

**MICROWAVE ANTENNAS**  
**KS-15970 PARABOLIC ANTENNA**  
**ASSEMBLY AND INSTALLATION**

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REFLECTOR POSITION ON MOUNTING FRAME . . . . .	7	1. GENERAL	
5. INSTALLATION . . . . .	8	1.01 The KS-15970 parabolic antenna (Fig. 1) is a dually polarized, 5-foot diameter, parabolic- reflector antenna. It consists principally of a spun-aluminum dish and a simple primary feed system. The feed system is protected by a laminated-glass-fabric dished radome, which is attached to the front of the reflector flange. The antenna is arranged to mount with standoff brackets and a T-frame. The brackets and frame permit independent azimuth and elevation orientation adjustments when the antenna is used as a direct radiator, or in a periscopic system.	
GENERAL . . . . .	8	1.02 The KS-15970 antenna is intended for use in the TJ and TL Microwave Radio Relay Systems to transmit and receive microwave signals in the frequency range 10.7 to 11.7 GHz.	
PRECAUTIONS . . . . .	8	1.03 The antenna is covered by the following specification and list numbers:	
INSTALLATION ON AT-7728 B GUYED TOWER . . . . .	9		
INSTALLATION ON AT-7729 B SELF-SUPPORTING TOWER . . . . .	11		
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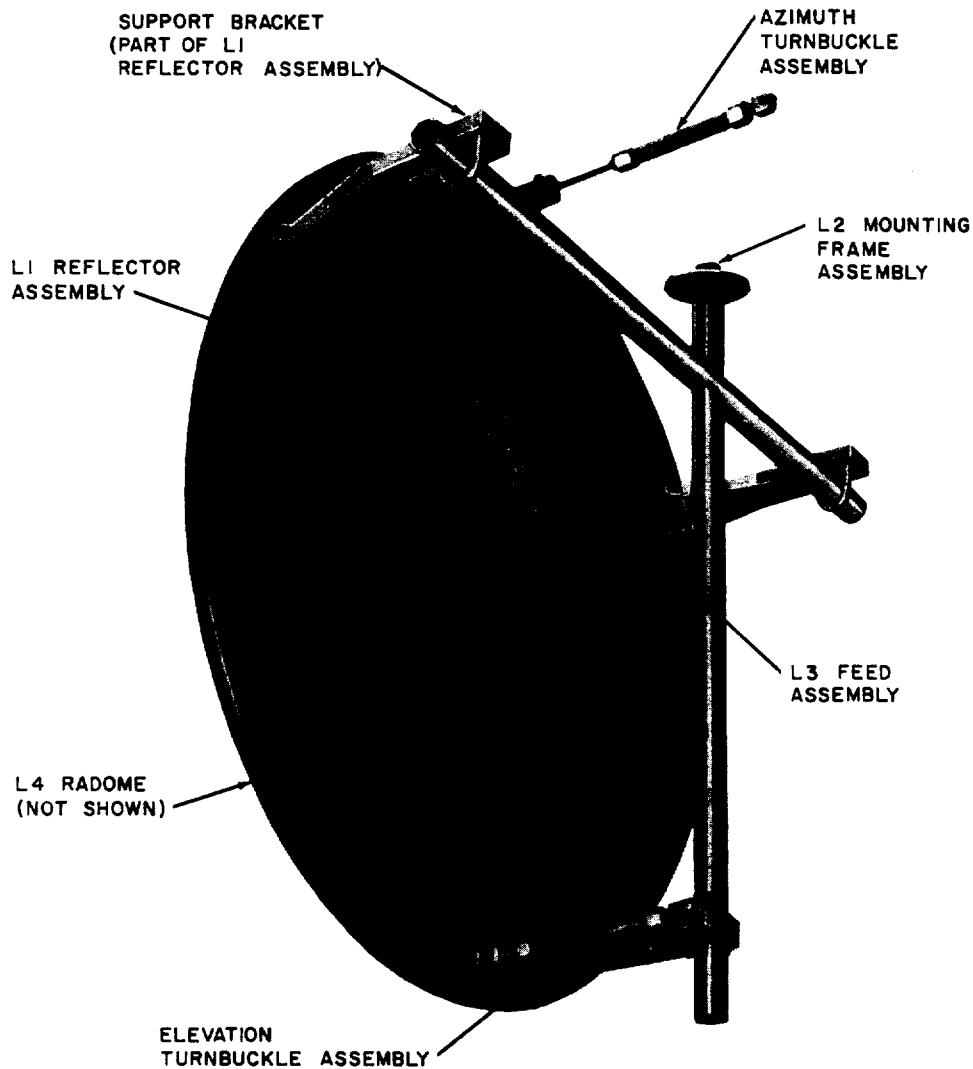


Fig. 1—Overall View of Antenna

- KS-15970 L1 Reflector Assembly
- KS-15970 L2 Mounting Frame Assembly
- KS-15970 L3 Feed Assembly
- KS-15970 L4 Radome

No list number is assigned to cover a complete antenna assembly.

1.04 The KS-15970 antenna is not equipped with dish or feed heaters and has not been designed

to be used without the radome. The antenna assembly normally consists of one L1 reflector assembly, one L2 mounting frame assembly, one L3 feed assembly, and one L4 radome.

1.05 The complete antenna and mounting frame weighs approximately 150 pounds.

2. TOOLS AND EQUIPMENT

2.01 Tools required for assembly, installation, and orientation of the KS-15970 parabolic antenna are:

QUANTITY	DESCRIPTION
1	5/16-inch Open-End Wrench
1	7/16-inch Open-End Wrench
1	1/2-inch Open-End Wrench
1	5/8-inch Open-End Wrench
1	1-inch Open-End Wrench
1	1-1/8 inch Open-End Wrench
1	1-1/2 inch Open-End Wrench
1	Adjustable Open-End Wrench with 3-inch capacity
1	Electrician's Side-Cutter Pliers
1	Diagonal-Cutter Pliers
1	Needle-Nose Pliers
1	Wire Stripper
1	Screwdriver, 5-inch blade, 5/16- by 0.045-inch tip
1	Screwdriver, 8-inch blade, 3/8- by 0.050-inch tip

**2.02** The following equipment and miscellaneous tools are needed for the purposes listed:

- (a) Tools for opening wooden crates and removing metal straps.
- (b) Eight-ounce tube, KS-19094 L1 Anti-seize Compound for coating pipe threads.
- (c) Several 4 by 4 timbers approximately 6 to 8 feet long, for unpacking and assembling antenna on rough terrain. (Optional, see 3.02).
- (d) Carpenters square for orientation of the antenna. (See 6.16).

### 3. UNPACKING AND HANDLING

**3.01** The antenna is shipped in three crates. The reflector comes assembled to the mounting frame and is contained in one crate. Strapped to the base of the crate is another crate containing the feed assembly. The radome is shipped in a separate crate.

**3.02** The crates should be unloaded in an area where the terrain is relatively smooth and level and as close as practicable to the base of the supporting structure. If the area is sufficiently flat and smooth, the crates may be placed directly

upon the ground. Since the crates consist of open construction, they should be set upon skids or other supports when rocks or other ground projections are present.

**3.03** The feed assembly should be removed first from its individual crate after the antenna crate is positioned. The crates should be opened carefully and the lumber retained for use in reshipping the equipment if it has been damaged in transit.

**3.04** Remove the equipment carefully, place in a convenient location and arrange the labeled cloth bags of bolts and miscellaneous hardware items so they will be accessible during assembly.

**3.05** The shipment should be checked thoroughly with the packing list. Each item shall also be inspected for damage. Note particularly any signs of a damaged antenna feed, distorted reflector contour, bent or stripped elevation or azimuth adjustment screw, and radome damage. If any items are missing or damaged, local supervision shall be notified.

## 4. ASSEMBLY

### FEED ASSEMBLY

**4.01** Remove the feed assembly from its shipping container.

**4.02** Insert the feed assembly, disc reflector first, through the mounting hole in the ring assembly of the antenna reflector (Fig. 2). The nameplate on the feed assembly should face the top of the reflector for optimum transmitting and receiving characteristics.

**Caution:** *Handle the feed assembly carefully. Slight dents in the feed tube or disc reflector can affect transmission. The disc reflector is cemented on the feed tube, and must not be roughly handled.*

**4.03** Attach the flange of the feed assembly to the four threaded studs on the antenna ring assembly using the mounting hardware furnished with the reflector.

**Note:** Do not remove the protective cover on the connecting flange of the feed assembly.

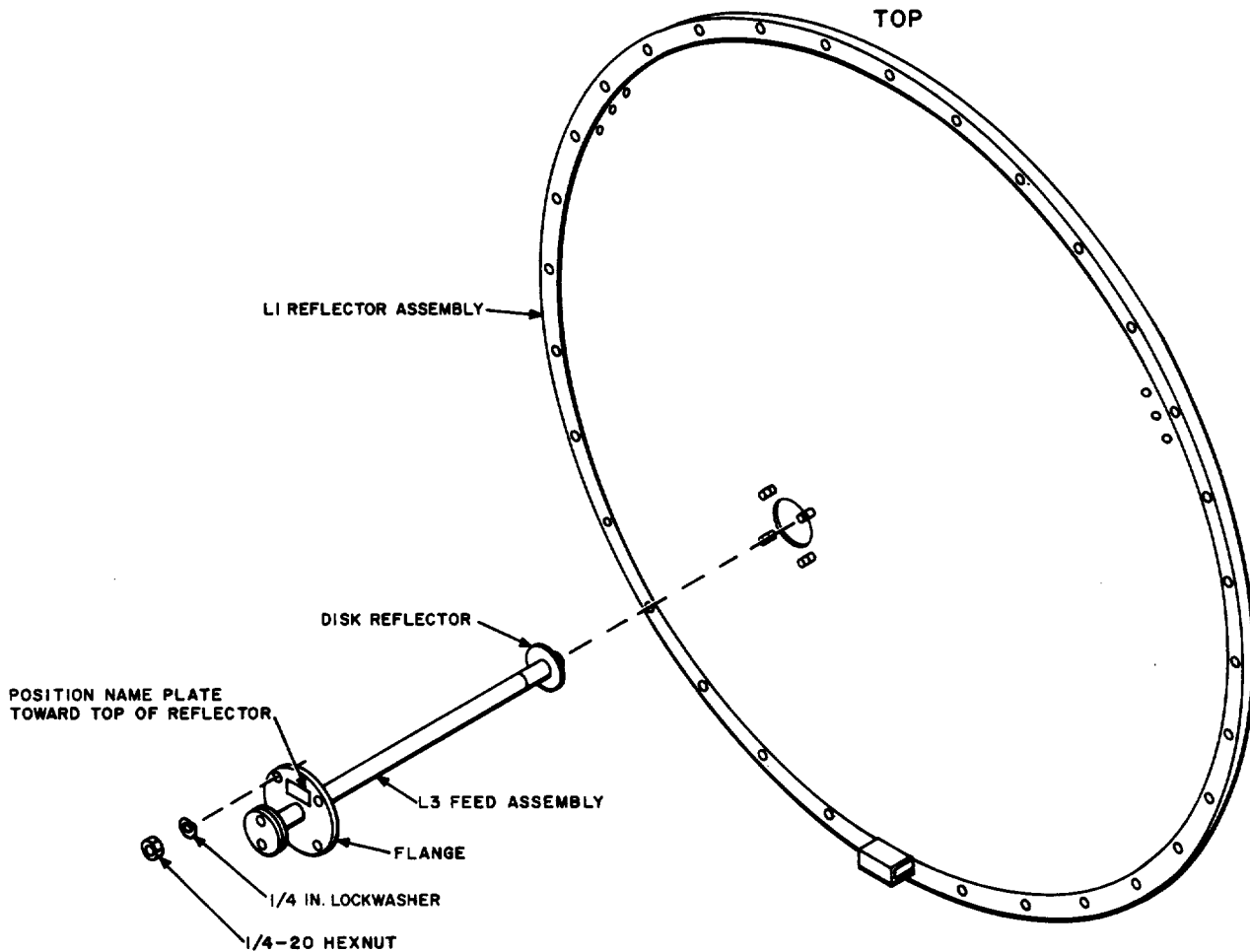


Fig. 2—Installation of L3 Feed Assembly into L1 Reflector

This shall remain in place to prevent foreign matter from entering the feed tube.

#### RADOME

- 4.04** Remove the radome from its shipping crate.
- 4.05** Place the rubber gasket, shipped with the radome, over the lip of the reflector as shown in Fig. 3. Align the 32 holes in the gasket with the holes in the lip.
- 4.06** Position the radome on the gasket and secure the radome to the reflector with the 1/4-20 machine screws, plain washers, 1/4 medium lockwashers, and 1/4-20 hex nuts shipped with the reflector. Tighten the nuts securely, but do not crush the edge of the radome.

#### AZIMUTH TURNBUCKLE ASSEMBLY

**4.07** The azimuth adjustment turnbuckle assembly (Fig. 4) is attached to the horizontal arm of the antenna mounting frame assembly. This turnbuckle normally is supplied with a pipe length of 10 inches for a range of azimuth adjustment as shown in Table A. If a greater azimuth range is necessary, a longer pipe length may be substituted for the 10-inch length. Table A includes the azimuth adjustment possible with a 20-inch pipe length. A 20-inch pipe is supplied with the elevation adjustment turnbuckle and may be used with the azimuth turnbuckle if required.

**4.08** If it becomes necessary to install a longer length of pipe for greater azimuth range, remove the 10-inch pipe by unscrewing a coupling nut from each end of the pipe. Coat the threads

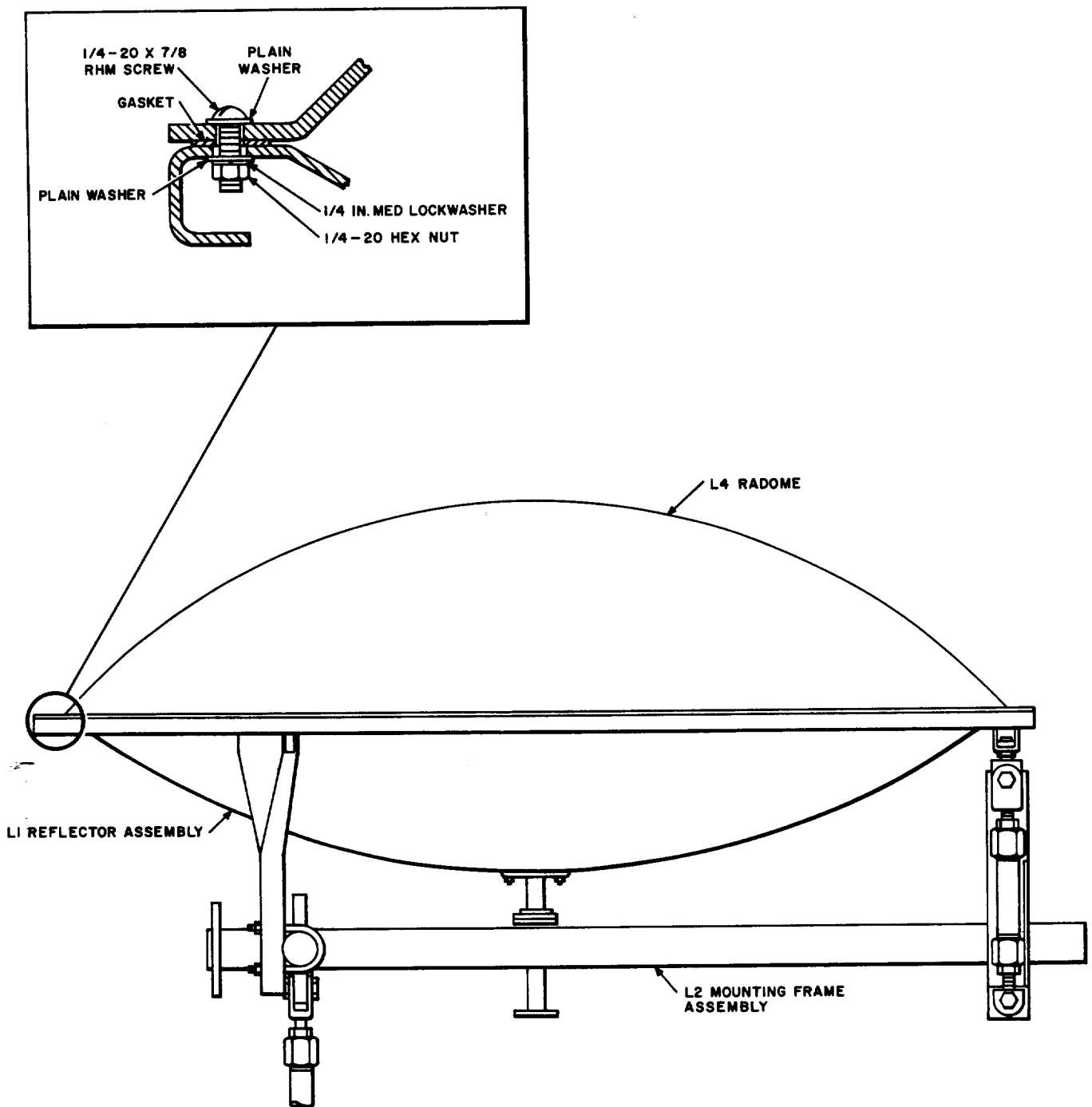


Fig. 3—Installation of Radome on Reflector

of the replacement pipe with KS-19094 L1 anti-seize compound and attach a coupling nut to each end. Tighten securely by using a 1-1/4 inch, open-end wrench on the coupling nuts. **Do not use a pipe wrench.** Allow the pipe to tighten as the coupling nut is tightened.

#### ELEVATION TURNBUCKLE ASSEMBLY

4.09 The elevation adjustment turnbuckle assembly (Fig. 4) is attached between the lower rim of the antenna reflector and the elevation turnbuckle bracket on the mounting frame assembly. This

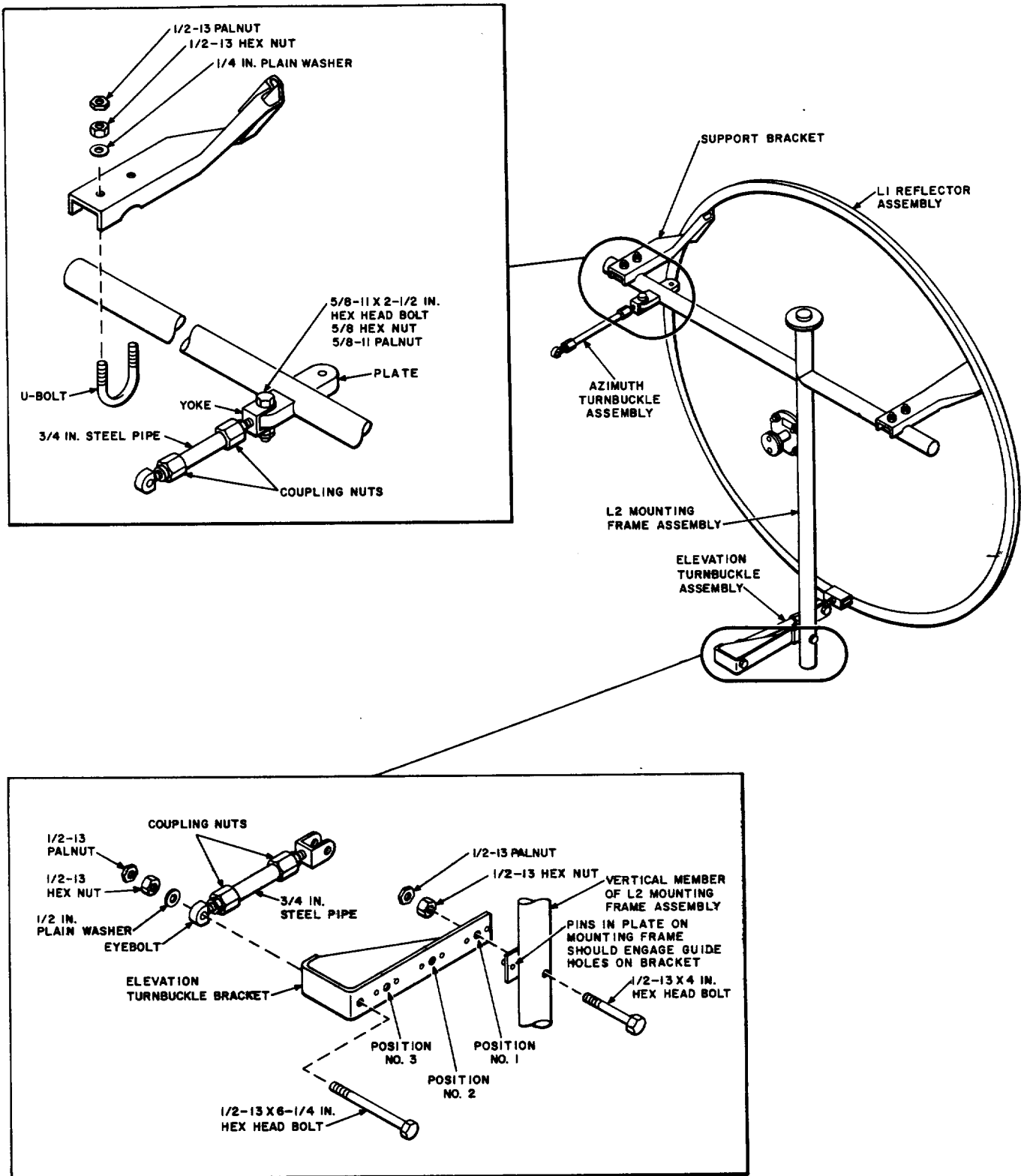


Fig. 4—Azimuth and Elevation Turnbuckle Assemblies

**TABLE A — AZIMUTH TURNBUCKLE ADJUSTMENT RANGE FOR ANTENNA MOUNTED ON B GUYED TOWER OR MOUNTED ON ROOF**

ADJUSTMENT RANGE (DEGREES)	PIPE LENGTH (INCHES)
-9 to +24	10
+20 to +65	20

turnbuckle is normally supplied with a pipe length of 10 inches for a range of elevation adjustment as shown in Table B. If a different elevation range is necessary, the desired pipe length may be inserted.

**TABLE B — ELEVATION TURNBUCKLE ADJUSTMENT RANGE**

BRACKET POSITION (SEE FIG. 4)	PIPE LENGTH (INCHES)	ADJUSTMENT RANGE (DEGREES)*
1	5	-9½ to -7½
2	5	-8 to -2
3	5	-2½ to +3½
1	10	-7½ to -1
2	10	-1½ to +4
3	10	+3½ to +9
1	20	+5½ to +11½
2	20	+11 to +17
3	20	+15½ to +22½
1	30	+19 to +25½
2	30	+24½ to +30
3	30	+29½ to +36

\*Minus indicates below horizontal plane, and plus indicates above horizontal plane.

**4.10** Five-inch, 20-inch, and 30-inch lengths of pipe are supplied as spares with the elevation adjustment turnbuckle. The 20-inch pipe may also be used for the azimuth adjustment turnbuckle when required.

**4.11** The bracket on the antenna mounting frame assembly also may be installed in one of

three positions to vary the elevation adjustment range as shown in Fig. 4. Table B includes adjustment ranges possible with different bracket positions.

**4.12** To install a different length of pipe, the elevation turnbuckle assembly must be detached from the mounting frame assembly. Detach the turnbuckle assembly by removing the bolt, washer, and two nuts holding it to the elevation turnbuckle bracket. Remove the coupling nut from each end of the 3/4-inch pipe. Coat the threads of the replacement pipe with KS-19094 L1 anti-seize compound and attach a coupling nut to each end.

**4.13** Loosen the U-bolts which secure the antenna reflector to the mounting frame assembly. Tilt the reflector so the turnbuckle eyebolt may be fastened to the mounting frame assembly. Attach the turnbuckle with the hardware removed as in 4.12. Tighten the U-bolts securing the antenna reflector to the mounting frame assembly.

#### REFLECTOR POSITION ON MOUNTING FRAME

**4.14** The L2 mounting frame assembly is reversible, ie, it may be used with the vertical member either to the right or to the left of the center of the antenna. Local supervision shall review the antenna orientation plan to determine if the reflector is mounted on the correct side of the mounting frame assembly. If the position of the reflector must be changed, the following procedures should be used, (See Fig. 4):

(a) Remove the Palnut, hex nut, washer and bolt which secure the elevation turnbuckle eyebolt to the elevation turnbuckle bracket.

(b) Remove the Palnuts, hex nuts, washers and U-bolts which secure the horizontal member of the mounting frame assembly to the two supports of the antenna reflector. The reflector can now be removed from the mounting frame assembly.

(c) Loosen the Palnut and hex nut which secure the elevation turnbuckle bracket to the vertical member of the mounting frame assembly. Disengage the bracket from the two pins on the mounting frame, rotate the bracket 180 degrees, and again engage the pins. Tighten the hex nut and Palnut to secure the bracket to the vertical member.

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(d) Remove the Palnut, hex nut, and bolt which secure the yoke of the azimuth turnbuckle to the plate on the horizontal member of the mounting frame assembly. Remove the azimuth turnbuckle and attach the yoke to the opposite plate. Replace the hardware in the proper sequence and tighten securely.

**Note:** The head of the bolt, which secures the azimuth turnbuckle yoke to the plate, should face up with respect to the normal mounting position of the mounting frame assembly.

(e) Remount the antenna reflector on the mounting frame assembly. Place the horizontal member of the mounting frame assembly into the cutouts in the lower flanges of the reflector channel assemblies. Insert the U-bolts around the horizontal member and through the channels. Replace the hex nuts and Palnuts, and tighten securely.

**Note:** The correct position of the horizontal member relative to the reflector channel assemblies shall be determined by placing the eyebolt of the elevation turnbuckle against the mounting surface of the elevation turnbuckle bracket. When the elevation turnbuckle extends perpendicularly to the reflector rim and rests upon the bracket mounting surface, the horizontal member is properly positioned on the channels.

(f) Position the elevation turnbuckle eyebolt on the mounting hole of the elevation turnbuckle bracket. Replace the washer, bolt, hex nut, and Palnut and tighten securely.

## 5. INSTALLATION

### GENERAL

**5.01** Provide suitable hoisting tackle and rig the tackle so the reflector and associated parts can be raised directly to the elevation at which the installation is to be made.

**5.02** Connect the hoisting sling to the antenna mounting frame assembly at the junction of the horizontal member of the mounting frame support assemblies which connect to the antenna reflector (Fig. 5).

**Caution:** *To prevent the azimuth turnbuckle from swinging freely during hoisting operations, the turnbuckle should be secured to the horizontal arm of the antenna mounting frame assembly.*

**5.03** Connect two tag lines to the mounting frame assembly at the junction of the vertical member of the mounting frame and the elevation turnbuckle bracket (Fig. 5). The tag lines should be used to prevent the antenna from striking the side of the support structure during the hoisting operation. As the antenna rises, it may be necessary for the tag line men to move farther from the support structure in order to gain better control.

### PRECAUTIONS

**5.04** Installation of the antenna should not be attempted unless wind velocities are moderate and weather conditions are expected to remain stable.

**5.05** While work is in progress, there shall be at least one person in attendance on the ground. Anyone who is required to climb the supporting structure, while work is in progress aloft, should arrange to climb at a time when there is the least probability of any object being dropped or falling from the work location aloft.

**5.06** All personnel who will be on the structure or working in its vicinity shall wear safety headgear. Body belts and safety straps are to be worn and used whenever the need is indicated.

**5.07** Tools, parts, hardware, etc, should be hauled aloft on a line or carried aloft in a closed bag, pouch, or in suitable slots in a tool belt. Any tools or other objects used aloft shall be lowered to the ground when their use is no longer required. Do not leave tools or other loose objects lying on ledges. Place them in a bag or pouch or otherwise secure them where they will not fall.

**5.08** When work is being done on guyed structures, exercise care to avoid striking the guys with objects being raised or lowered.

**5.09** The precautions given in 5.04 through 5.08 are basic precautions to be observed. However, they are neither all-inclusive nor do they supersede established safety practices of reliable contractors.



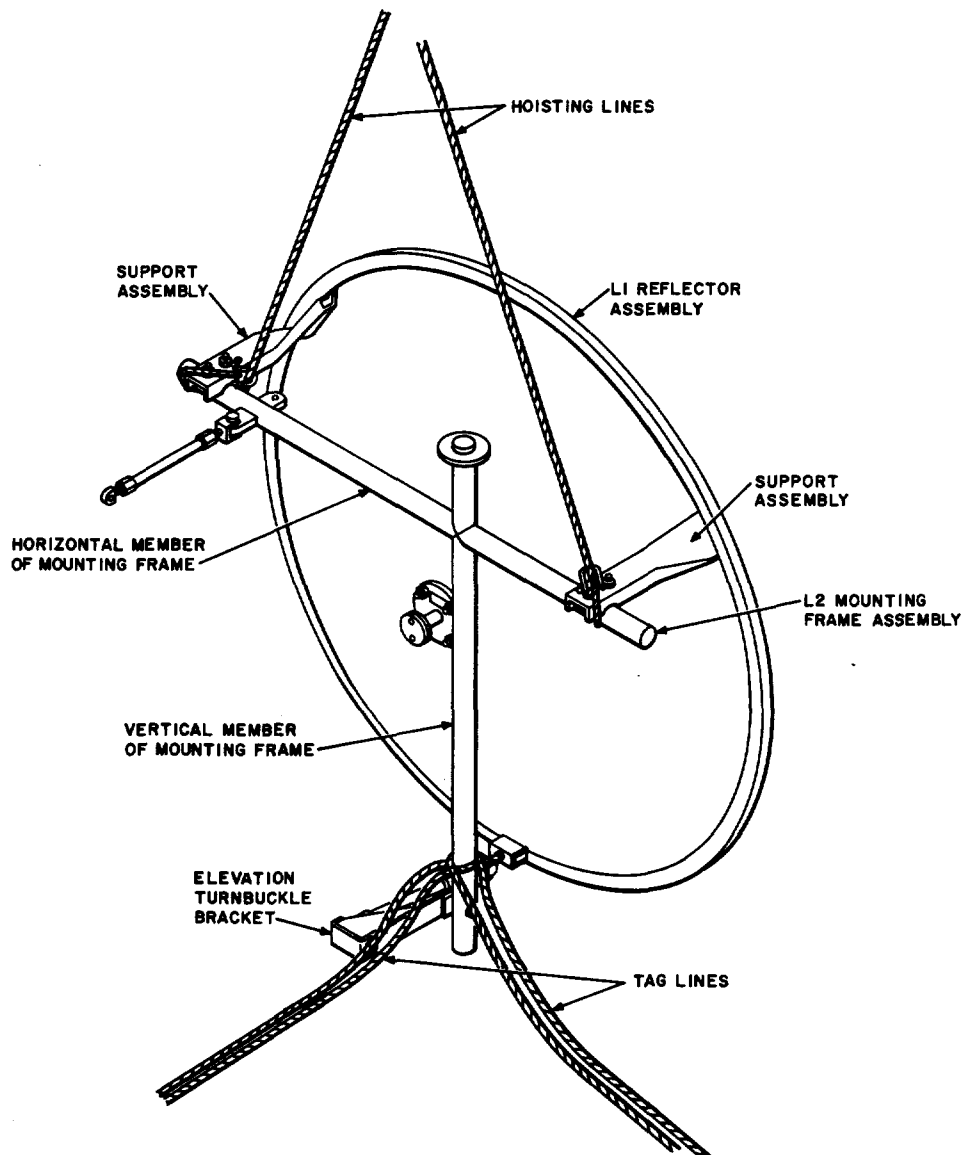


Fig. 5—Hoisting Sling and Tag Line Attachment to Antenna

Bell System personnel should observe the precautions given here as well as those established locally.

#### INSTALLATION ON AT-7728 B-GUYED TOWER

**5.10** Attach the two P-44R161 bracket assemblies to the tower leg as shown in Fig. 6. Local supervision shall determine, using Table C as a guide, if the brackets should be mounted on the left or right of the tower leg. Secure each bracket assembly with three 5/8-11 x 1 1/2 hex head bolts, 5/8-11 hex nuts, and Palnuts.

**5.11** Hoist the antenna to the installation level.

Guide the vertical member of the mounting frame into position against the two brackets (Fig. 6). The collar of the mounting frame should rest on top of the upper bracket. Secure the mounting frame to each P-44R161 bracket assembly using a P-48R221 U-bolt, two 1/2 lockwashers, and two 1/2-13 hex nuts as shown in Fig. 6.

**5.12** With the antenna still supported by the winch line, install the azimuth adjustment turnbuckle using a 5/8-11 jam hex nut, 5/8 plain washer, 5/8-11 hex nut, and Palnut as shown in Fig. 6. The

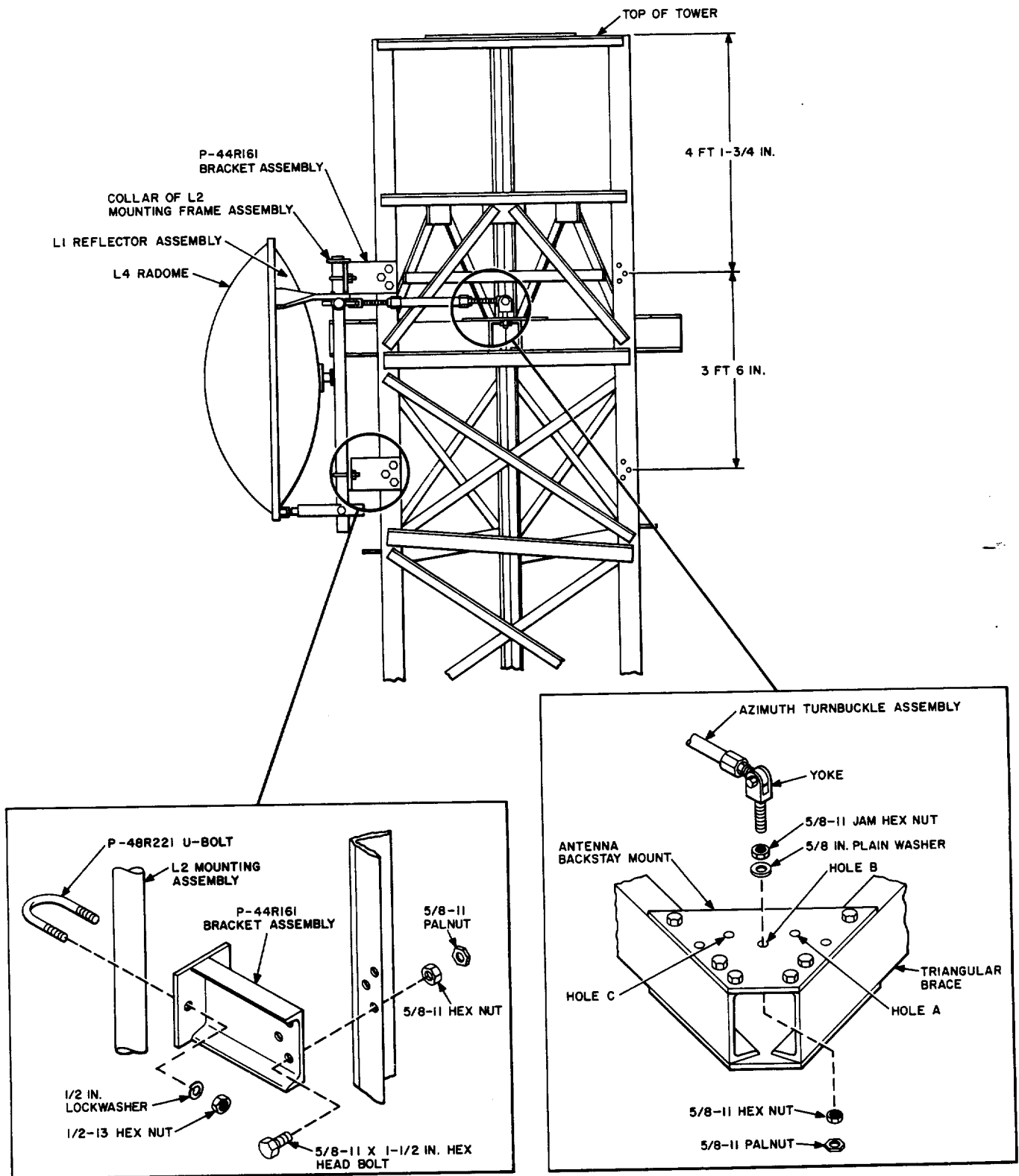


Fig. 6—Mounting Antenna on B Guyed Tower

**TABLE C — AZIMUTH TURNBUCKLE RANGE  
DETERMINED BY SELECTED MOUNTING HOLES  
IN B GUYED TOWER OR C SELF-SUPPORTING**

BRACKET POSITION	PIPE LENGTH (INCHES)	ADJUSTMENT RANGE (DEGREES)		
		HOLE A	HOLE B	HOLE C
Left	10	-5 to +16	0 to +21	+4 to +20
Left	20	+16 to +38	+21 to +44	+26 to +50
Right	30	+37 to +61	+43 to +65	Not recommended

turnbuckle may be attached to the tower in any one of three holes in the tower triangular brace. Table C lists the range of azimuth adjustment permissible using each of the three holes and the P-44R161 bracket mounted on the right or left of the tower leg. Data is also included on the adjustment range for different pipe lengths used in the azimuth turnbuckle assembly.

**5.13** Mechanically orient the antenna to the azimuth and elevation specified on the plot plan.

**5.14** Check that all supporting hardware is properly secured and remove the hoist line, sling, and tag lines from the mounting frame assembly.

#### **INSTALLATION ON AT-7729 B SELF-SUPPORTING TOWER**

**5.15** Hoist the antenna to the installation level. Place two P-15G468 saddles between the vertical member of the mounting frame assembly and the top and center mounting rings of the tower (Fig. 7). The collar of the mounting frame assembly should rest on top of the upper saddle.

**5.16** Attach the saddles and the mounting frame to the tower rings using the two P-15G471 V-bolts, four 5/8 plain washers, 5/8-11 hex nuts, and Palnuts as shown in Fig. 7. Do not tighten securely until the azimuth adjusting arm is installed and the antenna mechanically oriented.

**5.17** Set the azimuth turnbuckle at mid-range. Attach the P-15G401 angle to the azimuth turnbuckle using a 5/8-11 jam hex nut, 5/8 plain washer, 5/8-11 hex nut, and Palnut as shown in

Fig. 7. Swing the turnbuckle and angle to the circular ring and attach the angle to the nearest set of holes on the ring. Minor adjustment may be necessary for hole alignment.

**5.18** Mechanically orient the antenna to the azimuth and elevation specified on the plot plan.

**5.19** Check that all supporting hardware is properly secured. Remove the hoist line, sling, and tag lines from the mounting frame assembly.

#### **INSTALLATION ON AT-8013 C SELF-SUPPORTING TOWER**

**5.20** Attach the two P-44R161 bracket assemblies to the tower leg as shown in Fig. 8. Local supervision shall determine, using Table C as a guide, if the brackets should be mounted on the left or right of the tower leg. Secure each bracket assembly with three 5/8-11 x 1-1/2 hex head bolts, 5/8-11 hex nuts, and Palnuts.

**5.21** Hoist the antenna to the installation level. Guide the vertical member of the mounting frame into position against the two brackets (Fig. 8). The collar of the mounting frame should rest on top of the upper bracket. Secure the mounting frame to each P-44R161 bracket assembly using a P-44R221 U-bolt, two 1/2 lockwashers, and two 1/2-13 hex nuts as shown in Fig. 8.

**5.22** With the antenna still supported by the winch line, install the azimuth adjustment turnbuckle using a 5/8-11 jam hex nut, 5/8 medium washer, 5/8-11 hex nut, and Palnut as shown in Fig. 8.

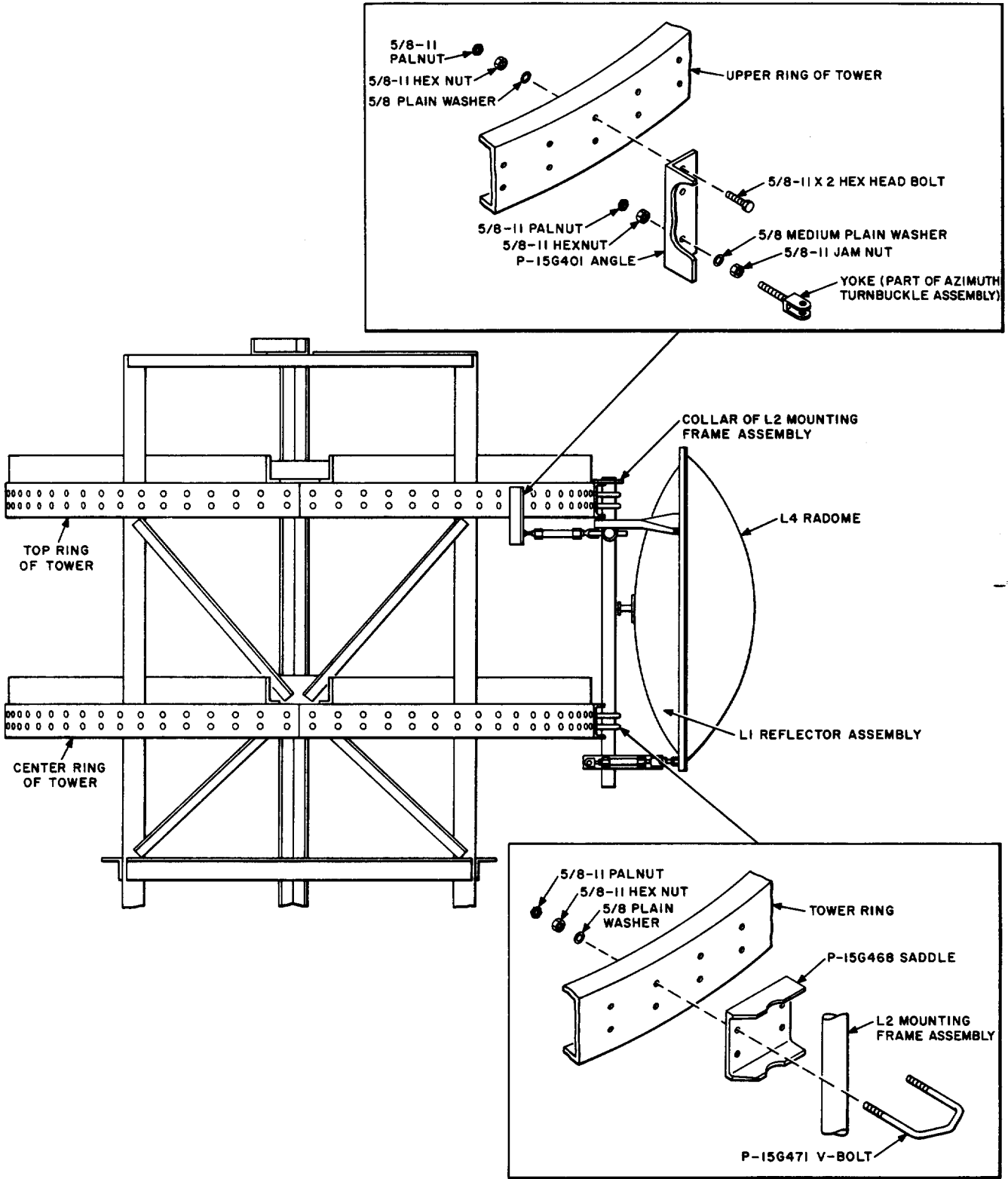


Fig. 7—Mounting on B Self-Supporting Tower

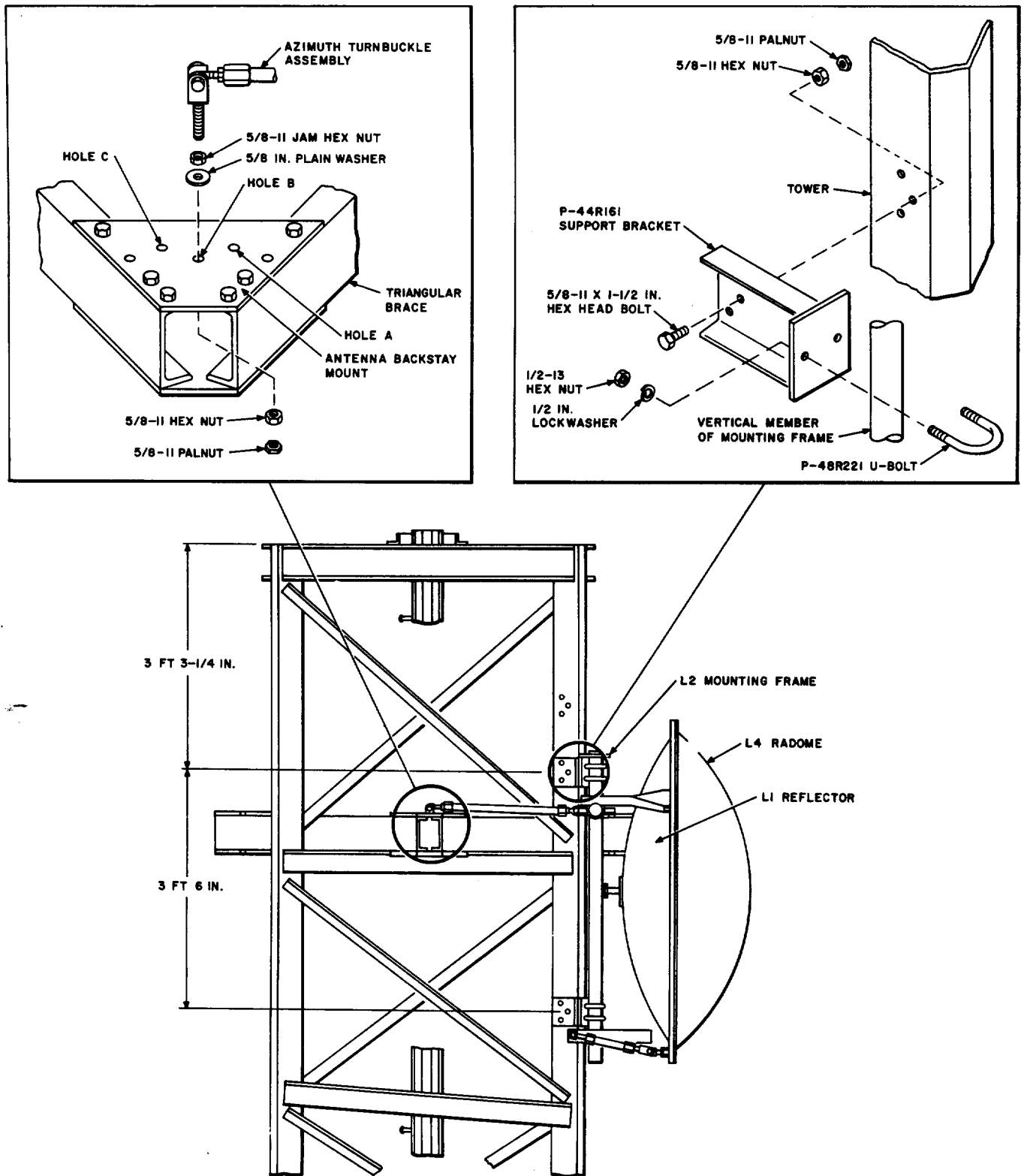


Fig. 8—Mounting Antenna on C Self-Supporting Tower

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Refer to 5.12 and Table C for adjustment ranges and method of adjustment.

**5.23** Mechanically orient the antenna to the azimuth and elevation specified on the plot plan.

**5.24** Check that all supporting hardware is properly secured. Remove the hoist line, sling, and tag lines from the mounting frame assembly.

### INSTALLATION OF ED-95187-30 ANTENNA SUPPORT STRUCTURE

#### General

**5.25** The ED-95187-30 antenna support structure is a steel-frame structure which mounts either on the ED-50240-30 7 ft by 7 ft TL equipment shelter or ED-50241-30 7 ft by 16 ft TL equipment shelter.

**5.26** When mounted on an equipment shelter, the antenna support structure provides a support and mounting surface for one or two KS-15970 antennas in a direct radiator configuration, periscopic system, or a combination of direct and periscopic signal transmissions.

**5.27** The antenna support structure is divided into four groups, based upon various mounting arrangements, as follows:

- (a) Group 1—Two P-44R165 beams and associated hardware required for mounting one or two KS-15970 antennas in periscopic and/or direct radiator configurations.
- (b) Group 2—Four P-44R158 corner upright assemblies, four P-44R164 strut angles, four P-44R163 top angles, and one P-44R162 adjustment angle and associated hardware required in addition to Group 1 for mounting one or two KS-15970 antennas as direct radiators.
- (c) Group 3—Two P-44R161 support brackets and associated hardware required in addition to Group 2 for each KS-15970 antenna mounted as a direct radiator.
- (d) Group 4—Two P-44R186 brackets and one P-44R187 angle and associated hardware required in addition to Group 1 for mounting one KS-15970 antenna in a periscopic arrangement.

#### Group 1 Installation

**5.28** Orient the two P-44R165 beams as shown in Fig. 9. Align the holes in the bottom flange of the beams with the holes of the mounting bracket on the shelter. When the beam is installed on a 7 ft by 7 ft shelter utilize the outer two pairs of mounting holes and when the beam is installed on a 7 ft by 16 ft shelter utilize the inner two pairs of holes. Secure each beam to the shelter bracket by using eight 5/8-11 x 1 1/2 hex head bolts, 5/8-11 hex head nuts, and Palnuts.

#### Group 2 and 3 Installation for One or Two KS-15970 Antennas as Direct Radiators

**5.29** Assemble the Group 2 support structure as shown in Fig. 10 utilizing the four P-44R158 corner upright assemblies, four P-44R164 strut angles, four P-44R163 top angles, and one P-44R162 adjustment angle. Fasten the framework together with the 5/8-11 x 1-1/2 hex head bolts, 5/8-11 hex head nuts, and Palnuts.

**5.30** Position the Group 2 support structure on the two P-44R165 beams in position 1 as shown in Fig. 10 and secure with the 5/8-11 x 1-1/2 hex head bolts, 5/8-11 hex head nuts, and Palnuts.

**5.31** Position the Group 3 mounting assembly consisting of two P-44R161 support brackets as shown in Fig. 10 and secure with six each 5/8-11 x 1-1/2 hex head bolts, 5/8-11 hex head nuts, and Palnuts. The mounting assembly may be mounted on any of the four corners of the support structure framework and on either face of a corner. Local supervision shall determine the correct mounting position.

#### Group 2 and 3 Installation for One KS-15970 Antenna as Direct Radiator and One KS-15970 Antenna in Periscopic Concurrently or Later

**5.32** Assemble the Group 2 support structure as outlined in 5.29 .

**5.33** Position the Group 2 support structure on the two P-44R165 beams as shown in Fig. 11 and secure with the 5/8-11 x 1-1/2 hex head bolts, 5/8-11 hex head nuts, and Palnuts. The Group 2 support structure may be placed on either end of the beams referred to as position 2 or alternate position 2 in Fig. 11.

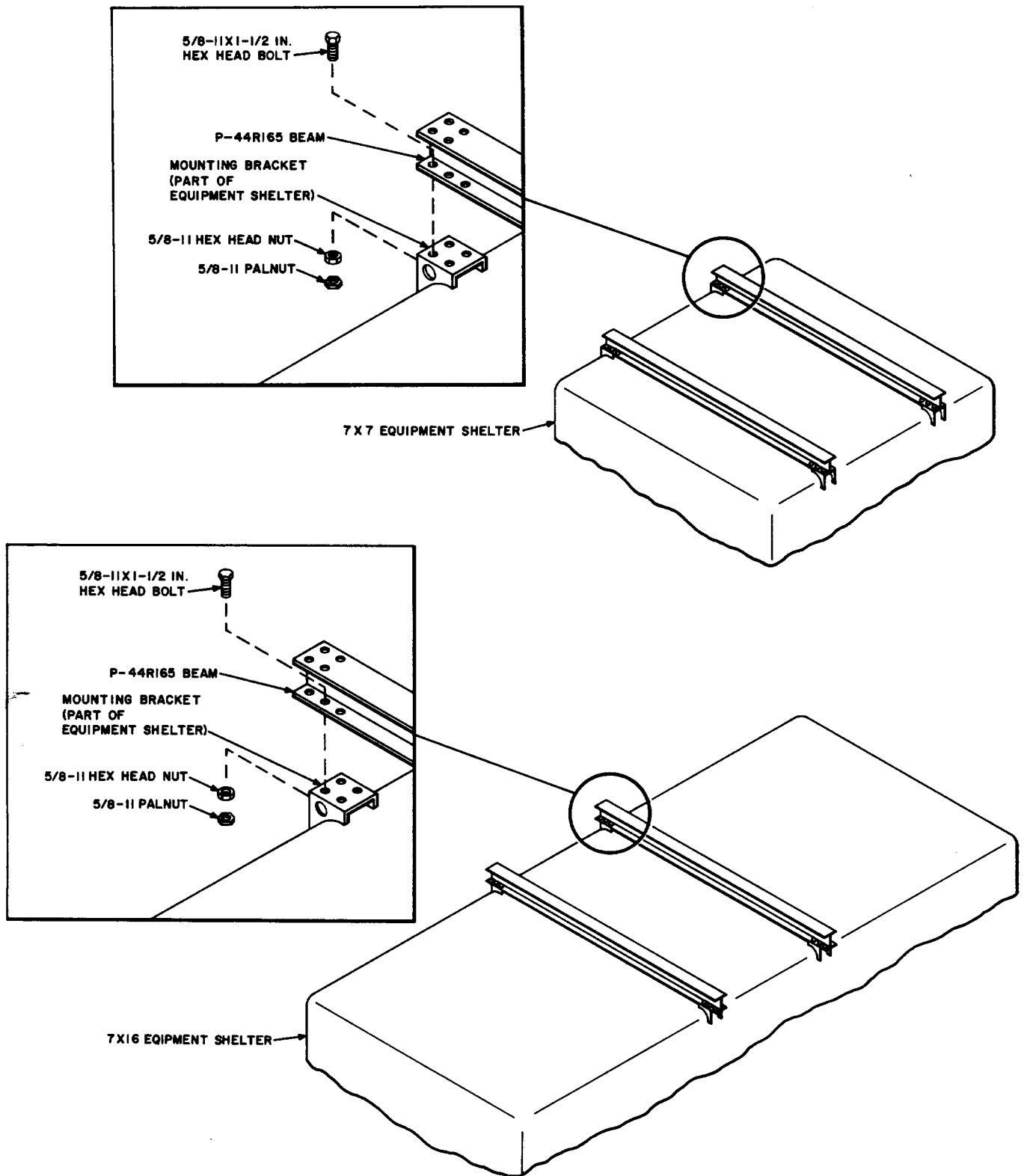
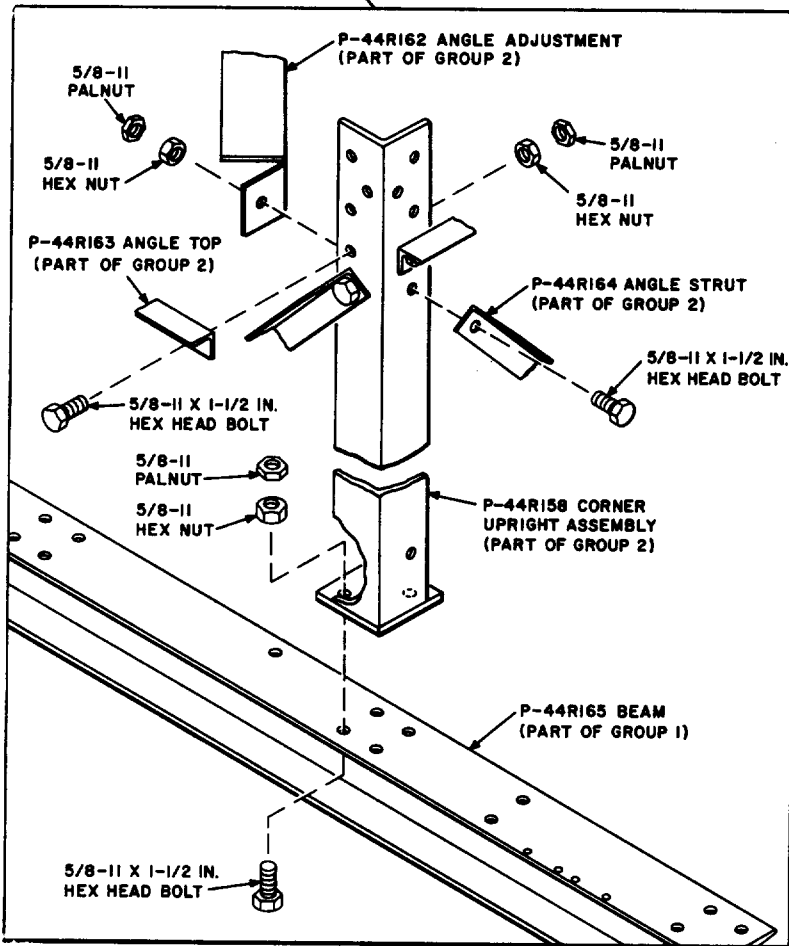
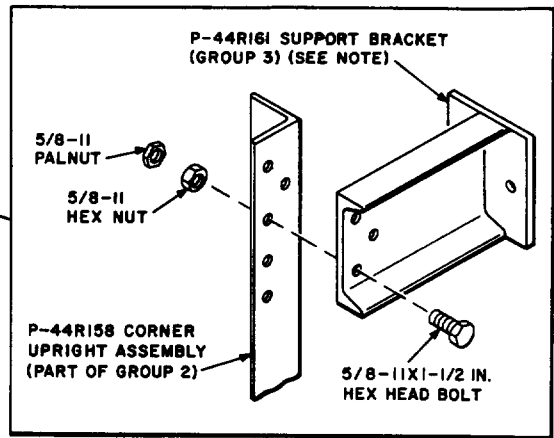
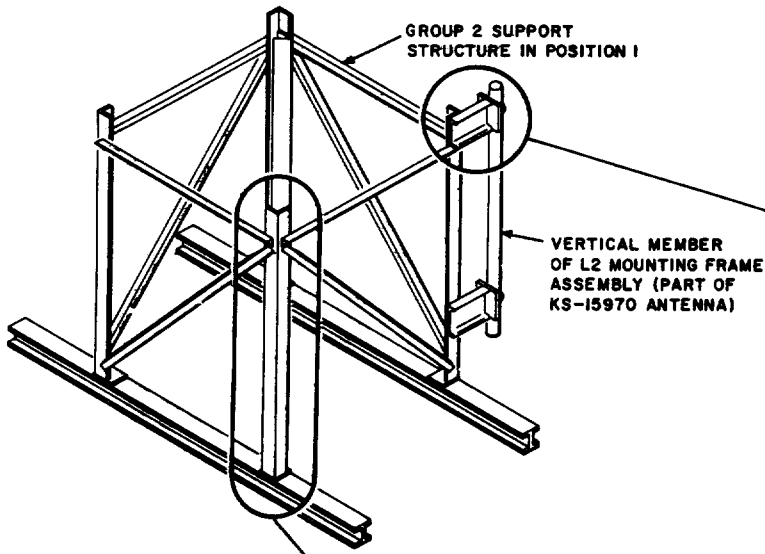


Fig. 9—ED-95187-30 Antenna Support Structure, Installation of Group 1 Components

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NOTE:

THE P-44R161 SUPPORT BRACKET MAY BE MOUNTED ON ANY OF THE FOUR CORNERS OF THE STRUCTURE AND ON EITHER FACE OF A CORNER.

Fig. 10—ED-95187-30 Antenna Support Structure, Installation Procedure of Groups 2 and 3 Components for One or Two Antennas as Direct Radiators



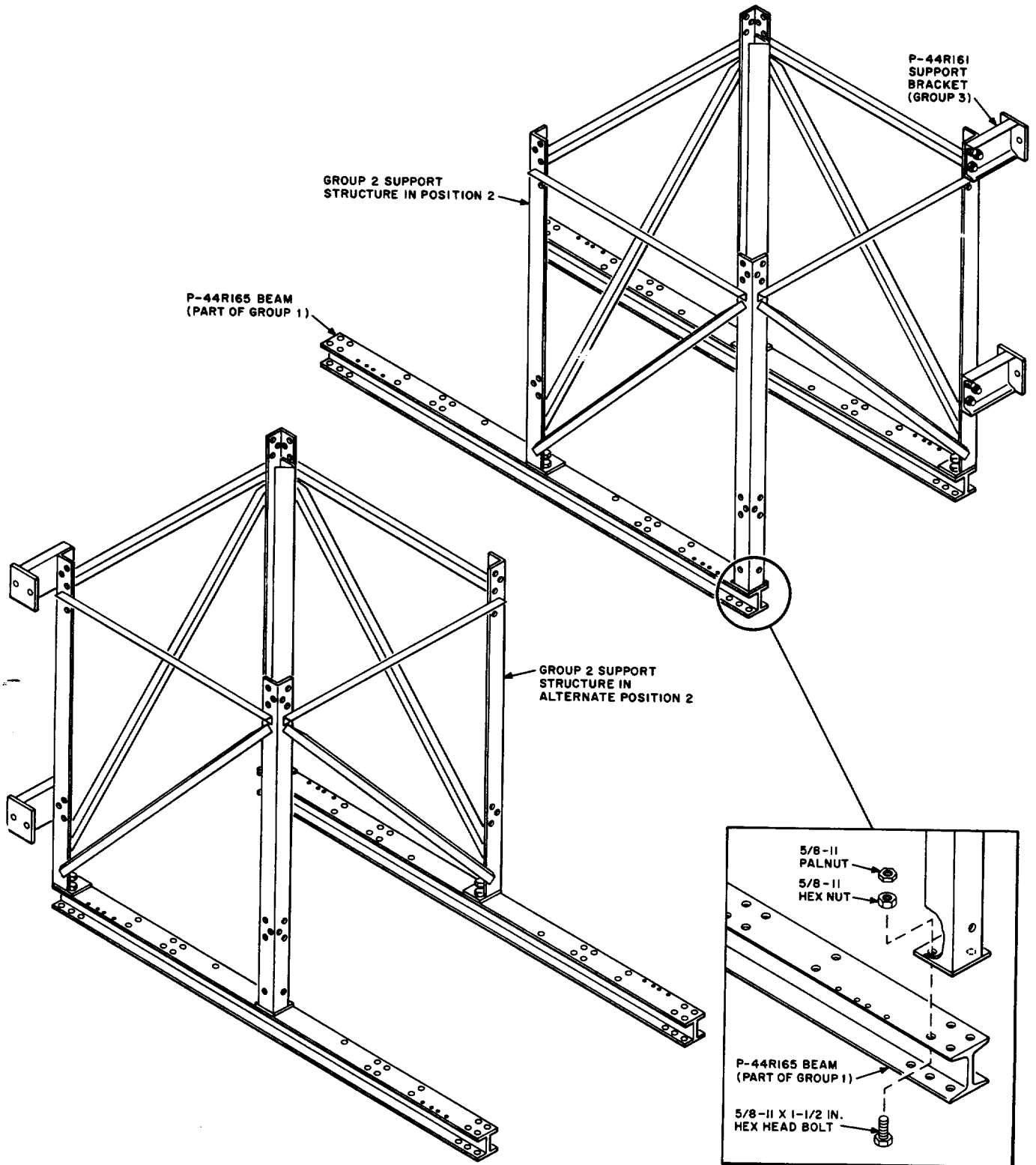


Fig. 11—ED-95187-30 Antenna Support Structure, Installation Procedure of Group 2 and 3 Components for One Antenna as Direct Radiator and One Antenna in Periscopic Arrangement

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**5.34** Install the P-44R161 support brackets (Group 3) as outlined in 5.31. The mounting assembly may be mounted on any of the four corners of the support structure framework and on either face of a corner.

### Group 4 Installation for One or Two KS-15970 Antennas in Periscopic Arrangement

**5.35** To install Group 4, position the two P-44R186 brackets and the P-44R187 angle on the P-44R165 beams as shown in Fig. 12A. Secure with ten 5/8-11 x 1-1/2 hex head bolts, 5/8-11 hex head nuts, and Palnuts. Group 4 provides for the mounting of one antenna in a periscopic arrangement.

**5.36** To provide mounting for two antennas in periscopic array, install two Group 4 assemblies as shown in Fig. 12B. Refer to 5.35 for installation procedures.

**5.37** To provide mounting for one antenna as a direct radiator and one in periscopic (Fig. 12C), install the Group 4 assembly on the desired end of the P-44R165 beams as shown in Fig. 12A. Local supervision shall determine the correct mounting position. Install the Group 2 assembly on the opposite end of the beams as shown in Fig. 11.

### INSTALLATION ON ROOF PER ED-95182-30

#### General

**5.38** The ED-95182-30 roof mounting provides for the mounting of one or two KS-15970 antennas in direct-radiator or periscopic configurations on the roof of an ED-50240-30 7 ft by 7 ft TL equipment shelter. The antennas mount upon the ED-95187-30 antenna support structure which is installed upon the shelter roof. Fig. 13A and 13B illustrate typical mounting positions for one or two antennas used as direct-radiators. Fig. 13C illustrates one antenna being used as a direct radiator and one antenna in a periscopic system. Fig. 14 illustrates the periscopic array.

#### Installation of One or Two KS-15970 Antennas as Direct Radiators

**5.39** The antenna may be mounted on any of the four corners of the ED-95187-30 G2 support structure and on either face of a corner. Local supervision shall determine the correct mounting position. When the mounting position is selected, install the P-44R161 support brackets (Group 3) as

shown in Fig. 10 and 13E. When the position of the reflector on the mounting frame assembly needs to be changed, refer to the procedure given in 4.14.

**5.40** Hoist the antenna to the installation level on the antenna support structure and guide it into position upon the P-44R161 support brackets. Place the vertical member of the mounting frame assembly against the face of each support bracket. The collar on the vertical member rests upon the top of the upper support bracket (Fig. 13E). Secure the mounting frame to each P-44R161 support bracket using a P-48R221 U-bolt, two 1/2 lockwashers, and two 1/2-13 hex nuts.

**5.41** With the antenna still supported by the hoist line, install the yoke of the azimuth turnbuckle as shown in Fig. 13E. Secure the turnbuckle to the P-44R162 adjustment angle using a 5/8-11 jam hex nut, 5/8 plain washer, 5/8-11 hex nut, and Palnut.

**5.42** Check that all supporting hardware is properly secured and remove the hoist line and sling from the mounting frame assembly.

#### Installation of One or Two KS-15970 Antennas in Periscopic Array

**5.43** When one or two antennas are installed in periscopic array, one ED-95187-30, Group 4 is used for each antenna. Group 4 consists of two P-44R186 brackets, one P-44R187 angle and associated mounting hardware. The installation procedure for Group 4 is given in 5.35 through 5.37.

**5.44** If only one antenna is to be mounted in periscopic, local supervision shall determine that the ED-95187-30, Group 4 is installed on the correct end of the P-44R165 beams. When the position of the reflector on the mounting frame assembly needs to be changed, refer to the procedure given in 4.14.

**5.45** Hoist the antenna to the installation level and guide it into position upon the P-44R186 brackets (Fig. 14). Place the vertical member of the mounting frame assembly upon the P-44R186 brackets with the collar of the vertical member flush with the outer edge of one bracket. Secure the mounting frame to each P-44R186 bracket using a P-48R221 U-bolt, two 1/2 lockwashers, and two 1/2-13 hex nuts.

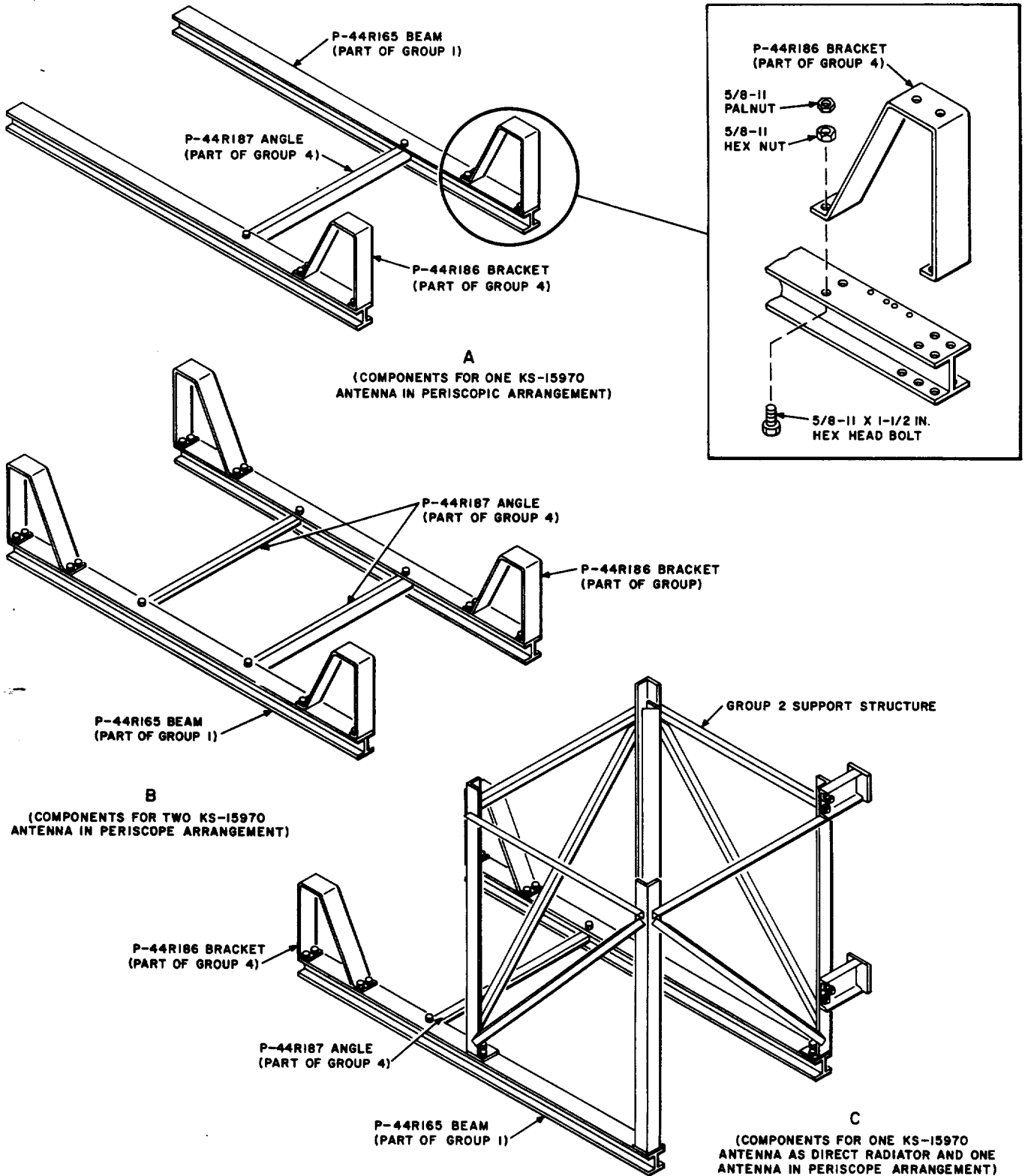
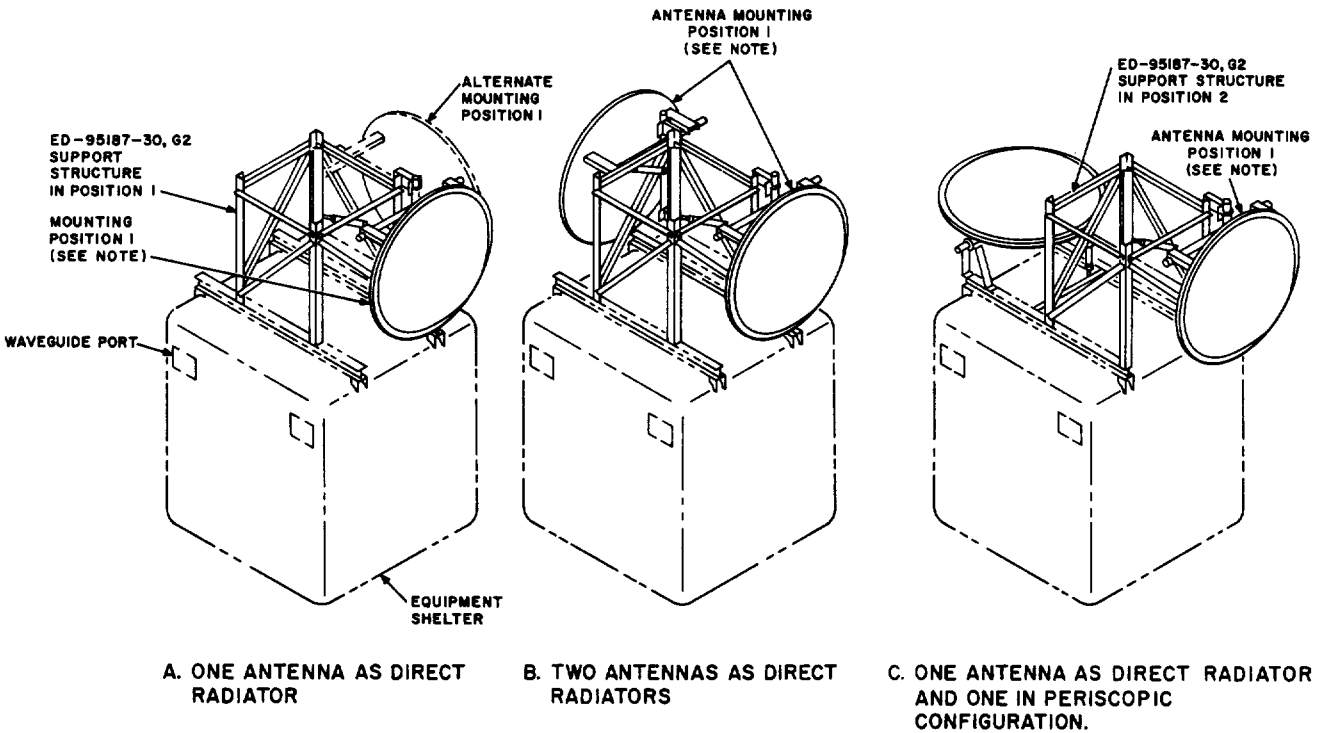
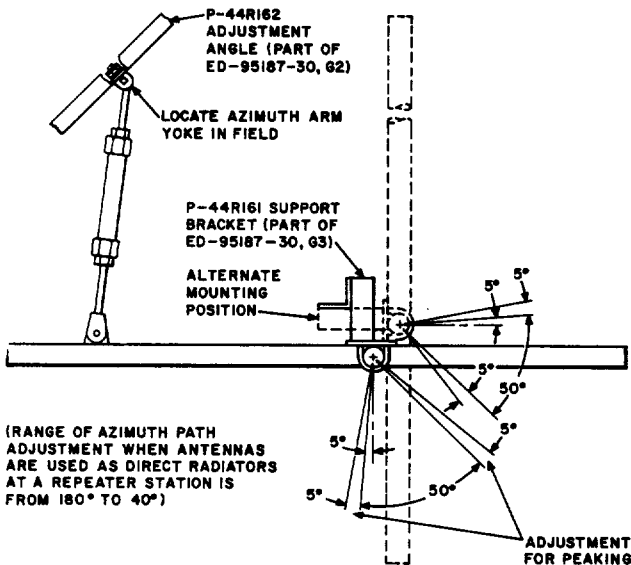


Fig. 12—ED-95187-30 Antenna Support Structure Installation Procedure of Group 4 Components for One or Two Antennas in Periscopic Arrangement

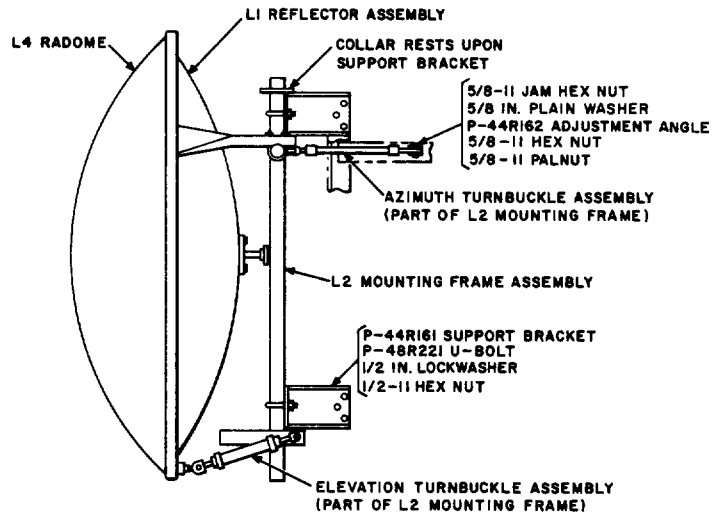
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NOTE:  
ANTENNA MAY BE MOUNTED ON ANY OF THE FOUR CORNERS OF THE SUPPORT STRUCTURE AND ON EITHER FACE OF A CORNER.



D. LIMITS OF ANTENNA AZIMUTH ADJUSTMENT



E. MOUNTING DETAILS

Fig. 13—ED-95182-30 Roof Mounting Installation Procedure for Direct Radiator Antennas on 7 by 7 TL Equipment Shelter

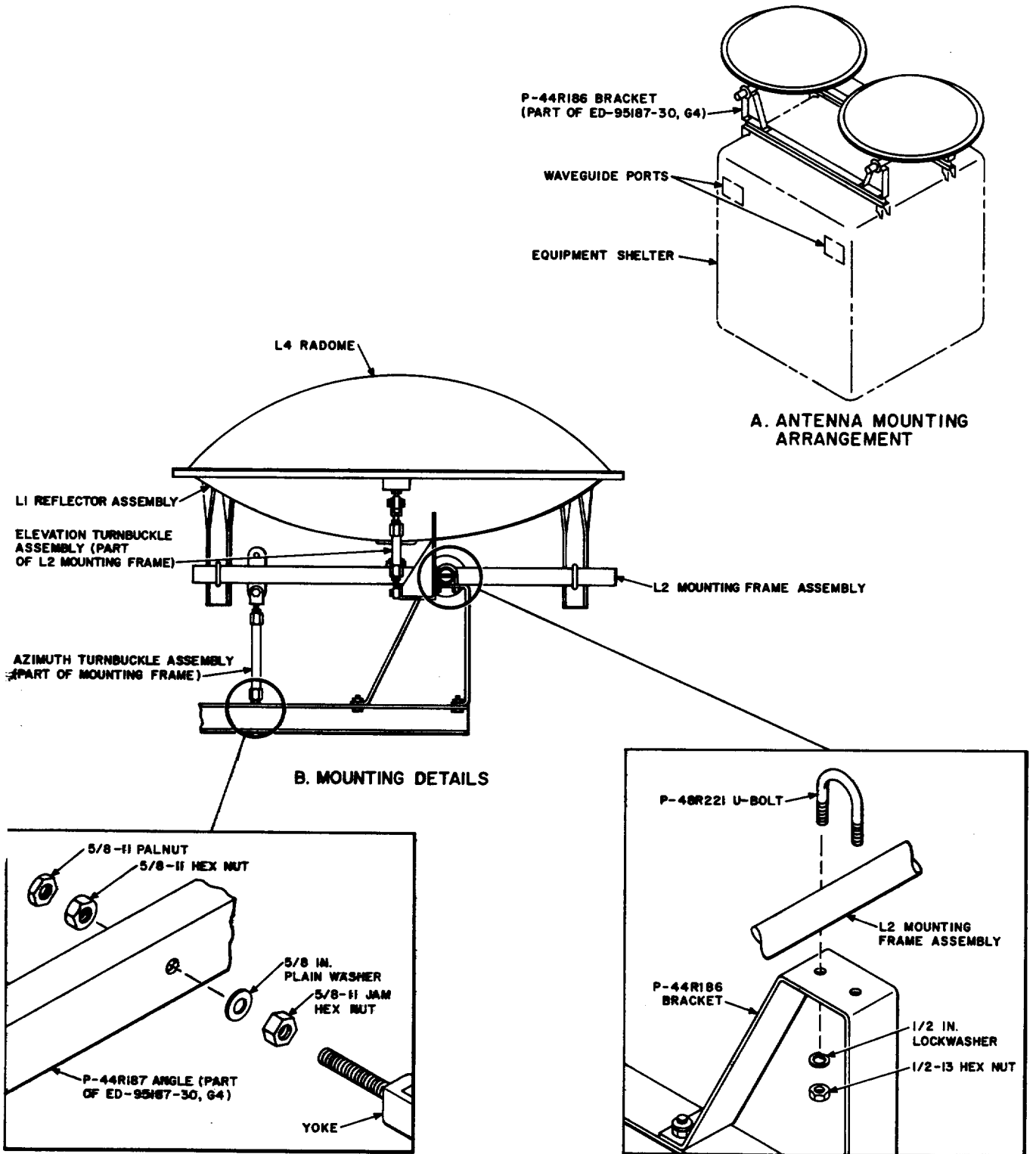


Fig. 14—ED-95182-30 Roof Mounting Installation Procedure for Periscopic Antennas on 7 by 7 Equipment Shelter

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**5.46** With the antenna still supported by the hoist line, install the yoke of the azimuth turnbuckle as shown in Fig. 14. Secure the turnbuckle to the P-44R187 angle using a 5/8-11 jam hex nut, 5/8 plain washer, 5/8-11 hex nut, and Palnut.

**5.47** Check that all supporting hardware is properly secured and remove the hoist line and sling from the mounting frame assembly.

### INSTALLATION ON ROOF PER ED-95189-30

#### General

**5.48** The ED-95189-30 roof mounting provides for the mounting of one or two KS-15970 antennas in direct-radiator or periscopic configurations on the roof of an ED-50241-30 7 ft by 16 ft TL equipment shelter. The antennas mount upon the ED-95187-30 antenna support structure which is installed upon the shelter roof.

#### Installation of One or Two KS-15970 Antennas as Direct Radiators

**5.49** The installation of KS-15970 antennas as direct radiators on an ED-50241-30 7 ft by 16 ft TL equipment shelter is identical to antenna installation on an ED-50240-30 7 ft by 7 ft TL equipment shelter. The only differences, which have no effect upon the installation, are the size of equipment shelter and the location of shelter waveguide ports. Refer to Fig. 13 and paragraphs 5.39 through 5.42 for installation procedures.

#### Installation of One or Two KS-15970 Antennas in Periscopic Array

**5.50** The installation of KS-15970 antennas as periscopic radiators on an ED-50241-30 7 ft by 16 ft TL equipment shelter is identical to antenna installation on an ED-50240-30 7 ft by 7 ft TL equipment shelter. The only differences, which have no effect upon the installation, are the size of equipment shelter and the location of shelter waveguide ports. Refer to Fig. 14 and paragraphs 5.43 through 5.47 for installation procedures.

### INSTALLATION ON ROOF PER ED-59804-30

**5.51** When the antenna is mounted on a roof other than a TL equipment shelter, it is used in a periscopic system in conjunction with passive reflectors. For this type of roof mounting,

the antenna utilizes a P-44R911 antenna support Assembly, shown in Fig. 15.

**5.52** Local supervision shall determine the mounting position of the P-44R911 antenna support assembly based upon the location of the associated passive reflector in the periscopic system. Fig. 16 illustrates the relationship of the antenna support assembly to the passive reflector.

**5.53** The method of attaching the P-44R911 antenna support assembly, ED-59823-30 roof entrance assembly, and the azimuth turnbuckle shall be job engineered. With the aid of Fig. 15, local supervision shall plan and expedite the preliminary task of preparing the roof for the installation of the antenna support assembly and roof entrance assembly. The following procedures should be used where practicable:

(a) To prevent water seepage, do not use through bolts in the roof. Instead, studs (threaded 5/8-11) should be placed into the roof and cemented in place. Allow sufficient stud projection above roof for attachment of antenna support assembly flange, washer, hex nut, and Palnut. (See Fig. 15.)

(b) After the ED-59823-30 roof entrance assembly is attached to the roof (Fig. 16), install flashing completely up to the underside of the upper flanges on the roof entrance assembly. Apply roofing cement over flashing to ensure a watertight joint.

**5.54** After the necessary preparations have been completed on the roof, place the mounting flanges of the antenna support assembly over the mounting studs in the roof. Secure with four 5/8 flat washers, 5/8-11 hex nuts, and 5/8 Palnuts as shown in Fig. 15.

**5.55** Position the antenna mounting frame assembly upon the antenna support assembly with the collar on the mounting frame assembly flush with the edge of the flange on the antenna support assembly. Secure with two P-48R221 U-bolts, four 1/2-13 hex nuts, and four Palnuts as shown in Fig. 17.

**5.56** Install the backstay of the azimuth adjustment turnbuckle to the mounting hole in the foot of the antenna support assembly. Secure with a

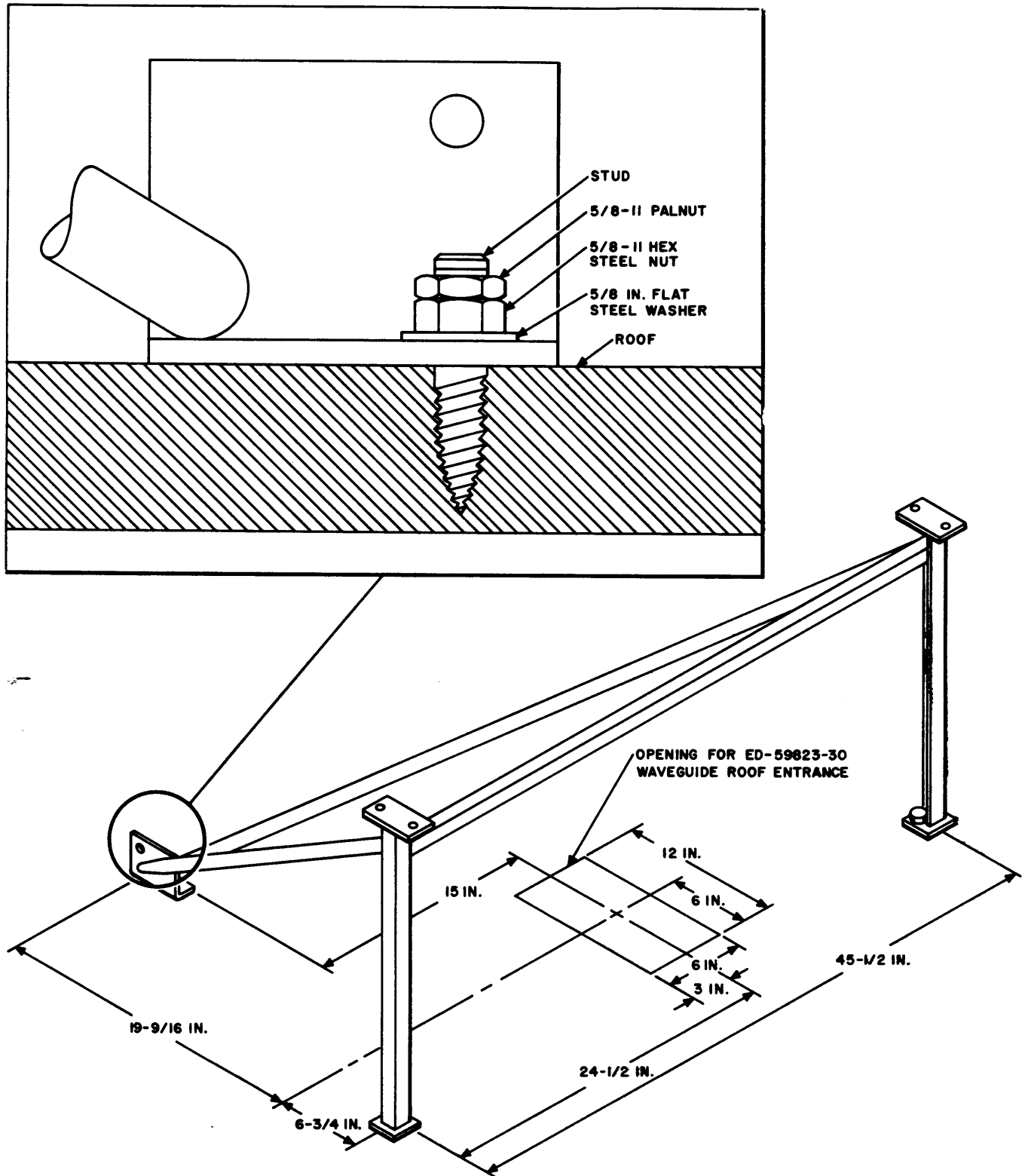


Fig. 15—P-44R911 Antenna Support Assembly, Installation Procedure

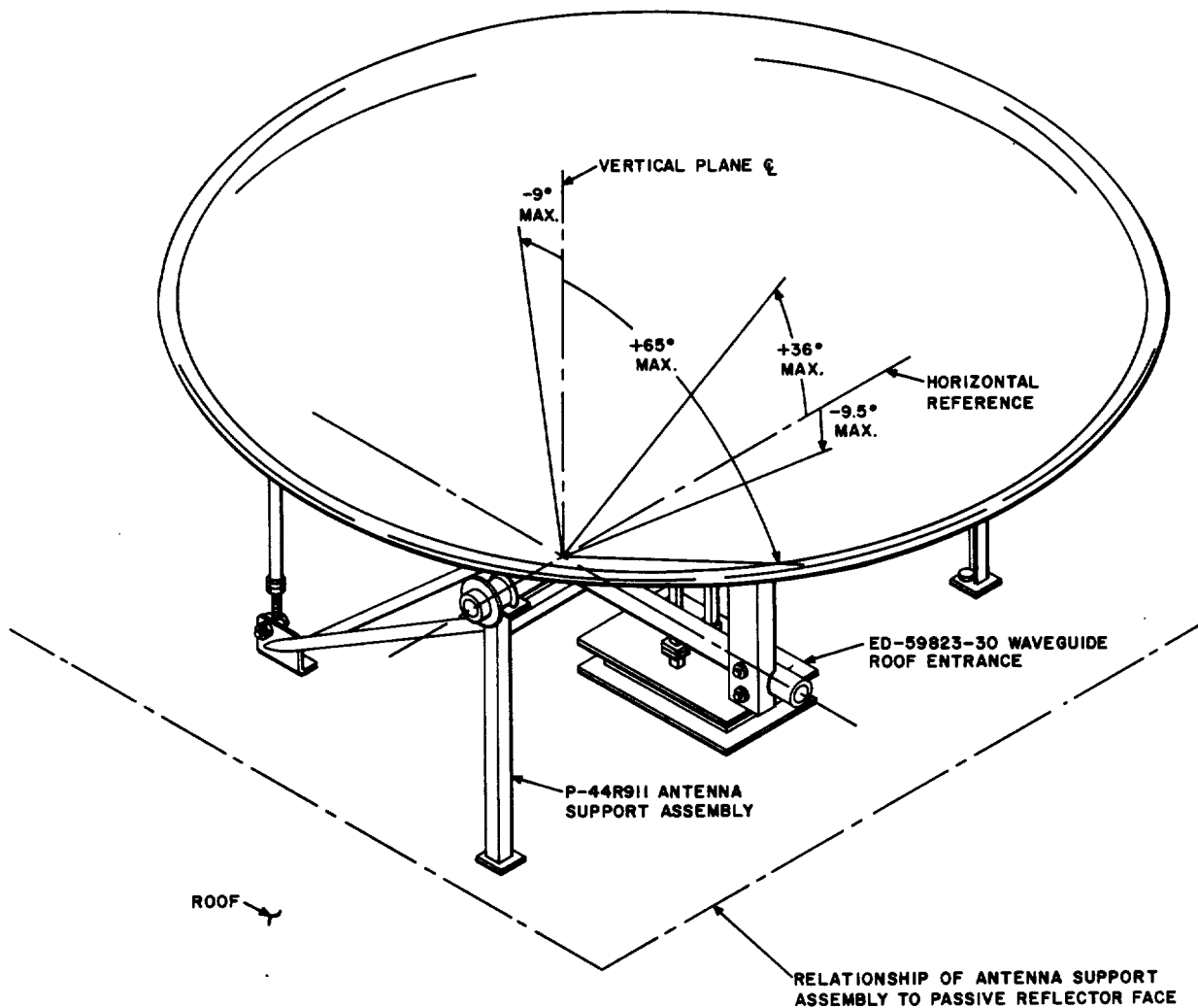


Fig. 16—ED-59804-30 Roof Mounting, Directivity of Antenna on P-44R911 Antenna Support Assembly

1/2-13 x 1-1/2 hex head bolt, 1/2 plain washer, 1/2-13 jam hex nut, and Palnut as shown in Fig. 17.

5.57 To allow easier orientation later with the associated passive reflector, the azimuth and elevation turnbuckles should be set at midrange. Check that all supporting hardware is properly secured on the antenna and antenna support assembly.

## 6. ORIENTATION

### GENERAL

6.01 The following orientation procedures do not cover electrical orientation of the antenna,

but discuss only the mechanical orientation of the antenna in azimuth and elevation.

### DIRECT RADIATOR APPLICATION

6.02 The antenna should be oriented mechanically so the transmitted beam will be directed at the next antenna in the microwave link.

6.03 Orientation of the antenna in azimuth is accomplished by changing the overall length of the azimuth turnbuckle. The azimuth turnbuckle, Fig. 4, is located between the horizontal member of the mounting frame and azimuth turnbuckle bracket or yoke on the support structure.



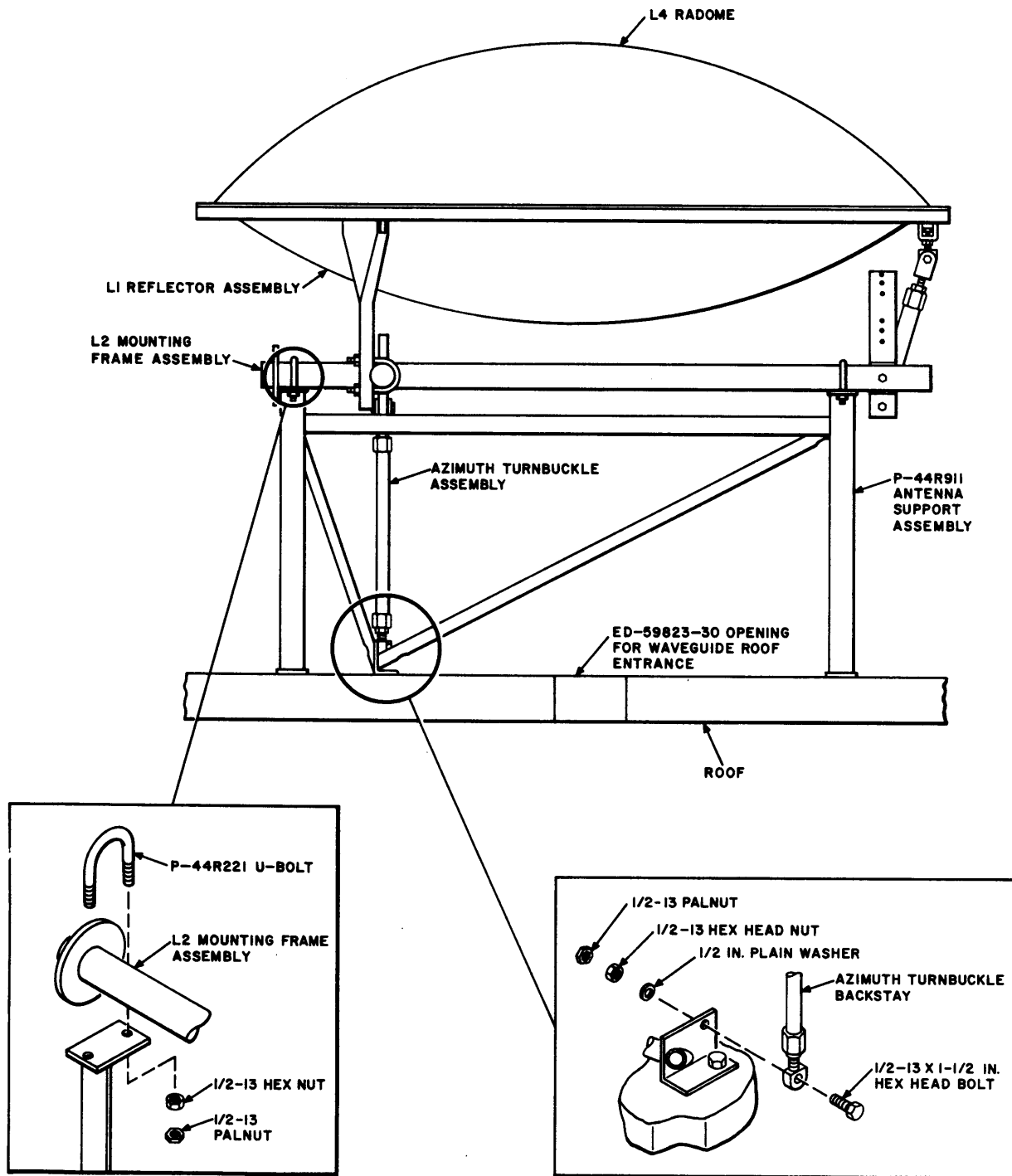


Fig. 17—ED-59804-30 Roof Mounting, Installation Procedure for Antenna

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- 6.04** Loosen the four nuts on the U-bolts which hold the vertical member of the mounting frame in the mounting saddles, Fig. 4. This permits the antenna assembly to rotate in azimuth as the turnbuckle is adjusted to the proper length.
- 6.05** Loosen the jam nuts at both ends of the azimuth turnbuckle, Fig. 4, and back off several turns on each nut. Rotate the turnbuckle until the desired azimuth angle is achieved. Refer to Table A for the adjustment range of the turnbuckle for a given length of pipe when the antenna is installed on the AT-7729 B self-supporting tower, ED-95182-30 roof mounting, ED-95189-30 roof mounting, or ED-95804-30 roof mounting. Table C should be consulted for installations on the AT-7728 B guyed tower and the AT-8013 C self-supporting tower, since there are three positions for mounting the azimuth bracket or yoke on the support structure.
- 6.06** When the azimuth angle has been set, secure the jam nuts on the turnbuckle and the four U-bolt nuts which were loosened in 6.04.
- 6.07** Orientation of the antenna in elevation is accomplished by changing the overall length of the elevation turnbuckle or by relocating the elevation turnbuckle bracket on the vertical member of the mounting frame. The latter is mounted at one of three available positions during installation as per the plot plan and should not require repositioning during final orientation.
- 6.08** The elevation turnbuckle, Fig. 4, is located between the lower rim of the reflector and the elevation turnbuckle bracket on the vertical member of the mounting frame.
- 6.09** Loosen the four nuts on the U-bolts which secure the top of the reflector to the horizontal member of the mounting frame. This permits the reflector to pivot about the horizontal member as the turnbuckle is adjusted to the proper length.
- 6.10** Loosen the jam nuts at both ends of the elevation turnbuckle, Fig. 4, and back off several turns with each nut. Rotate the turnbuckle

until the desired elevation angle is achieved. Refer to Table B for the adjustment ranges possible with different bracket positions and lengths of pipe used for the turnbuckle of a given installation.

- 6.11** When the elevation angle has been set, secure the jam nuts on the turnbuckle and the four U-bolt nuts which were loosened in 6.09.

### PERISCOPIC APPLICATION

- 6.12** The parabolic antenna should be oriented so the transmitted beam is aimed directly at the center of the passive reflector.
- 6.13** Loosen the U-bolt nuts on both the vertical and horizontal members of the mounting frame. This permits the antenna reflector and feed assembly to pivot about both axes as the azimuth and elevation turnbuckles are adjusted.
- 6.14** Loosen the jam nuts on both ends of the turnbuckle assemblies and back off several turns on all four jam nuts.
- 6.15** Initially orient the antenna by adjusting the turnbuckles so that the face of the antenna is approximately perpendicular to an imaginary line extending from the center of the associated passive reflector to the antenna feed.
- 6.16** Final mechanical orientation should be made with the aid of a carpenter's square. Place the long side of the square under the rim of the antenna. Sight up along the short side of the square toward the reflector and swing the square so the short side scribes an arc across the reflector. Adjust the antenna until this arc cuts through the center of the reflector. Then move the square 90 degrees around the antenna and repeat the procedure outlined above. With this completed, the antenna should be pointed directly at the center of the reflector.
- 6.17** When the antenna is properly oriented, tighten the jam nuts on the turnbuckle and the U-bolt nuts on both the vertical and horizontal members of the mounting frame.