STATE OF TENNESSEE

DEPARTMENT OF TRANSPORTATION

UTILITY SPECIFICATION BOOK

FOR THE CONSTRUCTION OF

Contract No. CNQ921

CUMBERLAND COUNTY

Project No. STP-101(16), 18038-3240-14 (PIN 100268.01)
The grading, drainage and paving on S.R. 101 from Firetower Road to near Lakeview Drive.
Project Length - 3.025 miles

Project No. R-STP-101(17), 18038-3242-14 (PIN 100268.02)
The grading, drainage and paving on S.R. 101 from Lakeview Drive to east of Westchester Drive/Catoosa Boulevard in Fairfield Glade.
Project Length - 2.653 miles

SPECIFICATIONS AND CONTRACT DOCUMENTS
FOR
TELEPHONE UTILITY CONSTRUCTION

SR-101
IN
CUMBERLAND COUNTY

FOR

TENNESSEE DEPARTMENT OF TRANSPORTATION

FRONTIER/CITIZENS COMMUNICATIONS COMPANY

PROPOSED RELOCATION OF TELEPHONE UTILITIES

LADD ENGINEERING ASSOCIATES, INC.
CONSULTING ENGINEERS
P.O. BOX 680747
FORT PAYNE, ALABAMA 35968

JOB NO.: 664 Phase 1
DATE: JANUARY 2012

CAROL LEIGH BRACKETT
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 108179
STATE OF TENNESSEE

SECTION 0

LIST OF DRAWINGS

TDOT #STP-101(16)

SR 101 RELOCATION PROJECT
FRONTIER/CITIZENS COMMUNICATIONS COMPANY

DRAWING NO.	DRAWING TITLE
U5-1	Estimated Utility Quantities
U5-2	STA. 63+00 to 76+00
U5-3	STA. 76+00 to 89+00
U5-4	STA. 89+00 to 102+00
U5-5	STA. 102+00 to 115+00
U5-6	STA. 115+00 to 128+00
U5-7	STA. 128+00 to 141+00
U5-8	STA. 141+00 to 154+00
U5-9	STA. 154+00 to 167+00
U5-10	STA. 167+00 to 180+00
U5-11	STA. 180+00 to 193+00
U5-12	STA. 193+00 to 206+00
U5-13	STA. 206+00 to 219+00
U5-14	STA. 219+00 to 232+00
U5-15	Proposed Pole Locations

INDEX

SECTION 1

GENERAL SCOPE AND SPECIAL REQUIREMENTS

1.01 Scope of Work

The work described in these Contract Documents consists of furnishing all labor, materials, equipment, and services necessary for the construction of telephone utility relocation for Frontier/Citizens Communications Company in conjunction with Tennessee Department of Transportation (TDOT) Construction Project No. STP-101(16) as specifically described in these Contract Documents and depicted on the accompanying Plans.

1.02 Definitions and Meaning of Terms

Whenever the following terms or pronouns referring to them are used in these Contract Documents, the intent and meaning shall be interpreted as follows:

1.02(a) The term "OWNER" shall mean Frontier/Citizens Communications Company, 250 South Franklin Avenue, Cookeville, TN 38501, or duly authorized representatives.

1.02(b) The term "CONTRACTOR" shall mean the party who is obligated under the Contract to perform the work and must be licensed in the State of Tennessee.

1.02(c) The term "ENGINEER" or "ENGINEERS" shall mean Ladd Engineering Associates, Inc., Consulting Engineers, P.O. Box 680747, Fort Payne, AL 35968, successors, or duly authorized representatives.

1.02(d) The term "TDOT SPECIFICATIONS" shall mean the Standard Specifications for Road and Bridge Construction dated March 1, 2006 and all subsequent revisions as prepared by the Tennessee Department of Transportation.

1.02(e) The term "PLANS" refers only to those Plans titled *S.R. 101 from Fire Tower Road to Lakeview Drive (Phase 1) Telephone Utility Relocation for Frontier/Citizens Communications Company, Sheet Nos. U5-1 through U5-15.*

1.02(f) The term "Project" refers only to the construction area as depicted on the Plans titled *S.R. 101 from Fire Tower Road to Lakeview Drive (Phase 1) Telephone Utility Relocation for Frontier/Citizens Communications Company, Sheet Nos. U5-1 through U5-15.*

1.03 General Provisions

The telephone utility relocation work described in these Contract Documents and on the accompanying Plans shall be prosecuted under the terms of the Contract awarded by the Tennessee Department of Transportation for TDOT Construction Project No. STP-101(16). Unless specifically described otherwise in these Contract Documents, the telephone utility relocation work described in these Contract Documents and depicted on the Plans shall be in accordance with Part I – General Provisions of the TDOT Specifications.

1.04 Coordination of the Work

It is intended that the scope of work described in these Contract Documents shall be accomplished so as to cause the minimum interference with the normal operation of the existing utilities along the construction route. Work along the construction route shall be carefully coordinated with the Owner and Engineer. The Contractor shall have sufficient materials, equipment, labor, and supervision available to accomplish the work required in the time allotted.

1.05 Coordination with Tennessee Department of Transportation (TDOT) Roadway Construction

This telephone utility relocation work described in these Contract Documents will be performed in conjunction with roadway construction improvements to State Route 101, Tennessee Department of Transportation (TDOT) Construction Project No. STP-101(16). As much as possible, utilities shall be relocated prior to the start of roadway construction in an area.

The Contractor shall use TDOT survey reference stakes and consult with the TDOT representative at the site of the work to insure that the proper depths and alignment of any new buried telecommunications cable and appurtenances are ascertained to prevent conflicts or interference with the roadway construction work. The information depicted on the Plans relating to proposed roadway construction was taken from Plans furnished by the Tennessee Department of Transportation and neither the Owner nor the Engineer will be responsible for changes made by the Tennessee Department of Transportation or accuracy of the information depicted on the accompanying Plans relating to proposed roadway construction.

> *The Owner shall have the right to observe all work performed under these Contract Documents; however, all instructions to the Contractor shall be made through the Tennessee Department of Transportation project representative.*

If the Contractor becomes aware of a conflict between the telephone utility relocation work described in these Contract Documents and the roadway work, it shall be his responsibility to notify the Engineer prior to performing additional work.

1.06 Guarantee

If any workmanship, material, or equipment which does not comply with the requirements of these Contract Documents shall be discovered within one (1) year after completion of construction of the Project, the Contractor shall remedy any such defective workmanship or replace such defective materials or equipment within thirty (30) days after notice in writing of the existence thereof shall have been given by the Owner. In the event of failure by the Contractor to do so, the Owner may remedy such defective workmanship or replace such defective materials or equipment, as the case may be, and in such event the Contractor shall pay to the Owner the cost and expense thereof. Except as otherwise agreed to by the Owner all such corrective work shall be performed by the Contractor without interruption to or interference with existing telecommunications service, if any.

1.07 Engineer's Authority

The Engineer does not have the authority to stop work, order work done or to direct or supervise any of the Contractor's forces.

The Engineer is the agent of the Owner. The Engineer will decide the meaning and intent of any portion of these Contract Documents and of the drawings depicted on the accompanying Plans.

The Engineer, in conjunction with the Tennessee Department of Transportation project representative, will determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under these Contract Documents and will decide all questions which may arise in relation to said work and the construction thereof.

The Engineer shall have authority to reject work and materials described in these Contract Documents and depicted on the accompanying Plans which do not conform to the requirements of these Contract Documents and/or the Plans.

The Owner/Engineer contract provides substantially as follows:

> *The Engineer shall not and will not be considered in charge of or responsible for acts of the Contractor(s), methods of construction, construction, construction progress, construction forces or equipment or safety procedures." It is not the intention of these Contract Documents to give the Engineer authority to direct any of the Contractor's forces.*

The Engineer shall, within a reasonable time after their presentation to him, make decisions on all claims of the Owner or Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the these Contract Documents and the accompanying Plans.

In case of the termination of the employment of the Engineer, the Owner shall appoint a capable and reputable Engineer, whose status under these Contract Documents will be the same as that of the former Engineer.

1.08 Submittals

The Engineer will prepare and provide TDOT, the Owner and Contractor with a construction schedule for the proposed construction. A bi-weekly progress report for the proposed construction will be prepared and signed by the Engineer and Contractor. These progress reports will be submitted to TDOT and Owner with a copy retained by the Engineer and Contractor.

1.09 Job Site Administration

The Contractor shall make a careful examination of the Plans and shall become informed as to the location and nature of the proposed construction, the transportation facilities, the kind and character of soil and terrain to be encountered, and the kind of facilities required before and during the construction of the Project, and has become acquainted with the labor conditions which would affect the proposed construction.

The Contractor shall perform work in such a manner as to maximize preservation of beauty and conservation of natural resources and minimize marring and scarring of the landscape and silting of streams. The Contractor shall not deposit trash in streams or waterways, and shall not deposit herbicides or other chemicals or their containers in or near streams, waterways or pastures.

1.10 Utilities Required by Contractor

All electric power, water and/or any other utility service required by the Contractor shall be furnished by the Contractor except as otherwise stated in these Contract Documents.

1.11 Project Identification Sign

A project identification sign is not required.

1.12 Existing Utilities

Based on investigations performed during the preparation of these Contract Documents the following existing utilities may be present in the area:

1.12(a) Power: Volunteer Electric Co-op.

1.12(b) Gas: Upper Cumberland Gas Utility.

1.12(c) Telephone: Frontier/Citizens Communications Company

1.12(d) Water: Crossville Water Department.

The Contractor understands that the location shown on the Plans for existing telecommunications plant and other utilities is approximate and no changes to the Plans shall be made by the Contractor without prior approval of the Engineer.

Special precautions shall be taken by the Contractor to avoid damage to existing overhead and underground utilities owned and operated by the Owner or by public or private utility companies. The Contractor shall contact Tennessee "OneCall" at 811 at least 72 business hours in advance of performing excavation in any area. Before proceeding with the work, the Contractor shall confer with all public or private utilities in the vicinity of the construction work. The Contractor shall notify Highway Department or County Authorities prior to setting poles or burying cable twenty-four (24) hours in advance.

The purpose of the conference or conferences shall be to notify said companies, agencies or departments of the proposed construction schedule, verify the location of any possible interference with the existing utilities, arrange for necessary suspension of service where possible and approved by the utility, and make arrangements to locate and avoid interference with all utilities. The Engineer and Owner have no objection to the Contractor arranging for said utility companies, agencies or departments to locate and uncover their own utilities; however, the Contractor shall bear the entire responsibility for locating and avoiding or repairing damage to said existing utilities. Work shall not proceed without all underground utilities being located and marked.

Where existing utilities or other underground structures are encountered, they shall not be displaced or disturbed unless necessary and approved by the utility owner, and in such case they shall be replaced in as good or better condition than found as quickly as possible. All such utilities that are so damaged or disturbed shall be replaced at the Contractor's expense; unless, in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

The Contractor shall comply with the requirements of the Underground Utility Damage Prevention Act found in Tennessee Code Annotated (TCA) §§65-31-101 through 113, as amended, concerning the responsibilities involved in excavation procedures to prevent damage of underground utilities. It is expected that the Contractor will be diligent in his efforts and use every possible means to locate existing utilities. Any claims for unavoidable damage, based on improper or unknown locations, will be thoroughly examined in light of the Contractor's efforts to locate the said utilities or obstructions prior to beginning construction.

1.13 <u>Protection of Roadways On and Off-Site</u>

In the hauling of materials and/or equipment to and from the construction site, the Contractor shall take care to protect State, Federal, Municipal and County roads, highways and/or streets. The Contractor shall be responsible for repair of highways, roads or streets damaged by his operations (or operations of his subcontractors) and shall repair said damage to the original condition. If repair to the original condition is not practical or possible, the Contractor shall be responsible for obtaining proper release from the owner of the damaged facility.

1.14 Protection to Persons and Property

The Contractor shall at all times take all reasonable precautions for the safety of employees on the work and of the public, and shall comply with all applicable provisions of Federal, State and Municipal safety laws, environmental regulations, and building and construction codes.

The following provisions shall not limit the generality of the above requirements:

1.14(a) The Contractor shall at no time and under no circumstances cause or permit any employee of the Contractor to perform any work upon poles carrying energized electric power lines, except on telecommunications system units having clearances from the electric power system equal to or greater than required by applicable provisions of Federal, State or Municipal laws or regulations and the National Electrical Safety Code (NESC).

1.14(b) The Contractor shall so conduct the construction of the Project as to cause the least possible obstruction of public highways.

1.14(c) The Contractor shall provide and maintain all such guard lights and other protection for the public as may be required by applicable statutes, ordinances and regulations or by local conditions.

1.14(d) The Contractor shall do all things necessary or expedient to protect properly any and all parallel, converging and intersecting lines, joint line poles, highways, other utilities and any and all property of others from damage, and in the event that any such parallel, converging and intersecting lines, joint line poles, highways, other utilities or other property are damaged in the course of the construction of the Project the Contractor shall at its own expense restore any or all of such damaged property immediately to as good a state as before such damage occurred.

1.14(e) Where the construction corridor of the Project traverses cultivated land, the Contractor shall limit the movement of its crews and equipment so as to cause as little damage as possible to crops, orchards, or property and shall endeavor to avoid marring the lands. All fences which are necessarily opened or moved during the construction of the Project shall be replaced in as good a condition as they were found and precautions shall be taken to prevent the escape of livestock. Except as otherwise provided in respect of buried plant described in these Contract Documents, the Contractor shall not be responsible for loss of or damage to crops, orchards or property (other than livestock) on the construction corridor necessarily incident to the construction of the Project and not caused by negligence or inefficient operation of the Contractor. The Contractor shall be responsible for all other loss of or damage to crops, orchards, or property, whether on or off the construction corridor and for all loss of or damage to livestock caused by the construction of the Project.

1.14(f) The Project, from the commencement of work to completion of construction, or to such earlier date or dates when the Owner may take possession and control in whole or in part as hereinafter provided shall be under the charge and control of the Contractor and during such period of control by the Contractor all risks in connection with the construction of the Project and the materials to be used therein shall be borne by the Contractor. The Contractor shall make good and fully repair all injuries and damages to the Project or any portion thereof under the control of the Contractor by reason of any act of God or other casualty or cause whether or not the same shall have occurred by reason of the Contractor's negligence. The Contractor shall hold the Owner harmless from any and all claims for injuries to persons or for damage to property happening by reason of any negligence on the part of the Contractor or any of the Contractor's agents or employees during the control by the Contractor of the Project or any part thereof.

1.14(g) Any and all excess earth, rock, debris, underbrush and other useless material shall be removed by the Contractor from the site of the Project or relocated (distributed) to the satisfaction of the Owner as rapidly as practicable as the work progresses.

1.14(h) Upon violation by the Contractor of any of the provisions of this Section, after written notice of such violation given to the Contractor by the Engineer or the Owner, the Contractor shall immediately correct such violation. Upon failure of the Contractor to do so, the Owner may correct such violation at the Contractor's expense. Provided, however, that the Owner may, if it deems it necessary or advisable, correct such violation at the Contractor's expense without such prior notice to the Contractor.

1.14(i) The Contractor shall immediately notify the Owner of any accidents, giving such data as may be prescribed by the Owner.

1.14(j) The Contractor shall not proceed with the cutting of trees or clearing of right-of-way without written notification from the Owner that proper authorization has been received from the owner of the property, and the Contractor shall promptly notify the Owner whenever any landowner objects to the trimming or felling of any trees or the performance of any other work on its land in connection with the Project and shall obtain the consent in writing of the Owner before proceeding in any such case.

1.15 Materials and Equipment to be Furnished

The Contractor shall purchase all materials and supplies outright and not subject to any conditional sales agreement, bailment lease, or other agreement reserving to the seller any right, title, or interest therein. All materials and supplies shall become the property of the Owner upon acceptance.

In the performance of these Contract Documents there shall be used only such unmanufactured articles, materials, and supplies as have been mined or produced in the United States or an eligible country, and only such manufactured articles, materials, and supplies as have been manufactured in the United States or an eligible country, substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States or an eligible country; The Contractor agrees to submit to the Owner such certificate or certificates (RUS Form 213), signed by the Contractor and all subcontractors, with respect to compliance with the foregoing provisions as required.

1.16 Pre-installation Inspection of Cable

The Contractor and Engineer shall jointly inspect a representative sample of cable and wire on reels prior to installation. Based on the inspection, the Engineer shall make a determination if the cable and wire are suitable for construction. Unsuitable reels of cable and wire shall be replaced by the Contractor. In the case of nonconformance of a minor nature not affecting performance of the cable, the Contractor and Owner may negotiate a basis for the use of these nonconforming cables. In such cases, the specific characteristic being waived shall be noted in writing.

1.17 Supervision

The Contractor shall cause the construction work on the Project to receive constant supervision by a competent superintendent (hereinafter called the "Superintendent") who shall be present at the Project during working hours when construction is being carried on. The Contractor shall also employ, in connection with the construction of the Project, capable, experienced and reliable foremen and such skilled workmen as may be required for the various classes of work to be performed. Directions and instructions given to the Superintendent shall be binding upon the Contractor.

The manner of construction of the Project, and all materials and equipment used therein, shall be subject to the inspection, tests and approval of the Engineer and the Owner, and the Contractor shall furnish all information required by the Engineer or by the Owner concerning the nature or source of any materials incorporated or to be incorporated in the Project. The Owner shall have the right to inspect all payrolls, invoices of materials, and other data and records of the Contractor and of any subcontractor, relevant to the construction of the Project. The Contractor shall provide all reasonable facilities necessary for such inspection and tests and shall maintain an office at the construction site, with telephone service where obtainable, and at least one office employee to whom directions and instructions may be delivered. Delivery of such directions or instructions in writing to the employee of the Contractor at such office shall constitute delivery to the Contractor. The Contractor shall have an authorized agent accompany the Engineer when final inspection is made and, if requested by the Owner, when any other inspection is made.

The Engineer may recommend to the Owner that the Contractor suspend the work wholly or in part for such period or periods as may be deemed necessary due to unsuitable weather or such other conditions as are considered unfavorable for the satisfactory prosecution of the work or because of the failure of the Contractor to comply with any of the provisions of the Contract: Provided, however, that the Contractor shall not suspend work pursuant to this provision without written authority from the Owner so to do. The time of completion hereinabove set forth shall be increased by the number of days of any such suspension, except when such suspension is due to the failure of the Contractor to comply with any of the provisions of these Contract Documents. In the event that work is suspended by the Contractor with the consent of the Owner, the Contractor before resuming work shall give the Owner at least twenty-four (24) hours notice thereof in writing.

1.18 Inspection

The Contractor and the Engineer shall jointly inspect splice closures, cable terminals, buried plant housings, Network Interface Devices, service entrances, and other housings applicable to the plant facilities constructed pursuant to the Contract. Except where otherwise stated the inspection shall be on a random sampling basis and the samples inspected in each instance shall consist of at least five percent (5%) of the specified utility items installed, but no fewer than ten (10) terminals, ready-access closures, housings, and Network Interface Device installations along Project Route. A written report giving the date, location of the plant inspected, and tabulated results of the inspections, signed by the Engineer and Contractor shall be presented to the Owner after the inspections are completed.

1.19 Acceptance Tests and Measurements

All acceptance tests and measurements to be performed on the various portions of the outside plant construction pursuant to this Contract, and the party(s) who will participate in conducting the acceptance tests and measurements, shall be as checked in the Schedule of Acceptance Tests and Measurements Table attached in appendix. All tests and measurements shall be conducted by the Engineer in accordance with RUS Bulletin 1753F-201(PC-4), "RUS Standard for Acceptance Tests and Measurements of Telecommunications Plant." A written report including the tabulated results of the acceptance tests and measurements on forms similar to those included in RUS Bulletin 1753F-201(PC-4), "RUS Standard for Acceptance Tests and Measurements of Telecommunications Plant" shall be signed by the Engineer and the Contractor and furnished to the Owner. Where Contractor participation is specified, compensation shall be included in the appropriate cable unit.

1.20 Pre-Cutover Testing

Prior to the Completion of Construction of the Project, the Owner, acting in accordance with plans of the Engineer, upon written notice to the Contractor, may perform operational tests of any portion or portions thereof. During the period of such tests, the portion or portions of the Project being so tested shall be considered as within the possession and control of the Owner. Upon written notice to the Contractor by the Owner of the completion of such tests said portion or portions of the Project shall be considered as returned to the possession and control of the Contractor unless the Owner shall elect to continue possession and control.

The Owner shall have the right to permanently place in service any portion or portions of the Project delivered to its possession and control.

1.21 Insurance

During the Contractor's performance hereunder, the Contractor shall take out and maintain fully paid insurance providing not less than the minimum coverage required by 7 CFR part 1788, Subpart C.

The Contractor shall include as co-insured the Owner, and their personnel, and the Engineer and their personnel. The added costs shall be included in the bid price.

The Owner shall have the right to require public liability insurance and property damage liability insurance in an amount greater than those required in 7 CFR Part 1788, Subpart C. The added costs shall be included in the bid price.

Upon request by the Engineer, the Contractor shall furnish to the Engineer a certificate, evidencing compliance with the foregoing requirements. (See 7 CFR Part 1788.55).

1.22 Assignment of Guarantees

All guarantees of materials and workmanship running in favor of the Contractor shall be transferred and assigned to the Owner upon completion of construction and at such time as the Contractor receives final payment.

1.23 Patent Infringement

The Contractor shall save harmless and indemnify the Owner from any and all claims, suits and proceedings for the infringement of any patent or patents covering any materials or equipment used in construction of the Project.

1.24 Permits for Explosives

All permits necessary for the handling or use of dynamite or other explosives in connection with the construction of this Project shall be obtained by and at the expense of the Contractor.

1.25 Outside Plant Inventory

The Contractor shall provide a competent representative to work with the Engineer on the ongoing and final inventory and inspection of outside plant units. The wire and cable shall be inventoried immediately after the placement operation. Contractor and Engineer are to maintain a daily record of construction by legibly marking and recording at each section the actual products utilized on the Plans.

1.26 Nonassignment of Contract

The Contractor shall perform directly, and without subcontracting, not less than fifty percent (50%) of the labor required for the construction of the Project, to be calculated on the basis of that portion of the contract price constituting total labor costs of the Project. The Contractor shall not assign this Contract or any interest in any funds that may be due or become due hereunder or enter into any Contract with any person, firm, or corporation for the performance of the Contractor's obligations hereunder or any part thereof, without the approval in writing of the Owner and of the surety or sureties on any bond furnished by the Contractor for the faithful performance of the Contractor's obligations hereunder. If the Contractor, with the consent of the Owner, and any surety or sureties on the Contractor's Bond or Bonds, shall enter into a subcontract (RUS Form 282) with any subcontractor for the performance of any part of this Contract, the Contractor shall be as fully responsible to the Owner and TDOT for the acts and fully responsible to the Owner and the TDOT for the acts and omissions of such subcontractor and of persons employed by such subcontractor as the Contractor would be for its own acts and omissions and those of persons directly employed by it.

1.27 Franchises and Rights-of-Way

The Contractor shall be under no obligation to obtain or assist in obtaining: Any franchises, authorizations, permits, or approvals required to be obtained by the Owner from Federal, State, County, Municipal, or other authorities; any rights-of-way over private lands; or any agreements between the Owner and third parties with respect to the joint use of poles, crossings, or any other matter incident to the construction and operation of these Contract Documents.

1.28 Contract Closeout

Upon the completion by the Contractor of the construction of the Project but prior to payment to the Contractor of any amount in excess of ninety-five percent (95%) of the total cost of all utility items comprising the completed Project, the Contractor shall deliver to the Owner, in duplicate, releases of all liens and of rights to claim any lien (RUS Form 224) from all manufacturers, materialmen, and subcontractors furnishing services or materials for the Project and a certificate of contractor (RUS Form 231) to the effect that all labor used on or for the Project has been paid and that all such releases have been submitted to the Owner.

A final inspection of the Project will be made after all construction is completed. The Engineer will provide Contractor with a final cleanup list of areas where there are apparent defects. The Contractor shall remedy these apparent defects to the satisfaction of the Engineer.

The Final Application for Payment must reflect the "As Built Adjusted Quantities" that are agreed upon by the Engineer and Contractor as determined from the final construction drawings that are fully and clearly marked as to the actual installation.

END OF SECTION

SECTION 2

REFERENCE STANDARDS

2.01 General

Wherever in these Contract Documents references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date of the Contract is advertised for bids shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth in the Specifications or shown on the Plans will be waived because of any provision of, or omission from, said standards or requirements.

2.02 Reference Specifications, Codes and Standards

The Contractor shall construct this Project in accordance with these Contract Documents and the referenced portions of those referenced codes, standards, and specifications.

In case of conflict between codes, reference standards, drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or furnishing labor. The Contractor shall bid for the most stringent requirements.

2.03 Abbreviations of Institutions

As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Contract Documents shall have the meanings indicated herein.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFPA	American Forest Products Association
AGA	American Gas Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Institute of Steel Construction
AITC	American Institute of Timber Construction

ANSI	American National Standards Institute, Inc.
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators
CDA	Copper Development Association
CMA	Concrete Masonry Association
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FPL	Forest Products Laboratory
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IME	Institute of Makers of Explosives
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NISO	National Information Standards Organization
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RCRA	Resource Conservation and Recovery Act
RUS	Rural Utilities Service
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SSBC	Southern Standard Building Code
SSPWC	Standard Specifications for Public Works Construction
TIA	Telecommunications Industries Association
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WEF	Water Environment Federation

2.04 Abbreviations

°C	Degrees Celsius
EHS	Extra High Strength Galvanized Steel
°F	Degrees Fahrenheit
ft	Feet
H	Height
in.	Inches
L	Lead
lbf	Pounds-force
L/H	Lead/Height Ratio
m	Meter
MGN	Multigrounded Neutral
mm	Millimeter
N	Newton
NESC	National Electrical Safety Code
PF	Anchor Assembly Unit
RUS	Rural Utilities Service
TE&CM	Telecommunications Engineering and Construction Manual

2.05 References

2.05(a) RUS Bulletin 1753F-151 Specifications and Drawings for Construction of Underground Plant (RUS Form 515b)

2.05(b) RUS Bulletin 1753F-152 Specifications and Drawings for Construction of Aerial Plant (RUS Form 515c)

2.05(c) RUS Bulletin 1753F-153 Specifications and Drawings for Service Installation at Customer Access Locations (RUS Form 515d)

2.05(d) RUS Bulletin 1753F-401 (PC-2) RUS Standard for Splicing Copper and Fiber Optic Cables

2.05(e) RUS Bulletin 1751F-635 Aerial Plant Construction

2.05(f) RUS Bulletin 1751F-644 Underground Plant Construction

2.05(g) RUS Bulletin 1751F-650 Aerial Plant Guying and Anchoring

2.05(h) RUS Bulletin 1751F-815 Electrical Protection of Outside Plant

END OF SECTION

SECTION 3

WOOD POLES

3.01 General

Wood poles are to be tested or certified in accordance with applicable standard procedures which confirm the minimum ratings specified in ANSI 5.1 specifications and dimensions for wood poles or RUS Specifications DT.5C or as specified in these Contract Documents.

3.02 Wood Poles

Wood poles are to be ASA class and of the species Douglas Fir, Southern Yellow Pine. Pole preservative is to be Pentachlorophenol meeting the requirements of AWPA by pressure over the full length.

3.03 Pole Top Assembly

Do not cut the top of poles except under very exceptional conditions and upon prior approval by the Resident Project Representative. If the top is cut, cover with an approved pole cap. Do not, under any circumstances, cut off the butt of any pole.

This unit consists of the hardware, crossarms and their appurtenances, support hardware, connectors, clamps, and jumpers, etc. The pole ground wire is not included.

This unit also includes the spreading of existing cables onto temporary extension arms as required for working clearances.

END OF SECTION

SECTION 4

POLE INSTALLATION

4.01 General

This section consists of one pole in place. The first two digits indicate length and the third digit shows ASA classification. For example: Add "35-4" signifies a 35 foot class 4 pole. Poles shall be handled carefully. Damaged poles shall not be used.

The pole hole shall be of sufficient diameter to permit the pole to settle freely to the bottom of the hole without trimming the butt and still have sufficient space between the pole and the sides of the hole to permit proper tamping of the backfill at every point around the pole, and throughout the entire depth of the hole.

4.02 Pole Setting Depth

The minimum setting depth shall be as follows:

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

The "Setting in Soil" depth as shown in above, shall apply where poles are to be set in soil only; where there is a layer of soil more than 2 feet (0.61 m) in depth over solid rock; or where the pole 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.

The "Setting in Solid Rock" depth as shown in above, shall apply where solid rock is encountered at the ground line and where the hole is substantially vertical, approximately uniform in diameter, and large enough to permit the use of tamping bars the full depth of the hole.

Where there is a layer of soil 2 feet (0.61 m) or less in depth over solid rock, the depth of the hole shall be the depth of the soil in addition to the depth specified above under

Setting in Solid Rock," provided, however, that such depth shall not exceed the depth specified under "Setting in Soil."

On sloping ground the depth of the hole shall be measured from the low side of the hole. Where a pole is to be set on the side of a steep grade where soil erosion appears to be a consideration, the hole should be one (1) foot (0.305 m) deeper than specified above under "Setting in Soil."

When an earth boring machine is employed for holes for guyed poles, the bottom of the hole shall be thoroughly tamped to compact any loose earth that may be present.

All holes shall be backfilled with soil or small rock and all pole holes in rock shall be inspected and approved by the Engineer before being backfilled.

Backfill shall be thoroughly tamped the full depth of the pole hole. Earth must be banked around the pole to a minimum height of 6 in. [15.24 centimeters (cm)] above ground level.

Holes in soil for poles at unguyed corners where the pole will not be keyed shall be one (1) foot (0.305 m) deeper than the "Setting in Soil" depth as shown in above. For holes in solid rock the "Setting in Solid Rock" depth will apply.

The Contractor shall be responsible for setting poles in alignment according to the Plans. If the Contractor should find stakes out of alignment, the Engineer shall, upon request of the Contractor, realign the stakes according to the Plans.

Poles shall be set plumb except at corners where they shall be set and raked against the load so that the pole top will be in line after the load is applied. The rake in pole shall not exceed 6 in. (15.24 cm) for each 10 feet (3.05 m) of pole length after the conductors are installed at the required tension. Deadend shall be set so as to be plumb and in line after the load it applied.

Pole lightning protection shall be a #6 AWG bare copper wire installed in accordance with assembly unit drawing PM1.

END OF SECTION

SECTION 5

OVERHEAD COMMUNICATIONS CABLE

5.01 General

This part of the specification is concerned with the various materials required for the construction of overhead communications cable for the telephone utility relocation for Frontier/Citizens Communications Company in conjunction with Tennessee Department of Transportation (TDOT) Construction Project No. STP-101(16) as specifically described in these Contract Documents and depicted on the accompanying Plans.

5.02 Specifications for Construction and Installation

All construction and installation work shall be done in a thorough and workmanlike manner in accordance with the Plans and shall be subject to acceptance by the Owner and the Engineer.

All material to be used in construction of the Project shall be stored so as to be protected from deteriorating effects of the elements.

All guy strand, suspension strand, aerial cables, and accessory materials used in the construction of the Project shall be handled with care. Each reel of aerial cable shall be inspected for damage. All damage shall be repaired to the satisfaction of the Engineer and in accordance with the methods or other instructions described in these Contract Documents. If reel wrap is present, the reel wrap shall remain intact on the reel until the cable is ready to be placed.

Deviations from the Plans shall not be permitted except upon written permission of the Engineer.

The latest revision of the National Electrical Safety Code (NESC) and the National Electrical Code (NEC) shall be followed in every case except where local regulations are more stringent, in which case local regulations shall govern.

The Contractor shall maintain conductor polarity (tip and ring) identification at the main distributing frame, cable terminals, wire terminals, terminal blocks, and in the service entrance, all in accordance with the Specifications (see guide drawing 815).

5.03 Mounting Hardware and Guys

All bolts employed for the mounting of hardware items on poles shall be long enough to fully engage the nut (including locknut, where applicable) but shall not extend more than 2 inches (50.8 mm) beyond the nut after the nut is tightened. The ends of bolts shall not be cut.

The Engineer shall determine all guy locations and shall specify the type of guy. Guys shall be installed before conductors or cable suspension strands are placed.

5.04 Anchors

Anchor assembly units shall be installed at locations designated on the Plans. All anchors and rods shall be in line with the load and shall be so installed that the eye of the rod is above grade.

When an expansion type anchor is used, the anchor shall be fully expanded and shall be expanded into undisturbed earth before backfilling the anchor hole.

Backfill shall be thoroughly tamped the full depth of all anchor holes.

Rock anchors shall be placed in accordance with the detailed instructions of the Engineer. Where a rock is encountered below the surface of the ground, instructions from the Engineer shall be obtained before placing an anchor at that location.

Rock anchors are to be painted red when installed and are to be no more than 6 inches (152 mm) above ground when installed. Shallow anchors are to be painted yellow and are to be no more than 18 inches (457 mm) above ground when installed.

5.05 Suspension Strand

The cable shall be installed within a reasonable time after the strand is installed and tensioned. If a delay in installing cable in excess of 24 hours is encountered, temporary dampers shall be installed on the strand.

When tensioning strand the cable suspension clamps shall be loose enough to allow free movement of the strand.

Suspension strand shall be placed in accordance with the Plans and shall be tensioned in accordance with instructions, which shall be furnished, to the Contractor by the Engineer.

The suspension strand shall be placed on the roadside of the pole line unless otherwise directed by the Engineer.

In tangent construction, the lip of the suspension strand clamp shall point toward the pole. At angles in the line, the suspension strand clamp lip shall point away from the load.

In level construction the suspension strand clamp shall be placed in such a manner that it shall hold the strand below the through-bolt. At points where there is an up-pull on the strand, the clamp shall be so placed that it shall support the strand above the through-bolt.

When a thimbleye bolt is used both to mount the suspension strand clamp and to make the guy attachment, the size of the suspension strand clamp shall be governed by the size of the thimbleye bolt required for the guy.

The air temperature at the time and place of tensioning the strand shall be determined by means specified by the Engineer.

The suspension strand shall be made electrically continuous throughout its entire length as indicated on the Plans.

Suspension strands shall be bonded to other bare cable suspension strands, and guys on the same pole and grounded by connection to ground leads at locations specified by the Engineer and in the manner specified by the Engineer. Where the strand is to be grounded to a multigrounded neutral on a pole which does not carry a vertical pole ground wire, a #6 AWG bare copper wire shall be left coiled and taped to permit it to be extended up the pole and connected to the multiground neutral by a representative of the power company.

5.06 Aerial Cable

The Contractor and Engineer shall jointly inspect all reels of cable for damage prior to installation.

Cable ends shall be kept sealed at all times, i.e., during transportation, in storage, and during cable placement to prevent moisture entry into the cable core. Acceptable cable end caps shall be used for this purpose.

Cable shall be taken from the reel only as it is placed. Bends of small radii and twists shall be avoided in handling cable.

If the jacket is deformed in handling the cable, the Engineer shall be notified. If directed by the Engineer, the deformed section of the jacket shall be removed; the insulation and conductors shall be examined and if damaged shall be repaired. The opening in the jacket shall then be closed by means of a suitable enclosure. Repairs so made shall be done in accordance with appropriate specifications.

5.07 Aerial Cable Placement

During placing operations, copper cables shall not be bent in a radius less than 10 times the outside diameter of the cable and fiber optic cables shall not be bent in a radius less than 20 times the outside diameter of the cable. Temporary supports where necessary, shall be placed sufficiently close together and proper tensioning of the cable shall be employed to prevent bending in excess of the above requirements.

In those instances where spiraling of cable is involved, the mounting of closures for purposes of splicing and distribution shall be accomplished after the spiraling operation has been completed.

Cable guards shall be applied over the cable at points of potential abrasion such as at supports, and in locations where tree trimming is not permitted.

Cable shall be lashed with lashing wire to the suspension strand by means of a suitable lashing machine.

The pitch of the lashing wire may be from 10 to 15 inches (254 to 381 mm) but must be constant for any section of cable of the same size and gauge. For cables of 3/4 inches (19 mm) or larger in diameter, the lashing wire shall be placed with a tension of 35 to 40 lbs (156 to 178 N). Cables having a smaller diameter less than 3/4 inches (19 mm) shall be lashed with a lashing wire tension of 18 to 25 lbs (80 to 111 N).

During the placing operation, precautions shall be taken to prevent slippage of the cable sheath or jacket over the core.

The cable shall be snug against the suspension strand throughout the span. It shall be supported in a position directly below the strand insofar as possible, except where spiraling has been specified. Where more than one cable is placed on a strand, the cables shall be arranged as shown on the Plans so that the cables are snug against the suspension strand and against each other.

The lashing wire shall be terminated at each pole and the cable shall be supported and protected at the suspension clamp in accordance with the Plans.

At lashing wire terminating points, the tension placed in the lashing wire by the lashing machine shall be maintained. No slack in the lashing wire shall be permitted to run into the span.

When lashing wire is spliced in a span, the splice shall be made by means of a compression type splicing sleeve. The completed splice shall be placed on the strand in such a position that it shall not result in damage to the cable sheath or jacket.

Where suspension strand attachments such as suspension strand cross-over, suspension strand pull-offs, etc., are encountered in the span, a positive separation shall be provided between the suspension strand attachment and the cable, and the cable shall be supported and protected in accordance with the Plans.

At splices where the cable is not cut, no slack shall be left in the cable. So that no slack can run into the span, the lashing wire shall be securely clamped to the strand until the splice is completed, at which time the lashing wire shall be terminated in accordance with the Plans.

At cut splices in the cable, sufficient overlap shall be provided to permit splicing without piecing out the conductors.

Spiraling of lashed cable where specified shall be performed in accordance with the method shown on the Construction Guide Drawing 250. Spiraling of the cable shall be performed within 48 hours of the tensioning operation.

Where the new cable is to be lashed to existing strand and cable(s), the preceding requirements for placement of lashed cable shall also be adhered to, except as modified and/or supplemented as follows:

5.07(a) The cable shall be lashed to the existing strand and cable(s) so that it and the existing cable(s) shall be as snug against the existing strand as is practicable.

5.07(b) If the existing cable is spiraled, the spiraling shall first be removed. The existing cable after unspiraling and the new cable shall then be lashed, without either being spiraled, to the existing strand in the same lashing operation.

5.07(c) The lashing wire shall be terminated on both sides of all splices and devices in/on the existing cable where interference with the lashing operation is encountered.

5.07(d) Cable spacers and cable straps, as required, shall be used at all points of lashing wire termination to maintain proper separation and support for the new cable.

5.07(e) Spacers shall be added to the existing suspension clamp mountings, where required, to maintain proper separation between the cable and the surface of the pole.

5.07(f) Ready-access closures to be installed on the new cable(s) shall be equipped with extension fittings so that they will be located below and separate from the existing cable.

5.07(g) The existing lashing wire, fittings and attachments shall be adjusted as necessary to maintain proper security of the new cable and the existing cable, and to maintain adequate separations and clearances.

5.08 <u>Cable Splicing and Terminals</u>

Splicing for copper cable and fiber optic cable shall be in accordance with RUS Splicing Standard Bulletin 1753F-401 (PC-2).

Aerial cable terminals and ready-access closures equipped with filled terminal blocks shall be installed in accordance with the Plans and connected in accordance with the cable schematic drawings furnished by the Engineer. Splicing shall be performed in accordance with RUS Splicing Standard Bulletin 1753F-401 (PC-2).

5.09 Clearing Right-of-Way

In clearing the right-of-way, trees shall be removed or trimmed and underbrush cleared in accordance with the Plans. Trees fronting the side of the right-of-way shall be trimmed symmetrically unless otherwise directed by the Engineer.

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, may be removed or topped at the option of the Contractor; however, the Contractor shall trim and not remove shade, fruit, or ornamental trees unless otherwise directed by the Engineer.

END OF SECTION

SECTION 6

GUYING AND ANCHORING

6.01 General

This section discusses in particular the guying and anchoring of overhead communications cable using filled copper and fiber optic. The information and recommendations in this section are advisory.

6.02 Guying of Unusual Cases

Guying may be required in certain unusual cases not covered in this section. In such cases the Resident Engineer or the Resident Engineer's representative should make a thorough study of the situation and provide adequate guying in accordance with the NESC or other local code, whichever is the more stringent code.

In some situations, guying may be required at locations where normal placement of anchor guys may be impracticable because conditions do not allow sufficient L/H ratios to be obtained while maintaining the required clearances. In these circumstances sidewalk guys or other acceptable methods should be used but only as last resorts.

6.03 Guy Attachments to Poles and Push Braces used in Place of Guys

Guys with downward pulls should be attached to poles by means of thimbleye angle bolts, guy hooks, or other suitable types of hardware. Guys with horizontal pulls should be attached to poles by means of straight thimbleye bolts, guy hooks, or other suitable types of hardware.

Push braces should be used for supporting horizontal loads on poles only when it is impracticable to place down guys or overhead guys to stub poles. When push braces are used, the push braces should be of the same pole classes as the poles they brace. Push brace installations recommend the installation of pole keys at pole butts to prevent lifting of poles during storm conditions and plank footings where rock footings are not present at butts of braces.

6.04 Pole to Pole and Pole to Stub Pole Guys

Pole-to-pole guys should be only installed when it is impracticable to install anchor guys.

The sizes of down guys at stub poles in pole-to-stub pole guy installations should be selected as though the down guys are to be attached to line corner poles instead of stub poles. The overhead guy sizes should be the same sizes as required for down guys with L/H ratios of 1.

6.05 Electrical Protection of Exposed Guys to Existing Anchors

Guys classified as exposed guys should be considered electrical hazards to workmen and the public and should be electrically protected.

6.05(a) Guys are considered to be exposed guys when:

6.05(a)(1) Guys pass over, under, or between supply conductors having voltages that exceed 300 volts to ground.

6.05(a)(2) Guys are attached to poles carrying supply conductors having voltages exceeding 300 volts to ground.

6.05(a)(3) The minimum horizontal distance between the guy and the nearest supply conductor having voltages that exceed 300 volts is less than 10 ft [3 meters (m)].

6.05(a)(4) Guys that are connected to continuous cable suspension strands which are not systematically and effectively grounded.

6.05(b) Electrical protection of exposed guys should be accomplished by grounding the guys. The grounding of the guys should be accomplished by:

6.05(b)(1) Bonding guys to vertical pole ground wires which are connected to multiground neutrals (MGN).

6.05(b)(2) Bonding guys to effectively grounded cable suspension strands.

Guys on the same throughbolts with effectively grounded cable suspension strands are considered to be electrically bonded to the suspension strands thus eliminating the need for separate bonding conductors.

Auxiliary eye bolts should be use for attaching second guys to existing anchor rods having eyes for only one guy strand. When attachment of guys to existing anchors of foreign companies is contemplated, the foreign companies should be notified. Permission from the foreign companies should be obtained before attaching the guys to the anchor rods. In any event the attachment of second guys to existing anchors should only be performed if it is known that the existing anchors have sufficient holding power for the load of the two guys.

6.06 Anchor Installation Precautions

Holes dug for anchors should be no larger than necessary to permit entry of anchors into the holes.

Care should be exercised in placing certain types of expanding anchors to prevent earth or sand falling into the holes and lodging between the plates which could prevent full expansion of the plates and which could result in a reduction of the anchor's holding power.

Anchor holes should be dug to such depths that no more than about 6 inches (152 mm) of anchor rods should be above ground after strain is applied by guys. Anchor holes should be dug so that anchor rods will be in line with guys. Anchor rods should not be bent. Thimbleyes of anchor rods should never be covered with earth.

END OF SECTION

SECTION 7

UNDERGROUND COMMUNICATIONS CABLE

7.01 General

This section is concerned with the various materials required for the construction of underground communications cable for the telephone utility relocation for Frontier/Citizens Communications Company in conjunction with Tennessee Department of Transportation (TDOT) Construction Project No. STP-101(16) as specifically described in these Contract Documents and depicted on the accompanying Plans.

7.02 Specifications for Construction and Installation

All construction and installation work shall be done in a thorough and workmanlike manner in accordance with the Plans and shall be subject to acceptance by the Owner and the Engineer.

All material to be used in construction of the Project shall be stored so as to be protected from deteriorating effects of the elements.

All underground cables and accessory materials used in the construction of the Project shall be handled with care. Each reel of underground cable shall be inspected for damage. Prior to installation, all damage shall be repaired to the satisfaction of the Engineer. If reel wrap is present, the reel wrap shall remain intact on the reel until the cable is ready to be placed.

Deviations from the Plans shall not be permitted except upon written permission of the Engineer.

The latest revision of the National Electrical Safety Code (NESC) and the National Electrical Code (NEC) shall be followed in every case except where local regulations are more stringent, in which case local regulations shall govern.

7.03 Underground Cable Placement

Prior to entry, testing shall be conducted in excavations to determine if there is an oxygen deficiency or a presence of harmful gas, in accordance with federal, state, and/or local requirements.

Cable reels, which are delivered to the work location and are not set up immediately for placing operations shall be securely blocked or secured to a substantial support to prevent rolling.

The Contractor and Engineer shall jointly verify distances between splice points prior to ordering cable in specific cut lengths.

The duct assignment for each individual cable for any conduit section shall be specified on the Plans. Cables shall not be placed in ducts other than those specified on the Plans without prior approval of the Engineer.

It shall be the Contractor's responsibility to determine whether ducts assigned for occupancy shall be rodded and cleaned.

All ducts containing earth, sand or gravel shall be cleaned. Ducts, which cannot be cleaned, shall be reported to the Engineer.

Reels shall be rolled in the direction indicated by the arrows painted on the reel flanges.

Cable reels shall be set up on the same side as the conduit section in which the cable is to be placed. The reel shall be leveled and brought into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be payed off from the bottom of a reel.

The Contractor shall check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started.

A cable feeder guide of suitable dimensions shall be used between the cable reel and the face of the duct to protect the cable and guide it into the duct as it is payed off the reel. Copper cable shall not be bent to a radius of less than 10 times the diameter of the cable. Fiber optic cable shall not be bent to a radius of less than 20 times the diameter of the cable.

The mechanical stress placed upon a cable during installation shall not be such that the cable is twisted or stretched. During installation, the Contractor shall not exceed the maximum pulling tension of the cable as specified by the cable manufacturer.

As the cable is payed off the reel, it shall be carefully inspected for jacket defects. If defects are noticed, the pulling operations shall be stopped immediately and the Engineer will determine what corrective action shall be taken.

As the cables are payed off the reel into the cable feeder guide, they shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole it shall also be sufficiently lubricated at the intermediate manhole.

Cable placement shall be stopped immediately if the cable on a reel binds or does not pay off freely. The cause of the binding must be cleared to the satisfaction of the Engineer before the pulling operation is continued.

When blowing of underground cable is specified, the installation shall be in accordance with the manufacturer of the blowing installation equipment.

Sufficient cable shall be provided in each manhole to properly rack and splice the cables as shown on the Plans.

All cable ends, shall be protected at all times with acceptable end caps except during actual splicing. During the splicing operations, protection shall be available for immediate installation in case water.

END OF SECTION

SECTION 8

ELECTRICAL PROTECTION OF OUTSIDE PLANT

8.01 General

This part of the specification is concerned with the various materials required for the grounding of overhead and buried communications cable for the telephone utility relocation for Frontier/Citizens Communications Company in conjunction with Tennessee Department of Transportation (TDOT) Construction Project No. STP-101(16) as specifically described in these Contract Documents and depicted on the accompanying Plans.

8.02 Disturbing Potentials

Lightning is a transient discharge between a charged cloud and the earth or another cloud, involving high peak currents (several tens of thousands to more than a 100,000 amperes) usually lasting a few hundred microseconds. Lightning surges in cable plant may occasionally arise because of direct strokes to pole tops or to the cable itself. Successful protective measures against damage are usually not practicable for direct lightning strokes to elements of telephone cable plant. Fortunately, however, lightning disturbances more commonly appear in cable plant in lower energy levels by conduction from connecting distribution wire, by induction from nearby strokes-to-earth, by conduction from the earth at or near the stroke point to the cable through guys or pole grounding wires, or because of a rise in ground potential at nearby grounded points such as station protectors. If adequate protective measures are not taken, lightning discharges may result in the breakdown of the insulating materials between cable conductors and the grounded metallic cable shields or between the conductors themselves. The effect of dielectric failure on service outage will depend on the magnitude and duration of the surge and the susceptibility of the materials involved to permanent damage, such as melting of the conductor and conductor insulation or carbonization of the conductor insulation.

Excessive lightning surge currents can cause telecommunications conductors to fuse open. The use of improved plastic insulation, however, has increased the dielectric strength of cable conductors to the point at which dielectric failure seldom occurs. The dielectric strength of cable causes the current surges to flow through the conductors rather than being bypassed through conductor insulation. As a result, lightning damage to plastic cable plant is more likely to be caused by conductor fusing rather than from dielectric failure.

Mutual association of telephone cable (or wire) facilities with power distribution circuits, as a result of joint use or joint occupancy of poles or at crossings, involves the possibility of incidental electrical contacts between these systems. Such electrical contacts usually are caused by severe mechanical stresses produced by high wind, heavy ice and snow loads, or combinations of these factors. Although peak currents in cable plant as a result of such contacts are likely to be in the order of hundreds rather than thousands of amperes, their duration is in the order of seconds rather than microseconds. Consequently, power contacts are likely to subject telephone plant to heating and burning, as well as dielectric stress. Power contacts with metal shielded cable and strand may occasionally burn down cable because of resulting arcing and current flow, or more likely may only generate sufficient enough current flow in telecommunications conductors to result in fusing of conductors. Fortunately, however, the frequency of power contacts is much lower than that of lightning interference.

8.03 Protection Principles

Direct lightning strokes to cable plant are likely to cause extensive damage because of the magnitude of the currents involved. However, because the cost for total protection, if even possible, would be immense and because such strokes occur so infrequently, protection against direct strokes is impracticable.

Lightning surges may also reach the conductors and/or shields of aerial cable by currents conducted from non-cable plant, by induction from nearby strokes-to-ground, and by currents developed because of rise in ground potential at stroke points near station protector installations. (The term "non-cable plant" as used here refers to wire circuit facilities not enclosed in a metal shield, such as overhead drop wires.) Cables having plastic-insulated conductors do not require protective measures except in unusual circumstances as outlined in subsequent paragraphs.

To prevent dielectric failure of the cable conductor insulation (by cable design), all conducting elements of a cable installation have to be at the same potential. The shields of all aerial cable sections should be bonded together and buried cable shields and to the central office ground. Cable support strands (messengers) should be electrically continuous and cable shields should be bonded to the support strands (messengers) at appropriate intervals.

Important protective construction practices also consist of providing low impedance paths to ground which will aid in rapid de-energization of a power line in the event of a power contact. Such grounding is also required by the National Electrical Safety Code (NESC).

8.04 Lightning Protection for Plastic Insulated Cable

The surge dielectric strength of cable utilizing plastic-insulated conductors is conservatively considered for engineering design purposes to be as follows:

SURGE DIELECTRIC STRENGTH		
Insulator Type	Conductor to Conductor	Core to Shield
Solid, Gel Filled	20 kV	35 kV
Gel filled, Expanded	15 kV	25 kV

Cables having dielectric strengths of these magnitudes will in most cases be free from damage by lightning. The relative immunity of PIC cable without arresters (except in special circumstances) to lightning damage has been well established by experience in the Bell Systems and RUS borrower systems over a period of many years.

The protection of PIC cable in all areas normally should consist of: (1) bonding and grounding cable shields at the central office; (2) maintaining electrical continuity of the shield; (3) bonding cable shields to support strands (messengers); (4) grounding of cable shields (in aerial circuits via grounding messengers, etc.); (5) providing gas tubes or the equivalent at junctions with facilities serving severely exposed stations; (6) protecting against fusing of cable conductors; (7) complying with the NEC at service drops; and (8) providing supplementary protection measures at known severe exposure locations.

The shields and other metallic members of plant entering a central office should be bonded to each other and to the central office ground. This bonding helps to minimize harmful differences of potential between the various cables entering the central office. RUS requires that special provisions be undertaken for bonding and grounding of outside plant cable shields, metallic armor, etc., with terminating cables in a central office. Basically, non-current carrying metallic outside plant items (shields, armor, strength members, etc.,) are all bonded together in a entering cable vault and they are in turn bonded to a Cable Entrance Ground Bar (CEGB) installed within the vault. The CEGB is, in turn, bonded to the office's Master Ground Bar and the elaborate grounding provisioning established at the office. The shields of the office's terminating cables are (deliberately) electrically isolated in the cable vault and connected to the office ground <u>only</u> at their other end, at the office mainframe ground bar. The purpose of this grounding and bonding arrangement is to divert any incoming surges that may be on the outside plant cable shields, armor, etc., directly to ground and not provide a path for these surges to make it directly to other parts of the mainframe. For more detail on these special central office procedures, readers should refer to TE&CM Section 810 (proposed conversion to RUS Bulletin 1751F-810).

It is important that electrical continuity of aerial cable shields be maintained and that such shields be bonded to any connecting buried cable shields in order to provide a path to ground for lightning and power currents, and to provide an effective noise shield. The installation of ready-access enclosures and the application of cable splicing procedures as covered in RUS Standard PC-2, Bulletin 345-6 (proposed conversion to 7 CFR 1755.200), will usually ensure adequate bonding of shields from a protection standpoint.

Cable shields should be bonded to support strands (messengers) at frequent intervals to prevent arcing and to provide a low impedance path to ground for power contact or lightning related surge currents. Plastic-jacketed cable should be bonded between the shield and strand at all splices, terminals, and loading points. The methods of bonding the shield to the strand depend on the types of enclosures used and are described in detail in PC-2.

Four or more bonds per mile (Two and one-half or more bonds per kilometer [km]) should be provided if possible without opening the plastic jacket solely for this purpose. Where long runs without splices, terminals, or load points are involved, at least one bond per mile (1.6 km) should be provided even if the cable sheath has to be opened solely for this purpose. If more than one cable is attached to the same pole, the shields of the various cables should be bonded together: (1) at crossing poles; (2) at the beginning and ending of multi cable runs; and (3) at approximately 1500 foot (460 meter) intervals in long multi-cable runs.

Normal construction practices and NESC provisions require that cable shields, messengers, and other non-current carrying metallic hardware be effectively grounded. It is especially important to effectively ground cable shields, messengers and non-current-carrying metallic hardware at dead ends and other junction points for noise mitigation, personnel protection, and/or power contact protection. Such grounds are also beneficial in reducing lightning potentials between the core and the shield if voltage limiting gaps (such as terminal studs or arrester gaps) are applied to the conductors. Grounds are also beneficial in reducing the probability of fusing of cable conductors from lightning surges by diverting a portion of the surge to ground before it reaches the cable conductors.

At junctions with facilities of any type or length serving stations that are severely exposed to lightning surges (such as fire towers and radio towers), it is recommended that 800 volt or greater breakdown gas tube arresters be installed on the exposed pairs between the conductors and the shield. An accepted alternative to gas tubes would be to install yellow-coded, 10 mil (0.3 mm) gap carbon arresters.

The probability of fusing cable conductors can be minimized by providing conducting paths for surge currents, which divert the incoming surges to the shield and ground before they reach the cable conductors.

Arresters for lightning protection are not normally required at points where service drops are connected along aerial cable runs. Connections of drop wires to aerial cable conductors normally should be made so as to meet National Electrical Code (NEC), formally identified as ANSI/NFPA 70, fuse coordinating requirements for station protection.

In addition to the above items, under severe exposure conditions, supplementary protection measures may be needed, e.g., plant protection near electric power generating stations and substations. Details of such supplementary protection should be determined by a borrower after a careful study.

8.05 Bonding and Grounding for Power Contact Protection

Where practicable, crossings between aerial telephone cables and electric distribution lines of any type should be made on jointly used or jointly occupied poles. At joint pole crossings with Multi Grounded Neutral (MGN) type power lines, the cable support strand (messenger) should be interconnected to the MGN via a vertical pole ground wire. Where it is not practicable to obtain joint pole crossings with electric distribution lines and for all aerial crossings with electric transmission lines, in span crossings may be used. For all in span crossings, protection of the telephone plant depends primarily on adequate structural strength and clearances, which in some cases may require using buried cable.

Where a telephone cable is supported by the same poles used for electric supply circuits of the MGN type, the cable shield and suspension strand (messenger) should be grounded by bonding the strand to the MGN. These bonding connections should be made at the following locations:

8.05(a) Where the joint use or joint occupancy arrangement begins and ends.

8.05(b) On every electric supply pole that carries a vertical pole ground wire to which are connected transformers, capacitors or other types of power equipment that draw load current under normal conditions.

If the joint use or joint occupancy section is longer than 1/2 mile (0.8 km), bonds should be made to the MGN every 1/4 mile (0.4 km). The NESC requires additional grounding considerations for certain messenger sizes where the messengers are exposed to possible power contacts, power induction, or lightning. If the ampacity of the messengers are not adequate for system grounding conductors, grounding of messengers has to be increased to intervals of eight per mile (1.6 km).

Where telephone cables are supported by the same poles used for electric supply circuits of the non-MGN type, cable shields should be grounded by means of their connections to the central office ground and by such other additional grounds as necessary to satisfy the frequency of occurrence described. Cable suspension strand should be bonded to the vertical pole ground wire on poles carrying vertical pole ground wires to which are connected transformer, capacitors, or other types of equipment that draw load currents.

Vertical pole ground wires on electric supply poles interconnected to transformers or capacitor banks should be connected directly to the power system neutral. The transformers or capacitor banks should also have direct connections to the power system neutral. At such locations visual inspection from the ground should be made, before climbing, to ascertain that the vertical pole ground wire is actually connected to the neutral. If the vertical pole ground wire is not connected, this fact should be reported to the power company; and the wire should be regarded as energized. The pole should not be touched or climbed by the telephone line workers until the condition has been corrected by the power company.

Where interconnection of the support strand (messenger) to the MGN, the interconnection should be accomplished by the appropriate method for the conditions prevailing at the pole in question as listed below.

If the pole is already equipped with vertical pole ground wire connected to the MGN, then a ground wire assembly unit (PM2A) should be installed. A bonding conductor should be attached to vertical ground wire by telephone construction personnel if it is satisfactory to the power company.

If the pole is not equipped with vertical ground wire, a ground wire assembly unit (PM2A) should be installed and sufficient slack left to permit the bonding wire to be extended to and connected to the MGN if the pole in question is at the beginning or at the end of the joint use section. Connection of the bonding wire to the MGN should be made only by the power company. For intermediate bonds, a pole already equipped with a pole ground wire should be selected and a ground wire assembly unit (PM2A) should be installed.

In most instances, interconnection of the cable shield to the MGN will result in a decrease in noise levels on the telephone system because of the additional shielding effect provided by the neutral conductor. In a few instances noise levels could increase if excessive residual power currents flow in the shield as a result of bonding. This situation is most likely to occur if the resistance of the neutral to ground is relatively high. In such instances removal of a number of bonds to the MGN to reduce the shield current usually will be beneficial.

8.06 Miscellaneous

No special protection is required at the junctions of aerial cable and short buried plastic-sheathed cable dips in aerial cable runs.

Where a good shield ground such as a MGN of approximately 25 ohms or less cannot be obtained at or within 200 feet (60 meters) of a cable-noncable junction, the beneficial effect of such a ground may be achieved by placing buffer protection in the form of yellow coded arresters between the non-cable pairs and ground at a point about 1500 feet ± 1000 feet (460 meters ± 300 meters) from the junction, provided a ground of approximately 25 ohms or less can be obtained at that point.

Lightning protection wires may be necessary to prevent the splitting of wood poles used for cable supports in certain areas of high lightning incidence and severe exposures. Normally, extensive use of lightning protection wires is necessary in the shaded areas of the map on Figure 1, Lightning Damage Probability Map, and in unshaded areas which have more than 60 thunderstorm days per year. In systems within areas affected by high levels of lightning damage and where local experience clearly indicates the need, lightning protection wires should be installed on poles which are severely exposed because of being on or near the top of a hill with little or no shielding such as buildings, trees, or a higher foreign pole line. In hilly areas, installation of protection wires on a number of consecutive poles is desirable. With flat terrain where the exposure is more uniform and less severe, protection wires should be installed on every third or fourth pole.

8.07 Metallic Housings on Vertical Power Poles

When a metallic buried plant housing is mounted on a power pole, the grounding conductor of the housing should be bonded with at least a #6 AWG bare copper wire to the vertical pole ground wire, if present, on the pole. The purpose of this bond is to maintain the ground wire and the buried plant housing at the same potential, thereby preventing a shock hazard that otherwise might exist during a fault condition on the power line.

8.08 Effective Grounding of Cable Shields

Application of an effective grounding system is recommended for all locations. Both the National Electrical Code (NEC) and the National Electrical Safety Code (NESC) cite a 25 ohm resistance-to-ground for grounding systems. See Section 250-84 of the NEC and Rule 96B of the NESC. Note by attempting to obtain at least four grounds per mile (1.6 km), attention to obtaining 25 ohms at individual grounds is not necessary (except at special equipment sites) as the multiplicity of grounds helps to achieve an overall low impedance to ground.

The Purpose of Grounding Cable Shields is to protect telephone plant from the effects of ground potential rise (GPR) caused by power system faults. Grounding telephone cable shields helps to direct excessive voltages and currents induced on the shields to earth. This can often be achieved before these currents and voltages reach the location of plant or equipment requiring protection.

The Application of an Effective Grounding System can increase the flow of current in the shielding circuit and help to reduce noise. The shield should be continuous with no opens or bonding problems, so that the maximum benefits of effective grounding can be realized.

Isolating Damage Caused by a Lightning Stroke: An effective grounding system can isolate damage by dissipating the current through multiple paths to ground along the cable shield. Because of the high magnitude of current in a lightning strike and the associated GPR, it is not feasible to protect the entire telephone plant from damage. As a result it is desirable to isolate damage from a near or direct lightning strike to the least plant length as possible.

Obtaining a 25 Ohm Ground Provision of a ground at every location with a resistance-to-ground of 25 ohms or less cannot always be accomplished with a 5 foot (1.5 meter) ground rod. Use of a longer rod or multiple rods connected together may be necessary. This is especially true in areas of the country where there is an extremely high earth resistivity. In many areas of the country the winter frost line exceeds 18 inches (45.7 cm) or more. In such areas of the country use of eight foot (2.4 meter) rods should be made standard practice.

8.09 Effective Grounding Theory

Effective Grounding is based on the theory that multiple grounds along a cable shield will provide a low resistance-to-ground. This low resistance-to-ground provides for the dissipation of high voltages and currents induced or conducted on the cable shield.

For protection purposes, it is desirable to have the earth electrodes spaced every quarter mile (0.4 km) but this is not practical in most buried cable plant. In aerial plant, especially in situations of joint use or joint occupancy, grounding of messengers at four or eight times a mile (1.6 km) is required by the NESC and is most beneficial because the lower the value of effective resistance-to-ground, the better the overall system will perform during power cross situations.

Once the earth resistivity at a location has been determined, selection of the proper electrode can be made. A 5 foot (1.5 meter) rod is normally used. If the earth resistivity at the location is extremely high, an 8 foot (2.4 meter) rod should be used. An 8 foot (2.4 meter) rod should also be used in areas where the average frost line is 18 inches (45.7 cm) or deeper.

END OF SECTION

SECTION 9

SERVICE INSTALLATION AT CUSTOMER LOCATION

9.01 General

This part of the specification is concerned with the various materials required for the construction of service installation at customer location for the telephone utility relocation for Frontier/Citizens Communications Company in conjunction with Tennessee Department of Transportation (TDOT) Construction Project No. STP-101(16) as specifically described in these Contract Documents and depicted on the accompanying Plans.

9.02 Specifications for Construction and Installation

All construction and installation work shall be done in a thorough and workmanlike manner in accordance with the Plans and shall be subject to acceptance by the Owner.

All material to be used in construction of the Project shall be stored so as to be protected from deteriorating effects of the elements.

All service wires and cables, and accessory materials used in the construction of the Project shall be handled with care. Each reel of service wire or cable shall be inspected for damage. Prior to installation, all damage shall be repaired to the satisfaction of the Engineer. If reel wrap is present, the reel wrap shall remain intact on the reel until the wire or cable is ready to be placed.

Deviations from the Plans shall not be permitted except upon written permission of the Engineer.

The latest revision of the National Electrical Safety Code (NESC) and the National Electrical Code (NEC) shall be followed in every case except where local regulations are more stringent, in which case local regulations shall govern.

The Contractor shall maintain conductor polarity (tip and ring) identification at the main distributing frame, cable terminals, wire terminals, terminal blocks, and for Service Entrances at the network interface device (NID), all in accordance with the Specifications and Construction Sheets.

9.03 Aerial Service Entrances

Aerial service wires shall be installed in accordance with RUS Service Installation Standard Bulletin 1753F-801(PC-5A), and the Construction Sheets.

All clearances shall comply with the applicable requirements of the NESC, and NEC, or local laws, or ordinances, whichever are most stringent.

9.04 Buried Service Entrances

Buried service entrances shall be installed at the depth listed below unless otherwise specified by the Engineer.

minimum depth in soil	- 24 inches
minimum depth in ditches	- 36 inches
minimum depth in rock	- 3 inches

Buried services shall contact the building as near as practicable to the NID or proposed NID location.

Buried services shall be located to avoid damage from lawn mowers, animals, etc., and, where deemed necessary by the Engineer, shall be guarded.

The method of installation is shown on the Plans.

Buried services shall be installed against a foundation wall or pillar to provide adequate support and mechanical protection.

The buried service conductors shall be terminated in the NID, when specified by the Engineer, as shown on the Plans.

END OF SECTION

SECTION 10

DESCRIPTION OF UNITS NOT DESCRIBED ELSEWHERE

10.01 All poles are to be Southern Yellow Pine poles, pressure treated along the full length with Pentachlorophenol type treatment.

10.02 When installing new poles or cables along existing pole lines where the existing DW, open wire, or cable is to be removed, the Contractor may lean or alter the position of the existing poles and make other temporary adjustments to the line or service wires or cables required so as to permit construction of the project to proceed without interrupting service to the existing lines. No rearrangements (W units) will be paid in these instances.

10.03 All cable is to meet RUS Spec. PE89 (7CFR 1753F-208).

10.04 All copper cable will be 24 gauge Superior Essex 09-097-02 cable. Cable is to be foam skin with a filled core (SEAL PIC-FSF).

10.05 All fiber cable is to be Corning SMF28, non-armored, multiple loose tube core construction with a dry filled core and dry buffer tubes. Cable is to have non-metallic strength members, single jacket cable with 12 fibers per tube. The attenuation is to be no greater than 0.4 dB/Km at 1310 nm and at 1550 nm. All fiber is to be from the same manufacturer and have matched cladding.

10.06 Lashing wire will be .045 stainless steel.

10.07 All bonding harnesses are to be any acceptable flat braided type with insulation.

10.08 Where new cable is to be "E" lashed on an existing strand, any rearrangement of the existing lashing wire termination (for proper specifications) is to be included as a part of the new unit. Maximum number of lashing wires per lashing wire clamp is two (2).

10.09 Drip loops are required (5"minimum radius) at every pole, on copper. Maintain uniformity in drip loop.

10.10 All cables placed across roads will be double lashed. All copper cables 200 pair and above will be double lashed.

10.11 Where two cables are to be placed on the same strand, the second cable is to be placed in a following and separate operation.

10.12 5/16" (10M) EHS galvanized steel strand and EHS hardware is to be used. Use automatics on all dead ends placed on thimble eye nuts and use strand sleeves on all strand splices. (No wraps).

10.13 Aerial cable spacers are to be of the 3M stackable type.

10.14 FOSB(A) This unit includes all labor and materials necessary to install a fiber optic storage bracket. This unit will be placed at fiber optic cable loop locations only. FOSB(A)(2) is for fiber optic cable sizes up to and including 72 fibers. See special guide drawing located in Section 11 of this document.

10.15 All HC3's are to be spliced with 3M modules.

10.16 All aerial copper splice cases are to be 3M SLiC type cases and are to be sized to the size of the copper cable.

10.17 All fiber splice cases will be the Preform "Coyote" case.

10.18 As part of the HO1 unit, the Contractor is to provide in writing and on diskette End to End Insertion Loss Attenuation Testing at 1310 nm and at 1550 nm, splice loss verification, and fiber continuity verification test results and individual Fusion Splice Test results per splice location for each fiber. Tests are to be run in both directions. No additional compensation will be paid for this testing.

10.19 Maximum loss per fiber per splice = 0.1dB.

10.20 Contractor is to place fiber splices only at locations shown. Any fiber sections that are damaged enough to require a splice are to be completely replaced, unless approval to do otherwise is obtained from the Engineer after consultation with Frontier/Citizens Communications.

10.21 PE units apply to both new and existing poles. OK to use guy wrap at top position only. Use three bolt clamp at bottom of guy. On overheads it is okay to use guy wraps or automatics.

10.22 All anchors are the bust type (PF1-5A) anchors unless there is rock and then it will be a wedge type rock anchor (PF5-3A). PF3-5A anchors will be screw in type anchors.

10.23 PM91()()() This unit includes all labor and materials necessary to install a cable stub. Size, gauge and length are shown in the parenthesis.

10.24 PM52 Unit includes removal of all of old number at same location, if required. Pole numbers will be a metal strip with numbers and letters (orange background with black numbers and letters) that slide in metal strip and the strip is nailed on the pole with aluminum nails. Numbers start with L for the lead and if it is a Frontier pole there will be a blue CT tag in the middle between the lead and the p ole number and then there will be a P and the pole number. Contact: Tech Products, Inc., 105 Willow Avenue, Stanton Island, New York. Phone number: (800)221-1311.

10.25 Ground connectors will be placed at every pole. They are called C-Taps and they have to be crimped to the strand and the pole ground wire with special tool. Connector is made by Thomas and Betts.

10.26 Removals of miscellaneous items (drops, dry spots, etc.) on XX poles, will not be compensated separately but will be included in the XX pole unit. Riser guards and crossarms will be compensated separately.

10.27 All XX units, to be removed under this contract will become the property of the Contractor and it will be the Contractor's responsibility to remove the materials from the site of the project and dispose of it in such a manner as to not create any liability to the Owner. Old pole (power or telephone) is to be left with property owner if so requested at no cost to property owner. Contractor will need to get pole agreement and release form signed by property owner.

10.28 XXCA Remove aerial strand (any size or type) and all cables, enclosures, grounds, etc., attached to it. Compensation per foot.

10.29 XXDW Remove aerial distribution wire (any size or type). Compensation per unit.

10.30 XXPE Remove any size or type aerial guy and associated hardware, including guards.

10.31 XXPF Remove any size or type anchor.

10.32 XXPM4 Remove metal extension arm (any size or type).

10.33 XXPole Remove any size or height pole.

10.34 XXSE Remove aerial or buried drop, any size or type (including CATV drop). Per unit basis, one unit per span (vertical runs included). Miscellaneous material included.

10.35 XXU-GUARD Remove BM80, 81, 82, or 83.

10.36 XXWT Remove pole mounted terminal, any size or type. Per unit basis, miscellaneous materials included.

10.37 WBFCR Transfer existing buried cable and/or drop from existing pole and/or pedestal to new pole and/or pedestal. All miscellaneous items (including cable straps, etc.) are included.

10.38 WC1 Rearrange strand regardless of size or number of cables attached to it on straight line poles and maintaining proper sag in front and backspan at no additional compensation. Also includes bonding of strand on tap cables or others where no vertical ground exists, and correcting make-up to specs. Per attachment basis, all miscellaneous materials are included.

10.39 WC2 Same as WC1, except for angle poles and dead ends. Per attachment basis, all miscellaneous materials are included.

10.40 WCA Resag existing strand and/or relash existing cable (any size or type) and all cables lashed to it. Unit also includes the correcting of makeup to specs. Compensation per foot. This unit will not be paid where new cable will be added on existing cable or cables. If new cable is being added any resagging will be included as part of the new cable unit and no additional compensation will be paid.

10.41 WHC Same as HC1, except involves splicing existing working cables. The same specifications apply to WHC unit as apply to HC1 unit and no additional compensation will be paid for testing. See page 19 of RUS Form 515a dated 9/17/01 for description.

10.42 WHR Rearrange any size or type of aerial splice case and any blocks, etc. that may be involved. Per unit basis, all miscellaneous materials are included.

10.43 WHO Same as HO1, except involves splicing existing working cables. The same specifications apply to WHO unit as apply to HO1 unit and no additional compensation will be paid for testing. See page 20 of RUS Form 515a dated 9/17/01 for description

10.44 WPM4 Rearrange metal extension arm (any size or type).

10.45 WSE Rearrange aerial or buried drop (any size or type). Per unit basis, one unit per span (vertical runs included). Miscellaneous material included.

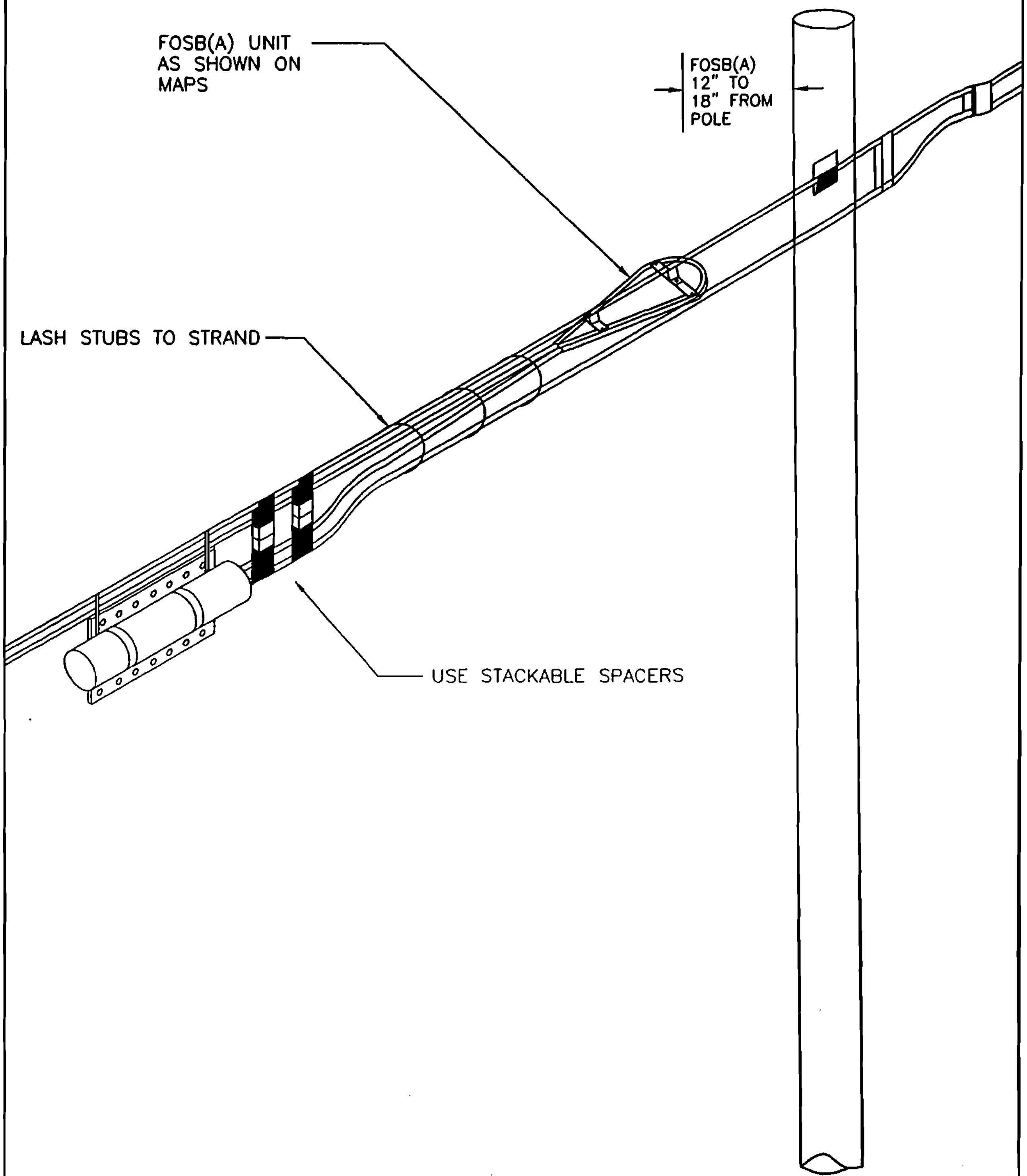
10.46 WWT Rearrange pole mounted wire terminal or protector regardless of size or type. Per unit basis, miscellaneous material included.

10.47 WU-GUARD Rearrange BM80, 81, 82 and/or 83.

END OF SECTION

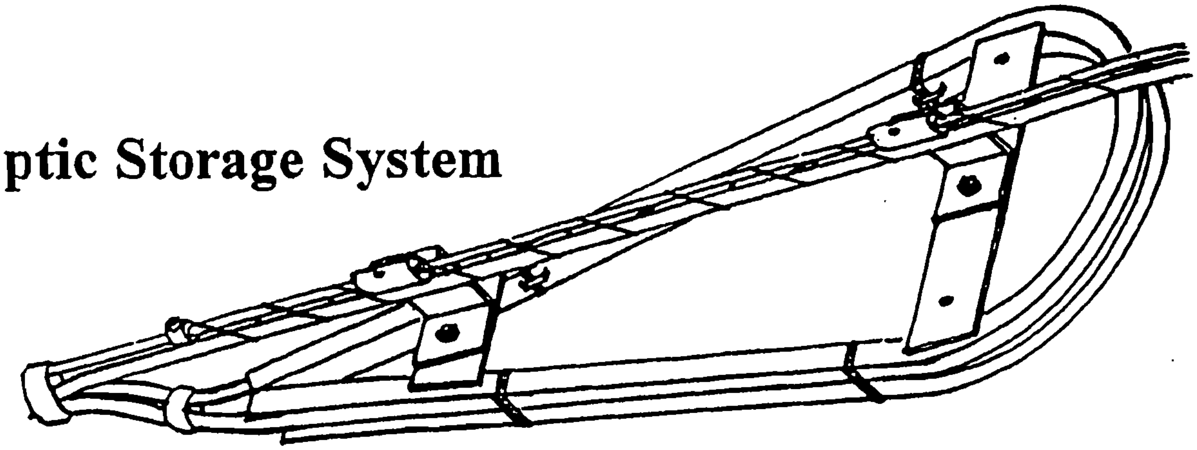
SECTION 11

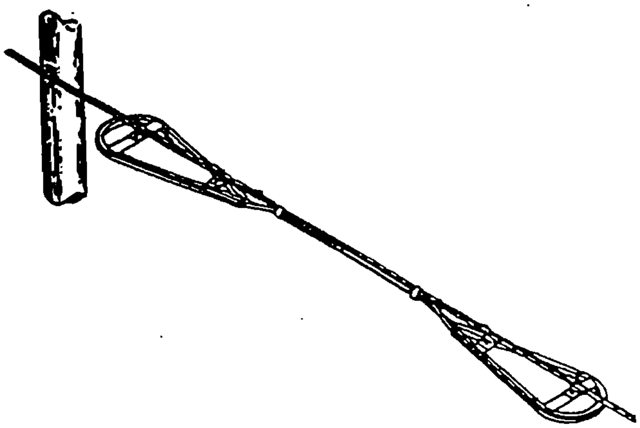
ASSEMBLY UNITS



LIST OF MATERIALS	GUIDE DRAWING
CASE, ORGANIZER TRAY, AND AERIAL HANGER BRACKETS MISCELLANEOUS MATERIALS	FOR SPLICING AERIAL FIBER
	HACO

Fiber Optic Storage System



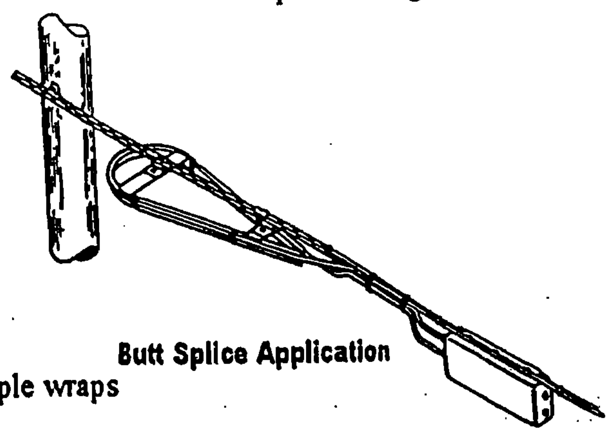


Reserve Cable Length Strand Storage Application

- All aluminum construction
- Continuous welds at crossbars and ends
- Each pair individually boxed
- Stainless steel mounting bolts, nuts and washers included
- Three models efficiently sized to accommodate all fiber cable up to .91" OD
- Dual coat baked on polyester powder coat finish
- Tie eyelets designed to accommodate both stainless steel and tie wrap securing methods

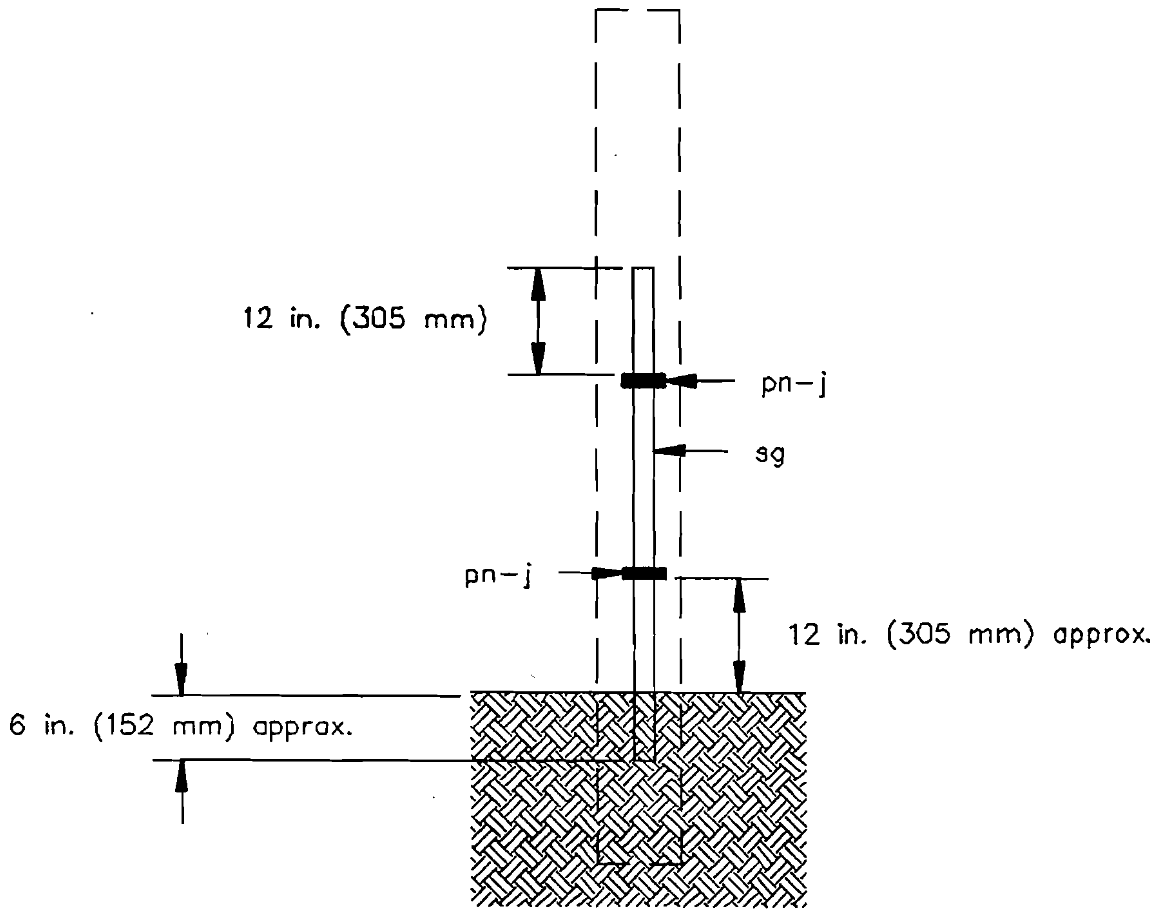
Product Information

Model	Channel Width	Overall Length	Diameter	Cable Application
FOS-1	.650	25.75	12.250	OD up to .61" single wrap
* FOS-2	1.250	25.75	12.250	OD up to .61" 2-3 wraps
* FOS-3	.900	31.25	16.250	OD up to .81" single wrap
FOS-5	1.750	32.50	18.250	OD up to .91" or for multiple wraps



Butt Splice Application

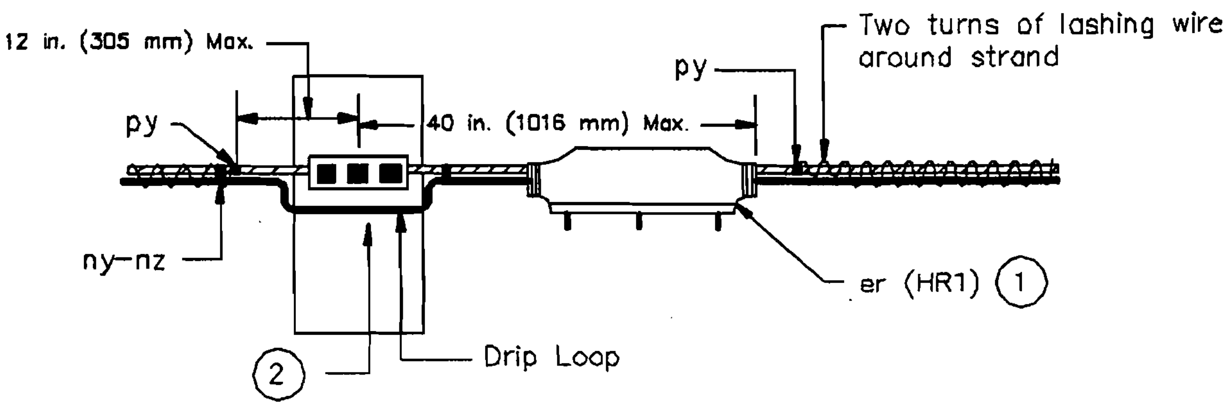
FOSB(A)



		BM80	BM81	BM82
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
sg	Guard, riser 1 in. ID * 8 ft (25 mm ID * 2.4 m)	1	–	–
sg	Guard, riser 2 in ID * 8 ft (51 mm ID * 2.4 m)	–	1	–
sg	Guard, riser 3 in. ID * 8 ft (76 mm ID * 2.4 m)	–	–	1
*pn	Strap, riser guard	2	2	2
j	Screw, lag (size as required)	4	4	4

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
RISER GUARDS

Scale: NTS	March 2001
	BM80, 81, 82



Notes:

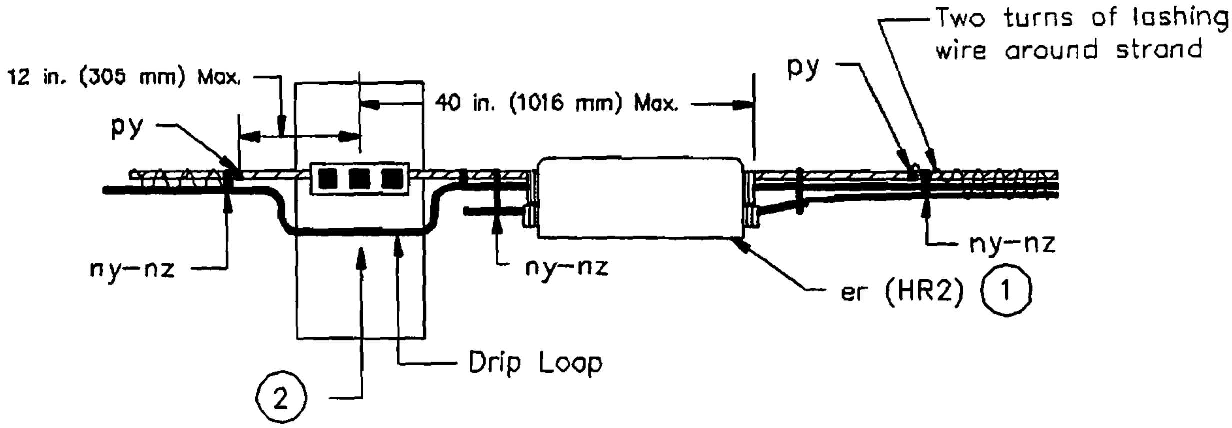
1. Select enclosure size for the main cable diameter from 0.4 to 3.0 in. (10 to 76 mm) and install in accordance with the enclosure manufacturer's instructions.

2. Lashed cable supports with the proper size cable spacers shall be used to hold the cable parallel to the strand and clear of the hardware.

		HR1
ITEMS	MATERIALS	NO. REQUIRED
er	Enclosure, ready–access	1
*ny	Spacers, cable	As required
*nz	Supports, lashed cable	As required
*py	Clamps, lashing wire, terminating	As required

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
READY–ACCESS ENCLOSURE
LASHED CABLE – STRAIGHT SPLICE

Scale: NTS		March 2001
		HR1



Notes:

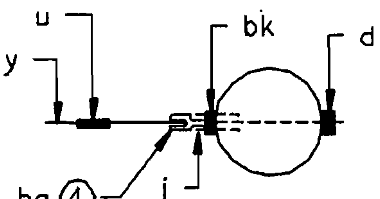
1. Select enclosure size for the main cable diameter from 0.4 to 3.0 in. (10 to 76 mm) and install in accordance with the enclosure manufacturer's instructions.

2. Lashed cable supports with the proper size cable spacers shall be used to hold the cable parallel to the strand and clear of the hardware.

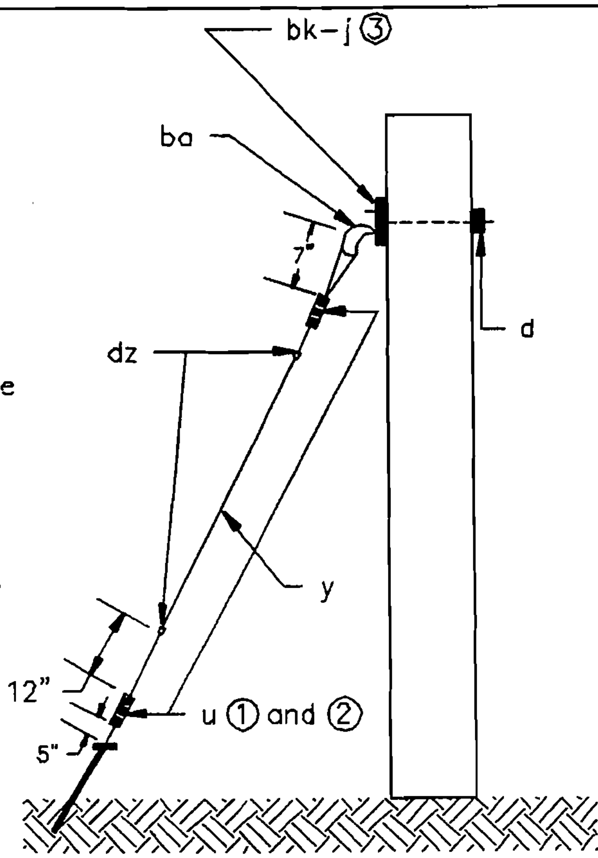
		HR2
ITEMS	MATERIALS	NO. REQUIRED
er	Enclosure, ready-access	1
*ny	Spacers, cable	As required
*nz	Supports, lashed cable	As required
*py	Clamps, lashing wire, terminating	As required

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
READY-ACCESS ENCLOSURE
LASHED CABLE - BRANCH SPLICE

Scale: NTS		March 2001
		HR2



Plan



Elevation

Notes:

1. An equivalent guy terminating device (mu) rated to develop the strength of the appropriate guy strand may be used in lieu of the 3-bolt guy clamps listed.

2. Where 3-bolt guy clamps are used, place 1 or 2 clamps depending on stand size.

3. For 6M sizes of guy strand, omit items bk and j and substitute a 2 1/2" x 2 1/2" x 3/16", 11/16" hole curved washer, item d.

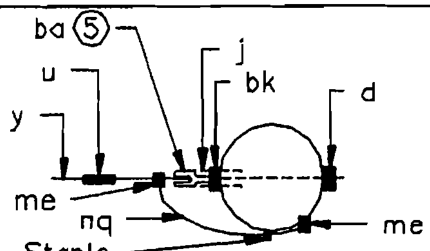
4. If a guy hook is used in lieu of a thimbleye bolt refer to Guide Drawing 812 for installation details.

5. For converting English units to metric units use 1 in. = 25.4 mm and 1 ft = 0.3048 m.

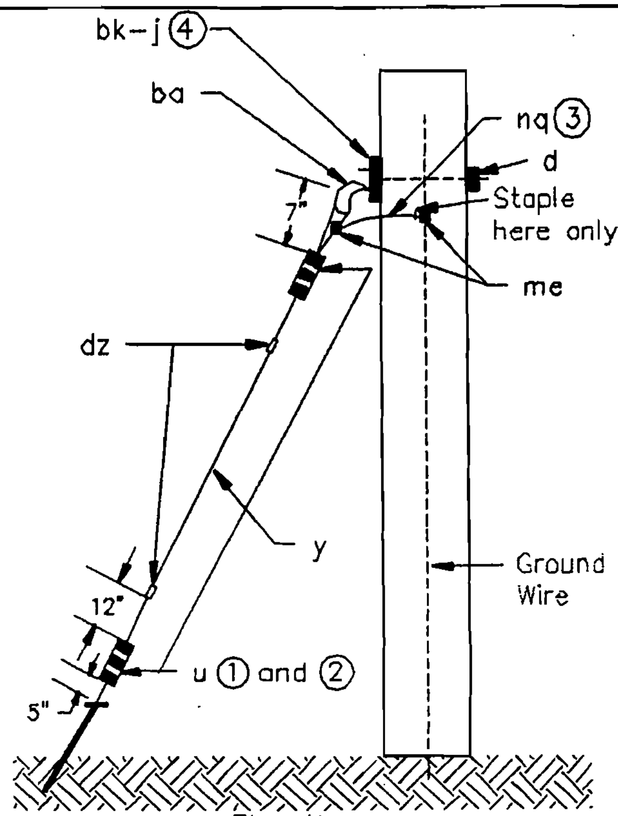
		PE1–2	PE1–3	PE1–4
		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
d	Washers, curved, 3" x 3" x 1/4", 13/16" hole	–	–	1
d	Washers, curved, 2 1/2" x 2 1/2" x 3/16", 11/16" hole	2	1	–
j	Screws, lag, 1/2" x 4"	–	2	2
u	Clamps, guy, 3–bolt	2	2	4
y	Strand, guy	req'd lgth	req'd lgth	req'd lgth
ba	Bolts, angle, thimbleye, 3/4" x req'd length	–	–	1
ba	Bolts, angle, thimbleye, 5/8" x req'd length	1	1	–
bk	Plates, lift, curved, 7" x 2 1/2" x 5/16"	–	–	1
bk	Plates, lift, curved, 7" x 2 1/2" x 1/4"	–	1	–
*dz	Clips, guy	2	2	2

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
DOWN GUY

Scale: NTS	March 2001
	PE1–2, –3, –4



Plan



Elevation

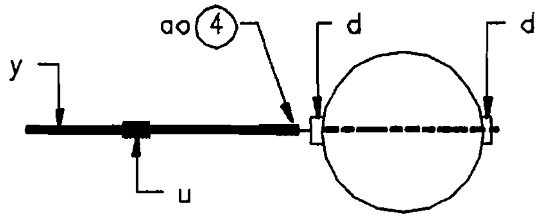
Notes:

1. An equivalent guy terminating device (mu) rated to develop the strength of the appropriate guy strand may be used in lieu of the 3–bolt guy clamps listed.
2. Where 3–bolt guy clamps are used, place 1 or 2 clamps depending on strand size.
3. On joint use poles where no vertical pole ground wire is present, leave enough length of #6 AWG copper ground wire (item nq) coiled and taped to enable it to be extended up the pole and connected to a multigrounded neutral by a representative of the power company.
4. For 6M sizes of guy strand, omit items bk and j and substitute a 2 1/2" x 2 1/2" x 3/16", 11/16" hole curved washer, item d.
5. If a guy hook is used in lieu of a thimbleye bolt refer to Guide Drawing 812 for installation details.
6. For converting English units to metric units use 1 in. = 25.4 mm and 1 ft = 0.3048 m.

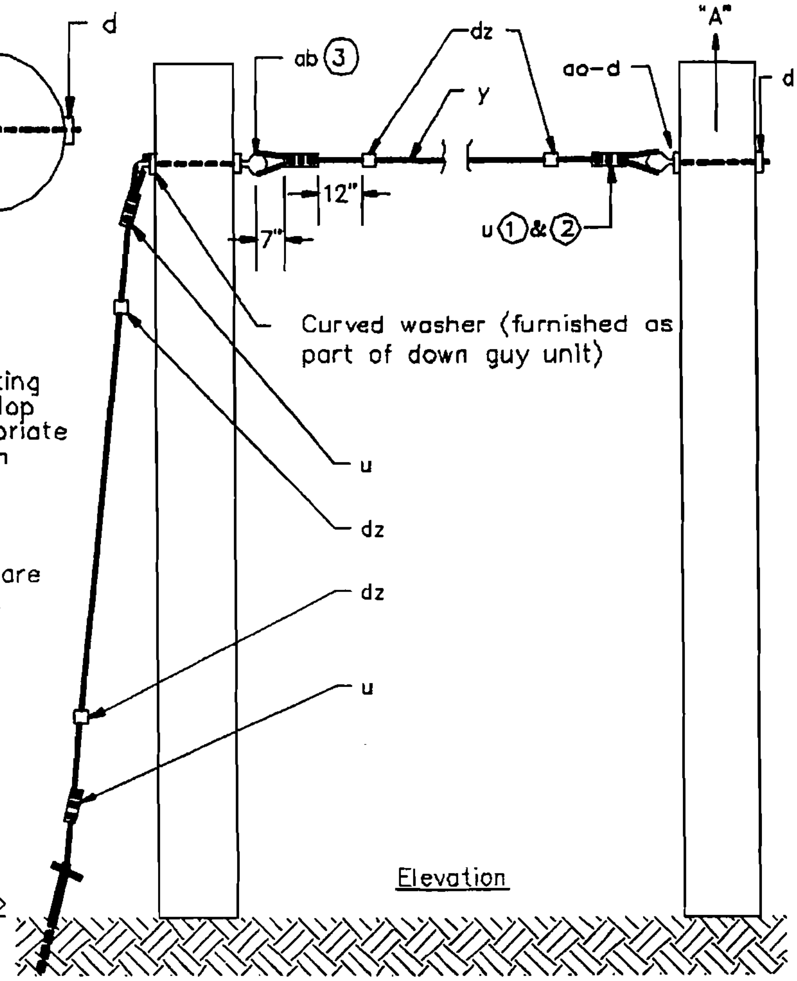
		PE1–2G	PE1–3G	PE1–4G
		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
d	Washers, curved, 3" x 3" x 1/4", 13/16" hole	–	–	1
d	Washers, curved, 2 1/2" x 2 1/2" x 3/16", 11/16" hole	2	1	–
j	Screws, lag, 1/2" x 4"	–	2	2
u	Clamps, guy, 3–bolt	2	2	4
y	Strand, guy	req'd lgth	req'd lgth	req'd lgth
ba	Bolts, angle, thimbleye, 3/4" x req'd length	–	–	1
ba	Bolts, angle, thimbleye, 5/8" x req'd length	1	1	–
bk	Plates, lift, curved, 7" x 2 1/2" x 5/16"	–	–	1
bk	Plates, lift, curved, 7" x 2 1/2" x 1/4"	–	1	–
*dz	Clips, guy	2	2	2
me	Connector, grounding	2	2	2
*nq	Wire, ground, bare #6 AWG copper	req'd lgth	req'd lgth	req'd lgth

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
DOWN GUY, GROUND CONNECTIONS

Scale: NTS	March 2001
	PE1–2G, –3G, –4G



Plan of Pole "A"



Notes:

1. An equivalent guy terminating device (mu) rated to develop the strength of the appropriate guy strand may be used in lieu of 3-bolt guy clamps listed.

2. Where 3-bolt guy clamps are used, place 1 or 2 clamps depending on strand size.

3. Size of thimbleye nut is governed by size of thimbleye bolt used for down guy.

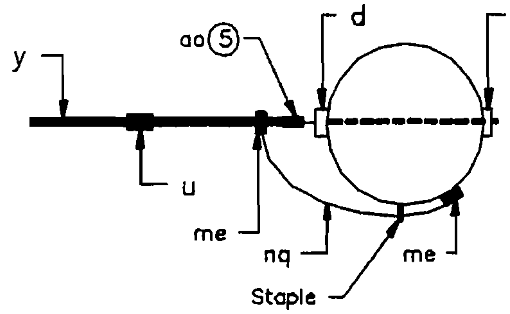
4. If a guy hook is used in lieu of a thimbleye bolt refer to Guide Drawing 812 for installation details.

5. For converting English units to metric units use 1 in. = 25.4 mm and 1 ft = 0.3048 m.

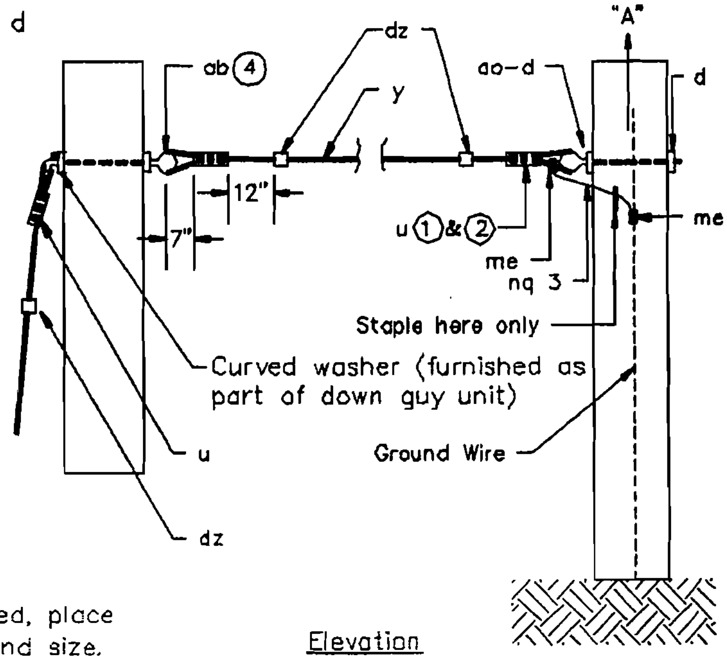
		PE2-2	PE2-3	PE2-4
		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
ab	Nuts, thimbleye	1	1	1
ao	Bolts, thimbleye, 3/4" x req'd lgth.	–	–	1
ao	Bolts, thimbleye, 5/8" x req'd lgth.	1	1	–
d	Washers, curved, 3" x 3" x 1/4", 13/16" hole	–	–	2
d	Washers, curved, 2 1/2" x 2 1/2" x 3/16", 11/16" hole	2	2	–
*dz	Clips, guy	2	2	2
u	Clamps, guy, 3-bolt	2	2	4
y	Strand, guy	req'd lgth	req'd lgth	req'd lgth

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
OVERHEAD GUY

Scale: NTS		March 2001
		PE2-2, -3, -4



Plan of Pole "A"



Elevation

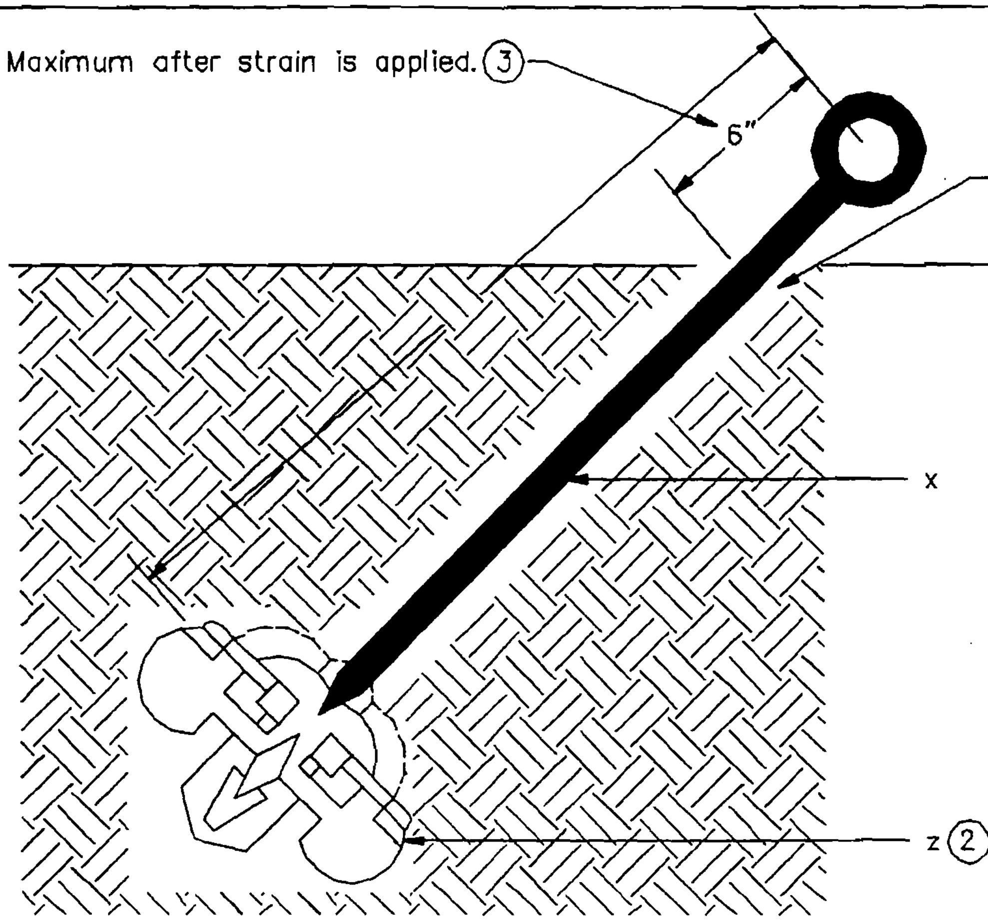
Notes:

1. An equivalent guy terminating device (mu) rated to develop the strength of the appropriate guy strand may be used in lieu of 3-bolt guy clamps listed.
2. Where 3-bolt guy clamps are used, place 1 or 2 clamps depending on strand size.
3. On joint use poles where no vertical pole ground wire is present, leave enough length of #6 AWG copper ground wire (Item nq) coiled and taped to enable it to be extended up the pole and connected to a multigrounded neutral by a representative of the power company.
4. Size of thimbleye nut is governed by size of thimbleye bolt used for down guy.
5. If a guy hook is used in lieu of a thimbleye bolt refer to Guide Drawing 812 for installation details.
6. For converting English units to metric units use 1 in. = 25.4 mm and 1 ft = 0.3048 m.

		PE2-2G	PE2-3G	PE2-4G
		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
ab	Nuts, thimbleye	1	1	1
ao	Bolts, thimbleye, 3/4" x req'd lgth.	–	–	1
ao	Bolts, thimbleye, 5/8" x req'd lgth.	1	1	–
d	Washers, curved, 3" x 3" x 1/4", 13/16" hole	–	–	2
d	Washers, curved, 2 1/2" x 2 1/2" x 3/16", 11/16" hole	2	2	–
*dz	Clips, guy	2	2	2
u	Clamps, guy, 3-bolt	2	2	4
y	Strand, guy	req'd lgth	req'd lgth	req'd lgth
me	Connectors, grounding	2	2	2
*nq	Wires, ground, bare #6 AWG copper	req'd lgth	req'd lgth	req'd lgth

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
OVERHEAD GUY, GROUND CONNECTIONS

Scale: NTS		March 2001
		PE2-2G, -3G, -4G



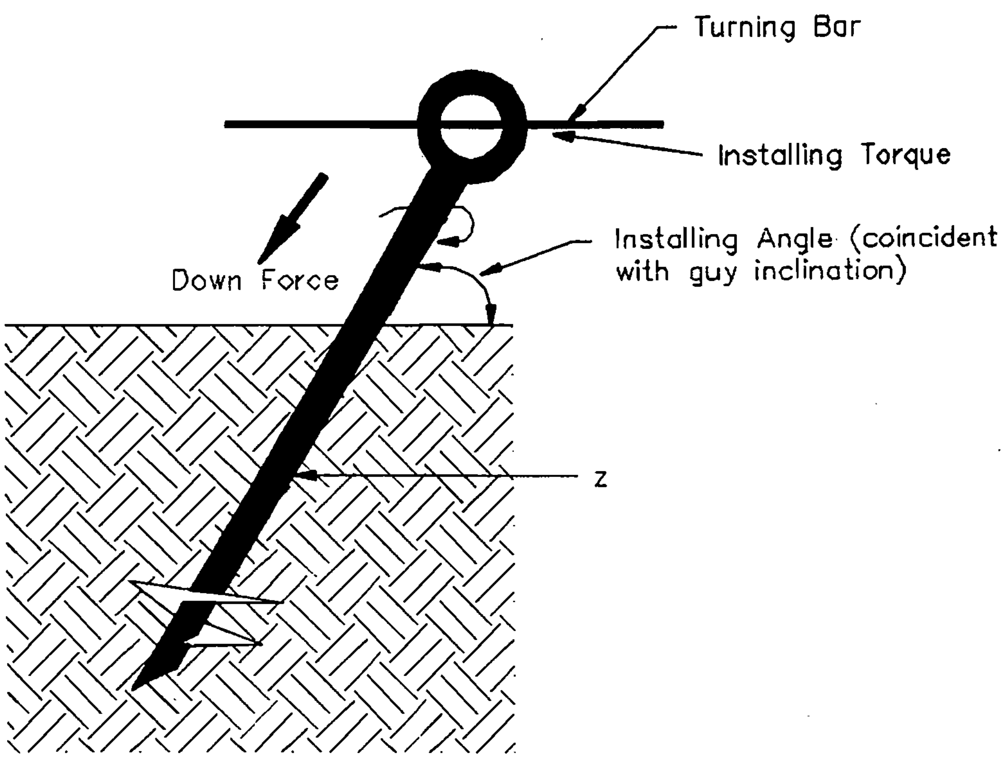
Notes:

1. Size of hole shall be governed by the diameter of the unexpanded anchor.
2. Expand the blades into undisturbed earth.
3. Eye of anchor rod shall not be below surface of ground.
4. For converting English units to metric units use 1 in. = 25.4 mm, 1 ft = 0.3048 m, and 1 lbf = 4.448 N.

ITEMS	MATERIALS	PF1-3 6,000 lbf Holding Power NO. REQ'D	PF1-5 10,000 lbf Holding Power NO. REQ'D	PF1-7 16,000 lbf Holding Power NO. REQ'D
x	Rod, anchor, thimbleye type, 5/8" x 7'0"	1	–	–
x	Rod, anchor, thimbleye type, 3/4" x 8'0"	–	1	–
x	Rod, anchor, thimbleye type, 1" x 10'0"	–	–	1
z	Anchor, expanding	1	1	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
EXPANDING ANCHOR ASSEMBLY

Scale: NTS	March 2001
	PF1-3, -5, -7



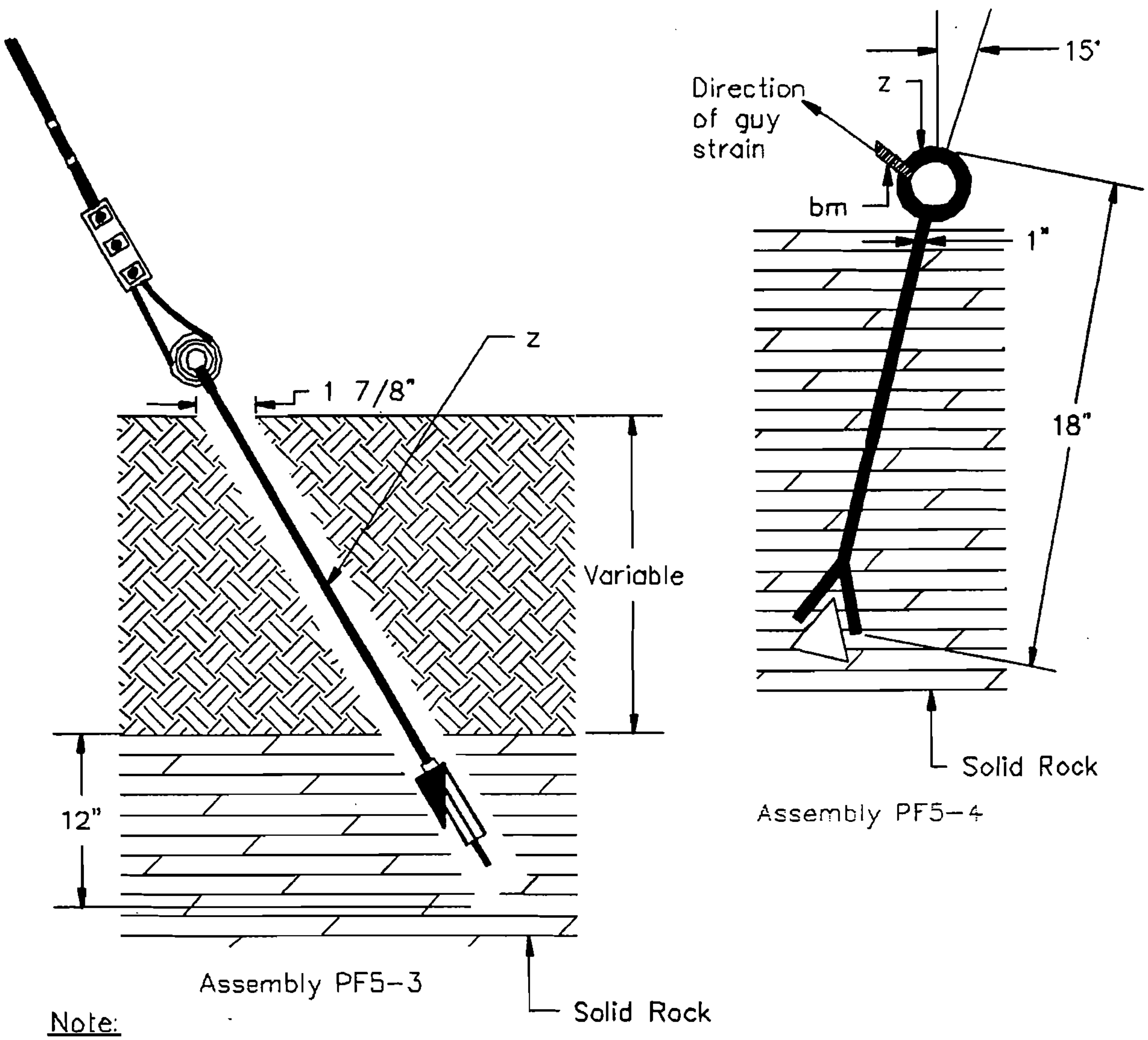
Note:

For converting English units to metric units use 1 in. = 25.4 mm and 1 lbf = 4.448 N.

ITEMS	MATERIALS	PF3-3 6,000 lbf Holding Power NO. REQ'D	PF3-5 10,000 lbf Holding Power NO. REQ'D	PF3-7 16,000 lbf Holding Power NO. REQ'D
z	Anchor, screw – 8" (203 mm) helix dia.	1	–	–
z	Anchor, screw – 10" (254 mm) helix dia.	–	1	–
z	Anchor, screw – 12" (305 mm) helix dia.	–	–	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
SCREW ANCHOR ASSEMBLY

Scale: NTS	March 2001
	PF3-3, -5, -7



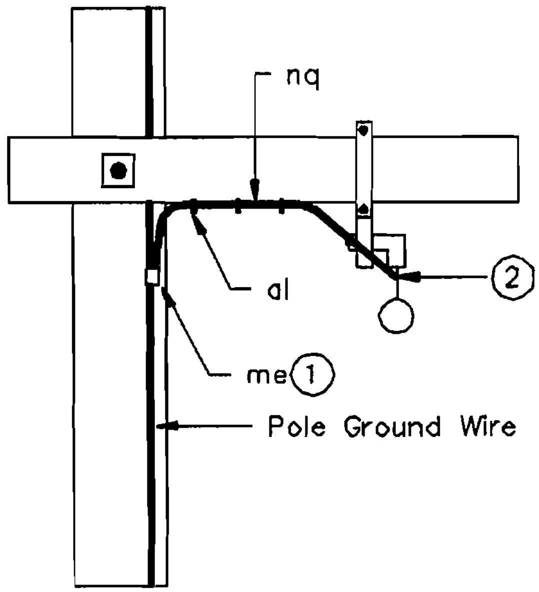
Note:

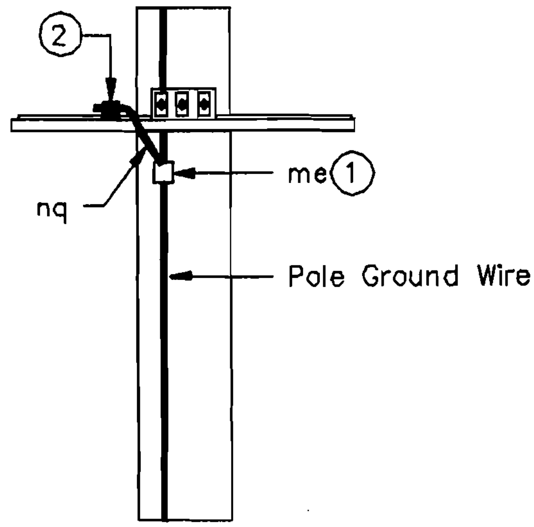
For converting English units to metric units use 1 in. = 25.4 mm and 1 lbf = 4.448 N.

		PF5-3	PF5-4
		16,000 lbf Holding Power	12,000 lbf Holding Power
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D
z	Anchor, rock, expanding	1	–
z	Anchor, rock, split wedge type	–	1
*bm	Thimble, guy	–	1

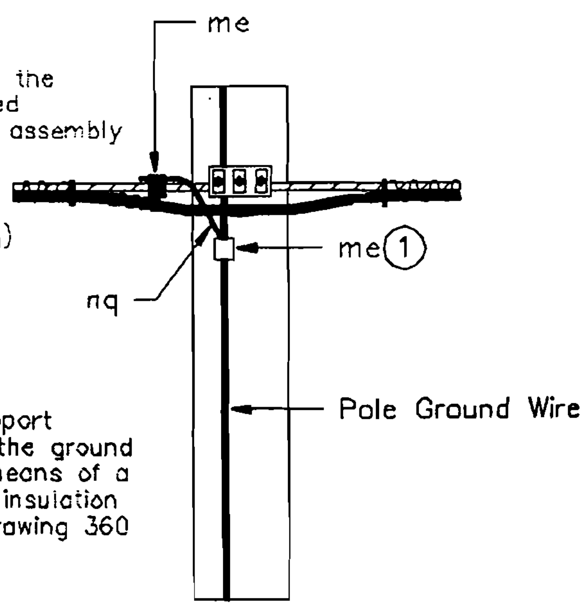
RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
ROCK ANCHOR ASSEMBLY

Scale: NTS		March 2001
		PF5-3, -4





Notes:



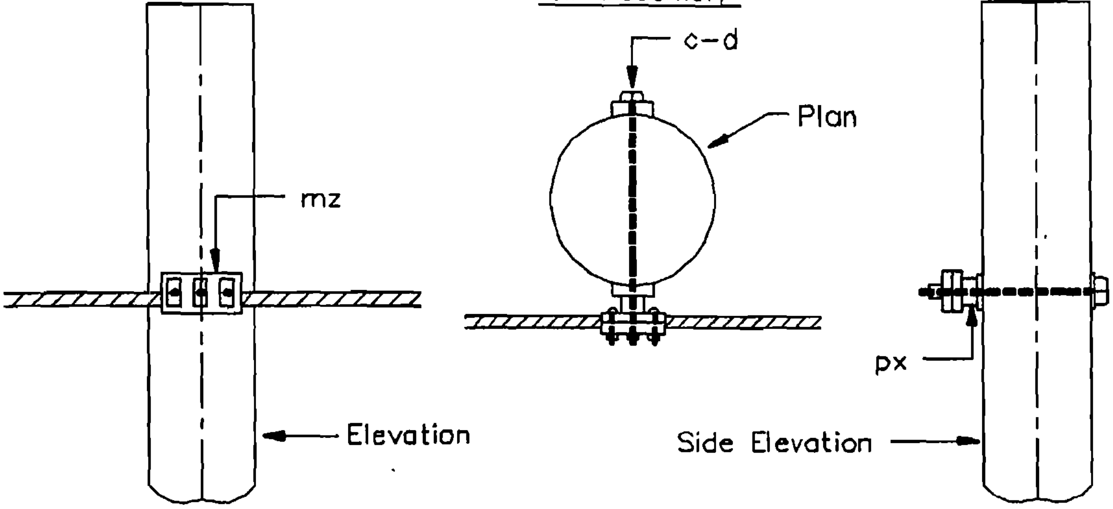
1. Ground wire (item nq) shall be connected to the vertical pole ground wire of the multigrounded power system neutral or to the pole ground assembly (PM2 unit). If a multigrounded power system neutral is present on the pole but there is no vertical pole ground wire, a sufficient length of bare #6 AWG copper wire (item nq) shall be left coiled and taped to permit it to be extended up the pole and connected to the multigrounded neutral by a representative of the power company.

2. Carefully remove the insulation from the support wire or the strand to permit connection of the ground wire to the support wire or the strand by means of a grounding connector (item me). Where the insulation is required to be restored, refer to Guide Drawing 360 for restoration details.

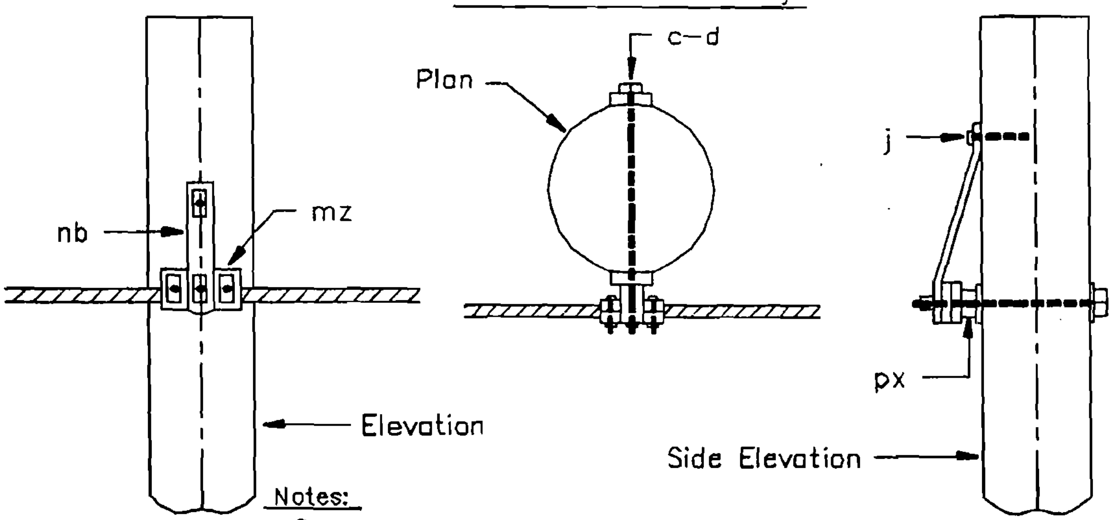
ITEMS	MATERIALS	NO. REQ'D
me	Connectors, grounding	2
*nq	Wire, ground, bare, #6 AWG copper	as required
*al	Staples, ground wire	as required

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES GROUND WIRE ASSEMBLY	
Scale: NTS	March 2001
	PM2A

6M Assembly



10M and 16M Assembly



Notes:

1. Use for tangent to 15 degrees construction.
2. For converting English units to metric units use 1 in. = 25.4 mm.

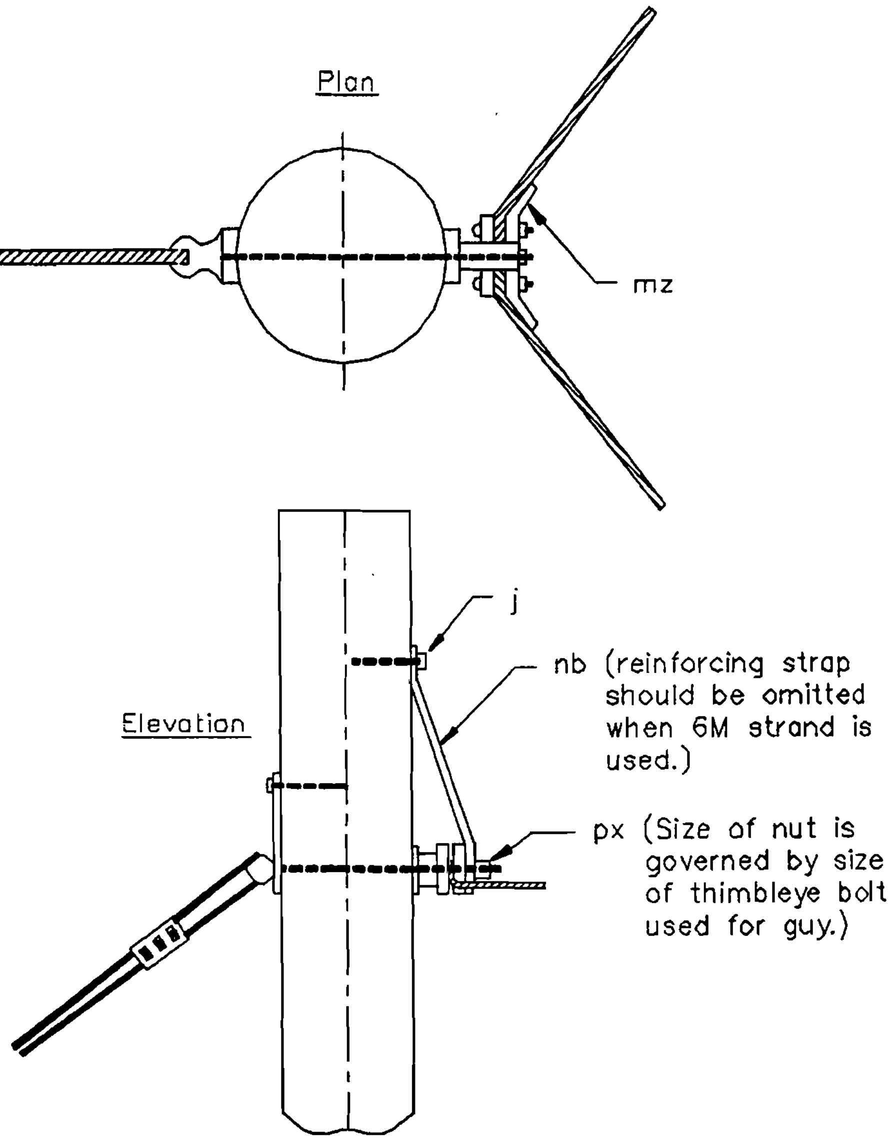
ITEMS	MATERIALS	6M NO. REQ'D	10M NO. REQ'D	16M NO. REQ'D
c	Bolts, machine, 5/8" x required length	1	1	1
d	Washers, curved, 2 1/2" x 2 1/2" x 3/16", 11/16" hole	2	2	2
j	Screws, lag, 1/2" x 4"	–	1	1
px	Nuts, regular square, 5/8"	1	1	1
mz	Clamps, cable, suspension	1	1	1
nb	Straps, suspension clamp, reinforcement	–	1	1

RURAL TELECOMMUNICATION CONSTRUCTION PRACTICES
SUSPENSION STRAND MOUNTING

Scale: NTS

March 2001

201



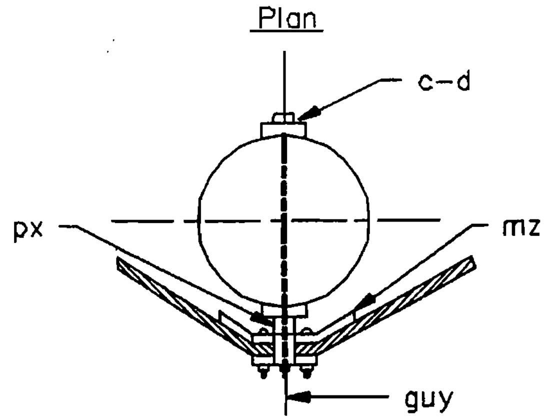
Notes:

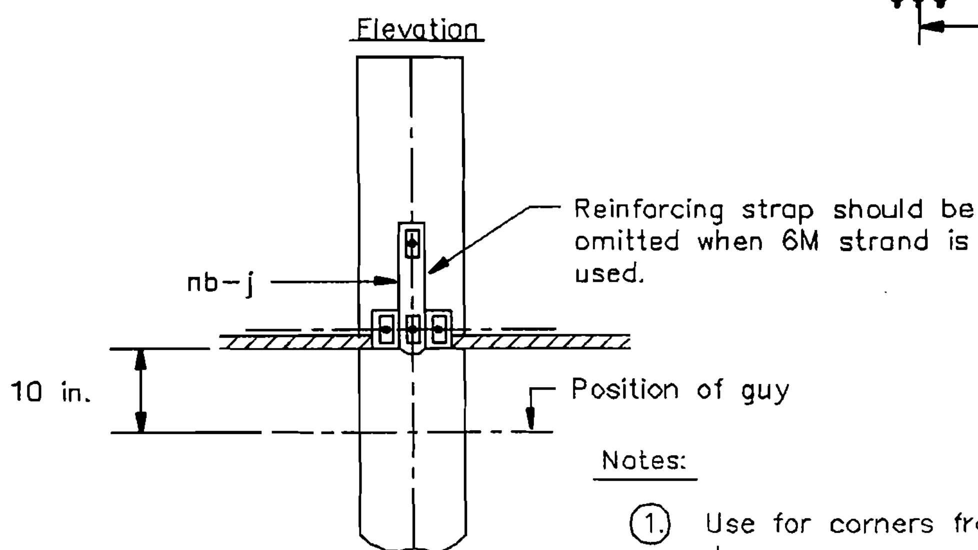
1. Use for corners from 15 to 60 degrees.
2. See guy assembly drawings for guying, materials.

		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
j	Screws, lag, 1/2 in x 4 in. (13 mm x 102 mm)	–	1	1
px	Nuts, regular square	1	1	1
mz	Clamps, corner suspension	1	1	1
nb	Straps, suspension clamp, reinforcement	–	1	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
SUSPENSION STRAND MOUNTING
(PULL AWAY FROM POLE)

Scale: NTS	March 2001
	202





Notes:

1. Use for corners from 15 to 60 degrees.
2. For converting English units to metric units use 1 in. = 25.4 mm.

ITEMS	MATERIALS	6M NO. REQ'D	10M NO. REQ'D	16M NO. REQ'D
c	Bolts, machine, 5/8" x required length	1	1	–
d	Washers, curved, 2 1/2" x 2 1/2" x 3/16", 11/16" hole	1	1	–
px	Nuts, regular square, 5/8"	1	1	–
j	Screws, lag, 1/2" x 4"	–	1	1
nb	Straps, suspension clamp, reinforcement	–	1	1
mz	Clamps, corner suspension	1	1	1
c	Bolts, machine, 3/4" x required length	–	–	1
d	Washers, curved, 3" x 3" x 1/4", 13/16" hole	–	–	2
px	Nuts, regular square, 3/4"	–	–	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
SUSPENSION STRAND MOUNTING
(PULL AGAINST POLE)

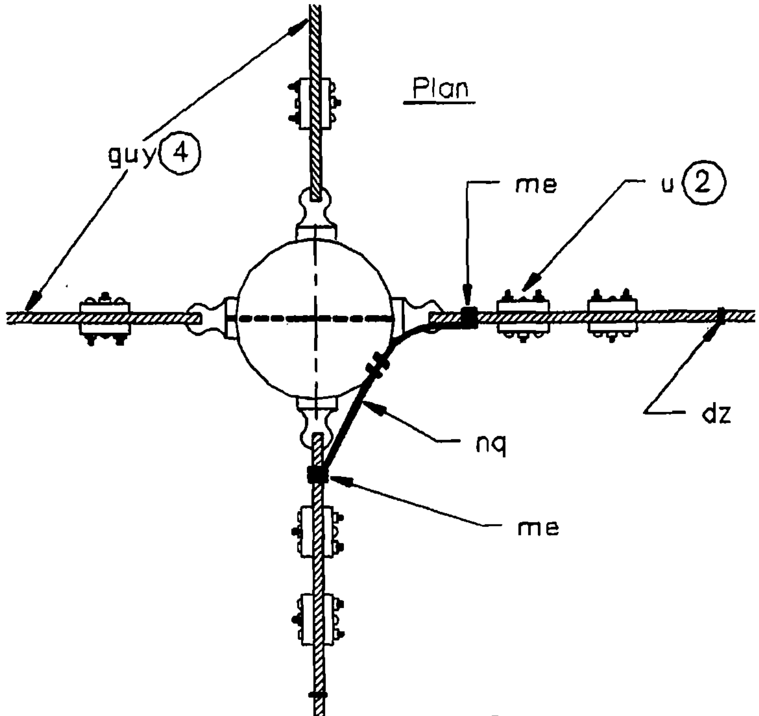
Scale: NTS

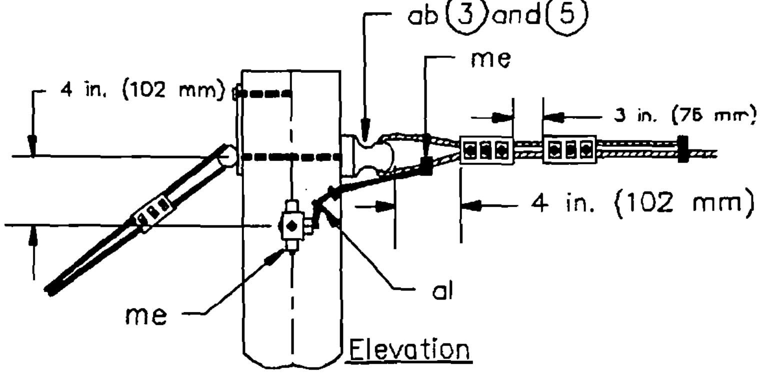
March 2001

202-1

Notes:

1. Use for corners from 60 to 90 degrees.
2. An equivalent terminating device (mu) rated to provide the strength of the appropriate suspension strand may be used in lieu of 3-bolt guy clamps listed.
3. Square nut under eye nut may be omitted when length of bolt thread extending beyond pole is short enough to permit turning eye nut down to curved washer without interfering with the placing of strand.
4. Refer to guy assembly drawings PE1-2, -3, -4; PE1-2G, -3G, -4G; , PE2-2, -3, -4; and PE2-2G, -3G, -4G for for guying materials.
5. Size of thimbleye nut is governed by size of thimbleye bolt used for guys.

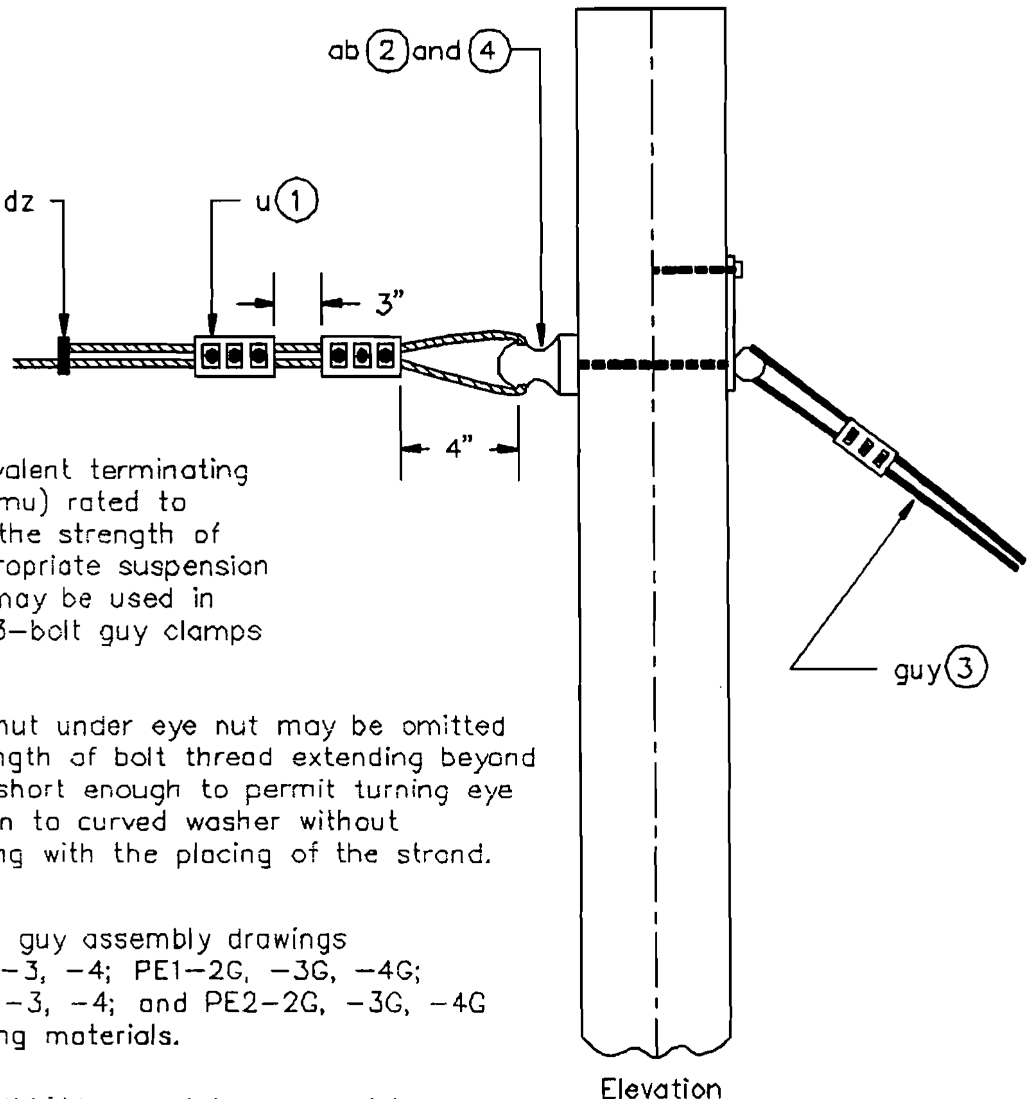




		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
u	Clamps, guy, 3-bolt	1	1	2
ab	Nuts, thimbleye	1	1	1
*dz	Clips, guy	1	1	1
me	Connectors, grounding	2	2	2
*al	Staples, ground wire	as req'd	as req'd	as req'd
*nq	Wire, ground, bare, #6 AWG copper	as req'd	as req'd	as req'd

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
SUSPENSION STRAND MOUNTING (CORNERS)

Scale: NTS	March 2001
	203



Notes:

(1.) An equivalent terminating device (mu) rated to provide the strength of the appropriate suspension strand may be used in lieu of 3-bolt guy clamps listed.

(2.) Square nut under eye nut may be omitted when length of bolt thread extending beyond pole is short enough to permit turning eye nut down to curved washer without interfering with the placing of the strand.

(3.) Refer to guy assembly drawings PE1-2, -3, -4; PE1-2G, -3G, -4G; PE2-2, -3, -4; and PE2-2G, -3G, -4G for guying materials.

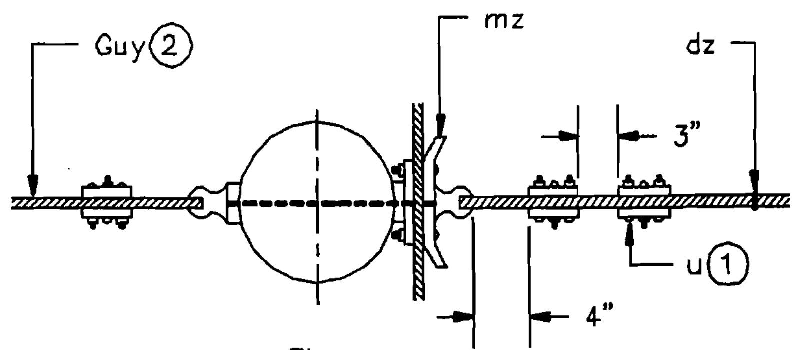
(4.) Size of thimbleye nut is governed by the size of the thimbleye bolt used for the guys.

(5.) For converting English units to metric units use 1 in. = 25.4 mm.

		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
u	Clamps, guy, 3-bolt	1	1	2
ab	Nuts, thimbleye	1	1	1
*dz	Clips, guy	1	1	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
SUSPENSION STRAND DEADEND

Scale: NTS	March 2001
	204



Plan

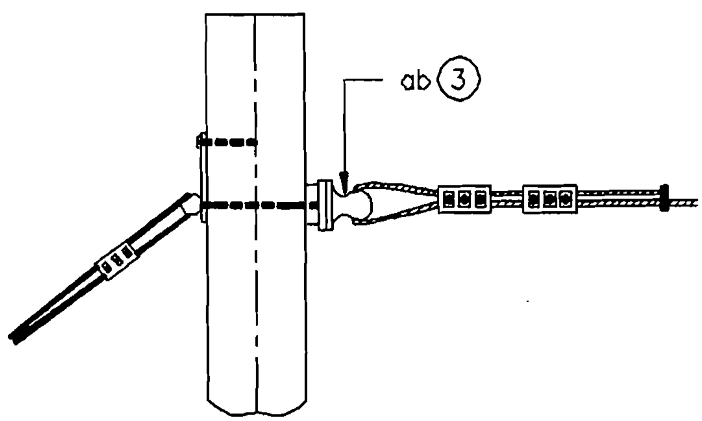
Notes:

1. An equivalent terminating device (mu) rated to provide the strength of the appropriate suspension strand may be used in lieu of 3-bolt guy clamps listed.

2. Refer to guy assembly drawings PE1-2, -3, -4; PE1-2G, -3G, -4G; PE2-2, -3, -4; and PE2-2G, -3G, -4G for guying materials.

3. Size of thimbleye nut is governed by the size of the thimmbleye bolt used for the guys.

4. For converting English units to metric units use 1 in. = 25.4 mm.



Elevation

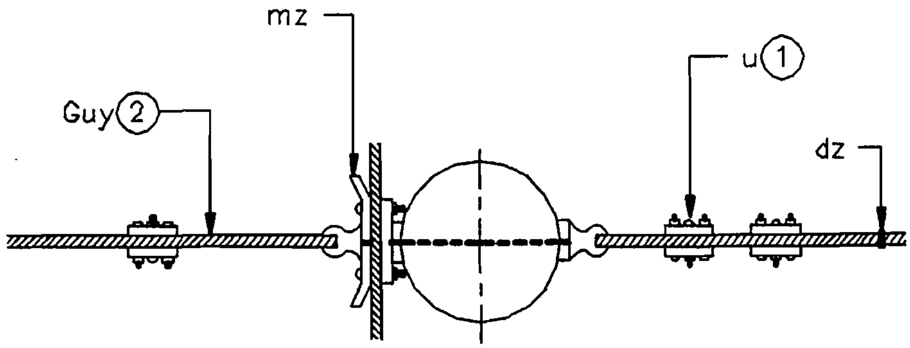
		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
u	Clamps, guy, 3-bolt	1	1	2
ab	Nuts, thimbleye	1	1	1
*dz	Clips, guy	1	1	1
mz	Clamps, suspension, corner	1	1	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
BRANCH SUSPENSION STRAND

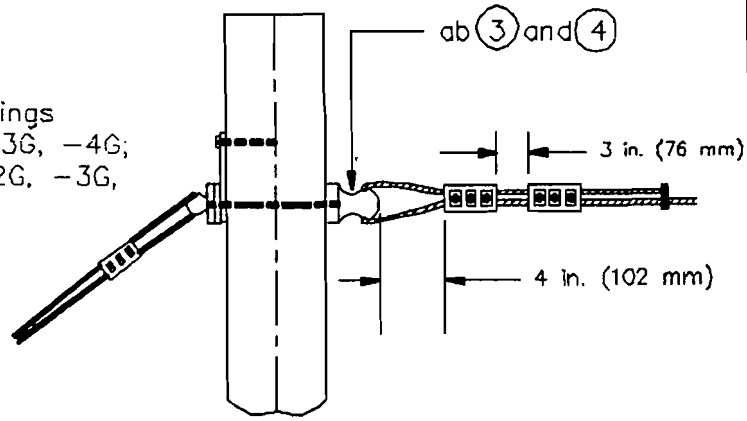
Scale: NTS

March 2001

206



Plan



Elevation

Notes:

(1.) An equivalent terminating device (mu) rated to provide the strength of the appropriate suspension strand may be used in lieu of 3-bolt guy clamps listed.

(2.) Refer to guy assembly drawings PE1-2, -3, -4; PE1-2G, -3G, -4G; PE2-2, -3, -4; and PE2-2G, -3G, -4G for guying materials.

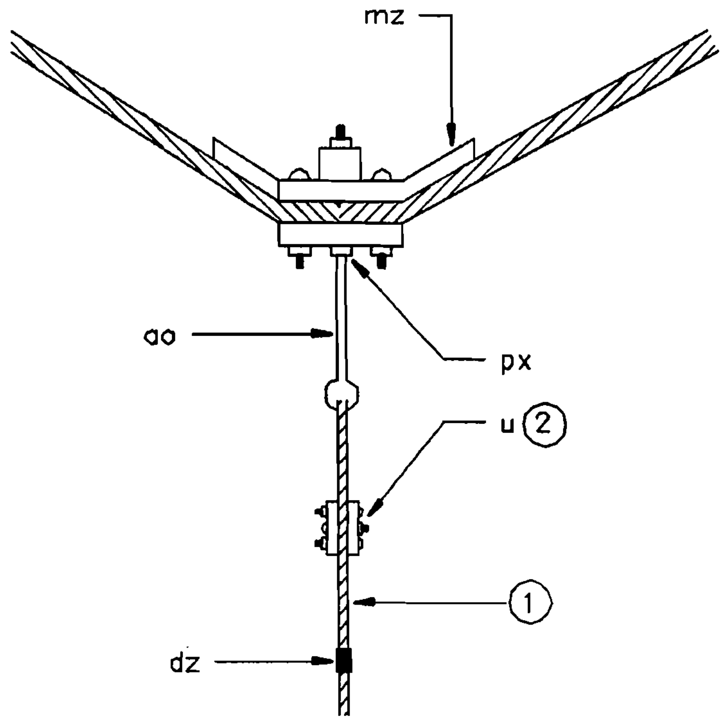
(3.) Size of the thimbleye nut is governed by the size of the thimbleye bolt used for the guys.

(4.) Square nut under eye nut may be omitted when length of bolt thread extending beyond pole is short enough to permit turning eye nut down to curved washer without interfering with the placing of strand.

		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
u	Clamps, guy, 3-bolt	1	1	2
ab	Nuts, thimbleye	1	1	1
*dz	Clips, guy	1	1	1
mz	Clamps, suspension, corner	1	1	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
BRANCH SUSPENSION STRAND

Scale: NTS		March 2001
		207



Plan

Notes:

1. Assembly unit designations refer to this strand.

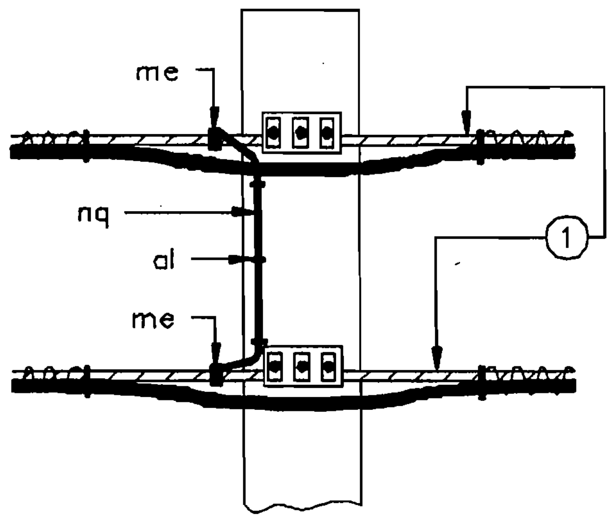
2. An equivalent terminating device (mu) rated to provide the strength of the appropriate suspension strand may be used in lieu of 3-bolt guy clamps listed.

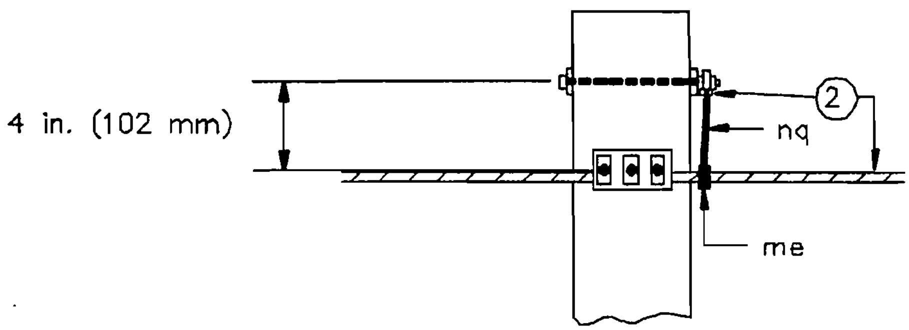
		6M	10M	16M
ITEMS	MATERIALS	NO. REQ'D	NO. REQ'D	NO. REQ'D
mz	Clamps, corner suspension	1	1	1
u	Clamps, guy, 3-bolt	1	1	2
*dz	Clips, guy	–	–	1
ao	Bolts, thimbleye, 3/4 in. (19 mm) diameter	–	–	1
ao	Bolts, thimbleye, 5/8 in. (16 mm) diameter	1	1	–
px	Nuts, regular square, 5/8 in. (16 mm)	1	1	–
px	Nuts, regular square, 3/4 in. (19 mm)	–	–	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
SUSPENSION STRAND PULL-OFF

Scale: NTS

March 2001





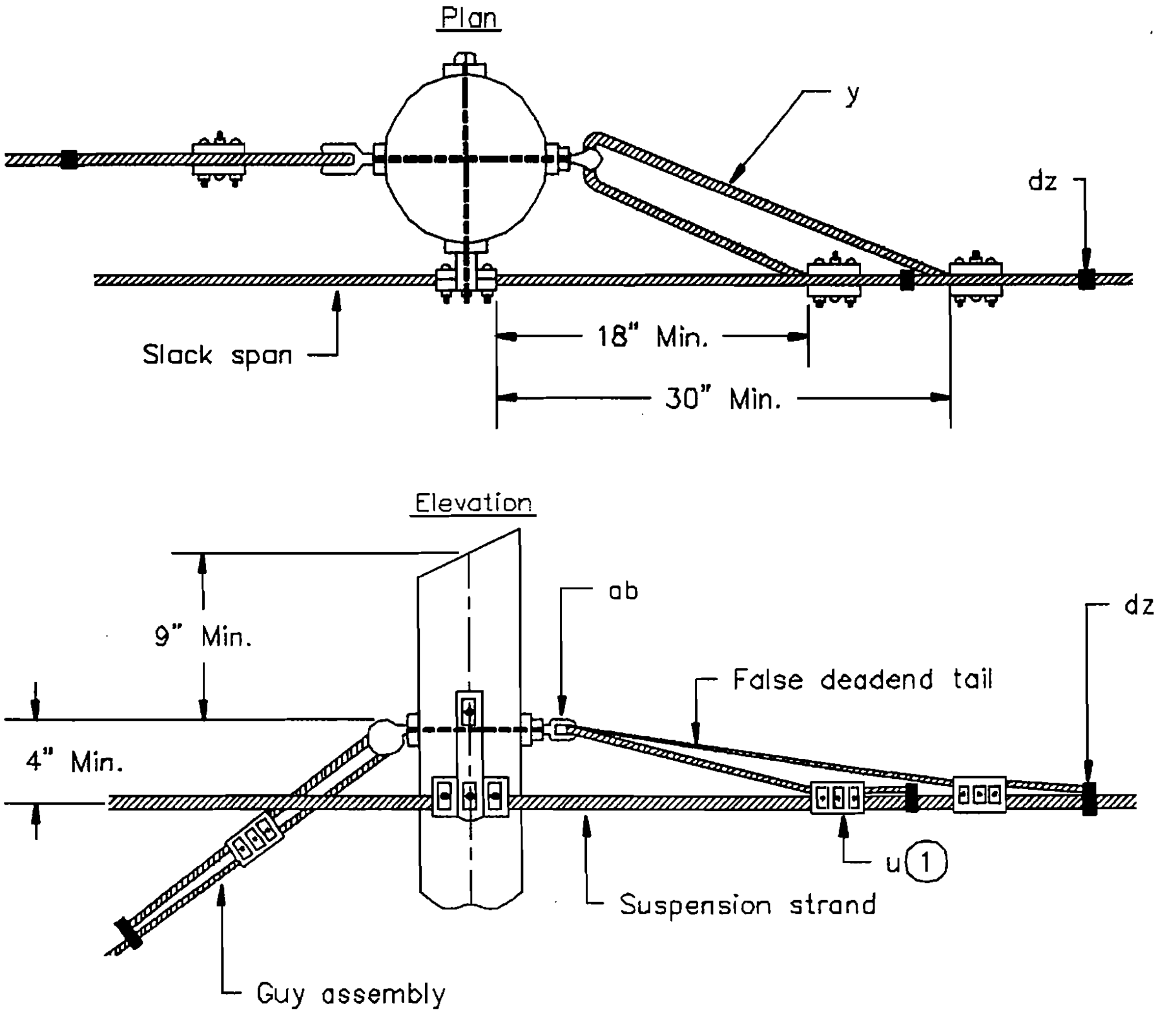
Notes:

1. On pole lines carrying two strand-mounted cable leads and paralleling each other, the suspension strands shall be bonded at each end of the joint section and at approximately 1/4-mile (402 m) intervals as directed by the Engineer.

2. Where two cable leads cross each other at a pole, the two strands shall be bonded as shown.

ITEMS	MATERIALS	NO. REQ'D
me	Connectors, grounding	2
*nq	Wire, ground, bare, #6 AWG copper	as required
*al	Staples, ground wire	as required

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES SUSPENSION STRAND BONDING		
Scale: NTS		March 2001
		209-1



Notes:

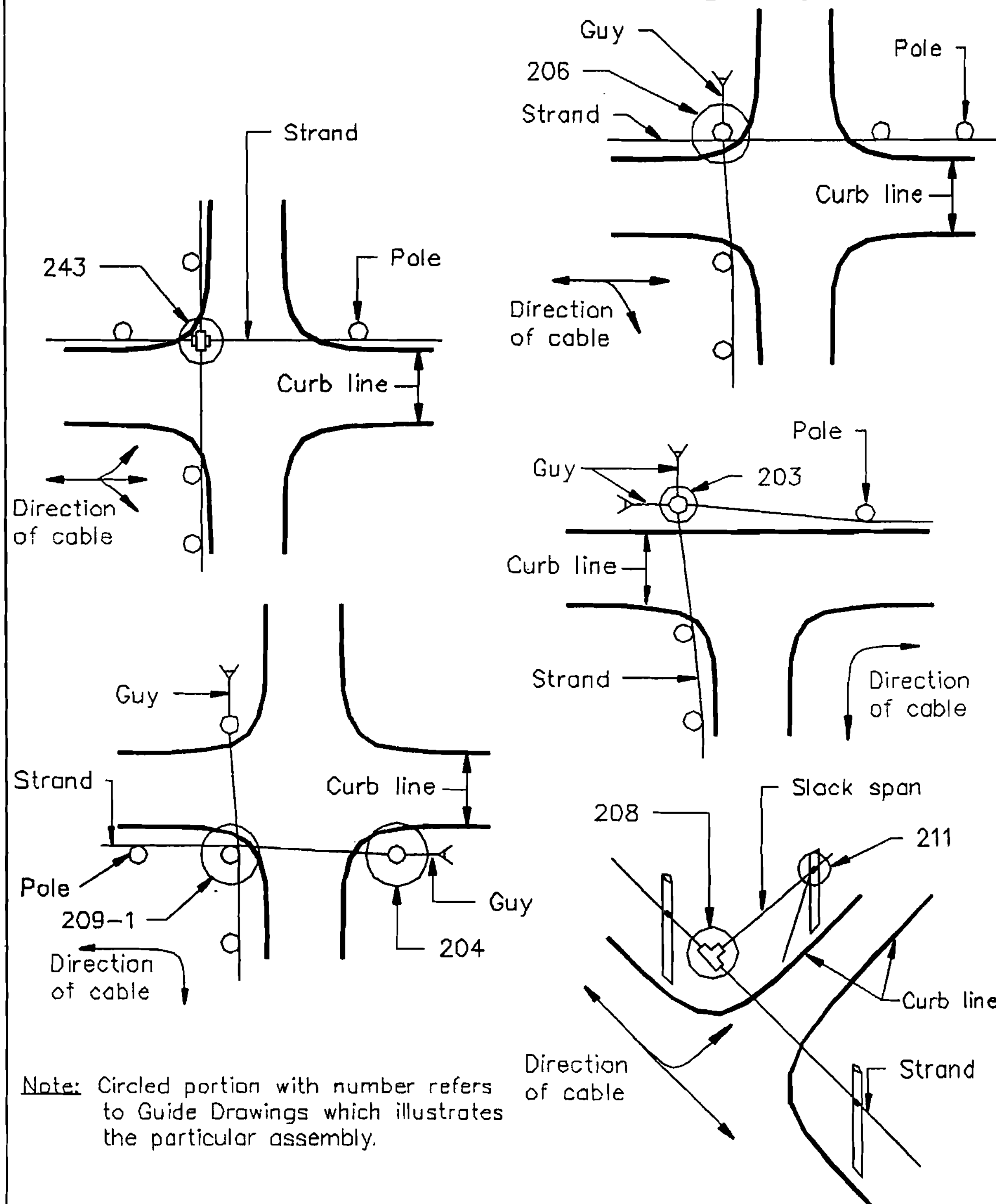
1. An equivalent terminating device (mu) rated to provide the strength of the appropriate suspension strand may be used in lieu of 3-bolt guy clamps listed.

2. For converting English units to metric units use 1 in. = 25.4 mm.

ITEMS	MATERIALS	6M NO. REQ'D	10M NO. REQ'D	16M NO. REQ'D
u	Clamps, guy, 3-bolt	2	2	2
y	Strand, as required	6M	10M	16M
ab	Nuts, thimbleye, for 5/8 in. (16 mm) bolt	1	1	–
ab	Nuts, thimbleye, for 3/4 in. (19 mm) bolt	–	–	1
*dz	Clips, guy	2	2	2

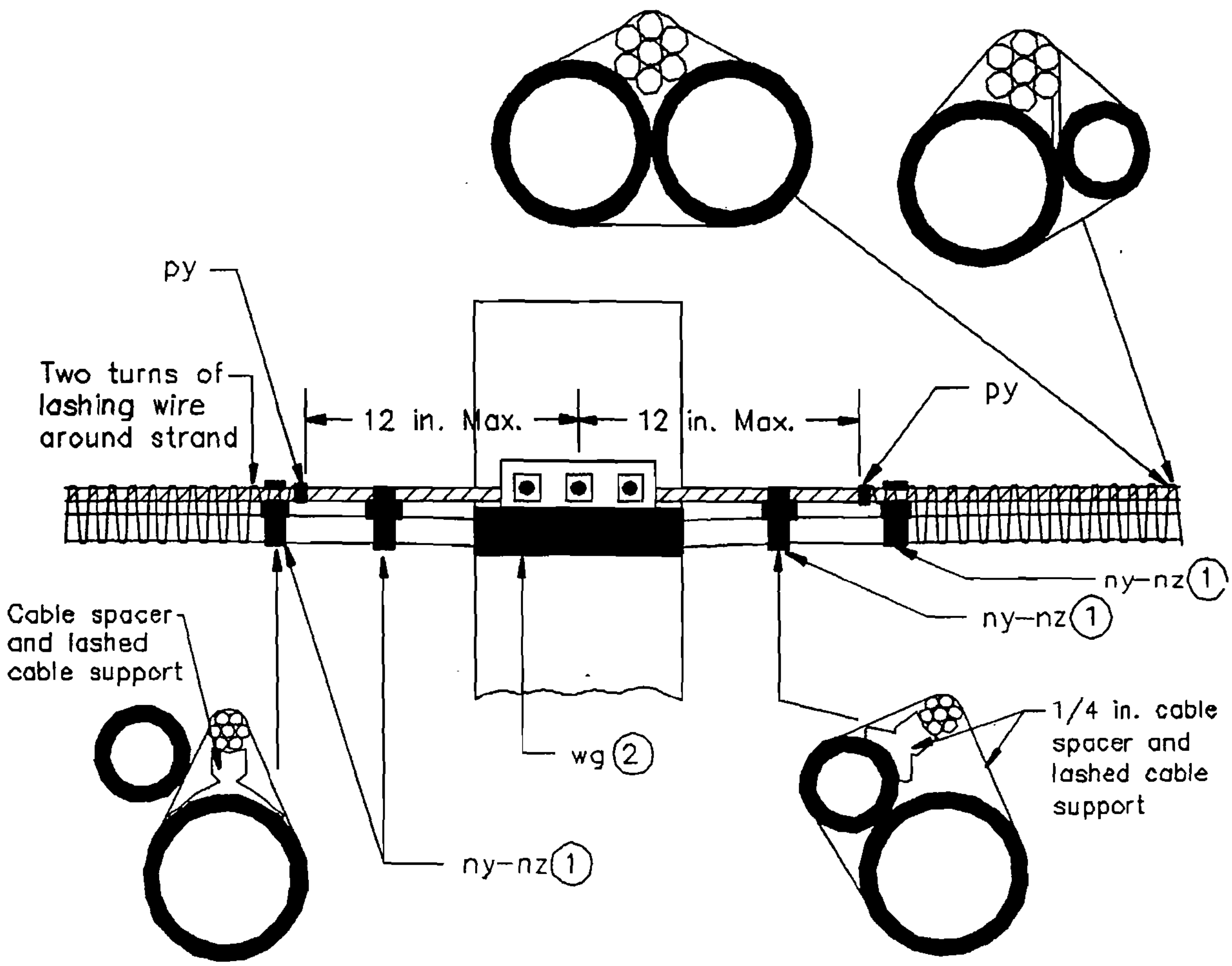
RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
FALSE DEADEND

Scale: NTS | March 2001 | 211



Note: Circled portion with number refers to Guide Drawings which illustrates the particular assembly.

	RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES STRAND LAYOUTS
	Scale: NTS | March 2001
	212



Notes:

(1) Install cable spacers and lashed cable supports as needed to hold cable in position.

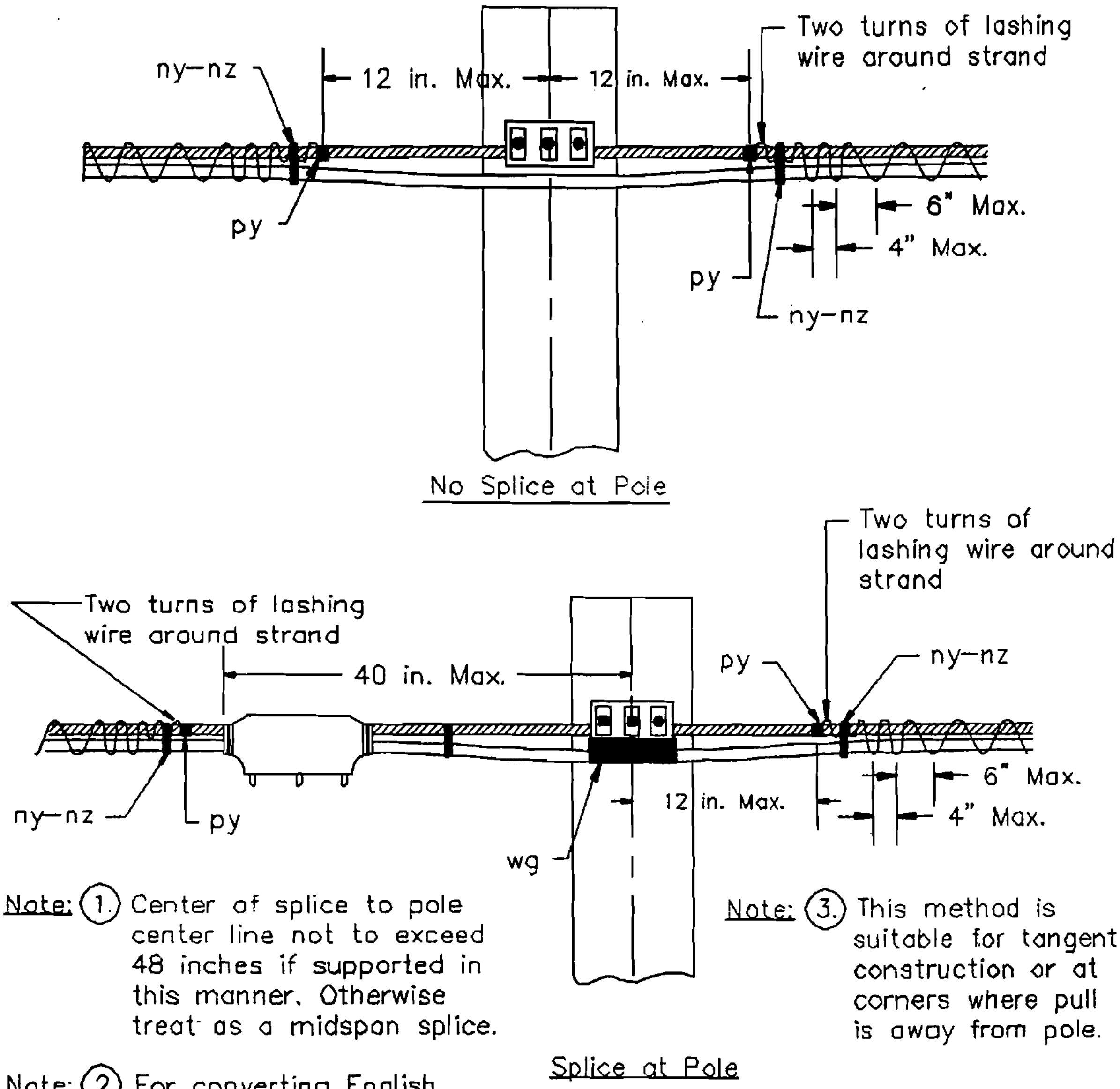
(2) Place split cable guard around cable at point of contact with suspension clamp to prevent abrasion of cable. Secure split cable guard to cable by means of 3 full layers of vinyl tape.

(3) For converting English units to metric units 1 in. = 25.4 mm

ITEMS	MATERIALS
*py	Clamps, terminating, lashing wire
*ny	Spacers, cable, 1/4"
*nz	Supports, lashed cable
wg	Guards, cable, split

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
ARRANGEMENT DETAILS OF CABLES AT
POLE SUPPORTS

Scale: NTS	March 2001
	214



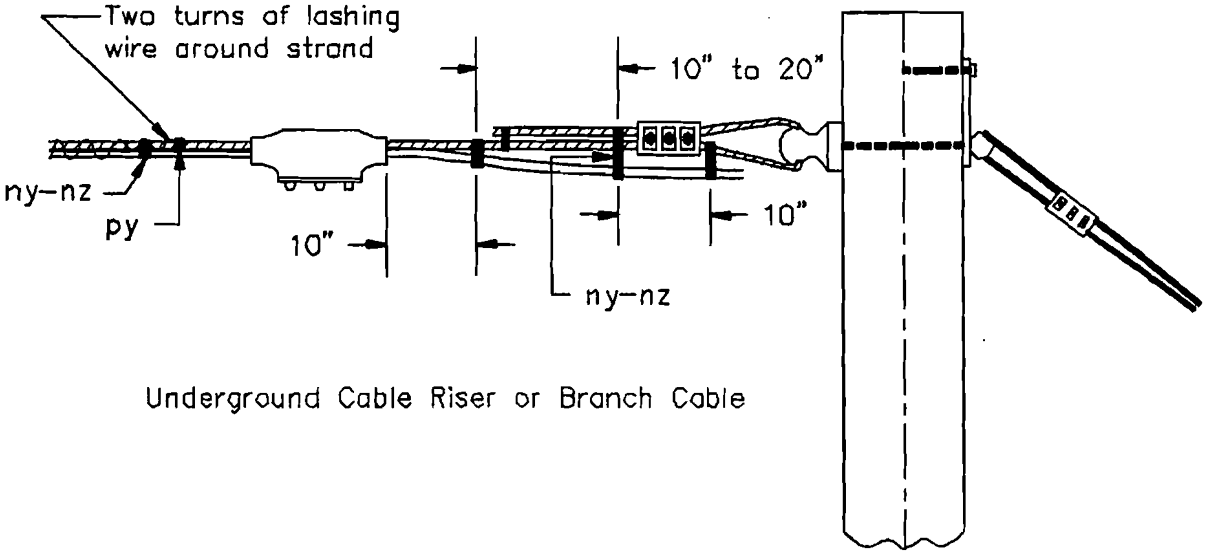
Note: (1.) Center of splice to pole center line not to exceed 48 inches if supported in this manner. Otherwise treat as a midspan splice.

Note: (2.) For converting English units to metric units use 1 in. = 25.4 mm.

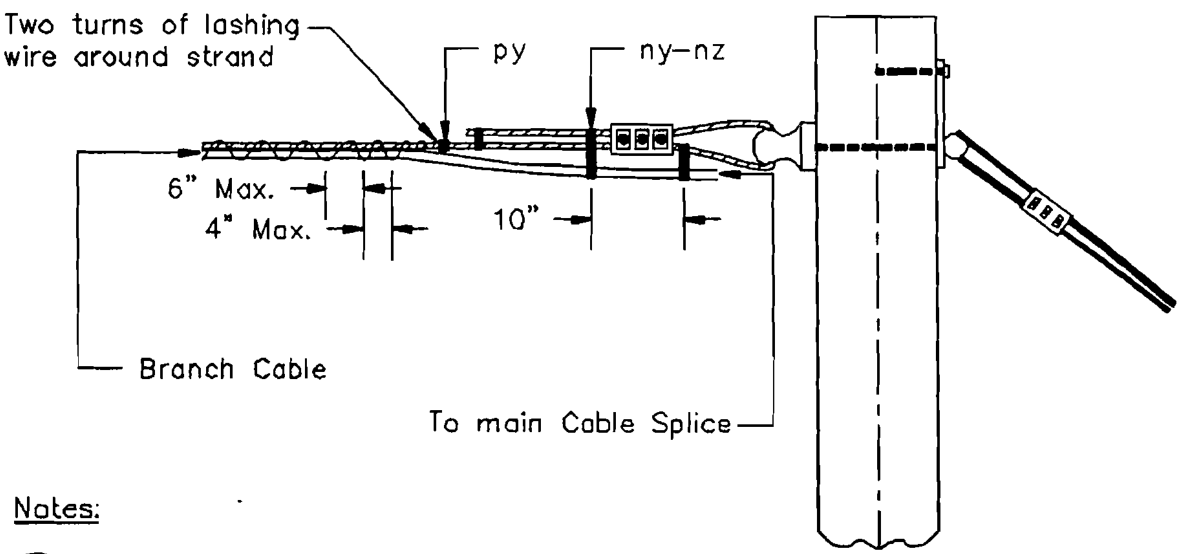
Note: (3.) This method is suitable for tangent construction or at corners where pull is away from pole.

ITEMS	MATERIALS	NO. REQ'D
*ny	Spacers, cable	2
*nz	Supports, lashed cable	2
*py	Clamps, terminating, lashing wire	2
wg	Guard, cable, plastic	1

	RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES LASHED CABLE SUPPORT AT POLE		
	Scale: NTS		March 2001
			241



Underground Cable Riser or Branch Cable



Notes:

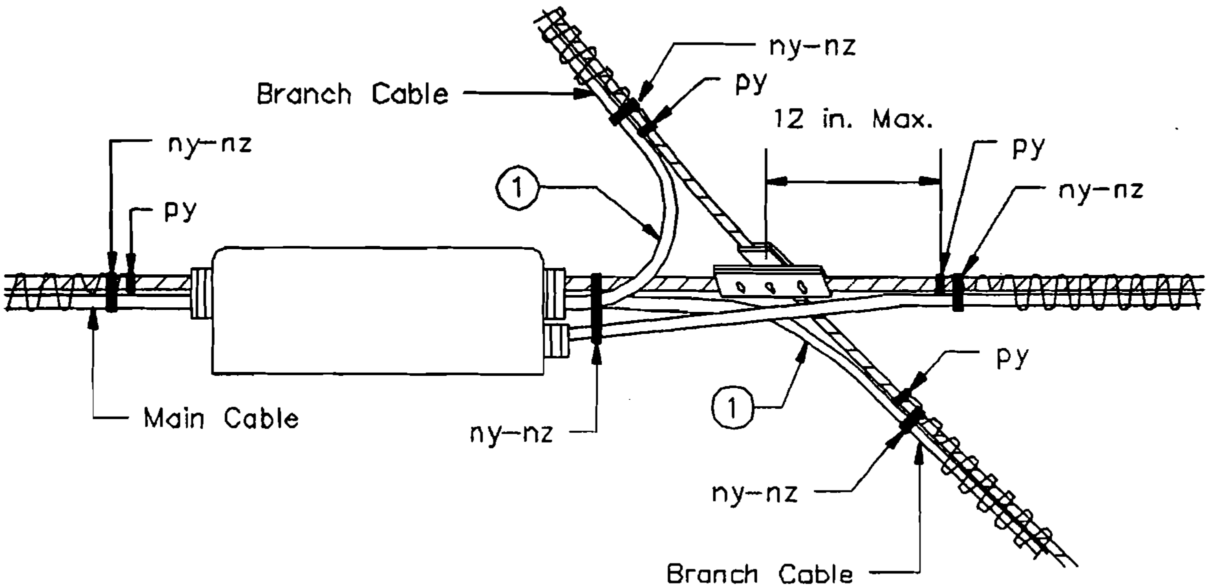
1. For converting English units to metric units use 1 in. = 25.4 mm.

2. This method of terminating lashing wire should be used at deadend junction of aerial cable and underground riser, and junction of branch and main cable.

ITEMS	MATERIALS	NO. REQ'D
*ny	Spacers, cable	as required
*nz	Supports, lashed cable	as required
*py	Clamps, terminating, lashing wire	1

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
LASHING WIRE TERMINATIONS

Scale: NTS | March 2001 | 242



Notes:

1. The radius of bend shall not be less than 10 times the outside diameter for copper cables. THe radius of bend shall not be less than 20 times the outside diameter for fiber optic cables.

2. For converting English units to metric units use 1 in. = 25.4 mm.

ITEMS	MATERIALS	NO. REQUIRED
*ny	Spacers, cable	5
*nz	Supports, lashed cable	5
*py	Clamps, terminating, lashing wire	4

RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES
LASHING WIRE TERMINATIONS AT
SUSPENSION STRAND CROSSOVERS

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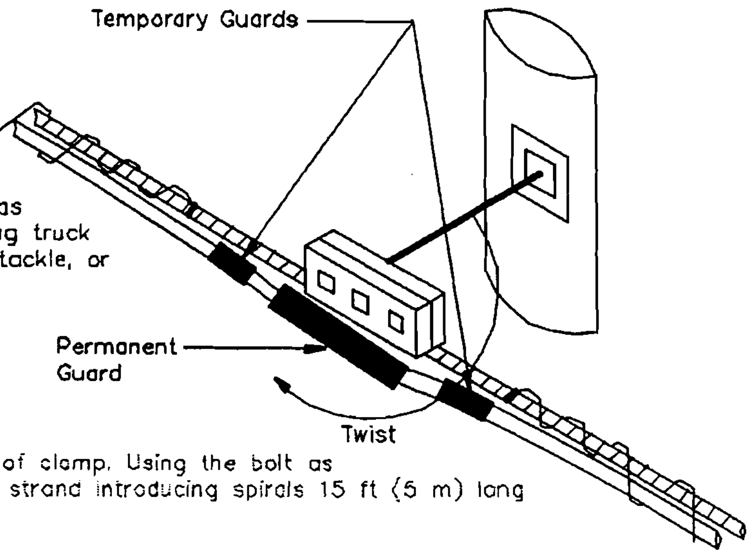
	243

Spiraling Operation Detail



Step (1) Place split cable guards. (plastic)

Step (2) Loosen lashing wire clamps as required to allow for movement of lashing wire.

Step (3) Support and position cable as necessary for operation, using truck mounted derrick, block and tackle, or other means.

Step (4) Remove suspension clamp from through bolt allowing cable and strand to swing free.

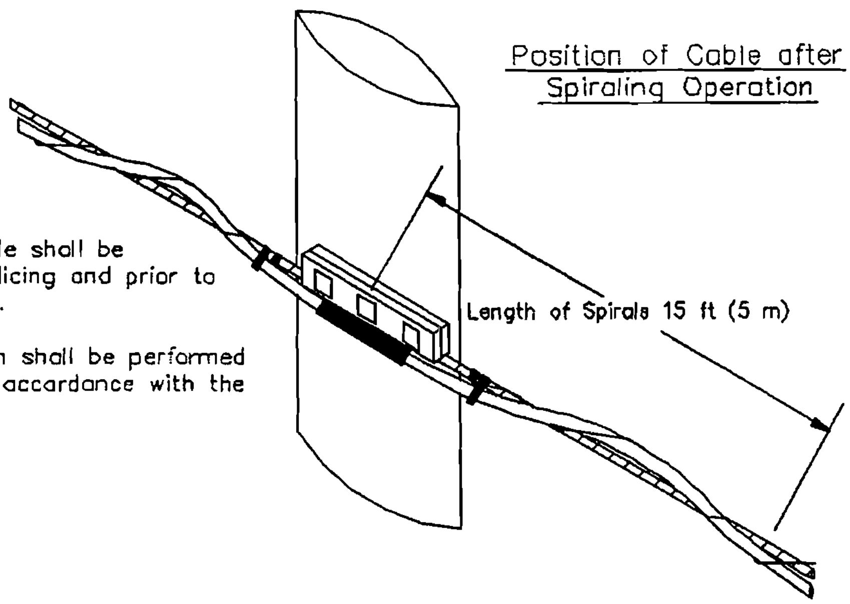
Step (5) Place a bolt in center hole of clamp. Using the bolt as a lever, twist the cable and strand introducing spirals 15 ft (5 m) long in the adjacent spans.

Step (6) In the spiraling operation, lashing wire will tighten in the span on one side of pole and loosen on the other. Lashing wire clamps shall be adjusted to allow for this movement. After spiraling, the lashing wire shall be adjusted, tapping on the strand as the lashing wire is pulled up or adjusted and clamps tightened to hold cable firmly in place.

Step (7) Reattach cable and remove temporary cable guards.

Step (8) A split cable guard shall also be installed on the cable at each tangent pole adjacent to the pole on which spiraling has been performed.

Position of Cable after Spiraling Operation



Notes:

1. Spiraling of aerial cable shall be performed prior to splicing and prior to mounting of terminals.
2. The spiraling operation shall be performed on alternate poles in accordance with the steps shown above.

	RURAL TELECOMMUNICATIONS CONSTRUCTION PRACTICES METHOD OF SPIRALING AERIAL CABLE
	Scale: NTS | | March 2001
	250

SECTION 12

UTILITY ITEM LIST

FRONTIER/CITIZENS COMMUNICATIONS COMPANY PROPOSED RELOCATION OF TELEPHONE UTILITIES STP-101(16) ESTIMATED UTILITY ITEMS		
773-25.26	INSTALL 35-2 SYP WOOD POLE	1
773-25.27	INSTALL 35-4 SYP WOOD POLE	1
773-25.28	INSTALL 3" SLIC SPLICE CASE	22
773-25.29	INSTALL 5" SLIC SPLICE CASE	57
773-25.30	INSTALL 7" SLIC SPLICE CASE	4
773-25.31	INSTALL 9" SLIC SPLICE CASE	4
773-25.32	INSTALL AKF25-24(.25M) COMM. CA.	128
773-25.33	INSTALL AKF25-24(10M) COMM. CA.	1751
773-25.34	INSTALL AKF50-24(10M) COMM. CA.	316
773-25.35	INSTALL AKF100-24(10M) COMM. CA.	934
773-25.36	INSTALL AKF100-24(E) COMM. CA.	426
773-25.38	INSTALL AKF300-24(10M) COMM. CA.	536
773-25.39	INSTALL AKF400-24(10M) COMM. CA.	12332
773-25.41	INSTALL AKF600-24(10M) COMM. CA.	4670
773-25.43	INSTALL BM80 1 INCH RISER GUARD	2
773-25.44	INSTALL BM83 SERVICE GUARD	4
773-25.45	INSTALL FOSB(A)2 SNOW SHOE	22
773-25.46	INSTALL HACO(12) FIBER SPLICE CASE	1
773-25.47	INSTALL HACO(24) FIBER SPLICE CASE	1
773-25.48	INSTALL HACO(72) FIBER SPLICE CASE	4
773-25.50	INSTALL HO1 FIBER CA. SPLICING	96
773-25.51	INSTALL PE1-3G DOWN GUY ASSEMBLY	81
773-25.52	INSTALL PE2-3G OVHD GUY ASSEMBLY	13
773-25.53	INSTALL PF1-5A ANCHOR ASSEMBLY	1
773-25.54	INSTALL PF3-5A SCREW IN ANCHOR ASSMBLY	34
773-25.55	INSTALL PF5-3A ROCK ANCHOR ASSMBLY	36
773-25.56	INSTALL PG31-100(88) LOAD COIL	1
773-25.57	INSTALL PG32-12(88) LOAD COIL	3
773-25.58	INTALL PM11 GUY GUARD ASSEMBLY	77
773-25.59	INSTALL PM2A POLE GRND ASSMBLY	181
773-25.60	INSTALL PM52 POLE NUMBER	47
773-25.61	INSTALL PM91-25-24-20 CABLE STUB	2
773-25.62	INSTALL PM91-50-24-20 CABLE STUB	2
773-25.63	INSTALL PM91-200-24-24 CABLE STUB	2
773-25.64	INSTALL SEA2-22 AERIAL DROP	7012
773-25.65	INSTALL SEB2-22 BURIED DROP	422
773-25.66	INSTALL SEB5-22 BURIED DROP	300
773-25.67	INSTALL UO12 UNDGRD FIBER CABLE	100
773-25.68	INSTALL YFD12-SMDE(10M) FIBER CA.	38
773-25.69	INSTALL YFD12-SMDE(E) FIBER CA.	874
773-25.70	INSTALL YFD12-SMDE LOOP FIBER CA.	450

773-25.71	INSTALL YFD24-SMDE(.25M) FIBER CA.	156
773-25.72	INSTALL YFD24-SMDE LOOP FIBER CA.	200
773-25.73	INSTALL YFD72-SMDE(10M) FIBER CA.	15714
773-25.74	INSTALL YFD72-SMDE LOOP FIBER CA.	1800
773-25.75	REARRANGE EXISTING BURIED CA.	3
773-25.76	REARRANGE CABLE STRAIGHT LINE POLE	4
773-25.77	REARRANGE CABLE ANGLE POLE	20
773-25.78	REARRANGE COMM. CABLE	600
773-25.79	REARRANGE COMM. CA. SPLICING	5190
773-25.80	REARRANGE FIBER CA. SPLICING	132
773-25.81	REARRANGE COMM. SPLICE CASE	2
773-25.82	REARRANGE PM4 CABLE ARM	1
773-25.83	REARRANGE AERIAL DROP WIRE	77
773-25.84	REARRANGE RISER GUARD	2
773-25.85	REARRANGE WIRE TERMINAL	29
773-25.86	REMOVE COMM. CABLE	51931
773-25.87	REMOVE DISTRIBUTION WIRE	2
773-25.88	REMOVE COMM. SPLICE CASE	1
773-25.89	REMOVE GUY ASSEMBLY	91
773-25.90	REMOVE ANCHOR ASSEMBLY	42
773-25.91	REMOVE PM4 CROSS ARM	7
773-25.92	REMOVE SYP POLE	99
773-25.93	REMOVE AERIAL DROP	152
773-25.94	REMOVE RISER GUARD	10
773-25.95	REMOVE WIRE TERMINAL	7
773-25.96	INSTALL AKFS104-24(10M) COMM. CA.	296
773-25.97	INSTALL AKF200-24(10M) COMM. CA.	224
773-25.98	INSTALL HC3 COMM. CA. SPLICING	4302

SECTION 13

FORMS

U.S. Department of Agriculture
Rural Utilities Service

CERTIFICATE

With respect to compliance with the second paragraph of the Rural Electrification Act of 1938, being Title IV of the Work Relief and Public Works Appropriation Act of 1938 (Public Resolution No. 122, 75th Congress, approved June 21, 1938).

Rural Utilities Service Project ______________________________.

The undersigned, being, the ______________________________[1],

in a certain contract No. ______________ *dated* ____________, ______, *between the undersigned*

and ______________________________[2],

does hereby certify that in the performance of the said contract there have been used or furnished no unmanufactured articles, materials or supplies which have not been mined or produced in the United States[3] or in any eligible country and no manufactured articles, materials or supplies which have not been manufactured in the United States or in any eligible country substantially all from articles, materials or supplies mined, produced or manufactured, as the case may be, in the United States or in any eligible country, except to the extent that compliance with the second paragraph of the Rural Electrification Act of 1938, being Title IV of the Work Relief and Public Works Appropriation Act of 1938 (Public Resolution No. 122, 75th Congress, approved June 21, 1938) has been waived by the Administrator of the Rural Utilities Service. For purposes of this certificate, an "eligible country" is any country that applies with respect to the United States an agreement ensuring reciprocal access for United States products and services and suppliers to the markets of that country, as determined by the United States Trade Representative.[4]

____

By ______________________________

Date ______________, *20*____

---

[1] Insert "Contractor," "Subcontractor," "Seller," Or "Material Supplier," as the case may be.
[2] Insert the name of the RUS Borrower.
[3] United States means United States, its territories and possessions.
[4] A current list of eligible countries may be obtained by contacting RUS.

U.S. Department of Agriculture
Rural Utilities Service

WAIVER AND RELEASE OF LIEN

WHEREAS the undersigned, ______________________________
NAME OF MANUFACTURER, MATERIAL SUPPLIER OR SUBCONTRACTOR

has furnished to ______________________________ *the following:*
NAME OF CONTRACTOR

______________________________ *for*
KIND OF MATERIAL AND SERVICES FURNISHED

use in the construction of a project belonging to ______________________________
NAME OF BORROWER

and designated the Rural Utilities Service as ______________________________
RUS DESIGNATION

NOW, THEREFORE, the undersigned, ______________________________
NAME OF MANUFACTURER, MATERIAL SUPPLIER, OR SUBCONTRACTOR

for and in consideration of $ ____________________ *and other good and valuable consideration, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all liens, or right to or claim of lien, on the above described project and premises, under any law, common or statutory, on account of labor or materials, or both, heretofore or hereafter furnished by the undersigned to or for the account of*

said ______________________________ *for said project.*
NAME OF CONTRACTOR

Given under my (our) hand(s) and seal(s) this __________ *day of* __________ *,20* _____ .

____
Name of Manufacturer, Material Supplier, or Subcontractor

By ______________________________
President

This Waiver and Release of Lien must be signed with the full name of the Manufacturer, Material Supplier, or Subcontractor. If the Manufacturer, Material Supplier, or Subcontractor is a partnership, this Waiver and Release of Lien must be signed in the partnership name by a partner. If the Manufacturer, Material Supplier, or Subcontractor is a corporation, this Waiver and Release of Lien must be signed in the corporate name by a duly authorized officer and the corporate seal affixed and attested by the Secretary of the Corporation.

U.S. Department of Agriculture
Rural Utilities Service

CERTIFICATE OF CONTRACTOR

______________________________________ *certifies that he or she is the*

_________________________ *of* ____________________________,
TITLE NAME OF CONTRACTOR

the Contractor, in a Construction Contract No. ____________________________,

dated _________________________, *20*_____, *entered into between the Contractor and*

____________________________________, *RUS designation* ____________,
NAME OF RUS BORROWER

the Owner, and that he or she is authorized to and does make this certification on behalf of said Contractor in order to induce the Owner to make payment to the Contractor, in accordance with the provisions of said Construction Contract.

Undersigned further says that all persons who have furnished labor in connection with said construction have been paid in full, that the names of manufacturers, material suppliers, and subcontractors that furnished material or services or both in connection with such construction and the kind or kinds of material or services or both so furnished are:

NAME	*KIND OF MATERIAL OR SERVICES*

and that the releases of liens executed by all such manufacturers, material suppliers, and subcontractors have been furnished the Owner.

____________________ *By* ______________________________
Date *President*

This Certificate must be signed with the full name of the Contractor. If the Contractor is a partnership, this Certificate must be signed in the partnership name by a partner. If the Contractor is a corporation, this Certificate must be signed in the corporate name by a duly authorized officer.

U.S. DEPARTMENT OF AGRICULTURE
RURAL UTILITIES SERVICE

BIWEEKLY PROGRESS REPORT OF TELEPHONE CONSTRUCTION AND ENGINEERING SERVICES

No further loan advances may be made unless this report is completed & filed as required (7 U. S. C. 901 et seq.)

PROJECT

WEEK ENDING 20

INSTRUCTIONS - *Engineer prepares 5 copies of this form every other Friday night from time staking commences and continuing until completion of the project, mail 1 copy to reach RUS Monday. Send 1 copy to RUS Field Engineer; 1 copy to Owner and retain 1 copy. Sections to be completed as applicable.*

PART I OUTSIDE PLANT

(☐ CONTRACT NO. ☐ FORCE ACCOUNT PROPOSAL NO.)

CONSTRUCTION STATUS

TOTAL DOLLAR VALUE OF ASSEMBLY UNITS ON STAKING SHEETS RELEASED TO DATE
$

TOTAL CONTRACT PRICE AS AMENDED: $

CONTRACT MILEAGE AS AMENDED
EXCLUSIVE OF MODIFICATIONS ; MODIFICATIONS

OPERATION	CONSTRUCTION COMPLETED					
	THIS WEEK		TO DATE		SCHEDULE TO DATE	
	NEW CONSTR.	MODIFI-CATIONS	NEW CONSTR.	MODIFI-CATIONS	NEW CONSTR.	MODIFI-CATIONS
1. MILES STAKED						
2. MILES RELEASED						
3. MILES WITH RIGHT-OF-WAY CLEARED						
4. MILES WITH POLES SET, GUYED, AND ANCHORED						
5. MILES WITH AERIAL WIRE: AND AERIAL CABLE IN PLACE						
6. MILES OF CABLE OR WIRE BURIED						
7. MILES OF BURIED CABLE OR WIRE WITH PEDESTALS INSTALLED AND SPLICING COMPLETED						
8. NO. OF SERVICE DROPS AND TELEPHONE SETS INSTALLED						
9. MILES INSPECTED WITH ACCEPTANCE TESTS COMPLETED						
10. MILES INVENTORIED BY ENGINEER						

DATE CONSTRUCTION STARTED	DATE CONSTRUCTION SCHEDULED TO BE COMPLETED PER CONTRACT	ESTIMATED COMPLETION DATE OF CONSTRUCTION (Including time extentions and cleanup)	DATE CONSTRUCTION COMPLETED (Including cleanup)
20	20	20	20

CAUSES FOR DELAYED CONSTRUCTION - THIS WEEK (Check reasons)

☐ WEATHER - NO. OF DAYS DELAYED BY:

SNOW	RAIN	FROST	WIND	RESULTS OF SNOW, RAIN OR FROST

☐ MATERIAL ☐ PERSONNEL ☐ EQUIPMENT
☐ EASEMENTS ☐ STAKING ☐

REMARKS: (Explain delays)

FINAL INVENTORY DOCUMENTS

STATUS

SCHEDULED FOR SUBMISSION TO RUS FIELD ENGINEER

DATE SUBMITTED TO RUS FIELD ENGINEER
- -

APPROVED (Items above):

NAME OF CONTRACTOR (or Owner if Force Account) NAME OF ENGINEERING FIRM

SIGNATURE CONTRACTOR'S SUPT. (or System .Mgr. if Force Acct.) SIGNATURE OF RESIDENT ENGINEER

EXTENSION OF CONSTRUCTION TIME

IT IS REQUESTED THAT THE TIME SPECIFIED FOR THE CONSTRUCTION OF THE PROJECT BE EXTENDED ________ DAYS FOR THE FOLLOWING REASONS:

APPROVED:

NAME OF OWNER NAME OF CONTRACTOR

SIGNATURE AND TITLE SIGNATURE AND TITLE

Specifications and Drawings
For
Power Line Relocation

TDOT
Project: 18038-2237-14
STP-101(16)
State Route 101 (16)

By

FISHER & ARNOLD, INC.
9180 Crestwyn Hills Drive • Memphis, Tennessee 38125
901-748-1811 • Fax: 901-748-3115 • Web: www.fisherarnold.com
Architects • Engineers • Environmental Consultants • Interior Designers • Landscape Architects • Planners • Surveyors

Quantities provided on MUES sheet and title sheet are estimates only.
Quantity discrepancies between the MUES documents and the design plans shall be resolved in favor of the design plans.

INDEX OF CONSTRUCTION UNITS

1. Specifications for Construction

2. Poles:

790-01.05	30-6	30' Class 6 Wood Pole
790-02.04	35-5	35' Class 5 Wood Pole
790-02.05	35-6	35' Class 6 Wood Pole
790-03.02	40-3	40' Class 3 Wood Pole
790-03.03	40-4	40' Class 4 Wood Pole
790-04.02	45-2	45' Class 2 Wood Pole
790-04.03	45-3	45' Class 3 Wood Pole
790-05.02	50-2	50' Class 2 Wood Pole
790-06.02	55-2	55' Class 2 Wood Pole
790-07.01	60-1	60' Class 1 Wood Pole
790-20.01	65-1	65' Class 1 Wood Pole

3. Single-Phase Pole Tops:

790-22.01	VA1	Single Primary Support
790-22.10	VA3	Primary 1-Phase 20° to 60° Angle
790-22.11	VA4	Primary 1-Phase 60° to 90° Angle
790-22.13	VA5	Dead-end (single)
790-22.12	VA5-2 VA5-4	Primary, Single Phase Tap
790-22.16	VA6	Vertical Dead-end (Double)

4. Two-Phase Pole Tops:

790-24.08	VB7-1	Cross arm Construction Dead-end (Single)
790-24.10	VB8	Cross arm Construction Dead-end (Double)

5. Three-Phase Pole Tops:

790-26.01	VC1-1	Cross arm Construction Double Support
790-26.03	VC1-2P	Cross arm Construction Single Support (LC)
790-26.15	VC2-2P	Cross arm Construction Double Support (LC)
790-26.20	VC3L	Vertical Construction (LC)
790-26.18	VC3-1	Vertical Construction (Standoff Bracket)
790-26.20	VC3-1L	Vertical Construction (LC)
790-26.21	VC4-1	Vertical Construction
790-26.24	VC5-1M	Vertical Construction Dead-end (Single) (LC)

790-26.24	VC5-1L	Vertical Construction Dead-end (Single) (LC)
790-26.26	VC7	Cross arm Construction Dead-end (Single)
790-26.26	VC7-1	Cross arm Construction Dead-end (Single)
790-26.26	VC7-3L	Cross arm Construction Dead-end (Single)
790-26.27	VC8	Cross arm Construction Dead-end (Double)
790-26.28	C8-2LA	Cross arm Construction Dead-end (Double) (LC)

6. Guy Assemblies:

790-32.01	E1-2	Single Down Guy, Through Bolt
770-32.01	E1-5	Single Down Guy, Through Bolt
770-32.06	E1-5G	Single Down Guy, Through Bolt
770-32.06	E1-5GH	Single Down Guy, Through Bolt
770-32.01	E1-5H	Single Down Guy, Through Bolt
790-32.28	E3-10	Single Down Guy, Wrapped Type

7. Anchor Assemblies:

790-33.18	F5-3A	Expanding Anchor Assembly

8. Service Assemblies:

790-31.02	K11	Service Assembly (Cable)
790-31.02	K11-2	Service Assembly (Cable)
790-31.02	K11-N	Service Assembly (Cable)
790-31.02	K15	Service Assembly (For Ranch Type Houses)
790-30.01	J5	Secondary Assembly
790-30.03	J6	Secondary Assembly (Copper)
790-xx.xx	UM5	Underground Riser
790-xx.xx	VUM2-3-1L	3Ph UG Source Riser Pole w/Cond, 200A CO

9. Transformer Assemblies:

790-46.01	G105A-5	Single Phase at 1-Phase Tangent
790-46.01	G105-1.5	Single Phase at 1-Phase Tangent
790-46.01	G105-3	Single Phase at 1-Phase Tangent
790-46.01	G105-10	Single Phase at 1-Phase Tangent
790-46.01	G105-15	Single Phase at 1-Phase Tangent
790-46.01	G105-50	Single Phase at 1-Phase Tangent
790-46.01	G106-15	Single Phase at Dead-end
790-47.02	G210-15	Two Transformers Cluster Mounted
790-47.02	G210-37	Two Transformers Cluster Mounted
790-47.02	G210-15/25	Three Transformers Cluster Mounted
790-49.02	G310-25	Three Transformers Cluster Mounted

10. Miscellaneous Assemblies:

790-68.01	M2-11A	Grounding Assembly Ground Rod Type
790-61.10	VM3-3A	Disconnect Switches (2 or 3 Single-Phase)
790-60.03	VM3-10	Single Phase Oil Circuit Recloser
790-60.05	VM3-11A	2 or 3 Sectionalizing Oil Circuit Recloser
790-65.06	VM5-6	Lightning Arrestor
790-68.10	VM5-9	Single Disconnect Switch

11. Conductors:

790-40.02	#2 ACSR
790-30.13	#2 TRIPLEX
790-30.06	#6 DUPLEX
790-40.03	1/0 ACSR
790-40.05	3/0 ACSR
790-40.49	795 AAC

12. Removals

790-98.01 REMOVAL OF WIRE

2 ACSR
336 AAC
6 Duplex
2 AT
1/0 AT
2/0 AT

790-98.02 REMOVAL OF POLES

30Ft Class 5 Wood Pole
30Ft Class 6 Wood Pole
35Ft Class 7 Wood Pole
35Ft Class 5 Wood Pole
35Ft Class 6 Wood Pole
40Ft Class 2 Wood Pole
40Ft Class 3 Wood Pole
40Ft Class 4 Wood Pole
40Ft Class 5 Wood Pole
45Ft Class 2 Wood Pole
45Ft Class 4 Wood Pole
50Ft Class 2 Wood Pole
50Ft Class 4 Wood Pole
55Ft Class 1 Wood Pole

60Ft Class 1 Wood Pole
65Ft Class 1 Steel Pole
65Ft Class H Wood Pole
70Ft Class 1 Wood Pole
75Ft Class 1 Wood Pole
75Ft Class H Wood Pole
85Ft Class 1 Wood Pole
LD4 105Ft Steel Pole
LD6 105Ft Steel Pole

790-98.03 REMOVAL OF FRAMING/ASSOCIATED APPARATUS

TCD-11-FG	Transmission Cross arm
TCD-26	Transmission Cross arm
TH-7	Two Pole Double Dead-end
TM-2	Insulator String with Cushioned Suspension
TM-2D	Dead-end Assembly
TM-3	Line Post Insulator Assembly
TM-3A	Cushioned Support Clamp
TM-3E	Vertical Post Insulator
TP-34G	Tangent Horizontal Line Post
TP-7	Tangent Line Post
TS-3G	Medium and Large Vertical Angles
A1-1	Double Support Tangent
A4	Dead-end Angle
A4-P	1-Phase Angle
A4T	Dead-end Angle
A5	1-Phase Dead-end
A5-1	1-Phase Tap
A5-2	1-Phase Tap
VA5-2	1-Phase Tap
A6	1-Phase Vertical Dead-end Double
VA6P	1-Phase Vertical Dead-end Double
A9	1-Phase Cross arm Double Arm
B7-1	Cross arm Construction Dead-end (Single)
B8	Cross arm Construction Dead-end (Double)
C1-2HAX	3-Phase Cross arm Construction Double Support
C1-2U	3-Phase Cross arm Construction Double Support
C1-H	3-Phase Cross arm Construction Double Support
C2H	3-Phase Cross arm Construction Double Support
C2-2U	3-Phase Cross arm Construction Double Support
C3	3-Phase Vertical Construction Angle
C7	3-Phase Cross arm Construction Dead-end (Single)
VC7	3-Phase Cross arm Construction Dead-end (Single)
C8-1	3-Phase Cross arm Construction

C8-2P	3-Phase Cross arm Construction Dead-end
E1-2	Single Down Guy, Through Bolt Type
E1-3	Single Down Guy, Pole Band Type
E1-5G	Single Down Guy, Through Bolt With Insulator
E2-2	Single Overhead Guy, Through Bolt Type
E2-5	Single Overhead Guy, Through Bolt Type
E3-2	Single Down Guy, Wrap Type
E3-10	Single Down Guy, Wrap Type
F1-2	Anchor Assembly
G105-50	Single Phase Transformer with Connections
G105-25	Single Phase Transformer with Connections
G105-10	Single Phase Transformer with Connections
J5	Secondary Assembly
J6	Secondary Assembly (Copper)
J7	Secondary Assembly
J10	Secondary Assembly
K11	Service Assembly (Cable)
K11-2	Service Assembly (Cable)
K11-N	Service Assembly (Cable)
K15	Service Assembly (For Ranch Type House)
K16	Service Assembly (For Ranch Type House)
M2-11	Ground Assembly Ground Rod Type
M2-11A	Ground Assembly Ground Rod Type
M3-11A	2 or 3 Sectionalizing Oil Circuit Recloser
M3-16	Gang Operated Air Break Switch
M5-4	Removable Units for 25kV Conversion
M5-6	Miscellaneous Primary Assemblies
M5-7	Miscellaneous Primary Assemblies
M5-8	Miscellaneous Primary Assemblies
M5-9	Miscellaneous Primary Assemblies
M5-12	Miscellaneous Primary Assemblies
M5-13	Miscellaneous Primary Assemblies
TH-7	Two Pole Double Dead-end
TP-7	Tangent with Line Post Insulators
TS-3	Medium Vertical Angle
UA1	Single Phase Cable Terminal Pole
UM2-3-1L	3-Phase UG Source Riser Pole w/Cond, 200A CO
UM5	Underground Riser
VM5-A	Single14.4kV Pin Ins & Pin Conv Install
VM5-8	Single 14.4kV Susp Ins Conv Construction Unit

13. Sags and Tensions

Section 1: Specifications for Construction

1. General

All Construction work shall be performed in a safe, thorough, and skillful manner in accordance with the staking sheets, plans and specifications, and the construction drawings.
The 2007 or latest edition of the National Electric Safety Code (NESC), ANSI C2, shall be followed except where local regulations are more stringent, in which case local regulations shall govern.

The permitted loading, strength, and spacing (separation) of structures, assemblies and conductors shown on the assembly drawings in this bulletin are based on and are in compliance with the 2007 Edition of the NESC.

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. Distribution lines that underbuild transmission circuits or that cross over limited access highways and railroad tracks shall be constructed with not less than the Grade B strength requirements as described in NESC Section 26.

Pole top construction on main primary line must be rated for the maximum 795AAC conductor design tension and maximum weighted span.

Double dead-end crossarms of VC8-2LA pole top units for use with 795AAC primary conductors must have minimum longitudinal strength of 10,000 lbs. per wire.

Tangent crossarms for all C1 and C2 pole top units for use with 795AAC primary conductors must have minimum vertical loading rating of 5,000 lbs. per side.

Pole top hardware, anchors, and guys for use with main line primary 795AAC primary conductors and associated pole top units mentioned above must be rated appropriately.

2. Distribution of Poles

Large, dense poles that have no serious defects shall be used at transformer, dead-end, angle, and corner locations.

3. Pole Setting

Pole length selection on design plans is based upon imbedded depth of power pole in solid rock. Pole lengths shall be increased by 5 ft. where "Setting in Soil" depths apply and also where the layer of soil above solid rock is less than 2 ft. The taller/longer poles shall be topped or adjusted according to the instructions below.

Where layer of soil above solid rock is less than 2 ft the taller/longer pole shall be either topped by an amount equal to (5 ft. minus the depth of the soil above solid rock) or buried into solid rock by an additional amount equal to (5 ft. minus the depth of the soil above solid rock).

"Setting in Soil" depths shall apply where:

a. Poles are set in soil;
b. There is a layer of soil of more than two (2) feet in depth over solid rock; or
c. The hole in solid rock is not substantially vertical or the diameter of the hole at the surface of the rock exceeds approximately twice the diameter of the pole at the same level

"Setting in all Solid Rock" depths shall apply where poles are 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 shall be the depth of the soil in addition to the depth specified under "Setting in All Solid Rock" provided.

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

The minimum depth for setting poles shall be as follows:

As Shown on Plans "Setting in all Solid Rock"		Adjustments of Pole lengths and Burial Depths when solid rock is not encountered - "Setting in Soil"	
Length of Pole (feet)	Setting in Rock (feet)	Length of Pole in Soil (feet)-Adjusted	Total Depth in Soil
30	3.5	35	8
35	4	40	8.5
40	4	45	8.5
45	4.5	50	9
50	4.5	55	9
55	5	60	9.5
60	5	65	9.5
65	6	70	10.5
70	6	75	10.5
75	7	80	11.5

Note: Design Plans Based upon embedded depth of power poles in rock.
When Rock is encountered adjust the pole heights and setting depths per the table above.

Poles shall be set so that the cross-arm gains face in opposite directions on every other pole. However at line dead-ends, the last two poles shall be set so that the pole gains face the dead-end. On unusually long spans, the poles shall be set so that the cross-arm is located on the side of the pole away from the long span. On lines that curve, the cross-arms shall be installed on the side of the pole that faces the midpoint of the curve. On sloping terrain, the cross-arms shall be installed on the uphill side of the pole. Pole top insulator brackets and pole top pins shall be installed on the opposite side of the pole from the gain.

At line angles and dead-ends, poles shall be set such that they lean away from the strain of the primary conductors. They shall be set such that the final rake is not less than 1 inch for each 10 feet of pole height above ground after the conductors are installed at the required tension.

Newly set poles shall be backfilled and tamped to the full depth. Excess dirt shall be banked around the base of the pole.

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

Poles shall be raked against the conductor strain not lass than 1 inch for each 10 feet of pole length nor more than 2 inches for each 10 feet of pole length after conductors are installed at the required tension.

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

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

4. <u>Grading of Line</u>

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

5. <u>Guys and Anchors</u>

The design engineer shall determine the number and type of guys needed to be installed.

Guys shall be attached to the pole as shown in the construction drawings and shall be installed before conductors are strung. Dead-end structure guys shall be installed, as nearly as practicable, in line with the pull of conductors. Guys that bisect line angles (bisector guys) at line angle structures shall be installed as nearly as practicable to the true bisector of the line angle.

The distance from the pole to the anchor rod (the guy lead) is recommended to be the same distance as from the ground to the guy attachment on the pole. This 1:1 guy slope is especially recommended on dead-end structures.

The NESC requires that the grade of construction of guys be the same or higher as the grade of construction of: (1) the pole or structure to which they are attached, or (2) the highest grade required for any conductors supported by the pole or structure.

If the separation on the pole between any guy attachment bolt or hardware and any phase conductor attachment bolt is less than 15 inches, then a guy strain insulator assembly shall be installed at the top of the guy and the guy wire shall be effectively grounded below the insulator by bonding the guy wire to the system neutral and the pole ground if present. Alternatively, an insulated extension link (item "eu") shall be installed in the primary conductor tap, dead-end, or suspension angle subassembly where it attaches to the pole.

Down guy and overhead guy wires shall be effectively grounded in accordance with Rule 215C2 of the NESC and in accordance with the RUS assembly drawings. Effectively grounded guy wires provide a direct path to ground and thus decrease the chances of electric shock, serious injury and even death to a person standing on the ground and making contact with a guy wire that has accidentally become energized by means of contact with a primary, secondary, service or neutral conductor. Furthermore, effectively grounded guy wires bonded to anchor rods decrease the overall system impedance to ground and improve the chances of primary over-current protection devices to operate as designed.

Down guys installed on tangent, double dead-end assemblies shall have a minimum clearance to the neutral conductor of 6 inches and shall have a guy strain insulator installed at the top of the guy that extends from the pole attachment to at least 12 inches past the neutral conductor. Alternatively, two down guys without guy strain insulators may be installed, one on each side of the neutral, such that clearance between each down guy wire and the neutral conductor is a minimum of 12 inches. For either of the above designs, the down guy wire shall be effectively bonded to ground in accordance with RUS specifications and the rules of the NESC.

As much as practicable, anchors and rods shall be installed in line with, and in the opposite direction of, the resultant strain of the conductors. Anchor assemblies 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 fillings. The reminder of the hole shall be backfilled and tamped with dirt.

The designated holding powers shown on the anchor assembly drawings are based on the maximum holding power of average, Class 5 soil. When the anchor is installed in poorer soils, the holding power of the anchor shall 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.

6. Locknuts and Washers

Normally cross-arm pins and post-type insulators come equipped with washers and locknuts. Thus, the washers and locknuts for cross-arm pins are not tallied in the "QTY" (quantity) columns in the material boxes on the construction drawings. However, the cross-arm pin washers and locknuts are shown on the construction drawings in parenthesis to depict proper construction. If cross-arm pins or post-type insulators are purchased without washers, locknuts or studs, the quantity totals in the material boxes on the construction drawings will need to be adjusted accordingly.

Locknuts shall be installed on all threaded material and hardware in addition to nuts and washers. The threads on installed bolts shall protrude past the lock washers a minimum of one inch but not more than two inches.

And 3 inch by 3 inch (minimum), square, curved washer (item "d") shall be used abutting the pole when installing primary dead-end, neutral dead-end and guy assemblies directly to the pole. These washers mitigate the crushing of wood fibers and facilitate the permitted longitudinal loads shown on the construction drawings.

A 2 ¼ inch (minimum) square washer shall be placed under the shoulder of 7.2 kV cross-arm insulator pins whose surface area abutting the cross-arm is less than 4 square inches. These washers mitigate the crushing of wood fibers and facilitate the permitted transverse loading shown in the maximum line angle tables in Exhibit 1.

7. Conductors

Conductors shall be handled with care and shall not be trampled on or run over by vehicles. Each reel shall be examined and the wire shall be inspected for cuts, kings, or other damage. Damaged 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 cross-arm to prevent binding or damage while stringing.

The neutral conductor shall be installed on the same side (preferably the roadside) of all tangent and small angle poles throughout each line section.

Neutral attachments may be lowered on standard pole top assemblies a distance not exceeding 2 feet for the purpose of economically meeting conductor clearance requirements of the NESC.

Neutral attachments may be lowered on standard pole top assemblies a distance not exceeding an additional 6 feet for the purpose of performing construction and future line maintenance on these assemblies from bucket trucks designed for such work.

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

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

8. Splices and Dead Ends

For new construction, splices shall be no closer than 1,000 feet from one another and there shall be no more than 3 splices per mile in any primary phase or neutral conductor. Furthermore, splices shall not be located within 10 feet of any supporting structure. For all construction, splices shall not 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.

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 the adjacent spans. Splices shall be installed in accordance with the manufacturer's recommendations.

9. Taps and Jumpers

Jumpers and other leads connected to line conductors shall have sufficient slack to allow free movement of the conductors without causing the jumpers to be pulled from their connectors. Even if not shown on the drawings, jumpers shall have at least two bends in a vertical plane, or one in a horizontal plane, or the equivalent.

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 unplated bronze terminals shall be made by splicing a short stub of copper to the aluminum jumper using a compression connector suitable for the bimetallic connection.

10. Hot-Line Clamps and Connectors

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

Stirrups are not recommended to be used to connect reclosers, autotransformers, or line regulators to primary conductors. Stirrups and hot line clamps shall not be used form sectionalizing taps nor taps for main lines for operational or maintenance purposes. Permanent compression or bolted type connectors shall 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

11. Surge Arrester Gap Settings

Where applicable, the external gap on surge arresters shall be set according to the manufacturer's recommended spacing.

The construction drawings for three-phase transformer banks show cutouts and arresters mounted adjacent to one another on the cross-arm. However, a cutout and arrester, as shown, may be replaced with a combination cutout/arrester (item "ax"). This change will require a change in the assembly's material shown on the construction drawings. Moreover, the arresters may be mounted directly on the transformer tank. (The cutouts remain on the arm.) Any of the above mounting arrangements for three-phase transformer banks are acceptable; the choice is left to the design engineer.

Tank-mounted arresters provide maximum surge protection to transformers because of the arresters' minimum lead lengths. However, when arresters are mounted directly on transformer tanks, the fused cutouts have less surge protection and are subject to more frequent operations. Nuisance operations on fused cutouts with minimal surge protection can be lessened with the use of dual-element fuses.

12. Conductor Ties

Hand-formed ties shall be in accordance with construction drawings. Factory-formed ties shall be installed in accordance with the manufacturer's recommendations.

The conductor shall be tied to the top groove of pin-type and post-type insulators on tangent poles. On angle structures the conductor shall be tied on the side of the insulator opposite the direction of the strain. Pin-type and post-type insulators shall be tight on the pins and brackets, respectively, and the top groove shall be in line with the conductor after tying. Borrowers shall not allow any up-strain on pin-type or post-type insulators.

13. Sagging of Conductors

Conductors shall be sagged evenly and in accordance with the conductor manufacturer's recommendations. The air temperature at the time and place of sagging shall be determined by the use of a certified thermometer. The sag of all conductors after stringing shall be in accordance with the engineer's instructions.

14. Secondaries and Service Drops

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

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

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

15. Grounds

Ground rods (item "ai") shall be driven to their full length in undisturbed earth, a minimum of 2 feet from the face of the pole. The tops of ground rods shall be at least 12 inches below the surface of the earth. The ground wire (item "av") shall be attached to the rod with a ground rod clamp (item "aj") and shall be secured to the pole with staples. The staples on the ground wire shall be spaced 2 feet apart, except for the first 8 feet above the ground and the top 8 feet of the ground wire where they shall be spaced 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 shall be installed in the shortest and most direct path according to the construction drawings. Splices, if required, shall be made using a compression type connector and shall 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 two (2) connections from the frame, case or tank to the multi-grounded neutral conductor as shown in the construction drawings. The pole ground wire may be used for one or both of these connections.

All neutral conductors on the pole shall be bonded directly to each other, and connected to the pole ground wire if present. All equipment ground wires, neutral conductors, down-guys, messenger wires, and surge-protection ground wires shall be interconnected and attached to a common (pole) ground wire in accordance with the requirements of the NESC.

Borrowers shall install effectively grounded driven ground rods or trench type grounding assemblies a maximum of 1,320 feet apart along overhead distribution lines. Customer-owned or other installed electric service grounds shall not be counted in the above minimum grounding assembly requirement.

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

16. Clearing Right-of-Way

The right-of-way shall be prepared by removing trees, clearing underbrush, and trimming trees so that the right-of-way is cleared close to the ground and to the width specified. However, low-growing shrubs, which will not interfere with the operation or maintenance of the line, can be left undisturbed if so directed by the property owner. Slash may be chipped and blown on the right-of-way if so allowed. Trim, but do not remove shade, fruit, or ornamental trees unless otherwise authorized.

All trimming shall be done using good arboricultural practices.

The landowner's written permission is usually required prior to cutting trees outside of the right-of-way. Trim trees fronting each side of the right-of-way symmetrically unless otherwise specified. Remove dead trees beyond the right-of-way which would strike the line in falling. Also, either remove or top leaning trees beyond the right-of-way that would strike the line in falling.

17. Structures Exceeding 200 Feet in Height and Structures in the Vicinity of Airports

The Federal Aviation Administration (FAA) requires (14 **CFR** 77) that in cases where structures or conductors will exceed a height of 200 feet, 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 filed if necessary.

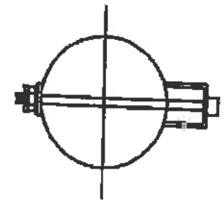
Section 2: Poles

Poles shall be Southern Pine Poles (or equivalent) with dimensions shown below. Dimensions are from ANSI 05.1-1992. Refer to the ANSI spec if a wood other than Douglas-Fir or Southern Pine is used.

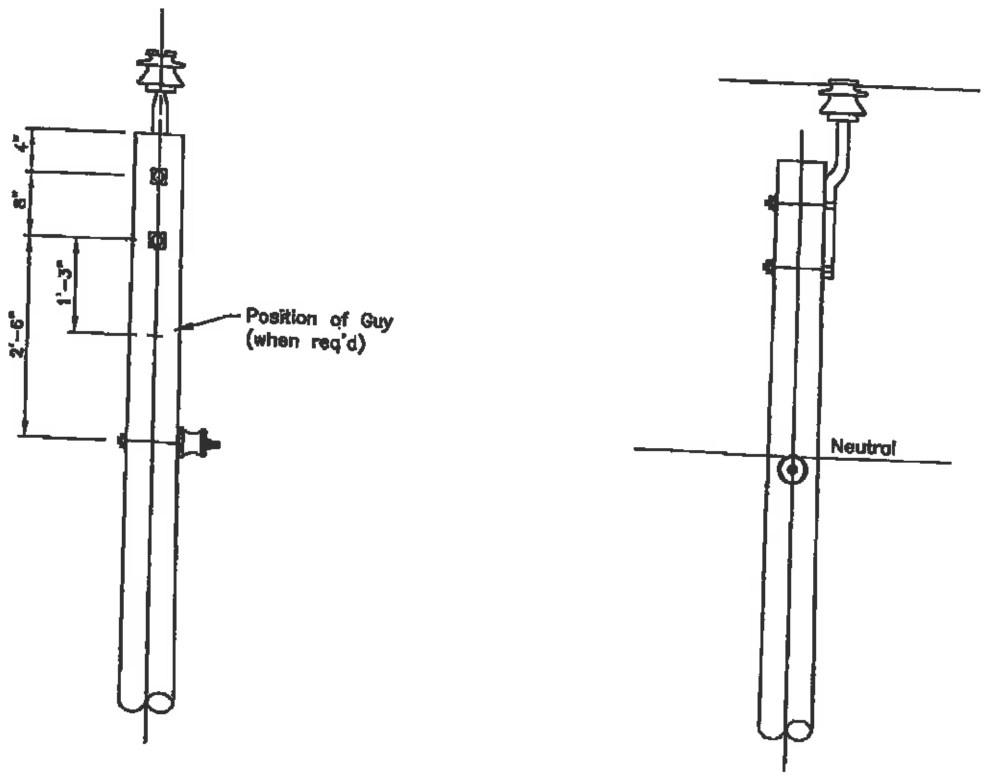
Class		2	3	4	5	6
Min Circumference at top (in.)		25	23	21	19	17
Length of Pole (ft)	Ground line distance from butt (ft.)	Minimum circumference at 6ft from butt (in.)				
30	5.5	37.5	35.0	32.5	30.0	28.0
35	6.0	40.0	37.5	34.5	32.0	30.0
40	6.0	42.5	39.5	36.5	34.0	31.5
45	6.5	44.5	41.5	38.5	36.0	33.0
50	7.0	46.5	43.5	40.0	37.5	-
55	7.5	48.5	45.0	42.0	-	-
60	8.0	50.0	46.5	43.5	-	-
65	8.5	51.5	48.0	45.0	-	-
70	9.0	53.0	49.5	46.0	-	-
75	9.5	54.5	51.0	-	-	-
80	10.0	56.0	52.0	-	-	-

"Hughes Brothers T & D Materials" by Hughes Brothers, Inc.

Section 3: Single-Phase Pole Tops



POLE TOP PIN ASSEMBLY



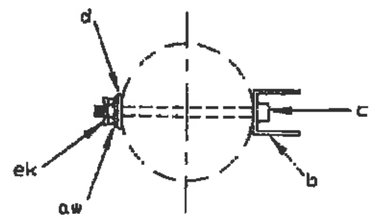
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 5/8" x Req'd Length	0370	1	Insulator, Spool Sec.	102000
1	D.U. Bolt, 5/8" x Req'd Length	0425	1	Insulator, Pin Type 25kv	107500
3	Washer, Square 11/16" Hole	061001			
1	Pin, Pole Top 25kv Offset	092501			

UP TO 1/0 ACSR

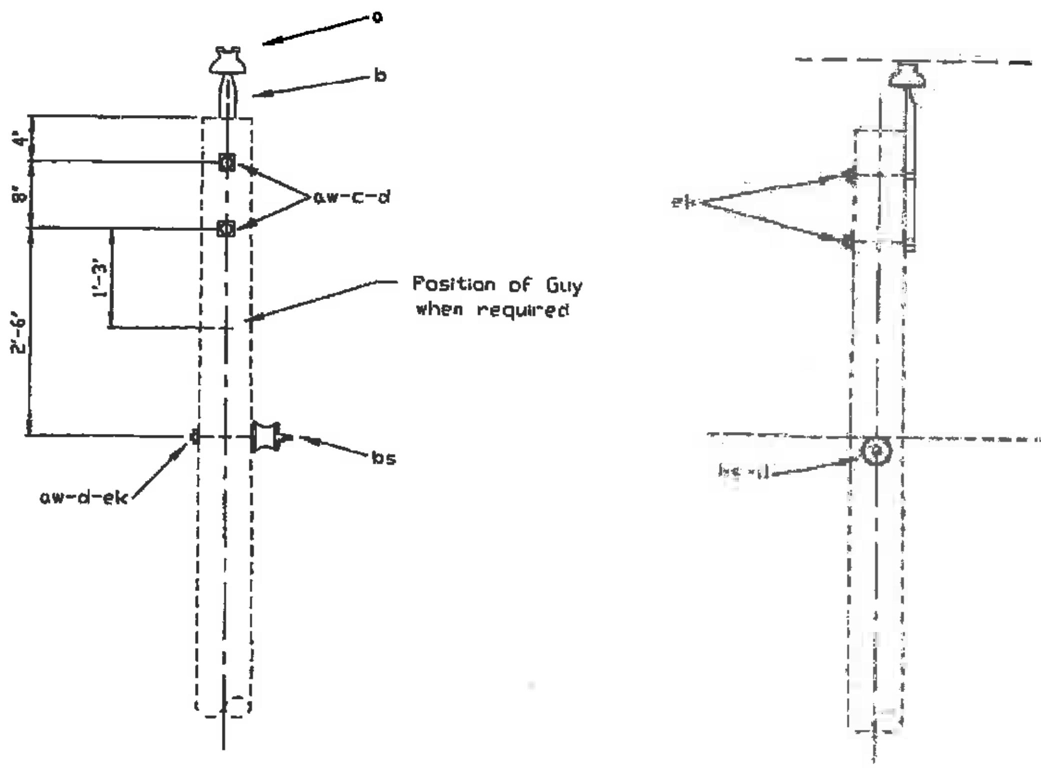
14.4/24.9 KV, 1-PHASE
SINGLE PRIMARY SUPPORT
0° TO 5° ANGLE

Revised
May 2003

VA1



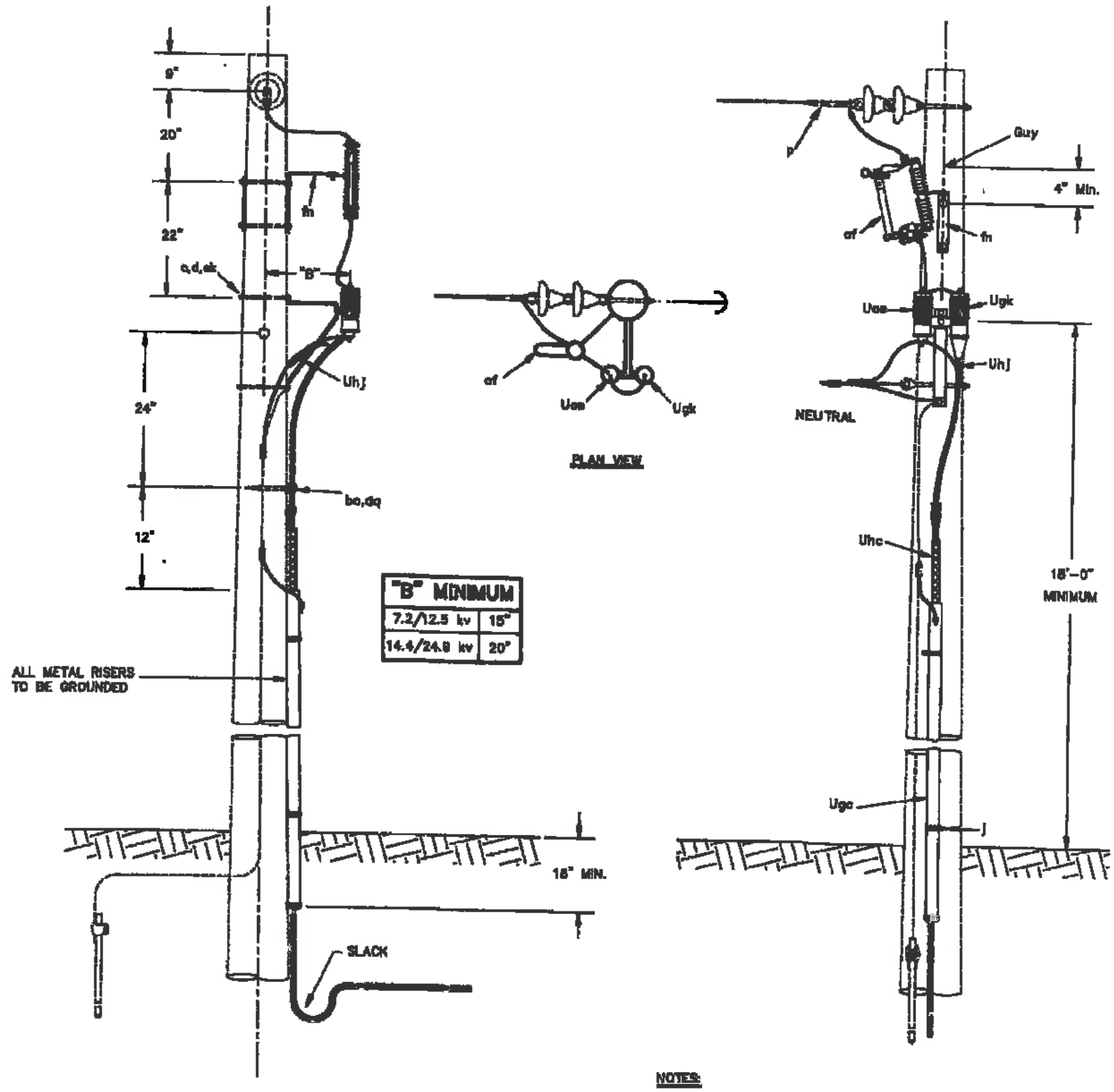
POLE TOP PIN ASSEMBLY



NOTES:
1- Maximum transverse load: 500 lbs. per conductor
2- Maximum line angle within load limits: 5°

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Insulator, pin type	1040	3	Washer, square, 2 1/4"	0610
1	Pin, pole top, 20"	0900	1	Bolt, Double upset	0425
2	Bolt, machine, 5/8"	0370			
1	Ins. Spool Secondary	1020			

2, 4 & 1/0 ACSR COND	7.2/12.5 KV. PRIMARY, 1-PHASE 0° TO 5° ANGLE, SINGLE PRIMARY SUPPORT
	Revised Sept. 1994 — A1



"B" MINIMUM	
7.2/12.5 kv	15"
14.4/24.9 kv	20"

NOTES:

1. TOTAL ARRESTER LEAD LENGTH MUST BE UNDER 3'.
2. NO BENDS PERMITTED WITHIN 6" OF CABLE TERMINAL BASE.
3. ALLOW MINIMUM CABLE SLACK OF 24" AT BOTTOM OF RISER.
4. ALL LIVE PARTS MUST HAVE AN 18 FOOT CLEARANCE ABOVE GROUND AND MUST BE INSTALLED A MINIMUM OF 6 INCHES ABOVE THE NEUTRAL CONDUCTOR.

DESIGNATE AS:

1 SINGLE DISTRIBUTION ARRESTER

1A PARALLEL DISTRIBUTION ARRESTER

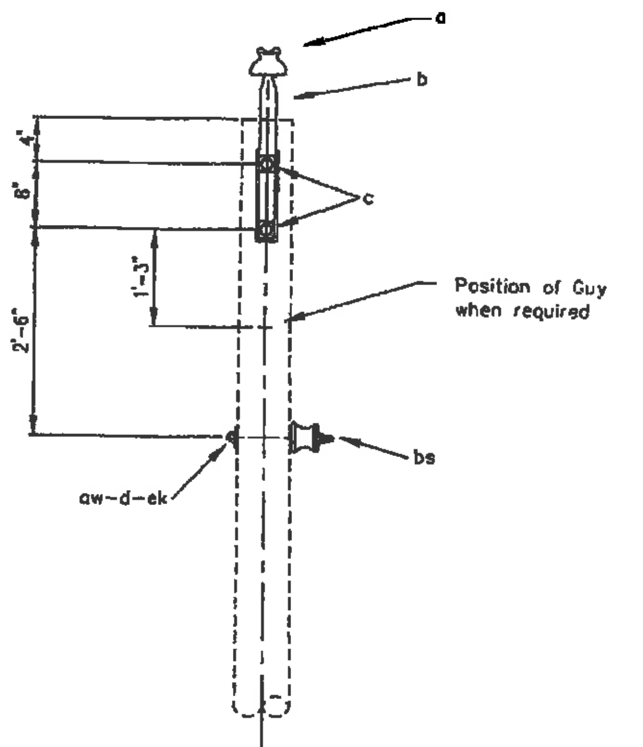
1B INTERMEDIATE ARRESTER

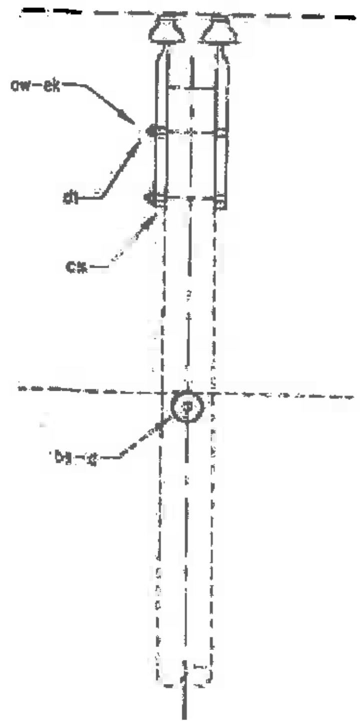
* 2 ARRESTERS TO BE INSTALLED ON PARALLEL ARRESTER APPLICATIONS.

ITEM	QTY.	MATERIAL
c	3	Bolt, machine, 5/8" x required length.
d	4	Washer, square 2 1/4".
j		Screw, lag 1/2" x 4" as required.
p		Connectors, as required.
af	1	Fuse link.
af	1	Cutout (load break type).
av		Jumpers, as required.
bo	1	Anchor, shackle. Do not use if drive hook is used.
dq	1	Eye screw, elliptical or drive hook.
ek		Locknuts, as required.
fn	1	Bracket, cutout extension.
Uae	1*	Surge arrester
Ugc	1	Cable riser shield. Length as required.
Ugk	1	Cable termination.
Uhc	1	Cable support.
Uhj	1	Bracket combination.

SINGLE PHASE CABLE TERMINAL POLE

UA1





Specify A1-1A for
offset neutral assembly

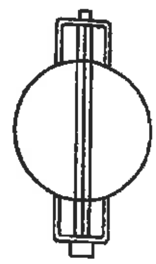
NOTES:
1- Maximum transverse load: 500 lbs. per conductor
2- Maximum line angle within load limits: 5°

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Insulator, pin type	1040	1	Bolt, Double upset	0425
2	Pin, pole top, 20"	0900	3	Washer, square	0610
2	Bolt, machine, 5/8"	0370			
1	Ins. Spool Secondary	1020			

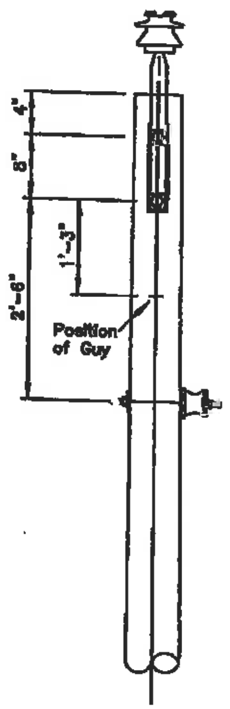
7.2/12.5 KV. PRIMARY, 1-PHASE
0° TO 5° ANGLE, DOUBLE PRIMARY
SUPPORT

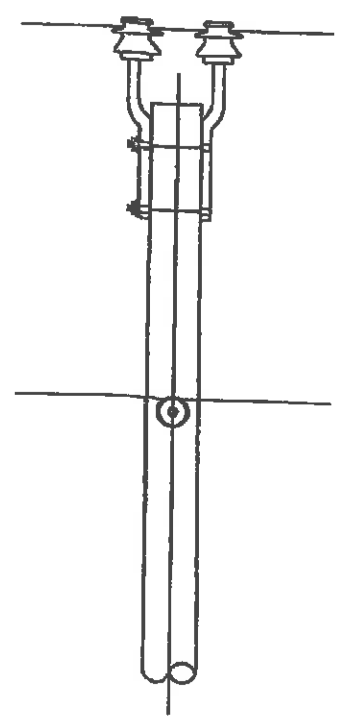
Revised
Sept. 1994

A1-1



POLE TOP PIN ASSEMBLY





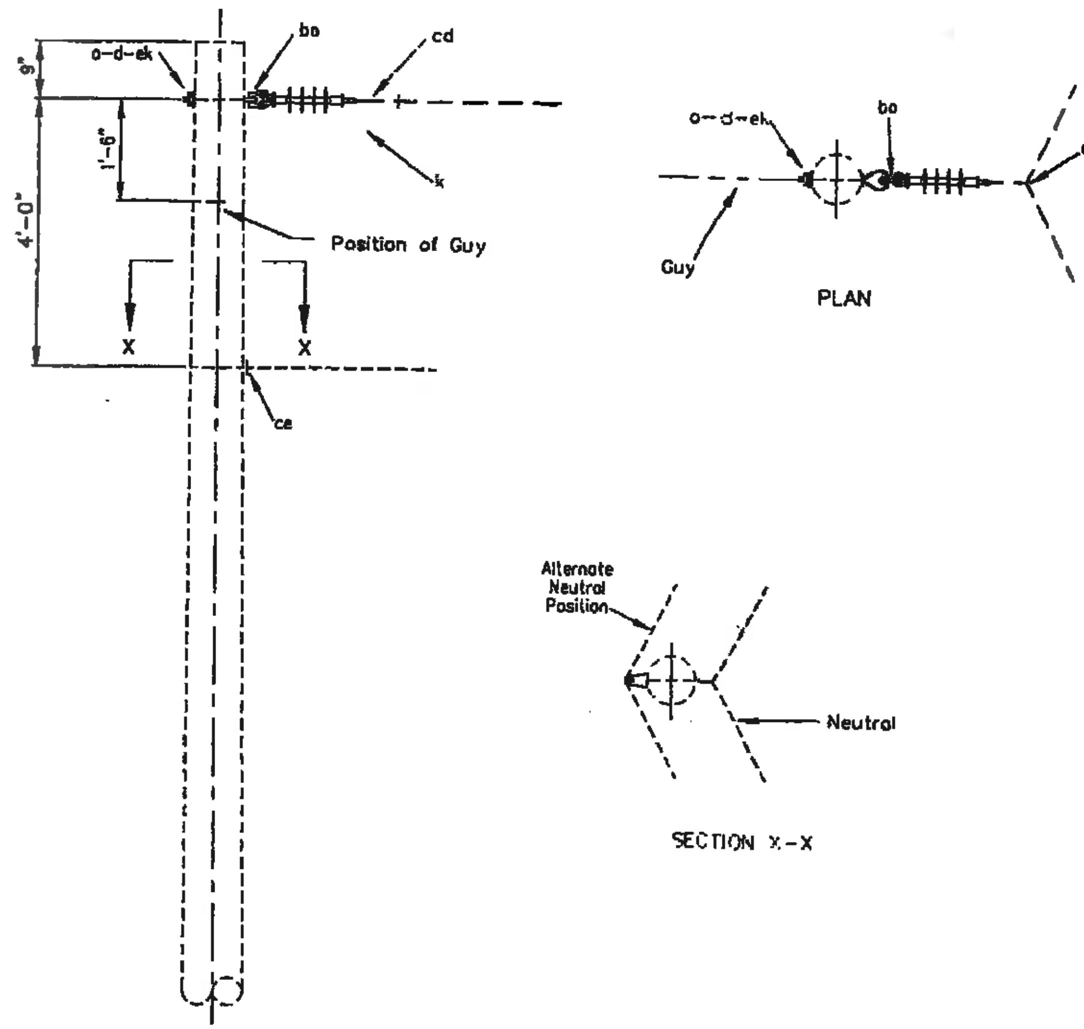
Quan.	Material	Item No.	Quan.	Material	Item No
2	Mach Bolt, 5/8" x Req'd Length	0370			
1	DU Bolt, 5/8" x Req'd Length	0425			
1	Washer, Square 11/16" Hole	061001			
2	Pin, Pole Top 25kv Offset	092501			
1	Insulator, Spool Sec	102000			
2	Insulator, Pin Type 25kv	107500			

UP TO 1/0 ACSR

14.4/24.9 KV, 1-PHASE
DOUBLE PRIMARY SUPPORT
0° TO 5° ANGLE

Revised
May 2003

VA1-1



NOTES:

1– Items cd and ce are shown on assembly drawings AC-6 and CU-3.

2– Maximum transverse load: 4000 lbs. per conductor

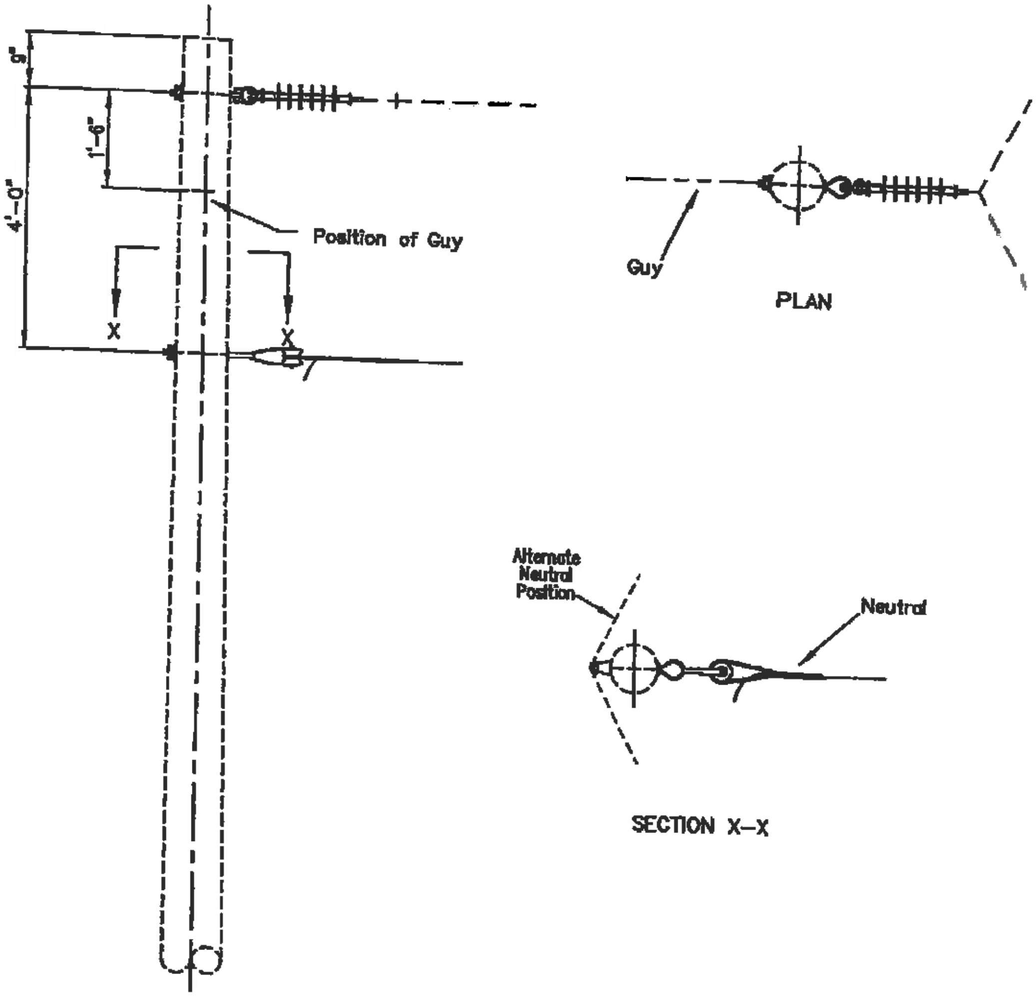
3– Maximum line angle within load limits: 15 kV – 20°-60° / 25 kV – 30° – 60°

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610	1	Shackle, anchor	1360
1	Insulator, Polly	1110	1	Clamps, Angle	1960
2	Bolt, eye, 5/8" Oval	0320	1	Clevis, Sec. Swinging	1815
			1	Ins. Spool Sec.	1020

7.2/12.5 KV. PRIMARY, 1-PHASE
30° TO 60° ANGLE

Revised Sept. 1994

A3



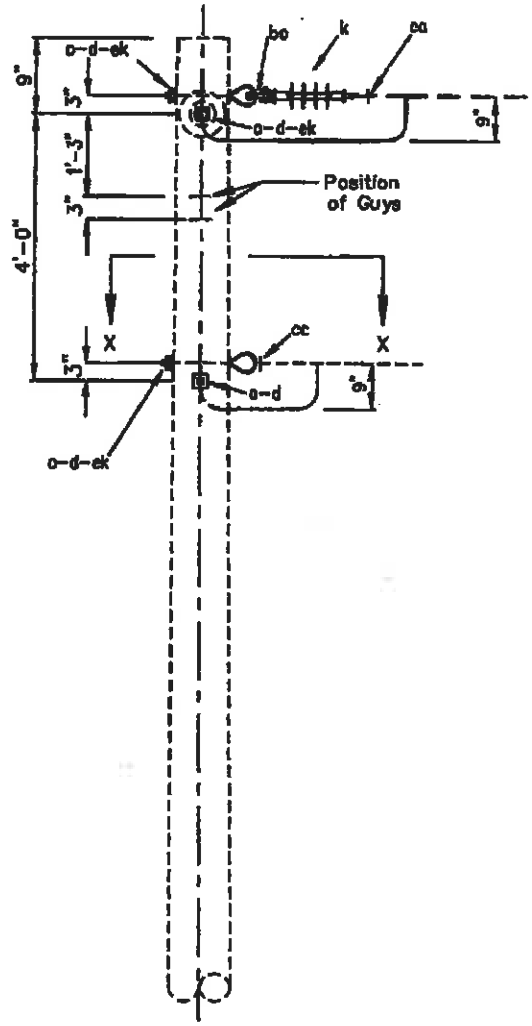
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Eye Bolt, 5/8" x Req'd Length	0320	1	Clamps, Angle 2, 4 & 1/0 ACSR	196000
2	Washer, Square 11/16" Hole	061001	1	Insulator, 25kv Polly Suspension	911001
1	Insulator, Spool Sec	102000			
1	Anchor Shackel, 2"	136000			
1	Clevis, Swinging J6	181500			

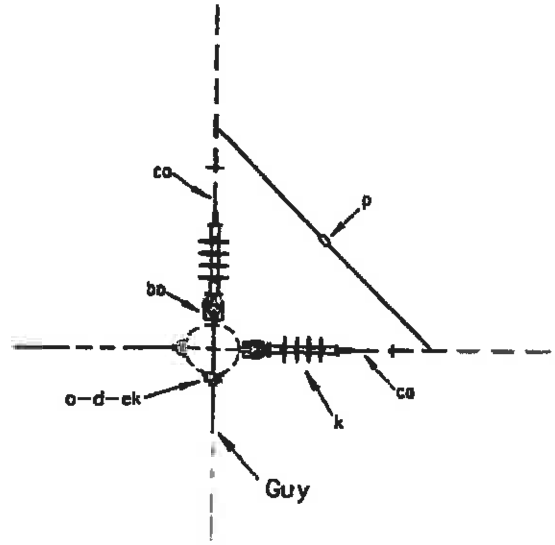
UP TO 1/0 ACSR

14.4/24.9 KV, 1-PHASE
30° TO 60° ANGLE

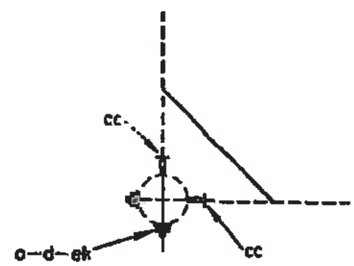
Revised
May 2003

VA3





PLAN



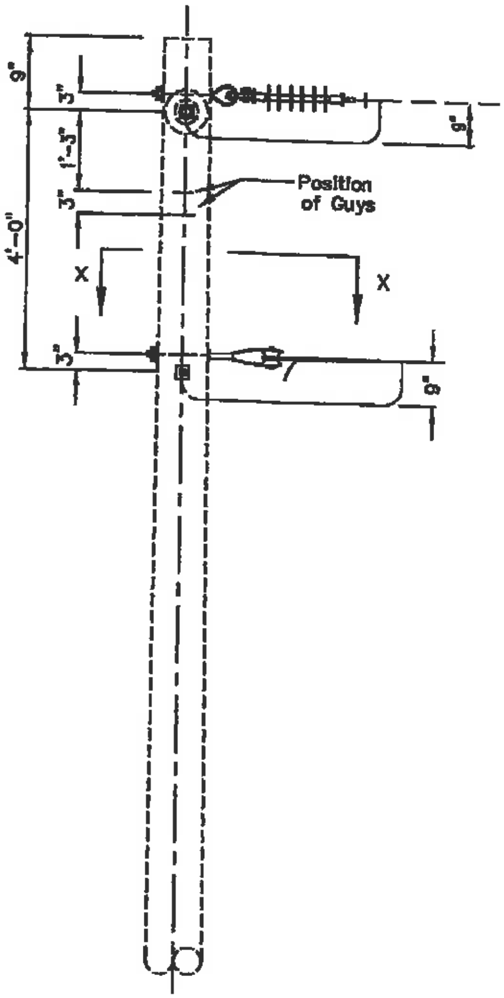
SECTION X-X

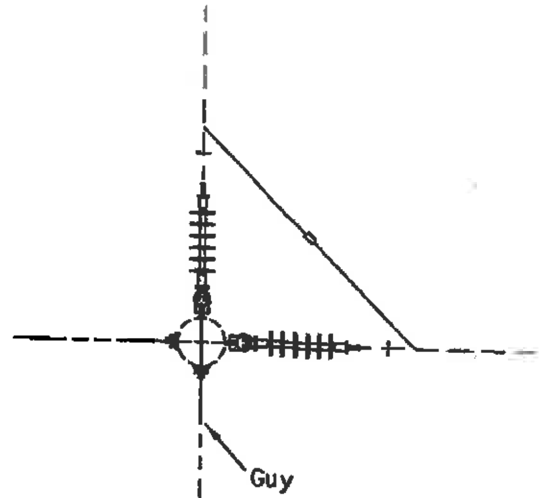
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	4	Clamp C412	1950
2	Insulator, Polly	1110	2	Deadend Clamp, primary	1910
4	Bolt, eye, 5/8"	0320	2	Clevis Sec. Swing J 6	1815
2	Ins. Spool Sec.	1020			

7.2/12.5 KV. PRIMARY, 1-PHASE
60° TO 90° ANGLE

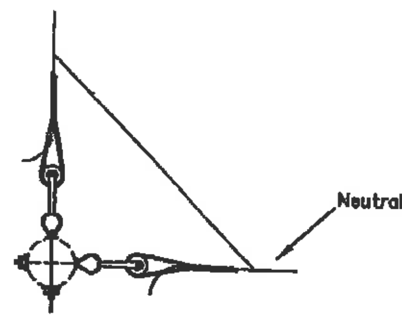
Revised
Sept. 1994

A4





PLAN



SECTION X-X

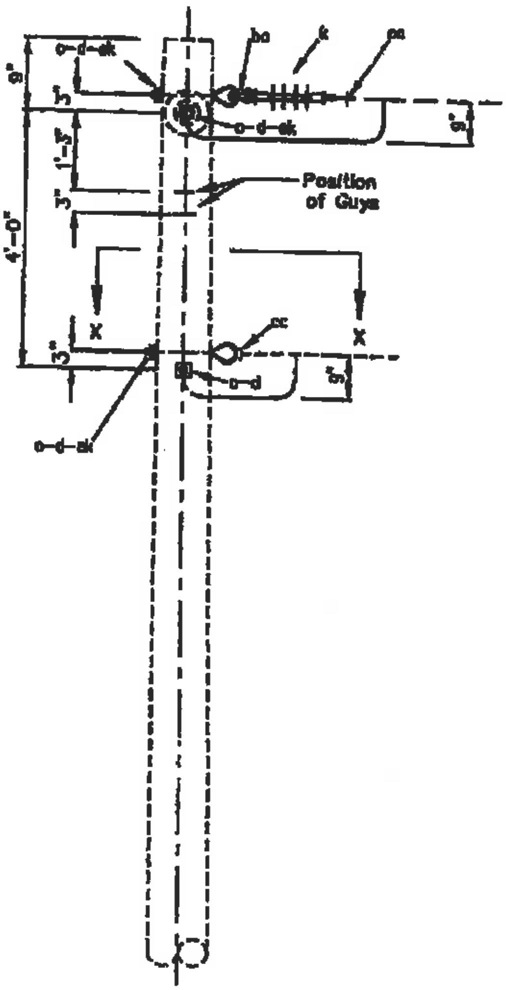
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Eye Bolt, 5/8" x Req'd Length	0320	2	1/0 ACSR Neutral DE Tie	195001
4	Washer, Square 11/16" Hole	061001	2	Insulator, 25kv Polly Suspension	911001
2	Insulator, Spool Sec	102000			
2	Clevis, Swinging J6	181500			
2	DE Clamp 4 Thru 1/0 ACSR	191000			

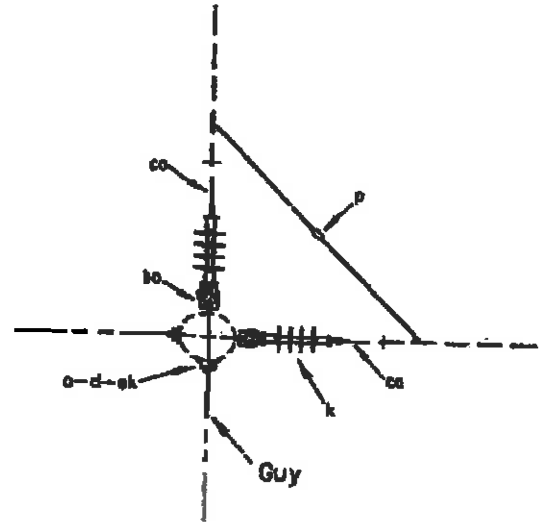
UP TO 1/0 ACSR

14.4/24.9 KV, 1-PHASE
60° TO 90° ANGLE

Revised
May 2003

VA4





PLAN

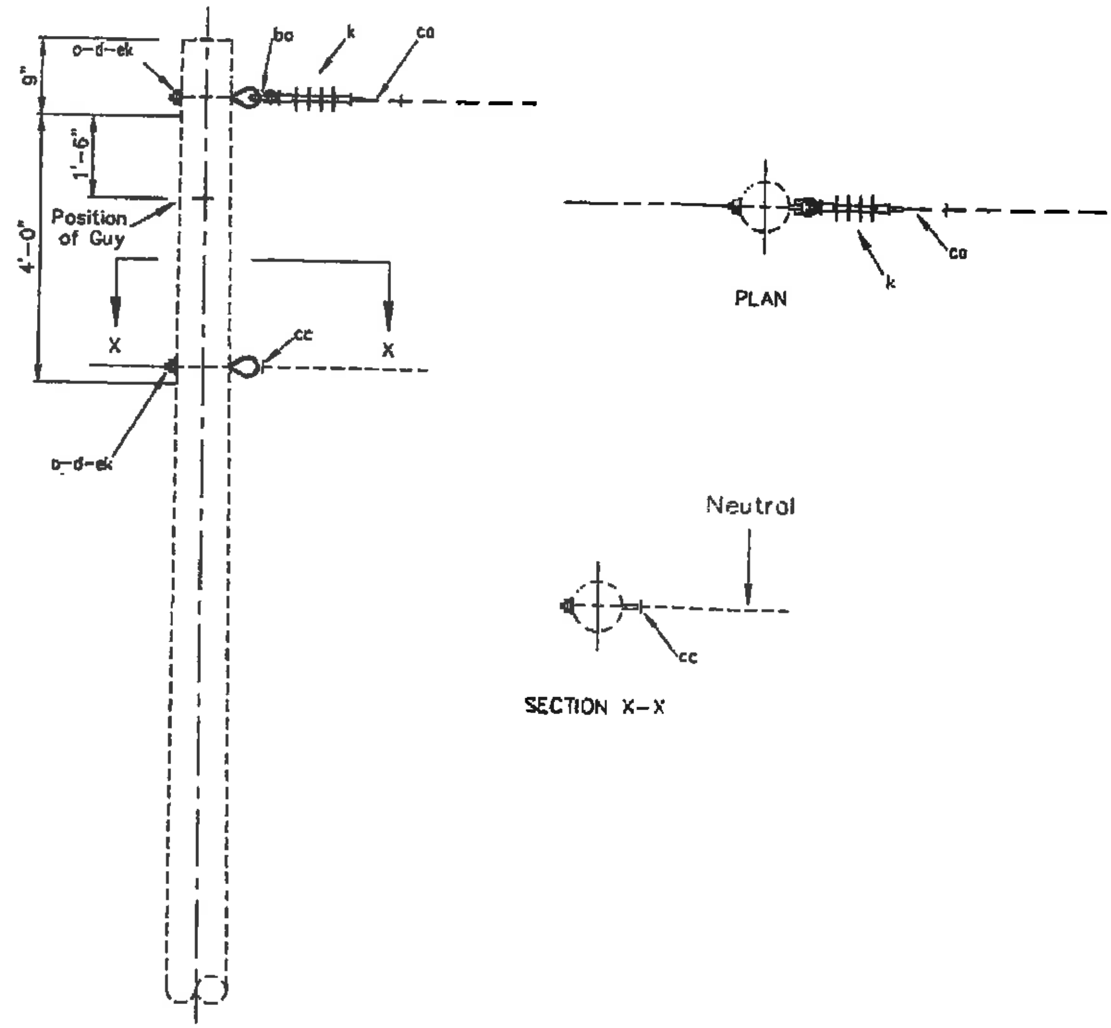
SECTION X-X

Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	4	Clamp C412	1950
2	Insulator, Polly	1110	2	Deadend Clamp, primary	1910
4	Bolt, eye, 5/8"	0320	2	Clevis Sec. Swing J 6	1815
2	Ins Spool Sec.	1020			

7.2/12.5 KV PRIMARY, 1-PHASE
60° TO 90° ANGLE

Revised
Sept. 1994

A4-P

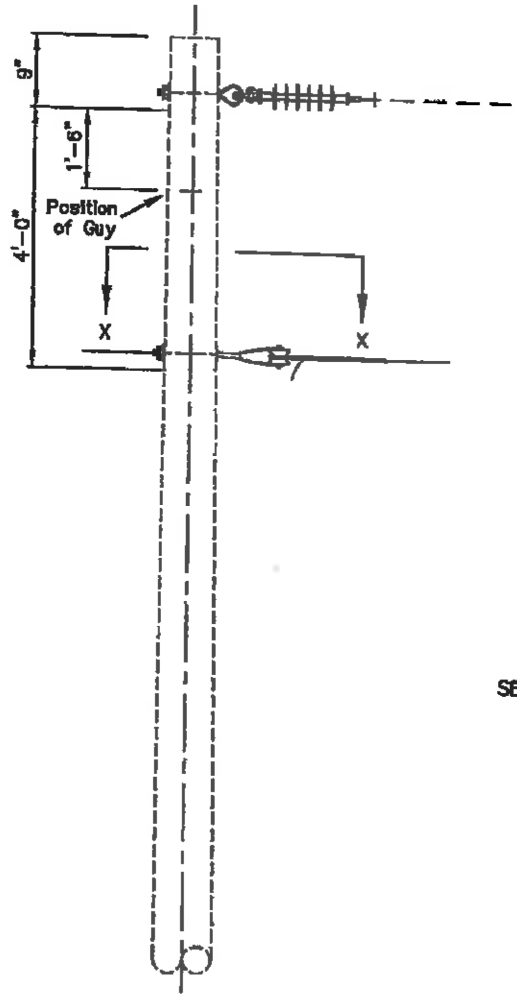


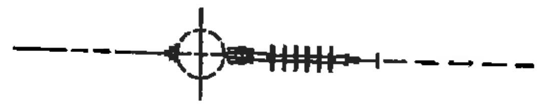
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610	1	Clevis. Sec. Swing J6	1815
1	Insulator, Polly	1110	2	Clamp C412	1950
2	Bolt, Eye, 5/8"	0320	1	Ins. Spool Sec.	1020
1	Deadend Clamp Primary	1910			

7.2/12.5 KV. PRIMARY, 1-PHASE
DEADEND (SINGLE)

Revised Sept. 1994

A5




PLAN

SECTION X-X

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Eye Bolt, 5/8" x Req'd Length	0320			
2	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec	102000			
1	Clevis, Swingin J6	181500			
1	DE Clamp 4 Thru 1/0 ACSR	191000			
1	1/0 ACSR Neutral DE Tie	195001			
1	1/0 & 2/0 ACSR Amp Stirrup	201006			
1	Insulator, 25kv Polly Suspension	911001			

UP TO 1/0 ACSR

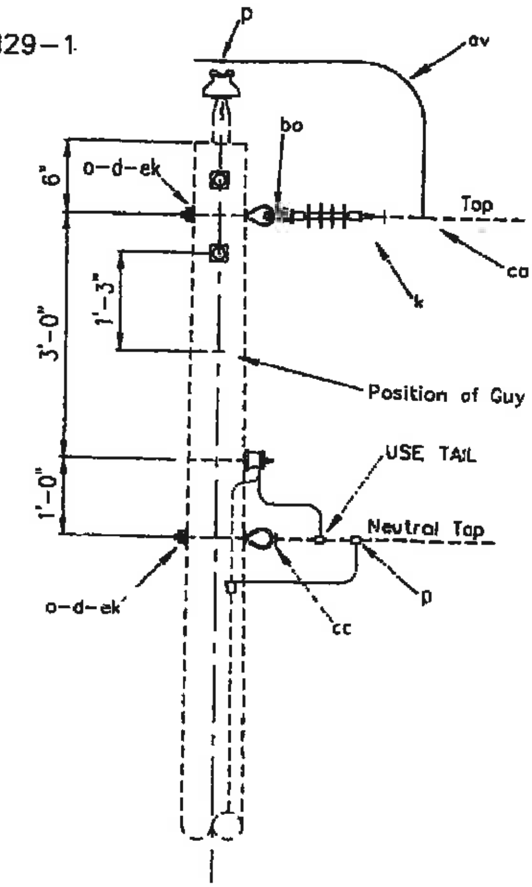
14.4/24.9 KV, 1-PHASE
SINGLE DEADEND

Revised
May 2003

VA5

NOTES:

SEE GUIDE DRAWINGS M29-1 AND M29-2.



NOTES:

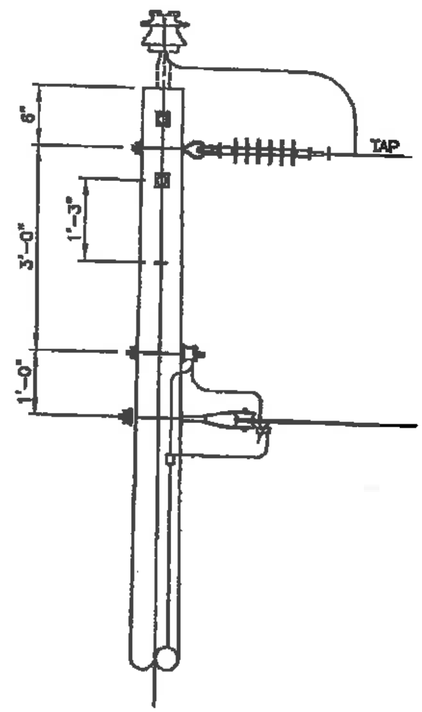
A5-1 ASSEMBLY MAY BE USED WITH DRAWINGS SUCH AS A1, A1-1, A1-2, A2, A2-3.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610			
1	Insulator, Polly	1110			
2	Bolt, eye, 5/8"	0320			
1	Ins. Spool Sec.	1020			
1	Hot Line Clamp	2000			
1	Deadend Clamp, Primary	1910			
1	Clevis, Sec. Swing J 6	1815			
2	Clamp C412	1950			

7.2/12.5 KV. PRIMARY, 1-PHASE TAP

Revised Sept. 1994

A5-1



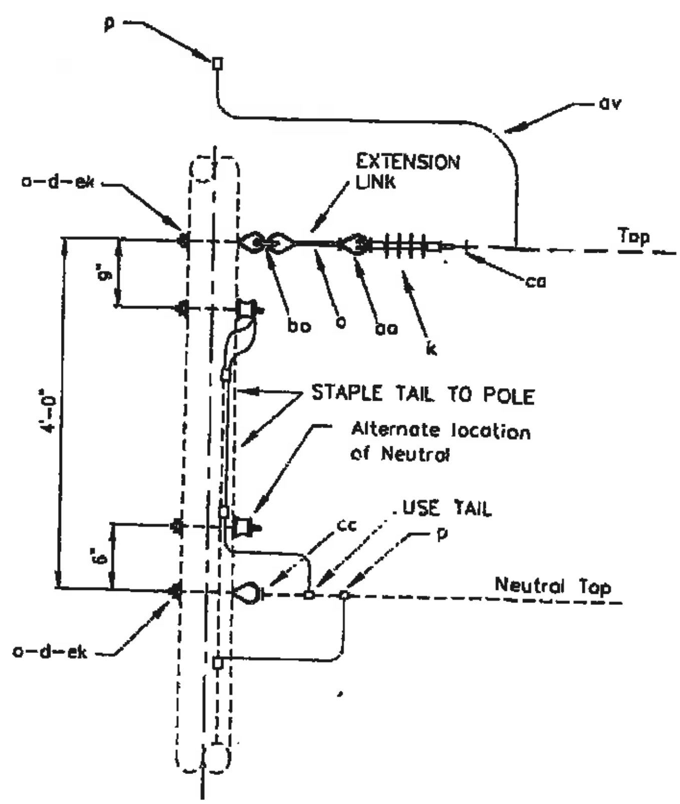
VA5-1

Notes:

1. VA5-1 assembly may be used with single phase units.
2. See drawing VM29-1 for tap assembly giude.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Eye Bolt, 5/8" x Req'd Length	0320			
2	Washer Square, 11/16" Hole	061001			
1	Insulator, Spool Sec	102000			
1	Clevis, Swinging J6	181500			
1	DE Clamp 4 Thru 1/0 ACSR	191000			
1	1/0 ACSR Neuatrl DE Tie	195001			
1	2-4/0 AL Hot Line Clamp	200003			
1	Insulator, 25kv Polly Suspension	911001			

UP TO 1/0 ACSR	14.4/24.9 KV, 1-PHASE SINGLE PHASE TAP	
	Revised May 2003	VA5-1



NOTES:

A5-2 ASSEMBLY MAY BE USED WITH DRAWINGS SUCH AS B1, B1-1, B2, B7 C1, C1-2, C1-3, C1-4, C2-1 & C2-2. (SEE TAPE ASSEMBLY GUIDE M29-1 AND M29-2)

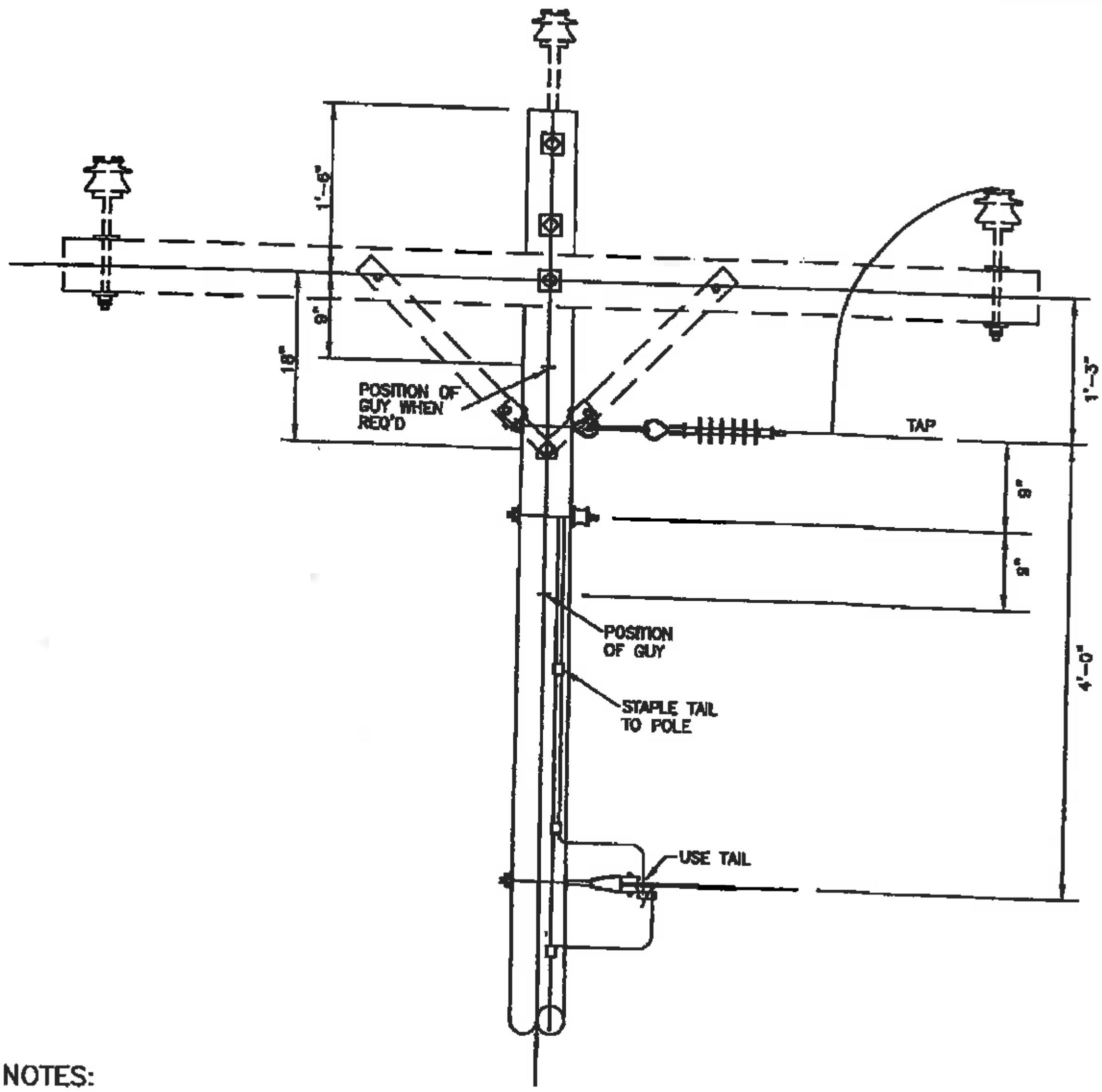
SPECIFY A5-2A FOR TAP TO EXISTING EYEBOLT.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610			
1	Insulator, Polly	1110			
2	Bolt, eye, 5/8"	0320			
1	Ins. Spool Sec.	1020			
1	Hot Line Clamp	2000			
1	Deadend Clamp, Primary	1910			
1	Clevis, Sec. Swing J 6	1815			
2	Clamp C412	1950			
1	Extension Link	1130			

7.2/12.5 KV. PRIMARY, 1-PHASE TAP

Revised Sept. 1994

A5-2



NOTES:

1. VA5-2 assembly may be used with two & three phase units.
2. See drawing VM29-1 for tap assembly guide.
3. Attach to closest phase if load balance allows.

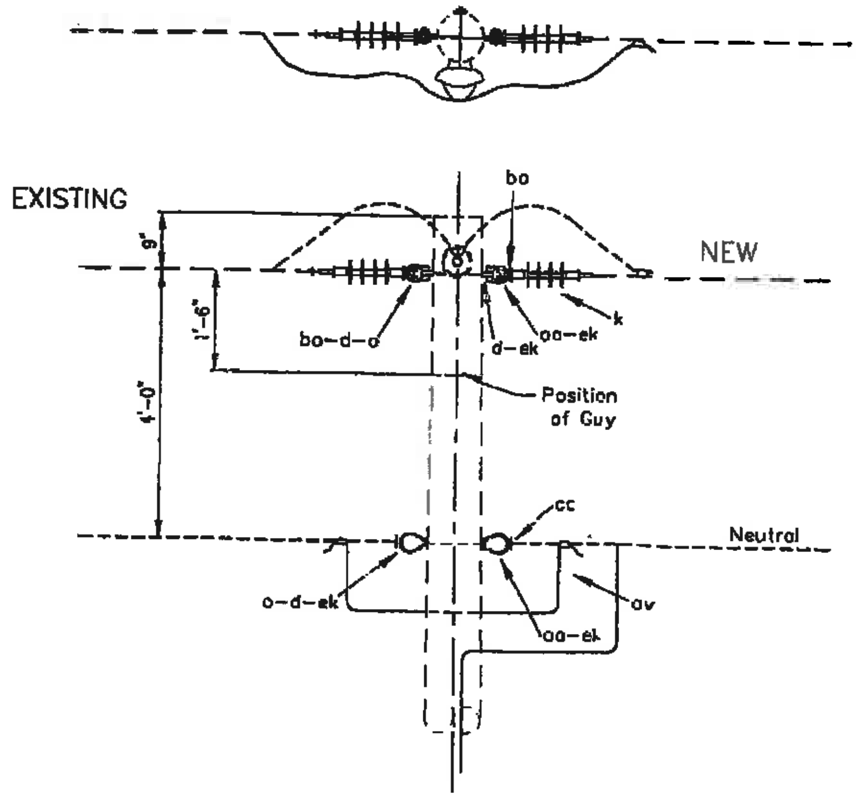
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Eye Bolt, 5/8" x Req'd Length	0320			
2	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec	102000			
1	Ext Link For Susp Insulator	113000			
1	Clevis, Swinging J6	181500			
1	DE Clamp 4 Thru 1/0 ACSR	191000			
1	1/0 ACSR Neutral DE Tie	195001			
1	2-4/0 AL Hot Line Clamp	200003			
1	Insulator, 25kv Polly Suspension	911001			

UP TO 1/0 ACSR

14.4/24.9 KV, 1-PHASE
SINGLE PHASE TAP

Revised May 2003

VA5-2



NOTES:

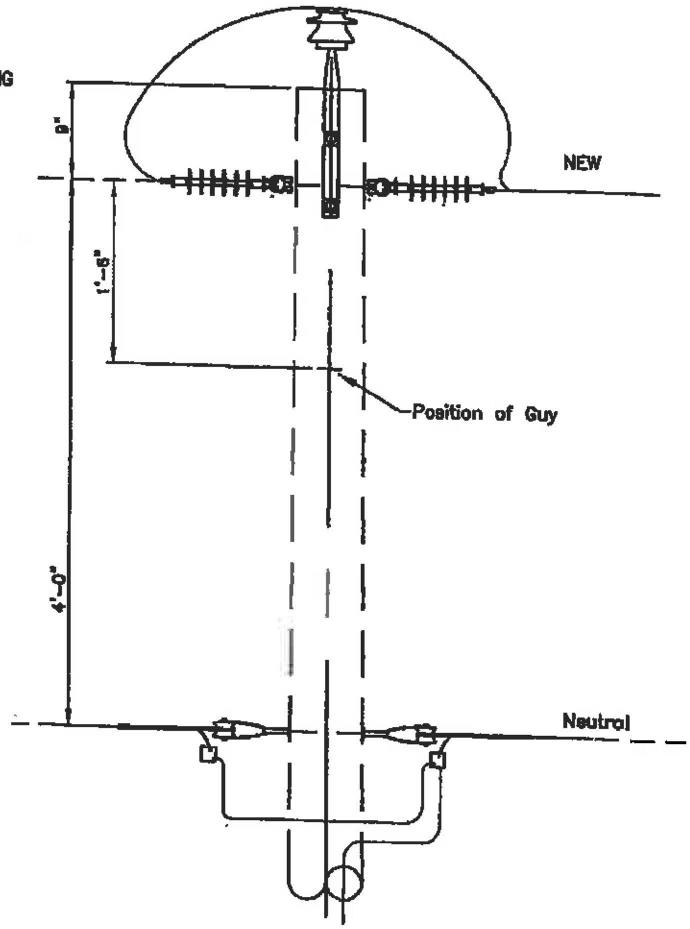
A5-4 MAY BE USED WITH DRAWINGS SUCH AS: A3, A5, B3, B5, B5-1, C3, C5, C5-1

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Adapter, Pin Head	0960	1	Ins. Spool Sec.	1020
1	Ins. Pin Type	1040	1	Bolts, D.A.	0270
1	Insulator, Polly	1110	1	Clamp. Pri. D.E.	1910
1	Washer, Square	0610	1	Clevis. Sec. J 6	1815
2	Nut, Eye 5/8"	0640	1	Clamp. Hot Line	2000
			2	Clamp. C412	1950

SINGLE PHASE TAP

Revised Sept. 1994

A5-4



Note:
1. VA5-4 assembly may be used with drawings such as the folowing; VA3, VA5, VB3, VB5, VB5-1, VC3, VC5 & VC5-1.

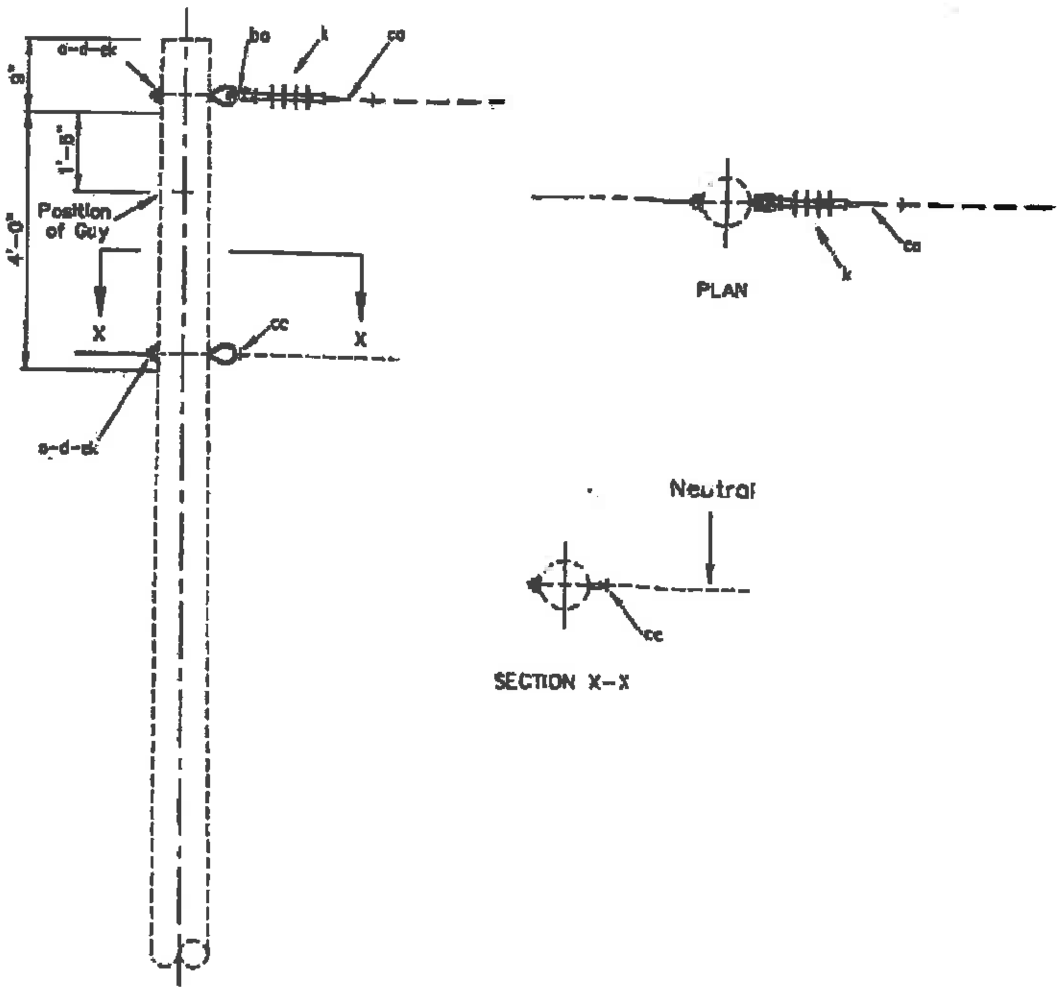
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 5/8" x Req'd Length	0370	1	1/0 ACSR Neutral DE Tie	195001
2	Washer, Square 11/16" Hole	061001	1	2-4/0 AL Hot Line Clamp	200003
2	Nut, Oval Eye	064000	1	Insulator, 25kv Polly Suspension	911001
1	Pin, Pole Top 25kv Offset	092501			
1	Insulator, Spool Sec.	102000			
1	Insulator, Pin Type 25kv	107500			
1	Clevis, Swinging J6	181500			
1	DE Clamp 4 Thru 1/0 ACSR	191000			

UP TO 1/0 ACSR

14.4/24.9 KV, 1-PHASE
SINGLE PHASE TAP

Revised
May 2003

VA5-4

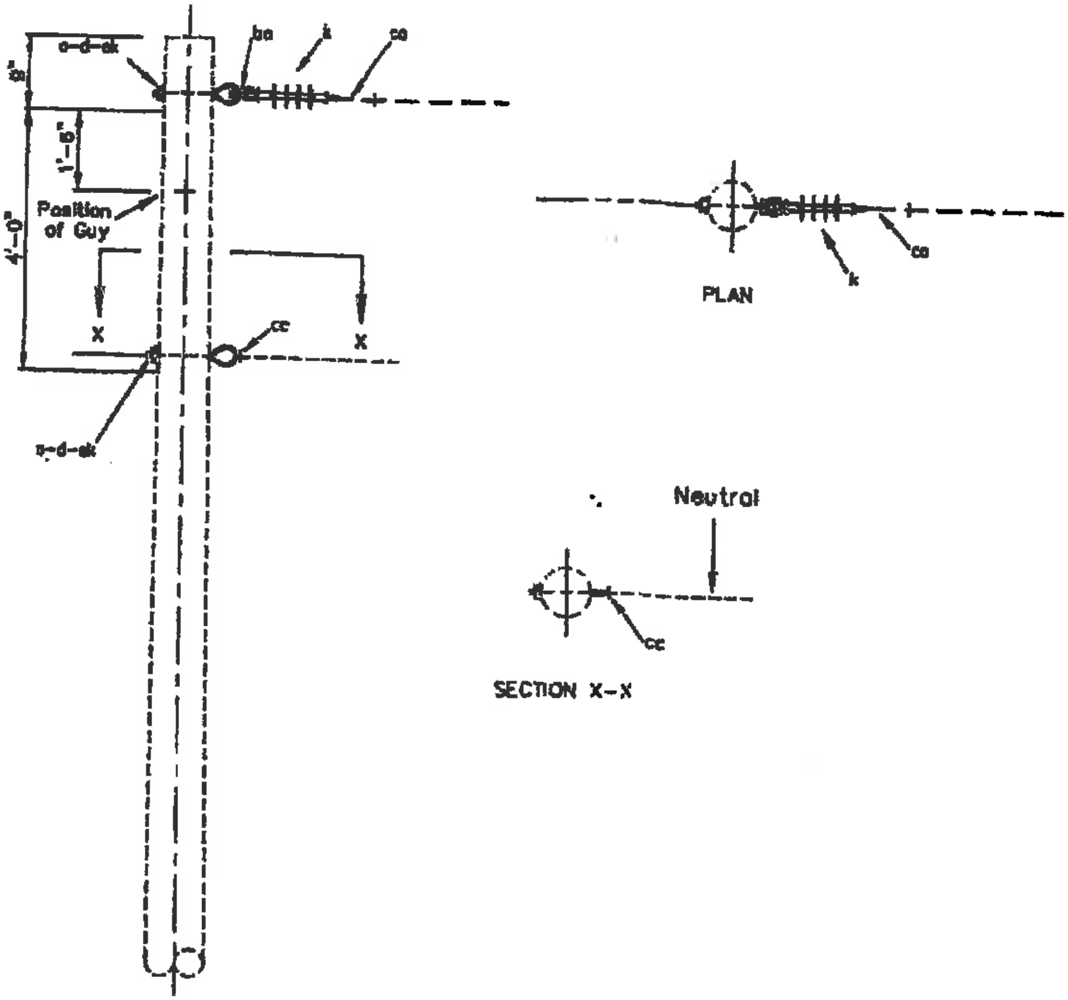


Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610	1	Clevis, Sec. Swing J6	1815
1	Insulator, Polly	1110	2	Clamp C412	1950
2	Bolt, Eye, 5/8"	0320	1	Ins. Spool Sec.	1020
1	Deadend Clamp Primary	1910			

7.2/12.5 KV. PRIMARY, 1-PHASE
DEADEND (SINGLE)

Revised
Sept. 1994

A5-P

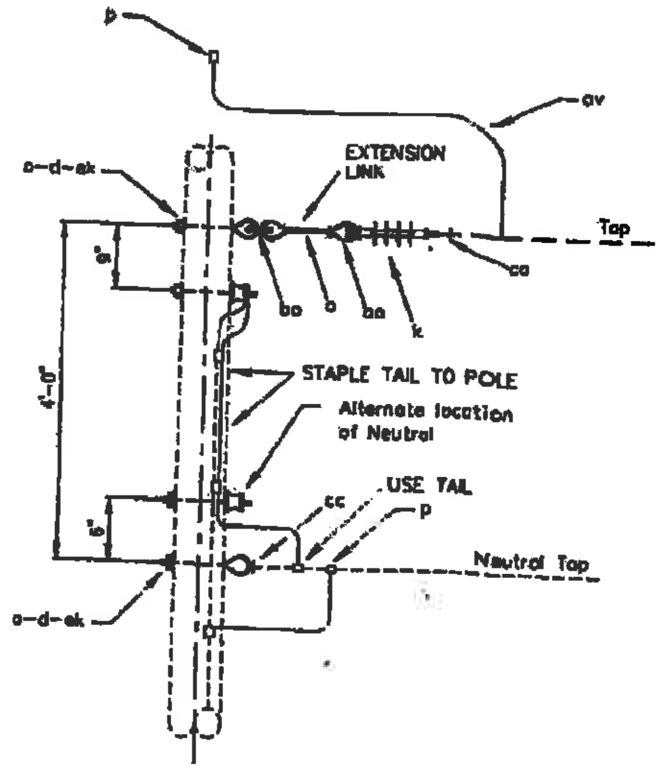


Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610	1	Clevis, Sec. Swing J6	1815
1	Insulator, Polly	1110	2	Clamp C412	1950
2	Bolt, Eye, 5/8"	0320	1	Ins. Spool Sec.	1020
1	Deadend Clamp Primary	1910			

14.4/24.9 KV. PRIMARY, 1-PHASE
DEADEND (SINGLE)

Revised Sept. 1994

VA5-P



NOTES:

A5-2 ASSEMBLY MAY BE USED WITH DRAWINGS SUCH AS B1, B1-1, B2, B7 C1, C1-2, C1-3, C1-4, C2-1 & C2-2. (SEE TAPE ASSEMBLY GUIDE M29-1 AND M29-2)

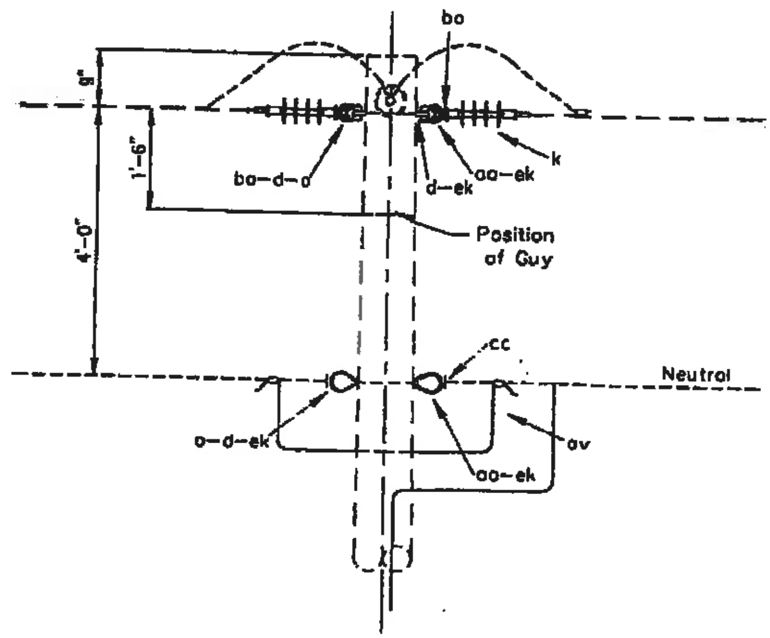
SPECIFY A5-2A FOR TAP TO EXISTING EYEBOLT.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610			
1	Insulator, Polly	1110			
2	Bolt, eye, 5/8"	0320			
1	Ins. Spool Sec.	1020			
1	Hot Line Clamp	2000			
1	Deadend Clamp, Primary	1910			
1	Clevis, Sec. Swing J 6	1815			
2	Clamp C412	1950			
1	Extension Link	1130			

7.2/12.5 KV. PRIMARY, 1-PHASE TAP

Revised Sept. 1994

A5-2P



NOTES:

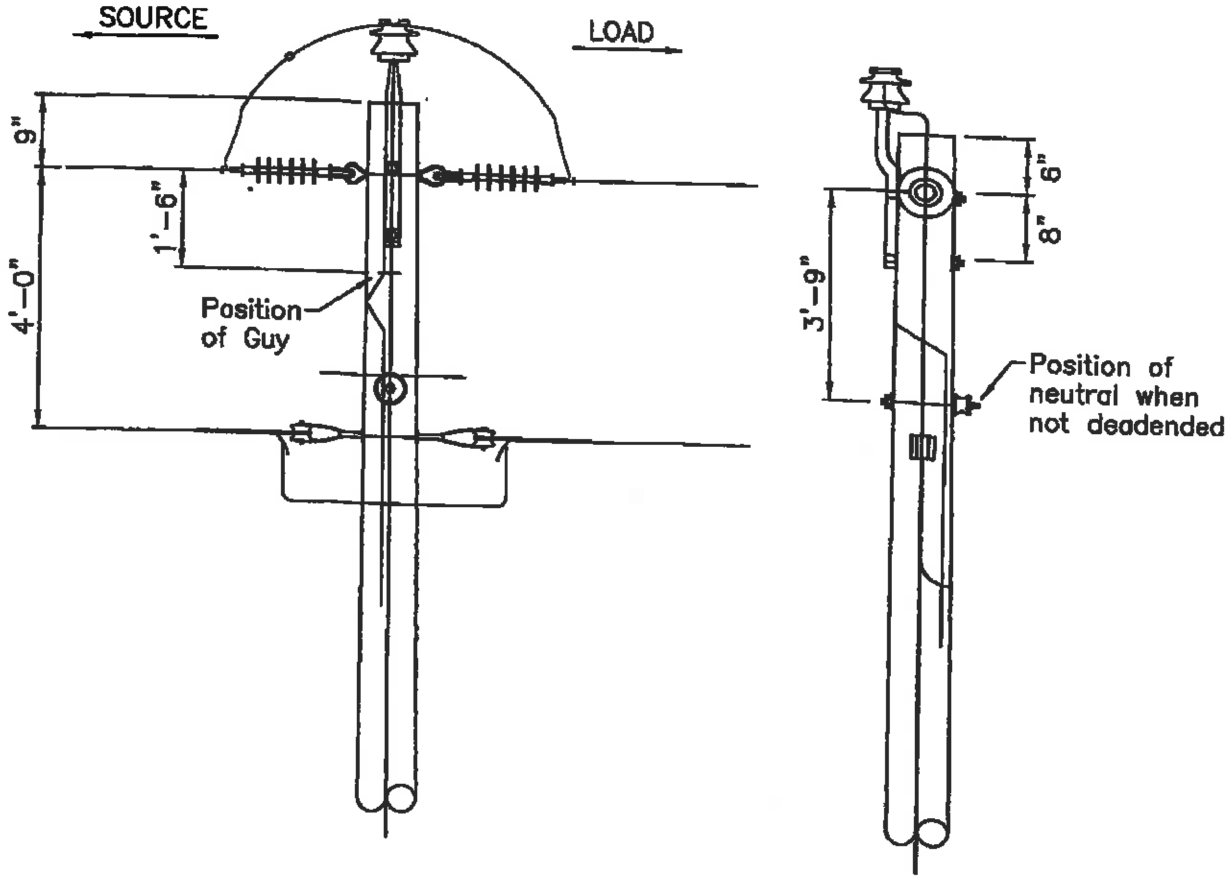
A6 MAY BE USED WITH DRAWINGS SUCH AS: M3-1, M3-1A, M3-10, M3-41, M3-23, M5-1, M5-4, M5-2 (AS SHOWN).

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Adapter, Pin Head	0960	2	Clamp, Pri. D.E.	1910
1	Washer, Square	0610	1	Clamp Hot Line	2000
4	Insulator, Polly	1110	1	Bolt, D.A.	0270
1	Ins. Pin Type	1040	3	Connectors, Small	3000
2	Bolt, Eye 5/8"	0320	2	Ins. Spool Sec.	1020
2	Nut, Eye 5/8"	0640	2	Clevis, Sec. J 6	1815
			4	Clamp C412	1950

1-PHASE VERTICAL DEADEND (DOUBLE)

Revised Sept. 1994

A6



Note:

VA6 may be used with drawings such as VM3-1, VM3-1A, VM3-10, VM3-23, VM5-1, VM5-4, VM5-2 (as shown).

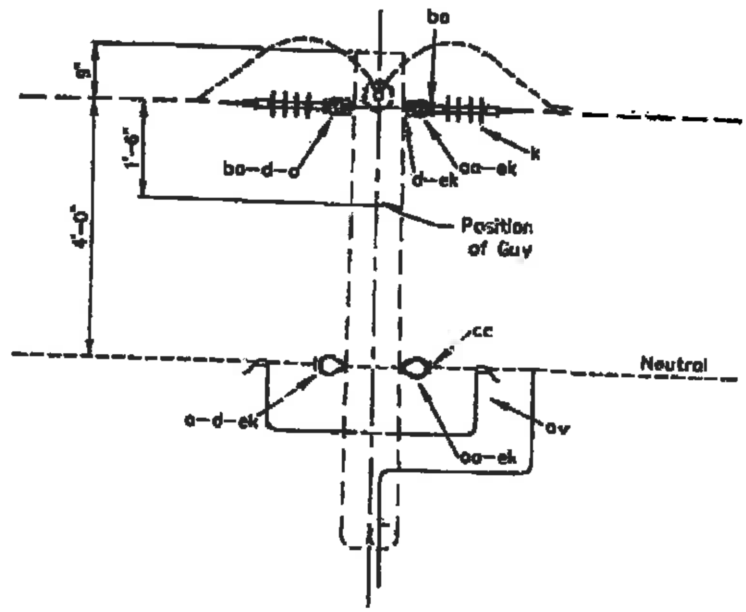
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Eye Bolt, 5/8" x Req'd Length	0320	2	DE Clamp 4 Thru 1/0 ACSR	191000
2	Mach Bolt, 5/8" x Req'd Length	0370	2	1/0 ACSR Neutral DE Tie	195001
7	Washer, Square 11/16" Hole	061001	1	2-4/0 AL Hot Line Clamp	200003
2	Nut, Oval Eye	064000	2	Insulator, 25kv Polly Suspension	911001
1	Pin, Pole Top 25kV Offset	092501			
2	Insulator, Spool Sec	102000			
1	Insulator, Pin Type 25kv	107500			
2	Clevis, Swinging J6	181500			

UP TO 1/0 ACSR

14.4/24.9 KV, 1-PHASE
VERTICAL CONSTRUCTION
DOUBLE DEADEND

Revised
May 2003

VA6



NOTES:

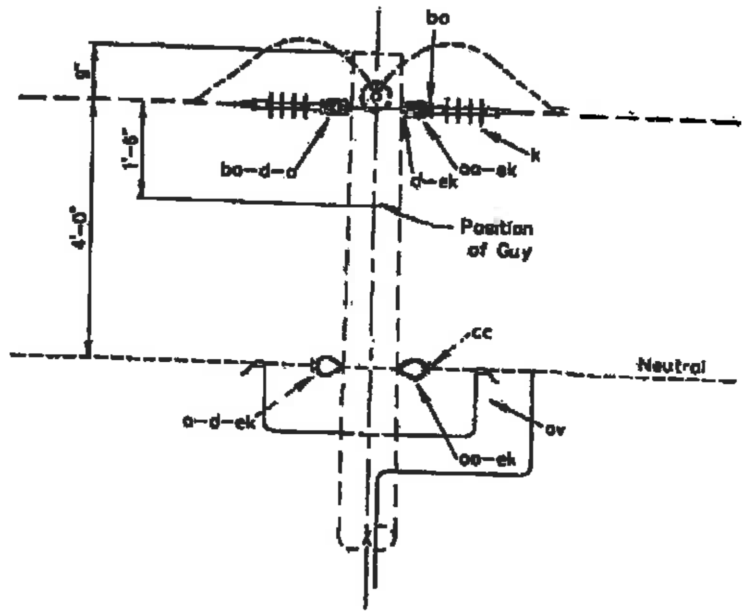
A6 MAY BE USED WITH DRAWINGS SUCH AS: M3-1, M3-1A, M3-10, M3-41, M3-23, M5-1, M5-4, M5-2 (AS SHOWN).

Quan.	Material	Item No.	Quan.	Material	Item No
1	Adapter, Pin Head	0960	2	Clamp, Pri. D.E.	1910
1	Washer, Square	0610	1	Clamp Hot Line	2000
4	Insulator, Polly	1110	1	Bolt, D.A.	0270
1	Ins. Pin Type	1040	3	Connectors, Small	3000
2	Bolt, Eye 5/8"	0320	2	Ins. Spool Sec.	1020
2	Nut, Eye 5/8"	0640	2	Clevis, Sec. J 6	1815
			4	Clamp C412	1950

1-PHASE VERTICAL DEADEND
(DOUBLE)

Revised
Sept. 1994

A6 - P



NOTES:

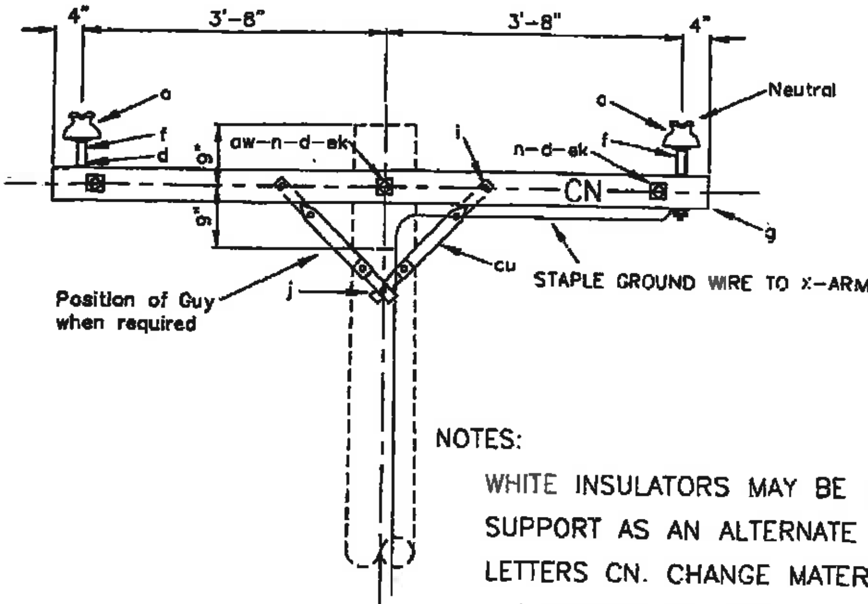
A6 MAY BE USED WITH DRAWINGS SUCH AS: M3-1, M3-1A, M3-10, M3-41, M3-23, M5-1, M5-4, M5-2 (AS SHOWN).

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Adapter, Pin Head	0960	2	Clamp, Pri. D.E.	1910
1	Washer, Square	0610	1	Clamp Hot Line	2000
4	Insulator, Polly	1110	1	Bolt, D.A.	0270
1	Ins. Pin Type	1040	3	Connectors, Small	3000
2	Bolt, Eye 5/8"	0320	2	Ins. Spool Sec.	1020
2	Nut, Eye 5/8"	0640	2	Clevis, Sec. J 6	1815
			4	Clamp C412	1950

1-PHASE VERTICAL DEADEND (DOUBLE)

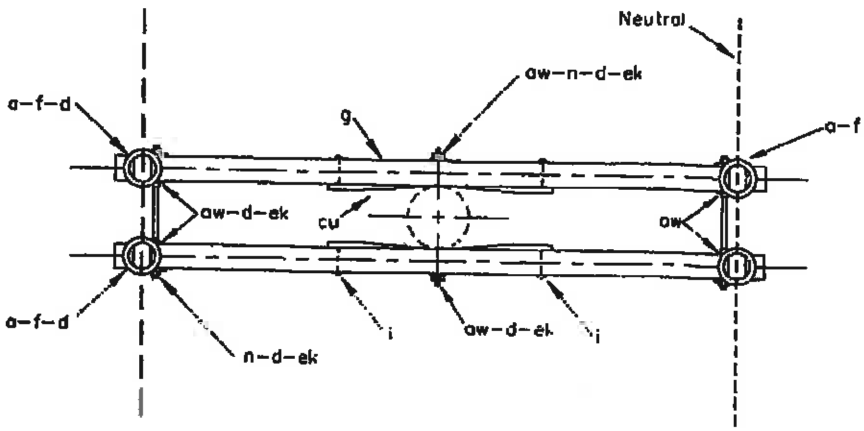
Revised Sept. 1994

VA6-P



NOTES:

WHITE INSULATORS MAY BE USED FOR THE NEUTRAL SUPPORT AS AN ALTERNATE TO THE BROWN INSULATOR AND LETTERS CN. CHANGE MATERIAL LIST AS NECESSARY AND SPECIFY AS A9W.



PLAN

Quan.	Material	Item No.	Quan.	Material	Item No.
4	Insulator, Pin Type	1040	4	Bolt, Carriage	0210
10	Washer, 2 1/4" Square	0610	2	Screw, Lag	0550
4	Pin, Crossarm, Steel	0910	3	Bolt, Double Arming	0270
2	Crossarm, 8' X 3 3/4" X 4 3/4"	0710			
4	Brace, 28"	0800			

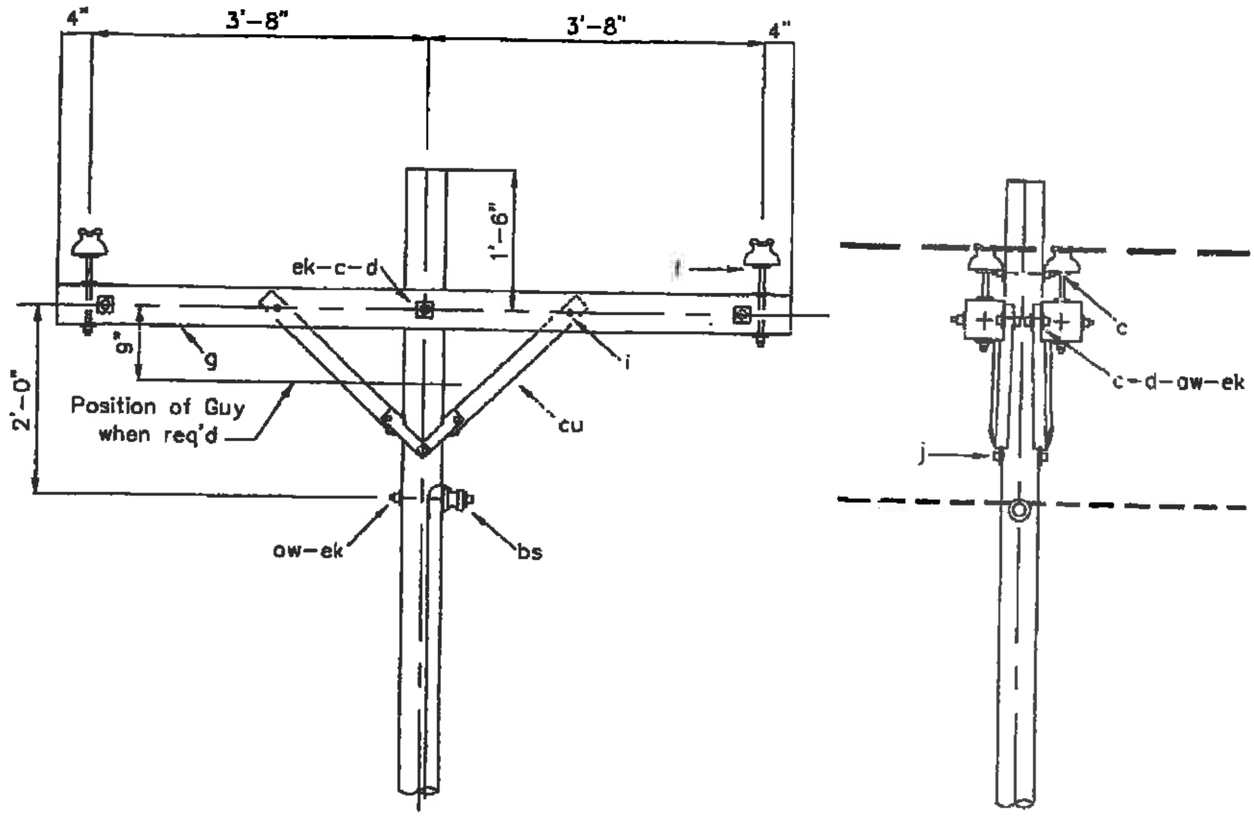
2, 4 & 1/0 ACSR COND

7.2/12.5 KV.,
1-PHASE CROSSARM CONSTRUCTION-
DOUBLE LINE ARM

Revised
Sept. 1994

A9

Section 4: Two-Phase Pole Tops



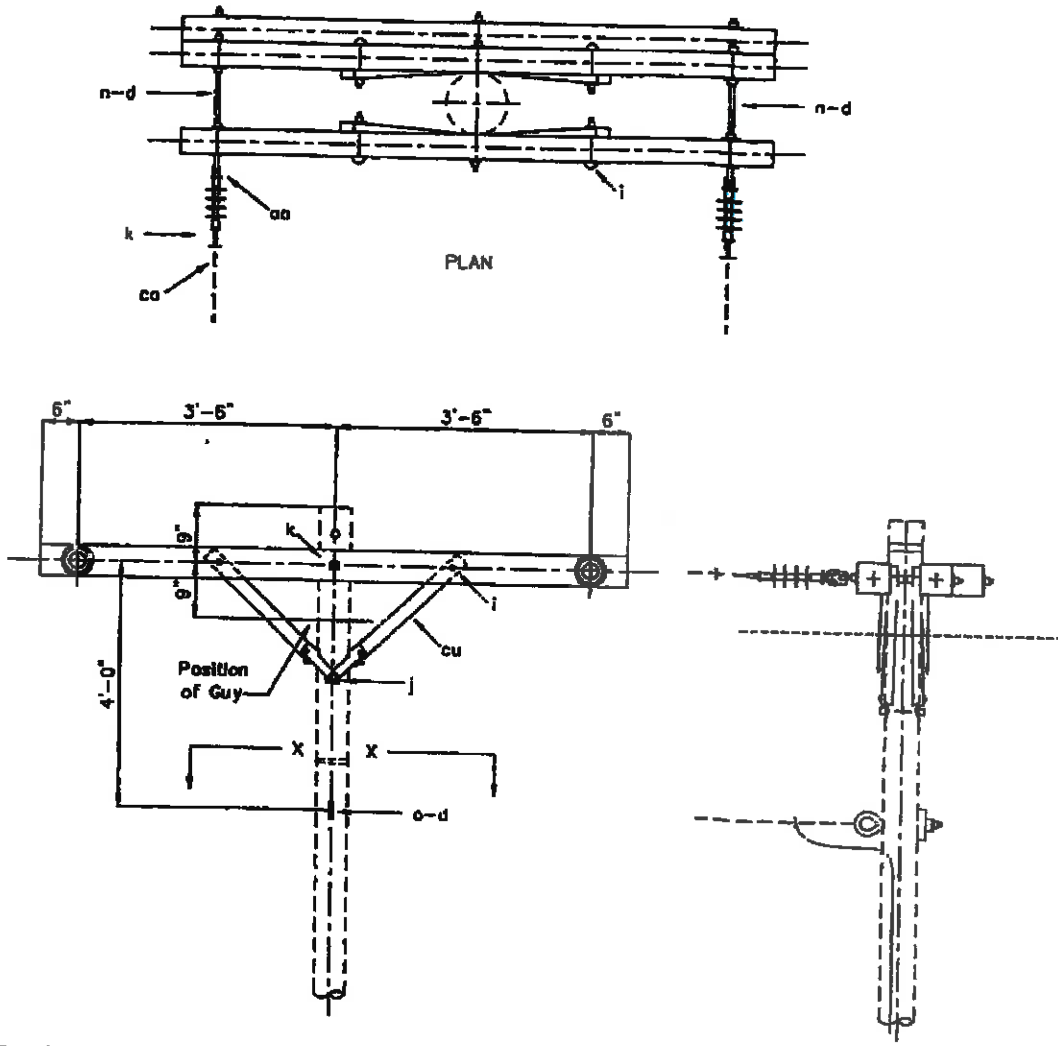
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Insulator, Pin Type	1040	4	Bolt, Carriage	0210
11	Washer, 2 1/4" Square	0610	2	Screw, Lag	0550
4	Pin, Crossarm, Steel	0910	3	Bolt, Double Arming	0270
2	Crossarm, 8'X 3 3/4" X 4 3/4"	0710	1	Bolt, Double Upset	0425
4	Brace, Wood, 28"	0800	1	Ins. Spool Sec.	1020

2, 4 & 1/0 ACSR COND

7.2/12.5 KV. 2-PHASE,
CROSSARM CONSTRUCTION
DOUBLE PRIMARY SUPPORT AT
0° TO 5° ANGLE

Revised
Sept. 1994

B1-1



Notes:

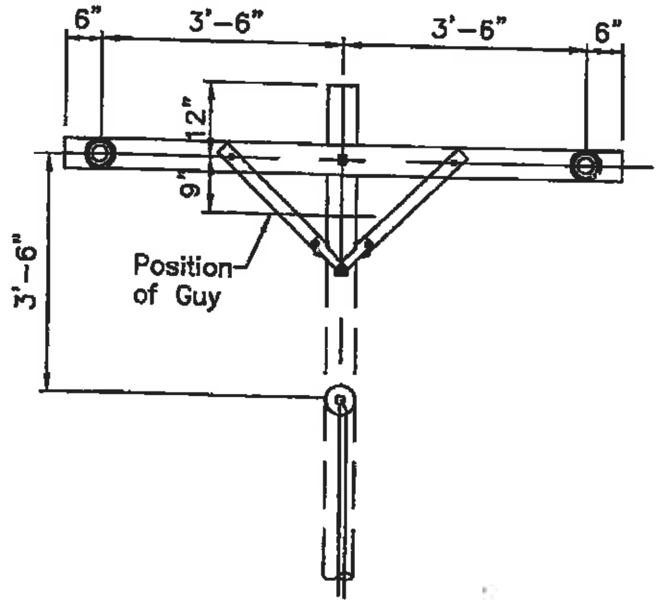
1. Designate as B7–1 for assembly with three crossarms.
2. See drawing E5–1 for crossarm loading limitations.

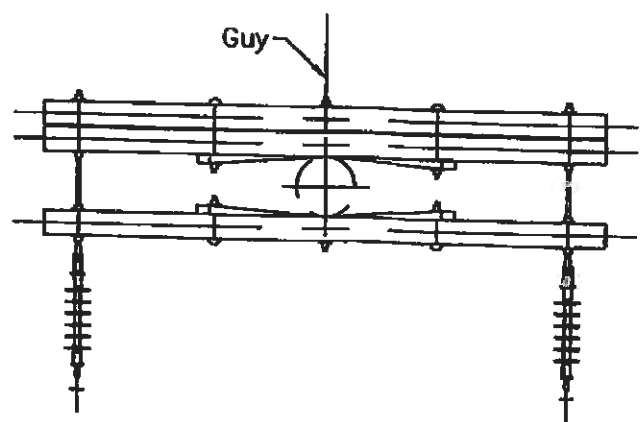
Quan.	Material	Item No.	Quan.	Material	Item No.
14	Washer, Square	0610	3	Bolt, D.A.	0270
3	Crossarm 8'	0710	1	Bolt, Eye	0320
4	Brace, Steel 28"	0800	2	Nut, Eye	0640
4	Bolt, Carriage	0210	2	Clamp, Pri, D.E.	1910
2	Screw, Lag	0550	1	Clevis, Sec. J 6	1815
4	Insulator, Polly	1110	2	Clamp, C 412	1950
1	Connector, Small	3000	1	Ins. Spool Sec.	1020

TWO–PHASE CROSSARM CONSTRUCTION
DEADEND (SINGLE)

Revised
Sept. 1994

B7–1





PLAN

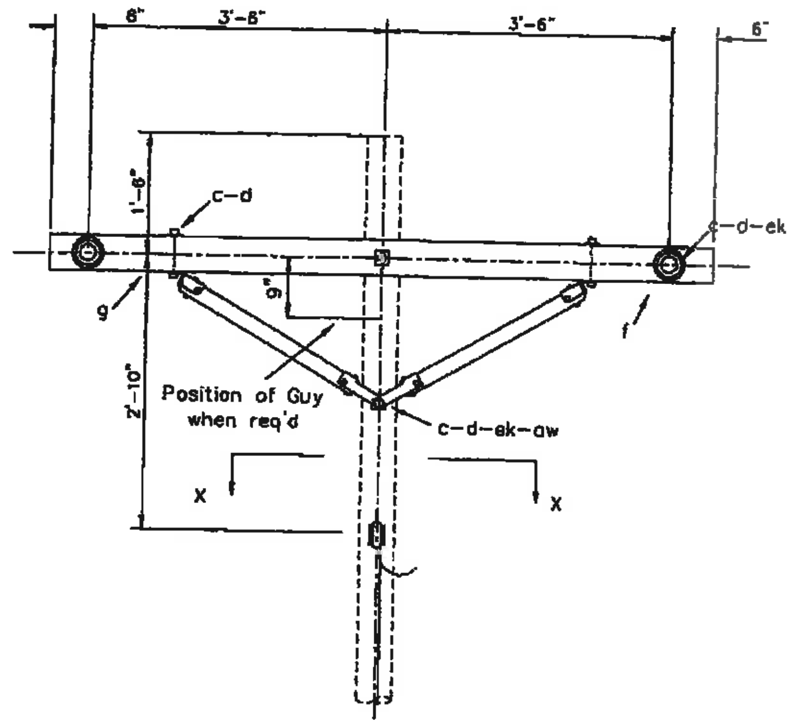
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Carriage Bolt, 3/8"	021000	1	Insulator, Spool Sec	102000
3	DA Bolt, 5/8" x Req'd Length	0270	1	Clevis, Swinging J6	181500
1	Eye Bolt, 5/8" x Req'd Length	0320	2	D.E. Clamp 4 Thru 1/0 ACSR	191000
2	Large Lag Screw	055002	1	1/0 ACSR Neutral D.E. Tie	195001
14	Washer, Square 11/16" Hole	061001	2	Insulator, 25kV Polly Suspension	911001
2	Nut, Oval Eye	064000			
3	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			

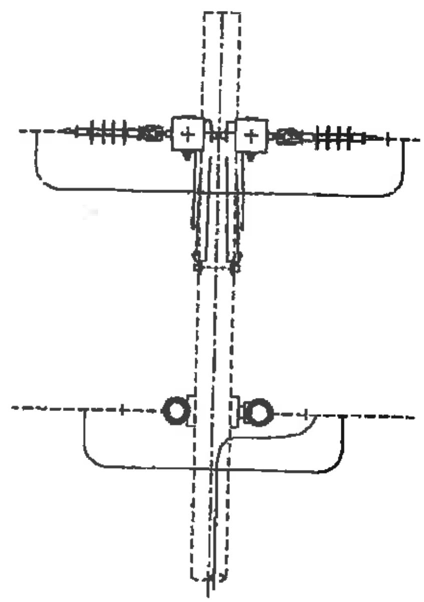
UP TO 1/0 ACSR

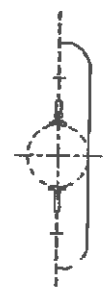
14.4/24.9 KV, 2-PHASE
CROSSARM CONSTRUCTION
SINGLE DEADEND

Revised
May 2003

VB7–1







SECTION X-X

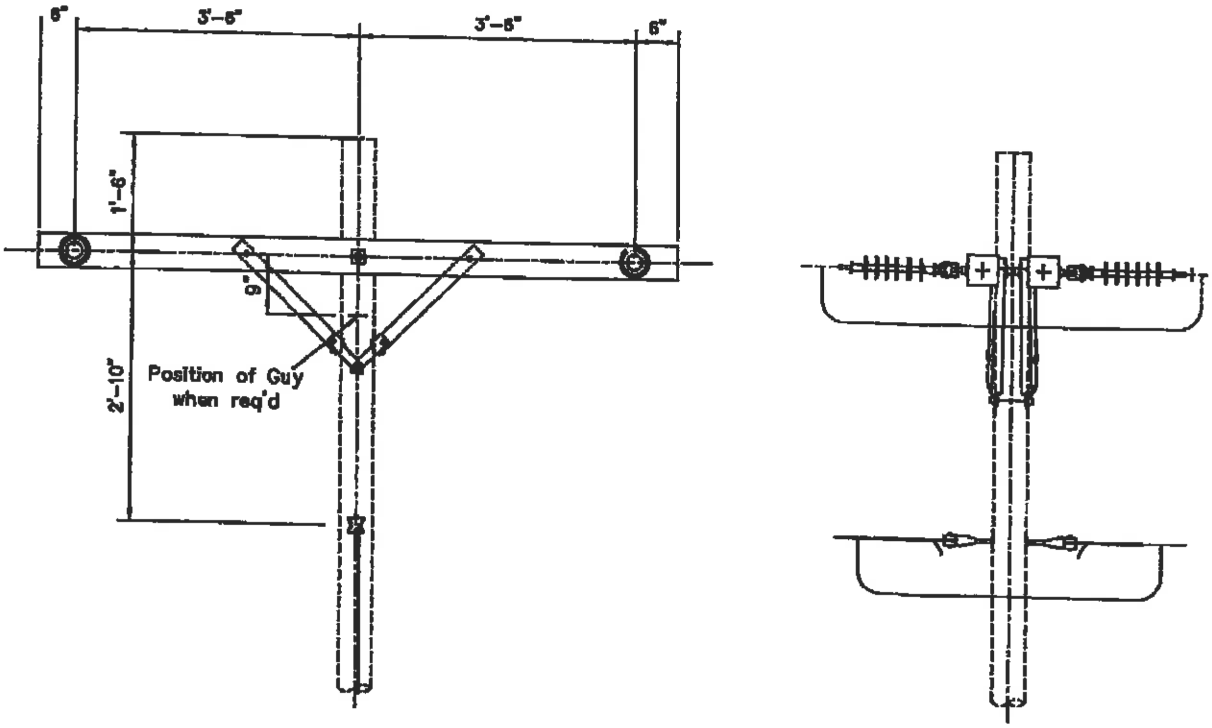
Quan.	Material	Item No.	Quan.	Material	Item No.
12	Washer, Square	0610	3	Bolt, D.A.	0270
2	Crossarm, 8' X 3 3/4" X 4 3/4"	0710	1	Bolt, Eye 5/8"	0320
4	Bolt, Carriage	0210	5	Nut, Eye 5/8"	0640
4	Brace, 28" Wood	0800	4	Clamp, Pri. D.E.	1910
4	Ins. Susp. Polly	1110	2	Clevis, Sec. J 6	1815
4	Washers, Round	0600	2	Ins. Spool Sec.	1020
2	Lag, Screw	0550	4	Clamps, C412	1950

2, 4 & 1/0 ACSR COND

TWO-PHASE CROSSARM CONSTRUCTION
DEADEND

Revised
Sept. 1994

B8



Quan.	Material	Item No.	Quan.	Material	Item No.
4	Carriage Bolt, 3/8"	021000	2	Insulator, Spool Sec	102000
3	DA Bolt, 5/8" x Req'd Length	0270	2	Clevis, Swinging J6	181500
1	Eye Bolt, 5/8" x Req'd Length	0320	4	D.E. Clamp 4 Thru 1/0 ACSR	191000
2	Large Lag Screw	055002	2	1/0 ACSR Neutral D.E. Tie	195001
12	Washer, Square 11/16" Hole	061001	4	Insulator, 25kV Polly Suspension	911001
5	Nut, Oval Eye	064000			
2	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			

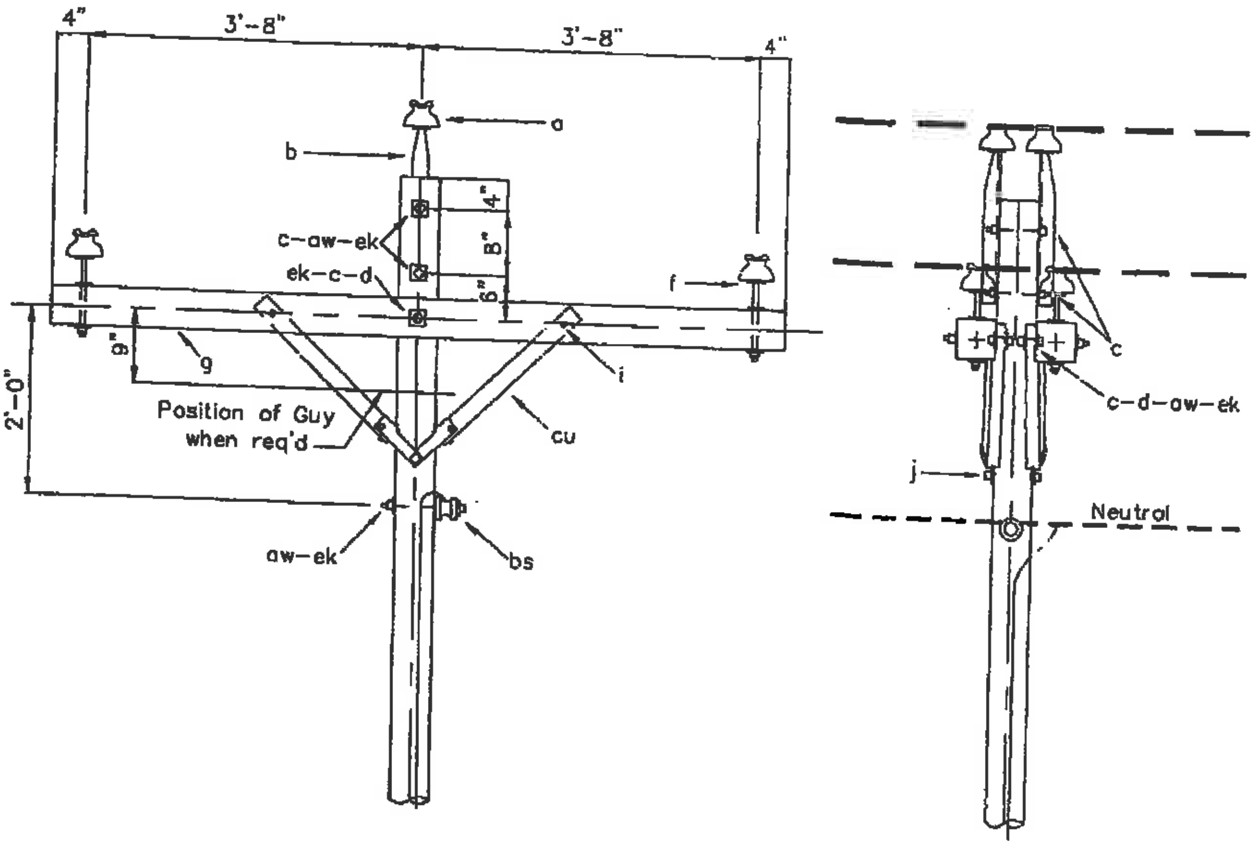
UP TO 1/0 ACSR

14.4/24.9 KV, 2-PHASE
CROSSARM CONSTRUCTION
DOUBLE DEADEND

Revised
May 2003

VB8

Section 5: Three-Phase Pole Tops



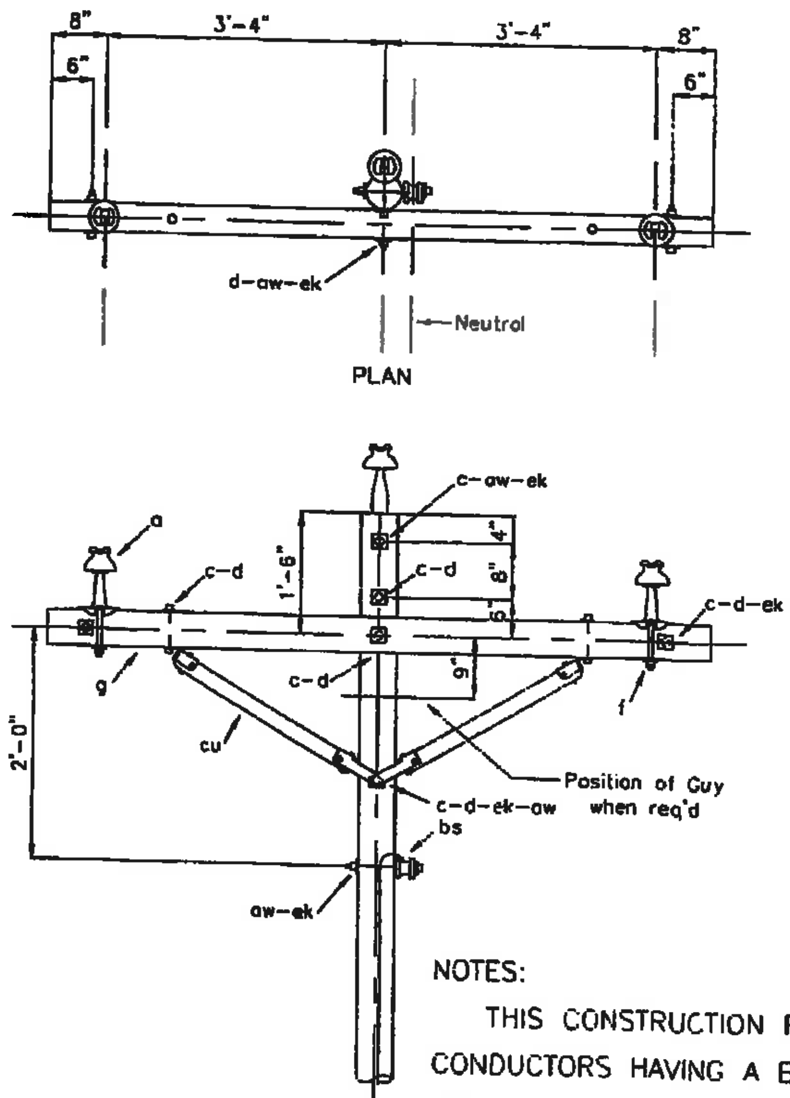
Quan.	Material	Item No.	Quan.	Material	Item No.
6	Ins. Pin Type	1040	4	Bolt, Carriage	0210
2	Pin, Pole Top	0900	2	Screw, Lag	0550
2	Bolt, Machine	0370	3	Bolt, D.A.	0270
11	Washer, Square	0610	1	Bolt Double Upset	0425
4	Pin Crossarm, Steel	0910	1	Ins. Spool Sec.	1020
2	Crossarm 8' X 3 3/4" X 4 3/4"	0710			
4	Brace, Wood 28"	0800			

2, 4 & 1/0 ACSR COND

3-PHASE CROSSARM CONSTRUCTION
0° TO 5° ANGLE
DOUBLE PRIMARY SUPPORT

Revised
Sept. 1994

C1-1



NOTES:

THIS CONSTRUCTION REQUIRED FOR ALL CONDUCTORS HAVING A BREAKING STRENGTH OF MORE THAN 4500 POUNDS.

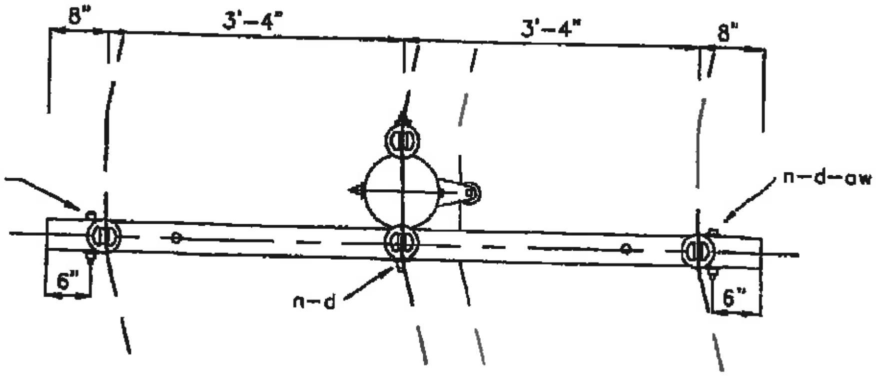
Quan.	Material	Item No.	Quan.	Material	Item No.
3	Ins., Pin Type	1040	2	Pin, Saddle	0930
1	Pin, Pole Type, 20	0900	1	Crossarm, 8' X 3 3/4" X 4 3/4"	0710
6	Bolt, Machine	0370	1	Bolt, Double Upset	0425
2	Bolt, Machine, 6" X 12"	0350	1	Brace, Bow	0860
10	Washer, 2 1/4" Square	0610	1	Ins. Spool Sec.	1020
2	Washer, Round	0600	1	Connector	3010

3/0, 336.4 & 795 MCM

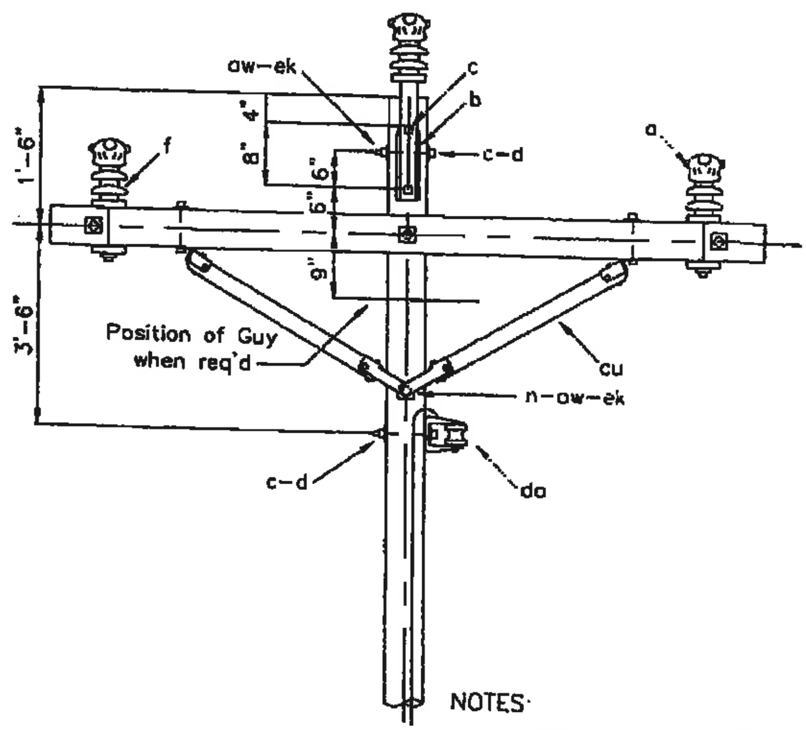
7.2/12.5 KV., 3-PHASE
CROSSARM CONSTRUCTION
0° TO 2° ANGLE
(LARGE CONDUCTORS)

Revised
Sept. 1994

C1-2



PLAN



NOTES·

1. INSULATORS TO BE EQUAL TO O.B. 43902
2. POLT TOP BRACKETS TO BE EQUAL TO O.B. 84324

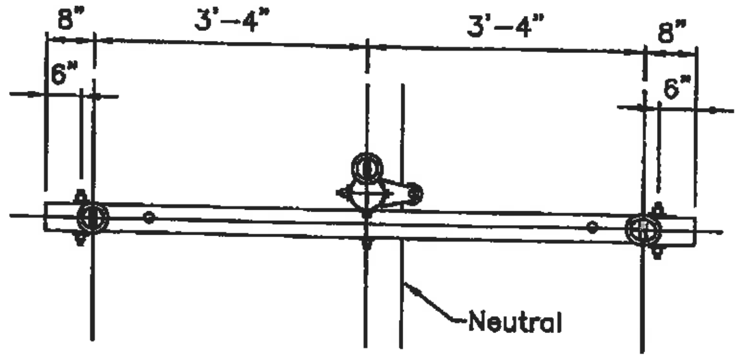
Quan.	Material	Item No.	Quan.	Material	Item No.
3	Insulator, Post Type	1073	1	Ins. Spool Sec.	1020
1	Bracket, Post Type	1080	1	Crossarm, 8' X 3 3/4" X 4 3/4"	0710
6	Bolt, Machine, 5/8"	0370	1	Bolt, Double Upset	0425
2	Bolt, Machine, 1/2"	0350	1	Brace, Steel 60"	0860
10	Washer, 2 1/4" Square	0610	1	Connector	3010
2	Washer, Round	0600			

795 MCM CONDUCTOR

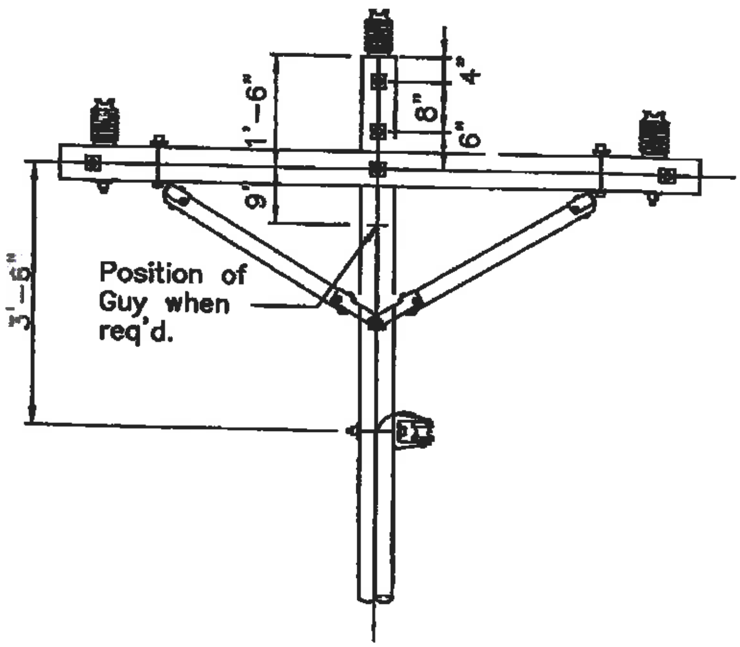
7.2/12.5 KV. 3-PHASE CROSSARM CONSTRUCTION
CLAMP TOP POST INSULATORS

Revised
Sept. 1994

C1-2P



PLAN



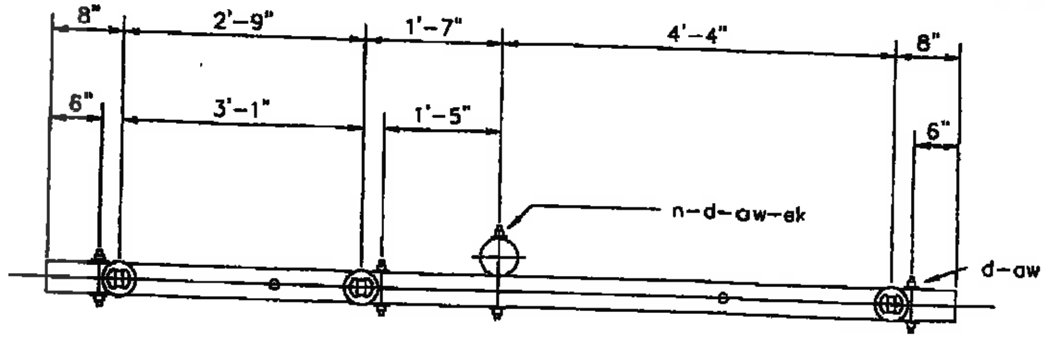
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 1/2" x 7"	035002	3	Insulator, Post Type 25kV	107300
5	Mach Bolt, 5/8" x Req'd Length	0370	1	Bracket, 25kV Post Type	108001
2	Mach Bolt, 5/8" x 5"	037001	1	Clevis, Secondary J10	181000
2	Washer, 1/2" Round	060001			
10	Washer, Square 11/16" Hole	061001			
1	Crossarm, 4 3/4" x 5 3/4" x 8'	072000			
1	Brace, Wood Bow 60" Span	086000			
1	Insulator, Spool Sec Large	103000			

795 MCM

14.4/24.9 KV, 3–PHASE
CROSSARM CONSTRUCTION
0° TO 2° ANGLE

Revised
June 2003

VC1–2P



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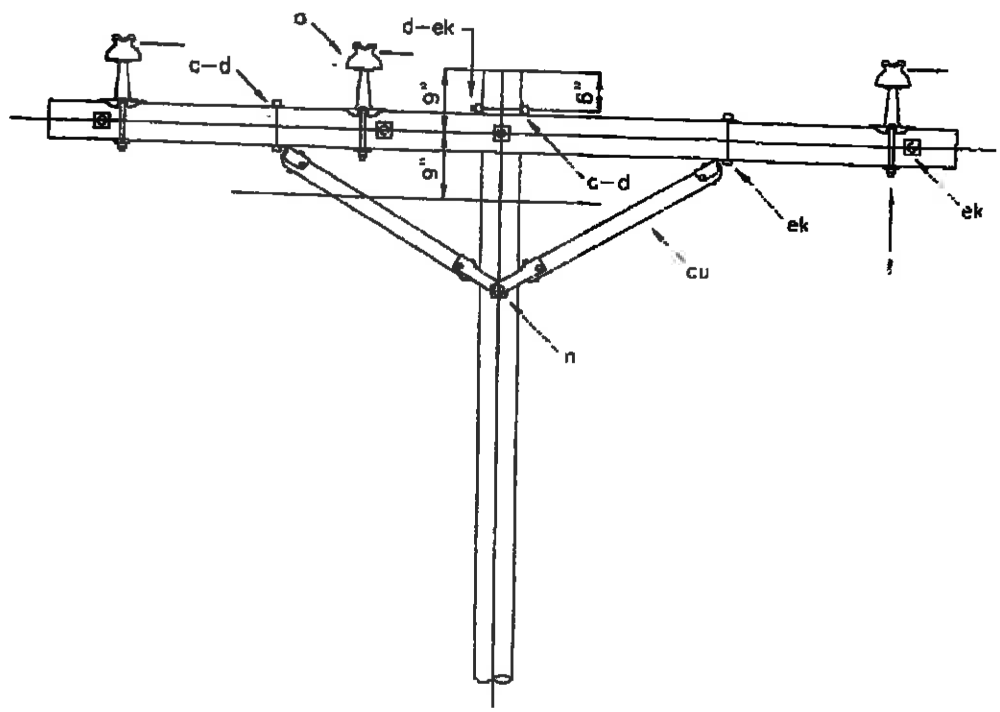
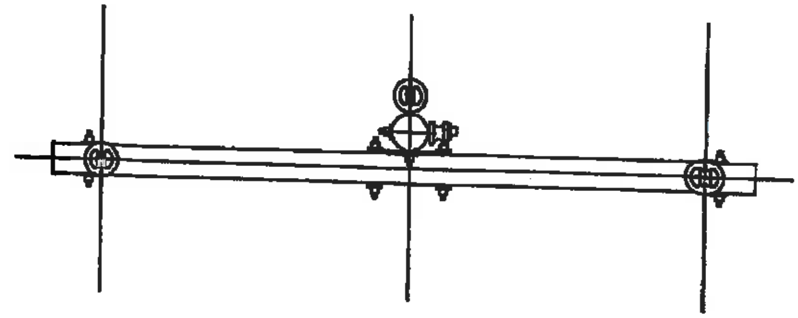


Quan.	Material	Item No.	Quan.	Material	Item No.
3	Ins. Pin Type	1040	3	Saddle Pins	0930
5	Bolt, Machine, 5/8"	0370	1	Crossarm 10' X 3 3/4" X 4 3/4"	0735
2	Bolt, Machine, 1/2"	0350	1	Brace, Wood 60"	0860
9	Washer, 2 1/4" X Square	0610			
2	Washer, Round	0600			

3/0, 336.4 & 795 MCM

Revised Sept. 1994

C1-2U



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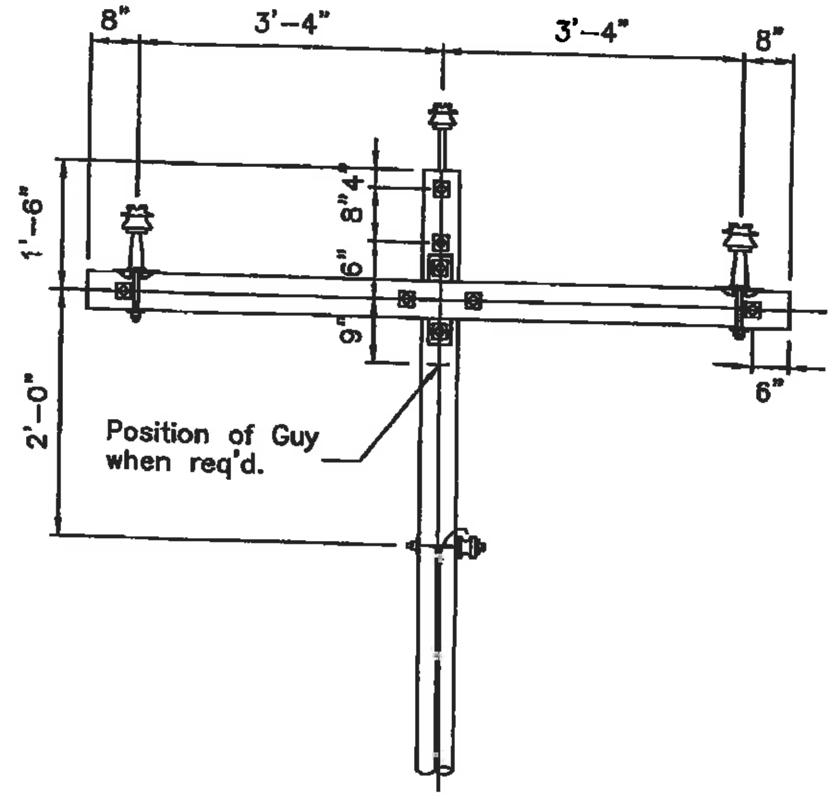


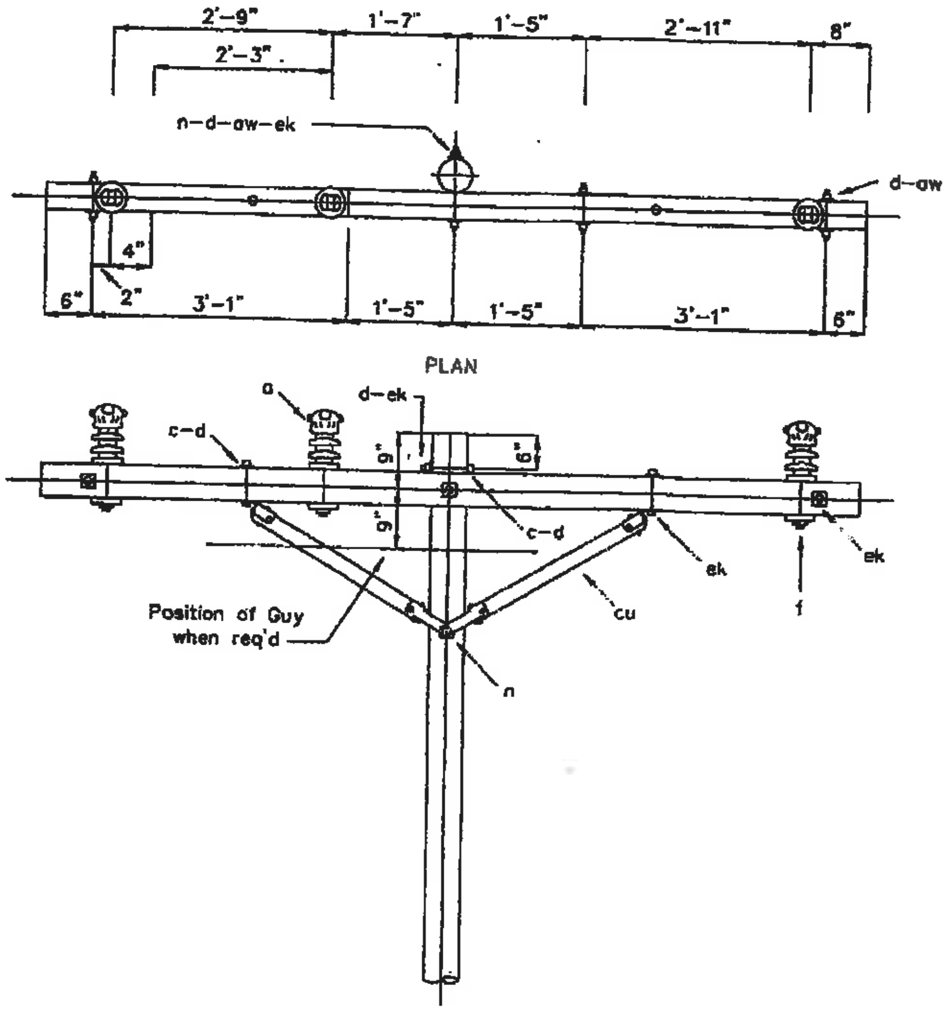
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Mach Bolt, 5/8" x Req'd Length	0370			
1	DU Bolt, 5/8" x Req'd Length	0425			
5	Washer, Square 11/16" Hole	061001			
1	Crossarm, 8' Fiberglass Tangent	070000			
2	Pin, Saddle 25kV	094000			
1	Insulator, Spool Sec Large	103000			
3	Insulator, Pin Type 25kV	107500			

3/0, 336 MCM

14.4/24.9 KV, 3–PHASE
CROSSARM CONSTRUCTION
0° TO 2° ANGLE

Revised
May 2003

VC1–2F



NOTES:

1. CENTER PHASE WIRE OR NEUTRAL WIRE MAY BE LOCATED ON THE OPPOSITE SIDE OF THE POLE WHERE NECESSARY TO AVOID CROSSING OF WIRES IN MIDSPAN.
2. ARMOR RODS REQUIRED FOR ALL SPANS.
3. INSULATORS TO BE EQUAL TO OHIO BRASS 43902 (CLAMP TOP TYPE)

Quan.	Material	Item No.	Quan.	Material	Item No.
3	Insulator, Post Type	1073	1	Brace, Wood Bow 60"	0860
4	Bolt, Machine, 5/8"	0370			
2	Bolt, Machine, 1/2"	0350			
13	Washer, 2 1/4" X Square	0610			
4	Washer, Round	0600			
1	Crossarm, 10' X 3 3/4" X 4 3/4"	0735			

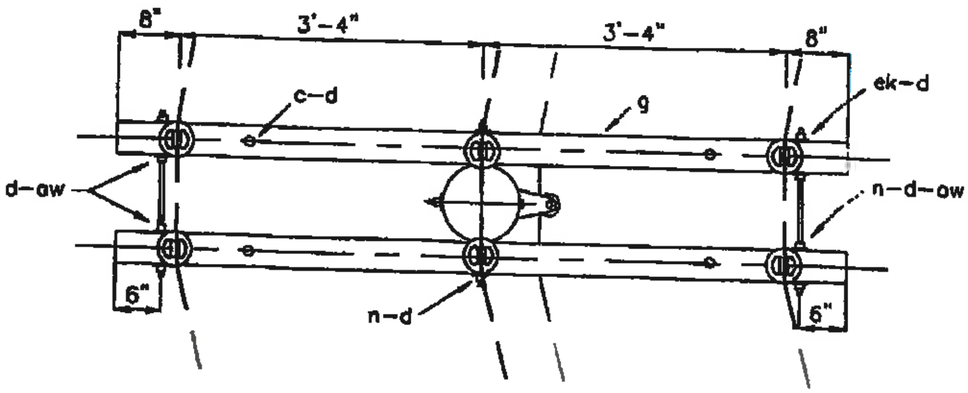
795 MCM CONDUCTOR

LESS NEUTRAL

7.2/12.5 KV. PRIMARY, 3-PHASE
CROSSARM CONSTRUCTION DOUBLE PRIMARY SUPPORT
CLAMP TOP POST INSULATORS

Revised Sept. 1994

C1-2HAX



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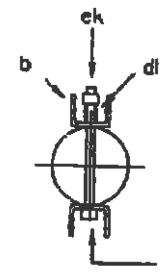
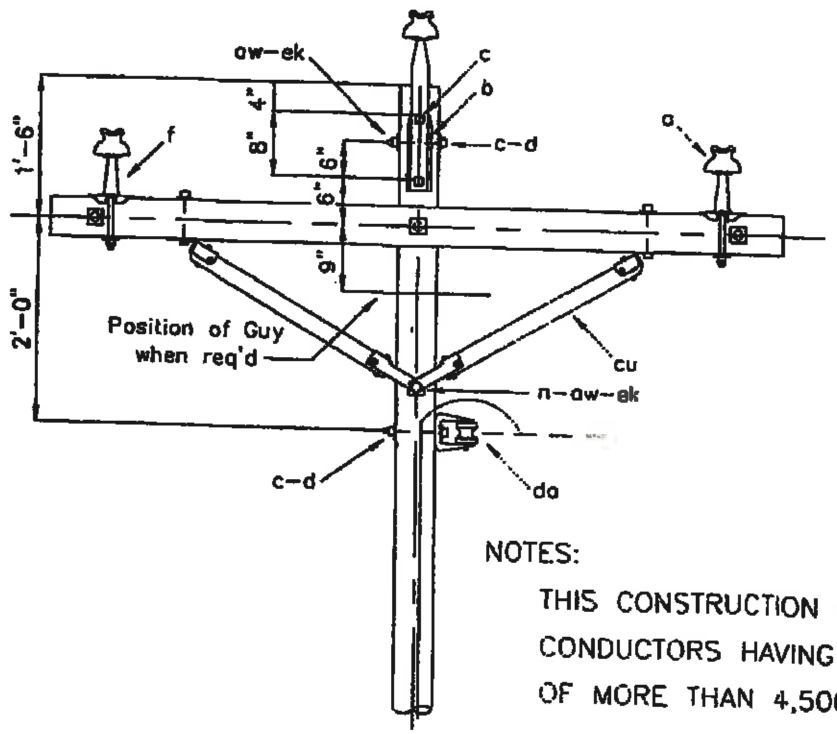


DETAIL OF POLE TOP PIN ASSEMBLY



NOTES:

THIS CONSTRUCTION REQUIRED FOR ALL CONDUCTORS HAVING A BREAKING STRENGTH OF MORE THAN 4,500 POUNDS.

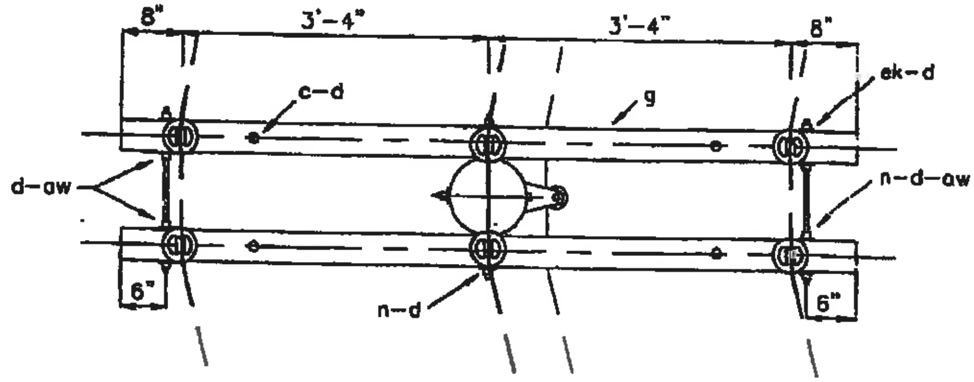
Quan.	Material	Item No.	Quan.	Material	Item No.
6	Insulator, Pin Type	1040	2	Crossarm, 8' X 3 3/4" X 4 3/4"	0710
2	Pin, Pole Top, 20"	0900	3	Bolt, Double Arming	0270
7	Bolt, Machine, 5/8"	0370	2	Brace, Wood Bow 60"	0860
4	Bolt, Machine, 1/2" X 6"	0350	4	Pin, Saddle	0930
16	Washer, 2 1/4" Square	0610	1	Ins. Spool Sec.	1030
4	Washer, Round	0600	1	Clevice, Sec. J 10	1810
1	Connector	3010			

3/0, 336.4 & 795 MCM

7.2/12.5 KV. 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE PRIMARY SUPPORT, 0° TO 5° ANGLE
(LARGE CONDUCTORS)

Revised Sept. 1994

C1-3



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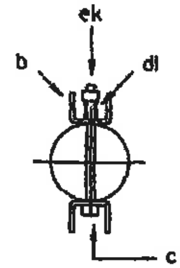
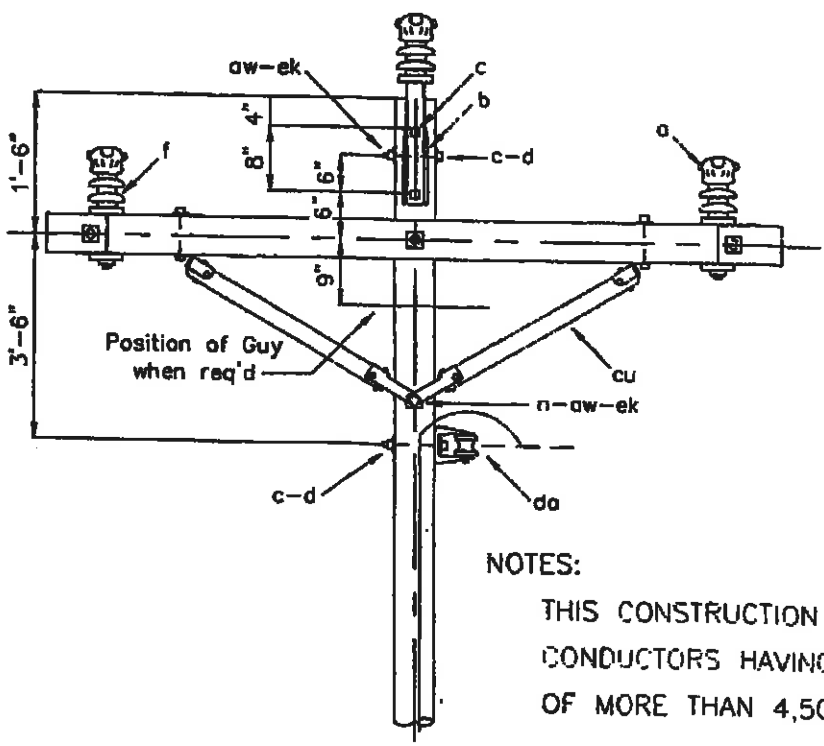


DETAIL OF POLE TOP PIN ASSEMBLY



NOTES:

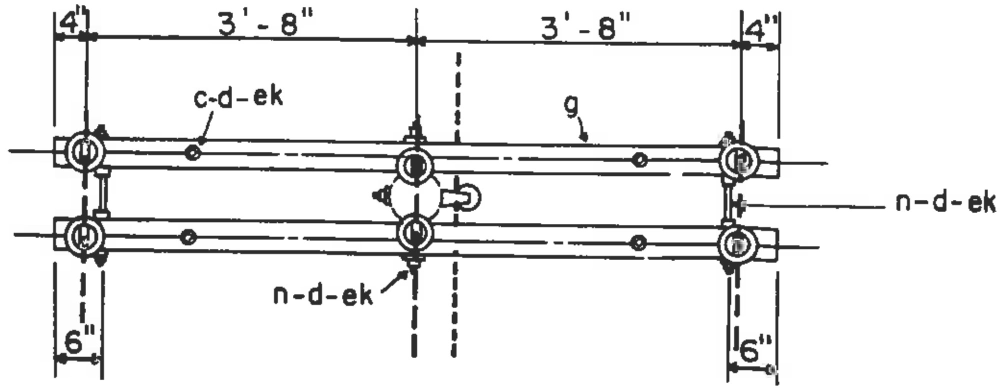
THIS CONSTRUCTION REQUIRED FOR ALL CONDUCTORS HAVING A BREAKING STRENGTH OF MORE THAN 4,500 POUNDS.

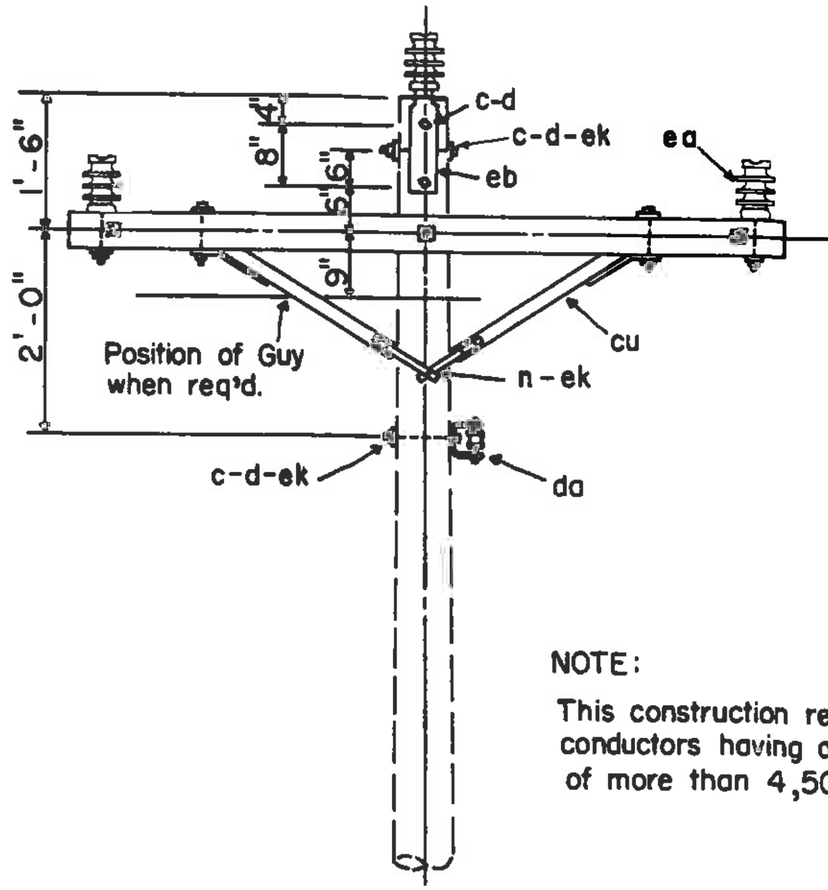
Quan.	Material	Item No.	Quan.	Material	Item No.
6	Insulator, Post Type	1073	1	Connector	3010
2	Bracket, Post Type	1080	2	Crossarm, 8' X 3 3/4" X 4 3/4"	0710
5	Bolt, Machine, 5/8"	0370	3	Bolt, D.A.	0270
4	Bolt, Machine, 1/2"	0350	2	Brace, Wood 60"	0860
13	Washer, Square	0610	1	Bracket, Insulated J 10	1810
4	Washer, Round	0600	1	Spool, Insulator	1030

795 MCM CONDUCTOR

7.2/12.5 KV. 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE ARM

Revised Sept. 1994	C1-3P





NOTE:

This construction required for all conductors having a breaking strength of more than 4,500 pounds.

ITEM	NO.	MATERIAL	ITEM	NO.	MATERIAL
c	4	Bolt, machine, 5/8" x required length	ea	6	Insulator, post type
c	4	Bolt, machine, 1/2" x required length	eb	2	Bracket, pole top
d	13	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole	cu	2	Brace, wood, 60" span
d	4	Washer, round, 1 3/8" diam., 9/16" hole	da	1	Bracket, insulated
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"			
n	4	Bolt, double arming, 5/8" x req'd. length	ek		Locknuts, as required

DESIGN LIMITS

Max. transverse load: 1500 lbs. per conductor

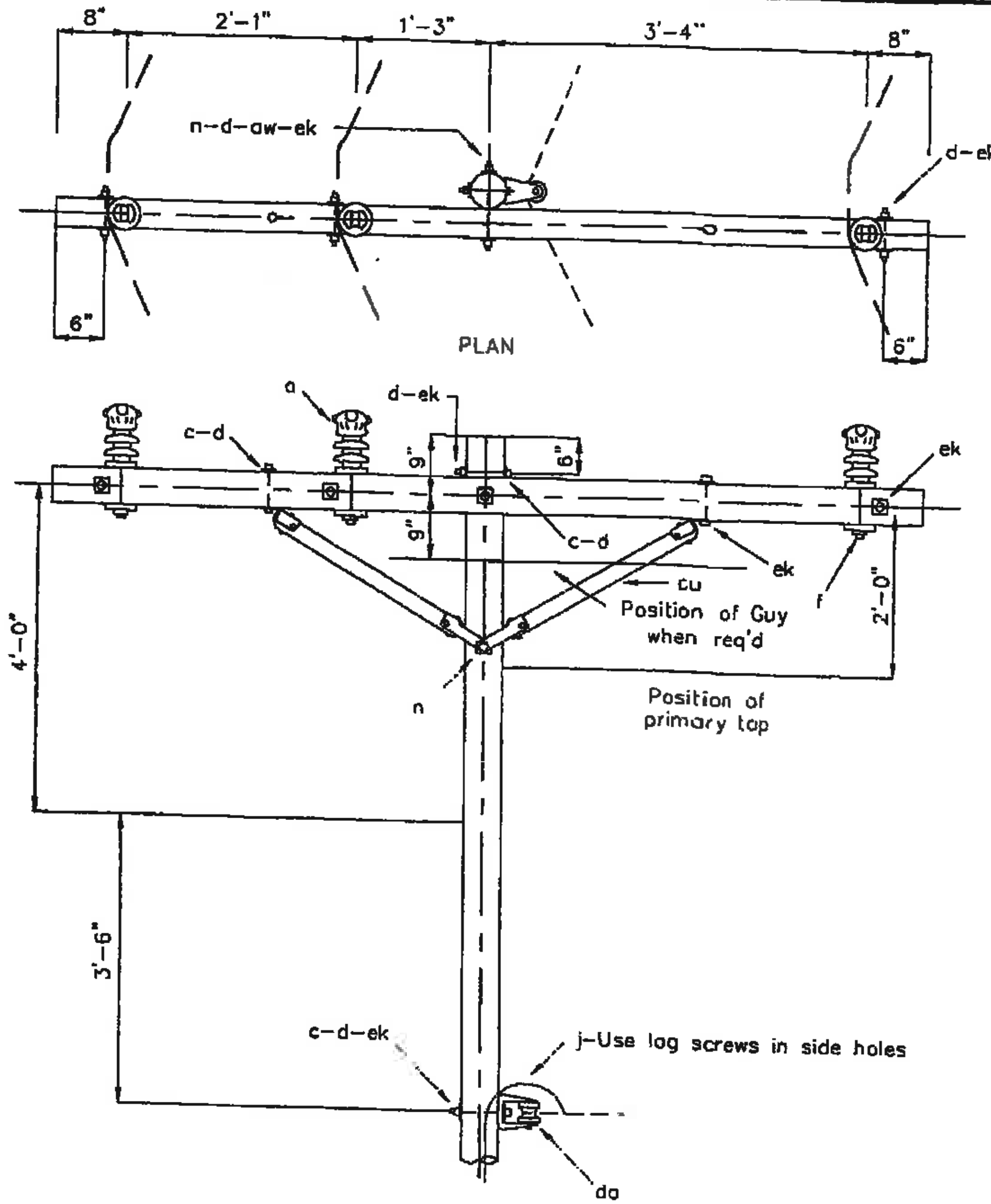
Max. line angle within load limits: 5°

14.4/24.9 kV

3-PHASE, CROSSARM CONSTRUCTION
DOUBLE PRIMARY SUPPORT
(LARGE CONDUCTORS)

Apr., 1983

VC1-3P



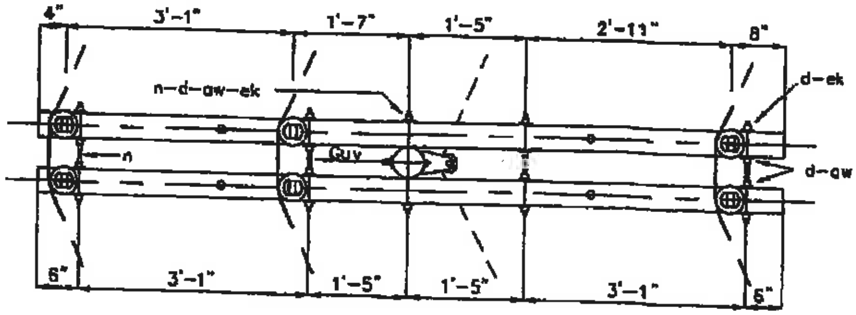
Quan.	Material	Item No.	Quan.	Material	Item No.
3	Insulator Top, Post	1073	2	Bolt, Machine 1/2"	0350
2	Bolt, Machine, 5/8"	0370	2	Washer, Round	0600
8	Washer, Square	0610	5	Bolt, Machine 5/8"	0370
1	X-Arm, 3 3/4" x 4 3/4" x 8'	0710	1	Connectors	3010
1	Brace, Wood 60"	0860	1	Clevis, Sec. J10	1810
			1	Ins. Spool Sec.	1020

795 MCM CONDUCTOR

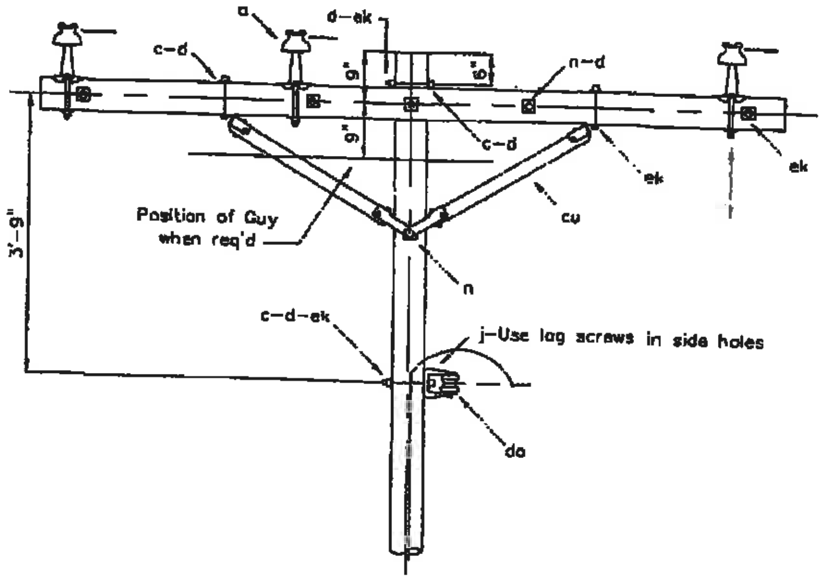
12.5 PRIMARY 3 PHASE 4 WIRE STAR
CROSSARM CONSTRUCTION
SINGLE PRIMARY SUPPORT, 0° TO 3° ANGLE
(LARGE CONDUCTORS)

Revised
Sept. 1994

C1H



PLAN



NOTES:

1. SIDE GROOVE OF INSULATOR MUST ALWAYS BE LARGER THAN THE OVERALL DIAMTER OF CONDUCTOR INCLUDING ARMOR RODS WHEN REQUIRED.
2. CENTER PHASE WIRE OR NEUTRAL WIRE MAY BE LOCATED ON THE OPPOSITE SIDE OF THE POLE WHERE NECESSARY TO AVOID CROSSING OF WIRES IN MIDSPAN.
3. THIS CONSTRUCTION REQUIRED FOR ALL CONDUCTORS HAVING A BREAKING STRENGTH OF MORE THAN 4500 POUNDS.

Quan.	Material	Item No.	Quan.	Material	Item No.
6	Insulator, Pin Type	1040	1	Ins. Spool Sec.	1030
2	Bolt, Machine, 5/8"	0370	2	Brace, Wood Bow 60"	0860
4	Bolt, Machine, 1/2"	0350	1	Clevice, Sec. J 10	1810
19	Washer, 2 1/4" x Square	0610	5	Bolt, Double Arming	0270
4	Washer, Round	0600			
6	Pin, Crossarm, Saddle	0930			
2	Crossarm, 10' X 3 3/4" X 4 3/4"	0735			
2	Screw, Lag	0550			

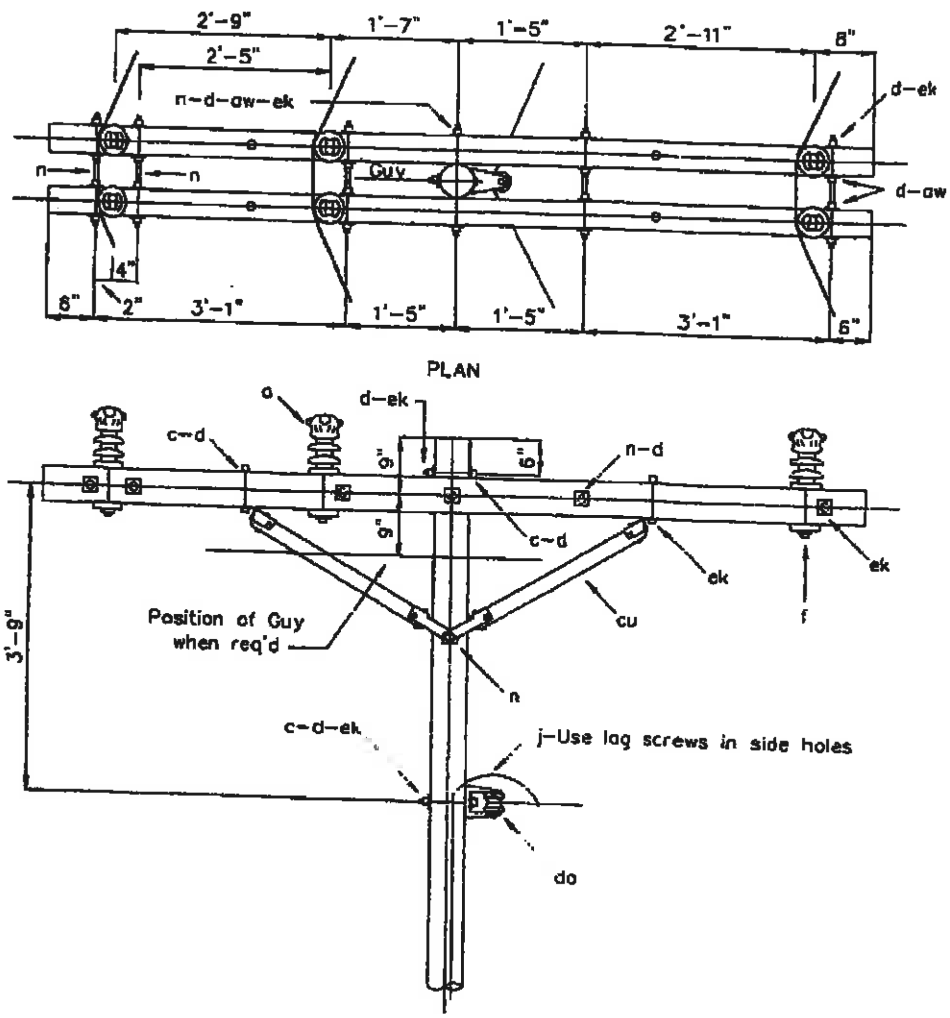
795 CONDUCTOR

795 MCM MAX. 12'
336.4 MCM MAX. 17'

7.2/12.5 KV. 3-PHASE
CROSSARM CONSTRUCTION DOUBLE PRIMARY SUPPORT-(LARGE CONDUCTORS) - MAX. TRANSVERSE LOADING - 1000 LBS/PIN

Revised
Sept. 1994

C2-2

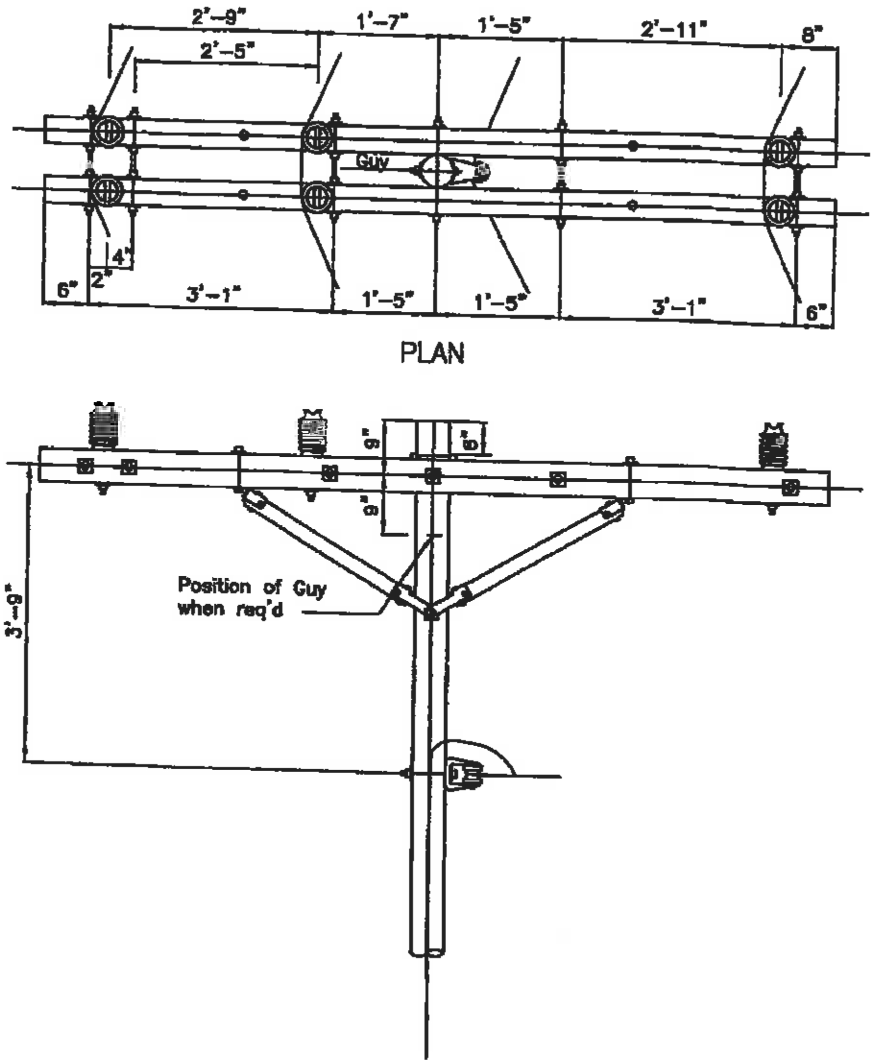


NOTES:

1. CENTER PHASE WIRE OR NEUTRAL WIRE MAY BE LOCATED ON THE OPPOSITE SIDE OF THE POLE WHERE NECESSARY TO AVOID CROSSING OF WIRES IN MIDSPAN.
2. ARMOR RODS REQUIRED FOR ALL SPANS.
3. INSULATORS TO BE EQUAL TO OHIO BRASS 43902 (CLAMP TOP TYPE)

Quan.	Material	Item No.	Quan.	Material	Item No.
6	Insulator, Post Type	1073	1	Connector	3010
2	Bolt, Machine, 5/8"	0370	1	Ins. Spool Sec.	1020
4	Bolt, Machine, 1/2"	0350	2	Brace, Wood 60"	0860
23	Washer, 2 1/4" x Square	0610	1	Clevice, Sec. J 10	1810
4	Washer, Round	0600	6	Bolt, Double Arming	0270
2	Crossarm, 10' X 3 3/4" X 4 3/4"	0735			
6	X-Arm Angle Bracket	0951			

795 MCM CONDUCTOR 795 MCM MAX. 12° 336.4 MCM MAX. 17°	7.2/12.5 KV. 3-PHASE CROSSARM CONSTRUCTION DOUBLE PRIMARY SUPPORT CLAMP TOP POST INSULATORS
	Revised Sept. 1994 — C2-2P

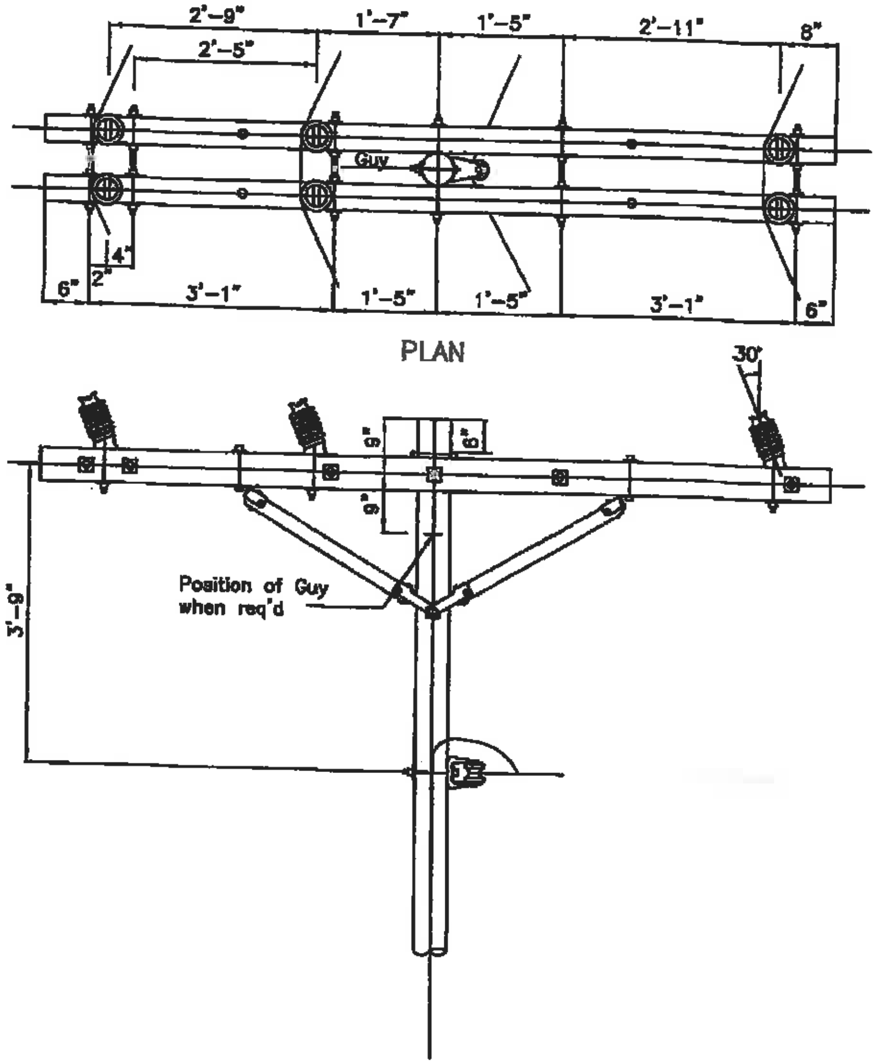


Note:

1. Center phase wire or neutral wire may be located on the opposite side of the pole where necessary to avoid crossing of wires in midspan.

Quan.	Material	Item No.	Quan.	Material	Item No.
6	DA Bolt, 5/8" x Req'd Length	0270	6	Insulator, Post Type 25kV	107300
4	Mach Bolt, 1/2"x 7"	035002	1	Clevis, Secondary J10	181000
3	Mach Bolt, 5/8" x Req'd Length	0370			
4	Washer, 1/2" Round	060001			
25	Washer, Square 11/16" Hole	061001			
2	Crossarm, 4 3/4" x 5 3/4" x 10'	074000			
2	Brace, Wood Bow 60" Span	086000			
1	Insulator, Spool Sec Large	103000			

795 MCM	14.4/24.9 KV, 3-PHASE CROSSARM CONSTRUCTION DOUBLE PRIMARY SUPPORT MAX. 12°
Revised May 2003	VC2-2P



Note:

1. Center phase wire or neutral wire may be located on the opposite side of the pole where necessary to avoid crossing of wires in midspan.

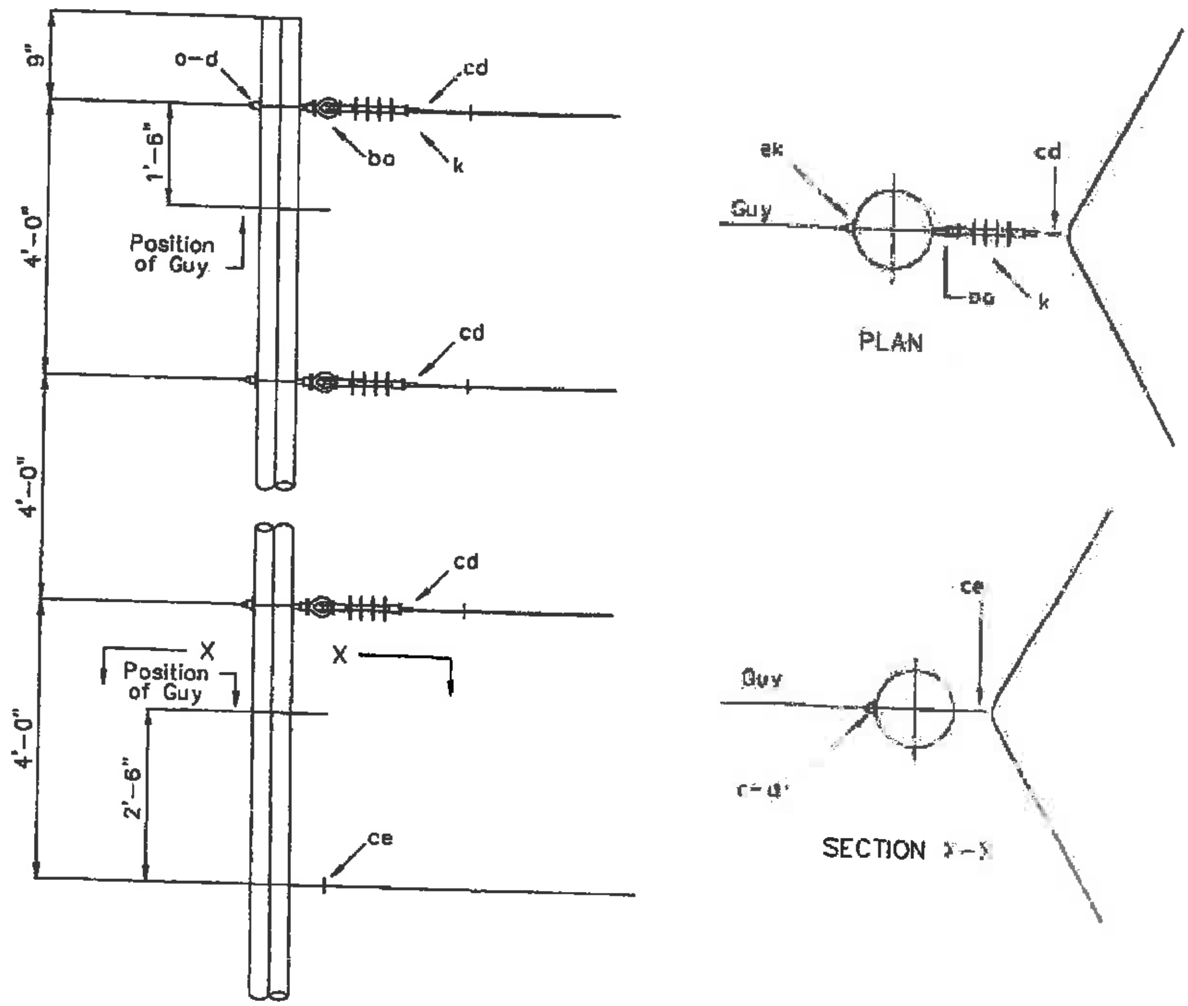
Quan.	Material	Item No.	Quan.	Material	Item No.
6	DA Bolt, 5/8" x Req'd Length	0270	1	Insulator, Spool Sec Large	103000
4	Mach Bolt, 1/2"x 7"	035002	6	Insulator, Post Type 25kV	107300
3	Mach Bolt, 5/8" x Req'd Length	0370	1	Clevis, Secondary J10	181000
4	Washer, 1/2" Round	060001			
25	Washer, Square 11/16" Hole	061001			
2	Crossarm, 4 3/4" x 5 3/4" x 10'	074000			
2	Brace, Wood Bow 60" Span	086000			
6	Bracket, Crossarm Angle	095100			

795 MCM

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE PRIMARY SUPPORT
MAX. 24°

Revised Mar. 2001

VC2-2PB



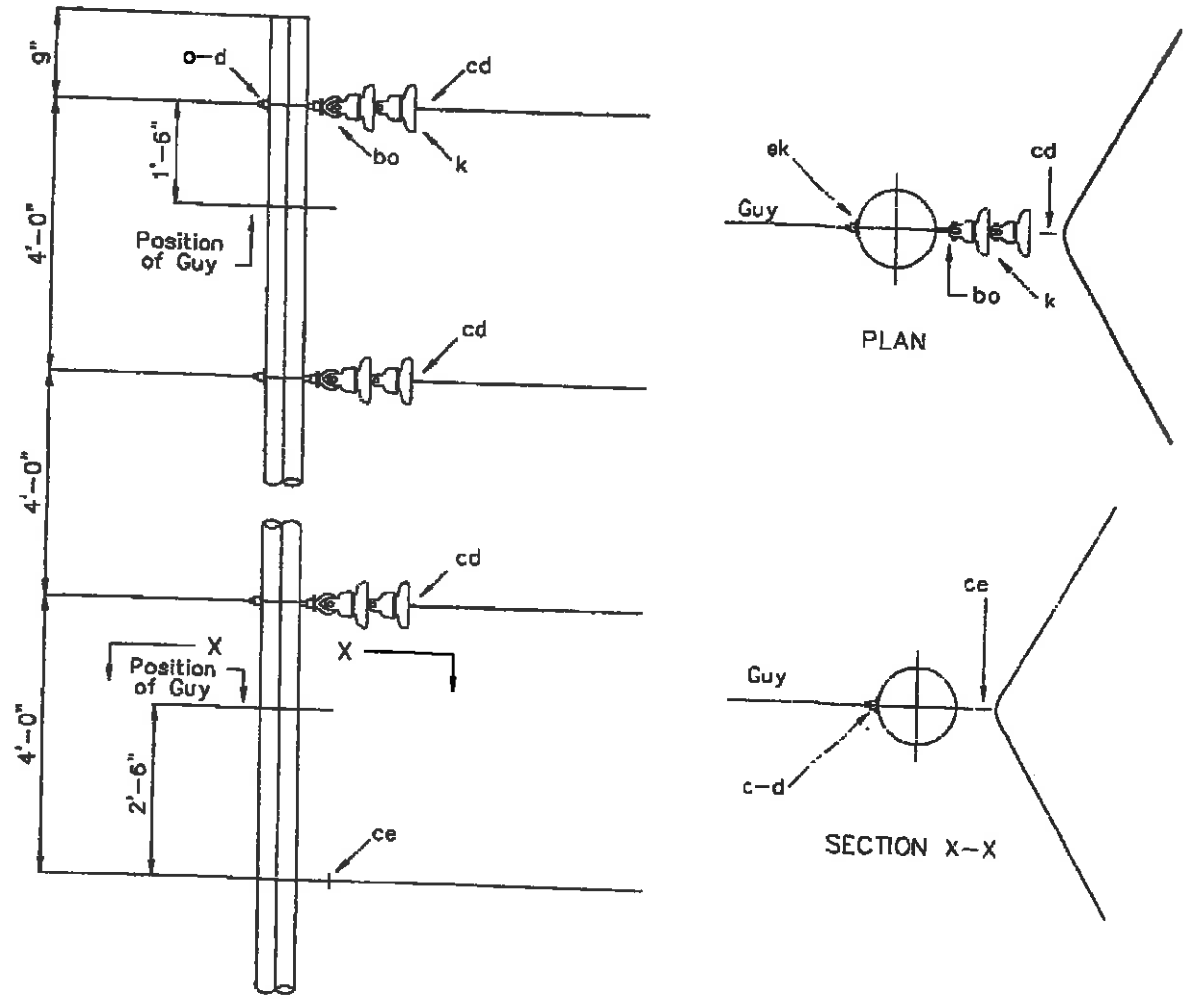
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	3	Shackle, Anchor	1360
6	Insulator, Polly	1110	3	Clamp, Angle Primary	1960
4	Bolt, Eye	0320	1	Clevis Sec. Swing. J 6	1815
			1	Ins. Spool Sec.	1020

2 & 1/0 ACSR

7.2/12.5 KV. 3-PHASE
VERTICAL CONSTRUCTION-30° TO 60° ANGLE

Revised
Sept. 1994

C3

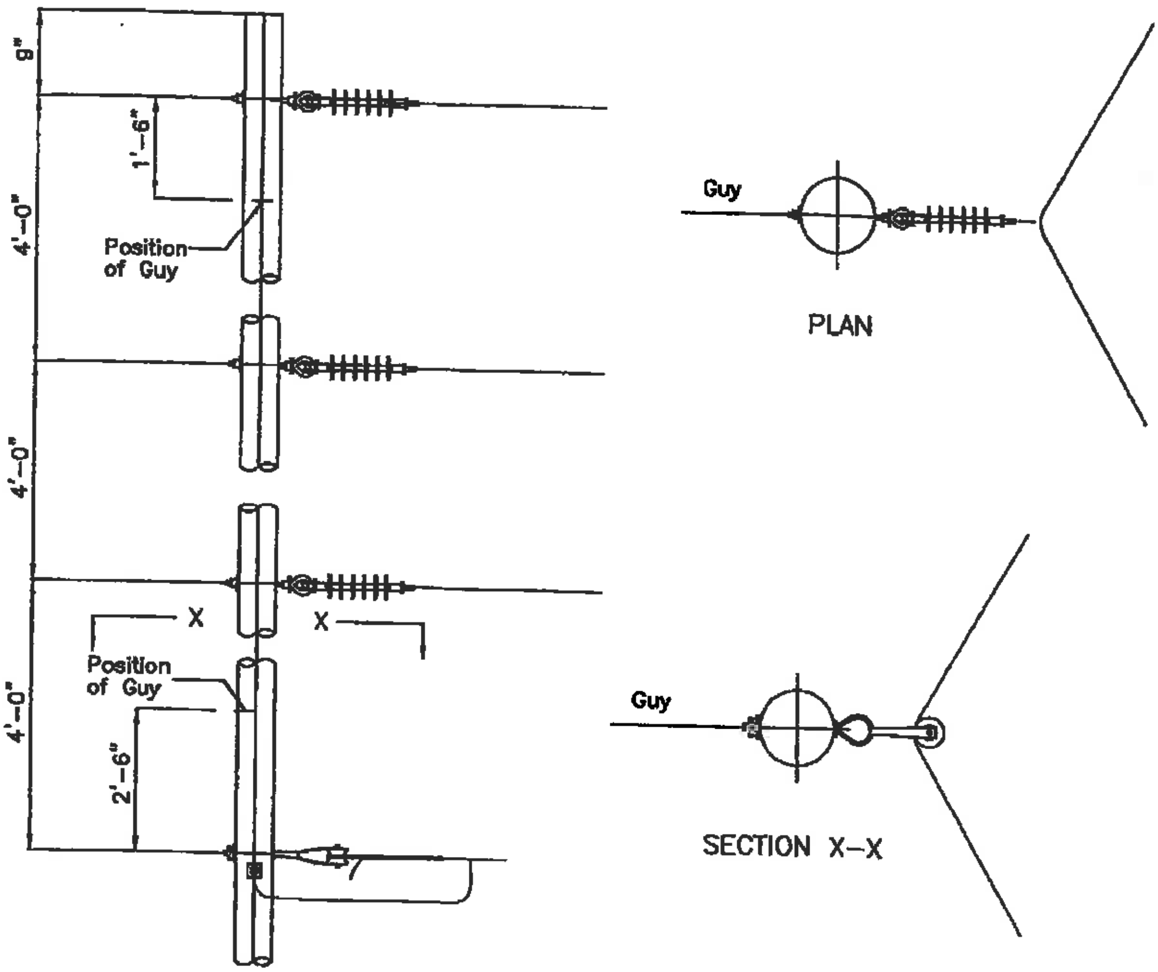


Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	3	Shackle, Anchor	1360
6	Insulator, Suspension	9110	3	Clamp, Angle 795	1985
4	Bolt, Eye	0320	1	Clevis Sec. Swing. J 6	1815
1	Spool, Sec. Ins.	1030	4	Armor Rods	3600
			1	Connector	3010

7.2/12.5 KV. 3-PHASE
VERTICAL CONSTRUCTION-30° TO 60°
ANGLE

Revised
Sept. 1994

C3L



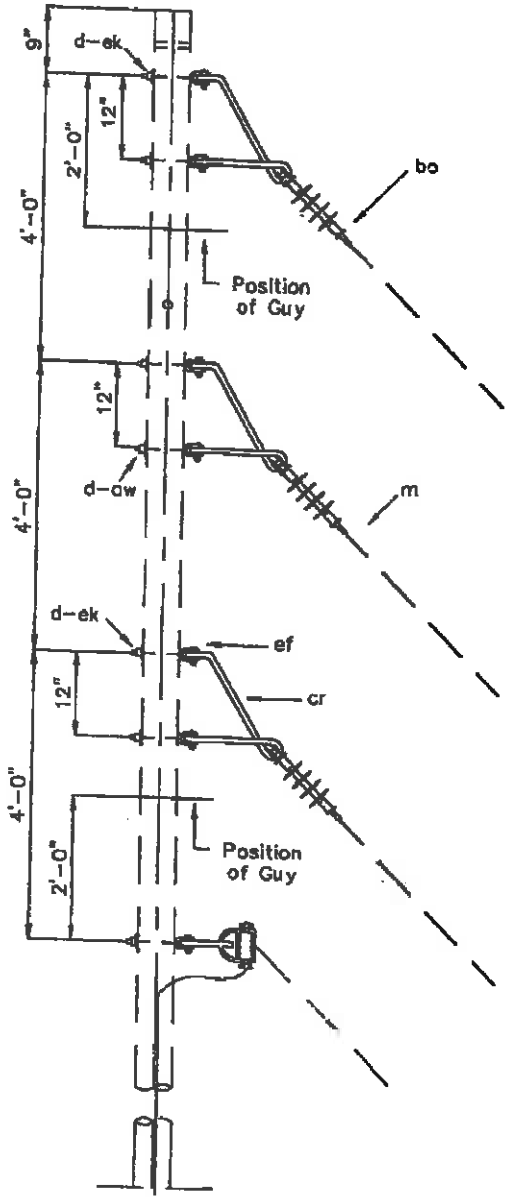
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Eye Bolt, 5/8" Req'd Length	0320			
4	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec large	103000			
3	Anchor, Shackel 3"	136001			
1	Clevis, Swinging J6	181500			
3	Clamps, Angle 795 MCM	198500			
3	Insulator, 25kV Polly Suspension	911001			

795 MCM

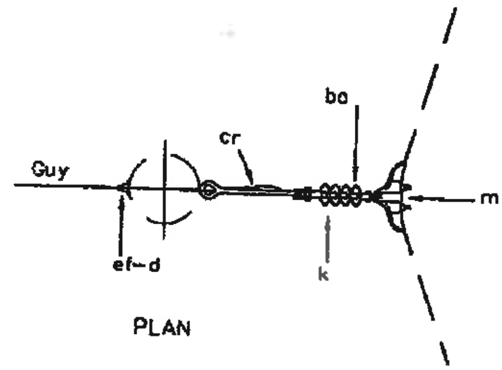
14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
30° TO 60° ANGLE

Revised
May 2003

VC3L



ELEVATION



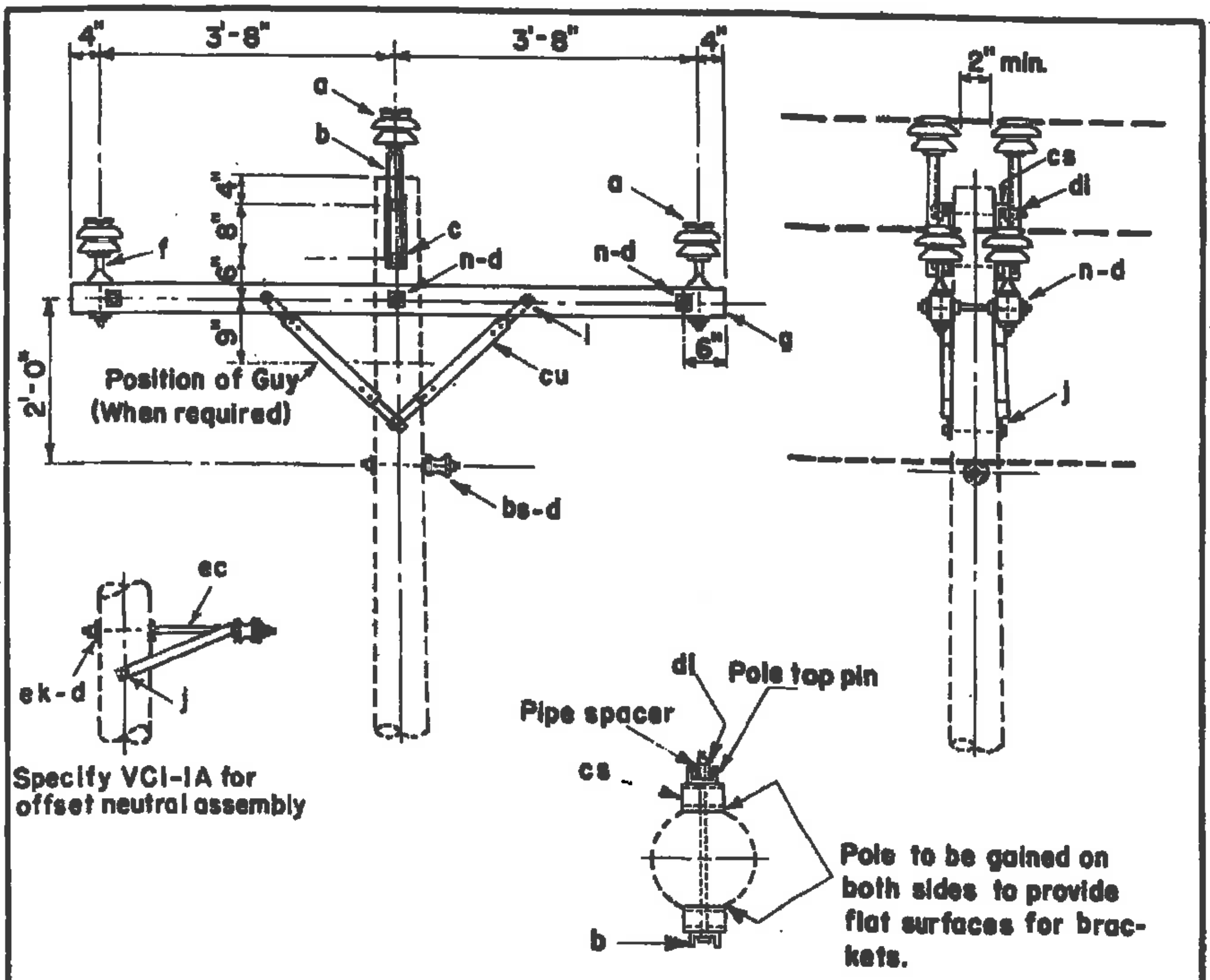
PLAN

Quan.	Material	Item No.	Quan.	Material	Item No.
7	Washer, 2 1/4" Square	0610	3	Shackle, Anchor	1360
6	Insulator, Polly	1110	3	Bracket, Angle, 5/8"	1975
3	Clamp, Angle 3/0	1970	6	Bolt, Clevis	0346
1	Clevis J 6	1815	1	Connector	3010
1	Ins. Spool	1020			
1	Bolt, Eye	0320			

7.2/12.5 KV.
VERTICAL CONSTRUCTION 10° TO 20° ANGLE
(LARGE CONDUCTORS)

Revised Sept. 1994

C3–1



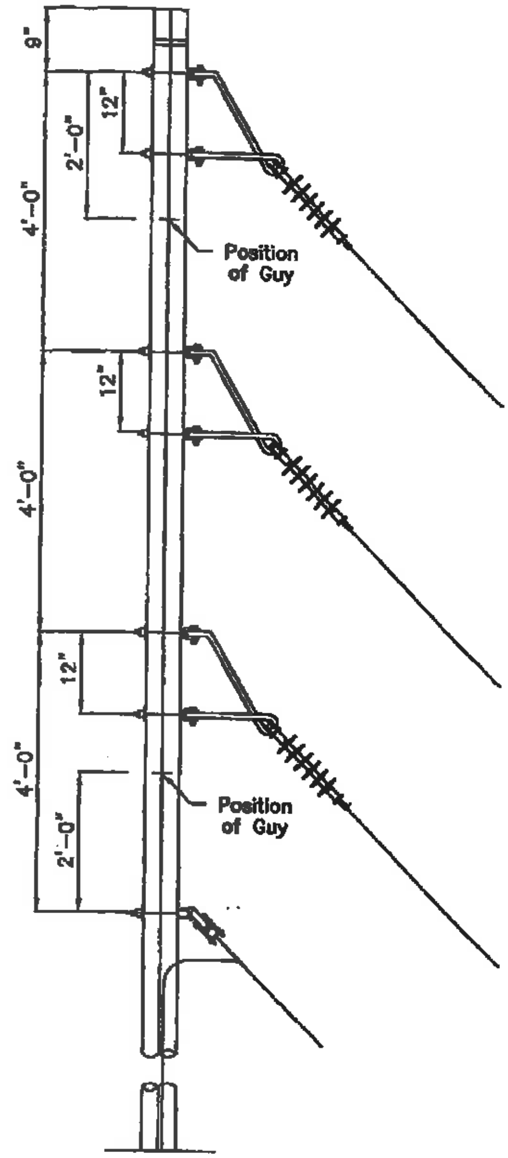
POLE TOP PIN ASSEMBLY

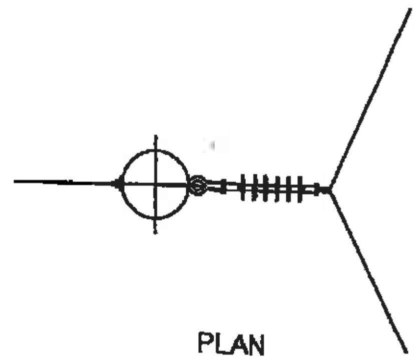
ITEM	NO.	MATERIAL		ITEM	NO.	MATERIAL	
a	6	Insulator, pin type		n	3	Bolt, double arming, 5/8" x req'd length	
b	2	Pin, pole top, 20"		bs	1	Bolt, single upset, insulated (VCI-1 only)	
c	2	Bolt, machine, 5/8" x req'd length		cs	2	Pole top bracket	
d	11	Washer, square 2 1/4"		dl	2	Pipe spacer, 3/4" dia. x 1½"	
f	4	Pin, crossarm, steel, 5/8" x 14"		ek		Locknuts	
g	2	Crossarm, 3½" x 4½" x 8'-0"		j	2	Screw, lag, ½" x 4" (VCI-1 only)	
cu	4	Brace, wood, 28"		ec	1	Bracket, offset, insulated (VCI-1A only)	
i	4	Bolt, carriage, 3/8" x 4½"		j	4	Screw, lag, ½" x 4" (VCI-1A only)	

14.4/24.9 KV., 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE PRIMARY SUPPORT AT 0° TO 5° ANGLE

Jan. 1, 1963

VCI-1, VCI-1A





PLAN

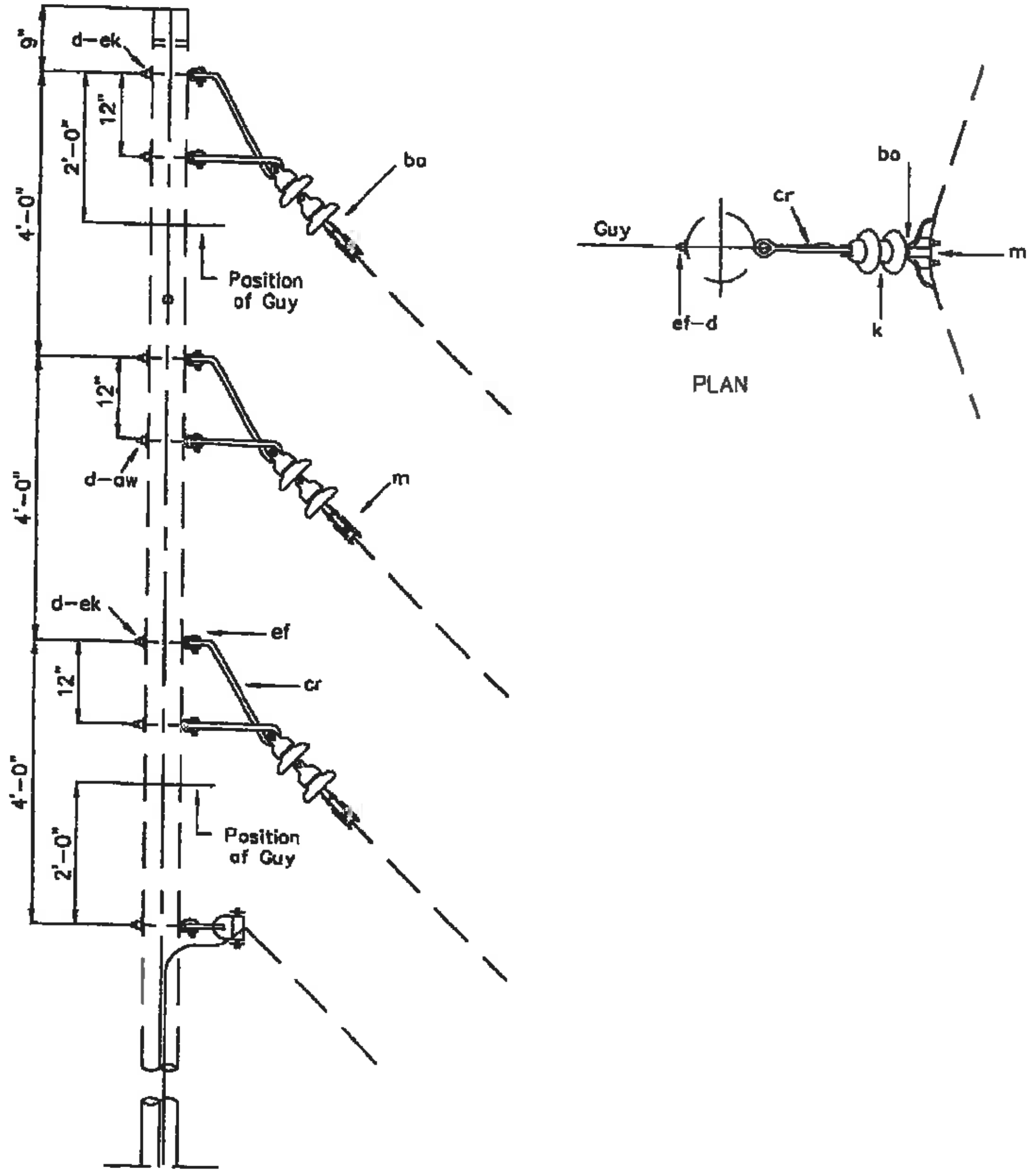
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Eye Bolt, 5/8" x Req'd Length	0320	3	Insulator, 25kVPolly Suspension	911001
6	Mach Bolt, 5/8" x Req'd Length	0370			
7	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec Large	103000			
3	Anchor, Shackel 2"	136000			
1	Clevis, Swinging J6	181500			
3	Clamps, Angle 3/0 ACSR	197000			
3	Bracket, Angle 5/8"	197500			

UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
10° TO 20° ANGLE

Revised May 2003

VC3-1



ELEVATION

PLAN

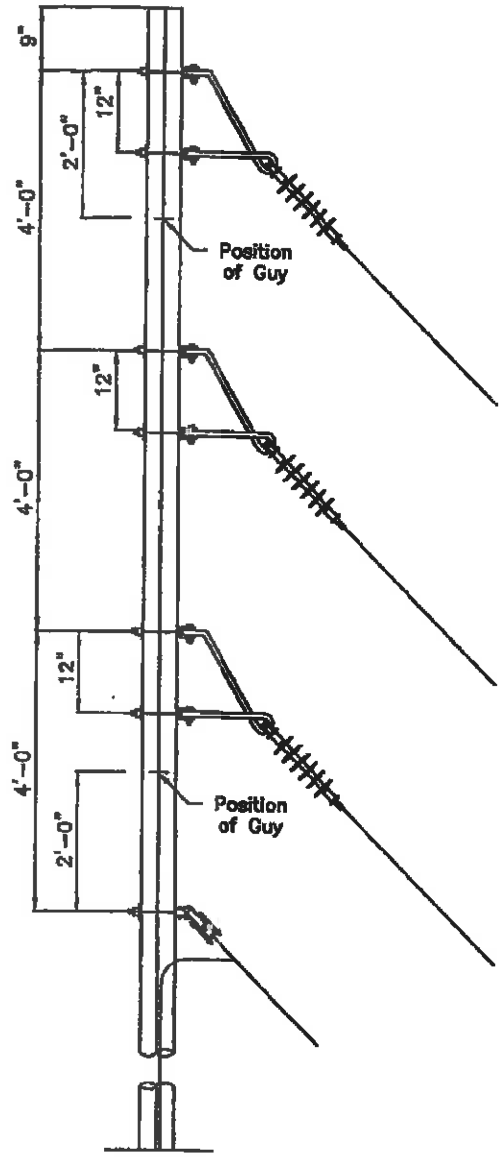
Quan.	Material	Item No.	Quan.	Material	Item No.
7	Washer, 2 1/4" Square	0610	3	Shackle, Anchor	1360
6	Insulator, Suspension	9110	3	Bracket, Angle, 5/8"	1975
3	Clamp, Angle 795	1985	6	Bolt, Clevis	0346
1	Spool, Sec. Insulator	1030	1	Connector	3010
1	Clevis, Sec. Swing J·6	1815			
1	Bolt, Eye	0320			

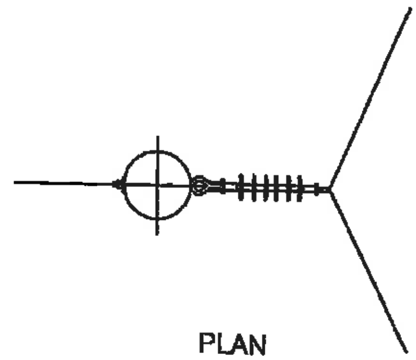
795 MCM CONDUCTOR

7.2/12.5 KV.
VERTICAL CONSTRUCTION 10° TO 20°
ANGLE
(LARGE CONDUCTORS)

Revised
Sept. 1994

C3-1L





PLAN

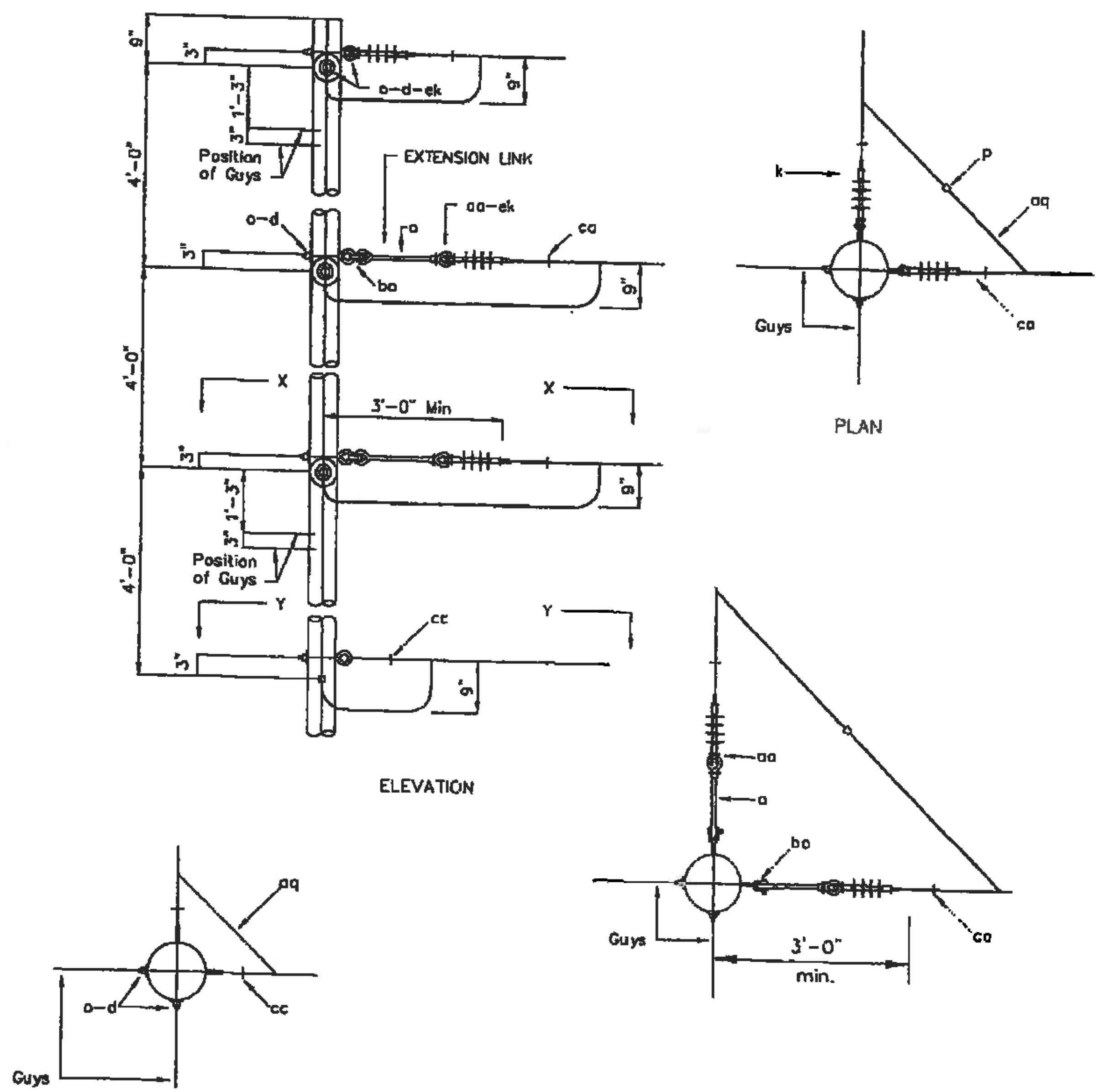
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Eye Bolt, 5/8" x Req'd Length	0320	3	Insulator, 25kV Polly Suspension	911001
6	Mach Bolt, 5/8" x Req'd Length	0370			
7	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec Large	103000			
3	Anchor, Shackel 3"	136001			
1	Clevis, Swinging J6	181500			
3	Bracket, Angle 5/8"	197500			
3	Clamps, Angle 795 MCM	198500			

795 MCM

14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
10° TO 20° ANGLE

Revised
May 2003

VC3-1L



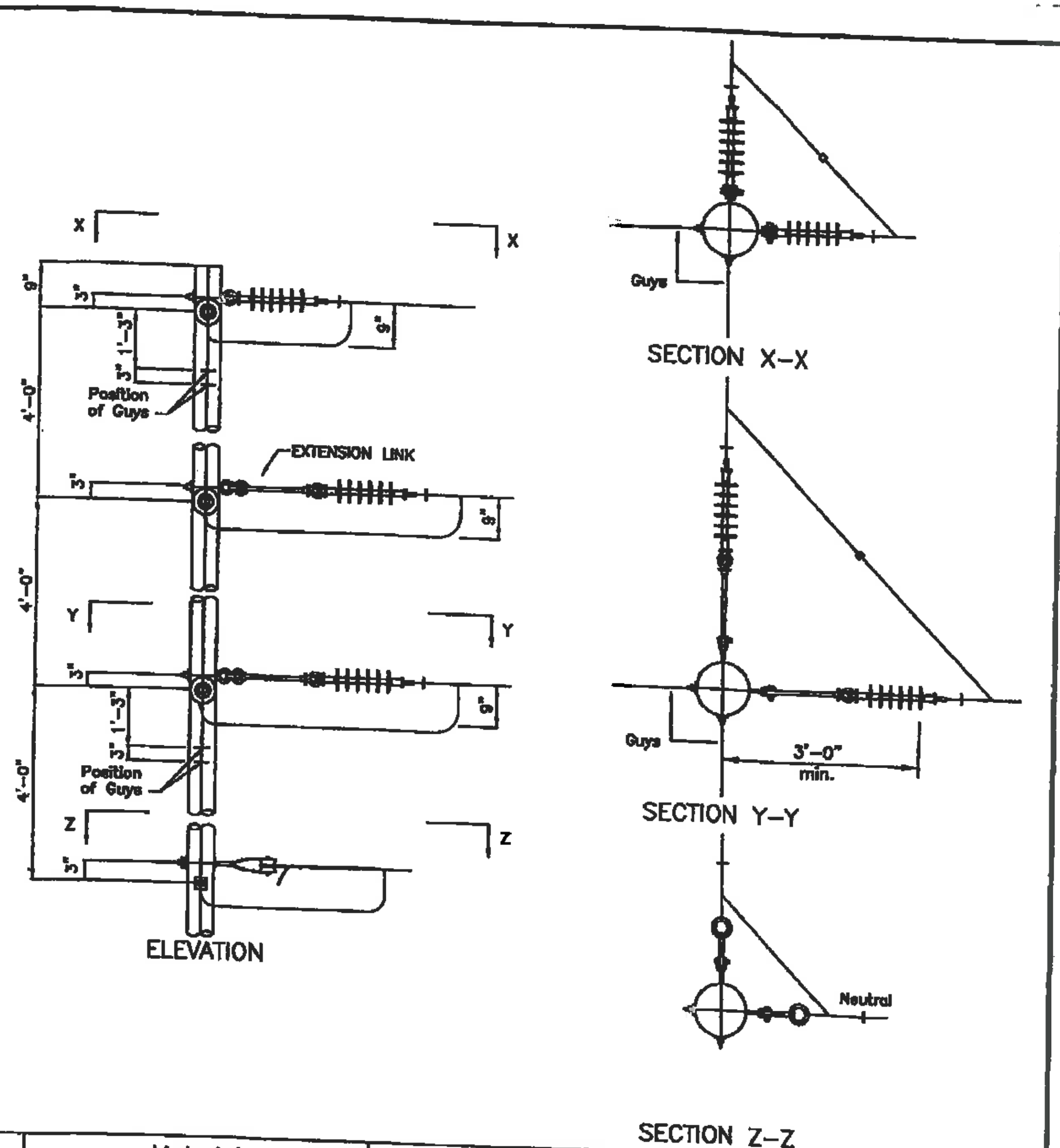
Quan.	Material	Item No.	Quan.	Material	Item No.
8	Washer, 2 1/4" Square	0610	4	Clamp C 412	1950
12	Insulator, Polly	1110	2	Ins. Spool Sec.	1020
8	Bolt, Eye	0320	6	Deadend Clamp, Primary	1910
4	Ext. Link	1130	2	Clevis, Sec. Swing J 6	1815

2 & 1/0 ACSR

7.2/12.5 KV. 3-PHASE
VERTICAL CONSTRUCTION – 60° TO 90° ANGLE

Revised
Sept. 1994

C4-1



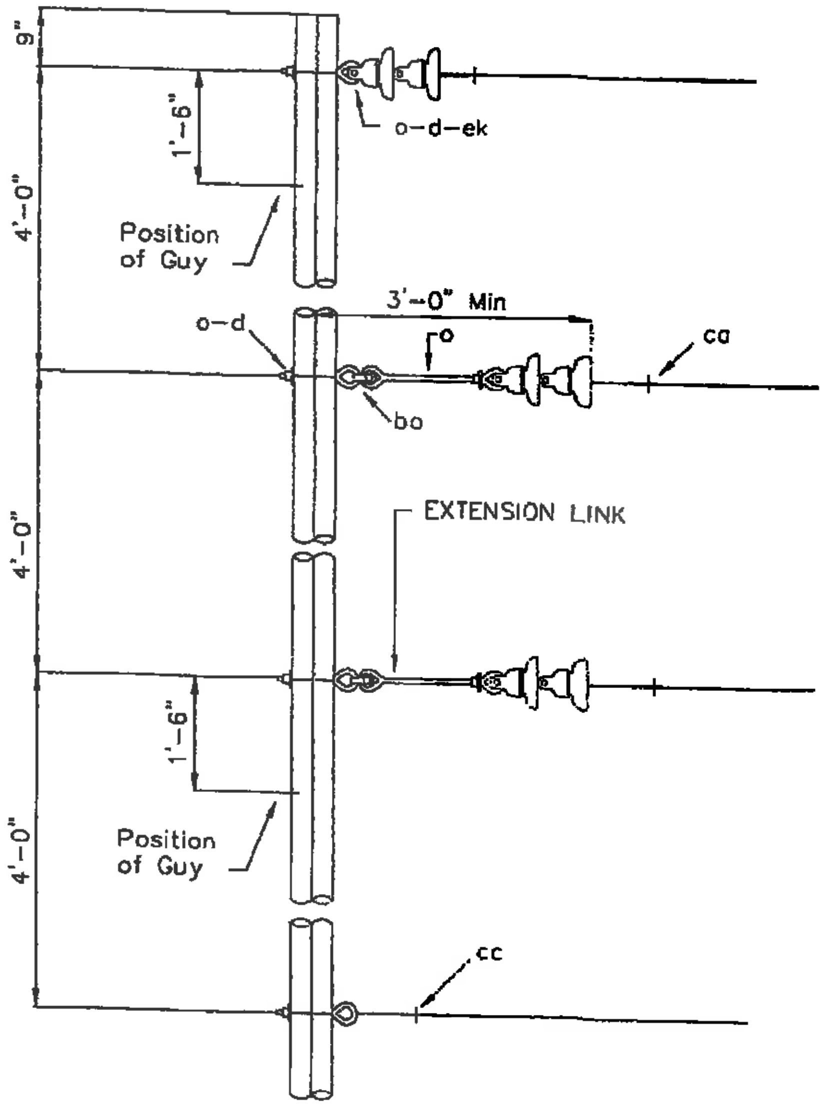
Quan.	Material	Item No.	Quan.	Material	Item No.
8	Eye Bolt, 5/8" x Req'd Length	0320			
8	Washer, Square 11/16" hole	061001			
2	Insulator Spool Sec	103000			
4	Ext Link For Susp Insulator	113000			
2	Clevis, Swinging J6	181500			
6	DE Clamp 4 Thru 1/0 ACSR	194300			
2	1/0 ACSR Neutral DE Tie	195001			
6	Insulator, 25kV Polly Suspension	911001			

795 MCM

14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
60° TO 90° ANGLE

Revised
May 2003

VC4-1L



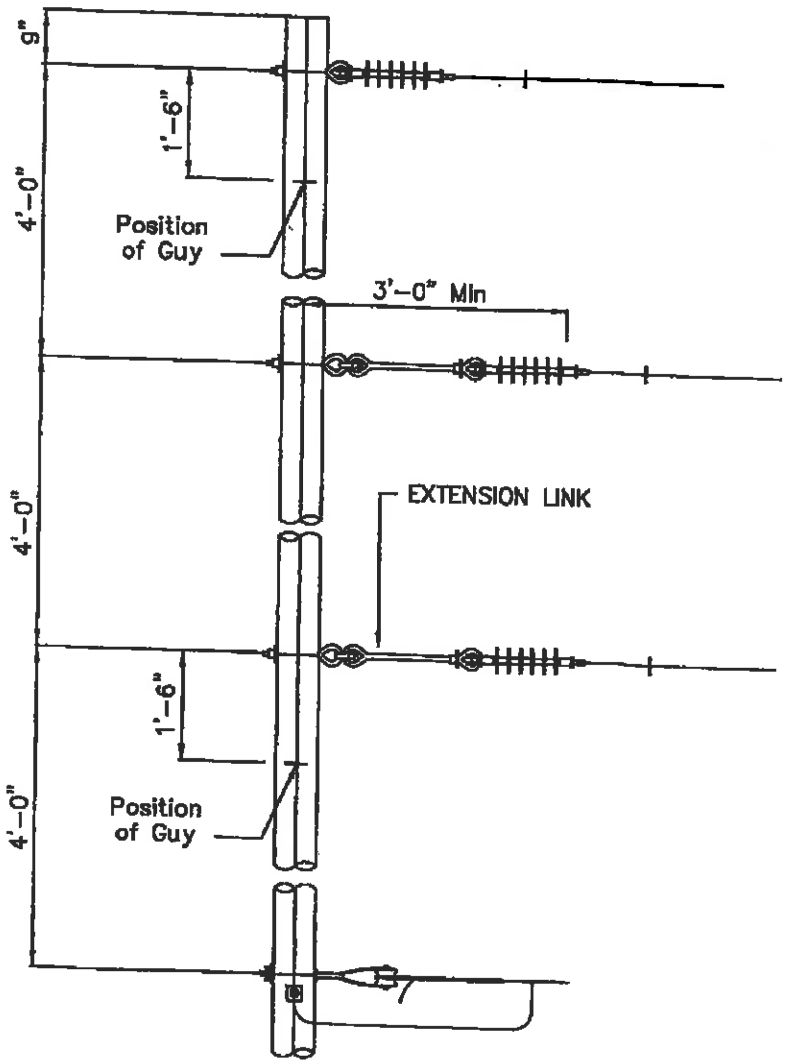
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	3	Deadend Clamp, Pri.	1930
6	Insulator, Suspension	9110	1	Clevis, Sec. Swing J 6	1815
4	Bolt, Eye, 5/8"	0320	2	Clamp, C413	1951
1	Ins. Spool Sec.	1030	1	Connector	3010
2	Ext. Links	1130			

336.4 MCM CONDUCTOR

7.2/12.5 KV.
3-PHASE, VERTICAL CONSTRUCTION
DEADEND (SINGLE)

Revised
Sept. 1994

C5-1M



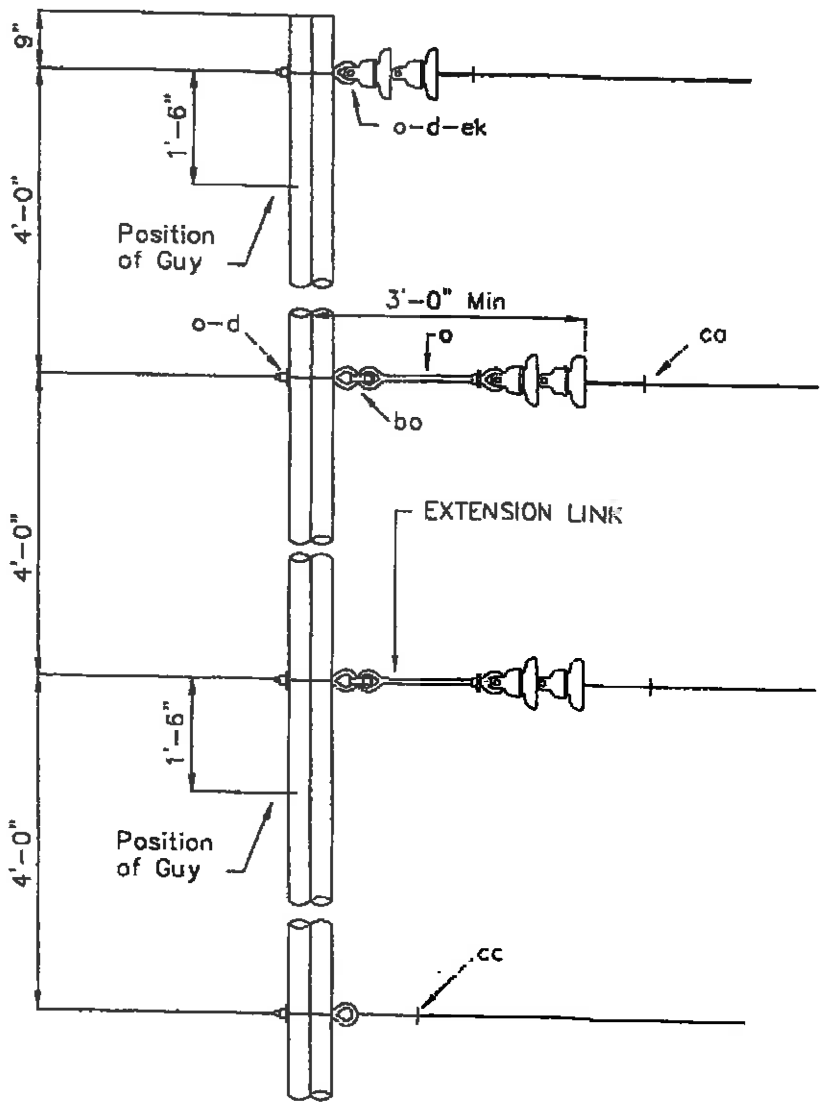
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Eye Bolt, 5/8" x Req'd Length	0320			
4	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec Large	103000			
2	Ext Link For Susp Insulator	113000			
1	Clevis, Swinging J6	181500			
3	DE Clamp 336 AL	193000			
2	Clamps, C4-13	195100			
3	Insulator, 25kV Polly Suspension	911001			

336 .MCM

14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
SINGLE DEADEND

Revised
May 2003

VC5-1M



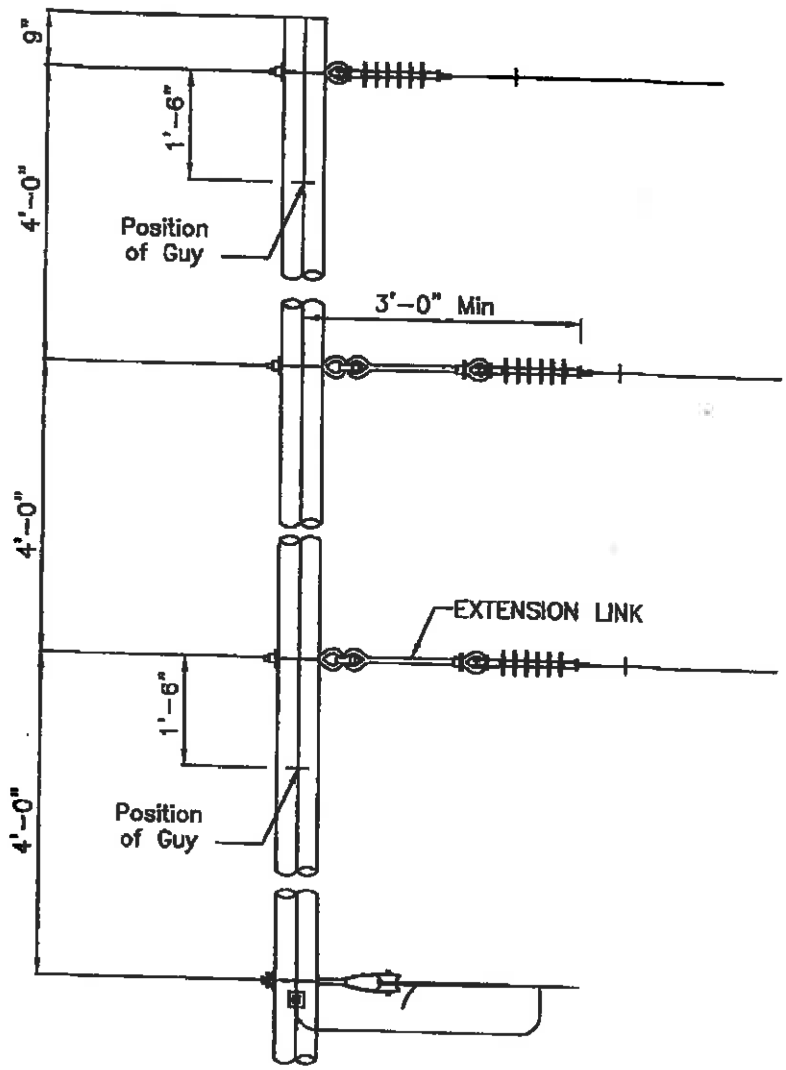
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	3	Deadend Assembly, Pri.	1943
6	Insulator, Suspension	9110	1	Clevis, Sec. Swing J 6	1815
4	Bolt, Eye, 5/8"	0320	1	Connector	3010
2	Ext. Links	1130	1	Ins. Spool	1030
2	Clamps, C413	1951			

795 MCM CONDUCTOR

7.2/12.5 KV.
3-PHASE, VERTICAL CONSTRUCTION
DEADEND (SINGLE)

Revised
Sept. 1994

C5-1L



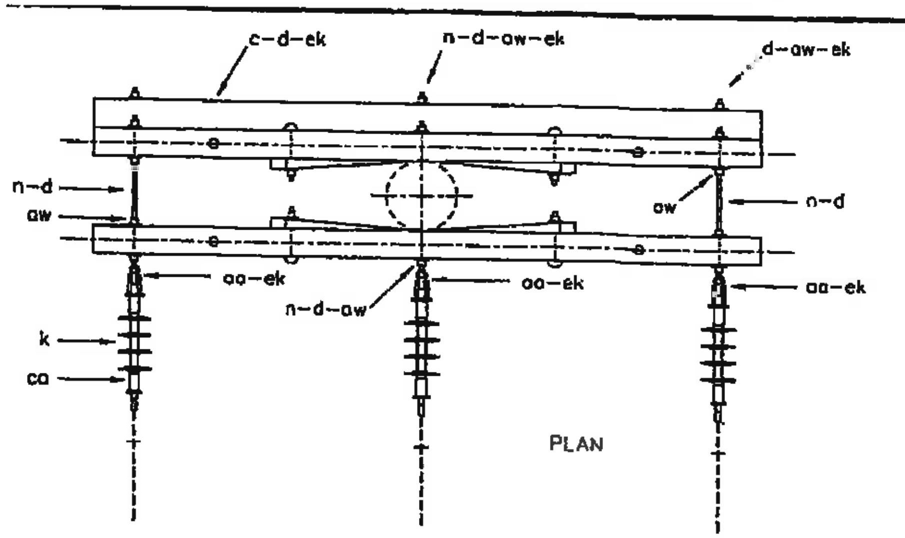
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Eye Bolt, 5/8" x Req'd Length	0320			
4	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec Large	103000			
2	Ext Link For Susp Insulator	113000			
1	Clevis, Swinging J6	181500			
3	DE Clamp 795	194300			
2	Clamps, C4-13	195100			
3	Insulator, 25kV Polly Suspension	911001			

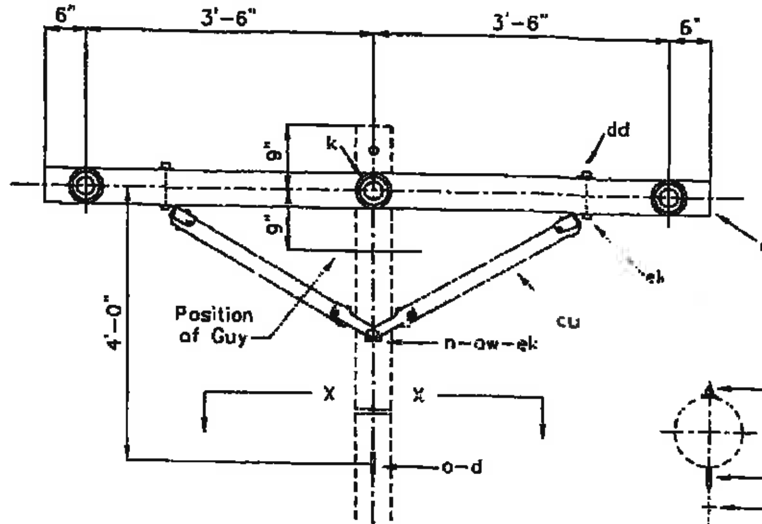
795 MCM

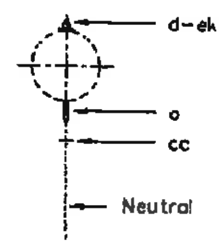
14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
SINGLE DEADEND

Revised
May 2003

VC5-1L







SECTION X-X

NOTES:

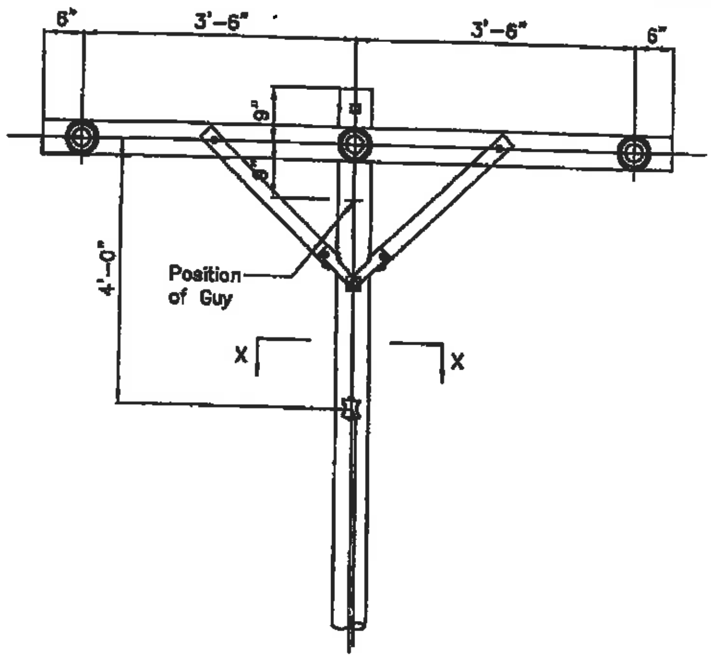
1. SEE DWG. E5-1 FOR CROSSARM LOADING LIMITATIONS.
2. DESIGNATE AS C7-1 FOR ASSEMBLY WITH THREE CROSSARMS.

Quan.	Material	Item No.	Quan.	Material	Item No.
11	Washer, 2 1/4" Square	0610	3	Bolt, Double Arming	0270
2	Crossarm, 8'	0700	1	Bolt, Eye, 5/8"	0320
4	Brace, 28"	0800	3	Nut, Eye, 5/8"	0640
4	Bolt, Carriage	0210	1	Clevis, Sec. Swing J 6	1815
2	Screw, Lag	0550	1	Ins. Spool Sec.	1020
6	Insulator, Polly	1110	2	Clamp, C412	1950
3	Deadend, Clamp Pri.	1910			
1	Connector	3000			

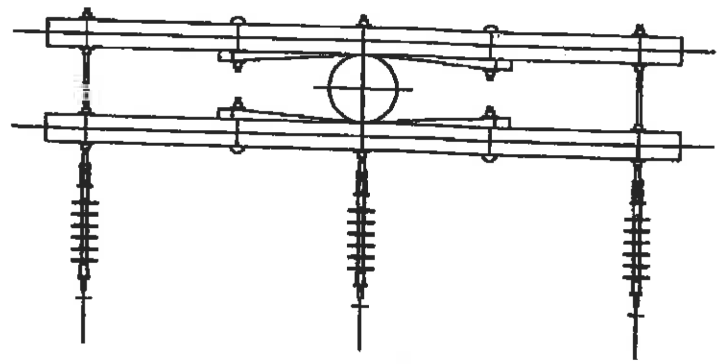
3-PHASE CROSSARM CONSTRUCTION
DEADEND (SINGLE)

Revised Sept. 1994

C7,C7-1



SECTION X–X



PLAN

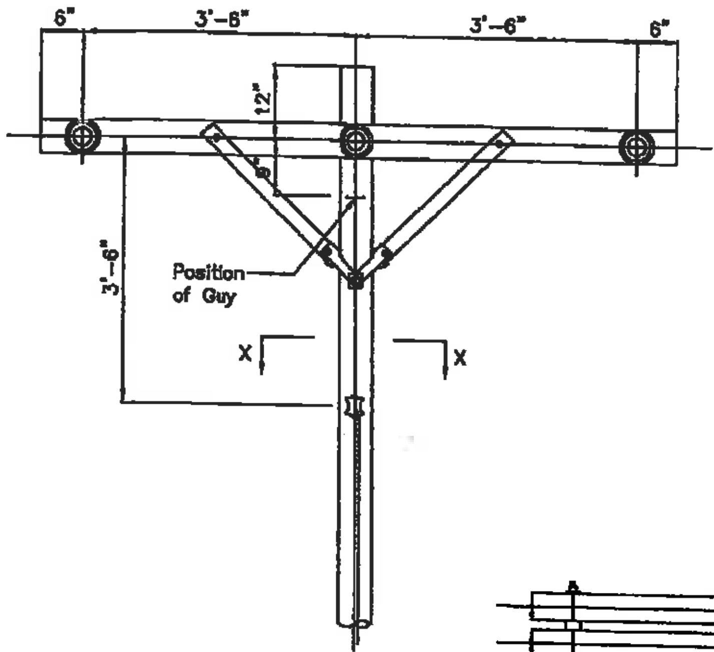
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Carriage Bolt, 3/8"	021000	1	Insulator, Spool Sec	102000
3	DA Bolt, 5/8" x Req'd Length	0270	1	Clevis, Swinging J6	181500
1	Eye Bolt, 5/8" x Req'd Length	0320	3	DE Clamp 4 Thru 1/0 ACSR	191000
2	Large Lag Screw	055002	1	1/0 ACSR Nuetral DE Tie	195001
11	Washer, Square 11/16" Hole	061001	3	Insulator, 25kV Polly Suspension	911001
3	Nut, Oval Eye	064000			
2	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			

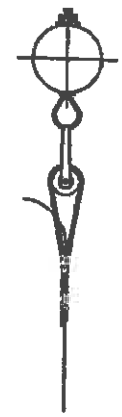
UP TO 1/0 ACSR

14.4/24.9 KV, 3–PHASE
CROSSARM CONSTRUCTION
SINGLE DEADEND

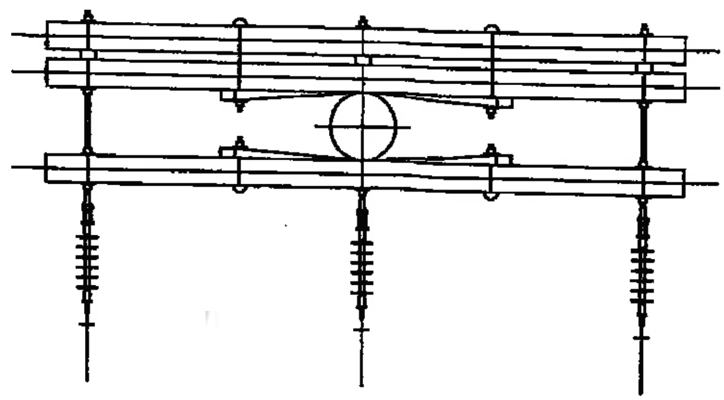
Revised
May 2003

VC7





SECTION X–X



PLAN

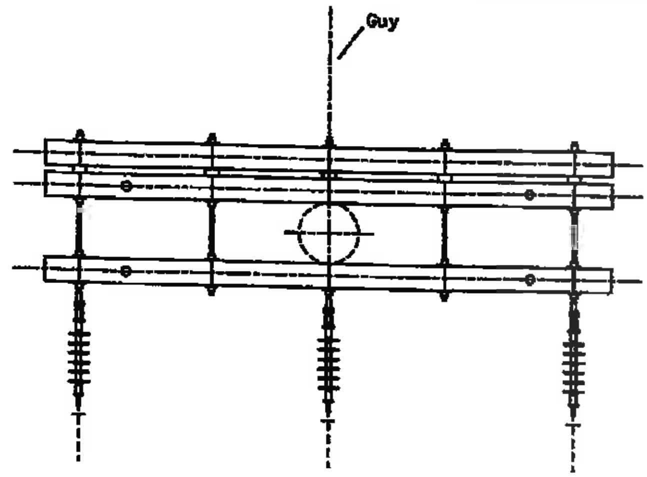
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Carriage Bolt, 3/8"	021000	1	Insulator, Spool Sec	102000
3	DA Bolt, 5/8" x Req'd Length	0270	1	Clevis, Swinging J6	181500
1	Eye Bolt, 5/8" x Req'd Length	0320	3	DE Clamp 4 Thru 1/0 ACSR	191000
2	Large Lag Screw	055002	1	1/0 ACSR Nuetral DE Tie	195001
14	Washer, Square 11/16" Hole	061001	3	Insulator, 25kV Polly Suspension	911001
3	Nut, Oval Eye	064000			
3	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			

UP TO 1/0 ACSR

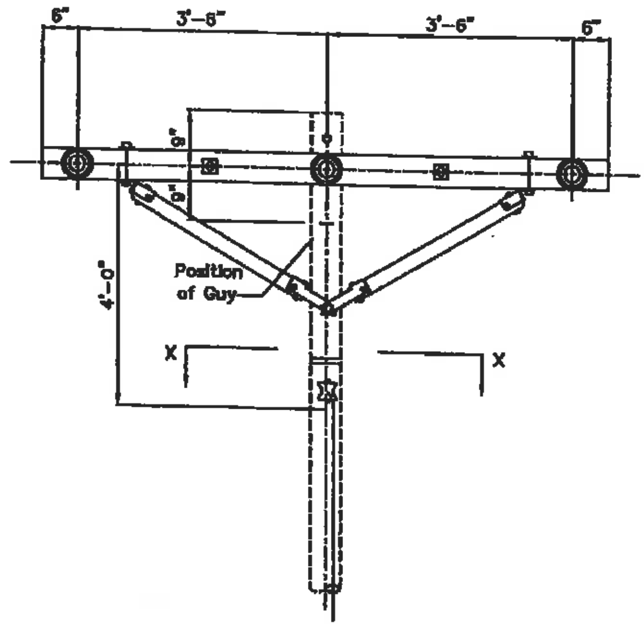
14.4/24.9 KV, 3–PHASE
CROSSARM CONSTRUCTION
SINGLE DEADEND

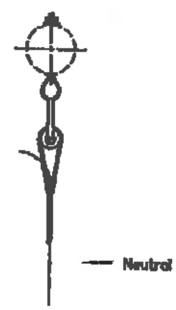
Revised
May 2003

VC7–1



PLAN





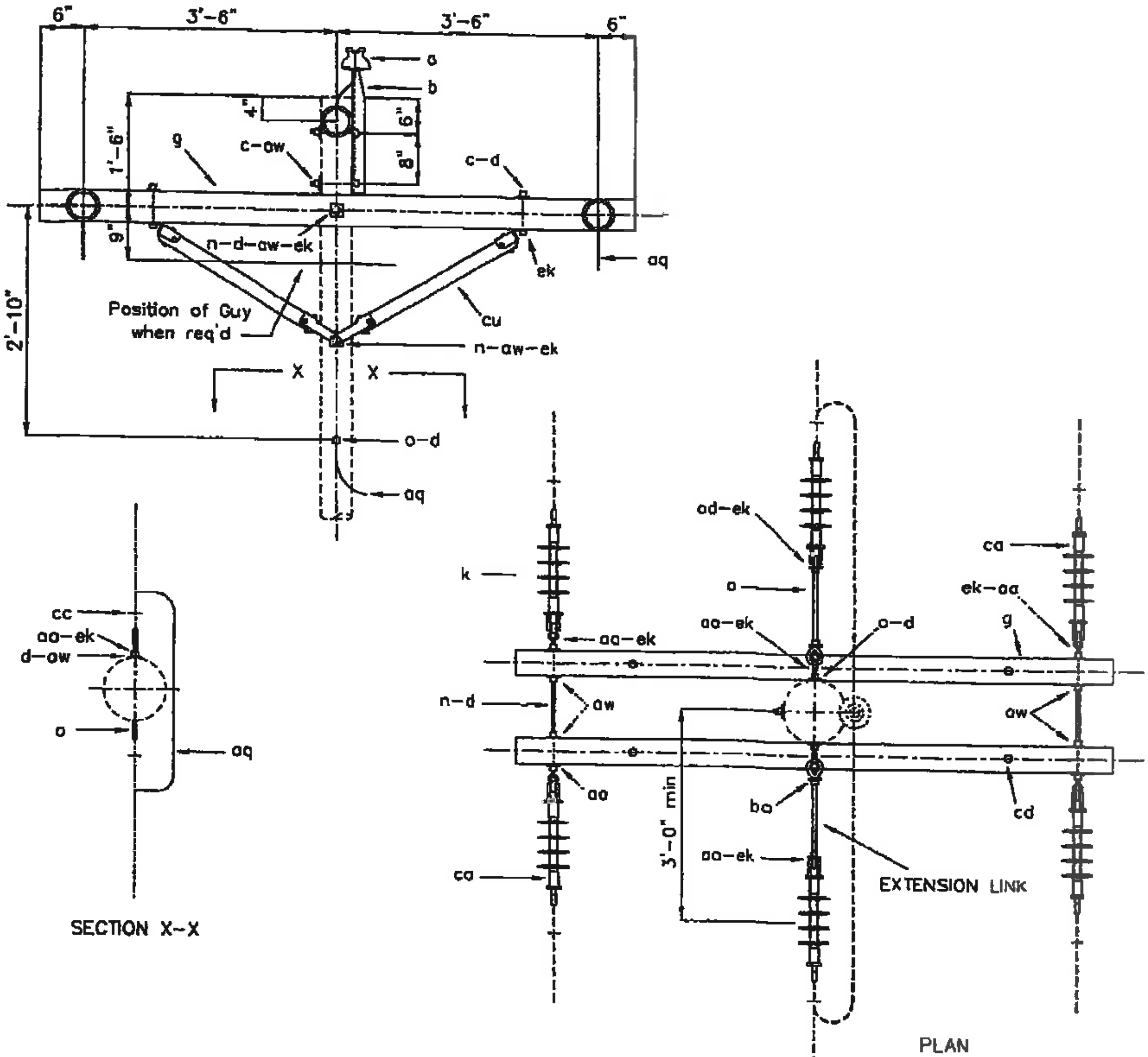
Quan.	Material	Item No.	Quan.	Material	Item No.
5	DA Bolt, 5/8" x Req'd Length	0270	2	Brace, Wood Bow 60" Span	086000
1	Eye Bolt, 5/8" x Req'd Length	0320	1	Insulator, Spool Sec Large	103000
4	Mach Bolt, 1/2" x 7"	035002	1	Clevis, Swinging J6	181500
1	Mach Bolt, 5/8" x Req'd Length	0370	3	DE Clamp, 795	194300
4	Washer, 1/2" Round	060001	2	Clamp, C4-13	195100
2	Washer, Square 11/16" Hole	061001	3	Insulator, 25kV Polly Suspension	911001
3	Nut, Oval Eye	064000			
3	Crossarm, 4 3/4" x 5 3/4" x 8'	072000			

795 MCM

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
SINGLE DEADEND

Revised
May 2003

VC7-3L



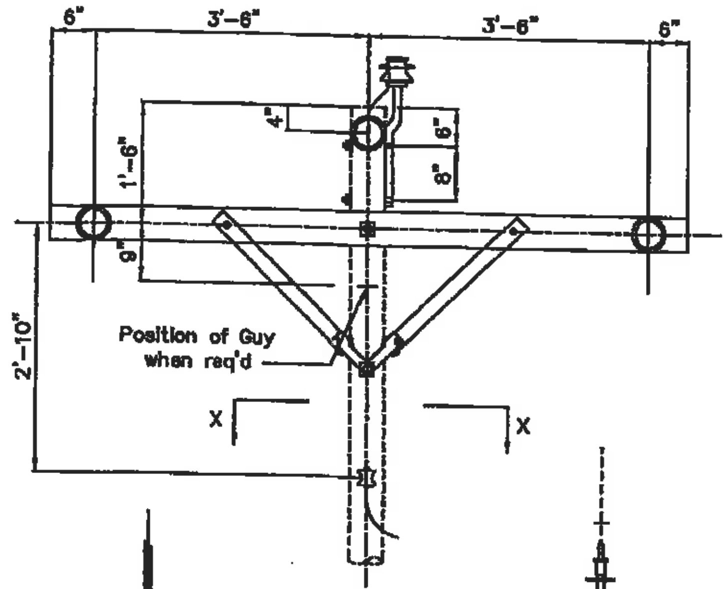
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Clamp, C412	1950	2	Bolt, Eye, 5/8"	0320
2	Bolt, Machine, 5/8"	0370	4	Bolt, Carriage	0210
2	Screw, Lag	0550	6	Nut, Eye, 5/8"	0640
15	Washer, 2 1/4" Square	0610	1	Pin, P.T. 20"	0900
4	Washer, Round	0600	1	Ins. P.T.	1040
2	Ext. Links	1130	6	Deadend Clamp, Pri.	1910
2	Crossarm 8' 3 3/4" x 4 3/4"	0710	2	Clevis, Sec. Swing J6	1815
6	Insulator, Polly	1110	4	Brace, Wood 28"	0800
3	Bolt, Double Arming	0270	2	Ins. Spool Sec.	1020

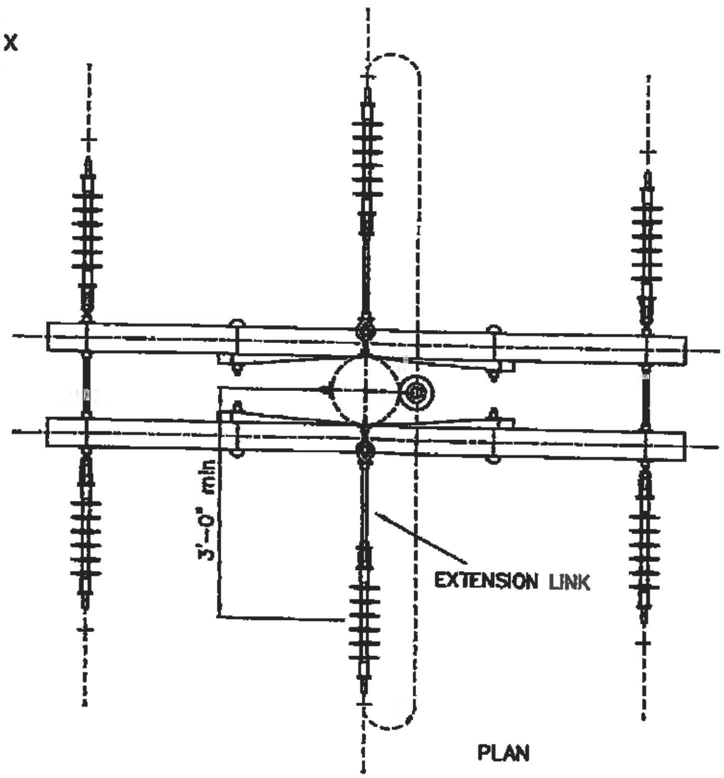
2, 4 & 1/0 ACSR

7.2/12.5 KV. 3-PHASE
CROSSARM CONSTRUCTION
DEADEND (DOUBLE)

Revised
Sept. 1994

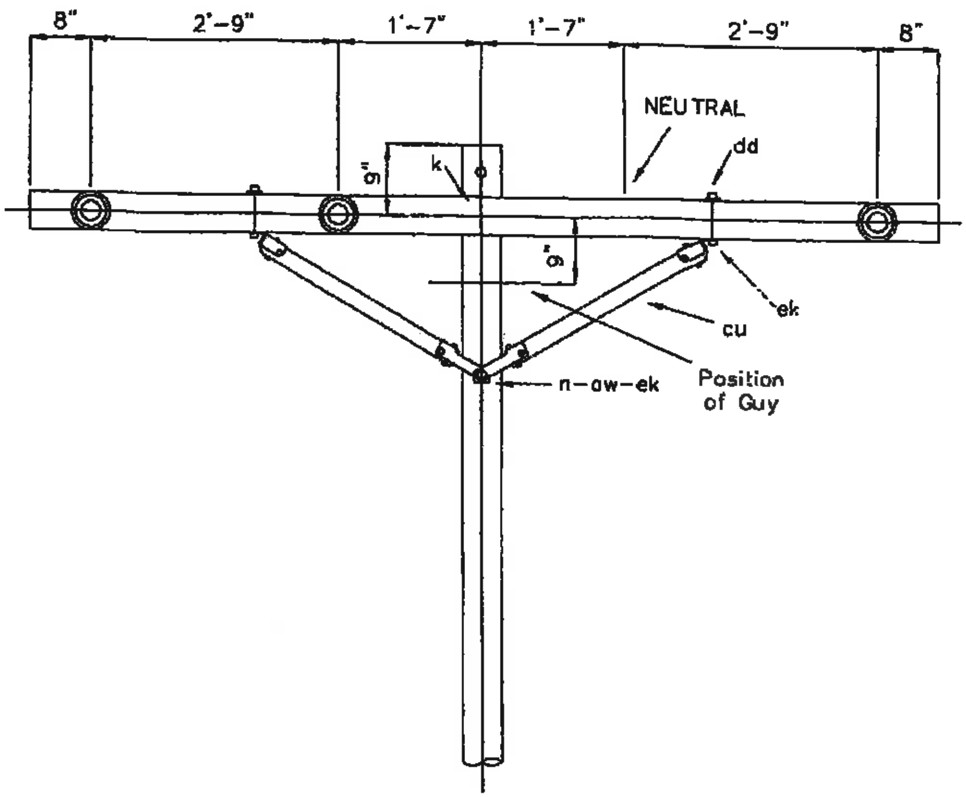
C8





Quan.	Material	Item No.	Quan.	Material	Item No.
3	DA Bolt, 5/8" x Req'd Length	0270	1	Insulator, Pin Type 25kV	107500
2	Eye Bolt, 5/8" x Req'd Length	0320	2	Ext Link For Susp Insulator	113000
2	Mach Bolt, 5/8" x Req'd Length	0370	2	Clevis, Swinging J6	181500
2	Large Lag Screw	055002	6	DE Clamp 4 Thru 1/0 ACSR	191000
15	Washer, Square 11/16" Hole	061001	2	1/0 ACSR Neutral DE Tie	195001
6	Nut, Oval Eye	064000	6	Insulator, 25kV Polly Suspension	911001
2	Crossarm 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			
1	Pin, Pole Top 25kV Offset	092501			
2	Insulator, Spool Sec	102000			

UP TO 1/0 ACSR	14.4/24.9 KV, 3-PHASE CROSSARM CONSTRUCTION DOUBLE DEADEND
Revised May 2003	VC8



#2 & 1/0 ACSR CONDUCTORS

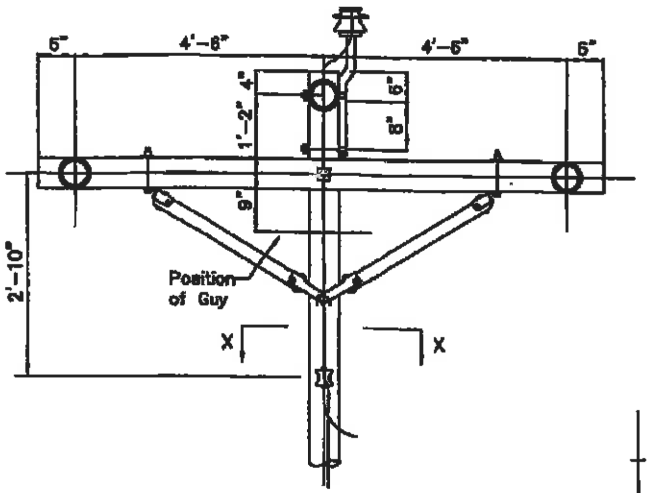
Quan.	Material	Item No.	Quan.	Material	Item No.
19	Washers, Square	0610	8	Nut, Eye	0640
2	Crossarm, 10'	0735	6	Clamp, Pri. D.E.	1910
4	Brace, 28"	0800	2	Clevis, Sec. J6	1815
1	Bolt, Machine 5/8"	0370	2	Ins. Sec. Spool	1020
4	Bolt, Machine 1/2"	0350	4	Clamp, C412	1950
6	Ins. Polly	1110	2	Screw, Lag	0550
4	Washer, Round	0600			
4	Bolt, D.A.	0270			

2 & 1/0 ACSR
NEUTRAL ON X-ARM

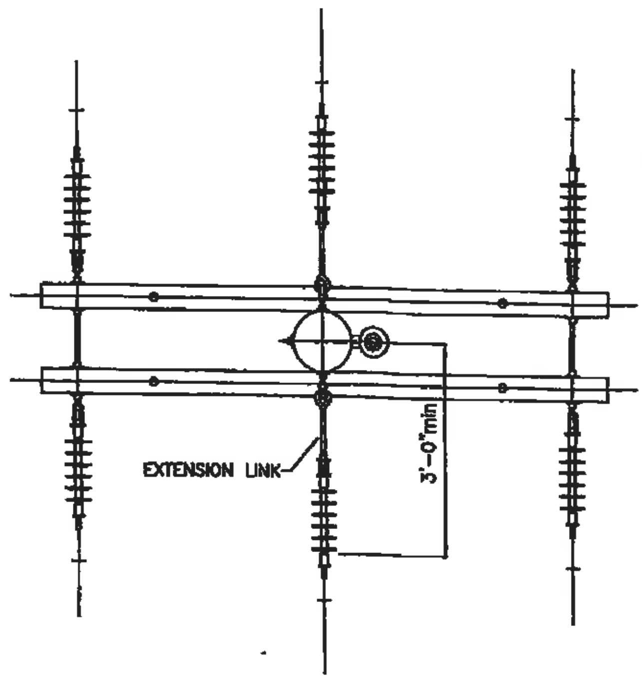
3-PHASE CROSSARM CONSTRUCTION
#2 & 1/0 ACSR PRI.

Revised
Sept. 1994

C8-1



SECTION X–X



PLAN

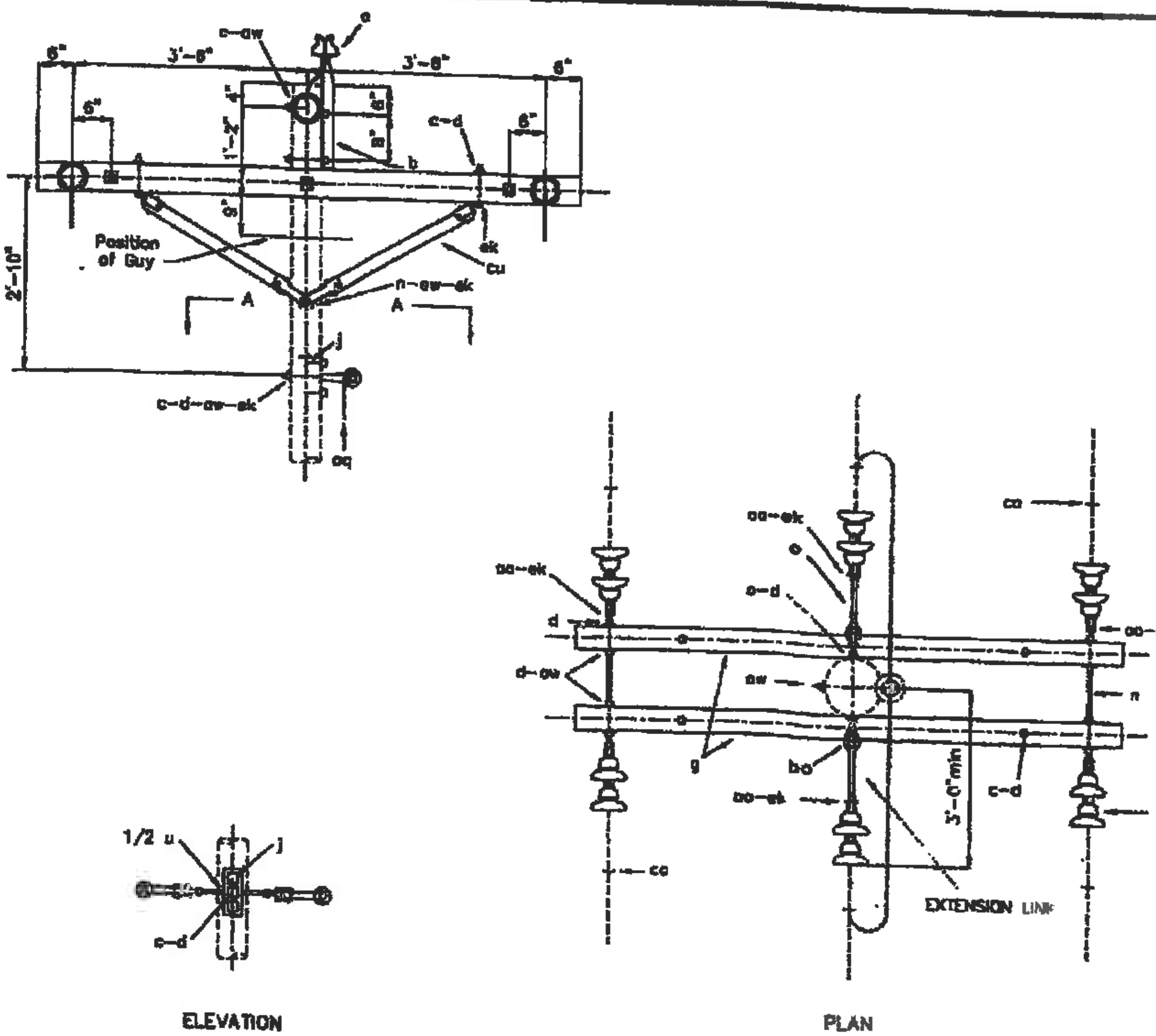
Quan.	Material	Item No.	Quan.	Material	Item No.
3	DA Bolt, 5/8" x Req'd Length	0270	1	Pin, Pole Top 25kV Offset	092501
2	Eye Bolt, 5/8" x Req'd Length	0320	2	Insulator, Spool Sec Large	103000
2	Mach Bolt, 1/2" x 7"	035002	1	Insulator, Pin Type 25kV	107500
3	Mach Bolt, 5/8" x Req'd Length	0370	2	Ext Link For Susp Insulator	113000
4	Washer, 1/2" Round	060001	2	Clevis, Secondary J6	181500
18	Washer, Square 11/16" Hole	061001	6	DE Clamp 795	194300
7	Nut, Oval Eye	064000	4	Clamps, C4–13	195100
2	Crossarm, 4 3/4" x 5 3/4" x 10'	074000	6	Insulator, 25kV Polly Suspension	911001
2	Brace, Wood Bow 60" Span	086000			
4	Pin, Steel Crossarm 25kV	091200			

795 MCM

14.4/24.9 KV, 3–PHASE
CROSSARM CONSTRUCTION
DOUBLE DEADEND – 10' CROSSARM

Revised
May 2003

VC8–2LA



3/0 & 336.4 CONDUCTOR

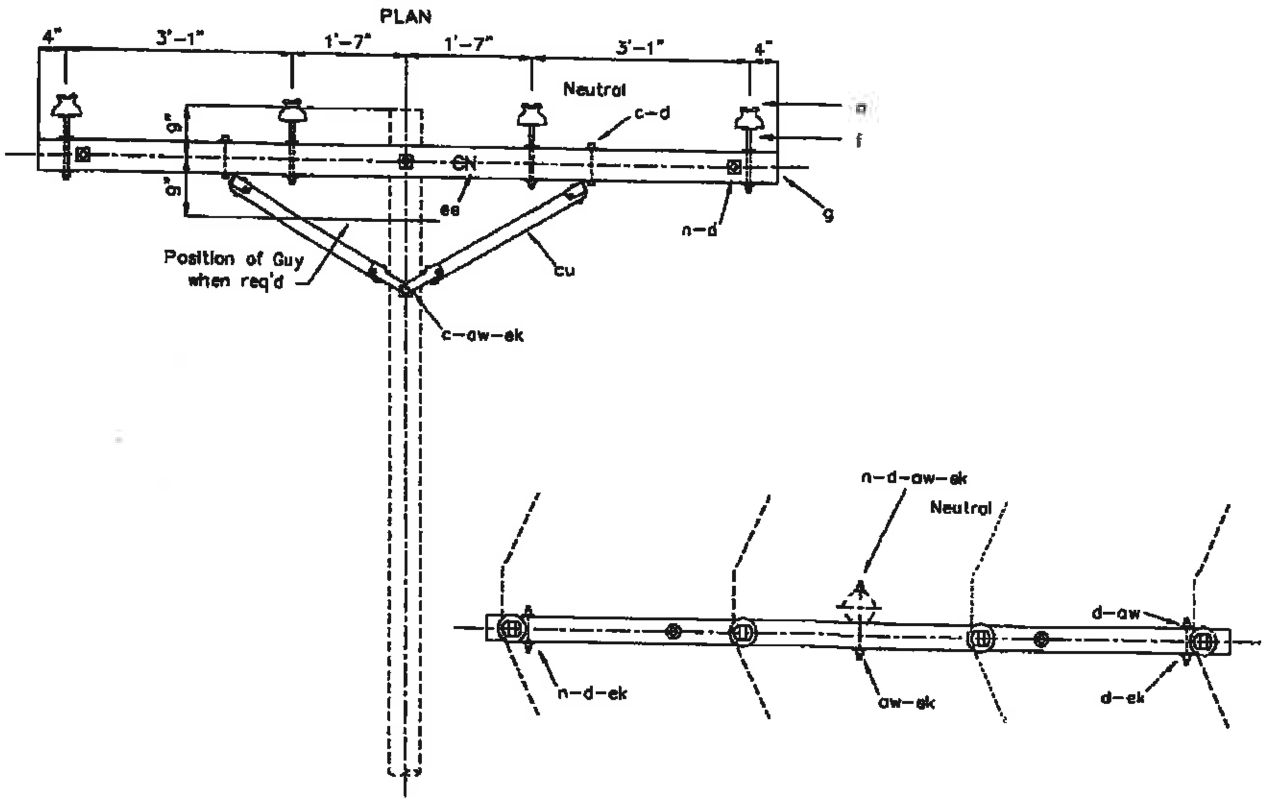
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Bolt, Machine, 5/8"	0370	1	Bolt, Eye, 5/8"	0320
4	Bolt, Machine, 1/2"	0350	1	Ins. Pin Type	1040
14	Washer, 2 1/4" Square	0610	2	Ins. Spool Sec.	1030
4	Washer, Round	0600	8	Nut, Eye, 5/8"	0640
1	Pin, P.T. 20"	0900	4	Clamp, C413	1951
2	Crossarm, 8' 3 3/4" x 4 3/4"	0710	6	Deadend Clamp, Pri.	1930
2	Ext. Links	1130	2	Clevis Sec. Swing J6	1815
13	Insulator, Suspension, Polly	9110	2	Brace, Wood, 60" Span	0860
3	Bolt, Double Arming	0270	4	Connectors	3010
2	Screws, Lag	0550			

3/0 & 336.4 MCM CONDUCTOR

7.2/12.5 KV. 3-PHASE
CROSSARM CONSTRUCTION
DEADEND (DOUBLE)
LARGE CONDUCTORS

Revised Sept. 1994

C8-2P



NOTES:

WHITE INSULATORS MAY BE USED AS AN ALTERNATE TO THE BROWN INSULATOR AND LETTERS "CN". CHANGE MATERIAL LIST AS NECESSARY AND SPECIFY AS C9-1W.

Quan.	Material	Item No.	Quan.	Material	Item No.
4	Insulator, Pin Type	1040	2	Washer, Round	0600
2	Bolt, Machine, 5/8"	0370	4	Pin, Crossarm, Steel	0910
2	Bolt, Machine, 1/2" x 6"	0350	1	Crossarm, 10' 3 3/4" x 4 3/4"	0735
3	Washer, 2 1/4" Square	0610	2	Brace, Wood Bow 60"	0800
1	Screw, Lag	0550			

2, 4 & 1/0 ACSR COND
NEUTRAL ON X-ARM

7.2/12.5 KV.
3-PHASE CROSSARM CONSTRUCTION
SINGLE LINE ARM

Revised
Sept. 1994

C9-1

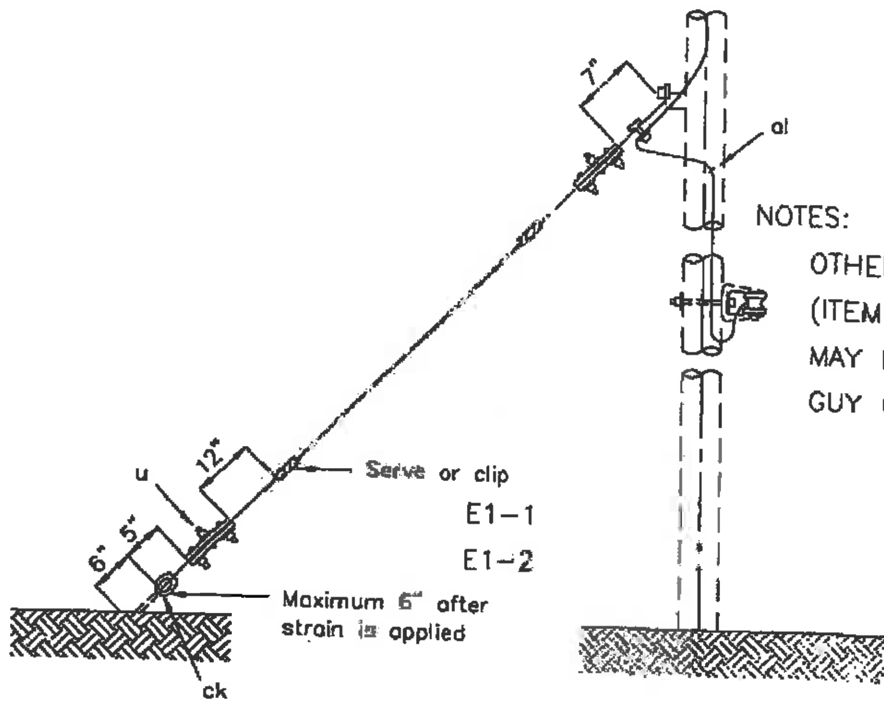
Section 6: Guy Assemblies

RUS Unit	Manufacturer	Rated Strength	Dimension Size
E1-2	FWC	EHS-15400#	3/8"
E1-3	FWC	EHS-20800#	7/16"
E1-3	FWC	EHS-35000#	9/16"
E2-2	FWC	EHS-15400#	3/8"
E2-3	FWC	EHS-20800#	7/16"

The 7/16" Extra High Strength guy wire is recommended to be installed as part of the E1-3 unit, the E1-5H unit, and the E1-5GH unit. The 9/16" Extra high Strength wire may be substituted if the designated design limits are exceeded for dead-end construction of 795AAC – 3/0ACSR conductor. The table below shows the recommended pole guy plates that may be substituted corresponding to the various guy assemblies.

RUS Unit	Manufacturer	Rated Strength	Dimension Size
E1-2, E2-2	Hughes Bros 1258	28000# 45°	5" – 2 Hole Spacing
E1-3, E2-3	Hughes Bros B1912	70000#	9" - 2 Hole Spacing
E1-3, E2-3	Hughes Bros A2132	70000# / 35000#	9" – 2 Hole Spacing

The specifications shown above supersede the specifications shown on the attached guy assembly drawings.



NOTES:

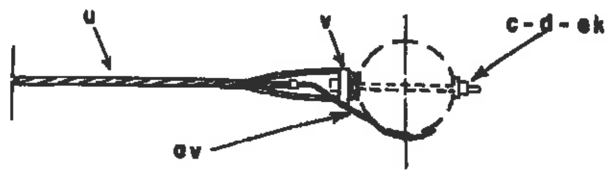
OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

SEE GUIDE DRAWINGS M30-1 AND M30-2

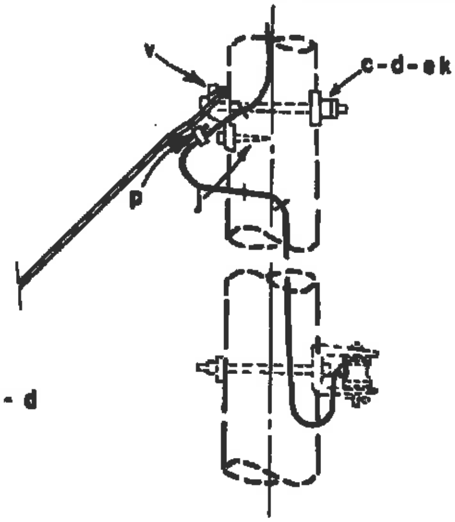
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Bolt, Machine, 5/8"	0370	1	Bolt, Machine, 5/8"	0370
1	Washer, 2 1/4" Square	0610	1	Washer, Square	0610
2	Guy, D.E.	1440	2	Clamp, 3-Bolt	1440
1	Guy Attachment	1465	1	Guy Attachment	1465
1	Clamp, Anchor Rod, Bonding	1455-1456	1	Clamp, Anc. Rod	1456
50'	Guy, Wire	1400	50'	Guy Wire	1411
			1	Guy Clip	1457

7.2/12.5 KV.
SINGLE DOWN GUY, THROUGH BOLT TYPE

Revised Sept. 1994	E1-1, E1-2



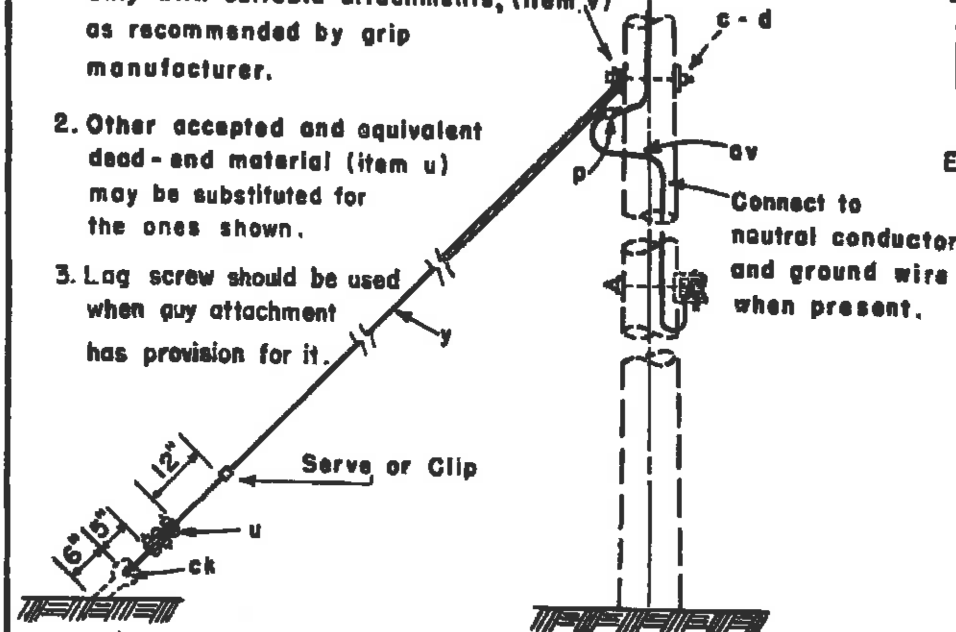
PLAN



E1-3

NOTES:

1. Formed type grips may be used only with suitable attachments, (item v) as recommended by grip manufacturer.
2. Other accepted and equivalent dead-end material (item u) may be substituted for the ones shown.
3. Lag screw should be used when guy attachment has provision for it.



E1-1, E1-2

See guide drawings M30 - 1 and M30 - 2

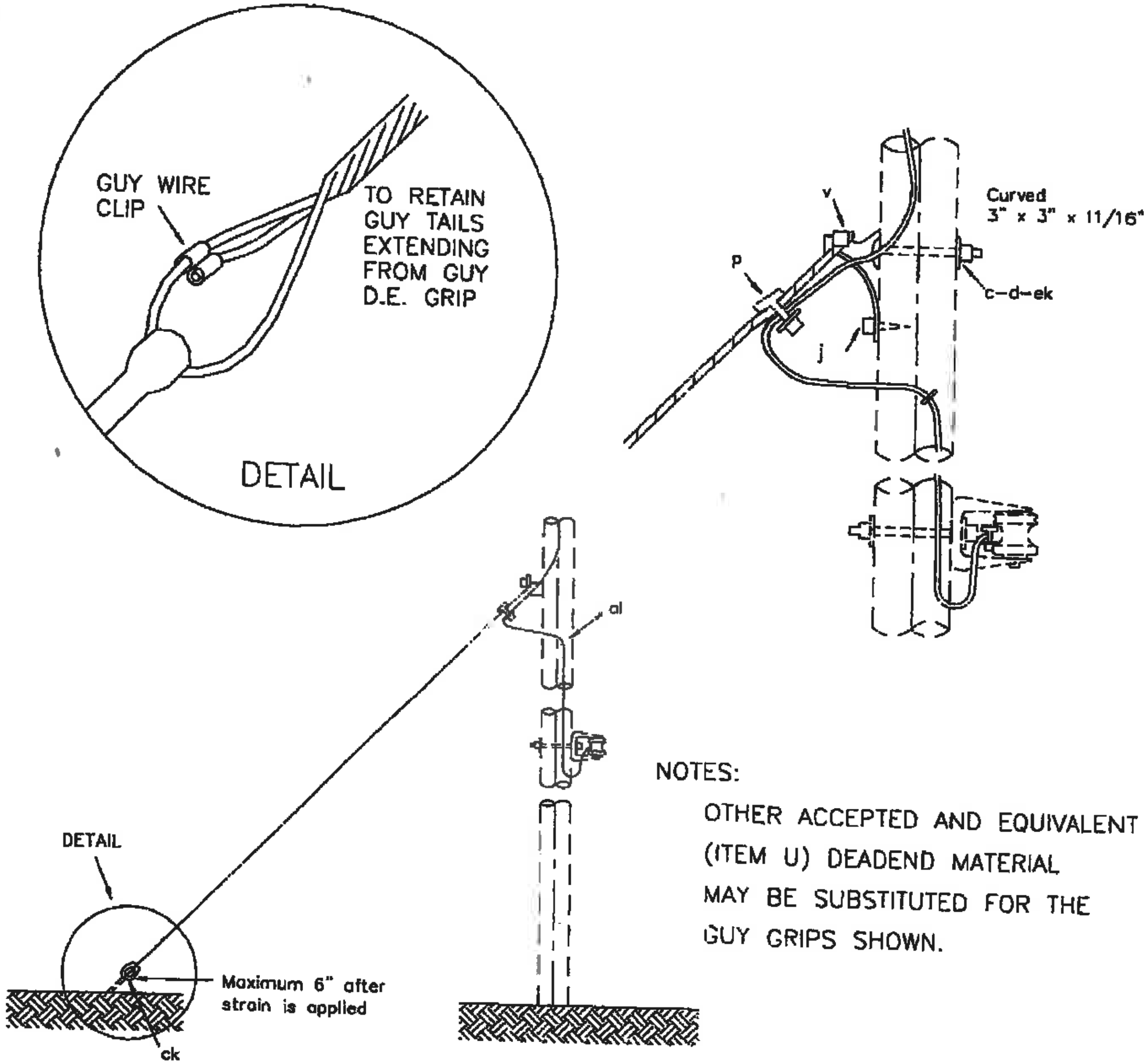
ITEM	MATERIAL	ASSEMBLY UNIT E1-1 No. REQ'D.	ASSEMBLY UNIT E1-2 No. REQ'D.	ASSEMBLY UNIT E1-3 No. REQ'D.	
c	Bolt, machine, 5/8" x required length	1	1	1	
d	Washer, curved	1-2 1/4" x 2 1/4"	1-3" x 3"	1-4" x 4"	
j	Screw, lag, 1/2" x 4"			1	
p	Connectors	as req'd	as req'd	as req'd	
u	Deadend for guy strand	2	2	2	
v	Guy attachment (rating)	1-(5200 lbs.)	1-(5200 lbs.)	1-(6500 lbs.)	
y	Guy wire, S.M., 7 strand req'd length by	1/4"	3/8"	7/16"	
av	Jumper, No. 4 stranded Al. alloy or equiv.	req'd length	req'd length	req'd length	
ck	Clamp, anchor rod bonding	1	1	1	
ek	Locknuts, as required				

12.5 / 7.2 kV

SINGLE DOWN GUY, THROUGH BOLT TYPE

Apr., 1983

E1-1, E1-2, E1-3



NOTES:

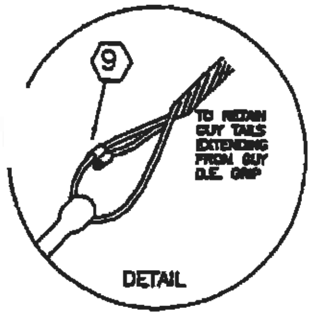
OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

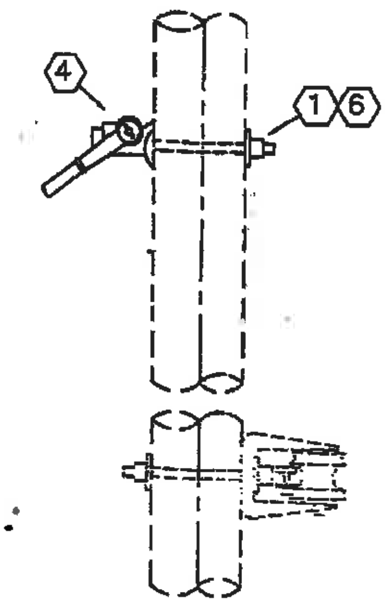
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Bolt, Machine, 5/8"	0370	1	Eye, Double	1456
1	Screw, Lag	0550			
2	Connectors	3000			
1	D.E. Guy Attach. H.D.	1468			
50'	Guy Write, 3/8" H.S.	1411			
1	Washer, Curved 3 x 3 x 11/16	0650			
2	Guy Grips	1440			
1	Guy Wire Clip	145700			

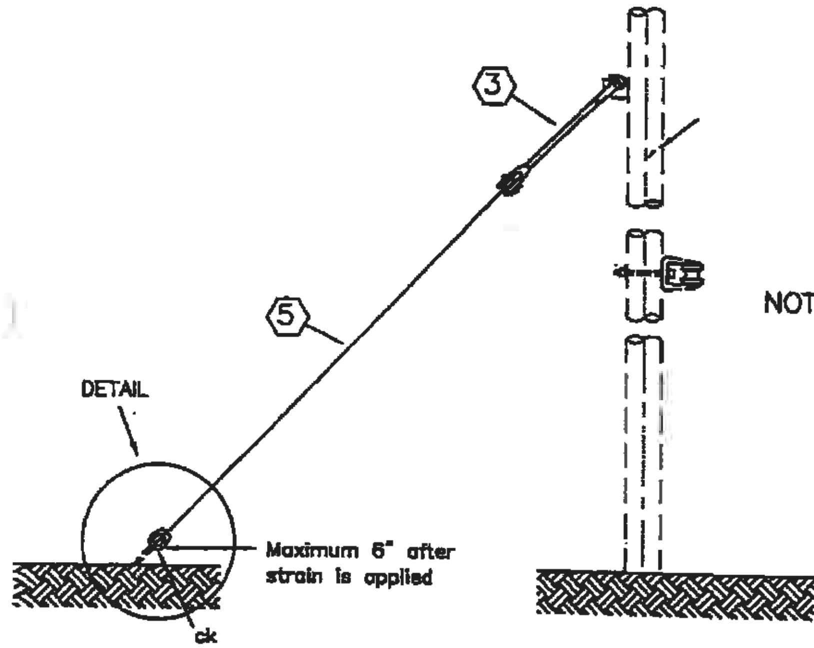
7.2/12.5 KV.
SINGLE DOWN GUY
THROUGH BOLT TYPE

Revised
Sept. 1994

E1–5







NOTES:

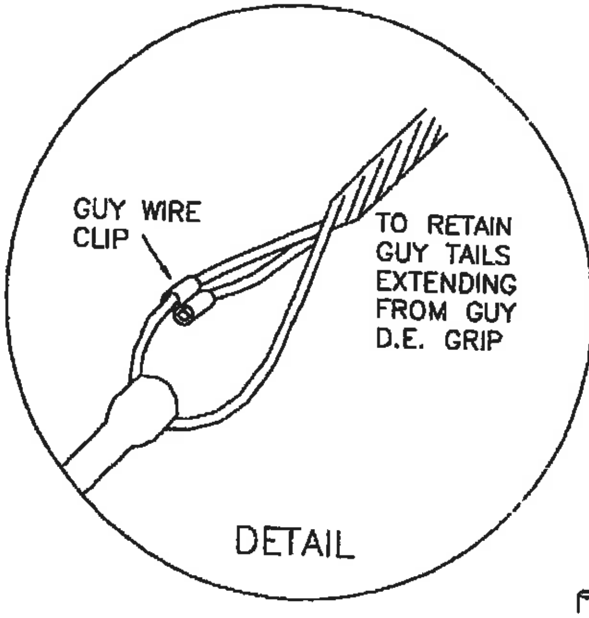
OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

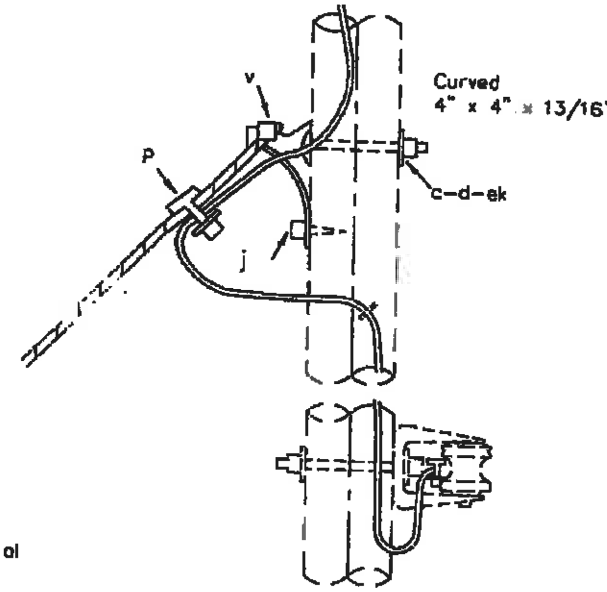
tem	No.	Material	Part No.	Item	No.	Material	Part No.
1	1	Bolt, Machine, 5/8"	0370	9	1	Eye, Double Bond Clamp	1456
2	1	Screw, Lag	0550				
3	1	54" Fiber. Guy Strain Ins.	9755				
4	1	Guy Attach. For Strain Ins	9756				
5	50'	Guy Wire, 3/8" H.S.	1411				
6	1	Washer, Curved 11/16"	0650				
7	2	Guy Grips	1440				
	1	Guy Wire Clip	145700				

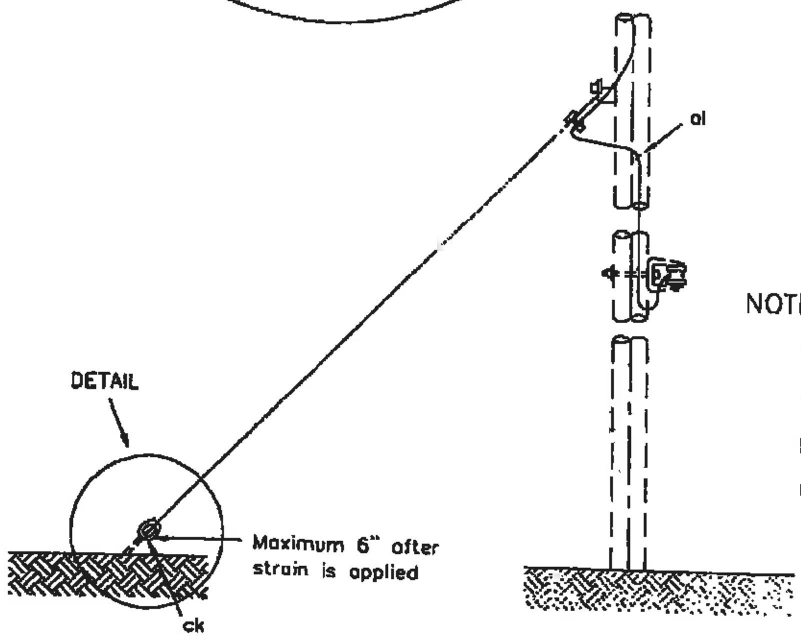
7.2/12.5 KV.
SINGLE DOWN GUY
THROUGH BOLT TYPE WITH FIBERGLASS LINK

Revised Nov. 1998

E1-5G







NOTES:

OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

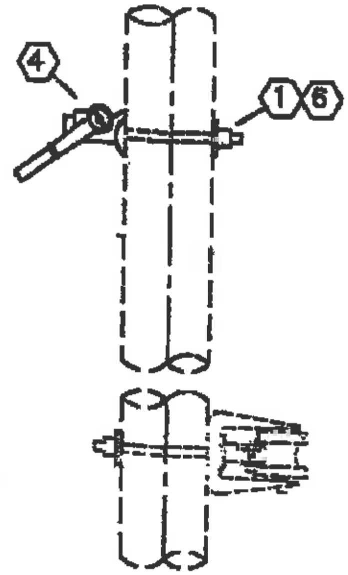
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Bolt, Machine, 3/4"	9370	1	Eye, Double	1456
1	Screw, Lag	0550			
2	Connectors	3000			
1	D.E. Guy Attach. H.D.	1468			
50'	Guy Write. 3/8" H.S.	1411			
1	Washer, Curved 4 x 4 x 13/16	9611			
2	Guy Grips	1440			
1	Guy Wire Clip	145700			

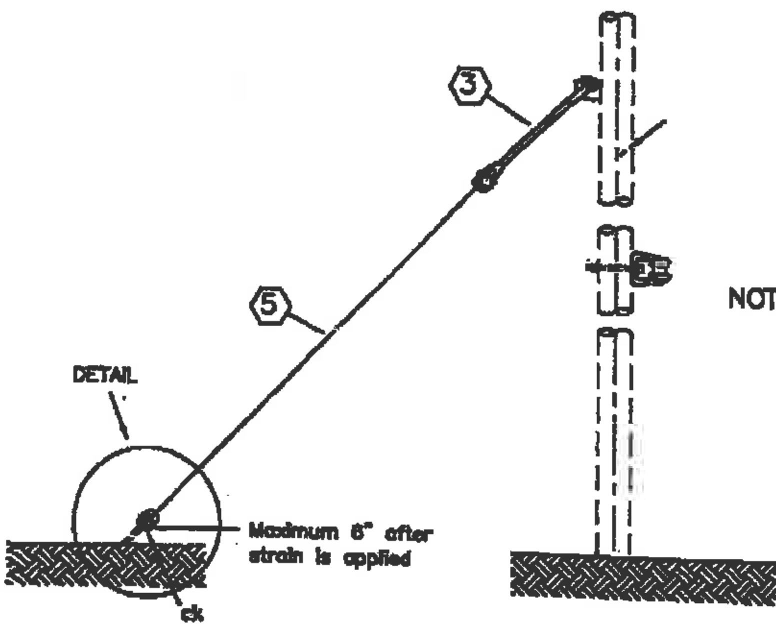
3/0 & 336.4 MCM CONSTRUCTION

7.2/12.5 KV.
SINGLE DOWN GUY
THROUGH BOLT TYPE

Revised
Sept. 1994

E1–5H





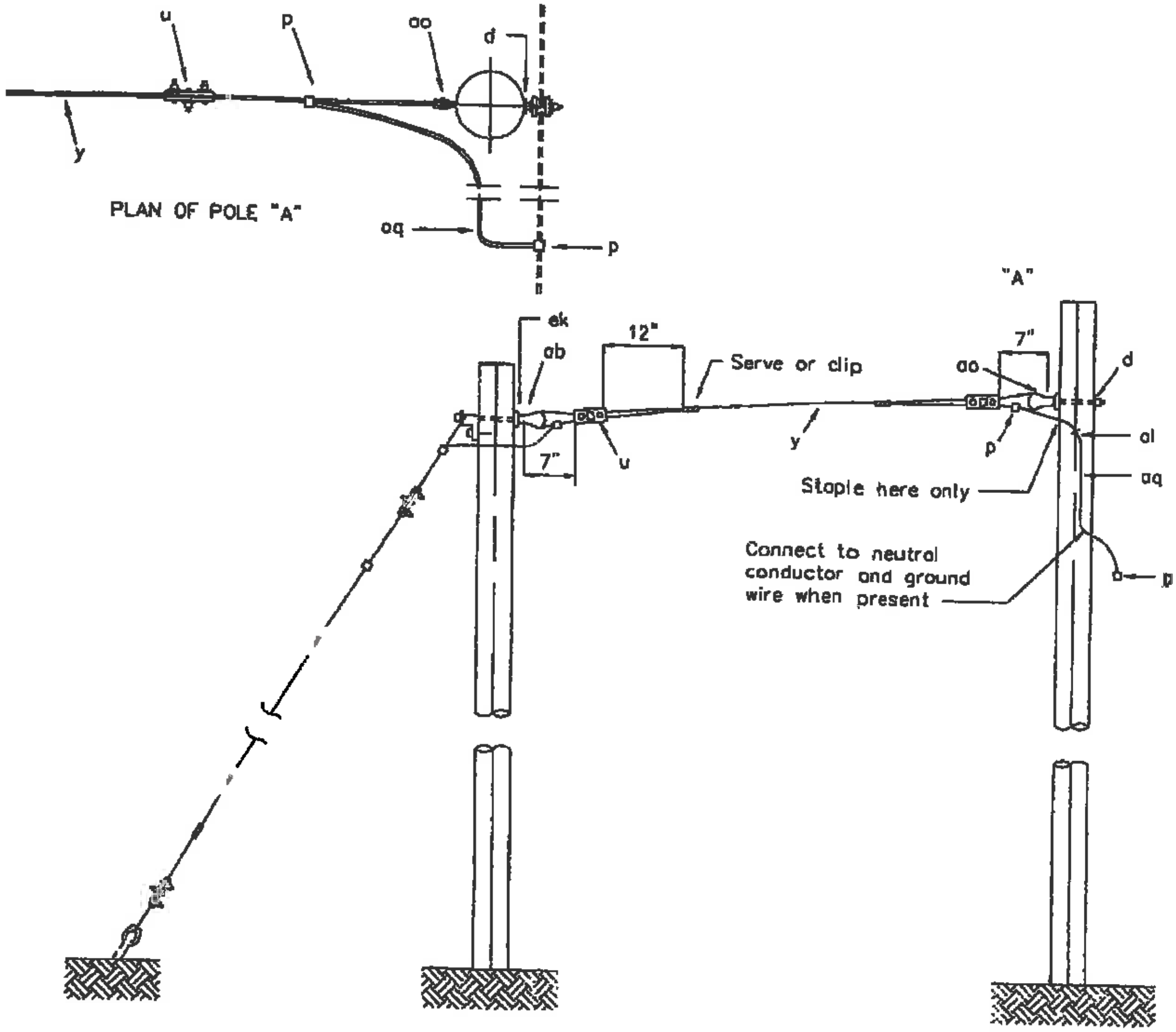
NOTES:

OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN:

Item	No.	Material	Part No.	Item	No.	Material	Part No.
1	1	Bolt, Machine, 5/8"	0370	9	1	Eye, Double Bond Clamp	1456
2	1	Screw, Lag	0550				
3	1	54" Fiber. Guy Strain Ins.	9755				
4	1	Guy Attach. For Strain Ins	9756				
5	50'	Guy Wire, 3/8" H.S.	1411				
6	1	Washer, Curved 11/16"	0650				
7	2	Guy Grips	1440				
	1	Guy Wire Clip	145700				

7.2/12.5 KV.
SINGLE DOWN GUY
THROUGH BOLT TYPE WITH FIBERGLASS LINK

Revised Nov. 1998	E1—5GH



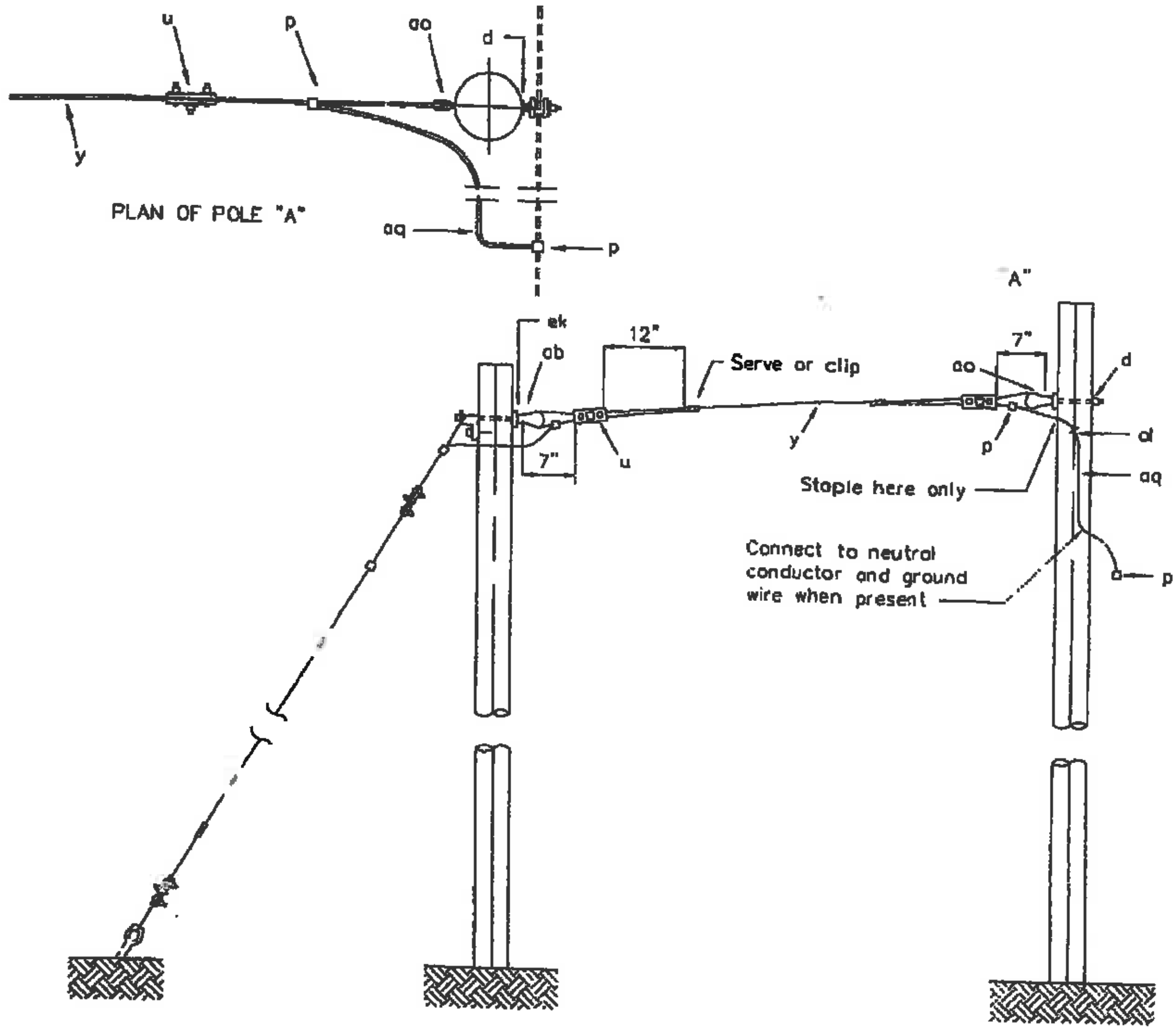
NOTES:
1– Other accepted and equivalent item u deadend material may be substituted for the 3-bolt clamp shown.

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Washer, 2 1/4" Square	0610			
2	Guy, D.E.	1440			
50'	Guy Wire	1411			
2	Nut, Thimble Type Eye	0660			
2	Bolt, Machine	0370			

7.2/12.5 KV.
SINGLE OVERHEAD GUY
THROUGH BOLT TYPE

Revised
Sept. 1994

E2–2



NOTES:

1– Other accepted and equivalent item u deadend material may be substituted for the 3–bolt clamp shown.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, Curved	0650			
2	D.E. Guy Att. H.D.	1468			
70'	Guy Wire	1411			
2	Lag Screw	0550			
2	Bolt, Machine. 5/8"	0370			

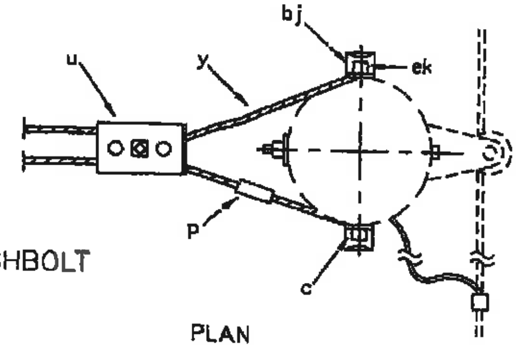
7.2/12.5 KV.
SINGLE OVERHEAD GUY
THROUGH BOLT TYPE

Revised
Sept. 1994

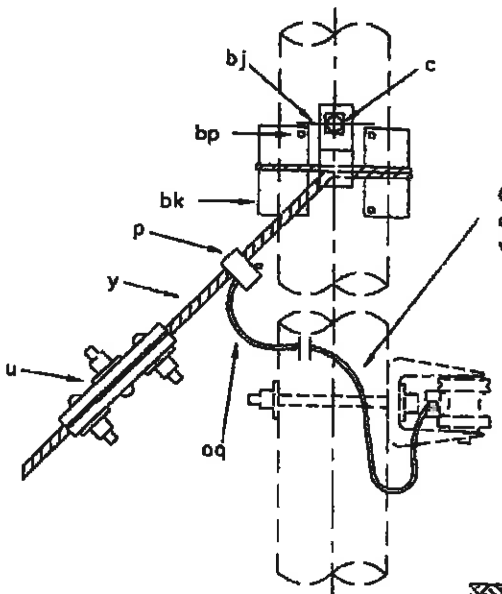
E2–5

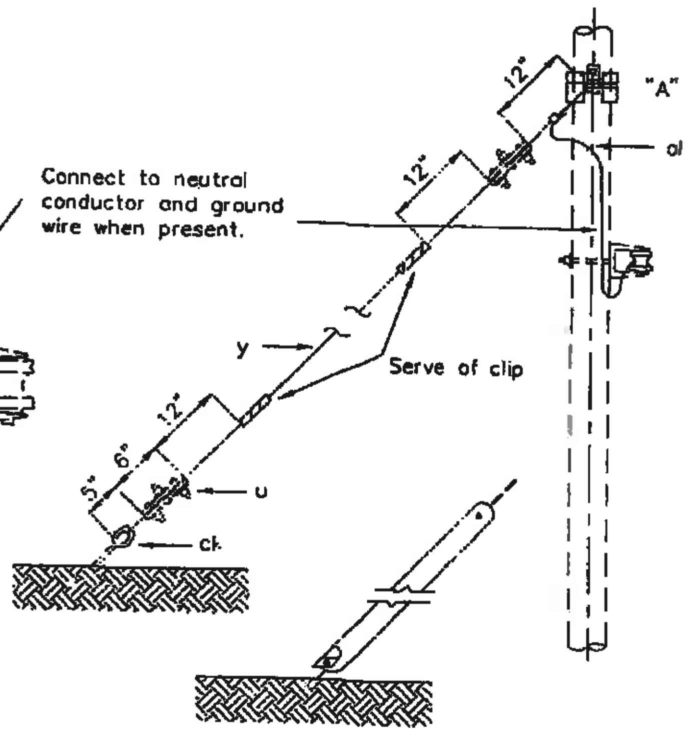
NOTES:

1. OTHER ACCEPTED AND EQUIVALENT (ITEM U) GUY CLAMPS MAY BE SUBSTITUTED FOR THE 3-BOLT CLAMPS SHOWN.
2. ASSEMBLIES E1-2 AND E1-3 (THROUGHBOLT TYPE) ARE PREFERRED UNITS.



PLAN





E3-10
GUY GUARD

E3-2

Quan.	Material	Item No.
1	Bolt, Machine, 5/8"	0370
2	Connectors, Small	3000
2	Clamp, Guy, 3-Bolt	1440
2	Guy Hook	1460
2	Guy Plate	1470
60'	Guy Wire	1411
1	Clamp, Anchor Rod Bonding	1455

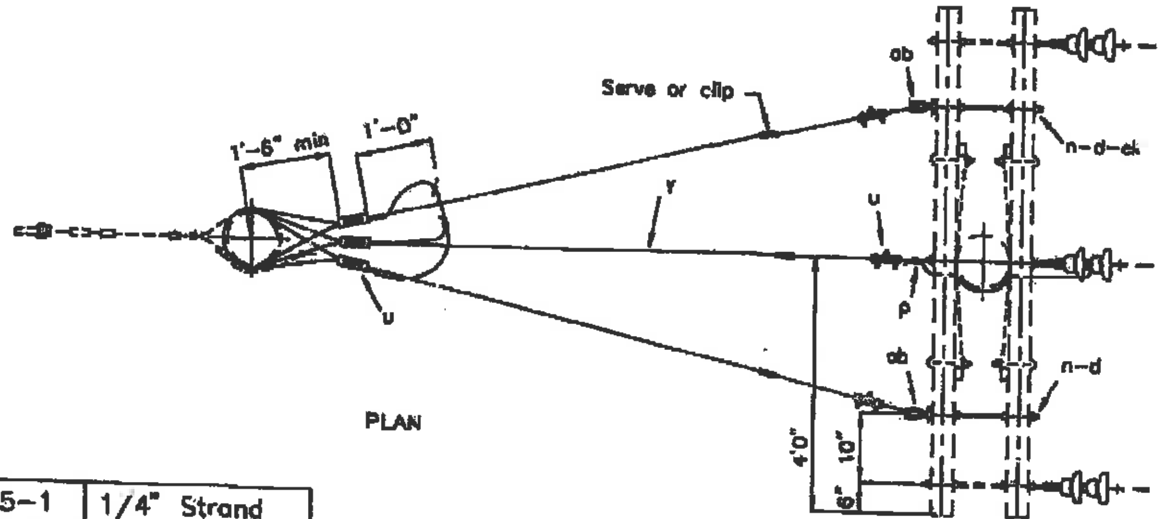
E3-3

Quan.	Material	Item No.
1	Bolt, Mach. 5/8"	0370
2	Connector	3000
2	Clamp, Guy	1441
2	Guy Hook	1460
2	Guy Plate	1470
60'	Guy Wire	1420
1	Clamp, Anchor Rod	1456

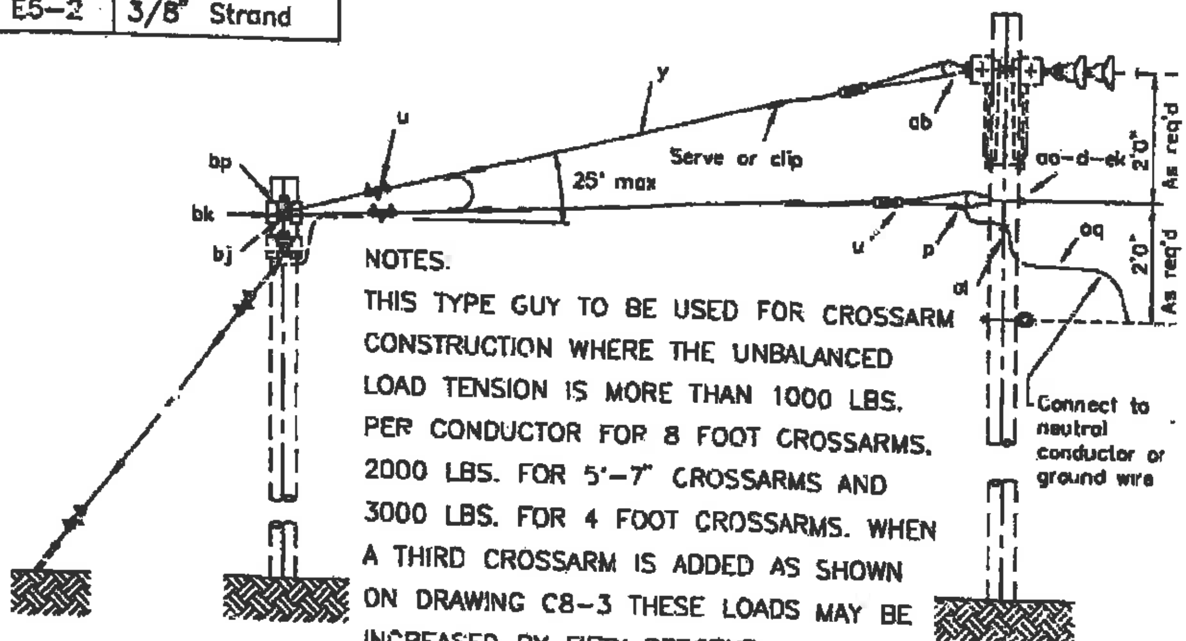
7.2/12.5 KV.
SINGLE DOWN GUY
WRAPPED TYPE

Revised Sept. 1994

E3-2,E3-3,E3-10



E5-1	1/4" Strand
E5-2	3/8" Strand



NOTES.

THIS TYPE GUY TO BE USED FOR CROSSARM CONSTRUCTION WHERE THE UNBALANCED LOAD TENSION IS MORE THAN 1000 LBS. PER CONDUCTOR FOR 8 FOOT CROSSARMS. 2000 LBS. FOR 5'-7" CROSSARMS AND 3000 LBS. FOR 4 FOOT CROSSARMS. WHEN A THIRD CROSSARM IS ADDED AS SHOWN ON DRAWING C8-3 THESE LOADS MAY BE INCREASED BY FIFTY PERCENT.

Quan.	Material	Item No.	Quan.	Material	Item No.
9	Washer, 2 1/4" Square	0610	2	Guy Plate	1470
2	Bolt, Double Arming	0270	2	Guy Hook	1460
6	Guy Clamp, 3-Bolt	1440			
210'	Wire, Guy, 3/8"	1411			
2'	Bolt, Machine, 5/8"	0370			
3	Nut, Thimble Type Eye	0660			

7.2/12.5 KV.
DEADEND GUY
CROSSARM CONSTRUCTION

Revised Sept. 1994

E5-1H. E5-2

Section 7: Anchor Assemblies

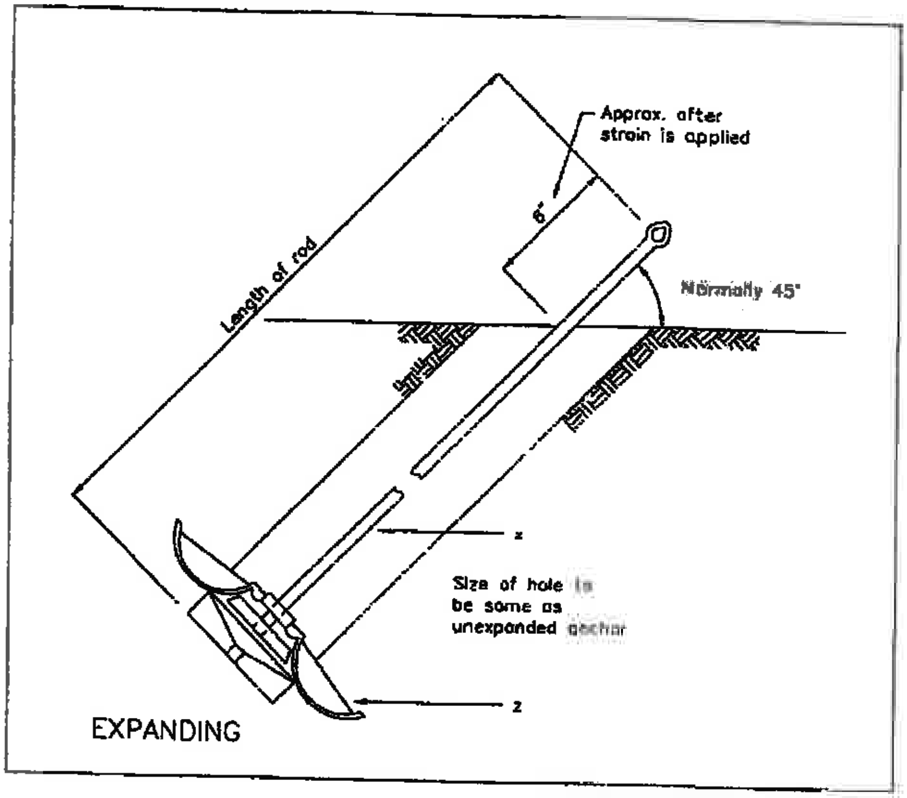
RUS Unit	Manufacturers	Rated Strength	Dimension Size
F1-2	Chance #88135	18000# Class 5 Soil	8" – ¾ rod
F1-4	Chance #1283-1	26500# Class 5 Soil	12" – 1' rod

F5-3A assembly is to be used where solid rock is encountered and should have no less than the rated strength of the F1-4 assembly above.

When two guy anchors are required, use minimum spacing of five feet. For the guy plates, guy wires and anchor assemblies specified, other manufacturer's hardware of equivalent ratings may be substituted. Included on the drawings are minimum anchor placements from the pole (guy leads) for the guy/anchor assemblies specified.

The installation of guy/anchor assemblies are dependant upon the design location of poles. The actual staking of the line may result in changes to pole locations and therefore changes in the angles formed by the conductors. The appropriate changes in the number, size, and placement of guy/anchor assemblies will have to be made by the staking engineer. These changes must include transverse wind loading on conductors, wind loading on pole, maximum design tension of conductor, and NESC over-capacity factors.

The specifications shown above supersede the specifications shown on the attached anchor assembly drawings.



F1–2

Quan.	Material	Item No.
1	Rod, Anchor, Thimble Eye	1345
1	Anchor, Exp. 12,000#	1312
	5/8"	

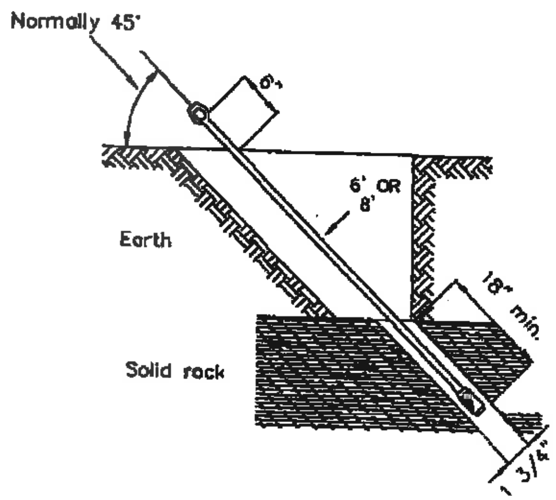
F1–4

Quan.	Material	Item No.
1	Rod, Anchor, Thimble Eye	1340
1	Anchor, Exp. 12,000#	1312
	3/4"	

ANCHOR ASSEMBLY

Revised Sept. 1994

F1–2 & F1–4



F5–3A

NOTES:

1. ONLY ONE GUY SHALL BE ATTACHED TO A ROCK ANCHOR. WHERE MORE THAN ONE GUY IS REQUIRED SPACE ANCHORS 2 FT. MINIMUM AND WHERE PRACTICAL THEY SHALL BE IN DIRECT LINE WITH POLE.

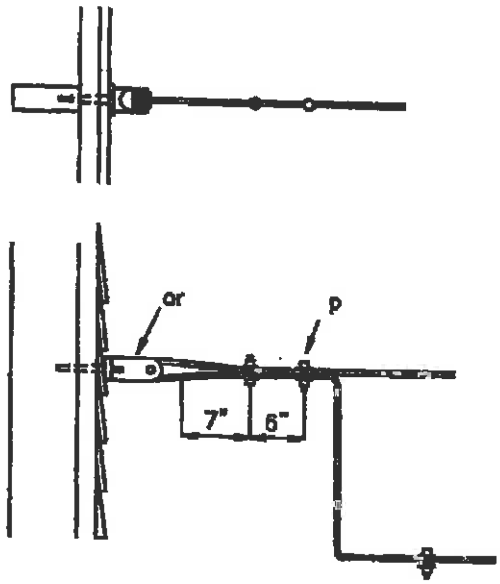
2. DO NOT ANCHOR TO ANY BOULDER MEASURING LESS THAN 5FT. IN TWO DIRECTIONS AT RIGHT ANGLES TO EACH OTHER.

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Anchor, Rock 6' or 8'	9987			

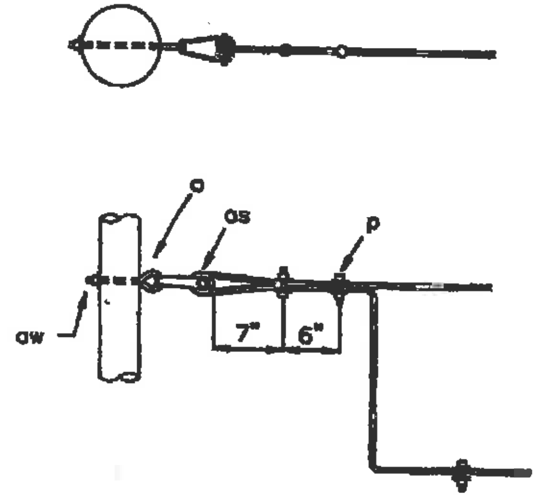
Revised Sept. 1994

F5–3A

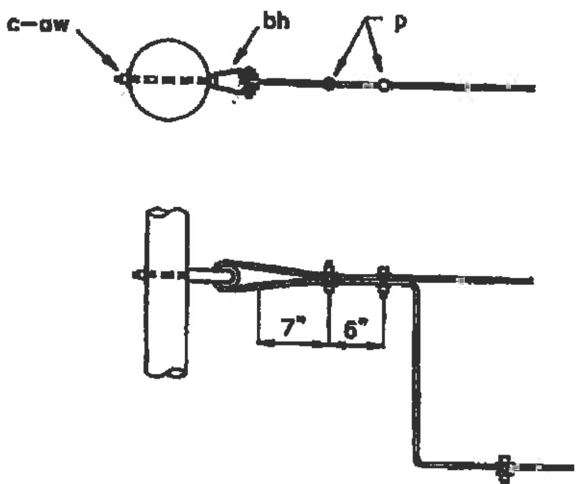
Section 8: Service Assemblies



K10



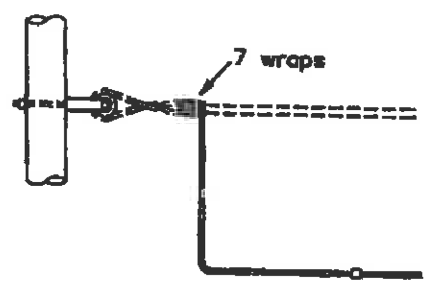
K11



K12

DETAIL OF WRAPS & TURNS

WRAP DETAIL FOR SMALL COVERED CONDUCTORS



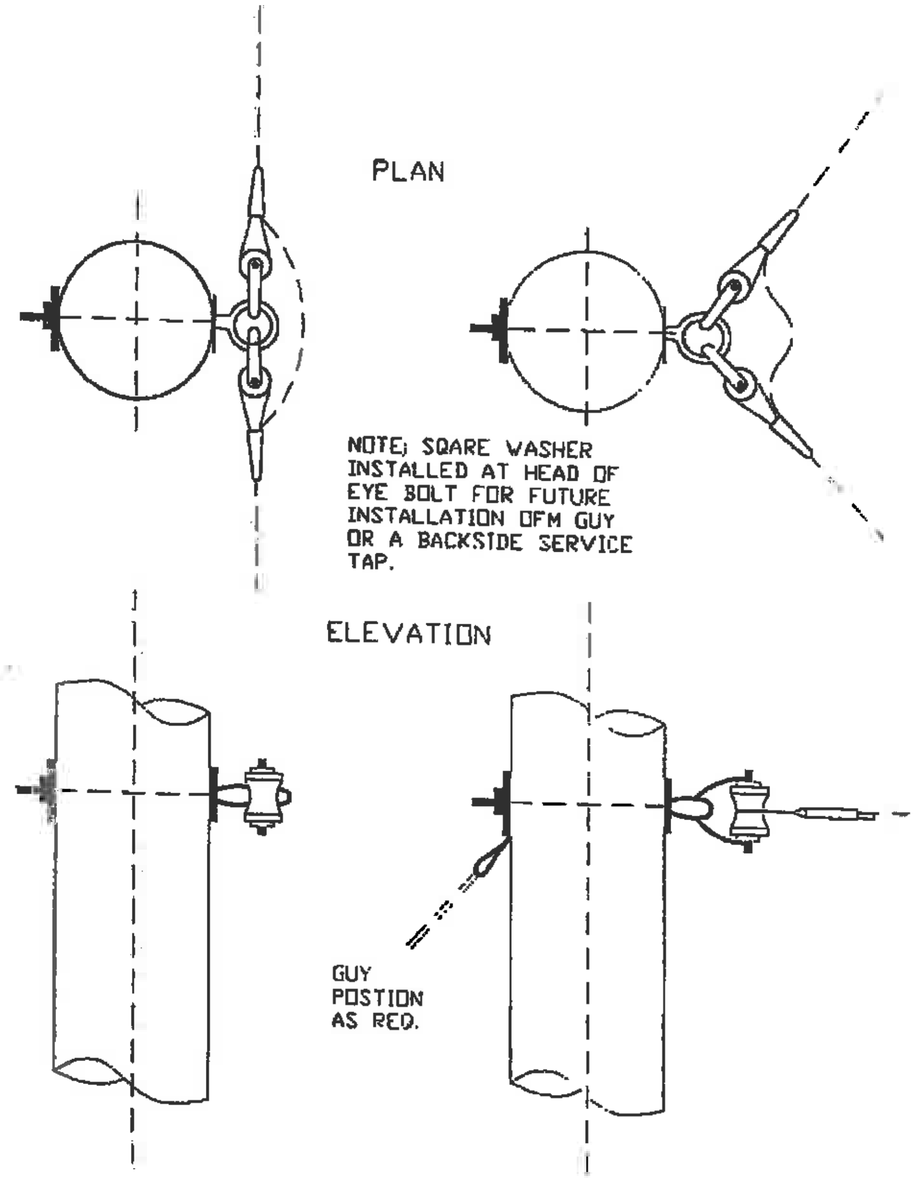
Quan.	Material	Item No.
1	Wireholder	1000

Quan.	Material	Item No.
1	Ins. Spool Sec. K11	1010
1	Clevis, Sec. Swinging	1805

SERVICE ASSEMBLIES

Revised Sept. 1994

K10 TO K11

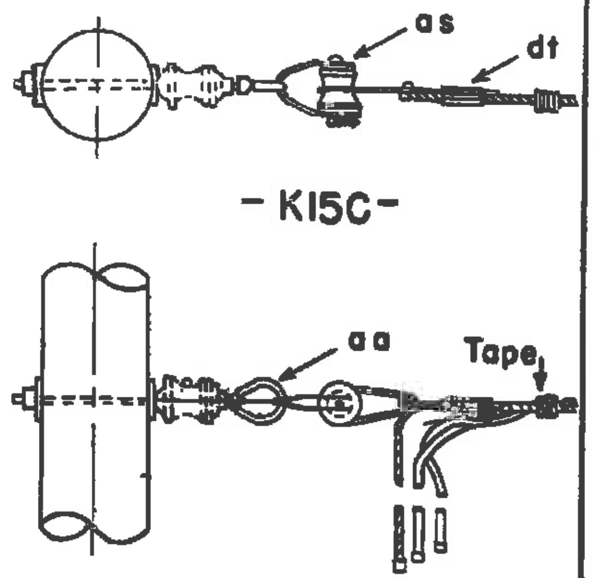


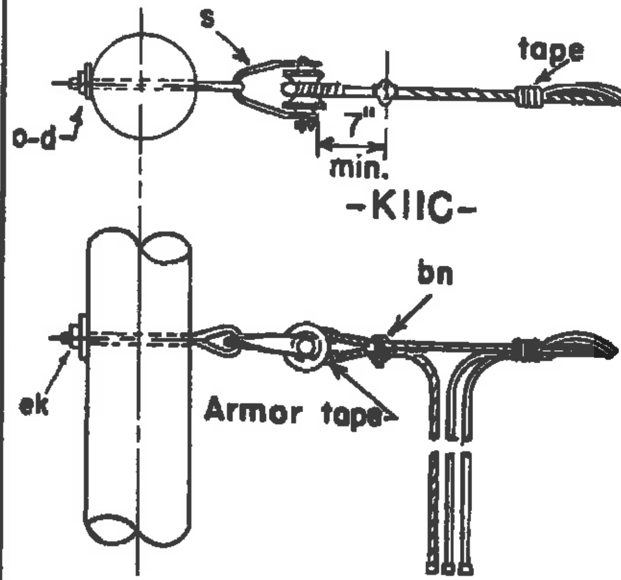
Quan.	Material	Item No.	Quan.	Material	
1	5/8" Eye Bolt	0320			
2	2 1/4" Square Washer	0610			
2	K11 Clevis	1805			
2	K11 Spool	1010			
2	Wedge	1990			

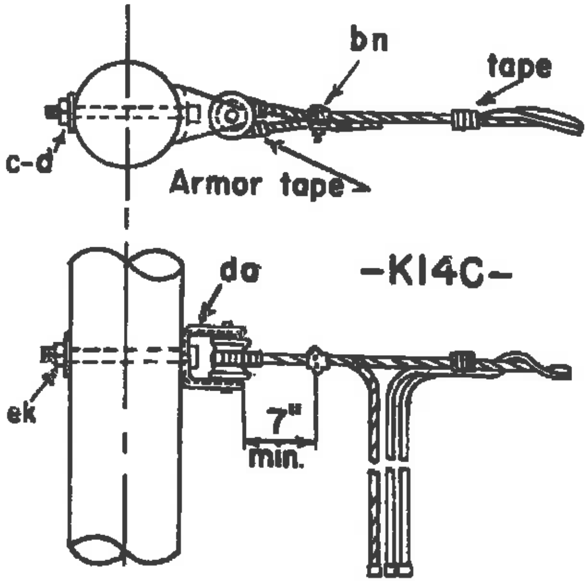
SERVICE POLE ASSEMBLY
0° TO 60°

Revised
Sept. 1994

K11-2







NOTES

This type construction should be used for 3 or 4 conductor service cables with bare A.C.S.R. neutral.

Service connectors to be insulated compression type.

Groove diameter of insulators $1\frac{3}{4}$" minimum for loop deadends.

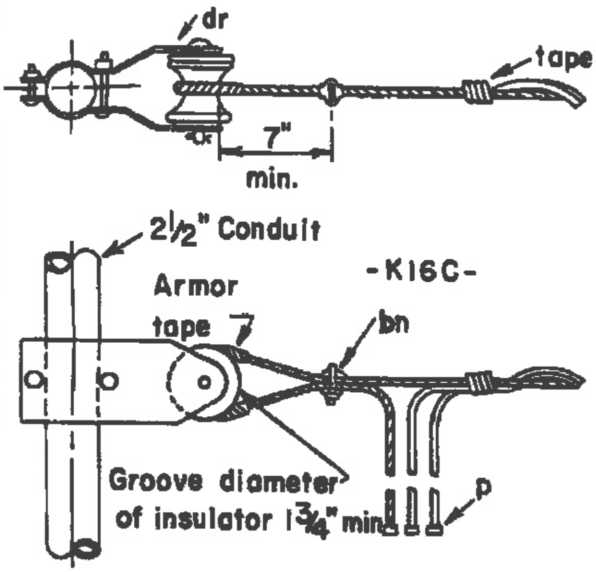
ITEM		MATERIAL	
c		Bolt, machine, $\frac{5}{8}$" x req'd. length	
d		Washer, $2\frac{1}{4}$" x $2\frac{1}{4}$" x $\frac{3}{16}$" - $\frac{13}{16}$" hole	
o		Bolt, eye, $\frac{5}{8}$" x req'd. length	
s		Clévis, secondary, swinging, insul.	
aa		Nut, eye	
ek		Locknuts, as required	

ITEM		MATERIAL	
bn		Clamp, loop deadend	
da		Bracket, insulated	
as		Clevis, service swinging	
p		Connectors, as required	
dt		Service deadend	

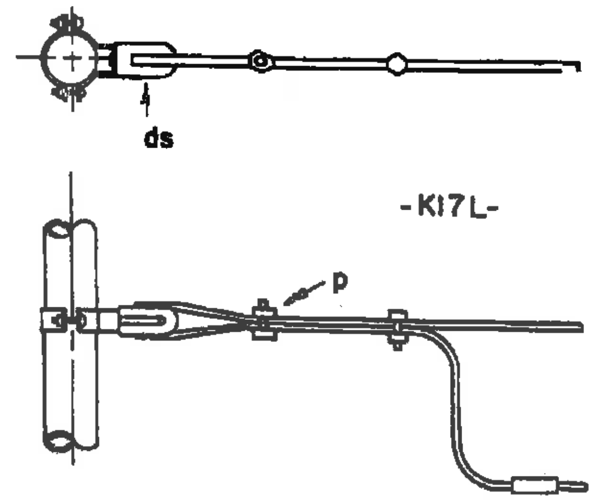
SERVICE ASSEMBLIES, CABLE

Apr., 1983

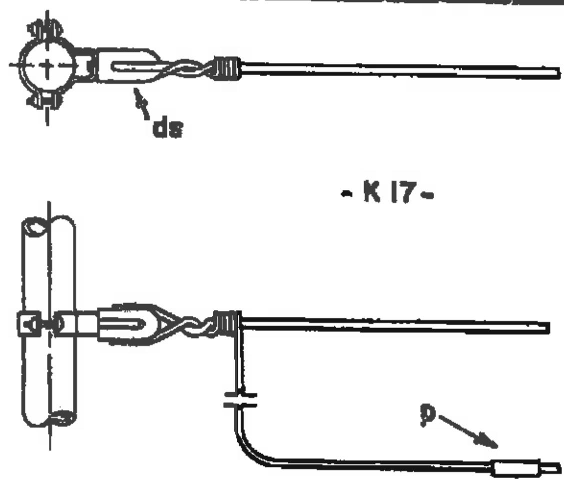
K11C, K14C, K15C



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



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



NOTES:

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

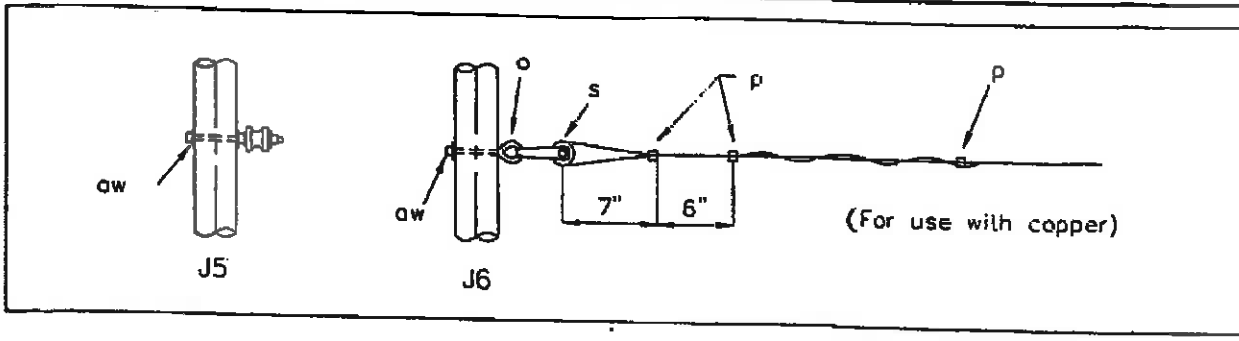
ITEM	NO.	MATERIAL	
p		Connectors, as req'd	
bn		Clamp, loop deadend	

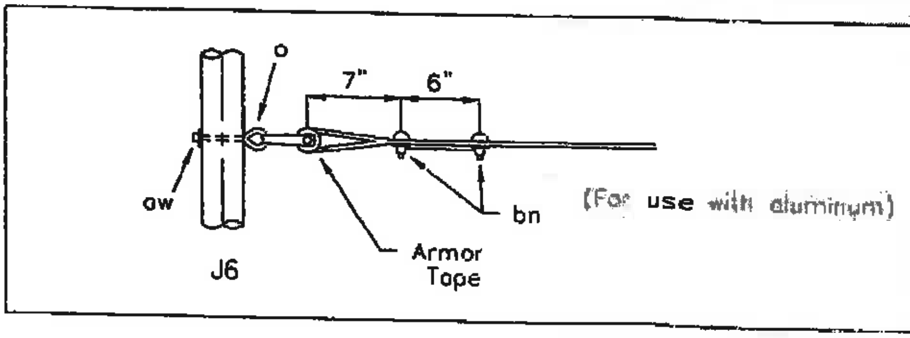
ITEM	NO.	MATERIAL	
dr		Clevis, conduit insulated	
ds		Wireholder, conduit	

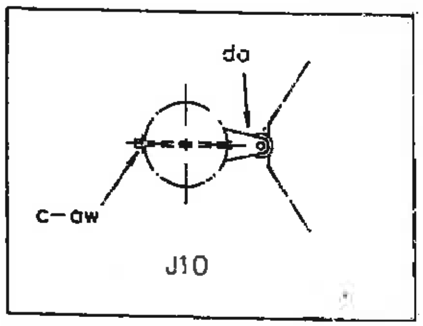
SERVICE ASSEMBLIES
(FOR RANCH TYPE HOUSES)

Apr., 1983

K16 C, K17L, K17







FOR USE ON SELF SUPPORTING SERVICE CABLE

J5

Quan.	Material	Item No.
1	Washer, 2 1/4" Square	0610
1	Ins. Spool Sec.	1020
1	Bolt, Double Upset	0425
	J6	
1	Washer, 2 1/4" Square	0610
1	Bolt, Eye, 5/8"	0320
1	Ins. Spool Sec.	1020
1	Clevis, Sec. Swinging	1815

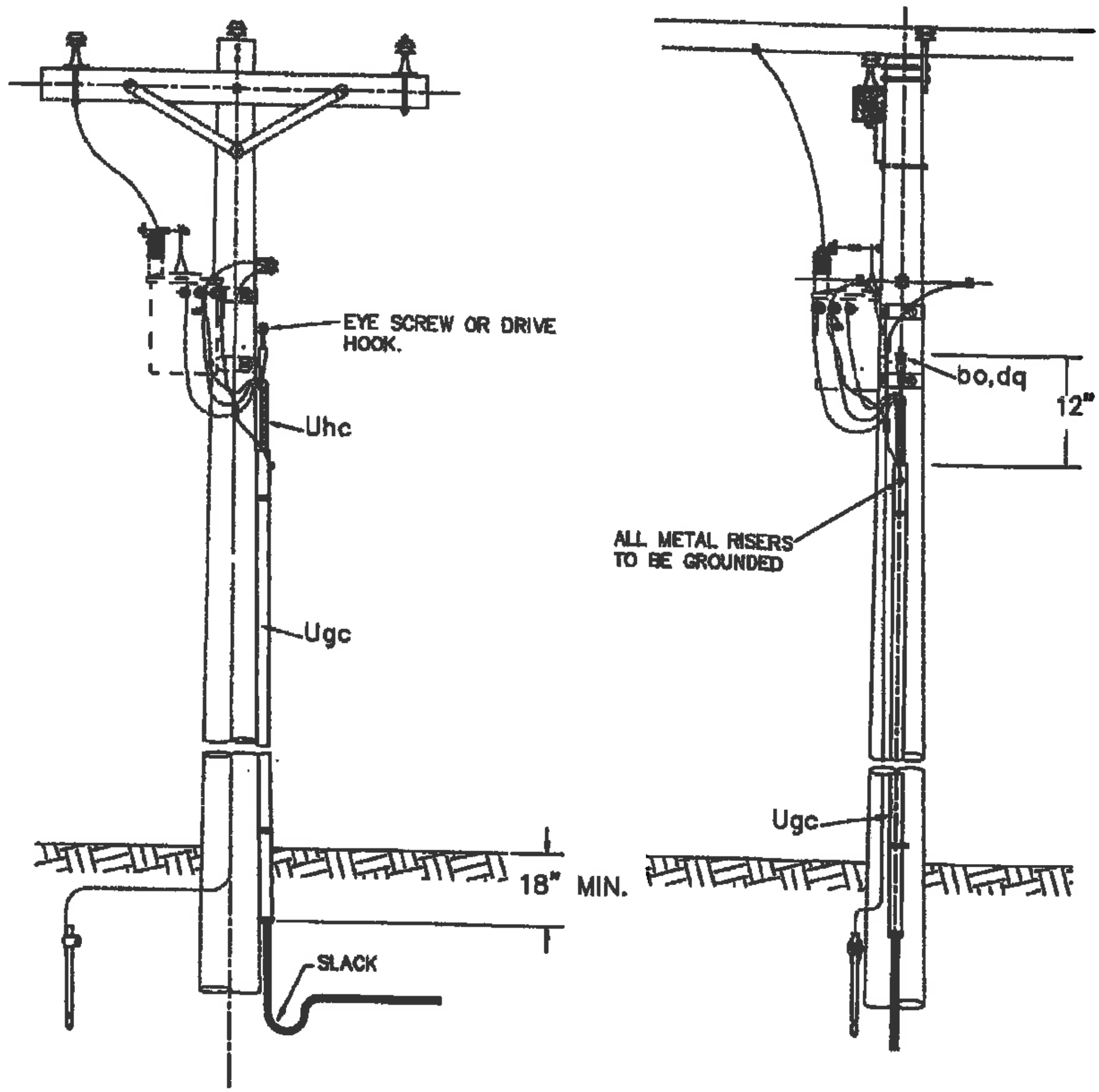
J10

Quan.	Material	Item No.
1	Bolt, Mach. 5/8"	0370
1	Washer, 2 1/4" Square	0610
1	Ins. Spool Sec.	1020
1	Clevis, Sec. D.E.	1810

SECONDARY ASSEMBLIES

Revised Sept. 1994

J5 TO J10



NOTES:

1. ALLOW MINIMUM CABLE SLACK OF 24" AT BOTTOM OF RISER.

ITEM	QTY.	MATERIAL
bo		Anchor, shackle. Do not use if drive
		hook is used.
dq	1	Eye screw, elliptical or drive hook.
Ugc	1	Cable riser shield. Length as required.
Uhc	1	Cable support.

SECONDARY CABLE TERMINAL POLE

	2000	UM5

Section 9: Transformer Assemblies

It may be necessary, and it is permissible, to lower the neutral attachment on standard single-phase conventional type transformer assemblies an additional distance not exceeding 2 feet to provide adequate clearances for cutouts.

The wiring schematics on the three-phase transformer/meter connection guide drawings are based on single-phase transformers with additive polarity. ANSI Standard C57-12.20 specifies that all single-phase transformers large than 200 kVA have subtractive polarity. If the transformer/meter connection guides are used for single-phase transformers larger than 200 kVA, the schematic diagrams will need to be modified accordingly.

All transformers are to be in compliance with TVA's "Distribution Transformer Specification" which follow this page.

Partnership Standardization Group	Distribution Transformer Specification *7200 X 14400 and 14400*	TRANS2 Rev12/31/08 Revision 3 Page 1 of 30

TRANS2 PARTNERSHIP GROUP

Customer Procurement Partnerships

Table of Contents

The following Power Distributors are partnering & standardizing to TRANS2:

POWER DISTRIBUTOR	CORPORATE LOCATION
Duck River Electric Membership Corporation (DREMC)	Shelbyville, TN
Fayetteville Public Utilities (FPU)	Fayetteville, TN
Fort Loudoun electric Cooperative	Vonore, TN
Middle Tennessee Electric Membership Corporation (MTEMC)	Murfreesboro, TN
Sequachee Valley Electric Cooperative (SVEC)	South Pittsburg, TN
Tennessee Valley Electric Cooperative (TVEC)	Savannah, TN
Volunteer Energy Cooperative (VEC)	Decatur, TN

The following specifications for dual voltage 7.2 x 14.4 and 14.4 voltages shall apply to transformers purchased through the **Transformer Buying Group Co-Sponsored by MTEMC and VEC, herein Partners**. These specifications in no way exempt the manufacturer from furnishing a complete transformer and the necessary accessories in accordance with the latest ANSI, NEMA, and IEEE standards.

REFERENCES

1. ANSI C57.12.00 - 2000, IEEE Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers
2. IEEE Std. C57.12.20 - 2005, IEEE Std. for Overhead-Type Distribution Transformers, 500 kVA and Smaller: High Voltage, 34 500 V and Below; Low Voltage 7970/13 800 V and Below
3. IEEE Std. C57.12.21 - 1992, American National Standard Requirements for Mounted, Compartmental - Type, Self-Cooled, Single - Phase Distribution Transformers with High - Voltage Bushings; High - Voltage, 34 500 GrdY/19 920 Volts and Below; Low - Voltage, 240/120 Volts; 167 KVA and Smaller
4. ANSI C57.12.25 - 1990, Pad-Mounted Compartmental-Type Self-Cooled Single-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 GrdY/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller, Requirements for
5. IEEE Std. C57.12.28 - 2005, IEEE Standard for Pad Mounted Equipment-Enclosure Integrity
6. IEEE Std C57.12.31 - 2002, IEEE Standard for Pole Mounted Equipment-Enclosure Integrity
7. IEEE Std. C57.12.34 - 2004, IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High-Voltage: 34,500 GrdY/19,920 Volts and Below; Low-Voltage: 480 Volts and Below
8. IEEE Std. C57.12.70 - 2002, for Terminal Markings and Connections for Distribution and Power Transformers
9. ANSI/IEEE C57.12.80 - 1999, Terminology for Power and Distribution Transformers
10. ANSI C57.12.90 - 1999, Test Code for Liquid Immersed Distribution, Power, and Regulating Transformers and Guide for Short - Circuit Testing of Distribution and Power Transformers
11. ANSI/IEEE C57.123 - 2002 - Guide for Transformer Loss Measurement
12. Rural Utility Service (RUS-formerly REA) Specification U-5; Other Applicable RUS

13. ANSI Z535, Safety Sign & Labels - Accident Prevention Tags
14. WUG 2.13, Security For Padmounted Equipment Enclosures
15. **Federal Register, Friday October 12, 2007, Part III, Department of Energy, 10 CFR Part 431, Vo. 72, No.197, Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule**

PRESENT WORTH - TOTAL OWNERSHIP COST

- The manufacturer shall perform all applicable tests as prescribed by NEMA, ANSI and DOE Rules and Regulations.
- The standards set forth shall be adhered to in all cases and any exceptions shall be approved in advance by the Partner using this Specification.
- Transformer losses for the proposal shall be specified as guaranteed no load and total losses per ANSI C57.12.00 - 2000 edition with tolerances specified in section 9.3 and with all losses referenced to an 85 degree centigrade winding temperature. The total losses are to include any breaker losses, if applicable, and any other incidental losses. The present worth of the transformer shall be evaluated according to the following formula:

Total Owning Cost = 1.14 X Bid Price + $ "A" X No Load KW + Load KW $"B" X Load KW (see table below for "A and B" Factors)

GROUPING	"A" FACTOR	"B" FACTOR
1KVA TO 50KVA Single Phase	$8272	$990
75KVA TO 167KVA Single Phase	$8272	$1450
75KVA TO 500KVA Three Phase	$8272	$2000
750KVA TO 2500KVA Three Phase	$.8272	$.3150

- Load KW will be used as "Total Loss less No Load Loss at 100% rated voltage."
- Evaluation will be made on core loss at 105% rated voltage and total loss at 100% load and voltage. Additional evaluation will be on replacement warranty and past failure rate performance of the manufacturer on single phase units.
- Any transformer with losses testing greater than +/- 10% on NO LOAD LOSS or +/- 6% on TOTAL LOSSES may be returned to the Manufacturer/Supplier at their expense or Owner may request damages as outlined in LOSS DAMAGES AND NIST COMPLIANCE (next page).
- The manufacturer shall furnish actual loss data on the completed transformers. This information shall be furnished by e-mail ***to each Partners designee within 30 days of shipment.***

GENERAL REQUIREMENTS - ALL TRANSFORMERS

Includes Common Features and Material Requirements

1. All transformer oil furnished shall conform to ASTM D 3487 – 1988 Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus, and be inhibited with ditertiary-butyl-paracresol (DBPC); Amount provided shall be 0.3% by weight. Oil shall contain less than 1 PPM of PCBs (Polychlorinated Biphenyls).

2. The nameplate shall state that the oil is inhibited or an external, permanently affixed tag shall state, non-PCB Less Than 1 PPM.

3. Label stating compliance with EPA Standards for non-PCB oil at time of manufacture.

4. Units expected to be operated in an outdoor situation with environment conditions of rain, snow, sleet and Sunshine. The ambient temperature range to which the unit will be subjected will be -30 degrees F to 120 degrees F.

5. Oil-Immersed Self-Cooled (OISC) type

6. *RECOMMENDATION*: For single-phase pole mount and pad mount transformers, manufacturer to provide serial number on top exterior of tank with a permanent or non-permanent label. The serial number on the manufacturer's bar-coding strip is an acceptable fulfillment of this request.

7. Notification of delivery:

Single Phase	*24 hours
Three Phase	*72 hours

**Unless otherwise noted on Purchase Order or Release*

NOTE: Provide weight for individual units > 5,000 lbs.

LOSS DAMAGES AND NIST COMPLIANCE

Liquidated Damages for Exceeding Guaranteed Losses

The No-Load and Load (winding) Losses quoted by the QUOTER are of UTMOST IMPORTANCE to the contract(s). Should the QUOTER neglect, refuse, or fail to meet the quoted losses herein provided, in the event and in view of the difficulty of determining with exactness damages caused by such failure, the OWNER shall have the right to deduct from and/or retain out of such monies that which may be due or which may become due and payable to the QUOTER: a sum equal to the difference in quoted loss values and the actual loss values as verified by the certified test reports provided after manufacture. Such sum shall be computed in dollars, utilizing the No-Load Loss and Load (winding) Loss values listed above (Refer to formula below as well). Such sum shall be considered liquidated damages and not a penalty.

Liquidated Damages for 1KVA to 50KVA Single Phase = $8272 * (Actual No Load kW - Guaranteed No Load kW) + $990 * (Actual Load kW - Guaranteed Load kW)

Liquidated Damages for 75KVA to 167KVA Single Phase = $8272 * (Actual No Load kW - Guaranteed No Load kW) + $1450 * (Actual Load kW - Guaranteed Load kW)

Liquidated Damages for 75KVA to 500KVA Three Phase = $8272 * (Actual No Load kW - Guaranteed No Load kW) + $2000 * (Actual Load kW - Guaranteed Load kW)

Liquidated Damages for 750KVA to 2500KVA Three Phase = $8272 * (Actual No Load kW - Guaranteed No Load kW) + $3150 * (Actual Load kW - Guaranteed Load kW)

No adjustment will be made for negative loss damages

<u>Under no circumstance</u> shall the adjustment factor under this provision result in a net price increase to the OWNER. If the amount due or to become due from the OWNER to the QUOTER is insufficient to pay in full any such liquidated damages, the QUOTER shall pay to the OWNER the amount necessary to effect such payment in full, provided; however, that the OWNER shall promptly notify the QUOTER in writing the manner in which the amount retained, deducted, or claimed as liquidated damages was computed.

The loss measurement system shall be traceable to the National Institute of Standards & Testing (NIST) by means of a procedure described in NIST Technical Note 1204 or an approved equivalent procedure. The QUOTER (manufacturer) shall clearly indicate the ability to comply with this requirement. Inability to comply during the quotation process shall result in an adjustment to the No-Load and Load (winding) Loss quoted by the QUOTER for purposes of evaluation. This adjustment shall be made by multiplying the quoted losses as used for evaluation purposes by a factor of 1.15. The QUOTER's failure to comply with NIST Technical Note 1204 during the testing of the transformers shall result in an adjustment to the computation of the liquidated damage provisions contained in this section. The certified test report losses shall be multiplied by and compared to the quoted losses including any adjustments made at the time of the bid evaluation. The OWNER shall have the right to deduct from and retain such monies which may be due to the QUOTER, a sum equal to the difference in quoted loss values and the actual loss values as verified by the certified test reports as adjusted above.

Offeror shall respond to the following in **Part IV, Data Section**, of the RFP.

The manufacturer currently complies with NIST Technical Note 1204 (Yes or No)
The manufacturer will comply at the time of test with NIST Technical Note 1204 (Yes or No)

SPECIAL INSTRUCTIONS

1.0 The terms "shall" and "will" which appear in the Proposal and Specifications place an absolute obligation on the QUOTER to do that which is designated and/or specified.

1.1 Descriptive literature, including dimensions, approximate weights and impedance's of the transformers, shall be furnished with the Proposal. A schedule of the manufacturer's recommendations for inspection and testing needed prior to operating the transformers should also be included.

1.2 The Power Distributors evaluation of the proposal will be based upon the transformers providing the best compromise for all of the PARTNER (OWNER)'s requirements based on:

- Initial Cost
- Total Ownership cost over thirty (30) years
- Warranty periods
- Product performance and quality
- Delivery
- PARTNER (OWNER)'S previous history dealing with both the approved manufacturer and approved supplier. (See approved lists below)

Delivery quantities and requested delivery dates for each item will be stated in individual orders. No deliveries will be requested before quoted delivery time submitted in this proposal by QUOTER.

1.3 Acceptance of manufacturer's documentation by the ENGINEER will be general only. Such acceptance will not relieve the QUOTER of responsibility for meeting all requirements of the Specifications and for providing a complete operational transformer.

APPROVED MANUFACTURER'S:	APPROVED SUPPLIERS:
Asea Brown Boveri (ABB)	WESCO
Cooper Power Systems	HD
Central Maloney	EPE Solutions/Power Supply/HD
ERMCO	Utility Sales Agency/GRESCO
General Electric (GE)	UtiliCor
Howard Industries	Stuart C. Irby Company/ Whitehead & Assoc.
Kuhlman Electric Corporation (as Purchased by ABB)	Sales remain same
Pauwels	HD
United Utility Supply (UUS)	DECO/UUS

A user list will be required for any manufacturer and/or quoter not approved.

TRANSFORMER SPECIFICATIONS

Single Phase Polemount

FEATURES AND MATERIAL REQUIREMENTS

1. Tank:
   a. Finish shall conform to ANSI Gray Number 70, Munsell Notation 5BG 7.0/0.4, as described in IEEE Std C57.12.31. With minimum of 3 MIL paint thickness.
   b. Cover shall be sloped for moisture runoff
   c. Have an insulated coating capable of withstanding 15kV at a 2,000 volt/sec. rate of rise
2. Transformer shall have insulated neutral with external copper ground strap
3. Two grounding lugs to accept #8 through #2 solid copper
4. For 10 and 15 KVA units maximum impedance shall not exceed 2.0%
5. Dual Voltage (DV) labeling, as applicable
6. Two required lifting lugs on opposite sides of tank and positioned to support tank in a near vertical position during lifting.
7. All Secondary Bushings shall be polymer or RUS approved composite material; however, **no porcelain bushings are accepted.**

Additional

Minimum I year warranty, $15 credit will be given in loss evaluation formula for 10 year warranty.

10 TO 50 KVA CSP Pole

Single phase Completely Self Protecting	Pole mounted OISC cooling
65 degree rise	No taps
Outdoor installation	2 position hangers
Complies with **RUS D10** design for CSP pole-mounted transformers with standard features and accessories as appropriate	Pressure relief device (valve with pull ring)
18 kV (15.3 MCOV) metal oxide polymer surge arrestor ONLY. Gapless, with bottom isolator, either GE 9L23AHX018BC, OB213715-7533, or Cooper UHS 18080A1C1C1A are acceptable	

Primary: 24940 GrdY/14400 volt, 125 kV BIL

- Fused
- **ONE** cover mounted bushing with all-purpose eye bolt terminal

Secondary: 120/240 volt, 30 kV BIL

- Secondary breaker
- Three tank mounted all purpose eye bolt terminals

10 TO 50 KVA CSP Pole

DUAL VOLTAGE

Single phase Completely Self Protecting	Pole mounted OISC cooling
65 degree rise	No taps
Outdoor installation	2 position hangers
Complies with **RUS D10** design for CSP pole-mounted transformers with standard features and accessories as appropriate	Pressure relief device (valve with pull ring)
18 kV (15.3 MCOV) metal oxide polymer surge arrestor ONLY. Gapless, with bottom isolator, either GE 9L23AHX018BC, OB213715-7533, or Cooper UHS 18080A1C1C1A are acceptable	External selector switch for switching 7200 - 14400; w/lockable provisions

Primary: 12470 GrdY/7200 X 24940 GrdY/14400 volt, 125 kV BIL

- Fused
- **ONE** cover mounted bushing with all-purpose eye bolt terminal

Secondary: 120/240 volt, 30 kV BIL

- Secondary breaker
- Three tank mounted all purpose eye bolt terminals

For dual voltage – dual voltage decal to be placed in center unit above KVA decal

10 TO 50 KVA Conventional Pole

Single Bushing

Single phase **Conventional**	Pole mounted OISC cooling
65 degree rise	Outdoor installation
Complies with **RUS** D10	No taps
Pressure relief device (valve with pull ring)	2 position hangers
18 kV (15.3 MCOV) metal oxide polymer surge arrestor ONLY. Gapless, with bottom isolator, either GE 9L23AHX018BC, OB213715-7533, or Cooper UHS 18080A1C1C1A are acceptable	Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings
Manufacturer to connect insulated No. 6 Copper wire from arrestor to high voltage bushing	"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use

Primary: 24940 GrdY/14400 volt, 125 kV BIL

- **ONE** cover mounted bushing with all-purpose eye bolts

Secondary: 120/240 volt, 30 kV BIL

- Three tank mounted all purpose eye bolt terminals

NOTE: Lightning arrestor should be mounted such that the top of the arrestor is approximately at the level of the top of the primary bushing.

10 TO 50 KVA Conventional Pole

Single Bushing

Dual Voltage

Single phase **Conventional**	Pole mounted OISC cooling
65 degree rise	Outdoor installation
Complies with RUS D10	No taps
Pressure relief device (valve with pull ring)	2 position hangers
18 kV (15.3 MCOV) metal oxide polymer surge arrestor ONLY. Gapless, with bottom isolator, either GE 9L23AHX018BC, OB213715-7533, or Cooper UHS 18080A1C1C1A are acceptable	Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings
Manufacturer to connect insulated No. 6 Copper wire from arrestor to high voltage bushing	"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use
External selector switch for switching 7200 - 14400; w/lockable provisions	Polarity shall be in accordance with ANSI C57.12.00-2000, paragraph 5.7.1

Primary: 12470 GrdY/7200 X 24940 GrdY/14400 volt, 125 kV BIL

- ONE cover mounted bushing with all-purpose eye bolts

Secondary: 120/240 volt, 30 kV BIL

- Three tank mounted all purpose eye bolt terminals

NOTE:

Lightning arrestor should be mounted such that the top of the arrestor is approximately at the level of the top of the primary bushing.

For dual voltage – dual voltage decal to be placed in center unit above KVA decal

10 TO 50 KVA Conventional Pole

Two Bushing

Single phase **Conventional**	Pole mounted OISC coding
65 degree rise	Outdoor installation
Complies with **RUS** D10	**No taps or "DR" taps***
Pressure relief device (valve with pull ring)	**No arrestor**
Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings	Single Mounting position
"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use	

Primary: 24940 GrdY/14400 volt, 125 kV BIL

– TWO cover mounted bushings with all-purpose eye bolt terminals

Secondary: 120/240 volt, 30 kV BIL

– Three tank mounted all purpose eye bolt terminals

***Full capacity taps with tap changer switch (de-energized operation, externally operated, tank mounted, and non-load break) with tap voltages: 14,760; 14,400; 14,040; 12,540; and 12,160**

75 TO 250 KVA Conventional Pole

Single Bushing

Single phase **Conventional**	Pole mounted OISC cooling
65 degree rise	Outdoor installation
Complies with **RUS** D10	Four 2.5% taps down with externally operated tap changer
Pressure relief device (valve with pull ring)	18 kV (15.3 MCOV) metal oxide polymer surge arrestor ONLY. Gapless, with bottom isolator, either GE 9L23AHX018BC, OB213715-7533, or Cooper UHS 18080A1C1C1A are acceptable
Manufacturer to connect insulated No. 6 Copper wire from arrestor to primary bushing	"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use

Primary: 24940 GrdY/14400 volt, 125 kV BIL

- **ONE** cover mounted bushing with all-purpose eye bolts

Secondary: 120/240 volt, 30 kV BIL

- Four hole NEMA spade terminals

NOTE: Lightning arrestor should be mounted such that the top of the arrestor is approximately at the level of the top of the primary bushing.

75 TO 250 KVA Conventional Pole

Two Bushing

Single phase **Conventional**	Pole mounted OISC cooling
65 degree rise	Outdoor installation
Complies with <u>RUS</u> D10	**Split taps (2-1/2% above and 2-1/2% below) OR "DR" taps***
Single mounting position	
Pressure relief device (valve with pull ring)	**No arrestor**
"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use	

<u>Primary: 24940 GrdY/14400 volt, 125 kV BIL</u>

– TWO cover mounted bushings with all-purpose eye bolt terminals

<u>Secondary: 120/240 volt, 30 kV BIL</u>

– Four hole NEMA spade terminals

***Full capacity taps with tap changer switch (de-energized operation, externally operated, tank mounted, and non-load break) with tap voltages: 14,760; 14,400; 14,040; 12,540; and 12,160**

10 TO 250 KVA Conventional Pole

Two Bushing

Dual Voltage

Single phase **Conventional**	Pole mounted OISC cooling
65 degree rise	Outdoor installation
Complies with **RUS** D10	Split taps with externally operated tap changer
Pressure relief device (valve with pull ring)	External selector switch for switching 7200 - 14400; w/lockable provisions
Manufacturer to connect insulated No. 6 Copper wire from arrestor to primary bushing	"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use
Single Mounting position	

Primary: 12470 GrdY/7200 X 24940 GrdY/14400 volt, 125 kV BIL

– TWO cover mounted bushing with all-purpose eye bolts

Secondary: 120/240 volt, 30 kV BIL

– Four hole NEMA spade terminals

NOTE: Lightning arrestor should be mounted such that the top of the arrestor is approximately at the level of the top of the primary bushing.

For dual voltage – dual voltage decal to be placed in center unit above KVA decal

25 TO 167 KVA Conventional Pole

Single Bushing

Single phase **Conventional**	Pole mounted, OISC cooling
65 degree rise	Outdoor installation
Complies with **RUS** D10	Two 2½% taps above and two 2½% taps below rated voltage with externally operated tap changer
Pressure relief device (valve with pull ring)	18 kV (15.3 MCOV) metal oxide polymer surge arrestor ONLY. Gapless, with bottom isolator, either GE 9L23AHX018BC, OB213715-7533, or Cooper UHS 18080A1C1C1A are acceptable
Manufacturer to connect insulated No. 6 Copper wire from arrestor to primary bushing	Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings
"CONV" shall be marked beneath the low voltage bushings with labeling suitable for outdoor use	

Primary: 24940 GrdY/14400 volt, 125 kV BIL

- **ONE** cover mounted bushing with all-purpose eye bolts.

Secondary: 277 volt, 30 kV BIL

- Two tank mounted all purpose eye bolt terminals 50 KVA and below
- Two four hole NEMA spades 75 KVA and above

NOTE: Lightning arrestor should be mounted such that the top of the arrestor is approximately at the level of the top of the primary bushing.

10 TO 333 KVA Conventional Pole

Two Bushing

Single phase **Conventional**	Pole mounted OISC cooling
65 degree rise	Outdoor installation
Complies with **RUS** D10	**Split taps (2-1/2% above and 2-1/2% below) OR "DR" taps***
Single mounting position	"CONV" shall be marked beneath the secondary bushings with labeling suitable for outdoor use
Pressure relief device (valve with pull ring)	**No arrestor**

Primary: 24940 GrdY/14400 volt, 125 kV BIL

- TWO cover mounted bushings with all-purpose eye bolt terminals

Secondary: 277 volt, 30 kV BIL

- Two tank mounted all purpose eye bolt terminals 50 KVA and below
- Two four hole NEMA spades 75 KVA and above

*Full capacity taps with tap changer switch (de-energized operation, externally operated, tank mounted, and non-load break) with tap voltages: 14,760; 14,400; 14,040; 12,540; and 12,160

For dual voltage – dual voltage decal to be placed in center unit above KVA decal

10 TO 333 KVA Conventional Pole

Two Bushing

Dual Voltage

Single phase **Conventional**	Pole mounted, OISC cooling
65 degree rise	Outdoor installation
Complies with **RUS** D10	Two 2½% taps above and two 2½% taps below rated voltage with externally operated tap changer on 14400 winding
Pressure relief device (valve with pull ring)	Single Mounting position
Manufacturer to connect insulated No. 6 Copper wire from arrestor to primary bushing	Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings
"CONV" shall be marked beneath the low voltage bushings with labeling suitable for outdoor use	External selector switch for switching 7200 - 14400; w/lockable provisions

Primary: 12470 GrdY/7200 X 24940 GrdY/14400 volt, 125 kV BIL

- **TWO** cover mounted bushings with all-purpose eyebolts

Secondary: 277 volt, 30 kV BIL

- Two tank mounted all purpose eye bolt terminals 50 KVA and below
- Two four hole NEMA spades 75 KVA and above

NOTE: Lightning arrestor should be mounted such that the top of the arrestor is approximately at the level of the top of the primary bushing.

For dual voltage – dual voltage decal to be placed in center unit above KVA decal

Single Phase Padmount

15 TO 167 KVA Pads

FEATURES AND MATERIAL REQUIREMENTS

1. Single phase, pad mounted, oil air-cooling.
2. Dead Front, Loop Feed, 60 Hertz
3. RUS approved recessed Penta-head locking, pressure relief device, 65 degree C rise, oil-immersed self-cooled (OISC) cooling.
4. Oil drip plate for fuse draw out
5. No taps, RUS U-5, ANSI C57.12.25 - 1990 type 2 arrangement
6. Non-PCB Less Than 1 PPM
7. Cooling fins will not be acceptable
8. Grounding connectors as shown under item bu of RUS Bulletin 43.5 shall be provided, two each installed in the tapped grounding holes as provided for in ANSI C57.12.25 - 1990 par 6.6.4. Low voltage removable ground strap.
9. Externally fastened field replaceable primary bushing wells and secondary bushings (Universal epoxy primary load break bushing wells with stainless steel retaining flange having hold down bail tab.) Universal well high voltage bushings; The high voltage side should be equipped with (2) load break bushing wells for dead front, system feed through, load break design; Wells shall be externally clamped and removable to allow for field replacement of the bushings without opening the tank
10. Bayonet fuse device with dual fuse element, isolation link shall be included (for fuse draw out)
11. **Stated at line item level**: Primary fusing shall consist of partial range current limiting fuse mounted under oil, in series with a "RTE Dual Sensing Bay-O-Net Fuse Link (RTE 358)" type draw-out expulsion fuse.
12. Low voltage bushing studs:

15 KVA - 75 KVA	5/8" - 11 threaded copper stud
100 KVA and above	1" - 14 threaded copper stud

13. The low voltage side should be equipped with (3) threaded low voltage bushings as depicted in Figure 4(c) of the ANSI C57.12.25.
14. Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings. **NOTE:** Must note in TRANS2 Exceptions if not in compliance.
15. Minimum footprint dimensions shall be 36 inches front to back and 32 inches across the front. **NOTE:** Must supply footprint dimensions w/proposal. Verified at time of award by each Partner
16. The top of the transformer shall be ridged to assure water drainage. **NOTE:** See "DANGER" and "WARNING" Single Phase Pad Sign Requirements section.
17. Transformers kVA rating shall be placed on the front middle portion of the cabinet with labeling suitable for outdoor use.
18. The munsell green tank coating shall meet all requirements in ANSI C57.12.28.
19. Minimum 1 year warranty

20. For Dual Voltage - External selector switch for switching 7200 - 14400; w/lockable provisions

FEATURES AND MATERIAL REQUIREMENTS, *continued*

Primary: 24940 GrdY/14400 volt, 125 kV BIL **OR**
12470GrdY/7200 x 24940GrdY/14400

- TWO bushing well feed thru

Secondary: 240/120 volt, 30 kV BIL

- Three threaded

OR

Dual Voltage

Primary: 12470 GrdY/7200 X 24940 GrdY/14400 volt, 125 kV BIL

- TWO bushing well feed thru

Secondary: 240/120 volt, 30 kV BIL

- Three threaded

Single Phase Pad "DANGER" and "WARNING" Sign Requirements, Other Labeling

High voltage warning device (sign)

A. Apply 3-1/2" X 5" **"DANGER"** Sign (per ANSI Z535 specifications) as follows:

   1) **Inside Cabinet**. Apply one (1) "DANGER" sign on the coil barrier as high in the cabinet as practical, avoiding areas where cables and accessories might block the sign from view.

   2) The sign shown shall be manufactured by one of the following **RUS** accepted sign manufacturers: Almetek, Electromark, TEK, American Safety, and Uticom.

B. Apply 7" X 10" **"WARNING"** sign (per ANSI Z535 specifications) as follows:

   1) **Outside Cabinet**. Apply one (1) "WARNING" sign just above the penta-head bolt locking mechanism.

   2) The sign shall be as shown and as is manufactured by one of the following sign manufacturers: Almetek, Electromark, TEK, American Safety, and Uticom.

   3) Sign shown below shall provide individual Partner Name and applicable phone number.

Partner Warning Sign Example

- **For dual voltage** - Dual Voltage decal to be placed in center of unit above KVA decal
- Non-PCB decal placed on outside of unit

Three Phase Padmount

75 to 1000 KVA Three Phase Pad

Primary: 24940 GrdY/14400 volt, 125 kV BIL OR 12470GrdY/7200 x 24940GrdY/14400

Secondary: 208 GrdY/120 volt, 30kV BIL

Three phase, pad mounted per "Features and Material Requirements" herein

75 to 2500 KVA Three Phase Pad

Primary: 24940 GrdY/14400 volt, 125 kV BIL OR 12470GrdY/7200 x 24940GrdY/14400

Secondary: 480 GrdY/277 volt, 30kV BIL

Three phase, pad mounted per "Features and Material Requirements" herein

FEATURES AND MATERIAL REQUIREMENTS

1. Primary: 24940 GrdY/14400 OR 12470GrdY/7200 x 24940GrdY/14400.
2. Secondary: 208 GrdY/120 or 480 GrdY/277 as required by order.
3. Taps: Two 2½% above and two 2½% below rated voltage with externally operated tap changer.
4. BIL: 125 kV primary and 30 kV secondary.
5. Comply with ANSI C57.12.34 - 2004 unless otherwise noted.
6. High Voltage bushing arrangement: High voltage compartment shall be equipped with six (6) load break bushing wells for dead front, system feed through, load break design as depicted in Figure 5(a) of ANSI C57.12.34 "Specific Dimensions for Loop Feed Transformers" and ANSI C57.12.34 - 2004 Fig. 6, "Compartment Designations and Specific Dimensions for Loop Feed or Radial Transformers."
7. Staggered low voltage arrangement per ANSI C57.12.34 - 2004 Fig. 6, "Compartment Designations and Specific Dimensions for Loop or Radial Transformers" and ANSI C57.12.34 - 2004 Fig. 12, "Low Voltage Terminal Arrangements and Specific Dimensions."
8. Grounding connectors as shown under item BU-1 of RUS Informational Publication 202-1, July 2006 "List of Materials Acceptable for Use on Systems of USDA Rural Development Electrification Borrowers", shall be provided - one each in the primary and secondary compartments installed in the tapped grounding holes as provided for in ANSI C57.12.34 - 2004 par 9.11.
9. Low Voltage terminals – All low voltage terminals are to be:
   - *Minimum ten (10) hole NEMA spades for ALL voltages* per Figure 13 (a) in ANSI C57.12.34.
   - Supplied with an insulated and disconnectable support to prevent upward and downward movement of the terminal
   - Provide with space to mount a 2.25 inch thick slip-on current transformer leaving a minimum **of ten (10) usable holes.**
10. Oil drip shields shall be provided under each bayonet fuse.
11. Oil temperature gauge on 300 KVA and above.
12. Oil level gauge on 500 KVA and above.
13. Oil drain valve with sampling device located in the primary compartment.
14. Complies with RUS U5 design where not otherwise declared in this specification.
15. Wells for externally fastened, field replaceable primary bushings and field replaceable secondary bushings.
16. The secondary bushing/terminal arrangement shall be a one-piece design on 500 kVA and larger.
17. Pressure relief device (valve with pull ring)
18. 65 degree centigrade temperature rise, oil-immersed self-cooled (OISC) cooling.
19. Five leg core or three separate cores design.

FEATURES AND MATERIAL REQUIREMENTS, *continued*

20. Cabinet Depth (as depicted by the "F" dimension in Figure 6, "Compartment Designations and Specific Dimensions for Loop-Feed or Radial-Feed Transformers" ANSI C57.12.34) for all transformers
    - 24" 75 KVA – 500 KVA
    - 30" 750 KVA – 2500 KVA

Exceptions will be as specified per line items
- As specified in line item Cabinet "A" (24")
- As specified in line item Cabinet "B" (30")

21. Steel midpartition plate between high and low voltage compartments.

22. FUSING - Stated at line item level:

FUSING "A"
Primary fusing shall consist of a bayonet-type fuse in an oil-immersed draw-out expulsion fuse - RTE Dual Sensing Bay-O-Net Fuse Link (RTE 358). The fuse shall be designed to protect the transformer in the event of internal or secondary faults or under overload conditions. An isolation link shall be included. The bayonet fuse holder shall be hook-stick operable.

FUSING "B"
Primary fusing (for 1000 KVA and smaller only) shall consist of partial range current limiting fuse mounted under oil, in series with a "RTE Dual Sensing Bay-O-Net Fuse Link (RTE 358) type draw-out expulsion fuse. The fuse shall be designed to protect the transformer in the event of internal or secondary faults or under overload conditions. The bayonet fuse holder shall be hook-stick operable.

For 1500 KVA and larger, no fusing will be required

23. The top of the transformer shall be ridged to assure water drainage.

24. Apply 3½" X 5" "DANGER" sign (per ANSI Z535 specifications") as follows:

    A. **Inside Cabinet**. Apply one (1) "DANGER" sign in the top third of the primary side cabinet above the primary bushings, and apply one (1) "DANGER" sign in the top third of the secondary side cabinet above the secondary bushings (low voltage and high voltage sides).

    B. The sign shall be as shown and as manufactured by one of the following **RUS** accepted sign manufacturers: Almetek, Electromark, TEK, American Safety, and Uticom.

25. Apply 7" X 10" "WARNING" sign (per ANSI Z535 specifications) as follows:

    A. **Outside Cabinet**. Apply one (1) "WARNING" sign to the left-hand side of the penta-head bolt locking mechanism.

    B. The sign shall be as shown and as manufactured by one of the following sign manufacturers: Almetek, Electromark, TEK, American Safety, and Uticom.

    C. ***See Partner Warning Sign Example in Single Phase Padmount section.***

FEATURES AND MATERIAL REQUIREMENTS, *continued*

26. Transformers kVA rating, secondary voltage and dual voltage as applicable shall be placed on the front upper right portion of the cabinet with labeling suitable for outdoor use.

27. The tank coating shall meet all requirements in ANSI C57.12.28.

28. Penta-head locking.

29. Low voltage neutral terminal shall be supplied with removable ground strap connected to tank.

30. Minimum 1-year warranty.

31. Leads from the windings to the secondary bushings shall have either copper or hard aluminum at the point of connection to the low voltage bushings.

32. For Dual Voltage - External selector switch for switching 7200 - 14400; w/lockable provisions

14400 / DV TRANS2 SPECIFICATION TEAM:

NAME	*COMPANY*	*PHONE*	*E-MAIL*
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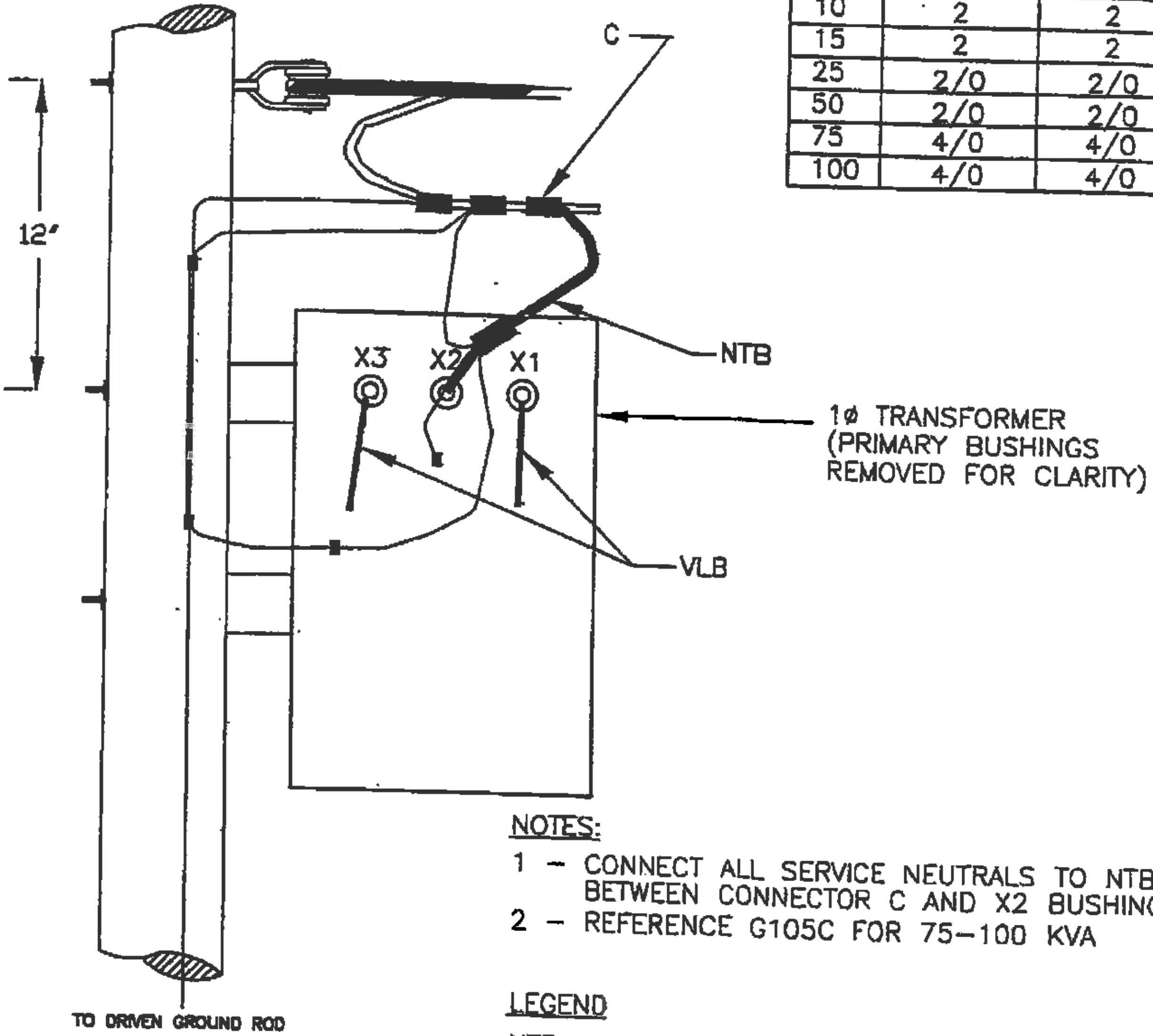
REVISION LOG

Rev. 0	MTEMC	Specification under annual review/revision by MTEMC Standards Engineer.
Rev. 1	April 2002	Complete review and revision by 14400 specification team in Preparation to go to market with solicitation on behalf of 32 Power Distributors. MTEMC and SVEC approve and partner in this Specification.
Rev. 2	Aug 2006	Complete review and revision by specification team in preparation for new Group Bids in 2007. Added dual voltage. **Standardization effort** by Group: Cost of Losses; padmount features and material requirements; danger and warning labels; arrestor type; bushing choice; cabinet depth dimensions; overall general edit.; Manufacturer review performed, subsequent feedback considered.
Rev. 3	Jan 2009	Complete review and revision by specification team in preparation for new Group Bids in 2009 due to the new DOE Standards' which go into affect January 2010 Made partial range current limiting fuse an alternate Three Phase specification changes: Low Voltage terminals; Cabinet Depth; fusing designation to "A" & "B" (deleted as an adder)



	COPPER STRAND	
kVA	NTB SIZE	VLB SIZE
10	2	2
15	2	2
25	2/0	2/0
50	2/0	2/0
75	4/0	4/0
100	4/0	4/0

NOTES:

1 – CONNECT ALL SERVICE NEUTRALS TO NTB BETWEEN CONNECTOR C AND X2 BUSHING.

2 – REFERENCE G105C FOR 75–100 KVA

LEGEND

NTB – DENOTES NEUTRAL TIE BUS
VLB – DENOTES VOLTAGE LEG BUS

10–15 KVA G105A

Item No.	Material	Qty.
2130	2 BARE CU STR	5'
0370	BOLT, 5/8" MACHINE	2
0610	WASHER, 2 1/4" SQUARE	2
2100	WIRE, #6 BARE CU SD	8'
2101	WIRE, #4 B CU SD	10'
2000	CLAMP, HOT LINE	1

25–50 KVA G105B

Item No.	Material	Qty.
2150	2/0 BARE CU STR	5'
3010	2/0 CU CONN.	1
0370	BOLT, 5/8" MACHINE	2
0610	WASHER, 2 1/4" SQUARE	2
2100	WIRE, #6 BARE CU SD	8'
2101	WIRE, #4 B CU SD	10'
2000	CLAMP, HOT LINE	1

FILE: G105A2.DWG

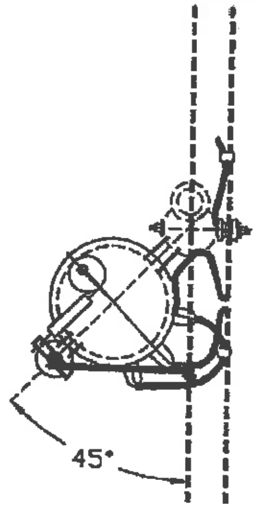
DATE 6/97 | BY JEL | APP. LMD

SINGLE–PHASE TRANSFORMER NEUTRAL AND VOLTAGE CONDUCTOR CONNECTION

STANDARD DETAIL

G105A&B

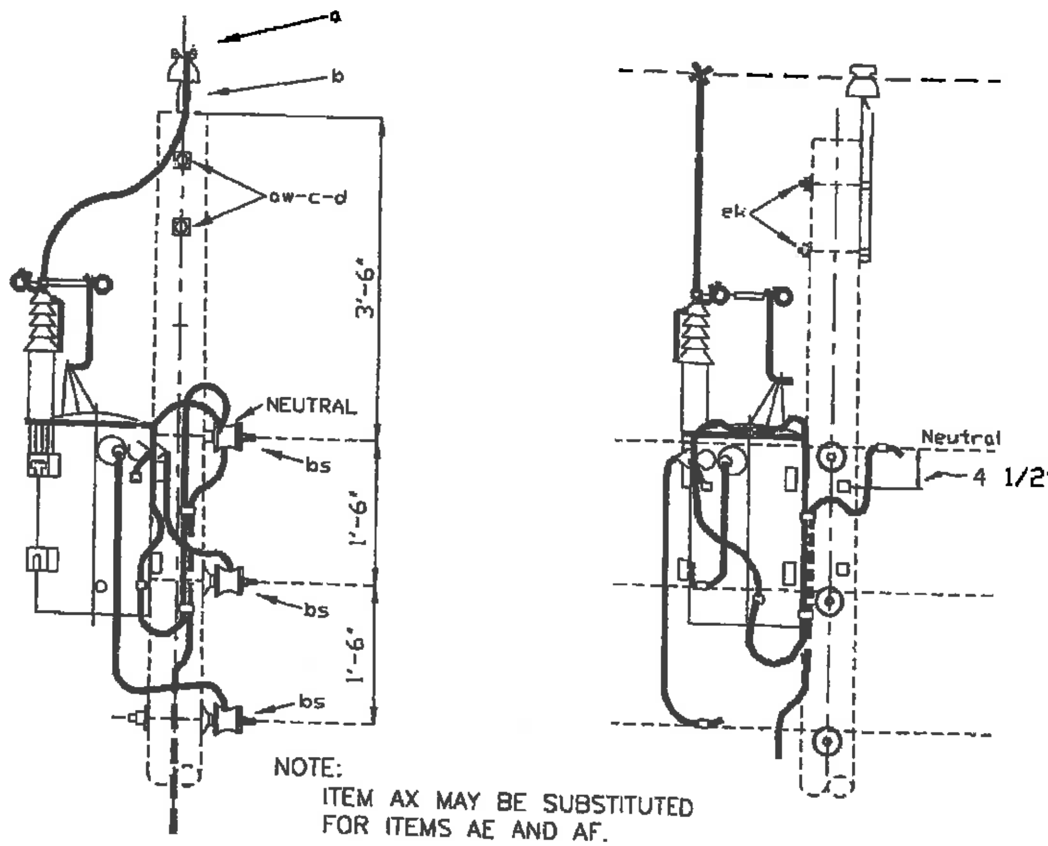
SHEET 1 OF 1



NOTES:

1. DESIGNATES G9 FOR CONVENTIONAL TRANSFORMER WITH TANK MOUNTED CUTOUT AND ARRESTER, G65 FOR TRANSFORMER WITH DOUBLE GAP AND INTERNAL FUSE.

2. SEE GUIDE DRAWINGS FOR DETAILS OF TRANSFORMER SECONDARY AND SERVICE CONNECTIONS.



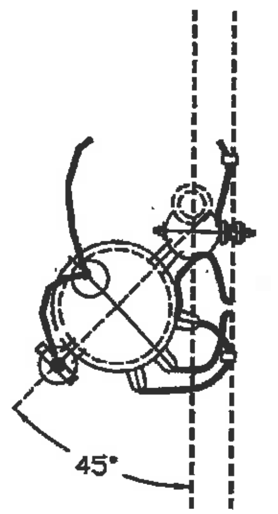
NOTE:
ITEM AX MAY BE SUBSTITUTED FOR ITEMS AE AND AF.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Bolt, Machine, 5/8"	0370	8'	#4 BC	2101
2	Washer, 2 1/4" Square	0610			
12'	Wire, #6 S.D.	2100			
1	Clamp, Hot Line	2000			

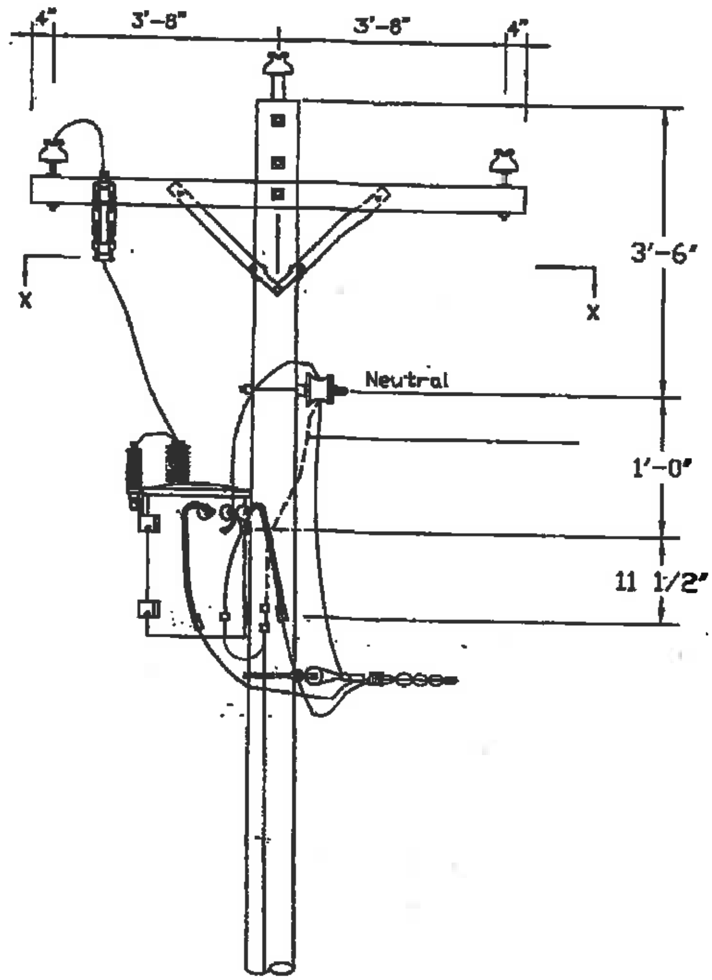
7.2/12.5 KV.
SINGLE PHASE TRANSFORMER
AT 1-PHASE TANGENT

Revised
Sept. 1994

G105



SECTION X–X



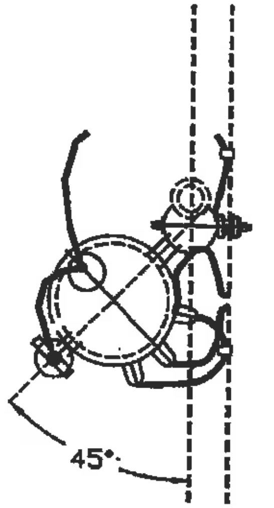
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 5/8" x Req'd Length	0370	8'	4 Bare Cu SD 7.911 FPP	210100
2	Washer, Square 11/16" Hole	061001	5'	2 Bare Cu Str 4.88 FPP	213000
1	2–4/0 AL Hot Line Clamp	200003	1	Fused Disconnect, 100A 15 kV	512000
1	1/0 & 2/0 ACSR Amp Stirrup	201006			
12'	6 Bare Cu SD 12.584 FPP	210000			

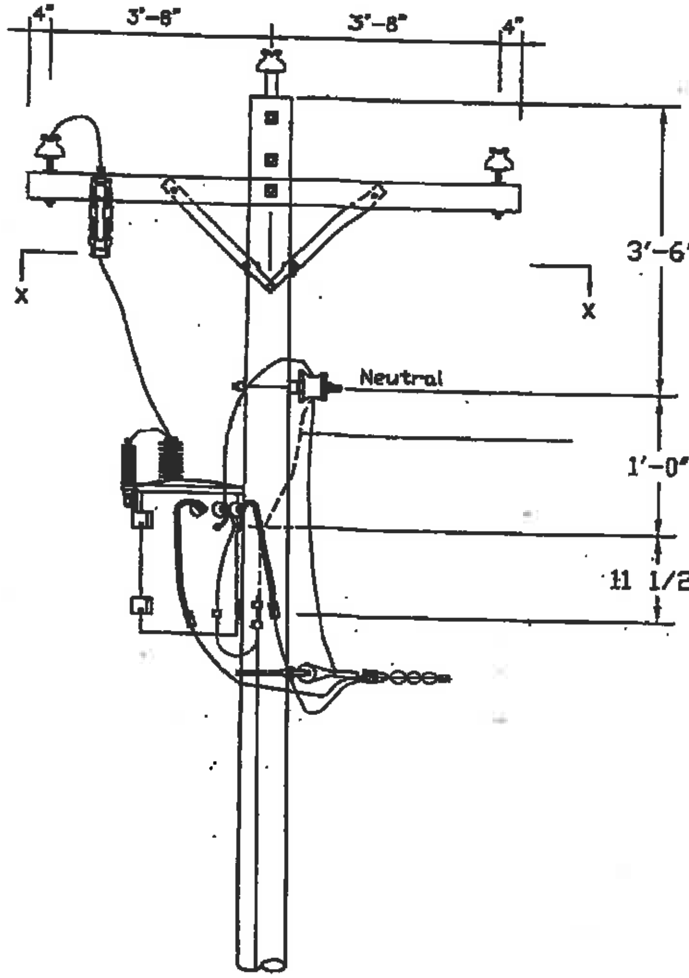
UP TO 15 KVA

7.2/12.5 KV.
SINGLE PHASE CONVENTIONAL TRANSFORMER WITH SINGLE BUSHING AND TANK MOUNT ARRESTOR

Revised Nov 2004

G106A





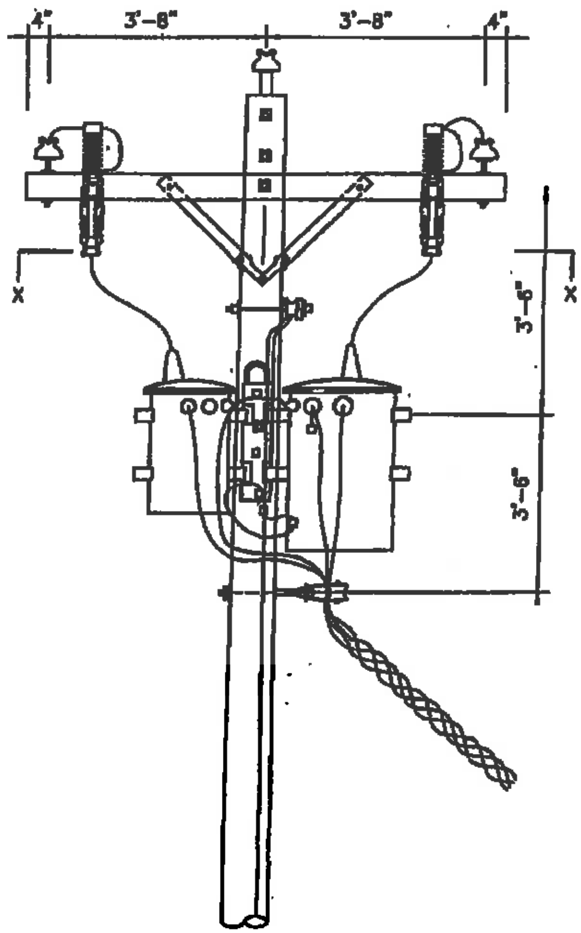
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 5/8" x Req'd Length	0370	8'	4 Bare Cu SD 7.911 FPP	210100
2	Washer, Square 11/16" Hole	061001	5'	2/0 Bare Cu Str 2.433 FPP	215000
1	2–4/0 AL Hot Line Clamp	200003	1	Fused Disconnect, 100A 15 kV	512000
1	1/0. & 2/0 ACSR Amp Stirrup	201006			
12'	6 Bare Cu SD 12.584 FPP	210000			

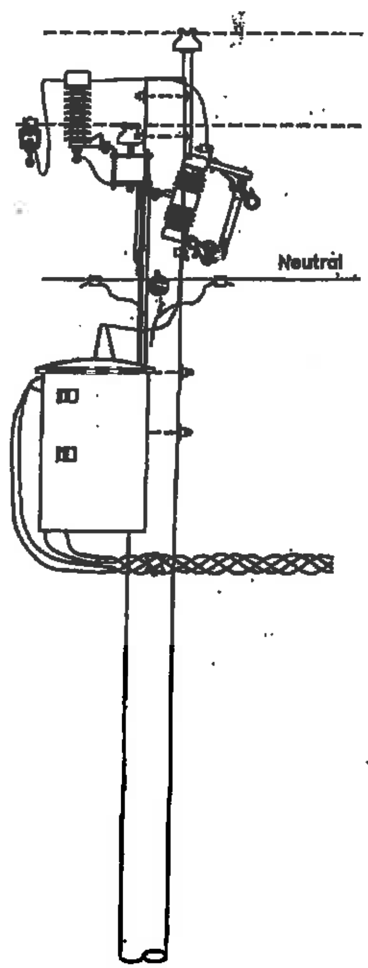
25 TO 50 KVA

7.2/12.5 KV.
SINGLE PHASE CONVENTIONAL TRANSFORMER WITH SINGLE BUSHING AND TANK MOUNT ARRESTOR

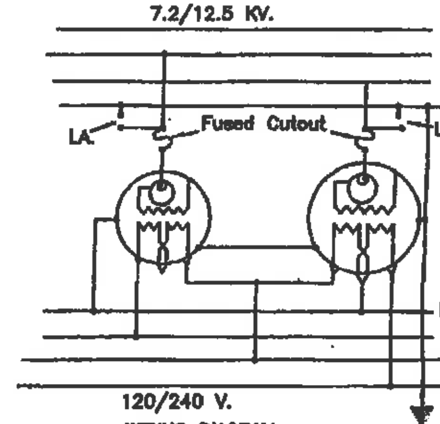
Revised Nov 2004

G106B

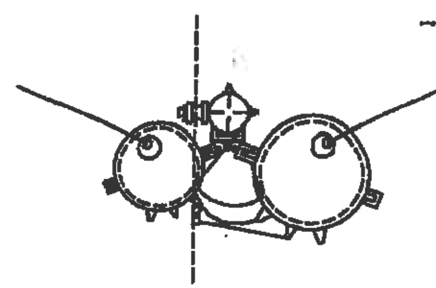




Quan.	Material	Item
2	Mach Bolt, 5/8" x Req'd Length	037C
2	Washer, Square 11/16" Hole	061C
2	2-4/0 AL Hot Line Clamp	200C
2	1/0 & 2/0 ACSR Amp Stirrup	201C
20'	6 Bare Cu SD 12.584 FPP	210C
15'	4 Bare Cu SD 7.911 FPP	2101
2	Arrestor, 10kV Dist Class	503C
2	Fused Disconnect, 100A 15 kV	512C



WIRING DIAGRAM

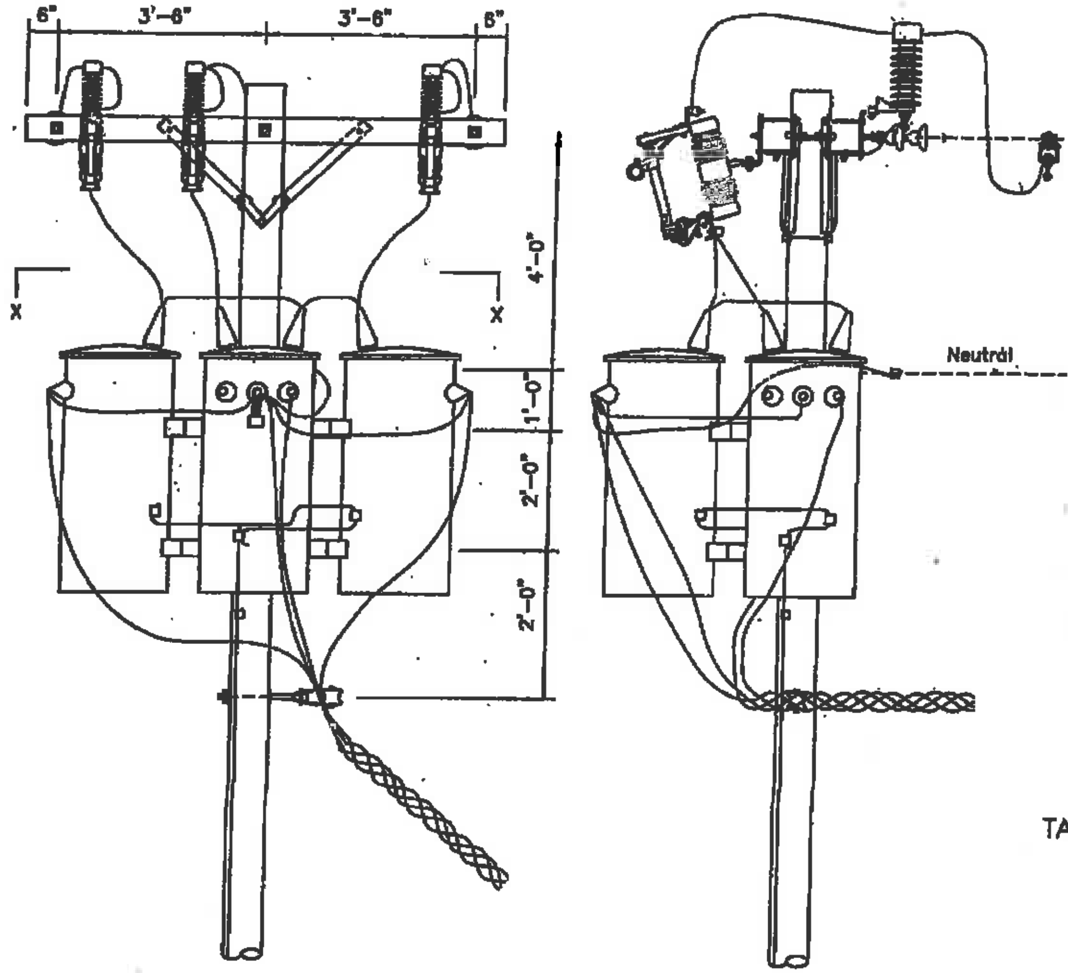


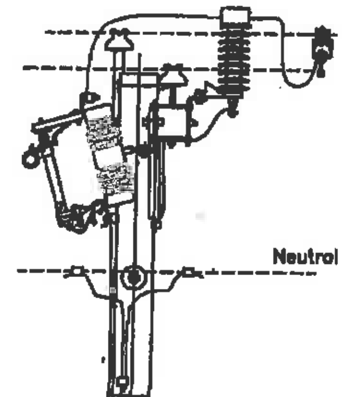
SECTION X-X

7.2/12.5 KV.
TWO TRANSFORMERS CLUSTER MOUNTED
OPEN WYE DELTA FOR
120/240 VOLT POWER LOADS

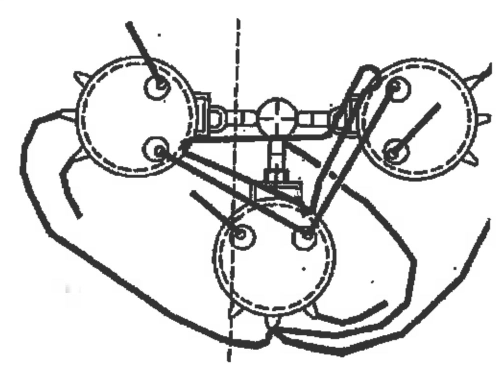
Revised Nov 2004	G210

Quan.	Material	Item
2	Mach Bolt, 5/8" x Req'd Length	0370
2	Washer, Square 11/16" Hole	0610
3	2-4/0 AL Hot Line Clamp	2000
3	1/0 & 2/0 ACSR Amp Stirrup	2010
25'	6 Bare Cu SD 12.584 FPP	2100
20'	4 Bare Cu SD 7.911 FPP	2101
3	Arrestor, 10kV Dist Class	5030
3	Fused Disconnect, 100A 15 kV	5120





TANGENT LINE ASSEMBLY

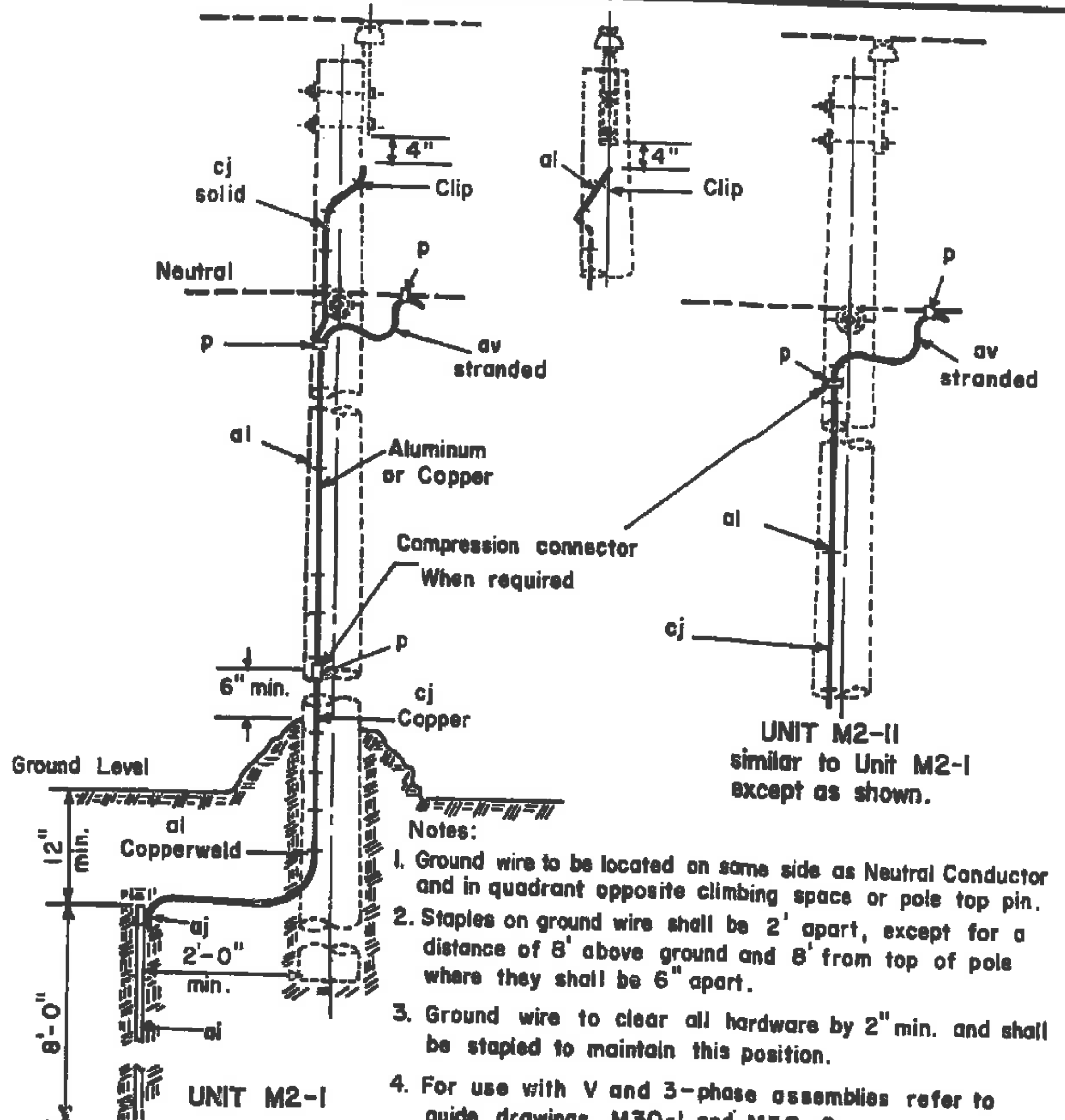


SECTION X-X

NOTE:
FOR 120/208 INSTALLATION, PARALLEL SECONDARY WINDINGS IN EACH TRANSFORMER BEFORE ENERGIZING.

7.2/12.5 KV. THREE TRANSFORMERS CLUSTER MOUNTED UNGROUNDED WYE WYE FOR 120/208 VOLT POWER LOADS	
Revised Nov 2004	G310

Section 10: Miscellaneous Assemblies



Notes:

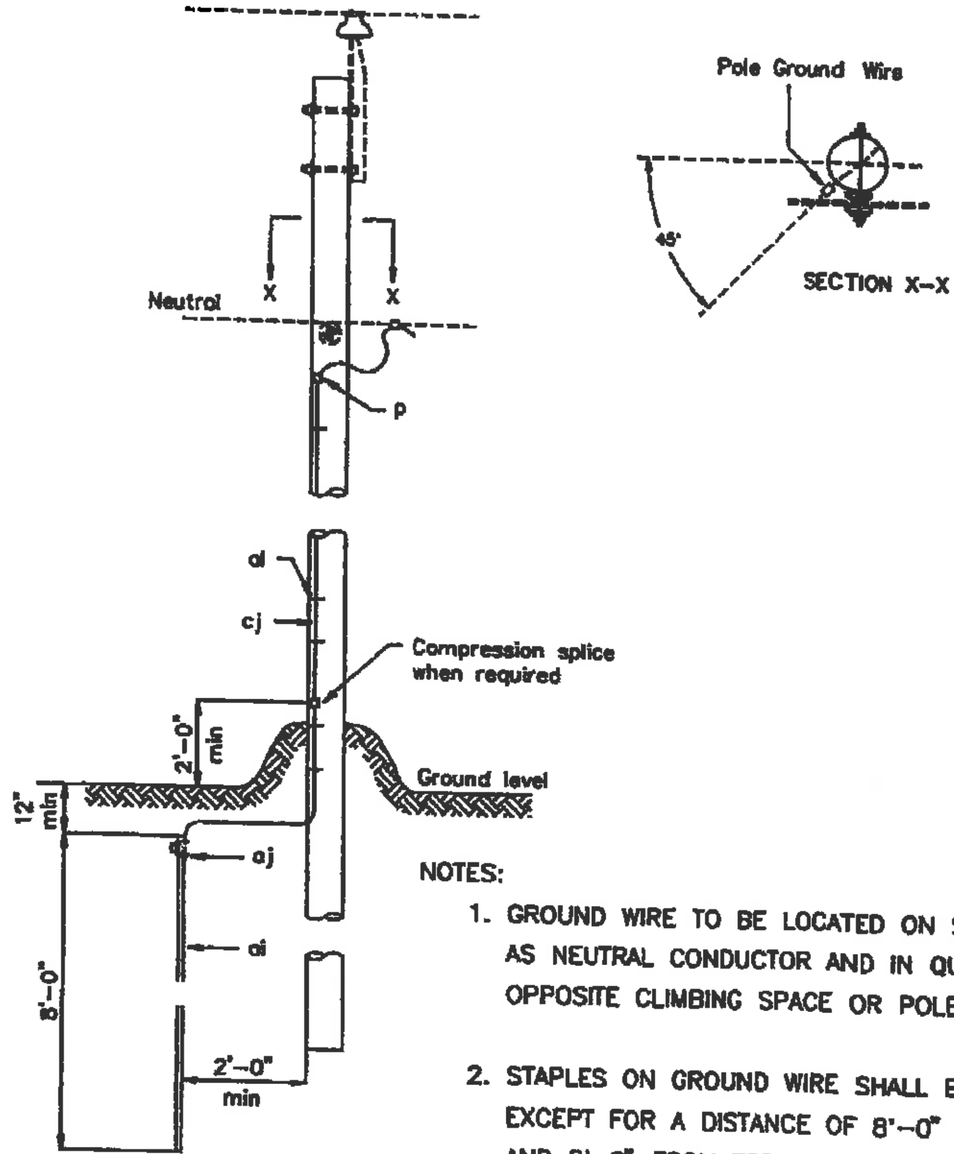
1. Ground wire to be located on same side as Neutral Conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be 2' apart, except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Ground wire to clear all hardware by 2" min. and shall be stapled to maintain this position.
4. For use with V and 3-phase assemblies refer to guide drawings M30-I and M30-2.

ITEM	MATERIAL	ASSEMBLY UNIT	
		M2-I	M2-II
p	Connector, compression	as req'd.	as req'd.
ai	Rod, ground, 5/8" minimum diameter	1	1
aj	Clamp, ground rod wire	1	1
al	Staples, ground wire (copper or steel to match ground wire)	as req'd.	as req'd.
al	Ground wire clip	1	
cj	Ground wire, minimum No. 6 copper or equiv. conductivity	as req'd.	as req'd
av	Jumper, stranded, min. No 6 copper or equiv. conductivity	as req'd	as req'd

12.5/7.2 kV
GROUNDING ASSEMBLY - GROUND ROD TYPE

Apr., 1983

M2-I, M2-II



NOTES:

1. GROUND WIRE TO BE LOCATED ON SAME SIDE AS NEUTRAL CONDUCTOR AND IN QUADRANT OPPOSITE CLIMBING SPACE OR POLE TOP PIN.

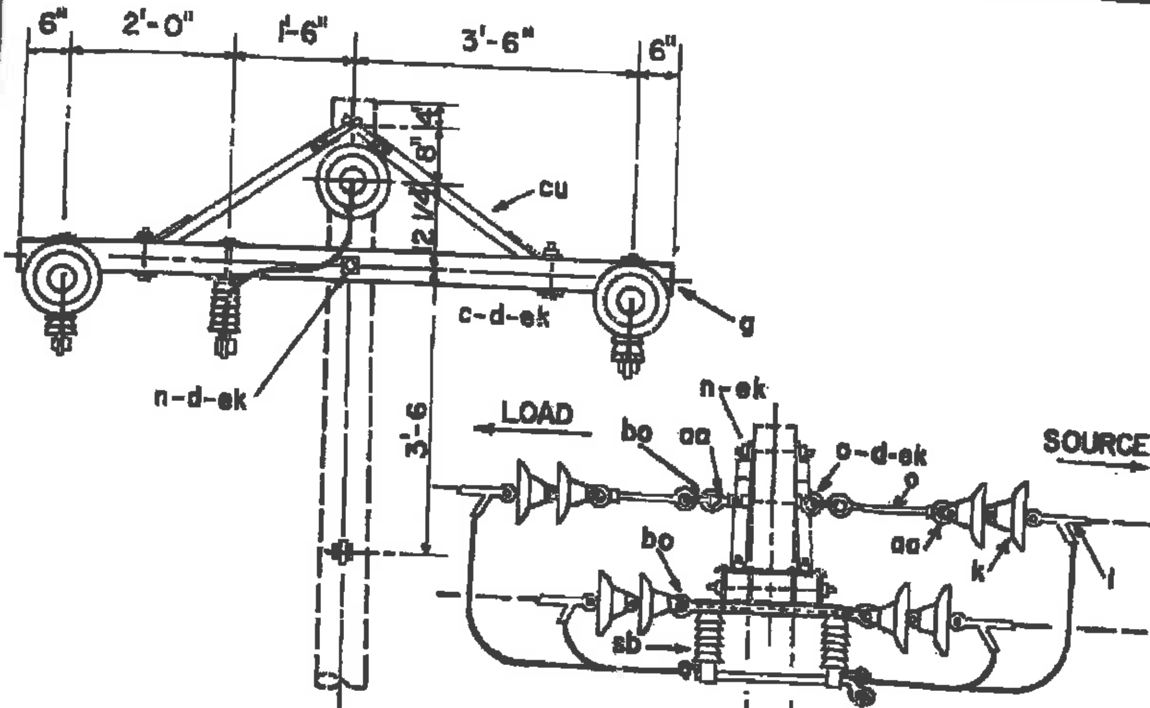
2. STAPLES ON GROUND WIRE SHALL BE 2'-0" APART EXCEPT FOR A DISTANCE OF 8'-0" ABOVE GROUND AND 8'-0" FROM TOP OF POLE WHERE THEY SHALL BE 6" APART.

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Rod, Ground	1730			
35'	Ground Wire, #4 Aluminum	2510			

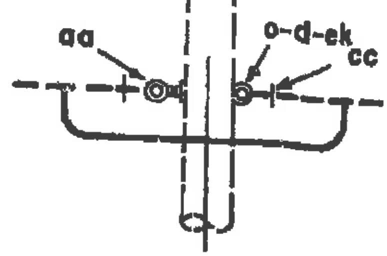
GROUNDING ASSEMBLY
GROUND ROD TYPE

Revised Sept. 1994

M2-11A



Note:
For V-phase installations omit switch and related items on center phase. Designate as M3-2A.
Item cc is shown on assembly drawings M42-3, M42-11, M42-13, and M42-21.



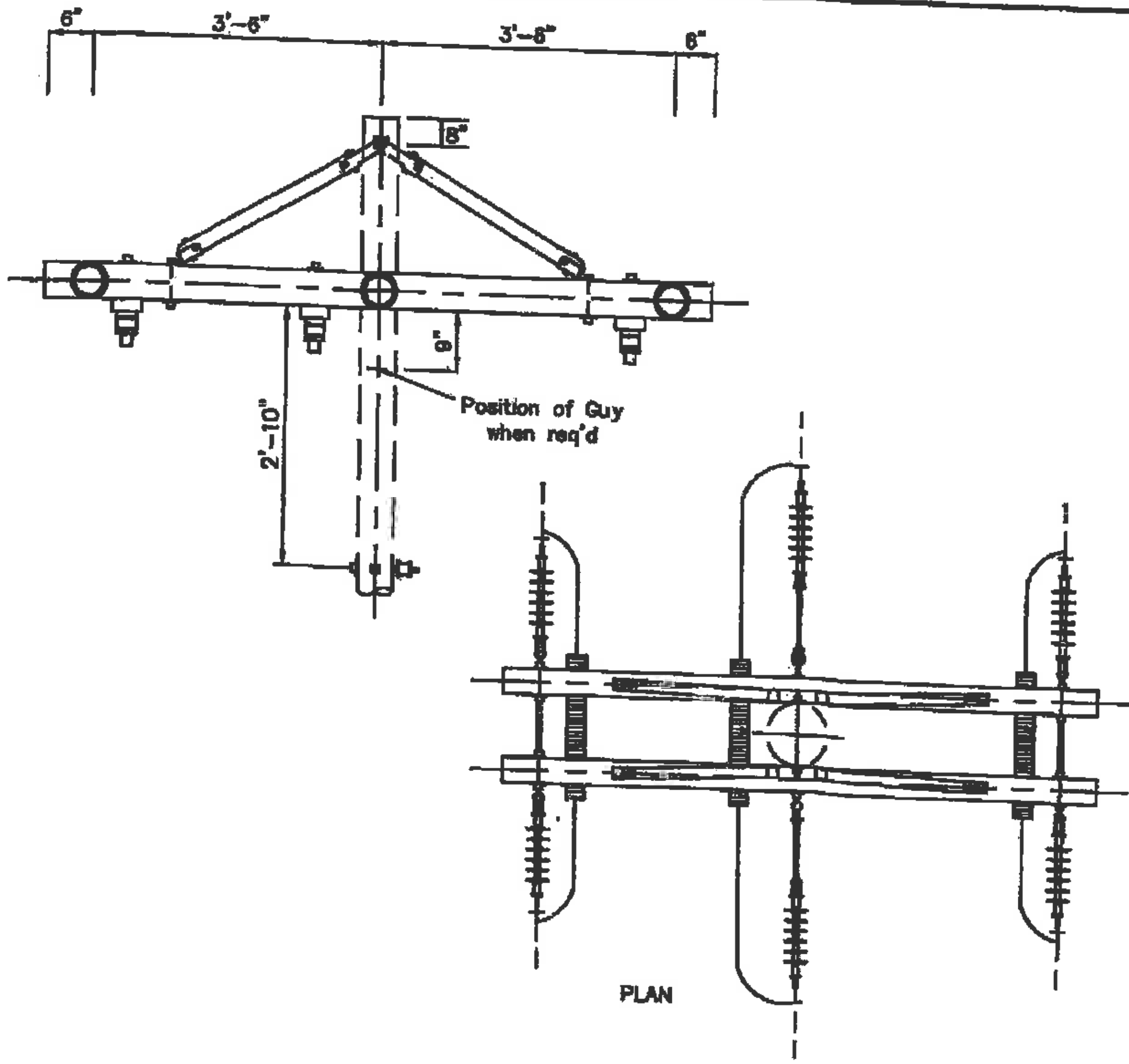
ITEM	NO.	MATERIAL	
c	4	Bolt, machine, 1/2" x reqd. length	
d	4	Washer, round, 1 3/8" dia.	
d	3	Washer, square, 2 1/4"	
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"	
l	6	Clamp, deadend	
n	2	Bolt, double arming, 5/8" x req'd. lgth.	
o	4	Bolt, eye, 5/8" x required length	
p		Connectors, as required	
aa	4	Nut, eye, 5/8"	

ITEM	NO.	MATERIAL	
aq		Jumpers, as required	
bo	6	Shackle, anchor	
cc	2	Deadend assembly, neutral	
cu	2	Brace, crossarm, wood, 60" span	
ek		Locknuts, as required	
sb	3	Switch, disconnect, 15 kV, with mounting hardware	
k	12	Insulator, suspension	

12.5/7.2 kV
TWO OR THREE SECTIONALIZING
DISCONNECT SWITCHES

Apr., 1983

M3-2A, M3-3A



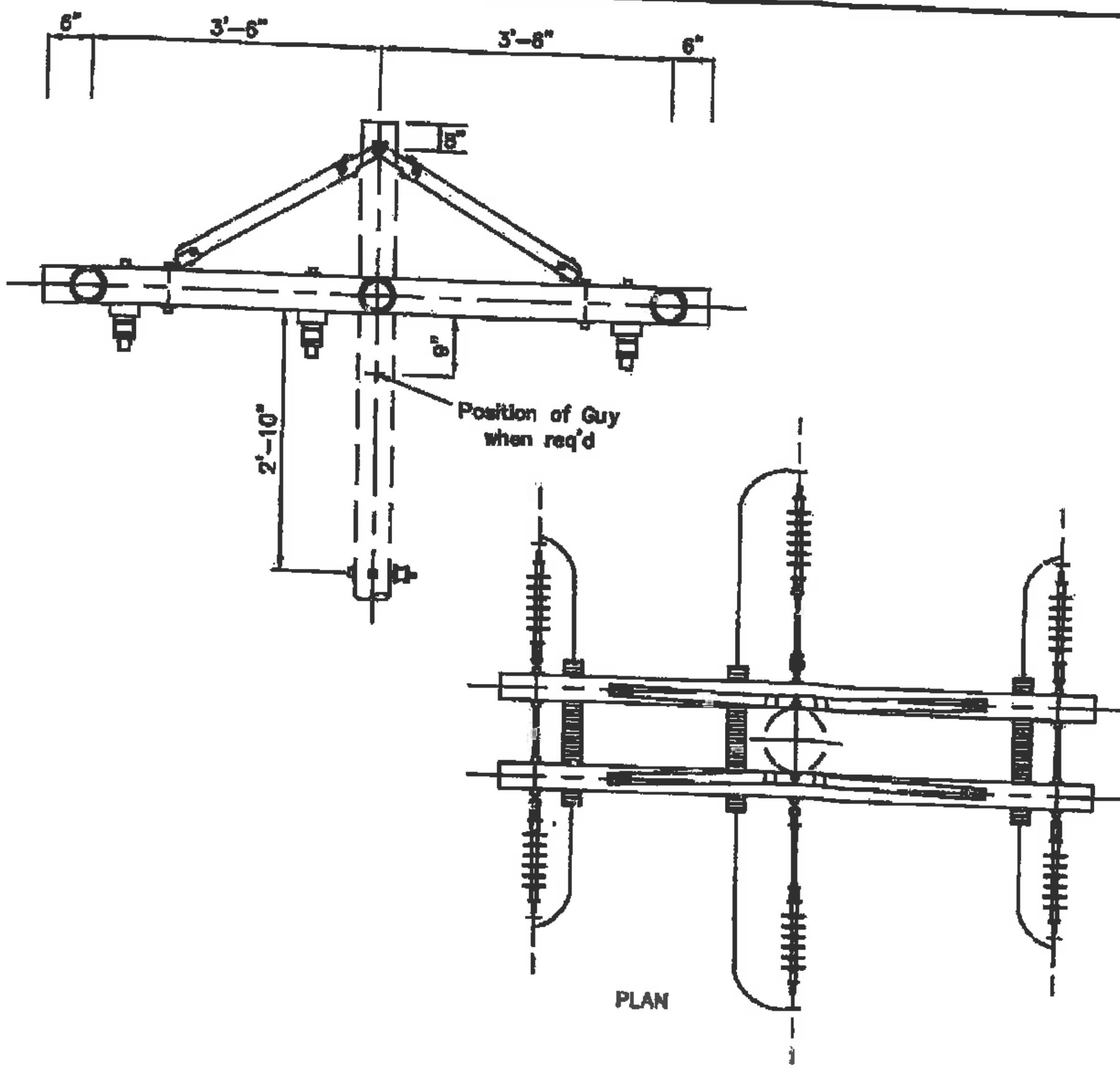
Quan.	Material	Item No.	Quan.	Material	Item No.
3	DA Bolt, 5/8" Req'd Length	0270	2	Ext Link For Susp Insulator	113000
1	Eye Bolt, 5/8" Req'd Length	0320	6	DE Clamp 4 Thru 1/0 ACSR	191000
4	Mach Bolt, 1/2" x 6"	035001	3	Switch, 600A 15/27kV Blade Type	523001
1	Mach Bolt, 5/8" x Req'd Length	0370	6	Insulator, 25kV Polly Suspension	911001
4	Washer, 1/2" Round	060001			
12	Washer, Square 11/16" Hole	061001			
7	Nut, Oval Eye	064000			
2	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
2	Brace, Wood Bow 60" Span	086000			

UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE DEADEND

Revised
May 2003

VM3-3A



Quan.	Material	Item No.	Quan.	Material	Item No.
3	DA Bolt, 5/8" Req'd Length	0270	2	Ext Link For Susp Insulator	113000
1	Eye Bolt, 5/8" Req'd Length	0320	6	DE Clamp 4 Thru 1/0 ACSR	191000
4	Mach Bolt, 1/2" x 6"	035001	3	Switch, 600A 15/27kV Blade Type	523001
1	Mach Bolt, 5/8" x Req'd Length	0370	6	Insulator, 25kV Polly Suspension	911001
4	Washer, 1/2" Round	060001			
12	Washer, Square 11/16" Hole	061001			
7	Nut, Oval Eye	064000			
2	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
2	Brace, Wood Bow 60" Span	086000			

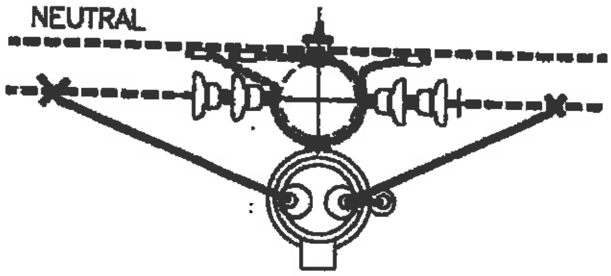
UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE DEADEND

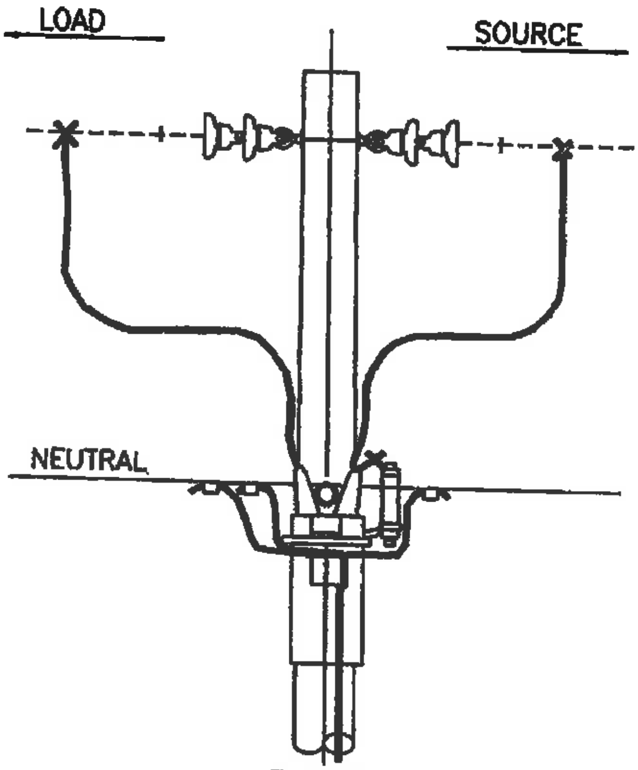
Revised
May 2003

VM3-3c

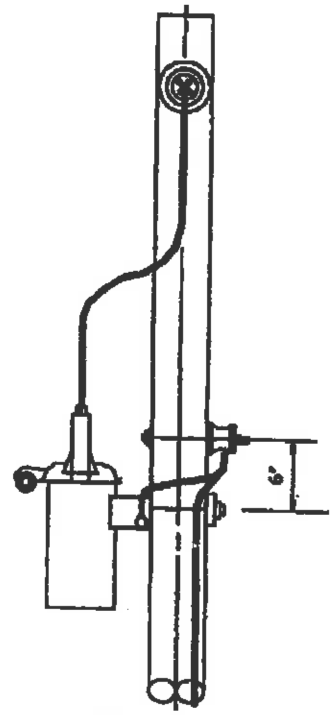
NOTE:
The terminal bushing connected directly to the coil should be connected to the source. Where necessary to to provide for this connection the recloser may be mounted on the other side of the pole and the neutral deadended.



PLAN



ELEVATION



SIDE ELEVATION

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Bolt, Machine 5/8"	0370			
2	Washer, 2 1/4" Square	0610			
2	Clamp, Hot Line	2000			
1	Lt. Arrestor	5030			
15'	Ground Wire #4 B.C.	2101			

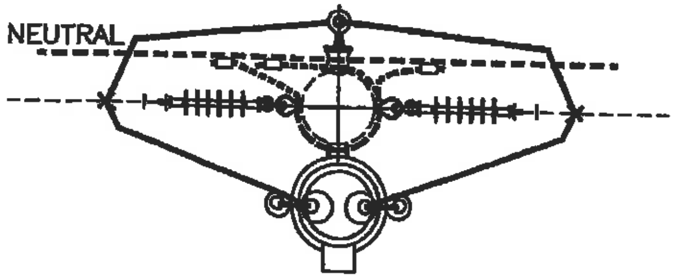
*CHARGE EXTRA ARRESTOR FOR TYPE "E" AND "L" RECLOSERS

16 ocB

7.2/12.5 KV
OIL CIRCUIT RECLOSER

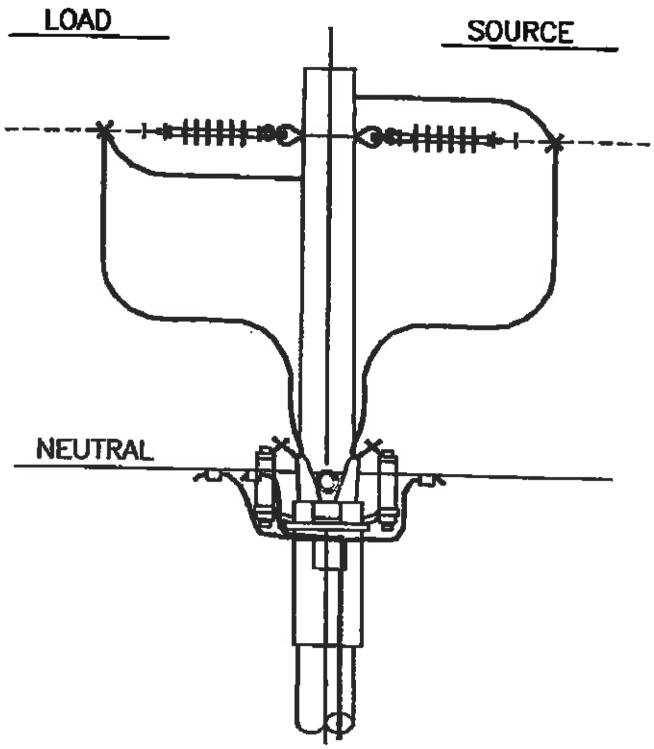
Revised Sept. 1994

M3-10

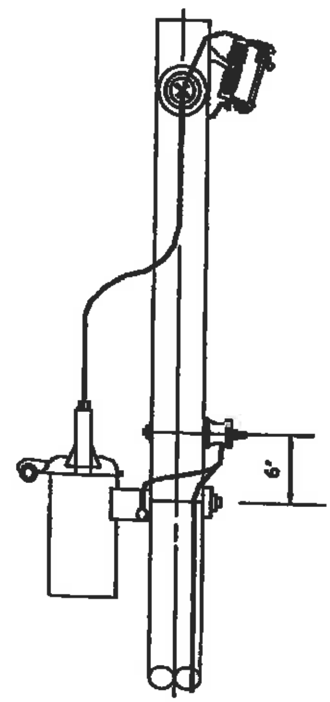


PLAN

NOTE:
The terminal bushing connected directly to the coil should be connected to the source. Where necessary to to provide for this connection the recloser may be mounted on the other side of the pole and the neutral deadended.



ELEVATION



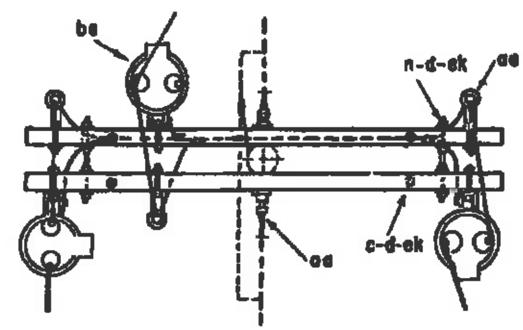
SIDE ELEVATION

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 5/8" x Req'd Length	0370			
2	Washer, Square 11/16" Hole	061001			
2	6-1/0 CU Hot Line Clamp	200001			
15'	4 Bare CU SD 7.911 FPP	210100			
1	Switch, 100A. 15/27kv Drop Out	512000			
2	Arrestor, 18kv Dist Class	998600			

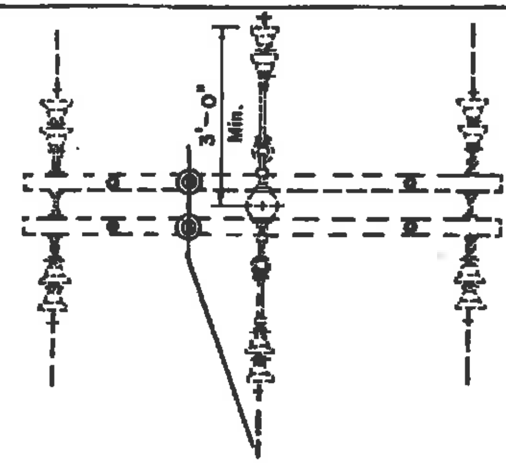
14.4/24.9 KV
OIL CIRCUIT RECLOSER

Revised
May 2003

VM3-10

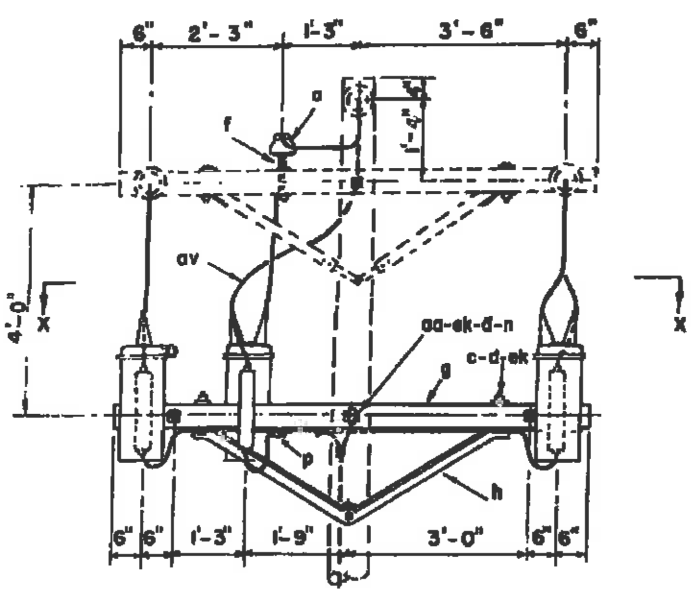


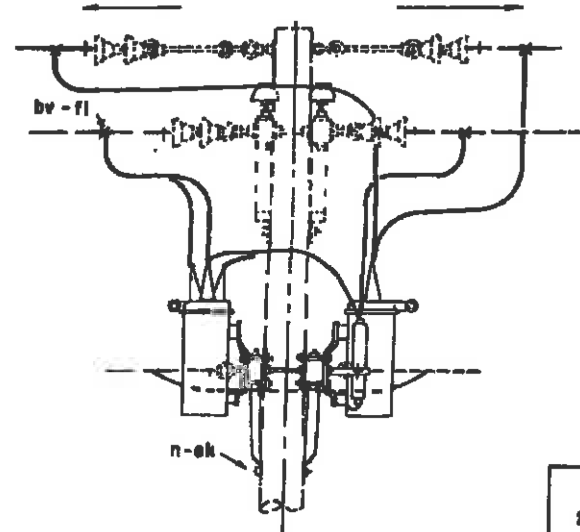
SECTION X-X



PLAN

ITEM	NO.	MATERIAL
a	2	Insulator, pin type
c	4	Bolt, machine, 1/2" x req'd. lg'th.
d	4	Washer, Rd. 1 3/8" dia. 9/16" hole
d	10	Washer, 2 1/4" x 2 1/4" x 3/16", 11/16" hole
f	2	Pin, crossarm, steel 5/8" x 10 3/4"
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"
h	2	Brace, 1 1/2" x 1 1/2" x 3/16", 60" span
n	4	Bolt, double arming, 5/8" x req'd. length
p		Connectors, as req'd.
aa	1	Nut, eye, 5/8"
ae	3	Surge arrester
av		Jumpers, stranded, as req'd.
be	3	Recloser, oil circuit
bv	6	Rods, armor
ek		Locknuts, as required
fi	6	Connector, hot line, tap assembly





NOTES:

1. The recloser terminal bushing connect directly to the coil should be connected to the source.

2. For V-phase installation omit center phase; adjust material list and designate M3-11.

3. Each recloser tank shall have two separate connections to ground.

12.5/7.2 kV
2 OR 3-PHASE, THREE SECTIONALIZING OIL CIRCUIT RECLOSERS

Apr., 1983

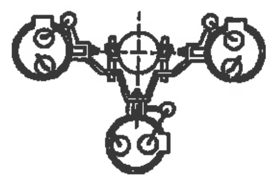
M3-11, M3-12

NOTES:

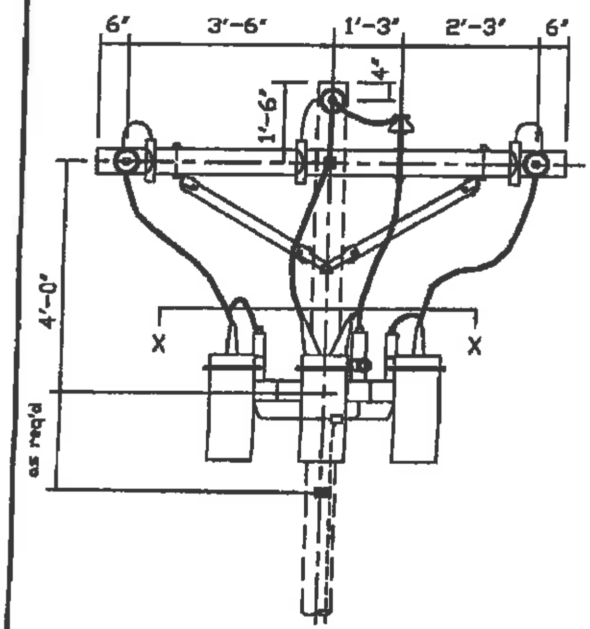
1. THE RECLOSER TERMINAL BUSHING CONNECTED DIRECTLY TO THE COIL SHOULD BE CONNECTED TO THE SOURCE.

2. FOR V PHASE INSTALLATIONS OMIT RECLOSER AND RELATED ITEMS ON CENTER PHASE. DESIGNATE AS ASSEMBLY VM3-11A

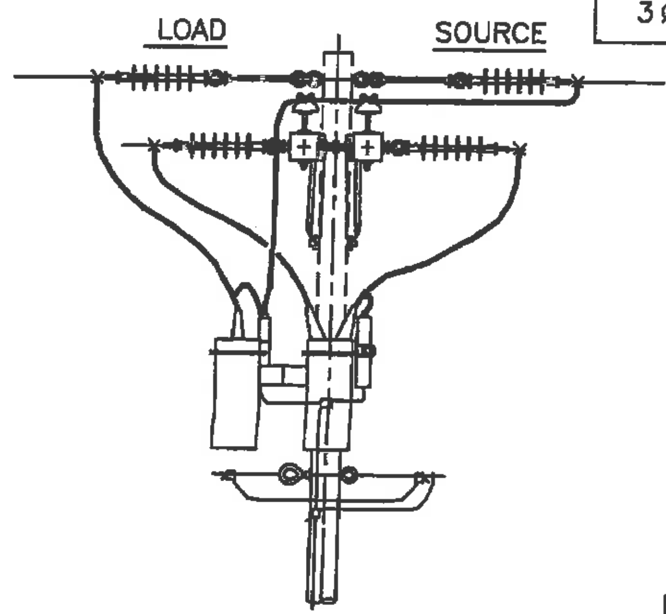
3. EACH RECLOSER TANK SHALL HAVE TWO CONNECTIONS TO GROUND.



SECTION X-X



ELEVATION



* USED IN CONJUNCTION WITH APPROPRIATE B8, C8, OR C8-2 UNIT.

Assembly	Quan.	Material	Item No
M3-11A VØ	2	Bolt, Machine, 5/8" x Req'd Length	0370
	2	Washer, Square 11/16" Hole	061001
	2	Pin Head Adapter	096000
	2	25 kV Pin Adapter	097000
	2	Ins. Pin Type 25kV	107500
	6	Clamp, Hot Line, 2-4/0 Al	200003
	25	Ground Wire, #4 BC	210100
	2	Drop Out Switch, 100A	512000
	2	Lightning Arrester, 10kV	503000
M3-12A 3Ø	2	Bolt, Machine, 5/8" x Req'd Length	0370
	2	Washer, Square 11/16" Hole	061001
	2	Pin Head Adapter	096000
	2	25 kV Pin Adapter	097000
	2	Ins. Pin Type 25kV	107500
	9	Clamp, Hot Line, 2-4/0 Al	200003
	30	Ground Wire, #4 BC	210100
	3	Drop Out Switch, 100A	512000
	3	Lightning Arrester, 10kV	503000

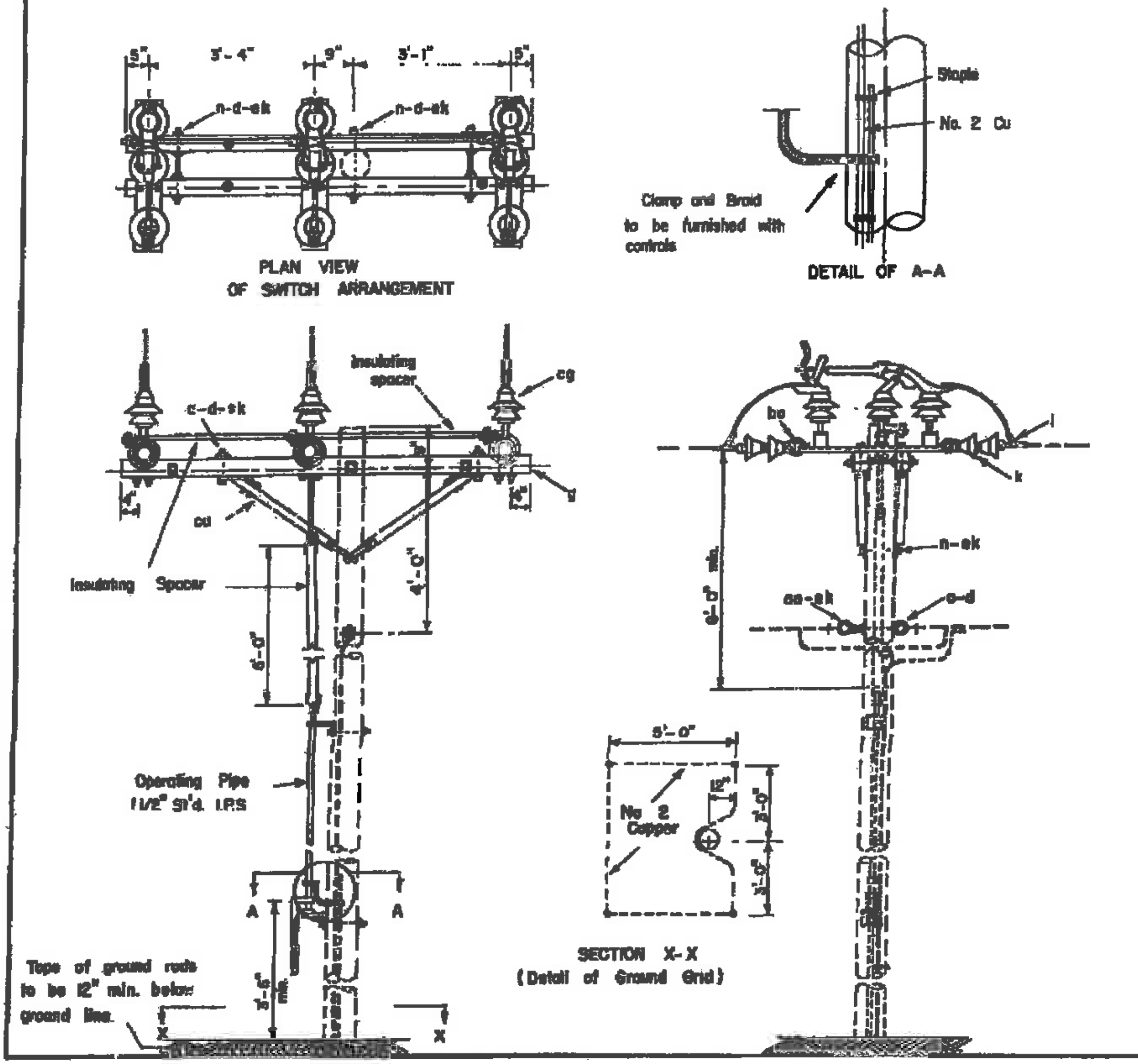
7.2/12.5 KV

2 OR 3 SECTIONALIZING OIL CIRCUIT RECLOSERS

Revised Jan. 2002

M3-11A, M3-12A

ITEM	NO.	MATERIAL
c	14	Bolt, machine, 5/8" x req'd. length
c	2	Bolt, machine, 1/2" x req'd length
d	25	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole
d	4	Washer, rd., 1 3/8" dia., 9/16" hole
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"
k	12	Insulator, suspension
l	6	Clamp, deadend
n	4	Bolt, double arming, 5/8" x req'd. length
bo	b	Shackle, anchor
cc	2	Deadend assembly, neutral
cg	1	Switch, airbreak, 3 pole unit 15 KV
		with operating mechanism, and insul. spacers
cu	2	Brace, wood, 60" span
e	1	Bolt, eye, 5/8" x required length
ek		Locknuts, as required
ee	1	Nut, eye, 5/8"



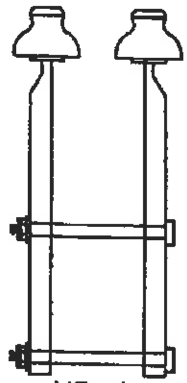
Note:
For ground assembly, see drawings M2-15 and M2-15A.

See drawings M42-3, M42-11, M42-13, M42-21 for item cc.

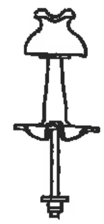
12.5/7.2 kV
SECTIONALIZING AIR BREAK SWITCH

Apr., 1965

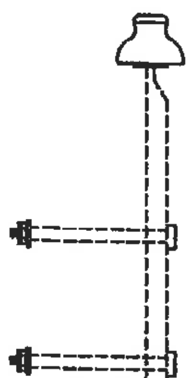
M3-16



M5-4



M5-7



M5-5

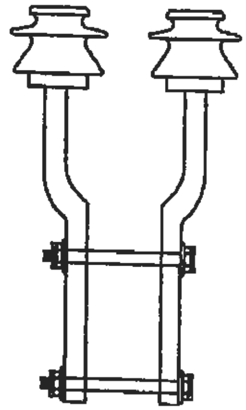
M5-8

Quan.	Material	Item No.	Quan.	Material	Item No.
	M5-4			M5-7	
2	Bolt,mach, 5/8"xReq'd Lngth	0370	1	Insulator, Post Type	107000
2	Pin, Pole Top, 20"	090000	1	Washer, square, 2 1/4"	061001
2	Insulator, Pin Type	104000		M5-8	
	M5-5		1	Insulator, Susp Type	111000
1	Insulator, Pin Type	104000	1	Deadend Clamp, Primary	191000

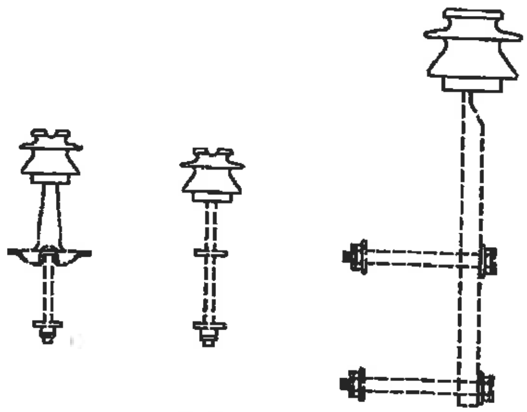
REMOVAL UNITS
FOR 25KV CONVERSIONS

Revised
March 2003

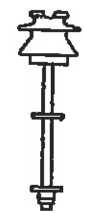
M5-4, M5-5, M5-7, M5-8



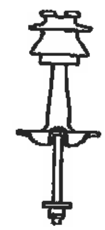
VM5-4



VM5-5



VM5-5A



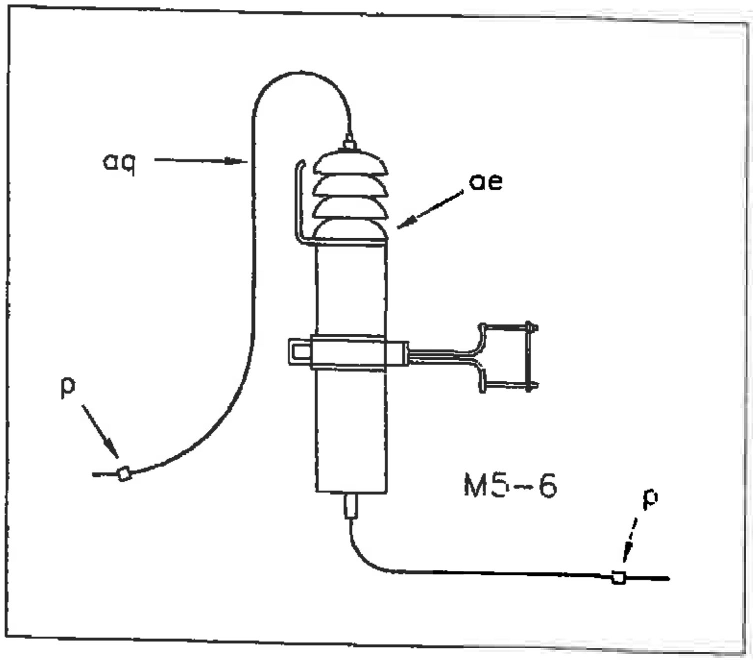
VM5-5B

VM5-8

Quan.	Material	Item No.	Quan.	Material	Item No.
	VM5-4			VM5-5A	
2	Bolt,mach, 5/8"xReq'd Lngth	0370	1	Pins, Steel Crossarm 25kV	91200
2	Pin, Pole Top, 25KV Offset	092501	1	Ins. Pin Type 25kV	107500
2	Ins. Pin Type 25kV	107500		VM5-5B	
	VM5-5		1	Pins, 25kV Saddle	94000
1	25kV Pin Adapter	97000	1	Ins. Pin Type 25kV	107500
1	Ins. Pin Type 25kV	107500		VM5-8	
			1	Ins. Susp Type 25kV	911001

INSTALLATION UNITS
FOR 25KV CONVERSIONS

Revised March 2003	VM5-4, VM5-5, VM5-5A, VM5-8.

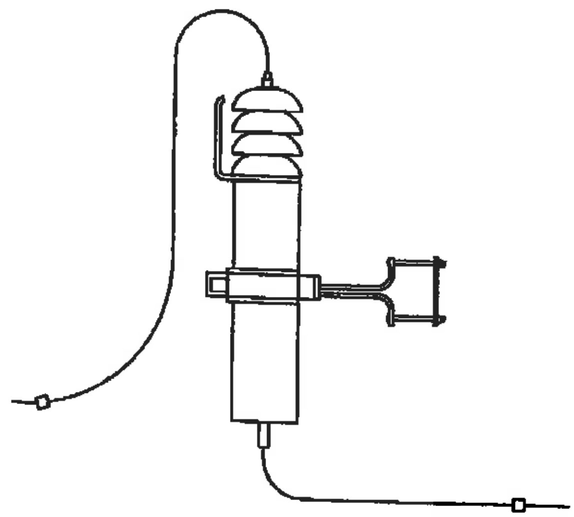


A			B		
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Lightning Arrestor	5030			

7.2/12.5 KV.
MISCELLANEOUS PRIMARY ASSEMBLIES

Revised Sept. 1994

M5-6 A&B

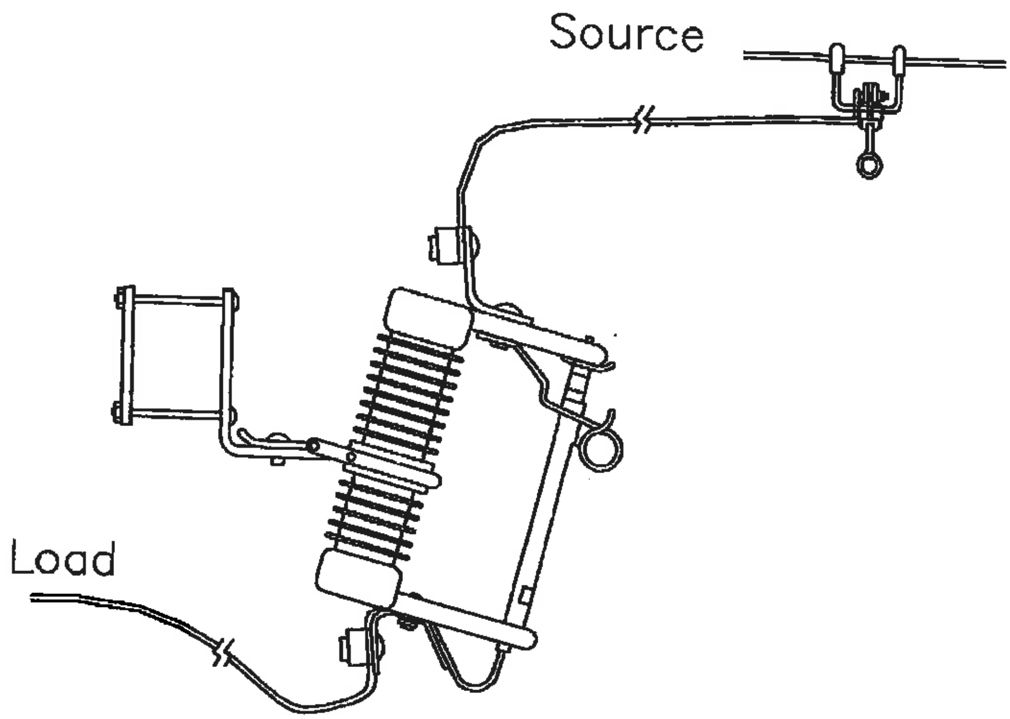


Quan.	Material	Item No.	Quan.	Material	Item No.
1	2-4/0 AL Hot Line Clamp	200003			
15	6 Bare Cu SD 12.584 FPP	210000			
1	Arrestor, 18kV Dist Class	998600			

14.4/24.9 KV.
MISCELLANEOUS PRIMARY ASSEMBLIES

Revised
May 2003

VM5-6

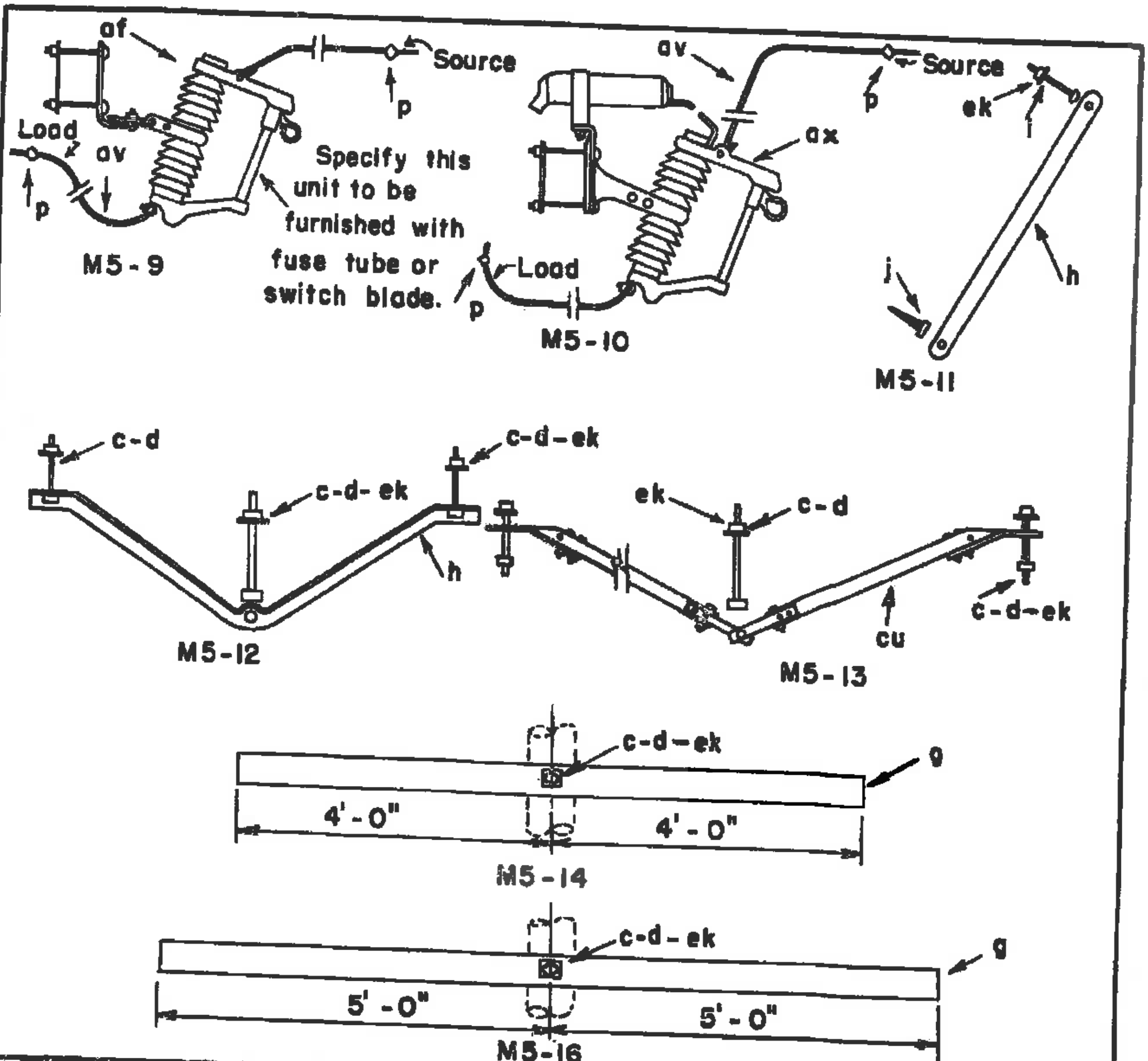


Quan.	Material	Item No.	Quan.	Material	Item No.
1	2-4/0 Al Hot Line Clamp	200003			
1	Switch, 100A. 15/27 kV Drop Out	512000			

14.4/24.9 KV
SINGLE DISCONNECT SWITCH

Revised
May 2003

VM5-9

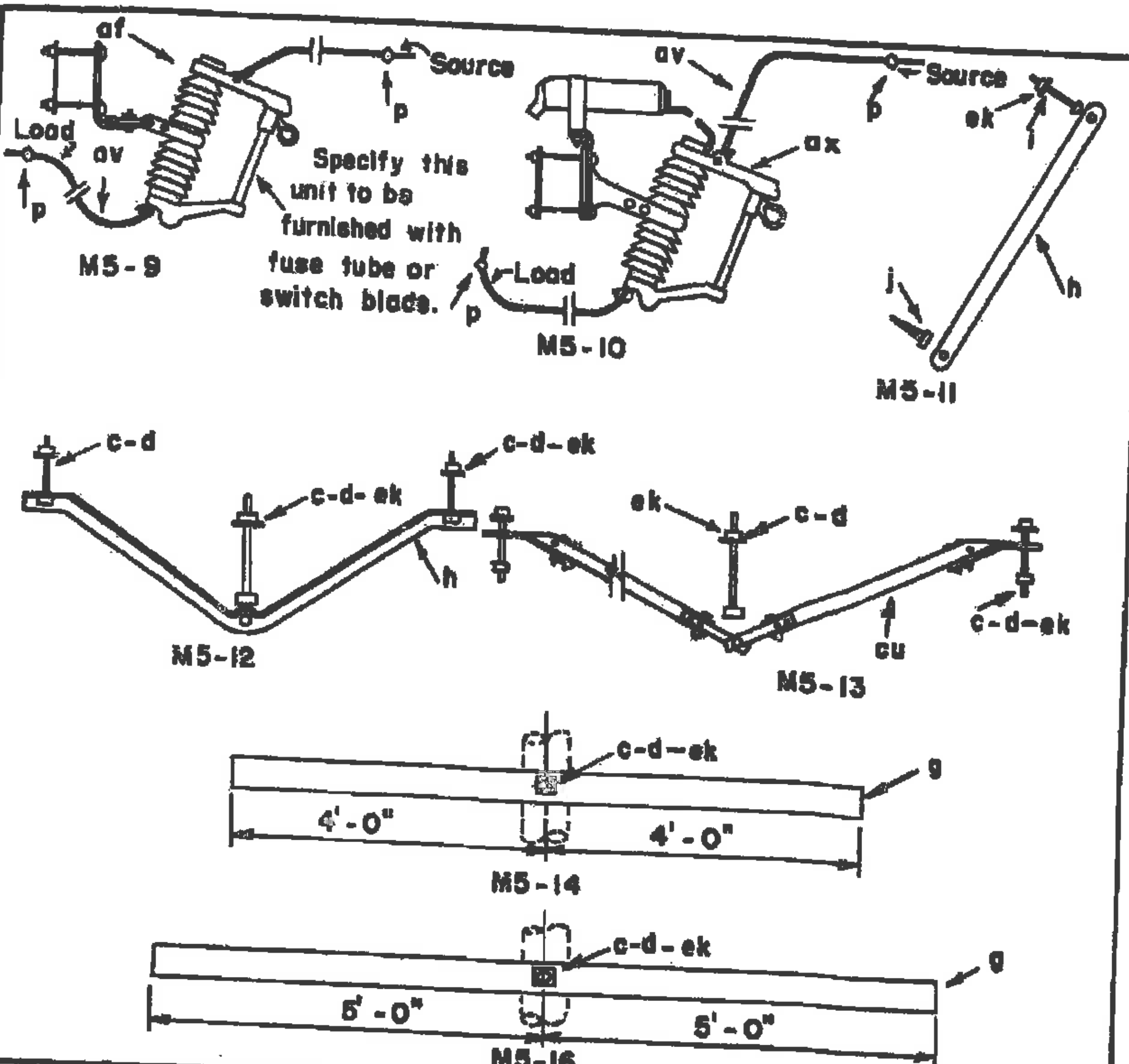


ITEM	MATERIAL	NUMBER REQUIRED							
		M5-9	M5-10	M5-11	M5-12	M5-13	M5-14		M5-16
c	Bolt, machine, 5/8" x req'd length								
c	Bolt, machine, 1/2" x req'd length				1	1	1		
d	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole				2	2			
d	Washer, round, 1 3/8" dia., 9/16" hole				1	1	2		2
g	Crossarm, 3 5/8" x 4 5/8" x 8'-0"				2	2			
g	Crossarm, 3 5/8" x 4 5/8" x 10'-0"						1		
h	Brace, flat, 1 1/4" x 1/4" x 28"								1
h	Brace, angle, 1 1/2" x 1 1/2" x 3/16", 60" span			1					
i	Bolt, carriage, 3/8" x 4 1/2"				1				
j	Screw, lag, 1/2" x 4"			1					
p	Connector			1					
af	Cutout, single-shot	2	2						
av	Jumper	1							
ax	Cutout and arrester combination	2	2						
cu	Brace, wood, 60" span		1						
ek	Locknuts, as required					1			

MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

M5-9 TO 16

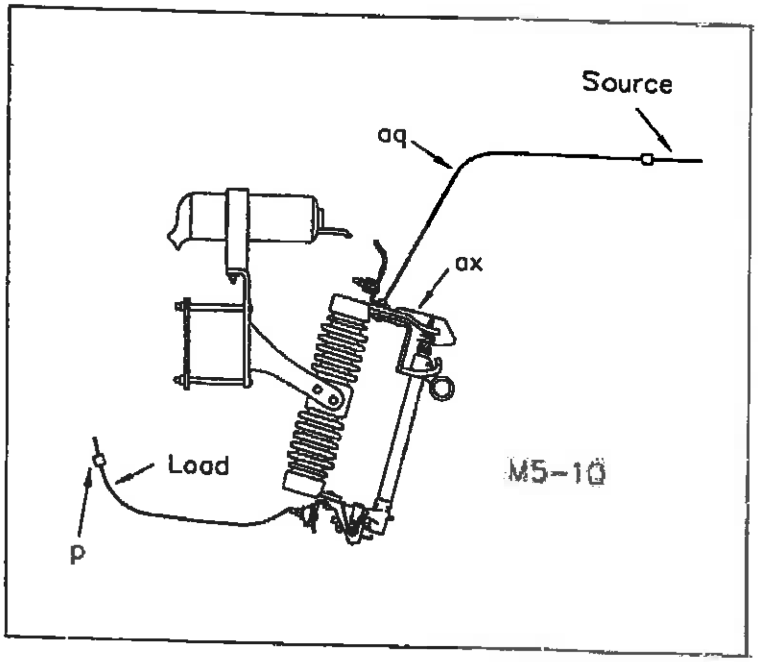


ITEM	MATERIAL	NUMBER REQUIRED							
		M5-9	M5-10	M5-11	M5-12	M5-13	M5-14		M5-16
c	Bolt, machine, 5/8" x req'd length				1	1	1		
c	Bolt, machine, 1/2" x req'd length				2	2			
d	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole				1	1	2		2
d	Washer, round, 1 3/8" dia., 9/16" hole				2	2			
g	Crossarm, 3 5/8" x 4 5/8" x 8'-0"						1		
g	Crossarm, 3 5/8" x 4 5/8" x 10'-0"								1
h	Brace, flat, 1 1/4" x 1/4" x 28"			1					
h	Brace, angle, 1 1/2" x 1 1/2" x 3/16", 60" span				1				
i	Bolt, carriage, 3/8" x 4 1/2"			1					
j	Screw, lag, 1/2" x 4"			1					
p	Connector	2	2						
af	Cutout, single-shot	1							
av	Jumper	2	2						
ax	Cutout and arrester combination		1						
cu	Brace, wood, 60" span					1			
ek	Locknuts, as required								

MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

VM5-9 TO 16



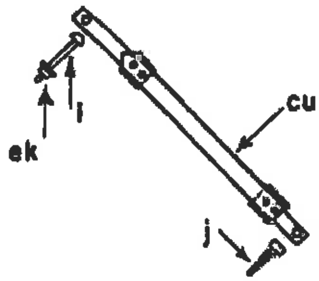
COMBINATION SWITCH AND ARRESTER

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Clamp, Hot Line	2000			
1	Connector	3000			
1	Switch, Comb.	5150			

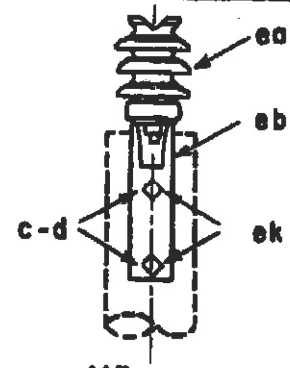
7.2/12.5 KV.
MISCELLANEOUS PRIMARY ASSEMBLIES

Revised
Feb. 1994

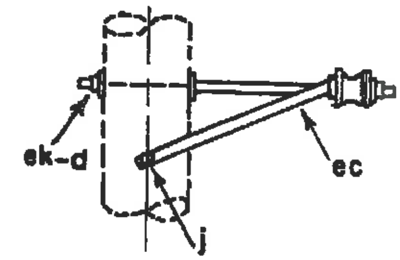
M5-10



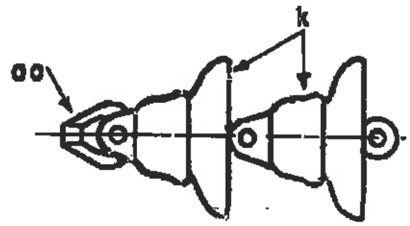
M5 – 17



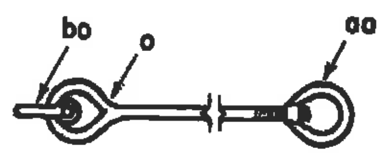
M5 – 18



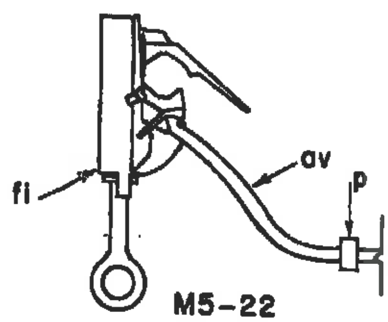
M5 – 19



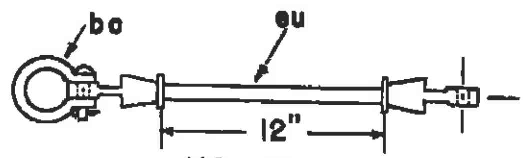
M5 – 20



M5-21



M5-22



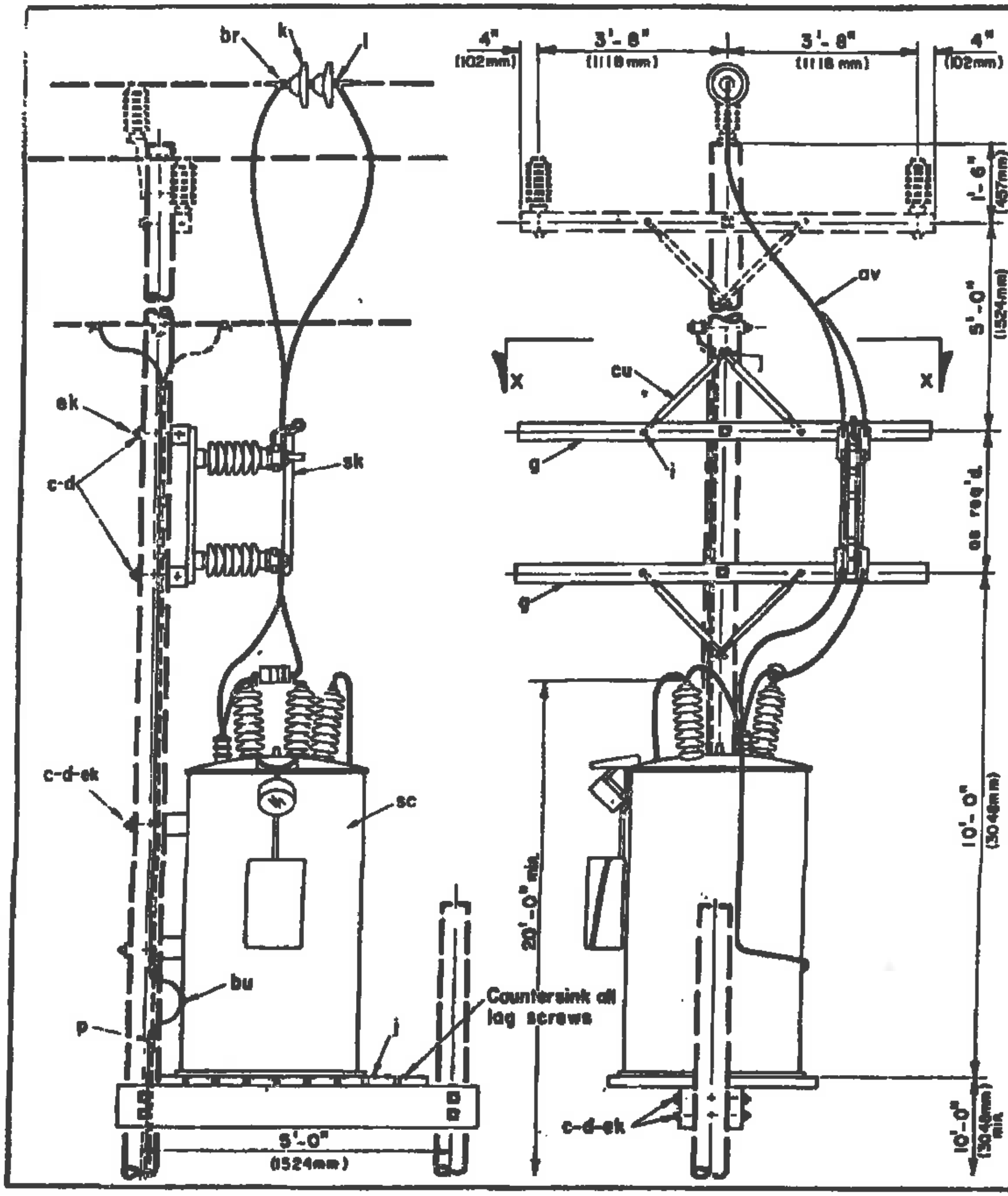
M5 - 23

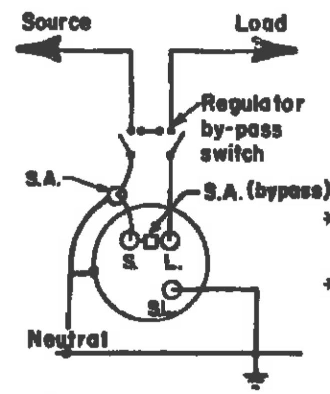
ITEM	MATERIAL	M5-17	M5-18	M5-19	M5-20	M5-21	M5-22	M5-23	
c	Bolt, machine, 5/8"x required length		2						
d	Washer, 2 1/4" square		2	1					
i	Bolt, carriage, 3/8"x 4 1/2"	1							
j	Screw, lag, 1/2" x 4"	1		2					
k	Insulator, suspension				2				
ea	Insulator, post type, 1 3/4" stud		1						
eb	Bracket, for post type insulator		1						
ec	Bracket, offset, neutral, insulated			1					
ek	Locknuts, as required								
cu	Brace, wood, 28"	1							
aa	Eye nut				1	1			
bo	Shackle, anchor					1		1	
o	Bolt, eye, 5/8" x reqd. length					1			
fi	Connector, hot line						1		
av	Jumper						1		
p	Connector						1		
eu	Link, extension, insulated							1	

MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

M5-17 TO 23

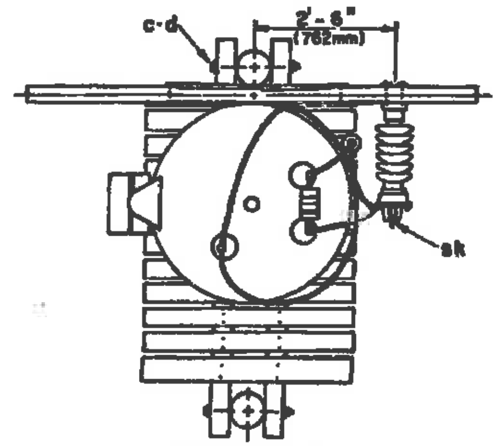




WIRING DIAGRAM

ITEM	NO.	MATERIAL
c	4	Bolt, machine, 1/2" x req'd. length
c	4	Bolt, machine, 5/8" x req'd. length
c	4	Bolt, machine, 3/4" x req'd. length
d	4	Washer, round, 1 3/8"
e	16	Washer, square, 2 1/4"
g	2	Crossarm, 3 5/8 x 4 5/8 x 8'-0"
i	4	Bolt, carriage, 5/8" x 4 1/2"
j	2	Screw lag 1/2" x 4"
j		Screw lag 1/2" x 5" as req'd.
l	2	Clamp, deadend
p		Connectors, as req'd.
ae	1	Surge arrester
* ae	1	By-pass arrester
av		Jumpers, stranded, as req'd
br	1	Chain link, 5/8" x 3/4"
* bu	1	Connector, solderless
cu	4	Brace, wood, 28"
sc	1	Regulator, step type
sk	1	Regulator, by-pass switch
k	2	Insulator, suspension, 10"
	2	Structural timber, 4" x 10" x 6'-0"
		Planks, 2" or 3" thick,
		length as req'd.
ek		Locknuts, as req'd.

* Specify this item to be furnished by the manufacturer

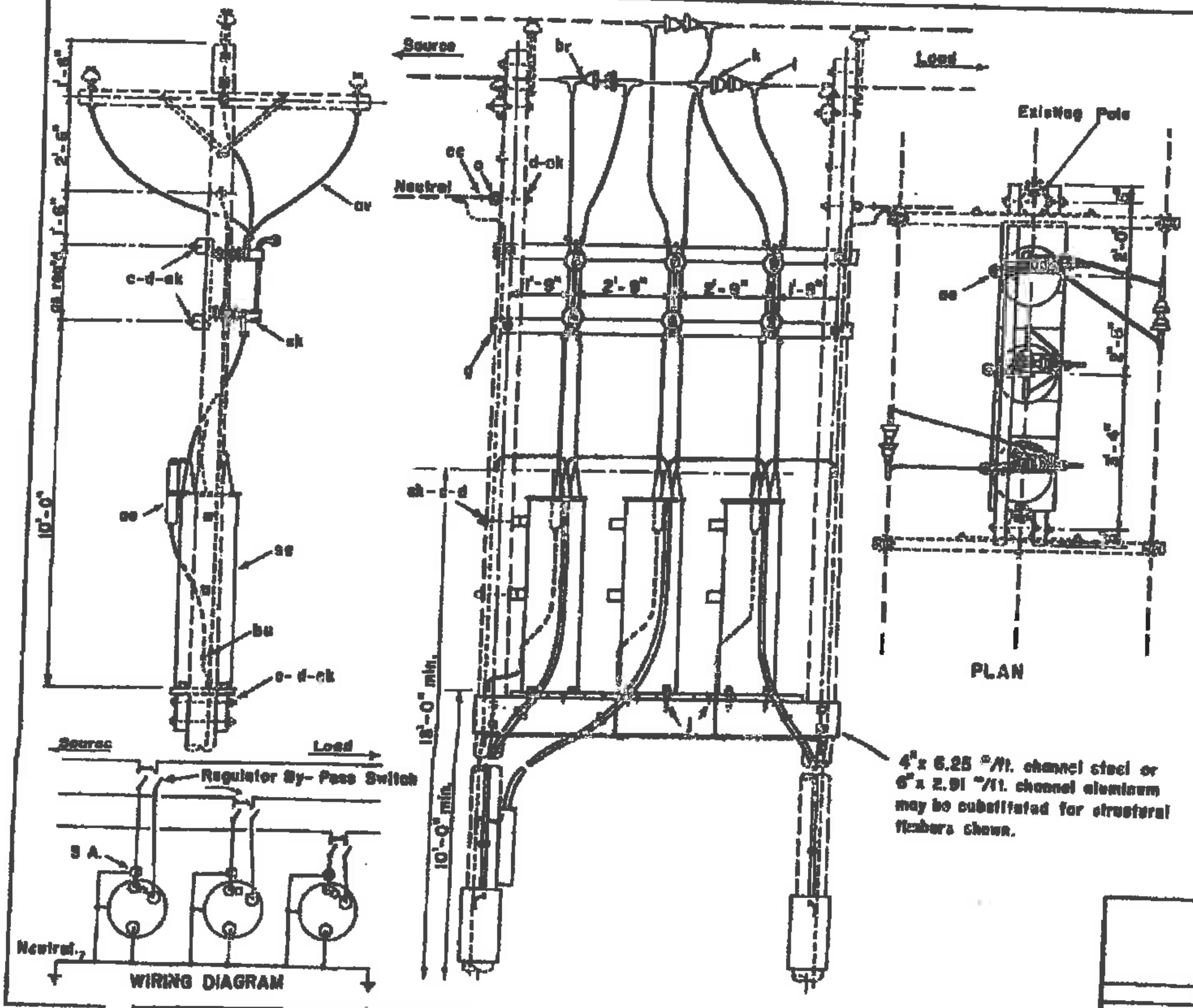


SECTION X-X

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

34.5/19.9 kV
SINGLE PHASE STEP VOLTAGE REGULATOR
PLATFORM MOUNTED

NOV. 1986 | ZM7-1



ITEM	No. Req'd	MATERIAL	
a	8	Bolt, machine, 5/8" x req'd. length	
c	4	Bolt, machine, 3/4" x req'd. length	
d	20	Washer, 2¼" x 2¼" x 3/16", 13/16" hole	
e	2	Crossarm, 3⅝" x 4⅝" x 10'-0"	
j		Screw lag, ½" x 5", as req'd.	
f	8	Screw lag, 5/8" x 6"	
k	6	Insulator, suspension, 15 kv	
l	6	Clamp, deadend	
o	2	Bolt, eye, 5/8" x req'd length	
p		Connectors, as required	
ae	3	Surge arrester	
ae	3	By-pass arrester *	
av		Jumpers, stranded, as required	
br	3	Chain link, 5/8" x 3½"	
bu	3	Connector, solderless *	
cc	2	Deadend assembly, neutral	
sc	3	Regulator, step type	
sk	3	Regulator by-pass switch	
	2	Structural timber, 4" x 12" x 10'-0"	
		Planks, 2" thick, length as req'd.	
ek		Locknuts, as required	
		Remote control kit with	
		mounting hardware *	
a	12	Bolt, machine, 1/2" x req'd. length	

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

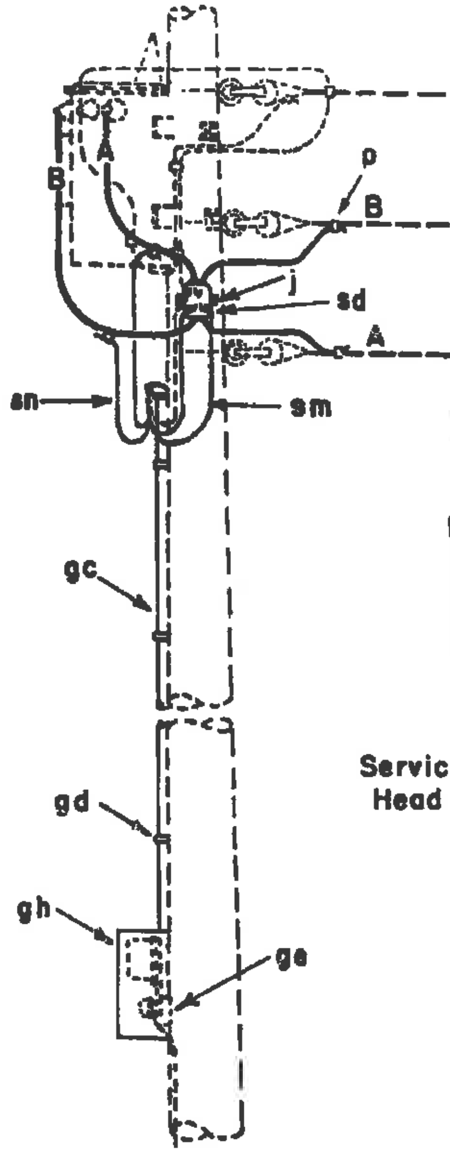
Note: All structural timber and planks to be treated as per REA Specification DT-5B.

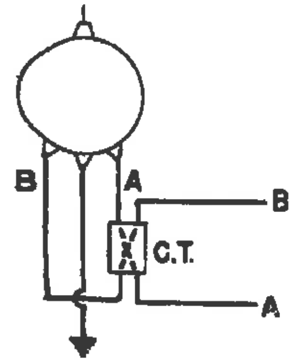
See drawings M42-3, M42-11, M42-13, M42-21 for item cc.

12.5/7.2 kV
THREE VOLTAGE REGULATORS
PLATFORM MOUNTED

Apr., 1983

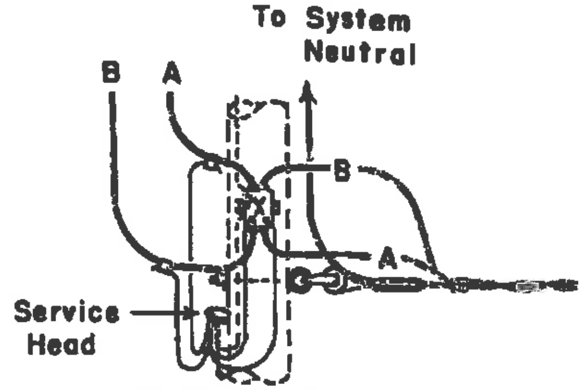
M7-13P





Note: WIRING DIAGRAM

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



TRIPLEX SERVICE

ITEM	NO.	MATERIAL
j	2	Screw, lag, 1/2" x 4"
p		Connectors, as required
gc		Conduit, 1 1/4", as required
gd		Straps, conduit, as required
ge	1	Condulet, type "LB"
gh	1	Meter box, meter and test block

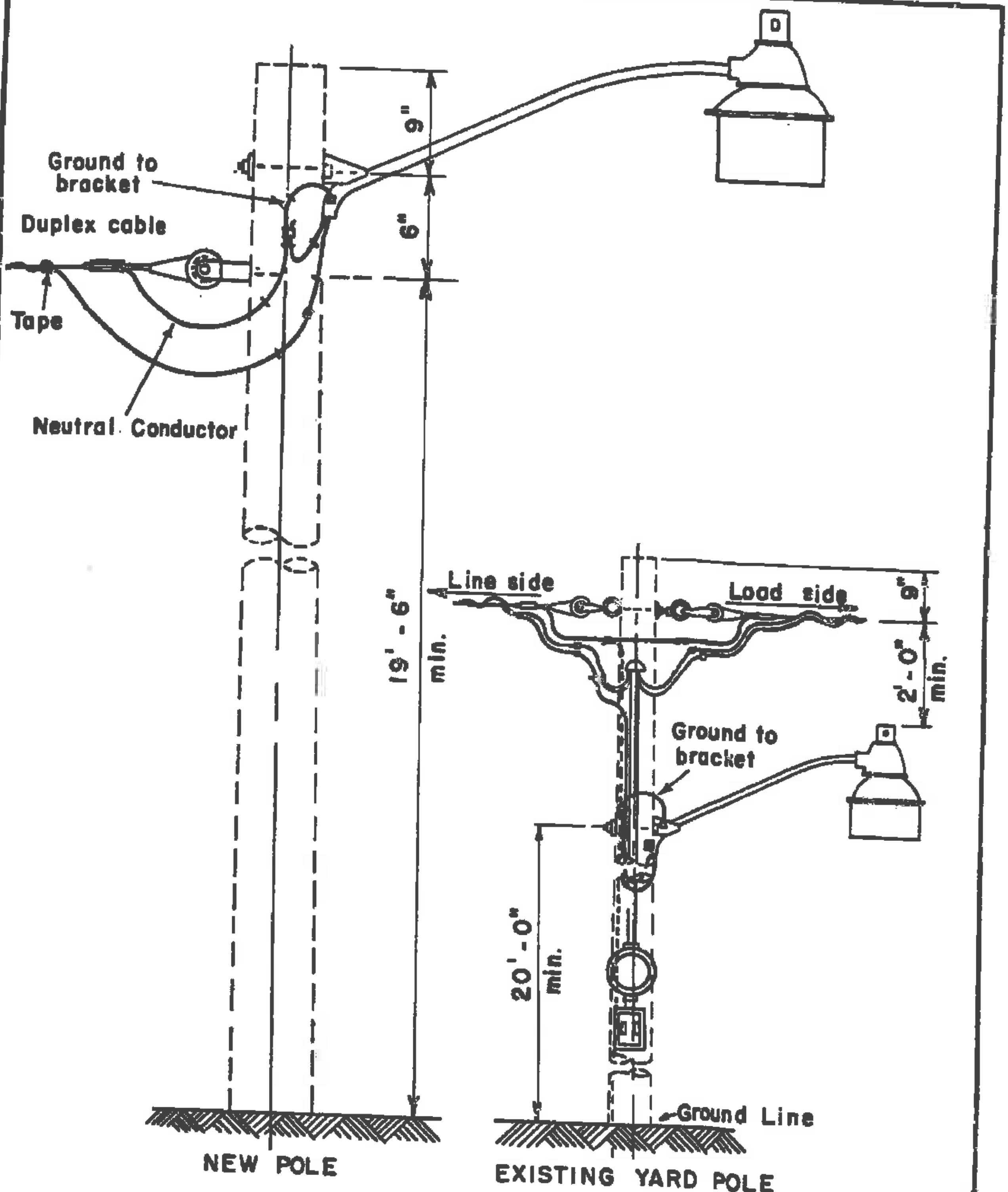
ITEM	NO.	MATERIAL
sd	1	Transformer, current
sm		Wire, No. 12, insul. for current
sn		Wire, No. 14, insul. for potential
	1	Service head

SECONDARY METERING GUIDE

SINGLE PHASE 120 / 240 VOLTS

Apr., 1983

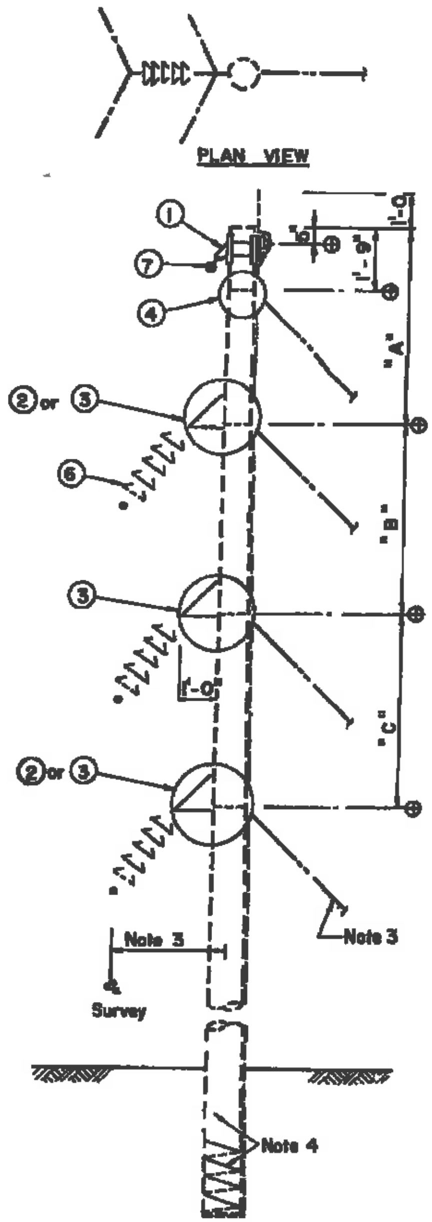
M8



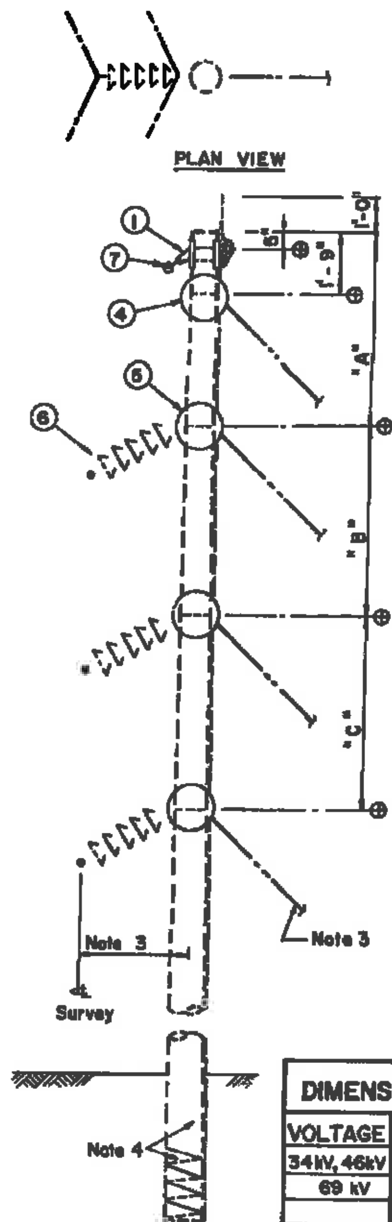
SECURITY LIGHT INSTALLATION GUIDE
(UNMETERED)

Apr., 1983

M26-5



TS - 3G
TS - 3GA



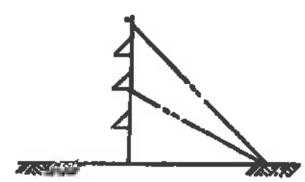
TS - 4G
aissued 03/98

LIST OF MATERIALS

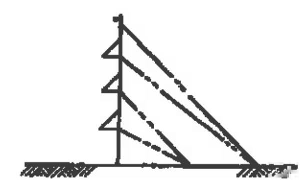
DRG. REF.	TS - 3G	TS - 3GA	TS - 4G	DESCRIPTION	ITEM	DET.	CODE No.
1	1	1	1	OHGW Support Assembly, double bolt	-	TM-6B	
2	2	-	-	BRACKET ASSEMBLY, ________ DUTY	-	TG-____	
3	1	3	-	BRACKET & GUY ATTACH. ________ DUTY	-	TG-____	
4	1	1	1	GUY ATTACHMENT ________ DUTY	-	TG-____C	
5	-	-	3	GUY ATTACHMENT ________ DUTY	-	TG-____D	
6	3	3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-____C	
7	1	1	1	OHGW ASSEMBLY, ANGLE	-	TM-4____	

NOTES:

1. Maximum line angle for TS-4G is 50 degrees.
2. Drawing TE-1 gives guidance to subassembly alternatives.
3. For guying arrangements and offset table, see drawing TM6-26.
4. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.



TS - 3G



TS - 3GA
TS - 4G

DIMENSIONS A, B, & C

VOLTAGE	A	B	C
34kV, 46kV	6'-0"	6'-0"	6'-0"
69 kV	7'-0"	7'-0"	7'-0"

No.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

MEDIUM AND LARGE VERTICAL ANGLES

(69 kV MAXIMUM)

Aug., 1986

TS-3G,3GA,4G

Section 11: Conductors

Primary Distribution physical and electrical cable characteristics (Southwire Company) are shown below.

Main Pole Line Conductors:
Primary – ARBUTUS – 37 Strands – 795AAC – See Sag & Tension Charts (Section 13)
Neutral – PIGEON – 6/1 Strands – 3/0 ACSR – See Sag & Tension Charts (Section 13)

Primary Tap Conductors:

Code Word	Size (Acsr)	Strand	Diameter (ins.)				Weight Per 1000 ft. (lbs.)		
			Individual Wires		Steel Core	Complete Cable			
			Al	Stl			Al	Stl	Total
Pelican	477	18/1	.1628	.1628	.1628	.814	447.8	70.2	517
Merlin	336	18/1	.1367	.1367	.1367	.684	315.8	49.5	365
Sparrow	#2	6/1	.1052	.1052	.1052	.316	62.0	29.3	91
Swan	#4	6/1	.0834	.0834	.0834	.250	39.0	18.4	57

Code Word	Content (%)		Rated Strength (lbs.)	Resistance Ohms/1000 ft		Allowable Ampacity (Amps)
	Al	Stl		DC@20°C	AC@20°C	
Pelican	86.45	13.55	11,800	.0360	.0442	646
Merlin	86.45	13.55	8,620	.0510	.0625	519
Sparrow	58.13	41.87	2,850	.254	.332	184
Swan	67.90	32.10	1,860	.403	.515	140

Design tensions for bare wire primary and neutral conductors are given in the following table for a medium loading district according to the National Electric Safety Code.

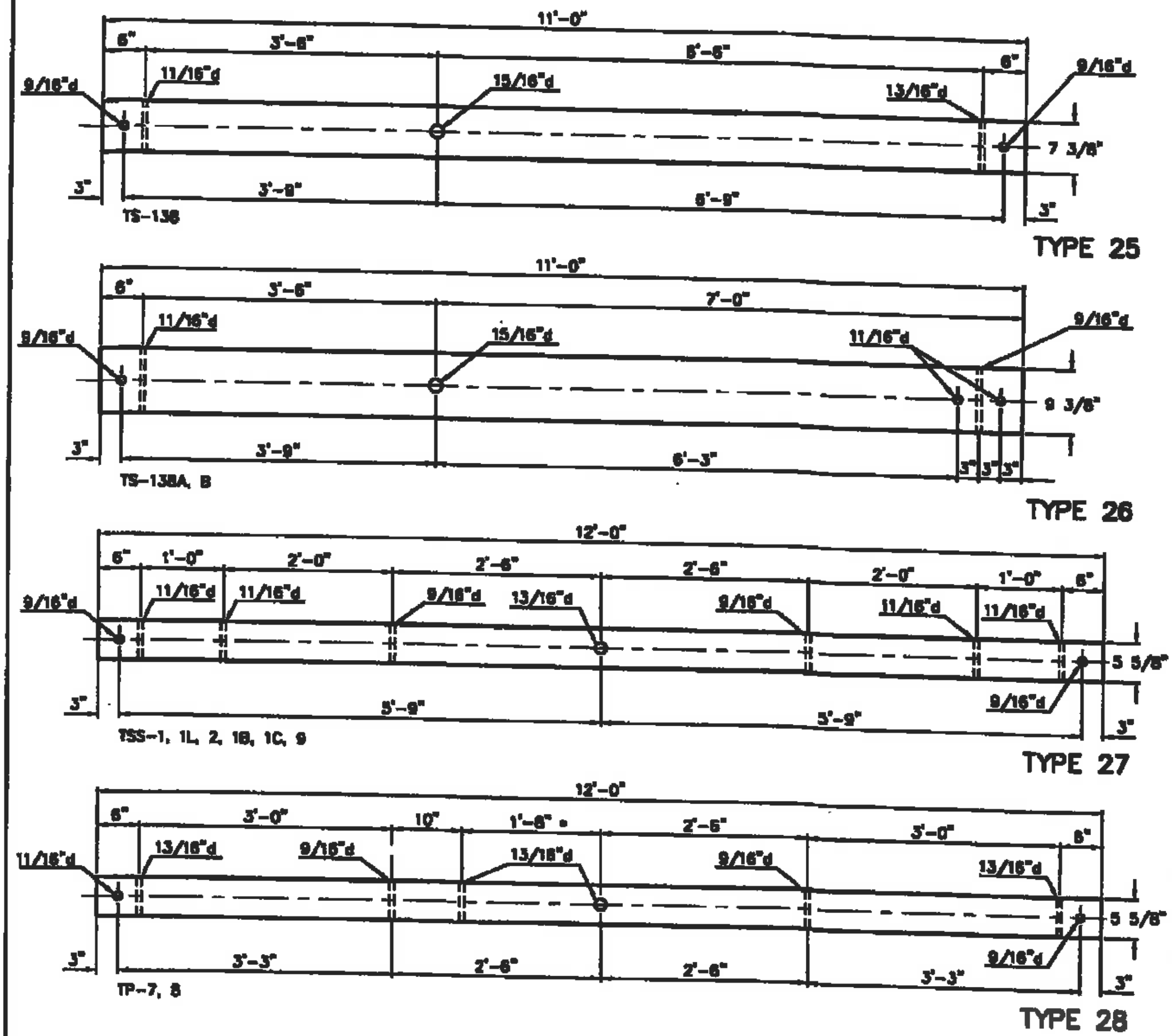
Code Word	35% of Rated Design Tension Initial Unloaded	60% of Rated Design Tension Initial Loaded
Pelican	4,130	7,080
Merlin	3,038	5,208
Sparrow	998	1,710
Swan	651	1,116

The physical and electrical cable characteristics (Southwire Company) for the secondary and service wires are shown below.

Code Word	Phase Conductor			Bare Neutral Messanger		
	Size	Strand	Insul. Thick. (mils)	Size	Strand	Rated Strength (lbs.)
Gammarus	1/0TP	7	60	1/0	7	4,460
Shrimp	#2TP	7	45	2	7	2,800
Barnacles	#4TP	7	45	4	7	1,760
Vizsla	#6DP	7	45	6	7	1,110

Code Word	Weight per 1000 ft.		Allowable Ampacity	
	VIP	POLY	VIP	POLY
Gammarus	406	390	205	160
Shrimp	250	242	150	120
Barnacles	166	156	115	90
Vizsla	70	67	70	70

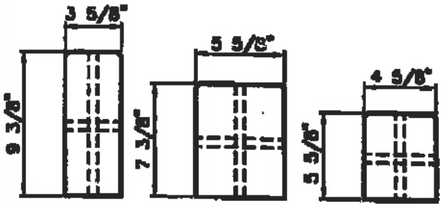
Section 12: Removals



NOTES:

1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

ENLARGED END VIEWS



Tolerance:

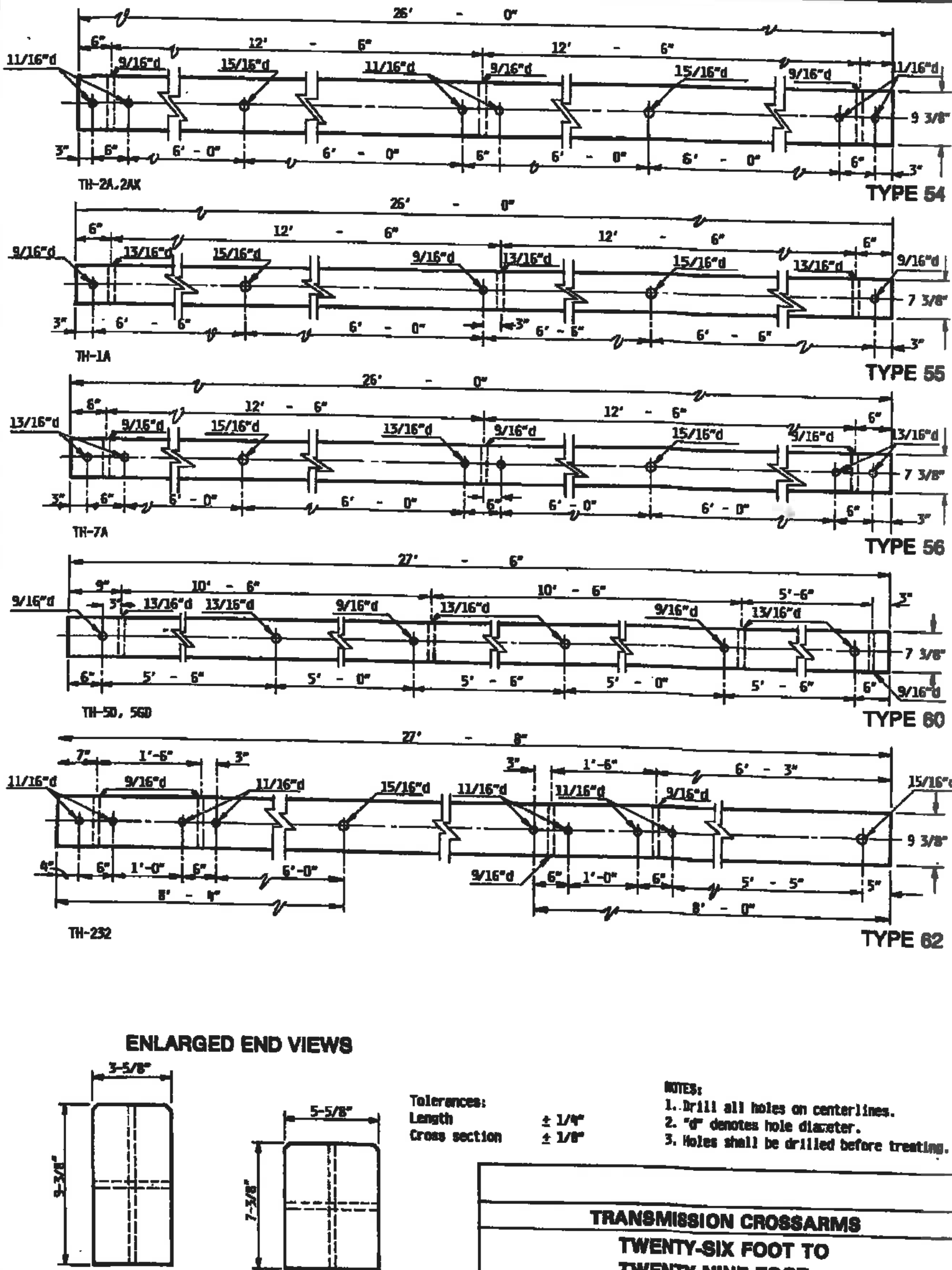
Length	± 1/4"
Cross section	± 1/8"

NO.	REVISION	DATE
1, *	TP-7, #28	03/98

TRANSMISSION CROSSARMS

TEN FOOT TO TEN FOOT-SIX INCHES

TCD-11



Tolerances:

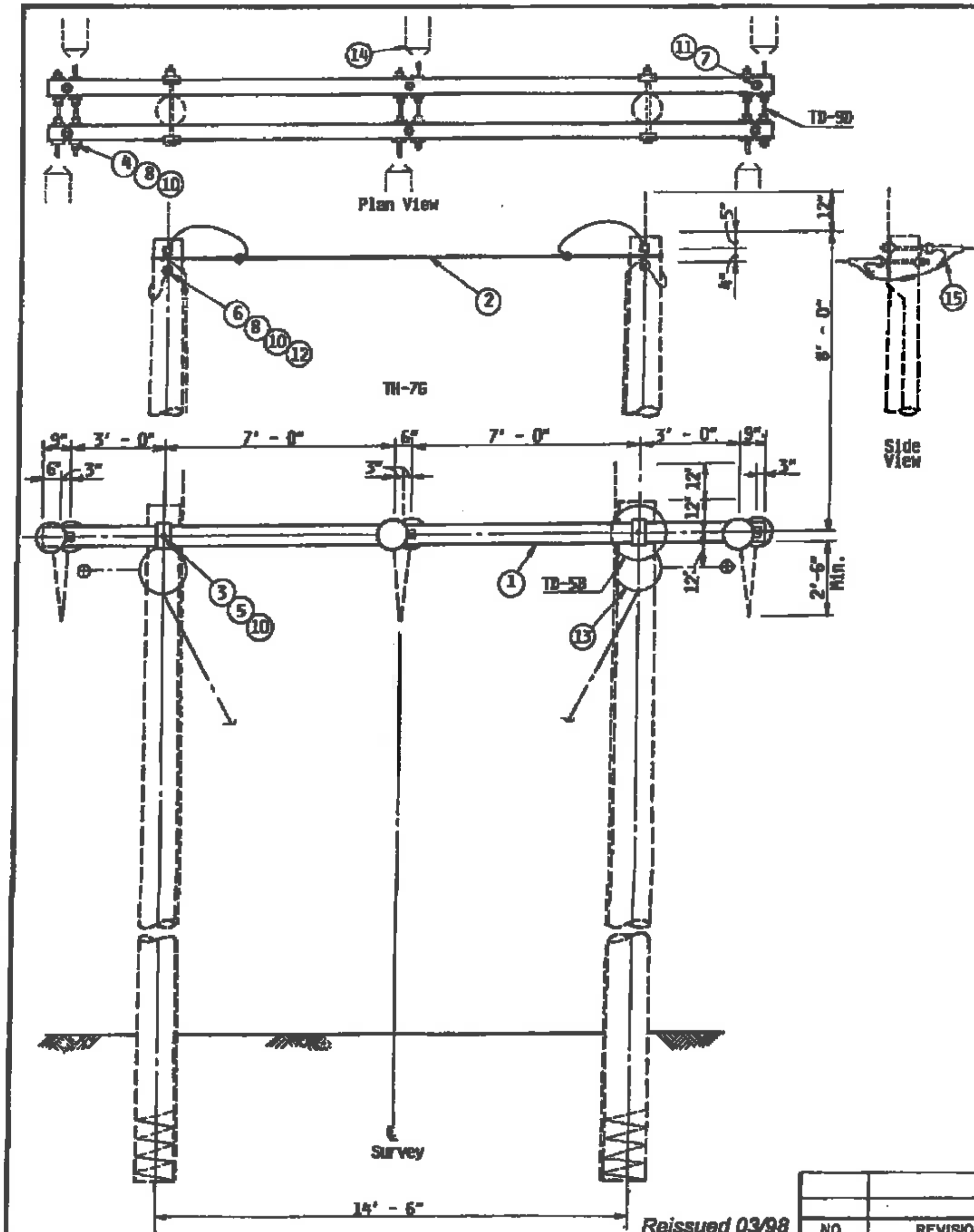
Length	± 1/4"
Cross section	± 1/8"

NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS
TWENTY-SIX FOOT TO TWENTY-NINE FOOT

Reissued 03/98

TCD-26



LIST OF MATERIALS

DRG. REF	TH- 7	TH- 76	DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	X-Arm, 5 5/8"x7 3/8"x22'-0", #42		TCD-20	
2	-	1	Grounding Assembly, Pole Tie		TM-9C	
3	4	4	Plate, Crossarm Reinforcing			
4	6	6	3/4" Bolt, D'ble Arm'g Eye by r.l.	dy		
5	2	2	3/4" Bolt, Machine, by req'd length	c		
6	-	4	3/4" Bolt, Shoulder Eye, by r.l.	o		
7	6	6	1/2" Bolt, Washer Head w/Washer nut	c		
8	24	24	Washer, Flat 4"sq.x3/16", 13/16" hole	d		
9	-	4	Washer, Curved, 4"sq.x1/4",13/16"hole	d		
10	20	24	3/4" Locknut, MF Type	ek		
11	6	6	1/2" Locknut, MF Type	ek		
12	2	2	3/4" Clamp, Groundwire, + 1 nut	dp		
13	2	2	GUY ATTACHMENT, LIGHT DUTY		TG-16A	
14	6	6	INSULATOR ASSEMBLY, DEADEND		TM-	
15	-	4	OHGW ASSEMBLY, DEADEND		TM-	
16						

NOTES:

1. Drawing TE-1 gives guidance to subassembly alternatives.
2. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.
3. Use a TG-1 type guying assembly with item 13.

NO.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

TWO POLE DOUBLE DEADEND

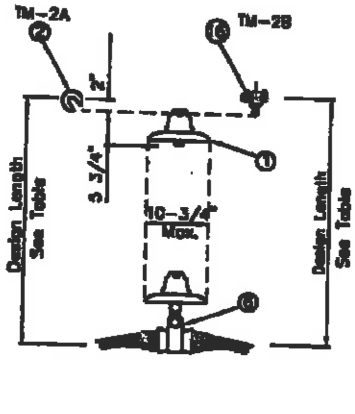
(69 kV MAXIMUM)

Aug., 1986

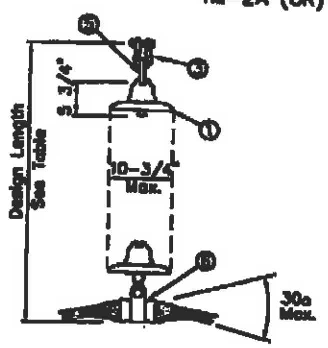
TH-7, 76

LIST OF MATERIALS

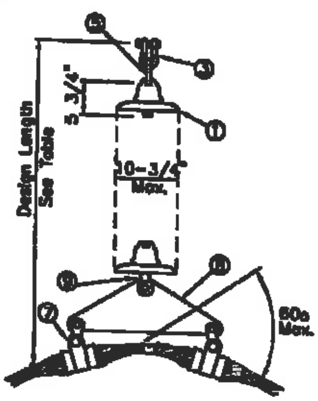
DWG. REF.	DESCRIPTION	ITEM	DET.	CODE No.
1	Insulator, Suspension	k		
2	Hook, Ball, 30,000 lb.	sh		
3	Anchor Shackle, 30,000 lb. BNC	bo		
4	Anchor Shackle, 50,000 lb. BNC	bo		
5	Oval Eye Ball, 30,000 lb.			
6	Clamp, Suspension & Socket Eye	ei		
7	Clamp, Suspension & Clevis Eye	ei		
8	Yoke Plate			
9	Socket Adapter (Socket Eye or Clevis)	fh		
10	Link, Extension, Oval Eye Ball, 30k			
11	Link, Extension, Oval Eye Ball, 50k			
12	Clamp, Bolted D.E. & Socket Eye	ej		
13	Clamp, Compression D.E.	cp		
14	Jumper Connector, Compression	p		
15	Jumper Terminal, Compression			
16	30k Ball Y-Clevis	ft		



TANGENT ASSEMBLY
TM-2A (OR) TM-2B

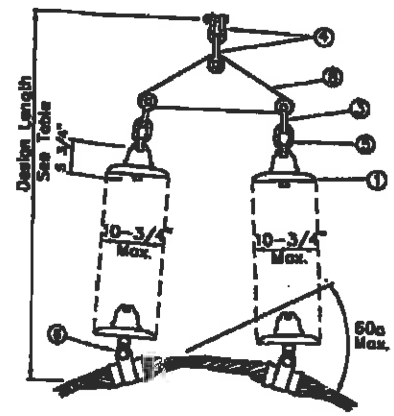


TYPE 1

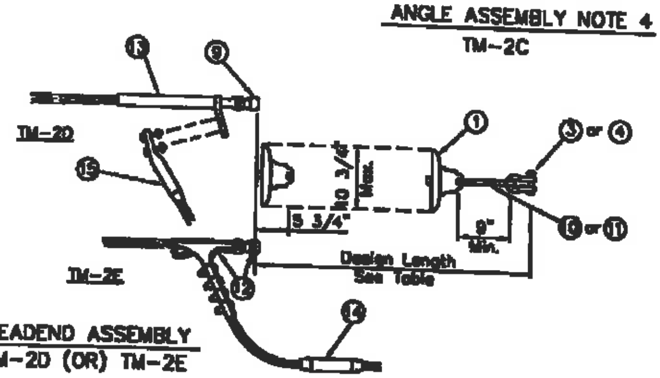


TYPE 2

ANGLE ASSEMBLY NOTE 4
TM-2C



TYPE 3



DEADEND ASSEMBLY
TM-2D (OR) TM-2E

NOTES:

1. The table at the right shall be completed for each project.
2. Suitable suspension clamps must be selected for the conductor being used. The type of conductor and diameter of the conductor shall be considered. Cushioned suspension rods shall have parrot bill ends for 230 kv transmission lines.
3. The capacity of the hardware must be equal to or greater than the M&E strength of the insulator units shown in the table at the right. The capacity of drg. ref. 4 and 5 shall be twice the M&E strength of the insulators. Use item 11 for 36,000 lb. insulators.
4. Appropriate angle assemblies shall be installed for line angles shown on the plan and profile drawings:
   A. For angles from 0 degrees to 30 degrees use type 1.
   B. For angles from 30 degrees to 60 degrees use type 2 or 3.
5. When specified the ball hook may be used for TM-1C, Type 1 & 2.

______ KV	TANGENT ASSEMBLY	ANGLE ASS'Y TYPE 1	ANGLE ASS'Y TYPE 2 or 3	DEADEND ASSEMBLY
Quantity of Units				
ANSI C29.2, Class				
M & E Strength (lb.)				
Assembly Weight (lb.)				
Design Length (in)				
Color of Units				

NO.	REVISION	DATE
1.*	Add item 16,TM-2B	03/98

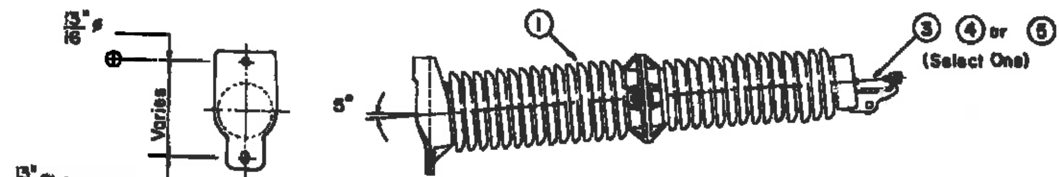
INSULATOR ASSEMBLIES

INSULATOR STRING WITH CUSHIONED SUSPENSION

TM-2

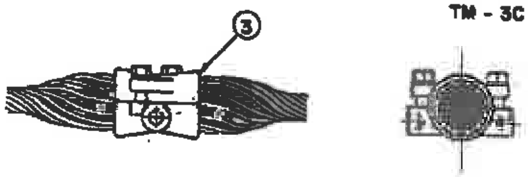
LIST OF MATERIALS

DRG. REF.	DESCRIPTION	ITEM	DET.	CODE No.
1	Insulator, Horizontal Post, with base	ea		
2	Insulator, Vertical Post, w/mtg. hdwr.			
3	Clamp, Cushioned Support			
4	Clamp, Post Suspension (to 15^{0})			
5	Clamp, Angle			



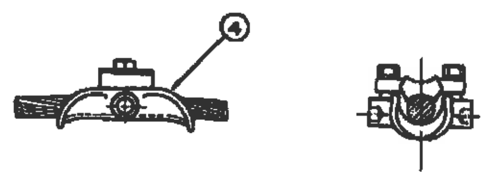
HORIZONTAL POST INSULATOR

TM - 3A (DETAIL A)
TM - 3B (DETAIL B)
TM - 3C (DETAIL C)



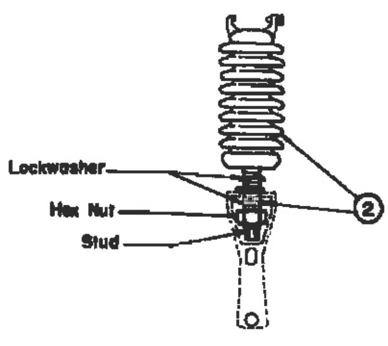
CUSHIONED SUPPORT CLAMP

DETAIL A



POST CLAMP

DETAIL B



VERTICAL POST INSULATOR

TM - 3E (DETAIL A)
TM - 3F (DETAIL B)

ANGLE CLAMP

DETAIL C

NOTES:

1. The appropriate conductor clamp shall be used for the line angles shown on the plan-profile drawings. For line angles from:

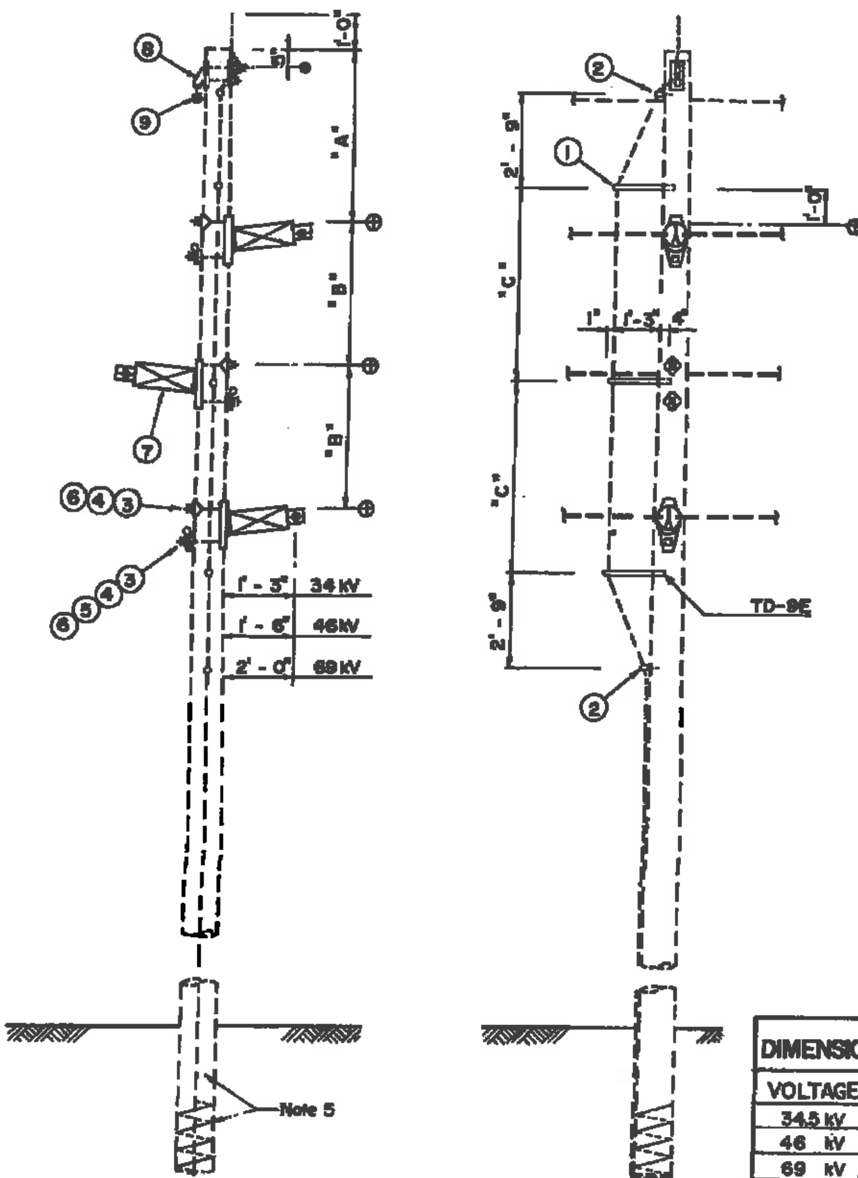
   A. 0 degrees to 30 degrees TM-3A
   B. 0 degrees to 15 degrees TM-3B, 3E, 3F
   C. 15 degrees to 30 degrees. TM-3C

INSULATOR ASSEMBLIES

LINE POST

No.	REVISION	DATE	Aug., 1986		TM-3

Reissued 03/98



LIST OF MATERIALS					
DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	Rod, Fiberglass, 3/4" x 1'-8"			
2	2	Wireholder, w/#22 wood screw	ar		
3	6	3/4" Bolt, Machine, by req'd length	c		
4	6	Washer, Curved, 4" sq.x 1/4", 13/16" hole	d		
5	3	Washer, Spring, 13/16" hole	aw		
6	6	3/4" Locknut, MF Type	ek		
7	3	INSULATOR, HORIZONTAL POST, WITH CLAMP	-	TM-3	
8	1	OHGW SUPPORT ASSEMBLY	-	TM-6	
9	1	OHGW ASSEMBLY, TANGENT	-	TM-4	

NOTES:

1. Metal shims should be used to adjust post insulator when brackets are located on uneven pole surfaces.
2. Strength limitations of horizontal post:
   a. Maximum cantilever load 2,800 lbs.
   b. Maximum tensile and compression 5,000 lbs.
   (Loads a and b are simultaneous)
3. For strength limitations of overhead ground wire support assembly, see TM-6.
4. Drawing TE-1 gives guidance to subassembly alternatives.
5. The following materials are to be specified on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.

DIMENSIONS A, B, AND C			
VOLTAGE	A	B	C
34.5 kV	5'-0"	4'-0"	5'-5"
46 kV	5'-6"	4'-6"	5'-11"
69 kV	6'-0"	5'-0"	6'-6"

Reissued 03/98

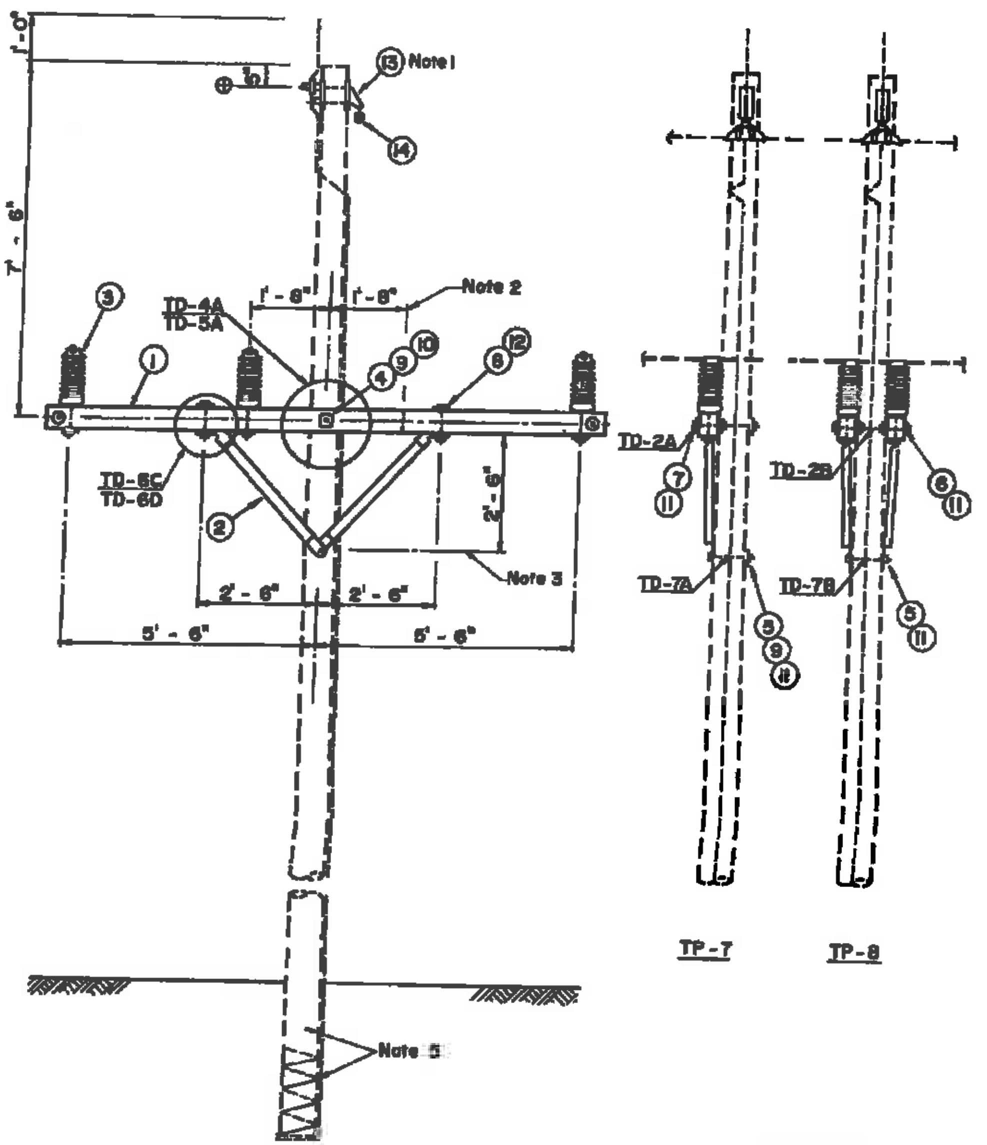
NO.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

TANGENT HORIZONTAL LINE POST
(69 kV MAXIMUM)

Aug., 1986

TP-34G,46G,69G



DRG. REF.	TP- 7	TP- 8	DESCRIPTION	ITEM	DET.	CODE No.
1	1	2	X-Arm, 4-5/8" x 5-5/8" x 12'-0", #28		TCD-11	
2	1pr.	2pr.	Brace, X-Arm, 60"/30"	cu		
3	3	6	Insulator, Post Type, w/long mtg. hdwr.	eq		
4	1	1	3/4" Bolt, Machine, by req'd length	c		
5	1	1	5/8" Bolt, Machine, by req'd length	c		
6	-	2	5/8" Bolt, Double Arming, w/4 Washer Nuts	n		
7	2	-	5/8" Bolt, Washer Head, w/Washer Nut	c		
8	2	4	1/2" Bolt, Washer Head, by req'd length	c		
9	3	2	Washer, Flat, 2-1/4"sq. x 3/16", 13/16"h.	d		
10	1	1	3/4" Locknut, MF Type	ek		
11	3	9	5/8" Locknut, MF Type	ek		
12	2	4	1/2" Locknut, MF Type	ek		
13	1	1	OHGW SUPPORT ASSEMBLY, TANGENT	-	TM-6	
14	1	1	OHGW ASSEMBLY, TANGENT	-	TM-4	

LIST OF MATERIALS

NOTES:

1. Mount items 13 and 14 on side opposite the inner post insulator.
2. Drill crossarm for alternate location of post insulator.
3. Field drilled holes shall be thoroughly treated.
4. At line angles, mount the OHGW Support Assembly on the interior angle side of the pole.
5. The following materials are to be specified seperately on plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

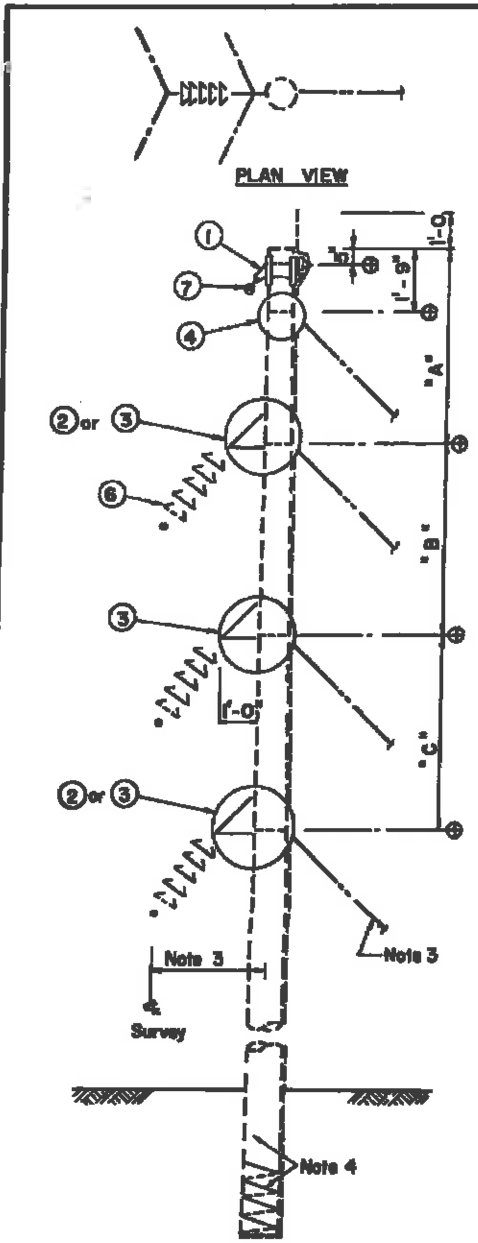
No.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

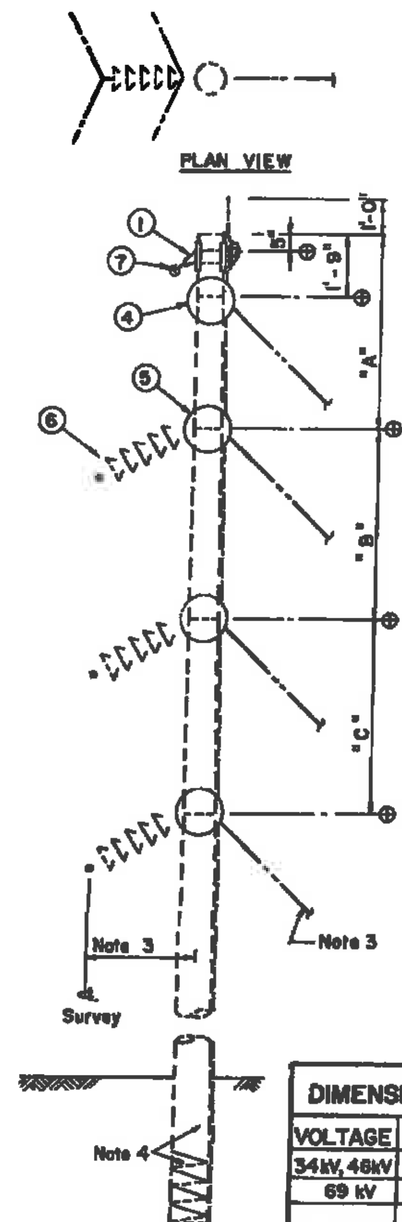
TANGENT LINE POST
(46 kV MAXIMUM)

Aug., 1986

TP - 7,8



TS - 3G
TS - 3GA



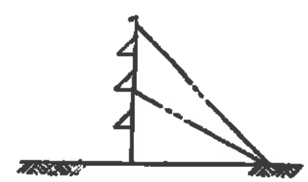
TS - 4G

eissued 03/98

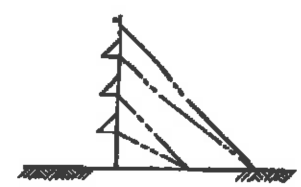
	TS -			LIST OF MATERIALS			
DRG. REF	3G	3GA	4G	DESCRIPTION	ITEM	DET.	CODE No.
1	1	1	1	OHGW Support Assembly, double bolt	-	TM-6B	
2	2	-	-	BRACKET ASSEMBLY, ______ DUTY	-	TG-	
3	1	3	-	BRACKET & GUY ATTACH, ______ DUTY	-	TG-	
4	1	1	1	GUY ATTACHMENT ______ DUTY	-	TG- ___C	
5	-	-	3	GUY ATTACHMENT ______ DUTY	-	TG- ___D	
6	3	3	3	INSULATOR ASSEMBLY, ANGLE	-	TM- ___C	
7	1	1	1	OHGW ASSEMBLY, ANGLE	-	TM-4	

NOTES:

1. Maximum line angle for TS-4G is 50 degrees.
2. Drawing TE-1 gives guidance to subassembly alternatives.
3. For guying arrangements and offset table, see drawing TMG-26.
4. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.



TS - 3G



TS - 3GA
TS - 4G

DIMENSIONS A, B, & C			
VOLTAGE	A	B	C
34kV, 46kV	6'-0"	6'-0"	6'-0"
69 kV	7'-0"	7'-0"	7'-0"

No.	REVISION	DATE

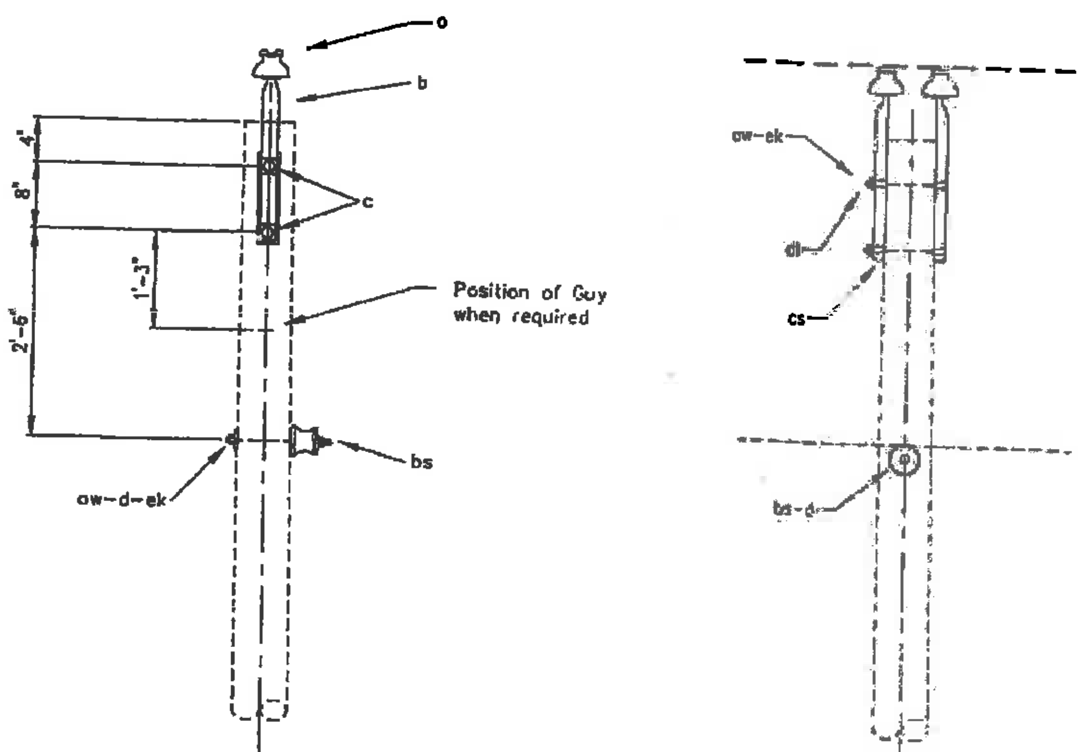
TRANSMISSION LINE STRUCTURE

MEDIUM AND LARGE VERTICAL ANGLES

(69 kV MAXIMUM)

Aug., 1986

TS-3G,3GA,4G



Specify A1-1A for offset neutral assembly

NOTES:

1– Maximum transverse load: 500 lbs. per conductor

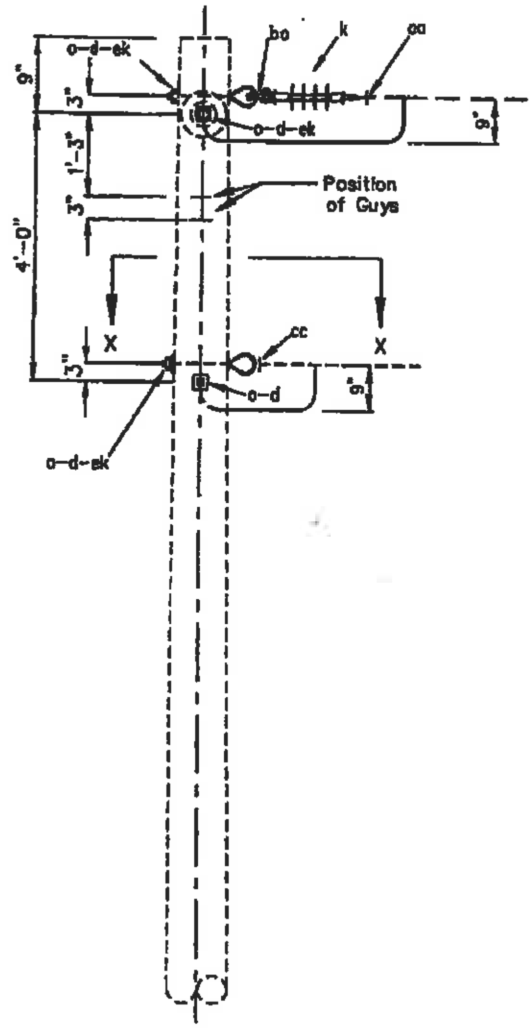
2– Maximum line angle within load limits: 5°

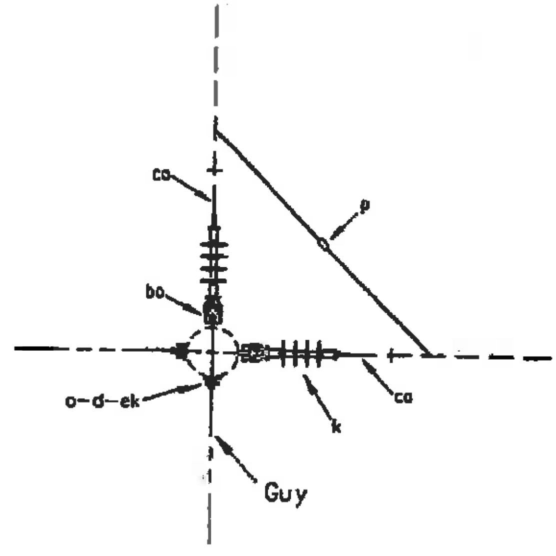
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Insulator, pin type	1040	1	Bolt, Double upset	0425
2	Pin, pole top, 20"	0900	3	Washer, square	0610
2	Bolt, machine, 5/8"	0370			
1	Ins. Spool Secondary	1020			

7.2/12.5 KV. PRIMARY, 1–PHASE
0° TO 5° ANGLE, DOUBLE PRIMARY
SUPPORT

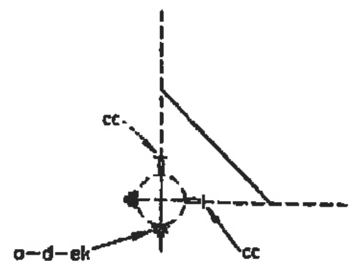
Revised
Sept. 1994

A1 – 1





PLAN



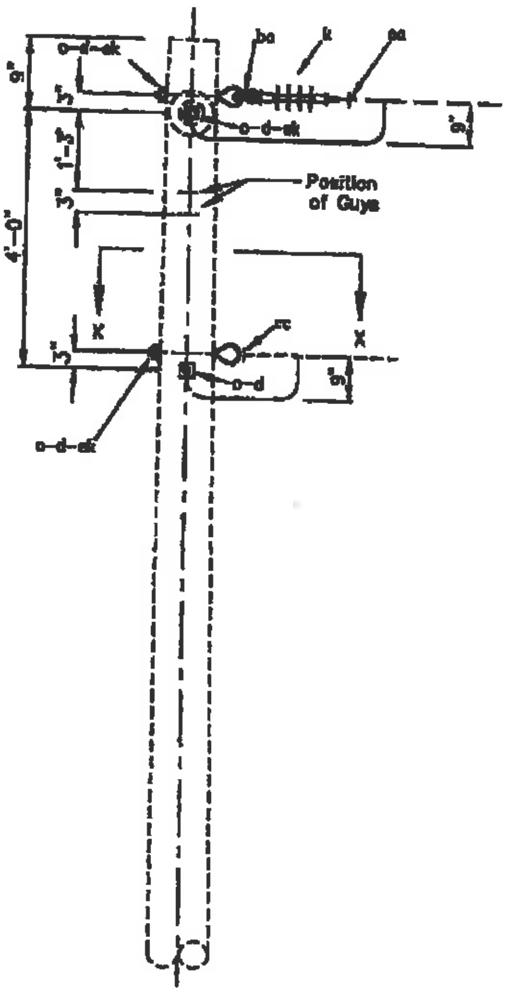
SECTION X-X

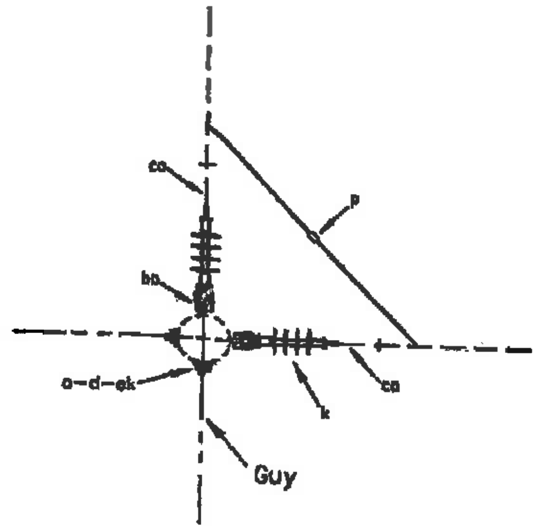
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	4	Clamp C412	1950
2	Insulator, Polly	1110	2	Deadend Clamp, primary	1910
4	Bolt, eye, 5/8"	0320	2	Clevis Sec. Swing J 6	1815
2	Ins. Spool Sec.	1020			

7.2/12.5 KV. PRIMARY, 1-PHASE
60° TO 90° ANGLE

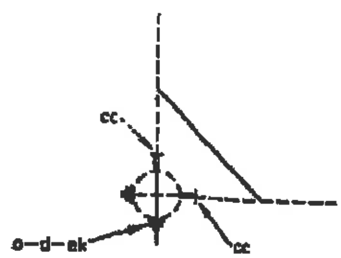
Revised
Sept. 1994

A4





PLAN



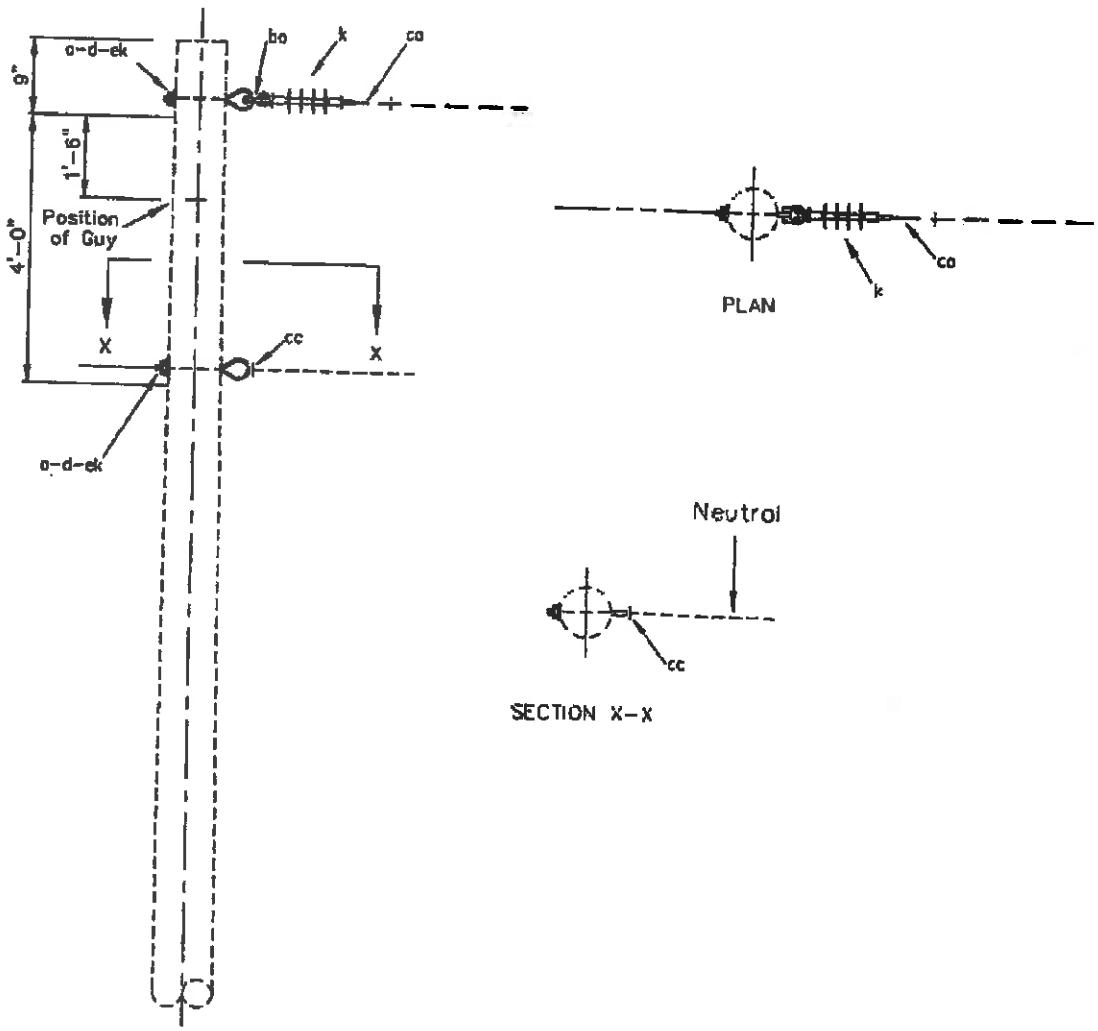
SECTION X-X

Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	4	Clamp C412	1950
2	Insulator, Polly	1110	2	Deadend Clamp, primary	1910
4	Bolt, eye, 5/8"	0320	2	Clevis Sec. Swing J 6	1815
2	Ins. Spool Sec.	1020			

7.2/12.5 KV. PRIMARY, 1-PHASE
60° TO 90° ANGLE

Revised
Sept. 1994

A4-P

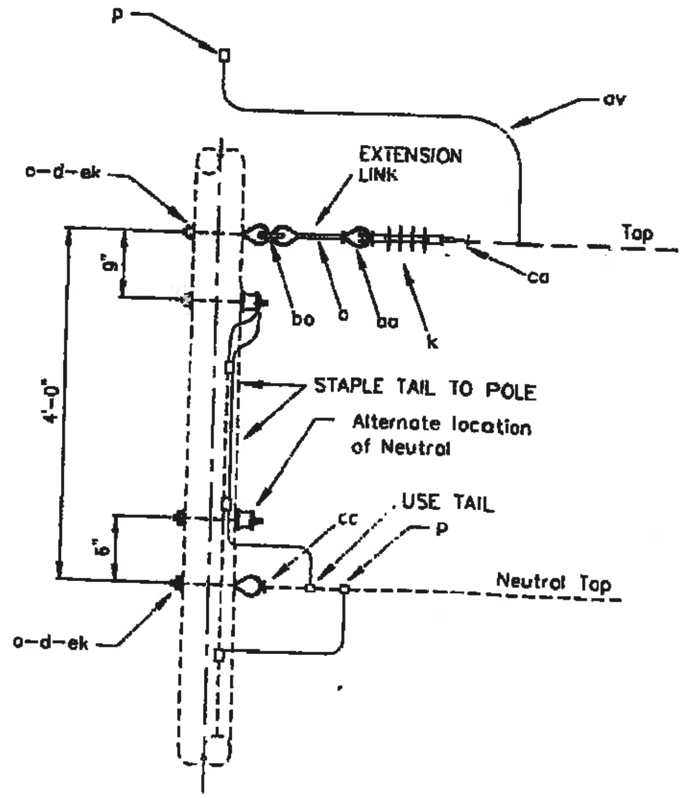


Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610	1	Clevis, Sec. Swing J6	1815
1	Insulator, Polly	1110	2	Clamp C412	1950
2	Bolt, Eye, 5/8"	0320	1	Ins. Spool Sec.	1020
1	Deadend Clamp Primary	1910			

7.2/12.5 KV. PRIMARY, 1-PHASE
DEADEND (SINGLE)

Revised
Sept. 1994

A5



NOTES:

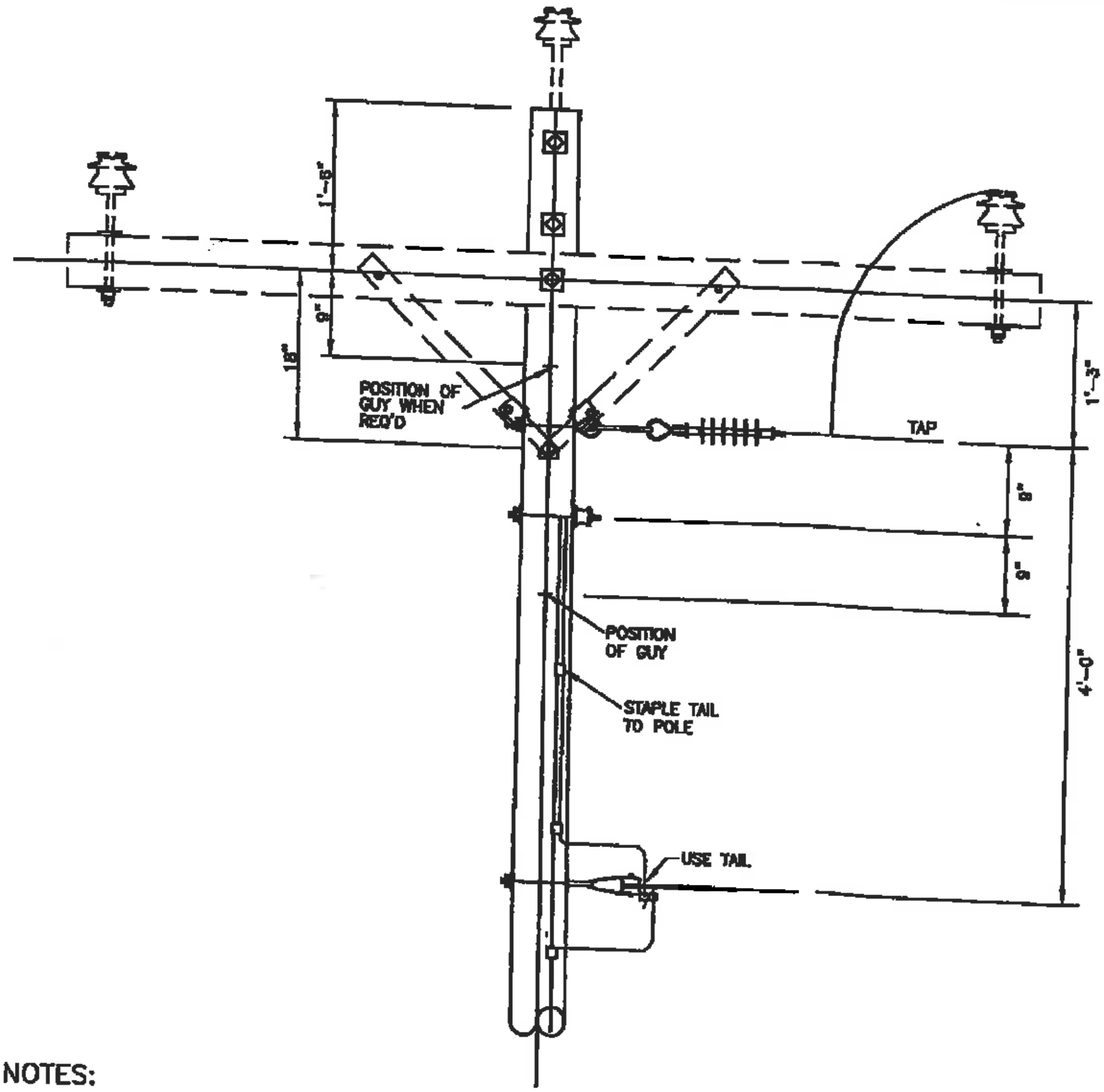
A5-2 ASSEMBLY MAY BE USED WITH DRAWINGS SUCH AS B1, B1-1, B2, B7 C1, C1-2, C1-3, C1-4, C2-1 & C2-2. (SEE TAPE ASSEMBLY GUIDE M29-1 AND M29-2)

SPECIFY A5-2A FOR TAP TO EXISTING EYEBOLT.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, 2 1/4" Square	0610			
1	Insulator, Polly	1110			
2	Bolt, eye, 5/8"	0320			
1	Ins. Spool Sec.	1020			
1	Hot Line Clamp	2000			
1	Deadend Clamp, Primary	1910			
1	Clevis, Sec. Swing J 6	1815			
2	Clamp C412	1950			
1	Extension Link	1130			

7.2/12.5 KV. PRIMARY, 1-PHASE TAP

Revised Sept. 1994	A5-2



NOTES:

1. VA5–2 assembly may be used with two & three phase units.
2. See drawing VM29–1 for tap assembly guide.
3. Attach to closest phase if load balance allows.

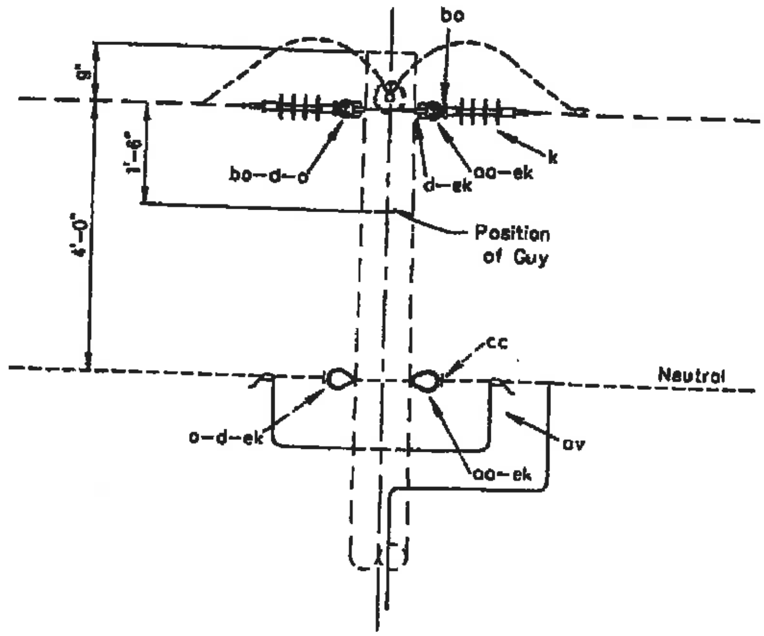
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Eye Bolt, 5/8" x Req'd Length	0320			
2	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec	102000			
1	Ext Link For Susp Insulator	113000			
1	Clevis, Swinging J6	181500			
1	DE Clamp 4 Thru 1/0 ACSR	191000			
1	1/0 ACSR Neutral DE Tie	195001			
1	2–4/0 AL Hot Line Clamp	200003			
1	Insulator, 25kv Polly Suspension	911001			

UP TO 1/0 ACSR

14.4/24.9 KV, 1–PHASE
SINGLE PHASE TAP

Revised
May 2003

VA5–2



NOTES:

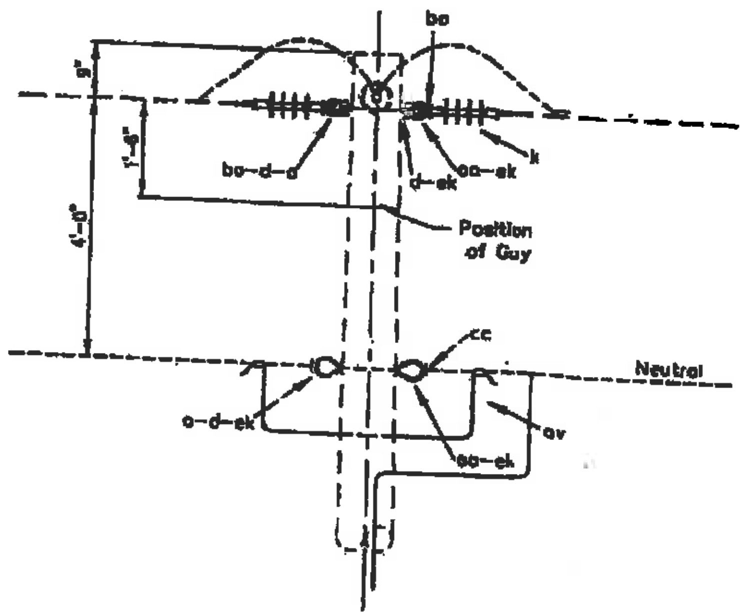
A6 MAY BE USED WITH DRAWINGS SUCH AS: M3-1, M3-1A, M3-10, M3-41, M3-23, M5-1, M5-4, M5-2 (AS SHOWN).

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Adapter, Pin Head	0960	2	Clamp, Pri. D.E.	1910
1	Washer, Square	0610	1	Clamp Hot Line	2000
4	Insulator, Polly	1110	1	Bolt, D.A.	0270
1	Ins. Pin Type	1040	3	Connectors, Small	3000
2	Bolt, Eye 5/8"	0320	2	Ins. Spool Sec.	1020
2	Nut, Eye 5/8"	0640	2	Clevis, Sec. J 6	1815
			4	Clamp C412	1950

1-PHASE VERTICAL DEADEND
(DOUBLE)

Revised
Sept. 1994

A6



NOTES:

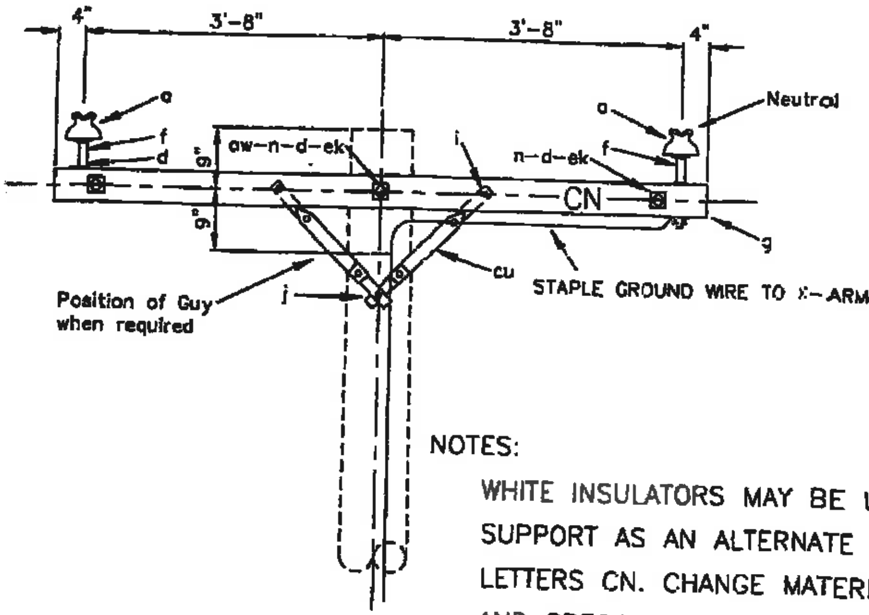
A6 MAY BE USED WITH DRAWINGS SUCH AS: M3-1, M3-1A, M3-10, M3-41, M3-23, M5-1, M5-4, M5-2 (AS SHOWN).

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Adapter, Pin Head	0960	2	Clamp, Pri. D.E.	1910
1	Washer, Square	0610	1	Clamp Hot Line	2000
4	Insulator, Polly	1110	1	Bolt, D.A.	0270
1	Ins. Pin Type	1040	3	Connectors, Small	3000
2	Bolt, Eye 5/8"	0320	2	Ins. Spool Sec.	1020
2	Nut, Eye 5/8"	0640	2	Clevis, Sec. J 6	1815
			4	Clamp C412	1950

1-PHASE VERTICAL DEADEND
(DOUBLE)

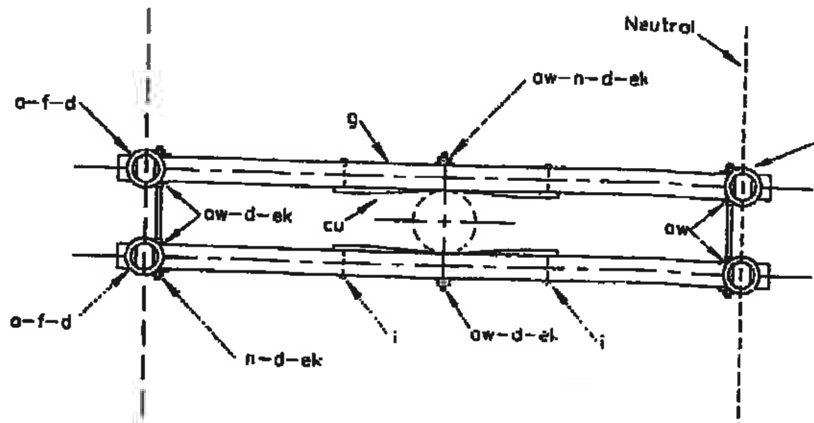
Revised
Sept. 1994

VA6 - P



NOTES:

WHITE INSULATORS MAY BE USED FOR THE NEUTRAL SUPPORT AS AN ALTERNATE TO THE BROWN INSULATOR AND LETTERS CN. CHANGE MATERIAL LIST AS NECESSARY AND SPECIFY AS A9W.



PLAN

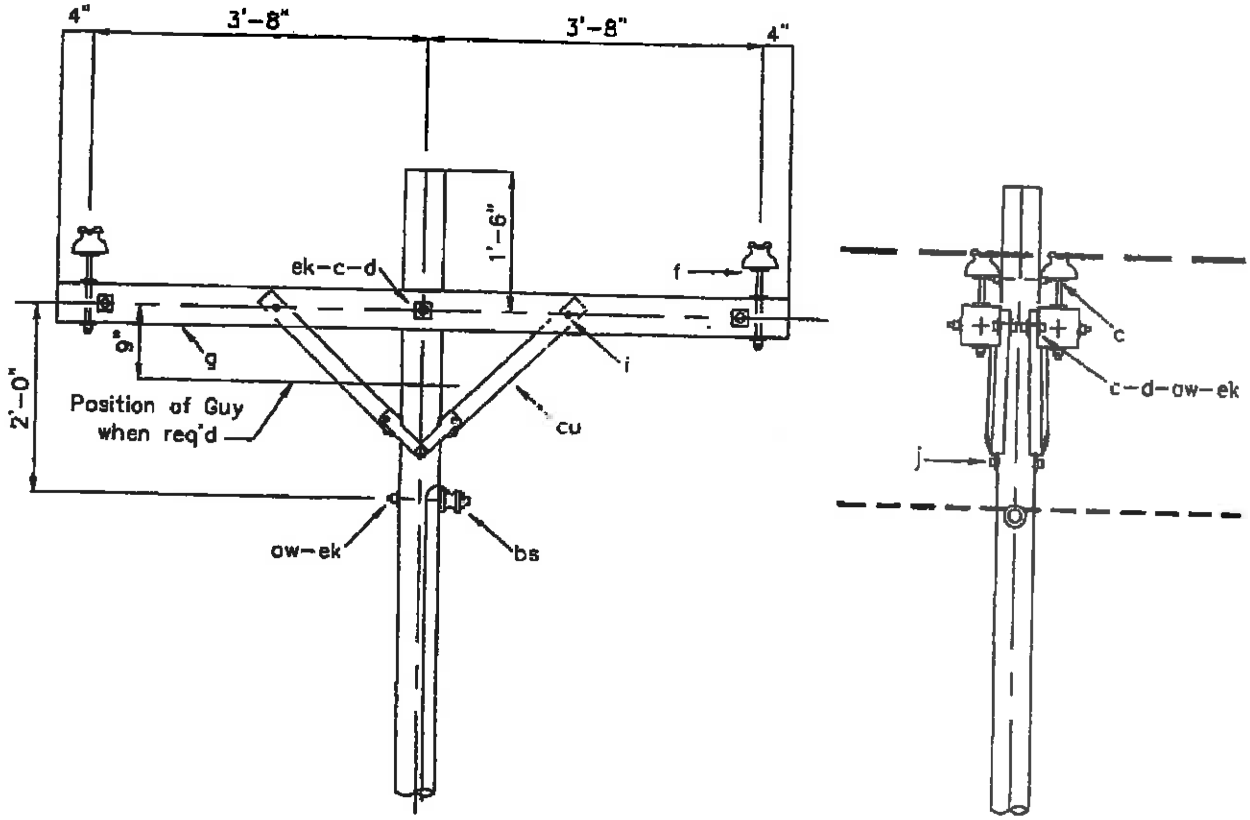
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Insulator, Pin Type	1040	4	Bolt, Carriage	0210
10	Washer, 2 1/4" Square	0610	2	Screw, Lag	0550
4	Pin, Crossarm, Steel	0910	3	Bolt, Double Arming	0270
2	Crossarm, 8' X 3 3/4" X 4 3/4"	0710			
4	Brace, 28"	0800			

2, 4 & 1/0 ACSR COND

7.2/12.5 KV.,
1-PHASE CROSSARM CONSTRUCTION-
DOUBLE LINE ARM

Revised
Sept. 1994

A9



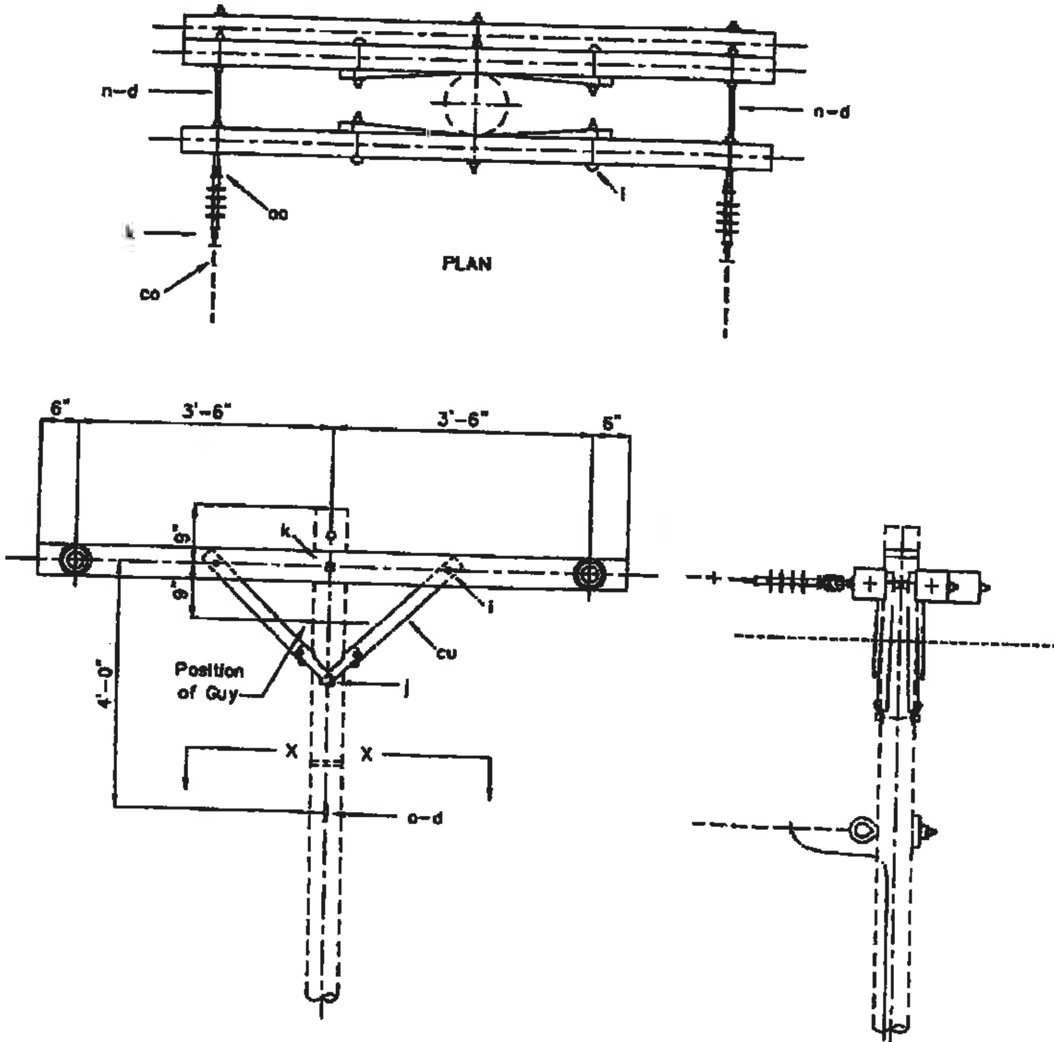
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Insulator, Pin Type	1040	4	Bolt, Carriage	0210
11	Washer, 2 1/4" Square	0610	2	Screw, Lag	0550
4	Pin, Crossarm, Steel	0910	3	Bolt, Double Arming	0270
2	Crossarm, 8'X 3 3/4" X 4 3/4"	0710	1	Bolt, Double Upset	0425
4	Brace, Wood, 28"	0800	1	Ins. Spool Sec.	1020

2, 4 & 1/0 ACSR COND

7.2/12.5 KV. 2-PHASE, CROSSARM CONSTRUCTION DOUBLE PRIMARY SUPPORT AT 0° TO 5° ANGLE

Revised Sept. 1994

B1-1



Notes:

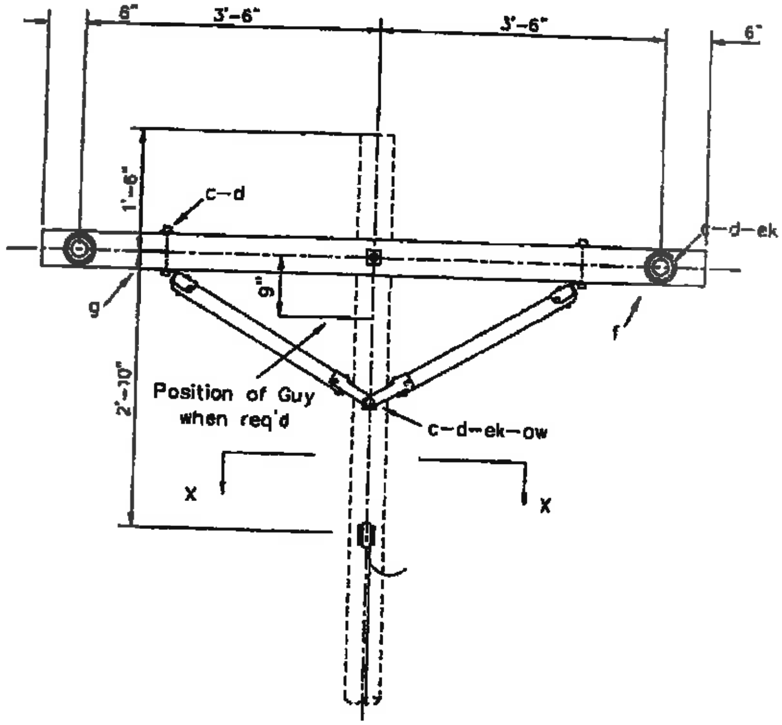
1. Designate as B7-1 for assembly with three crossarms.
2. See drawing E5-1 for crossarm loading limitations.

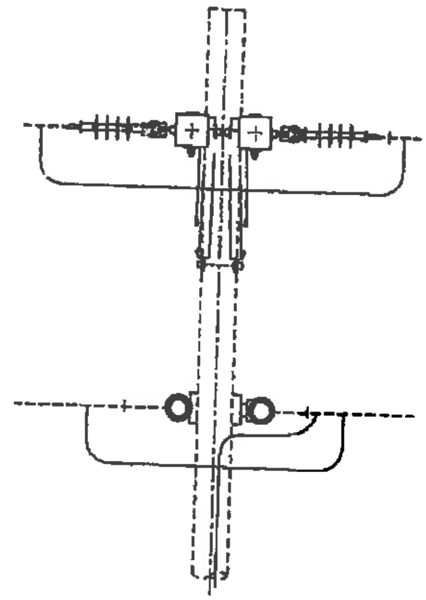
Quan.	Material	Item No.	Quan.	Material	Item No.
14	Washer, Square	0610	3	Bolt, D.A.	0270
3	Crossarm 8'	0710	1	Bolt, Eye	0320
4	Brace, Steel 28"	0800	2	Nut, Eye	0640
4	Bolt, Carriage	0210	2	Clamp, Pri, D.E.	1910
2	Screw, Lag	0550	1	Clevis, Sec. J 6	1815
4	Insulator, Polly	1110	2	Clamp, C 412	1950
1	Connector, Small	3000	1	Ins. Spool Sec.	1020

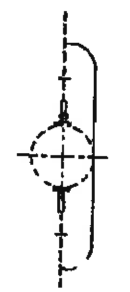
TWO-PHASE CROSSARM CONSTRUCTION
DEADEND (SINGLE)

Revised
Sept. 1994

B7-1







SECTION X-X

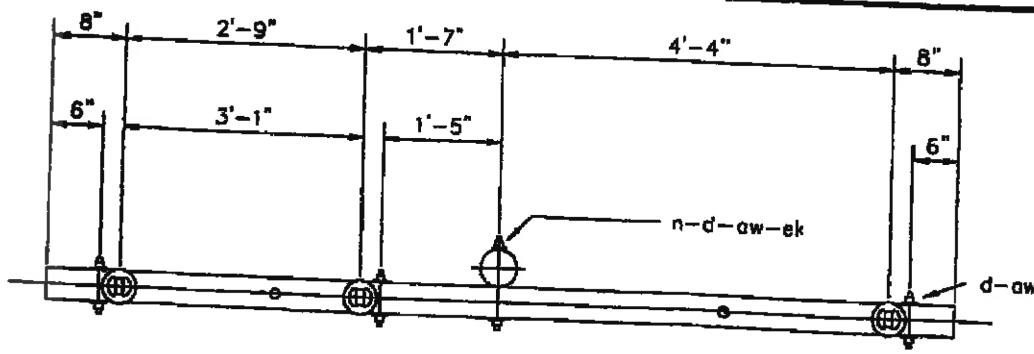
Quan.	Material	Item No.	Quan.	Material	Item No.
12	Washer, Square	0610	3	Bolt, D.A.	0270
2	Crossarm, 8' X 3 3/4" X 4 3/4"	0710	1	Bolt, Eye 5/8"	0320
4	Bolt, Carriage	0210	5	Nut, Eye 5/8"	0640
4	Brace, 28" Wood	0800	4	Clamp, Pri. D.E.	1910
4	Ins. Susp. Polly	1110	2	Clevis, Sec. J 6	1815
4	Washers, Round	0600	2	Ins. Spool Sec.	1020
2	Lag. Screw	0550	4	Clamps, C412	1950

2, 4 & 1/0 ACSR COND

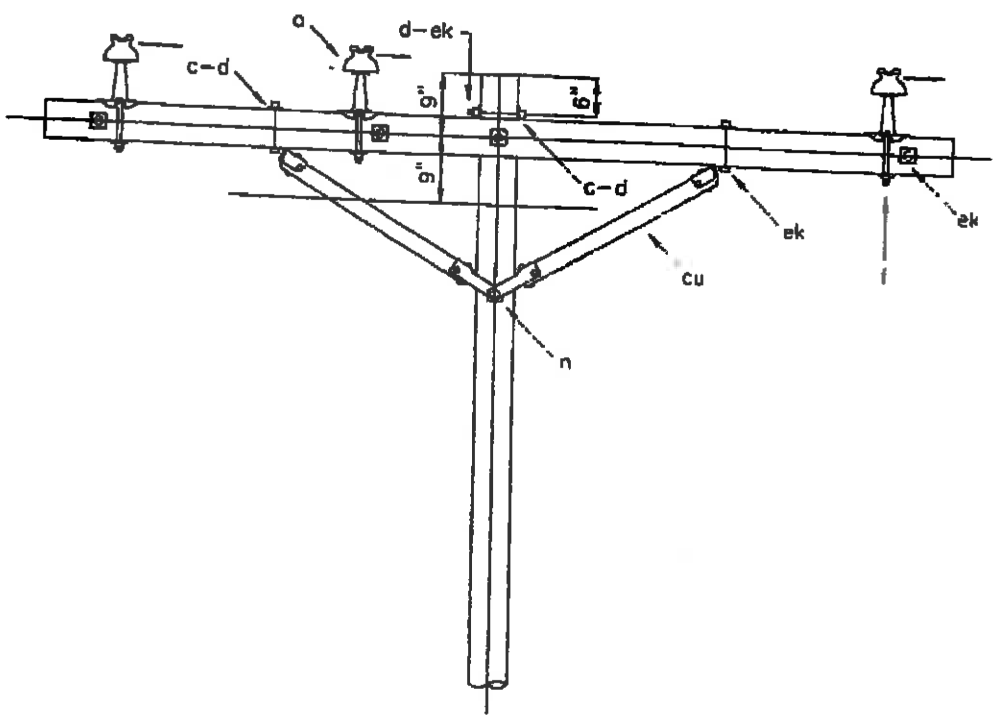
TWO-PHASE CROSSARM CONSTRUCTION DEADEND

Revised Sept. 1994

B8



PLAN

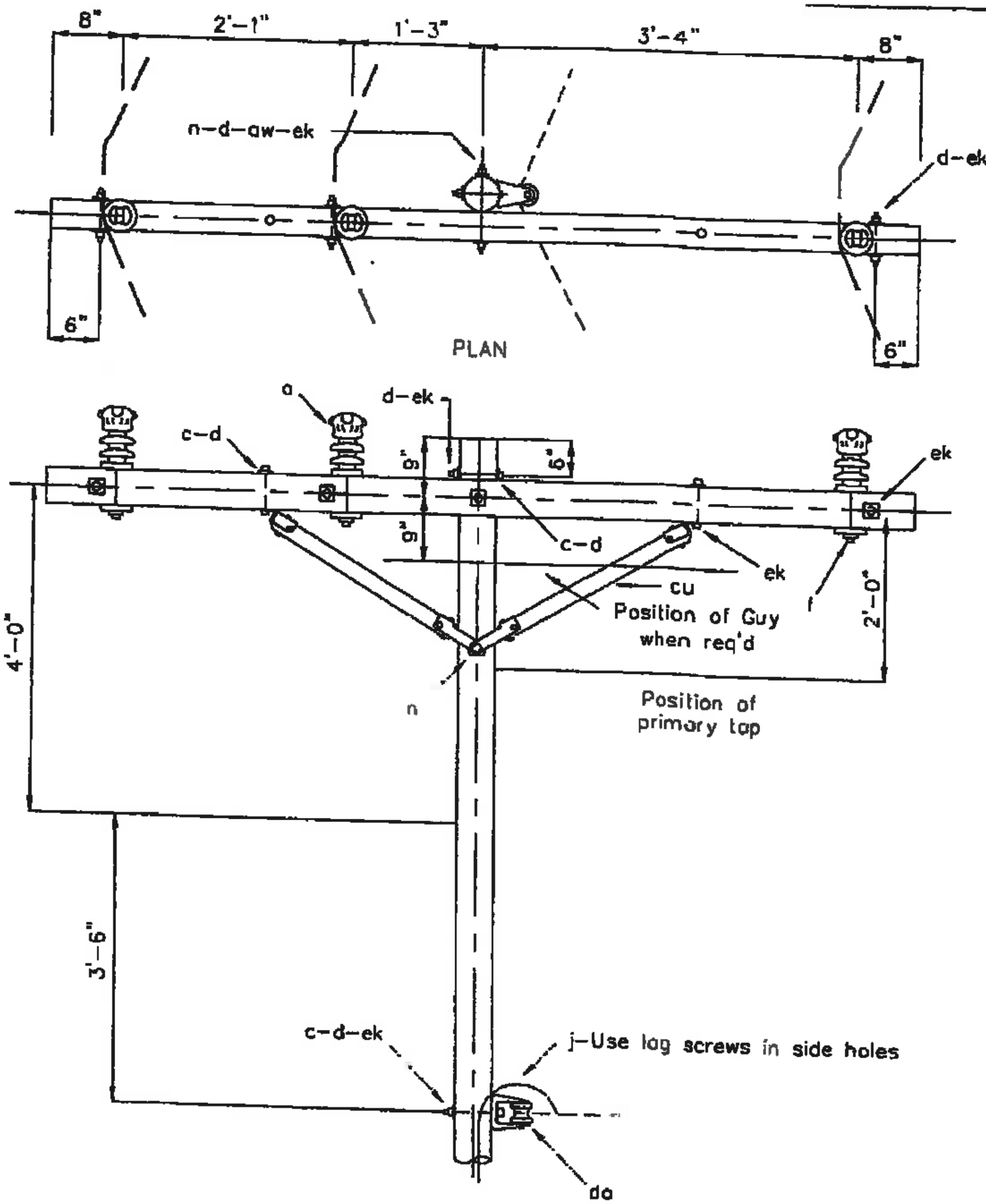


Quan.	Material	Item No.	Quan.	Material	Item No.
3	Ins. Pin Type	1040	3	Saddle Pins	0930
5	Bolt, Machine, 5/8"	0370	1	Crossarm 10' X 3 3/4" X 4 3/4"	0735
2	Bolt, Machine, 1/2"	0350	1	Brace, Wood 60"	0860
9	Washer, 2 1/4" X Square	0610			
2	Washer, Round	0600			

3/0, 336.4 & 795 MCM

Revised
Sept. 1994

C1-2U



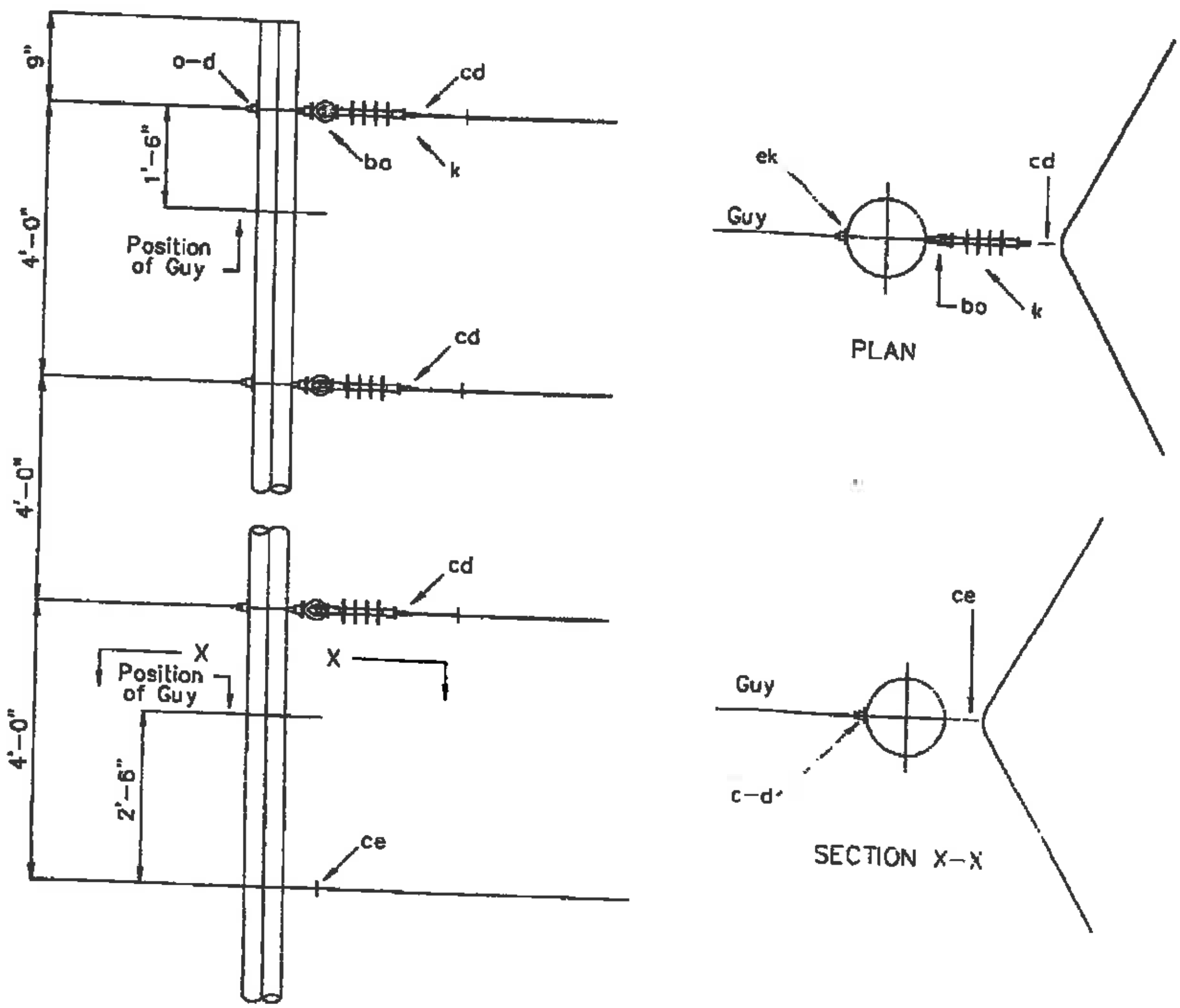
Quan.	Material	Item No.	Quan.	Material	Item No.
3	Insulator Top, Post	1073	2	Bolt, Machine 1/2"	0350
2	Bolt, Machine, 5/8"	0370	2	Washer, Round	0600
8	Washer, Square	0610	5	Bolt, Machine 5/8"	0370
1	X-Arm, 3 3/4" x 4 3/4" x 8'	0710	1	Connectors	3010
1	Brace, Wood 60"	0860	1	Clevis, Sec. J10	1810
			1	Ins. Spool Sec.	1020

795 MCM CONDUCTOR

12.5 PRIMARY 3 PHASE 4 WIRE STAR
CROSSARM CONSTRUCTION
SINGLE PRIMARY SUPPORT, 0° TO 3° ANGLE
(LARGE CONDUCTORS)

Revised
Sept. 1994

C1H



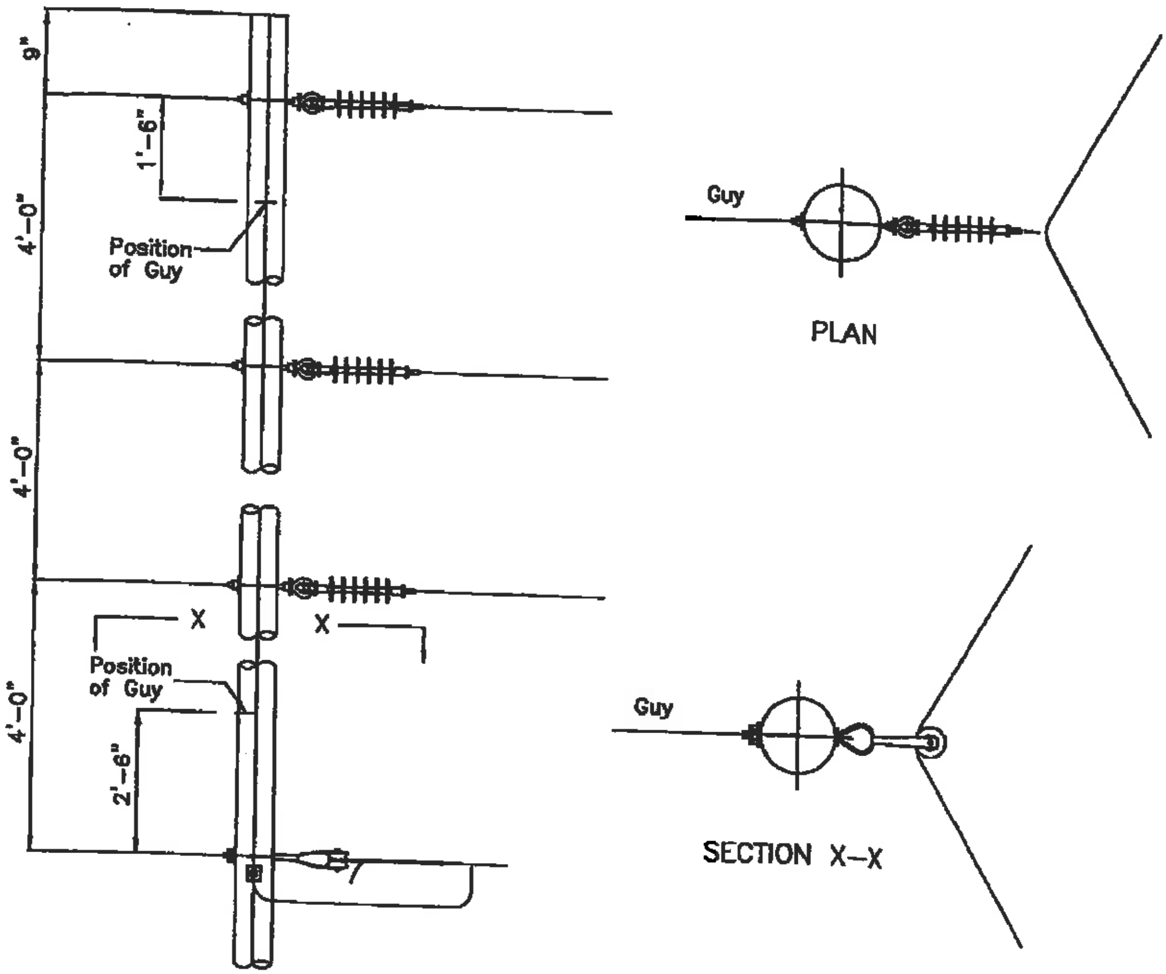
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Washer, 2 1/4" Square	0610	3	Shackle, Anchor	1360
6	Insulator, Polly	1110	3	Clamp, Angle Primary	1960
4	Bolt, Eye	0320	1	Clevis Sec. Swing. J 6	1815
			1	Ins. Spool Sec.	1020

2 & 1/0 ACSR

7.2/12.5 KV. 3-PHASE
VERTICAL CONSTRUCTION—30° TO 60° ANGLE

Revised
Sept. 1994

C3



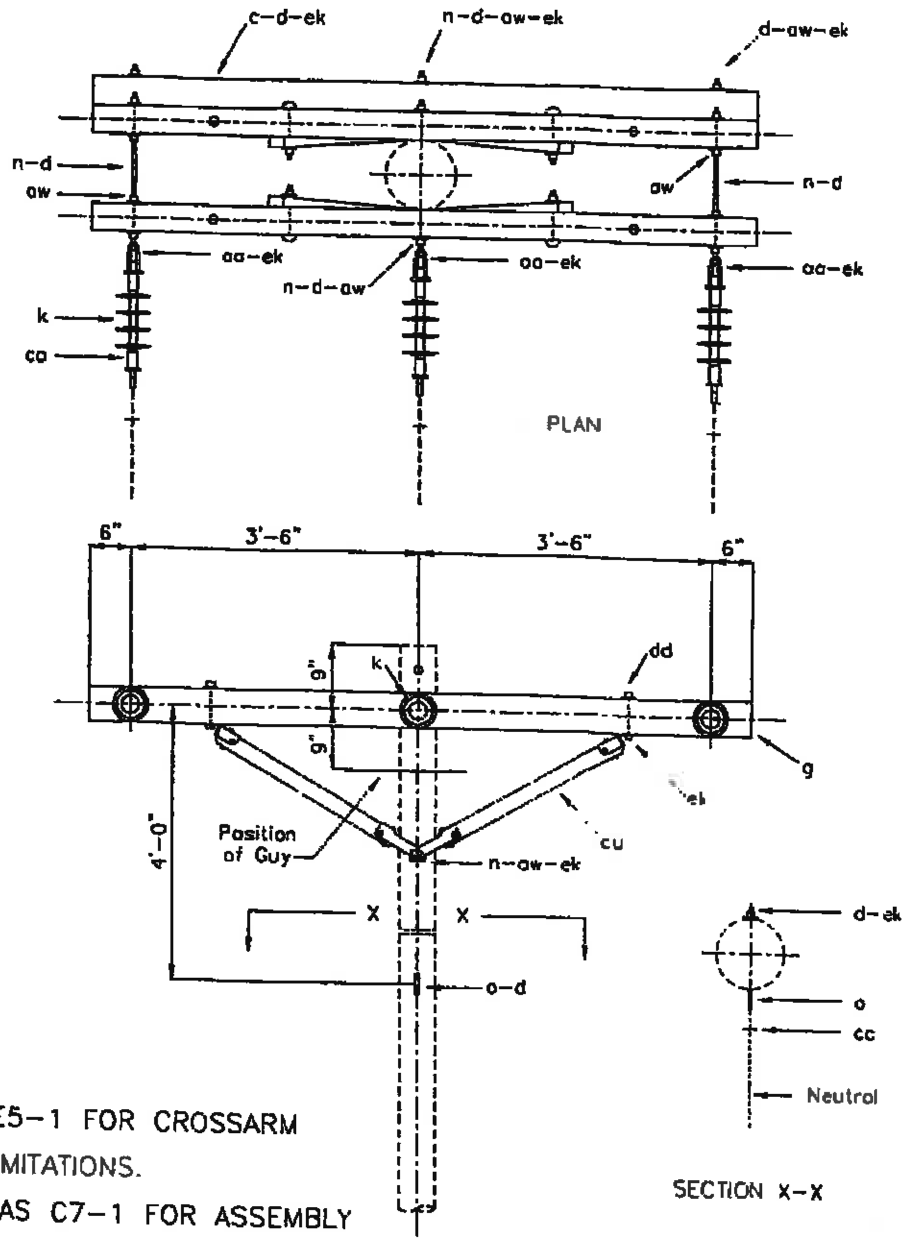
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Eye Bolt, 5/8" Req'd Length	0320			
4	Washer, Square 11/16" Hole	061001			
1	Insulator, Spool Sec large	103000			
3	Anchor, Shackel 3"	136001			
1	Clevis, Swinging J6	181500			
3	Clamps, Angle 795 MCM	198500			
3	Insulator, 25kV Polly Suspension	911001			

795 MCM

14.4/24.9 KV, 3-PHASE
VERTICAL CONSTRUCTION
30° TO 60° ANGLE

Revised
May 2003

VC3L



NOTES:

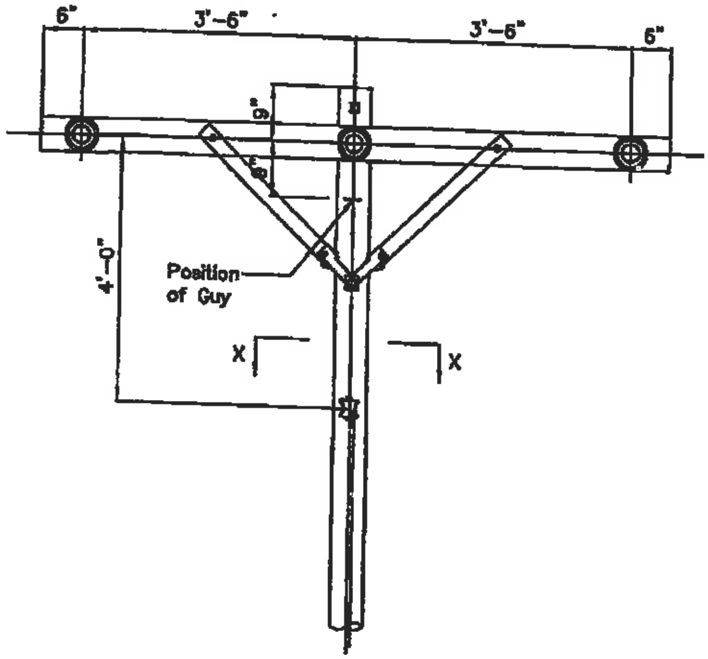
1. SEE DWG. E5-1 FOR CROSSARM LOADING LIMITATIONS.
2. DESIGNATE AS C7-1 FOR ASSEMBLY WITH THREE CROSSARMS.

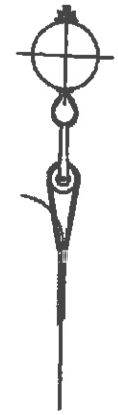
Quan.	Material	Item No.	Quan.	Material	Item No.
11	Washer, 2 1/4" Square	0610	3	Bolt, Double Arming	0270
2	Crossarm, 8'	0700	1	Bolt, Eye, 5/8"	0320
4	Brace, 28"	0800	3	Nut, Eye, 5/8"	0640
4	Bolt, Carriage	0210	1	Clevis, Sec. Swing J 6	1815
2	Screw, Lag	0550	1	Ins. Spool Sec.	1020
6	Insulator, Polly	1110	2	Clamp, C412	1950
3	Deadend, Clamp Pri.	1910			
1	Connector	3000			

3-PHASE CROSSARM CONSTRUCTION
DEADEND (SINGLE)

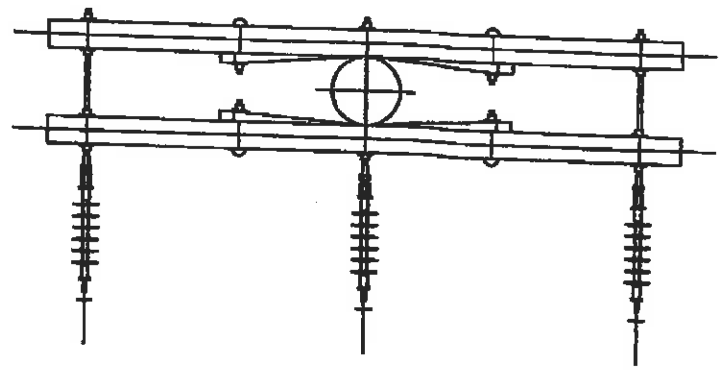
Revised
Sept. 1994

C7,C7-1





SECTION X-X



PLAN

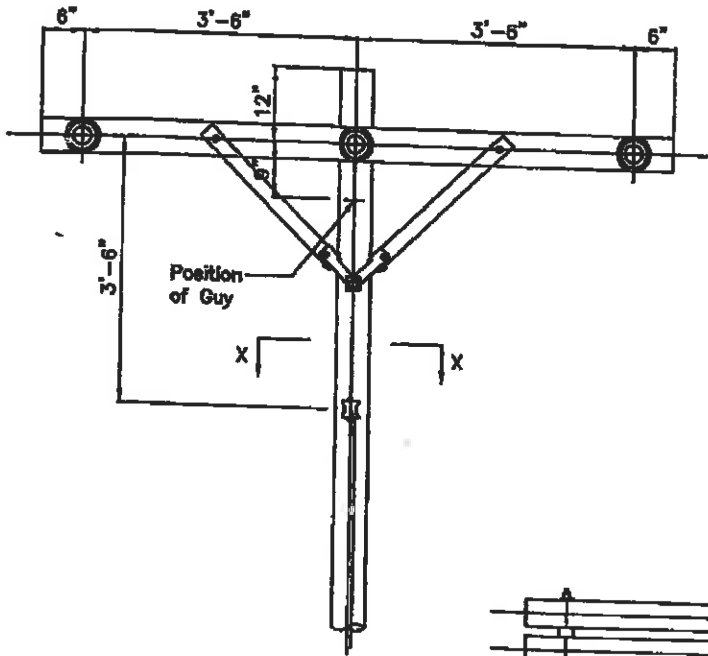
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Carriage Bolt, 3/8"	021000	1	Insulator, Spool Sec	102000
3	DA Bolt, 5/8" x Req'd Length	0270	1	Clevis, Swinging J6	181500
1	Eye Bolt, 5/8" x Req'd Length	0320	3	DE Clamp 4 Thru 1/0 ACSR	191000
2	Large Lag Screw	055002	1	1/0 ACSR Nuetral DE Tie	195001
11	Washer, Square 11/16" Hole	061001	3	Insulator, 25kV Polly Suspension	911001
3	Nut, Oval Eye	064000			
2	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			

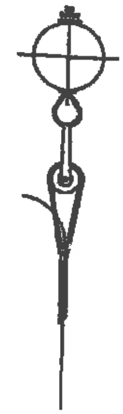
UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
SINGLE DEADEND

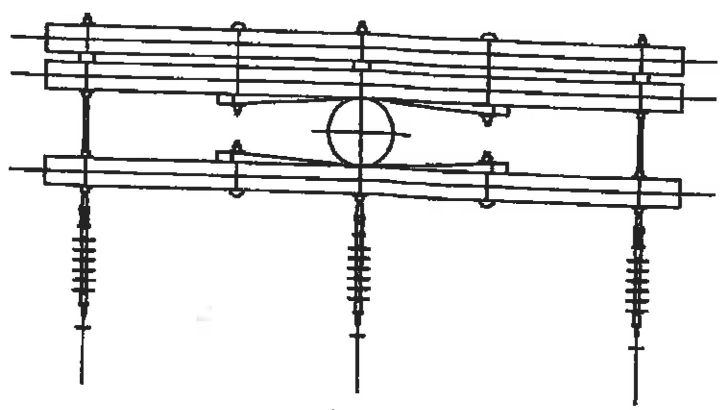
Revised
May 2003

VC7





SECTION X-X



PLAN

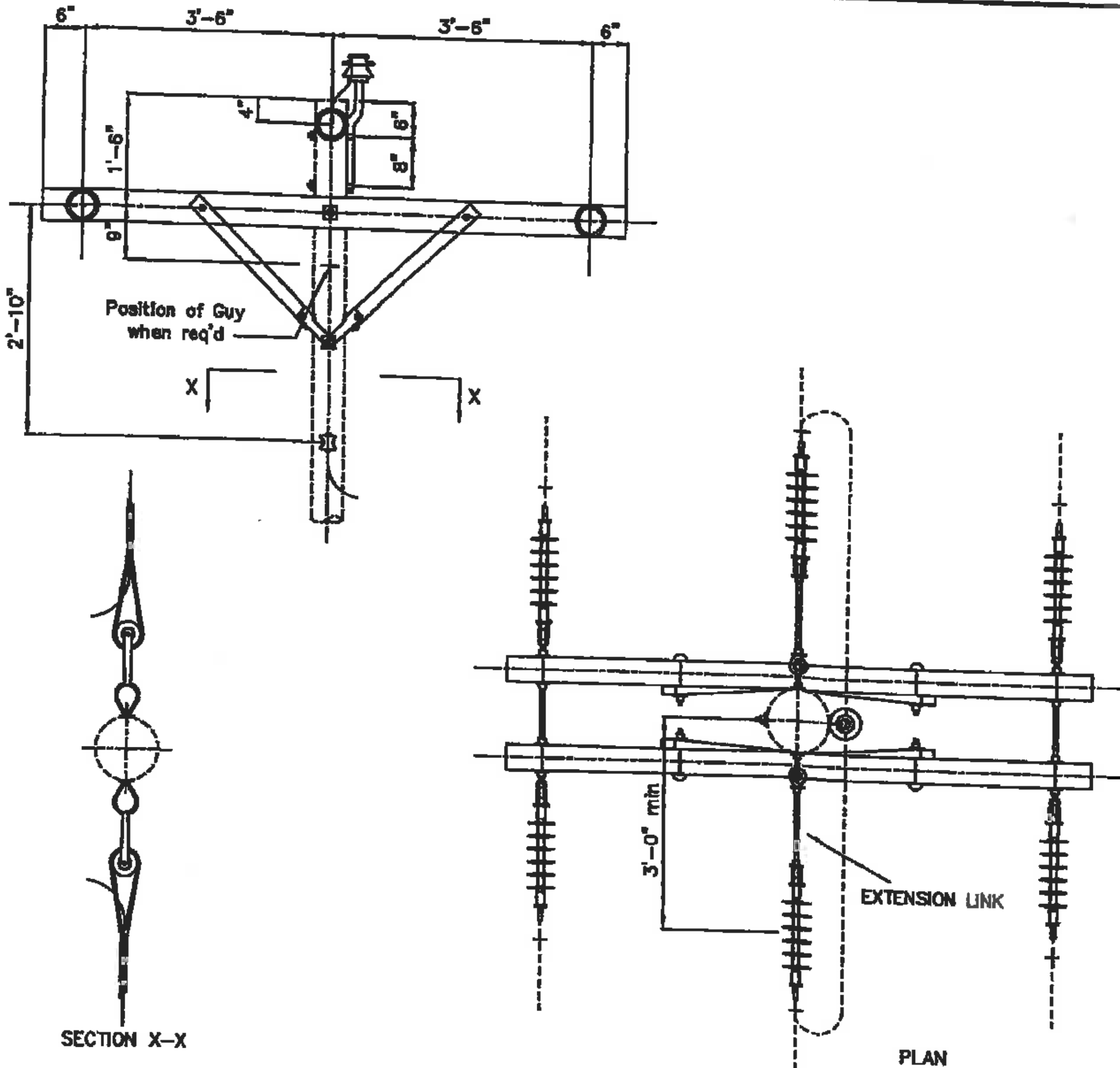
Quan.	Material	Item No.	Quan.	Material	Item No.
4	Carriage Bolt, 3/8"	021000	1	Insulator, Spool Sec	102000
3	DA Bolt, 5/8" x Req'd Length	0270	1	Clevis, Swinging J6	181500
1	Eye Bolt, 5/8" x Req'd Length	0320	3	DE Clamp 4 Thru 1/0 ACSR	191000
2	Large Lag Screw	055002	1	1/0 ACSR Nuetral DE Tie	195001
14	Washer, Square 11/16" Hole	061001	3	Insulator, 25kV Polly Suspension	911001
3	Nut, Oval Eye	064000			
3	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			

UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
SINGLE DEADEND

Revised
May 2003

VC7-1



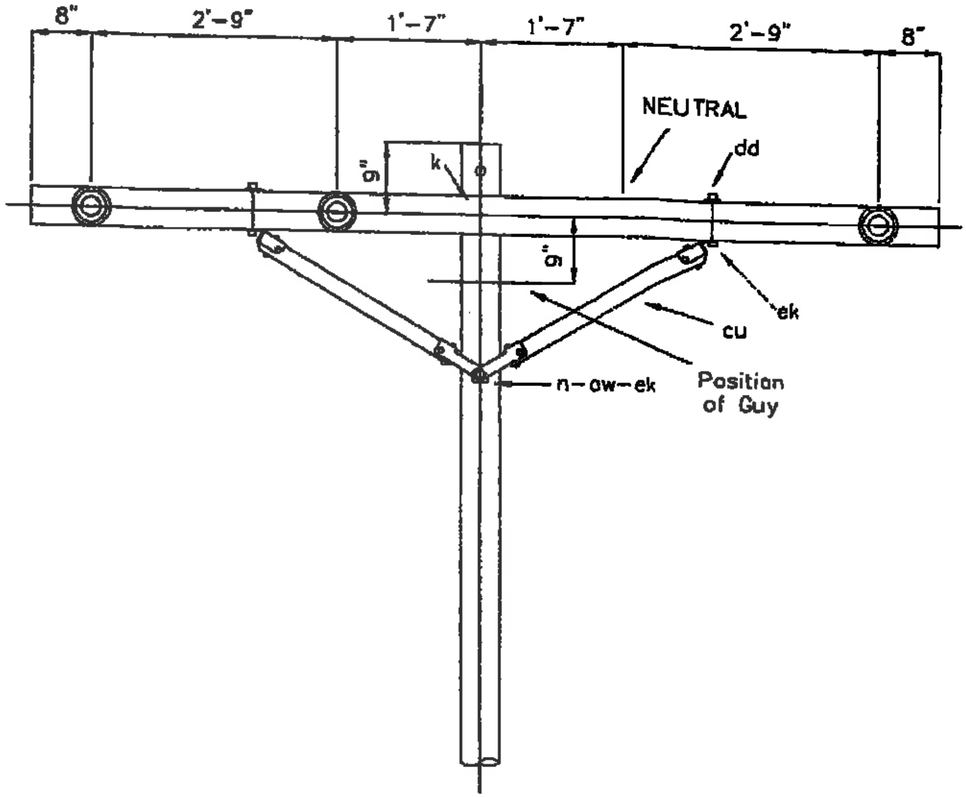
Quan.	Material	Item No.	Quan.	Material	Item No.
3	DA Bolt, 5/8" x Req'd Length	0270	1	Insulator, Pin Type 25kV	107500
2	Eye Bolt, 5/8" x Req'd Length	0320	2	Ext Link For Susp Insulator	113000
2	Mach Bolt, 5/8" x Req'd Length	0370	2	Clevis, Swinging J6	181500
2	Large Lag Screw	055002	6	DE Clamp 4 Thru 1/0 ACSR	191000
15	Washer, Square 11/16" Hole	061001	2	1/0 ACSR Neutral DE Tie	195001
6	Nut, Oval Eye	064000	6	Insulator, 25kV Polly Suspension	911001
2	Crossarm 3 3/4" x 4 3/4" x 8'	071000			
4	Brace, Wood 28"	080001			
1	Pin, Pole Top 25kV Offset	092501			
2	Insulator, Spool Sec	102000			

UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE DEADEND

Revised May 2003

VC8



#2 & 1/0 ACSR CONDUCTORS

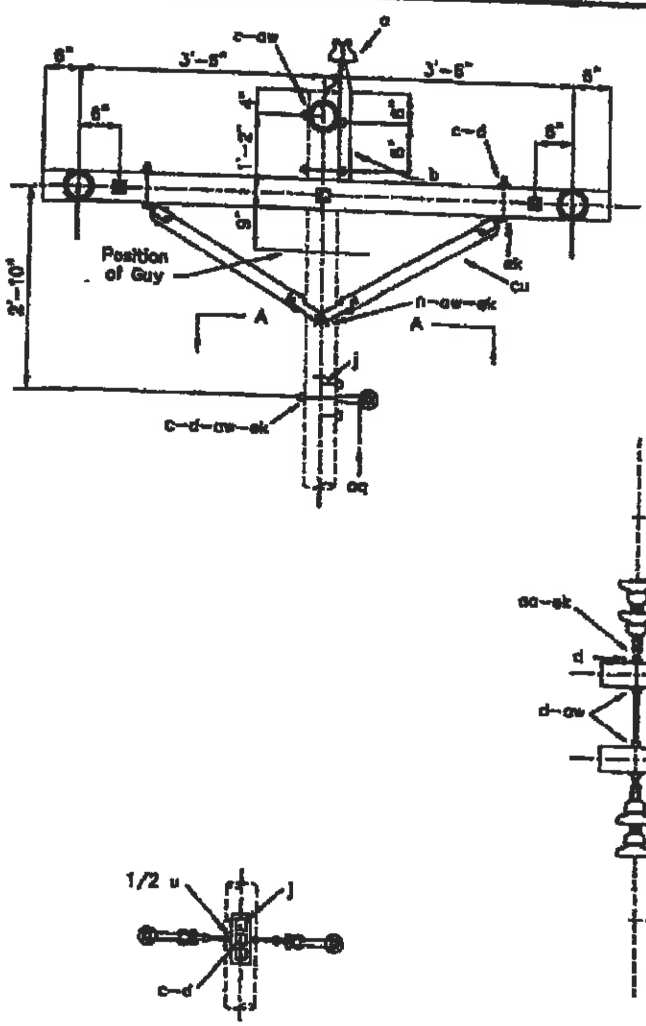
Quan.	Material	Item No.	Quan.	Material	Item No.
19	Washers, Square	0610	8	Nut, Eye	0640
2	Crossarm, 10'	0735	6	Clamp, Pri. D.E.	1910
4	Brace, 28"	0800	2	Clevis, Sec. J6	1815
1	Bolt, Machine 5/8"	0370	2	Ins. Sec. Spool	1020
4	Bolt, Machine 1/2"	0350	4	Clamp. C412	1950
6	Ins. Polly	1110	2	Screw, Lag	0550
4	Washer, Round	0600			
4	Bolt, D.A.	0270			

2 & 1/0 ACSR
NEUTRAL ON X-ARM

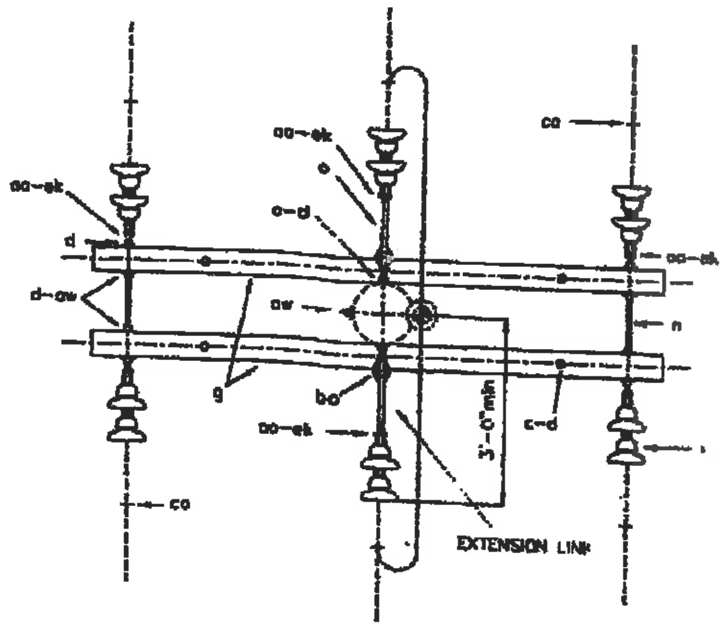
3-PHASE CROSSARM CONSTRUCTION
#2 & 1/0 ACSR PRI.

Revised
Sept. 1994

C8-1



ELEVATION



PLAN

3/0 & 336.4 CONDUCTOR

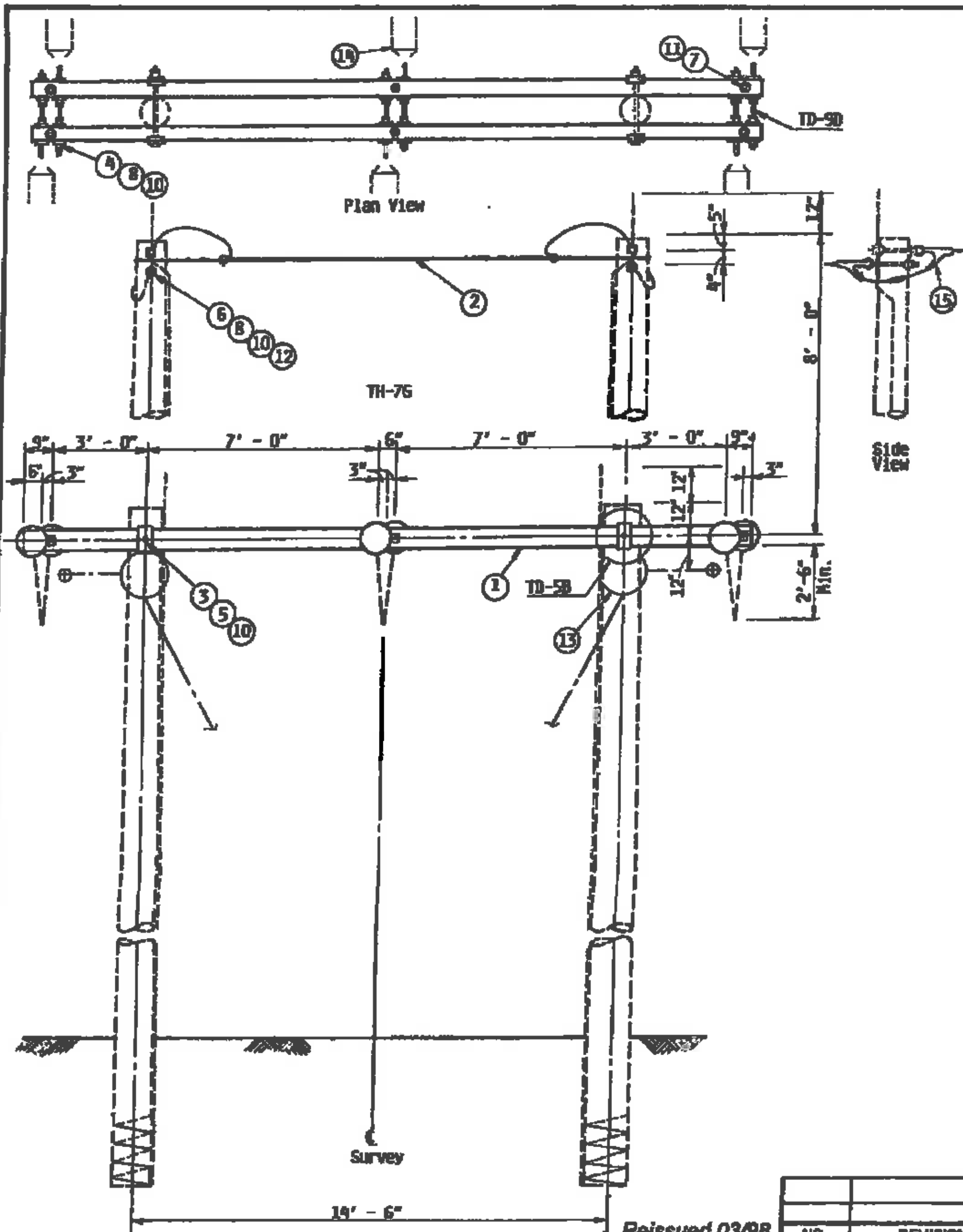
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Bolt, Machine, 5/8"	0370	1	Bolt, Eye, 5/8"	0320
4	Bolt, Machine, 1/2"	0350	1	Ins. Pin Type	1040
14	Washer, 2 1/4" Square	0610	2	Ins. Spool Sec.	1030
4	Washer, Round	0600	8	Nut, Eye, 5/8"	0640
1	Pin, P.T. 20"	0900	4	Clamp, C413	1951
2	Crossarm, 8' 3 3/4" x 4 3/4"	0710	6	Deadend Clamp, Pri.	1930
2	Ext. Links	1130	2	Clevis Sec. Swing J6	1815
13	Insulator, Suspension, Polly	9110	2	Brace, Wood, 60" Span	0860
3	Bolt, Double Arming	0270	4	Connectors	3010
2	Screws, Lag	0550			

3/0 & 336.4 MCM CONDUCTOR

7.2/12.5 KV. 3-PHASE
CROSSARM CONSTRUCTION
DEADEND (DOUBLE)
LARGE CONDUCTORS

Revised
Sept. 1994

C8-2P



DRG. REF	TH- 7	7G	LIST OF MATERIALS DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	X-Arm, 5 5/8"x7 3/8"x22'-0", #N2		TCD-20	
2	-	1	Grounding Assembly, Pole Tie		TM-9C	
3	4	4	Plate, Crossarm Reinforcing			
4	6	6	3/4" Bolt, D'ble Arm'g Eye by r.l.	dy		
5	2	2	3/4" Bolt, Machine, by req'd length	c		
6	-	4	3/4" Bolt, Shoulder Eye, by r.l.	o		
7	6	6	1/2" Bolt, Washer Head w/Washer nut	c		
8	24	24	Washer, Flat 4"sq.x3/16", 13/16" hole	d		
9	-	4	Washer, Curved, 4"sq.x1/4",13/16"hole	d		
10	20	24	3/4" Locknut, MF Type	ek		
11	6	6	1/2" Locknut, MF Type	ek		
12	2	2	3/4" Clamp, Groundwire, + 1 nut	dp		
13	2	2	GUY ATTACHMENT, ____LIGHT___ DUTY		TG-16A	
14	6	6	INSULATOR ASSEMBLY, DEADEND		TM-	
15	-	4	OHGW ASSEMBLY, DEADEND		TM-	
16						

NOTES:

1. Drawing TE-1 gives guidance to subassembly alternatives.
2. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.
3. Use a TG-1 type guying assembly with item 13.

Reissued 03/98

NO.	REVISION	DATE

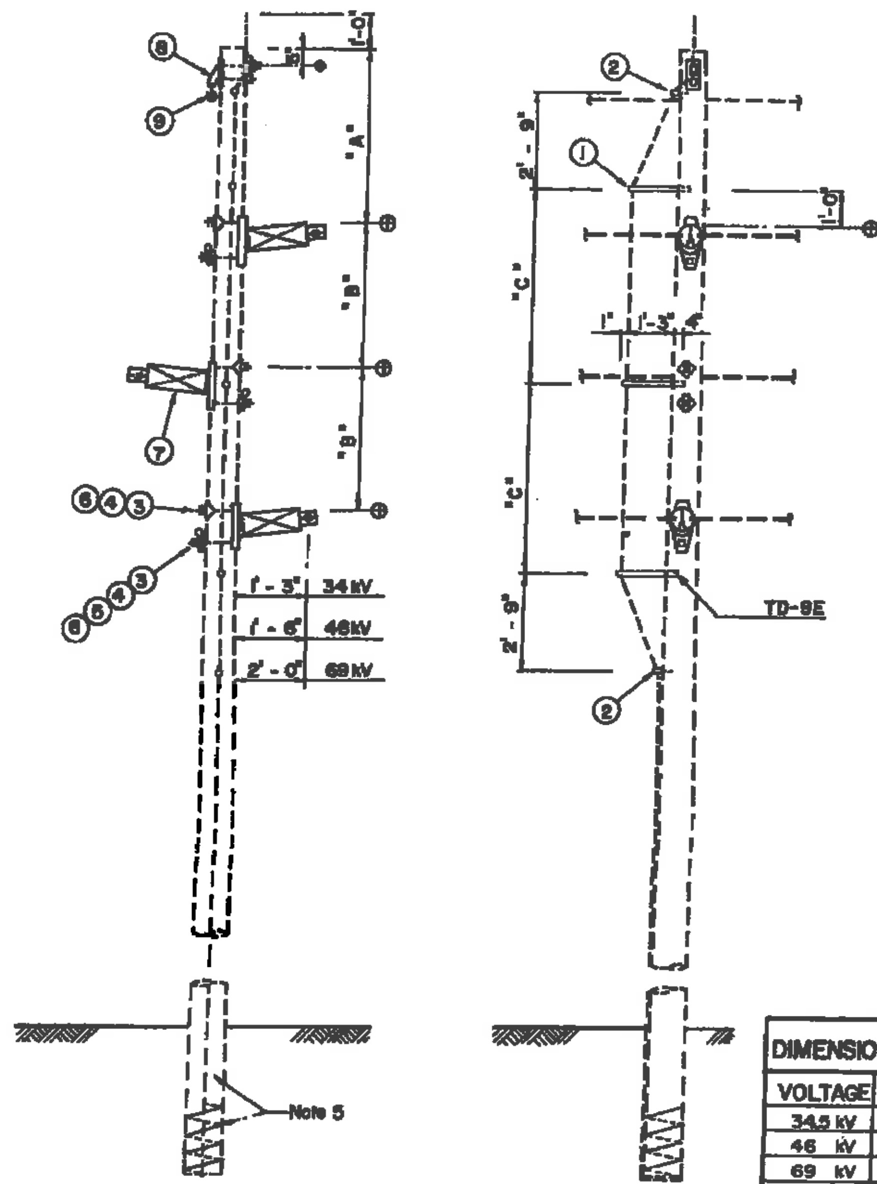
TRANSMISSION LINE STRUCTURE

TWO POLE DOUBLE DEADEND

(69 kV MAXIMUM)

Aug., 1986

TH-7, 7G



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	Rod, Fiberglass, 3/4" x 1'-8"			
2	2	Wireholder, w/#22 wood screw	ar		
3	6	3/4" Bolt, Machine, by req'd length	c		
4	6	Washer, Curved, 4" sq.x 1/4", 13/16" hole	d		
5	3	Washer, Spring, 13/16" hole	aw		
6	6	3/4" Locknut, MF Type	ek		
7	3	INSULATOR, HORIZONTAL POST, WITH CLAMP	-	TM-3	
8	1	OHGW SUPPORT ASSEMBLY	-	TM-6	
9	1	OHGW ASSEMBLY, TANGENT	-	TM-8	

NOTES:

1. Metal shims should be used to adjust post insulator when brackets are located on uneven pole surfaces.
2. Strength limitations of horizontal post:
   a. Maximum cantilever load 2,800 lbs.
   b. Maximum tensile and compression 5,000 lbs.
   (Loads a and b are simultaneous)
3. For strength limitations of overhead ground wire support assembly, see TM-6.
4. Drawing TE-1 gives guidance to subassembly alternatives.
5. The following materials are to be specified on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.

DIMENSIONS A, B, AND C

VOLTAGE	A	B	C
34.5 kV	5'-0"	4'-0"	5'-5"
46 kV	5'-6"	4'-6"	5'-11"
69 kV	6'-0"	5'-0"	6'-6"

NO.	REVISION	DATE

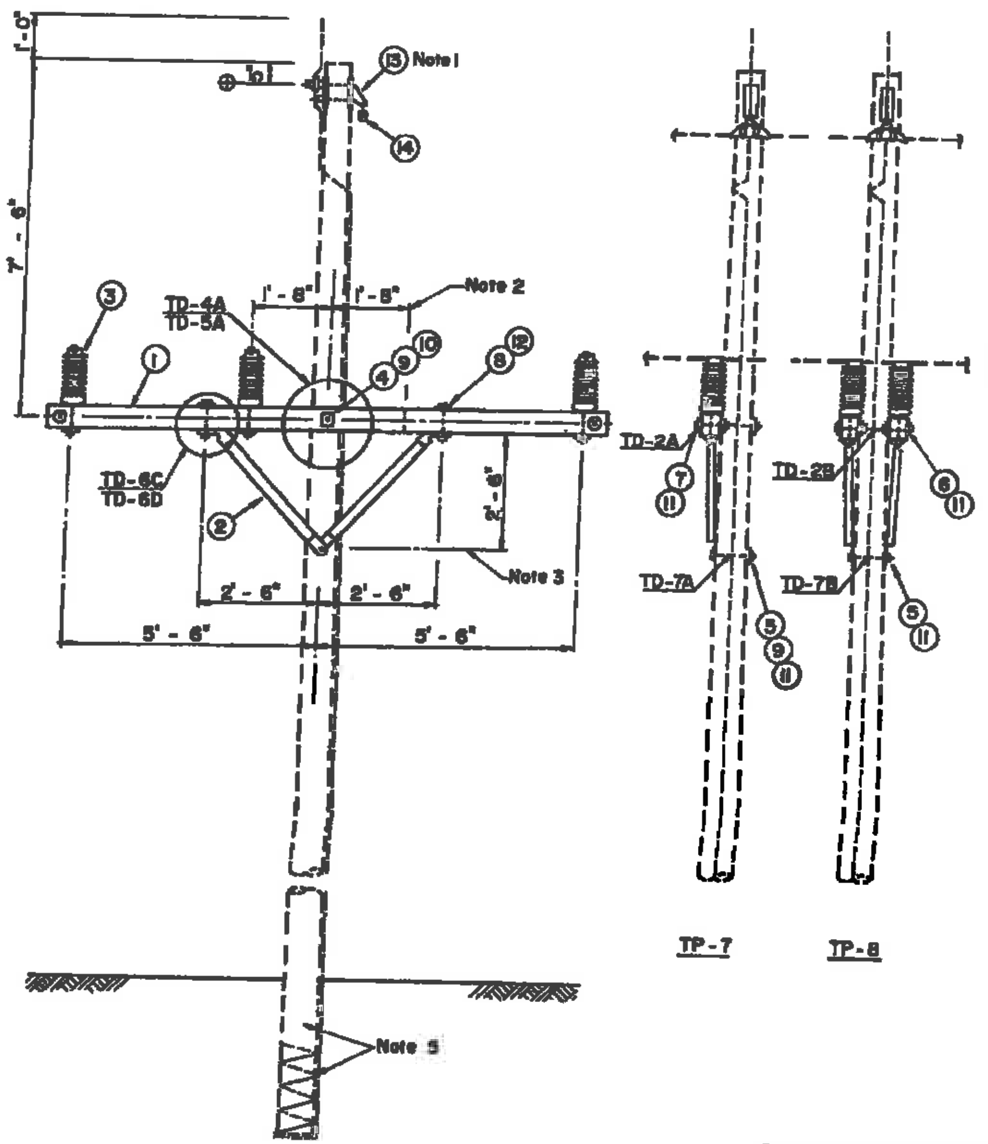
Reissued 03/98

TRANSMISSION LINE STRUCTURE

TANGENT HORIZONTAL LINE POST
(69 kV MAXIMUM)

Aug., 1986

TP-34G,46G,69G



LIST OF MATERIALS

DRG. REF.	TP-7	TP-8	DESCRIPTION	ITEM	DET.	CODE No.
1	1	2	X-Arm, 4-5/8" x 5-5/8" x 12'-0", #28		TCD-11	
2	1pr.	2pr.	Brace, X-Arm, 60"/30"	cu		
3	3	6	Insulator, Post Type, w/long mtg. hdwr.	eg		
4	1	1	3/4" Bolt, Machine, by req'd length	c		
5	1	1	5/8" Bolt, Machine, by req'd length	c		
6	-	2	5/8" Bolt, Double Arming, w/4 Washer Nuts	n		
7	2	-	5/8" Bolt, Washer Head, w/Washer Nut	c		
8	2	4	1/2" Bolt, Washer Head, by req'd length	c		
9	3	2	Washer, Flat, 2-1/4"sq. x 3/16", 13/16"h.	d		
10	1	1	3/4" Locknut, MF Type	ek		
11	3	3	5/8" Locknut, MF Type	ek		
12	2	4	1/2" Locknut, MF Type	ek		
13	1	1	OHGW SUPPORT ASSEMBLY, TANGENT	-	TM-5	
14	1	1	OHGW ASSEMBLY, TANGENT	-	TM-4	

NOTES:

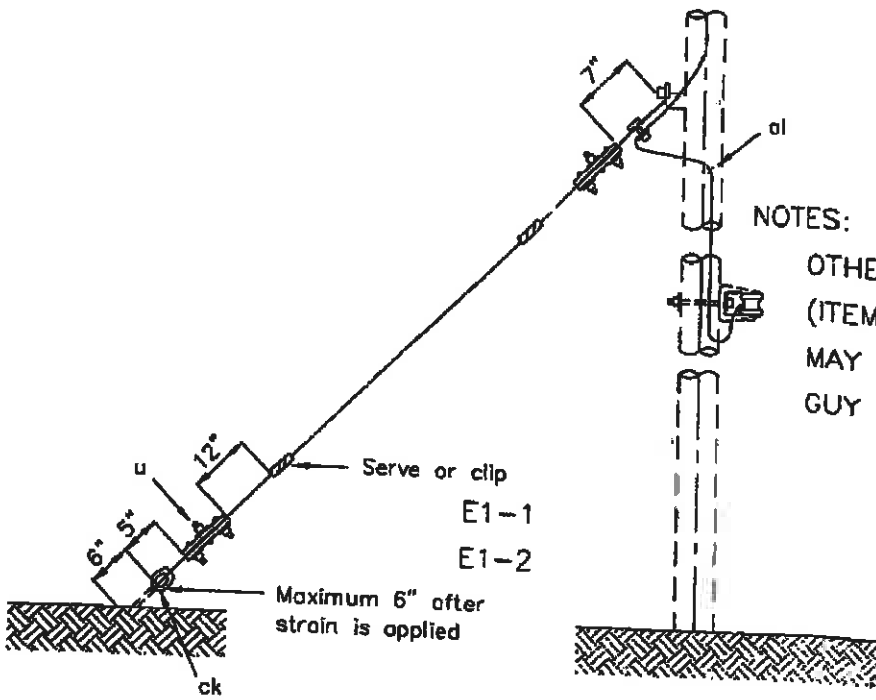
1. Mount items 13 and 14 on side opposite the inner post insulator.
2. Drill crossarm for alternate location of post insulator.
3. Field drilled holes shall be thoroughly treated.
4. At line angles, mount the OHGW Support Assembly on the interior angle side of the pole.
5. The following materials are to be specified separately on plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

No.	REVISION	DATE		
			Aug., 1986	TP - 7,8

TRANSMISSION LINE STRUCTURE

TANGENT LINE POST
(46 kV MAXIMUM)



NOTES:

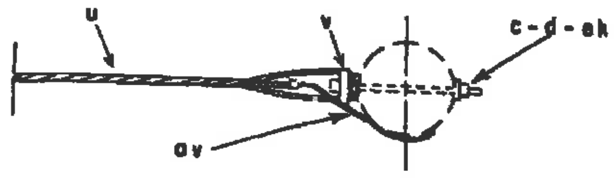
OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

SEE GUIDE DRAWINGS M30-1 AND M30-2

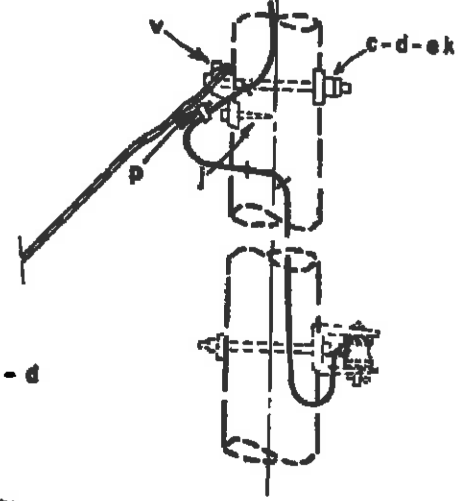
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Bolt, Machine, 5/8"	0370	1	Bolt, Machine, 5/8"	0370
1	Washer, 2 1/4" Square	0610	1	Washer, Square	0610
2	Guy, D.E.	1440	2	Clamp, 3-Bolt	1440
1	Guy Attachment	1465	1	Guy Attachment	1465
1	Clamp, Anchor Rod, Bonding	1455-1456	1	Clamp, Anc. Rod	1456
50'	Guy, Wire	1400	50'	Guy Wire	1411
			1	Guy Clip	1457

7.2/12.5 KV.
SINGLE DOWN GUY, THROUGH BOLT TYPE

Revised Sept. 1994	E1-1, E1-2



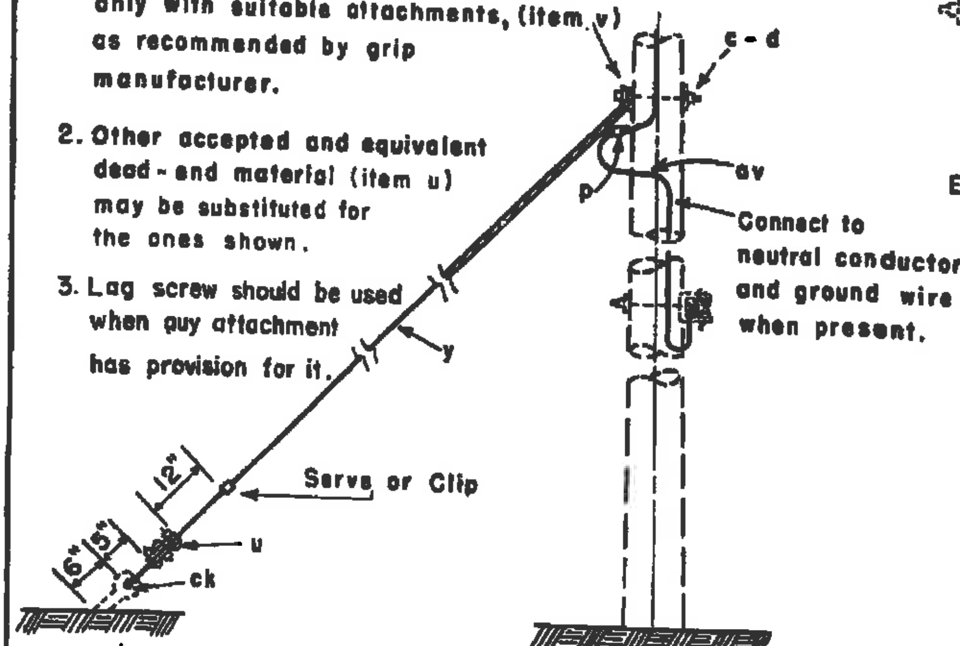
PLAN



E1-3

NOTES:

1. Formed type grips may be used only with suitable attachments, (item v) as recommended by grip manufacturer.
2. Other accepted and equivalent dead-end material (item u) may be substituted for the ones shown.
3. Lag screw should be used when guy attachment has provision for it.



E1-1, E1-2

See guide drawings M30-1 and M30-2

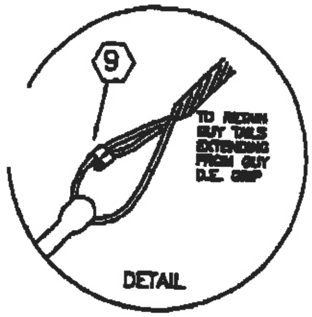
ITEM	MATERIAL	ASSEMBLY UNIT E1-1 No. REQ'D.	ASSEMBLY UNIT E1-2 No. REQ'D.	ASSEMBLY UNIT E1-3 No. REQ'D.
c	Bolt, machine, 5/8" x required length	1	1	1
d	Washer, curved	1-2 1/4"x2 1/4"	1-3"x3"	1-4"x4"
j	Screw, lag, 1/2" x 4"			1
p	Connectors	as req'd	as req'd	as req'd
u	Deadend for guy strand	2	2	2
v	Guy attachment (rating)	1-(5200 lbs.)	1-(5200 lbs.)	1-(8500 lbs.)
y	Guy wire, S.M., 7 strand req'd length by	1/4"	3/8"	7/16"
av	Jumper, No. 4 stranded Al. alloy or equiv.	req'd length	req'd length	req'd length
ck	Clamp, anchor rod bonding	1	1	1
ek	Locknuts, as required			

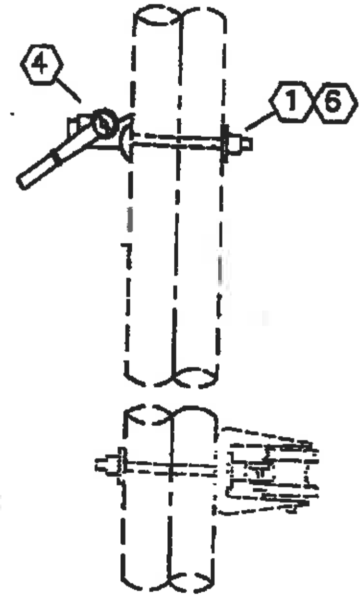
12.5/7.2 kV

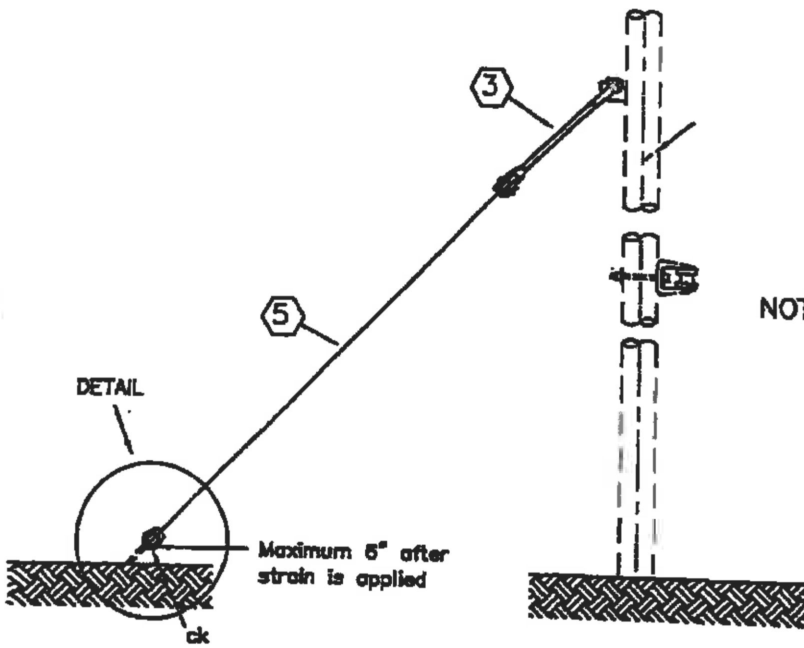
SINGLE DOWN GUY, THROUGH BOLT TYPE

Apr., 1983

E1-1, E1-2, E1-3







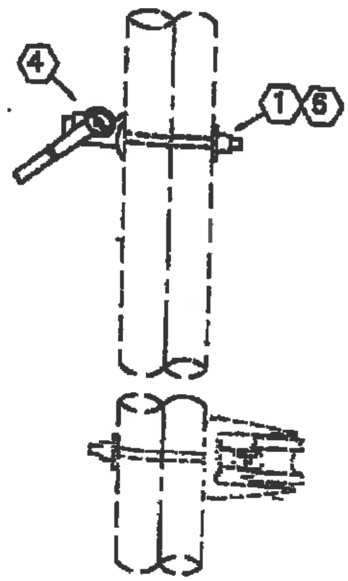
NOTES:

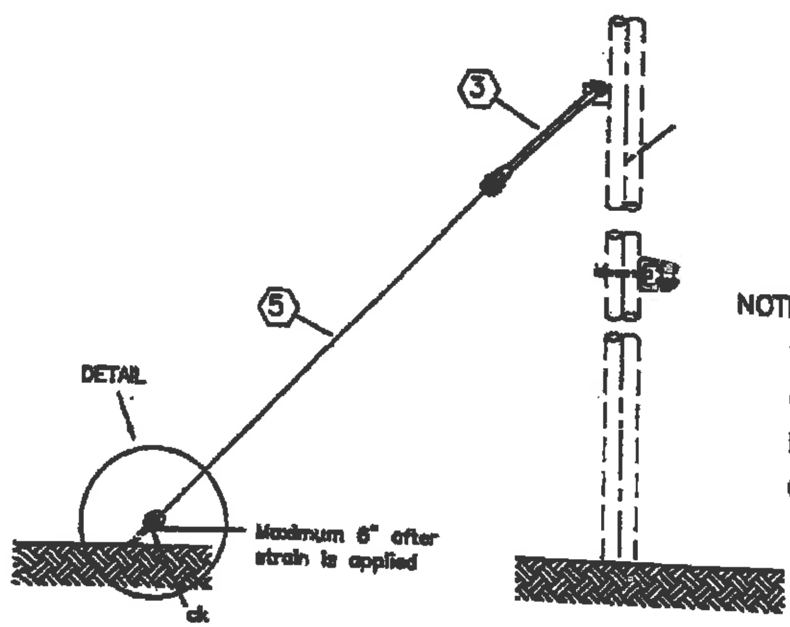
OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

Item	No.	Material	Part No.	Item	No.	Material	Part No.
1	1	Bolt, Machine, 5/8"	0370	9	1	Eye, Double Bond Clamp	1456
2	1	Screw, Lag	0550				
3	1	54" Fiber. Guy Strain Ins.	9755				
4	1	Guy Attach. For Strain Ins	9756				
5	50'	Guy Wire, 3/8" H.S.	1411				
6	1	Washer, Curved 11/16"	0650				
7	2	Guy Grips	1440				
	1	Guy Wire Clip	145700				

7.2/12.5 KV.
SINGLE DOWN GUY
THROUGH BOLT TYPE WITH FIBERGLASS LINK

Revised Nov. 1998 | E1-5G





NOTES:

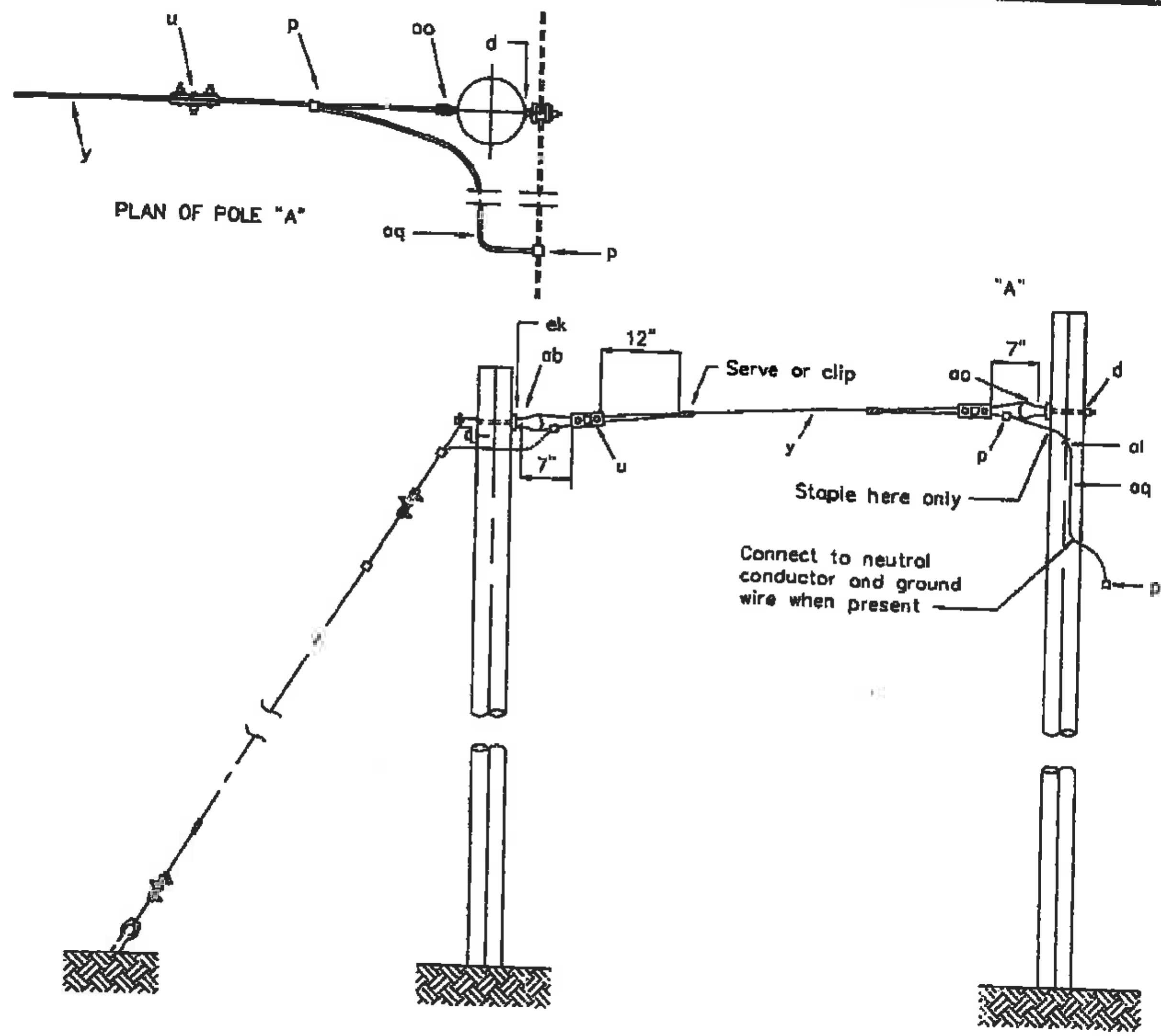
OTHER ACCEPTED AND EQUIVALENT (ITEM U) DEADEND MATERIAL MAY BE SUBSTITUTED FOR THE GUY GRIPS SHOWN.

Item	No.	Material	Part No.	Item	No.	Material	Part No.
1	1	Bolt, Machine, 5/8"	0370	9	1	Eye, Double Bond Clamp	1456
2	1	Screw, Lag	0550				
3	1	54" Fiber. Guy Strain Ins.	9755				
4	1	Guy Attach. For Strain Ins	9756				
5	50'	Guy Wire, 3/8" H.S.	1411				
6	1	Washer, Curved 11/16"	0650				
7	2	Guy Grips	1440				
	1	Guy Wire Clip	145700				

7.2/12.5 KV.
SINGLE DOWN GUY
THROUGH BOLT TYPE WITH FIBERGLASS LINK

Revised Nov. 1998

E1-5GH



NOTES:

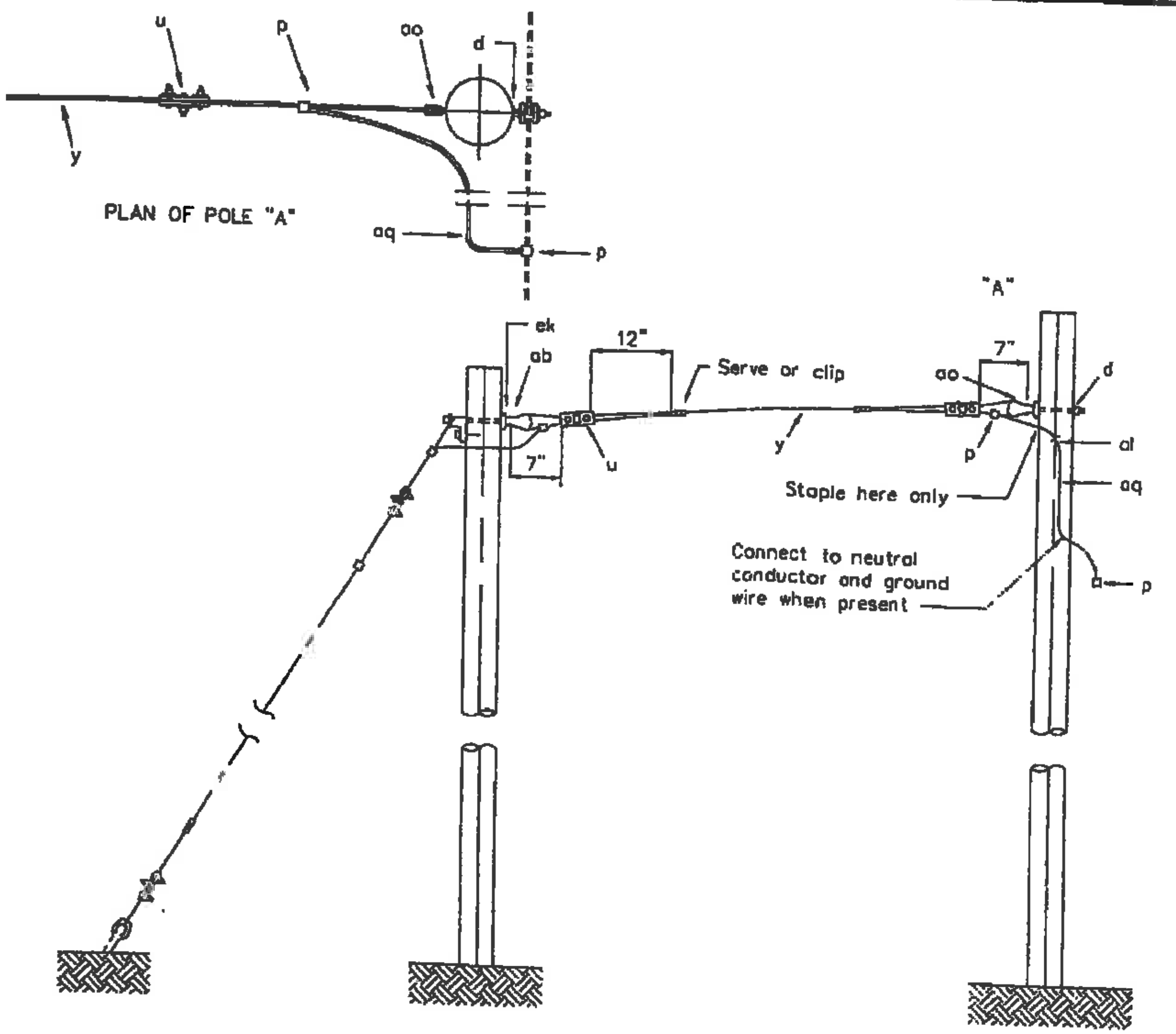
1– Other accepted and equivalent item u deadend material may be substituted for the 3–bolt clamp shown.

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Washer, 2 1/4" Square	0610			
2	Guy, D.E.	1440			
50'	Guy Wire	1411			
2	Nut, Thimble Type Eye	0660			
2	Bolt, Machine	0370			

7.2/12.5 KV.
SINGLE OVERHEAD GUY
THROUGH BOLT TYPE

Revised
Sept. 1994

E2–2



NOTES:

1– Other accepted and equivalent item u deadend material may be substituted for the 3-bolt clamp shown.

Quan.	Material	Item No.	Quan.	Material	Item No.
2	Washer, Curved	0650			
2	D.E. Guy Att. H.D.	1468			
70'	Guy Wire	1411			
2	Lag Screw	0550			
2	Bolt, Machine. 5/8"	0370			

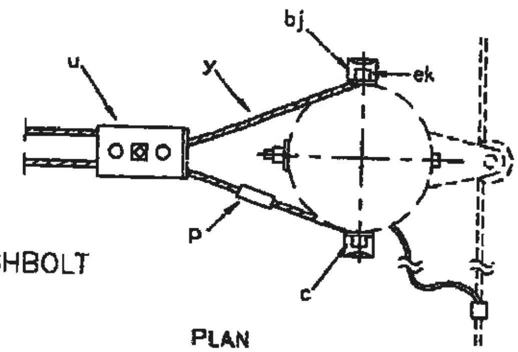
7.2/12.5 KV.
SINGLE OVERHEAD GUY
THROUGH BOLT TYPE

Revised Sept. 1994

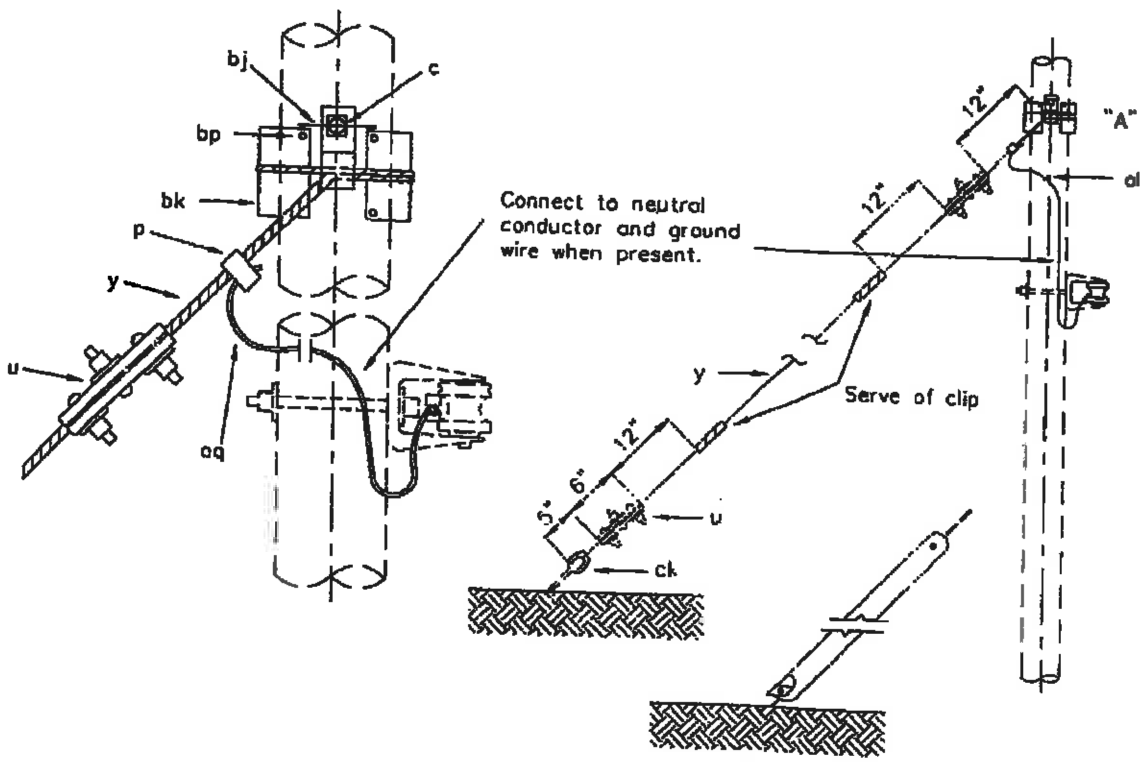
E2–5

NOTES:

1. OTHER ACCEPTED AND EQUIVALENT (ITEM U) GUY CLAMPS MAY BE SUBSTITUTED FOR THE 3-BOLT CLAMPS SHOWN.
2. ASSEMBLIES E1-2 AND E1-3 (THROUGHBOLT TYPE) ARE PREFERRED UNITS.



PLAN



E3-10
GUY GUARD

E3-2

Quan.	Material	Item No.
1	Bolt, Machine, 5/8"	0370
2	Connectors, Small	3000
2	Clamp, Guy, 3-Bolt	1440
2	Guy Hook	1460
2	Guy Plate	1470
60'	Guy Wire	1411
1	Clamp, Anchor Rod Bonding	1455

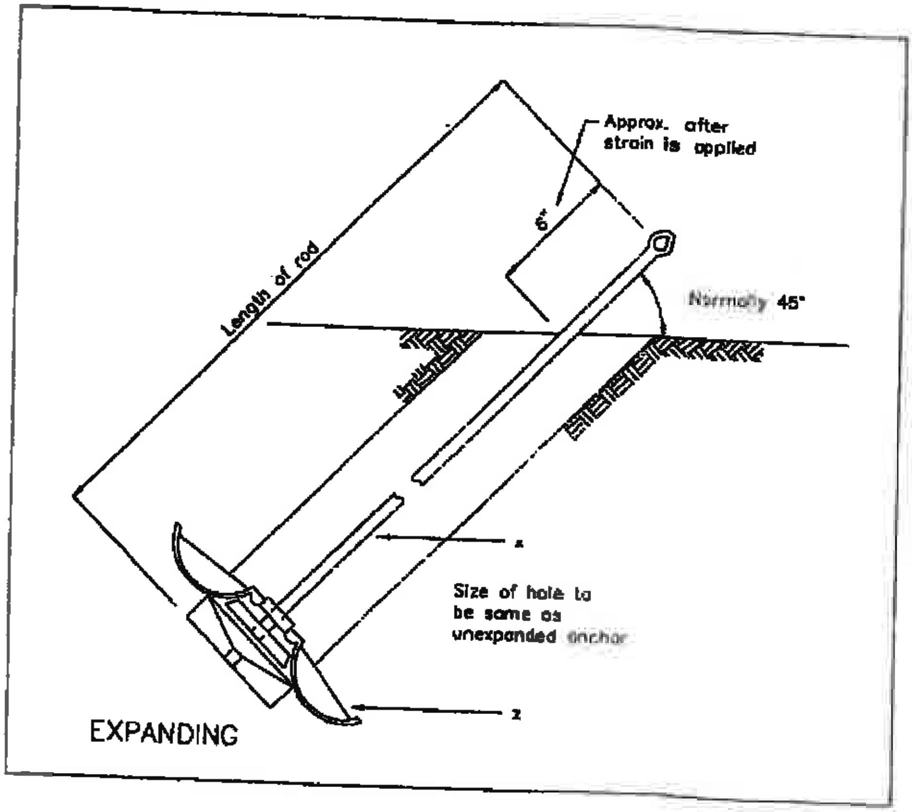
E3-3

Quan.	Material	Item No.
1	Bolt, Mach. 5/8"	0370
2	Connector	3000
2	Clamp, Guy	1441
2	Guy Hook	1460
2	Guy Plate	1470
60'	Guy Wire	1420
1	Clamp, Anchor Rod	1456

7.2/12.5 KV.
SINGLE DOWN GUY
WRAPPED TYPE

Revised Sept. 1994

E3-2,E3-3,E3-10

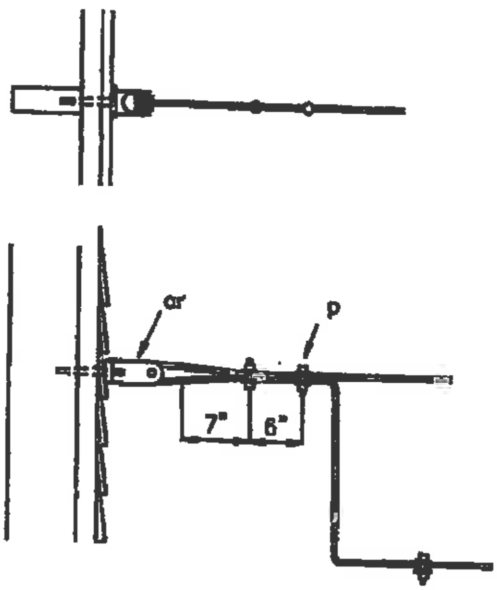


F1-2			F1-4		
Quan.	Material	Item No.	Quan.	Material	Item No.
1	Rod, Anchor, Thimble Eye	1345	1	Rod, Anchor, Thimble Eye	1340
1	Anchor, Exp. 12,000#	1312	1	Anchor, Exp. 12,000#	1312
	5/8"			3/4"	

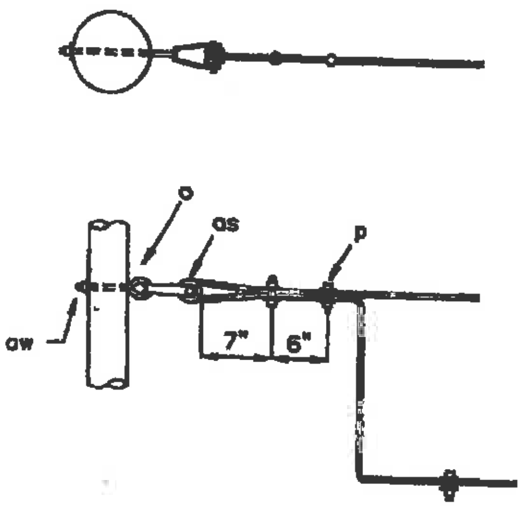
ANCHOR ASSEMBLY

Revised Sept. 1994

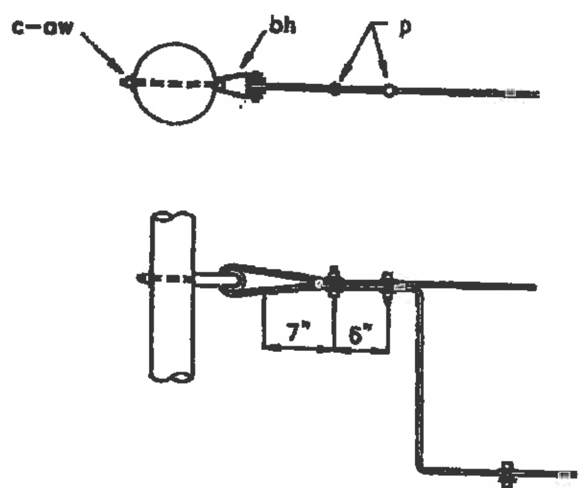
F1-2 & F1-4



K10

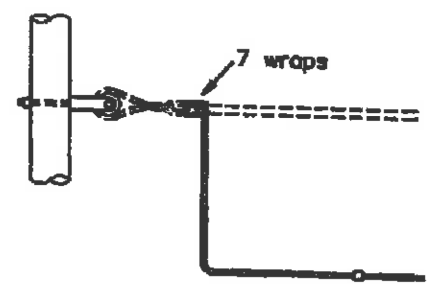


K11



K12

DETAIL OF WRAPS & TURNS
WRAP DETAIL FOR SMALL COVERED CONDUCTORS



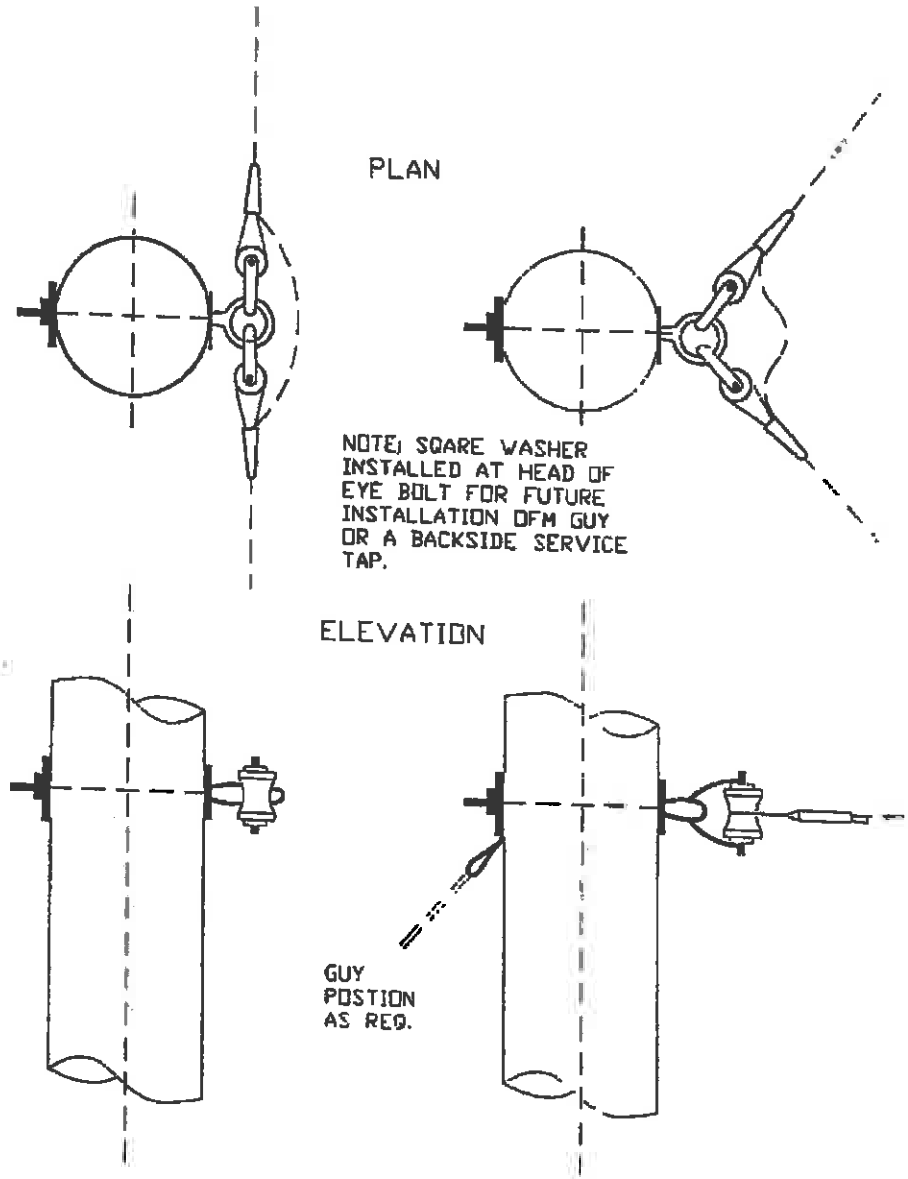
Quan.	Material	Item No.
1	Wireholder	1000

Quan.	Material	Item No.
1	Ins. Spool Sec. K11	1010
1	Clevis, Sec. Swinging	1805

SERVICE ASSEMBLIES

Revised Sept. 1994

K10 TO K11

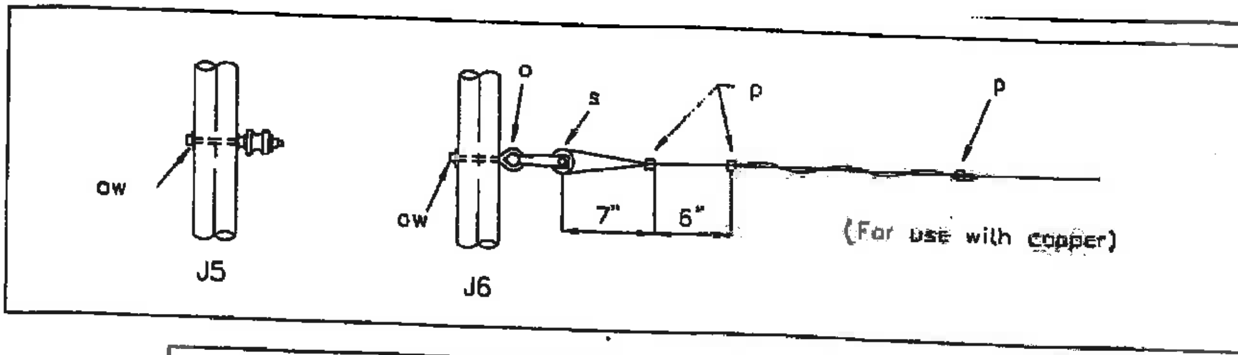


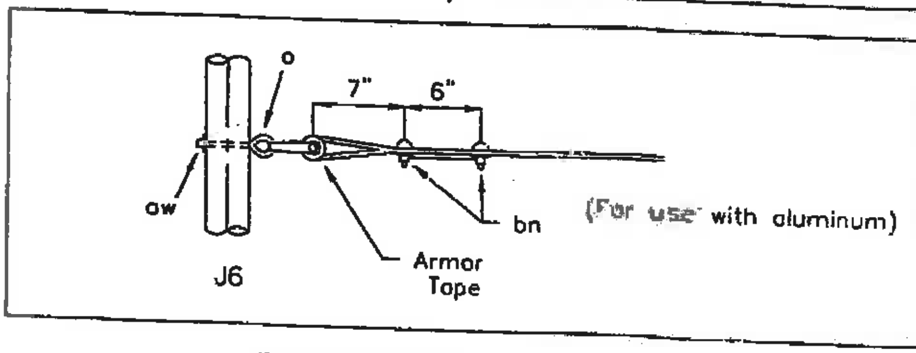
Quan.	Material	Item No.	Quan.	Material	
1	5/8" Eye Bolt	0320			
2	2 1/4" Square Washer	0610			
2	K11 Clevis	1805			
2	K11 Spool	1010			
2	Wedge	1990			

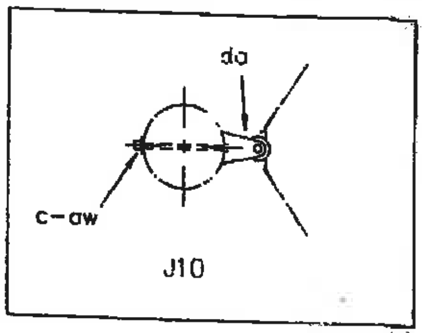
SERVICE POLE ASSEMBLY
0° TO 60°

Revised
Sept. 1994

K11-2







FOR USE ON SELF SUPPORTING SERVICE CABLE

J5

Quan.	Material	Item No.
1	Washer, 2 1/4" Square	0610
1	Ins. Spool Sec.	1020
1	Bolt, Double Upset	0425
	J6	
1	Washer, 2 1/4" Square	0610
1	Bolt, Eye, 5/8"	0320
1	Ins. Spool Sec.	1020
1	Clevis, Sec. Swinging	1815

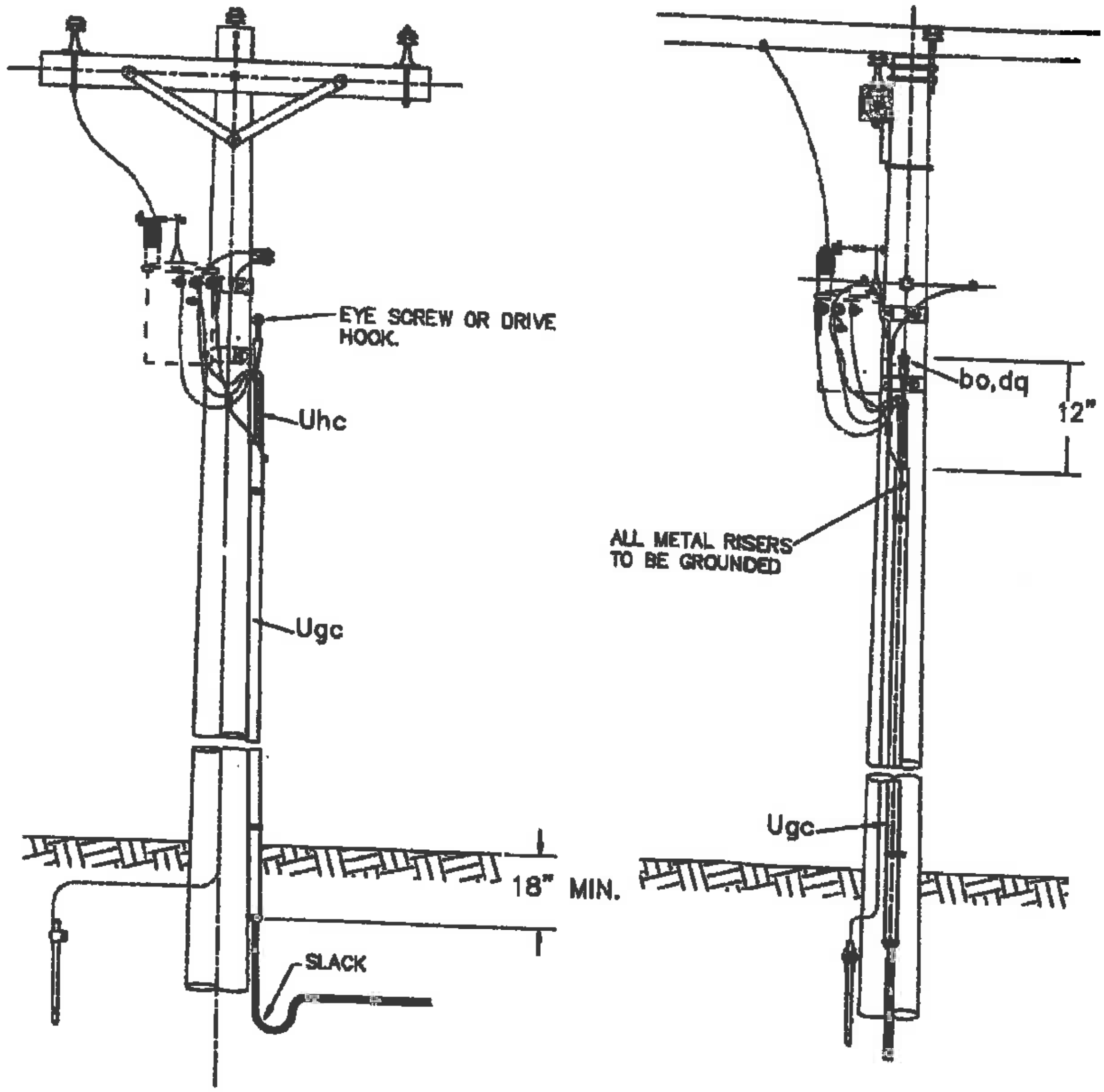
J10

Quan.	Material	Item No.
1	Bolt, Mach. 5/8"	0370
1	Washer, 2 1/4" Square	0610
1	Ins. Spool Sec.	1020
1	Clevis, Sec. D.E.	1810

SECONDARY ASSEMBLIES

Revised Sept. 1994

J5 TO J10



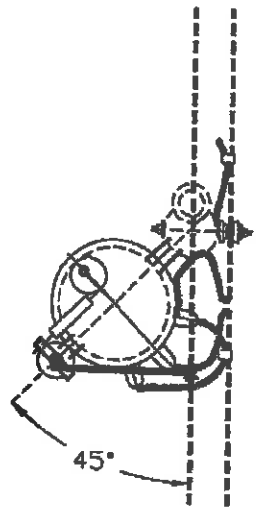
NOTES:

1. ALLOW MINIMUM CABLE SLACK OF 24" AT BOTTOM OF RISER.

ITEM	QTY.	MATERIAL
bo		Anchor, shackle. Do not use if drive hook is used.
dq	1	Eye screw, elliptical or drive hook.
Ugc	1	Cable riser shield. Length as required.
Uhc	1	Cable support.

SECONDARY CABLE TERMINAL POLE

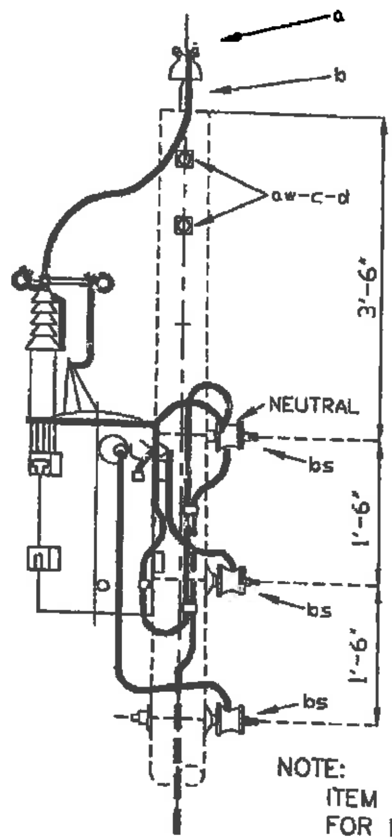
	2000	UM5

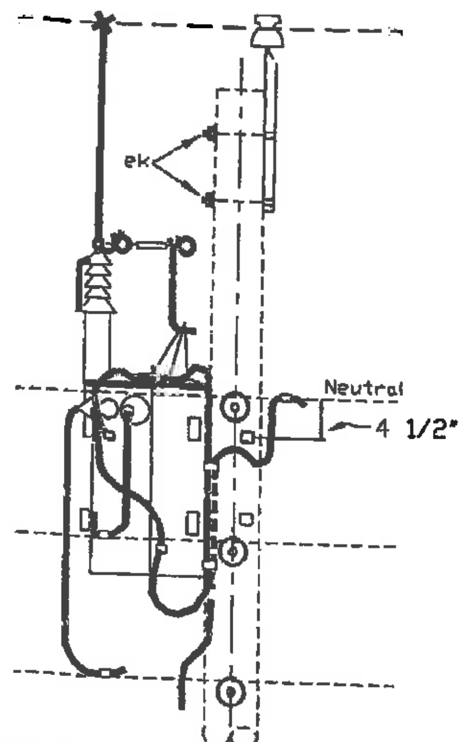


NOTES:

1. DESIGNATES G9 FOR CONVENTIONAL TRANSFORMER WITH TANK MOUNTED CUTOUT AND ARRESTER, G65 FOR TRANSFORMER WITH DOUBLE GAP AND INTERNAL FUSE.

2. SEE GUIDE DRAWINGS FOR DETAILS OF TRANSFORMER SECONDARY AND SERVICE CONNECTIONS.





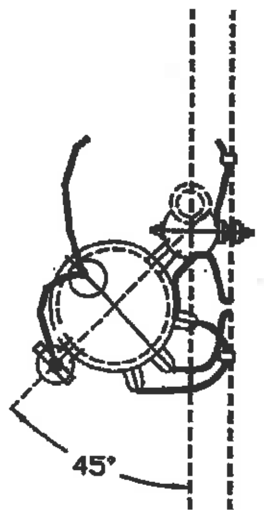
NOTE:
ITEM AX MAY BE SUBSTITUTED FOR ITEMS AE AND AF.

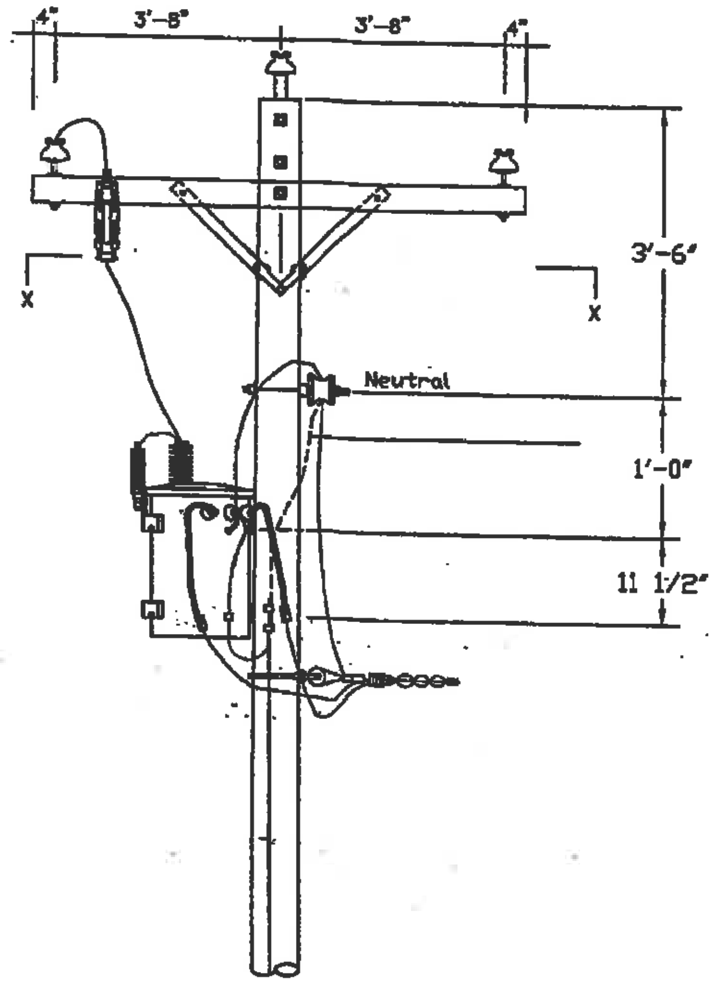
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Bolt, Machine, 5/8"	0370	8'	#4 BC	2101
2	Washer, 2 1/4" Square	0610			
12'	Wire, #6 S.D.	2100			
1	Clamp, Hot Line	2000			

7.2/12.5 KV.
SINGLE PHASE TRANSFORMER
AT 1-PHASE TANGENT

Revised Sept. 1994

G105





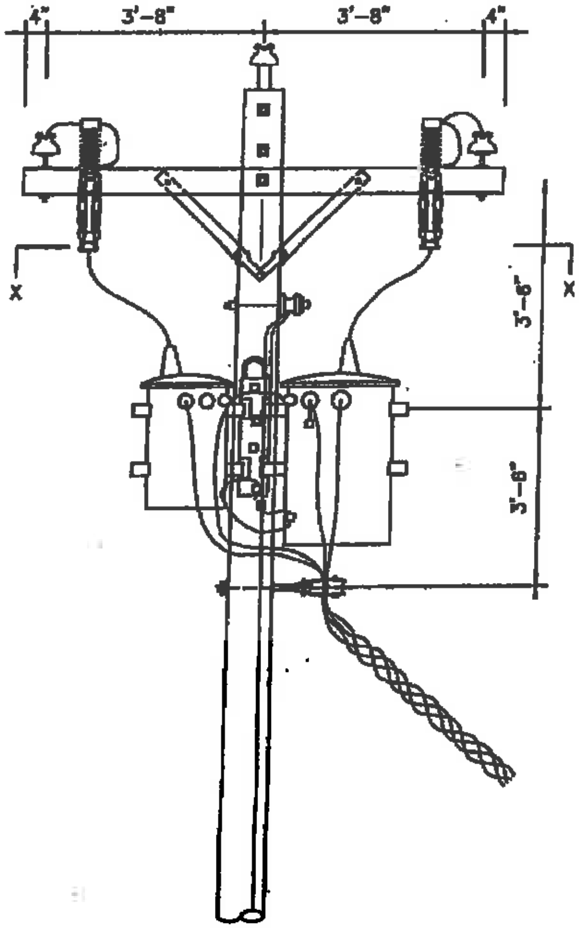
Quan.	Material	Item No.	Quan.	Material	Item No.
2	Mach Bolt, 5/8" x Req'd Length	0370	8'	4 Bare Cu SD 7.911 FPP	210100
2	Washer, Square 11/16" Hole	061001	5'	2 Bare Cu Str 4.88 FPP	213000
1	2-4/0 AL Hot Line Clamp	200003	1	Fused Disconnect, 100A 15 kV	512000
1	1/0 & 2/0 ACSR Amp Stirrup	201006			
12'	6 Bare Cu SD 12.584 FPP	210000			

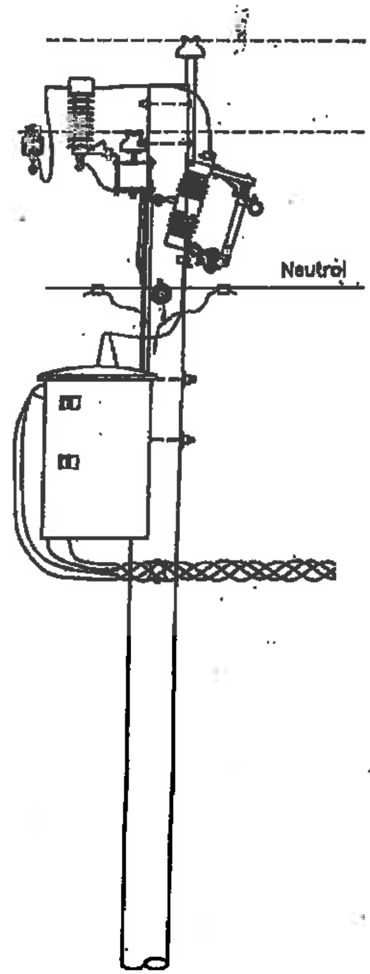
UP TO 15 KVA

7.2/12.5 KV.
SINGLE PHASE CONVENTIONAL TRANSFORMER WITH SINGLE BUSHING AND TANK MOUNT ARRESTOR

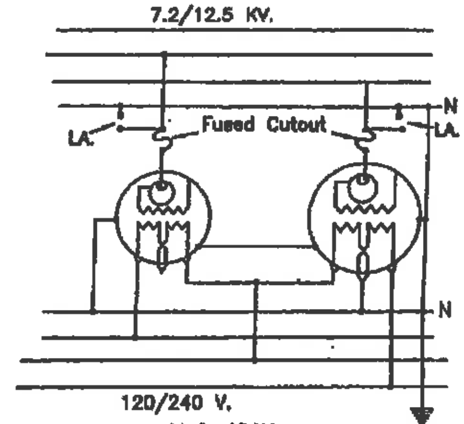
Revised Nov 2004

G106A

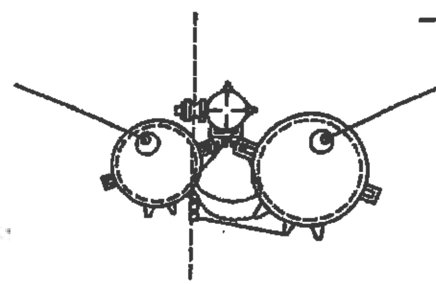




Quan.	Material	Item
2	Mach Bolt, 5/8" x Req'd Length	0370
2	Washer, Square 11/16" Hole	0610
2	2-4/0 AL Hot Line Clamp	2000
2	1/0 & 2/0 ACSR Amp Stirrup	2010
20'	6 Bare Cu SD 12.584 FPP	2100
15'	4 Bare Cu SD 7.911 FPP	2101
2	Arrestor, 10kV Dist Class	5030
2	Fused Disconnect, 100A 15 kV	5120

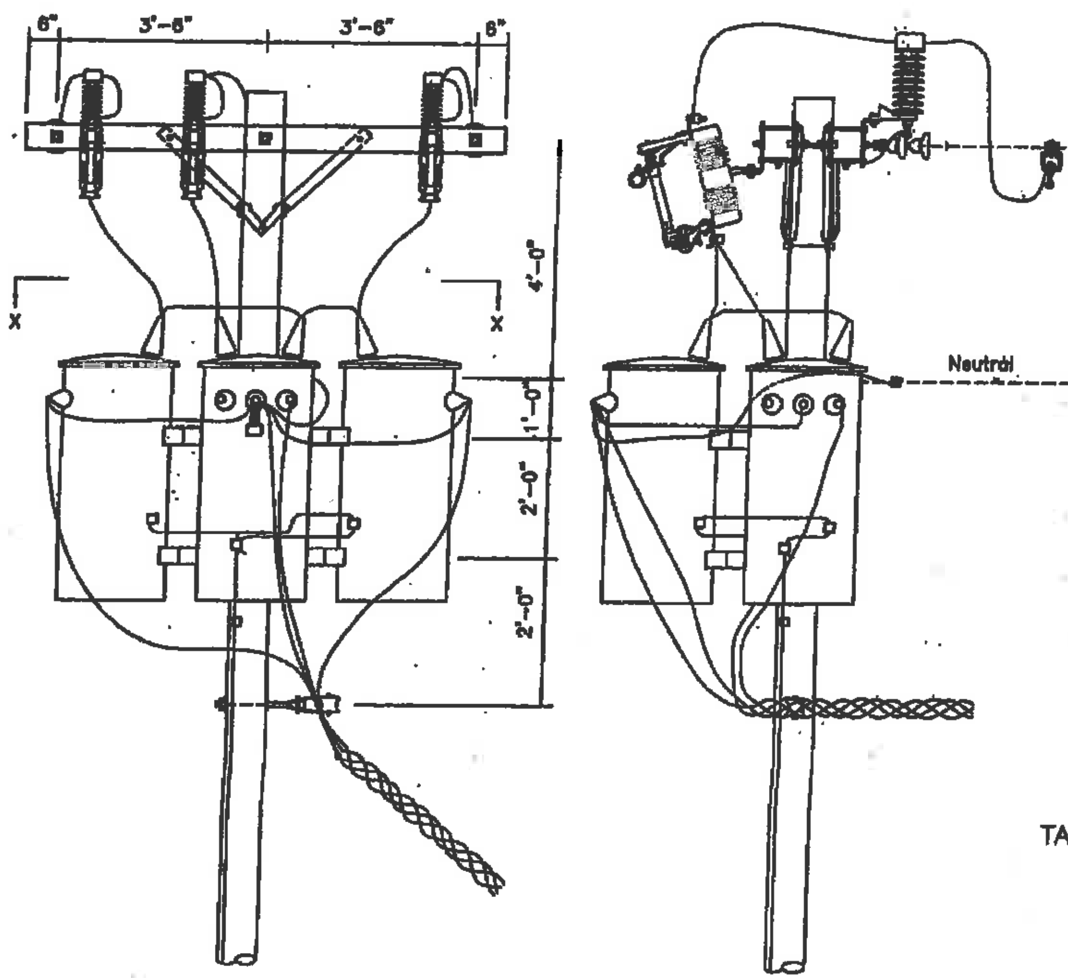


WIRING DIAGRAM

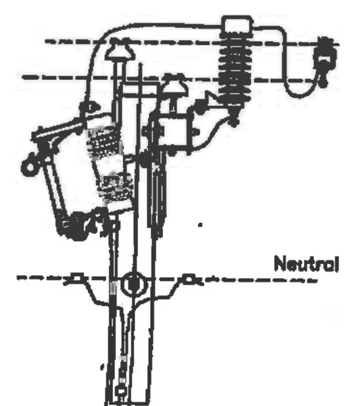

SECTION X-X

7.2/12.5 KV.
TWO TRANSFORMERS CLUSTER MOUNTED
OPEN WYE DELTA FOR
120/240 VOLT POWER LOADS

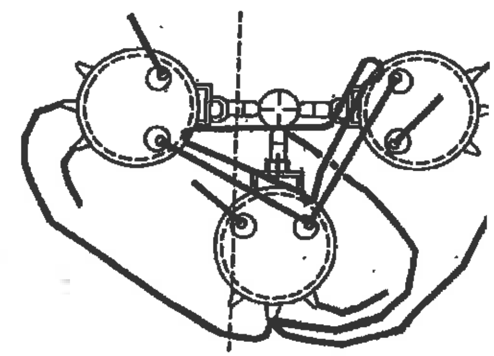
Revised Nov 2004	G210



Quan.	Material	Item
2	Mach Bolt, 5/8" x Req'd Length	0370
2	Washer, Square 11/16" Hole	0610
3	2-4/0 AL Hot Line Clamp	2000
3	1/0 & 2/0 ACSR Amp Stirrup	2010
25'	6 Bare Cu SD 12.584 FPP	2100
20'	4 Bare Cu SD 7.911 FPP	2101
3	Arrestor, 10kV Dist Class	5030
3	Fused Disconnect, 100A 15 kV	5120



TANGENT LINE ASSEMBLY

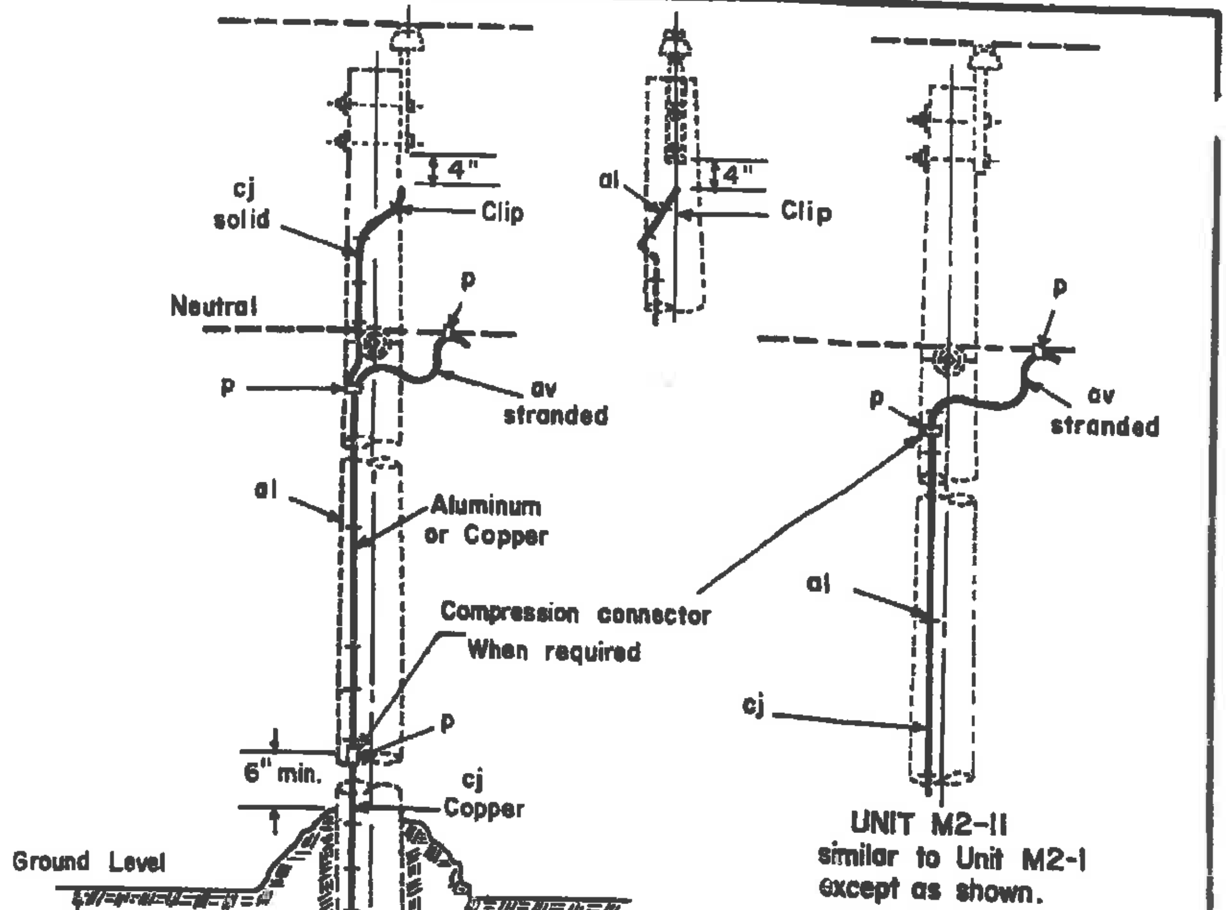


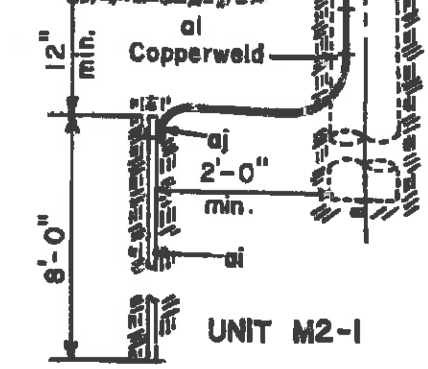
SECTION X–X

NOTE:
FOR 120/208 INSTALLATION, PARALLEL SECONDARY WINDINGS IN EACH TRANSFORMER BEFORE ENERGIZING.

7.2/12.5 KV.
THREE TRANSFORMERS CLUSTER MOUNTED UNGROUNDED WYE WYE FOR 120/208 VOLT POWER LOADS

Revised Nov 2004	G310





Notes:

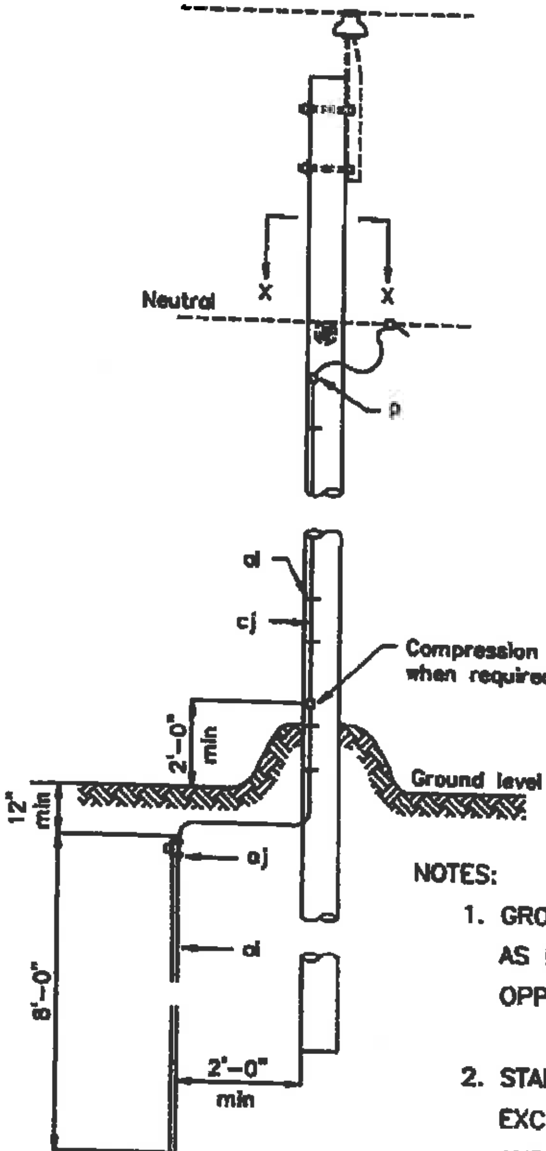
1. Ground wire to be located on same side as Neutral Conductor and in quadrant opposite climbing space or pole top pin.
2. Staples on ground wire shall be 2' apart, except for a distance of 8' above ground and 8' from top of pole where they shall be 6" apart.
3. Ground wire to clear all hardware by 2" min. and shall be stapled to maintain this position.
4. For use with V and 3-phase assemblies refer to guide drawings M30-I and M30-2.

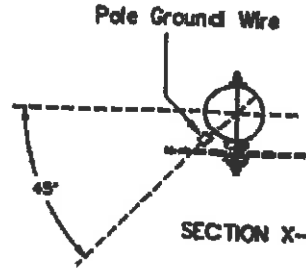
ITEM	MATERIAL	ASSEMBLY UNIT	
		M2-I	M2-II
p	Connector, compression	as req'd.	as req'd.
ai	Rod, ground, 5/8" minimum diameter	I	I
aj	Clamp, ground rod wire	I	I
al	Staples, ground wire (copper or steel to match ground wire)	as req'd.	as req'd.
al	Ground wire clip	I	
cj	Ground wire, minimum No. 6 copper or equiv. conductivity	as req'd.	as req'd
av	Jumper, stranded, min. No 6 copper or equiv. conductivity	as req'd	as req'd

12.5/7.2 kV
GROUNDING ASSEMBLY - GROUND ROD TYPE

Apr., 1983

M2-I, M2-II





SECTION X-X

NOTES:

1. GROUND WIRE TO BE LOCATED ON SAME SIDE AS NEUTRAL CONDUCTOR AND IN QUADRANT OPPOSITE CLIMBING SPACE OR POLE TOP PIN.

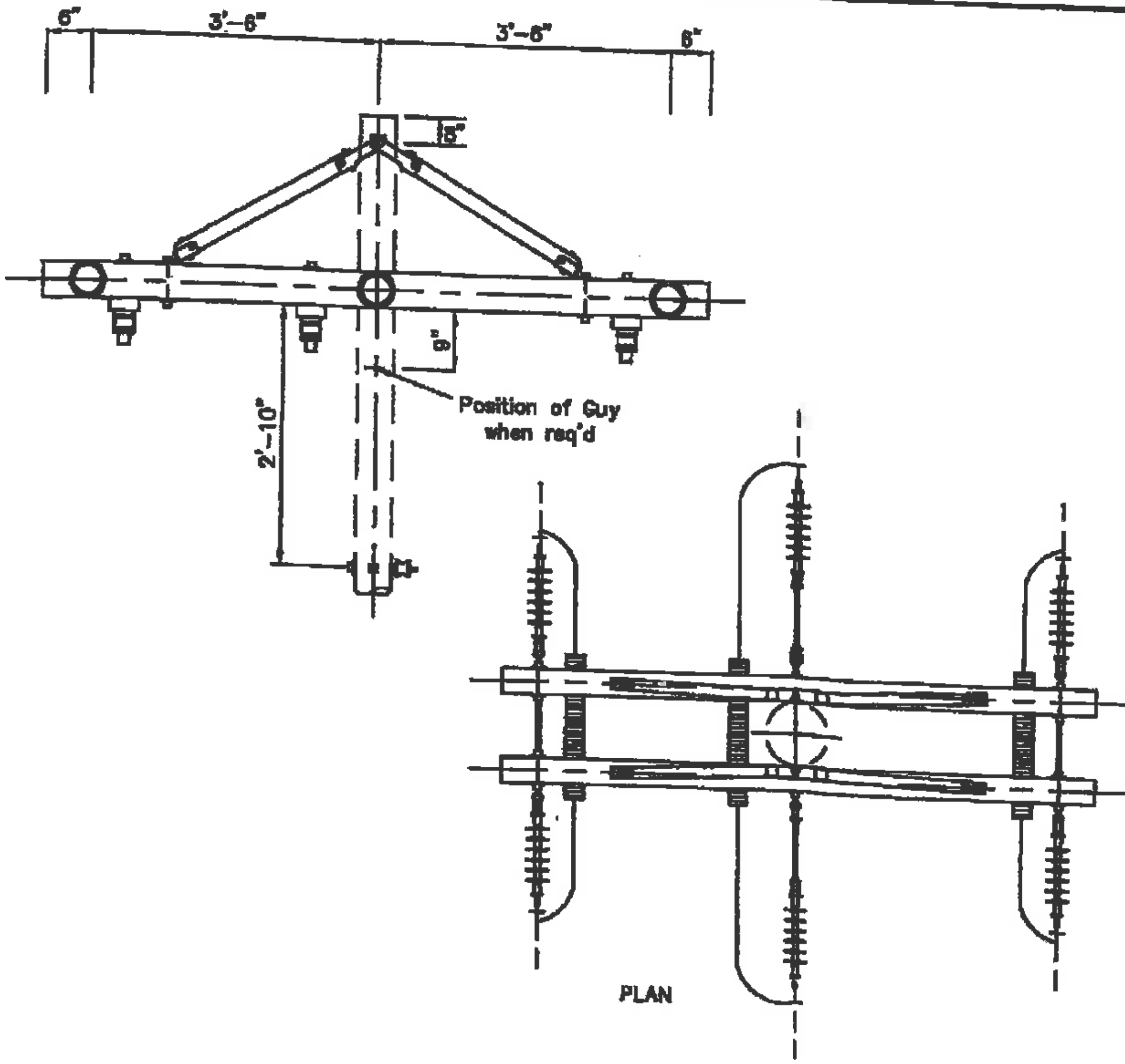
2. STAPLES ON GROUND WIRE SHALL BE 2'-0" APART EXCEPT FOR A DISTANCE OF 8'-0" ABOVE GROUND AND 8'-0" FROM TOP OF POLE WHERE THEY SHALL BE 6" APART.

Quan.	Material	Item No.	Quan.	Material	Item No.
1	Rod, Ground	1730			
35'	Ground Wire, #4 Aluminum	2510			

GROUNDING ASSEMBLY
GROUND ROD TYPE

Revised
Sept. 1994

M2-11A



Quan.	Material	Item No.	Quan.	Material	Item No.
3	DA Bolt, 5/8" Req'd Length	0270	2	Ext Link For Susp Insulator	113000
1	Eye Bolt, 5/8" Req'd Length	0320	6	DE Clamp 4 Thru 1/0 ACSR	191000
4	Mach Bolt, 1/2" x 6"	035001	3	Switch, 600A 15/27kV Blade Type	523001
1	Mach Bolt, 5/8" x Req'd Length	0370	6	Insulator, 25kV Polly Suspension	911001
4	Washer, 1/2" Round	060001			
12	Washer, Square 11/16" Hole	061001			
7	Nut, Oval Eye	064000			
2	Crossarm, 3 3/4" x 4 3/4" x 8'	071000			
2	Brace, Wood Bow 60" Span	086000			

UP TO 1/0 ACSR

14.4/24.9 KV, 3-PHASE
CROSSARM CONSTRUCTION
DOUBLE DEADEND

Revised
May 2003

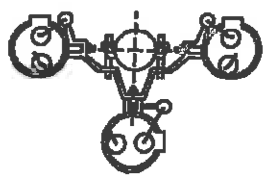
VM3-3

NOTES:

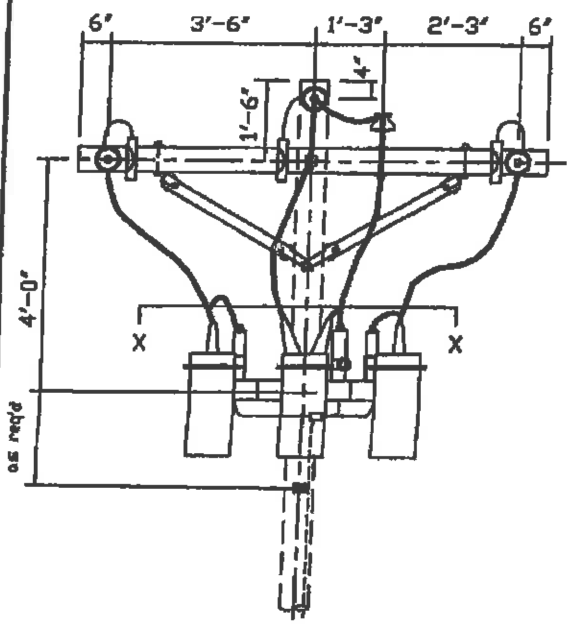
1. THE RECLOSER TERMINAL BUSHING CONNECTED DIRECTLY TO THE COIL SHOULD BE CONNECTED TO THE SOURCE.

2. FOR V PHASE INSTALLATIONS OMIT RECLOSER AND RELATED ITEMS ON CENTER PHASE. DESIGNATE AS ASSEMBLY VM3-11A

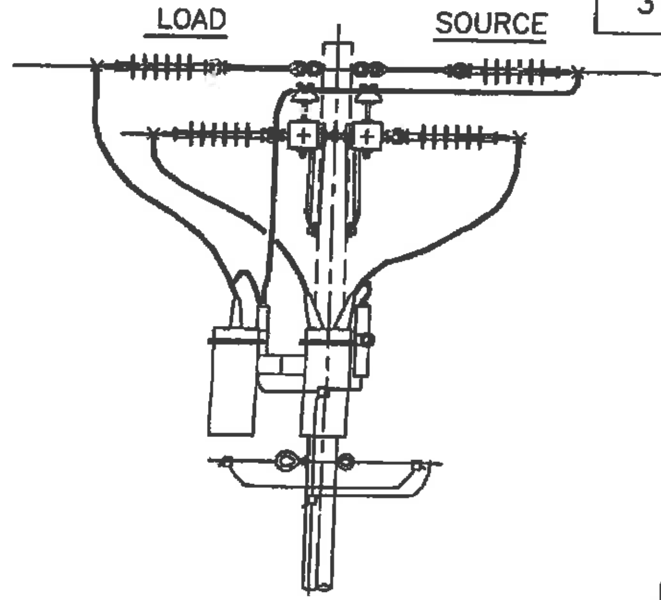
3. EACH RECLOSER TANK SHALL HAVE TWO CONNECTIONS TO GROUND.



SECTION X-X



ELEVATION



* USED IN CONJUNCTION WITH APPROPRIATE B8, C8, OR C8-2 UNIT.

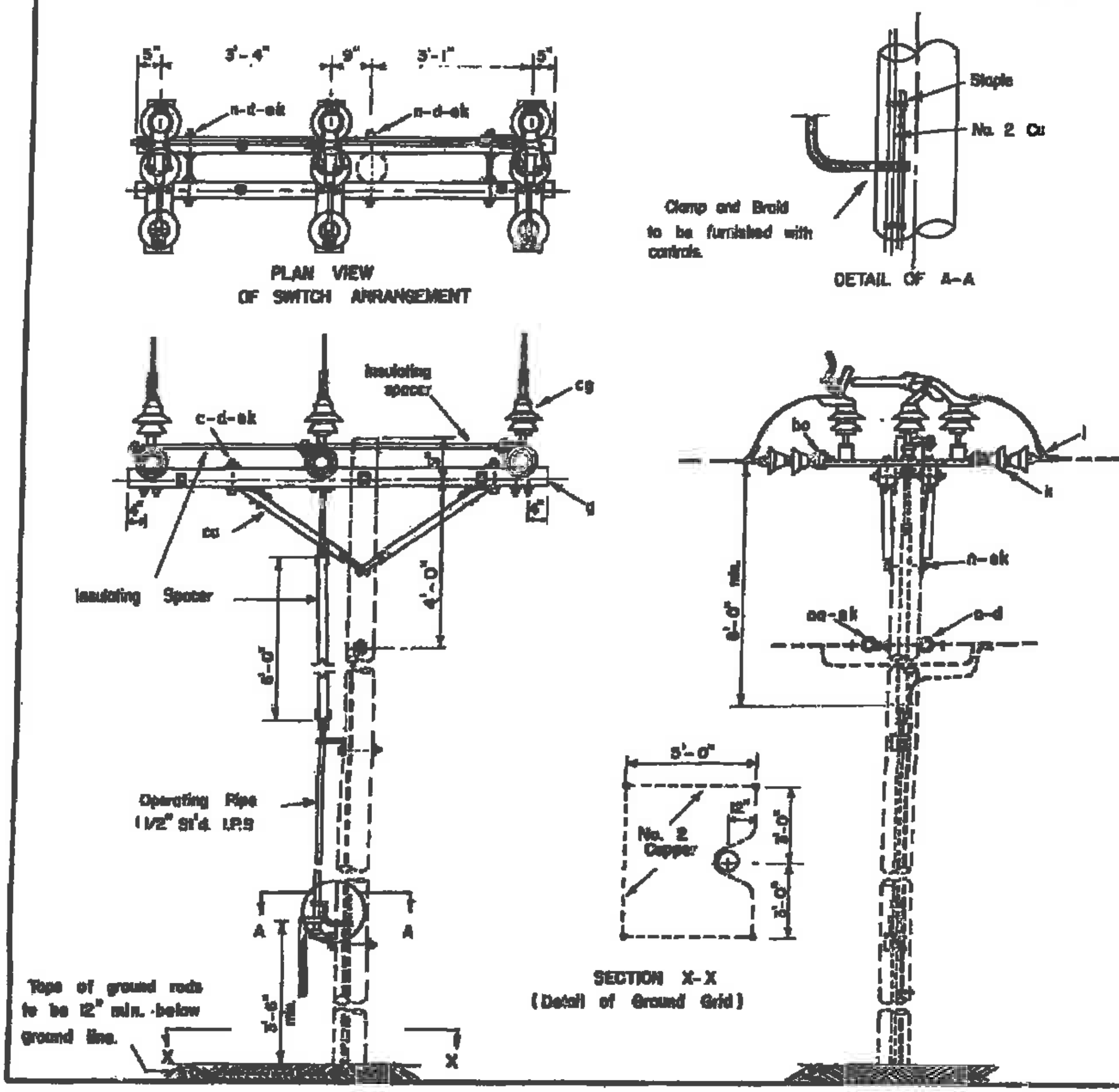
Assembly	Quan.	Material	Item No
M3-11A VØ	2	Bolt, Machine, 5/8" x Req'd Length	0370
	2	Washer, Square 11/16" Hole	06100
	2	Pin Head Adapter	09600
	2	25 kV Pin Adapter	09700
	2	Ins. Pin Type 25kV	10750
	6	Clamp, Hot Line, 2-4/0 Al	20000
	25	Ground Wire, #4 BC	21010
	2	Drop Out Switch, 100A	512000
	2	Lightning Arrester, 10kV	503000
M3-12A 3Ø	2	Bolt, Machine, 5/8" x Req'd Length	0370
	2	Washer, Square 11/16" Hole	061001
	2	Pin Head Adapter	096000
	2	25 kV Pin Adapter	097000
	2	Ins. Pin Type 25kV	107500
	9	Clamp, Hot Line, 2-4/0 Al	200003
	30	Ground Wire, #4 BC	210100
	3	Drop Out Switch, 100A	512000
	3	Lightning Arrester, 10kV	503000

7.2/12.5 KV

2 OR 3 SECTIONALIZING OIL CIRCUIT RECLOSERS

Revised Jan. 2002

M3-11A, M3-12A



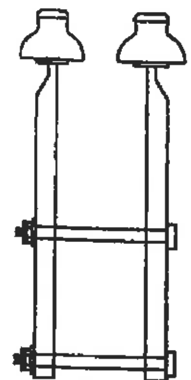
ITEM	NO.	MATERIAL
c	14	Bolt, machine, 5/8" x req'd. length
c	2	Bolt, machine, 1/2" x req'd length
d	25	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole
d	4	Washer, rd., 1 3/8" dia., 9/16" hole
g	2	Crossarm, 3 5/8" x 4 5/8" x 8'-0"
k	12	Insulator, suspension
l	6	Clamp, deadend
n	4	Bolt, double arming, 5/8" x req'd. length
bo	6	Shackle, anchor
cc	2	Deadend assembly, neutral
cg	1	Switch, airbreak, 3 pole unit 15 kV
		with operating mechanism and insulated spacers
cu	2	Brace, wood, 60" span
e	1	Bolt, eye, 5/8" x required length
ek		Locknuts, as required
aa	1	Nut, eye, 5/8"

Note:
For ground assembly, see drawings M2-15 and M2-15A.
See drawings M42-3, M42-11, M42-13, M42-21 for item cc.

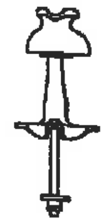
12.5/7.2 kV
SECTIONALIZING AIR BREAK SWITCH

Apr., 1983

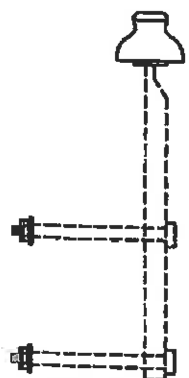
M3-16



M5-4



M5-7



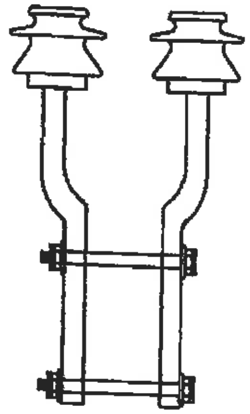
M5-5

M5-8

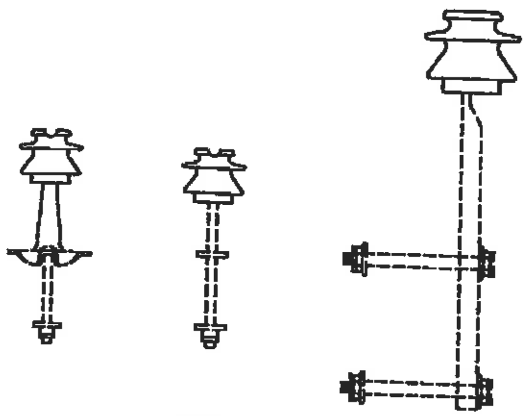
Quan.	Material	Item No.	Quan.	Material	Item No.
	M5-4			M5-7	
2	Bolt,mach, 5/8"xReq'd Lngth	0370	1	Insulator, Post Type	107000
2	Pin, Pole Top, 20"	090000	1	Washer, square, 2 1/4"	061001
2	Insulator, Pin Type	104000		M5-8	
	M5-5		1	Insulator, Susp Type	111000
1	Insulator, Pin Type	104000	1	Deadend Clamp, Primary	191000

REMOVAL UNITS
FOR 25KV CONVERSIONS

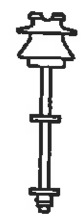
Revised March 2003	M5-4, M5-5, M5-7, M5-8



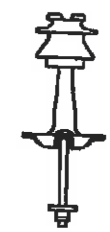
VM5-4



VM5-5



VM5-5A



VM5-5B

VM5-8

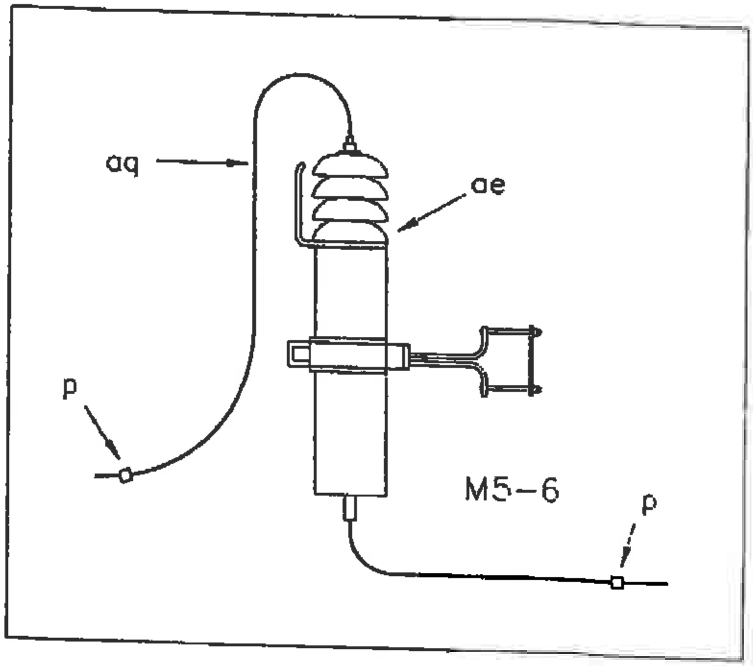
Quan.	Material	Item No.
	VM5-4	
2	Bolt,mach, 5/8"xReq'd Lngth	0370
2	Pin, Pole Top, 25KV Offset	092501
2	Ins. Pin Type 25kV	107500
	VM5-5	
1	25kV Pin Adapter	97000
1	Ins. Pin Type 25kV	107500

Quan.	Material	Item No.
	VM5-5A	
1	Pins, Steel Crossarm 25kV	91200
1	Ins. Pin Type 25kV	107500
	VM5-5B	
1	Pins, 25kV Saddle	94000
1	Ins. Pin Type 25kV	107500
	VM5-8	
1	Ins. Susp Type 25kV	911001

INSTALLATION UNITS
FOR 25KV CONVERSIONS

Revised
March 2003

VM5-4, VM5-5, VM5-5A, VM5-8.

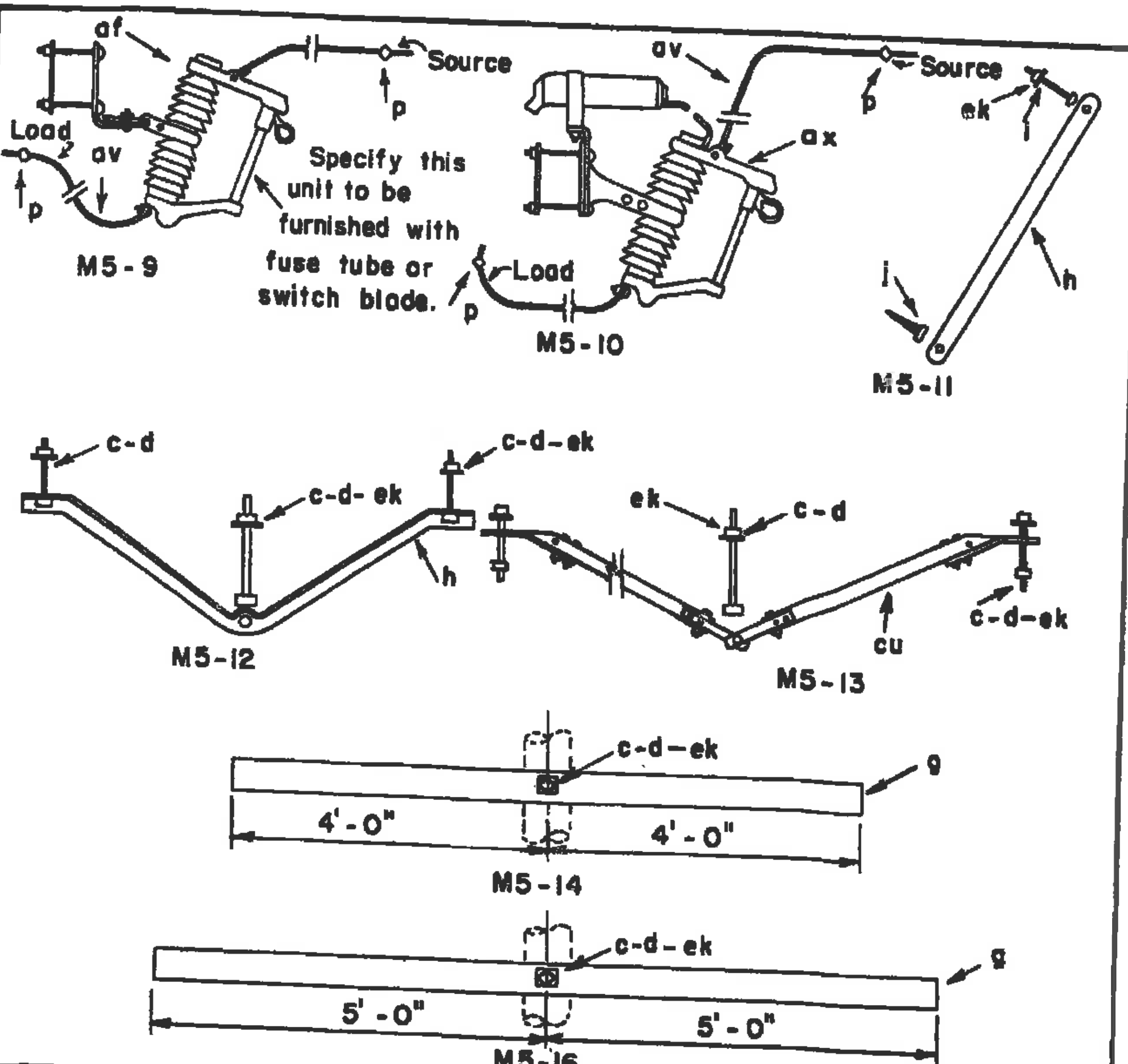


	A			B	
Quan.	Material	Item No.	Quan.	Material	Item .No.
1	Lightning Arrestor	5030			

7.2/12.5 KV.
MISCELLANEOUS PRIMARY ASSEMBLIES

Revised
Sept. 1994

M5 – 6

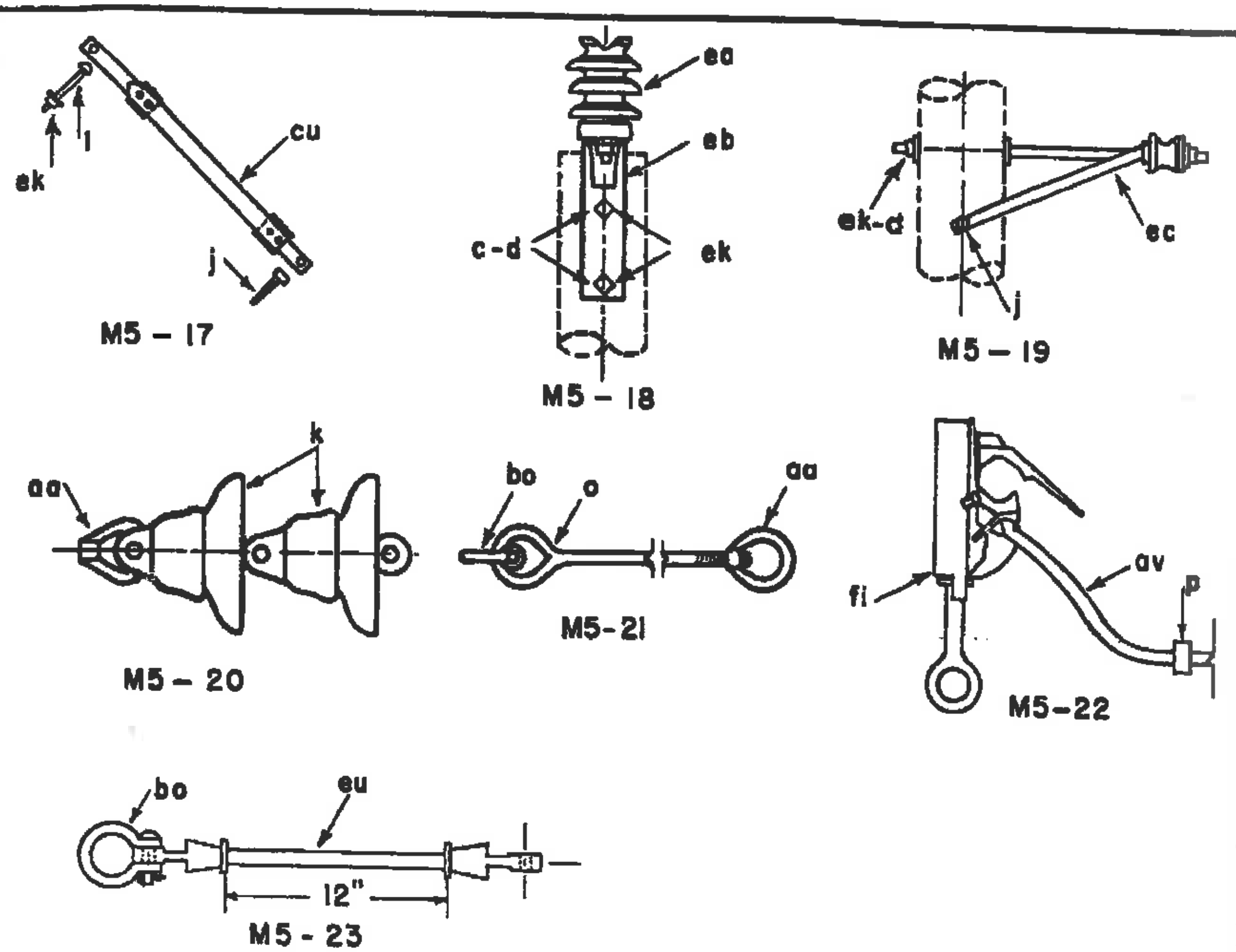


ITEM	MATERIAL	NUMBER REQUIRED							
		M5-9	M5-10	M5-11	M5-12	M5-13	M5-14		M5-16
c	Bolt, machine, 5/8" x req'd length								
c	Bolt, machine, 1/2" x req'd length				1	1	1		
d	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole				2	2			
d	Washer, round, 1 3/8" dia., 9/16" hole				1	1	2		2
g	Crossarm, 3 5/8" x 4 5/8" x 8'-0"				2	2			
g	Crossarm, 3 5/8" x 4 5/8" x 10'-0"						1		
h	Brace, flat, 1 1/4" x 1/4" x 28"								1
h	Brace, angle, 1 1/2" x 1 1/2" x 3/16", 60" span			1					
i	Bolt, carriage, 3/8" x 4 1/2"				1				
j	Screw, lag, 1/2" x 4"			1					
p	Connector			1					
af	Cutout, single-shot	2	2						
av	Jumper	1							
ax	Cutout and arrester combination	2	2						
cu	Brace, wood, 60" span		1						
ek	Locknuts, as required					1			

MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

M5-9 TO 16

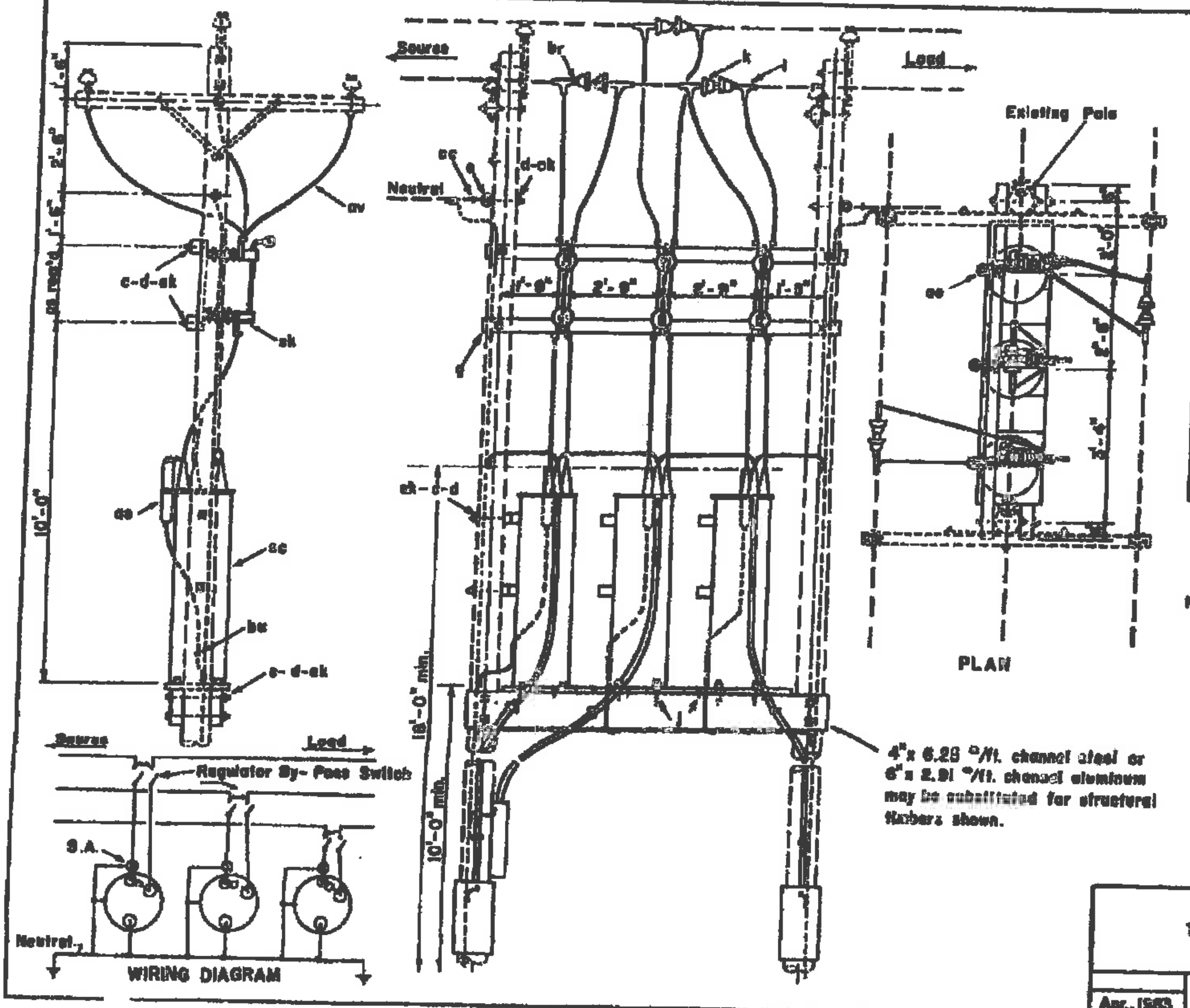


ITEM	MATERIAL	M5-17	M5-18	M5-19	M5-20	M5-21	M5-22	M5-23	
c	Bolt, machine, 5/8"x required length		2						
d	Washer, 2 1/4" square		2	1					
i	Bolt, carriage, 3/8"x 4 1/2"	1							
j	Screw, lag, 1/2" x 4"	1		2					
k	Insulator, suspension				2				
ea	Insulator, post type, 1 3/4" stud		1						
eb	Bracket, for post type insulator		1						
ec	Bracket, offset, neutral, insulated			1					
ek	Locknuts, as required								
cu	Brace, wood, 28"	1							
aa	Eye nut				1	1			
bo	Shackle, anchor					1		1	
o	Bolt, eye, 5/8" x req'd. length					1			
fi	Connector, hot line						1		
av	Jumper						1		
p	Connector						1		
eu	Link, extension, insulated							1	

MISCELLANEOUS PRIMARY ASSEMBLIES

Apr., 1983

M5-17 TO 23



ITEM	No. Req'd	MATERIAL	
a	8	Bolt, machine, 5/8" x req'd. length	
c	4	Bolt, machine, 3/4" x req'd. length	
d	20	Washer, 2 1/4" x 2 1/4" x 3/16", 13/16" hole	
e	2	Crossarm, 3 5/8" x 4 5/8" x 10'-0"	
j		Screw lag, 1/2" x 5", as req'd.	
j	8	Screw lag, 1/2" x 6"	
k	6	Insulator, suspension, Poly	
l	6	Clamp, deadend	
o	2	Bolt, eye, 5/8" x req'd length	
p		Connectors, as required	
ag	1	Surge arrester	
ae	3	By-pass arrester *	
av		Jumpers, stranded, as required	
br	3	Chain link, 5/8" x 3 1/2"	
bu	3	Connector, solderless *	
cc	2	Deadend assembly, neutral	
rg	3	Regulator, step type	
sk	3	Regulator by-pass switch	
	2	Structural timber, 4" x 12" x 10'-0"	
		Planks, 2" thick, length as req'd.	
pt		Locknuts, as required	
		Remote control kit with	
		mounting hardware *	
c	12	Bolt, machine, 1/2" x req'd. length	

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

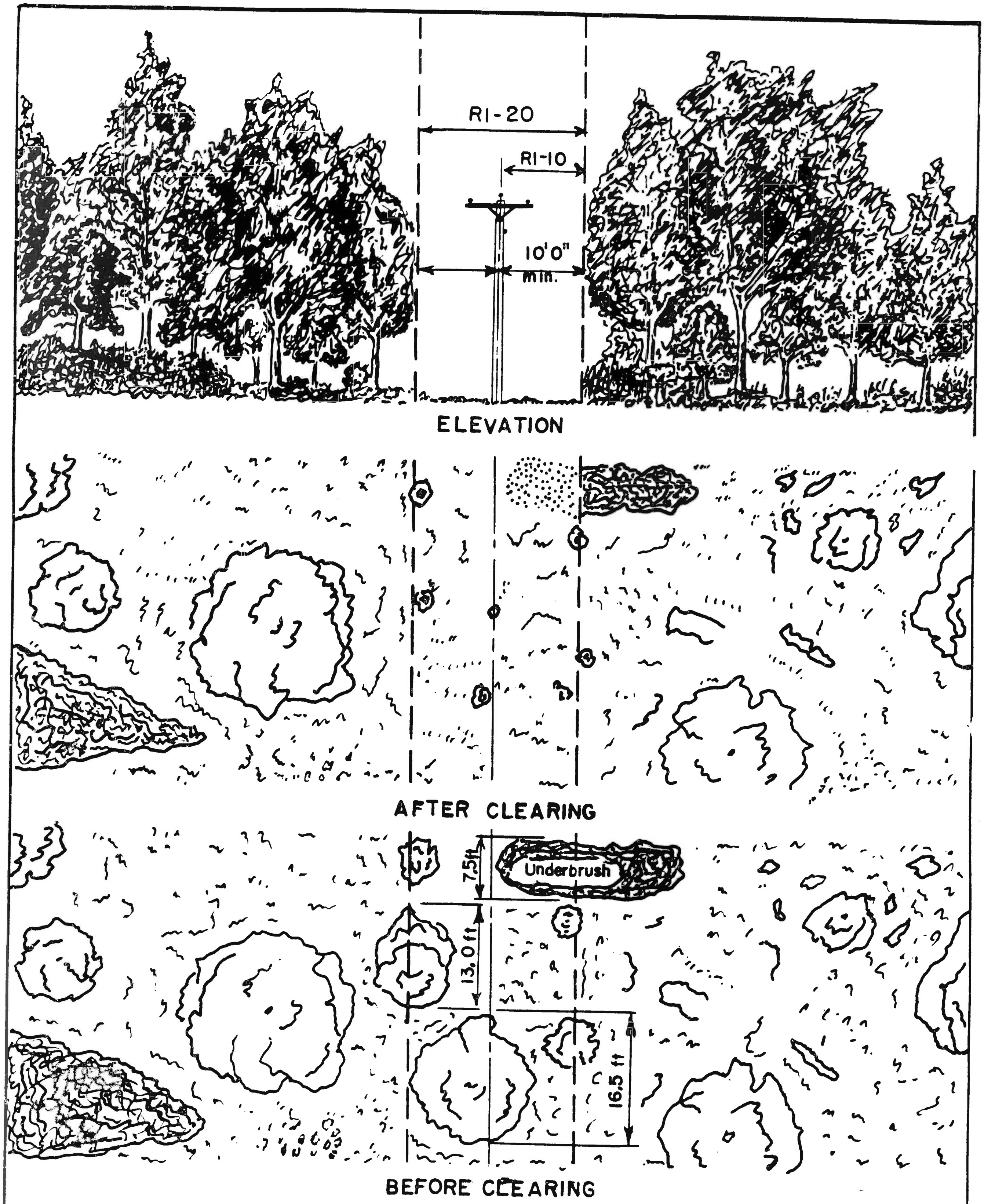
Note: All structural timber and planks to be treated as per REA Specification DT-5B.

See drawings M42-3, M42-11, M42-13, M42-21 for item cc.

12.5/7.2 kV
THREE VOLTAGE REGULATORS
PLATFORM MOUNTED

Apr., 1983

M7-13B



CLEARING RIGHT-OF-WAY GUIDE

Apr., 1983

R1

Section 13: Sags and Tensions

Supply conductors and shield wires shall not exceed 60% of their rated breaking strength for the combined ice and wind loading of the National Electric Safety Code (NESC) medium loading district. The tension at 60° F without external load shall not exceed 35% of rated breaking strength for initial unloaded tension. The main line ruling span for the project (795AAC – 3/0ACSR) is 280'. The resulting ground clearances shall be in compliance with the NESC clearances.

Drawing R1 depicts a Clearing Right-of-Way Guide for a 20 foot right of way. The desired right of way for Volunteer Electric Cooperative needs to be verified by Volunteer Electric Cooperative's Engineering Staff.

Southwire SAG10™

4/23/2013

FA-MEM48

VEC - Primary -795AAC
Volunteer Energy Cooperative
STP-101(16)
ARBUTUS 37 Strands
280 FT RS

Conductor: 795.0 Kcmil 37 Strands AAC "ARBUTUS"

Area = 0.6245 Sq. in Diameter = 1.026 in Weight = 0.746 lb/ft RTS = 13900 lb
Data from Chart No. 1-1049
English Units
Limits and Outputs in Average Tensions.

Span = 280.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	2.47	5757	2.05	6946
32.0	0.25	0.00	0.00	1.143	2.44	4590	1.81	6182
0.0	0.00	0.00	0.00	0.746	1.23	5945	1.02	7195
15.0	0.00	0.00	0.00	0.746	1.45	5043	1.10	6641
30.0	0.00	0.00	0.00	0.746	1.74	4201	1.21	6065
60.0	0.00	0.00	0.00	0.746	2.58	2834	1.50	4865*
90.0	0.00	0.00	0.00	0.746	3.65	2006	1.99	3666
120.0	0.00	0.00	0.00	0.746	4.70	1557	2.77	2638
167.0	0.00	0.00	0.00	0.746	6.14	1192	4.34	1688
212.0	0.00	0.00	0.00	0.746	7.32	1001	5.75	1275

* Design Condition

Span = 300.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	2.82	5788	2.34	6972
32.0	0.25	0.00	0.00	1.143	2.79	4616	2.08	6196
0.0	0.00	0.00	0.00	0.746	1.43	5875	1.17	7178
15.0	0.00	0.00	0.00	0.746	1.68	4991	1.27	6625
30.0	0.00	0.00	0.00	0.746	2.01	4173	1.39	6053
60.0	0.00	0.00	0.00	0.746	2.93	2864	1.73	4865*
90.0	0.00	0.00	0.00	0.746	4.06	2071	2.27	3691
120.0	0.00	0.00	0.00	0.746	5.16	1630	3.11	2697
167.0	0.00	0.00	0.00	0.746	6.67	1260	4.75	1768
212.0	0.00	0.00	0.00	0.746	7.92	1062	6.23	1349

* Design Condition

Span = 250.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	1.98	5715	1.64	6910
32.0	0.25	0.00	0.00	1.143	1.96	4554	1.45	6161
0.0	0.00	0.00	0.00	0.746	0.96	6050	0.81	7220
15.0	0.00	0.00	0.00	0.746	1.14	5124	0.87	6662
30.0	0.00	0.00	0.00	0.746	1.37	4249	0.96	6082
60.0	0.00	0.00	0.00	0.746	2.09	2790	1.20	4865*
90.0	0.00	0.00	0.00	0.746	3.07	1902	1.61	3629
120.0	0.00	0.00	0.00	0.746	4.04	1443	2.29	2547
167.0	0.00	0.00	0.00	0.746	5.37	1087	3.73	1562
212.0	0.00	0.00	0.00	0.746	6.45	906	5.03	1159

* Design Condition

Span = 200.0 Feet
Creep IS a Factor

NESC Medium Load Zone

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	1.28	5658	1.06	6856
32.0	0.25	0.00	0.00	1.143	1.27	4505	0.93	6131
0.0	0.00	0.00	0.00	0.746	0.60	6216	0.51	7254
15.0	0.00	0.00	0.00	0.746	0.71	5259	0.56	6693
30.0	0.00	0.00	0.00	0.746	0.86	4335	0.61	6107
60.0	0.00	0.00	0.00	0.746	1.37	2720	0.77	4865*
90.0	0.00	0.00	0.00	0.746	2.18	1711	1.04	3570
120.0	0.00	0.00	0.00	0.746	3.03	1234	1.56	2386
167.0	0.00	0.00	0.00	0.746	4.15	900	2.80	1334
212.0	0.00	0.00	0.00	0.746	5.04	741	3.90	957

* Design Condition

Span = 600.0 Feet
Creep IS a Factor

NESC Medium Load Zone

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	10.26	6371	8.82	7406
32.0	0.25	0.00	0.00	1.143	10.10	5099	7.98	6446
0.0	0.00	0.00	0.00	0.746	6.68	5025	4.93	6807
15.0	0.00	0.00	0.00	0.746	7.51	4473	5.32	6307
30.0	0.00	0.00	0.00	0.746	8.38	4007	5.78	5811
60.0	0.00	0.00	0.00	0.746	10.19	3297	6.90	4865*
90.0	0.00	0.00	0.00	0.746	11.97	2809	8.31	4044
120.0	0.00	0.00	0.00	0.746	13.65	2465	9.90	3395
167.0	0.00	0.00	0.00	0.746	16.07	2095	12.48	2695
212.0	0.00	0.00	0.00	0.746	18.16	1855	14.83	2270

* Design Condition

Span = 500.0 Feet
Creep IS a Factor

NESC Medium Load Zone

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	7.36	6165	6.25	7258
32.0	0.25	0.00	0.00	1.143	7.25	4931	5.62	6360
0.0	0.00	0.00	0.00	0.746	4.44	5247	3.35	6950
15.0	0.00	0.00	0.00	0.746	5.09	4583	3.63	6428
30.0	0.00	0.00	0.00	0.746	5.81	4015	3.95	5900
60.0	0.00	0.00	0.00	0.746	7.38	3161	4.79	4865*
90.0	0.00	0.00	0.00	0.746	8.97	2601	5.93	3936
120.0	0.00	0.00	0.00	0.746	10.48	2228	7.30	3198
167.0	0.00	0.00	0.00	0.746	12.63	1850	9.60	2433
212.0	0.00	0.00	0.00	0.746	14.48	1616	11.69	1999

* Design Condition

Span = 400.0 Feet
Creep IS a Factor

NESC Medium Load Zone

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	4.87	5965	4.08	7110
32.0	0.25	0.00	0.00	1.143	4.80	4765	3.64	6275
0.0	0.00	0.00	0.00	0.746	2.70	5537	2.11	7076
15.0	0.00	0.00	0.00	0.746	3.14	4755	2.28	6535
30.0	0.00	0.00	0.00	0.746	3.67	4065	2.49	5982
60.0	0.00	0.00	0.00	0.746	4.95	3015	3.07	4865*
90.0	0.00	0.00	0.00	0.746	6.33	2360	3.91	3817
120.0	0.00	0.00	0.00	0.746	7.65	1954	5.03	2967
167.0	0.00	0.00	0.00	0.746	9.50	1574	7.02	2128
212.0	0.00	0.00	0.00	0.746	11.06	1353	8.82	1694

* Design Condition

Span = 757.0 Feet
Creep IS a Factor

NESC Medium Load Zone

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb

15.0	0.25	4.00	0.20	1.451	15.62	6663	13.69	7602
32.0	0.25	0.00	0.00	1.143	15.37	5333	12.52	6543
0.0	0.00	0.00	0.00	0.746	11.20	4776	8.20	6522
15.0	0.00	0.00	0.00	0.746	12.25	4368	8.81	6069
30.0	0.00	0.00	0.00	0.746	13.31	4021	9.49	5633
60.0	0.00	0.00	0.00	0.746	15.40	3475*	11.07	4832
90.0	0.00	0.00	0.00	0.746	17.42	3074	12.86	4161
120.0	0.00	0.00	0.00	0.746	19.33	2771	14.75	3628
167.0	0.00	0.00	0.00	0.746	22.12	2424	17.72	3022
212.0	0.00	0.00	0.00	0.746	24.57	2184	20.42	2625

* Design Condition

Span = 1116.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	33.82	6704	31.07	7292
32.0	0.25	0.00	0.00	1.143	33.51	5328	29.57	6034
0.0	0.00	0.00	0.00	0.746	28.61	4070	23.22	5009
15.0	0.00	0.00	0.00	0.746	29.88	3898	24.42	4764
30.0	0.00	0.00	0.00	0.746	31.13	3742	25.63	4540
60.0	0.00	0.00	0.00	0.746	33.54	3475*	28.06	4150
90.0	0.00	0.00	0.00	0.746	35.85	3253	30.44	3827
120.0	0.00	0.00	0.00	0.746	38.06	3066	32.77	3557
167.0	0.00	0.00	0.00	0.746	41.34	2825	36.26	3216
212.0	0.00	0.00	0.00	0.746	44.31	2638	39.43	2960

* Design Condition

Span = 457.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	6.24	6077	5.27	7193
32.0	0.25	0.00	0.00	1.143	6.14	4859	4.72	6323
0.0	0.00	0.00	0.00	0.746	3.63	5364	2.78	7007
15.0	0.00	0.00	0.00	0.746	4.19	4649	3.01	6476
30.0	0.00	0.00	0.00	0.746	4.83	4031	3.28	5936
60.0	0.00	0.00	0.00	0.746	6.29	3099	4.00	4865*
90.0	0.00	0.00	0.00	0.746	7.79	2502	5.01	3886
120.0	0.00	0.00	0.00	0.746	9.22	2115	6.28	3103
167.0	0.00	0.00	0.00	0.746	11.25	1735	8.45	2308
212.0	0.00	0.00	0.00	0.746	12.98	1506	10.42	1873

* Design Condition

Span = 419.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	5.31	6002	4.46	7137
32.0	0.25	0.00	0.00	1.143	5.23	4796	3.99	6291
0.0	0.00	0.00	0.00	0.746	2.99	5477	2.32	7053
15.0	0.00	0.00	0.00	0.746	3.47	4717	2.51	6516
30.0	0.00	0.00	0.00	0.746	4.04	4052	2.74	5967
60.0	0.00	0.00	0.00	0.746	5.38	3044	3.37	4865*
90.0	0.00	0.00	0.00	0.746	6.80	2409	4.26	3840
120.0	0.00	0.00	0.00	0.746	8.16	2009	5.44	3014
167.0	0.00	0.00	0.00	0.746	10.07	1629	7.49	2190
212.0	0.00	0.00	0.00	0.746	11.69	1405	9.35	1755

* Design Condition

Span = 1163.0 Feet NESC Medium Load Zone
Creep IS a Factor

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	1.451	36.72	6707	33.90	7261
32.0	0.25	0.00	0.00	1.143	36.40	5328	32.37	5987
0.0	0.00	0.00	0.00	0.746	31.46	4021	25.92	4875
15.0	0.00	0.00	0.00	0.746	32.75	3864	27.16	4653
30.0	0.00	0.00	0.00	0.746	34.00	3722	28.41	4451
60.0	0.00	0.00	0.00	0.746	36.44	3475*	30.88	4097
90.0	0.00	0.00	0.00	0.746	38.77	3268	33.30	3800

120.0	0.00	0.00	0.00	0.746	41.01	3091	35.65	3551
167.0	0.00	0.00	0.00	0.746	44.34	2861	39.19	3233
212.0	0.00	0.00	0.00	0.746	47.35	2681	42.41	2990

* Design Condition

Southwire SAG10™

4/23/2013

FA-MEM48

VEC - Neutral - 3/0ACSR
Volunteer Energy Cooperative
STP-101(16)
PIGEON 6/1 Strands
280 FT RS

Conductor: #3/0 AWG 6/ 1 Stranding ACSR "PIGEON"

Area = 0.1537 Sq. in   Diameter = 0.502 in   Weight = 0.231 lb/ft   RTS = 6620 lb
Data from Chart No. 1-938
English Units
Limits and Outputs in Average Tensions.

Span = 280.0 Feet   NESC Medium Load Zone
Creep IS a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	2.70	2803	2.52	3001
32.0	0.25	0.00	0.00	0.465	1.99	2293	1.69	2697
0.0	0.00	0.00	0.00	0.231	0.84	2688	0.77	2942
15.0	0.00	0.00	0.00	0.231	0.93	2422	0.81	2793
30.0	0.00	0.00	0.00	0.231	1.05	2160	0.86	2638
60.0	0.00	0.00	0.00	0.231	1.37	1655*	0.98	2313
90.0	0.00	0.00	0.00	0.231	1.88	1203	1.15	1968
120.0	0.00	0.00	0.00	0.231	2.64	857	1.41	1610
167.0	0.00	0.00	0.00	0.231	3.22	704	2.12	1069
212.0	0.00	0.00	0.00	0.231	3.75	604	3.26	695

* Design Condition

Span = 300.0 Feet   NESC Medium Load Zone
Creep IS a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	3.06	2839	2.88	3021
32.0	0.25	0.00	0.00	0.465	2.27	2307	1.94	2702
0.0	0.00	0.00	0.00	0.231	0.97	2678	0.89	2936
15.0	0.00	0.00	0.00	0.231	1.08	2414	0.93	2786
30.0	0.00	0.00	0.00	0.231	1.21	2154	0.99	2632
60.0	0.00	0.00	0.00	0.231	1.57	1655*	1.13	2307
90.0	0.00	0.00	0.00	0.231	2.14	1214	1.32	1964
120.0	0.00	0.00	0.00	0.231	2.96	878	1.61	1610
167.0	0.00	0.00	0.00	0.231	3.61	719	2.40	1082
212.0	0.00	0.00	0.00	0.231	4.18	622	3.62	719

* Design Condition

Span = 250.0 Feet   NESC Medium Load Zone
Creep IS a Factor   Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	2.20	2749	2.03	2969
32.0	0.25	0.00	0.00	0.465	1.60	2269	1.35	2688
0.0	0.00	0.00	0.00	0.231	0.67	2699	0.61	2949
15.0	0.00	0.00	0.00	0.231	0.74	2432	0.64	2799
30.0	0.00	0.00	0.00	0.231	0.83	2167	0.68	2644
60.0	0.00	0.00	0.00	0.231	1.09	1653	0.78	2317*
90.0	0.00	0.00	0.00	0.231	1.52	1186	0.92	1969
120.0	0.00	0.00	0.00	0.231	2.20	822	1.12	1606
167.0	0.00	0.00	0.00	0.231	2.66	679	1.72	1047
212.0	0.00	0.00	0.00	0.231	3.14	575	2.76	655

* Design Condition

Span = 200.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	1.45	2660	1.32	2916
32.0	0.25	0.00	0.00	0.465	1.04	2229	0.87	2668
0.0	0.00	0.00	0.00	0.231	0.43	2711	0.39	2953
15.0	0.00	0.00	0.00	0.231	0.47	2441	0.41	2803
30.0	0.00	0.00	0.00	0.231	0.53	2172	0.44	2647
60.0	0.00	0.00	0.00	0.231	0.70	1646	0.50	2317*
90.0	0.00	0.00	0.00	0.231	1.00	1154	0.59	1965
120.0	0.00	0.00	0.00	0.231	1.49	777	0.72	1593
167.0	0.00	0.00	0.00	0.231	1.82	635	1.15	1005
212.0	0.00	0.00	0.00	0.231	2.21	522	2.00	579

* Design Condition

Span = 600.0 Feet
Creep is NOT a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	10.36	3358	10.36	3358
32.0	0.25	0.00	0.00	0.465	8.25	2538	7.49	2796
0.0	0.00	0.00	0.00	0.231	4.20	2475	3.73	2787
15.0	0.00	0.00	0.00	0.231	4.63	2248	3.93	2643
30.0	0.00	0.00	0.00	0.231	5.11	2034	4.16	2496
60.0	0.00	0.00	0.00	0.231	6.28	1655*	4.73	2198
90.0	0.00	0.00	0.00	0.231	7.68	1355	5.47	1902
120.0	0.00	0.00	0.00	0.231	9.19	1133	6.41	1622
167.0	0.00	0.00	0.00	0.231	11.15	934	8.30	1254
212.0	0.00	0.00	0.00	0.231	12.12	859	10.37	1004

* Design Condition

Span = 500.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	7.57	3192	7.45	3244
32.0	0.25	0.00	0.00	0.465	5.90	2463	5.26	2762
0.0	0.00	0.00	0.00	0.231	2.83	2552	2.54	2845
15.0	0.00	0.00	0.00	0.231	3.13	2309	2.67	2699
30.0	0.00	0.00	0.00	0.231	3.48	2077	2.83	2549
60.0	0.00	0.00	0.00	0.231	4.36	1655*	3.22	2239
90.0	0.00	0.00	0.00	0.231	5.50	1313	3.75	1924
120.0	0.00	0.00	0.00	0.231	6.81	1061	4.46	1618
167.0	0.00	0.00	0.00	0.231	8.38	863	6.01	1202
212.0	0.00	0.00	0.00	0.231	9.23	783	7.83	923

* Design Condition

Span = 400.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	0.772	5.12	3017	4.94	3129
32.0	0.25	0.00	0.00	0.465	3.90	2385	3.41	2730
0.0	0.00	0.00	0.00	0.231	1.76	2621	1.60	2896
15.0	0.00	0.00	0.00	0.231	1.95	2366	1.68	2748
30.0	0.00	0.00	0.00	0.231	2.18	2118	1.78	2595
60.0	0.00	0.00	0.00	0.231	2.79	1655*	2.03	2276
90.0	0.00	0.00	0.00	0.231	3.65	1265	2.37	1946
120.0	0.00	0.00	0.00	0.231	4.73	977	2.86	1614
167.0	0.00	0.00	0.00	0.231	5.82	794	4.04	1145
212.0	0.00	0.00	0.00	0.231	6.54	707	5.57	830

* Design Condition

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