C SELF-SUPPORTING TOWERS
ERECTION

CONTENTS PAGE

1. GENERAL

1.01 This section outlines the general considerations involved in erecting C Self-Supporting Towers, and includes recommended procedures and precautions for tower erection.

1.02 Erection drawings are furnished with each tower. The drawings 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 tags which correspond to the markings shown on the erection drawings. The drawings also show the quantity and type of bolts, nuts, and washers necessary to complete all connections. A more than adequate supply of each type of bolt, nut, and washer is furnished with the tower, but care must be exercised to assure that the proper type and size of each is used for each connection, or a shortage of some types or sizes may develop.

2. PRE-ERECTION CONSIDERATIONS

2.01 Tower erection must not be started until all required permits have been obtained, as outlined in Section AG25.460.

2.02 The permit issued by the Federal Communications Commission (FCC) to construct and operate a radio system, usually specifies whether or not lighting and painting to improve visibility are required. Where only receivers are to be installed, and FCC permission is not required, the Federal Aviation Agency (FAA) will determine the necessity for markings to improve visibility. If lighting is required, arrangements must be made to assure the availability of electric power at the site, and the lighting facilities must be ordered. Methods for lighting and painting towers are described in Sections AG25.230 and AG25.300.

2.03 The rules of the FCC and FAA specify 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 is exceeded. Temporary lights should be installed at approximately the 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.

2.04 Temporary lights are to burn steadily from sunset to sunrise. Top lights are to consist of two 100- or 111-watt lamps (#100 A21/TS or #111 A21/TS) 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 so positioned that at least one of the two lights at each level will be visible from any angle of approach. Many contractors are equipped with temporary warning lights for use during tower erection, but it is advisable to notify them if temporary lighting will be required, and also whether it will be one-, two-, or three-level.

2.05 Section AG25.460 provides information on foundations for C Self-Supporting Towers. The foundation must be located accurately and oriented properly. Steel erection should not

be started until the results of concrete compression tests are known to be satisfactory.

2.06 The connections to the tower grounding system should be readily accessible. Installation of the grounding system is described in Section AG25.460.

2.07 All equipment to be installed on the tower should be available when required. The mounting location for radio equipment on the tower should be specified to the contractor, in order that hoisting equipment will not interfere with the installation.

2.08 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.

3. INSTALLATION OF BASE PLATE ASSEMBLY

3.01 The base plate assemblies must be oriented so that the stub legs slope toward the centroid of the tower.

3.02 As shown in Fig. 1, each base plate should be set on four tapered steel wedges placed close to the anchor bolt. The base plate should be leveled by adjusting the wedges. With the base plate leveled on the wedges, the anchor bolt nuts should be tightened.

3.03 The ground connection to the base stub should not be made until the legs of the first section are in place. Care should be taken to avoid damaging the ground wire when driving the structural rib bolts which secure the legs to the base plate. As the tower is leveled by means of steel wedges, it may be advisable to remove the ground connection temporarily during this operation. These connections should be restored promptly after leveling is completed.

3.04 After a minimum of 30 feet of the tower has been erected, the tower should be leveled and plumbed by loosening the anchor bolt nuts and readjusting the wedges. With the nuts tight, the wedges should provide a clearance from 3/4 to 1-1/4 inches for grout between the base plate and the top of the pier. The plumbing operation must be controlled carefully to assure that the tower will not deviate from vertical by more than the height of the tower divided by 720.

3.05 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 AG25.130. Clean sand from a reliable supplier should be used in the grout. The water should be clean and potable.

3.06 The consistency of the grout must be very stiff. The sand and cement should be thoroughly mixed in a dry condition. 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 will crumble freely when disturbed.

3.07 Grout should be forced under the base plate from all sides, completely filling all voids. Then the wedges should be removed and the voids filled with additional grout. If a sledgehammer is used to loosen and remove the wedges, the electrical ground should be disconnected to avoid damaging the ground wire. The grounding connection should be restored immediately after the wedges have been removed and the voids have been grouted.

4. ERECTION CONSIDERATIONS

4.01 Leg members are lap spliced, as shown in Fig. 2, using 5/8-inch structural rib bolts equipped with washers and locknuts (see Fig. 3). The number of bolts required at each splice varies from 8 to 12. The ribs of these bolts gouge into the sides of the hole, to assure a snug fit and to prevent rotation. The ribbed portion of the bolt should extend completely through the members being spliced. The underside of the bolt head should contact the surface of the member, but the bolt must not be overdriven. A washer is used to permit drawing the nut up tightly to obtain firm contact with the leg members before reaching the last of the threads. Structural rib bolts should not be reused after having been driven and removed. Ordinary tower bolts should not be used in leg member lap splices. The leg members take alternate positions at the lap splices as the tower height increases. Fig. 4 shows the leg member positions for the various heights.

4.02 All bolted connections in the tower (except leg splices and grating platform attachments) are made with 5/8-inch tower bolts. The grating platform attachments are made

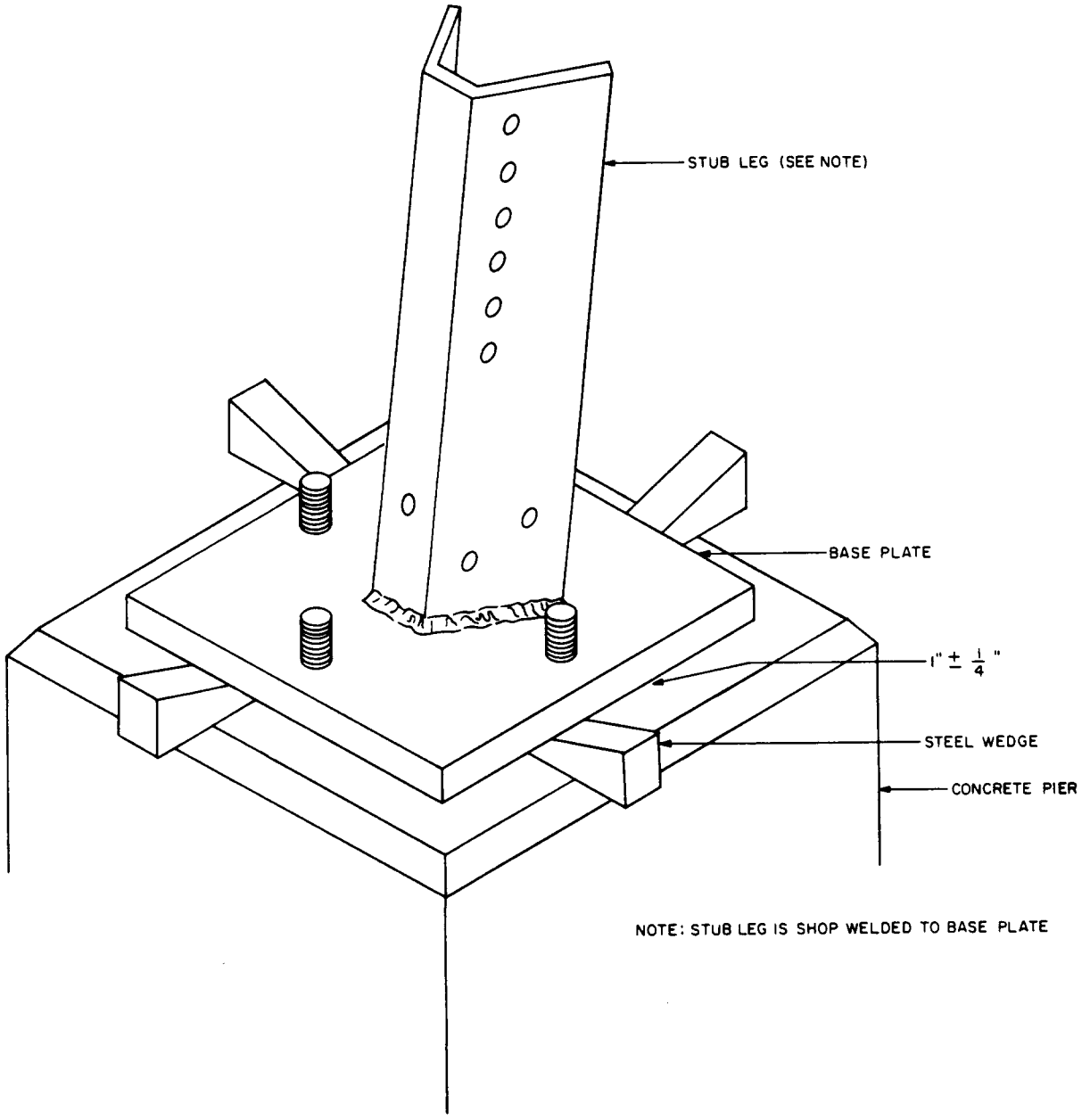

Fig. 1 – Installation of Base Plate Assembly

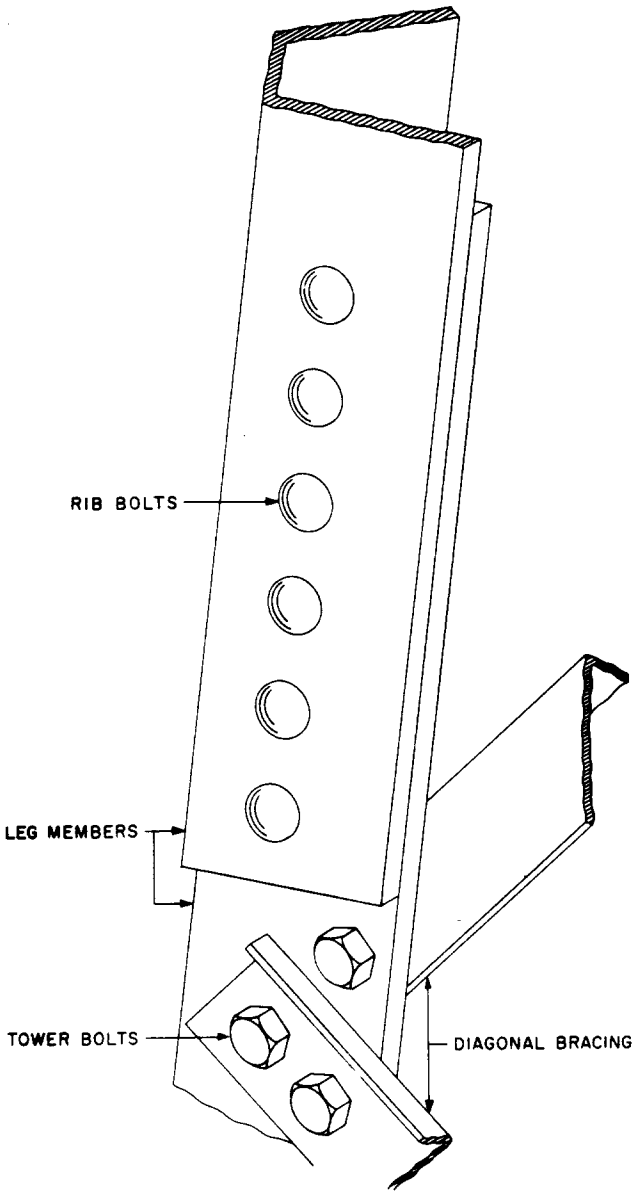

Fig. 2 – Lap Splice and Bracing Connections

with saddle clamps and 1/4-inch stove bolts equipped with washers, nuts, and Palnuts. A typical tower bolt assembly is shown in Fig. 5. For the various tower bolt connections, the erection drawings indicate the proper length bolt to permit the threaded portion to clear the members being joined. A washer is used to assure that the service nut can be tightened completely before it reaches the unthreaded portion of the bolt. The service nut should be installed, as illustrated, with the chamfered corners against the washer. The Palnut is used to prevent vibration from loosening the service nut.

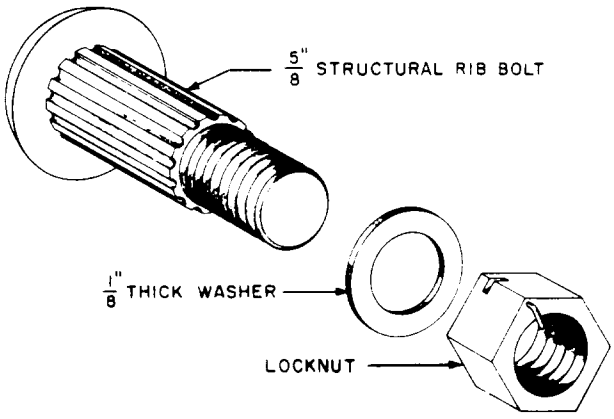

Fig. 3 – Structural Rib Bolt Assembly

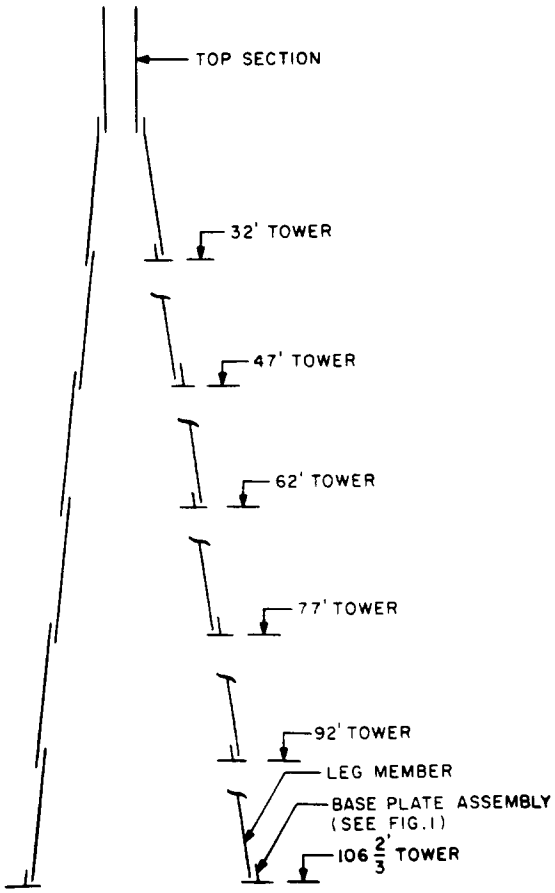

Fig. 4 – Position of Leg Members at Lap Splices

4.03 The upper 32 feet of the tower has no horizontal bracing where the diagonal bracing angles cross. Since the diagonal angles will be separated by the thickness of the leg members (5/16 inch), a combination of 1/8-inch and 3/16-inch thick washers is used as spacers in the bolted connection at the crossover. Fig. 6 shows the spacer washers used in a bolted diagonal bracing crossover connection. Fig. 7 shows a bolted diagonal and horizontal bracing crossover connection.

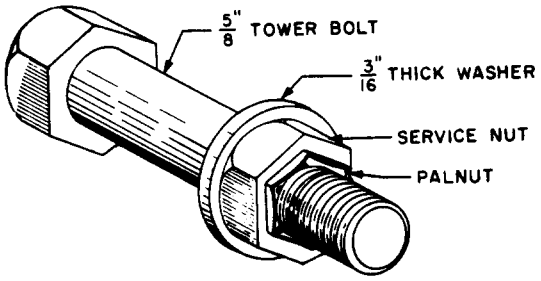

Fig. 5 – Tower Bolt Assembly

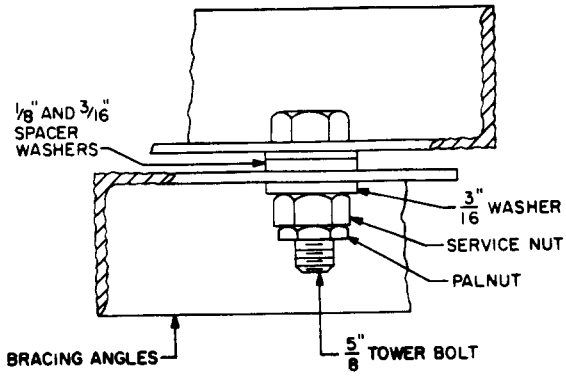

Fig. 6 – Diagonal Bracing Crossover Using Spacer Washers

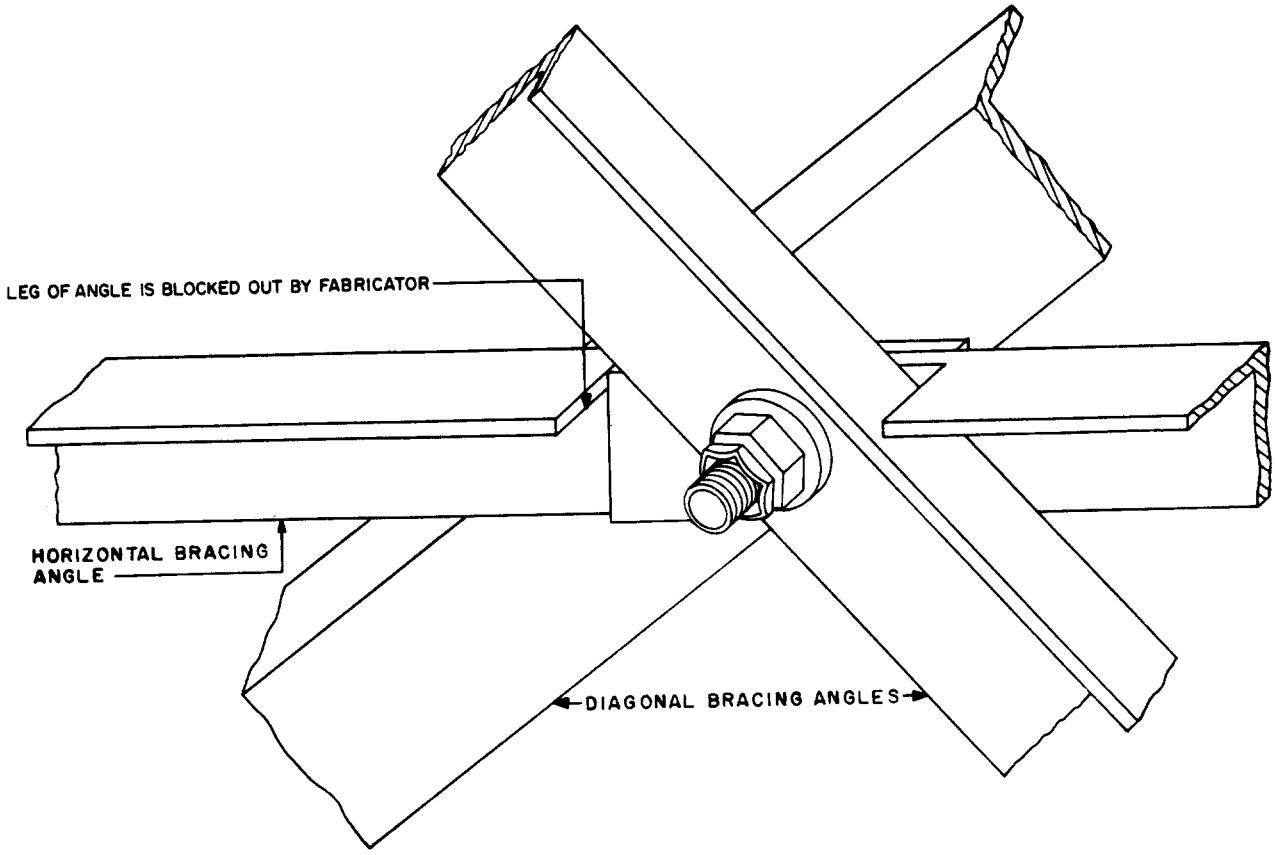

Fig. 7 – Diagonal and Horizontal Bracing Crossover Connection

4.04 Contractors may differ in the methods of rigging and hoisting. The methods selected should assure that all members will be adequately supported during construction, to avoid overstressing any member to the extent that bending or buckling results. Any member which has been stressed beyond the yield point should be replaced.

4.05 Slight force will be required to align holes of some members for bolting. If the holes cannot be aligned with reasonable force (well below the yield point of the steel), a careful inspection should be made to determine the cause of the difficulty. Some of the probable causes are as follows:

(a) Foundation piers, base plates, or anchor bolts not properly located or oriented.

(b) Members used in wrong places.

(c) Errors in fabrication.

(d) Errors in marking members.

4.06 Three leg members with bracing comprise approximately a 15-foot section of a tower. One leg of each section is punched with 11/16-inch holes on approximately 15-inch centers (on alternate sides) to accommodate step bolts, as described in Section AG25.450. The upper section is punched to about 5 feet above this platform. The step bolts are equipped with two hexagonal nuts, a washer, and a Palnut, as shown in Fig. 8. One hexagonal nut should be turned down to the end of the threaded portion before the step bolt is installed. The other two legs are punched with groups of 7/16- and 9/16-inch holes for waveguide restrainers. These holes will be used only if waveguide is installed.

4.07 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 paint. These paints are 90% (or more) powdered zinc and will provide some galvanic protection in the same fashion as galvanizing. They also have the property of preventing rust creep under the paint film. They can be applied to damp or wet steel, but cannot be applied successfully over steel 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 sq. ft./gallon. If this type of paint is not available, zinc oxide — zinc dust paint is an acceptable substitute. It must be applied over clean dry metal and should conform to Federal Specification TT-P-641 Type I or Type II.

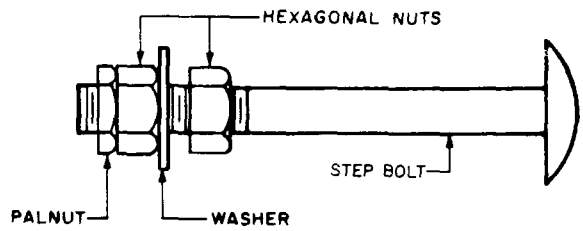

Fig. 8 – Step Bolt

4.08 Orientation of the tower is determined by the azimuth adjustment limitations of the antennas and reflectors, as indicated in Section AG25.450. Radio equipment will usually be mounted on two legs of the top section of the tower. The tower should be initially oriented so as to mount the radio equipment on other than the step bolt leg.

4.09 All material comprising the towers is of special design and is not normally stocked by either the telephone companies or the Western Electric Company. If a shortage of items develops or if damaged members must be replaced, the required material should be ordered from the Western Electric Company with a request that the order be handled expeditiously, to avoid delaying the tower erection.