United States
Department of
Agriculture

Rural
Utilities
Service

RUS Bulletin
1728F-811

April 1998

Electric Transmission Specifications and Drawings, 115 kV Through 230 kV

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UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Utilities Service

BULLETIN 1728F-811

SUBJECT: **Electric Transmission Specifications and Drawings, 115 kV Through 230 kV**

Incorporated by reference in 7 CFR Part 1728

TO: All Electric Borrowers
RUS Electric Staff

EFFECTIVE DATE: Date Of Approval

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

OFFICE OF PRIMARY INTEREST: Transmission Branch, Electric Staff Division

PREVIOUS INSTRUCTIONS: This bulletin replaces Bulletin 50-1, Electric Transmission Specifications and Drawings, 115 kV Through 230 kV, issued October 4, 1988.

FILING INSTRUCTIONS: Discard Bulletin 50-1 dated October 4, 1988, and replace with this bulletin. File with 7 CFR part 1728.

PURPOSE: To provide general construction requirements for representative wood pole structures and assemblies for 115 through 230 kV transmission lines.

/S/ Blaine Stockton
Assistant Administrator
Electric Program

April 9, 1999
Date

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ABBREVIATIONS

ANSI	*American National Standards Institute*
CFR	*Code of Federal Regulations*
FAA	*Federal Aviation Administration*
IEEE	*Institute of Electrical and Electronics Engineers*
NESC	*National Electrical Safety Code*
OHGW	*Overhead Ground Wire*
RUS	*Rural Utilities Service*

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INTRODUCTION - GENERAL

Purpose: These specifications and drawings provide general minimum requirements for constructing standard wood pole structures and assemblies for 115 kV through 230 kV transmission lines.

The borrower or borrower's representative is responsible for preparing a complete construction contract consisting of the construction contract form (RUS Form 830 or 831) and all applicable specifications, plans, and drawings to construct transmission line project.

RUS borrowers are required to construct projects that meet the minimum requirements of their loan documents and all applicable RUS regulations. The requirements set forth in this bulletin implement provisions of the standard form of loan documents between RUS and its electric borrowers and RUS regulations. The loan documents require RUS borrowers to construct electric facilities in accordance with RUS approved plans and specifications.

Scope: The specification for construction covers right-of-way clearing and access, wood poles, pole top assemblies, structure assembly and structure erection, guys and anchors, grounding and bonding, insulators and hardware, and phase conductors and overhead ground wires.

The drawings provided in this specification include wood pole structures, guying attachments, miscellaneous assemblies, foundation units, guying assembly units, and anchor units. These drawings cover usual construction needs and conditions. Borrowers may need to develop drawings which address specific unusual construction conditions.

Preparation of the Construction Contract: This bulletin does not set forth all the terms and conditions that are necessary for a specific construction contract. This bulletin sets forth the minimum specifications and drawings for standard wood pole structures and assemblies for 115 kV through 230 kV transmission lines.

When preparing a complete construction contract, the borrower or borrower's representative should remove pages i to viii and add to Part I and Part II of this bulletin the following:

- *RUS Form 830, Electric System Construction Contract, or RUS Form 831, Electric Transmission Construction Contract*
- *General Conditions*
- *Plans Including Maps and Special Drawings*
- *Plan-and-Profile Drawings*

RUS Forms 830 and 831 cover "Notice and Instructions to Bidders," "Contractor's Proposal," "Transmission Construction Units and Prices," "Acceptance," and "Contractor's Bond." All appropriate blanks and selections in the RUS contract must be completed by the borrower.

The RUS borrower or the borrower's representative is responsible for setting forth and including in sufficient detail the construction RUS specifications and drawings. In the preparation of Part I, Specifications, and Part II, Drawings, the borrower or borrower's representative is responsible for assuring that the RUS approved specifications and drawings for a transmission line project are set forth in sufficient detail in the construction contract and that the completed construction project complies with the contract. RUS construction specifications have been arranged so that they may be expanded to include any specific borrower requirements or they may be reduced to exclude any sections that are not necessary (such as clearing, etc.,) if the work will not be included in the contract.

INTRODUCTION - SPECIFIC INSTRUCTIONS

A construction contract with detailed construction specifications and drawings must be prepared before requesting bids. Preparation of the construction specification and drawings is discussed below:

1. *Construction Specification: The following is a checklist of pages in this specification where there are certain specific options available to the borrower and also specified areas where additional information can be added to meet special circumstances relating to the project:*

   a. *Page 1-1, Paragraph 1.2*
   b. *Page 3-1, Paragraph 3.1.2 - check one*
   c. *Page 4-2, Paragraphs 4.2.3 and 4.2.4 - check one*
   d. *Page 11-2, Paragraph 11.4.2 - check one*
   e. *Page 11-2, Paragraph 11.5.1 - complete when appropriate*
   f. *Page 12-1, Index of Drawings - complete*
   g. *Special Requirement Sections - if there are no special requirements, indicate "none"*

2. *Drawings:*

   a. *Structural Material List: All items that are blank in the "List of Materials" for each structure drawing must be completed. Drawing TE-2 gives guidance to the selection of assemblies which may be specified by the borrower or borrower's representative in the material list. Descriptions of these assemblies are as follows:*

      (1) *Cushioned suspension assemblies or bolted clamp assemblies for the conductor or overhead ground wire*
      (2) *Single or double bolt overhead ground wire support brackets*
      (3) *Guy attachments*
      (4) *Angle bracket and guy attachments*
      (5) *Overhead guy assemblies*

   b. *Guying Guide Drawings: A guying guide for angle and deadend structures should show the centerline offset dimension for each structure; the type, quantity, and location for all guy assemblies and anchor installations, and pole-to-pole spacing if other than that given on the structure drawings.*

   c. *Pole Framing Drawings: Appropriate pole framing drawings should be included. For structures with crossbraces, the location of the top mounting holes for the crossbrace should be clearly dimensioned on the pole framing drawings.*

   d. *Crossarm Drilling Drawings: Any crossarm drilling drawings not set forth in this bulletin should be added.*

3. *Miscellaneous Information*

a. Insulator Information: The following tables provide nominal insulator string lengths. The exact length required is to be shown on drawings TM-1 and TM-2 and will reflect actual dimensions of hardware, suspension clamp, and deadend clamps specified.

Table 1
Lengths of Insulator Strings for TM-1

Voltage Class	No. of Bell Units	Tangent TM-1A	Tangent TM-1B	No. Bell Units	Angle TM-1C	No. Bell Units	Deadends TM-1D or 1E
115 kV	7	3′-11″	4′-0″	8	4′-10″	9	5′-3″
138 kV	8	4′-5″	4′-6″	9	5′-4″	10	5′-9″
161 kV	10	5'-4″	5'-5″	11	6′-3″	12	6′-8″
230 kV	12	6′-4″	6′-5″	13	7′-3″	16	8′-7″
	14	7′-3″	7′-4″	16	8′-8″		

Table 2
Lengths of Insulator Strings for TM-2

Voltage Class	No. of Bell Units	TM-2A	TM-2B	No. of Bell Units	Angle, TM-2C Type 1	Type 2	Type 3	No. of Bell Units	Deadends TM-1d or 1E
115 kV	7	4′-1″	4′-2″	8	5′-0″	*	*	9	5′-3″
138 kV	8	4′-7″	4′-8″	9	5′-6″	*	*	10	5′-9″
161 kV	10	5′-6″	5′-7″	11	6′-6″	*	*	12	6′-8″
230 kV	12	6′-6″	6′-7″	13	7′-6″	*	*	16	8′-7″
	14	7′-5″	7′-6″	16	8′-10″	*	*		

**Varies with yoke dimensions.*

The borrower or borrower's representative is responsible for ensuring that required proper clearances between insulator strings and guy wires and structures are maintained for the actual insulator string lengths. For certain angle structures, recommended pole-to-pole spacings are provided on the structure drawings based on insulator string lengths using bolted clamps.

b. Structure Strength: The borrower or borrower's representative is responsible for ensuring that the design strength of each structure will be adequate. Included are poles, crossarms, bolts, braces, insulators, and connections.

c. Drawing TE-2: This drawing is a checklist which includes the subassembly alternatives which the borrower needs to specify on the structure drawings.

PART I

SPECIFICATIONS

1. GENERAL

1.1 Standard of Work and Schedules

1.1.1 All work must be performed in a thorough and proficient manner in accordance with the plans, specifications, and construction drawings.

1.1.2 In accordance with the requirements of 7 CFR 1724 Subpart E, Electric System Design, the latest edition of the National Electrical Safety Code (NESC), American National Standards Institute (ANSI) C2, must be followed wherever applicable to the work, except where local regulations or specification requirements are more stringent, in which case the more stringent requirements must govern. The NESC may be obtained from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, P.O. Box 1331, Piscataway, N.J., 08855-1331, USA.

1.2 Technical Specifications: The following sections form the technical specifications (engineer to complete):

General	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

1.3 Drawing and Maps

1.3.1 All drawings and maps accompanying this specification or listed herein must be considered a part of these plans and specifications. The specific drawings included as part of this technical specification are listed and indexed in section 12, Drawings.

1.3.2 If the drawings specify a requirement different from the worded specifications, the specifications must govern.

1.4 Locations of Structures and Appurtenances: Structures, anchors, access roads, and other major items to be constructed must be placed in locations determined and staked by the engineer and as shown on the plan-and-profile drawings. The contractor is responsible for verifying the location of structures and appurtenances to be installed.

1.5 Safety

1.5.1 The work must be performed in accordance with all applicable Federal, State, and local safety laws and regulations.

1.5.2 The contractor shall be responsible for the observance of proper safety practices and the avoidance of damage to property by all personnel engaged in the work.

1.5.3 The contractor shall take all steps necessary to prevent damage to or interference with existing power lines, communication facilities, roadways, railroads, waterways, buried cables, pipelines, and other facilities adjacent to or crossing the project right-of-way.

1.5.4 The contractor shall develop and maintain for the duration of this contract a safety program which will provide for compliance with applicable provisions of the National Electrical Safety Code and Federal, State, and local safety laws and regulations. The contractor shall designate a qualified employee to supervise the safety program and ensure compliance with applicable safety laws and regulations.

1.5.5 Structures and Conductors in the Vicinity of Airports or Exceeding 200 Feet in Height - 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 must be contacted and if required, FAA Form 7460-1, "Notice of Proposed Construction or Alteration," is to be filed.

1.6 Definitions

1.6.1 Construction unit means a specifically defined portion of a construction project containing materials, labor, or both for purposes of bidding and payment.

1.6.2 Contractor means a person or firm furnishing materials or performing construction at a specified price.

1.6.3 Engineer means a registered or licensed person employed by the borrower to provide engineering services for a project and duly authorized assistants and representatives.

1.6.4 Owner-furnished materials means materials or equipment or both supplied by the borrower for installation by the contractor.

1.7 Abbreviations

ANSI	American National Standards Institute
CFR	Code of Federal Regulations
FAA	Federal Aviation Administration
IEEE	Institute of Electrical and Electronics Engineers
NESC	National Electrical Safety Code
OHGW	Overhead Ground Wire
RUS	Rural Utilities Service

1.8 Special Requirements (to be completed by the engineer):

2. CLEARING

2.1 General Requirements

2.1.1 Clearing units specified may cover full width right-of-way clearing, selective clearing, treetopping, spraying of herbicides, or other forms of right-of-way preparation. Only those areas shown on the drawings or specified by the engineer shall be cleared in accordance with the applicable clearing units. Isolated ("danger") trees to be removed will be marked in the field by the engineer.

2.1.2 Only such vegetation should only be removed as necessary to permit construction, operation, and maintenance of the transmission line. Care must be taken to prevent denuding of ground cover and erosion of the soil.

2.2 Clearing Methods and Equipment

2.2.1 Unless otherwise specified, all timber to be cleared must be felled. The removal of brush must be in a manner so as to reduce the overall impact on the root structure of the ground cover.

2.2.2 Equipment must be in good repair and appropriate for the types of clearing specified.

2.2.3 When specified in the right-of-way construction units, stumps left in place must be treated with a heavy application of an appropriate herbicide approved by the engineer. Chemical treatment of stumps must occur as soon as possible after cutting. The chemical application must be sufficient to saturate the entire above ground surface of the stump and cause a small amount to run down the sides and collect at the base to penetrate below the ground line into the roots. Any stumps showing resurgent growth prior to completion of line construction must be treated to kill all such growth.

2.2.4 Chemical sprays or herbicides must only be used with the approval of the engineer, and only in areas so designated for their use. Herbicides must be applied in accordance with the manufacturer's recommendations and only by a licensed/certified applicator. The chemical sprays and herbicides must meet the environmental requirements of all governing agencies. Spraying must be performed in such manner, at such pressure, and under such wind conditions that drift of spray material to adjacent plants, animals, or persons will be avoided.

Such application must not be made: a) when the ground is continuously frozen; b) adjacent to streams or other water bodies; c) when the ground is or may be flooded during the period in which the herbicide retains its toxicity; or d) in a marsh or other wetland.

2.2.5 If required by the "Special Requirements" paragraph below, stumps must be removed.

2.2.6 The landowner's written permission must be received prior to cutting trees outside the right-of-way.

2.2.7 Disposal of trees, brush, branches, and refuse must be in accordance with the methods specified in the construction units.

2.2.8 Avoid clearing vegetation in riparian areas to the extent possible. A vegetative buffer zone should be left along creeks and streams to minimize siltation and sedimentation and prevent adverse impacts to riparian habitat.

2.3 Special Requirements (to be completed by the engineer):

3. ACCESS

3.1 Ingress And Egress

3.1.1 The activities of the contractor are to be restricted to along the right-of-way.

3.1.2 Where access to the right-of-way is across private property, the owner, tenant, or occupant shall be contacted to obtain permission for ingress and egress to the right-of-way. Such arrangements, including obtaining releases for damage, must be made by (engineer to check one):

a. The borrower or engineer ..... ☐
b. The contractor ..... ☐
c. Other (specify) ..... ☐

3.1.3 Access across public land must be accomplished as described in Access, Section 3.6, "Special Requirements."

3.2 Fences and Gates

3.2.1 Where fences must be cut to allow access for the work, gates must be installed as shown on the drawings or as directed by the engineer. All material and labor required for such installations must be furnished by the contractor per bid unit.

3.2.2 Types and details of gate construction must be shown on the drawings or approved by the engineer.

3.2.3 Brace posts must be installed at each fence cut to insure that adjacent fence spans will not become slack. A wire fence must not be cut until it is secured to the brace post.

3.2.4 All gates must be closed and locked when required by the landowner.

3.2.5 Gate units may include removal of the gate after construction of the line is complete. In those cases as determined by the engineer, the contractor shall remove the gate and restore the fence. All labor and material required must be furnished by the contractor. If removal is required, gate material must be disposed of in a manner acceptable to the engineer.

3.3 Access Roads

3.3.1 Access road construction may be required as a part of the work. Where specified, roads must be of the type, dimensions, and grades shown on the drawings, and must be located as shown on the drawings and as staked by the engineer.

3.3.2 Borrowed material for access road fill must be a compactible granular material suitable for such a purpose, free of brush, refuse, or organic material. Fill must be compacted by the use of suitable heavy construction equipment. The finished road must be maintained smooth and free of ruts and sink holes until completion of construction. Water bars, drainage ditches, or other special requirements as called for on the drawings must be installed in accordance with the plans and specifications. All materials and labor required for such work must be furnished by the contractor.

3.4 Culverts: Culvert pipes must be installed as shown on the drawings or as directed by the engineer. Each pipe must be of a type, diameter, and length as specified and must be properly set, backfilled, and tamped. All labor and material required must be provided by the contractor.

3.5 Restoration: The contractor shall have a continuous cleanup program throughout construction. The contractor shall restore the land that is crossed to its original condition. This restoration includes the removal of deep ruts and the disposal of foreign objects such as stumps or chunks of concrete. It also includes smoothing and reseeding damaged vegetation areas with vegetation similar to the original, cleaning out gullies, and restoring terraces. Roads existing prior to construction must be restored to equal or better than their original condition.

3.6 Special Requirements (to be completed by the engineer):

4. WOOD POLES

4.1 Pole Inspection, Handling, and Distribution

4.1.1 The contractor shall immediately notify the engineer of freight damage or misfabrication of poles. The framing, boring, and gaining, if required, must agree with the Pole Framing Details for the specific structures to be erected.

4.1.2 The pole lengths and classes must agree with the Pole Units specified for the structures to be erected, as tabulated in the Transmission Construction Units and shown on the plan-and-profile drawings.

4.1.3 Poles must be handled with care so as not to damage the wood or preservative treatment. Poles must be lifted off of the pole hauler at designated structure locations. They must not be rolled or dragged along the ground. Lifting slings must be used and must be fabricated from a material that protects the wood from damage. Pole tongs are not permitted when handling poles.

4.1.4 If poles are stored after delivery, they must be carefully arranged and placed on wide blocking to prevent crushing. Poles must not come in contact with standing water or the ground. No pole will have an unsupported length greater than 20 feet. The blocking must be provided by the contractor and included in this unit price.

4.1.5 The contractor shall distribute extra heavy, choice, close-grained poles to angle, deadend, and crossing structures.

4.1.6 When ungained poles and adjustable spacer fittings are specified for multi-pole structures, the contractor shall match the poles as directed by the engineer.

4.2 Field Drilling and Treating

4.2.1 All field drilled holes must be thoroughly treated with a heavy application of preservative compound approved by the engineer. The contractor shall include any required field drilling and treating in the unit cost for pole top assemblies.

4.2.2 Unused holes or holes that are misdrilled must be plugged prior to erection using treated wood dowel pins 3 inches in length. When a hole is misdrilled, the engineer shall be notified. A pole will be rejected by the engineer if two or more misdrilled holes occur at a connection. If a pole is rejected due to misdrilling of holes by the contractor, the contractor shall replace the damaged pole at no additional cost to the borrower.

4.2.3 Double crossarm spacer fittings, if required, are indicated in the List of Materials on the transmission line

structure drawings. Fixed spacers must be used with factory gained and treated poles. Adjustable spacers must be used with ungained and treated poles. The gaining of poles, and the type of crossarm spacers are as follows (engineer to check one):

a. Factory gained and treated poles for fixed spacer fittings .....☐

b. Ungained and treated poles for adjustable spacer fittings .....☐

c. Gained and treated poles for adjustable spacer fittings .....☐

d. Gained and treated poles for adjustable spacer fittings .....☐

d. Structure with double crossarms are not required ..☐

4.2.4 Poles may be supplied with flat or 15 degree sloping roofs. Tops of poles must not be cut except with the expressed approval of the borrower. If cutting is deemed necessary, the pole top must be cut off at a slope of 15 degrees, thoroughly treated with preservative approved by the engineer, and covered with a mastic type cap. Poles are to be supplied with (engineer to check one):

a. Flat roofs .....☐

b. 15 degree sloping roofs .....☐

c. Contractor's option .....☐

4.2.5 The butt of any pole is not to be cut under any circumstances.

4.3 **Special Requirements** (to be completed by the engineer)

5. POLE TOP ASSEMBLIES

5.1 Reference to Drawings

5.1.1 The pole top assembly unit consists of all items shown in the List of Materials on the transmission line structure drawings. If spacers for double crossarms are required, the type of spacer must be as noted in Wood Poles, section 4.2.3.

5.1.2 Unless shown in the List of Materials, the pole top assembly unit does not include other units such as pole units, pole grounding units, foundation units, guying assembly units, and anchor units.

5.2 Handling of Materials

5.2.1 Care must be exercised in the handling of all materials. Defective or damaged material must not be installed.

5.2.2 Equipment to load and haul to the job site. All owner-furnished material must be provided. The contractor shall bear the cost of all handling, such as loading, hauling, and unloading.

5.2.3 If framing members (crossarms, bracing, and X-braces) are stored after delivery, they must be arranged with care and placed on blocking at least 1 foot above ground to prevent contact with standing water or the ground. No crossarm must have an unsupported length greater than 20 feet. The blocking must be provided by the contractor and included in the contract's unit prices.

5.2.4 Care must be exercised in handling crossarm assemblies, pole band assemblies, and other factory subassemblies to prevent loss of components for which the contractor is responsible.

5.2.5 Materials or equipment must not be placed where it will be damaged by or cause damage to vehicular traffic, livestock, persons, and property.

5.3 Special Requirements (to be completed by the engineer):

6. STRUCTURE ASSEMBLY

6.1 Reference to Drawings

6.1.1 The contractor shall assemble each structure using the assemblies designated on the plan-and-profile drawings and as shown on the structure and assembly drawings.

6.1.2 Connection details to assemble each structure are referenced on the structure drawings and included with the plans and specifications.

6.2 Structure Framing

6.2.1 The contractor shall frame structures on flat or uniformly sloping terrain located at or near the structure site. Framing on rolling terrain where poles become unsupported should be avoided. If assembly on uniform terrain is not possible, the contractor shall temporarily support the structure components to prevent racking during assembly.

6.2.2 All grid gain teeth must be fully embedded into the wood surface to meet the approval of the engineer. Grid gains must be seated by a combination of tightening assembly bolts and hammering on wood blocking.

6.2.3 All hardware at a connection must be compatible with the fastener diameter. The holes in the hardware must be 1/16 of an inch greater than the fastener diameter, unless otherwise noted. The quantity of square nuts required for a fastener must conform (unless otherwise noted in the List of Materials on the transmission line structure drawings) to ANSI C135.1, Galvanized Steel Bolts and Nuts.

6.2.4 Fasteners must be sized so that they extend not less than 1/2 of an inch nor more than 2-1/2 inches beyond the face of the last nut or locknut. Galvanized bolts must not be cut off unless the engineer allows it for special requirements. Where bolts are not of proper length due to variations in the material, the contractor shall replace the fasteners with ones of proper length at no cost to the borrower.

6.2.5 Spring washers must be installed where specified. The curved portion of the spring washer must be installed horizontally to facilitate inspection of wood shrinkage in the future.

6.2.6 Double crossarms, when installed, must not bow by more than plus or minus 1/2 of an inch per arm. The contractor shall replace spacer fittings, where required, to meet this specification. The additional cost to replace spacers to meet this tolerance must be included in the contractor's unit costs

for pole top assemblies. Field gaining of poles will not be acceptable.

6.2.7 Pole bands must be sized for the poles upon which they are to be mounted and must fit securely on the poles. Pole bands must be securely tightened around the pole with even spacing between vangs. Where pole bands are not of proper size due to variations in the wood, the contractor shall replace the bands, where required, to met this specification. The additional cost to replace bands must be included in the contractor's unit costs for pole top assemblies.

6.2.8 Pole ground wires must be installed when specified on the plan-and-profile drawings. The downlead must be sufficiently tightened and routed as shown on the respective structure drawings and described on drawing TM-9.

6.2.9 Where X-braces are specified, the lower holes through the pole must be field drilled. These holes must pass through the center of the pole, and must be thoroughly treated with preservative compound approved by the engineer. The heads of machine bolts for mounting the X-braces must be toward the center of the structure.

6.2.10 Guying attachments, where specified, must be oriented as shown on the transmission line structure drawings and as shown on the guying attachment drawings. Pole bands must be installed complete with through bolts, links, grounding clips, and all items indicated on the manufacturer's drawings.

6.2.11 The contractor shall check the end fittings of crossarms, braces, X-braces, and other factory assembled components to see that all factory-installed hardware is secured properly. The cost of retightening factory-installed hardware, if required, must be included in the contractor's unit cost for pole top assemblies.

6.2.12 Assembled structures must be prepared for erection with all items shown in the List of Materials such as conductor assemblies, OHGW assemblies, X-brace assemblies, pole tie assemblies, guying attachments, guying assemblies, and pole ground assemblies.

6.3 **Special Requirements** (to be completed by the engineer):

7. STRUCTURE ERECTION

7.1 Reference to Drawings

7.1.1 The contractor shall check structure locations prior to erecting structures. Structures and specified assemblies must be erected at locations shown on the plan-and-profile drawings.

7.1.2 Tangent structures must be erected as shown on the transmission line structure drawings. The poles or center of H-frames must be placed on the survey centerlines, unless offset left or right of the survey centerlines by the dimension shown on the guying guide drawings or plan-and-profile drawings.

7.1.3 Angle structures and deadend structures must be erected as shown on the structure drawings, guying guide drawings, and plan-and-profile drawings. Angle structures must be placed so that all poles are set on a line perpendicular to the bisector of the line angle. The angle structure must be offset to the left or right of the survey centerline so that all poles are offset by the dimension shown on the guying guide or plan-and-profile drawings.

For deadend structures in which the line angle is 0 degrees, the structures must be placed perpendicular to the survey centerline.

7.2 Structure Erection

7.2.1 Tangent structures with single crossarms must be erected with crossarms on alternating sides of the poles. At unusually long spans, the poles must be set so that the crossarms are on the side of the pole away from the long span. At crossings, single crossarms should be attached to the face of the structure away from the crossing.

7.2.2 Care must be taken not to overstress any members or connections when installing structures.

7.2.3 Hardware, bolts, nuts, locknuts, and spring washers must be tight after erection of the structures.

7.3 Excavation, Setting, and Backfill

7.3.1 Unless otherwise indicated, all poles must be embedded in soil to a minimum depth of 10 percent of the pole length plus 2 feet and not to exceed 3 inches deeper. Where the ground is sloping, the embedded depth of multiple pole structures with equal pole sizes must be measured on the side of the structure where the ground is lower. (On the high side, greater depth is needed for the purpose of leveling the crossarms.) For multiple pole structures with unequal size poles, poles must be overburied to get the correct ground to phase height.

7.3.2 Pole holes must be a minimum of 8 inches wider than the butt diameter of the pole. When pole bearing plates are used, pole holes must be the minimum diameter necessary for installation of the pole. The excavated hole must be at least as large at the bottom as at the top.

7.3.3 Accumulated water must be removed from the hole prior to setting the pole. Any soil added to level the bottom of the holes must be tamped before the pole is set in the hole.

7.3.4 Pole backfill material must be compactible and suitable for providing a dense supportive soil mass, free of voids, not frozen, and must be approved by the engineer. Where native soil is not suitable for backfill, the contractor shall furnish suitable granular imported material for this purpose which must be paid for at the unit price for granular backfill for poles.

7.3.5 Poles must be set plumb before the backfill is placed; and after placing the backfill, the poles must remain plumb. If the poles are out of plumb, the backfill must be removed and replaced. Plumbing of poles by pushing or pulling the structure must not be permitted.

7.3.6 Backfill must be placed around the pole in layers not exceeding 6 inches in depth, with each layer mechanically tamped before the next layer is added. The backfill must be compacted to a density equal to or greater than that of the surrounding undisturbed soil.

7.3.7 Backfilling and compaction must be done at a rate no faster than one laborer shoveling fill and two others using mechanical or pneumatic tamper.

7.3.8 Native soil must be banked up and tamped around the pole to a height of 6 inches above the natural grade, and must be sloped away from the pole.

7.3.9 After completion of wire stringing, all poles must be reinspected to check that poles remain plumb and the backfill has not settled. The backfill must be retamped at any pole location where the backfill shows settlement or movement. If required by the engineer, the backfill must be completely dug out, the pole readjusted if necessary, and the backfill retamped. This work must be done at no additional cost to borrower.

7.3.10 When approved by the engineer, surplus excavated soil may be carefully spread and leveled on the surface of the ground near the structure and in a manner to minimize damage to the grass areas or other foliage.

7.4 <u>Special Requirements</u> (to be completed by the engineer):

8. GUYS AND ANCHORS

8.1 Reference to Drawings: Guys and anchors must be installed at locations shown on the drawings or specified by the engineer. Anchor rod locations must be staked by the engineer. The contractor shall check locations of anchors before installation.

8.2 General Installation Requirements

8.2.1 Anchor rods must be installed in line with the guy wire and installed so that not more than 8 inches of rod (including eye) remain out of the ground after guy tension is applied. In cultivated fields or other locations deemed necessary, the projection of the anchor rod above earth may be increased to a maximum 12 inches to prevent burial of the rod eye.

8.2.2 Anchors must be of the type, size, and depth as shown on the drawings.

8.2.3 Anchors placed in a hole must be approved by the engineer in writing before the anchor hole is backfilled. The holes must be backfilled and tamped in the same manner as is required for wood pole backfilling. Only suitable native soil or approved imported granular material must be used for anchor backfill.

8.2.4 Where required by the engineer, anchors must be tested to 50 percent of their designated ultimate rated capacity. All material and labor required for testing of the anchors must be furnished by the contractor and included in the unit costs for testing anchors.

8.2.5 Power installed screw anchors must be installed with the appropriate size and type of equipment in accordance with the engineer's requirements and manufacturer's recommendations. Screw anchors must not be reversed to meet the requirements of project of the rods above the ground. All installations must be witnessed by the borrower's representative.

8.2.6 Guys must be installed and attached to the structures as shown on the transmission line structure drawings before conductors or overhead ground wires are strung. Each guy must be pretensioned to remove any slack in the guy. Guys must be retensioned after the conductors and overhead ground wires are installed to plumb the poles and to equalize tensions in the guys. If slack guys are found, they must be readjusted so that all guys in any structure have approximately equal tension. The final tension in the guys and the plumb of the poles must meet the approval of the engineer.

8.3 Special Requirements (to be completed by the engineer):

9. GROUNDING AND BONDING

9.1 Reference to Drawings: All structures must be grounded as shown on the plan-and-profile drawings and transmission line structure drawings, and subject to the following provisions.

9.2 Structure Grounding

9.2.1 The engineer may require that ground resistance measurements be made for each structure and that additional grounding be added to that already provided by the basic structure grounding assemblies.

9.2.2 Where structure grounding tests are required by the engineer, the contractor shall measure the ground resistance after the structure is erected, but before the overhead ground wire is installed. The method of measuring ground resistance must be subject to the approval of the engineer.

9.2.3 All labor and materials for ground resistance measurements and installation of additional grounding must be provided by the contractor and must be covered by the unit costs for testing and for grounding units.

9.2.4 The contractor shall install counterpoise only after approval of the engineer.

9.3 Bonding of Ground Wire

9.3.1 The pole ground wire must be continuous and not spliced from top of pole to the pole butt grounding assembly. Should damage occur during erection of the structure, the pole ground wire may be spliced with the engineer's approval.

9.3.2 Hardware must be bonded to the pole ground wire as shown on the drawings. The ground wire must clear any unbonded hardware by at least 3 inches.

9.4 Fence and Gate Grounding: Fence and gate grounds must be installed as shown on the drawings. All labor and material required must be furnished by the contractor at the unit prices for fence and gate grounding.

9.5 Special Requirements (to be completed by the engineer):

10. INSULATORS AND HARDWARE

10.1 Reference to Drawings: Insulator and hardware assemblies must be fully assembled and installed as shown on the drawings. Items of hardware and insulators must be inspected for missing parts, defects, and proper fit before installation. Defective or missing pieces must be replaced.

10.2 Handling and Storage

10.2.1 Insulators and hardware must be stored in their appropriate shipping containers until installation. They must be properly supported and stacked so as not to damage the individual items. They must be blocked up off the ground so that they cannot come in contact with the ground or standing water.

10.2.2 Insulators must be carefully handled to prevent damage to the porcelain skirts, pins, galvanizing, and cotter keys. A cradle or other suitable device must be used to hoist all insulator strings whenever the quantity exceeds 6 units per string.

10.2.3 Insulators that are cracked, chipped, or damaged in any way must be replaced with units that are not defective. The cost for replacement of previously accepted units must be borne by the contractor.

10.2.4 All insulators must be wiped clean with a clean, soft, nonabrasive cloth.

10.3 Installation

10.3.1 All connections must be made in accordance with the drawings. Bolts must be torqued to the manufacturer's specifications. Cotter keys, where required, must be fully inserted.

10.3.2 Cotter key eyes on insulators and hardware items must be oriented toward the structure, or in such a way as to facilitate easy removal during hot line maintenance.

10.3.3 Pins and bolts to insulator string assemblies must be oriented with the head upright wherever possible.

10.4 Special Requirements (to be completed by the engineer):

11. CONDUCTORS AND OVERHEAD GROUND WIRES

11.1 General

11.1.1 All conductor and overhead ground wire installation work must be done in accordance with the manufacturer's recommendations and the IEEE Standard 524, Guide to the Installation of Overhead Transmission Line Conductors. If there is a discrepancy between the guide and the manufacturer's recommendation, the contractor should follow the manufacturer's recommendation. The following provisions are for tension stringing of conductors and overhead ground wires. IEEE Standard 524 may be obtained from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, P.O. Box 1331, Piscataway, N.J., 08855-1331, USA.

11.1.2 It is very important to avoid damaging the wire or the associated fittings in any way. It is the contractor's responsibility to protect the wire and fittings against damage. If the wire and associated materials are damaged due to the contractor's mishandling, negligence, or faulty equipment, the contractor shall repair or replace the damaged sections, including furnishing of necessary materials, in a manner satisfactory to the engineer and at no additional cost to the borrower.

11.2. Handling and Storage

11.2.1 Reels of wire must be stored off the ground and adequately supported so as to avoid damage to the reel, protective covering, and wire. Wire and reels must be kept free of standing water, excessive dust, and mud, and stored no closer than 50 feet from an energized portion of a substation or transmission line. The conductor must be covered.

11.2.2 Protective covering must be removed at the job site and the outside layer of each reel must be examined by the contractor and the engineer to be sure that the wire is in good condition and that no nails, staples, or other sharp objects, which could damage the wire during unreeling, protrude on the inside of the reel heads.

11.2.3 Identification tags and markers must be retained on the reels. For future reference, the contractor shall record on forms supplied by the engineer, the reel number, length of wire, net weight, and the structure numbers where the wire was installed.

11.2.4 Conductor reels should not be rolled. They should be lifted or transported by a reel dolly. If they do need to be rolled to a location where they can be easily handled, they should be rolled in the direction that would tend to tighten rather than loosen the conductor on the reel.

11.3. Tools and Equipment

11.3.1 Tools and equipment for wire work must be of the proper size and type for the job and must be in good working condition. Sheaves, tensioners, pullers, wire grips compressors, and dies must be properly sized for the specific wires to be installed.

11.3.2 Stringing blocks must be neoprene lined, free running, and of the proper diameter and groove size for the wire being pulled.

11.3.3 Tensioner bullwheels must be neoprene lined and of the proper size and design for the wire being pulled.

11.4 Guard Structures

11.4.1 Guard structures must be furnished and installed by the contractor, where required, to prevent the conductor or overhead ground wires which are being pulled from coming into contact with existing overhead electric supply lines, communication lines, roads, highways, and railroads crossed by the transmission line. All labor and materials required must be furnished by the contractor and included in the unit cost for conductor units.

11.4.2 If not part of the right-of-way agreement previously executed, permission to install guard structures on private property or public highway right-of-way must be obtained by (engineer to check one):

	Private	Public
a. The borrower or engineer	☐	☐
b. The contractor	☐	☐

11.4.3 After completion of all wire work, the contractor shall remove the guard structures, fill and tamp all pole holes, and restore the right-of-way and access to its original condition.

11.5 Stringing

11.5.1 The method of installing the conductor and the overhead ground wire must be as designated by the engineer. When controlled tension stringing is specified, it must be performed in accordance with IEEE Standard 524, Guide to the Installation of Overhead Transmission Line Conductors, and subject to the manufacturer's concurrence (engineer to check one for each):

Conductor Installation

a. Controlled Tension Stringing .....☐
b. Other (specify) _____☐

Overhead Ground Wire Installation

a. Controlled Tension Stringing .....☐
b. Other (specify) _____☐

11.5.2 The precise stringing procedure which the contractor intends to use must be submitted to the engineer for review and approval prior to any wire work. This procedure must include a description of all major pieces of equipment to be used, number of crews, composition and responsibilities of each crew, proposed equipment set up locations, wire reel locations, locations of all splices, and locations and descriptions of temporary snubs and anchors.

11.5.3 Extreme care must be exercised during the wire stringing operation to avoid damage to conductor or overhead ground wire strands. If damage is found, the stringing must be stopped. Damage is defined as any deformity of the wire which can be detected by sight or touch. Kinked, twisted, abraded, "bird-caged," or flattened wire will not be allowed to remain on the line. Any wire so damaged must be repaired or replaced by the contractor at his own expense and to the satisfaction of the engineer.

11.5.4 The contractor shall continuously inspect the wire as it leaves the reels. If the wire has an accumulation of dirt, oil, grease, or any other foreign substance, such substance must be removed as the wire leaves the reels during the stringing operation by a method approved by the engineer.

11.5.5 Wire tension during stringing must be high enough to ensure that the wire does not drag across the ground, underbrush, trees, towers, fences, guard structures, or any other surface other than the stringing sheaves. A stringing tension of not less than 50 percent nor more than 80 percent of the initial sagging tension should be used.

11.5.6 No more than two reels of wire per phase may be pulled at a time. Full tension compression splices must not be pulled through the stringing blocks.

11.5.7 When stringing wire on H-frame structures, the center phase must always be pulled first. The outside phases must be pulled alternately in successive pulls. If all three phases are strung in one pull, the middle phase must lead the outer phases by not less than 100 feet.

11.5.8 Wire must not be pulled during adverse weather conditions or when such conditions are imminent as determined by the engineer.

11.5.9 The air temperature at the time and place of stringing must be determined by a certified thermometer.

11.6 Sagging

11.6.1 Wires must be sagged to the proper tensions in accordance with the initial stringing sag and tension tables provided by the engineer. Sags will be checked by sighting with target and transit as indicated in the IEEE Standard 524. Sags must be within a tolerance of +3 and -0 inches of the specified values. When approved by the engineer, sags may be checked by the return wave method.

11.6.2 The air temperature at the time and place of clipping in must be determined using a certified thermometer. The temperatures at which the conductor is sagged in and the spans in which sags are measured must be recorded, and the information given to the engineer.

11.6.3 In hilly or mountainous terrain, the offset clipping method may be required in order to insure equalized tensions and plumbing of insulators on suspension structures. Calculations for offset clipping/sag corrections must be done and values for sagging must be furnished by the engineer. The contractor shall furnish all stringing set up information to the engineer at least 6 weeks prior to the sagging operations. The contractor shall keep a record of sag data.

11.6.4 The contractor shall select the length of each sag and the sag-checking spans, subject to the review and approval of the engineer. The contractor's sagging method must result in uniform tensions throughout the sag and the allowable sag tolerances must not be exceeded.

11.6.5 The contractor shall budget the stringing time so that a reel of wire is sagged within 72 hours after the start of the stringing operation. If this is not possible in isolated areas, the engineer shall be consulted regarding the necessity of using creep correction factors with the specified chart sags.

11.6.6 The contractor shall make any necessary adjustments in the wires or clamps at any time during the construction period to insure that the wire is at the proper tension, sags are within tolerance, suspension insulator strings and overhead ground wire assemblies hang plumb.

11.7 Clipping, Deadending, and Splicing

11.7.1 The contractor shall take into consideration the strength limitations of all structures in so far as the application of temporary wire stringing loads. All temporary back snubs and pull-downs on structures other than strain structures must be carefully planned and must meet the approval of the engineer.

11.7.2 Use of wire reels must be carefully planned to minimize the number of full tension splices. There must never be more than one compression fitting per wire in any span and splices must not be located within 25 feet of a conductor support. Splices must not be located in spans over roads, railroads, and utility crossings, or in the spans adjacent to the crossing span. Splices must also not be located in the span where the conductor is to be deadended.

11.7.3 Compression deadends and splices must be installed in accordance with the manufacturer's recommendations. Conductor strands within the splice area must be carefully cleaned with a steel brush, cotton rags, and solvents. Filler compound must be furnished and pressure installed by the contractor. Special care must be exercised in making compression fittings to insure use of proper die size, accurate cutting of wire, complete insertion of the cable strands, and pressing to produce a straight, uniform fitting. The contractor shall make up one splice and deadend to use as a sample in order to determine how much wire needs to be cut back.

11.7.4 After completion of pressing operations, the contractor shall clean the wire and fittings of excess grease and compound. All burrs and die flash marks must be removed with emery cloth.

11.7.5 U-bolts on suspension clamps and strain deadend clamps must be evenly torqued to the manufacturer's recommended values. Keeper plates must be in place and properly seated. Conductor strands within the area of the fitting must be clean. The recommended cleaning method is to use a steel brush, cotton rags, and solvents.

11.7.6 Wires must be clipped into suspension clamps within not less than 12 hours and not more than 72 hours after the start of each individual wire pulling operation. Cables must be lifted from the sheaves using standard suspension clamps or plate hooks 8 inches or larger to provide adequate support for the cables without damaging individual strands or kinking the wire.

11.8 Jumper

11.8.1 Jumpers must be installed as shown on the drawings. Compression jumper terminals must be used with compression deadends and compression jumper connectors must be used with strain clamps. The cost of installation of these items must be included with the bid units for installing conductors. All jumpers must be installed in accordance with the manufacturer's recommendations.

11.8.2 Jumper wire loops must be of sufficient length to present a smooth, uniformly curving appearance, and which do not put the jumper string of insulators in compression. Excess length of conductor from the wire stringing operation may be used to make up the jumper loops.

11.9 Temporary Grounds

11.9.1 During the wire work, the contractor shall take all necessary steps to insure proper temporary grounding of the structures, cables, and equipment. All applicable Federal, State, and local safety regulations must be strictly adhered to.

11.9.2 A record of all temporary conductor grounds must be kept to insure that they are all removed and the line can be safely energized at the end of the construction period.

11.10 Reels and Excess Conductor

11.10.1 When wire is furnished by the borrower, the contractor shall be responsible for salvaging the wire reels and all excess conductor and overhead ground wire. All such wire must be inventoried, placed on reels, and returned to the borrower or disposed of as directed by the engineer.

11.10.2 Returnable reels must be shipped back to the wire fabricators in accordance with the engineer's instruction. Nonreturnable wood reels must be disposed of in a manner meeting the approval of the engineer.

11.10.3 All costs associated with the receiving, handling, shipping, or disposal of excess wire and reels must be in the labor costs for installation of wire units.

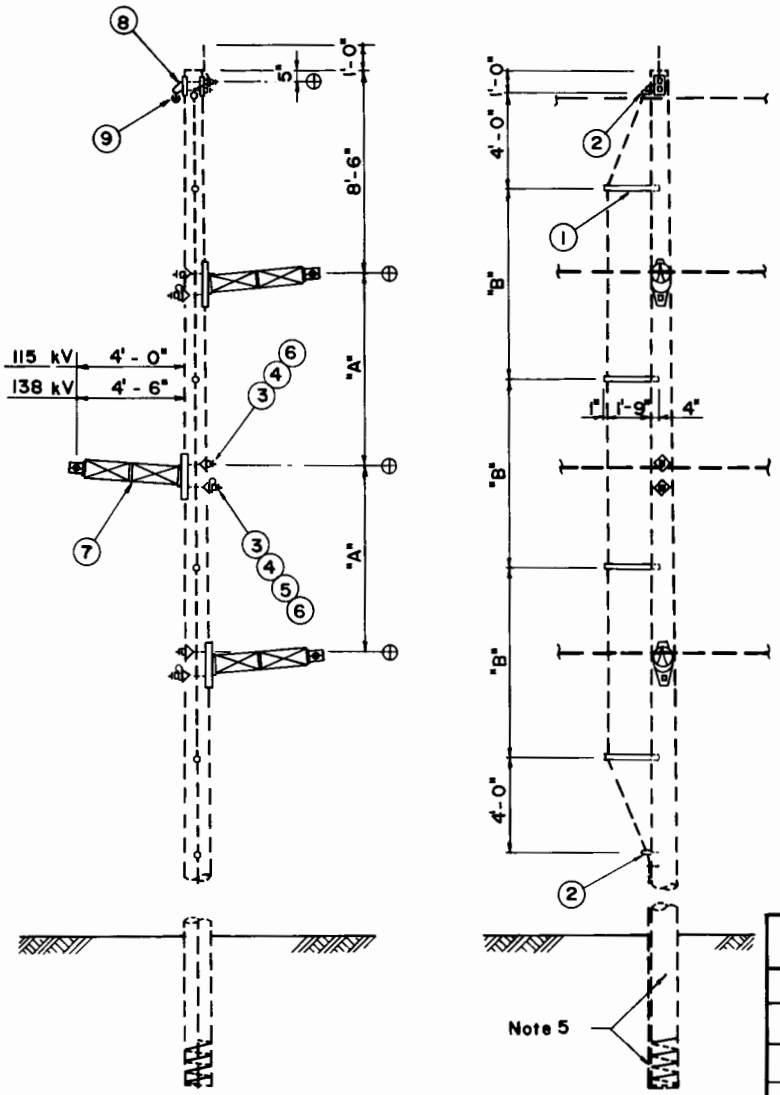
11.11 Special Conditions (to be completed by the engineer):

12. DRAWINGS

12.1 Index of Drawings: The following drawings are part of the technical specification (engineer to complete):

PART II

DRAWINGS



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	4	Rod, Fiberglass, 3/4" x 2'-2"			
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-2 gives guidance to subassembly alternatives.
5. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.

DIMENSIONS A & B		
VOLTAGE	A	B
115 kV	8'-0"	8'-0"
138kV	9' 0"	9'-0"

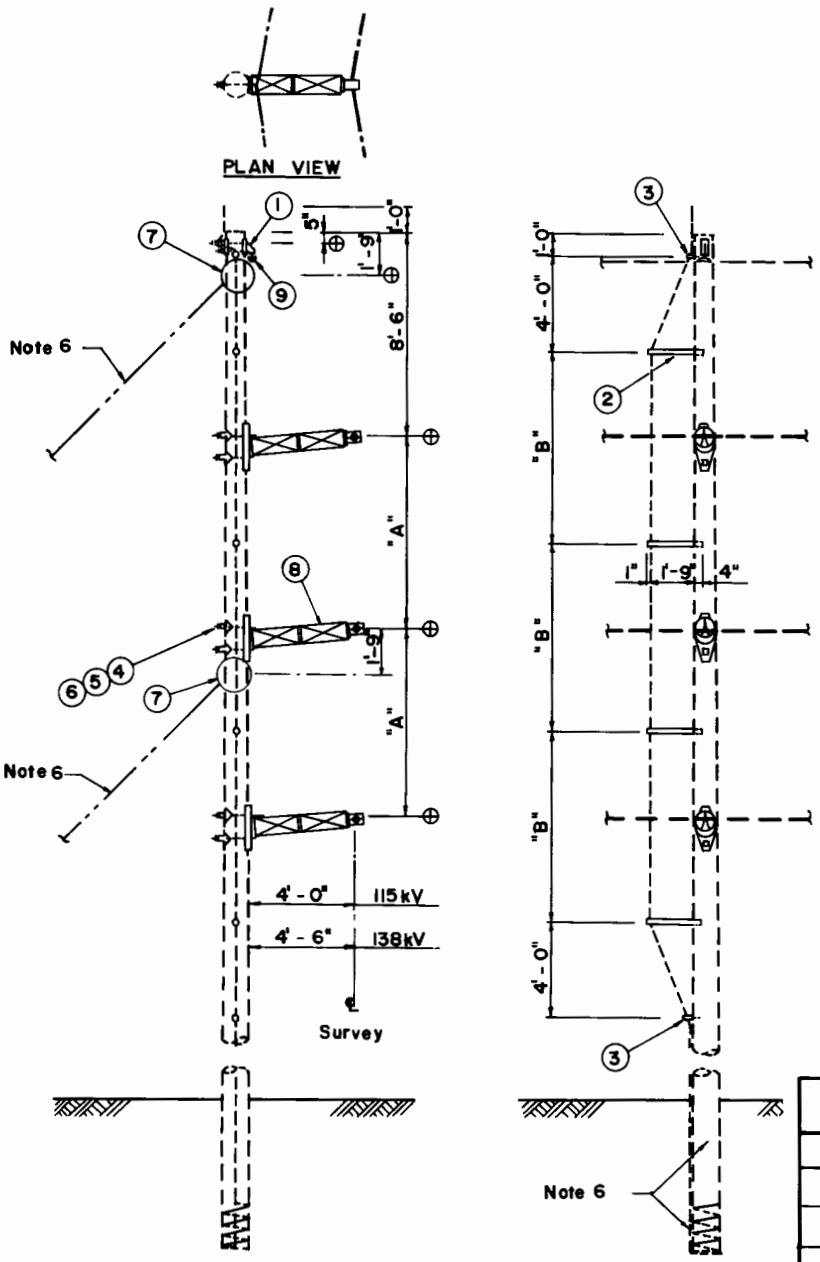
NO.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

TANGENT HORIZONTAL LINE POST
(138kV MAXIMUM)

SCALE:

TP-115, TP-138

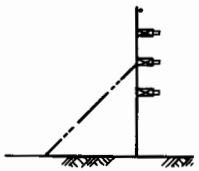


DWG. REF	TP-115 TP-138 B1	TP-115 TP-138 B2	DESCRIPTION	ITEM	DET.	CODE No.
1	1	1	OHGW Support Assembly, double bolt	-	TM-6B	
2	4	4	Rod, Fiberglass, 3/4" x 2'-2"			
3	2	2	Wireholder, w/#22 wood screw	ar		
4	6	6	3/4" Bolt, Machine, by req'd length	c		
5	6	6	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
6	6	6	3/4" Locknut, MF Type	ek		
7	1	2	GUY ATTACHMENT,_____ DUTY	-	TG-____C	
8	3	3	INSULATOR, HORIZONTAL POST, WITH CLAMP	-	TM-3____	
9	1	1	OHGW ASSEMBLY, TANGENT	-	TM-4____	

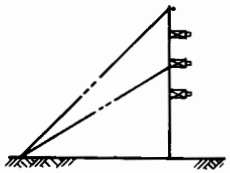
LIST OF MATERIALS

Notes:

1. Metal shims should be used to adjust post insulator when brackets are located on uneven pole surfaces.
2. This structure is to be used for line angles up to 15 degrees.
3. Strength limitations of horizontal post:
   A. Maximum cantilever load - - - - - - - - - - - - - - - 2,800 lbs.
   B. Maximum tensile load - - - - - - - - - - - - - - - - 5,000 lbs.
   (Load A plus B are simultaneous)
4. Strength limitations of overhead ground wire support assembly, see TM-6B.
5. See drawing TE-2 for guidance to subassembly alternatives.
6. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.



TYPE B1



TYPE B2

DIMENSIONS A & B		
VOLTAGE	A	B
115 kV	9'-0"	9'-0"
138 kV	10'-0"	10'-0"

NO.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

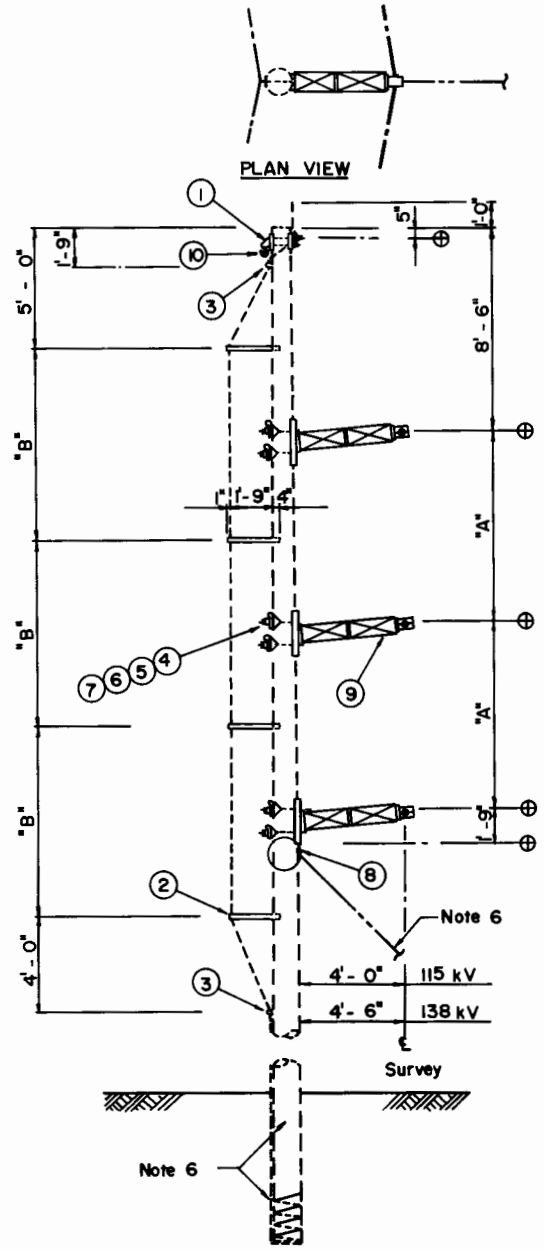
SMALL ANGLE HORIZONTAL LINE POST

(138 kV MAXIMUM)

SCALE:

TP-115 B1, B2/TP-138 B1, B2

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	OHGW Support Assembly, double bolt	-	TM-6B	
2	4	Rod, Fiberglass, 3/4" x 2'-2"			
3	2	Wireholder, w/#22 wood screw	ar		
4	6	3/4" Bolt, Machine, by req'd length	c		
5	6	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
6	6	Washer, Spring, 13/16" hole	aw		
7	6	3/4" Locknut, MF Type	ek		
8	1	GUY ATTACHMENT,_____ DUTY	-	TG-___C	
9	3	INSULATOR, HORIZONTAL POST, WITH CLAMP	-	TM-3___	
10	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. This structure is to be used for line angles up to 15 degrees.
3. Strength limitations of horizontal post:
   A. Maximum cantilever and - - - - - - - - - - - - - - - 2,800 lbs.
   B. Maximum tensile load - - - - - - - - - - - - - - - - 5,000 lbs.
   (Loads A plus B are simultaneous)
4. Strength limitations of overhead ground wire support assembly, see TM-6B.
5. See drawing TE-2 for guidance to subassembly alternatives.
6. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.

DIMENSIONS A & B		
VOLTAGE	A	B
115 kV	9'- 0"	9'- 0"
138 kV	10' - 0"	10' - 0"

NO.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

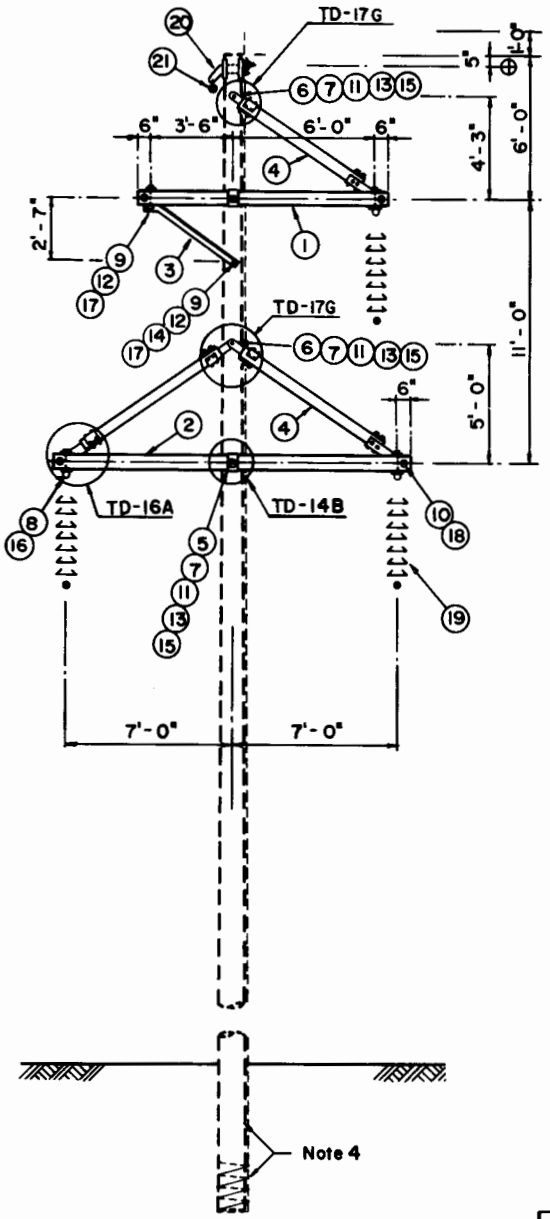
SMALL ANGLE HORIZONTAL LINE POST

(138kV MAXIMUM)

SCALE:

TP-115C, 138C

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 5-5/8" x 7-3/8" x 10-6", #23		TCD-10	
2	1	X-Arm, 5-5/8" x 7-3/8" x 15'-0", #29		TCD-15	
3	1	Brace, X-Arm, 42"/27"	em		
4	3	Brace, X-Arm, 3 3/8" x 4 3/8" x req'd l.			
5	2	Plate, X-Arm Reinforcing	eg		
6	2	Grid Gain, 4" x 4", 15/16" hole	bi		
7	4	7/8" Bolt, Machine, by req'd length	c		
8	3	3/4" Bolt, Shoulder Eye, by req'd l.	o		
9	2	5/8" Bolt, Machine, by req'd length	c		
10	4	1/2" Bolt, Washer Head, w/Washer Nut	c		
11	4	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
12	2	Washer, Flat, 2-1/4" sq. x 3/16", 11/16"h.	d		
13	4	Washer, Spring, 15/16" hole	aw		
14	1	Washer, Spring, 11/16" hole	aw		
15	4	7/8" Locknut, MF Type	ek		
16	3	3/4" Locknut, MF Type	ek		
17	2	5/8" Locknut, MF Type	ek		
18	4	1/2" Locknut, MF Type	ek		
19	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
20	1	OHGW SUPPORT ASSEMBLY	-	TM-6___	
21	1	OHGW ASSEMBLY, TANGENT	-	TM-4___	

Notes:

1. Field drilled holes shall be thoroughly treated.
2. For strength limitations of OHGW support assembly, see TM-6.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY ASSEMBLIES, AND ANCHOR ASSEMBLIES.

TRANSMISSION LINE STRUCTURE

TANGENT – SINGLE ARM

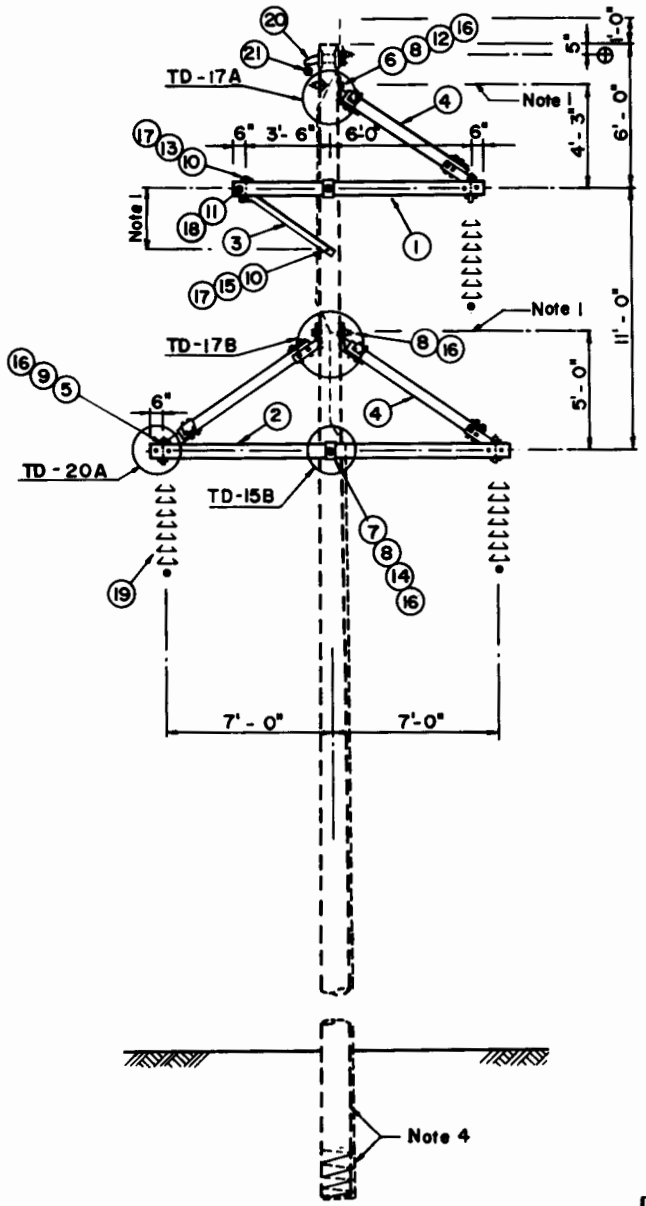
(115 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TS-115

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 3-5/8" x 9-3/8" x 10'-6", #24		TCD-10	
2	2	X-Arm, 3-5/8" x 9-3/8" x 15'-0", #30		TCD-15	
3	2	Brace, X-Arm, 42"/27"	em		
4	3	Brace, X-Arm, 3 3/8" x 4 3/8" x req'd l.			
5	3	Spacer Assembly, see construction spec.	-	TM-111	
6	-	Grid Gain, 4" x 4", 15/16" hole	bl		
7	4	Plate, X-Arm Reinforcing	eg		
8	4	7/8" Bolt, Machine, by req'd length	c		
9	3	7/8" Bolt, Bent			
10	3	5/8" Bolt, Machine by req'd length	c		
11	2	1/2" Bolt, Washer Head, w/Washer Nut	c		
12	1	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
13	2	Washer, Flat, 2-1/4" sq. x 3/16", 11/16"h	d		
14	2	Washer, Spring, 15/16" hole	aw		
15	1	Washer, Spring, 11/16" hole	aw		
16	7	7/8" Locknut, MF Type	ek		
17	3	5/8" Locknut, MF Type	ek		
18	2	1/2" Locknut, MF Type	ek		
19	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
20	1	OHGW SUPPORT ASSEMBLY	-	TM-6___	
21	1	OHGW ASSEMBLY, TANGENT	-	TM-4___	

Notes:

1. Field drilled holes shall be thoroughly treated.
2. For strength limitations of OHGW support assembly, see TM-6.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY ASSEMBLIES, AND ANCHOR ASSEMBLIES.

TRANSMISSION LINE STRUCTURE

TANGENT – DOUBLE ARM

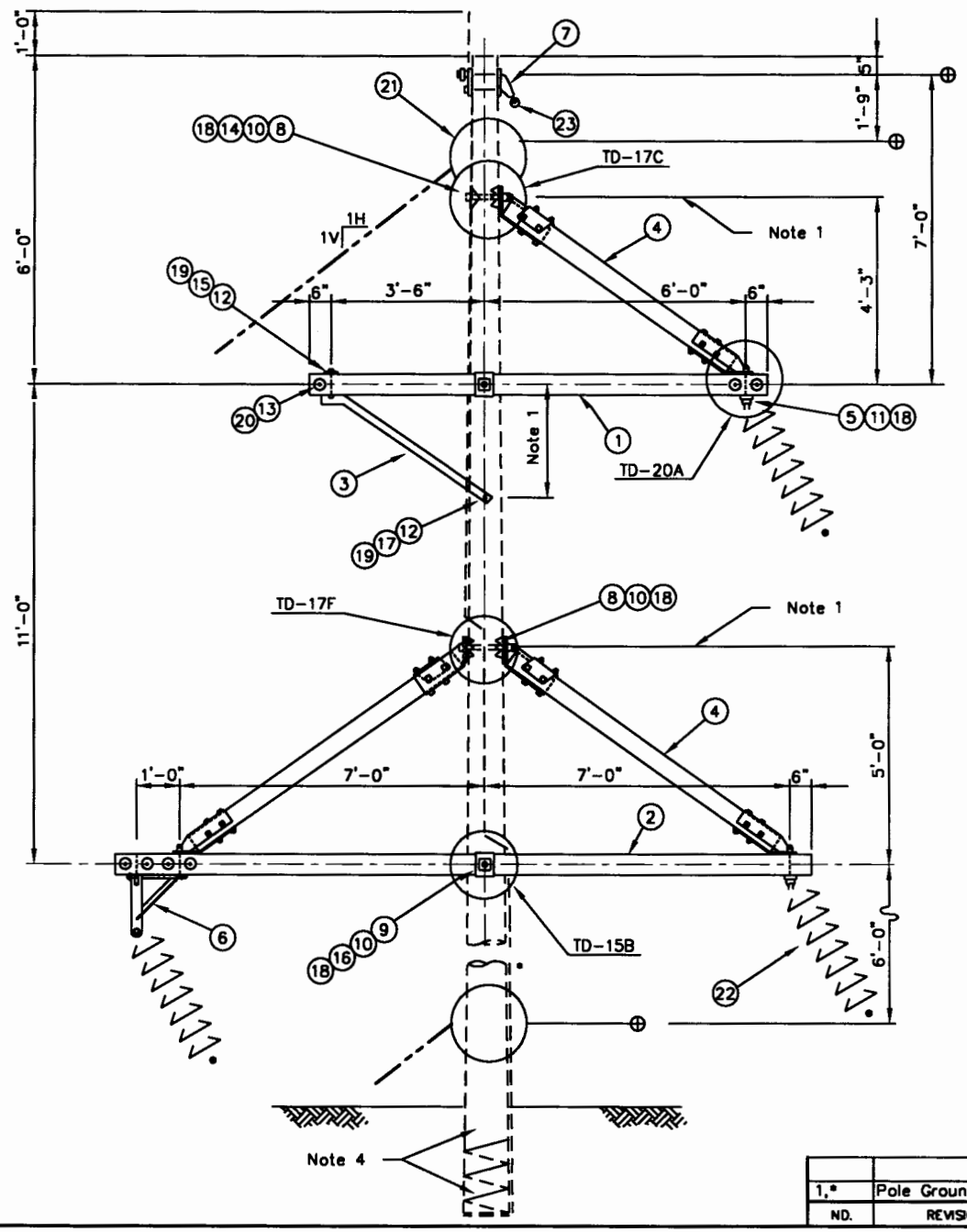
(115 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TS-115 A

Reissued 03/98



LIST OF MATERIALS

DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 3-5/8"x9-3/8"x10'-6" #24		TCD-10	
2	2	X-Arm, 3-5/8"x9-3/8"x16'-0" #31		TCD-15	
3	2	Brace, X-Arm, 42"/27"	em		
4	3	Brace, X-Arm, 3 3/8"x4 3/8"x req'd l.			
5	4	Spacer Assembly, see construction spec	–	TM-111	
6	1	Bracket, Swinging Angle Assembly	–	TM-112B	
7	1	OHGW Support Assembly, double bolt	–	TM-6B	
8	3	Grid Gain, 4"x4", 15/16" hole	bl		
9	4	Plate, X-Arm Reinforcing	eg		
10	4	7/8" Bolt, Machine, by req'd length	c		
11	3	7/8" Bolt, Bent			
12	3	5/8" Bolt, Machine, by req'd length	c		
13	2	1/2" Bolt, Washer Head, w/Washer Nut	c		
14	1	Washer, Curved, 4"sq x1/4",15/16"hole	d		
15	2	Washer, Flat, 2-1/4"sq x3/16, 11/16"h.	d		
16	2	Washer, Spring, 15/16" hole	aw		
17	1	Washer, Spring, 11/16" hole	aw		
18	7	7/8" Locknut, MF Type	ek		
19	3	5/8" Locknut, MF Type	ek		
20	2	1/2" Locknut, MF Type	ek		
21	2	GUY ATTACHMENT,_____DUTY	–	TG-__C	
22	3	INSULATOR ASSEMBLY, TANGENT	–	TM-___	
23	1	OHGW ASSEMBLY, TANGENT	–	TM-4__	

NOTES:

1. Field drilled holes shall be thoroughly treated.
2. For strength limitations of OHGW support assembly, see TM-6.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. The following materials are to be specified separately on plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANCHOR ASSEMBLIES.

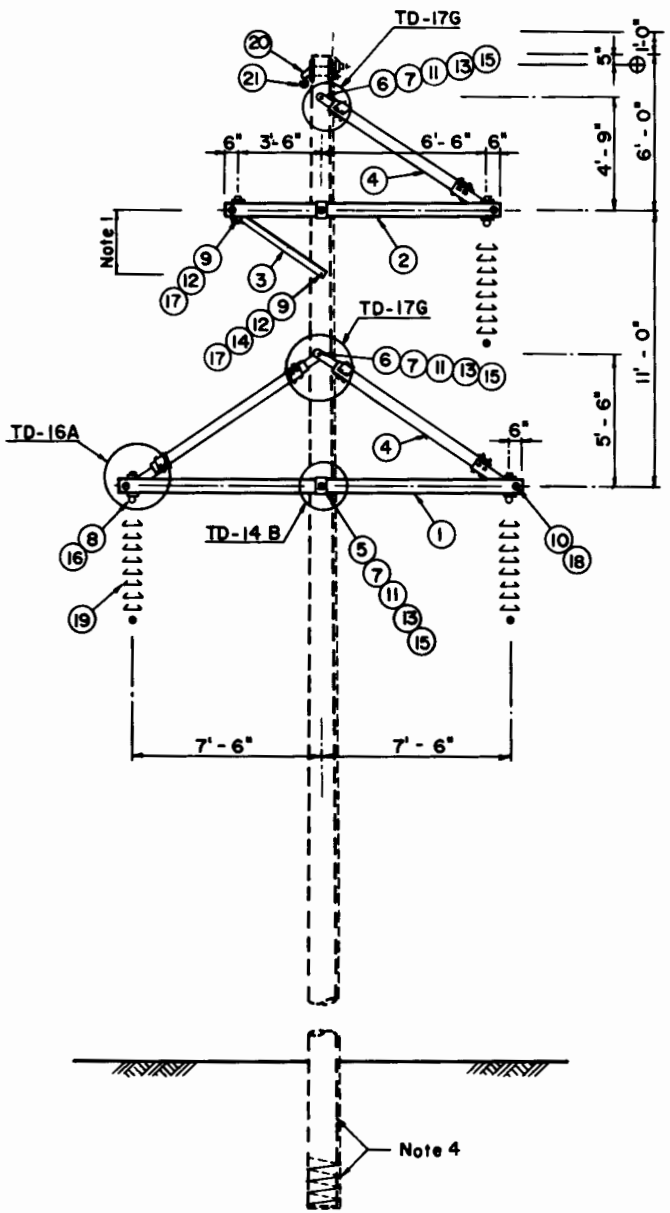
TRANSMISSION LINE STRUCTURE

SMALL ANGLE – DOUBLE ARM

(115 kV MAXIMUM)

NO.	REVISION	DATE
1.*	Pole Ground loc.	03/98

TS-115B



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 5-5/8" x 7-3/8" x 11'-0", # 25		TCD-11	
2	1	X-Arm, 5-5/8" x 7-3/8" x 16'-0", # 32		TCD-15	
3	1	Brace, X-Arm, 42"/27"	em		
4	3	Brace, X-Arm, 3-3/8" x 4-3/8" x req'd l.			
5	2	Plate, X-Arm Reinforcing	eg		
6	2	Grid Gain, 4" x 4", 15/16" hole	bi		
7	4	7/8" Bolt, Machine, by req'd length	c		
8	3	3/4" Bolt, Shoulder Eye, by req'd l.	o		
9	2	5/8" Bolt, Machine, by req'd length	c		
10	4	1/2" Bolt, Washer Head, w/Washer Nut	c		
11	4	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
12	2	Washer, Flat, 2-1/4" sq. x 3/16", 11/16"h.	d		
13	4	Washer, Spring, 15/16" hole	aw		
14	1	Washer, Spring, 11/16" hole	aw		
15	4	7/8" Locknut, MF Type	ek		
16	3	3/4" Locknut, MF Type	ek		
17	2	5/8" Locknut, MF Type	ek		
18	4	1/2" Locknut, MF Type	ek		
19	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
20	1	OHGW SUPPORT ASSEMBLY	-	TM-6____	
21	1	OHGW ASSEMBLY, TANGENT	-	TM-4____	

Notes:

1. Field drilled holes shall be thoroughly treated.
2. For strength limitations of OHGW support assembly, see TM-6.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY ASSEMBLIES, AND ANCHOR ASSEMBLIES.

TRANSMISSION LINE STRUCTURE

TANGENT – SINGLE ARM

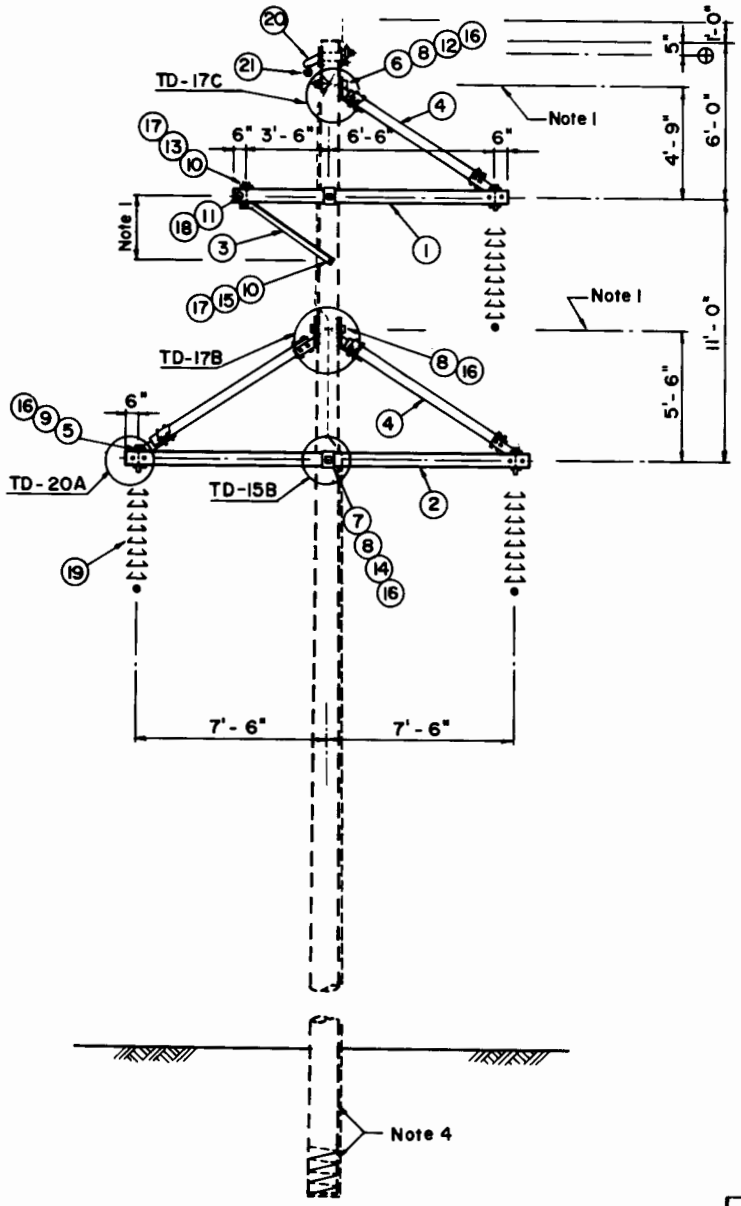
(138 kV MAXIMUM)

NO.	REVISION	DATE

SCALE

TS-138

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 3-5/8" x 9-3/8" x 11'-0" # 26		TCD-11	
2	2	X-Arm, 3-5/8" x 9-3/8" x 16'-0", #33		TCD-15	
3	2	Brace, X-Arm, 42"/27"	em		
4	3	Brace, X-Arm, 3-3/8" x 4-3/8" x req'd l.			
5	3	Spacer Assembly, see construction spec.	-	TM-111	
6	-	Grid Gain, 4" x 4", 15/16" hole	bi		
7	4	Plate, X-Arm Reinforcing	eg		
8	4	7/8" Bolt, Machine, by req'd length	c		
9	3	7/8" Bolt, Bent			
10	3	5/8" Bolt, Machine by req'd length	c		
11	2	1/2" Bolt, Washer Head, w/Washer Nut	c		
12	1	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
13	2	Washer, Flat, 2-1/4" sq. x 3/16", 11/16"h.	d		
14	2	Washer, Spring, 15/16" hole	aw		
15	1	Washer, Spring, 11/16" hole	aw		
16	7	7/8" Locknut, MF Type	ek		
17	3	5/8" Locknut, MF Type	ek		
18	2	1/2" Locknut, MF Type	ek		
19	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
20	1	OHGW SUPPORT ASSEMBLY	-	TM-6____	
21	1	OHGW ASSEMBLY, TANGENT	-	TM-4____	

Notes:

1. Field drilled holes shall be thoroughly treated.
2. For strength limitations of OHGW support assembly, see TM-6.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY ASSEMBLIES, AND ANCHOR ASSEMBLIES.

TRANSMISSION LINE STRUCTURE

TANGENT – DOUBLE ARM

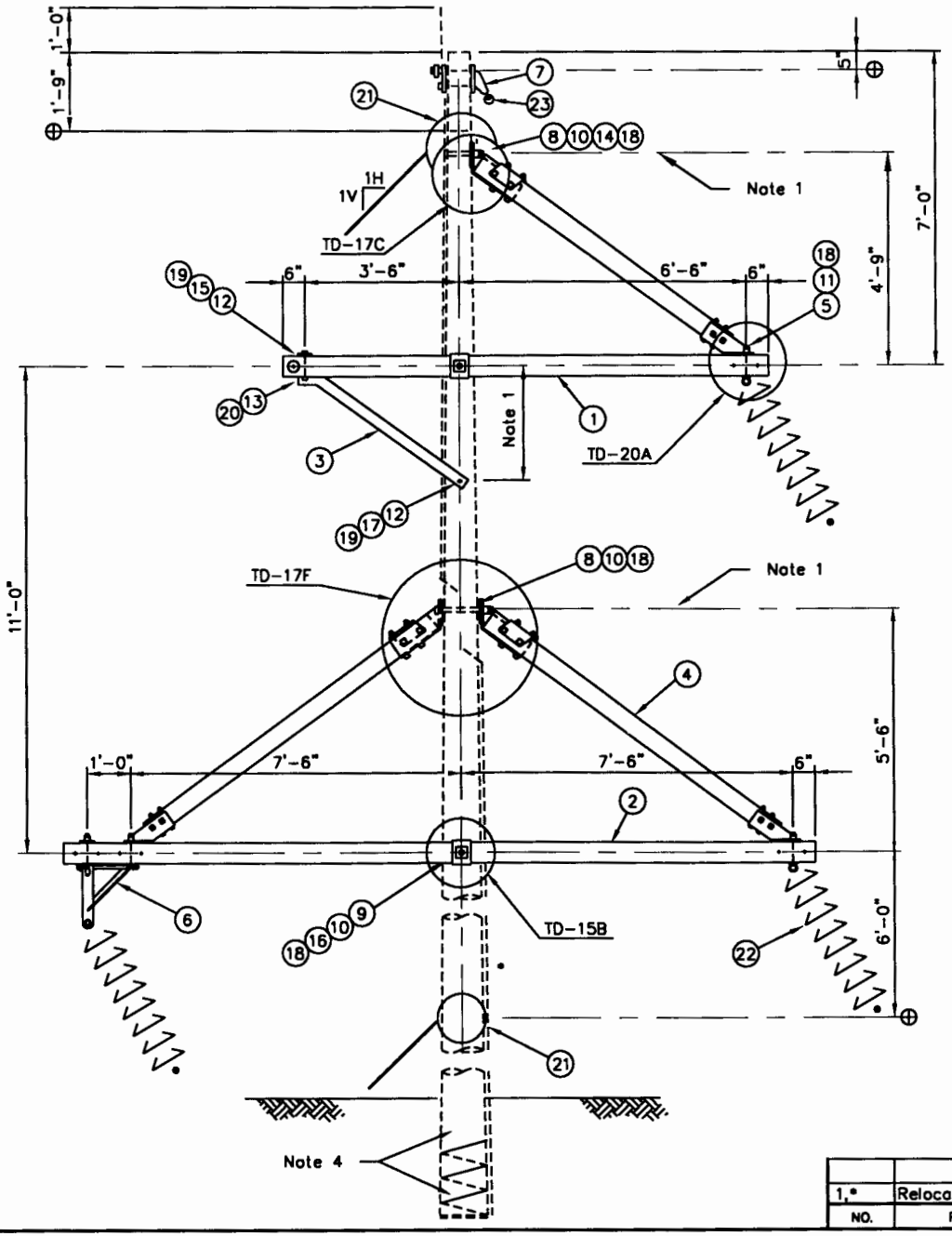
(138 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TS-138A



LIST OF MATERIALS

DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 3-5/8"x9-3/8"x11'-0" #26		TCD-11	
2	2	X-Arm, 3-5/8"x9-3/8"x17'-0" #34		TCD-15	
3	2	Brace, X-Arm, 42"/27"	em		
4	3	Brace, X-Arm, 3-3/8"x4-3/8"x req'd l			
5	4	Spacer Assembly, see construction spec	–	TM-111	
6	1	Bracket, Swinging Angle Assembly	–	TM-112B	
7	1	OHGW Support Assembly, double bolt	–	TM-6B	
8	3	Grid Gain, 4"x4", 15/16" hole	bl		
9	4	Plate, X-Arm Reinforcing	eg		
10	4	7/8" Bolt, Machine, by req'd length	c		
11	3	7/8" Bolt, Bent	–		
12	3	5/8" Bolt, Machine, by req'd length	c		
13	2	1/2" Bolt, Washer Head, w/Washer Nut	c		
14	1	Washer, Curved, 4"sq x1/4",15/16"hole	d		
15	2	Washer, Flat, 2-1/4"sq x3/16, 11/16"h.	d		
16	2	Washer, Spring, 15/16" hole	aw		
17	1	Washer, Spring, 11/16" hole	aw		
18	7	7/8" Locknut, MF Type	ek		
19	3	5/8" Locknut, MF Type	ek		
20	2	1/2" Locknut, MF Type	ek		
21	2	GUY ATTACHMENT,_____DUTY	–	TG-__C	
22	3	INSULATOR ASSEMBLY, TANGENT	–	TM-____	
23	1	OHGW ASSEMBLY, TANGENT	–	TM-4__	

NOTES:

1. Field drilled holes shall be thoroughly treated.
2. For strength limitations of OHGW support assembly, see TM-6.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. The following materials are to be specified separately on plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY ASSEMBLIES, AND ANCHOR ASSEMBLIES.

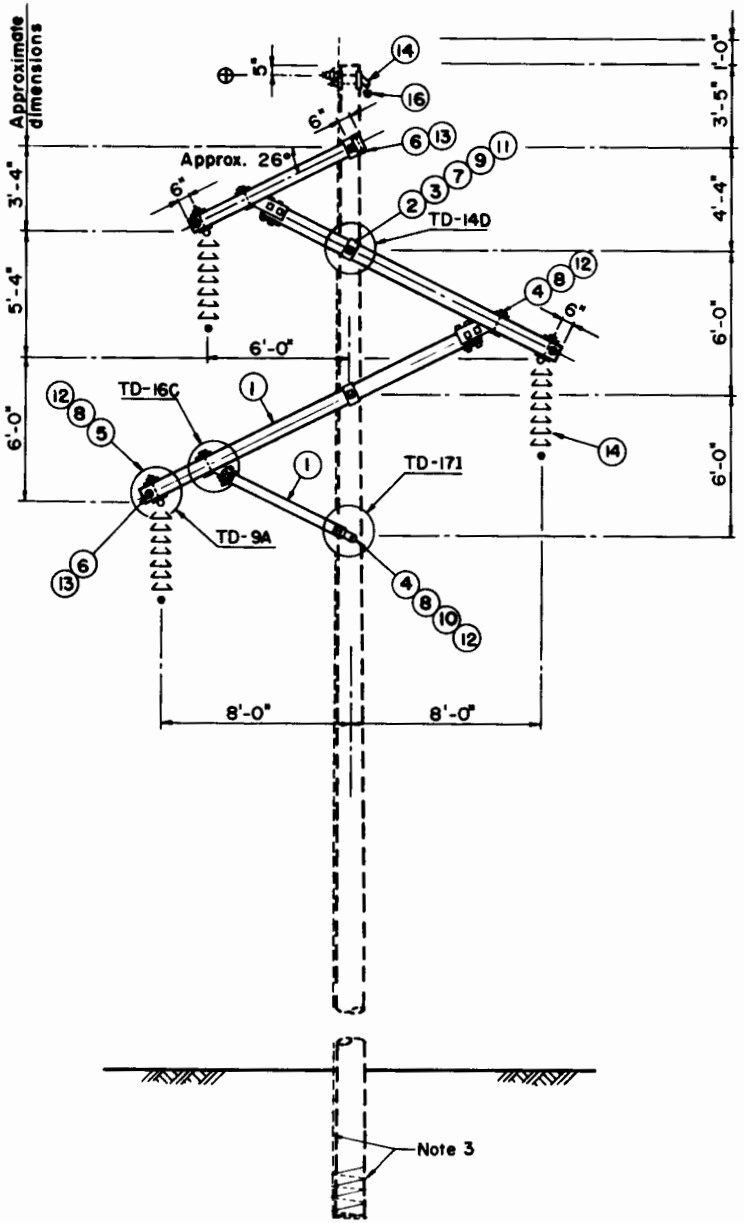
NO.	REVISION	DATE
1,*	Relocate pole grd.	03/98

TRANSMISSION LINE STRUCTURE

SMALL ANGLE-DOUBLE ARM

(138 kV MAXIMUM)

TS-138B



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
		X-Arm Assembly, 3-5/8" x 7-3/8" and			
1	1	Brace, 2-3/4" x 3-1/2" complete with end			
		fittings and fasteners			
2	3	Plate, X-Arm reinforcing			
3	3	7/8" Bolt, Machine, by req'd length			
4	4	3/4" Bolt, Machine, by req'd length			
5	3	3/4" Bolt, Shoulder Eye, by req'd l.			
6	4	1/2" Bolt, Washer Head, w/Washer Nut			
7	3	Washer, Curved, 4" sq. x 1/4", 15/16" hole	gz		
8	7	Washer, Flat, 2-1/4" sq. x 3/16", 13/16"h.			
9	3	Washer, Spring, 15/16" hole			
10	1	Washer, Spring, 13/16" hole			
11	3	7/8" Locknut, MF Type			
12	7	3/4" Locknut, MF Type			
13	4	1/2" Locknut, MF Type			
14	1	OHGW SUPPORT ASSEMBLY	-	TM-6	
15	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
16	1	OHGW ASSEMBLY, TANGENT	-	TM-4	

NOTES:

1. For strength limitations of overhead ground wire support assembly, see TM-6.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

TANGENT DELTA — SINGLE ARM

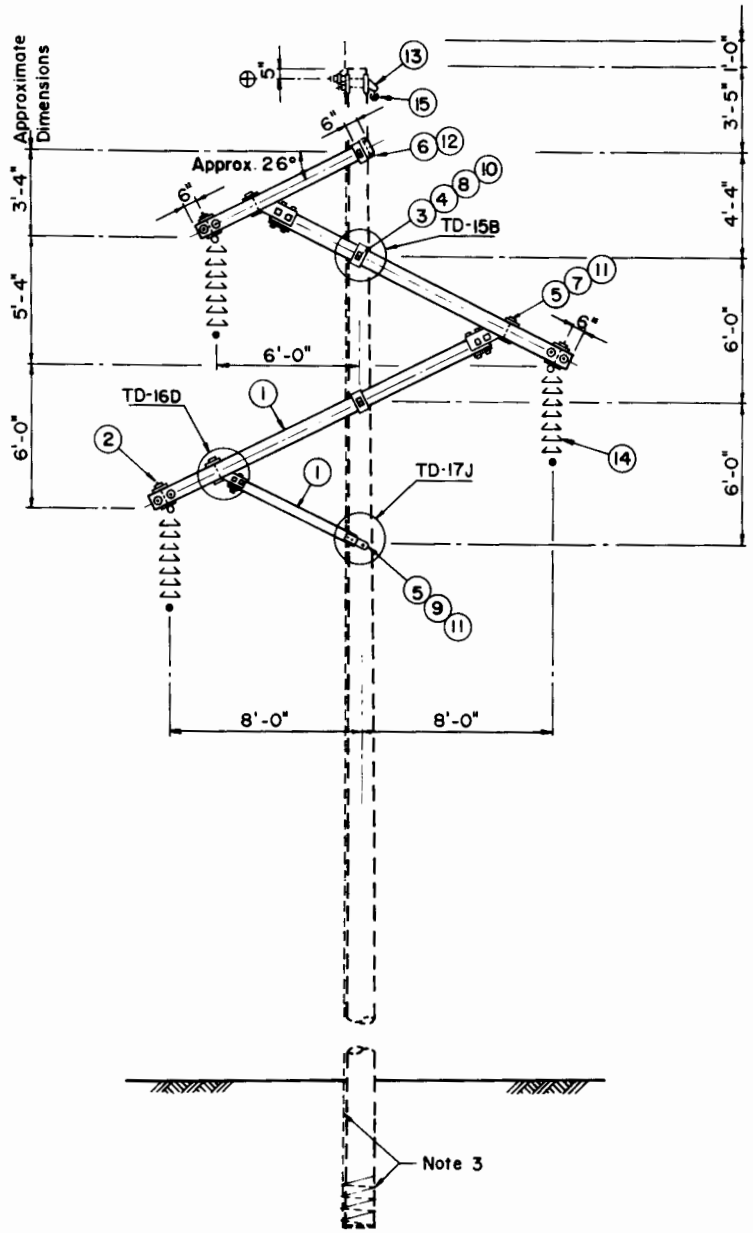
(115 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TSZ-115

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	Double X-Arm Assembly, 3-5/8" x 7-3/8" and Brace, 2-3/4" x 3-1/2" complete with end fittings and fasteners			
2	3	Spacer Assembly, see construction spec.		TM-111	
3	6	Plate, X-Arm Reinforcing			
4	3	7/8" Bolt, Machine, by req'd length			
5	7	3/4" Bolt, Machine, by req'd length	gz		
6	2	1/2" Bolt, Washer Head, w/Washer Nut			
7	6	Washer, Flat, 2-1/4" sq. x 3/16", 13/16"h.			
8	3	Washer, Spring, 15/16" hole			
9	1	Washer, Spring, 13/16" hole			
10	3	7/8" Locknut, MF Type			
11	7	3/4" Locknut, MF Type			
12	2	1/2" Locknut, MF Type			
13	1	OHGW SUPPORT ASSEMBLY	-	TM-6___	
14	3	INSULATOR ASSEMBLY, TANGENT	-	TM-___	
15	1	OHGW ASSEMBLY, TANGENT	-	TM-4___	

NOTES:

1. For strength limitations of overhead ground wire support assembly, see TM-6.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. 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 FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

TANGENT WISHBONE - DOUBLE ARM

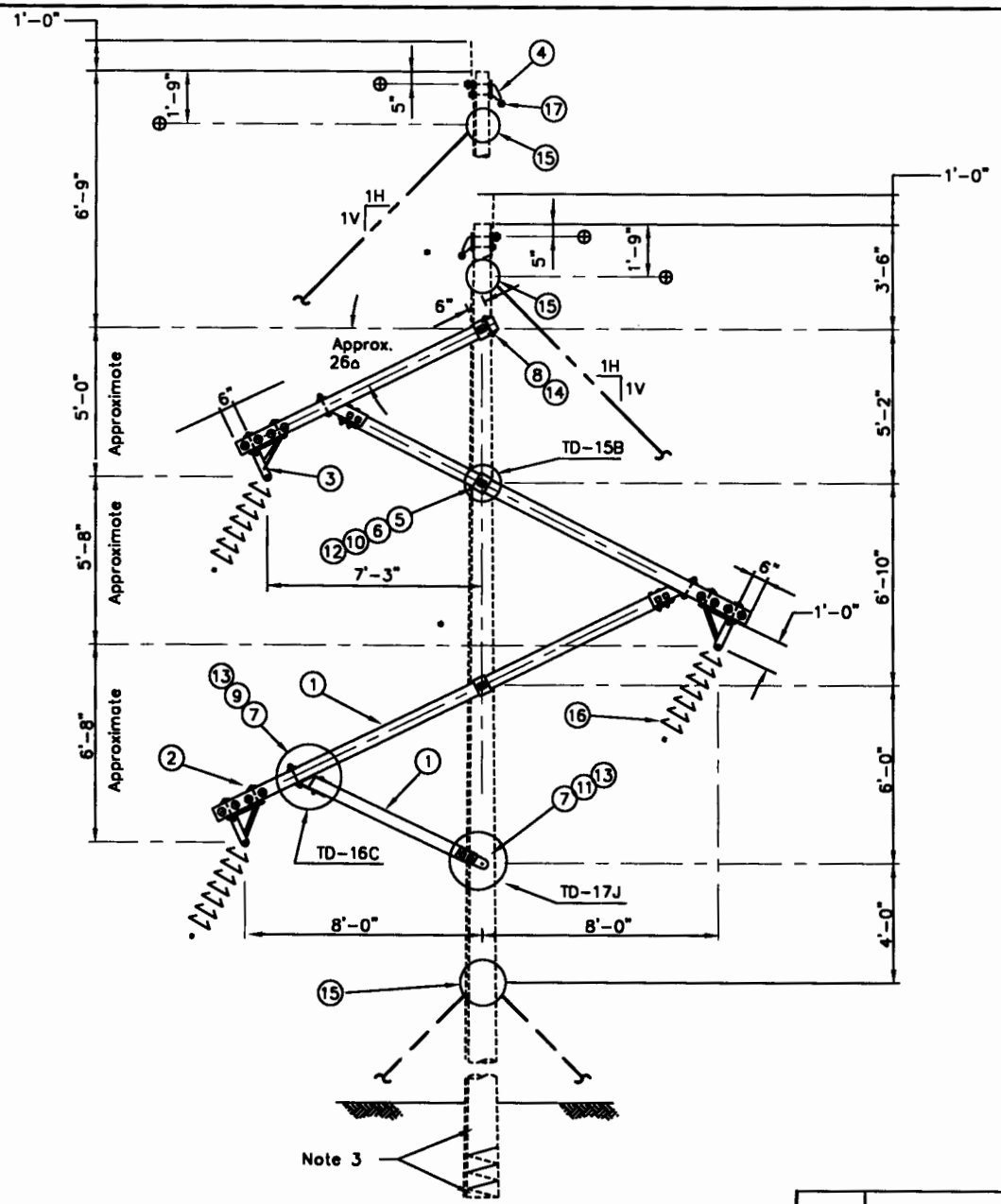
(115 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE

TSZ-115 A



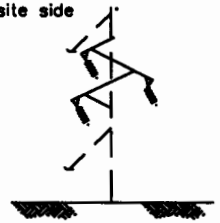
TSZ-115B

LIST OF MATERIALS

DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	Double X-Arm Assembly, 3-5/8"x7-3/8" and Brace, 2-3/4"x3-1/2" complete with end fittings and fasteners			
2	6	Spacer Assembly, see construction spec		TM-111	
3	3	Bracket, Swinging Angle Assembly		TM-112A	
4	1	OHGW Support Assembly, double bolt		TM-6B	
5	6	Plate, X-Arm Reinforcing			
6	3	7/8" Bolt, Machine, by req'd length			
7	7	3/4" Bolt, Machine, by req'd length			
8	2	1/2" Bolt, Washer Head, w/Washer Nut	gz		
9	6	Washer, Flat, 2-1/4"sq x3/16",13/16"h.			
10	3	Washer, Spring, 15/16" hole			
11	1	Washer, Spring, 13/16" hole			
12	3	7/8" Locknut, MF Type			
13	7	3/4" Locknut, MF Type			
14	2	1/2" Locknut, MF Type			
15	2	GUY ATTACHMENT, MEDIUM DUTY	-	TG-__C	
16	3	INSULATOR ASSEMBLY, TANGENT	-	TM-___	
17	1	OHGW ASSEMBLY, TANGENT	-	TM-4__	

NOTES:

1. For strength limitations of overhead groundwire support assembly, see TM-6.
2. Drawing TE-2 gives guidonce to subassembly alternatives.
3. The following materials ore to be specified separately on plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY AND ANCHOR ASSEMBLIES, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.
4. Locote pole ground on opposite side for TSZ-115C.



TSZ-115C

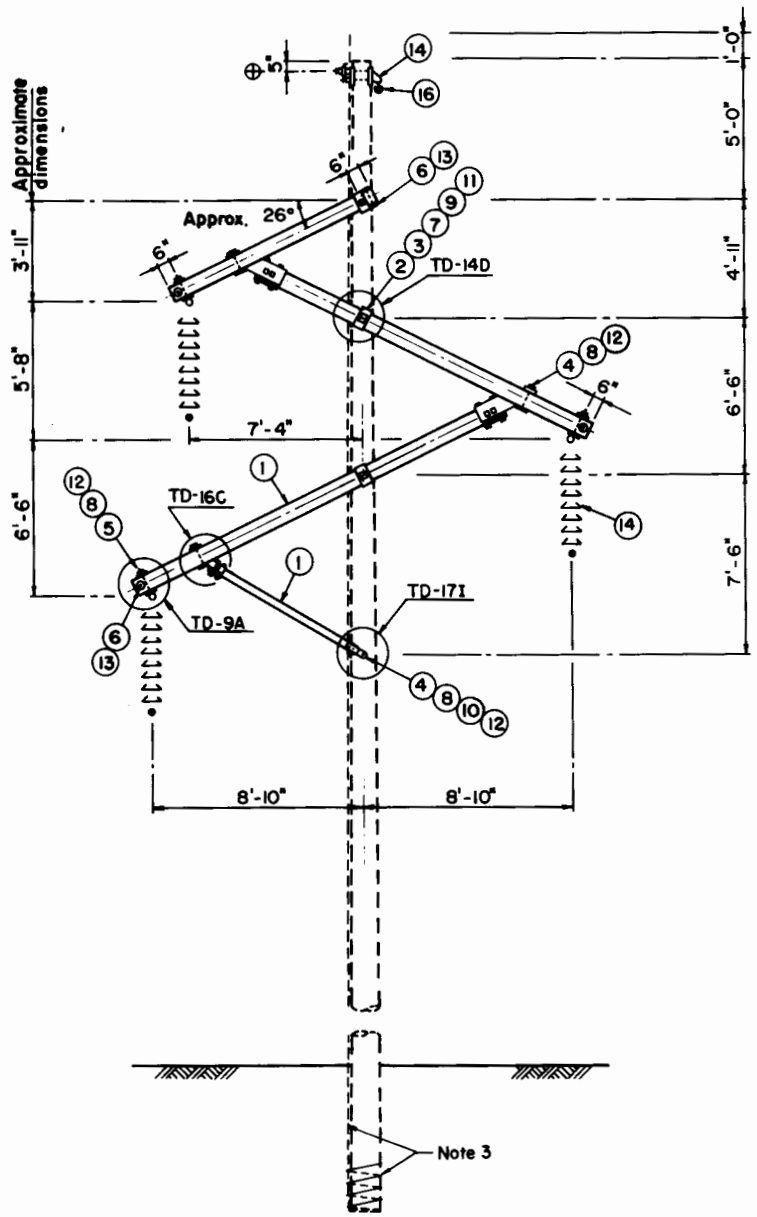
TRANSMISSION LINE STRUCTURE

SMALL ANGLE WISHBONE - DOUBLE ARM

(115 kv MAXIMUM)

NO.	REVISION	DATE
1.*	Ground&item 17 loc	03/98

TSZ-115B,115C



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
		X-Arm Assembly, 3-5/8" x 7-3/8" and			
1	1	Brace, 2-3/4" x 3-1/2" complete with end			
		fittings and fasteners			
2	3	Plate, X-Arm reinforcing			
3	3	7/8" Bolt, Machine, by req'd length			
4	4	3/4" Bolt, Machine, by req'd length			
5	3	3/4" Bolt, Shoulder Eye, by req'd l.			
6	4	1/2" Bolt, Washer Head, w/Washer Nut			
7	3	Washer, Curved, 4" sq. x 1/4", 15/16" hole	gz		
8	7	Washer, Flat, 2-1/4" sq. x 3/16", 13/16"h.			
9	3	Washer, Spring, 15/16" hole			
10	1	Washer, Spring, 13/16" hole			
11	3	7/8" Locknut, MF Type			
12	7	3/4" Locknut, MF Type			
13	4	1/2" Locknut, MF Type			
14	1	OHGW SUPPORT ASSEMBLY	-	TM-6	
15	3	INSULATOR ASSEMBLY, TANGENT	-	TM-	
16	1	OHGW ASSEMBLY, TANGENT	-	TM-4	

NOTES:

1. For strength limitations of overhead ground wire support assembly, see TM-6.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. The following materials are to be specified separately on the plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

TANGENT WISHBONE– SINGLE ARM

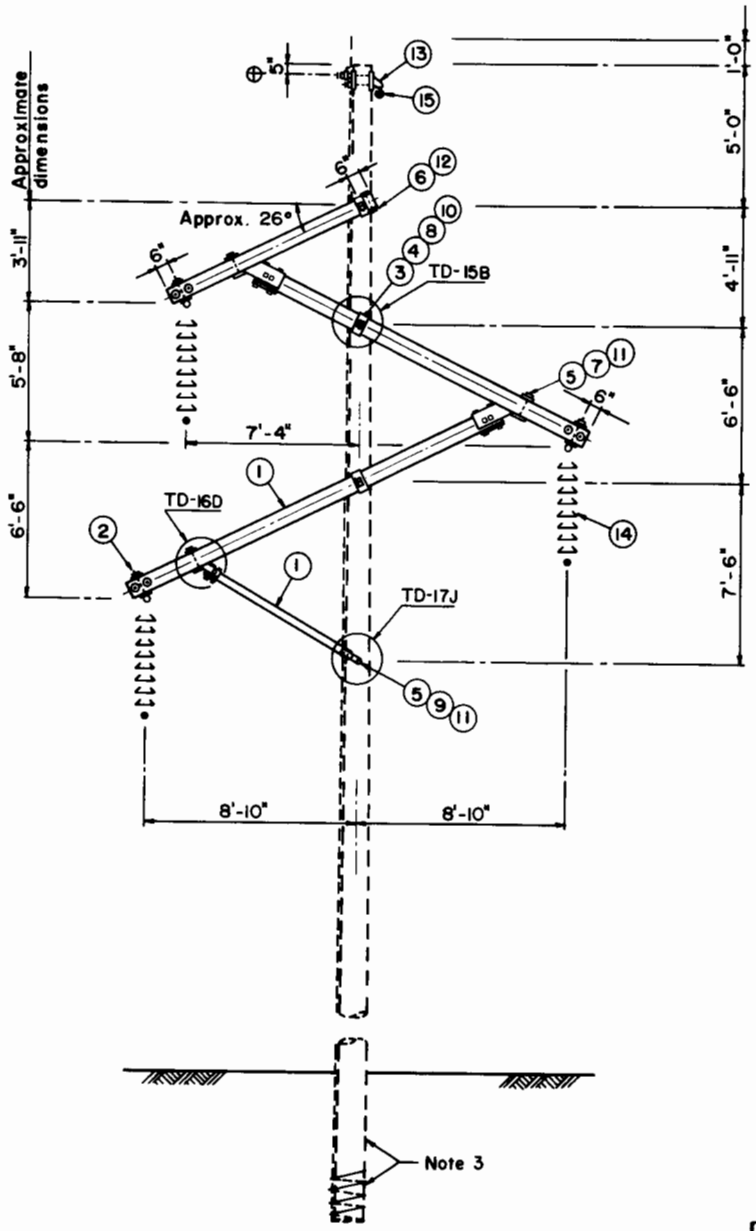
(138 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TSZ-138

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	Double X-Arm Assembly, 3-5/8" x 7-3/8" and Brace, 2-3/4" x 3-1/2" complete with end fittings and fasteners			
2	3	Spacer Assembly, see construction spec.		TM-111	
3	6	Plate, X-Arm Reinforcing			
4	3	7/8" Bolt, Machine, by req'd length			
5	7	3/4" Bolt, Machine, by req'd length	gz		
6	2	1/2" Bolt, Washer Head, w/Washer Nut			
7	6	Washer, Flat, 2-1/4" sq. x 3/16", 13/16"h.			
8	3	Washer, Spring, 15/16" hole			
9	1	Washer, Spring, 13/16" hole			
10	3	7/8" Locknut, MF Type			
11	7	3/4" Locknut, MF Type			
12	2	1/2" Locknut, MF Type			
13	1	OHGW SUPPORT ASSEMBLY	-	TM-6	
14	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
15	1	OHGW ASSEMBLY, TANGENT	-	TM-4	

NOTES:

1. For strength limitations of overhead ground wire support assembly, see TM-6.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. 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 FOUNDATION UNITS.

Reissued 03/98

NO.	REVISION	DATE

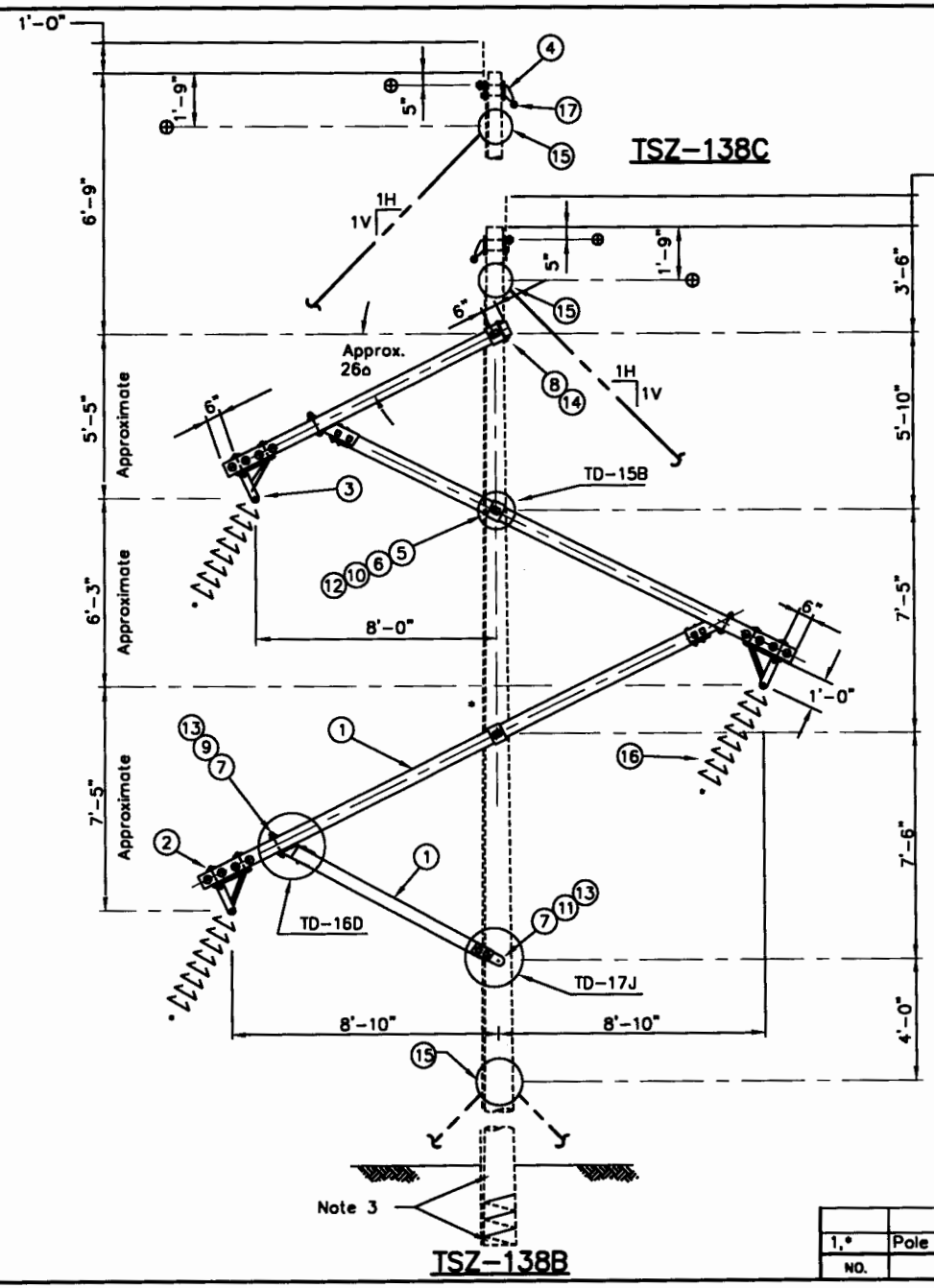
TRANSMISSION LINE STRUCTURE

TANGENT DELTA – DOUBLE ARM

(138 kV MAXIMUM)

SCALE:

TSZ-138A

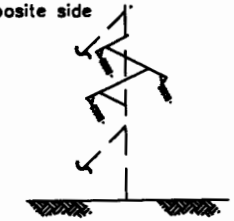


LIST OF MATERIALS

DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	Double X-Arm Assembly, 3-5/8"x7-3/8" and Brace, 2-3/4"x3-1/2" complete with end fittings and fasteners			
2	6	Spacer Assembly, see construction spec		TM-111	
3	3	Bracket, Swinging Angle Assembly		TM-112A	
4	1	OHGW Support Assembly, double bolt		TM-6B	
5	6	Plate, X-Arm Reinforcing			
6	3	7/8" Bolt, Machine, by req'd length			
7	7	3/4" Bolt, Machine, by req'd length			
8	2	1/2" Bolt, Washer Head, w/Washer Nut	-gz		
9	6	Washer, Flat, 2-1/4"sq x3/16",13/16"h.			
10	3	Washer, Spring, 15/16" hole			
11	1	Washer, Spring, 13/16" hole			
12	3	7/8" Locknut, MF Type			
13	7	3/4" Locknut, MF Type			
14	2	1/2" Locknut, MF Type			
15	2	GUY ATTACHMENT, MEDIUM DUTY	-	TG-__C	
16	3	INSULATOR ASSEMBLY, TANGENT	-	TM-___	
17	1	OHGW ASSEMBLY, TANGENT	-	TM-4__	

NOTES:

1. For strength limitations of overhead groundwire support assembly, see TM-6.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. The following materials are to be specified separately on plan and profile drawings and staking sheets: POLE, POLE GROUNDING ASSEMBLY, GUY AND ANCHOR ASSEMBLIES, AND ANY ADDITIONAL GROUNDING OR FOUNDATION UNITS.
4. Locate pole ground on opposite side for TSZ-138C.



TSZ-138C

NO.	REVISION	DATE
1,*	Pole ground loc.	03/98

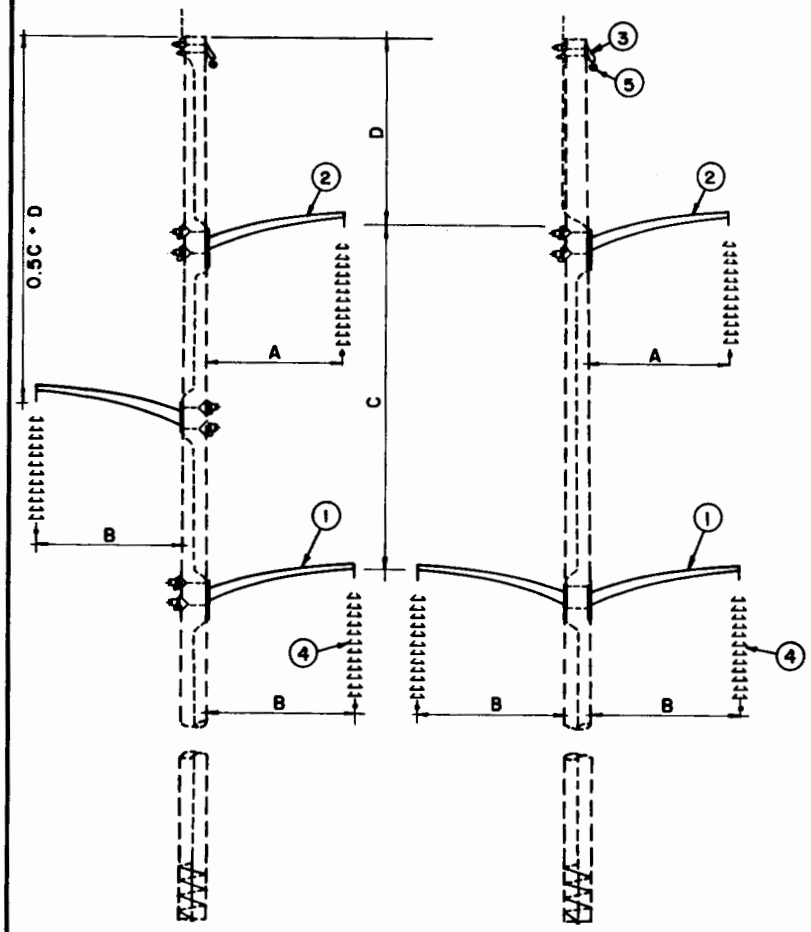
TRANSMISSION LINE STRUCTURE

SMALL ANGLE WISHBONE - DOUBLE ARM
(138 kv MAXIMUM)

TSZ-138B,138C

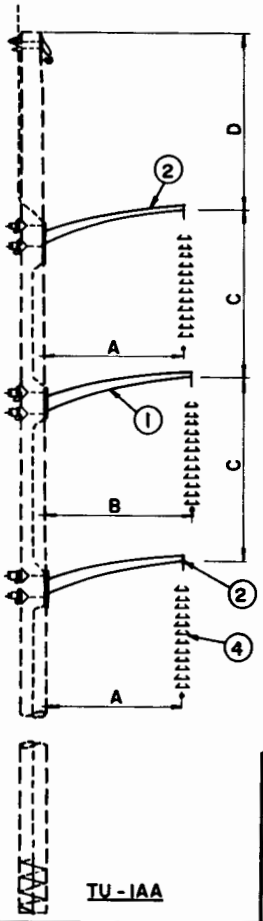
MINIMUM DIMENSIONS								
VOLTAGE	69 kV		115 kV		138 kV		161 kV	
A		4.0		6.0		7.0		8.0
B		5.0		7.0		8.0		9.0
C		7.0		9.0		10.0		12.0
D		4.5		6.5		7.5		9.0

LIST OF MATERIALS						
DRG. REF.	TU- 1,1A	TU- 1AA	DESCRIPTION	ITEM	DET.	CODE No.
1	2	1	STEEL ARM ASS'Y _____ Duty, ____ Ft.		TM-115_	
2	1	2	STEEL ARM ASS'Y _____ Duty, ____ Ft.		TM-115_	
3	1	1	OHGW SUPPORT ASSEMBLY		TM-6__	
4	3	3	INSULATOR ASSEMBLY, TANGENT		TM-__	
5	1	1	OHGW ASSEMBLY, TANGENT		TM-4__	
6						
7						
8						



TU - 1

TU - 1A



TU - 1AA

NOTES

1. For strength limitations and other assembly requirements, see REA Specification T-11.
2. Metal shims shall be used to adjust davit arms on uneven pole surfaces.
3. The following materials are to be specified on the plan-profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATIONS UNITS.

TRANSMISSION LINE STRUCTURE

STEEL UPSWEPT ARMS

(161 kV MAXIMUM)

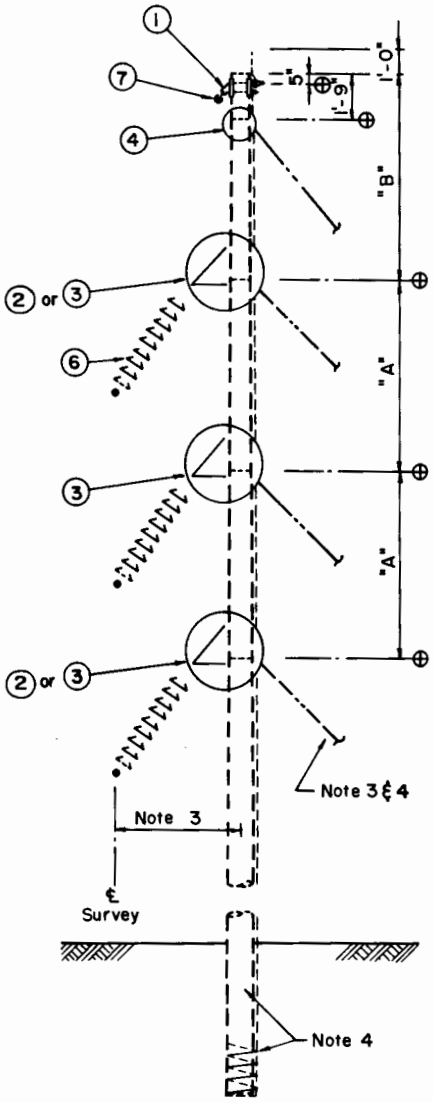
Reissued 03/98

NO.	REVISION	DATE

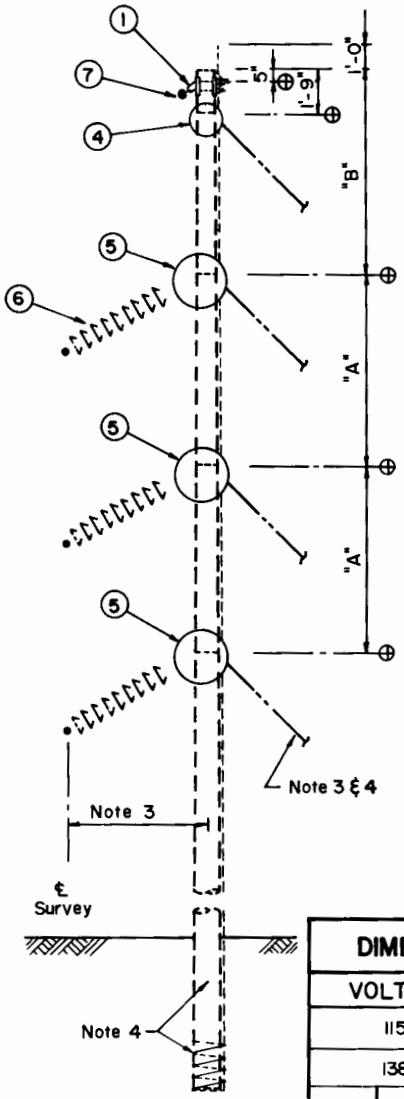
Aug., 1986

TU-1,1A,1AA

DRG. REF.	TS- 3A	3AA	4A	LIST OF MATERIALS 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___	



TS-3A
TS-3AA

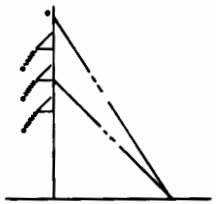


TS-4A

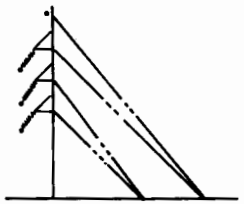
Reissued 03/98

NOTES:

1. Maximum line angle for TS-4A is 50 degrees.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements and offset table, see drawing TMG-2.
4. The following materials are to be specified separately on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.



TS - 3A



TS - 3AA

DIMENSIONS A℄B		
VOLTAGE	A	B
115 kV	9'-0"	9'-0"
138kV	10'-0"	10'-0"

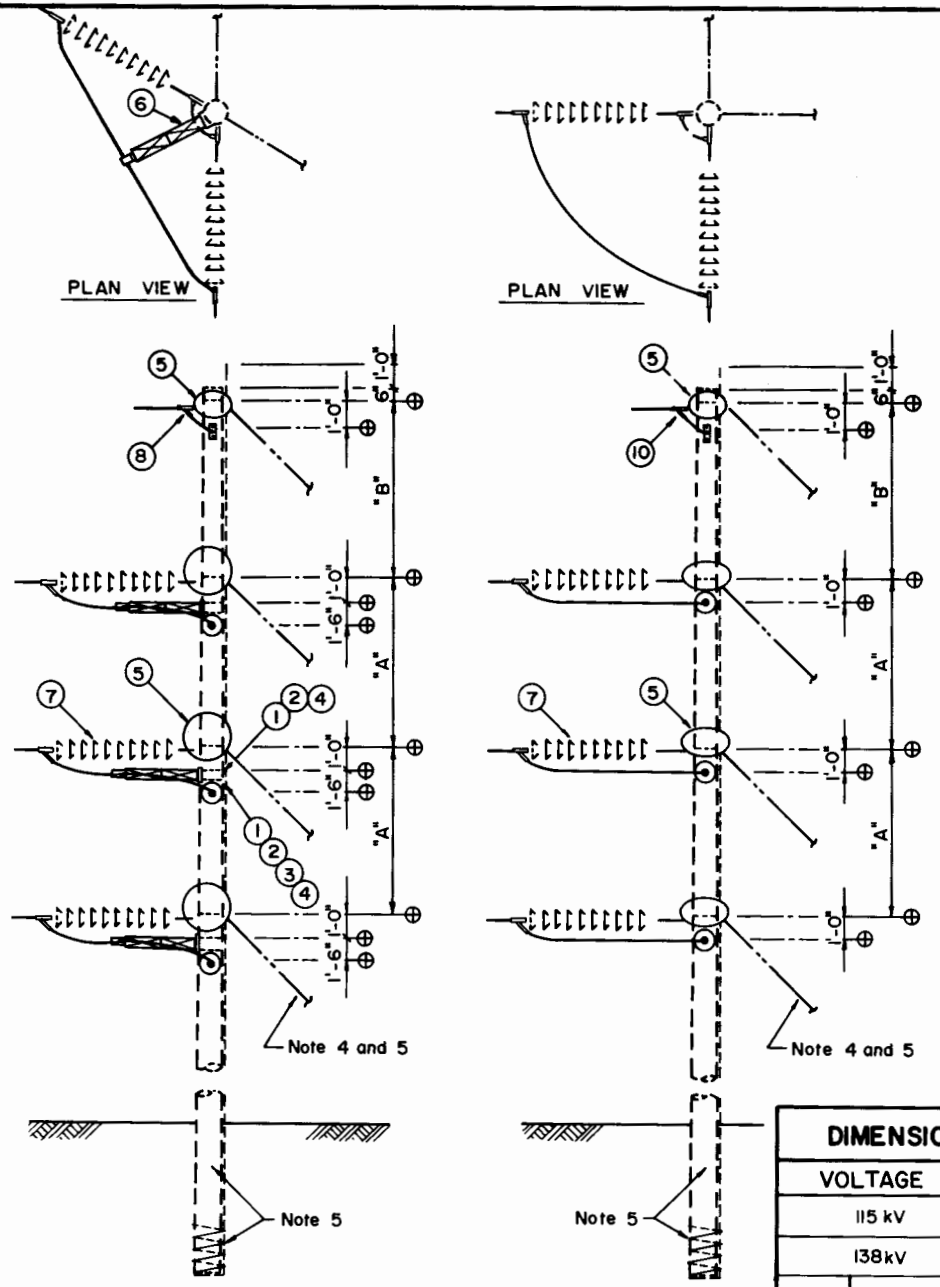
NO.	REVISION	DATE

TRANSMISSION LINE STRUCTURE

MEDIUM AND LARGE VERTICAL ANGLES
(138 kV MAXIMUM)

SCALE:

TS-3A,3AA,4A



TS - 5AA

TS - 5A

DRG. REF.	TS-5 AA	TS-5 A	DESCRIPTION	ITEM	DET.	CODE No.
1	6	-	3/4" Bolt, Machine, by req'd length	c		
2	6	-	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
3	3	-	Washer, Spring, 13/16" hole	aw		
4	6	-	3/4" Locknut, MF Type	ek		
5	8	8	GUY ATTACHMENT, _____ DUTY	-	TG-___D	
6	3	-	INSULATOR, HORIZONTAL POST, WITH CLAMP	-	TM-3___	
7	6	6	INSULATOR ASSEMBLY, DEADEND	-	TM-_____	
8	2	2	OHGW ASSEMBLY, DEADEND	-	TM-4___	

LIST OF MATERIALS

Notes:

1. Metal shims should be used to adjust post insulators when brackets are located on uneven pole surfaces.
2. Minimum line angle for TS-5AA is 40 degrees. Maximum line angle for TS-5A is 90 degrees.
3. Drawing TE-2 gives guidance to subassembly alternatives.
4. For guying arrangements, see drawing TMG-2.
5. The following materials are to be specified separately on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

DIMENSIONS A & B		
VOLTAGE	A	B
115 kV	9'-0"	9'-0"
138kV	10'-0"	10'-0"

NO.	REVISION	DATE

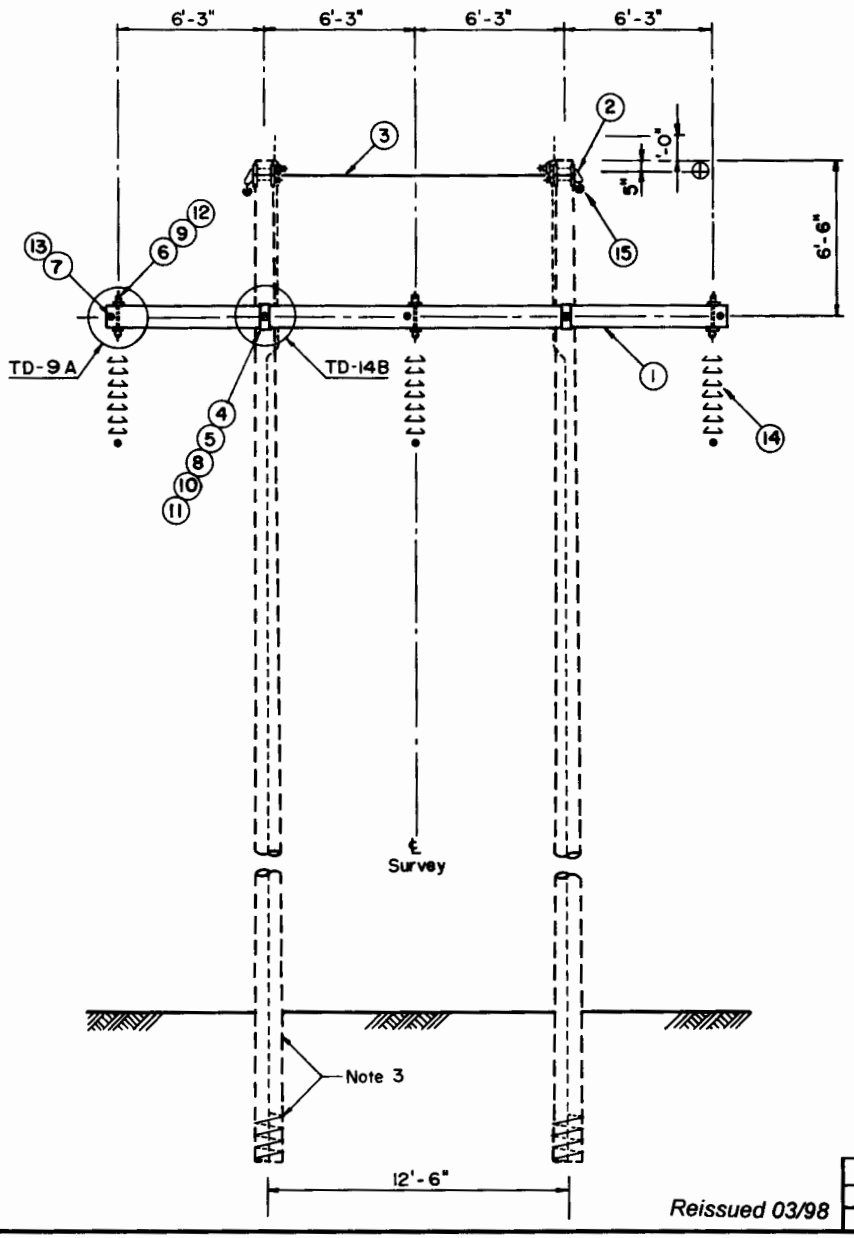
TRANSMISSION LINE STRUCTURE

VERTICAL DOUBLE DEADEND

(138kV MAXIMUM)

SCALE:

TS-5A,5AA



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 5-5/8" x 7-3/8" x 26'-0", #55		TCD-26	
2	2	OHGW Support Assembly, double bolt	-	TM-6B	
3	1	Grounding Assembly	-	TM-9C	
4	2	Plate, X-Arm Reinforcing	eg		
5	2	7/8" Bolt, Machine, by req'd length	c		
6	3	3/4" Bolt, Shoulder Eye, by req'd l.	o		
7	3	1/2" Bolt, Washer Head, w/Washer Nut	c		
8	2	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
9	3	Washer, Flat, 4" sq. x 3/16", 13/16" hole	d		
10	2	Washer, Spring, 15/16" hole	aw		
11	2	7/8" Locknut, MF Type	ek		
12	3	3/4" Locknut, MF Type	ek		
13	3	1/2" Locknut, MF Type	ek		
14	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
15	2	OHGW ASSEMBLY, TANGENT	-	TM-4____	

NOTES:

1. Strength limitations of the overhead groundwire support are given on drawing TM-6.
2. Drawing TE-2 gives guidance to subassembly alternatives.
3. The following materials are specified on plan and profile drawing and staking sheets: POLES, POLE GROUNDING ASSEMBLY AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

TANGENT H-FRAME-SINGLE ARM

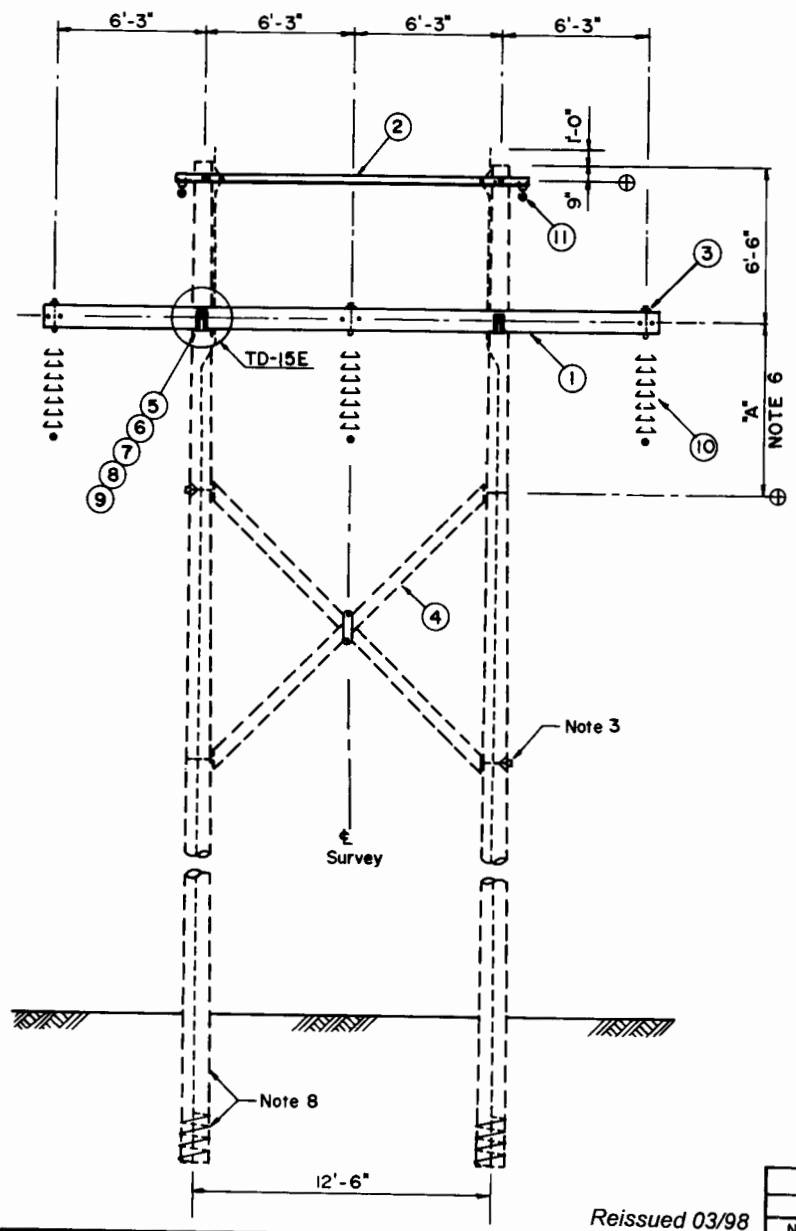
(115kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-1A

Reissued 03/98



DRG. REF.	TH- IAA	IAAX	DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	X-Arm, 3-5/8" x 9-3/8" x 26'-0", #54		TCD-26	
2	1	1	OHGW Support Assembly	-	TM-7A	
3	3	3	Spacer Assembly, see construction spec.	-	TM-111	
4	-	1	X-Brace Assembly	-	TM-110A	
5	4	4	Plate, Gain, 3" x 9-1/2" x 1/4"			
6	4	4	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
7	2	2	7/8" Threaded Rod w/2 Nuts, by r.l.			
8	2	2	Washer, Spring, 15/16" hole	aw		
9	4	4	7/8" Locknut, MF Type	ek		
10	3	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
11	2	2	OHGW ASSEMBLY, TANGENT	-	TM-4___	

NOTES:

1. Use of X-Brace assembly must be economically justified.
2. Double X-Arm shall be shipped complete with factory assembled hardware.
3. Field drilled holes shall be thoroughly treated.
4. For strength limitations of overhead groundwire support assembly, see TM-7A.
5. Maximum strength of X-Brace is ±20,000 lbs.
6. Dimension "A" is to be specified by the engineer on the pole framing drawing.
7. Drawing TE-2 gives guidance to subassembly alternatives.
8. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

NO.	REVISION	DATE

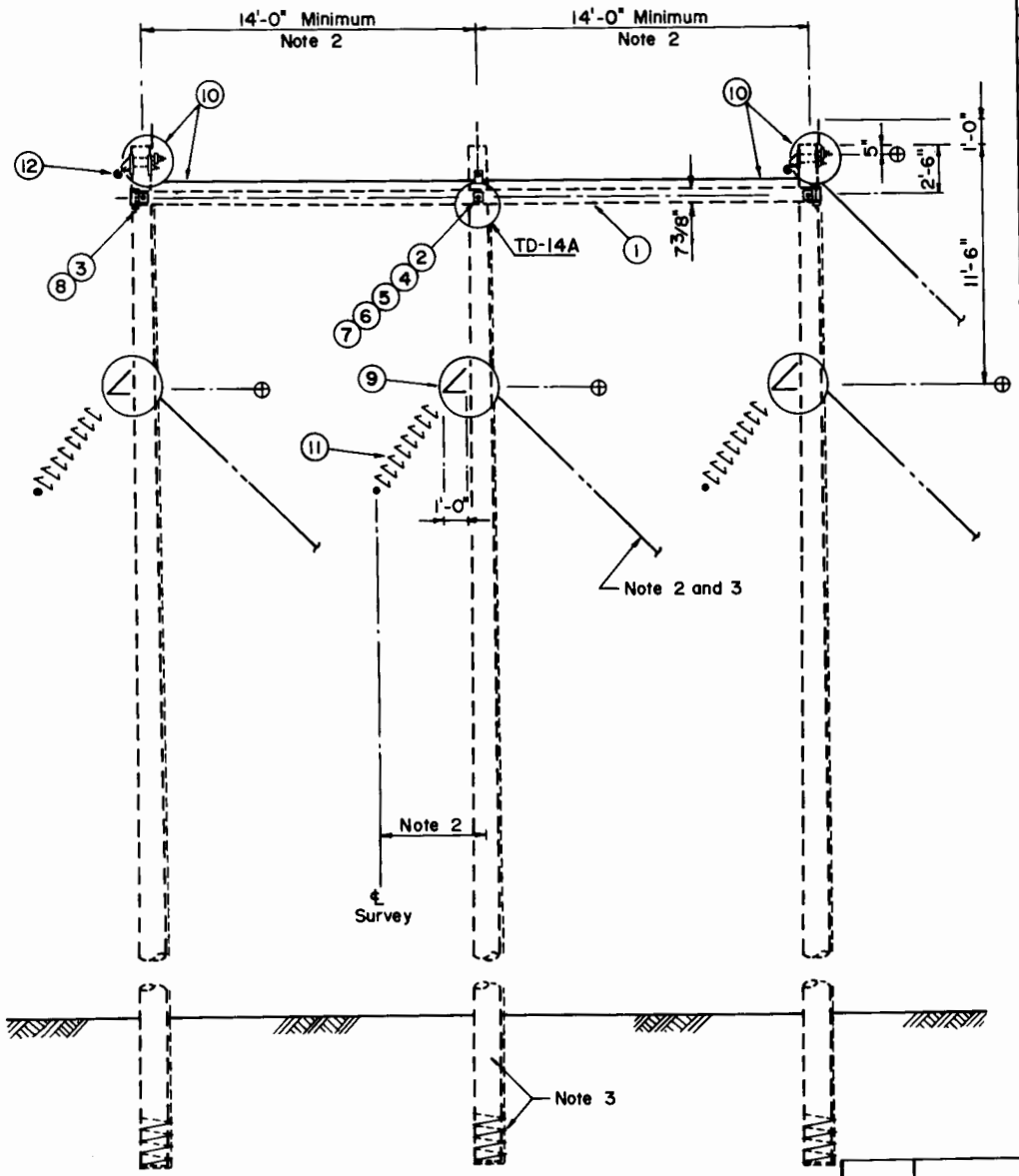
TRANSMISSION LINE STRUCTURE

TANGENT H-FRAME-DOUBLE ARM

(115kV MAXIMUM)

SCALE:

TH-IAA, IAAX



	TH-3		LIST OF MATERIALS			
DRG. REF.	A	AA	DESCRIPTION	ITEM	DET.	CODE No.
1	1	-	X-Arm, 5-5/8" x 7-3/8" x req'd l., #86		TCD-91	
2	3	-	3/4" Bolt, Machine, by req'd length	c		
3	2	-	1/2" Bolt, Washer Head, w/Washer Nut	c		
4	3	-	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
5	3	-	Washer, Flat, 4" sq. x 1/16", 13/16" hole	d		
6	3	-	Washer, Spring, 13/16" hole	aw		
7	3	-	3/4" Locknut, MF Type	ek		
8	2	-	1/2" Locknut, MF Type	ek		
9	3	3	BRACKET & GUY ATTACH. _____ DUTY	-	TG-____	
10	1	1	POLE TIE, LARGE ANGLE, _____ DUTY	-	TG-___A	
11	3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-___C	
12	2	2	OHGW ASSEMBLY, ANGLE	-	TM-4___	

Notes:

1. Drawing TE-2 gives guidance to subassembly alternatives.
2. For guying arrangements and offset table, see drawing TMG-13. Pole spacing shall conform to minimum dimensions unless otherwise indicated. X-Arm drilling shall be coordinated with pole spacing.
3. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

NO.	REVISION	DATE

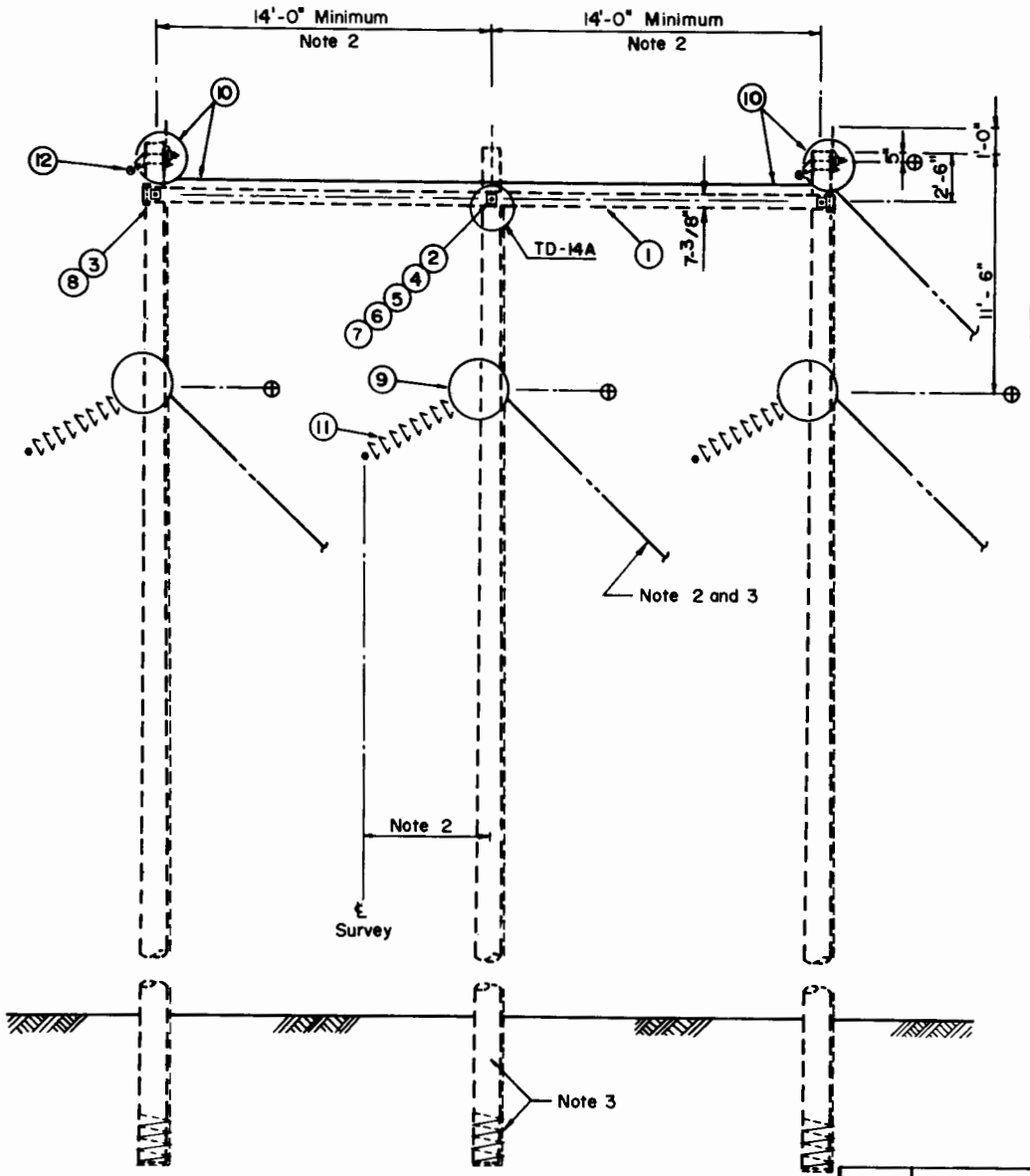
TRANSMISSION LINE STRUCTURE

MEDIUM ANGLE

(115kV MAXIMUM)

SCALE:

TH-3A,3AA



	TH-4		LIST OF MATERIALS			
DRG. REF.	A	AA	DESCRIPTION	ITEM	DET.	CODE No.
1	1	-	X-Arm, 5-5/8" x 7-3/8" x req'd l., #86		TCD-91	
2	3	-	3/4" Bolt, Machine, by req'd length	c		
3	2	-	1/2" Bolt, Washer Head, w/Washer Nut	c		
4	3	-	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
5	3	-	Washer, Flat, 4" sq. x 3/16", 13/16" hole	d		
6	3	-	Washer, Spring, 13/16" hole	aw		
7	3	-	3/4" Locknut, MF Type	ek		
8	2	-	1/2" Locknut, MF Type	ek		
9	3	3	GUY ATTACHMENT, _____ DUTY	-	TG-___D	
10	1	1	POLE TIE, LARGE ANGLE, _____ DUTY	-	TG-___A	
11	3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-___C	
12	2	2	OHGW ASSEMBLY, ANGLE	-	TM-4___	

Notes:

1. Drawing TE-2 gives guidance to subossembly alternatives.
2. For guying arrangements and offset table, see drawing TMG-14. Pole spacing shall conform to minimum dimensions unless otherwise indicated. X-Arm drilling shall be coordinated with pole spacing.
3. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

NO.	REVISION	DATE

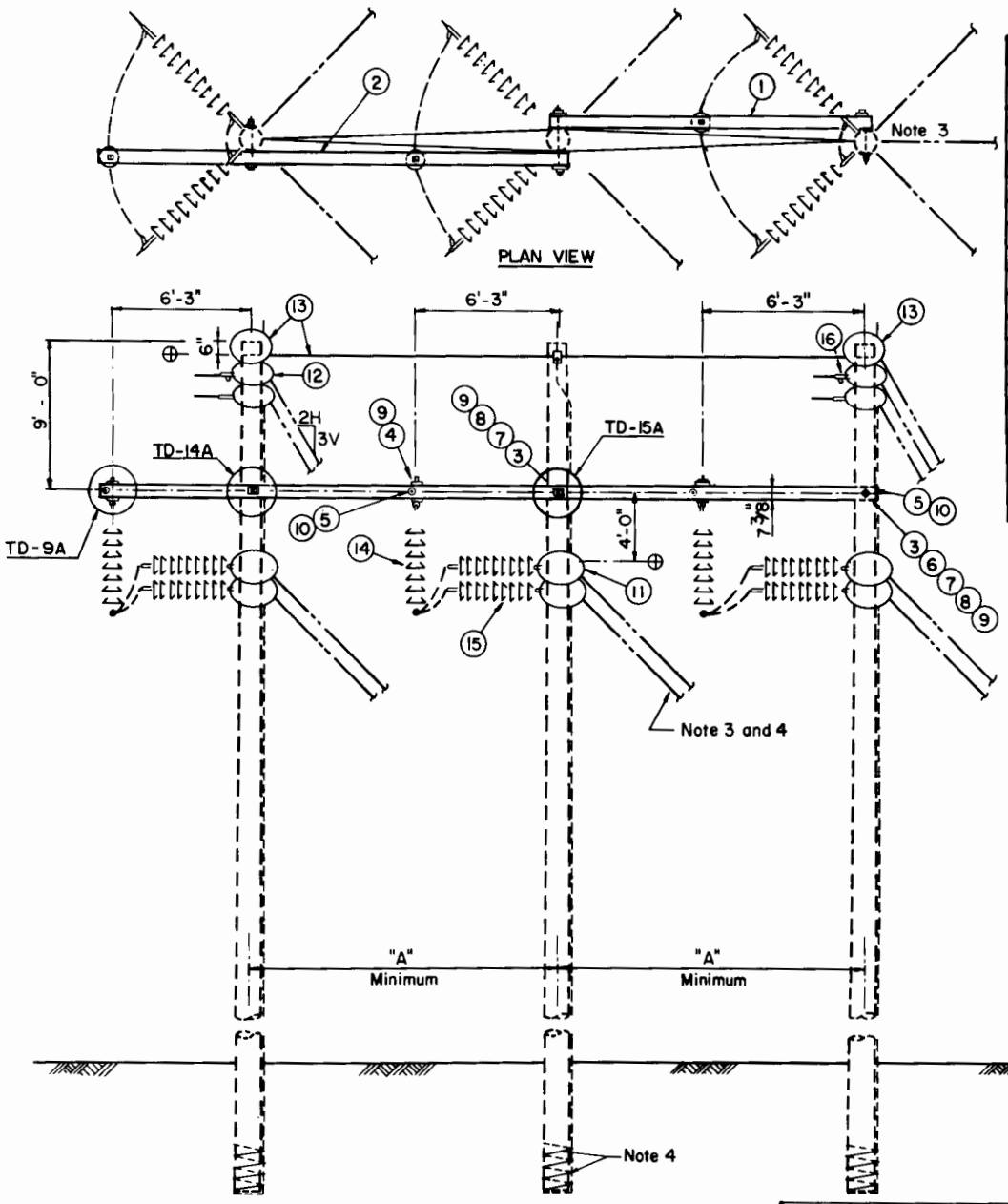
TRANSMISSION LINE STRUCTURE

LARGE ANGLE

(115 kV MAXIMUM)

SCALE:

TH-4A, 4AA



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 5-5/8"x7-3/8"xreq'd l., #88	-	TCD-91	
2	1	X-Arm, 5-5/8"x7-3/8"xreq'd l., #89	-	TCD-91	
3	3	3/4" Bolt, Machine, by req'd length	c		
4	3	3/4" Bolt, Shoulder Eye w/Washer Nut	o		
5	6	1/2" Bolt, Washer Head, w/Washer Nut	c		
6	2	Washer, Curved, 4"sq.x1/4",13/16"hole	d		
7	4	Washer, Flat, 4"sq.x3/16",13/16"hole	d		
8	3	Washer, Spring, 13/16" hole	aw		
9	6	3/4" Locknut, MF Type	ek		
10	6	1/2" Locknut, MF Type	ek		
11	6	GUY ATTACHMENT, _____ DUTY	-	TG- D	
12	4	GUY ATTACHMENT, _____ DUTY	-	TG- D	
13	1	POLE TIE, GUYING, _____ DUTY	-	TG- B	
14	3	INSULATOR ASSEMBLY, TANGENT	-	TM-	
15	6	INSULATOR ASSEMBLY, DEADEND	-	TM-	
16	4	OHGW ASSEMBLY, DEADEND	-	TM-4	
17					

NOTES:

1. Drawing TE-2 gives guidance to subassembly alternatives.
2. For an OHGW guy slope of 3V to 2H, the following minimum pole spacings are recommended:

LINE ANGLE	DIMENSION "A"
to 50° Max	13'-6"
50° to 60° Max	14'-6"
60° to 70° Max	15'-6"
70° to 80° Max	16'-6"
80° to 90° Max	18'-0"

3. For guying arrangements, see drawing TMG-15. A bisector guy is recommended for the line angles less than 60 degrees.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE DOUBLE DEADEND

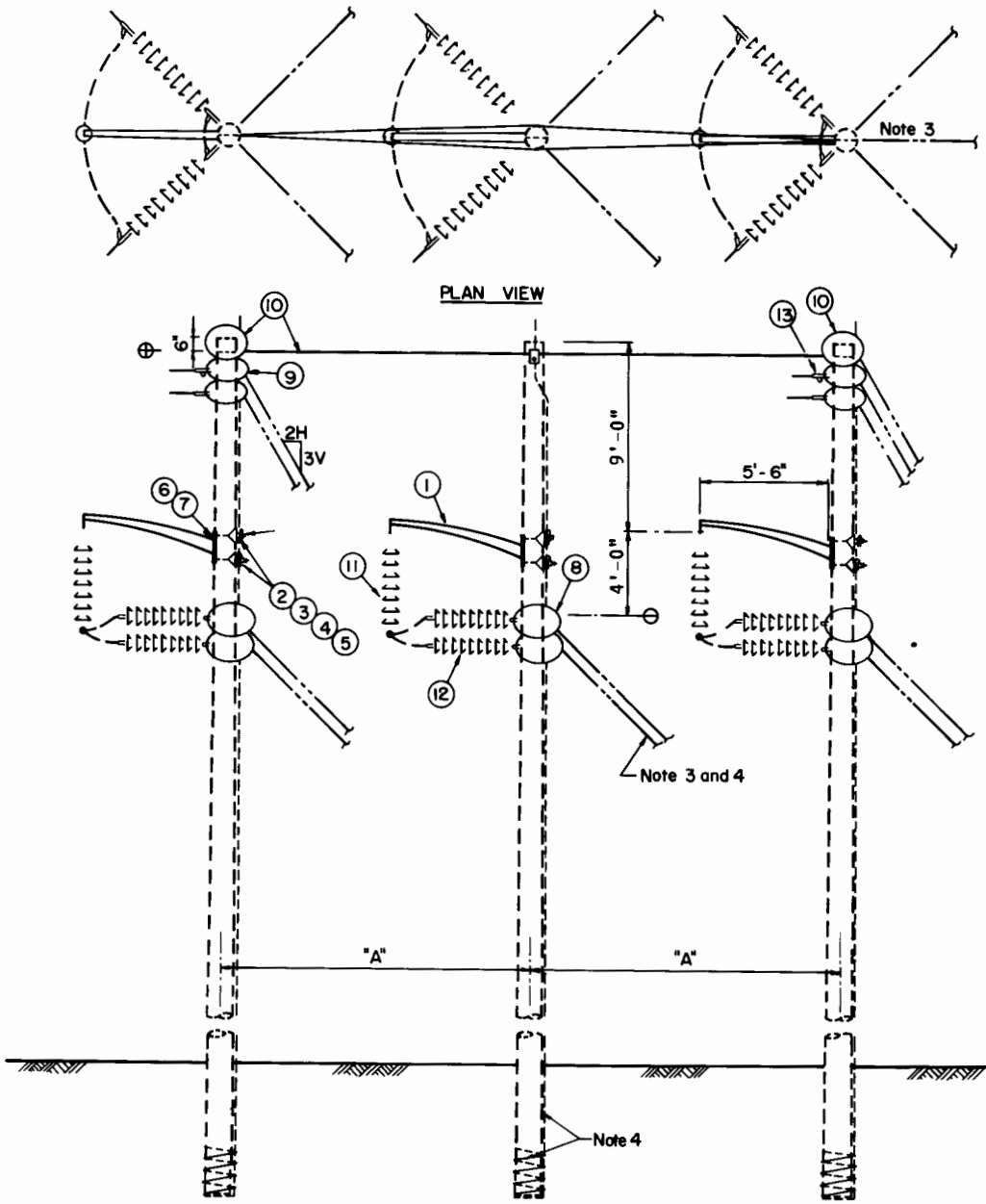
(115kV MAXIMUM)

NO.	REVISION	DATE

SCALE

TH-5A

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	Davit Arm, steel, medium duty	gk		
2	6	1" Bolt, Machine, by req'd length	c		
3	6	Washer, Curved, 4"Sq.x1/4", 1-1/16"hole	d		
4	6	Washer, Spring, 1-1/16" hole	aw	TM-115	
5	6	1" Locknut, MF Type	ek		
6	3	5/8" Bolt, Carriage			
7	3	5/8" Clamp, Groundwire	dp		
8	6	GUY ATTACHMENT, _____ DUTY	-	TG-__D	
9	4	GUY ATTACHMENT, DUTY	-	TG-__D	
10	1	POLE TIE, GUYING, DUTY	-	TG-__B	
11	3	INSULATOR ASSEMBLY, ANGLE	-	TM-__C	
12	6	INSULATOR ASSEMBLY, DEADEND	-	TM-__	
13	4	OHGW ASSEMBLY, DEADEND	-	TM-4__	

NOTES:

1. For an OHGW guy slope of 3V to 2H, the following minimum pole spacings are recommended:

LINE ANGLE	DIMENSION "A"
to 50° Max	13'-6"
50° to 60° Max	14'-6"
60° to 70° Max	15'-6"
70° to 80° Max	16'-6"
80° to 90° Max	18'-0"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements, see drawing TMG-15. A bisector guy is recommended for line angles less than 60 degrees.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE DOUBLE DEADEND - DAVIT ARM

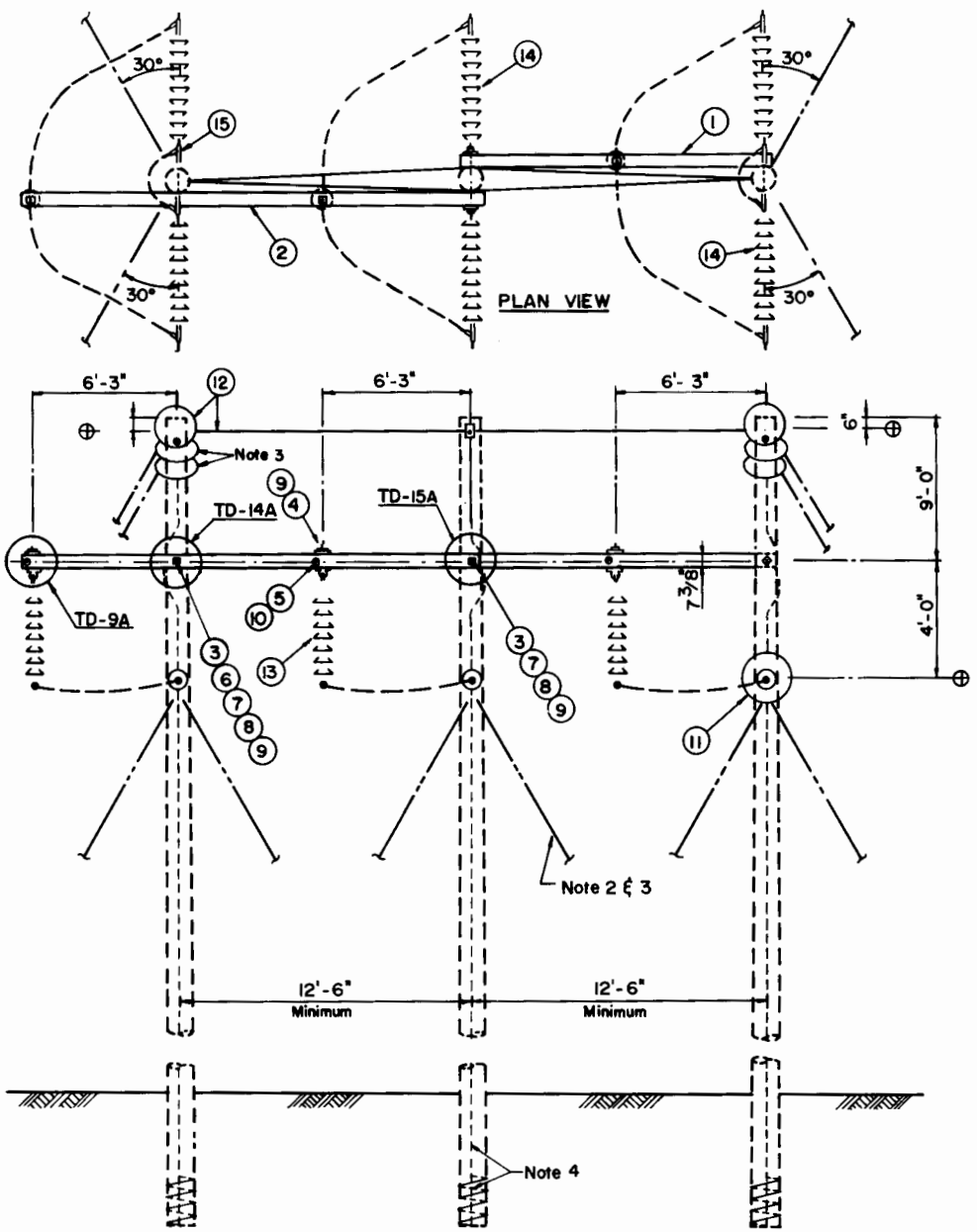
(115 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TH-5AA



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 5-5/8"x7-3/8"xreq'd l., #88	-	TCD-91	
2	1	X-Arm, 5-5/8"x7-3/8"xreq'd l., #89	-	TCD-91	
3	3	3/4" Bolt, Machine, by req'd length	c		
4	3	3/4" Bolt, Shoulder Eye, w/Washer Nut	o		
5	6	1/2" Bolt, Washer Head, w/Washer Nut	c		
6	2	Washer, Curved, 4"sq.x1/4",13/16"hole	d		
7	4	Washer, Flat, 4"sq.x3/16",13/16"hole	d		
8	3	Washer, Spring, 13/16" hole	aw		
9	6	3/4" Locknut, MF Type	ek		
10	6	1/2" Locknut, MF Type	ek		
11	3	GUY ATTACHMENT, _____ DUTY	-	TG-__E	
12	1	POLE TIE ASSEMBLY, DEADEND, ____DUTY	-	TG-__C	
13	3	INSULATOR ASSEMBLY, TANGENT	-	TM-__	
14	6	INSULATOR ASSEMBLY, DEADEND Note 5	-	TM-	
15	4	OHGW ASSEMBLY, DEADEND	-	TM-4__	
16					
17					

NOTES:

1. Drawing TE-2 gives guidance to subassembly alternatives.
2. For guying arrangements, see drawing TMG-15D.
3. Angled guying attachments below the OHGW deadend may be needed. If necessary, the engineer should modify the material list by adding these guy attachments.
4. 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.
5. When necessary, Engineer shall increase the length of the Extension Link of the INSULATOR DEADEND ASSEMBLY in order to maintain clearance to the guy.

TRANSMISSION LINE STRUCTURE

TANGENT DOUBLE DEADEND

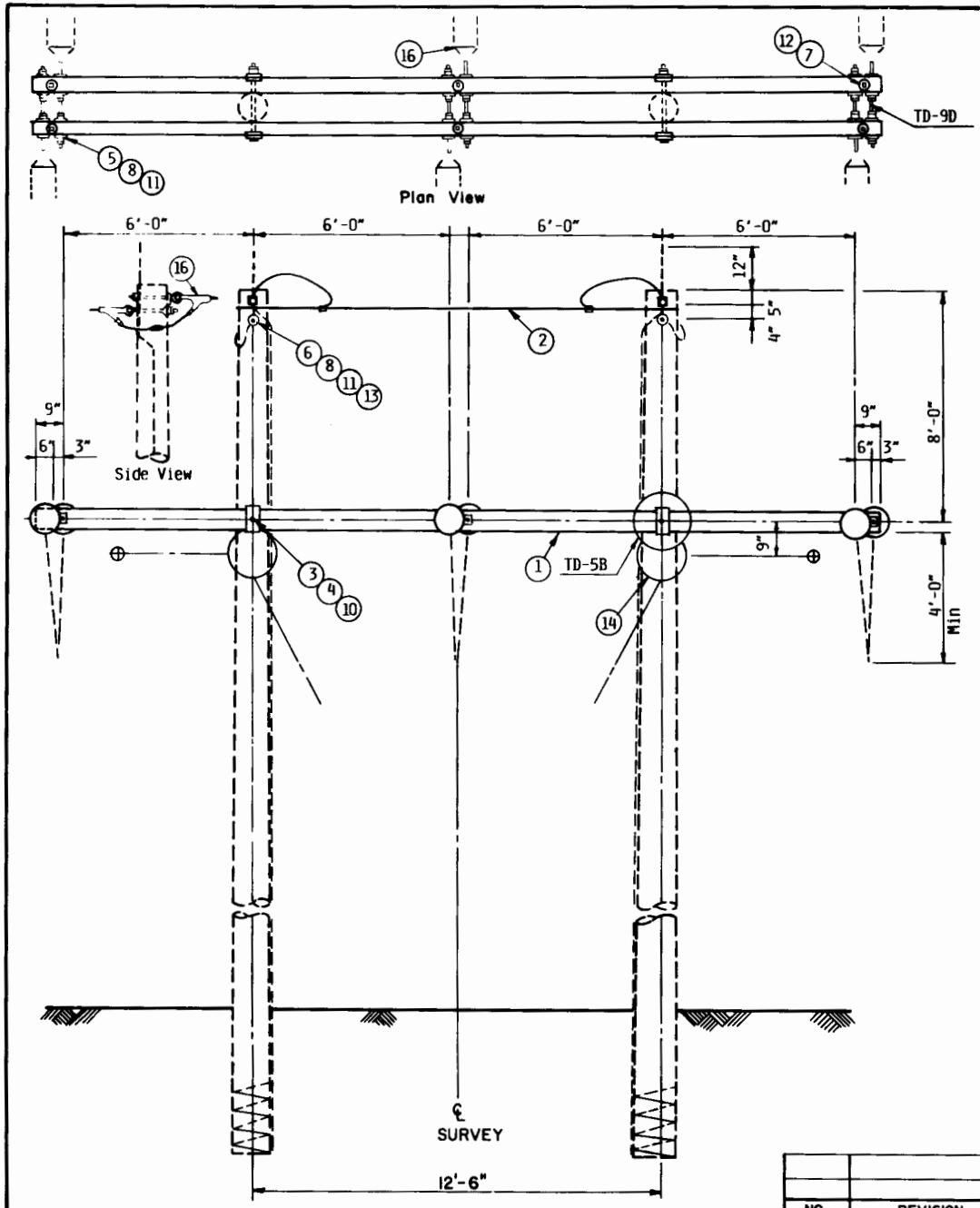
(115 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-5AD

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 5 5/8" X 7 3/8" X 26'-0", #56		TCD-26	
2	1	Grounding Assembly, Pole Tie		TM-9C	
3	4	Plate, Crossarm Reinforcing			
4	2	7/8" Bolt, Machine, by req'd length	c		
5	6	3/4" Bolt, D'ble Arm'g Eye by r.l.			
6	4	3/4" Bolt, Shoulder Eye, by r.l.	o		
7	6	1/2" Bolt, Washer Head w/Washer Nut	c		
8	24	Washer, Flat, 4"sq.X3/16", 13/16" hole	d		
9	4	Washer, Curved, 4"sq.X1/4", 13/16"hole	d		
10	2	7/8" Locknut, MF Type	ek		
11	22	3/4" Locknut, MF Type	ek		
12	6	1/2" Locknut, MF Type	ek		
13	2	3/4" Clamp, Groundwire + 1 Nut			
14	2	GUY ATTACHMENT, LIGHT DUTY		TG-16A	
15	6	INSULATOR ASSEMBLY, DEADEND		TM-___	
16	4	OHGW ASSEMBLY, DEADEND		TM-___	
17					
18					

NOTES:

1. Drawing TE-2 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 14

Reissued 03/98

TRANSMISSION LINE STRUCTURE

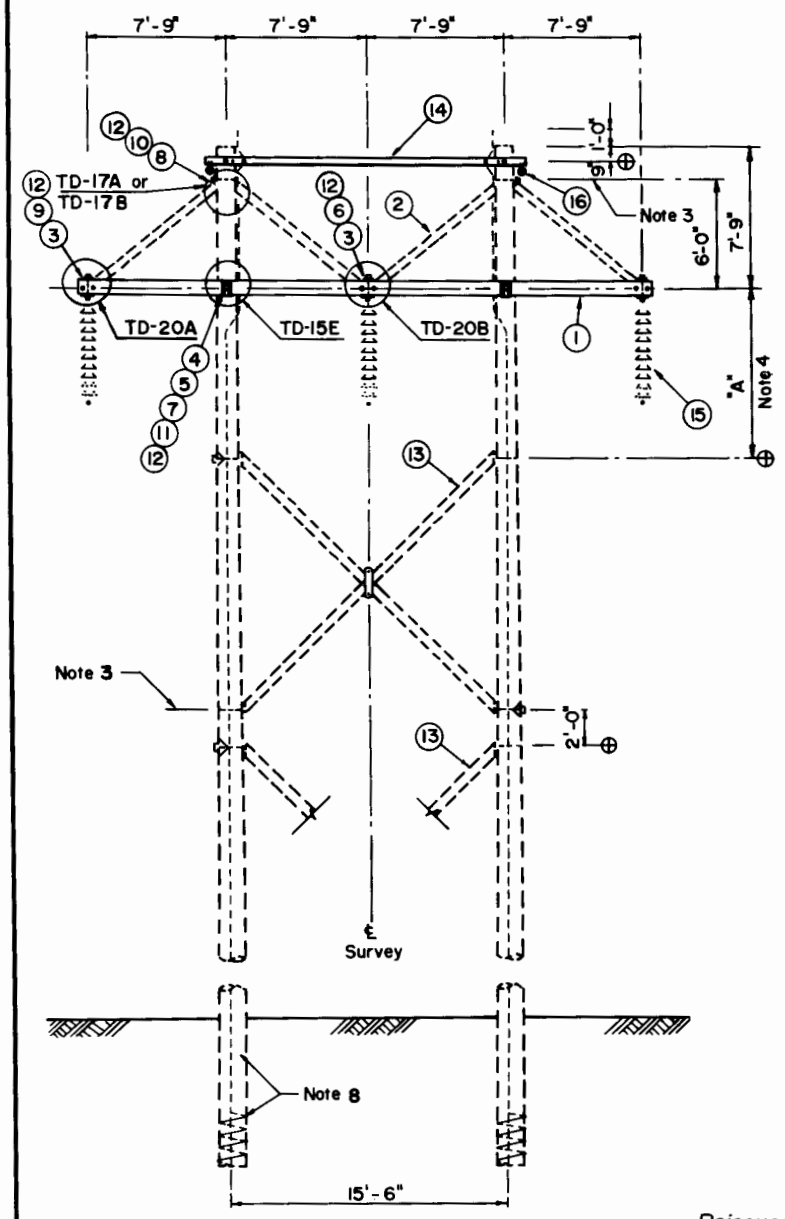
TWO POLE DOUBLE DEADEND

(115 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-7A



DWG. REF.	TH-10				X-BRACE		LIST OF MATERIALS			
		VO	VI	V4	X	XX	DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	2	2	-	-	X-Arm, 3-5/8" x 9-3/8" x 32'-0", #71		TCD-32	
2	-	2	2	4	-	-	Brace, X-Arm, 3-3/8" x 5-3/8" x req'd l.			
3	3	3	3	3	-	-	Spacer Assembly, see construction spec.		TM-111	
4	4	4	4	4	-	-	Plate, Gain, 3" x 9-1/2" x 1/4"			
5	4	4	4	4	-	-	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
6	-	-	1	1	-	-	7/8" D.E Bolt, Bent w/2 recessed nuts			
7	2	2	2	2	-	-	7/8" Threaded Rod, w/2 nuts	gy		
8	-	2	2	2	-	-	7/8" Bolt, Machine, by req'd length			
9	-	2	-	2	-	-	7/8" Bolt, Bent			
10	-	2	2	-	-	-	Washer, Curved, 4" sq. x 1/4", 15/16" hole			
11	2	2	2	2	-	-	Washer, Spring, 15/16" hole			
12	4	8	8	10	-	-	7/8" Locknut, MF Type			
13	-	-	-	-	1	2	X-Brace Assembly	vx	TM-110B	
14	1	1	1	1	-	-	OHGW SUPPORT ASSEMBLY	-	TM-7___	
15	3	3	3	3	-	-	INSULATOR ASSEMBLY, TANGENT	-	TM-___	
16	2	2	2	2	-	-	OHGW ASSEMBLY, TANGENT	-	TM-4___	

Notes:

1. Description and materials for structures are as follows:
   TH-10 - - - no braces
   TH-10X- - - same as TH-10 with one X-Brace
   TH-10VO - - two outside X-Arm braces
   TH-10VOX- - same as TH-10VO with one X-Brace
   TH-10VI - - two inside X-Arm braces
   TH-10VIX- - same as TH-10VI with one X-Brace
   TH-10V4 - - four X-Arm braces
   TH-10V4X- - same as TH-10V4 with one X-Brace
   (For two X-Braces, structure designation to use "XX" suffices.)
2. Double X-Arms shall be shipped with factory assembled hardware.
3. Field drilled holes shall be thoroughly treated.
4. Dimension "A" shall be as shown on the pole framing drawing.
5. For other requirements, refer to REA specification T-7.
6. For strength limitations of OHGW support assembly, see TM-7B or TM-7C.
7. Drawing TE-2 gives guidance to subassembly alternatives.
8. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLIES, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

TANGENT H-FRAME

(161 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-10 SERIES

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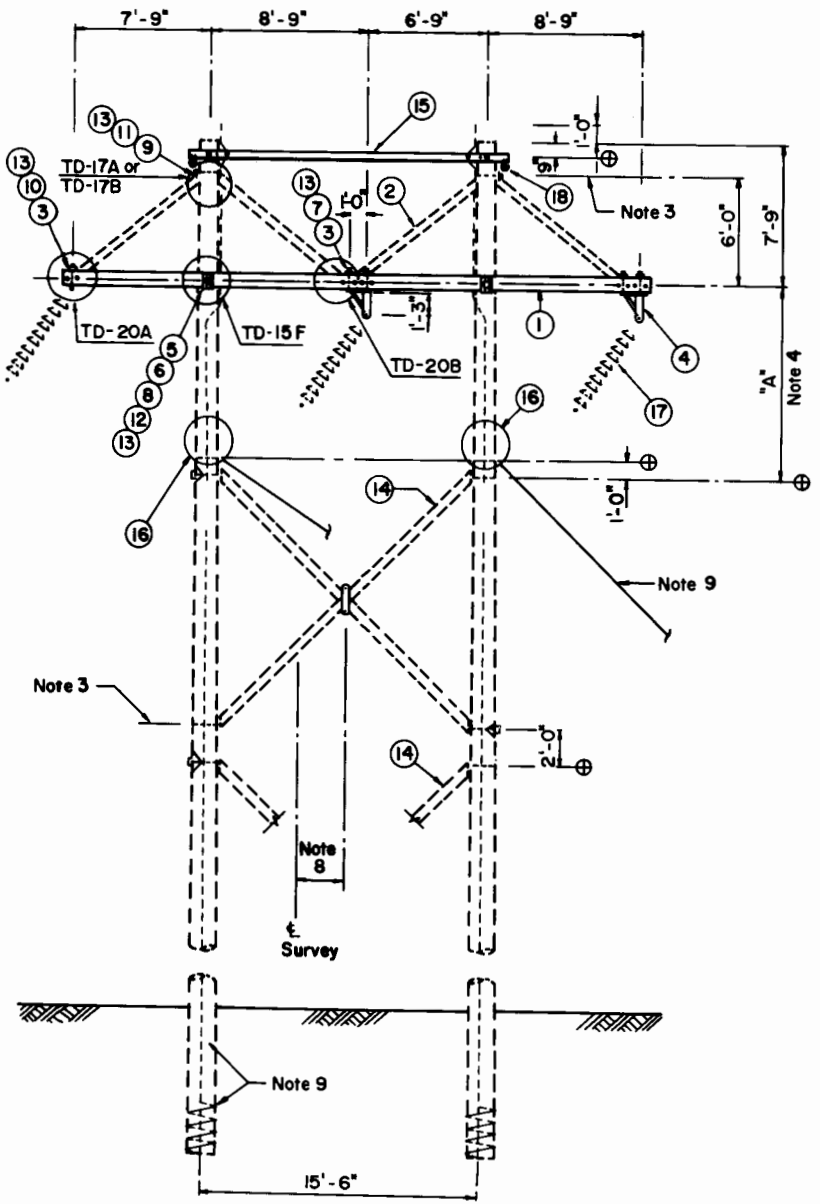

DRG. REF.	TH-11 VO	TH-11 V1	TH-11 V4	X-BRACE X	X-BRACE XX	DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	2	-	-	X-Arm, 3-5/8" x 9-3/8" x 33'-0", #72		TCD-32	
2	-	2	2	4	-	-	Brace, X-Arm, 3-3/8" x 5-3/8" x req'd l.			
3	5	5	5	5	-	-	Spacer Assembly, see construction spec.		TM-111	
4	2	2	2	2	-	-	Bracket, Swinging Angle, Assembly		TM-112B	
5	4	4	4	4	-	-	Grid Gain, 4-1/2" x 9", 15/16" hole			
6	4	4	4	4	-	-	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
7	-	-	1	1	-	-	7/8" D.E. Bolt, Bent w/2 recessed nuts	gw		
8	2	2	2	2	-	-	7/8" Threaded Rod, w/2 nuts			
9	-	2	2	2	-	-	7/8" Bolt, Machine, by req'd length			
10	-	2	-	2	-	-	7/8" Bolt, Bent			
11	-	2	2	-	-	-	Washer, Curved, 4" sq. x 1/4", 15/16" hole			
12	2	2	2	2	-	-	Washer, Spring, 15/16" hole			
13	4	8	8	10	-	-	7/8" Locknut, MF Type			
14	-	-	-	-	1	2	X-Brace Assembly	vx	TM-110B	
15	1	1	1	1	-	-	OHGW SUPPORT ASSEMBLY	-	TM-7____	
16	2	2	2	2	-	-	GUY ATTACHMENT, MEDIUM DUTY	-	TG-____C	
17	3	3	3	3	-	-	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
18	2	2	2	2	-	-	OHGW ASSEMBLY, TANGENT	-	TM-4____	

Notes:

1. Description and materials of structures are similar to TH-10 series.
2. Double X-Arms shall be shipped with factory assembled hardware.
3. Field drilled holes shall be thoroughly treated.
4. Dimension "A" shall be as shown on the pole framing drawing.
5. For other requirements, refer to REA specification T-7.
6. For strength limitations of OHGW support assemblies, see TM-7B or TM-7C.
7. Drawing TE-2 gives guidance to subassembly alternatives.
8. For guying arrangements and offset table, see drawing TMG-11.
9. 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.

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NO.	REVISION	DATE

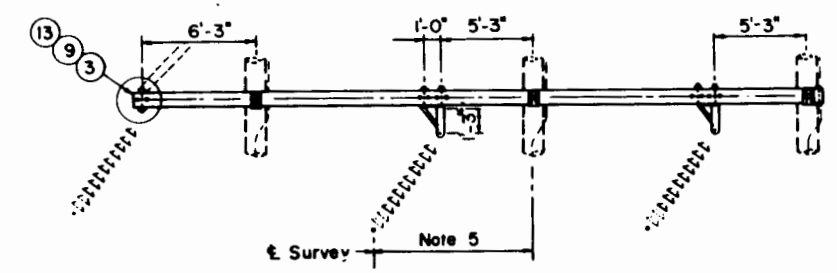
TRANSMISSION LINE STRUCTURE

SMALL ANGLE H-FRAME

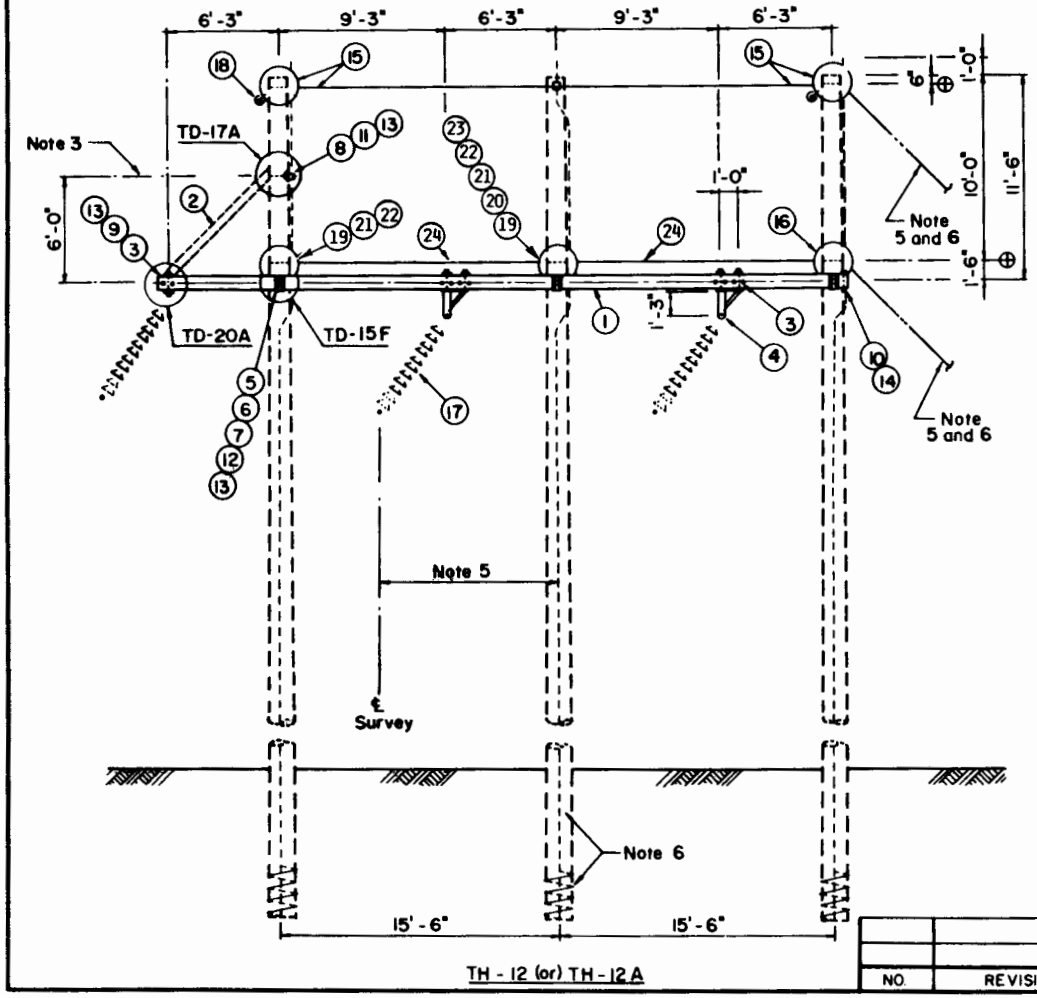
(161kV MAXIMUM)

SCALE:

TH-11 SERIES



TH - 12B (or) TH - 12C



TH - 12 (or) TH - 12A

DRG. REF.	TH-12 B and B	TH-12 A and C	DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	X-Arm, 3-5/8" x 9-3/8" x 38'-6", #74	g	TCD-32	
2	-	1	Brace, X-Arm, 3-3/8" x 5-3/8" x req'd l.			
3	5	5	Spacer Assembly, see construction spec.	-	TM-111	
4	2	2	Bracket, Swinging Angle, Assembly	-	TM-112B	
5	6	6	Grid Gain, 4-1/2" x 9", 15/16" hole	bl		
6	6	6	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
7	3	3	7/8" Threaded Rod, w/2 nuts			
8	-	1	7/8" Bolt, Machine, by req'd length	c		
9	-	1	7/8" Bolt, Bent			
10	2	2	1/2" Bolt, Washer Head, w/Washer Nut	o		
11	-	1	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
12	3	3	Washer, Spring, 15/16" hole	aw		
13	6	8	7/8" Locknut, MF Type	ek		
14	2	2	1/2" Locknut, MF Type	ek		
15	1	1	POLE TIE, LARGE ANGLE, MEDIUM DUTY	-	TG-___A	
16	1	1	GUY ATTACHMENT, MEDIUM DUTY	-	TG-___D	
17	3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-____	
18	2	2	OHGW ASSEMBLY, ANGLE	-	TM-4____	
19	2	2	3/4" Bolt, Double Arm'g Eye, by r.l.	dy		
20	1	1	3/4" Nut, Eye + nut	aa		
21	4	4	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
22	4	4	3/4" Locknut, MF Type	ek		
23	2	2	3/4" Clamp, Groundwire + 1 nut			
24	2	2	OVERHEAD GUY, MEDIUM DUTY		TG-___D	

LIST OF MATERIALS

Notes:

1. Description of structures is as follows:
   TH-12 - - - no brace and symmetrical brackets
   TH-12A- - - brace and symmetrical brackets
   TH-12B- - - no brace and unsymmetrical brackets
   TH-12C- - - brace and unsymmetrical brackets
2. Double X-Arms shall be shipped complete with factory assembled hardware.
3. Field drilled pole holes shall be thoroughly treated.
4. Drawing TE-2 gives guidance to subassembly alternatives.
5. For guying arrangements and offset table, see drawing TMG-12.
6. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

Reissued 03/98

NO.	REVISION	DATE

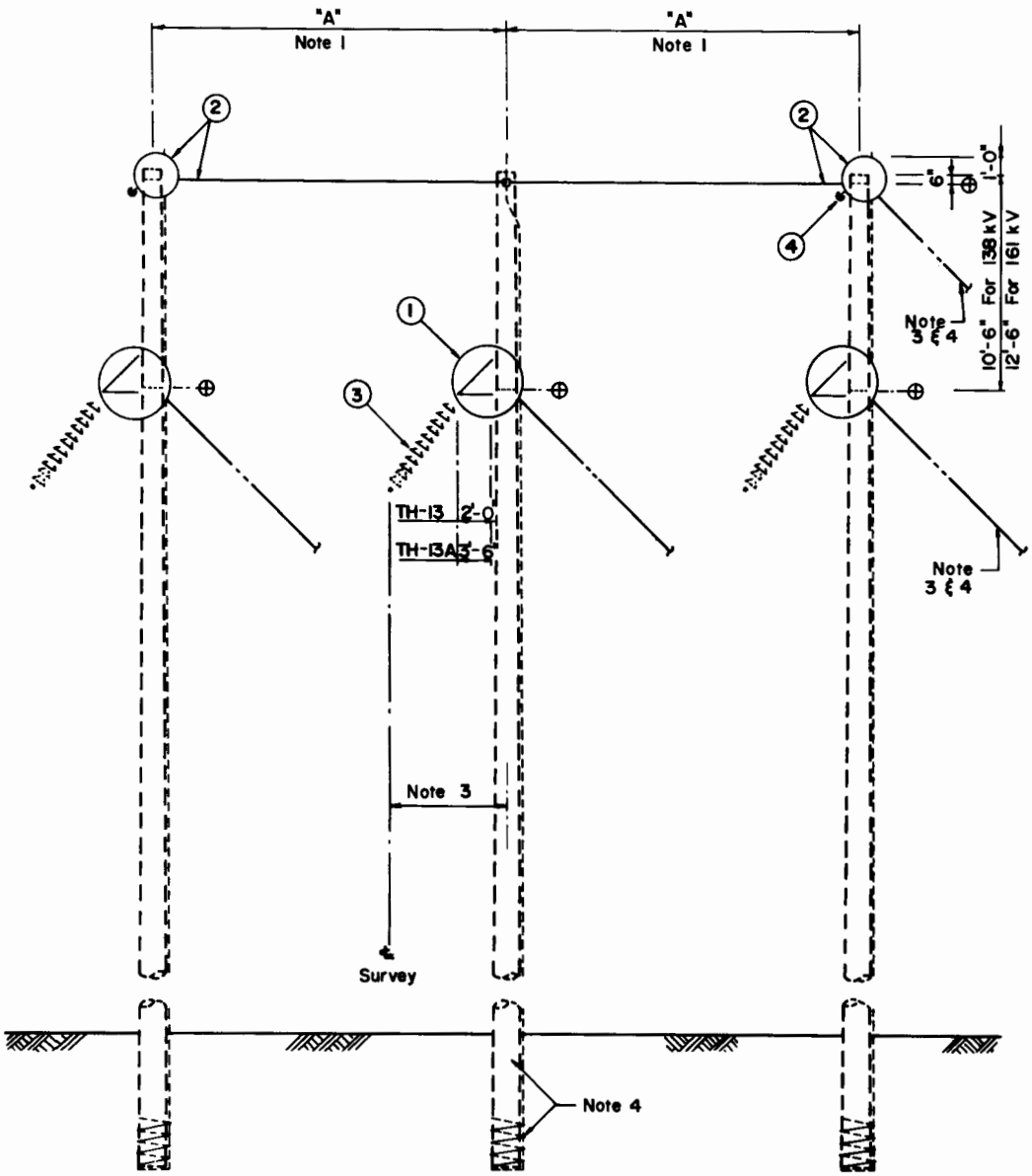
TRANSMISSION LINE STRUCTURE

INTERMEDIATE ANGLE

(161 kV MAXIMUM)

SCALE:

TH-12 SERIES



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	BRACKET & GUY ATTACHMENT, MEDIUM DUTY	-	TG-29___	
2	1	POLE TIE, LARGE ANGLE, MEDIUM DUTY	-	TG-___A	
3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-___C	
4	2	OHGW ASSEMBLY, ANGLE	-	TM-4___	

Notes:

1. For 1V:1H guy slopes, the minimum pole spacings, dimension "A", are:

Structure	138 kV	161 kV
TH-13	18'-6"	20'-0"
TH-13A	21'-0"	22'-6"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements and offset table, see drawing TMG-13. Pole spacing shall conform to minimum dimensions unless otherwise indicated.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

MEDIUM ANGLE

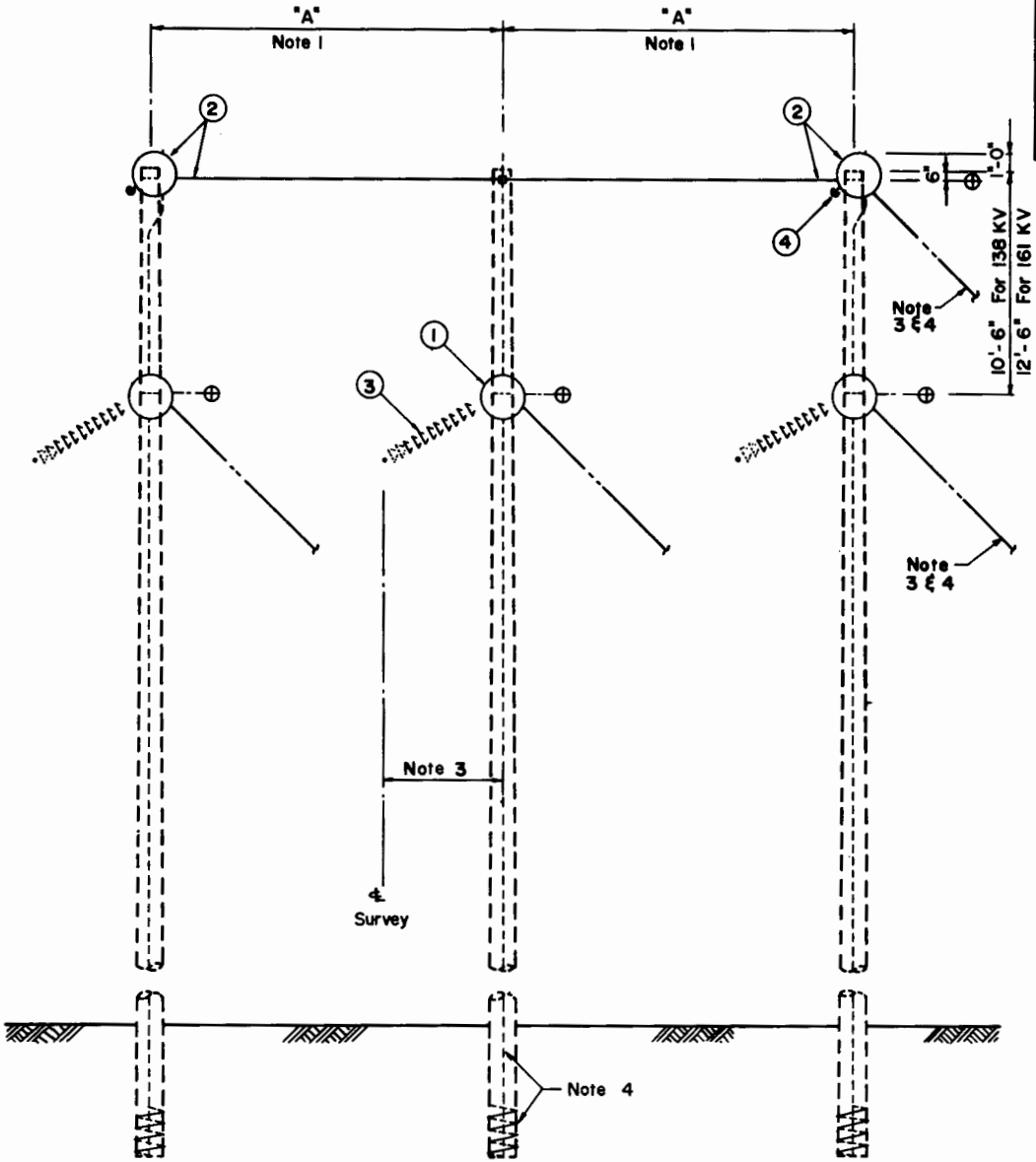
(161 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TH-13,13A



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	GUY ATTACHMENT, MEDIUM DUTY	-	TG-____D	
2	1	POLE TIE, LARGE ANGLE, MEDIUM DUTY	-	TG-____A	
3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-____C	
4	2	OHGW ASSEMBLY, ANGLE	-	TM-4____	

Notes:

1. For 1V:1H guy slopes, the minimum pole spacings, dimension "A" are:

Structure	138 kV	161 kV
TH-14	17'-6"	20'-0"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements and offset table, see drawing TMG-13. Pole spacing shall conform to minimum dimensions unless otherwise indicated.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE

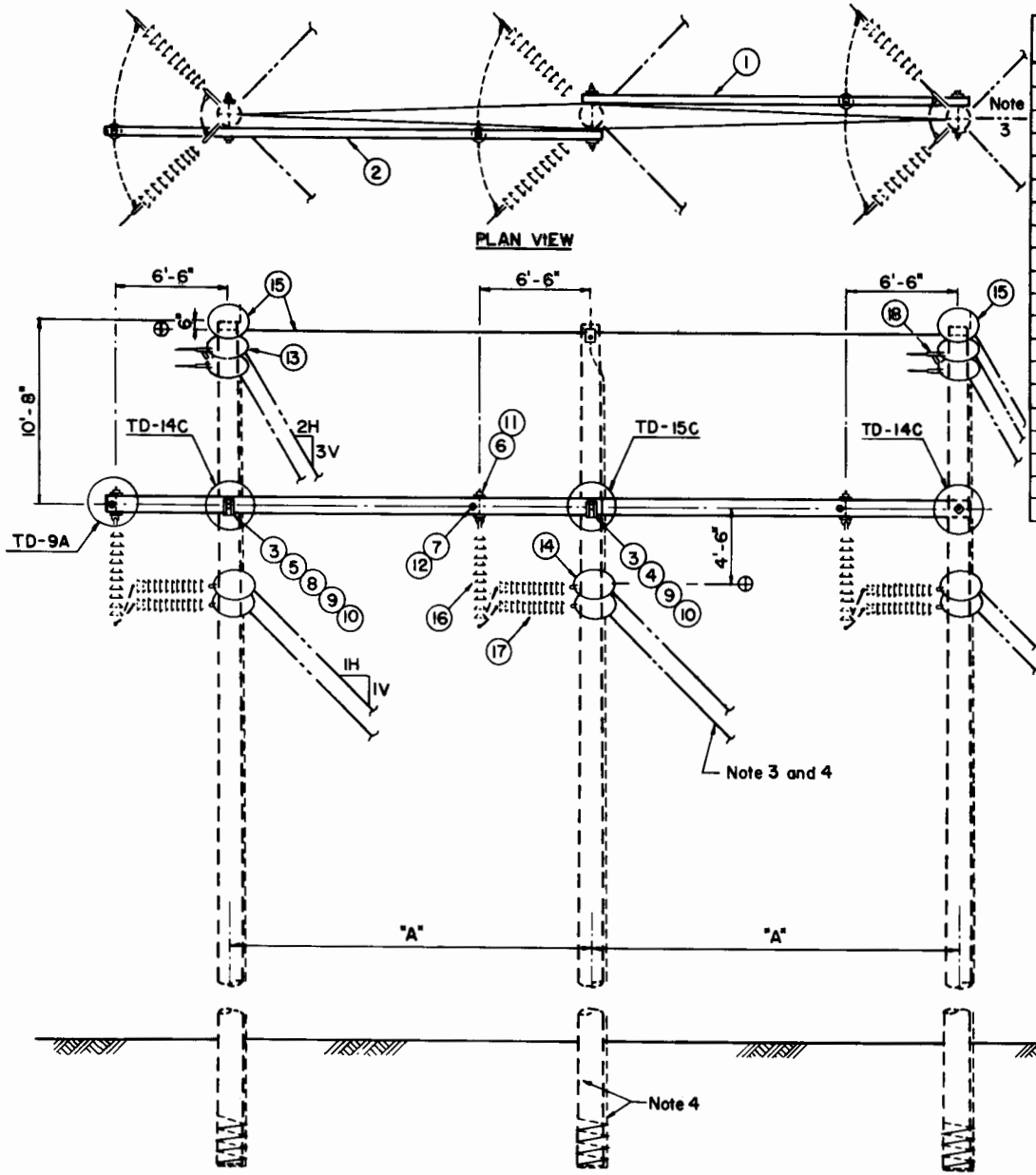
(161 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TH-14



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 3-5/8" x 9-3/8" x req'd l., #90	g	TCD-92	
2	1	X-Arm, 3-5/8" x 9-3/8" x req'd l., #91	g	TCD-92	
3	4	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
4	1	7/8" Threaded Rod, w/2 nuts			
5	2	7/8" Bolt, Machine, by req'd length	c		
6	3	3/4" Bolt, Shoulder Eye, w/Washer Nut	o		
7	3	1/2" Bolt, Washer Head, w/Washer Nut	c		
8	2	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
9	3	Washer, Spring, 15/16" hole	aw		
10	3	7/8" Locknut, MF Type	ek		
11	3	3/4" Locknut, MF Type	ek		
12	4	1/2" Locknut, MF Type	ek		
13	4	GUY ATTACHMENT, MEDIUM DUTY	-	TG-____D	
14	6	GUY ATTACHMENT,_____DUTY	-	TG-____D	
15	1	POLE TIE, GUYING, MEDIUM DUTY	-	TG-____B	
16	3	INSULATOR ASSEMBLY, TANGENT	-	TM-_____	
17	6	INSULATOR ASSEMBLY, DEADEND	-	TM-_____	
18	4	OHGW ASSEMBLY, DEADEND	-	TM-4____	

NOTES:

1. For an OHGW guy slope of 3V to 2H, the following minimum pole spacings are recommended:

LINE ANGLE	DIMENSION "A"
to 50° Max.	17'-0"
50 to 60° Max.	18'-0"
60 to 70° Max.	19'-6"
70 to 80° Max.	21'-6"
80 to 90° Max.	23'-6"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements, see drawing TMG-15. Bisector guy is recommended for line angles less than 60 degrees.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE DOUBLE DEADEND

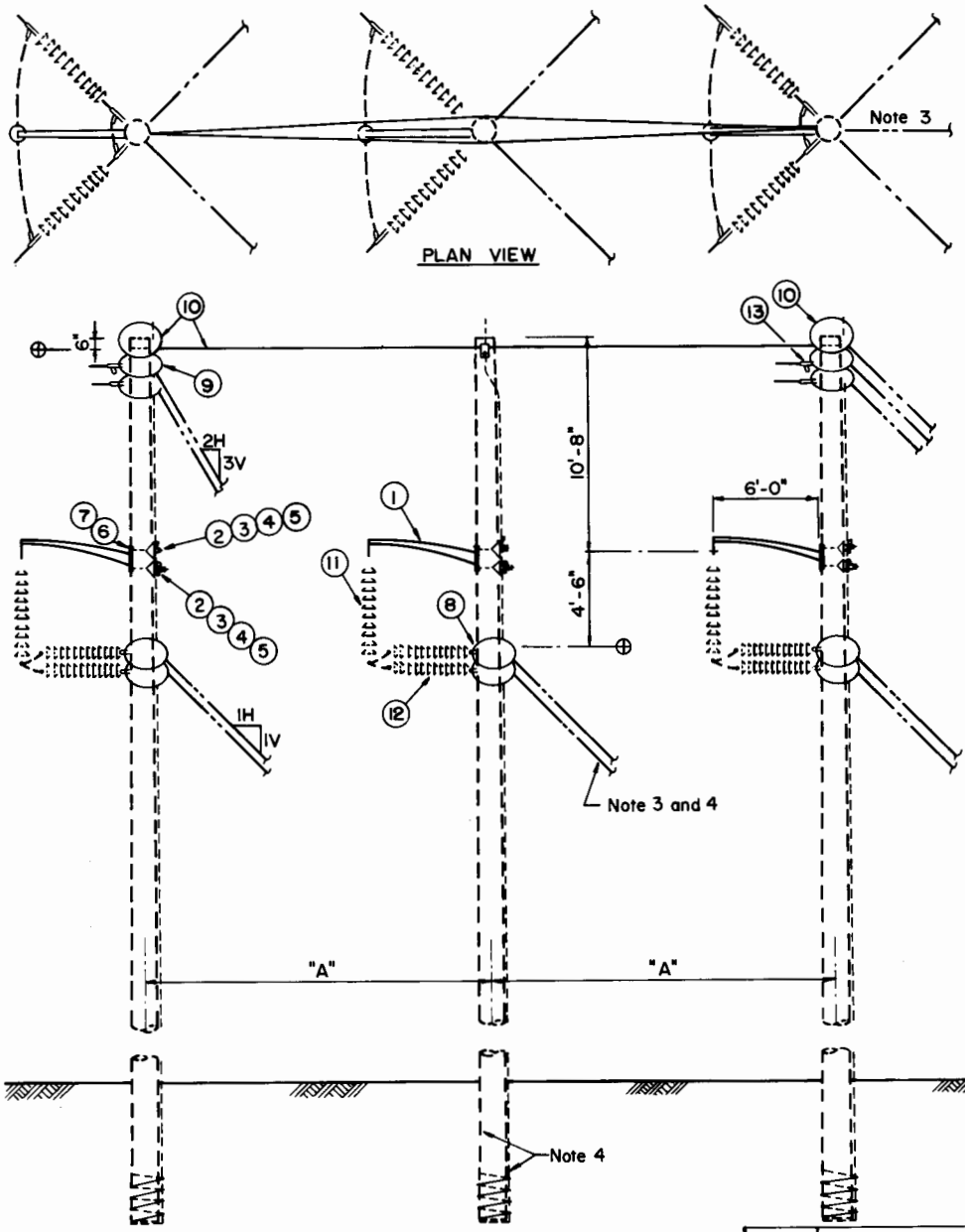
(161 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-15

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	Davit Arm, steel, medium duty	gk		
2	6	1" Bolt, Machine, by req'd length	c		
3	6	Washer, Curved, 4"Sq.x1/4", 1-1/16"hole	d		
4	6	Washer, Spring, 1-1/16" hole	aw	TM-115	
5	6	1" Locknut, MF Type	ek		
6	3	5/8" Bolt, Carriage			
7	3	5/8" Clamp, Groundwire	dp		
8	6	GUY ATTACHMENT, _____ DUTY	-	TG-___D	
9	4	GUY ATTACHMENT, MEDIUM DUTY	-	TG-___D	
10	1	POLE TIE, GUYING, MEDIUM DUTY	-	TG-___B	
11	3	INSULATOR ASSEMBLY, ANGLE	-	TM-___C	
12	6	INSULATOR ASSEMBLY, DEADEND	-	TM-___	
13	4	OHGW ASSEMBLY, DEADEND	-	TM-4__	

NOTES:

1. For an OHGW guy slope of 3V to 2H, the following minimum pole spacings are recommended:

LINE ANGLE	DIMENSION "A"
to 5° Max.	17'-0"
5° to 6° Max.	18'-0"
6° to 7° Max.	19'-6"
7° to 8° Max.	21'-6"
8° to 9° Max.	23'-6"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements, see drawing TMG-15. Bisector guy is recommended for line angles less than 60 degrees.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE DOUBLE DEADEND - DAVIT ARM

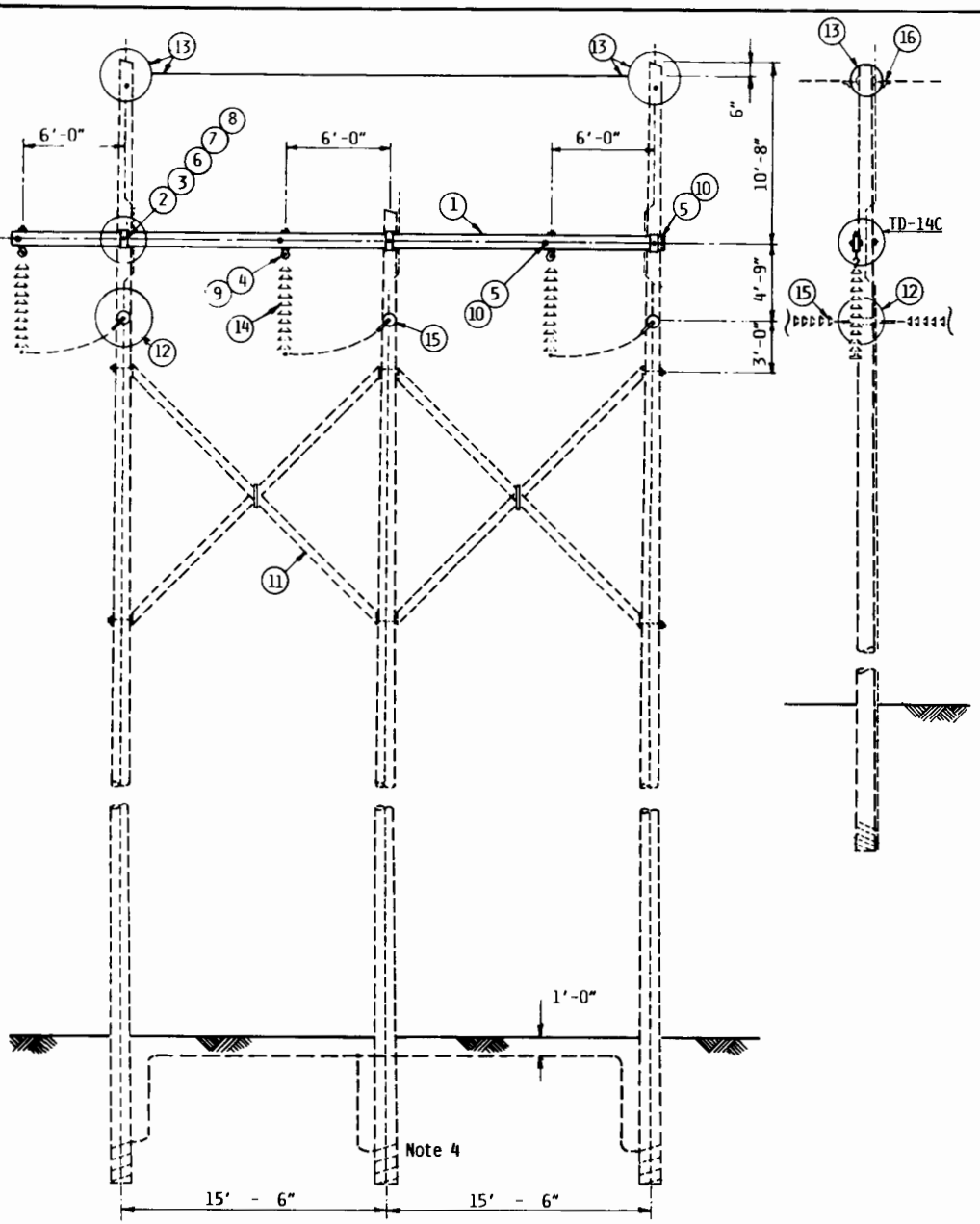
(161kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE

TH-15A



TH-15B		LIST OF MATERIALS			
DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 3 5/8" X 9 3/8" X 38'-6", #73		TCD-32	
2	3	Plate, Ribbed Tie, 3" X 9 1/2" X 1/4"			
3	3	7/8" Bolt, Machine, by req'd length	c		
4	3	3/4" Bolt, Shoulder Eye, w/Washer Nut	o		
5	4	1/2" Bolt, Washer Head, w/Washer Nut	o		
6	3	Washer, Curved, 4"sq.X1/4",15/16"hole	d		
7	3	Washer, Spring, 15/16" hole	aw		
8	3	7/8" Locknut, MF Type	ek		
9	3	3/4" Locknut, MF Type	ek		
10	4	1/2" Locknut, MF Type	ek		
11	-	X-Brace Assembly, See Note 1	vx		
12	3	GUY ATTACHMENT, DUTY	-	TG E	
13	1	POLE TIE, DEADEND, MEDIUM DUTY	-	TG F	
14	3	INSULATOR ASSEMBLY, TANGENT	-	TM	
15	6	INSULATOR ASSEMBLY, DEADEND Note 5		TM-	
16	4	OHGW ASSEMBLY, DEADEND		TM-4	
17					
18					

NOTES:

1. The number of X-brace assemblies for structures other than the TH-15B are as follows:

   TH-15BX ...one X-brace
   TH-15BXX ..two X-braces

   TH-15BX4 ..four X-braces

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. Field drilled pole holes shall be thoroughly treated.
4. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLIES, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.
5. When necessary, Engineer shall increase the length of the Extension Link of the INSULATOR DEADEND ASSEMBLY in order to maintain clearance to the guy.

Reissued 03/98

NO.	REVISION	DATE

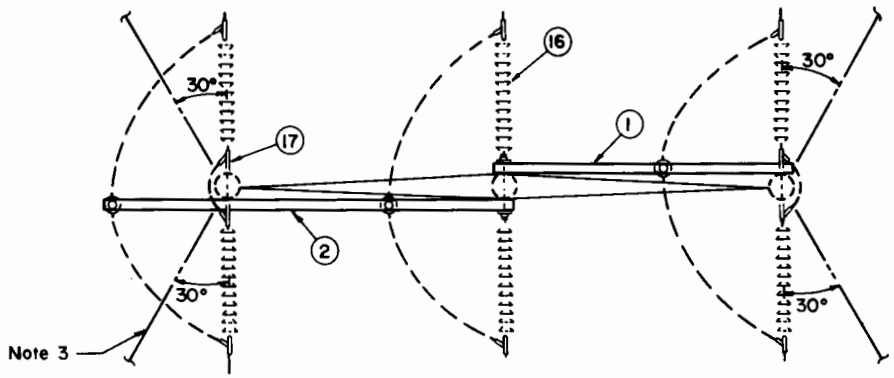
TRANSMISSION LINE STRUCTURE

TANGENT DOUBLE DEADEND

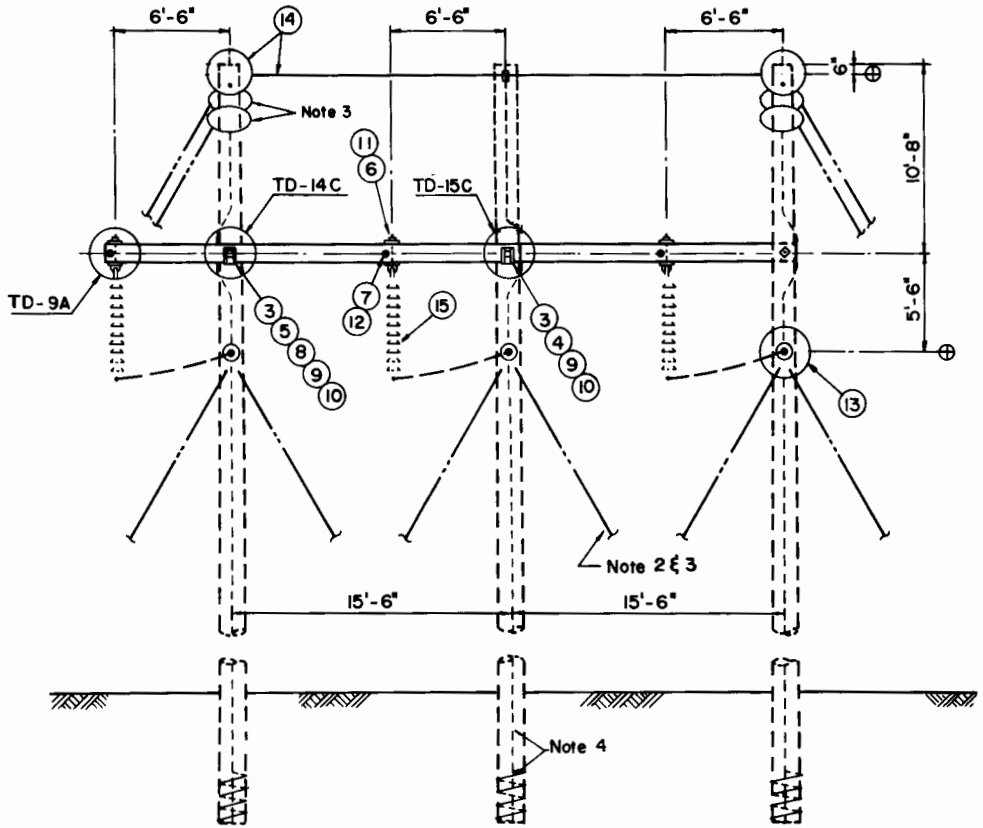
(kV MAXIMUM)

SCALE:

TH-15B SERIES



PLAN VIEW



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 3-5/8" x 9-3/8" x 16'-6", #90		TCD-92	
2	1	X-Arm, 3-5/8" x 9-3/8" x 23'-0", #91		TCD-92	
3	4	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
4	1	7/8" Threaded Rod, w/2 nuts			
5	2	7/8" Bolt, Machine, by req'd length	c		
6	3	3/4" Bolt, Shoulder Eye, w/Washer Nut	o		
7	3	1/2" Bolt, Washer Head, w/Washer Nut	o		
8	2	Washer, Curved, 4"sq.x1/4",15/16"hole	d		
9	3	Washer, Spring, 15/16" hole	aw		
10	4	7/8" Locknut, MF Type	ek		
11	3	3/4" Locknut, MF Type	ek		
12	3	1/2" Locknut, MF Type	ek		
13	3	GUY ATTACHMENT, _____ DUTY	-	TG-__E	
14	1	POLE TIE, DEADEND, MEDIUM DUTY	-	TG-__C	
15	3	INSULATOR ASSEMBLY, TANGENT	-	TM-___	
16	6	INSULATOR ASSEMBLY, DEADEND Note 5	-	TM-___	
17	4	OHGW ASSEMBLY, DEADEND	-	TM-4___	
18					

NOTES:

1. Drawing TE-2 gives guidance to subassembly alternatives.
2. For guying arrangements, see drawing TMG-15D.
3. Angled guying attachments below the OHGW deadend may be needed. If necessary, the engineer should modify the material list by adding these guy attachments.
4. 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.
5. When necessary, Engineer shall increase the length of the Extension Link of the INSULATOR DEADEND ASSEMBLY in order to maintain clearance to the guy.

TRANSMISSION LINE STRUCTURE

TANGENT DOUBLE DEADEND

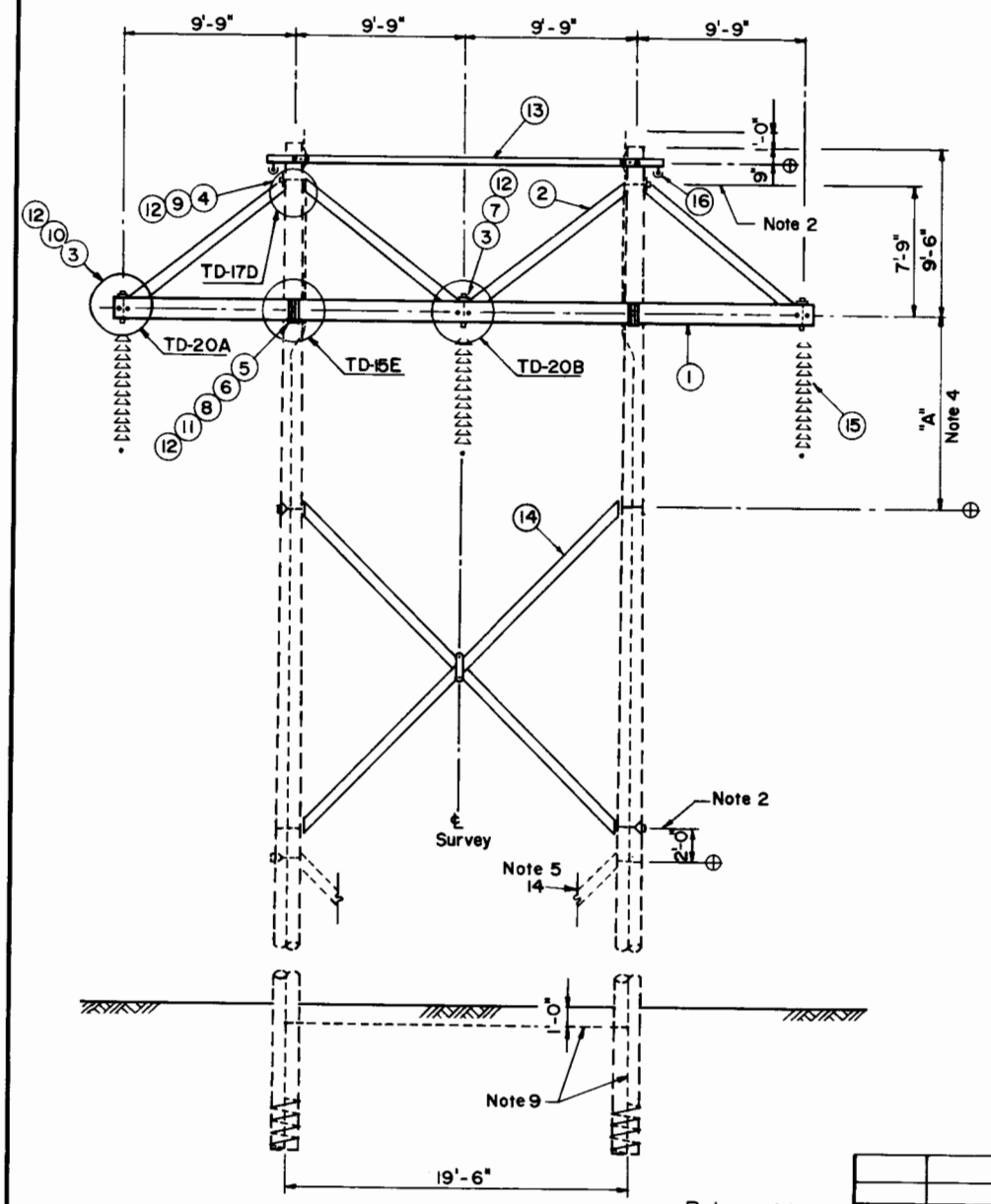
(161 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE

TH-15 D



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 40'-0" (see Note 3), #81		TCD-40	
2	4	Brace, X-Arm, 3-3/8" x 5-3/8" x req'd l.			
3	3	Spacer Assembly, see construction spec.		TM-111	
4	2	Grid Gain, 4" x 4", 15/16" hole			
5	4	Plate, Gain			
6	4	Plate, Ribbed Tie			
7	1	7/8" D.E Bolt, Bent w/2 recessed nuts	gy		
8	2	7/8" Threaded Rod, w/2 nuts			
9	2	7/8" Bolt, Machine, by req'd length			
10	2	7/8" Bolt, Bent			
11	2	Washer, Spring, 15/16" hole			
12	10	7/8" Locknut, MF Type			
13	1	OHGW Support Assembly	-	TM-7D	
14	1	X-Brace Assembly	vx	TM-110C	
15	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
16	2	OHGW ASSEMBLY, TANGENT		TM-4____	

Notes:

1. Double X-Arms shall be shipped with factory assembled hardware.
2. Field drilled holes shall be thoroughly treated.
3. Engineer to specify X-Arm size by type number. X-Arm may be 3-5/8" x 9-3/8 solid sawn (X-Arm #81) or 5-1/8" x 7-1/2" laminate (X-Arm #83).
4. Dimension "A" shall be as shown on the pole framing drawing.
5. Structure TH-230X is the same as TH-230 with one additional X-Brace.
6. For other assembly requirements, see REA specification T-8.
7. For strength limitations of OHGW support assembly, see drawing TM-7D.
8. Drawing TE-2 gives guidance to subassembly alternatives.
9. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLIES, AND ANY POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

TANGENT H FRAME

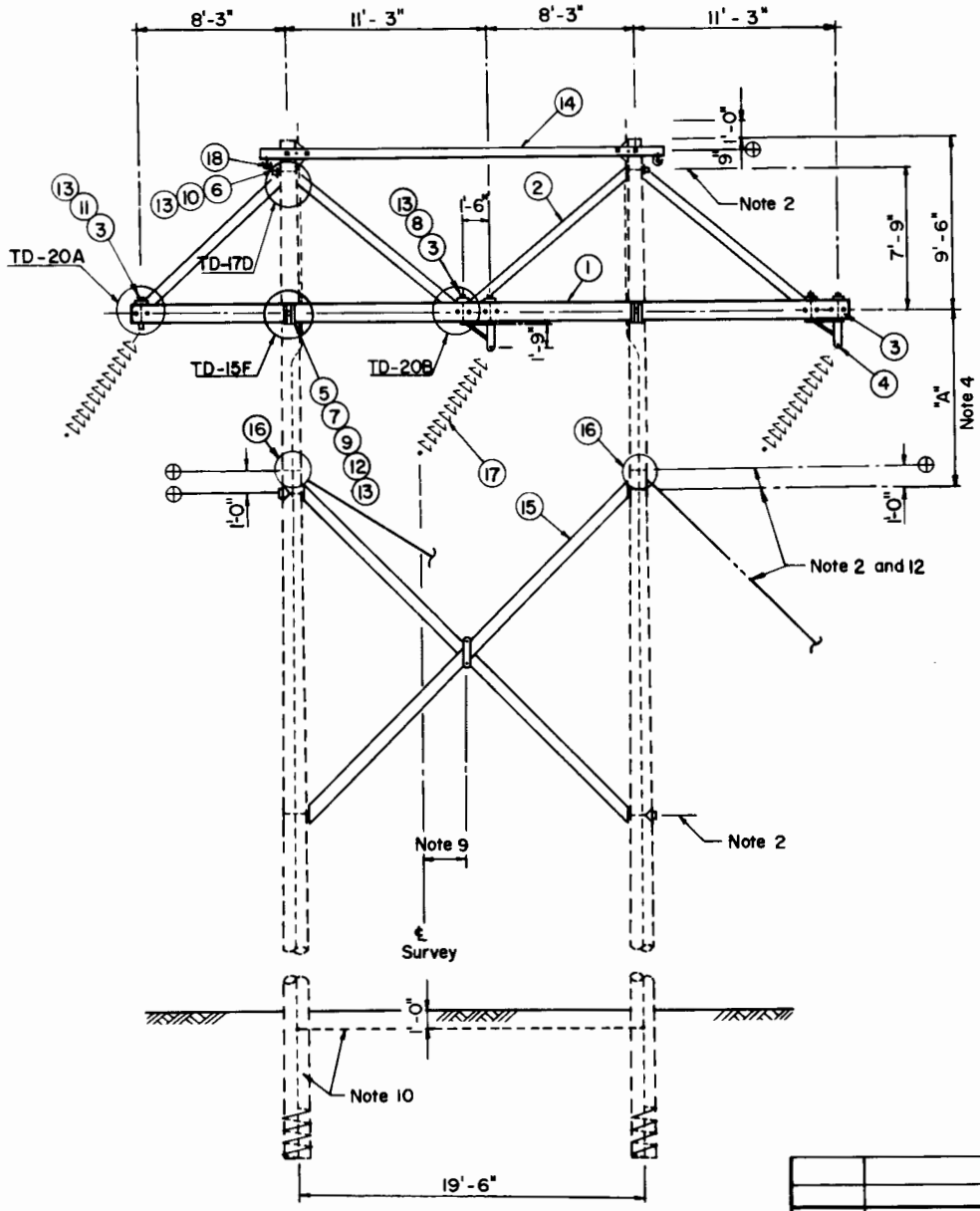
(230 kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-230

Reissued 03/98



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 40'-0" (see Note 3), #82		TCD-40	
2	4	Brace, X-Arm, 3-3/8" x 5-3/8" x req'd l.			
3	5	Spacer Assembly, see construction spec.		TM-111	
4	2	Bracket, Swinging Angle, Assembly		TM-112C	
5	4	Grid Gain, 4-1/2" x 9", 15/16" hole			
6	2	Grid Gain, 4" x 4", 15/16" hole			
7	4	Plate, Ribbed Tie	GW		
8	1	7/8" D.E Bolt, Bent w/2 recessed nuts			
9	2	7/8" Threaded Rod, w/2 nuts			
10	2	7/8" Bolt, Machine, by req'd length			
11	2	7/8" Bolt, Bent			
12	2	Washer, Spring, 15/16" hole			
13	10	7/8" Locknut, MF Type			
14	1	OHGW Support Assembly	-	TM-7D	
15	1	X-Brace Assembly	VX	TM-110C	
16	2	GUY ATTACHMENT, MEDIUM DUTY	-	TG-____C	
17	3	INSULATOR ASSEMBLY, TANGENT	-	TM-_____	
18	2	OHGW ASSEMBLY, TANGENT		TM-4____	

Notes:

1. Double X-Arms shall be shipped complete with factory assembled hardware.
2. Field drilled hole shall be thoroughly treated.
3. Engineer to specify X-Arm size by type number. X-Arm may be 3-5/8" x 9-3/8" solid sawn (X-Arm #82) or 5-1/8" x 7-1/2" laminate (X-Arm #84).
4. Dimension "A" shall be as shown on the pole framing drawing.
5. For other assembly requirements, see REA specification T-8.
6. For strength limitations of OHGW support assembly, see drawing TM-7D.
7. Drawing TE-2 gives guidance to subassembly alternatives.
8. When guying is not required, delete drawing reference 16.
9. For guying arrangements and offset table, see drawing TMG-11.
10. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, AND ANY POLE FOUNDATION UNITS.

Reissued 03/98

NO.	REVISION	DATE

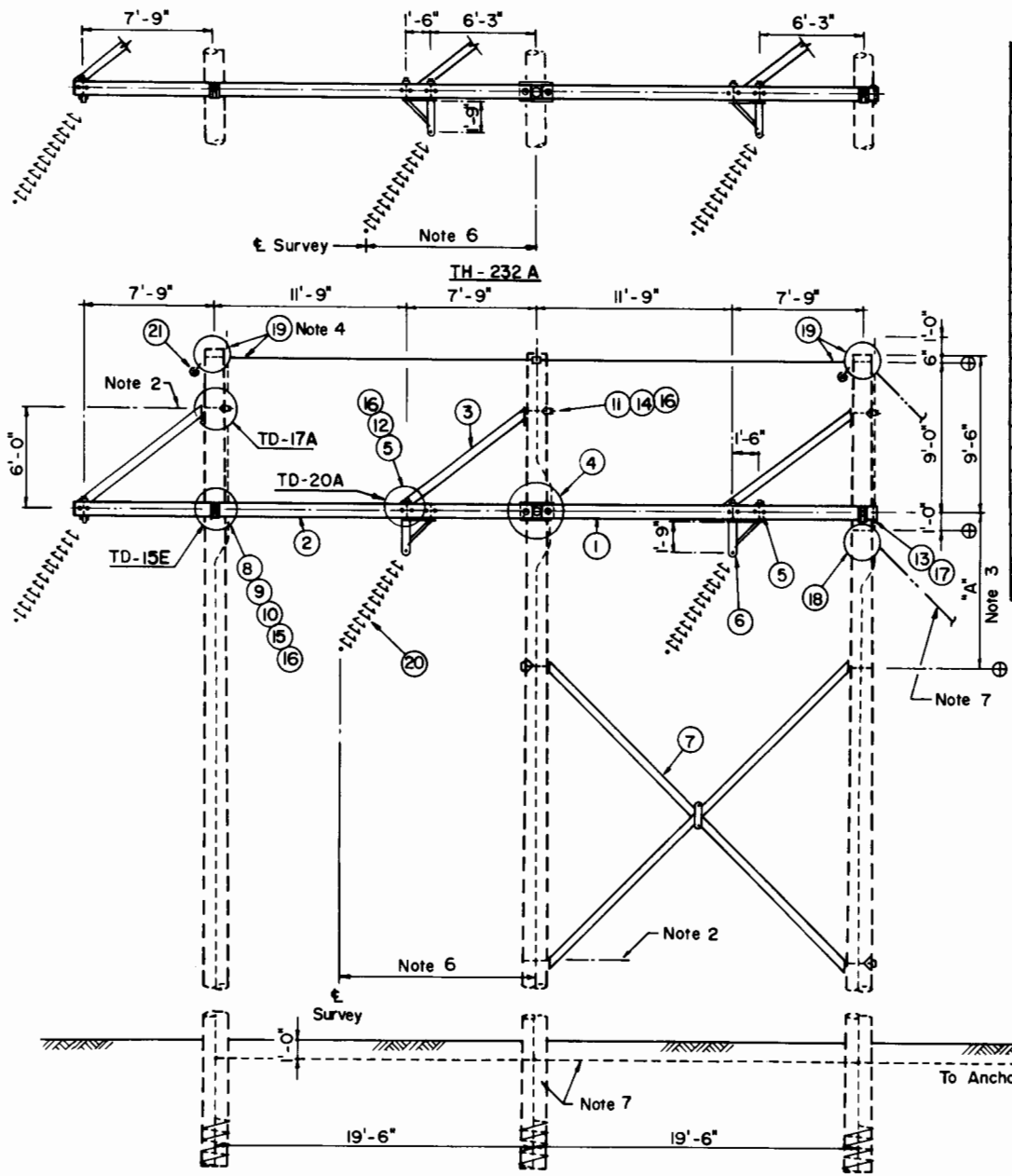
TRANSMISSION LINE STRUCTURE

SMALL ANGLE H-FRAME

(230kV MAXIMUM)

SCALE:

TH-231



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	2	X-Arm, 3-5/8" x 9-3/8" x 20'-0", #37		TCD-20	
2	2	X-Arm, 3-5/8" x 9-3/8" x 28'-0", #62		TCD-27	
3	3	Brace, X-Arm, 3-3/8" x 5-3/8" x req'd l.			
4	1	Channel Splice Assembly	-	TM-114B	
5	5	Spacer Assembly, see construction spec.	-	TM-111	
6	2	Bracket, Swinging Angle, Assembly	-	TM-112C	
7	1	X-Brace Assembly	vx	TM-110C	
8	6	Grid Gain, 4-1/2" x 9", 15/16" hole	bi		
9	4	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
10	3	7/8" Threaded Rod, by Req'd length			
11	3	7/8" Bolt, Machine, by req'd length	c		
12	3	7/8" Bolt, Bent			
13	2	1/2" Bolt, Washer Head, w/Washer Nut	c		
14	3	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
15	3	Washer, Spring, 15/16" hole	aw		
16	12	7/8" Locknut, MF Type	ek		
17	2	1/2" Locknut, MF Type	ek		
18	1	GUY ATTACHMENT, MEDIUM DUTY	-	TG-___C	
19	1	POLE TIE, LARGE ANGLE, MEDIUM DUTY	-	TG-___A	
20	3	INSULATOR ASSEMBLY, TANGENT	-	TM-___	
21	2	OHGW ASSEMBLY, TANGENT	-	TM-4___	

NOTES:

1. Double X-Arms shall be shipped complete with factory assembled hardware.
2. Field drilled holes shall be thoroughly treated.
3. Dimension "A" shall be as specified on the pole framing drawing.
4. The OHGW's are shown for optimum lightning protection and guying. In areas having galloping conductor problems, the OHGW may be moved to the middle pole. This drawing must be modified accordingly.
5. Maximum strength of X-Arm brace and X-Brace is ±20,000 lbs.
6. For guying arrangements and offset table, see drawing TMG-12.
7. The following materials are to be specified on plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY POLE FOUNDATION UNITS.

Reissued 03/98

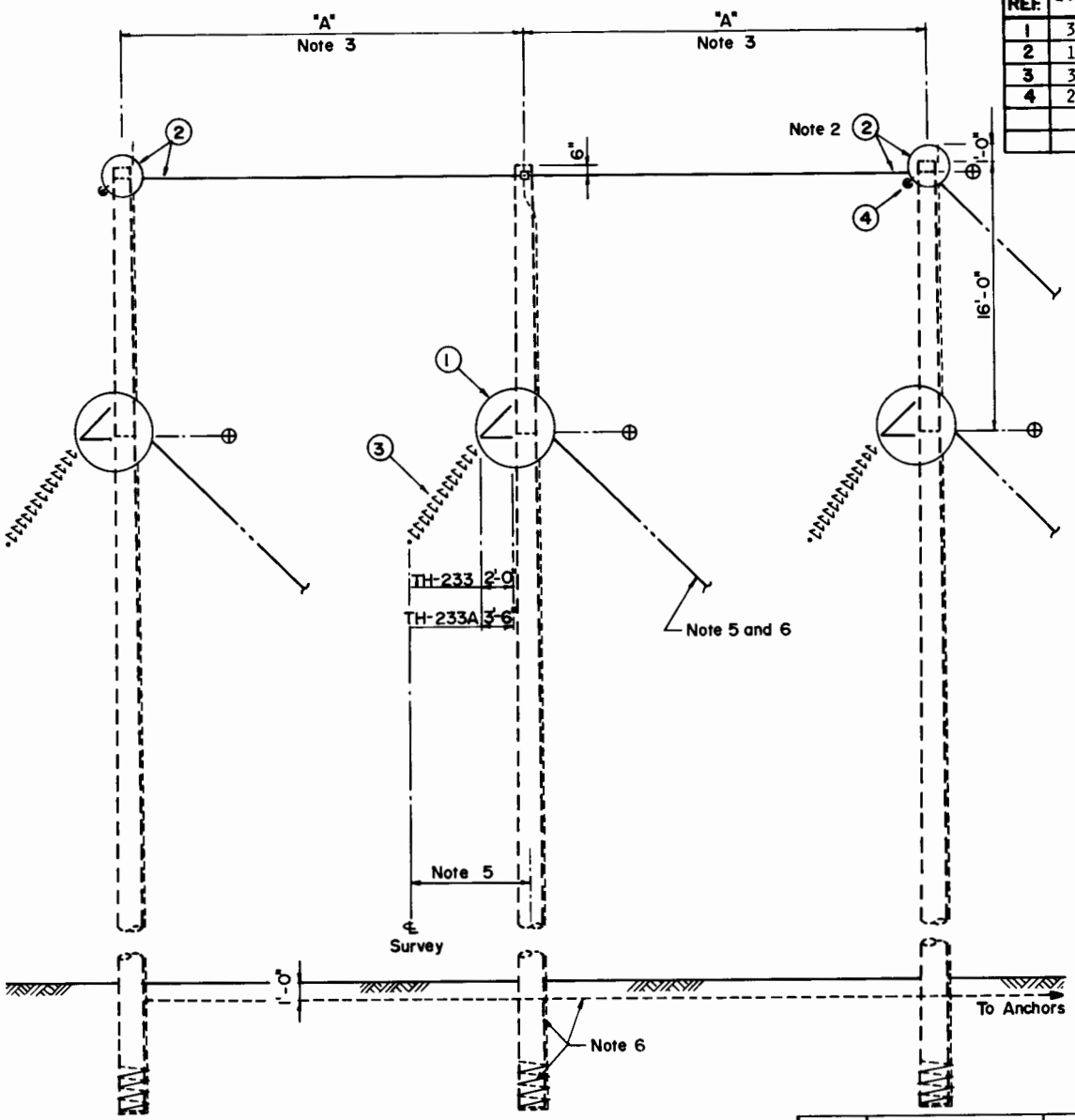
TRANSMISSION LINE STRUCTURE

INTERMEDIATE ANGLE
(230kV MAXIMUM)

NO.	REVISION	DATE

SCALE:

TH-232, 232A



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	BRACKET & GUY ATTACHMENT, MEDIUM DUTY	-	TG-29___	
2	1	POLE TIE, LARGE ANGLE, MEDIUM DUTY	-	TG-___A	
3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-___C	
4	2	OHGW ASSEMBLY, ANGLE	-	TM-4___	

Notes:

1. Field drilled holes shall be thoroughly treated.
2. The location of the OHGW's are shown for optimum lightning protection and guying. In areas having galloping conductor problems, the OHGW may be moved to the middle pole. This drawing must be modified accordingly.
3. For 1V:1H guy slopes, minimum pole-to-pole spacings are:

Structure	Dimension "A" (Min)
TH-233	26'-0"
TH-233A	27'-6"

4. Drawing TE-2 gives guidance to subassembly alternatives.
5. For guying arrangements and offset table, see drawing TMG-13. Pole spacing shall conform to minimum dimensions unless otherwise indicated.
6. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

MEDIUM ANGLE

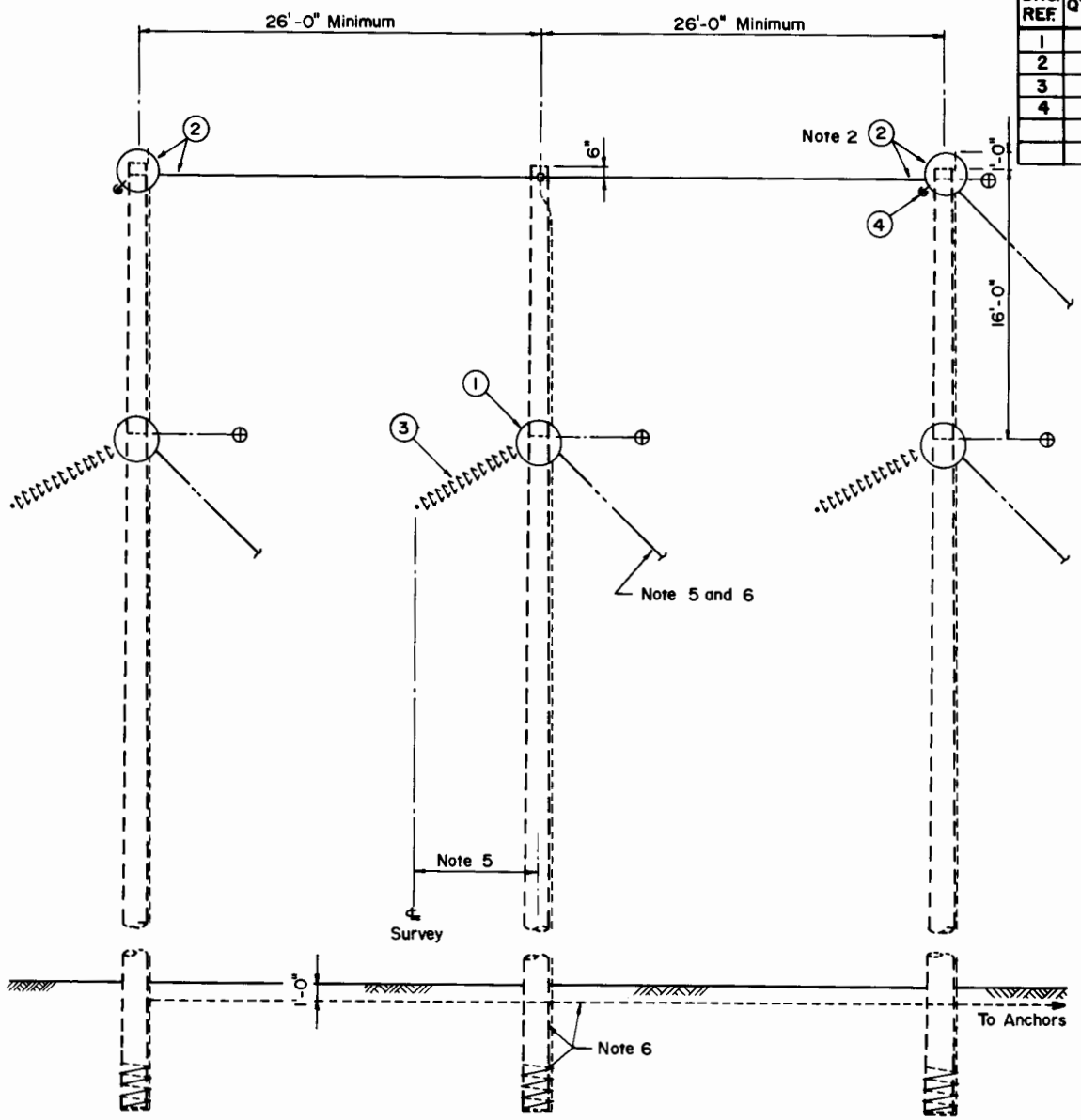
(230 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TH-233, 233A



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	GUY ATTACHMENT, MEDIUM DUTY	-	TG-____D	
2	1	POLE TIE, LARGE ANGLE, MEDIUM DUTY	-	TG-____A	
3	3	INSULATOR ASSEMBLY, ANGLE	-	TM-____C	
4	2	OHGW ASSEMBLY, ANGLE	-	TM-4____	

1. Field drilled holes shall be thoroughly treated.
2. The location of the OHGW's are shown for optimum lightning protection and guying. In areas having galloping conductor problems, the OHGW may be moved to the middle pole. This drawing must be modified accordingly.
3. The minimum pole-to-pole spacing is for guy slopes of 1V:1H.
4. Drawing TE-2 gives guidance to subassembly alternatives.
5. For guying arrangements and offset table, see drawing TMG-14.
6. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE

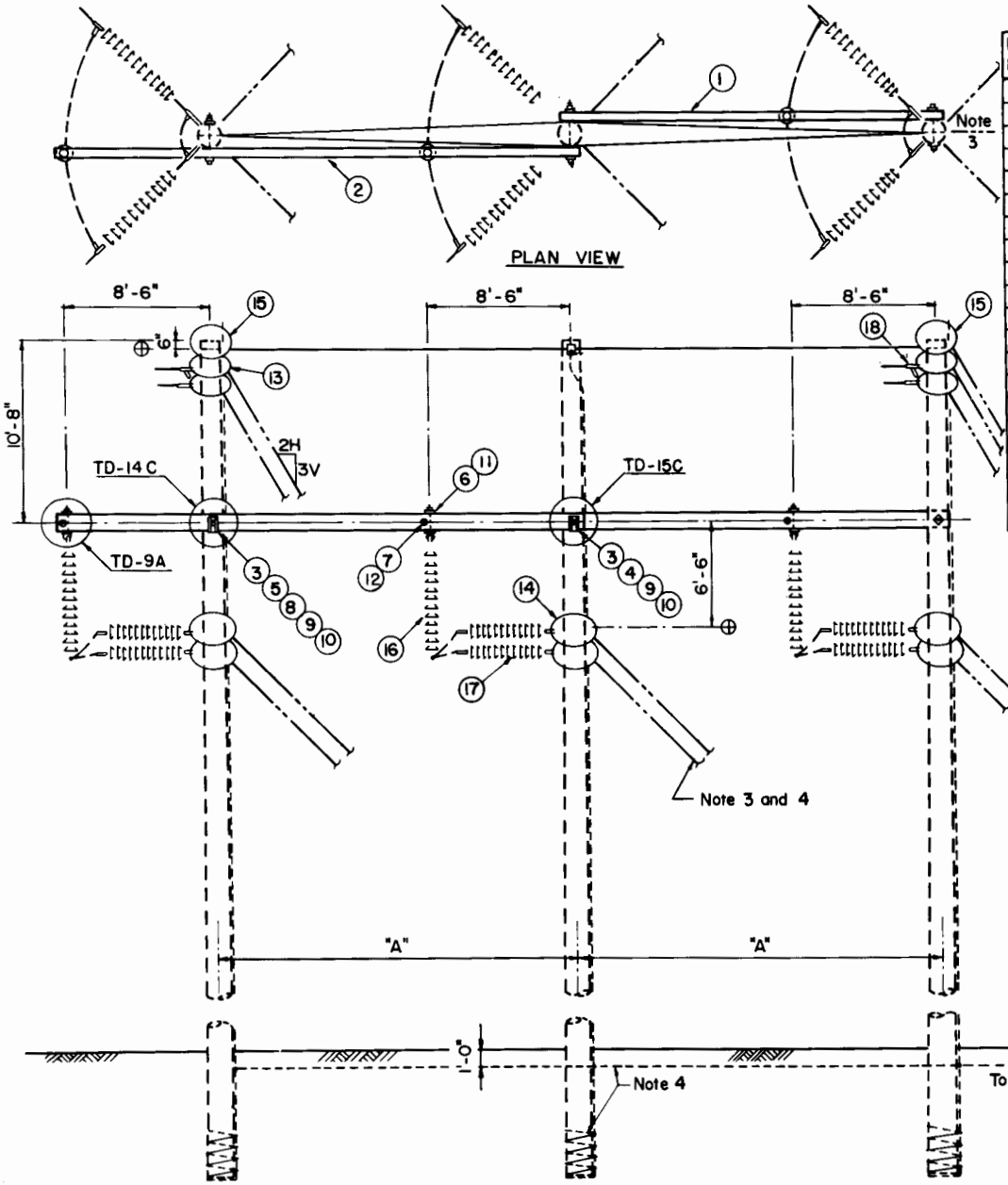
(230 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TH-234



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 3-5/8" x 9-3/8" x req'd l., #92		TCD-92	
2	1	X-Arm, 3-5/8" x 9-3/8" x req'd l., #94		TCD-92	
3	4	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
4	1	7/8" Threaded Rod, w/2 nuts			
5	2	7/8" Bolt, Machine, by req'd length	c		
6	3	3/4" Bolt, Shoulder Eye, w/Washer Nut	o		
7	3	1/2" Bolt, Washer Head, w/Washer Nut	o		
8	2	Washer, Curved,4" sq. x 1/4", 15/16" hole	d		
9	3	Washer, Spring, 15/16" hole	aw		
10	4	7/8" Locknut, MF Type	ek		
11	3	3/4" Locknut, MF Type	ek		
12	3	1/2" Locknut, MF Type	ek		
13	4	GUY ATTACHMENT, MEDIUM DUTY	-	TG-____D	
14	6	GUY ATTACHMENT,_____DUTY	-	TG-____D	
15	1	POLE TIE, GUYING, MEDIUM DUTY	-	TG-____B	
16	3	INSULATOR ASSEMBLY, TANGENT	-	TM-_____	
17	6	INSULATOR ASSEMBLY, DEADEND	-	TM-_____	
18	4	OHGW ASSEMBLY, DEADEND	-	TM-4____	

NOTES:

1. For an OHGW guy slope of 3V to 2H, the following minimum pole spacings are recommended:

LINE ANGLE	DIMENSION "A"
to 50° Max.	21'-6"
50 to 60° Max.	22'-6"
60 to 70° Max.	24'-6"
70 to 80° Max.	27'-0"
80 to 90° Max.	30'-0"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements, see drawing TMG-15. Bisector guy is recommended for line angles less than 60 degrees.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE DOUBLE DEADEND

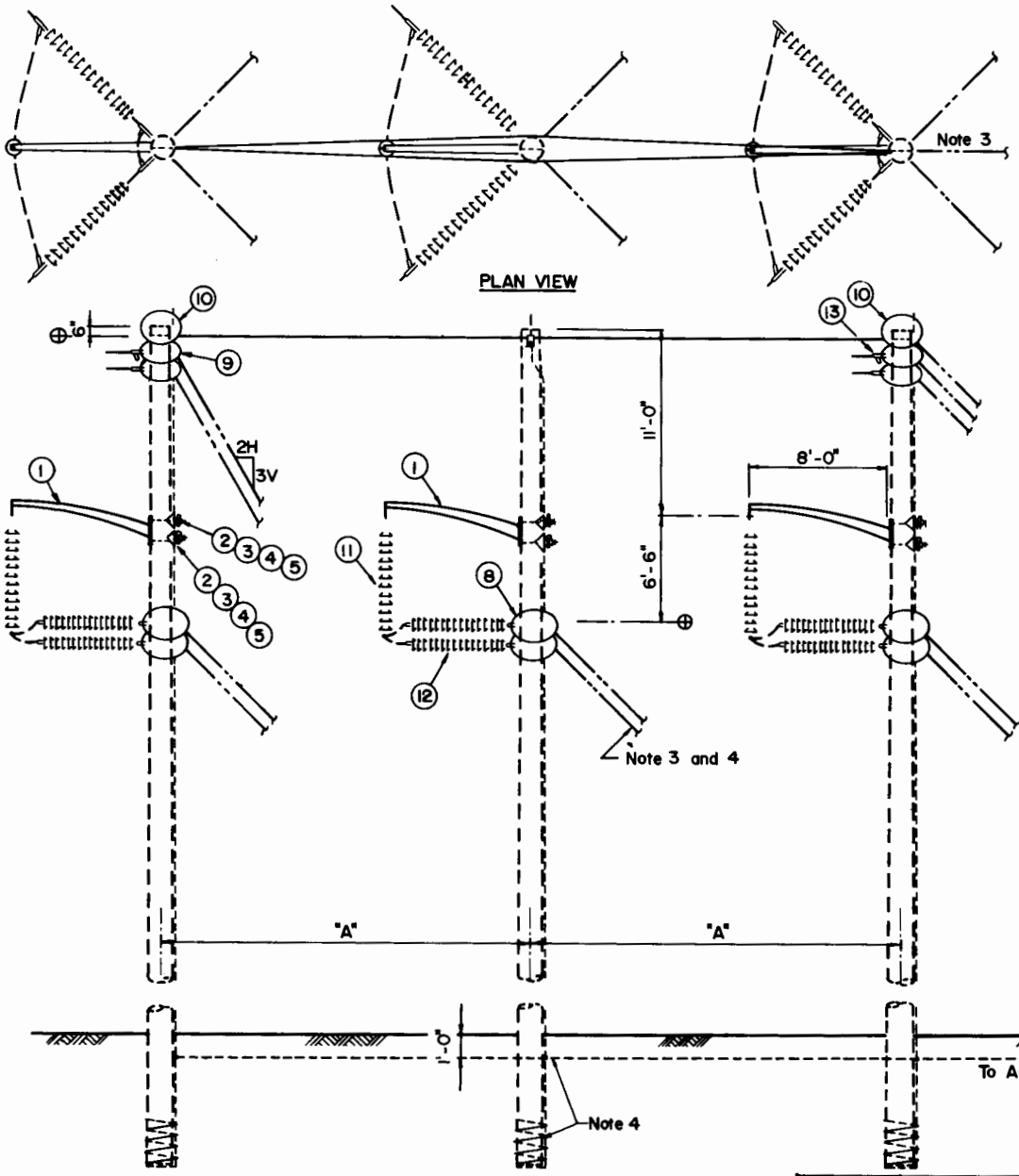
(230kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE:

TH-235



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	3	Davit Arm, steel, medium duty	gk		
2	6	1" Bolt, Machine, by req'd length	c		
3	6	Washer, Curved, 4"Sq.x1/4", 1-1/16"hole	d		
4	6	Washer, Spring, 1-1/16" hole	aw	TM-115	
5	6	1" Locknut, MF Type	ek		
6	3	5/8" Bolt, Carriage			
7	3	5/8" Clamp, Groundwire	dp		
8	6	GUY ATTACHMENT, _____ DUTY	-	TG-__D	
9	4	GUY ATTACHMENT, MEDIUM DUTY	-	TG-__D	
10	1	POLE TIE, GUYING, MEDIUM DUTY	-	TG-__B	
11	3	INSULATOR ASSEMBLY, ANGLE	-	TM-__C	
12	6	INSULATOR ASSEMBLY, DEADEND	-	TM-__	
13	4	OHGW ASSEMBLY, DEADEND	-	TM-4__	

NOTES:

1. For an OHGW guy slope of 3V to 2H, the following minimum pole spacings are recommended:

LINE ANGLE	DIMENSION "A"
to 50° Max.	21'-6"
50 to 60° Max.	22'-6"
60 to 70° Max.	24'-6"
70 to 80° Max.	27'-0"
80 to 90° Max.	30'-0"

2. Drawing TE-2 gives guidance to subassembly alternatives.
3. For guying arrangements, see drawing TMG-15. Bisector guy is recommended for line angles less than 60 degrees.
4. The following materials are to be specified on the plan and profile drawings and staking sheets: POLES, POLE GROUNDING ASSEMBLY, GUYING ASSEMBLIES, ANCHORS, AND ANY ADDITIONAL GROUNDING OR POLE FOUNDATION UNITS.

TRANSMISSION LINE STRUCTURE

LARGE ANGLE DOUBLE DEADEND - DAVIT ARM

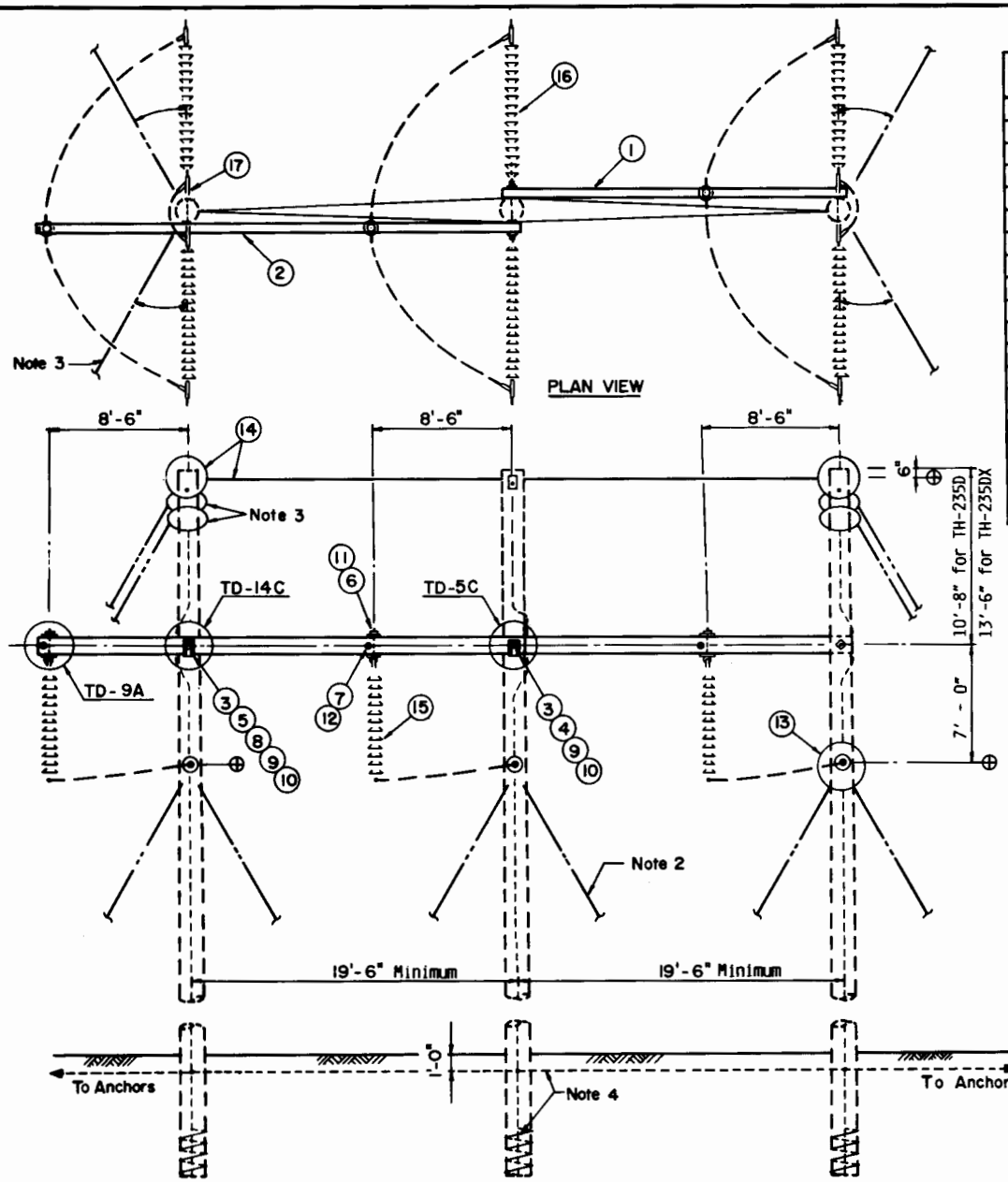
(230kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

SCALE

TH-235A



LIST OF MATERIALS

DRG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	X-Arm, 3-5/8" x 9-3/8" #92		TCD-92	
2	1	X-Arm, 3-5/8" x 9-3/8" #94		TCD-92	
3	4	Plate, Ribbed Tie, 3" x 9-1/2" x 1/4"			
4	1	7/8" Threaded Rod, w/2 nuts			
5	2	7/8" Bolt, Machine, by req'd length	c		
6	3	3/4" Bolt, Shoulder Eye, w/Washer Nut	o		
7	3	1/2" Bolt, Washer Head, w/Washer Nut	o		
8	2	Washer, Curved, 4" sq.x1/4",15/16"hole	d		
9	3	Washer, Spring, 15/16" hole	aw		
10	4	7/8" Locknut, MF Type	ek		
11	3	3/4" Locknut, MF Type	ek		
12	3	1/2" Locknut, MF Type	ek		
13	3	GUY ATTACHMENT,_____DUTY	-	TG-__E	
14	1	POLE TIE, DEADEND,_____DUTY	-	TG-__C	
15	3	INSULATOR ASSEMBLY, TANGENT	-	TM-____	
16	6	INSULATOR ASSEMBLY, DEADEND Note 5	-	TM-____	
17	4	OHGW ASSEMBLY, DEADEND	-	TM-4__	
18					

NOTES:

1. Drawing TE-2 gives guidance to subassembly alternatives.
2. For guying arrangements, see drawing TMG-15D.
3. Angled guying attachments below the OHGW deadend may be needed. If necessary, the engineer should modify the material list by adding these guy attachments.
4. 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.
5. When necessary, Engineer shall increase the length of the Extension Link of the INSULATOR DEADEND ASSEMBLY in order to maintain clearance to the guy.

TRANSMISSION LINE STRUCTURE

TANGENT DOUBLE DEADEND

(230 kV MAXIMUM)

NO.	REVISION	DATE

Reissued 03/98

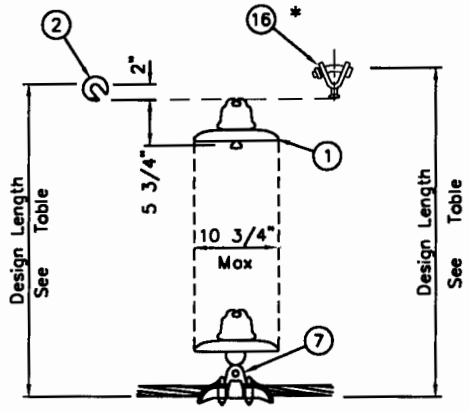
SCALE:

TH-235D, 235DX

LIST OF MATERIALS

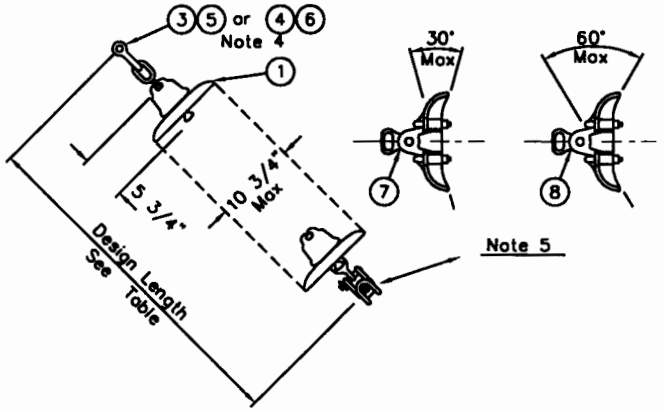
DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	–	Insulator,Suspen'n,5–3/4x10–3/4 max.	k		
2	–	Hook, Ball 30,000 lb.	eh		
3	–	Anchor Shackle 30,000 lb. BNC	bo		
4	–	Anchor Shackle 50,000 lb. BNC	bo		
5	–	Oval Eye, Ball 30,000 lb.			
6	–	Oval Eye, Ball 50,000 lb.			
7	–	Clamp,Suspension & Socket Eye; to 30°	el		
8	–	Clamp,Suspension & Socket Eye; to 60°	el		
9	–	Link, Extension, Oval Eye Ball,30k			
10	–	Link, Extension, Oval Eye Ball,50k			
11	–	Clamp, Bolted D.E. & Socket Eye	ej		
12	–	Clamp Compression D.E.	cp		
13	–	Jumper Connector, Compression	p		
14	–	Jumper Terminal, Compression			
15	–	Socket Adapter (Socket Eye or Clevis)	fh		
* 16	–	30k Ball Y–Clevis	ft		
17	–				

TM–1A

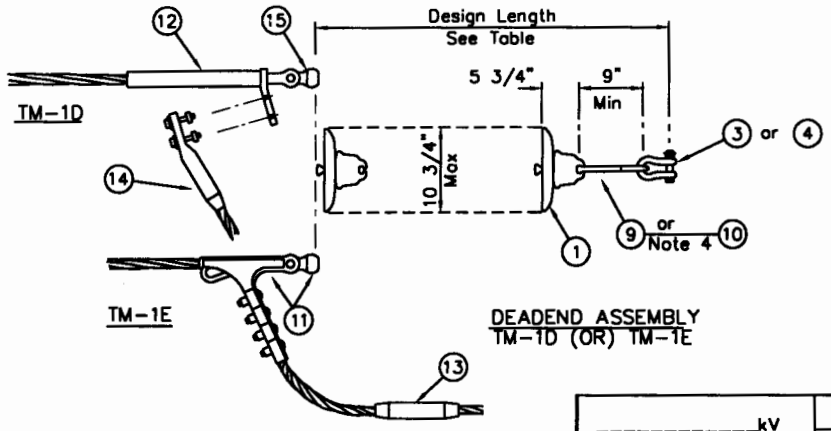


TANGENT ASSEMBLY
TM–1A (OR) TM–1B

TM–1B



ANGLE ASSEMBLY
TM–1C



DEADEND ASSEMBLY
TM–1D (OR) TM–1E

_____kV	ASSEMBLY		
	TANGENT	ANGLE	DEADEND
Quantity of Units			
ANSI C29.2, Class			
M & E Strength (lb.)			
Assembly Weight (lb.)			
Design Length (in.)			
Color of Units			

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 following are to be considered: type of conductor, diameter of conductor (considering armor rods and/or liners), etc.
3. Corona–free suspension clamps shall be used for 230 kV transmission lines.
4. 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. Use items 4, 6 or 10 for 36,000 lb. insulators.
5. Appropriate clamps shall be installed for line angles shown on the plan and profile:
   A. For angles from 0 degrees to 30 degrees use dwg. ref. 7.
   B. For angles from 30 degrees to 60 degrees use dwg. ref. 8.
6. When specified by the engineer, the ball hook may be used for TM–1C.

INSULATOR ASSEMBLIES

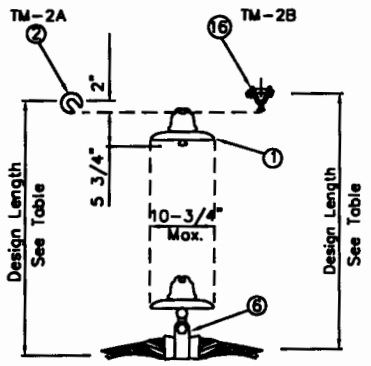
INSULATOR STRING WITH SUSPENSION CLAMP

NO.	REVISION	DATE
1, *	Add item 16, TM–1B	03/98

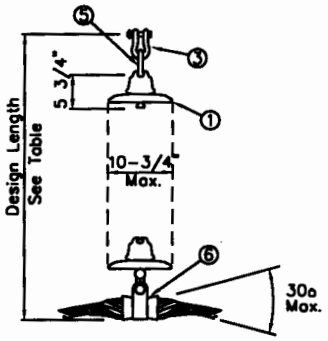
TM–1

LIST OF MATERIALS

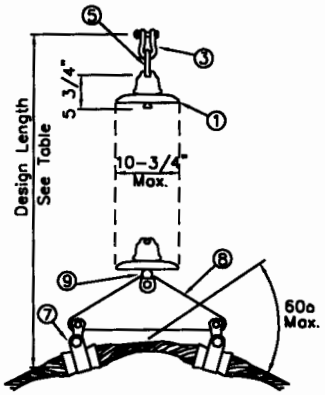
DWG. REF.	DESCRIPTION	ITEM	DET.	CODE No.
1	Insulator, Suspension	k		
2	Hook, Ball, 30,000 lb.	eh		
3	Anchor Shackle, 30,000 lb. BNC	bo		
4	Anchor Shackle, 50,000 lb. BNC	bo		
5	Oval Eye Ball, 30,000 lb.			
6	Clamp, Suspension & Socket Eye	el		
7	Clamp, Suspension & Clevis Eye	el		
8	Yoke Plate			
9	Socket 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		



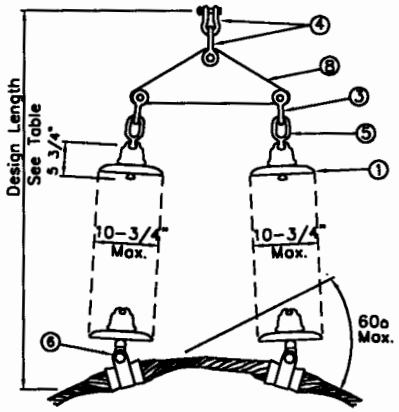
TANGENT ASSEMBLY
TM-2A (OR) TM-2B



TYPE 1

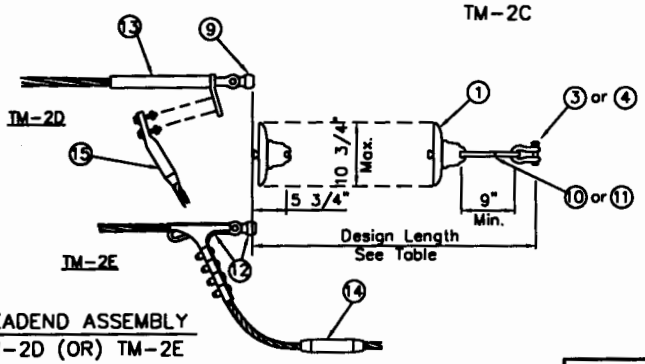


TYPE 2



TYPE 3

ANGLE ASSEMBLY NOTE 4
TM-2C



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 8 shall be twice the M&E strength of the insulators. Use item 11 for 36,000 lb. insulators.
4. Appropiate 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				

INSULATOR ASSEMBLIES

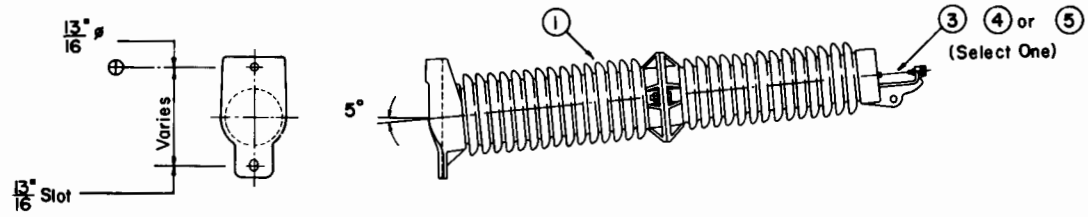
INSULATOR STRING WITH CUSHIONED SUSPENSION

NO.	REVISION	DATE
1.*	Add item 16, TM-2B	03/98

TM-2

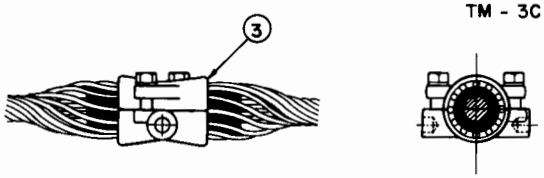
LIST OF MATERIALS

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°)			
5	Clamp, Angle			



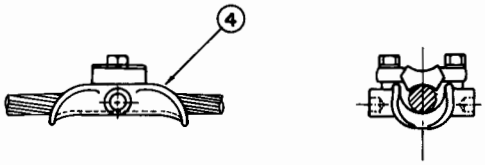
HORIZONTAL POST INSULATOR

TM - 3A (DETAIL A)
TM - 3B (DETAIL B)
TM - 3C (DETAIL C)



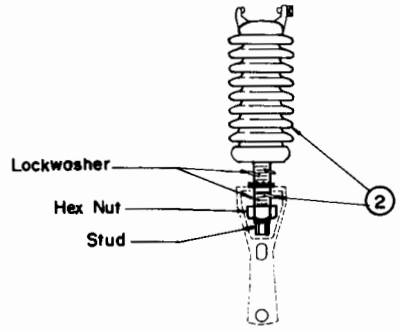
CUSHIONED SUPPORT CLAMP

DETAIL A



POST CLAMP

DETAIL B



VERTICAL POST INSULATOR

TM - 3E (DETAIL A)
TM - 3F (DETAIL B)

LEFT TURN

RIGHT TURN

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

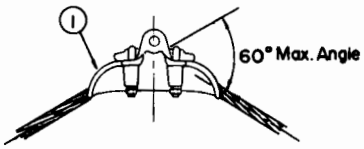
SCALE

Reissued 03/98

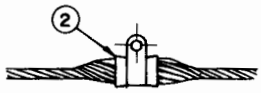
TM-3

LIST OF MATERIALS

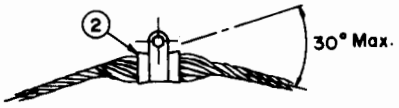
DRG. REF.	DESCRIPTION	ITEM	DET.	CODE No.
1	Clamp, Suspension (to 60°)	m		
2	Clamp, Cushioned Suspension	el		
3	Clamp, Cushioned Susp. & Clevis Eye	el		
4	Anchor Shackle, 30,000 lbs., BNC	bo		
5	Yolk Plate			
6	Clamp, Bolted Deadend	l		
7	Clamp, Compression Deadend	l		
8	Link, Extension, Clevis 6"			
9	Jumper Connector, Compression	p		
10	Jumper Terminal, Compression			
11	3 Bolt Clamp, 6"			



TANGENT ℄ ANGLE CLAMP
TM-4A

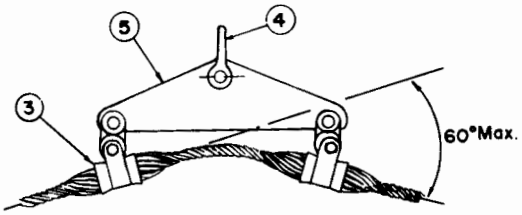


TANGENT ASSEMBLY
TM-4B

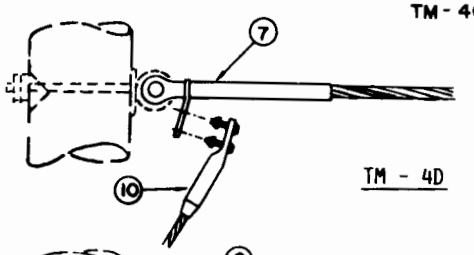


TYPE 1

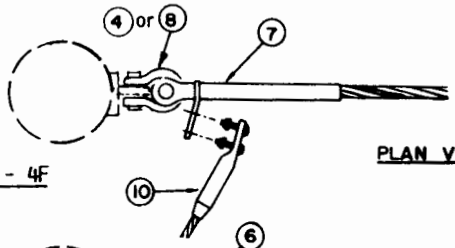
ANGLE ASSEMBLY
TM-4C (Note 1)



TYPE 2

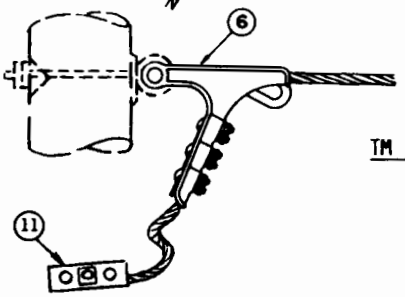


TM - 4D

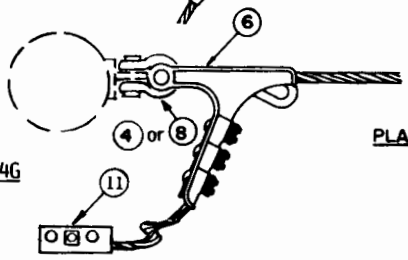


TM - 4F

PLAN VIEW

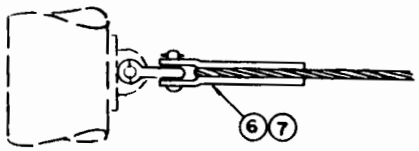


TM - 4E



TM - 4G

PLAN VIEW



DEADEND ASSEMBLY

Notes:

1. The appropriate cushioned suspension angle assembly shall be installed for the line angles shown on the plan-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.

O.H.G.W. ASSEMBLIES

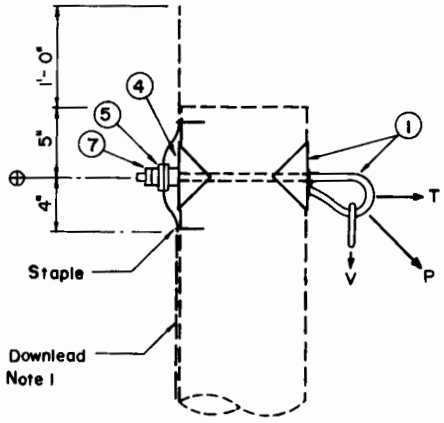
CUSHIONED SUSPENSION AND SUSPENSION CLAMP

NO.	REVISION	DATE

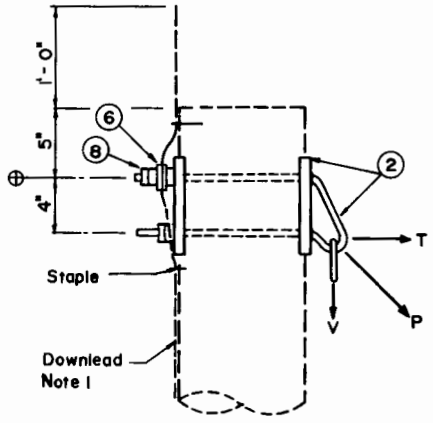
Reissued 03/98

TM-4

	TM-6		LIST OF MATERIALS			
DWG. REF.	A	B	DESCRIPTION	ITEM	DET.	CODE No.
1	1	-	Support, Single Bolt OHGW, 3/4" d.	ed		
2	-	1	Support, Double Bolt OHGW, 5/8" d.	ed		
3		-	5/8" Bolt, Washer Head, w/Washer Nut	c		
4	1	-	Washer, Curved, 4"sq.x 1/4", 13/16" hole	d		
5	1	-	3/4" Clamp, Groundwire + 1 nut	dp		
6	-	1	5/8" Clamp, Groundwire + 1 nut	dp		
7	1	-	3/4" Locknut, MF Type	ek		
8		2	5/8" Locknut, MF Type	ek		
9						



SINGLE BOLT O.H.G.W. SUPPORT
TM-6A



DOUBLE BOLT O.H.G.W. SUPORT
TM-6B

NOTES:

1. For placement of downlead and staples see respective structure drawings and drawing TM-9.
2. TM-6B is to be used for all single pole angle structures and H-frame structures.
3. Designated strength limitations of the overhead ground-wire support assemblies are:

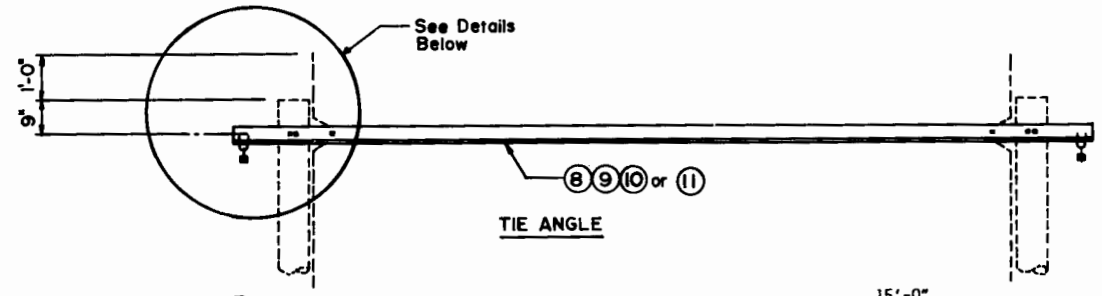
	Allowable Vertical Load
TM-6A	1,200 lbs.
TM-6B	1,600 lbs.

O.H.G.W. SUPPORT ASSEMBLY

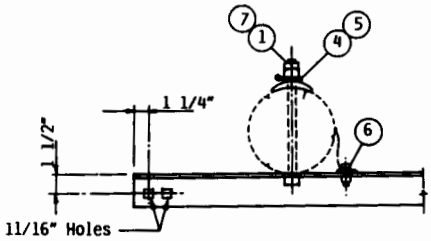
SINGLE AND DOUBLE BOLT

NO.	REVISION	DATE	Aug., 1986	TM-6

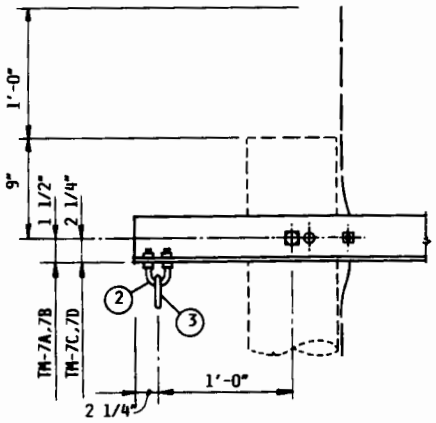
TM-7						LIST OF MATERIALS			
DWG. REF.	A	B	C	D		DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	2	2		7/8" Bolt, Machine, by req'd length	c		
2	2	2	2	2		5/8" U-Bolt, w/4 nuts			
3	2	2	2	2		Chain Link, 5/8" x 2 1/4"	br		
4	2	2	2	2		Washer, Curved, 4"sqx1/4",15/16" hole	d		
5	2	2	2	2		Washer, Spring, 15/16" hole	aw		
6	2	2	2	2		Clamp, Groundwire, 1/2"	dp		
7	2	2	2	2		7/8" Locknut, MF Type	ek		
8	1	-	-	-		Angle, Tie, 3 1/2 x 3 x 1/4 x 15'-0"	-	A	
9	-	1	-	-		Angle, Tie, 3 1/2 x 3 x 1/4 x 18'-0"	-	B	
10	-	-	1	-		Angle, Tie, 5 x 3 x 1/4 x 18'-0"	-	C	
11	-	-	-	1		Angle, Tie, 5 x 3 x 1/4 x 22'-0"	-	D	
12									
13									



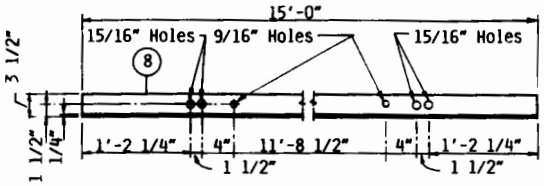
TIE ANGLE



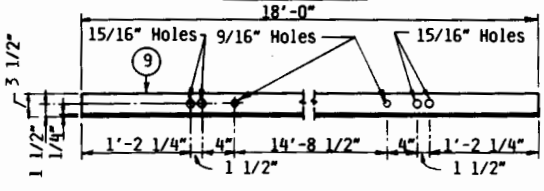
PLAN



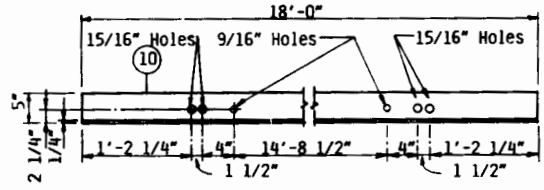
DETAIL



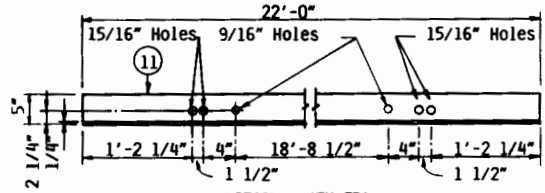
DETAIL A (TM-7A)



DETAIL B (TM-7B)



DETAIL C (TM-7C)



DETAIL D (TM-7D)

NOTES:

1. The strength limitations of the OHGW Support Assemblies are:

	Allowable Vertical Load	Maximum Vertical Load
TM-7A, 7B	1200 lbs.	1900 lbs.
TM-7C, 7D	2300 lbs.	3700 lbs.

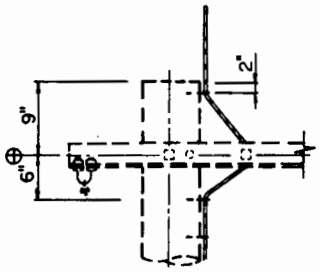
2. Tie angle steel shall conform to ASTM A36. Angle shall be hot dip galvanized per ASTM A123.
3. Substitute TM-7C for TM-7B when specified on TH-10 or TH-11B.

OHGW SUPPORT ASSEMBLY

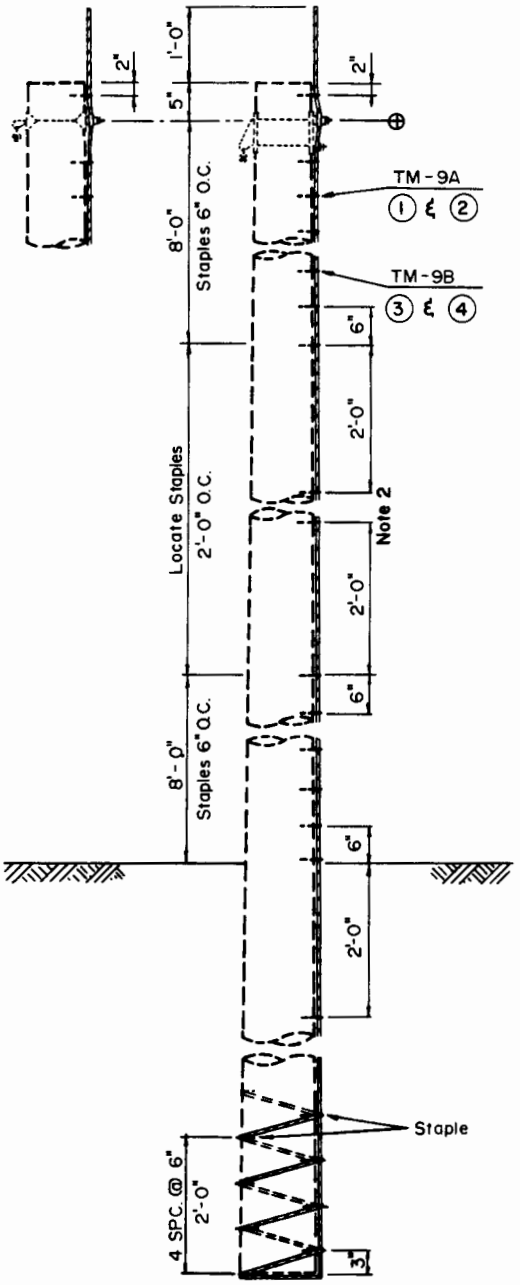
STEEL TIE ANGLE

No.	REVISION	DATE	SCALE:	
				TM-7

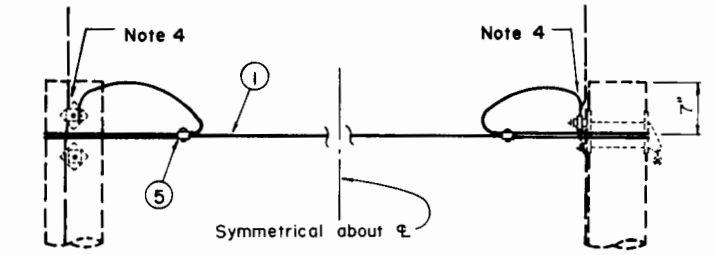
Reissued 03/98



DRG. REF.	TM-9 A	B	C	DESCRIPTION	ITEM	DET.	CODE No.
1	ft.	-	ft.	5/16" Wire, soft annealed iron	cj		
2	lb.	-	-	2" x 1/2" Staples, galvanized steel	al		
3	-	ft.	-	#6 or #4 Wire AWG,copper or copperclad	cj		
4	-	lb.	-	1-1/2" x 3/8" Staples, copperclad	al		
5	-	-	2	Clamp, U-Bolt	u		



TM-9A
TM-9B



OHGW IN DEAD END OR OHGW IN SUSPENSION

TM-9C

NOTES:

1. Orientate the downlead as shown on the transmission line structure drawings. On structures with X-Arms, the downlead shall be located and stapled so that it does not come in contact with the X-Arm or the through bolts.
2. Staple the downlead to the pole leaving one foot of wire projecting above the poles. Staples on the downlead shall be 2 feet apart, except for a distance of 8 feet above the ground and 8 feet from the top of the pole where they shall be 6 inches apart.
3. Carry the downlead under the bottom of the pole, and then wrap the downlead four turns back up the pole. Staple the groundwire to the pole at each wire crossing and on the opposite sides of the pole.
4. Terminate the tie wire for TM-9C at the groundwire clamp.

GROUNDING ASSEMBLIES

POLE GROUND AND BUTT WRAP

No.	REVISION	DATE

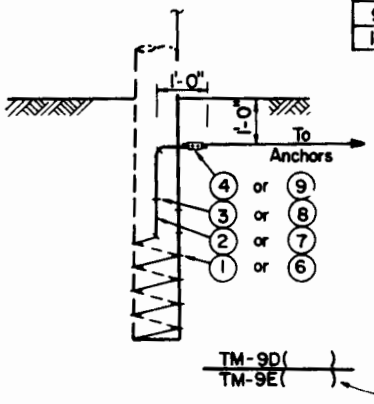
Reissued 03/98

Aug., 1986

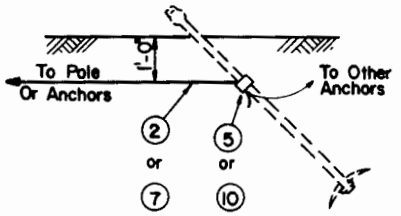
1 OF 2

TM-9

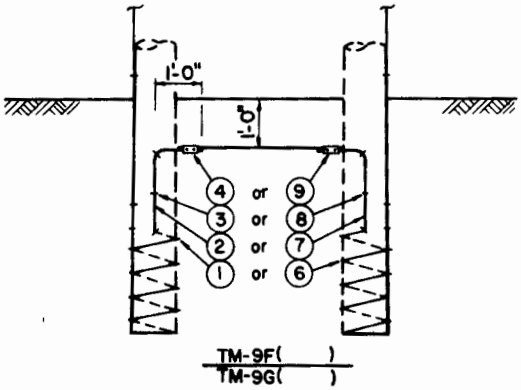
	TM - 9		LIST OF MATERIALS			
DRG. REF.	D, J, F, L, H,	E, K, G, M, I,	DESCRIPTION	ITEM	DET.	CODE No.
1	as req'd	-	Pole Ground & Butt Wrap	-	TM-9A	
2	ft.	-	5/16" Wire, soft annealed iron	cj		
3	as req'd	-	2" x 1/2" Staples, galvanized steel	al		
4	as req'd	-	Connector, compression, for item 2	p		
5	as req'd	-	Connector, galvanized steel			
6	-	as req'd	Pole Ground & Butt Wrap	-	TM-9B	
7	-	ft.	#6 or #4 Wire AWG, copper or copperclad	cj		
8	-	as req'd	1-1/2" x 3/8" Staples, copperclad	al		
9	-	as req'd	Connector, compression, for item 7	p		
10	-	as req'd	Connector, copper (or) bronze			



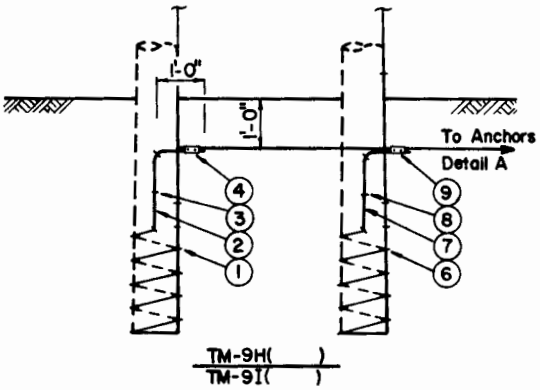
TM-9D( )
TM-9E( ) Note 4



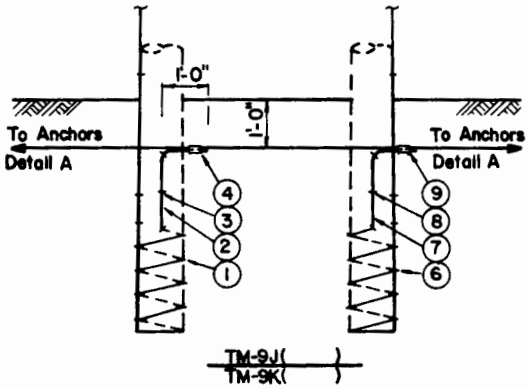
DETAIL A



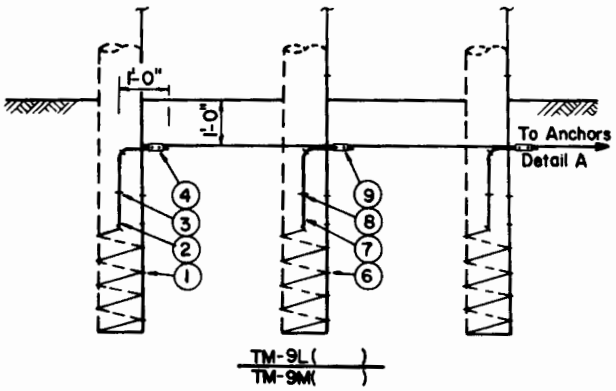
TM-9F( )
TM-9G( )



TM-9H( )
TM-9I( )



TM-9J( )
TM-9K( )



TM-9L( )
TM-9M( )

Notes:

1. For other installation details, refer to sheet 1 of 2, TM-9.
2. Grounding materials must be consistent with good corrosion prevention practices. When galvanized hardware and 5/16" iron wire are used, anchor rods shall be galvanized steel. When copper, copperclad or bronze hardware are used, anchor rods shall be copperclad.
3. Bid items on this drawing include material to top of pole in accordance with sheet 1 of 2, TM-9.
4. ( ) indicates number of anchors.

GROUNDING ASSEMBLIES

MULTIPLE POLE AND ANCHOR GROUNDING

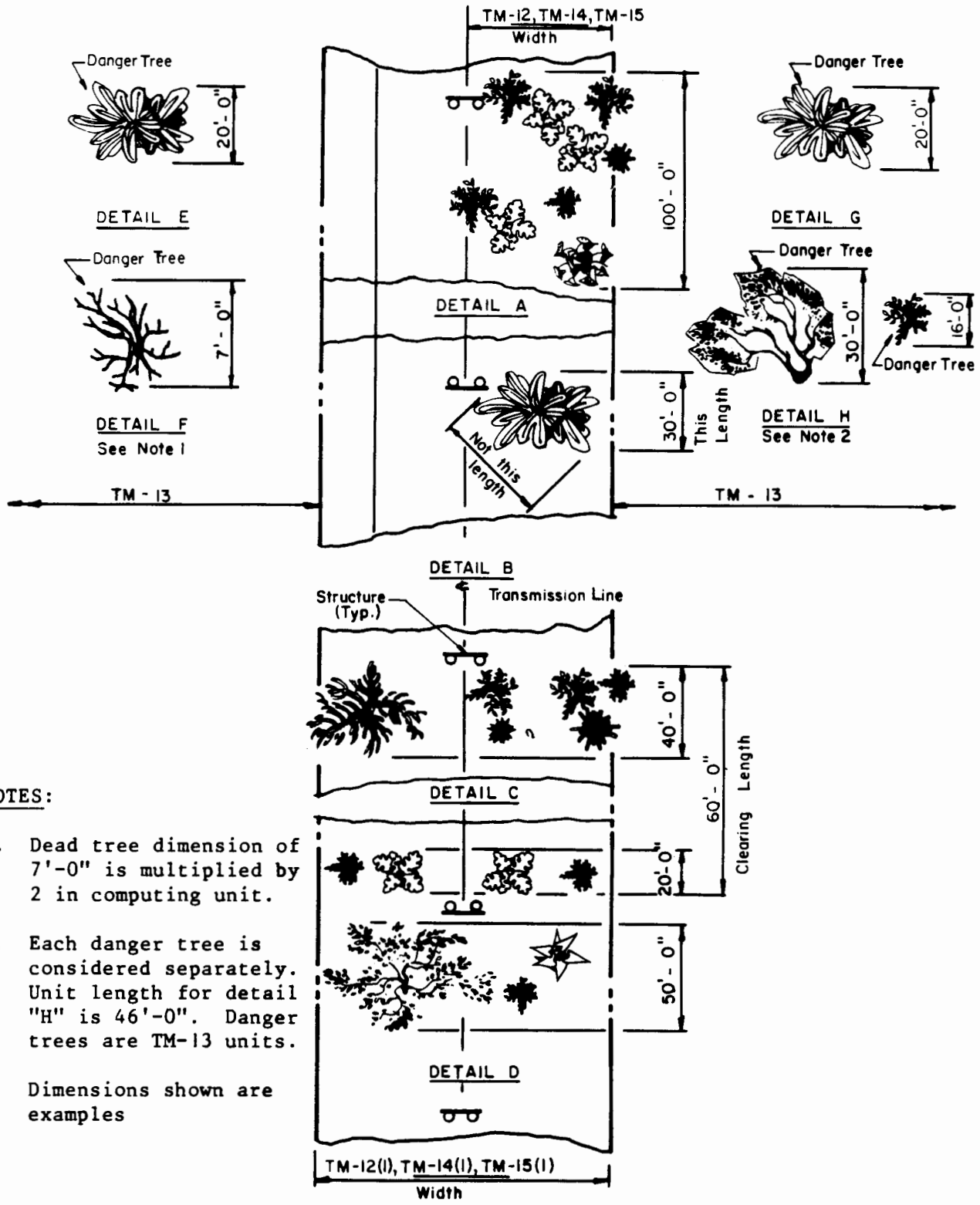
NO.	REVISION	DATE

Reissued 03/98

Aug., 1986

2 OF 2

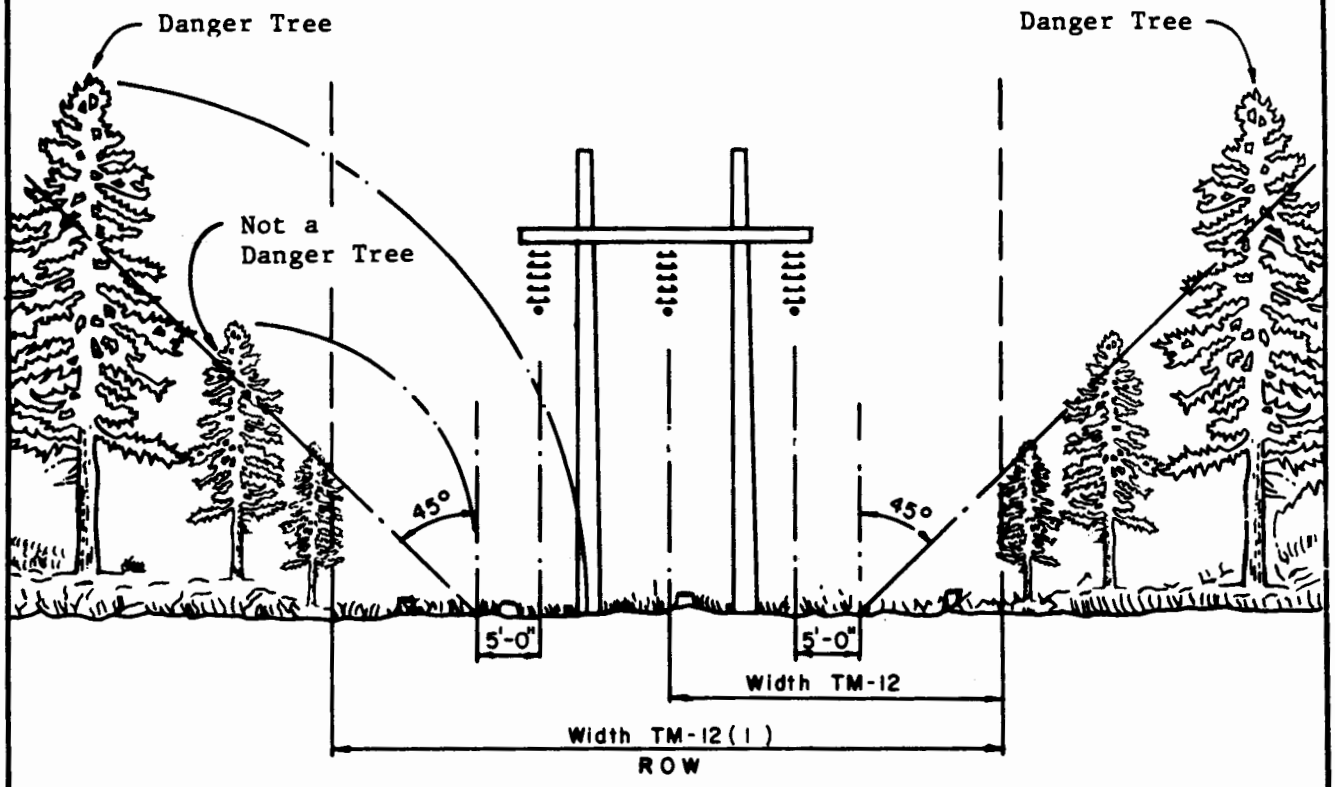
TM-9



NOTES:

1. Dead tree dimension of 7'-0" is multiplied by 2 in computing unit.
2. Each danger tree is considered separately. Unit length for detail "H" is 46'-0". Danger trees are TM-13 units.
3. Dimensions shown are examples

			TRANSMISSION ROW CLEARING GUIDE FOR MEASURING RIGHT - OF - WAY CLEARING UNITS		
Reissued 03/98	NO.	REVISION	DATE	Aug., 1986	TM-11



NOTES:

1. Engineer will designate all danger trees which shall be removed or topped at option of contractor. In approximately level terrain, trees which would reach within 5 feet of a point underneath the outside conductor in falling are examples of danger trees.

2. As directed by the engineer, portions of the right-of-way (ROW) must be cut so that stumps will not prevent the passage of tractor and trucks along the ROW.

3. The unit for clearing one-half of the ROW is "WIDTH TM-12."

4. The unit for clearing the full ROW is "WIDTH TM-12(1)."

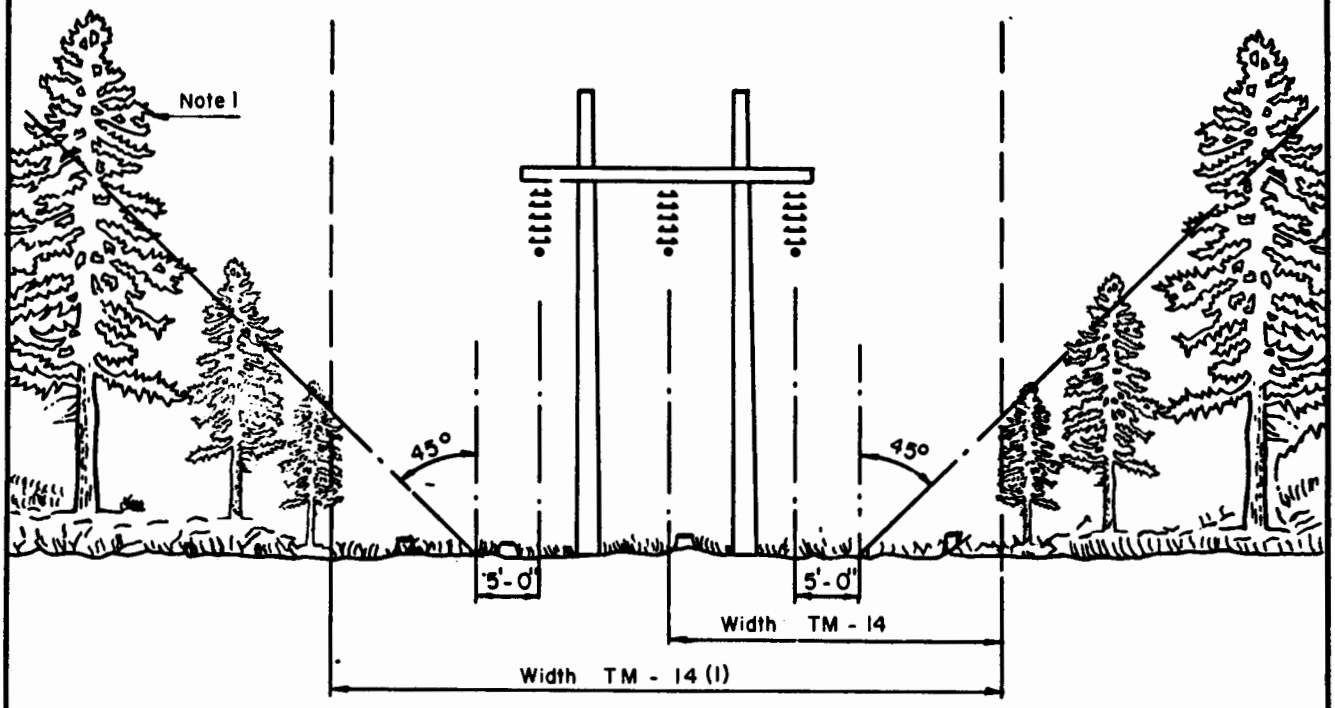
5. The unit for clearing danger trees is "TM-13."

			TRANSMISSION ROW CLEARING		
			RIGHT-OF-WAY CLEARING GUIDE		
Reissued 03/98	NO.	REVISION DATE	Aug., 1986		TM-12,-12(1),-13

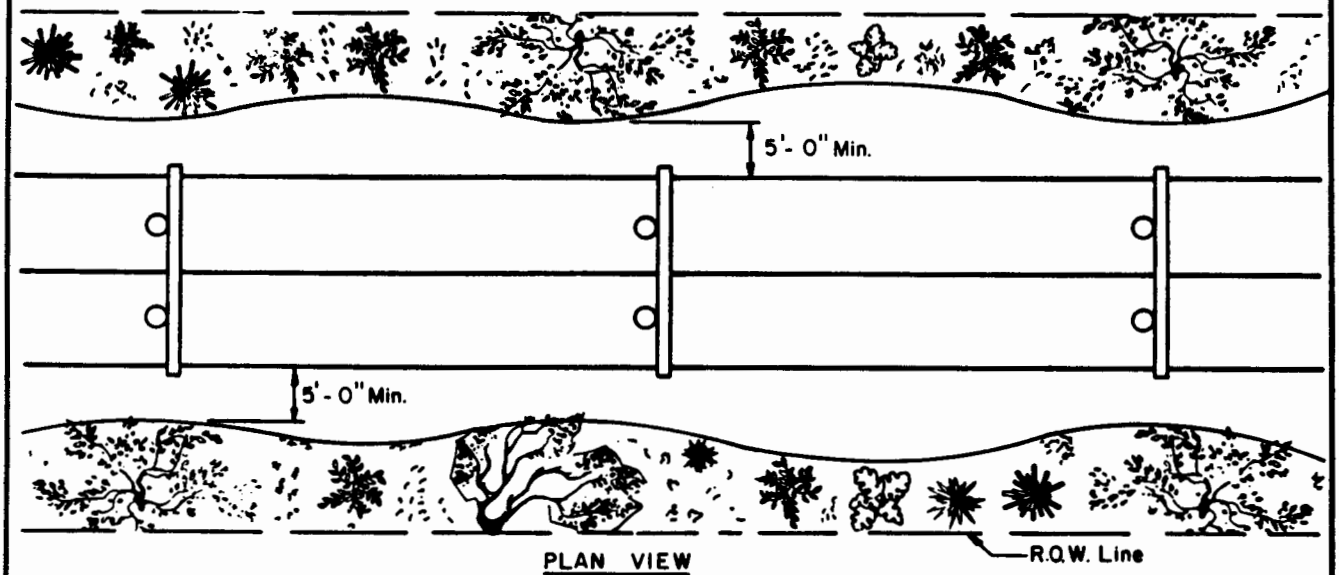
NOTES:

1. Engineer shall designate all danger trees which are to be removed or topped. The unit for clearing danger trees is "TM-13."

2. The unit for clearing right-of-way of specified width is "TM-14" or "TM-14(1)."



FEATHERED CLEARING



PLAN VIEW

TRANSMISSION ROW CLEARING

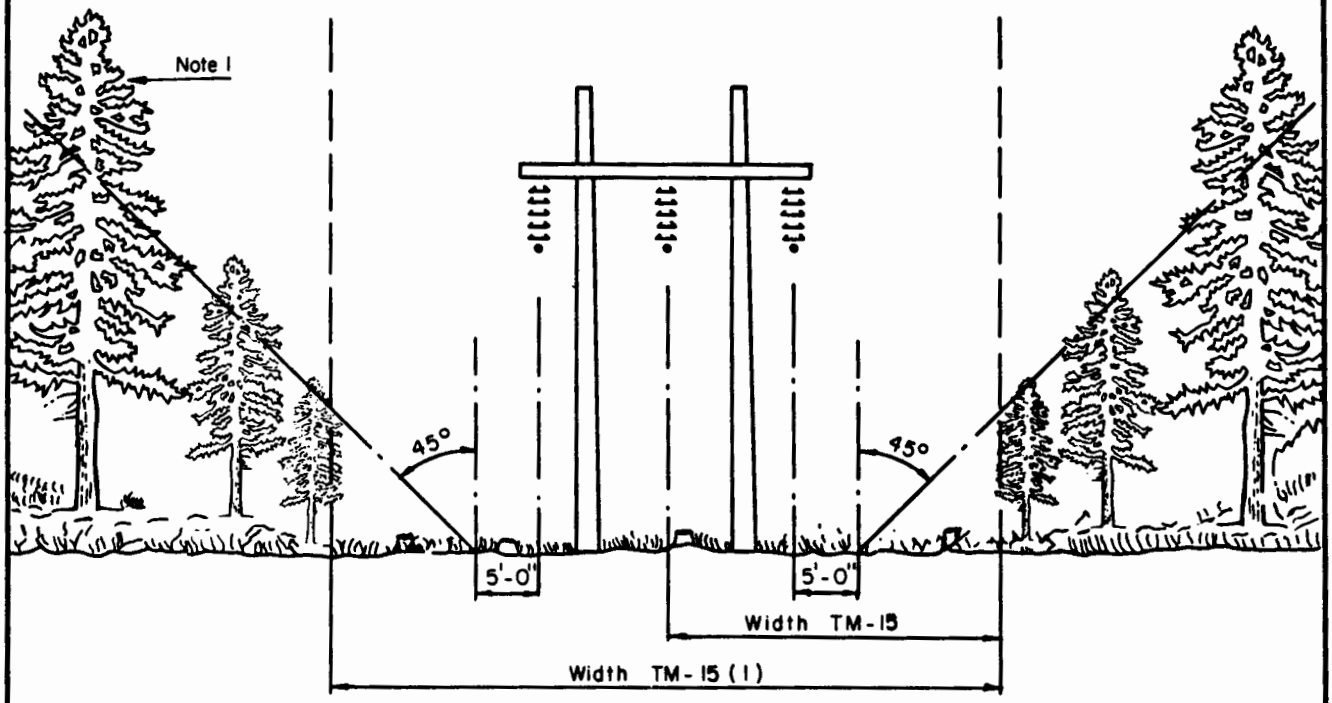
FEATHERED/UNDULATING CLEARING

Reissued 03/98	NO.	REVISION	DATE	Aug., 1986	TM-14,14(1),13

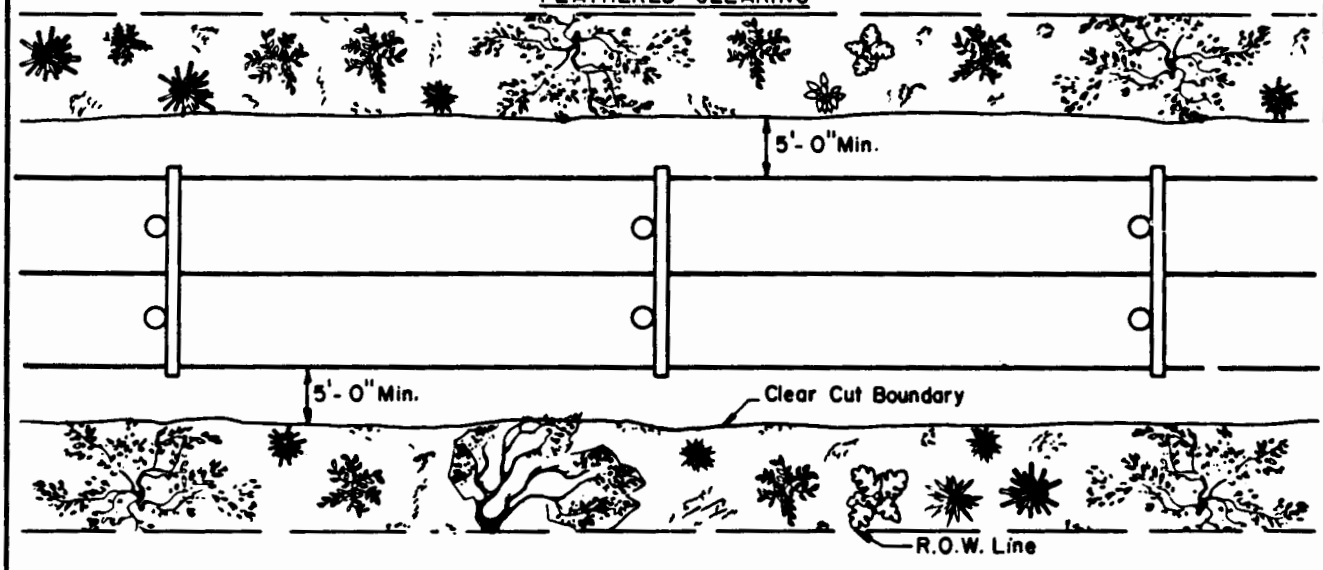
NOTES:

1. Engineer shall designate all danger trees which are to be removed or topped. The unit for clearing danger trees is "TM-13."

2. The unit for clearing right-of-way of specified width is "TM-15" or "TM-15(1)."



FEATHERED CLEARING



PLAN VIEW

TRANSMISSION ROW CLEARING

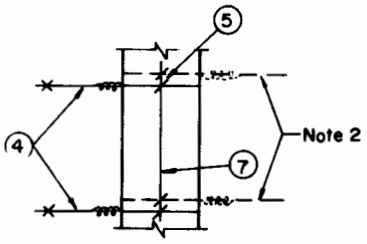
FEATHERED/CLEAR-CUT CLEARING

NO.	REVISION	DATE

Reissued 03/98

Aug., 1986

TM-15,15(1),13

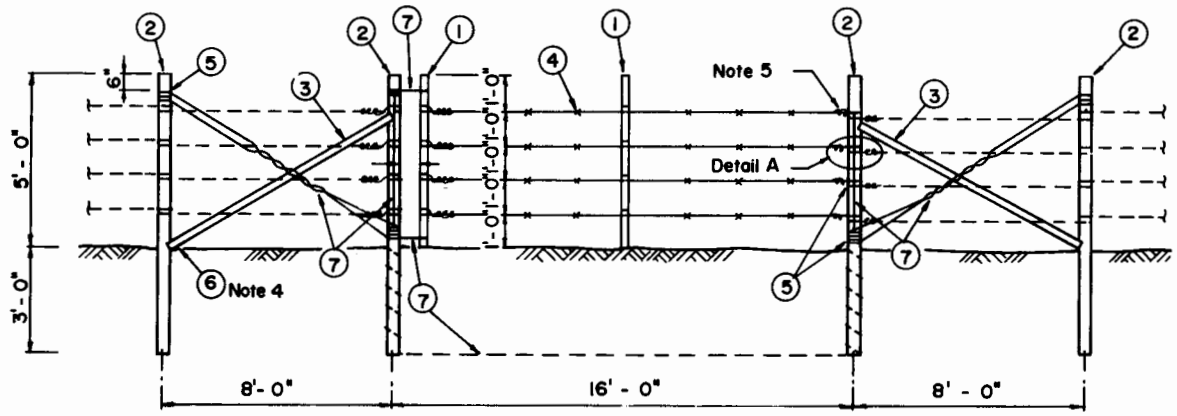


DETAIL A

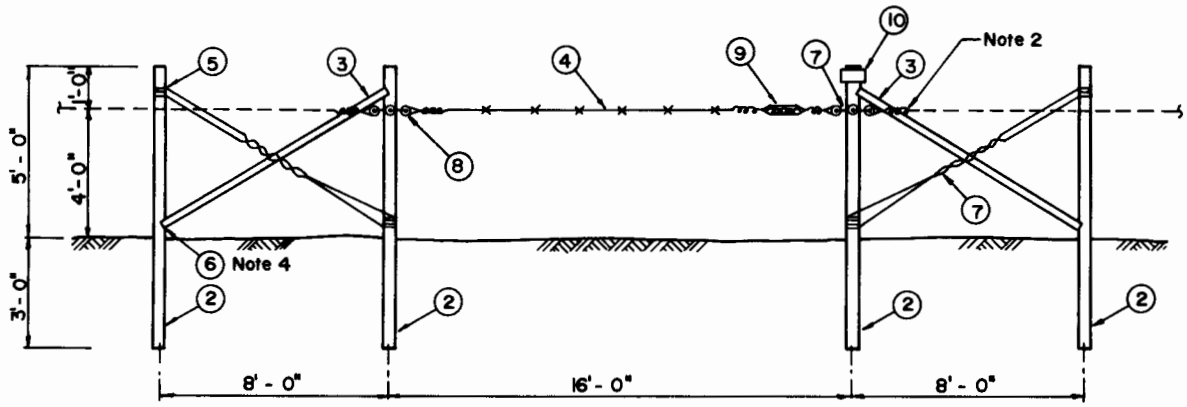
TM- 30

LIST OF MATERIALS

DRG REF	A	B	DESCRIPTION	ITEM	DET.	CODE No.
1	2	-	Post, Wood, 2" dia. x 5'-0"	-		
2	4	4	Post, Wood, 6" dia. x 8'-0"	-		
3	2	2	Post, Wood, 4" dia. x 9'-0"	-		
4	70ft.	16ft.	Barbed Wire, galv., 2-#12 strands	-		
5	as req	as req	2" x 1/2" Staples, galvanized	al		
6	as req	as req	20 d Nails, galvanized	-		
7	as req	as req	No. 9 Wire, galvanized	-		
8	-	8	Insulators, Spool	cm		
9	-	1	Insulated Coil Spring Handle	-		
10	-	1	Sign "ELECTRIC FENCE" 4" x 8"	-		



TM - 30A



TM - 30B

Notes:

1. Gates shall be erected in locations and grounded as specified by the engineer.
2. Posts and bracing shall be in place before existing fence wire is cut. The existing fence wire shall be wrapped around gate posts or insulators.
3. Posts and braces shall be creosoted pine, 6 lb. retention, location of latch post on right or left side is optional.
4. Notch post for braces and nail braces in place, twist steel guys to tighten.
5. To terminate new and existing barbed wire, make two complete wraps around stake and tie off with No. 14 wire.
6. All gates to be closed after passing through.

MISCELLANEOUS ASSEMBLIES

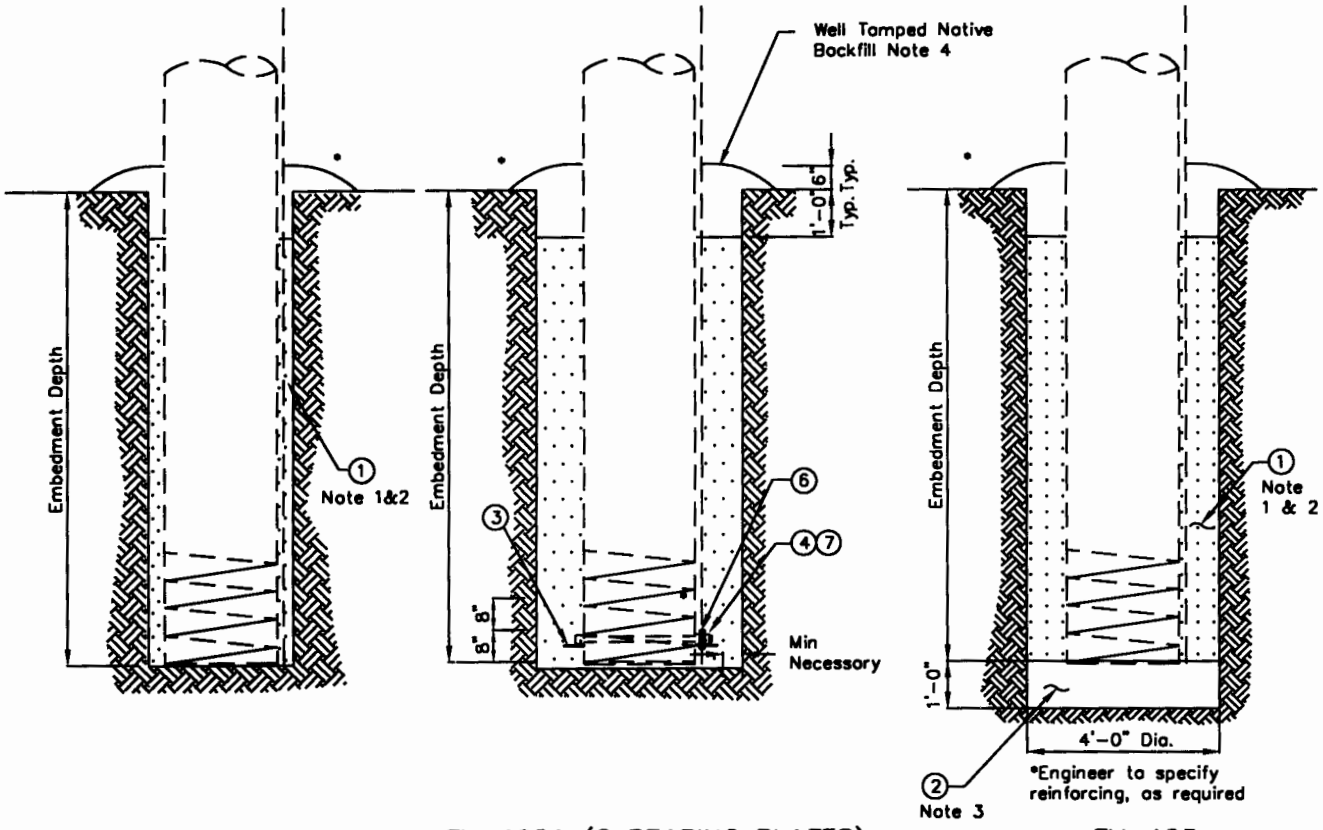
FENCE GATES

No.	REVISION	DATE	SCALE :	
			Aug., 1986	TM- 30

Reissued 03/98

LIST OF MATERIALS

DWG. REF.	TM- 101	102A	–	103	DESCRIPTION	ITEM	DET.	CODE No.
1	cu.yd	cu.yd	–	cu.yd	Imported Backfill (Note 1 & 2)	–	–	
2	–	–	–	1/2yd	Concrete, 2000 psi. (Note 9)	–		
3	–	2	–	–	Pole Bearing Plates	fs		
4	–	1	–	–	7/8" Bolt, Machine by req'd length	c		
5	–	–	–	–	5/8" Bolt, Machine by req'd length	c		
6	–	1	–	–	7/8"Clamp,Groundwire +1 nut (Note 5)	dp		
7	–	1	–	–	7/8" Locknut, MF Type	ek		



TM–101 • TM–102A (2 BEARING PLATES) TM–103

NOTES:

1. Gradation for imported backfill is shown in the table. The aggregate shall be well mixed in a stock pile, and pneumatically placed and tamped in 6–inch lifts.
2. The specification for aggregate given in the table is minimum. In areas where smaller fines are available at comparable cost, it is recommended that the engineer specify smaller fines.
3. Concrete shall be 2000 psi high early strength concrete. It shall be deposited in a manner which will prevent segregation of the aggregate and cement. Care should be taken to avoid getting dirt mixed with the concrete. The pole shall not be set until the concrete bearing base has attained sufficient strength to support the pole. During placement of pole, avoid bumping concrete base.
4. Well tamped native backfill should be placed around the pole as shown.
5. All buried metals must be consistent with good corrosion prevention practices. Similar or compatible metals should be used for bearing plates, pole ground wire and ground connectors.

GRADATION FOR IMPORTED GRANULAR BACKFILL	
SIZE OF GRAVEL (OR) CRUSHED STONE	SIZE OF MESH (in)
100% By Weight to pass 1" screen	1.00
60% – 90% By Weight to pass 1/2" screen	0.500
40% – 60% By Weight to pass no. 4 screen	0.187
25% – 50% By Weight to pass no. 8 screen	0.0937
20% – 40% By Weight to pass no. 16 screen	0.0469
15% – 30% By Weight to pass no. 40 screen	0.0165

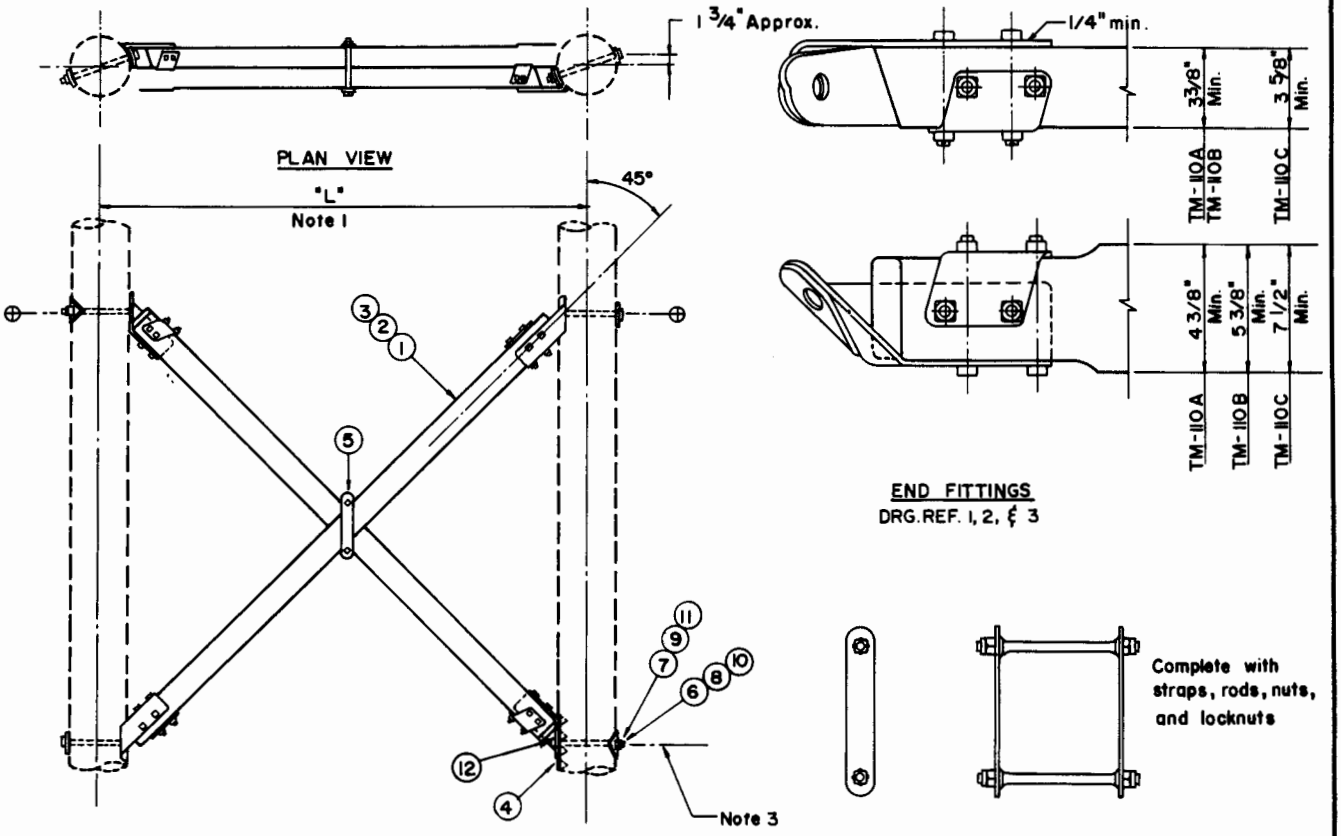
FOUNDATION UNITS

POLE STABILITY,BEARING,& UPLIFT FOUNDATIONS

NO.	REVISION	DATE
1,*	TM101,102A,103,dr.6	03/98

TM–101,102,103

	TM - 110			LIST OF MATERIALS			
DWG. REF.	A	B	C	DESCRIPTION	ITEM	DET.	CODE No.
1	1	-	-	Set, X-Brace, 3-3/8 x 4-3/8 min.			
2	-	1	-	Set, X-Brace, 3-3/8 x 5-3/8 min.			
3	-	-	1	Set, X-Brace, 3-5/8 x 7-1/2 min.			
4	-	-	4	Grid Gain, 4" x 6", 1-1/16" hole			
5	1	1	1	Clamp, Center, Assembly			
6	-	-	4	1" Bolt, Machine, by req'd length	vx		
7	4	4	-	7/8" Bolt, Machine, by req'd length			
8	-	-	4	Washer, Curved, 4" sq. x 3/8", 1-1/16 h.			
9	4	4	-	Washer, Curved, 4" sq. x 1/4", 15/16" h.			
10	-	-	4	1" Locknut, MF Type			
11	4	4	-	7/8" Locknut, MF Type			
12	-	-	4	Washer, Flat 3-1/2"sq.x 3/8"x 1-1/16"h.		note 5	



NOTES:

1. X-Brace length shall be suitable to accommodate the pole spacing shown on the respective transmission line structure drawings.
2. Machine bolts must pass through center of pole and fit tightly in the holes.
3. Lower holes shall be field drilled and be thoroughly treated.
4. Use of X-Brace should be economically justified by the engineer.
5. End fittings for TM-110C may be channel type. Item 12, reinforcing washer, shall be supplied when channel type end fittings are used. The washer shall be placed between the head of the bolt and the end fitting.
6. Bolts with rolled threads or cut threads and full size shanks shall be used for items 6 & 7.
7. Minimum number of bolts for end fittings are shown.
8. Supplier shall test the X-Brace assembly and obtain REA standard approval.
9. Maximum tensile-compressive capacity of X-Brace assembly is 20,000 lbs. for the following:

X-Brace	Max. Pole Spacing
TM-110A	14'-0"
TM-110B	15'-6"
TM-110C	19'-6"

10. For other assembly requirements, see REA Specifications T-7 and T-8.

MISCELLANEOUS ASSEMBLIES

X- BRACE

(20,000 lb. MAXIMUM)

NO.	REVISION	DATE

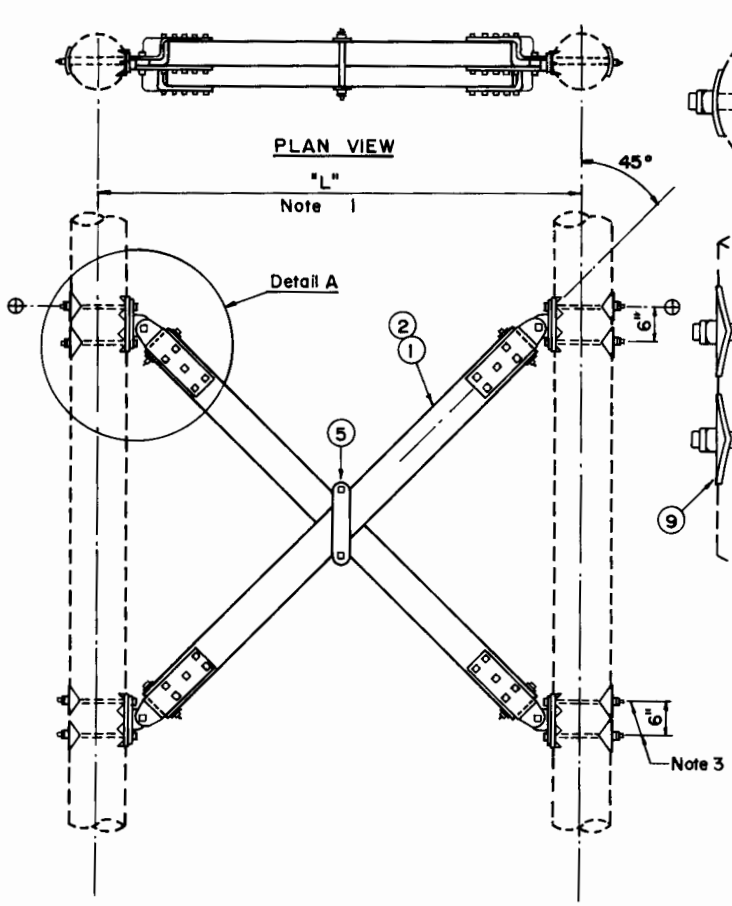
Reissued 03/98

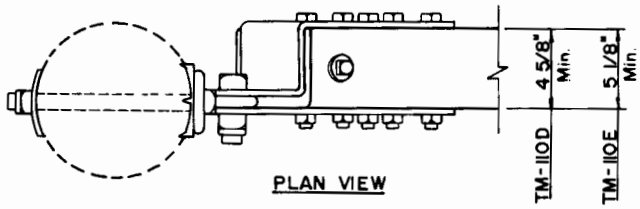
Aug., 1986

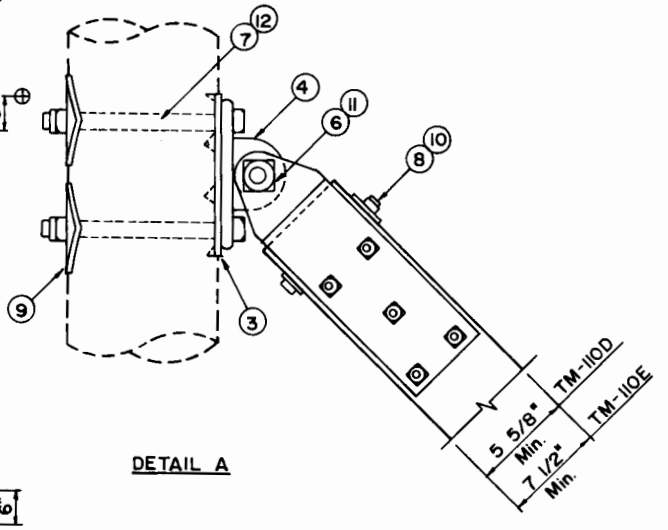
1 OF 2

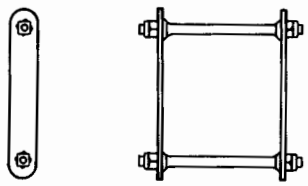
TM-110 A,B,C

	TM-110		LIST OF MATERIALS			
DWG. REF.	D	E	DESCRIPTION	ITEM	DET.	CODE No.
1	1	-	Set, X-Brace, 4-5/8" x 5-5/8" min.			
2	-	1	Set, X-Brace, 5-1/8" x 7-1/2" min.			
3	4	4	Grid Gain, 4-1/2" x 9", 15/16" hole			
4	4	4	Tee, Dead End, medium duty			
5	1	1	Clamp, Center, Assembly			
6	4	4	1" Bolt, Machine, by req'd length			
7	8	8	7/8" Bolt, Machine, by req'd length	vx		
8	4	4	1/2" Bolt, Washer Head, by req'd length			
9	8	8	Washer, Curved, 4" sq. x 1/4", 15/16"h.			
10	4	4	Washer Nut, for 1/2" Washer Head bolt			
11	4	4	1" Locknut, MF Type			
12	8	8	7/8" Locknut, MF Type			









CENTER CLAMP
DRG. REF. 5

NOTES:

1. X-Brace length shall be suitable to accommodate the pole spacing shown on the respective transmission line structure drawings.
2. Machine bolts must pass through center of pole and fit tightly in the holes.
3. Lower holes shall be field drilled and thoroughly treated.
4. Use of X-Brace should be economically justified by the engineer.
5. Minimum number of bolts for end fittings are shown.
6. Supplier shall test the X-Brace assembly and obtain REA standard approval. Maximum capacity of the brace is 30,000 lbs. for the following maximum pole spacings:

Structure Type	Max. Pole Spacing
TM-110D	19'-6"
TM-110E	24'-6"

7. When this X-Brace is used the engineer should check the longitudinal stability of the H-frame. It is recommended that this X-Brace not be used for structures with poles of class 1 or smaller.

Reissued 03/98

MISCELLANEOUS ASSEMBLIES

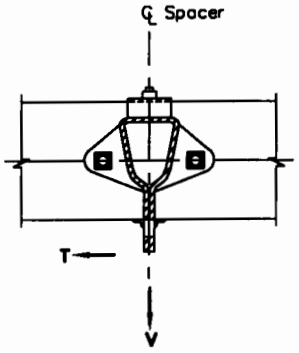
X-BRACE
(30,000 lb. MAXIMUM)

SCALE :

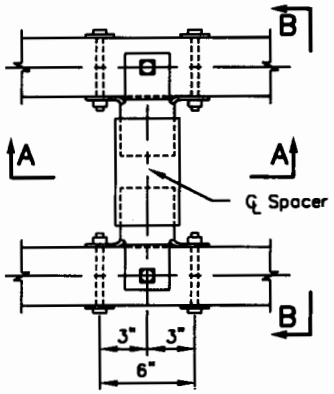
2 OF 2

TM-110D,E

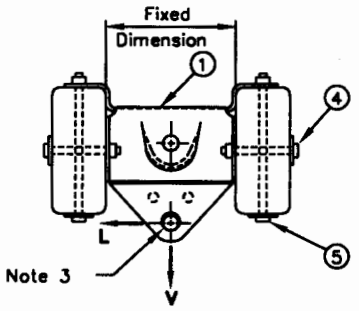
	TM-111		LIST OF MATERIALS			
DWG. REF.	A	B	DESCRIPTION	ITEM	DET.	CODE No.
1	1	–	Fixed Spacer Body			
2	–	1	Center Spacer Section			
3	–	2	End Spacer Section			
4	–	2	5/8" Bolt, hex + MF locknut			
5	4	4	5/8" Bolt Washer Head, by req'd I.			
6	2	2	1/2" Bolt, Washer Head, by req'd I.			



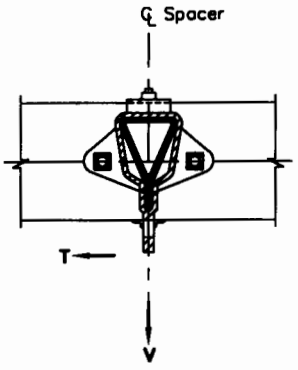
SECTION AA



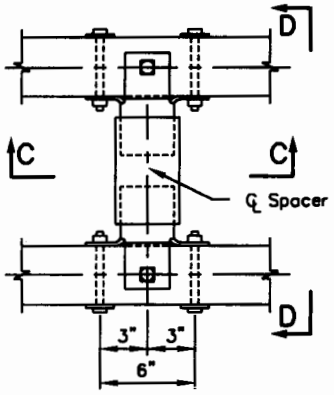
FIXED SPACER ASSEMBLY
TM-111B



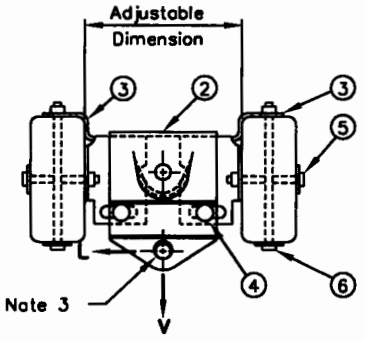
SECTION BB



SECTION CC



ADJUSTABLE SPACER ASSEMBLY
TM-111B



SECTION DD

Notes:

1. Details of hardware on typical manufacturers standard hardware providing same dimensions and strength will be acceptable.
2. Static proof hardware, threaded holes for fasteners, and washer head bolts shall be used.
3. The 1-1/4" diameter holes shall be reamed on both sides, suitable for self-locking ball hook and for insulator clearance.
* 4. Spacer Assembly shall meet the strength requirements in RUS Specifications T-7 and T-8. The spacer is to sustain the following independent ultimate loads:
   A. Vertical load - - - V = 14,000 lbs.
   B. Transverse load - - - T = 5,000 lbs.
   C. Longitudinal load - - - L = 1,400 lbs.

MISCELLANEOUS ASSEMBLIES

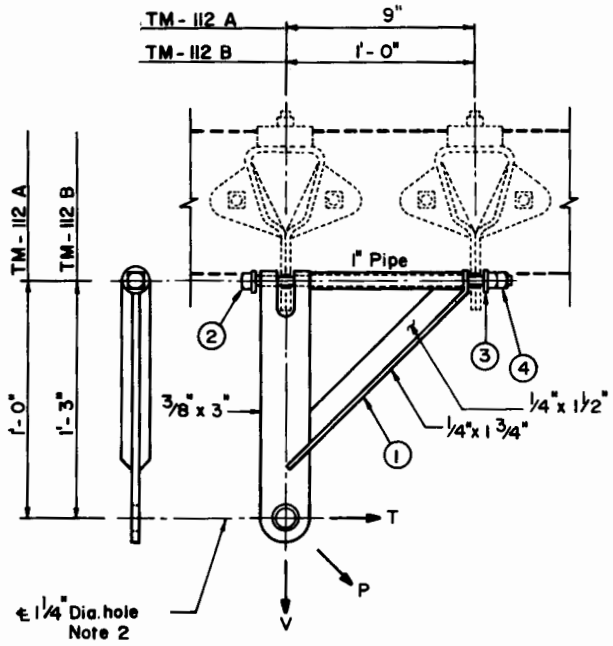
X-ARM SPACER

NO.	REVISION	DATE
1,*	Revise Note 4.	03/98

TM-111

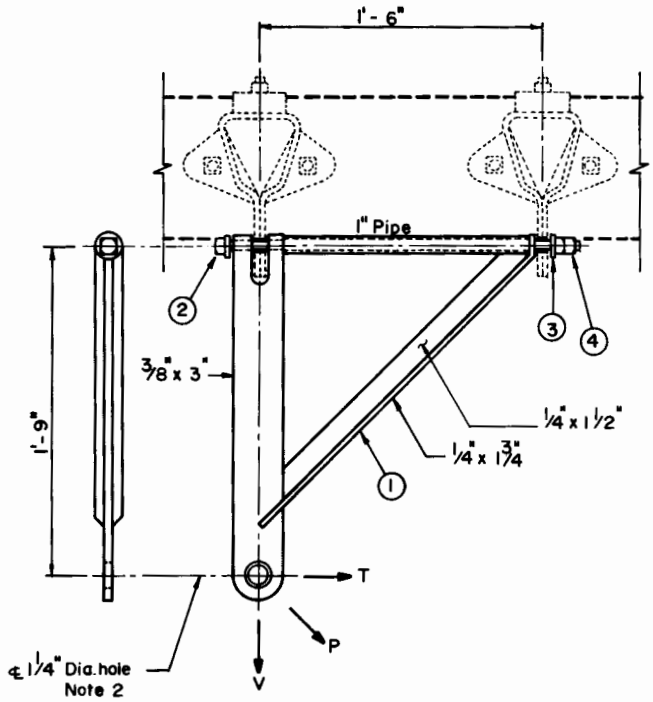
LIST OF MATERIALS

DRG. REF	DESCRIPTION	ITEM	DET.	CODE No.
1	Bracket, Welded Assembly			
2	3/4" Bolt, Washer Head			
3	Washer Nut , or std. nut			
4	3/4" Locknut			
5				



TM - 112 A

TM - 112 B



TM - 112 C

Notes:

1. The above brackets are used with spacer assemblies TM-111.
2. The 1-1/4" diameter hole shall be reamed on both sides suitable for self-locking ball hook.
3. Loads "P" and "T" also act to the left.
4. Strength limitation of swinging angle bracket assembly:
   A. Maximum vertical load - - - - - - - - - - - - - V=10,000 lbs.
   B. Maximum transverse load - - - - - - - - - - - - T= 5,000 lbs.
   C. Maximum oblique load - - - - - - - - - - - - - P=12,000 lbs.

MISCELLANEOUS ASSEMBLIES

X-ARM ANGLE BRACKET

No.	REVISION	DATE

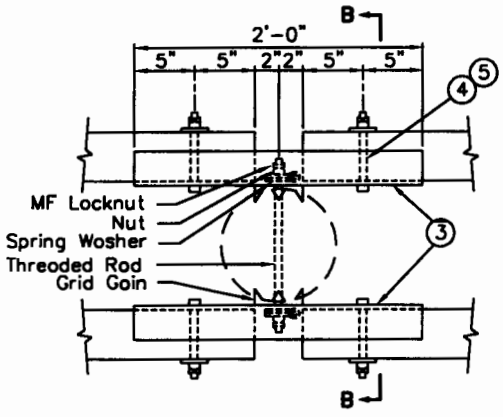
SCALE :

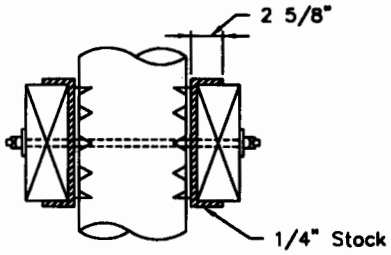
Reissued 03/98

TM-112

	TM–114		LIST OF MATERIALS			
DWG. REF.	A	B	DESCRIPTION	ITEM	DET.	CODE No.
1	–	–	Angles, Formed, from 3/8" steel plate			
2	–	–	5/8" Bolt, Mochine, by req'd length	c		
3	–	2	Channel, Formed, from 1/4" steel plate	c		
4	–	4	7/8" Bolt, Mochine, w/Washer Nut	ek		
5	–	4	7/8" Locknut, MF Type			

(For future use)
TM–114A





SECTION BB

CHANNEL SPLICE ASSEMBLY
TM–114B

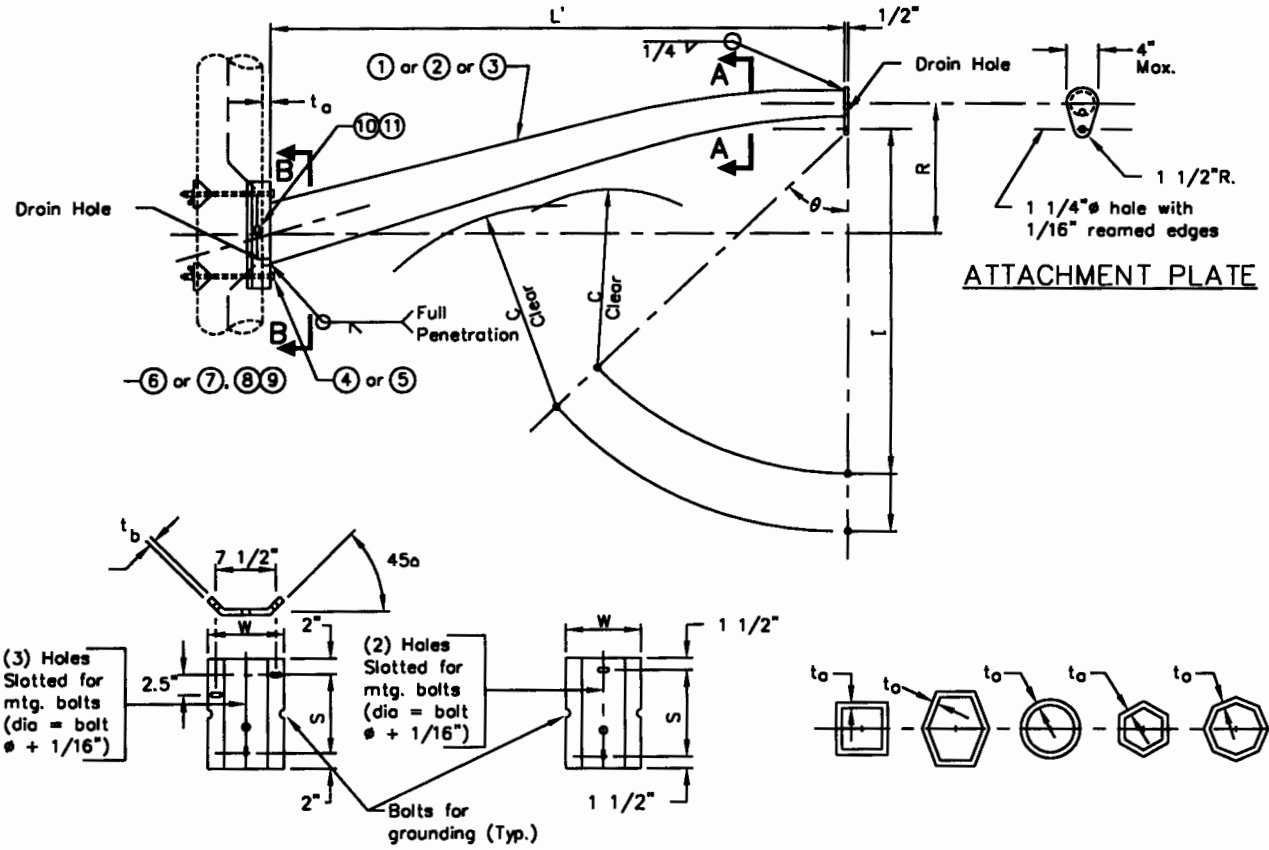
MISCELLANEOUS ASSEMBLIES

X–ARM SPLICE

NO.	REVISION	DATE
1	Remove TM–114A	03/98

TM–114

TM-115					LIST OF MATERIALS			
DWG. REF.	A	B	C		DESCRIPTION	ITEM	DET.	CODE No.
1	1	–	–		Davit Arm, light duty			
2	–	1	–		Davit Arm, medium duty			
3	–	–	1		Davit Arm, heavy duty			
4	2	–	–		3/4" Bolt, Machine, length as required	c		
5	–	2	3		1" Bolt, Machine, length as required	c		
6	2	–	–		3/4" Locknut, MF Type	ek		
7	–	2	3		1" Locknut, MF Type	ek		
8	2	2	3		Washer, Spring	ow		
9	2	2	3		Washer, Curved, 4" sq. x 1/4"	d		
10	1	1	1		5/8" Bolt, Carriage			
11	1	1	1		5/8" Clamp, Groundwire	dp		



HEAVY DUTY LIGHT & MEDIUM DUTY

SECTION B–B
(BASE PLATE DETAILS)

SECTION A–A
(TYPICAL ARMS)

NOTES:

1. For an explanation of dimensions C, l, R, S, t_b, t_a, W and θ, see Table 1.
2. Arms shall be upswept to provide the required clearance for the insulator swing conditions specified in Table 1.
3. Steel arms and plates are to withstand the following load combinations for each case without yielding or permanent set when applied at the attachment point:

		Arm Type (lbs.)		
Load Case	Maximum Loads	Light	Medium	Heavy
1	Vertical	2,000	3,100	3,500
2	Vertical	1,500	2,400	2,800
	Transverse	1,500	2,000	2,000
3	Vertical	1,000	1,750	2,000
	Transverse	450	800	900
	Longitudinal	1,000	1,500	1,500

TABLE 1 – REQUIRED DIMENSIONS AND SWING ANGLE CLEARANCES

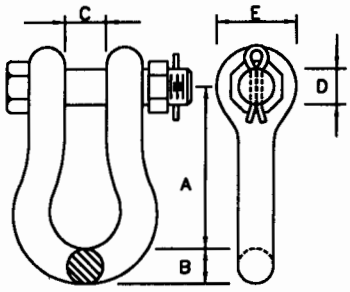
ARM CLASS		LIGHT	MEDIUM					HEAVY		
ARM	LENGTH, L', FT	4.0	5.0	4.0	5.0	6.0	7.0	8.0	9.0	7.0	8.0	9.0
	Min. t_a (in)	1/8		3/16						3/16		
	Min. R (in)	14	19	14	19	23	28	33	38	28	33	38
	Max. R (in)	22		30			38			38		
	ANGLE, θ DEG	50		45						45		
	l (in) C (in)	36/16		36/16		54/26	60/30	72/35		60/30	72/35	
MAX. VOLT (kV)		69		69		115	138	161		138	161	
BASE	MIN. t_b (in.)	1/2		5/8						5/8		
	S (in)	12		14						14		
	MIN. W (in)	9		12						12		

MISCELLANEOUS ASSEMBLIES

STEEL UPSWEPT ARM ASSEMBLY

NO.	REVISION	DATE
1,*	Add Table 1	03/98

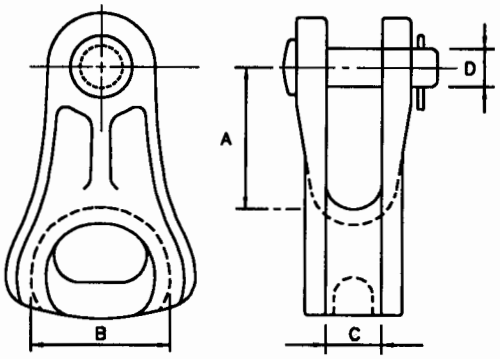
TM-115



DIMENSIONS *					
CAPACITY	A	B	C	D	E
30,000 lbs.	2 3/4"	9/16"	7/8"	3/4"	1 3/8"
40,000 lbs.					
o 50,000 lbs.	3-1/2"	7/8"	1"	7/8"	1 5/8"

* Minimun Dimensions

ANCHOR SHACKLE -Item bo



DIMENSIONS *				
CAPACITY	A	B	C	D
20,000 lbs.	1 3/4"	2 1/4"	13/16"	5/8"
40,000 lbs.	2 1/4"	2 1/4"	7/8"	3/4"
50,000 lbs.	3 1/2"	2 1/2"	1"	7/8"

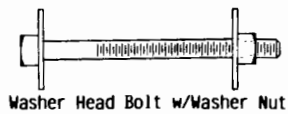
* Minimun Dimensions Nut and cotter may be included.

THIMBLE CLEVIS -Item ci

MISCELLANEOUS

HARDWARE

NO.	REVISION	DATE			
1, o	Correct dimen,bo	03/98			TM-120

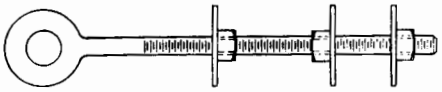


Washer Head Bolt w/Washer Nut

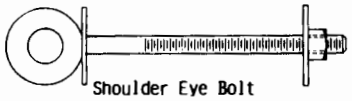
Washer Head Bolt

Machine Bolt w/Washer Nut

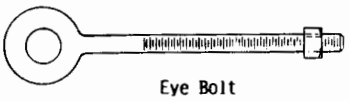
Double Arming Bolt



Double Arming Eye Bolt

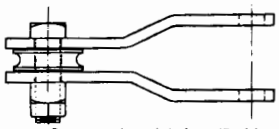


Shoulder Eye Bolt

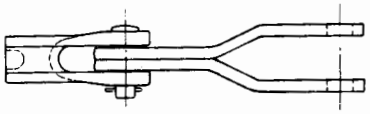


Eye Bolt

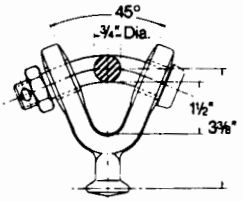
Insulator Pin

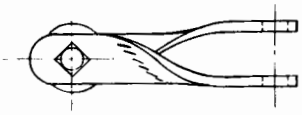


Connecting Link w/Roller

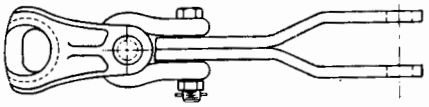


Thimble Clevis & Connecting Link





Twisted Link w/Roller



Thimble Clevis, Anchor Shackle, & Conn. Link

Ball Y-Clevis

STATIC PROOF HARDWARE		↔	EQUIVALENT STANDARD HARDWARE	
DESCRIPTION	ITEM		DESCRIPTION	ITEM
1/2" Washer Head Bolt w/Washer Nut	c		1/2" Machine Bolt & (2) 1 3/8" Round Washers, 9/16" h.	c,d
1/2" Washer Head Bolt	c		1/2" Machine Bolt & (1) 1 3/8" Round Washer, 9/16" h.	c,d
5/8" Washer Head Bolt w/Washer Nut	c		5/8" Machine Bolt & (2) 2 1/4" Sq. Flat Washers, 13/16" h.	c,d
5/8" Machine Bolt w/Washer Nut	c		5/8" Machine Bolt & (1) 2 1/4" Sq. Flat Washer, 13/16" h.	c,d
5/8" Double Arming Bolt w/(4) Washer Nuts	n		5/8" Double Arming Bolt&(4)2 1/4"Sq. Flat Washers,13/16"h.	n,d
5/8" Shoulder Eye Bolt w/Washer Nut	o		5/8" Oval Eye Bolt & (2) 2 1/4" Sq. Flat Washers,13/16" h.	o,d
5/8" Shoulder Eye Bolt	o		5/8" Oval Eye Bolt & (1) 2 1/4" Sq. Flat Washer, 13/16" h.	o,d
3/4" Insulator Pins w/Washer Nut, & Locknut	f		3/4" Insulator Pin /(1) 3" Sq. Flat Washer, Nut, Locknut	f
3/4" Double Arming Eye Bolt w/(3) Washer Nuts	dy		3/4" Double Arm'g Eye Bolt&(3)4"Sq. Flat Washer,13/16" h.	dy,d
3/4" Shoulder Eye Bolt w/Washer Nut	o		3/4" Eye Bolt & (2) 4" Sq. Flat Washer, 13/16" h.	o,d
3/4" Shoulder Eye Bolt	o		3/4" Eye Bolt & (1) 4" Sq. Flat Washer, 13/16 h.	o,d
3/4" Shoulder Eye Bolt w/Washer Nut	o		3/4" Shoulder Eye Bolt & (1) 4" Sq. Flat Washer, 13/16 h.	o,d
OTHER EQUIVALENT HARDWARE				
(2)2"x3/8" Pole Band Conn. Links,w/Roller,7/8",Bolt,Locknut		⟷	Thimble Clevis,40k,&(2)2"x3/8" Pole Band Connecting Links	c1 du
(2)2"x3/8" Pole Band Twisted Links,Roller,7/8"Bolt,Locknut		⟷	Thimble Clevis, 40k, Anchor Shackle, &	c1 bo
			(2) 2"x3/8" Pole Band Connecting Links	du
(2)3"x3/8" Pole Band Conn. Links,w/Roller,1" Bolt,Locknut		⟷	Thimble Clevis, 50k, & (2) 3"x3/8" Connecting Links	c1 du
30k Anchor Shackle w/Oval Eye Bail		⟷	30k Ball Y-Clevis	
30k Ball Hook		⟷	30k Ball Y-Clevis	

NOTES:

1. When approved by the engineer, equivalent hardware may be substituted for hardware shown on the structure drawings.
2. All hardware shall bear the manufacturers symbol or identification mark in accordance with ANSI standards.
3. Bolts and nuts assembled shall meet the strength requirements of ANSI standards.
4. Unless otherwise specified, bolts come assembled with the following number of nuts:

Machine Bolt	- 1 Nut	Oval Eye Bolt	- 1 Nut
Double Arming Eye Bolt	- 3 Nuts	Washer Head Bolt	- 1 Nut
Double Arming Bolt	- 4 Nuts	Shoulder Eye Bolt	- 1 Nut
Double End Bolt	- 2 Nuts	Threaded Rod	- 2 Nuts

5. For 5/8" bolts, a 2 1/4" square flat washer is often specified on the structure drawings. The hole for this washer is shown to have a 13/16" diameter. A 2 1/4" square flat washer with a 11/16" diameter hole can also be used.
6. Connecting links and twisted links with rollers to be used with pole bands shall exceed the designated strength of the pole band. Links and rollers shall be obtained from the same supplier as the pole bands.

Reissued 03/98

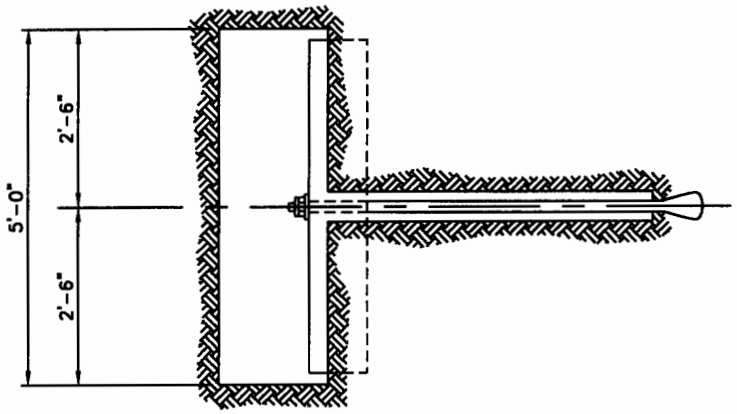
MISCELLANEOUS

INTERCHANGEABLE HARDWARE

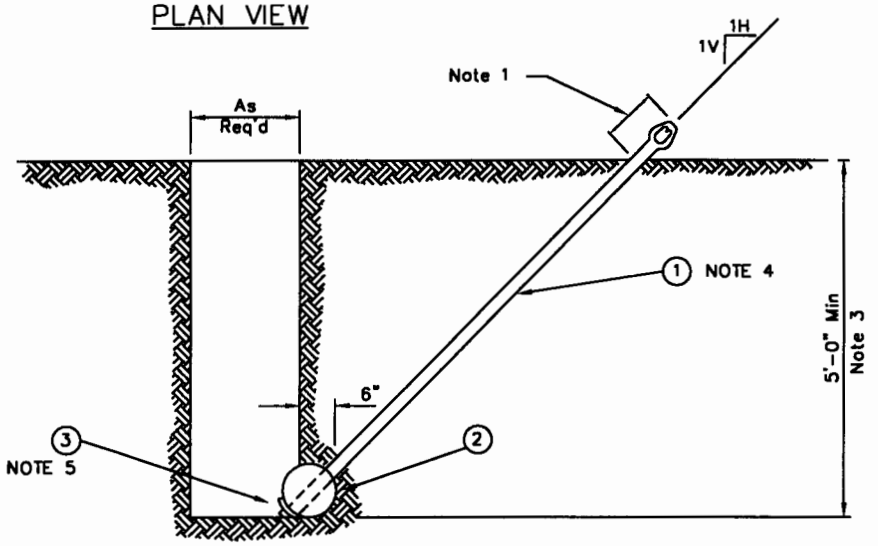
TM-121

LIST OF MATERIALS

DWG. REF.	TA- 2L	TA- *	DESCRIPTION	ITEM	DET.	CODE No.
1	1	–	Rod, Anchor, Twin eye	x		
2	1	–	Anchor, Log, 8" x 5'-0"	z		
3	1	–	Washer, Curved, 4"sq x 1/2", 13/16"hole	d		
4	–	–	Washer, Curved, 4"sq x 1/2", 1-1/16"h	d		
5						
6						



PLAN VIEW



NOTES:

1. Maximum projection after prelooding is 8 inches. Projection of onchor rods above earth may be increased to a maximum of 12 inches in cultivated fields or other locations where necessary to prevent burying of the rod eye.
2. If soil class at depth of anchor is worse than that shown, use another anchor type.
3. For guy slope of 2H:3V, minimum depth shall be 6'-0".
4. TA-2L units shall have galvanized rods and nuts. TA-2LC units shall have copperplated rods and bronze nuts.
5. The washers for the TA-2L units shall be galvanized. The washers for the TA-2LC units shall be copperplated or bronze. Aluminum alloy washers shall not be used.

LOG ANCHOR UNITS AND CAPACITIES

UNIT No.	SOIL CLASS (MIN)	ULTIMATE CAPACITY (LB)	ANCHOR ROD SIZE (DRG. REF.1)
TA-2L,2LC	5*	16,000	3/4" dia. x 8'-0" long

ANCHORS

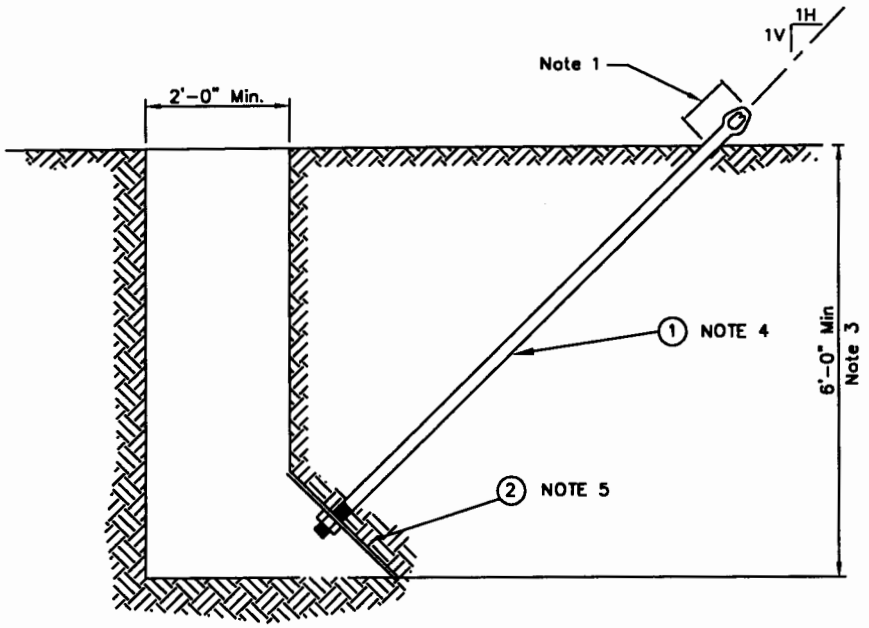
SINGLE ROD LOG ANCHOR

NO.	REVISION	DATE
1,*	Elim. TA-3L,3LC, s.c	03/98

TA-2L,2LC

LIST OF MATERIALS

DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
1	1	Rod, Anchor, Twin eye + nut	x		
2	1	Anchor, Plate	z		



TA-2P (OR) TA-3P

TA-2PC (OR) TA-3PC

NOTES:

*1. Maximum projection after loading is 8 inches. Projection of anchor rods above earth may be increased to a maximum of 12 inches in cultivated fields or other locations where necessary to prevent burying of the rod eye.

2. If soil class at depth of anchor is worse than that shown, use another anchor type.

3. For guy slope of 2H:3V, minimum depth shall be 7'-0".

4. TA-2P, 3P units shall have galvanized rods and nuts. TA-2PC, 3PC units shall have copperplated rods and bronze nuts.

5. The anchor plates for the TA-2P,3P shall be galivanized or completely coated with an ospholtum base coating. The anchor plates for TA-2PC, 3PC shall be copperplated for protection against corrosion.

6. For other requirements, refer to RUS Specification T-3.

LOG ANCHOR UNITS AND CAPACITIES

UNIT No.	SOIL CLASS (MIN)	ULTIMATE CAPACITY (LB)	ANCHOR ROD SIZE (DRG. REF.1)
TA-2P,2PC	5*	16,000	3/4" dia. x 8'-0" LONG
TA-3P,3PC	4*	24,000	1" dia. x 8'-0" LONG

ANCHORS

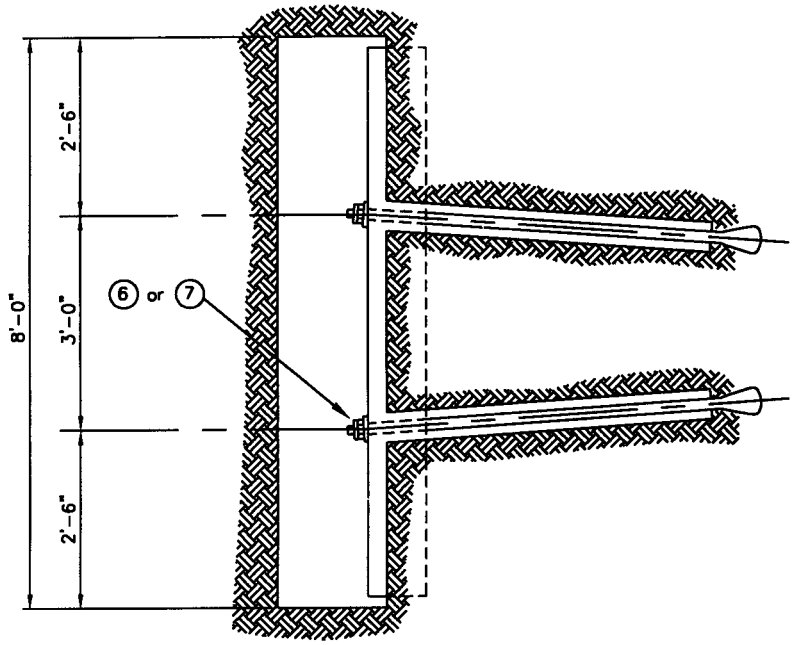
STEEL CROSS PLATE

NO.	REVISION	DATE
1.*	SOIL CLASS,NOTE 1	03/98

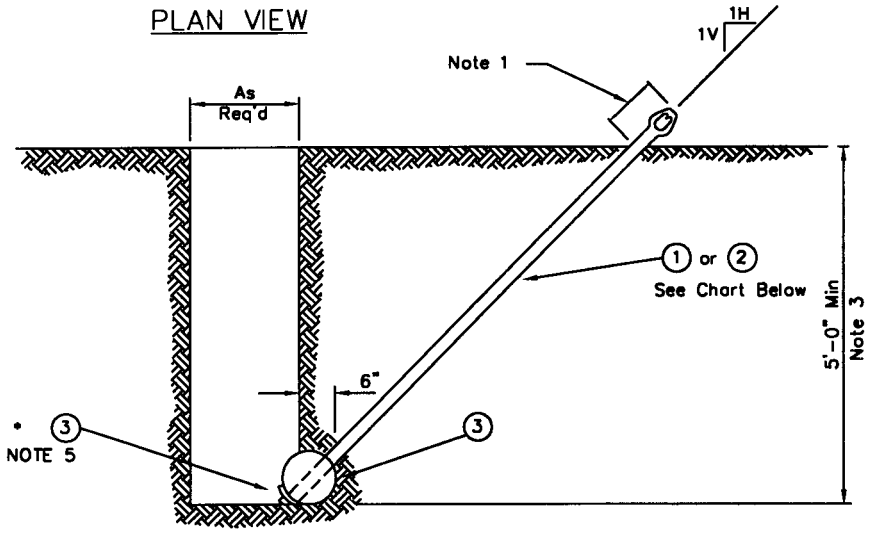
TA-2P,3P,2PC,3PC

LIST OF MATERIALS

DWG. REF.	TA- 4L	*	DESCRIPTION	ITEM	DET.	CODE No.
1	2		Rod, Anchor, Twin eye	x		
2	1		Anchor, Log, 8" x 8'-0"	z		
3	2		Washer, Curved,4"sq x 1/2",13/16"hole	d		
4	–		Washer, Curved, 4"sq x 1/2", 1-1/16"h	d		



PLAN VIEW



NOTES:

1. Maximum projection after prelooding is 8 inches. Projection of onchor rods obove earth moy be increosed to o maximum of 12 inches in cultivoted fields or other locations where necessory to prevent burying of the rod eye.
2. If soil closs ot depth of onchor is worse thon thot shown, use onother onchor.
3. For guy slope of 2H:3V, minimum depth sholl be 6'-0".
4. TA-4L units sholl hove golvonized rods ond nuts. TA-4LC units sholl hove copperplated rods ond bronze nuts.
5. The woshers for the TA-4L units shall be golvonized. The woshers for the TA-4LC units sholl be copperplated or bronze.

LOG ANCHOR UNITS AND CAPACITIES

UNIT No.	SOIL CLASS (MIN)	ULTIMATE CAPACITY (LB)	ANCHOR ROD SIZE (DRG. REF.1)
TA-4L,4LC	5*	32,000	3/4" dio. x 8'-0" long

ANCHORS

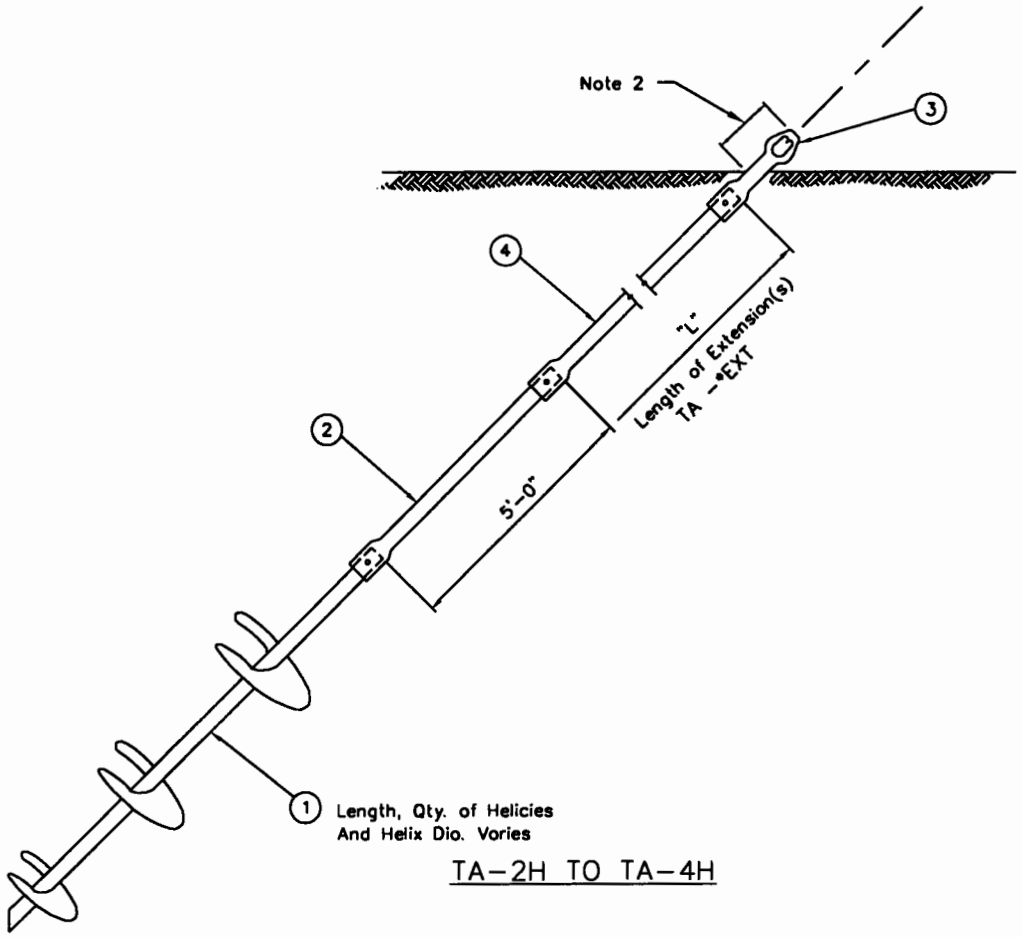
DOUBLE ROD LOG ANCHOR

NO.	REVISION	DATE
1,*	Elim. TA-5L,5LC,s.c.	03/98

TA-4L,4LC

LIST OF MATERIALS

	DWG. REF.	QTY.	DESCRIPTION	ITEM	DET.	CODE No.
	1	1	Anchor, Helix Section	z		
*	2	1	Anchor, Ext. Shaft, 5 ft, 1 1/2" sq	z		
	3	1	Adapter, Guy, Twin eye	z		
*	4		TA- * EXT			



TA-2H TO TA-4H

NOTES:

1. Appropriate anchor unit and maximum holding power shall be specified on plan and profile drawings.
2. Recommended maximum projection after preloading is 8 inches. Projection may be increased to avoid overtorquing of the shaft. Final projection shall be approved by the engineer.
3. The entire anchor assembly shall be hot dipped galvanized in accordance with ASTM A153.
4. Contractor shall install screw anchors in accordance with manfacturer's recommendations.
5. Engineer shall consult manfacturer in selection of screw anchor.
6. * Anchor rod extension shaft beyond five feet is not a part of the anchor assembly unit. The extension shaft beyond five feet is included in UNIT TA-*EXT where the "*" represents the length of the extension shaft beyond 5 feet. For example, an installation requiring two 10 ft. extension shafts would be indicated by 2(TA-10EXT)
7. * Anchors shall be installed in line with the guys.

UNITS	ANCHOR TYPE
*TA-2H	DOUBLE HELIX
*TA-3H	TRIPLE HELIX
*TA-4H	QUAD HELIX

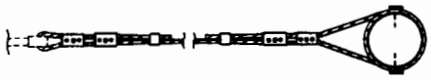
ANCHORS

POWER SCREW ANCHOR

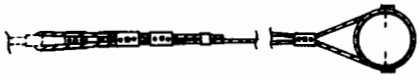
NO.	REVISION	DATE
1,*	note 6,7,itms 2,4	03/98

* TA-2H to 4H

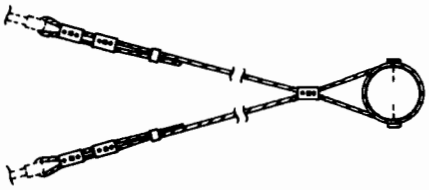
	TG-1				LIST OF MATERIALS			
DRG. REF.	A	B	C	D	DESCRIPTION	ITEM	DET.	CODE No.
1	4	5	5	4	Connector, 3 Bolt Guy Clamp, w/5/8" bolts	u		
2	2	2	2	2	Guy Clip	dz		
3	ft.	ft.	ft.	ft.	GUY WIRE	y		



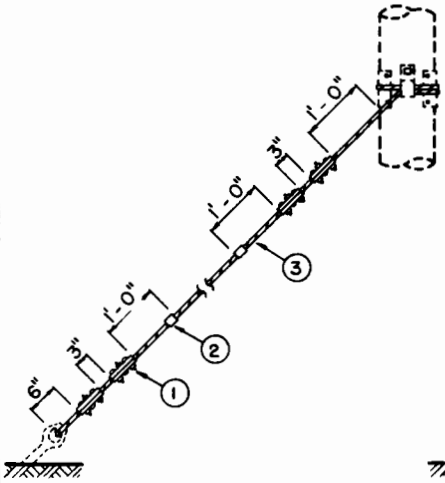
PLAN VIEW



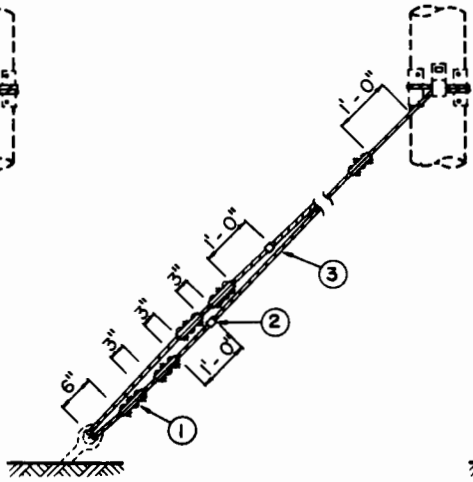
PLAN VIEW



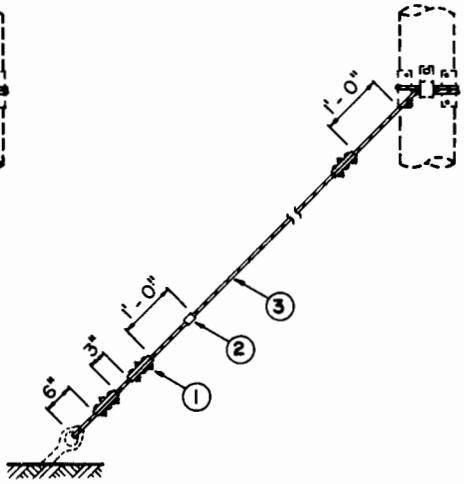
PLAN VIEW



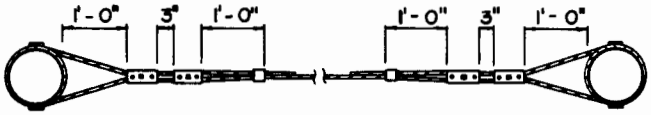
TG - 1A
SINGLE GUY TO ONE ROD



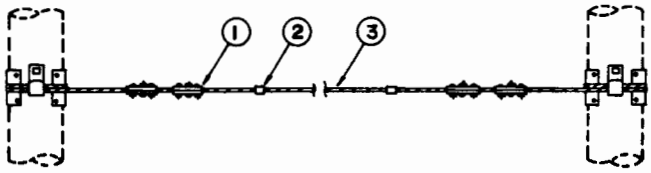
TG - 1B
OOUBLE GUY TO ONE ROD



TG - 1C
DOUBLE GUY TO TWO RODS



PLAN VIEW



TG - 1D
TWO POLE TIE

NOTES:

1. Guying assemblies are to be coordinated with light duty guy attachments TG-16.
2. The three bolt guy clamp is 6" long, heavy duty, and will accommodate 5/16" to 1/2" galvanized steel guy strand.
3. The maximum size guy strand to be used with these assemblies is 7/16".

GUYING ASSEMBLIES

WRAP

(LIGHT DUTY)

No.	REVISION	DATE

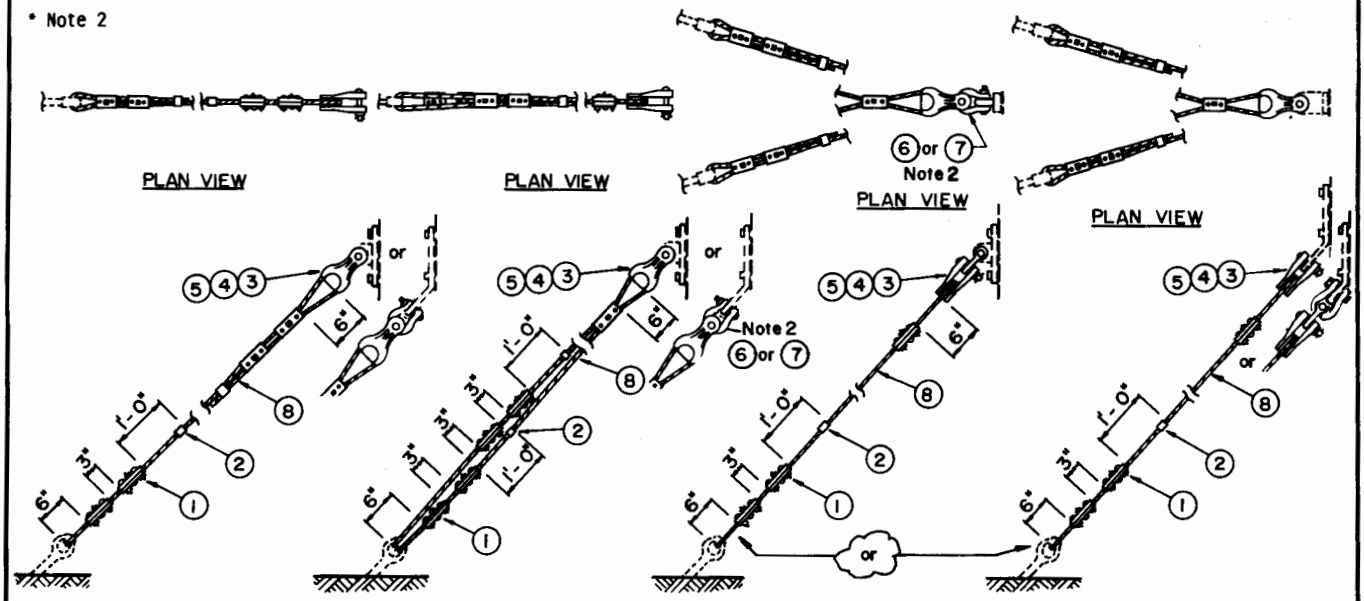
Reissued 03/98

Aug., 1986

TG-1

DRG. REF.	TG - 10 20,000 lb Max. A	B	C	D	E	TG - 20 35,400 lb Max. A	B	C	D	E	TG - 30 50,000 lb Max. A	B	C	D	E	LIST OF MATERIALS DESCRIPTION	ITEM	DET.	CODE No.
1	4	5	5	4	4	4	5	5	4	4		5	5			Connector, 3 Bolt Guy Clamp, w/5/8 bolts	u		
2	2	2	2	2	2	2	2	2	2	2		2	2			Guy Clip	dz		
3	1	1	1	2	2	-	-	-	-	-		-	-			Thimble Clevis 20,000 lb. 5/8 pin	ci		
4	-	-	-	-	-	1	1	1	2	2		-	-			Thimble Clevis 40,000 lb. 3/4 pin	ci		
5	-	-	-	-	-	-	-	-	-	-		1	1			Thimble Clevis 50,000 lb. 7/8 pin	ci		
6	•	•	1•	-	2	-	-	-	-	2		-	-			Anchor Shackle 30,000 lb. BNC	bo		
7	-	-	-	-	-	•	•	1•	-			-	1			Anchor Shackle 50,000 lb. BNC	bo		
8	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.		ft.	ft.			GUY WIRE	y		

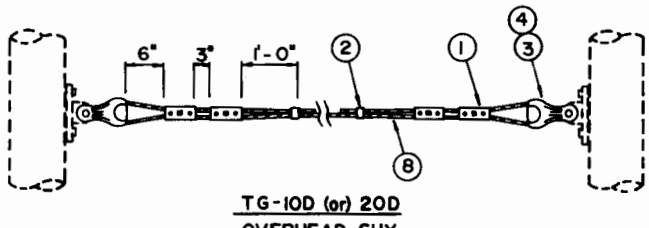
• Note 2



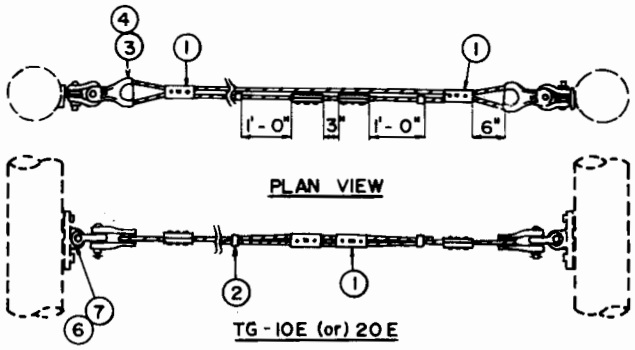
TG - 10A
TG - 20A
SINGLE GUY TO ONE ROD

TG - 10B
TG - 20B
TG - 30B
DOUBLE GUY TO ONE ROD

TG - 10C
TG - 20C
TG - 30C
DOUBLE GUY TO TWO RODS



TG-10D (or) 20D
OVERHEAD GUY



TG-10E (or) 20E
OVERHEAD GUY

NOTES:

1. Guying assemblies are to be coordinated with the guy attachments. For example, if medium duty guy attachments are specified on the structure drawings, then medium duty guying assemblies are to be used.
2. Anchor shackles may be required to orientate the guy assembly to the guy attachment. If guy slopes are other than 1/1 add an anchor shackle when connecting the thimble clevis to a bent plate.
3. The capacity of a guy assembly is limited by either the strength of the guy strand or hardware. When aluminum clad guy strand is used, the capacity of guy assembly should be limited to 80% of the rated breaking strength of the guy strand. The strength limitation for TG-10D&E is 15,000 lbs; for TG-20D&E, 25,000 lbs.
4. The maximum size guy strand to be used with these assemblies is 7/16" E.H.S. galvanized steel or 20 M. aluminum clad steel strand. The three bolt guy clamp is 6" long, heavy duty, and will accommodate a minimum size guy strand of 5/16"
5. Assembly "C" is for normal guying. Do not use for spread guying.

GUYING ASSEMBLIES

THREE BOLT CLAMP WITH THIMBLE CLEVIS

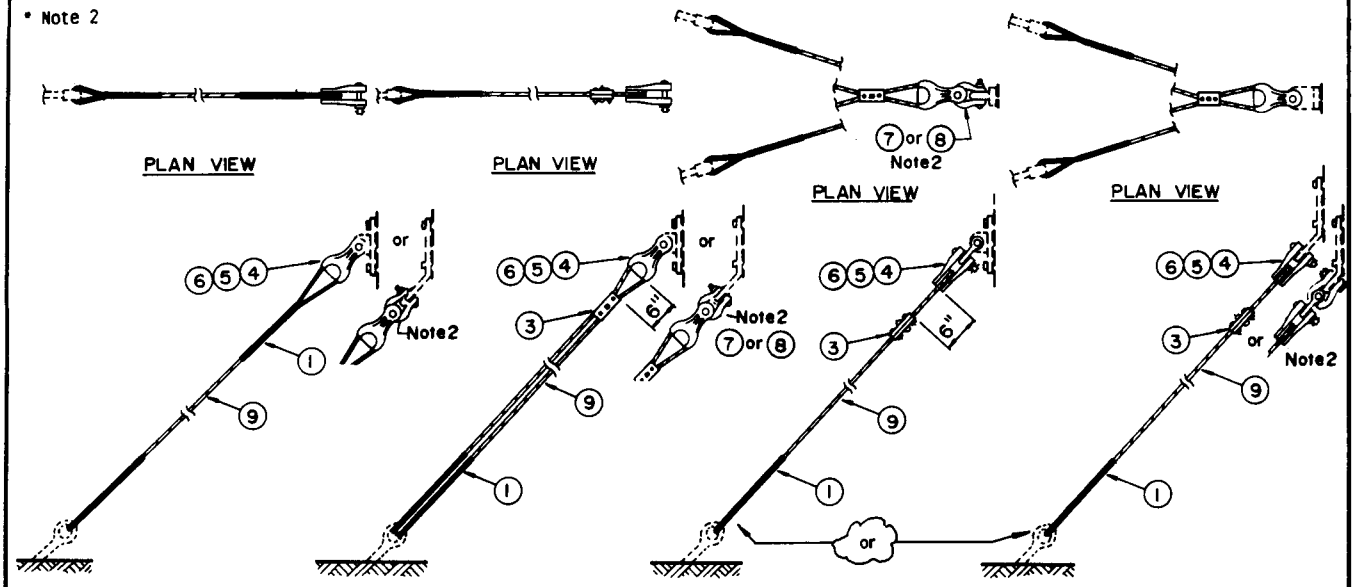
Reissued 03/98

NO.	REVISION	DATE

TG-10, 20, 30

DRG. REF.	TG - 11 20,000 lb Max. A	B	C	D	E	TG - 21 35,400 lb Max. A	B	C	D	E	TG - 31 50,000 lb Max. A	B	C	D	E	LIST OF MATERIALS DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	2	2	-	2	2	2	2	-		2	2			Deadend, Factory Formed	u		
2	-	-	-	-	1	-	-	-	-	1		-	-			Splice, Factory Formed			
3	-	1	1	-	2	-	1	1	-	2		1	1			Connector, 3 Bolt Guy Clamp, w/5/8 bolts	u		
4	1	1	1	2	2	-	-	-	-	-		-	-			Thimble Clevis 20,000 lb. 5/8 pin	ci		
5	-	-	-	-	-	1	1	1	2	2		-	-			Thimble Clevis 40,000 lb. 3/4 pin	ci		
6	-	-	-	-	-	-	-	-	-	-		1	1			Thimble Clevis 50,000 lb. 7/8 pin	ci		
7	*		]*	-	2	-	-	-	-	2		-	-			Anchor Shackle 30,000 lb.	bo		
8	-	-	-	-	-	*	*	1*	-			-	1			Anchor Shackle 50,000 lb.	bo		
9	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.		ft.	ft.			GUY WIRE	y		

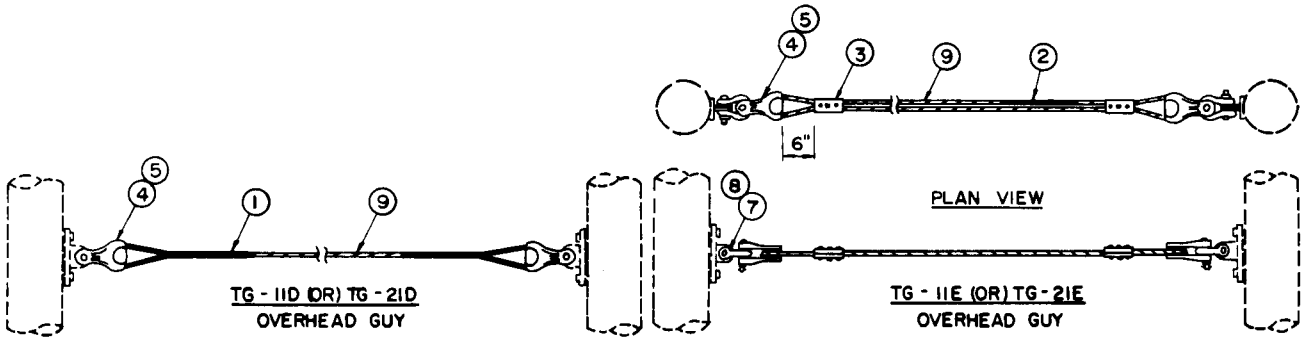
* Note 2



TG - 11 A
TG - 21 A
TG - 31 A
SINGLE GUY TO ONE ROD

TG - 11 B
TG - 21 B
TG - 31 B
DOUBLE GUY TO ONE ROD

TG - 11 C
TG - 21 C
TG - 31 C
DOUBLE GUY TO TWO RODS



TG - 11D (OR) TG - 21D
OVERHEAD GUY

TG - 11E (OR) TG - 21E
OVERHEAD GUY

NOTES:

1. Guying assemblies are to be coordinated with the guy attachments. For example, if medium duty guy attachments are specified on the structure drawings, then medium duty guying assemblies are to be used.
2. Anchor shackles may be required to orientate the guy assembly to the guy attachment. If guy slopes are other than 1/1 add an anchor shackle when connecting the thimble clevis to a bent plate.
3. The capacity of a guy assembly is limited by either the strength of the guy strand or the hardware. The strength limitation for TG-11D&E is 15,000 lbs.; for TG-21D&E, 25,000 lbs.
4. Type "C" Guy Assembly is for normal guying. Do not use for spread guying.

GUYING ASSEMBLIES

FACTORY FORMED WITH THIMBLE CLEVIS

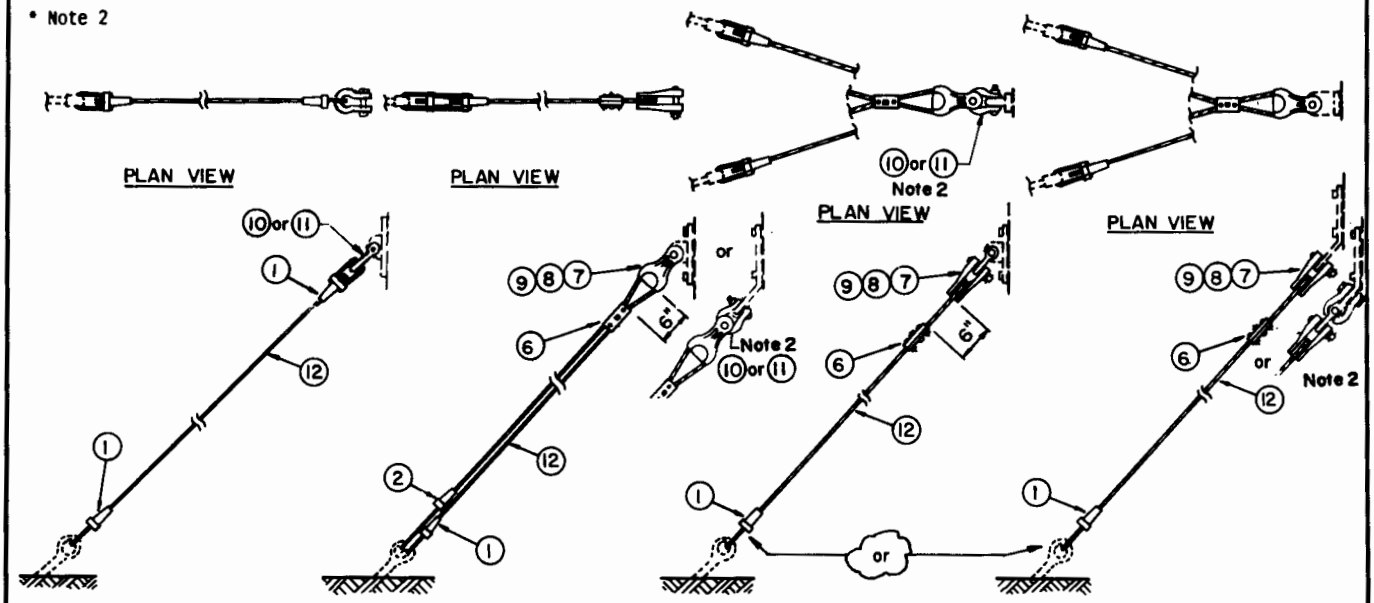
No.	REVISION	DATE

Reissued 03/98

TG-11, 21, 31

	TG - 12 20,000 lb Max.					TG - 22 35,400 lb Max.					TG - 32 50,000 lb Max.								
DRG. REF.	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	DESCRIPTION	ITEM	DET.	CODE No.
1	2	1	2	-	-	2	1	2	-	-		1	2			Deadend, Automatic, short bail	u		
2	-	1	-	-	-	-	1	-	-	-		1	-			Deadend, Automatic, long bail	u		
3	-	-	-	-	-	-	-	-	-	-		-	-			Deadend, Automatic, Clevis Type	u		
4	-	-	-	2	-	-	-	-	2	-		-	-			Deadend, Factory Formed	u		
5	-	-	-	-	1	-	-	-	-	1		-	-			Splice, Factory Formed			
6	-	1	1	-	2	-	1	1	-	2		1	1			Connector, 3 Bolt Guy Clamp, w/5/8 bolts	u		
7	-	1	1	2	2	-	-	-	-	-		-	-			Thimble Clevis 20,000 lb. 5/8 pin	ci		
8	-	-	-	-	-	-	1	1	2	2		-	-			Thimble Clevis 40,000 lb. 3/4 pin	ci		
9	-	-	-	-	-	-	-	-	-	-		1	1			Thimble Clevis 50,000 lb. 7/8 pin	ci		
10	1	*	1	-	2	-	-	-	-	2		-	-			Anchor Shackle 30,000 lb. BNC	bo		
11	-	-	-	-	-	1	*	1	-			-	1			Anchor Shackle 50,000 lb. BNC	bo		
12	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.		ft.	ft.			GUY WIRE	y		

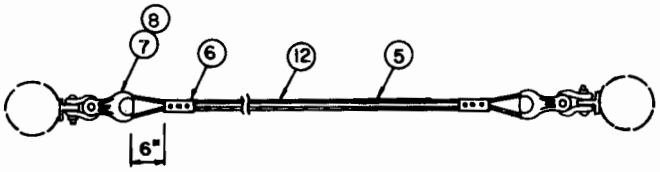
* Note 2

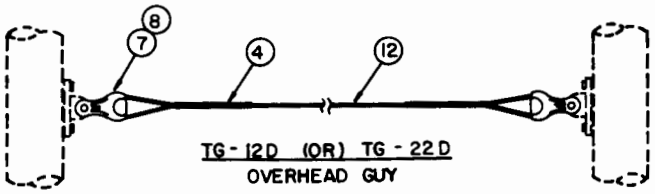


TG - 12A
TG - 22A
SINGLE GUY TO ONE ROD

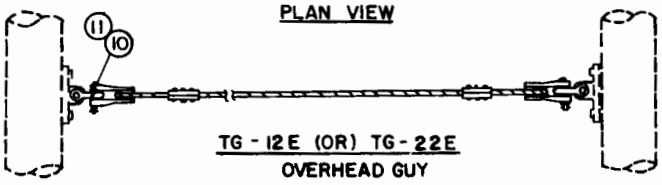
TG - 12B
TG - 22B
TG - 32B
DOUBLE GUY TO ONE ROD

TG - 12C
TG - 22C
TG - 32C
DOUBLE GUY TO TWO RODS





TG - 12D (OR) TG - 22D
OVERHEAD GUY



TG - 12E (OR) TG - 22E
OVERHEAD GUY

NOTES:

1. Guying assemblies are to be coordinated with the guy attachments. For example, if medium duty guy attachments are spedified on the structure drawings, then medium duty guying assemblies are to be used.
2. Anchor shackles may be required to orientate the guy assembly to the guy attachment. If guy slopes are other than 1/1 add an anchor shackle when connecting the thimble clevis to a bent plate.
3. The capacity of a guy assembly is limited by either the strength of the guy strand or the hardware. The strength limitation for TG-12D&E is 15,000 lbs.; for TG-22D&E, 25,000 lbs.
4. Type "C" Guy Assembly is for normal guying. Do not use for spread guying.

GUYING ASSEMBLIES

AUTOMATIC WITH THIMBLE CLEVIS

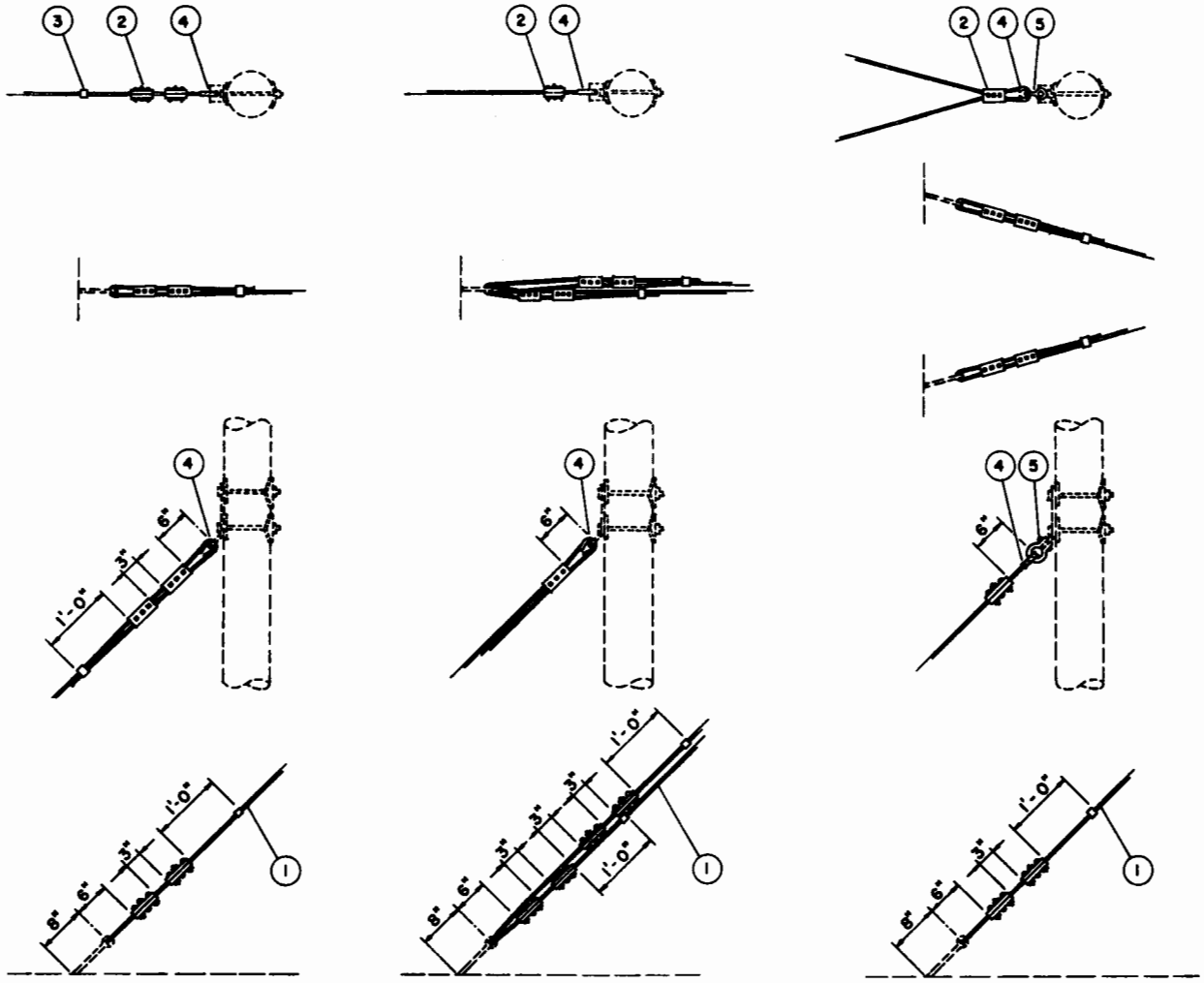
Reissued 03/98

NO.	REVISION	DATE

TG-12,22,32

TG - 14

DRG. REF.	A	B	C	D	E	DESCRIPTION	ITEM	DET.	CODE No.
1	ft.	ft.	ft.	ft.		GUY WIRE, See Construction Spec.	y		
2	4	5	5	4		Connector, 3 Bolt Guy Clamp, 5/8" Bolts	u		
3	2	2	2	2		Guy Clip	dz		
4	1	1	1	2		Guy Thimble, Heavy Duty			
5	-	-	1	-		Anchor Shackle, 30,000 lbs.	bo	NOTE 1	



SINGLE GUY

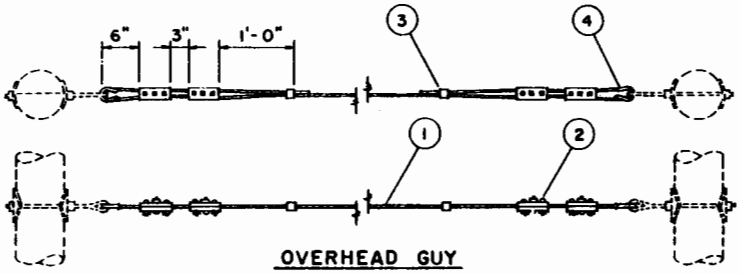
TG-14A

DOUBLE GUY TO ONE ROD

TG-14B

DOUBLE GUY TO TWO RODS

TG-14C



OVERHEAD GUY

TG-14D

NOTES:

1. Use an anchor shackle to attach the guy thimble to a pole eye plate.
2. Assembly "C" is for normal guying. Do not use for spread guying.

GUYING ASSEMBLIES

GUY THIMBLE

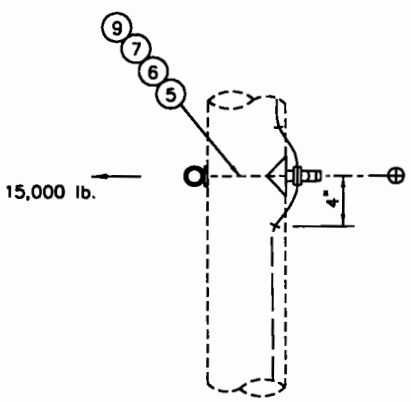
REVISION	DATE

Reissued 03/98

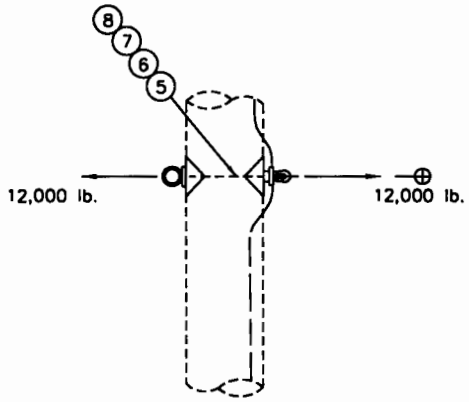
TG-13

DWG. REF.	TG – 15 A	B	C	D	E	–	DESCRIPTION	ITEM	DET.	CODE No.
1	–	–	1	1	–	–	Plate, Guying, light duty, 5/8" x 3"	fv		
2	–	–	–	–	2	–	Tee, Deadend & Guying	fv		
3	–	–	2	2	4	–	Grid Gain, 4"x4", 15/16" hole	bl		
4	–	–	2	1	2	–	3/4" Bolt, Machine, by req'd length	c		
5	1	1	–	1	–	–	3/4" Bolt, Shoulder Eye, by req'd lgth	o		
6	1	2	2	1	–	–	Washer, Curved, 4"sq.x1/4",13/16"hole	d		
7	1	1	1	1	1	–	3/4" Clamp, Groundwire + 1 nut	dp		
8	–	1	–	–	–	–	3/4" Nut Eye	aa		
9	1	–	2	2	2	–	3/4" Locknut, MF Type	ek		
10	–	–	1	–	–	–	Connector, Compression	p		

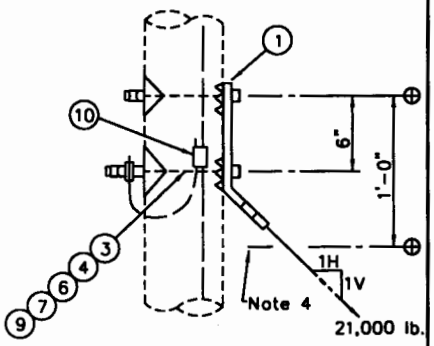
LIST OF MATERIALS



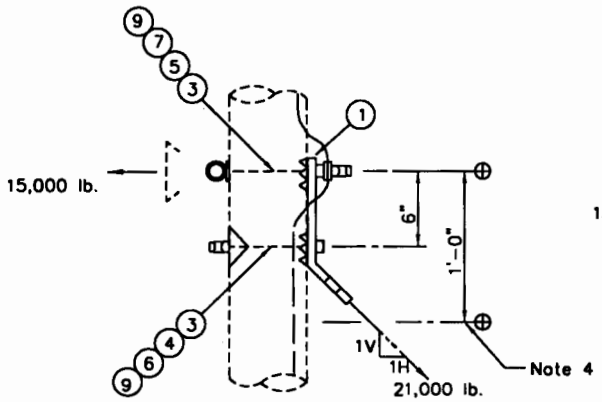
TG–15A



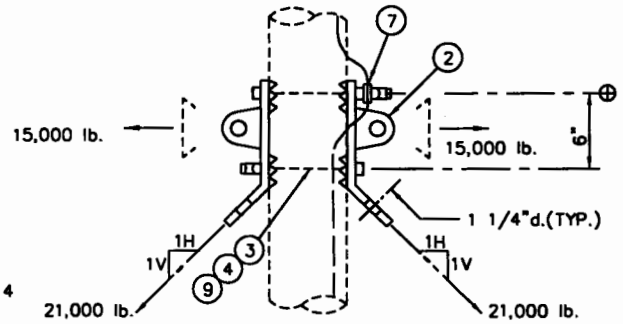
TG–15B



TG–15C



TG–15D



TG–15E

NOTES

1. The indicated loads are design maximum.
2. For guy slopes more than 1V to 1H the maximum vertical capacity should not exceed 15,000 lbs.
3. Do not use TG–15B for conductor double deadends.
4. The lower work points (⊕) are for locations where two guy attachments are required.
5. When there is no pole groundwire or when the pole groundwire is stood off from the pole, items 7 & 10 are not required.
6. Dimensions of the guying attachments shall accomodate light duty guying assemblies.
7. Item 10, compression connector, may not be necessary depending on the location of the pole ground shown on the structure drawings.
8. For poles other than Douglas Fir or SYP, the capacity should be derated.

GUY ATTACHMENTS

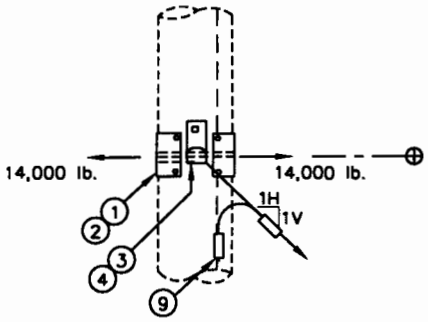
LIGHT DUTY GUY PLATE

NO.	REVISION	DATE
1, *	Dwg Ref 1,2;note 8	03/98

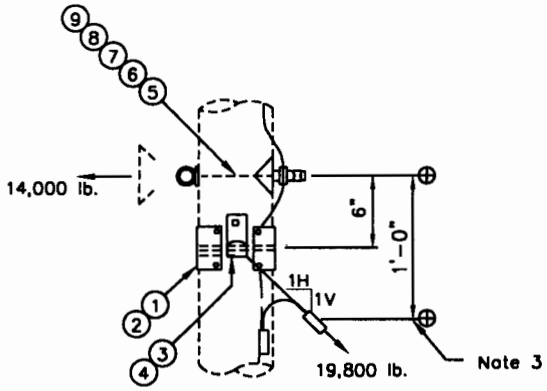
TG–15

DWG. REF.	TG-16 ABC	D	E		DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	2		Guy plate, Strain, 4" x 8" 14 ga	bk		
2	8	8	8		8 d Nails, galvanized	–		
3	2	2	2		Hook, Guy	bj		
4	2	2	2		1/2" x 4" Screw, Lag	j		
5	–	1	2		3/4" Bolt, Shoulder Eye, by req'd	o		
6	–	1	2		Washer, Curved, 4"sq x1/4",13/16"hole	d		
7	–	1	2		3/4"Locknut, MF Type	ek		
8	–	1	2		3/4" Clamp, Groundwire + 1 nut	ek		
9	2	2	2		Connector, Compression	p		

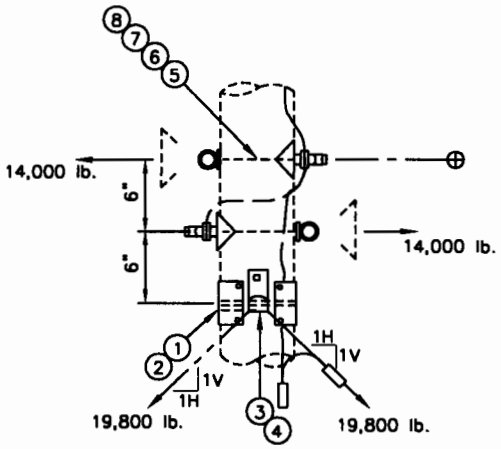
LIST OF MATERIALS



TG-16A,B,C



TG-16D



TG-16E

NOTES:

1. The indicated loads are design maximum.
2. The capacity for the wrap guy is for Douglas Fir and SYP. For western red cedar derate the capacity.
3. The lower work point (⊕) on TG-16D is for large angle deadend structures where two TG-16D are required.
4. When installing, the wrap should be placed below the head of the lag screw.
5. Where there is no pole groundwire or the pole groundwire is stood off from the pole, item 8 is not required.

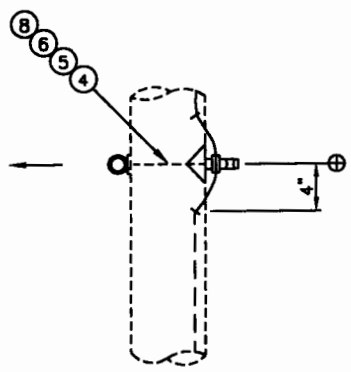
GUY ATTACHMENTS

LIGHT DUTY WRAPPED

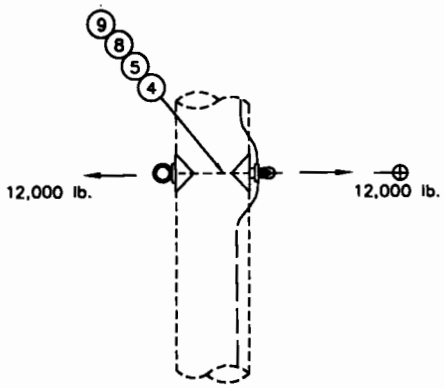
NO.	REVISION	DATE
1. *	Item 9 added	03/98

TG-16

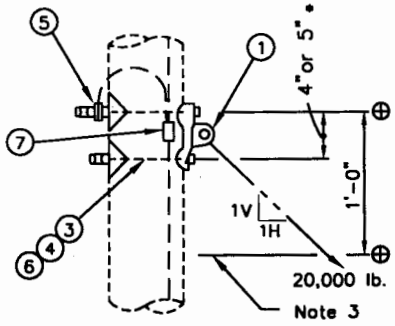
DWG. REF.	TG-17 A	B	C	D	E		LIST OF MATERIALS DESCRIPTION	ITEM	DET.	CODE No.
1	–	2	1	1	–		Plate, Pole Eye, light duty	fv		
2	–	–	–	–	2		Plate, Pole Eye, Double, light duty	fv		
3	–	2	2	1	2		3/4" Bolt, Machine, by req'd length	c		
4	1	–	2	–	–		Washer, Curved,4"sq x1/4",13/16" hole	d		
5	1	1	1	1	1		3/4" Clamp, Groundwire + 1 nut	dp		
6	1	2	2	2	2		3/4" Lock MF Type	ek		
7	–	–	1	–	–		Connector, Compression	p		
8	1	–	–	1	–		3/4" Bolt, Shoulder Eye, by req'd l.			
9	–	1	–	–	–		3/4" Nut, Eye	oo		
10	–	–	–	–	2		Anchor, shackle, 30,000 lbs.	bo		



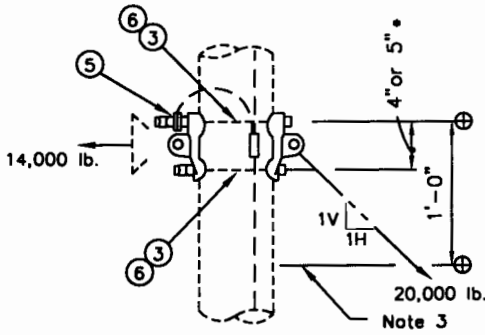
TG-17A



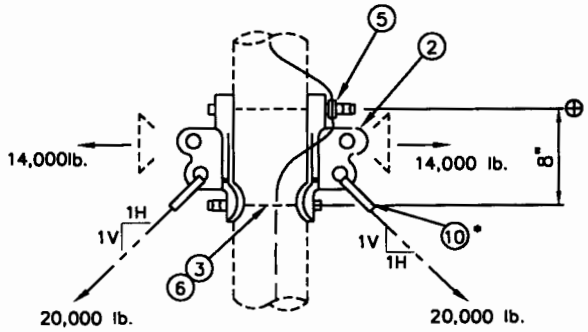
TG-17B



TG-17C*



TG-17D*



TG-17E*

NOTES:

1. The indicated loads are design maximum.
2. For guy slopes more than 1V to 1H, the maximum vertical capacity should not exceed 15,000 lbs.
3. The lower work points (⊕) are for locations where two guy attachments are required.
4. When there is no pole groundwire or the groundwire is stood off from the pole,items 5 and 7 are not required.
- * 5. Dimensions of the single eye guying attachments shall accommodate light duty guying assemblies.
6. Item 7, compression connector, may not be necessary depending on the pole location of the pole groundwire shown on the structure drawings.
- * 7. Do not deodend conductors to TG-17A or 17B.

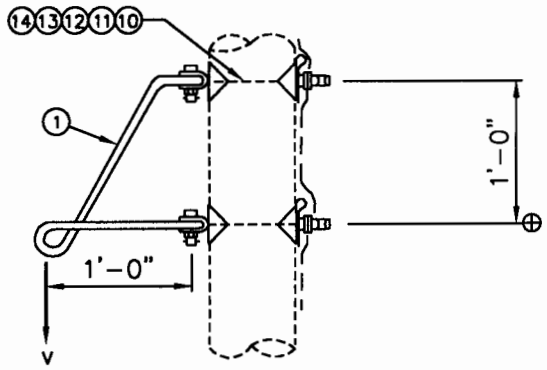
GUY ATTACHMENTS

LIGHT DUTY POLE EYE PLATES

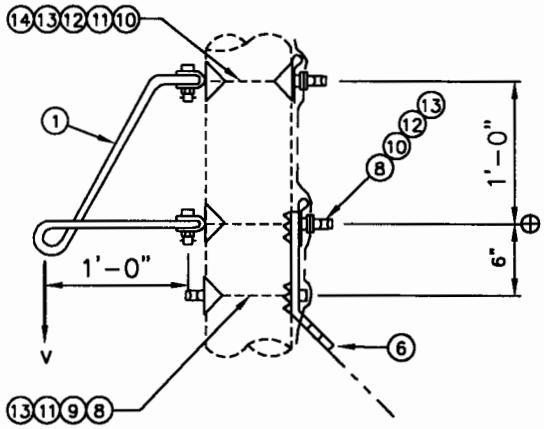
NO.	REVISION	DATE
1. *	17B,D,E,notes 5,7	3/98

TG-17

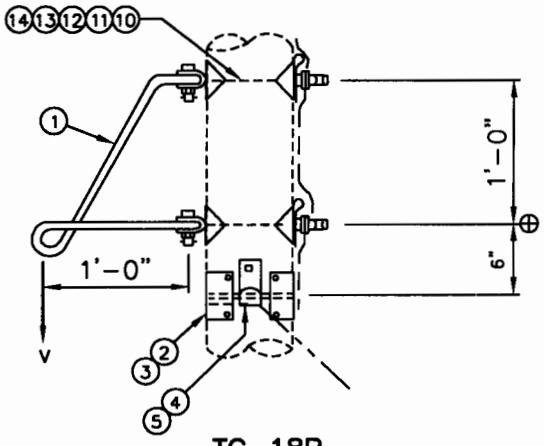
	TG-18				LIST OF MATERIALS			
DWG. REF.	18	18A	18B	18C	DESCRIPTION	ITEM	QET.	CODE No.
1	1	1	1	1	Bracket, Swinging Angle, 3/4" bar	cr		
2	–	–	2	–	Guy Plate, Strain, 4" x 8" x 14 Ga.	bk		
3	–	–	8	–	8d Nails, galvanized	–		
4	–	–	2	–	Hook, Guy	bl		
5	–	–	2	–	1/2" x 4" Screw, Lag	j		
* 6	–	1	–	–	Plate, Guying, light duty, 5/8" x 3"	fv		
* 7	–	–	–	1	Plate, Pole Eye	fv		
8	–	2	–	–	Grid Gain, 4" x 4", 15/16" hole	bl		
9	–	1	–	1	3/4" Bolt, Machine, by req'd length	c		
10	2	2	2	2	3/4" Bolt, Clevis, by req'd length	ef		
* 11	4	4	4	4	Washer, Curved, 4"sq x1/4",13/16"hole	d		
12	2	2	2	2	3/4" Clamp, Groundwire + 1 nut	dp		
13	2	3	2	3	3/4" Locknut, MF Type	ek		
14	2	2	2	2	Washer, Spring, 13/16" h.	ow		



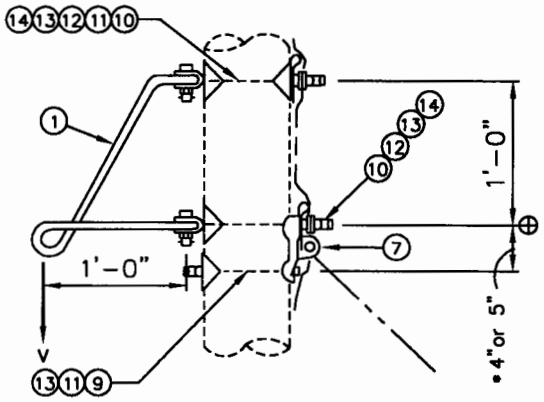
TG–18



TG–18A



TG–18B



TG–18C

NOTES:

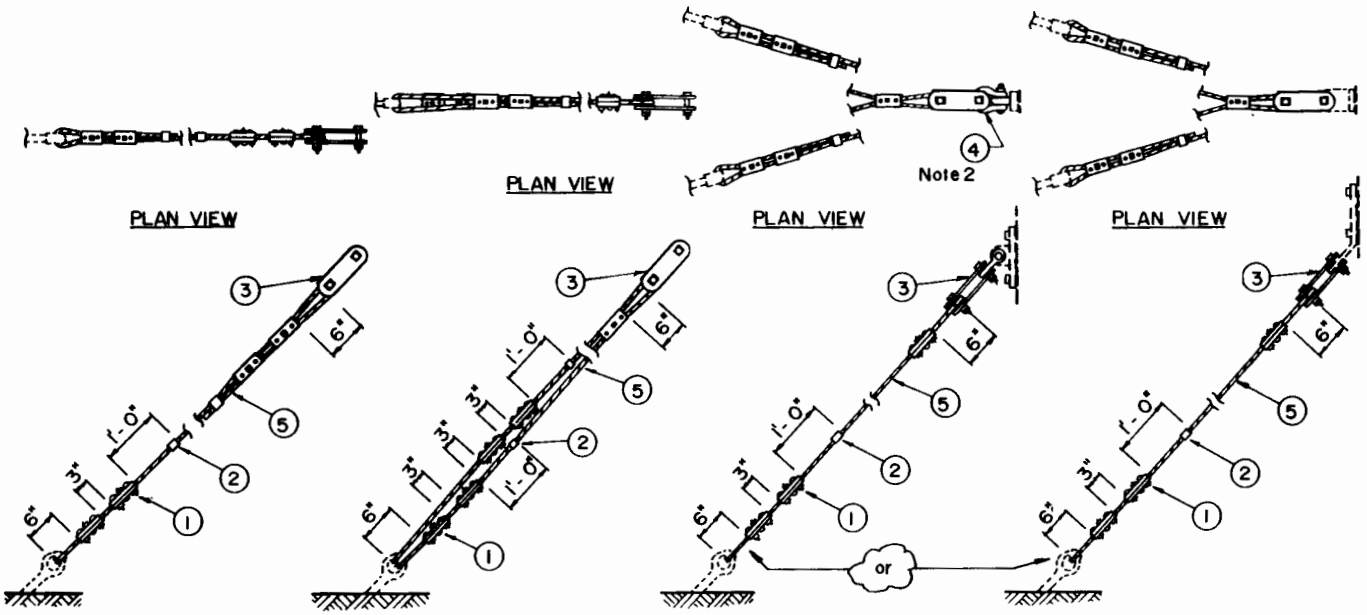
1. The maximum vertical load of the swing angle bracket is 2,500 lbs. The allowable vertical load is 1250 lbs.
2. For, other requirements, see RUS Specification DT–4.

BRACKET AND GUY ATTACHMENTS

LIGHT DUTY, ONE FOOT BRACKET

NO.	REVISION	DATE	TG–18
1, *	Itms6,7,11,note 1	03/98	

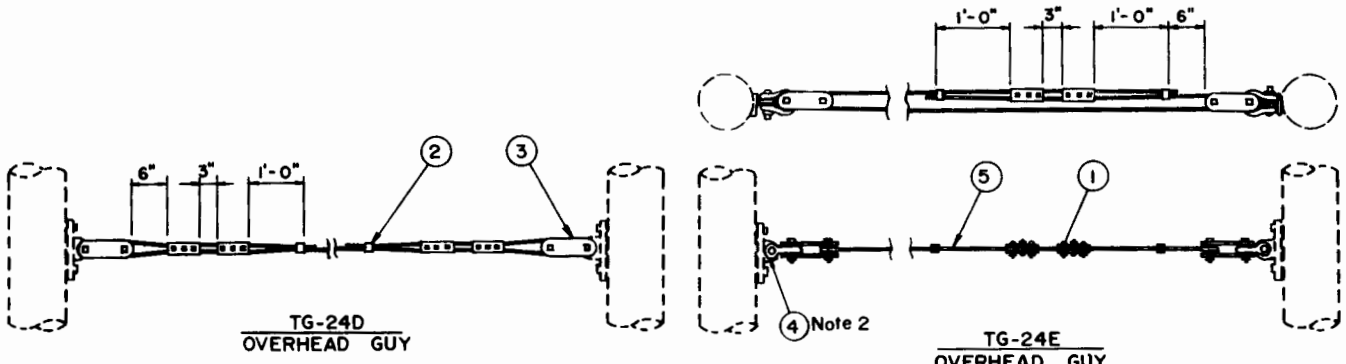
	TG - 24 (35,400 lbs. max.)					LIST OF MATERIALS			
DRG. REF.	A	B	C	D	E	DESCRIPTION	ITEM	DET.	CODE No.
1	4	5	5	4	2	Connector,3 Bolt Guy Clamp,w5/8" bolt	u		
2	2	2	2	2	2	Guy Clip	dz		
3	1	1	1	2	2	Guy Link, Type 1		TG-92	
4	-	-	-	-	1	Anchor Shackle, 50,000 lbs.	bo		
5	ft.	ft.	ft.	ft.	ft.	GUY WIRE	y		
6									



TG-24A
SINGLE GUY TO ONE ROD

TG-24B
DOUBLE GUY TO ONE ROD

TG-24C
DOUBLE GUY TO TWO RODS



TG-24D
OVERHEAD GUY

TG-24E
OVERHEAD GUY

NOTES:

1. Guying assemblies are to be coordinated with the guy attachments. For example, if medium duty guy attachments are specified on the structure drawings, then medium duty guying assemblies are to be used.
2. Anchor shackles may be required for orientating the guy assembly to the guy attachments for Assembly "C" and "E".
3. The maximum size guy strand to be used with these assemblies is 7/16" E.H.S. galvanized steel or 20 M aluminum clad steel strand. The three bolt guy clamp is 6" long, heavy duty, and will accommodate a minimum size guy strand of 5/16".
4. The capacity of a guy assembly is limited by either the strength of the guy strand or hardware. When aluminum clad guy strand is used, the capacity of the guy assembly should be limited to 80% of the rated breaking strength of the guy strand. The strength limitation of the TG-24D&E is 25,000 lbs.
5. An anchor shackle may be required to attach the Link Assembly to the Deadend and Guying Pole Eye Plate, TG-27E.
6. Assembly "C" is for normal guying. Do not use for spread guying.

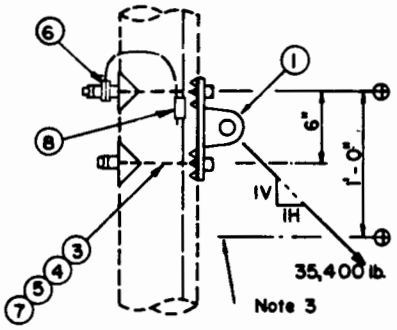
GUYING ASSEMBLIES

GUY LINK
(MEDIUM DUTY)

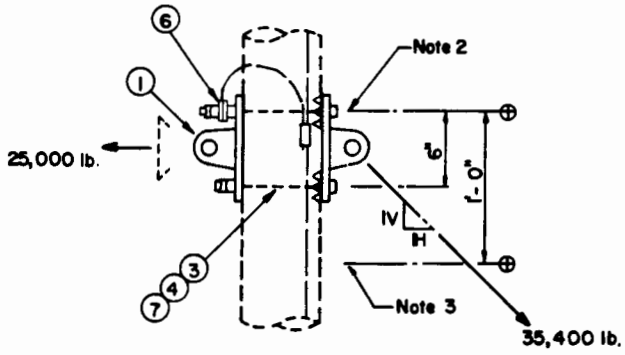
Reissued 03/98

TG-24

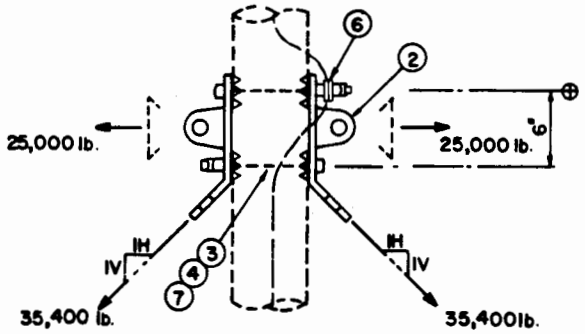
	TG - 25					LIST OF MATERIALS			
DRG. REF.	A	B	C	D	E	DESCRIPTION	ITEM	DET.	CODE No.
1			1	2	-	Tee, Deadend, medium duty	fv		
2			-	-	2	Tee, Deadend & Guying, medium duty	fv		
3			2	2	4	Grid Gain, 4" x 4", 15/16" hole	bi		
4			2	2	2	7/8" Bolt, Machine, by req'd length	c		
5			2	-	-	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
6			1	1	1	7/8" Clamp, Groundwire + 1 nut	dp		
7			2	2	2	7/8" Locknut, MF Type	ek		
8			1	1	-	Connector, Compression	p		



TG - 25 C



TG - 25 D



TG - 25 E

NOTES:

1. The indicated loads are design maximum.
2. For guy slopes more than 1V to 1H the maximum vertical capacity should not exceed 25,000 lbs.
3. The lower work points (⊕) are for locations where two guy attachments are required.
4. When there is no pole groundwire or the groundwire is stood off from the pole, items 6 & 8 are not required.
5. Dimensions of the guying attachments shall accommodate medium duty guying assemblies.
6. Item 8, compression connector, may not be necessary depending on the location of the pole ground shown on the structure drawings.

GUY ATTACHMENTS

MEDIUM DUTY GUYING TEES

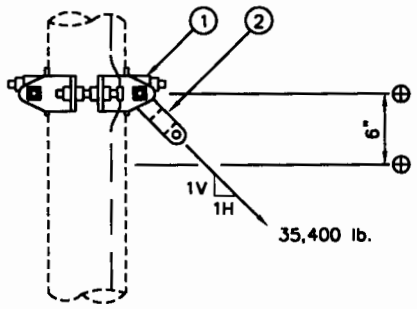
NO	REVISION	DATE

Reissued 03/98

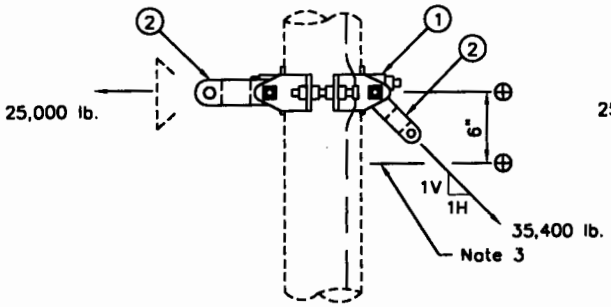
Aug., 1986

TG-25

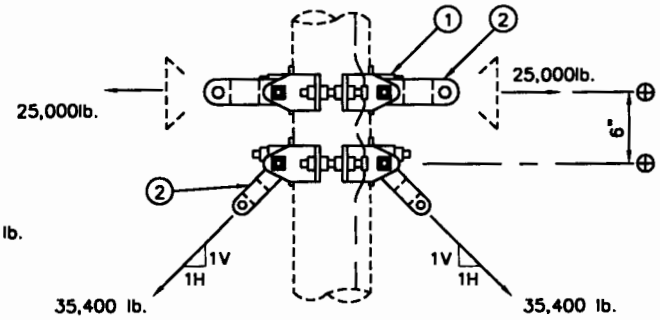
	TG-25						LIST OF MATERIALS			
DWG. REF.	A	B	C	D	E		DESCRIPTION	ITEM	DET.	CODE No.
1			1	1	2		Band, 4Way Pole, ass'y w/7/8 thru rod	fv		
* 2			1	2	2		Links, Connecting	du		
* 3				1	2		Links, Connecting	du		



TG-26C



TG-26D



TG-26E

Notes:
1. The indicated loads are design maximum.
2. For guy slopes more than 1V to 1H the maximun vertical capacity shuld not exceed 25,000 lbs.
3. The lower work points (⊕) are for locations where two guy attachments are required.
4. A groundwire clamp is included with item 1, pole band assembly.

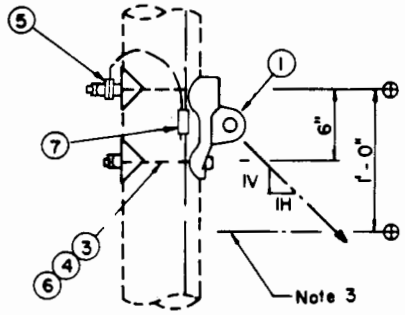
GUY ATTACHMENTS

MEDIUM DUTY POLE BANDS

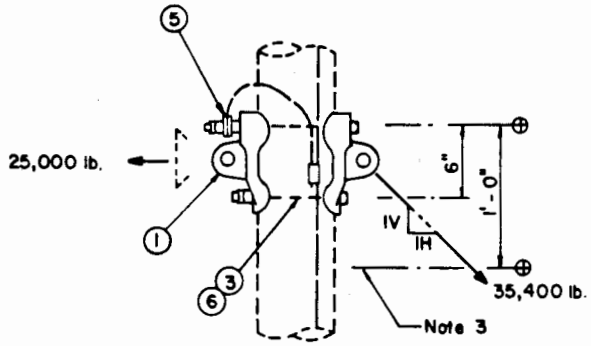
NO.	REVISION	DATE
1, *	Items 2,3	03/98

TG-26

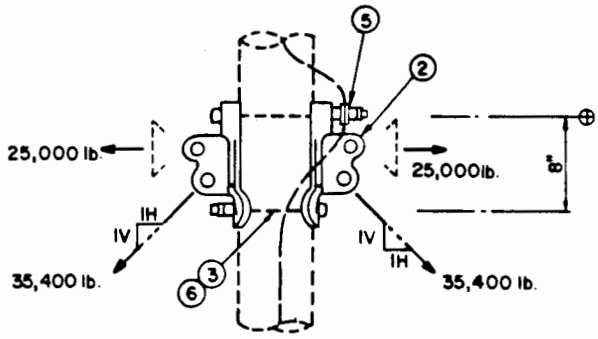
	TG - 27					LIST OF MATERIALS			
DRG. REF.	A	B	C	D	E	DESCRIPTION	ITEM	DET.	CODE No.
1			1	2	-	Plate, Pole Eye, medium duty	fv		
2			-	-	2	Plate, Pole Eye, Double, medium duty	fv		
3			2	2	2	7/8" Bolt, Machine, by req'd length	c		
4			2	-	-	Washer, Curved, 4" sq. x 1/4", 15/16" hole	d		
5			1	1	1	7/8" Clamp, Groundwire + 1 nut	dp		
6			2	2	2	7/8" Locknut, MF Type	ek		
7			1	1	-	Connector, Compression	p		



TG - 27 C



TG - 27 D



TG - 27 E

NOTES:

1. The indicated loads are design maximum.
2. For guy slopes more than 1V to 1H the maximum vertical capacity should not exceed 25,000 lbs.
3. The lower work points (⊕) are for locations where two guy attachments are required.
4. When there is no pole groundwire or the groundwire is stood off from the pole, items 5 & 7 are not required.
5. Dimensions of the guying attachments shall accommodate medium duty guying assemblies.
6. Item 7, compression connector, may not be necessary depending on the location of the pole ground shown on the structure drawings.

GUY ATTACHMENTS

MEDIUM DUTY POLE EYE PLATES

NO	REVISION	DATE

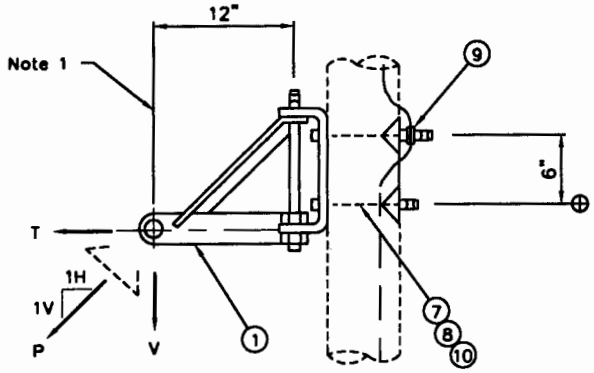
Reissued 03/98

Aug., 1986

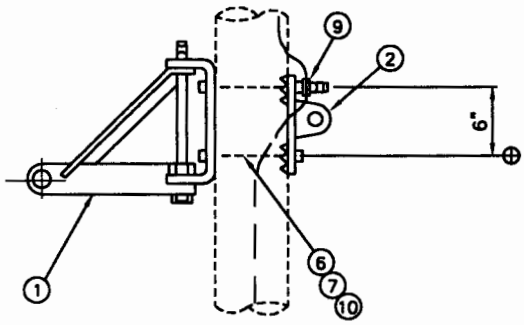
TG-27

LIST OF MATERIALS

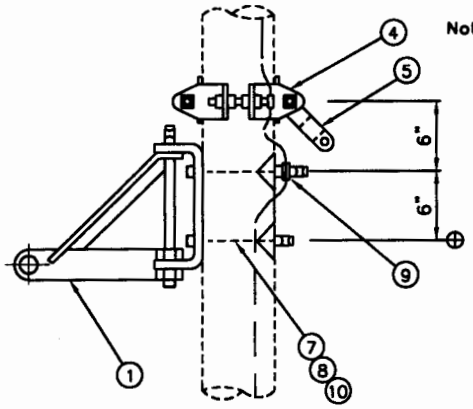
DWG. REF.	TG-28	A	B	C	DESCRIPTION	ITEM	DET.	CODE No.
1	1	1	1	1	Bracket, Swinging Angle, Assembly	fu		
2	–	1	–	–	Tee, Deadend, medium duty	fv		
3	–	–	–	1	Plate, Pole Eye, medium duty	fv		
4	–	–	1	–	Band, 4Way Pole, Ass'y w/7/8 thru rod	fv		
* 5	–	–	1	–	Links, Connecting	du		
6	–	2	–	–	Grid Grain, 4" x 4", 15/16" hole	bi		
7	2	2	2	2	7/8" Bolt, Machine, by req'd length	c		
8	2	–	2	–	Washer, Curved, 4"sq x1/4",15/16"hole	d		
9	1	1	1	1	7/8" Clamp, Groundwire + 1 nut	dp		
10	2	2	2	2	7/8" Locknut, MF Type	ek		



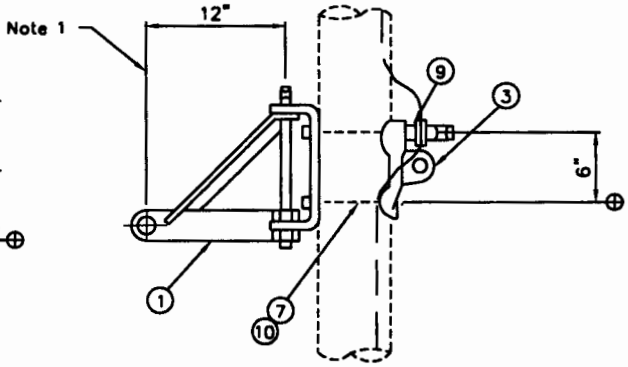
TG-28



TG-28A



TG-28B



TG-28C

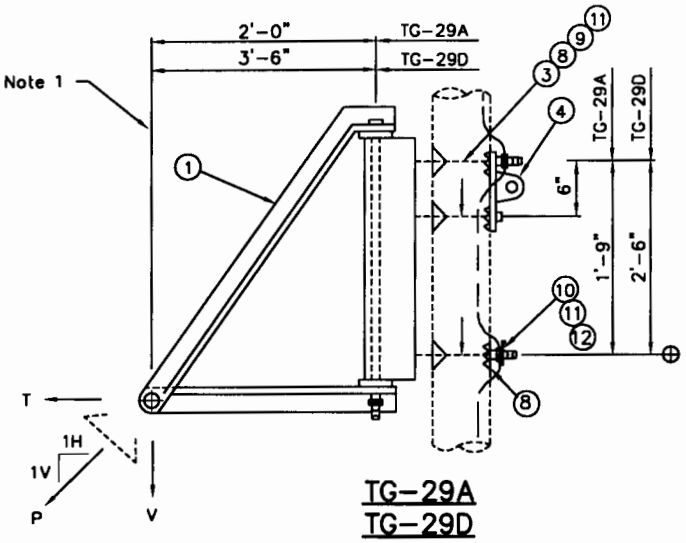
Notes:
1. The 1-1/4" diameter hole shall be reamed on both sides to be suitable for self-locking ball hook.
* 2. Angle bracket assembly shall be hot dip galvanized per ASTM A153.
* 3. Details of hardware are typical. Supplier shall test the swinging angle bracket and obtain RUS acceptance. Bracket assembly shall be tested to a minimum vertical load of 10,000 lbs. and oblique load of 14,000 lbs.
* 4. The allowable vertical load is 2500 lbs.

BRACKET AND GUY ATTACHMENT
MEDIUM DUTY, 1'-0" BRACKET

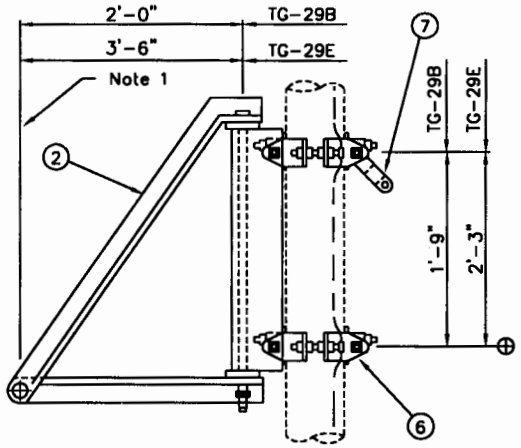
NO.	REVISION	DATE
1,*	Note2,3,4,item 5	03/98

TG-28

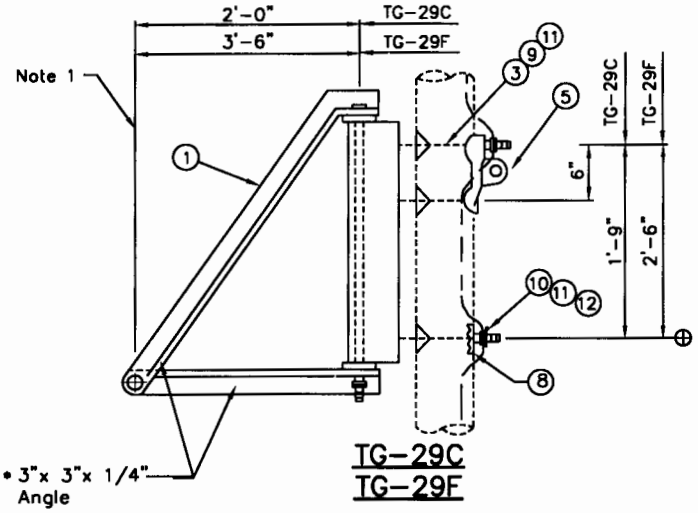
DWG. REF.	TG-29 A, D	TG-29 B, E	TG-29 C, F		DESCRIPTION	ITEM	DET.	CODE No.
1	1	–	1		Bracket, Swinging Angle, bolted attach.			
2	–	1	–		Bracket, Swinging Angle, band attach.	fu		
3	1	–	1		7/8" Mounting Hardware	fu		
4	1	–	–		Tee, Deadend, medium duty	fv		
5	–	–	1		Plate, Pole Eye, medium duty	fv		
6	–	2	–		Band, 4Way Pole, ass'y w/7/8 thru rod	fu		
7	–	1	–		Links, Connecting,	du		
8	3	–	1		Grid Grain, 4" x 4", 15/16" hole	bi		
9	3	–	3		Washer, Curved, 4"sq x1/4",15/16"hole	d		
10	2	–	2		7/8" Clamp, Groundwire + 1 nut	dp		
11	3	–	3		7/8" Locknut, MF Type	ek		
11	2	–	2		7/8" Locknut, MF Type	ek		



TG-29A
TG-29D



TG-29B
TG-29E



TG-29C
TG-29F

Notes:

1. The 1–1/4" diameter hole shall be reamed on both sides suitable for self–locking ball hook.
2. Angle bracket assembly shall be hot dip galvanized per ASTM A153.
3. Supplier shall test the swinging angle bracket and obtain RUS acceptance. Bracket assembly shall be tested to a minimum ultimate vertical load of 10,000 lbs and oblique load of 14,000 lbs.
4. The allowable vertical load is 2500 lbs.

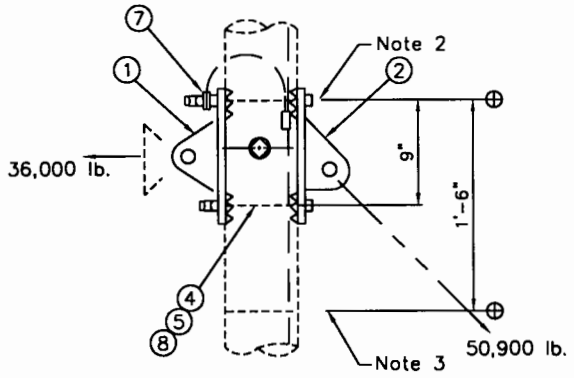
BRACKET AND GUY ATTACHMENT

MEDIUM DUTY, 2'–0" & 3'–6" BRACKET

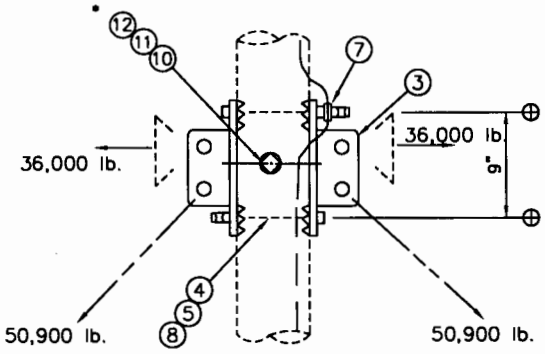
NO.	REVISION	DATE
1,*	Min. Size, notes2,3,4	03/98

TG–29

	TG-35						LIST OF MATERIALS			
DWG. REF.	A	B	C	D	E		DESCRIPTION	ITEM	DET.	CODE No.
1				1	–		Tee, Deadend, heavy duty	fv		
2				1	–		Tee, Droopy Deadend , heavy duty	fv		
3				–	2		Tee, Deadend & Guying, heavy duty	fv		
4				4	4		Grid Gain, 4" x 6", 1-1/16 hole	bl		
5				2	2		1" Bolt, Machine, by req'd length	c		
6				–	–		Washer, Curved, 4"sq x3/8",1-1/16"h.	d		
7				1	1		1" Clamp, Groundwire + 1 nut	dp		
8				2	2		1" Locknut, MF Type	ek		
9				1	–		Connector, Compression	p		
• 10				1	1		1/2" Bolt, Machine, by req'd length	c		
• 11				2	2		Washer, Round, 1-3/8"	d		
• 12				1	1		1/2" Locknut, MF Type	ek		



TG-35D



TG-35E

Notes:

1. The indicated loads are design maximum.
2. The bolt heads shall be located on the guy side for TG-35D.
3. For guy slopes more than 1V to 1H the maximun vertical capacity should not exceed 36,000 lbs.
4. The lower work points (⊕) are for locations where two guy attachments are required.
5. For poles other than Douglas Fir or SYP, the capacity should be derated.

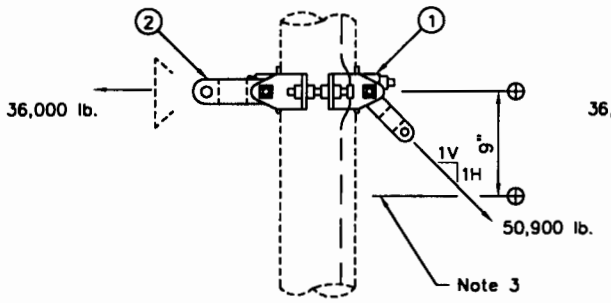
GUY ATTACHMENTS

HEAVY DUTY GUYING TEES

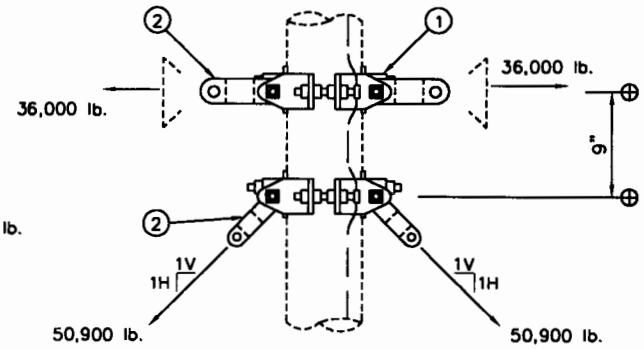
NO.	REVISION	DATE
1 •	Add #10,11,12,note5	03/98

TG-35

	TG-36						LIST OF MATERIALS			
DWG. REF.	A	B	C	D	E		DESCRIPTION	ITEM	DET.	CODE No.
1				1	2		Band,4Way Pole,ass'y w/1-1/4 thru rod	fv		
2				2	4		Links, Connecting, 2: 3/8x3, w/1-1/16h	du		



TG-36D



TG-36E

Notes:

1. The indicated loads are design maximum.
2. For guy slopes more than 1V to 1H the maximun vertical capacity should not exceed 36,000 lbs.
3. The lower work points (⊕) are for locations where two guy attachments are required.
4. A groundwire clamp is included with item 1, pole bond assembly.

*5. Engineer shall check capacity of pole.

*6. Minimum pole diameter shall be 12".

*7. Antisplit bolt shall be added if required by the engineer.

GUY ATTACHMENTS

HEAVY DUTY POLE BANDS

NO.	REVISION	DATE			
1,*	Add notes 5,6,7	03/98			TG-36

	TG-37						LIST OF MATERIALS			
DWG. REF.	A	B	C	D	E		DESCRIPTION	ITEM	DET.	COOE No.
1										
2										
3										
4										
5										
6										
7										

For future use.

GUY ATTACHMENTS

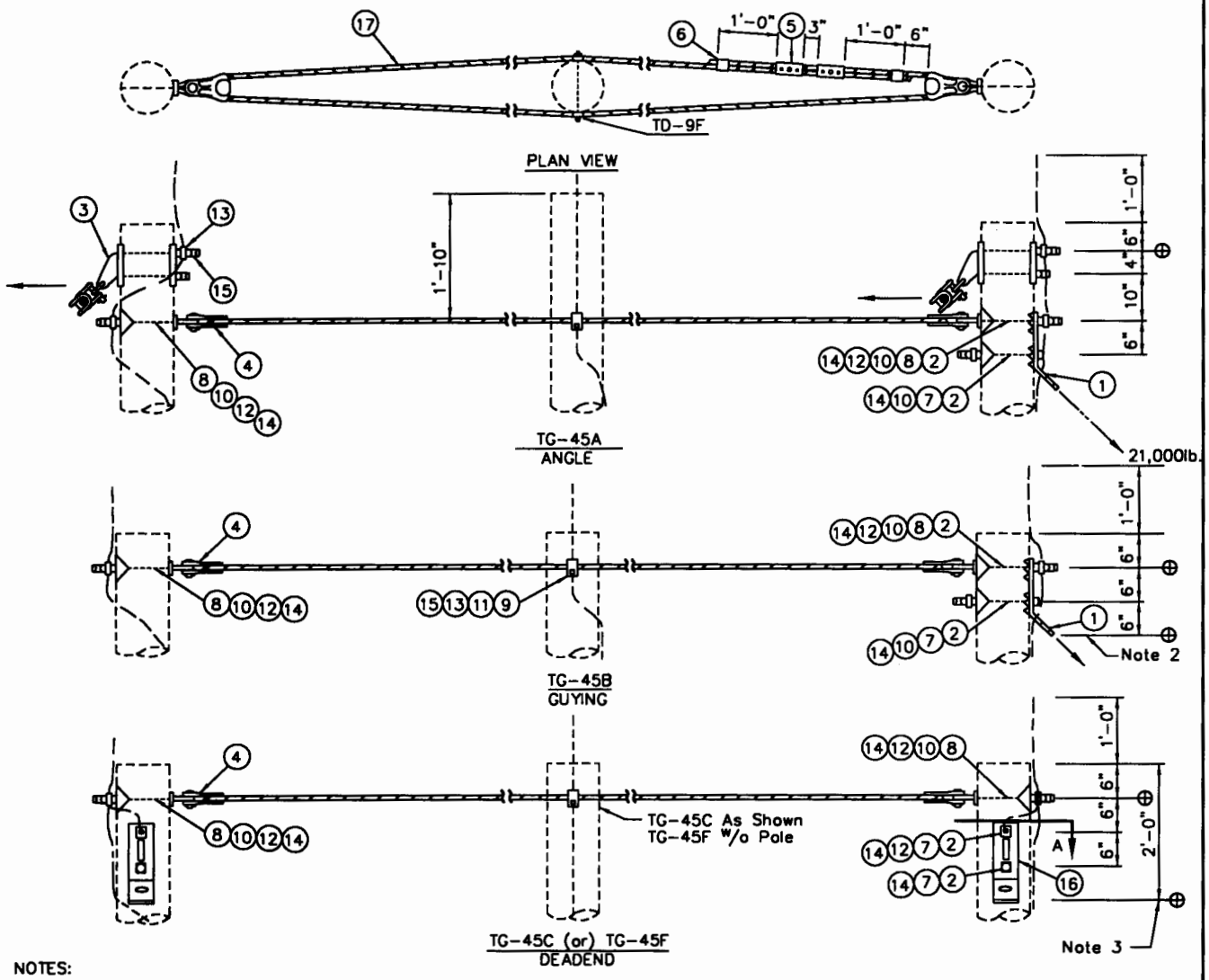
NO.	REVISION	DATE
1	Elim Hvy Pole Eye	03/98

TG-37

SECTION AA

DWG. REF.	TG-45 A	B	C	F	DESCRIPTION	ITEM	DET.	CODE No.
1	1	1	–	–	Plate, guying, 5/8" x 3"	fv		
2	2	2	8	8	Grid Gain, 4" x 4",	bl		
3	2	–	–	–	Support, Double Bolt OHGW, 5/8" d.	ed		
4	2	2	2	2	Thimble Clevis 20,000 lb.	ci		
5	2	2	2	2	Connect.,3 Bolt Guy Clamp,w/5/8 bolts	u		
6	2	2	2	2	Guy Clip	dz		
7	1	1	4	4	3/4" Bolt Machine, by req'd length	c		
8	2	2	2	2	3/4" Bolt, Shoulder Eye, by req'd lgth.	o		
9	1	1	1	–	5/8" Bolt, Machine, by req'd length	c		
10	3	3	2	2	Washer, Curved,4"sq.x1/4",13/16"hole	d		
11	2	2	2	–	Clamp, Messenger			
12	2	2	4	4	3/4" Clamp, Groundwire + 1 nut	dp		
13	3	1	1	–	5/8" Clamp, Groundwire + 1 nut	dp		
14	3	3	6	6	3/4" Locknut, MF Type	ek		
15	5	1	1	–	5/8" Locknut, MF Type	ek		
16	–	–	4	4	Plate, Deadend & Guying, Light Duty	fv		
17	ft.	ft.	ft.	ft.	GUY WIRE, see construction spec.	y		

LIST OF MATERIALS



NOTES:

1. The indicated loads are design maximum.
2. The lower work point (⊕) on TG-45B is for OHGW deadend and guy attachments when required. Connect the groundwire clamps of the guy attachments to the pole groundwire.
3. Engineer should determine if additional guy attachments are required for tangent deadend structures.

POLE TIE ASSEMBLIES

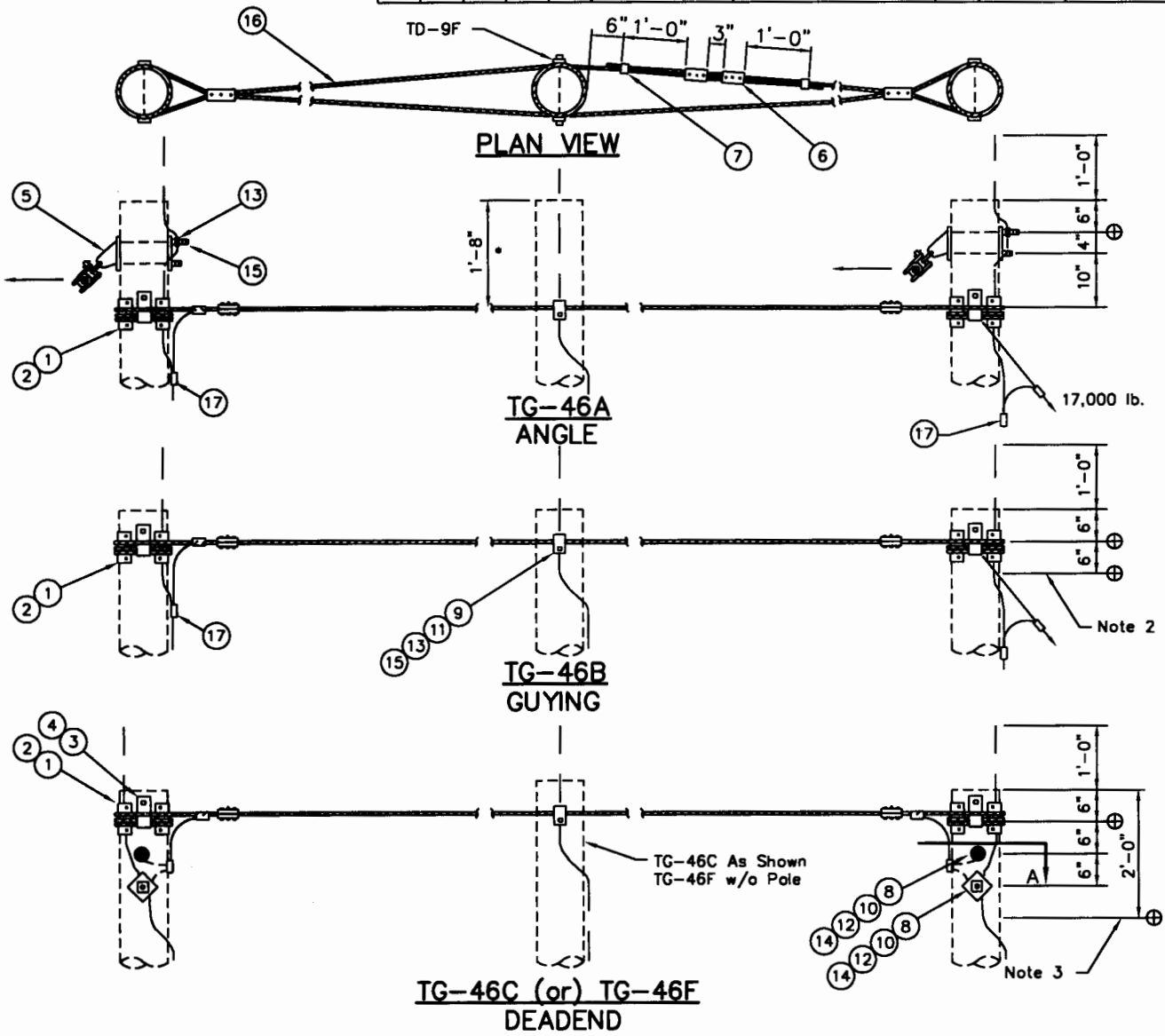
ANGLE, GUYING, & DEADEND POLE TIES

(LIGHT DUTY, GUY PLATE)

NO.	REVISION	DATE			
1,*	Dwg. ref 1	03/98			TG-45

DWG. REF.	TG-46 A	B	C	F	LIST OF MATERIALS DESCRIPTION	ITEM	DET.	CODE No.
1	4	4	4	4	Guy Plate, Strain, 4"x8"x14" Ga.	bk		
2	16	16	16	16	8d Nails, galvanized	–		
3	4	4	4	4	Hook, Guy	bj		
4	4	4	4	4	1/2"x4" Screw, Lag	j		
5	2	–	–	–	Support, Double Bolt OHGW, 5/8" d.	ed		
6	4	4	4	4	Connector, 3 Bolt Guy Clamp,w/5/8"bolts	u		
7	2	2	2	2	Guy Clip	dz		
8	–	–	4	4	3/4" Bolt, Shoulder Eye,by req'd l.	o		
9	1	1	1	–	5/8" Bolt, Machine, by req'd length	c		
10	–	–	4	4	Washer,Curved,4"sq.x1/4", 13/16"hole	d		
11	2	2	2	–	Clamp, Messenger			
12	–	–	4	4	3/4" Clamp, Groundwire + 1 nut	dp		
13	3	1	1	–	5/8" Clamp, Groundwire + 1 nut	dp		
14	–	–	4	4	3/4" Locknut, MF Type	ek		
15	5	1	1	–	5/8" Locknut, MF Type	ek		
16	ft.	ft.	ft.	ft.	GUY WIRE, see construction spec	y		
• 17	4	4	4	4	Connector, Compression	p		

SECTION AA



NOTES:

1. The indicated loads are design maximum.
2. The lower work point (●) is for OHGW deadend and guy attachments when required.
3. The lower work point (●) is for guy attachments.

POLE TIE ASSEMBLIES

ANGLE, GUYING & DEADEND POLE TIES

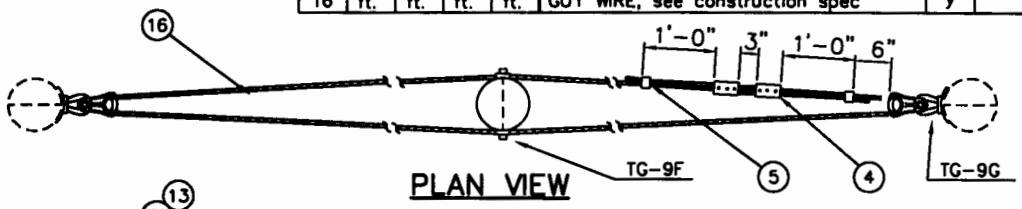
(LIGHT DUTY WRAPPED)

NO.	REVISION	DATE
1.•	item17added,dim	03/98

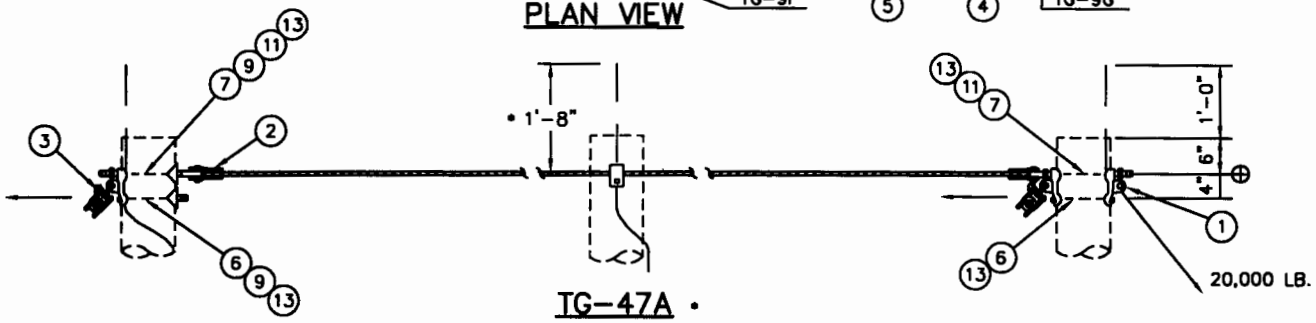
TG-46

DWG. REF.	TG-47 A	B	C	F	DESCRIPTION	ITEM	DET.	CODE No.
1	3	1	–	–	Plate, Pole Eye, light duty	fv		
2	2	2	2	2	Thimble, Clevis 20,000lb.	cl		
3	2	–	4	4	Anchor Shackle 30,000lb.	bo		
4	2	2	2	4	Connector, 3 Bolt Guy Clamp,w/5/8"bolts	u		
5	2	2	2	2	Guy Clip	dz		
6	2	1	4	4	3/4" Bolt, Machine, by req'd length	c		
7	2	2	2	2	3/4" Bolt, Double Arm Eye, by r.l.	dy		
8	1	1	1	–	5/8" Bolt, Machine, by req'd length	c		
9	2	4	4	4	Washer,Curved,4"sq.x1/4", 13/16"hole	d		
10	2	2	2	–	Clamp, Messenger			
11	2	2	2	2	3/4" Clamp, Groundwire + 1 nut	dp		
12	1	1	1	–	5/8" Clamp, Groundwire + 1 nut	dp		
13	6	5	8	8	3/4" Locknut, MF Type	ek		
14	1	1	1	–	5/8" Locknut, MF Type	ek		
15	–	–	4	4	Plate, Pole Eye, Double	fv		
16	ft.	ft.	ft.	ft.	GUY WIRE, see construction spec	y		

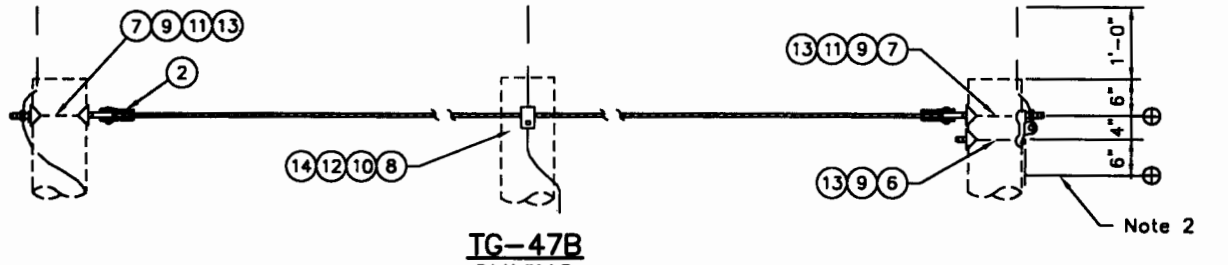
SECTION AA



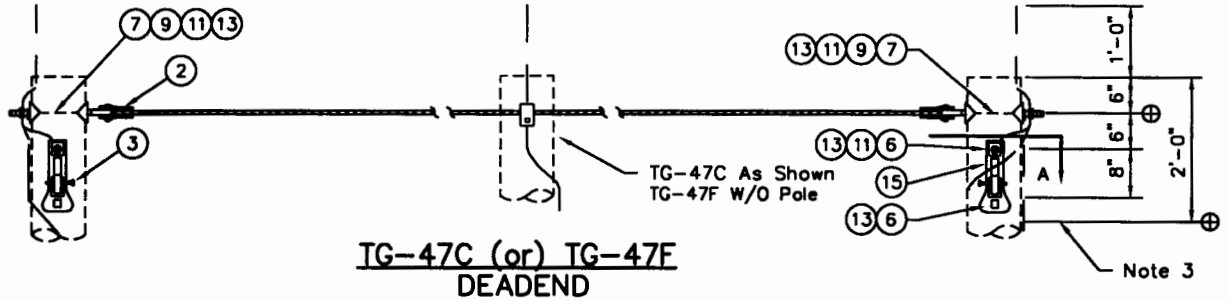
PLAN VIEW



TG-47A •



TG-47B
GUYING



TG-47C (or) TG-47F
DEADEND

NOTES:

1. The indicated loads are designated maximums (ultimates).
2. The lower work point (●) on TG-47B is for OHGW deadend and guy attachments when required. Connect the groundwire clamps of the guy attachments to the pole groundwire.
3. Engineer should determine if additional guy attachments are required for tangent deadend structures.

POLE TIE ASSEMBLIES

ANGLE, GUYING & DEADEND POLE TIES

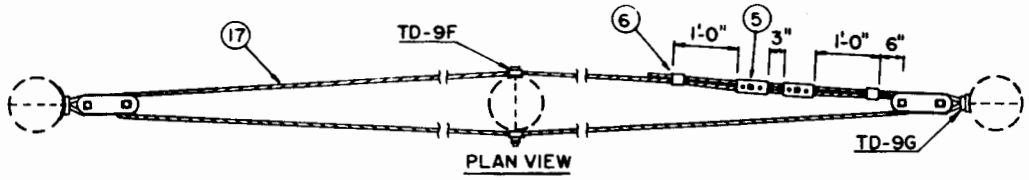
(LIGHT DUTY POLE EYE PLATES)

NO.	REVISION	DATE
1.•	note1, TG-47A dim	03/98

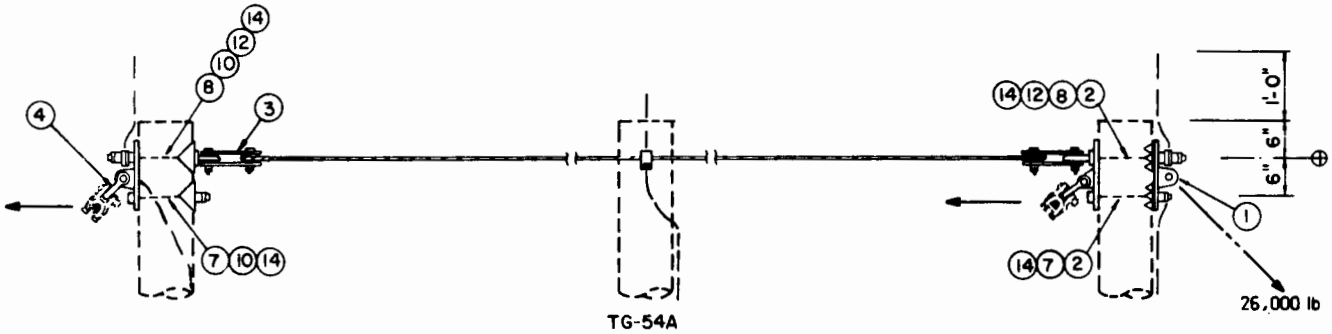
TG-47

SECTION AA

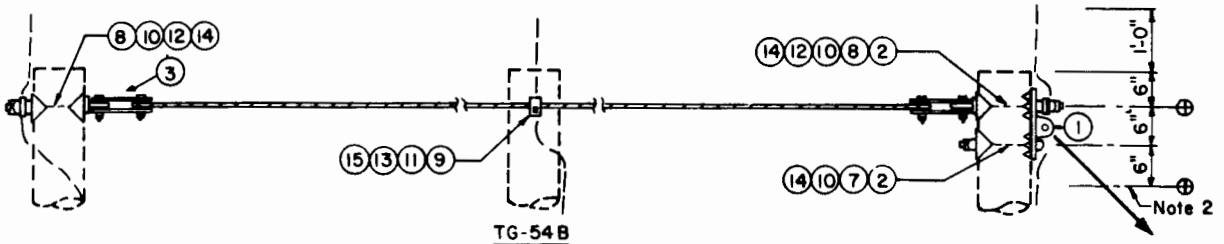
DRG. REF.	TG-54 A	B	C	F	DESCRIPTION	ITEM	DET.	CODE No.
1	3	1	4	4	Tee, Deadend, medium duty	fv		
2	2	2			Grid Gain, 4" x 4", 15/16" hole	bl		
3	2	2	2	2	Guy Link, Type 1			
4	2	-	-	-	Anchor Shackle 30,000 lb. BNC	bo		
5	2	2	2	2	Connector, 3 Bolt Guy Clamp, w/5/8 bolts	u		
6	2	2	2	2	Guy Clip	dz		
7	2	1			3/4" Bolt, Machine, by req'd length	c		
8	2	2	2	2	3/4" Bolt, Double Arm'g Eye, by r.l.	dy		
9	1	1	1	-	5/8" Bolt, Machine, by req'd length	c		
10	2	4	4	4	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
11	2	2	2	-	Clamp, Messenger			
12	2	2			3/4" Clamp, Groundwire + 1 nut	dp		
13	1	1	1	-	5/8" Clamp, Groundwire + 1 nut	dp		
14	6	5			3/4" Locknut, MF Type	ek		
15	1	1	1	-	5/8" Locknut, MF Type	ek		
16	-	-	4	4	GUY ATTACHMENT, MEDIUM Deadend & Guy'g		TG-25E	
17	ft.	ft.	ft.	ft	GUY WIRE, see construction spec.	y		



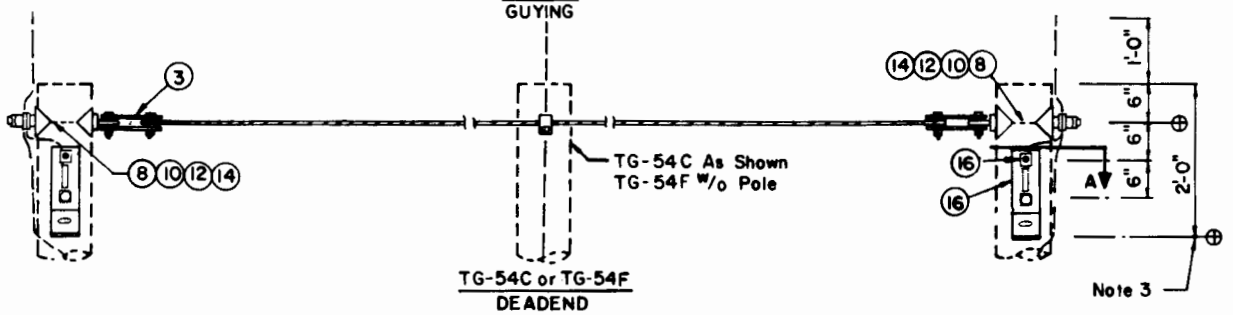
PLAN VIEW



TG-54A
ANGLE



TG-54B
GUYING



TG-54C or TG-54F
DEADEND

NOTES:

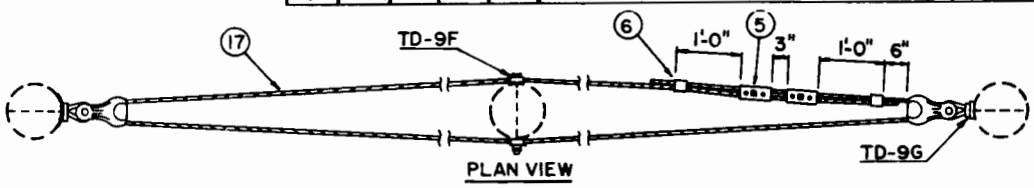
1. The indicated loads are design maximum.
2. The lower work point (●) on the TG-54B is for OHGW deadend and guy attachments. The pole groundwire is to be connected to the groundwire clamps of the guy attachments.
3. The engineer should determine if additional guy attachments are required for tangent deadend structures.

POLE TIE ASSEMBLIES

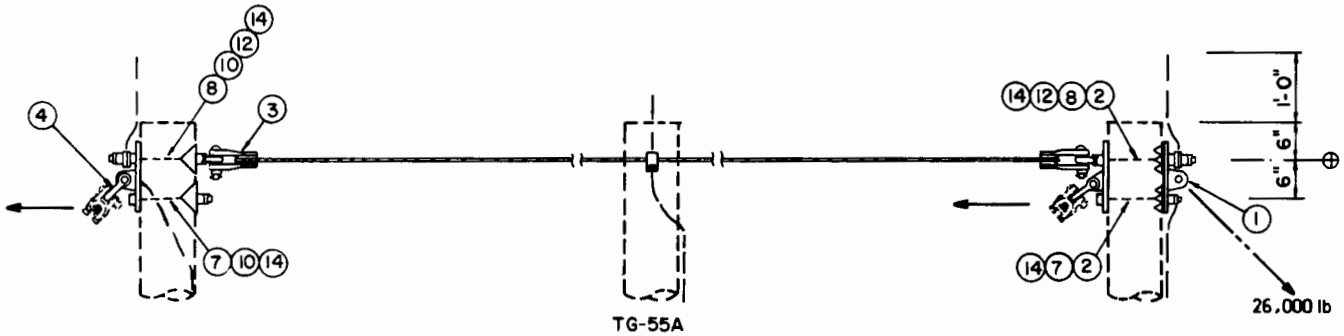
ANGLE, GUYING, & DEADEND POLE TIES
(MEDIUM DUTY, GUY LINK & TEES)

Reissued 03/98		Aug., 1986		**TG-54**

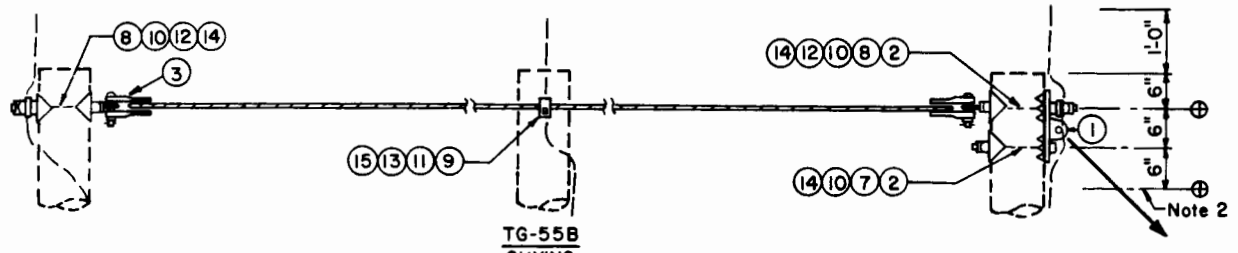
DRG. REF.	TG-55 A	B	C	F	LIST OF MATERIALS DESCRIPTION	ITEM	DET.	CODE No.
1	3	1	-	-	Tee, Deadend, medium duty	fv		
2	2	2			Grid Gain, 4" x 4", 15/16" hole	bi		
3	2	2	2	2	Thimble Clevis 20,000 lb.	ci		
4	2	-	-	-	Anchor Shackle 30,000 lb. BNC	bo		
5	2	2	2	2	Connector, 3 Bolt Guy Clamp, w/5/8 bolts	u		
6	2	2	2	2	Guy Clip	dz		
7	2	1			3/4" Bolt, Machine, by req'd length	c		
8	2	2	2	2	3/4" Bolt, Double Arm'g Eye, by r.l.	dy		
9	1	1	1	-	5/8" Bolt, Machine, by req'd length	c		
10	2	4	4	4	Washer, Curved, 4" sq. x 1/4", 13/16" hole	d		
11	2	2	2	-	Clamp, Messenger			
12	2	2			3/4" Clamp, Groundwire + 1 nut	dp		
13	1	1	1	-	5/8" Clamp, Groundwire + 1 nut	dp		
14	6	5			3/4" Locknut, MF Type	ek		
15	1	1	1	-	5/8" Locknut, MF Type	ek		
16	-	-	4	4	GUY ATTACHMENT, Deadend & Guy'g Tee		TG-25E	
17	ft.	ft.	ft.	ft.	GUY WIRE, see construction spec.	y		



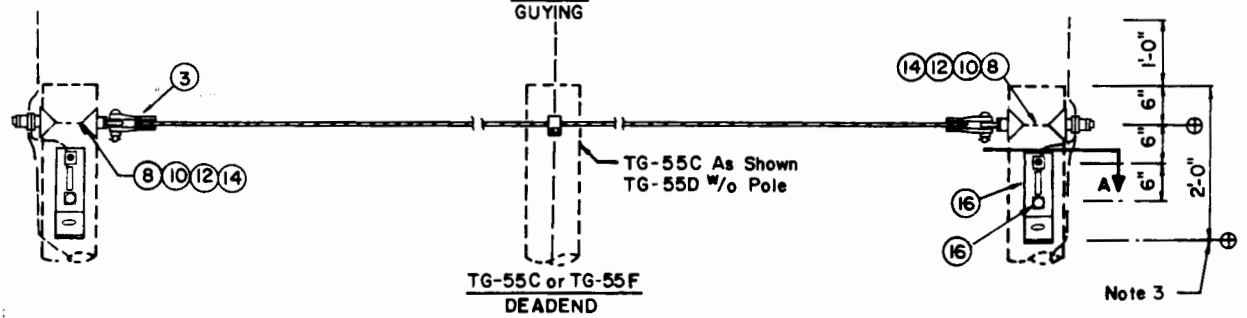
PLAN VIEW



TG-55A
ANGLE



TG-55B
GUYING



TG-55C or TG-55F
DEADEND

NOTES:

1. The indicated loads are design maximum.
2. The lower work point (⊕) on TG-55B is for OHGW deadend and guy attachments when required. Connect the groundwire clamps of the guy attachments to the pole groundwire.
3. Engineer should determine if additional guy attachments are required for tangent deadend structures.

POLE TIE ASSEMBLIES

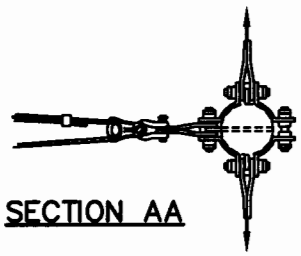
ANGLE, GUYING, & DEADEND POLE TIES

(MEDIUM DUTY GUYING TEES)

NO.	REVISION	DATE

Reissued 03/98

TG-55

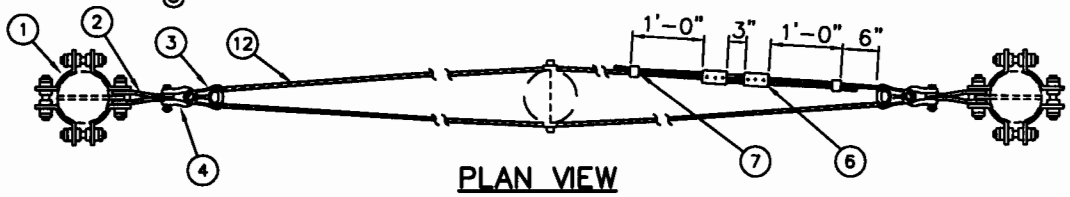


SECTION AA

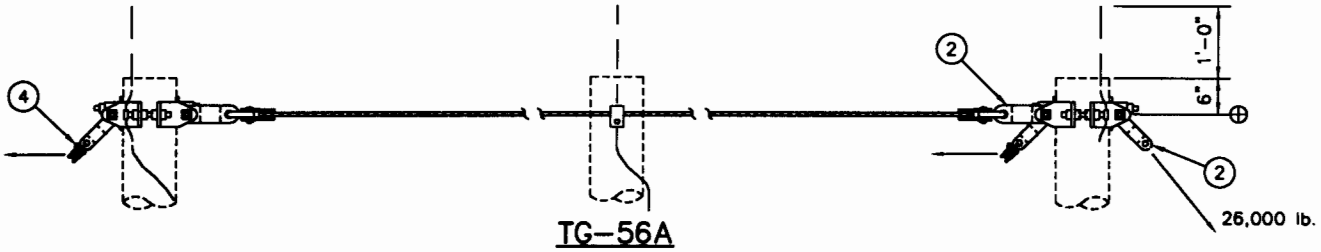
SECTION BB

4 or 5

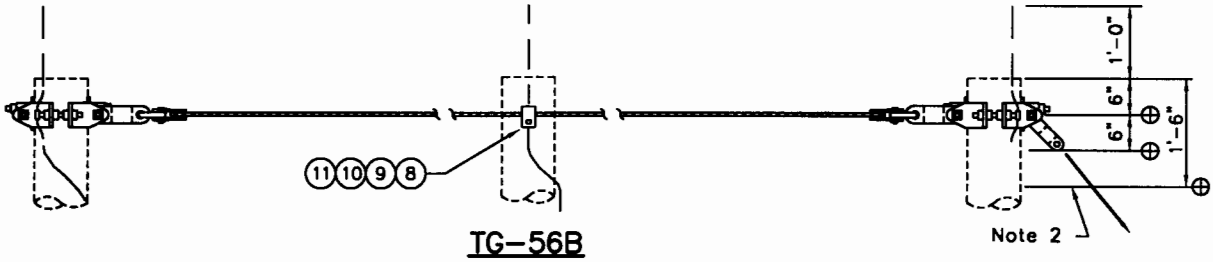
	TG-56				LIST OF MATERIALS			
DWG. REF.	A	B	C	F	DESCRIPTION	ITEM	DET.	CODE No.
1	2	2	4	4	Band,4 Way, oss'y w/7/8" thru rod	fv		
2	5	3	10	10	Links, Connecting	du		
3	2	2	2	2	Thimble, Clevis 20,000 lb.	cl		
4	4	2	2	2	Anchor Shackle 30,000 lb.	bo		
5	–	–	4	4	Anchor Shackle 50,000 lb.	bo		
6	2	2	2	2	Connector, 3 Bolt Guy Clamp,w/5/8"bolts	u		
7	2	2	2	2	Guy Clip	dz		
8	1	1	1	–	5/8" Bolt, Machine, by req'd length	c		
9	2	2	2	–	Clamp, Messenger			
10	1	1	1	–	5/8" Clamp, Groundwire + 1 nut	dp		
11	1	1	1	–	5/8" Locknut, MF Type	ek		
12	ft.	ft.	ft.	ft.	GUY WIRE, see construction spec	y		



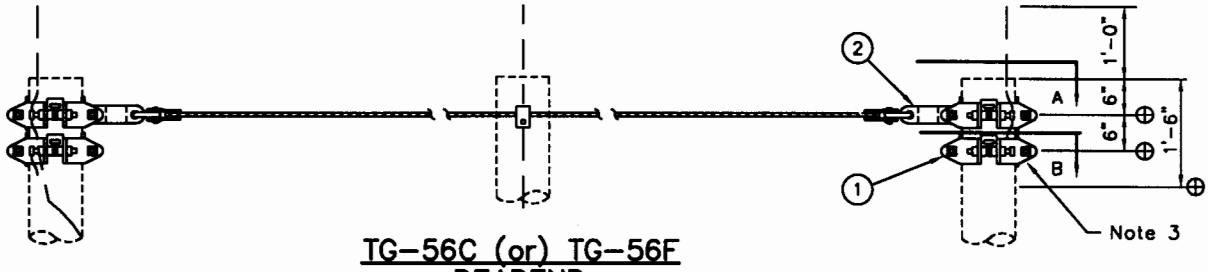
PLAN VIEW



TG-56A
ANGLE



TG-56B
GUYING



TG-56C (or) TG-56F
DEADEND

NOTES:

1. The indicated loads are design maximum.
2. The lower work point ● on TG-56B is for deadend and guy attachments when required. Connect the pole groundwire to the groundwire clamps on the pole bonds.
3. When angled guying attachments are required below the OHGW deadend for TG-56C or TG-56F, the lower pole bond assembly shall not be considered as part of the deadend pole tie assembly.

POLE TIE ASSEMBLIES

ANGLE, GUYING, & DEADEND POLE TIES

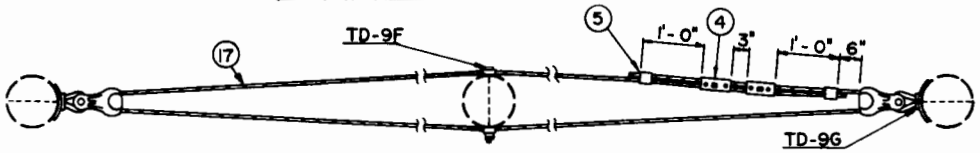
(MEDIUM DUTY POLE BANDS)

NO.	REVISION	DATE
1,*	Dwg. Ref. 2	03/98

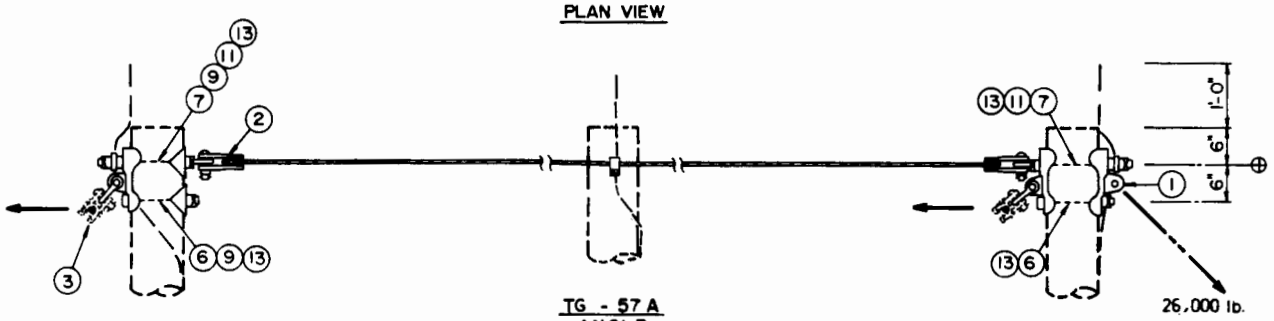
TG-56

DRG. REF.	TG – 57 A	B	C	F	DESCRIPTION	ITEM	DET.	CODE No.
1	3	1	-	-	Plate, Pole Eye, Medium duty	fv		
2	2	2	2	2	Thimble Clevis 20,000 lb	ci		
3	2	-		-	Anchor Shackle 30,000 lb BNC	bo		
4	2	2	2	2	Connector, 3 Bolt Guy Clamp, w 5/8 bolts	u		
5	2	2	2	2	Guy Clip	dz		
6	2	1			3/4" Bolt, Machine, by req'd length	c		
7	2	2	2	2	3/4" Bolt, Double Arm'g Eye, by r.l.	dy		
8	1	1	1	-	5/8" Bolt, Machine, by req'd length	c		
9	2	4	4	4	Washer, Curved, 4"sq.x 1/4",13/16"hole	d		
10	2	2	2	-	Clamp, Messenger			
11	2	2			3/4" Clamp, Groundwire + 1 nut	dp		
12	1	1	1	-	5/8" Clamp, Groundwire + 1 nut	dp		
13	6	5			3/4" Locknut, MF Type	ek		
14	1	1	1	-	5/8" Locknut, MF Type	ek		
15	-	-	4	4	Anchor Shackle 50,000 lb,7/8" pin BNC	bo		
16	-	-	4	4	GUY ATTACHMENT, MEDIUM Double Pole Eye		TG-27E	
17	ft.	ft.	ft.	ft.	GUY WIRE, see construction spec.	y		

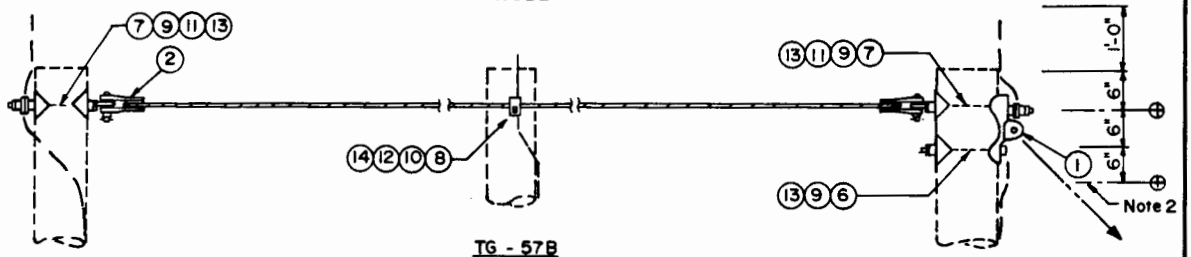
SECTION AA



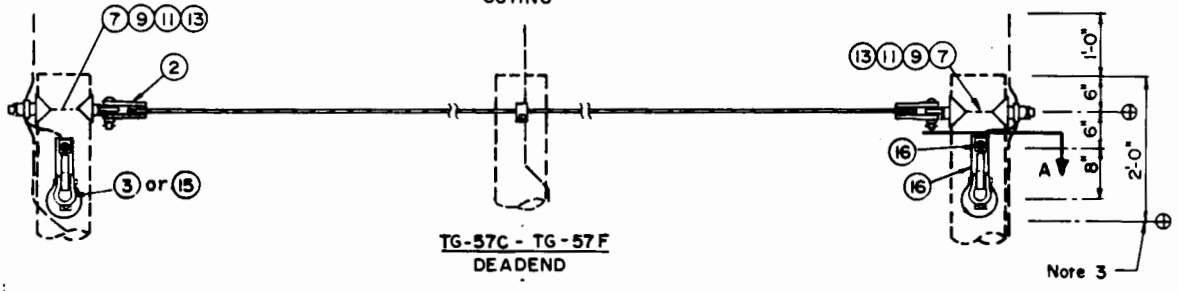
PLAN VIEW



TG - 57A
ANGLE



TG - 57B
GUYING



TG-57C - TG-57F
DEADEND

NOTES:

1. The indicated loads are design maximum.
2. The lower work point (⊕) on TG-57B is for OHGW deadend and guy attachments when required. Connect the groundwire clamps of the guy attachments to the pole groundwire.
3. Engineer should determine if additional guy attachments are required for tangent deadend structures.

POLE TIE ASSEMBLIES

ANGLE, GUYING, & DEADEND POLE TIES

(MEDIUM DUTY POLE EYE PLATES)

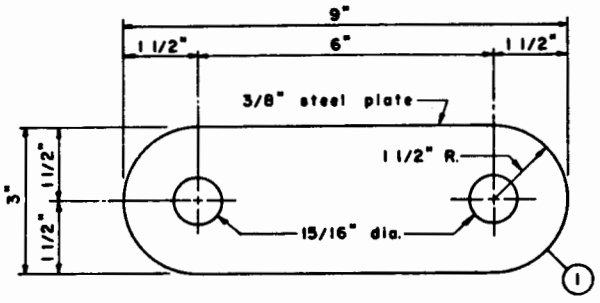
NO.	REVISION	DATE

Reissued 03/98

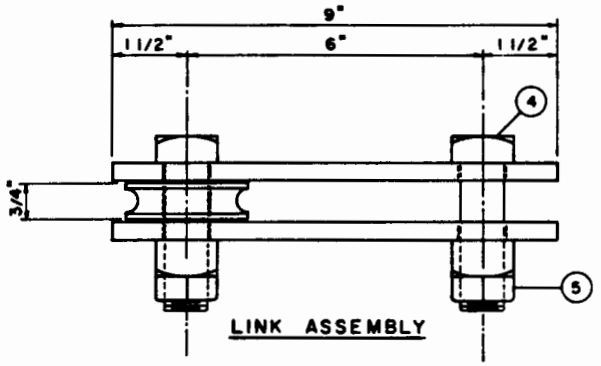
TG-57

NOTES:

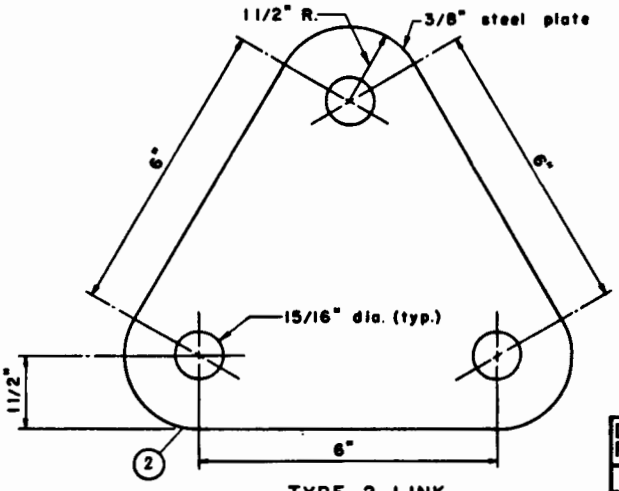
1. Type 2, Guy Link Assembly, is to be used when attaching two down guy assemblies to one guy attachment for spread guying such as head or back guying of the OHGW on tangent structures where the OHGW is located directly above the conductor.
2. Substitute one Type 2 Guy Link Assembly, TG-92, for two thimble clevises or for two Type 1 link assemblies.
3. Leave roller free to turn during adjustment of guys. Tighten nuts and locknuts after completion of adjustments.
4. Links are to be fabricated from ASTM-36 steel plate and hot dip galvanized per ASTM A-153 and A-123 requirements.
5. Type 1, Guy Link Assembly, is for normal guying.
6. Ultimate strength of link is 36,000 lbs.



TYPE 1 LINK

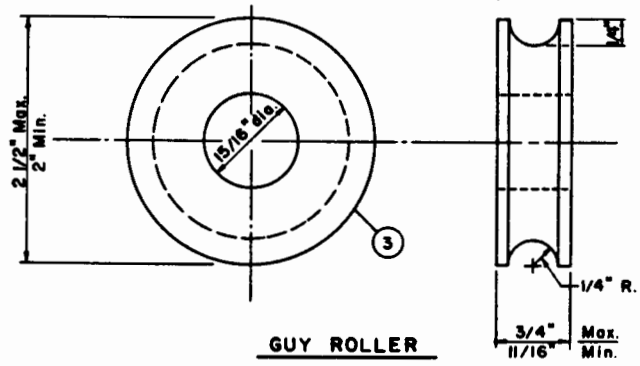


LINK ASSEMBLY



TYPE 2 LINK

TG-92



GUY ROLLER

DRG. REF.	REQ'D. TYPE 1	REQ'D. TYPE 2	DESCRIPTION	ITEM	CODE No.
1	1		Type 1 link		
2		1	Type 2 link		
3	1	2	Guy Roller		
4	2	3	Bolt Machine, 7/8" x 3"	c	
5	2	3	Locknut for 7/8" bolt, MF Type	ek	
6					

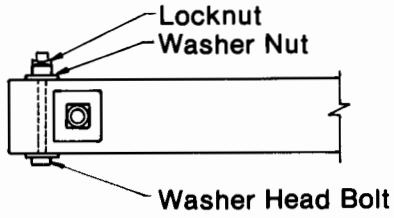
LIST OF MATERIALS

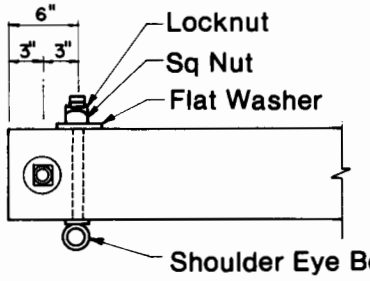
GUY LINK ASSEMBLIES

REVISION	DATE	

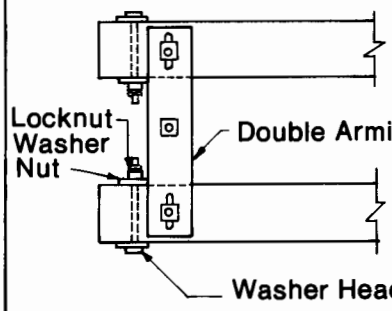
Reissued 03/98

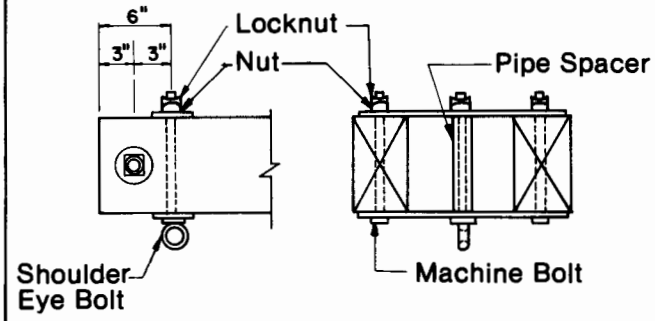
TG-92



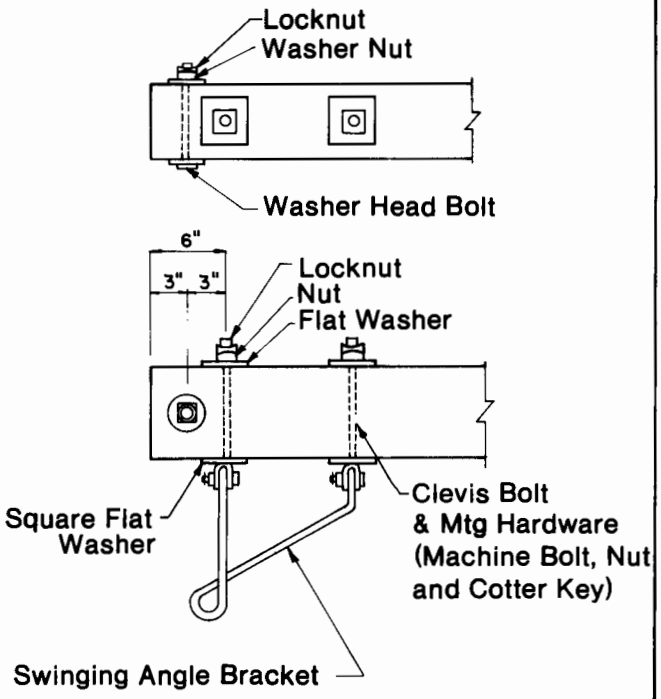


TD-9A

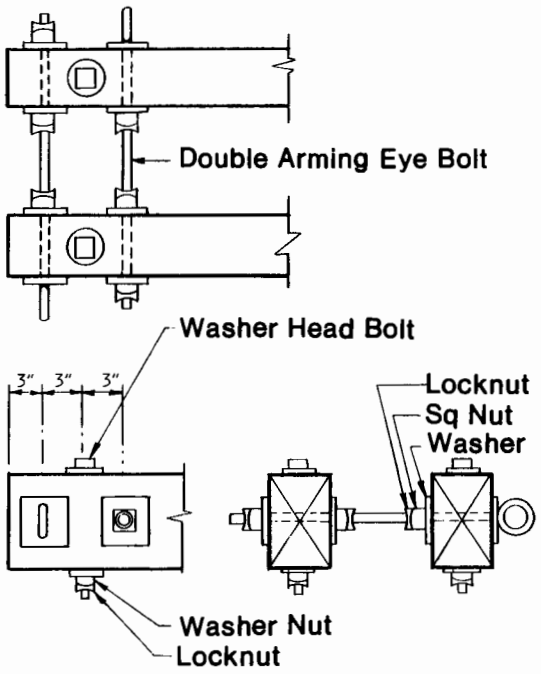




TD-9B



TD-9C



TD-9D

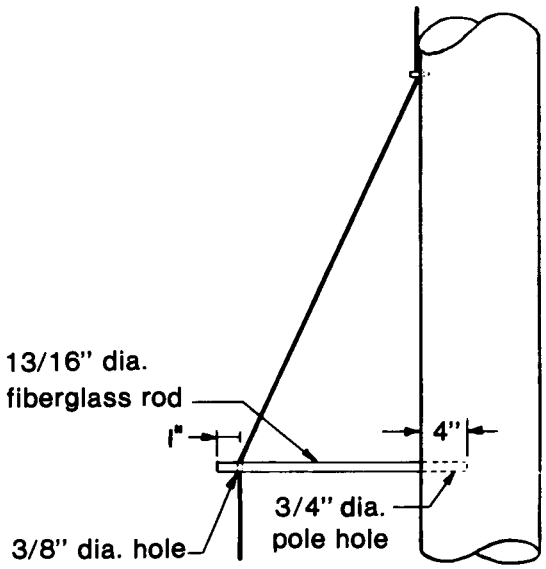
DETAILS

MISCELLANEOUS

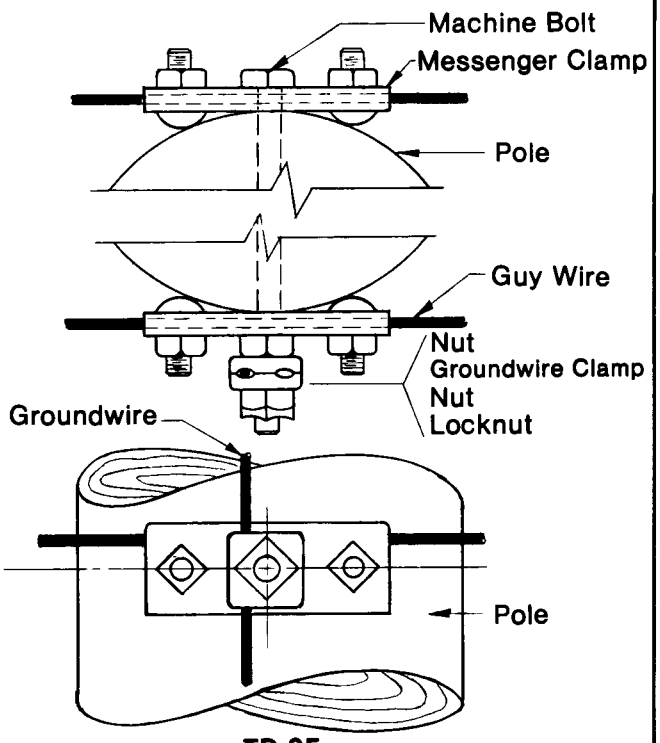
Reissued 03/98

Sheet 1 of 2

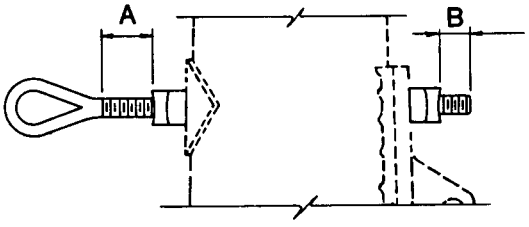
TD-9



TD-9E



TD-9F



Dimension "A"= 2" Minimum
Dimension "B"=1/2"Minimum
Dimension "A"+ "B"= 4"± 1"

TD-9G

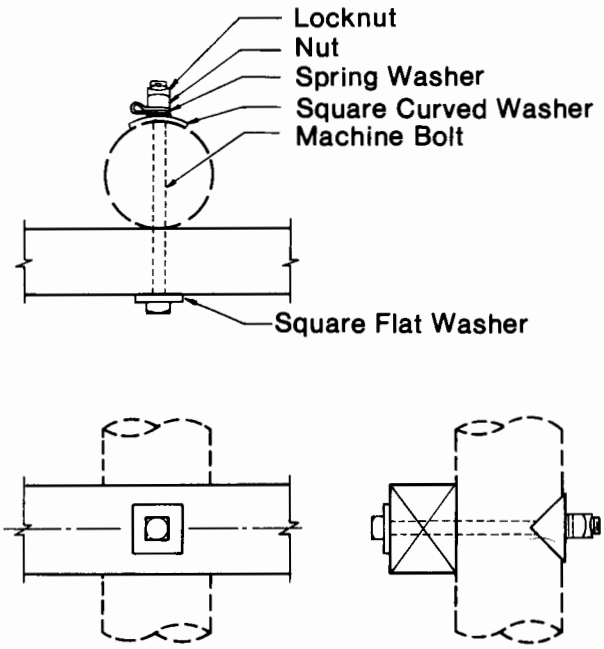
DETAILS

MISCELLANEOUS

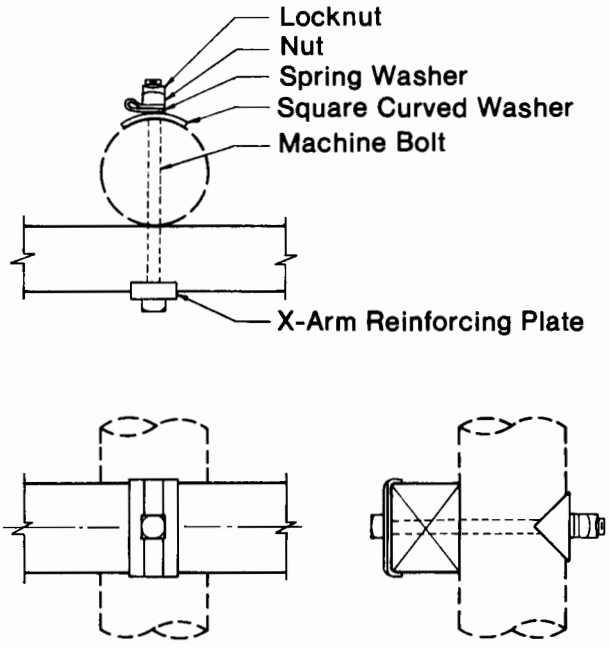
Reissued 03/98

Sheet 2 of 2

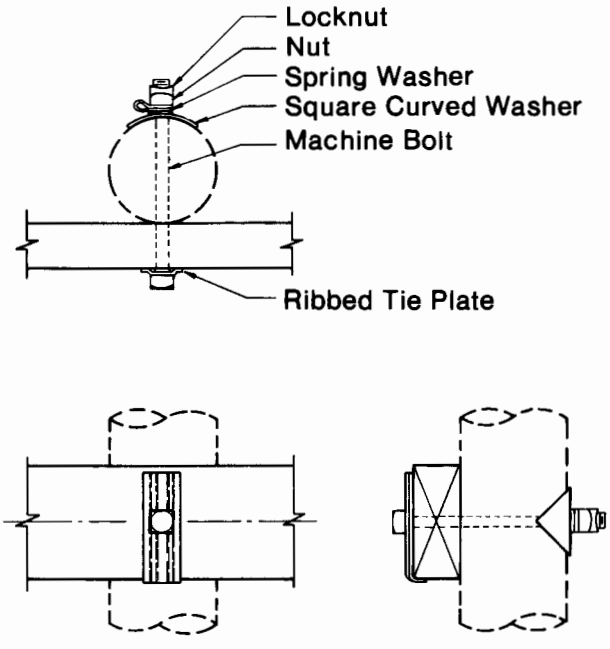
TD-9



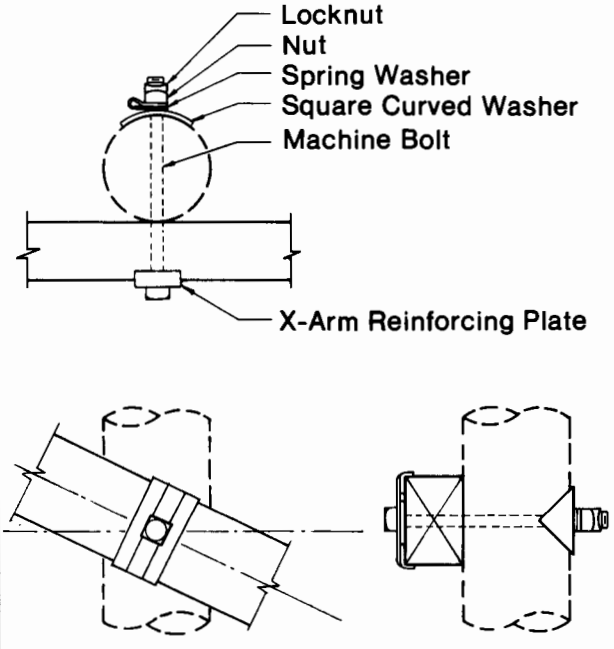
TD-14A



TD-14B



TD-14C



TD-14D

DETAILS

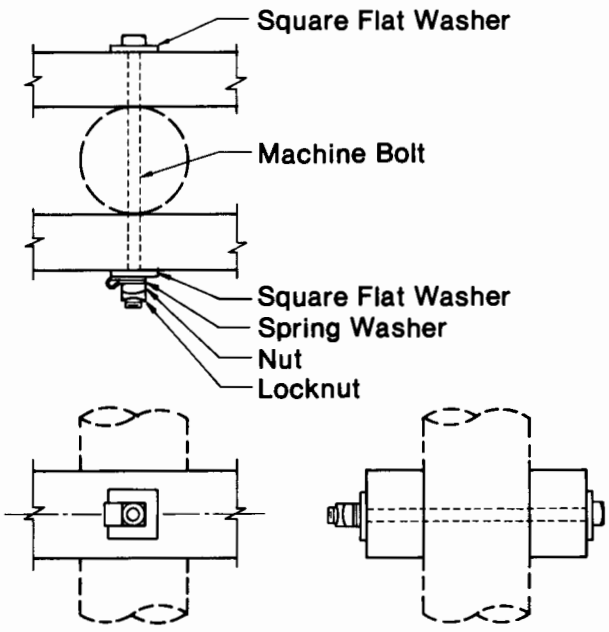
SINGLE CROSSARM TO POLE

NO.	REVISIONS	DATE

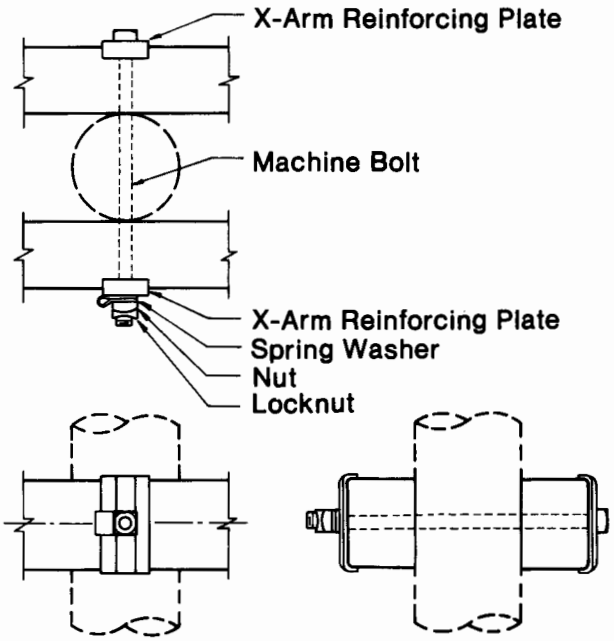
SCALE :

Reissued 03/98

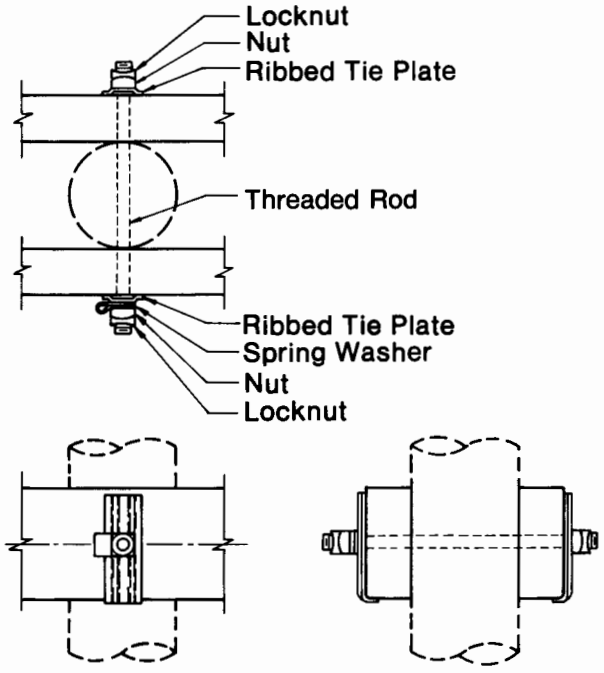
TD-14



TD-15A



TD-15B



TD-15C

TD-15D

DETAILS

DOUBLE CROSSARM TO POLE

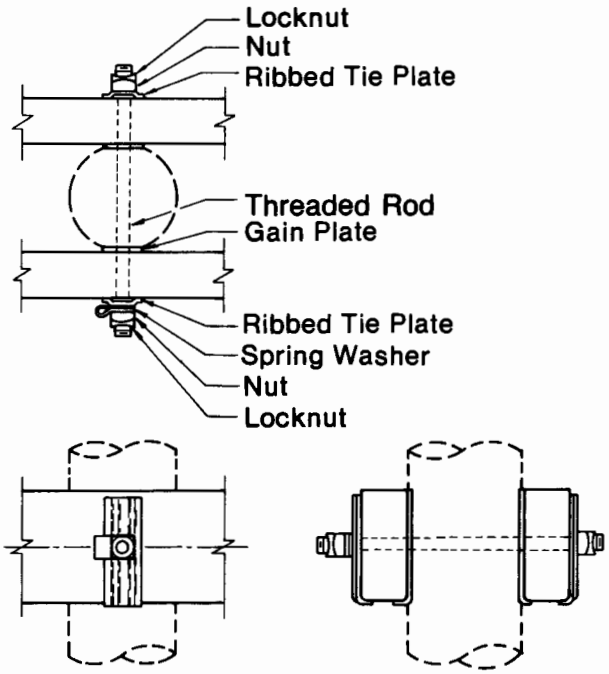
NO.	REVISION	DATE

Reissued 03/98

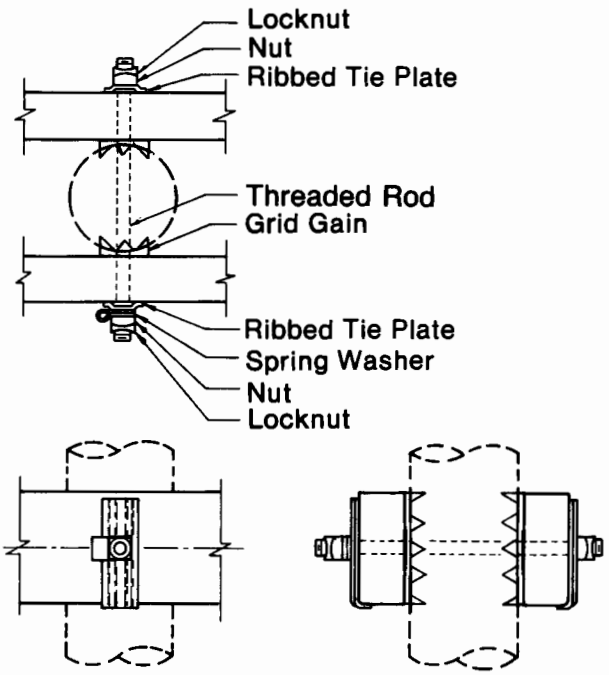
SCALE:

SHEET 1 of 2

TD-15



TD-15E



TD-15F

DETAILS

DOUBLE CROSSARM TO POLE

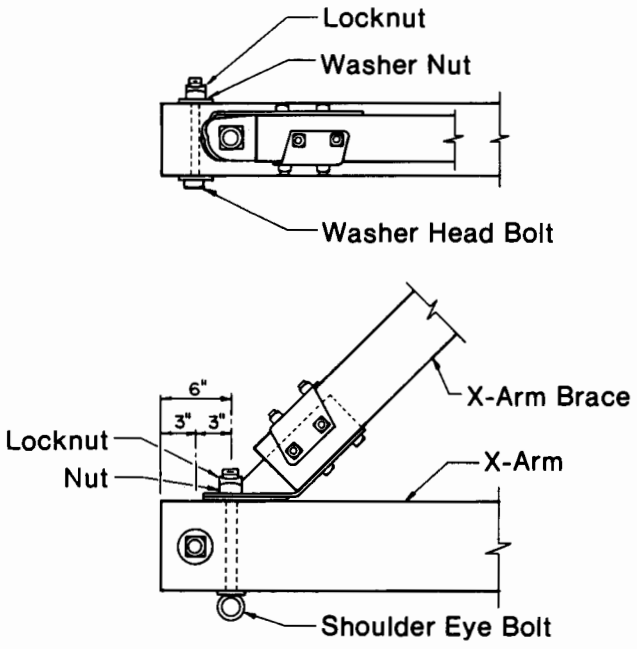
NO.	REVISION	DATE

Reissued 03/98

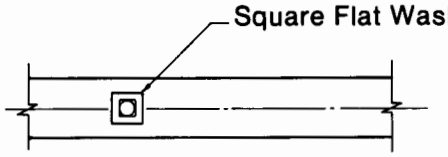
SCALE:

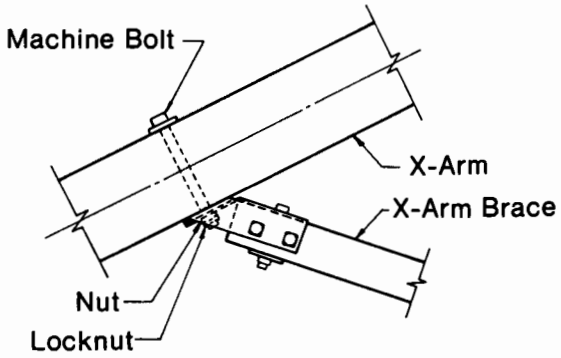
SHEET 2 of 2

TD-15

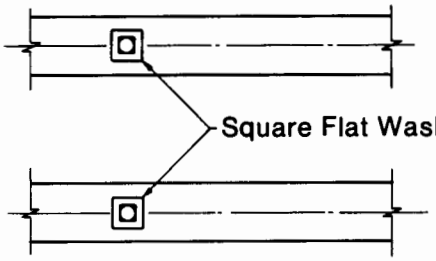


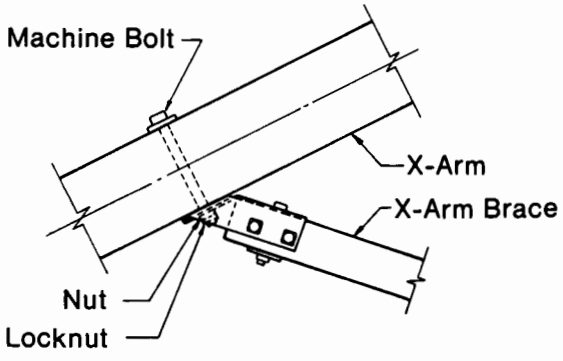
TD-16A





TD-16C





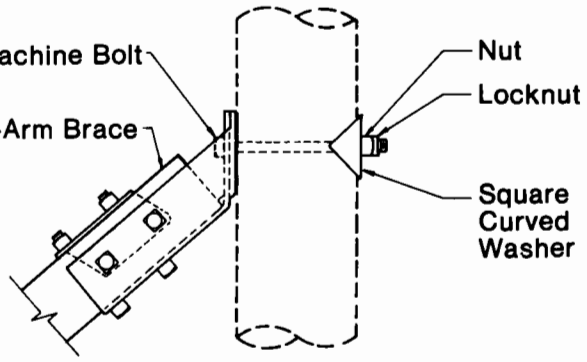
TD-16D

DETAILS

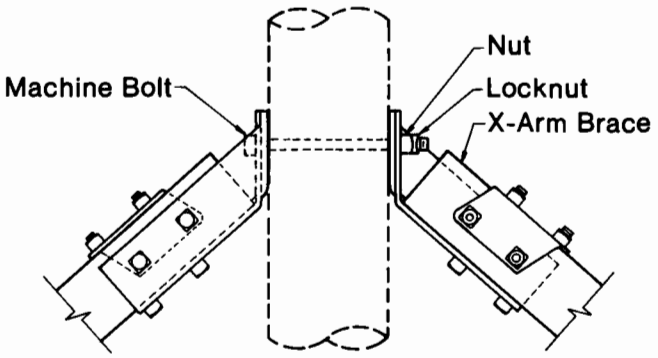
BRACE TO ARM CONNECTIONS

Reissued 03/98

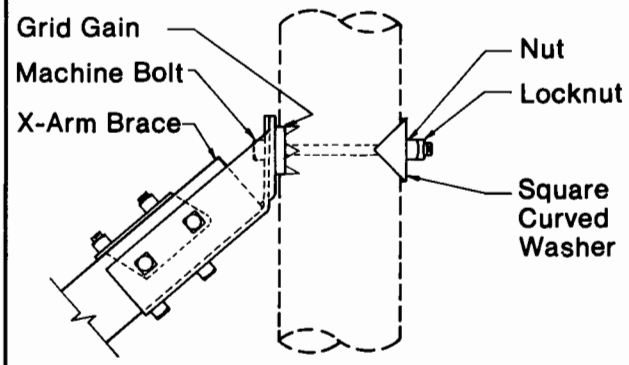
TD-16



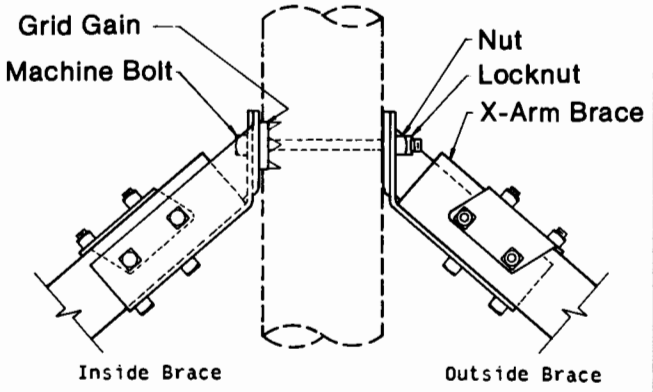
TD-17A



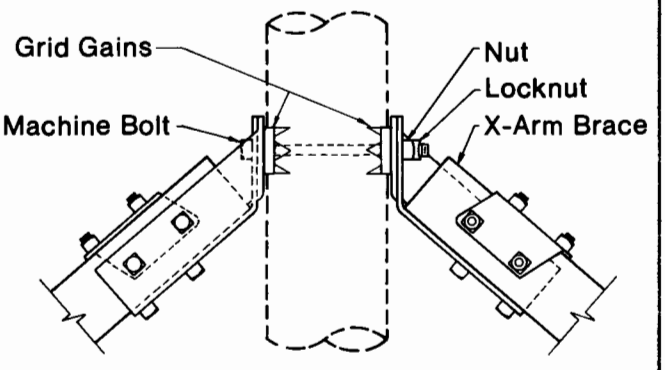
TD-17B



TD-17C



TD-17D



TD-17F

DETAILS

BRACE TO POLE CONNECTIONS

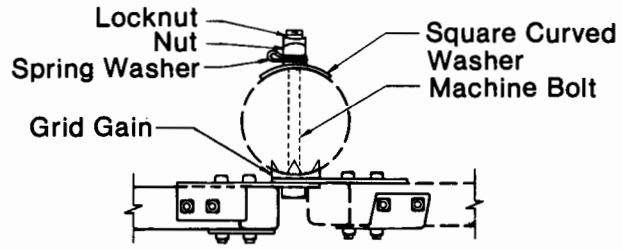
NO.	REVISION	DATE

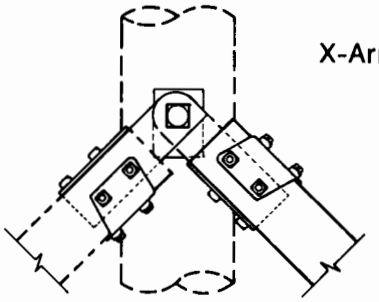
Reissued 03/98

SCALE :

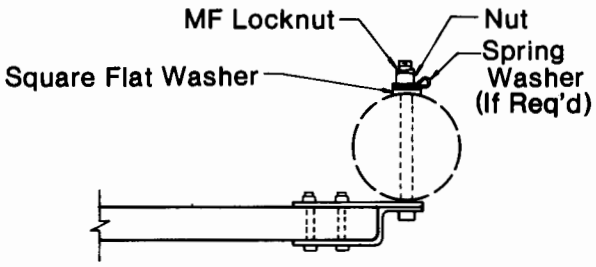
SHEET 1 of 2

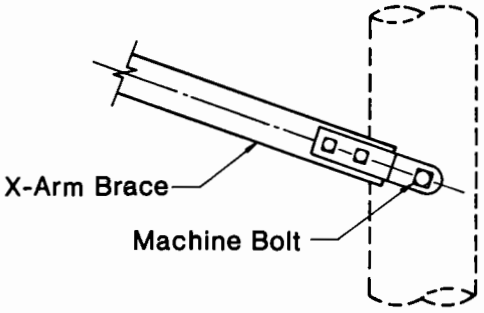
TD-17



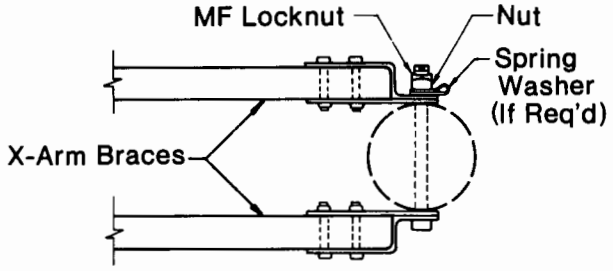


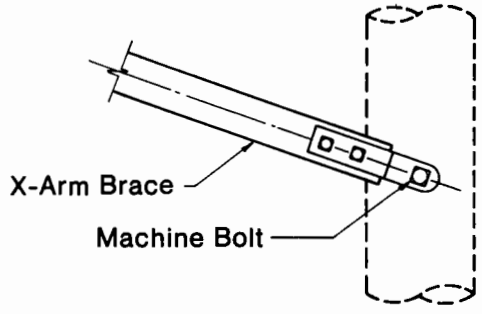
TD-17G
(SINGLE OR DOUBLE BRACE)





TD-17I





TD-17J

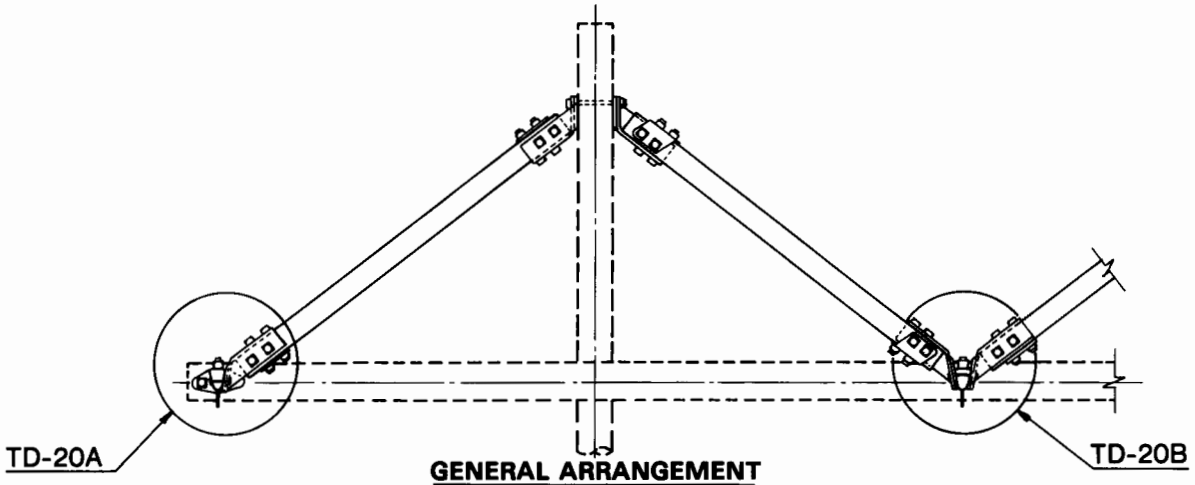
DETAILS

BRACE TO POLE CONNECTIONS

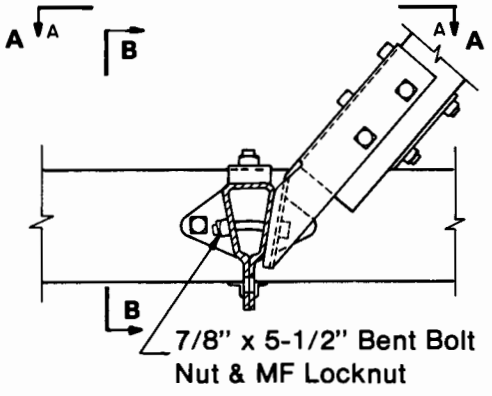
Reissued 03/98

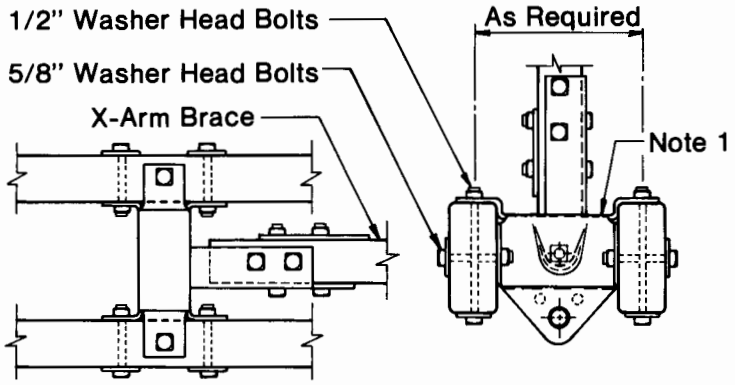
SHEET 2 of 2

TD-17



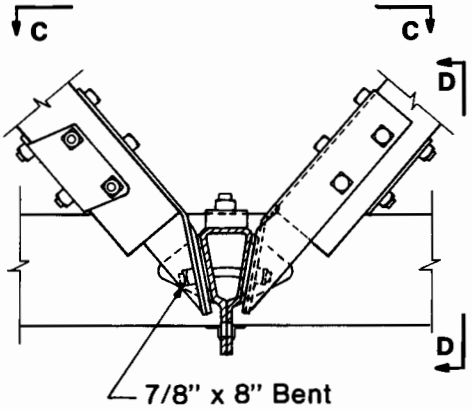
GENERAL ARRANGEMENT

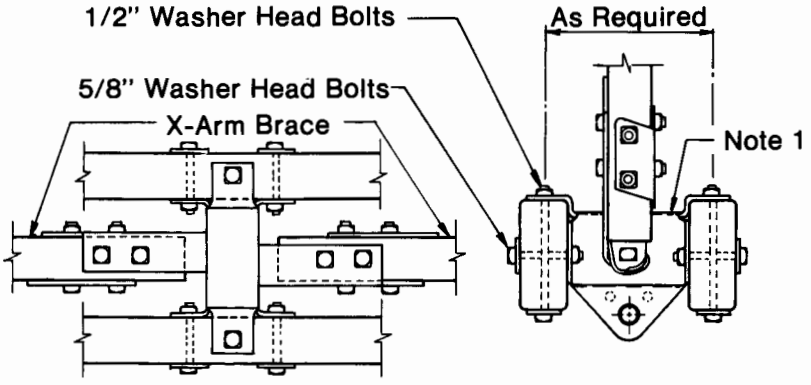




SECTION A-A
TD-20A

SECTION B-B





SECTION C-C
TD-20B

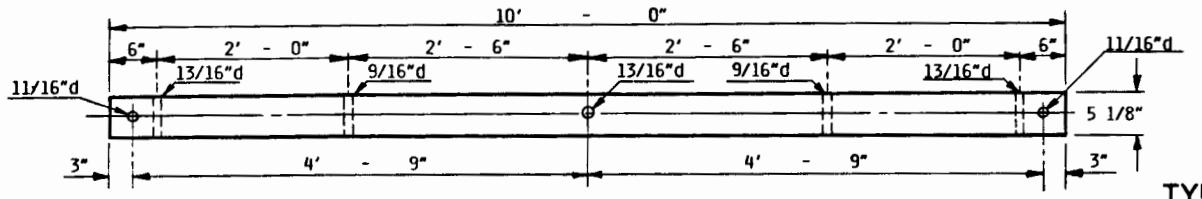
SECTION D-D

DETAILS

SPACER ASSEMBLY-CROSSARM BRACE

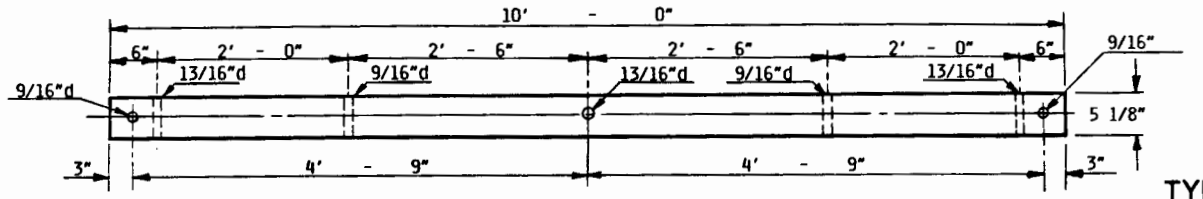
NO.	REVISION	DATE	SCALE :	TD-20

Reissued 03/98



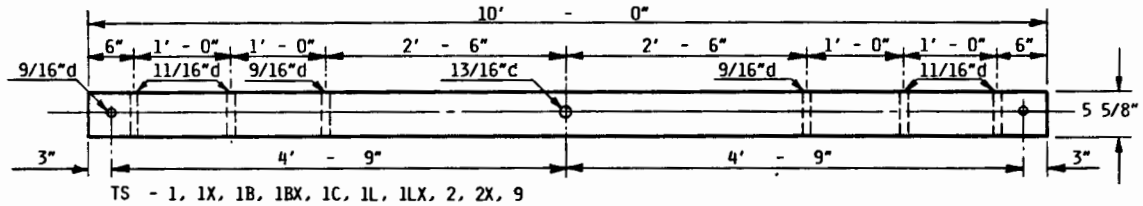
TYPE 20

TP - 3, 3A, 4, 4A
TPD - 3, 4, 7, 8



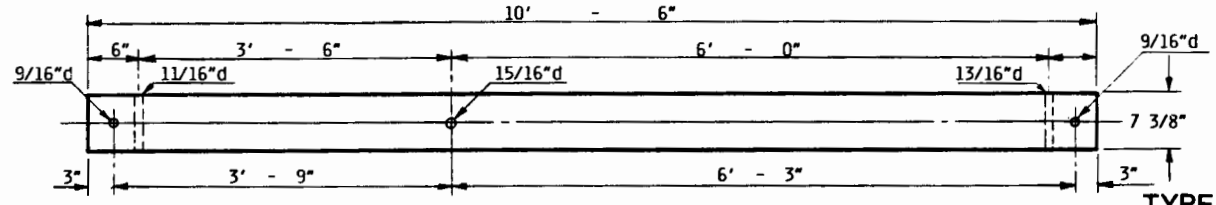
TYPE 21

TP - 1A, 2A, 5A, 6A
TPD - 1, 2, 5, 6
TPS - 1



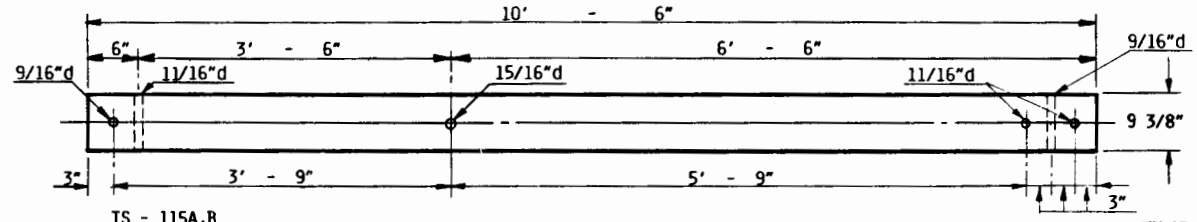
TYPE 22

TS - 1, 1X, 1B, 1BX, 1C, 1L, 1LX, 2, 2X, 9
TSD - 1, 1X, 2, 2X
TSSD - 1, 1X, 2, 2X



TYPE 23

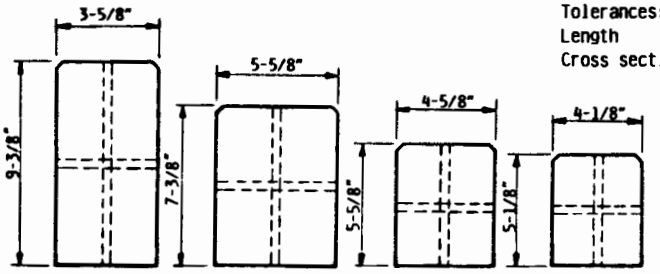
TS - 115



TYPE 24

TS - 115A,B

ENLARGED END VIEWS



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.

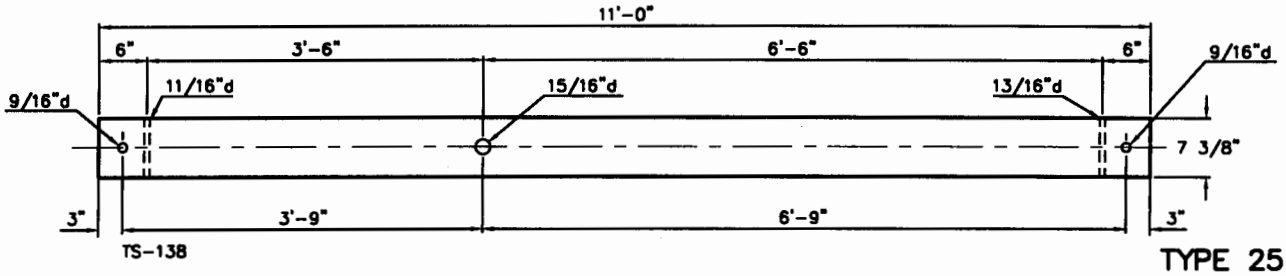
TRANSMISSION CROSSARMS

TEN FOOT TO TEN FOOT-SIX INCHES

Reissued 03/98

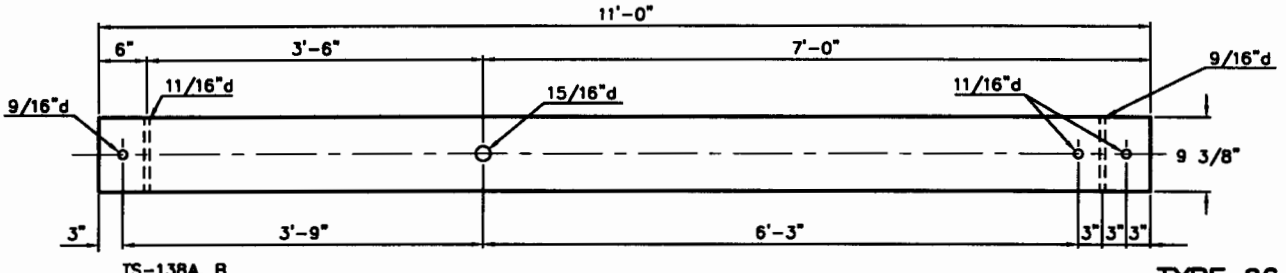
Aug., 1986

TCD-10



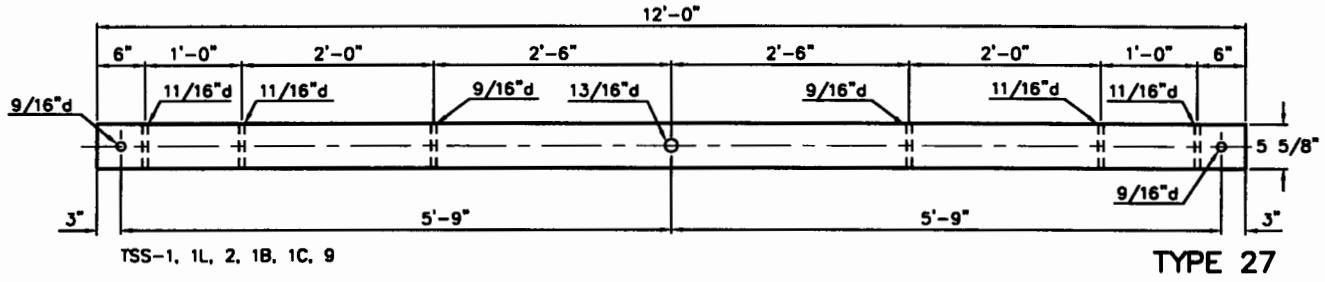
TS-138

TYPE 25



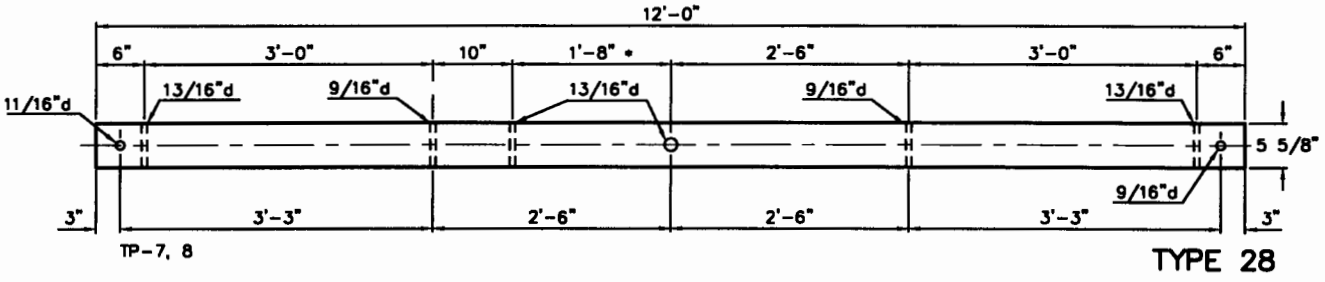
TS-138A, B

TYPE 26



TSS-1, 1L, 2, 1B, 1C, 9

TYPE 27



TP-7, 8

TYPE 28

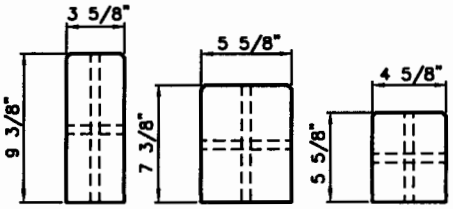
NOTES:

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"

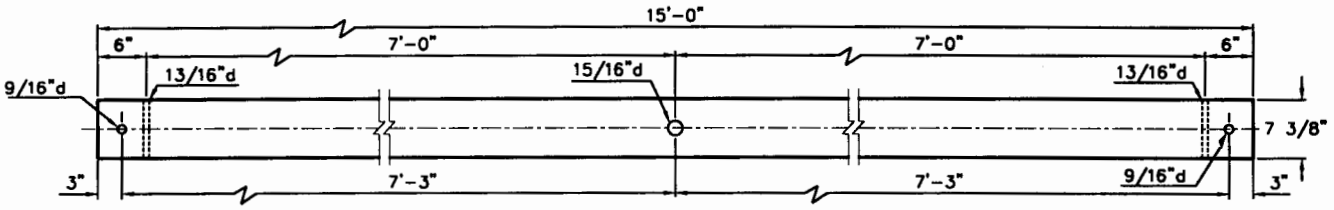


TRANSMISSION CROSSARMS

TEN FOOT TO TEN FOOT–SIX INCHES

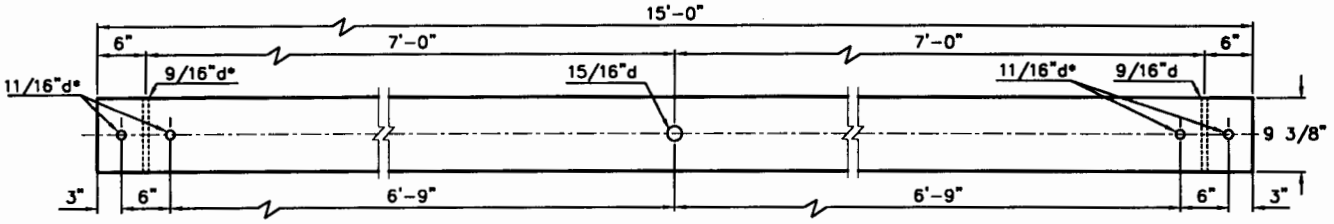
NO.	REVISION	DATE
1, *	TP-7, #28	03/98

TCD-11



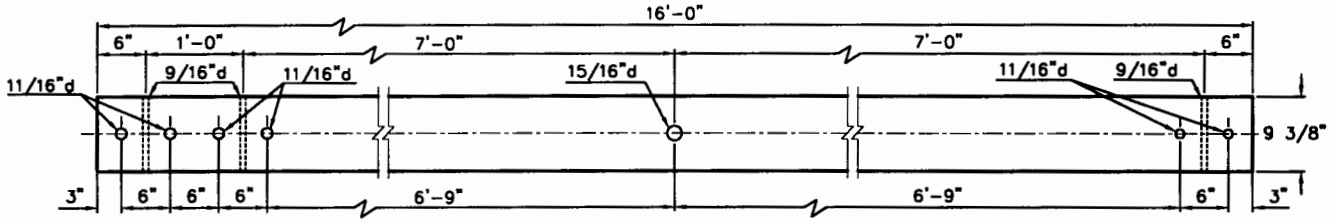
TS-115

TYPE 29



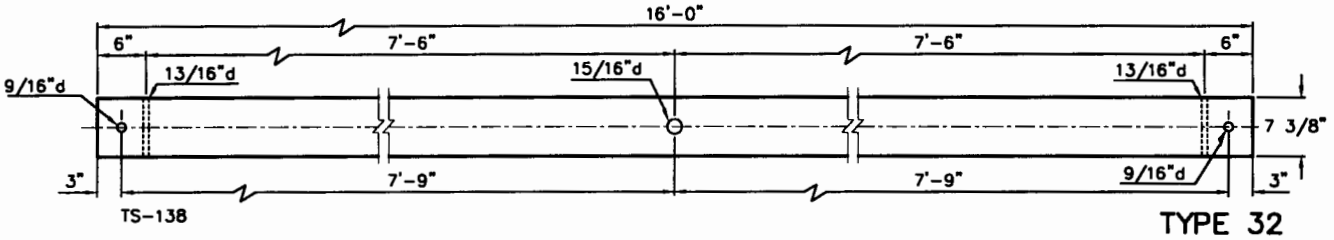
TS-115A

TYPE 30



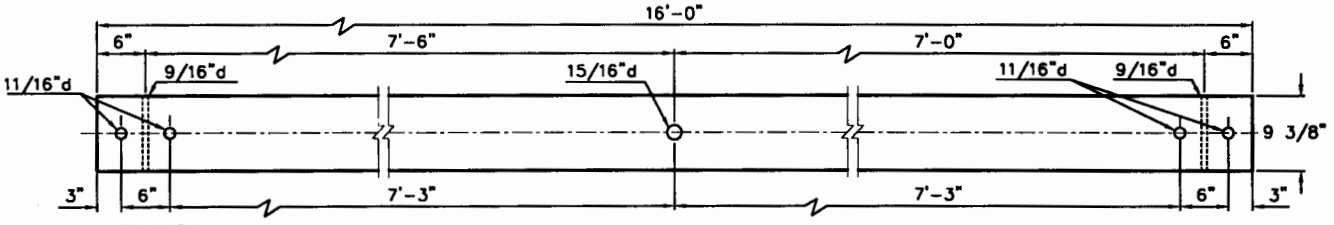
TS-115B

TYPE 31



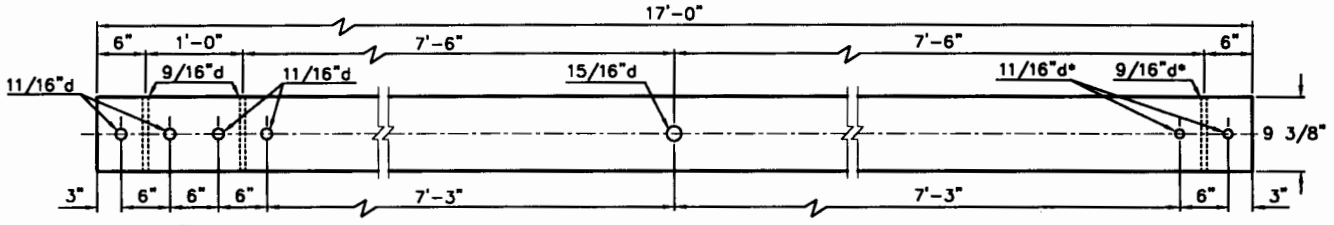
TS-138

TYPE 32



TS-138A

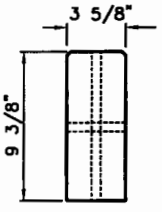
TYPE 33

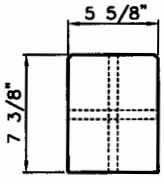


TS-138B

TYPE 34

ENLARGED END VIEWS





Tolerance:
Length ± 1/4"
Cross section ± 1/8"

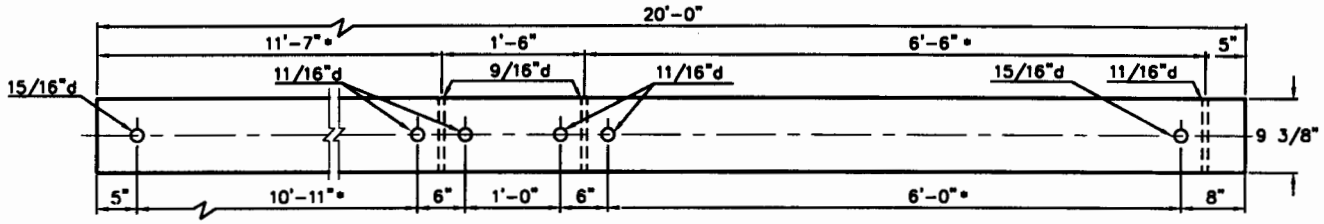
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

FIFTEEN FOOT TO SEVENTEEN FOOT

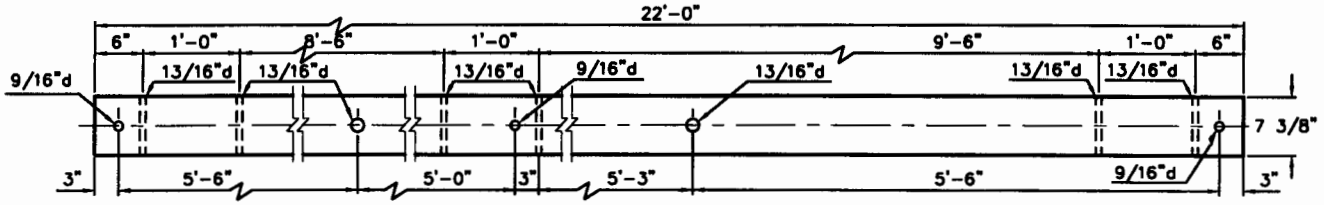
NO.	REVISION	DATE
1, *	Bolt holes,#30,34	03/98

TCD-15



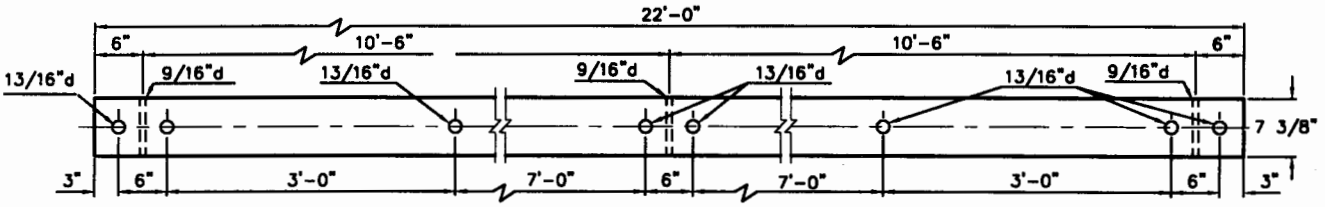
TH-232

TYPE 37



TH-1, 1G
TH-1C, 1CX, 1CG, 1CGX
TH-9, 9G

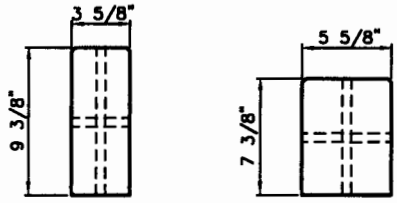
TYPE 41



TH-7, 7G

TYPE 44

ENLARGED END VIEWS



Toleronce:
Length ± 1/4"
Cross section ± 1/8"

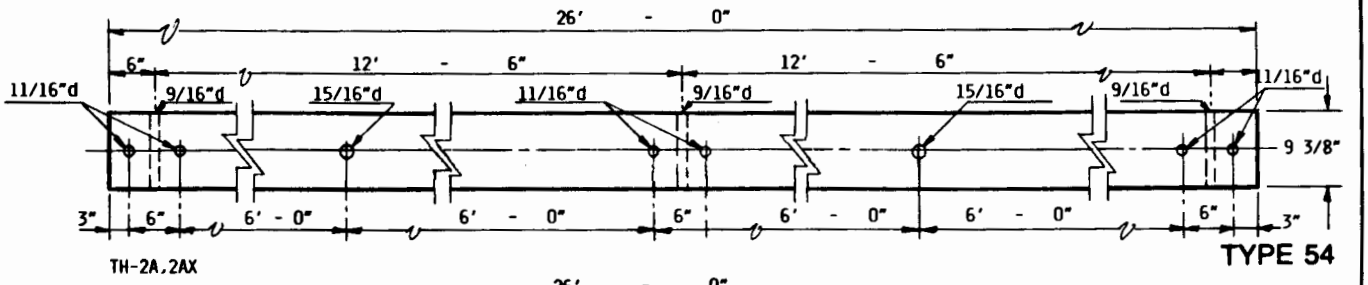
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

TWENTY FOOT TO TWENTY THREE FOOT

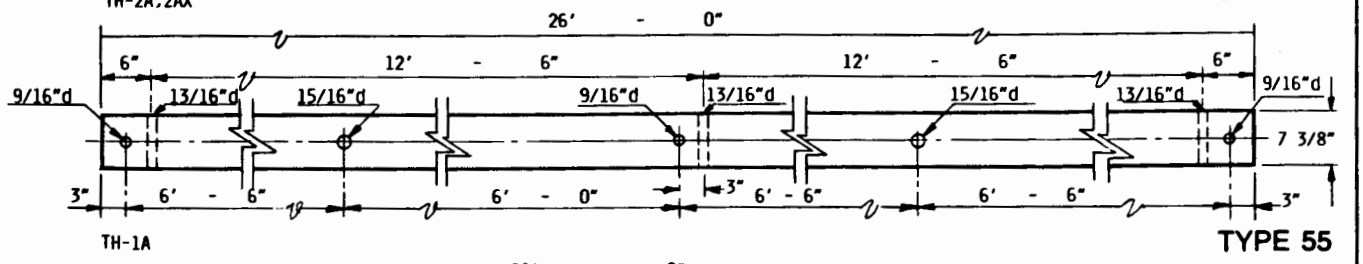
NO.	REVISION	DATE
1, *	Dimensions, #37	03/98

TCD-20



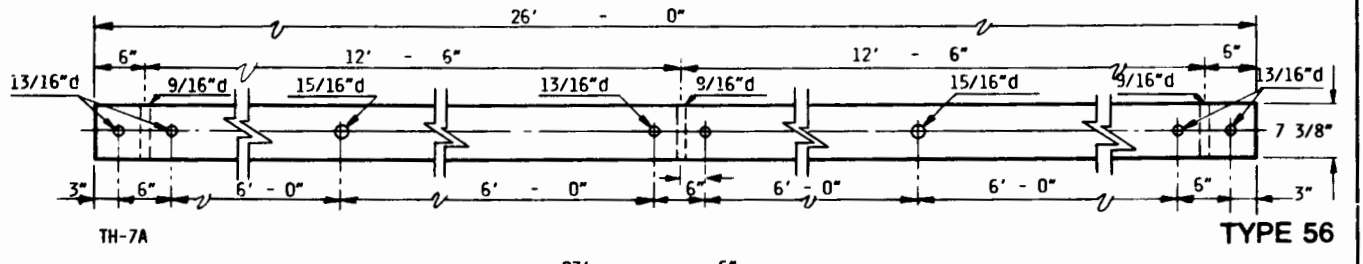
TH-2A,2AX

TYPE 54



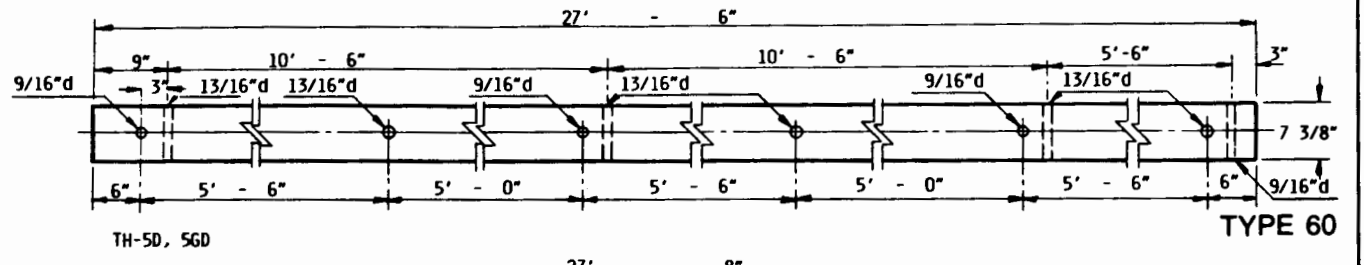
TH-1A

TYPE 55



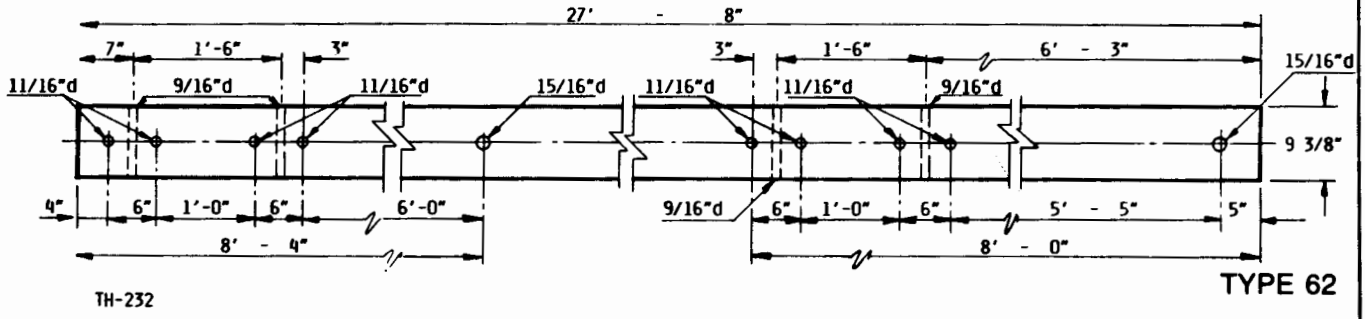
TH-7A

TYPE 56



TH-5D, 5GD

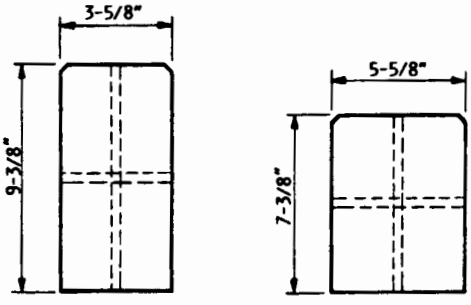
TYPE 60



TH-232

TYPE 62

ENLARGED END VIEWS



Tolerances:

Length	± 1/4"
Cross section	± 1/8"

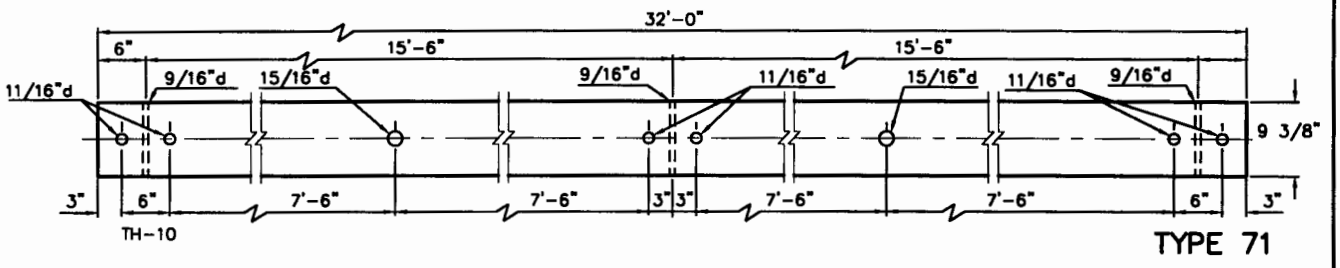
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

TWENTY-SIX FOOT TO TWENTY-NINE FOOT

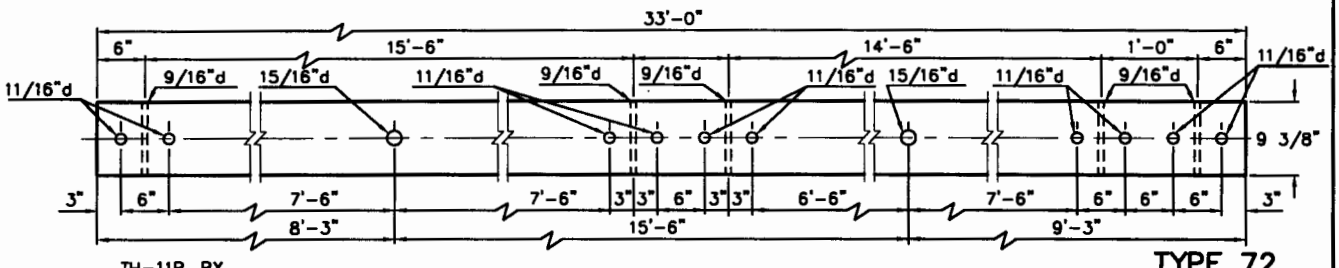
Reissued 03/98

TCD-26



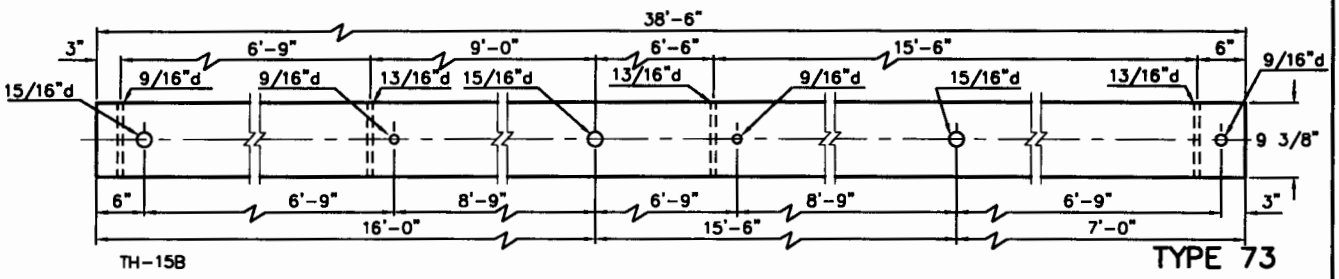
TH-10

TYPE 71



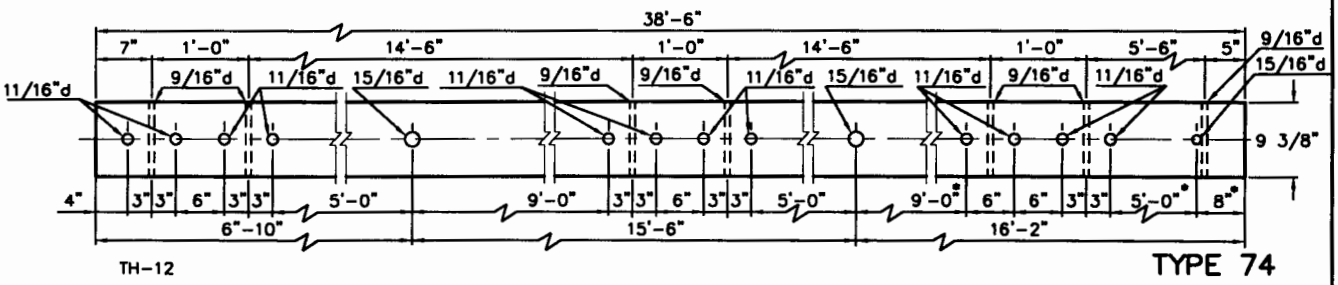
TH-11B, BX

TYPE 72



TH-15B

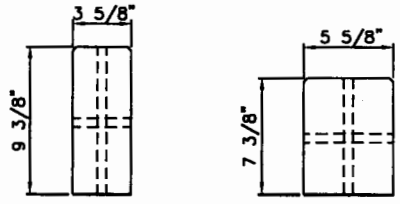
TYPE 73



TH-12

TYPE 74

ENLARGED END VIEWS



Tolerance:
Length ± 1/4"
Cross section ± 1/8"

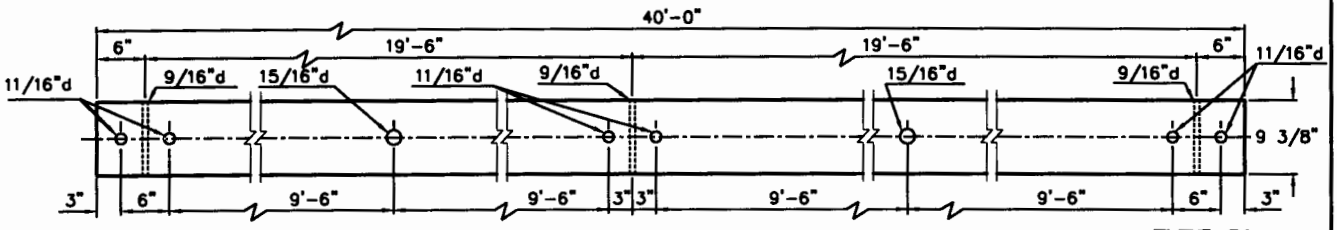
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

THIRTY-TWO FOOT TO THIRTY-NINE FOOT

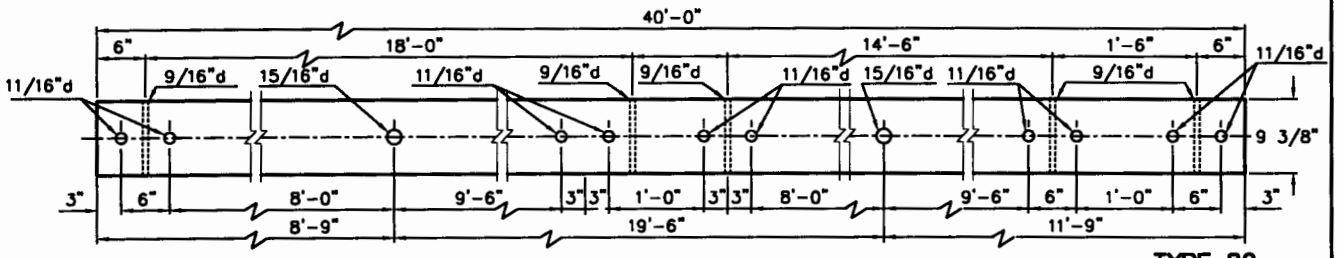
NO.	REVISION	DATE
1, *	Dimensions, #74	03/98

TCD-32



TH-230

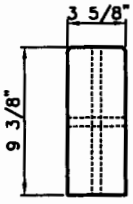
9 3/8" for **TYPE 81**



TH-118, BX

TYPE 82

ENLARGED END VIEWS



Tolerance:
Length ± 1/4"
Cross section ± 1/8"

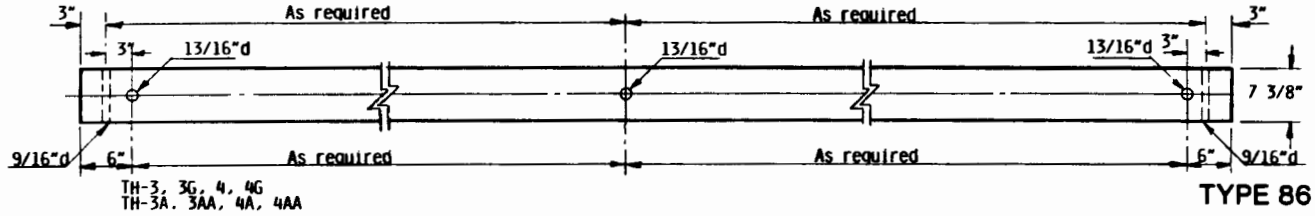
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

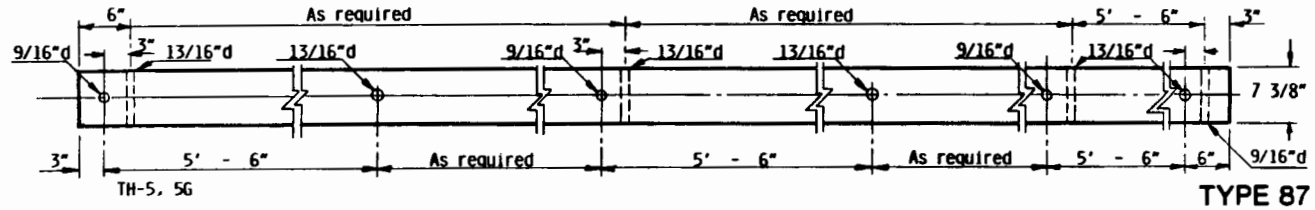
FORTY FOOT

NO.	REVISION	DATE
1.*	REMOVE #80.83	03/98

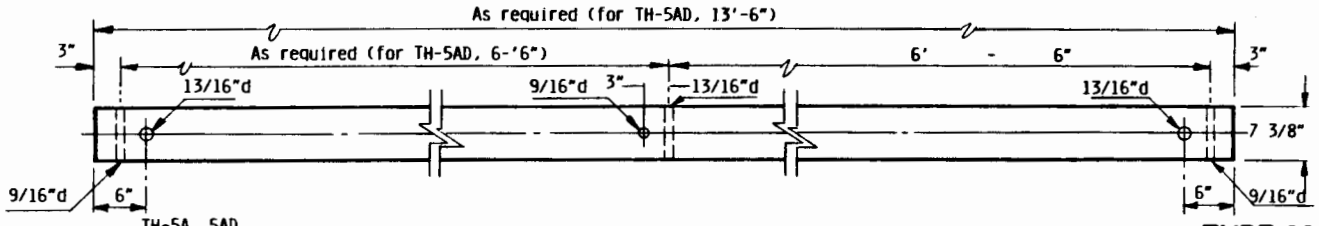
TCD-40



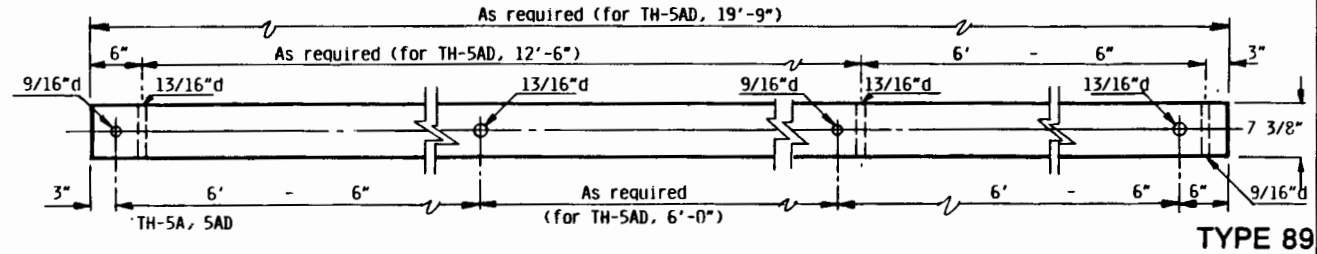
TYPE 86



TYPE 87

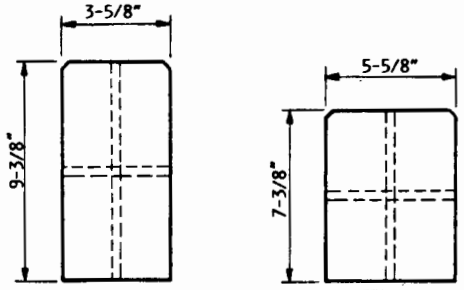


TYPE 88



TYPE 89

ENLARGED END VIEWS



Tolerances:

Length	± 1/4"
Cross section	± 1/8"

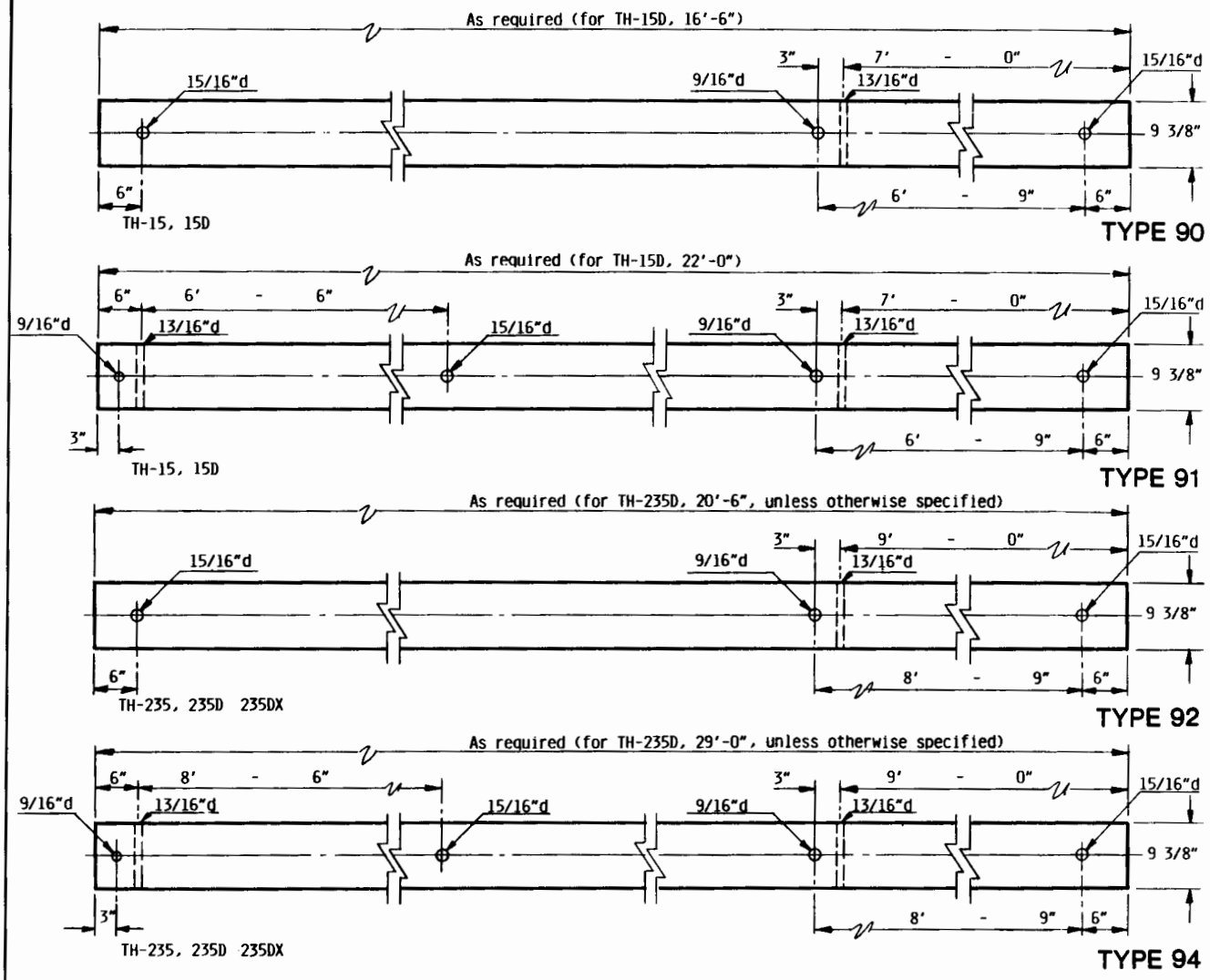
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

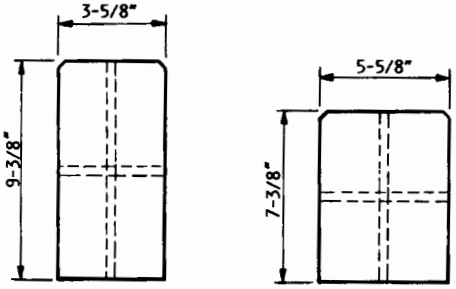
LENGTH AS REQUIRED

Reissued 03/98

TCD 91



ENLARGED END VIEWS



Tolerances:

Length	± 1/4"
Cross section	± 1/8"

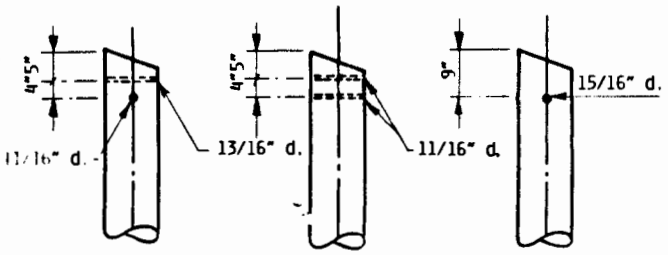
NOTES:
1. Drill all holes on centerlines.
2. "d" denotes hole diameter.
3. Holes shall be drilled before treating.

TRANSMISSION CROSSARMS

LENGTH AS REQUIRED

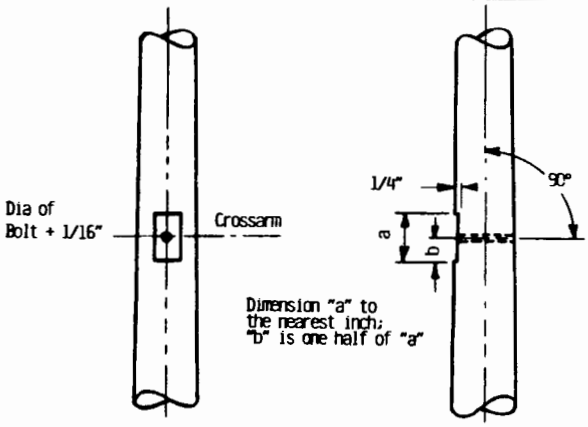
Reissued 03/98

TCD-92

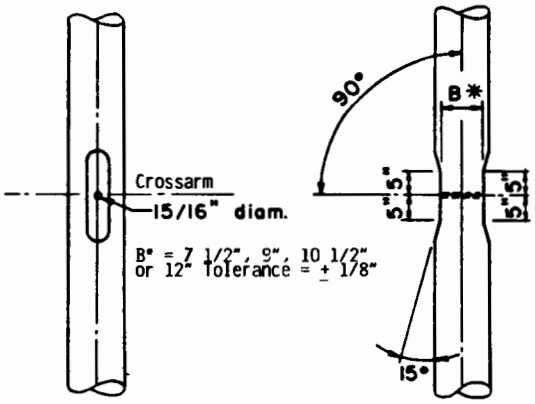


Single Bolt TM-6A | Double Bolt TM-6B | Tie Angle TM-7

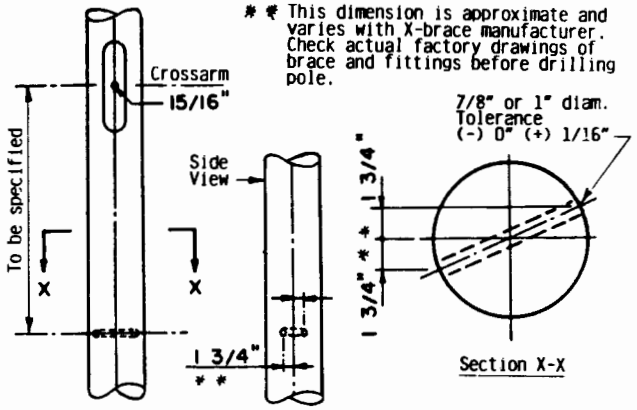
OHGW SUPPORT ASSEMBLY
DETAIL A



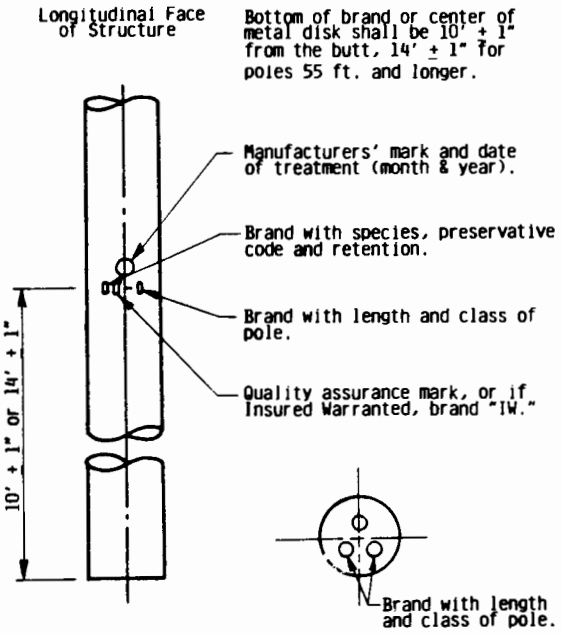
POLE GAIN FOR MOUNTING CROSSARMS (NO SPACERS)
DETAIL B



POLE GAIN FOR MOUNTING CROSSARMS (FIXED SPACERS)
DETAIL C



POLE DRILLING FOR CROSSBRACE (TM 110A, B, C)
DETAIL D



BRANDING
DETAIL E

Reissued 03/98

NOTES:

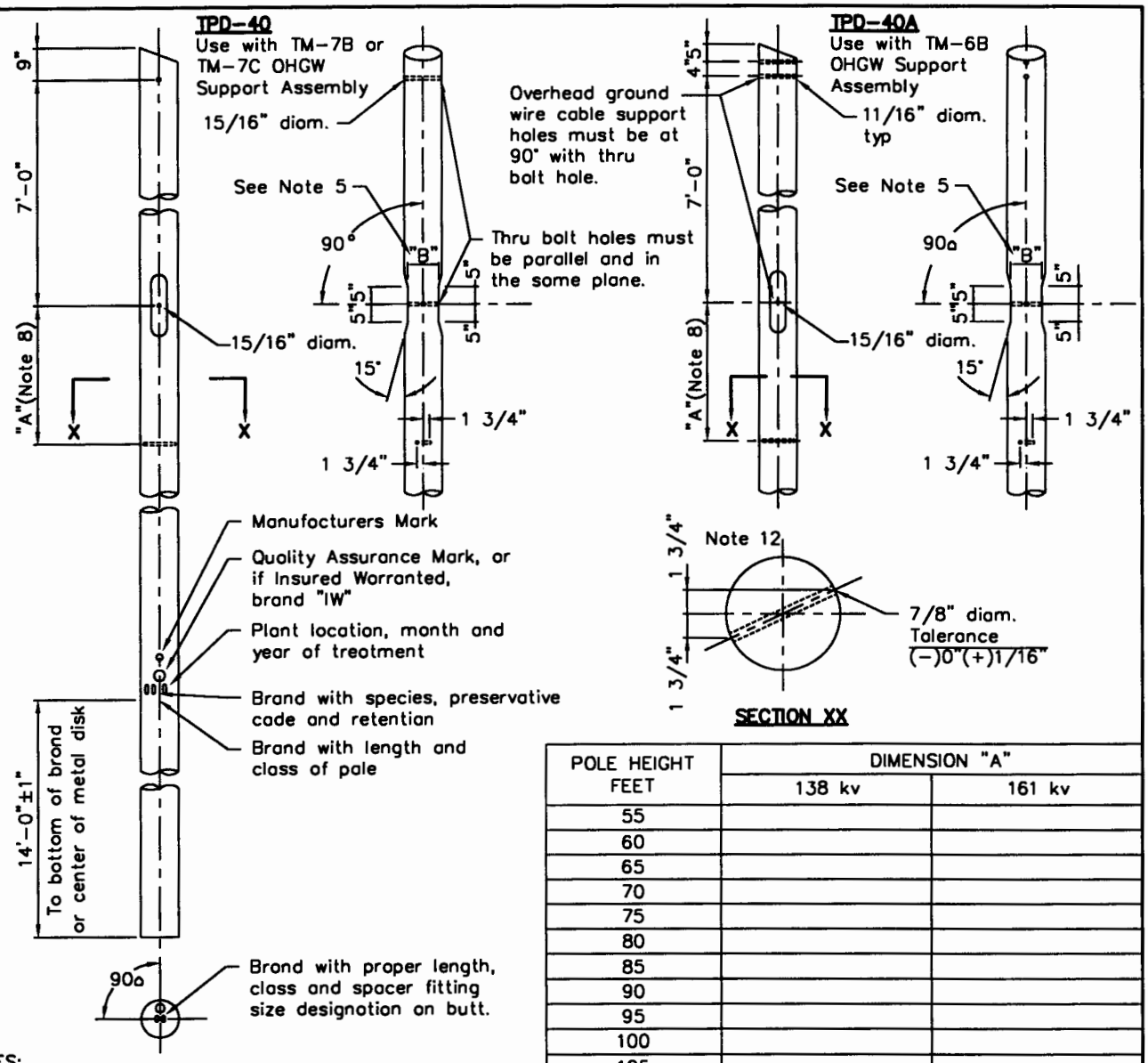
1. Poles and treatment shall conform to REA Specification DT-5C latest revision.
2. All poles treated full length must be bored (except where otherwise specified), roofed, and gained before treatment.
3. Refer to the construction specification to determine if roofs are to be flat or at an angle of 15°.
4. Gains shall be flat with their plane at right angles to bolt holes.
5. All field drilled holes shall be thoroughly treated.
6. Crossarms may be bowed ± 1/2".

TYPICAL NOTES

TRANSMISSION POLES

POLE FRAMING GUIDE DETAILS

Aug., 1986		TPF-1



POLE HEIGHT FEET	DIMENSION "A"	
	138 kv	161 kv
55		
60		
65		
70		
75		
80		
85		
90		
95		
100		
105		

Circumference of Pole at Point of Gain Inches	Dimension "B" Inches	Spacer Fitting Size	Spacer Fitting Designation
21.0 - 21.9	6.5	7 1/2	A
22.0 - 23.5	7.0	7 1/2	B
23.6 - 25.1	7.5	7 1/2	C
25.2 - 26.7	8.0	9	D
26.8 - 28.2	8.5	9	E
28.3 - 29.8	9.0	9	F
29.9 - 31.4	9.5	10 1/2	G
31.5 - 33.0	10.0	10 1/2	H
33.1 - 34.5	10.5	10 1/2	I
34.6 - 36.2	11.0	12	J
36.3 - 37.7	11.5	12	K

NOTES:

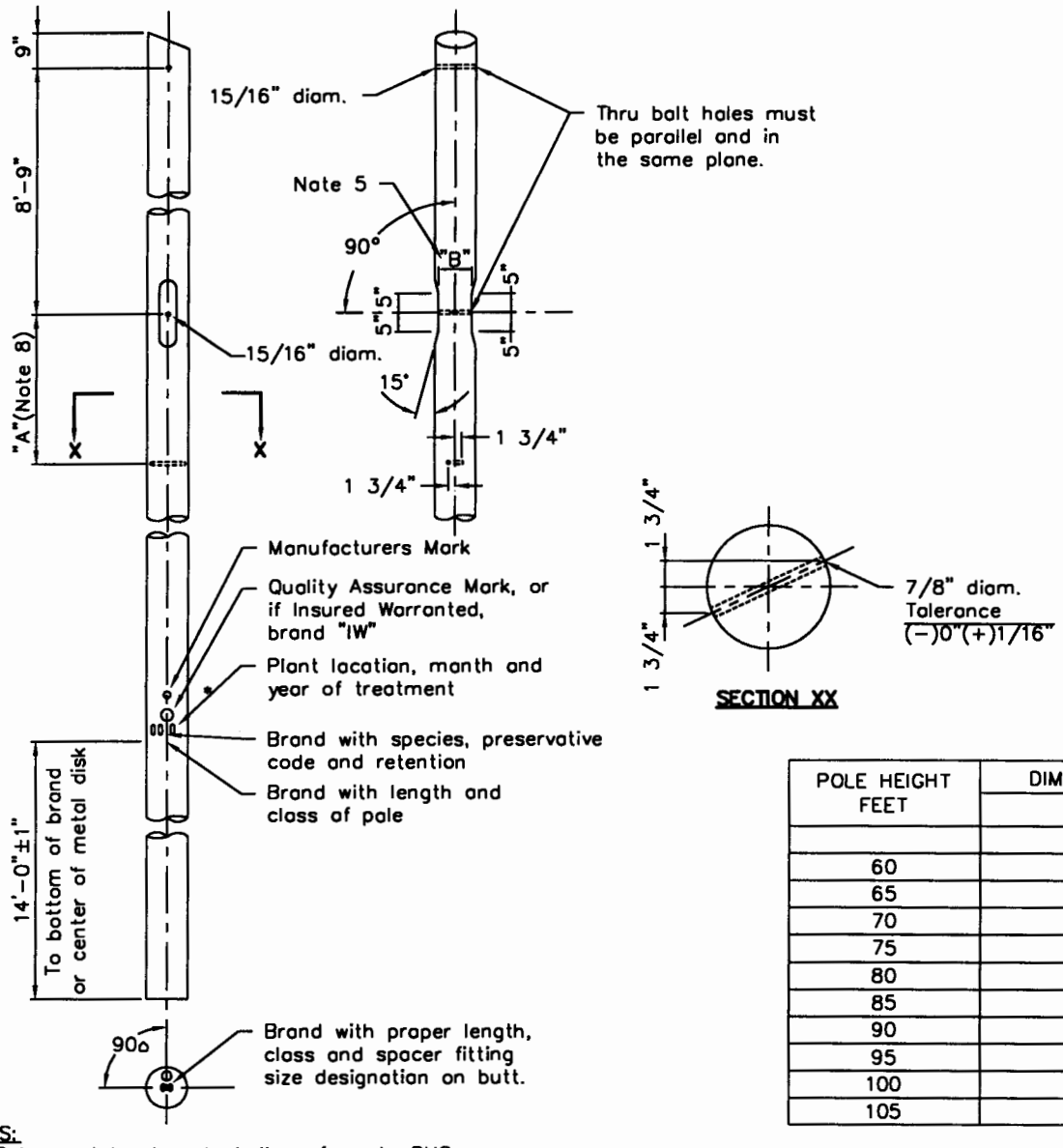
1. • Poles and treatment shall conform to RUS Specifications on Wood Poles, Stubs, and Anchor Logs.
2. All poles treated full length must be bored (except where otherwise specified), roafed, and gained before treatment.
3. Refer to the construction specification to determine if roofs are to be flat or at an angle of 15°.
4. Gains are to be flat with their planes at right angles to the bolt holes.
5. Separation between double gains shall conform to Dimension "B" in the table (tolerence ±1/8).
6. • Refer to the construction specifications for gaining of poles when using adjustable spacers.
7. Crossarms may be bowed ±1/2".
8. Dimension "A" shall conform to the table (Engineer to insert proper dimensions).
9. The hole at Section XX may be bored prior to treatment or field drilled at contractor's option unless otherwise specified.
10. All field drilled holes in full length treated poles shall be pressure treated.
11. Poles in each structure shall be matched in size, strength and straightness.
12. This dimension is approximate and varies with X-Brace manufacturer. Check actual factory drawings of brace and fittings before drilling poles.

TRANSMISSION POLES

STRUCTURE TH-10

Rev 03/98•

TPF-40



POLE HEIGHT FEET	DIMENSION "A" 230 kv
60	
65	
70	
75	
80	
85	
90	
95	
100	
105	

NOTES:

1. * Poles and treatment shall conform to RUS Specifications on Wood Poles, Stubs, and Anchor Logs.
2. All poles treated full length must be bored (except where otherwise specified), roofed, and gained before treatment.
3. Refer to the construction specification to determine if roofs are to be flat or at an angle of 15°.
4. Gains are to be flat with their planes at right angles to the bolt holes.
5. Separation between double gains shall conform to Dimension "B" in the table (tolerance ±1/8).
6. * Refer to the construction specifications as to gaining of the poles when using adjustable spacers.
7. Crossarms may be bowed ±1/2".
8. Dimension "A" shall conform to the table (Engineer to insert proper dimensions).
9. The hole at Section XX may be bored prior to treatment or field drilled at contractor's option unless otherwise specified.
10. All field drilled holes in full length treated poles shall be pressure treated.
11. Poles in each structure shall be matched in size, strength and straightness.
12. This dimension is approximate and varies with X-Brace manufacturer. Check actual factory drawings of brace and fittings before drilling poles.

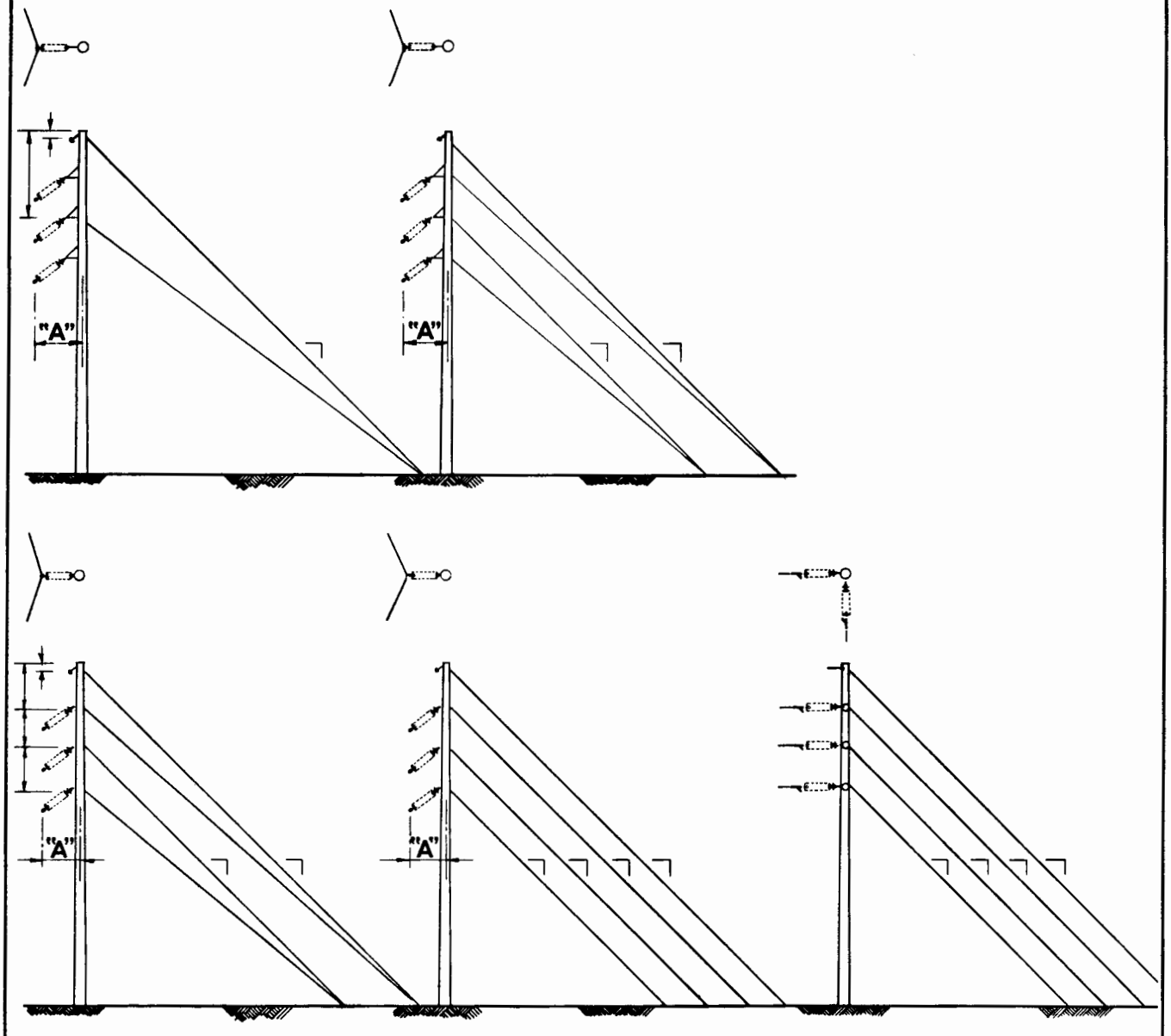
Circumference of Pole at Point of Gain Inches	Dimension "B" Inches	Spacer Fitting Size	Spacer Fitting Designation
21.0 – 21.9	6.5	7 1/2	A
22.0 – 23.5	7.0	7 1/2	B
23.6 – 25.1	7.5	7 1/2	C
25.2 – 26.7	8.0	9	D
26.8 – 28.2	8.5	9	E
28.3 – 29.8	9.0	9	F
29.9 – 31.4	9.5	10 1/2	G
31.5 – 33.0	10.0	10 1/2	H
33.1 – 34.5	10.5	10 1/2	I
34.6 – 36.2	11.0	12	J
36.3 – 37.7	11.5	12	K

TRANSMISSION POLES

STRUCTURE TH–230

Rev 03/98*

TPF–50



DESIGN CONDITIONS

RULING SPAN:
CONDUCTOR : D.T. =
OHGW : D.T. =
GUY WIRE SIZE:

Struct. Type	Line Angles	Guys Req'd	Anchors Req'd

1. On the elevation and plan drawings, the engineer is to indicate guy slopes, guy arrangements, and dimensions

DIMENSION "A" TABLE (60° Initial)

STRUCT. NO.	SHEET	ANGLE	DIM. "A"

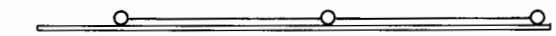
GUYING GUIDE

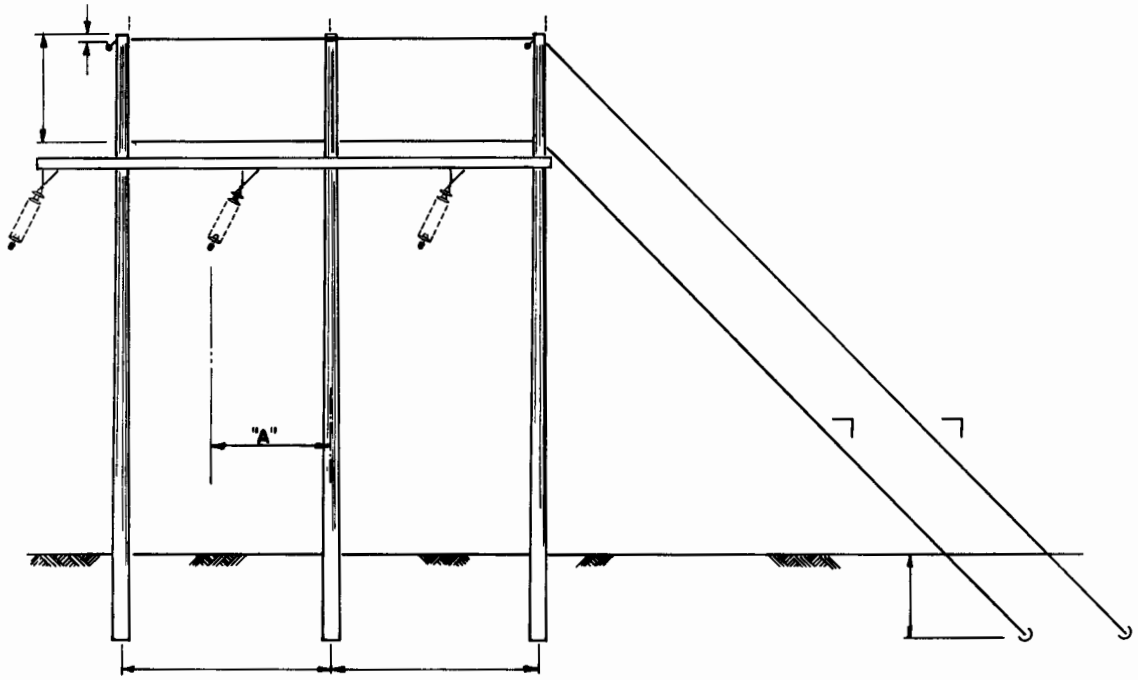
SINGLE POLES
(WITH OHGW)

Reissued 03/98

Aug., 1986

TMG-2G





DESIGN CONDITIONS

RULING SPAN :

CONDUCTOR : D.T. =

OHGW : D.T. =

STRUCTURE TYPE: GUY WIRE:

Line Angle	Guys Req'd	Anchors Req'd

NOTES:

1. On the elevation and plan drawings, the engineer is to indicate guy slopes, guy arrangements, and dimensions necessary for construction.

Reissued 03/98

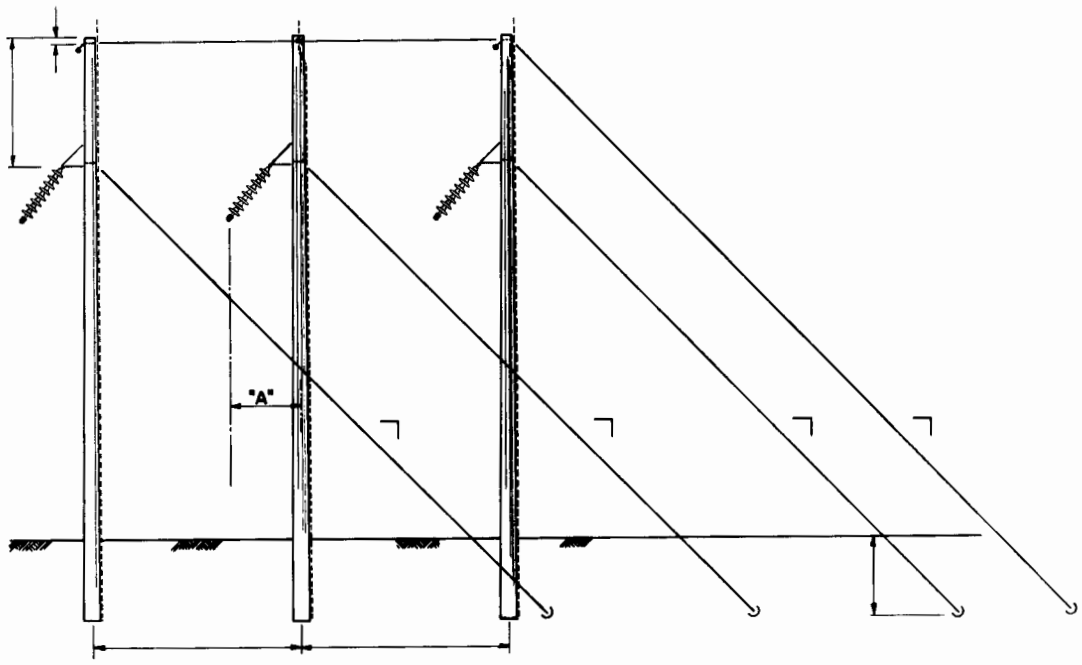
DIMENSION "A" TABLE (60° Initial)

STRUCT. NO.	SHEET	ANGLE	DIM. "A"

GUYING GUIDE

3 POLE INTERMEDIATE ANGLE

TMG-12



DESIGN CONDITIONS

RULING SPAN :

CONDUCTOR : D.T. =

OHGW : D.T. =

STRUCTURE TYPE: GUY WIRE:

Line Angle	Guys Req'd	Anchors Req'd

NOTES:

1. On the elevation and plan drawings, the engineer is to indicate guy slopes, guy arrangements, and dimensions necessary for construction.

Reissued 03/98

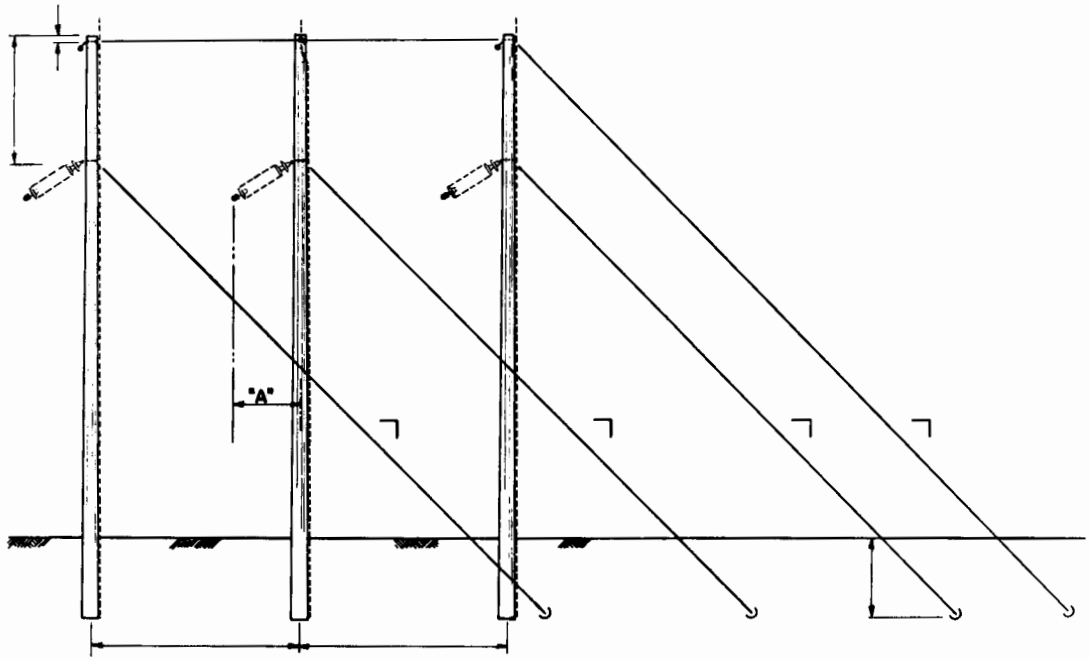
DIMENSION "A" TABLE (60° Initial)

STRUCT. NO.	SHEET	ANGLE	DIM. "A"

GUYING GUIDE

3 POLE MEDIUM ANGLE

TMG - 13



DESIGN CONDITIONS

RULING SPAN :

CONDUCTOR : D.T. =

OHGW : D.T. =

STRUCTURE TYPE: GUY WIRE:

Line Angle	Guys Req'd	Anchors Req'd

DIMENSION "A" TABLE (60° Initial)

STRUCT. NO.	SHEET	ANGLE	DIM. "A"

NOTES:

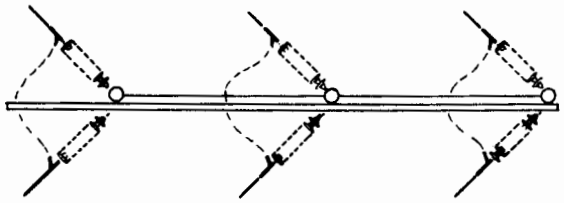
1. On the elevation and plan drawings, the engineer is to indicate guy slopes, guy arrangements, and dimensions necessary for construction.

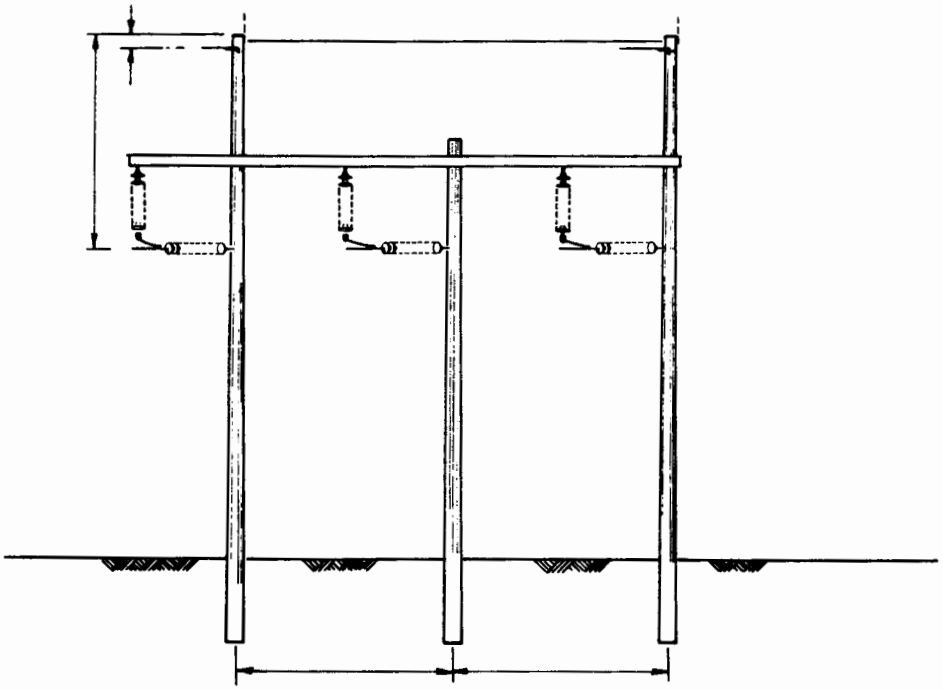
GUYING GUIDE

3 POLE LARGE ANGLE

Reissued 03/98

TMG-14





DESIGN CONDITIONS

RULING SPAN :

CONDUCTOR : D.T. =

OHGW : D.T. =

STRUCTURE TYPE: GUY WIRE:

Line Angle Range	Guys Req'd	Anchors Req'd

DIMENSION "A" TABLE (60° Initial)

STRUCT. NO.	SHEET	ANGLE	DIM. "A"

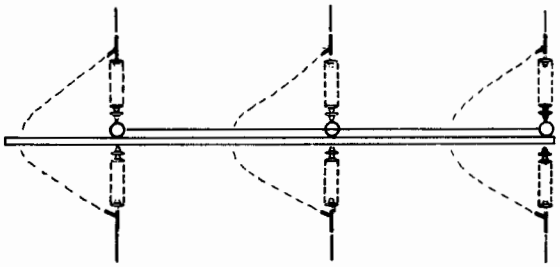
NOTES:

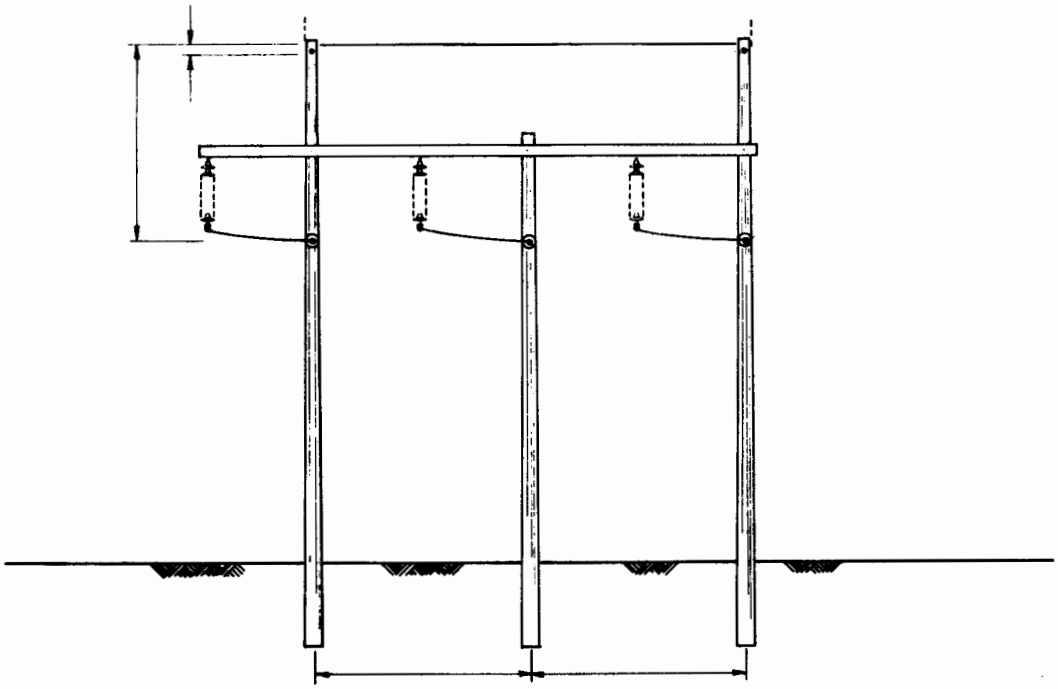
1. On the elevation and plan drawings, the engineer is to indicate guy slopes, guy arrangements, and dimensions necessary for construction.

GUYING GUIDE

3 POLE LARGE ANGLE DEADEND

Reissued 03/98	Aug., 1986		TMG-15





DESIGN CONDITIONS

RULING SPAN :

CONDUCTOR : D.T. =

OHGW : D.T. =

STRUCTURE TYPE: **GUY WIRE:**

Guys Req'd	Anchors Req'd

NOTES:

1. On the elevation and plan drawings, the engineer is to indicate guy slopes, guy arrangements, and dimensions necessary for construction.

GUYING GUIDE

3 POLE TANGENT DEADEND

Reissued 03/98

Aug., 1986

TMG- 15D

CONSTRUCTION DRAWINGS
INDEX BY DESCRIPTION

INDEX BY DESCRIPTION

INDEX BY DESCRIPTION

CONSTRUCTION DRAWINGS
INDEX BY DESIGNATION

INDEX BY DESIGNATION

INDEX BY DESIGNATION

Selected SI-Metric Conversions

AREA

To Convert From	To	Multiply by	
circular mil (cmil)	square meter (m^2)	5.067075	E-10
square centimeter (cm^2)	square meter (m^2)	*1.000	E-04
square foot (ft^2)	square meter (m^2)	*9.290304	E-02
square inch (in^2)	square meter (m^2)	*6.451600	E-04
square kilometer (km^2)	square meter (m^2)	*1.000	E+06
square mile (mi^2)	square meter (m^2)	2.589988	E+06

FORCE

To Convert From	To	Multiply by	
kilgram force (kgf)	newton (N)	*9.806650	
kip	newton (N)	4.448222	E+01
pound force (1bf)	newton (N)	4.448222	

FORCE PER LENGTH

To Convert From	To	Multiply by	
kilogram force (kgf) meter (kgf/m)	newton per meter (N/m)	*9.806650	
pound per foot (1b/ft)	newton per meter (N/m)	1.459390	E+01

DENSITY

To Convert From	To	Multiply by	
pound per cubic inch ($1b/in^3$)	kilogram per cubic meter (kg/m^3)	2.76790	E+04
pound per cubic foot ($1b/ft^3$)	kilogram per cubic meter (kg/m^3)	1.6014	E+01

LENGTH

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

LINEAR DENSITY

To Convert From	To	Multiply by	
pound per foot (1b/ft)	kilogram per meter (kg/m)	1.488164	
pound per inch (1b/in)	kilogram per meter (kg/m)	1.785797	E+01

LOAD CONCENTRATION

To Convert From	To	Multiply by	
pound per square inch ($1b/in^3$)	kilogram per square meter (kg/m^3)	7.030696	E+02
pound per square foot ($1b/ft^3$)	kilogram per square meter (kg/m^3)	4.882428	
ton per square foot (ton/ft^3)	kilogram per square meter (kg/m^3)	9.071847	E+02

* Exact Conversion.

Selected SI-Metric Conversions, cont.

MASS

To Convert From	To	Multiply by	
pound (avoirdupois) 1b)	kilogram (kg)	4.535924	E-01

PRESSURE

To Convert From	To	Multiply by	
kip per square inch (kip/in^2)	pascal (Pa)	6.894757	E+06
kip per square foot (kip/ft^2)	pascal (Pa)	4.788026	E+04
newton per square meter (N/m^2)	pascal (Pa)	*1.000	
pound per square foot ($1b/in^2$)	pascal (Pa)	4.788026	E+01
pound per square inch ($1b/in^2$)	pascal (Pa)	6.894757	E+03

BENDING MOMENT

To Convert From	To	Multiply by	
kilogram force meter (kgf-m)	newton meter (N-m)	*9.806650	
kip-foot (kip-ft)	newton meter (N-m)	1.355818	E+02
pound per foot (1b/ft)	newton meter (N-m)	1.459390	E+01

VELOCITY

To Convert From	To	Multiply by	
foot per second (ft/s)	meter per second (m/s)	*3.048	E-01
kilometer per hour (km/h)	meter per second (m/s)	2.777778	E-01
mile per hour (mi/h)	meter per second (m/s)	4.470400	E-01
meter per hour (m/h)	meter per second (m/s)	2.777778	E-04

VOLUME

To Convert From	To	Multiply by	
cubic foot (ft^3)	cubic meter (m^3)	2.831685	E-02
cubic inch (in^3)	cubic meter (m^3)	1.638706	E-05
cubic kilometer (km^3)	cubic meter (m^3)	*1.000	E+09
cubic millimeter (mm^3)	cubic meter (m^3)	*1.000	E-09

TEMPERATURE

	°C	°F
X°C =	---	$\frac{9}{5}X + 32$
X°F =	$\frac{5}{9}(X - 32)$	---

* Exact Conversion.