AT-8511 GUYED TOWERS

ERECTION

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1. GENERAL

1.01 This section outlines the general considerations for erecting AT-8511 guyed towers, and includes recommended procedures and precautions.

1.02 Erection drawings are normally furnished with the tower and provide information necessary for the field assembly of the tower, including the location and orientation of every piece and subassembly. All steel (except nuts, bolts, and washers) is identified by stencils, stamps, or metal taps which correspond to the markings shown on the erection drawings. The identifying mark on leg members is located on the outer face near the lower end. These drawings also show the number and type of bolts, nuts, and washers required to join members. A more-than-adequate supply of each specified type of bolt, nut, and washer is furnished with the tower, but care must be exercised to ensure that the proper type and size of each is used for each joint.

1.03 The initial tension to which the guys should be set is listed on the erection drawings shipped with each tower. These tensions assume an ambient temperature of 40°F $\pm$5°F, and that erection will be on level terrain. When the temperature is not within these limits or the grade is not level, the guy tensions should be adjusted accordingly.

2. PRE-ERECTION CONSIDERATIONS

2.01 Tower erection should not be started until all required permits have been obtained, as outlined in Section 760-925-570. Note that the Federal Aviation Agency (FAA) requires notification 48 hours prior to starting construction and should also be notified as soon as construction is completed.

2.02 The permit issued by the Federal Communications Commission (FCC) to construct and operate a radio system usually indicates whether lighting and painting to improve visibility are required. Where only receivers are to be installed and it has been determined that FCC permission is not required, the FAA will determine the necessity for painting and lighting to improve visibility. If lighting is required, arrangements must be made to ensure the availability of electric power at the site, and the lighting facilities must be ordered and on hand at the tower site. Note that the standard lighting kit provides only the material which goes on the tower. Conduit and wire from the base of the tower to the lighting control panel in the building should be ordered locally. Methods of lighting and painting towers are described in Sections 760-925-230 and 760-925-300. Information on temporary warning lights is contained in Part 4 of this section.

2.03 Section 760-925-570 provides information on foundations and anchors for AT-8511 guyed towers. Steel erection should not be started until the results of concrete compression tests are known to be satisfactory. (See Section 760-925-130 for a discussion of concrete.)

2.04 The grounding system at the anchors should be completed and the grounding connections at the foundation should be readily accessible. Installation of the grounding system is described in Section 760-925-570.

2.05 All equipment to be installed on the tower should be available when required, and its mounting location on the tower should be specified

to the contractor in order that hoisting equipment may be positioned to avoid conflict.

2.06 If aerial electric power facilities are in a location that may present a hazard to or interfere with temporary guys, hoisting equipment, tag lines, etc, arrangements should be made to have the power company relocate, de-energize, or insulate their facilities.

2.07 Foundations and anchors should be carefully checked to ensure that they are located correctly and are of the right size. This should include checking the azimuths of the anchors to ensure proper orientation of the tower relative to the transmitting paths of any antennas (see Section 760-925-560). Details on anchor and foundation layout are covered in Section 760-925-570.

2.08 Installation of a talking circuit on the tower to facilitate adjustment of antennas during system lineup may be desirable. Information on this subject is contained in Section 760-925-230. A physical circuit can be avoided by use of the walkie-talkie radio, if this equipment is available. This equipment may also prove of value in the erection of the tower itself.

3. INSTALLATION OF BASE PLATE ASSEMBLY

3.01 Both the foundation surface and the base plate assembly should be cleaned of mud, grime, and other foreign matter. The base plate assembly is then installed, as illustrated in Fig. 1, by placing it on four tapered steel wedges located about midway between the anchor bolts. The plate is leveled by adjusting the wedges. Since the base plate is symmetrical about the center, it may be installed without regard to its orientation on the pier.

3.02 After the base plate has been leveled, the anchor bolt nuts should be tightened. The wedges should provide a clearance of 3/4 to 1-1/4 inches between the base plate and pier to allow for grout. The base plate may be installed at any time after the results of the compression tests on the concrete are known to be satisfactory.

3.03 The grout should consist of one part portland cement (Type I or III) to two parts sand (by volume). Portland cement is described in Section 760-925-130. Clean sand from a reliable supplier should be used in the grout. The water should be clean and fit for drinking.

3.04 The consistency of the grout must be very stiff. The sand and cement should be thoroughly mixed in a dry condition, and then water should be added sparingly so that the mixture retains a granular appearance. Grout of the proper consistency will form a lump when squeezed in the hand, and the lump will crumble freely when disturbed.

3.05 Grout should be forced under the base plate from all sides, completely filling all voids. The wedges should then be removed, and the void left by removing the wedges should be filled immediately with additional grout. The grout should be beveled as illustrated in Fig. 1.

4. TEMPORARY WARNING LIGHTS

4.01 The rules of the FCC and FAA require that temporary warning lights be placed on any tower which is required to have permanent air obstruction warning lights. The number of sets (or levels) of temporary lights required will be the same as the number of levels of permanent lighting. Where two or three levels of permanent lights are required, only one temporary set of lights is required (at the top) until the level of the first permanent lights have been exceeded. Temporary lights should then be installed at the approximate level of permanent lights and, in addition, a set of temporary lights is always required at the uppermost point of the structure. Even on towers requiring only one level of permanent lighting, a set of temporary lights is required at the top of the structure, and this applies even though only one section of the tower may have been erected by sunset.

4.02 Temporary lights are to burn steadily from sunset to sunrise. Top lights are to consist of two 100-, 107-, or 116-watt lamps (#100 A21/TS, #107 A21/TS, or #116 A21/TS, respectively) enclosed in aviation red obstruction light globes. Two similar lights are required at each level where permanent lights would be installed. (Permanent lights may be used in lieu of temporary lights.) All side lights are to be positioned so that at least one of the two lights at each level will be visible from any angle of approach. Many contractors have temporary warning lights for use during erection, but it is advisable to notify them if temporary lighting will

be required, and whether it will be one-, two-, or three-level.

5. ERECTION CONSIDERATIONS

5.01 Erection of steel towers is usually performed by contractors rather than by telephone company personnel. It should be noted that the contractor is responsible for the job and for the construction methods he chooses to use. He is, presumably, the best judge of the condition of his equipment and the loads which it can handle. However, the person representing the telephone company should assure normal safeguards and require the contractor to correct any obviously dangerous items, such as frayed winch lines and ropes. The representative should also make sure that the contractor observes the requirements of the Occupational Safety and Health Act.

5.02 The general appearance of the base of the tower is shown in Fig. 2. Since this base will collect water, a 3/4-inch hole is provided for drainage. Mud or other foreign matter should be removed to permit drainage. Bolts are 5/8-inch diameter high-strength A325 bolts equipped with a washer, hex nut, and Palnut*.

*Registered trademark of the Palnut Company

5.03 Most structural members of the tower are formed of angles. All legs are high-strength (50-KSI yield) structural steel 6 by 6 by 1/2-inch angles formed to 60 degrees. All other members are of structural (36-KSI yield) steel. Note that the legs are double-laced with 3 by 3 by 1/4-inch angles, ie, cross-braced. This is a tension-compression system, and to obtain the maximum strength from these small angles, they are bolted together at the point where they cross. On a given face, since one set of lacing angles is bolted to the inside of the legs and the other is bolted to the outside, angles which cross each other are separated by the thickness of the leg members. As shown in Fig. 3, spacer washers are installed to avoid bending these angles. Washers are also used in bolting to the flange of channels (Fig. 3).

5.04 It is general practice for contractors to assemble the tower sections on the ground, with the associated splice plates attached loosely at the top of each leg. The lower diagonals are usually left loose to facilitate lining up holes when the section is put in place. The sections should be inspected for such items as correct assembly, spacer washers, tightness of bolts, etc. All bolts should be equipped with a plain washer, hex nut, and Palnut.

5.05 Contractors will vary in the exact manner in which they assemble the tower. Usually the bottom section, and sometimes the two bottom sections, are bolted together on the ground and lifted onto the base plate. Because of the ball-and-socket type of connection to the base pier, it is necessary to use temporary guys to prevent the tower from overturning. Selection of the size and type of temporary guys is the responsibility of the erection contractor. Temporary guys are to be moved up with the tower so there is never more than one section (25 feet) extending above the level of the temporary guys. Guy strand intended for permanent guys should not be used for temporary guys.

5.06 As soon as the first unit is in place and is stabilized with temporary guys, the grounding connections should be established. All faces of the tower base have two 9/16-inch holes for a 1/2-inch machine bolt. Only one hole in each of the two faces is used. The ground wire is secured under a grooved washer held in place by the 1/2-inch machine bolt. Since the wire is tinned copper and the base plate is galvanized, the presence of water in the joint will cause a galvanic action between the dissimilar metals. The bolt should be drawn up tightly and painted with hot pitch or other waterproofing material in order to prevent this galvanic action.

5.07 Permanent guys should be installed at their appropriate level as the tower reaches the height at which they are required. The structure should be made plumb and guys tensioned to their correct tension before adding any more sections. Guy strand is furnished in quantities sufficient to make up all guys with each anchor on a minus 6-degree (ground) slope, ie, a drop of about 10-1/2 feet per hundred feet.

5.08 All guys are 19-wire, extra-high-strength galvanized steel strand. Four different sizes of strand are used with the AT-8511 towers. The sizes used on any one tower and their initial tensions are shown on the erection drawings furnished

with the tower. The maximum design tensions for each of the sizes are as follows:

5/8 inch = 16,080 pounds

3/4 inch = 23,320 pounds

7/8 inch = 31,880 pounds

1 inch = 41,800 pounds.

5.09 The ends of the guys are made up with preformed guy grips, which are in turn connected to the tower and to their respective turnbuckles (Fig. 4). Care should be taken to install these grips properly so the full strength of the connection is developed. If it is necessary to remove the grip from the strand, it should be discarded, and not reused.

5.10 A typical arrangement which is often used to erect guyed towers employs a gin pole, as shown in Fig. 5. The gin pole is attached to one face of the tower at two points. The bottom of the gin pole is usually hung by two short lengths of steel cable or chain attached to leg members (A in Fig. 5). These cables or chains support the dead load of the gin pole plus the loads imposed by hoisting. The upper attachments (B in Fig. 5) serve to support the gin pole in a vertical position. Usually the lengths of the cables or chains are kept short enough so that the gin pole does not swing more than about ± 10 degrees from vertical. This serves to restrict the bending moment imposed on both the tower and the gin pole. Use of wood poles as gin poles is not recommended.

5.11 Usually, the gin pole will extend above the tower by a distance equal to the length of a tower section plus two feet or more. This is necessary to provide head room when a section is being hoisted and set in position. The top of the gin pole is usually equipped with a swivel head.

5.12 When a section is being hoisted, the top of the gin pole will lean out to the limit of its top shackles. When the section reaches the upper block, hoisting is halted, and the section is pivoted (A-A of Fig. 5) around the pole. With this transfer of weight, the tip of the pole will kick in and the bottom will kick out. This action will put the center of the hoisted section near the center of the tower and it can be lowered into place and bolted. All bolts should be installed and tightened before raising the gin pole to the next level. Antennas or reflectors may also be installed by use of the gin pole, but this should not be done until the tower has been completely erected, with permanent guys installed at correct tension and the tower plumbed.

5.13 The gin pole method, when properly used, is capable of hoisting any single assembled tower section, System standard antenna or reflector (or comparable weights), without exceeding the design criteria of the tower. There are other satisfactory construction methods, such as boom cranes, which are used quite frequently. Some contractors erect supplementary portable towers on the site for use in hoisting tower sections and equipment items.

5.14 The tower is erected by joining abutting leg angles, using bolts and splice plates. In order to effect savings in fabrication, only one size leg and one size splice plate is used. Each splice plate provides two groups of 11-bolt holes, as shown in Fig. 6.

5.15 Members which have been bent or buckled should be replaced. Occasionally, it will be found that holes do not line up closely enough to permit bolting without drifting of holes. Drilling of holes should not be permitted. However, there is no objection to removing excess zinc (galvanizing) which may have unduly reduced the hole size. Members which cannot be installed without modification should not be installed without first checking dimensions to determine the reasons for the misfit. Members which are merely too long may be cut to proper length, provided distances between bolt holes are correct and edge distances will be correct after cutting. Grinding may by permitted in lieu of cutting; cutting by torch should not be allowed.

5.16 Freshly cut surfaces, or any surface where galvanizing has been damaged, should be painted immediately. The best protection is probably provided by the zinc-rich type of paints. These paints are 90 percent (or more) powdered zinc and will provide some galvanic protection in the same fashion as galvanizing. They also have the property

of preventing rust from creeping under the paint film. They should not be applied to steel which is damp or wet or coated with mud, oil, grease, mill scale, bird droppings, etc. Paint of this kind, to be effective, should not have a spreading rate exceeding 350 square feet per gallon. If this type of paint is not available, zinc oxide-zinc dust paint is an acceptable substitute. It should be applied over clean, dry metal and should conform to Federal Specification TT-P-641, Type I or Type II.

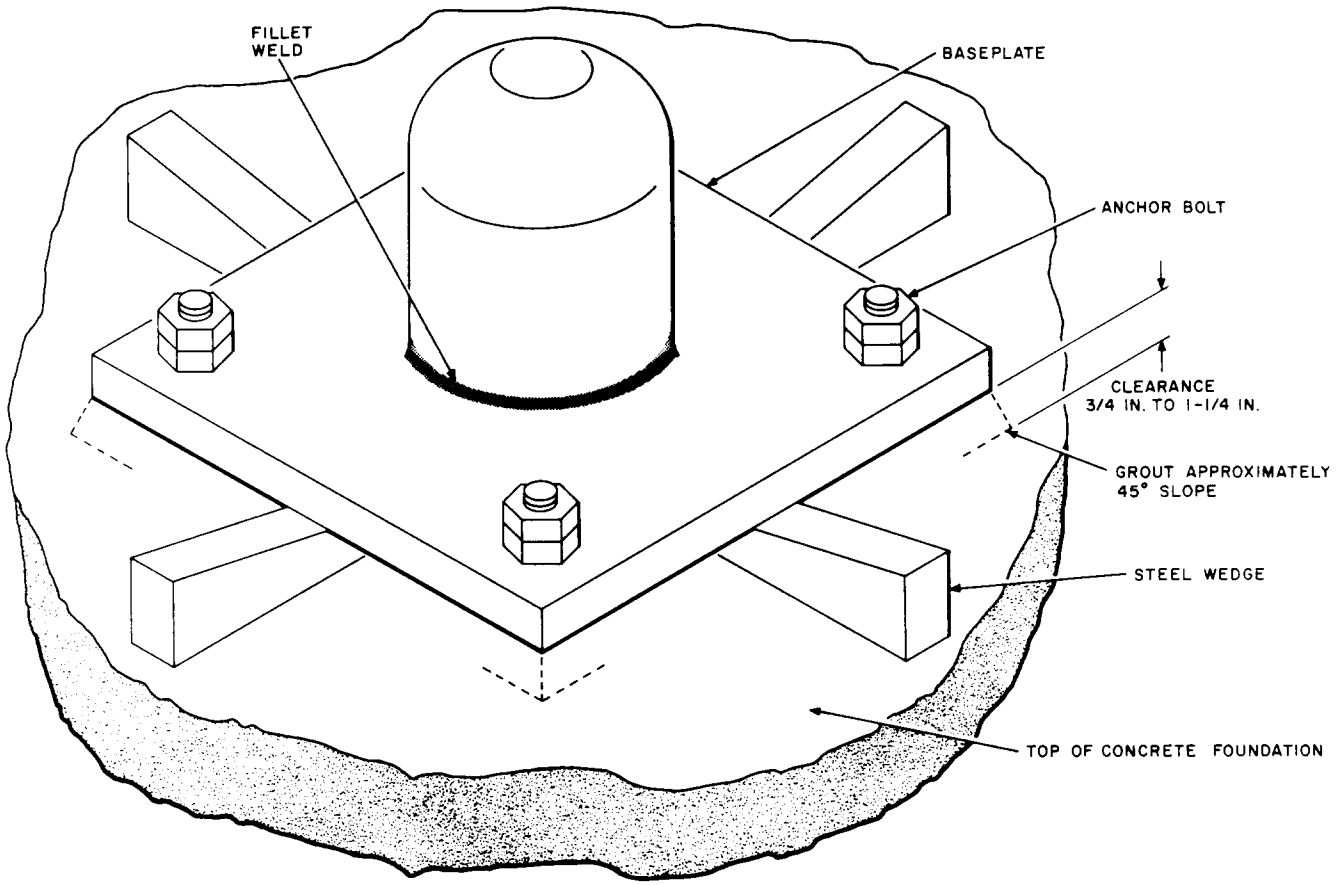

Fig. 1—Installation of Base Plate Assembly

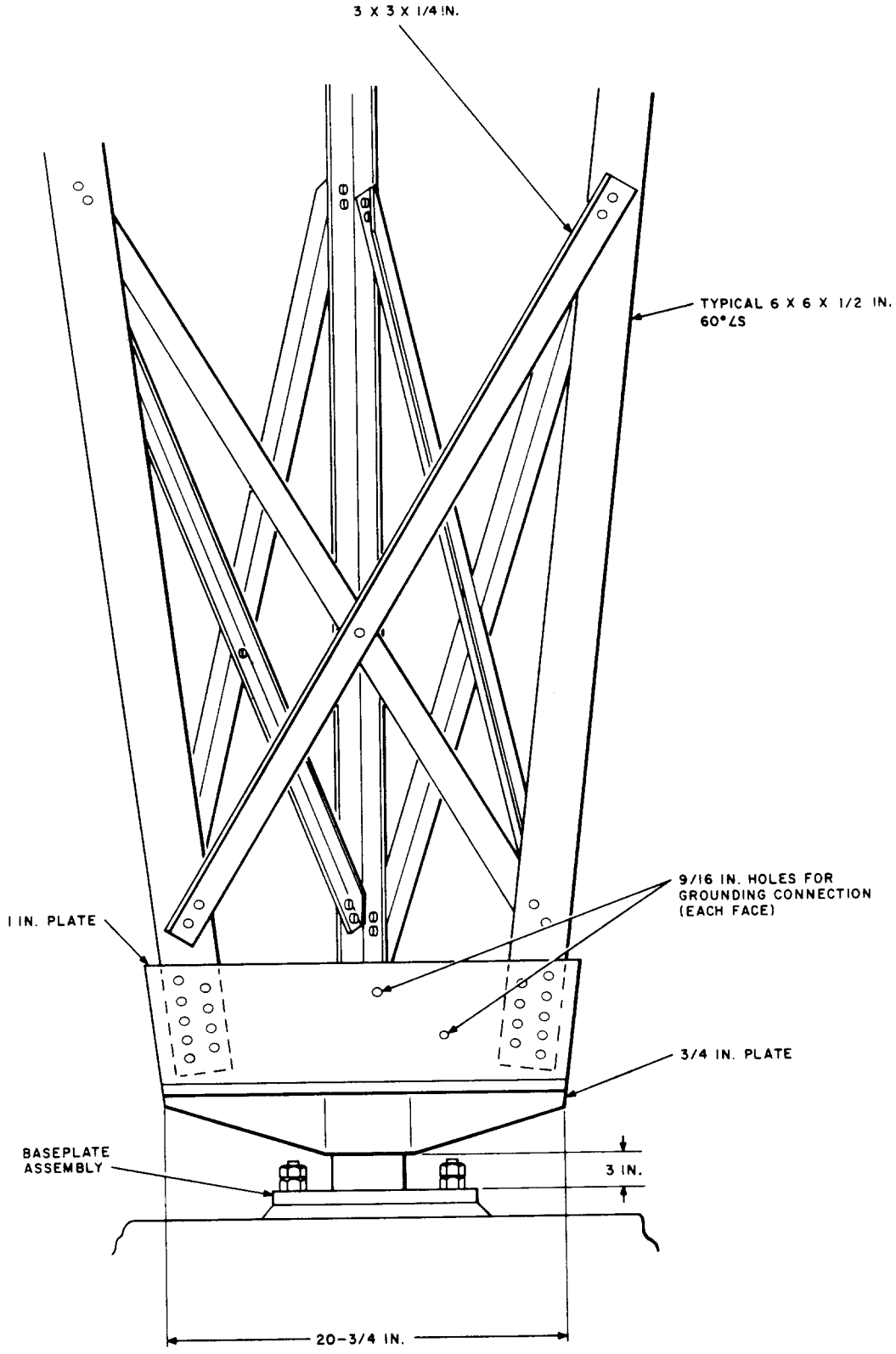

Fig. 2—Base of Tower

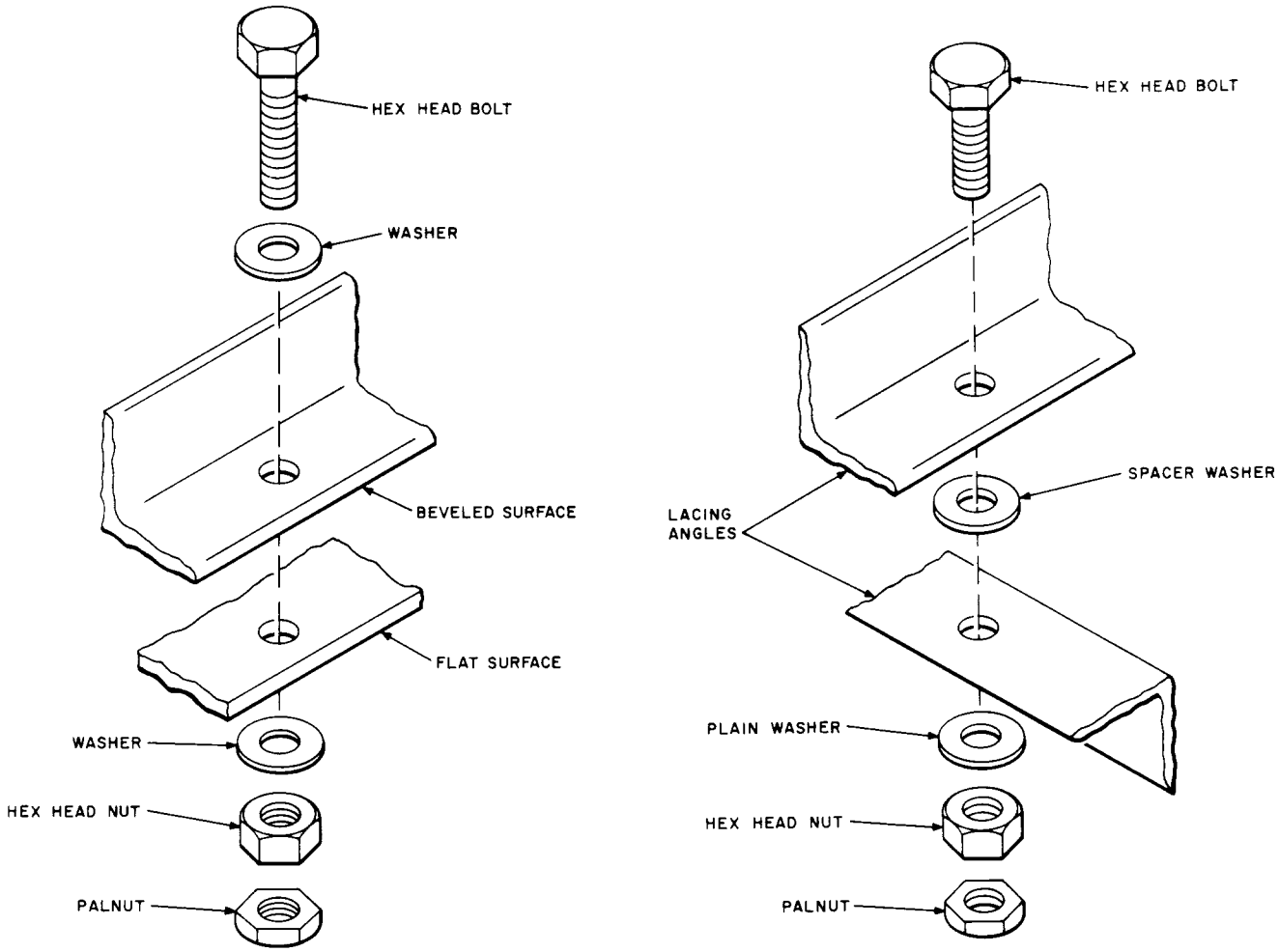

Fig. 3—Use of Washers

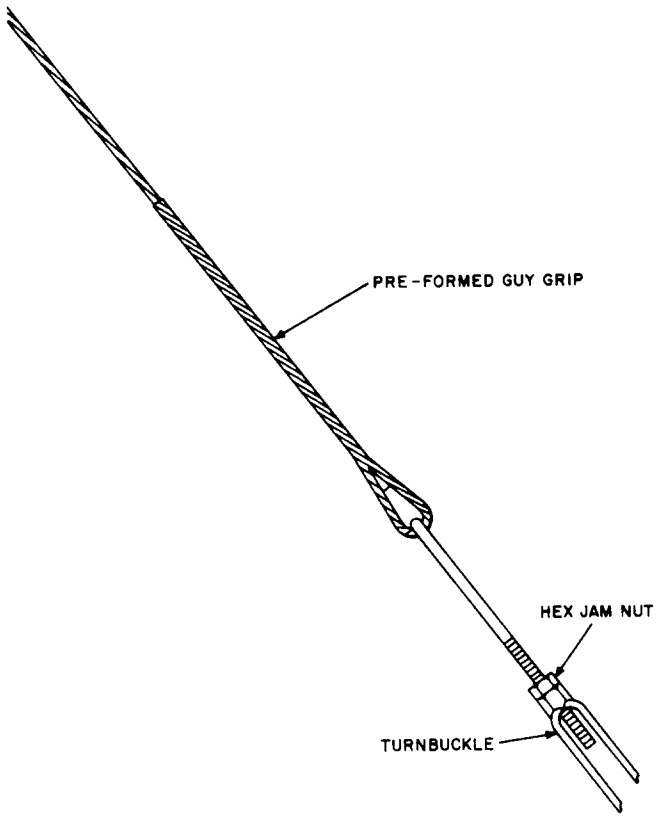

Fig. 4—Lower End of Guy

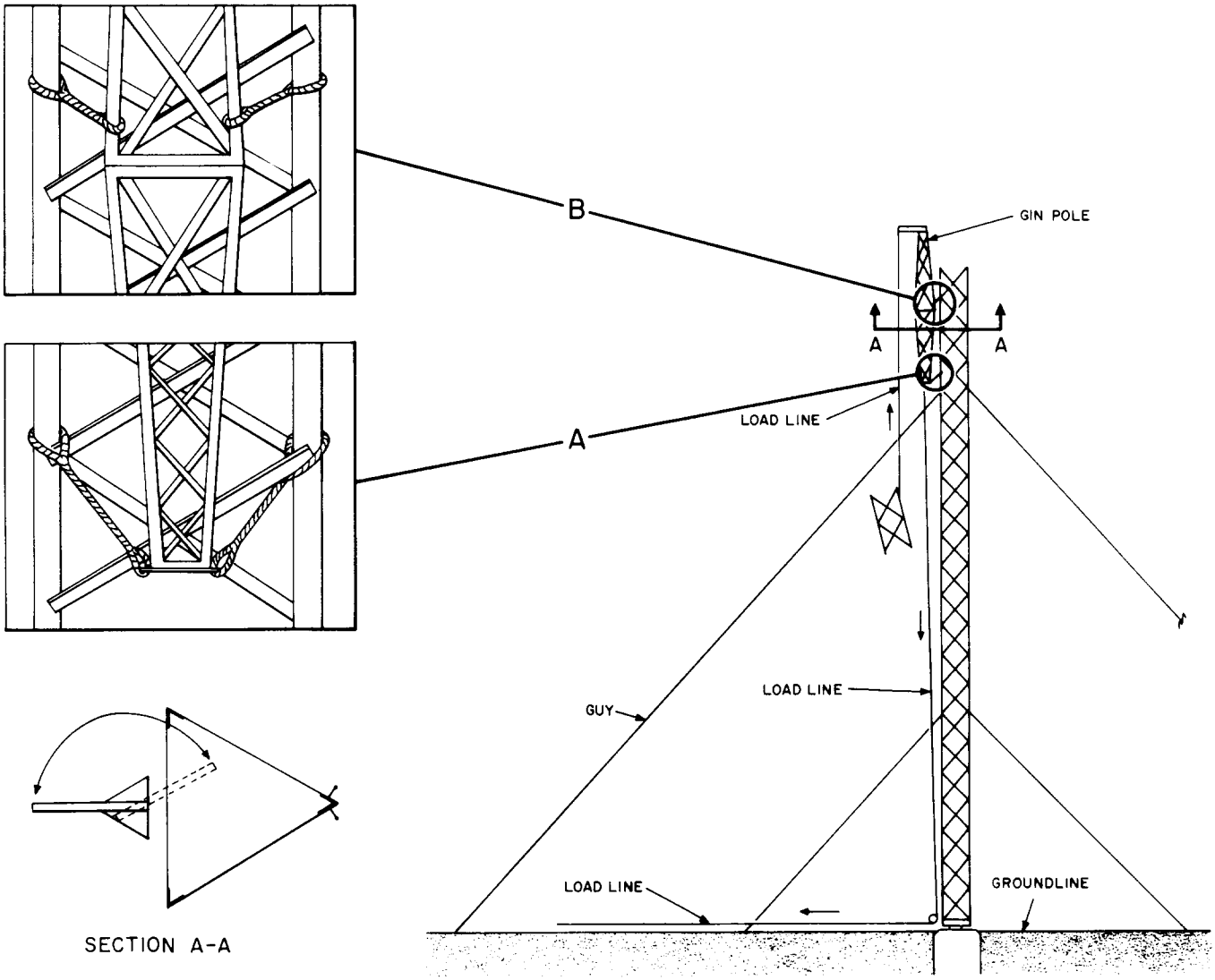

Fig. 5—Typical Gin Pole Setup for Hoisting Tower Sections

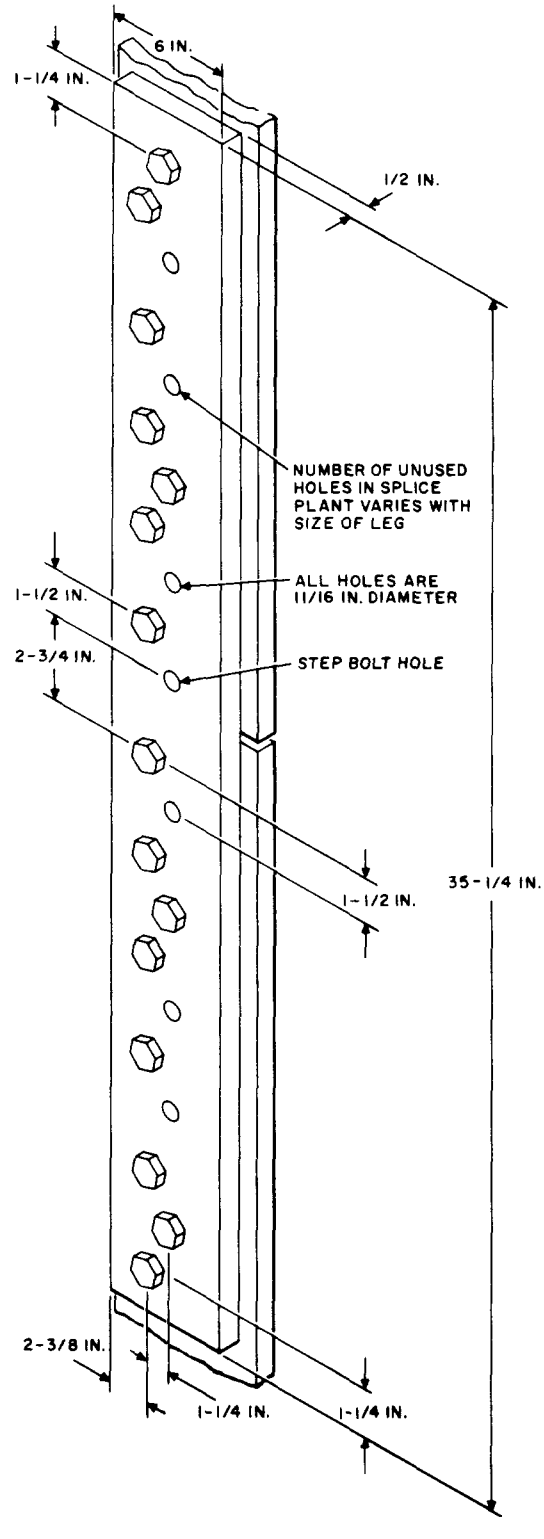

Fig. 6—Splice Plate