



**United States
Department of
Agriculture**

Rural Electrification
Administration

REA Bulletin 50-4
Standard D-801

Specifications and Drawings for 34.5/19.9 kV Distribution Line Construction

UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Electrification Administration

November 20, 1986

REA BULLETIN 50-4

SUBJECT: Specifications and Drawings for 34.5/19.9 kV Distribution Line Construction (D-801).

- I. **Purpose:** To announce the issuance of REA Standard D-801, Specifications and Drawings for 34.5/19.9 kV Distribution Line Construction.
- II. **General:** REA has prepared this bulletin to provide borrowers with standard construction drawings for 34.5/19.9 kV overhead distribution lines. The decision to use 34.5/19.9 kV should be based on the borrower's individual situation and should include an economic analysis.

This bulletin is similar to REA's Specifications and Drawings for 24.9/14.4 kV Line Construction with increased clearance where necessary, the use of post insulators instead of pin insulators, and the use of dual dimensions (customary and metric). The metric dimensions are approximate equivalents for the customary dimensions.

- III. **Availability of Standard:** Copies of REA Bulletin 50-4 may be purchased from the Government Printing Office. Questions concerning this standard may be referred to the Chief, Distribution Branch, Electric Staff Division, Rural Electrification Administration, U.S. Department of Agriculture, Washington, D.C. 20250.



Assistant Administrator – Electric

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SPECIFICATIONS AND STANDARDS

Construction Specifications and Drawings - Bul 50-4(D-801)

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SPECIFICATIONS FOR CONSTRUCTION

1. General

All construction work shall be done in accordance with the staking sheets, plans and specifications, and the construction drawings.

The 1987 or latest edition of the National Electrical Safety Code (NESC), ANSI C2, shall be followed except where local regulations are more stringent, in which case local regulations shall govern.

2. Distribution of Poles

In distributing the poles, large, choice, dense poles shall be used at transformer, dead-end, angle, and corner locations.

3. Pole Setting

The minimum depth for setting poles shall be as follows:

<u>Length of Pole</u>	<u>Setting in Soil</u>	<u>Setting in All Solid Rock</u>
<u>feet (meters)</u>	<u>feet (meters)</u>	<u>feet (meters)</u>
20 (6.10)	4.0 (1.22)	3.0 (0.91)
25 (7.62)	5.0 (1.52)	3.5 (1.07)
30 (9.14)	5.5 (1.68)	3.5 (1.07)
35 (10.67)	6.0 (1.83)	4.0 (1.22)
40 (12.19)	6.0 (1.83)	4.0 (1.22)
45 (13.72)	6.5 (1.98)	4.5 (1.37)
50 (15.24)	7.0 (2.13)	4.5 (1.37)
55 (16.76)	7.5 (2.29)	5.0 (1.52)
60 (18.29)	8.0 (2.44)	5.0 (1.52)

“Setting in Soil” depths shall apply:

- a. Where poles are to be set in soil.
- b. Where there is a layer of soil of more than 2 feet (610 mm) in depth over solid rock.
- c. Where the hole in solid rock is not substantially vertical or the diameter of the hole at the surface of the rock exceeds approximately twice the diameter of the pole at the same level.

"Setting in All Solid Rock" depths shall apply where poles are to be set in solid rock and where the hole is substantially vertical, approximately uniform in diameter and large enough to permit the use of tamping bars the full depth of the hole.

Where there is a layer of soil 2 feet (610 mm) or less in depth over solid rock, the depth of the hole shall be the depth of the soil in addition to the depth specified under "Setting in All Solid Rock" provided, however, that such depth shall not exceed the depth specified under "Setting in Soil."

On sloping ground, the depth of the hole shall be measured from the low side of the hole.

Poles shall be set so that alternate crossarm gains face in opposite directions, except at terminals and dead ends where the gains of the last two (2) poles shall be on the side facing the terminal or dead end. On unusually long spans, the poles shall be set so that the crossarm is located on the side of the pole away from the long span. Where pole top insulator brackets are used, they shall be located on the opposite side of the pole from the gain.

Poles shall be set in alignment and plumb, except at corners, terminals, angles, junctions, or other points of strain, where they shall be set and raked against the strain so that the conductors are in line.

Poles shall be raked against the conductor strain not less than 1-inch (25 mm) for each 10 feet (3.05 m) of pole length nor more than 2 inches (51 mm) for each 10 feet (3.05 m) of pole length after conductors are installed at the required tension.

Pole backfill shall be thoroughly tamped in full depth. Excess dirt shall be banked around the pole.

Poles which have been in storage for more than 1 year from the date of treatment shall be ground line treated when installed.

4. Grading of Line

When using high poles to clear obstacles such as buildings, foreign wire crossings, railroads, etc., there shall be no upstrain on pin-type or post-type insulators in grading the line each way to lower poles.

5. Guys and Anchors

Guys shall be placed before the conductors are strung and shall be attached to the pole as shown in the construction drawings.

All anchors and rods shall be in line with the strain and shall be installed so that approximately 6 inches (152 mm) of the rod remain out of the ground. In cultivated fields or other locations, as deemed necessary, the projection of the anchor rod above earth may be increased to a maximum of 12 inches (305 mm) to prevent burial of the rod eye. The backfill of all anchor holes must be thoroughly tamped the full depth.

After a cone anchor has been set in place, the hole shall be backfilled with coarse crushed rock for 2 feet (610 mm) above the anchor, tamping during the filling. The remainder of the hole shall be backfilled and tamped with dirt.

6. Locknuts

A locknut shall be installed with each nut, eyenut or other fastener on all bolts or threaded hardware such as insulator studs, upset bolts, double arming bolts, etc.

7. Conductors

Conductors must be handled with care. Conductors shall neither be trampled on nor run over by vehicles. Each reel shall be examined and the wire shall be inspected for cuts, kinks, or other injuries. Injured portions shall be cut out and the conductor spliced. The conductors shall be pulled over suitable rollers or stringing blocks properly mounted on the pole or crossarm if necessary to prevent binding while stringing.

The neutral conductor should be maintained on one side of the pole (preferably the road side) for tangent construction and for angles not exceeding 20°.

With pin-type or post-type insulators, the conductors shall be tied in the top groove of the insulator on tangent poles and on the side of the insulator away from the strain at angles. Post-type insulators shall be tight on the studs and brackets, respectively, and the top groove must be in line with the conductor after tying.

For line angles of 0° to 5° in locations known to be subject to considerable conductor vibration, insulated brackets (material item da) may be substituted for the single and double upset bolts used for supporting the neutral and secondary conductors.

All conductors shall be cleaned thoroughly by wirebrushing before splicing or installing connectors or clamps. A suitable inhibitor shall be used before splicing or applying connectors over conductor.

8. Splices and Dead Ends

Conductors shall be spliced and dead-ended as shown on the construction drawings. There shall be not more than one splice per conductor in any span and splices shall be located at least 10 feet (3.05 m) from the conductor support. No splices shall be located in Grade B crossing spans and preferably not in the adjacent spans. Splices shall be installed in accordance with the manufacturer's recommendations.

9. Taps and Jumpers

Jumpers and other leads connected to line conductors shall have sufficient slack to allow free movement of the conductors. Where slack is not shown on the construction drawings, it will be provided by at least two (2) bends in a vertical plane, or one (1) in a horizontal plane, or the equivalent. In areas where aeolian vibration occurs, special measures to minimize the effects of jumper breaks shall be used as specified.

All leads on equipment such as transformers, reclosers, etc., shall be a minimum of #6 copper conductivity. Where aluminum jumpers are used, a connection to an unplated bronze terminal shall be made by splicing a short stub of copper to the aluminum jumper using a compression connector suitable for the bimetallic connection.

10. Hot-Line Clamps and Connectors

Connectors and hot-line clamps suitable for the purpose shall be installed as shown on the guide drawings. On all hot-line clamp installations, the clamp and jumper shall be installed so that they are permanently bonded to the load side of the line, allowing the jumper to be de-energized when the clamp is disconnected.

11. Surge Arrester Gap Settings

All surge arresters shall be the direct-connected type. The interconnecting leads shall be kept as short as possible.

12. Conductor Ties

Factory-formed ties shall be sagged in accordance with the manufacturer's recommendations.

13. Sagging of Conductors

Conductors shall be sagged in accordance with the conductor manufacturer's recommendations. All conductors shall be sagged evenly. The air temperature at the time and place of sagging shall be determined by a certified thermometer.

The sag of all conductors after stringing shall be in accordance with the engineer's instructions.

14. Secondaries and Service Drops

Secondary conductors may be bare or covered wires or multi-conductor service cable. The conductors shall be sagged in accordance with the manufacturer's recommendations.

Conductors for secondary underbuild on primary lines will normally be bare, except in those instances where prevailing conditions may limit primary span lengths to the extent that covered wires or service cables may be used. Service drops shall be covered wire or service cable.

Secondaries and service drops shall be so installed as not to obstruct climbing space. There shall not be more than one splice per conductor in any span, and splices shall be located at least 10 feet (3.05 m) from the conductor support. Where the same covered conductors or service cables are to be used for the secondary and service drop, they may be installed in one continuous run.

15. Grounds

Ground rods shall be driven full length in undisturbed earth in accordance with the construction drawings. The top shall be at least 12 inches (305 mm) below the surface of the earth. The ground wire shall be attached to the rod with a clamp and shall be secured to the pole with staples. The staples on the ground wire shall be spaced 2 feet (610 mm) apart, except for a distance of 8 feet (2.44 m) above the ground and 8 feet (2.44 m) down from the top of the pole where they shall be 6 inches (152 mm) apart.

All equipment shall have at least two (2) connections from the frame, case or tank to the multi-grounded neutral conductor.

The equipment ground, neutral wires, and surge-protection equipment shall be interconnected and attached to a common ground wire.

16. Clearing Right-of-Way

The right-of-way shall be prepared by removing trees, clearing underbrush, and trimming trees so that the right-of-way is cleared close to the ground and is the width specified, except that low growing shrubs which will not interfere with the operation or maintenance of the line shall be left undisturbed if so directed by the owner. Slash may be chipped and blown on the right-of-way. The landowner's written permission shall be received prior to cutting trees outside the right-of-way. Trees fronting each side of the right-of-way shall be trimmed symmetrically unless otherwise specified. Dead trees beyond the right-of-way which would strike the line in falling shall be removed. Leaning trees beyond the right-of-way, which would strike the line in falling and which would require topping if not removed, shall either be removed or topped, except that shade, fruit, or ornamental trees shall be trimmed and not removed, unless otherwise authorized.

17. Structures Exceeding 200 Feet (60.96 m) in Height and Structures in the Vicinity of Airports

The Federal Aviation Administration (FAA) requires (14 CFR 77) that in cases where structures or conductors will exceed a height of 200 feet (60.96 m), or are within 20,000 feet (6.10 km) of an airport, the nearest regional or area office of the FAA be contacted and FAA Form 7460-1 be filed if necessary.

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ZA6	Vertical Deadend (Double)
ZA7, ZA7-1	Crossarm Construction Deadend (Single)
ZA8	Crossarm Construction Deadend (Double)
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Two Phase:

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ZB9-2	Crossarm Construction Double
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ZC2	Crossarm Construction Double Primary Support
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Three Phase (Cont'd):

ZC7, ZC7-1	Crossarm Construction Deadend (Single)
ZC7-2, ZC7-3	Crossarm Construction Deadend (Single)
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ZC8-2	Crossarm Construction Deadend (Double) (Large Conductors)
ZC8-3	Crossarm Construction Deadend (Double) Large Conductors with Unbalanced Loads
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ZDC-C1	Crossarm Construction Double Circuit Single Primary Support 2 Crossarm Type
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Guy Assemblies:

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ZG210	Two Transformers, Cluster Mounted Open Wye- Open Delta for 120/240 Volt Power Loads
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Secondary Assemblies

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K10L, K11L, K14L
K11C, K14C, K15C
K16C, K17L, K17

Service Assemblies
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Service Assemblies (Large Conductors)
Service Assemblies, Cable
Service Assemblies, (For Ranch Type House)

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ZM5-22
ZM5-7, 8, 18, 20
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19, 21, 23

Grounding Assembly Ground Rod Type
Pole Protection Assembly
Grounding Assembly Ground Rod Type for
Sectionalizing Air Break Switch
One Sectionalizing Fuse Cutout
2 or 3 Sectionalizing Disconnect Switches
One Sectionalizing Oil Circuit Recloser
Sectionalizing Air Break Switch
2 or 3 Sectionalizing Oil Circuit Reclosers
2 or 3 Sectionalizing Oil Circuit Reclosers
One Sectionalizing Oil Circuit Reclosers with
By-Pass Switches
2 or 3 Sectionalizing Oil Circuit Reclosers
with By-Pass Switches
2 or 3 Sectionalizing Oil Circuit Reclosers
with By-Pass Switches
Miscellaneous Primary Assemblies
Miscellaneous Primary Assemblies
Miscellaneous Primary Assemblies

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One Voltage Regulator Platform Mounted

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Secondary Metering Guide Single Phase
120/240 Volts

M8-9

Guide to Yard Pole Meter Installation (Showing
Pump Service Carried Underground)

M8-10

Guide to Yard Pole Meter Installation (Showing
All Building Services Carried Underground)

M8-11

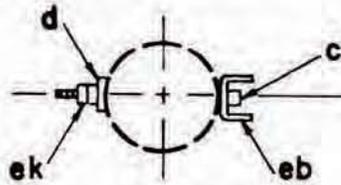
Secondary Metering Guide Three-Phase,
208/120 Volts 4-Wire Grounded Wye

MB-12

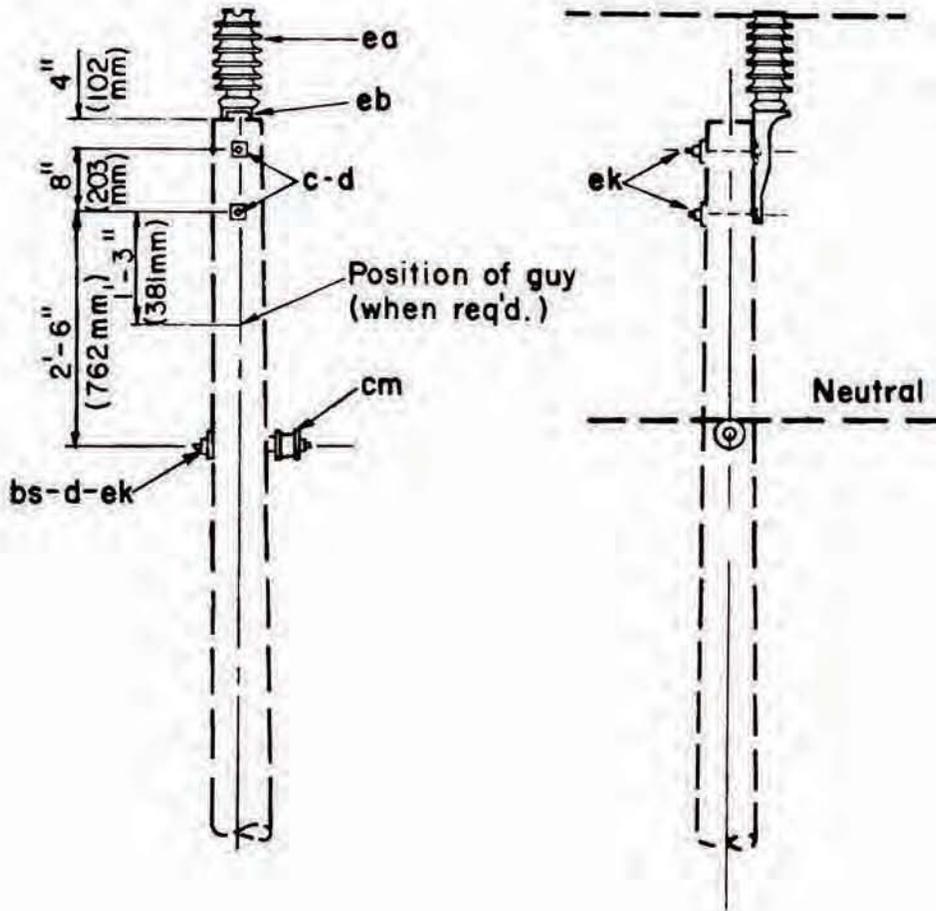
Secondary Metering Guide Three-Phase 240 Volts
3 Wire Corner Grounded Delta

Guide Drawings:

M19	Crossarm Drilling Guide
M20	Pole Framing Guide
M21	Angle Construction Guide Crossarm to Vertical Const. - 20 to 60 Angle
ZM22-1	Tree Trimming Guide
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M24	Cable Service Assembly Guide
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M26-5	Security Light Installation Guide (Unmetered) Transformer
M27	Connection Guide Open Wire Services
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M27-2	Transformer Connection Guide Secondary Underbuild
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ZM29-1A	Tap Assembly Guide
ZM29-1B	Tap Assembly Guide
M41-1	Angle Assembly Guide, Vertical Construction 20 to 60 Angle, Copper Type Conductors with Formed Type Armor Rods
M41-10	Angle Assembly Guide, Vertical Construction 20 to 60 Angle, A.C.S.R. Conductors with Straight or Formed Type Armor Rods
M42-11	Deadend Assembly Guide - Deadend Clamp Method A.C.S.R. Conductors
M42-13	Deadend Assembly Guide (Large Conductors)
M43-4	Tap Assembly Guide Copperweld-Copper and Copper Conductors
M43-10	Tap Assembly Guide, A.C.S.R. Conductors
M52-3, M52-4	Neutral Identification and Pole Numbering Guide
RI	Clearing Right-of-Way Guide



POLE TOP INSULATOR ASSEMBLY



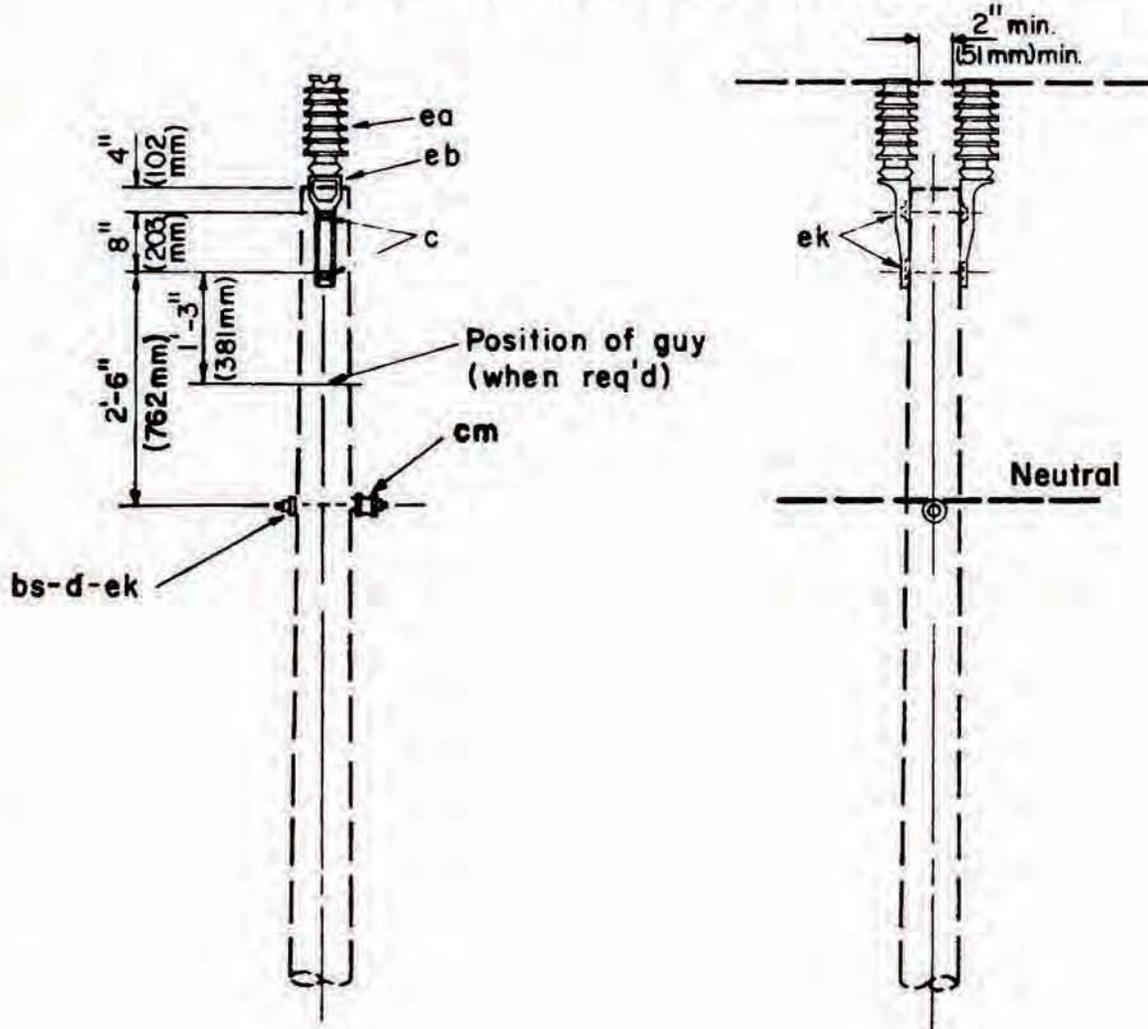
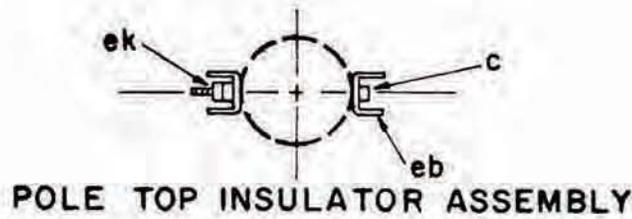
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
bs 1	Bolt, single upset	ea 1	Insulator, post type
c 2	Bolt, machine, 5/8" x req'd length	eb 1	Bracket, pole top
d 3	Washer, square, 2 1/4"	ek	Locknuts, as required
cm 1	Insulator, spool		

Maximum Transverse
Load: 750 lbs. (3336 N)
Angle: 0° - 5°

**34.5/19.9 kV PRIMARY I - PHASE,
SINGLE PRIMARY SUPPORT**

NOV. 1986

ZAI



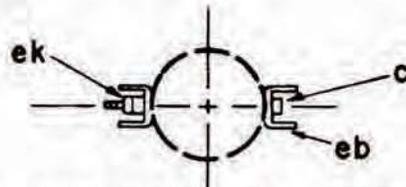
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
bs	1 Bolt, single upset	ea	2 Insulator, post type
c	2 Bolt, machine, 5/8" x req'd length	eb	2 Bracket, pole top
d	1 Washer, square, 2 1/4"	ek	Locknuts, as required
cm	1 Insulator, spool		

Maximum Transverse
 Load: 750 lbs. (3336 N)/Insulator
 1500 lbs. (6672 N) Total
 Angle: 0° - 5°

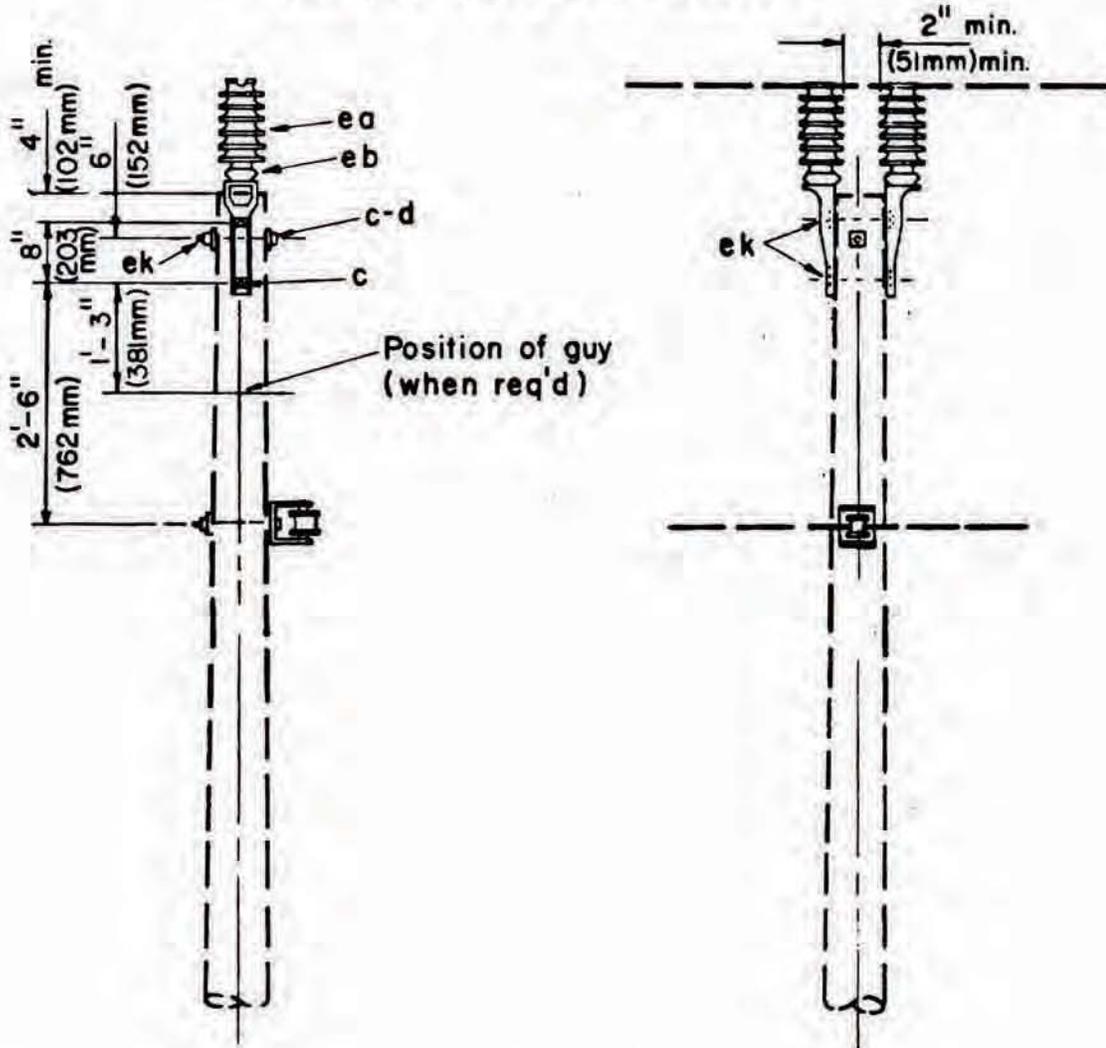
**34.5/19.9 kV PRIMARY, I-PHASE
 DOUBLE PRIMARY SUPPORT**

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ZAI-1



POLE TOP INSULATOR ASSEMBLY



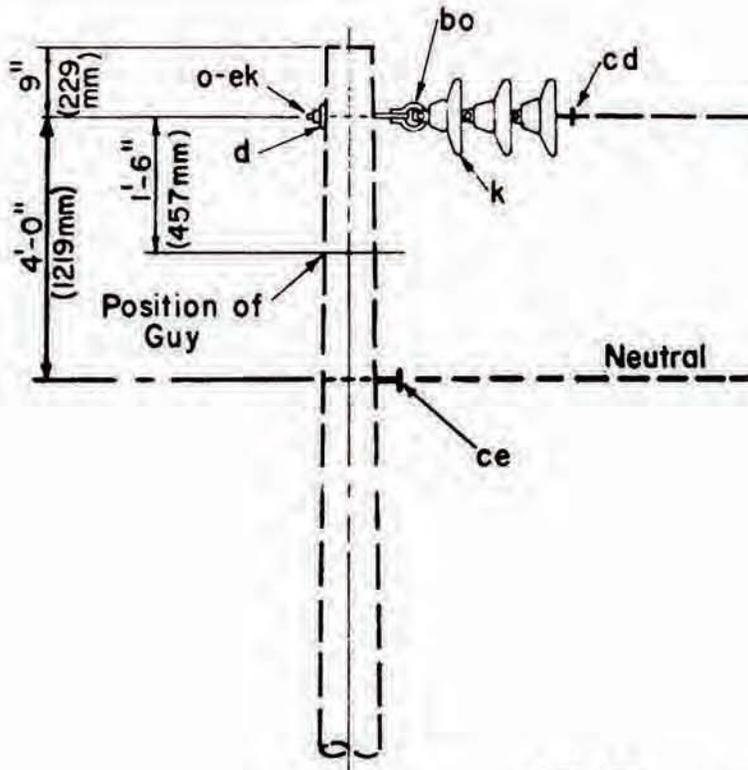
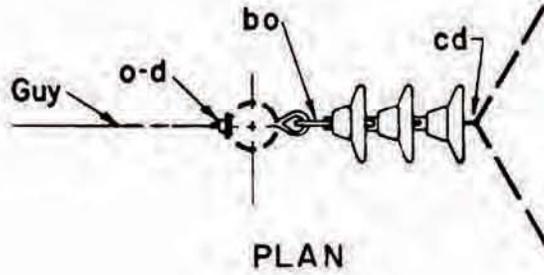
ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
c	4	Bolt, machine, 5/8" x req'd length	ea	2	Insulator, post type
d	3	Washer, square, 2 1/4"	eb	2	Bracket, pole top
da	1	Bracket, insulated	ek		Locknuts, as required

Maximum Transverse
 Load : 750 lbs. (3336 N)/ Insulator
 1500 lbs. (6672 N) Total
 Angle : 5°-20°

34.5/19.9 kV PRIMARY, 1 PHASE
 DOUBLE PRIMARY SUPPORTS

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ZA 2



NOTE:
For units ce and cd
see guide drawings
M41-1 or M41-10

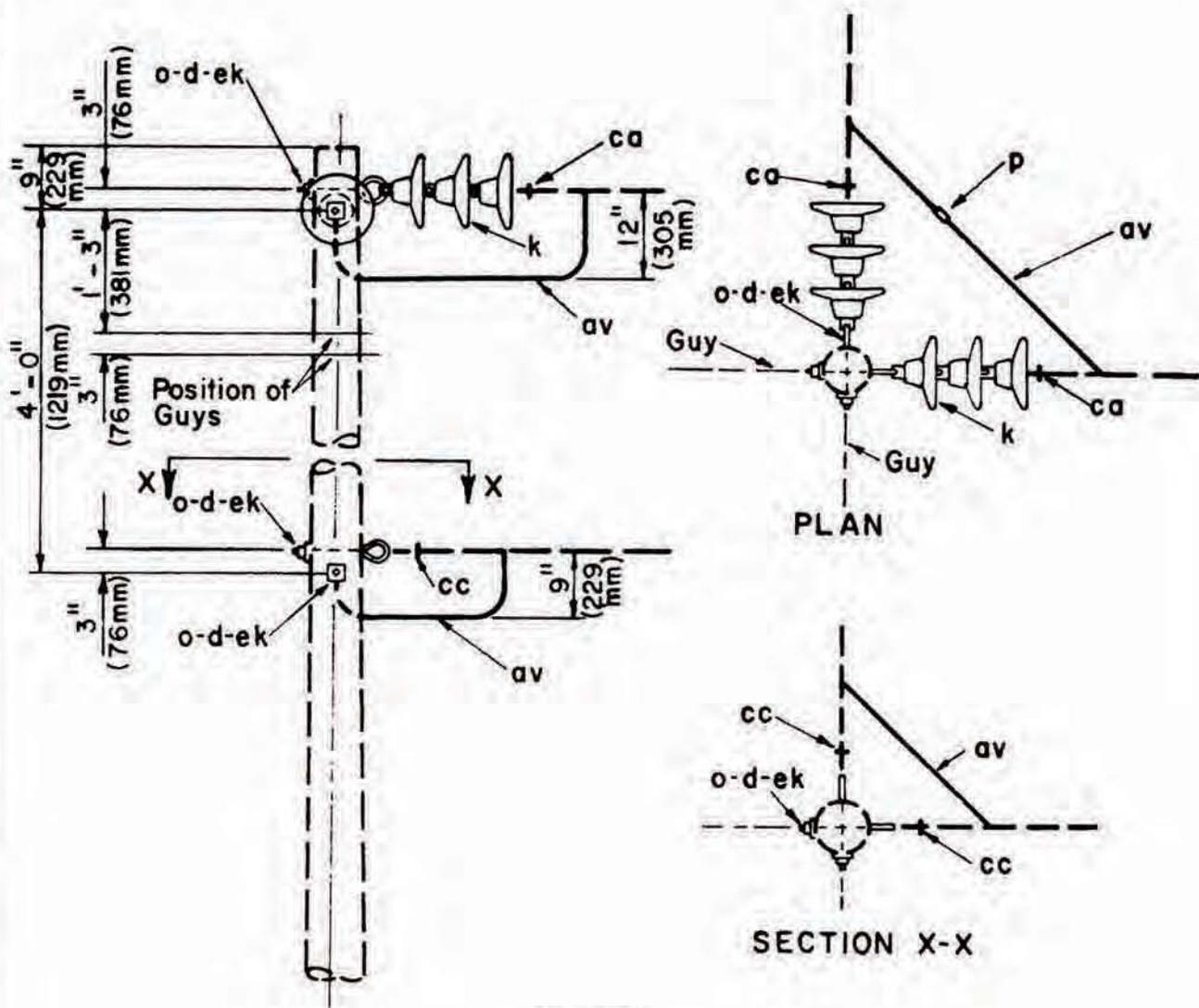
ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
bo	1	Shackle, anchor	ek		Locknuts, as required
ce	1	Angle assembly, neutral	k	3	Insulator, suspension, 10"
cd	1	Angle assembly, primary	o	1	Bolt, eye, 5/8" x req'd length
d	1	Washer, square, 2 1/4"			

Angle: 20° - 60°

34.5/19.9 kV PRIMARY, 1-PHASE

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ZA3



NOTES:

For units ca and cc
see guide drawings
M42-11 and M42-13

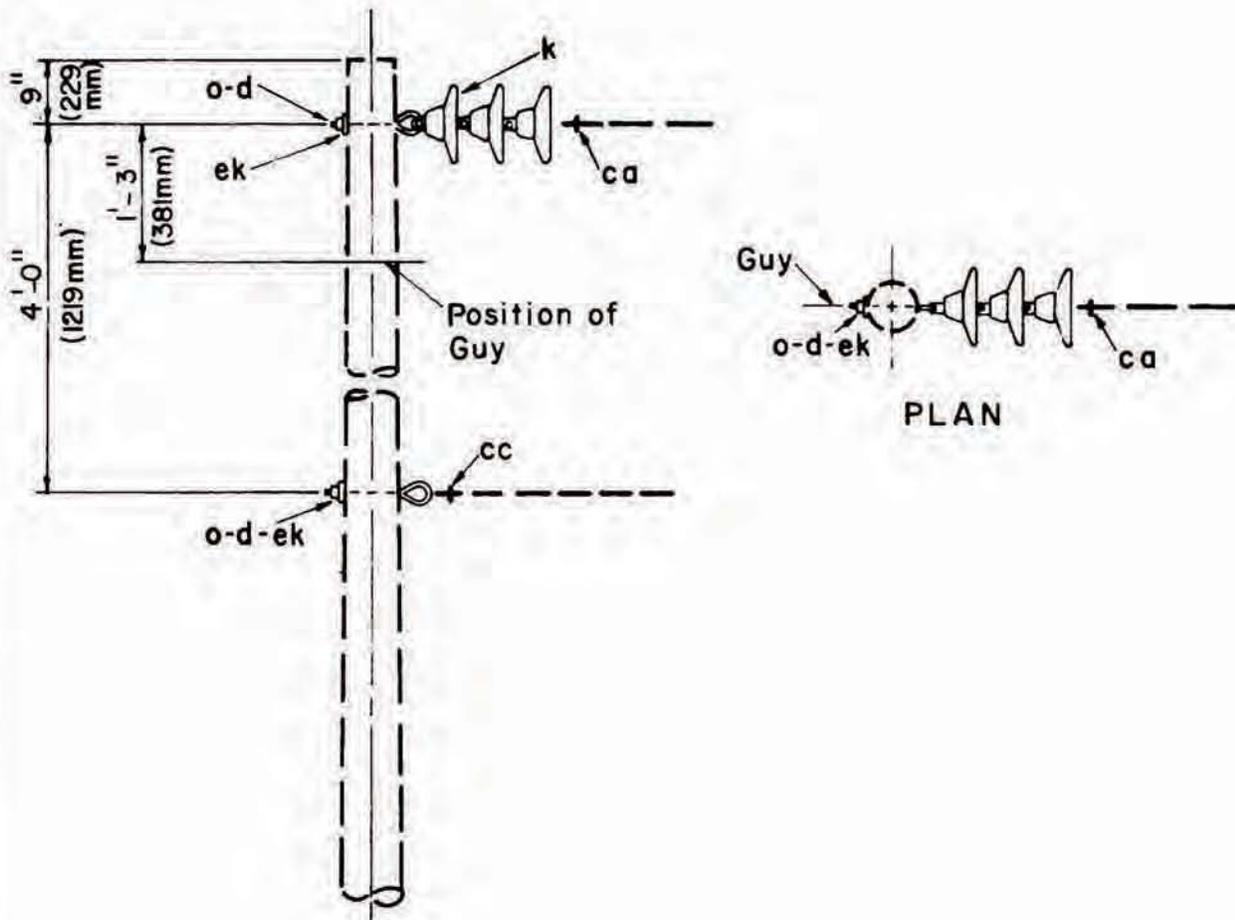
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
av	Jumpers, as required	ek	Locknuts, as required
ca	2 Deadend, assembly, primary	o	4 Bolt, eye, 5/8" x req'd length
cc	2 Deadend, assembly, neutral	p	Connectors, as req'd
d	4 Washer, square, 2 1/4"	k	6 Insulator, suspension, 10"

Angle: 60°-90°

**34.5/19.9 kV PRIMARY
I-PHASE**

NOV. 1986

Z A 4



NOTE:

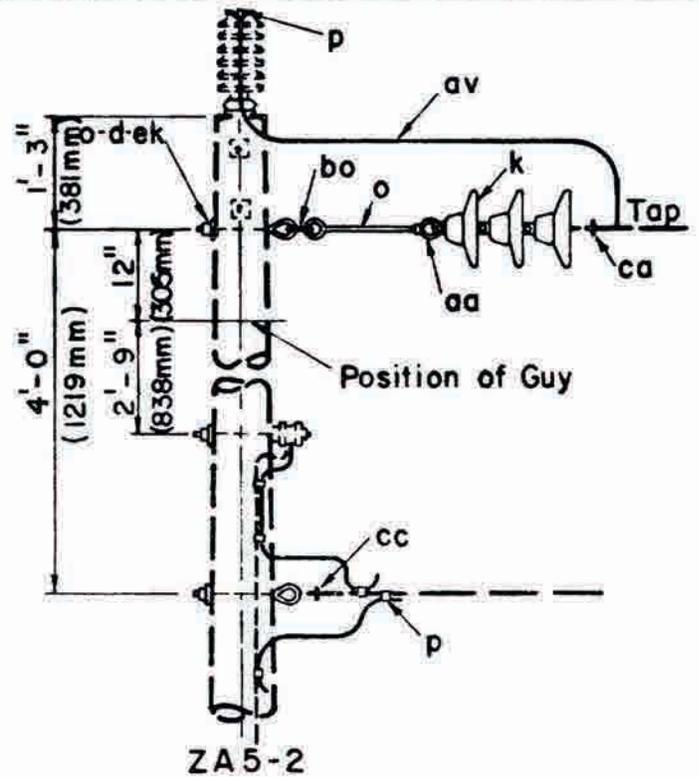
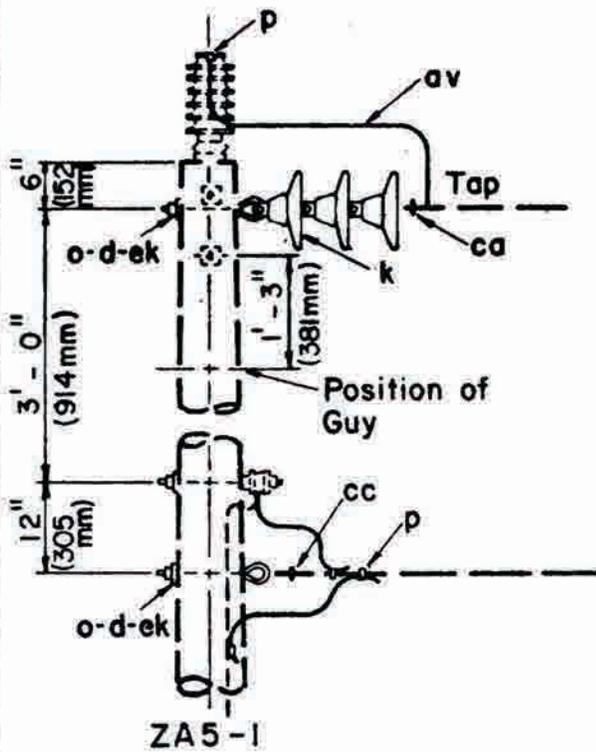
For units ca and cc
see guide drawings
M42-11 and M42-13

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
ca 1	Deadend assembly, primary	ek	Locknuts, as required
cc 1	Deadend assembly, neutral	k 3	Insulator, suspension, 10"
d 2	Washer, square, 2 1/4"	o 2	Bolt, eye, 5/8" x req'd length

34.5/19.9 kV PRIMARY
I-PHASE, DEADEND (SINGLE)

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ZA 5



NOTES:

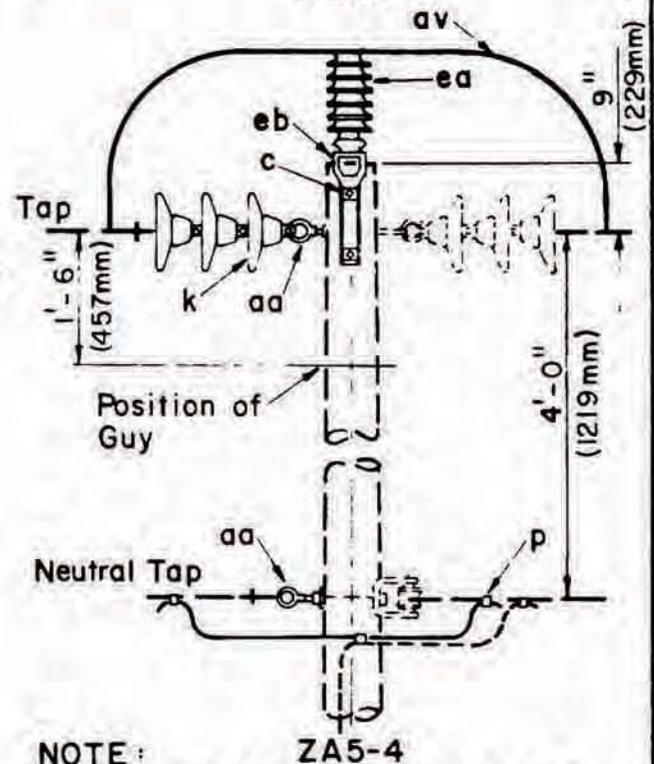
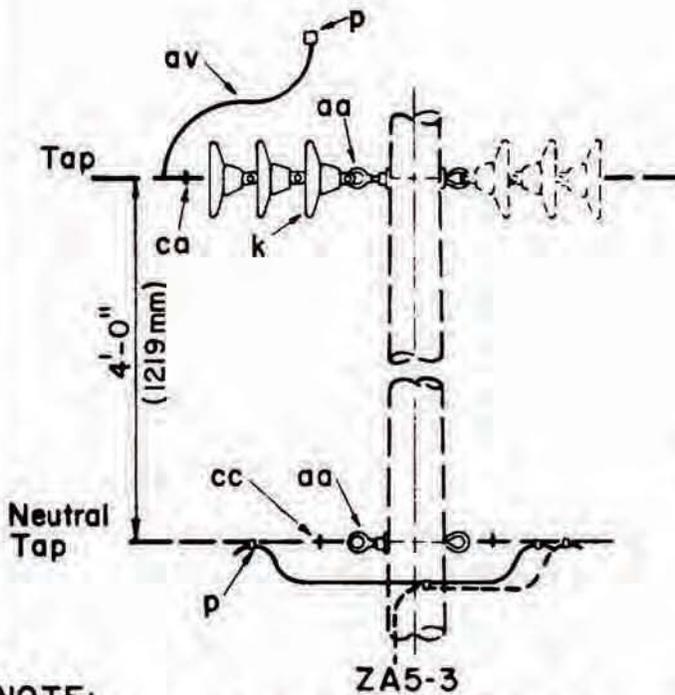
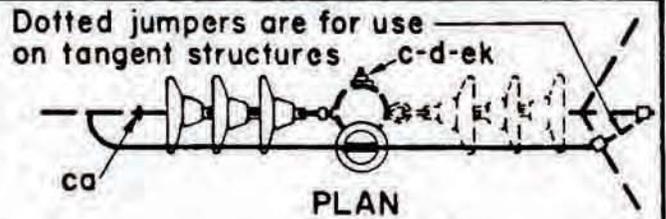
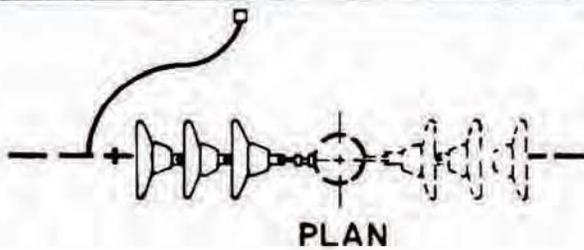
1. ZA5-1 and ZA5-2 assemblies may be used with the following drawings: ZA1, ZA1-1, and ZA2.
2. See drawings ZM29-1A, ZM29-1B for tap assembly guide.
3. Specify ZA5-2A for tap to existing eyebolt.
- 4 For units ca and cc see guide drawings M42-11 and M42-13.

ITEM	MATERIAL	ASSEMBLY UNIT		
		ZA5-1	ZA5-2	ZA5-2A
aa	Nut, eye, 5/8"		1	3
av	Jumpers, as required			
bo	Shackle, anchor		1	1
ca	Deadend assembly, primary	1	1	1
cc	Deadend assembly, neutral	1	1	1
d	Washer, square, 2 1/4"	2	2	
k	Insulator, suspension 10"	3	3	
o	Bolt, eye, 5/8" x req'd length	2	3	1
p	Connectors, as req'd			
ek	Locknuts, as required			

34.5/19.9 kV PRIMARY
SINGLE PHASE TAP

NOV. 1986

ZA5-1, ZA5-2, ZA5-2A



NOTE:
ZA5-3 assembly may be used with the following drawings: ZA4, ZA5, ZB4-1, and ZC4-1.

NOTE:
ZA5-4 assembly may be used with the following: ZA3, ZA5, ZB3, ZB5-1, ZC3, and ZC5-1

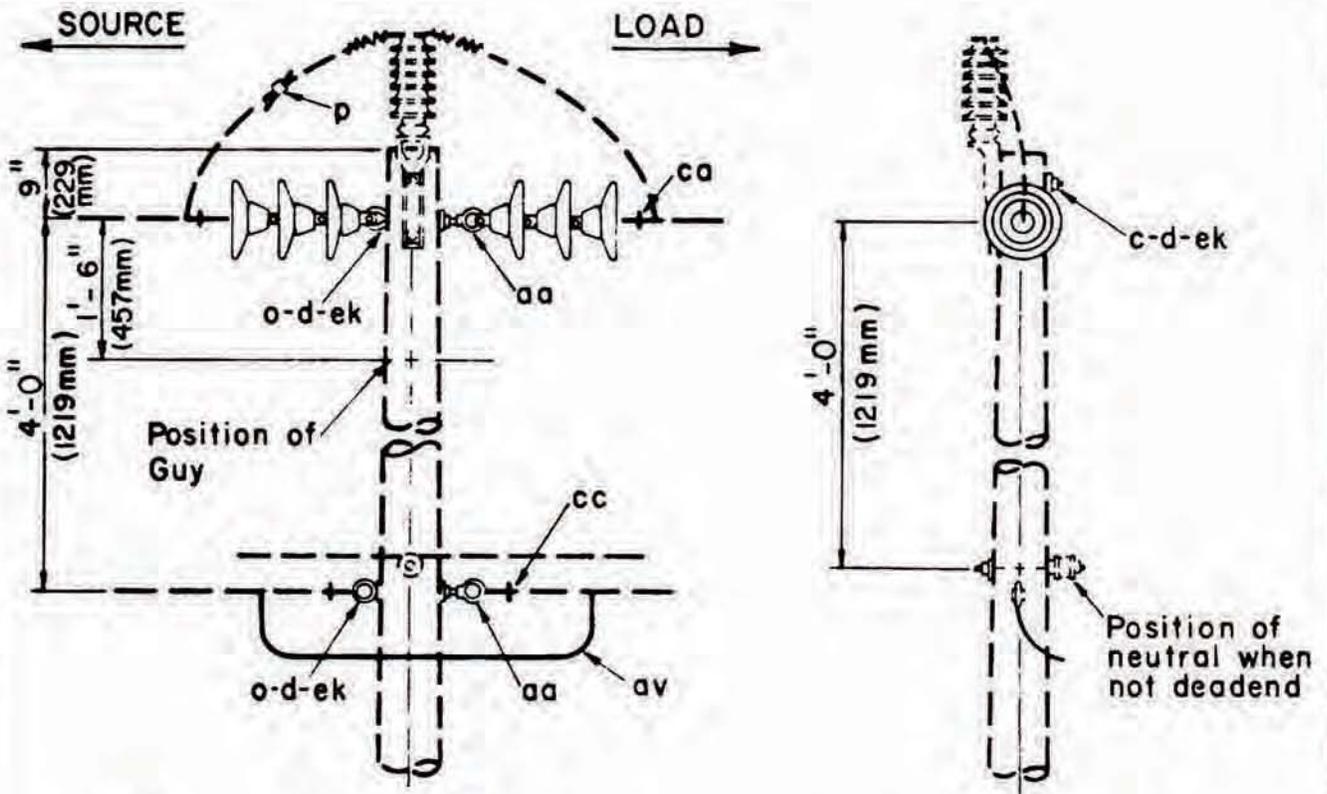
See drawing ZM29-1A, ZM29-1B for tap assembly guide
See drawings M42-11 and M42-13 for units ca and cc.

		ASSEMBLY UNIT	
		ZA5-3	ZA5-4
ITEM	MATERIAL	NO REQ'D	NO REQ'D
aa	Nut, eye 5/8"	2	2
av	Jumpers, as required		
c	Bolt, machine, 5/8" x req'd		2
ca	Deadend assembly, primary	1	1
cc	Deadend assembly, neutral	1	1
d	Washer, square 2 1/4"		2
ea	Insulator, post type		1
eb	Bracket, pole top		1
ek	Locknuts, as required		
k	Insulator, suspension 10"	3	3
p	Connectors, as required		

34.5/19.9 kV PRIMARY
SINGLE PHASE TAP

NOV. 1986

ZA5-3, ZA5-4



NOTE:

ZA6 may be used with drawings such as ZM3-1A, ZM3-10A, ZM3-23, ZM5-18 (as shown)

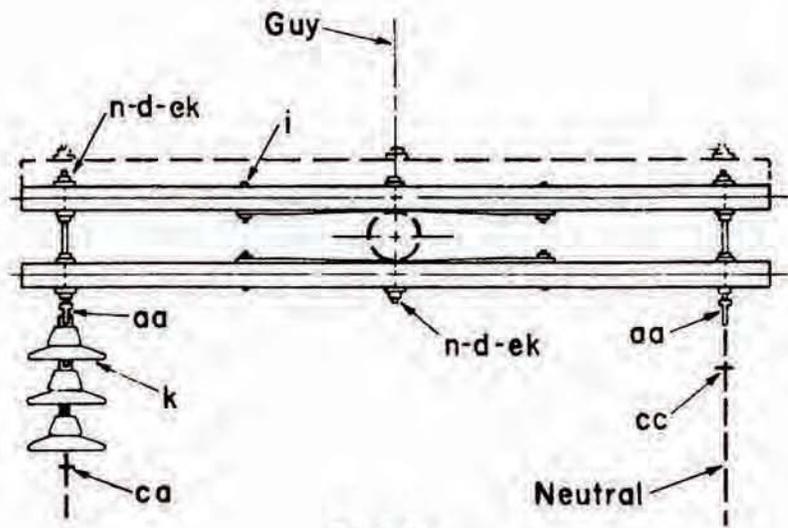
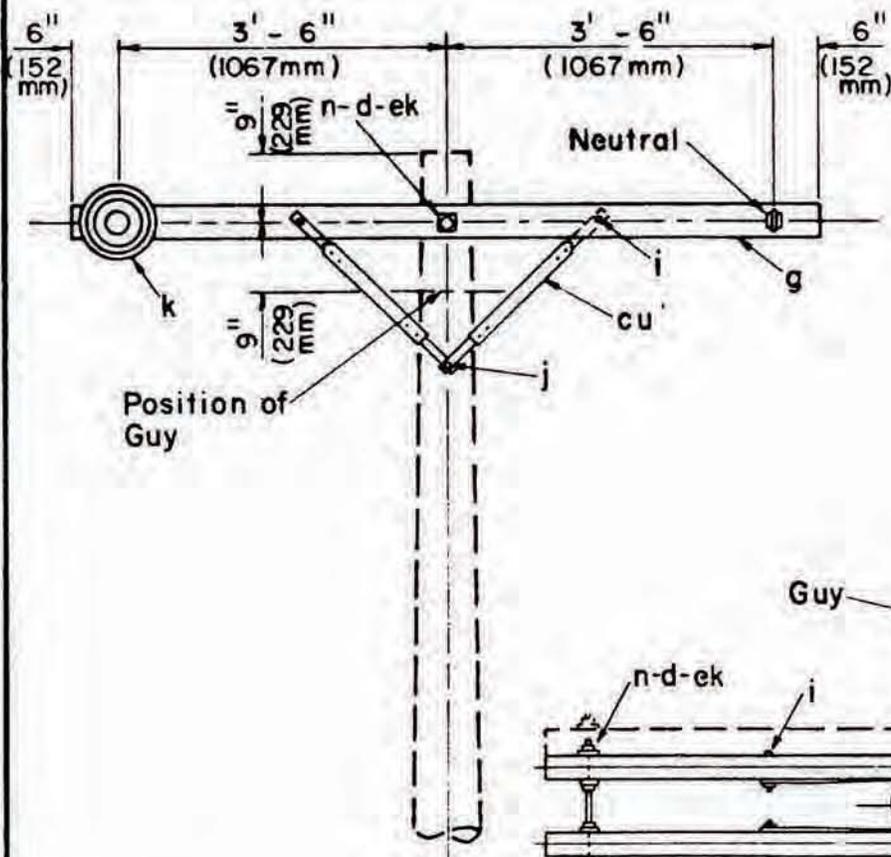
For units ca and cc see guide drawings M42-11 and M42-13.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
aa	2 Nut, eye, 5/8"	d	4 Washer, square, 2 1/4"
av	Jumpers, as required	ek	Locknuts, as required
c	2 Bolt, machine, 5/8" x req'd length	k	6 Insulator, suspension, 10"
ca	2 Deadend assembly, primary	o	2 Bolt, eye, 5/8" x req'd length
cc	2 Deadend assembly, neutral	p	Connectors, as required

34.5/19.9 kV PRIMARY, 1-PHASE
VERTICAL DEADEND (DOUBLE)

NOV. 1986

ZA6



NOTES:

1. See drawing ZE5-1 for crossarm loading limitations
2. Designate as ZA7-1 for assembly with three crossarms
3. For units ca and cc see guide drawings M42-11 and M42-13.

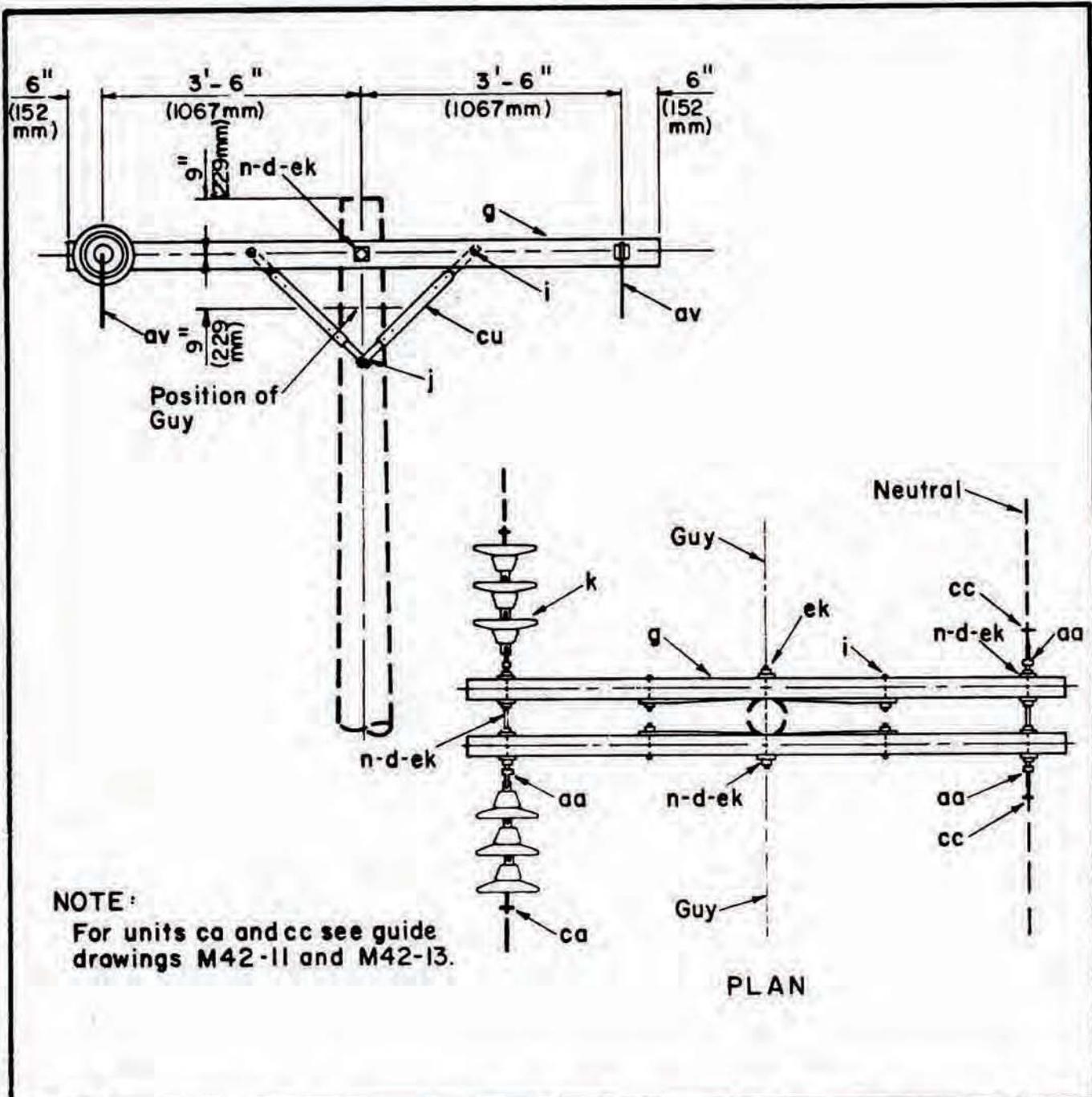
PLAN

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
aa	2 Nut, eye 5/8"	g	2 Crossarm, 3 5/8" x 4 5/8" x 8'-0"
ca	1 Deadend assembly, primary	i	4 Bolt carriage 3/8" x 4 1/2"
cc	1 Deadend assembly, neutral	j	2 Screw, lag 1/2" x 4"
cu	4 Brace, wood 28"	k	3 Insulator, suspension 10"
d	10 Washer, square, 2 1/4"	n	3 Bolt, double arming, 5/8" x req'd length
ek	Locknuts, as required		

**34.5/19.9 kV PRIMARY I-PHASE
CROSSARM CONSTR.-DEADEND (SINGLE)**

NOV. 1986

ZA7, ZA7-1

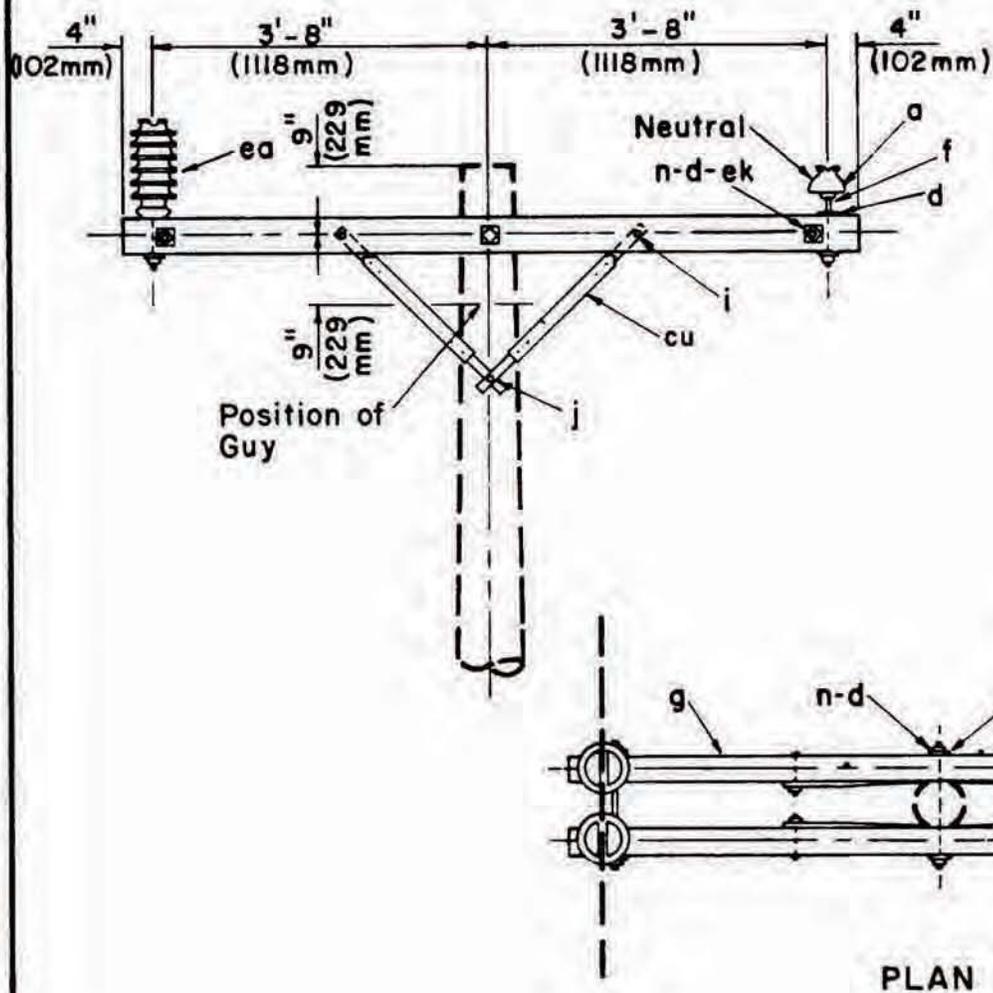


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
aa	4 Nut, eye, 5/8"	g	2 Crossarm, 3 5/8" x 4 5/8" x 8'-0"
av	Jumpers, as required	i	4 Bolt, carriage 3/8" x 4 1/2"
ca	2 Deadend assembly, primary	j	2 Screw, lag 1/2" x 4"
cc	2 Deadend assembly, neutral	k	6 Insulator, suspension, 10"
cu	4 Brace, wood, 28"	n	3 Bolt, double arming 5/8" x req'd length
d	10 Washer, square 2 1/4"	p	Connectors, as required
ek	Locknuts, as required		

**34.5/19.9 kV PRIMARY, I-PHASE
CROSSARM CONSTRUCTION - DEADEND (DOUBLE)**

NOV. 1986

ZA8



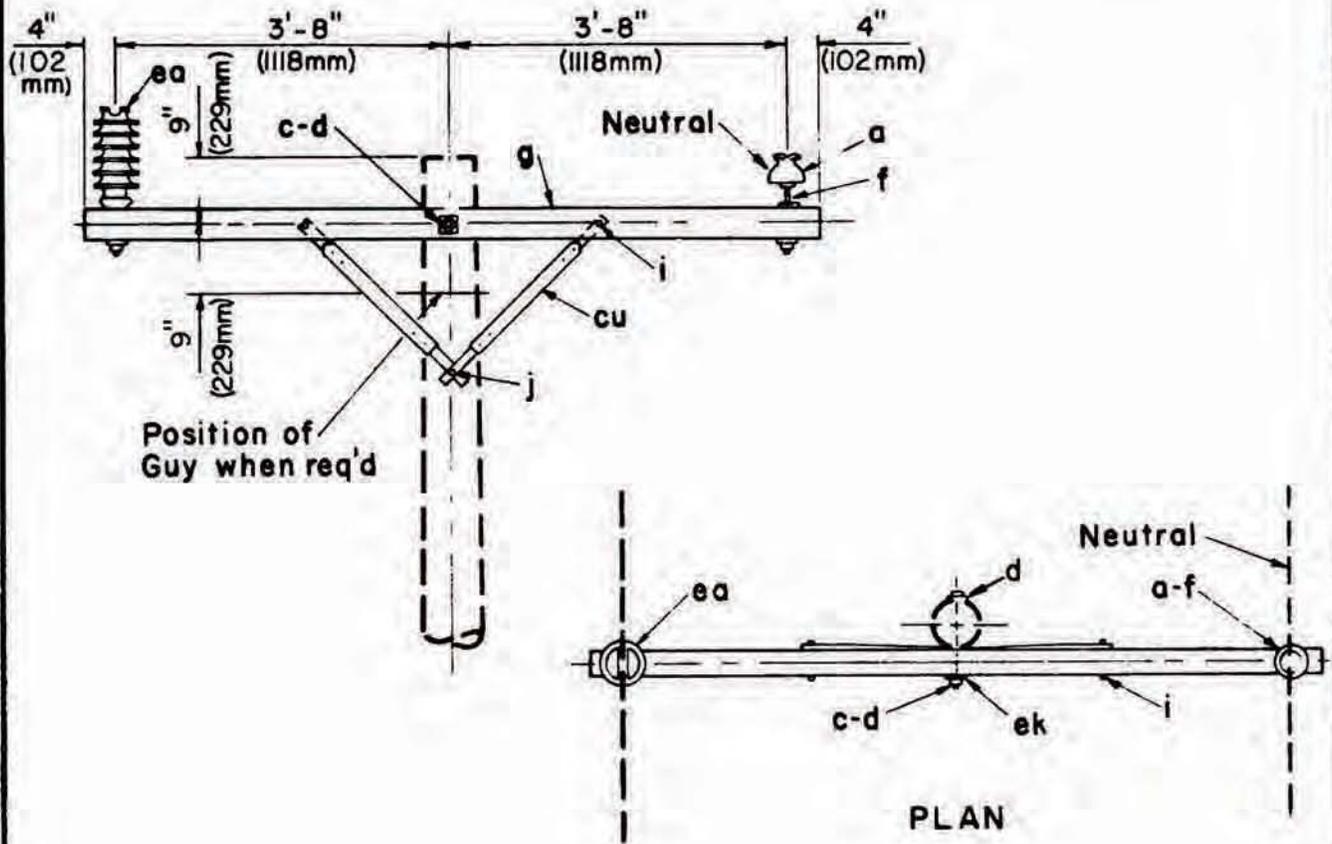
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	2 Insulator, pin type, (ANSI Class 55-3)	j	2 Screw, lag 1/2" x 4"
d	2 Washer, square 3"	n	3 Bolt, double arming, 5/8" x req'd length
d	10 Washer, square 2 1/4"	ea	2 Insulator, post type
f	2 Pin, crossarm, steel, 5/8" x 10 3/4"	ek	Locknuts as req'd
g	2 Crossarm 3 5/8" x 4 5/8" x 8'-0"	cu	4 Brace, wood, 28"
i	4 Bolt, carriage, 3/8" x 4 1/2"		

Maximum Transverse
Load: 750lbs (3336N)/Insulator
1500lbs (6672N) Total
Angle: 0°-20°

34.5/19.9 kV, I-PHASE
CROSSARM CONSTRUCTION-DOUBLE LINE ARM

NOV. 1986

ZA9



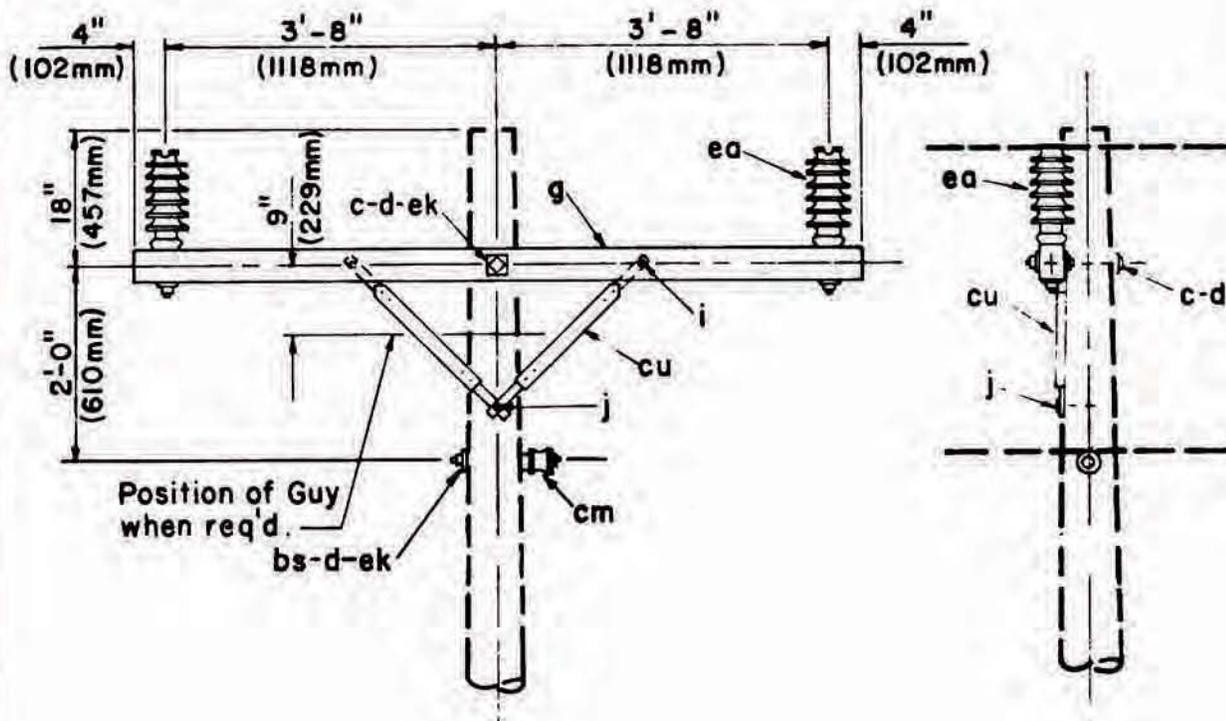
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	1 Insulator, pin type, (ANSI class 55-3)	j	1 Screw, lag 1/2" x 4"
c	1 Bolt, machine, 5/8" x req'd length	ea	1 Insulator, post type
d	2 Washer, square, 2 1/4"		
f	1 Pin, crossarm, 5/8" x 10 3/4"	ek	Locknuts, as req'd
g	1 Crossarm 3 5/8" x 4 5/8" x 8'-0"	cu	2 Brace, wood, 2B"
i	2 Bolt, carriage, 3/8" x 4 1/2"		

Maximum Transverse
Load : 750 lbs (3336 N)
Angle: 0° - 5°

34.5/19.9 kV, 1-PHASE
CROSSARM CONSTRUCTION-SINGLE LINE ARM

NOV. 1986

ZA9-1



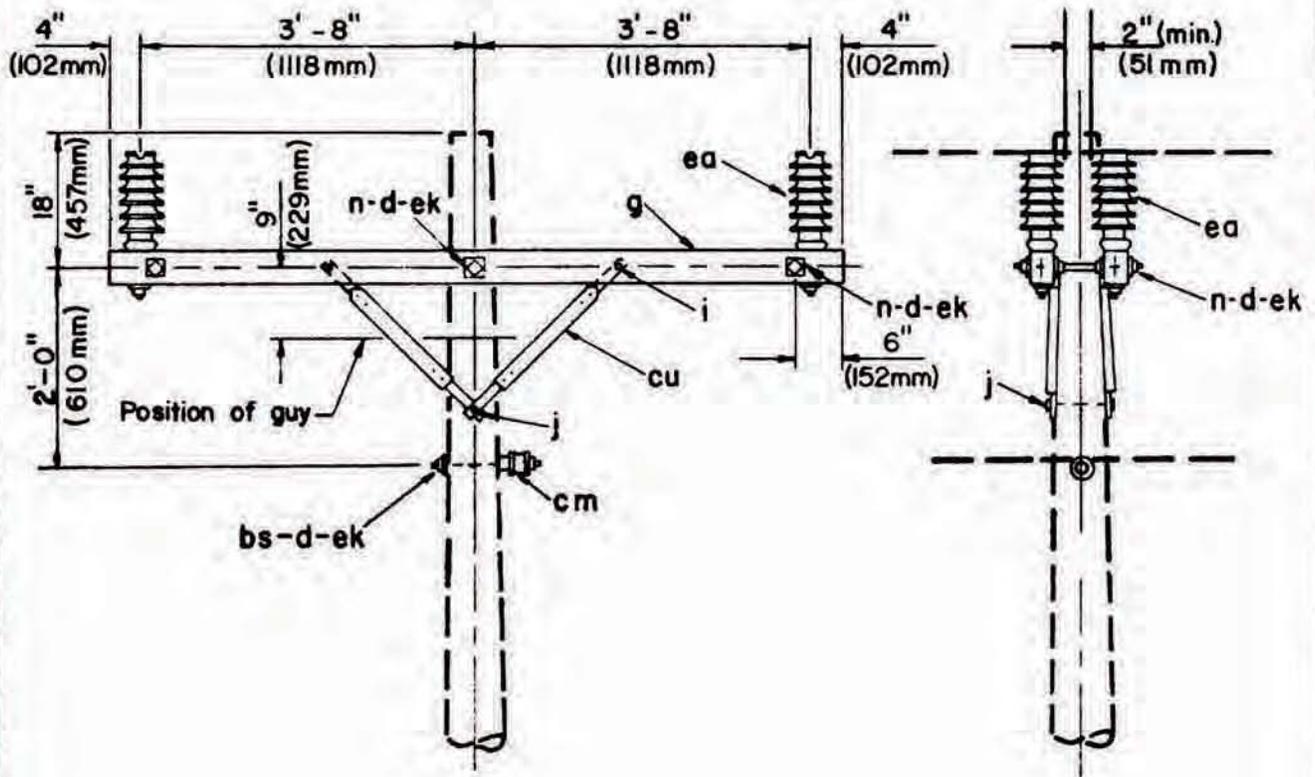
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 1	Bolt, machine, 5/8" x req'd length	bs 1	Bolt, single upset
d 3	Washer, square, 2 1/4"	cu 2	Brace, wood, 28"
g 1	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	ea 2	Insulator, post type
i 2	Bolt, carriage, 3/8" x 4 1/2"	ek	Locknuts, as req'd
j 1	Screw, lag 1/2" x req'd length	cm 1	Insulator spool

Maximum Transverse
Load: 750lbs (3336N)
Angle: 0° - 5°

34.5/19.9 kV, TWO PHASE
SINGLE PRIMARY SUPPORT

NOV. 1986

ZBI



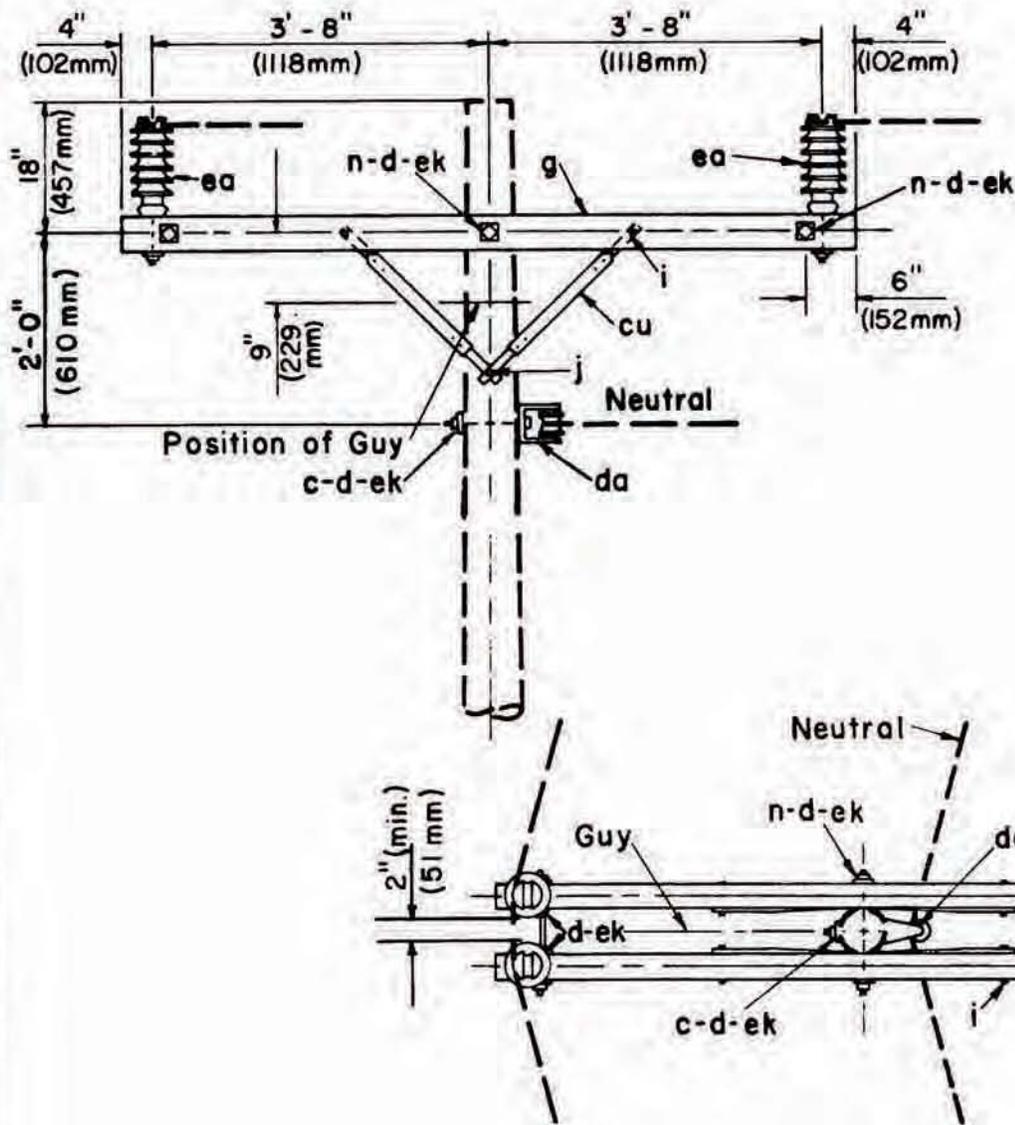
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d 11	Washer, square, 2 1/4"	bs 1	Bolt, single, upset
g 2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	cm 1	Insulator spool
i 4	Bolt, carriage, 3/8" x 4 1/2"	cu 4	Brace, wood, 28"
j 2	Screw, lag 1/2" x 4"	ea 4	Insulator, post type
n 3	Bolt, double arming, 5/8" x req'd length	ek	Locknuts, as req'd

Maximum Transverse
 Load : 750 lbs (3336N) /Insulator
 1500 lbs (6672N) Total
 Angle: 0°-5°

34.5/199 kV, TWO PHASE
 DOUBLE PRIMARY SUPPORT

NOV. 1986

ZBI-1



ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 1	Bolt, machine, 5/8" x req'd length	n 3	Bolt, double arming, 5/8" x req'd length
d 11	Washer, square 2 1/4"	ea 4	Insulator, post type
da 1	Bracket, insulated	ek	Locknuts, as req'd
g 2	Crossarm, 3 5/8" x 4 5/8" x 8' - 0"	cu 4	Brace, wood 2B"
i 4	Bolt, carriage, 3/8" x 4 1/2"		
j 2	Screw, lag, 1/2" x req'd length		

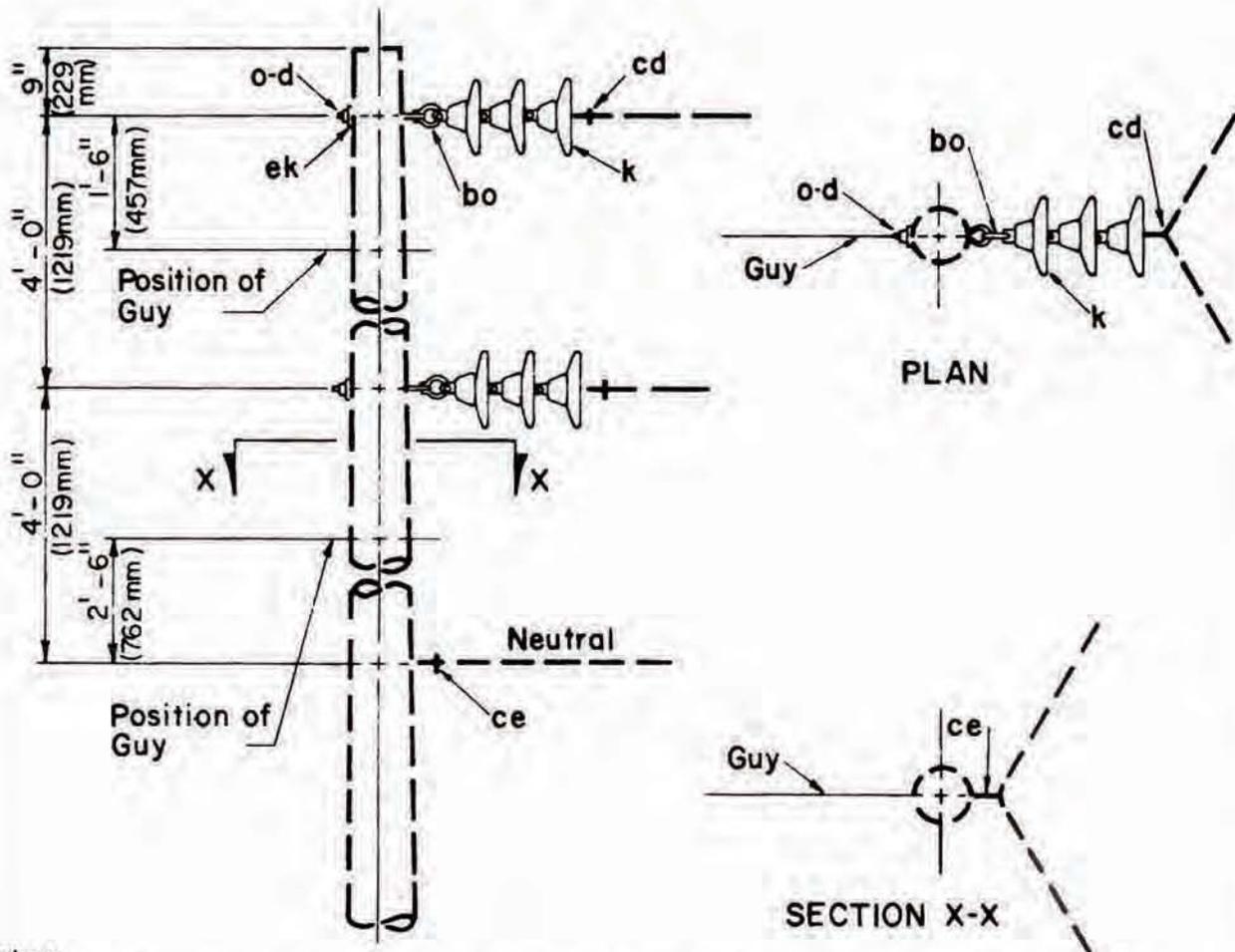
Maximum Transverse
Load: 750 lbs (3336 N)/Insulator
1500 lbs (6672 N) Total

Angle: 5° - 20°

34.5/19.9 kV TWO PHASE
DOUBLE PRIMARY SUPPORT

NOV. 1986

ZB2



Note:

1. If future conversion is likely, allow space at top of pole for middle phase. Designate as ZB3A for this construction.
2. For units cd and ce see guide drawings M41-1 and M41-10.

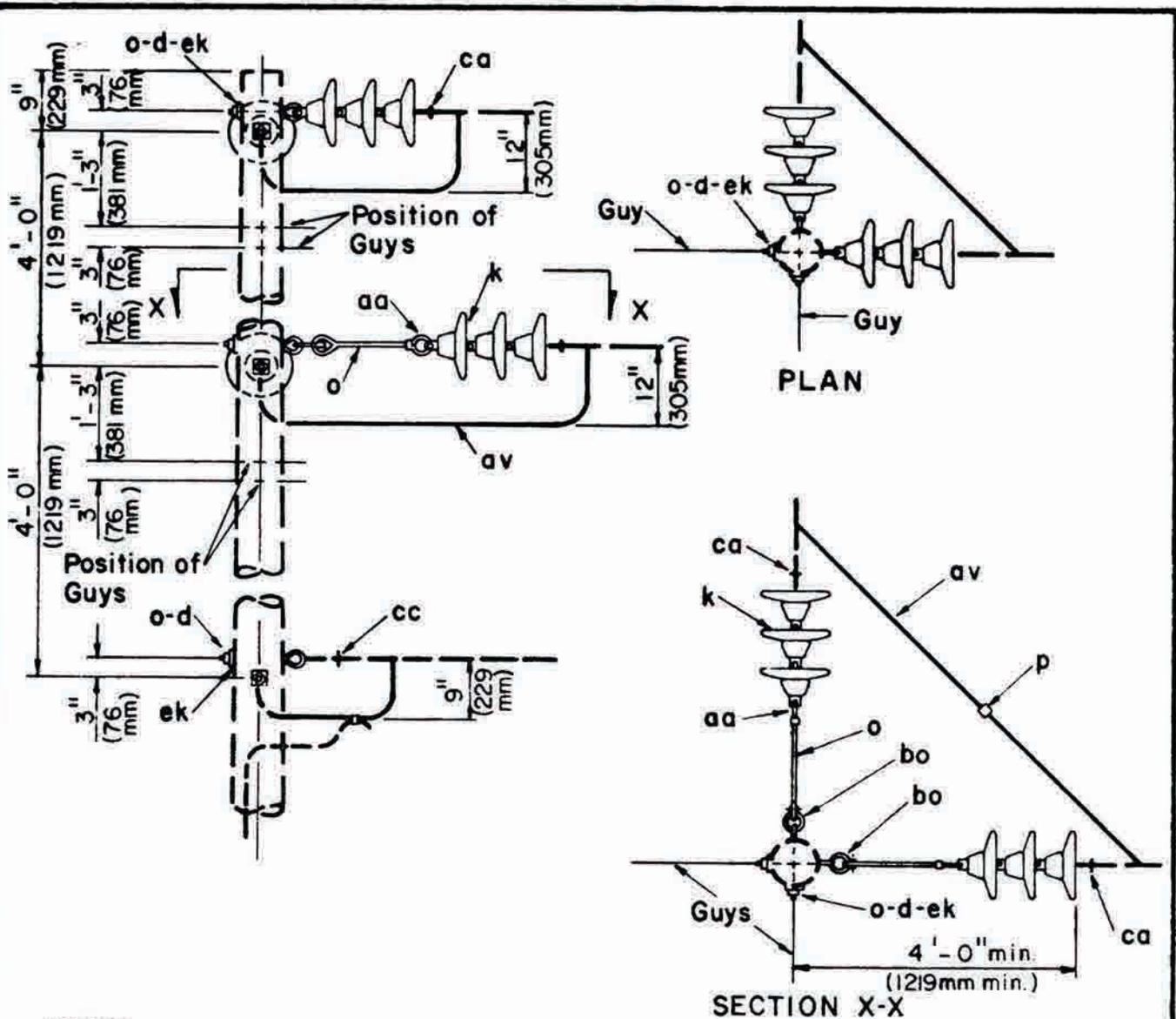
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d	2 Washer, square 2 1/4"	cd	2 Angle assembly, primary
k	6 Insulator, suspension, 10"	ce	1 Angle assembly, neutral
o	2 Bolt, eye 5/8" x req'd length	ek	Locknuts, as required
bo	2 Shackle, anchor		

Angle: 20° - 60°

34.5/19.9 kV, TWO PHASE
VERTICAL CONSTRUCTION

NOV. 1986

ZB3, ZB3A



NOTE :

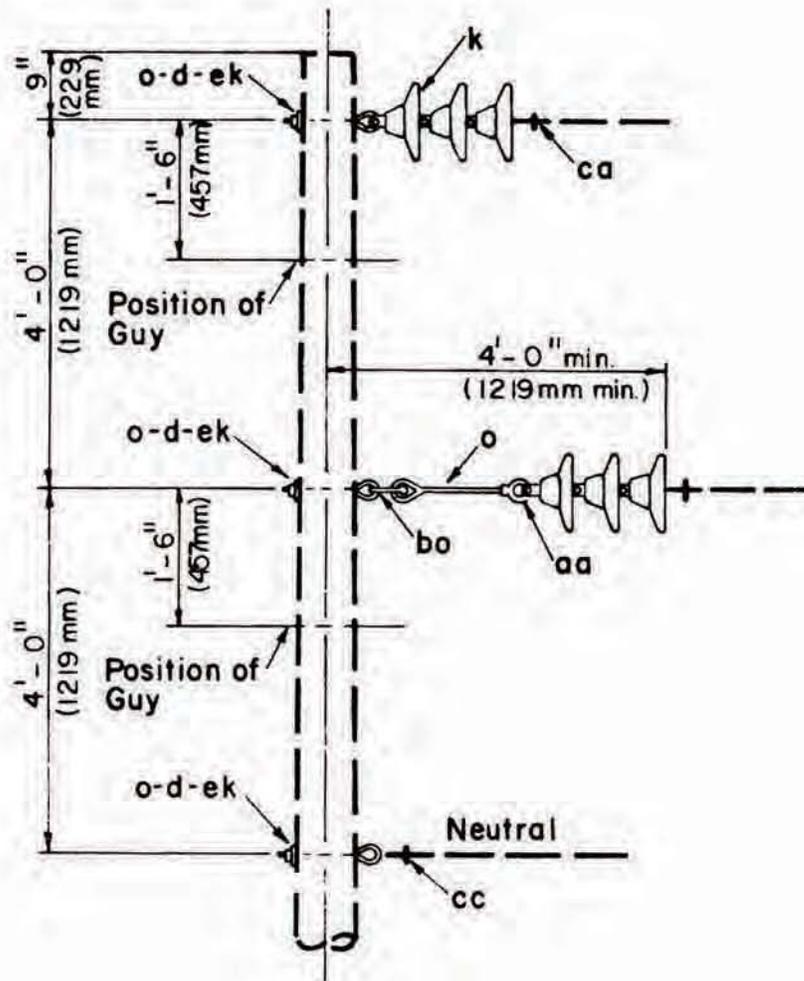
1. If future conversion is likely, allow space at top of pole for middle phase. Designate as ZB4-1A for this construction.
2. For units ca and cc see guide drawings M42-11 and M42-13.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d 6	Washer, square, 2 1/4"	av	Jumpers, as required
k 12	Insulator, suspension, 10"	bo 2	Shackle, anchor
o 8	Bolt, eye, 5/8" x req'd length	ca 4	Deadend assembly, primary
p	Connector, as required	cc 2	Deadend assembly, neutral
aa 2	Nut, eye, 5/8"	ek	Locknuts, as required

**34.5/19.9 kV, TWO PHASE
VERTICAL CONSTRUCTION**

NOV. 1986

ZB4-1, ZB4-1A



NOTE:

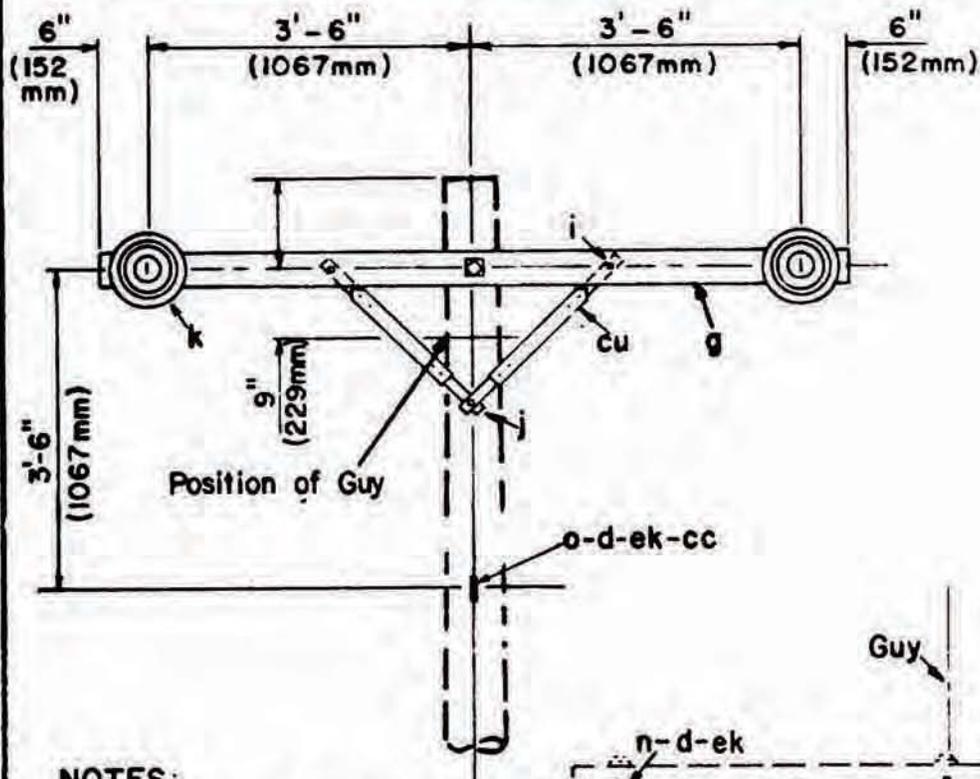
1. If future conversion to three phase is likely, allow space at top of pole for middle phase. Designate as ZB5-1A for this construction
2. For units ca and cc see guide drawings M42-11 and M42-13.

ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
d	3	Washer, square, 2 1/4"	ca	2	Deadend assembly, primary
k	6	Insulator, suspension, 10"	cg	1	Deadend assembly, neutral
o	4	Bolt, eye, 5/8" x req'd length	bo	1	Shackle, anchor
aa	1	Nut, eye, 5/8"	ek		Lock nuts, as required

**34.5/19.9 kV TWO PHASE
VERTICAL CONSTRUCTION-DEADEND(SINGLE)**

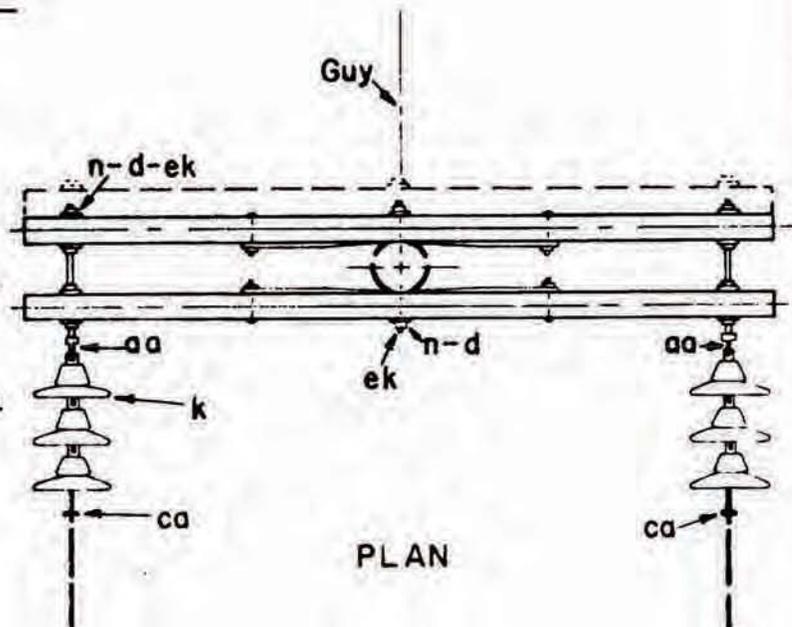
NOV. 1986

ZB5-1, ZB5-1A



NOTES:

1. See drawing ZE5-1 for crossarm loading limitations.
2. Designate as ZB7-1 for assembly with three crossarms.
3. For units ca and cc see guide drawings M42-11 and M42-13.

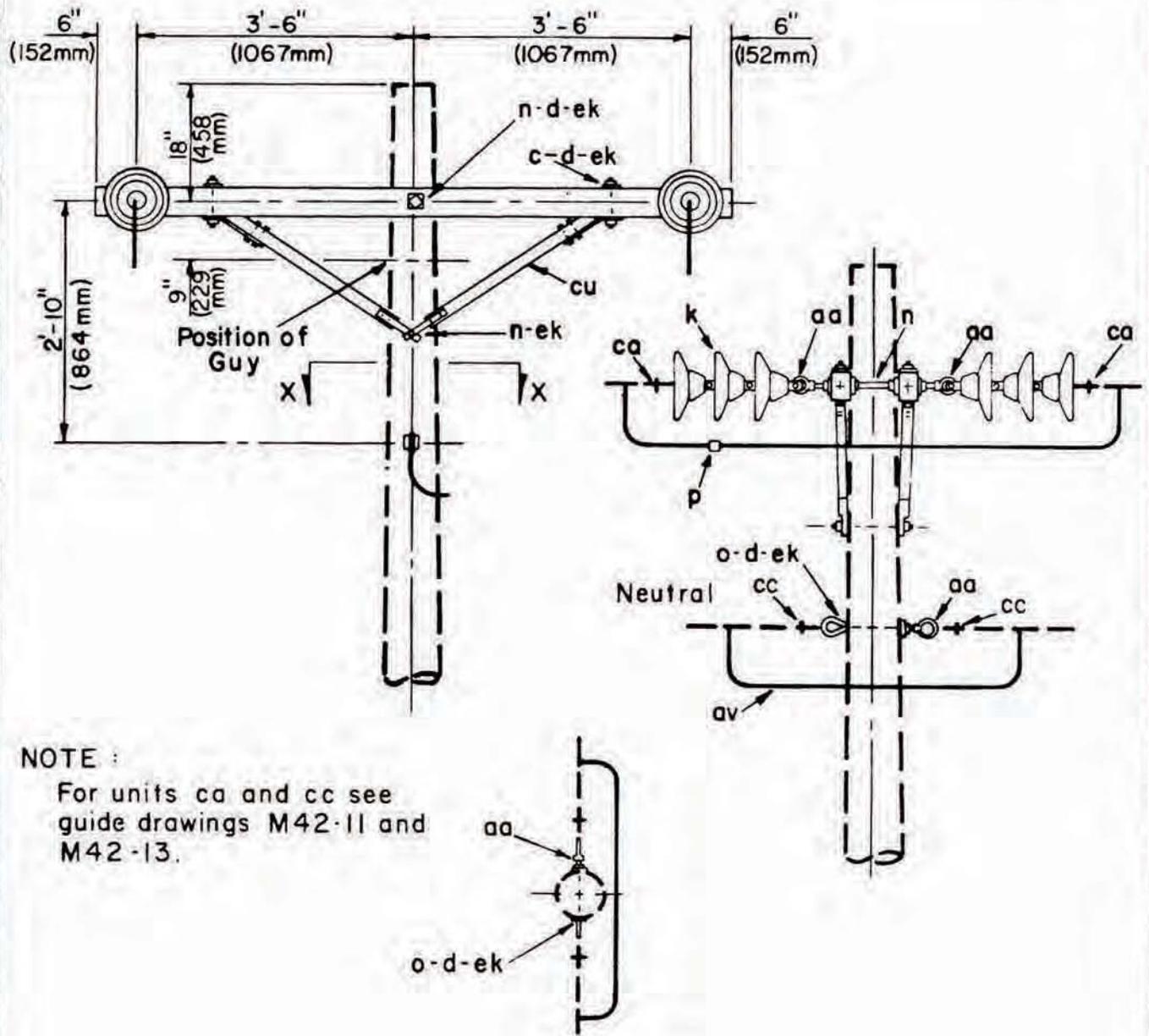


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d 11	Washer, square, 2 1/4"	aa 2	Nut, eye, 5/8"
g 2	Crossarm 3 5/8" x 4 5/8" x 8'-0"	ca 2	Deadend assembly, primary
l 4	Bolt, carriage 3/8" x 4 1/2"	cc 1	Deadend assembly, neutral
j 2	Screw, lag, 1/2" x 4"	cu 4	Brace, wood, 2x8"
k 6	Insulator, suspension, 10"	ek	Locknuts as required
n 3	Bolt, double arming, 5/8" x req'd length		
o 1	Bolt, eye, 5/8" x req'd length		

**34.5/ 19.9 kV, TWO PHASE
CROSSARM CONSTRUCTION- DEADEND (SINGLE)**

NOV. 1986

ZB7, ZB7-1



NOTE :
 For units ca and cc see
 guide drawings M42-11 and
 M42-13.

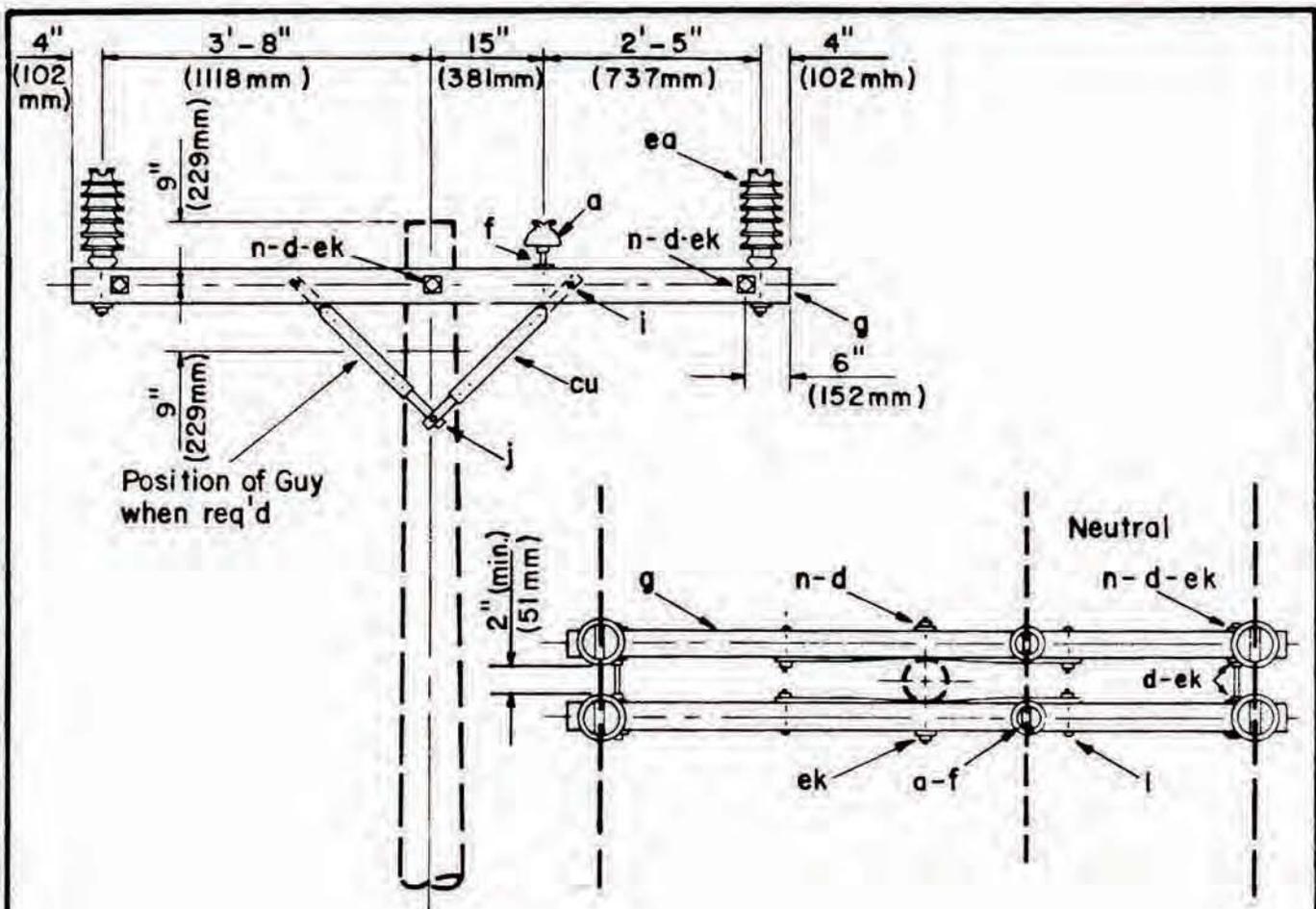
SECTION X-X

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 4	Bolt, machine, 1/2" x req'd length	p	Connectors as required
d 12	Washer, square 2 1/4"	aa 5	Nut, eye, 5/8"
d 4	Washer, round 1 3/8" dia.	av	Jumpers as required
g 2	Crossarm 3 5/8" x 4 5/8" x 8'-0"	ca 4	Deadend assembly, primary
k 12	Insulator, suspension, 10"	cc 2	Deadend assembly, neutral
n 4	Bolt, double arming, 5/8" x req'd length	cu 2	Brace, wood, 60" span
o 1	Bolt eye, 5/8" x req'd length	ek	Locknuts, as required

34.5/19.9 kV, TWO PHASE
 CROSSARM CONSTRUCTION - DEADEND (DOUBLE)

NOV. 1986

ZB8



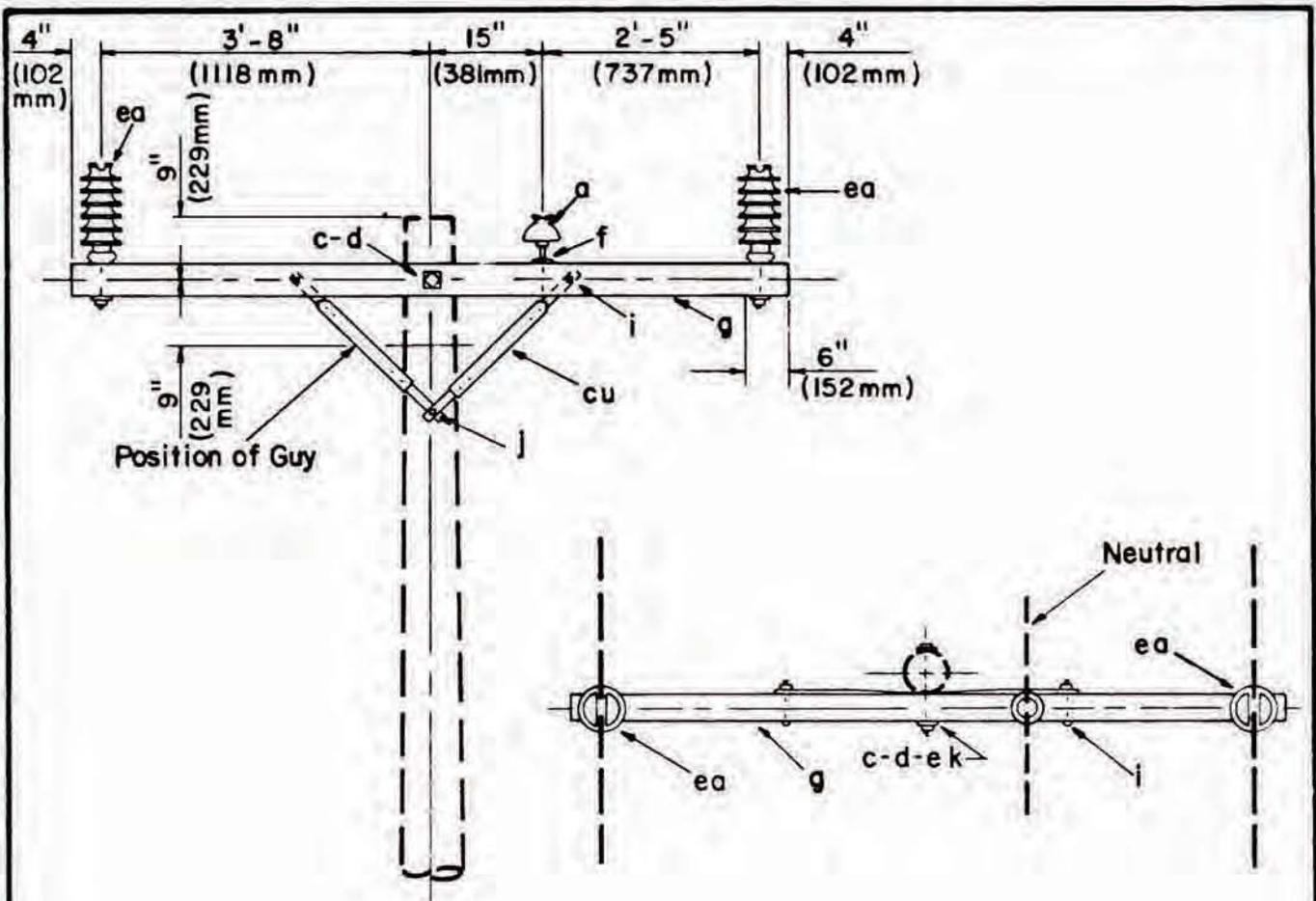
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	2 Insulator, pin type, (ANSI class 55-3)	n	3 Bolt, double arming, 5/8" x req'd length
d	10 Washer square 2 1/4"	cu	4 Brace, wood, 28"
f	2 Pin, crossarm, steel, 5/8" x 10 3/4"	ea	4 Insulator, post type
g	2 Crossarm, 3 5/8" x 4 5/8" x 8'-0"	ek	Locknuts as required
l	4 Bolt, carriage, 3/8" x 4 1/2"		
j	2 Screw lag 1/2" x 4"		

Maximum Transverse
 Load: 750 lbs (3336N) / Insulator
 1500lbs (6672N) / Total
 Angle: 0° - 20°

34.5/19.9 kV TWO PHASE
 CROSSARM CONSTRUCTION-DOUBLE LINE ARM

NOV. 1986

ZB9



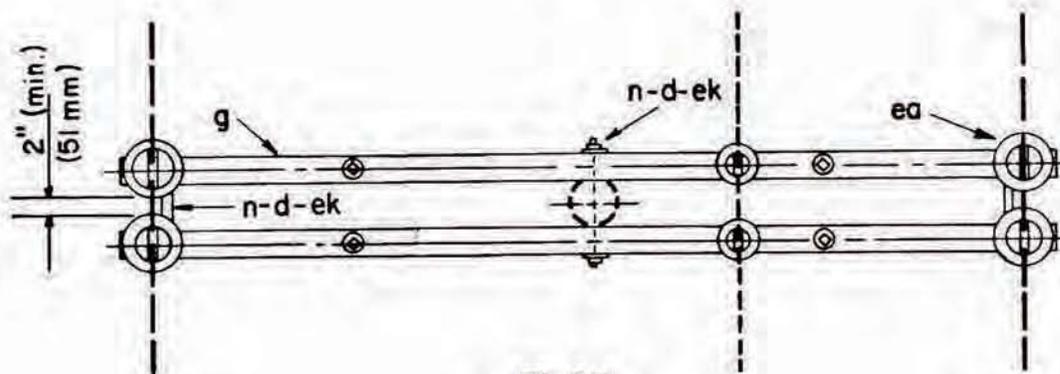
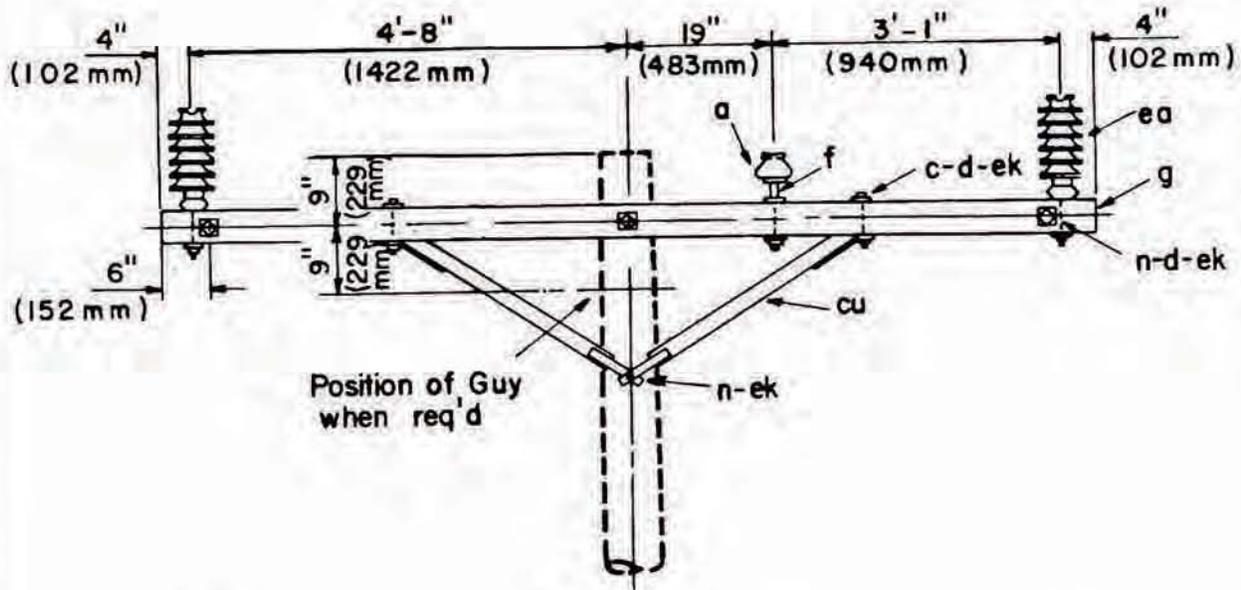
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	1 Insulator, pin type, (ANSI class 55-3)	i	2 Bolt, carriage, 3/8" x 4 1/2"
c	1 Bolt, machine, 5/8" x req'd length	j	1 Screw, lag, 1/2" x 4"
d	2 Washer, square, 2 1/4"	cu	2 Brace, wood 28"
f	1 Pin, crossarm, steel, 5/8" x 10 3/4"	ek	Locknuts as required
g	1 Crossarm 3 5/8" x 4 5/8" x 8'-0"	ea	2 Insulator, post type

Maximum Transverse Load : 750lbs (3336N)
 Angle: 0°- 5°

34.5 / 19.9 kV, TWO PHASE
 CROSSARM CONSTRUCTION-SINGLE LINE ARM

NOV. 1986

ZB9-1



PLAN

This construction should be used where future conversion to three phase is likely.

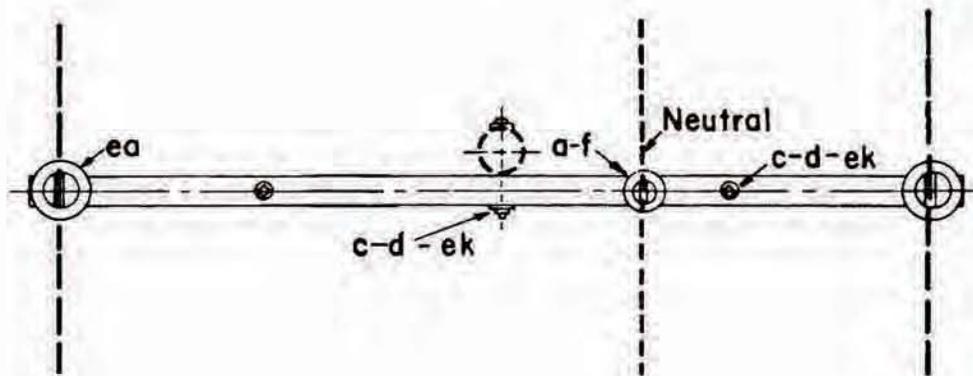
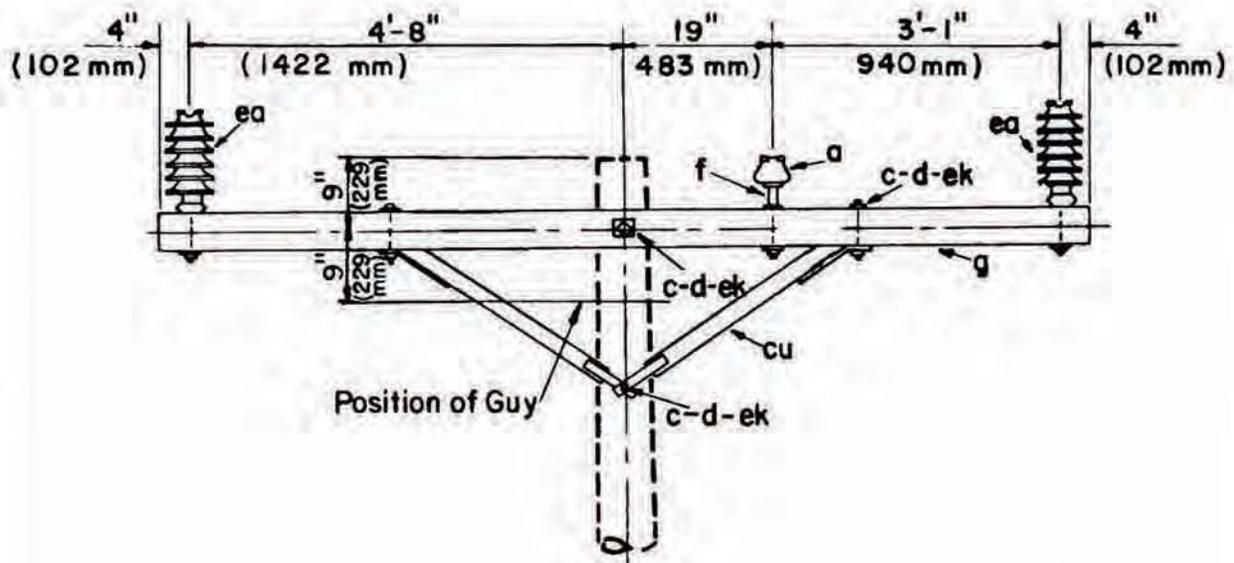
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	2 Insulator, pin type, (ANSI Class 55-3)	n	4 Bolt, double arming, 5/8" x req'd length
c	4 Bolt, machine 1/2" x req'd length	cu	2 Brace, crossarm, wood, 60" span
d	10 Washer, square 2 1/4"	ea	4 Insulator, post type
d	4 Washer, round 1 3/8"		
f	2 Pin, crossarm, steel 5/8" x 10 3/4"	ek	Locknuts as req'd
g	2 Crossarm 3 5/8" x 4 5/8" x 10'-0"		

Maximum Transverse
Load 750lbs(3336N) Insulator
1500lbs(6672N) Total
Angle : 0°-20°

34.5/19.9 kV, 2 - PHASE
CROSSARM CONSTRUCTION - DOUBLE LINE ARM

NOV. 1986

ZB9-2



This construction should be used where future conversion to three phase is likely.

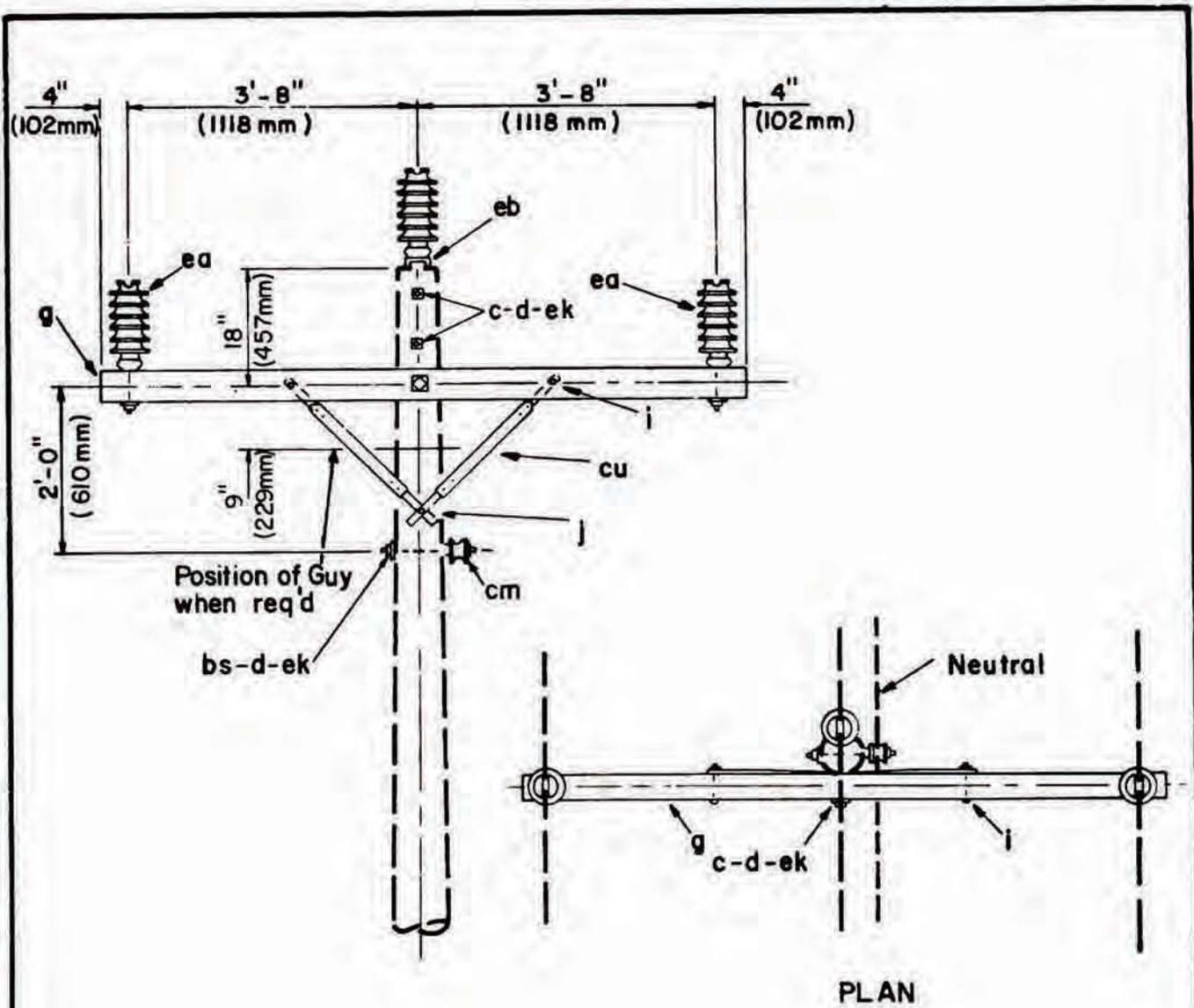
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	1 Insulator, pin type, (ANSI class 55-3)	g	1 Crossarm, 3 5/8" x 4 5/8" x 10'-0"
c	2 Bolt, machine, 5/8" x req'd length	cu	1 Brace, crossarm, wood, 60" span
c	2 Bolt, machine, 1/2" x req'd length	ea	2 Insulator, post type
d	3 Washer, square, 2 1/4"		
d	2 Washer, round, 1 3/8"	ek	Locknuts as required
f	1 Pin, crossarm, steel 5/8" x 10 3/4"		

Maximum Transverse
Load: 750lbs (3336N)/insulator
Angle: 0° - 5°

34.5/19.9 kV, 2 -PHASE
CROSSARM CONSTRUCTION - SINGLE LINE ARM

NOV. 1986

ZB9-3



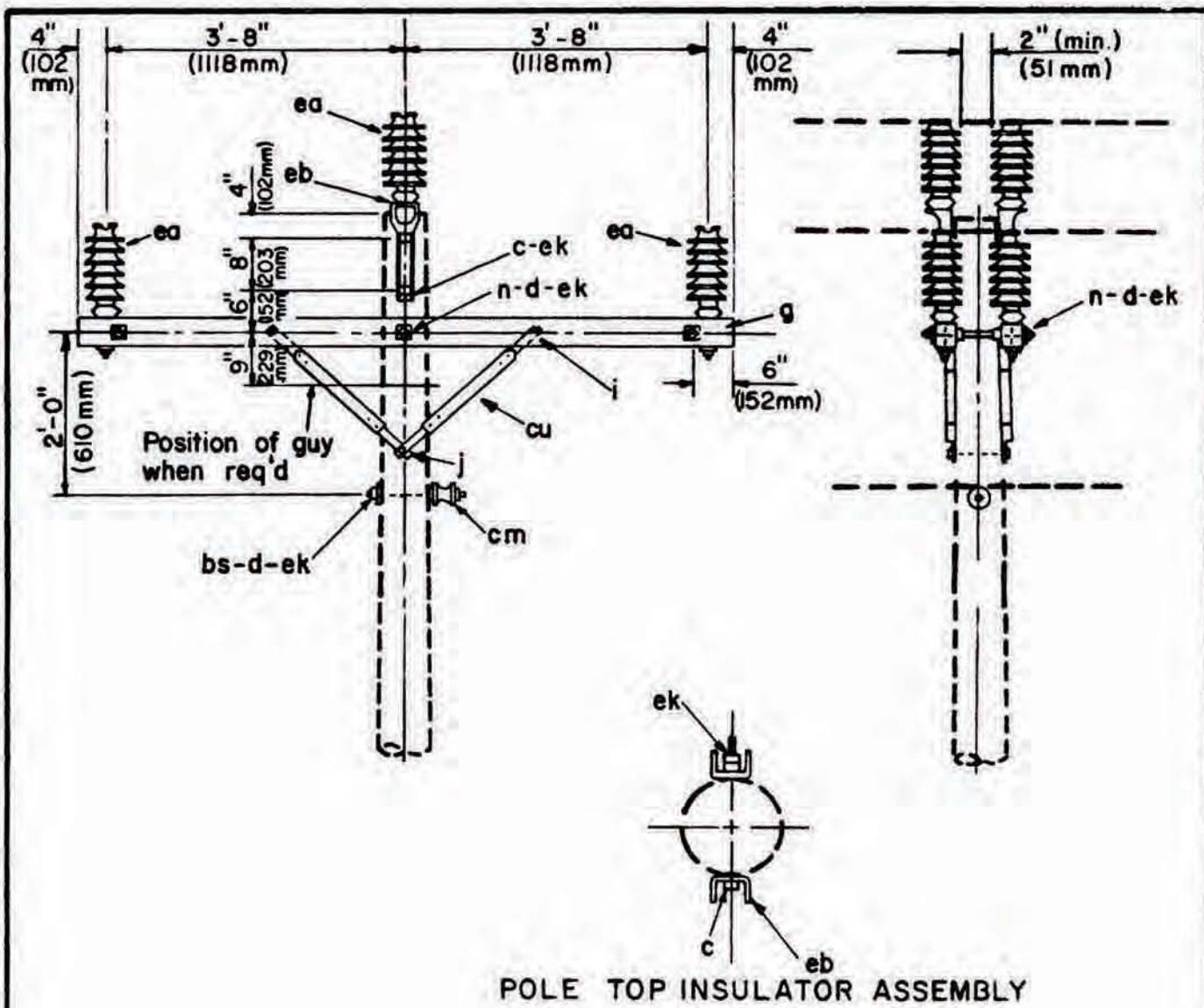
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
e 3	Bolt, machine, 5/8" x req'd length	cu 2	Brace, wood 2 8"
d 5	Washer, square, 2 1/4"	ea 3	Insulator, post type
g 1	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	eb 1	Bracket, pole top
l 2	Bolt, carriage 3/8" x 4 1/2"	ek	Locknuts as required
j 1	Screw, lag, 1/2" x 4"		
bs 1	Bolt, single, upset		
cm 1	Spool insulator		

Maximum Transverse
Load: 750lbs (3336N)/insulator
Angle: 0° - 5°

34.5/19.9 kV, 3-PHASE
CROSSARM CONSTRUCTION-SINGLE PRIMARY SUPPORT

NOV. 1986

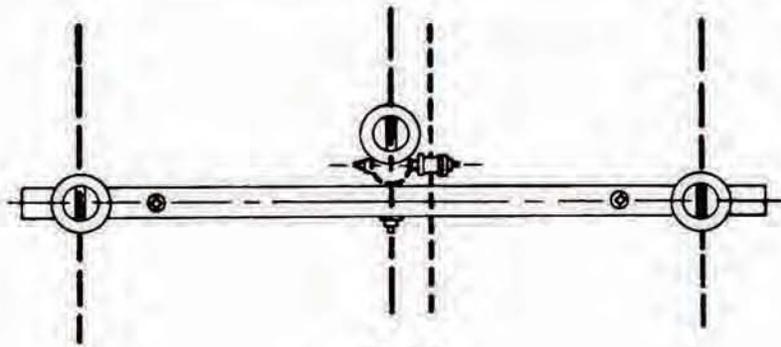
ZCI



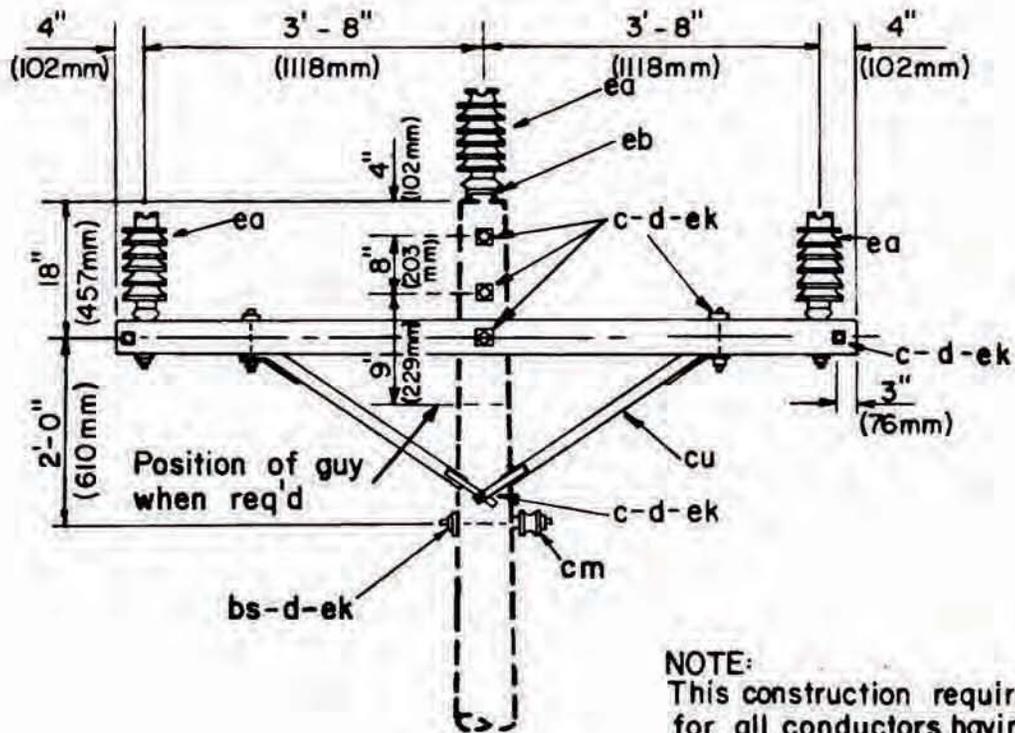
POLE TOP INSULATOR ASSEMBLY

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	2 Bolt, machine, 5/8" x req'd length	cm	1 Spool Insulator
d	11 Washer, square, 2 1/4"	cu	4 Brace, wood, 28"
g	2 Crossarm 3 5/8" x 4 5/8" x 8'-0"	ea	6 Insulator, post type
i	4 Bolt carriage 3/8" x 4 1/2"	eb	2 Bracket pole top
j	2 Screw, Lag 1/2" x 4"	ek	Locknuts as required
n	3 Bolt, double arming 5/8" x required	bs	1 Bolt, Single upset

Maximum Transverse Load: 750 lbs (3336N)/Insulator 1500 lbs (6672N) Total Angle: 0°- 5°	34.5/19.9 kV, 3-PHASE CROSSARM CONSTRUCTION-DOUBLE PRIMARY SUPPORT	
	NOV. 1986	ZCI-1



PLAN



NOTE:
This construction required
for all conductors having a
breaking strength of more
than 4500 lbs (20016 N)

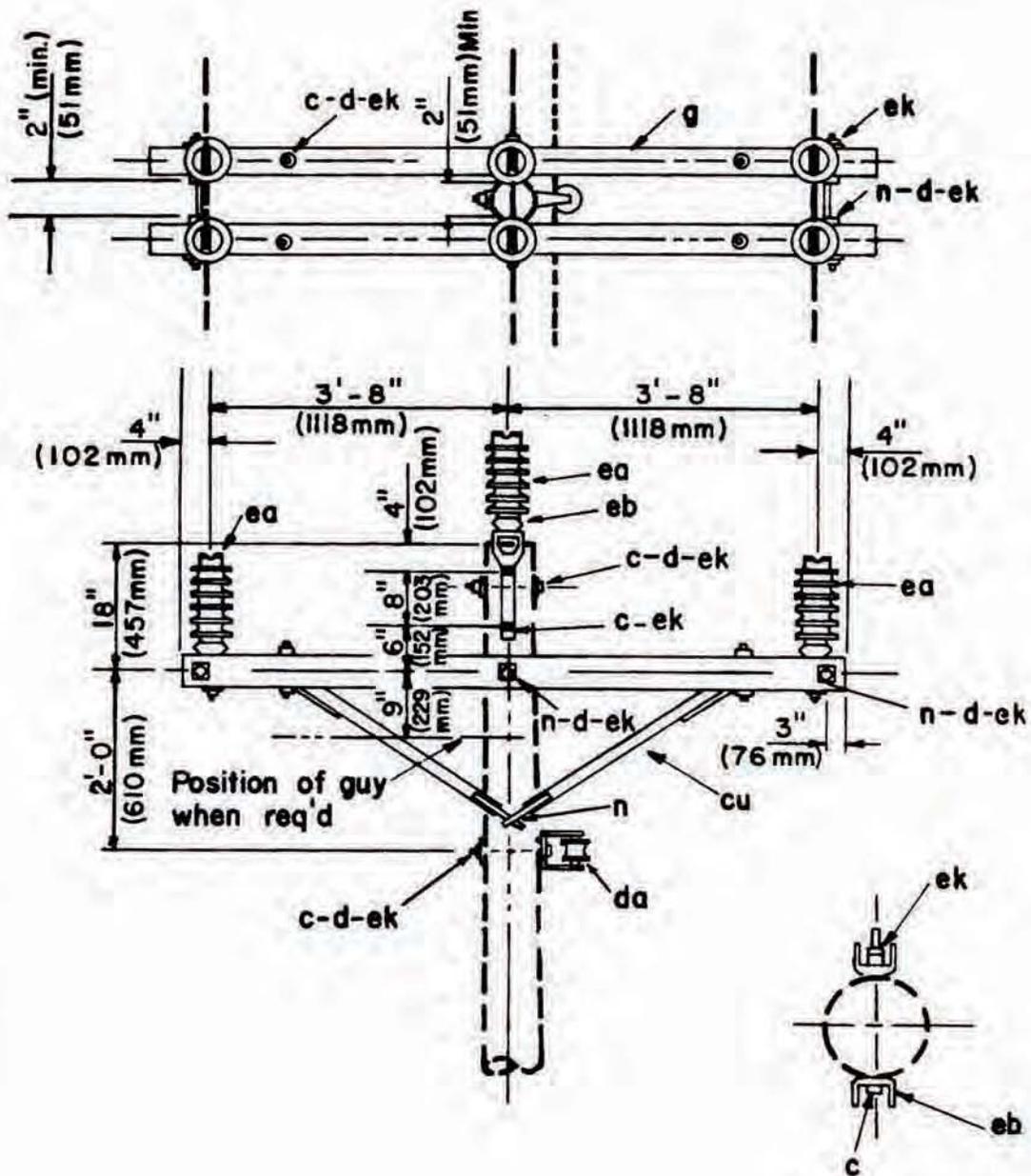
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 2	Bolt, machine, 1/2" x req'd length	bs 1	Bolt, single upset
c 6	Bolt, machine, 5/8" x req'd length	cu 1	Brace, wood, 60" span
d 2	Washer, round 1 3/8" dia.	ea 3	Insulator, post type
d 10	Washer, square, 2 1/4"	eb 1	Bracket, pole top
g 1	Crossarm 3 5/8" x 4 5/8" x 8'-0"	ek	Locknuts as required
		cm 1	Insulator, spool

Maximum Transverse
Load: 750 lbs (3336 N)/insulator
Angle: 0° - 2°

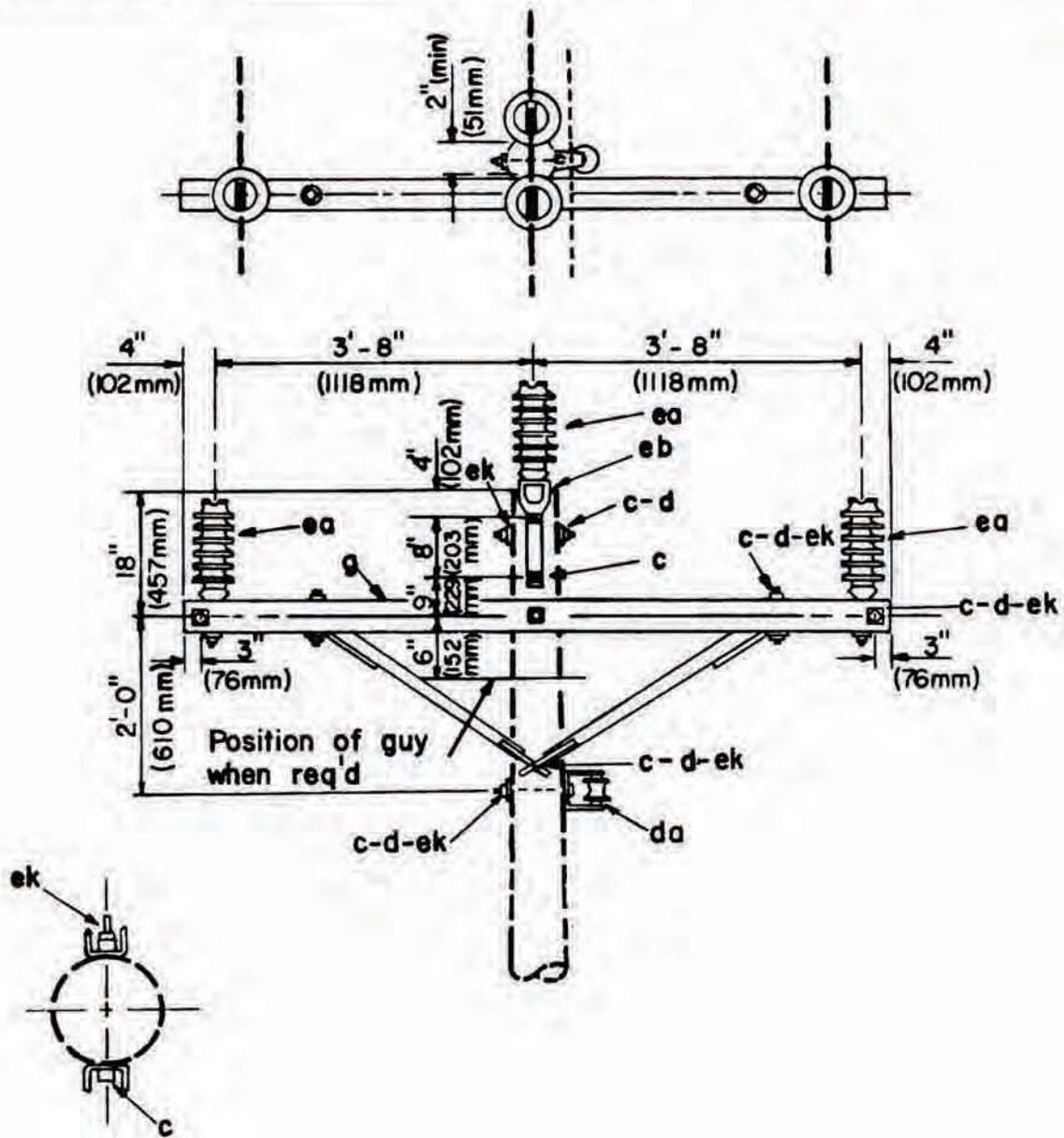
34.5/19.9 kV
3 - PHASE CROSSARM CONSTRUCTION
(LARGE CONDUCTORS)

NOV. 1986

ZCI-2



ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
c	4	Bolt, machine, 5/8" x req'd length	cu	2	Brace, wood 60" span
c	4	Bolt, machine, 1/2" x req'd length	da	1	Bracket, insulated
d	13	Washer, square, 2 1/4"	eb	2	Bracket, pole top
d	4	Washer, round 1 3/8"	ek		Locknuts as required
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"			
n	4	Bolt, double arming, 5/8" x req'd lenth			
ea	6	Insulator, post type			
Maximum Transverse Load : 750lbs(3336N)/Insulator 1500lbs(6672N) Total Angle: 0°- 5°		34.5/19.9 kV, 3-PHASE CROSSARM CONSTRUCTION-DOUBLE PRIMARY SUPPORT (LARGE CONDUCTORS)			
		NOV. 1986		ZCI-3	



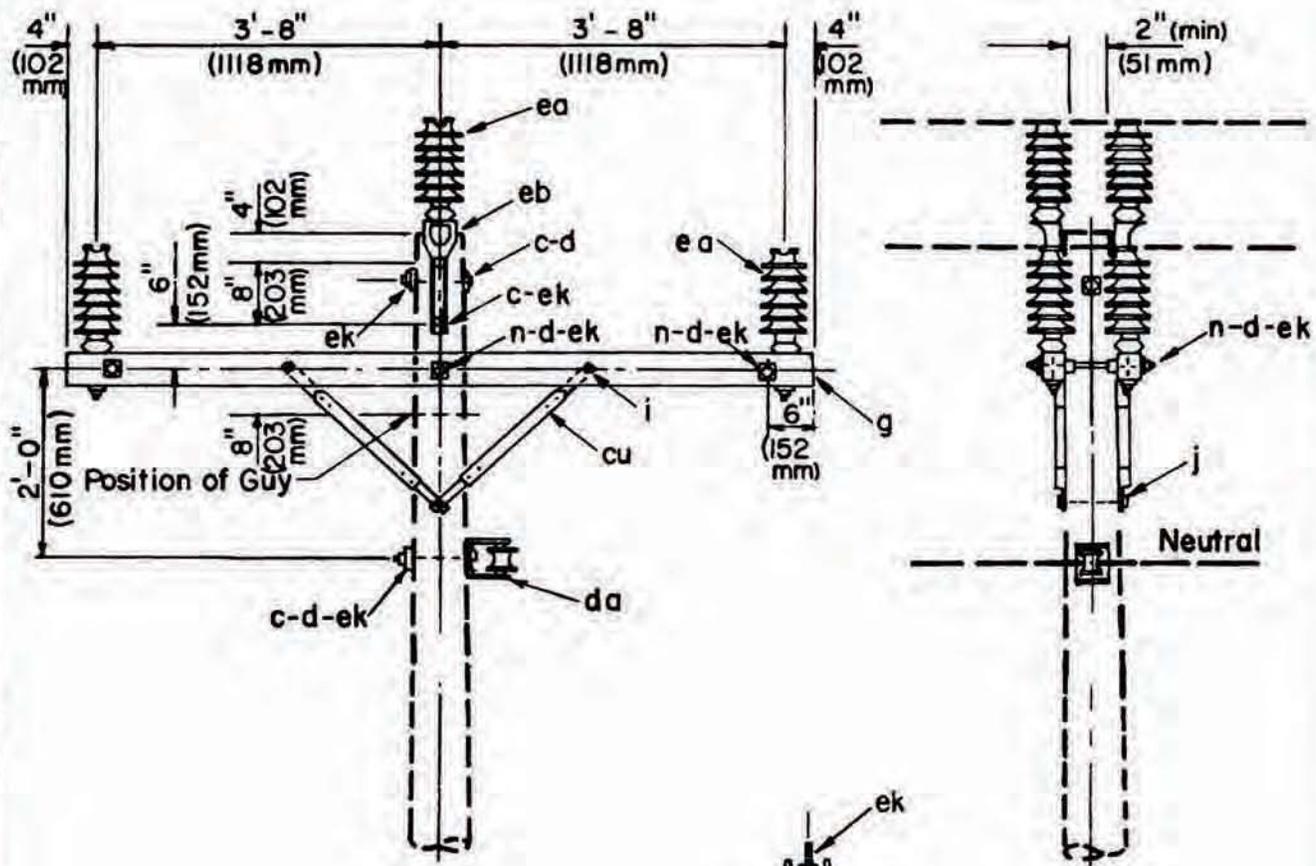
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 8	Bolt, machine, 5/8" x req'd length	da 1	Brocket, insulated
c 2	Bolt, machine, 1/2" x req'd length	ea 4	Insulator, post type
d 10	Washer, square, 2 1/4"	eb 2	Bracket, pole top
d 2	Washer, round, 1 3/8" dia.	ek	Locknuts as required
g 1	Crossarm 3 5/8" x 4 5/8" x 8'-0"		
cu 1	Brace, wood, 60" span		

Maximum Transverse
Load: 750lbs (3336N)/insulator
Angle 2° - 5°

34.5/19.9 kV
3 - PHASE CROSSARM CONSTRUCTION
(LARGE CONDUCTORS)

NOV. 1986

ZCI-4



NOTE:
 When the transverse load is more than 750 lbs (3336N) per insulator, construction similar to ZC3 should be used

POLE TOP INSULATOR ASSEMBLY

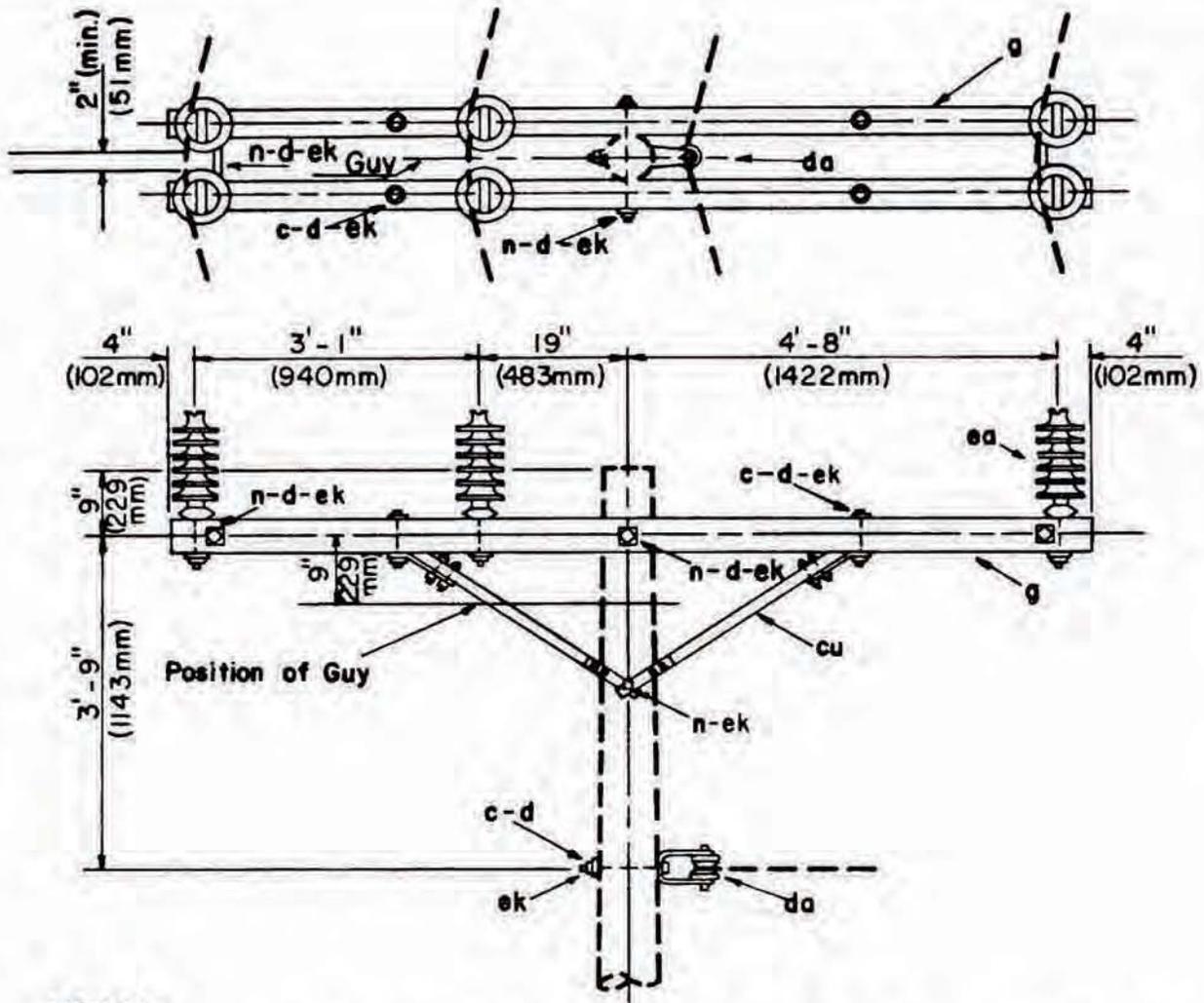
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 4	Bolt machine 5/8" x req'd length	cu 4	Brace, wood, 28"
d 13	Washer, square 2 1/4"	da 1	Bracket, Insulated
n 3	Bolt, double arming 5/8" x req'd length	ea 6	Insulator, Post type
g 2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	eb 2	Bracket, pole top
i 4	Bolt carriage 3/8" x 4 1/2"	ek	Locknuts as req'd
j 2	Screw lag 1/2" x 4"		

Maximum Transverse Load: 750 lbs (3336N)/Insulator
 1500 lbs (6672N) Total
 Angle 5°-20°

34.5/19.9 kV, 3-PHASE
 CROSSARM CONSTRUCTION- DOUBLE PRIMARY SUPPORT

NOV. 1986

ZC2



NOTES:

1. Center phase wire or neutral wire may be located on the opposite side of the pole where necessary to avoid crossing of wires
2. Neutral may also be mounted on the crossarm.
3. When the transverse load is more than 750lbs (3336 N) per insulator construction similar to ZC3-1 should be used.

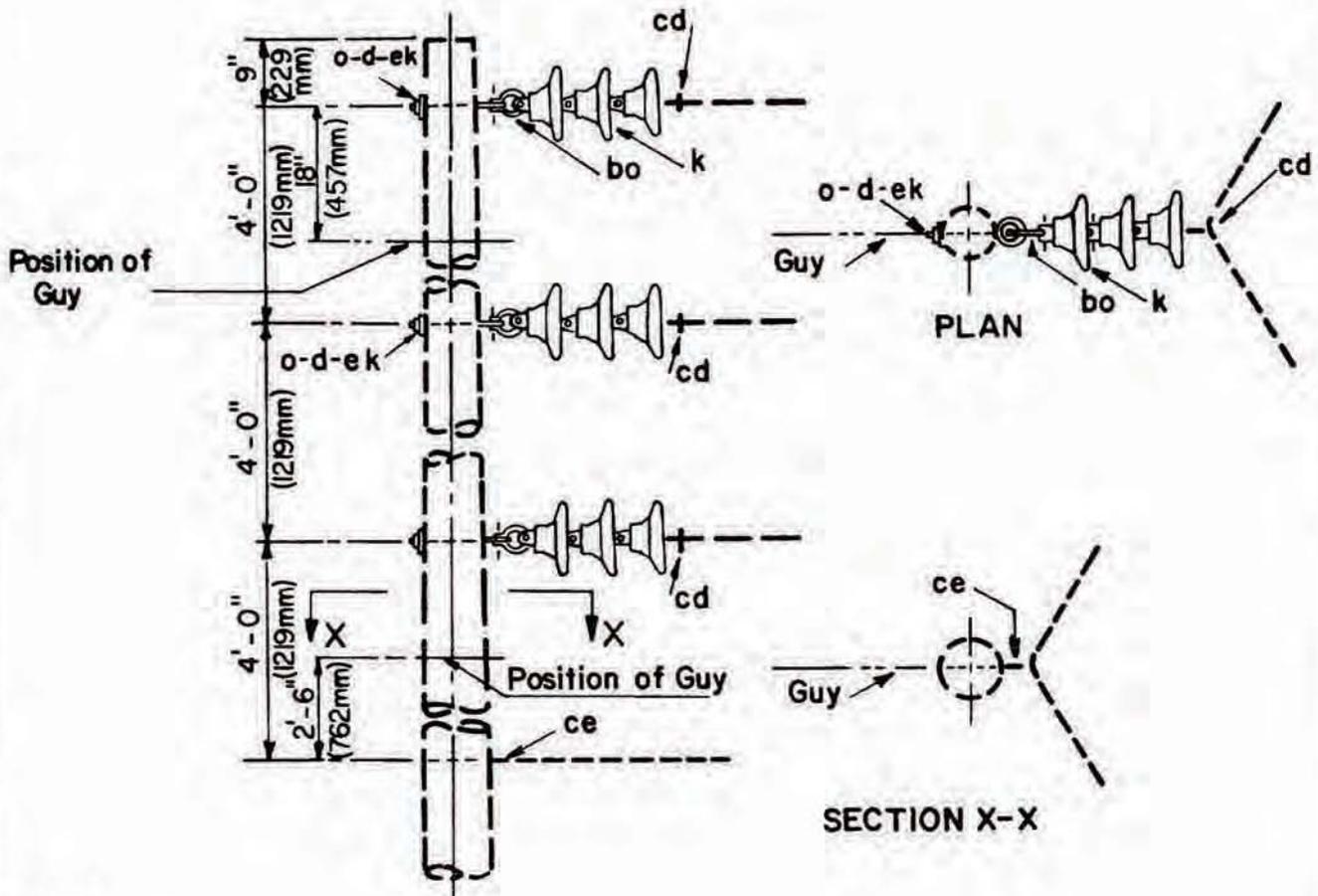
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 1	Bolt, machine, 5/8" x req'd length	g 2	Crossarm, 3 5/8" x 4 5/8" x 10'-0"
c 4	Bolt, machine, 1/2" x req'd length	n 4	Bolt, double arming, 5/8" x req'd length
d 11	Washer, square 2 1/4"	cu 2	Brace, wood, 60" span
d 4	Washer, round 1 3/8" dia.	da 1	Bracket, insulated
		ek	Locknuts as req'd

MAXIMUM TRANSVERSE LOAD: 750 lbs (3336 N)/insulator
1500 lbs (6672N) Total
ANGLE: 5° - 20°

**34.5/19.9 kV, 3 PHASE
CROSSARM CONSTRUCTION DOUBLE PRIMARY**

NOV. 1986

ZC2-1



NOTE:

For units cd and ce see guide drawings M41-1 and M41-10.

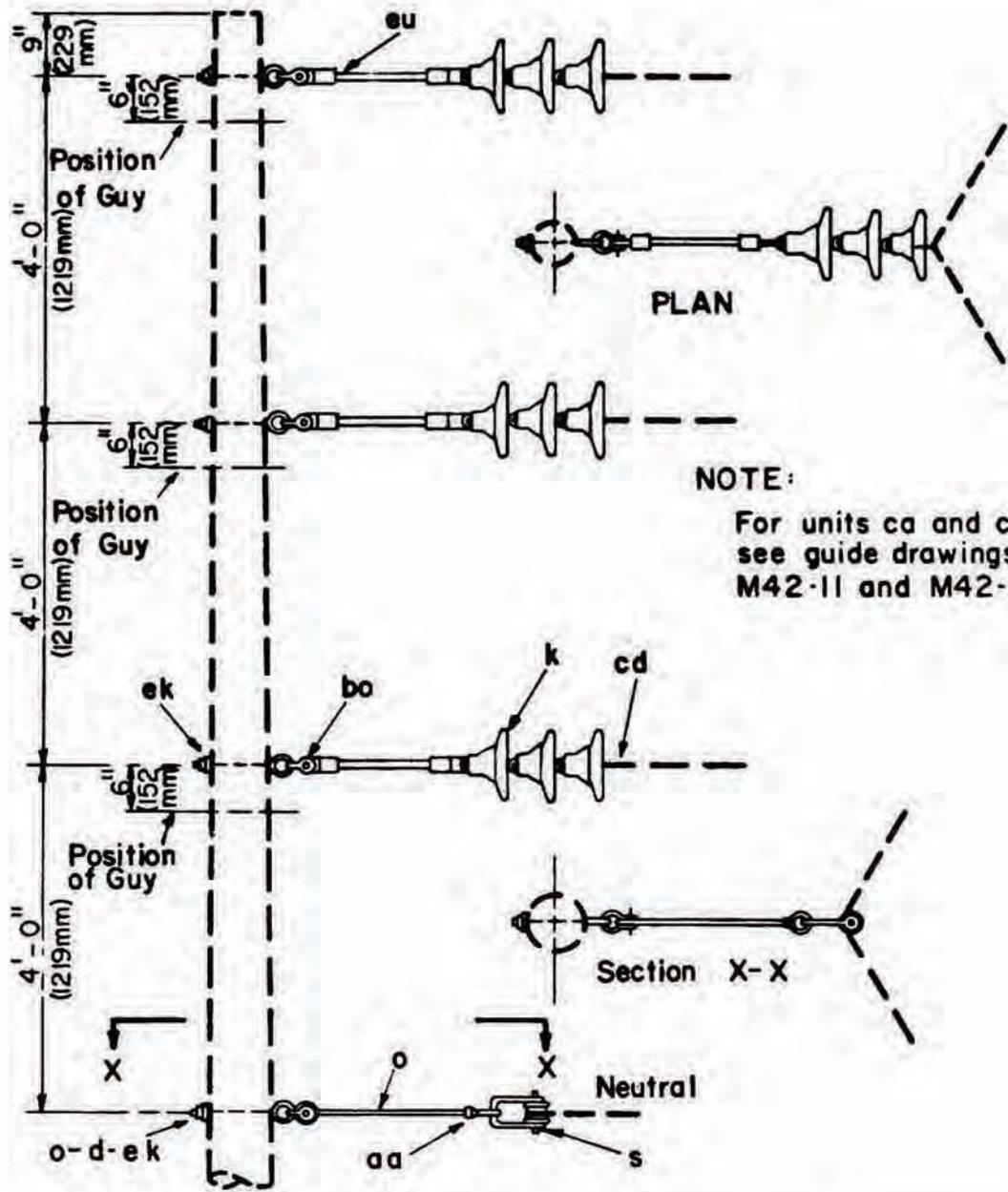
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d	3 Washer, square 2 1/4"	cd	3 Angle assembly, primary
k	9 Insulator, suspension 10"	ce	1 Angle assembly, neutral
o	3 Bolt, eye, 5/8" x req'd length	ek	Locknuts as required
bo	3 Shackle, anchor		

Angle: 20° - 60°

34.5/19.9 kV PRIMARY, 3-PHASE
VERTICAL CONSTRUCTION

NOV. 1986

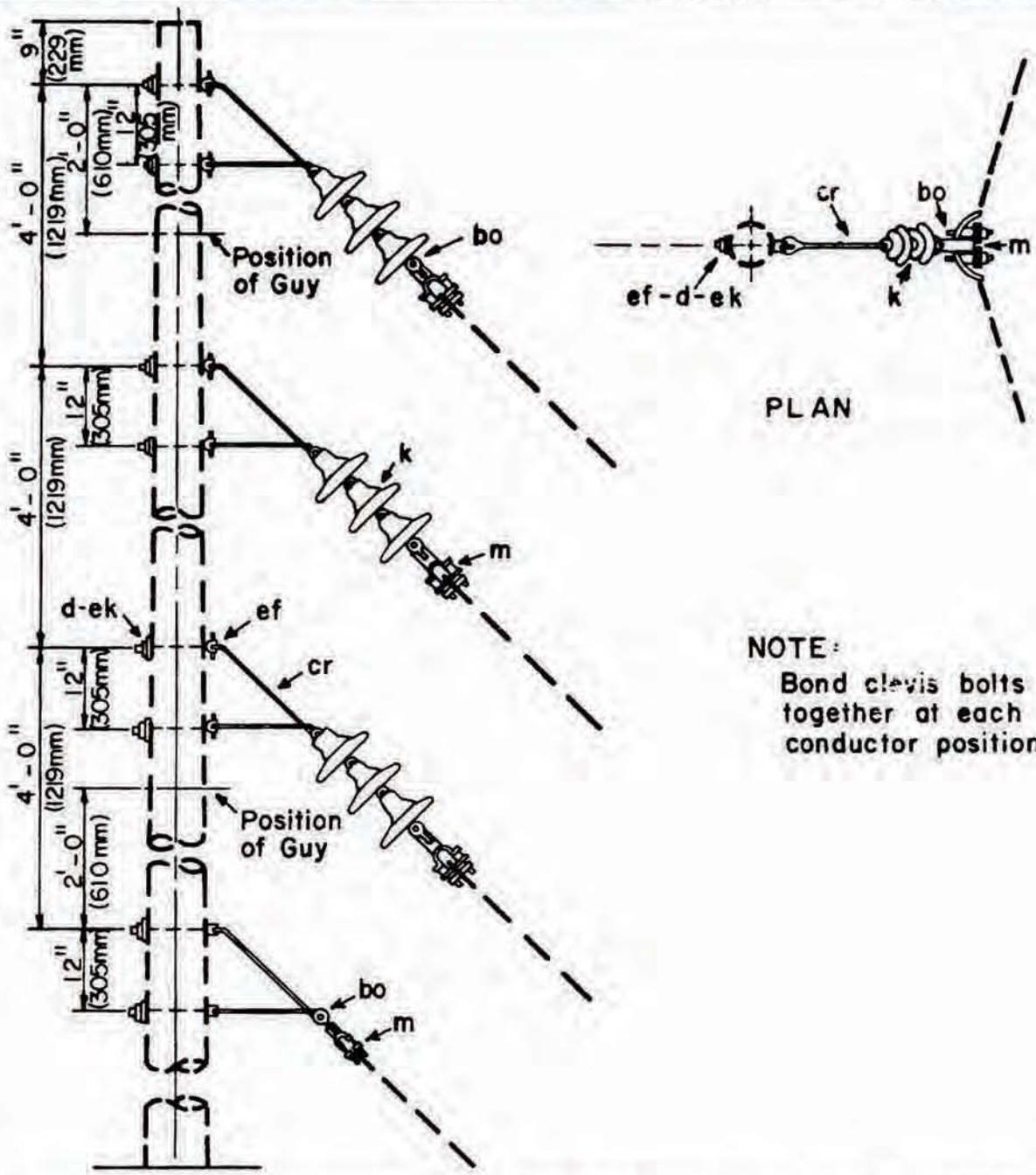
ZC3



NOTE:
For units ca and cc
see guide drawings
M42-11 and M42-13

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d	4 Washer, square 2 1/4"	bo	4 Shackle, anchor
k	9 Insulator, suspension, 10"	cd	3 Angle assembly, primary
o	5 Bolt, eye, 5/8" x req'd length	ek	Locknuts as req'd
s	1 Clevis, secondary, swinging, insulated	eu	3 Link, extension, insulated
ea	1 Nut, eye, 5/8"		

Angle: 20° - 60°	34.5/19.9 kV - THREE PHASE VERTICAL CONSTRUCTION, LARGE CONDUCTORS	
	NOV. 1986	ZC3L



NOTE:
Bond clevis bolts together at each conductor position

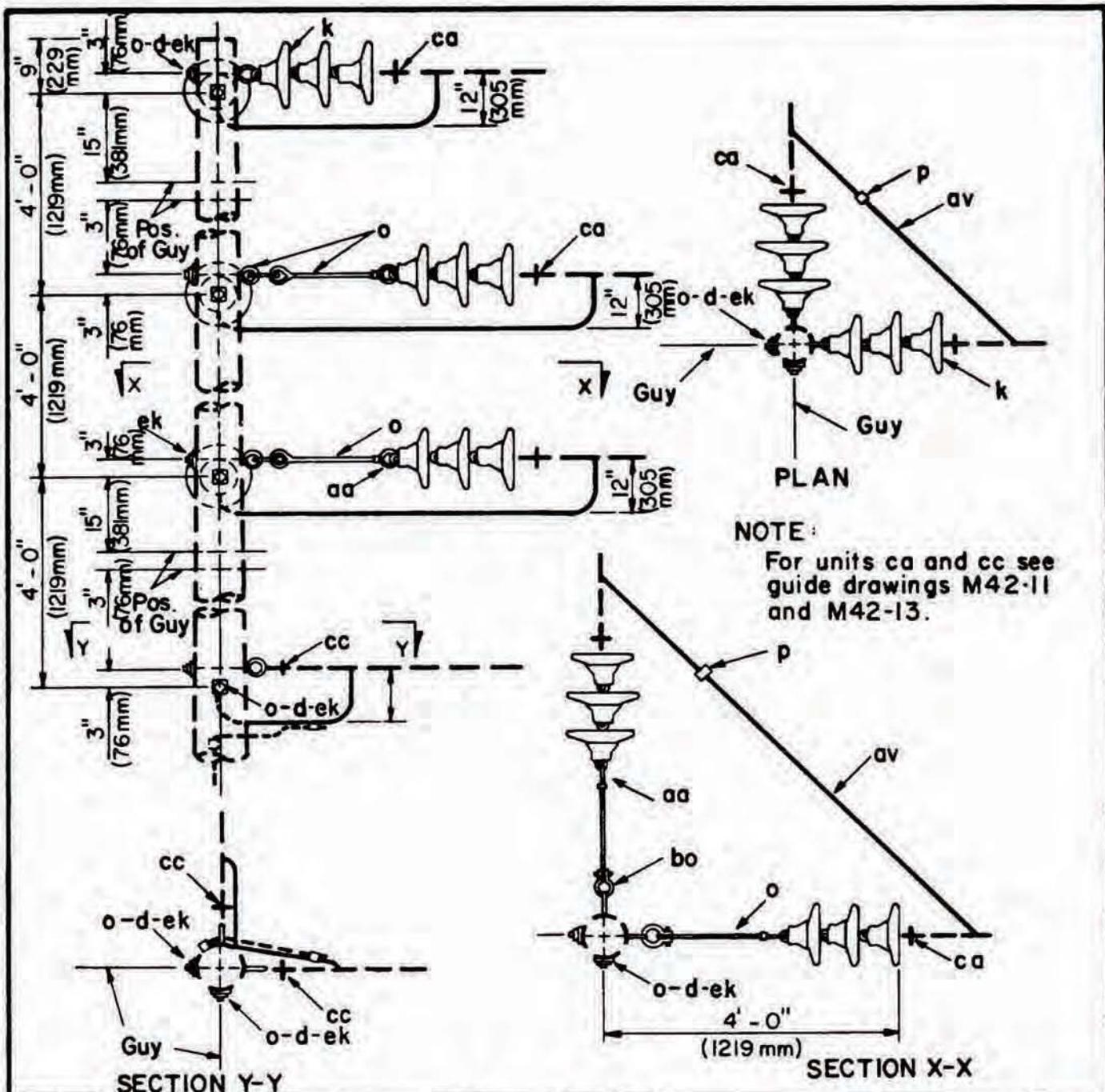
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d	8 Washer, square, 2 1/4"	cr	4 Bracket, angle, 5/8"
k	9 Insulator, suspension, 10"	ef	8 Bolt, clevis, 5/8" x req'd length
m	4 Clamp, suspension	ek	Locknuts as req'd
bo	4 Shackle, Anchor		

Angle: 10° - 20°

**34.5/19.9 kV
VERTICAL CONSTRUCTION
LARGE CONDUCTORS**

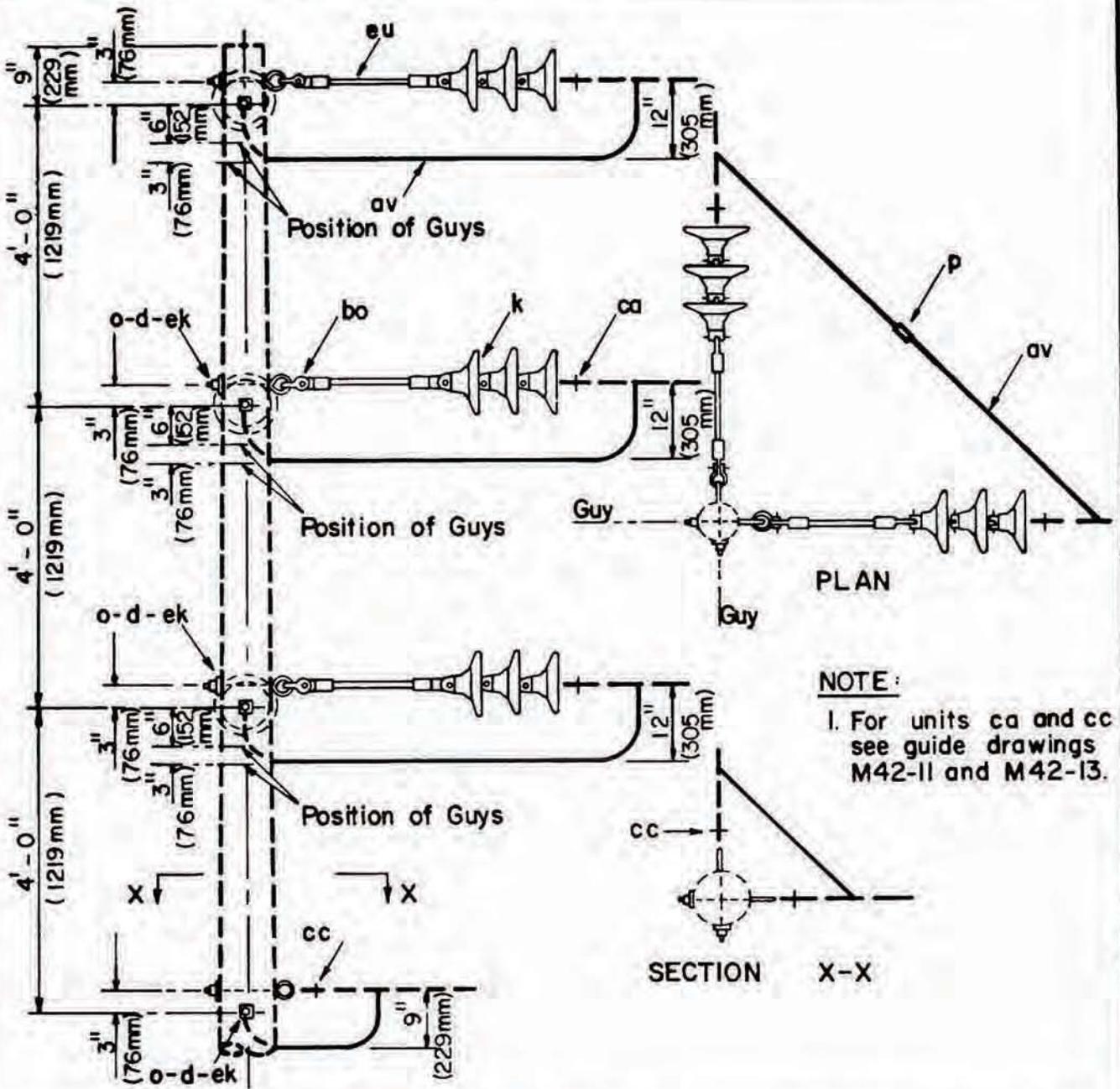
NOV. 1986

ZC3-1



ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d	8 Washer, square 2 1/4"	av	Jumpers as required
k	18 Insulator suspension 10"	bo	4 Shackle anchor
o	12 Bolt, eye, 5/8" x req'd length	ca	6 Deadend assembly, primary
p	Connectors as req'd	cc	2 Deadend assembly, neutral
aa	4 Nut, eye 5/8"	ek	Locknuts as required

Angle 60° - 90°	34.5/19.9 kV, 3-PHASE VERTICAL CONSTRUCTION	
	NOV. 1986	ZC4-1



NOTE:
 1. For units ca and cc see guide drawings M42-11 and M42-13.

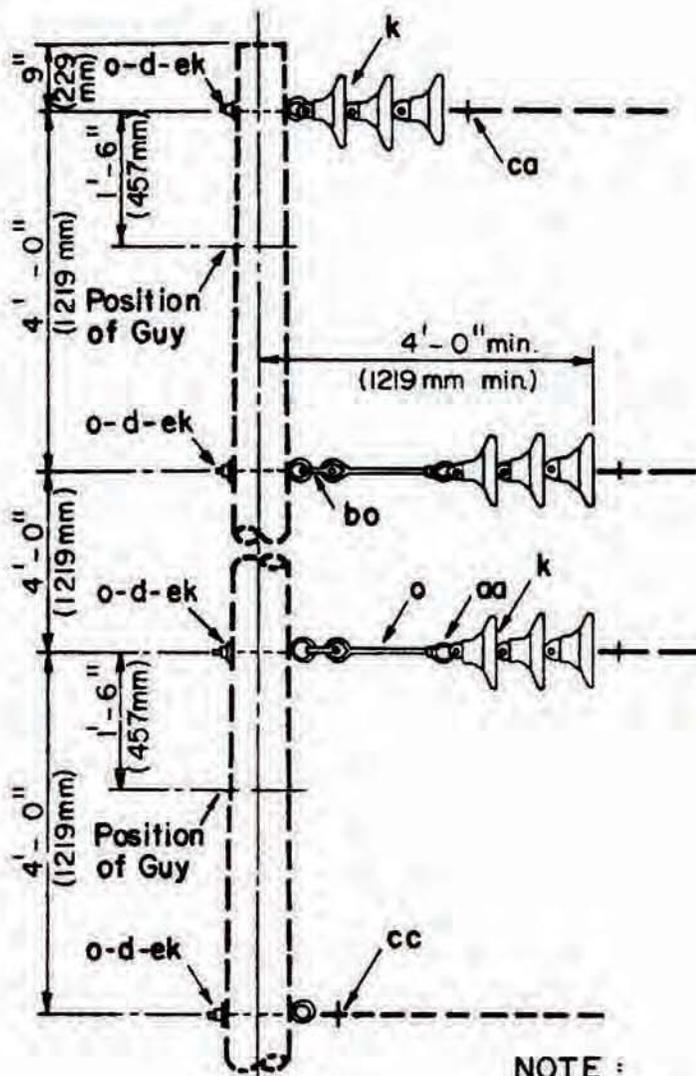
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d	8 Washer, square, 2 1/4"	bo	6 Shackle, anchor
k	18 Insulator, suspension 10"	ca	6 Deadend assembly, primary
o	8 Bolt, eye 5/8" x req'd length	cc	2 Deadend assembly, neutral
p	Connectors as req'd	ek	Locknuts as req'd
av	Jumpers as req'd.	eu	6 Link, extension, insulated

ANGLE 60° - 90°

34.5/19.9 kV - THREE PHASE
 VERTICAL CONSTRUCTION, LARGE CONDUCTORS

NOV. 1986

ZC4-1L



NOTE :

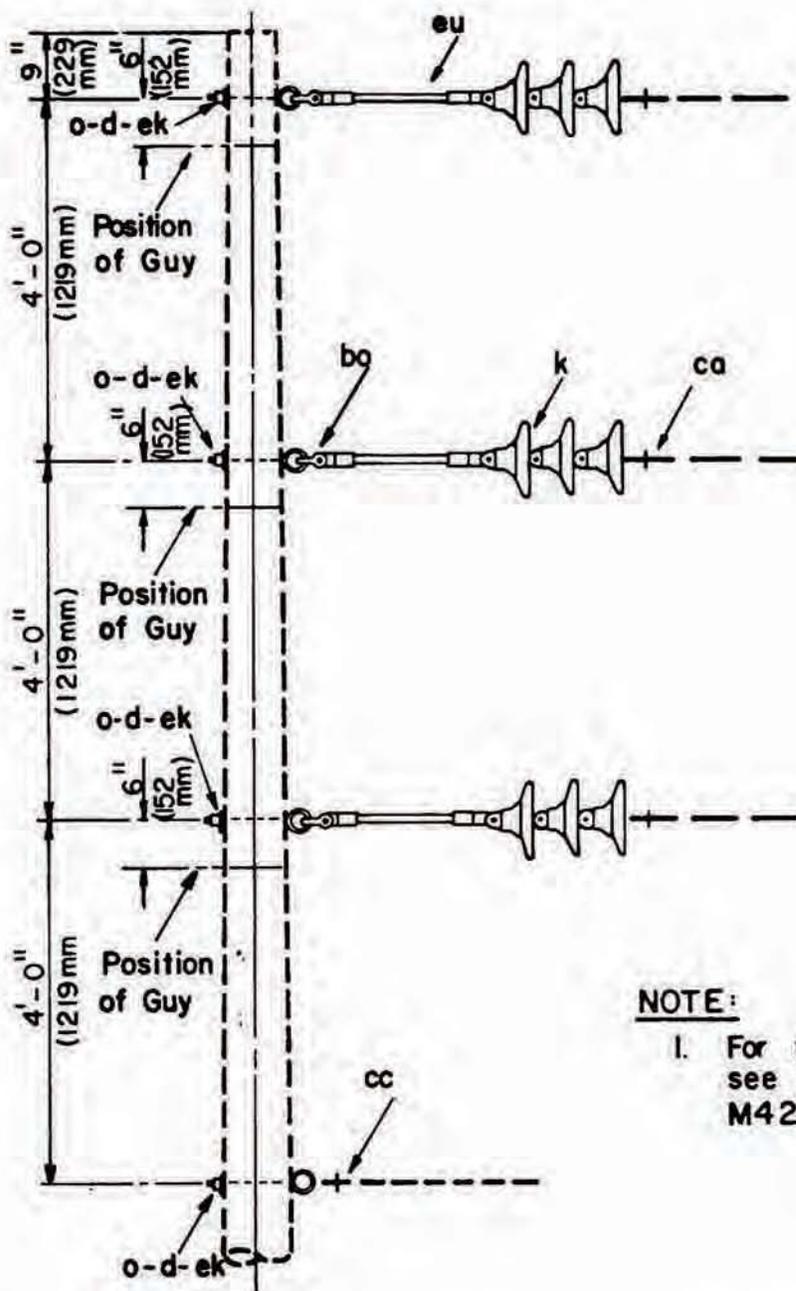
1. For units ca and cc see guide drawings M42-11 and M42-13.

ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
d	4	Washer square 2 1/4"	ca	3	Deadend assembly, primary
k	9	Insulator suspension 10"	cc	1	Deadend assembly, neutral
o	6	Bolt, eye 5/8", req'd length	ek		Locknuts as req'd
aa	2	Nut, eye 5/8"			
bo	2	Shackle anchor			

**345/19.9 kV, 3- PHASE
VERTICAL CONSTRUCTION - DEADEND (SINGLE)**

NOV. 1986

ZC5-1



NOTE:

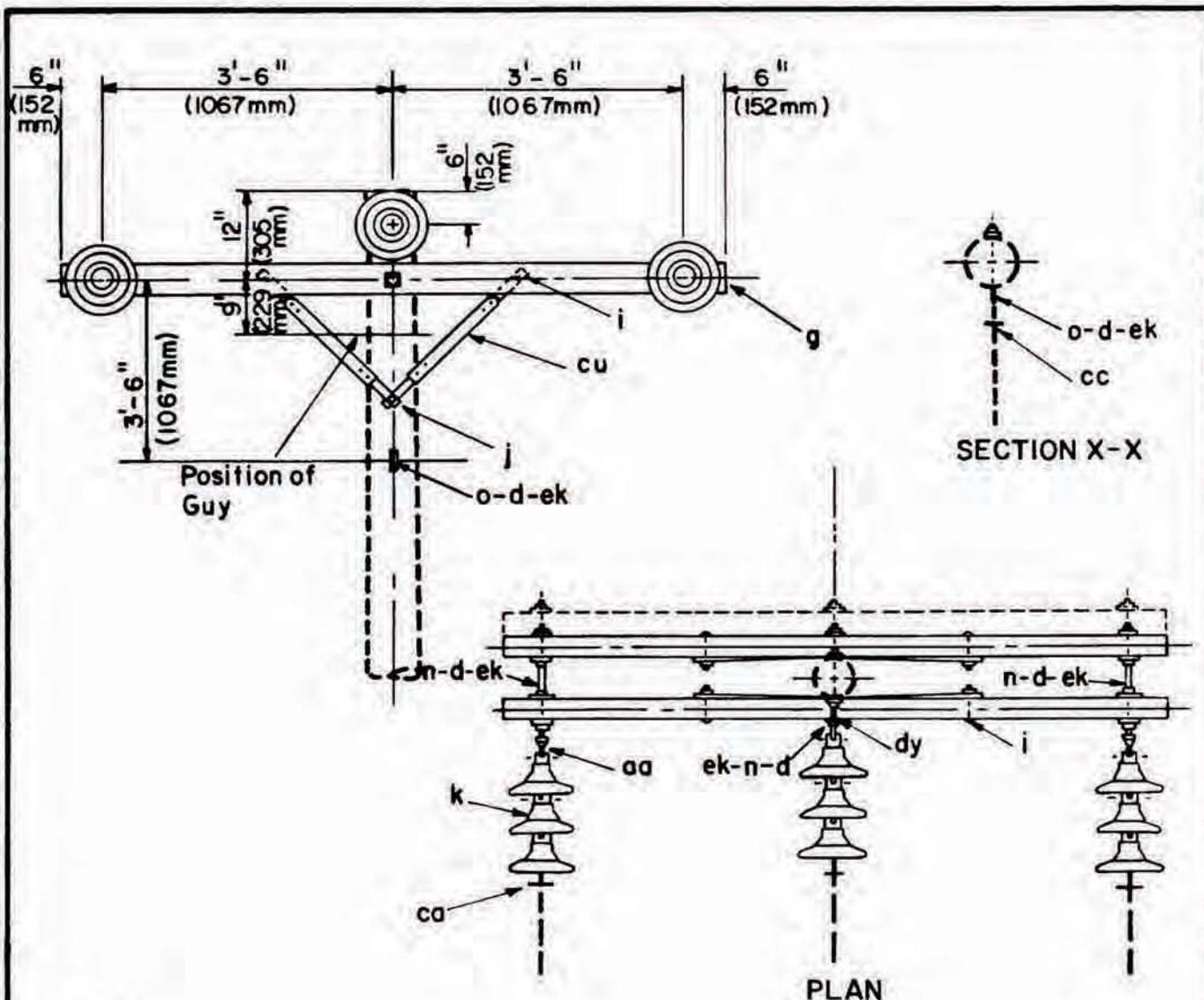
1. For units ca and cc see guide drawings M42-11 and M42-13.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d 4	Washer, square, 2 1/4"	cc 1	Deadend assembly, neutral
k 9	Insulator, suspension 10"	ek	Locknuts as req'd
e 4	Bolt, eye, 5/8" x req'd length	eu 3	Link, extension, insulated
bo 3	Shackle, anchor		
ca 3	Deadend assembly, primary		

**34.5/19.9 kV - THREE PHASE
VERTICAL CONSTRUCTION, DEADEND (SINGLE)
LARGE CONDUCTORS**

NOV. 1986

ZC5-1L



NOTES:

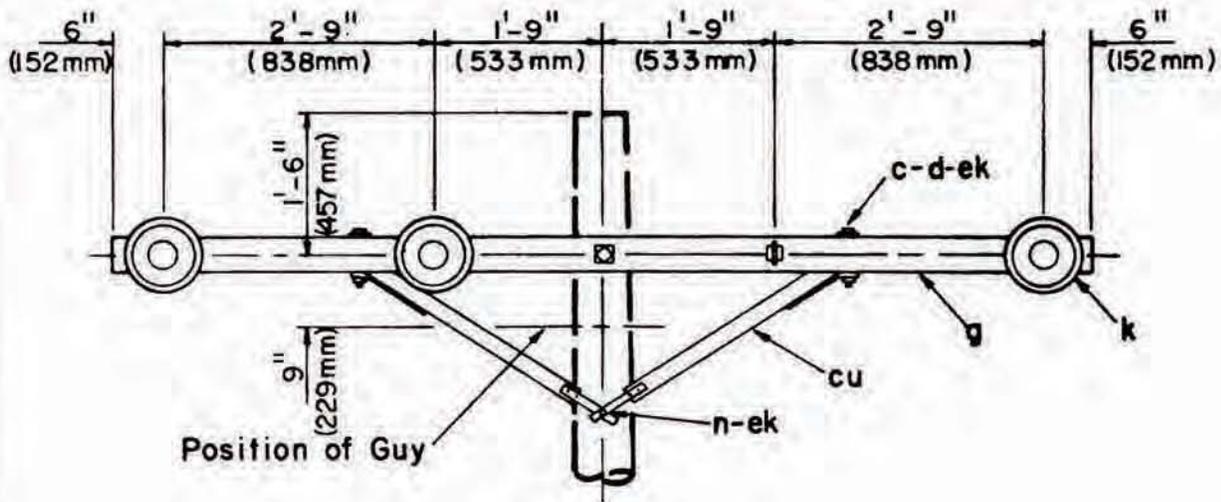
1. See drawing ZE5-1 for crossarm loading limitations.
2. Designate as ZC7-1 for assembly with three crossarms.
3. For units ca and cc see guide drawings M42-11 and M42-13.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d 13	Washer, square, 2 1/4"	aa 2	Nut, eye 5/8"
g 2	Crossarm 3 5/8" x 4 5/8" x 8'-0"	ca 3	Deadend assembly, primary
i 4	Bolt, carriage, 3/8" x 4 1/2"	cc 1	Deadend assembly, neutral
j 2	Screw, lag 1/2" x 4"	cu 4	Brace, wood 28"
k 9	Insulator suspension	dy 1	Bolt, eye, double arming 5/8" x req'd length
n 3	Bolt, double arming 5/8" x req'd length	ek	Locknuts as required

34.5/19.9 kV, 3-PHASE
CROSSARM CONSTRUCTION - DEADEND (SINGLE)

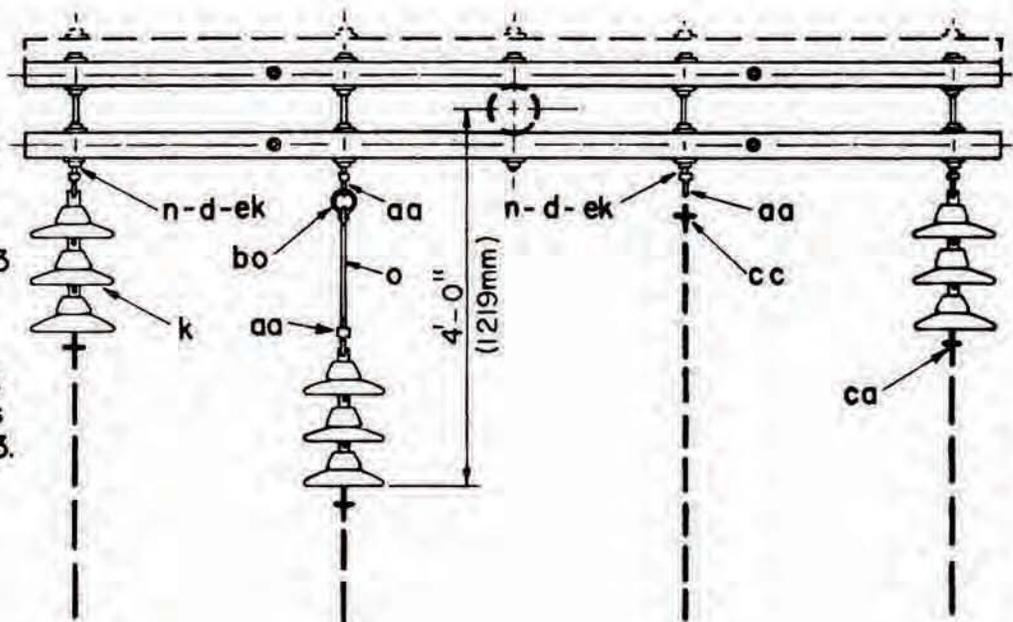
NOV. 1986

ZC7, ZC7-1



NOTES:

1. See drawing ZE5-1 for crossarm loading limitations.
2. Designate as ZC7-3 for assembly with 3 crossarms.
3. For units ca and cc see guide drawings M42-11 and M42-13.

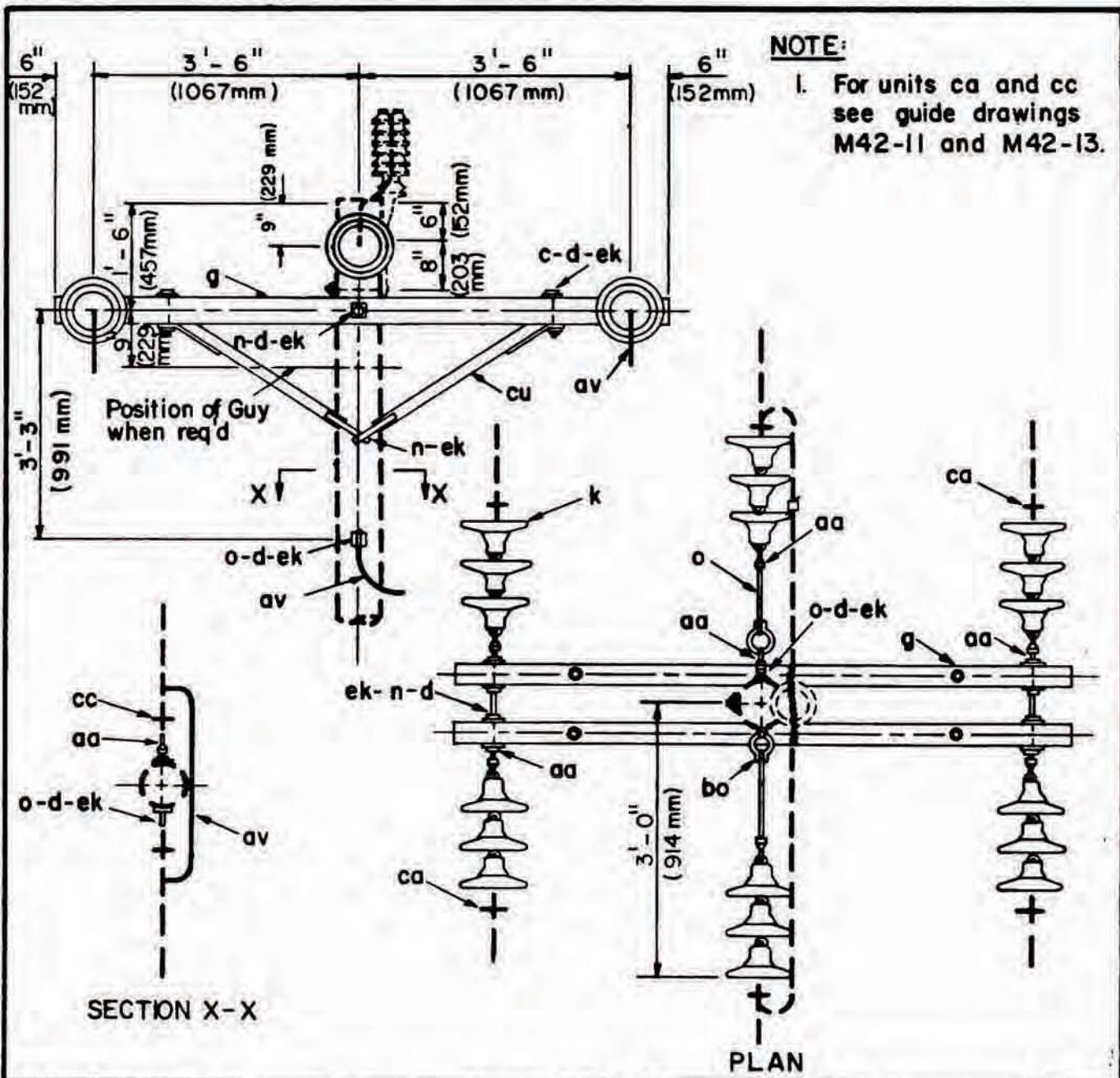


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 4	Bolt, machine, 1/2" req'd length	aa 5	Nut, eye 5/8"
d 18	Washer, square, 2 1/4"	bo 1	Shackle, anchor
d 4	Washer, round, 1 3/8" dia.	ca 3	Deadend assembly, primary
g 2	Crossarm, 3 5/8" x 4 5/8" x 10' - 0"	cc 1	Deadend assembly, neutral
k 9	Insulator, suspension 10"	cu 2	Brace, crossarm, wood, 60" span
n 6	Bolt, double arming, 5/8" x req'd length	ek	Locknuts, as req'd
o 1	Bolt, eye, 5/8" x req'd length		

**34.5/19.9 kV 3-PHASE
CROSSARM CONSTRUCTION-DEADEND (SINGLE)**

NOV. 1986

ZC7-2, ZC7-3

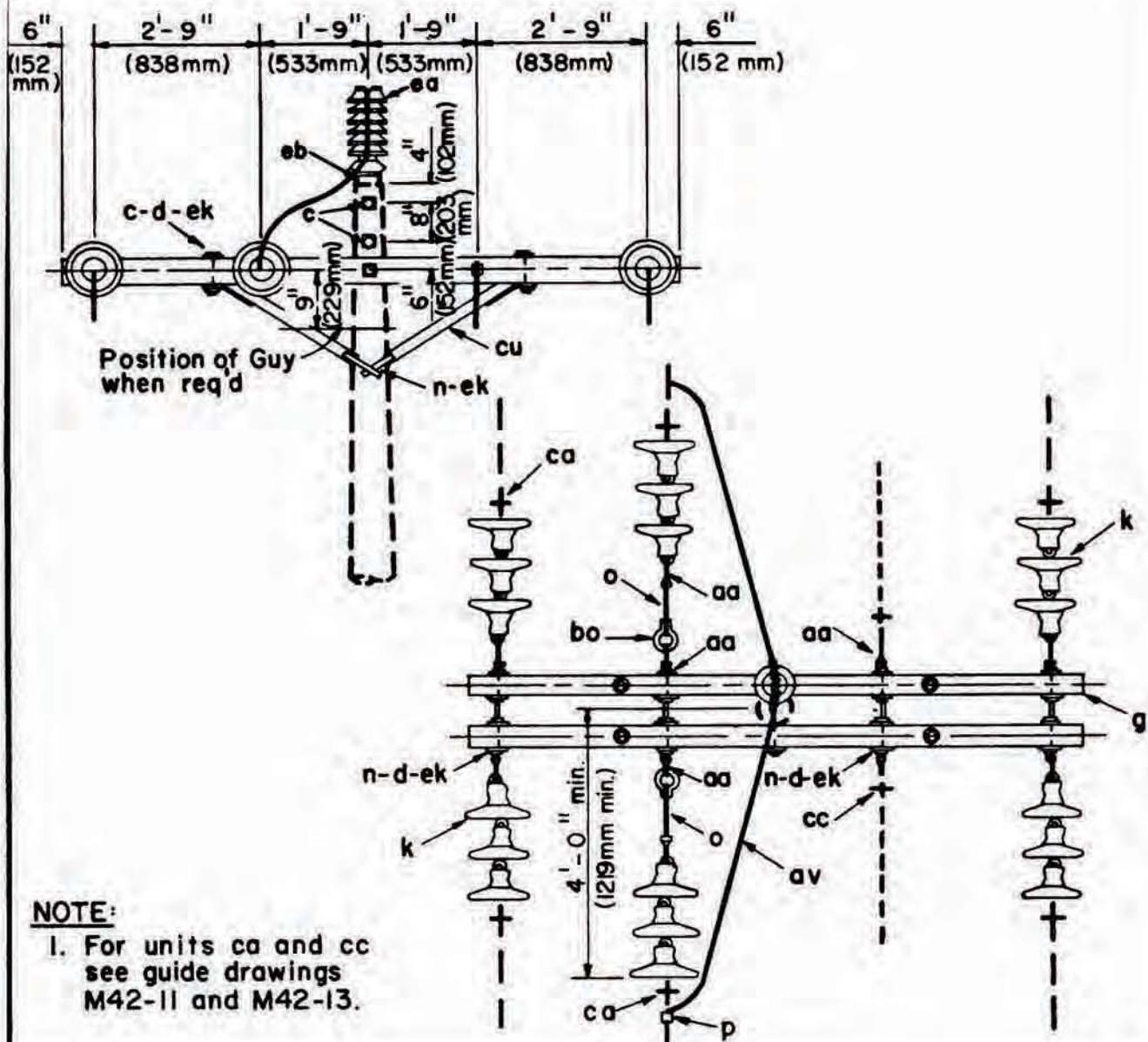


ITEM NO	MATERIAL	ITEM NO	MATERIALS
c	4 Bolt, machine, 1/2" x req'd length	aa	8 Nut, eye, 5/8"
d	14 Washer, square, 2 1/4"	av	Jumpers and leads as req'd
d	4 Washer, round 1 3/8" dia.	bo	2 Shackle, anchor
g	2 Crossarm 3 5/8" x 4 5/8" x 8'-0"	ca	6 Deadend assembly, primary
k	18 Insulator, suspension 10"	cc	2 Deadend assembly, neutral
n	4 Bolt, double arming, 5/8" x req'd length	cu	2 Brace, wood, 60" span
o	4 Bolt, eye, 5/8" x req'd length	ek	Locknuts as req'd
p	Connectors as req'd		

**34.5/19.9 kV, 3-PHASE
CROSSARM CONSTRUCTION-DEADEND(DOUBLE)**

NOV. 1986

ZC8

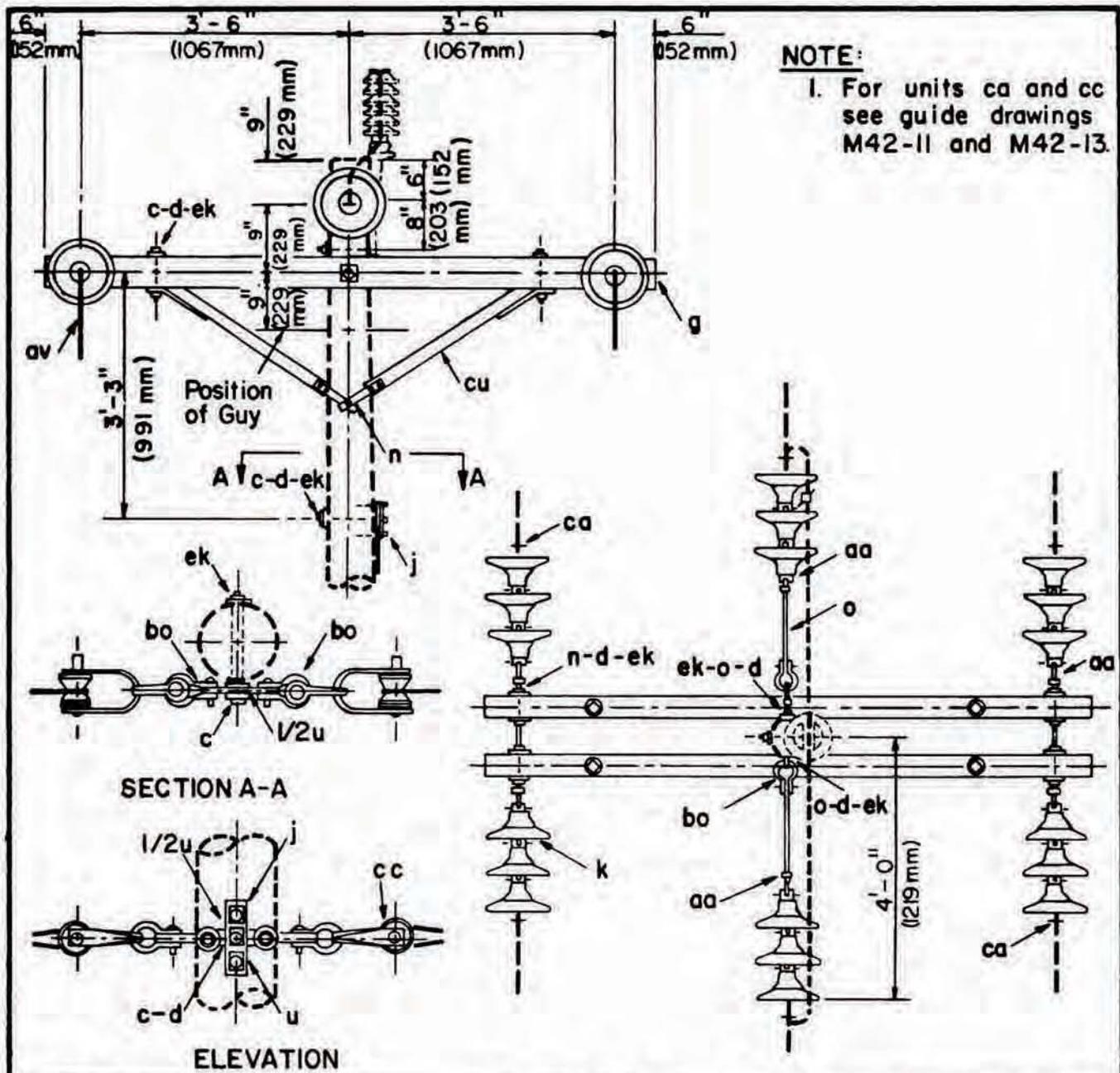


NOTE:

1. For units ca and cc see guide drawings M42-11 and M42-13.

ITEM	NO	MATERIAL	ITEM	NO	MATERIAL
c	2	Bolt, machine 5/8" x req'd length	aa	10	Nut, eye, 5/8"
c	4	Bolt, machine 1/2" x req'd length	av		Jumpers or leads required
d	4	Washer round 1 3/8" dia.	bo	2	Shackle, anchor
d	20	Washer square 2 1/4"	ca	6	Deadend assembly, primary
g	2	Crossarm 3 5/8" x 4 5/8" x 8'-0"	cc	2	Deadend assembly, neutral
k	18	Insulator, suspension 10"	cu	2	Brace, crossarm, wood 60" span
a	6	Bolt, double arming 5/8" x req'd length	ea	1	Insulator, post type
o	2	Bolt, eye 5/8" x req'd length	eb	1	Bracket pole
p		Connectors as required	ek		Locknuts as required

**34.5/19.9 kV, 3- PHASE
CROSSARM CONSTRUCTION - DEADEND (DOUBLE)**

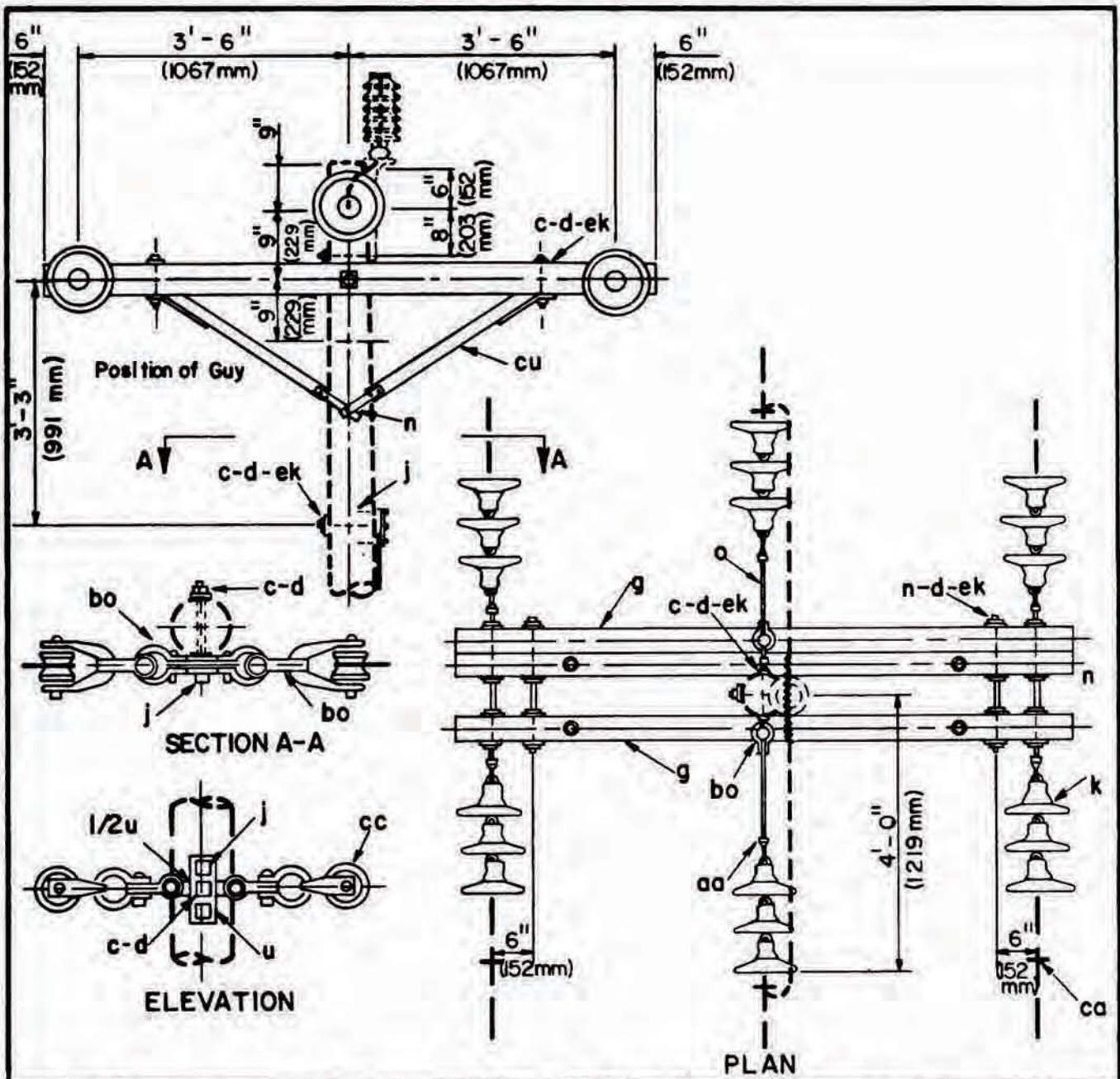


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 1	Bolt, machine, 5/8" x req'd length	p	Connectors as required
c 4	Bolt, machine, 1/2" x req'd length	u 1/2	Clamp guy, 6" - heavy duty
d 13	Washer, square 2 1/4"	aa 7	Nut, eye, 5/8"
d 4	Washer, round, 1 3/8" dia.	av	Jumpers as required
g 2	Crossarm, 3 5/8" x 4 5/8" x 8' - 0"	bo 6	Shackle, anchor
j 2	Screw lag 1/2" x 4"	ca 6	Deadend assembly, primary
k 8	Insulator suspensio 10"	cc 2	Deadend assembly, neutral
n 4	Bolt, double arming 5/8" x req'd length	cu 2	Brace, wood, 60" span
o 3	Bolt, eye, 5/8" x req'd length	ek	Locknuts as req'd

**345/19.9 kV, 3-PHASE
CROSS ARM CONSTRUCTION- DEADEND(DOUBLE)
(LARGE CONDUCTORS)**

NOV. 1986

ZC8-2

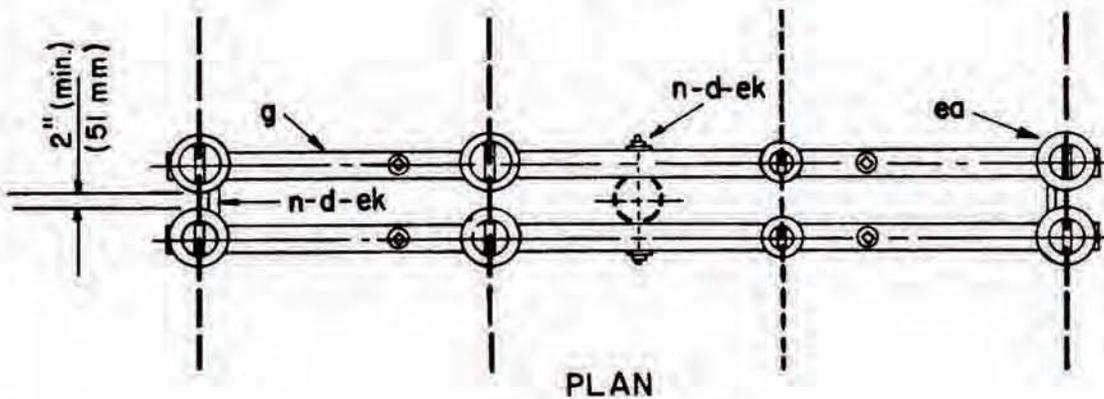
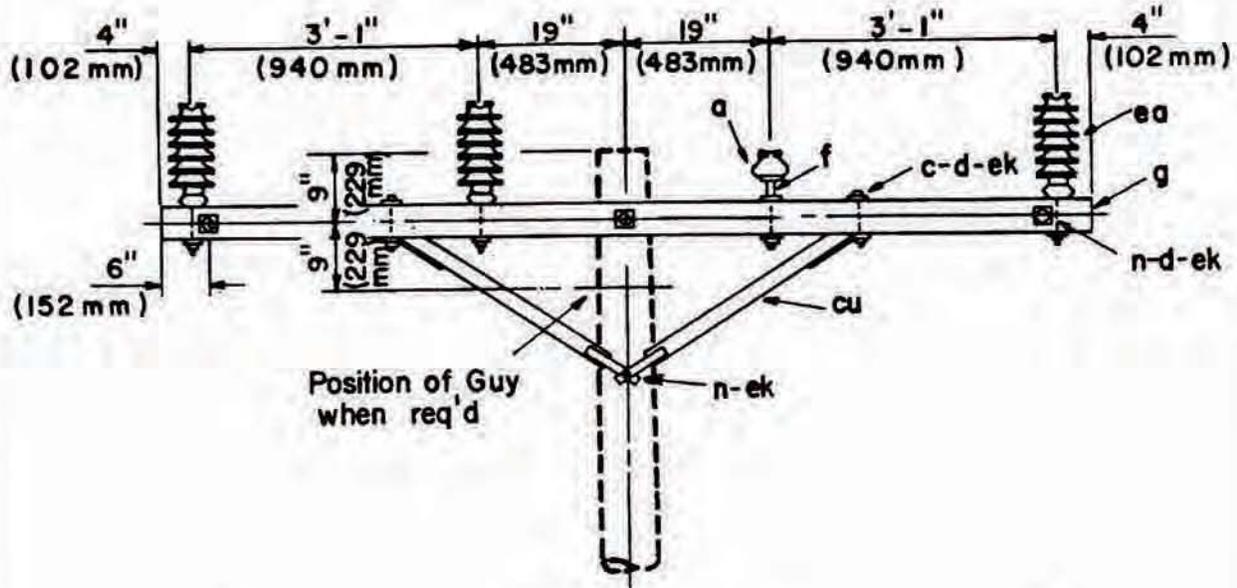


ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
c	1	Bolt, machine, 5/8" x req'd length	p		Connectors as req'd
c	4	Bolt, machine, 1/2" x req'd length	u	1 1/2	Clamp, guy, 6" heavy duty
d	21	Washer square, 2 1/4"	aa	7	Nut, eye 5/8"
d	4	Washer round 1 3/8"	av		Jumpers as required
g	3	Crossarm 3 5/8" x 4 5/8" x 8'-0"	bo	6	Shackle, anchor
j	2	Screw lag 1/2" x 4"	ca	6	Deadend assembly, primary
k	18	Insulator, suspension 10"	cc	2	Deadend assembly, neutral
n	6	Bolt, double arming 5/8" x req'd length	cu	2	Brace, wood, 60" span
o	3	Bolt, eye, 5/8" x req'd length	ek		Locknuts as req'd

**34.5/19.9 kV, 3-PHASE
CROSSARM CONSTRUCTION-DEADEND (DOUBLE)
LARGE CONDUCTORS WITH UNBALANCED LOADS**

NOV. 1986

ZC8-3



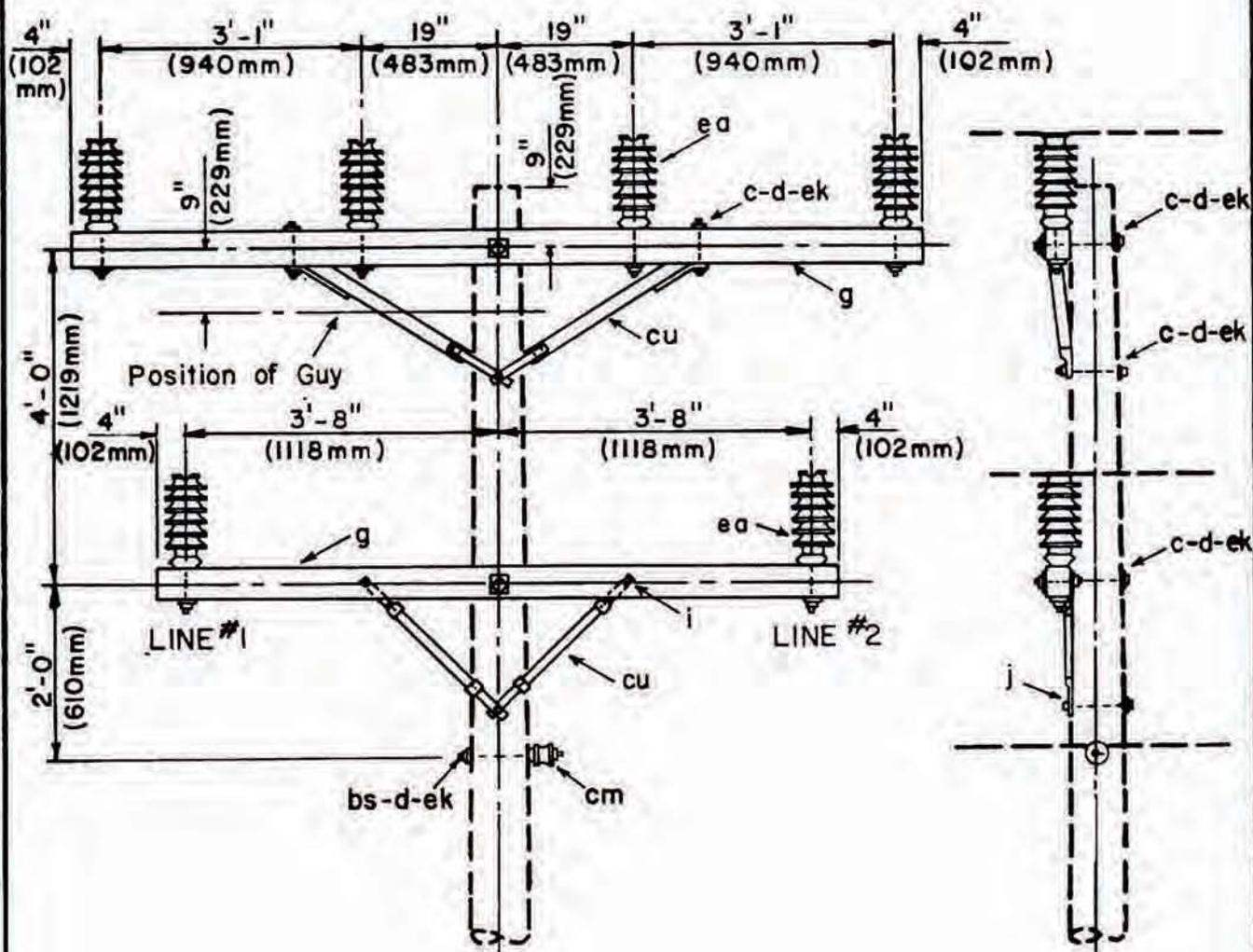
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
a	2 Insulator, pin type, (ANSI Class 55-3)	n	4 Bolt, double arming, 5/8" x req'd length
c	4 Bolt, machine 1/2" x req'd length	cu	2 Brace, crossarm, wood, 60" span
d	10 Washer, square 2 1/4"	ea	6 Insulator, post type
d	4 Washer, round 1 3/8"		
f	2 Pin, crossarm, steel 5/8" x 10 3/4"	ek	Locknuts as req'd
g	2 Crossarm 3 5/8" x 4 5/8" x 10'-0"		

Maximum Transverse
 Load : 750lbs(3336N) Insulator
 1500lbs(6672N) Total
 Angle : 0°-20°

34.5/19.9 kV, 3-PHASE
 CROSSARM CONSTRUCTION - DOUBLE LINE ARM

NOV. 1986

ZC9



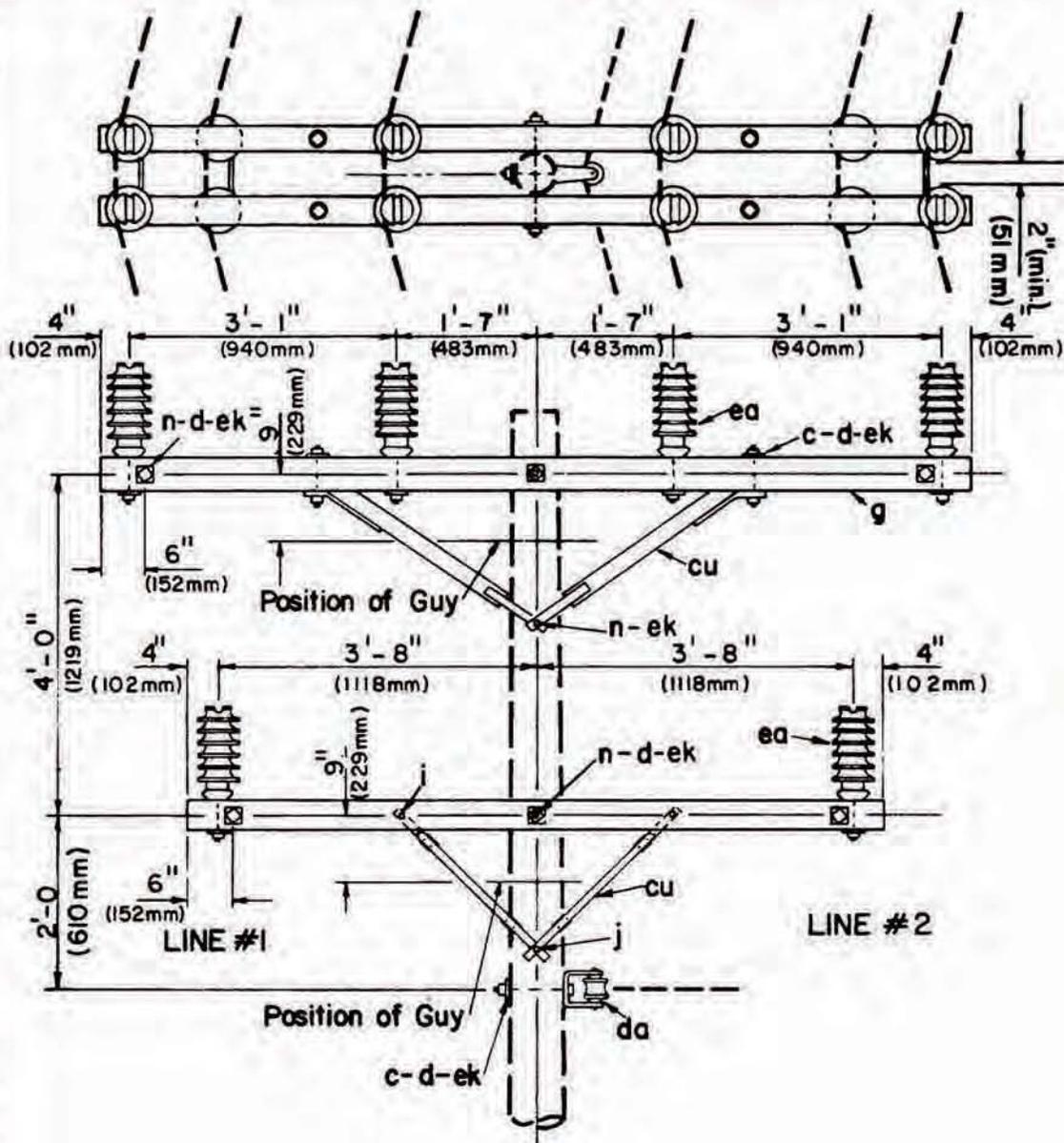
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 3	Bolt, machine, 5/8" x req'd length	j 1	Screw, lag, 1/2" x 4"
c 2	Bolt, machine, 1/2" x req'd length	bs 1	Bolt, single upset
d 6	Washer, square, 2 1/4"	cu 1	Brace, wood, 60" span
d 2	Washer, 1 3/8" diam.	cu 2	Brace, wood, 28"
g 1	Crossarm, 3 5/8" x 4 5/8" x 10'-0"	cm 1	Insulator, spool
g 1	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	ea 6	Insulator, post type
l 2	Bolt, carriage, 3/8" x 4 1/2"	ek	Locknut, as req'd

Maximum Transverse
Load: 750 lbs. (3336 N)
Angle: 0°-5°

34.5/19.9 kV, 3-PHASE
CROSSARM CONSTRUCTION-DOUBLE CIRCUIT
SINGLE PRIMARY SUPPORT

NOV. 1986

ZDC-C1



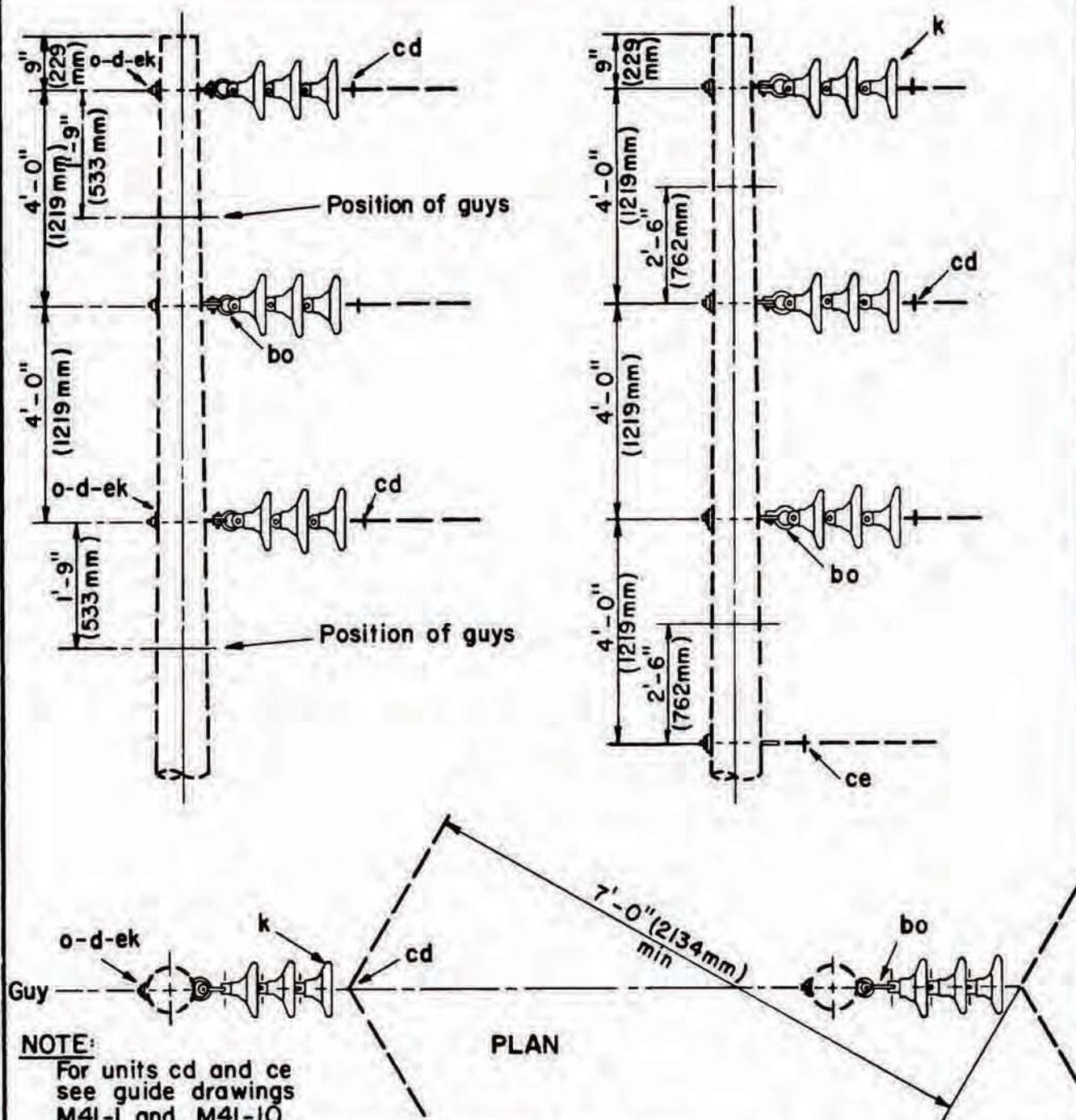
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 1	Bolt, machine, 5/8" x req'd length	j 2	Screw, lag, 1/2" x 4"
c 4	Bolt, machine, 1/2" x req'd length	n 7	Bolt, double arming, 5/8" x req'd length
d 21	Washer, square, 2 1/4"	cu 4	Brace, wood 28"
d 4	Washer, round, 1 3/8"	cu 2	Brace, wood, 60" span
g 2	Crossarm, 3 5/8" x 4 5/8" x 10'-0"	da 1	Bracket, insulated
g 2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	ea 12	Insulator, post type
i 4	Bolt, carriage, 3/8" x 4 1/2"	ek	Locknuts

Maximum Transverse
Load: 750 lbs.(3336N)/Insulator
1500 lbs.(6672N) Total
Angle: 5° - 20°

34.5/199 kV 3-PHASE
CROSSARM CONSTRUCTION - DOUBLE CIRCUIT

NOV. 1986

ZDC-C2-1



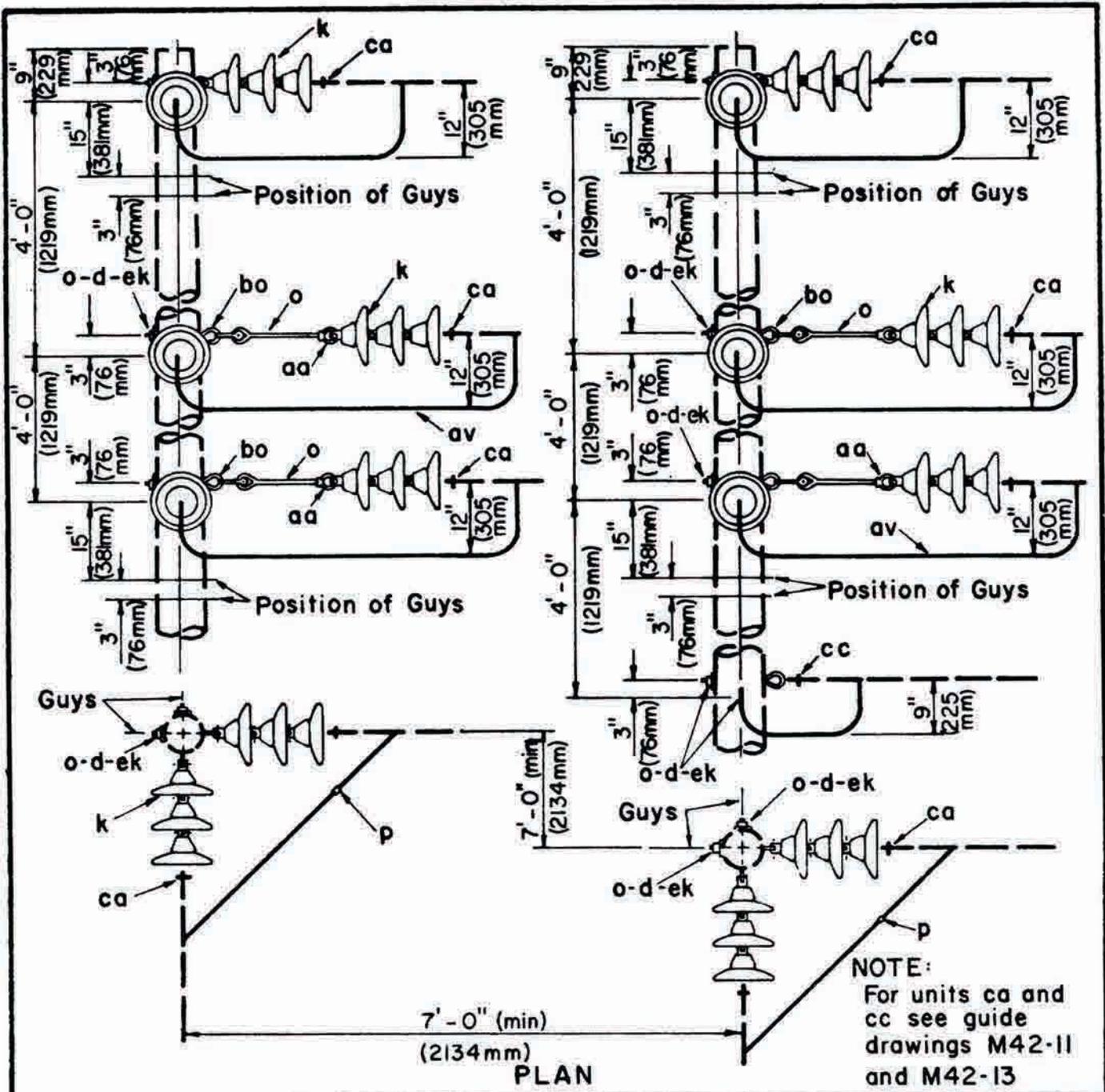
NOTE:
 For units cd and ce
 see guide drawings
 M41-1 and M41-10.

ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
d	6	Washer, square, 2 1/4"	cd	6	Angle assembly, primary
k	18	Insulator, suspension, 10"	ce	1	Angle assembly, neutral
o	6	Bolt eye 5/8" x req'd	ek		Locknuts as req'd
bo	6	Shackle, anchor			

Angle: 20°-60°

**34.5/19.9 kV, 3-PHASE
 VERTICAL CONSTRUCTION DOUBLE CIRCUIT**

NOV. 1986		ZDC-C3
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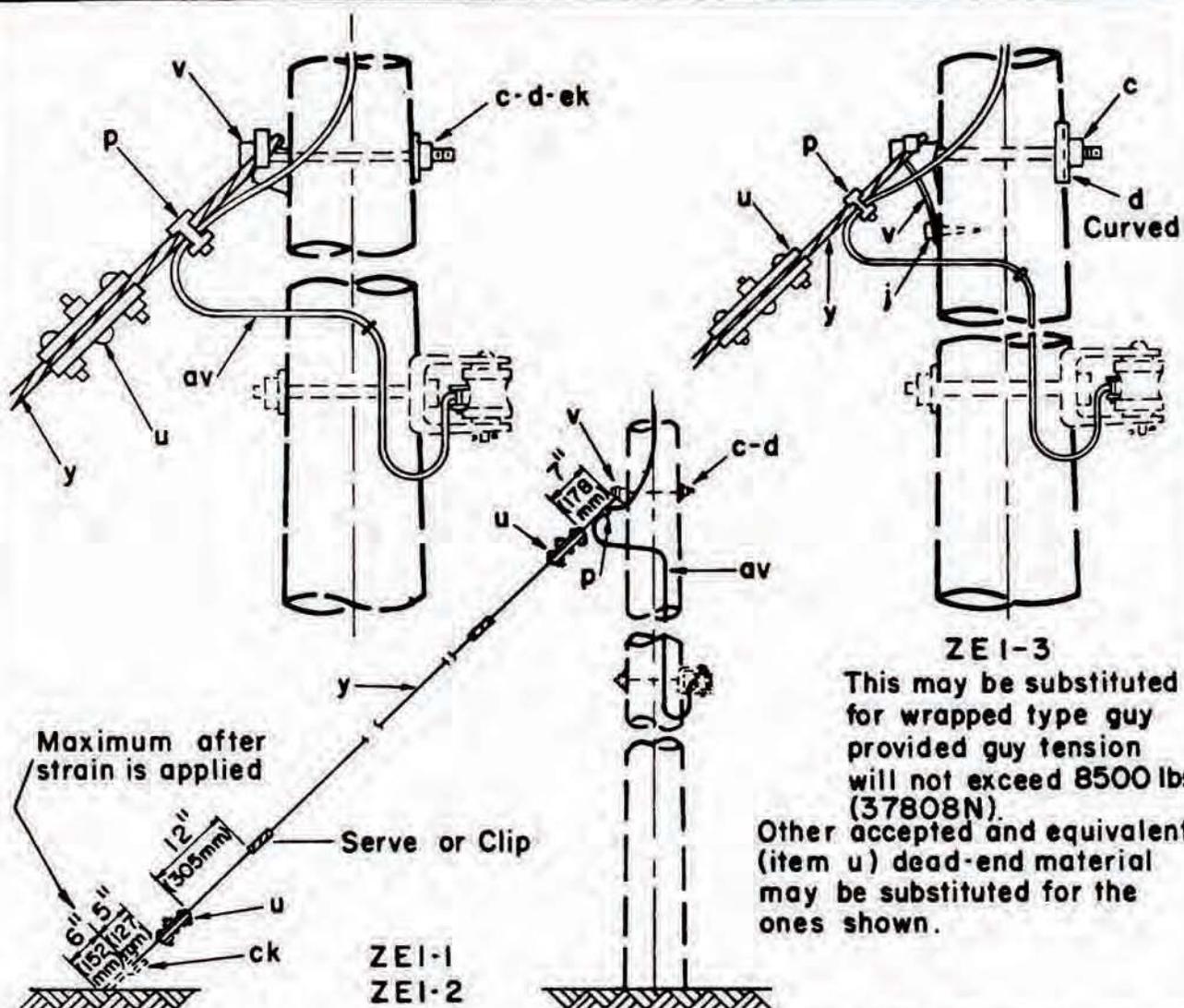


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
d 14	Washer, square, 2 1/4"	av	Jumpers, as req'd
k 36	Insulator, suspension, 10"	bo 8	Shackle, anchor
o 22	Bolt, eye 5/8" x req'd length	ca 12	Deadend assembly, primary
p	Connectors, as req'd	cc 2	Deadend assembly, neutral
aa 8	Nut, eye, 5/8"	ek	Locknuts, as req'd

Angle : 60°-90°

34.5/19.9 kV, 3-PHASE, DOUBLE CIRCUIT VERTICAL CONSTRUCTION

NOV. 1986 ZDC-C4-1



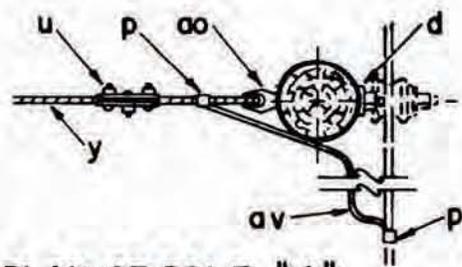
ZEI-3
 This may be substituted for wrapped type guy provided guy tension will not exceed 8500 lbs. (37808N).
 Other accepted and equivalent (item u) dead-end material may be substituted for the ones shown.

ASSEMBLY UNIT			
	ZEI-1 1/4" Guy Wire	ZEI-2 3/8" Guy Wire	ZEI-3 7/16" Guy Wire
ITEM	NO REQ'D.	NO REQ'D.	NO REQ'D.
c	1	1	1
d	1	1	
d			1
j			1
p			
u	2-Light Duty	2-Heavy Duty	2-Heavy Duty
v	1	1	1-Heavy Duty
y	req'd length	req'd length	req'd length
av	1	1	1
ck	1	1	1
ek			

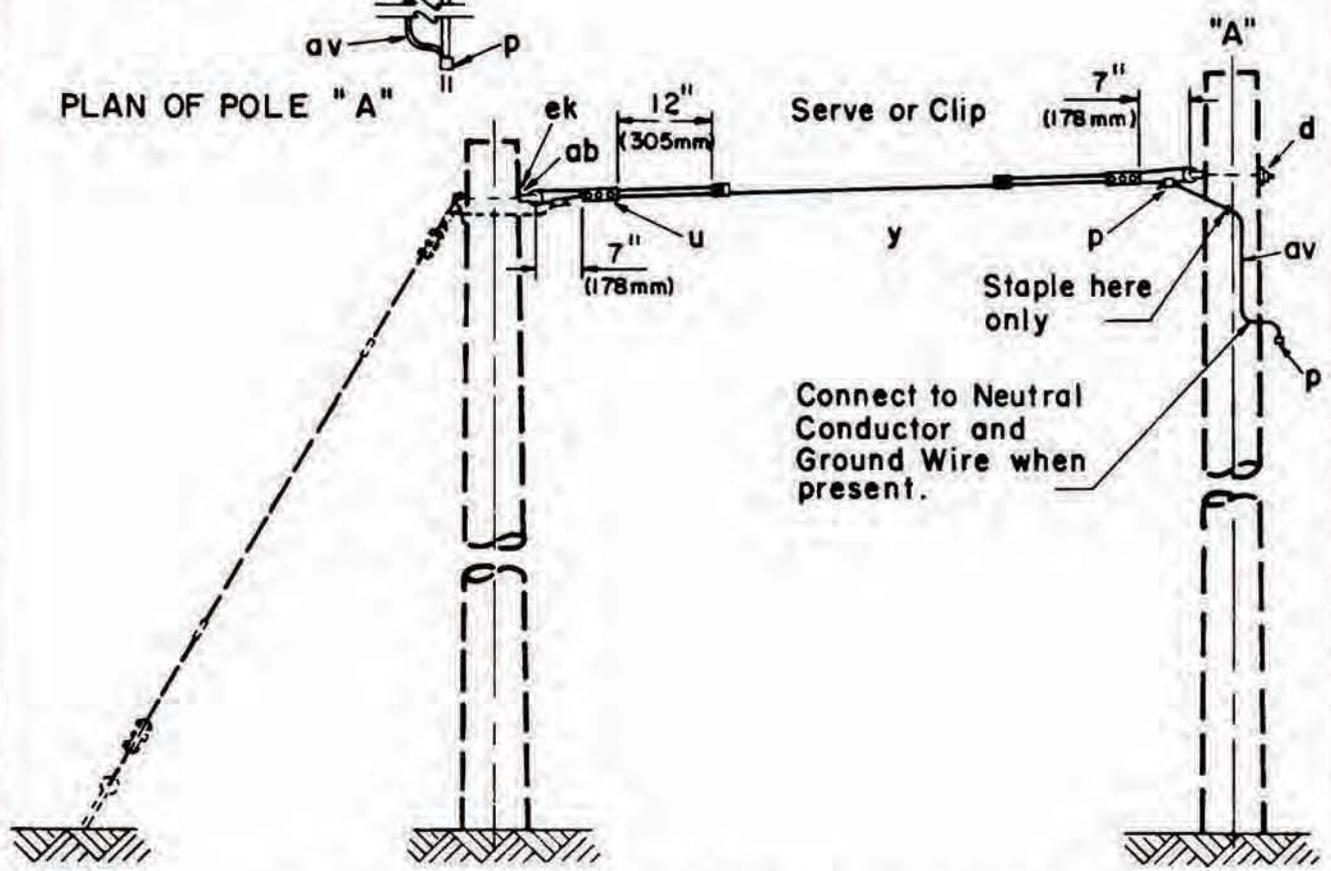
34.5 / 19.9 kV
 SINGLE DOWN GUY, THROUGH BOLT TYPE

NOV. 1986

ZEI-1, ZEI-2, ZEI-3



PLAN OF POLE "A"



NOTE :

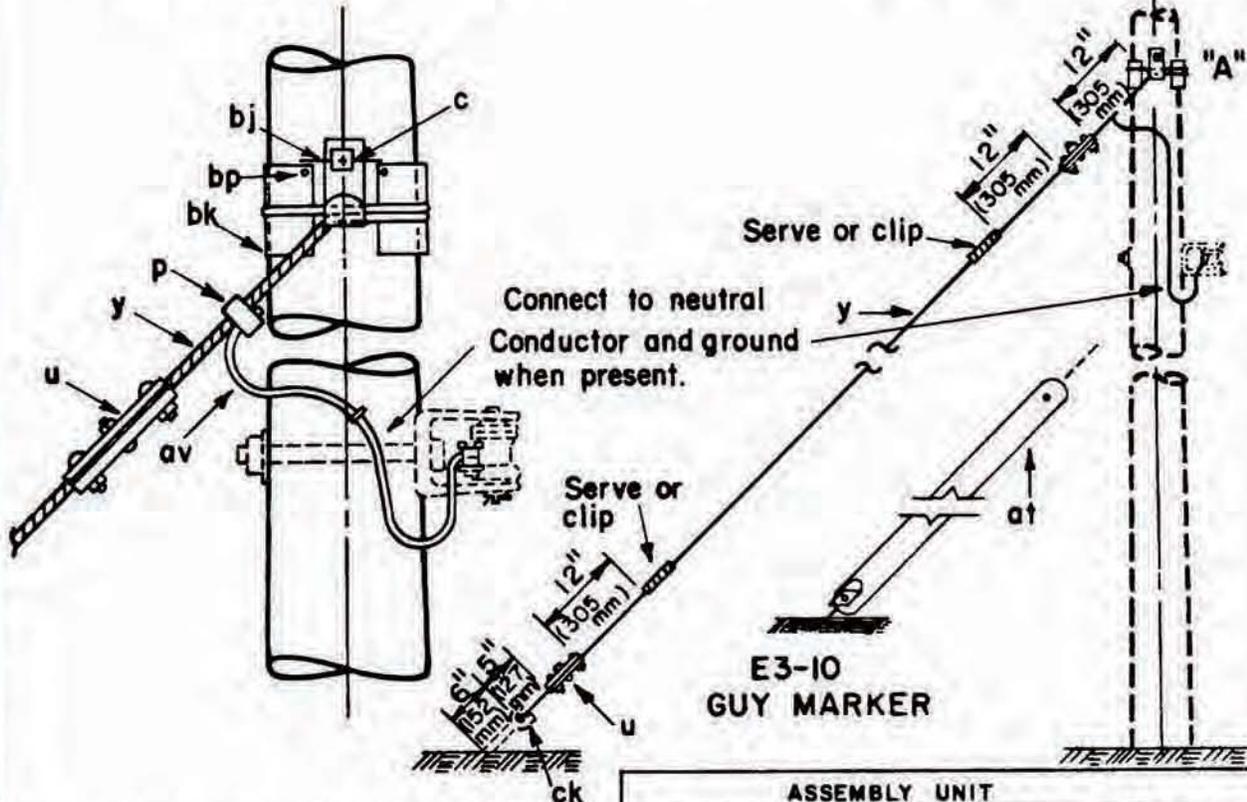
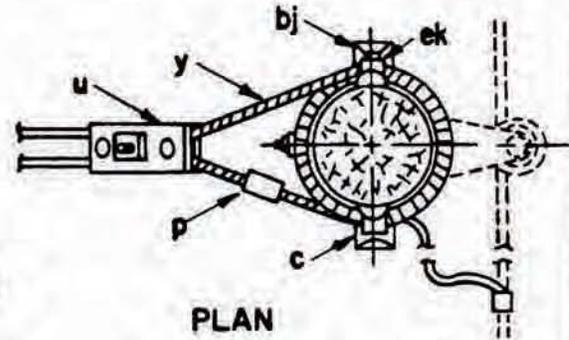
Other accepted and equivalent items of deadend material may be substituted for the 3-bolt clamp shown.

ITEM	MATERIAL	ASSEMBLY UNIT		
		E2-1 1/4" Guy Wire	E2-2 3/8" Guy Wire	E2-3 7/16" Guy Wire
d	Washer, square 2 1/4"	1		
d	Washer, round 3"		1	1
u	Deadend for guy strand	2-Light Duty	2-Heavy Duty	2-Heavy Duty
y	Guy wire, S.M. 7-strand	req'd length	req'd length	req'd length
ab	Nut, thimble type eye, 5/8"	1	1	1
ao	Bolt, thimble type, 5/8"	1	1	1
av	Jumpers, no. 4 stranded, Al. alloy or equiv.	1	1	1
p	Connectors, as req'd			
ek	Locknuts as req'd			

34.5/19.9 kV
SINGLE OVERHEAD GUY, THROUGH BOLT TYPE

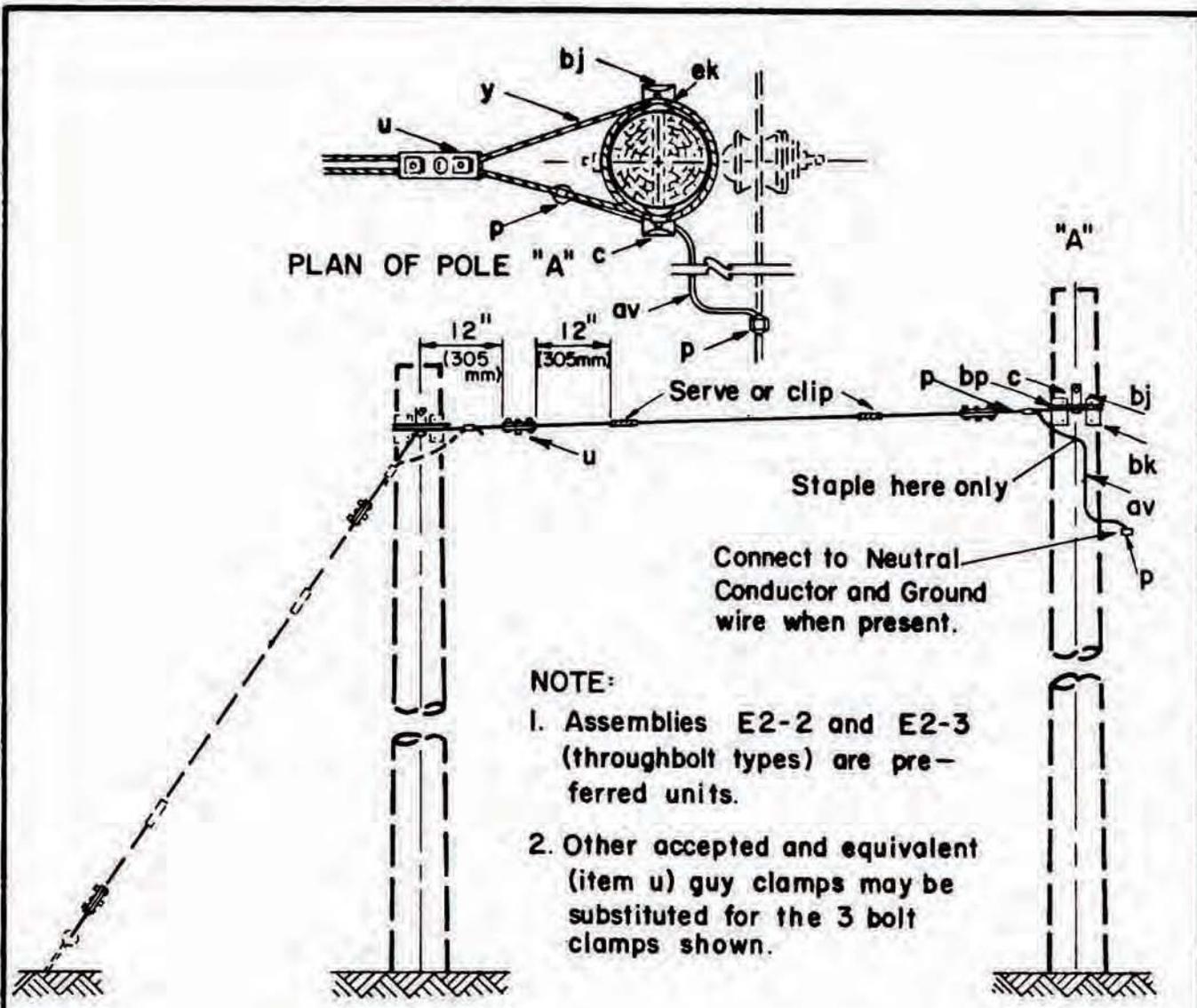
NOTES:

1. Other accepted and equivalent (item u) guy clamps may be substituted for the 3-bolt clamps shown.
2. Assemblies E1-2 and E1-3 (throughbolt type) are preferred units.



See guide drawings M30-1 and M30-2.

ITEM	MATERIAL	ASSEMBLY UNIT		
		E3-2 3/8" Guy Wire	E3-3 7/16" Guy Wire	E3-10 Guy Marker
		No. REQ'D	No. REQ'D	
c	Bolt, machine, 5/8" x req'd length	1	1	
p	Connectors, as req'd			
u	Clamp, guy	2-Heavy Duty	2-Heavy Duty	
y	Guy Wire, S-M, 7-strand	req'd length	req'd length	
av	Jumper, no. 4 stranded Al alloy or equiv.			
at	Guy marker, 8'-0" min. length			1
bj	Guy Hook, J	2	2	
bk	Guy Plate, 4" x 8", 14 gauge	2	2	
bp	Nail, 6 penny, galv.	8	8	
ck	Clamp, anchor rod bonding	1	1	
ek	Locknuts as req'd			
		34.9/19.9 kV SINGLE DOWN GUY, WRAPPED TYPE		
		NOV. 1986	E3-2, E3-3, E3-10	



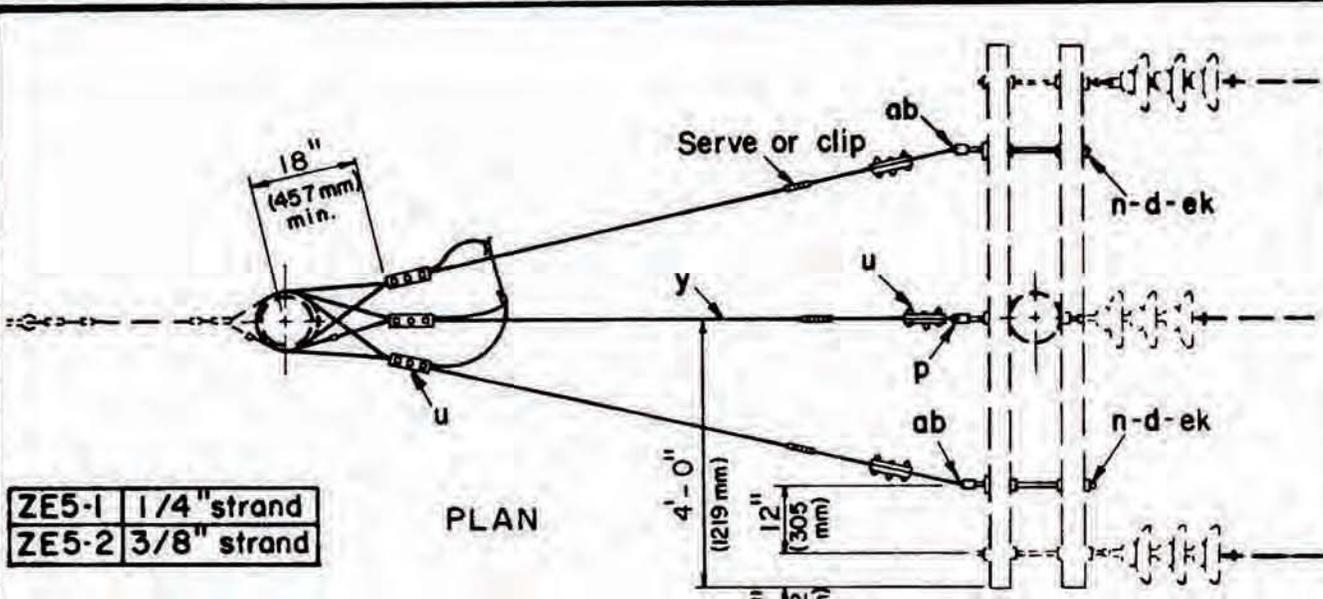
- NOTE:**
1. Assemblies E2-2 and E2-3 (throughbolt types) are preferred units.
 2. Other accepted and equivalent (item u) guy clamps may be substituted for the 3 bolt clamps shown.

		ASSEMBLY UNIT	
		E4-2 3/8" Guy Wire	E4-3 7/16" Guy Wire
ITEM	MATERIAL	No. REQ'D	No. REQ'D
c	Bolt, machine, 5/8" x req'd length	1	1
p	Connectors, as req'd		
u	Deadend for guy strand	2- Heavy Duty	2- Heavy Duty
y	Guy Wire, S M, 7 strand	req'd length	req'd length
av	Jumper, no. 4 stranded Al. alloy or equiv.	1	1
bj	Guy Hook, J	2	2
bk	Guy Plate 4" x 8", 14 gauge	2	2
bp	Nail, 8 penny, galv.	8	8
ek	Locknuts as req'd		

**34.5/19.9 kV
SINGLE OVERHEAD GUY WRAPPED TYPE**

NOV. 1986

E4-2, E4-3

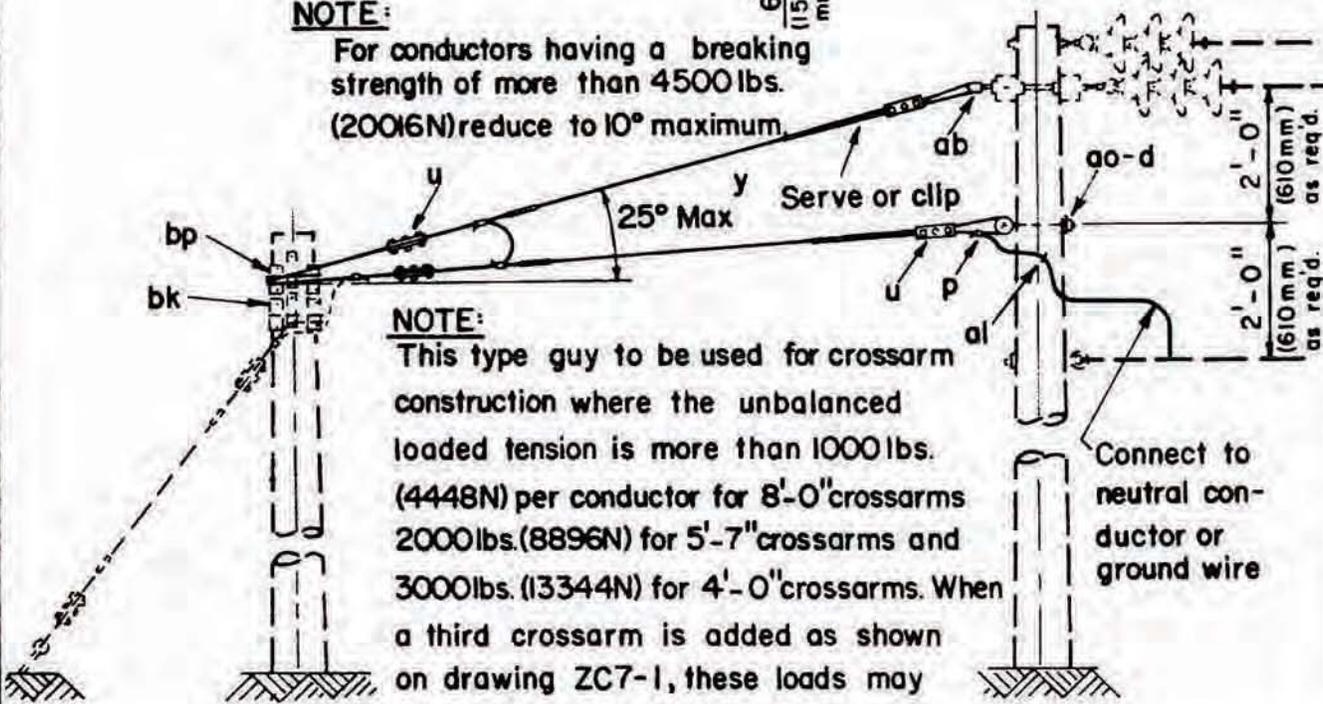


ZE5-1	1/4" strand
ZE5-2	3/8" strand

PLAN

NOTE:

For conductors having a breaking strength of more than 4500 lbs. (20016N) reduce to 10° maximum.



NOTE:

This type guy to be used for crossarm construction where the unbalanced loaded tension is more than 1000 lbs. (4448N) per conductor for 8'-0" crossarms 2000 lbs. (8896N) for 5'-7" crossarms and 3000 lbs. (13344N) for 4'-0" crossarms. When a third crossarm is added as shown on drawing ZC7-1, these loads may be increased by fifty percent.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 1	Bolt, machine, 5/8" x req'd length	al 1	Staple, ground wire
d 9	Washer, square, 2 1/4"	ao 1	Bolt, thimble type eye, 5/8" x req'd length
n 2	Bolt, double arming, 5/8" x req'd length	av	Jumper, no. 4 stranded Al. alloy or equiv.
p	Connectors as req'd	bj 2	Guy Hook, J
u 6	Deadend for guy strand	bk 2	Guy Plate, 4" x 8", 14 gauge
y	Wire, guy, S. M. 7 strand, as req'd	bp 8	Nail, 8 penny, galv.
ab 2	Nut, thimble type eye, 5/8"	ek	Locknuts as req'd

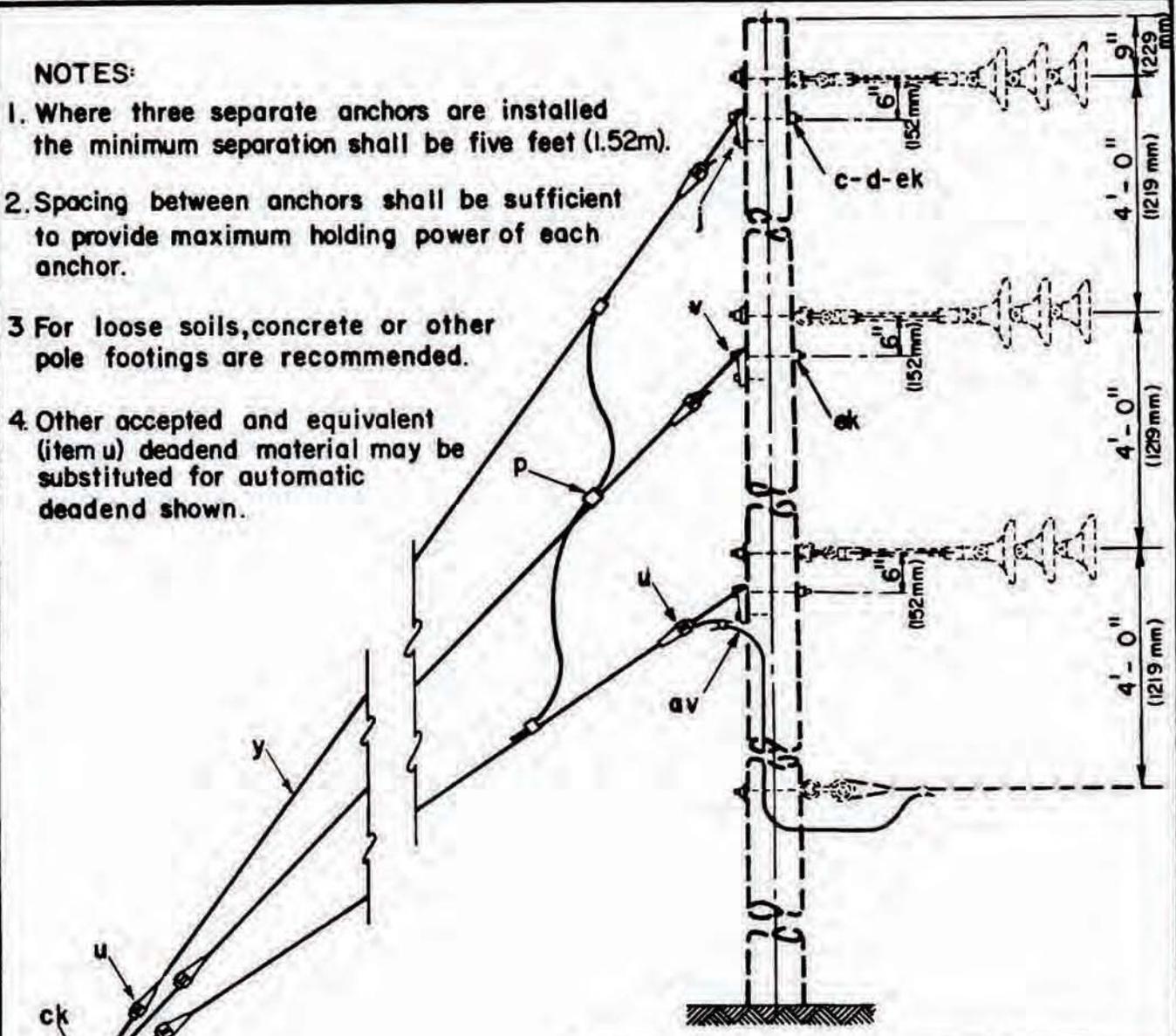
34.5/19.9 kV
DEADEND GUY
CROSSARM CONSTRUCTION

NOV. 1986

ZE5-1, ZE5-2

NOTES:

1. Where three separate anchors are installed the minimum separation shall be five feet (1.52m).
2. Spacing between anchors shall be sufficient to provide maximum holding power of each anchor.
- 3 For loose soils, concrete or other pole footings are recommended.
- 4 Other accepted and equivalent (item u) deadend material may be substituted for automatic deadend shown.



ITEM	MATERIAL	ASSEMBLY UNIT	
		ZE7-2L- 3/8" Guy Wire	ZE7-3L-7/16" Guy Wire
		No. Required	No. Required
c	Bolt, machine, 5/8" x req'd length	3	3
d	Washer, curved, 3" x 3" x 5/16"	3	3
j	Screw, lag, 1/2" x 4"	3	3
p	Connectors as req'd		
u	Deadend for guy strand	6	6
v	Guy attachment, mall iron, heavy duty	3	3
y	Guy wire, S.M., 7 Strand	req'd length	req'd length
av	Jumpers, No. 4 stranded Al. alloy or equiv.	as req'd	as req'd
ck	Clamp, guy bonding, as req'd		
ek	Locknuts as req'd		

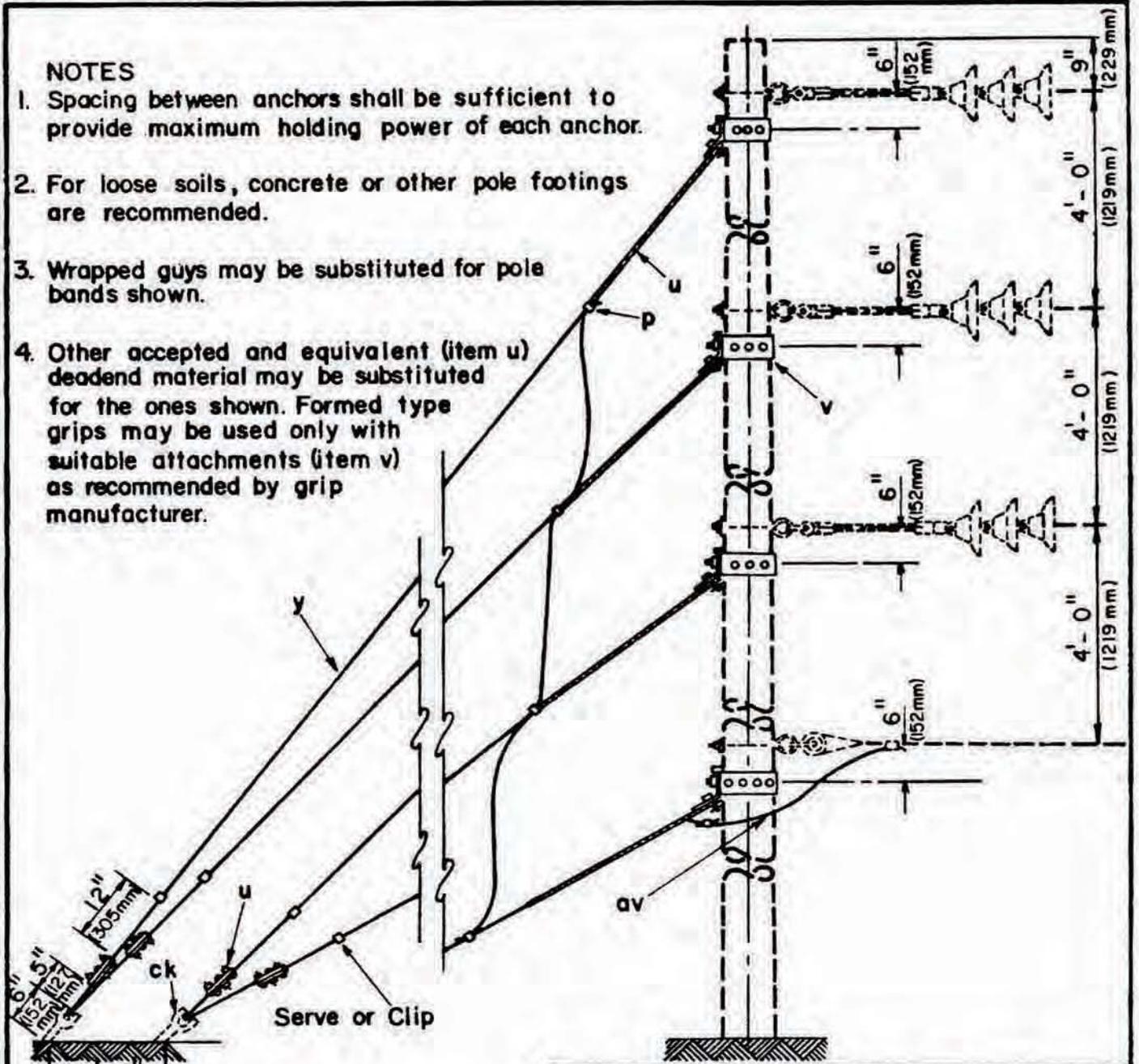
**34.5/19.9 kV- THREE DOWN GUYS
(LARGE CONDUCTORS)**

NOV. 1986

ZE7-2L, ZE7-3L

NOTES

1. Spacing between anchors shall be sufficient to provide maximum holding power of each anchor.
2. For loose soils, concrete or other pole footings are recommended.
3. Wrapped guys may be substituted for pole bands shown.
4. Other accepted and equivalent (item u) deadend material may be substituted for the ones shown. Formed type grips may be used only with suitable attachments (item v) as recommended by grip manufacturer.

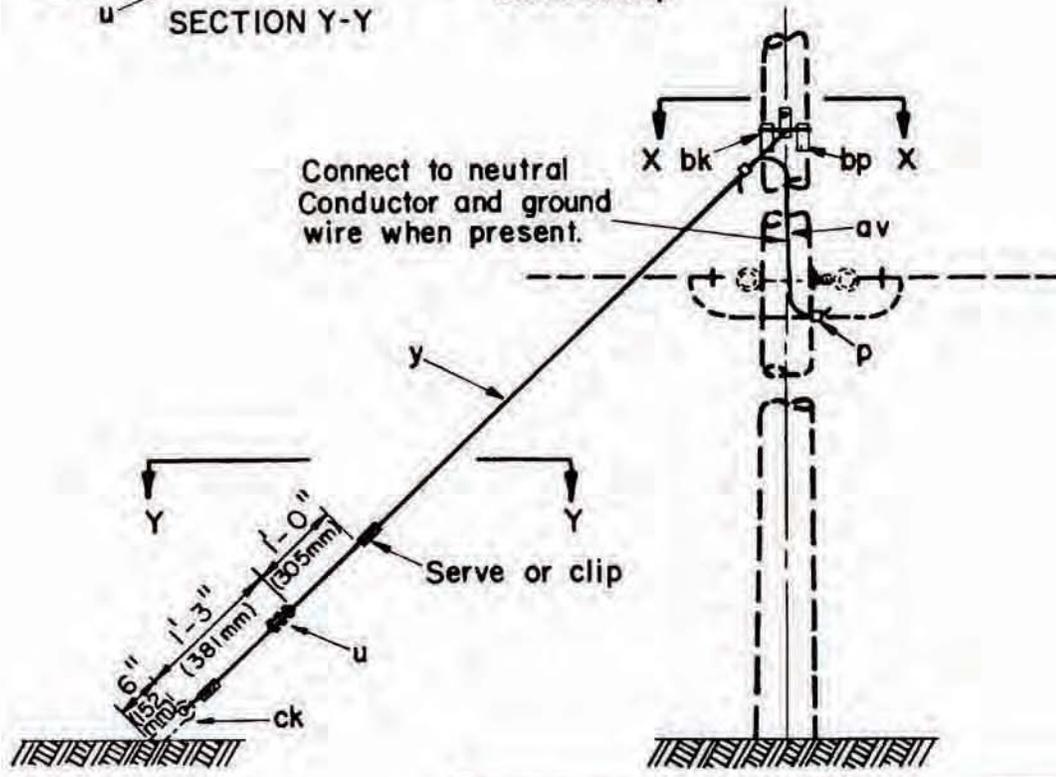
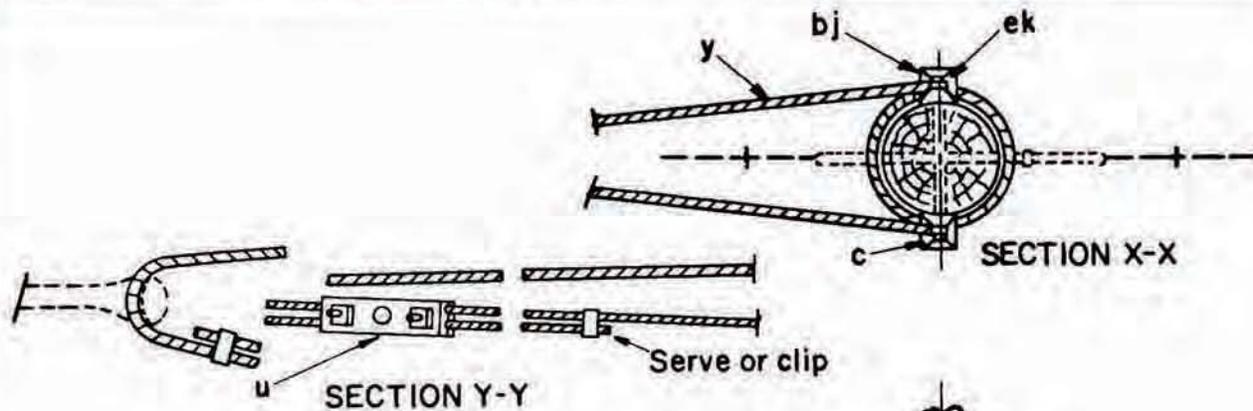


		ASSEMBLY UNIT	
		ZEB-2L- 3/8" Guy Wire	ZEB-3L- 7/16" Guy Wire
ITEM	MATERIAL	No. Req'd	No. Req'd
p	Connectors, as req'd		
u	Deadend for guy strand	8	8
v	Guy attachment, pole band type	4	4
y	Guy Wire, S.M.7 strand	req'd length	req'd length
av	Jumpers, No. 4 stranded Al. alloy or equiv.	as req'd	as req'd
ck	Clamp, guy bonding	2	2

34.5/19.9 kV
FOUR DOWN GUYS
(LARGE CONDUCTORS)

NOV. 1986

ZEB-2L, ZEB-3L

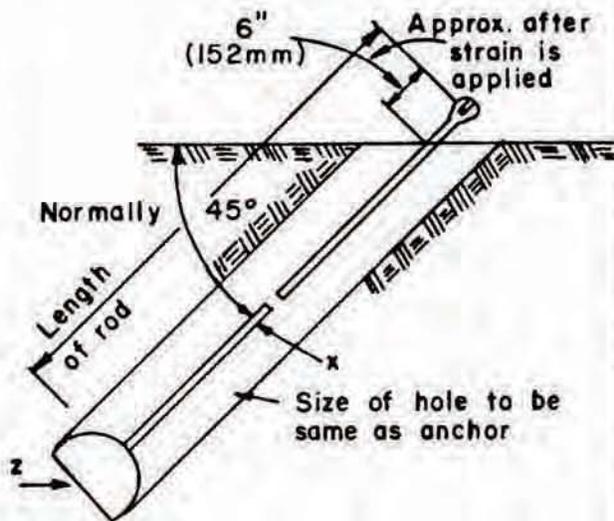


ASSEMBLY UNIT			
		E11 1/4" Guy Wire	E12 3/8" Guy Wire
ITEM	MATERIAL	No. Req'd	No. Req'd
c	Bolt, machine, 5/8" x req'd length	1	1
p	Connectors as req'd		
u	Clamp, guy	1- Light Duty	1- Heavy Duty
y	Guy Wire, S.M., 7 strand	Req'd length	Req'd length
av	Jumper, #4 stranded Al. alloy or equiv.		
bj	Guy hook, J	2	2
bk	Guy plate, 4" x 8", 14 gauge	2	2
bp	Nail, 8 penny, galv.	8	8
ck	Clamp, anchor rod bonding	1	1
ek	Locknuts as req'd		

345/19.9 kV
SINGLE LOOP GUY, WRAPPED TYPE

NOV. 1986

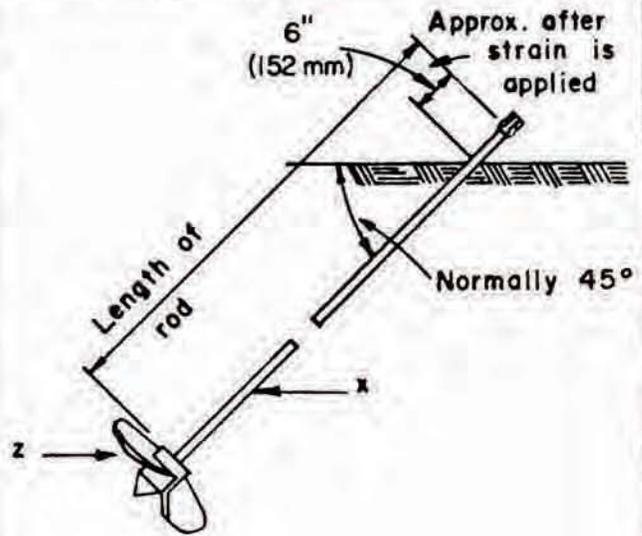
E11, E12



CONE

FI-1C, FI-2C, FI-3C

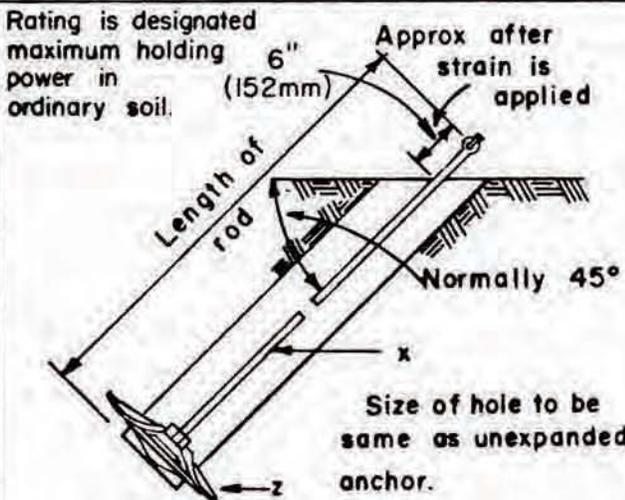
Rating is designated maximum holding power in hardpan and rocky soil.



SCREW

FI-1S, FI-2S, FI-3S, FI-4S

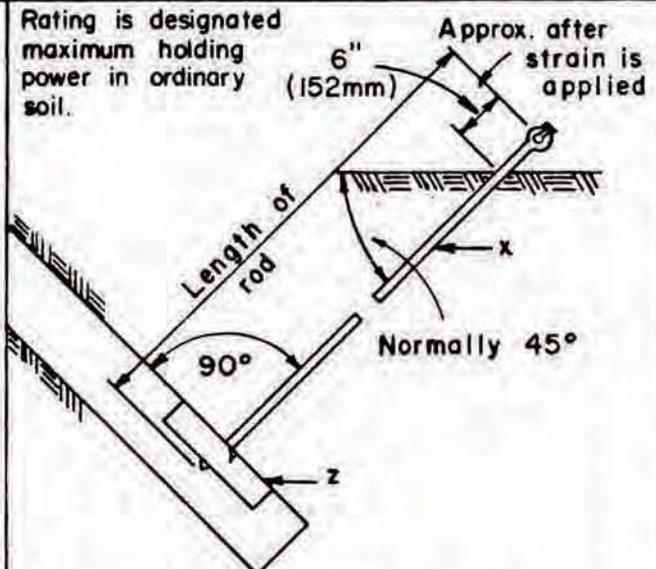
Rating is designated maximum holding power in ordinary soil.



EXPANDING

FI-1, FI-2, FI-3, FI-4

Note: Projection of anchor rods above earth may be increased to a max of 12" (305mm) in cultivated fields or other locations where necessary to prevent burying of the rod eye.



PLATE

FI-1P, FI-2P, FI-3P, FI-4P

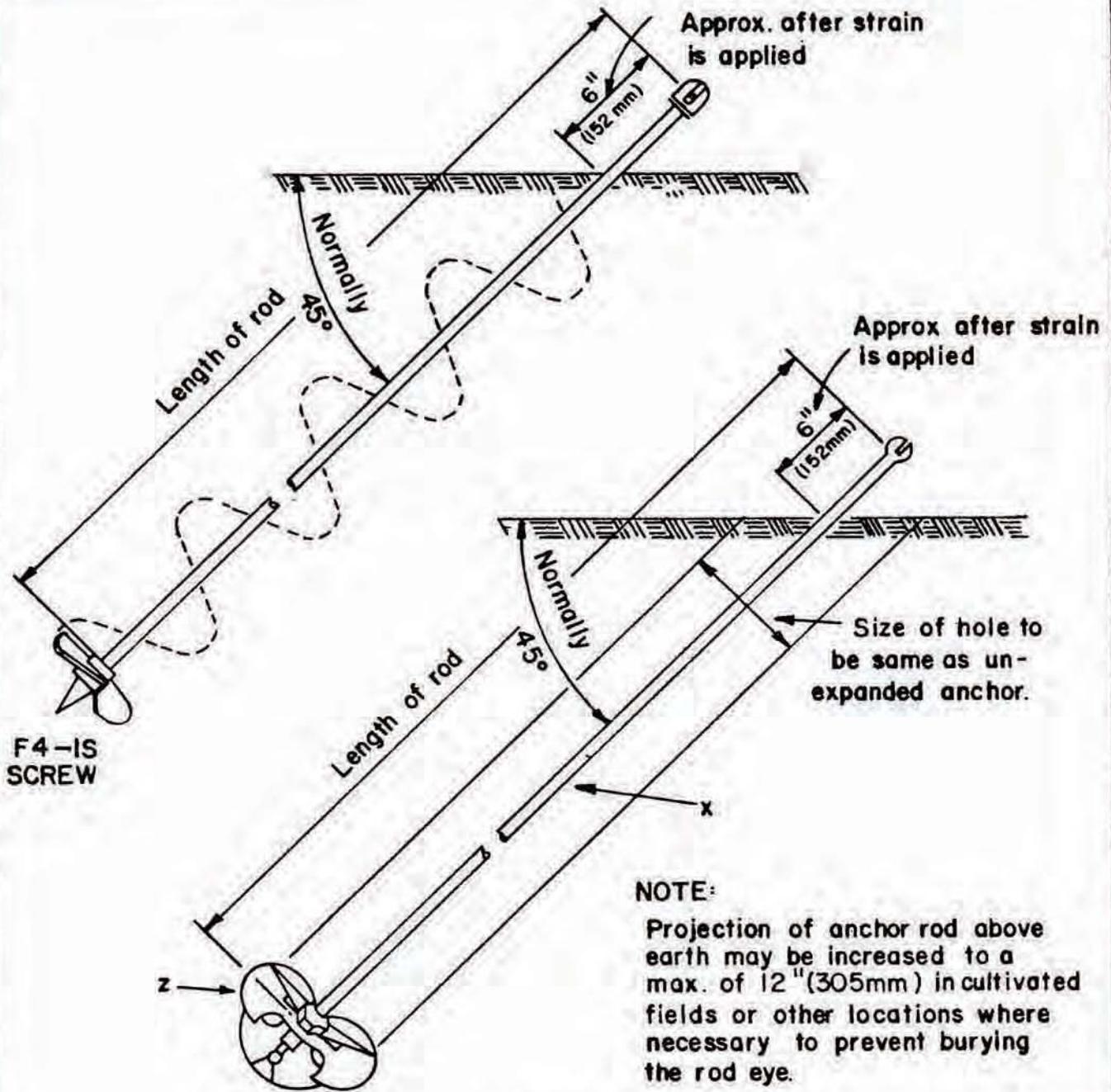
ASSEMBLY UNIT

	FI-1	FI-2	FI-3	FI-4
Holding Power in Ordinary Soil	Pounds	6000	8000	10000
	Newtons	26688	35584	44480
ITEM	MATERIAL	NO.	NO.	NO.
x	Rod, anchor, thimble eye	1 5/8"x7'-0"	1 5/8"x7'-0"	
x	Rod, anchor, twin eye		1 3/4"x8'-0"	1 3/4"x8'-0"
z	Anchor ----- type	1	1	1

LINE ANCHOR ASSEMBLIES

NOV. 1986

FI-1 TO 4

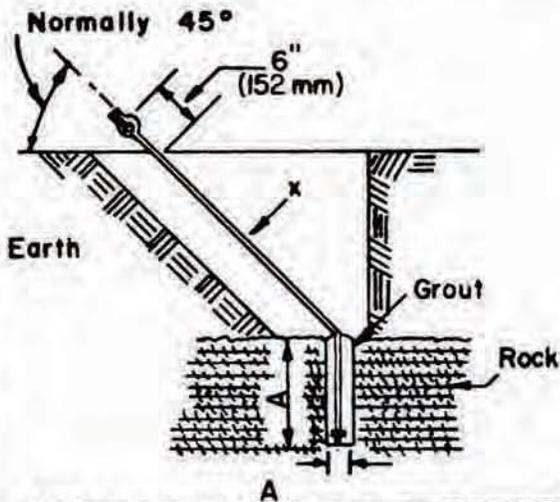


ITEM	MATERIAL	ASSEMBLY UNIT			
		F4-IS	F4-IE		
x	Rod, anchor, thimble type eye 5/8" x 6' - 0"		1	5/8" x 6' - 0"	
z	Anchor, service	1	1		
	Designated maximum holding power in sand	2500 # (1120 N)	2500 # (1120 N)		

SERVICE ANCHOR ASSEMBLY

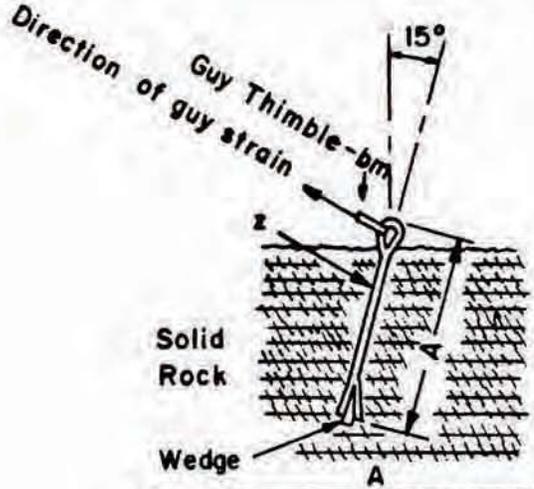
NOV. 1986

F4-1



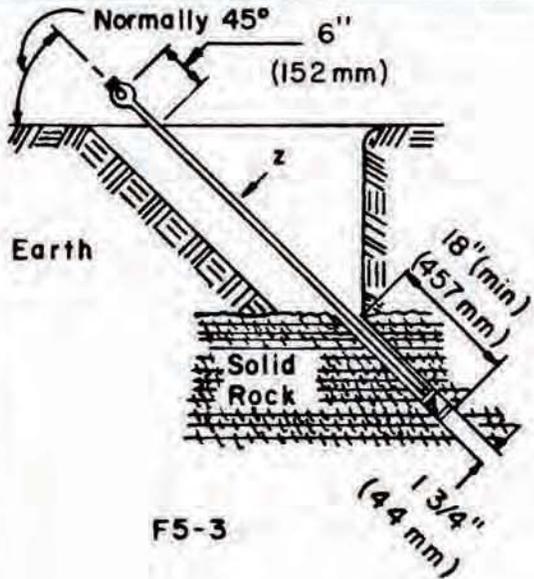
18" (457mm) min. for sound solid rock
 30" (762mm) min. for stratified rock

F5-1



Guy Bolt 18" (457 mm)
 Rock Anchor 15" (381 mm)

F5-2



F5-3

NOTES:

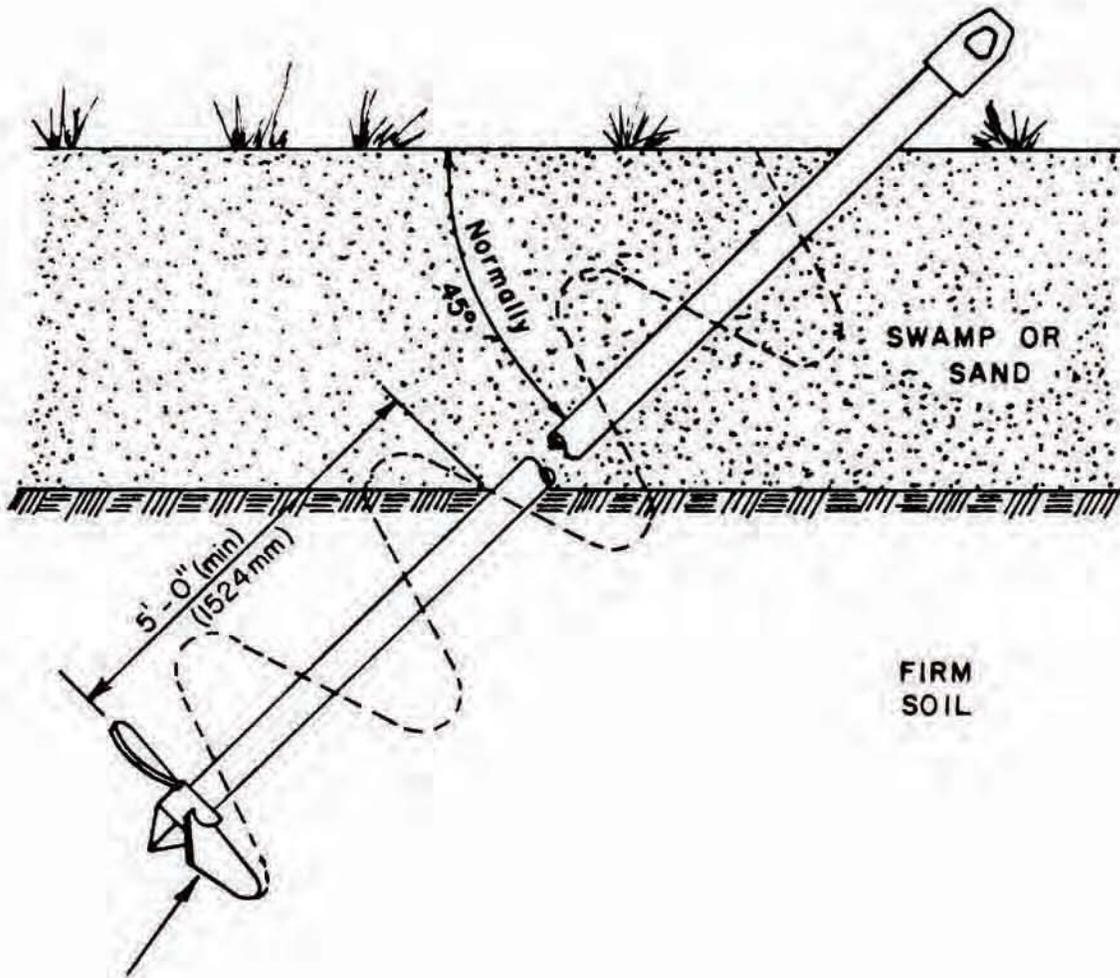
1. Only one guy shall be attached to a rock anchor. Where more than one guy is required space anchors 2 feet (610 mm) minimum and where practical they shall be in direct line with pole.
2. Do not anchor to any boulder which measures less than 5 feet (1524 mm) in two directions at right angles to each other.

ASSEMBLY UNIT

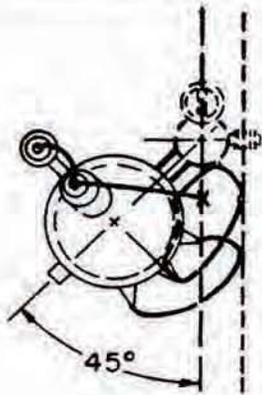
F5-1	F5-2	F5-3
No. REQ'D	No. REQ'D	No. REQ'D
1	1	1
	1	
	1	

ITEM	MATERIAL
x	Rod, anchor or thimble type eye
z	Anchor, rock
bm	Thimble, guy

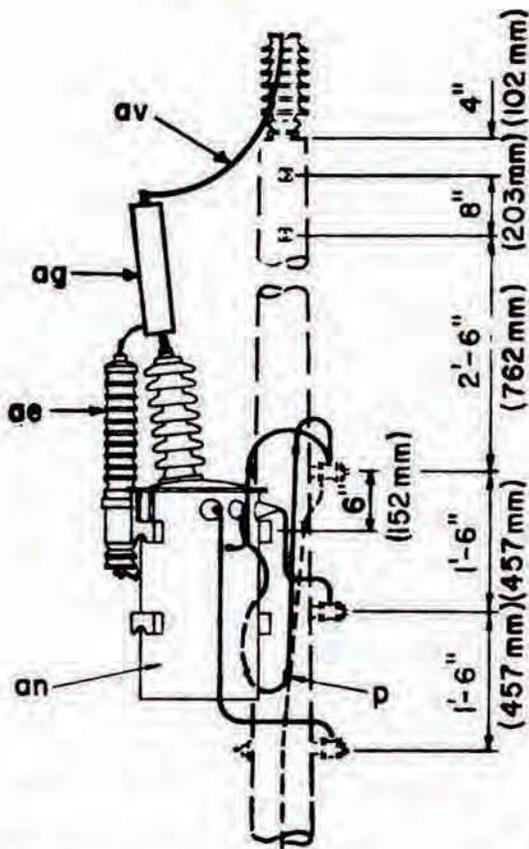
ROCK ANCHOR ASSEMBLIES



		ASSEMBLY UNIT							
		F6-1		F6-2		F6-3			
ITEM	MATERIAL	NO.	TYPE	NO.	TYPE	NO.	TYPE	NO.	TYPE
z	Anchor, swamp	1	10"	1	12"	1	15"		
	Designated maximum holding power		6000 # 26888N		8000 # 35984N		10000 # 44480N		
	Nut, thimble type eye	1		1		1			
	Pipe, galvanized, as req'd								
		SWAMP ANCHOR ASSEMBLY							
		NOV. 1986						F6-1, F6-2, F6-3	

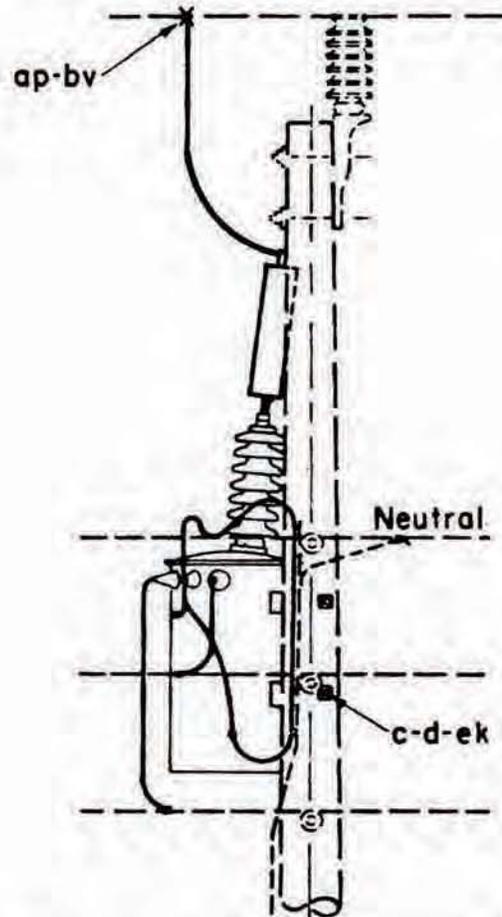


PLAN



NOTES:

1. See guide drawings for details of transformer secondary and service connections
2. Arresters must be connected directly to transformer bushing.
3. Current limiting fuse (item ag) to be used in locations where the available fault current exceeds 800A.

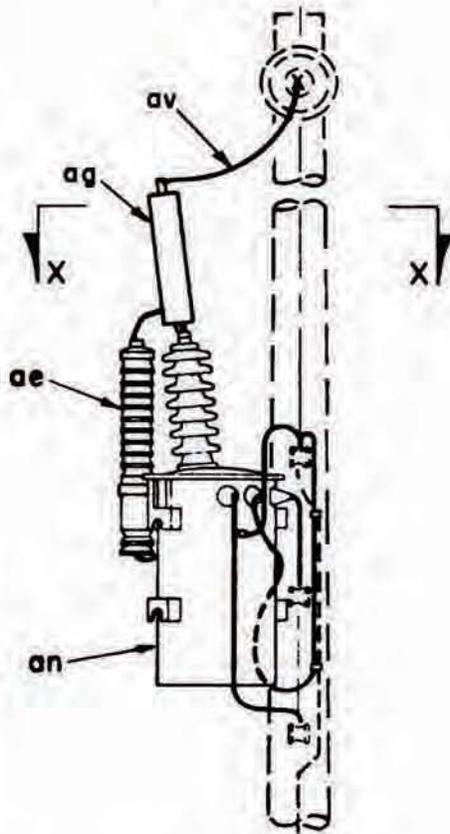
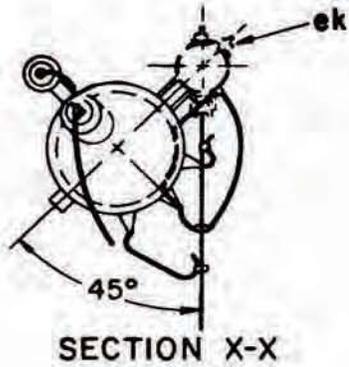


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 2	Bolt, machine, 5/8" x req'd length	ap 1	Clamp, hot line, tap assembly
d 2	Washer, square, 2 1/4"	av	Jumpers, stranded, as required
p	Connectors, as required	bv 1	Rods, armor
ae 1	Arrester, surge	ek	Locknuts as required
an 1	Transformer, CSP	ag 1	Fuse, current limiting

34.5/19.9 kV
SINGLE PHASE TRANSFORMER
AT I-PHASE TANGENT

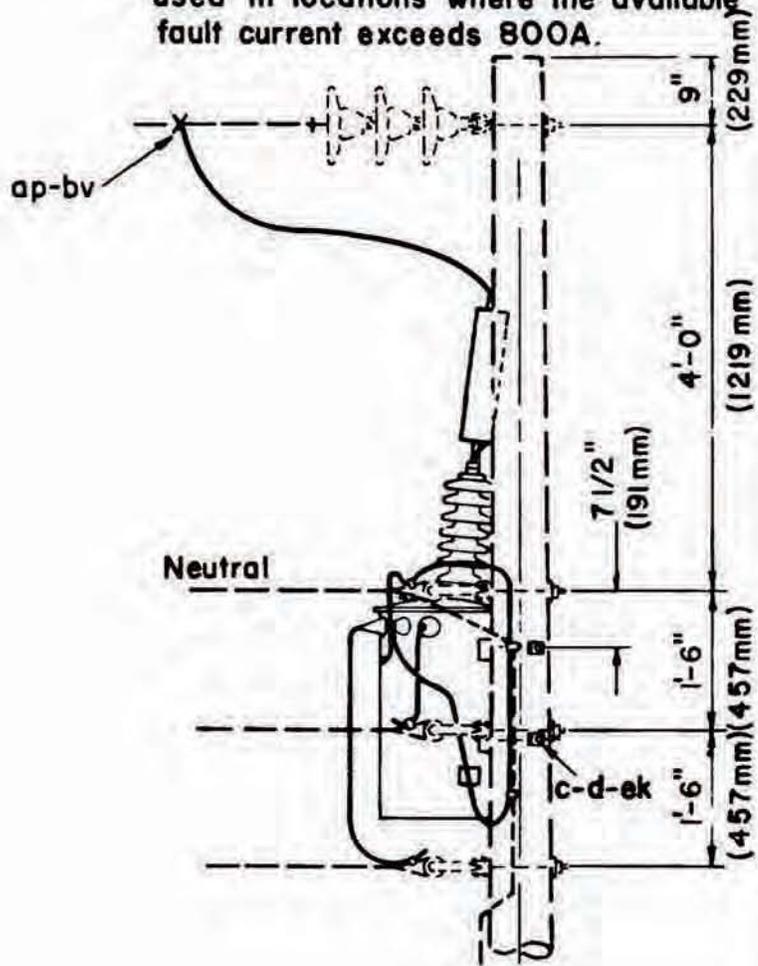
NOV. 1986

ZG105



NOTES:

1. See guide drawings for details of transformer secondary and service connections
2. Arresters must be connected directly to transformer bushing.
3. Current limiting fuse (item ag) to be used in locations where the available fault current exceeds 800A.

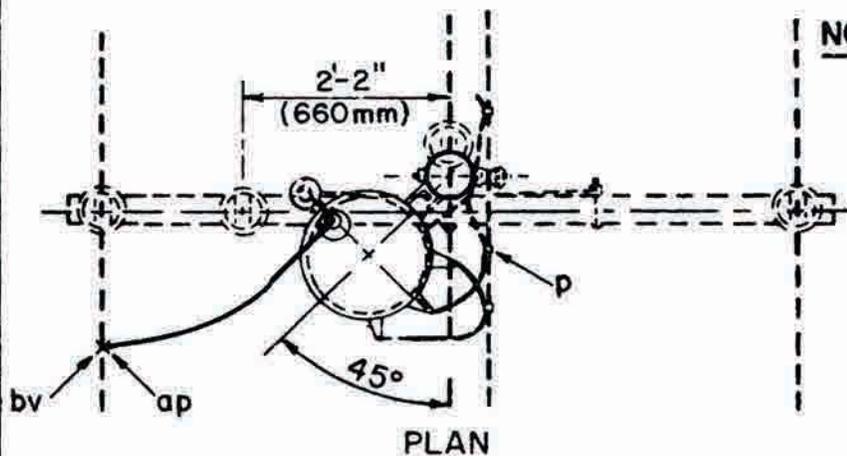


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 2	Bolt machine 5/8" x req'd length	ap 1	Clamp, hot line tap, assembly
d 2	Washer, square 2 1/4"	av	Jumpers, stranded, as req'd
p	Connectors, as req'd	bv 1	Rods, armor
ae 1	Arrester, surge	ek	Locknuts as req'd
an 1	Transformer, CSP	ag 1	Fuse, current limiting

**34.5/19.9 kV
SINGLE PHASE TRANSFORMER
AT DEADEND**

NOV. 1986

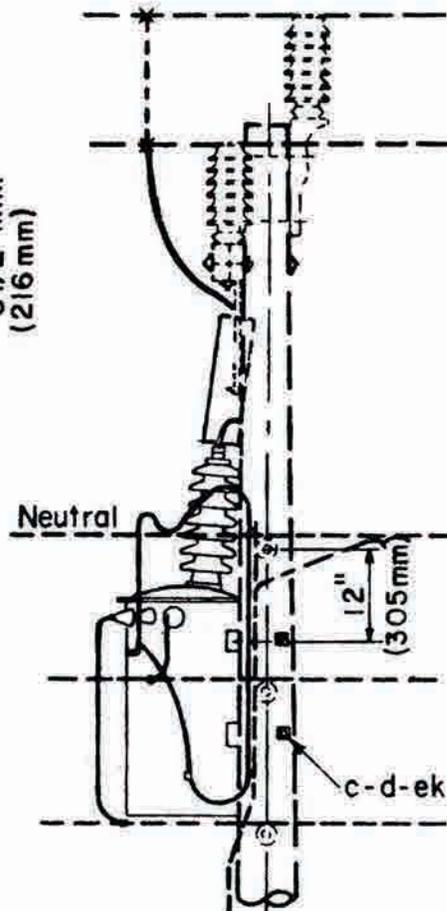
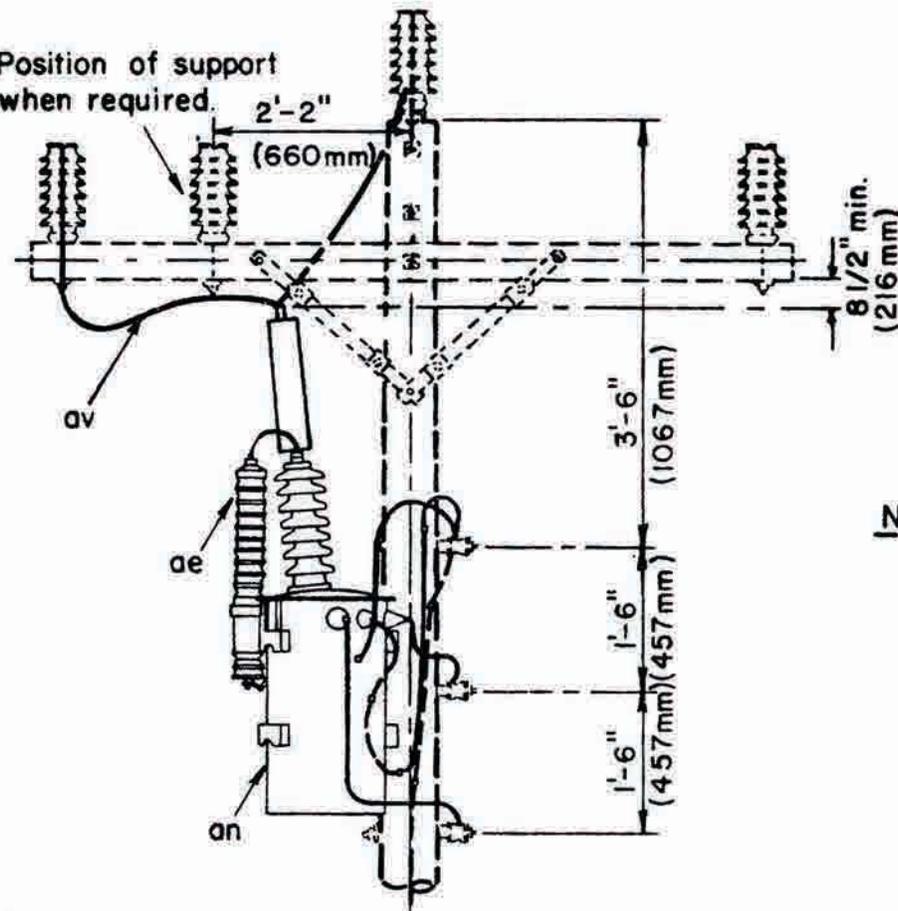
ZG 106



NOTES:

1. See guide drawings for details of transformer and service connections.
2. Reverse for connection to other outside phase.
3. Current limiting fuse (item ag) to be used in locations where the available fault current exceeds 800A.

Position of support when required.



ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 2	Bolt, machine, 5/8" x req'd length	an 1	Transformer, CSP
d 2	Washer, square 2 1/4"	ap 1	Clamp, hot line, tap assembly
p	Connectors as required	av 1	Jumpers, stranded, as required
ae 1	Surge arrester	bv 1	Rods, armor
ag 1	Fuse, current limiting	ek	Locknuts

**34.5/19.9 kV
SINGLE PHASE TRANSFORMER
ON THREE PHASE CIRCUIT**

NOV. 1986

ZG136

ITEM NO	MATERIAL
c	Bolt, machine, 5/8" x req'd length
c	Bolt, machine, 3/4" x req'd length
d	Washer, square, 2 1/4"
g	Crossarm, 3 3/8" x 4 5/8" x 8'-0"
i	Bolt, carriage, 3/8" x 4 1/2"
j	Screw, lag, 1/2" x 4"
k	Insulator, suspension, 10"
n	Bolt, double arming 5/8" x req'd length
o	Bolt, eye, 5/8" x req'd length
p	Connector, compression type
q	Connectors as required
aa	Nut, eye, 5/8"
ae	Arrestor, surge, 9 kV
af	Cutout, blade, 9 kV (G150 only)
av	Jumpers, stranded, as req'd
aw	Transformer, auto
bu	Connector, solder less
cc	Decend assembly, primary
cc	Decend assembly, neutral
cu	Brace, wood, 2x
ee	Insulator, post type, with 7" stud (G150 only)
eo	Insulator, post type, with 7" stud (35 kV) (ZG150 only)
ae	Arrestor, surge, 27 kV
af	Cutout, blade, 27 kV (ZG150 only)
ek	Locknuts as required
eg	Structural timber 4" x 10" x 6'-0"
	Fuse, current limiting

NOTES:

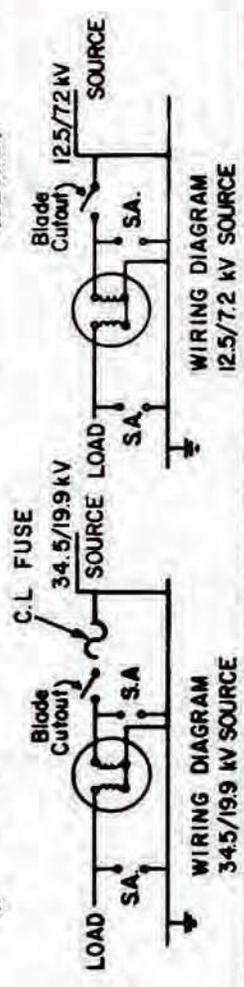
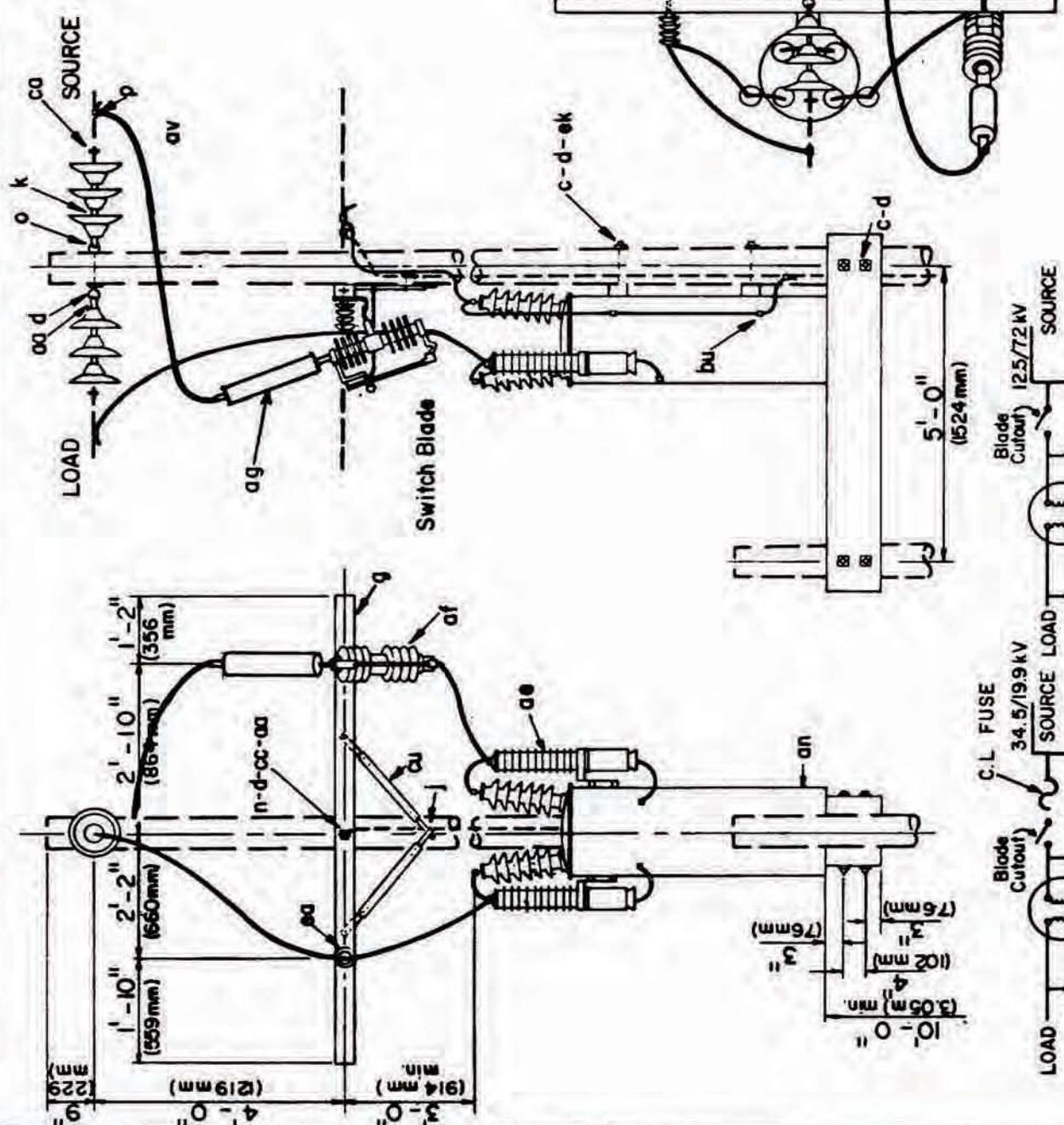
- All structural timbers to be treated per REA specification.
- Designate as G150 when 12.5/7.2 kV is the source and ZG150 when 34.5/19.9 kV is the source. Strike out items (af and ee) in material list which do not apply.
- For units cc and cc see guide drawings M42-11 and M42-13.
- Current limiting fuse (item ag) to be used in locations where the available fault current exceeds 800A. At the 34.5/19.9 kV source.

x Specify this item to be furnished by the transformer manufacturer.

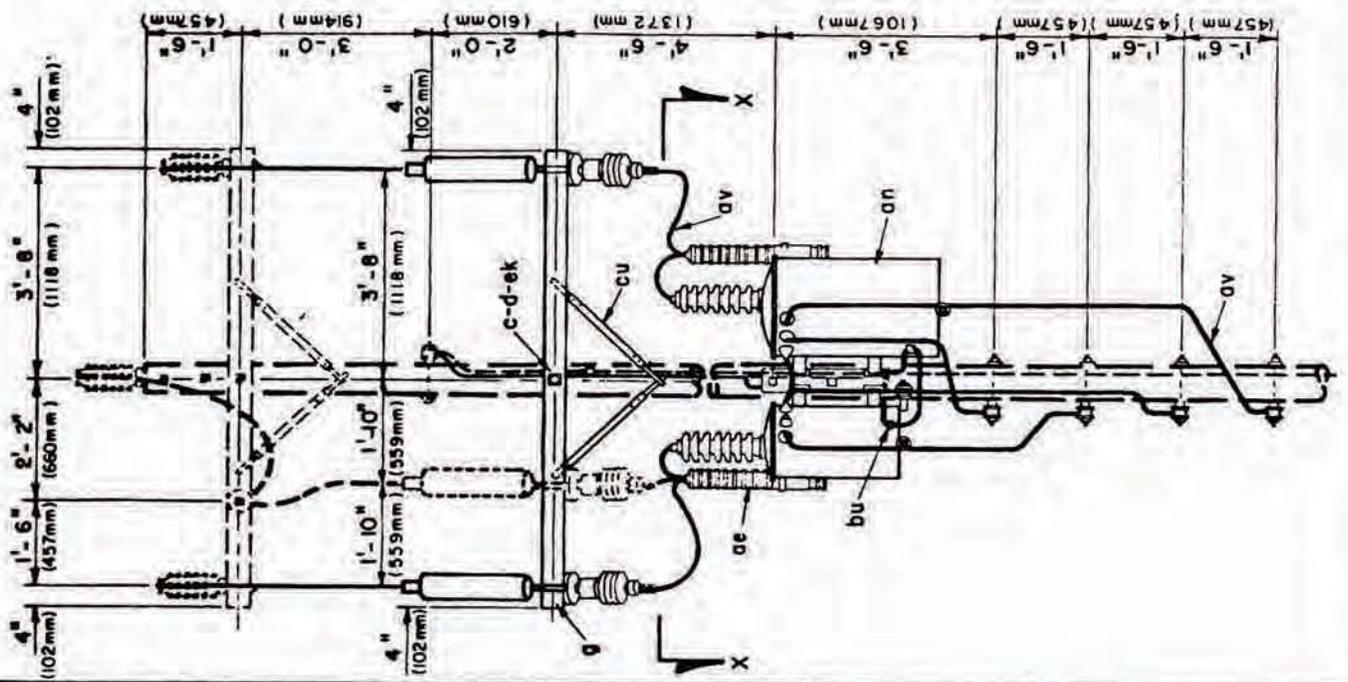
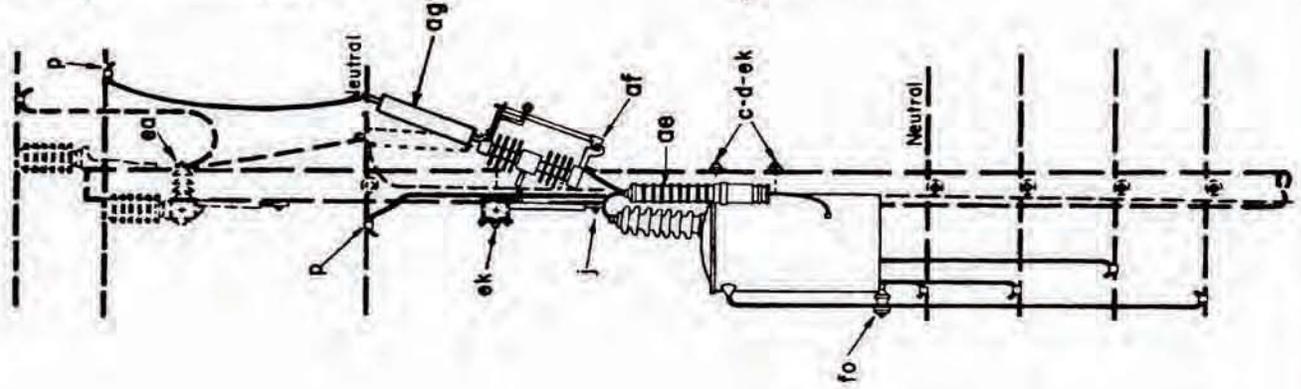
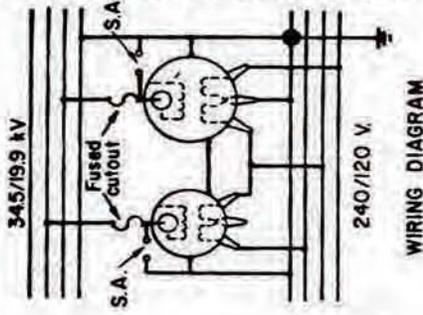
**34.5/199 kV - 12.5 / 7.2 kV
ONE STEP - UP/STEP-DOWN
TRANSFORMER**

NOV. 1986

G150.ZG150

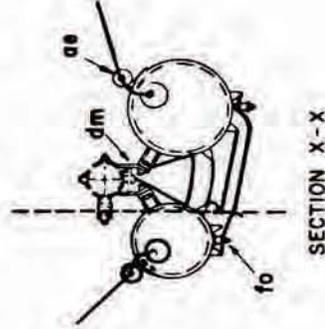


ITEM NO.	MATERIAL
0	Bolt, machine, 5/8" x req'd length
1	Washer, square, 2 1/4"
2	Greaserm, 3 5/8" x 1/2" x 1/2"
3	Bolt, carriage, 3/8" x 4 1/2"
4	Screw, lag, 1/2" x 4"
5	Connector, compression type
6	Connectors, as required
7	Transformer, conventional 25 kva max
8	Jumper, bars, stranded, as required
9	Surge arrester
10	Cutout
11	Brades, transformer
12	Insulator, post type, with 7" stud
13	Transformer, secondary bracket
14	Locknuts
15	Brace, wood, 2x4
16	Fuse, current limiting



Note:

Current limiting fuse (item ag) to be used in locations where the available fault current exceeds 800A.



345/19.9 kV

TWO TRANSFORMERS, CLUSTER MOUNTED
OPEN WYE - OPEN DELTA
SINGLE PHASE AND THREE PHASE POWER LOAD

NOV. 1986

ZG210

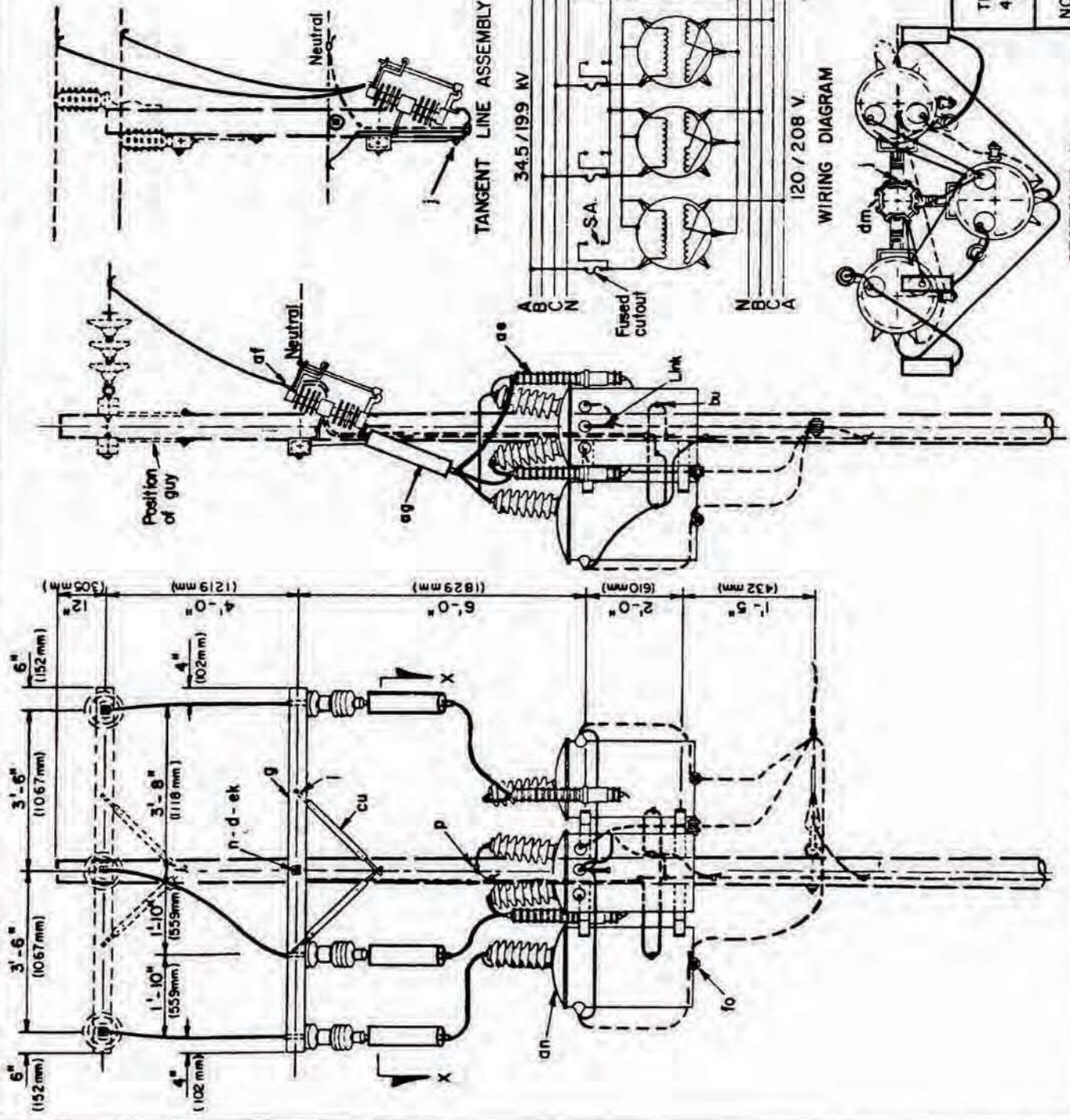
ITEM NO	MATERIAL
d	Washer, square, 2 1/4"
g	Crossarm 3 5/8 x 4 5/8 x 8 - 0"
i	Bolt, carriage 3/8" x 1/2"
j	Screw, lag 1/2" x 4" as reqd
n	Bolt, double arming, 5/8" x reqd length
p	Connector, compression type
pe	Connectors, as required
ae	Surge arrester
af	Cutout
an	Transformer, 100 kVA max
av	Jumper, secondary, weatherproof
av	Jumper, bare, stranded as reqd
bu	Connector, solderless
cu	Brace, wood 2x8"
dm	Bracket, transformer, cluster and adapter plates as required
ek	Locknuts
fo	Transformer secondary bracket
	insulated
eg	Link, grounding
eg	Fuse, current limiting

* Specify these items to be furnished by the manufacturer.

NOTES:

- 1 For transformers 75 kVA and larger use two cluster brackets
- 2 Single bushing transformers may be used if desired
- 3 Re-connect internal windings of secondary as shown
- 4 For metering, see drawing M8-11.
- 5 Current limiting fuse (item eg) to be used in locations where the available fault current exceeds 800A.

Primary and secondary neutrals must be interconnected

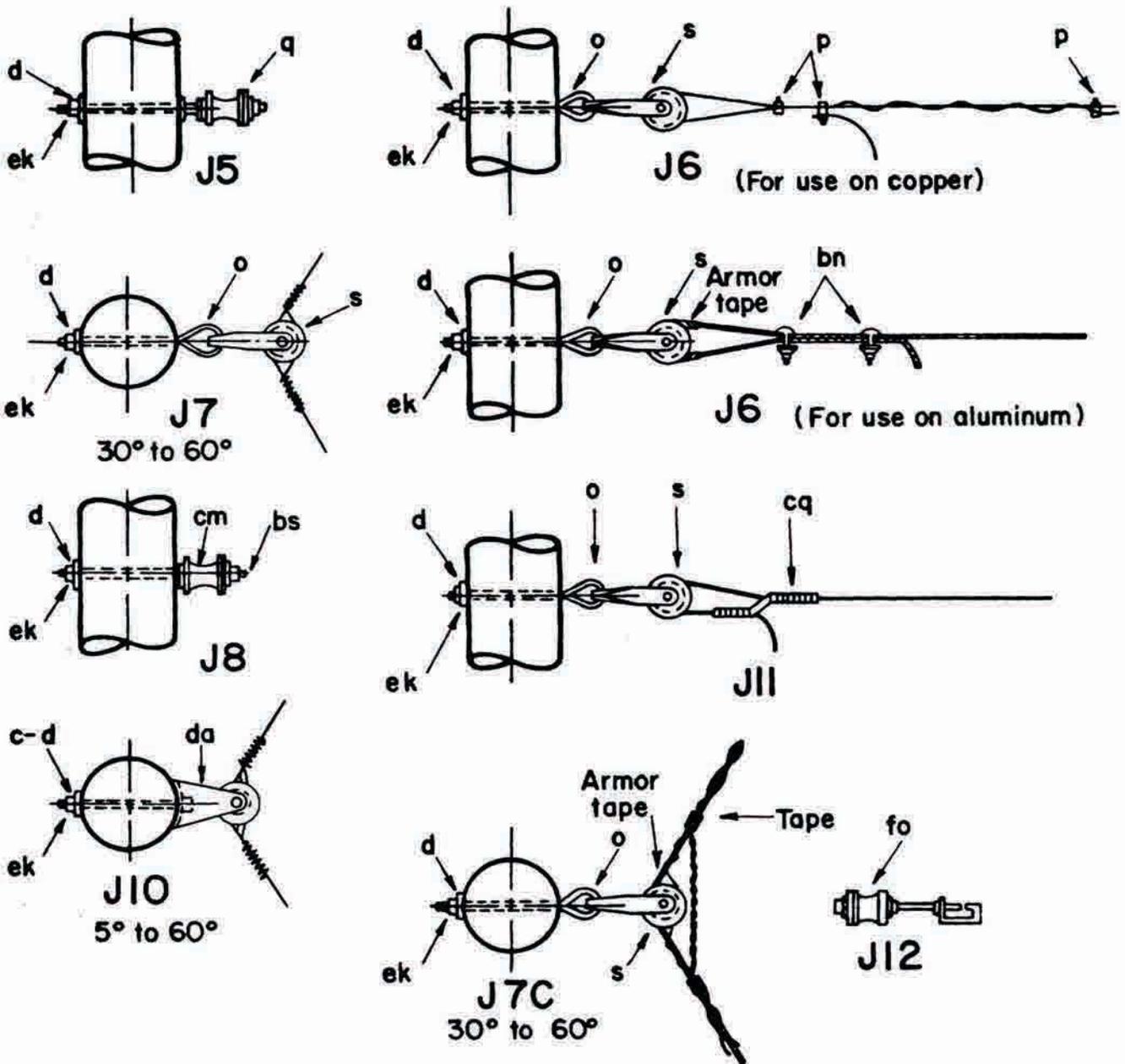


34.5/199 kV
THREE TRANSFORMERS, CLUSTER MOUNTED
4-WIRE GROUND WYE - GROUND WYE
FOR 120/208 VOLT POWER LOADS

NOV. 1986

ZG312

SECTION X-X



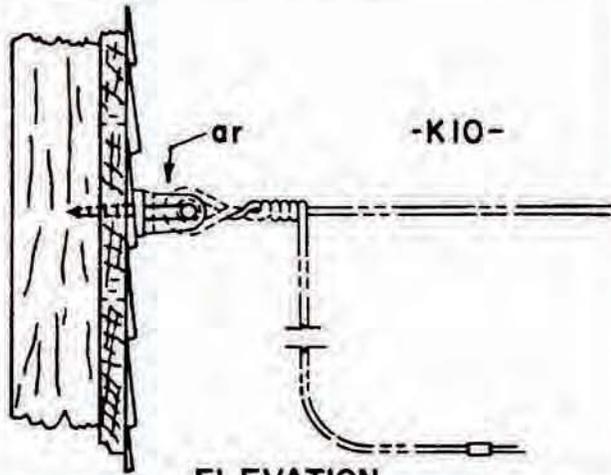
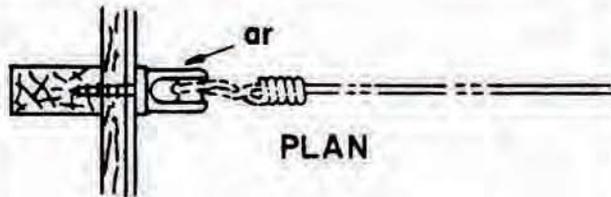
For use on Self Supporting Service Cable

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	Bolt, machine, 5/8" x req'd length	bs	Bolt, single, upset
d	Washer, square 2 1/4"	bn	Clamp, loop, deadend
o	Bolt, eye, 5/8" x req'd length	cq	Sleeve, offset, splicing
p	Connectors as req'd	da	Bracket, insulated
q	Bolt, double upset, insulated	fo	Transformer secondary bracket
s	Clevis, secondary, swinging, insulated	ek	Locknuts as req'd
cm	Insulator, spool		

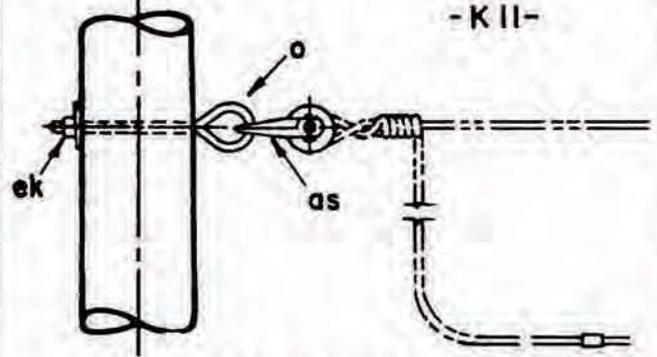
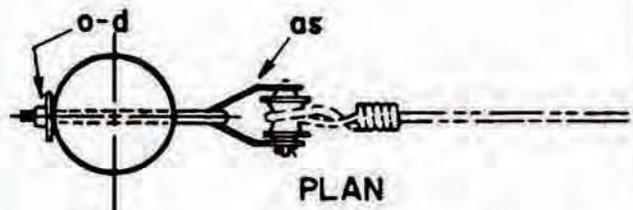
SECONDARY ASSEMBLIES

NOV. 1986

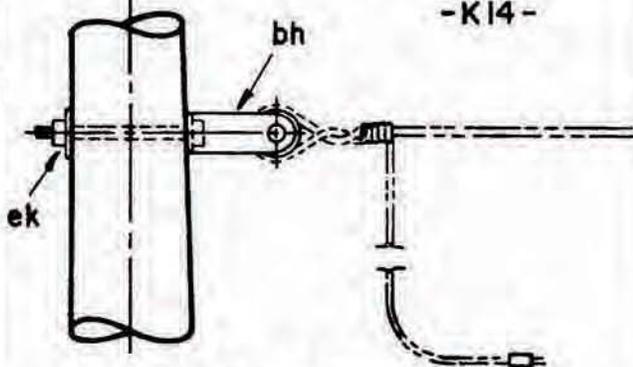
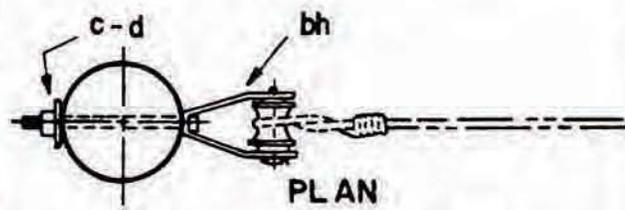
J5 to J12



-K10-



-K11-



-K14-

NOTE :

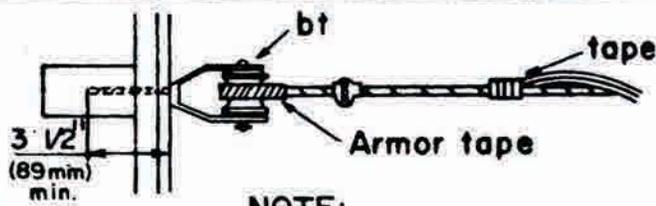
Service connectors to be insulated compression type.

ITEM NO	MATERIAL	ITEM NO	MATERIAL
c	Bolt, machine, 5/8" x req'd length	as	Clevis, service, swinging, insulated
d	Washer, square 2 1/4"	bh	Clevis, service, deadend, insulated
o	Bolt, eye, 5/8" x req'd length	ek	Locknuts as req'd
ar	Wire holder		

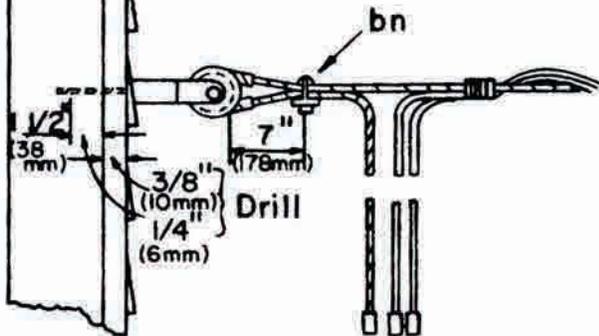
SERVICE ASSEMBLIES

NOV. 1986

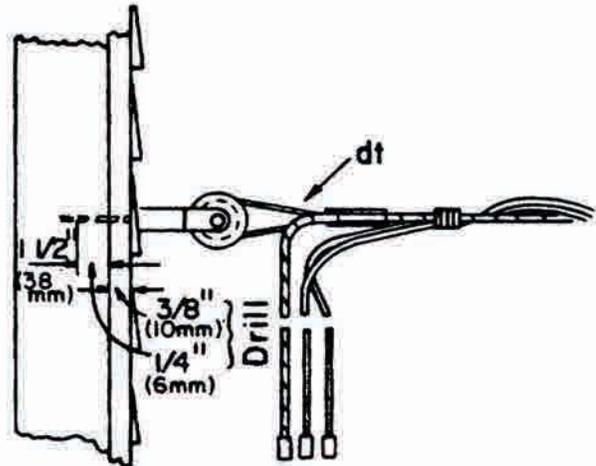
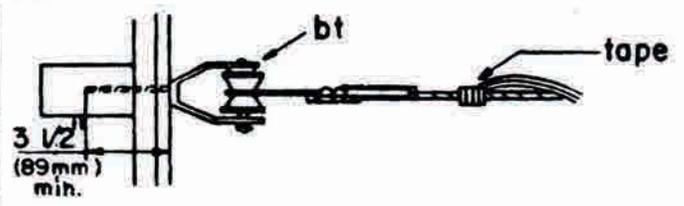
K10, K11, K14



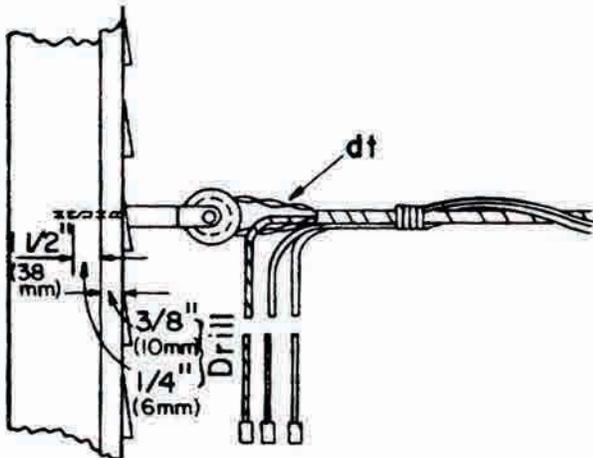
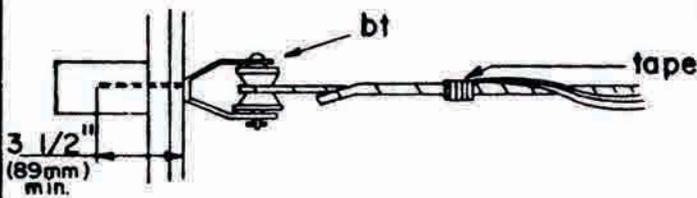
NOTE:
Groove diameter of insulator 1 3/4" (44mm) min.



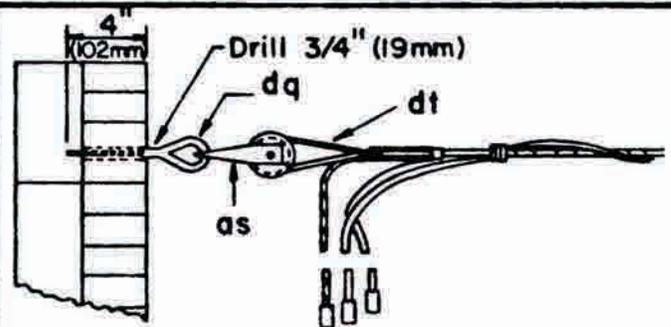
LOOP TYPE



WEDGE TYPE



FORMED TYPE

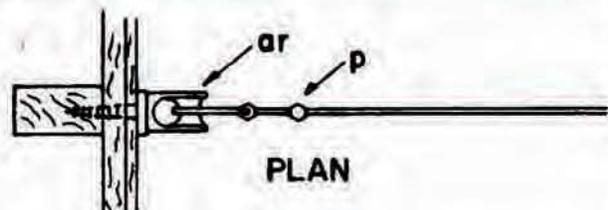


BRICK OR MASONRY

NOTE:
Wedge and preformed service dead-ends in sizes shown on page dt of the List of Materials may be subst. for those shown on KIIC, KI4C, KI5C, and KI6C. This type construction should be used for 3 or 4 conductor service cables with bare ACSR neutral. Service connectors to be insulated compression type.

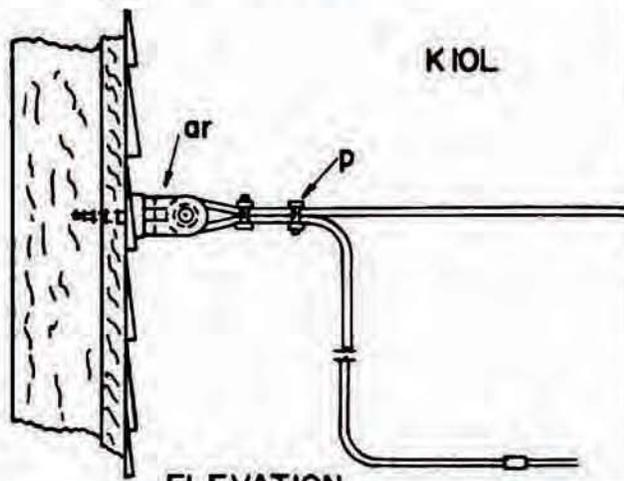
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
p	Connectors, as req'd	dt	Service deadend, wedge type
as	Clevis, service, insulated	dt	Service deadend, formed type
bn	Clamp, loop deadend	dq	Eye screw, elliptical 1/2" x 6"
bt	Wireholder, clevis type, insulated		3/4" x 3 1/2" expansion shield
	# 24 woodscrew		

SERVICE ASSEMBLIES, CABLE

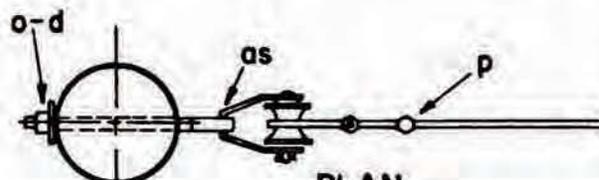


PLAN

K10L

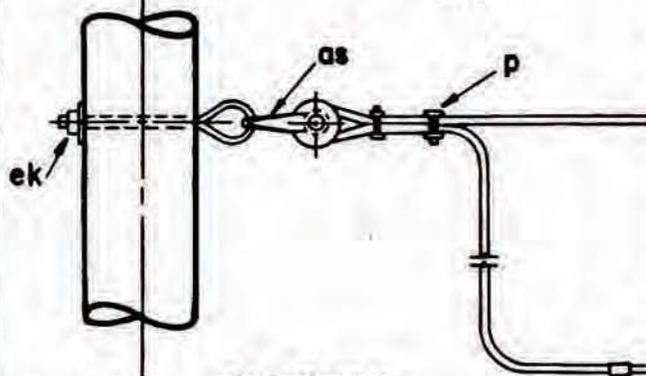


ELEVATION

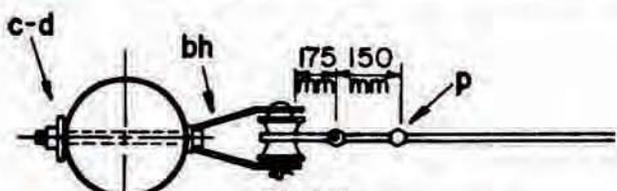


PLAN

K11L

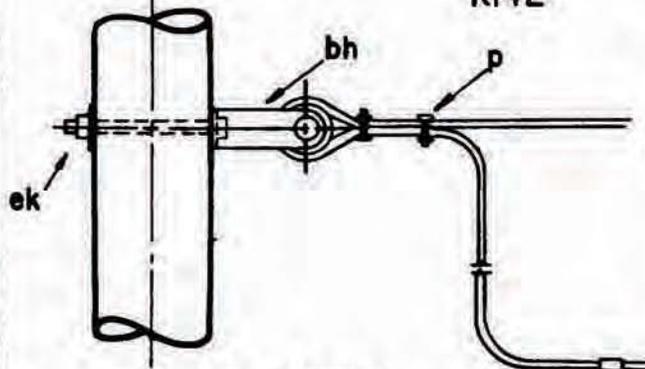


ELEVATION



PLAN

K14L



ELEVATION

NOTE

1. This type construction should be used for #2 covered aluminum and larger.
2. Service connectors to be insulated compression type.

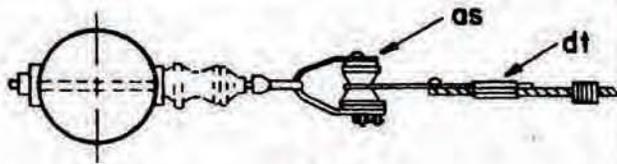
ITEM NO	MATERIAL
e	Bolt, machine, 5/8" x req'd length
d	Washer, square 1/4"
o	Bolt, eye, 5/8" x req'd length
p	Connectors, as req'

ITEM NO.	MATERIAL
ar	Wireholder
as	Clevis, service, swinging, insulated
bh	Clevis service, deadend, insulated
ek	Locknuts as req'd

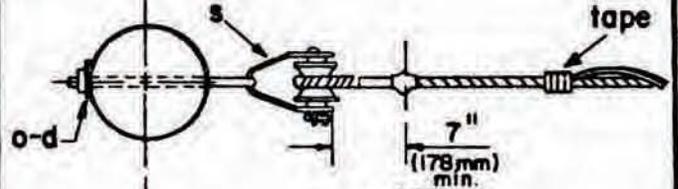
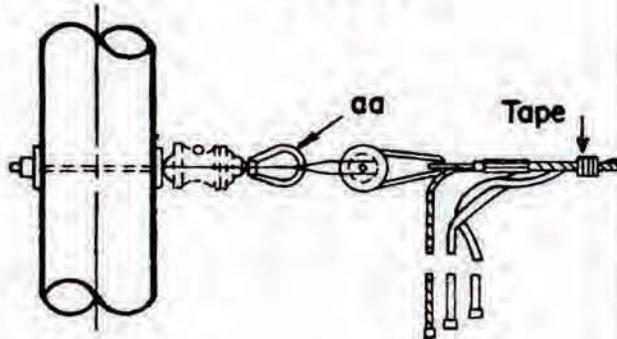
**SERVICE ASSEMBLIES
(LARGE CONDUCTORS)**

NOV. 1986

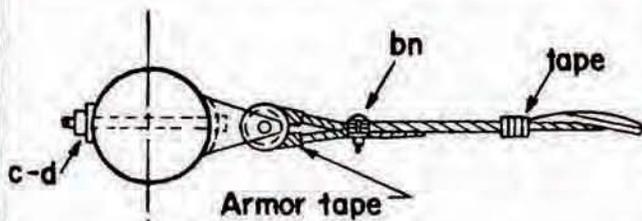
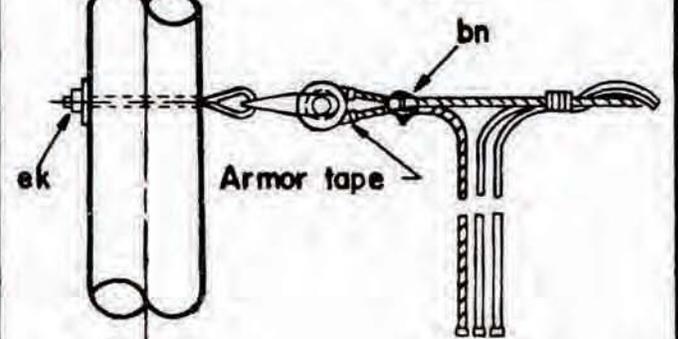
KIOL, KIIL, KI4L



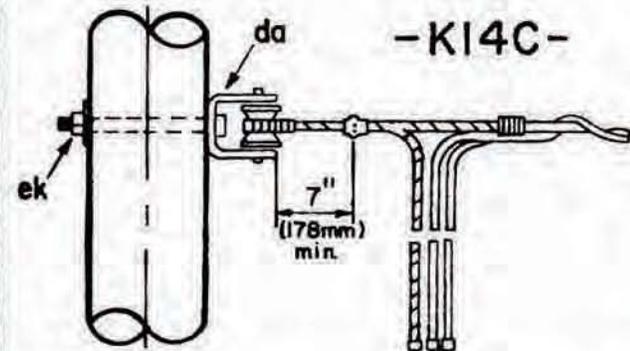
- KI5C -



- KIIC -



- KI4C -



NOTES:

This type construction should be used for 3 or 4 conductor service cables with bare ACSR neutral.

Service connectors to be insulated compression type.

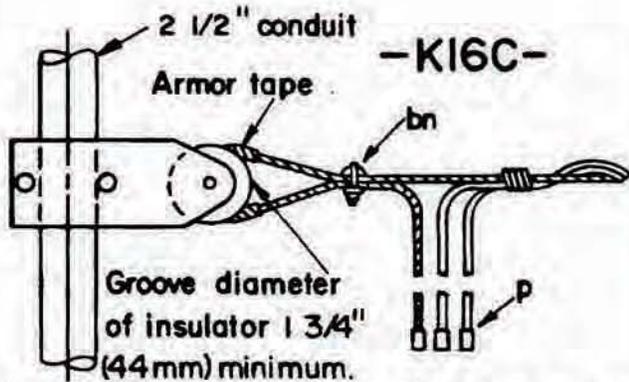
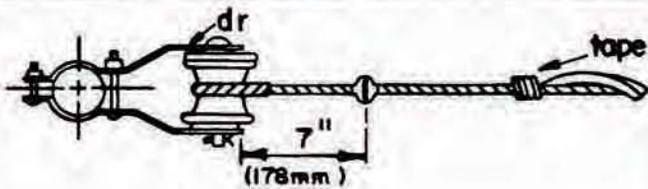
Groove diameter of insulators 1 3/4" (44 mm) minimum for loop deadend.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	Bolt machine, 5/8" x req'd length	as	Clevis, service swinging
d	Washer, square, 2 1/4"	bn	Clamp, loop deadend
o	Bolt, eye, 5/8" x req'd length	da	Bracket, insulated swinging
p	Connectors as req'd	dt	Service deadend
s	Clevis, secondary, swinging, insulated	ek	Locknuts as req'd
aa	Nut, eye		

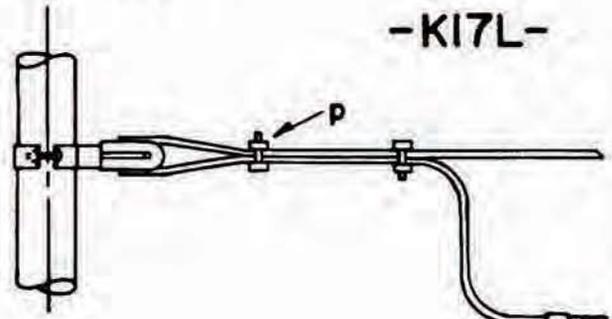
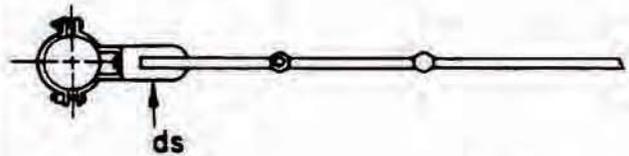
SERVICE ASSEMBLIES, CABLE

NOV. 1986

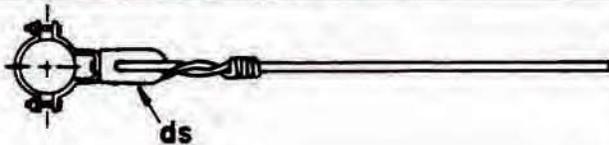
KIIC, KI4C, KI5C



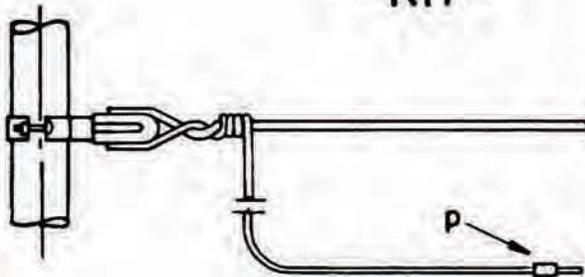
NOTE: This type constr. should be used for three conductor service cables with bare ACSR neutral.



NOTE: This type constr. should be used for No. 2 covered aluminum conductor.



-K17-



NOTES:

1. Service connectors to be insulated compression type.
2. For arrangement of service assembly units see drawing M24-10.

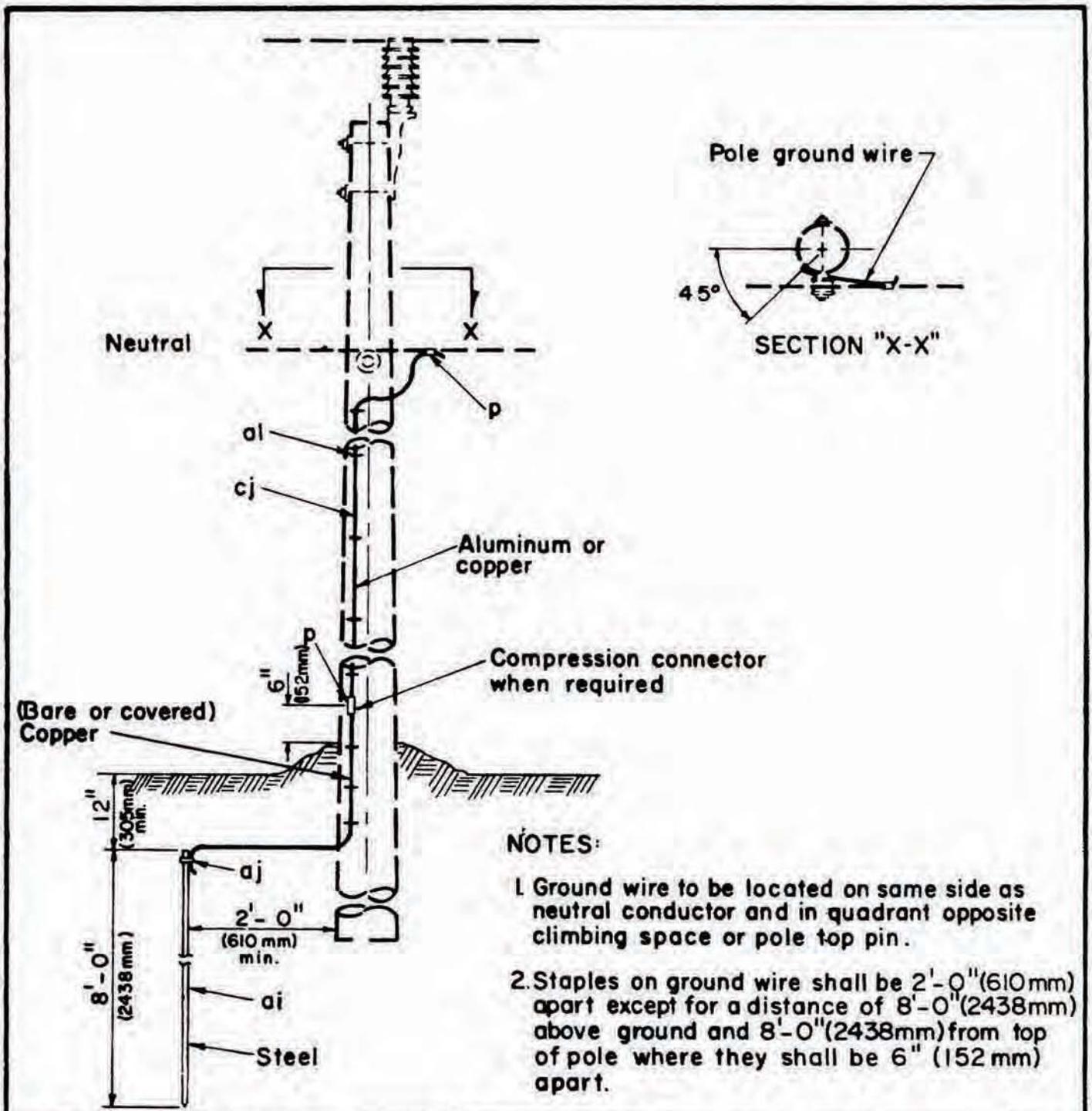
ITEM NO.	MATERIAL
p	Connectors as req'd
bn	Clamp, loop deadend

ITEM NO.	MATERIAL
dr	Clevis, conduit insulated
ds	Wireholder, conduit

SERVICE ASSEMBLIES
(FOR RANCH TYPE HOUSE)

NOV. 1986

K16C, K17L, K17



NOTES:

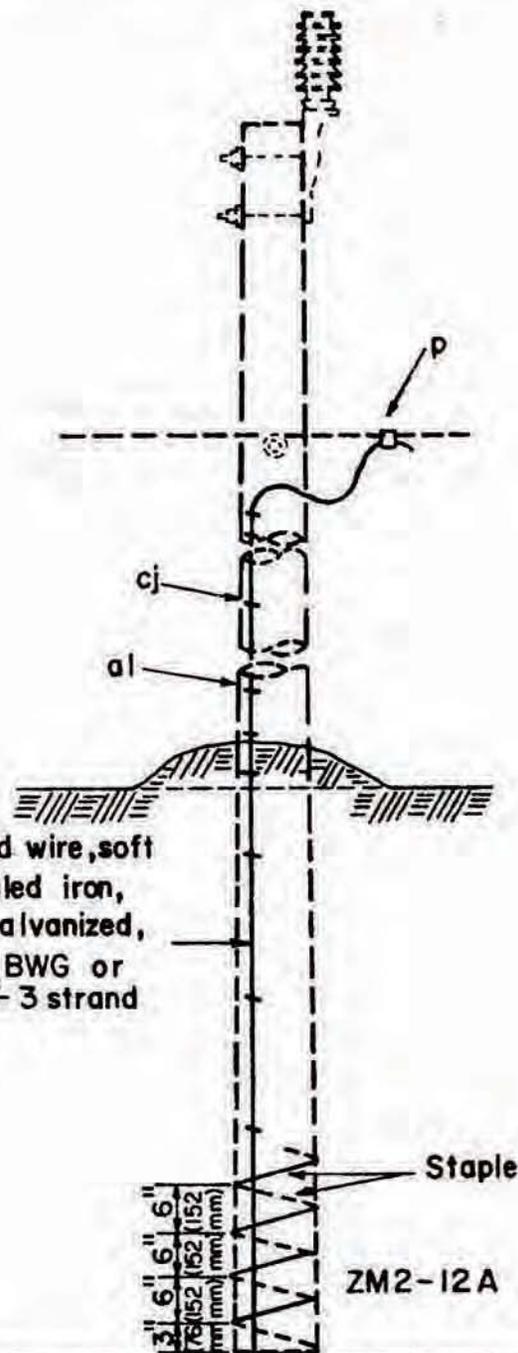
1. Ground wire to be located on same side as neutral conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be 2'-0" (610mm) apart except for a distance of 8'-0" (2438mm) above ground and 8'-0" (2438mm) from top of pole where they shall be 6" (152 mm) apart.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
P	Connectors, as required	ai	Staples, ground wire, as required
ai	Rod, ground, steel, 5/8" dia. min.	cj	Ground wire, No. 6 copper or equiv. conductivity as required
aj	Clamp, ground rod		

GROUNDING ASSEMBLY-GROUND ROD TYPE

NOV. 1986

ZM2-II

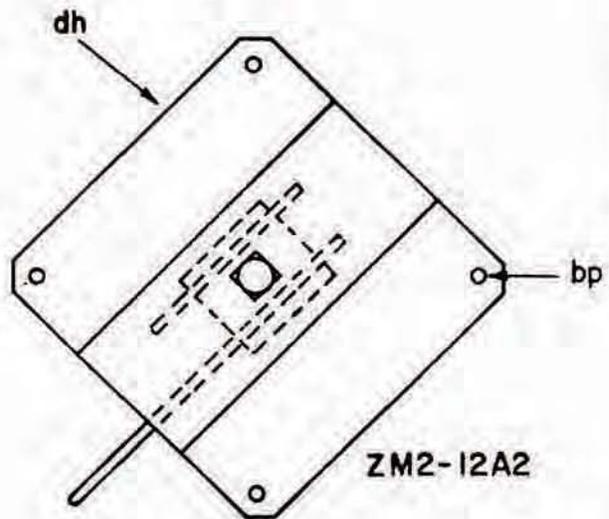


Ground wire, soft annealed iron, "C" galvanized, No. 5 BWG or 5/16" - 3 strand

Staple

ZM2-12A

PLAN OF PLATE



ZM2-12A2

NOTES:

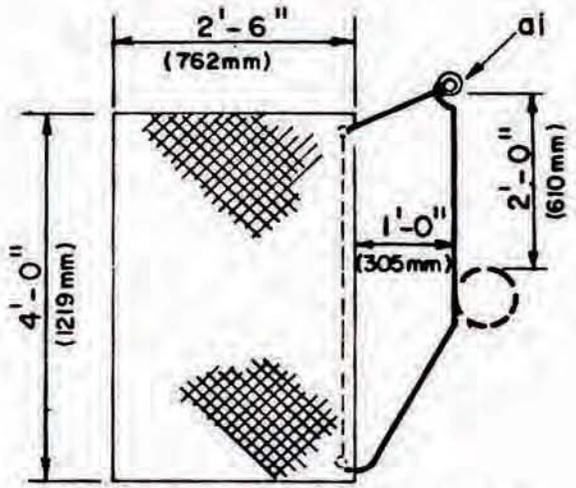
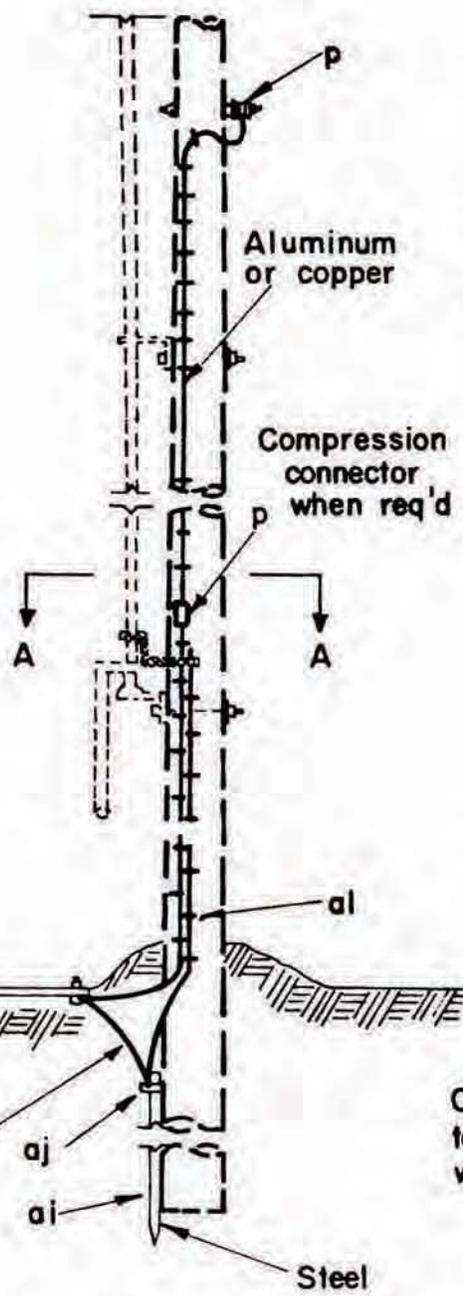
1. Ground wire to be located on same side as neutral conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be 2'-0" (610 mm) apart except for a distance of 8'-0" (2438 mm) above ground and 8'-0" (2438 mm) from top of pole where they shall be 6" (152 mm) apart.

ITEM	MATERIAL	ASSEMBLY UNIT	
		ZM2-12A	ZM2-12A2
p	Connectors	as req'd	as req'd
al	Staples, ground wire	as req'd	as req'd
bp	Nails, galvanized, 1" , round head	-	4
cj	Ground wire, soft annealed iron, "C" galvanized, No. 5 BWG or 5/16" - 3 strand	as req'd	as req'd
dh	Grounding plate, butt type, galvanized steel	-	1

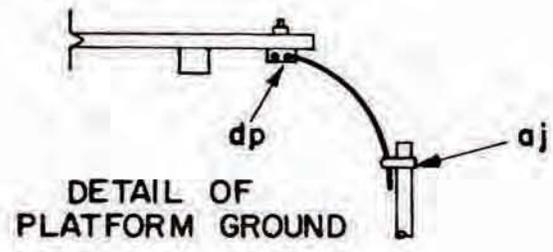
POLE PROTECTION ASSEMBLY
WRAP-AROUND TYPE(A): PLATE TYPE (A2)

NOV. 1986

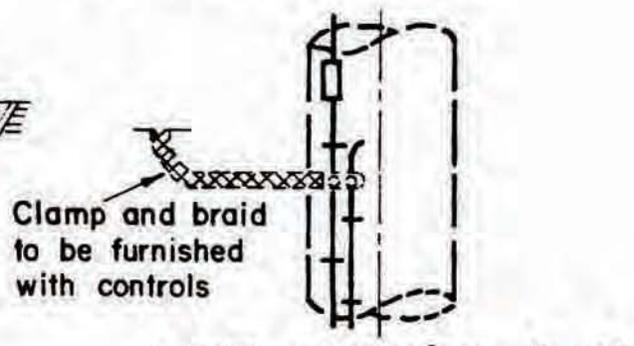
ZM2-12A, ZM2-12A2



DETAIL OF PLATFORM



DETAIL OF PLATFORM GROUND



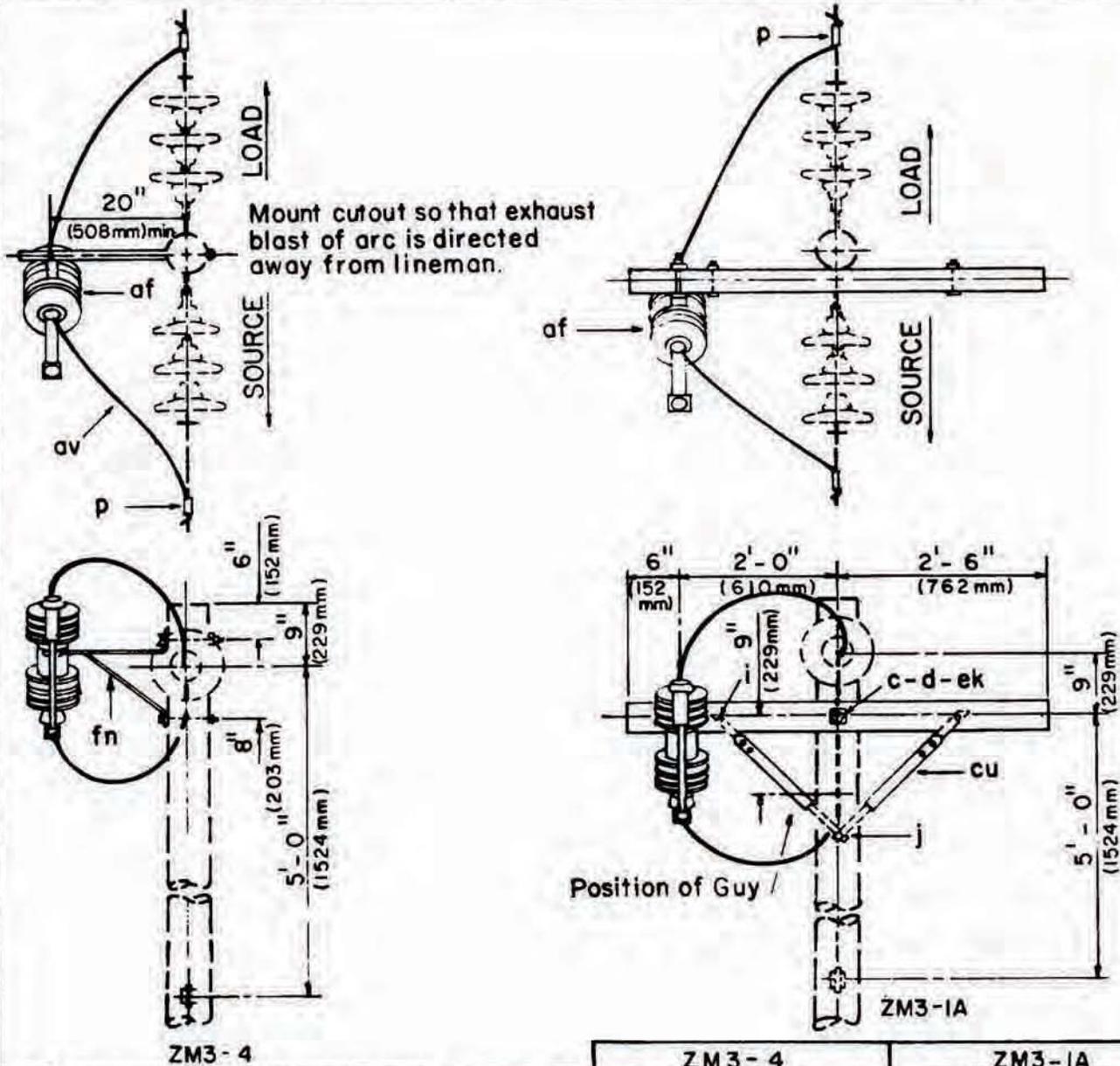
DETAIL OF SECTION "A-A"

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
p	Connectors, as req'd	cj	Ground wire, No. 2 copper or equiv. conductivity, as req'd
ai	1 Rod, ground, steel, 5/8" dia. x 8'-0"	dp	2 Grounding connector and lockwasher
aj	1 Clamp, ground rod	i	1 Grounding iron platform plate
ai	Staples, ground wire, as req'd		

GROUNDING ASSEMBLY - PLATFORM TYPE FOR SECTIONALIZING AIR BREAK SWITCH

NOV. 1986

M2-15 A

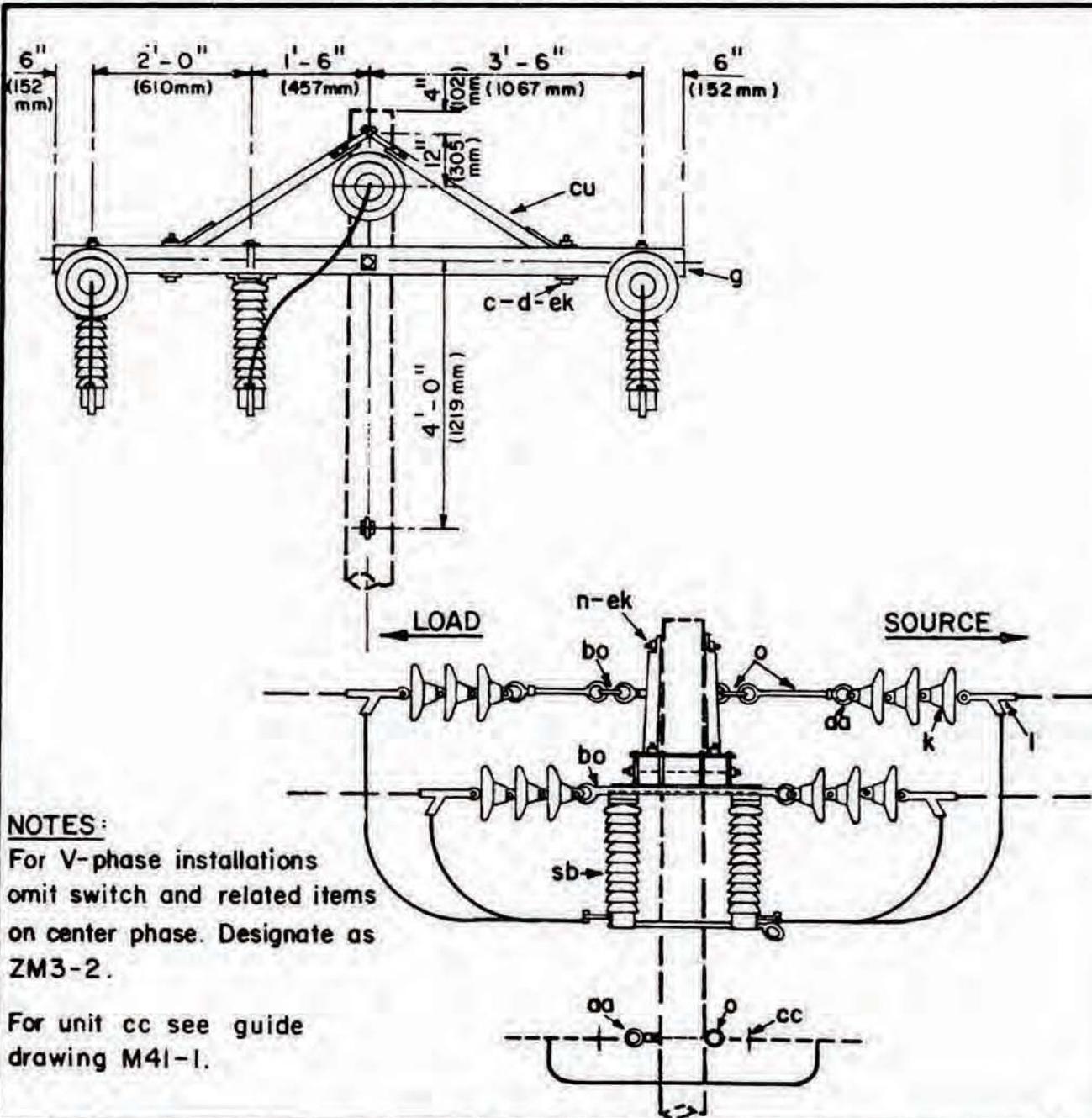


ITEM	MATERIAL	ZM3-4 NO. REQUIRED	ZM3-1A NO. REQUIRED
c	Bolt, machine, 5/8" x required length	2	1
d	Washer, square, 2 1/4"	2	2
g	Crossarm, 3 5/8" x 4 5/8" x 5'-0"		1
i	Bolt, carriage, 3/8" x 4 1/2"		2
j	Screw, lag, 1/2" x 4"		1
p	Connector, compression type	2	2
af	Cutout, fuse, single shot	1	1
av	Leads or jumpers as required		
cu	Brace, wood, 28"		2
ek	Locknuts		
fn	Bracket, extension	1	

34.5 / 19.9 kV, 1-PHASE
ONE SECTIONALIZING FUSE CUTOUT

NOV. 1986

ZM3-1A, ZM3-4



NOTES:
 For V-phase installations omit switch and related items on center phase. Designate as ZM3-2.

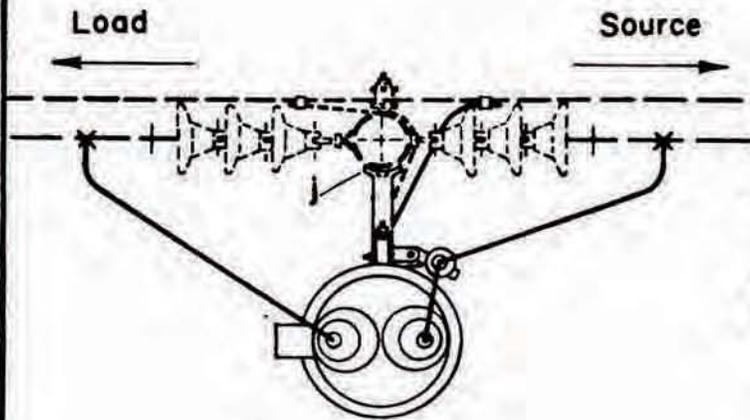
For unit cc see guide drawing M41-1.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c 4	Bolt, machine, 1/2" x req'd length	bo 6	Shackle, anchor
d 4	Washer, round, 1 3/8"	cc 2	Deadend assembly neutral
d 3	Washer, square, 2 1/4"	cu 2	Brace, crossarm, wood, 60" span
g 2	Crossarm 3 5/8" x 4 5/8" x 8' - 0"	ek	Locknuts as req'd
k 18	Insulator, suspension, 10"	sb 3	Switch, disconnect with mounting hardware
l 6	Clamp, deadend		
n 2	Bolt, double arming, 5/8" x req'd length		
o 4	Bolt, eye, 5/8" x req'd. length		
aa 4	Nut, eye, 5/8"		

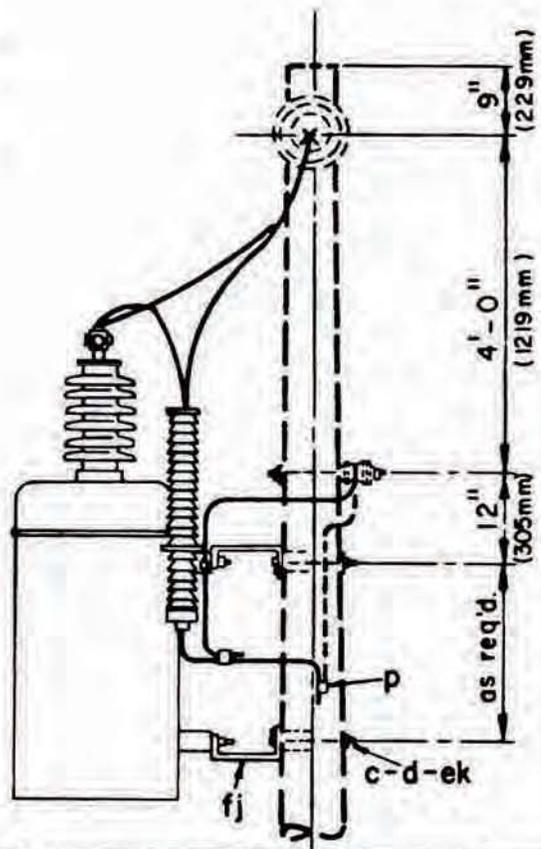
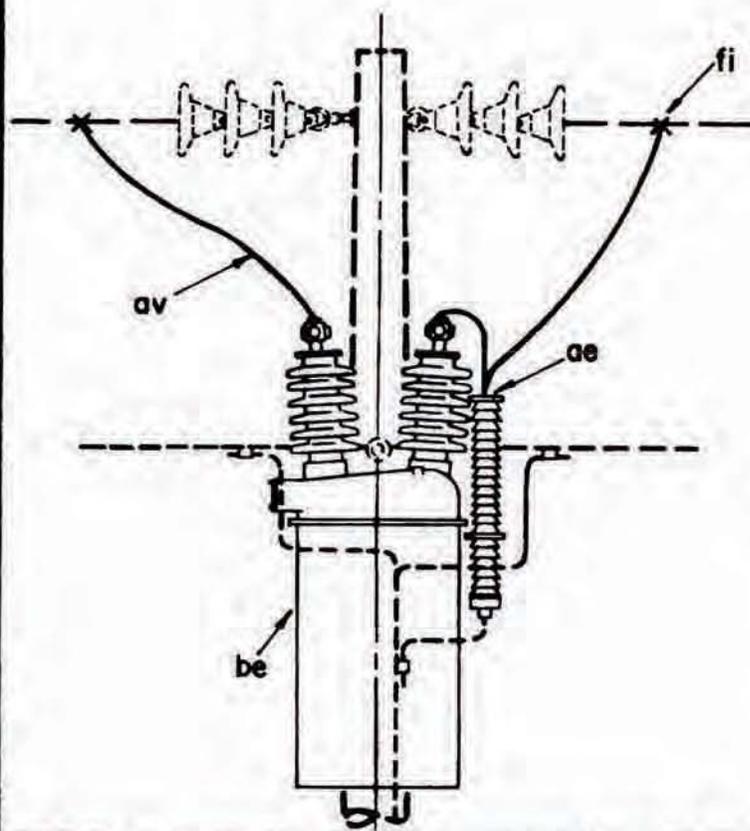
34.5/ 19.9 KV
 TWO OR THREE SECTIONALIZING
 DISCONNECT SWITCHES

NOV. 1986

ZM3-2, ZM3-3



NOTE:
The recloser terminal bushing connected directly to the coil should be connected to the source.



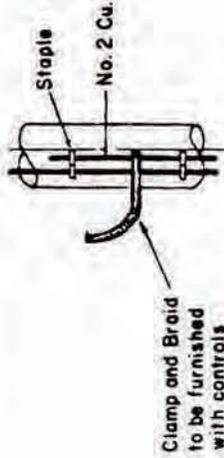
ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	2 Bolt, machine, 5/8" x req'd length	be	1 Recloser, oil circuit
d	2 Washer, square, 2 1/4"	ek	Locknuts as req'd
l	4 Screw, lag, 1/2" x 4"	fi	2 Connector, hot line
ae	1 Arrestor, surge	fj	2 Bracket, extension
av	Jumpers, strand	p	Connectors as req'd

**34.5/19.9 kV
ONE SECTIONALIZING OIL CIRCUIT RECLOSER**

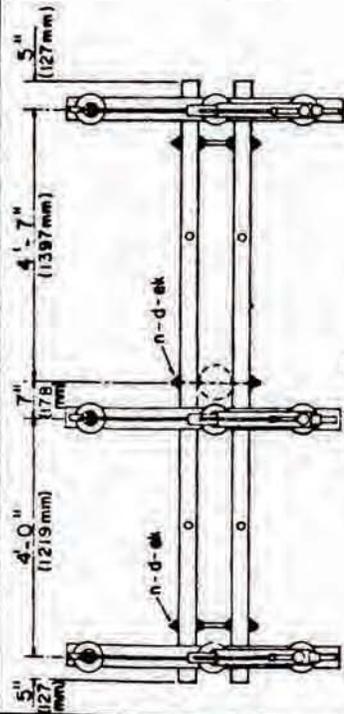
NOV. 1986

ZM3-10A

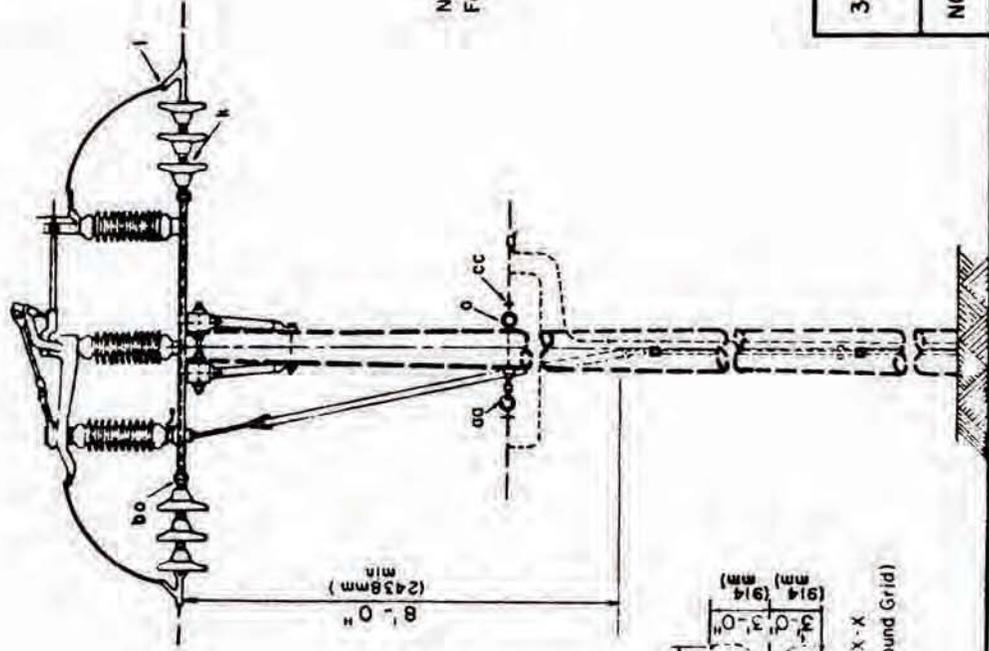
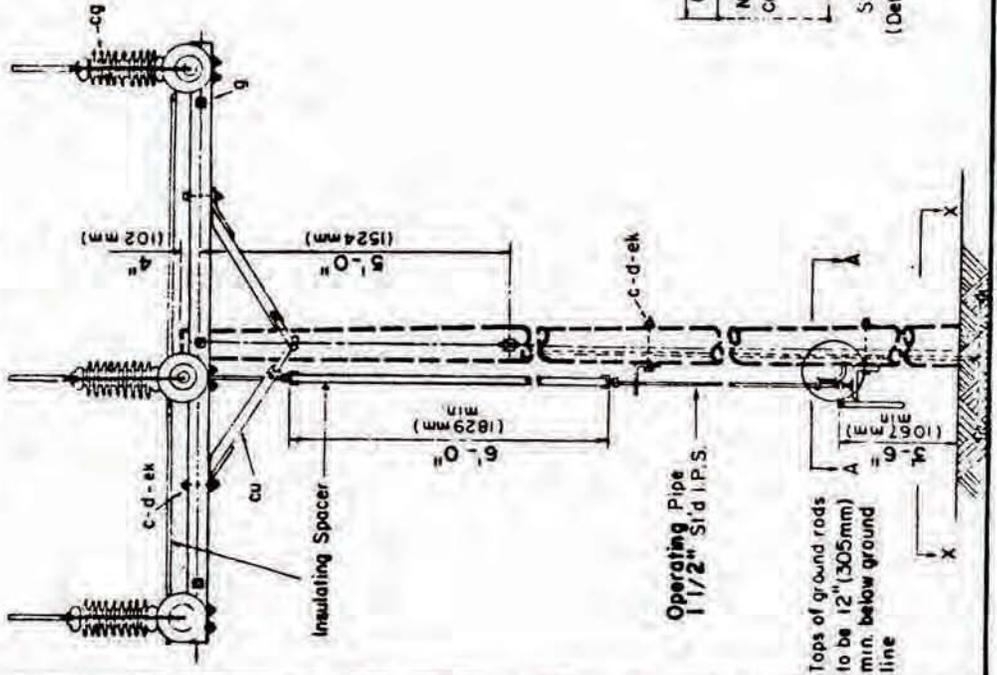
ITEM NO	MATERIAL
c	14 Bolt, machine, 5/8" x req'd length
c	4 Bolt, machine, 1/2" x req'd length
d	25 Washer, 2 1/4 square
d	4 Washer, round, 1 3/8" dia
g	2 Crossarm, 3 5/8" x 4 5/8" x 10'-0"
k	12 Insulator, suspension, 10"
l	6 Clamp, deadend
n	4 Bolt, double orming, 5/8" x req'd length
bo	6 Shackle, anchor
cg	1 Switch, airbreak, 3 pole unit
cu	2 35 kv. with operating mechanism
cc	2 Brace, wood, 60' span
cc	2 Deadend assembly, neutral
oo	1 Bolt, eye, 5/8"
oo	1 Nut, eye, 5/8"
gh	Locknuts, as required



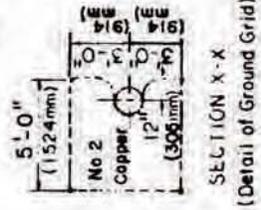
DETAIL OF A-A



PLAN VIEW OF SWITCH ARRANGEMENT



NOTE:
For grounding assembly, see drawing ZM2-15



SECTION X-X
(Detail of Ground Grid)

34.5/19.9 kV PRIMARY, 3-PHASE 4-WIRE STAR
SECTIONALIZING AIR BREAK - SWITCH

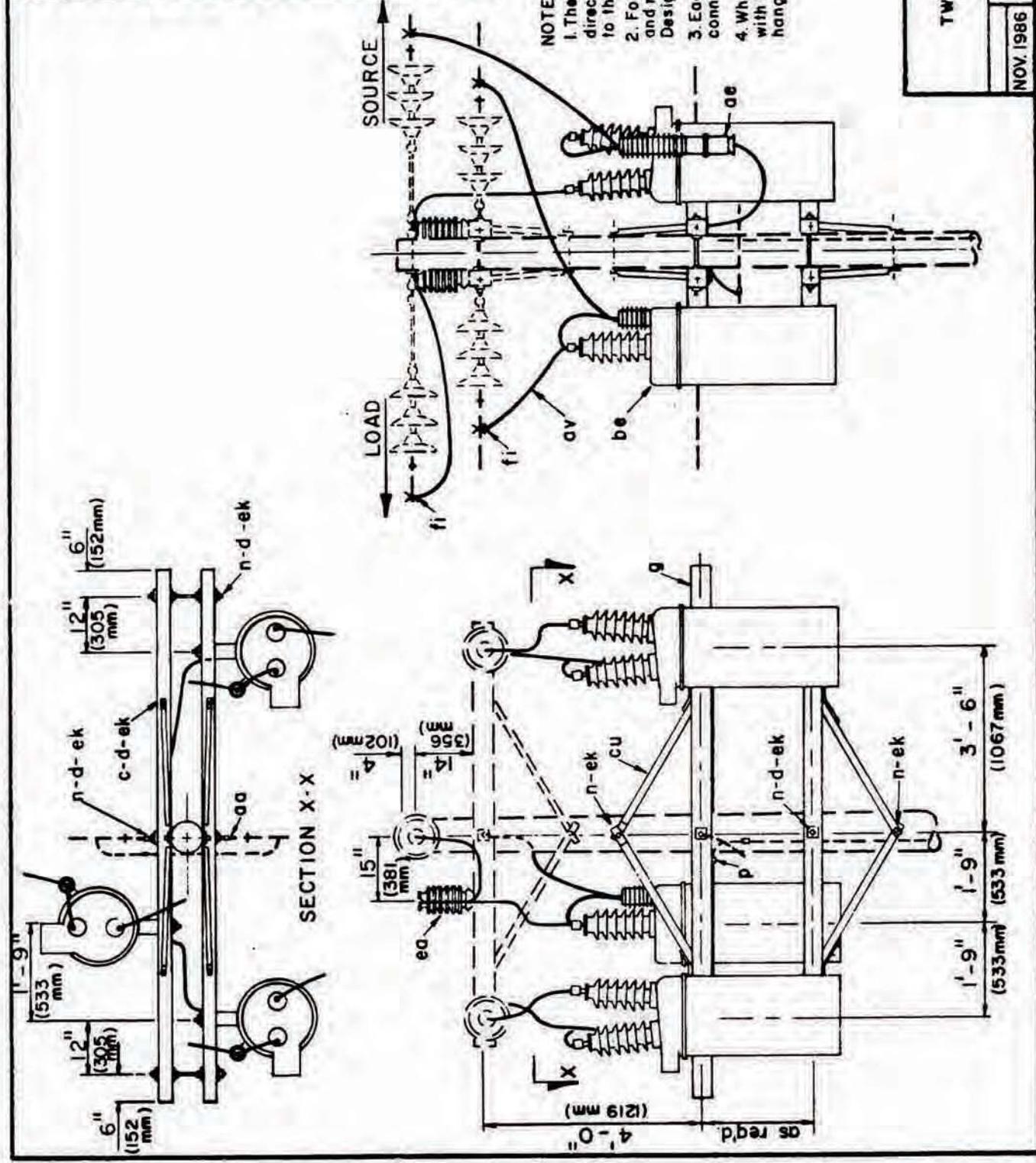
NOV. 1986

ZM3-16

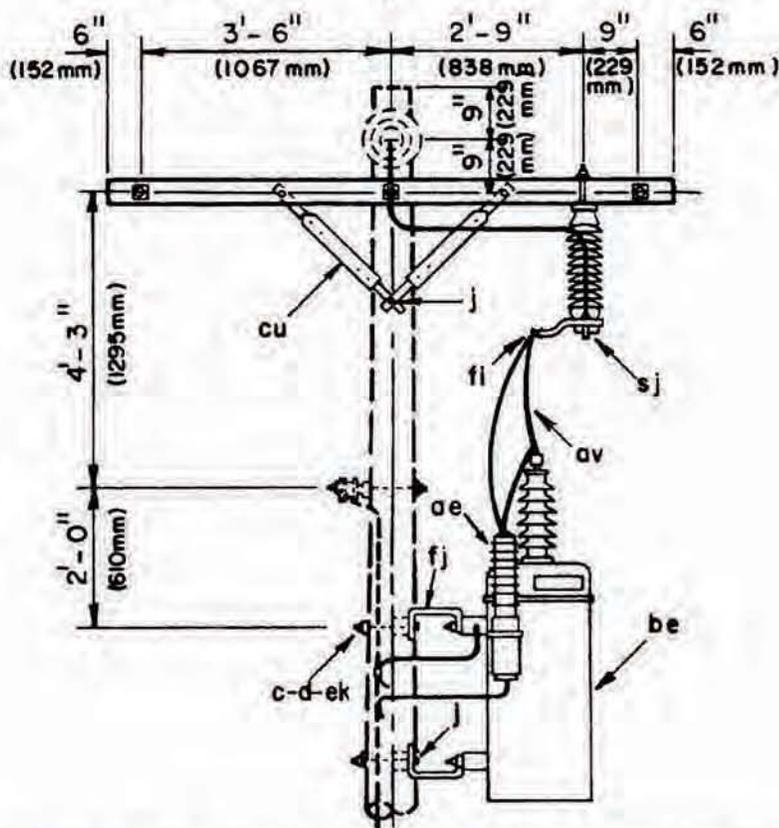
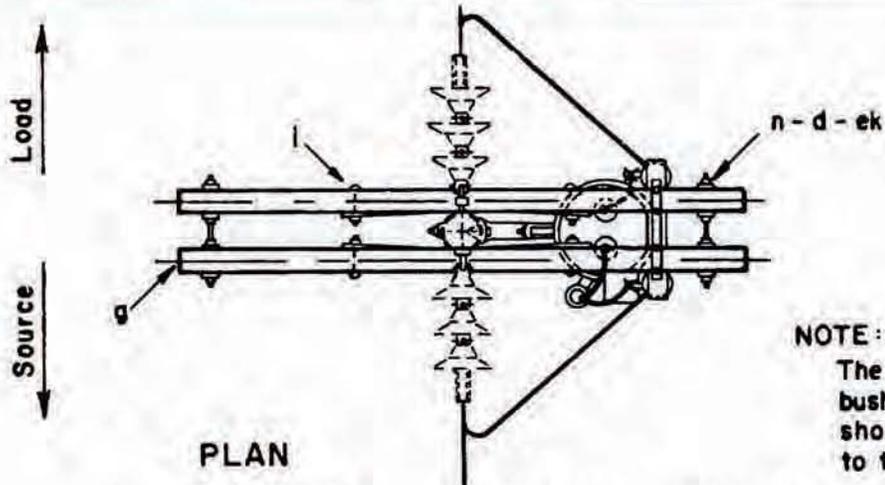
ITEM	NO. REQ	MATERIAL
c	3	Bolt, machine, 5/8" req'd length
c	8	Bolt, machine, 1/2" x req'd length
d	23	Washer square, 2 1/4"
d	8	Washer 1 3/8" dia.
g	2	Crossarm 3 5/8" x 4 5/8" x 10' - 0"
g	2	Crossarm 3 5/8" x 4 5/8" x 8' - 0"
n	8	Bolt, double arming, 5/8" x req'd length
p		Connectors as req'd
aa	1	Nut, eye 5/8"
ae	3	Surge arrester
av		Jumpers, stranded as req'd
ba	3	Recloser, oil circuit
cu	4	Brace wood 60" span
ea	2	Insulator, post type
fi	6	Connector, hot line, tap assembly
ek		Locknuts, as required

NOTES:

1. The recloser terminal bushing connected directly to the coil should be connected to the source.
2. For V-Phase installations omit recloser and related items on center phase. Designate as assembly ZM 3-19.
3. Each recloser tank shall have two connections to ground
4. Where suitable hanger is not furnished with the recloser a standard transformer hanger may be used as indicated.



34.5/19.9 kV
 TWO OR THREE SECTIONALIZING
 OIL CIRCUIT RECLOSER
 NOV. 1986
 ZM3-19, ZM3-20



ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	2 Bolt, machine, 5/8" x req'd. length	ae	1 Lightning arrester
d	12 Washer, square, 2 1/4"	av	Jumpers, stranded, as required
g	2 Crossarm, 3 5/8" x 4 5/8" x 8'-0"	be	1 Recloser, oil circuit
i	4 Bolt, carriage, 3/8" x 4 1/2"	cu	4 Brace, wood, 28"
j	6 Screw, lag, 1/2" x 4"	ek	Locknuts
n	3 Bolt, double arming 5/8" x req'd. length	fi	2 Connector, hot line
p	Connectors, as required	sj	1 Switch, recloser, by-pass
fj	2 Bracket, extension		

34.5 / 19.9 kV
ONE SECTIONALIZING OIL CIRCUIT RECLOSER
WITH BY-PASS SWITCH

NOV. 1986

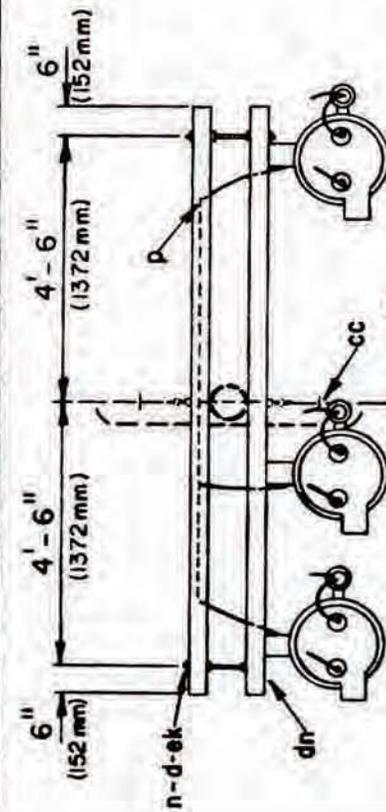
ZM3-23

ITEM NO.	MATERIAL
c	10 Bolt, machine, 1/2" x req'd length
c	14 Bolt, machine, 5/8" x req'd length
d	10 Washer, round, 1 3/8" dia.
d	14 Washer, square, 2 1/4"
g	2 Crossarm, 3 5/8" x 4 5/8" x 8" - 0"
g	3 Crossarm, 3 5/8" x 4 5/8" x 10" - 0"
k	18 Insulator suspension 10"
l	6 Clamp, deadend
n	6 Bolt, double arming, 5/8" x req'd length
o	3 Bolt, eye, 5/8"
p	Connectors as required
oo	5 Nut, eye, 5/8"
os	3 Surge arrester
ov	Jumpers, stranded as required
ba	3 Recloser, oil circuit
bo	6 Shecks anchor
cc	2 Deadend assembly, neutral
cu	5 Brace, crossarm, wood, 6 D" span
dn	3 Hanger, T-crossarm, as required M
ek	Locknuts, as required
fl	6 Connector, hot line
sl	3 Switch recloser, by-pass

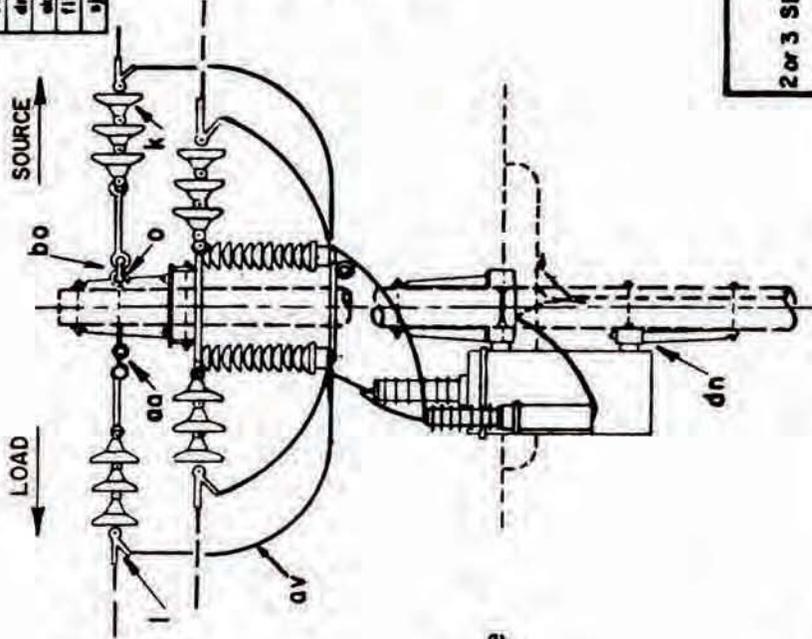
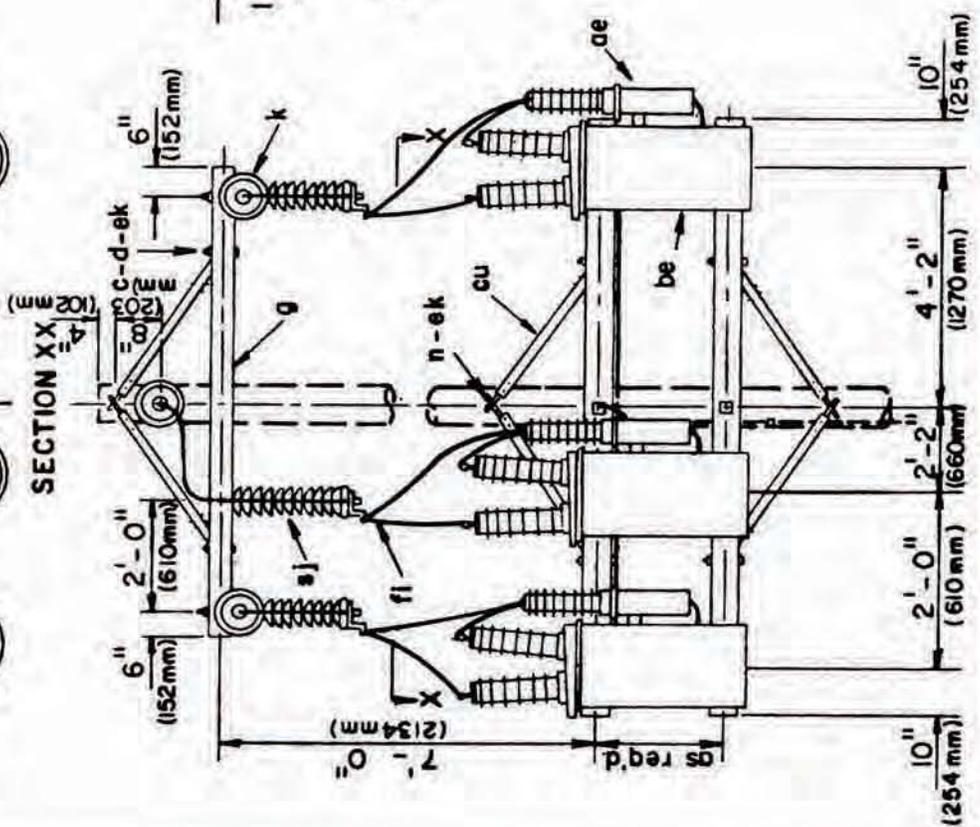
* Specify this item to be furnished by the recloser manufacturer.

NOTES:

1. The recloser terminal bushing connected directly to the coil should be connected to the source.
2. For V-Phase installations omit recloser and related items on center phase. Designate as ZM3-24.
3. Each reclose tank shall have two connections to ground.
4. Where suitable hanger is not furnished with the recloser a standard transformer hanger may be used as indicated.



SECTION XX

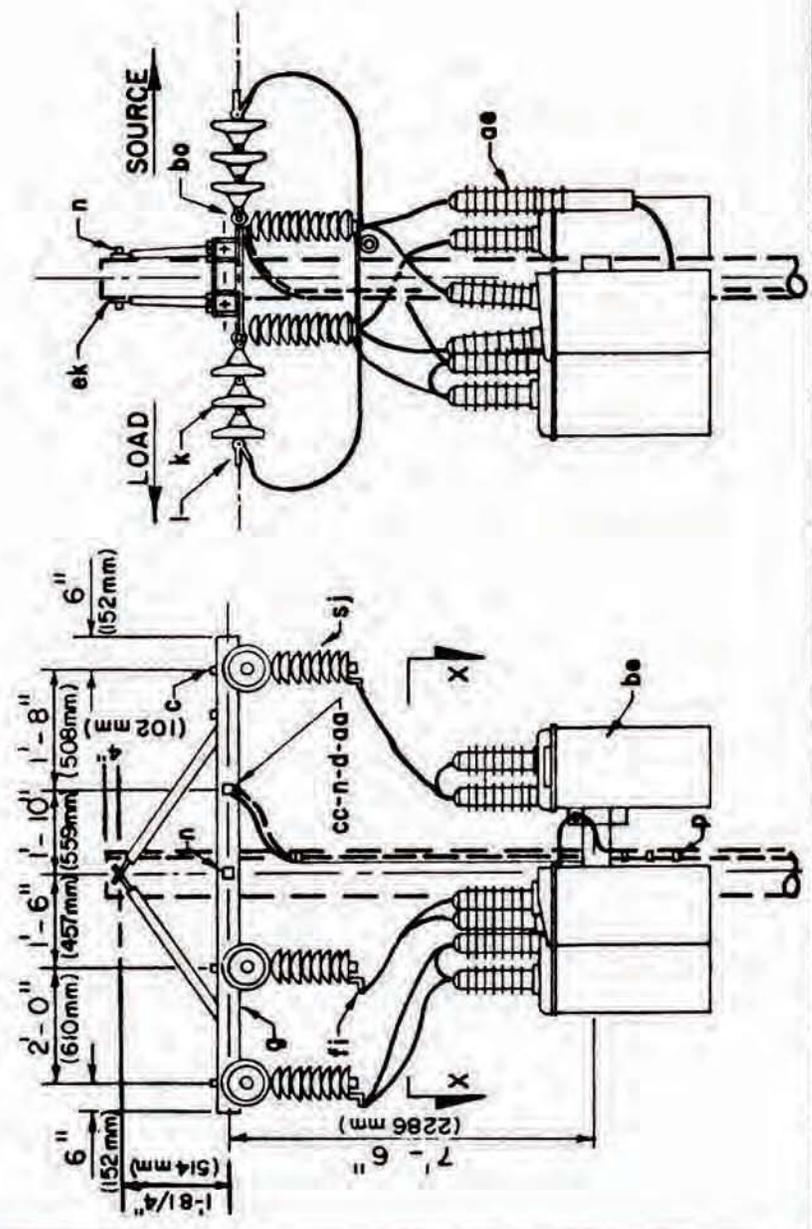
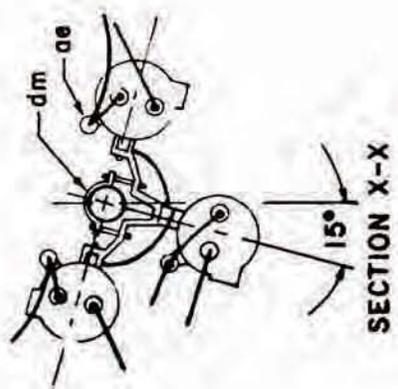


34.5/19.9 kV
2 or 3 SECTIONALIZING OIL CIRCUIT RE ClosERS
WITH BY-PASS SWITCHES
 NOV. 1986
ZM3-24, ZM3-25

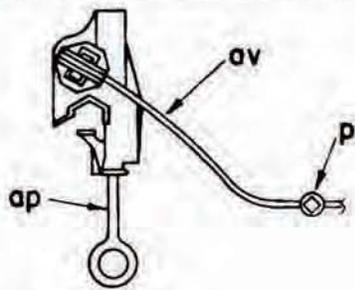
ITEM NO.	MATERIAL
c	12 Bolt, machine, 5/8" x req'd length
e	4 Bolt, machine, 1/2" x req'd length
d	6 Washer, square, 2 1/4"
d	4 Washer, round, 1 3/8" dia.
g	2 Crossarm, 3 5/8" x 4 5/8" x 8" x 1-0"
k	18 Insulator, suspension, 10"
l	6 Clamp, deadend
n	3 Bolt, double arm, 5/8" x req'd length
p	Connectors, as req'd
oo	2 Nut, eye, 5/8"
aa	3 Lightning arrester
av	Jumpers, stranded, as req'd
be	3 Recloser, oil circuit
bo	6 Shockle, anchor
cc	2 Deadend assembly
cu	2 Brackets, crossarm, wood, 60" span
dm	1 Bracket, cluster type, with adapter plate as req'd
ek	Locknuts, as req'd
fi	6 Connector, hot line, top assembly
sj	3 Switch, recloser by-pass

NOTES

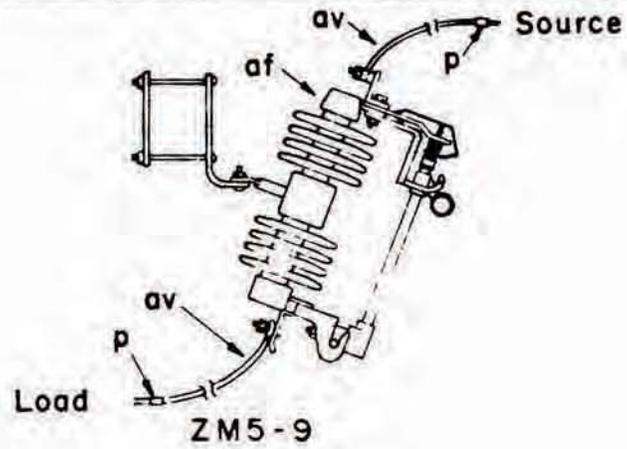
1. The recloser terminal bushing connected directly to the coil should be connected to the source.
2. For V-Phase installations omit recloser and related items on center phase. Designate as ZM3-24A.
3. Each recloser tank shall have two connections to ground.
4. Where suitable hanger is not furnished with the recloser a standard transformer hanger may be used as indicated.



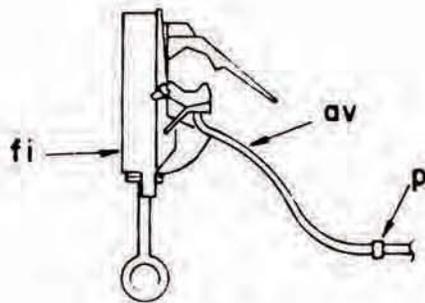
34.5 / 19.9 kV
 2 or 3 SECTIONALIZING OIL CIRCUIT RECLOSERS
 WITH BY-PASS SWITCHES
 NOV. 1986
 ZM3-24A, ZM3-25A



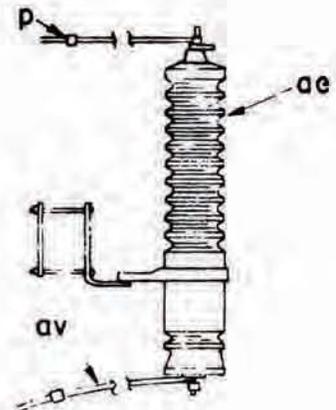
ZM5-1



ZM5-9



ZM5-22



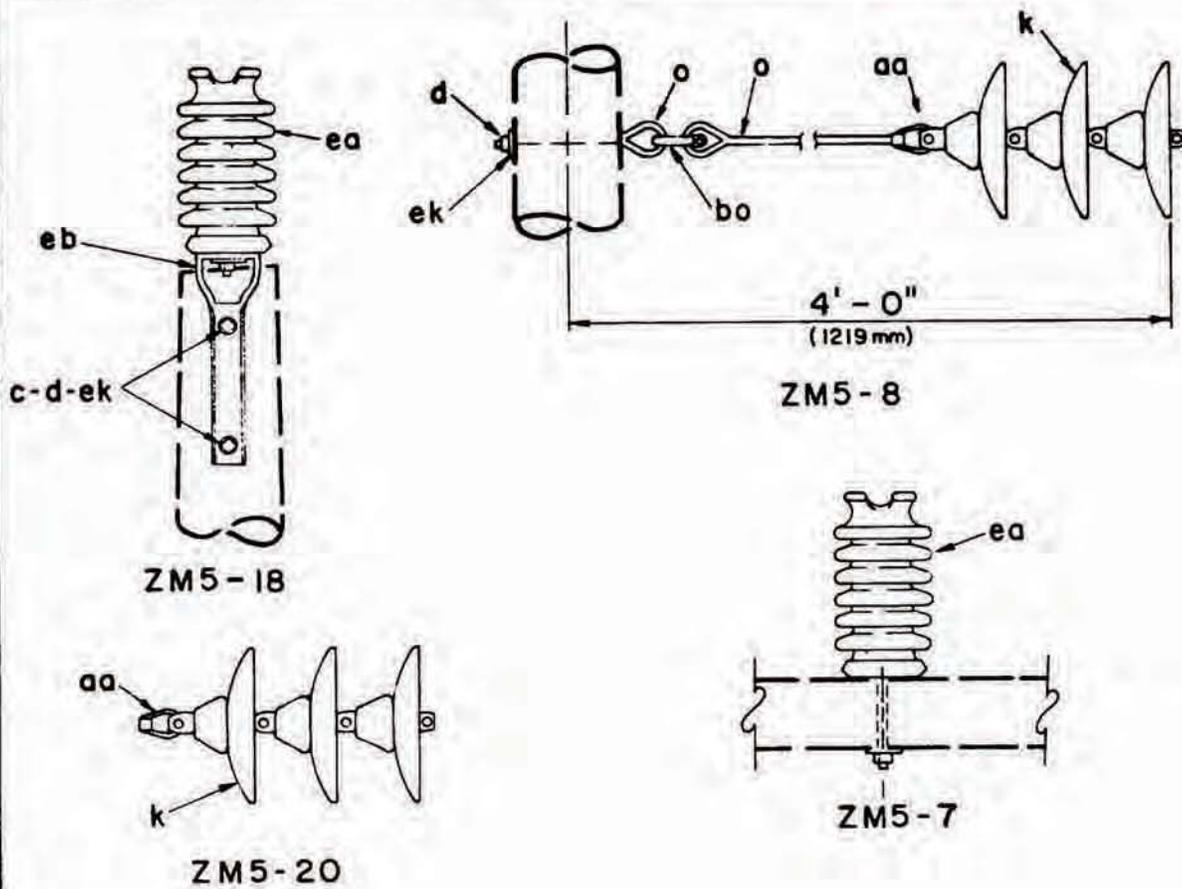
ZM5-6

ITEM	MATERIAL	ZM5-1	ZM5-6	ZM5-9	ZM5-22
p	Connector	1	2	2	1
ae	Surge arrester		1		
af	Cutout, single-shot			1	
ap	Clamp, hot line	1			
av	Jumper	1	2	2	1
fi	Connector, hot line				1

MISCELLANEOUS PRIMARY ASSEMBLY

NOV. 1986

ZM5-1,ZM5-6,ZM5-9,ZM5-22

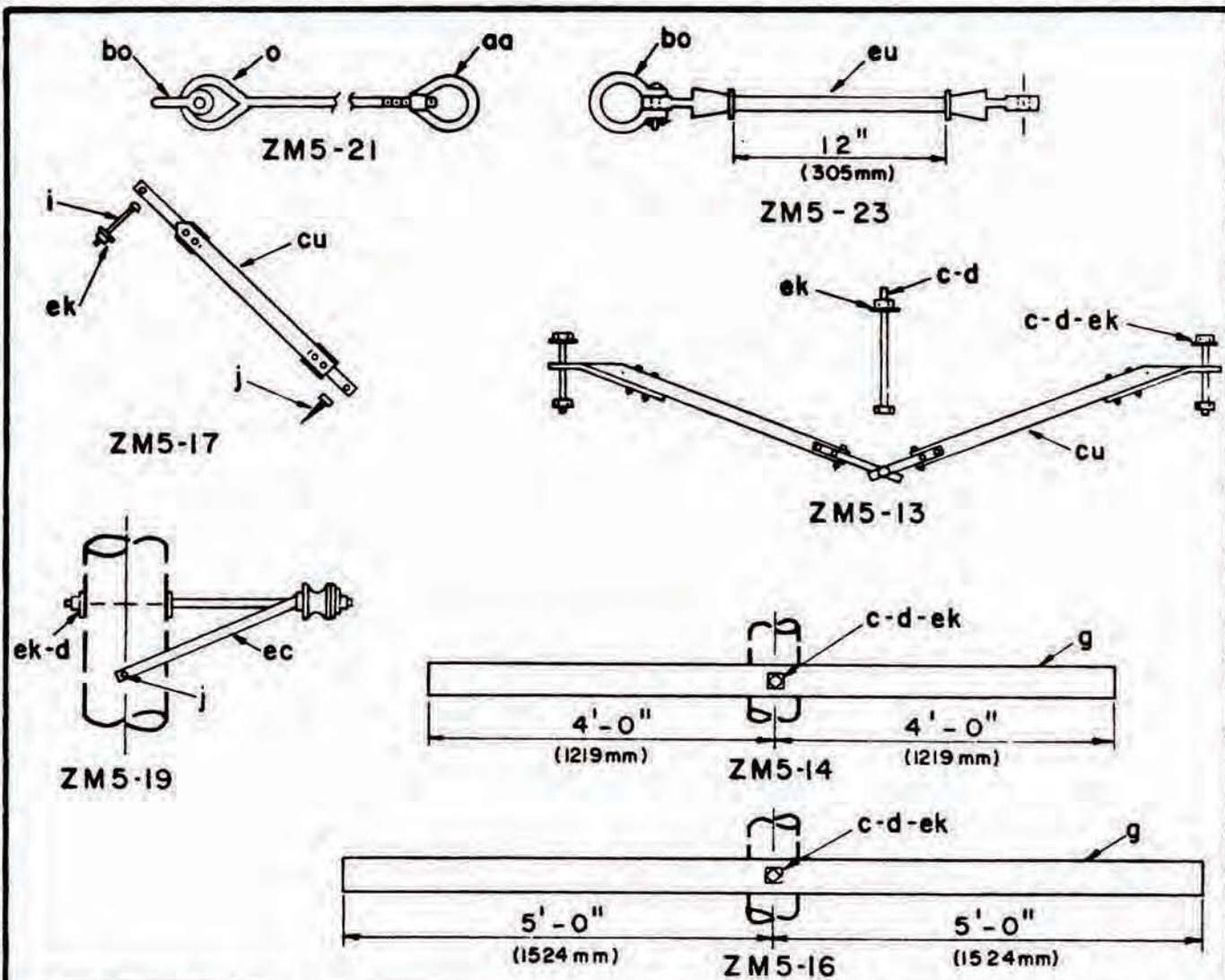


ITEM	MATERIAL	ZM5-7	ZM5-8	ZM5-18	ZM5-20
c	Bolt, machine 5/8" x req'd length			2	
d	Washer, square 2 1/4"		1	2	
k	Insulator, suspension 10"		3		3
o	Bolt, eye 5/8" x req'd length		2		
aa	Nut, eye 5/8"		1		1
bo	Shackle anchor		1		
ea	Insulator, post type	1		1	
eb	Bracket, pole top			1	
ek	Locknuts, as required				

**34.5/19.9 kV
MISCELLANEOUS PRIMARY ASSEMBLIES**

NOV. 1986

ZM5-7,8,18,20



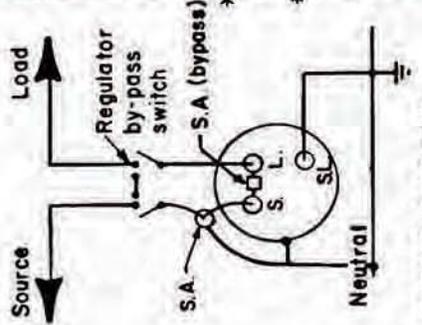
ITEM	MATERIAL	ZM5-13	ZM5-14	ZM5-16	ZM5-17	ZM5-19	ZM5-21	ZM5-23
c	Bolt, machine, 5/8" x req'd length	1	1	1				
c	Bolt, machine, 1/2" x req'd length	2						
d	Washer, square 2 1/4"	1	2	2		1		
d	Washer, round 1 3/8" dia.	2						
g	Crossarm 3 5/8" x 4 5/8" x 8'-0"		1					
g	Crossarm 3 5/8" x 4 5/8" x 10'-0"			1				
i	Bolt, carriage 3/8" x 4 1/2"				1			
j	Screw, lag 1/2" x 4"				1	2		
o	Bolt, eye 5/8" x req'd length						1	
aa	Nut, eye 5/8"						1	
bo	Shackle anchor							1
cu	Brace wood	1			1			
ec	Bracket, offset, neutral, insulated					1		
ek	Locknuts	3	1	1	1	1		
eu	Link, extension, insulated							1

MISCELLANEOUS PRIMARY ASSEMBLIES

NOV. 1986

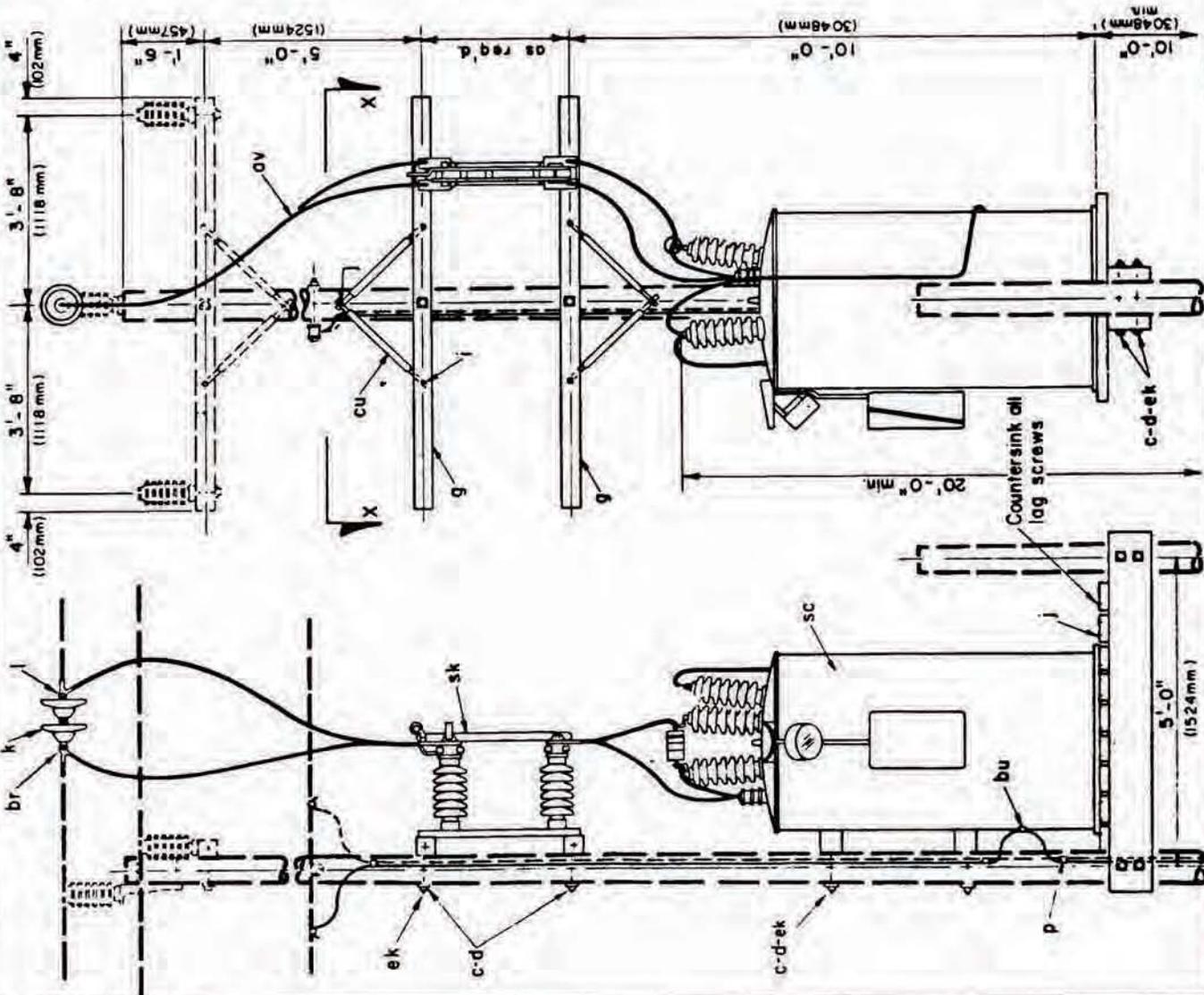
ZM5-13,14,16,17,19,21,23

ITEM NO	MATERIAL
c	Bolt, machine, 1/2" x req'd length
c	Bolt, machine, 5/8" x req'd length
c	Bolt, machine, 3/4" x req'd length
d	Washer, round, 1 3/8"
d	Washer, square, 2 1/4"
g	Crossarm, 3 5/8 x 4 5/8 x 8" - 0"
i	Bolt, carriage, 3/8" x 4 1/2"
i	Screw lag 1/2" x 4"
i	Screw lag 1/2" x 5" as req'd
p	Clamp, deadend
p	Connectors, as req'd
ae	Surge arrester
av	By-pass arrester
br	Jumpers, stranded, as req'd
bu	Chain link, 5/8" x 3/4"
bu	Connector, solderless
cu	Brace, wood, 2"
sc	Regulator, step type
sk	Regulator, by-pass switch
k	Insulator, suspension, 10"
k	Structural timber, 4" x 10" x 6" - 0"
ek	Planks, 2" or 3" thick, length as req'd
ek	Locknuts, as req'd



WIRING DIAGRAM

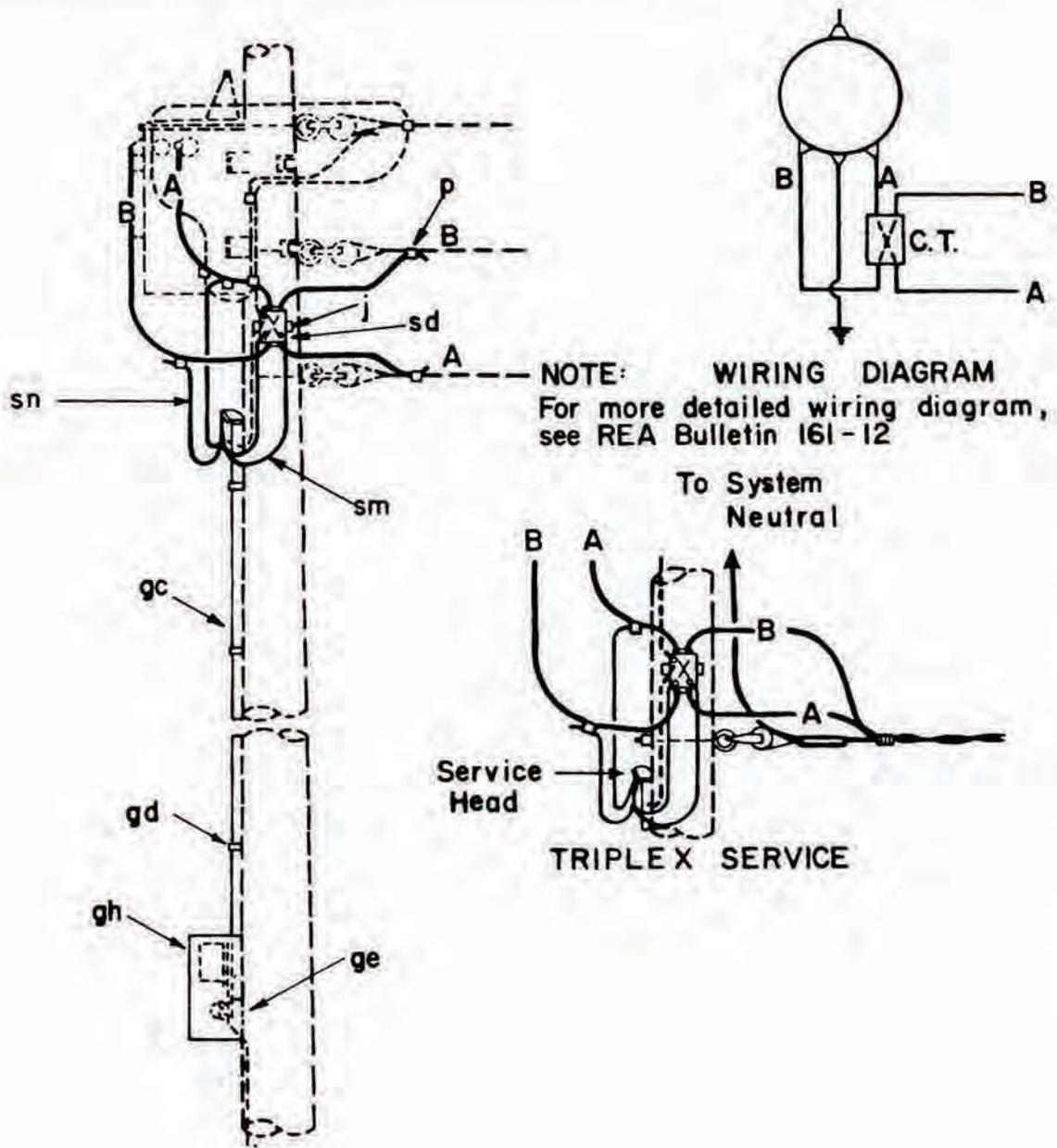
* Specify this item to be furnished by the manufacturer



SECTION X-X

NOTE: All structural timber and planks to be treated per REA specification

34.5/19.9 KV SINGLE PHASE STEP VOLTAGE REGULATOR PLATFORM MOUNTED
NOV. 1986
ZM7-1

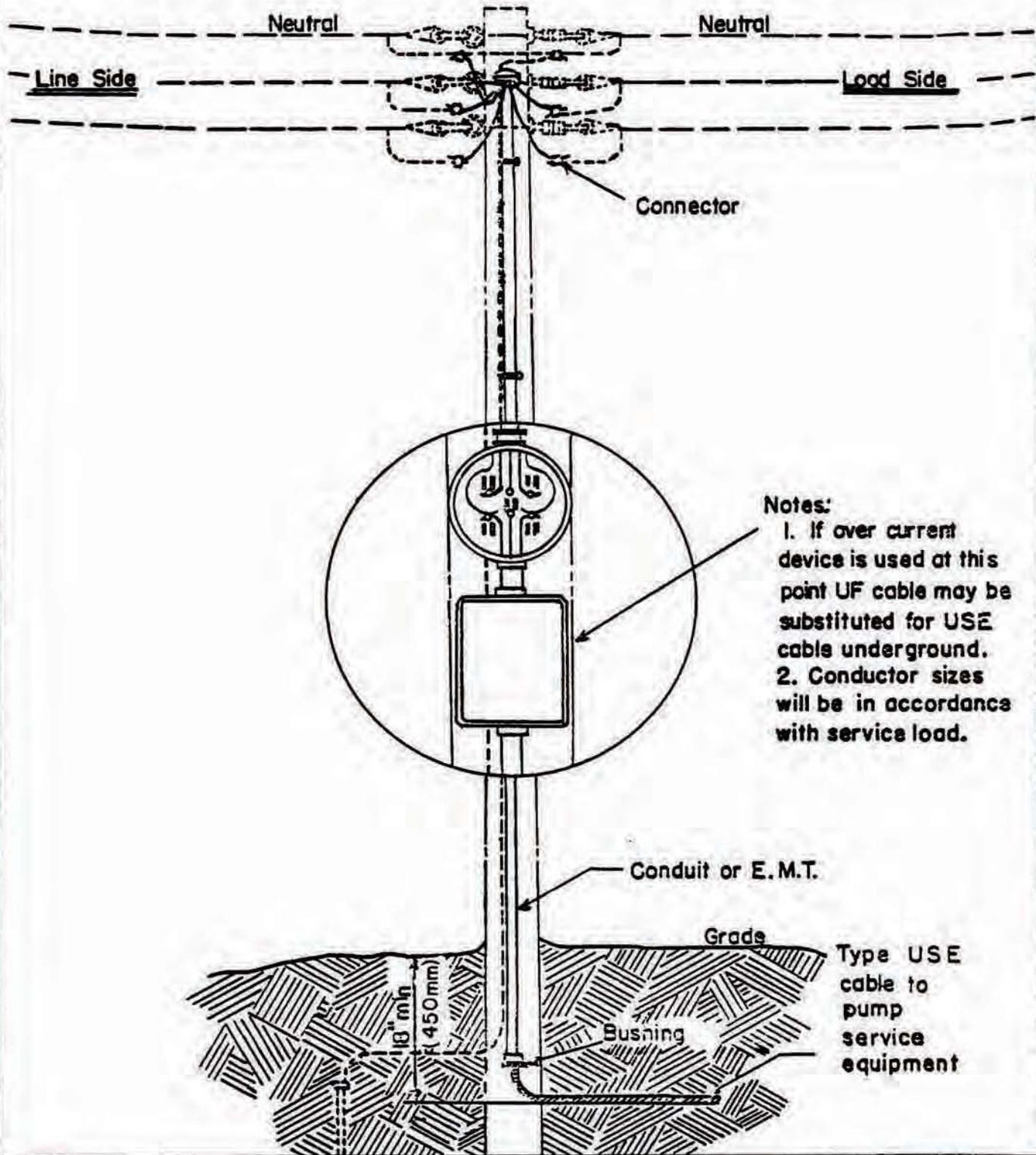


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
j 2	Screw, lag, 1/2" x 4"	gh 1	Meter box, meter and test block
p	Connectors, as req'd	sd 1	Transformer, current
gc	Conduit, 1 1/4", as req'd	sm	Wire, No. 12, insulated for current
gd	Straps, conduit, as req'd	sn	Wire, No. 14, insulated for potential
ge 1	Condulet, type "LB"	1	Service head

SECONDARY METERING GUIDE
SINGLE PHASE 120/240 VOLTS

NOV. 1986

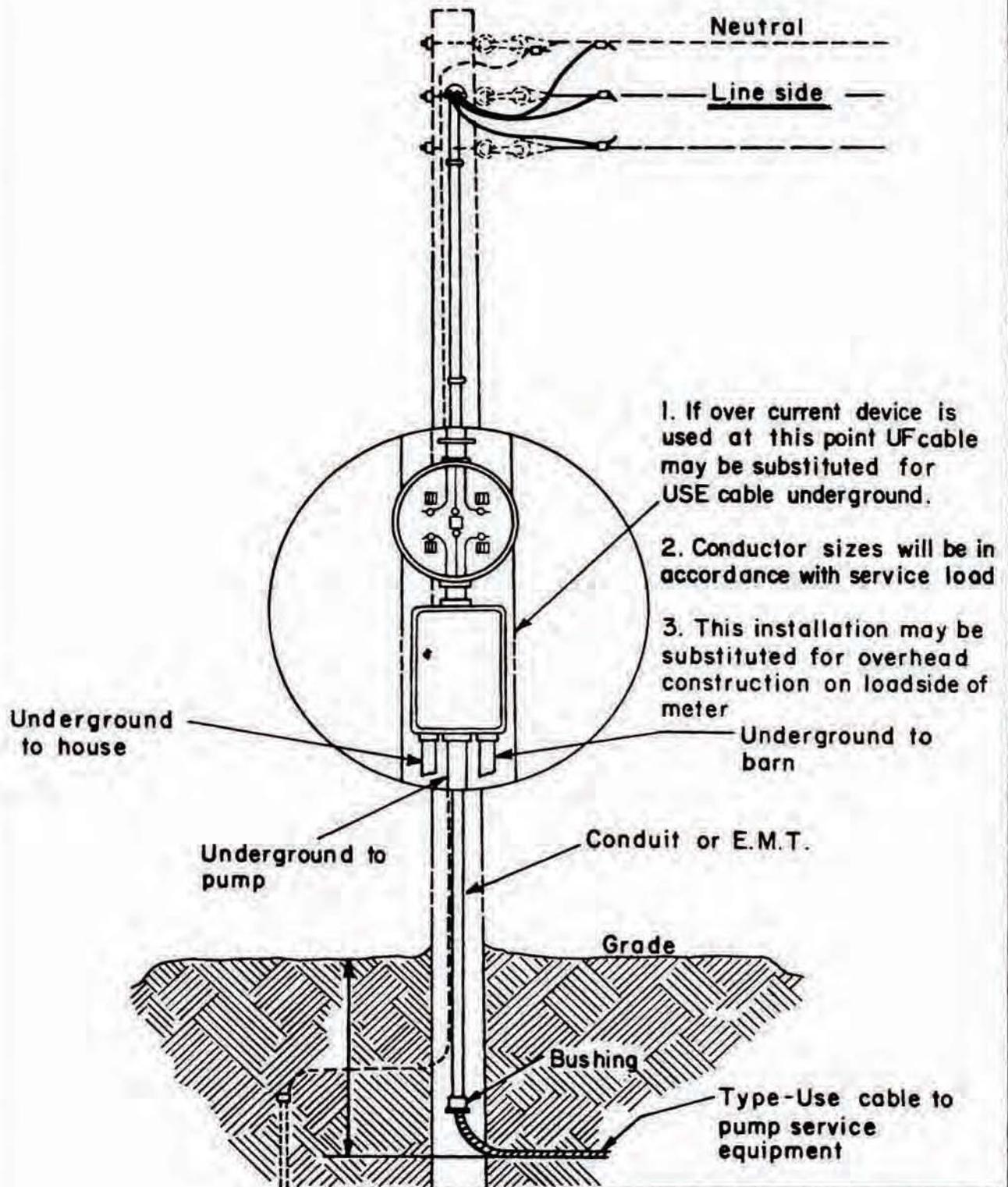
M8



**GUIDE TO YARD POLE METER INSTALLATION
(SHOWING PUMP SERVICE CARRIED
UNDERGROUND)**

NOV. 1986

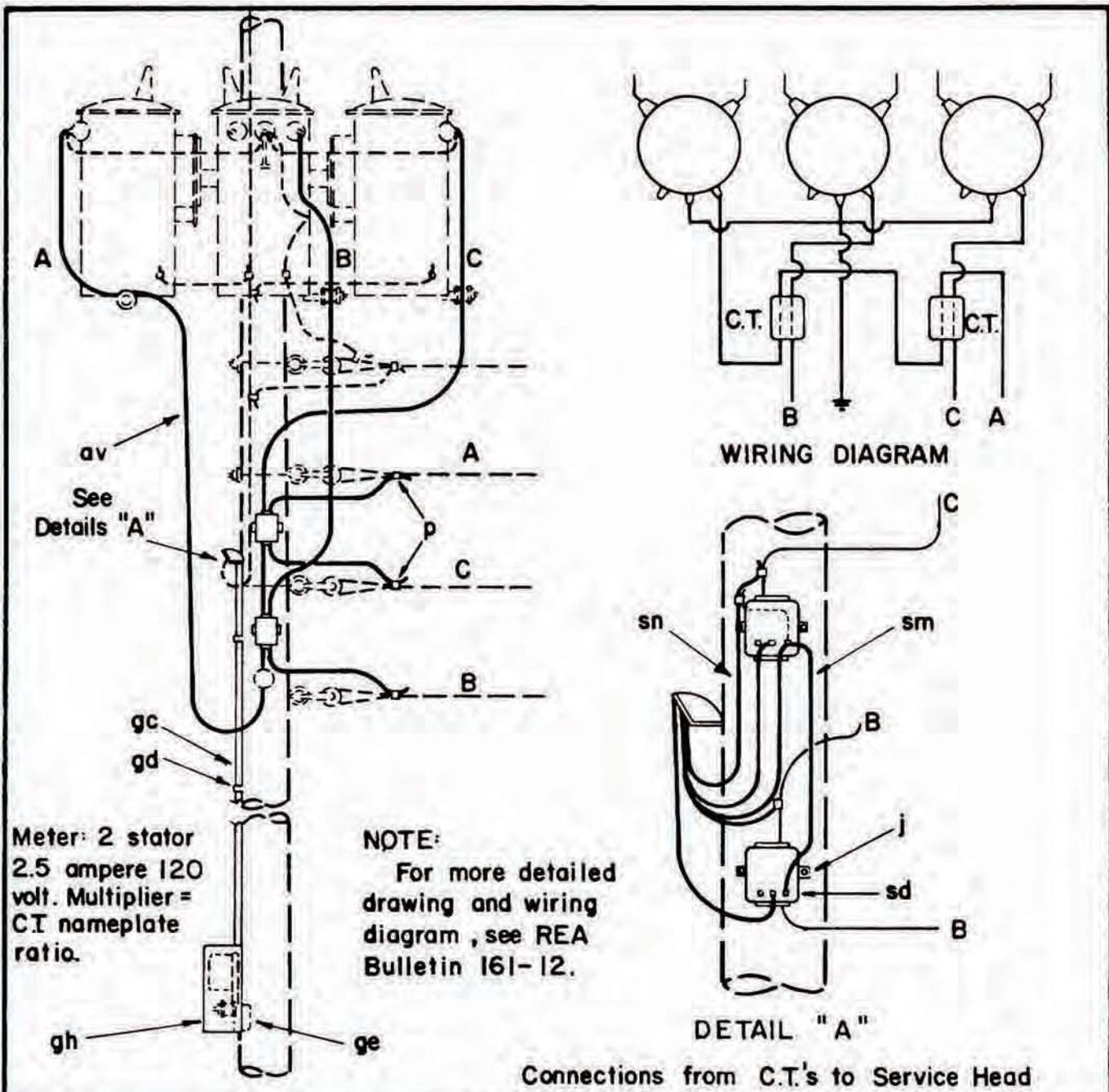
M8-9



**GUIDE TO YARD POLE METER INSTALLATION
(SHOWING ALL BUILDING SERVICES CARRIED
UNDERGROUND)**

NOV. 1986

M8-10

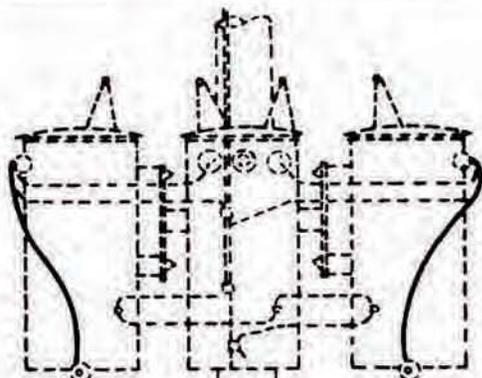


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
j 4	Screw, lag	gh 1	Meter box, meter and test block
p	Connectors, as req'd	sd 2	Transformer, current
av	Jumpers, insulated	sm	Wire, No. 12, insul. for current
gc	Conduit, 1 1/4", as req'd	sn	Wire, No. 14, insul. for potential
gd	Straps, conduit, as req'd	l	Service head
ge 1	Condulet, type "LB"		

SECONDARY METERING GUIDE
THREE PHASE, 208/120 VOLTS
4 WIRE GROUNDED WYE

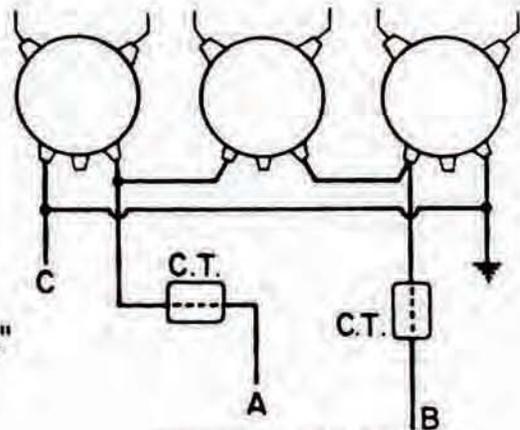
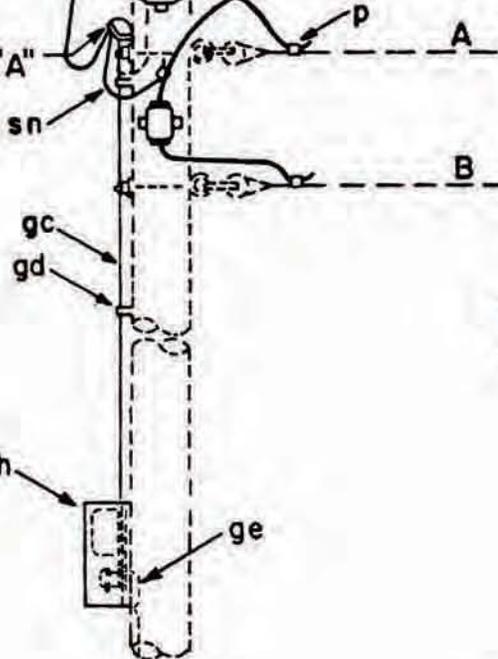
NOV. 1986

M8-11



Grounded phase "C"

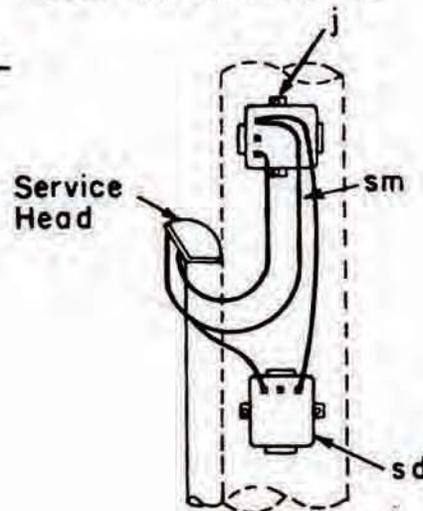
See Detail "A"



WIRING DIAGRAM

NOTE:

For more detailed wiring diagram, see REA Bulletin 161-12



DETAIL "A"

Connections from C.T.'s to Service Head

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
j 4	Screw, lag, 1/2" x 4"	gh 1	Meter box, meter and test block
p	Connectors, as req'd	sd 2	Transformer, current
gc	Conduit, 1/4", as req'd	sm	Wire, No. 12, insul. for current
gd	Straps, conduit, as req'd	sn	Wire, No. 14, insul. for potential
ge 1	Condulet type "LB"		

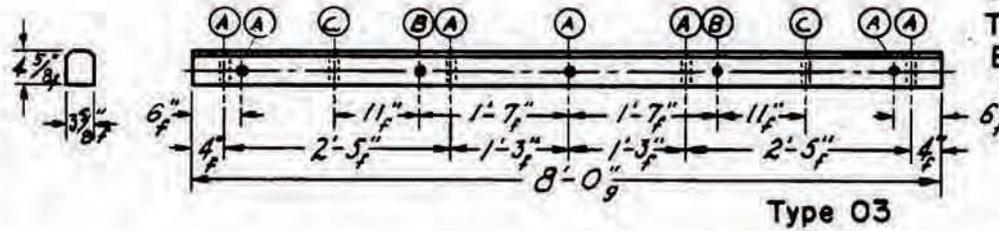
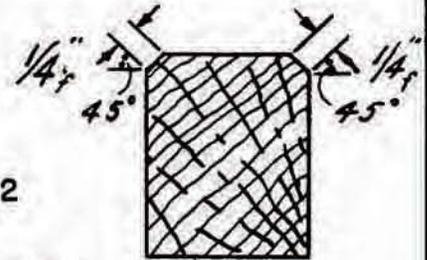
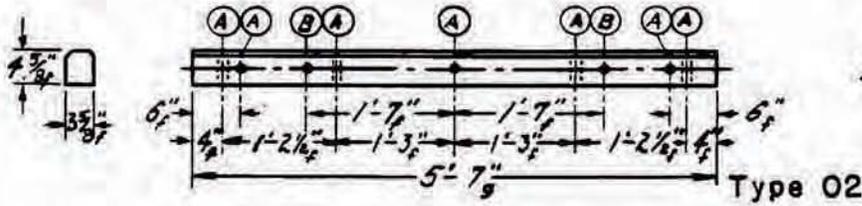
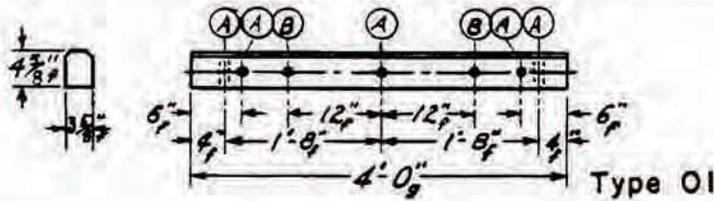
SECONDARY METERING GUIDE
 THREE PHASE 240 VOLTS
 3 WIRE CORNER GROUNDED DELTA

NOV. 1986

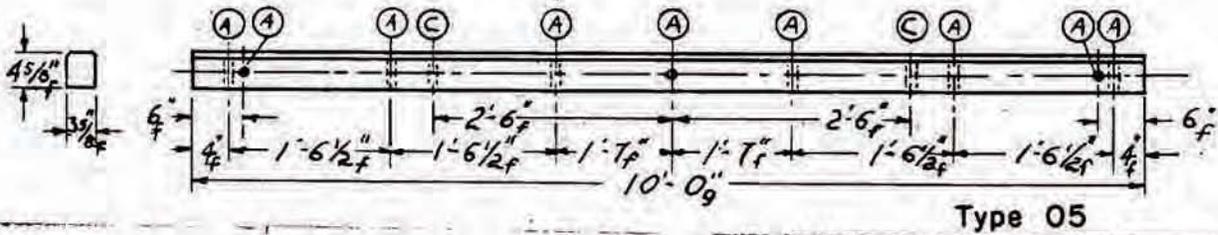
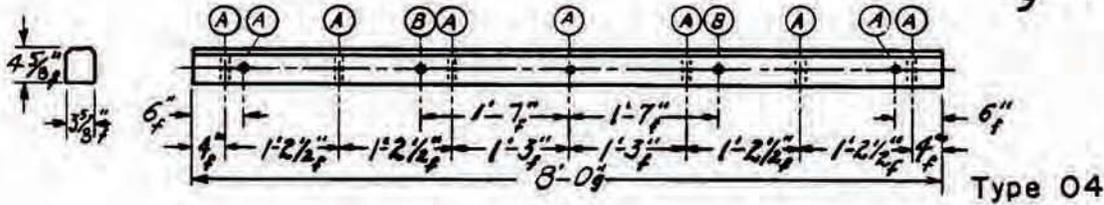
M 8-12

TOLERANCES
SIZES OF HOLES

Nominal	Go	No Go
(A) 1/16"	9/16"	3/4"
(B) 3/16"	3/8"	1/2"
(C) 9/16"	1/2"	5/8"



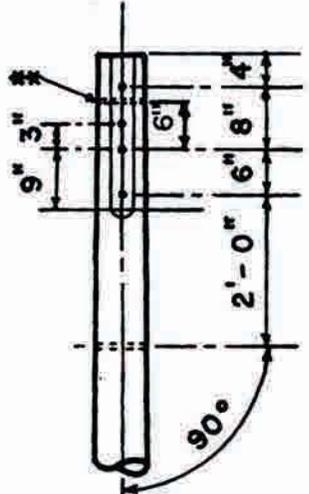
f --- ± 1/8"
g --- ± 1/4"



CROSSARM DRILLING GUIDE

NOV. 1986

M19



Through-bolt holes must be parallel and in the same plane.

HOLES: Drill 11/16" diameter.

GAINS: Gains are to be flat with plane at right angles to bolt hole.

Neutral bolt hole must be at 90° angle with through-bolt holes.

All poles shorter than 50 feet must be bored, roofed and gained before treatment, except that Class 7 and smaller poles need not be gained unless requested by purchaser. Roofs may be flat or at a 15° angle at the producer's option.



*Bottom of brand or center of metal disk shall be 10' ± 1" from pole butt; 14' ± 1" mark for poles 55' and longer.

If insured warranted pole, Brand "IW".

Manufacturer's Mark and Date of Treatment, (Month and Year).

Brand with proper length and class.

Brand with species, preservative code and retention.

Tolerance:

Holes

On the gain ± 1/8" from the centerlines of the holes.

On the side opposite the gain ± 1/4" from the centerlines of the holes.

Location - measured from roof

Gain side ± 1/4"

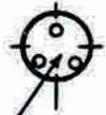
Opposite side ± 1/2"

Diameter ± 1/16"

Gains out of parallel ± 1/2"

** Optional, anti-split bolt hole to be drilled only when so specified by the purchaser.

See note *



Brand butt with proper length and class

POLE FRAMING GUIDE

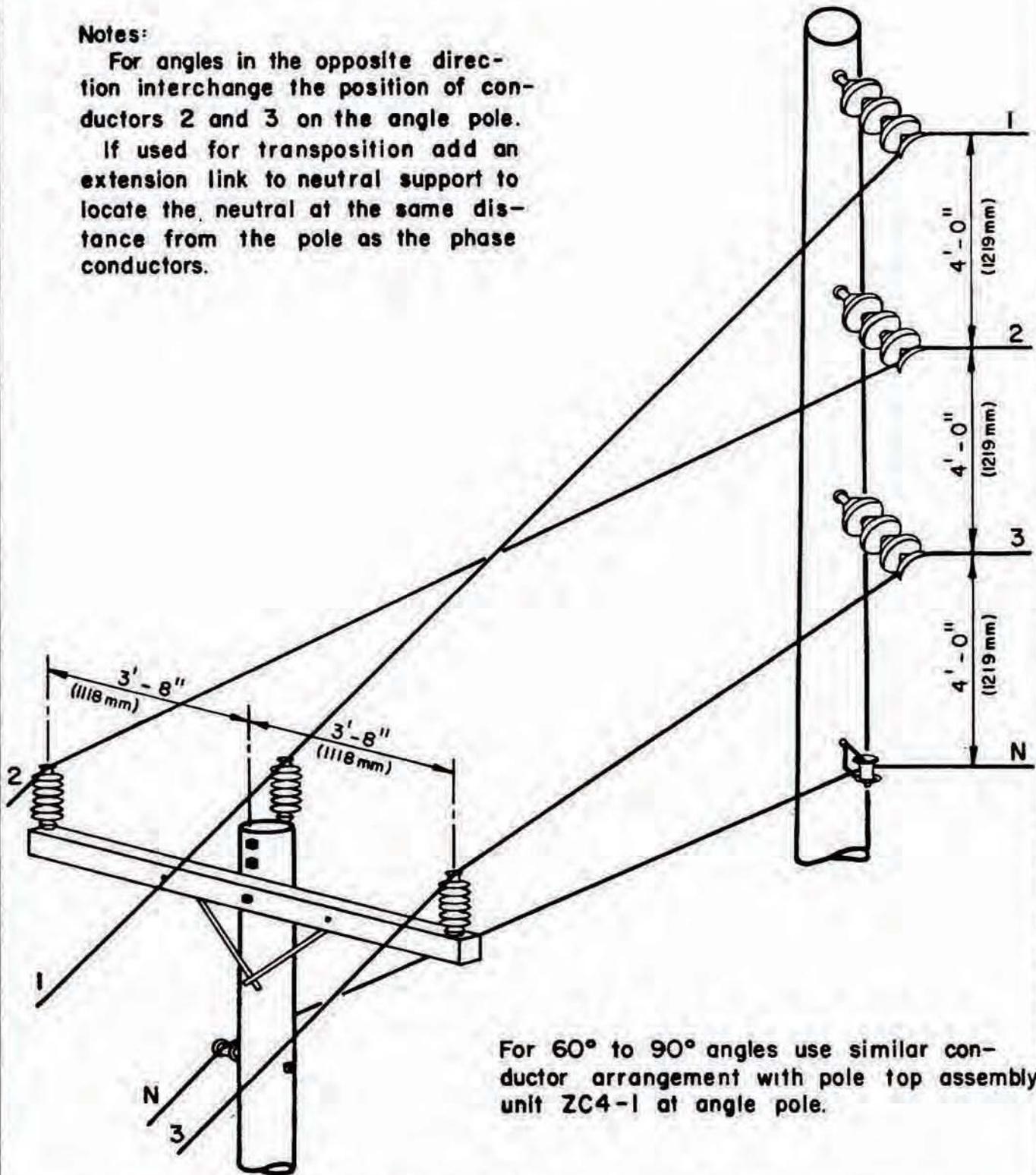
NOV. 1986

M20

Notes:

For angles in the opposite direction interchange the position of conductors 2 and 3 on the angle pole.

If used for transposition add an extension link to neutral support to locate the neutral at the same distance from the pole as the phase conductors.

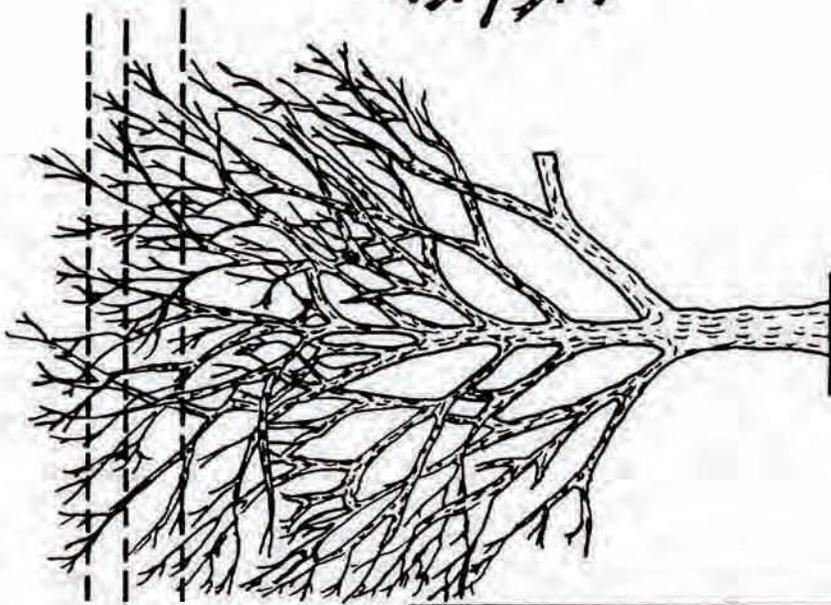


For 60° to 90° angles use similar conductor arrangement with pole top assembly unit ZC4-1 at angle pole.

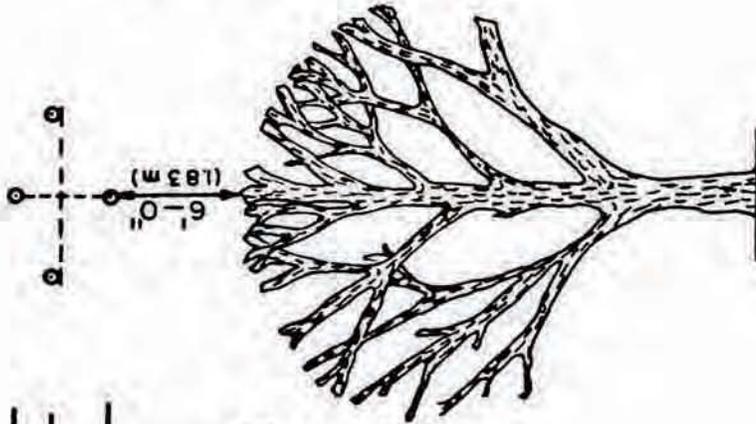
**ANGLE CONSTRUCTION GUIDE
CROSSARM TO VERTICAL CONST.-20° TO 60°ANGLE**

NOV. 1986

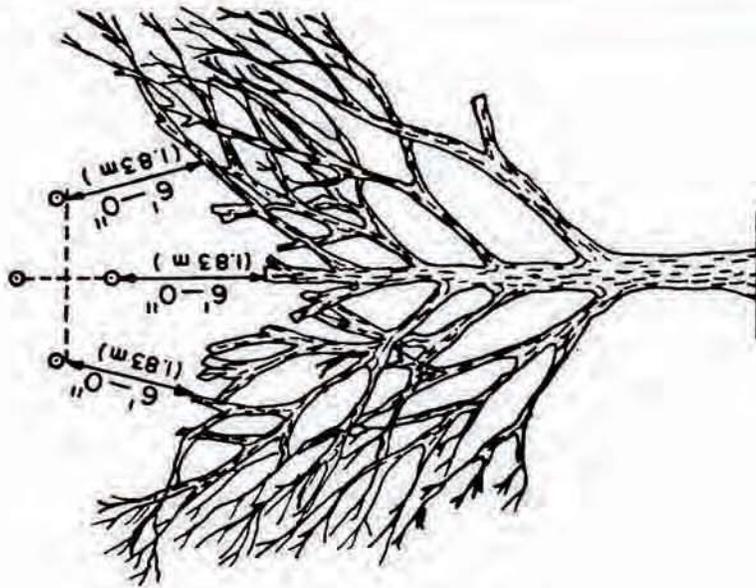
M21



Before Trimming



Right Way



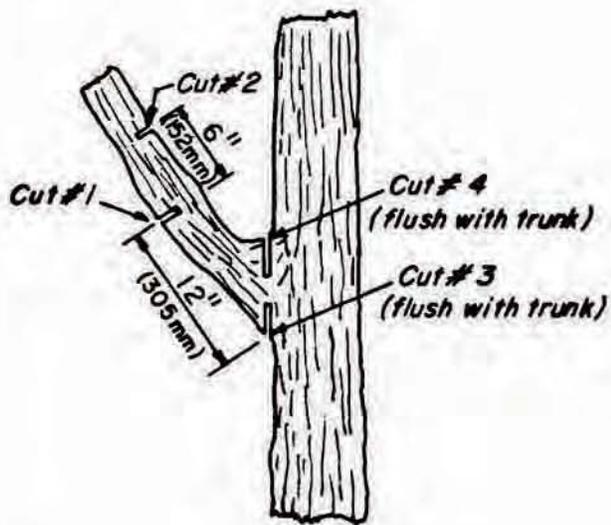
Wrong Way

NOTE: No parts of tree should be closer than 6'-0" (1.83 m) from open wiring. Trimming should leave tree with symmetrical appearance.

TREE TRIMMING GUIDE

NOV. 1986

ZM22-1



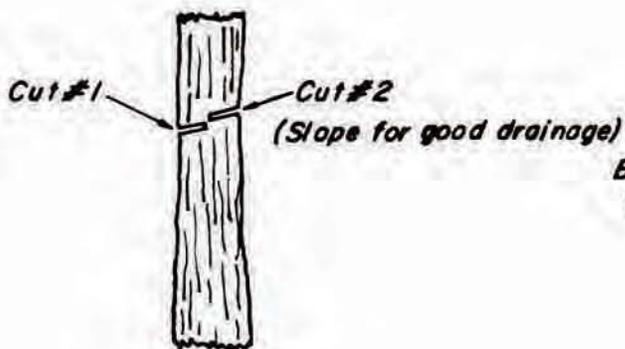
Right Way



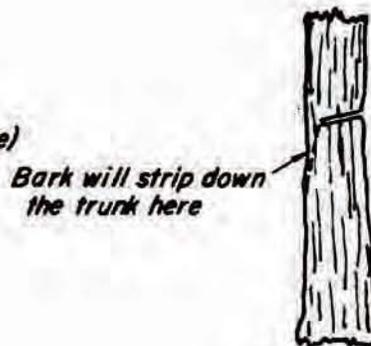
Wrong Way

*For small branches
omit Cuts #1 and #2*

REMOVAL OF HEAVY SIDE LIMB



Right Way



Wrong Way

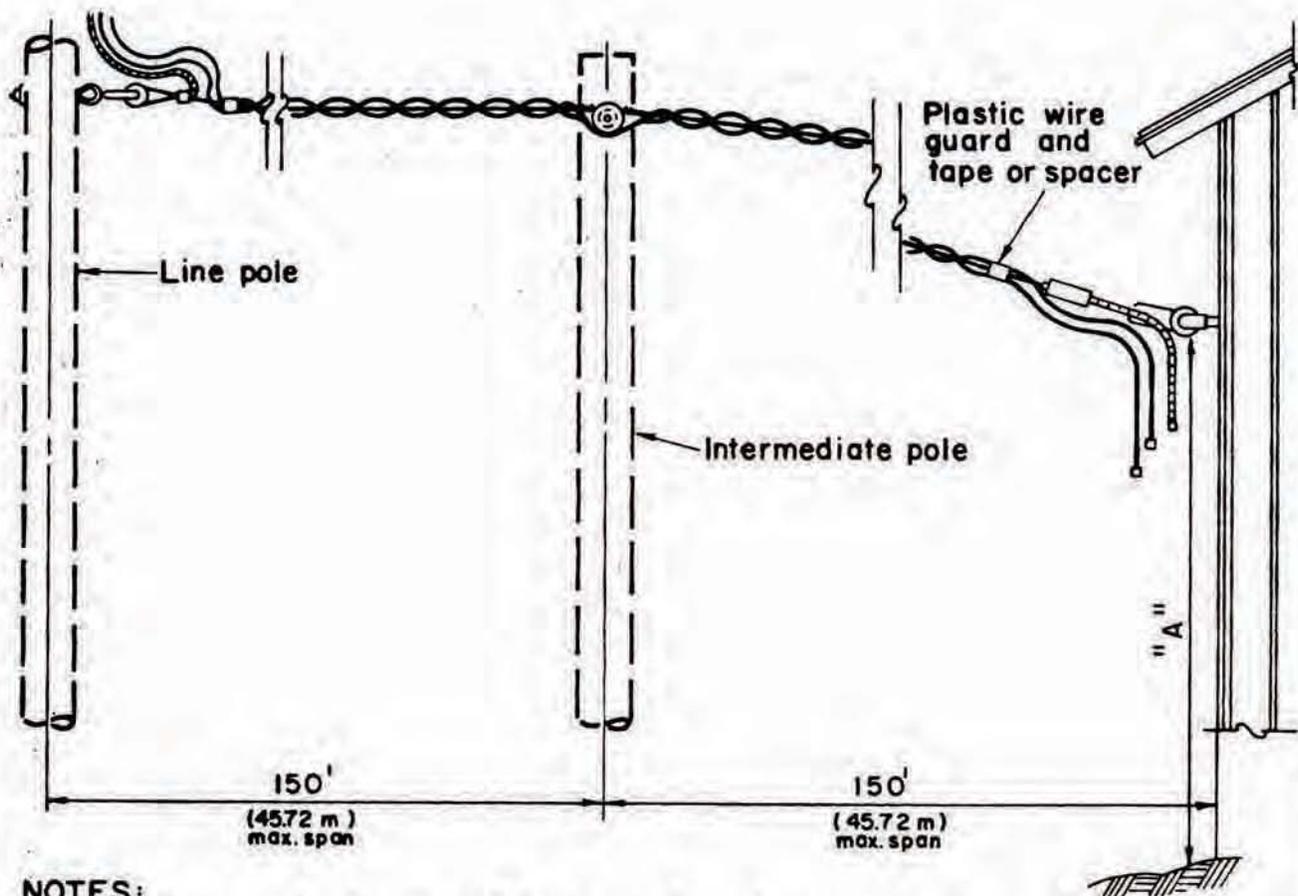
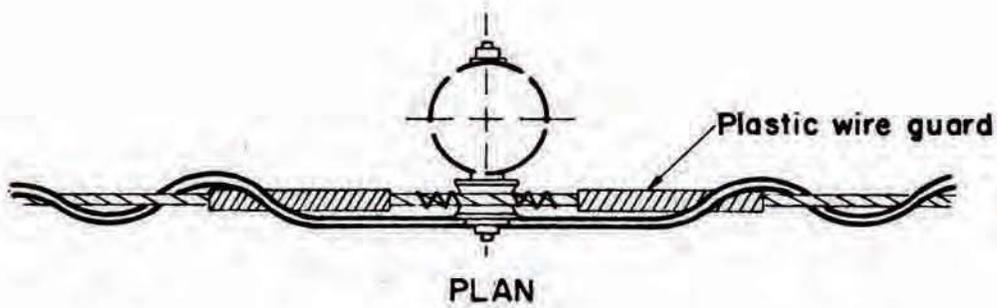
REMOVAL OF VERTICAL LIMB

NOTE: Coat final cut with tree paint.

TREE TRIMMING GUIDE

NOV. 1986

ZM22-2



NOTES:

1. Services as short as possible are preferred.
2. Refer to secondary and service assemblies for construction details.

Clearance "A" minimum

To bottom of drip loop	10' (3.05 m)
To service assembly and service drop conductor in span.	12' (3.66 m)

CABLE SERVICE ASSEMBLY GUIDE

NOV. 1986

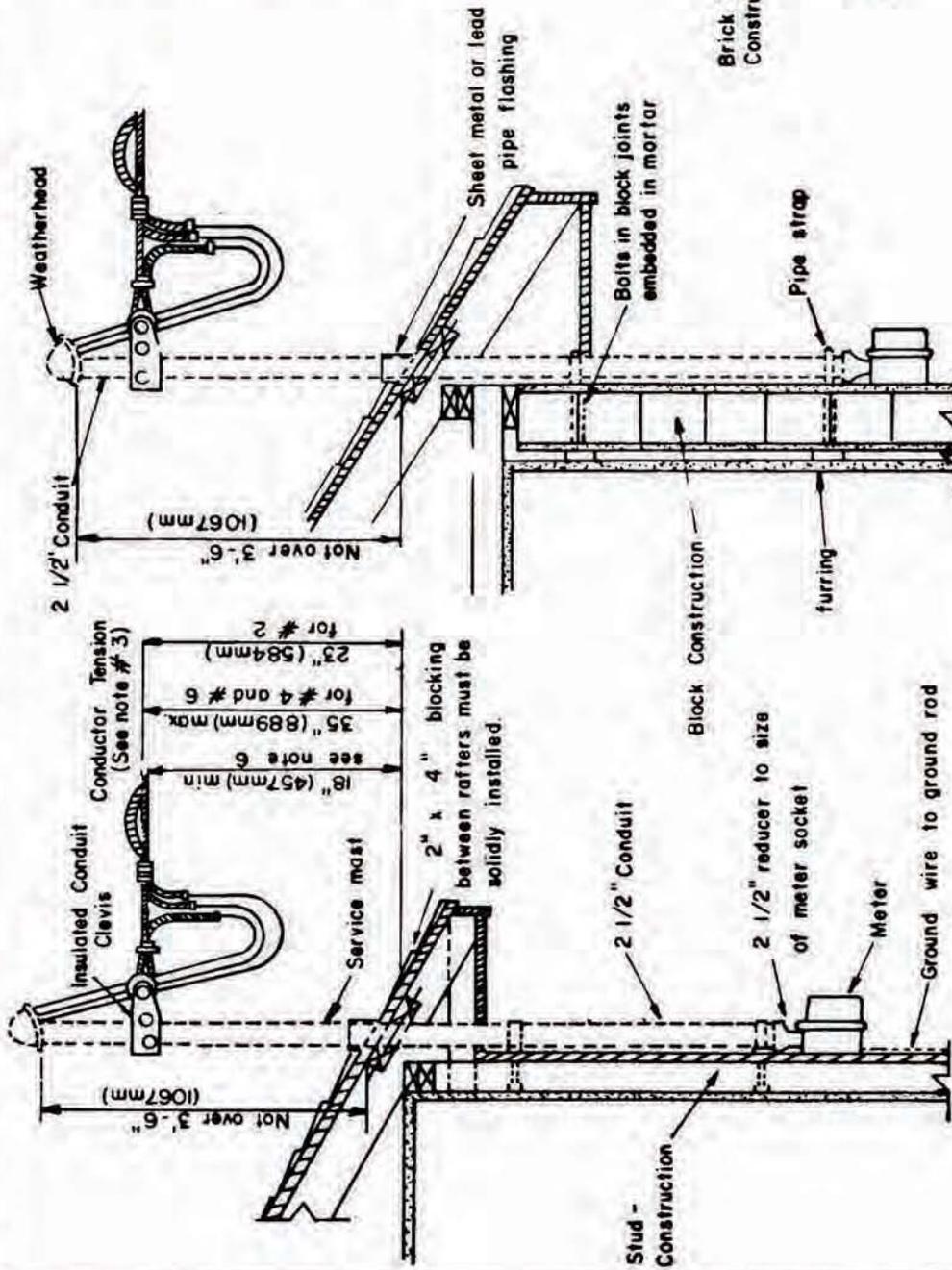
M 24



**ASSEMBLY GUIDE OF SERVICE MAST
FOR RANCH TYPE HOUSE**

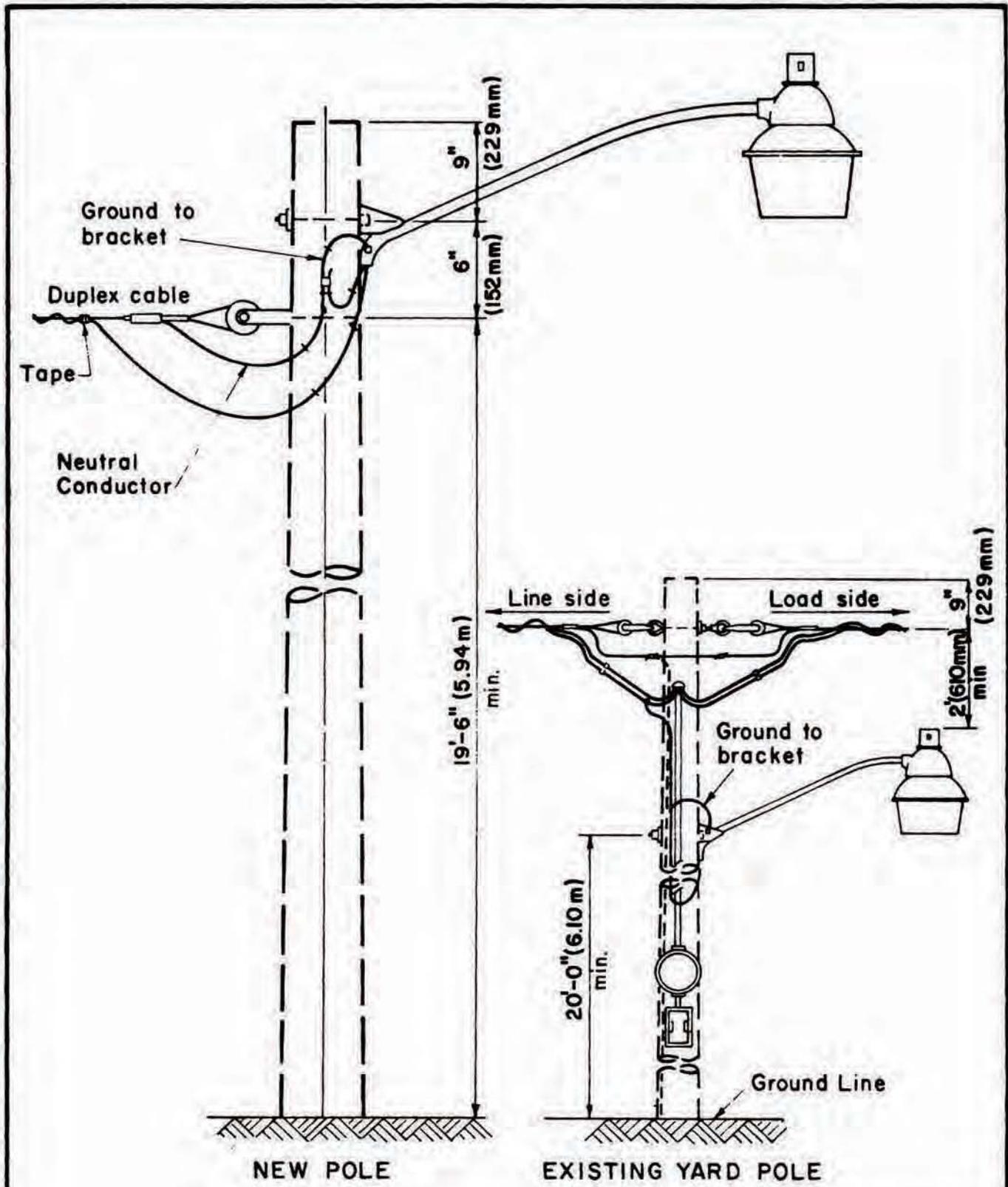
NOV. 1986

M24-10



Clearance "A"	Minimum
To bottom of drip loop	10'-0" (3.05 m)
To service assembly & service drop conductor in span	12'-0" (3.66 m)

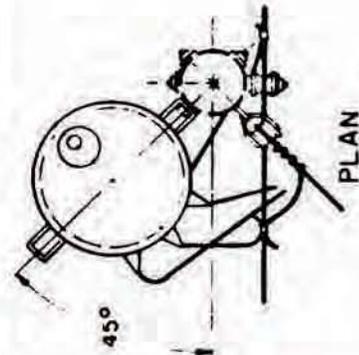
- NOTES:**
1. If length of conduit exceeds 10 feet (3.05 m) coupling will be permitted on end adjacent to meter.
 2. Meter to be located 5'-6" (1676 mm) from ground level.
 3. Maximum tension of conductor not to exceed 50% of ultimate strength.
 4. For service assemblies see drawings K16C, K17, K17L.
 5. Service connectors to be insulated compression type.
 6. This dimension applies to both drip loop and span.



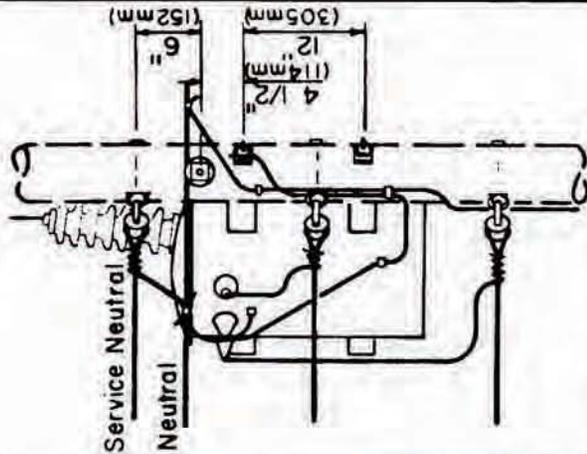
SECURITY LIGHT INSTALLATION GUIDE
(UNMETERED)

NOV. 1986

M 26-5

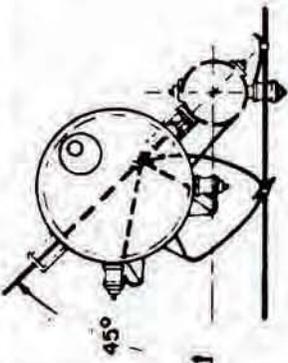


PLAN

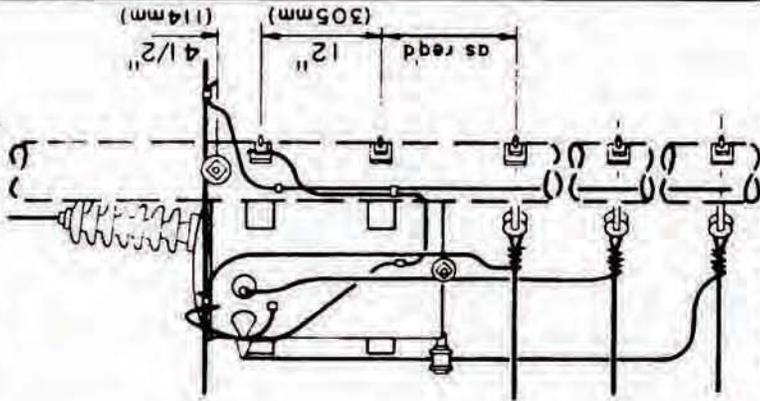


PRIMARY TANGENT SERVICE TAKE-OFF AT TRANSFORMER LEVEL

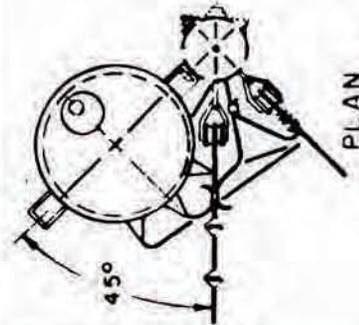
NOTE:
Transformers may be mounted in alternate positions and quadrants as practical in order to facilitate services in directions not shown.



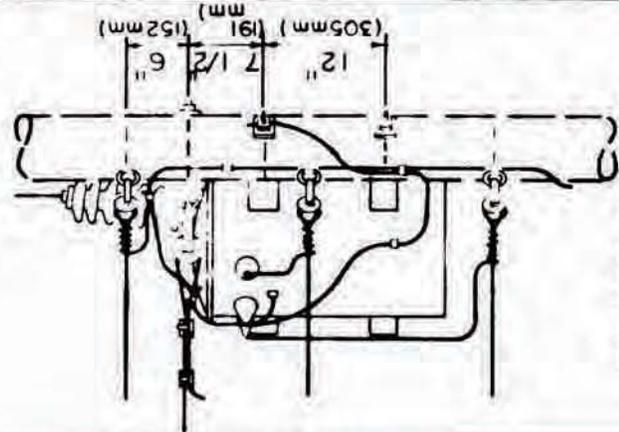
PLAN



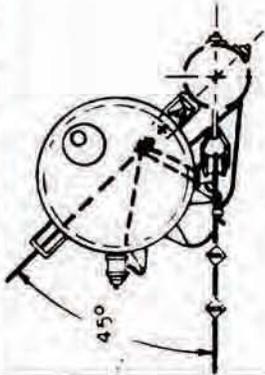
PRIMARY TANGENT SERVICE TAKE-OFF BELOW TRANSFORMER



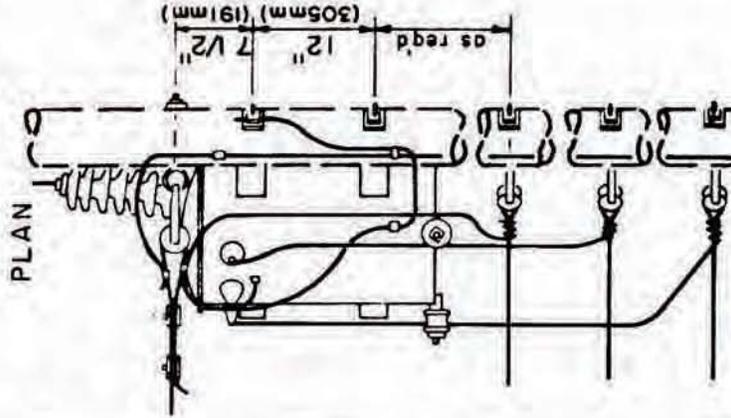
PLAN



PRIMARY DEADEND SERVICE TAKE-OFF AT TRANSFORMER LEVEL



PLAN

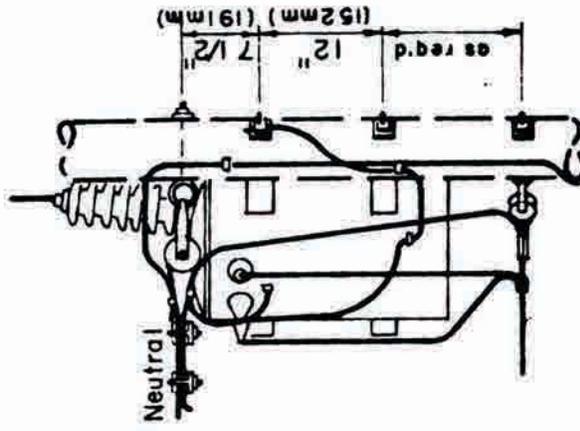
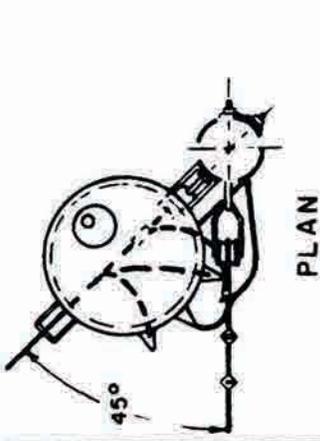


PRIMARY DEADEND SERVICE TAKE-OFF BELOW TRANSFORMER

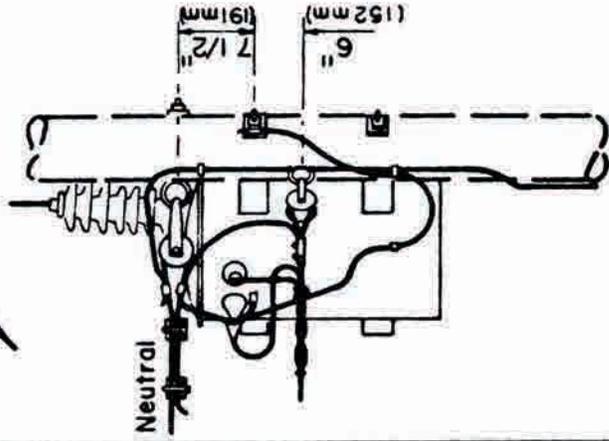
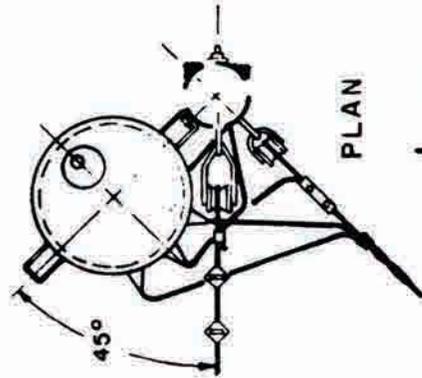
TRANSFORMER CONNECTION GUIDE
OPEN WIRE SERVICES

NOV. 1986

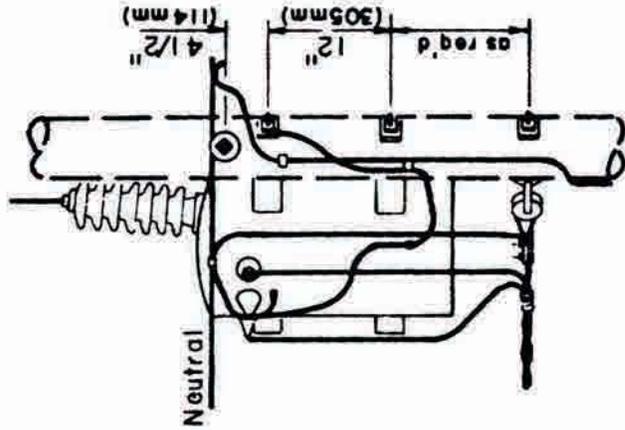
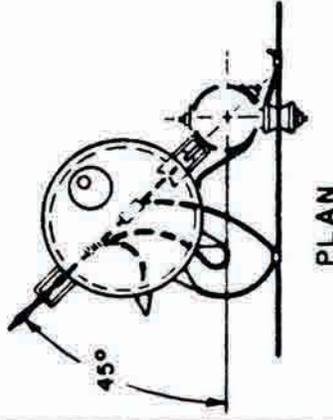
M 27



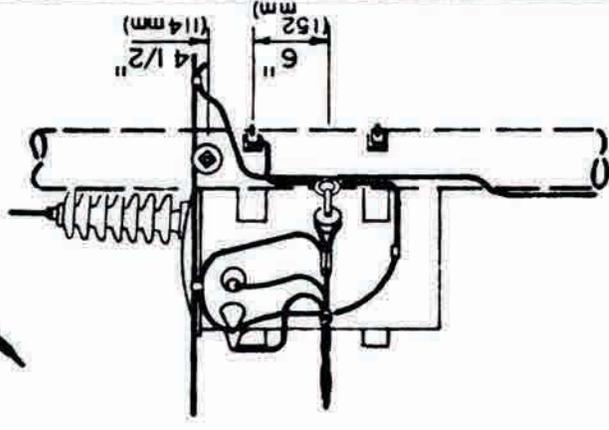
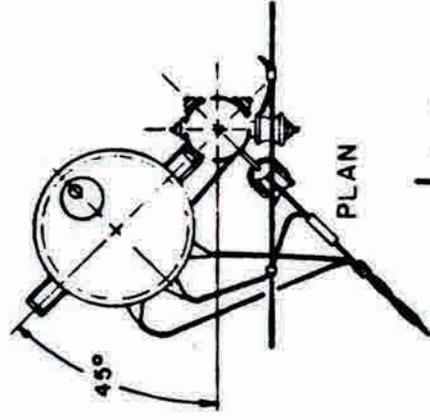
PRIMARY DEADEND
SERVICE TAKE-OFF
BELOW TRANSFORMER



PRIMARY DEADEND
SERVICE TAKE-OFF AT
TRANSFORMER



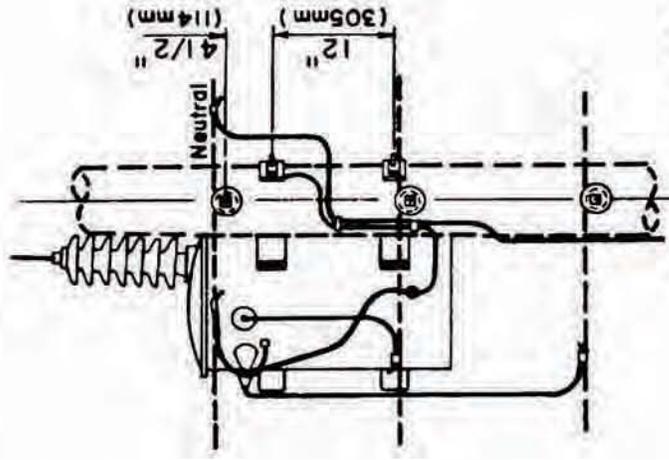
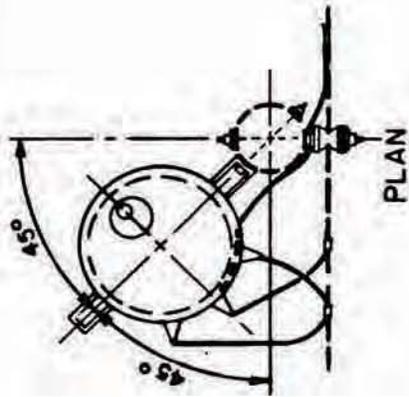
PRIMARY TANGENT
SERVICE TAKE-OFF
BELOW TRANSFORMER



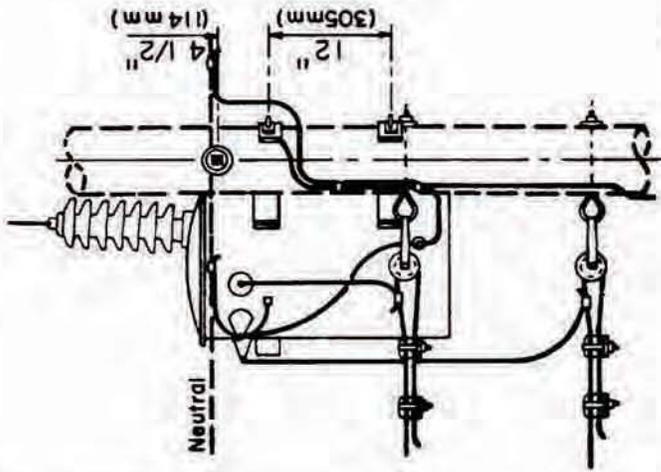
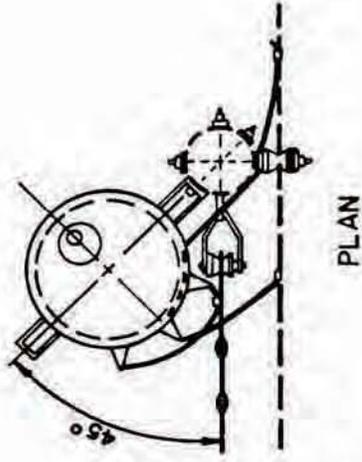
PRIMARY TANGENT
SERVICE TAKE-OFF AT
TRANSFORMER

NOTES

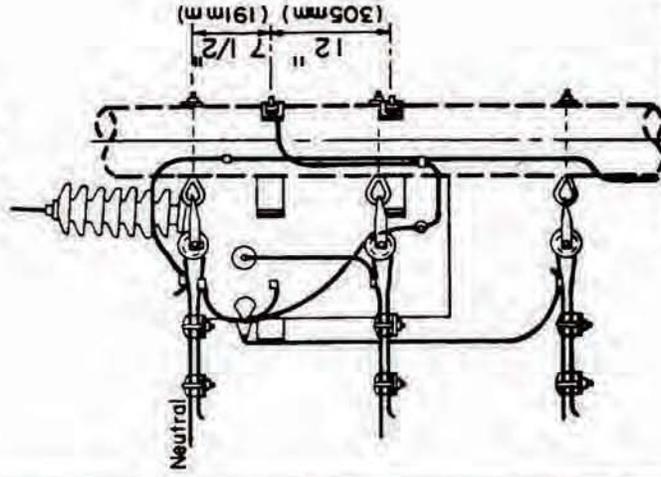
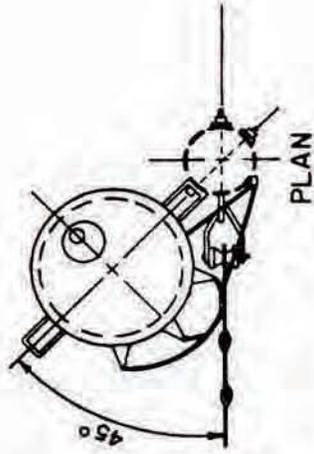
1. Secondary bushing not to be used for bi-metal connection.
2. Transformers may be mounted in alternate positions and quadrants as practical in order to facilitate services not shown.



PRIMARY TANGENT
SECONDARY TANGENT



PRIMARY TANGENT
SECONDARY DEADEND

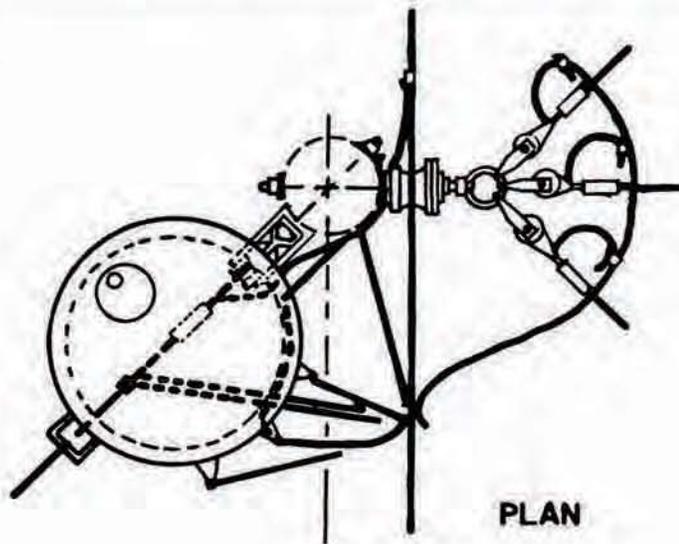


PRIMARY DEADEND
SECONDARY DEADEND

TRANSFORMER CONNECTION GUIDE
SECONDARY UNDERBUILD

NOV. 1986

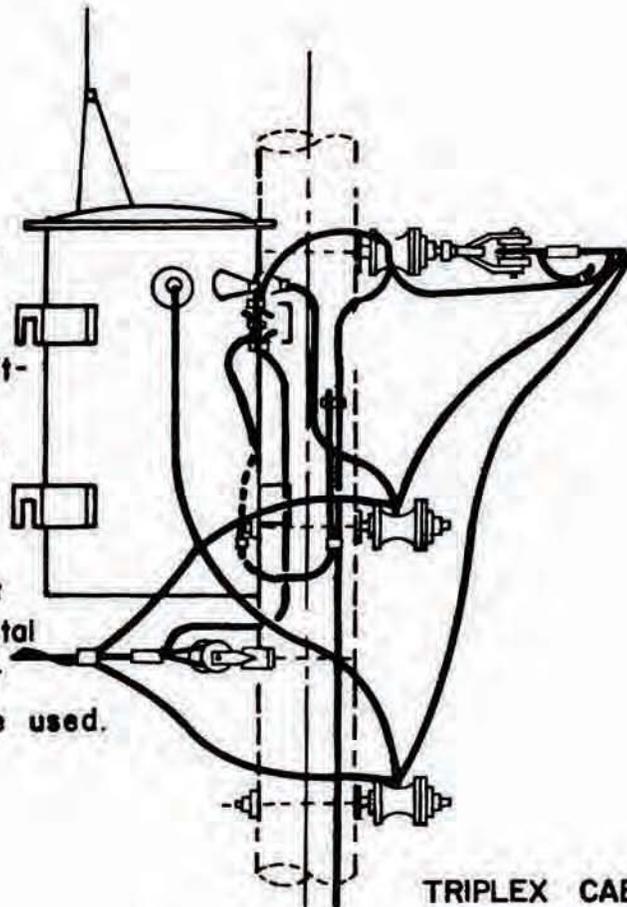
M27-2



PLAN

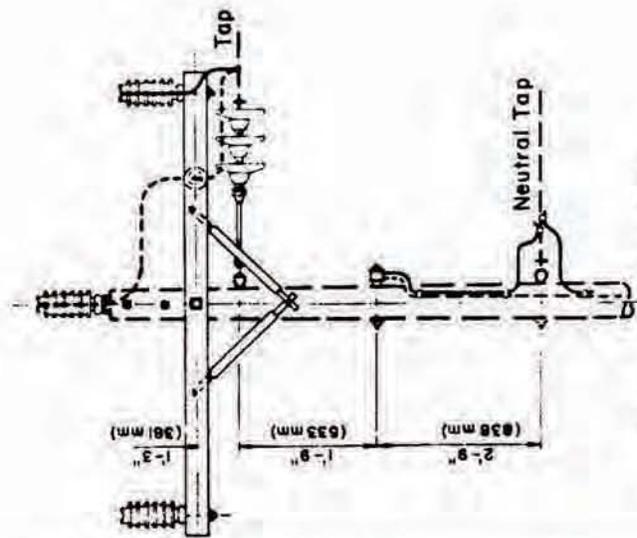
NOTES:

1. Use compression type connectors.
2. Stranded aluminum alloy or stranded soft-drawn copper is recommended for the grounding loop conductor.
3. Secondary bushing not to be used for bi-metal connection. Spades or copper studs may be used.

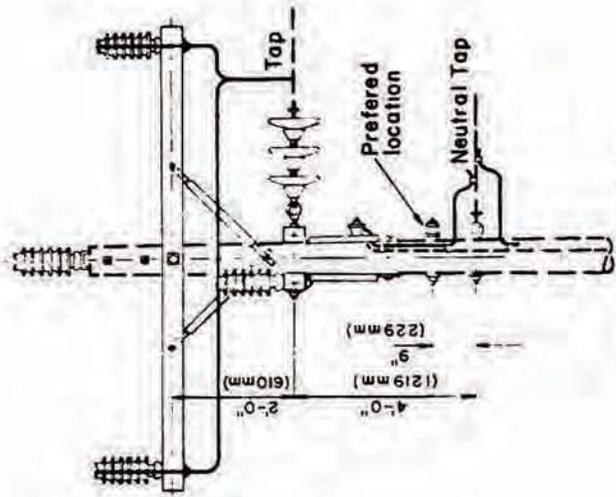


TRIPLEX CABLE

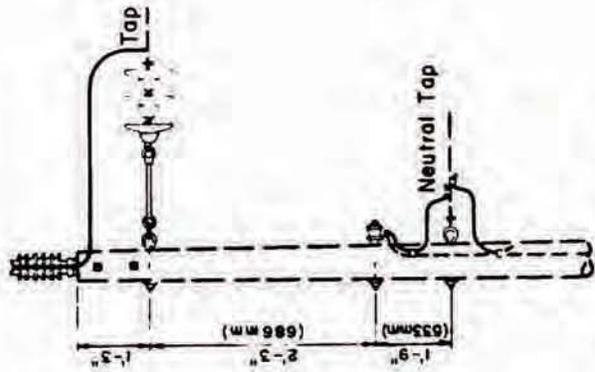
TRANSFORMER CONNECTION AND SERVICE TAKE-OFF GUIDE FROM SECONDARY



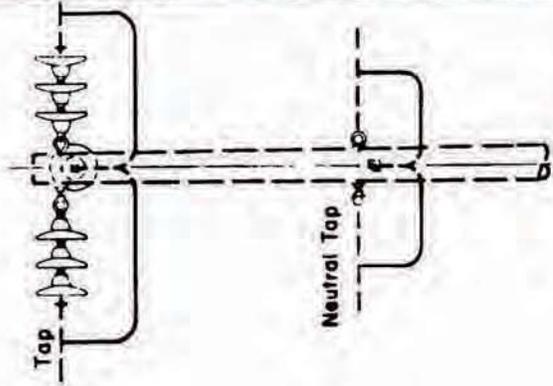
COMPLETE ASSEMBLY
ZC1, ZA5-2 and ZM5-7 (if needed)



COMPLETE ASSEMBLY
ZC1 and ZB7



COMPLETE ASSEMBLY
ZA5-2 and ZA1



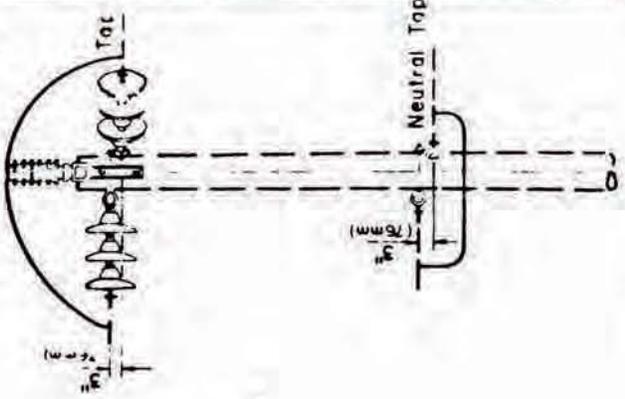
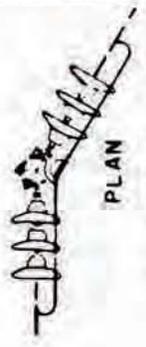
COMPLETE ASSEMBLY
ZA5-3 and ZA4

NOTE
This drawing illustrates the addition
of standard tap assemblies to other
standard pole tap assemblies

TAP ASSEMBLY GUIDE

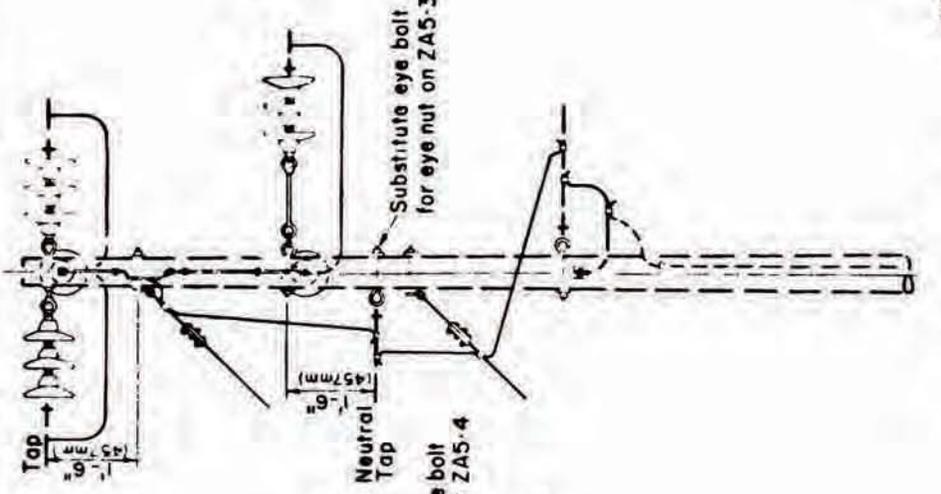
NOV. 1986

ZM29-1A

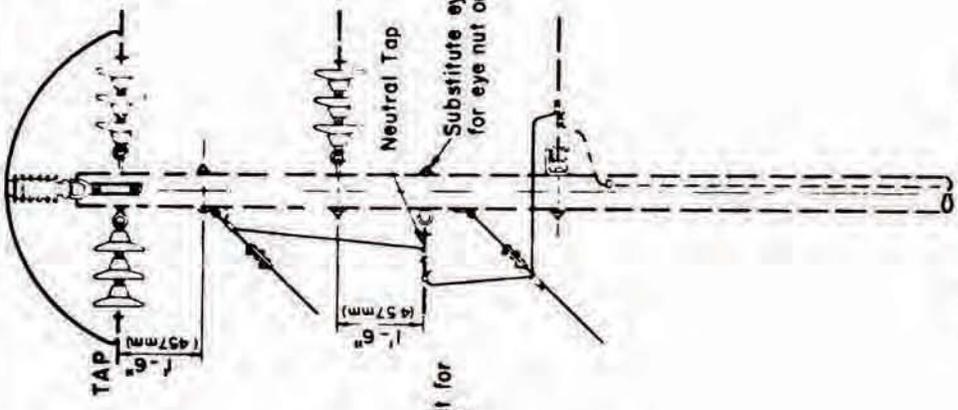


COMPLETE ASSEMBLY
ZAS-3 and ZAS

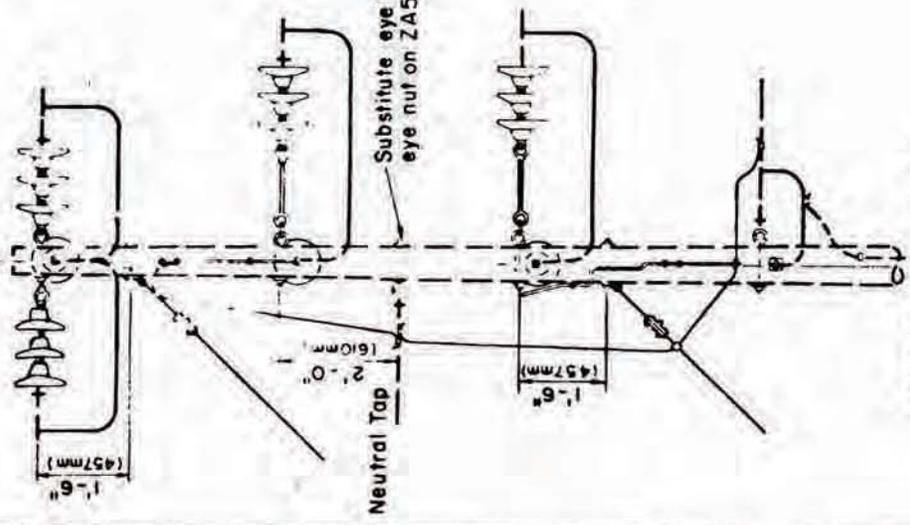
NOTE
This drawing illustrates the addition
of standard tap assemblies to other
standard pole top assemblies



COMPLETE ASSEMBLY
ZAS-3, ZB4-1 and ZM10-14

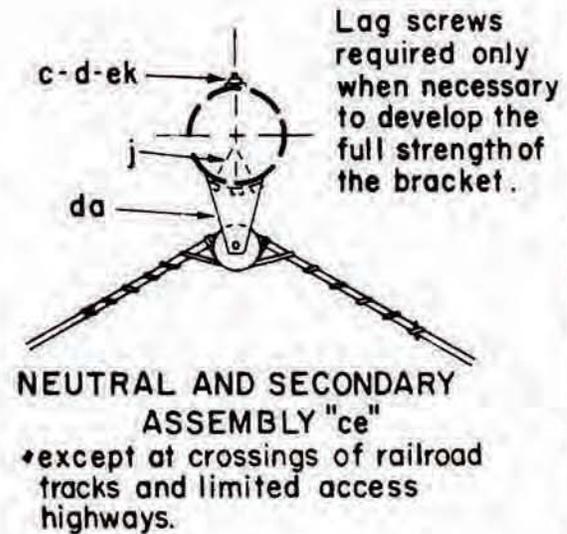
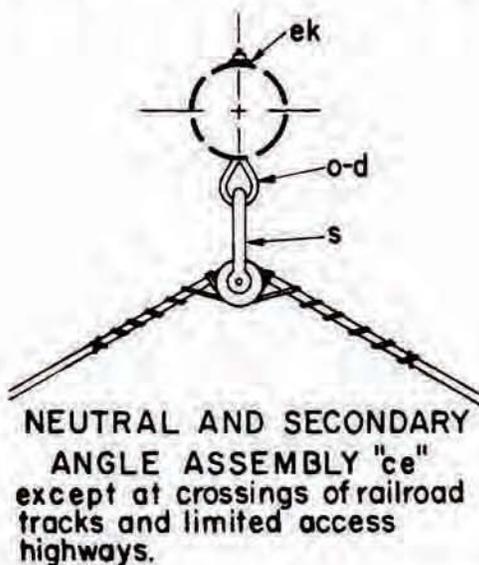
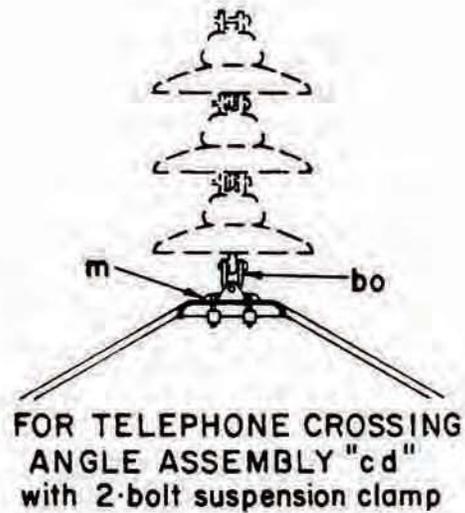
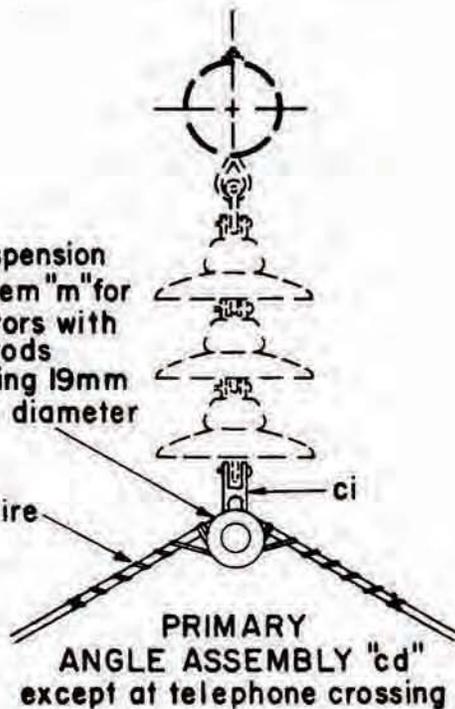


COMPLETE ASSEMBLY
ZAS-4, ZB3 and ZM10-14



COMPLETE ASSEMBLY
ZAS-3, ZC4-1 and ZM10-14

Use suspension clamp item "m" for conductors with armor rods exceeding 19mm overall diameter

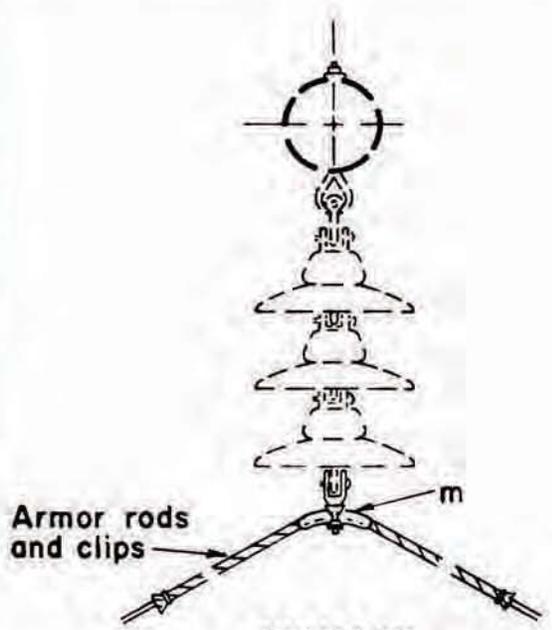


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	Bolt, machine, 5/8" x req'd length	j	Screw, lag, 1/2" x 4"
m	Clamp, suspension	bo	Shackle, anchor
s	Clevis, secondary, swinging, insulated	o	Bolt, eye, 5/8" x req'd length
ek	Locknuts, as req'd.	ci	Clevis, thimble, side opening
d	Washer, square, 2 1/4"	da	Bracket, insulated

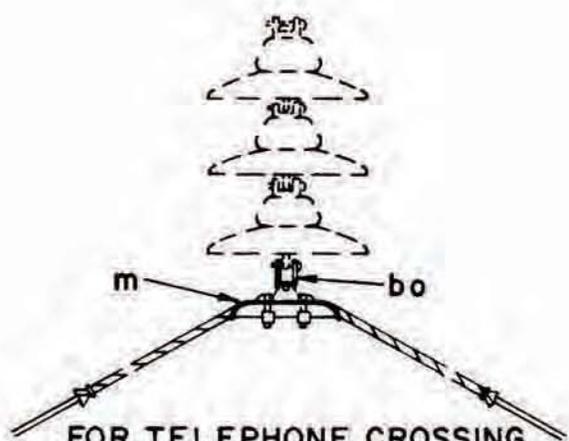
ANGLE ASSEMBLY GUIDE, VERTICAL CONSTRUCTION
20° TO 60° ANGLE, COPPER TYPE CONDUCTORS
WITH FORMED TYPE ARMOR RODS

NOV. 1986

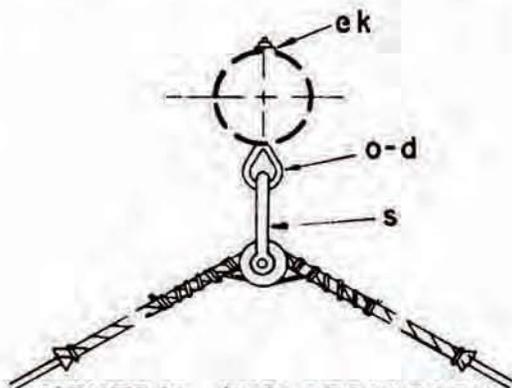
M41-1



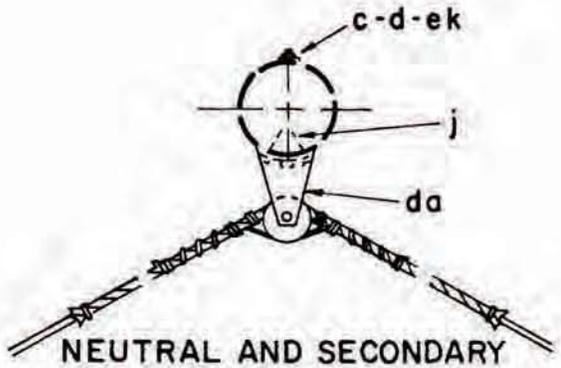
**PRIMARY
ANGLE ASSEMBLY "cd"
except at telephone crossing**



**FOR TELEPHONE CROSSING
ANGLE ASSEMBLY "cd"
with 2-bolt suspension clamp**



**NEUTRAL AND SECONDARY
ANGLE ASSEMBLY "ce"
except at crossings of railroad
tracks and limited access
highways.**



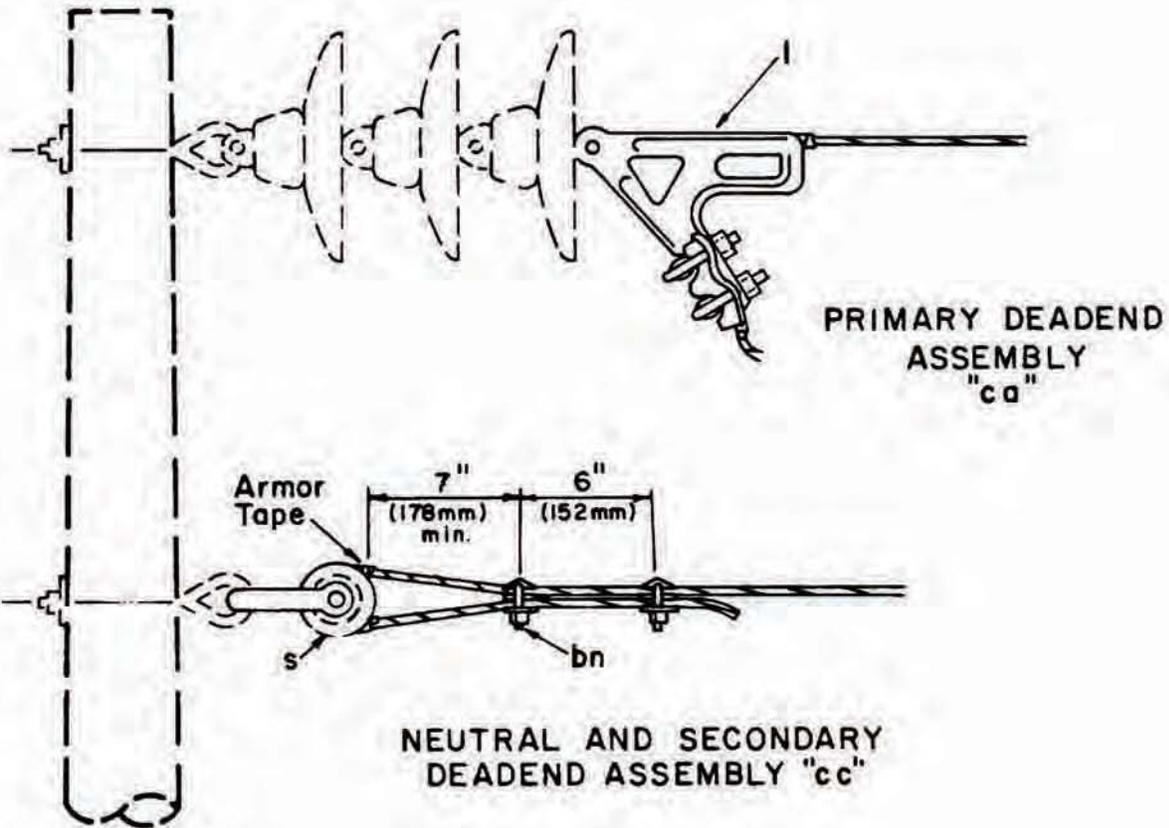
**NEUTRAL AND SECONDARY
ASSEMBLY "ce"
except at crossings of railroad
tracks and limited access
highways.**

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
c	Bolt, machine, 5/8" req'd length	d	Washer, square 2 1/4"
m	Clamp, suspension	j	Screw, lag, 1/2" x 4"
s	Clevis, secondary, swinging, insulated	bo	Shackle, anchor
ek	Locknuts, as required	o	Bolt, eye, 5/8" x req'd length
		da	Bracket, insulated

**ANGLE ASSEMBLY GUIDE, VERTICAL CONSTRUCTION
20° TO 60° ANGLE, ACSR CONDUCTORS WITH
STRAIGHT OR FORMED TYPE ARMOR RODS**

NOV. 1986

M41-10



NOTES:

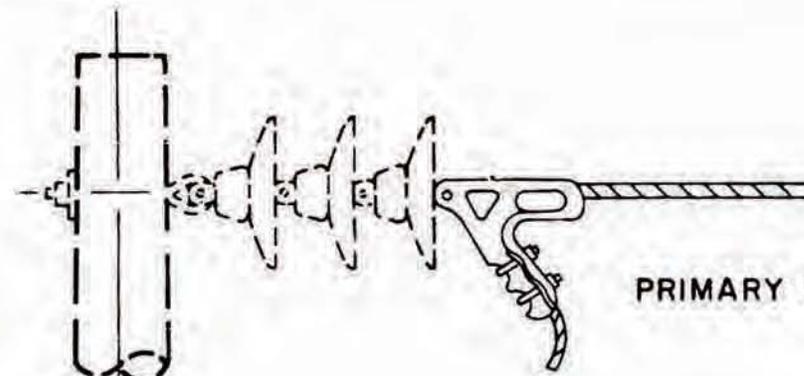
1. Armor tape wrapping to extend not more than two wraps beyond the mouth of spool insulator.
2. For 1/0 and larger use spool of 3" (76 mm) minimum groove diameter on neutral and secondary deadend.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
1	Clamp, deadend	bn	Clamp, loop deadend
s	Clevis, secondary, swinging, insulated		

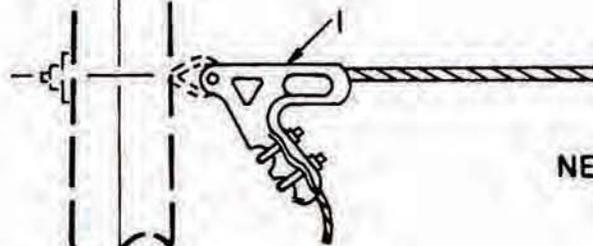
**DEADEND ASSEMBLY GUIDE
DEADEND CLAMP METHOD
A. C. S. R. CONDUCTORS**

NOV. 1986

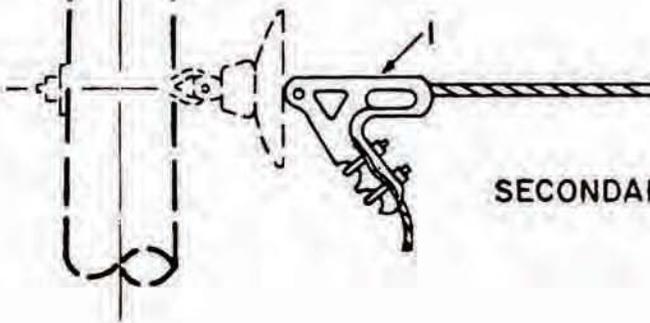
M42-11



PRIMARY DEADEND ASSEMBLY
"ca"



NEUTRAL DEADEND ASSEMBLY
"cb"



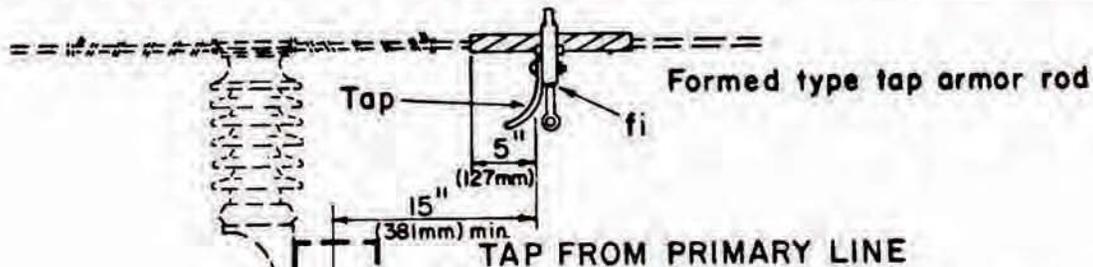
SECONDARY DEADEND ASSEMBLY
"cc"

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
1	Clamp, deadend		

DEADEND ASSEMBLY GUIDE
(LARGE CONDUCTORS)

NOV. 1986

M 42-13



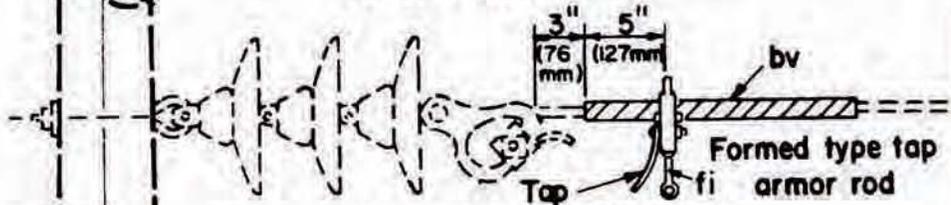
TAP FROM PRIMARY LINE

NOTE:

To be used on existing construction where full length armor rods were not installed.

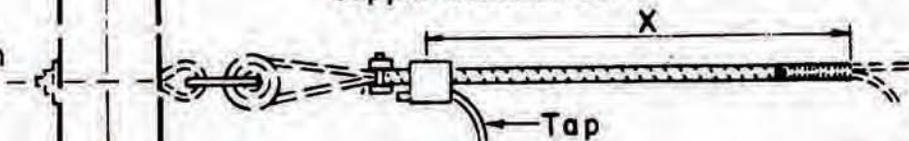


TAP FROM NEUTRAL OR SECONDARY LINE WITH CONNECTOR



TAP FROM PRIMARY DEADEND WITH HOT LINE CLAMP

Add third connectors at "X" for solid copper conductors.



TAP FROM NEUTRAL OR SECONDARY DEADEND

NOTES

1. Arrangement shown on M42-11 may be used for neutral and secondary deadend if preferred.

2. When installing armor rods on existing lines, both conductor and armor rods should be wire brushed to provide clean contact surfaces. A corrosion inhibitor should be applied before or immediately after brushing.

3. Taps to be slack.

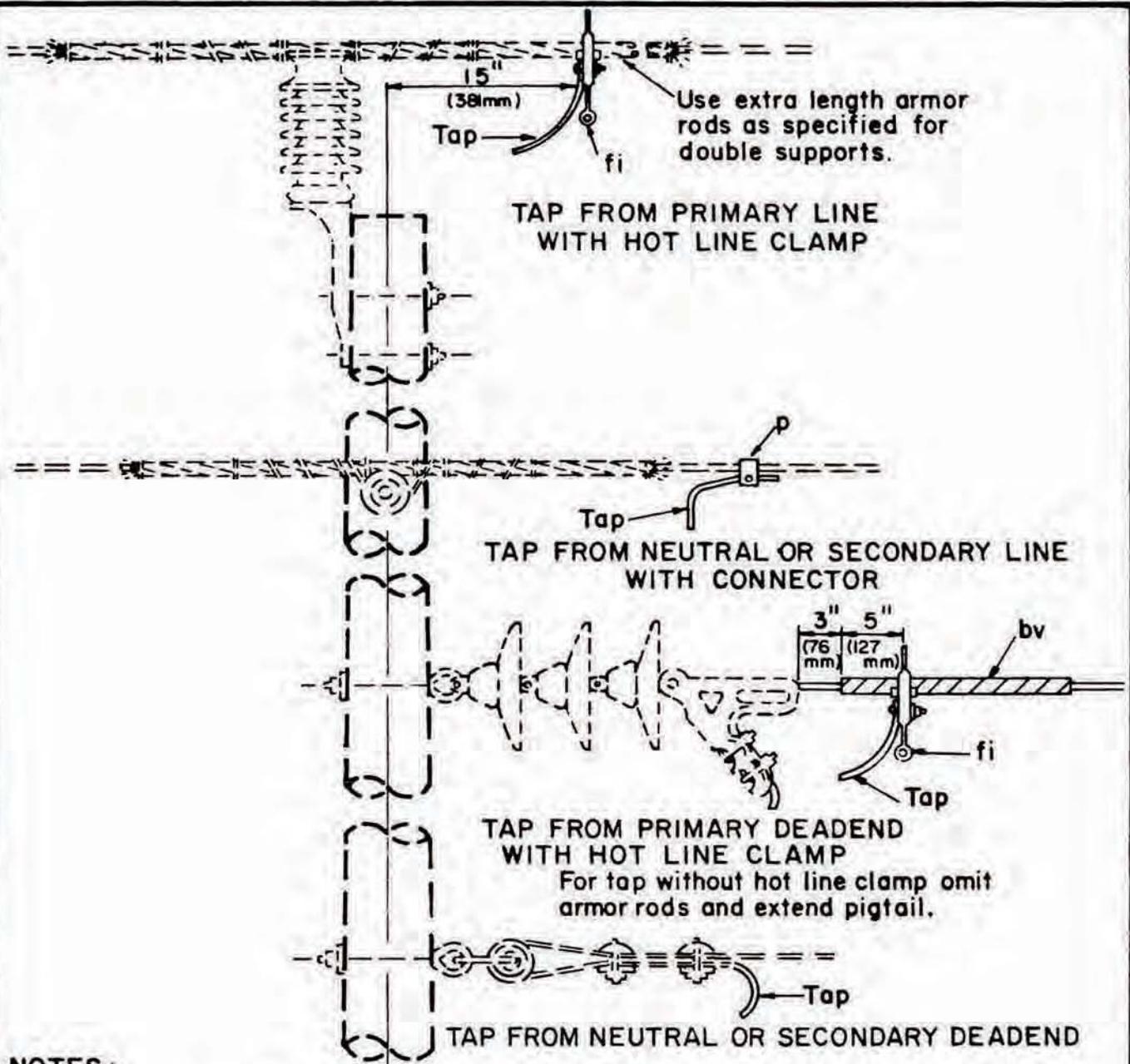
Size of solid conductor	X
No. 6 Copper	18" (457mm)
No. 4 Copper	20" (508mm)

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
p	Connectors, as required	bv	Tap armor rods, bronze
fi	Connectors, hot line tap assembly		

TAP ASSEMBLY GUIDE
COPPERWELD-COPPER AND COPPER CONDUCTORS

NOV. 1986

M43-4



NOTES :

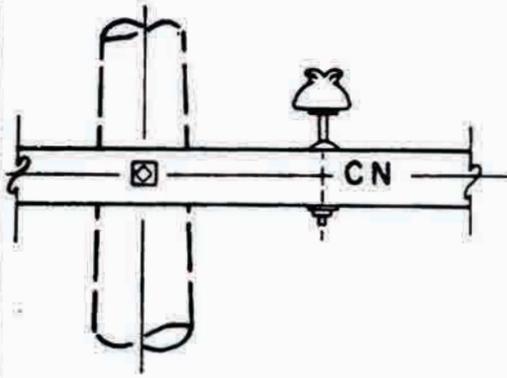
1. On new construction, tap may be made directly over armor rods provided conductor is thoroughly cleaned and inhibitor used before installing.
2. When installing armor rods on existing lines, conductor should be wire brushed thoroughly and inhibitor used before installing rods.

ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
p	Connector	bv	Tap armor rods, formed type
fi	Connector, hot line tap assembly		

**TAP ASSEMBLY GUIDE
A.C.S.R. CONDUCTORS**

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M 43-10



M52-4

IA 23

May be placed
IA
23
instead of as shown

M52-3

NOTES:

1. Numbers and letters shall:
 - a) be of cutout aluminum or electroplated soft steel, fastened to pole with galvanized or aluminum barbed 1" round head nails; or
 - b) be either die stamped or printed with a reflectorized background on individual pieces of aluminum and mounted in an aluminum holder and fastened to pole with aluminum barbed round head nails. If numbers smaller than 1 1/2" are used, they shall be reflectorized.
2. Pole legends to be 1 1/2" to 3" high. Reflectorized numbers and letters may be 1" to 3" high.
3. "CN" to be 2" high.
4. Pole to be staggered 30° from direct facing highway. When line crosses highway or R.R., legend should face same.
5. On poles having limited climbing space due to special special equipment, pole legend should be so located as to leave climbing space quadrant unobstructed.

8'-0"
(2.44 m)

Ground Line

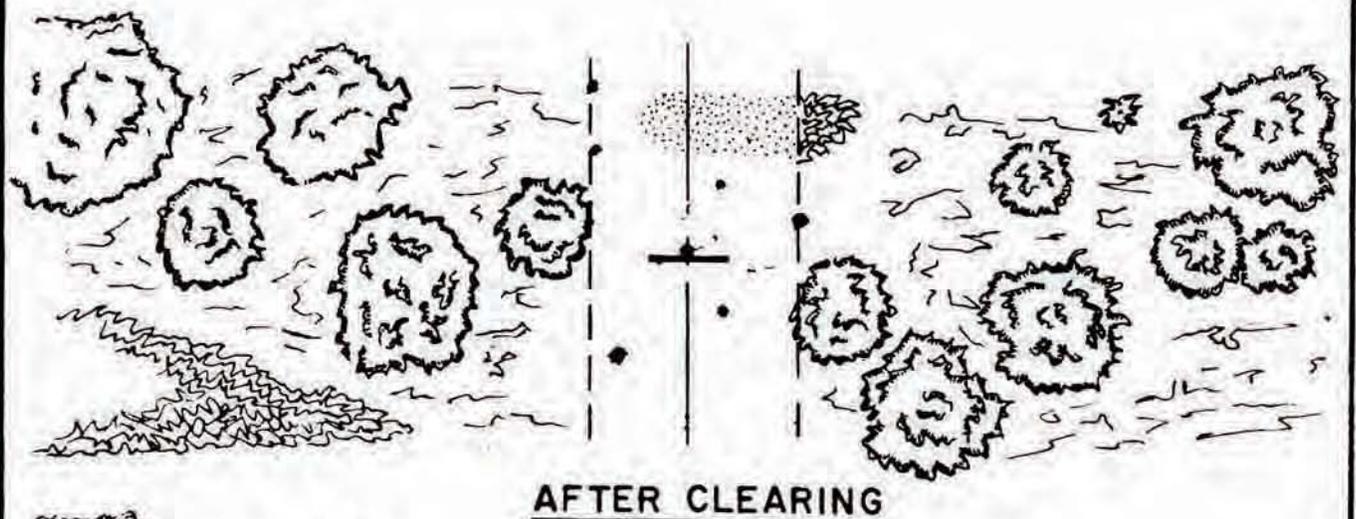
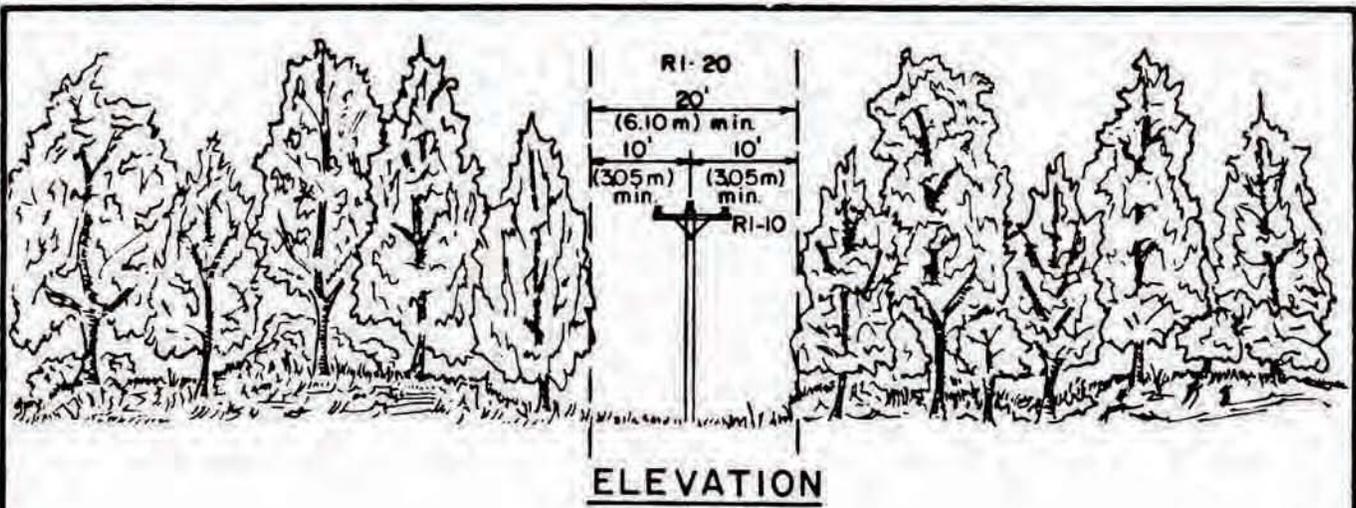


ITEM NO.	MATERIAL	ITEM NO.	MATERIAL
az	Pole numbers and letters as req'd	ee	Letters, "CN" with 1" nail

**NEUTRAL IDENTIFICATION AND
POLE NUMBERING GUIDE**

NOV. 1986

M52-3, M52-4



CLEARING RIGHT-OF-WAY GUIDE		
NOV. 1986		RI