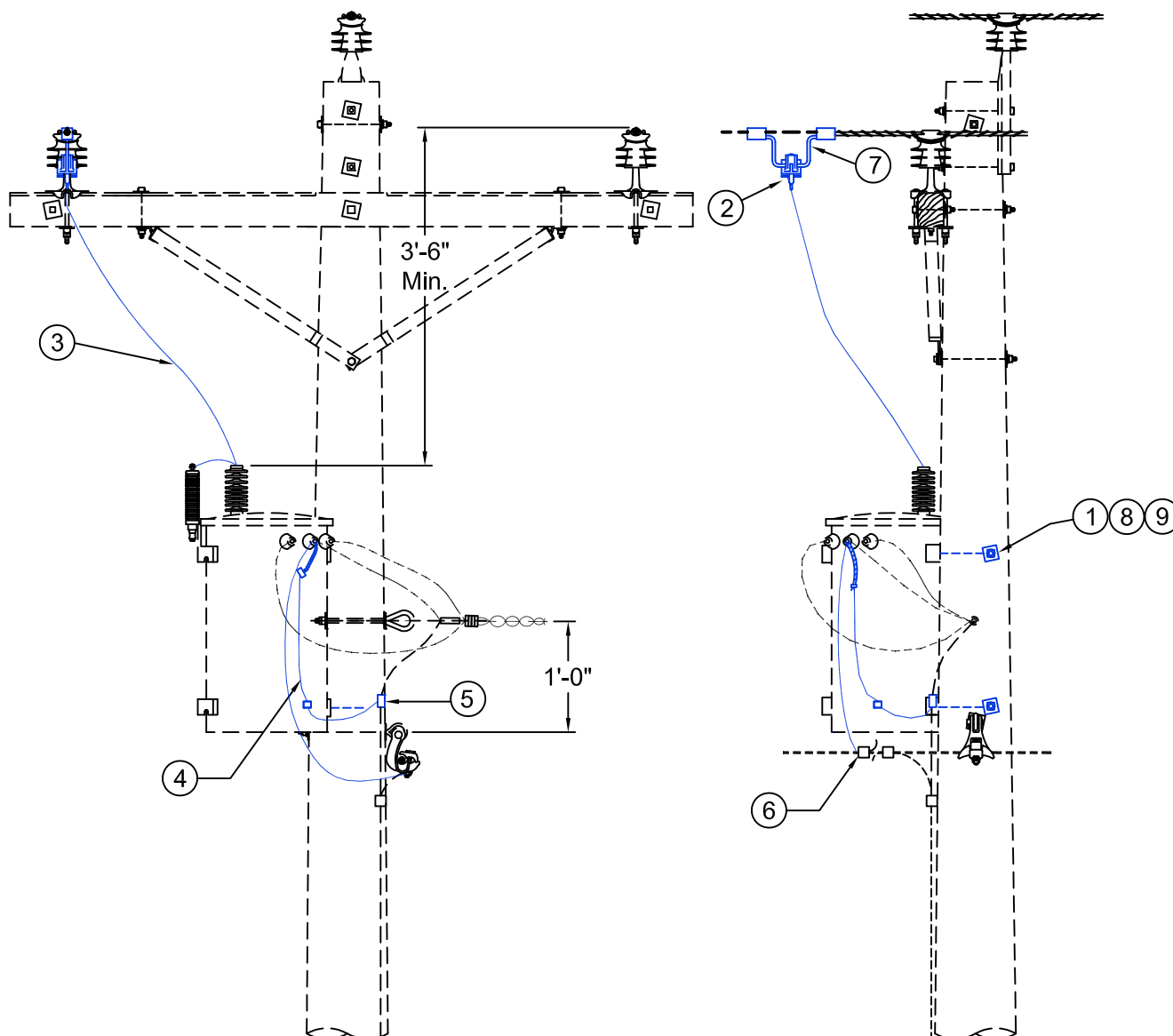
HG91-1.1 1-Ph CSP Trans Hendrix 1/0
 HG91-1.3 1-Ph CSP Trans Hendrix 336

Ref	Material #	Description	HG91-1.1	HG91-1.3
1	6380514	Bolt, Machine 5/8" x 14"	2	2
2	17410000	Clamp, Hot Line 8 – 1/0	1	1
3	16510407	Cond, 4 CU Poly SD Str	4	4
4	15610401	Cond, 4 Sol CU Soft Drawn	14	14
5	17015004	Conn, GC5004 #4 Solid	1	1
6	17010502	Con, Sicame TTD2710XFBTUNI	1	1
7	32000906	Hndx Clip-On Duc Std	3	3
8	62000510	Stirrups, Shoot-On 1/0	1	
8	62001000	Stirrups, Shoot-On 336.4		1
9	71053063	Washer, Spring – 5/8"	2	2
10	71020451	Washer, Square 2 1/4" x 13/16"	2	2

Construction and Design Notes:

1. See IG91 for grounding.

G91-2



----- CONSTRUCTION ASSEMBLIES -----

System Voltage	1/0 ACSR	336 ACSR
15 kV	G91-2.1	G91-2.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY FOR
SINGLE-PHASE CSP TRANSFORMER
CROSSARM CONSTRUCTION - RETIRE ONLY

G91-2

ISSUE DATE: 11/21

Materials List for Assemblies

Descriptions

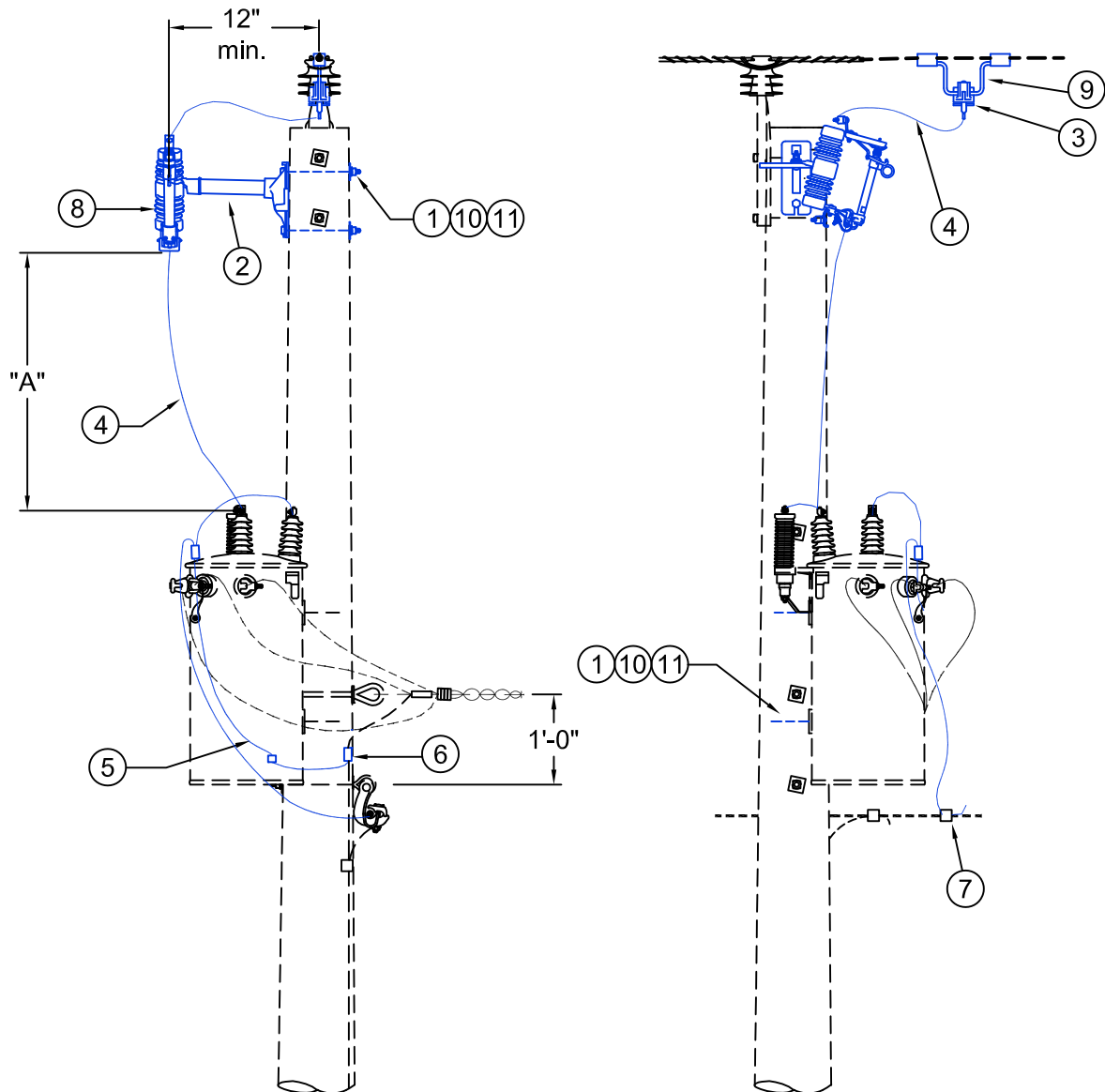
G91-2.1 1-Ph CSP Trans Crossarm 1/0

G91-2.3 1-Ph CSP Trans Crossarm 336

Ref	Material #	Description	G91-2.1	G91-2.3
1	6380514	Bolt, Machine 5/8" x 14"	2	2
2	17410000	Clamp, Hot Line 8 – 1/0	1	1
3	16510407	Cond, 4 CU Poly SD Str	8	8
4	15610401	Cond, 4 Sol CU Soft Drawn	10	10
5	17015004	Conn, GC5004 #4 Solid	1	1
6	17010502	Con, Sicame TTD2710XFBTUNI	1	
6	17010502	Con, Sicame TTD2710XFBTUNI		1
7	62000000	Stirrups, Comp 1/0	1	
7	62000336	Stirrups, Comp 336.4		1
8	71053063	Washer, Spring – 5/8"	2	2
9	71020451	Washer, Square 2 1/4" x 13/16"	2	2

Construction and Design Notes:

1. See drawing IG92 for grounding.
2. For 19.9 kV, check fuse size w/engineering.



CONSTRUCTION DIMENSIONS

"A" ... 24" min. (transformer directly beneath cutout)
12" min. (transformer on back of pole)

----- CONSTRUCTION ASSEMBLIES -----		
System Voltage	1/0 ACSR	336 ACSR
15 kV/25	G92-1.1 G92-1.1L	G92-1.3
35 kV	ZG92-1.1	ZG92-1.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY AND CUTOUT FOR
SINGLE-PHASE CONVENTIONAL TRANSFORMER
VERTICAL CONSTRUCTION

G92-1

ISSUE DATE: 9/2018

Materials List for Assemblies

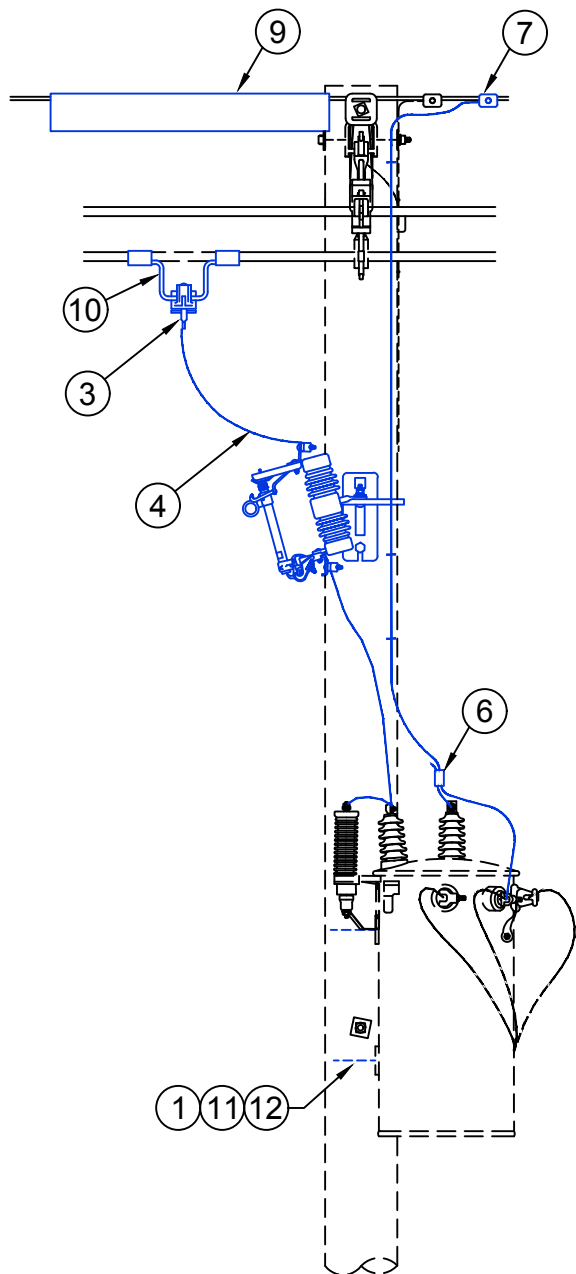
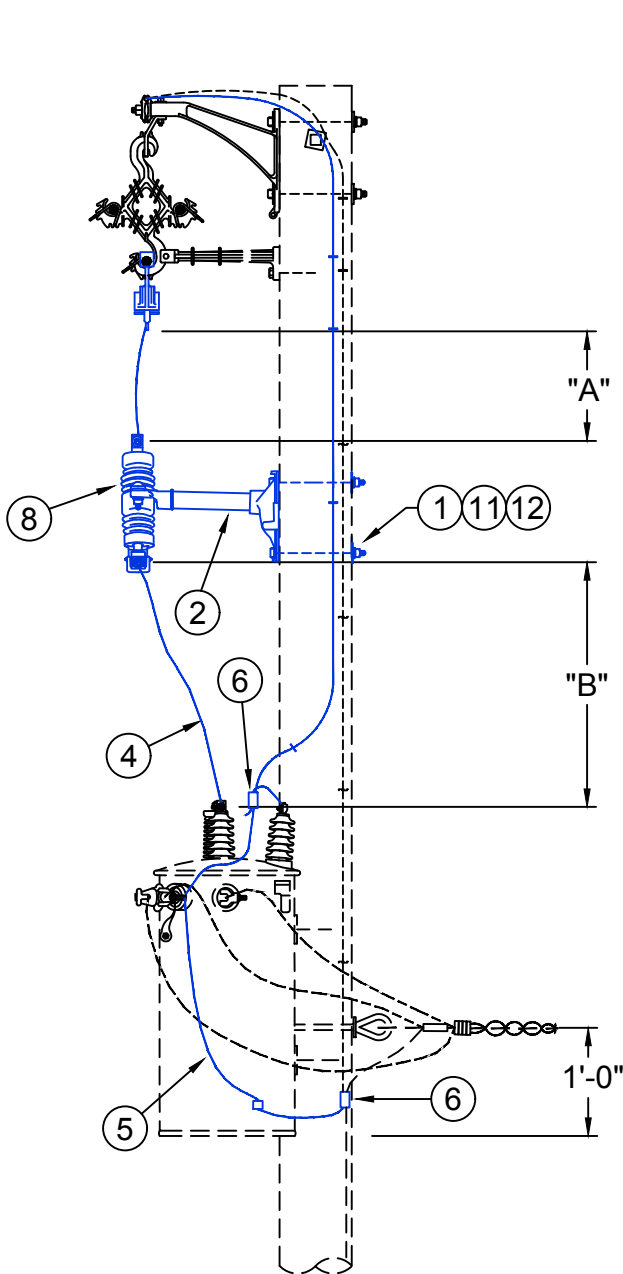
Descriptions

G92-1.1 1-Ph Conv. Trans 15kV Vertical 1/0, 12" Bracket
 G92-1.1L 1-Ph Conv. Trans 15kV Vertical 1/0, 24" Bracket
 G92-1.3 1-Ph Conv. Trans 15kV Vertical 336
 ZG92-1.1 1-Ph Conv. Trans 35kV Vertical 1/0
 ZG92-1.3 1-Ph Conv. Trans 35kV Vertical 336

Ref	Material #	Description	G92-1.1	G92-1.1L	G92-1.3	ZG92-1.1	ZG92-1.3
1	6380514	Bolt, Machine 5/8" x 14"	4	4	4	4	4
2	7800750	Brkt, Comb Arr/Cutout 12"	1		1	1	1
2	7800725	Brkt, Comb Arr/Cutout 24"		1			
3	17410000	Clamp, Hot Line #8 – 1/0	1	1	1	1	1
4	16510407	Cond, 4 CU Poly SD Str	8	8	8	8	8
5	15610401	Cond, 4 Sol CU Soft Drawn	10	10	10	10	10
6	17015004	Conn, GC5004 #4 Solid	2	2	2	2	2
7	17010502	Con, Sicame TTD2710XFBTUNI	1	1		1	
7	17010502	Con, Sicame TTD2710XFBTUNI			1		1
8	18312100	Cutout, 15/25 kV	1	1	1		
8	18312101	Cutout, 19.9/35 kV				1	1
9	62000000	Stirrup, Comp 1/0	1	1		1	
9	62000336	Stirrup, Comp 336.4			1		1
10	71053063	Washer, Spring - 5/8"	4	4	4	4	4
11	71020451	Washer, Sq. 2 1/4" x 13/16"	4	4	4	4	4

Construction and Design Notes:
1. See IHG92 for grounding.

HG92-1



CONSTRUCTION DIMENSIONS

- "A" ... 12" min. (cutout directly beneath phases)
6" min. (cutout on back of pole)
- "B" ... 24" min. (transformer directly beneath cutout)
6" min. (transformer on back of pole)

CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 HNDX	336 HNDX
15 kV	HG92-1.1	HG92-1.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY AND CUTOUT FOR
SINGLE-PHASE CONVENTIONAL TRANSFORMER
HENDRIX CONSTRUCTION

HG92-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

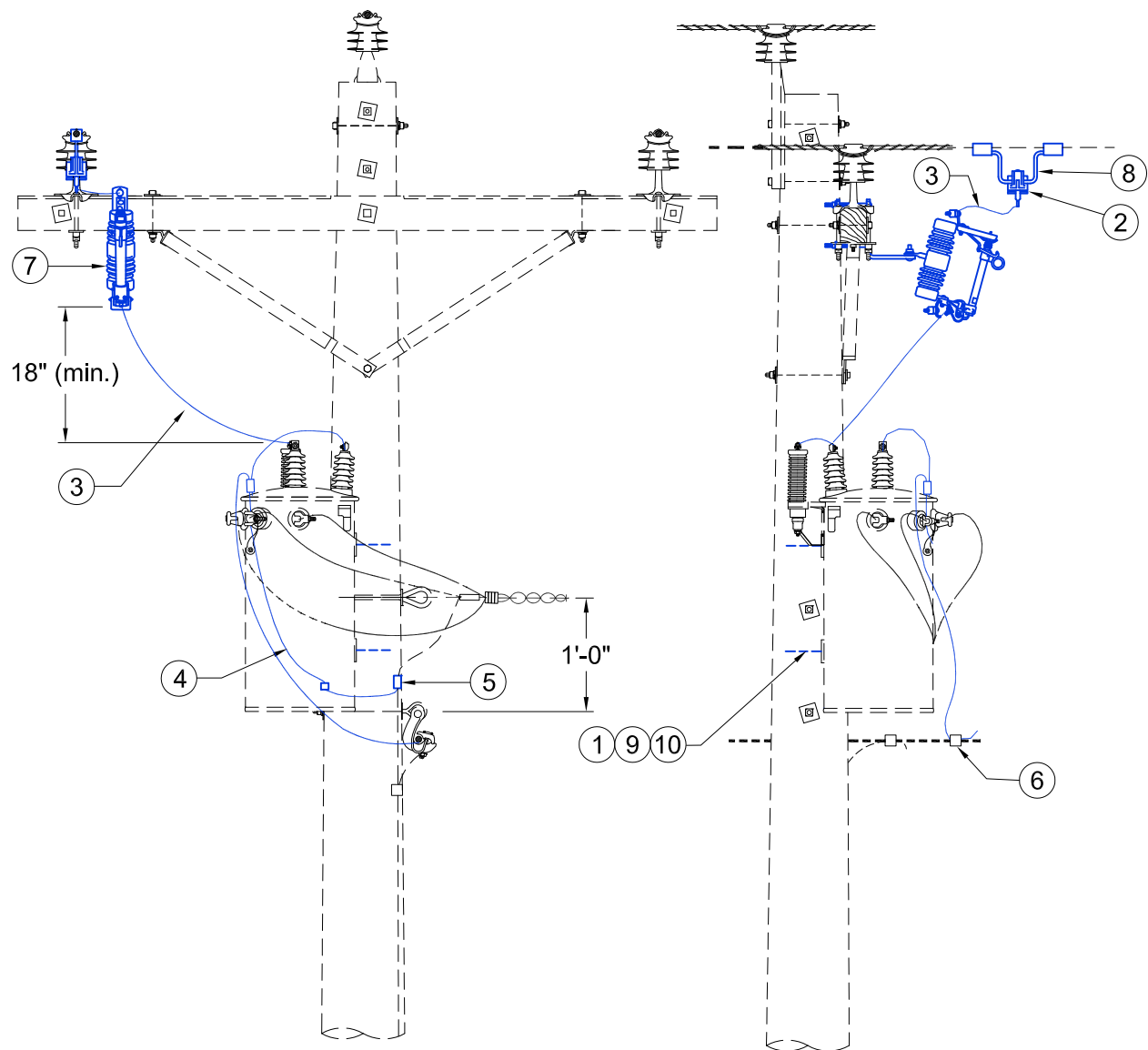
HG92-1.1 1-Ph Conv Trans Hendrix 1/0

HG92-1.3 1-Ph Conv Trans Hendrix 336

Ref	Material #	Description	HG92-1.1	HG92-1.3
1	6380514	Bolt, Machine 5/8" x 14"	4	4
2	7800750	Brkt, Comb Arr/Cutout 12"	1	1
3	17410000	Clamp, Hot Line 8 – 1/0	1	1
4	16510407	Cond, 4 CU Poly SD Str	8	8
5	15610401	Cond, 4 Sol CU Soft Drawn	12	12
6	17015004	Conn, GC5004 #4 Solid	5	5
7	17010502	Con, Sicame TTD2710XFBTUNI	1	1
8	18312100	Cutout 15/25 kV	1	1
9	32000906	Hndx Clip-On Duc Std	3	3
10	62000510	Stirrups, Shoot-On 1/0	1	
10	62001000	Stirrups, Shoot-On 336.4		1
11	71053063	Washer, Spring – 5/8"	4	4
12	71020451	Washer, Square 2 1/4" x 13/16"	4	4

Construction and Design Notes:
1. See drawing IG91 for grounding.

G92-2



CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 ACSR	336 ACSR
15 kV	G92-2.1	G92-2.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY AND CUTOUT FOR
SINGLE PHASE CONVENTIONAL TRANSFORMER
CROSSARM CONSTRUCTION

G92-2

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

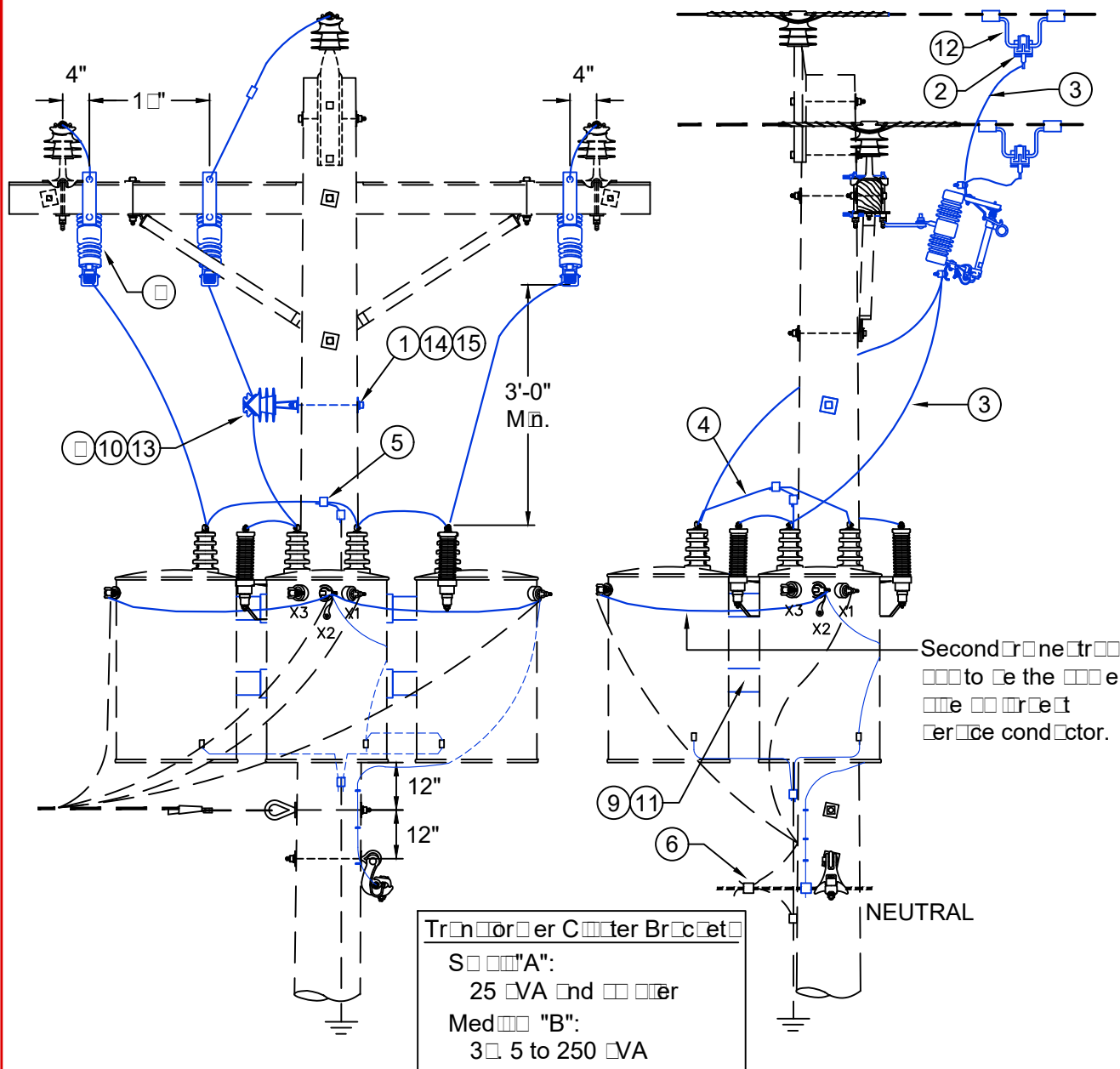
G92-2.1 1-Ph Conv. Trans Crossarm 1/0

G92-2.3 1-Ph Conv. Trans Crossarm 336

Ref	Material #	Description	G92-2.1	G92-2.3
1	6380514	Bolt, Machine 5/8" x 14"	2	2
2	17410000	Clamp, Hot Line #8 – 1/0	1	1
3	16510407	Cond, 4 CU Poly SD Str	8	8
4	15610401	Cond, 4 Sol CU Soft Drawn	10	10
5	17015004	Conn, GC5004 #4 Solid	3	3
6	17010502	Con, Sicame TTD2710XFBTUNI	1	
6	17010502	Con, Sicame TTD2710XFBTUNI		1
7	18312100	Cutout, 15/25 kV	1	1
8	62000510	Stirrup, Comp 1/0	1	
8	62001000	Stirrup, Comp 336.4		1
9	71053063	Washer, Spring – 5/8"	2	2
10	71020451	Washer, Square 2 1/4" x 13/16"	2	2

Construction and Design Notes

1. The above is for 15KV construction. See VG93 for 25KV construction.
2. See note IG9-CONNECTION.3 and IG93 for ground and bonding instructions.



Designation

- G93A.1... 3-Ph, S.B., 15KV, 1/0
- G93B.1... 3-Ph, Med Brt, 15KV, 1/0
- G93A.3... 3-Ph, S.B., 336
- G93B.3... 3-Ph, Med Brt, 336

CONSTRUCTION ASSEMBLIES

Size Voltage	1/0 ACSR	336 ACSR
15 KV	G93A.1 G93B.1	G93A.3 G93B.3



CONSTRUCTION STANDARDS
MOUNTING ASSEMBLY AND CUTOUTS FOR
THREE-PHASE TRANSFORMER BANK
CLUSTER MOUNT

G93

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

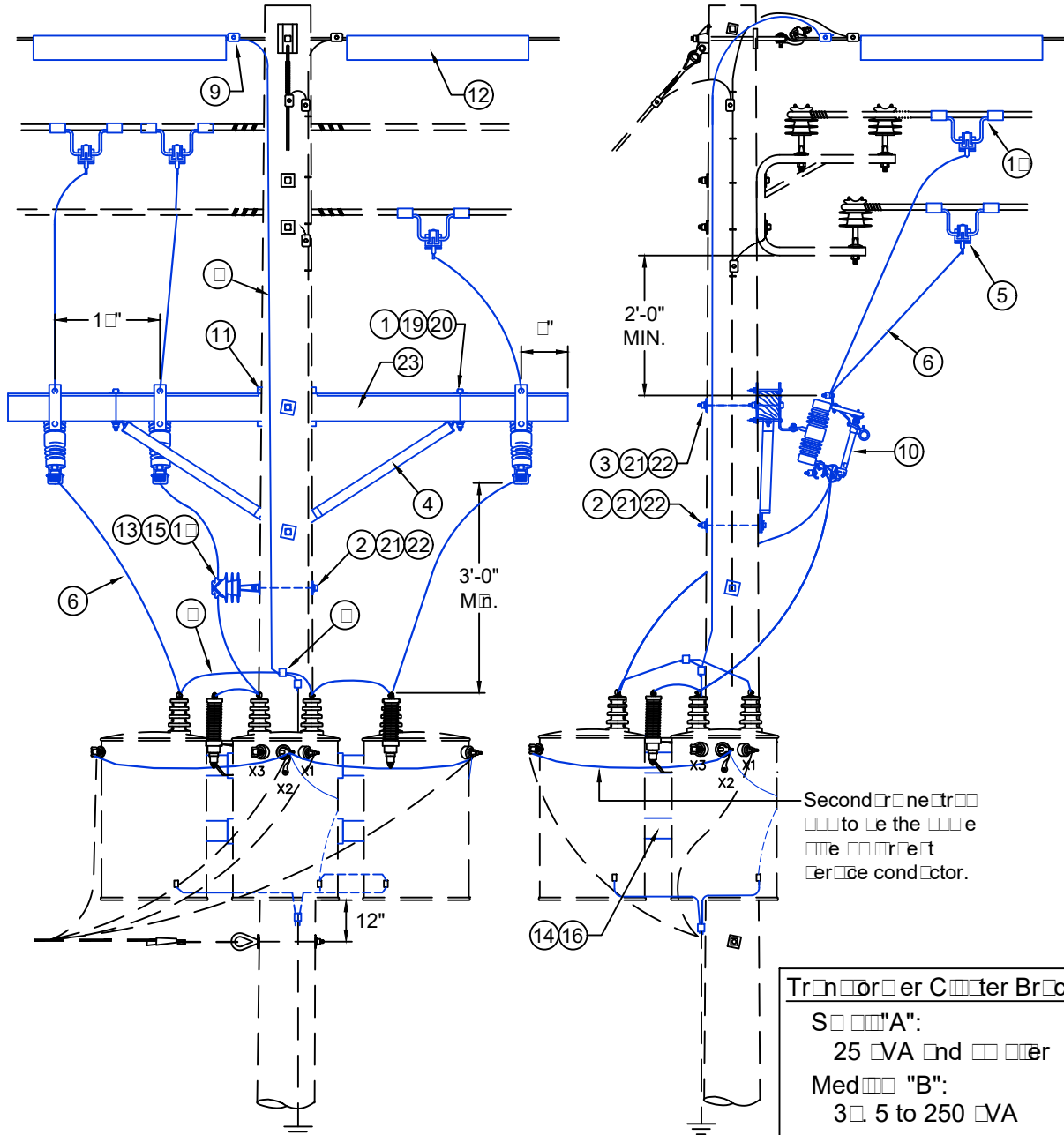
G93A.1	Xfmr Bank, 3-Ph, Sm Brkt, 15kV, 1/0
G93B.1	Xfmr Bank, 3-Ph, Med Brkt, 15kV, 1/0
G93A.3	Xfmr Bank, 3-Ph, Sm Brkt, 15kV, 336
G93B.3	Xfmr Bank, 3-Ph, Med Brkt, 15kV, 336

			G93A.1	G93B.1	G93A.3	G93B.3
Ref	Material #	Description				
1	6380514	Bolt, Machine 5/8" x 14"	1	1	1	1
2	17410000	Clamp, Hot Line 8 – 1/0	3	3	3	3
3	16510407	Cond 4 CU Poly SD Str	30	30	30	30
4	15610401	Cond 4 Sol CU Soft Drawn	10	10	10	10
5	17015004	Conn: GC 5004 #4 Solid	4	4	4	4
6	17010502	Con, Sicame TTD2710XFBTUNI	1	1		
6	17010502	Con, Sicame TTD2710XFBTUNI			1	1
7	18312100	Cutout 15/25 kV	3	3	3	3
8	32000901	Hndx Pin Ins Poly 15 kV	1	1	1	1
9	31002440	Hngr, 3-Way 0-25kVA	1		1	
9	31002490	Hngr, 3-Way 37-250		1		1
10	00340510	Pin, Adapter, 5/8" Bolt, 1"	1	1	1	1
11	55504440	Screw Lag, 1/2" x 4"	2	2	2	2
12	62000510	Stirrups, #4 – 1/0 Comp	3	3		
12	62001000	Stirrups, #4/0 to 477 ACSR Comp			3	3
13	67110000	Tie Wire, Alum Ins No 4 Solid	6	6	6	6
14	71053063	Washer, Spring – 5/8"	1	1	1	1
15	71020451	Washer, Square 2 1/4" x 2 1/4"	2	2	2	2

Construction and Detailing Notes

HG93

1. The above are approved for 15 and 25 kV construction.
2. See instruction code IG9-CONNECTION.3 and IHG93 for main and secondary connection.
3. Work on transformer enclosure mounted on outside of code clearance for main can be continued.



Description

HG93A.1... 3-Ph, Hnd, S Brt, 1/0
 HG93B.1... 3-Ph, Hnd, Med Brt, 1/0
 HG93A.3... 3-Ph, Hnd, S Brt, 336
 HG93B.3... 3-Ph, Hnd, Med Brt, 336

CONSTRUCTION ASSEMBLIES

Site Voltage	1/0 HND	336 HND
15/25 kV	HG93A.1 HG93B.1	HG93A.3 HG93B.3



CONSTRUCTION STANDARDS
 MOUNTING ASSEMBLY AND CUTOUTS FOR
 THREE-PHASE TRANSFORMER BANK
 CLUSTER MOUNT WITH WORKARM, HENDRI

HG93

ISSUE DATE: 05/16

Materials List for Assemblies

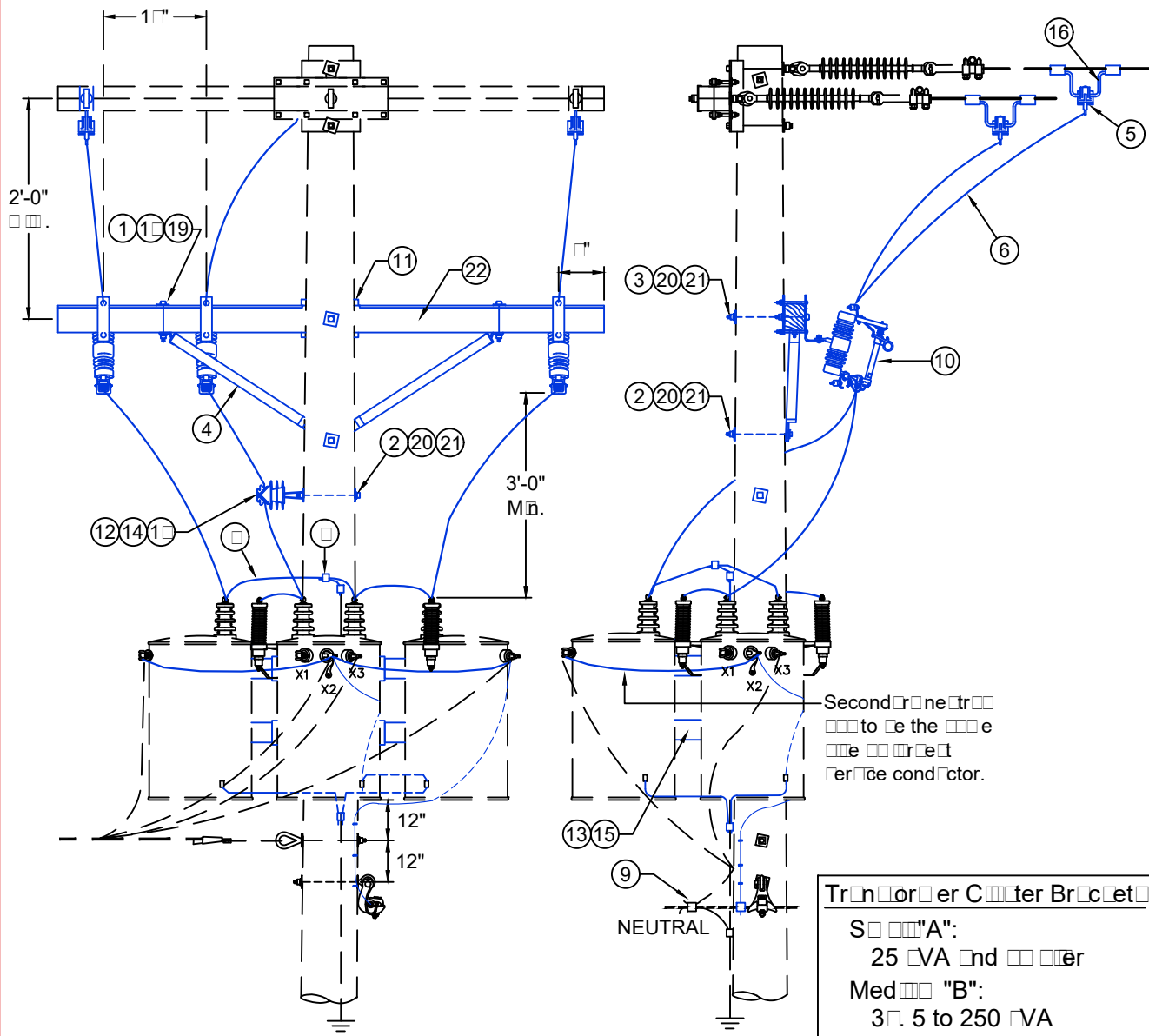
Descriptions

HG93A.1	Xfmr Bank, 3-Ph, Hndx, Sm Brkt, 1/0
HG93B.1	Xfmr Bank, 3-Ph, Hndx, Med Brkt, 1/0
HG93A.3	Xfmr Bank, 3-Ph, Hndx, Sm Brkt, 336
HG93B.3	Xfmr Bank, 3-Ph, Hndx, Med Brkt, 336

Ref	Material #	Description	HG93A.1	HG93B.1	HG93A.3	HG93B.3
1	6380406	Bolt, Machine 1/2" x 6"	2	2	2	2
2	6380514	Bolt, Machine 5/8" x 14"	2	2	2	2
3	6380518	Bolt, Machine 5/8" x 18"	1	1	1	1
4	7535168	Brace: Wood 60" (Pair)	1	1	1	1
5	17410000	Clamp, Hot Line 8 – 1/0	3	3	3	3
6	16510407	Cond 4 CU Poly SD Str	30	30	30	30
7	15610401	Cond 4 Sol CU Soft Drawn	25	25	25	25
8	17015004	Conn: GC 5004 #4 Solid	4	4	4	4
9	17010502	Con, Sicame TTD2710XFBTUNI	1	1	1	1
10	18312100	Cutout 15/25 kV	3	3	3	3
11	29799999	Gain Plates	1	1	1	1
12	32000906	Hndx, Clip-On Line Duc STD 8'	6	6	6	6
13	32000901	Hndx Pin, Ins, Poly 15kV	1	1	1	1
14	31002440	Hngr, 3-Way 0-25kVA	1		1	
14	31002490	Hngr, 3-Way 37-250		1		1
15	00340510	Pin, Adapter, 5/8" Bolt 1"	1	1	1	1
16	55504440	Screw Lag, 1/2 x 4"	2	2	2	2
17	62000510	Stirrups, Shoot-On 1/0	3	3		
17	62001000	Stirrups, Shoot-On 336.4			3	3
18	67110000	Tie Wire, Alum Ins, No 4 Solid	6	6	6	6
19	71035931	Washer, Round 1/2"	2	2	2	2
20	71053050	Washer, Spring – 1/2"	2	2	2	2
21	71053063	Washer, Spring – 5/8"	3	3	3	3
22	71020451	Washer, Square 2 1/4" x 13/16"	5	5	5	5
23	18210311	Xarm 8' 3 3/4" x 4 3/4"	1	1	1	1

Construction and Design Note

1. The device is required for 25KV construction. It is also required for 15KV construction when a ground rod is required.
2. See instruction code IG9-CONNECTION.3 and IG93 for pin and ground connection.
3. Work on transformer can be mounted on outside of code clearance for ground cannot be mounted.



Definition

- VG93A.1... 3-Ph, S Brt, 25kV, 1/0
 VG93B.1... 3-Ph, Med Brt, 25kV, 1/0
 VG93A.3... 3-Ph, S Brt, 25kV, 336
 VG93B.3... 3-Ph, Med Brt, 25kV, 336

CONSTRUCTION ASSEMBLIES

Size Voltage	1/0 ACSR	336 ACSR
15/25 kV	VG93A.1 VG93B.1	VG93A.3 VG93B.3



CONSTRUCTION STANDARDS
 MOUNTING ASSEMBLY AND CUTOUTS FOR
 THREE-PHASE TRANSFORMER BANK
 CLUSTER MOUNT WITH WORKARM

VG93

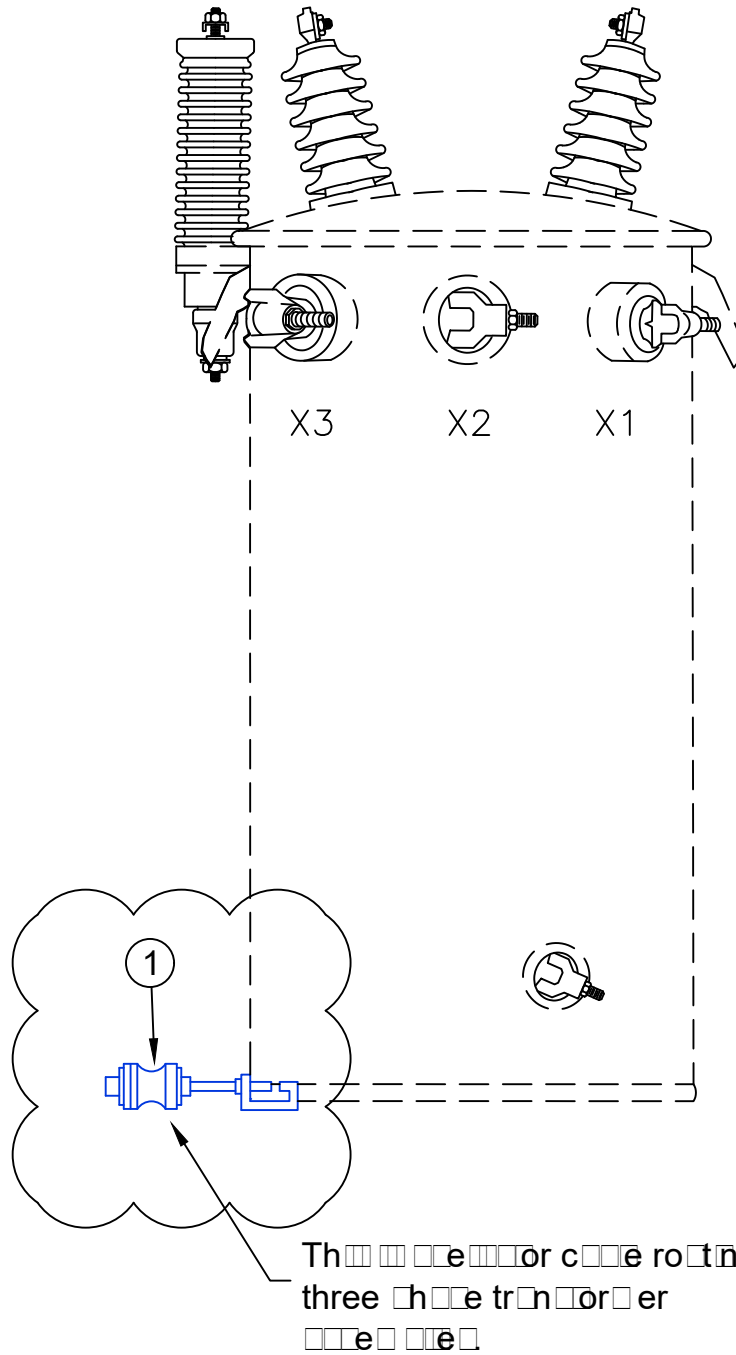
ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

VG93A.1	Xfmr Bank, 3-Ph Sm Brkt, 25kV, 1/0
VG93B.1	Xfmr Bank, 3-Ph Med Brkt, 25kV, 1/0
VG93A.3	Xfmr Bank, 3-Ph Sm Brkt, 25kV, 336
VG93B.3	Xfmr Bank, 3-Ph Med Brkt, 25kV, 336

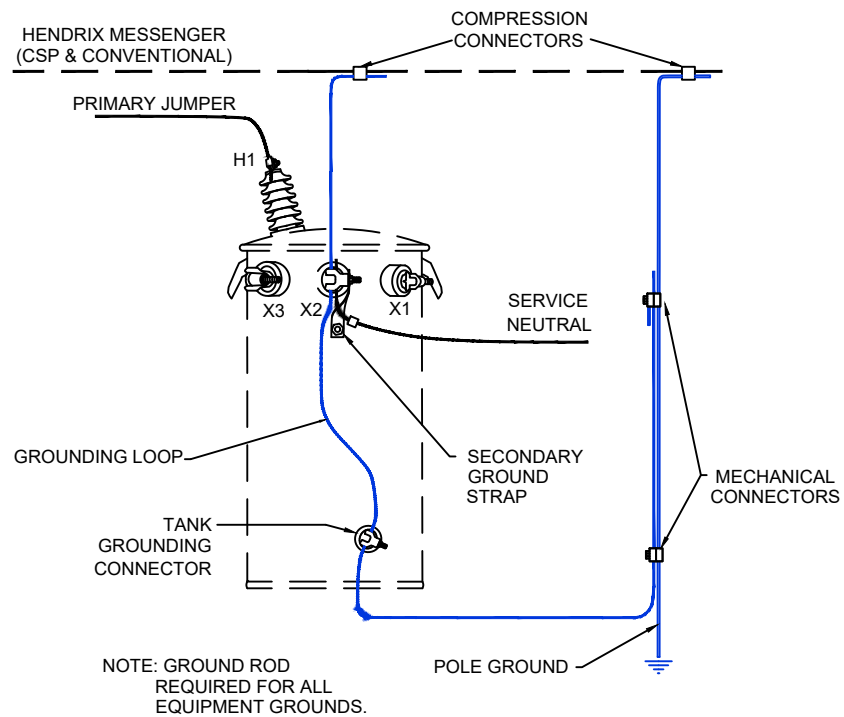
Ref	Material #	Description	VG93A.1	VG93B.1	VG93A.3	VG93B.3
1	6380406	Bolt, Machine 1/2" x 6"	2	2	2	2
2	6380514	Bolt, Machine 5/8" x 14"	2	2	2	2
3	6380518	Bolt, Machine 5/8" x 18"	1	1	1	1
4	7535168	Brace: Wood 60" (Pair)	1	1	1	1
5	17410000	Clamp, Hot Line 8 – 1/0	3	3	3	3
6	16510407	Cond 4 CU Poly SD Str	30	30	30	30
7	15610401	Cond 4 Sol CU Soft Drawn	10	10	10	10
8	17015004	Conn: GC 5004 #4 Solid	4	4	4	4
9	17010502	Con, Sicame TTD2710XFBTUNI	1	1		
9	17010502	Con, Sicame TTD2710XFBTUNI			1	1
10	18312100	Cutout 15/25 kV	3	3	3	3
11	29799999	Gain Plate	1	1	1	1
12	32000903	Hndx, Pin Ins Poly 35kV	1	1	1	1
13	31002440	Hngr, 3-Way 0-25kVA	1		1	
13	31002490	Hngr, 3-Way 37-250		1		1
14	00340512	Pin, Adapter 5/8" Bolt, 1 3/8"	1	1	1	1
15	5550440	Screw, Lag 1/2" x 4"	2	2	2	2
16	62000510	Stirrups, #4 – 1/0 Comp	3	3		
16	62001000	Stirrups, #4/0 to 477 ACSR Comp			3	3
17	67110000	Tie Wire, Alum Ins, No 4 Solid	6	6	6	6
18	71035931	Washer, Round 1/2"	2	2	2	2
19	71053050	Washer, Spring – 1/2"	2	2	2	2
20	71053063	Washer, Spring – 5/8"	3	3	3	3
21	71020451	Washer, Square 2 1/4" x 13/16"	4	4	4	4
22	18210311	Xarm 8' 3 3/4" x 4 3/4"	1	1	1	1



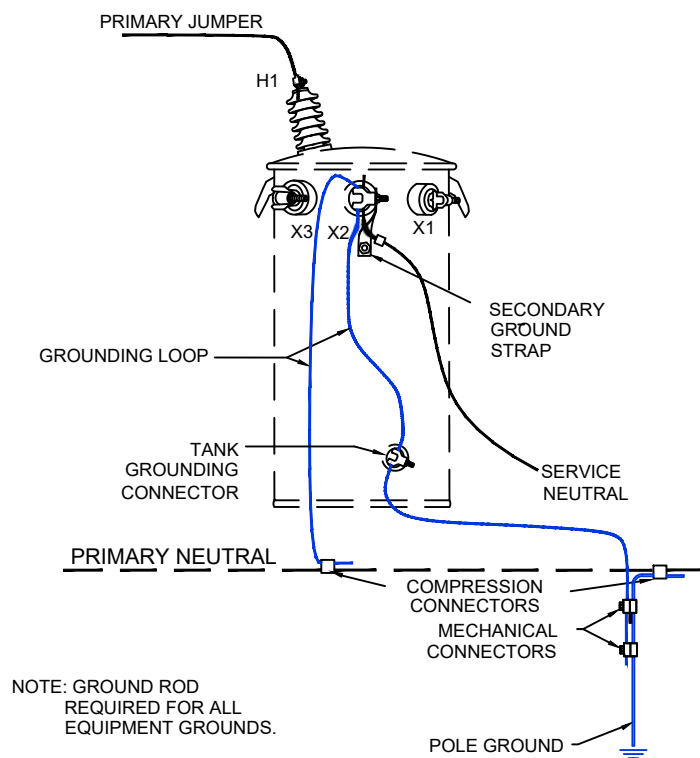
Ref. No.	Material #	Description	G9-1
1	7809700	Bracket, transformer secondary	1

CSP TRANSFORMER ON SPACER CABLE

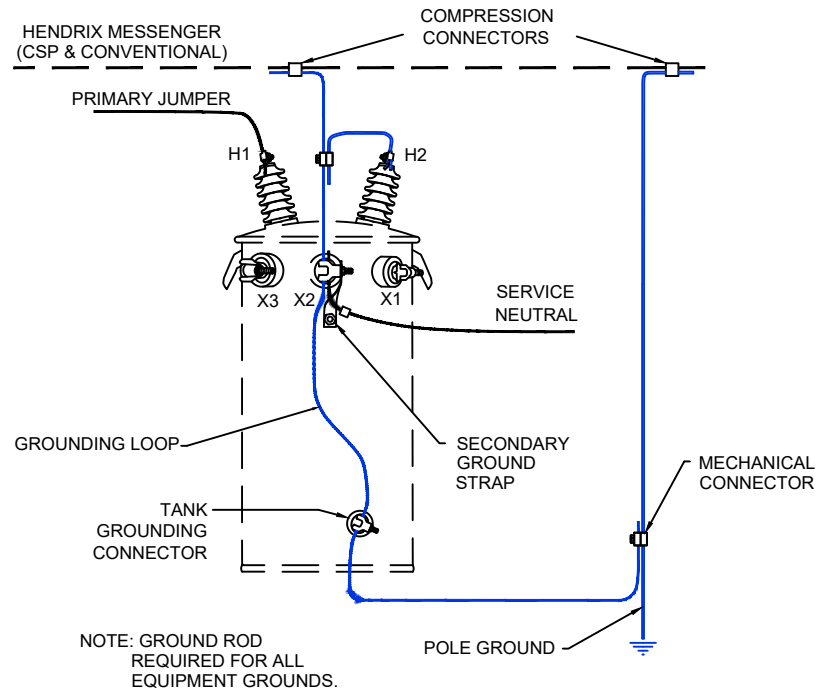
IG91



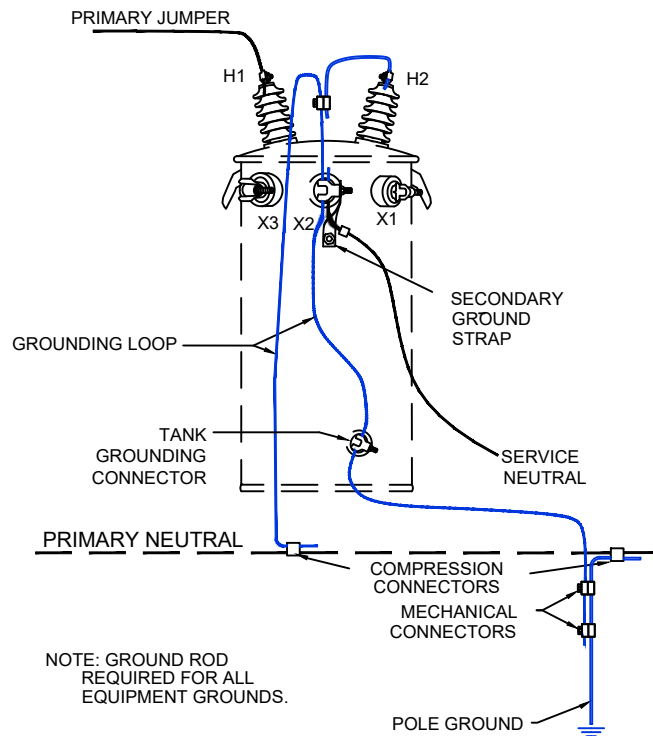
CSP TRANSFORMER ON OPEN WIRE



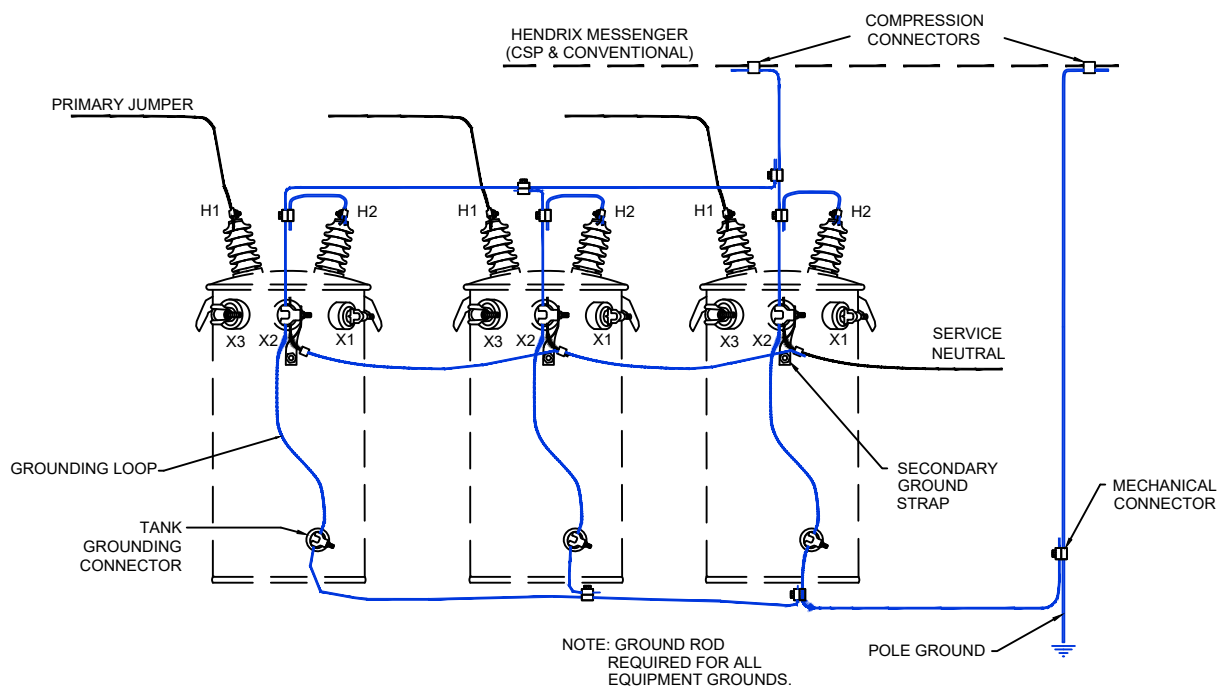
CONVENTIONAL TRANSFORMER ON SPACER CABLE



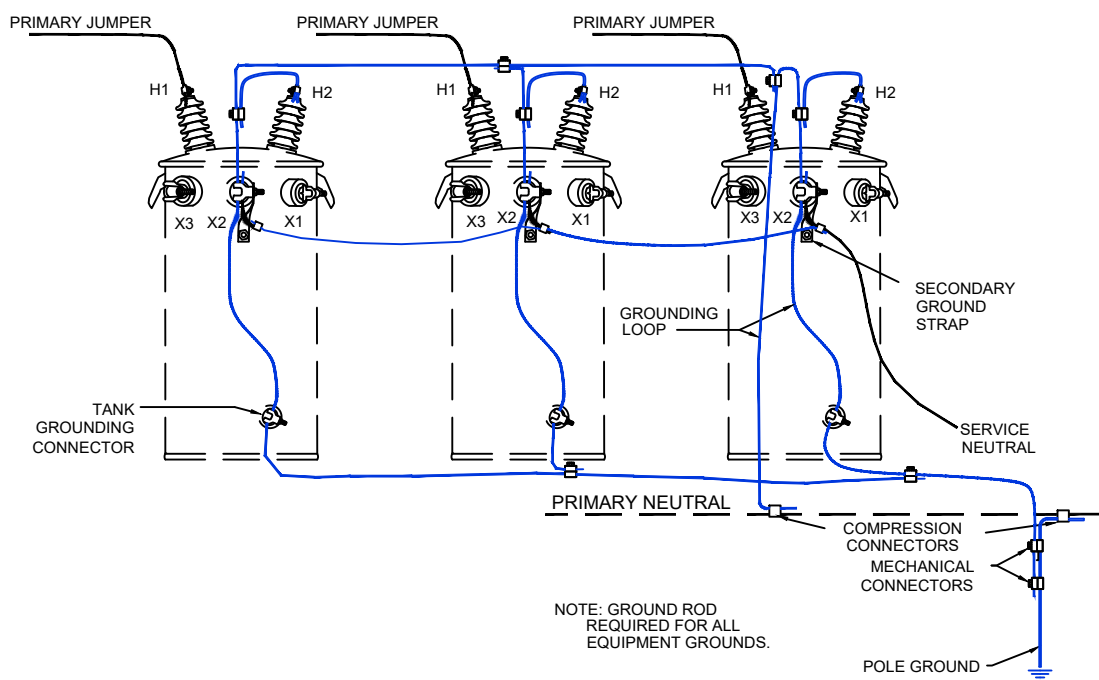
CONVENTIONAL TRANSFORMER ON OPEN WIRE

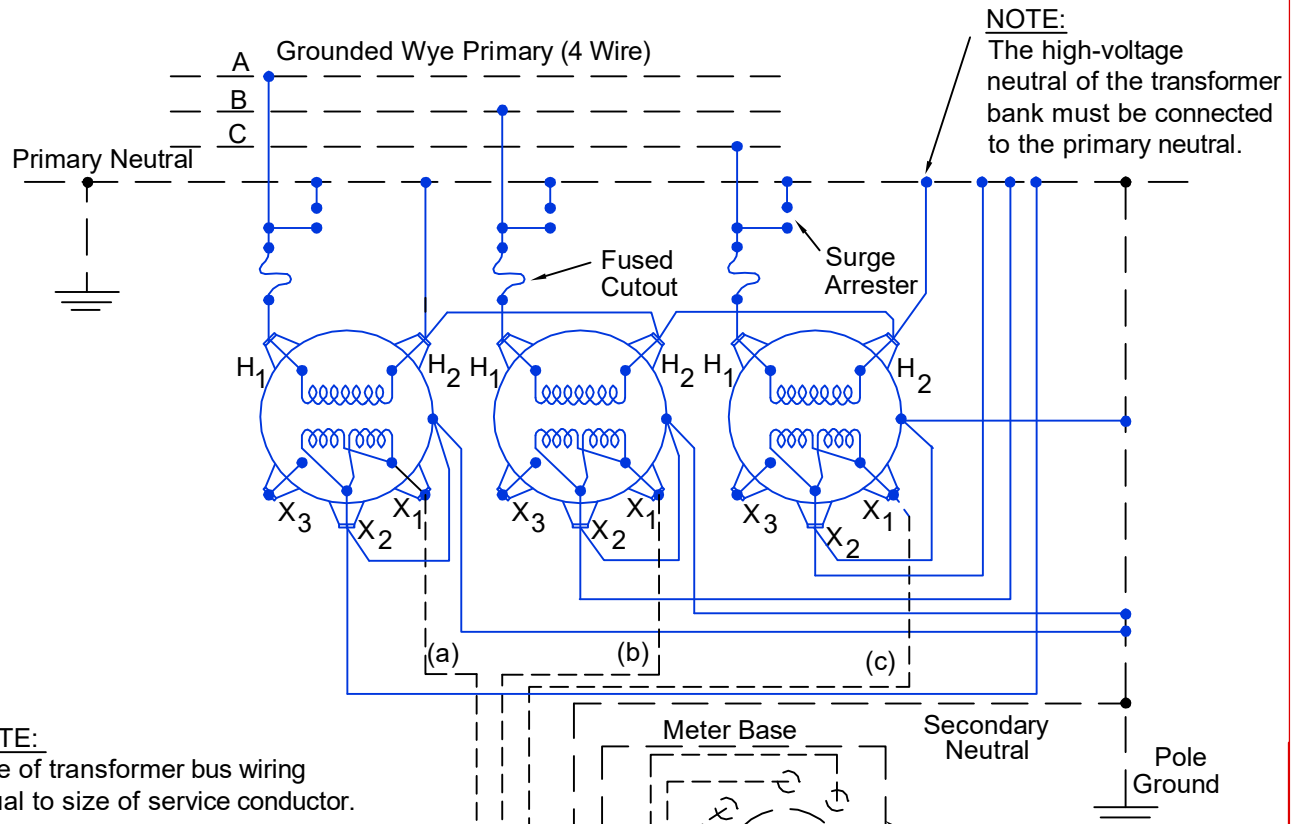


3-PHASE TRANSFORMER BANK ON SPACER CABLE



3-PHASE TRANSFORMER BANK ON OPEN WIRE





NOTE:
Size of transformer bus wiring equal to size of service conductor.

APPLICATION:

Used to supply 120/208 or 277/480 volt, three-phase power loads.

Reconnect secondary windings of transformers as shown. Matched (impedance and kVA) transformers are usually used.

BANK RATING:

Each unit will supply 1/3 of the three-phase load and all of the single-phase load connected to it.

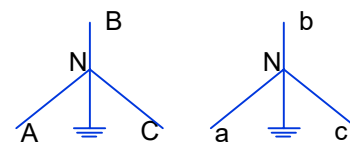
CAUTION:

The primary and secondary neutrals must be firmly tied together and grounded or else excessive secondary voltages may develop.

4 Wire-Wye Secondary
120/208 Volt (277/480)

VOLTAGE POTENTIALS-SECONDARY	
PHASES	VOLTAGE
a-b	208 VOLTS (480)
b-c	208 VOLTS (480)
a-c	208 VOLTS (480)
a-N	120 VOLTS (277)
b-N	120 VOLTS (277)
c-N	120 VOLTS (277)

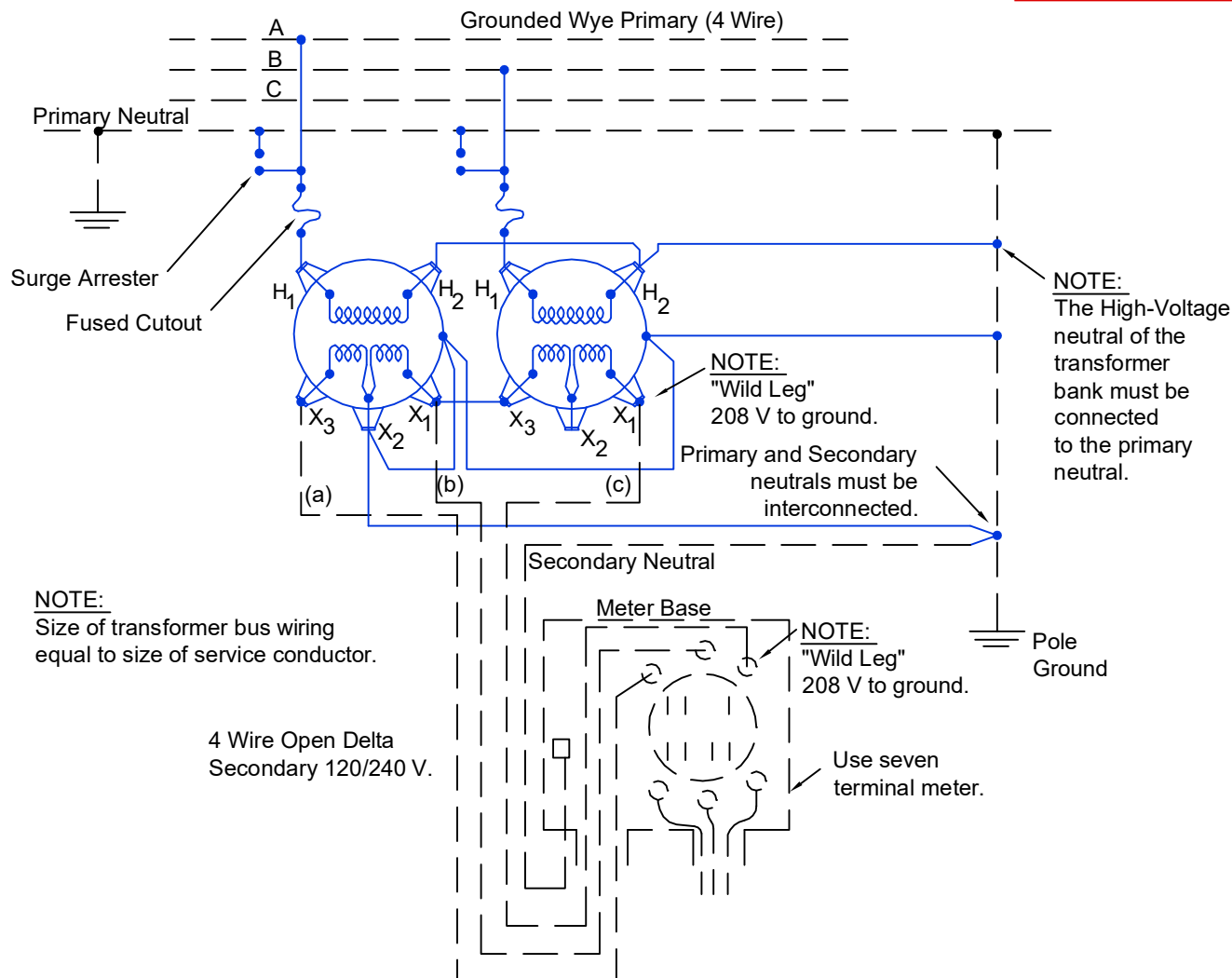
0° ANGULAR DISPLACEMENT



(Additive Polarity - See TRANSFORMER SPECIFICATIONS)



CONSTRUCTION STANDARDS
TRANSFORMER/METER CONNECTION GUIDE
GROUNDED WYE-GROUNDED WYE
FOR 120/208 AND 277/480 VOLT POWER LOADS



APPLICATION:

Used to supply large single-phase, 120/240 volt loads with small amount of three phase loads. Also used when only two phases of primary are available or during emergencies when one unit of a four-wire, wye-delta bank is disabled.

One-bushing or two-bushing transformers may be used. Usually transformers of different kVA sizes are used.

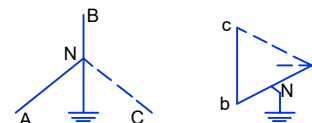
BANK RATING:

This bank has only 86.6% of the rating of the two units making up the three-phase bank and only 57.7% of the three-phase rating of a closed delta-delta bank of three transformers. Thus, it is relatively inefficient where three-phase loads predominate.

VOLTAGE POTENTIALS-SECONDARY

PHASES	VOLTAGE
a-b	240 VOLTS
b-c	240 VOLTS
a-c	240 VOLTS
a-N	120 VOLTS
b-N	120 VOLTS
c-N	208 VOLTS

210° ANGULAR DISPLACEMENT



(Additive Polarity - See TRANSFORMER SPECIFICATIONS)

Underground Transformers 20

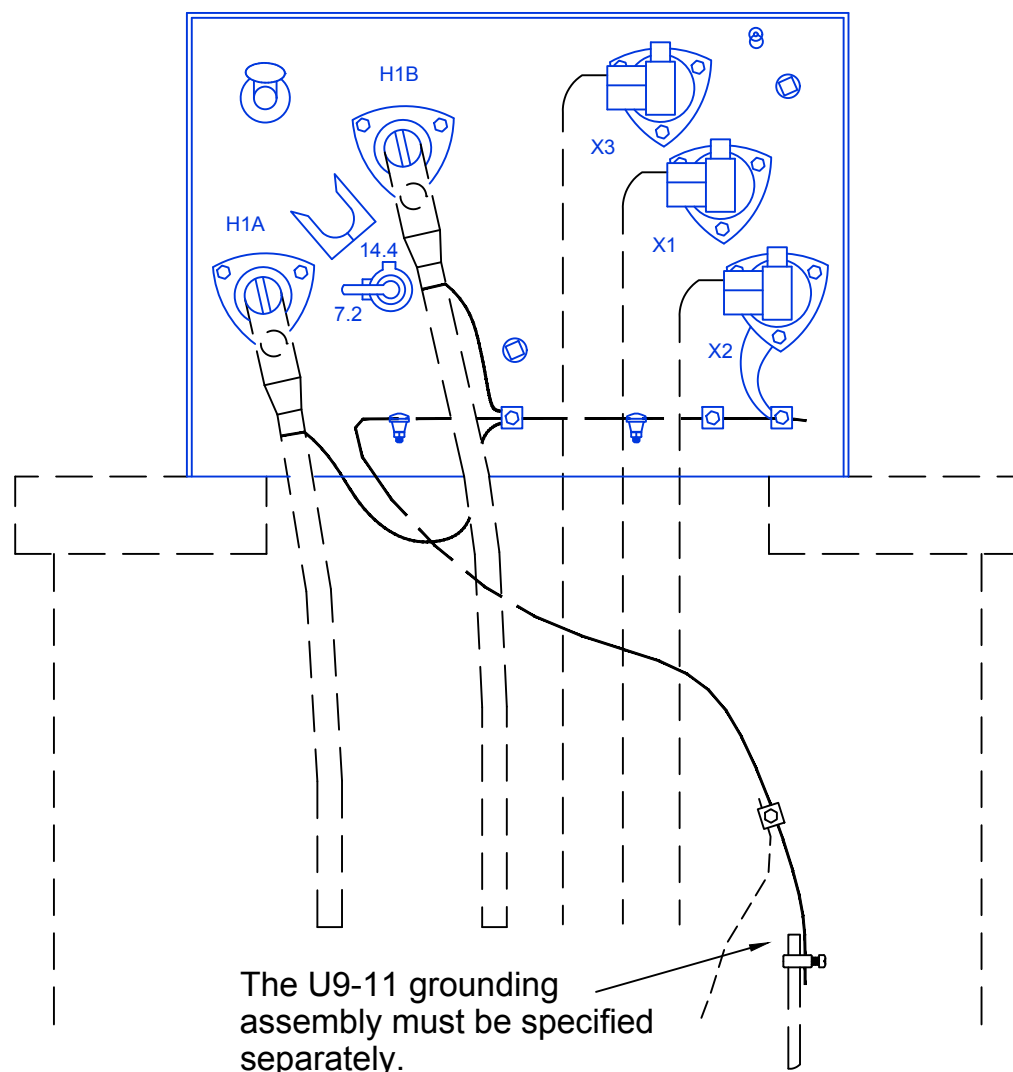
Transformer Assemblies

UG2 Single Phase Padmount Transformers

UG3 Three Phase Padmount Transformers

U9-11 Padmount equipment ground

Miscellaneous Assemblies (future)



The U9-11 grounding assembly must be specified separately.

SINGLE-PHASE PADMOUNT TRANSFORMER

UG Conventional transformers available in following configurations:

- Primary Voltage 7.2 kV
- Primary Voltage 14.4 kV *
- Primary Voltage 7.2/2.4 kV
- Primary Voltage 14.4/7.2 kV *
- Secondary Voltage 120/240 v

* Subtractive polarity

ASSEMBLY NAME	Transformer Size
	KVA
UG2.015	15
UG2.025	25
UG2.037	37.5
UG2.050	50
UG2.075	75
UG2.100	100
UG2.167	167



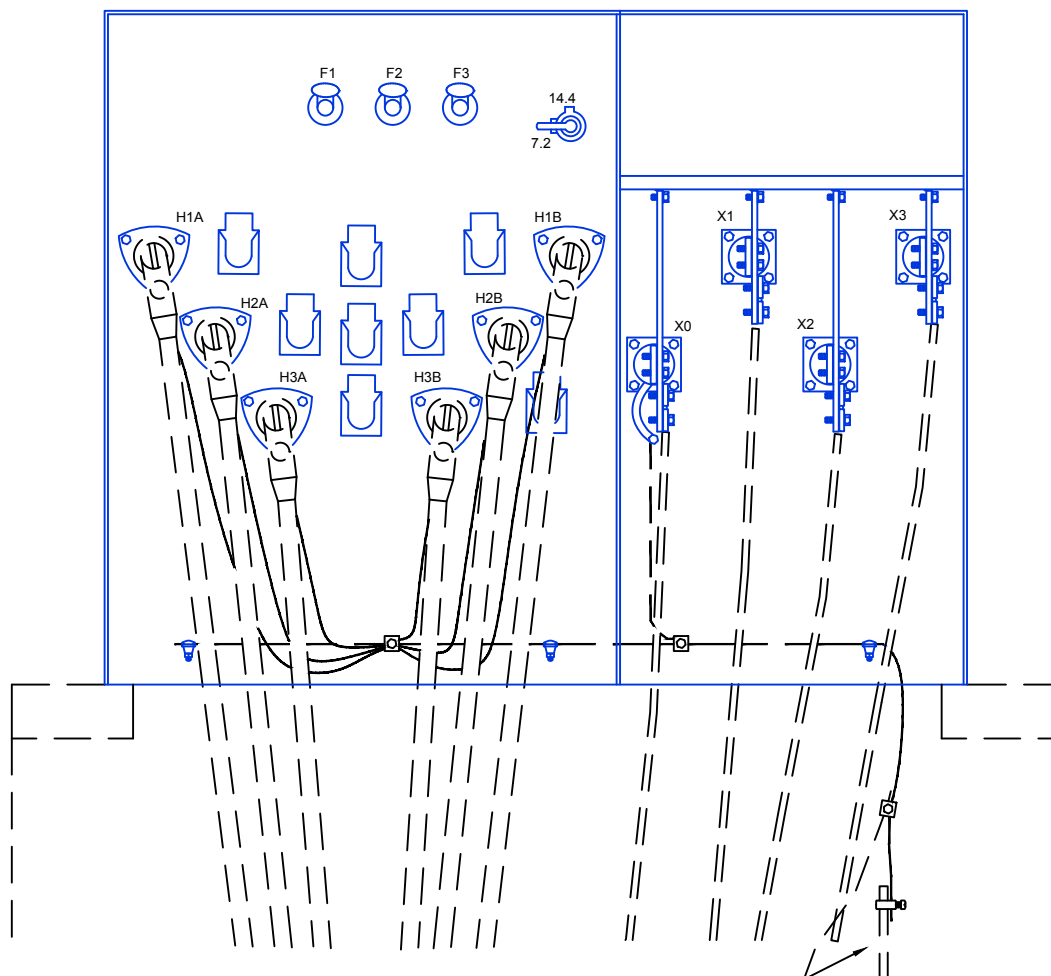
CONSTRUCTION STANDARDS

SINGLE-PHASE PADMOUNT TRANSFORMERS

Materials List for Assemblies

	Assembly Name	Material #	KVA	Single / Dual Voltage	Primary Voltage	Secondary Voltage
UG2.015	UG2.015S.120	69811813	15	Single	7.2 kV	120 / 240 V
	UG2.015D.120	69831813	15	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.015S.120 *	69821813	15	Single	14.4 kV	120 / 240 V
	VUG2.015D.120 *	69841813	15	Dual	14.4 / 7.2 kV	120 / 240 V
UG2.025	UG2.025S.120	69811815	25	Single	7.2 kV	120 / 240 V
	UG2.025D.120	69831815	25	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.025S.120 *	69821815	25	Single	14.4 kV	120 / 240 V
	VUG2.025D.120 *	69841815	25	Dual	14.4 / 7.2 kV	120 / 240 V
UG2.037	UG2.037S.120	69811817	37.5	Single	7.2 kV	120 / 240 V
	UG2.037D.120	69831817	37.5	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.037S.120 *	69821817	37.5	Single	14.4 kV	120 / 240 V
	VUG2.037D.120 *	69841817	37.5	Dual	14.4 / 7.2 kV	120 / 240 V
UG2.050	UG2.050S.120	69811819	50	Single	7.2 kV	120 / 240 V
	UG2.050D.120	69831819	50	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.050S.120 *	69821819	50	Single	14.4 kV	120 / 240 V
	VUG2.050D.120 *	69841819	50	Dual	14.4 / 7.2 kV	120 / 240 V
UG2.075	UG2.075S.120	69811820	75	Single	7.2 kV	120 / 240 V
	UG2.075D.120	69831820	75	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.075S.120 *	69821820	75	Single	14.4 kV	120 / 240 V
	VUG2.075D.120 *	69841820	75	Dual	14.4 / 7.2 kV	120 / 240 V
UG2.100	UG2.100S.120	69811821	100	Single	7.2 kV	120 / 240 V
	UG2.100D.120	69831821	100	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.100S.120 *	69821821	100	Single	14.4 kV	120 / 240 V
	VUG2.100D.120 *	69841821	100	Dual	14.4 / 7.2 kV	120 / 240 V
UG2.167	UG2.167S.120	69811823	167	Single	7.2 kV	120 / 240 V
	UG2.167D.120	69831823	167	Dual	7.2 / 2.4 kV	120 / 240 V
	VUG2.167S.120 *	69821823	167	Single	14.4 kV	120 / 240 V
	VUG2.167D.120 *	69841823	167	Dual	14.4 / 7.2 kV	120 / 240 V

*Subtractive polarity



The U9-11 grounding assembly must be specified separately.

3-PHASE PADMOUNT TRANSFORMER

3-Phase Padmount transformers available in following configurations:

- Primary Voltage 7.2 kV
- Primary Voltage 14.4 kV *
- Primary Voltage 7.2/2.4 kV
- Primary Voltage 14.4/7.2 kV *
- Secondary Voltage 120/240 v
- Secondary Voltage 277/480 v

*Subtractive polarity

ASSEMBLY NAME	Transformer Size	
	KVA	
UG3.0045	45	
UG3.0075	75	
UG3.0112	112	
UG3.0150	150	
UG3.0225	225	
UG3.0300	300	
UG3.0500	500	
UG3.0750	750	
UG3.1000	1000	
UG3.1500	1500	

Materials List for Assemblies

*Subtractive polarity

	Assembly Name	Material #	KVA	Single / Dual Voltage	Primary Voltage	Secondary Voltage
UG3.0045	UG3.0045S.120	69813855	45	Single	7.2 kV	120 / 208 V
	UG3.0045S.277	69816855	45	Single	7.2 kV	277 / 480 V
	UG3.0045D.120	69833855	45	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0045D.277	69836855	45	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0045S.120 *	69823855	45	Single	14.4 kV	120 / 208 V
	VUG3.0045S.277 *	69826855	45	Single	14.4 kV	277 / 480 V
	VUG3.0045D.120 *	69843855	45	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0045D.277 *	69846855	45	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.0075	UG3.0075S.120	69813857	75	Single	7.2 kV	120 / 208 V
	UG3.0075S.277	69816857	75	Single	7.2 kV	277 / 480 V
	UG3.0075D.120	69833857	75	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0075D.277	69836857	75	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0075S.120 *	69823857	75	Single	14.4 kV	120 / 208 V
	VUG3.0075S.277 *	69826857	75	Single	14.4 kV	277 / 480 V
	VUG3.0075D.120 *	69843857	75	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0075D.277 *	69846857	75	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.0112	UG3.0112S.120	69813859	112	Single	7.2 kV	120 / 208 V
	UG3.0112S.277	69816859	112	Single	7.2 kV	277 / 480 V
	UG3.0112D.120	69833859	112	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0112D.277	69836859	112	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0112S.120 *	69823859	112	Single	14.4 kV	120 / 208 V
	VUG3.0112S.277 *	69826859	112	Single	14.4 kV	277 / 480 V
	VUG3.0112D.120 *	69843859	112	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0112D.277 *	69846859	112	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.0150	UG3.0150S.120	69813860	150	Single	7.2 kV	120 / 208 V
	UG3.0150S.277	69816860	150	Single	7.2 kV	277 / 480 V
	UG3.0150D.120	69833860	150	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0150D.277	69836860	150	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0150S.120 *	69823860	150	Single	14.4 kV	120 / 208 V
	VUG3.0150S.277 *	69826860	150	Single	14.4 kV	277 / 480 V
	VUG3.0150D.120 *	69846860	150	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0150D.277 *	69843860	150	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.0225	UG3.0225S.120	69813862	225	Single	7.2 kV	120 / 208 V
	UG3.0225S.277	69816862	225	Single	7.2 kV	277 / 480 V
	UG3.0225D.120	69833862	225	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0225D.277	69836862	225	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0225S.120 *	69823862	225	Single	14.4 kV	120 / 208 V
	VUG3.0225S.277 *		225	Single	14.4 kV	277 / 480 V
	VUG3.0225D.120 *	69846862	225	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0225D.277 *	69843862	225	Dual	14.4 / 7.2 kV	277 / 480 V

Materials List for Assemblies

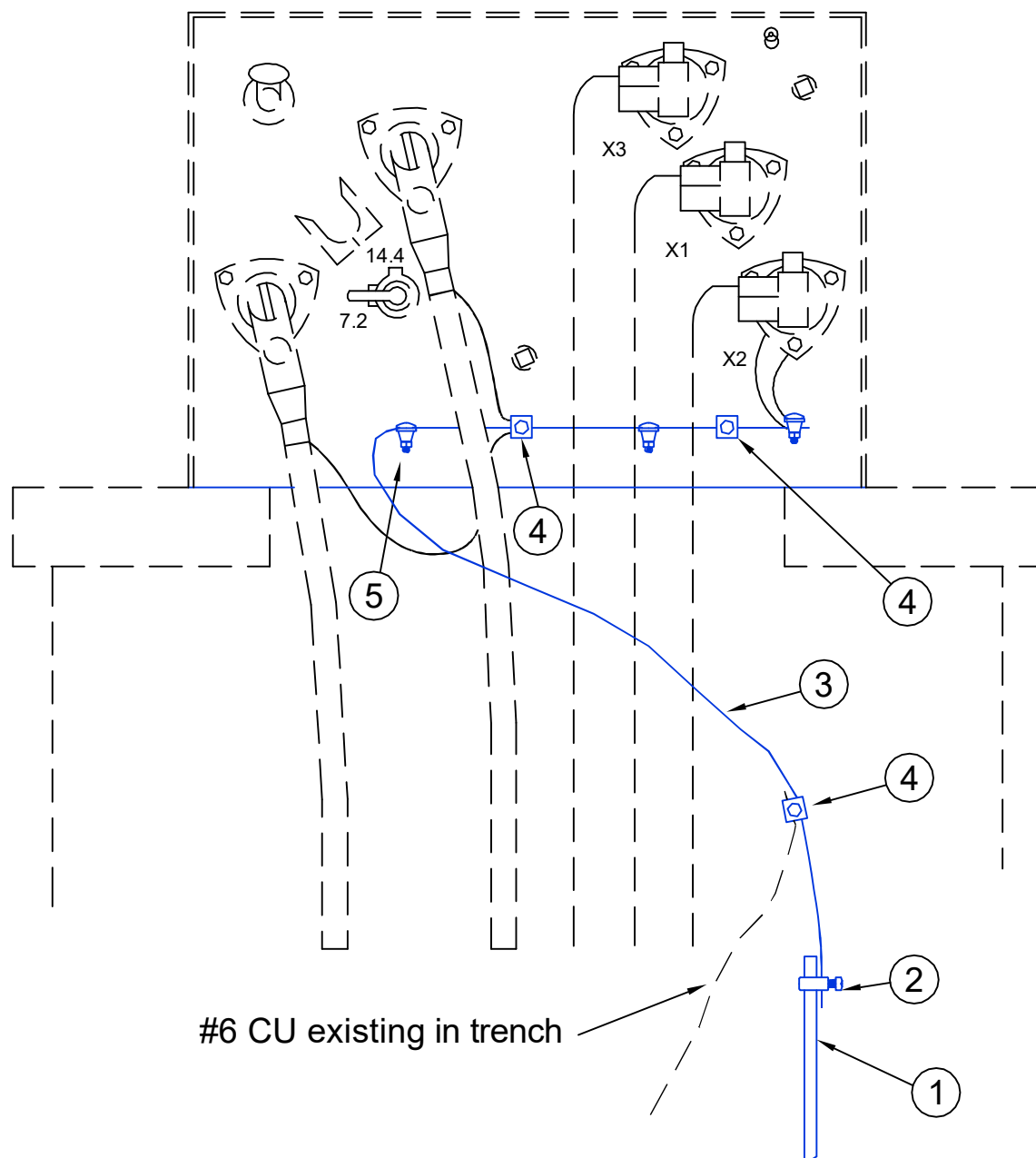
	Assembly Name	Material #	KVA	Single / Dual Voltage	Primary Voltage	Secondary Voltage
UG3.0300	UG3.0300S.120	69813864	300	Single	7.2 kV	120 / 208 V
	UG3.0300S.277	69816864	300	Single	7.2 kV	277 / 480 V
	UG3.0300D.120	69833864	300	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0300D.277	69836864	300	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0300S.120 *	69823864	300	Single	14.4 kV	120 / 208 V
	VUG3.0300S.277 *	69826864	300	Single	14.4 kV	277 / 480 V
	VUG3.0300D.120 *	69846864	300	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0300D.277 *	69843864	300	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.0500	UG3.0500S.120	69813866	500	Single	7.2 kV	120 / 208 V
	UG3.0500S.277	69833866	500	Single	7.2 kV	277 / 480 V
	UG3.0500D.120	69836866	500	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0500D.277	69823866	500	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0500S.120 *	69826866	500	Single	14.4 kV	120 / 208 V
	VUG3.0500S.277 *	69846866	500	Single	14.4 kV	277 / 480 V
	VUG3.0500D.120 *	69843866	500	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0500D.277 *	69813866	500	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.0750	UG3.0750S.120	69813868	750	Single	7.2 kV	120 / 208 V
	UG3.0750S.277	69816868	750	Single	7.2 kV	277 / 480 V
	UG3.0750D.120	69833868	750	Dual	7.2 / 2.4 kV	120 / 208 V
	UG3.0750D.277	69836868	750	Dual	7.2 / 2.4 kV	277 / 480 V
	VUG3.0750S.120 *	69823868	750	Single	14.4 kV	120 / 208 V
	VUG3.0750S.277 *	69826868	750	Single	14.4 kV	277 / 480 V
	VUG3.0750D.120 *	69846868	750	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.0750D.277 *	69843868	750	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.1000	UG3.1000S.120		1000	Single	7.2 kV	120 / 208 V
	UG3.1000S.277	69816872	1000	Single	7.2 kV	277 / 480 V
	VUG3.1000S.120 *		1000	Single	14.4 kV	120 / 208 V
	VUG3.1000S.277 *		1000	Single	14.4 kV	277 / 480 V
	VUG3.1000D.120 *		1000	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.1000D.277 *	69816874	1000	Dual	14.4 / 7.2 kV	277 / 480 V
UG3.1500	UG3.1500S.120		1500	Single	7.2 kV	120 / 208 V
	UG3.1500S.277		1500	Single	7.2 kV	277 / 480 V
	VUG3.1500S.120 *		1500	Single	14.4 kV	120 / 208 V
	VUG3.1500S.277 *		1500	Single	14.4 kV	277 / 480 V
	VUG3.1500D.120 *	69816875	1500	Dual	14.4 / 7.2 kV	120 / 208 V
	VUG3.1500D.277 *		1500	Dual	14.4 / 7.2 kV	277 / 480 V

*Subtractive polarity

Descriptions:

U9-11... URD Equipment Ground

U9-11



Ref. No.	Material #	Description	U9-11
1	53808508	Rod, ground, 5/8" min. dia.	1
2	17311000	Clamp, ground rod, 5/8"	1
3	15620203	Wire, #2 Stranded, Cu	15'
4	17015002	Conn: GC5002 #2 str	5
5	17010010	Con. Tran. Grd Lug #2 STR to 4/0	2



CONSTRUCTION STANDARDS
PAD MOUNT EQUIPMENT GROUND

U9-11

ISSUE DATE: 01/06

Equipment Overhead 21

Reclosers

R1 1-Phase Recloser Assemblies

R3 3-Phase Recloser Assemblies

R91-1 Single-phase Recloser Mount, Bypass 200 AMP CKT (1/0 Conductor and smaller)

R91-3 Three Single-phase Recloser Mount, Bypass 200 AMP CKT (1/0 Conductor and smaller)

R93-1 Three-Phase Recloser Mount, Bypass 200 AMP CKT (1/0 Conductor and smaller)

R93-3 Three-Phase Recloser Mount, Bypass 600 AMP CKT (3/0 conductor and larger)

Cutouts

S1-1 Sectionalizing assembly, Cutout, Bracket/Cross arm Mount

S1-A1 Sectionalizing assembly, Cutout, Bracket/Cross arm Mount 200 AMP CKT (AMPACT)

S1-A2S Sectionalizing assembly, Cutout, Combo Bracket Mount (short) 200 AMP CKT (AMPACT)

S1-A2L Sectionalizing assembly, Cutout, Combo Bracket Mount (long) 200 AMP CKT (AMPACT)

S1-2S Sectionalizing assembly, Cutout, Combo Bracket Mount (short)

S1-2L Sectionalizing assembly, Cutout, Combo Bracket Mount (long)

S1-3 Sectionalizing assembly, Cutout Only or Sectionalizer-Module Only

Switches

S2-1 Three Phase Horizontal

S2-2 Three Phase Vertical Break

S2-3 Line Tap LE / Bridges

S2-4L In Line tension, through line, Bridges

S2-4LA In Line tension switch, through line

S2-4DE In Line tension, Dead End, Bridges

S2-5 Regulator Bypass Seq (S&C)

S2-6 Single Blade 600 Amp (S&C)

S9-3 Grounding Assembly, switching platform

S3 Power Fuses (future)

Voltage Devices

V1 Voltage Regulators

V3 Capacitors (Future)

V6 Lightning Arresters

V9 Miscellaneous (Future)

V9-1 Voltage Regulators, Open wire construction, pole mounted

V9-3 Voltage Regulators, Open wire construction, platform mounted

HV9-1 Voltage Regulators, Hndx spacer-cable construction, pole mounted (one single- phase)

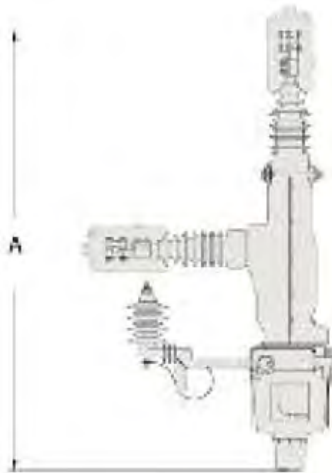
HV9-3 Voltage Regulators, Hndx spacer-cable construction, platform mounted (three single- phase)

IV OH Fault Indicator Guide

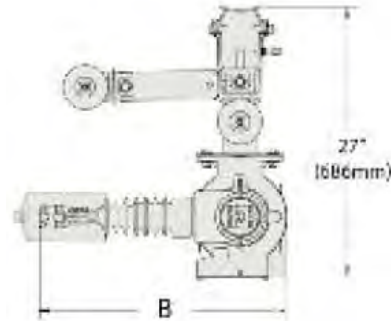
IV Neutral Blocker Isolator Application

Distribution Fusing Guidelines

G&W VIPER-SP



	15.5kV	27kV	38kV
A	47 (1194mm)	51 (1295mm)	55 (1397mm)
B	24 (610mm)	29 (737mm)	33 (838mm)



R1

COOPER RECLOSERS

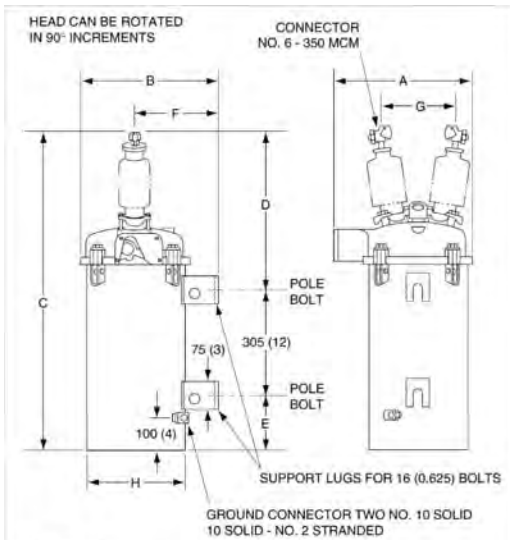


Figure 8.
Dimensions of E, 4E, V4E, V4H, L, and V4L
reclosers.

Recloser Dimensions

Description	Recloser Type				
	E	4E, V4E	4H, V4H	L	V4L
A	380 (15)	380 (15)	355 (14)	380 (15)	380 (15)
B	405 (16)	405 (16)	355 (14)	405 (16)	405 (16)
C	1050 41.5	1240 49	900 35.5	940 37	1140 45
D	505 (20)	570 (22.5)	430 (17)	480 (19)	480 (19)
E	230 (9)	14.5 (14.5)	175 (7)	150 (6)	370 (14.5)
F	254 (10)	254 (10)	230 (9)	254 (10)	254 (10)
G	280 (11)	305 (12)	215 (8.5)	280 (11)	280 (11)
H	280 (11)	280 (11)	230 (9)	280 (11)	280 (11)

CONST. UNIT	COIL RATING (AMPS)	MIN. TRIP RATING (AMPS)	INTERRUPT RATING (AMPS)	RECLOSER TYPE	INTERRUPT MEDIUM	CONTROL TYPE	MFG.
2.4-15.5 kV - 110 kV BIL							
R1.4H25	25	50	1,000	4H or V4H	OIL or VACUUM	HYDRAULIC	COOPER
R1.4H35	35	70	1,400				
R1.4H50	50	100	2,000				
R1.4H70	70	140	2,000				
R1.4H100	100	200	2,500				
R1.L25	25	50	1,500	L	OIL		
R1.L35	35	70	2,100				
R1.L50	50	100	3,000				
R1.L70	70	140	4,200				
R1.L100	100	200	5,000				
R1.VISP	630	20-1600	12,500	VIPER-SP	SOLID DIEL.	ELECTRONIC	G&W
27 kV - 125 kV BIL							
VR1.VISP	630	20-1600	12,500	VIPER-SP	SOLID DIEL.	ELECTRONIC	G&W



CONSTRUCTION STANDARDS

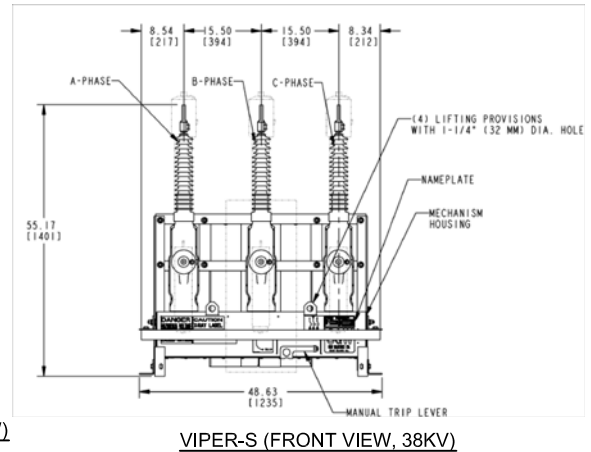
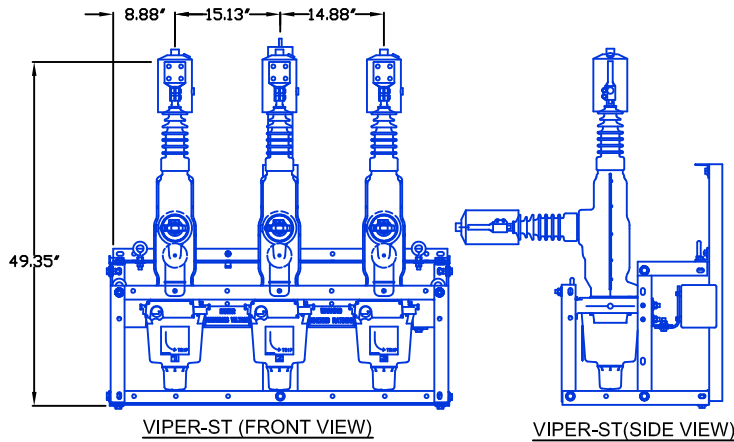
RECLOSERS, SINGLE-PHASE

R1

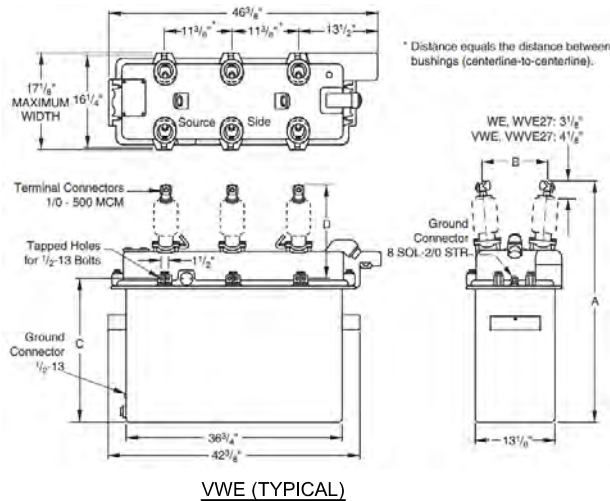
ISSUE DATE: 06/2012

G&W RECLOSERS

R3



COOPER RECLOSERS



Dimensions of Recloser Without BCT Accessory*

Type	Bushing Type	A (in.)	B (in.)	C (in.)	D (in.)
WE	13 in. standard creepage or 17 in. extra creepage	41%	11%	26%	15
VWE	13 in. standard creepage or 17 in. extra creepage	43%	11%	28%	15
VWE27	26 1/2 in. creepage	47%	11%	26%	21%
VWVE27	26 1/2 in. creepage	50	11%	28%	21%

*Dimensions configured to the nearest 1/8 in.

Dimensions of Recloser With and Without BCT Accessory*

Type	Bushing Type	A (in.)	B (in.)	C (in.)	D (in.)	E (in.)	F** (in.)
VWE38X	26 1/2 in. creepage	47%	15	26%	20%	10	15%
VWVE38X	26 1/2 in. creepage	49%	15	28%	20%	10	15%
VWE38X	26 1/2 in. w/ BCT	51%	15%	26%	25%	9%	15%
VWVE38X	26 1/2 in. w/ BCT	54	15%	28%	25%	9%	15%

* Dimensions configured to the nearest 1/8 in.

** Dimension F is the distance between bushings (centerline-to-centerline).

CONST. UNIT	COIL RATING (AMPS)	MIN. TRIP RATING (AMPS)	INTERRUPT RATING (AMPS)	RECLOSER TYPE	INTERRUPT MEDIUM	CONTROL TYPE	MFG.
2.4-15.5 kV - 110 kV BIL							
R3.R50	50	100	3,000	R	OIL	HYDRAULIC	COOPER
R3.R70	70	140	4,200				
R3.R100	100	200	5,000				
R3.RE	400	100-800	5,000	RE	VACUUM	ELECTRONIC	G&W
R3.RXE	400	100-800	6,000	RXE			
R3.VWE	560	100-1120	12,000	VWE/VWVE			
R3.VIST	630	20-1600	12,500	VIPER-ST	SOLID DIEL.		
R3.VIS	630	20-1600	12,500	VIPER-S			
27 kV - 125 kV BIL							
VR3.RVE	400	100-800	6,000	RVE	OIL	ELECTRONIC	COOPER
VR3.VWE	560	100-1120	12,000	VWVE27	VACUUM		
VR3.VIST	630	20-1600	12,500	VIPER-ST	SOLID DIEL.	ELECTRONIC	G&W
VR3.VIS	630	20-1600	12,500	VIPER-S			
38 kV - 150 kV BIL							
ZR3.VWE	560	100-1120	12,000	VWVE38(X)	VACUUM	ELECTRONIC	COOPER
ZR3.VIST	630	20-1600	12,500	VIPER-ST	SOLID DIEL.		G&W
ZR3.VIS	630	20-1600	12,500	VIPER-S			



CONSTRUCTION STANDARDS

RECLOSERS, THREE-PHASE

R3

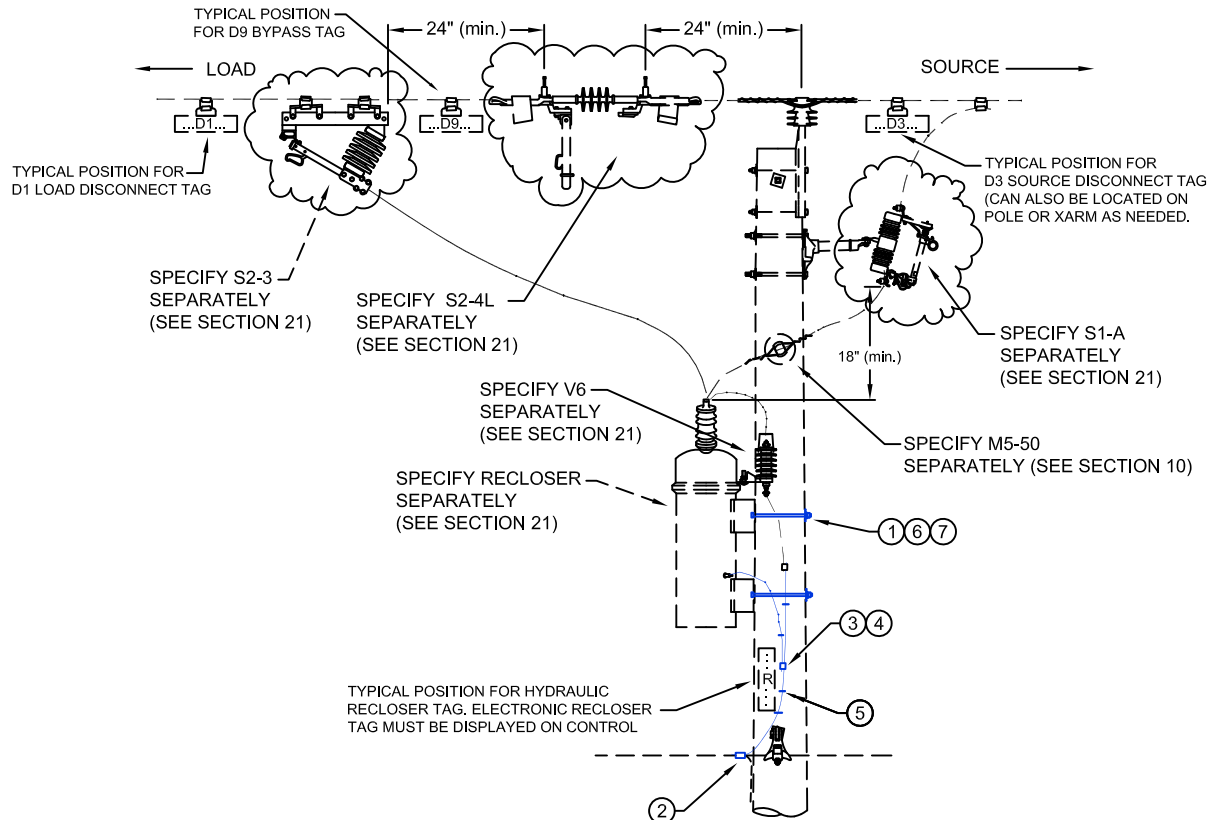
ISSUE DATE: 06/2012

Construction and Design Notes:

R91-1

1. This arrangement used for single-phase construction with either hydraulic or electronic reclosers on 200 amp rated circuits (1/0 bare or covered).
2. Specify pole top, recloser, and arrestor assemblies separately.
3. With deadend construction, can also use the S2-4DE by-pass switch assembly.
4. With straight line construction, use either the S2-4LA or S2-4L by-pass switch assemblies.
5. S1-A assembly can be crossarm mount or combinaton bracket as required.
6. The HR9-1 assembly to be used for 1/0 Hendrix spacer cable with the ground wire bonded to messenger (not shown)

STRAIGHT-LINE CONSTRUCTION (TYPICAL)



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S1-A SECTIONALIZING ASS'Y, CUTOUT	1
S2-4L IN-LINE TENSION SWITCH	1
S2-3 LINE-TAP SWITCH	1
V6 LIGHTNING ARRESTOR	1
R1 SINGLE-PHASE RECLOSER	1
M5-50 INSULATOR, PIN STAND-OFF	1

Ref.

No.	Material #	Description	R91-1	HR91-1
1	6380516	Bolt, Machine 5/8" x 16"	2	2
2	17010502	Con, Sicame TTD2710XFBTUNI	1	
2	17010502	Con, Sicame TTD2710XFBTUNI		1
3	15610401	Conductor, #4 Sol CU SD	10'	20'
4	17015004	Connector, GC5004 #4 Solid	1	1
5	61801810	Staple, Ground Wire	10	20
6	71053063	Washer, Spring 5/8"	2	2
7	71020451	Washer, Square 2 1/4 x 13/16	2	2

CONSTRUCTION ASSEMBLIES

System Voltage	1/0	1/0 HNDX
15/25/35 kV	R91-1	HR91-1



CONSTRUCTION STANDARDS
SINGLE-PHASE RECLOSER MOUNT, BYPASS
200 AMP CKT (1/0 CONDUCTOR AND SMALLER)

R91-1

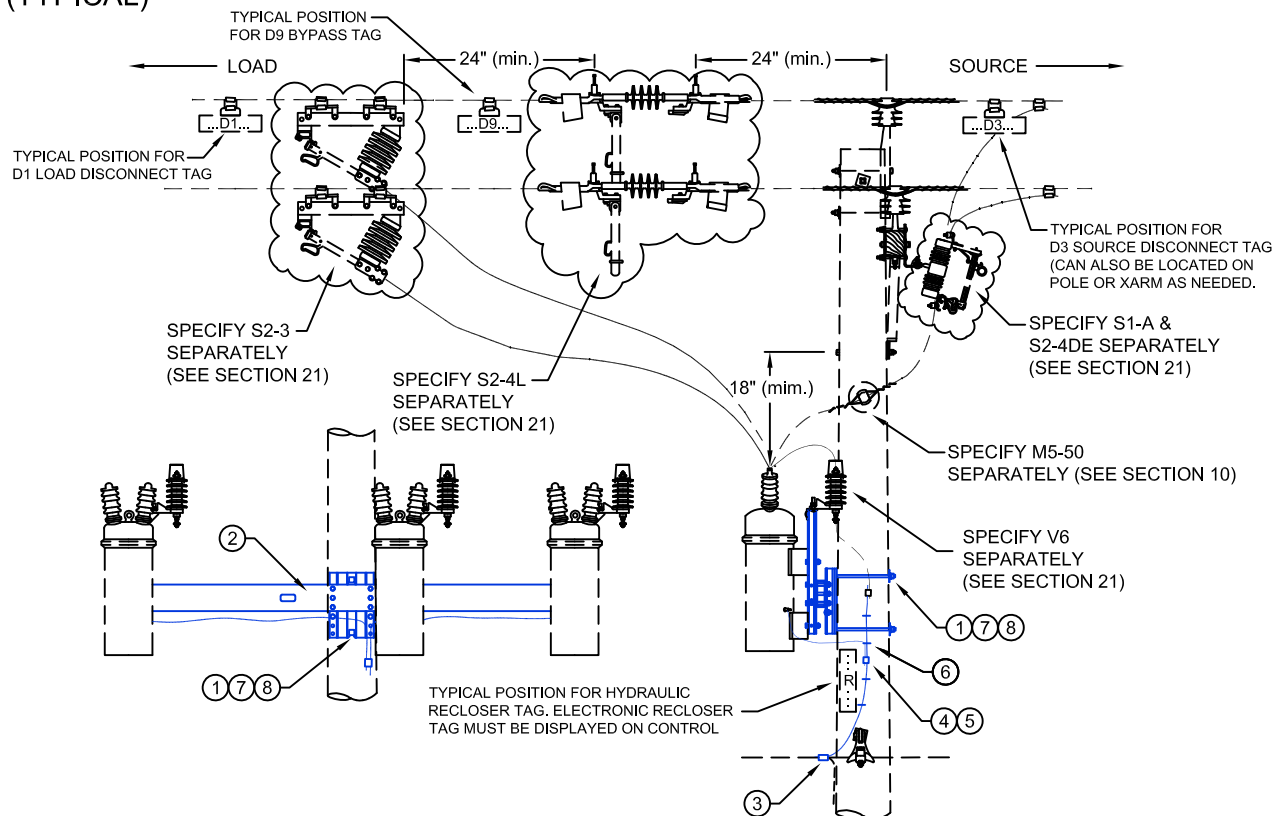
ISSUE DATE: 01/20

Construction and Design Notes:

R91-3

1. This arrangement used for two or three-phase construction with either hydraulic or electronic reclosers on 200 amp rated circuits (1/0 bare or covered).
2. Specify pole top, reclosers, and arrestor assemblies separately.
3. With deadend construction, can use the S2-4DE by-pass switch assemblies.
4. With straight line construction, use either the S2-4LA or S2-4L by-pass switch assemblies.
5. S1-A assembly can be crossarm mount or combination bracket as required.
6. Installation requires 8 or 10 ft. crossarm pole-top assemble for adequate clearance.
7. The HR91-3 assembly to be used for 1/0 Hendrix spacer cable with ground wire bonded to messenger (not shown).

STRAIGHT LINE CONSTRUCTION (TYPICAL)



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S1-A SECTIONALIZING ASS'Y, CUTOUT	2 or 3
S2-4 IN-LINE TENSION SWITCH	2 or 3
S2-3 LINE-TAP SWITCH	2 or 3
V6 LIGHTNING ARRESTOR	2 or 3
R1 SINGLE-PHASE RECLOSER	2 or 3
M5-50 INSULATOR, PIN STAND-OFF	1

Ref.

No.	Material #	Description	R91-3	HR91-3
1	6380516	Bolt, Machine 5/8" x 16"	2	2
2	7800715	Bracket, Arm for 3 reclosers	1	1
3	17010502	Con, Sicame TTD2710XFBTUNI	1	
3	17010502	Con, Sicame TTD2710XFBTUNI		1
4	15610401	Conductor, #4 Sol CU SD	20'	30'
5	17015004	Connector, GC5004 #4 Solid	3	3
6	61801810	Staple, Ground Wire	10	20
7	71053063	Washer, Spring 5/8"	2	2
8	71020451	Washer, Square 2 1/4 x 13/16	2	2

CONSTRUCTION ASSEMBLIES

System Voltage	1/0	1/0 HNDX
15/25/35 kV	R91-3	HR91-3



CONSTRUCTION STANDARDS

THREE SINGLE-PHASE RECLOSER MOUNT, BYPASS
200 AMP CKT (1/0 CONDUCTOR AND SMALLER)

R91-3

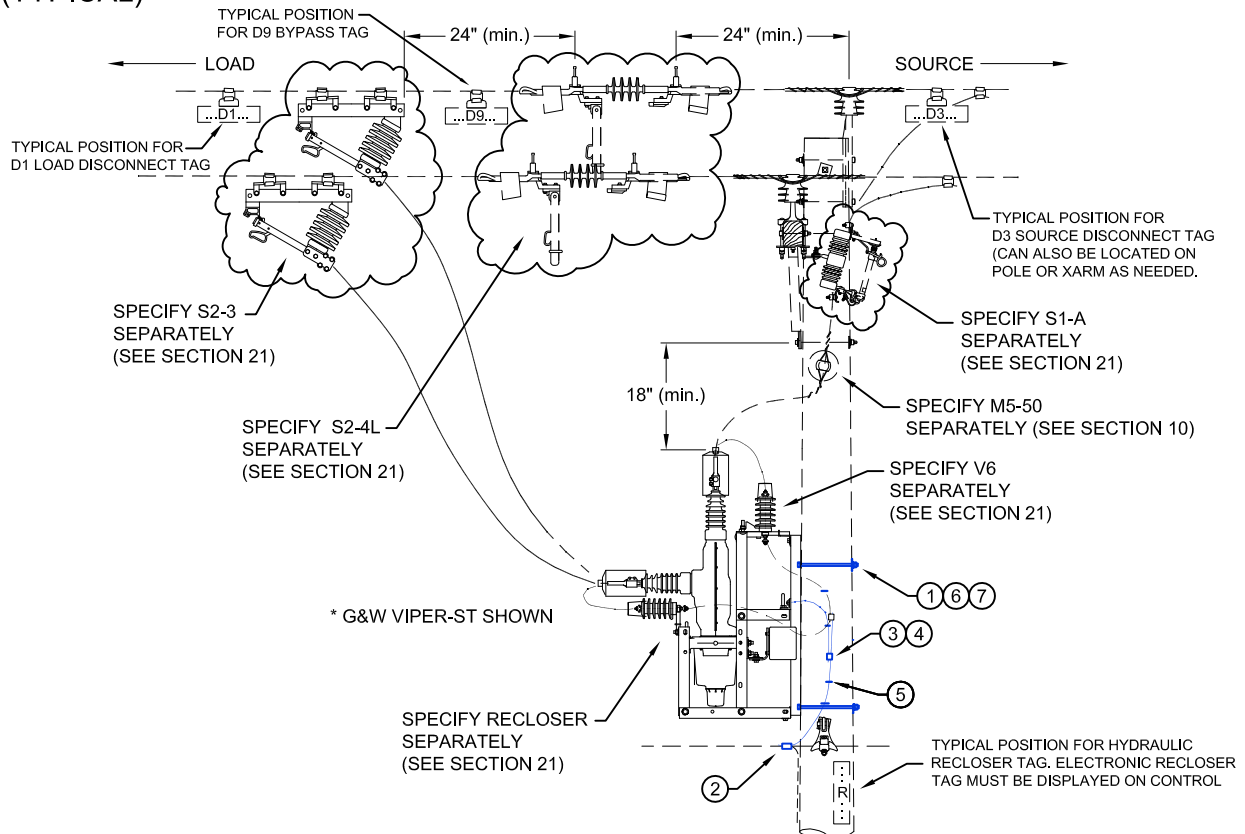
ISSUE DATE: 01/20

Construction and Design Notes:

R93-1

1. This arrangement used for three-phase construction with either hydraulic or electronic reclosers on 200 amp rated circuits (1/0 bare or covered).
2. Specify pole top, recloser, and arrestor assemblies separately.
3. With deadend construction, can also use the S2-4DE by-pass switch assembly.
4. With straight line construction, use either the S2-4LA or S2-4L by-pass switch assemblies.
5. S1-A assembly can be crossarm mount or combination bracket as required.
6. Installation requires 8 or 10 ft. crossarm pole-top assemble for adequate clearance.
7. The HR93-1 assembly to be used for 1/0 Hendrix spacer cable with ground wire bonded to messenger (not shown).

STRAIGHT-LINE CONSTRUCTION (TYPICAL)



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S1-A SECTIONALIZING ASS'Y, CUTOUT	3
S2-4L IN-LINE TENSION SWITCH	3
S2-3 LINE-TAP SWITCH	3
V6 LIGHTNING ARRESTOR	6
R3 THREE-PHASE RECLOSER	1
M5-50 INSULATOR, PIN STAND-OFF	1

Ref. No.	Material #	Description	R93-1	HR93-1
1	6380516	Bolt, Machine 5/8" x 16"	2	2
2	17010508	Con, H-Tap YHO-150	1	
2	17010503	Con, H-Tap YHO-250		1
3	15610401	Conductor, #4 Sol CU SD	10'	20'
4	17015004	Connector, GC5004 #4 Solid	1	1
5	61801810	Staple, Ground Wire	10	20
6	71053063	Washer, Spring 5/8"	2	2
7	71020451	Washer, Square 2 1/4 x 13/16	2	2

CONSTRUCTION ASSEMBLIES

System Voltage	1/0	1/0 HNDX
15/25/35 kV	R93-1	HR93-1



CONSTRUCTION STANDARDS

THREE-PHASE RECLOSER MOUNT, BYPASS
200 AMP CKT (1/0 CONDUCTOR AND SMALLER)

R93-1

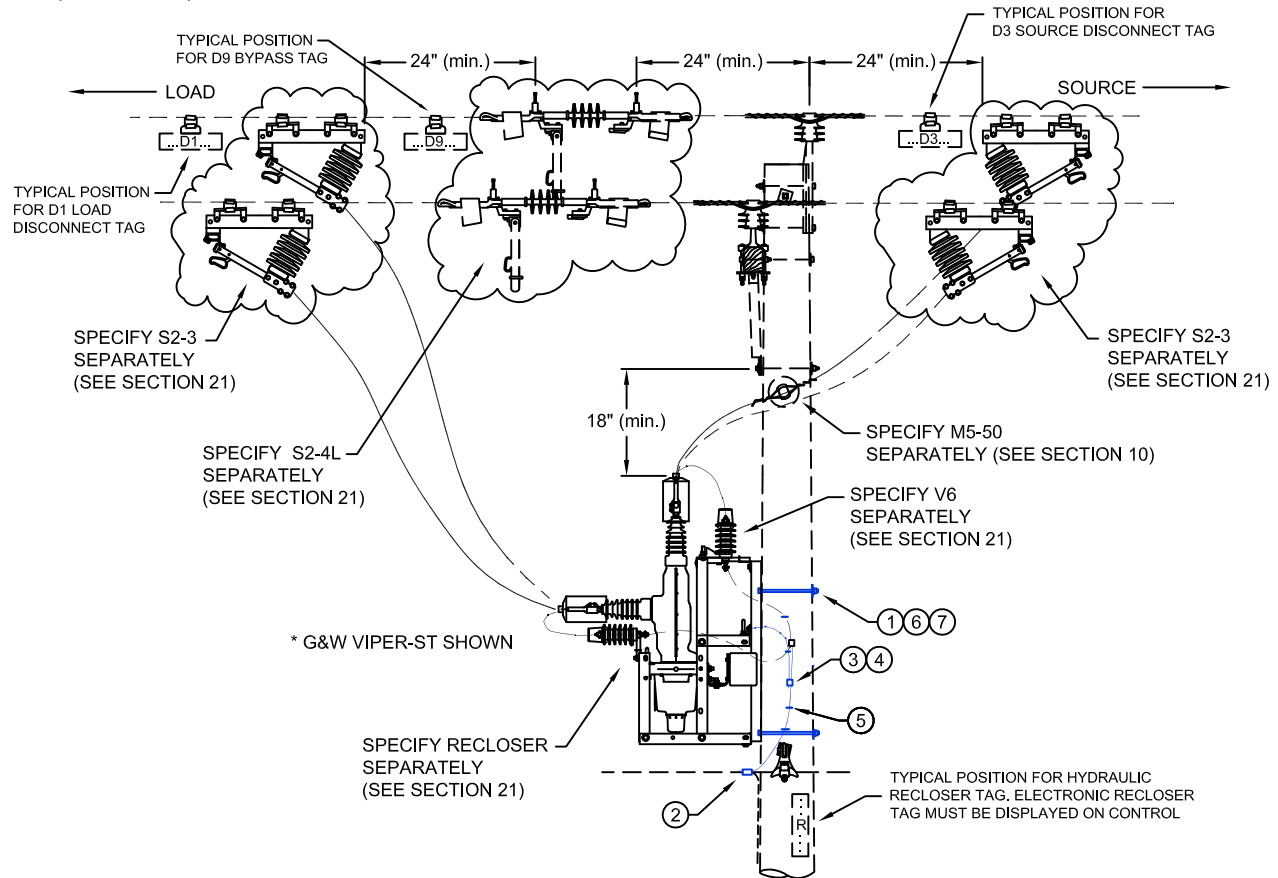
ISSUE DATE: 05/16

Construction and Design Notes:

R93-3

1. This arrangement used for three-phase construction with either hydraulic or electronic reclosers on 600 amp rated circuits (336 bare or covered).
2. Specify pole top, recloser, and arrestor assemblies separately.
3. With deadend construction, can also use the S2-4DE by-pass switch assembly.
4. With straight line construction, use either the S2-4LA or S2-4L by-pass switch assemblies.
5. Installation requires 8 or 10 ft. crossarm pole-top assemble for adequate clearance.
6. The HR93-3 assembly to be used for 336 Hendrix spacer cable with ground wire bonded to messenger (not shown).

STRAIGHT-LINE CONSTRUCTION (TYPICAL)



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S2-4L IN-LINE TENSION SWITCH	3
S2-3 LINE-TAP SWITCH	6
V6 LIGHTNING ARRESTOR	6
R3 THREE-PHASE RECLOSER	1
M5-50 INSULATOR, PIN STAND-OFF	1

Ref.

No.	Material #	Description	R93-3	HR93-3
1	6380516	Bolt, Machine 5/8" x 16"	2	2
2	17010502	Con, H-Tap YHO-250	1	1
3	15610401	Conductor, #4 Sol CU SD	10'	20'
4	17015004	Connector, GC5004 #4 Solid	1	1
5	61801810	Staple, Ground Wire	10	20
6	71053063	Washer, Spring 5/8"	2	2
7	71020451	Washer, Square 2 1/4 x 13/16	2	2

CONSTRUCTION ASSEMBLIES

System Voltage	336	336 HNDX
15/25/35 kV	R93-3	HR93-3



CONSTRUCTION STANDARDS

THREE-PHASE RECLOSER MOUNT, BYPASS
600 AMP CKT (3/0 CONDUCTOR AND LARGER)

R93-3

ISSUE DATE: 01/20

Construction and Design Notes:

1. This assembly is not approved for use on 350 or 500 MCM primary risers.

S1-1

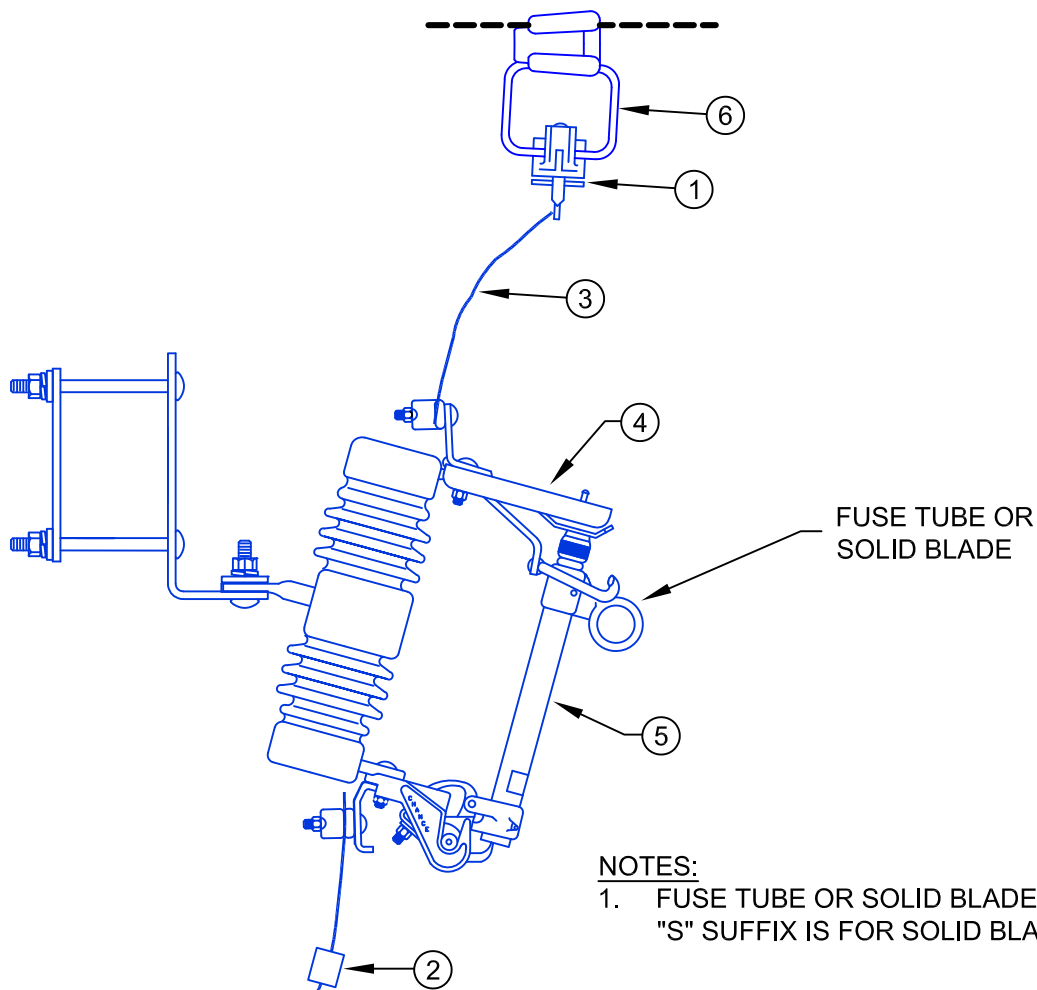
DESCRIPTIONS

S1-1.1... Cutout, Fuse, Bracket Mount, 1/0

S1-1.1S...Cutout, Blade, Bracket Mount, 1/0

S1-1.3... Cutout, Fuse, Bracket Mount, 336

S1-1.3S...Cutout, Blade, Bracket Mount, 336



Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S1-1.1	S1-1.1S	S1-1.3	S1-1.3S
1	17410000	Clamp, Hot Line, #8-1/0	1	1	1	1
	16020308	Connector, Amp Shells Yellow			1	1
2	17010502	Connector, Sicame TTD2710XFBTUNI	1	1	1	1
3	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'	12'	12'
4	18312100	Cutout, 15/25 kV	1	1	1	1
5	18314131	Cutout, solid door, type C		1		1
6	62000000	Stirrup, #4 - 1/0 comp.	1	1		
6	62001000	Stirrup, Shoot On, 336.4			1	1



CONSTRUCTION STANDARDS
SECTIONALIZING ASSEMBLY
CUTOUT - BRACKET/CROSSARM MOUNT
200 AMP CKT (STIRRUP)

S1-1

ISSUE DATE: 01/20

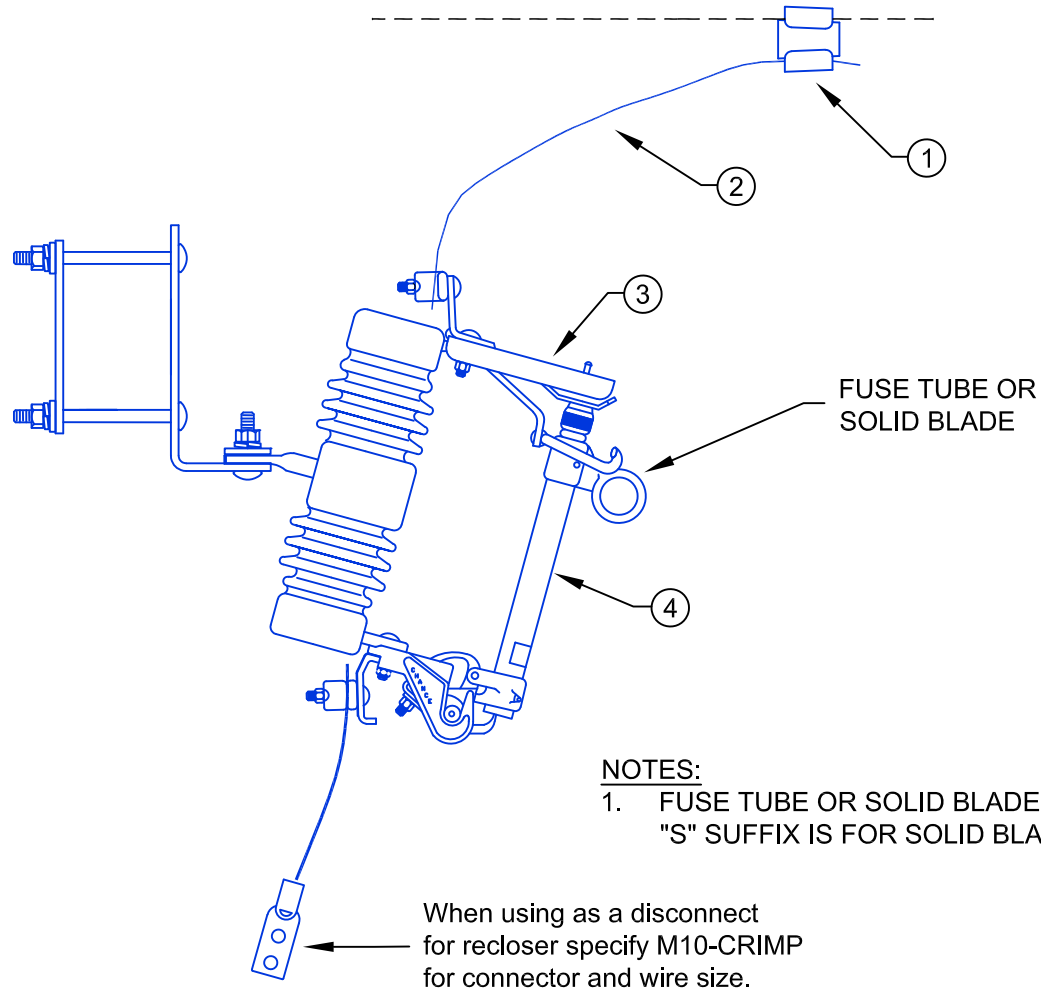
S1-A1

Construction and Design Notes:

1. Assembly is not approved for use on 350 or 500 MCM primary risers.
2. Assembly is approved for source disconnect (as solid) with recloser bypass on 200 amp rated circuits (1/0 bare or covered) only.

DESCRIPTIONS

- S1-A1.1... Cutout, Fuse, Bracket Mount, 1/0 Ampact
 S1-A1.1S... Cutout, Blade, Bracket Mount, 1/0 Ampact
 S1-A1.3... Cutout, Fuse, Bracket Mount, 336 Ampact
 S1-A1.3S... Cutout, Blade, Bracket Mount, 336 Ampact



NOTES:

1. FUSE TUBE OR SOLID BLADE. "S" SUFFIX IS FOR SOLID BLADE.

Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S1-A1.1	S1-A1.1S	S1-A1.3	S1-A1.3S
1	16600400	Conn, Amp 1/0-2	1	1		
1	16602000	Conn, Amp 336.4-2			1	1
	16020306	Connector, Amp Shells Blue	1	1		
	16020308	Connector, Amp Shells Yellow			1	1
2	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'	12'	12'
3	18312100	Cutout, 15/25 kV	1	1	1	1
4	18314131	Cutout, solid door, type C		1		1



CONSTRUCTION STANDARDS
 SECTIONALIZING ASSEMBLY
 CUTOUT - BRACKET/CROSSARM MOUNT
 200 AMP CKT (AMPACT)

S1-A1

ISSUE DATE: 10/16

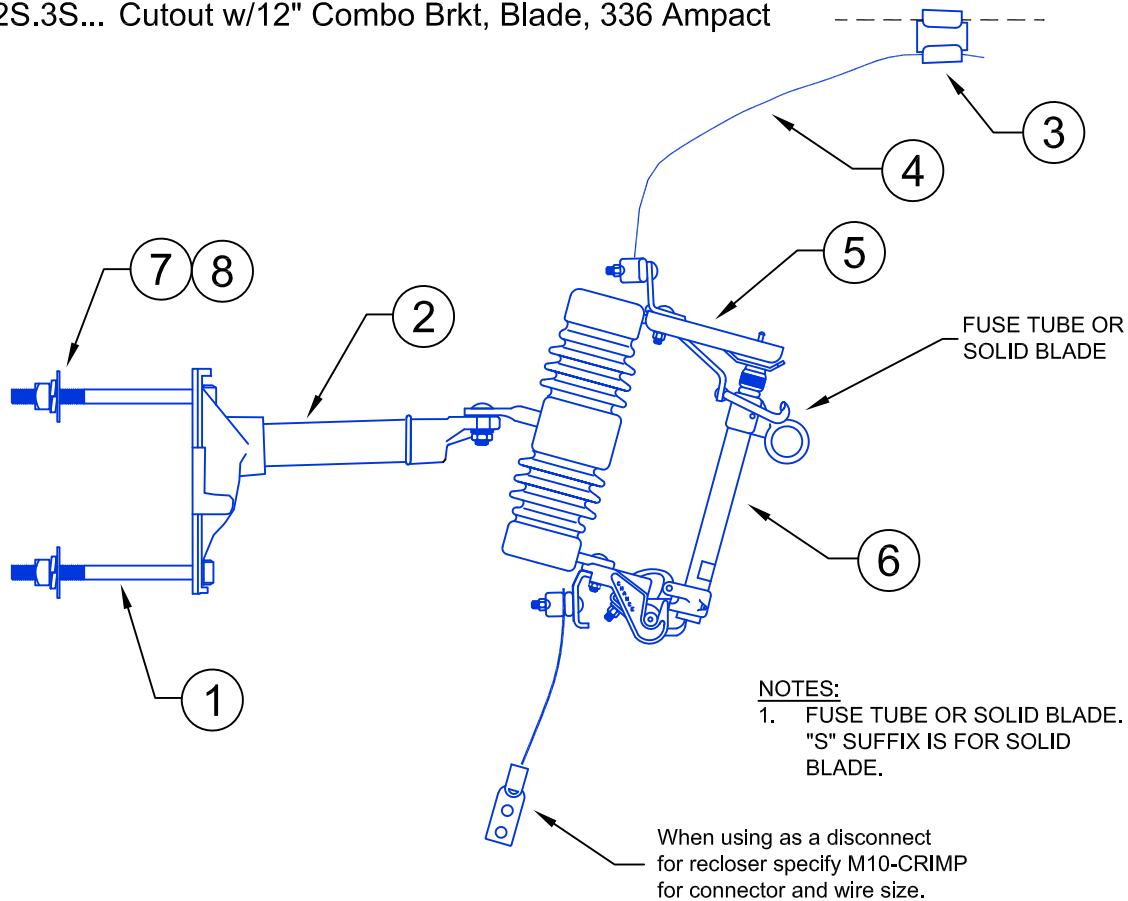
S1-A2S

Construction and Design Notes:

1. Assembly is not approved for use on 350 or 500 MCM primary risers.
2. Assembly is approved for source disconnect (as solid) with recloser bypass on 200 amp rated circuits (1/0 bare or covered) only.

DESCRIPTIONS

- S1-A2S.1... Cutout w/12" Combo Brkt, Fuse, 1/0 Ampact
 S1-A2S.1S... Cutout w/12" Combo Brkt, Blade, 1/0 Ampact
 S1-A2S.3... Cutout w/12" Combo Brkt, Fuse, 336 Ampact
 S1-A2S.3S... Cutout w/12" Combo Brkt, Blade, 336 Ampact



NOTES:

1. FUSE TUBE OR SOLID BLADE. "S" SUFFIX IS FOR SOLID BLADE.

When using as a disconnect for recloser specify M10-CRIMP for connector and wire size.

Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S1-A2S.1	S1-A2S.1S	S1-A2S.3	S1-A2S.3S
1	6380514	Bolt, Machine 5/8 x 14"	2	2	2	2
2	7800750	Brkt, Comb Arr/Cutout 12"	1	1	1	1
3	16600400	Conn, Amp 1/0-2	1	1		
3	16602000	Conn, Amp 336.4-2			1	1
	16020306	Connector, Amp Shells Blue	1	1		
	16020308	Connector, Amp Shells Yellow			1	1
4	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'	12'	12'
5	18312100	Cutout, 15/25 kV	1	1	1	1
6	18314131	Cutout, solid door, type C		1		1
7	71053063	Washer, Spring 5/8"	2	2	2	2
8	71020451	Washer, Square, 2-1/4" x 13/16"	2	2	2	2



CONSTRUCTION STANDARDS
 SECTIONALIZING ASSEMBLY
 CUTOUT & 12" COMBINATION BRACKET
 200 AMP CKT (AMPACT)

S1-A2S

ISSUE DATE: 10/16

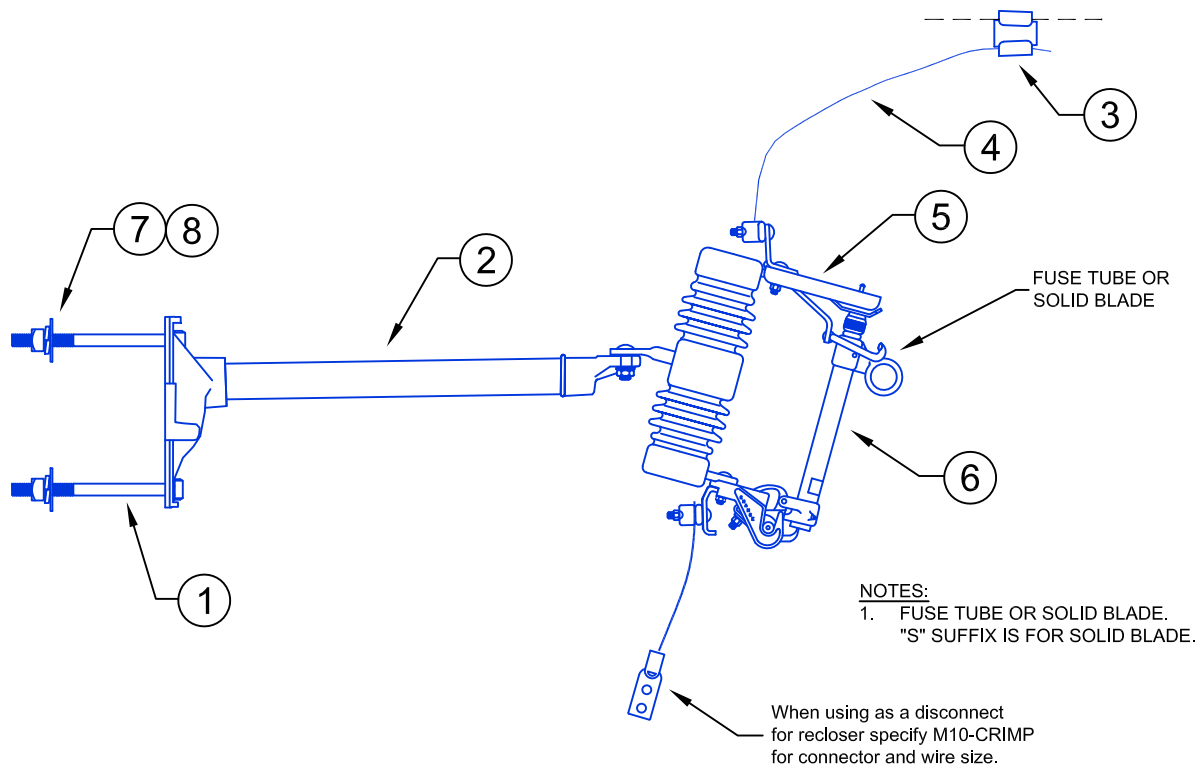
S1-A2L

Construction and Design Notes:

1. Assembly is not approved for use on 350 or 500 MCM primary risers.
2. Assembly is approved for source disconnect (as solid) with recloser bypass on 200 amp rated circuits (1/0 bare or covered) only.

DESCRIPTIONS

- S1-A2L.1... Cutout w/24" Combo Brkt, Fuse, 1/0 Ampact
 S1-A2L.1S... Cutout w/24" Combo Brkt, Blade, 1/0 Ampact
 S1-A2L.3... Cutout w/24" Combo Brkt, Fuse, 336 Ampact
 S1-A2L.3S... Cutout w/24" Combo Brkt, Blade, 336 Ampact



Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S1-A2L.1	S1-A2L.1S	S1-A2L.3	S1-A2L.3S
1	6380514	Bolt, Machine 5/8 x 14"	2	2	2	2
2	7800725	Brkt, Comb Arr/Cutout 24"	1	1	1	1
3	16600400	Conn, Amp 1/0-2	1	1		
3	16602000	Conn, Amp 336.4-2			1	1
	16020306	Connector, Amp Shells Blue	1	1		
	16020308	Connector, Amp Shells Yellow			1	1
4	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'	12'	12'
5	18312100	Cutout, 15/25 kV	1	1	1	1
6	18314131	Cutout, solid door, type C		1		1
7	71053063	Washer, Spring 5/8"	2	2	2	2
8	71020451	Washer, Square, 2-1/4" x 13/16"	2	2	2	2



CONSTRUCTION STANDARDS
 SECTIONALIZING ASSEMBLY
 CUTOUT & 24" COMBINATION BRACKET
 200 AMP CKT (AMPACT)

S1-A2L

ISSUE DATE: 10/16

Construction and Design Notes:

1. This assembly is not approved for use on 350 or 500 MCM primary risers.

S1-2S

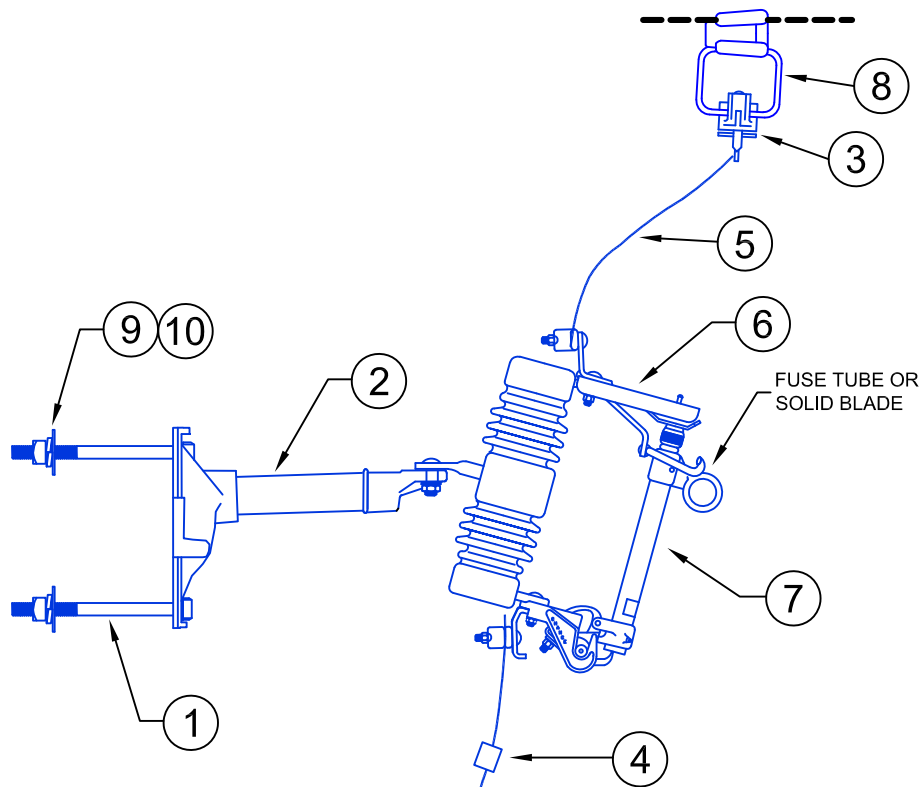
DESCRIPTIONS

S1-2S.1... Cutout w/12" Combo Brkt, Fuse, 1/0

S1-2S.1S...Cutout w/12" Combo Brkt, Blade, 1/0

S1-2S.3... Cutout w/12" Combo Brkt, Fuse, 336

S1-2S.3S...Cutout w/12" Combo Brkt, Blade, 336



NOTES:

1. FUSE TUBE OR SOLID BLADE.
"S" SUFFIX IS FOR SOLID BLADE.

Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S1-2S.1	S1-2S.1S	S1-2S.3	S1-2S.3S
1	6380514	Bolt, Machine 5/8 x 14"	2	2	2	2
2	7800750	Brkt, Comb Arr/Cutout 12"	1	1	1	1
3	17410000	Clamp, Hot Line, #8-1/0	1	1	1	1
	16020308	Connector, Amp Shells Yellow			1	1
4	17010502	Connector, Sicame TTD2710XFBTUNI	1	1	1	1
5	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'	12'	12'
6	18312100	Cutout, 15/25 kV *	1	1	1	1
7	18314131	Cutout, solid door, type C		1		1
8	62000000	Stirrup, #4 - 1/0 comp.	1	1		
8	62001000	Stirrup, Shoot On, 336.4			1	1
9	71053063	Washer, Spring 5/8"	2	2	2	2
10	71020451	Washer, Square, 2-1/4" x 13/16"	2	2	2	2



CONSTRUCTION STANDARDS
SECTIONALIZING ASSEMBLY
CUTOUT & 12" COMBINATION BRACKET
200 AMP CKT (STIRRUP)

S1-2S

ISSUE DATE: 01/20

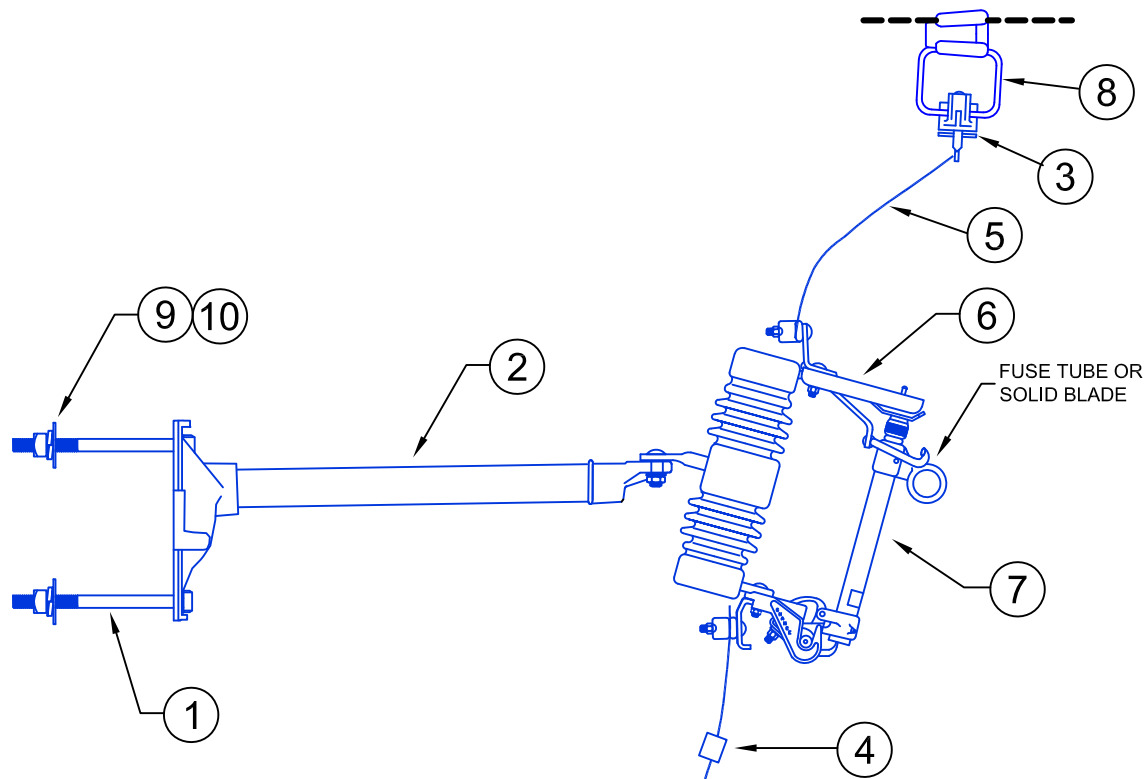
Construction and Design Notes:

1. This assembly is not approved for use on 350 or 500 MCM primary risers.

S1-2L

DESCRIPTIONS

- S1-2L.1... Cutout w/24" Combo Brkt, Fuse, 1/0
S1-2L.1S... Cutout w/24" Combo Brkt, Blade, 1/0
S1-2L.3... Cutout w/24" Combo Brkt, Fuse, 336
S1-2L.3S... Cutout w/24" Combo Brkt, Blade, 336



NOTES:

1. FUSE TUBE OR SOLID BLADE.
"S" SUFFIX IS FOR SOLID BLADE.

Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S1-2L.1	S1-2L.1S	S1-2L.3	S1-2L.3S
1	6380514	Bolt, Machine 5/8 x 14"	2	2	2	2
2	7800725	Brkt, Comb Arr/Cutout 24"	1	1	1	1
3	17410000	Clamp, Hot Line, #8-1/0	1	1	1	1
	16020308	Connector, Amp Shells Yellow			1	1
4	17010502	Connector, Sicame TTD2710XFBTUNI	1	1	1	1
5	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'	12'	12'
6	18312100	Cutout, 15/25 kV 6	1	1	1	1
7	18314131	Cutout, solid door, type C		1		1
8	62000000	Stirrup, #4 -1/0 comp.	1	1		
8	62001000	Stirrup, Shoot On, 336.4			1	1
9	71053063	Washer, Spring 5/8"	2	2	2	2
10	71020451	Washer, Square, 2-1/4" x 13/16"	2	2	2	2



CONSTRUCTION STANDARDS
SECTIONALIZING ASSEMBLY
CUTOUT & 24" COMBINATION BRACKET
200 AMP CKT (STIRRUP)

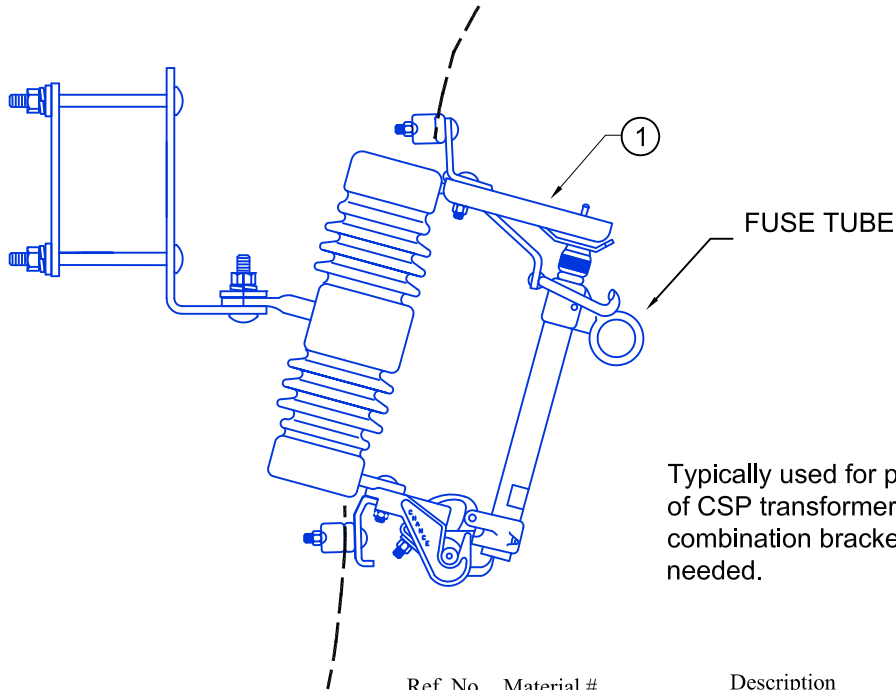
S1-2L

ISSUE DATE: 01/20

DESCRIPTIONS

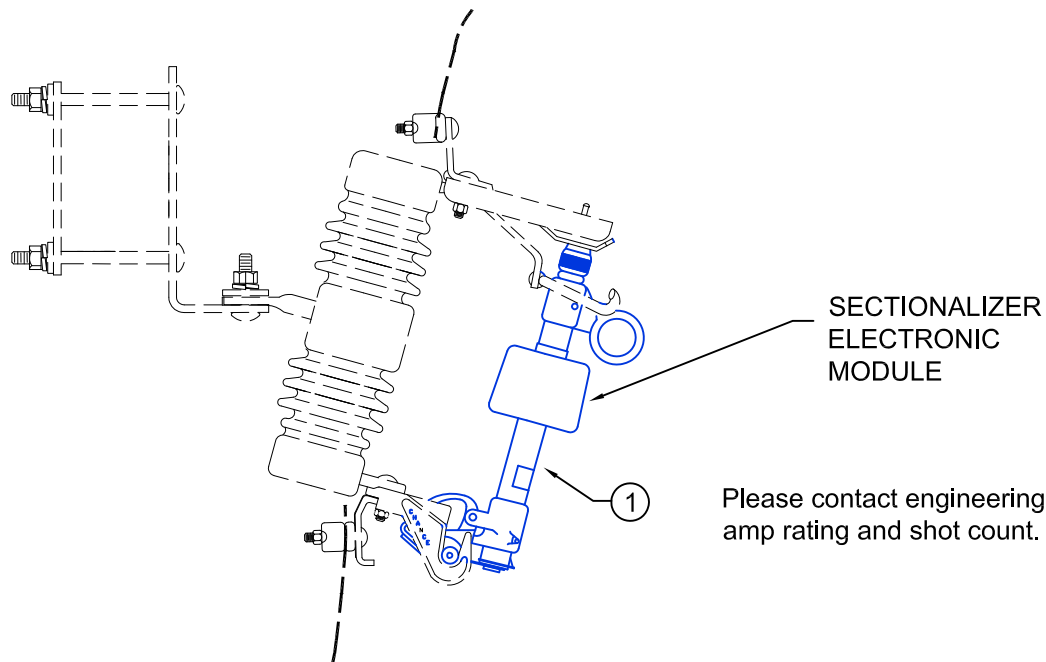
S1-3M... Cutout, Sectionalizer, Module only

S1-3C... Cutout, only w/Xarm Bracket



Typically used for primary protection of CSP transformers. Call out M4 combination brackets separately as needed.

Ref. No.	Material #	Description	S1-3C
1	18312100	Cutout, 15/25 kV	1



Please contact engineering for amp rating and shot count.

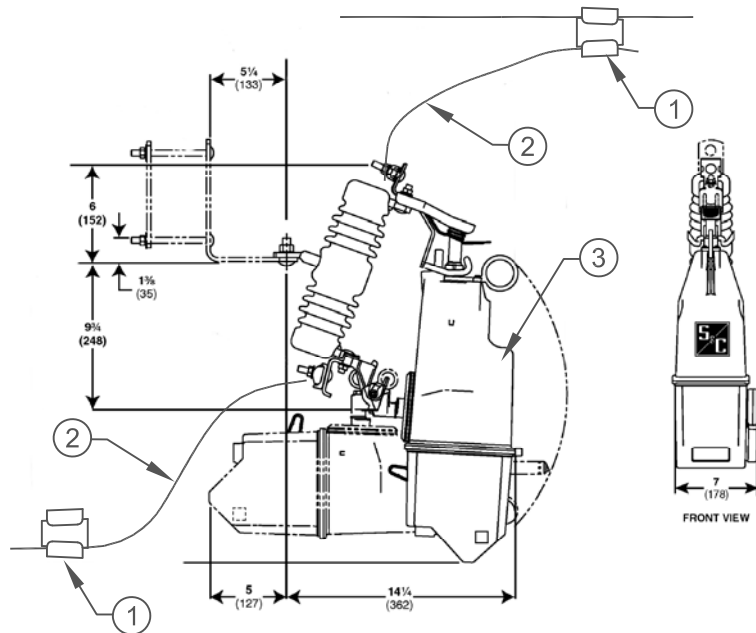
Ref. No.	Material #	Description	S1-3M
1	18314230	Cutout, Sectionalizer, Module Only	1

DESCRIPTIONS

S1-4R... Cutout, Recloser, TripSaver w/xarm bracket

S1-4S... Cutout, 15kV, solid door only

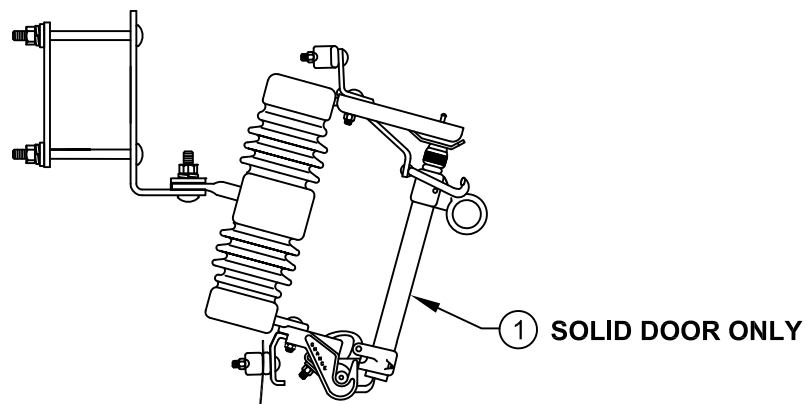
S1-4



NOTE:

Can also be mounted on the center hole of a M4 Combo Bracket.

Ref. No.	Material #	Description	1/0 ACSR	336 ACSR
			S1-4R.1	S1-4R.3
1	16600400	Conn, Amp 1/0-2	2	1
1	16602000	Conn, Amp 336.4-2		1
	16020306	Connector, Amp Shells Blue	1	1
	16020308	Connector, Amp Shells Yellow		1
2	16510207	Cond. 2 Cu Poly, Sd. Str.	12'	12'
3	50000001	Cutout, Recloser, TripSaver w/brkt	1	1



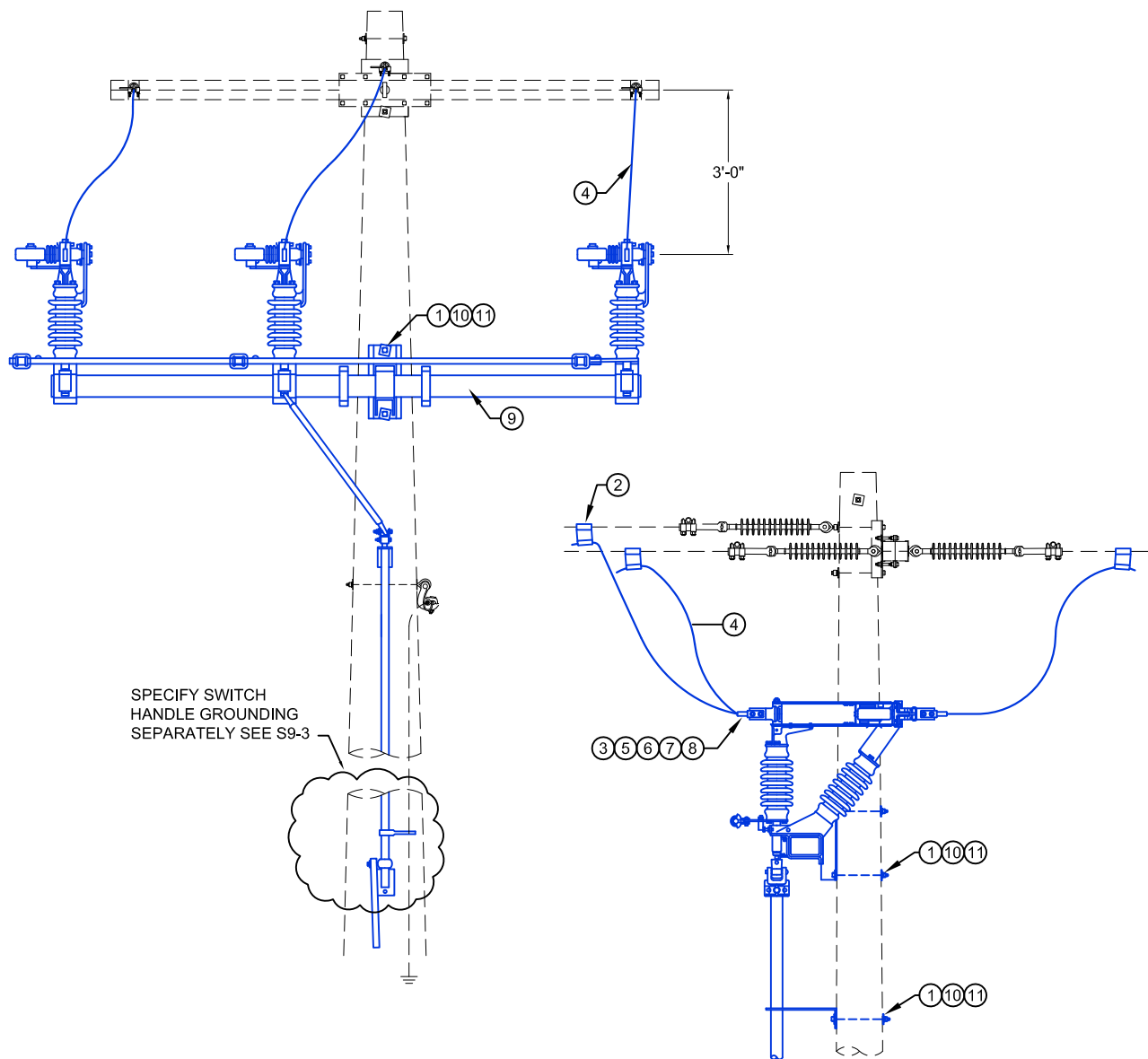
Ref. No.	Material #	Description	S1-4S
1	18314250	Cutout, 15kV, solid door only	1



CONSTRUCTION STANDARDS
SECTIONALIZING ASSEMBLY
CUTOUT - RECLOSER, TRIPSAVER

S1-4

ISSUE DATE: 02/19



CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR	336 ACSR	477 ACSR
15 kV	S2-1.1	S2-1.3	-
25/35 kV	ZS2-1.1	ZS2-1.3	ZS2-1.4



CONSTRUCTION STANDARDS

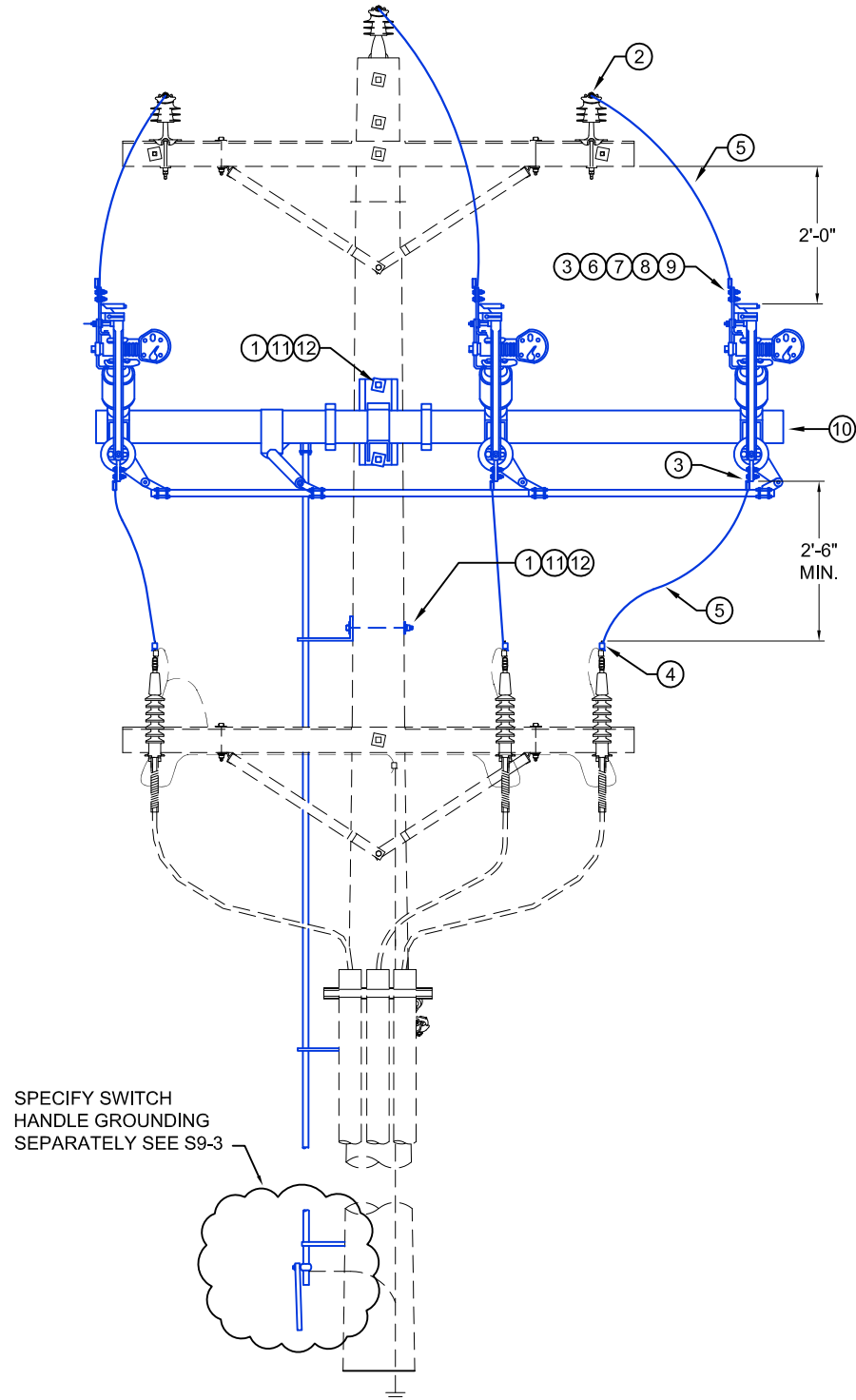
THREE PHASE HORIZONTAL MOUNT AIR BREAK SWITCH

Materials List for Assemblies

Descriptions

S2-1.1	Switch, 3-Pole Air Break, Horiz, 1/0
S2-1.3	Switch, 3-Pole Air Break, Horiz, 336
ZS2-1.1	Switch, 3-Pole Air Break, Horiz, 1/0, 35kV
ZS2-1.3	Switch, 3-Pole Air Break, Horiz, 336, 35kV
ZS2-1.4	Switch, 3-Pole Air Break, Horiz, 477, 35kV

Ref	Material #	Description	S2-1.1	S2-1.3	ZS2-1.1	ZS2-1.3	ZS2-1.4
1	6380514	Bolt, Machine 5/8" x 14"	4	4	4	4	4
2	16600400	Con, Amp 1/0 – 2	6		6		
2	16602004	Con, Amp 336 – 4/0		6		6	
2	16020316	Con, Amp 477 – 4/0					6
	16020304	Connector, Amp Shells White	6		6		
	16020308	Connector, Amp Shells Yellow		6		6	6
3	17019002	Conn, Comp Terminal NEMA #2	6		6		
3	17019040	Conn, Comp Terminal NEMA 4/0		6		6	6
4	16510207	Cond 2 CU Poly Str SD	30'		30'		
4	16514007	Cond 4/0 CU Poly Str		30'		30'	30'
5	17040100	Conn, Xfmr Stainless Bolts 1 1/2"	12	12	12	12	12
6	17040115	Conn, Xfmr Stainless Flat Washer	24	24	24	24	24
7	17040120	Conn, Xfmr Stainless Lock Washer	12	12	12	12	12
8	17040125	Conn: Xfmr Stainless nut	12	12	12	12	12
9	65416531	Switch, Air Break 3 Pole 15 kV	1	1			
9	65436531	Switch, Air Break 3 Pole 35 kV			1	1	1
10	71053063	Washer, Spring – 5/8"	4	4	4	4	4
11	71020451	Washer, Square 2 1/4" x 13/16"	4	4	4	4	4



CONSTRUCTION ASSEMBLIES		
System Voltage	1/0 ACSR	336 ACSR
15 kV	S2-2.1	S2-2.3
25/35 kV	ZS2-2.1	ZS2-2.3

Materials List for Assemblies

Descriptions

S2-2.1	Switch, 3-Pole, Vert Riser/Circuit Tie 1/0
S2-2.3	Switch, 3-Pole, Vert Riser/Circuit Tie 336
ZS2-2.1	Switch, 3-Pole, Vert Riser/Circuit Tie 1/0, 35kV
ZS2-2.3	Switch, 3-Pole, Vert Riser/Circuit Tie 336, 35kV

Ref	Material #	Description	S2-2.1	S2-2.3	ZS2-2.1	ZS2-2.3
1	6380514	Bolt, Machine 5/8" x 14"	4	4	4	4
2	16600400	Con, Amp 1/0 – 2	3		3	
2	16602004	Con, Amp 336 – 4/0		3		3
	16020304	Connector, Amp Shells White	6		6	
	16020308	Connector, Amp Shells Yellow		6		6
3	17019002	Conn, Comp Terminal NEMA #2	6		6	
3	17019040	Conn, Comp Terminal NEMA 4/0		9		9
4	17015002	Conn, GC5002 #2 Str	3		3	
5	16510207	Cond 2 CU Poly Str SD	24		24	
5	16514007	Cond 4/0 CU Poly Str		24		24
6	17040100	Conn, Xfmr Stainless Bolts 1 1/2"	12	18	12	18
7	17040115	Conn, Xfmr Stainless Flat Washer	24	36	24	36
8	17040120	Conn, Xfmr Stainless Lock Washer	12	18	12	18
9	17040125	Conn, Xfmr Stainless Nuts	12	18	12	18
10	65416515	Switch, Air Break 3 Pole 15 kV Riser	1	1		
10	65426531	Switch, Air Break 3 Pole 35 kV Riser			1	1
11	71053063	Washer, Spring – 5/8"	2	2	2	2
12	71020451	Washer, Square 2 1/4" x 13/16"	4	4	4	4

Construction and Design Notes:

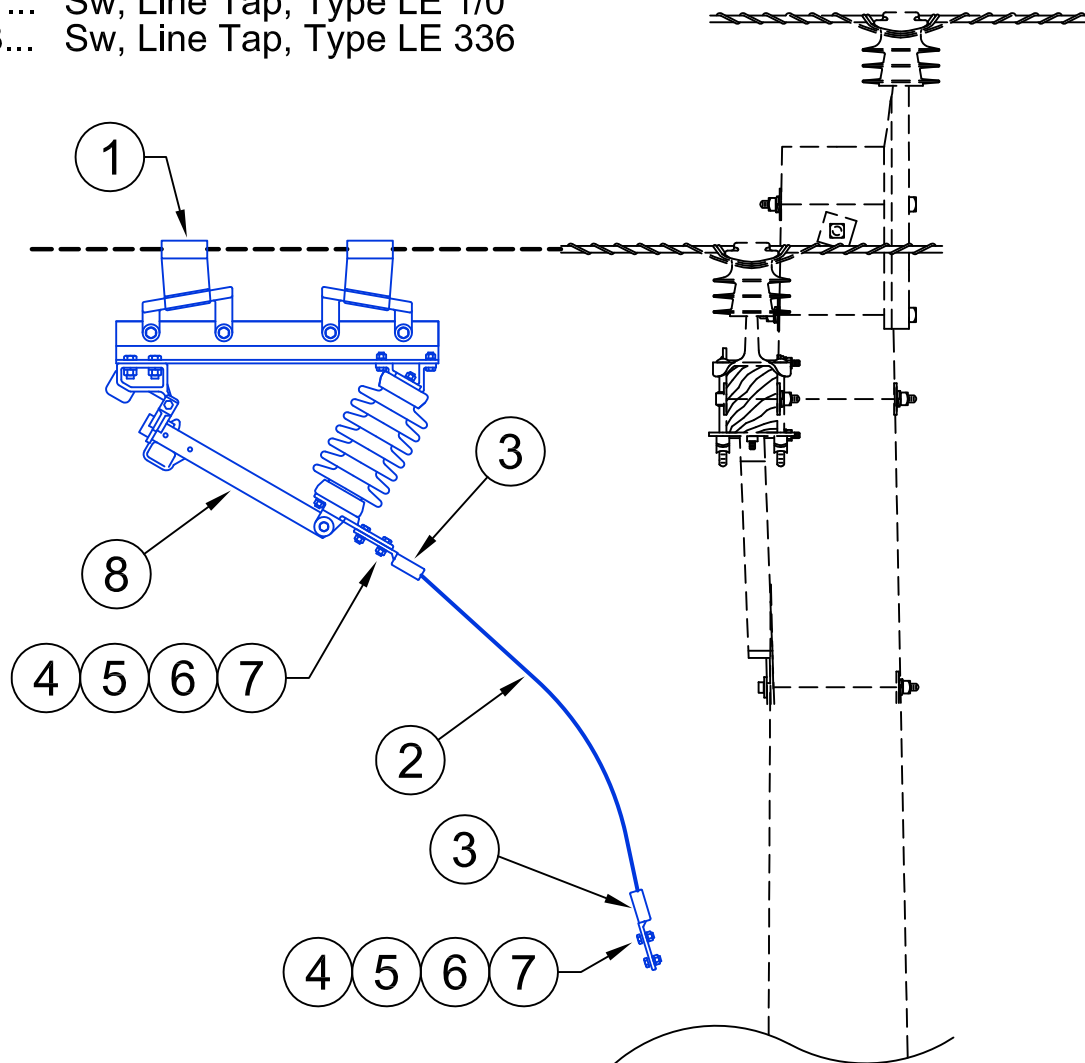
1. This assembly is approved for 15, 25 and 35kV construction.

S2-3

DESCRIPTIONS

S2-3.1... Sw, Line Tap, Type LE 1/0

S2-3.3... Sw, Line Tap, Type LE 336



Ref. No.	Material #	Description	S2-3.1	S2-3.3
1	16020319	Con:AMP 477 - 1/0	2	
1	16020314	Con:AMP 477 - 336		2
	16020308	Connector, Amp Shells Yellow	2	2
2	16510207	Cond 2 Cu Poly Sd Str	6	
2	16514007	Cond 4/0 Cu Poly Str		6
3	17019002	Conn: Comp Terminal NEMA #2	2	
3	17019040	Conn: Comp Terminal NEMA #4/0		2
4	17040100	Conn: Xfmr Stainless bolts 1 1/2"	4	4
5	17040125	Conn: Xfmr Stainless Nut	4	4
6	17040115	Conn: Xfmr Stainless washer flat	8	8
7	17040120	Conn: Xfmr Stainless washer lock	4	4
8	65450500	Sw: Line Tap TYPE LE 600 amp	1	1



CONSTRUCTION STANDARDS

Line-Tap Switch, 600 Amp

S2-3

ISSUE DATE: 08/13

Descriptions:

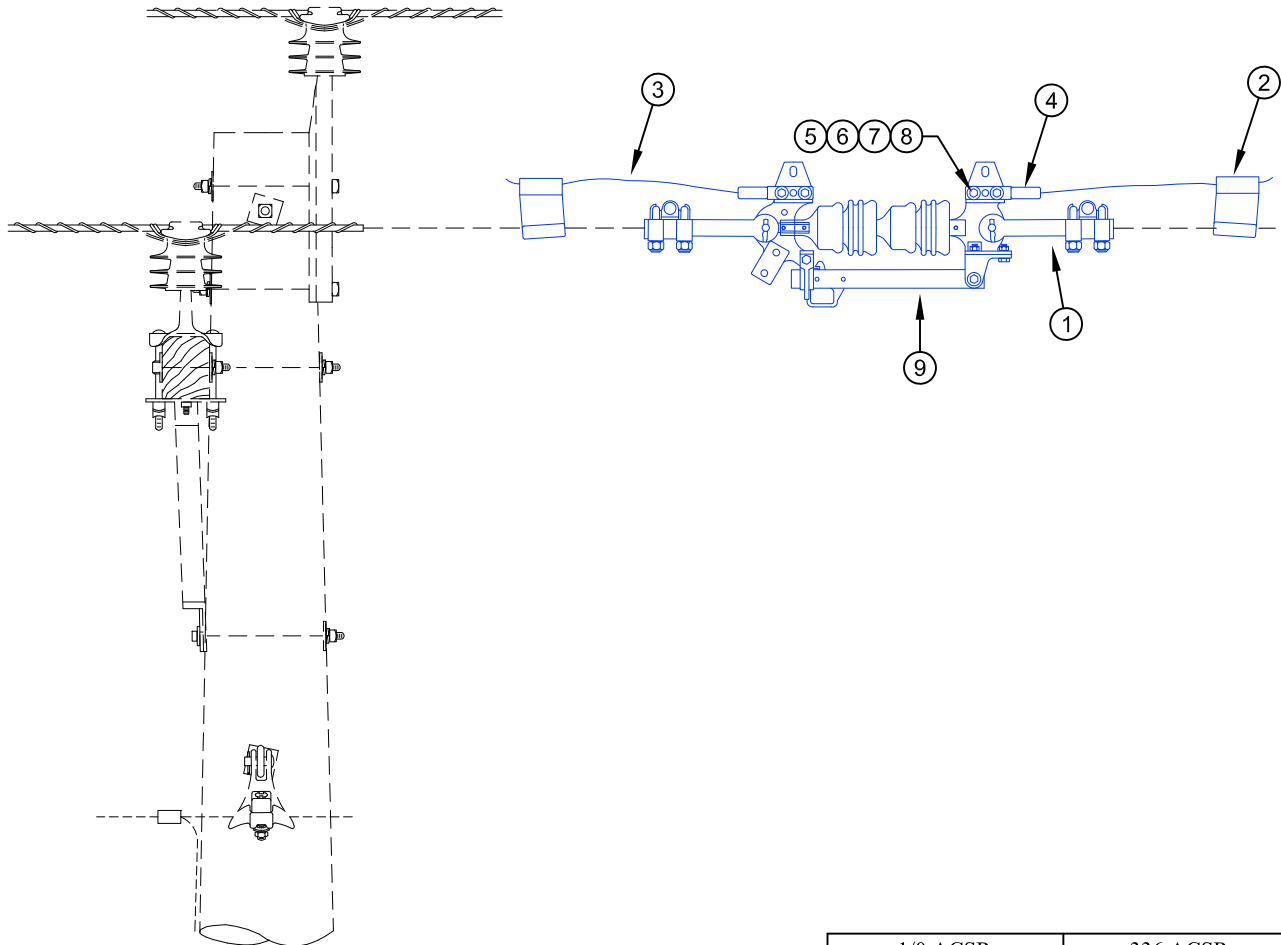
S2-4L

S2-4L.1... SW, In-Line Tension, T-L 1/0, 15/25kV

ZS2-4L.1... SW, In-Line Tension, T-L, 1/0, 35kV

S2-4L.3... SW, In-Line Tension, T-L, 336, 15/25kV

ZS2-4L.3... SW, In-Line Tension, T-L 336, 35kV



Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S2-4L.1	ZS2-4L.1	S2-4L.3	ZS2-4L.3
1	11723025	Clamp, DE #4-2/0 ACSR	2	2		
1	11723040	Clamp, DE 3/0- 477 ACSR Straight			2	2
2	16600400	Con:AMP 1/0 - 2	2	2		
2	16602004	Con:AMP 336.4 - 4/0			2	2
	16020304	Connector, Amp Shells White	2	2		
	16020308	Connector, Amp Shells Yellow			2	2
3	16510207	Cond 2 Cu Poly Sd Str	3	3		
3	16514007	Cond 4/0 Cu Poly Str			3	3
4	17019002	Conn: Comp Terminal NEMA #2	2	2		
4	17019040	Conn: Comp Terminal NEMA #4/0			2	2
5	17040100	Conn: Xfmr Stainless bolts 1 1/2"	4	4	4	4
6	17040115	Conn: Xfmr Stainless washer flat	8	8	8	8
7	17040120	Conn: Xfmr Stainless washer lock	4	4	4	4
8	17040125	Conn: Xfmr Stainless nut	4	4	4	4
9	65506400	Sw: In Line Dis Type SE BIL150	1		1	
9	65506450	Sw: In Line Dis Type SE BIL200		1		1



CONSTRUCTION STANDARDS
IN-LINE TENSION SWITCH (BRIDGES)
THROUGH - LINE

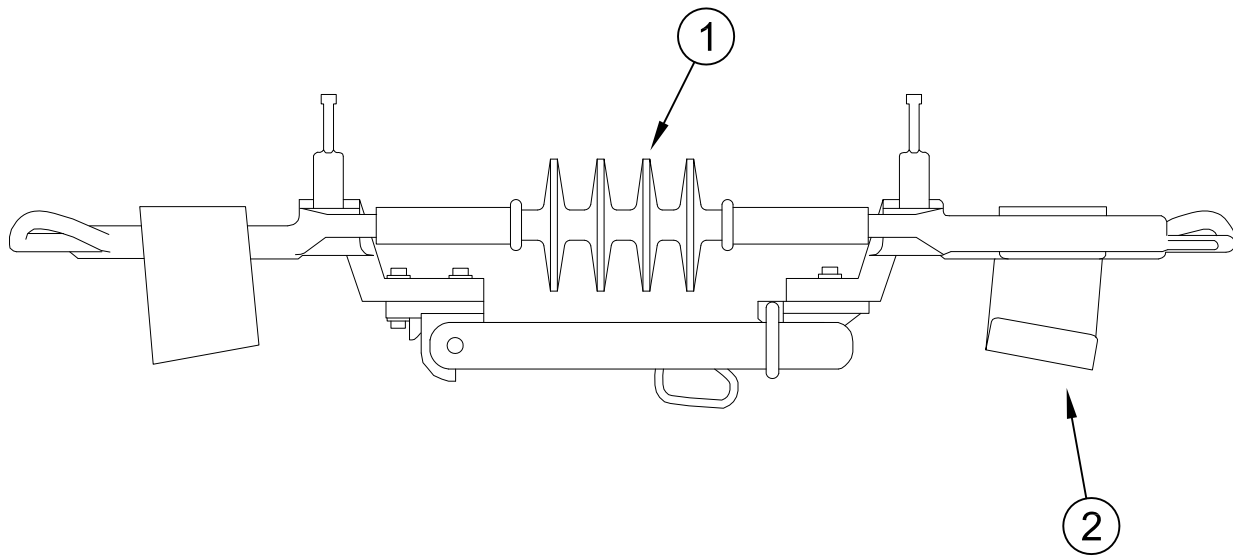
S2-4L

ISSUE DATE: 05/16

S2-4LA

Descriptions:

- S2-4LA.1... Switch, In-Line Tension, AMP 1/0 acsr 3/0 compact, 15KV
 S2-4LA.2... Switch, In-Line Tension, AMP 3/0 4/0 acsr, 15KV
 S2-4LA.3... Switch, In-Line Tension, AMP 336 compact, 15KV
 S2-4LA.4... Switch, In-Line Tension, AMP 336 acsr, 15KV



Ref.	Material #	Description	S2-4LA.1	S2-4LA.2	S2-4LA.3	S2-4LA.4
1	65470000	Sw: AMP In-Line 1/0 Acsr 3/0 Compact w/Conn	1			
1	65470001	Sw: AMP In-Line 3/0 - 4/0 Acsr w/Conn		1		
1	65470004	Sw: AMP In-Line 336 without Conn			1	1
2	17034000	Conn, AMP Sw for 336 Compact			2	
2	17034010	Conn, AMP Sw for 336 ACSR				2
	16020308	Connector, Amp Shells Yellow	2	2	2	2



CONSTRUCTION STANDARDS
 IN-LINE TENSION SWITCH (AMP)
 THROUGH-LINE

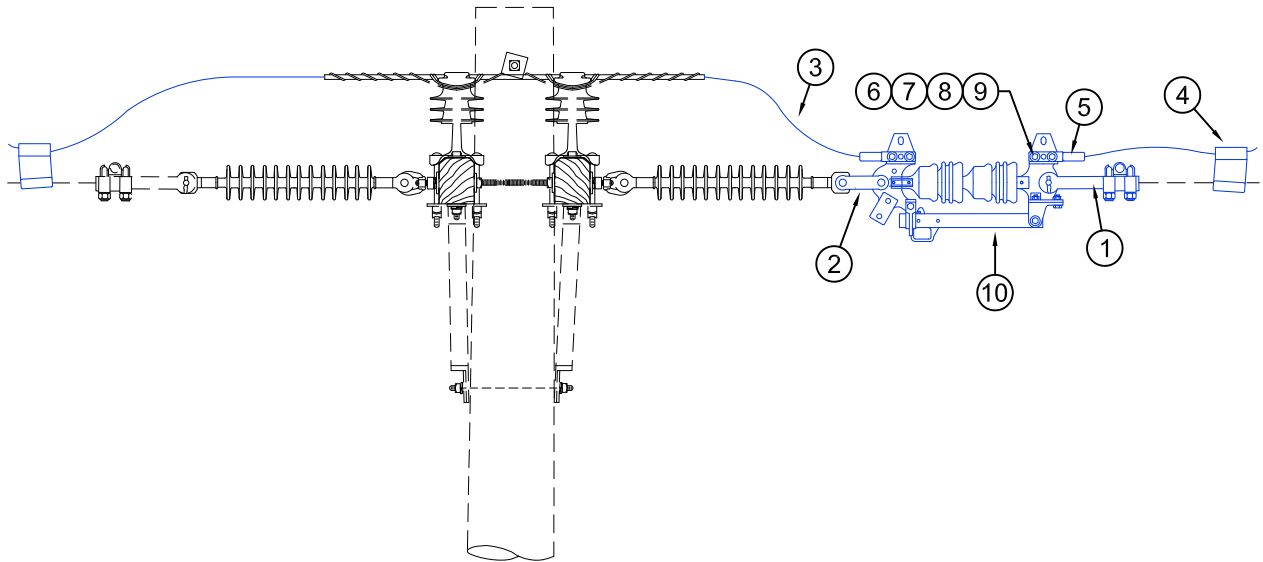
S2-4LA

ISSUE DATE: 05/16

S2-4DE

Descriptions:

S2-4DE.1... SW, In-Line Tension, DDE, 1/0, 15/25kV
 ZS2-4DE.1... SW, In-Line Tension, DDE, 1/0, 35kV
 S2-4DE.3... SW, In-Line Tension, DDE, 336, 15/25kV
 ZS2-4DE.3... SW, In-Line Tension, DDE, 336, 35kV



Ref. No.	Material #	Description	1/0 ACSR		336 ACSR	
			S2-4DE.1	ZS2-4DE.1	S2-4DE.3	ZS2-4DE.3
1	11723025	Clamp, DE #4-2/0 ACSR	1	1		
1	11723040	Clamp, DE 3/0- 477 ACSR Straight			1	1
2	18050000	Clevis Clevis	1	1	1	1
3	16510207	Cond 2 Cu Poly Sd Str	6	6		
3	16514007	Cond 4/0 Cu Poly Str			6	6
4	16600400	Con: AMP 1/0 - 2	2	2		
4	16602004	Con: AMP 336.4 - 4/0			2	2
5	17019002	Conn: Comp Terminal NEMA #2	2	2		
5	17019040	Conn: Comp Terminal NEMA #4/0			2	2
	16020304	Connector, Amp Shells White	2	2		
	16020308	Connector, Amp Shells Yellow			2	2
6	17040100	Conn: Xfmr Stainless bolts 1-1/2"	4	4	4	4
7	17040115	Conn: Xfmr Stainless washer flat	8	8	8	8
8	17040120	Conn: Xfmr Stainless washer lock	4	4	4	4
9	17040125	Conn: Xfmr Stainless nut	4	4	4	4
10	65506400	Sw: In Line Dis Type SE BIL150	1		1	
10	65506450	Sw: In Line Dis Type SE BIL200		1		1



CONSTRUCTION STANDARDS
 IN-LINE TENSION SWITCH (BRIDGES)
 DOUBLE DEAD-END

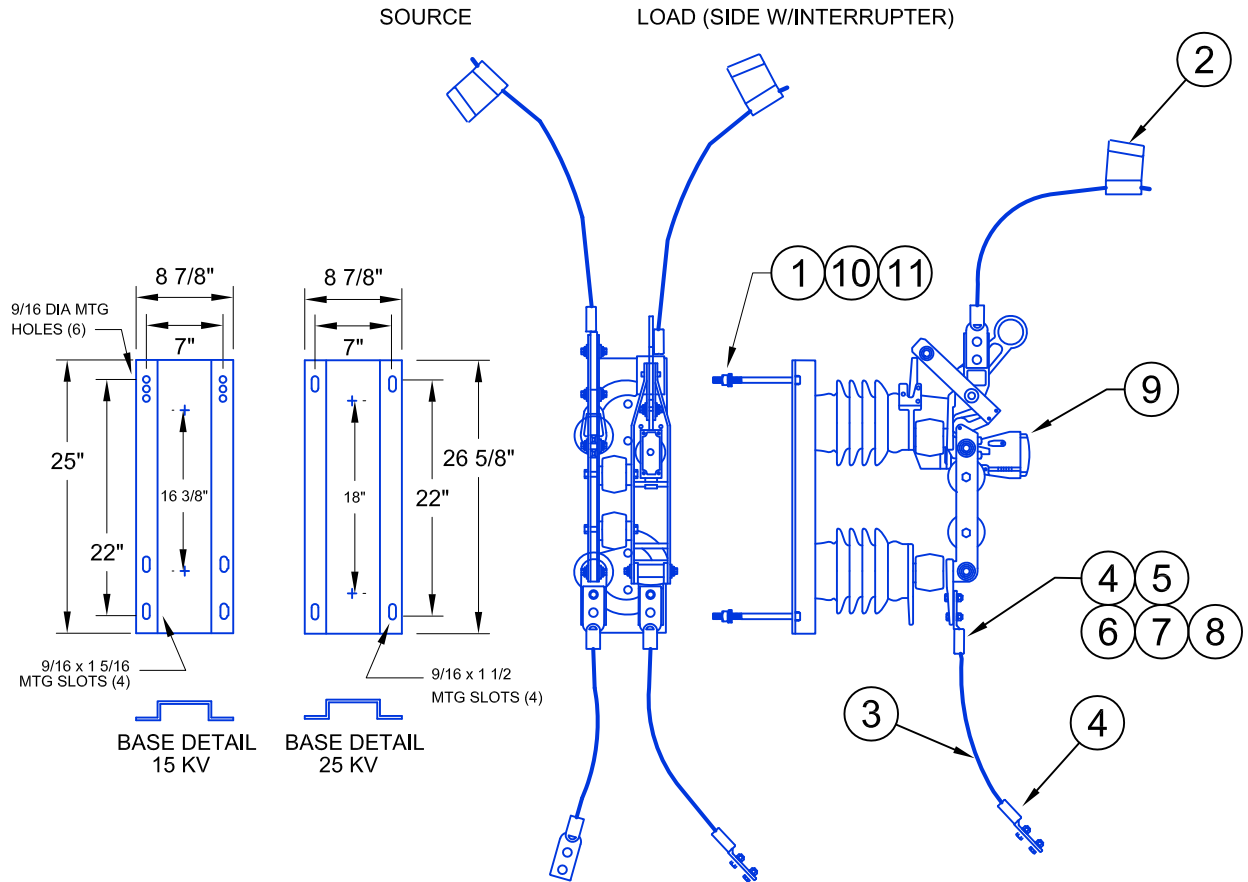
S2-4DE

ISSUE DATE: 05/16

Descriptions:

- S2-5.1... Switch, Regulator/Meter Bypass, 1/0, 15KV
 S2-5.3... Switch, Regulator/Meter Bypass, 336, 15KV
 VS2-5.1... Switch, Regulator/Meter Bypass, 1/0, 25KV
 VS2-5.3... Switch, Regulator/Meter Bypass, 336, 25KV

S2-5



Ref. No.	Material #	Description	S2-5.1	S2-5.3	VS2-5.1	VS2-5.3
1	6380408	Bolt, Machine 1/2 x 8"	4	4	4	4
2	16600400	Con, Amp 1/0-2	2		2	
2	16602004	Con, Amp 336 - 4/0		2		2
	16020304	Connector, Amp Shells White	2		2	
	16020308	Connector, Amp Shells Yellow		2		2
3	16510207	Cond 2 CU Poly Str SD	60'		60'	
3	16514007	Cond 4/0 CU Poly Str		60'		60'
4	17019002	Conn, Comp Terminal NEMA #2	6		6	
4	17019040	Conn: Comp Terminal NEMA 4/0		6		6
5	17040100	Conn: Xfmr Stainless bolts 1 1/2"	12	12	12	12
6	17040115	Conn: Xfmr Stainless washer flat	24	24	24	24
7	17040120	Conn: Xfmr Stainless washer lock	12	12	12	12
8	17040125	Conn: Xfmr Stainless nut	12	12	12	12
9	65616000	Switch, Reg. Bypass, 15 kV	1	1		
9	6562600	Switch, Reg. Bypass, 25 kV			1	1
10	71035931	Washer, Round 5/8"	4	4	4	4
11	71053050	Washer, Spring 1/2"	4	4	4	4



CONSTRUCTION STANDARDS

REGULATOR BYPASS
SEQUENCE STYLE

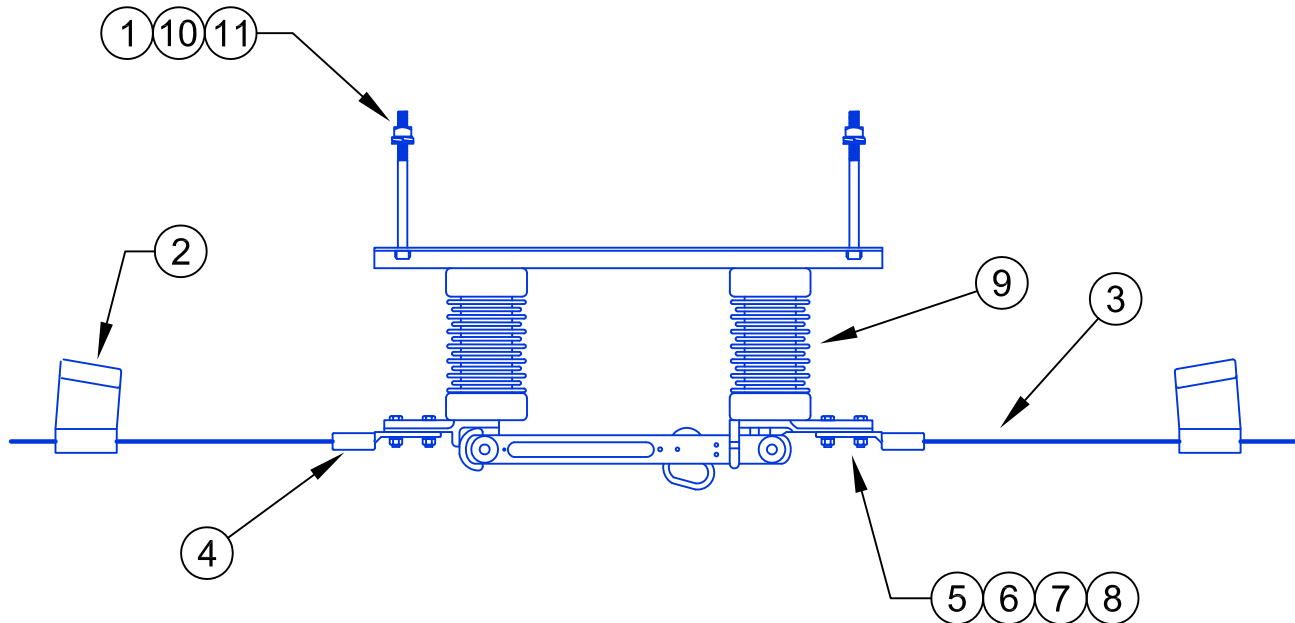
S2-5

ISSUE DATE: 05/16

S2-6

Descriptions:

S2-6.1... SW Blade 600 Amp 110 BIL 1/0
 S2-6.3... SW Blade 600 Amp 110 BIL 336
 VS2-6.1... SW Blade 600 Amp 150 BIL 1/0, 25kV
 VS2-6.3... SW Blade 600 Amp 150 BIL 336, 25kV
 ZS2-6.1... SW Blade 600 Amp 200 BIL 1/0, 35kV
 ZS2-6.3... SW Blade 600 Amp 200 BIL 336, 35kV



Ref. No.	Material #	Description	S2-6.1	S2-6.3	VS2-6.1	VS2-6.3	ZS2-6.1	ZS2-6.3
1	6380408	Bolt, Machine 1/2 x 8"	4	4	4	4	4	4
2	16600400	Con:AMP 1/0 - 2	2		2		2	
2	16602004	Con:AMP 336 - 4/0		2		2		2
	16020304	Connector, Amp Shells White	2		2		2	
	16020308	Connector, Amp Shells Yellow		2		2		2
3	16510207	Cond 2 Cu Poly Sd Str	15		15		15	
3	16514007	Cond 4/0 Cu Poly Str		15		15		15
4	17019002	Conn: Comp Terminal NEMA #2	2		2		2	
4	17019040	Conn: Comp Terminal NEMA #4/0		2		2		2
5	17040100	Conn: Xfmr Stainless bolts 1 1/2"	4	4	4	4	4	4
6	17040115	Conn: Xfmr Stainless washer flat	8	8	8	8	8	8
7	17040120	Conn: Xfmr Stainless washer lock	4	4	4	4	4	4
8	17040125	Conn: Xfmr Stainless nut	4	4	4	4	4	4
9	65440000	Sw: Sub Sta Blade 110 Bil	1	1				
9	65440014	Sw: Sub Sta Blade 150 Bil			1	1		
9	65440038	Sw: Sub Sta Blade 200 Bil					1	1
10	71035931	Washer, Round 5/8"	4	4	4	4	4	4
11	71053050	Washer, Spring 1/2"	4	4	4	4	4	4

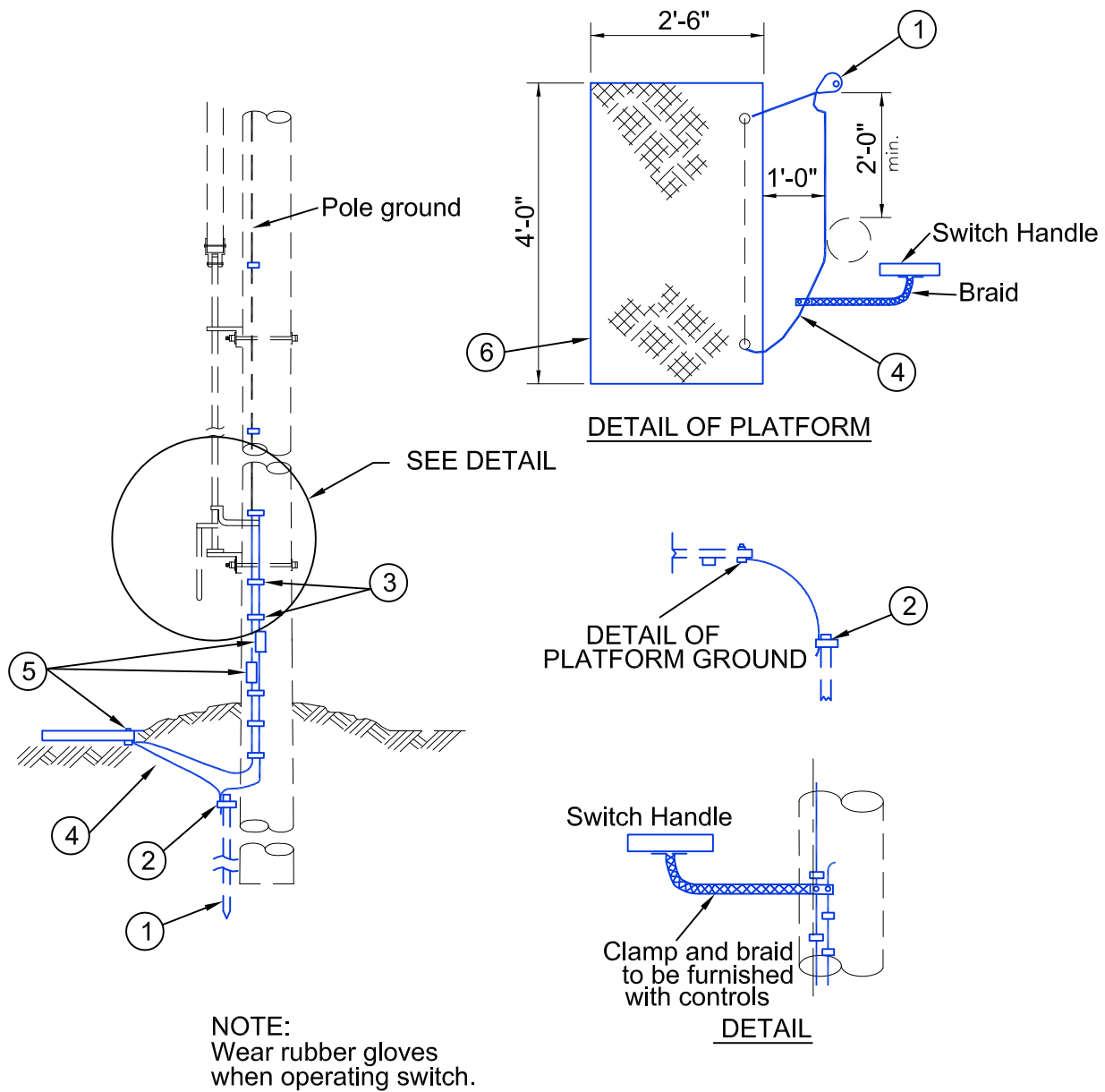


CONSTRUCTION STANDARDS

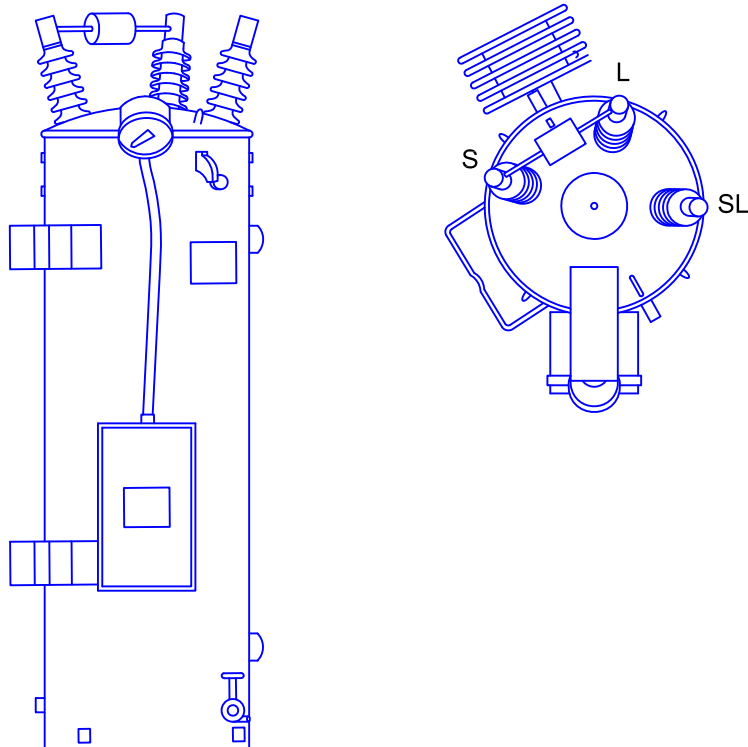
SINGLE BLADE 600 AMP DISCONNECT

S2-6

ISSUE DATE: 05/16



Ref. No.	Material #	Description	S9-3
1	53808508	Rod, ground, 5/8" min. dia.	1
2	17311000	Clamp, ground rod, 5/8"	1
3	61801810	Staples, ground wire as required	10
4	15610601	Wire, #6 Cu	12'
5	17015006	Connector, GC500 Solid, as required	4
6	65416520	Switch, grounding platform	1

VOLTAGE REGULATOR

CONST. UNIT	LOAD AMPS	KVA	APPROX. WT (LBS)	APPROX. OIL (GAL)	APPROX. HT (IN)	MOUNTING TYPE
7,620 VOLTS - 95 kV BIL (used on 7.2/12.47GY kV and 2.4/4.16GY kV CKTs)						
V1.050	50	38.1	1000	46	64	POLE / PLATFORM
V1.100	100	76.2	1280	57	70	POLE / PLATFORM
V1.150	150	114.3	1600	63	71	POLE / PLATFORM
V1.219	219	167	1900	67	75	POLE / PLATFORM
V1.328	328	250	2620	95	83	PLATFORM
V1.438	438	333	2980	100	88	PLATFORM / STATION
V1.548	548	416	3280	106	91	STATION
V1.668	668	509	3710	125	93	STATION
14,400 VOLTS - 150 kV BIL (used on 14.4/24.9GY kV and 7.2/12.47GY kV CKTs)						
VV1.050	50	72	1820	96	79	POLE / PLATFORM
VV1.100	100	144	2380	102	88	POLE / PLATFORM
VV1.200	200	288	3190	127	96	STATION
19,920 VOLTS - 150 kV BIL (used on 19.9/34.5GY kV CKTs)						
ZV1.050	50.2	100	2230	110	94	POLE / PLATFORM
ZV1.100	100.4	200	2940	132	101	STATION

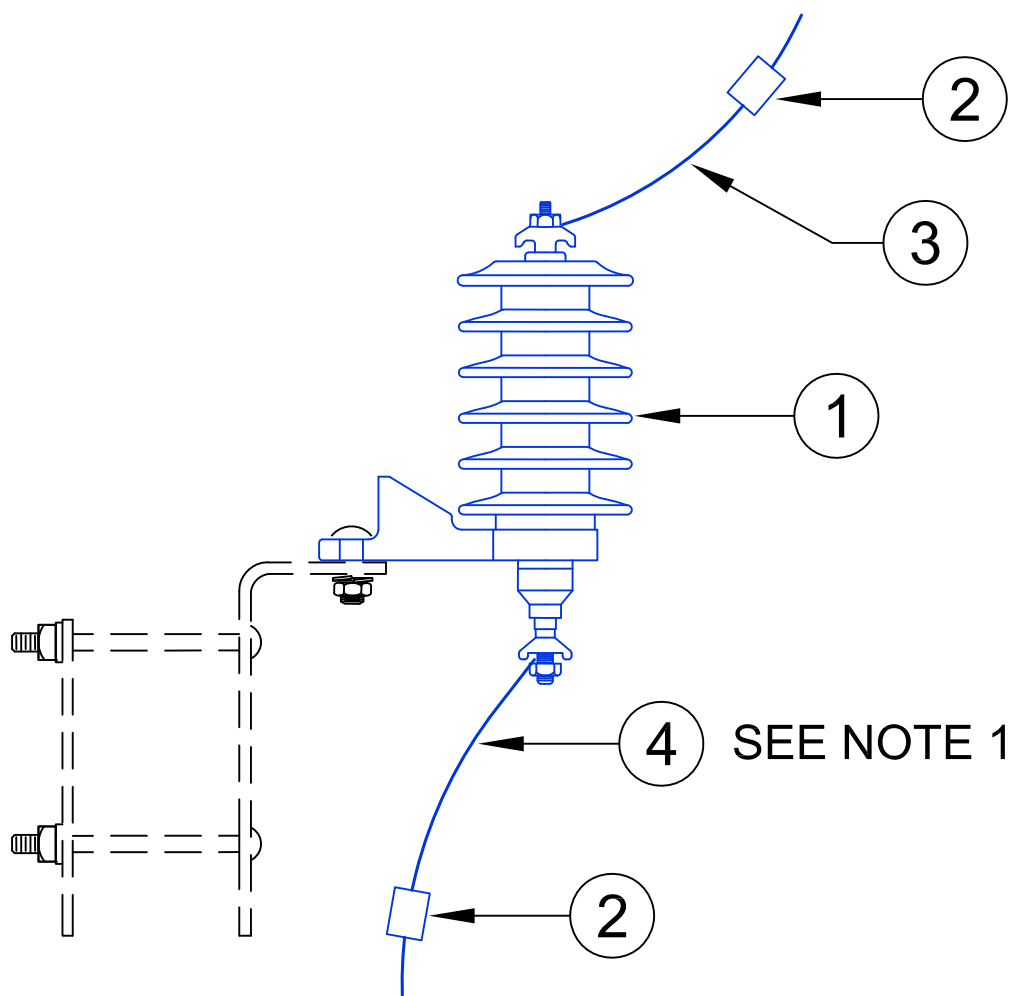
* TYPICAL DIMENSIONS FOR GE REGULATORS

Construction and Design Notes:
1. Limit to the shortest length possible.

V6

DESCRIPTIONS

- V6... Arrestor, Distribution, Overhead 9/10 kV
- VV6... Arrestor, Distribution, Overhead 18 kV
- ZV6... Arrestor, Distribution, Overhead 27 kV



Ref. No.	Material #	Description	V6	VV6	ZV6
1	1520900	Arrester, 9/10KV	1		
1	1521800	Arrester, 18KV		1	
1	1522700	Arrester, 27KV			1
2	17015004	Conn; GC5004 #4 Solid	2	2	2
3	16510407	Cond 4 Cu Poly Sd Str	4	4	4
4	15610601	Cond 6 Solid Cu Soft Drawn	4	4	4



CONSTRUCTION STANDARDS

LIGHTNING ARRESTORS

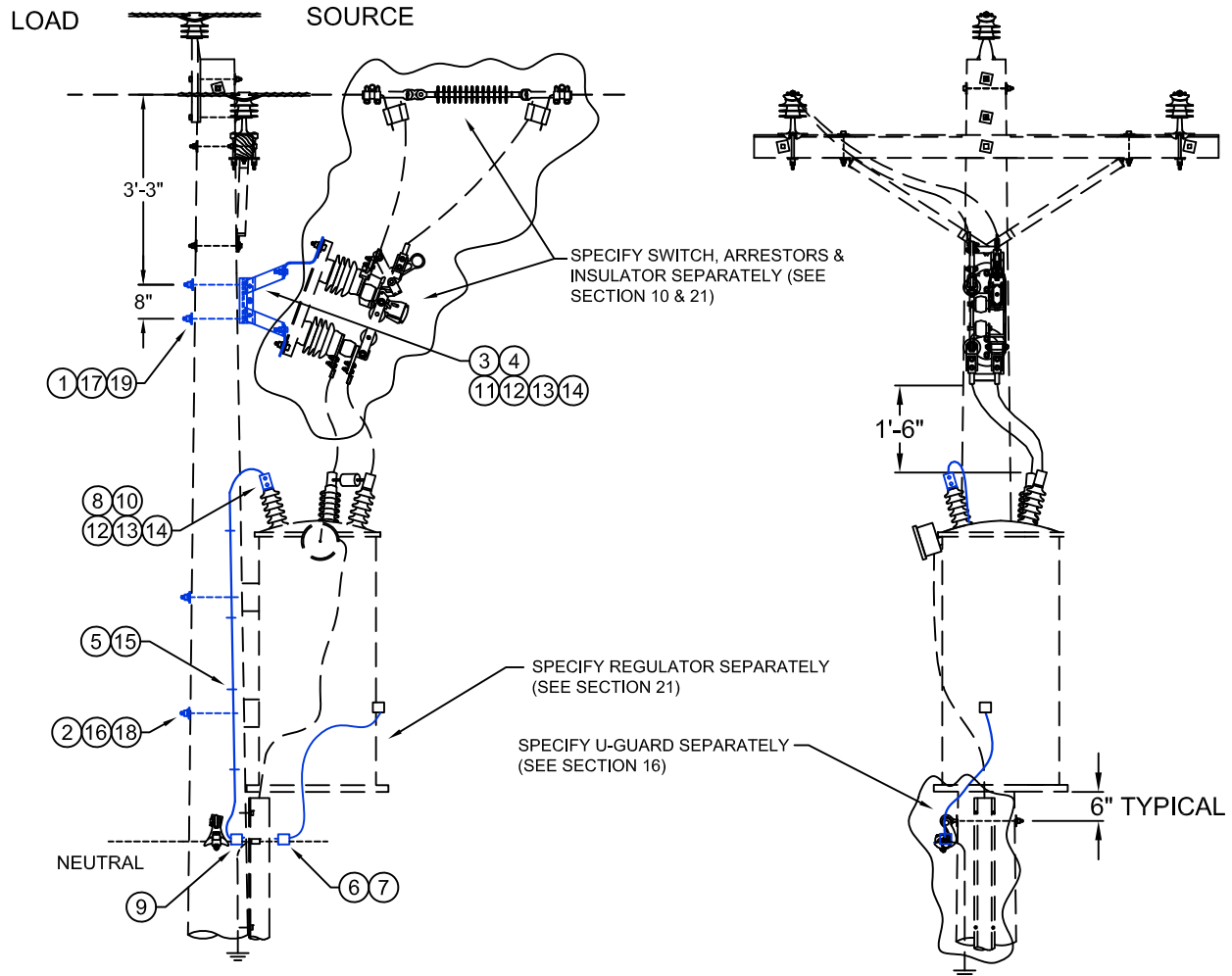
V6

ISSUE DATE: 04/13

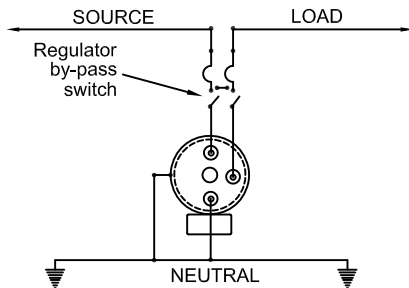
Construction and Design Notes:

1. Use minimum of 45'-2 pole.
2. Mount control box 5' from the ground on back of pole away from snow plow.
3. Hang regulator facing roadside and the bypass switch on the source side.
4. For use on open-wire construction only.
5. See table below for other assemblies required for this installation.

V9-1



WIRING DIAGRAM



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY		QUANTITY
S2-5	REGULATOR BYPASS SWITCH	1
M5-51	SUSPENSION INSULATOR	1
V1	VOLTAGE REGULATOR	1
U9-1	PVC U-GUARD, 2"	2

NOTE:

THIS INSTALLATION CAN BE USED FOR 167 KVA REGULATORS AND SMALLER.

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR	336 ACSR
15,25,35 kV	V9-1.1	V9-1.3



CONSTRUCTION STANDARDS

VOLTAGE REGULATORS, OPEN-WIRE CONSTRUCTION
POLE MOUNTED (ONE SINGLE-PHASE)

V9-1

ISSUE DATE: 12/21

Materials List for Assemblies

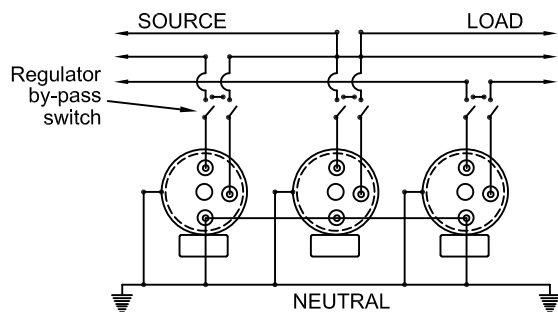
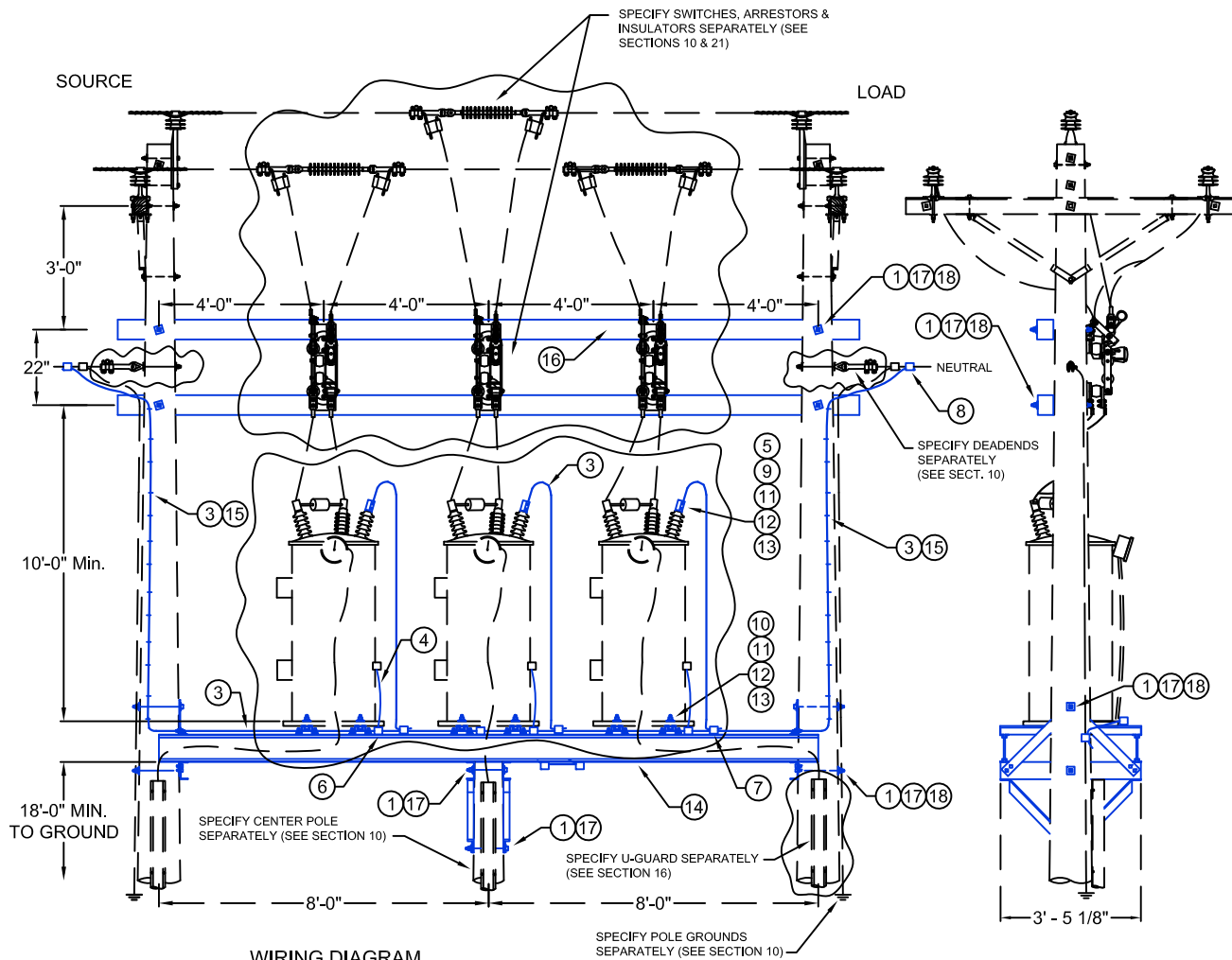
Descriptions

V9-1.1 Voltage Regulator Pole Mount, 1/0 Open-Wire
 V9-1.3 Voltage Regulator Pole Mount, 336 Open-Wire

Ref	Material #	Description	V9-1.1	V9-1.3
1	6380514	Bolt, Machine 5/8" x 14"	2	2
2	6380616	Bolt, Machine 3/4" x 16"	2	2
3	7806001	Bracket, Ext Recloser	1	1
4	7800718	Bracket, Bypass Switch	1	1
5	15624007	Conductor, 4/0 Str CU	20	20
6	15610401	Conductor, #4 Sol CU SD	12	12
7	17015004	Connector, GC5004 #4 Sol	1	1
8	17019010	Conn, Comp Terminal NEMA #1/0	1	1
9	17010502	Connector, Sicame TTD2710XFBTUNI	1	
9	17010502	Connector, Sicame TTD2710XFBTUNI		1
10	17040100	Conn, Xfmr Stainless Bolts 1 1/2"	2	2
11	17040105	Conn, Xfmr Stainless Bolt 2"	6	6
12	17040125	Conn, Xfmr Stainless Nut	6	6
13	17040115	Conn, Xfmr Stainless Washer Flat	12	12
14	17040120	Conn, Xfmr Stainless Washer Lock	6	6
15	61801810	Staple, Ground Wire	12	12
16	71013041	Washer, Curved Guy 3/4"	2	2
17	71053063	Washer, Spring 5/8"	2	2
18	71053075	Washer, Spring 3/4"	2	2
19	71020451	Washer, Square 2 1/4 x 13/16	2	2

Construction and Design Notes:

1. Use minimum of 45'-2 Poles. Center pole shall be a 30'-5.
2. Each regulator must be bolted to platform.
3. Control boxes shall be installed on poles below regulators. Control 5' from the ground (Specify additional control cable).
4. For use on open-wire construction only. Can be used on HNDX spacer-cable by transitioning to open-wire construction.
5. See table below for other assemblies required for this installation.



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S2-5 REGULATOR BYPASS SWITCH	3
M5-51 SUSPENSION INSULATOR	3
M5-55N NEUTRAL DEADEND	2
M2-51 POLE GROUND	1
V1 VOLTAGE REGULATOR	3
P1 WOOD POLE, 30-5	1
U9-1 PVC U-GUARD, 2"	4

NOTE:

THIS PLATFORM USED WITH THE CENTER POLE IS RATED 3,333 LBS PER UNIT OR TYPICALLY A 250 KVA REGULATOR AND SMALLER.

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR	336 ACSR
15,25,35 kV	V9-3.1	V9-3.3



CONSTRUCTION STANDARDS
VOLTAGE REGULATORS, OPEN-WIRE CONSTRUCTION
PLATFORM MOUNTED (THREE SINGLE-PHASE)

Materials List for Assemblies

Descriptions

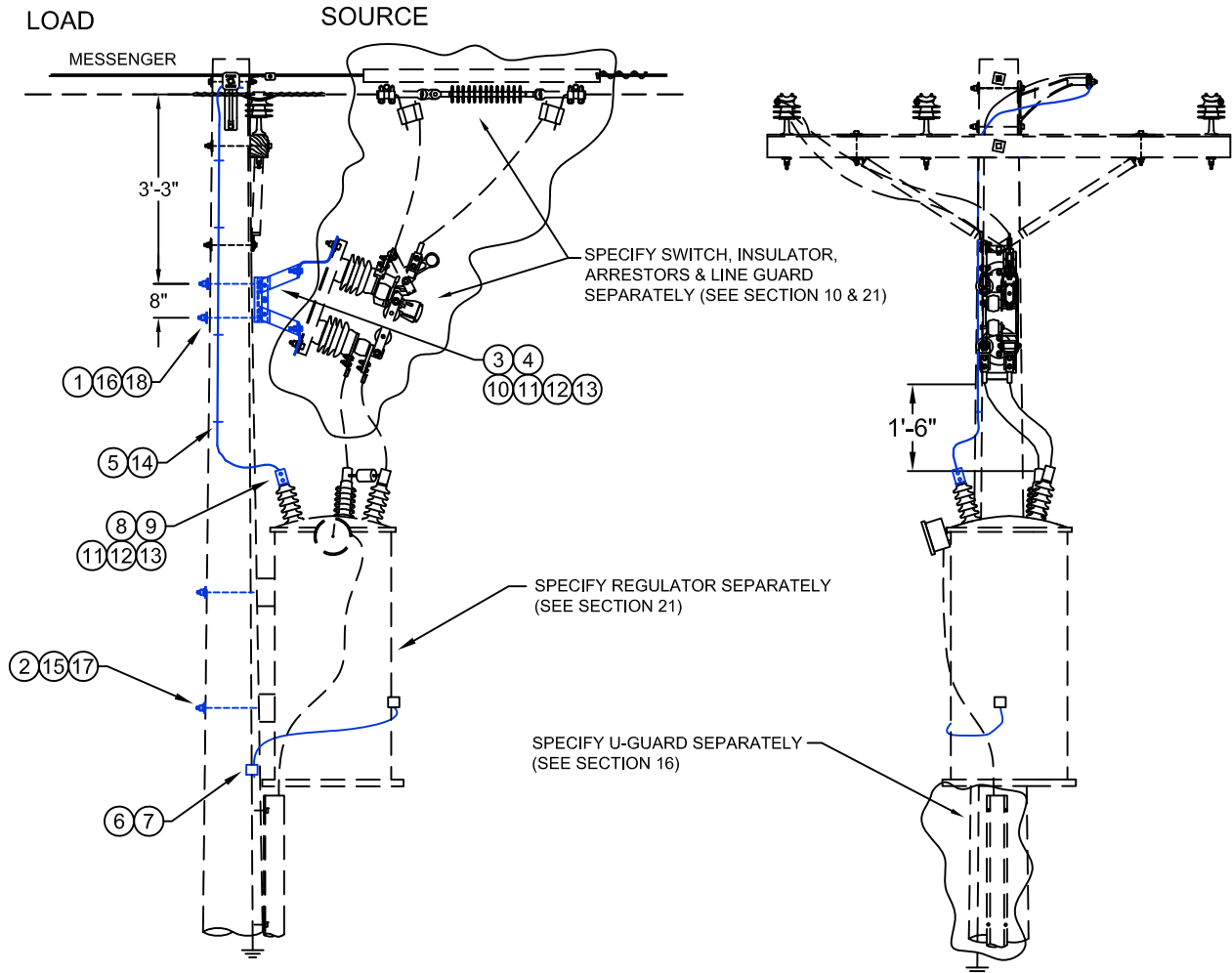
V9-3.1 Three Voltage Regulators, Platform, 1/0 Open-Wire
 V9-3.3 Three Voltage Regulators, Platform, 336 Open-Wire

Ref	Material #	Description	V9-3.1	V9-3.3
1	6380516	Bolt, Machine 5/8 x 16"	6	6
2	6380518	Bolt, Machine 5/8 x 18"	4	4
3	15624007	Cond 4/0 Str Cu	80	80
4	15610401	Conductor, #4 Sol Cu SD	20	20
5	17019010	Conn: Comp Terminal NEMA #1/0	3	3
6	17015004	Conn, GC5002 #4 str	6	6
7	17015020	Conn: GC5020 #2/0 str.	3	3
8	17010502	Con, Sicame TTD2710XFBTUNI	2	
8	17010502	Con, Sicame TTD2710XFBTUNI		2
9	17040100	Conn, Xfmr Stainless Bolt 1 1/2"	6	6
10	17040112	Conn, Xfmr Stainless Bolt 3 1/2"	12	12
11	17040115	Conn, Xfmr Stainless Washer Flat	18	18
12	17040120	Conn, Xfmr Stainless Washer Lock	18	18
13	17040125	Conn, Xfmr Stainless Nut	18	18
14	47000000	Platform For Xfmr/Reg	18	18
15	61801810	Staple, Ground Wire	24	24
16	18211511	Timber 4 3/4" x 5 3/4" x 18'	2	2
17	71053063	Washer, Spring 5/8"	10	10
18	71020451	Washer, Square 2 1/4 x 13/16"	12	12

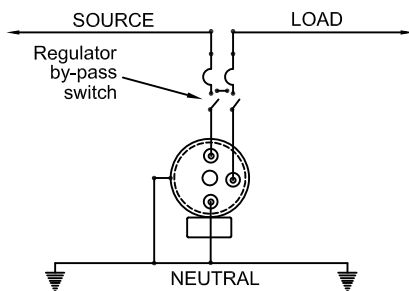
Construction and Design Notes:

1. Use minimum of 45'-2 pole.
2. Mount control box 5' from the ground on back of pole away from snow plow.
3. Hang regulator facing roadside and the bypass switch on the source side.
4. For use on HNDX spacer-cable construction only. Use HC1-2 pole top assemblies (as shown).
5. See table below for other assemblies required for this installation.

HV9-1



WIRING DIAGRAM



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S2-5 REGULATOR BYPASS SWITCH	1
M5-51 SUSPENSION INSULATOR	1
V1 VOLTAGE REGULATOR	1
U9-1 PVC U-GUARD, 2"	2
HM5-3 HNDX CLIP-ON LINE DUC	1

NOTE:

THIS INSTALLATION CAN BE USED FOR 167 KVA REGULATORS AND SMALLER.

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 ACSR	336 ACSR
15,25,35 kV	HV9-1	



CONSTRUCTION STANDARDS
VOLTAGE REGULATORS, HNDX SPACER-CABLE CONSTRUCTION
POLE MOUNTED (ONE SINGLE-PHASE)

HV9-1

ISSUE DATE: 12/21

Materials List for Assemblies

Descriptions

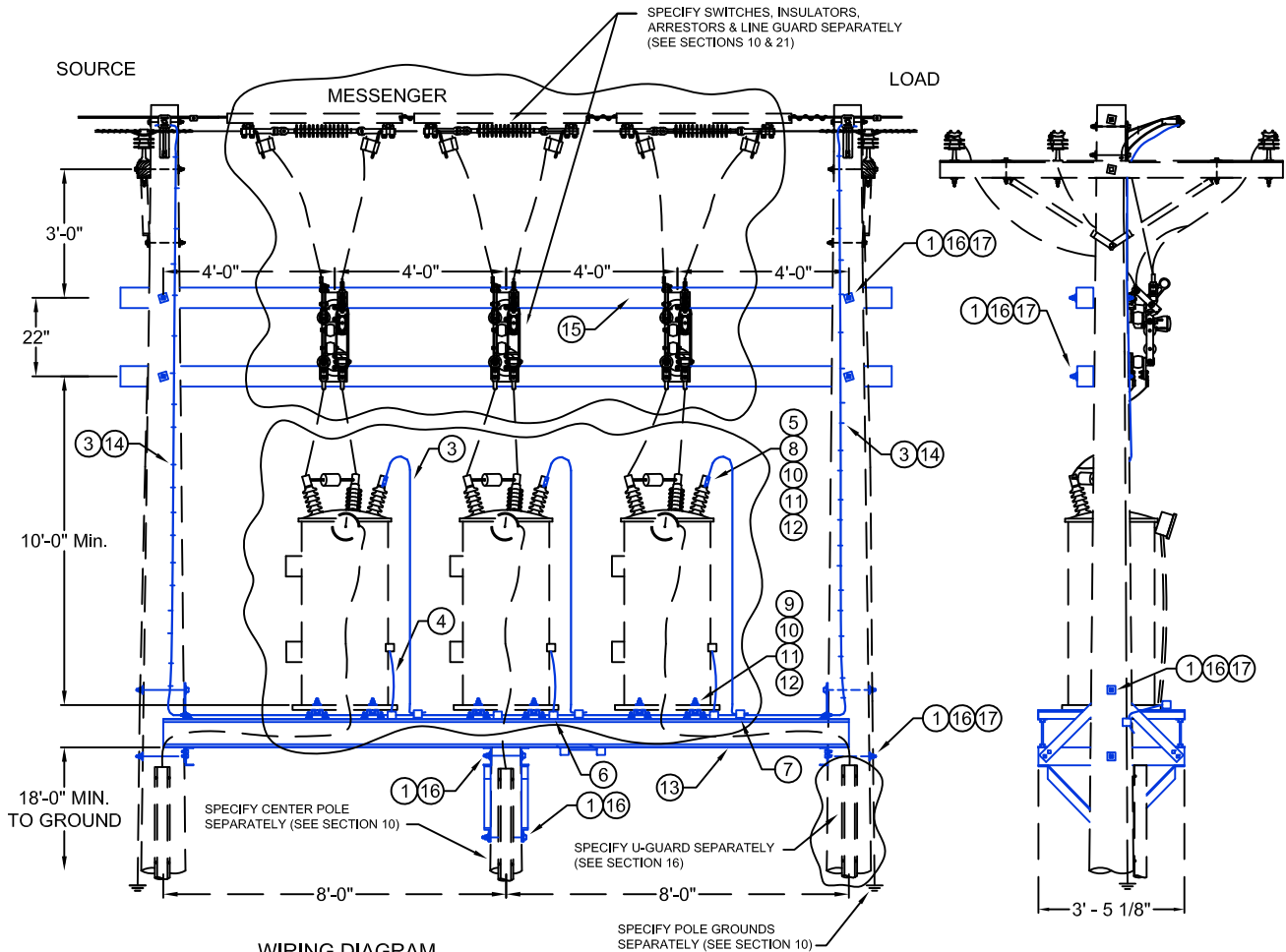
HV9-1 Voltage Regulator Pole Mount, HNDX Spacer Cable

			HV9-1
Ref	Material #	Description	
1	6380514	Bolt, Machine 5/8" x 14"	2
2	6380616	Bolt, Machine 3/4" x 16"	2
3	7806001	Bracket, Ext Recloser	1
4	7800718	Bracket, Bypass Switch	1
5	15620203	Conductor, 2 Str CU	20
6	15610401	Conductor, #4 Sol CU SD	12
7	17015004	Connector, GC5004 #4 Sol	1
8	17019002	Conn, Comp Terminal NEMA #2	1
9	17040100	Conn, Xfmr Stainless Bolts 1 1/2"	2
10	17040105	Conn, Xfmr Stainless Bolt 2"	6
11	17040125	Conn, Xfmr Stainless Nut	6
12	17040115	Conn, Xfmr Stainless Washer Flat	12
13	17040120	Conn, Xfmr Stainless Washer Lock	6
14	61801810	Staple, Ground Wire	12
15	71013041	Washer, Curved Guy 3/4"	2
16	71053063	Washer, Spring 5/8"	2
17	71053075	Washer, Spring 3/4"	2
18	71020451	Washer, Square 2 1/4 x 13/16	2

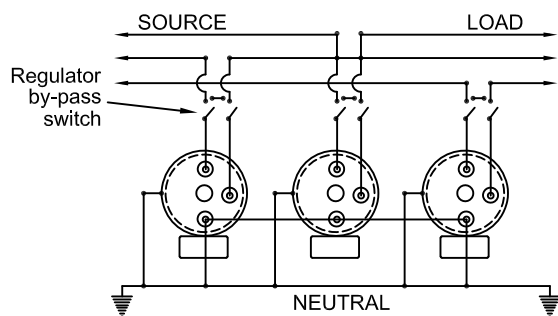
HV9-3

Construction and Design Notes:

1. Use minimum of 45'-2 Poles. Center pole shall be a 30'-5.
2. Each regulator must be bolted to platform.
3. Control boxes shall be installed on poles below regulators. Control 5' from the ground (Specify additional control cable).
4. For use on HNDX spacer-cable construction only. Use HC1-2 pole top assemblies (as shown).
5. See table below for other assemblies required for this installation.



WIRING DIAGRAM



ADDITIONAL ASS'YS REQUIRED FOR INSTALLATION

ASSEMBLY	QUANTITY
S2-5 REGULATOR BYPASS SWITCH	3
M5-51 SUSPENSION INSULATOR	3
M2-51 POLE GROUND	1
V1 VOLTAGE REGULATOR	3
P1 WOOD POLE, 30-5	1
U9-1 PVC U-GUARD, 2"	6
HM5-3 HNDX CLIP-ON LINE DUC	3

NOTE:

THIS PLATFORM USED WITH THE CENTER POLE IS RATED 3,333 LBS PER UNIT OR TYPICALLY A 250 KVA REGULATOR AND SMALLER.

CONSTRUCTION ASSEMBLIES

System Voltage	1/0 SPACER	336 SPACER
15,25,35 kV	HV9-3	



CONSTRUCTION STANDARDS
VOLTAGE REGULATORS, HNDX SPACER-CABLE CONSTRUCTION
PLATFORM MOUNTED (THREE SINGLE-PHASE)

HV9-3

ISSUE DATE: 12/21

Materials List for Assemblies

Descriptions

HV9-3 Three Voltage Regulators, Platform, HNDX Spacer Cable

			HV9-3
Ref	Material #	Description	
1	6380516	Bolt, Machine 5/8 x 16"	6
2	6380518	Bolt, Machine 5/8 x 18"	4
3	15620203	Cond 2 Str Cu	3
4	15610401	Conductor, #4 Sol Cu SD	20
5	17019002	Conn, Comp Terminal NEMA #2	3
6	17015004	Connector, GC5004 #4 Solid	6
7	17015020	Conn: GC5020 #2/0 str.	3
8	17040100	Conn, Xfmr Stainless Bolt 1 1/2"	6
9	17040112	Conn, Xfmr Stainless Bolt 3 1/2"	12
10	17040125	Conn, Xfmr Stainless Nut	18
11	17040115	Conn, Xfmr Stainless Washer Flat	18
12	17040120	Conn, Xfmr Stainless Washer Lock	18
13	47000000	Platform For Xfmr/Reg	1
14	61801810	Staple, Ground Wire	48
15	18211511	Timber 4 3/4" x 5 3/4" x 18'	2
16	71053063	Washer, Spring 5/8"	10
17	71020451	Washer, Square 2 1/4 x 13/16"	12

OVERHEAD FAULT INDICATOR GUIDELINE

General Information

Fault Indicators (FI) are a tool to help the lineman "track" the path of the fault current that has tripped his circuit. The FI is a single-phase device that monitors the current through one wire/cable. It does this by monitoring the magnetic field around the conductor that is produced by the current flowing through the conductor. When the FI sees a rapid increase of 100 amps or more, it assumes that a fault has occurred on the conductor. Typically one FI is placed on each of the phase conductors (one for a single-phase line, 2 for a delta line and 3 for a three-phase line). When a fault occurs on the distribution system, the current in the faulted conductor increases rapidly, up to several hundred amps, all along the conductor from the source substation to the fault location. This fault current lasts until a circuit breaker or a fuse opens the circuit. Any FI along this path will see a large increase in the magnetic field and will thus identify a fault on the conductor with a flashing LED light. Any FI beyond, or downstream, of the fault will not see the associated increase in magnetic field and will not identify a fault - its LED light will not be flashing. So, if for example you install 6 sets of FIs along the length of a feeder, and you have a line to ground fault between the 4th and 5th set of indicators, when you patrol the line you will find the indicators on the faulted phase flashing at locations 1, 2, 3, and 4. The indicators at location 5 and 6 will not be flashing because the fault current did not pass through their locations.

Location for Installation

FIs can be used to break-up any long section of line, be it 3-phase, 2-phase or single-phase. They typically are installed on the load side of a disconnect or a place where jumpers can easily be lifted.

Example: The station breaker is locked out. You patrol up to the first set of FIs and one of the three is flashing, meaning the fault is downstream from this point. At this time you could open the disconnects (if they exist) and close the station breaker (either you, another lineman or by SCADA) to heat up the customers to that point. You then patrol to the next set of FIs. If they are flashing you can open a second set of disconnects, close the first set to heat up to the second set and continue on in this fashion until you find the fault or you get to an FI that isn't flashing. This means you have passed the fault.

There are two primary locations for installation:

1. If a line splits and doesn't have a protective device on either branch, an FI can indicate which leg to continue patrolling and which one is OK.
2. If a section of line becomes inaccessible (into the woods, over a hill, etc.), an FI located where it leaves the road and another one where it becomes accessible again can tell you if you need to patrol the inaccessible portion or if you can forget that portion of the line.

Resetting the FI

The Fisher Pierce FIs that we are purchasing will automatically reset themselves when one of two followings things happen:

1. Normal current returns for at least 60 seconds (line back in service)
2. The reset timer runs out (we are buying units that will automatically reset in 4 hours if the line hasn't been restored in an attempt to conserve the battery. The battery is typically good for 10 years or 120 hours of continuous operation. The installation year is printed in bold letters on the units).

Installation

The Fisher-Pierce units we are buying can be hot stick mounted on circuits with a voltage up to and including 44kV, line to line. The jaws are made to accommodate up to a 1-inch cable. This will allow their use on 477 MCM and smaller conductors. These units can be used on all covered wire as long as there isn't a shield wire or a concentric neutral associated with the conductor that would interfere with the magnetic field.

Radio

We are anticipating that these units will remain at their original location once installed. With that in mind, we are purchasing them with an inexpensive radio transmitter that gives them a future capability of notifying the SCADA system when they detect a fault. To allow for this you must purchase an "A" phase unit for the FI you put on "A" phase, a "B" phase unit for the FI you put on "B" phase, and a "C" phase unit for the FI you put on "C" phase. If you want an FI that you can move around for spot troubleshooting you can order an FI without a radio.

Ordering

The FIs described above can be ordered right out of the warehouse if needed.

Co-Op SK#	Description	Fisher-Pierce Cat #
49500000	FI Radio/LED "A" phase	1548FH-ANC3-R-A-A
49500010	FI Radio/LED "B" phase	1548FH-ANC3-R-B-A
49500020	FI Radio/LED "C" phase	1548FH-ANC3-R-C-A
49500030	FI - LED only	1548FH-ANC3-L-N-A



CONSTRUCTION STANDARDS

OVERHEAD FAULT INDICATOR GUIDELINE

Record Keeping

Please notify Engineering/GIS of the type of FI and the permanent location pole number so the units can be added to our mapping. See the attached example and a blank form for your entries.

** This is very important for record keeping and planning purposes.

Misoperation

If improper operation should occur, document what worked and what did not on the Outage Report so engineering can follow-up with corrective action.

FAULT INDICATORS FIELD LOCATIONS

SUNAPEE DISTRICT

NAME (If Applicable)	SUBSTATION	CIRCUIT	BATTERY DATE	RADIO?	QUANTITY	POLE #
6 Line North	Cornish (CN)	#1	2001	Y	2	6/258
6 Line North	Cornish (CN)	#1	2001	Y	2	6/286
6 Line North	Cornish (CN)	#1	2001	Y	2	6/335
6 Line North	Cornish (CN)	#1	2001	Y	2	6/355
6 Line North	Cornish (CN)	#1	2001	Y	2	6/362
6 Line South	Cornish (CN)	#1	2001	Y	2	6/214
6 Line South	Cornish (CN)	#1	2001	Y	2	6/199
6 Line South	Cornish (CN)	#1	2001	Y	2	6/182
6 Line South	Cornish (CN)	#1	2001	Y	2	6/150.5
6 Line South	Cornish (CN)	#1	2001	Y	2	6/131
5 Line North	Sunapee (SP)	#3	2001	Y	3	5/40
5 Line North	Sunapee (SP)	#3	2001	Y	3	5/54
5 Line North	Sunapee (SP)	#3	2001	Y	3	5/58
5 Line North	Sunapee (SP)	#3	2001	Y	3	5/87
5 Line North	Sunapee (SP)	#3	2001	Y	3	5/116

FAULT INDICATORS FIELD LOCATIONS

Date: ____/____/____

[illegible]

PRIMARY/SECONDARY NEUTRAL ISOLATOR APPLICATION GUIDELINE

Overview

Neutral to earth voltages, sometimes called "stray" voltages, can develop on any multi-grounded electrical distribution system. A neutral to earth voltage is typically 10 volts or less and is defined as an AC voltage measured between the secondary neutral buss and a remote point on the earth, known as "True Earth" (a driven ground rod is commonly used to connect to the earth for this measurement). Historically, problems arising from stray voltage have been limited to dairy farms, fish farms, feeder and confinement operations, and sometimes swimming pools and water-related operations. Research has determined that dairy cows are negatively affected by stray voltage in levels above approximately 1.0 volt. This means that if one part of the cow's body is touching equipment that is bonded to the neutral/ground buss of the secondary electrical system as required by the NEC, and another part of its body is touching true earth, a voltage difference of 1 volt or higher will produce a current flow in the cow's body that will affect its overall well being. This becomes apparent to the dairyman as reduced milk output from the herd.

There are numerous causes for these voltages, which are a result of current flowing through the earth. The sources of these stray voltages can be separated into two groups:

1. Off-Site Sources
2. On-Site Sources

** The Co-Op is responsible for the Off-Site sources. The On-Site sources must be addressed by the dairyman/member.*

The Common Neutral System

Normally, primary and secondary neutrals are to be solidly connected together at the transformer location (pole or padmount transformer), as this is where the secondary neutral is derived. Typically these conductors are also connected to a ground rod at this location, which serves the purpose of connecting the neutral system to the earth. Because the primary neutral conductor is continuous throughout the distribution circuit, all ground rods, butt plates, and the earth itself become a second path, in parallel with the primary neutral conductor, back to the source/substation for unbalance or fault current on the primary circuit. The main purpose of doing this, from the utility perspective, is to provide a continuous, low impedance path for primary unbalance or fault current back to the source/substation. (Balanced currents cancel each other out and can only exist on a 3-phase circuit; all the primary current on a single-phase circuit is "unbalance" current.)



CONSTRUCTION STANDARDS

INFORMATION GUIDE
PRIMARY/SECONDARY NEUTRAL ISOLATOR APPLICATION

IV Neutral
Blocker

ISSUE DATE: 01/06

An additional goal is to minimize the voltage difference between the neutral system and the earth. Any unbalance current on the primary circuit will divide between the neutral conductor and the earth on its way back to the source/substation. If all the connections in the conductor are tight and clean, the majority of the return current will choose the wire to travel on due to its low impedance. If an "Open" develops in the neutral conductor, all the return current must travel through the earth to get back to the substation. In reality, the portion of the imbalance current that flows in the earth is determined by the resistivity of the soil the current must flow through.

Source of Off-Site Stray Voltage

As a result of any unbalance current flow in the primary neutral conductor, there is a voltage drop along the entire length of the conductor. Ohm's Law tells us that the magnitude of this voltage drop is determined by the impedance of the conductor and the amount of current flowing in the conductor. Typically this voltage drop is only a few volts. What this means is, if we take a volt meter to a remote point on the earth, drive a ground rod to connect to the earth, and then reach back to the primary neutral and take a voltage measurement between this remote point and the primary neutral, we would typically read a few volts difference.

When we connect the member's secondary neutral to our primary neutral, the member may see this same voltage difference between the frames of all his equipment (as it is bonded to the secondary neutral buss via an equipment grounding conductor per the NEC) and True Earth. This voltage difference can drive an objectionable current through anything making contact between the equipment frame and True Earth (like a cow).

Off-Site Stray Voltage Source Elimination

Solutions to eliminate or greatly reduce the Off-Site stray voltage source can include:

1. Reduce the unbalance current flowing on the neutral (not really an option for single-phase and 2-phase distribution systems). Balancing the main 3-phase line up to the tap to the farm will help.
2. Lower the impedance of the neutral - ensure all neutral/ground connections are clean and tight to make certain there are no opens in the primary neutral or reconductoring with a larger conductor.
3. Removal of the connection between the primary and secondary neutral as allowed by Section 97D of the National Electric Safety Code.

Solutions 1 & 2 can be implemented anytime where possible.

Solution 3 requires some care to ensure safety of the installation.



CONSTRUCTION STANDARDS

INFORMATION GUIDE
PRIMARY/SECONDARY NEUTRAL ISOLATOR APPLICATION

IV Neutral
Blocker

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Removing the Connection Between the Primary and Secondary Neutrals

NESC rule 97D2 requires that when the primary and secondary neutrals are separated:

1. The primary and secondary neutrals shall be connected through a device that will reconnect them if the voltage between them exceeds 3kV - a blocker.
2. There shall be at least 1 additional ground rod connected to the secondary neutral besides the rod at the member's service equipment location. This second rod shall be at least 6 feet away from the ground rod attached to the primary neutral.
3. There shall be a separate grounding conductor (the wire from the neutral to the ground rod) for the secondary and primary neutrals.
4. The grounding conductor for the secondary neutral shall be insulated for 600 volts AC.
5. There can be no other connection between the primary and secondary neutrals besides the blocker. Communication utilities should bond their main line messenger to the primary neutral. The communications wire going to the member's facilities should not be connected to anything at the pole/transformer location and shall be connected to the secondary neutral/ground at the customer's service panel only.

NHEC Service to Dairy, Fish Hatchery or Facility Where Stray Voltage Could Become an Issue

It will be standard practice for NHEC to separate the primary and secondary neutrals for service to a facility that would be adversely affected by Stray Voltage. This will effectively eliminate any Off-Site contributions to stray voltage.

To comply with NESC 97D2 the installation shall consist of the following:

1. Install a Ronk Blocker, part #SVI-50 and NHEC sk#06400000 on the pole near the transformer with lag bolts for an overhead installation. Consult engineering for a padmount installation. The primary neutral, the transformer tank and the primary ground (rod and butt plate if applicable) shall be connected to either one of the terminals on the blocker. The secondary neutral, the secondary neutral bushing and the 2 secondary ground rods shall be attached to the other terminal on the blocker. The blocker will connect the neutrals together if the voltage between them exceeds 11 volts AC for safety. Under normal conditions the blocker looks like an open circuit. In the unlikely event that the primary gets into the secondary, the blocker will provide a path for fault current by connecting the secondary and primary neutrals.



CONSTRUCTION STANDARDS

INFORMATION GUIDE
PRIMARY/SECONDARY NEUTRAL ISOLATOR APPLICATION

IV Neutral
Blocker

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2. Install two (2) ground rods at least 10 feet from the primary ground rod and at least 6 feet from each other. Install a #2 copper conductor or larger, 600 volt insulated, stranded conductor from rod to rod using approved connectors and then to the secondary neutral bushing of the transformer. Run the same type of insulated wire from the secondary neutral bushing on the transformer to one terminal of the Ronk Blocker. Tie the secondary neutral conductor to the transformer secondary neutral bushing and run to the member's service equipment.
3. Be sure to remove the tank-bonding strap from the secondary neutral connector.
4. Connect the transformer tank to the primary neutral using two (2) runs of #6 copper or larger. Connect a run of #6 copper or larger from the primary neutral down to the primary ground rod. Connect the remaining terminal of the Ronk Blocker to the primary neutral using #6 copper or larger conductor.
5. Make sure that communication conductors do not make a connection from the primary neutral to the secondary neutral. The main line communications messenger wire should connect to the primary neutral. The communication line going to the member should not be grounded at the pole. It shall be bonded to the secondary neutral and to the member's ground rod at the member's service equipment location.
6. It is very important that there are no connections between the primary and secondary neutrals other than the blocker. To verify this, take a voltage reading across the terminals of the blocker after everything is connected but before closing the member's main breaker. There should be some difference of potential (0.5 to a few volts). If the reading is exactly zero the neutrals are probably connected together somewhere. This will defeat the purpose of the blocker. Investigate to determine if there is an additional connection that must be removed.
7. Install a yellow caution band on the pole to indicate that the neutrals are separated on the pole.
8. Notify Engineering of the pole number where the blocker was installed so the Maps can be updated.

Neutral Isolator

Normally, primary and secondary neutrals are to be solidly connected. The only exception is when a neutral isolator is installed at a transformer location.

As shown in the figure below, there are two ground wires running down the pole, one for the primary neutral, and one for the secondary neutral. Communication utilities should bond to the bare ground wire attached to the primary neutral, but not to the insulated ground wire attached to the secondary neutral. This would bypass the isolator. Also, it will be necessary for the ground to be lifted on the communication tap to the customer's facilities. The communication and power grounds must still be bonded together at the customer's service entrance.

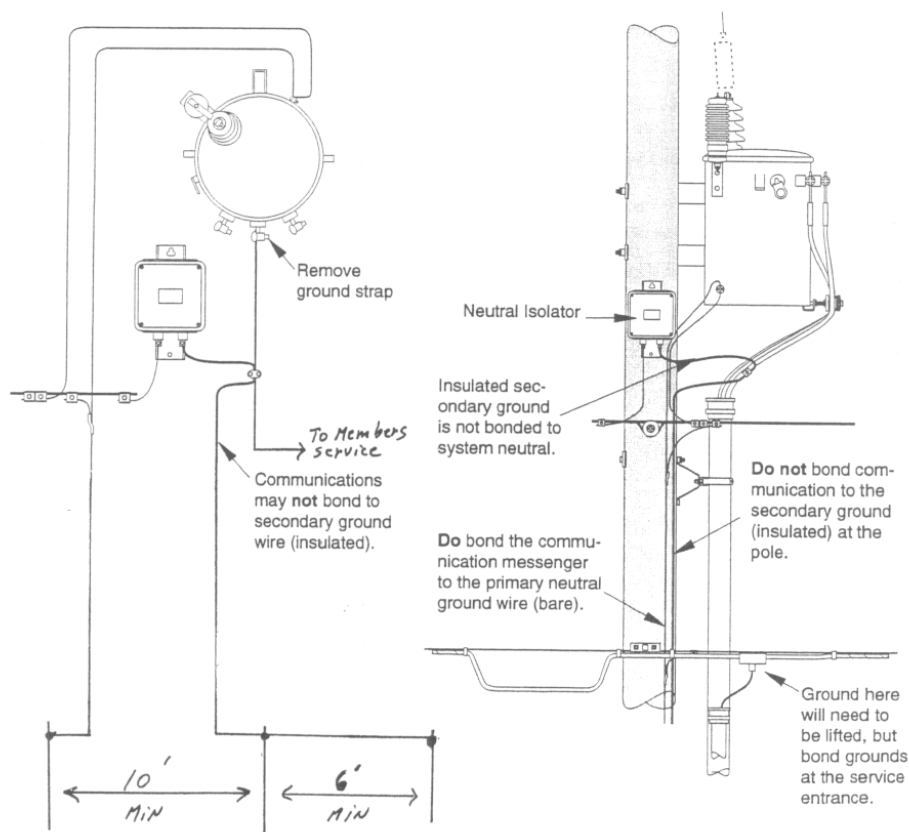


Figure 1 Primary-to-Secondary Neutral Isolator

New Hampshire Electric Co-op, Inc.

Transmission & Distribution Standards

Distribution Fusing Guidelines

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INFORMATION

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RECLOSER-FUSE
COORDINATION

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GENERAL INFORMATION

The purpose of this guideline is to provide standard practices for the installation of fusing to protect the Cooperative's distribution system and properly coordinate with other sectionalizing devices.

These standards & specifications, as detailed in this guideline, shall be used on all new distribution line construction.

All tap or lateral circuits, single and multi-phase, shall be fused or contain some other automatic interrupting device at or near the point of connection to the main circuit, unless the tap satisfies all of the following criteria:

- It does not exceed two (2) spans in length
- It does not contain tree exposure
- Its total length can be viewed from its take-off point
- It does not serve more than one CSP transformer

Only open-type fused cutouts are approved for use on the Cooperative's distribution system. All fuse links shall be installed in appropriate cutout and/or fuse holders. Fuse links are not to be used themselves without proper fuse holders.

A fused cutout will be required at CSP transformer installations when there is no protective device (fuse or recloser) between it and the substation or metering point or when the first up-line protective device is a 3-phase recloser.

The internal primary link on a CSP transformer has an interrupt rating of approximately 3,500 amps. Therefore, at locations where the available fault current exceeds this value, CSP transformers shall be protected with the appropriate fuse cutout. Please refer to the section on "Overhead Transformers" in this guideline for applicable locations and fusing.

Step-down transformers are not addressed in this guideline. Please contact engineering when issues or questions regarding fusing & protection arise.

DISTRIBUTION FUSE LINKS & CUTOUT RATINGS

Distribution Fuse Links

The standard distribution expulsion fuse link for use in open cutouts is the Kearney (owned by Cooper) Type 200 (N) fuse link. It is approved for use on all Cooperative 2.4/4.16 kV through 19.9/34.5 electric systems. These fuse links are used to protect electrical apparatus such as overhead distribution transformers, step-down transformers, and capacitors as well as for underground risers, and general line tap sectionalizing & coordination.

The Type 200 (N) fuse link has a tin fuse element and has the following characteristics:

- Continuous current rating of 150% of fuse rating (i.e. a 30N fuse will carry 45 amps)
- Minimum melting time-current curves (TCC) for these fuse links are at approximately 200% of the rated current at 300 seconds.
- These fuse links are classified as “medium” speed fuses, with a nominal speed ratio of 10. They have a good surge withstand capability and provide good coordination with relays and reclosers.
- They are available in the following fuse ratings: 3, 5, 7, 10, 15, 20, 25, 30, 40, 50, 65, 80, 100, 125, 150, and 200 (ratings of 1 and 2 are available, but not used on our system).

The smallest Type 200 (N) fuse link to normally be installed for general line protection is rated 10N. Special permission from Engineering shall be obtained for the use of a smaller fuse. Fuses rated 10N or smaller should have an appropriate surge arrester installed on the source side of the cutout.

Distribution Cutouts

The distribution open fuse cutouts used on the Cooperative's system are rated by the ANSI standards on the basis of frequency (60 Hz); continuous current-carrying capacity; nominal & maximum design voltage; symmetrical & asymmetrical interrupting capacity; and basic impulse levels (BIL). Composite-polymer silicone is the only NHEC approved material for cutout insulators. Porcelain cutouts are no longer approved for construction. The following table identifies the open fuse cutouts approved for use on the Cooperative's system.

APPROVED DISTRIBUTION OPEN FUSE CUTOUTS

SYSTEM VOLTAGE L-L (KV)	MAXIMUM DESIGN VOLTAGE (KV)	BIL (KV)	CONTINUOUS CURRENT RATING (AMPS)	INTERRUPTING RATING (ASSYMETRICAL AMPS)	LEAKAGE DIST. TO GND	MANUF. & CAT. #
All voltage thru 24.9	27	125	100	8,000	17"	PLH Manufact. Co. (SIL-127-1125PN)
						S&C Electric Co. (89042R10-PCD)
		125	200	10,000		PLH Manufact. Co. (SIL-227-3125PN)
		150				S&C Electric Co. (89092R11-PCD)
19.9/34.5 *	27	150	100	12,000	23.6"	PLH Manufact. Co. (SIL-227-2150PN/HP) *
					26"	S&C Electric Co. (89053R10-PCD) *

* Applicable for protection of single-phase-to-neutral circuits (lines or transformers) only, and grounded-wye connected capacitor banks in multi-grounded neutral systems rated through 34.5 kV where leakage distance meets users requirements.

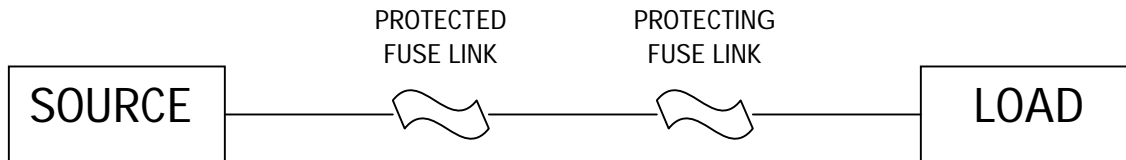
Distribution fuse links must be used in the correct size cutout for proper operation. The tube on the fuse link itself is capable of interrupting faults only to a given level without assistance from the cutout tube. The crossover amperage from fuse tube to cutout tube is higher for fuse links designed for 200 amp fuse tubes then for links designed for 100 amp fuse tubes. Use of a 100 amp designed fuse link in a 200 amp fuse tube creates a situation in which intermediate range faults cannot be interrupted. The time-current-characteristics of the fuse link will be changed and the fuse tube may fail to interrupt the fault. Fuse links rated through 100 amps are designed for use in 100 amp fuse tubes. Fuse links rated 125 amps or greater are designed for use in 200 amp fuse tube and are physically incapable of being used in 100 amp tubes.

All new cutouts purchased shall be equipped with attachment hooks for use with the S&C portable "Loadbuster" tool.

LINE FUSING & COORDINATION

The proper coordination between two Kearney Type 200 (N) fuses in series is a function the available fault current flowing through the fuses. The following table shows the maximum fault current (in amps) for safe coordination:

COORDINATION BETWEEN TYPE 200 (N) FUSES



PROTECTING FUSE AMP RATING	PROTECTED FUSE LINK AMP RATING												
	10	15	20	25	30	40	50	65	80	100	125	150	200
	MAXIMUM FAULT CURRENT (AMPS) FOR SAFE COORDINATION												
7	30	280	580	910	1250	1600	2360	3000	3800	4650	5700	7000	10000
10		85	475	830	1160	1530	2340	3000	3800	4650	5700	7000	10000
15			65	570	1000	1400	2240	2900	3775	4650	5700	7000	10000
20					640	1240	2100	2775	3675	4550	5700	7000	10000
25						750	1850	2600	3550	4450	5600	7000	10000
30						70	1425	2350	3350	4250	5400	6800	10000
40							400	1900	3000	4000	5250	6700	10000
50								120	1700	3150	4600	6100	9500
65										2000	3800	5500	9100
80											2000	4500	8500
100												2300	7500
125													5700
150													1500

OVERHEAD TRANSFORMERS

FUSING FOR CONVENTIONAL TRANSFORMERS

All conventional transformers, whether individual or banked, shall be fused with the appropriate Kearney Type 200 (N) fuse link as indicated in the table on the next page.

In the past, conventional transformers were fused with Chance “Slow-Fast” dual speed links. This practice has been discontinued due to miss-coordination issues with the Cooperative’s standard line fuse, the Kearney Type 200 (N). Slow-Fast fuses are no longer approved for use on the Cooperative’s electrical system and should be replaced, once faulted, with the proper Type 200 (N) link (replace all fuses in the bank). There is not, nor will there be, a replacement program implemented. Slow-Fast fuses will be replaced through attrition.

FUSING FOR CSP TRANSFORMERS

As previously discussed in the GENERAL INFORMATION section of this guideline, there may be instances where CSP transformers will require a distribution fuse cutout for proper protection, sectionalizing & coordination. At these installations, fuse the CSP transformer as if it were a conventional unit, with the appropriate Kearney Type 200 (N) fuse link as indicated in the table on the next page. Locations requiring fused cutouts are listed below:

- Where there is no protective device (fuse or recloser) between it and the substation or metering point
- Where the next up-line protective device is a 3-phase recloser.
- Where the available fault current exceeds 3,500 amps (the interrupt rating of a CSP transformer)

These areas are generally close to the substation on heavy-conductor circuits, particularly those with main power transformers rated 10 MVA larger. Provided below is a list of substations/meter points where fused cutouts shall be used with CSP transformers, located within one (1) circuit mile from the substation.

Chester
Conway
Derry
Fairgrounds
Jackson
Lincoln (12.47 kV system only)
Meredith
Perkins Corner
Woodstock

FUSE TABLE FOR OVERHEAD TRANSFORMERS (CONVENTIONAL & CSP)

INDIVIDUAL TRANSFORMER RATING (KVA)	3-PHASE BANK RATING (KVA)	PRIMARY FULL LOAD (AMPS)	EXPULSION FUSE KEARNEY TYPE 200 (N)
2.4 / 4.16 KV SYSTEM			
5	15	2.1	5
10	30	4.2	7
15	45	6.3	10
25	75	10.4	15
37.5	112.5	15.6	25
50	150	20.9	30
75	225	31.3	40
100	300	41.7	50
7.2 / 12.47 KV SYSTEM			
5	15	0.7	3
10	30	1.4	3
15	45	2.2	5
25	75	3.5	7
37.5	112.5	5.2	10
50	150	7.0	15
75	225	10.4	20
100	300	13.9	25
167	500	23.2	30
14.4 / 24.9 KV SYSTEM			
10	30	0.7	3
15	45	1.0	3
25	75	1.7	3
37.5	112.5	2.6	5
50	150	3.5	7
75	225	5.2	10
100	300	7.0	15
167	500	11.6	20
19.9 / 34.5 KV SYSTEM			
10	30	0.5	3
15	45	0.8	3
25	75	1.3	3
37.5	112.5	1.9	3
50	150	2.5	5
75	225	3.8	7
100	300	5.0	10
167	500	8.4	15
250	750	12.6	20

CAPACITOR BANKS

Capacitor banks installed on the Cooperatives distribution system shall be protected with Kearney Type 200 (N) fuse links as shown in the table below.

CAPACITOR BANK CONFIGURATION			FULL LOAD (AMPS)	TYPE 200 (N) FUSE LINK
UNITS PER PHASE	UNIT SIZE (KVAR)	BANK RATING (KVAR)		
2.4 / 4.16 KV SYSTEM				
1	50	150	20.8	25
7.2 / 12.47 KV SYSTEM				
1	50	150	6.9	7
2	50	300	13.9	15
1	100	300	13.9	15
2	100	600	27.8	30
1	150	450	20.8	25
2	150	900	41.7	40
1	200	600	27.8	30
14.4 / 24.9 KV SYSTEM				
1	100	300	6.9	7
2	100	600	13.9	15
1	150	450	10.4	15
2	150	900	20.8	25
1	200	600	13.9	15
2	200	1200	27.8	30
19.9 / 34.5 KV SYSTEM				
1	100	300	5	7
2	100	600	10	10
1	150	450	7.5	10
2	150	900	15.1	15
1	200	600	10	10
2	200	1200	20.1	20

PADMOUNT TRANSFORMERS

PADMOUNT TRANSFORMERS

Padmount transformers used on the Cooperative distribution system are protected with RTE/Cooper dual sensing fuse links installed in “Bay-O-Net” fuse assemblies configured for transformer sidewall mounting. Dual sensing links sense not only transformer faults and excessive load currents, but also transformer oil temperature.

Maximum single-phase interrupting ratings for the “Bay-O-Net” fuse links and assemblies are as follows:

<u>Fuse Rating</u>	<u>Maximum Interrupting Rating</u>
8.3 kV	3,500 amps, RMS asymmetrical
15.5 kV	2,500 amps, RMS asymmetrical
23.0 kV	1,000 amps, RMS asymmetrical

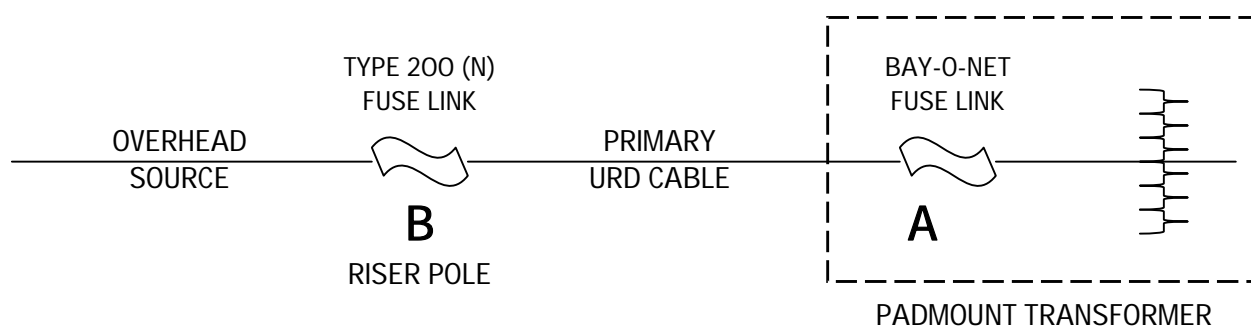
At padmount installations where the available fault currents exceed the above values, the fuse cutout (interrupt rating of 8,000 amps) at the riser pole provides adequate protection and therefore backup current limiting fuses are not required.

The continuous current ratings and catalog numbers of “Bay-O-Net” dual sensing fuse links are listed below:

<u>Catalog Number</u>	<u>Cont. Current Rating (amps)</u>
4000358C03	3
4000358C05	8
4000358C08	15
4000358C10	25
4000358C12	50
4000358C14	65
4000358C16	100
4000358C18	140

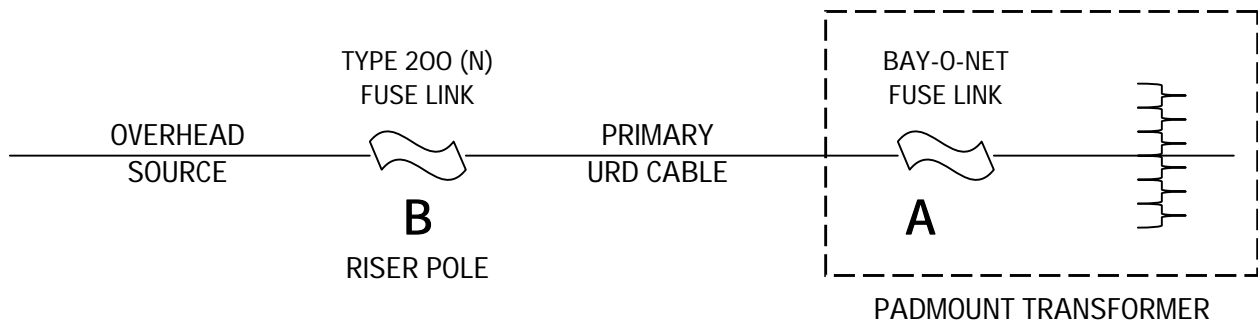
Fusing for padmount transformers and the smallest Type 200 (N) riser pole fuse link that will properly coordinate with the Bay-O-Net fuse are shown in the following tables. Larger riser pole fuse links may be required when the same URD cable serves several padmount transformers.

In many cases, it will not be possible to properly coordinate the riser pole fuse with the padmount transformer fuse...the riser fuse may be too large to coordinate with up-line fuses and/or reclosers. In these situations, selecting a smaller riser pole fuse (but one large enough to carry the load) will be required and possibly changes to the up-line coordination may also be required.

2.4/4.16 & 7.2/12.47 KV**PADMOUNT TRANSFORMER FUSING**

XFMR RATING (KVA)	2.4/4.16 KV SYSTEM			7.2/12.47 KV SYSTEM		
	XFMR FULL LOAD (AMPS)	A PADMOUNT TRANSFORMER FUSE	B SMALLEST RISER POLE FUSE	XFMR FULL LOAD (AMPS)	A PADMOUNT TRANSFORMER FUSE	B SMALLEST RISER POLE FUSE
SINGLE-PHASE TRANSFORMERS						
15	6.3	C08	30N	2.2	C03	10N
25	10.4	C10	50N	3.5	C05	15N
37.5	15.6	C12	* 100N	5.2	C08	30N
50	20.9	C12	* 100N	7.0	C08	30N
75	31.3	C14	* 200N	10.4	C10	50N
100	41.7	C14	* 200N	13.9	C10	50N
167	69.6	C18	* 200N	23.2	C12	* 100N
THREE-PHASE TRANSFORMERS						
45	6.3	C08	30N	2.2	C03	10N
75	10.4	C10	50N	3.5	C05	15N
112.5	15.6	C12	* 100N	5.2	C08	30N
150	20.9	C12	* 100N	7.0	C08	30N
225	31.3	C14	* 200N	10.4	C10	50N
300	41.7	C14	* 200N	13.9	C10	50N
500	69.6	C18	* 200N	23.2	C12	* 100N
750	104.1	C18	* 200N	34.7	C14	* 200N

* Type 200 (N) riser fuse link mostly likely will not coordinate with up-line protective devices.

14.4/24.9 & 19.9/34.5 KV**PADMOUNT TRANSFORMER FUSING**

XFMR RATING (KVA)	14.4/24.9 KV SYSTEM			19.9/34.5 KV SYSTEM		
	XFMR FULL LOAD (AMPS)	A PADMOUNT TRANSFORMER FUSE	B SMALLEST RISER POLE FUSE	XFMR FULL LOAD (AMPS)	A PADMOUNT TRANSFORMER FUSE	B SMALLEST RISER POLE FUSE
SINGLE-PHASE TRANSFORMERS						
15	1.0	C03	10N	0.8	C03	10N
25	1.7	C03	10N	1.3	C03	10N
37.5	2.6	C05	15N	1.9	C03	10N
50	3.5	C05	15N	2.5	C05	15N
75	5.2	C08	30N	3.8	C05	15N
100	7.0	C08	30N	5.0	C05	15N
167	11.6	C10	50N	8.4	C08	30N
THREE-PHASE TRANSFORMERS						
45	1.0	C03	10N	0.8	C03	10N
75	1.7	C03	10N	1.3	C03	10N
112.5	2.6	C05	15N	1.9	C03	10N
150	3.5	C05	15N	2.5	C05	15N
225	5.2	C08	30N	3.8	C05	15N
300	7.0	C08	30N	5.0	C05	15N
500	11.6	C10	50N	8.4	C08	30N
750	17.4	C12	* 100N	12.6	C10	50N

* Type 200 (N) riser fuse link mostly likely will not coordinate with up-line protective devices.

POWER FUSES

Power fuses shall be used for special case fusing when their desirable features outway their greatly increased cost as compared to distribution fuses.

S&C is the only approved manufacturer of power fuses used on the Cooperative's system. Power fuses are used in the Cooperative's substations for 34.5 kV main power transformer protection on transformer banks rated up to 5,000 kVA. Power fuses are also used at primary metering points to protect larger padmount transformers, typically rated 2,000 kVA and higher.

Power fuses, other than those listed below, are obsolete. These obsolete units should be replaced when ever work is done in the substations with approved fusing to eliminate the need to maintain a stock of refill units for them.

The following power fuse mountings & refill units shall be standard on the Cooperative's system:

S&C SWITCH MOUNTING TYPE	KV RATINGS		AMP RATINGS			WHERE USED
	MAX	BIL	SWITCH	FUSE UNIT		
				FUSE LINK RANGE	INTERR. (ASYM)	
SM-5 (SM FUSE UNIT)	27	150	600	3-300E	20,000	SUBSTATION RECLOSER BYPASS (4.16-24.9 KV)
SMD-20 (SMU-20 FUSE UNIT)	38	200	200	5-200E	10,000	SUBSTATION XFMR & LARGE PADMOUNT PROTECTION
SMD-1A (SMD-1A FUSE UNIT)	38	200	200	5-200E	17,500	MOBILE SUB PROTECTION

RECLOSER-FUSE COORDINATION

PHASE CONFIGURATION (1Ø or 3Ø)	COIL RATING (AMPS)	RECLOSER TYPE	DELAYED CURVE	LARGEST TYPE 200 (N) FUSE FOR COORDINATION *
1Ø	25	H, 4H, V4H, L	B	10N
			C	15N
		L	D	15N
1Ø	35	H, 4H, V4H, L	B	15N
			C	20N
		L	D	20N
1Ø	50	H, 4H, V4H, L	B	20N
			C	25N
		L	D	25N
1Ø	70	4H, V4H, L	B	25N
			C	30N
		L	D	30N
1Ø	100	4H, V4H, L	B	40N
			C	50N
		L	D	50N
3Ø	50	R	B	25N
			C	30N
			D	25N
			E	30N
3Ø	70	R	B	30N
			C	40N
			D	30N
			E	40N
3Ø	100	R	B	40N
			C	50N
			D	40N
			E	50N

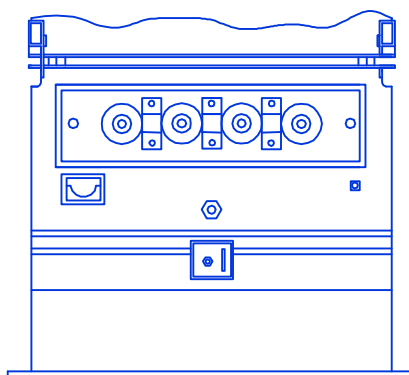
* Largest fuse that will clear fault without tripping the delayed curve and/or locking out recloser. The most common operations sequence for the above hydraulic reclosers is 2A-2B, two fast – two delayed trips, B being the delayed curve.

Equipment Underground 22

US4 Sectionalizing Assemblies
UV4 Fault Indicators (future)
UV6 Lightning Arresters
UV9 Miscellaneous (future)
U10-PSA Parking Stand Arrester

US4-1

SECT, CABINET 1 PH 200 Amp

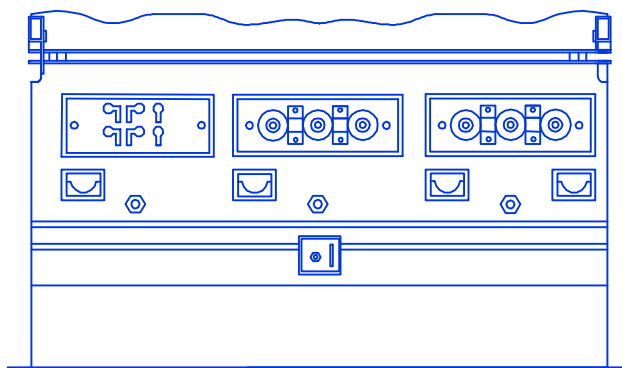


Note:

- 1.) Include a U9-11 Assembly for grounding.

US4-2 & US4-3

SECT, CABINET 3 PH 200 Amp



Note:

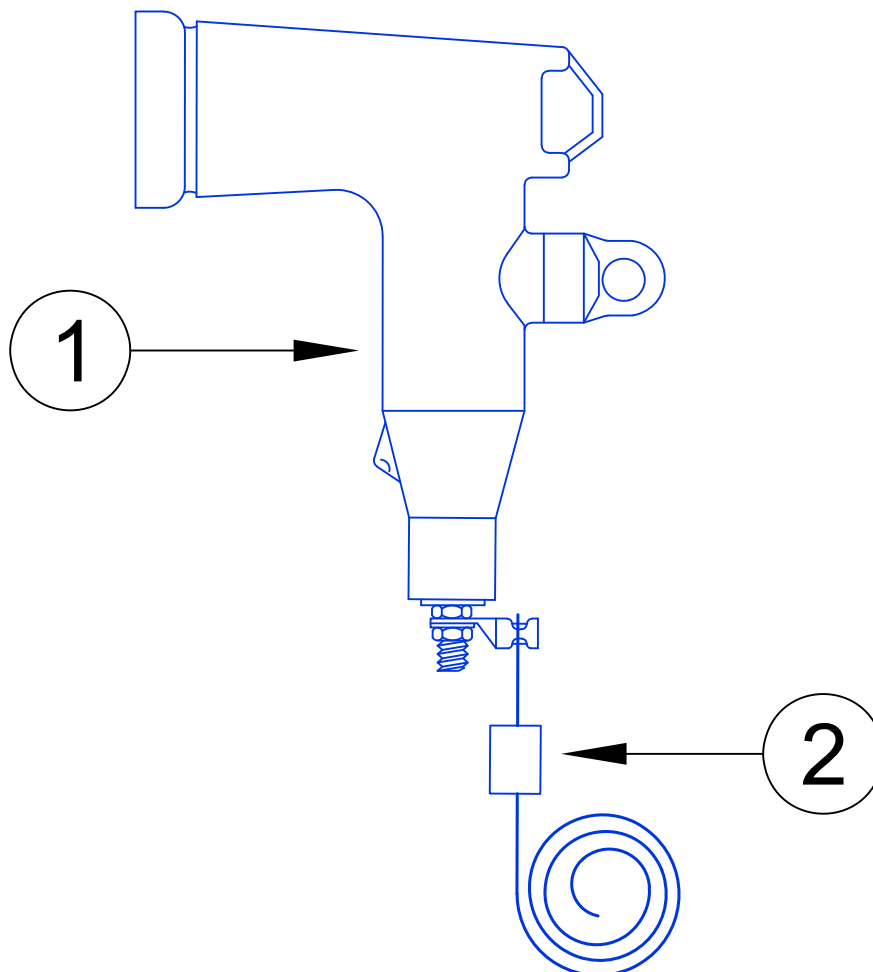
- 1.) Include a U9-11 Assembly for grounding.
- 2.) US4-3 is preferred for 25 kV Application.

Assembly Name	Material #	Description	Length	Height	Depth
US4-1	22014301	Encl, Steel Single Phase 200 Amps	30"	30"	22"
US4-2	22014302	Encl, Steel Three Phase 200 Amps	48"	30"	22"
US4-3	22014300	Encl, Steel for 3 or 4 position Junction	66"	30"	22"

DESCRIPTIONS

UV6

UV6... Arrester, Elbow, Underground 15 kV 9kV Rated
 VUV6... Arrester, Elbow, Underground 25 kV 9kV Rated
 ZUV6.18... Arrester, Elbow, Underground 25 kV 18kV Rated
 ZUV6... Arrester, Elbow, Underground 27 kV



Ref. No.	Material #	Description	UV6	VUV6	VUV6.18	ZUV6
1	1543450	Arrester, Elbow 9KV	1			
1	1543455	Arrester, Elbow 9KV		1		
1	1543460	Arrester, Elbow 18KV			1	
1	1543470	Arrester, Elbow 27KV				1
2	17015002	Conn, 2 Strand	1	1	1	1



CONSTRUCTION STANDARDS

LIGHTNING ARRESTOR - ELBOW

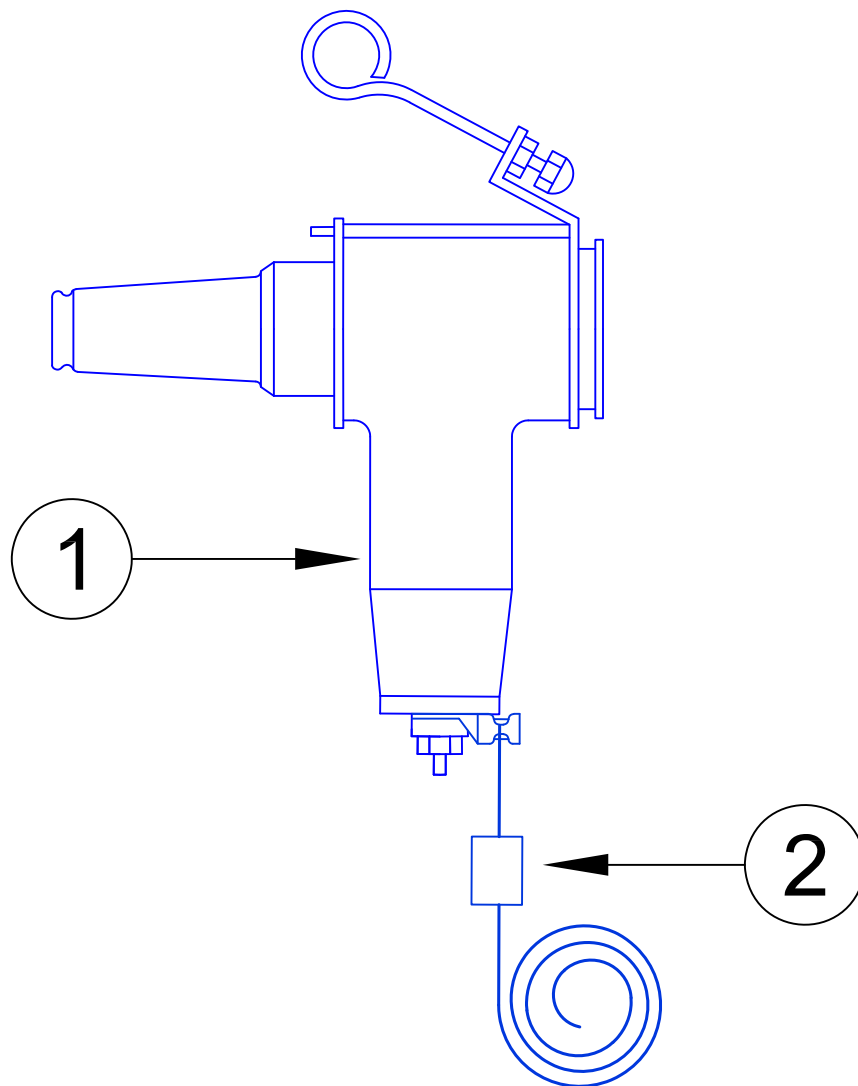
UV6

ISSUE DATE: 10/21

DESCRIPTIONS

U10-PSA

U10-PSA... Parking Stand Arrester 15KV 9kV Rated
VU10-PSA... Parking Stand Arrester 25KV 9kV Rated
VU10-PSA.18... Parking Stand Arrester 25KV 18kV Rated



Ref. No.	Material #	Description	U10-PSA	VU10-PSA	VU10-PSA.18
1	1543440	15kV Parking Stand Arrester 9kV	1		
1	1543445	25kV Parking Stand Arrester 9kV		1	
1	1543448	25kV Parking Stand Arrester 18kV			1
2	17015002	Conn, 2 Strand	1	1	1



CONSTRUCTION STANDARDS

PARKING STAND ARRESTER

U10-PSA

ISSUE DATE: 10/21

Lighting 23

IL9-1	Light Pole Installation Guidelines
IUL9-1	Underground Street Lighting
L1-1L	LED Roadway Lighting
L2	Aluminum Lighting Pole, 40'
L3-2L	LED Area/Flood Light
L5-1	Roadway Lighting Bracket (Wood Pole Mounting)
L5-2	Roadway Lighting Bracket (Aluminum Pole Mounting)
L5-3	Area/Flood Light Bracket (Wood Pole Mounting)
L9-1	Coupling base Cover

Underground Street Lighting

Rev 6/5/13

Introduction

The following guidelines are to be followed when installing street or area lighting that is supplied via an underground, low voltage, distribution system.

Conduit system - Supplied by Consumer

A conduit system will route all wiring from the source of power to the light poles. The conduit system will consist of 3-inch PVC, Schedule 40 conduit approved for the purpose, buried a minimum of 36 inches to top of conduit. This system will include a fiberglass hand hole adjacent to each of the light poles. From the hand hole, an appropriate nonmetallic conduit should run to the light pole.

Supply Conductors - Supplied by NHEC

All supply conductors shall be installed in the conduit system. The main conductors will consist of a 3 conductor 1/0 – 1/0 - #2 URD secondary cable, warehouse #9722404 installed into each of the hand holes. In the hand hole a 3 conductor, #10 copper UF cable, warehouse #15600001, will be spliced to the 1/0 aluminum using Tyco brand miniwedges, 2 each warehouse #16020210 and one each warehouse #16020200 with 3 gel type sealing covers warehouse #16020220. The #10 UF cable will then be routed through the LFNC into the wire entry hole and extended up to the hand hole located in the light pole. At the hand hole the #10 UF will be connected, using 3 – red wire nuts, warehouse #44779810, to 3 - #12 THWN copper conductors (Red 36705035, Black 36705040, and Green 36705045) which will extend to the pole to be connected using 3 more red wire nuts to connect to the fixture wires. All non-current carrying metal parts (on the pole or fixture) shall be bonded to the green wire using approved methods. Any splicing of the main 1/0 aluminum conductor shall use approved, watertight splicing kits.



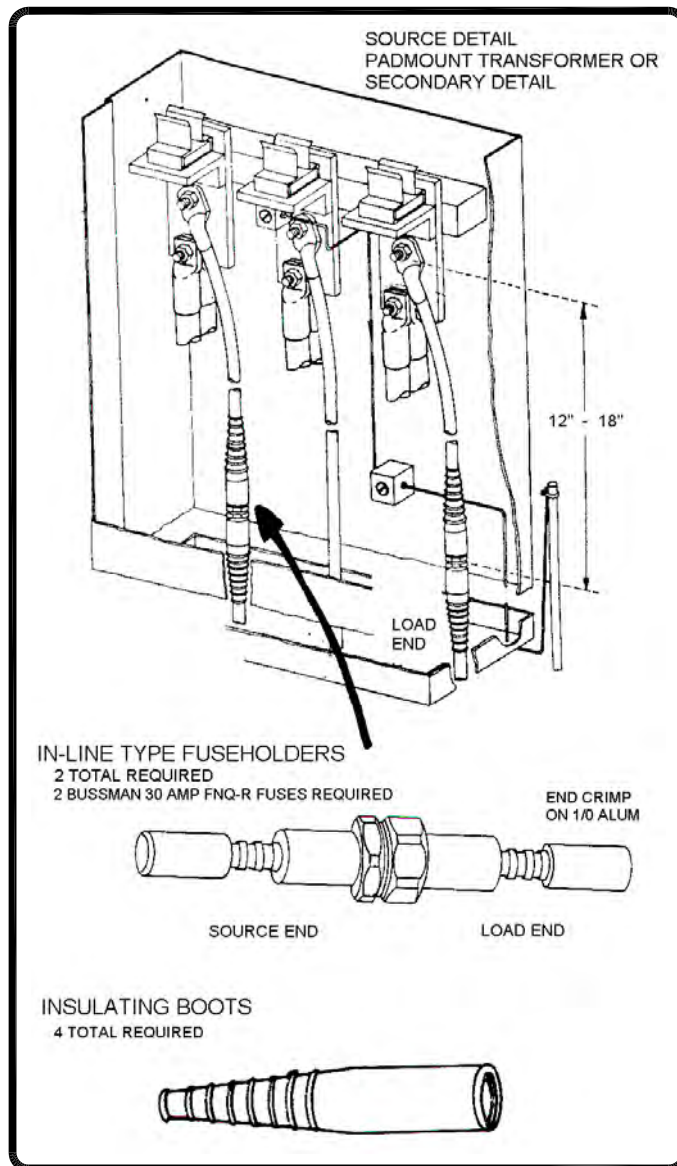
Source of Power

The voltage source (240 volt, single-phase) for powering the area lighting may come from any of the three following sources:

1. Pad-mount Transformers
2. Secondary Pedestals
3. Overhead Secondary

Fusing – Supplied by NHEC

The circuit feeding the area lighting will be fused at the source using 2 – Bussmann brand, TRON In-line fuseholders, warehouse #23100300 each containing a 30-amp type FNQ-R fuse warehouse #23100310. These in-line fuses will be crimped into the 1/0 secondary cable, approximately 6 to 10 inches from where the 1/0 ties onto the source. If the source is an overhead transformer, the fusing may be located in the first splice box if necessary. Install the end marked “Load” away from the source to prevent exposure of hot terminals when the fuse holder is separated. The installation of insulating boots, 2 required (Bussmann #2A0660), one for each fuse holder is required. These are included in the warehouse part number.



TO FIXTURE

WOOD POLE
PROVIDED BY NHEC

ALUMINUM POLE
AND FOUNDATION/BASE
PROVIDED BY MEMBER

ALUMINUM POLE
PROVIDED BY NHEC
FOR REPLACEMENT ONLY

3 X #12
THWN COPPER

SPLICE WITH
WIRE NUTS

6 FT. MAX.

18"

TWO - 1/0 - #10 MINI WEDGES
ONE - #2 - #10 MINI WEDGES
THREE - GEL COVERS

25" X 16" X 16"
HAND HOLE

FINISH GRADE

3" PVC WITH 2 X 1/0 & 1 X #2
(SUPPLIED & INSTALLED BY MEMBER)

FOUNDATION/BASE
SUPPLIED & INSTALLED
BY MEMBER

APPROPRIATE CONDUIT WITH 3/C UF #10
(SUPPLIED & INSTALLED BY MEMBER)

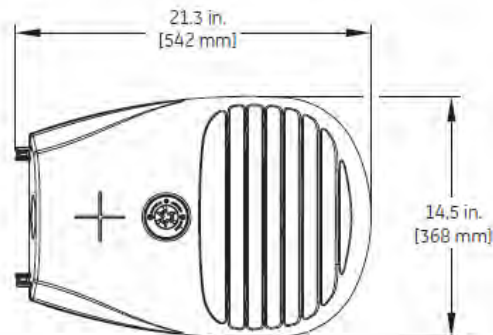
Descriptions:

L1-1L.100... Roadway LED Light, 100W/9500 (67W/3200)

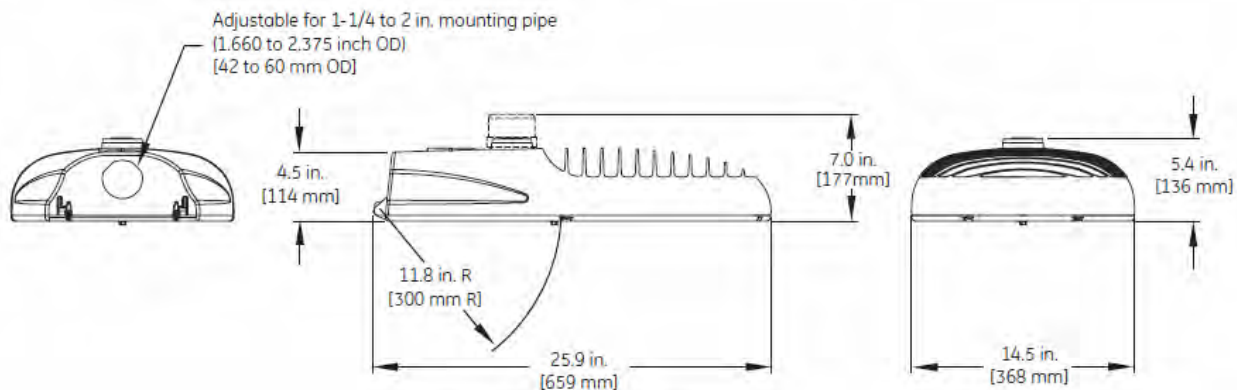
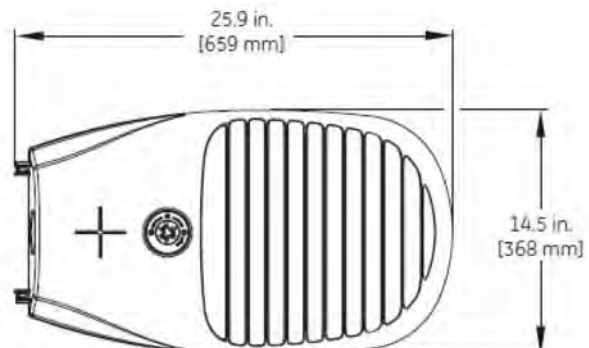
L1-1L.250... Roadway LED Light, 250W/30000 (130W/6300)

L1-1L

ESR1 - 100 WATT



ESR2 - 250 WATT



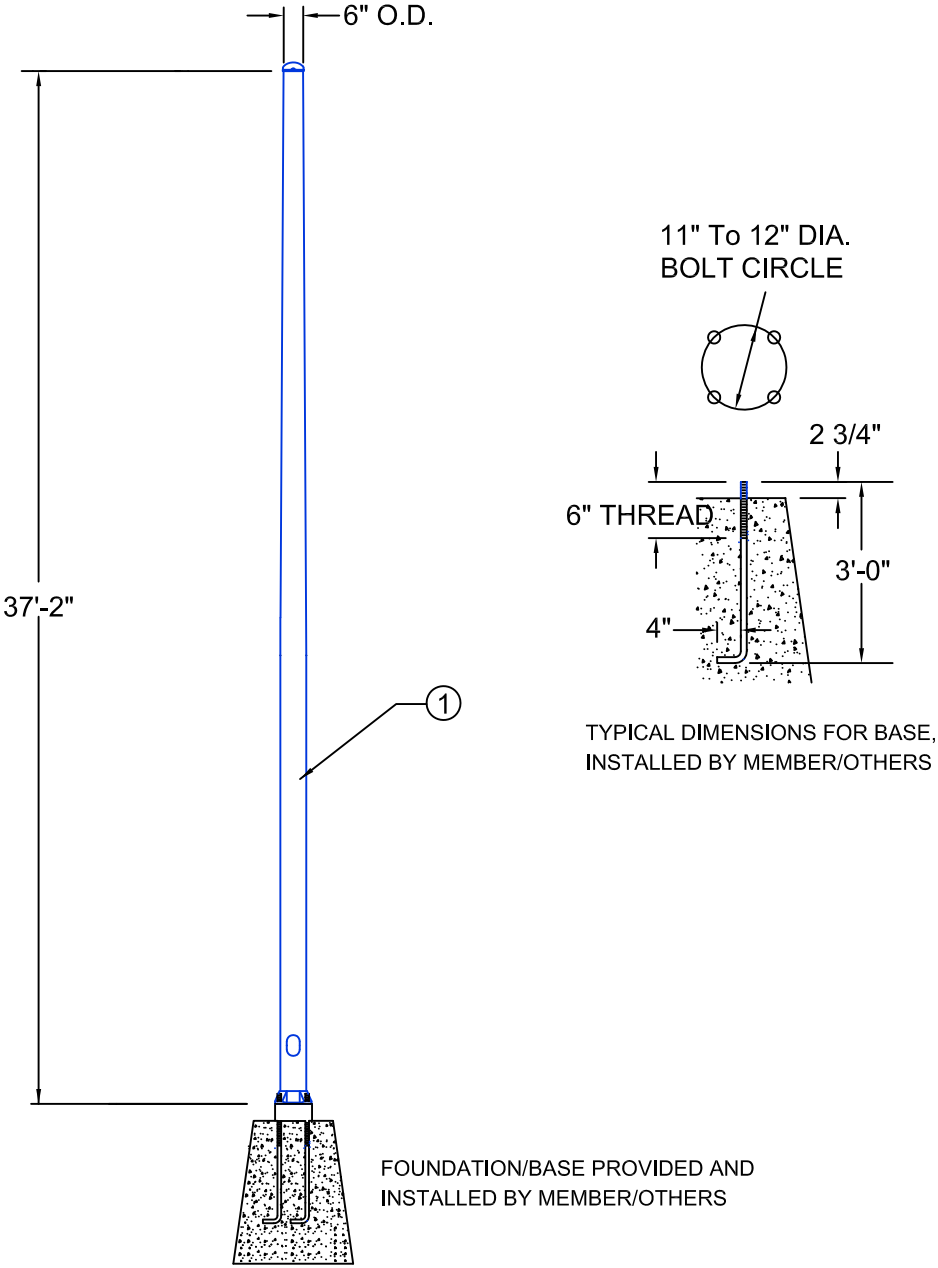
Ref. No.	Material #	Description	L1-1L.100	L1-1L.250
1	39003100	Out Lgt ROADWAY LED 100WATT	1	
1	39003250	Out Lgt ROADWAY LED 250WATT		1
2	39022000	Out Lgt LED photo cell	1	1



CONSTRUCTION STANDARDS
LED ROADWAY/ COBRAHEAD LIGHT

L1-1L

ISSUE DATE: 06/2013



Ref. No.	Material #	Description	L2.40
1	48091000	Poles, Al Hapco with cap, 40'	1

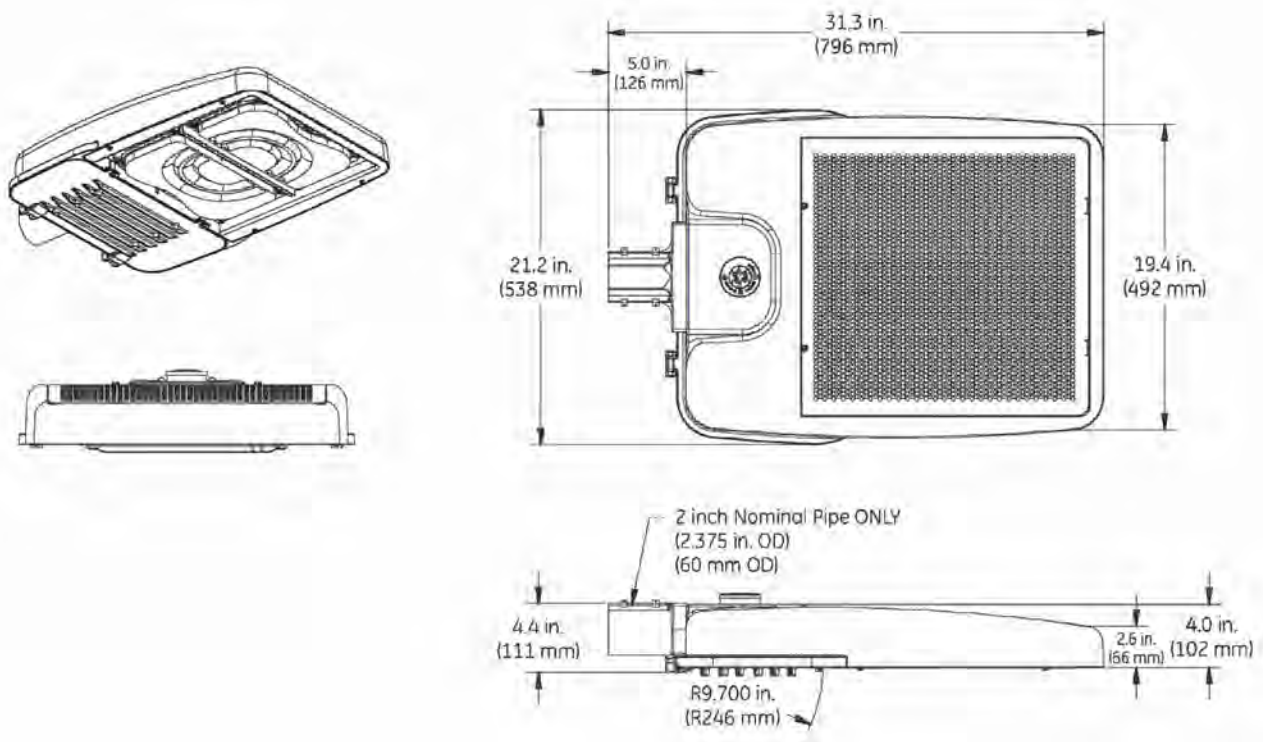


CONSTRUCTION STANDARDS

40' LIGHTING POLE

Description

L3-2L.119... LED Area Light, 119W/12900 (250W)

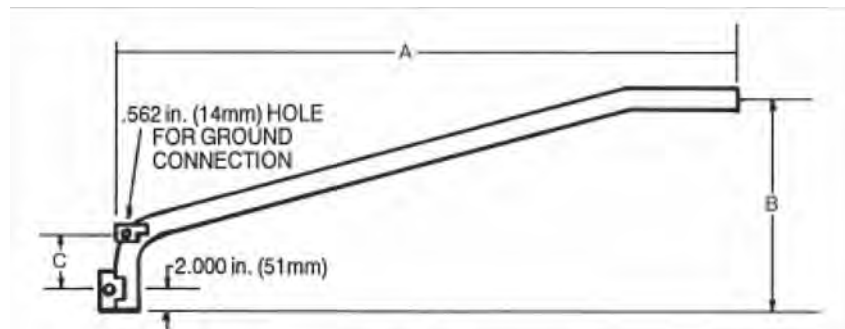
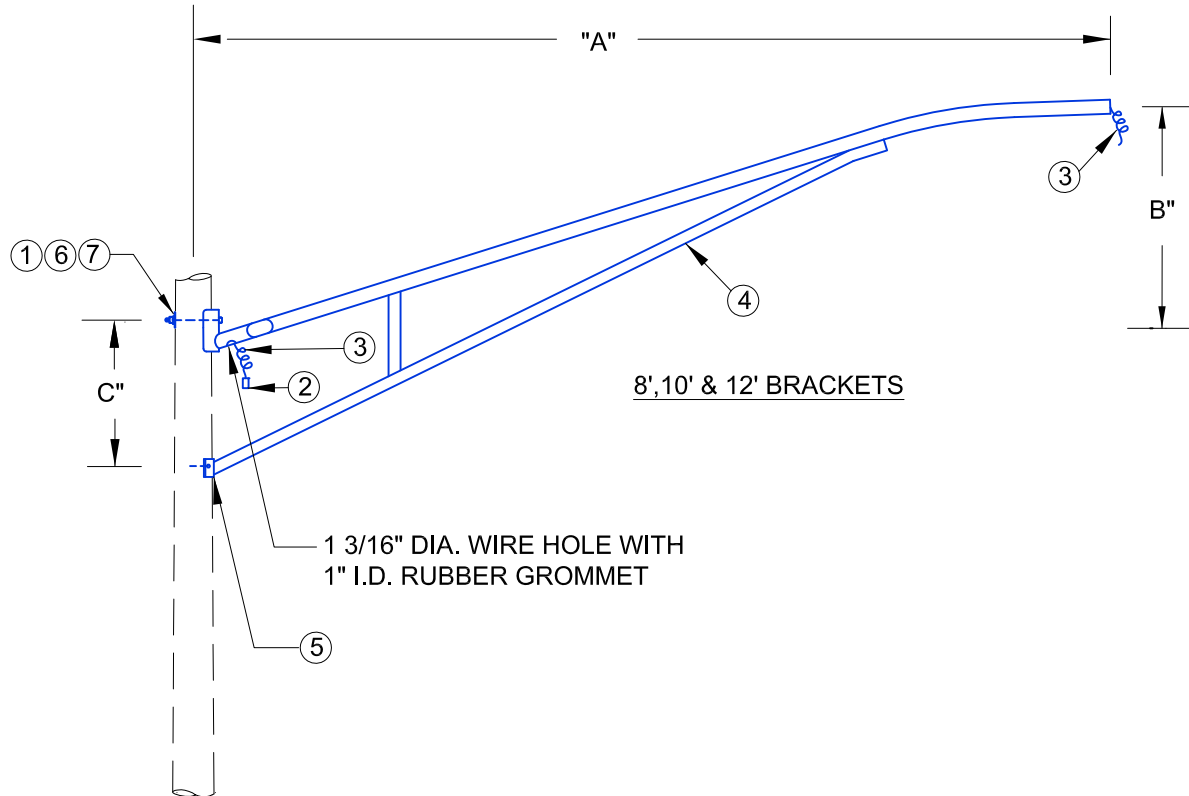


Ref. No.	Material #	Description	L3-2L.119
1	39004300	Out Lgt FLOOD LIGHT LED 119 W 12000 LUMENS (250)	1
2	39022000	Out Lgt LED photo cell	1

Construction and Design Notes:

- 1.) 7/16" sq. hole in lower plate for grounding provision
- 2.) Specify Modification #140 for 1.25" NPS slipfilter

L5-1



4' BRACKET

DIMENSIONS

ASSEMBLY	A"	B"	C"	UPPER TUBE	LOWER TUBE
L5-1.4	4'	18 $\frac{3}{8}$ "	8 $\frac{1}{4}$ "	2" O.D.	N/A
L5-1.8	8'	39"	24 $\frac{1}{2}$ "	3" O.D.	1 $\frac{1}{2}$ "
L5-1.10	10'	39"	24 $\frac{1}{2}$ "	3" O.D.	1 $\frac{1}{2}$ "
L5-1.12	12'	39"	24 $\frac{1}{2}$ "	3 $\frac{1}{2}$ " O.D.	1 $\frac{1}{2}$ "

CONSTRUCTION ASSEMBLIES

4 FT	8 FT	10 FT	12 FT
L5-1.4	L5-1.8	L5-1.10	L5-1.12



CONSTRUCTION STANDARDS
ROADWAY LIGHTING BRACKETS
(WOOD POLE MOUNTING)

L5-1

ISSUE DATE: 05/16

Materials List for Assemblies

Descriptions

L5-1.4	Street Light Bracket, Round Pipe, 4 ft.
L5-1.8	Street Light Bracket, Tapered Truss, 8 ft.
L5-1.10	Street Light Bracket, Tapered Truss, 10 ft.
L5-1.12	Street Light Bracket, Tapered Truss, 12 ft.

Ref	Material #	Description	L5-1.4	L5-1.8	L5-1.10	L5-1.12
1	6380512	Bolt, Machine 5/8" x 12"	1	1	1	1
2	17010214	Con, Sicame TTD0510XF	3	3	3	3
3	15600003	Cond, UF 12/3	13	13	15	17
4	43000048	Out. Lgt Brkt 48" for LED RDWY	1			
4	43000108	Out. Lgt Brkt Wood Pole 8'		1		
4	43000110	Out. Lgt Brkt Wood Pole 10'			1	
4	43000112	Out. Lgt Brkt Wood Pole 12'				1
5	55504440	Screw, Lag 1/2" x 4"	2	2	2	2
6	71053063	Washer, Spring 5/8"	1	1	1	1
7	71020451	Washer, Square 2-1/4" x 2-1/4"	1	1	1	1

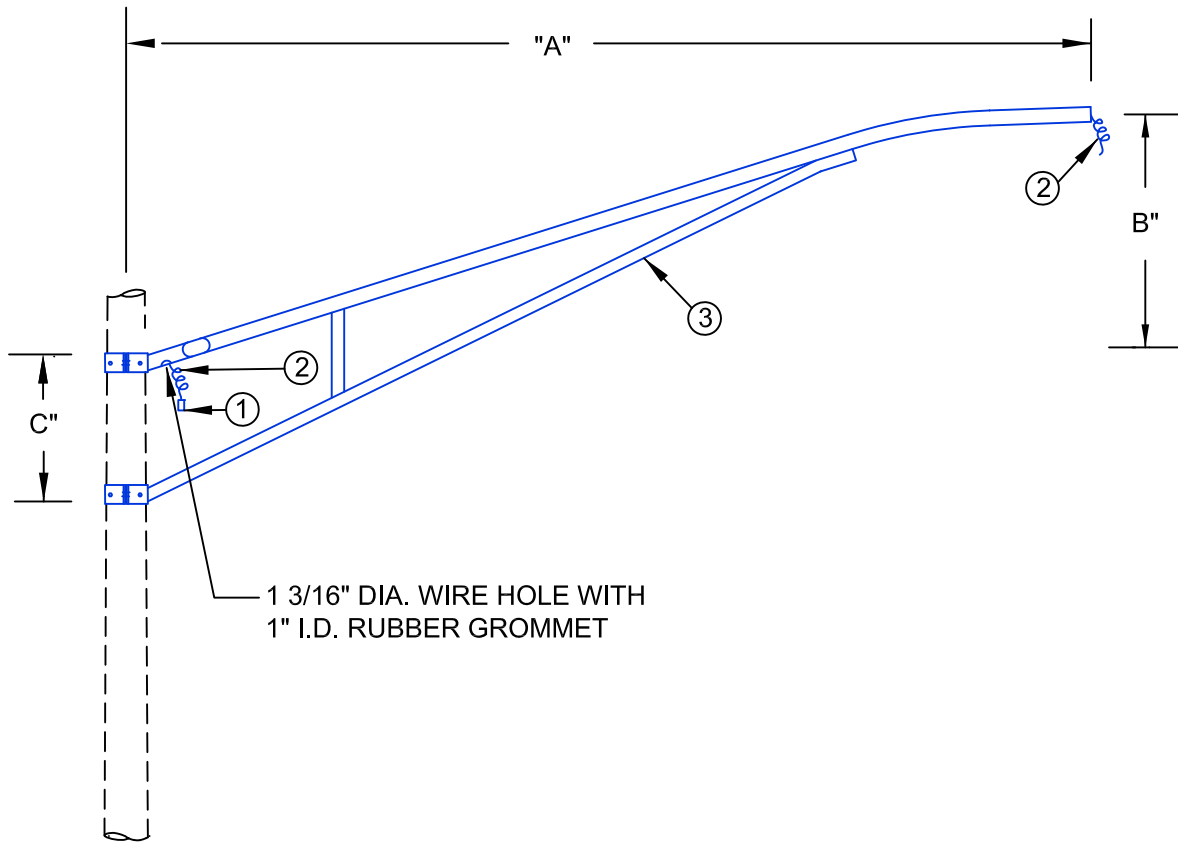


CONSTRUCTION STANDARDS

ROADWAY LIGHTING BRACKETS (WOOD POLE MOUNTING)

Construction and Design Notes:

- 1.) 7/16" sq. hole in lower plate for grounding provision
- 2.) Specify Modification #140 for 1.25" NPS slipfilter



DIMENSIONS

ASSEMBLY	A"	B"	C"	UPPER TUBE	LOWER TUBE
L5-2.8	8'	39"	24 $\frac{1}{2}$ "	3" O.D.	1 $\frac{1}{2}$ "
L5-2.12	12'	39"	24 $\frac{1}{2}$ "	3 $\frac{1}{2}$ " O.D.	1 $\frac{1}{2}$ "
L5-2.15	15'	39"	24 $\frac{1}{2}$ "	4" O.D.	2"

CONSTRUCTION ASSEMBLIES		
8 FT	12 FT	15 FT
L5-2.8	L5-2.12	L5-2.15



CONSTRUCTION STANDARDS
ROADWAY LIGHTING BRACKETS
(ALUMINUM POLE MOUNTING)

L5-2

ISSUE DATE: 07/2013

Materials List for Assemblies

Descriptions

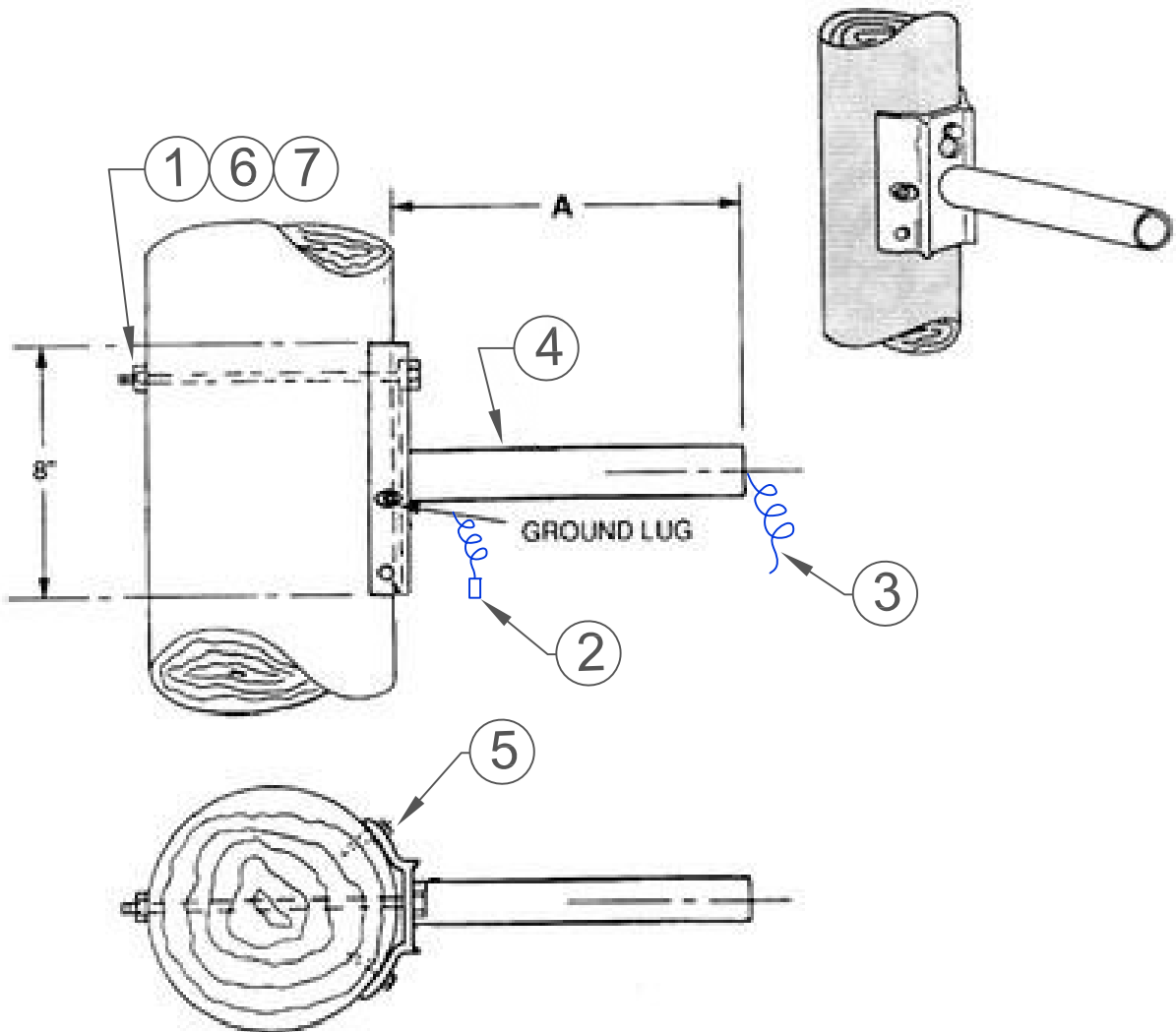
L5-2.8 Street Light Bracket, Alum. Pole, Tapered Truss, 8 ft.
 L5-2.12 Street Light Bracket, Alum. Pole, Tapered Truss, 12 ft.
 L5-2.15 Street Light Bracket, Alum. Pole, Tapered Truss, 15 ft.

Ref	Material #	Description	L5-2.8	L5-2.12	L5-2.15
1	17010214	Con, Sicame TTD0510XF	3	3	3
2	15600003	Cond, UF 12/3	13	17	20
3	43000210	Out Lgt Brkt Hapco 8ft	1		
3	43000212	Out Lgt Brkt Hapco 12ft		1	
3	43000215	Out Lgt Brkt Hapco 15ft			1



CONSTRUCTION STANDARDS

ROADWAY LIGHTING BRACKETS
(ALUMINUM POLE MOUNTING)



Ref. No.	Material #	Description	L5-3.1
1	6380512	Bolt, Machine 5/8" x 12"	1
2	17010214	Con, Sicame TTD0510XF	3
3	15600003	Cond, UF 12/3	6
4	43000012	Out Lgt Brkt 12" for LED flood	1
5	55504440	Screw, Lag 1/2" x 4"	2
6	71053063	Washer, Spring 5/8"	1
7	71020451	Washer, Square 2 1/4" x 2 1/4"	1

CONSTRUCTION ASSEMBLIES
1 FT
L5-3.1



CONSTRUCTION STANDARDS
AREA / FLOOD LIGHTING BRACKET
(WOOD POLE MOUNTING)

NOTES

1. THIS BASE COVER USED WITH COUPLING ASSEMBLY. TWO (2) REQUIRED PER ASSEMBLY.
2. MAXIMUM BOLT CIRCLE 12" DIA.
3. FURNISH WITH COVER: (4) #10 x 5/8" LONG SHEET METAL SCREWS.

1"- 8NC TORQUE CONTROL NUT
1.50" ACROSS FLATS

NUT SHEARS ALONG THIS LINE
AT REQUIRED TORQUE

1"- 8NC SUPPORT STUD
BONDED IN COUPLING

2" O.D. x 1.03" I.D. x
3/8" THICK WASHER

2-3/4" O.D. x 1.03" I.D. X 3/8" THICK
WASHER BONDED TO COUPLING

BREAKAWAY COUPLING

PFI 200-1A
BREAKAWAY COUPLING
ASSEMBLY

