RUS Bulletin 1728F-803
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United States Department of Agriculture

Rural Utilities Service

RUS Bulletin 1728F-803 (D-803)

December 1998

Specifications and Drawings for 24.9/14.4 kV Line Construction

UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Utilities Service

RUS BULLETIN 1728F-803

SUBJECT: **Specifications and Drawings for 24.9/14.4 kV Line Construction**

Incorporated by reference in 7 CFR Part 1728

TO: All RUS Borrowers
RUS Electric Staff

EFFECTIVE DATE: Date of Approval

EXPIRATION DATE: Not applicable. Incorporated by reference in 7 CFR Part 1728

OFFICE OF PRIMARY INTEREST: Distribution Branch, Electric Staff Division

FILING INSTRUCTIONS: This bulletin is an update and revision of previous REA Bulletin 50-5 (D-803), (revised September, 1969), and has been renumbered and renamed as RUS Bulletin 1728F-803, Specifications and Drawings for 24.9/14.4 kV Line Construction. Replace previous Bulletin 50-5 with this bulletin and file with 7 CFR Part 1728.

PURPOSE: The specifications and drawings of this bulletin have been published to set forth requirements, specifications and standards for the construction of 24.9/14.4 kV overhead electric distribution lines and associated equipment and construction assembly units.

GENERAL: Listed below are some of the significant changes and additions which were made during the update of this bulletin:

(a) The bulletin has been reformatted into 19 separate sections or categories. Each section generally contains construction specifications, an index of drawings, and construction drawings of assemblies designed to perform a similar function.

(b) New tables have been added to define maximum line angles and soil classification data. Appendix 2 at the end of the bulletin documents the formula and data used to determine the line angles in the tables.

(c) All of the drawing numbers have been changed to a uniform format in which each character in the number has a functional meaning.

(d) Each drawing has been given a new, shorter, and more uniform title or name.

(e) "Design parameters", which define and usually limit maximum line angles or mechanical loading (tension), have been added to most of the drawings.

(f) Several new drawings exhibit the application of post-type insulators.

(g) Several new construction "guide" drawings have been added which show the configuration and spacing of more than one assembly on a structure, or show the installation details of full or partial assembly units. These drawings do not list the material used.

(h) New conditions and specifications for the use of stirrups were added.

Administrator

12/15/98
Date

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GENERAL CONSTRUCTION SPECIFICATIONS

All construction work shall be done in a safe, thorough, and workmanlike manner in accordance with the staking sheets, plans and specifications, and the construction drawings.

The provision of 7 CFR section 1724.50 “Compliance with National Electrical Safety Code (NESC)” applies to all borrower electric system facilities regardless of the source of financing.

A borrower must ensure that its electric system, including all electric distribution, transmission, and generating facilities, is designed, constructed, operated, and maintained in accordance with all applicable provisions of the most current and accepted criteria of the National Electrical Safety Code (NESC) and all applicable and current electrical and safety requirements of any State or local governmental entity. This requirement applies to the borrower’s electric system regardless of the source of financing. Copies of the NESC may be obtained from the Institute of Electrical and Electronic Engineers, Inc. at the following address:

IEEE Customer Service
445 Hoes Lane, PO Box 1331
Piscataway, NJ 088555-1331

Any electrical standard requirements established by RUS are in addition to, and not in substitution for or a modification of, the most current and accepted criteria of the NESC and any applicable electrical or safety requirements of any State or local governmental entity.

Overhead distribution circuits shall be constructed with not less than the Grade C strength requirements as described in section 26, Strength Requirements, of the NESC when subjected to the loads specified in NESC Section 25, Loadings for Grades B and C. Overhead transmission circuits shall be constructed with not less than the Grade B strength requirements as described in NESC Section 26.

The drawings of equipment and materials used in the construction assemblies are meant to depict the general categories of items found in RUS Informational Publication 202-1, “List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers,” (“List of Materials”). Any drawing of any piece of equipment or material that resembles a specific product of a manufacturer is unintentional.

Materials to be used for construction are designated by one or more small alphabetic characters shown on the drawings and in the "ITEM" column in the material blocks. The borrower may use any material contained in the "List of Materials" from the category of material as designated by the corresponding small letter(s). For example, "b" designates a steel, pole top pin. The borrower may use, at its discretion, any of the applicable pole top pins from category "b" of the "List of Materials."

Similarly, the drawings of the bulletin show the use of three, 4 1/4 inch, ANSI Class 52-9A suspension insulators for 24.9/14.4 kV primary deadends. The borrower may use three, 6 inch, ANSI Class 52-1 or two, 9 inch, ANSI Class 52-4 suspension insulators, or one polymer distribution insulator, all of which are contained in category "k" in the "List of Materials." In the latter cases, the quantity ("QTY") of the insulators to be used must be modified accordingly.

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

CONDUCTOR INSTALLATION SPECIFICATIONS

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 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.

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.

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 from the conductor support. No splices shall be located in Grade B crossing spans and preferably not in adjacent spans. Splices shall be installed in accordance with the manufacturer's specifications and recommendations.

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 aluminum conductor.

Connectors and hot-line clamps suitable for the purpose shall be installed as shown on the drawings and also in accordance with the manufacturer's specifications and recommendations. 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.

The use of stirrups to connect tap conductors (jumper wires) to primary conductors may be used if the following criteria are met:

- The stirrup and hot line clamp shall be sized to meet or exceed the current carrying capacity of the tap conductor or equipment jumper;
- All stirrup conductors shall be made of copper or bronze;
- All stirrup conductors shall be made of #2 copper equivalent or larger;

- All-purpose or aluminum hot line clamps shall not be used with stirrups;
- All stirrups, connectors, and clamps shall be installed in accordance with the manufacturer’s specifications;
- Stirrups with two compression connectors are not to be used in areas of vibrating conductors;
- Stirrups are not to be used to connect main lines or heavily loaded tap lines.

Stirrups are not recommended to be used to connect reclosers, autotransformers, or line regulators. Stirrups and hot line clamps should not be used for sectionalizing tap and especially main lines for operational or maintenance purposes. Permanent compression or bolted type connectors should be used because of their better current carrying capabilities and reliability. Line switches, fused cutouts, or solid blade cutouts should be used at line locations where occasional line sectionalizing may be required.

At locations where permanent connections using compression or bolted type connectors are not desired, and where the installation or sectionalizing equipment is also not desired, then the standards specify the installation of hot line clamps (over armor rod on aluminum conductors).

INDEX A

SINGLE-PHASE PRIMARY POLE TOP ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VA1.0	SINGLE SUPPORT - MISCELLANEOUS
VA1.1, VA1.2	SINGLE SUPPORT - (TANGENT)
VA1.1P, VA1.2P	SINGLE SUPPORT - (TANGENT) (POST INSULATORS)
VA1.3	SINGLE SUPPORT
VA1.3P	SINGLE SUPPORT (POST INSULATORS)
VA1.11	SINGLE SUPPORT ON CROSSARM
VA1.11P	SINGLE SUPPORT ON CROSSARM (POST INSULATORS)
VA1.12G	SINGLE PHASE JUNCTION GUIDE
VA2.0	DOUBLE SUPPORT - MISCELLANEOUS
VA2.1	DOUBLE SUPPORT
VA2.1P	DOUBLE SUPPORT (POST INSULATORS)
VA2.21	DOUBLE SUPPORT ON CROSSARMS
VA2.21P	DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)
VA3.1	SUSPENSION ANGLE
VA3.2, VA3.3	SUSPENSION ANGLE
VA4.1	DEADEND ANGLE (90° - 150°)
VA4.2	DEADEND ANGLE (20° - 90°)
VA5.1	SINGLE DEADEND
VA5.2, VA5.3, VA5.4	SINGLE DEADENDS
VA5.5G	SINGLE PHASE TAP GUIDE
VA5.21, VA5.31	SINGLE DEADEND ON CROSSARMS
VA6.1	DOUBLE DEADEND (STRAIGHT)
VA6.2	DOUBLE DEADEND (FEED THROUGH)
VA6.21	DOUBLE DEADEND ON CROSSARMS
VA6.22G	DOUBLE DEADEND GUIDE (FEED THROUGH ON CROSSARMS)

CONSTRUCTION SPECIFICATIONS FOR POLE TOP ASSEMBLIES

Line designs which use high poles to clear obstacles such as railroads, must avoid upstrain on pin-type or post-type insulators on adjacent shorter poles.

The neutral conductor should be installed on the same side (preferably the road side) of all of the tangent and small angle poles throughout the length of the line.

Prior RUS approval is given if it is under the circumstances necessary to lower the neutral attachment on standard construction pole top assemblies an additional distance not exceeding 2 feet for the purpose of economically meeting conductor clearance requirements of the NESC.

Prior RUS approval is given if it is under the circumstances necessary to lower the neutral attachment on standard construction pole top assemblies an additional distance of up to 6 feet for the purpose of performing construction and future line maintenance on these assemblies from bucket trucks designed for such work.

With pin-type or post-type insulators, the conductor must be tied to the top groove of the insulator on tangent poles and on the side of the insulator away from the strain at angles. Pin-type and post-type insulators must be tight on the pins and bracket, respectively, and the top groove must be in line with the conductor after tying.

Factory-formed ties must be installed in accordance with the manufacturer’s specifications and recommendations.

A 3 inch by 3 inch (minimum), square, curved washer, item “d”, shall be used abutting the pole when installing primary or neutral conductor deadend assemblies directly to the pole to mitigate the crushing of wood fibers and to facilitate the allowable longitudinal loading as given in the design parameters on the construction drawings.

A locknut must be installed with each nut and eyenut, on all machine, upset and double arming bolts, and all other threaded hardware such as insulator pins and studs.

The calculated “maximum line angle” values in the tables are based on the “designated maximum” transverse loading on insulator pins as specified by RUS, and the application of the appropriate overload factors from the 1997 edition of the NESC.

“Allowable longitudinal (or transverse) loading” values in the design parameters were derived from known or designated maximum strengths of materials to which the appropriate NESC safety factors have already been applied.

TABLE I

MAXIMUM LINE ANGLES ON PIN INSULATOR ASSEMBLIES

Designated Maximum Transverse Load = 500 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	13	13	12	12	11	11
2 ACSR (6/1)	11	10	10	9	8	8
2 ACSR (7/1)	8	8	7	7	6	6
1/0 ACSR (6/1)	7	6	6	5	5	4
123.3 AAAC (7)	7	6	6	5	5	4
2/0 ACSR (6/1)	6	6	5	5	4	4
3/0 ACSR (6/1)	5	5	4	4	3	3
4/0 ACSR (6/1)	5	4	4	3	3	2
246.9 AAAC (7)	5	4	4	3	3	2
336.4 ACSR (18/1)	4	4	3	2	2	1
336.4 ACSR (26/7)	3	2	2	2	1	1
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	13	12	11	11	10	9
2 ACSR (6/1)	11	10	9	8	8	7
2 ACSR (7/1)	8	8	7	7	6	6
1/0 ACSR (6/1)	7	6	6	5	5	4
123.3 AAAC (7)	7	6	6	5	5	4
2/0 ACSR (6/1)	7	6	6	5	5	4
3/0 ACSR (6/1)	5	5	4	4	3	3
4/0 ACSR (6/1)	5	5	4	4	3	3
246.9 AAAC (7)	5	5	4	4	3	3
336.4 ACSR (18/1)	5	4	4	3	3	2
336.4 ACSR (26/7)	3	3	3	2	2	2
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	11	10	9	8	6	5
2 ACSR (6/1)	9	8	7	6	5	4
2 ACSR (7/1)	7	6	6	5	4	3
1/0 ACSR (6/1)	6	5	4	4	3	2
123.3 AAAC (7)	6	5	4	4	3	2
2/0 ACSR (6/1)	6	5	4	3	3	2
3/0 ACSR (6/1)	5	4	3	3	2	1
4/0 ACSR (6/1)	4	4	3	2	2	1
246.9 AAAC (7)	4	4	3	2	2	1
336.4 ACSR (18/1)	4	3	3	2	1	1
336.4 ACSR (26/7)	3	2	2	1	1	0

TABLE II

MAXIMUM LINE ANGLES ON PIN INSULATOR ASSEMBLIES

Designated Maximum Transverse Load = 750 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	21	21	20	19	19	18
2 ACSR (6/1)	17	17	16	15	15	14
2 ACSR (7/1)	13	13	12	12	11	11
1/0 ACSR (6/1)	11	10	10	9	9	8
123.3 AAAC (7)	11	10	10	9	9	8
2/0 ACSR (6/1)	11	10	9	9	8	8
3/0 ACSR (6/1)	8	8	7	7	6	6
4/0 ACSR (6/1)	8	8	7	6	6	5
246.9 AAAC (7)	8	7	7	6	6	5
336.4 ACSR (18/1)	7	7	6	5	5	4
336.4 ACSR (26/7)	5	5	4	4	3	3
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	21	20	19	18	18	17
2 ACSR (6/1)	17	16	16	15	14	13
2 ACSR (7/1)	13	13	12	12	11	10
1/0 ACSR (6/1)	11	10	10	9	9	8
123.3 AAAC (7)	11	10	10	9	9	8
2/0 ACSR (6/1)	11	10	10	9	9	8
3/0 ACSR (6/1)	8	8	8	7	7	6
4/0 ACSR (6/1)	8	8	7	7	6	6
246.9 AAAC (7)	8	8	7	7	6	6
336.4 ACSR (18/1)	8	7	7	6	6	5
336.4 ACSR (26/7)	5	5	5	4	4	4
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	19	18	17	15	14	13
2 ACSR (6/1)	16	15	13	12	11	10
2 ACSR (7/1)	12	11	10	10	9	8
1/0 ACSR (6/1)	10	9	8	8	7	6
123.3 AAAC (7)	10	9	8	8	7	6
2/0 ACSR (6/1)	10	9	8	7	7	6
3/0 ACSR (6/1)	8	7	7	6	5	5
4/0 ACSR (6/1)	8	7	6	6	5	4
246.9 AAAC (7)	7	7	6	6	5	4
336.4 ACSR (18/1)	7	7	6	5	4	4
336.4 ACSR (26/7)	5	5	4	4	3	3

TABLE III

MAXIMUM LINE ANGLES ON PIN INSULATOR ASSEMBLIES

Designated Maximum Transverse Load = 1,000 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	29	28	28	27	27	26
2 ACSR (6/1)	24	23	22	22	21	21
2 ACSR (7/1)	18	18	17	17	16	16
1/0 ACSR (6/1)	15	14	14	13	13	13
123.3 AAAC (7)	15	14	14	13	13	12
2/0 ACSR (6/1)	15	14	14	13	12	12
3/0 ACSR (6/1)	12	11	11	10	10	9
4/0 ACSR (6/1)	11	11	10	10	9	9
246.9 AAAC (7)	11	10	10	9	9	8
336.4 ACSR (18/1)	11	10	9	9	8	7
336.4 ACSR (26/7)	7	7	6	6	5	5
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	28	28	27	26	25	24
2 ACSR (6/1)	23	23	22	21	21	20
2 ACSR (7/1)	18	18	17	17	16	15
1/0 ACSR (6/1)	15	14	14	13	13	12
123.3 AAAC (7)	15	14	14	13	13	12
2/0 ACSR (6/1)	15	14	14	13	13	12
3/0 ACSR (6/1)	12	11	11	10	10	10
4/0 ACSR (6/1)	12	11	11	10	10	9
246.9 AAAC (7)	11	11	10	10	9	9
336.4 ACSR (18/1)	11	10	10	9	9	8
336.4 ACSR (26/7)	8	7	7	7	6	6
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	27	26	24	23	22	20
2 ACSR (6/1)	22	21	20	19	18	16
2 ACSR (7/1)	17	16	15	15	14	13
1/0 ACSR (6/1)	14	13	13	12	11	10
123.3 AAAC (7)	14	13	12	12	11	10
2/0 ACSR (6/1)	14	13	12	12	11	10
3/0 ACSR (6/1)	11	10	10	9	8	8
4/0 ACSR (6/1)	11	10	10	9	8	8
246.9 AAAC (7)	11	10	9	9	8	7
336.4 ACSR (18/1)	10	10	9	8	8	7
336.4 ACSR (26/7)	7	7	6	6	5	5

TABLE IV

MAXIMUM LINE ANGLES ON PIN INSULATOR ASSEMBLIES

Designated Maximum Transverse Load = 1,500 Lbs./Conductor

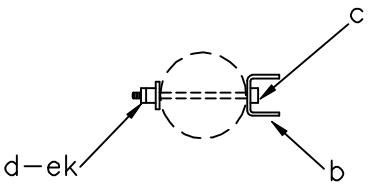
CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	45	44	44	43	42	42
2 ACSR (6/1)	37	36	35	35	34	33
2 ACSR (7/1)	28	28	27	27	26	26
1/0 ACSR (6/1)	23	23	22	22	21	21
123.3 AAAC (7)	23	22	22	21	21	20
2/0 ACSR (6/1)	23	22	22	21	21	20
3/0 ACSR (6/1)	18	18	17	17	16	16
4/0 ACSR (6/1)	18	17	17	16	16	15
246.9 AAAC (7)	17	17	16	16	15	15
336.4 ACSR (18/1)	17	16	15	15	14	14
336.4 ACSR (26/7)	12	11	11	10	10	9
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	44	44	43	42	41	40
2 ACSR (6/1)	36	36	35	34	33	33
2 ACSR (7/1)	28	28	27	27	26	25
1/0 ACSR (6/1)	23	23	22	22	21	21
123.3 AAAC (7)	23	22	22	21	21	20
2/0 ACSR (6/1)	23	22	22	21	21	20
3/0 ACSR (6/1)	18	18	17	17	17	16
4/0 ACSR (6/1)	18	18	17	17	16	16
246.9 AAAC (7)	18	17	17	16	16	15
336.4 ACSR (18/1)	17	17	16	16	15	15
336.4 ACSR (26/7)	12	12	11	11	11	10
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	43	41	40	39	37	36
2 ACSR (6/1)	35	34	33	32	30	29
2 ACSR (7/1)	27	26	25	25	24	23
1/0 ACSR (6/1)	22	22	21	20	19	19
123.3 AAAC (7)	22	21	21	20	19	18
2/0 ACSR (6/1)	22	21	21	20	19	18
3/0 ACSR (6/1)	18	17	16	16	15	14
4/0 ACSR (6/1)	17	17	16	15	15	14
246.9 AAAC (7)	17	16	16	15	14	14
336.4 ACSR (18/1)	17	16	15	14	14	13
336.4 ACSR (26/7)	12	11	11	10	10	9

TABLE V

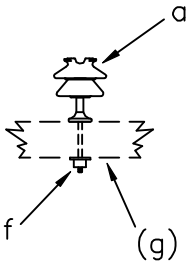
MAXIMUM LINE ANGLES ON PIN INSULATOR ASSEMBLIES

Designated Maximum Transverse Load = 2,000 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	60	60	60	60	59	59
2 ACSR (6/1)	50	50	49	48	48	47
2 ACSR (7/1)	39	38	38	37	37	36
1/0 ACSR (6/1)	32	31	31	30	30	29
123.3 AAAC (7)	31	31	30	30	29	29
2/0 ACSR (6/1)	31	31	30	30	29	28
3/0 ACSR (6/1)	25	24	24	23	23	22
4/0 ACSR (6/1)	24	24	23	23	22	22
246.9 AAAC (7)	24	23	23	22	22	21
336.4 ACSR (18/1)	23	22	22	21	20	20
336.4 ACSR (26/7)	16	16	15	15	14	14
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	60	60	60	59	58	57
2 ACSR (6/1)	50	49	48	48	47	46
2 ACSR (7/1)	39	38	37	37	36	36
1/0 ACSR (6/1)	32	31	31	30	30	29
123.3 AAAC (7)	31	31	30	30	29	29
2/0 ACSR (6/1)	31	31	30	30	29	29
3/0 ACSR (6/1)	25	24	24	24	23	23
4/0 ACSR (6/1)	25	24	24	23	23	22
246.9 AAAC (7)	24	24	23	23	22	22
336.4 ACSR (18/1)	24	23	23	22	22	21
336.4 ACSR (26/7)	16	16	16	15	15	15
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	60	58	57	55	54	52
2 ACSR (6/1)	49	47	46	45	44	43
2 ACSR (7/1)	38	37	36	35	34	33
1/0 ACSR (6/1)	31	30	29	28	28	27
123.3 AAAC (7)	30	30	29	28	27	26
2/0 ACSR (6/1)	30	30	29	28	27	26
3/0 ACSR (6/1)	24	24	23	22	22	21
4/0 ACSR (6/1)	24	23	23	22	21	21
246.9 AAAC (7)	23	23	22	21	21	20
336.4 ACSR (18/1)	23	22	21	21	20	19
336.4 ACSR (26/7)	16	16	15	14	14	13



SECTION A–A



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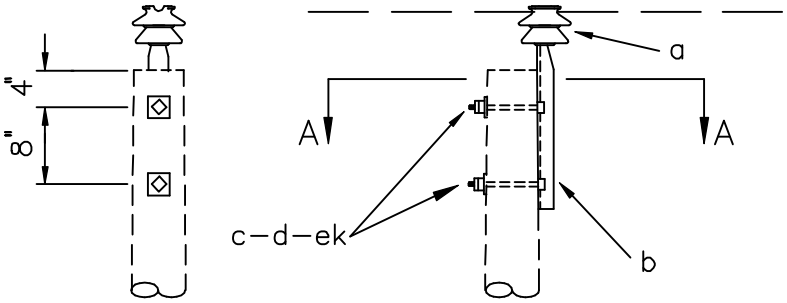
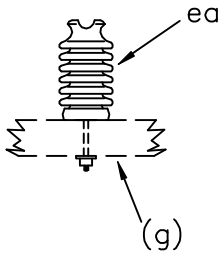
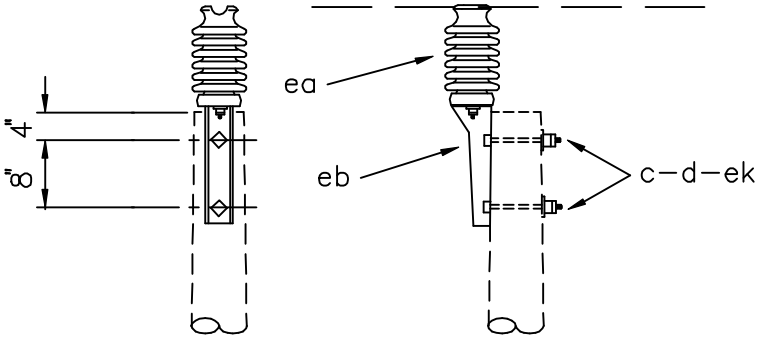


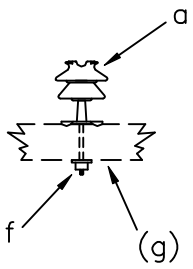
VA1.01



VA1.011P



VA1.01P



VA1.011L

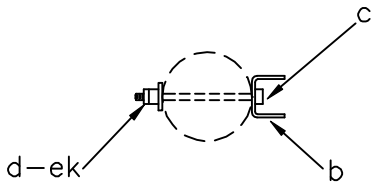
ASSEMBLY: VA1.		01	01P	011	011P	011L
ITEM	MATERIAL	QTY	QTY	QTY	QTY	QTY
a	Insulator, pin type (24.9/14.4 kV)	1		1		1
b	Pin, pole top, 20"	1				
c	Bolt, machine, 5/8" x req'd length	2	2			
d	Washer, square, 2 1/4"	2	2			
f	Pin, crossarm steel, 5/8" x 14"			1		
f	Pin, crossarm steel, clamp type					1
ea	Insulator, post type (24.9/14.4 kV)		1		1	
eb	Bracket, pole type		1			
ek	Locknuts	2	2			

DESIGN PARAMETERS:

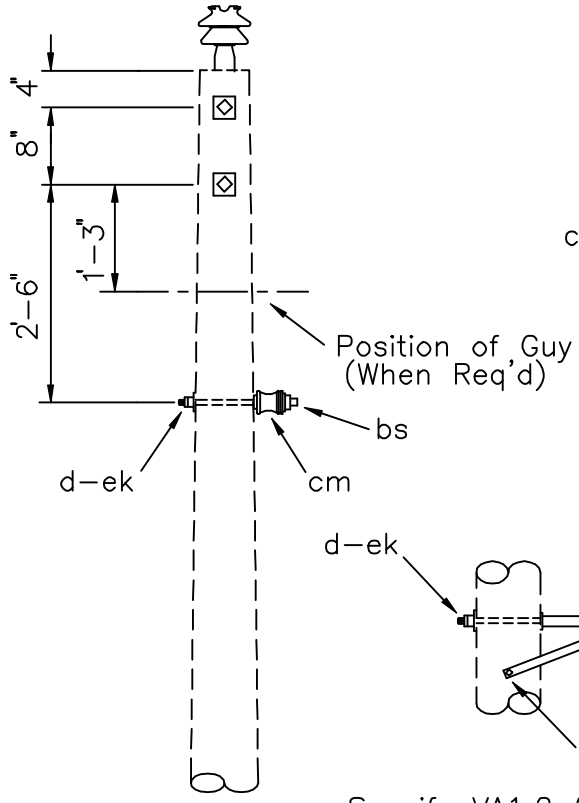
VA1.01: See TABLE I
VA1.01P: See TABLE II
VA1.011: See TABLE II
VA1.011P: See TABLE II
VA1.011L: See TABLE III

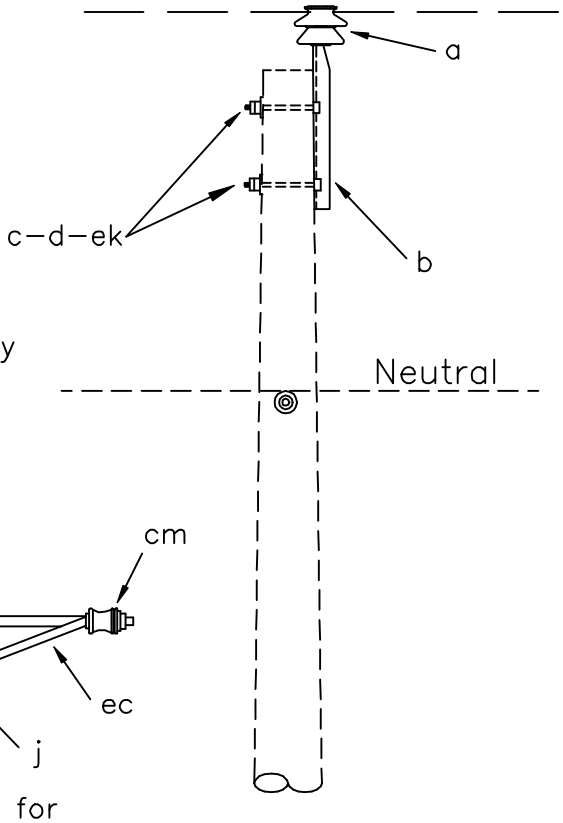
SINGLE SUPPORT–MISCELLANEOUS

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA1.0



PLAN





Specify VA1.2 for
offset neutral assembly

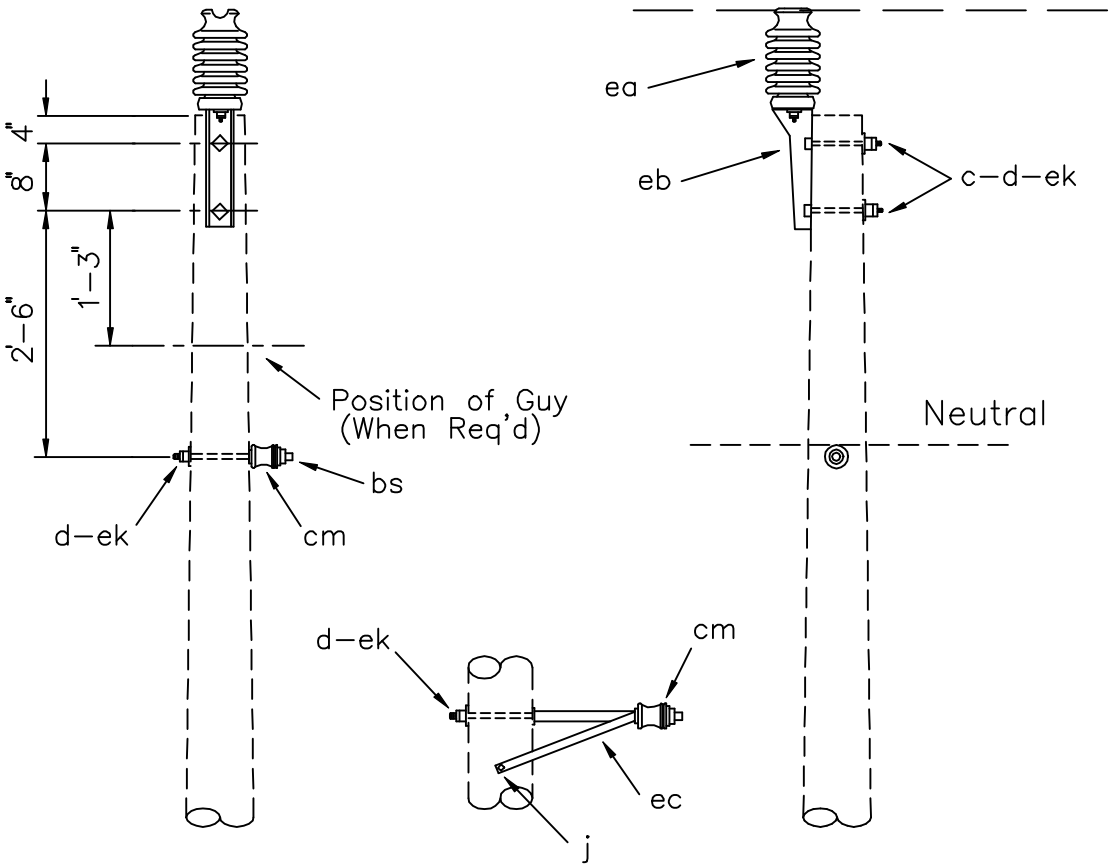
ASSEMBLY:		VA1.1	VA1.2
ITEM	MATERIAL	QTY	QTY
a	Insulator, pin type (24.9/14.4 kV)	1	1
b	Pin, pole top, 20"	1	1
c	Bolt, machine, 5/8" x req'd length	2	2
d	Washer, square 2 1/4"	3	3
j	Screw, lag, 1/2" x 4"		2
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
ec	Bracket, offset neutral		1
ek	Locknuts	3	3

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT (TANGENT)

DEC 1998	1 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VA1.1,VA1.2



Specify VA1.2P for
offset neutral assembly

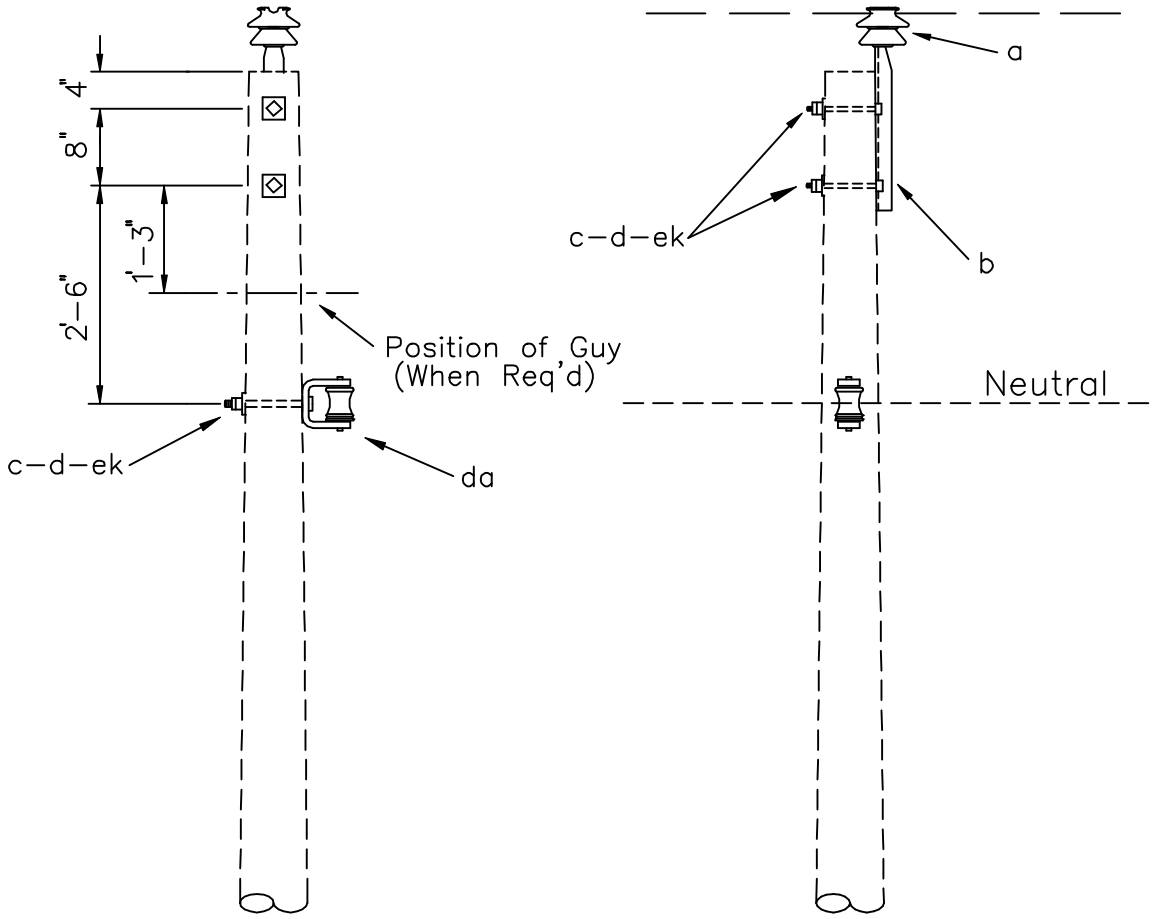
ASSEMBLY: VA1		.1P	.2P
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" x req'd length	2	2
d	Washer, square 2 1/4"	3	3
j	Screw, lag, 1/2" x 4"		2
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
ea	Insulator, post type (24.9/14.4 kV)	1	1
eb	Bracket, pole top	1	1
ec	Bracket, offset neutral		1
ek	Locknuts	3	3

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT (TANGENT)
(POST INSULATORS)

DEC 1998	1 – PHASE PRIMARY	VA1.1P,
RUS	24.9/14.4 kV	VA1.2P



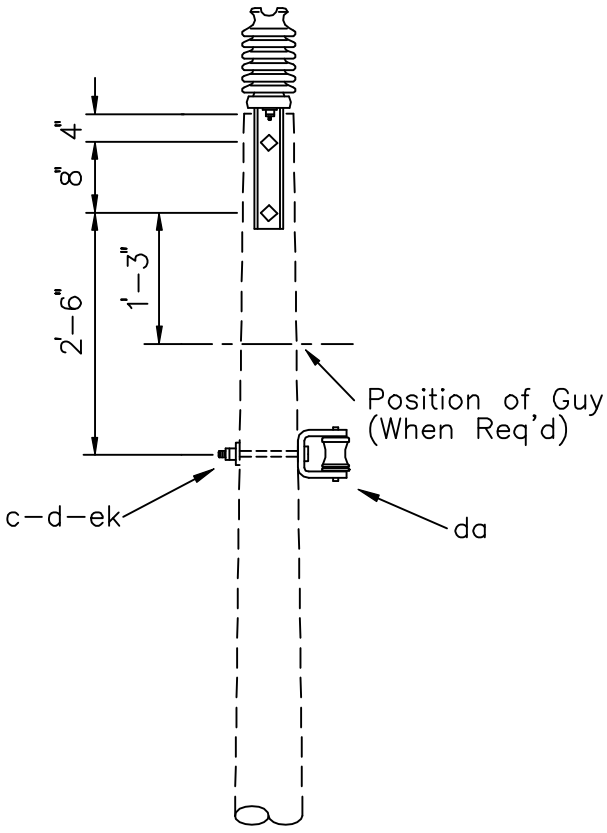
ITEM	QTY	MATERIAL
a	1	Insulator, pin type (24.9/14.4 kV)
b	1	Pin, pole top, 20"
c	3	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
da	1	Bracket, insulated
ek	3	Locknuts

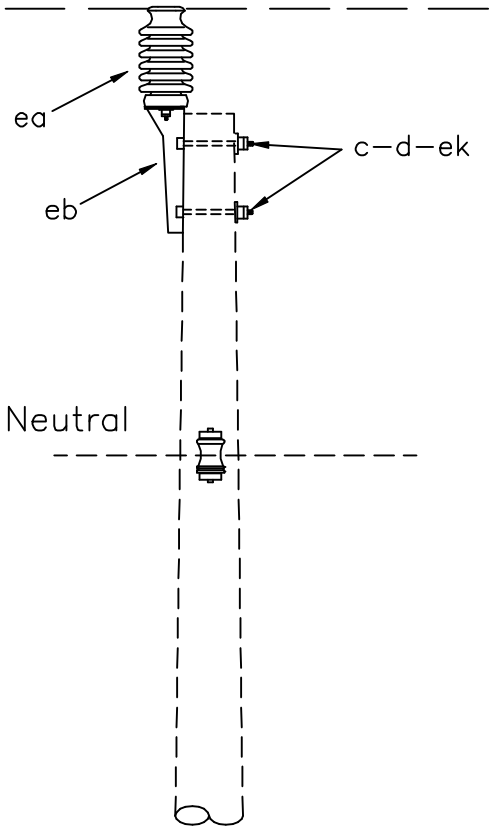
DESIGN PARAMETERS:

See TABLE I

SINGLE SUPPORT

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA1.3





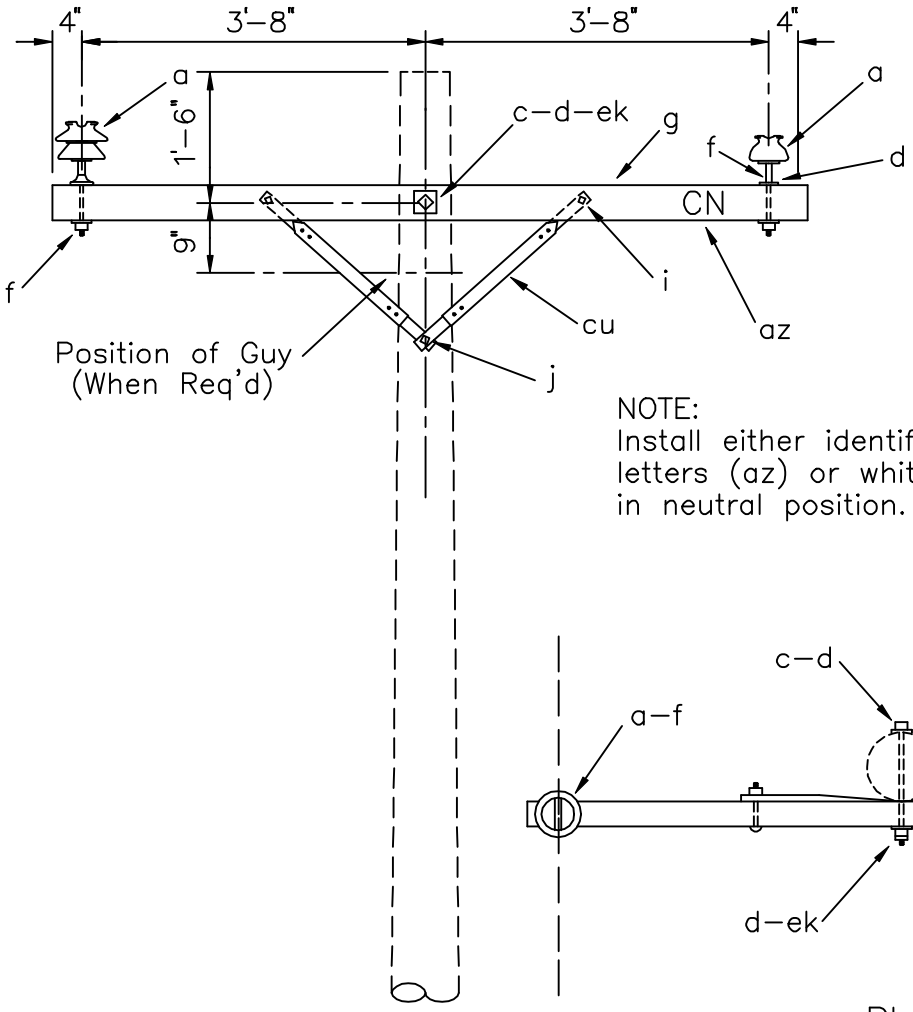
ITEM	QTY	MATERIAL
c	3	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
da	1	Bracket, insulated
ea	1	Insulator, post type (24.9/14.4 kV)
eb	1	Bracket, pole top
ek	3	Locknuts

DESIGN PARAMETERS:

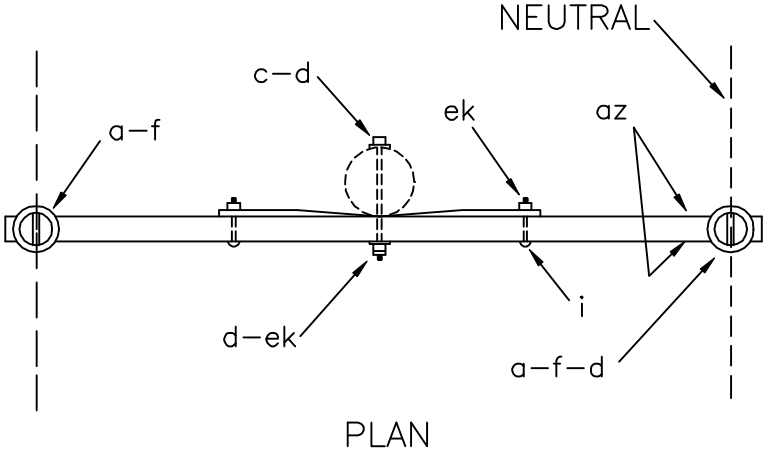
See TABLE II

SINGLE SUPPORT
(POST INSULATORS)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA1.3P



NOTE:
Install either identification letters (az) or white insulator in neutral position.



PLAN

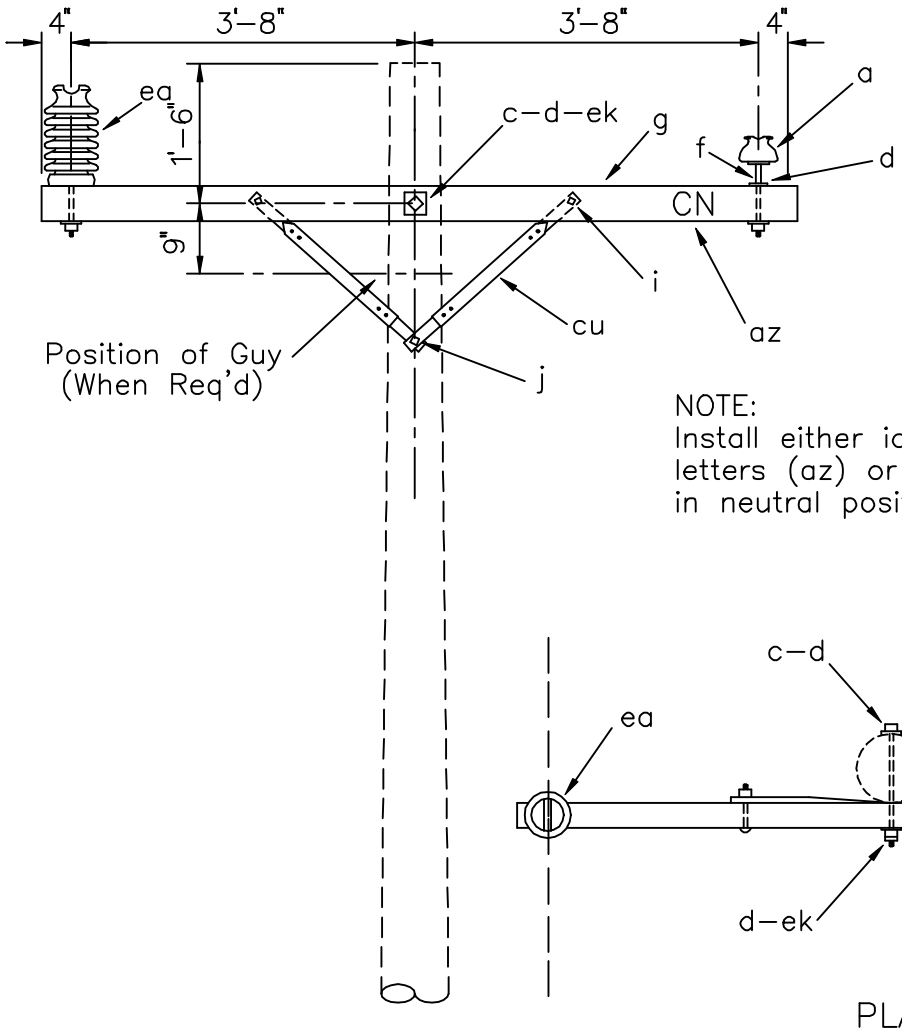
ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
a	1	Insulator, pin type (24.9/14.4 kV)
c	1	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
f	1	Pin, crossarm, steel, 5/8" x 10 3/4"
f	1	Pin, crossarm, steel, 5/8" x 14"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
az	4	Letters, 2" C, 2" N, with 1" nails
cu	2	Brace, 28"
ek	3	Locknuts

DESIGN PARAMETERS:

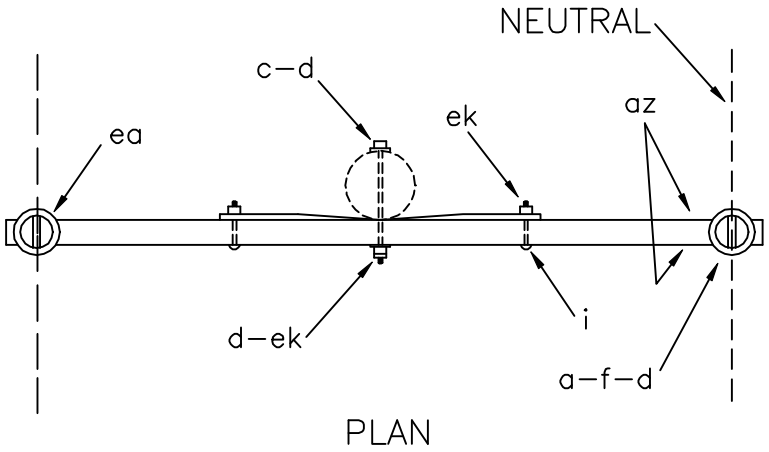
See TABLE II

SINGLE SUPPORT ON CROSSARM

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA1.11



NOTE:
Install either identification letters (az) or white insulator in neutral position.



PLAN

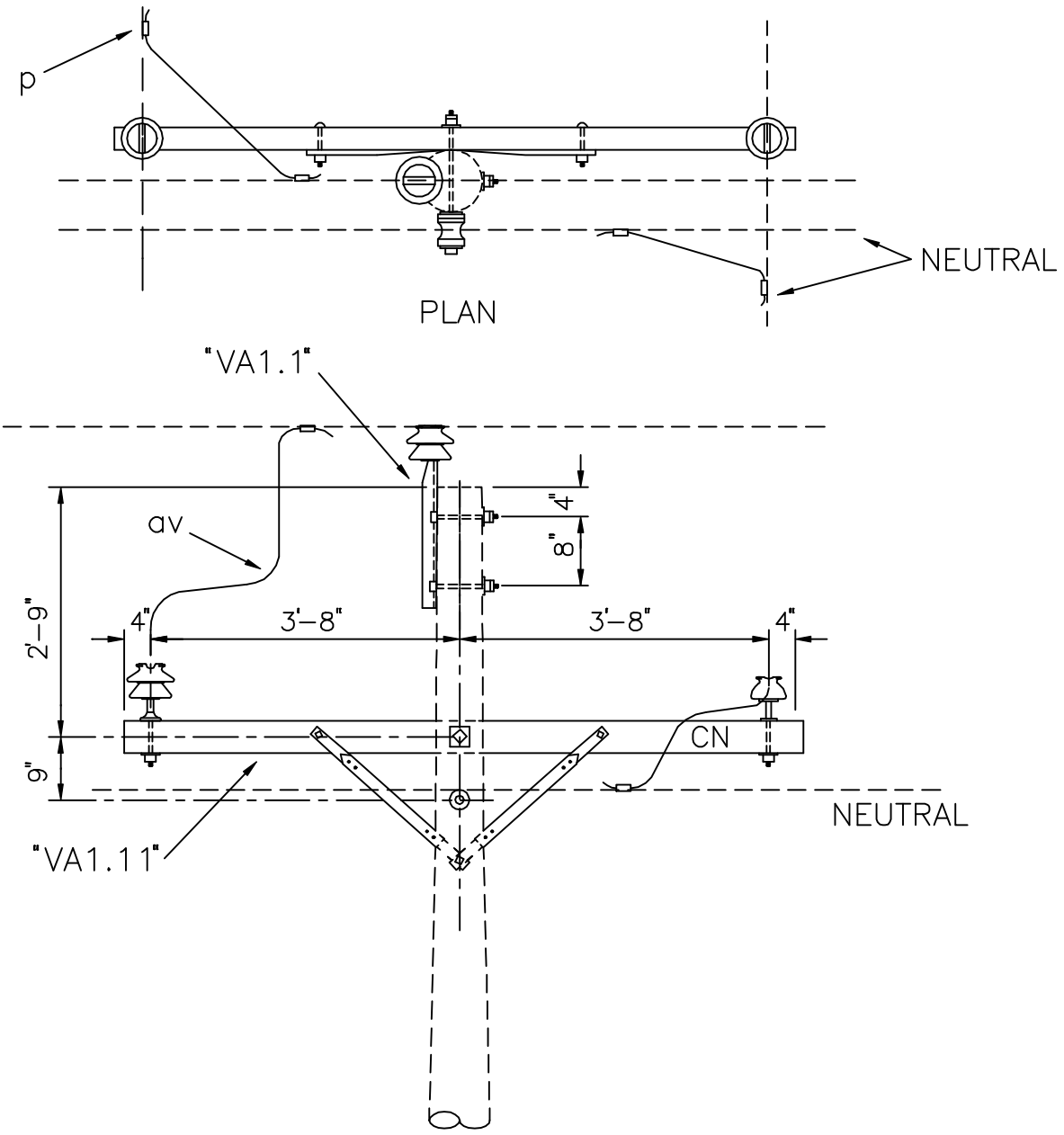
ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
c	1	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
f	1	Pin, crossarm, steel, 5/8" x 10 3/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
az	4	Letters, 2" C, 2" N, with 1" nails
cu	2	Brace, 28"
ea	1	Insulator, post type (24.9/14.4 kV)
ek	3	Locknuts

DESIGN PARAMETERS:

See TABLE II

SINGLE SUPPORT ON CROSSARM
(POST INSULATORS)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA1.11P



ITEM	QTY	MATERIAL
	1	VA1.1 Primary Assembly
	1	VA1.11 Primary Assembly
p		Connectors, as req'd
av		Jumpers, as req'd

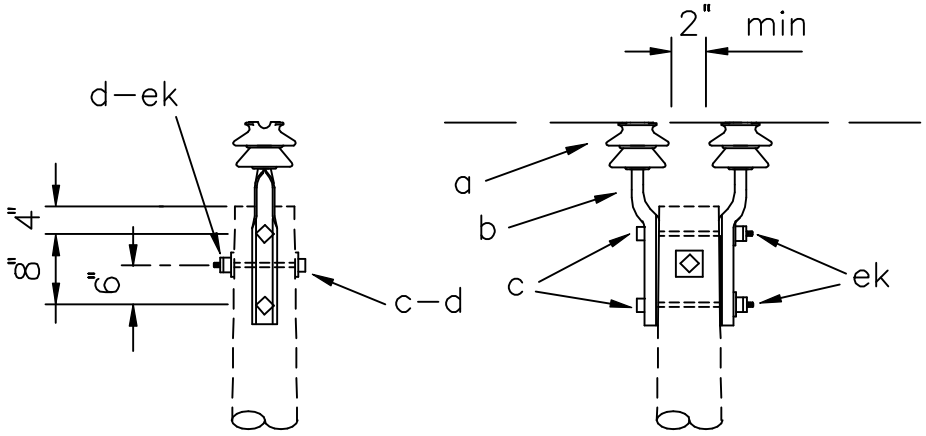
DESIGN PARAMETERS:

See: "VA1.1"
"VA1.11"

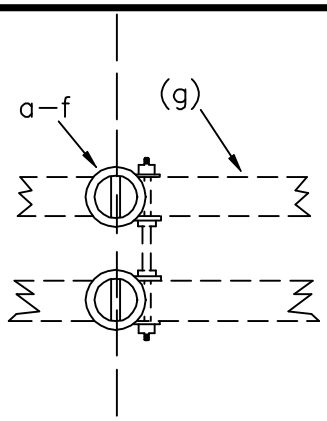
SINGLE PHASE JUNCTION GUIDE

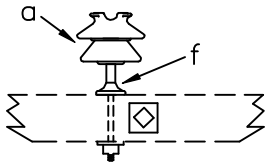
DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA1.12G

NOTE:
Straight, 20" pole top pins (item 'b'), pole top brackets ('ec'), and pipe spacers ('dl') may be used instead of offset pole top pin (item 'b').

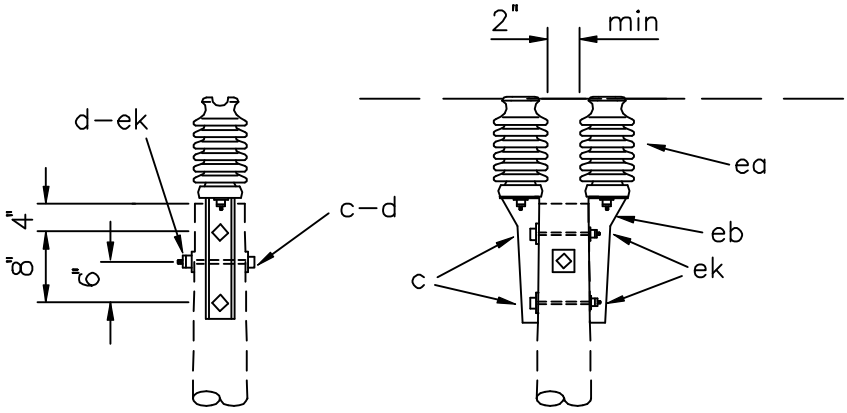


VA2.01

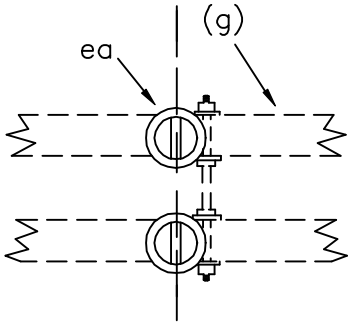


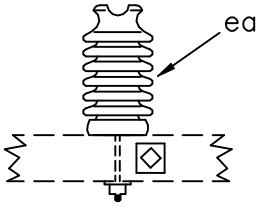


VA2.021



VA2.01P





VA2.021P

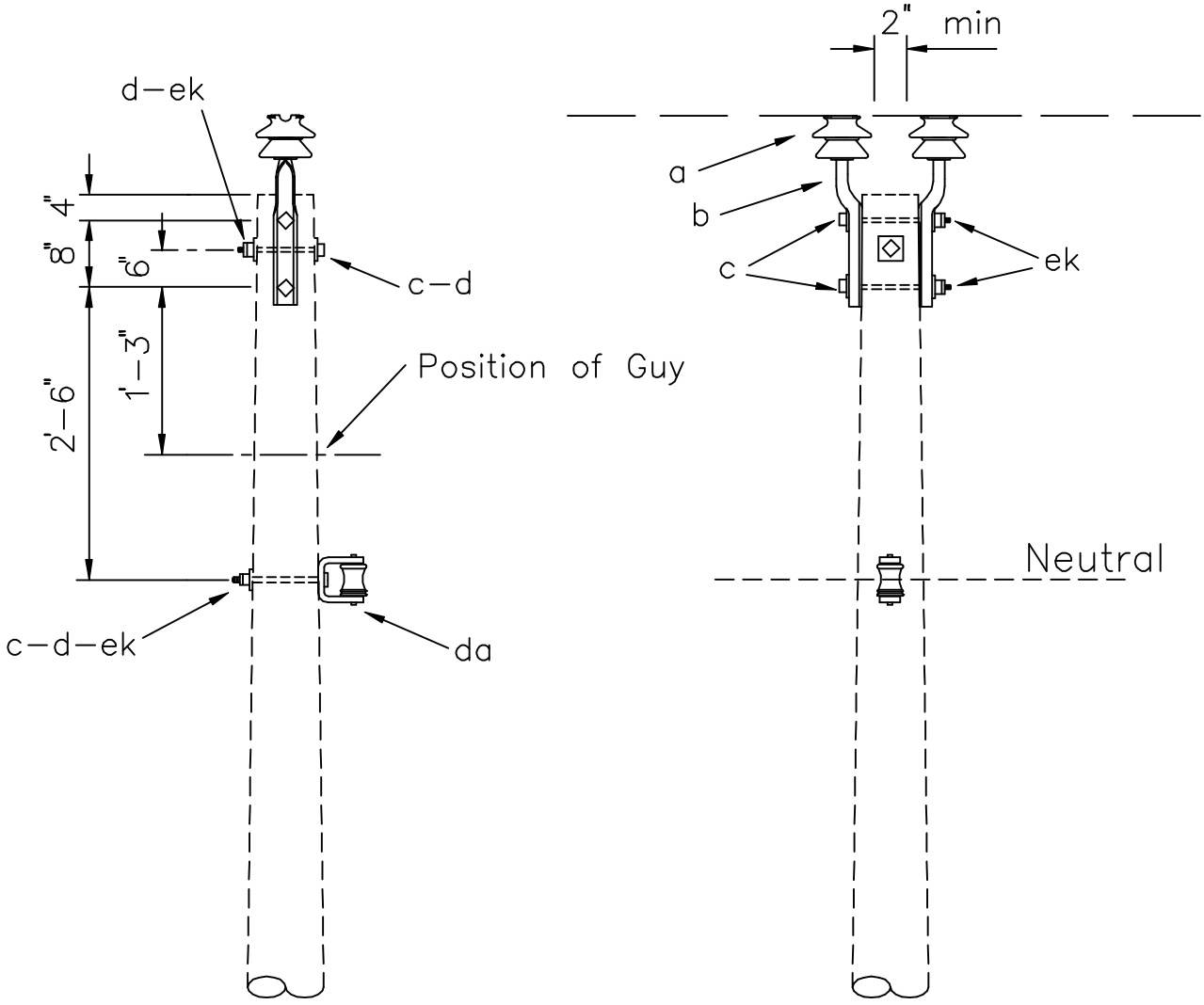
ASSEMBLY: VA2.		01	01P	021	021P
ITEM	MATERIAL	QTY	QTY	QTY	QTY
a	Insulator, pin type (24.9/14.4 kV)	2		2	
b	Pin, offset, pole top, 20"	2			
c	Bolt, machine, 5/8" x req'd length	3	3		
d	Washer, square, 2 1/4"	2	2		
f	Pin, crossarm steel, 5/8" x 14"			2	
ea	Insulator, post type (24.9/14.4 kV)		2		2
eb	Bracket, pole type		2		
ek	Locknuts	3	3		

DESIGN PARAMETERS:

VA2.01: See TABLE III
VA2.01P: See TABLE IV
VA2.021: See TABLE IV
VA2.021P: See TABLE IV

DOUBLE SUPPORT –MISCELLANEOUS

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA2.0



* See note on drawing "VA2.0"

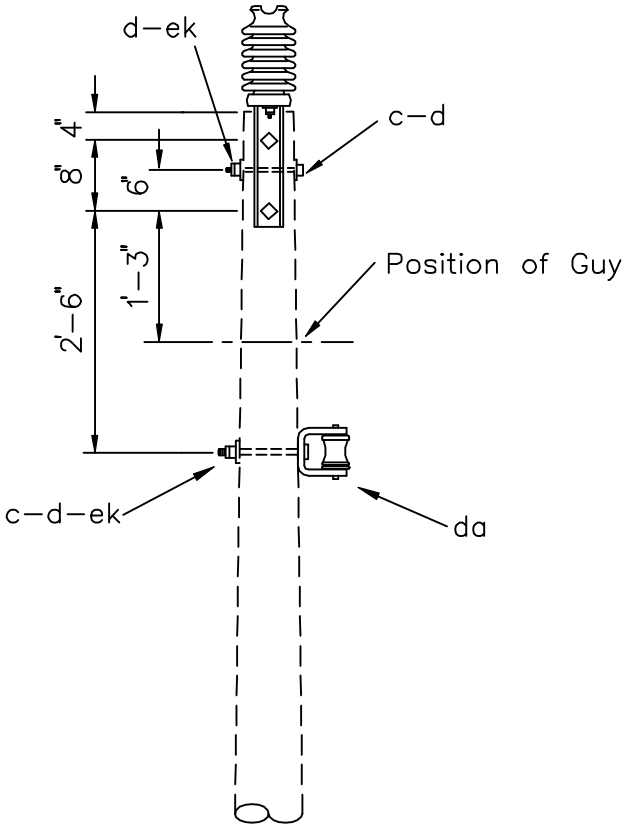
ITEM	QTY	MATERIAL
a	2	Insulator, pin type (24.9/14.4 kV)
b	2	Pin, offset, pole top *
c	4	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
da	1	Bracket, insulated
ek	4	Locknuts

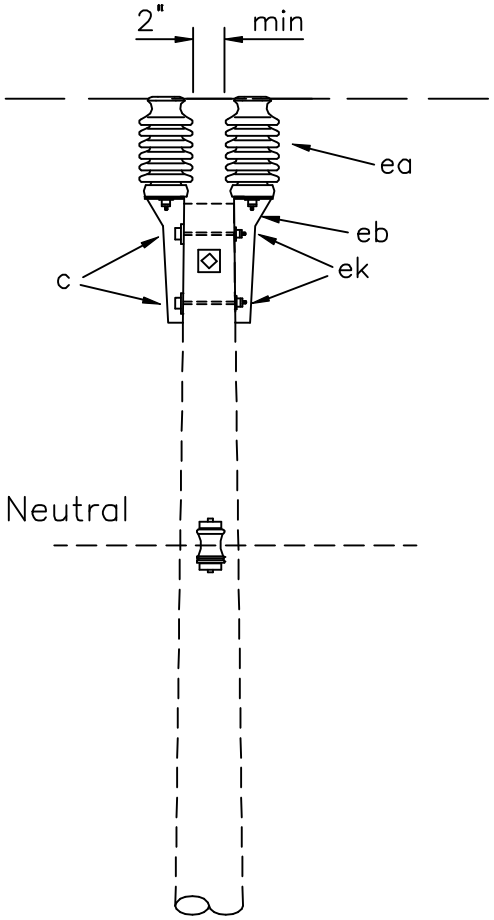
DESIGN PARAMETERS:

See TABLE III

DOUBLE SUPPORT

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA2.1





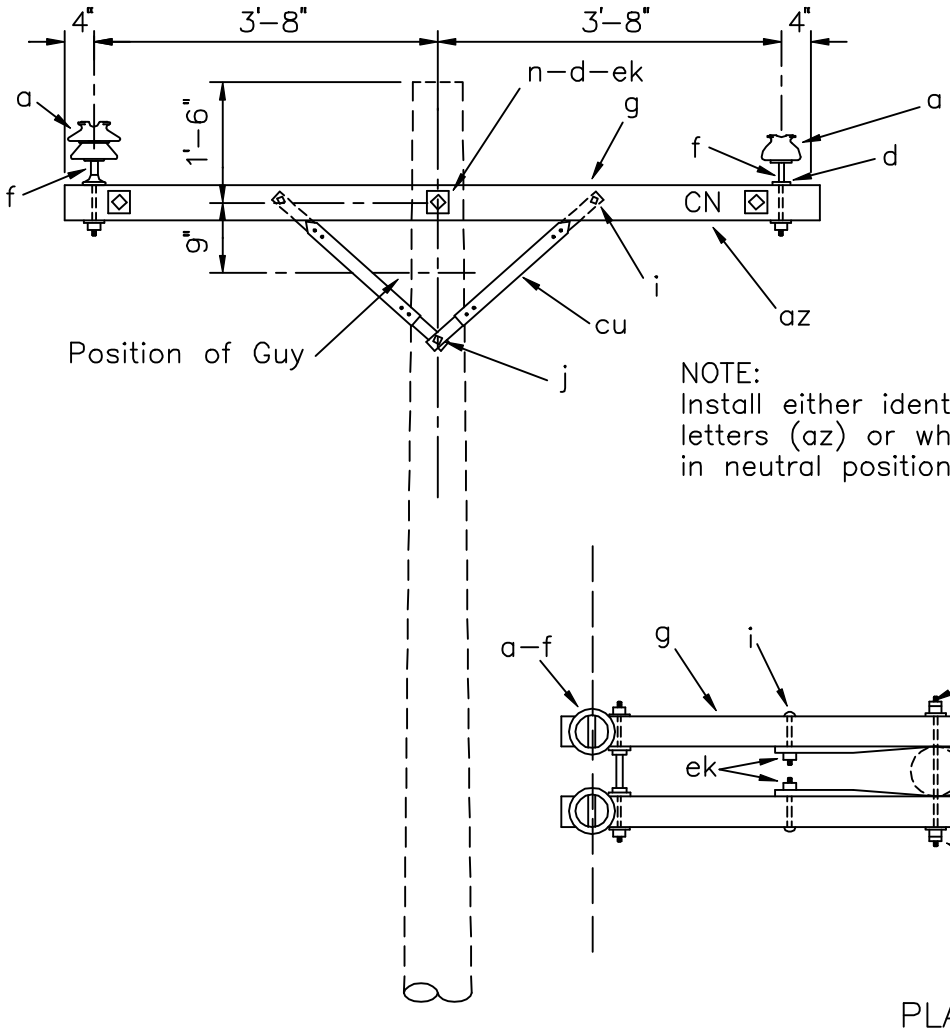
ITEM	QTY	MATERIAL
c	4	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
da	1	Bracket, insulated
ea	2	Insulator, post type (24.9/14.4 kV)
eb	2	Bracket, pole top
ek	4	Locknuts

DESIGN PARAMETERS:

See TABLE IV

DOUBLE SUPPORT
(POST INSULATORS)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA2.1P



NOTE:
Install either identification letters (az) or white insulators in neutral position.

PLAN

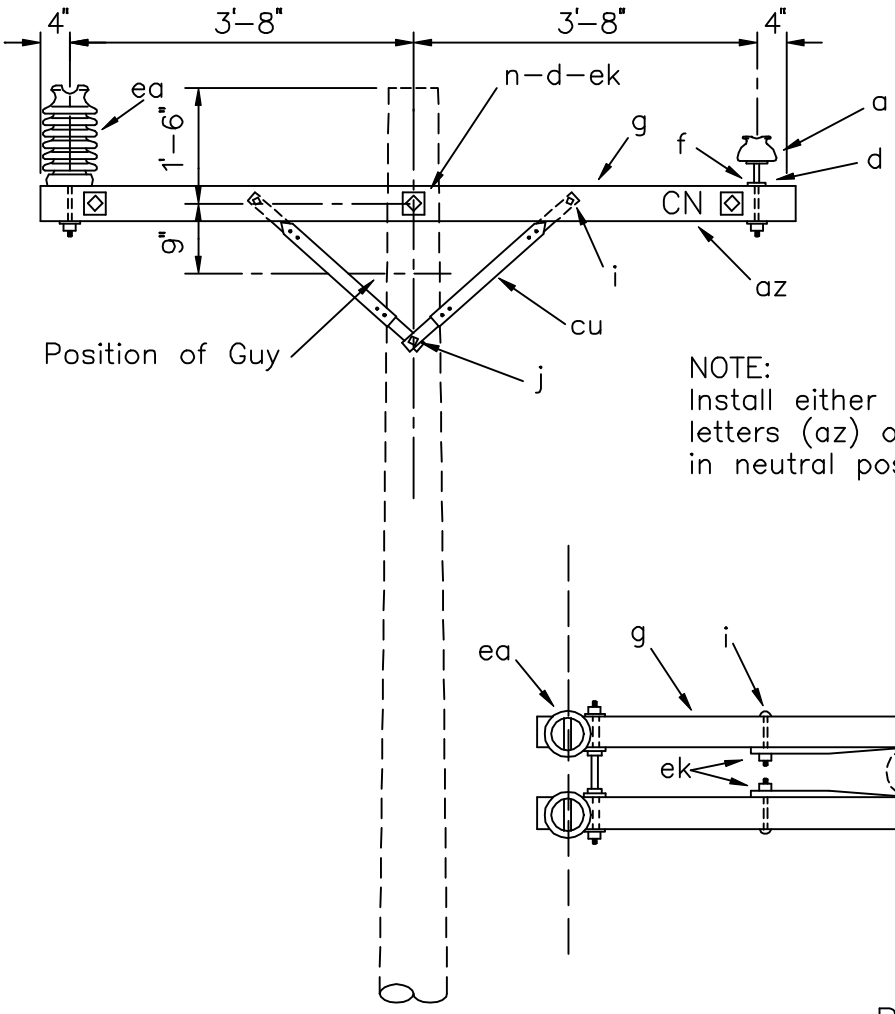
ITEM	QTY	MATERIAL
a	2	Insulator, pin type 15 kV white
a	2	Insulator, pin type (24.9/14.4 kV)
d	12	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 10 3/4"
f	2	Pin, crossarm, steel, 5/8" x 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arm, 5/8" x req'd length
az	4	Letters, 2" C, 2" N, with 1" nails
cu	4	Brace, 28"
ek	14	Locknuts

DESIGN PARAMETERS:

See TABLE IV

DOUBLE SUPPORT ON CROSSARMS

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA2.21



NOTE:
Install either identification letters (az) or white insulator in neutral position.

PLAN

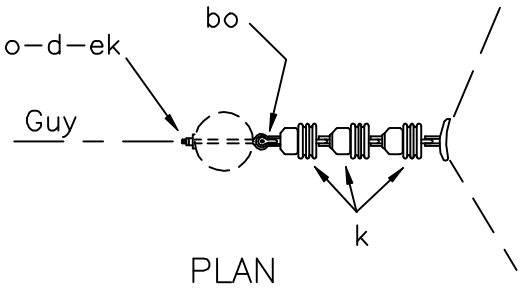
ITEM	QTY	MATERIAL
a	2	Insulator, pin type, 15 kV, white
d	12	Washer, square, 2 1/4"
f	2	Pin, crassarm, steel, 5/8" x 10 3/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arm, 5/8" x req'd length
az	4	Letters, 2" C, 2" N, with 1" nails
cu	4	Brace, 28"
ea	2	Insulator, post type (24.9/14.4 kV)
ek	14	Locknuts

DESIGN PARAMETERS:

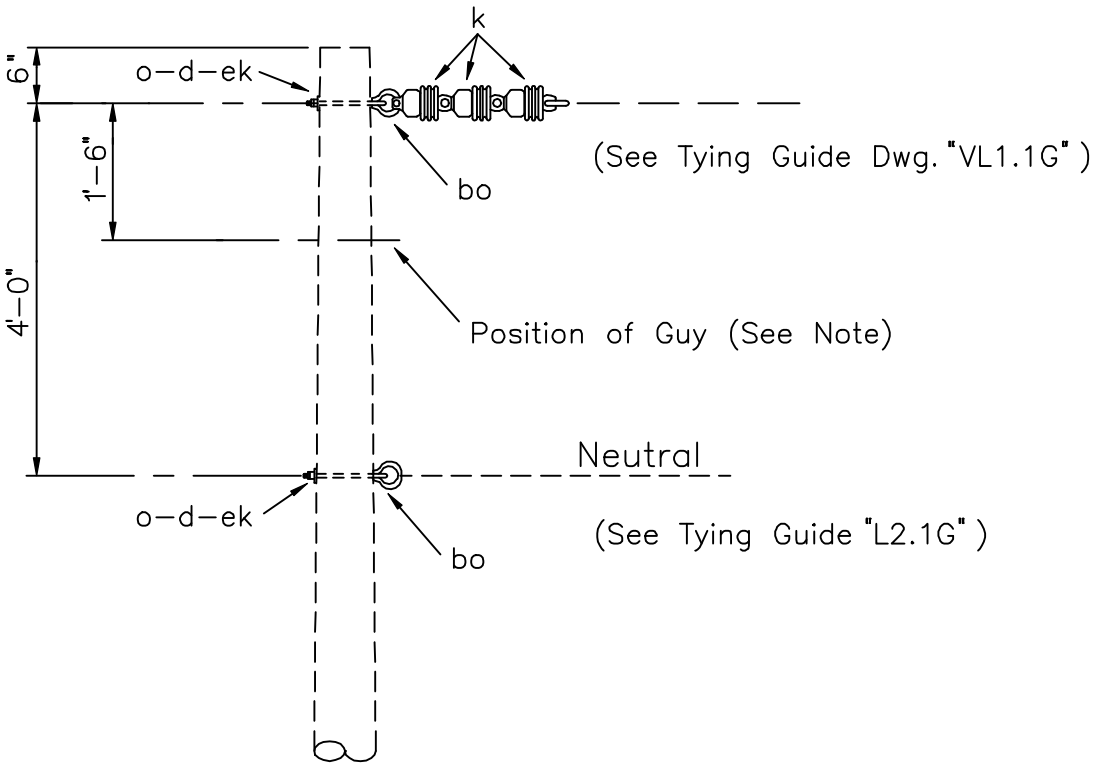
See TABLE IV

DOUBLE SUPPORT ON CROSSARMS
(POST INSULATORS)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA2.21P



PLAN



NOTE: When more than one guy is required, install guys 6" below assemblies and install 12" guy strain insulator ("w") at top of primary guy.

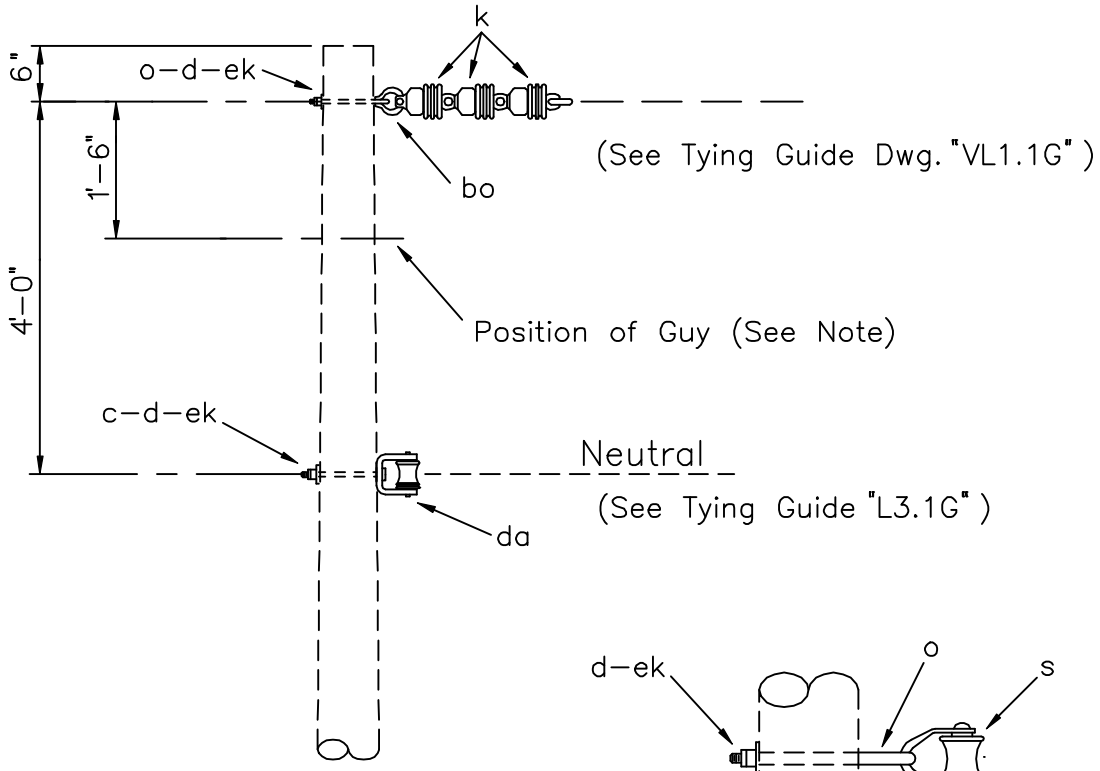
ITEM	QTY	MATERIAL
d	2	Washer, square, 3", curved
k	3	Insulator, suspension, 4 1/4"
o	2	Bolt, eye, 5/8" x req'd length
bo	2	Shackle, anchor
ek	2	Locknuts

DESIGN PARAMETERS:

ALLOWABLE TRANSVERSE
LOAD= 5000 lbs./Conductor
20° – 60°: #1/0 ACSR & Larger
30° – 60°: Smaller Conductors

SUSPENSION ANGLE

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA3.1



VA3.2

VA3.3

NOTE: When more than one guy is required, install guys 6" below assemblies and install 12" guy strain insulator ("w") at top of primary guy.

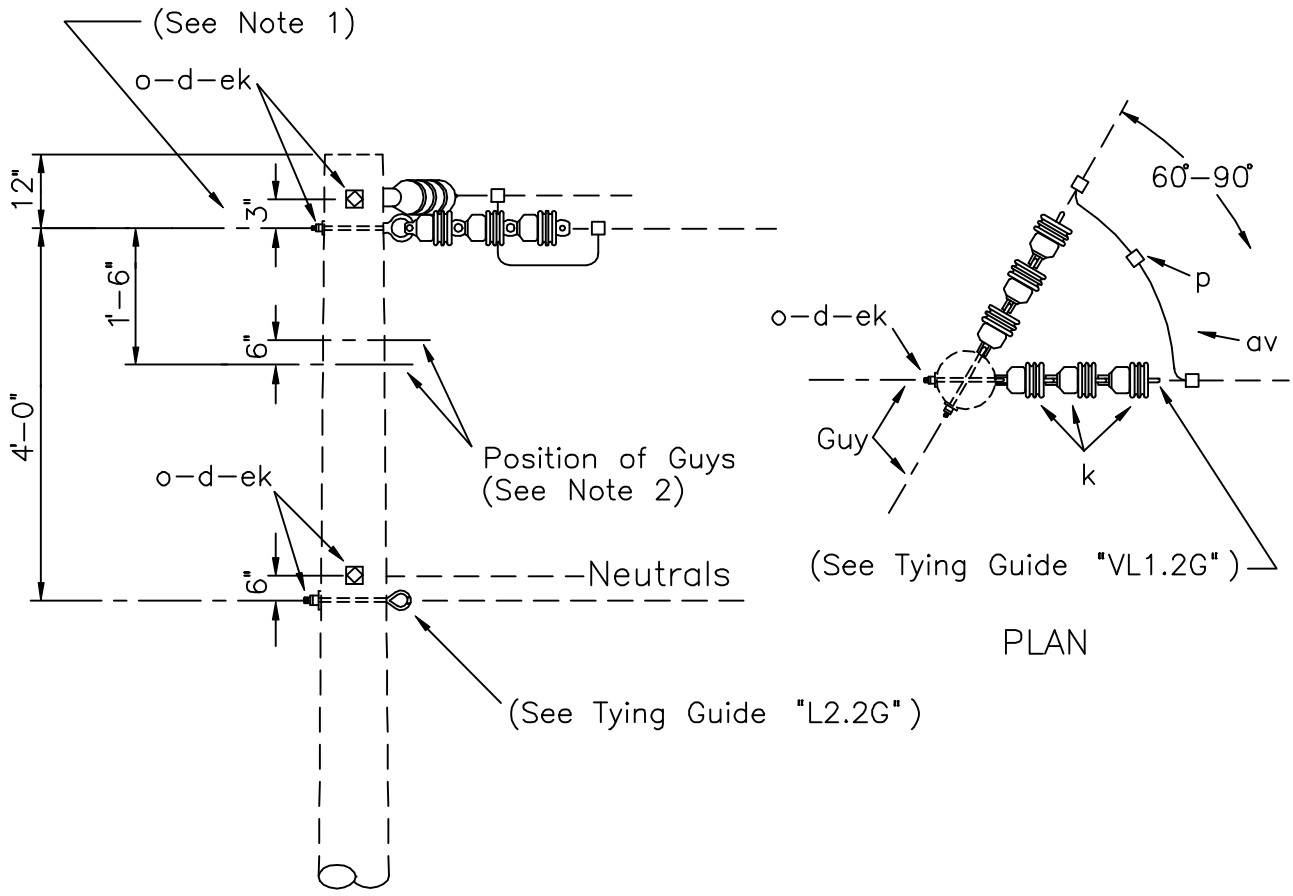
ASSEMBLY: VA3		.2	.3
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" x req'd length	1	
d	Washer, square, 3", curved	2	2
k	Insulator, suspension, 4 1¨/4"	3	3
o	Bolt, eye, 5/8" x req'd length	1	2
s	Clevis, secondary, swinging, insulated		1
bo	Shackle, anchor	1	1
da	Bracket, insulated	1	
ek	Locknuts	2	2

DESIGN PARAMETERS:

See Tables VI and VII

SUSPENSION ANGLE

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA3.2,VA3.3



NOTES:

1. Separate 6" (top position only) when angle equals 90°.

2. When additional guys are required, install guys 6" below deadend assemblies and use two VA5.4's or install 12" guy strain insulators ("w") at top of uppermost guys.

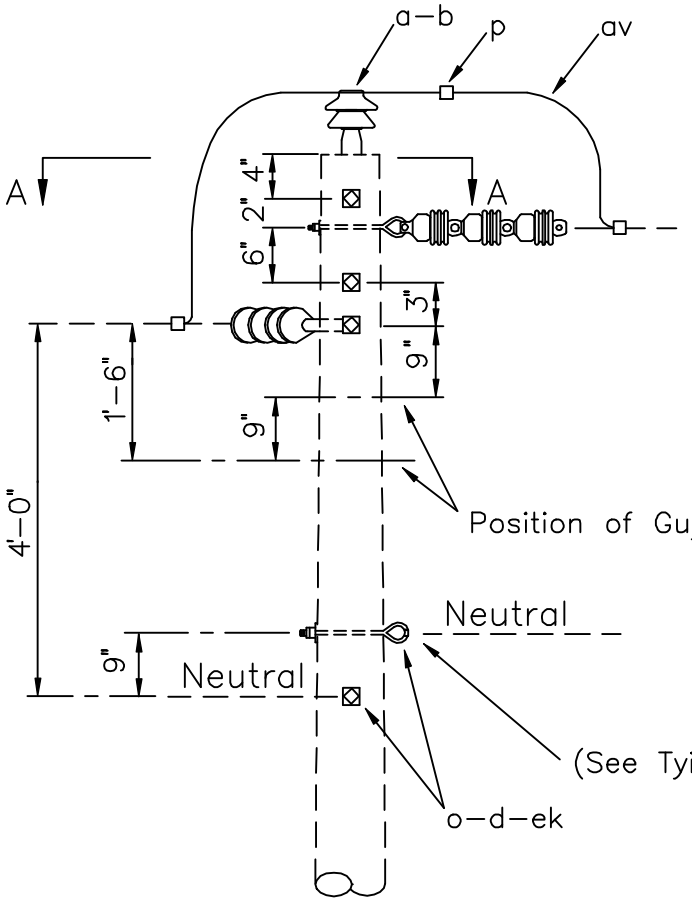
ITEM	QTY	MATERIAL
d	4	Washer, square, 3", curved
k	6	Insulator, suspension, 4 1/4"
o	4	Bolt, eye, 5/8" x req'd length
p		Connectors, as req'd
av		Jumpers, as req'd
ek	4	Locknuts

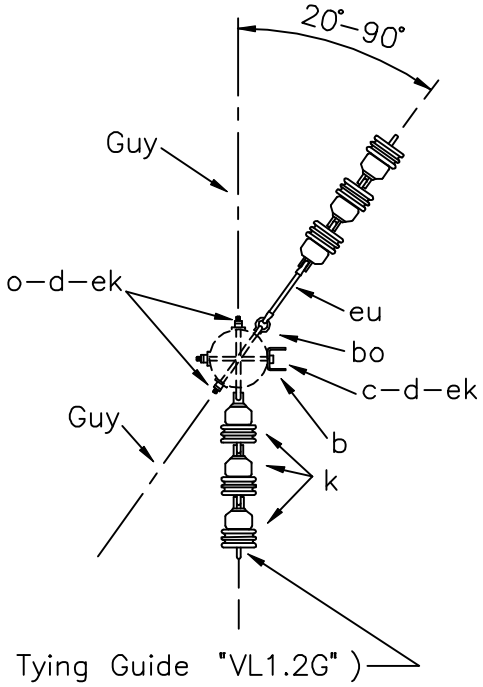
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5000 lbs./Conductor

DEADEND ANGLE (90°–150°)

DEC 1998	1 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VA4.1





SECTION A–A

NOTE: Use 3" curved washers, "d," on eyebolts, "o."

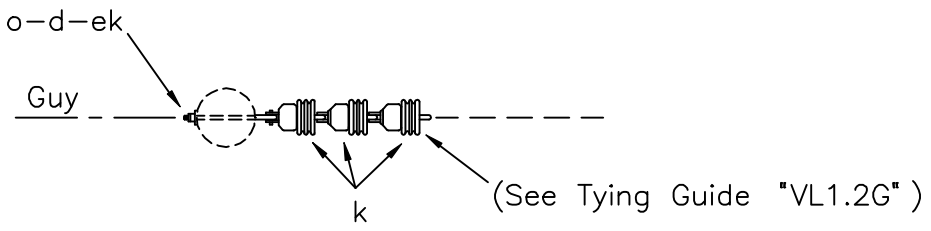
ITEM	QTY	MATERIAL
a	1	Insulator, pin type (24.9/14.4 kV)
b	1	Pin, pole top, 20"
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
d	4	Washer, square, 3," curved
k	6	Insulator, suspension, 4 1/4"
o	4	Bolt, eye, 5/8" x req'd length
p		Connectors, as req'd
av		Jumpers, as req'd
bo	1	Shackle, anchor
ek	6	Locknuts
eu	1	Link, extension, insulated, 12" min.

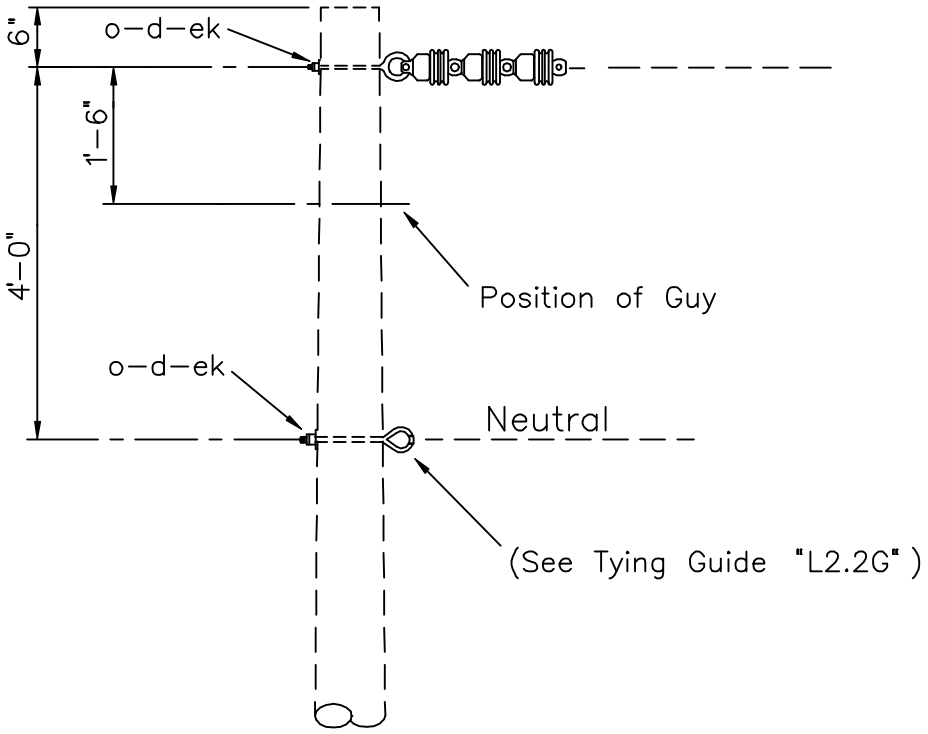
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5000 lbs./Conductor

DEADEND ANGLE (20°–90°)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA4.2





NOTES:

1. VA5.2, VA5.3 or VA5.4 may be used instead of assembly shown.
2. When more than one guy is required, install top guy 6" below primary assembly and use VA5.4 or install 12" guy strain insulator ("w") at top of guy.

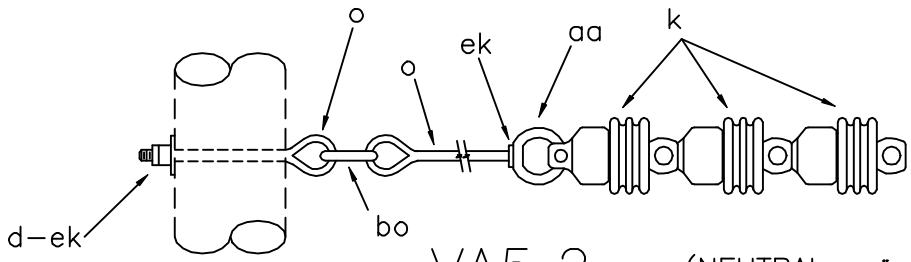
ITEM	QTY	MATERIAL
d	2	Washer, square, 3", curved
k	3	Insulator, suspension, 4 1/4"
o	2	Bolt, eye, 5/8" x req'd length
ek	2	Locknuts

DESIGN PARAMETERS:

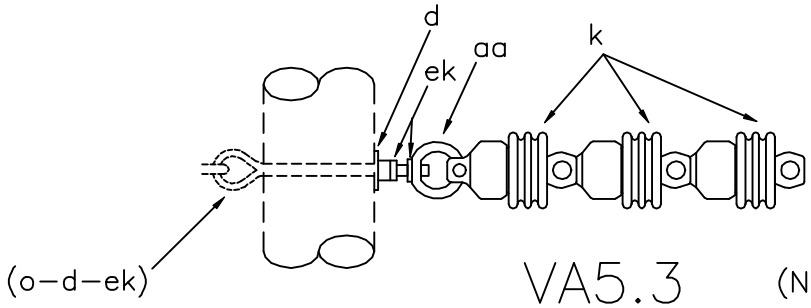
ALLOWABLE LONGITUDINAL LOAD = 5000 lbs./Conductor

SINGLE DEADEND

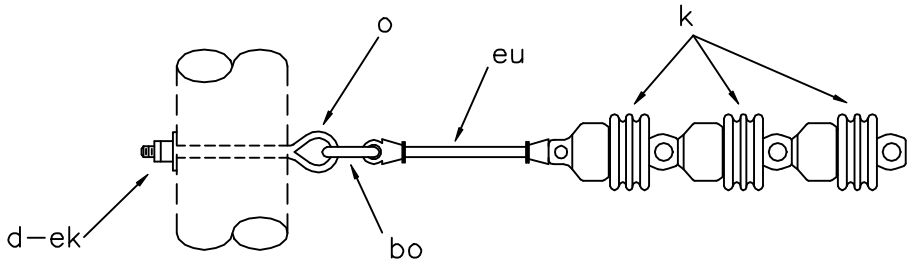
DEC 1998	1 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VA5.1



VA5.2 (NEUTRAL = "o–d–ek")



VA5.3 (NEUTRAL = "aa–ek")



VA5.4 (NEUTRAL = "o–d–ek")

NOTES:

1. See Assembly Drawing VA5.1
2. See Tying Guide Drawing VL1.2G
3. When connecting to existing bolt end, use eyenut "aa" and locknut "ek" instead of eyebolt assembly "o–d–ek"
4. If above assemblies used for primary angle assembly:
   (a) Rotate eyenut 90° & install anchor shackle "bo" in VA5.3
   (b) See Drawing VA3.1 and Tying Guide Drawing VL1.1G
5. Distribution extension link, (item "du"), may be substituted for anchor shackle (item "bo"), eye bolt (item "o") and eye nut (item "aa") on Assembly VA5.2.

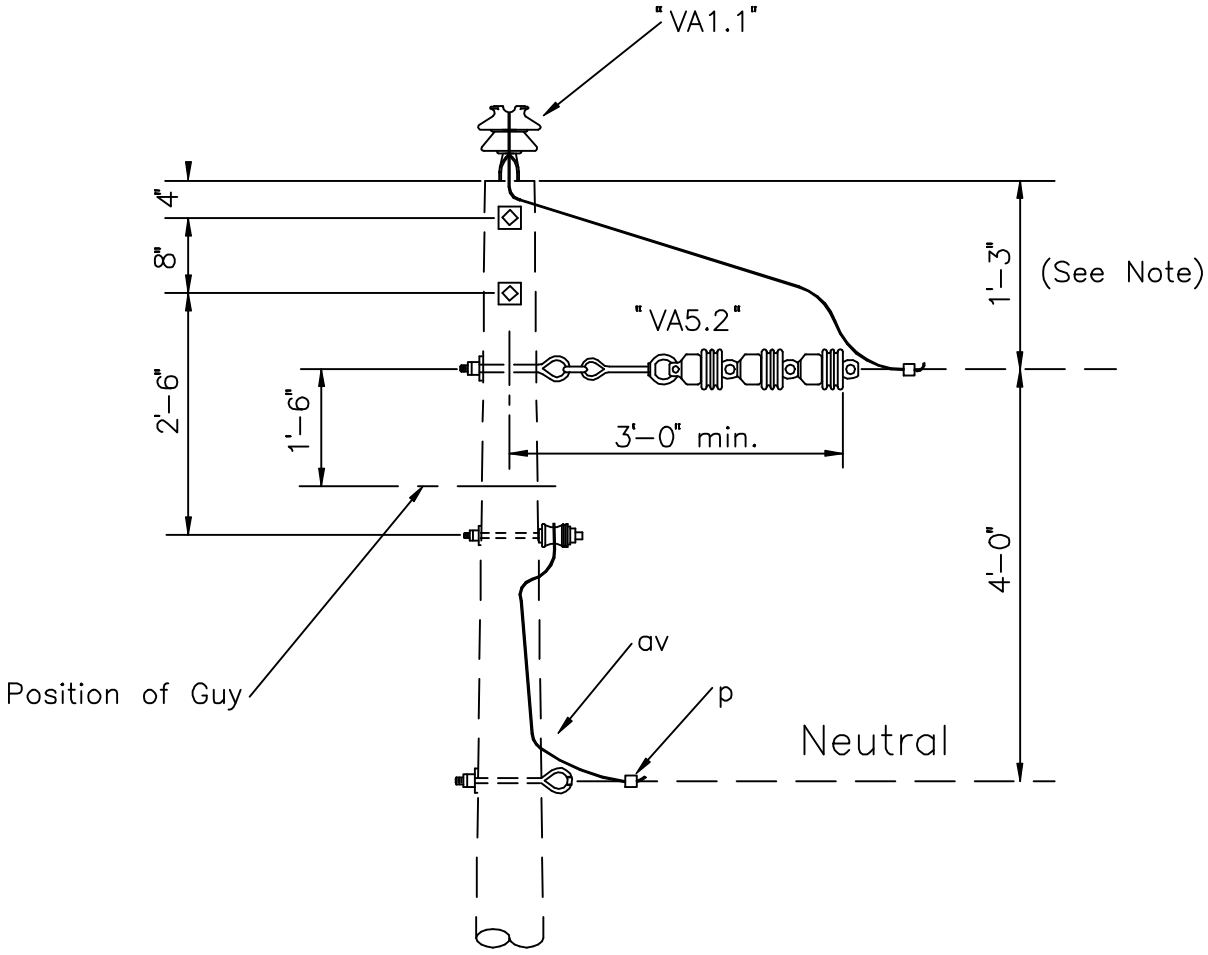
UNIT: VA5		.2	.3	.4
ITEM	MATERIAL (includes neutral assemblies)	QTY	QTY	QTY
d	Washer, square, 3", curved	2		2
k	Insulator, suspension, 4 1/4"	3	3	3
o	Bolt, eye, 5/8" x req'd length	3		2
aa	Nut, eye, 5/8"	1	2	
bo	Shackle, anchor	1		1
ek	Locknuts	3	3	2
eu	Link, extension, insulated, 12" min.			1

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL OR TRANSVERSE LOAD = 5000 lbs./Conductor

SINGLE DEADENDS

DEC 1998	1 – PHASE PRIMARY	VA5.2
RUS	24.9/14.4 kV	VA5.3,VA5.4



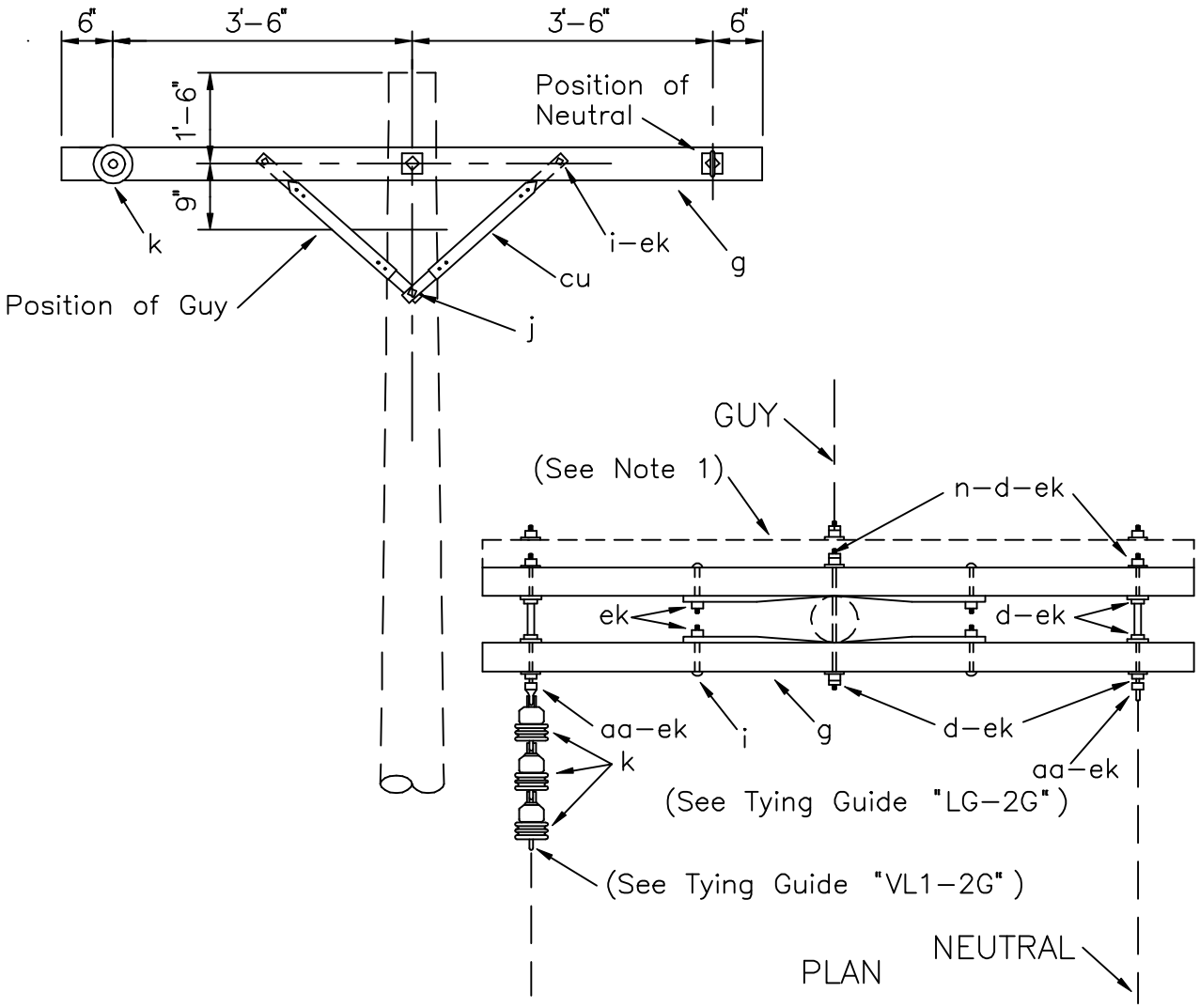
NOTE: Tap assembly may be installed 6" from top of pole when perpendicular to line. Raise neutral and guy attachment 9" also.

ITEM	QTY	MATERIAL
	1	VA1.1 Primary Assembly
	1	VA5.2 Primary Assembly
p		Connectors, as req'd
av		Jumpers, as req'd

DESIGN PARAMETERS:
ALLOWABLE LONGITUDINAL
LOAD = 5000 lbs./Conductor

SINGLE PHASE TAP GUIDE

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA5.5G



NOTES:

1. Designate as VA5.31 for assembly with three crossarms.
2. Neither assembly suitable for Grade B construction.
3. Double arming eye bolt, item "dy," may be used instead of double arming bolt, item "n," and eyenut, item "aa."

ITEM	QTY	MATERIAL
d	10	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
k	3	Insulator, suspension, 4 1/4"
n	3	Bolt,double arming,5/8" x req'd length
aa	2	Nut, eye, 5/8"
cu	4	Brace, 28"
ek	16	Locknuts

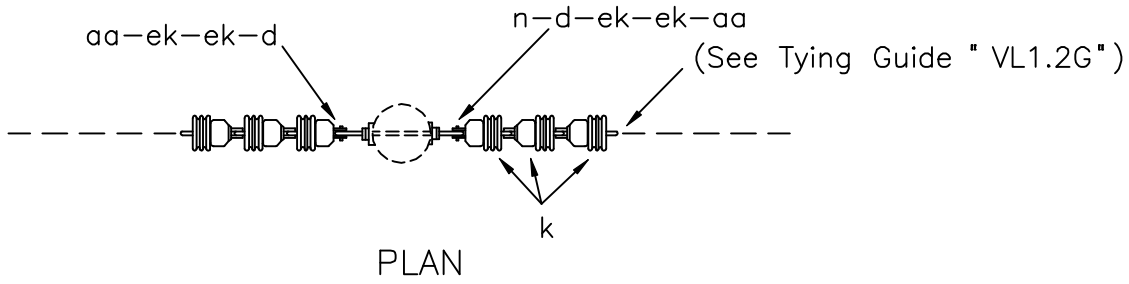
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOADING (lbs/conductor) =

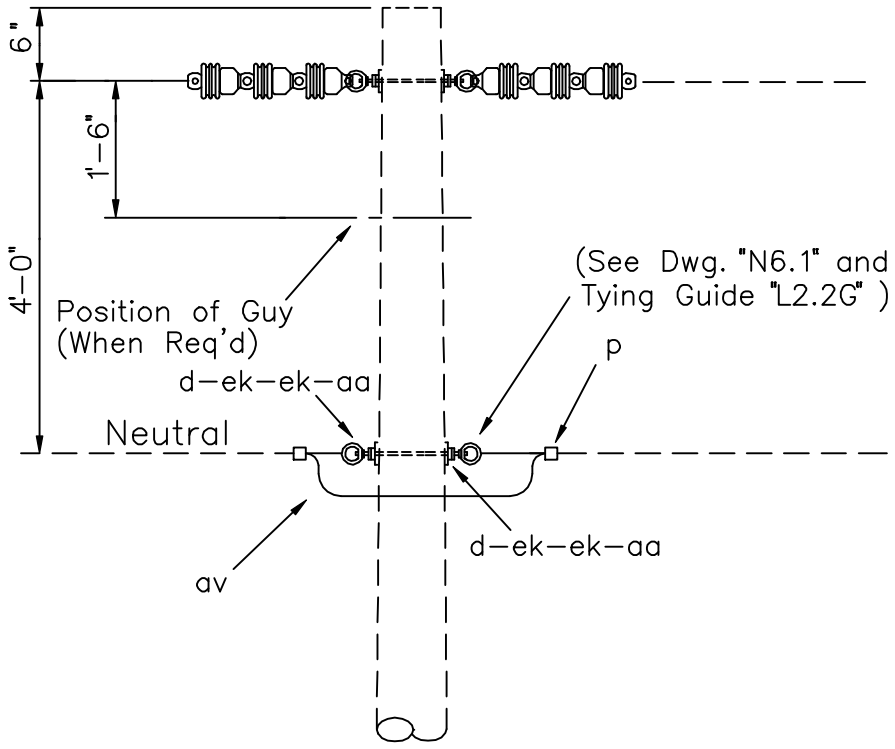
VA5.21: 2,000 (#2 ACSR max.)
VA5.31: 3,000 (#2/0 ACSR max.)

SINGLE DEADEND ON CROSSARMS

DEC 1998	1 – PHASE PRIMARY 24.9/14.4 kV	VA5.21 VA5.31
RUS		



PLAN



ITEM	QTY	MATERIAL
d	4	Washer, square, 3", curved
k	6	Insulator, suspension, 4 1/4"
n	2	Bolt,double arming,5/8" x req'd length
p		Connectors, as req'd
aa	4	Nut, eye, 5/8"
av		Jumpers, as req'd
ek	8	Locknuts

NOTE: Maximum line angle may be increased to 15° by installing anchor shackles, item "bo", to (horizontal) eyenuts and installing side guy as req'd.

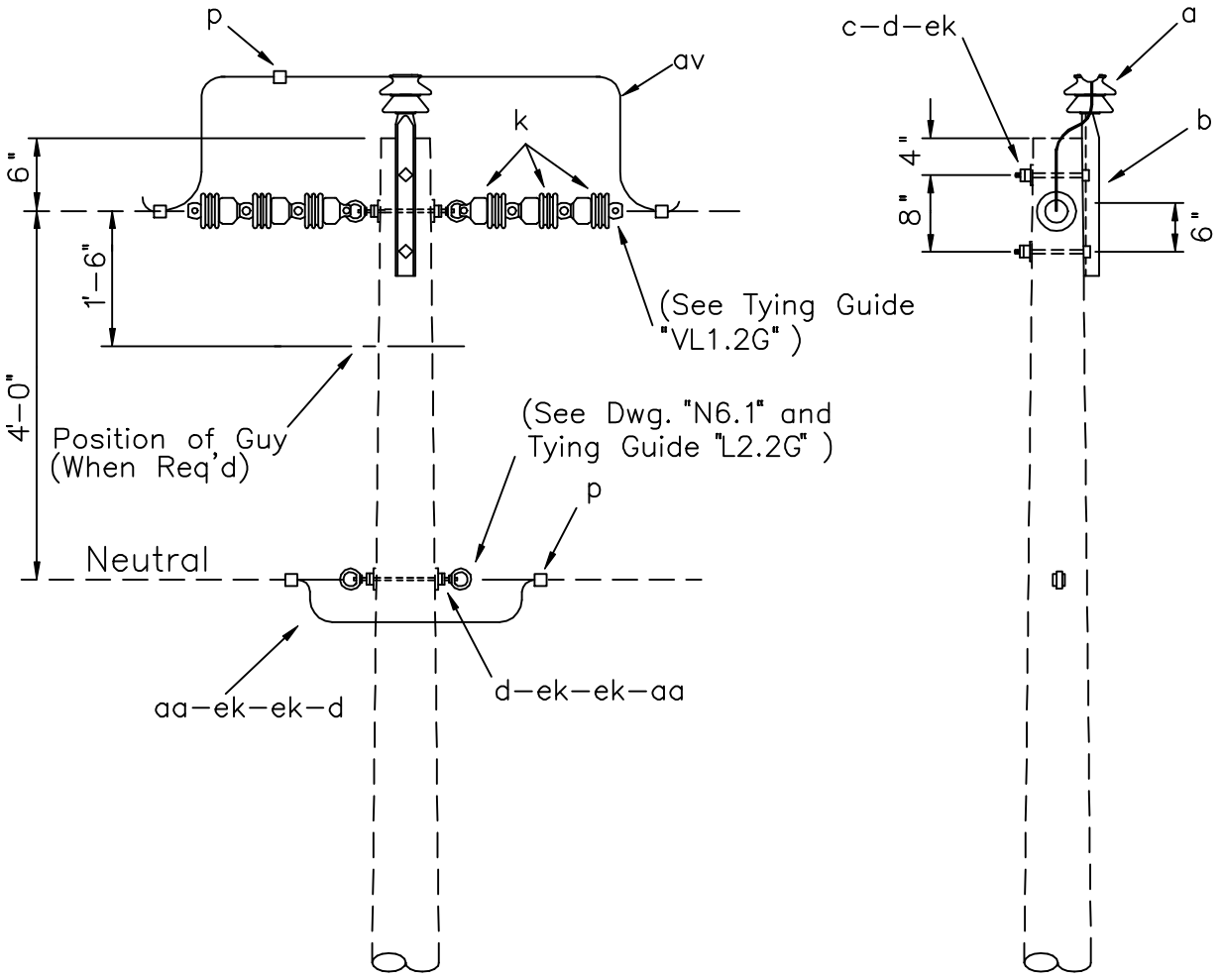
DESIGN PARAMETERS:

MAXIMUM ALLOWABLE LONGITUDINAL LOAD= 5000 lbs./Conductor

MAXIMUM LINE ANGLE = 5° (See Note)

DOUBLE DEADEND (STRAIGHT)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VA6.1



ITEM	QTY	MATERIAL
a	1	Insulator, pin type (24.9/14.4 kV)
b	1	Pin, pole top, 20"
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
d	4	Washer, square, 3," curved
k	6	Insulator, suspension, 4 1/4"
n	2	Bolt,double arming,5/8" x req'd length
p		Connectors, as req'd
aa	4	Nut, eye, 5/8"
av		Jumpers, as req'd
ek	10	Locknuts

NOTE: Maximum line angle may be increased to 15° by installing anchor shackles, item "bo", to (horizontal) eyenuts and installing side guy as req'd.

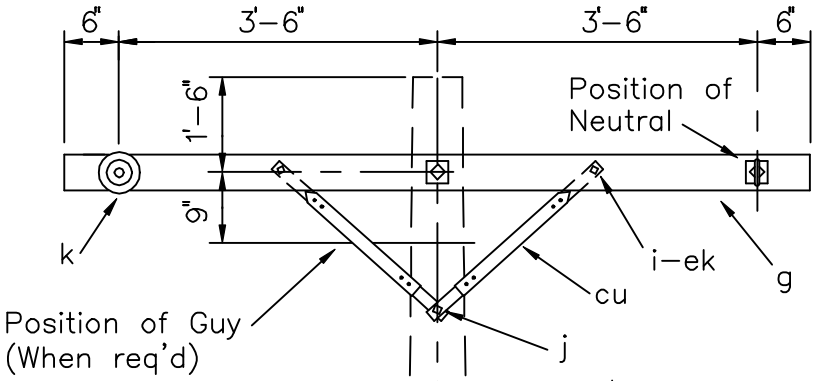
DESIGN PARAMETERS:

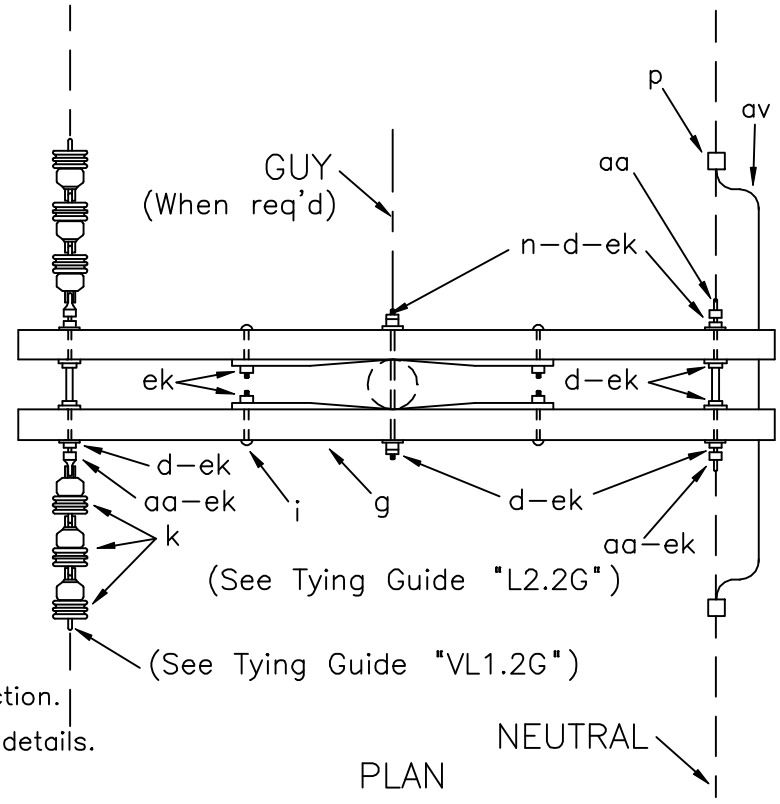
MAXIMUM ALLOWABLE LONGITUDINAL LOAD= 5000 lbs./Conductor

MAXIMUM LINE ANGLE = 5° (See Note)

DOUBLE DEADEND (FEED THROUGH)

DEC 1998	1 - PHASE PRIMARY 24.9/14.4 kV	
RUS		VA6.2





PLAN

NOTES:

1. Not suitable for Grade B construction.
2. See drawing "N6.21" for additional details.

ITEM	QTY	MATERIAL
d	10	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
k	6	Insulator, suspension, 4 1/4"
n	3	Bolt,double arming,5/8" x req'd length
p		Connectors, as req'd
aa	4	Nut, eye, 5/8"
av		Jumpers, as req'd
cu	4	Brace, wood, 28"
ek	18	Locknuts

NOTES:

3. Maximum line angle may be increased to 15° by installing anchor shackles, item "bo", to (horizontal) eyenuts and installing side guy as req'd.

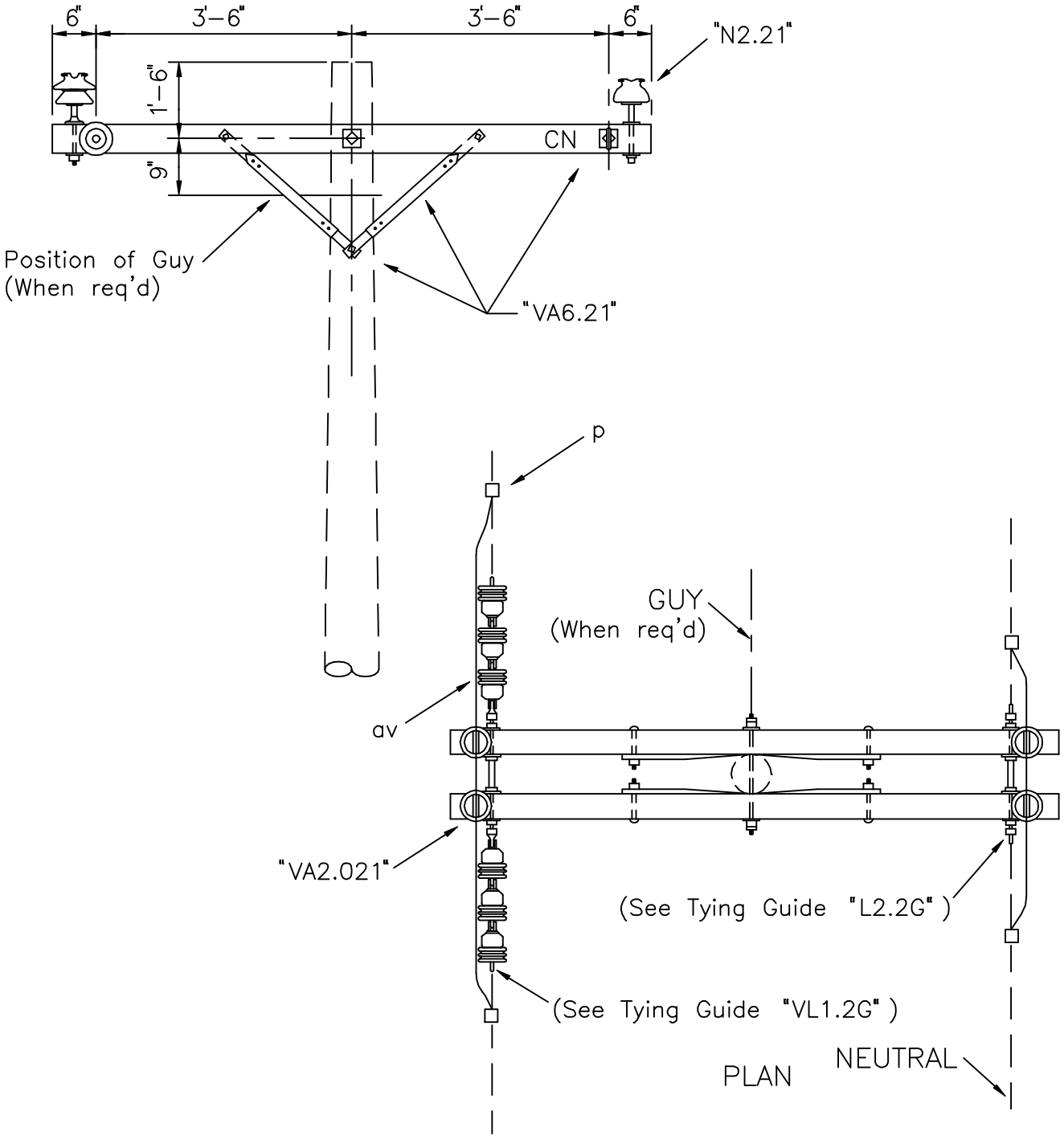
DESIGN PARAMETERS:

MAXIMUM ALLOWABLE UNBALANCED TENSION: 2,000 lbs./conductor

MAXIMUM ALLOWABLE LINE ANGLE = 5° (See Note 3)

DOUBLE DEADEND ON CROSSARMS

DEC 1998	1 - PHASE PRIMARY	
RUS	24.9/14.4 kV	VA6.21



ITEM	QTY	MATERIAL
	1	VA6.21 Primary Assembly
	1	VA2.021 Primary Assembly
	1	N2.21 Neutral Assembly
p		Connectors, as req'd
av		Jumpers, as req'd

NOTE: Not suitable for grade B construction

DESIGN PARAMETERS:

ALLOWABLE UNBALANCED LONGITUDINAL TENSION: 2,000 lbs./conductor

MAXIMUM LINE ANGLE = 5° (See Dwg. VA6–21)

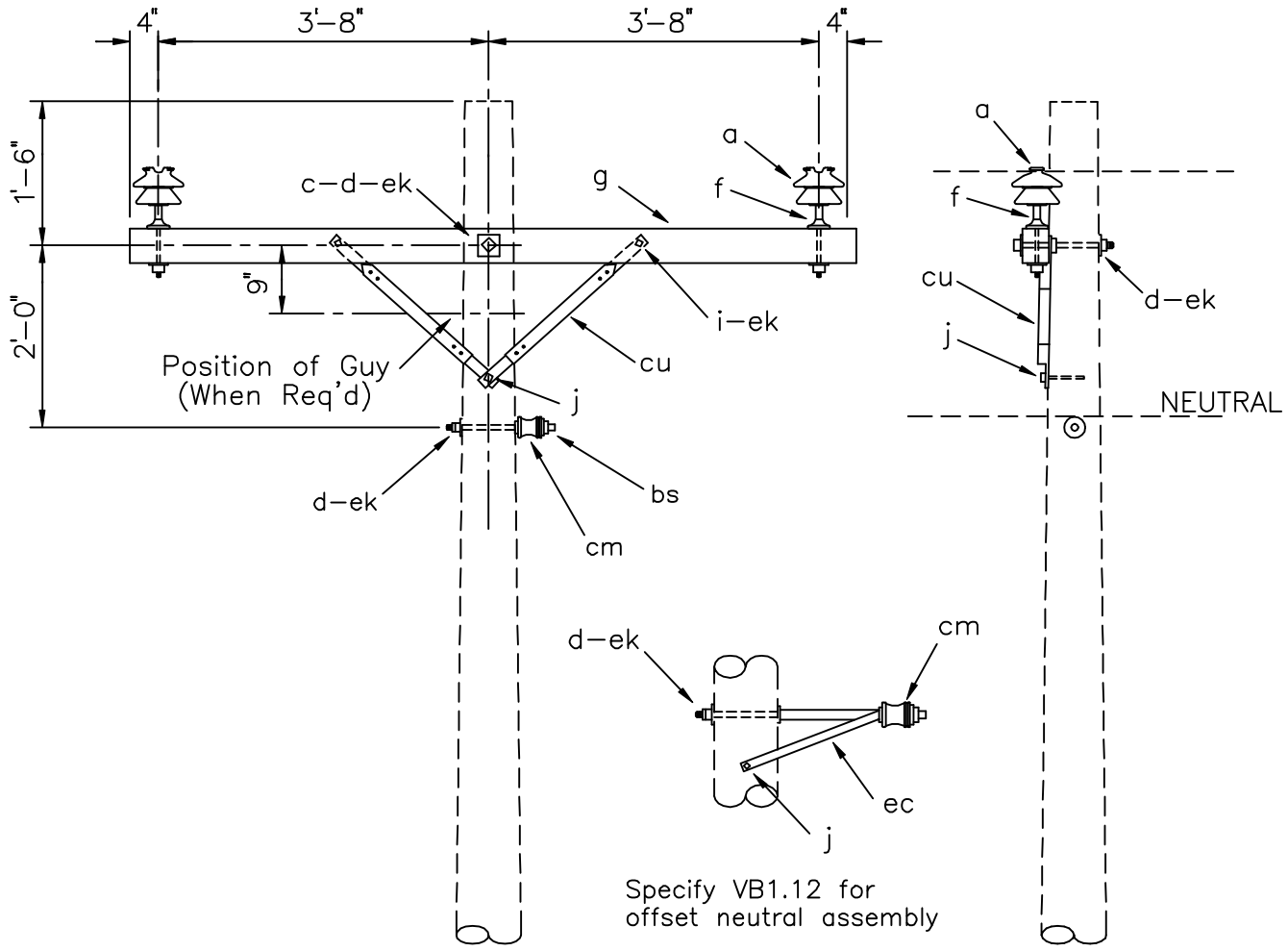
DOUBLE DEADEND GUIDE (FEED THROUGH ON CROSSARMS)

DEC 1998	1 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VA6.22G

INDEX B

TWO-PHASE PRIMARY POLE TOP ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VB1.11, VB1.12	SINGLE SUPPORT ON CROSSARM (TANGENT)
VB1.11P, VB1.12P	SINGLE SUPPORT ON CROSSARM (TANGENT) (POST INSULATORS)
VB1.13	SINGLE SUPPORT ON CROSSARM
VB1.13P	SINGLE SUPPORT ON CROSSARM (POST INSULATORS)
VB1.14	SINGLE SUPPORT, NEUTRAL ON CROSSARM
VB1.14P	SINGLE SUPPORT, NEUTRAL ON CROSSARM (POST INSULATORS)
VB2.21	DOUBLE SUPPORT ON CROSSARMS
VB2.21P	DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)
VB2.22	DOUBLE SUPPORT, NEUTRAL ON CROSSARMS
VB2.22P	DOUBLE SUPPORT, NEUTRAL ON CROSSARMS (POST INSULATORS)
VB3.1	SUSPENSION ANGLE
VB4.1	DEADEND ANGLE (90° - 150°)
VB5.1	SINGLE DEADEND
VB5.21, VB5.31	SINGLE DEADEND ON CROSSARMS
VB6.21	DOUBLE DEADEND ON CROSSARMS



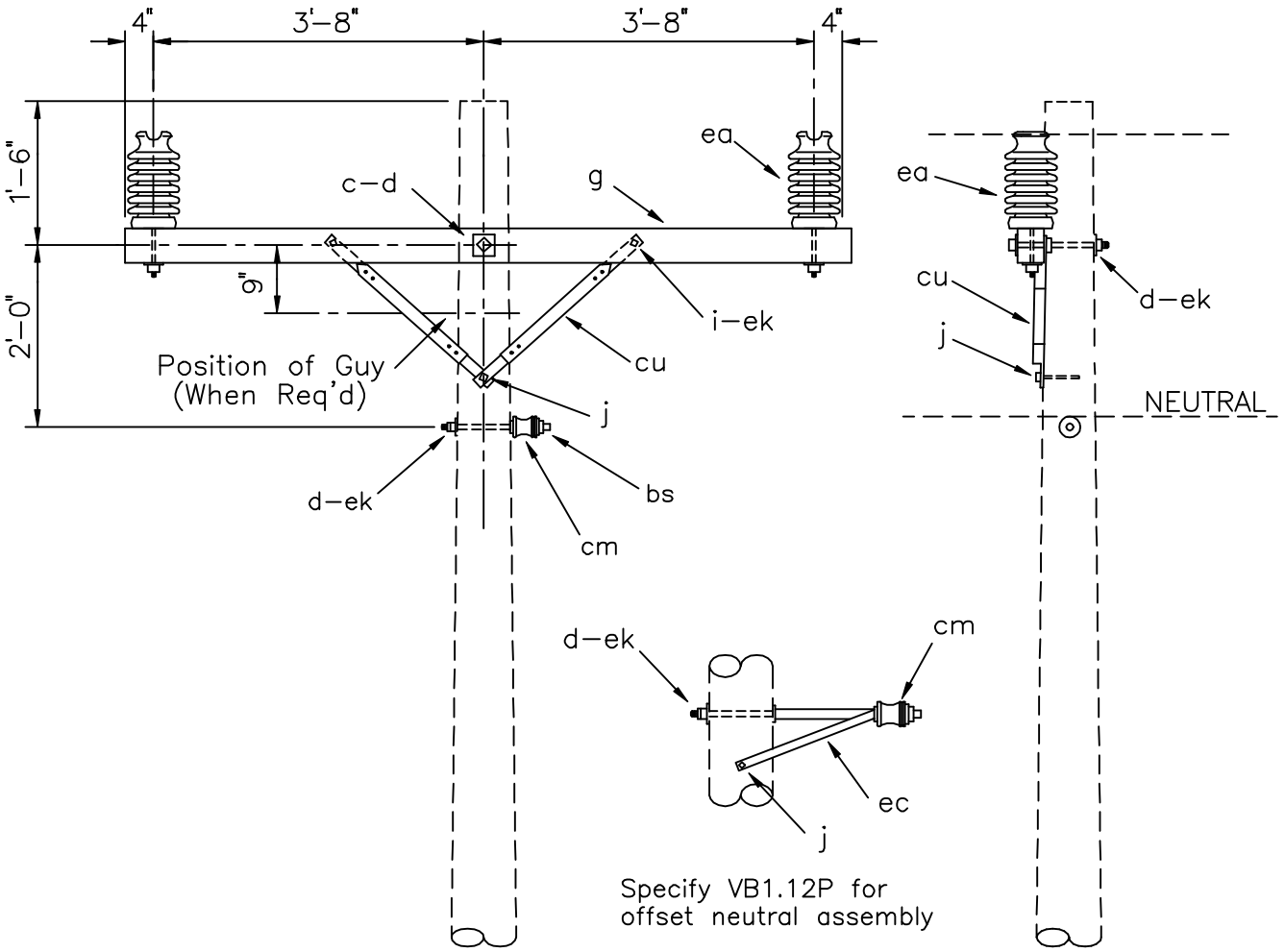
ASSEMBLY: VB1.		11	12
ITEM	MATERIAL	QTY	QTY
a	Insulator, pin type (24.9/14.4 kV)	2	2
c	Bolt, machine, 5/8" x req'd length	1	1
d	Washer, square, 2 1/4"	3	3
f	Pin, crossarm steel, 5/8" x 14"	2	2
g	Crossarm, 3 5/8" x 4 5/8" x 8'–0"	1	1
i	Bolt, carriage, 3/8" x 4 1/2"	2	2
j	Screw, lag, 1/2" x 4"	1	3
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
ec	Bracket, offset, neutral		1
ek	Locknuts	4	4

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT ON CROSSARM (TANGENT)

DEC 1998	2 – PHASE PRIMARY	VB1.11
RUS	24.9/14.4 kV	VB1.12



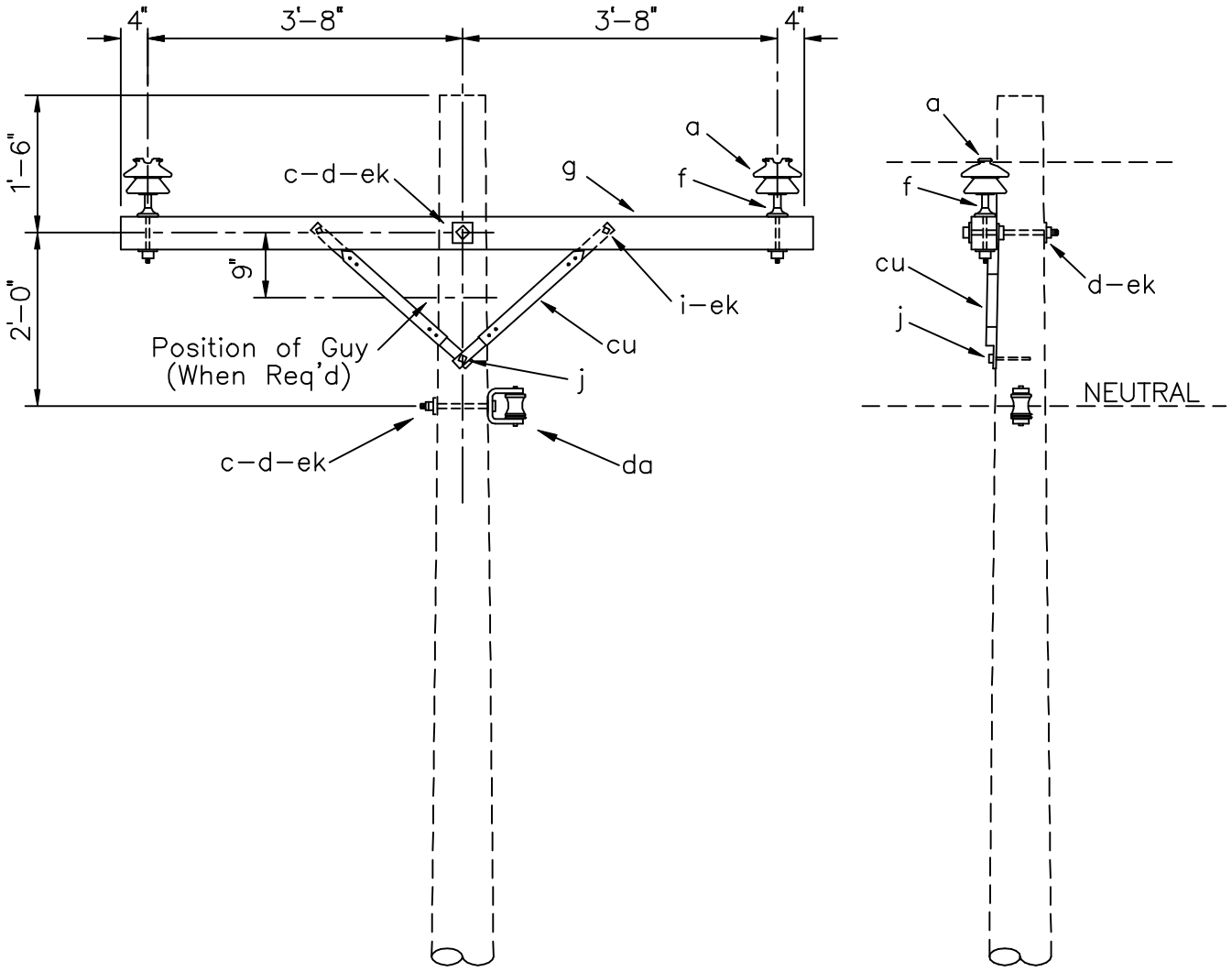
ASSEMBLY: VB1.		11P	12P
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" x req'd length	1	1
d	Washer, square, 2 1/4"	3	3
g	Crossarm, 3 5/8" x 4 5/8" x 8'–0"	1	1
i	Bolt, carriage, 3/8" x 4 1/2"	2	2
j	Screw, lag, 1/2" x 4"	1	3
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
ea	Insulator, post type, (24.9/14.4 kV)	2	2
ec	Bracket, offset, neutral		1
ek	Locknuts	4	4

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT ON CROSSARM (TANGENT) (POST INSULATORS)

DEC 1998	2 – PHASE PRIMARY	VB1.11P
RUS	24.9/14.4 kV	VB1.12P



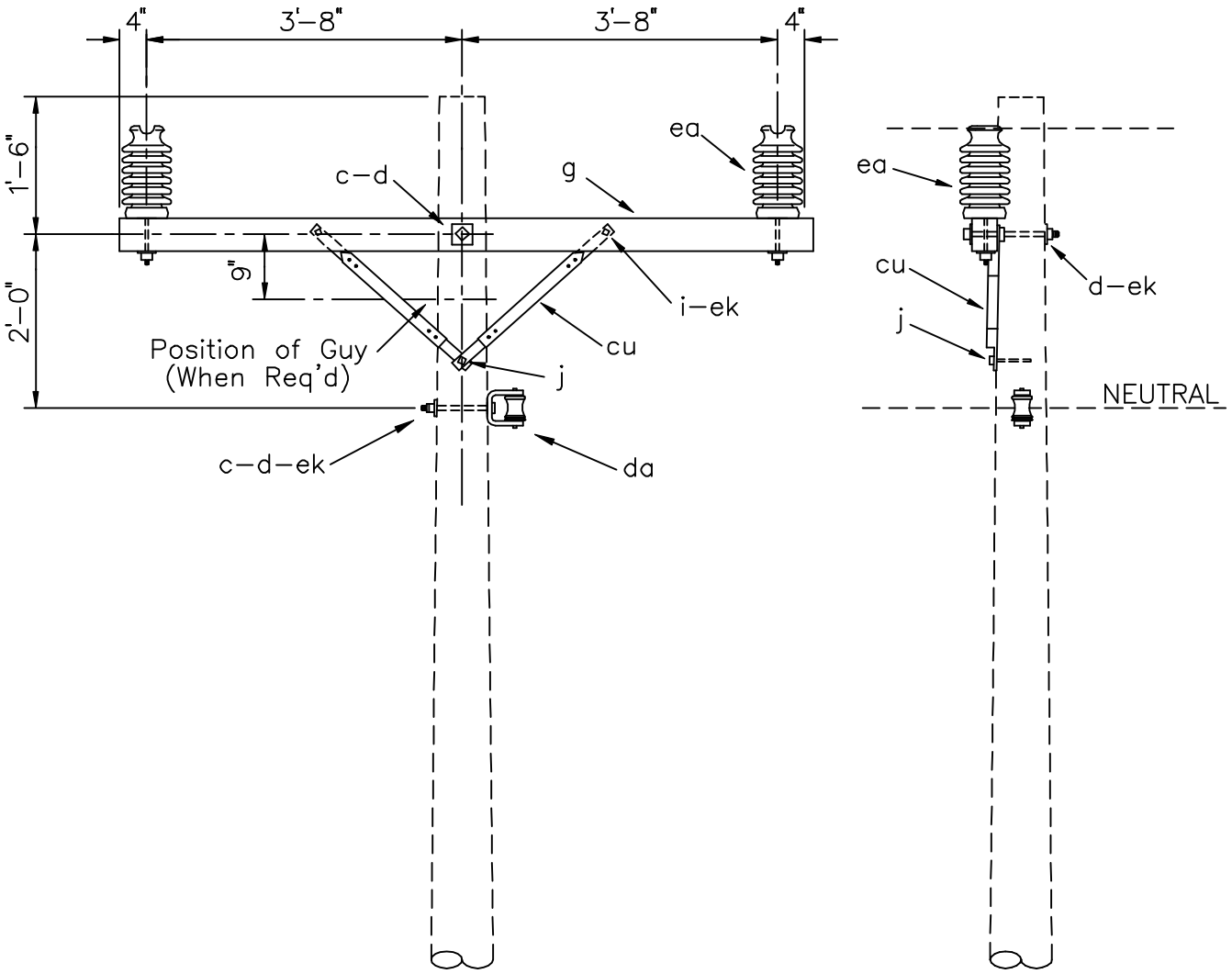
ITEM	QTY	MATERIAL
a	2	Insulator, pin type (24.9/14.4 kV)
c	2	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 14"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
da	1	Bracket, insulated
ek	4	Locknuts

DESIGN PARAMETERS:

See TABLE II

SINGLE SUPPORT ON CROSSARM

DEC 1998	2 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VB1.13



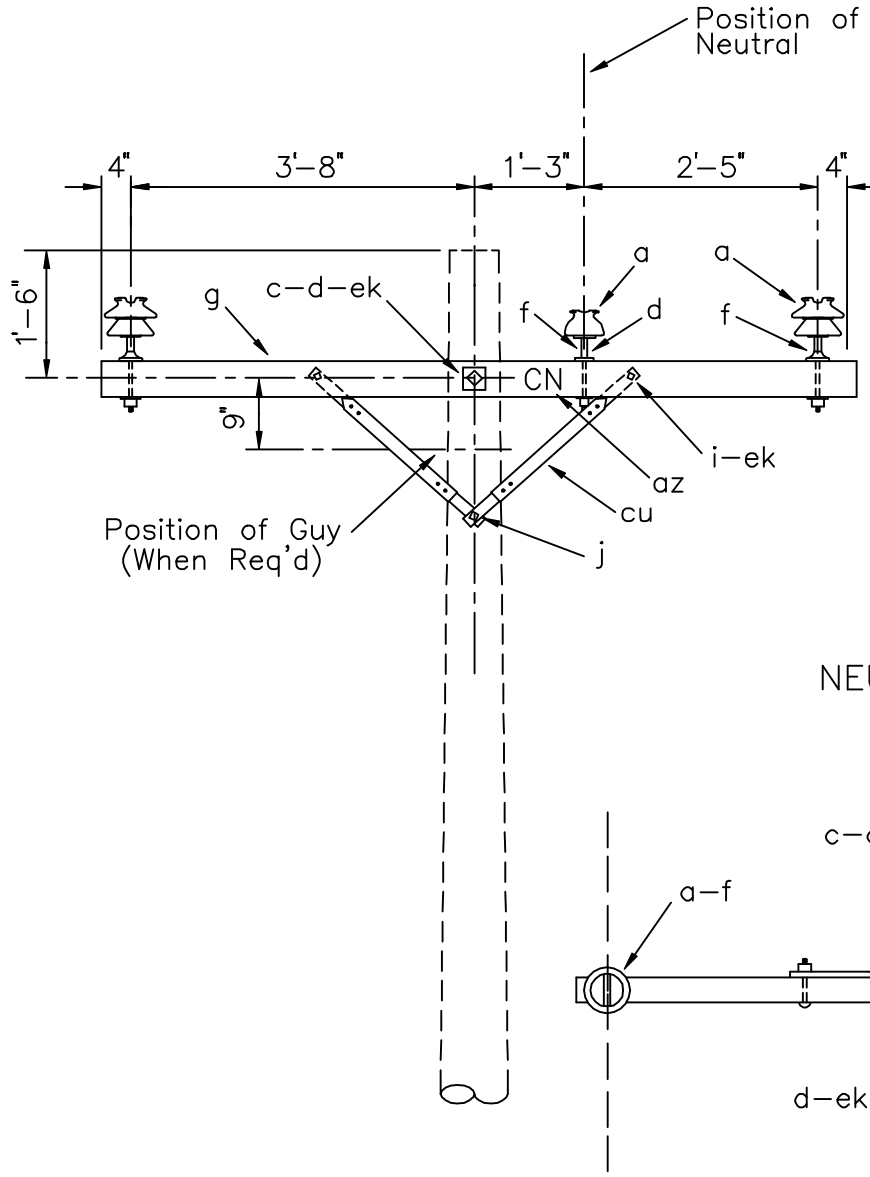
ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
da	1	Bracket, insulated
ea	2	Insulator, post type (24.9/14.4 kV)
ek	4	Locknuts

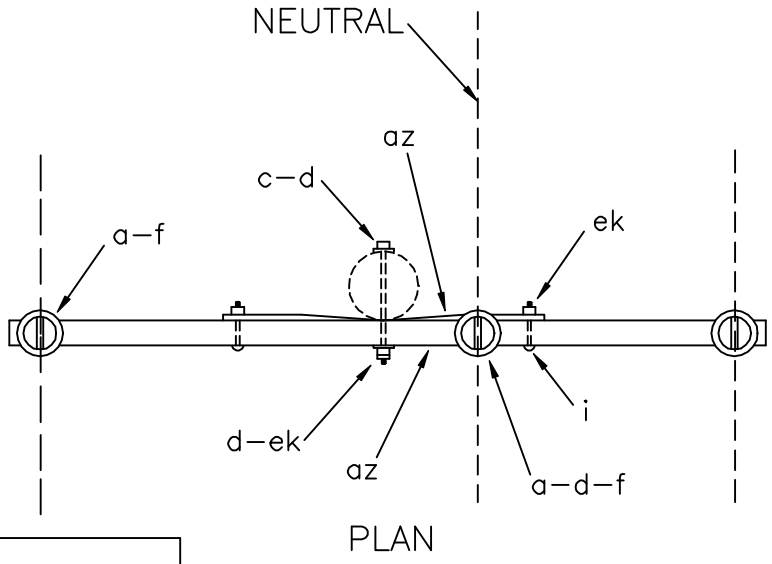
DESIGN PARAMETERS:

See TABLE II

SINGLE SUPPORT ON CROSSARM (POST INSULATORS)

DEC 1998	2 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VB1.13P





PLAN

ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
a	2	Insulator, pin type (24.9/14.4 kV)
c	1	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
f	1	Pin, crossarm, steel, 5/8" x 10 3/4"
f	2	Pin, crossarm, steel, 5/8" x 14"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
az	4	Letters, 2" C, 2" N, with nails
cu	2	Brace, 28"
ek	3	Locknuts

NOTES:

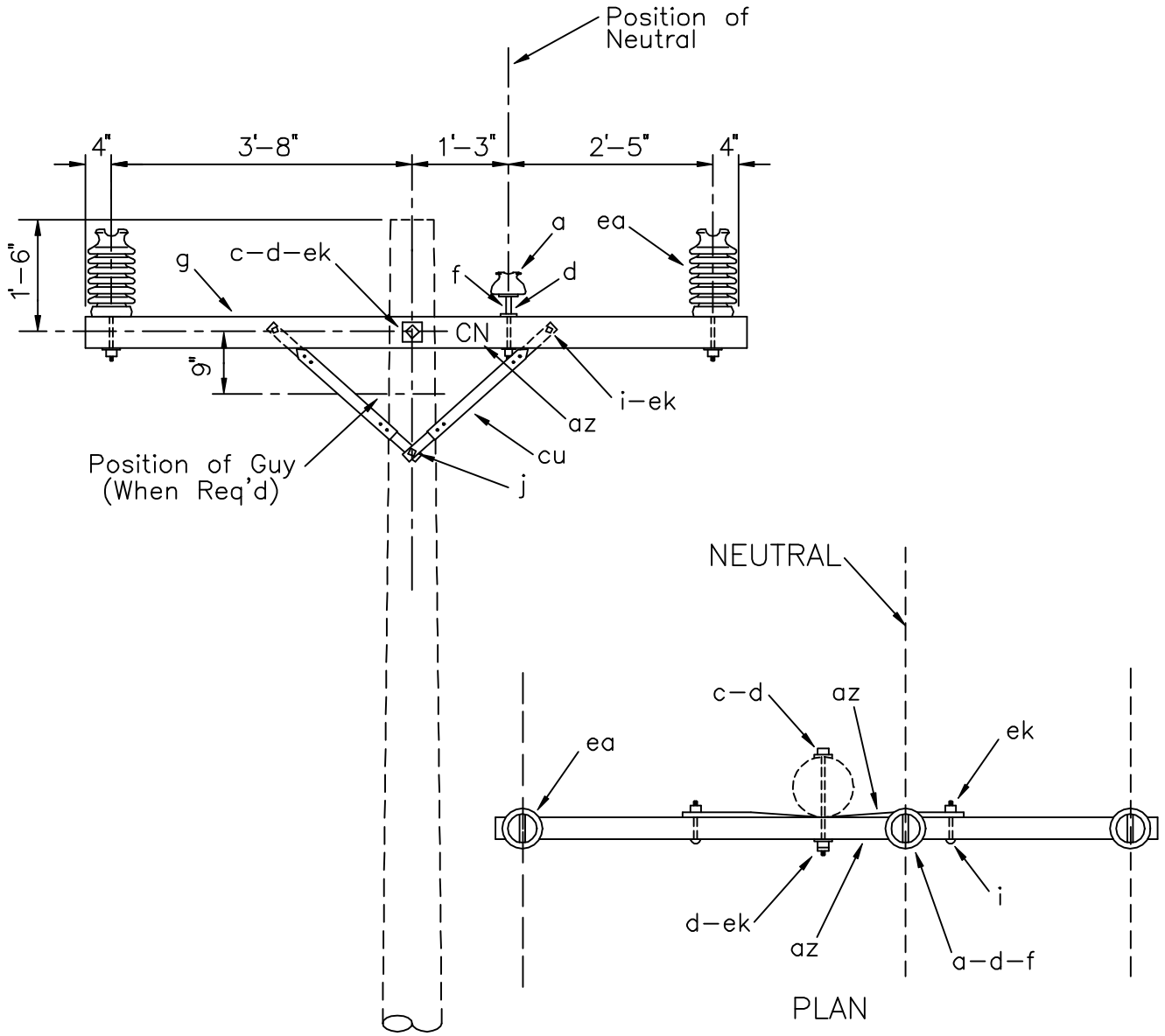
1. Install either identification letters (az) or white insulator in neutral position.
2. Where future construction to three–phase is likely, use construction similar to "VC1.41" and designate as "VB1.41".

DESIGN PARAMETERS:

See TABLE II

SINGLE SUPPORT, NEUTRAL ON CROSSARM

DEC 1998	2 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VB1.14



ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
c	1	Bolt, machine, 5/8" x req'd length
d	3	Washer, square, 2 1/4"
f	1	Pin, crossarm, steel, 5/8" x 10 3/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
az	4	Letters, 2" C, 2" N, with nails
cu	2	Brace, 28"
ea	2	Insulator, post type (24.9/14.4 kV)
ek	3	Locknuts

NOTES:

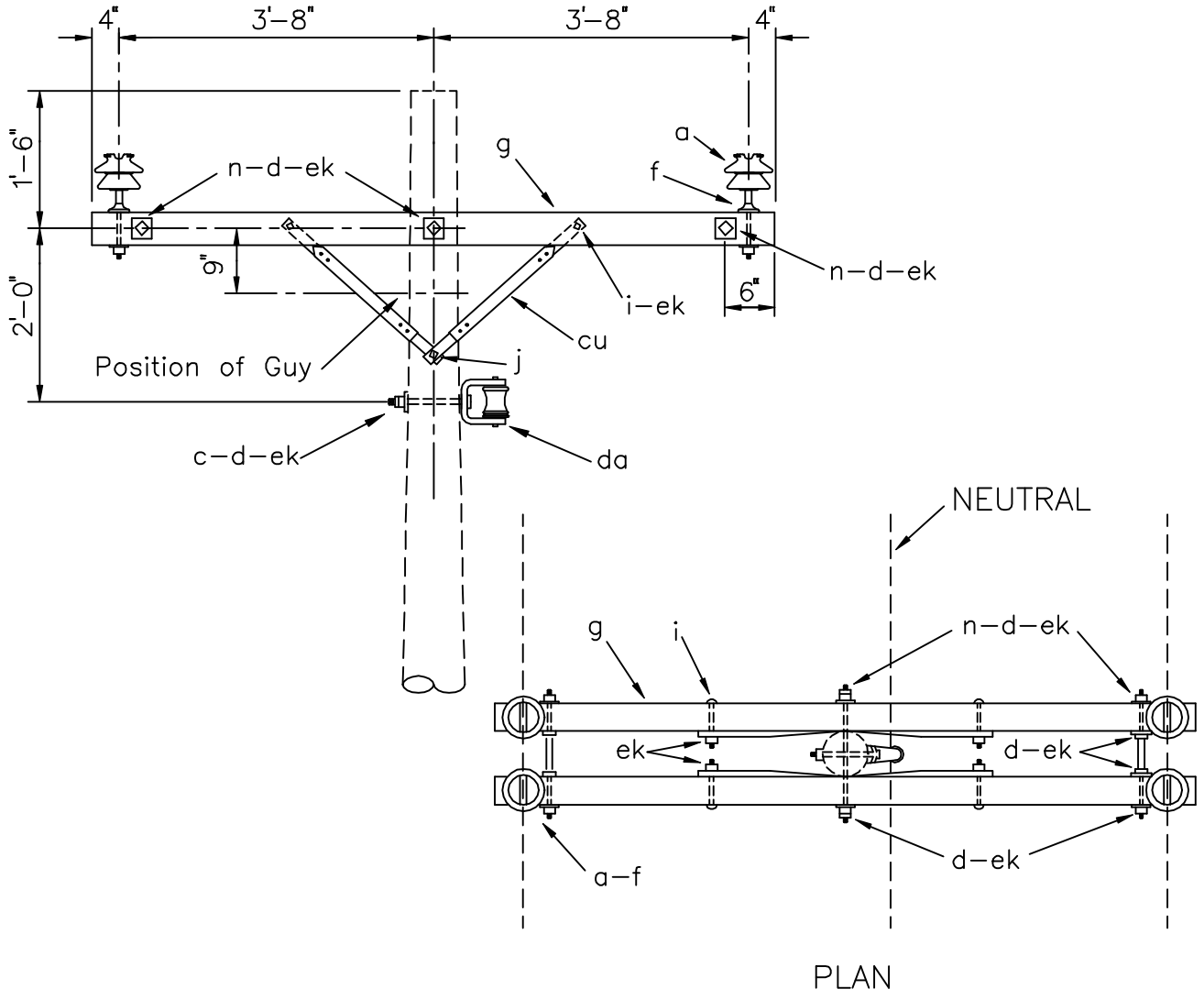
1. Install either identification letters (az) or white insulator in neutral position.
2. Where future construction to three–phase is likely, use construction similar to "VC1.41P" and designate as "VB1.41P."

DESIGN PARAMETERS:

See TABLE II

SINGLE SUPPORT, NEUTRAL ON CROSSARM (POST INSULATORS)

DEC 1998	2 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VB1.14P



PLAN

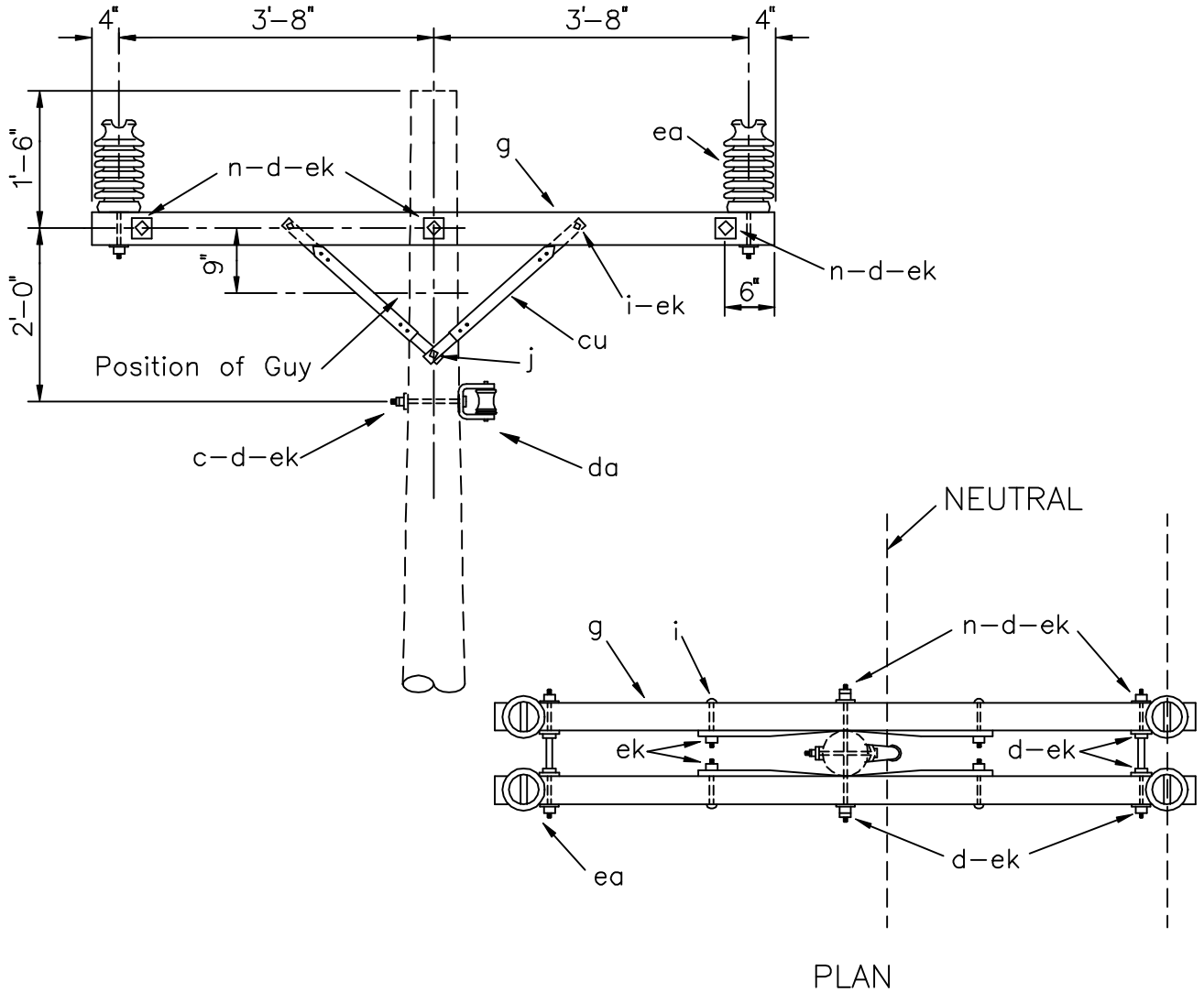
ITEM	QTY	MATERIAL
a	4	Insulator, pin type (24.9/14.4 kV)
c	1	Bolt, machine, 5/8" x req'd length
d	11	Washer, square, 2 1/4"
f	4	Pin, crossarm, steel, 5/8" x 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arm, 5/8" x req'd length
cu	4	Brace, 28"
da	1	Bracket, insulated
ek	15	Locknuts

DESIGN PARAMETERS:

See TABLE IV

DOUBLE SUPPORT ON CROSSARMS

DEC 1998	2 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VB2.21



PLAN

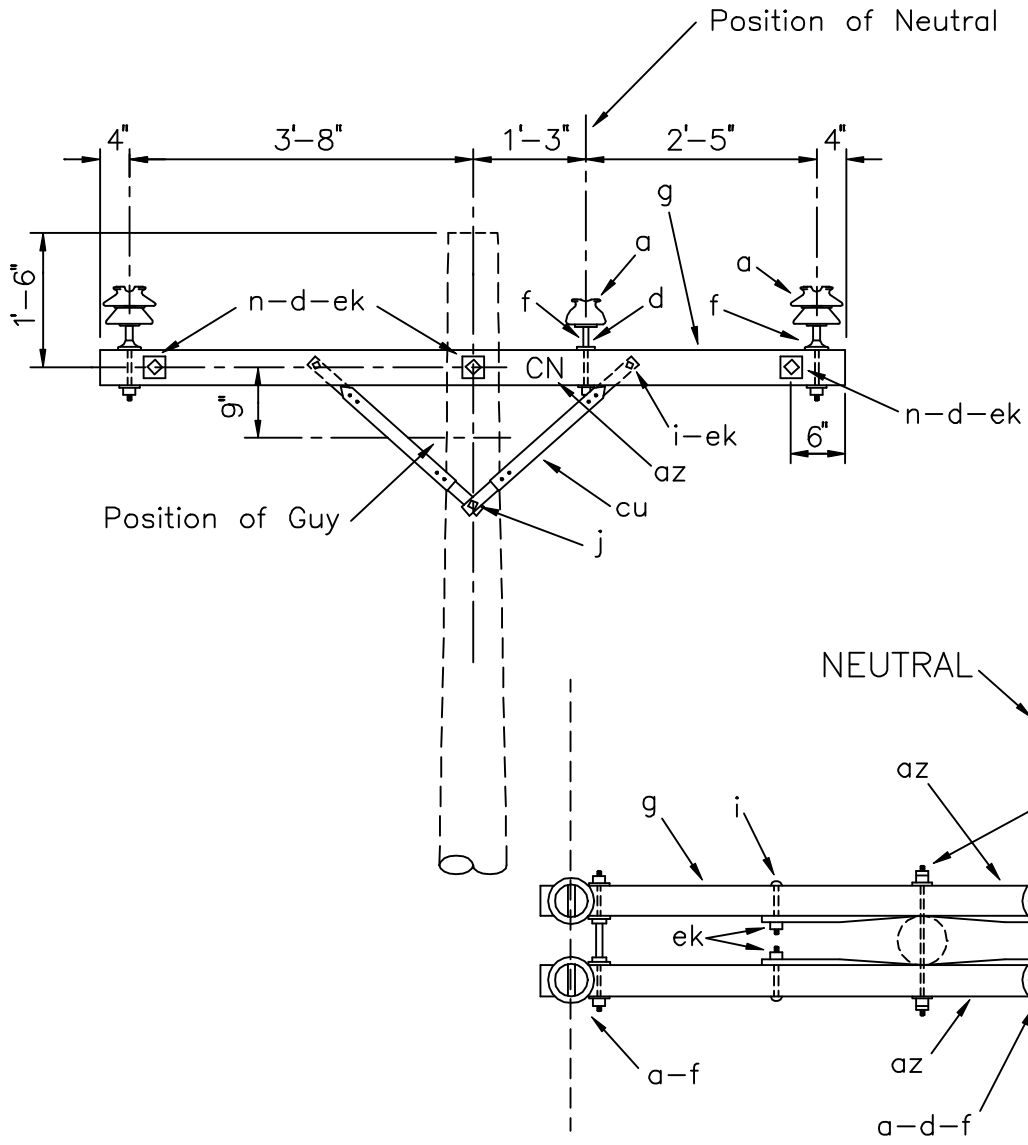
ITEM	QTY	MATERIAL
c	1	Bolt, machine, 5/8" x req'd length
d	11	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arm, 5/8" x req'd length
cu	4	Brace, 28"
da	1	Bracket, insulated
ea	4	Insulator, post type (24.9/14.4 kV)
ek	15	Locknuts

DESIGN PARAMETERS:

See TABLE IV

DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)

DEC 1998	2 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VB2.21P



PLAN

ITEM	QTY	MATERIAL
a	2	Insulator, pin type, white, (15 kV)
a	4	Insulator, pin type (24.9/14.4 kV)
d	12	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 10 3/4"
f	4	Pin, crossarm, steel, 5/8" x 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arm, 5/8" x req'd length
az	4	Letters, 2" C, 2" N, with nails
cu	4	Brace, 28"
ek	14	Locknuts

NOTES:

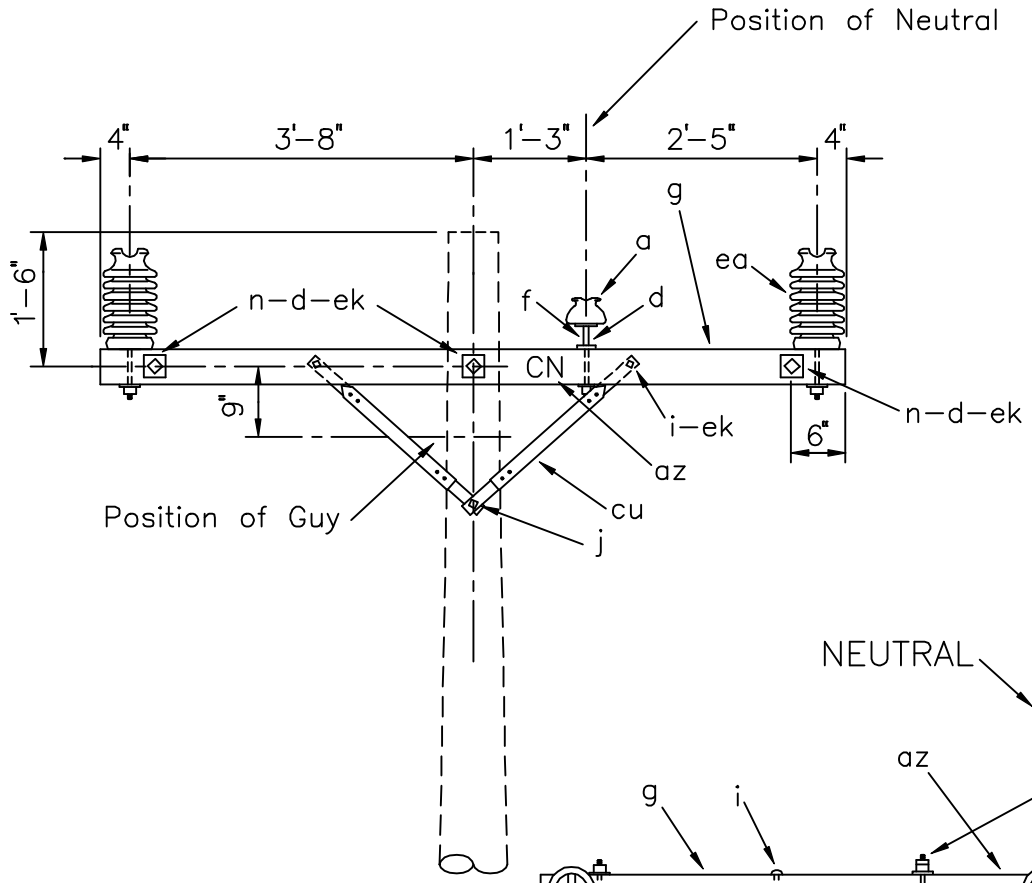
1. Install either identification letters (az) or white insulator in neutral position.
2. Where future construction to three–phase is likely, use construction similar to "VC2.51" and designate as "VB2.51".

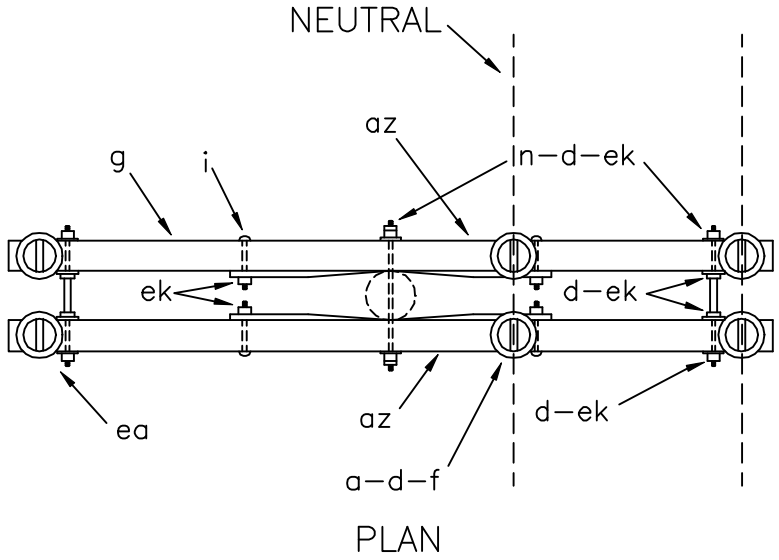
DESIGN PARAMETERS:

See TABLE IV

DOUBLE SUPPORT, NEUTRAL ON CROSSARMS

DEC 1998	2 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VB2.22





PLAN

ITEM	QTY	MATERIAL
a	2	Insulator, pin type, white, (15 kV)
d	12	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 10 3/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arm, 5/8" x req'd length
az	4	Letters, 2" C, 2" N, with nails
cu	4	Brace, 28"
ea	4	Insulator, post type (24.9/14.4 kV)
ek	14	Locknuts

NOTES:

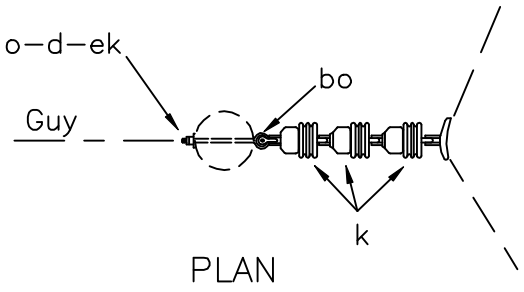
1. Install either identification letters (az) or white insulator in neutral position.
2. Where future construction to three–phase is likely, use construction similar to "VC2.51P" and designate as "VB2.51P."

DESIGN PARAMETERS:

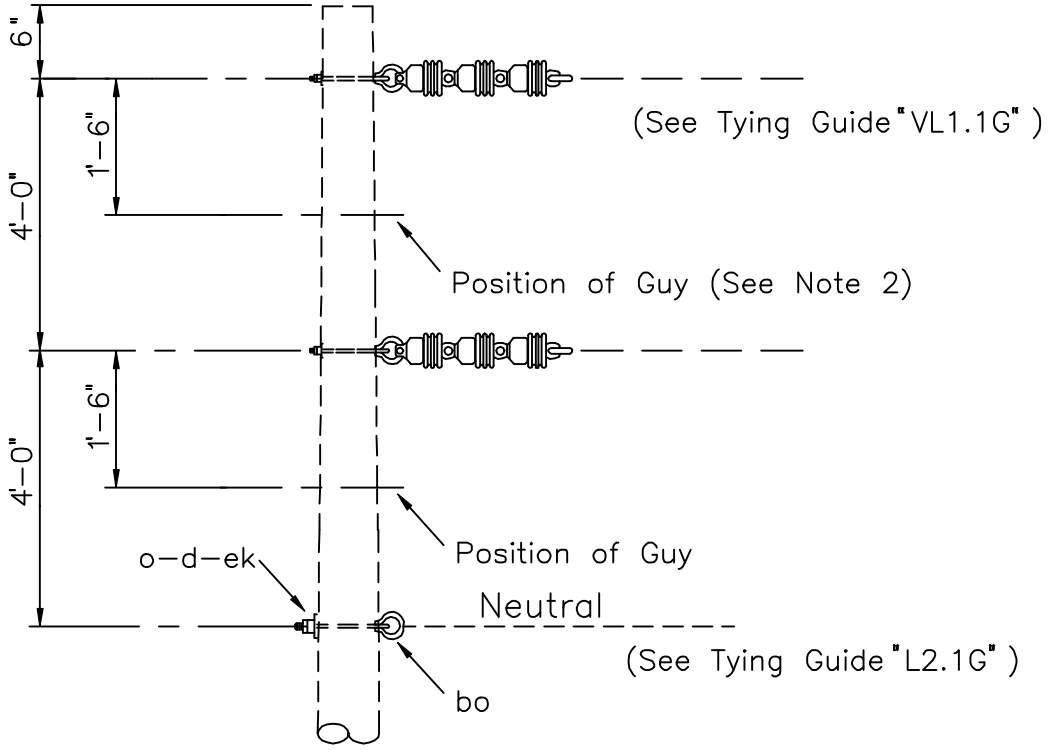
See TABLE Ⅳ

DOUBLE SUPPORT, NEUTRAL ON CROSSARMS (POST INSULATORS)

DEC 1998	2 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VB2.22P



PLAN



NOTES:

1. Assembly unit VA5.2 or VA5.4 may be substituted at the lower phase position if additional climbing space is desired.
2. When more guys are required, install guys 6" below assemblies and install 12" guy strain insulators ("w") at top of primary guys.

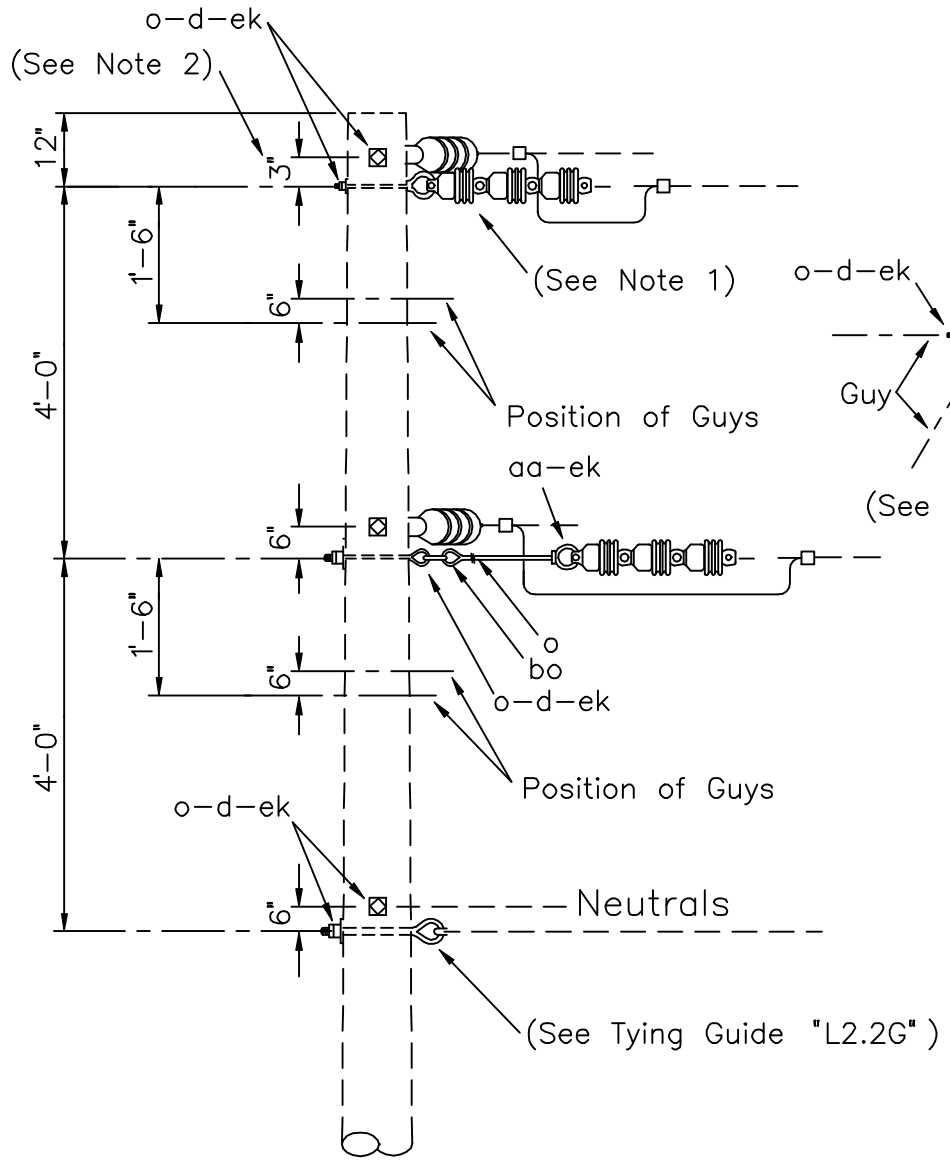
ITEM	QTY	MATERIAL
d	2	Washer, square, 3", curved
k	6	Insulator, suspension, 4 1/4"
o	2	Bolt, eye, 5/8" x req'd length
bo	3	Shackle, anchor
ek	2	Locknuts

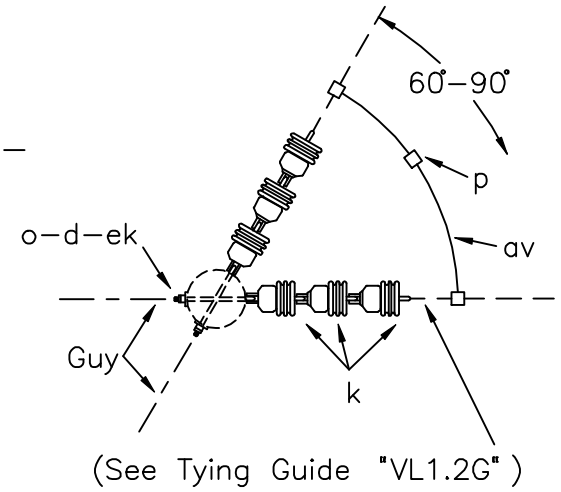
DESIGN PARAMETERS:

ALLOWABLE TRANSVERSE
LOAD= 5000 lbs./Conductor
20° – 60°: #1/0 ACSR & Larger
30° – 60°: Smaller Conductors

SUSPENSION ANGLE

DEC 1998	2 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VB3.1





PLAN
(Top Phase)

NOTES:

1. VA5.2's, VA5.3's or VA5.4's may be used instead of assembly shown.
2. Separate 6" (top position only) when angle equals 90°

ITEM	QTY	MATERIAL
d	6	Washer, square, 3", curved
k	12	Insulator, suspension, 4 1/4"
o	8	Bolt, eye, 5/8" x req'd length
p		Connectors, as req'd
aa	2	Nut, eye, 5/8"
av		Jumpers, as req'd
bo	2	Shackle, anchor
ek	8	Locknuts

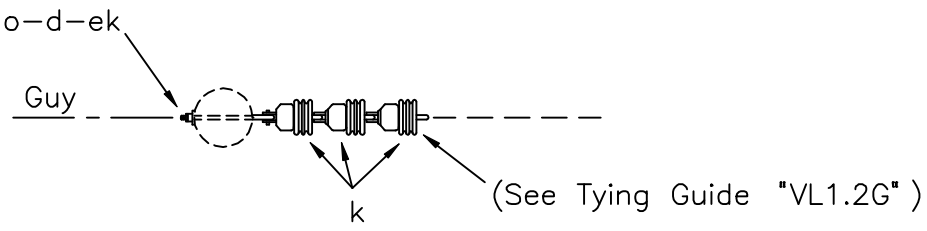
3. Distribution extension link, (item "du"), may be substituted for anchor shackle (item "bo"), eye bolt (item "o") and eye nut (item "aa").

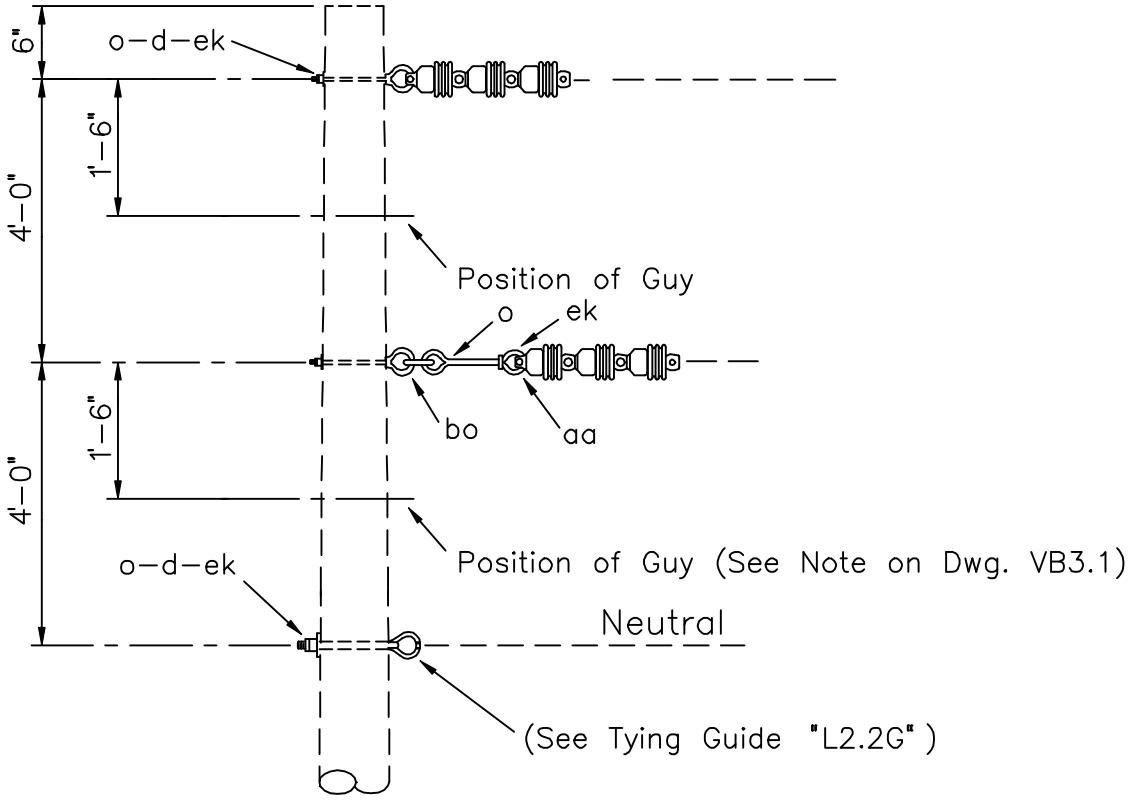
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5000 lbs./Conductor

DEADEND ANGLE (90°–150°)

DEC 1998	2 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VB4.1





NOTES:

1. VA5.2, VA5.3 or VA5.4 may be substituted for the primary assemblies shown.
2. Distribution extension link, (item "du"), may be substituted for anchor shackle (item "bo"), eye bolt (item "o") and eye nut (item "aa").

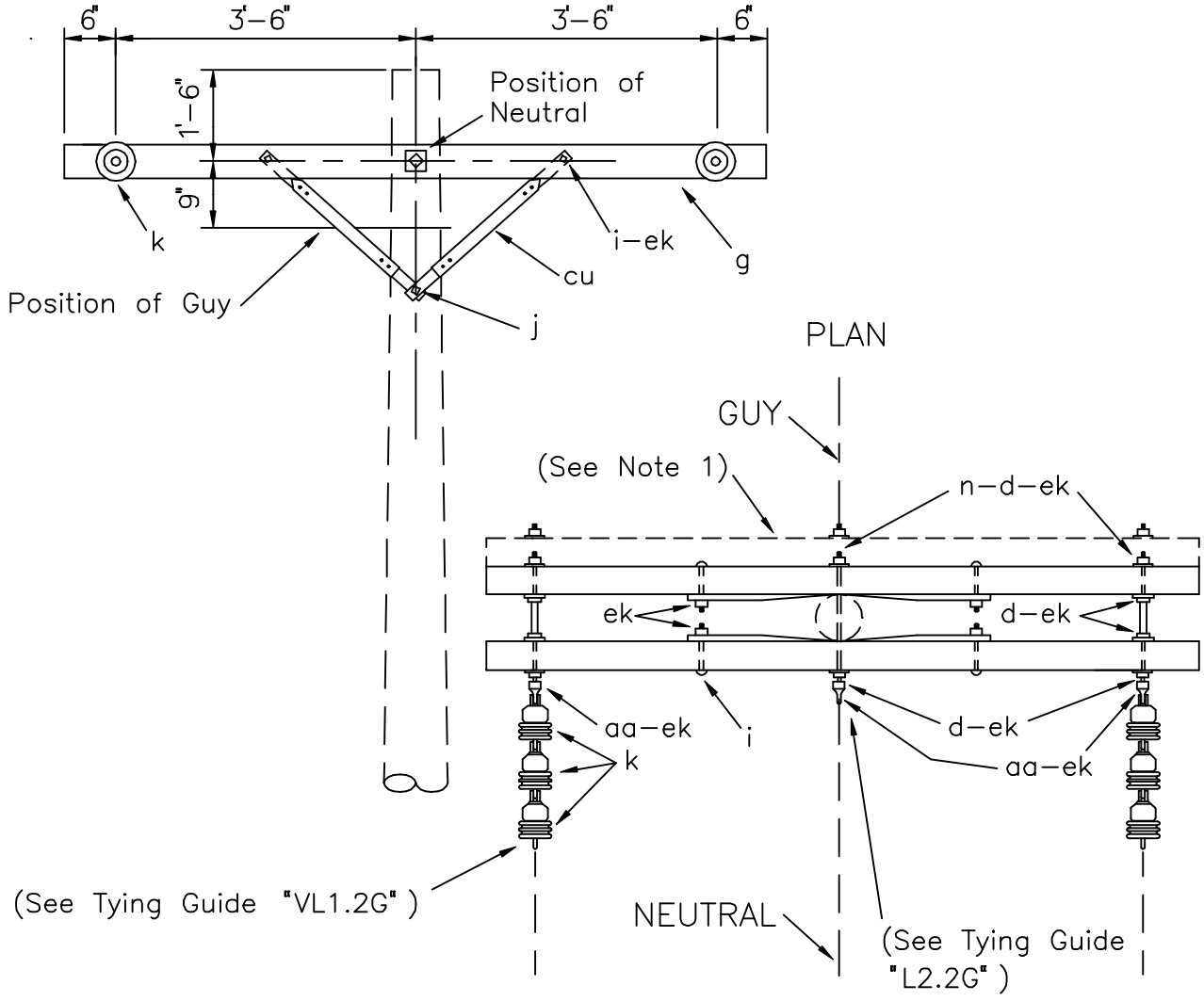
ITEM	QTY	MATERIAL
d	3	Washer, square, 3", curved
k	6	Insulator, suspension, 4 1/4"
o	4	Bolt, eye, 5/8" x req'd length
aa	1	Nut, eye, 5/8"
bo	1	Shackle, anchor
ek	4	Locknuts

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5000 lbs./Conductor

SINGLE DEADEND

DEC 1998	2 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VB5.1



NOTES:

1. Designate as VB5.31 for assembly with three crossarms.
2. Neither assembly suitable for Grade B construction.
3. Double arming eye bolt, item "dy," may be used instead of double arming bolt, item "n," and eyenut, item "aa."

ITEM	QTY	MATERIAL
d	10	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
k	6	Insulator, suspension, 4 1/4"
n	3	Bolt,double arming,5/8" x req'd length
aa	3	Nut, eye, 5/8"
cu	4	Brace, 28"
ek	17	Locknuts

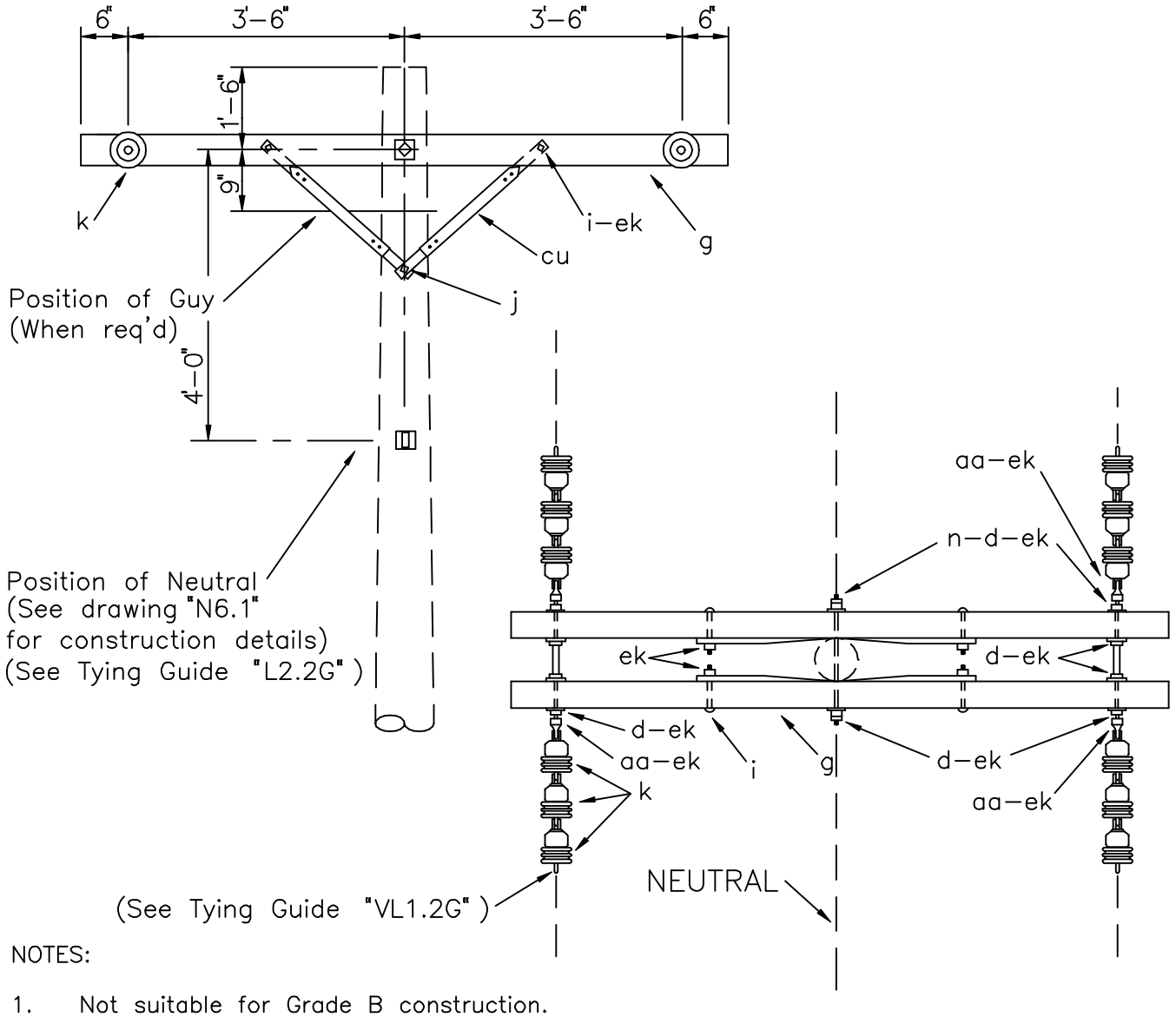
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOADING (lbs/conductor) =

VB5.21: 2,000 (#2 ACSR)
VB5.31: 3,000 (#2/0 ACSR)

SINGLE DEADEND ON CROSSARMS

DEC 1998 RUS	2 – PHASE PRIMARY 24.9/14.4 kV	VB5.21 VB5.31



PLAN

NOTES:

1. Not suitable for Grade B construction.
2. Double arming bolt, item "n", and eye nut, item "aa", may be replaced with double arming eye bolt, item "dy."

NOTES:

3. Maximum line angle may be increased to 15° by installing anchor shackles, item "bo", to (horizontal) eyenuts and installing side guy as req'd.

ITEM	QTY	MATERIAL
d	12	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
k	12	Insulator, suspension, 4 1/4"
n	4	Bolt,double arming,5/8" x req'd length
aa	6	Nut, eye, 5/8"
cu	4	Brace, 28"
ek	22	Locknuts

DESIGN PARAMETERS:

ALLOWABLE UNBALANCED LONGITUDINAL TENSION:
2,000 lbs./conductor

MAXIMUM LINE ANGLE = 5° (See Note 3)

DOUBLE DEADEND ON CROSSARMS

DEC 1998	2 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VB6.21

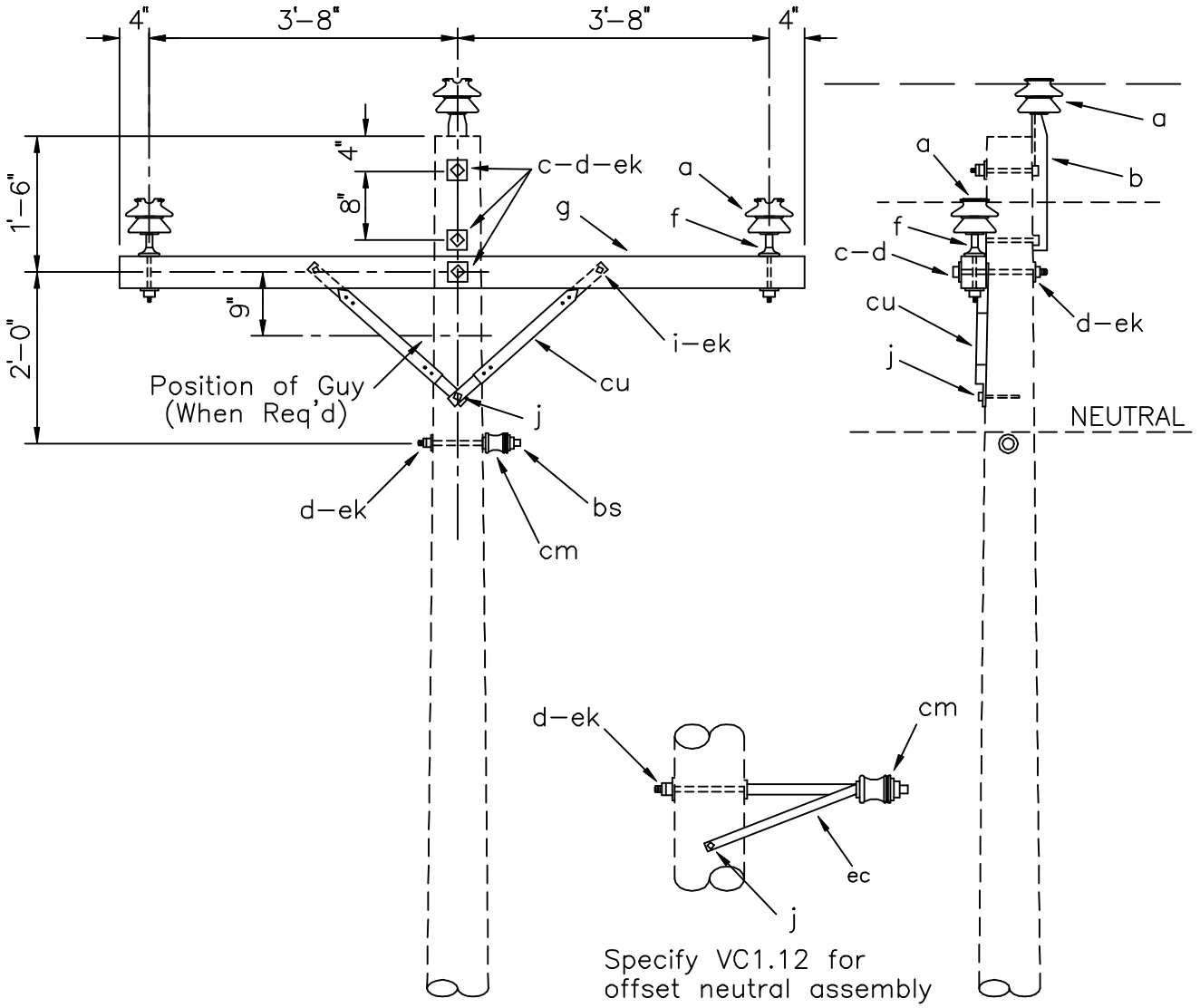
INDEX C

THREE-PHASE PRIMARY POLE TOP ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VC1.11, VC1.12	SINGLE SUPPORT ON CROSSARM (TANGENT)
VC1.11L, VC1.12L	SINGLE SUPPORT ON CROSSARM (TANGENT) (LARGE CONDUCTORS)
VC1.11P, VC1.12P	SINGLE SUPPORT ON CROSSARM (TANGENT) (POST INSULATORS)
VC1.13	SINGLE SUPPORT ON CROSSARM
VC1.13L	SINGLE SUPPORT ON CROSSARM (LARGE CONDUCTORS)
VC1.13P	SINGLE SUPPORT ON CROSSARM (POST INSULATORS)
VC1.41	SINGLE SUPPORT, NEUTRAL ON CROSSARM
VC1.41L	SINGLE SUPPORT, NEUTRAL ON CROSSARM (LARGE CONDUCTORS)
VC1.41P	SINGLE SUPPORT, NEUTRAL ON CROSSARM (POST INSULATORS)
VC1.81G	THREE-PHASE JUNCTION GUIDE
VC2.21	DOUBLE SUPPORT ON CROSSARMS
VC2.21L	DOUBLE SUPPORT ON CROSSARMS (LARGE CONDUCTORS)
VC2.21P	DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)
VC2.51	DOUBLE SUPPORT, NEUTRAL ON CROSSARMS
VC2.51L	DOUBLE SUPPORT, NEUTRAL ON CROSSARMS (LARGE CONDUCTORS)
VC2.51P	DOUBLE SUPPORT, NEUTRAL ON CROSSARMS (POST INSULATORS)
VC2.52	DOUBLE SUPPORT ON 10 FOOT CROSSARMS
VC2.52L	DOUBLE SUPPORT ON 10 FOOT CROSSARMS (LARGE CONDUCTORS)

THREE-PHASE PRIMARY POLE TOP ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VC2.52P	DOUBLE SUPPORT ON 10 FOOT CROSSARMS (POST INSULATORS)
VC3.1	SUSPENSION ANGLE
VC3.2L	SUSPENSION ANGLE (LARGE CONDUCTORS)
VC4.1	DEADEND ANGLE (ACUTE)
VC4.2L	DEADEND ANGLE (LARGE CONDUCTORS)
VC5.1	SINGLE DEADEND - VERTICAL
VC5.2L	SINGLE DEADEND - VERTICAL (LARGE CONDUCTORS)
VC5.11G	SINGLE PHASE TAP GUIDE
VC5.21, VC5.31	SINGLE DEADEND ON CROSSARMS
VC5.71L	SINGLE DEADEND ON CROSSARM ASSEMBLY
VC5.82G	THREE PHASE HORIZONTAL TAP GUIDE
VC6.21, VC6.31	DOUBLE DEADEND ON CROSSARMS
VC6.51	DOUBLE DEADEND ON 10 FOOT CROSSARMS
VC6.52G	DOUBLE DEADEND ON 10 FOOT CROSSARMS (FEEDTHROUGH GUIDE)
VC6.91G	DOUBLE DEADENDS (BUCKARMS) GUIDE



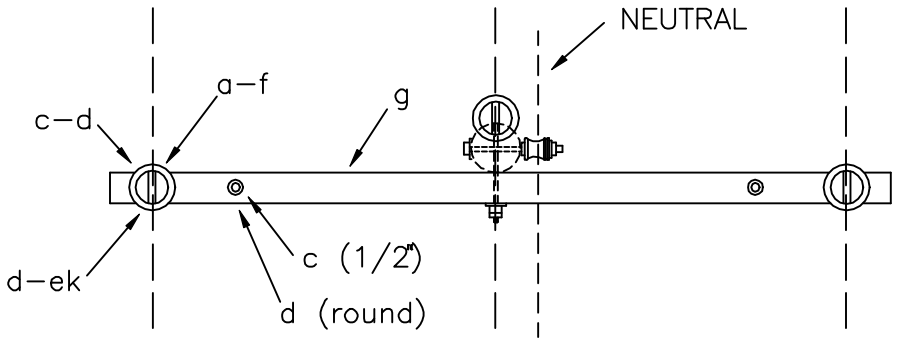
ASSEMBLY: VC1.		11	12
ITEM	MATERIAL	QTY	QTY
a	Insulator, pin type, (24.9/14.4 kV)	3	3
b	Pin, pole top, 20"	1	1
c	Bolt, machine, 5/8 x req'd length	3	3
d	Washer, square, 2 1/4"	5	5
f	Pin, crossarm, steel, 5/8" x 14"	2	2
g	Crossarm, 3 5/8" x 4 5/8" x 8'–0"	1	1
i	Bolt, carriage, 3/8" x 4"	2	2
j	Screw, lag, 1/2" x 4"	1	3
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
ec	Bracket, offset neutral		1
ek	Locknuts	6	6

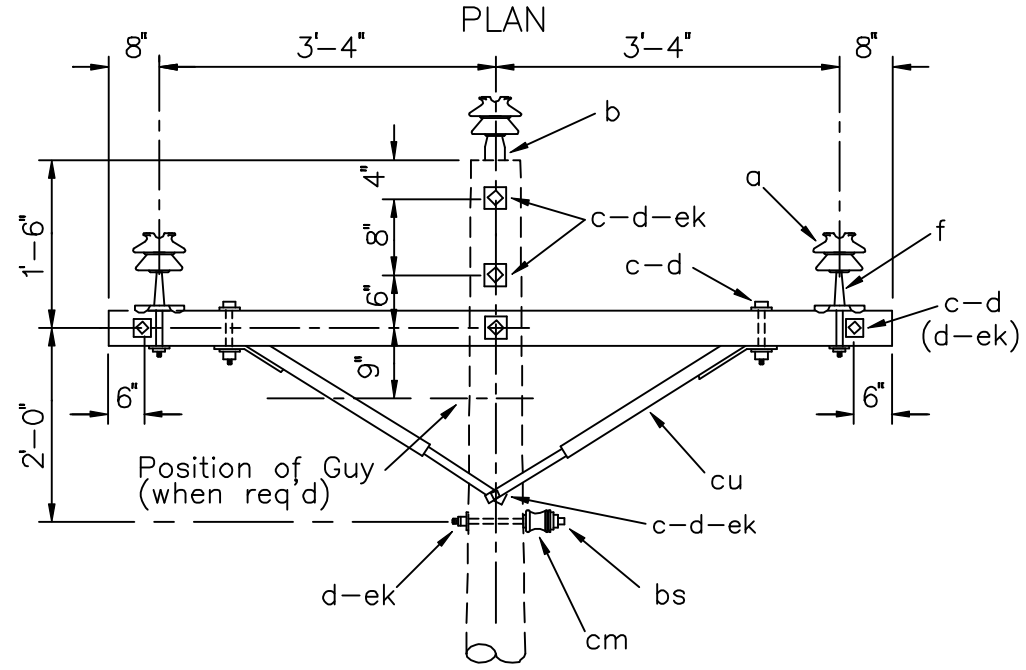
DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

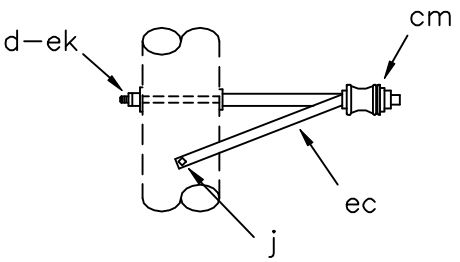
SINGLE SUPPORT ON CROSSARM (TANGENT)

DEC 1998	3 – PHASE PRIMARY	VC1.11
RUS	24.9/14.4 kV	VC1.12





ASSEMBLY: VC1.		11L	12L
ITEM	MATERIAL	QTY	QTY
a	Insulator, pin type, (24.9/14.4 kv)	3	3
b	Pin, pole top, 20"	1	1
c	Bolt, machine, 1/2" x req'd length	2	2
c	Bolt, machine, 5/8" x req'd length	6	6
d	Washer, round, 1 3/8"	2	2
d	Washer, square, 2 1/4"	10	10
f	Pin, crossarm, clamp type	2	2
g	Crossarm, 3 5/8" x 4 5/8" x 8'–0"	1	1
j	Screw, lag, 1/2" x 4"		2
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, wood, 60" span	1	1
ec	Bracket, offset neutral		1
ek	Locknuts	9	9



Specify VC1.12L for offset neutral assembly

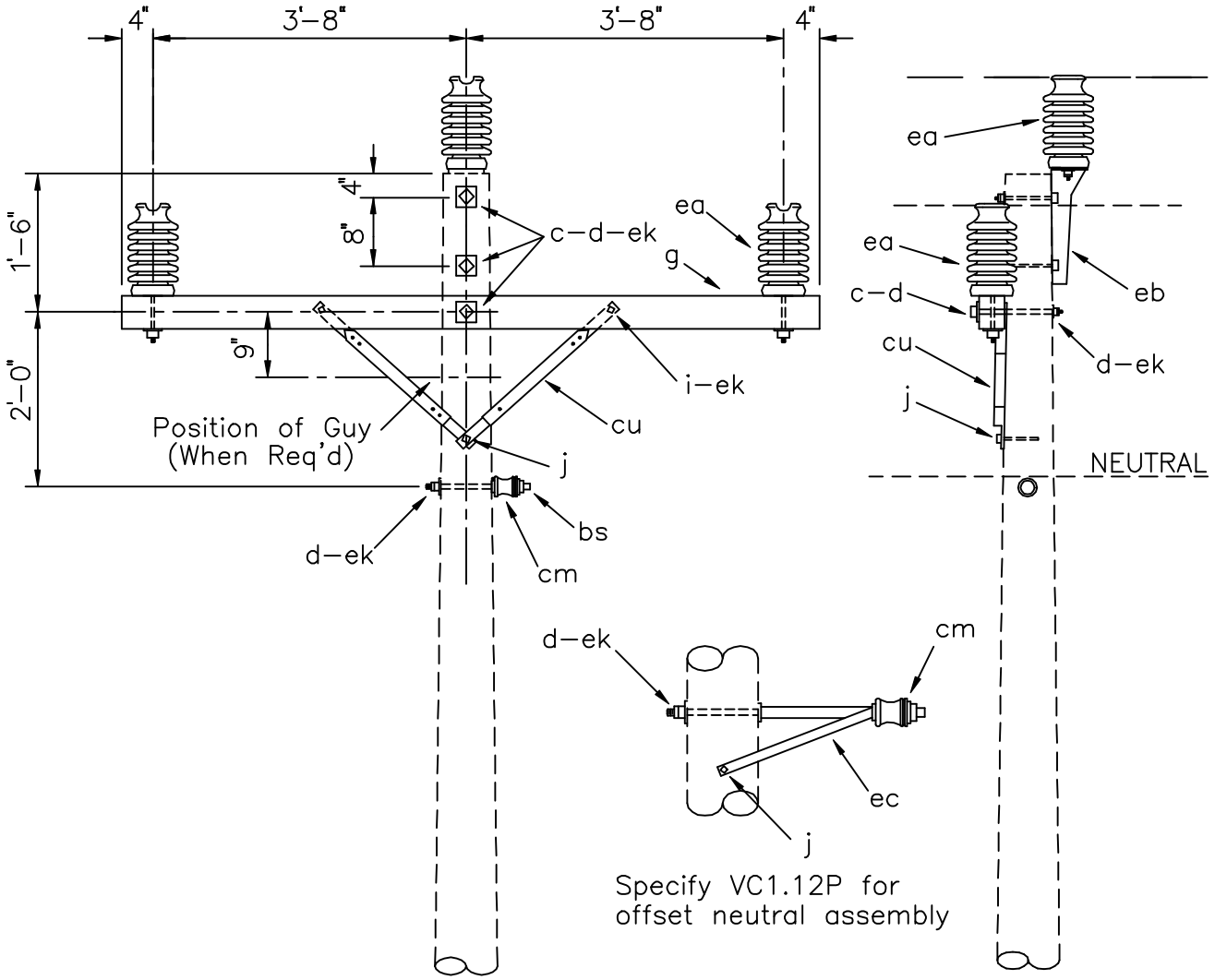
DESIGN PARAMETERS:

MAXIMUM LINE ANGLE:

2° – (Large Conductors)

SINGLE SUPPORT ON CROSSARM (TANGENT) (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	VC1.11L
RUS	24.9/14.4 kV	VC1.12L



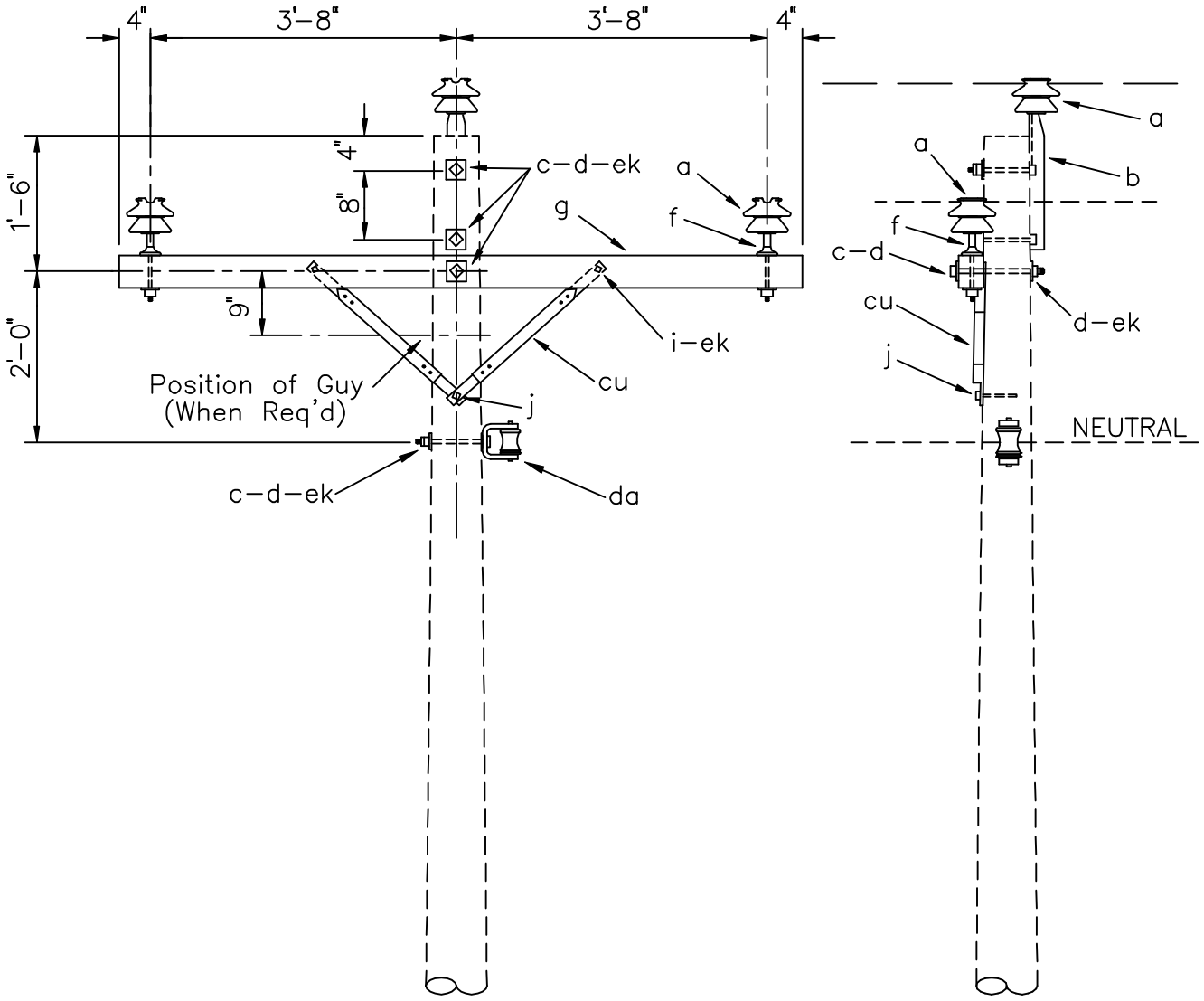
ASSEMBLY: VC1.		11P	12P
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" x req'd length	3	3
d	Washer, square, 2 1/4"	5	5
g	Crossarm, 3 5/8" x 4 5/8" x 8'–0"	1	1
i	Bolt, carriage, 3/8" x 4"	2	2
j	Screw, lag, 1/2" x 4"	1	3
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
ea	Insulator, post type (24.9/14.4 kV)	3	3
eb	Bracket, pole top	1	1
ec	Bracket, offset neutral		1
ek	Locknuts	6	6

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT ON CROSSARM (TANGENT) (POST INSULATORS)

DEC 1998	3 – PHASE PRIMARY	VC1.11P
RUS	24.9/14.4 kV	VC1.12P



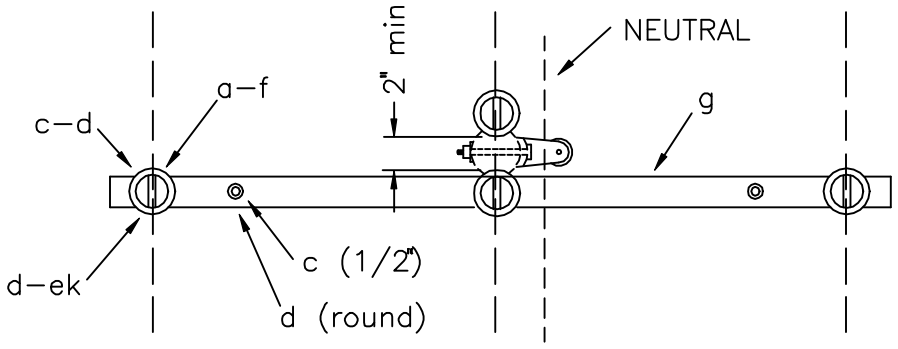
ITEM	QTY	MATERIAL
a	3	Insulator, pin type (24.9/14.4 kV)
b	1	Pin, pole top, 20°
c	4	Bolt, machine, 5/8" x req'd length
d	5	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 14"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
da	1	Bracket, insulated
ek	6	Locknuts

DESIGN PARAMETERS:

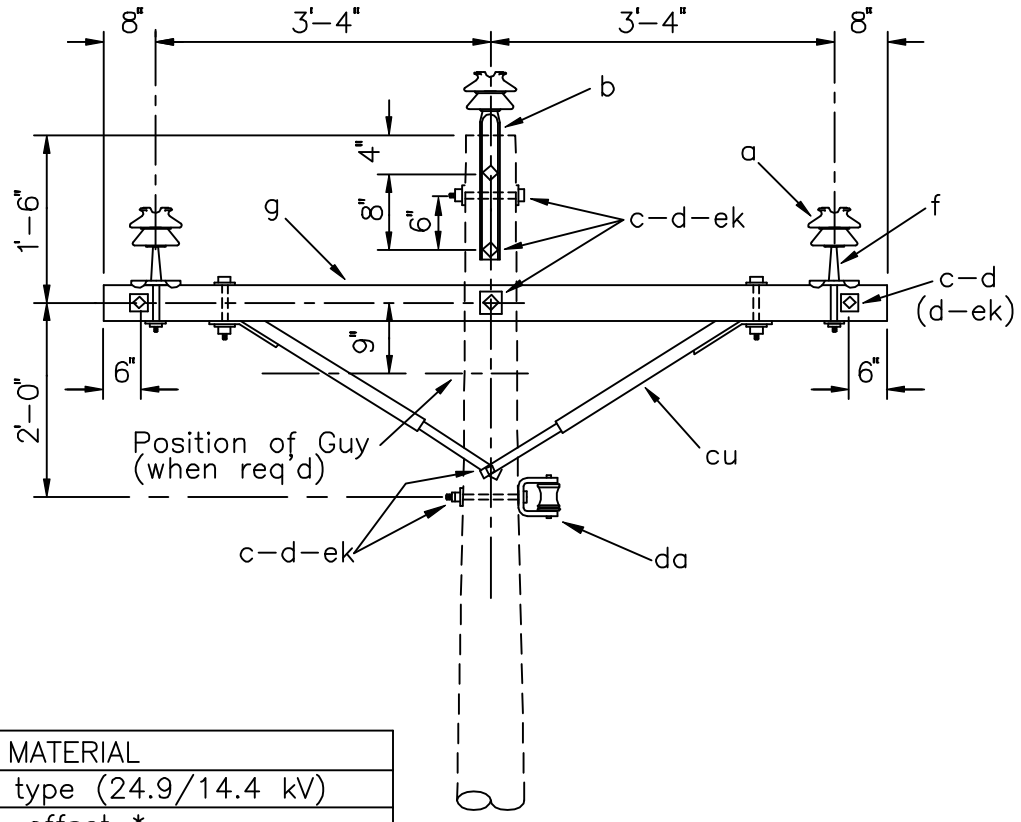
See TABLE I

SINGLE SUPPORT ON CROSSARM

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC1.13



PLAN



ITEM	QTY	MATERIAL
a	4	Insulator, pin type (24.9/14.4 kV)
b	2	Pin, pole top, offset *
c	2	Bolt, machine, 1/2" x req'd length
c	8	Bolt, machine, 5/8" x req'd length
d	2	Washer, round, 1 3/8"
d	10	Washer, square, 2 1/4"
f	2	Pin, crossarm, clamp type
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
cu	1	Brace, wood, 60" span
da	1	Bracket, insulated
ek	10	Locknuts

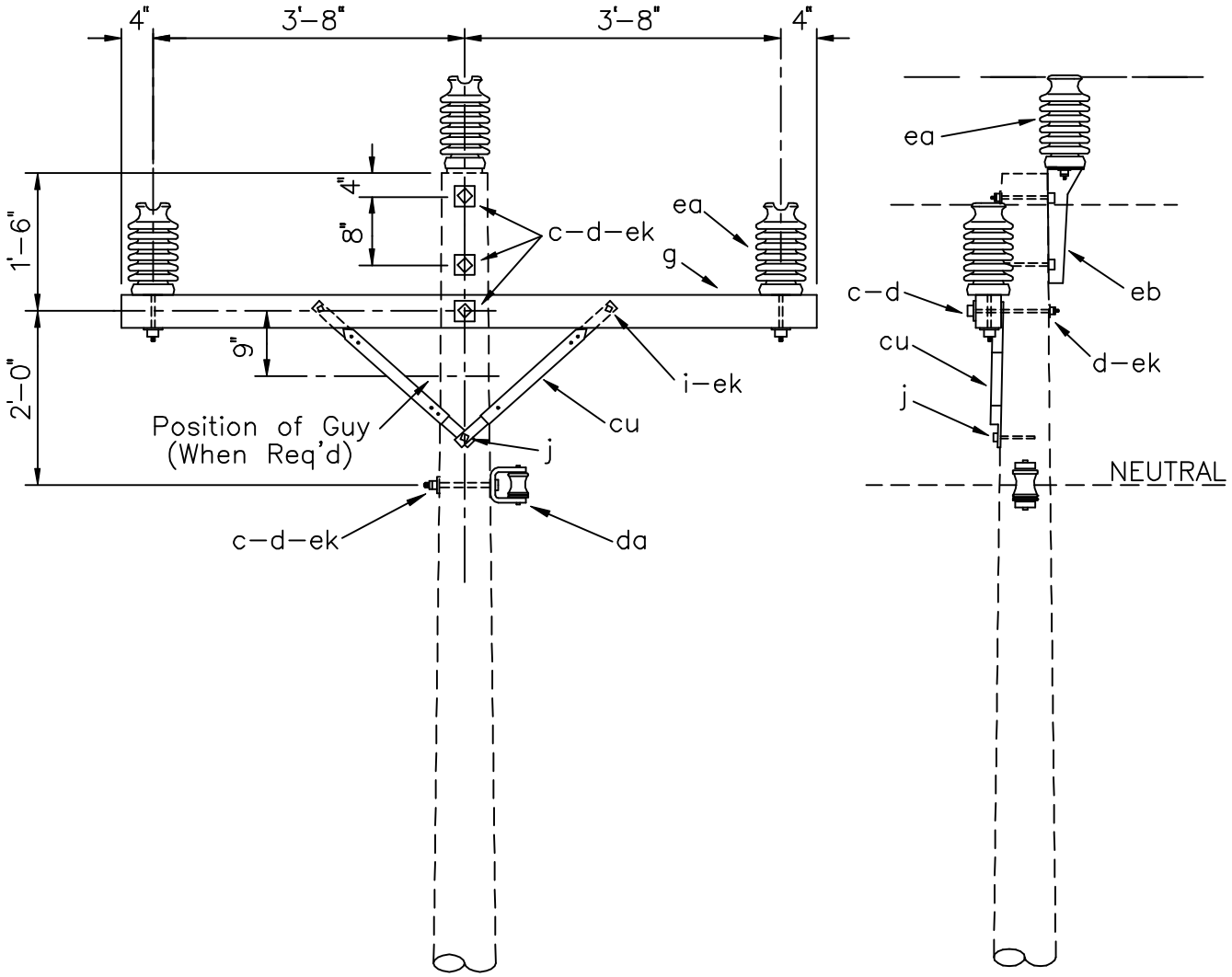
*(See Note on Dwg. VA2.01)

DESIGN PARAMETERS:

See TABLE III

SINGLE SUPPORT ON CROSSARM (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC1.13L



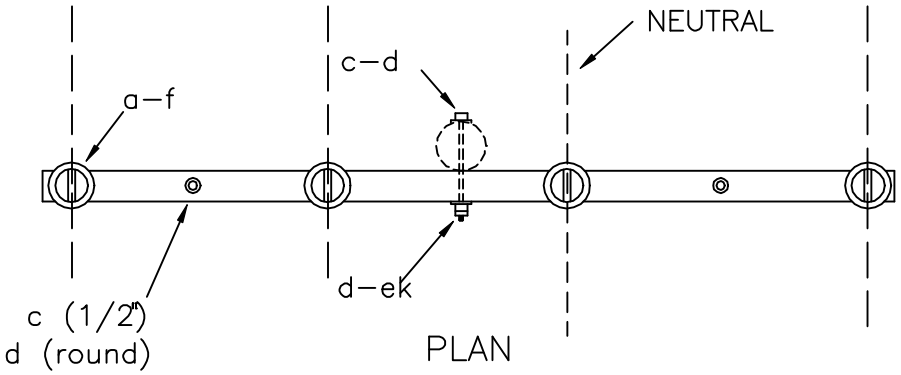
ITEM	QTY	MATERIAL
c	4	Bolt, machine, 5/8" x req'd length
d	5	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
da	1	Bracket, insulated
ea	3	Insulator, post type (24.9/14.4 kV)
eb	1	Bracket, pole top
ek	6	Locknuts

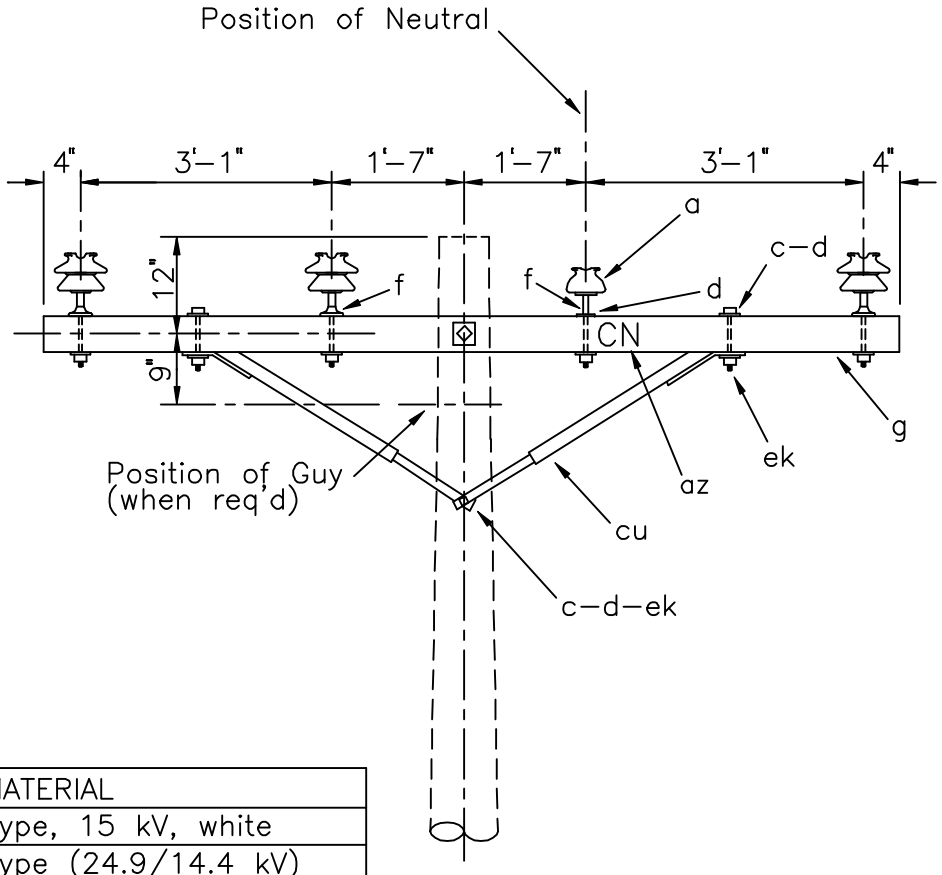
DESIGN PARAMETERS:

See TABLE II

SINGLE SUPPORT ON CROSSARM (POST INSULATORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC1.13P





ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
a	3	Insulator, pin type (24.9/14.4 kV)
c	2	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, round, 1 3/8"
d	4	Washer, square, 2 1/4"
f	1	Pin, crossarm, steel, 5/8" x 10 3/4"
f	3	Pin, crossarm, steel, 5/8" x 14"
g	1	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
az	4	Letters, 2" C, 2" N, with 1" nails
cu	1	Brace, wood, 60" span
ek	4	Locknuts

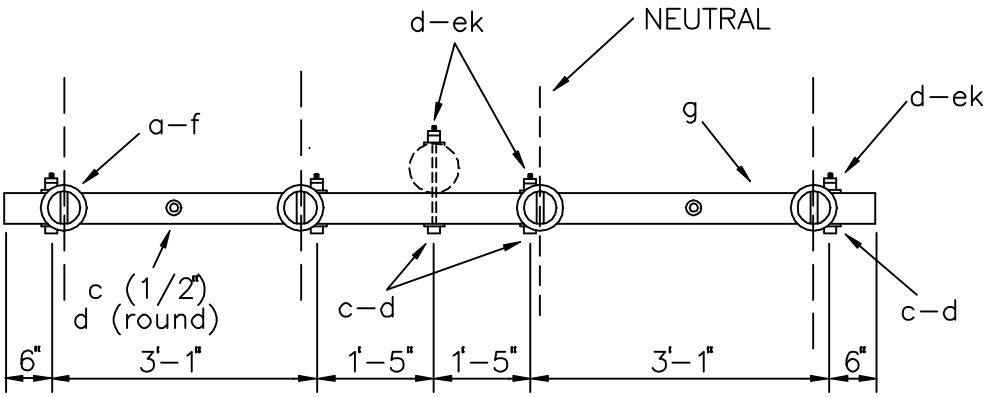
NOTE: Install either identification letters or white insulators in neutral position.

DESIGN PARAMETERS:

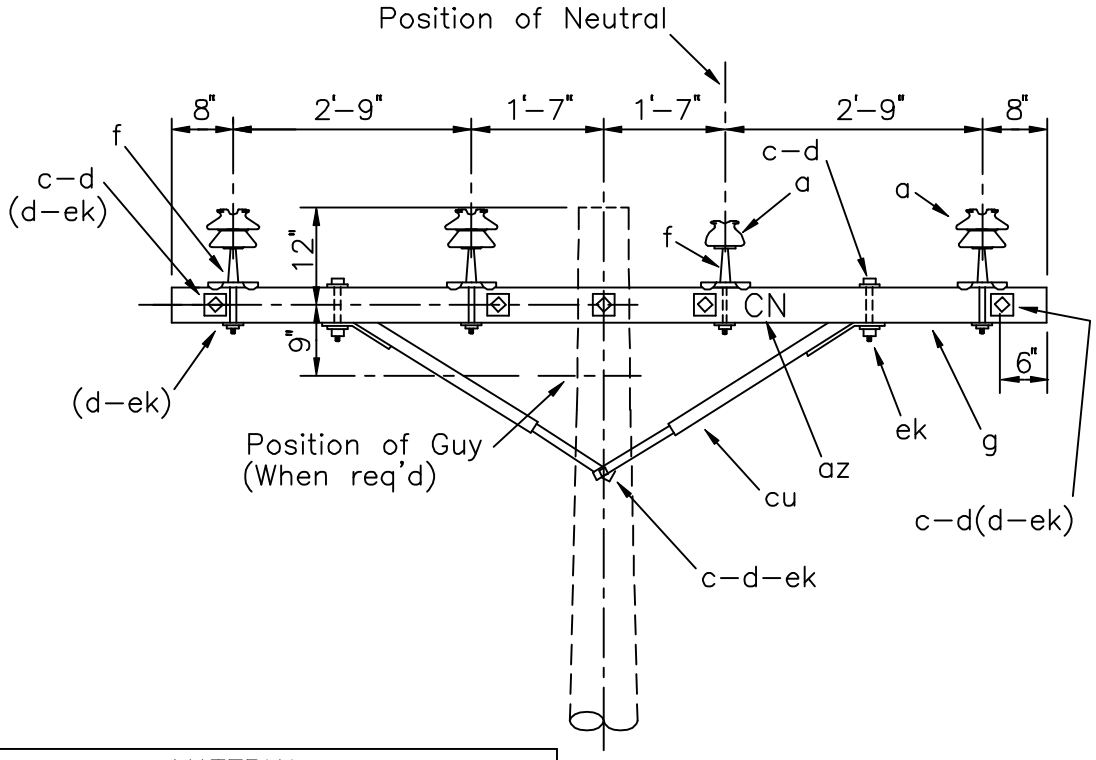
See TABLE II

SINGLE SUPPORT, NEUTRAL ON CROSSARM

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC1.41



PLAN



ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kv, white
a	3	Insulator, pin type (24.9/14.4 kV)
c	2	Bolt, machine, 1/2" x req'd length
c	6	Bolt, machine, 5/8" x req'd length
d	2	Washer, round, 1 3/8"
d	11	Washer, square, 2 1/4"
f	4	Pin, crossarm, steel clamp type
g	1	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
az	4	Letters, 2" C, 2" N, with 1" nails
cu	1	Brace, wood, 60" span
ek	9	Locknuts

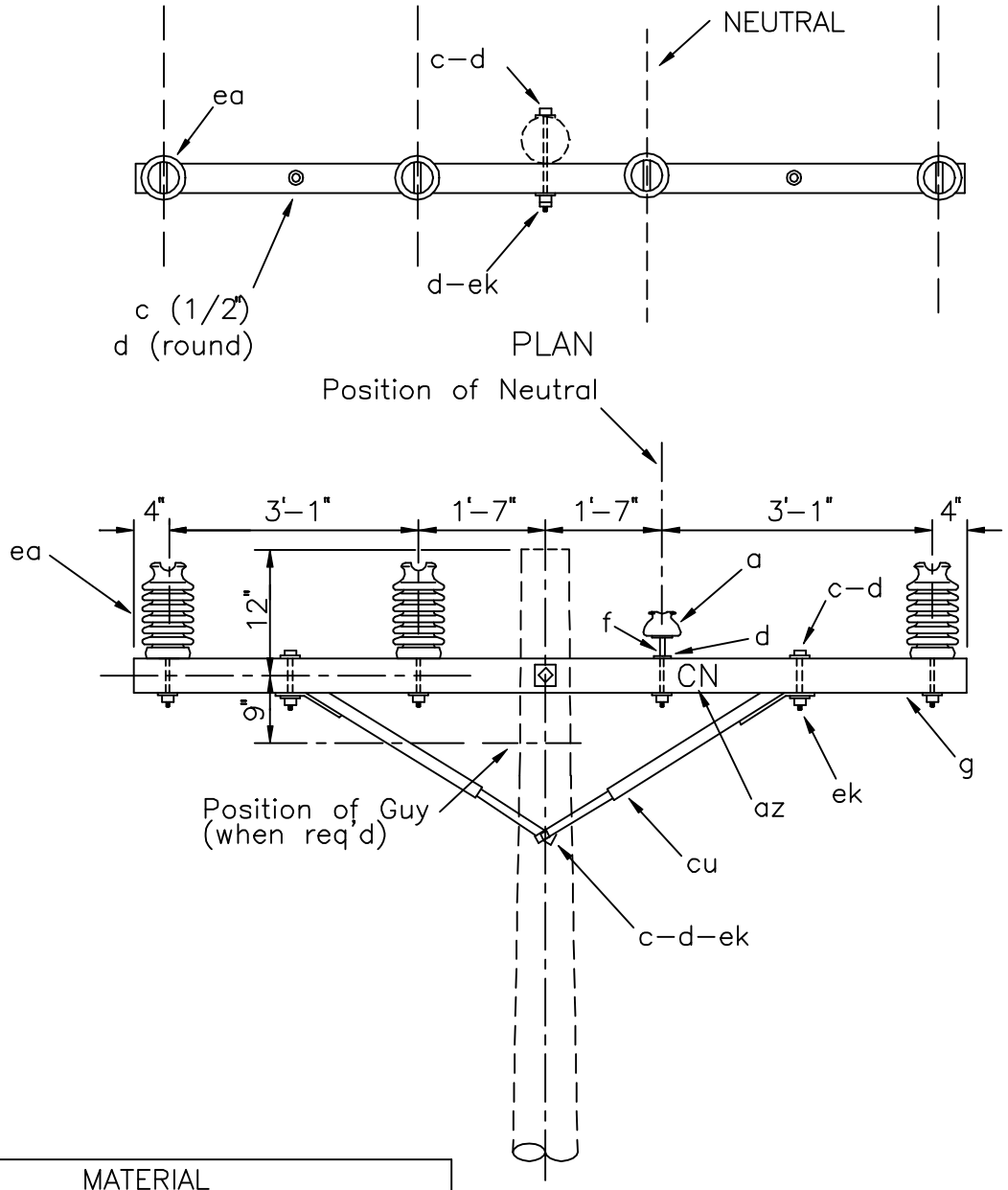
NOTE: Install either identification letters or white insulator in neutral position.

DESIGN PARAMETERS:

See TABLE III

SINGLE SUPPORT, NEUTRAL ON CROSSARM (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC1.41L



ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
c	2	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, round, 1 3/8"
d	4	Washer, square, 2 1/4"
f	1	Pin, crossarm, steel, 5/8" x 10 3/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
az	4	Letters, 2" C, 2" N, with 1" nails
cu	1	Brace, wood, 60" span
ea	3	Insulator, post type (24.9/14.4 kV)
ek	4	Locknuts

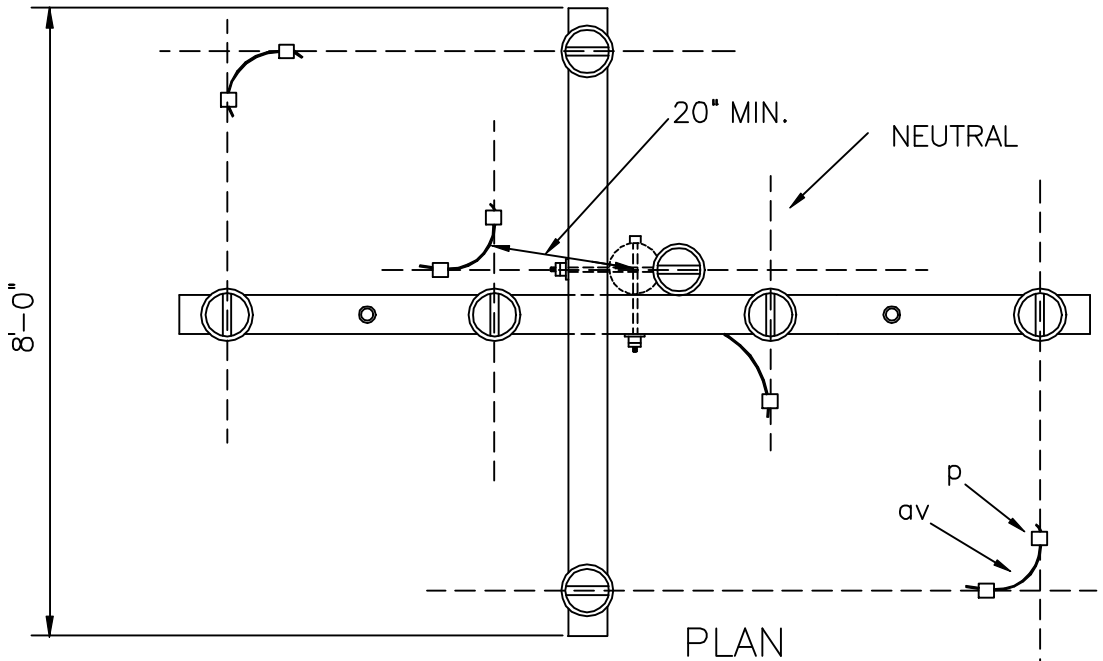
NOTE: Install either identification letters or white insulator in neutral position.

DESIGN PARAMETERS:

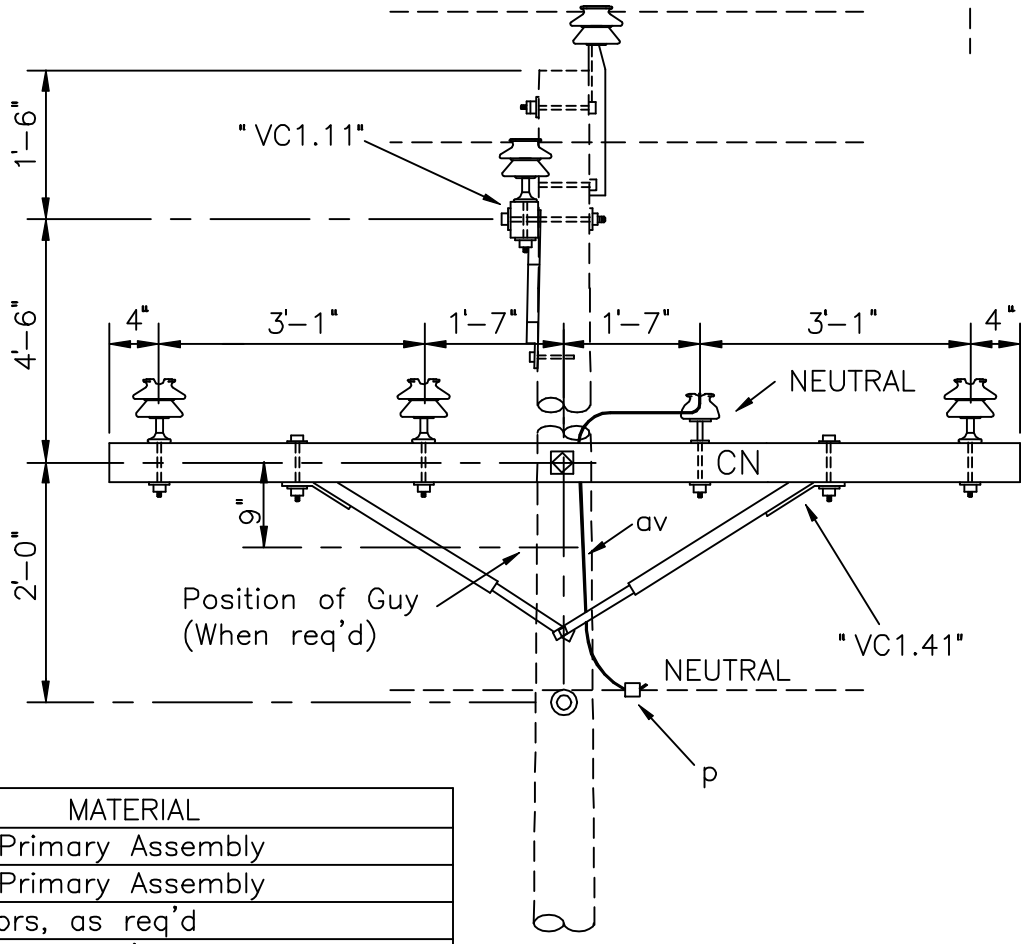
See TABLE II

SINGLE SUPPORT, NEUTRAL ON CROSSARM (POST INSULATORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC1.41P



PLAN



ITEM	QTY	MATERIAL
	1	VC1.11 Primary Assembly
	1	VC1.41 Primary Assembly
p		Connectors, as req'd
av		Jumpers, as req'd

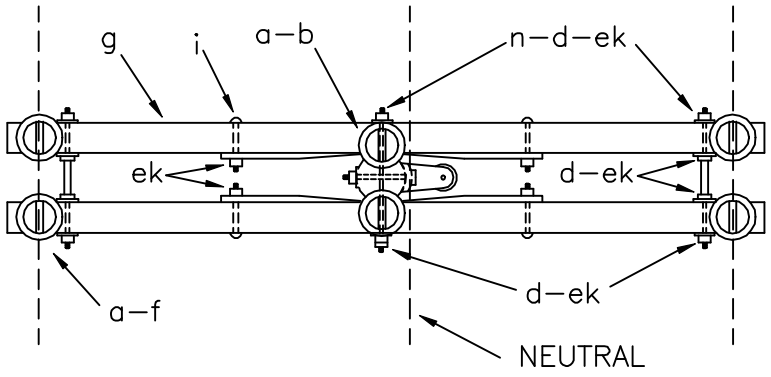
DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:

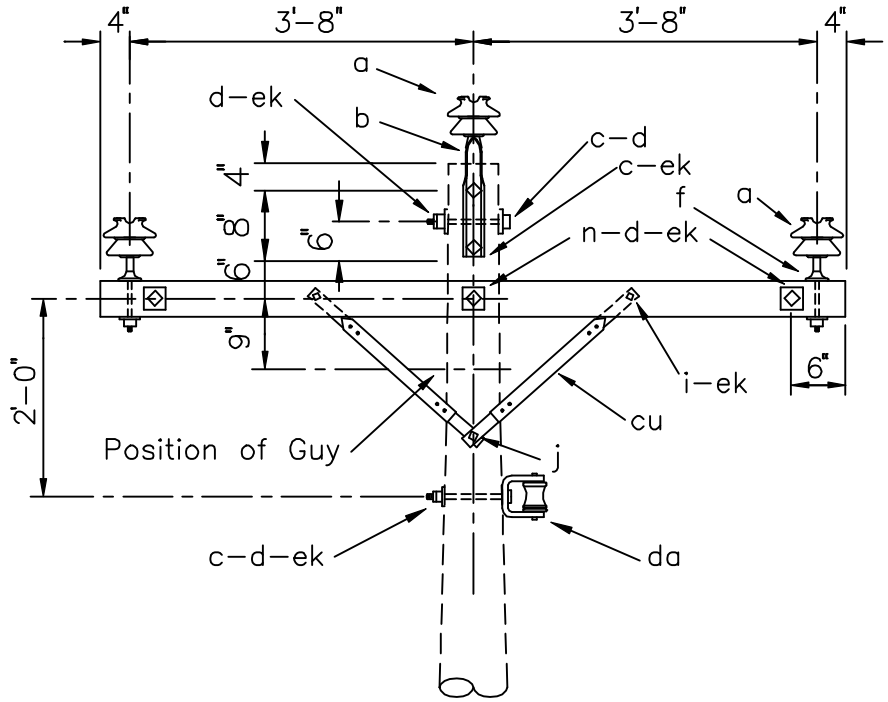
5° – Small Conductors
2° – Larger than #1/0

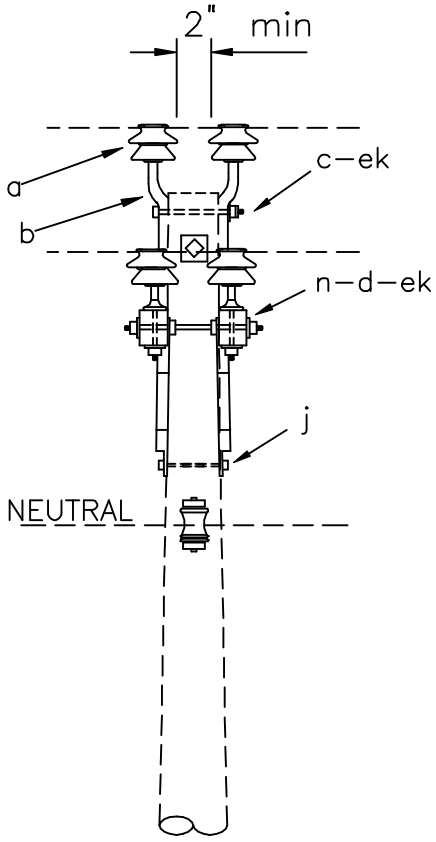
THREE PHASE JUNCTION GUIDE

DEC 1998	3 – PHASE PRIMARY	VC1.81G
RUS	24.9/14.4 kV	



PLAN





ITEM	QTY	MATERIAL
a	6	Insulator, pin type (24.9/14.4 kV)
b	2	Pin, offset, pole top *
c	4	Bolt, machine, 5/8" x req'd length
d	13	Washer, square, 2 1/4"
f	4	Pin, crossarm, steel, 5/8" x 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	3	Bolt, double arming, 5/8"xreq'd length
cu	4	Brace, 28"
da	1	Bracket, insulated
ek	18	Locknuts

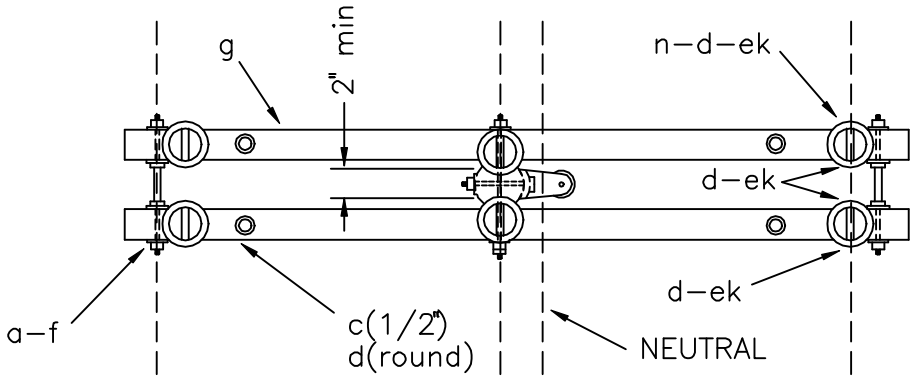
* See Note on Dwg. VA2.01

DESIGN PARAMETERS:

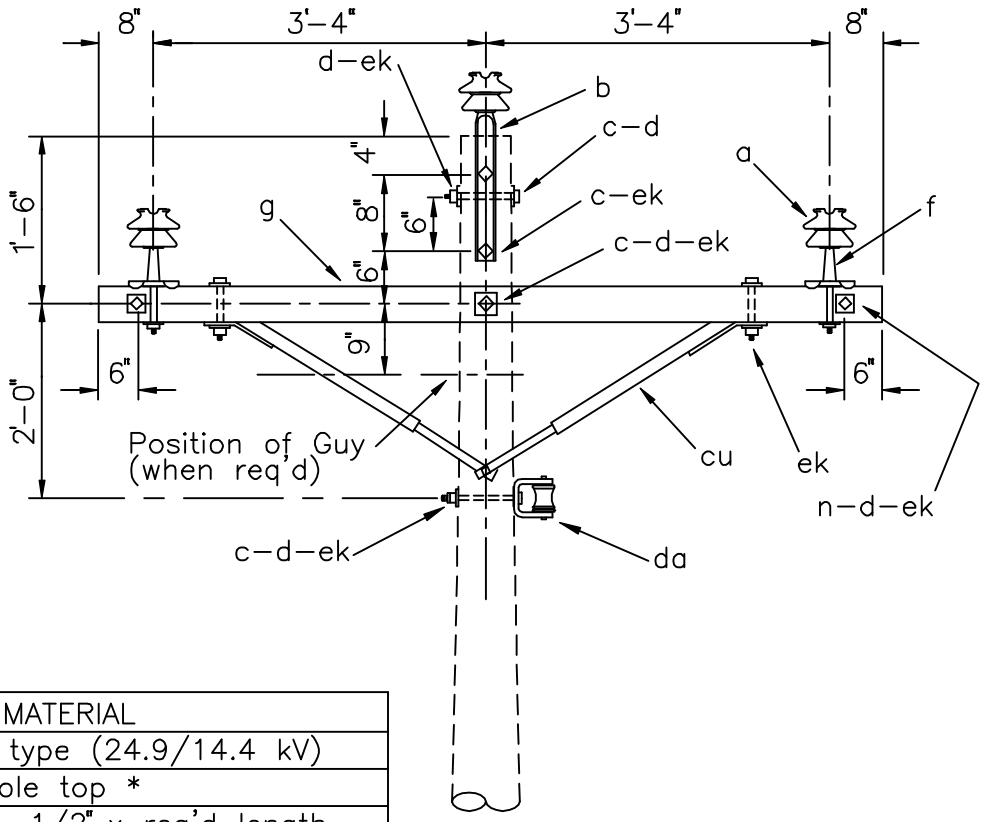
See TABLE III

DOUBLE SUPPORT ON CROSSARMS

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.21



PLAN



ITEM	QTY	MATERIAL
a	6	Insulator, pin type (24.9/14.4 kV)
b	2	Pin, offset, pole top *
c	4	Bolt, machine, 1/2" x req'd length
c	5	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	14	Washer, square, 2 1/4"
f	4	Pin, crossarm, steel, clamp type
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
n	3	Bolt, double arming,5/8"x req'd length
cu	2	Brace, wood, 60" span
da	1	Bracket, insulated
ek	19	Locknuts

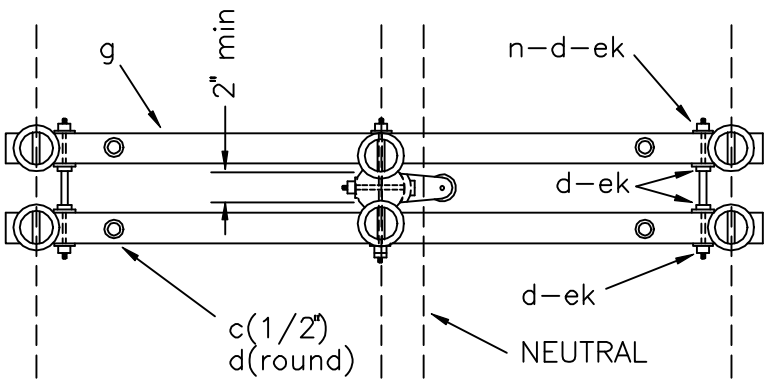
* See Note on Dwg. VA2.01

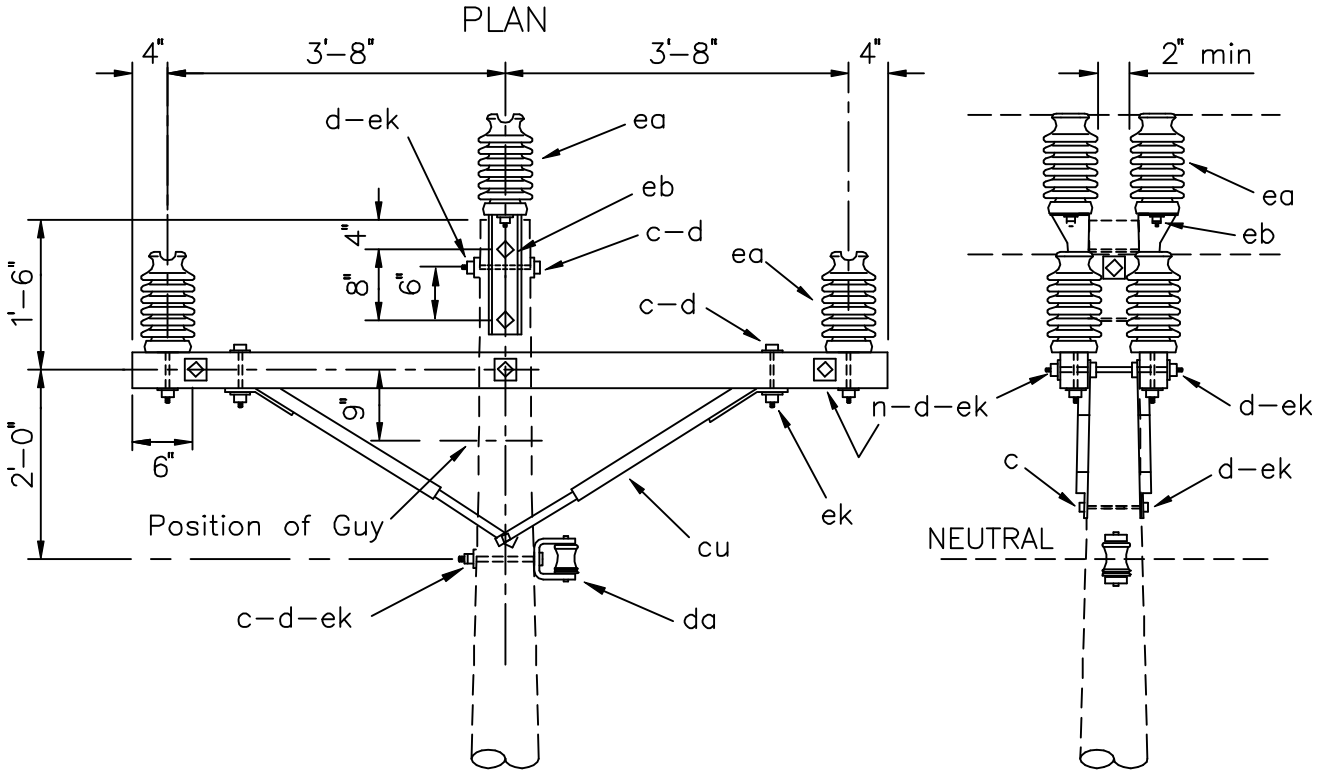
DESIGN PARAMETERS:

See TABLE III

DOUBLE SUPPORT ON CROSSARMS (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.21L





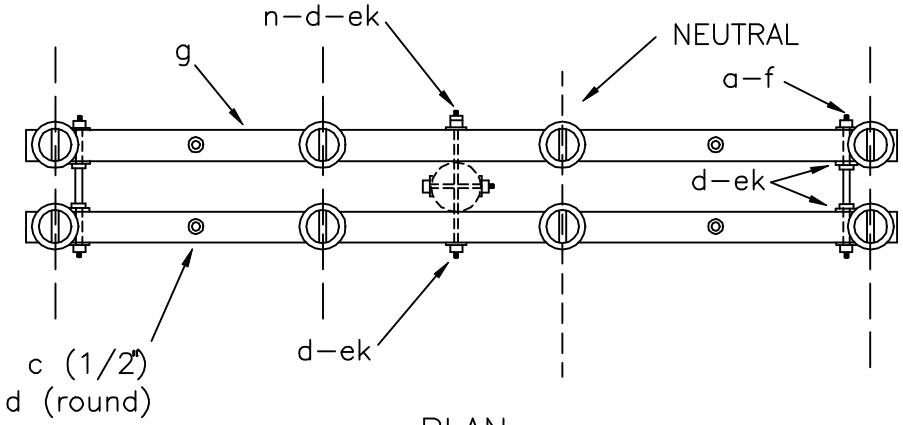
ITEM	QTY	MATERIAL
c	5	Bolt, machine, 5/8" x req'd length
c	4	Bolt, machine, 1/2" x req'd length
d	14	Washer, square, 2 1/4"
d	4	Washer, round, 1 3/8"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8' 0"
n	3	Bolt, double arming,5/8"xreq'd length
cu	2	Brace, wood, 60" span
da	1	Bracket, insulated
ea	6	Insulator, post type (24.9/14.4 kV)
eb	2	Bracket, pole top
ek	19	Locknuts

DESIGN PARAMETERS:

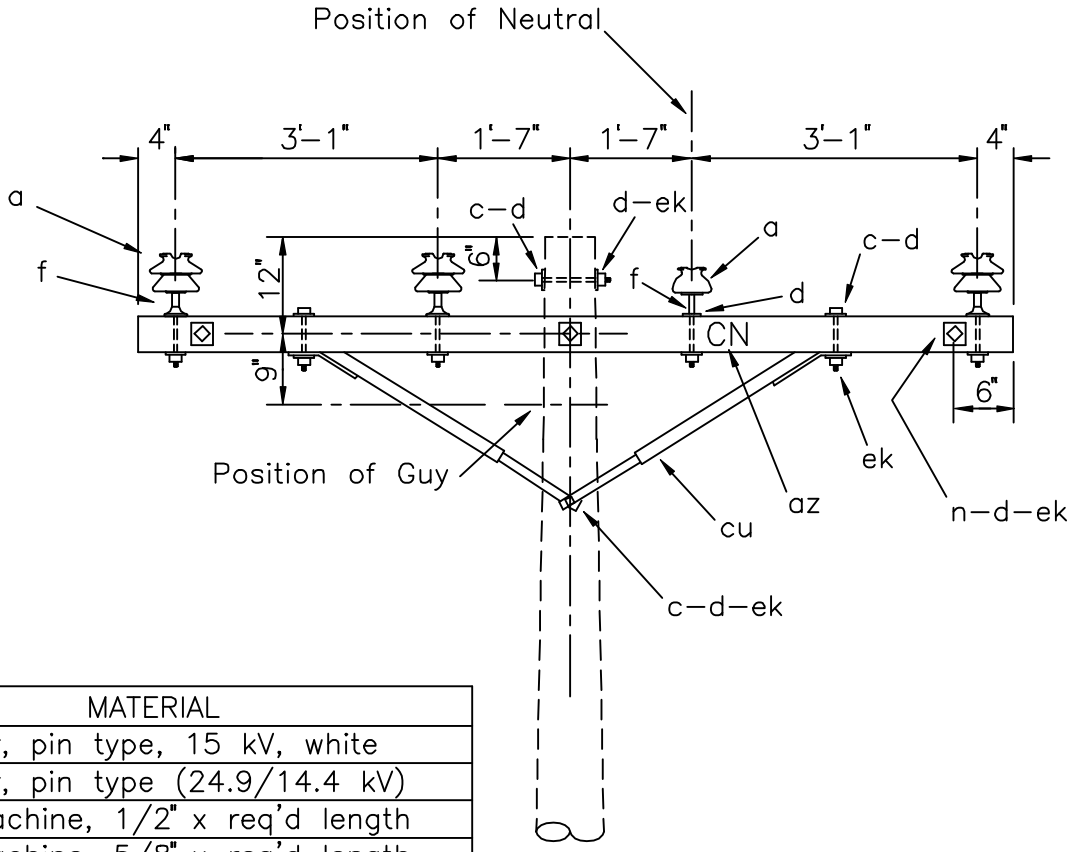
See TABLE IV

DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)

DEC 1998	3 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VC2.21P



PLAN



ITEM	QTY	MATERIAL
a	1	Insulator, pin type, 15 kV, white
a	6	Insulator, pin type (24.9/14.4 kV)
c	4	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	15	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 10 3/4"
f	6	Pin, crossarm, steel, 5/8" X 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
n	3	Bolt double arming,5/8"x req'd length
az	4	Letters, 2" C, 2" N, with 1" nails
cu	2	Brace, wood, 60" span
ek	16	Locknuts

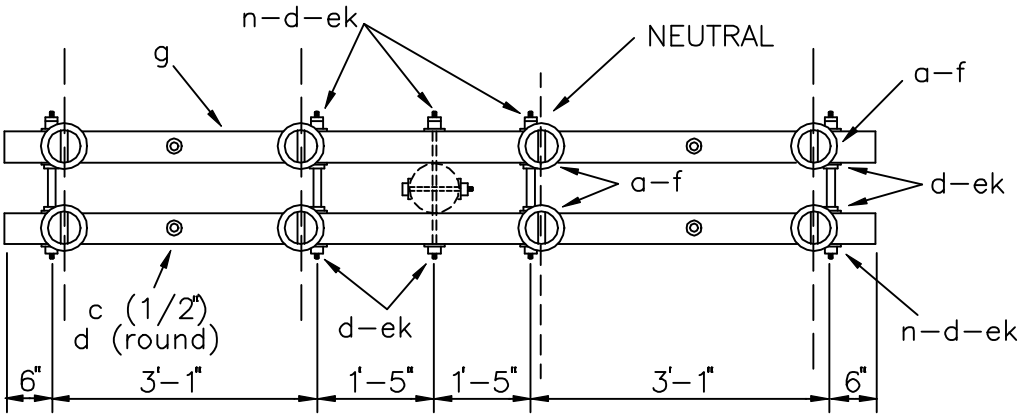
NOTE: Install either identification letters or white insulators in neutral position.

DESIGN PARAMETERS:

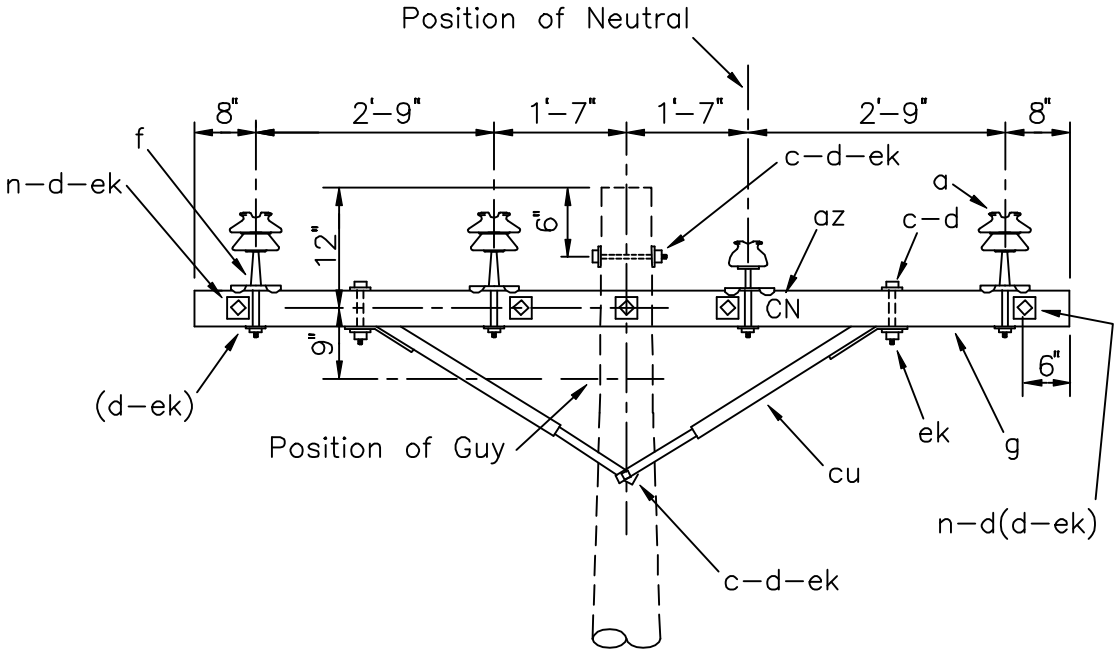
See TABLE IV

DOUBLE SUPPORT, NEUTRAL ON CROSSARMS

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.51



PLAN



ITEM	QTY	MATERIAL
a	2	Insulator, pin type, 15 kV, white
a	6	Insulator, pin type (24.9/14.4 kV)
c	4	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8 "
d	21	Washer, square, 2 1/4"
f	8	Pin, crossarm, steel clamp type
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
n	5	Bolt, double arming,5/8"xreq'd length
az	4	Letters, 2" C, 2" N, with 1" nails
cu	2	Brace, wood, 60" span
ek	24	Locknuts

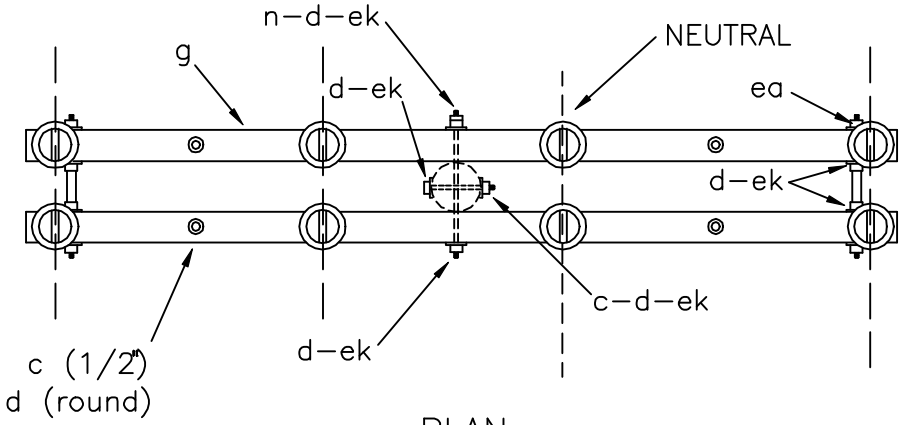
NOTE: Install either identification letters or white insulators in neutral position.

DESIGN PARAMETERS:

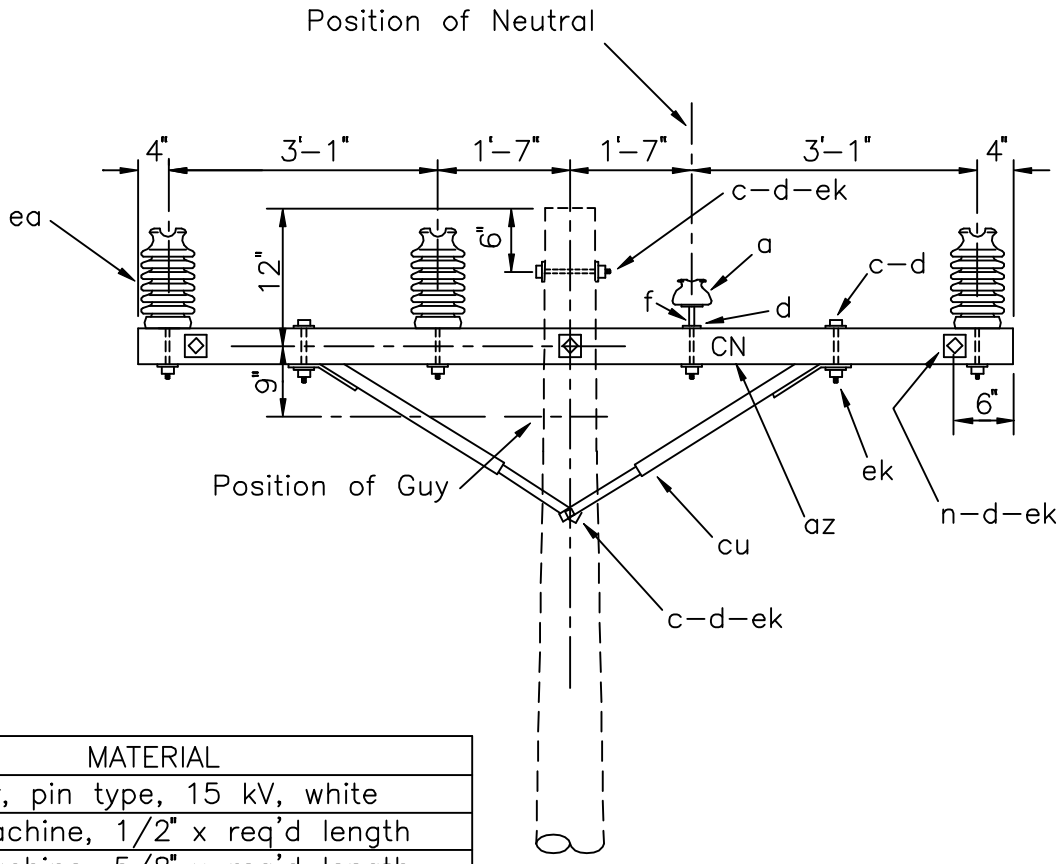
See TABLE V

DOUBLE SUPPORT, NEUTRAL ON CROSSARMS (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.51L



PLAN



ITEM	QTY	MATERIAL
a	2	Insulator, pin type, 15 kV, white
c	4	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	15	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 10 3/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
n	3	Bolt double arming,5/8"x req'd length
az	4	Letters, 2" C, 2" N, with 1" nails
cu	2	Brace, wood, 60" span
ea	6	Insulator, post type (24.9/14.4 kV)
ek	16	Locknuts

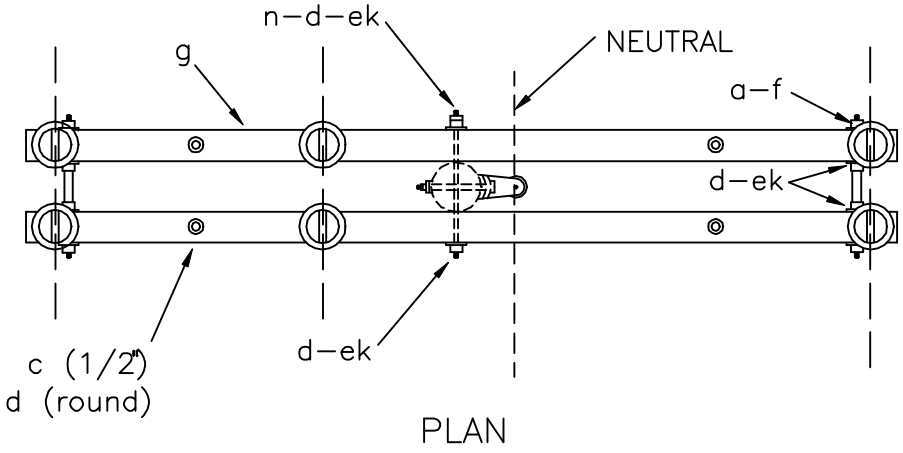
NOTE: Install either identification letters or white insulators in neutral position.

DESIGN PARAMETERS:

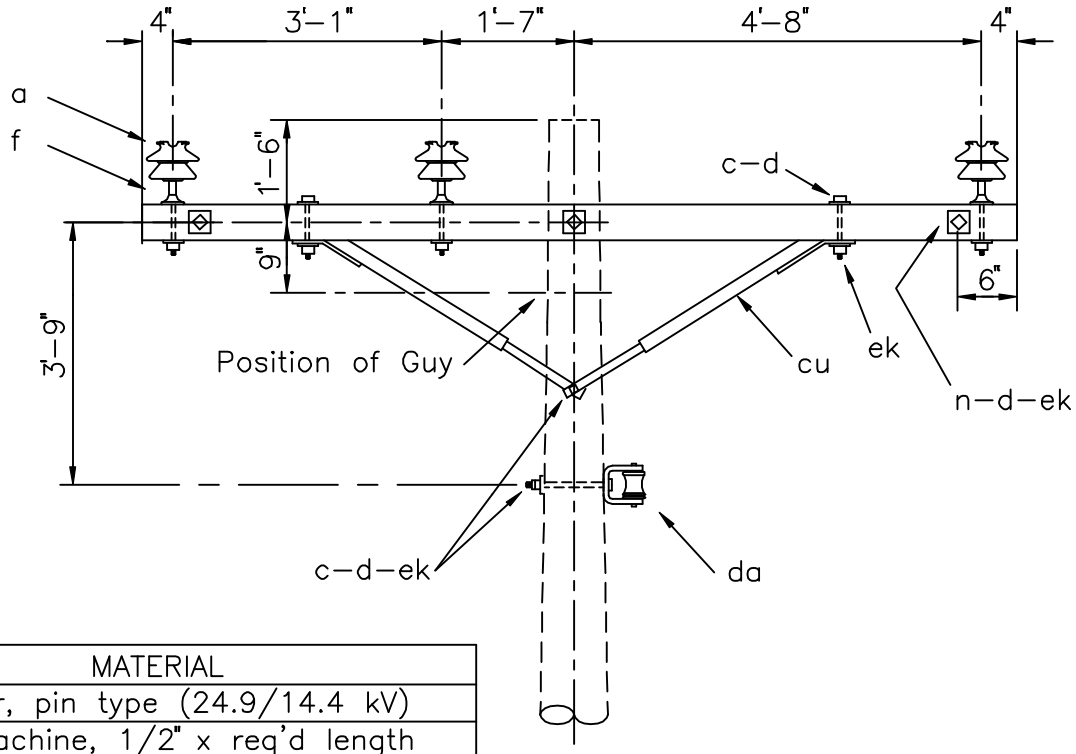
See TABLE IV

DOUBLE SUPPORT, NEUTRAL ON CROSSARMS (POST INSULATORS)

DEC 1998	3 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VC2.51P



PLAN



ITEM	QTY	MATERIAL
a	6	Insulator, pin type (24.9/14.4 kV)
c	4	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	12	Washer, square, 2 1/4"
f	6	Pin, crossarm, steel, 5/8" X 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
n	3	Bolt, double arm, 5/8" x req'd length
cu	2	Brace, wood, 60" span
da	1	Bracket, insulated
ek	16	Locknuts

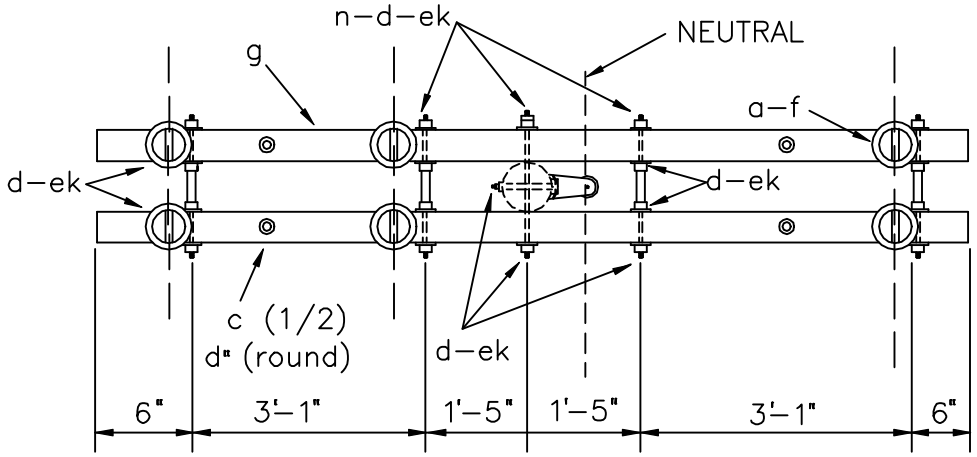
NOTE:
Neutral assembly may be installed on opposite side of pole when necessary to avoid midspan conductor clearance.

DESIGN PARAMETERS:

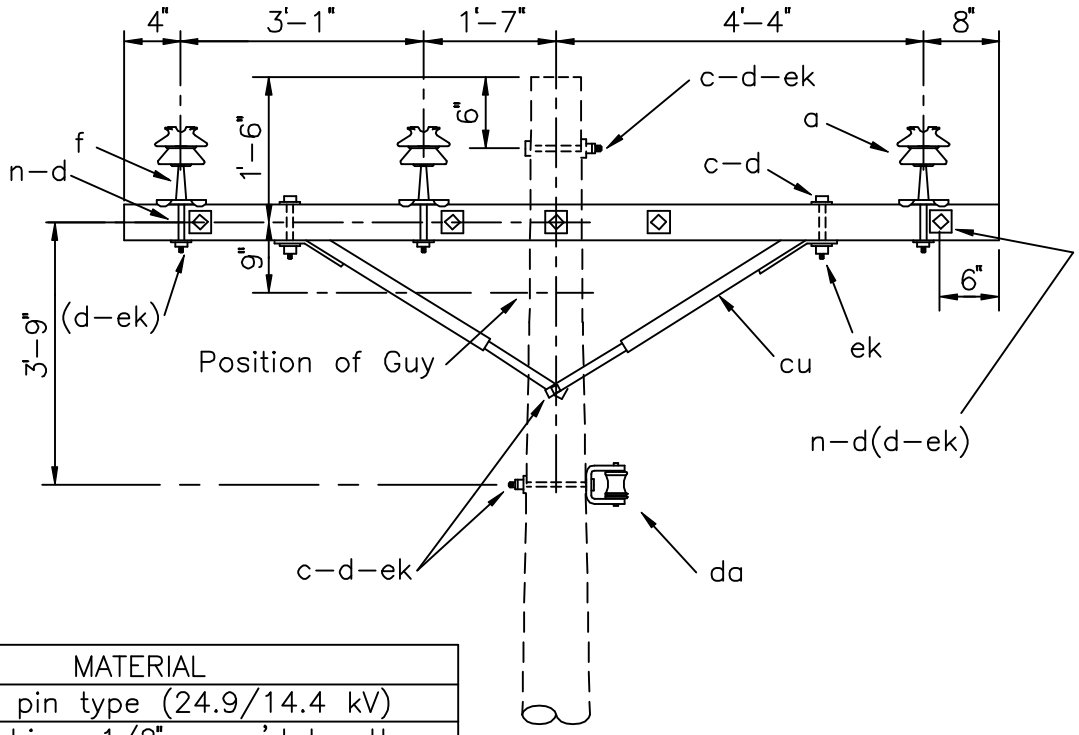
See TABLE IV

DOUBLE SUPPORT ON 10 FOOT CROSSARMS

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.52



PLAN



ITEM	QTY	MATERIAL
a	6	Insulator, pin type (24.9/14.4 kV)
c	4	Bolt, machine, 1/2" x req'd length
c	3	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	22	Washer, square, 2 1/4"
f	6	Pin, crossarm, steel, clamp type
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
n	5	Bolt, double arm, 5/8" x req'd length
cu	2	Brace, wood, 60" span
da	1	Bracket, w/ 3" x 3" spool insulator
ek	25	Locknuts

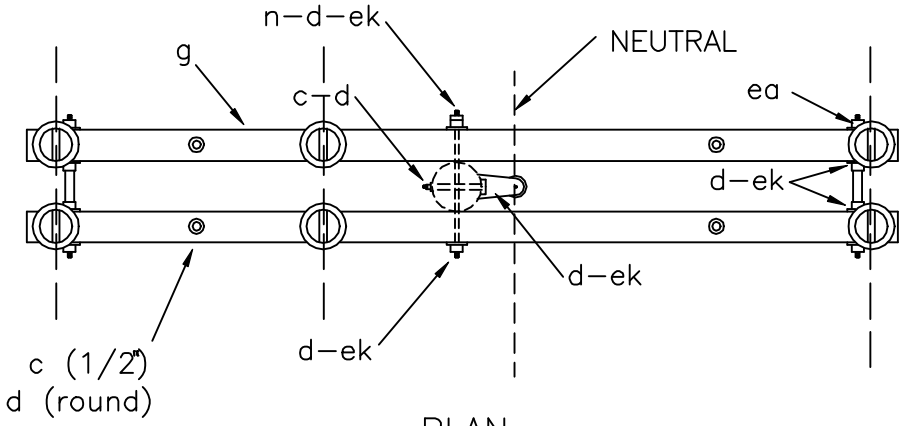
NOTE:
Neutral assembly may be installed on opposite side of pole when necessary to avoid midspan conductor clearance.

DESIGN PARAMETERS:

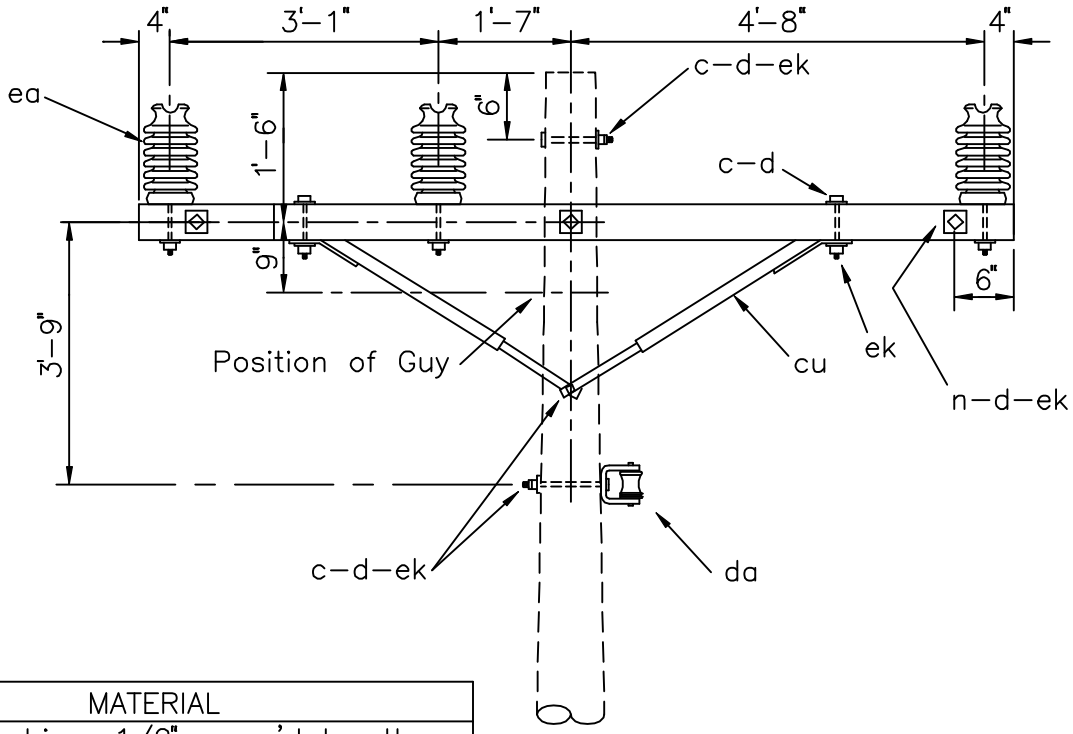
See TABLE V

DOUBLE SUPPORT ON 10 FOOT CROSSARMS (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.52L



PLAN



ITEM	QTY	MATERIAL
c	4	Bolt, machine, 1/2" x req'd length
c	3	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	14	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
n	3	Bolt, double arm, 5/8" x req'd length
cu	2	Brace, wood, 60" span
da	1	Bracket, Insulated
ea	6	Insulator, post type (24.9/14.4 kV)
ek	17	Locknuts

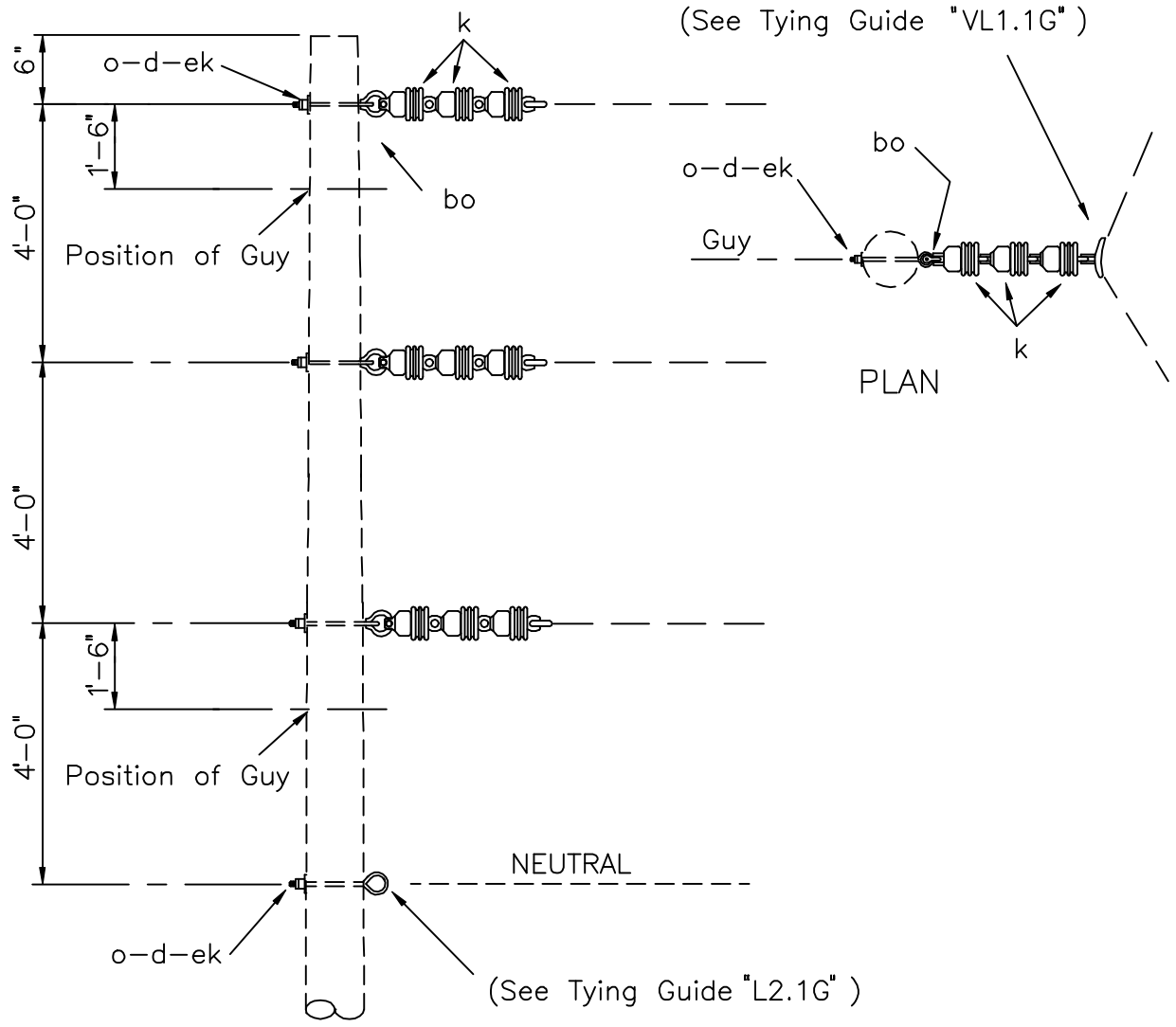
NOTE:
Neutral assembly may be installed on opposite side of pole when necessary to avoid midspan conductor clearance.

DESIGN PARAMETERS:

See TABLE IV

DOUBLE SUPPORT ON 10 FOOT CROSSARMS (POST INSULATORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC2.52P



NOTE:

1. Assembly units "VA5.2" or "VA5.4" may be used if additional climbing space is desired.
2. If additional down guys are required, construct similar to Dwg. "E2.3G."
3. See Dwg. "N2.1", "N3.1" for alternate neutral assemblies for smaller conductors.

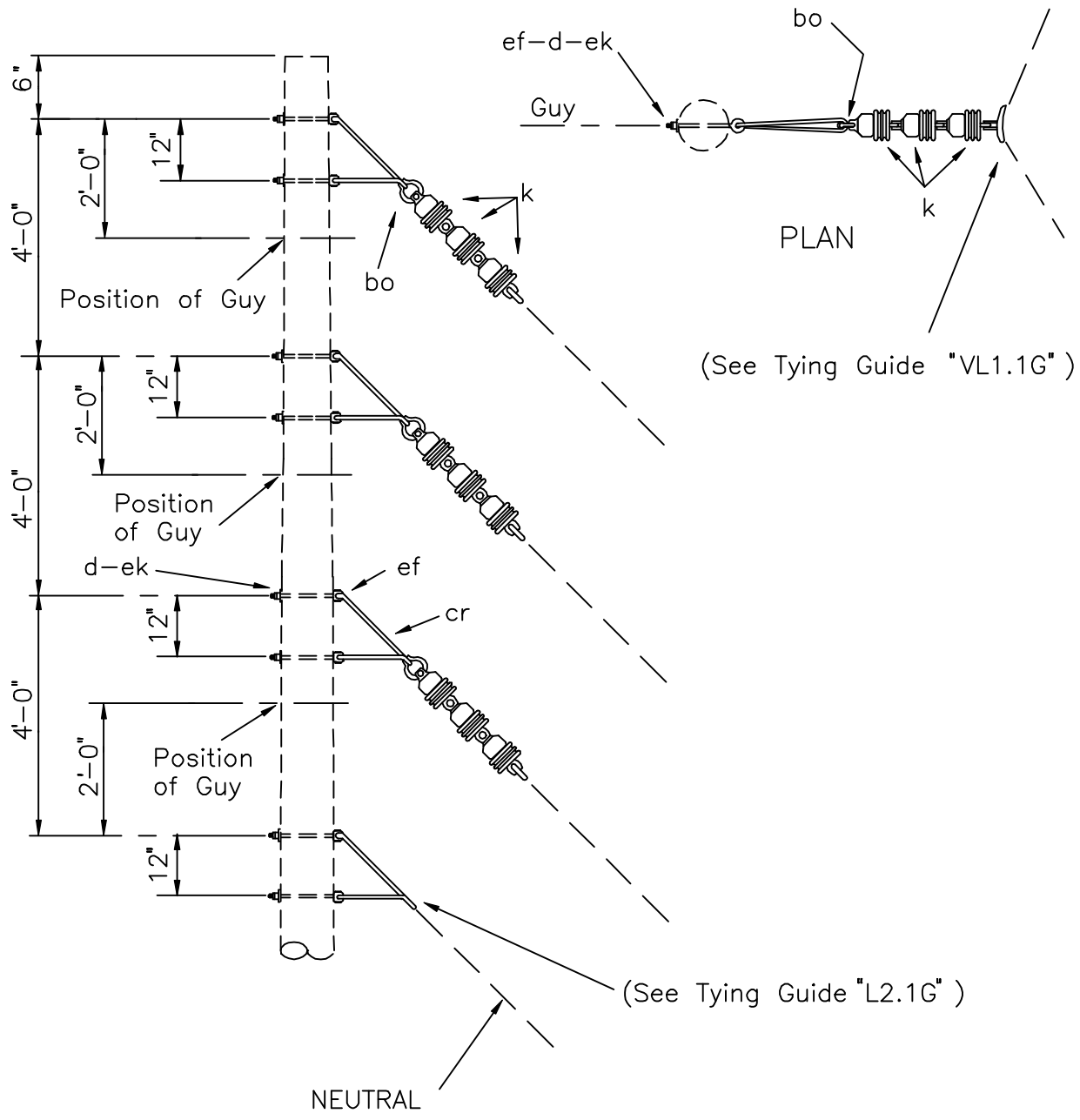
ITEM	QTY	MATERIAL
d	4	Washer, square, 3", curved
k	9	Insulator, suspension, 4 1/4"
o	4	Bolt, eye, 5/8" x req'd length
bo	4	Shackle, anchor
ek	4	Locknuts

DESIGN PARAMETERS:

ALLOWABLE TRANSVERSE
LOAD= 5000 lbs./Conductor
20° – 60°: #1/0 ACSR
30° – 60°: Smaller Conductors

SUSPENSION ANGLE

DEC 1998	3 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VC3.1



ITEM	QTY	MATERIAL
d	8	Washer, square, 3", curved
k	9	Insulator, suspension, 4 1/4"
bo	3	Shackle, anchor
cr	4	Bracket, angle, 5/8"
ef	8	Bolt, clevis, 5/8" x req'd length
ek	8	Locknuts

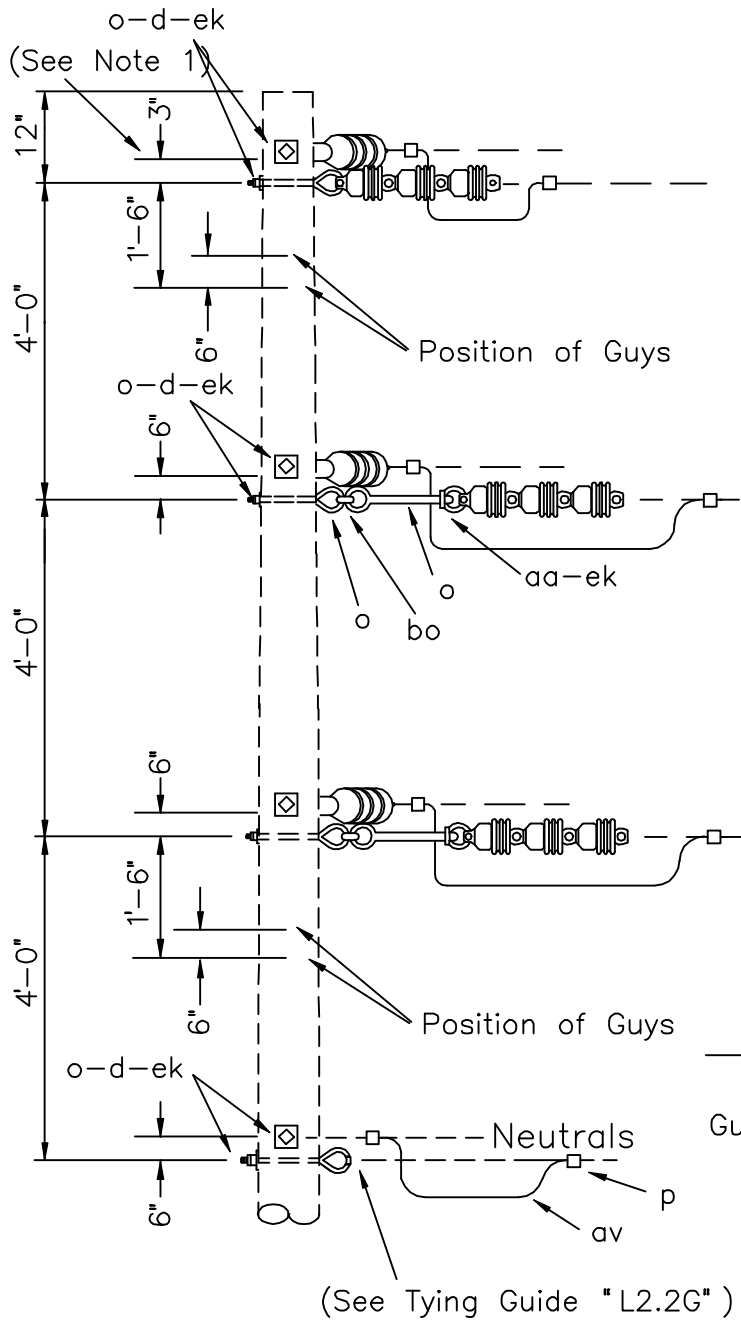
DESIGN PARAMETERS:

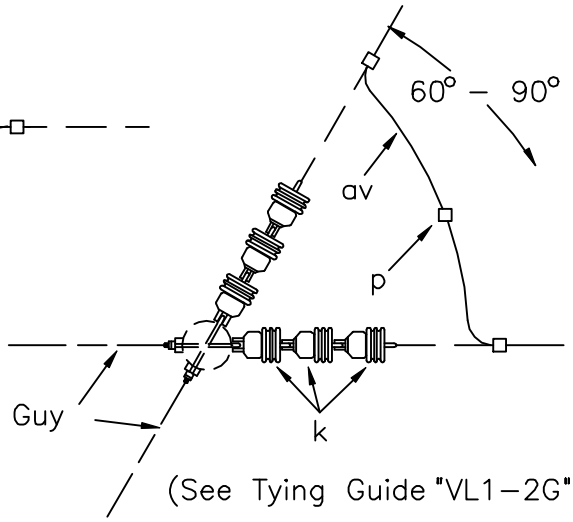
ALLOWABLE TRANSVERSE LOAD= 5000 lbs./Conductor

10° -30° Angles

SUSPENSION ANGLE (LARGE CONDUCTORS)

DEC 1998	3 - PHASE PRIMARY 24.9/14.4 kV	
RUS		VC3.2L





PLAN
(Top Phase)

ITEM	QTY	MATERIAL
d	8	Washer, square, 3", curved
k	18	Insulator, suspension, 4 1/4"
o	12	Bolt, eye, 5/8" x req'd length
p		Connectors, as req'd
aa	4	Nut, eye, 5/8"
av		Jumpers, as req'd
bo	4	Shackle, anchor
ek	12	Locknuts

NOTES:

1. Separate 6" (top position only) when angle equals 90°.

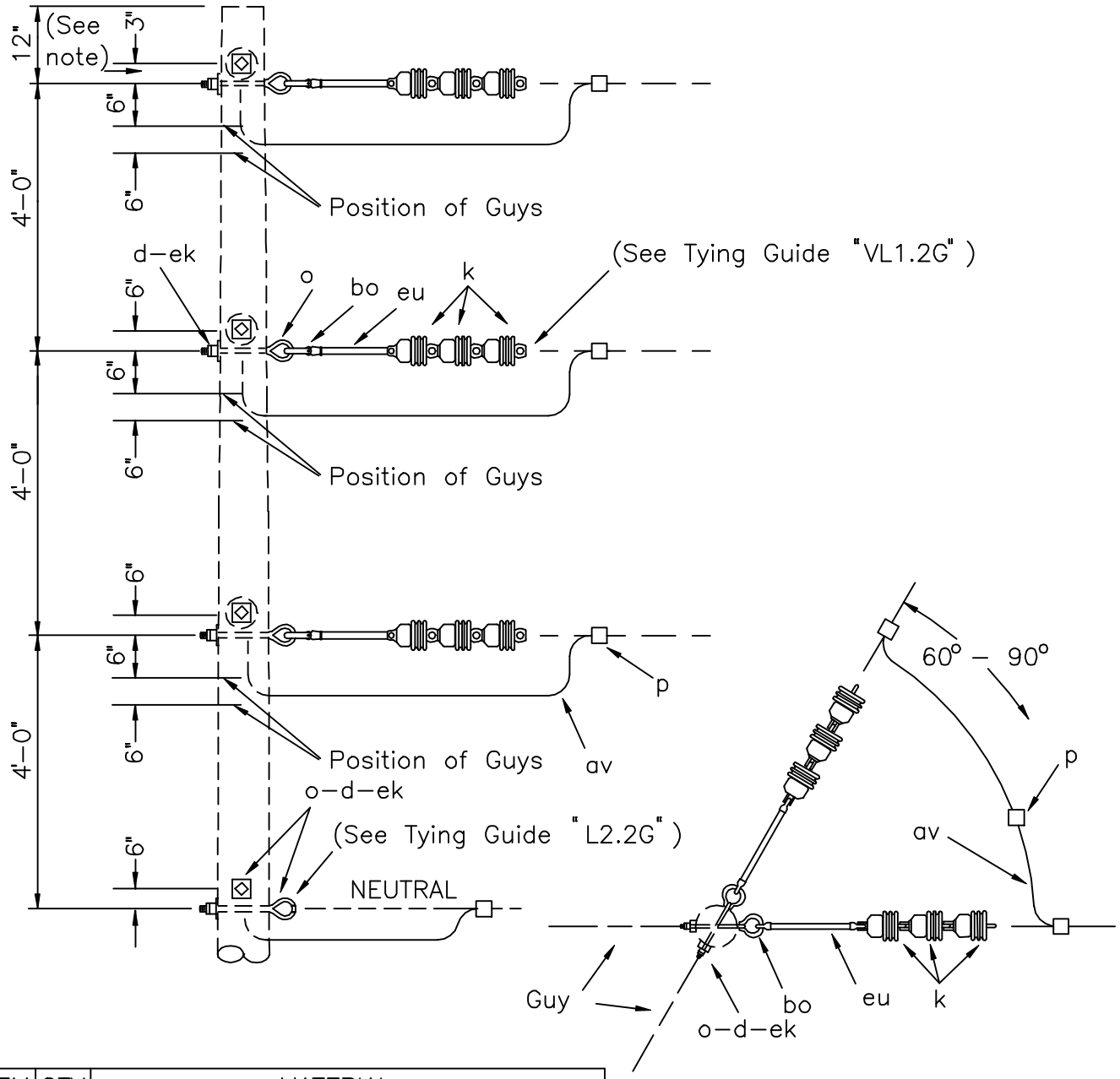
2. Distribution extension link, (item "du"), may be substituted for anchor shackle (item "bo"), eye bolt (item "o") and eye nut (item "aa").

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5,000 lbs./Conductor

DEADEND ANGLE (ACUTE)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC4.1



PLAN

ITEM	QTY	MATERIAL
d	8	Washer, square, 3", curved
k	18	Insulator, suspension, 4 1/4"
o	12	Bolt, eye, 5/8" x req'd length
p		Connectors, as req'd
av		Jumpers, as req'd
bo	6	Shackle, anchor
eu	6	Link, extension, insulated, 12" min
ek	12	Locknuts

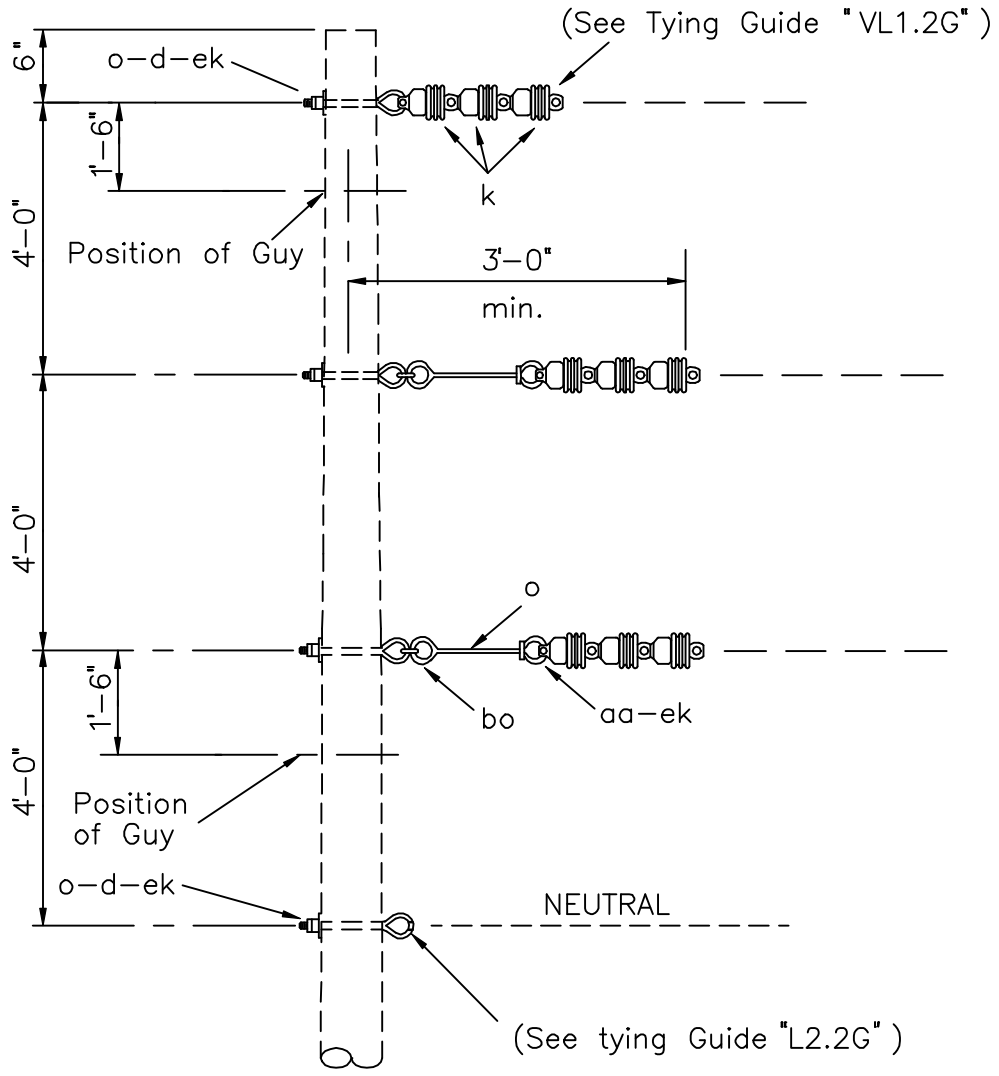
NOTE: Separate 6" (top position only) when angle equals 90°

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5,000 lbs./Conductor

DEADEND ANGLE (LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC4.2L



NOTE: Distribution extension link, (item "du"), may be substituted for anchor shackle (item "bo"), eye bolt (item "o") and eye nut (item "aa").

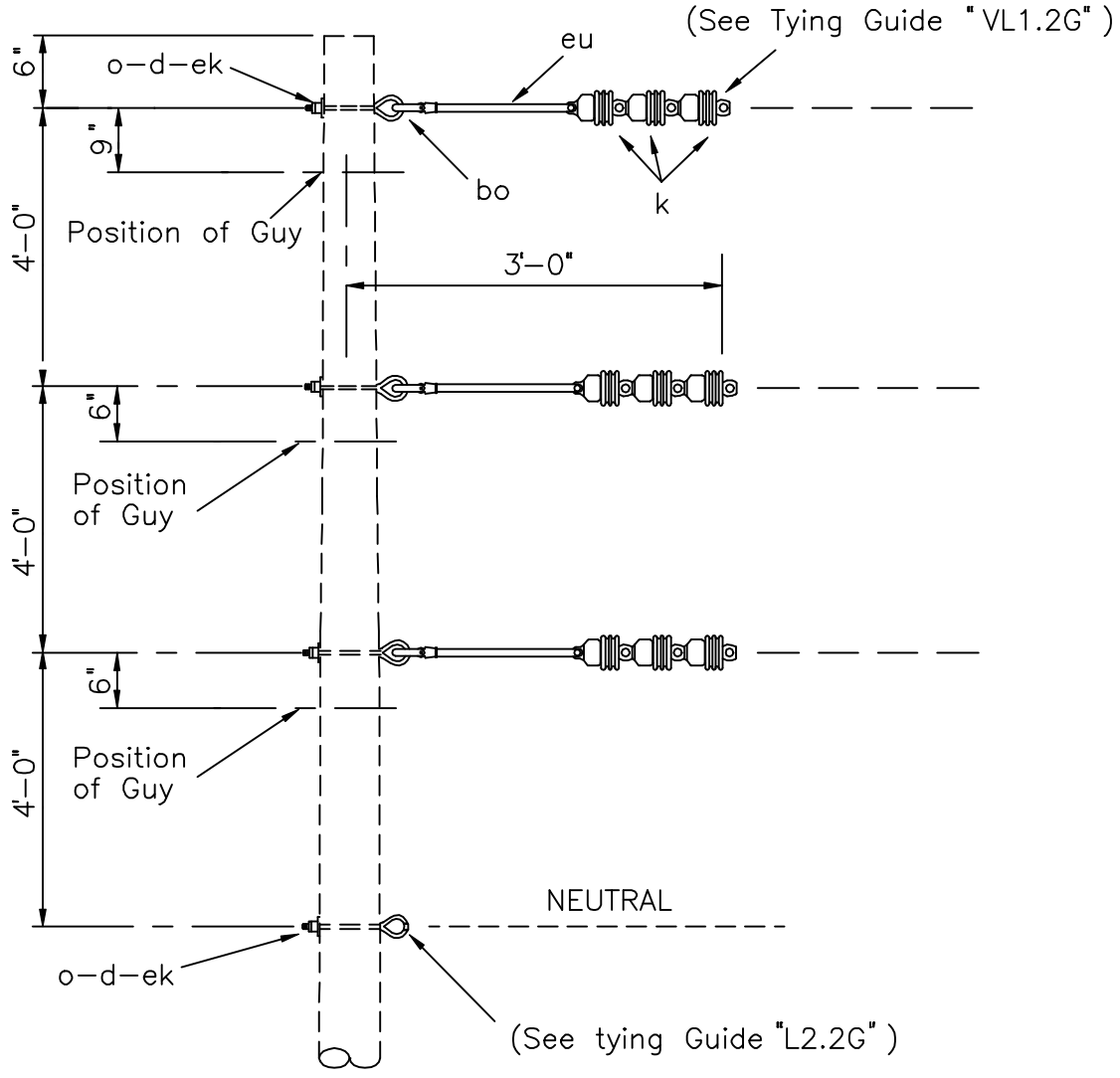
ITEM	QTY	MATERIAL
d	4	Washer, square, 3", curved
k	9	Insulator, suspension, 4 1/4"
o	6	Bolt, eye, 5/8" x req'd length
aa	2	Nut, eye, 5/8"
bo	2	Shackle, anchor
ek	6	Locknuts

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5,000 lbs./Conductor

SINGLE DEADEND – VERTICAL

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC5.1



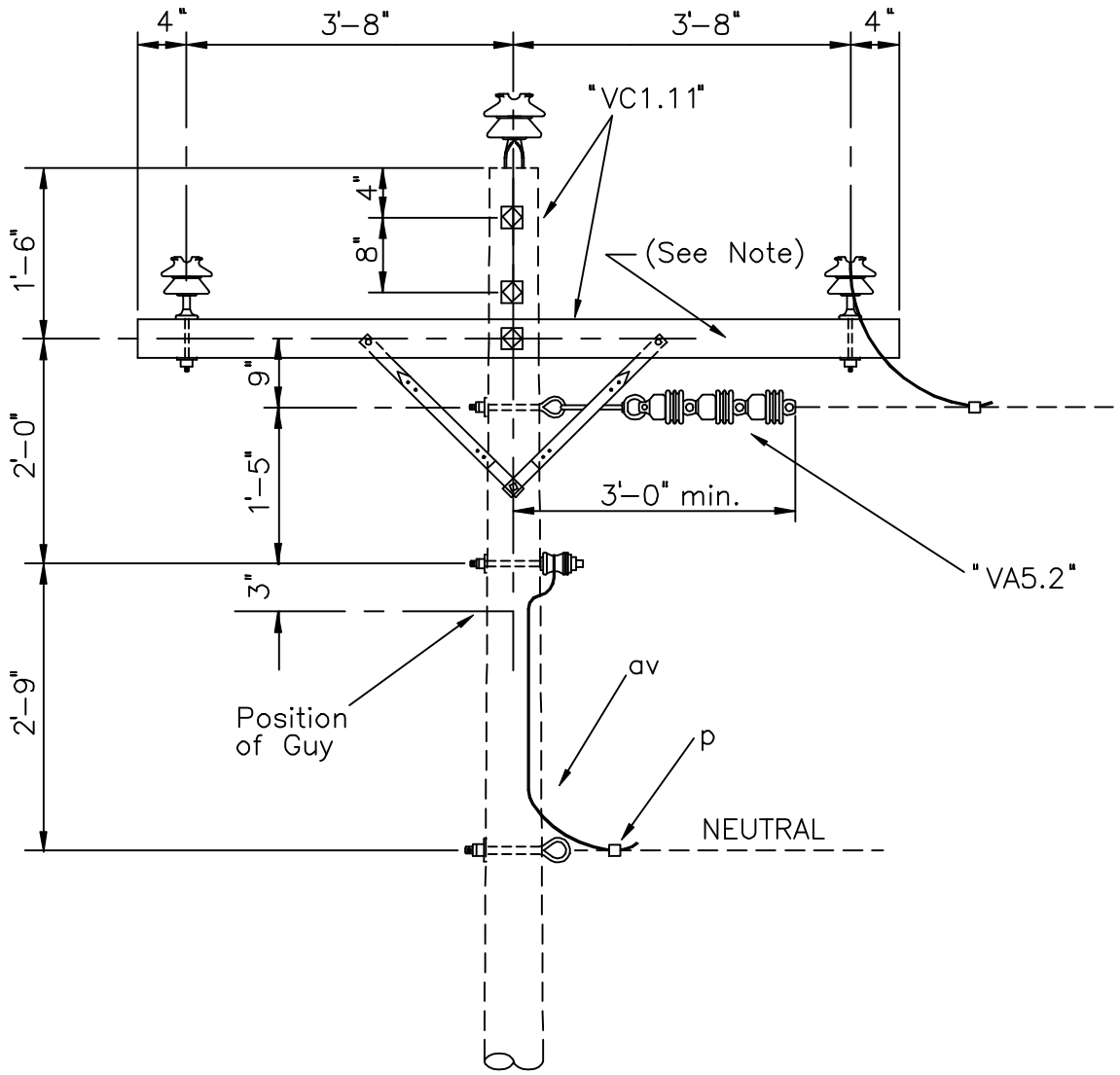
ITEM	QTY	MATERIAL
d	4	Washer, square, 3", curved
k	9	Insulator, suspension, 4 1/4"
o	4	Bolt, eye, 5/8" x req'd length
bo	3	Shackle, anchor
eu	3	Link, extension, insulated 12" mininum
ek	4	Locknuts

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL
LOAD = 5,000 lbs./Conductor

SINGLE DEADEND – VERTICAL
(LARGE CONDUCTORS)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC5.2L



NOTES:

When tapping center phase, install post type insulator, "VA1.011P," horizontally on crossarm, 24 inches from center of pole and fasten jumper to insulator.

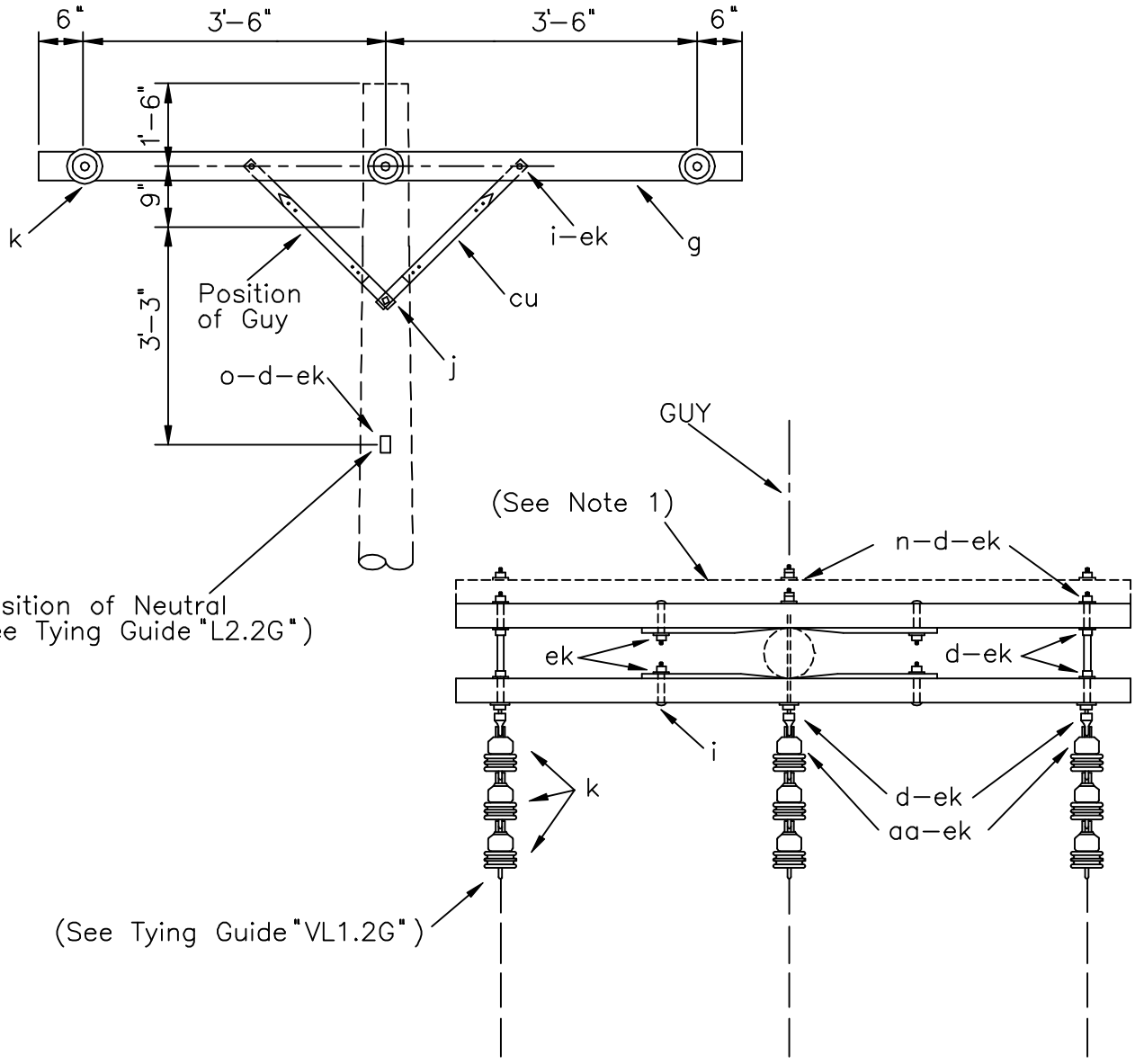
ITEM	QTY	MATERIAL
	1	"VC1.11" Primary Assembly
	1	"VA5.2" Primary Assembly
p		Connectors, as req'd
av		Jumpers, as req'd

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD = 5,000 lbs./Conductor

SINGLE PHASE TAP GUIDE

DEC 1998	3 – PHASE PRIMARY 24.9/14.4 kV	VC5.11G
RUS		



PLAN

ITEM	QTY	MATERIAL
d	11	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
k	9	Insulator, suspension, 4 1/4"
n	3	Bolt,double arming,5/8" x req'd length
o	1	Bolt, eye, 5/8" x req'd length
aa	3	Nut, eye, 5/8"
cu	4	Brace, 28"
ek	18	Locknuts

NOTES:

1. Designate as VC5.31 for assembly with three crossarms.
2. Neither assembly suitable for Grade B construction.
3. Double arming eye bolt, item "dy," may be used instead of double arming bolt, item "n", and eye nut, item "aa."

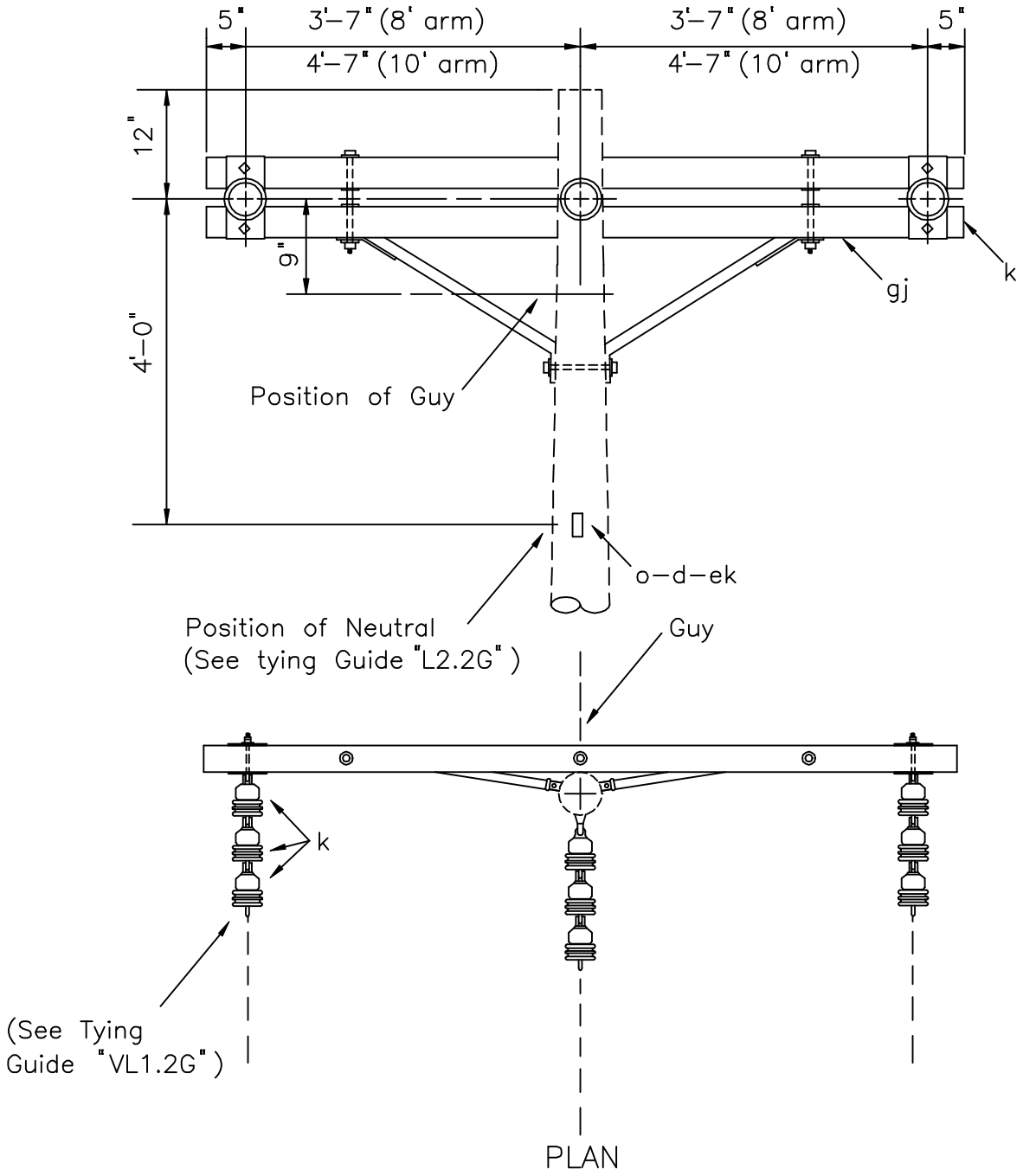
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOADING (lbs./conductor) =

VC5.21: 2,000 (#2 ACSR)
VC5.31: 3,000 (#2/0 ACSR)

SINGLE DEADEND ON CROSSARMS

DEC 1998	3 – PHASE PRIMARY	VC5.21
RUS	24.9/14.4 kV	VC5.31



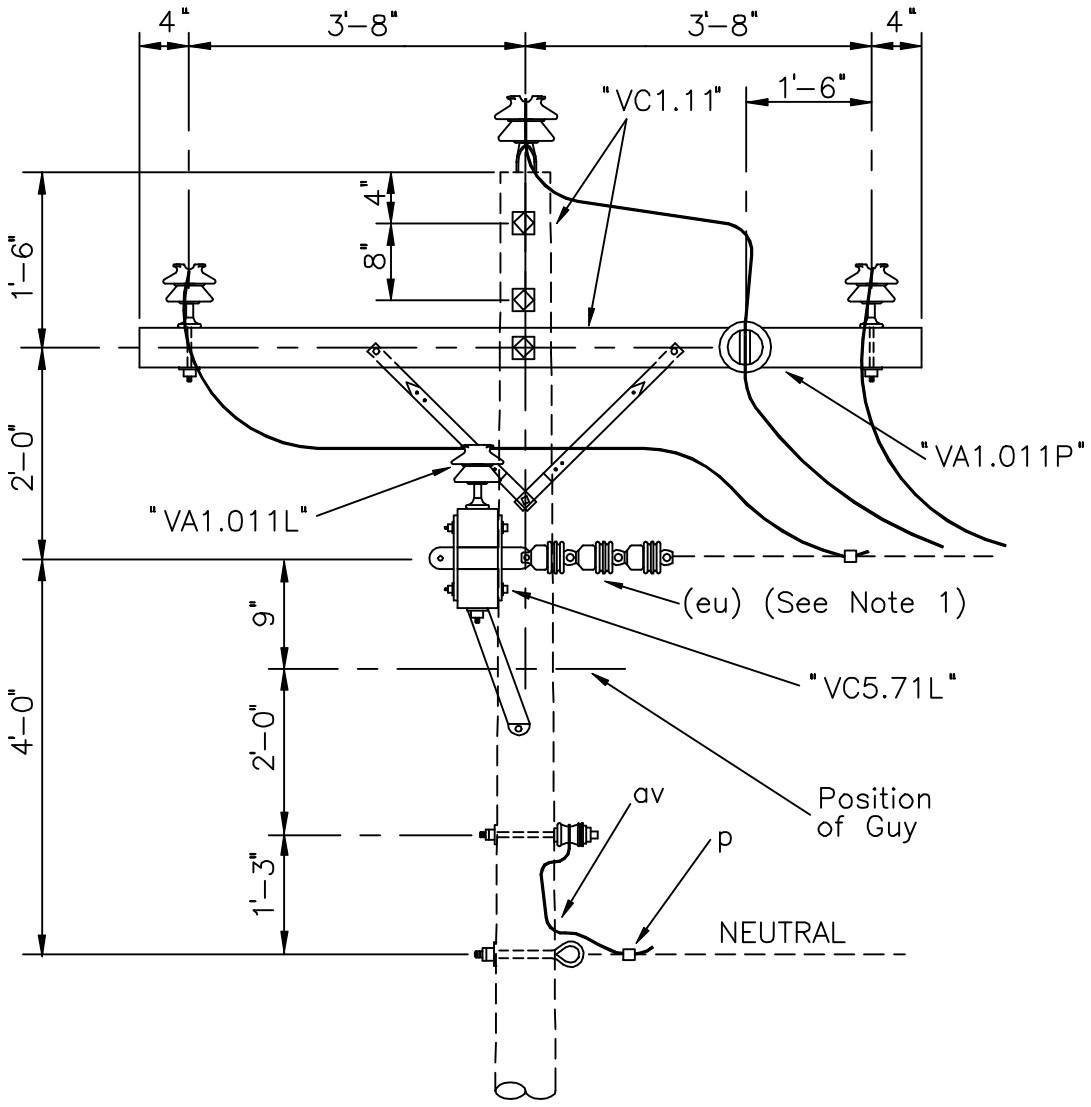
ITEM	QTY	MATERIAL
d	1	Washer, square, 3", curved
k	9	Insulator, suspension, 4 1/4"
o	1	Bolt, eye, 5/8"x req'd length
ek	1	Locknuts
gj	1	Crossarm Assembly

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD EQUALS LESSER OF:
5,000 lbs/Conductor, or
Manufacturer's Specifications

SINGLE DEADEND ON CROSSARM ASSEMBLY

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC5.71L



NOTES:

1. Install insulated extension link, item "eu," 12 inch mininum, in center phase of tap.
2. Three "VC5.1" vertical primary deadend assemblies, with adequately sized jumpers, is preferred construction.

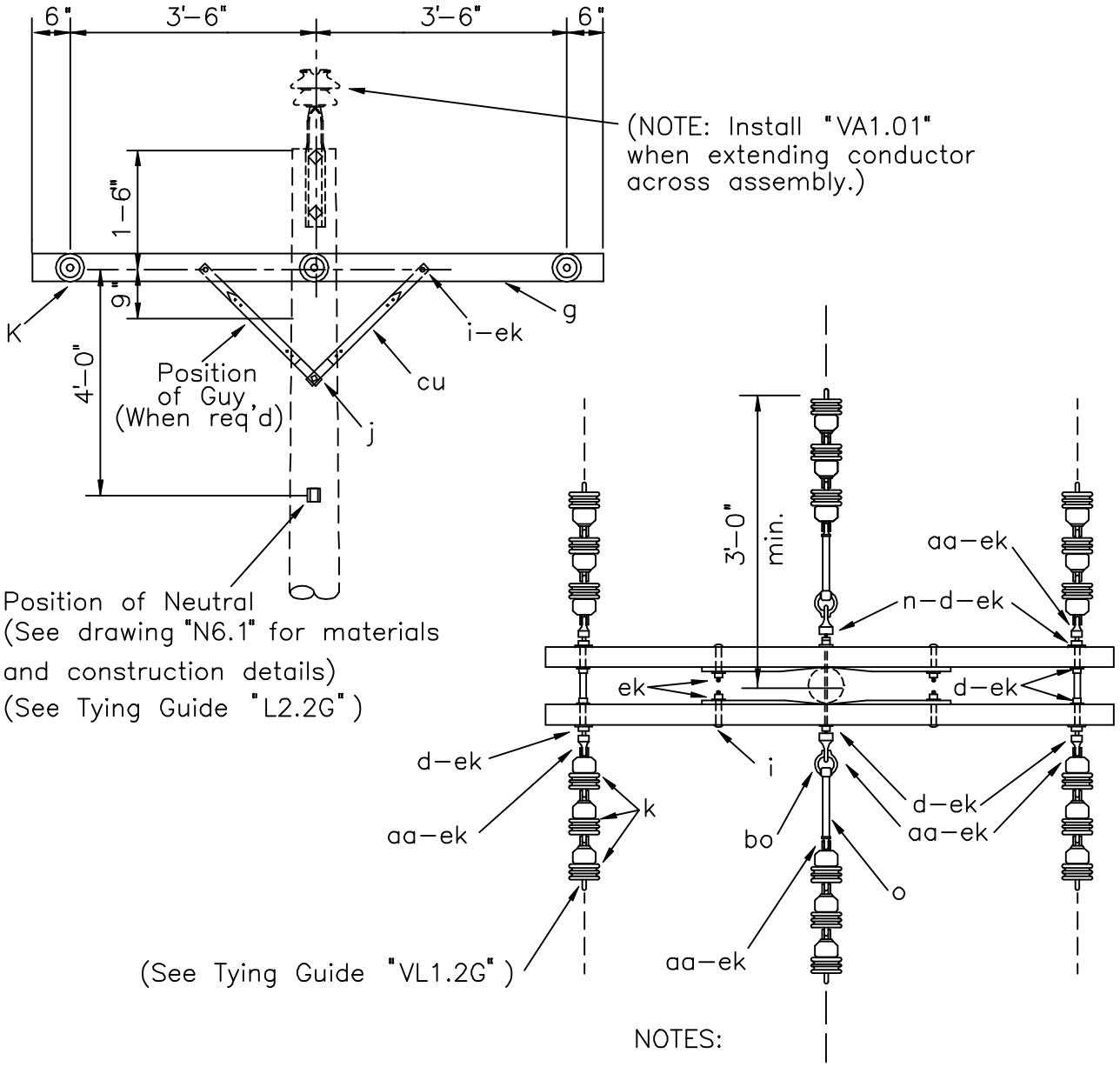
ITEM	QTY	MATERIAL
	1	VC1.11 Primary Assembly
	1	VA5.71L Primary Assembly
	1	VA1.011L Misc. Single Support
	1	VA1.011P Misc. Single Support
p		Connectors, as req'd
av		Jumpers, as req'd
eu	1	Link, extension, insulated

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD EQUALS LESSER OF:
5,000 lbs./Conductor, or
Manufacturer's Specifications

THREE PHASE HORIZONTAL TAP GUIDE

DEC 1998	3 – PHASE PRIMARY	VC5.82G
RUS	24.9/14.4 kV	



ITEM	QTY	MATERIAL
d	12	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
k	18	Insulator, suspension, 4 1/4"
n	4	Bolt,double arming,5/8" x req'd length
o	2	Bolt, eye, 5/8" x req'd length
aa	8	Nut, eye, 5/8"
bo	2	Shackle, anchor
cu	4	Brace, 28"
ek	26	Locknuts

NOTES:

1. Not suitable for Grade B construction.
2. Double arming bolt, item "n," and eye nut, item "aa," may be replaced with double arming eye bolt, item "dy."
3. Maximum line angle may be increased to 15° by installing anchor shackles, item "bo," to (horizontal) eye nuts and installing side guys as req'd.
4. Designate as VC6.31 for assembly with three crossarms.

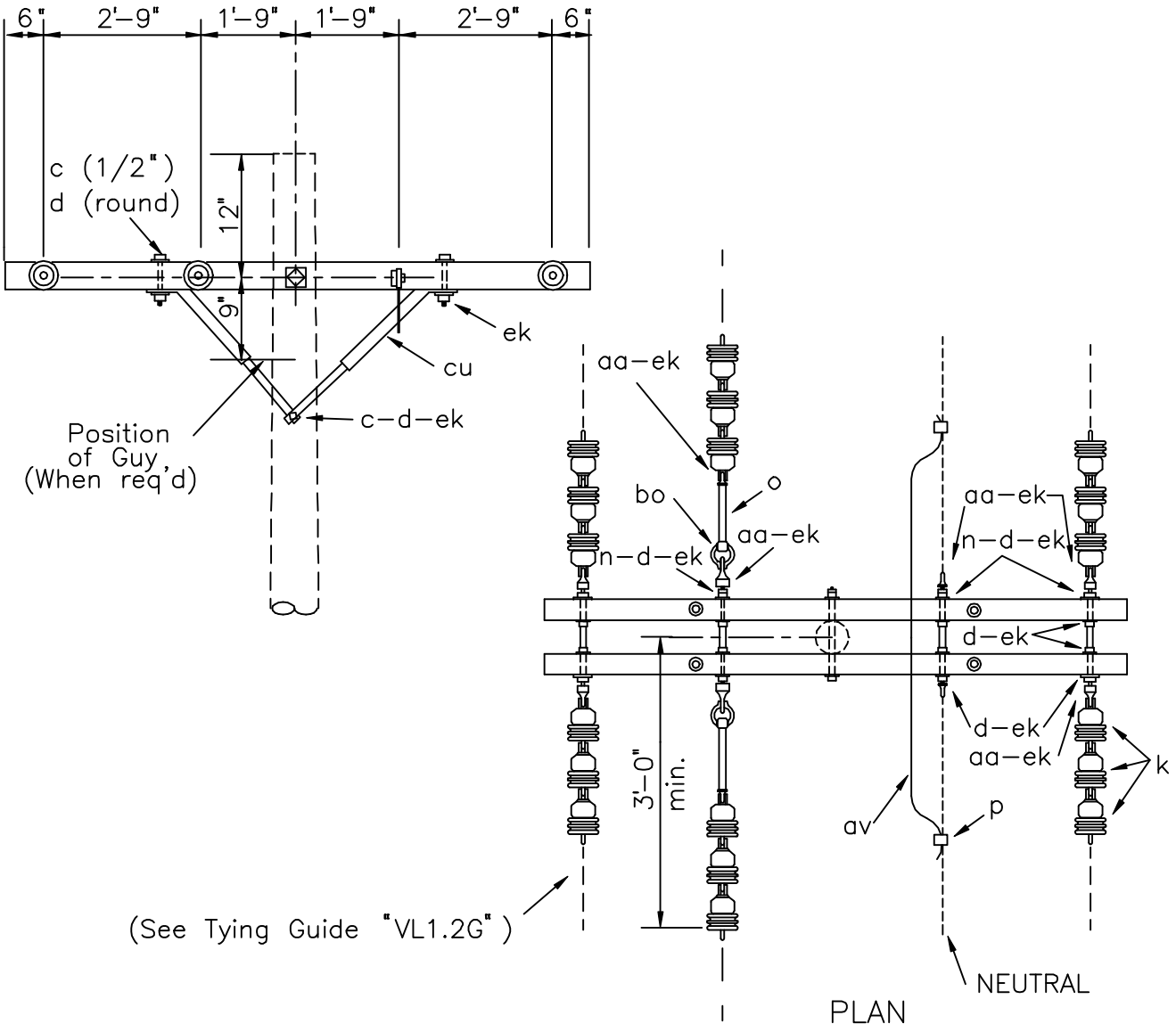
DESIGN PARAMETERS:

ALLOWABLE UNBALANCED LONGITUDINAL TENSION: (lbs./conductor)
VC6.21: 2,000 (#2 ACSR)
VC6.31: 3,000 (#2/0 ACSR)

MAXIMUM LINE ANGLE = 5°
(See Note 3)

DOUBLE DEADEND ON CROSSARMS

DEC 1998	3 – PHASE PRIMARY	VC6.21
RUS	24.9/14.4 kV	VC6.31



ITEM	QTY	MATERIAL
c	4	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	4	washer, round, 1 3/8"
d	19	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
k	18	Insulator, suspension, 4 1/4"
n	4	Bolt, double arm, 5/8" x req'd length
o	2	Bolt, eye, 5/8" x req'd length
aa	10	Nut, eye, 5/8"
bo	2	Shackle, anchor
cu	2	Brace, wood, 60" span
ek	26	Locknuts

NOTES:

1. Not suitable for Grade B construction.
2. Double arming bolt, item "n" and eye nut, item "aa", may be replaced with double arming eye bolt, item "dy."
3. Maximum line angle may be increased to 15° by installing anchor shackles, item "bo", to (horizontal) eye nuts and installing side guys as req'd.
4. See drawing "N6.21" for additional details.

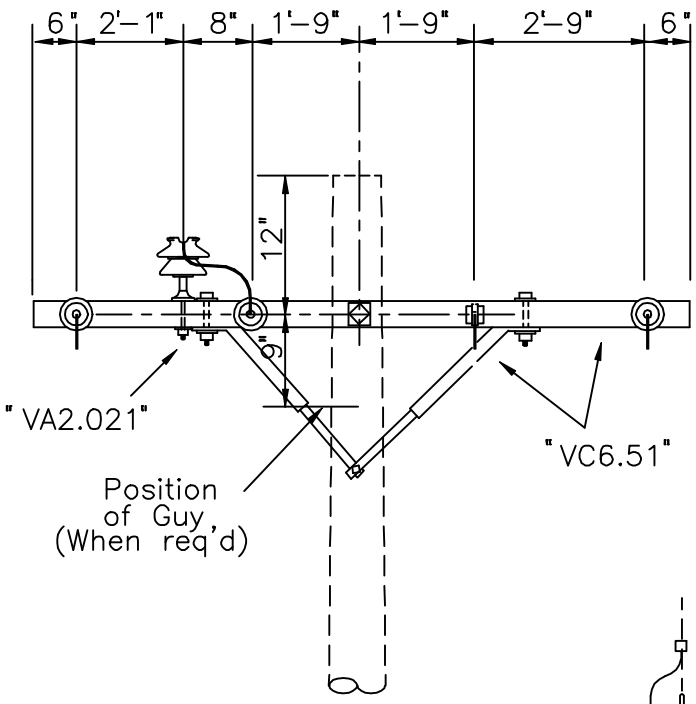
DESIGN PARAMETERS:

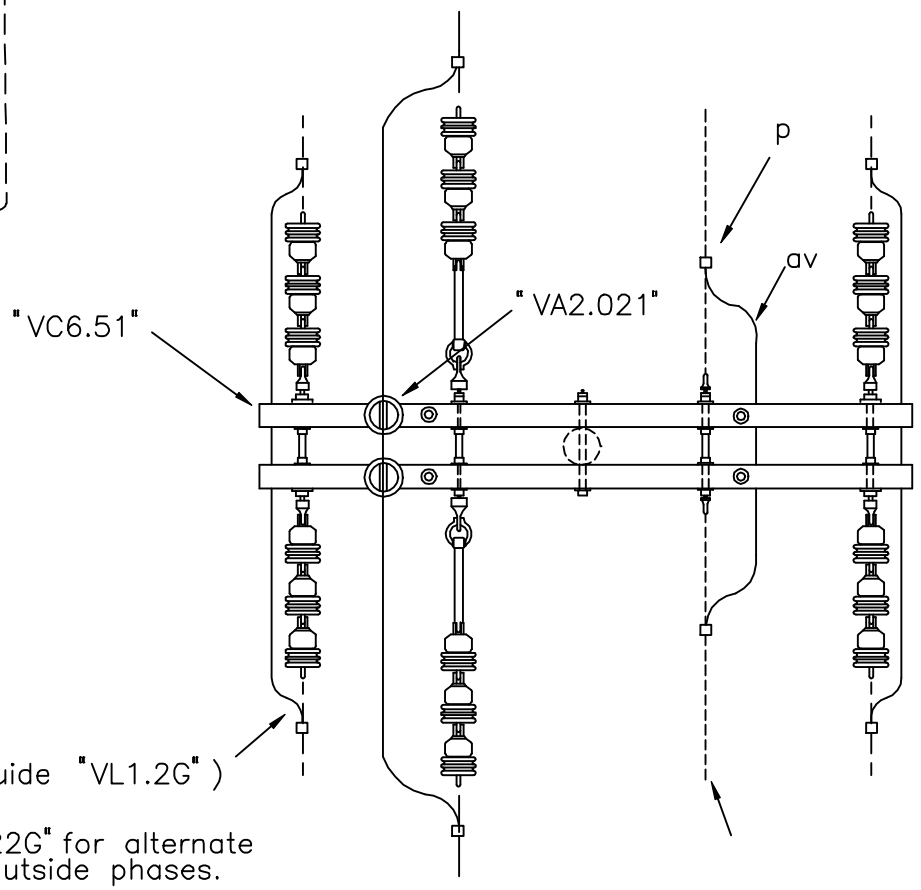
ALLOWABLE UNBALANCED LONGITUDINAL TENSION: 1,000 lbs./Conductor

MAXIMUM LINE ANGLE = 5°
(See Note 3)

DOUBLE DEADEND ON 10 FOOT CROSSARMS

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VC6.51





PLAN

Note: See drawing "VA6.22G" for alternate feed through of outside phases.

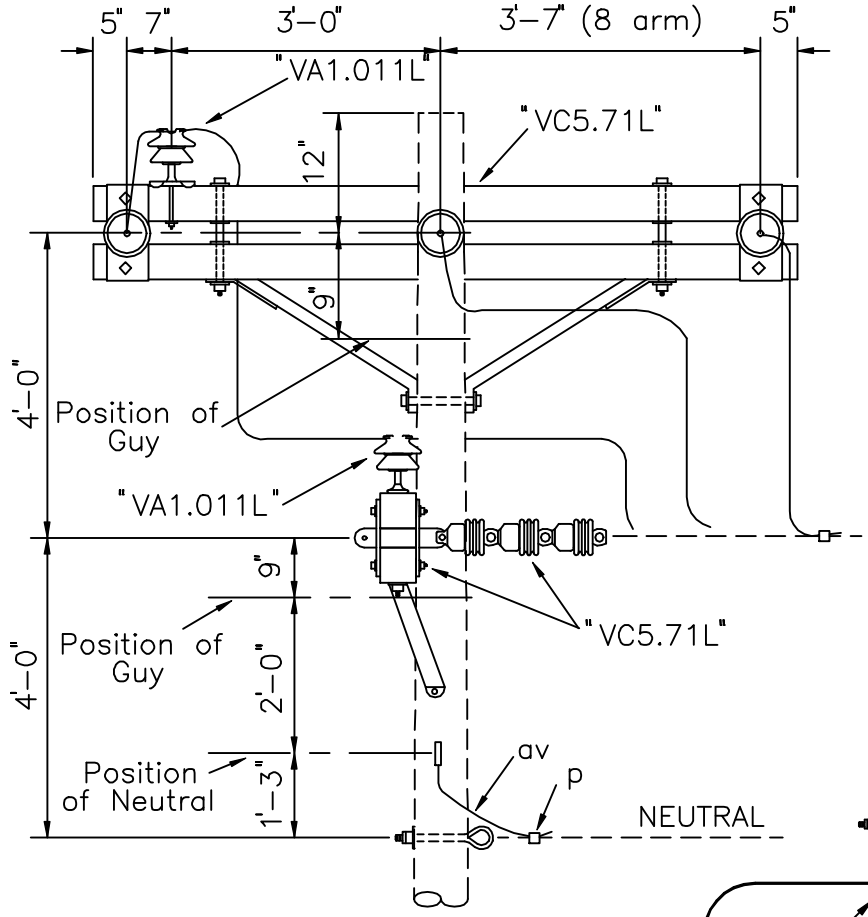
ITEM	QTY	MATERIAL
	1	VC6.51 Primary Assembly
	1	VA2.021 Primary Assembly
p		Connectors, as req'd
av		Jumpers, as req'd

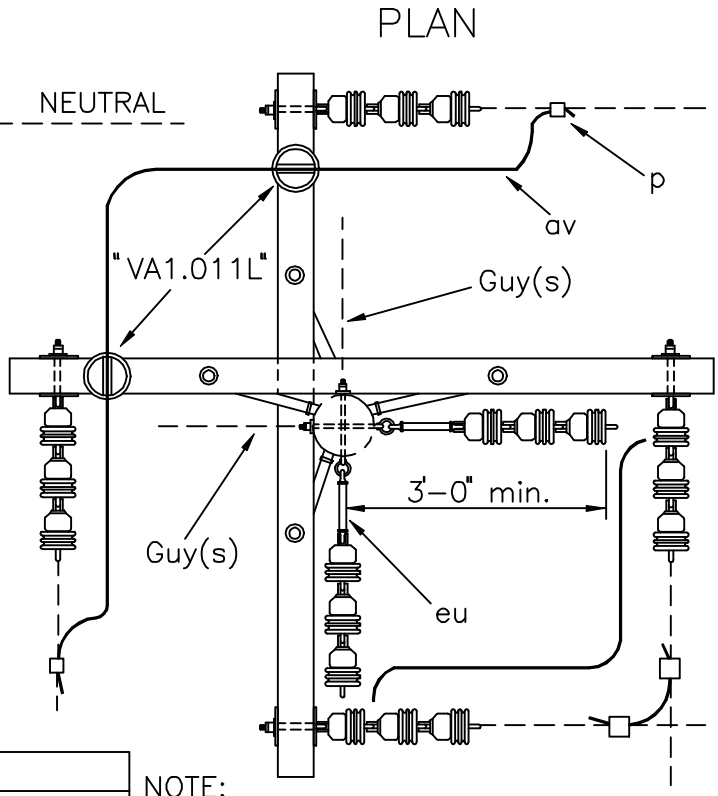
DESIGN PARAMETERS:

See: "VC6.51"
"VA2.021"

DOUBLE DEADEND ON 10 FOOT CROSSARMS (FEEDTHROUGH GUIDE)

DEC 1998	3 – PHASE PRIMARY 24.9/14.4 kV	
RUS		VC6.52G





ITEM	QTY	MATERIAL
	2	VC5.71L Primary (Crossarm) Assembly
	2	VA1.011L Misc. Single Support
p		Connectors, as req'd
av		Jumpers, as req'd
eu	2	Link, extension, insulated, 12" min.

NOTE:
Vertical deadends, Dwg. "VC4.1," is preferred construction.

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD EQUALS LESSER OF:
5,000 lbs./Conductor, or
Manufacturer's Specifications

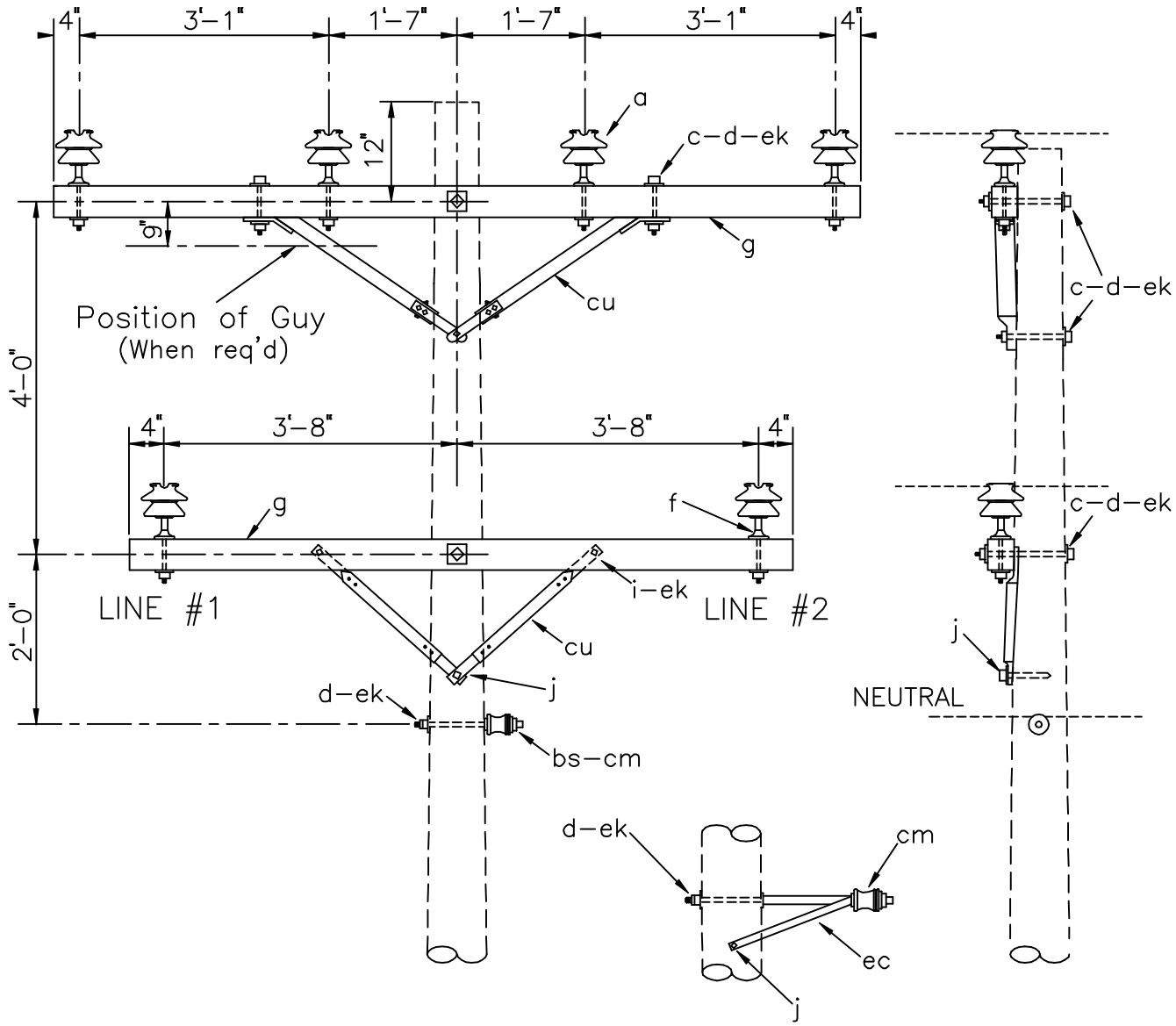
DOUBLE DEADENDS (BUCKARMS) GUIDE

DEC 1998	3 – PHASE PRIMARY 24.9/14.4 kV	VC6.91G
RUS		

INDEX D

DOUBLE CIRCUIT PRIMARY POLE TOP ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VD1.81, VD1.82	SINGLE SUPPORT ON CROSSARMS (TANGENT)
VD1.81L, VD1.82L	SINGLE SUPPORT ON CROSSARMS (TANGENT) (LARGE CONDUCTORS)
VD1.81P, VD1.82P	SINGLE SUPPORT ON CROSSARMS (TANGENT) (POST INSULATORS)
VD1.83	SINGLE SUPPORT ON CROSSARMS
VD1.83L	SINGLE SUPPORT ON CROSSARMS (LARGE CONDUCTORS)
VD1.83P	SINGLE SUPPORT ON CROSSARMS (POST INSULATORS)
VD2.91	DOUBLE SUPPORT ON CROSSARMS
VD2.91L	DOUBLE SUPPORT ON CROSSARMS (LARGE CONDUCTORS)
VD2.91P	DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)
VD3.1G	SUSPENSION ANGLE GUIDE
VD4.1G	DEADEND ANGLE GUIDE
VD5.91G	THREE PHASE TAP GUIDE
VD6.91	DOUBLE DEADENDS ON CROSSARMS (FEEDTHROUGH)



Specify VD1.82 for
offset neutral assembly

ASSEMBLY: VD1.		81	82
ITEM	MATERIAL	QTY	QTY
a	Insulater, pin type, (24.9/14.4 kV)	6	6
c	Bolt, machine, 1/2" x req'd length	2	2
c	Bolt, machine, 5/8 x req'd length	3	3
d	Washer, round, 1 3/8"	2	2
d	Washer, square, 2 1/4"	6	6
f	Pin, crossarm, steel, 5/8" x 14"	6	6
g	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"	1	1
g	Crossarm, 3 5/8" x 4 5/8" x 10'– 0"	1	1

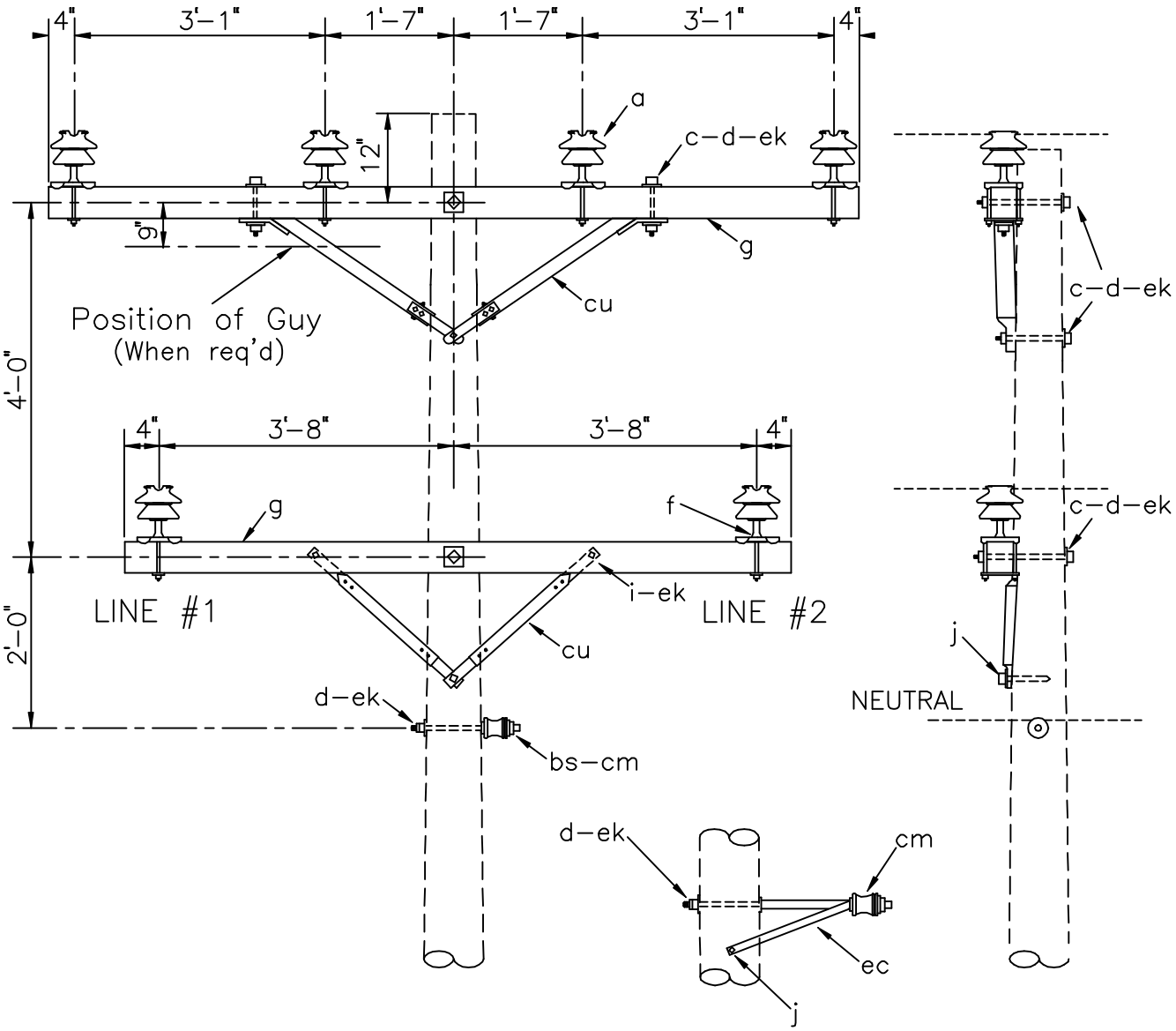
ASSEMBLY: VD1.		81	82
ITEM	MATERIAL	QTY	QTY
i	Bolt, carriage, 3/8" x 4 1/2"	2	2
j	Screw, lag, 1/2" x 4"	1	3
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
cu	Brace, wood, 60" span	1	1
ec	Bracket, offset, neutral		1
ek	Locknuts	8	8

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT ON CROSSARMS (TANGENT)

DEC 1998	DOUBLE CIRCUIT PRIMARY	VD1.81,
RUS	24.9/14.4 kV	VD1.82



Specify VD1.82L for offset neutral assembly

ASSEMBLY: VD1.		81L	82L
ITEM	MATERIAL	QTY	QTY
a	Insulater, pin type, (24.9/14.4 kV)	6	6
c	Bolt, machine, 1/2" x req'd length	2	2
c	Bolt, machine, 5/8 x req'd length	3	3
d	Washer, round, 1 3/8"	2	2
d	Washer, square, 2 1/4"	6	6
f	Pin, crossarm, steel, clamp type	6	6
g	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"	1	1
g	Crossarm, 3 5/8" x 4 5/8" x 10'– 0"	1	1

ASSEMBLY: VD1.		81L	82L
ITEM	MATERIAL	QTY	QTY
i	Bolt, carraige, 3/8" x 4 1/2"	2	2
j	Screw, lag, 1/2" x 4"	1	3
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
cu	brace, wood, 60" span	1	1
ec	Bracket, offset, neutral		1
ek	Locknuts	8	8

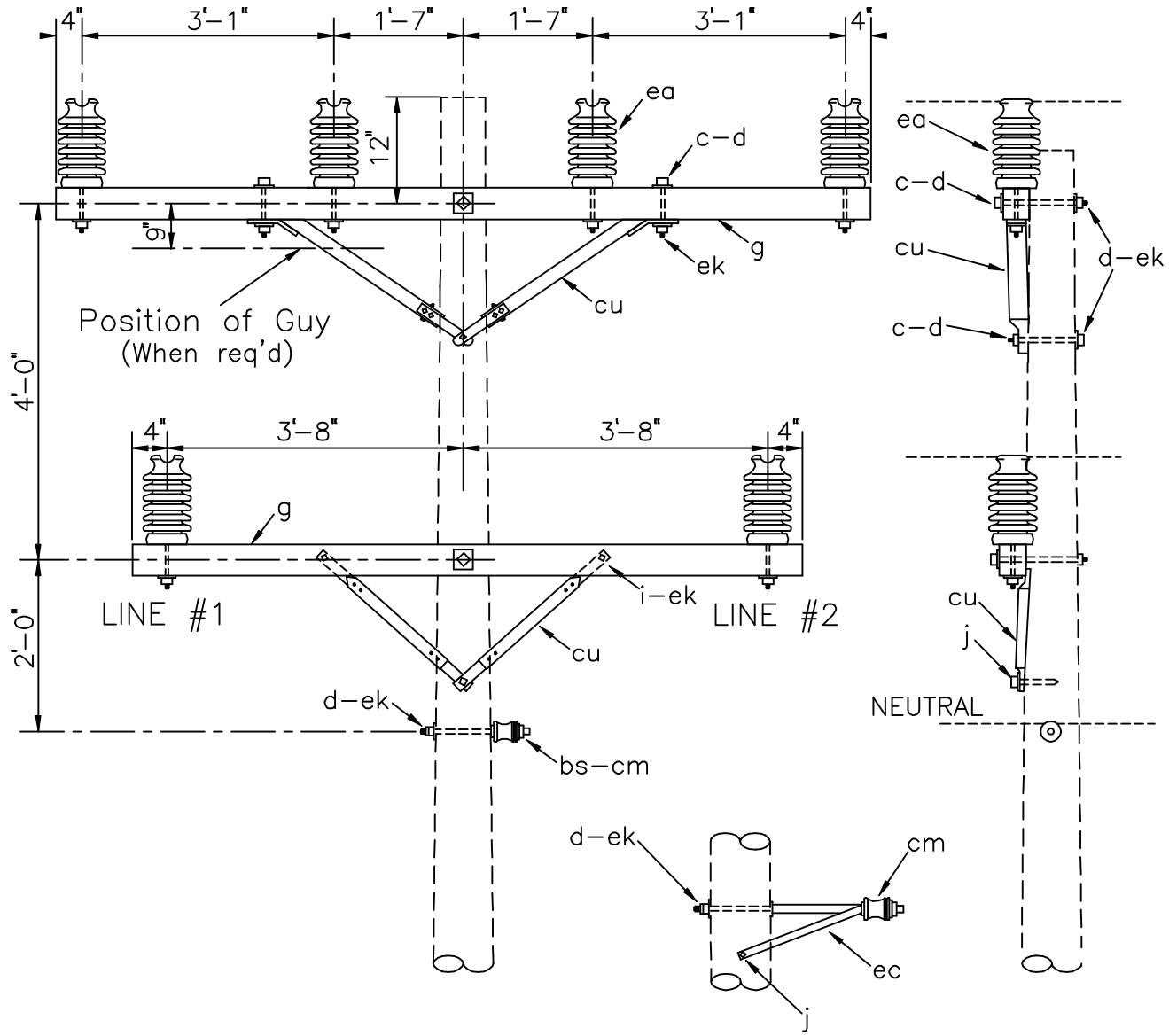
DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:

2° – Larger than #1/0

SINGLE SUPPORT ON CROSSARMS (TANGENT) (LARGE CONDUCTORS)

DEC 1998	DOUBLE CIRCUIT PRIMARY	VD1.81L,
RUS	24.9/14.4 kV	VD1.82L



Specify VD1.82P for offset neutral assembly

ASSEMBLY: VD1.

ITEM	MATERIAL	81P QTY	82P QTY
c	Bolt, machine, 1/2" x req'd length	2	2
c	Bolt, machine, 5/8 x req'd length	3	3
d	Washer, round, 1 3/8"	2	2
d	Washer, square, 2 1/4"	6	6
g	Crossarm, 3 5/8" x 4 5/8" x 8' – 0"	1	1
g	Crossarm, 3 5/8" x 4 5/8" x 10'– 0"	1	1
i	Bolt, carriage, 3/8" x 4 1/2"	2	2
j	Screw, lag, 1/2" x 4	1	3

ASSEMBLY: VD1.

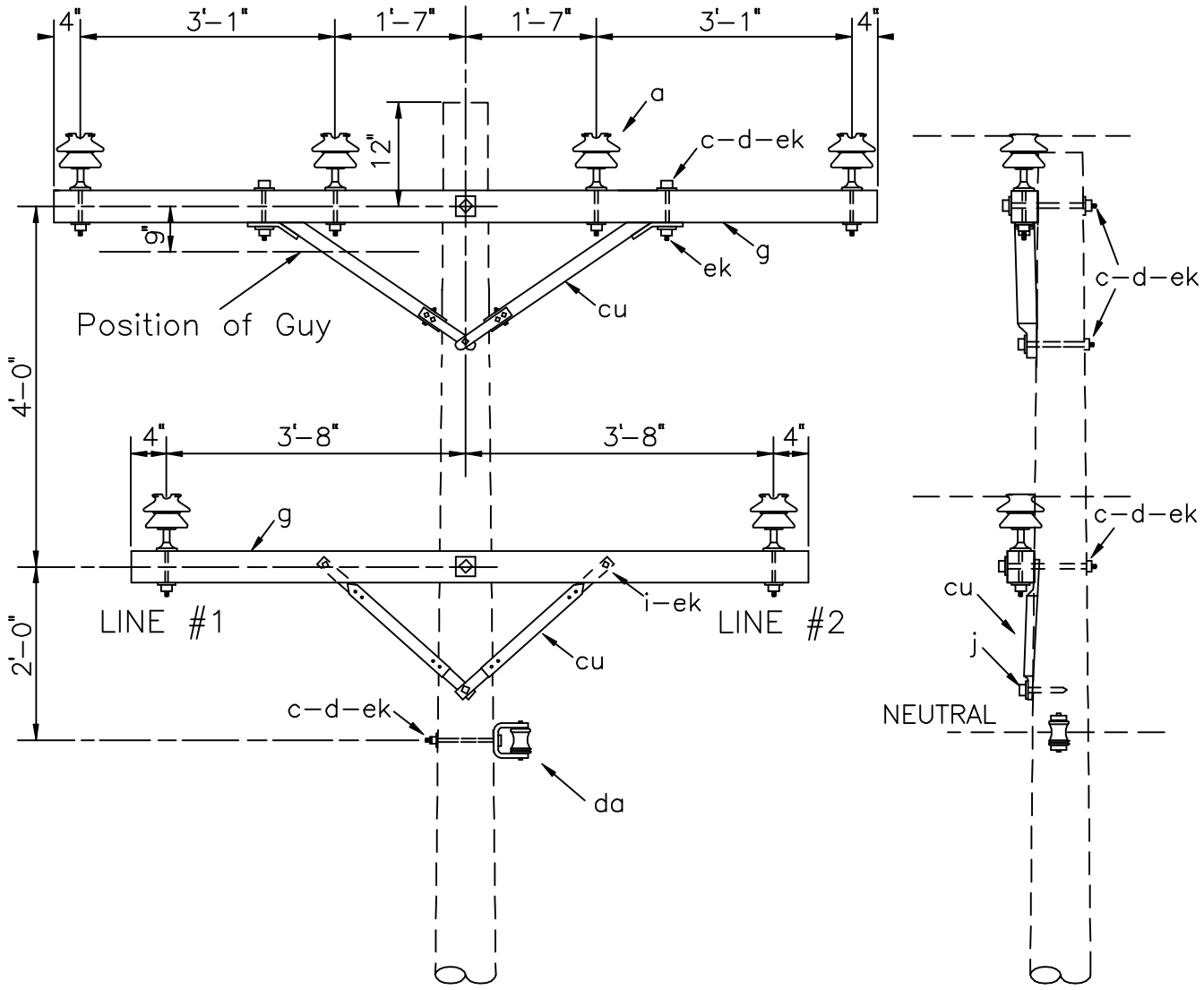
ITEM	MATERIAL	81P QTY	82P QTY
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
cu	Brace, 28"	2	2
cu	Brace, wood, 60" span	1	1
ea	Insulator, post type, (24.9/14.4 kV)	6	6
ec	Bracket, offset, neutral		1
ek	Locknuts	8	8

DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

SINGLE SUPPORT ON CROSSARMS (TANGENT) (POST INSULATORS)

DEC 1998	DOUBLE CIRCUIT PRIMARY	VD1.81P,
RUS	24.9/14.4 kV	VD1.82P



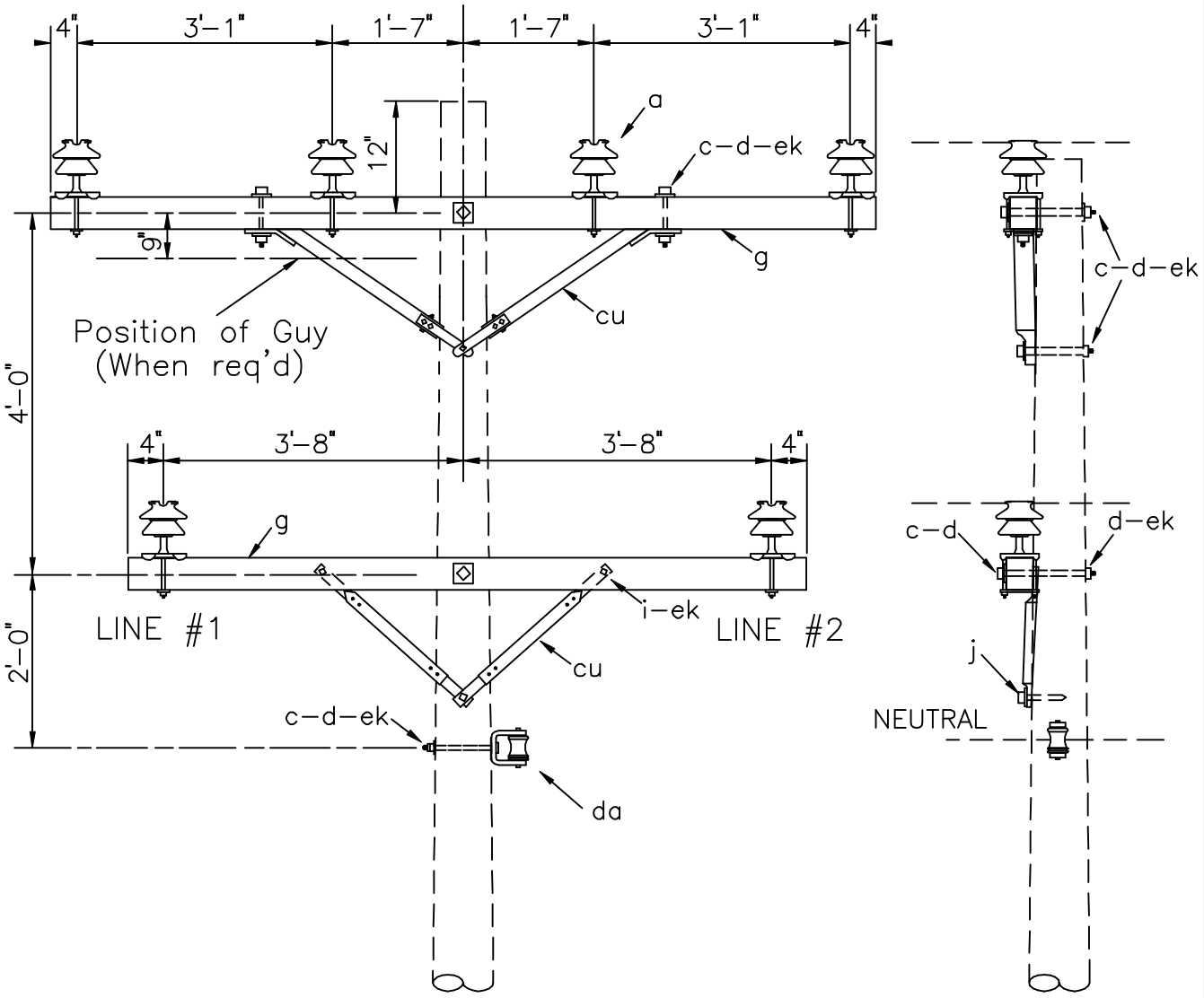
ITEM	QTY	MATERIAL
a	6	Insulator, pin type, (24.9/14.4 kV)
c	2	Bolt, machine, 1/2" x req'd length
c	4	Bolt, machine, 5/8" x length
d	2	Washer, round, 1 3/8"
d	6	Washer, square, 2 1/4"
f	6	Pin, crossarm, steel, 5/8" x 14"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"

ITEM	QTY	MATERIAL
g	1	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
cu	1	Brace, wood, 60" span
da	1	Bracket, insulated
ek	8	Locknuts

DESIGN PARAMETERS:
See Table II

SINGLE SUPPORT ON CROSSARMS

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD1.83



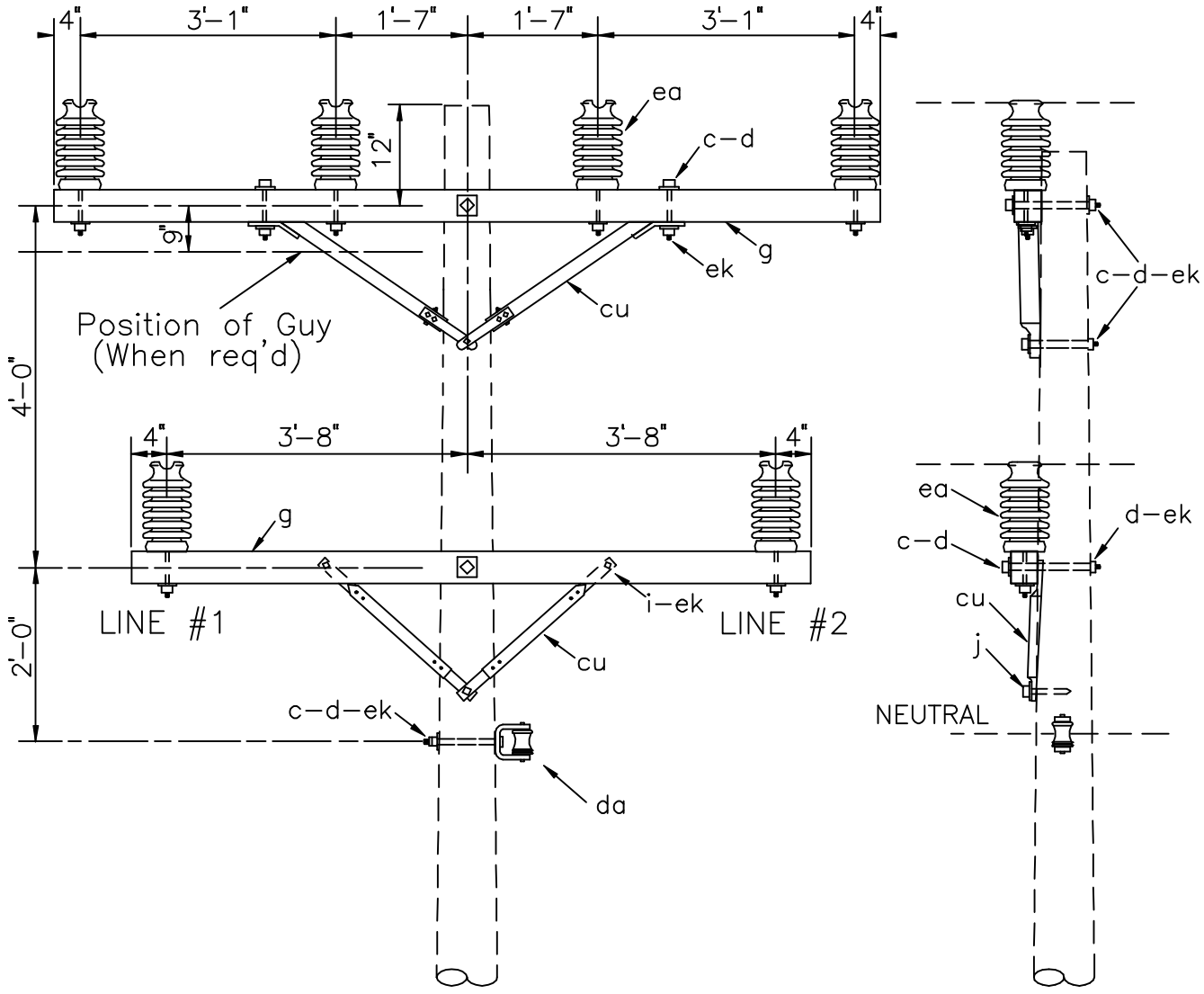
ITEM	QTY	MATERIAL
a	6	Insulator, pin type, (24.9/14.4 kV)
c	2	Bolt, machine, 1/2" x req'd length
c	3	Bolt, machine, 5/8" x length
d	2	Washer, round, 1 3/8"
d	6	Washer, square, 2 1/4"
f	6	Pin, crossarm, steel, clamp type
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"

ITEM	QTY	MATERIAL
g	1	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
cu	1	Brace, wood, 60" span
da	1	Bracket, insulator
ek	8	Locknuts

DESIGN PARAMETERS:
See Table III

SINGLE SUPPORT ON CROSSARMS (LARGE CONDUCTORS)

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD1.83L



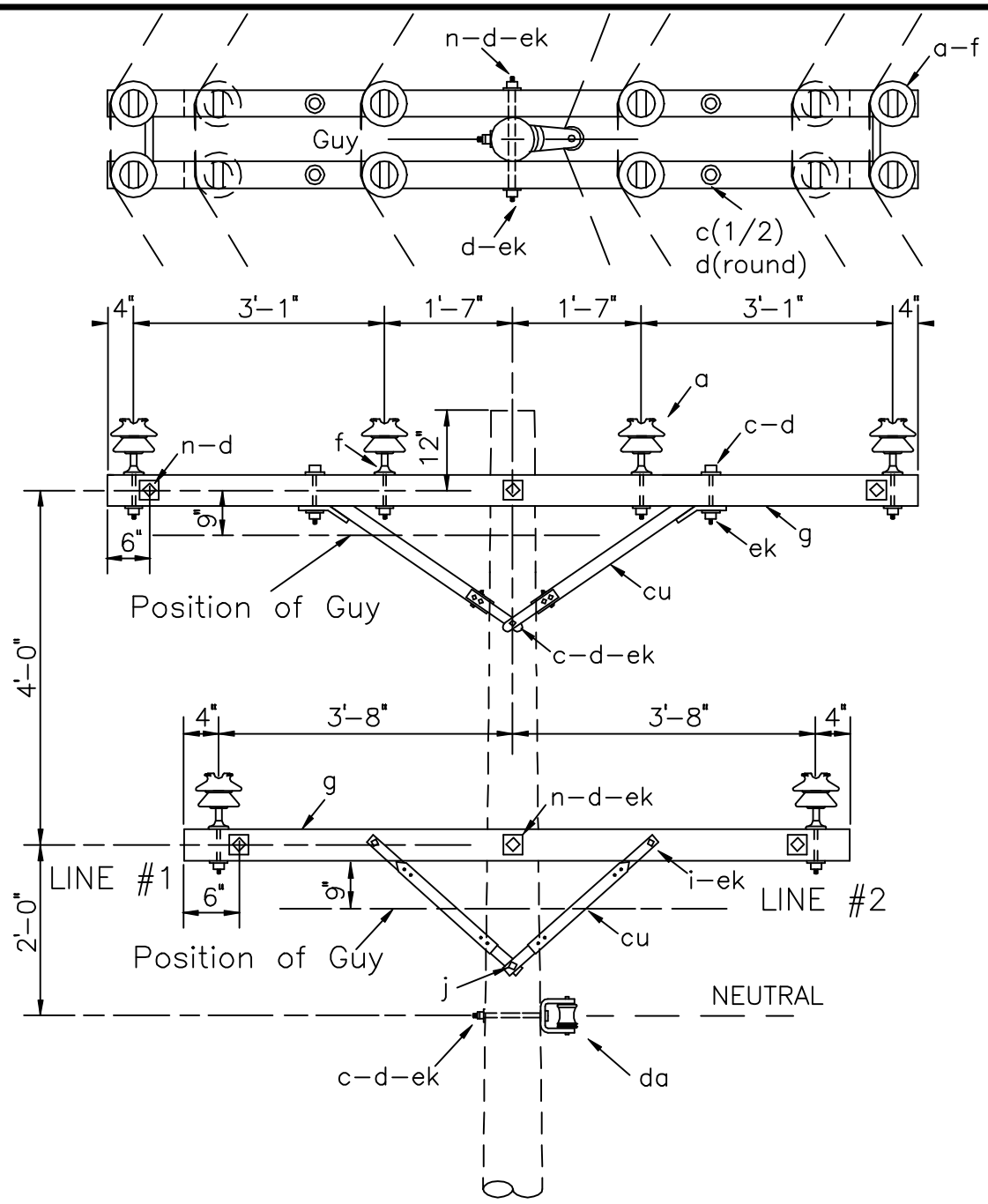
ITEM	QTY	MATERIAL
c	2	Bolt, machine, 1/2" x req'd length
c	3	Bolt, machine, 5/8" x req'd length
d	2	Washer, round, 1 3/8"
d	6	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
g	1	Crossarm, 2 5/8" x 4 5/8" x 10'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"

ITEM	QTY	MATERIAL
j	1	Screw, lag, 1/2" x 4"
cu	2	Brace, 28"
cu	1	Brace, wood, 60" span
da	1	Bracket, insulated
ea	6	Insulator, post type, (24.9/14.4 kV)
ek	8	Locknuts

DESIGN PARAMETERS:
See Table II

SINGLE SUPPORT ON CROSSARMS (POST INSULATORS)

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD1.83P



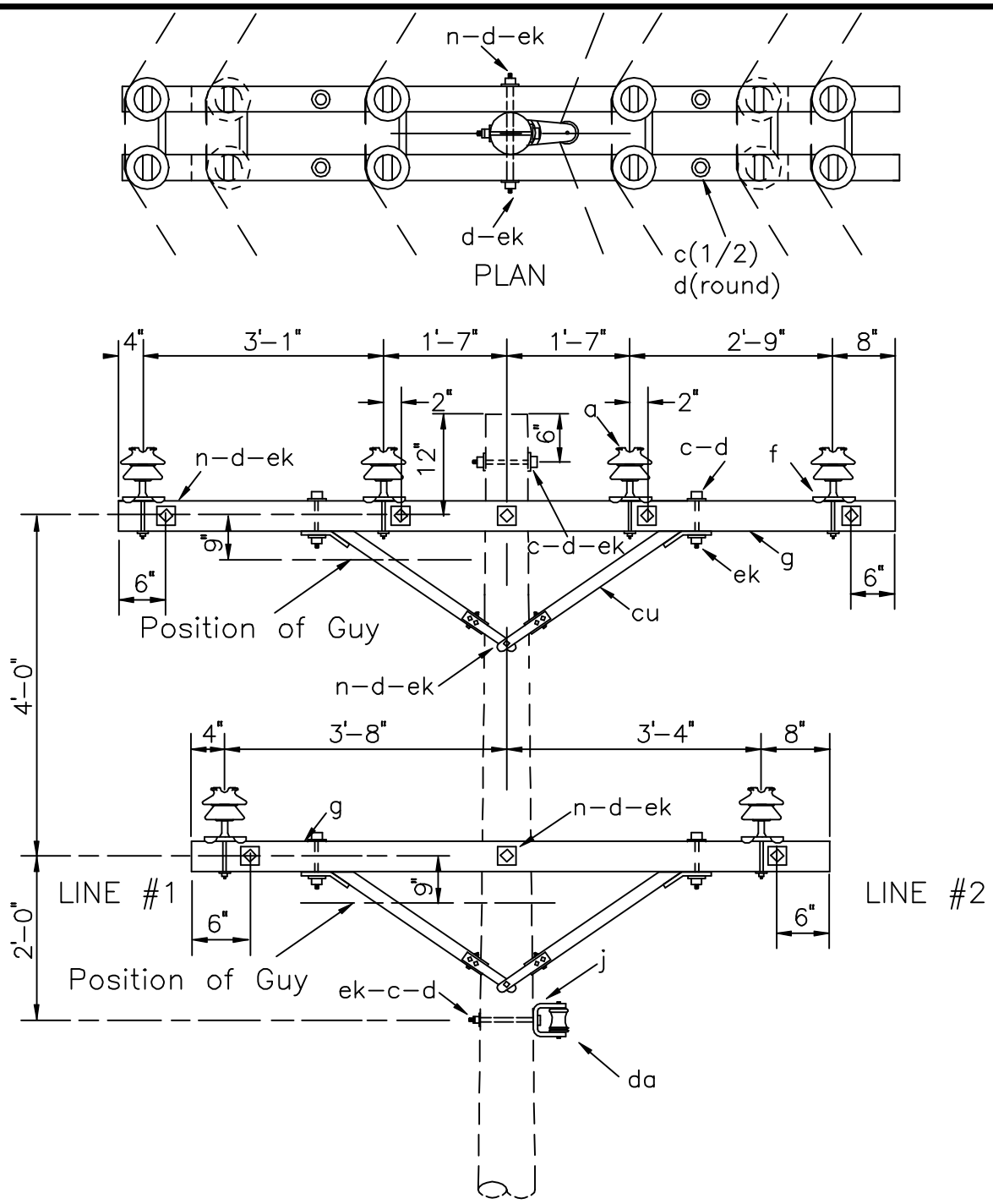
ITEM	QTY	MATERIAL
a	12	Insulator, pin type (24.9/14.4 kV)
c	4	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x length
d	4	Washer, round, 1 3/8"
d	22	Washer, square, 2 1/4"
f	12	Pin, crossarm, steel, 5/8" x 14"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"

ITEM	QTY	MATERIAL
i	4	Bolt, carriage, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"
n	6	Bolt,double arming, 5/8"xreq'd length
cu	4	Brace, 28"
cu	2	Brace, wood, 60" span
da	1	Bracket, insulated
ek	26	Locknuts

DESIGN PARAMETERS:
See Table IV

DOUBLE SUPPORT ON CROSSARMS

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD2.91



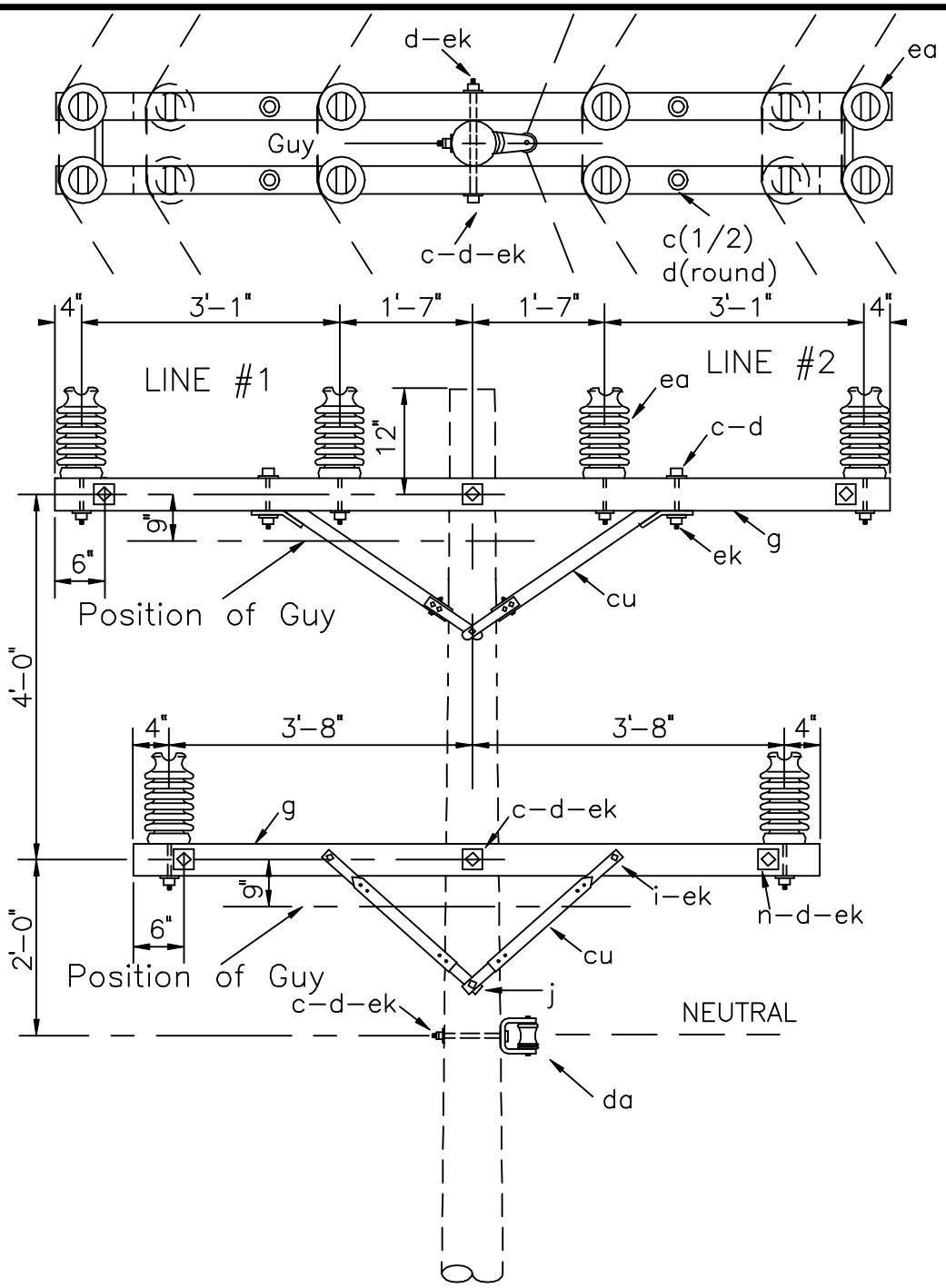
ITEM	QTY	MATERIAL
a	12	Insulator, pin type (24.9/14.4 kV)
c	8	Bolt, machine, 1/2" x req'd length
c	2	Bolt, machine, 5/8" x req'd length
d	8	Washer, round, 1 3/8" diam.
d	33	Washer, square, 2 1/4"
f	12	Pin, crossarm, steel, clamp type
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"

ITEM	QTY	MATERIAL
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
j	2	Screw, lag, 1/2" x 4"
n	10	Bolt,double arming, 5/8" x req'd length
cu	4	Brace, wood, 60" span
da	1	Bracket, insulated
ek	42	Locknuts

DESIGN PARAMETERS:
See Table V

DOUBLE SUPPORT ON CROSSARMS (LARGE CONDUCTORS)

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD2.91L



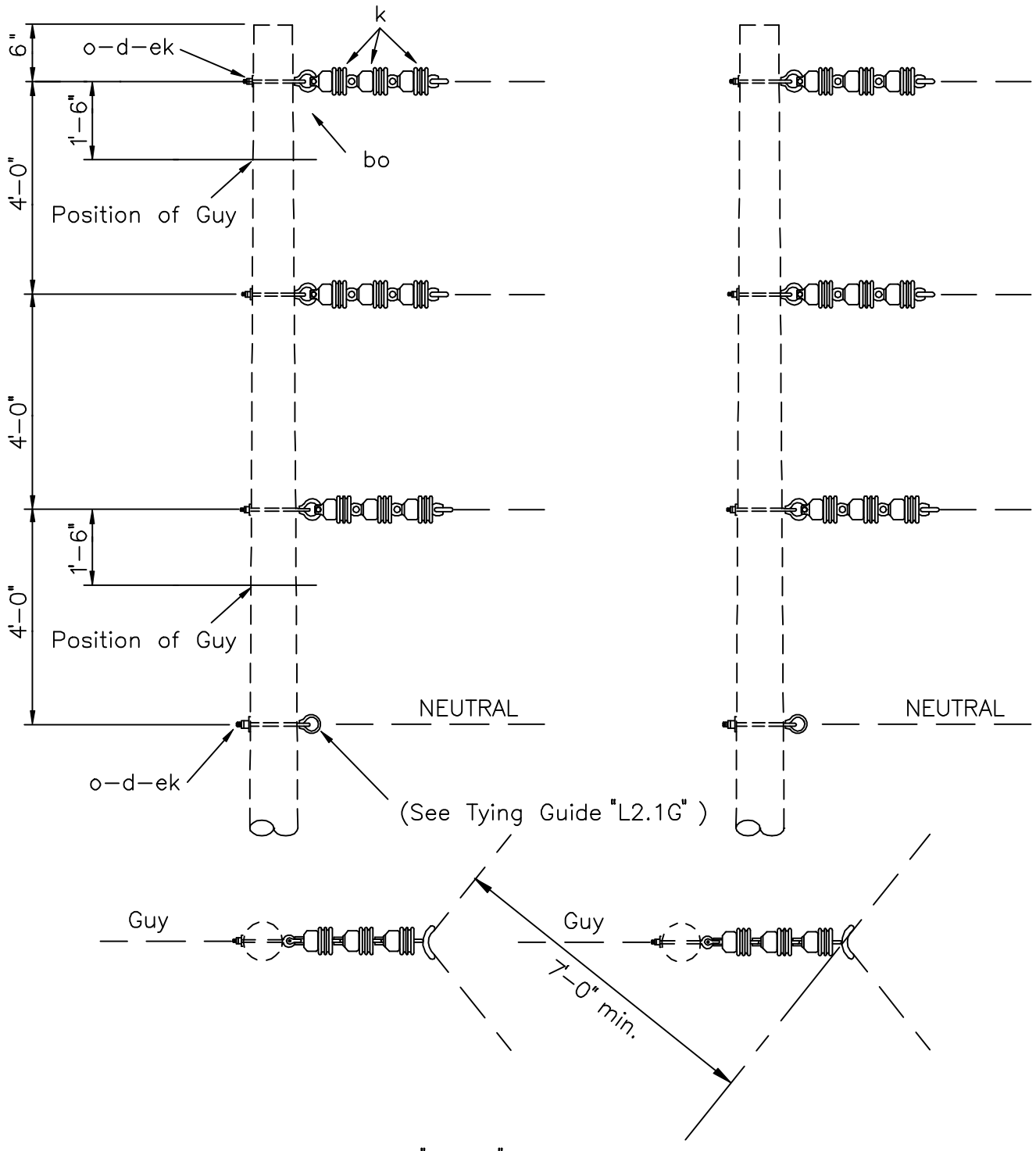
ITEM	QTY	MATERIAL
c	4	Bolt, machine, 1/2" x req'd length
c	4	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	22	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	4	Bolt, carriage, 3/8" x 4 1/2"

ITEM	QTY	MATERIAL
j	2	Screw, lag, 1/2" x 4"
n	4	Bolt,double arming, 5/8"x req'd length
cu	4	Brace, 28"
cu	2	Brace, wood, 60" span
da	1	Bracket, insulated
ea	12	Insulator, post type, (24.9/14.4 kV)
ek	28	Locknuts

DESIGN PARAMETERS:
See Table IV

DOUBLE SUPPORT ON CROSSARMS (POST INSULATORS)

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD2.91P



NOTE: For large conductors, use two "VC3.2L" assemblies and designate as "VD3.2LG"

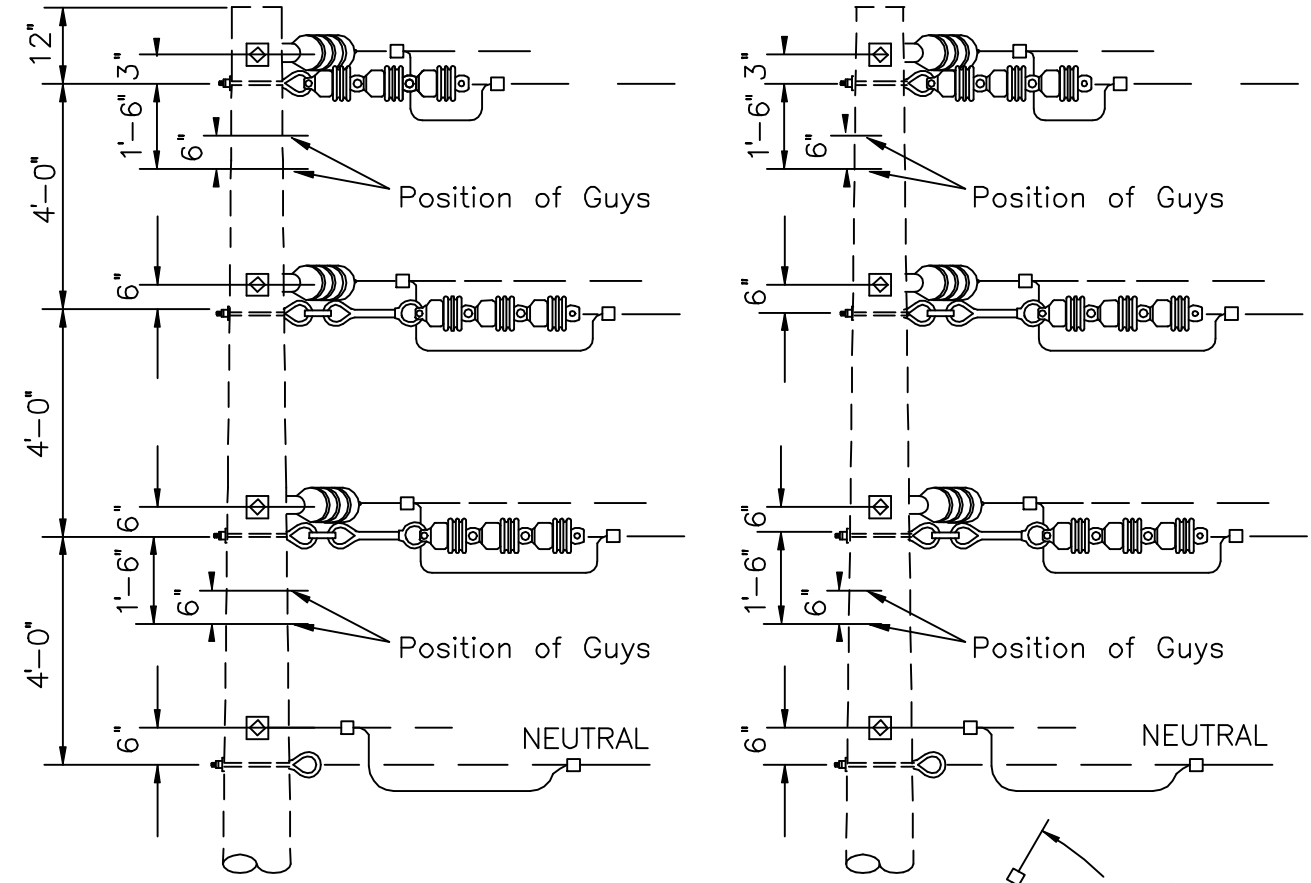
ITEM	QTY	MATERIAL
	2	"VC3.1" Primary Assembly Unit

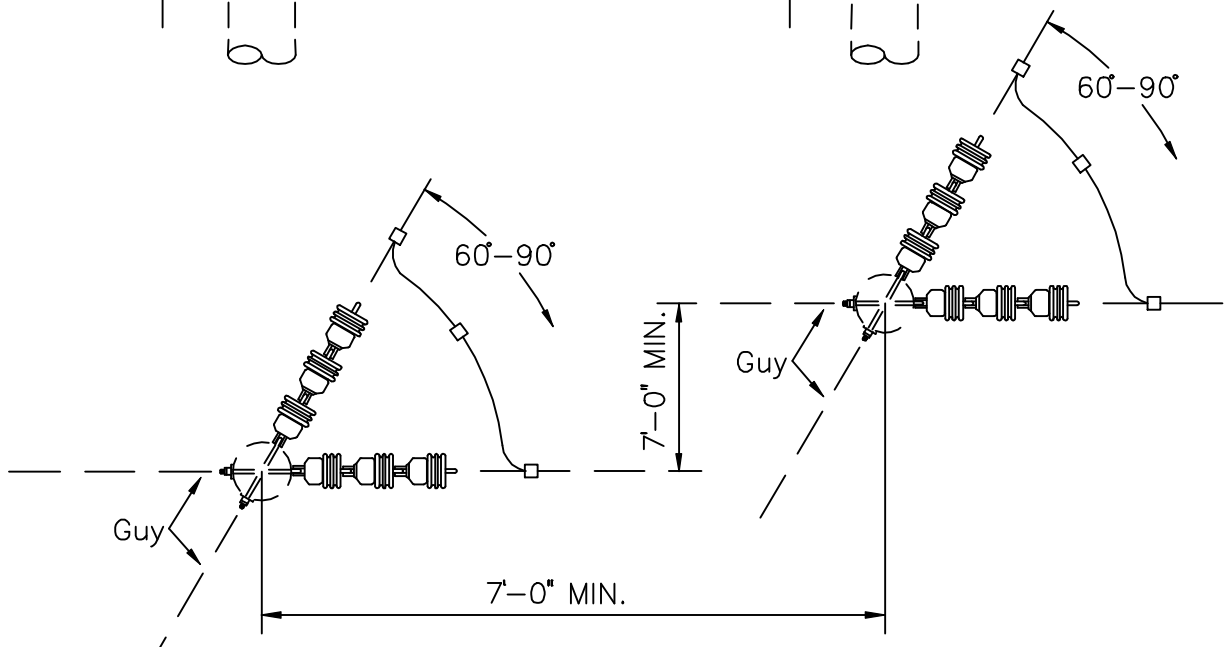
DESIGN PARAMETERS:

See: "VC3.1"
"VC3.2L"

SUSPENSION ANGLE GUIDE

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD3.1G





NOTE: For large conductors, use two "VC4.2L" assemblies and designate as "VD4.2LG"

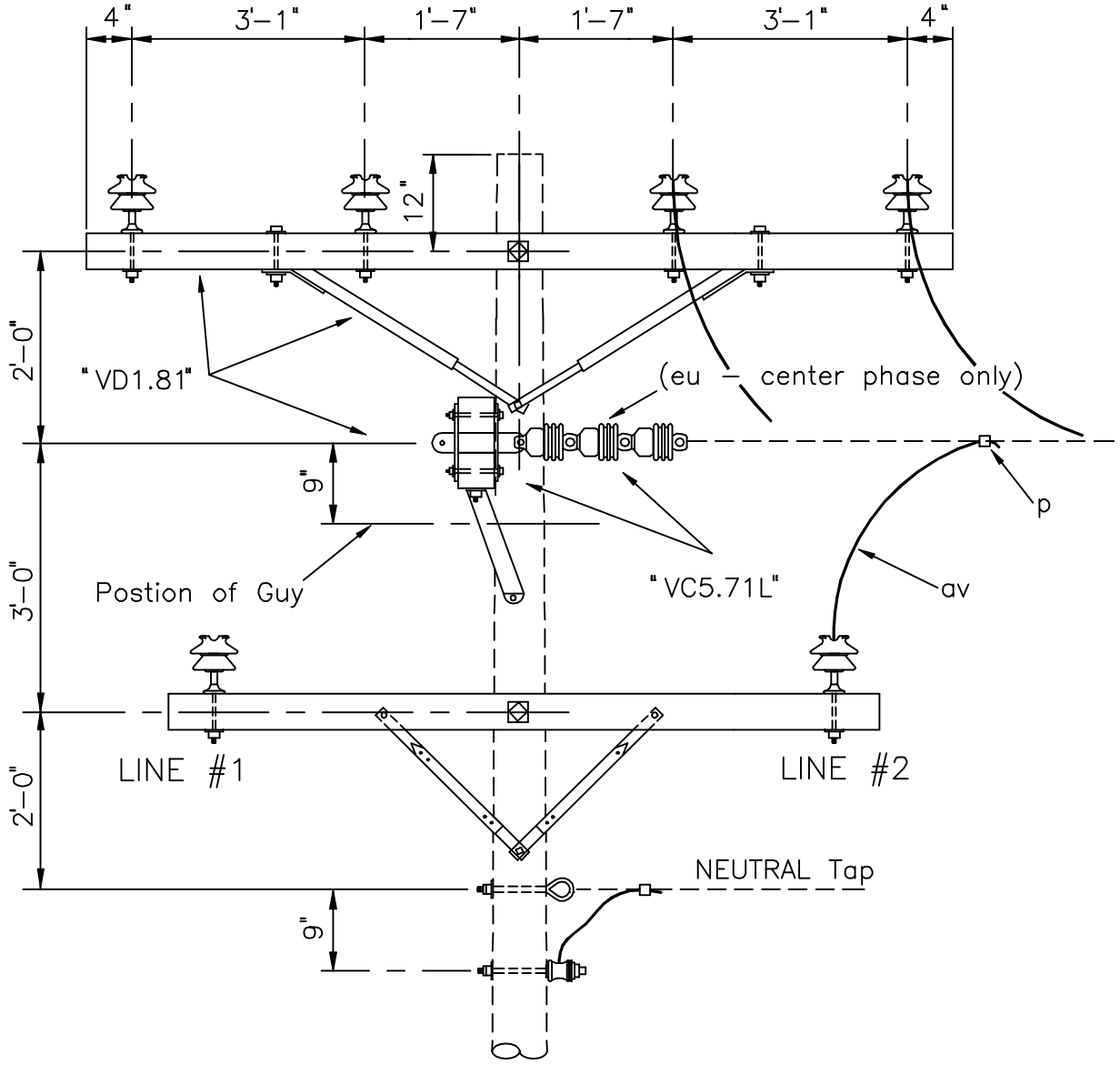
ITEM	QTY	MATERIAL
	2	"VC4.1" Primary Assembly Unit

DESIGN PARAMETERS:

See: "VC4.1"
"VC4.2L"

DEADEND ANGLE GUIDE

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD4.1G



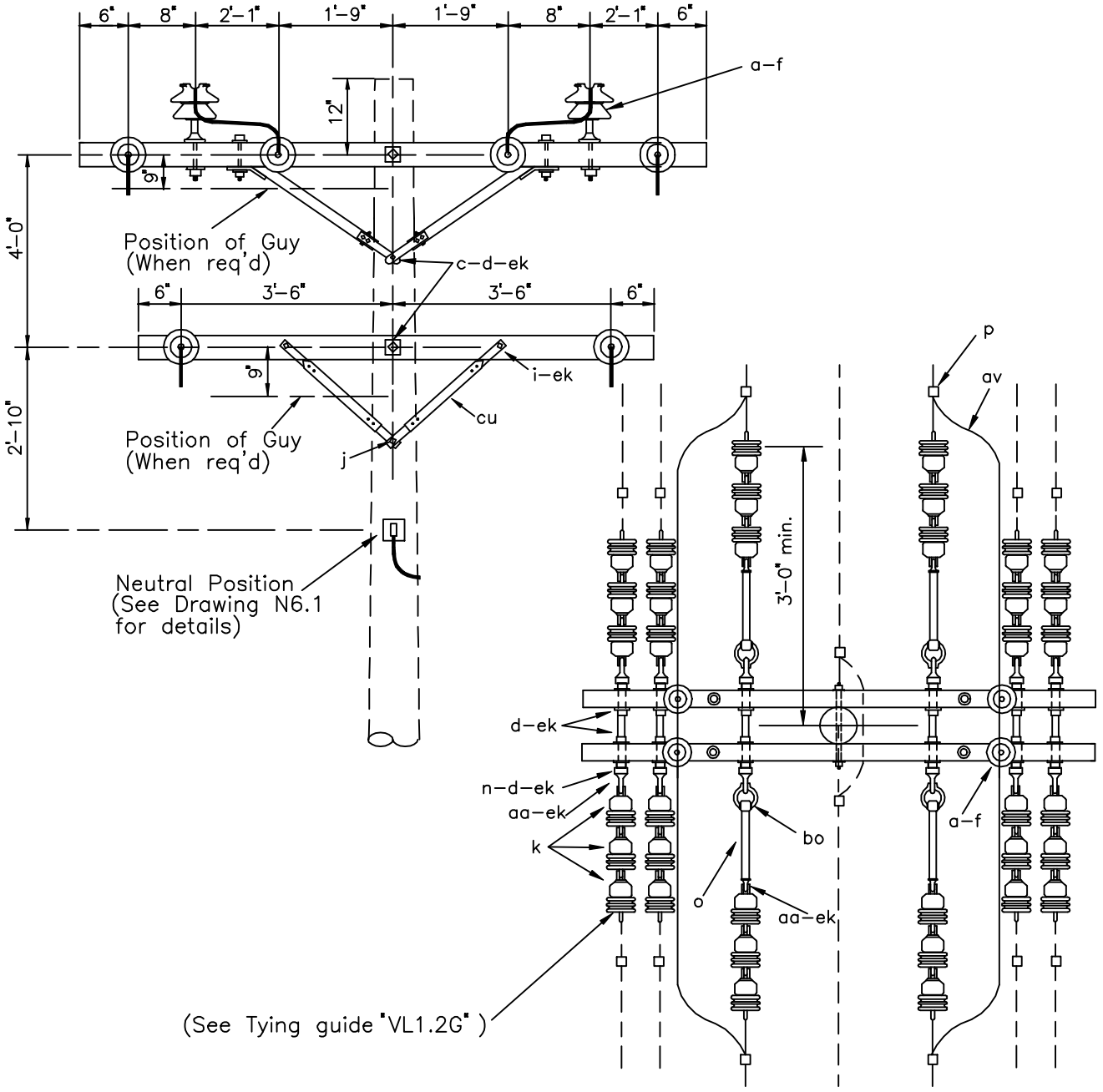
ITEM	QTY	MATERIAL
	1	VC5.71L Primary Assembly
	1	VD1.81 Primary Assembly
p		Connectors, as required
av		Jumpers, as required
eu		Link, extension, insulated, 12" min.

DESIGN PARAMETERS:

SEE: "VC5.71L"
"VD1.81"

THREE PHASE TAP GUIDE

DEC 1998 RUS	DOUBLE CIRCUIT PRIMARY 24.9/14.4 kV	VD5.91G



ITEM	QTY	MATERIAL
a	4	Insulator, pin type (24.9/14.4 kV)
c	4	Bolt, machine, 1/2" x req'd length
c	3	Bolt, machine, 5/8" x length
d	4	Washer, round, 1 3/8"
d	31	Washer, square, 2 1/4"
f	2	Pin, crossarm, steel, 5/8" x 14"
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"
i	4	Bolt, carraige, 3/8" x 4 1/2"
j	2	Screw, lag, 1/2" x 4"

ITEM	QTY	MATERIAL
k	36	Insulator, suspension, 4 1/2"
n	7	Bolt, double arm, 5/8 x req'd length
o	4	Bolt, eye, 5/8" x req'd length
p		Connectors, as req'd
aa	18	Nut, eye
av		Jumpers, as req'd
bo	4	Shackle, anchor
cu	2	Brace, wood, 60" span
cu	4	Brace, 28"
ek	51	Locknuts

DESIGN PARAMETERS:

ALLOWABLE UNBALANCED
LONGITUDINAL TENSION:
1,000 lbs./Conductor

(See Notes on Drawing "VC6.51")

DOUBLE DEADENDS ON CROSSARMS (FEEDTHROUGH)

DEC 1998	DOUBLE CIRCUIT PRIMARY	
RUS	24.9/14.4 kV	VD6.91

INDEX E

GUYING ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
E1.1	SINGLE DOWN GUY (THROUGH BOLT TYPE)
E1.01, E2..01	SINGLE OVERHEAD GUY (THROUGH BOLT TYPE)
E2.1	SINGLE DOWN GUY GUIDE - HEAVY DUTY (THROUGH BOLT TYPE)
E2.2G	DOUBLE DOWN GUY GUIDE - HEAVY DUTY (THROUGH BOLT TYPE)
E2.3G	THREE DOWN GUY GUIDE - HEAVY DUTY (THROUGH BOLT TYPE)
E3.1	SINGLE DOWN GUY (WRAPPED TYPE)
E4.1L	SINGLE DOWN GUY - LARGE CONDUCTORS (POLE BAND TYPE)
E4.4LG	FOUR DOWN GUY GUIDE - LARGE CONDUCTORS (POLE BAND TYPE)
E5.1G	GUY STRAIN INSULATOR GUIDE

CONSTRUCTION SPECIFICATIONS FOR GUYS

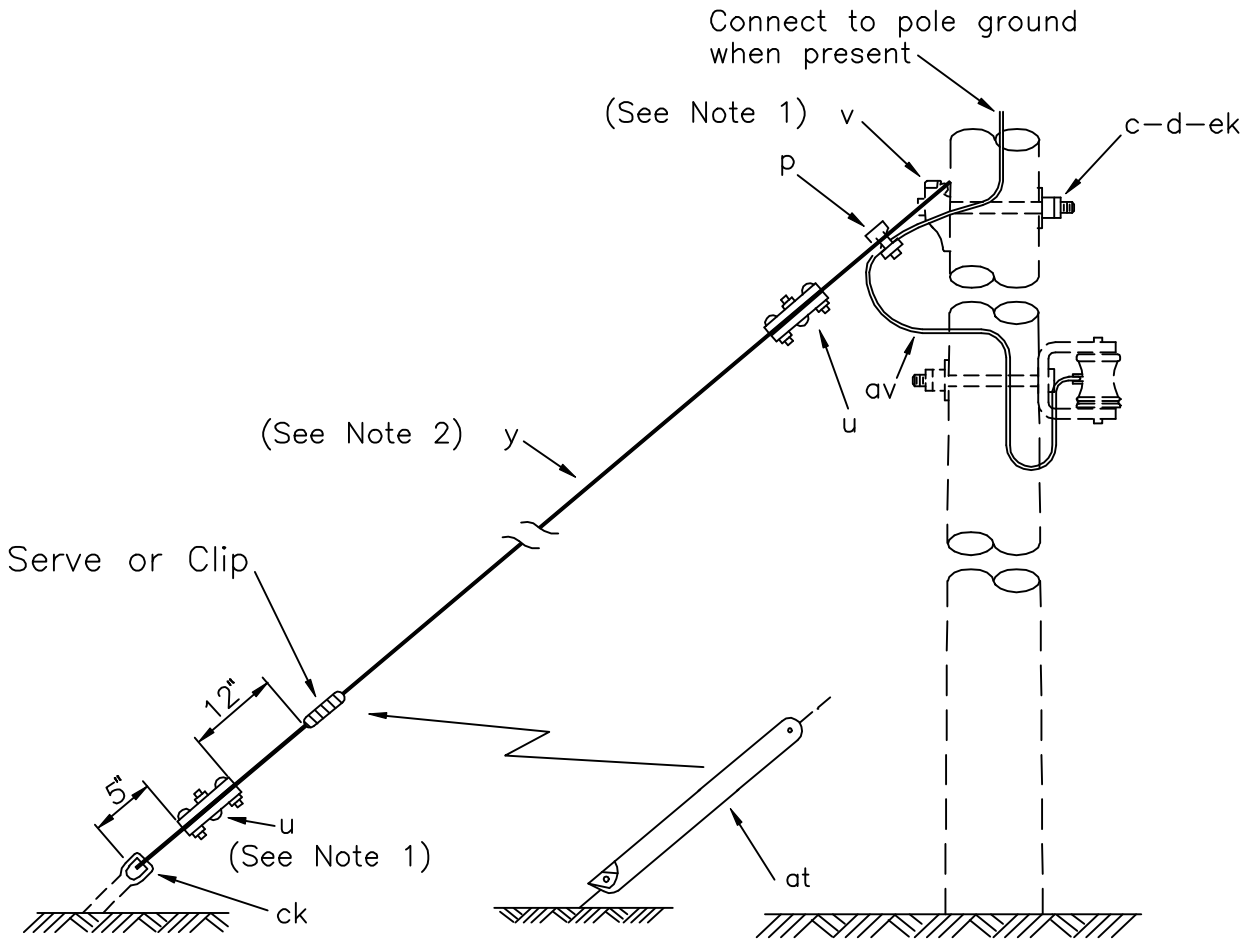
Guys shall be placed before the conductors are strung and shall be attached to the pole as shown in the construction drawings.

The grade of construction of the guys shall be the same as the structure or the highest grade required for any other conductors supported by the pole or structure.

Deadend structure guys shall be installed in line with the pull of conductors as nearly as practical. Bisector guys at an angle structure shall be installed as nearly as practical to the true bisector of the line angle.

A 1:1 slope for guy leads is recommended, especially on deadend structures. Minimum guy leads are not recommended.

The applicable NESC safety factors have not been but must be applied to determine the “allowable guy wire tension” as denoted in the design parameters of the guying assembly units.



NOTES:
1. Other accepted and equivalent guy deadend (item "u") and attachment (item "v") material may be substituted for the ones shown.
2. Specify guy wire size, type and required length.

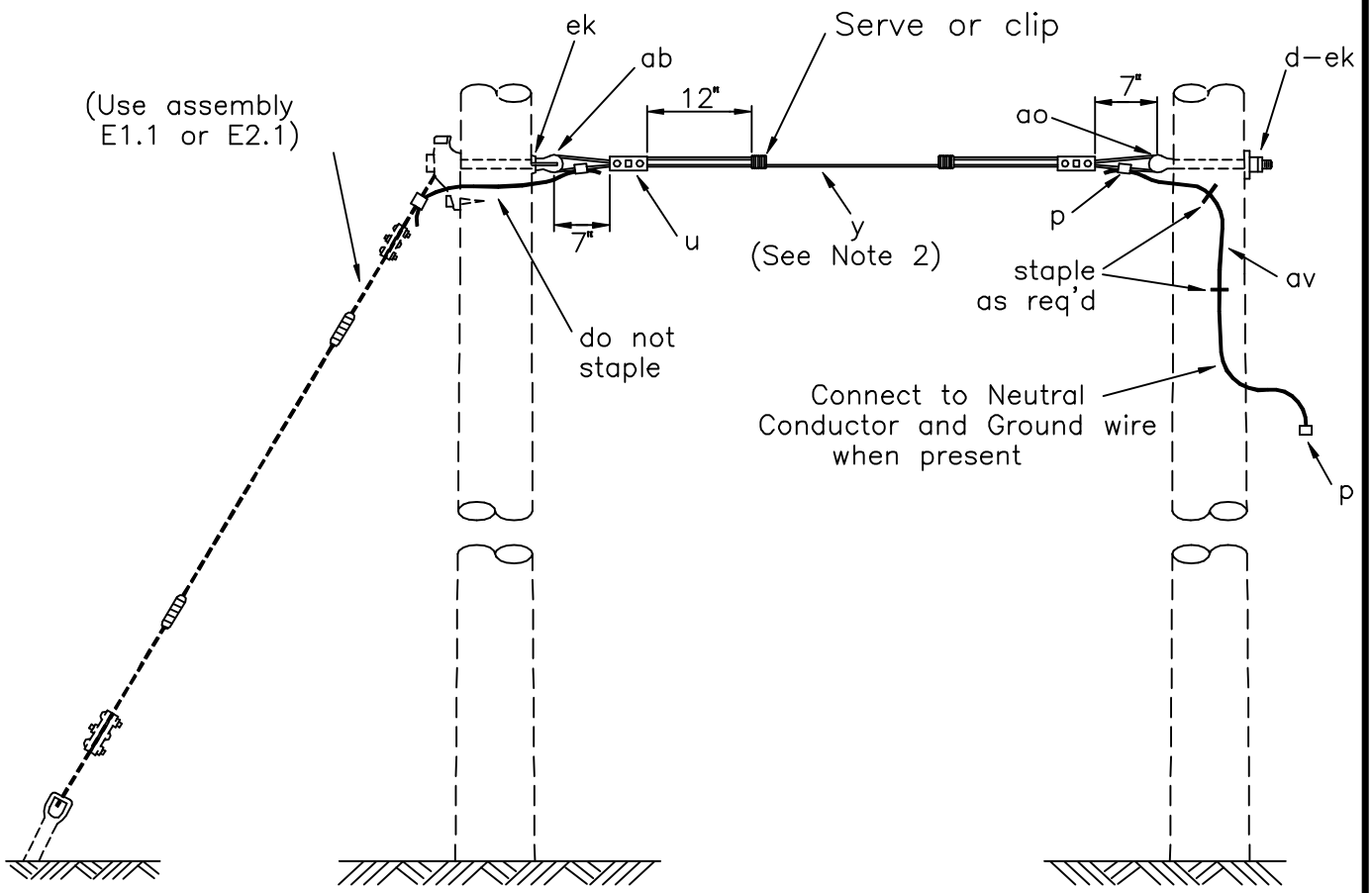
ITEM	QTY	MATERIAL
c	1	Bolt, machine, 5/8" x req'd length
d	1	Washer, square, 2 1/4"
p		Connectors, guy bond and as req'd
u	2	Deadend for guy strand (See Note 1)
v	1	Guy attachment (See Note 1)
y		Guy wire, as req'd (See Note 2)
at	1	Guy marker
av		Jumpers, as req'd
ck	1	Clamp, anchor bonding
ek	1	Locknuts

DESIGN PARAMETERS:

MAXIMUM WORKING
LOAD = LESSER OF
5,200 lbs HORIZONTAL
OR ALLOWABLE GUY WIRE TENSION

SINGLE DOWN GUY (THROUGH BOLT TYPE)

DEC 1998		
RUS		E1.1



NOTES:

1. Other accepted and equivalent, heavy duty, guy deadends (item "u"), may be substituted for the 3–bolt clamps shown.
2. Specify guy wire size, type and required length.
3. Wrapped type overhead guys may be used. See drawing E3.1.

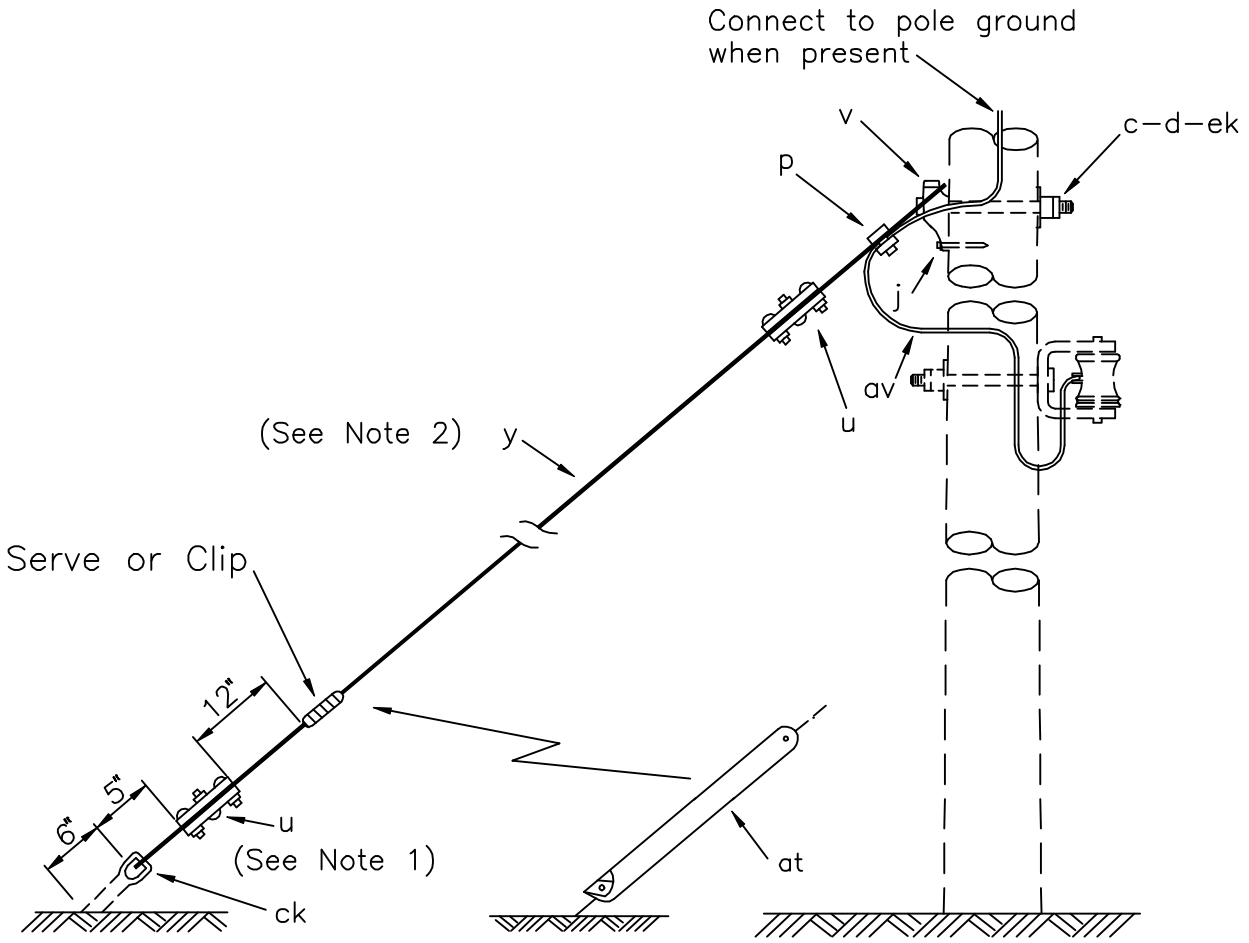
		ASSEMBLY:	E1.01	E2.01
ITEM	MATERIAL		QTY	QTY
d	Washer, square, 2 1/4"		1	
d	Washer, square, curved, 3" x 3"			1
p	Connectors, guy bond and as req'd			
u	Deadend for guy strand, heavy duty		2	2
y	Guy wire, as req'd (See Note 2)			
ab	Nut, thimble eye type, 5/8"		1	
ab	Nut, thimble eye type, 3/4"			1
ao	Bolt, thimble eye, 5/8" x req'd length		1	
ao	Bolt, thimble eye, 3/4" x req'd length			1
av	Jumpers, as req'd			
ek	Locknuts		2	2

DESIGN PARAMETERS:

MAXIMUM WORKING
LOAD = LESSER OF:
E1.01 5,200 lbs. HORIZONTAL
E2.01 8,500 lbs. HORIZONTAL
or ALLOWABLE GUY WIRE TENSION

SINGLE OVERHEAD GUY (THROUGH BOLT TYPE)

DEC 1998		E1.01,
RUS		E2.01



NOTES:

1. Other accepted and equivalent, heavy duty, guy deadend material (item "u") may be substituted for the ones shown.
2. Specify guy wire size, type and required length.

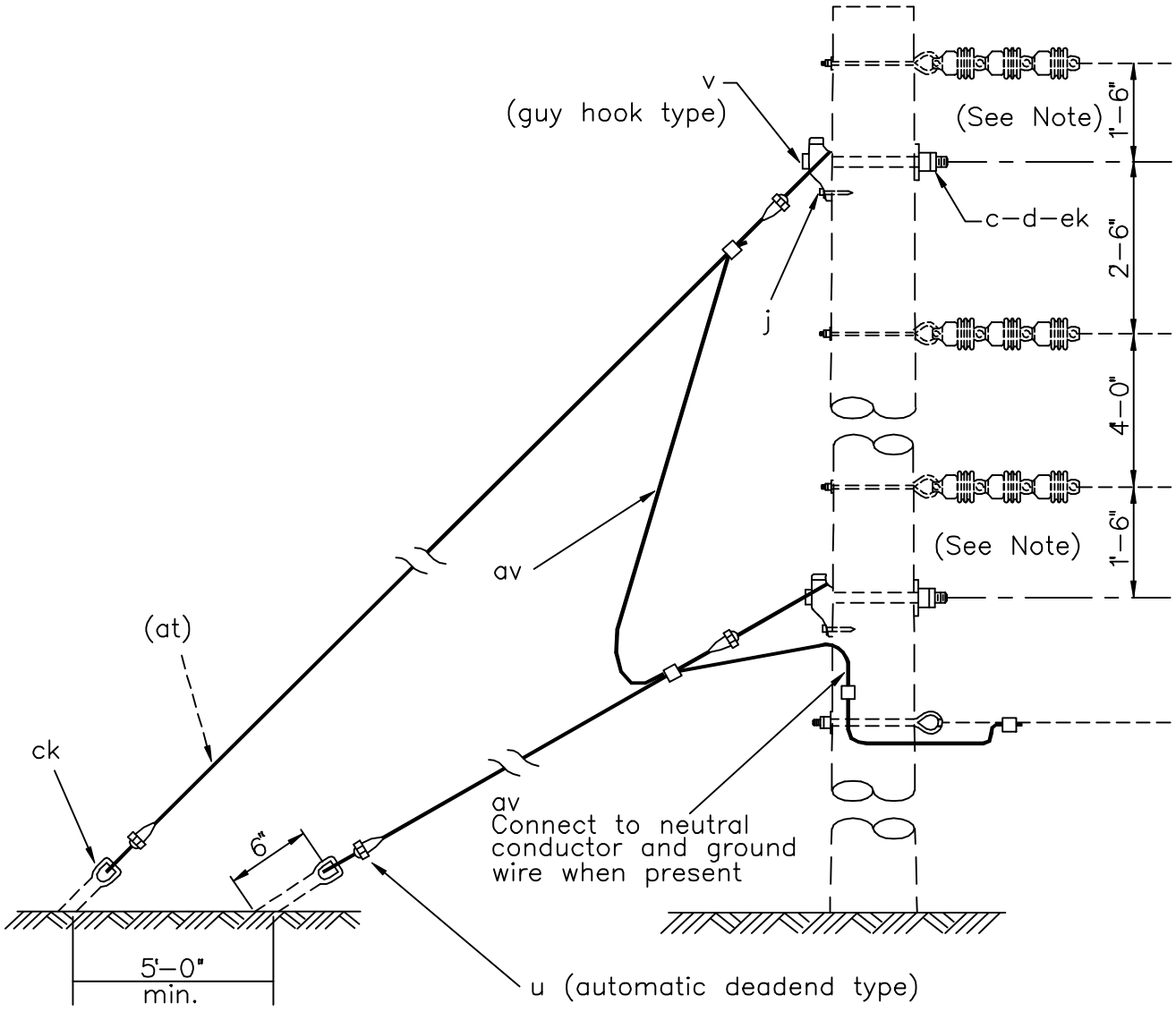
ITEM	QTY	MATERIAL
c	1	Bolt, machine, 3/4" x req'd length
d	1	Washer, square, 3", curved
p		Connectors, guy bond and as req'd
j	1	Screw, lag, 1/2" x 4"
u	2	Deadend for guy strand, heavy duty
v	1	Guy attachment, guy hook type
y		Guy wire, as req'd (See Note 2)
at	1	Guy marker
av		Jumpers, as req'd
ck	1	Clamp, anchor bonding
ek	1	Locknuts

DESIGN PARAMETERS:

MAXIMUM WORKING LOAD =
LESSER OF 8,500 lbs. HORIZONTAL
or ALLOWABLE GUY WIRE TENSION

SINGLE DOWN GUY – HEAVY DUTY (THROUGH BOLT TYPE)

DEC 1998		
RUS		E2.1



NOTES:
Position guys as shown on applicable pole top assembly unit if different than shown here. If distance between primary assembly and down guy is less than 12", install (minimum 12") guy strain insulator,(item "w"), or insulated extension link, (item "eu"), (mininum 12"), in primary assembly.

The following single down guy assemblies may be used,
(multiply material quantities by 2):

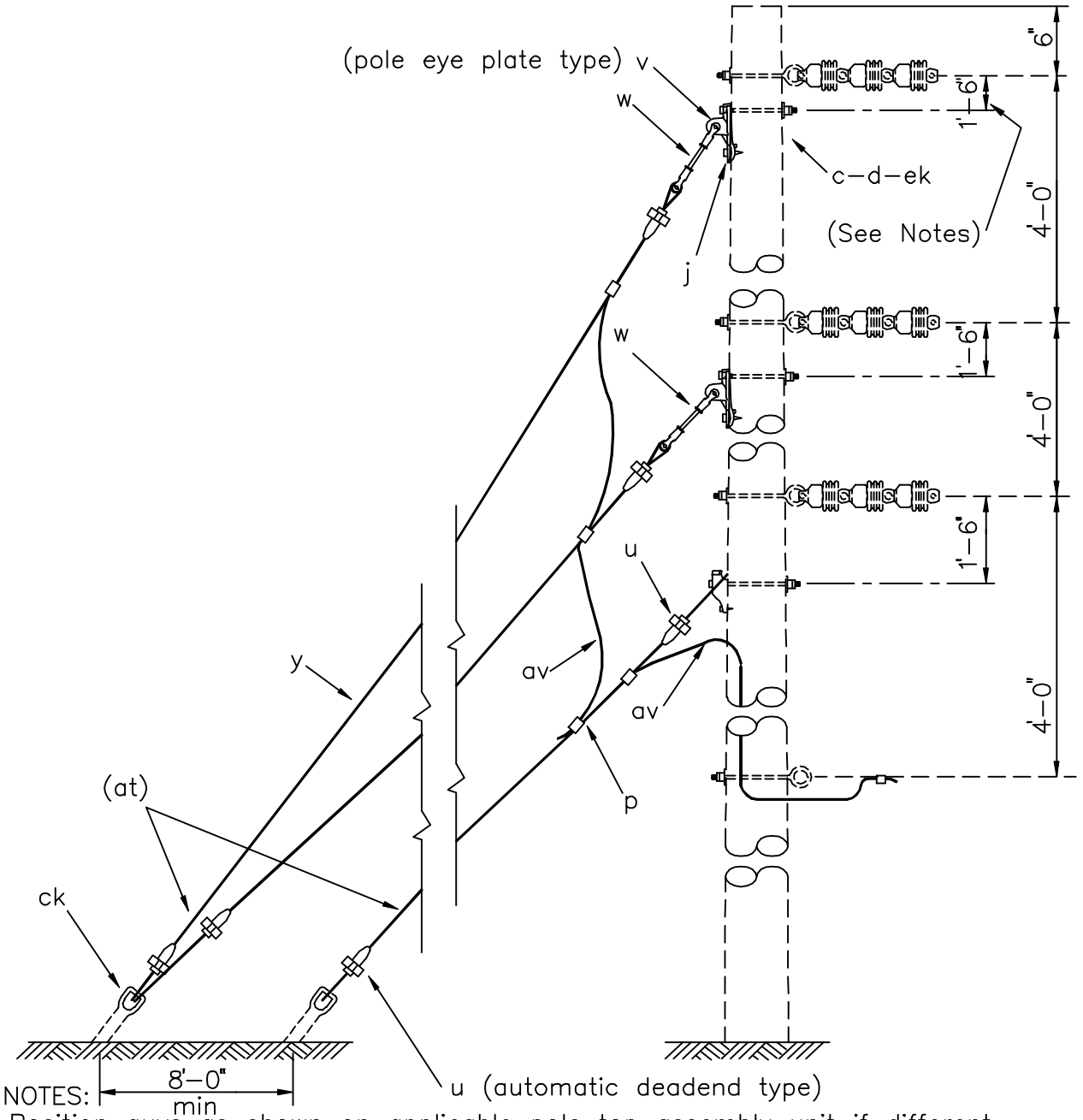
E1.1: Through Bolt Type
E2.1: Through Bolt Type, Heavy Duty (shown above)
E3.1: Wrapped Type
E4.1L: Pole Band Type

DESIGN PARAMETERS:

(See Single Down Guy drawings)

DOUBLE DOWN GUY GUIDE – HEAVY DUTY (THROUGH BOLT TYPE)

DEC 1998		
RUS		E2.2G



NOTES:

Position guys as shown on applicable pole top assembly unit if different than shown here. If distance between primary assembly and down guy is less than 12", install (minimum 12") guy strain insulator,(item "w"), or insulated extension link, (item "eu"), (mininum 12"), in primary assembly.

The following single down guy assemblies may be used,
(multiply material quantities by 3):

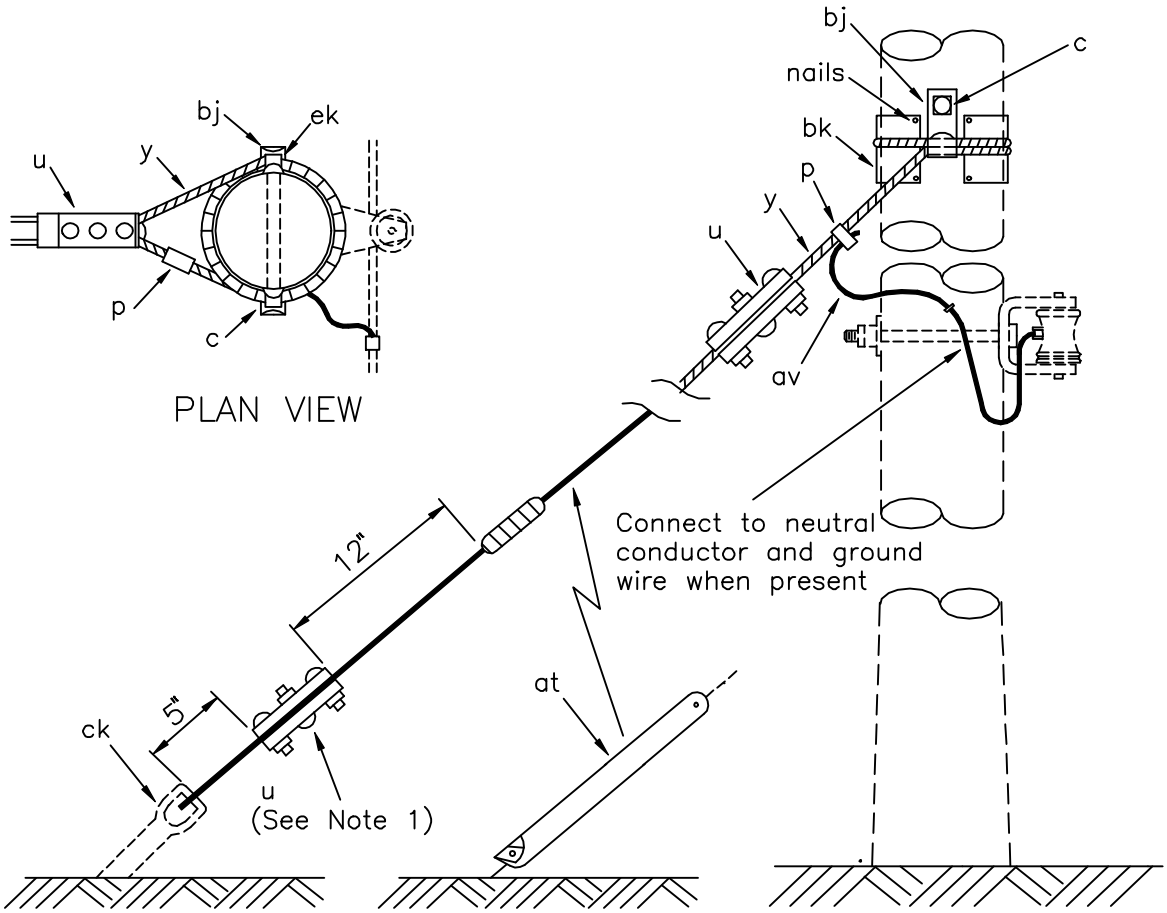
E1.1: Through Bolt Type
E2.1: Through Bolt Type, Heavy Duty (shown above)
E3.1: Wrapped Type
E4.1L: Pole Band Type

DESIGN PARAMETERS:

(See Single Down Guy drawings)

THREE DOWN GUY GUIDE – HEAVY DUTY (THROUGH BOLT TYPE)

DEC 1998		
RUS		E2.3G



NOTES:

1. Other accepted and equivalent, heavy duty, guy clamps, (item "u"), may be substituted for the 3-bolt clamps shown
2. Specify guy wire size, type and required length.
3. Assembly E2.1 is preferred unit.

ITEM	QTY	MATERIAL
c	1	Bolt, machine, 5/8" x req'd length
p		Connectors, guy bond and as req'd
u	2	Deadend for guy strand, heavy duty
y		Guy wire, as req'd (See Note 2)
at	1	Guy marker
av		Jumpers, as req'd
bj	2	Guy hook
bk	2	Guy Plate, 4" x 8", 14 gauge
ck	1	Clamp, anchor rod bonding
ek	1	Locknuts
	8	Nails, 8 penny galv.

DESIGN PARAMETERS:

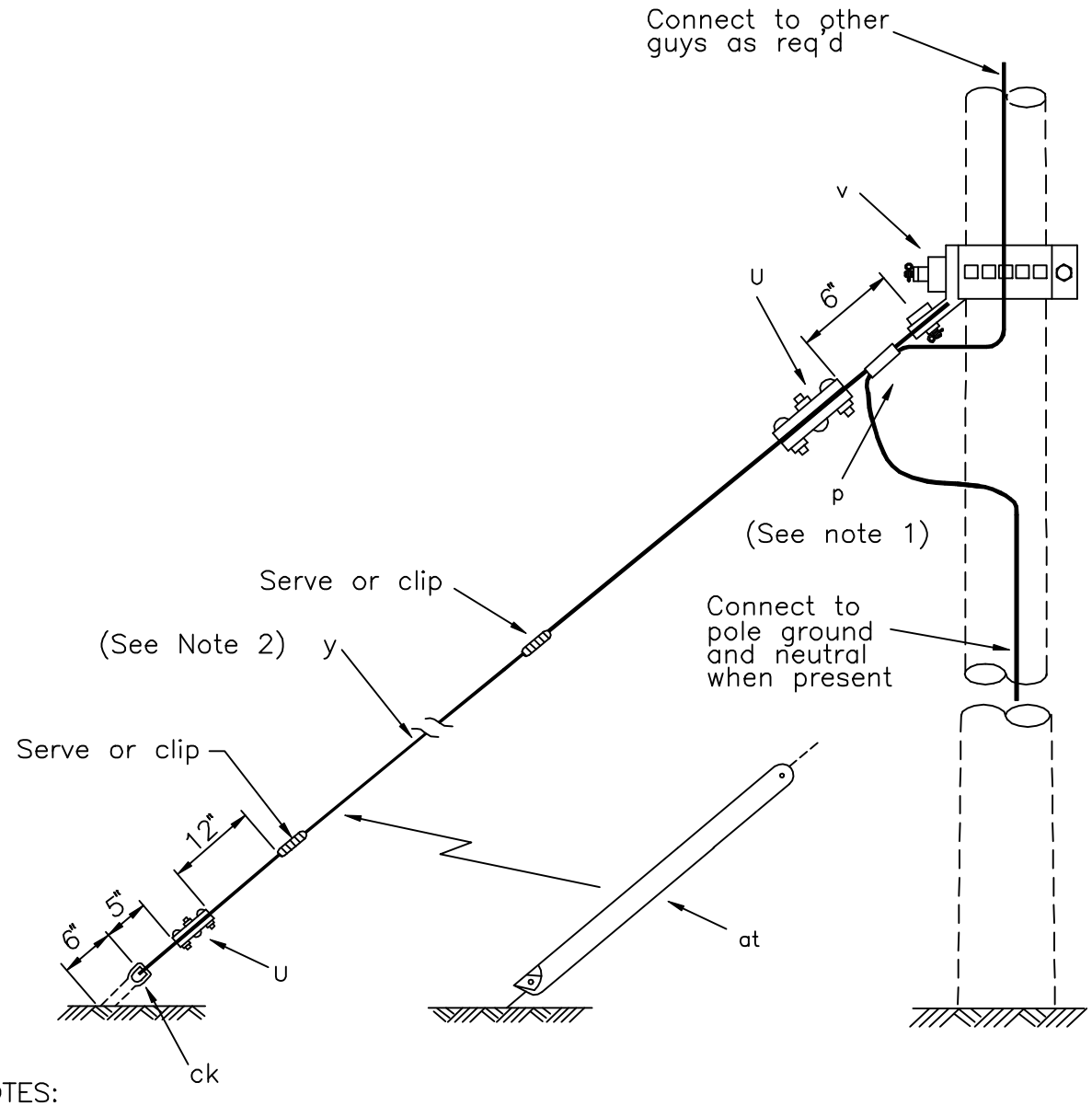
MAXIMUM WORKING LOAD =
LESSER OF 8,500 lbs. HORIZONTAL
or ALLOWABLE GUY WIRE TENSION

SINGLE DOWN GUY (WRAPPED TYPE)

DEC 1998

RUS

E3.1



NOTES:

1. Other accepted and equivalent, heavy duty, guy deadend material (item "u") may be substituted for the ones shown..
2. Specify guy wire size, type and required length.

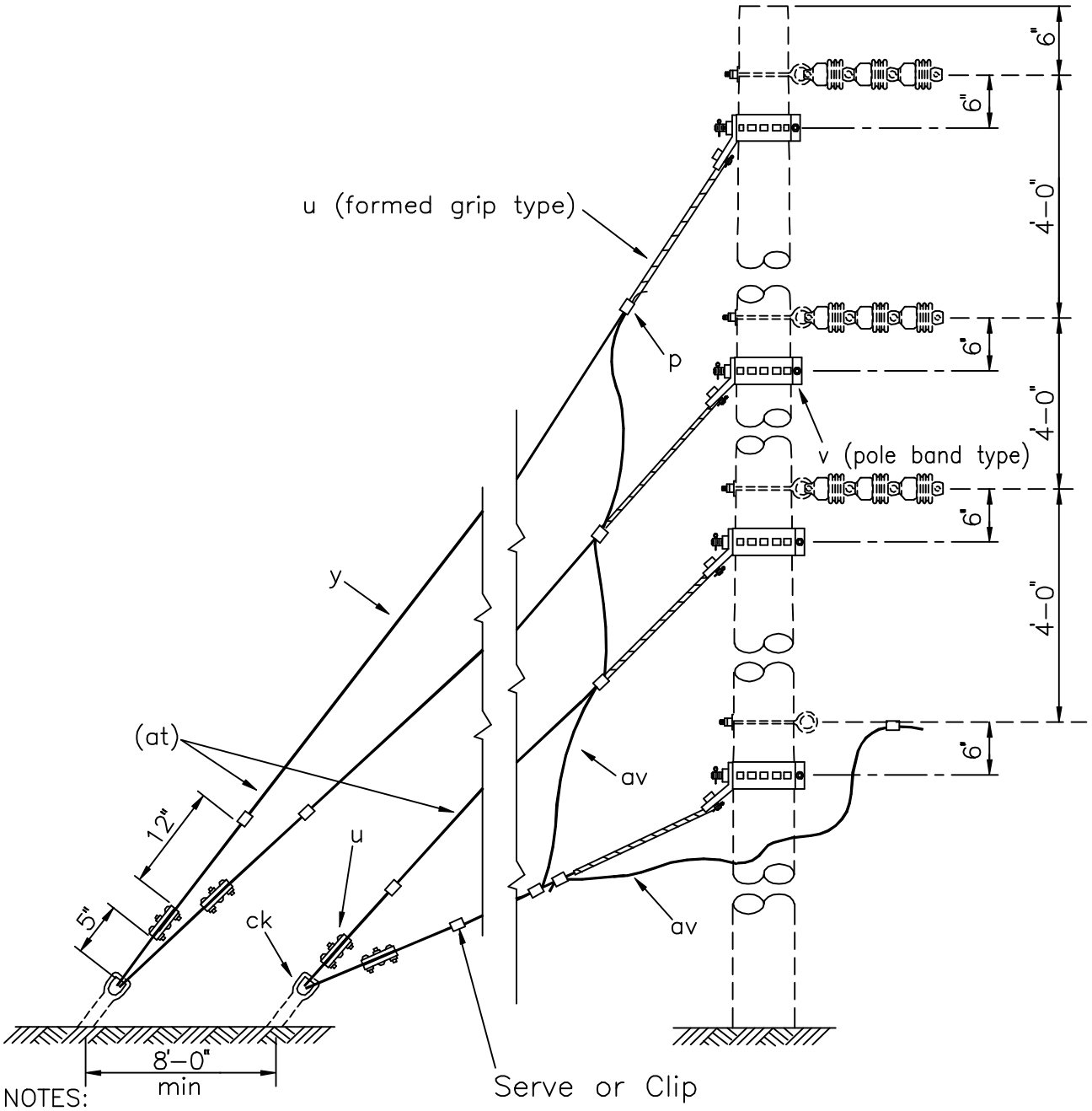
ITEM	QTY	MATERIAL
p		Connectors, guy bond as req'd
u	2	Deadend for guy strand, heavy duty
v	1	Guy attachment, pole band type
y		Guy wire, as req'd (See Note 2)
at	1	Guy marker
av		Jumpers, as req'd
ck	1	Clamp, anchor bonding

DESIGN PARAMETERS:

MAXIMUM WORKING LOAD =
LESSER OF 10,000 lbs. HORIZONTAL
or ALLOWABLE GUY WIRE TENSION

SINGLE DOWN GUY – LARGE CONDUCTORS (POLE BAND TYPE)

DEC 1998		
RUS		E4.1L



NOTES:

Position guys as shown on applicable pole top assembly unit if different than shown here. If distance between primary assembly and down guy is less than 12", install (minimum 12") guy strain insulator,(item "w"), or insulated extension link, (item "eu"), (mininum 12"), in primary assembly.

The following single down guy assemblies may be used, (multiply material quantities by 4):

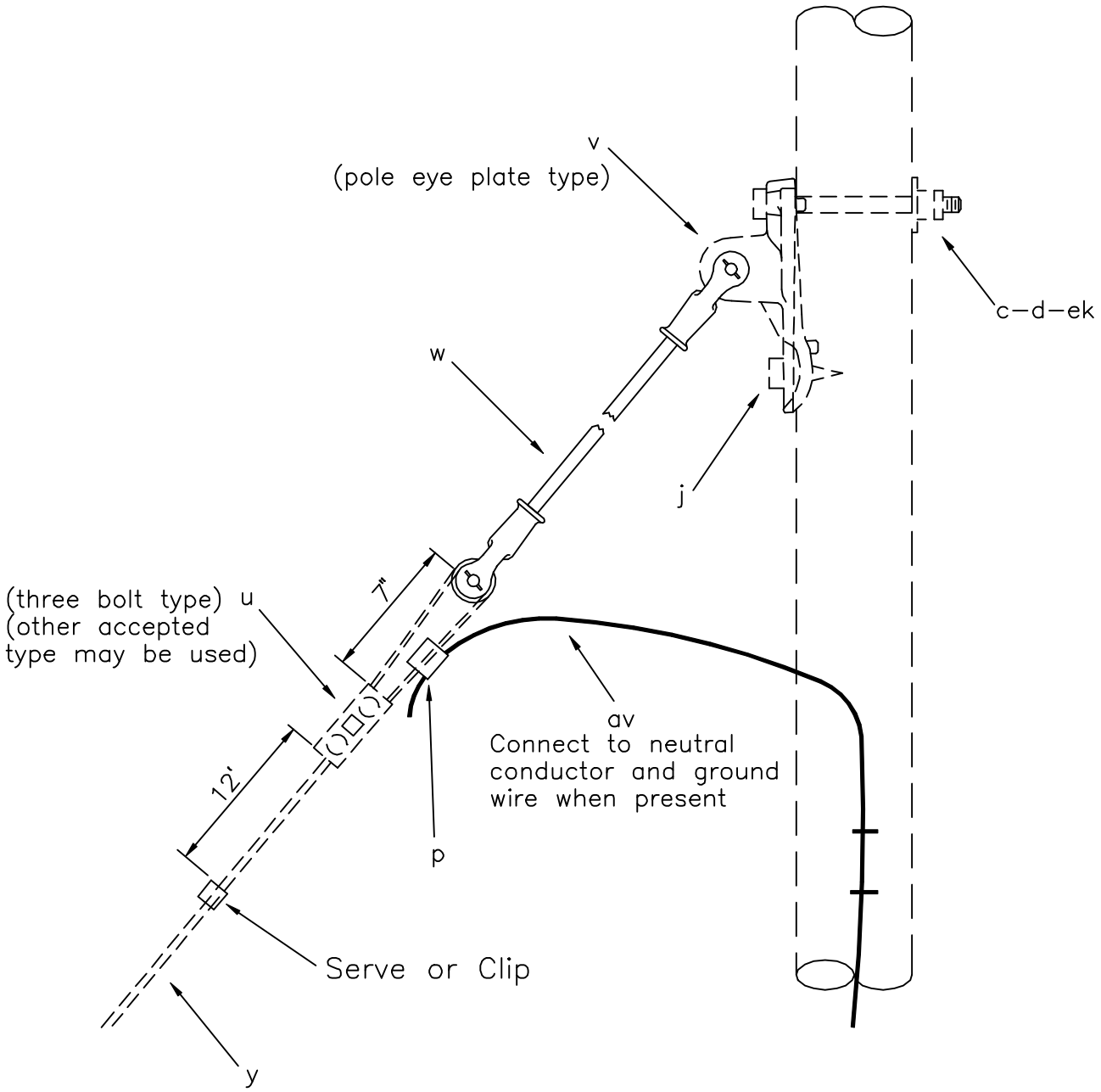
- E1.1: Through Bolt Type
- E2.1: Through Bolt Type, Heavy Duty
- E3.1: Wrapped Type
- E4.1L: Pole Band Type (Shown Above)

DESIGN PARAMETERS:

(See Single Down Guy drawings)

FOUR DOWN GUY GUIDE – LARGE CONDUCTORS (POLE BAND TYPE)

DEC 1998		
RUS		E4.4LG



ITEM	MATERIAL
w	Insulator, guy strain

DESIGN PARAMETERS:

DESIGNATED MAXIMUM
WORKING LOAD = 8,500 lbs.

GUY STRAIN INSULATOR GUIDE

DEC 1998		
RUS		E5.1G

INDEX F

ANCHOR ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
F1.6, F1.8, F1.10, F1.12	EXPANDING TYPE ANCHORS
F2.6, F2.8, F2.10, F2.12	SCREW ANCHORS, (POWER-INSTALLED)
F3.6, F3.8, F3.10, F3.12	PLATE TYPE ANCHORS
F4.1, F4.2	SERVICE ANCHORS
F5.1, F5.2, F5.3	ROCK ANCHORS
F6.6, F6.8, F6.10	SWAMP ANCHORS (POWER INSTALLED)

CONSTRUCTION SPECIFICATIONS FOR ANCHORING

All anchors and rods shall be in line with the strain and shall be installed so that approximately 6 inches of the rod remains 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 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 above the anchor and tamped during the filling. The remainder of the hole shall be backfilled and tamped with dirt.

The maximum load with overload factors transferred to the anchor should not exceed the designated maximum holding power given in the design parameters on the anchor assembly drawing. The rating is coordinated with the maximum holding power of average, class 5, soil conditions.

When the anchor is used in poorer soils, the holding power of the anchor should be derated. A suggested guide is to derate by 25 percent in class 6 soil and by 50 percent in class 7 soil. For class 8 soil it is usually necessary to use swamp anchors or power driven screw anchors which can penetrate the poor soil into firmer soil.

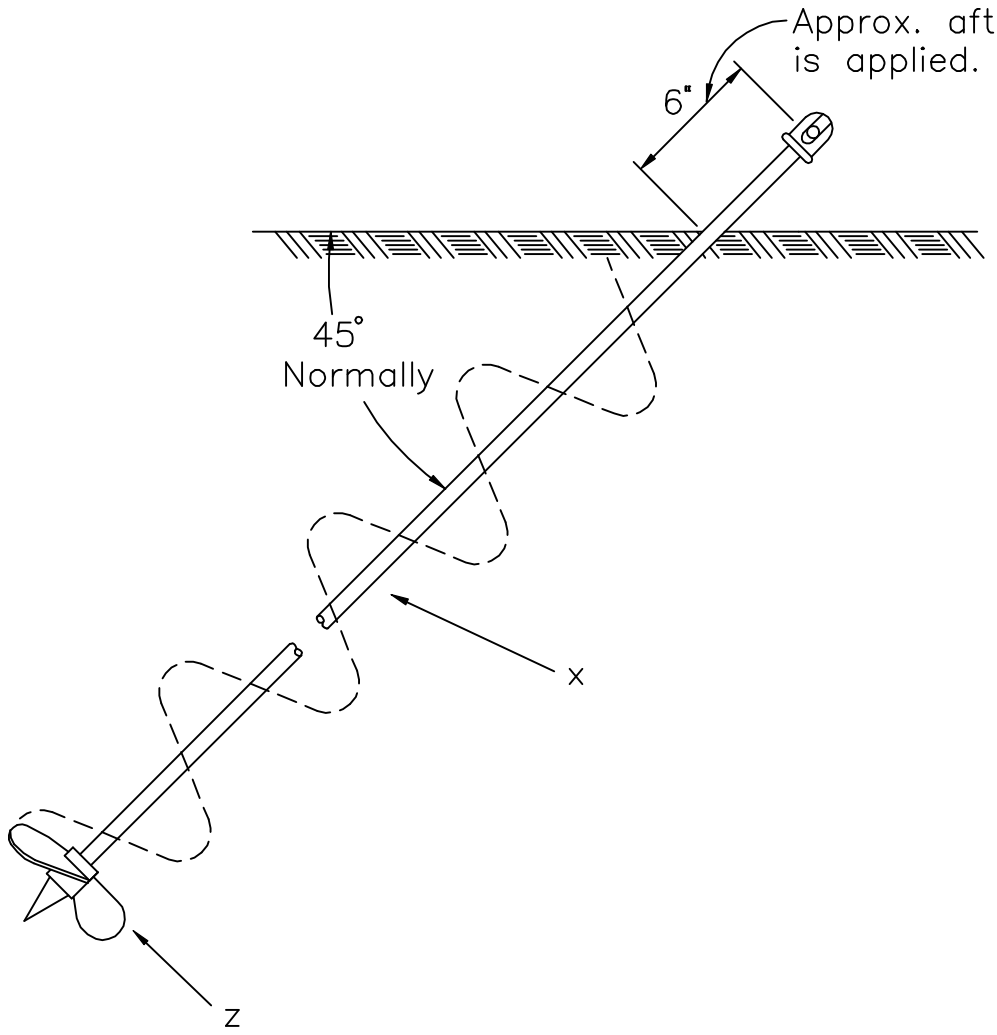
(See Table F)

Log type anchors are acceptable for use on distribution systems. Refer to the appropriate drawings in RUS Bulletin 1728F-811 “Electric Transmission Specifications and Drawings, 115 kV through 230 kV”, for assembly units and construction details.

TABLE F

Soil Classifications

CLASS	ENGINEERING DESCRIPTION
0	Sound hard rock, unweatherd
1	Very dense and/or cemented sands; coarse gravel and cobbles
2	Dense fine sand; very hard silts and clays (may be preloaded)
3	Dense clayed sand sand gravel; very stiff to hard silts and clays
4	Medium dense sandy gravel; very stiff to hard silts and clays
5	Medium dense coarse sand and sandy gravels; stiff to very stiff silts and clays
6	Loose to medium dense fine to coarse sand; firm to stiff clays and silts
7	Loose fine sand; alluvium; loess; soft-firm clays; varved clays; fill
8	Peat; organic silts; inundated silts; fly ash



NOTE: Designated maximum holding power rating assumes proper installation in class 5 soil. See Appendix F for additional information.

	ASSEMBLY:	F2.6	F2.8	F2.10	F2.12
	Minimum Area (sq. in.)	90	100	120	135
ITEM	MATERIAL	QTY	QTY	QTY	QTY
x	Rod, anchor, thimble eye, 5/8" x 7'0"	1	1		
x	Rod, anchor, twin eye, 3/4 X 8'0			1	1
z	Anchor, screw type, power installed	1	1	1	1

DESIGN PARAMETERS:
DESIGNATED MAXIMUM
HOLDING POWER (lbs.)

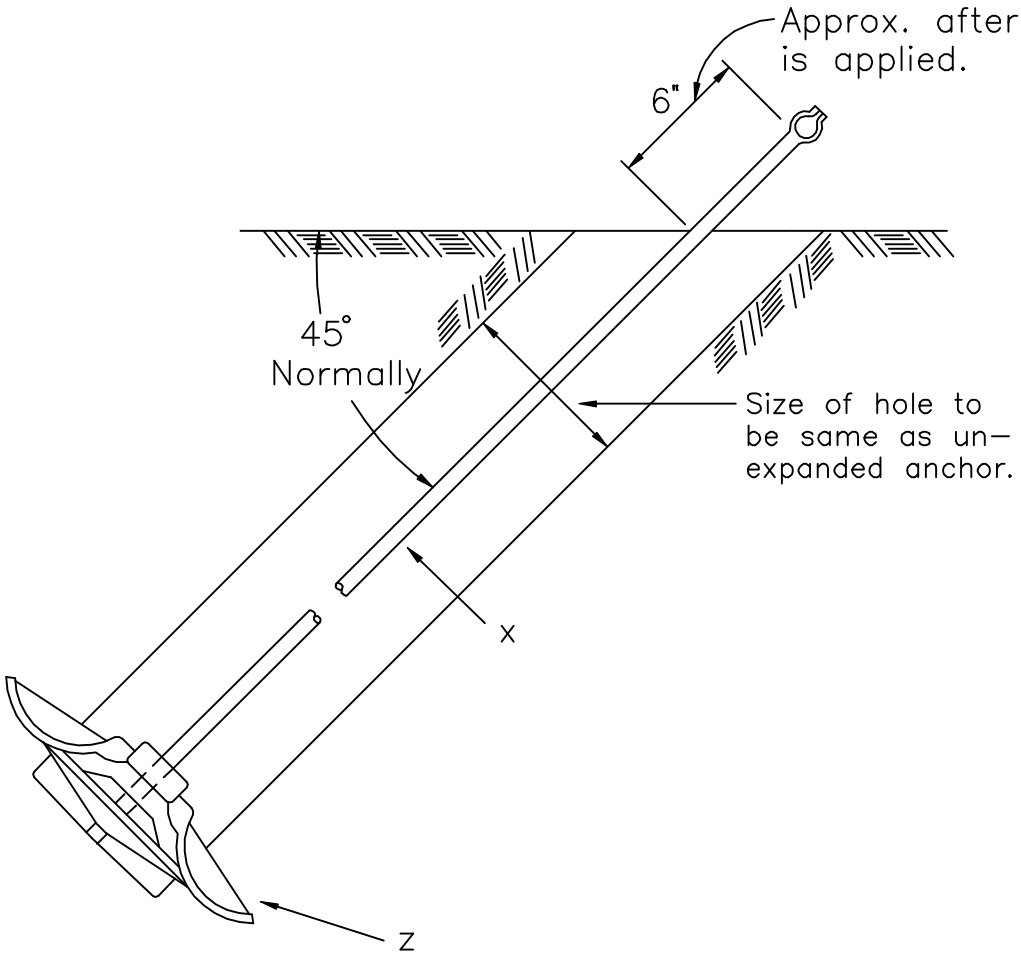
F2.6:	6,000
F2.8:	8,000
F2.10:	10,000
F2.12:	12,000

SCREW ANCHORS, (POWER INSTALLED)

DEC 1998

RUS

F2.6, F2.8, F2.10, F2.12



NOTE: Designated maximum holding power rating assumes proper installation in class 5 soil. See Appendix F for additional information.

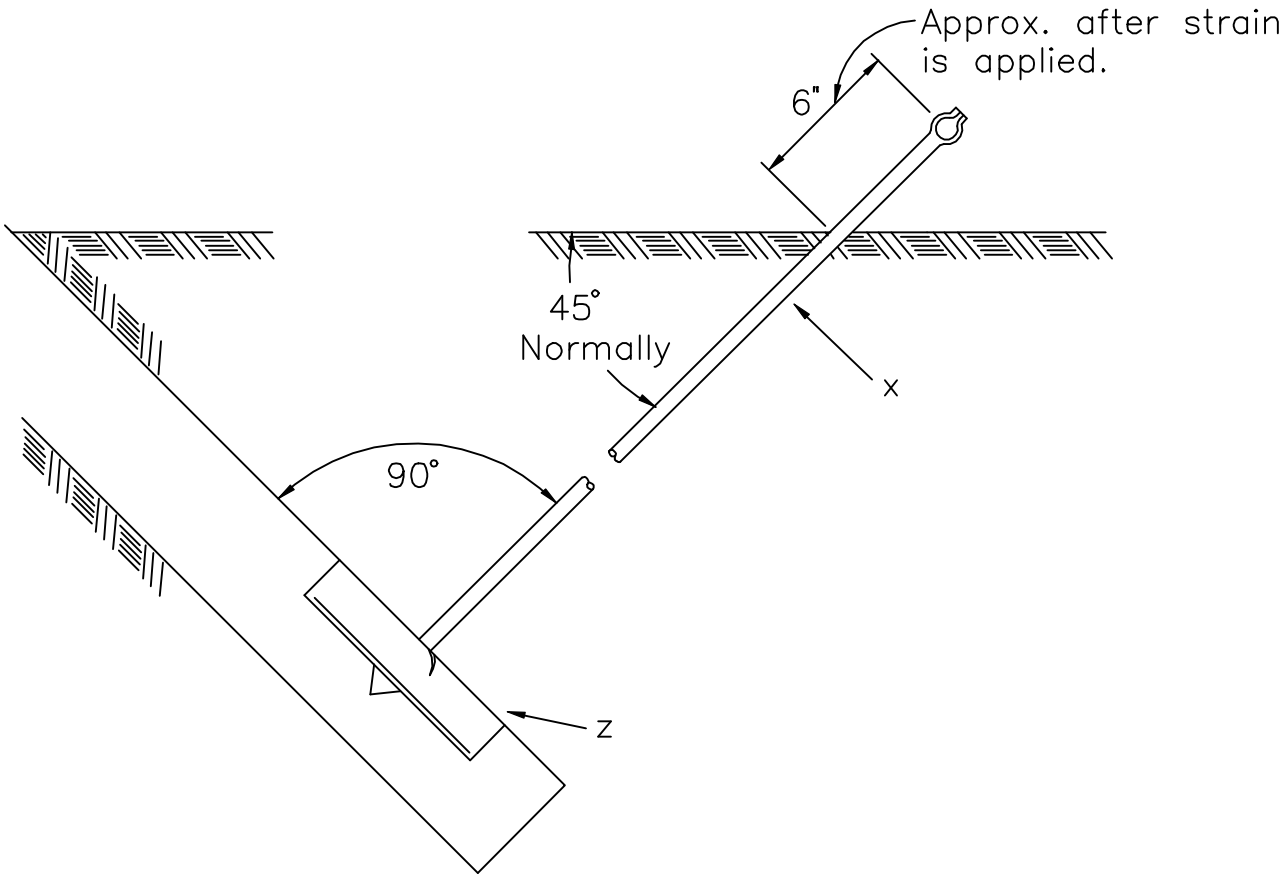
	ASSEMBLY:	F1.6	F1.8	F1.10	F1.12
	Minimum Area (sq. in.)	90	100	120	135
ITEM	MATERIAL	QTY	QTY	QTY	QTY
x	Rod, anchor, thimble eye, 5/8" x 7'0"	1	1		
x	Rod, anchor, twin eye, 3/4" X 8'0"			1	1
z	Anchor, expanding type	1	1	1	1

DESIGN PARAMETERS:
DESIGNATED MAXIMUM
HOLDING POWER (lbs.)

F1.6:	6,000
F1.8:	8,000
F1.10:	10,000
F1.12:	12,000

EXPANDING TYPE ANCHORS

DEC 1998		F1.6, F1.8,
RUS		F1.10, F1.12



NOTE: Designated maximum holding power rating assumes proper installation in class 5 soil. See Appendix F for additional information.

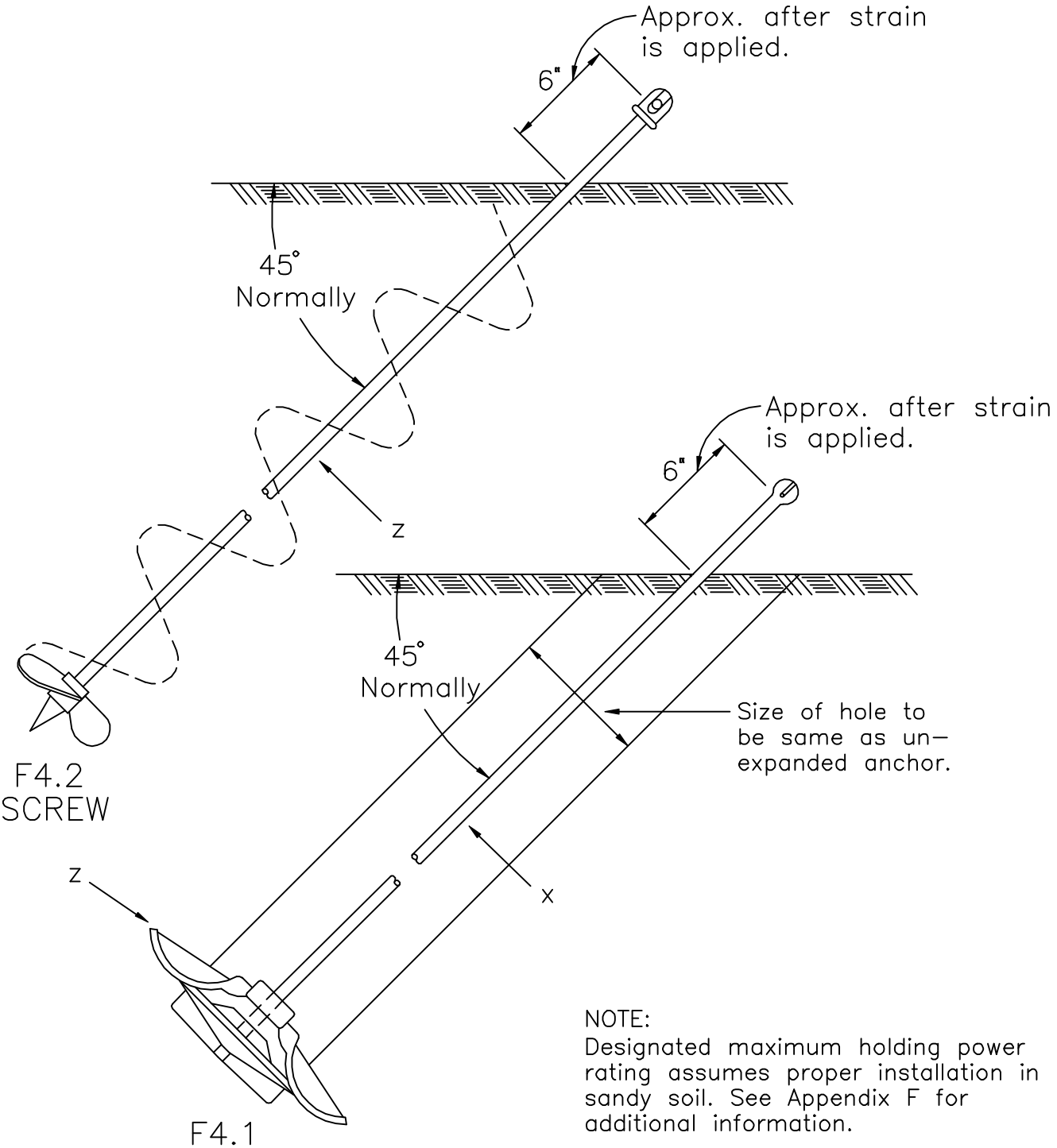
	ASSEMBLY:	F3.6	F3.8	F3.10	F3.12
	Minimum Area (sq. in.)	90	100	120	135
ITEM	MATERIAL	QTY	QTY	QTY	QTY
x	Rod, anchor, thimble eye, 5/8" x 7'0"	1	1		
x	Rod, anchor, twin eye, 3/4" X 8'0"			1	1
z	Anchor, plate type	1	1	1	1

DESIGN PARAMETERS:
DESIGNATED MAXIMUM
HOLDING POWER (lbs.)

F3.6:	6,000
F3.8:	8,000
F3.10:	10,000
F3.12:	12,000

PLATE TYPE ANCHORS

DEC 1998		F3.6, F3.8, F3.10, F3.12
RUS		



NOTE:
Designated maximum holding power rating assumes proper installation in sandy soil. See Appendix F for additional information.

ASSEMBLY:		F4.1	F4.2
ITEM	MATERIAL	QTY	QTY
x	Rod, anchor, thimble eye type	1	
z	Anchor, service, expanding type	1	
z	Anchor, service, screw type		1

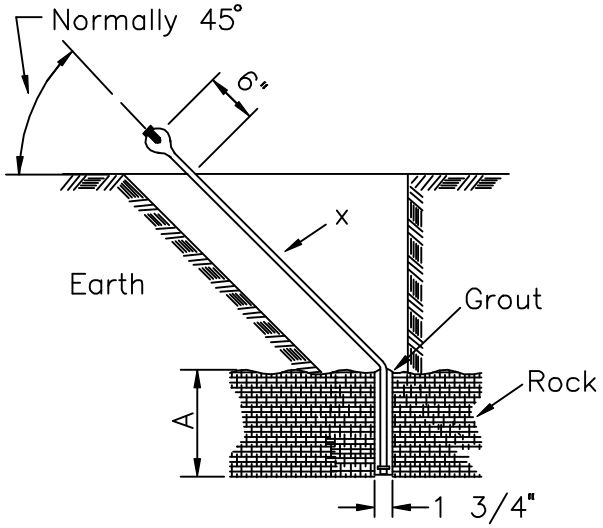
DESIGN PARAMETERS:

DESIGNATED MAXIMUM HOLDING POWER (lbs.)

F4.1: 2,500
F4.2: 2,500

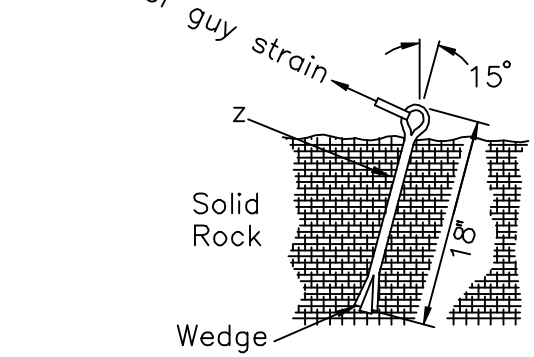
SERVICE ANCHORS

DEC 1998		F4.1,
RUS		F4.2



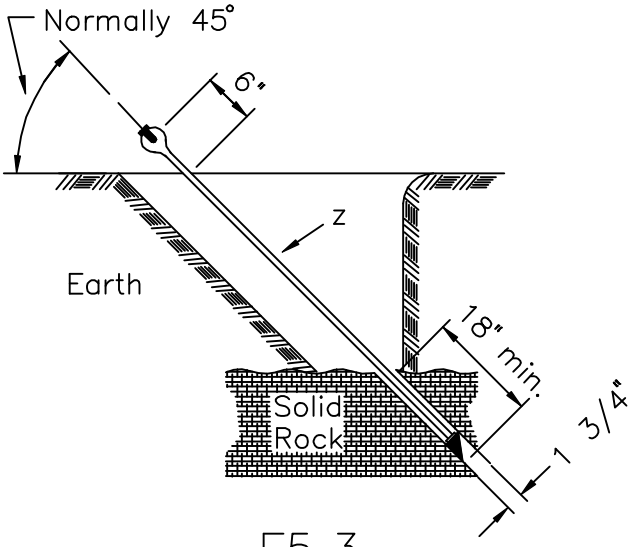
A = 18" min. for solid rock
= 30" min. for stratified rock

F5.1



NOTE: 15" expanding type rock anchor may be used

F5.2



F5.3

NOTES:

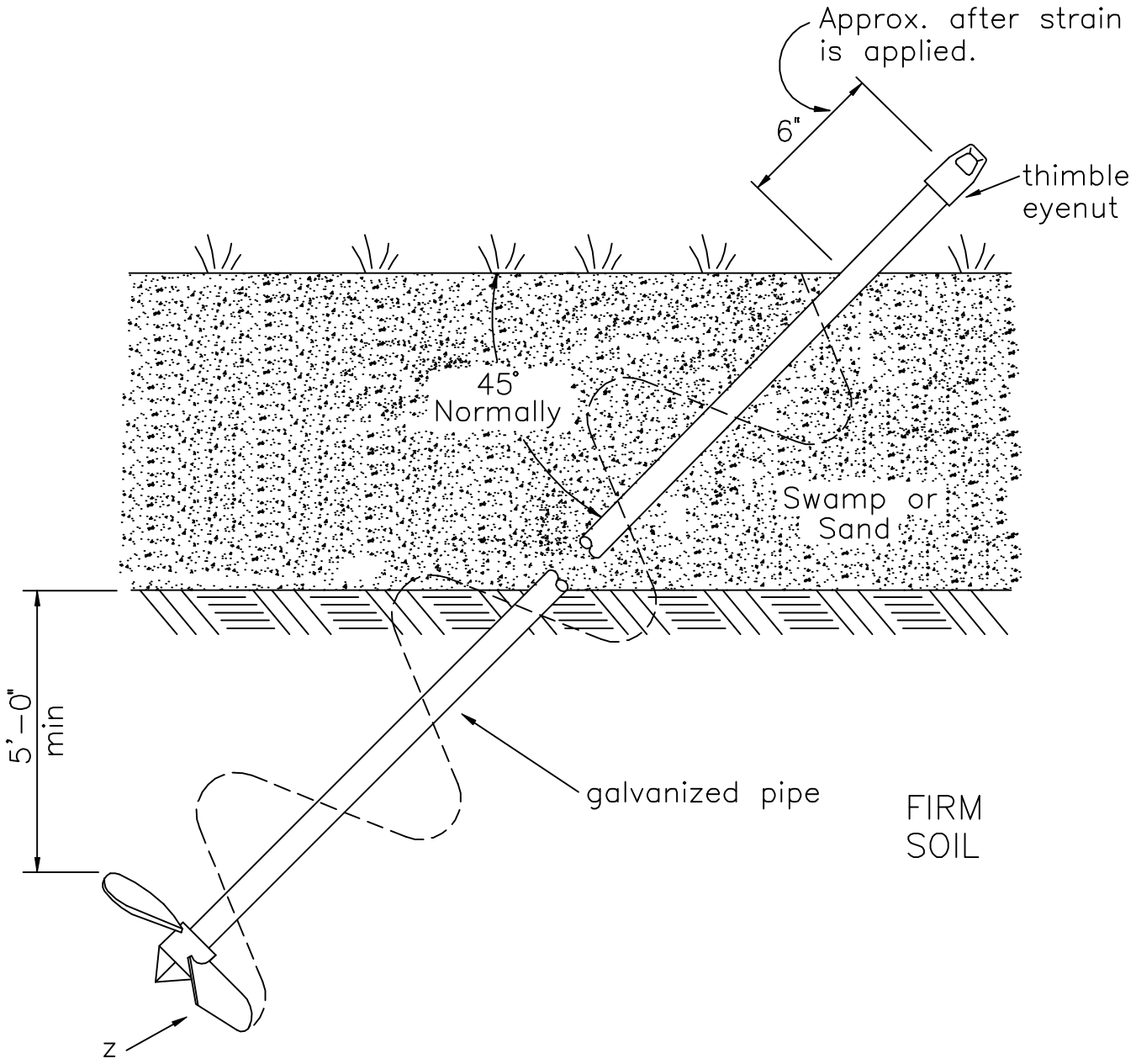
1. Only one guy shall be attached to a rock anchor. Where more than one guy is required, space anchors 2 feet minimum apart and, where practical, install in direct line with pole.
2. Do not anchor to any boulder measuring less than 4 feet in diameter.

	ASSEMBLY:	F5.1	F5.2	F5.3	
ITEM	MATERIAL	QTY	QTY	QTY	
x	Rod, anchor or thimble eye type	1			(* See Note)
z	Anchor, expanding rock type		*	1	
z	Anchor, rock, guy bolt type		1		

DESIGN PARAMETERS:

ROCK ANCHORS

DEC 1998		F5.1, F5.2, F5.3
RUS		



NOTE: Designated maximum holding power rating assumes proper installation. See anchor specifications for additional information.

		F6.6	F6.8	F6.10
ITEM	MATERIAL	QTY	QTY	QTY
z	Anchor, swamp type (diameter)	1-10"	1-12"	1-15"
	Nut, thimble eye type	1	1	1
	Pipe, galvanized, as req'd			

DESIGN PARAMETERS:
DESIGNATED MAXIMUM HOLDING POWER (lbs.)

F6.6: 6,000
F6.8: 8,000
F6.10: 10,000

SWAMP ANCHORS (POWER INSTALLED)

DEC 1998
RUS

F6.6, F6.8, F6.10

INDEX G

TRANSFORMER ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
G1.1G	TRANSFORMER INSTALLATION GUIDE SINGLE -PHASE, POLE-TYPE TRANSFORMER
VG1.2	SINGLE-PHASE, CSP TRANSFORMER (TANGENT POLE)
VG1.3	SINGLE-PHASE, CSP TRANSFORMER (DEADEND POLE)
VG1.4, VG1.5	SINGLE-PHASE, CONVENTIONAL TRANSFORMER (TANGENT POLE)
VG1.6	SINGLE-PHASE, CONVENTIONAL TRANSFORMER (DEADEND POLE)
VG1.7	SINGLE-PHASE, CONVENTIONAL TRANSFORMER (TANGENT POLE)
VG1.8	SINGLE-PHASE, CONVENTIONAL TRANSFORMER (DEADEND POLE)
VG2.1	TWO-PHASE TRANSFORMER BANK OPEN-WYE PRIMARY OPEN-DELTA, 4 WIRE SECONDARY
G2.1G	TRANSFORMER/METER CONNECTION GUIDE THREE-PHASE, OPEN-WYE - OPEN DELTA FOR 120/240 VOLT POWER LOADS
VG3.1	THREE-PHASE TRANSFORMER BANK UNGROUNDED-WYE PRIMARY CENTER-TAP GROUNDED DELTA, 4 WIRE SECONDARY
G3.1G	TRANSFORMER/METER CONNECTION GUIDE UNGROUNDED WYE - CENTER TAP GROUNDED DELTA FOR 120/240 VOLT POWER LOADS
VG3.2	THREE-PHASE TRANSFORMER BANK UNGROUNDED WYE - PRIMARY CORNER GROUNDED DELTA, 3 WIRE SECONDARY
G3.2G	TRANSFORMER/METER CONNECTION GUIDE UNGROUNDED WYE - CORNER GROUNDED DELTA FOR 240 OR 480 VOLT POWER LOADS
VG3.3	THREE-PHASE TRANSFORMER BANK GROUNDED-WYE PRIMARY GROUNDED WYE, 4 WIRE SECONDARY
G3.3G	TRANSFORMER/METER CONNECTION GUIDE GROUNDED WYE - GROUNDED WYE FOR 120/208 VOLT POWER LOADS

CONSTRUCTION SPECIFICATIONS FOR TAPS, JUMPERS, AND ARRESTERS

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 may be 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 jumpers using a compression connector suitable for the bimetallic connection.

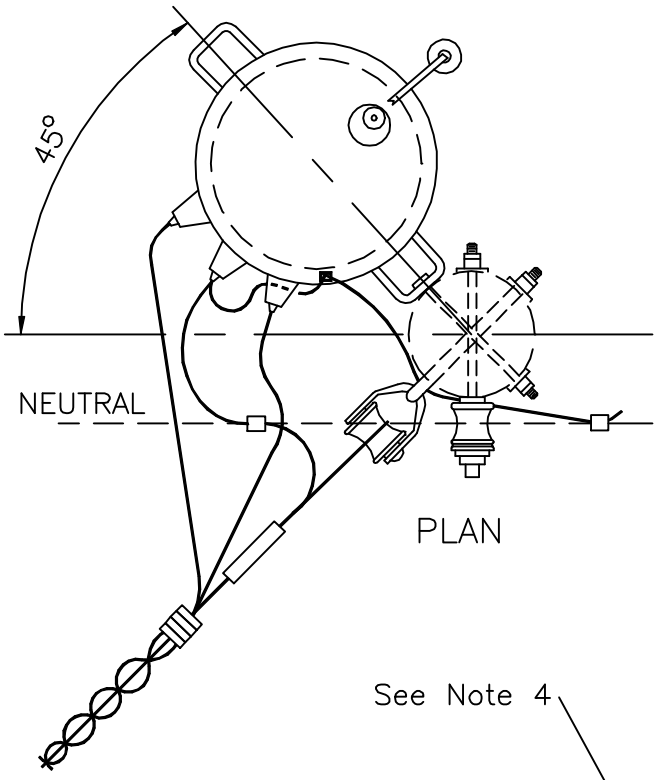
Where applicable, the external gap electrodes of surge arresters, combination arrester cutout units, and transformers mounted arresters shall be adjusted to the manufacturer’s recommended spacing. Care shall be taken so that the adjusted gap is not disturbed when the equipment is installed.

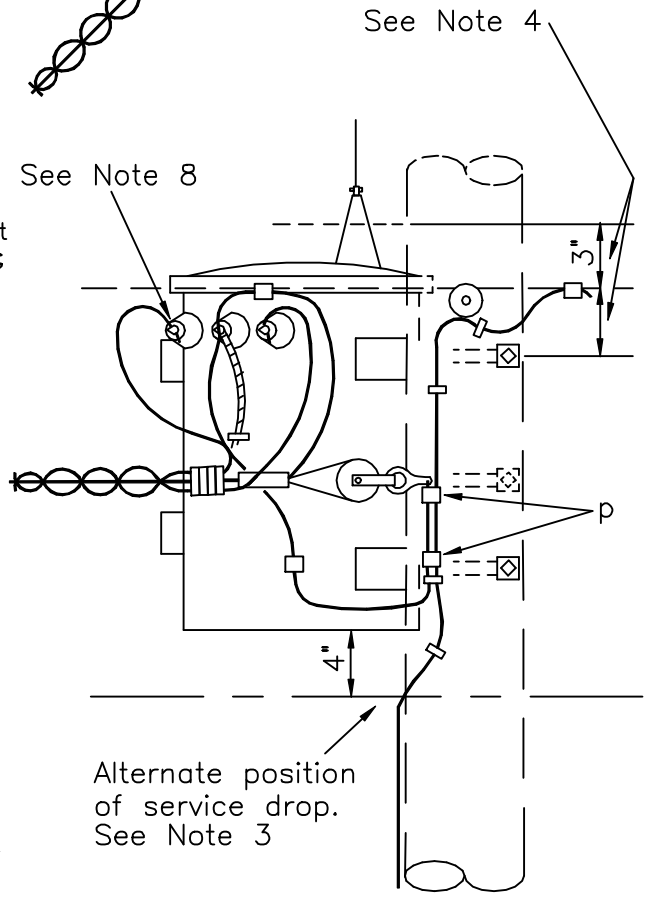
It may be necessary, and is permissible, to lower the neutral attachment on standard construction pole top assemblies an additional distance not exceeding 2 feet to provide adequate clearance between cutout and single-phase, conventional distribution transformers.

GUIDE FOR TRANSFORMER QUADRANT INSTALLATION		
When the SERVICE DROP in Quadrant:	Then install the TRANSFORMER in the Quadrant below: (Deadend Pole)	(Tangent Pole)
"A"	"C"	"C"*
"B"	"C"	"D"*
"C"	"A"	"A"
"D"	"A"	"B"

* May require lowering transformer 3" to avoid conflict between transformer and neutral.

PRI. NEUTRAL –> "A" | "B" / "C" | "D" "QUADRANTS"



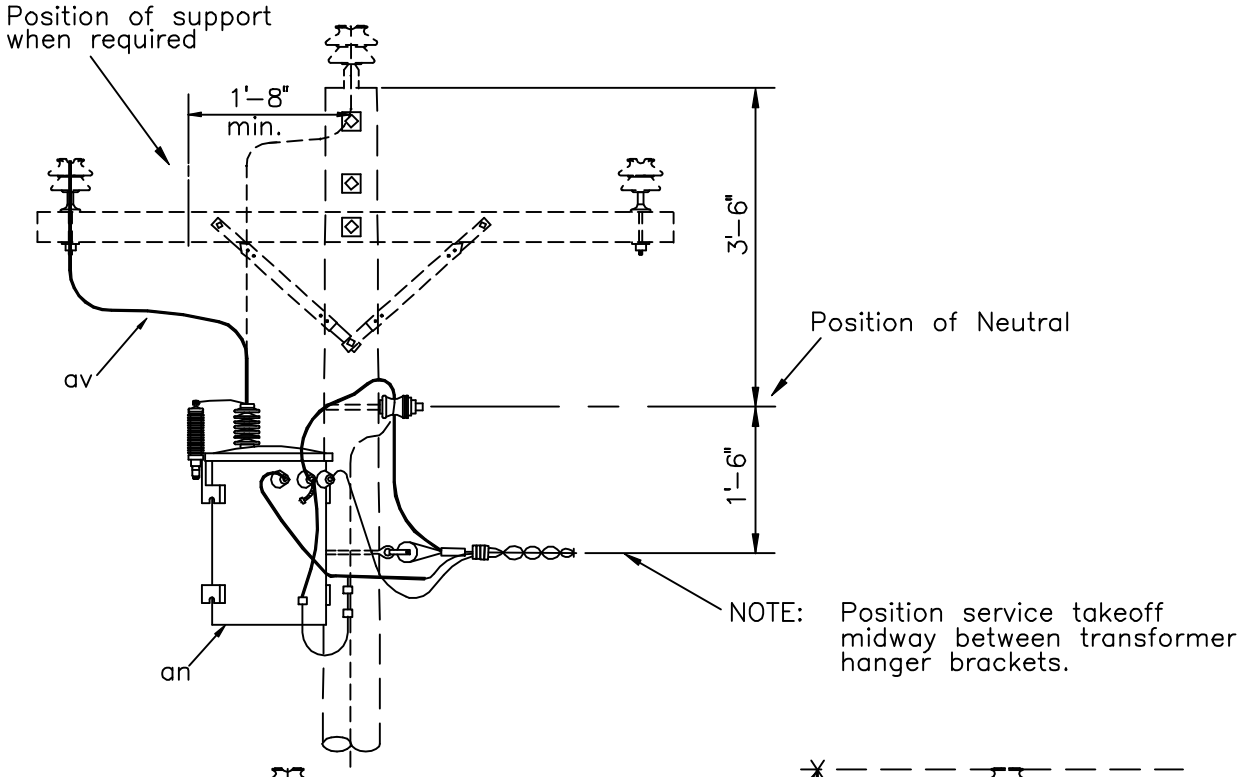


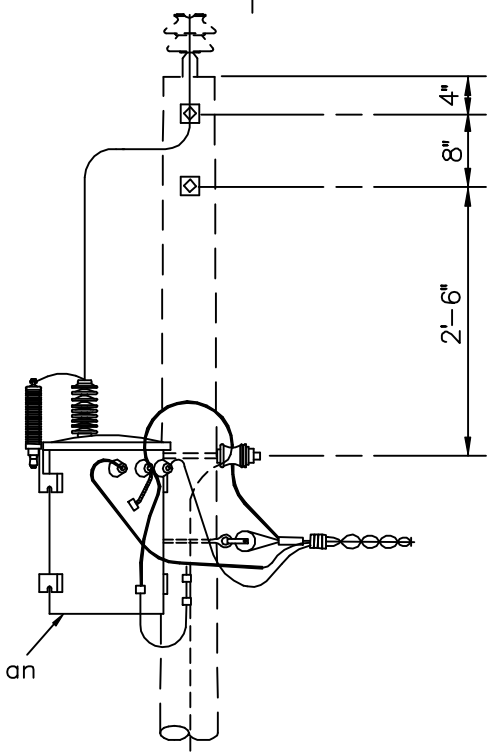
NOTES:

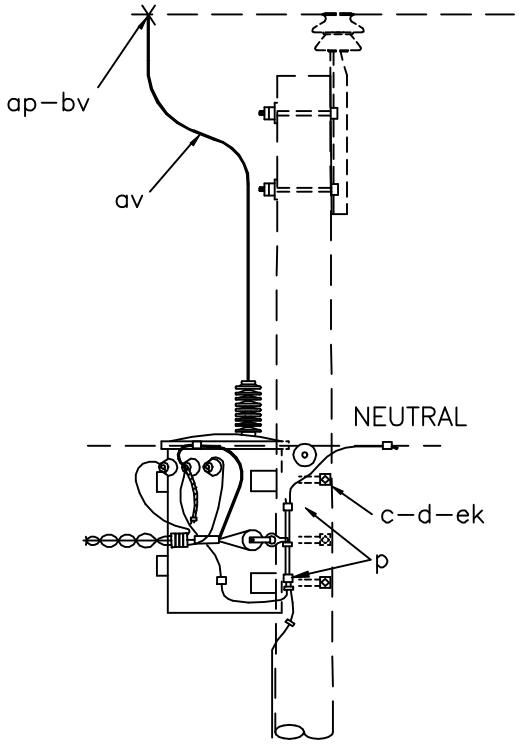
1. Install transformer on deadend poles so that secondary bushings are adjacent to and face the primary neutral.
2. Install transformer on tangent poles on a quadrant on the opposite side of pole from primary neutral; secondary bushings should face primary neutral.
3. When it is necessary to install transformer in the same quadrant as a service drop, attach the service drops 4 inches below the transformer.
4. Install transformer so that primary neutral is at same height as bottom of transformer lid on tangent poles, or 3 inches above bottom of transformer lid on deadend poles.
5. Use compression type connectors (item "p").
6. Standard aluminum alloy or standard soft–drawn copper is recommended for the grounding loop conductor.
7. Transformer secondary bushings are not to be used for bi–metal connections.
8. Cover secondary terminals with moisture seal and/or dress conductor ends downward to prevent entry of moisture. (Mininum bending radius is six times the overall cable diameter).

TRANSFORMER INSTALLATION GUIDE
SINGLE–PHASE, POLE–TYPE TRANSFORMER

DEC 1998		
RUS		G1.1G







ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
p		Connectors,compression type,as req'd
an	1	Transformer, 14.4 kV, self–protected

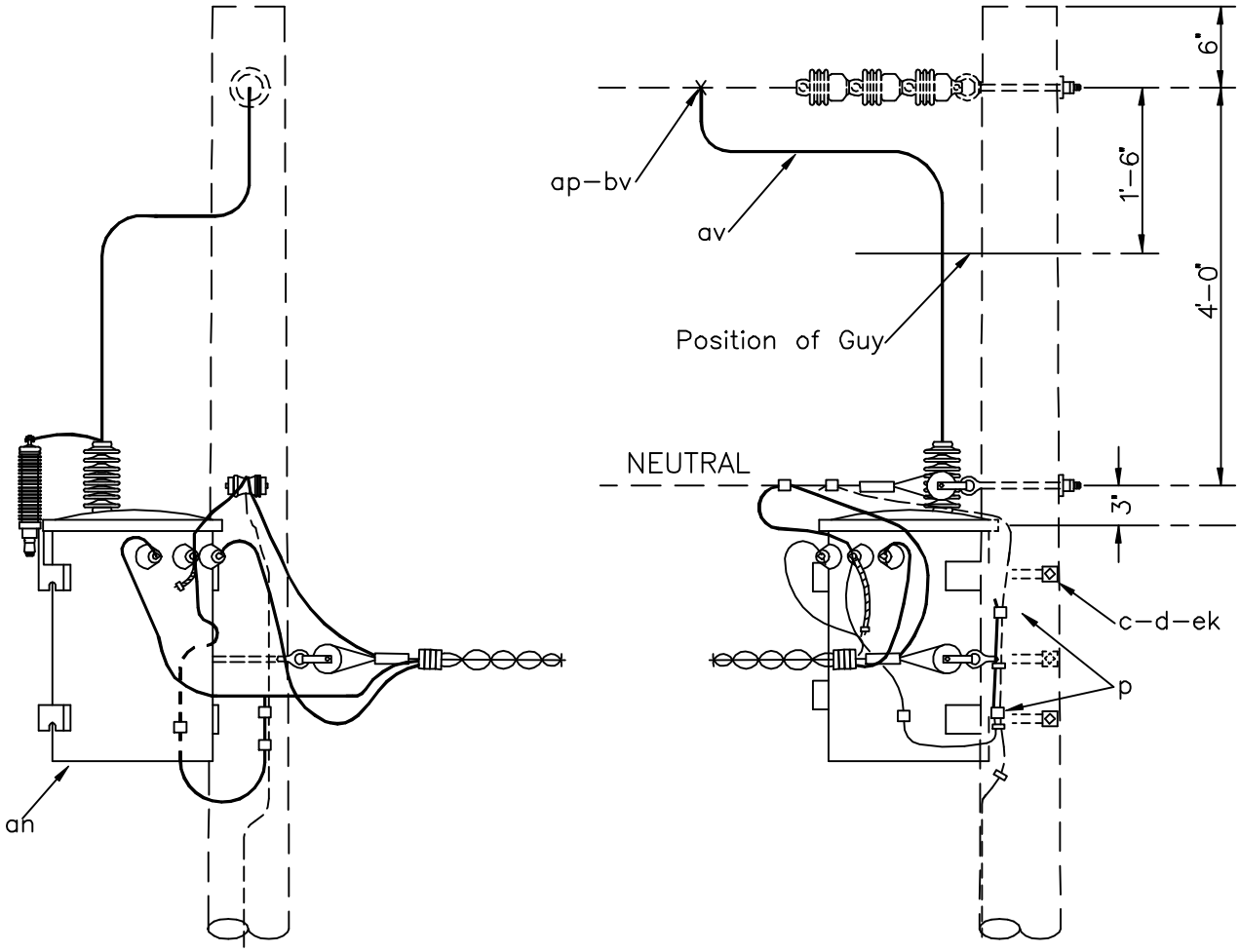
ITEM	QTY	MATERIAL
ap	1	Clamp, hot line
av		Jumpers, stranded, as req'd
bv	1	Rod, armor (as req'd)
ek	2	Locknuts

DESIGN PARAMETERS:

See Guide Drawing "G1.1G"

SINGLE–PHASE, CSP TRANSFORMER (TANGENT POLE)

DEC 1998		
RUS	24.9/14.4 kV	VG1.2



NOTE: Install transformer so that primary neutral is 3 inches above bottom of transformer lid on both single–phase and three–phase primary assemblies. See drawing "VC5.21" for three–phase deadend.

ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
p		Connectors,compression type as req'd
an	1	Transformer, 14.4 kV, self protected

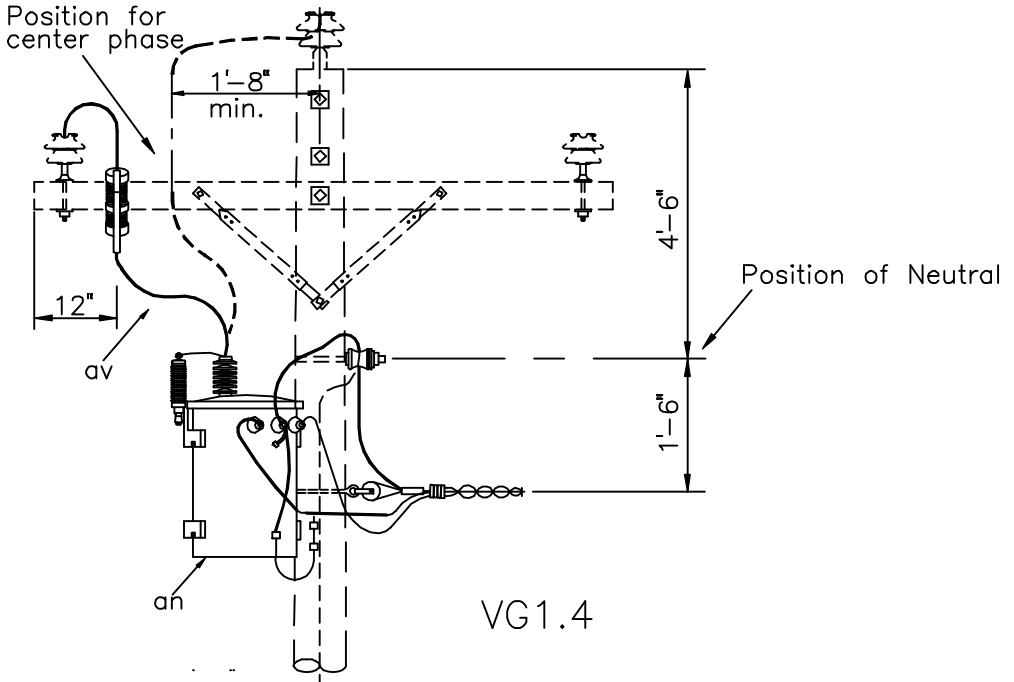
ITEM	QTY	MATERIAL
ap	1	Clamp, hot line
av		Jumpers, stranded, as req'd
bv	1	Rod, armor (as req'd)
ek	2	Locknuts

DESIGN PARAMETERS:

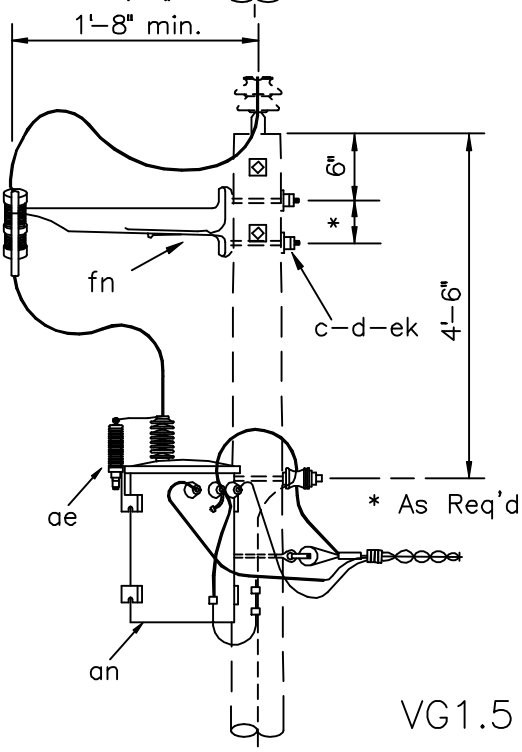
See Guide Drawing "G1.1G"

SINGLE–PHASE, CSP TRANSFORMER (DEADEND POLE)

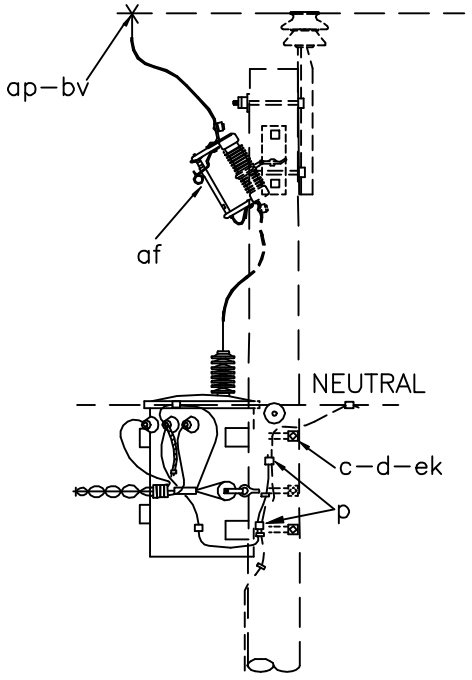
DEC 1998		
RUS	24.9/14.4 kV	VG1.3



VG1.4



VG1.5



NOTE: Rotate cutout so the blade faces climbing face of pole.

ASSEMBLY: VG1		.4	.5
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" x req'd length	2	4
d	Washer, square, 2 1/4"	2	4
p	Connectors, as req'd		
ae	Arrester, surge (18 kV)	1	1
af	Cutout, dist., open (27 kV)	1	1
an	Transformer, 14.4 kV, conventional	1	1

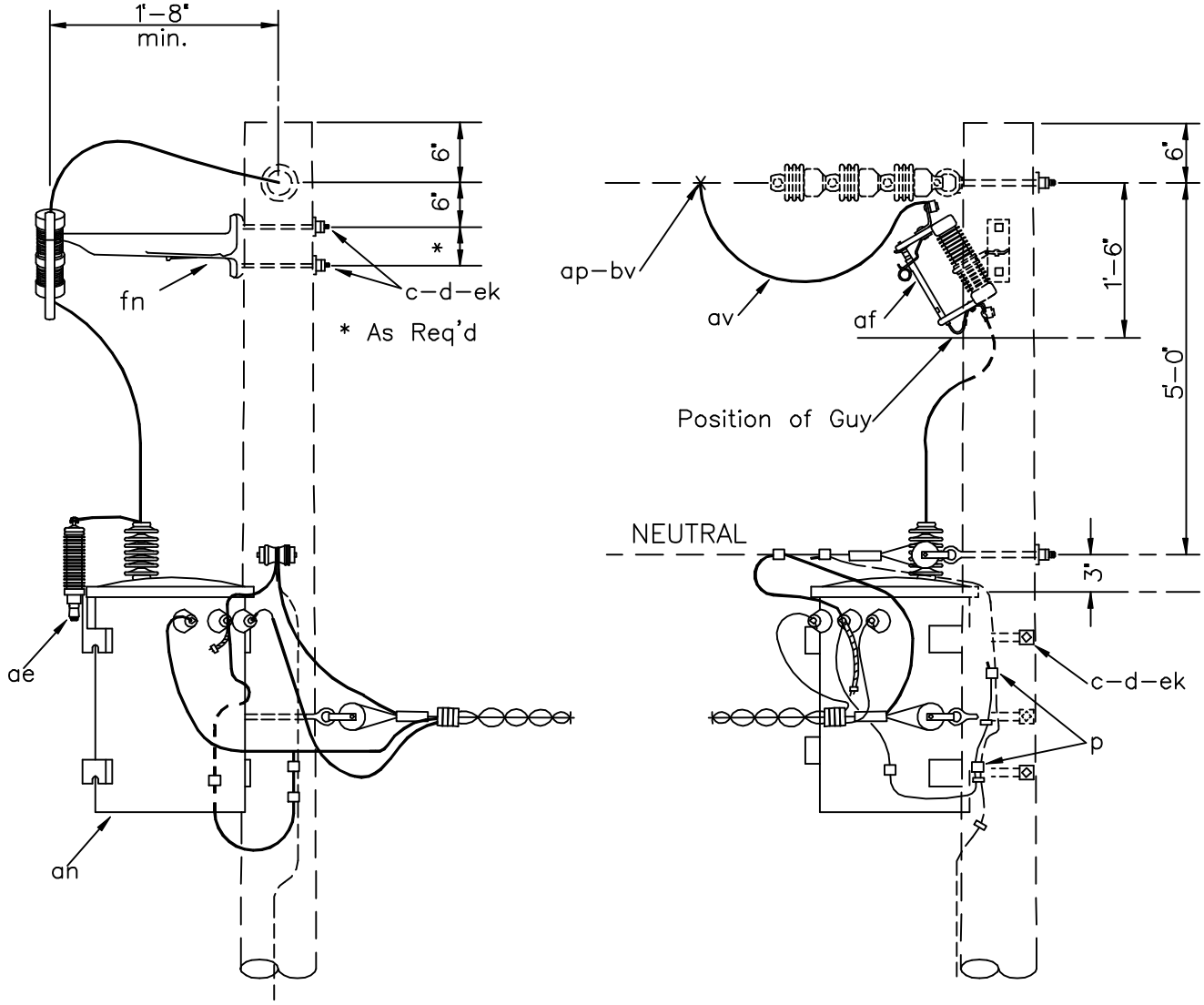
ASSEMBLY: VG1		.4	.5
ITEM	MATERIAL	QTY	QTY
ap	Clamp, hot line	1	1
av	Jumpers, stranded, as req'd		
bv	Rod, armor, as req'd		
ek	Locknuts,	2	4
fn	Bracket, extension		1

DESIGN PARAMETERS:

See Guide Drawing "G1.1G"

SINGLE–PHASE, CONVENTIONAL TRANSFORMER (TANGENT POLE)

DEC 1998		VG1.4
RUS	24.9/14.4 kV	VG1.5



NOTE: Rotate cutout so that the blade faces climbing face of pole.

ITEM	QTY	MATERIAL
c	4	Bolt, machine, 5/8" x req'd length
d	4	Washer, square, 2 1/4"
p		Connectors, as req'd
ae	1	Arrester, surge (18 kV)
af	1	Cutout, dist. open (27 kV)
an	1	Transformer, 14.4 kV, conventional

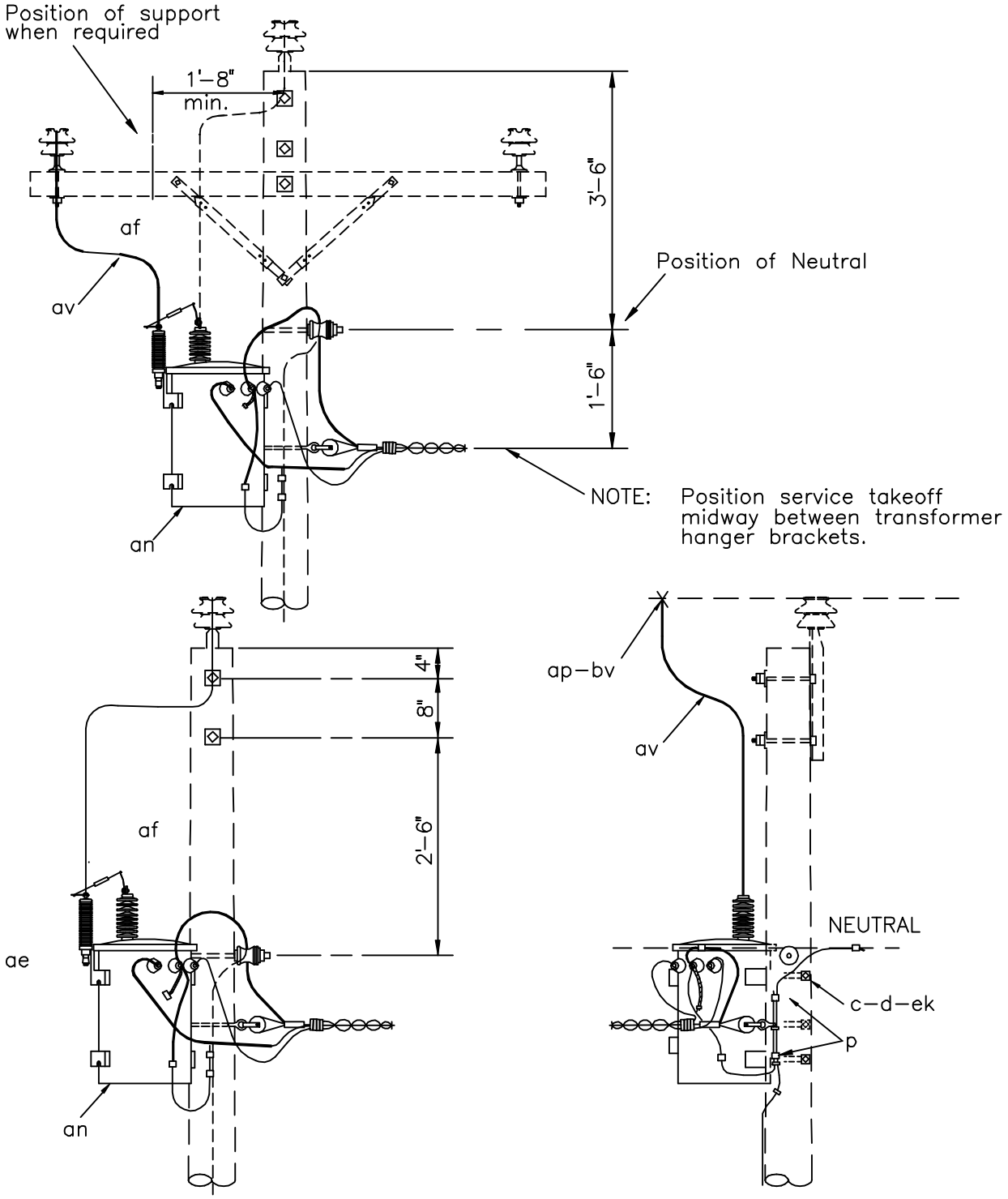
ITEM	QTY	MATERIAL
ap	1	Clamp, hot line
av		Jumpers, stranded, as req'd
bv	1	Rod, armor as req'd
ek	4	Locknuts
fn	1	Bracket, extension

DESIGN PARAMETERS:

See Guide Drawing "G1.1G"

SINGLE–PHASE, CONVENTIONAL TRANSFORMER (DEADEND POLE)

DEC 1998		
RUS	24.9/14.4 kV	VG1.6



ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
p		Connectors,compression type,as req'd
an	1	Transformer, 14.4 kV, self–protected
ae	1	Arrester, surge (18 kV)

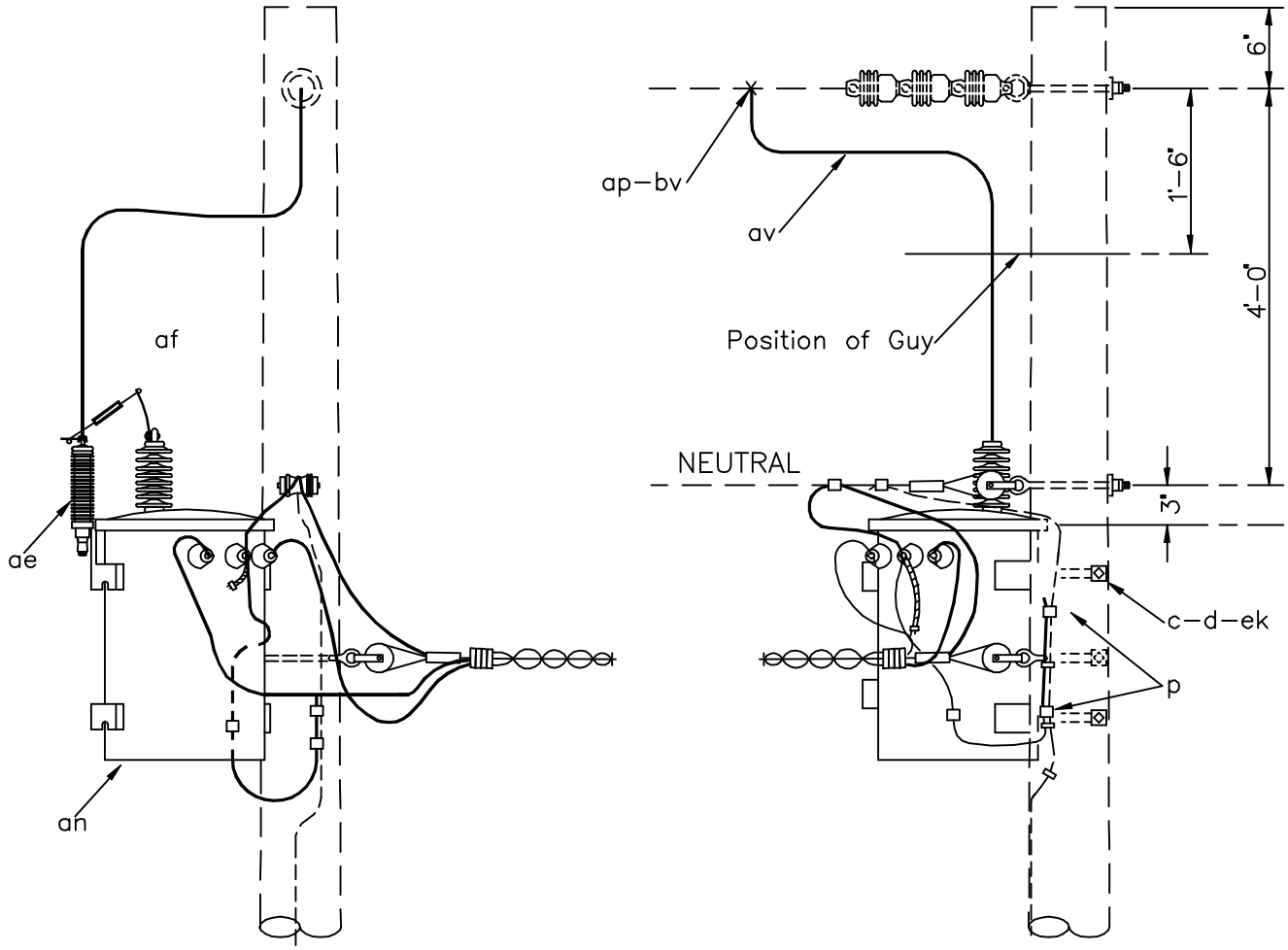
ITEM	QTY	MATERIAL
af	1	Cutout, fuse, open link
ap	1	Clamp, hot line
av		Jumpers, stranded, as req'd
bv	1	Rod, armor (as req'd)
ek	2	Locknuts

DESIGN PARAMETERS:

See Guide Drawing "G1.1G"

SINGLE–PHASE, CONVENTIONAL TRANSFORMER (TANGENT POLE)

DEC 1998		
RUS	24.9/14.4 kV	VG1.7



NOTE: Install transformer so that primary neutral is 3 inches above bottom of transformer lid on both single–phase and three–phase primary assemblies. See drawing "VC5.21" for three–phase deadend.

ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
p		Connectors,compression type as req'd
an	1	Transformer, 14.4 kV, self protected
ae	1	Arrester, surge (18 kV)

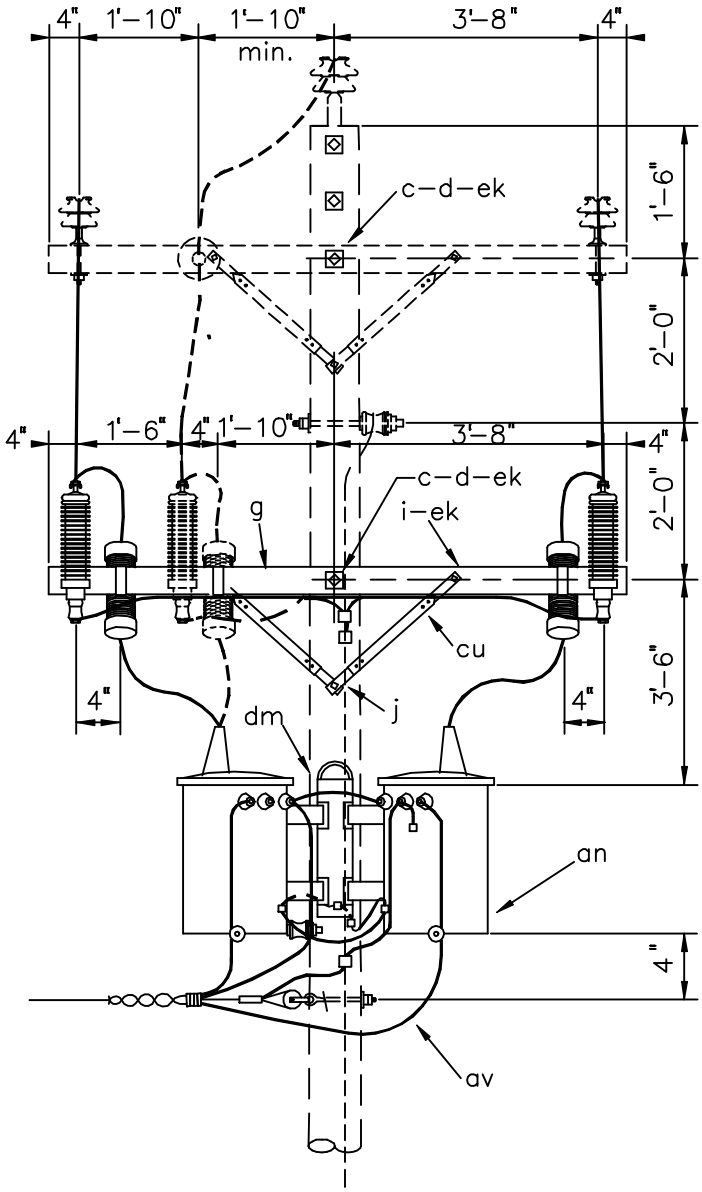
ITEM	QTY	MATERIAL
af	1	Cutout, fuse, open link
ap	1	Clamp, hot line
av		Jumpers, stranded, as req'd
bv	1	Rod, armor (as req'd)
ek	2	Locknuts

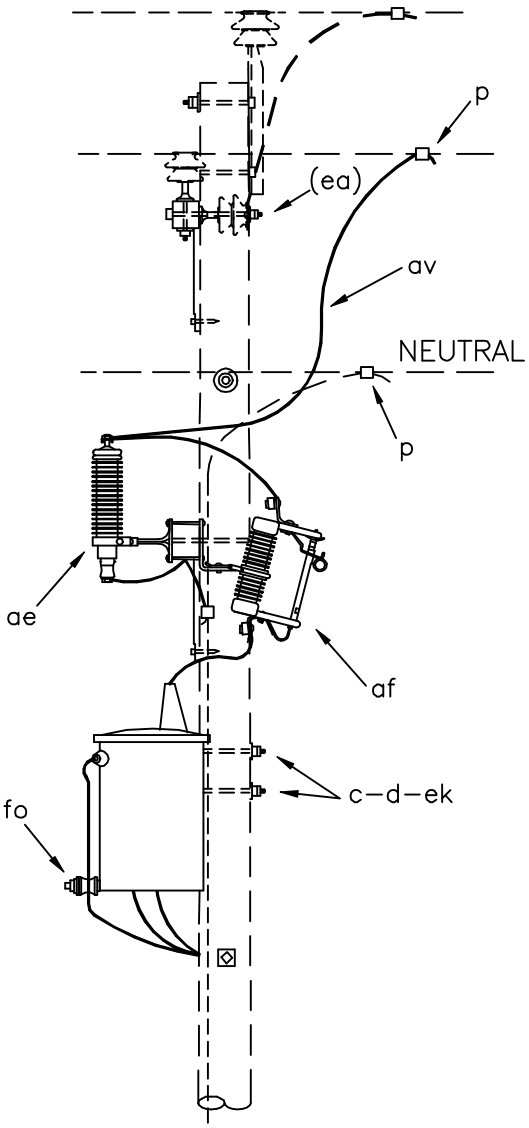
DESIGN PARAMETERS:

See Guide Drawing "G1.1G"

SINGLE–PHASE, CONVENTIONAL TRANSFORMER (DEADEND POLE)

DEC 1998		
RUS	24.9/14.4 kV	VG1.8





ITEM	QTY	MATERIAL
c	3	Bolt, machine, 5/8" x req'd length
d	4	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
p		Connectors, as req'd
p		Connectors, compression, as req'd
ae	2	Arrester, surge, (18 kV)

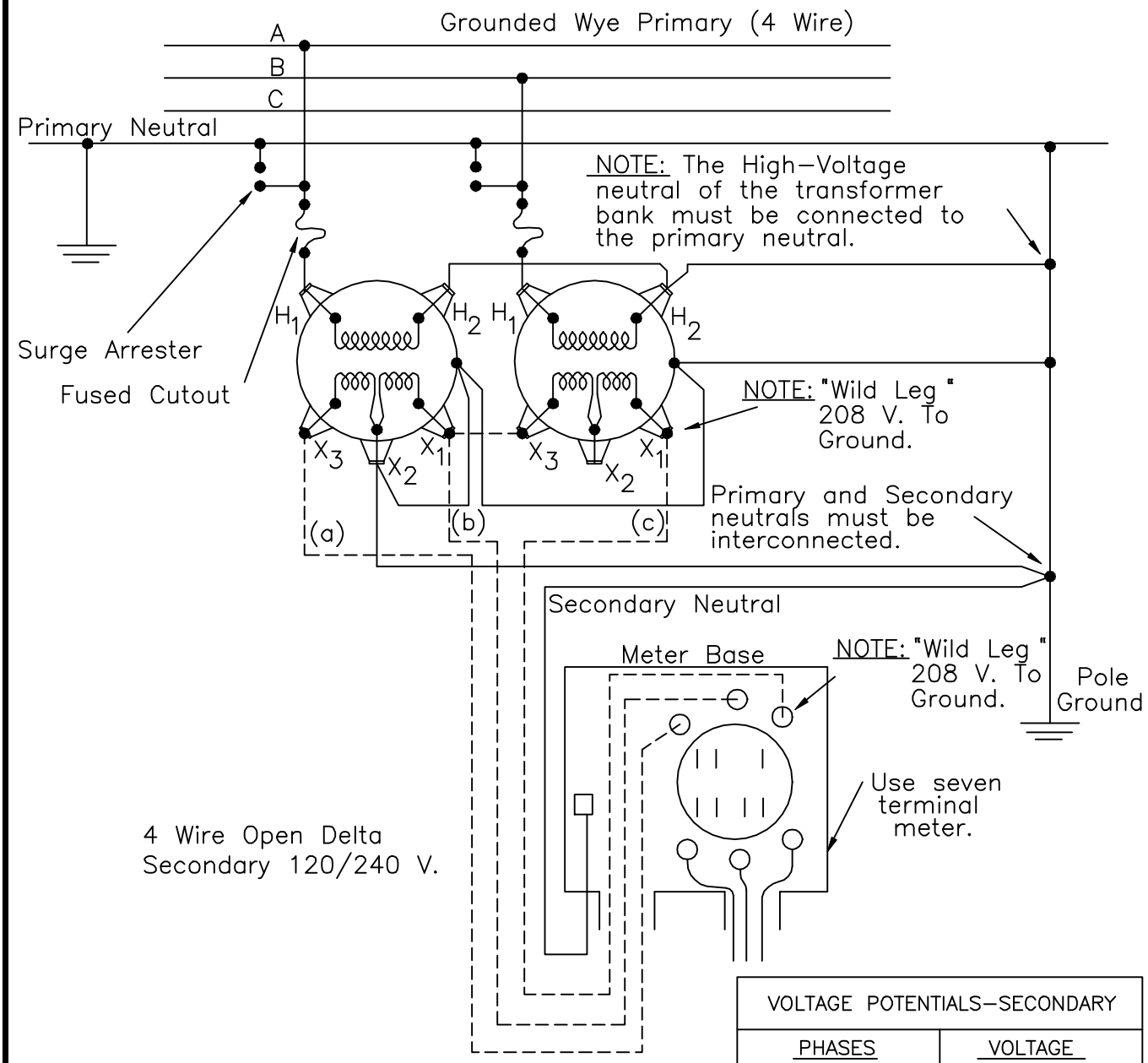
ITEM	QTY	MATERIAL
af	2	Cutout, dist. open (27 kV)
an	2	Transformer, 14.4 kV, conv.
av		Jumpers, bare, strandd
av		Jumpers, service, as req'd
cu	2	Brace, 28"
dm	1	Bracket, transformer
ek	5	Locknuts
fo	3	Bracket, transformer, insul.

DESIGN PARAMETERS:

See Guide Drawing "G2.1G"

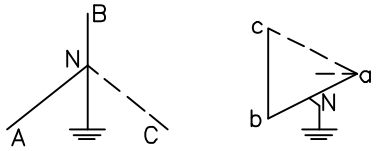
TWO–PHASE TRANSFORMER BANK
OPEN–WYE PRIMARY
OPEN–DELTA, 4 WIRE SECONDARY

DEC 1998		
RUS	24.9/14.4 kV	VG2.1



VOLTAGE POTENTIALS—SECONDARY	
PHASES	VOLTAGE
a–b	240 VOLTS
b–c	240 VOLTS
a–c	240 VOLTS
a–N	120 VOLTS
b–N	120 VOLTS
c–N	208 VOLTS

210° ANGULAR DISPLACEMENT



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

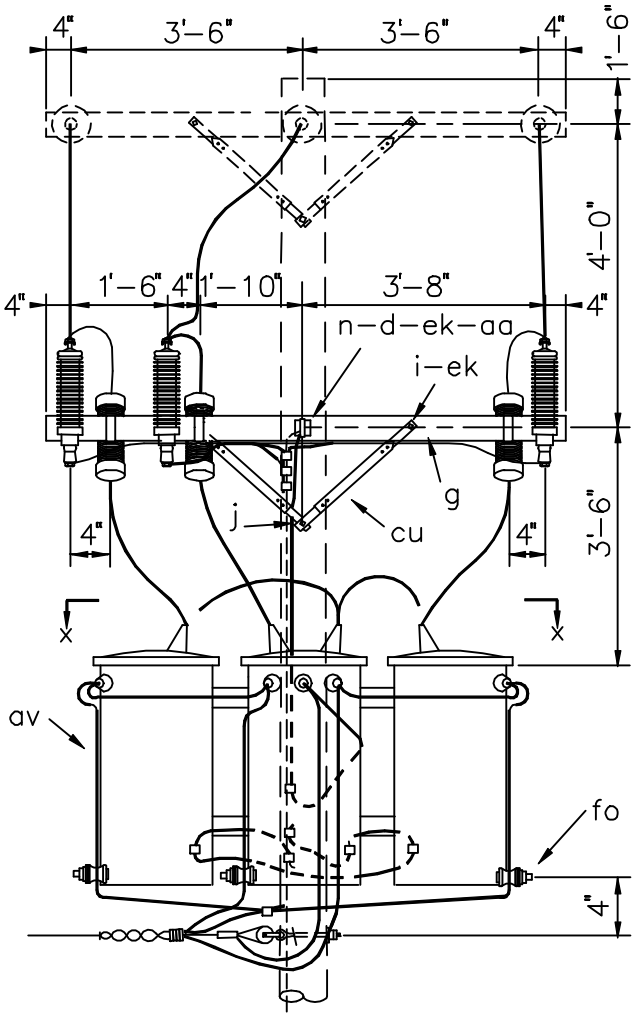
See drawing "G2.1" or "VG2.1" for construction details. One-bushing or two-bushing transformers may be used. Usually transformers of different KVA sizes are used.

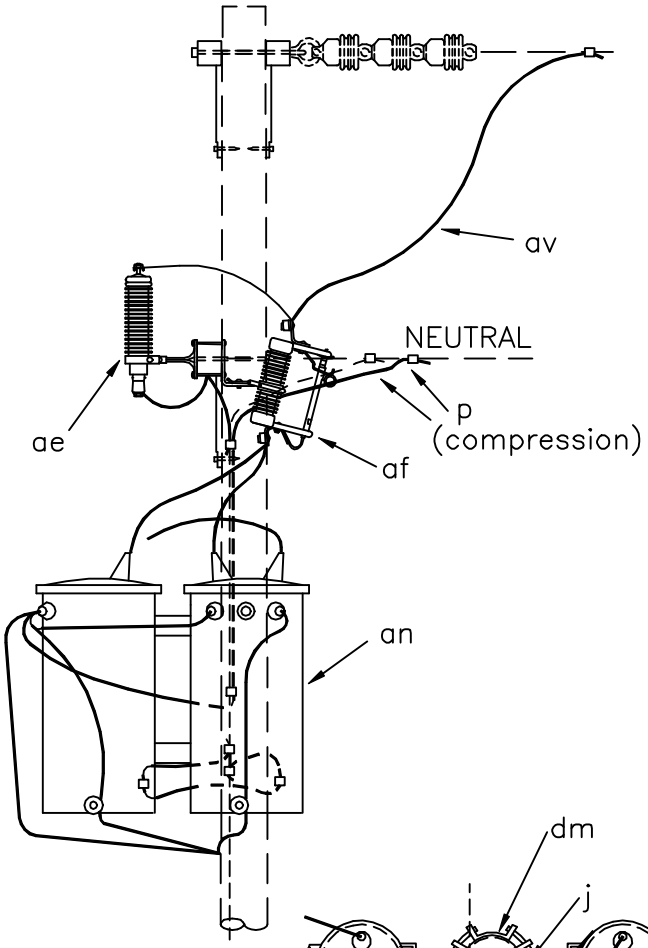
BANK RATING: This bank has only 86.6% of the rating of the two units making up the three-phase bank and only 57.7% of the three-phase rating of a closed delta-delta bank of three transformers. Thus, it is relatively inefficient where three-phase loads predominate.

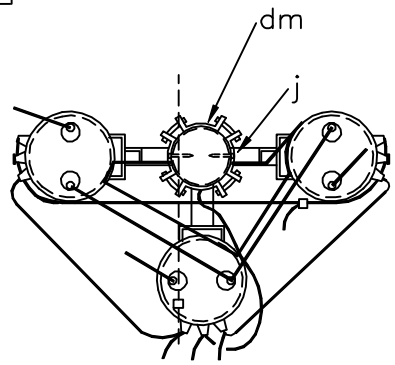
TRANSFORMER/METER CONNECTION GUIDE

THREE-PHASE, OPEN-WYE – OPEN DELTA
FOR 120/240 VOLT POWER LOADS

DEC 1998		
RUS		G2.1G







SECTION X–X

NOTES:
1. See Drawing "Q3.1" for additional connection and metering details.
2. All transformer tanks must be grounded.

ITEM	QTY	MATERIAL
d	2	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j		Screw, lag, 1/2" x 4" as req'd
n	1	Bolt, dble arm, 5/8 x req'd length
p		Connectors, as req'd
p		Connectors, compression, as req'd
aa	1	Nut, eye, 5/8
ae	3	Arrester, surge, (18 kV)

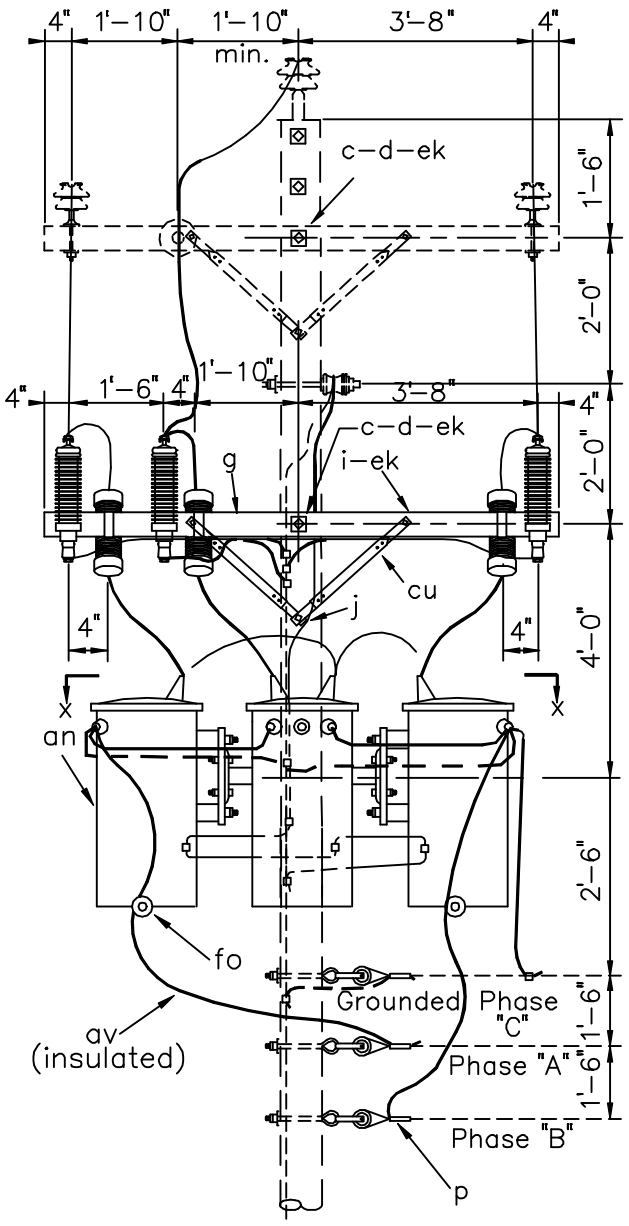
ITEM	QTY	MATERIAL
af	3	Cutout, dist. open (27 kV)
an	3	Transformer, 14.4 kV, conventional
av		Jumpers, bare, stranded
av		Jumpers, service, as req'd
cu	2	Brace, 28"
dm	1	Bracket, transformer, cluster with
		adapter plates as req'd
ek	5	Locknuts
fo	3	Bracket, transformer, insulated

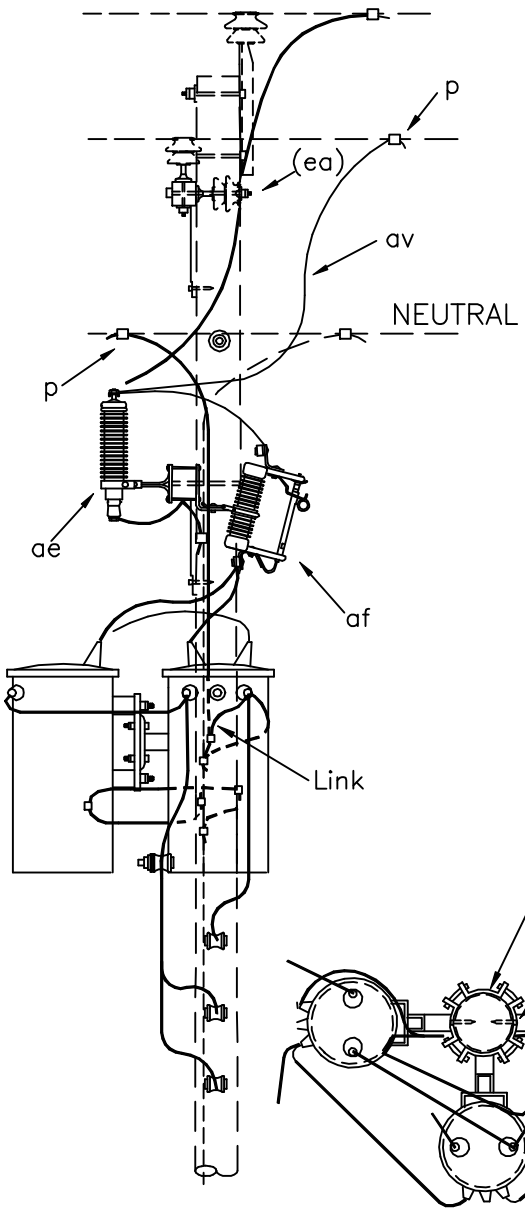
DESIGN PARAMETERS:

See Guide Drawing "G3.1G"

THREE–PHASE TRANSFORMER BANK
UNGROUNDED–WYE PRIMARY
CENTER–TAP GROUNDED DELTA, 4 WIRE SECONDARY

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VG3.1





SECTION X–X

NOTES:

1. See Drawing "Q3.2" for additional connection and metering details.

ITEM	QTY	MATERIAL
d	2	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j		Screw, lag, 1/2" x 4", as req'd
n	1	Bolt, dble arm, 5/8" x req'd length
p		Connectors, as req'd
p		Connectors, compression, as req'd
aa	1	Nut, eye, 5/8"
ae	3	Arrester, surge, (18 kV)

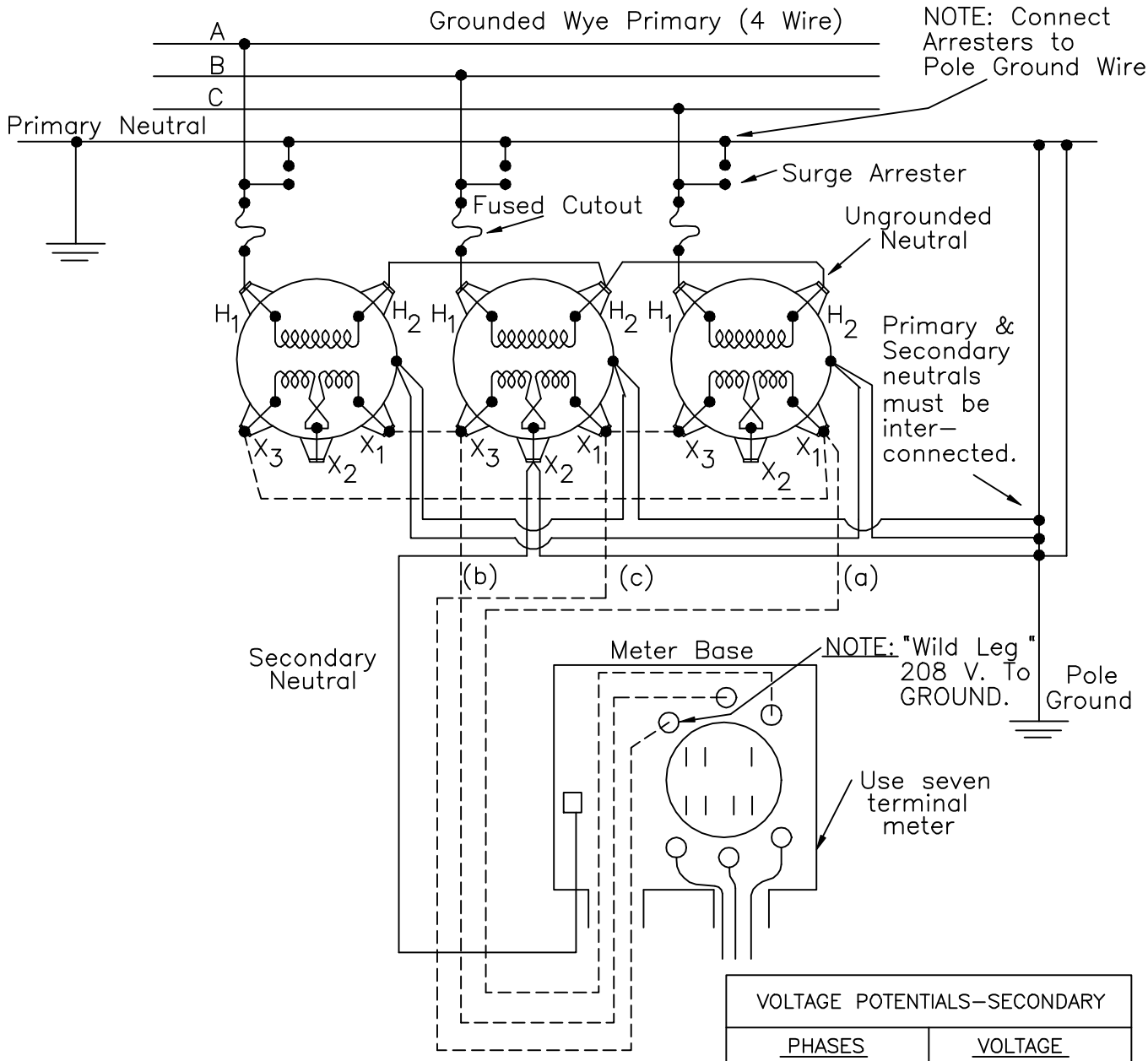
ITEM	QTY	MATERIAL
af	3	Cutout, dist. open (27 kV)
an	3	Transformer, 14.4 kV, conventional
av		Jumpers, bare, stranded
av		Jumpers, service, as req'd
cu	2	Brace, 28"
dm	1	Bracket, transformer, cluster with
		adapter plates as req'd
ek	5	Locknuts
fo	3	Bracket, transformer, insulated

DESIGN PARAMETERS:

See Guide Drawing "G3.2G"

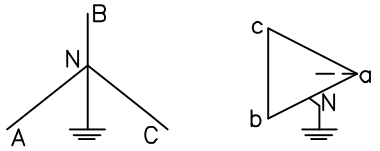
THREE–PHASE TRANSFORMER BANK
UNGROUNDED–WYE PRIMARY
CORNER GROUNDED DELTA, 3 WIRE SECONDARY

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VG3.2



VOLTAGE POTENTIALS–SECONDARY	
PHASES	VOLTAGE
a–b	240 VOLTS
b–c	240 VOLTS
a–c	240 VOLTS
a–N	120 VOLTS
b–N	120 VOLTS
c–N	208 VOLTS

210° ANGULAR DISPLACEMENT



APPLICATION: Used to supply three–phase, 240 volt loads with small amounts of 120/240 volt single–phase loads.

See drawing "G3.1" or "VG3.1" for construction details.

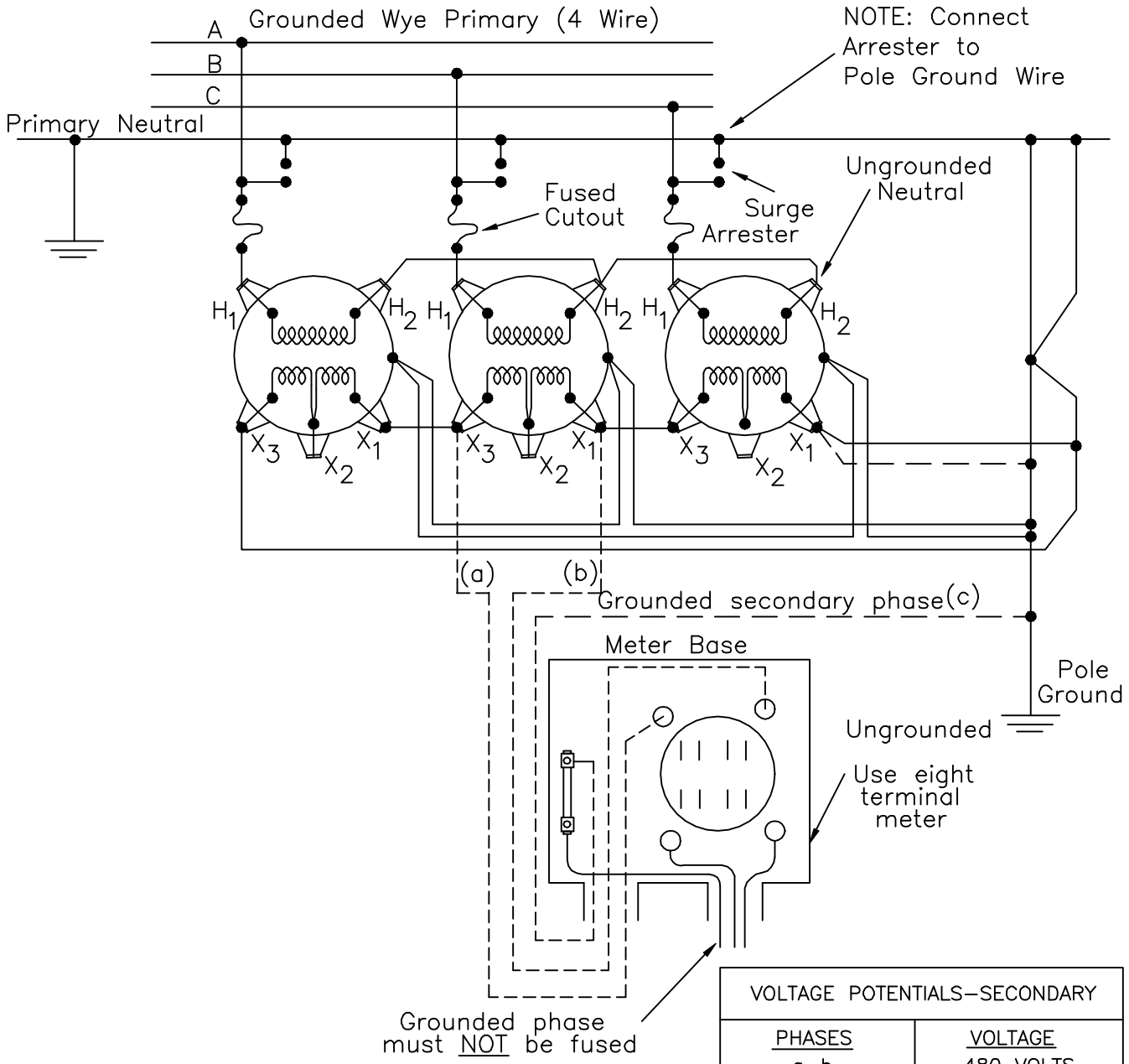
CAUTION: Only ground one secondary neutral bushing of the three transformers. Connecting the high–voltage neutral to the system neutral may cause the transformer bank to burn out.

BANK RATING: The center tapped transformer carries 2/3 of the 120/240 volt single–phase load; each of the three units carry 1/3 of the 240 volt three–phase load.

TRANSFORMER/METER CONNECTION GUIDE

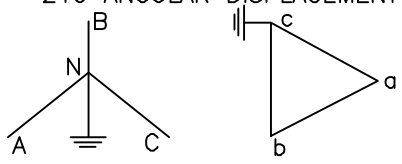
UNGROUNDED WYE – CENTER TAP GROUNDED DELTA FOR 120/240 VOLT POWER LOADS

DEC 1998	3 – PHASE PRIMARY	
RUS		G3.1G



VOLTAGE POTENTIALS—SECONDARY	
PHASES	VOLTAGE
a—b	480 VOLTS
b—c	480 VOLTS
a—c	480 VOLTS
a—GRD	480 VOLTS
b—GRD	480 VOLTS
c—GRD	0 VOLTS

210° ANGULAR DISPLACEMENT



APPLICATION: Used to supply three—phase (only), 240 or 480 volt power loads.

See drawing "G3.2" or "VG3.2" for construction details.

BANK RATING: The kVA rating of the bank is three times the kVA rating of the smallest transformer.

NOTES:

One—half of the above voltages apply when a 240 volt bank is used.

All tanks to be grounded.

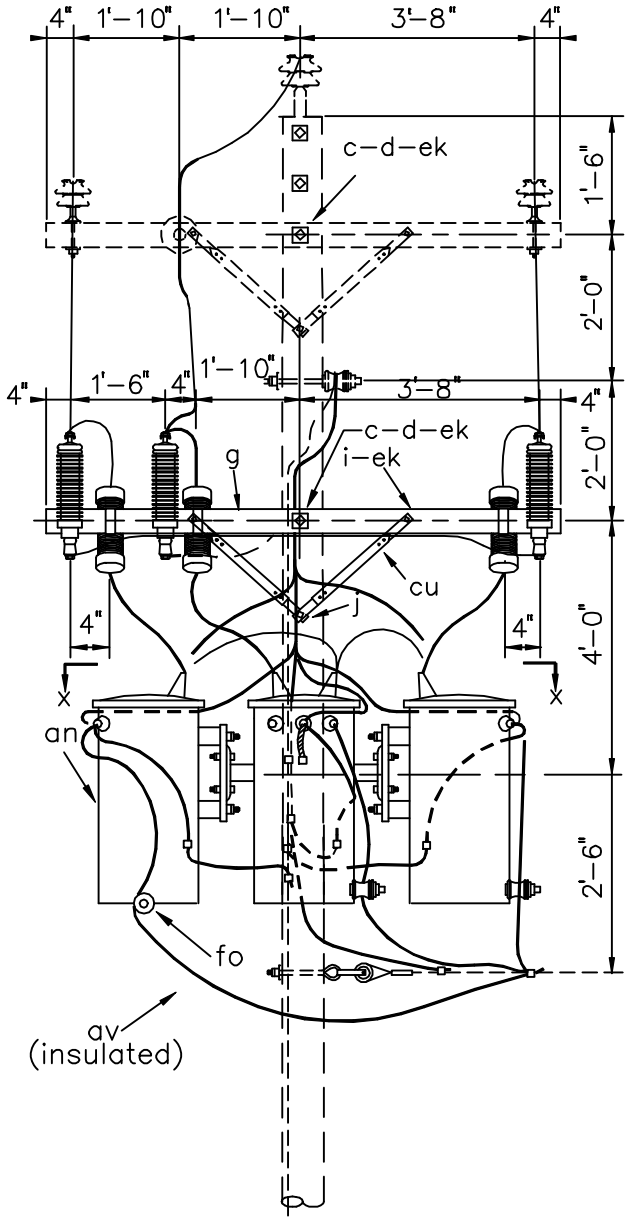
Disconnect all secondary neutrals from tank and do not ground. Do not ground bank on primary side. (If grounded, the bank would be a grounding bank for the entire circuit.)

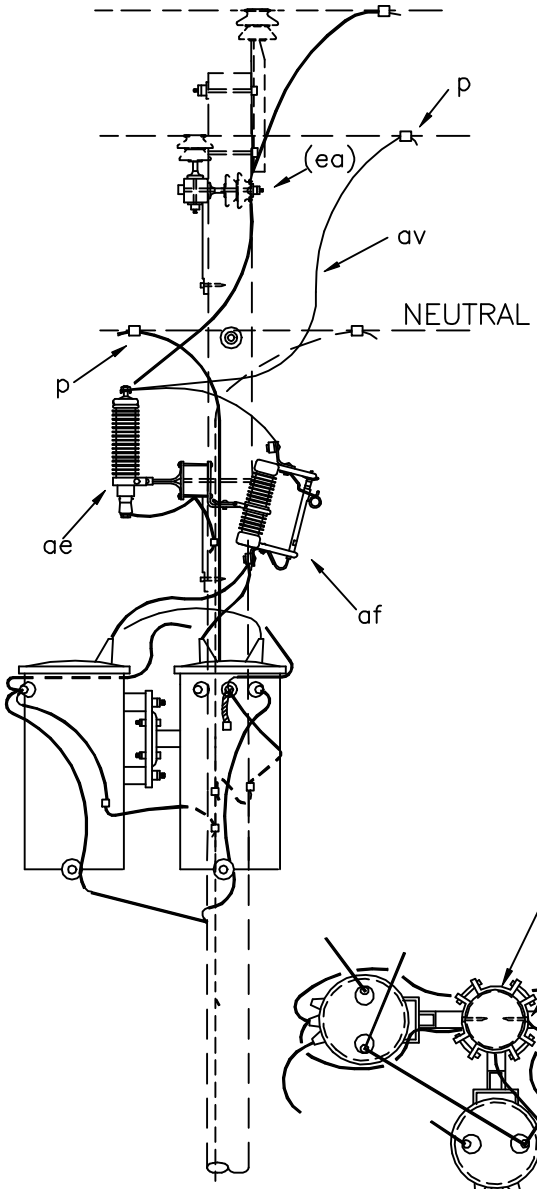
The grounding secondary wire is a current carrying phase wire operating at ground potential and must be identified throughout the circuit run. It is not a neutral.

TRANSFORMER/METER CONNECTION GUIDE

UNGROUNDED WYE — CORNER GROUNDED DELTA FOR 240 or 480 VOLT POWER LOADS

DEC 1998	3 — PHASE PRIMARY	
RUS		G3.2G





SECTION X–X

NOTES:

1. See Drawing "Q3.3" for additional connection and metering details.

ITEM	QTY	MATERIAL
d	2	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j		Screw, lag, 1/2" x 4", as req'd
n	1	Bolt, dble arm, 5/8" x req'd length
p		Connectors, as req'd
p		Connectors, compression, as req'd
aa	1	Nut, eye, 5/8"
ae	3	Arrester, surge, (18 kV)

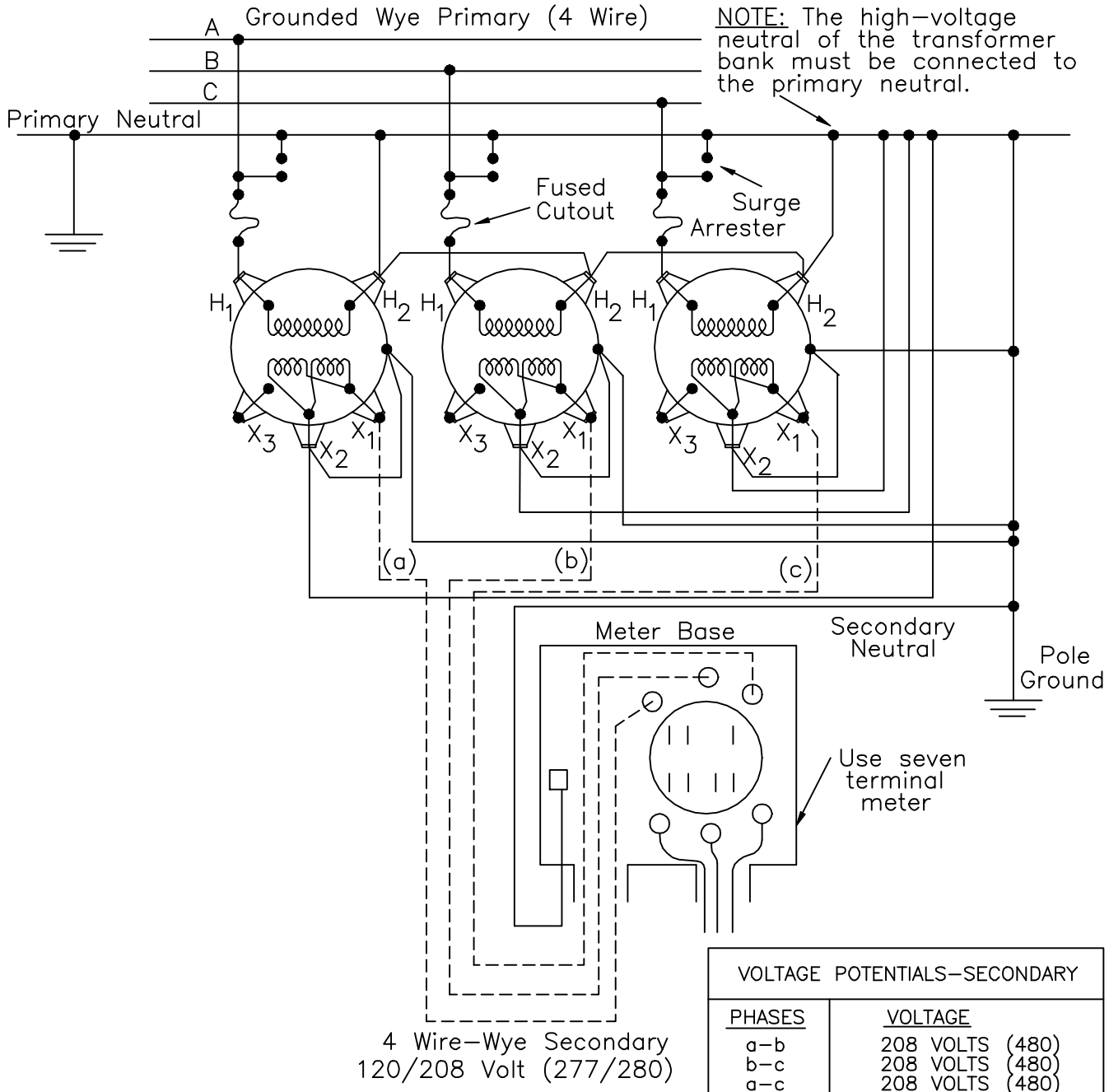
ITEM	QTY	MATERIAL
af	3	Cutout, dist. open (27 kV)
an	3	Transformer, 14.4 kV, conventional
av		Jumpers, bare, stranded
av		Jumpers, service, as req'd
cu	2	Brace, 28"
dm	1	Bracket, transformer, cluster with
		adapter plates as req'd
ek	5	Locknuts
fo	3	Bracket, transformer, insulated

DESIGN PARAMETERS:

See Guide Drawing "G3.3G"

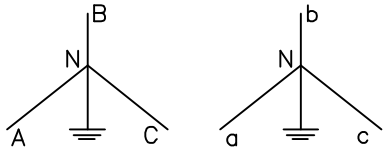
THREE–PHASE TRANSFORMER BANK
GROUNDED–WYE PRIMARY
GROUNDED WYE, 4 WIRE SECONDARY

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VG3.3



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

0° ANGULAR DISPLACEMENT



APPLICATION: Used to supply 120/208 volt single-phase and 208 volt, three-phase power loads.

See drawing "G3.3" or "VG3.3" for construction details. Reconnect secondary windings of transformers as shown. Matched (impedance and kVA) transformers are usually used.

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

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

TRANSFORMER/METER CONNECTION GUIDE

GROUNDED WYE – GROUNDED WYE FOR 120/208 VOLT POWER LOADS

DEC 1998	3 – PHASE PRIMARY	
RUS		G3.3G

INDEX H

GROUNDING ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
H1.1	GROUNDING ASSEMBLY - GROUND ROD TYPE
H2.1	GROUNDING ASSEMBLY - TRENCH TYPE
H3.1	GROUNDING ASSEMBLY - GROUND ROD TYPE (FOR SECTIONALIZING AIRBREAK SWITCH)
H4.1	GROUNDING ASSEMBLY - PLATFORM TYPE (FOR SECTIONALIZING AIRBREAK SWITCH)

CONSTRUCTION SPECIFICATIONS FOR GROUNDING

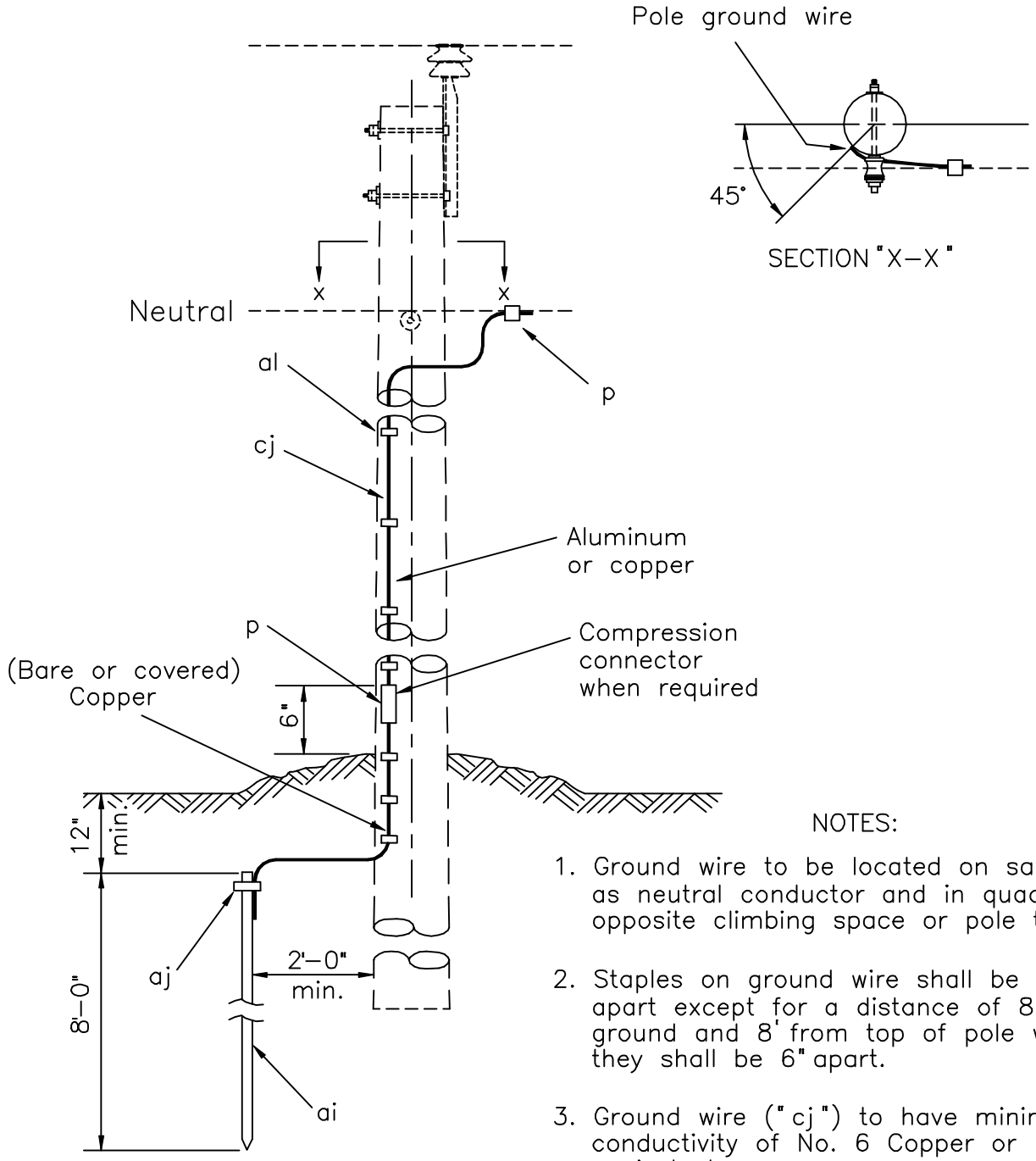
Ground rods shall be driven full length in undisturbed earth in accordance with the construction drawings. They shall be installed a minimum of 2 feet from the face of the pole. The top of the ground rods shall be at least 12 inches below the surface of the earth. The ground wire shall be attached to the rod with an appropriate ground rod clamp and shall be secured to the pole with staples. The staples on the ground wire shall be spaced 2 feet part, except for a distance of 8 feet above the ground and 8 feet down from the top of the pole, as applicable, where they shall be 6 inches apart.

The connection between the ground rod and the system neutral should be made by one continuous piece of conductor, (the pole ground wire), and installed in the shortest and most direct path according to the construction drawings. If a splice is required, it shall be made using a compression type connector. Such a splice shall only be installed a minimum of 6 inches above the ground line. The pole ground wire shall be connected to the system neutral using a compression type connector.

All equipment shall have at least 2 connections from the frame, case, or tank to the multi-grounded system neutral conductor. The pole ground wire may be used for one or both of these connections.

All neutral conductors on the pole shall be connected directly to each other, and connected to the pole ground wire if present. Ground connections, in addition to the ones required and specified herein, are acceptable unless they add undue congestion on the structure.

All equipment ground wires, neutral conductors, downguys, messenger wires, and surge-protection ground wires shall be interconnected and attached to a common (pole) ground wire in accordance with the requirements of, or exempted by, the National Electrical Safety Code.



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" apart except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Ground wire ("cj") to have minimum conductivity of No. 6 Copper or equivalent.
4. Use copper plated ground rod, copper ground wire and staples, OR, use galvanized steel ground rod, staples and aluminum ground wire.

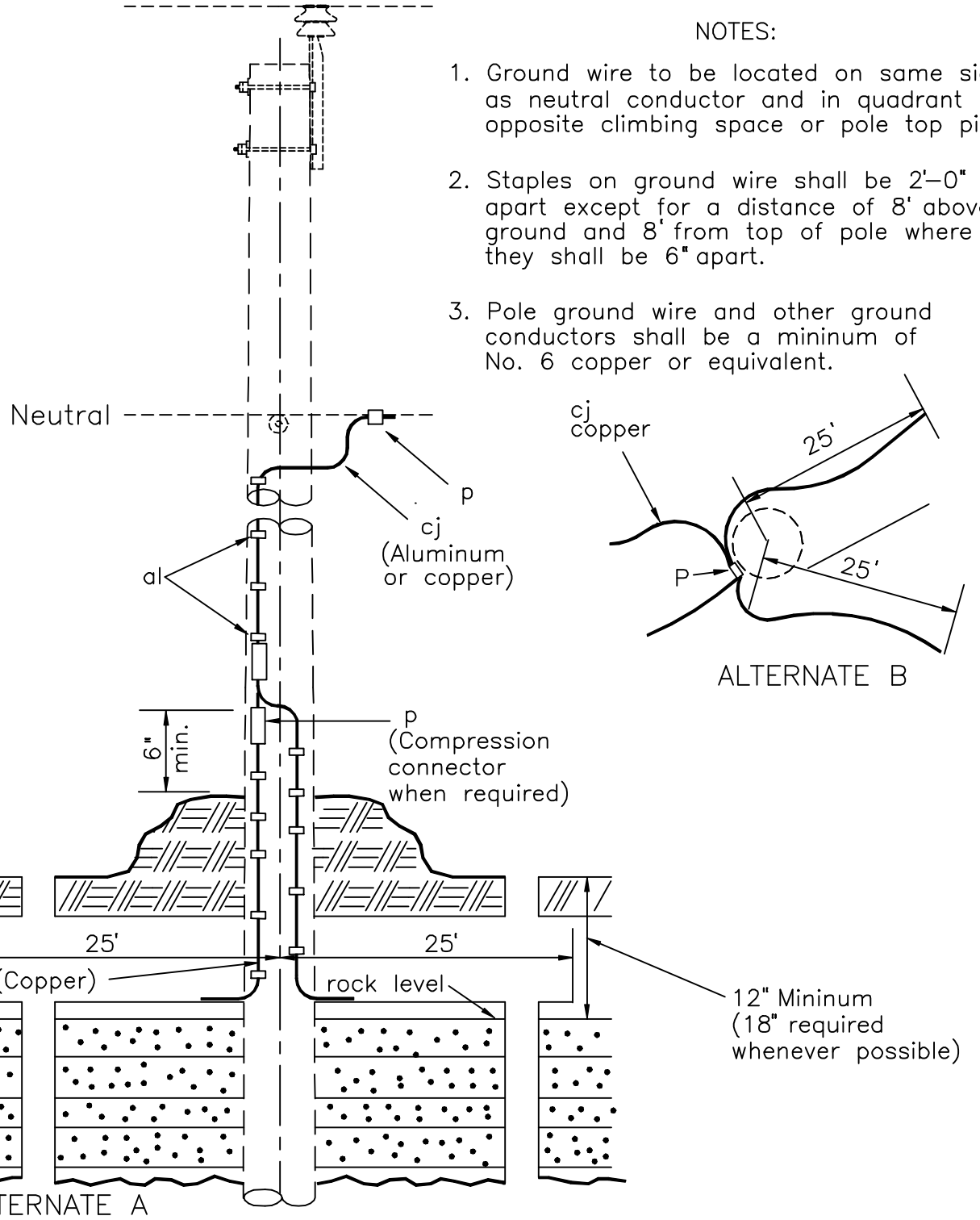
ITEM	QTY	MATERIAL
p		Connector, compression, as req'd
ai	1	Rod, ground, 5/8" min. diameter
aj	1	Clamp, ground rod
al		Staple, ground wire, as req'd
cj		Wire, pole ground, as req'd

GROUNDING ASSEMBLY – GROUND ROD TYPE

DEC 1998		
RUS		H1.1

NOTES:

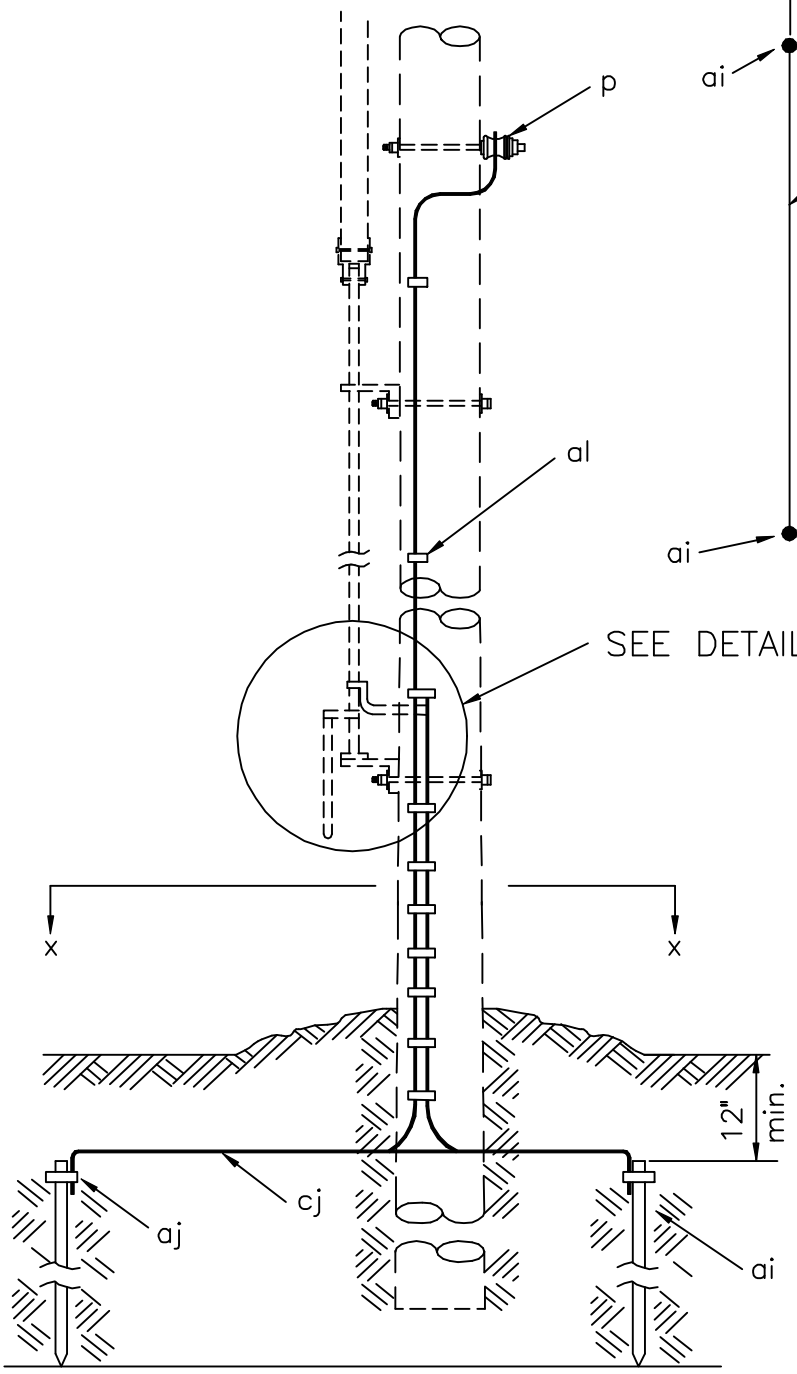
1. Ground wire to be located on same side as neutral conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be 2'–0" apart except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Pole ground wire and other ground conductors shall be a mininum of No. 6 copper or equivalent.

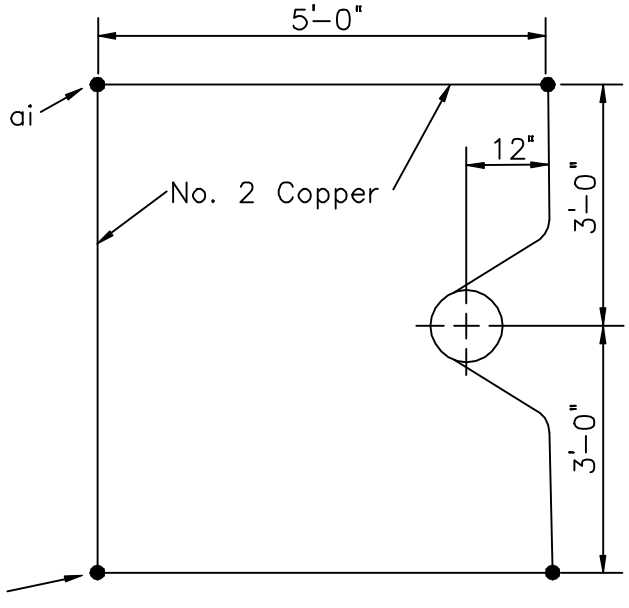


ITEM	QTY	MATERIAL
p		Connector, compression, as req'd
al		Staple, ground wire, as req'd
cj		Wire,pole ground,as req'd SEE NOTE 3

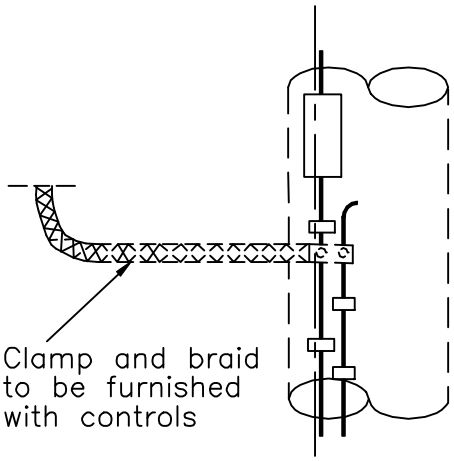
GROUNDING ASSEMBLY – TRENCH TYPE

DEC 1998		
RUS		H2.1





SECTION X–X
(Detail of ground Grid)

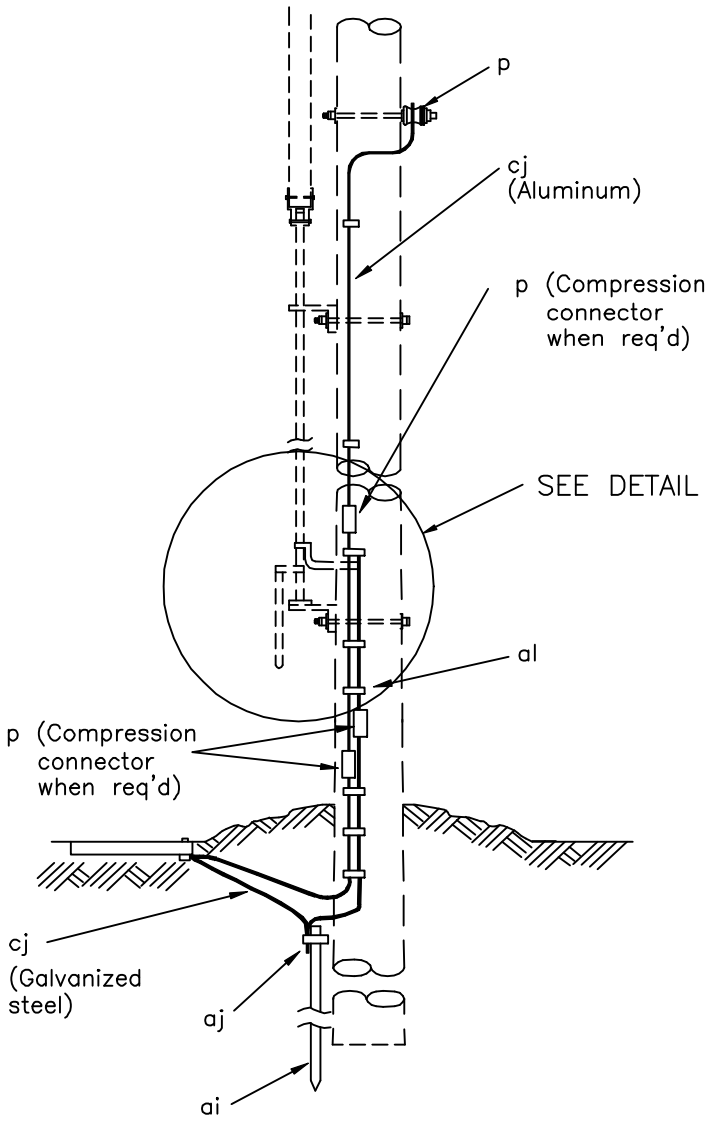


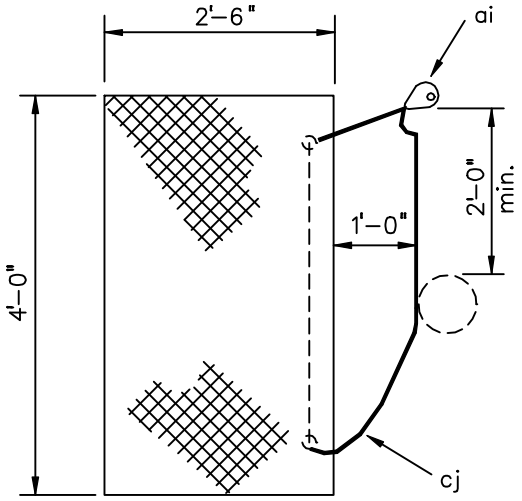
DETAIL

ITEM	QTY	MATERIAL
p		Connector, compression, as req'd
ai	4	Rod, ground, 5/8" min. dia., copper covered
aj	4	Clamp, ground rod
al		Staple, ground wire, (copper),as req'd
cj		Wire, pole ground, #2 S.D. Copper, as req'd

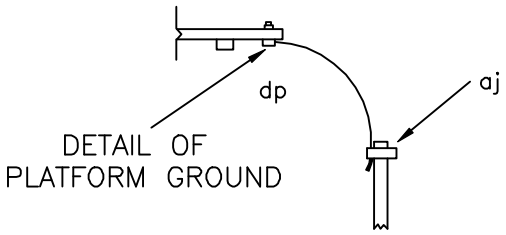
GROUNDING ASSEMBLY – GROUND ROD TYPE (FOR SECTIONALIZING AIRBREAK SWITCH)

DEC 1998		
RUS		H3.1

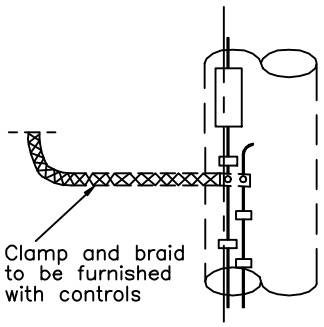




DETAIL OF PLATFORM



DETAIL OF
PLATFORM GROUND



DETAIL

ITEM	QTY	MATERIAL
p		Connector, compression, as req'd
ai	1	Rod, ground, 5/8" min. dia., (galv.)
aj	1	Clamp, ground rod, (galvanized steel)
al		Staple, ground wire, (galv.), as req'd
cj		Wire, pole ground,as req'd–SEE NOTE
dp	2	Clamp, ground wire, with lock washer
	1	Platform, grounding plate, galv. iron

NOTE:
For ground wire use soft annealed iron, class C galvanizing, 3–wire, 5/16."

GROUNDING ASSEMBLY – PLATFORM TYPE (FOR SECTIONALIZING AIRBREAK SWITCH)

DEC 1998		
RUS		H4.1

INDEX J

SECONDARY ASSEMBLY UNITS

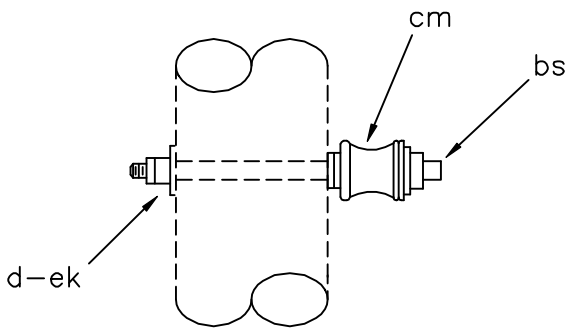
DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
J1.1, J1.2	SECONDARY ASSEMBLIES (SMALL ANGLE)
J2.1, J2.2	SECONDARY ASSEMBLIES (LARGE ANGLE)
J3.1, J4.1	SECONDARY ASSEMBLIES (DEADEND, MISC.)

CONSTRUCTION SPECIFICATIONS FOR SECONDARIES AND SERVICE DROPS

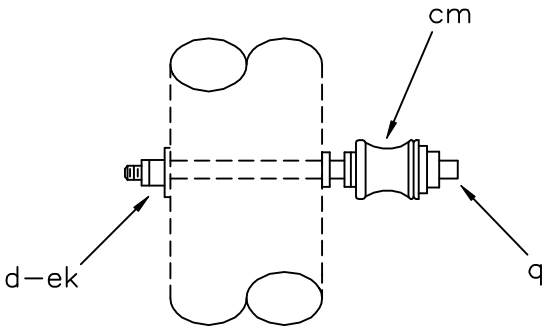
Secondary conductors may be bare or covered wires or multi-conductor service cable. The conductors shall be sagged in accordance with the manufacturer's recommendations.

Conductors for secondary underbuild on primary lines have normally been, and still may be bare, except in those circumstances where other conditions, such as long primary span lengths, may necessitate that covered wires or service cable may be or should be used. Service drops shall be covered wire or service cable.

Secondaries and service drops shall be so installed as not to obstruct the climbing space on poles. There shall not be more than one splice per conductor in any span, and splices shall be located at least 10 feet 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.



J1.1



J1.2

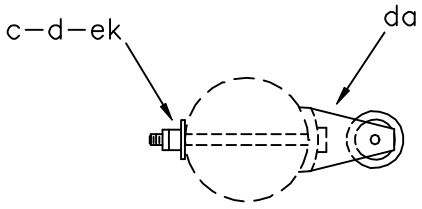
		J1.1	J1.2
ITEM	MATERIAL	QTY	QTY
d	Washer, 2 1/4" square	1	1
q	Bolt, double upset		1
bs	Bolt, single upset	1	
cm	Insulator, spool	1	1
ek	Locknuts	1	1

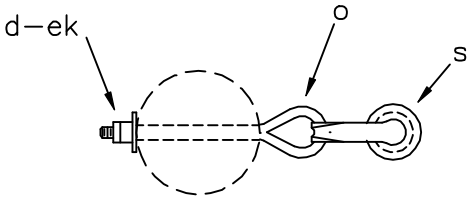
DESIGN PARAMETERS:
MAXIMUM LINE ANGLES

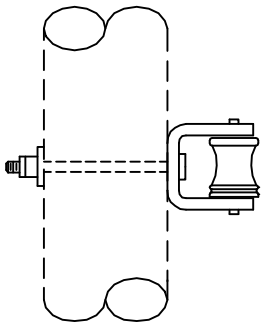
5° – Small Conductors
2° – Larger than #1/0

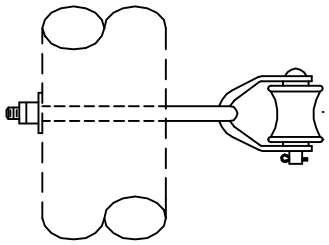
SECONDARY ASSEMBLIES
(SMALL ANGLE)

DEC 1998		J1.1,
RUS		J1.2









J2.1

J2.2

NOTE: See Tying Guide Drawing L3.1G

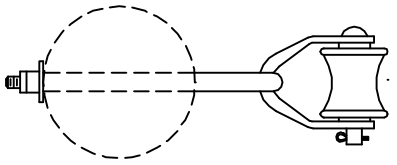
		J2.1	J2.2
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" X req'd length	1	
d	Washer, 2 1/4" square	1	1
o	Bolt, eye, 5/8" X req'd length		1
s	Clevis, secondary, swinging, insulated		1
da	Bracket, insulated	1	
ek	Locknuts	1	1

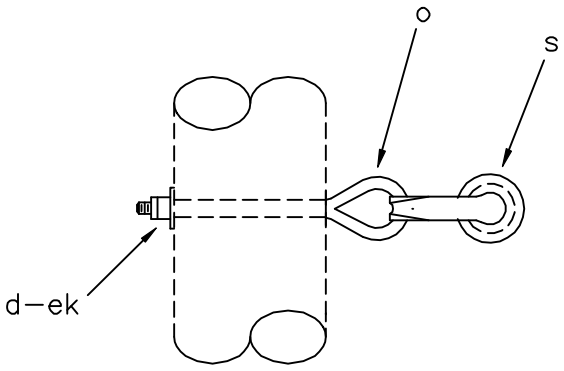
DESIGN PARAMETERS:
MAXIMUM LINE ANGLES

J2.1: 60°
J2.2: 60°

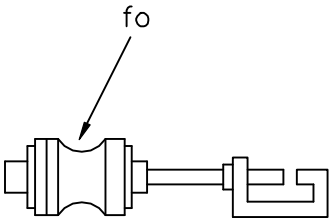
SECONDARY ASSEMBLIES (LARGE ANGLE)

DEC 1998		J2.1, J2.2
RUS		





J3.1



J4.1

NOTE: See Tying Guide Drawing L3.2G, L3.3G or L4.2G

		J3.1	J4.1
ITEM	MATERIAL	QTY	QTY
d	Washer, 2 1/4" square	1	
o	Bolt, eye, 5/8" x req'd length	1	
s	Clevis, secondary, swinging, insulated	1	
fo	Bracket, transformer secondary		1
ek	Locknuts	1	1

DESIGN PARAMETERS: (J3.1)

ALLOWABLE LONGITUDINAL LOADING:
1,500 lbs. (ANSI Class 53–2 Insulator)
2,250 lbs. (ANSI Class 53–4 Insulator)

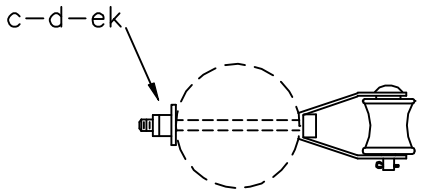
SECONDARY ASSEMBLIES (DEADEND, MISC.)

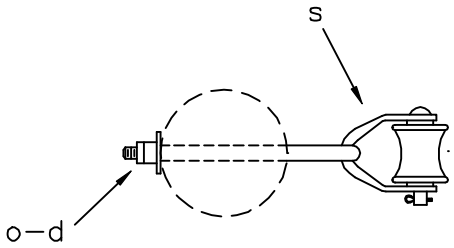
DEC 1998		J3.1, J4.1
RUS		

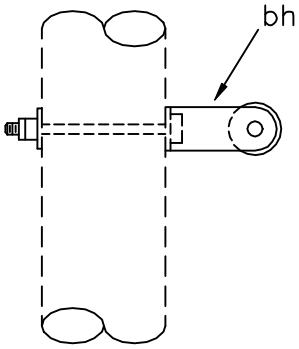
INDEX K

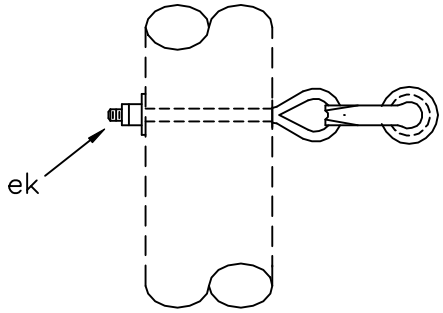
SERVICE ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
K1.1, K1.2	SERVICE ASSEMBLIES (POLE MOUNTED)
K1.3, K1.4	SERVICE ASSEMBLIES (POLE MOUNTED)
K2.1, K2.2, K2.3	SERVICE ASSEMBLIES
K3.1, K3.2	SERVICE ASSEMBLIES (MAST TYPE)
K4.1G	CABLE SERVICE ASSEMBLY GUIDE
K4.2G	MAST TYPE SERVICE ASSEMBLY GUIDE
K4.3G	POLE TYPE SERVICE ASSEMBLY GUIDE
K4.4G	YARD POLE METER INSTALLATION GUIDE









K1.1

K1.2

NOTE: See Tying Guide drawings L3.2G, L3.3G, L4.1G or L4.2G

	ASSEMBLY:	K1.1	K1.2
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8" X req'd length	1	
d	Washer, 2 1/4" square	1	1
o	Bolt, eye, 5/8" X req'd length		1
s	Clevis, secondary, swinging, insulated		1
bh	Clevis, service, deadend, insulated	1	
ek	Locknuts	1	1

DESIGN PARAMETERS:

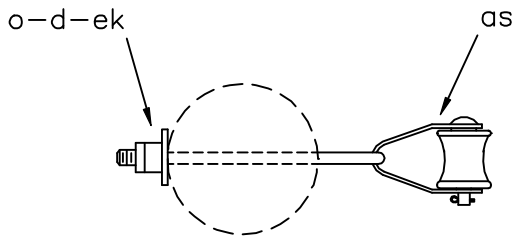
ALLOWABLE LONGITUDINAL LOADING:
1,500 lbs. (ANSI Class 53–2 Insulator)
2,250 lbs. (ANSI Class 53–4 Insulator)

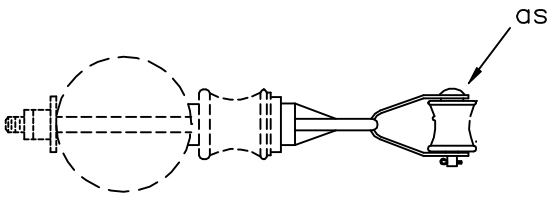
SERVICE ASSEMBLIES (POLE MOUNTED)

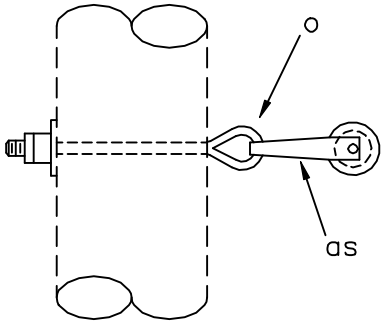
DEC 1998

RUS

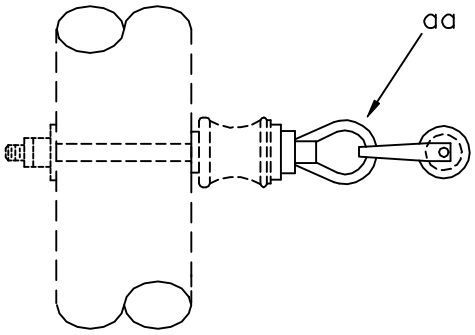
K1.1, K1.2







K1.3



K1.4

NOTE: See Tying Guide Drawings L3.2G, L3.3G, L4.1G or L4.2G

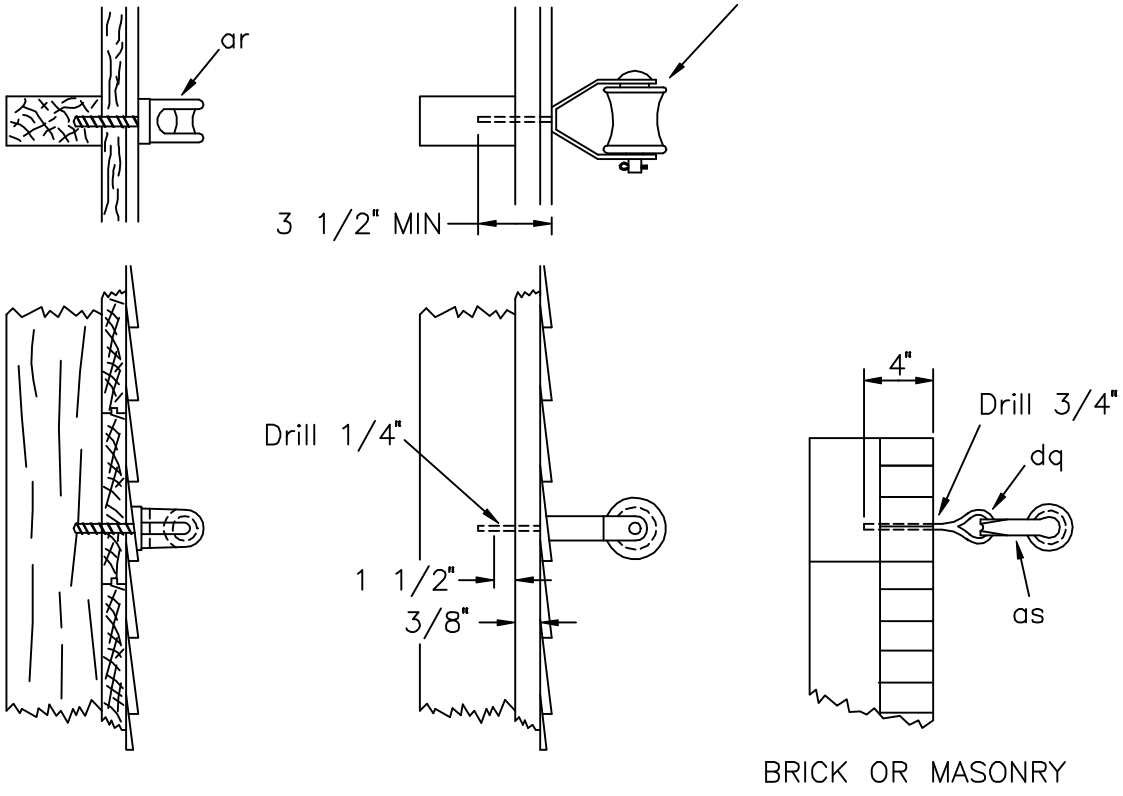
	ASSEMBLY:	K1.3	K1.4
ITEM	MATERIAL	QTY	QTY
d	Washer, 2 1/4" square	1	
o	Bolt, eye, 5/8" X req'd length	1	
aa	Nut, eye		1
as	Clevis, service, swinging, insulated	1	1
ek	Locknuts	1	

DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOAD:
1,500 lbs. (ANSI Class 53–2 Insulator)
2,250 lbs. (ANSI Class 53–4 Insulator)

SERVICE ASSEMBLIES (POLE MOUNTED)

DEC 1998		K1.3,
RUS		K1.4

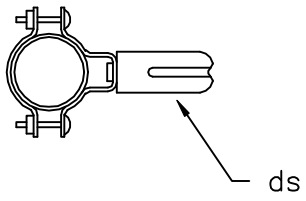


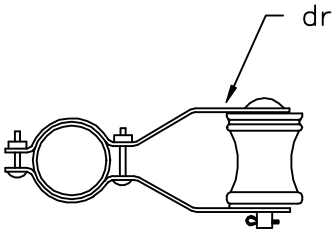
NOTES:
1. Assembly K2.1 not suitable for large conductors or cable services
2. See Tying Guide Drawings L3.2G, L3.3G, L4.1G or L4.2G

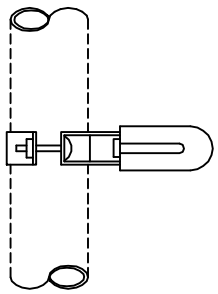
ASSEMBLY:		K2.1	K2.2	K2.3
ITEM	MATERIAL	QTY	QTY	QTY
ar	Wireholder	1		
as	Clevis, secondary, swinging, insulated			1
bt	Wireholder, clevis type insulated, #24 Woodscrew		1	
dq	Eye, screw, elliptical, 1/2" X 6"			1
	3/4" x 3 1/2" expansion shield			1

SERVICE ASSEMBLIES

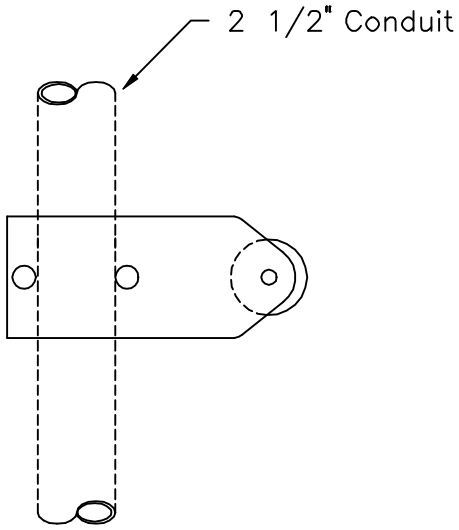
DEC 1998		K2.1, K2.2, K2.3
RUS		







K3.1



K3.2

NOTES:
1. Assembly K3.1 not suitable for large conductors or cable services
2. See Tying Guide Drawings L3.2G, L3.3G, L4.1G or L4.2G

	ASSEMBLY:	K3.1	K3.2
ITEM	MATERIAL	QTY	QTY
dr	Clevis, conduit, insulated		1
ds	Wireholder, conduit	1	

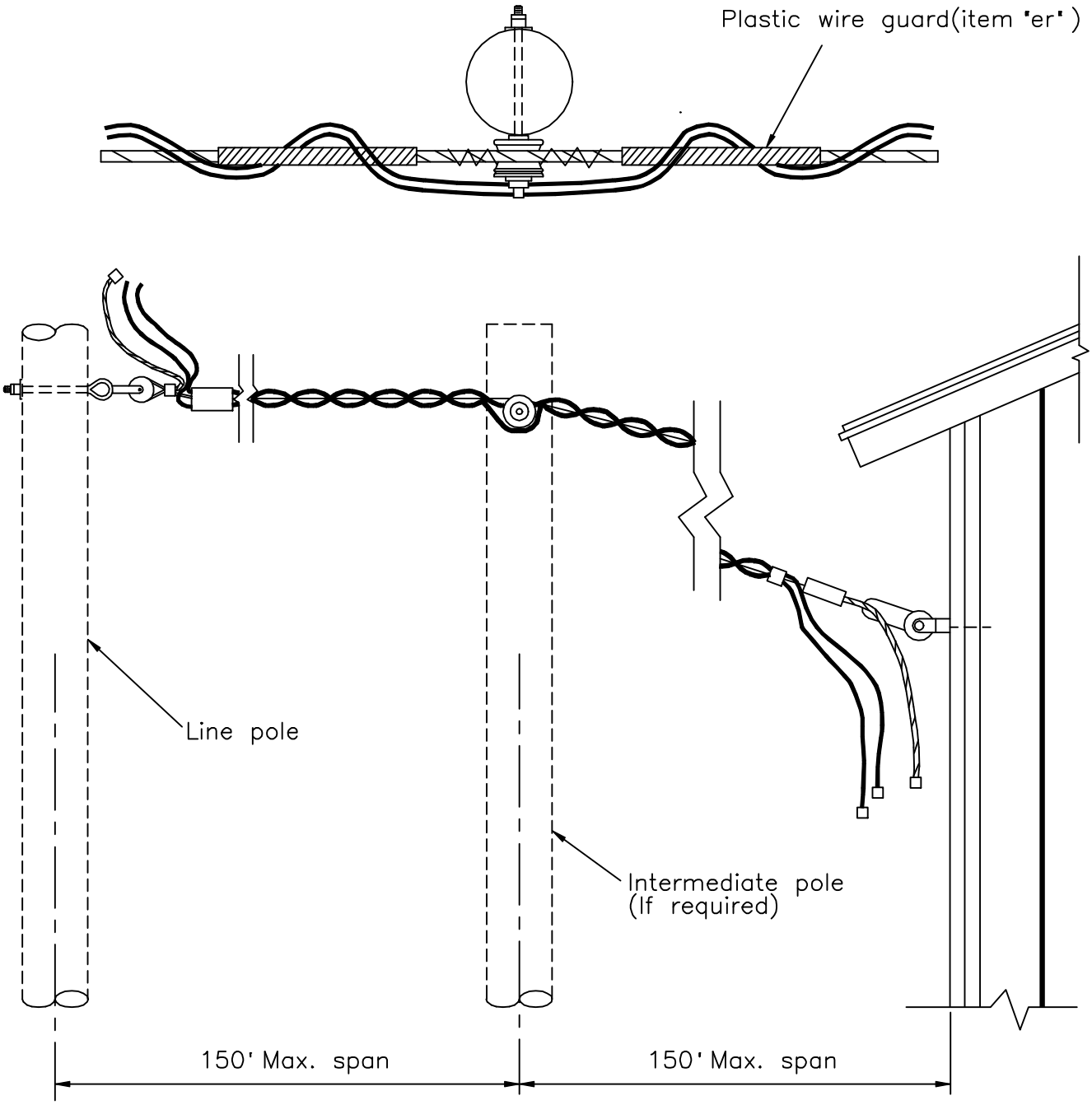
DESIGN PARAMETERS:

ALLOWABLE LOADING (lbs)

	Deadend	Cantilever
K3.1	1500	800
K3.2	1500	400

SERVICE ASSEMBLIES (MAST TYPE)

DEC 1998		K3.1, K3.2
RUS		

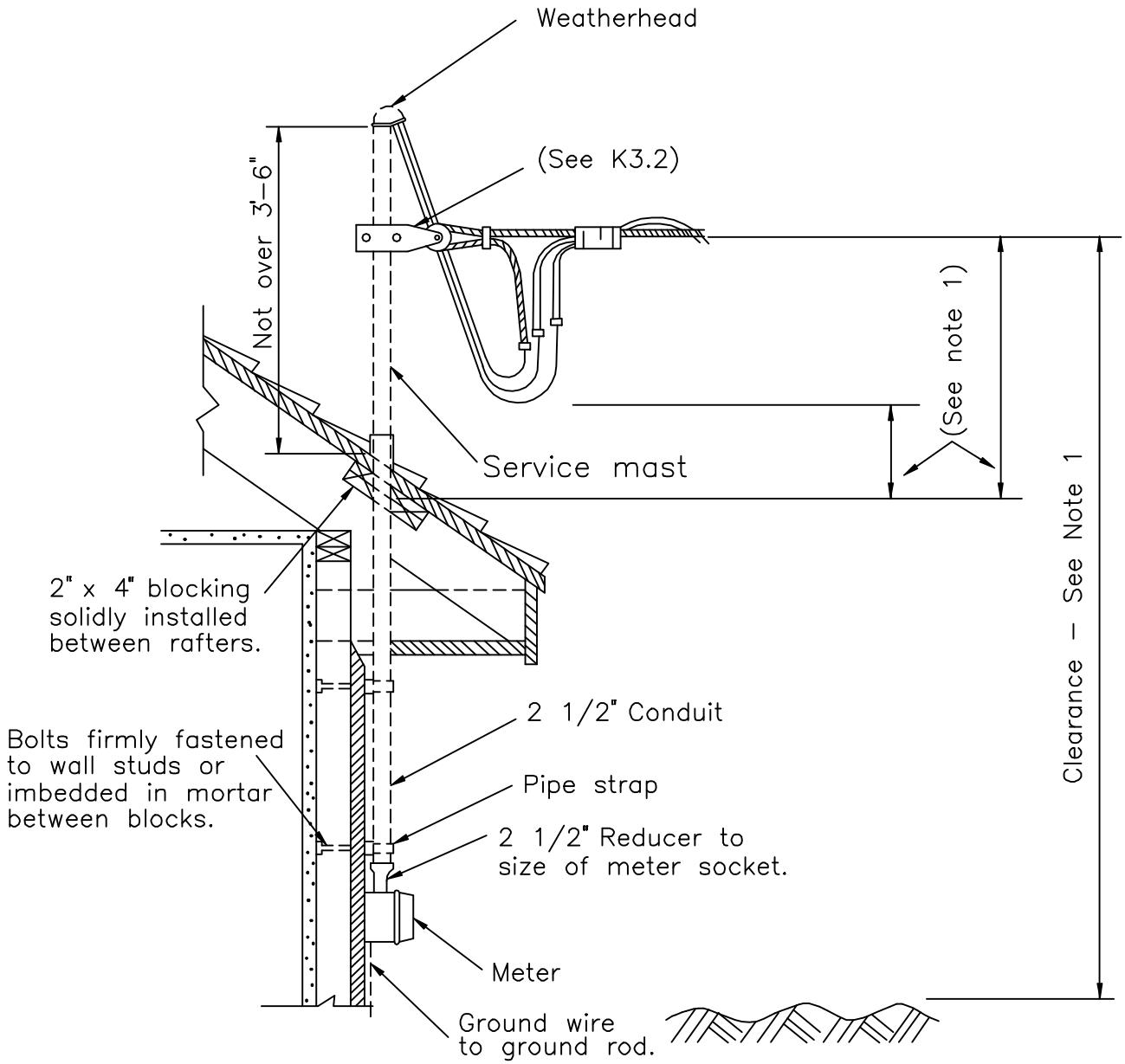


NOTES:

1. Services as short as possible are preferred.
2. Refer to secondary and service assemblies for construction details.
3. Service connectors to be insulated compression type.

CABLE SERVICE ASSEMBLY GUIDE

DEC 1998		
RUS		K4.1G



NOTES:

1. All clearances to be in conformance to the most stringent requirements of either the NESC, NEC or other codes of governmental or regulating authorities as applicable.

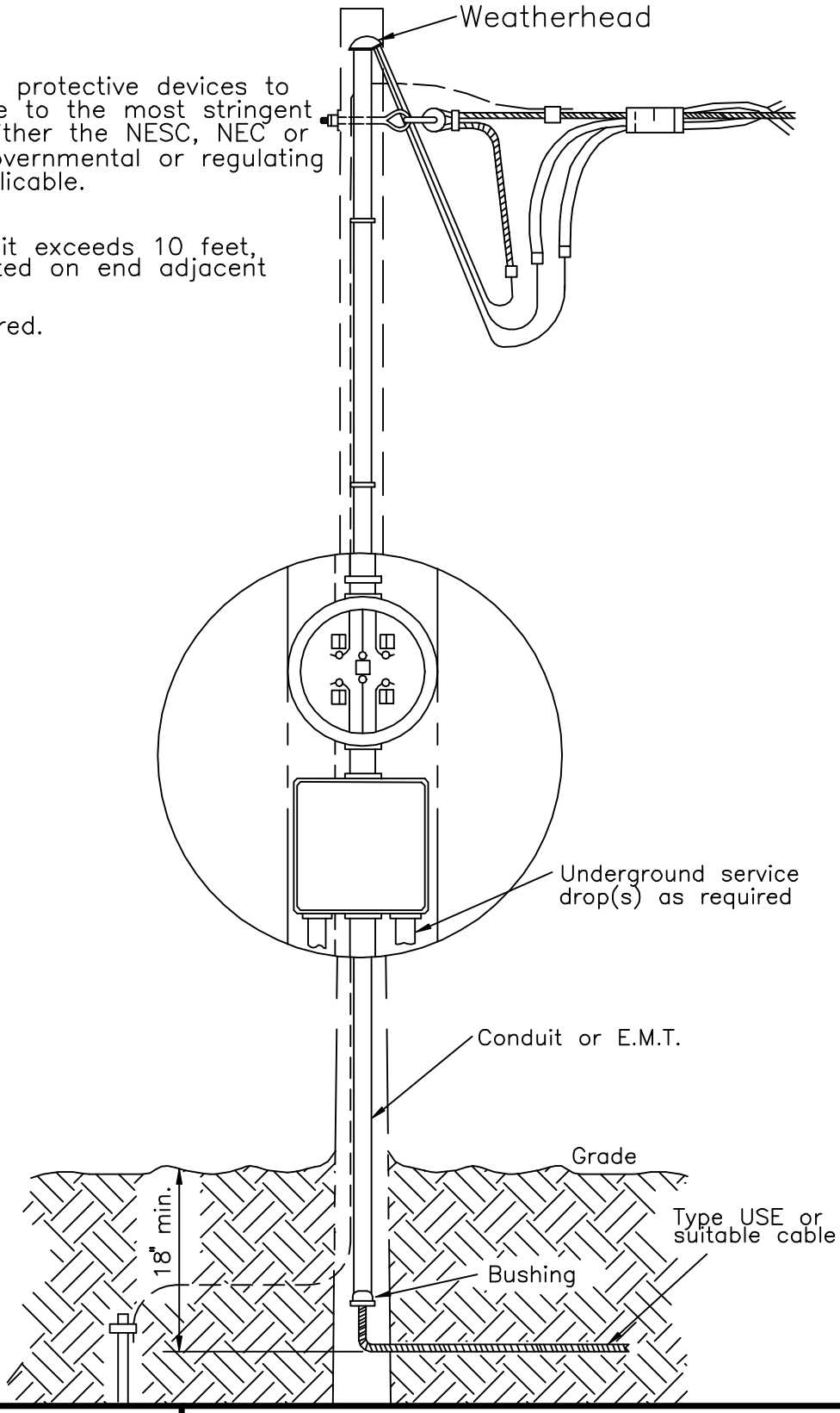
2. If length of conduit exceeds 10 feet, coupling is permitted on end adjacent to meter.

MAST TYPE SERVICE ASSEMBLY GUIDE

DEC 1998		
RUS		K4.2G

NOTES:

1. All Clearances and protective devices to be in conformance to the most stringent requirements of either the NESC, NEC or other codes of governmental or regulating authorities as applicable.
2. If length of conduit exceeds 10 feet, coupling is permitted on end adjacent to meter.
3. Guy pole as required.



DESIGN PARAMETERS:
(See NOTE 1)

POLE TYPE SERVICE ASSEMBLY GUIDE

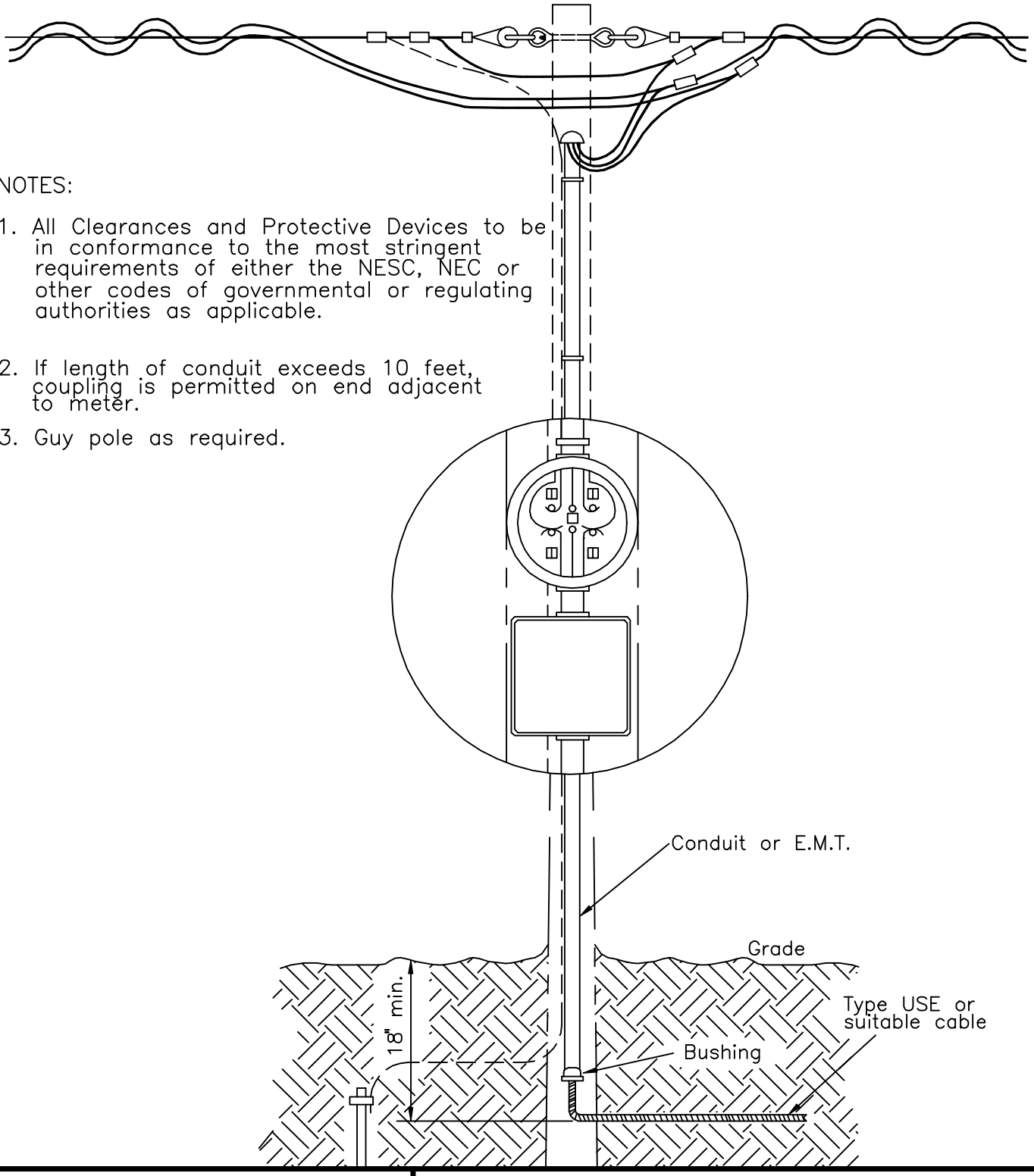
DEC 1998		
RUS		K4.3G

NOTES:

1. All Clearances and Protective Devices to be in conformance to the most stringent requirements of either the NESC, NEC or other codes of governmental or regulating authorities as applicable.

2. If length of conduit exceeds 10 feet, coupling is permitted on end adjacent to meter.

3. Guy pole as required.



DESIGN PARAMETERS:
(See NOTE 1)

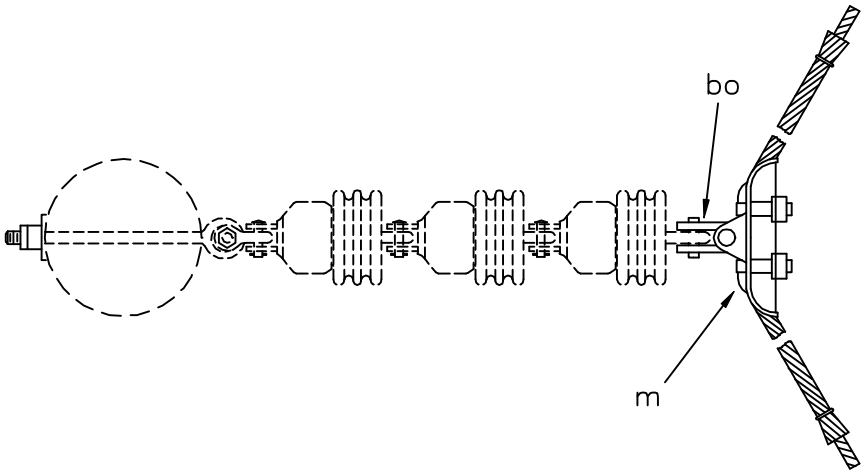
YARD POLE METER INSTALLATION GUIDE

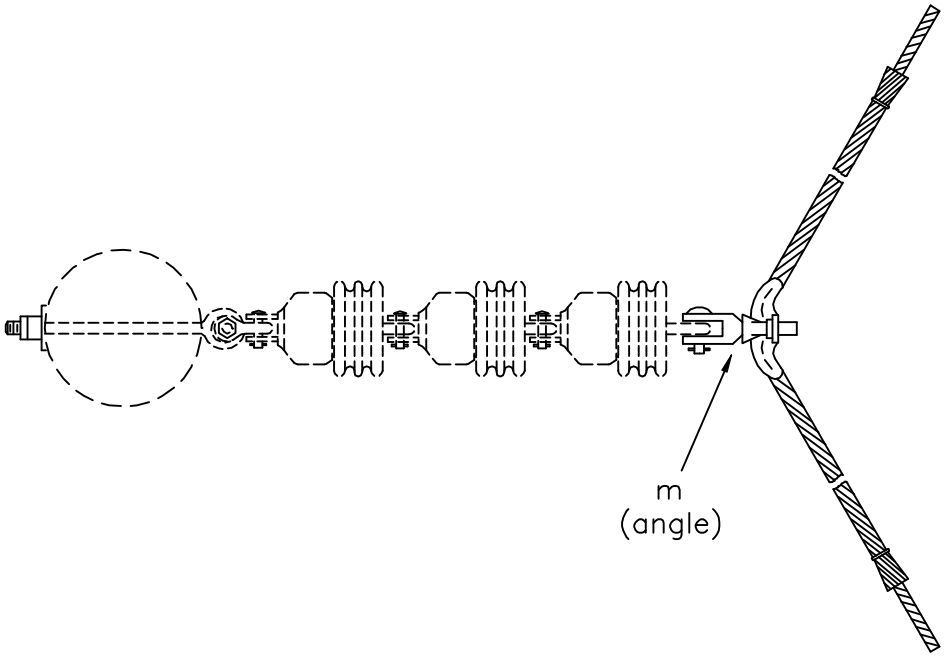
DEC 1998		
RUS		K4.4G

INDEX L

TYING GUIDES

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VL1.1G	TYING GUIDE PRIMARY ANGLE ASSEMBLIES
VL1.2G	TYING GUIDE PRIMARY DEADEND ASSEMBLIES
L2.1G	TYING GUIDE NEUTRAL ANGLE ASSEMBLIES
L2.2G	TYING GUIDE NEUTRAL DEADEND ASSEMBLIES
L3.1G	TYING GUIDE NEUTRAL & SECONDARY ANGLE ASSEMBLIES
L3.2G	TYING GUIDE NEUTRAL & SECONDARY DEADEND ASSEMBLIES (COPPER)
L3.3G	TYING GUIDE NEUTRAL & SECONDARY DEADEND ASSEMBLIES (ACSR)
L4.1G	TYING GUIDE SERVICE ASSEMBLIES
L4.2G	TYING GUIDE SERVICE ASSEMBLIES, CABLE





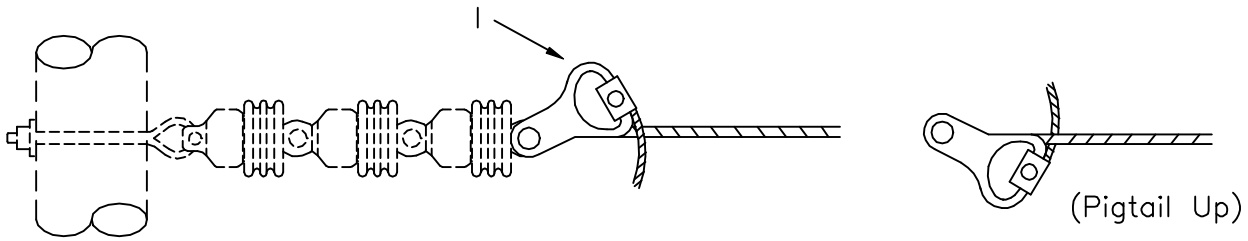
NOTES:

1. ACSR conductors require armor rods and clips (as shown).
2. Use angle suspension clamp with #2 or #4 ACSR only.

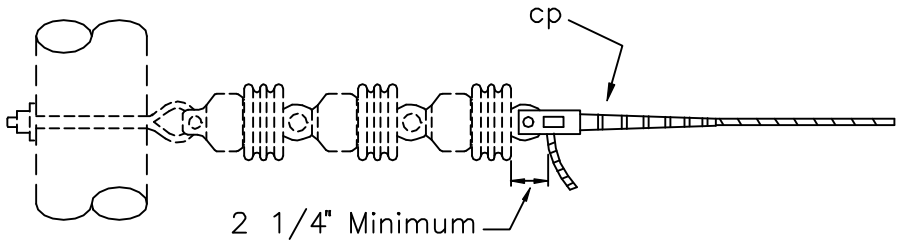
ITEM	MATERIAL
m	Clamp, 2 bolt, suspension (distribution)
m	Clamp, angle, suspension (distribution)
bo	Shackle, anchor
bv	Rods, armor (as req'd)

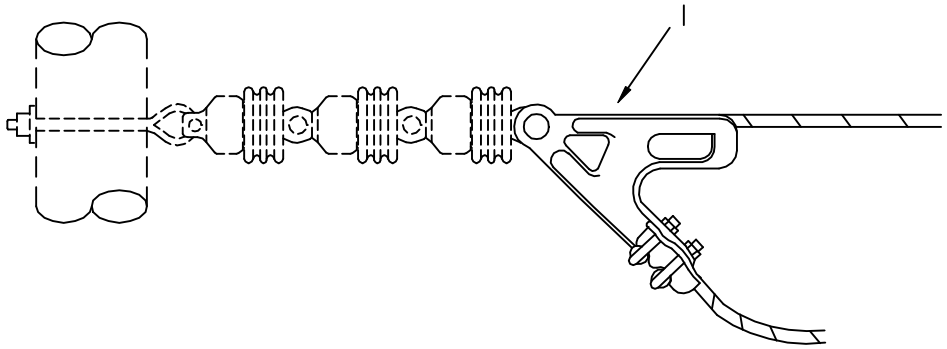
TYING GUIDE
PRIMARY ANGLE ASSEMBLIES

DEC 1998		
RUS	24.9/14.4 kV	VL1.1G



NOTE: For use with copper or copperweld–copper conductors only.





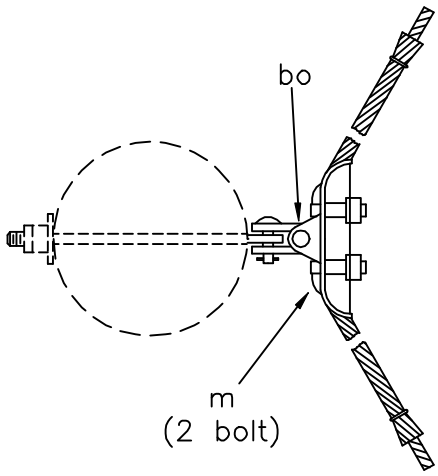
NOTES:

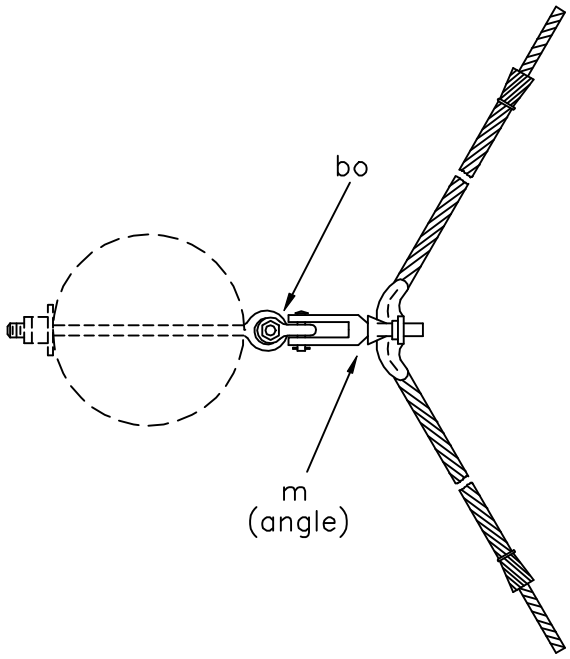
1. Item "by" may be substituted for item "cp" shown.
2. Specify "ej" clamp instead of "I" clamp for conductors larger than #4/0 ACSR.
3. Armor tape required for conductors in galvanized fittings not having aluminum liners.
4. Bend pigtails away from line conductors to avoid chafing.

ITEM	MATERIAL
I	Clamp, deadend (distribution)
by	Deadend, automatic or formed type
cp	Deadend, compression type
ej	Clamp, deadend with socket eye

TYING GUIDE
PRIMARY DEADEND ASSEMBLIES

DEC 1998		
RUS	24.9/14.4 kV	VL1.2G





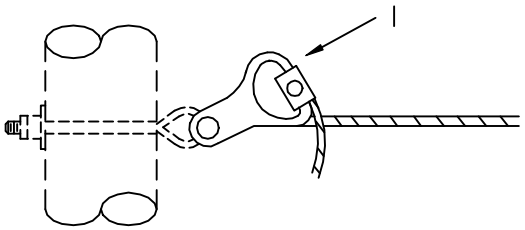
NOTES:

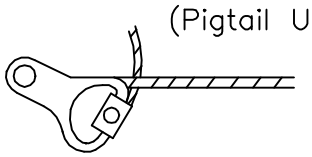
1. ACSR conductors require armor rods and clips (as shown).
2. Use angle suspension clamp with #2 or #4 ACSR only.

ITEM	MATERIAL
m	Clamp, 2 bolt, suspension (distribution)
m	Clamp, angle, suspension (distribution)
bo	Shackle, anchor
bv	Rods, armor (as req'd)

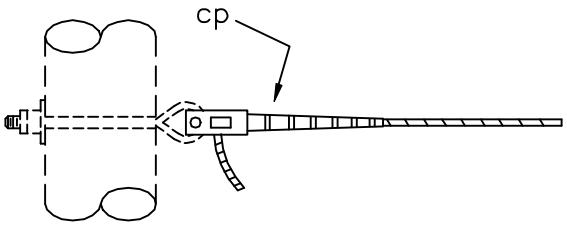
TYING GUIDE
NEUTRAL ANGLE ASSEMBLIES

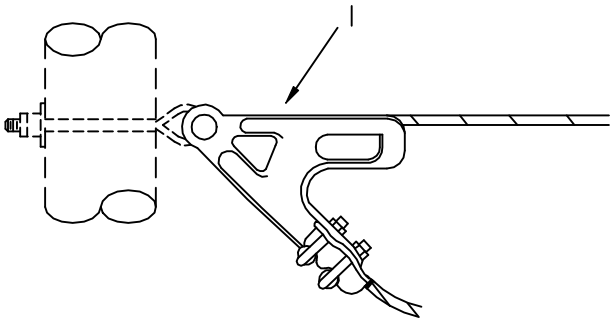
DEC 1998		
RUS		L2.1G





NOTE: For use with copper or copperweld–copper conductors only.





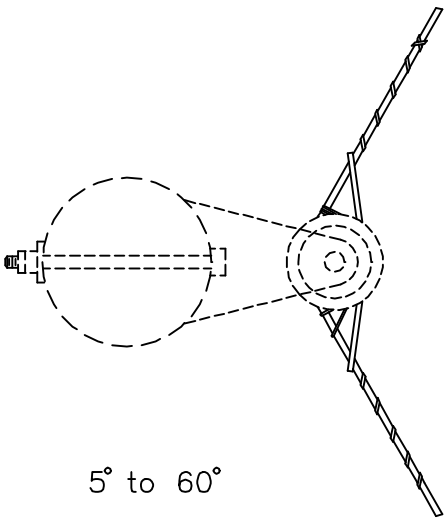
NOTES:

1. Item "by" may be substituted for item "cp" shown.
2. Specify "ej" clamp instead of "I" clamp for conductors larger than #4/0 ACSR.
3. Armor tape required for conductors in galvanized fittings not having aluminum liners.
4. Bend pigtails away from line conductors to avoid chafing.

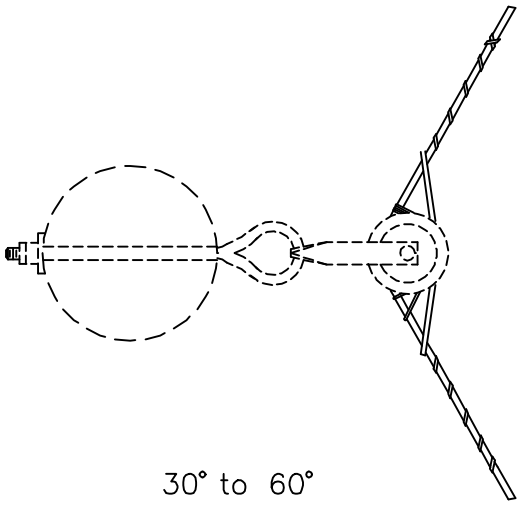
ITEM	MATERIAL
I	Clamp, deadend (distribution)
by	Deadend, automatic or formed type
cp	Deadend, compression type
ej	Clamp, deadend with socket eye

TYING GUIDE
NEUTRAL DEADEND ASSEMBLIES

DEC 1998		
RUS		L2.2G

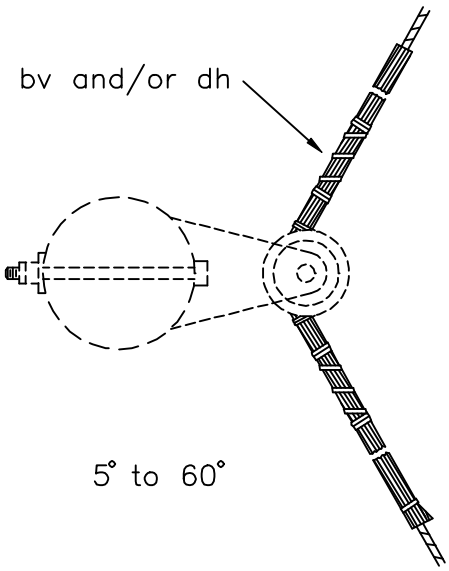


5° to 60°



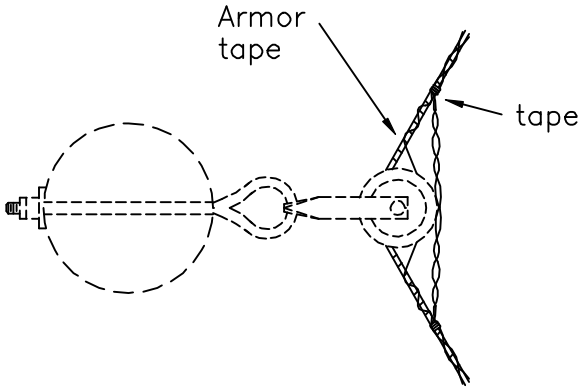
30° to 60°

For use with copper or copperweld–copper conductors.



5° to 60°

ACSR Conductors



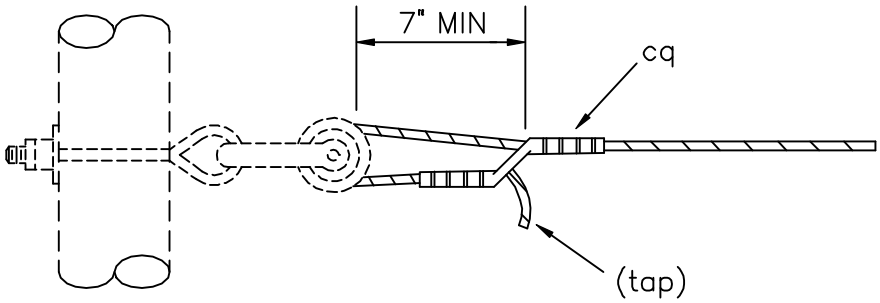
30° to 60°

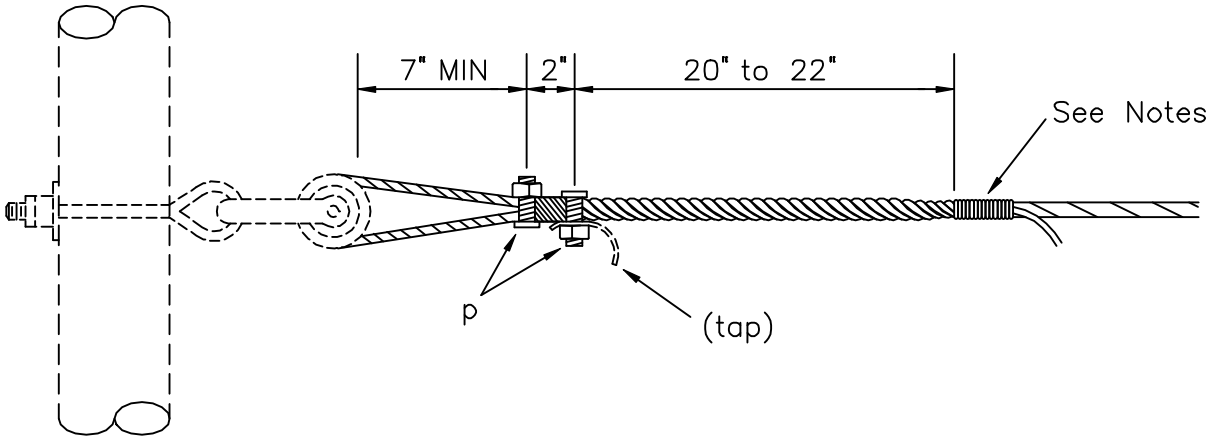
Self Supporting
Cable Conductors

ITEM	MATERIAL
bv	Rod, armor (formed type)
dh	Tie, insulator (formed type)

TYING GUIDE
NEUTRAL & SECONDARY
ANGLE ASSEMBLIES

DEC 1998		
RUS		L3.1G





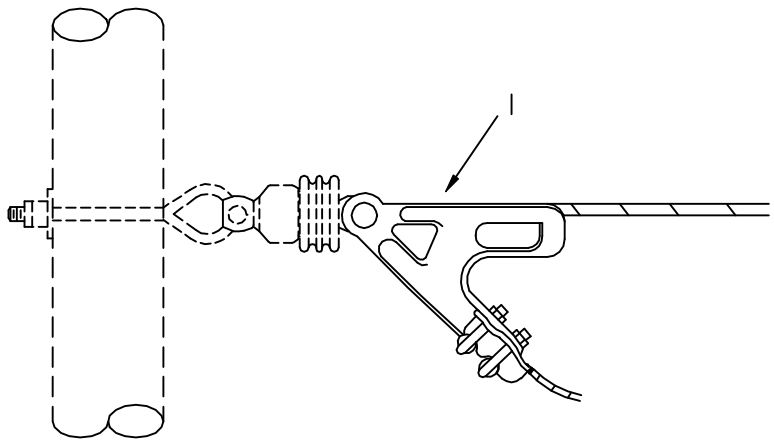
NOTES:

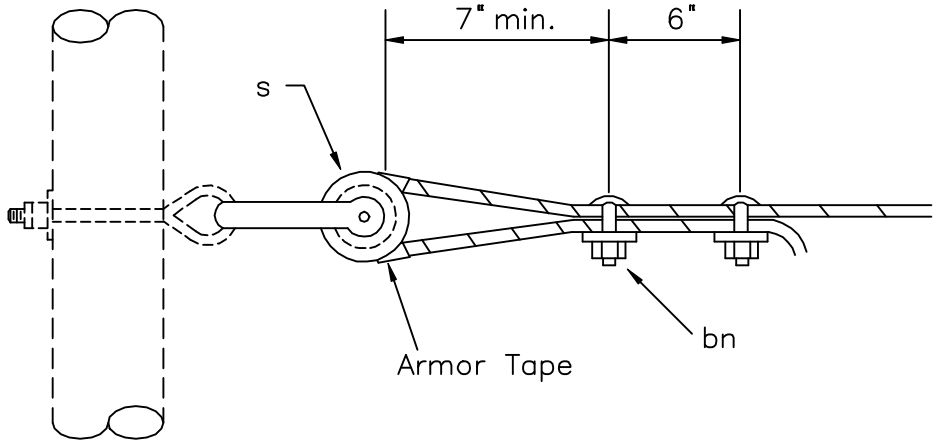
1. Bend all pigtails away from line conductor to avoid chafing.
2. Extend one strand of free end (the copperweld strand of copperweld–copper conductor) against line conductor. Wrap free ends of conductor along line conductor using same lay. Serve copper strands six turns each and then cut off.
3. For solid conductors, use same dimensions and install third connector "p" in lieu of serving.

ITEM	MATERIAL
p	Connectors, as req'd
cq	Deadend, secondary

TYING GUIDE NEUTRAL & SECONDARY DEADEND ASSEMBLIES (COPPER)

DEC 1998		
RUS		L3.2G





NOTES:

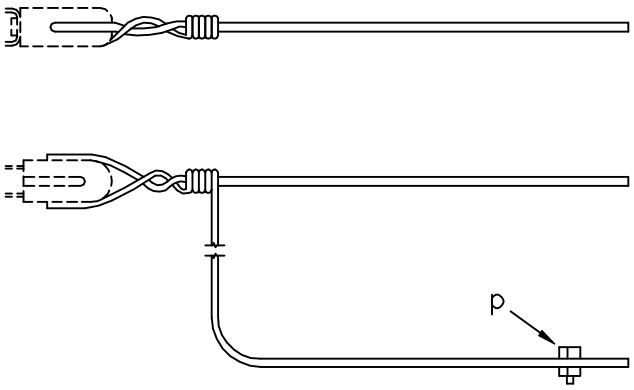
1. Armor tape wrapping to extend not more than two wraps beyond the mouth of deadend clamp or spool insulator.

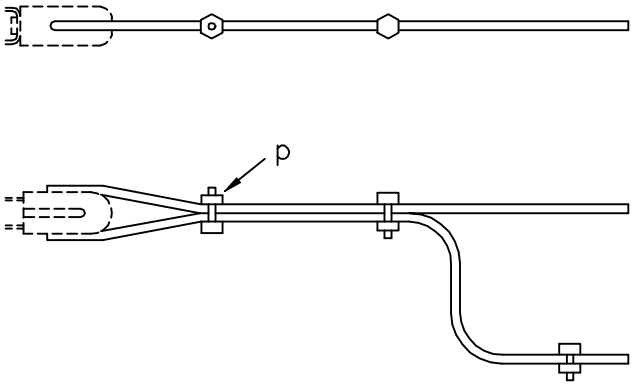
2. For #1/0 and larger, use spool with 3" minimum groove diameter.

ITEM	MATERIAL
i	Clamp, deadend
s	Clevis, secondary, swinging, insulated
bn	Clamp, loop deadend

TYING GUIDE NEUTRAL & SECONDARY DEADEND ASSEMBLIES (ACSR)

DEC 1998		
RUS		L3.3G





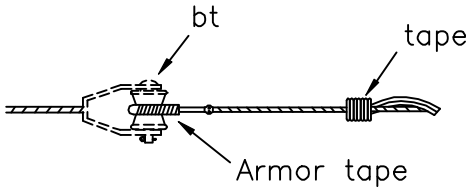
This type of construction should be used for small, aluminum weather–proof conductors.

NOTE: Service connectors (p) to be applied over bare wire and then taped as required.

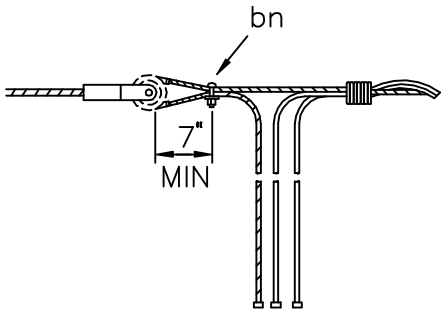
ITEM	MATERIAL
p	Connectors, as req'd

TYING GUIDE
SERVICE ASSEMBLIES

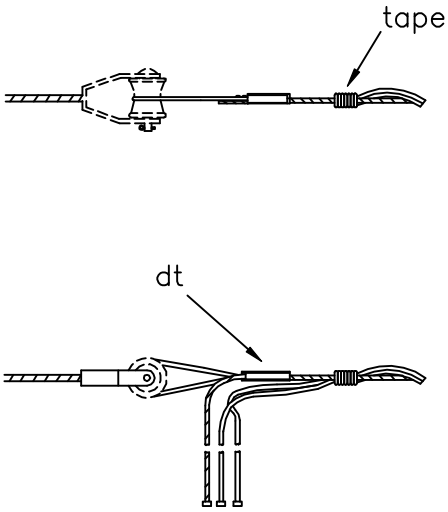
DEC 1998		
RUS		L4.1G



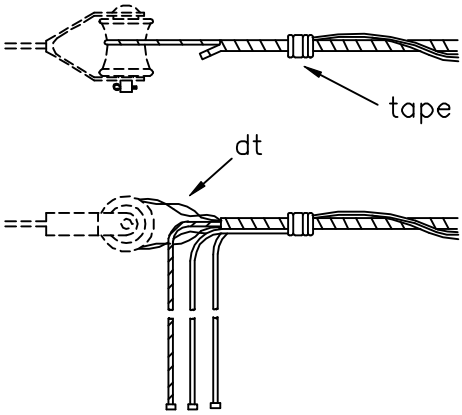
NOTE:
Groove diameter of insulator 1 3/4" min.



LOOP TYPE



WEDGE TYPE



PREFORMED TYPE

NOTES:

1. This type of construction should be for 3 or 4 conductor service cables with bare ACSR neutral.
   CAUTION: Not suitable for K2.1 or K3.1 Service Assemblies.
2. Service connectors (p) to be insulated, compression type.

ITEM	MATERIAL
dt	Service deadend, wedge type
dt	Service deadend, performed type
p	Connectors, as req'd
bn	Clamp, loop deadend

TYING GUIDE
SERVICE ASSEMBLIES, CABLE

DEC 1998		
RUS		L4.2G

INDEX M

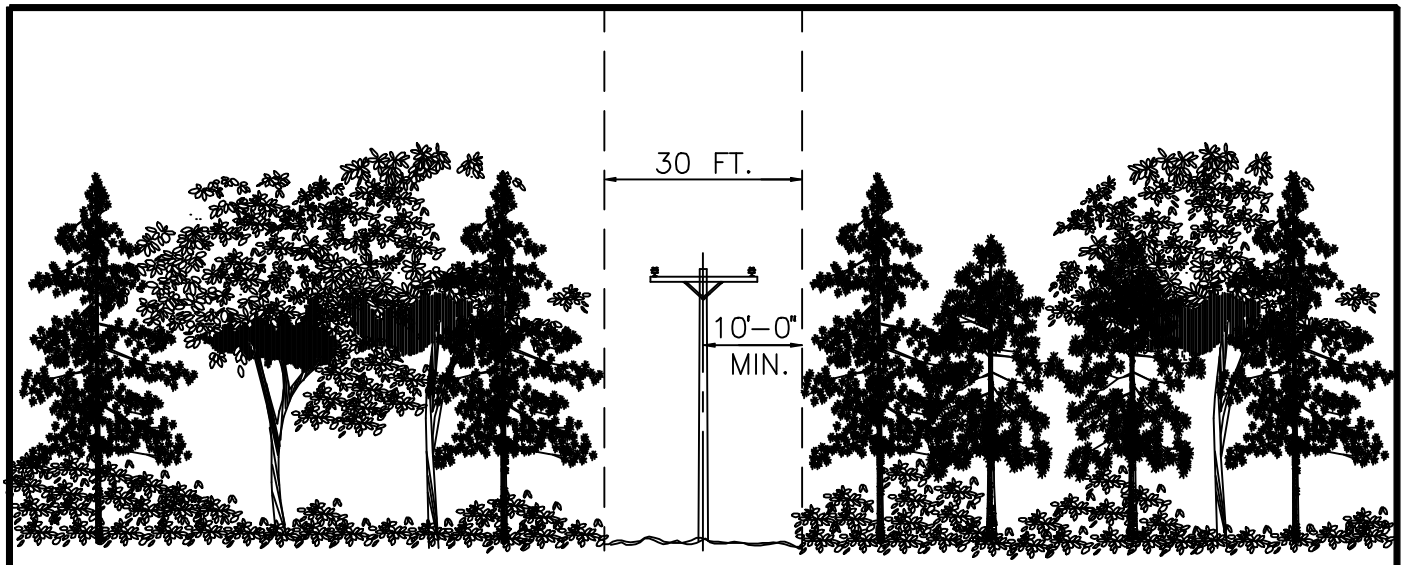
MISCELLANEOUS ASSEMBLY UNITS AND GUIDES

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
M1.30G	RIGHT-OF-WAY CLEARING GUIDE

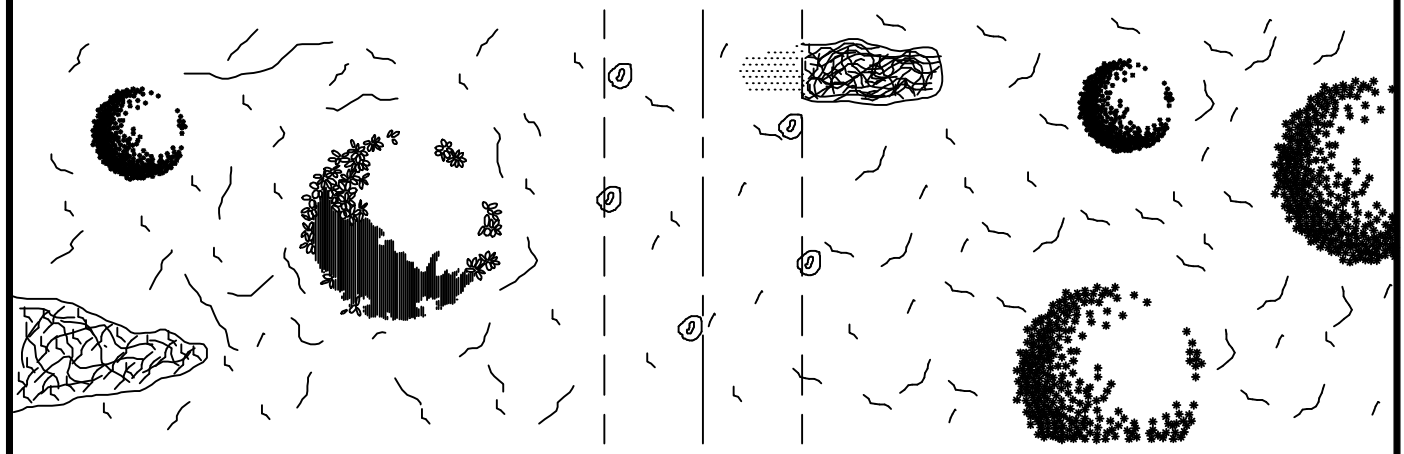
RIGHT-OF-WAY CLEARING SPECIFICATIONS

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 to the width specified. However, 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 if so specified.

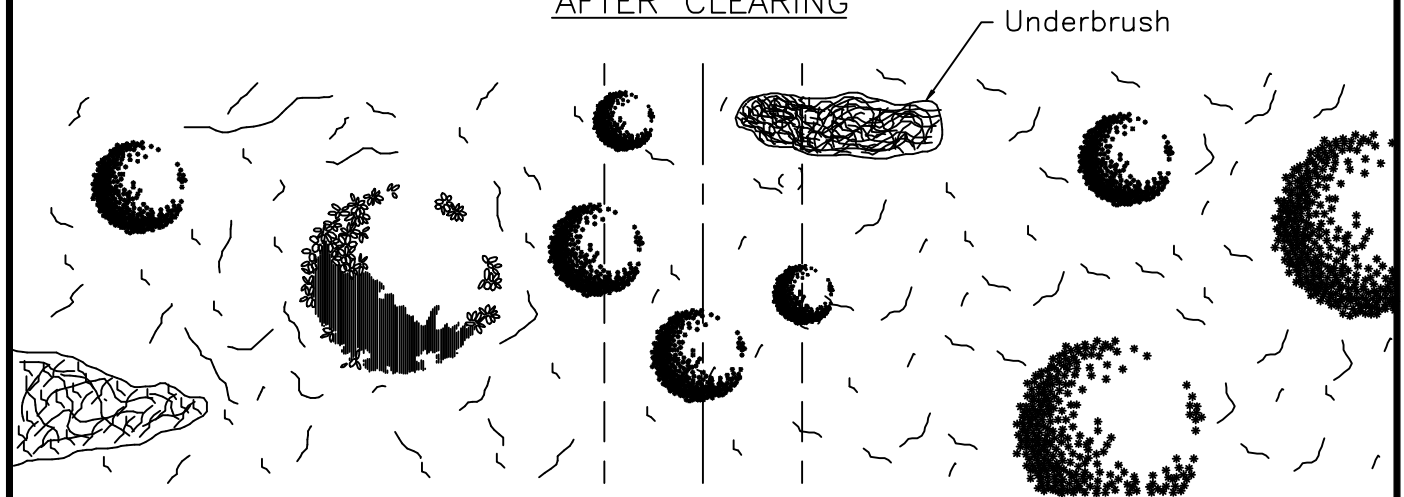
The landowner’s written permission shall be received prior to cutting trees outside of the right-of-way. Trees fronting each side of the right-of-way shall be trimmed symmetrically unless otherwise specified. Dead trees beyond the right-of-way which would strike the line in falling shall be removed. 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.



ELEVATION



AFTER CLEARING



BEFORE CLEARING

NOTE:
Change suffix of drawing number to designate clearing width. (e.g. M1.30G specifies 30 foot wide clearing).

RIGHT–OF–WAY CLEARING GUIDE

DEC 1998		
RUS		M1.30G

INDEX N

NEUTRAL ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
N1.1, N1.2	NEUTRAL ASSEMBLIES - TANGENT
N1.11, N2.21	NEUTRAL SUPPORTS ON CROSSARMS
N2.1, N2.1L, N3.1	NEUTRAL ASSEMBLIES - LARGE ANGLE
N5.1, N5.2	NEUTRAL ASSEMBLIES - SINGLE DEADENDS
N6.1	NEUTRAL ASSEMBLY - DOUBLE DEADEND
N6.21	NEUTRAL ASSEMBLY - DOUBLE DEADEND ON CROSSARMS

TABLE VI

MAXIMUM LINE ANGLES ON SPOOL INSULATOR ASSEMBLIES

(ANSI Clss 53-2 Spool Insulator)

Designated Maximum Transverse Load = 1,500 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	45	44	44	43	42	42
2 ACSR (6/1)	37	36	35	35	34	33
2 ACSR (7/1)	28	28	27	27	26	26
1/0 ACSR (6/1)	23	23	22	22	21	21
123.3 AAAC (7)	23	22	22	21	21	20
2/0 ACSR (6/1)	23	22	22	21	21	20
3/0 ACSR (6/1)	18	18	17	17	16	16
4/0 ACSR (6/1)	18	17	17	16	16	15
246.9 AAAC (7)	17	17	16	16	15	15
336.4 ACSR (18/1)	17	16	15	15	14	14
336.4 ACSR (26/7)	12	11	11	10	10	9
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	44	44	43	42	41	40
2 ACSR (6/1)	36	36	35	34	33	33
2 ACSR (7/1)	28	28	27	27	26	25
1/0 ACSR (6/1)	23	23	22	22	21	21
123.3 AAAC (7)	23	22	22	21	21	20
2/0 ACSR (6/1)	23	22	22	21	21	20
3/0 ACSR (6/1)	18	18	17	17	17	16
4/0 ACSR (6/1)	18	18	17	17	16	16
246.9 AAAC (7)	18	17	17	16	16	15
336.4 ACSR (18/1)	17	17	16	16	15	15
336.4 ACSR (26/7)	12	12	11	11	11	10
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	43	41	40	39	37	36
2 ACSR (6/1)	35	34	33	32	30	29
2 ACSR (7/1)	27	26	25	25	24	23
1/0 ACSR (6/1)	22	22	21	20	19	19
123.3 AAAC (7)	22	21	21	20	19	18
2/0 ACSR (6/1)	22	21	21	20	19	18
3/0 ACSR (6/1)	18	17	16	16	15	14
4/0 ACSR (6/1)	17	17	16	15	15	14
246.9 AAAC (7)	17	16	16	15	14	14
336.4 ACSR (18/1)	17	16	15	14	14	13
336.4 ACSR (26/7)	12	11	11	10	10	9

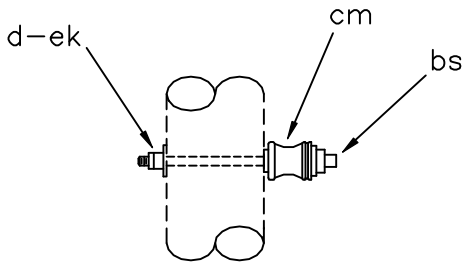
TABLE VII

MAXIMUM LINE ANGLES ON SPOOL INSULATOR ASSEMBLIES

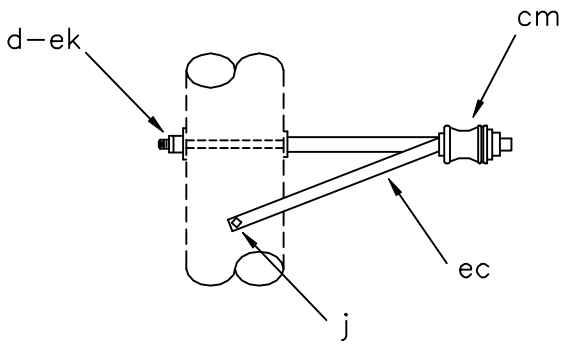
(ANSI Clss 53-4 Spool Insulator)

Designated Maximum Transverse Load = 1,500 Lbs./Conductor

CONDUCTOR SIZE	WIND SPAN (feet) 150	200	250	300	350	400
LIGHT LOADING DISTRICT						
4 ACSR (7/1)	45	44	44	43	42	42
2 ACSR (6/1)	37	36	35	35	34	33
2 ACSR (7/1)	28	28	27	27	26	26
1/0 ACSR (6/1)	23	23	22	22	21	21
123.3 AAAC (7)	23	22	22	21	21	20
2/0 ACSR (6/1)	23	22	22	21	21	20
3/0 ACSR (6/1)	18	18	17	17	16	16
4/0 ACSR (6/1)	18	17	17	16	16	15
246.9 AAAC (7)	17	17	16	16	15	15
336.4 ACSR (18/1)	17	16	15	15	14	14
336.4 ACSR (26/7)	12	11	11	10	10	9
MEDIUM LOADING DISTRICT						
4 ACSR (7/1)	44	44	43	42	41	40
2 ACSR (6/1)	36	36	35	34	33	33
2 ACSR (7/1)	28	28	27	27	26	25
1/0 ACSR (6/1)	23	23	22	22	21	21
123.3 AAAC (7)	23	22	22	21	21	20
2/0 ACSR (6/1)	23	22	22	21	21	20
3/0 ACSR (6/1)	18	18	17	17	17	16
4/0 ACSR (6/1)	18	18	17	17	16	16
246.9 AAAC (7)	18	17	17	16	16	15
336.4 ACSR (18/1)	17	17	16	16	15	15
336.4 ACSR (26/7)	12	12	11	11	11	10
HEAVY LOADING DISTRICT						
4 ACSR (7/1)	43	41	40	39	37	36
2 ACSR (6/1)	35	34	33	32	30	29
2 ACSR (7/1)	27	26	25	25	24	23
1/0 ACSR (6/1)	22	22	21	20	19	19
123.3 AAAC (7)	22	21	21	20	19	18
2/0 ACSR (6/1)	22	21	21	20	19	18
3/0 ACSR (6/1)	18	17	16	16	15	14
4/0 ACSR (6/1)	17	17	16	15	15	14
246.9 AAAC (7)	17	16	16	15	14	14
336.4 ACSR (18/1)	17	16	15	14	14	13
336.4 ACSR (26/7)	12	11	11	10	10	9



N1.1



N1.2

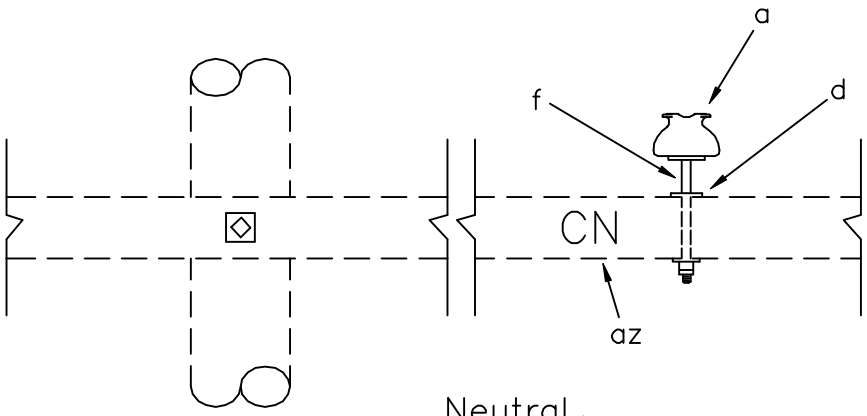
ASSEMBLY:		N1.1	N1.2
ITEM	MATERIAL	QTY	QTY
d	Washer, 2 1/4" square	1	1
j	Screw, lag, 1/2" x 4"		2
bs	Bolt, single, upset	1	
cm	Insulator, spool, 3"	1	1
ec	Bracket, offset neutral		1
ek	Locknuts	1	1

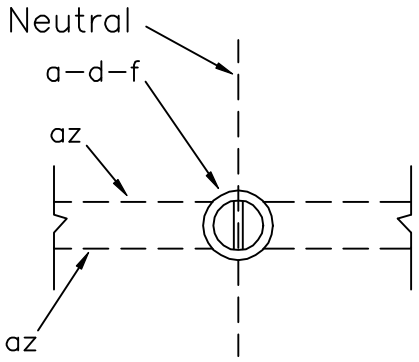
DESIGN PARAMETERS:

MAXIMUM LINE ANGLES:
5° – Small Conductors
2° – Larger than #1/0

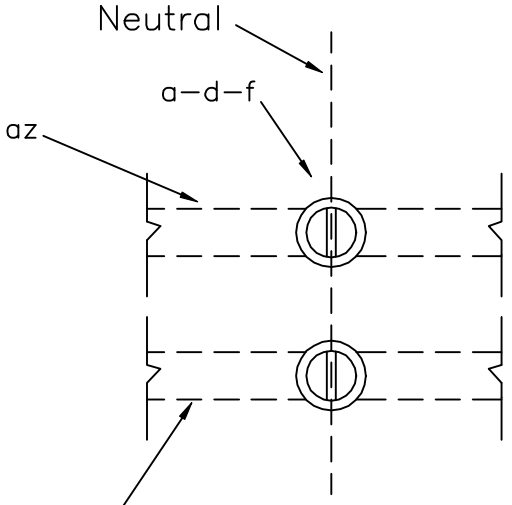
NEUTRAL ASSEMBLIES – TANGENT

DEC 1998		N1.1, N1.2
RUS		





N1.11



N2.21

NOTE: Install either identification letters (az) or white insulator.

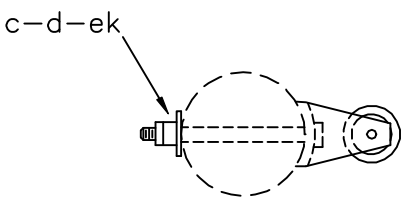
ASSEMBLY;		N1.11	N2.21
ITEM	MATERIAL	QTY	QTY
a	Insulator, pin type, 15 kV, white	1	2
d	Washer, 2 1/4" square	1	2
f	Pin, crossarm, steel, 5/8" x 10 3/4"	1	2
az	Letters, 2" C, 2" N, with 1" nails	4	4

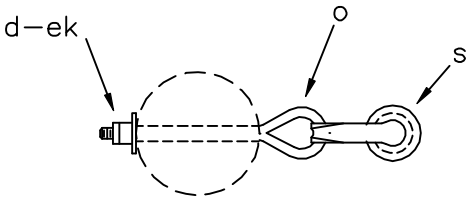
DESIGN PARAMETERS:

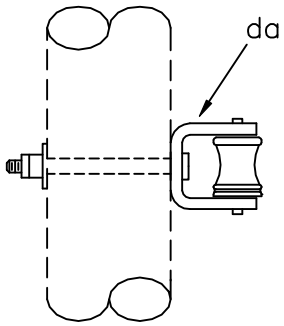
N1–11: See TABLE II
N2–21: See TABLE IV

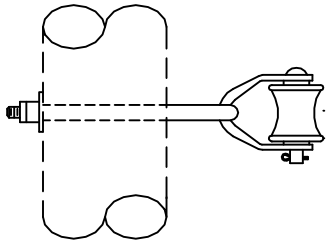
NEUTRAL SUPPORTS ON CROSSARMS

DEC 1998		N1.11,
RUS		N2.21









N2.1
(ANSI Class 53–2 Insulator)
N2.1L
(ANSI Class 53–4 Insulator)

N3.1

NOTE: See Tying Guide Drawing L3.1G

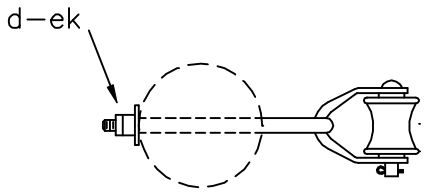
		N2.1	N2.1L	N3.1
ITEM	MATERIAL	QTY	QTY	QTY
c	Bolt, machine, 5/8" X req'd length	1	1	
d	Washer, 2 1/4" square	1	1	1
o	Bolt, eye, 5/8" X req'd length			1
s	Clevis, secondary, swinging, insulated			1
da	Bracket, with 3" x 1 3/4" spool insulator	1		
da	Bracket, with 3" x 3" spool insulator		1	
ek	Locknuts	1	1	1

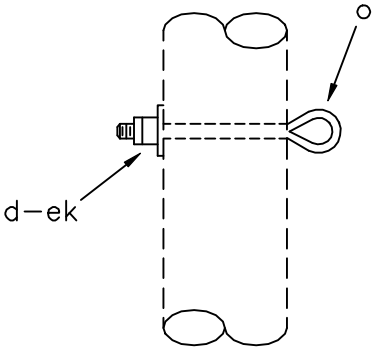
DESIGN PARAMETERS:

N2.1: See TABLE VI
N2.1L: See TABLE VII
N3.1: See TABLE VI

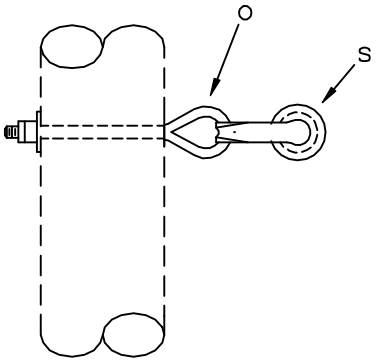
NEUTRAL ASSEMBLIES – LARGE ANGLE

DEC 1998		N2.1, N2.1L, N3.1
RUS		





N5.1



N5.2

NOTE: See Tying Guide Drawings; L2.2G, L3.2G or L3.3G

		ASSEMBLY;	N5.1	N5.2
ITEM	MATERIAL		QTY	QTY
d	Washer, square 3" curved		1	1
o	Bolt, eye, 5/8" X req'd length		1	1
s	Clevis, secondary, swinging, insulated			1
ek	Locknuts		1	1

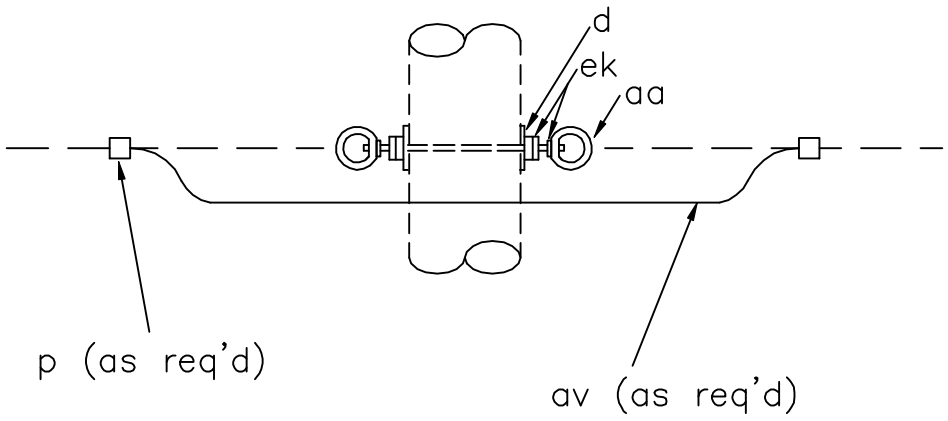
DESIGN PARAMETERS:

ALLOWABLE LONGITUDINAL LOADING:

N5.1 = 5,000 lbs.
N5.2 = 1,500 lbs.
(ANSI Class 53–2 Insulator)
N5.2 = 2,250 lbs.
(ANSI Class 53–4 Insulator)

NEUTRAL ASSEMBLIES (SINGLE DEADENDS)

DEC 1998		N5.1
RUS		N5.2



NOTE: See Tying Guide Drawings: L2.2G, L3.2G, L3.3G.

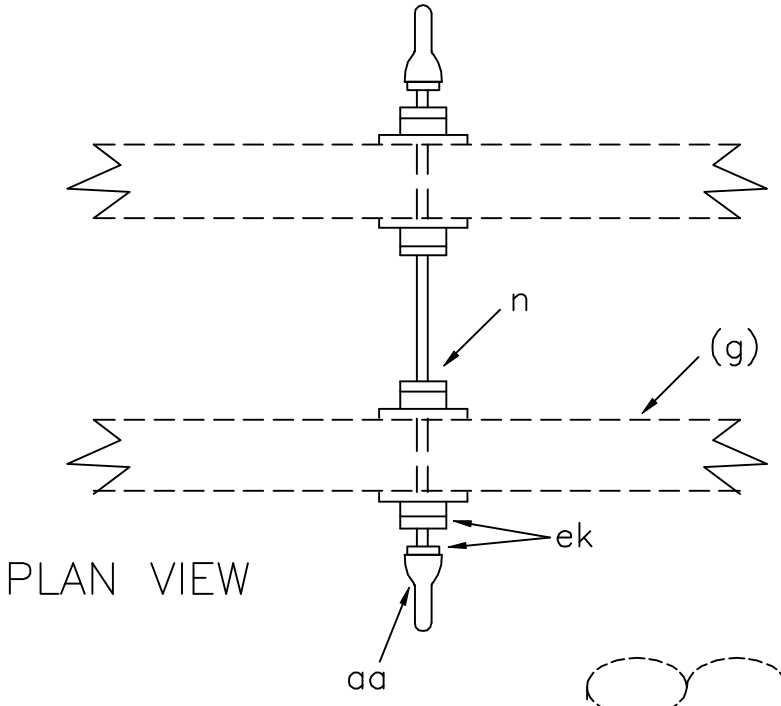
ITEM	QTY	MATERIAL
d	2	Washer, square 3" curve
n	1	Bolt,double arming,5/8" x req'd length
p		Connectors, as req'd
aa	2	Nut, eye, 5/8"
av		Jumpers, as req'd
ek	4	Locknuts

DESIGN PARAMETERS:

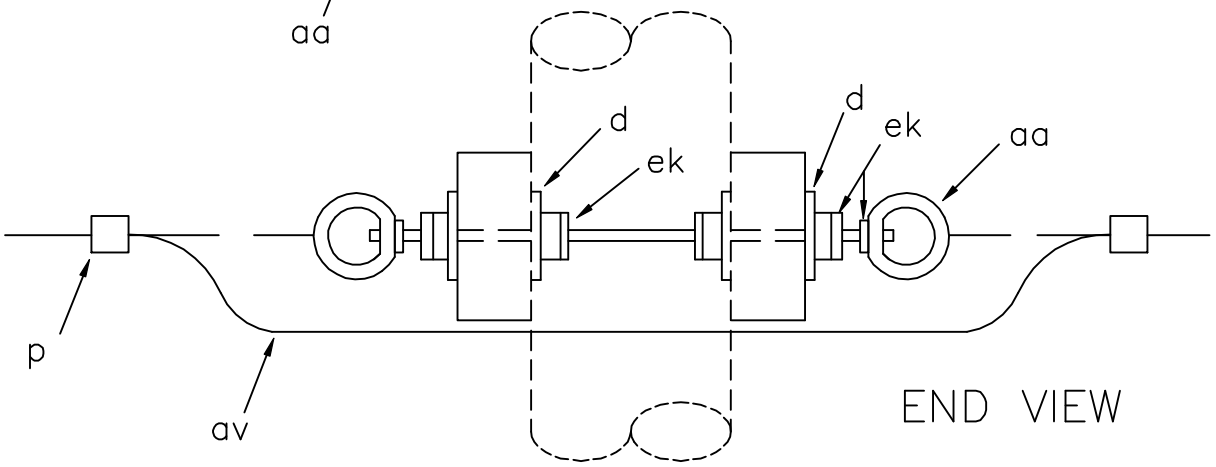
ALLOWABLE LONGITUDINAL LOADING: 5,000 lbs.

NEUTRAL ASSEMBLY – DOUBLE DEADEND

DEC 1998		
RUS		N6.1



PLAN VIEW



END VIEW

NOTES:

1. Not suitable for Grade B construction.
2. Doubling arming bolt, item "n" and eye nut, item "aa", may be replaced with doubling arming eye bolt, item "dy."
3. Maximum line angle may be increased to 15° by installing anchor shackles, item "bo" to (horizontally mounted) eye nuts and installing side guys.

ITEM	QTY	MATERIAL
d	4	Washer, square, 2 1/4"
n	1	Bolt,double arming,5/8" x req'd length
p		Connectors, as req'd
aa	2	Nut, eye, 5/8"
av		Jumpers, as req'd
ek	6	Locknuts

DESIGN PARAMETERS:

ALLOWABLE UNBALANCED TENSION:
(See drawings where assembly used)

ALLOWABLE LINE ANGLE = 5°
(See Note 3)

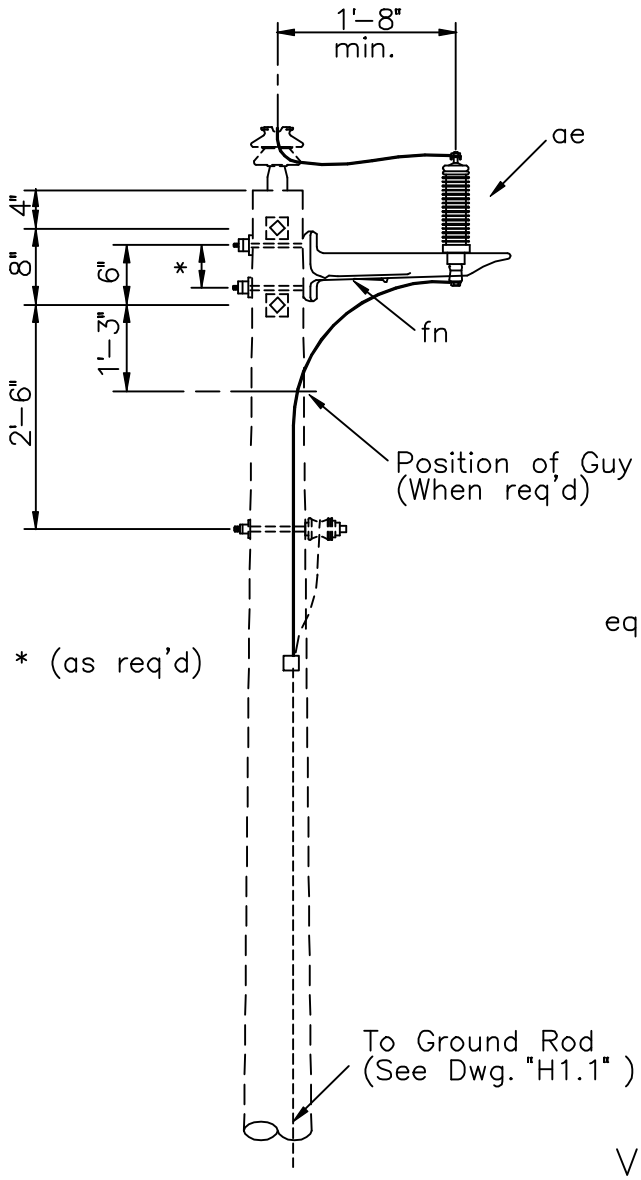
NEUTRAL ASSEMBLY – DOUBLE DEADEND ON CROSSARMS

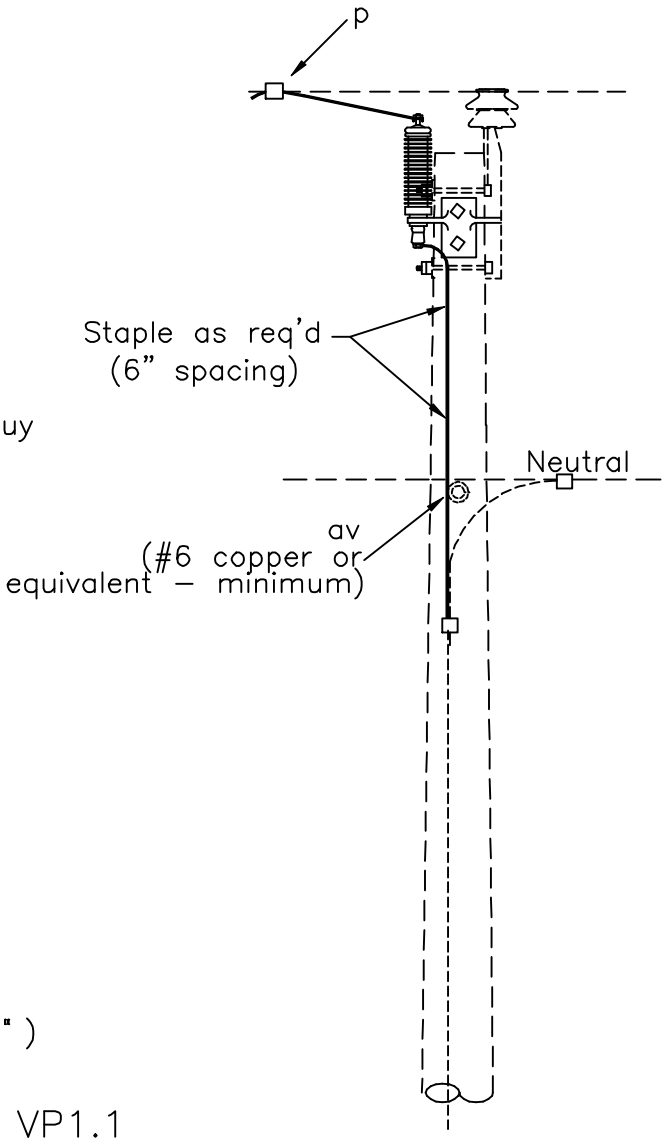
DEC 1998		
RUS		N6.21

INDEX P

PROTECTION ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VP1.01, VP1.1	SURGE ARRESTER - SINGLE PHASE
VP1.3	SURGE ARRESTER - 3 SINGLE PHASE
P2.1	POLE PROTECTION ASSEMBLY - PLATE TYPE
P2.2, P2.3	POLE PROTECTION ASSEMBLY - WRAP-AROUND TYPE
VP3.1G	RAPTOR PROTECTION ASSEMBLY GUIDE SUPPORT ON 8 FOOT CROSSARMS (TANGENT)
VP3.2G	RAPTOR PROTECTION ASSEMBLY GUIDE SUPPORT ON 10 FOOT CROSSARMS (TANGENT)
VP3.3G	RAPTOR PROTECTION PERCH GUARDS - GUIDE

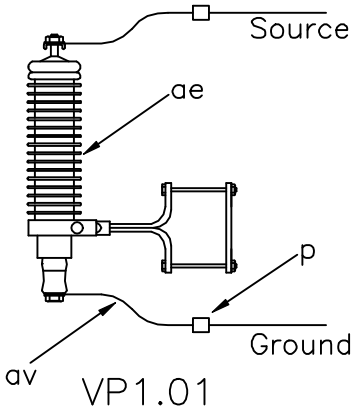




VP1.1

NOTE: Use "VP1.01" on existing arm, a minimum of 20" from center of pole.

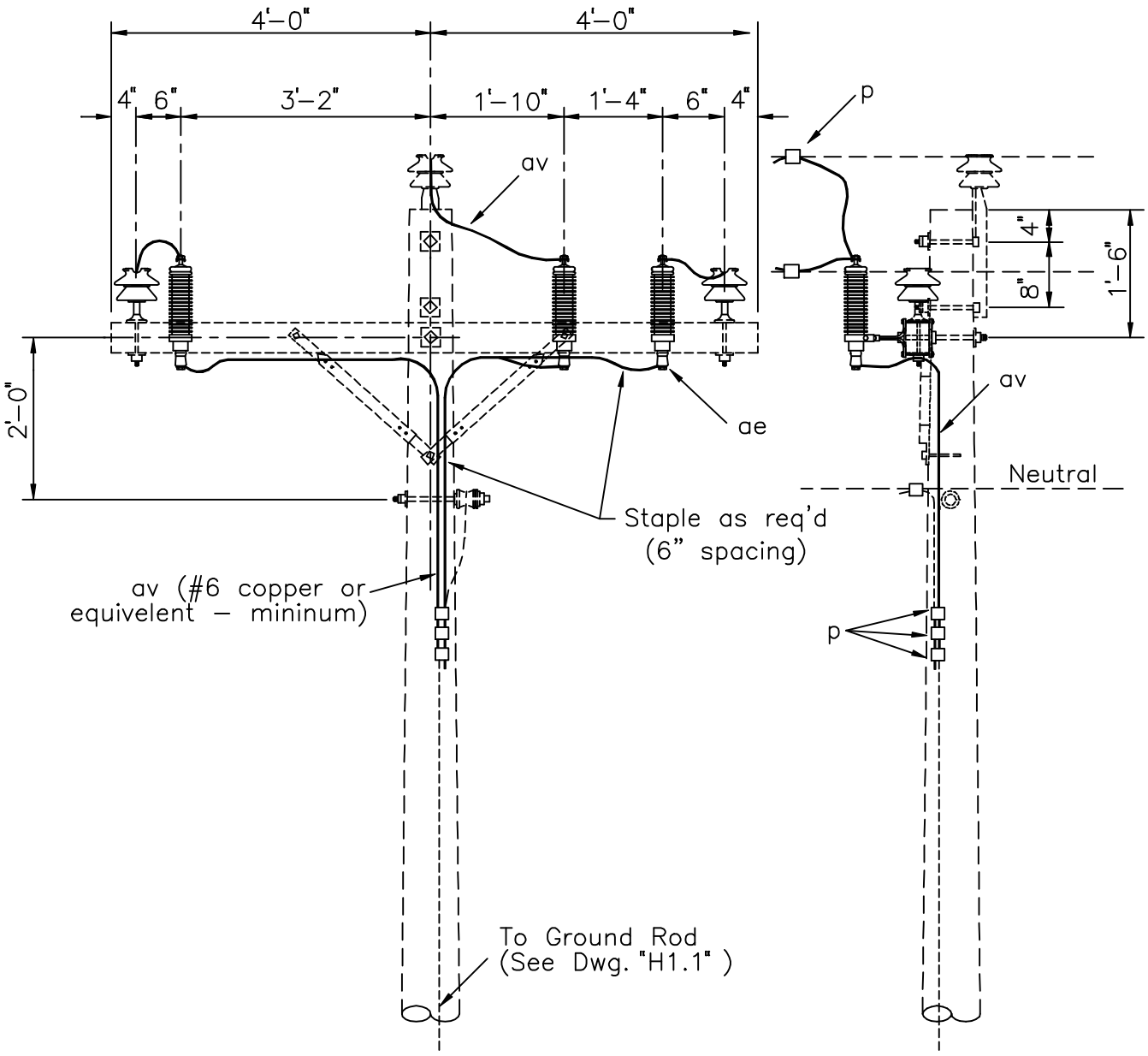
ASSEMBLY: VP1		.01	.1
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 5/8 x req'd length		2
d	Washer, square, 2 1/4		2
p	Connectors, as req'd		
ae	Arrester, surge, (18 kV)	1	1
av	Jumpers, as req'd		
fn	Bracket, cutout extension		1
ek	Locknuts		2



VP1.01

SURGE ARRESTERS – SINGLE PHASE

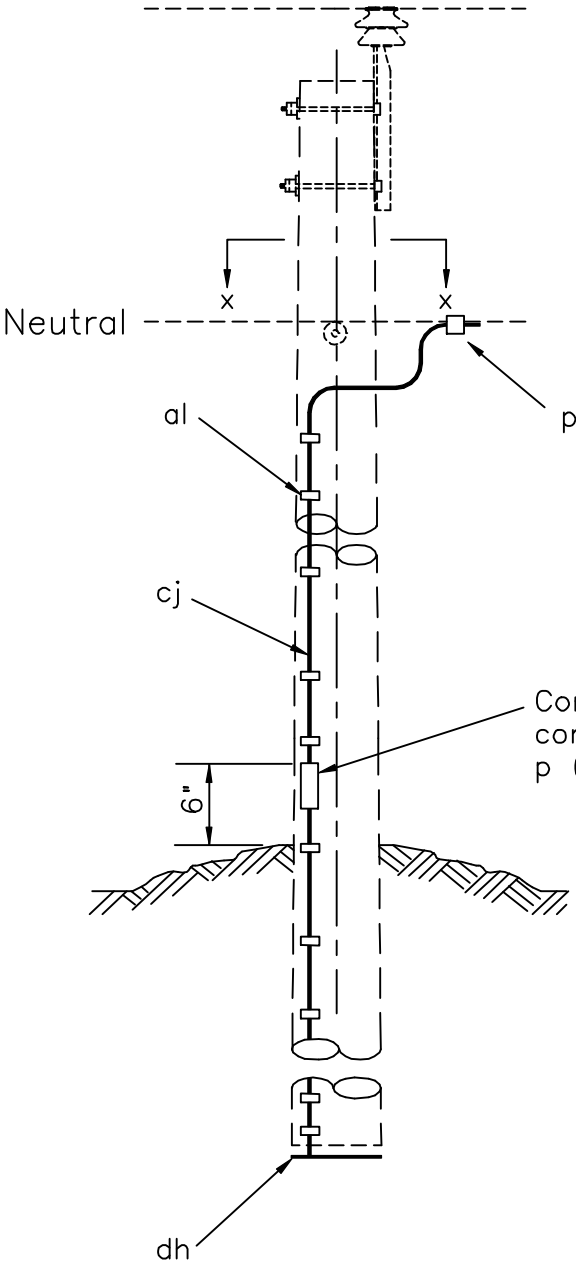
DEC 1998	1 – PHASE PRIMARY	VP1.01,
RUS	24.9/14.4 kv	VP1.1

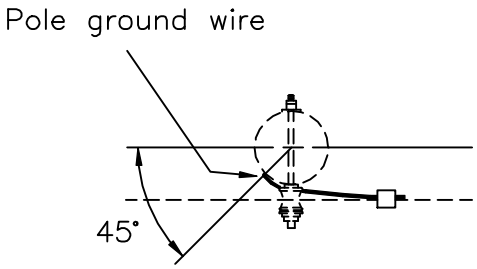


ITEM	QTY	MATERIAL
p		Connectors, as req'd
ae	3	Arrester, surge, (18 kv)
av		Jumpers, as req'd

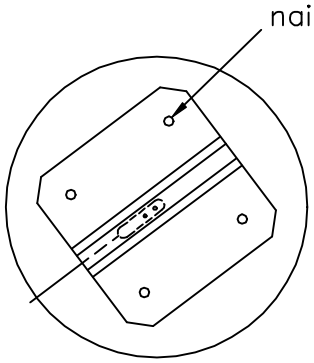
SURGE ARRESTERS – 3 SINGLE PHASE

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kv	VP1.3





SECTION "X–X"



Plan View
Grounding plate (dh)

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" apart except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.

3. Copper ground wire ("cj") to have a minimum conductivity of No. 6 Copper or equivelent; use copper ground plate and staples, OR, use soft annealed iron, class C, 3–wire, 5/16" ground wire ("cj") and galvanize steel ground plates and staples.

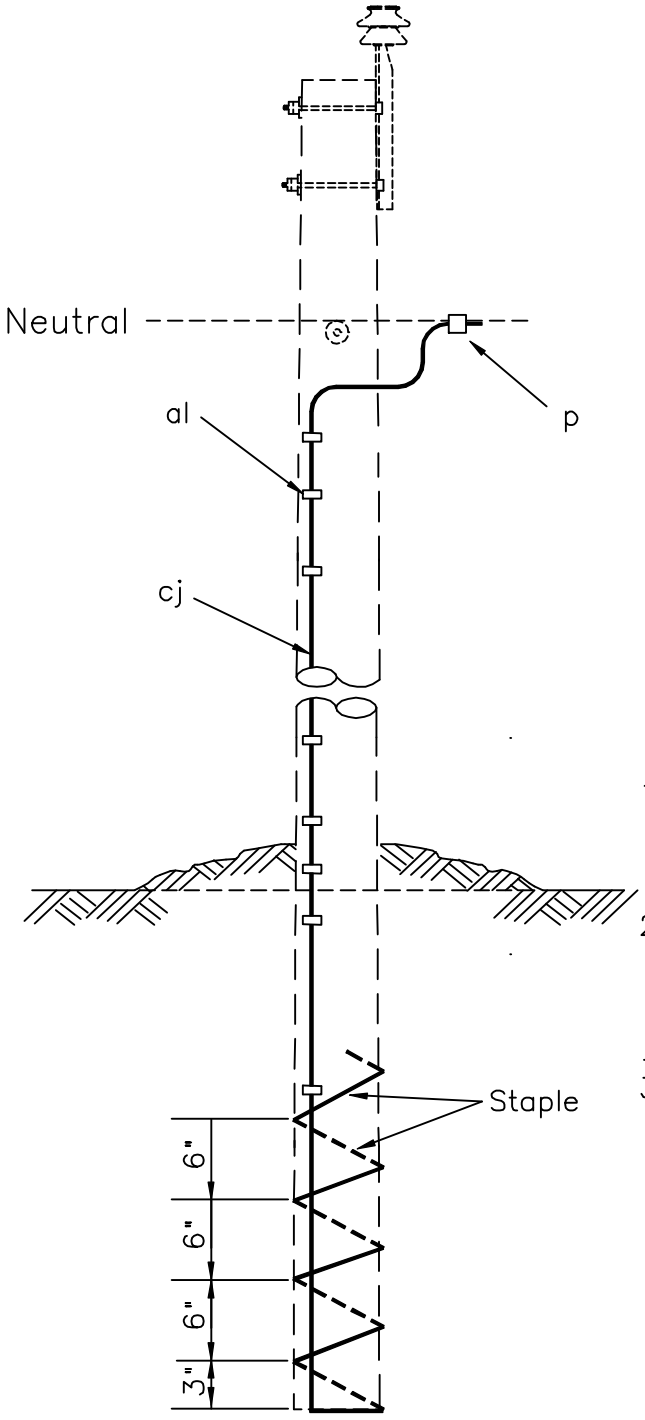
ITEM	QTY	MATERIAL
p		Connector, compression, as req'd
al		Staple, ground wire, as reg'd
cj		Wire, pole ground, as req'd
dh	1	Plate, grounding, butt type
	4	Nails, 1", galvanized, roofing

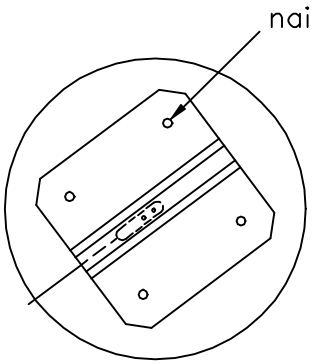
DESIGN PARAMETERS:

THIS ASSEMBLY CAN NOT BE COUNTED AS A SYSTEM GROUNDING ELECTRODE.

POLE PROTECTION ASSEMBLY – PLATE TYPE

DEC 1998		
RUS		P2.1





Plan View
Grounding plate (dh)

Designate assembly with grounding plate as "P2.3"

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" apart except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Copper ground wire ("cj") to have a minimum conductivity of No. 6 Copper or equivalent; use copper ground plate and staples, OR, use soft annealed iron, class C, 3–wire, 5/16" ground wire ("cj") and galvanized steel ground plate and staples.

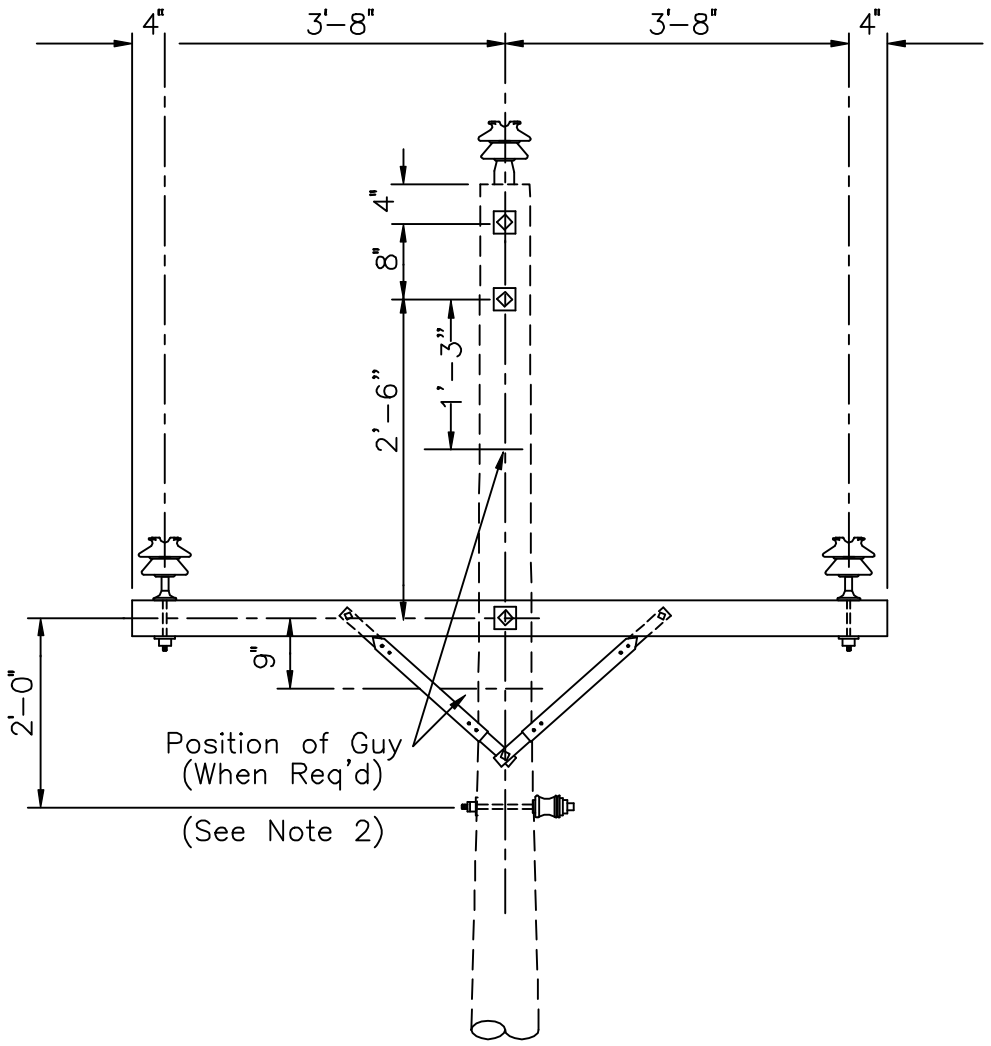
ASSEMBLY:		P2.2	P2.3
ITEM	MATERIAL	QTY	QTY
p	Connector, compression, as req'd		
al	Staples, ground wire, as req'd		
cj	Wire, pole ground, as req'd		
dh	Plate, grounding, butt type		1
	Nails, 1", galvanized, roofing		4

DESIGN PARAMETERS:

THIS ASSEMBLY CAN NOT BE COUNTED AS A SYSTEM GROUNDING ELECTRODE.

POLE PROTECTION ASSEMBLY – WRAP–AROUND TYPE

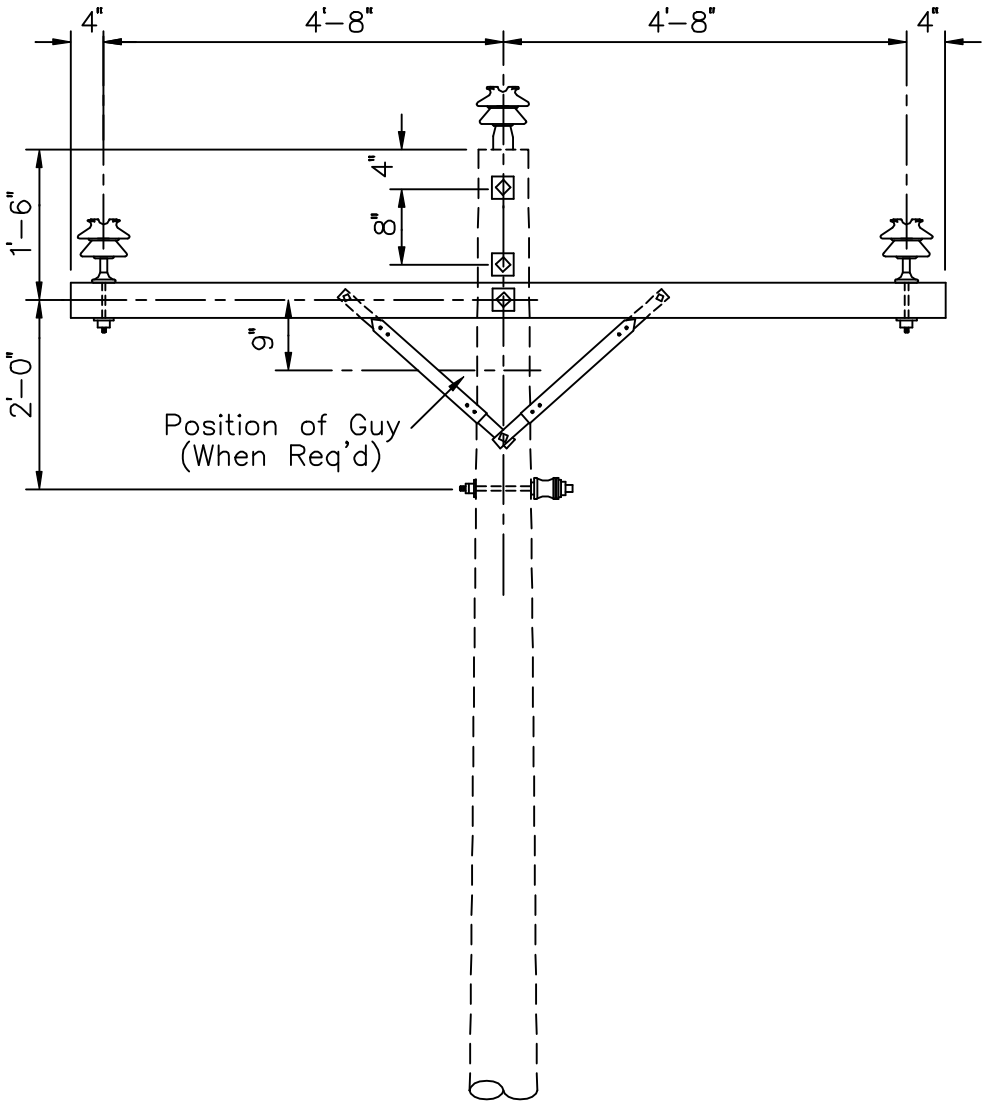
DEC 1998		P2.2
RUS		P2.3



NOTES:

1. See ''C1'', ''C2'', ''VC1'', and ''VC2'' drawings for additional construction details and materials.
2. All down guys must be insulated at top of pole.

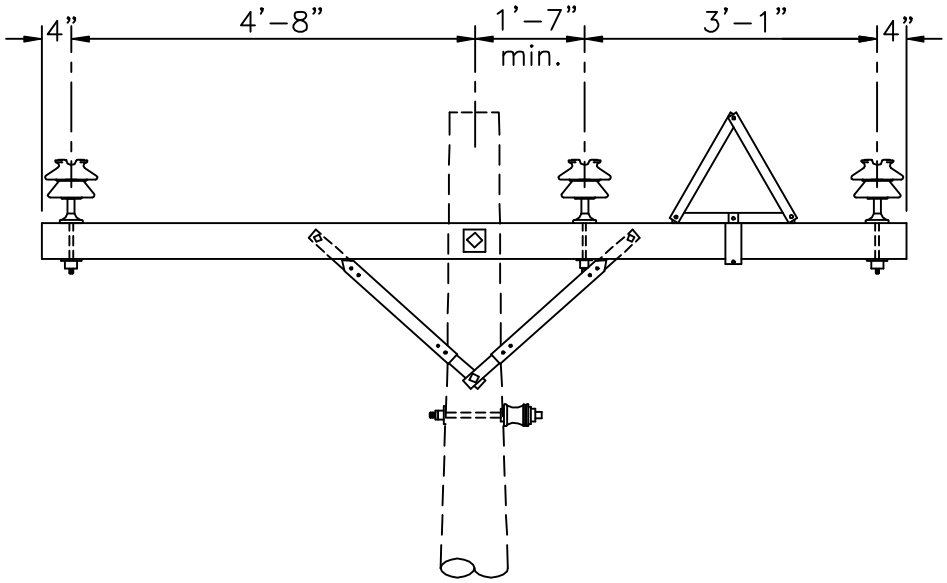
DESIGN PARAMETERS:	RAPTOR PROTECTION ASSEMBLY GUIDE SUPPORT ON 8 FOOT CROSSARMS (TANGENT)		
	DEC 1998 RUS	3 – PHASE PRIMARY 24.9/14.4 kV	VP3.1G

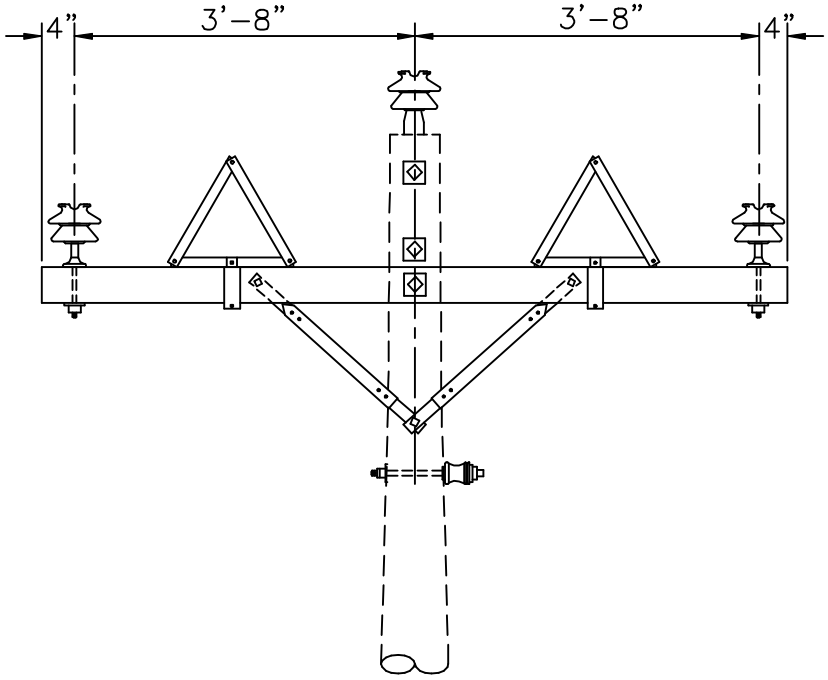


NOTE:

1. See ''C1'', ''C2'', ''VC1'', and ''VC2'' drawings for additional construction details and materials.

DESIGN PARAMETERS:	RAPTOR PROTECTION ASSEMBLY GUIDE SUPPORT ON 10 FOOT CROSSARMS (TANGENT)		
	DEC 1998 RUS	3 – PHASE PRIMARY 24.9/14.4 kV	VP3.2G





NOTE:

1. See ''C1'', ''C2'', ''C3'', and ''VC2'' drawings for additional construction details and materials.

DESIGN PARAMETERS:

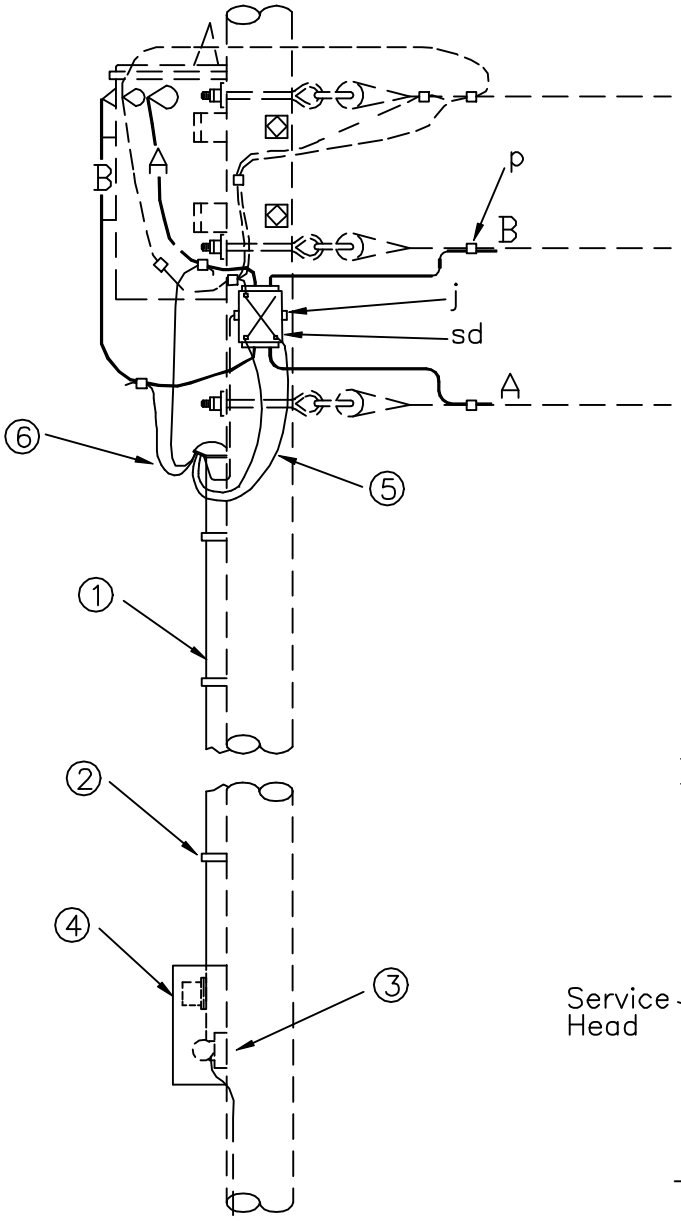
RAPTOR PROTECTION
PERCH GUARDS–GUIDE

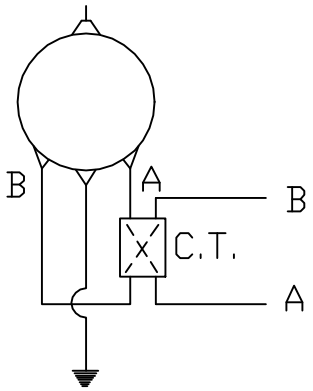
DEC 1998	3–PHASE PRIMARY	
RUS	24.9/14.4 kV	VP3.3G

INDEX Q

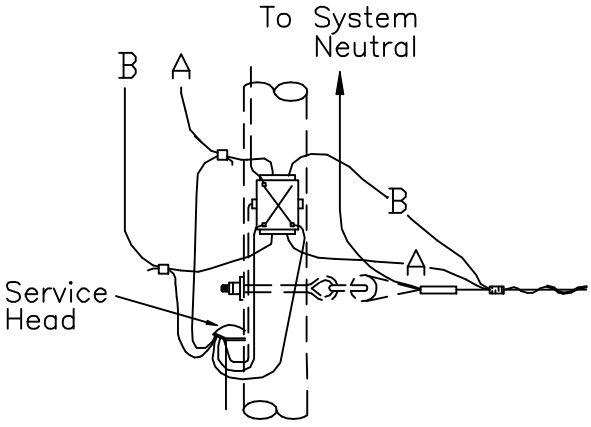
METERING ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
Q1.1	SECONDARY METERING SINGLE PHASE, 120/240 VOLTS
Q3.1	SECONDARY METERING THREE PHASE, 120/240 VOLTS (4 WIRE DELTA)
Q3.2	SECONDARY METERING THREE PHASE, 240 or 480 VOLTS (3 WIRE CORNER GROUNDED DELTA)
Q3.3	SECONDARY METERING THREE PHASE, 120/208 VOLTS (4 WIRE GROUNDED WYE)
VQ4.1	PRIMARY METERING, THREE PHASE (4 WIRE GROUNDED WYE)





WIRING DIAGRAM



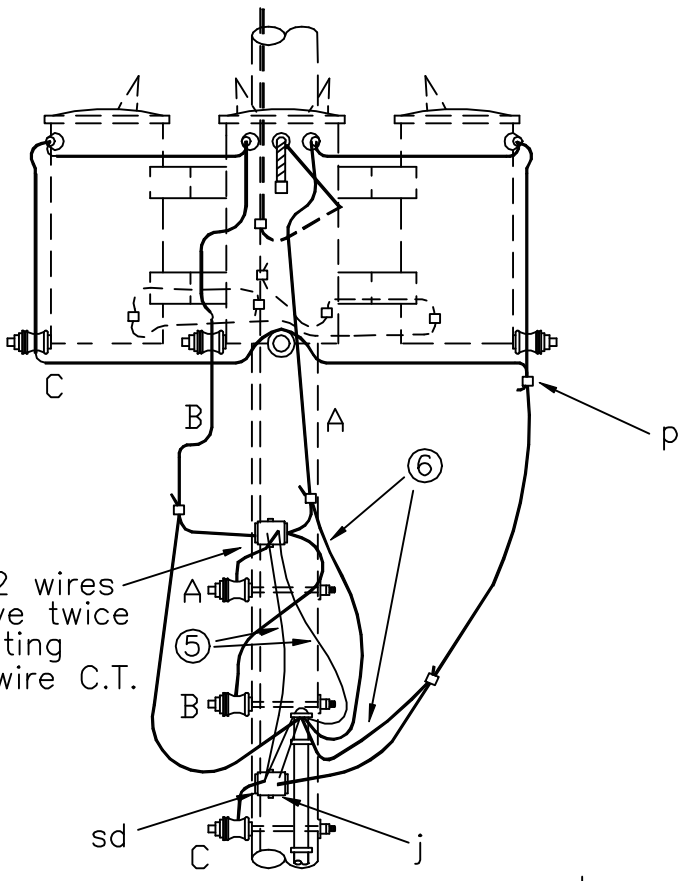
TRIPLEX SERVICE

ITEM	QTY	MATERIAL
j	2	Screw, lag, 1/2" x 4"
p		Connectors, as required
sd	1	Transformer, Current
①		Conduit, 1 1/4" as required
②		Straps, conduit, as required

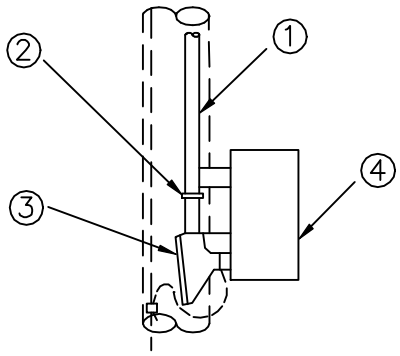
ITEM	QTY	MATERIAL
③	1	Condulet, type LB
④	1	Meter box, meter and test block
⑤		Wire, No. 12, insulation for current
⑥		Wire, No. 14, insulation for potential

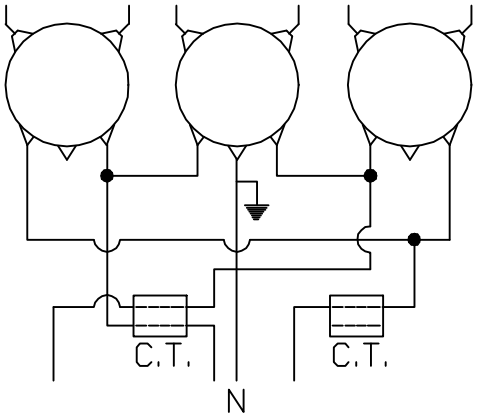
SECONDARY METERING
SINGLE PHASE, 120/240 VOLTS

DEC 1998		
RUS		Q1.1



Note:
C.T. with 2 wires should have twice primary rating of single wire C.T.





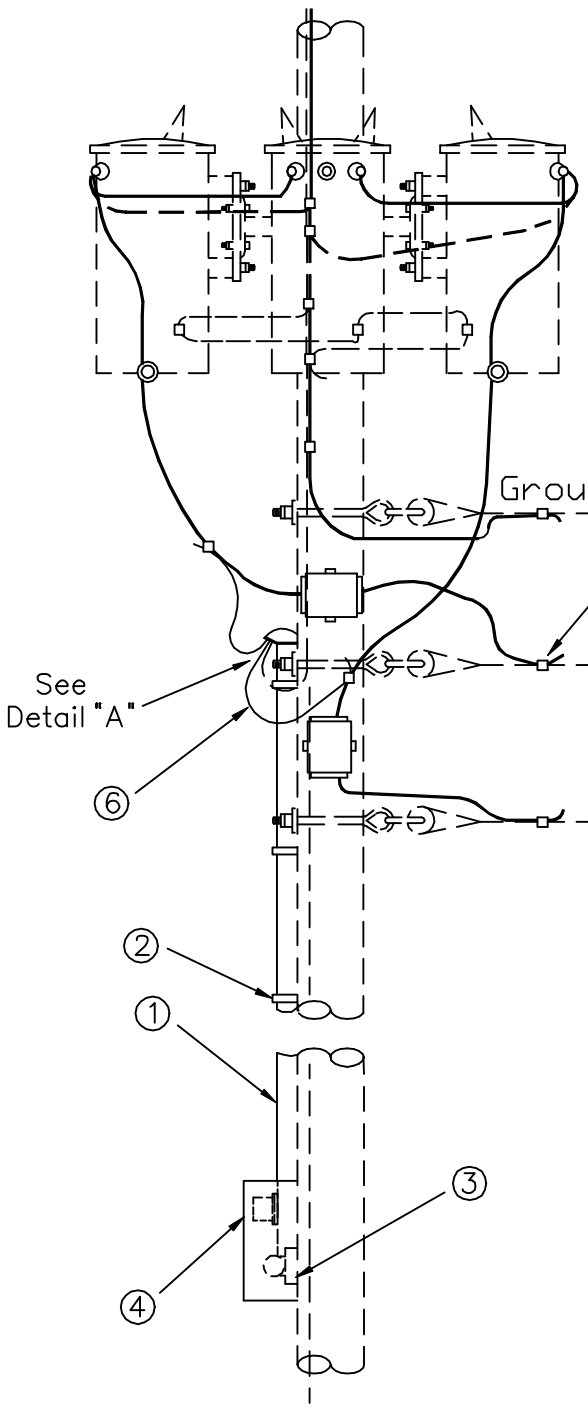
WIRING DIAGRAM
FOR INSTRUMENT TRANSFORMERS

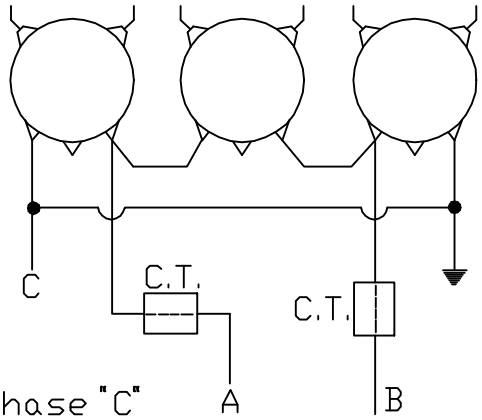
ITEM	QTY	MATERIAL
j	4	Screw, lag, 1/2" x 4"
p		Connectors, as required
sd	2	Transformer, Current
①		Conduit, 1 1/4" as required
②		Straps, conduit, as required

ITEM	QTY	MATERIAL
③	1	Condulet, type "LB"
④	1	Meter box, meter and test block
⑤		Wire, No. 12, insulation for current
⑥		Wire, No. 14, insulation for potential

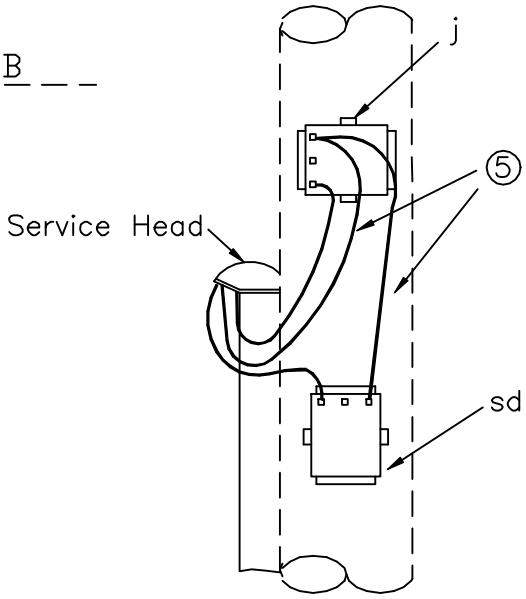
SECONDARY METERING
THREE PHASE, 120/240 VOLTS
(4 WIRE DELTA)

DEC 1998		
RUS		Q3.1





WIRING DIAGRAM



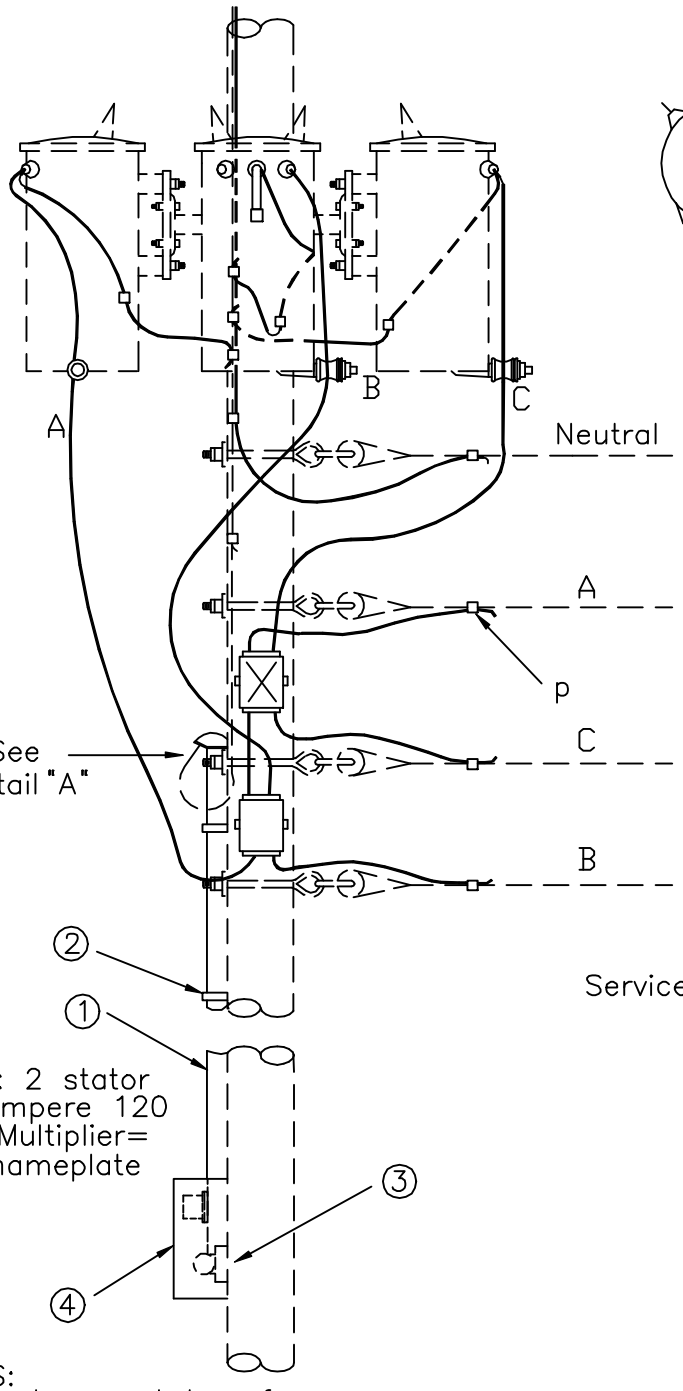
DETAIL "A"
Connections from C.T.'s to Service Head

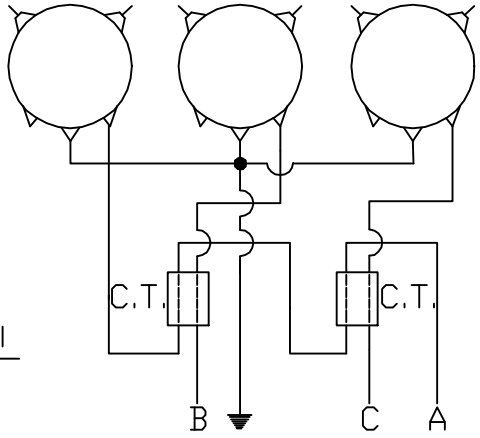
ITEM	QTY	MATERIAL
j	4	Screw, lag, 1/2" x 4"
p		Connectors, as required
sd	2	Transformer, Current
①		Conduit, 1 1/4" as required
②		Straps, conduit, as required

ITEM	QTY	MATERIAL
③	1	Condulet, type "LB"
④	1	Meter box, meter and test block
⑤		Wire, No. 12, insulation for current
⑥		Wire, No. 14, insulation for potential

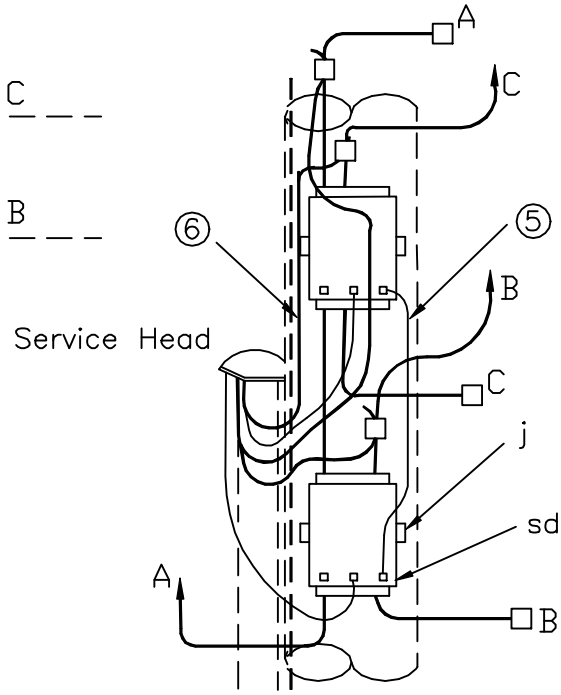
SECONDARY METERING
THREE PHASE, 240 or 480 VOLTS
(3 WIRE CORNER GROUNDED DELTA)

DEC 1998		
RUS		Q3.2





WIRING DIAGRAM



DETAIL "A"
Connections from C.T.'s to Service Head

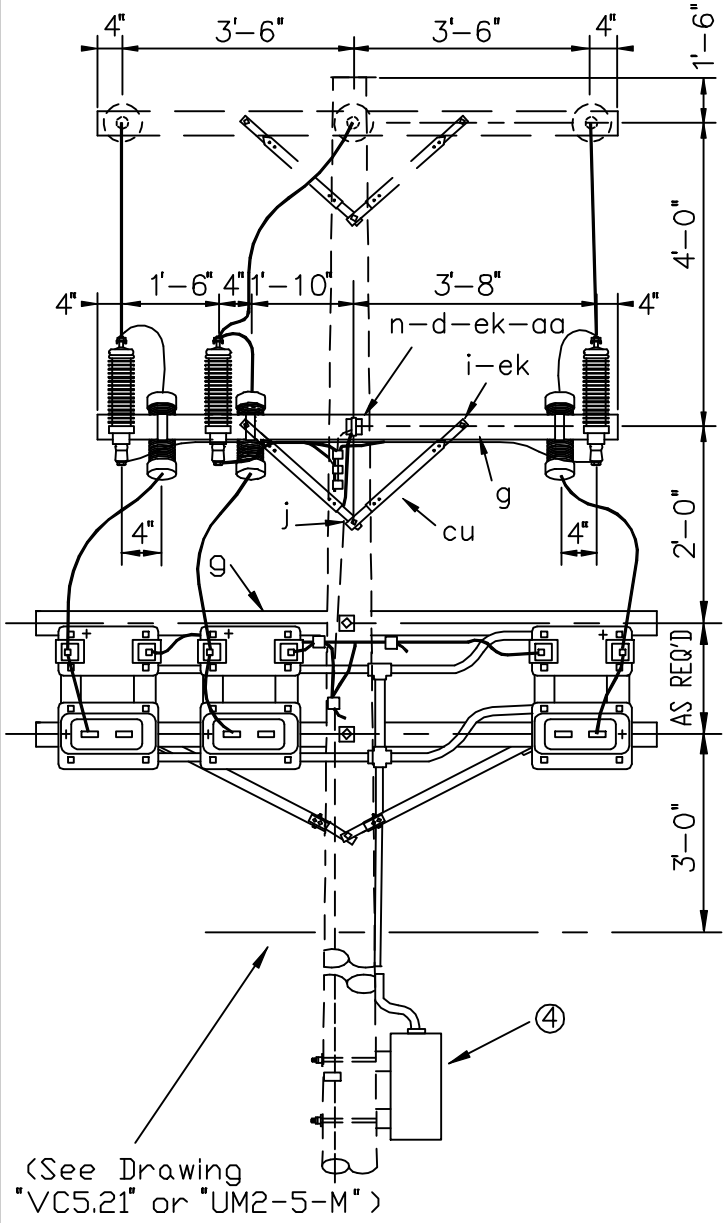
NOTES:
Ground current transformers as required (not shown)

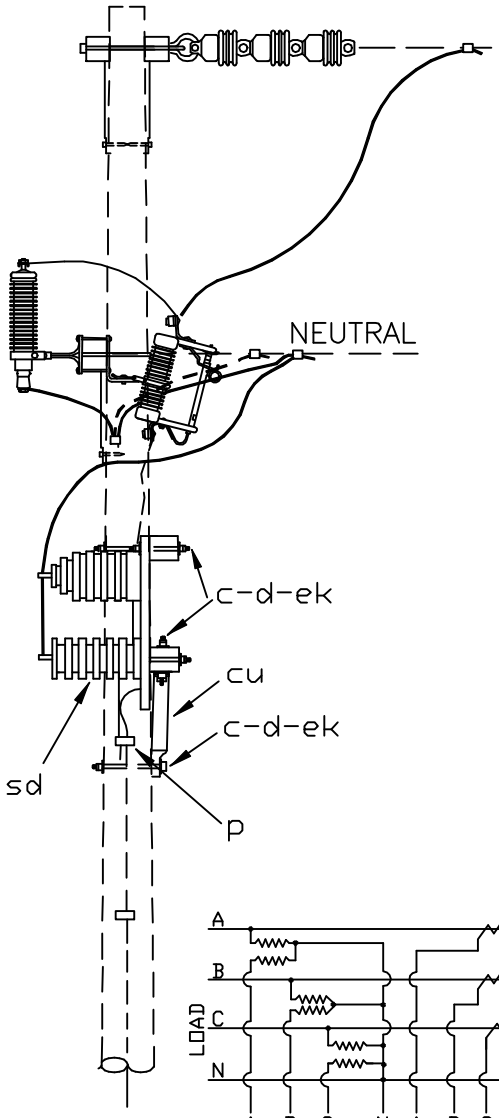
ITEM	QTY	MATERIAL
j	4	Screw, lag, 1/2" x 4"
p		Connectors, as required
sd	2	Transformer, Current
①		Conduit, 1 1/4" as required
②		Straps, conduit, as required

ITEM	QTY	MATERIAL
③	1	Condulet, type "LB"
④	1	Meter box, meter and test block
⑤		Wire, No. 12, insulation for current
⑥		Wire, No. 14, insulation for potential

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

DEC 1998		
RUS		Q3.3





WIRING DIAGRAM
8 Conductor metering cable in conduit

ITEM	QTY	MATERIAL
c	5	Bolt, machine, 5/8" x req'd length
c	26	Bolt, machine, 1/2" x req'd length
d	33	Washer, 2 1/4" square
d	2	Washer, round, 1 3/8" dia.
g	3	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
n	1	Bolt,double arming,5/8" x req'd length
p		Connectors, as required
aa	1	Nut, eye, 5/8"
av		Jumper, primary, bare, as required

ITEM	QTY	MATERIAL
ae	3	Arrester, surge (18 kV)
af	3	Cutout, dist. open (27 kV)
cu	2	Brace, 28"
cu	1	Brace, wood, 60" span
4		Meter box, meter on test block
		Condulets, as required
sd	3	Transformer, current
se	3	Transformer, potential
ek	34	Locknuts
*	6	Mounting brackets
		Metering cable, as req'd

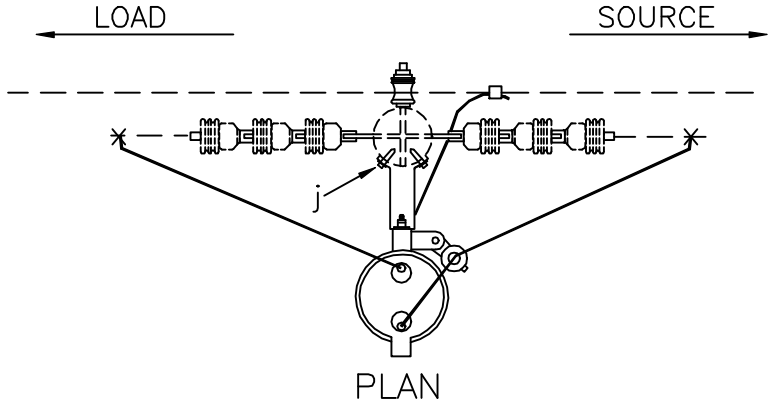
*Specify this item to be furnished by the transformer manufacturer.

PRIMARY METERING THREE PHASE (4 WIRE GROUNDED WYE)

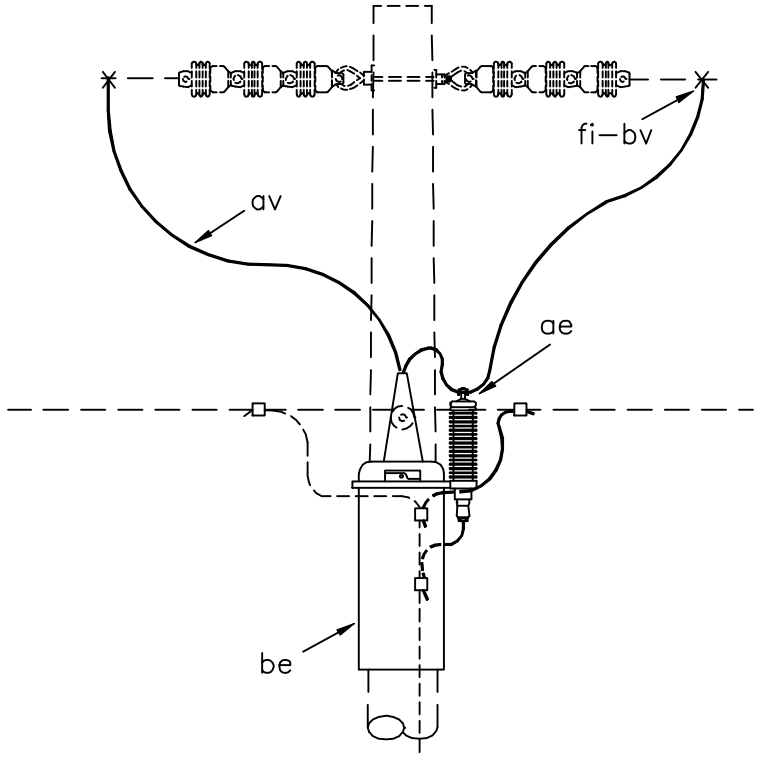
DEC 1998		
RUS	24.9/14.4 kV	VQ4.1

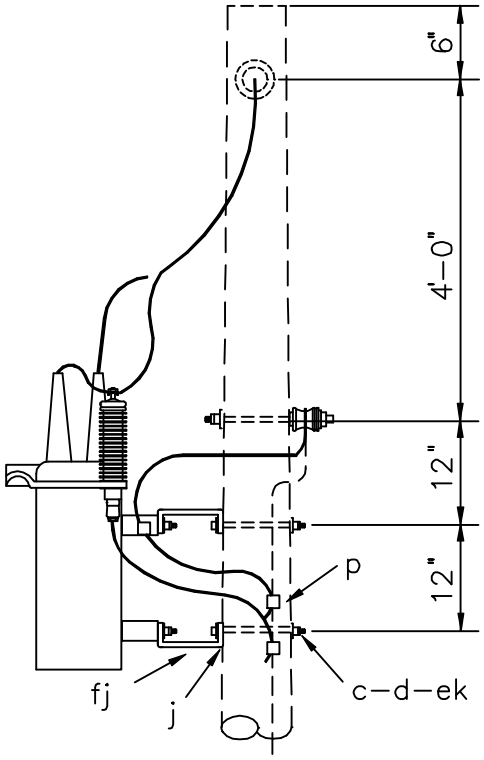
OIL CIRCUIT RECLOSER ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VR1.1	OIL CIRCUIT RECLOSER
VR1.2	OIL CIRCUIT RECLOSER (WITH BYPASS CUTOUT)
VR3.1	(THREE) OIL CIRCUIT RECLOSERS
VR3.2	(THREE) OIL CIRCUIT RECLOSERS (WITH BYPASS SWITCHES)



PLAN





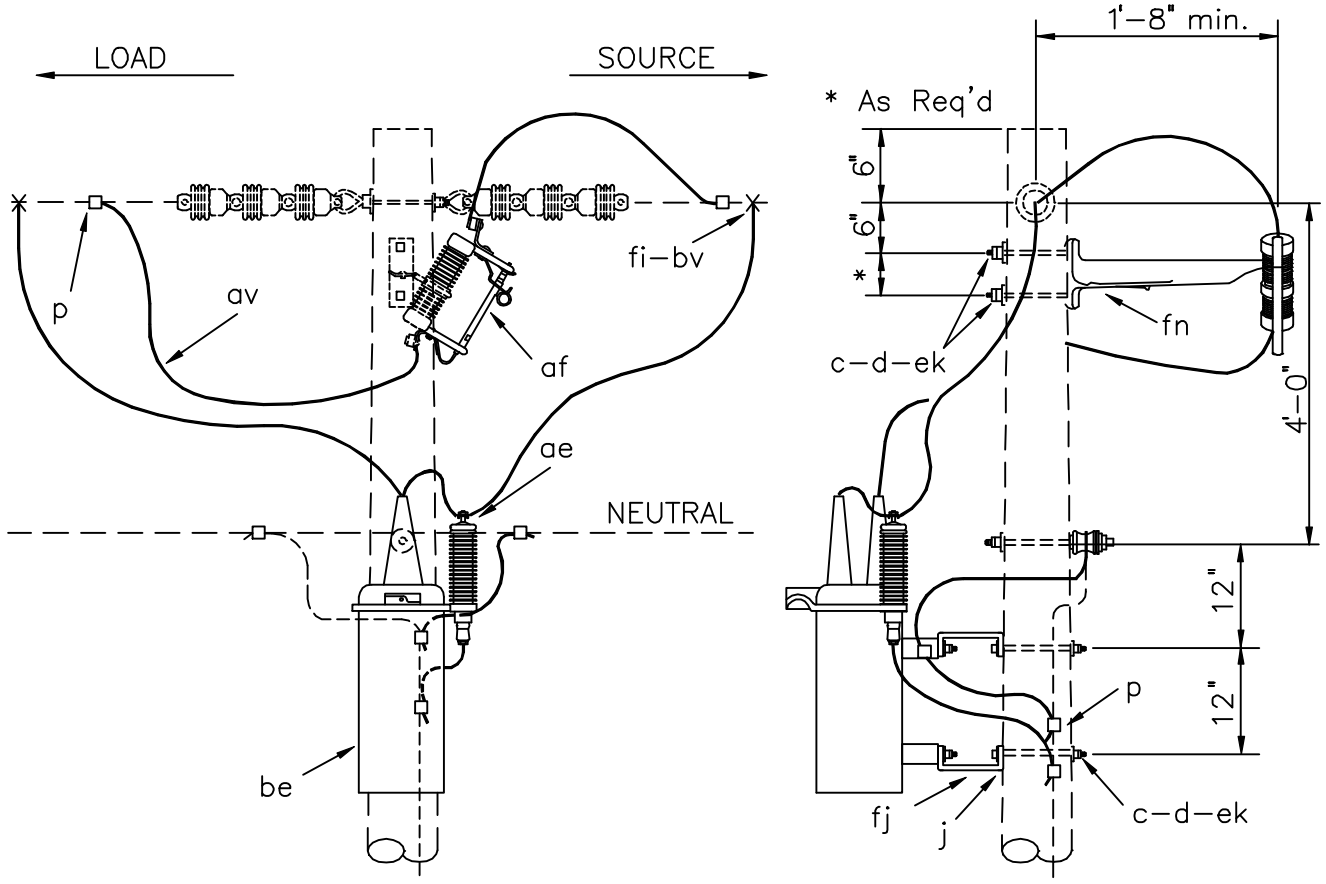
NOTE: The recloser terminal bushing connected to the coil should be connected to the source.

ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
j	4	Screw, lag, 1/2" x 4"
p		Connector, as required
ae	1	Arrester, surge (18 kV)
av		Jumpers, stranded, as required

ITEM	QTY	MATERIAL
be	1	Recloser, oil circuit (14.4 kV)
bv		Rod, armor, as req'd
ek	2	Locknuts
fi	2	Connector, hot line
fj	2	Brackets, extension, 9" long

OIL CIRCUIT RECLOSER

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VR1.1



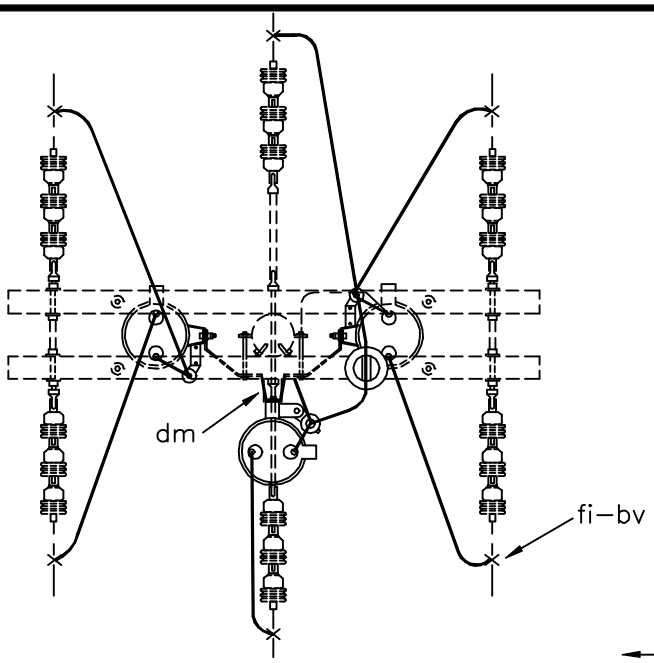
NOTE: The recloser terminal bushing connected to the coil should be connected to the source.

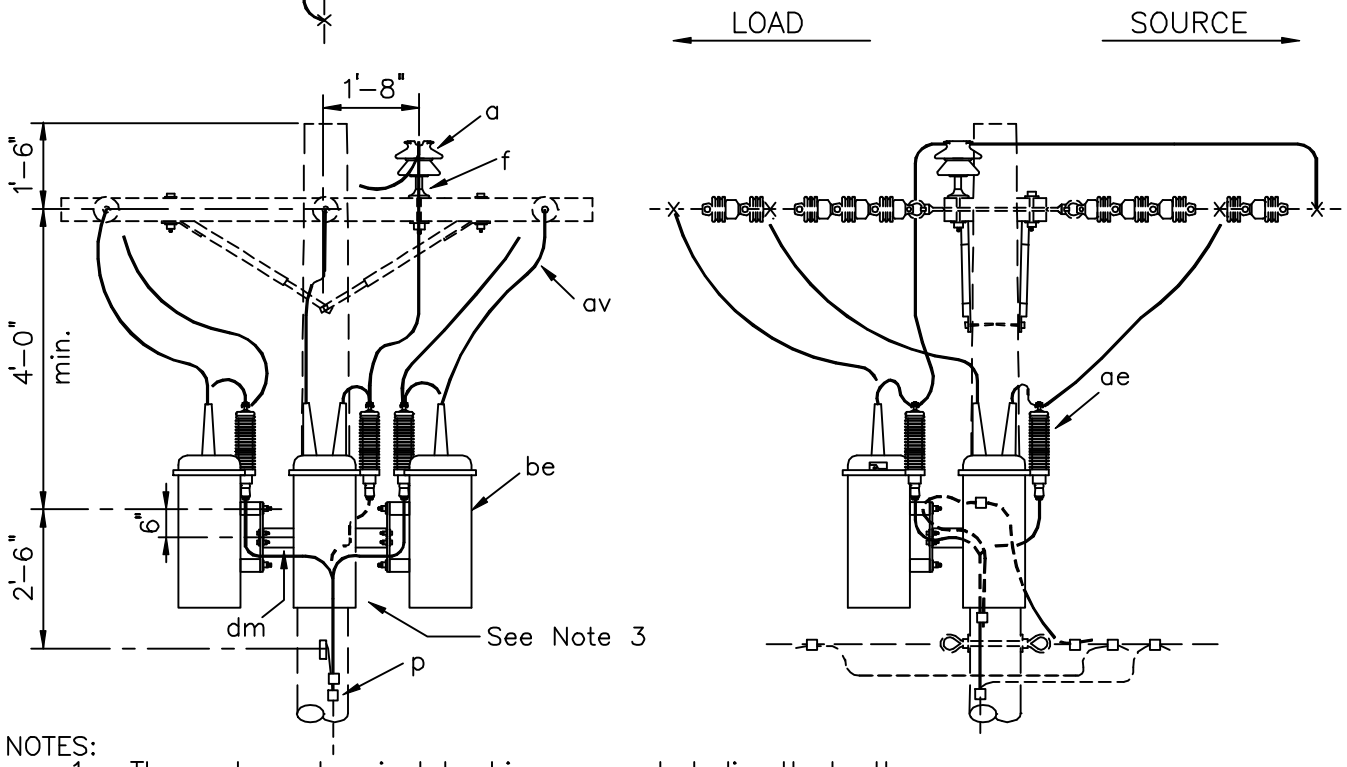
ITEM	QTY	MATERIAL
c	4	Bolt, machine, 5/8" x req'd length
d	4	Washer, square, 2 1/4"
j	4	Screw, lag, 1/2" x 4"
p		Connector, as required
ae	1	Arrester, surge (18 kV)
af	1	Cutout, distribution, open (27 kV)
av		Jumpers, stranded, as required

ITEM	QTY	MATERIAL
be	1	Recloser, oil circuit (14.4 kV)
bv		Rod, armor, as req'd
ek	4	Locknuts
fi	2	Connector, hot line
fj	2	Brackets, extension, 9" long
fn	1	Bracket, extension

OIL CIRCUIT RECLOSER (WITH BYPASS CUTOUT)

DEC 1998	1 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VR1.2





NOTES:

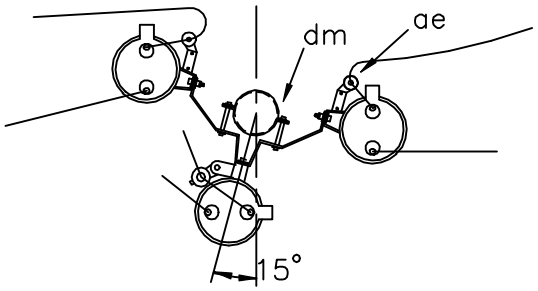
1. The recloser terminal bushing connected directly to the coil should be connected to the source.
2. For 2–phase installations, omit recloser and related items on center phase and designate as "VR2.1".
3. Each recloser tank shall have two connections to ground.

ITEM	QTY	MATERIAL
a	1	Insulator, pin type, (24.9/14.4 kV)
f	1	Pin, crossarm, steel, 5/8" x 14"
p		Connector, as required
ae	3	Arrester, surge (18 kV)
av		Jumpers, stranded, as required

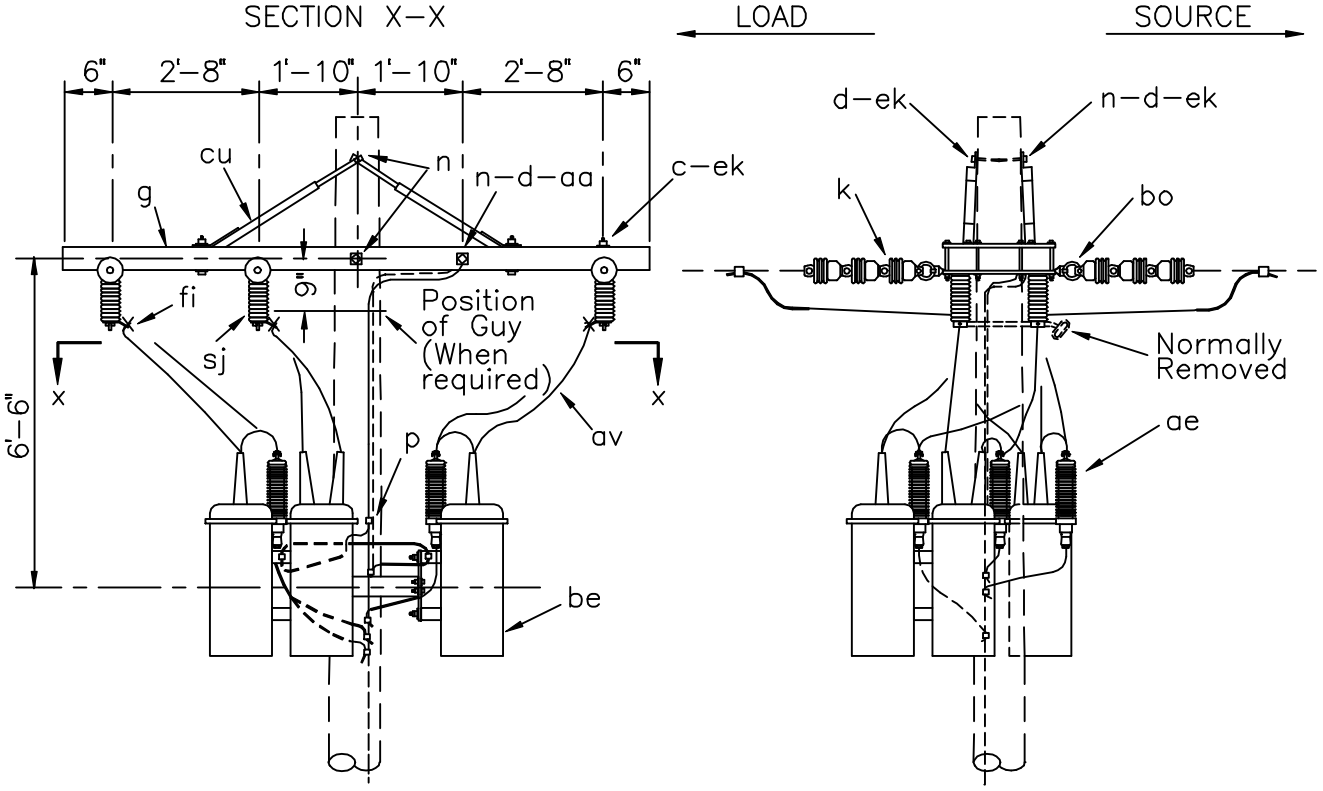
ITEM	QTY	MATERIAL
be	3	Recloser, oil circuit (14.4 kV)
bv	6	Rod, armor, as req'd
fi	6	Connector, hot line
dm	1	Bracket, cluster type, with 14" adapter plate

(THREE) OIL CIRCUIT RECLOSERS

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VR3.1



SECTION X–X



NOTES:

1. The recloser terminal bushing connected directly to the coil should be connected to the source.
2. For 2–phase installations, omit recloser and related items on center phase and designate as "VR2.2".
3. Each recloser tank shall have two connections to ground.

ITEM	QTY	MATERIAL
c	4	Bolt, machine, 1/2" x req'd length
c	12	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	8	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
k	18	Insulator, suspension, 4 1/4"
n	3	Bolt, double arm, 5/8" x req'd length
p		Connectors, as required
aa	2	Nut, eye, 5/8"
ae	3	Arresters, surge, (18 kV)

ITEM	QTY	MATERIAL
av		Jumpers, stranded, as req'd
be	3	Recloser, oil circuit (14.4 kV)
bo	6	Shackle, anchor
cu	2	Brace, wood, 60" span
dm	1	Bracket, cluster type with 14" adapter plate
ek	26	Locknuts
fi	6	Connector, hot line
sj	3	Switch, OCR, by–pass, (27 kV)

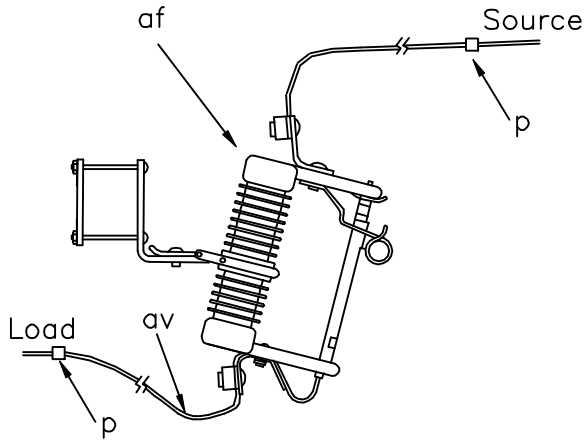
(THREE) OIL CIRCUIT RECLOSERS (WITH BYPASS SWITCHES)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VR3.2

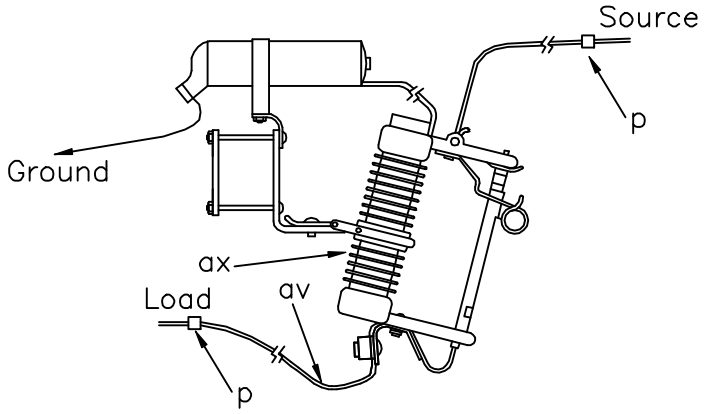
INDEX S

SECTIONALIZING ASSEMBLY UNITS

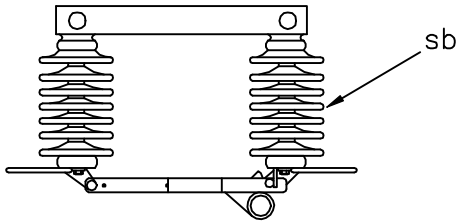
DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VS1.01, VS1.02, VS2.01	MISCELLANEOUS CUTOUTS AND DISCONNECT SWITCH
VS1.1	CUTOUT - SINGLE PHASE
VS1.3	CUTOUTS (THREE SINGLE-PHASE)
VS2.31	DISCONNECT SWITCHES (THREE SINGLE-PHASE)
VS2.32	GROUP-OPERATED AIRBREAK SWITCH (THREE-PHASE)



VS1.01



VS1.02



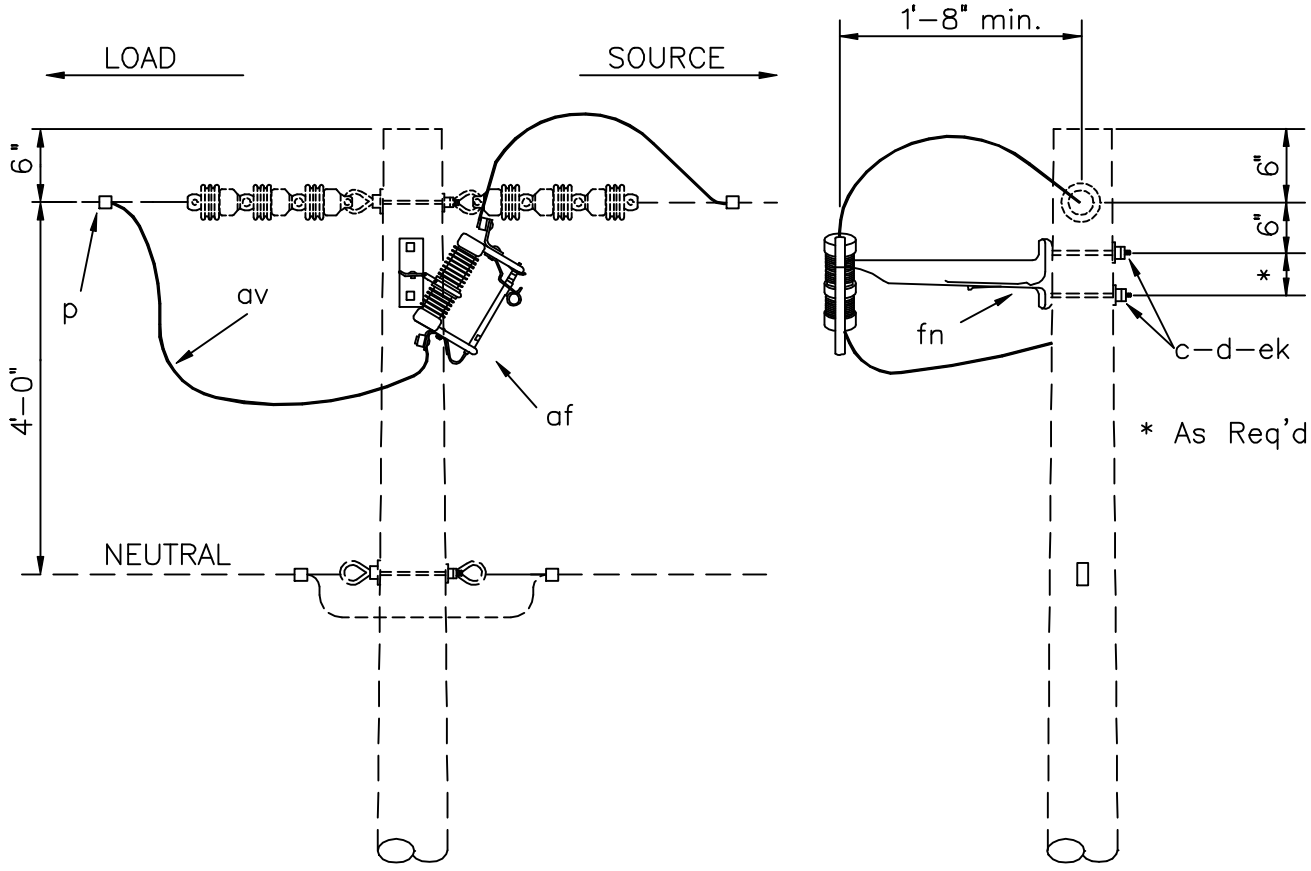
VS2.01

NOTES: Specify cutouts to be furnished with fuse tube or switch blade.

ASSEMBLY: VS		1.01	1.02	2.01
ITEM	MATERIAL	QTY	QTY	QTY
p	Connector, as req'd			
af	Cutout, dist., open (27 kV)	1		
ax	Cutout, & Arrester Comb. (18 kV)		1	
av	Jumpers, as req'd			
sb	Switch, disconnect (27 kV)			1

MISCELLANEOUS CUTOUTS AND DISCONNECT SWITCH

DEC 1998		VS1.01, VS1.02, VS2.01
RUS	24.9/14.4 kV	

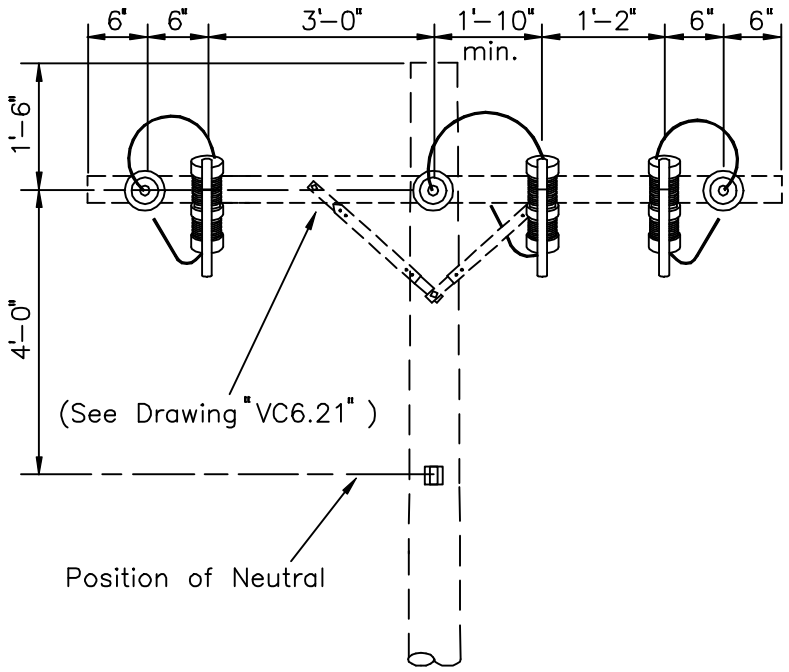


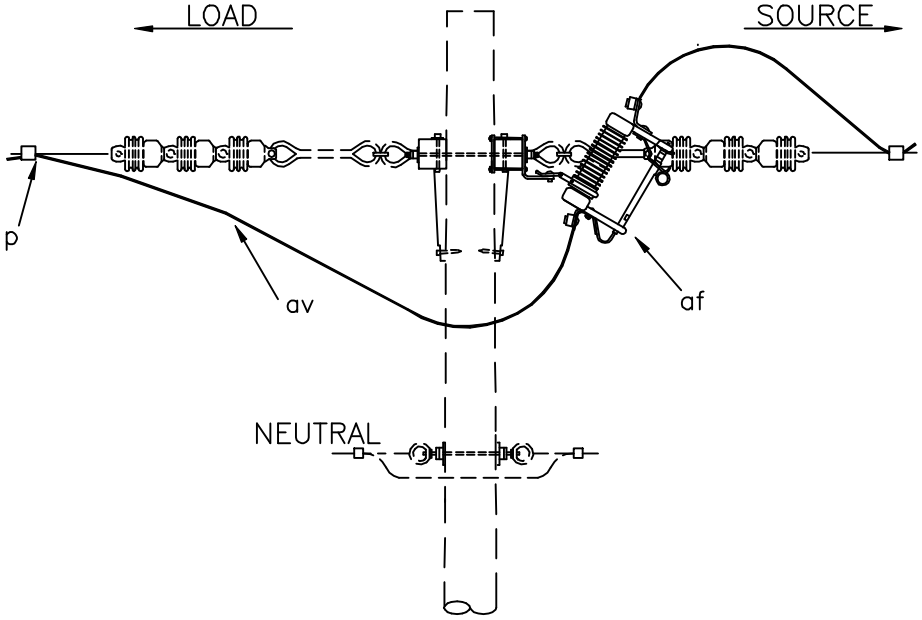
NOTE: Specify fuse size or solid blade

ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
d	2	Washer, square, 2 1/4"
p	2	Connector, compression type
af	1	Cutout, distribution, open (27 kV)
av		Jumpers, as required
ek	2	Locknuts
fn	1	Bracket, extension

CUTOUT – SINGLE PHASE

DEC 1998		
RUS	24.9/14.4 kV	VS1.1



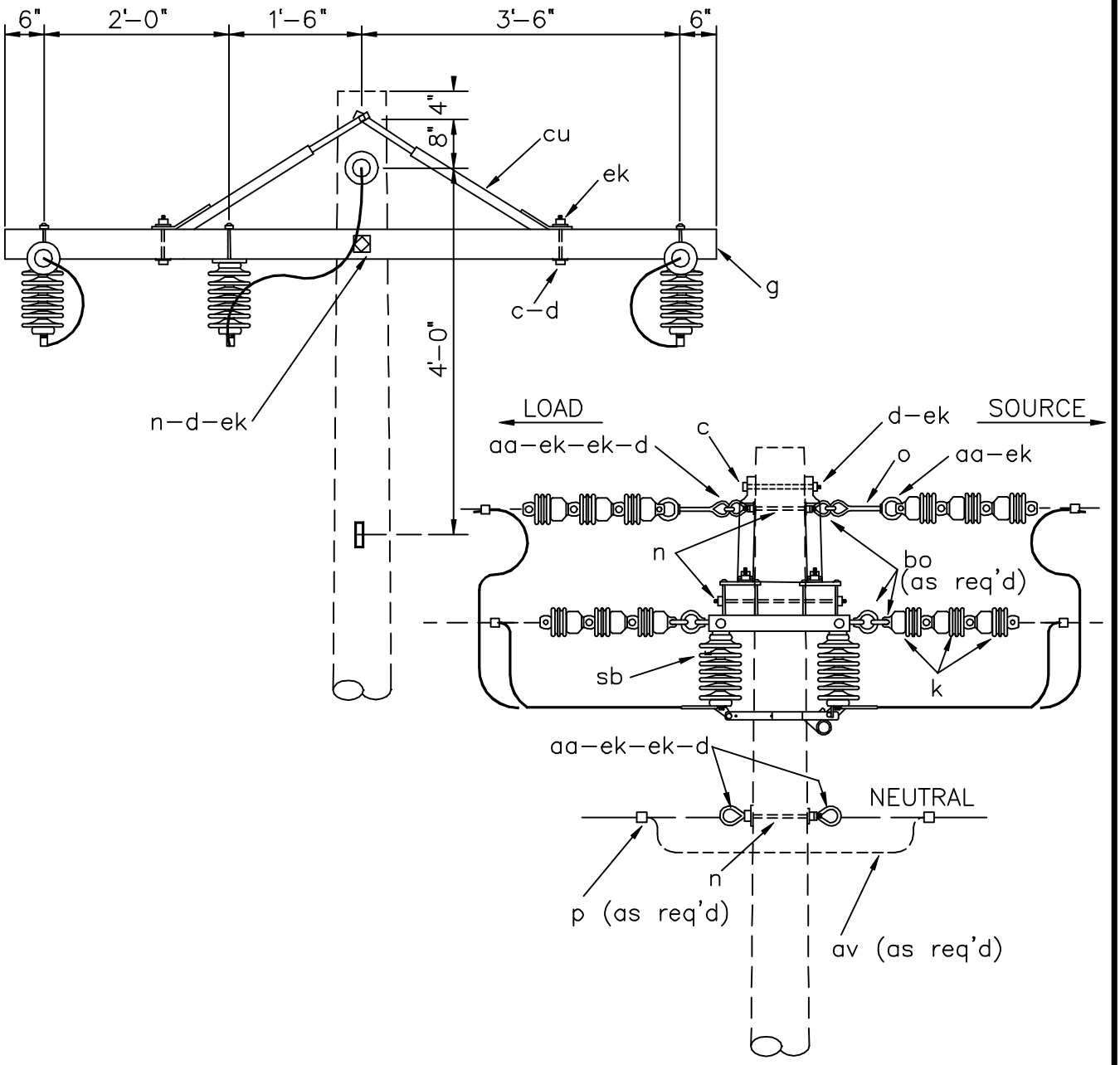


NOTES:
1. Specify fuse size or solid blade.
2. Mount cutouts so that blades face climbing face of pole.

ITEM	QTY	MATERIAL
p	6	Connector, compression type
af	3	Cutout, distribution open (27 kV)
av		Jumpers, as req'd

CUTOUTS
(THREE SINGLE–PHASE)

DEC 1998		
RUS	24.9/14.4 kV	VS1.3



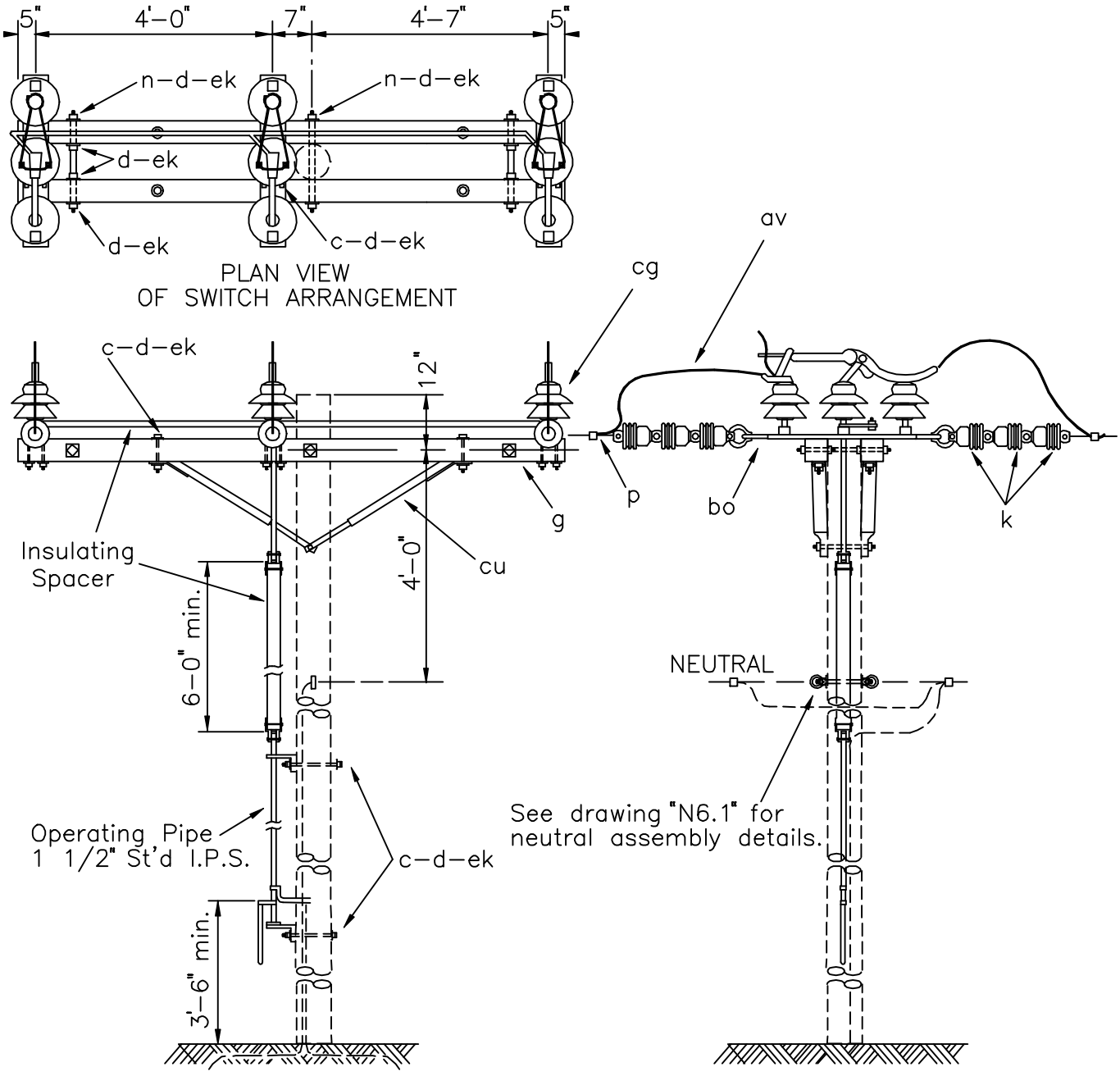
NOTE: For 2–phase installations, omit switch and related items on center phase and designate as "VS2.21".

ITEM	QTY	MATERIAL
c	4	Bolt, machine, 1/2" x req'd length
c	1	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	3	Washer, square, 2 1/4"
d	4	Washer, square, 3", curved
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
k	18	Insulator, suspension, 4 1/4"
n	3	Bolt, double arm, 5/8" x req'd length

ITEM	QTY	MATERIAL
o	2	Bolt, eye, 5/8" x req'd length
p		Connectors, compression as required
aa	6	Nut, eye, 5/8"
av		Jumpers, as required
bo	6	Shackle, anchor
cu	2	Brace, wood, 60" span
sb	3	Switch, disconnect, 27 kV,
		with mounting hardware

DISCONNECT SWITCHES (THREE SINGLE–PHASE)

DEC 1998		
RUS	24.9/14.4 kV	VS2.31



NOTE: See Dwg. "H4.1" (Preferred) or "H3.1" for required grounding assembly.

ITEM	QTY	MATERIAL
c	4	Bolt, machine, 1/2" x req'd length
c	15	Bolt, machine, 5/8" x req'd length
d	4	Washer, round, 1 3/8"
d	27	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 10'–0"
k	18	Insulator, suspension, 4 1/4"
n	4	Bolt, double arm, 5/8" x req'd length
p		Connectors, as required

ITEM	QTY	MATERIAL
aa	2	Nut, eye, 5/8"
av		Jumpers, as required
bo	6	Shackle, anchor
cg	1	Switch, airbreak, group oper.
		25 kV, w/ operating mechanism
cu	2	brace, wood, 60" span
ek	33	Locknuts

GROUP–OPERATED AIRBREAK SWITCH (THREE–PHASE)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VS2.32

INDEX W

WOOD POLES, CROSSARMS AND BRACES

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
W1.1G	POLE FRAMING GUIDE
W2.1G	CROSSARM DRILLING GUIDE
W3.1, W3.2	CROSSARM BRACES

CONSTRUCTION SPECIFICATIONS FOR POLES AND CROSSARMS

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

Poles shall be set so that alternate crossarm gains face in opposite directions, except at terminal and deadends where the gains of the last two (2) poles shall be on the side facing the terminal or deadend. 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. On lines that curve, crossarms shall be installed on the side of the pole which faces the midpoint of the curve. On sloping terrain, crossarms shall be installed on the uphill side of the pole. Where pole top insulator brackets or pole top pins are used, they shall be located on the opposite side of the pole from the gain.

Poles shall be set in an alignment and plumb, except at corners, terminal, 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 for each 10 feet of pole length nor more than 2 inches for each 10 feet of pole length after the conductors are installed at the required tension.

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

TABLE W

Pole Setting Depths

The minimum depth for setting poles must be as follows:

Length of Pole (Feet)	Setting in Soil (Feet)	Setting in All Solid Rock (Feet)
20	4.0	3.0
25	5.0	3.5
30	5.5	3.5
35	6.0	4.0
40	6.0	4.0
45	6.5	4.5
50	7.0	4.5
55	7.5	5.0
60	8.0	5.0

"Setting in Soil" depths must apply:

A. Where poles are to be set in soil;

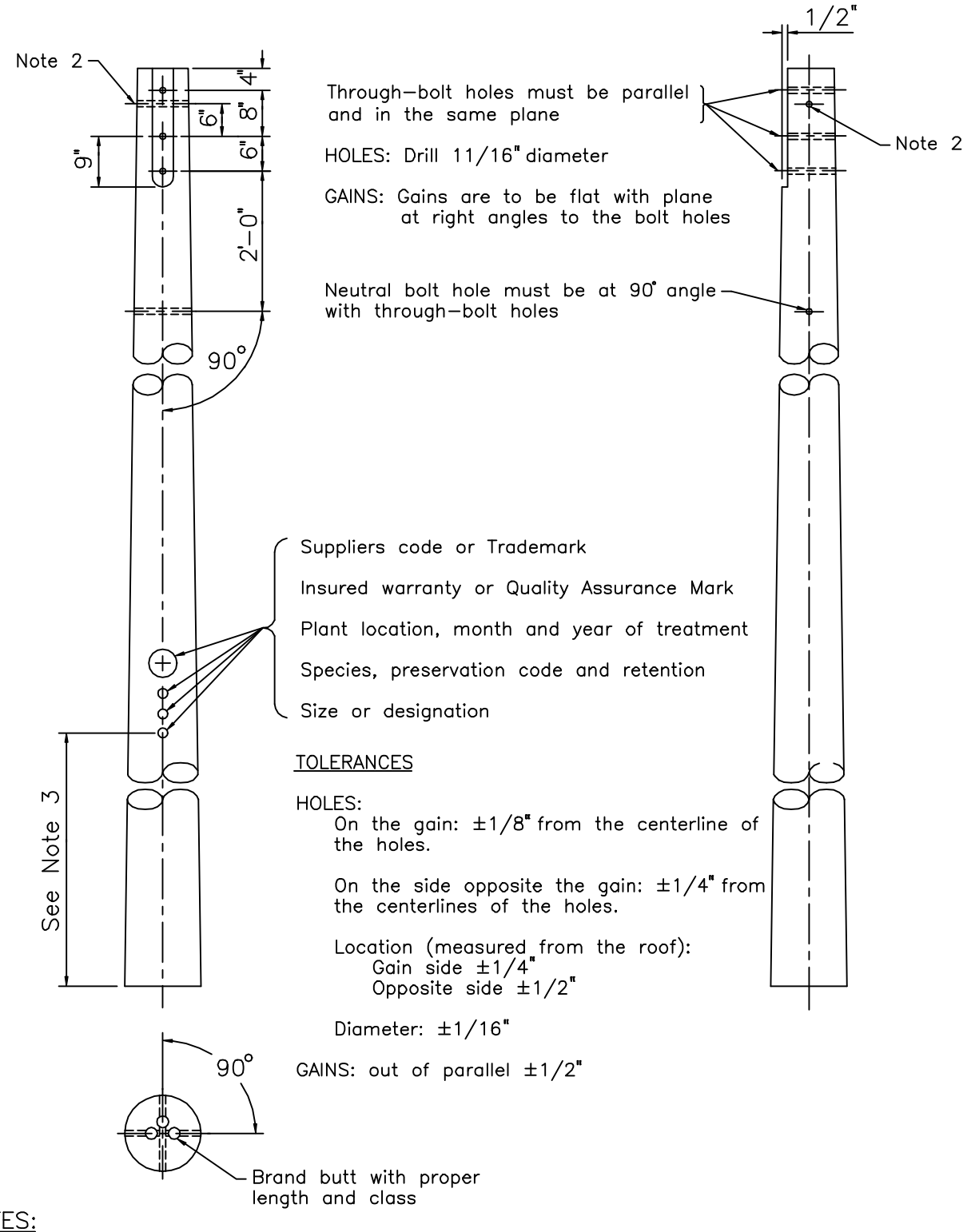
B. Where there is a layer of soil or more than two (2) feet in depth over solid rock;

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 must 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 two (2) feet or less in depth over solid rock, the depth of the hole must be the depth of the soil in addition to the depth specified under "Setting in All Solid Rock" provided, however, that such depth must not exceed the depth specified under "Setting in Soil."

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



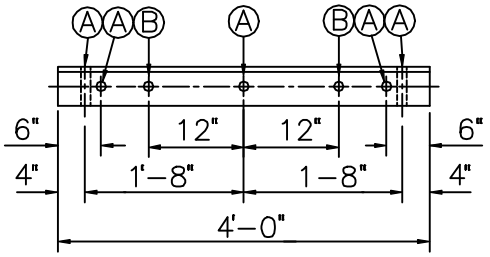
NOTES:

1. 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.
2. Anti-split bolt hole is optional and is to be drilled only when so specified by the purchaser.
3. Bottom of brand or center of metal disk shall be 10' ±2" from the pole butt for poles less than 55' in length; 14' ±2" for poles 55' and longer.

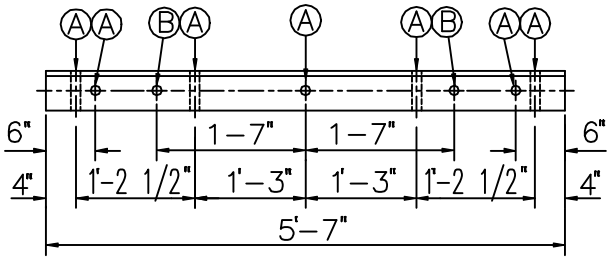
POLE FRAMING GUIDE

DEC 1998		
RUS		W1.1G

TOLERANCES AND SIZES OF HOLES			
NOMINAL		GO	NO GO
Ⓐ	11/16"	5/8"	3/4"
Ⓑ	7/16"	3/8"	1/2"
Ⓒ	9/16"	1/2"	5/8"



TYPE 01



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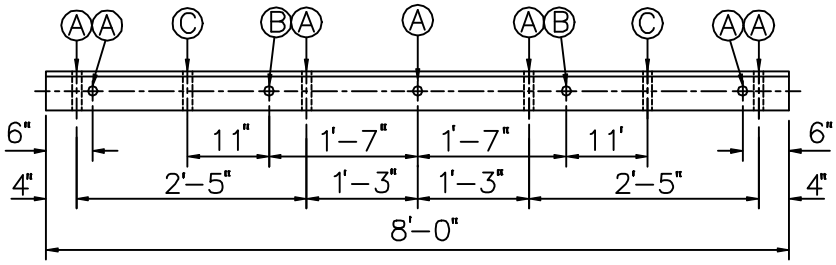
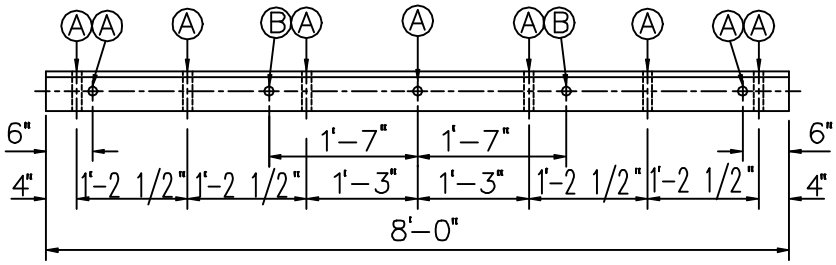


TYPE 03



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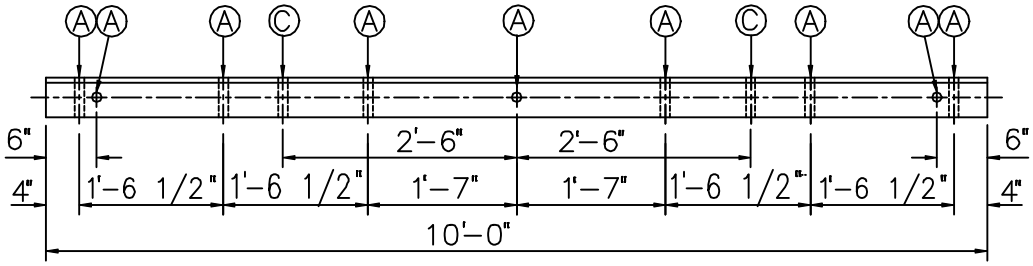

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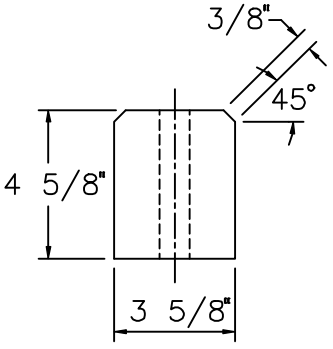


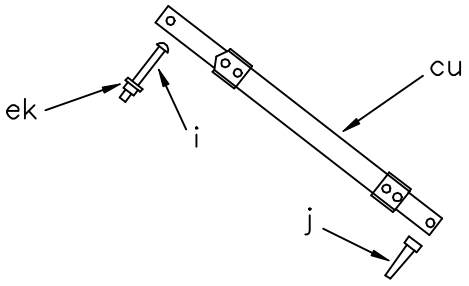
TYPICAL END SECTION

NOTES:

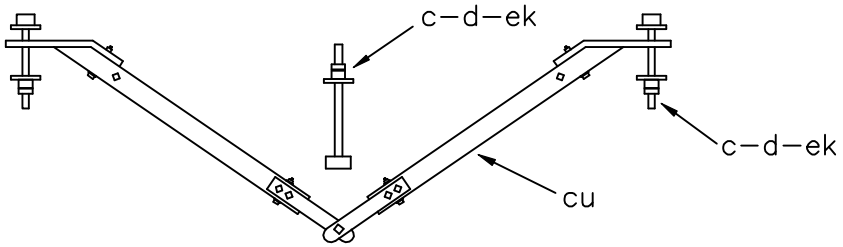
1. Holes are to be located within ±1/8"
2. Length of the crossarm is to be within ±1/4"
3. The tolerance of the cross section is +1/8" and −0" at time of manufacture.
4. All holes are to be drilled on centerlines of crossarm faces.

CROSSARM DRILLING GUIDE

DEC 1998		
RUS		W2.1G



W3.1



W3.2

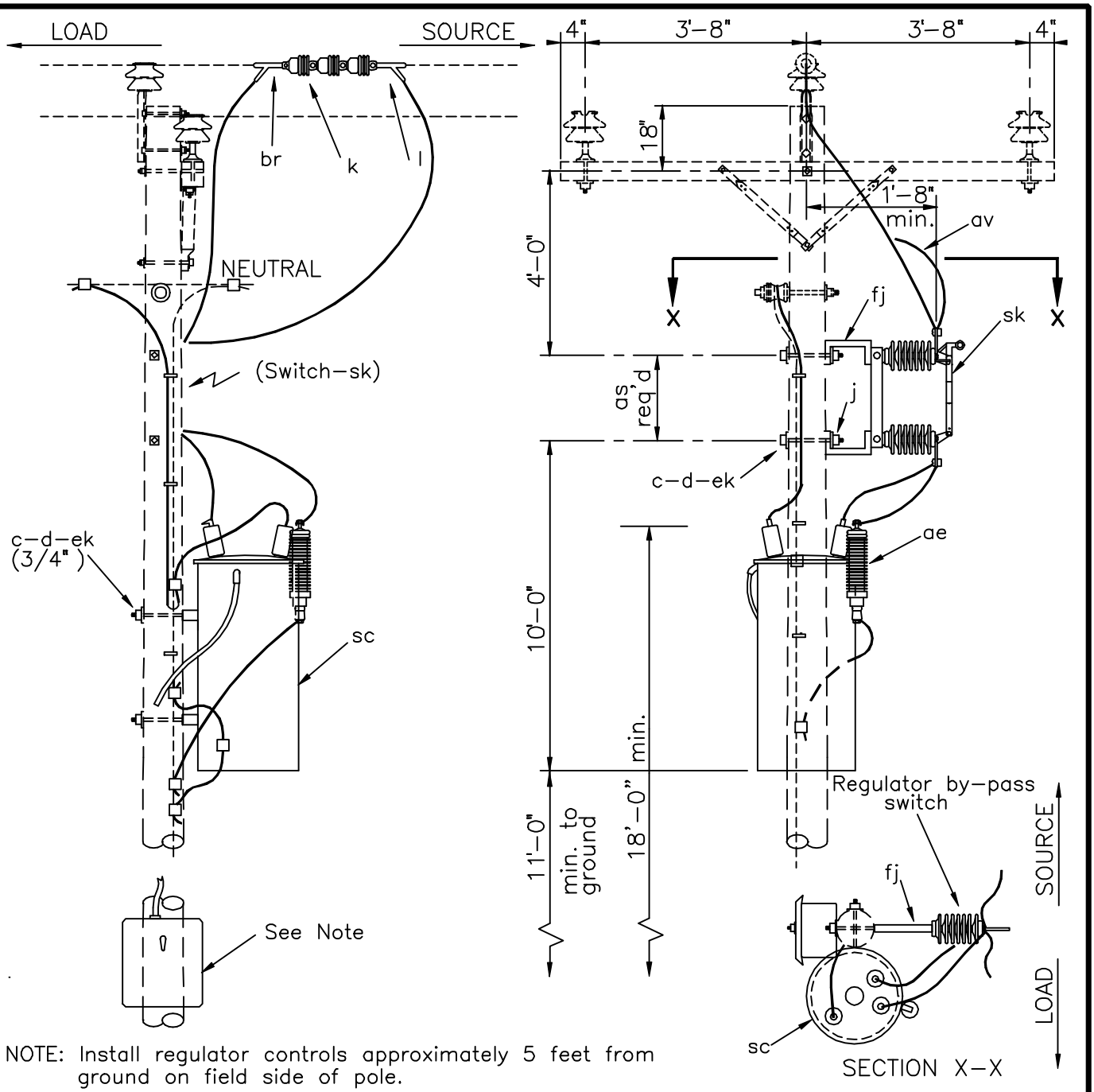
		W3.1	W3.2
ITEM	MATERIAL	QTY	QTY
c	Bolt, machine, 1/2" x req'd length		2
c	Bolt, machine, 5/8" x req'd length		1
d	Washer, round, 1 3/8"		2
d	Washer, square, 2 1/4"		1
i	Bolt, carriage, 3/8" x 4 1/2"	1	
j	Screw, lag, 1/2" x 4"	1	
cu	Brace, wood, 28"	1	
cu	Brace, wood, 60"		1
ek	Locknuts	1	3

CROSSARM BRACES

DEC 1998		W3.1,
RUS		W3.2

VOLTAGE ALTERATION EQUIPMENT ASSEMBLY UNITS

DRAWING NUMBER	DRAWING TITLE (DESCRIPTION)
VY1.1	VOLTAGE REGULATOR, POLE MOUNTED (ONE SINGLE-PHASE)
VY1.3	VOLTAGE REGULATORS, PLATFORM MOUNTED (THREE SINGLE-PHASE)
VY2.1	AUTOTRANSFORMER, POLE MOUNTED (ONE SINGLE-PHASE, STEP-DOWN)
VY3.3	THREE-PHASE CAPACITOR BANK



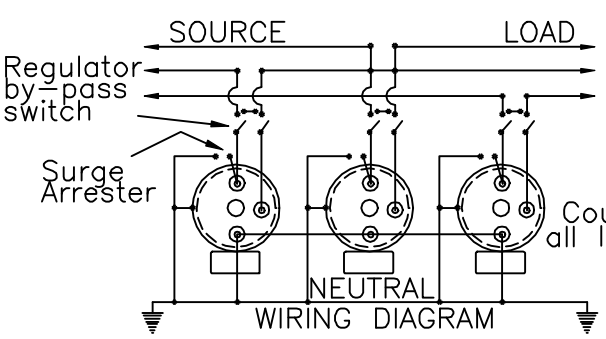
NOTE: Install regulator controls approximately 5 feet from ground on field side of pole.

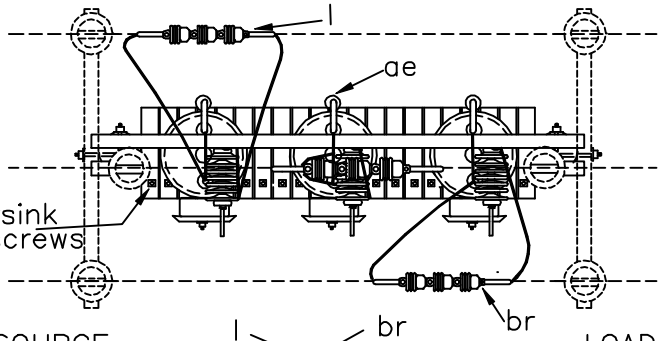
ITEM	QTY	MATERIAL
c	2	Bolt, machine, 5/8" x req'd length
c	2	Bolt, machine, 3/4" x req'd length
d	2	Washer, square, 2 1/4"
d	2	Washer, square, 3," curved
j	6	Screw, lag, 1/2" x 4"
k	3	Insulator, suspension, 4 1/4"
l	2	Clamp, deadend
p		Connectors, compression, as req'd
ae	1	Arrester, surge (18 kV)

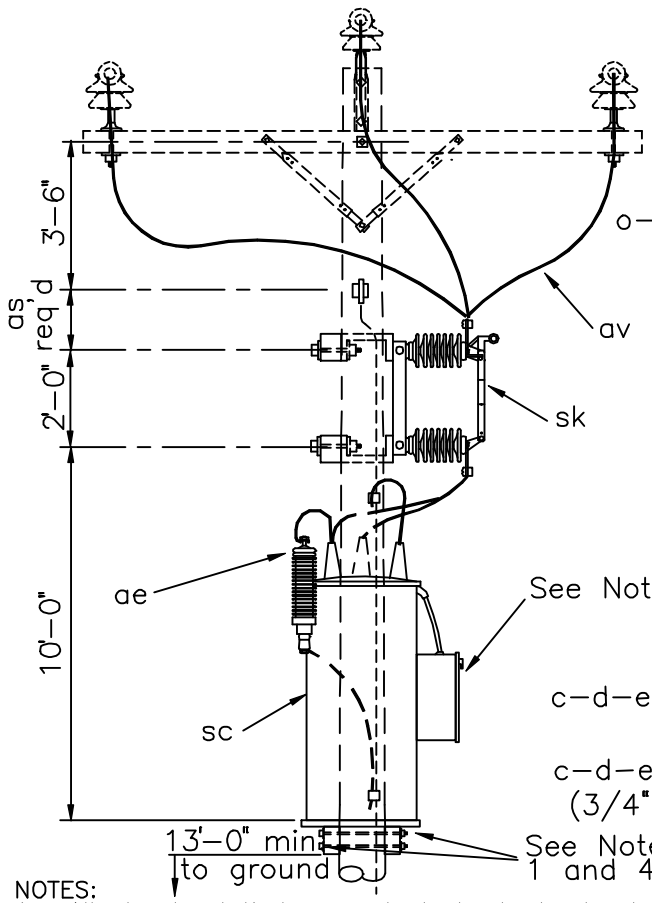
ITEM	QTY	MATERIAL
av		Jumpers, bare, stranded, as req'd
br	1	Chain link
bu		Connector, grounding
fj	2	Bracket, extension, 9"
sc	1	Regulator, voltage, step–type
		24.9/14.4 kV
sk	1	Switch, regulator by–pass
ek	4	Locknuts

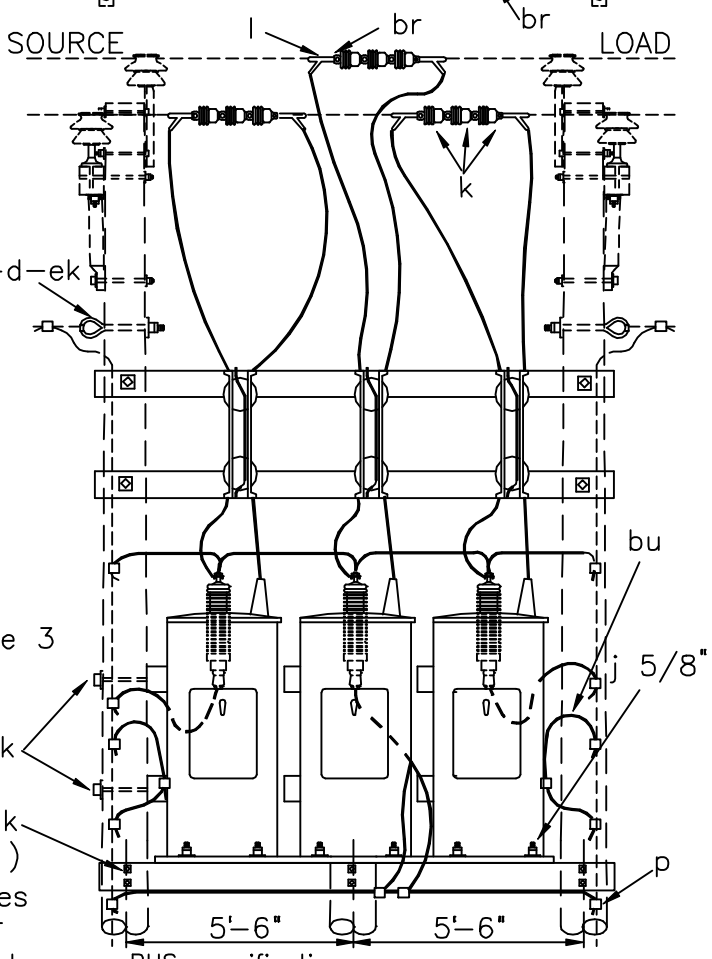
VOLTAGE REGULATOR, POLE MOUNTED (ONE SINGLE–PHASE)

DEC 1998		
RUS	24.9/14.4 kV	VY1.1









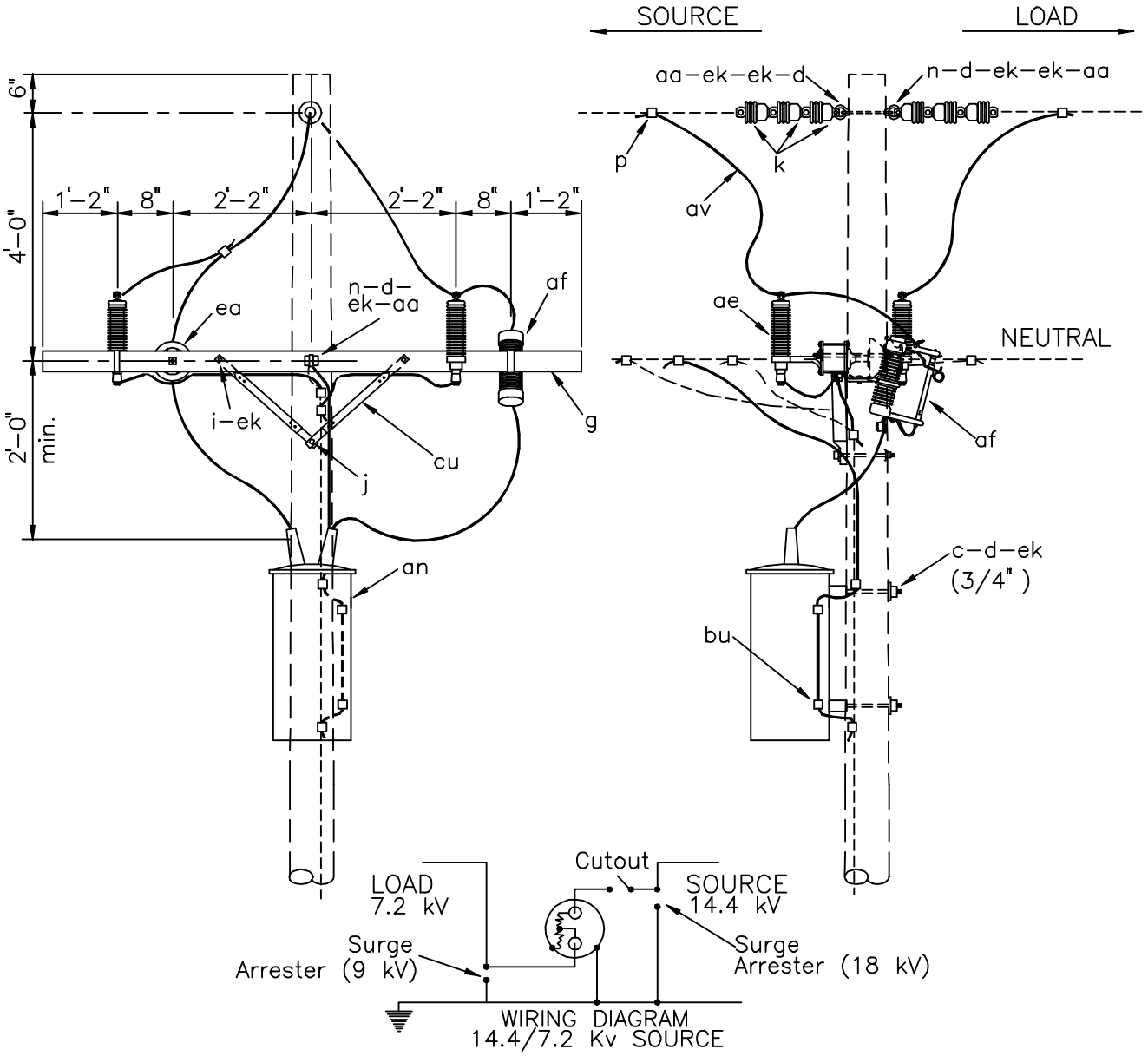
NOTES:
1. All structural timbers and planks to be treated as per RUS specifications.
2. Each regulator must be bolted to platform or pole.
3. Control boxes may be installed on poles below regulators, (Specify additional control cable).
4. 4 x 6.25 /ft. channel steel or 6 x 2.91#/ft. channel aluminum may be substituted for structural timbers.

ITEM	QTY	MATERIAL
c	12	Bolt, machine, 1/2" x req'd length
c	6	Bolt, machine, 5/8" x req'd length
c	6	Bolt, machine, 3/4" x req'd length
d	12	Washer, round, 1 3/8" diam.
d	24	Washer, square, 2 1/4"
j		Screw, lag, 1/2" x 5", as req'd
j	8	Screw, lag, 5/8" x 6"
k	9	Insulator, suspension, 4 1/4"
l	6	Clamp, deadend
o	2	Bolt, eye, 5/8" x req'd length
p		Connectors, compression, as req'd
ae	3	Arrester, surge (18 kV)

ITEM	QTY	MATERIAL
ae	3	Arrester, by–pass (furnished
		by manufacturer)
av		Jumpers, bare, stranded, as req'd
br	3	Chain link
bu	3	Connector, grounding
ek	26	Locknuts
sc	3	Regulator, voltage, step–type
		24.9/14.4 kV
sk	3	Switch, regulator by–pass
	2	Structural timber, 4" x 12" x 12'
		Planks, 2" or 3" thick –
		length and number as req'd

VOLTAGE REGULATORS, PLATFORM MOUNTED (THREE SINGLE–PHASE)

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VY1.3



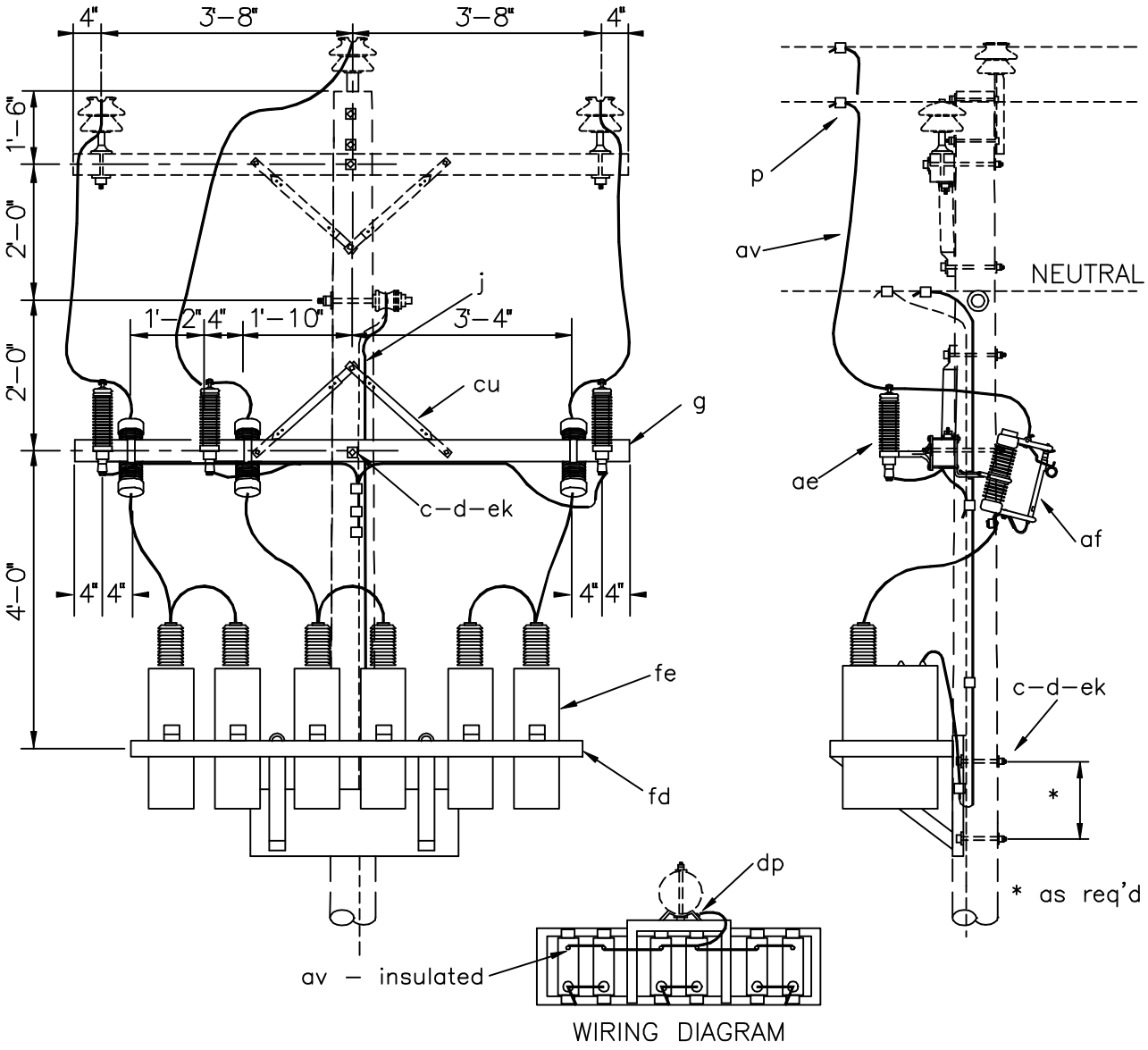
NOTE: For step–up operation, (7.2 kV source; 14.4 kV load), interchange the surge arrester locations, make autotransformer connections as required, and designate assembly as "Y2.1."

ITEM	QTY	MATERIAL
c	2	Bolt, machine, 3/4" x req'd length
d	1	Washer, square, 2 1/4"
d	5	Washer, square, 3", curved
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
k	6	Insulator, suspension, 4 1/4"
n	2	Bolt, dbl arm, 5/8" x req'd length
p		Connectors, compression, as req'd

ITEM	QTY	MATERIAL
aa	4	Nut, eye, 5/8"
ae	1	Arrester, surge (9 kV)
ae	1	Arrester, surge (18 kV)
af	1	Cutout, dist. open (27 kV)
an	1	Transformer, auto,14.4 kV 7.2 kV
av		Jumpers, bare, stranded, as req'd
bu	2	Connector, grounding
cu	2	Brace, 28"
ea	1	Insulator, post type, (25 kV)
ek	12	Locknuts

AUTOTRANSFORMER, POLE MOUNTED (ONE SINGLE–PHASE, STEP–DOWN)

DEC 1998	1 – PHASE PRIMARY	
RUS	(14.4 kV to 7.2 kV)	VY2.1



WIRING DIAGRAM

NOTE:
1. Specify insulating caps for primary terminal bushings.
2. For two–phase assemblies, omit capacitors and other material on center phase; designate assembly as "VY3.2".

ITEM	QTY	MATERIAL
c	3	Bolt, machine, 5/8" x req'd length
d	4	Washer, square, 2 1/4"
g	1	Crossarm, 3 5/8" X 4 5/8" X 8–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag, 1/2" x 4"
p		Connectors, as req'd
p		Connectors, compression, as req'd
ae	3	Arrester, surge (18 kV)
af	3	Cutout, dist., loadbreak, (27 kV)

ITEM	QTY	MATERIAL
av		Jumpers, bare, stranded, as req'd
av		Jumpers, insulated, as req'd
cu	2	Brace, 28"
dp	1	Clamp, ground wire
ek	5	Locknuts
fc		Capacitor, shunt, 24.9/14.4 kV
		(specify number and kVAR)
fd	1	Hanger, capacitor

THREE PHASE CAPACITOR BANK

DEC 1998	3 – PHASE PRIMARY	
RUS	24.9/14.4 kV	VY3.3

APPENDIX 1

TABLE OF SELECTED SI TO METRIC CONVERSIONS

LENGTH

To Convert From	*To*	*Multiply By*	
foot (ft.)	meter (m)	3.048	E-01
inch (in.)	meter (m)	2.540	E-02
kilometer (km)	meter (m)	1.000	E+03
mile (mi.)	meter (m)	1.609344	E+03

AREA

To Convert From	*To*	*Multiply By*	
circular mil (cmil)	square meter	5.067075	E-10
square centimeter	square meter	1.000	E-04
square foot	square meter	9.290304	E-02
square kilometer	square meter	1.000	E+06
square mile	square meter	2.589988	E+06

FORCE

To Convert From	*To*	*Multiply By*	
kilogram force (kgf)	newton (N)	9.806650	
kip	newton (N)	4.448222	E+03
pound force (lbf)	newton (N)	4.448222	

MASS

To Convert From	*To*	*Multiply By*	
pound (avoirdupois) (lb)	kilogram (kg)	4.535924	E-01

APPENDIX 2

DERIVIATION OF MAXIMUM PERMISSIBLE LINE ANGLES

FORMULA:

Sin(O/2) = (P-(Fw*Sw*Ww))/2*Ft*T
(From RUS Bulletin 160-2, Section III-12-F)

CONSTANTS:

Wind Overload Capacity Factor (Fw): 2.00
(NOTE: Use 2.67 at crossings)
Wire Tension Overload Capacity Factor (Ft): 1.33
(From 1997 NESC, TABLE 253-2, Grade C)

CONDUCTOR DATA (From RUS Bulletin 160-2, Table B-1)

Conductor Size	Strength	Maximum Tension	Design Tension (T)
4 ACSR (7/1)	2360	60%	1416
2 ACSR (6/1)	2850	60%	1710
2 ACSR (7/1)	3640	60%	2184
1/0 ACSR (6/1)	4380	60%	2628
123.3 AAC (7)	4460	60%	2676
2/0 ACSR (6/1)	5310	50%	2655
3/0 ACSR (6/1)	6620	50%	3310
4/0 ACSR (6/1)	8350	40%	3340
246.9 AAC (7)	8560	40%	3424
336.4 ACSR (18/1)	8680	40%	3472
336.4 ACSR (26/7)	14100	35%	4935

	WIND LOAD (Ww) by Loading District		
	LIGHT	MEDIUM	HEAVY
4 ACSR (7/1)	0.1928	0.2523	0.4190
2 ACSR (6/1)	0.2370	0.2720	0.4387
2 ACSR (7/1)	0.2438	0.2750	0.4417
1/0 ACSR (6/1)	0.2985	0.2993	0.4660
123.3 AAC (7)	0.2985	0.2993	0.4660
2/0 ACSR (6/1)	0.3353	0.3157	0.4823
3/0 ACSR (6/1)	0.3767	0.3340	0.5007
4/0 ACSR (6/1)	0.4223	0.3543	0.5210
246.9 AAC (7)	0.4223	0.3543	0.5210
336.4 ACSR (18/1)	0.5130	0.3947	0.5613
336.4 ACSR (26/7)	0.5408	0.4070	0.5737