

GROUNDING MICROWAVE TOWERS

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1. GENERAL

1.01 This section describes the methods to be used for grounding towers and waveguide supports. These structures should be grounded electrically in order to prevent possible damage by lightning to their buried concrete supporting structures.

1.02 When this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 Towers and waveguide supports are prime targets for lightning and constitute an excellent transmission path to ground via the tower foundations, guy-anchor blocks, and waveguide support foundations. At these points, explosive damage may occur unless alternate paths are provided to bypass the stroke currents and provision is made to equalize the voltage potential inside and outside the concrete mass. For guyed towers, grounding is accomplished by electrically connecting the leg of the tower and the guy rods to ground rods installed alongside the respective concrete foundations, with the tower leg connection attached to the station ground. For self-supporting towers, each leg of the tower is connected electrically to a ground rod installed at each foundation, with the connecting wire attached to a wire loop surrounding the foundations and the wire loop then connected to the station ground. Waveguide supports are grounded by electrically connecting the leg of the support to the station ground.

1.04 The grounding facilities should be installed after the concrete foundations and anchor blocks have been poured and allowed to set, but before the excavations are backfilled. To facilitate

placing the ground rods, a channel can be gouged in the sides of the excavation. The ground rods should be installed vertically, and should be located within 12 inches of the sides of the concrete structures so the pigtail wire at the end of the ground rod can be extended into the excavation area for making the required connection.

1.05 Where tower foundations are set in bedrock or high resistivity soil, a special arrangement of a ground and/or a buried wire counterpoise with radial extensions, as covered in Section 876-210-100, frequently is necessary to provide adequate protection.

1.06 Tower grounding kits containing ground rods, grooved washers, connectors, clamps, and a length of No. 2 AWG bare-tinned wire are available for electrically grounding the towers and the guys of guyed towers. Grounding kits for grounding the towers are specified in the sections that deal with the particular tower. The kit will contain sufficient wire to ground the towers and guys but not to connect the tower ground to the station ground. The length of wire to make this connection will vary for each installation and should be included as part of the wire ordered for the station grounding system. For the waveguide supports, material is supplied with the support to make the wire connections, but no wire is provided. An additional amount of wire is furnished with the tower grounding kit to ground the waveguide support. For detailed information on station grounding, see Section 876-210-100.

1.07 All connections in the grounding system, except those where the copper wire is connected to the galvanized steel, may be made by the Caldwell Process of Erico Brothers, Inc. This process may be used as an alternative to the mechanical connections that are supplied with the grounding kits.

2. GUYED TOWERS

2.01 Since the number of anchors which are a function of the tower height will influence the quantity of material required to ground the tower, the height of the tower must be specified as part of the ordering information.

2.02 The method of grounding a guyed tower is illustrated in Fig. 1 and 2. Grounding is accomplished by installing two ground rods alongside the foundation and each of the anchor blocks, and electrically connecting them to the tower leg and the anchor rods, respectively. For maximum protection, the ground rods should be located adjacent to the midpoint of opposite sides of the concrete blocks.

2.03 Grounding at the foundation is illustrated in Fig. 1. The ground rods are placed within 12 inches of the foundation and driven so the top of the rod is 6 inches below final grade. Connectors are used to join the pigtail wire at the top of the rod to a length of No. 2 AWG bare-tinned copper wire. About 7 feet of wire should be provided aboveground to make the connection to the base of the tower. Each wire is secured to the tower under a grooved washer held in place with a 1/2-inch machine bolt. Two 9/16-inch diameter holes are provided in the base for locating the bolts. The wire should extend about 1 inch beyond the edge of the washer. After the connection is tightened, it should be painted over with black pitch or a similar waterproofing to prevent galvanic action between the dissimilar metals, the copper wire and the galvanized tower.

2.04 Figure 2 shows grounding at the anchors. The ground rods are located within 12 inches of the anchor block and driven so the top of the rod is at the same level as the top of the anchor block. The two ground rods are connected to the guy rods with a length of No. 2 AWG bare-tinned copper wire. The length of wire used should be sufficiently long to connect the pigtail ends of both rods and permit attachments to all guy rods of the anchor block. The clamps at the guy rods should be positioned so they are at least 12 inches below final grade. The connection at the guy rod should be coated similar to that done at the tower base.

2.05 Excavations can be backfilled after all connections are tightened, exercising care to ensure that the connections are not broken or damaged in the process.

3. SELF-SUPPORTING TOWERS

3.01 The method of grounding a self-supporting tower is illustrated in Fig. 3 and 4. As

shown in Fig. 3, one ground rod should be installed alongside each foundation. It should be located within 12 inches of the outer edge of the concrete mat, with the lower end of the rod driven at least 2 feet below the bottom of the mat. A length of No. 2 AWG bare-tinned copper wire is connected to the pigtail wire at the end of the ground rod with one of the connectors provided (see Fig. 4). The wire should be placed on the mat between the rod and the pier, and should be long enough to run vertically up the pier, with about 3 feet extra to make the connection to the base shoe. The end of the wire should extend 1 inch beyond the edge of the grooved washer and be temporarily fastened.

3.02 The excavation can be backfilled in 2-foot layers and thoroughly tamped to minimize setting to a point 1 foot below final grade. The wire loop then should be placed surrounding the foundations. For larger towers, where separate excavations are made for the foundations, a trench 1 foot deep will be required to facilitate placing the wire between foundations. The wire should form a complete loop with the ends joined by a connector. The wires to the ground rods should be joined to the nearest point of the wire loop with connectors. The wires must be parallel where they are connected, and this might require some bending of one or both wires. Sharp bends should be avoided. The connection between the wire loop and the station ground should be made at this time. All connectors should be tightened securely and backfilling and tamping completed.

3.03 The connections at the base shoes should be made immediately after the legs of the first section are bolted in position. Avoid damage to the ground wire when driving the structural rib bolts that secure the legs to the base shoes. It might be advisable to temporarily remove the ground connections while the tower is being leveled. These connections should be restored immediately after leveling is completed.

3.04 The connection at the base shoe is shown in Fig. 4, and must be painted over as described in 2.03.

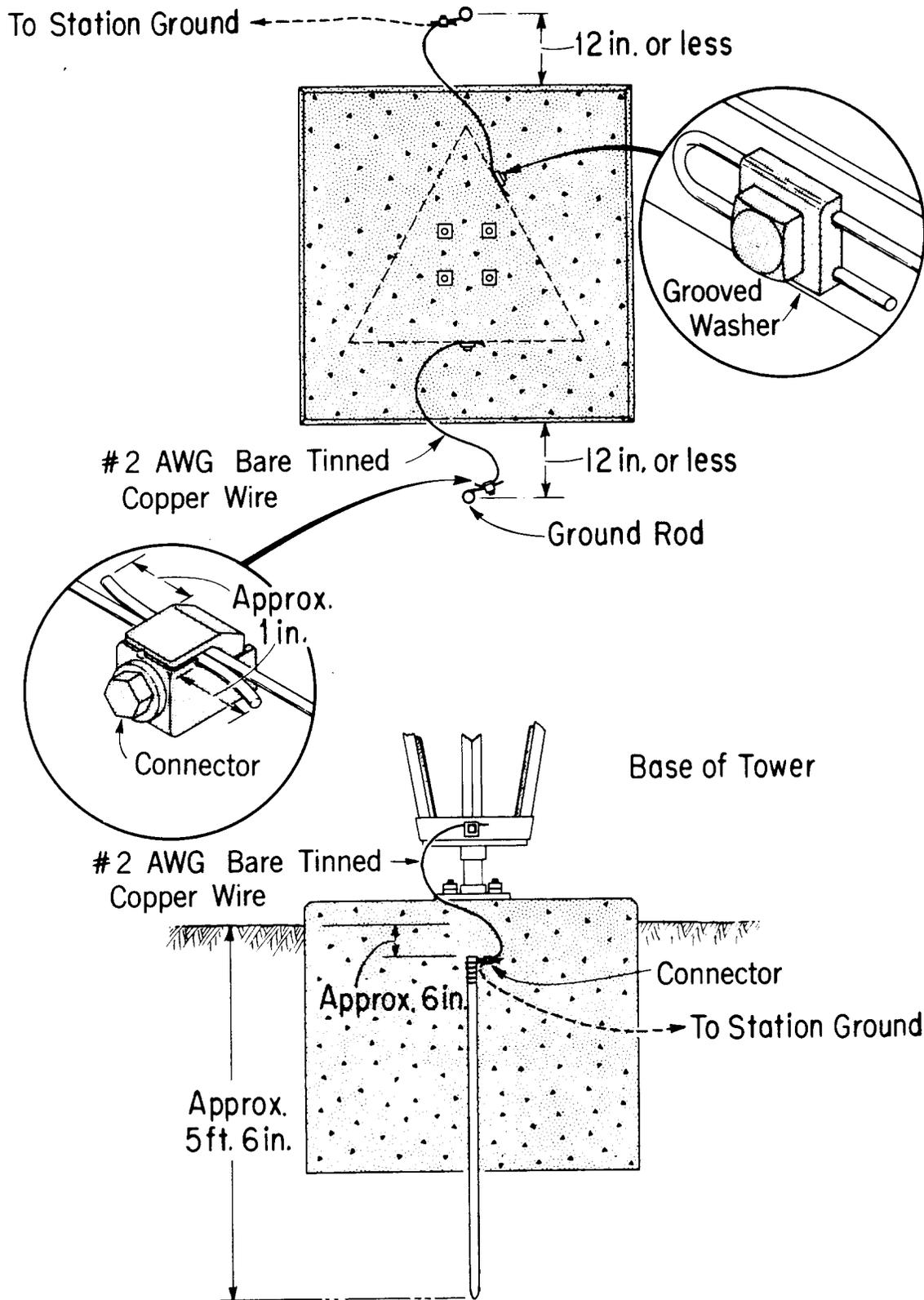


Fig. 1—Grounding at Guyed Tower Foundations

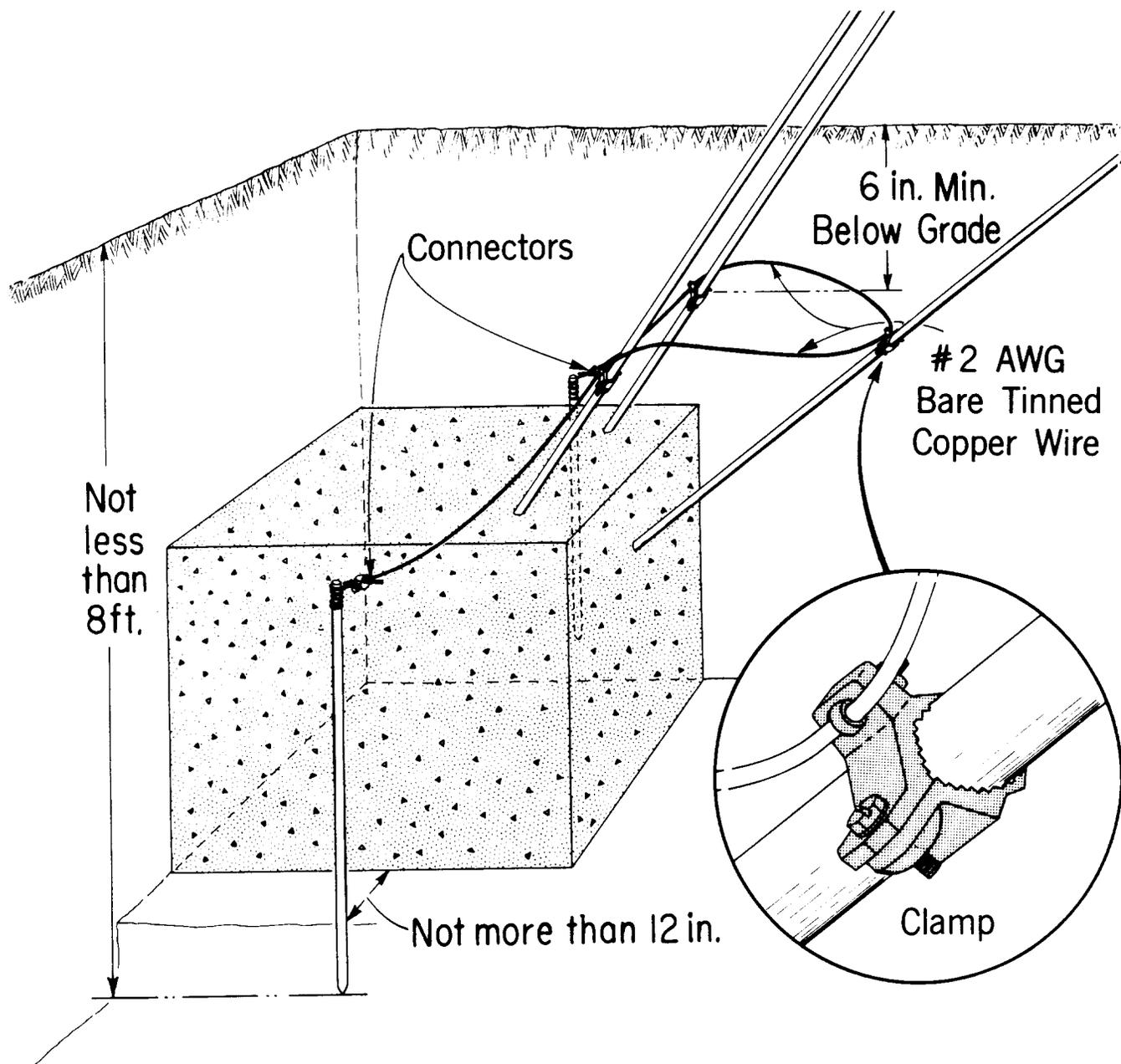


Fig. 2—Grounding at Anchors

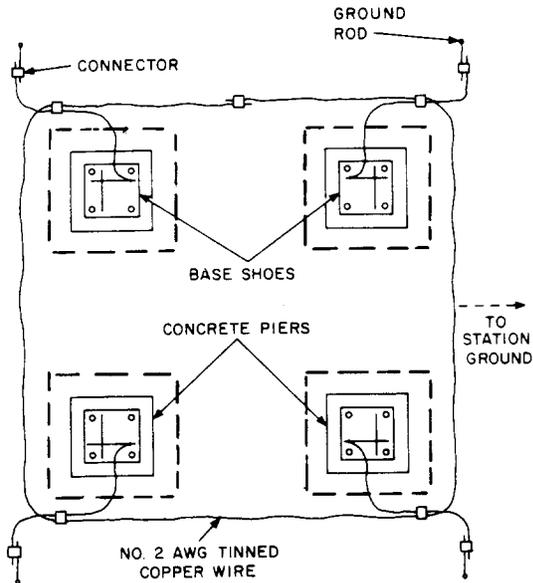


Fig. 3—Grounding System

NOTE:

BASE SHOE (ANCHOR BOLTS AND HOLES OMITTED FOR CLARITY).

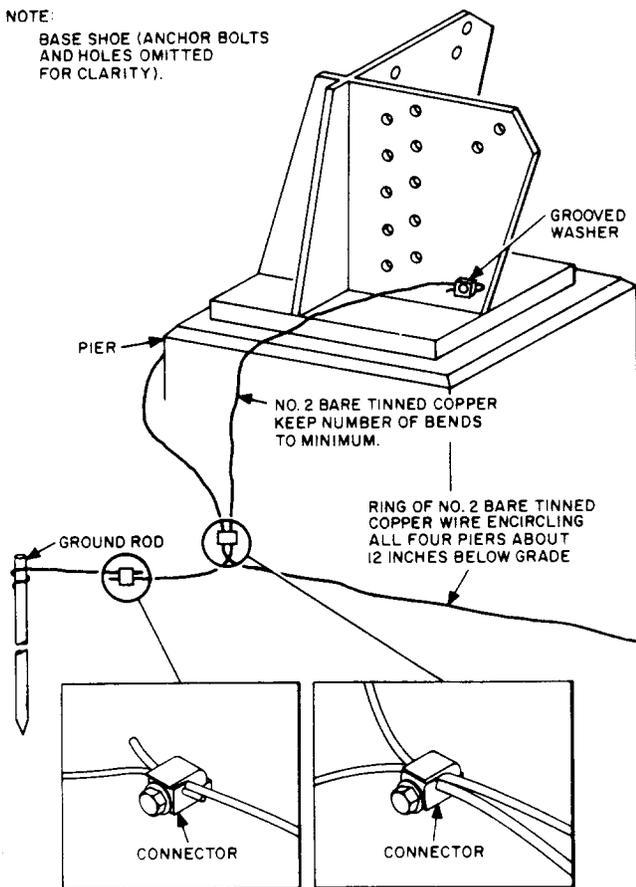


Fig. 4—Grounding Connections

4. WAVEGUIDE SUPPORTS

4.01 Grounding of the waveguide support is illustrated in Fig. 5. One ground connection is required for each leg of the waveguide support. One end of the ground wire is connected to the leg of the support and the other end to the station/tower ground. About 5 feet of wire should extend above grade for making the connection at the leg of the support. A hole is provided in the base of each leg to accept the 1/2-inch bolt used to hold the grooved washer in place. The connection to the station/tower ground is made with a connector. The connection at the support leg must be painted over with black pitch to prevent galvanic action.

4.02 The bolts, connectors, and washers required to make the connections are supplied with the waveguide support, while the wire is supplied as part of the tower grounding kit.

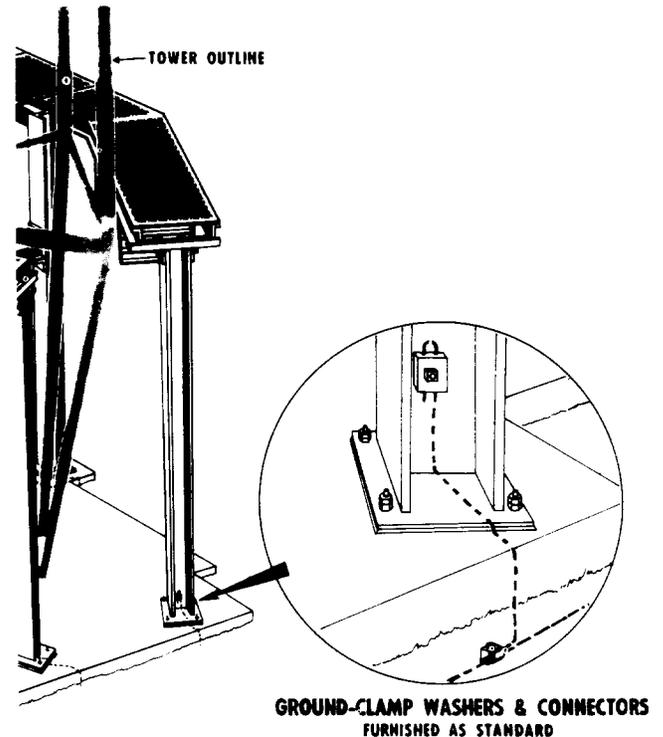


Fig. 5—Grounding at Waveguide Supports