

**MICROWAVE ANTENNAS**  
**KS-15676 HORN-REFLECTOR AND WAVEGUIDE SYSTEM**  
**INSTALLATION**  
**ANTENNA ASSEMBLY**

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**1. GENERAL**

**1.01** This section pertains to the assembly of the KS-15676, L9BC, L9BD, L14BC, and L14BD horn-reflector antennas used for the 4-, 6-, and 11-GHz Radio Relay Systems. The following items are covered in this section:

- (a) KS-15676, L9BC and L14BC horn-reflector antennas
- (b) KS-15676, L9BD and L14BD horn-reflector antennas
- (c) KS-15676, L4 mounting base
- (d) KS-15676, L3 feed horn
- (e) KS-15676, L11 antenna mounting clamp assembly.

**1.02** This section is reissued to delete all references to the List 8 antenna and to incorporate the latest changes made to the KS-15676 antenna. The new versions are coded KS-15676, List 9BC, 14BC, 9BD, or 14BD. Since this is a major revision, the arrows normally used to indicate changes have been omitted. This issue does not affect the Equipment Test List.

**1.03** The antennas are shipped lying on a side attached to a shipping skid. The overall dimensions of the antenna and skid are approximately 19 feet 10 inches long by 11 feet 6 inches high by 7 feet 8 inches deep with a weight of approximately 3500 pounds. All major subassemblies are furnished with the antenna. They include the List 2 weather cover, List 5 mounting frame, List 7 sealant kit, and four List 11 mounting clamps. A box of miscellaneous hardware is also furnished with the antenna.

**1.04** The List 9BC is the basic horn-reflector antenna assembly. The List 14BC is a factory-assembled hardened version of the List 9BC antenna. Hardening is accomplished by adding an external aluminum skin to the existing structure. The lower edge of the window opening is also reinforced. The List 9BD and 14BD are identical to the List 9BC and 14BC when received. Additional equipment (14-edge blinders and blinder support assemblies) is furnished with the List 9BD and List 14 BD antenna. These assemblies are attached to the shipping skid and must be added to the antenna in the field. These assemblies are secured to the antenna along the right and left sides of the window opening. They are bolted to the side panel assemblies and the weather cover clamping angles. The lower edge is supported with a blinder support and is bolted to the blinder and the front weather cover clamping angle.

**1.05** The assembled antenna, List 9BC, is shown in Fig. 1. It consists of a paraboloidal

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reflector mounted in the top of a pyramidal horn. A window or weather cover is fastened to the horn antenna in front of the reflector. This antenna is supported on trunnions in a square mounting frame. A tilt adjustment assembly between the back of the antenna and the square mounting frame provides for adjustment of the elevation angle of the antenna. The mounting frame is equipped with four brackets, each provided with two threaded studs with jam nuts. Tie-angle assemblies are attached to each of the four corners of the antenna horn at the mounting frame level. The antenna is adjusted in elevation by means of the tilt adjustment assembly, after which the studs in each bracket are turned into contact with the antenna tie-angle assemblies and locked with the jam nuts provided. This arrangement serves to lock the antenna against vertical movement in the mounting frame. Azimuth adjustment of the antenna is accomplished by means of the List 17 tool. Section 402-421-202 covers the use of this tool. The antenna is held in its final azimuth position by four List 11 clamps which fasten the List 5 mounting frame to the List 4 mounting base as shown in Section 402-421-202.

### 2. METHOD OF ASSEMBLY

**2.01** The assembly procedures for a List 9BC or 14BC antenna will consist of uncrating, inspecting the antenna for any damage that might have occurred during shipping, attaching the List 3 feed horn, and pressure testing the antenna. The assembly procedures for a List 9BD or 14BD consist of uncrating, inspecting, attaching the List 3 feed horn, pressure testing, securing the 14-edge blinders and supports, and repressure testing the antenna.

#### UNCRATING

**2.02** Remove the protective covering with which the antenna was shipped. Remove the wood protective panel from the face of the antenna. Unbolt the antenna from the shipping skid. Uncrate the miscellaneous hardware. Remove the 14-edge blinders and supports from the shipping skid. Remove the protective wood cover from the narrow end of the antenna.

#### INSPECTING

**2.03** Inspect the antenna for any obvious damage that might have occurred during shipping. Inspect the interior of the antenna for the presence of water or, in cold weather, ice or frost. If

moisture in any form is present, it must be removed before the feed horn is installed. A standard ventilating heater, as covered in Division 649 of the Bell System Practices, may be used to melt ice and speed drying.

### ATTACHING THE KS-15676, LIST 3 FEED HORN

**2.04** Clean the surface of the four bottom flange angles of the antenna using trichloroethane and clean rags. If necessary, fill out any unevenness at the four corners of the flange angles with EC-1162 sealer material. Remove the 1/4-inch plywood protective cover from the large end of the List 3 feed horn. Clean the surface that will mate with the bottom flanges of the antenna with trichloroethane and clean rags.

**2.05** Place the sealer strip assembly on the feed-horn flange 1/16 inch from the inside edge of the opening. Apply the strips with the black rubber against the feed-horn flange, the wire mesh towards the inside edge, and the rubber towards the bolt holes. Miter the corners of each strip to obtain tight joints. Do not overlap the strips. (See Fig. 2.)

**Caution:** *The surfaces which the seals will be in contact with must be clean and free from any moisture. Do not apply the sealer strip assembly when the air temperature within 1 foot of the metal is less than 40 degrees F.*

**2.06** Secure the feed horn to the antenna using the 3/8 by 1-3/4 inch bolts as shown in Fig. 2. Apply a coating of KS-19094 antiseize compound to the threads of all bolts and nuts before using. Tighten the bolts and nuts to a torque of 60 foot-pounds.

**Caution:** *In order to prevent possible damage to the seal, avoid loosening any bolt after it has been tightened.*

### 3. ANTENNA LEAKAGE TEST

**3.01** Remove the protecting cover from the feed horn, and bolt the test plate to the feed horn in accordance with Fig. 3, using a standard O-ring gasket.

**3.02** Figure 4 shows the test setup for supplying and metering dry nitrogen to the antenna.

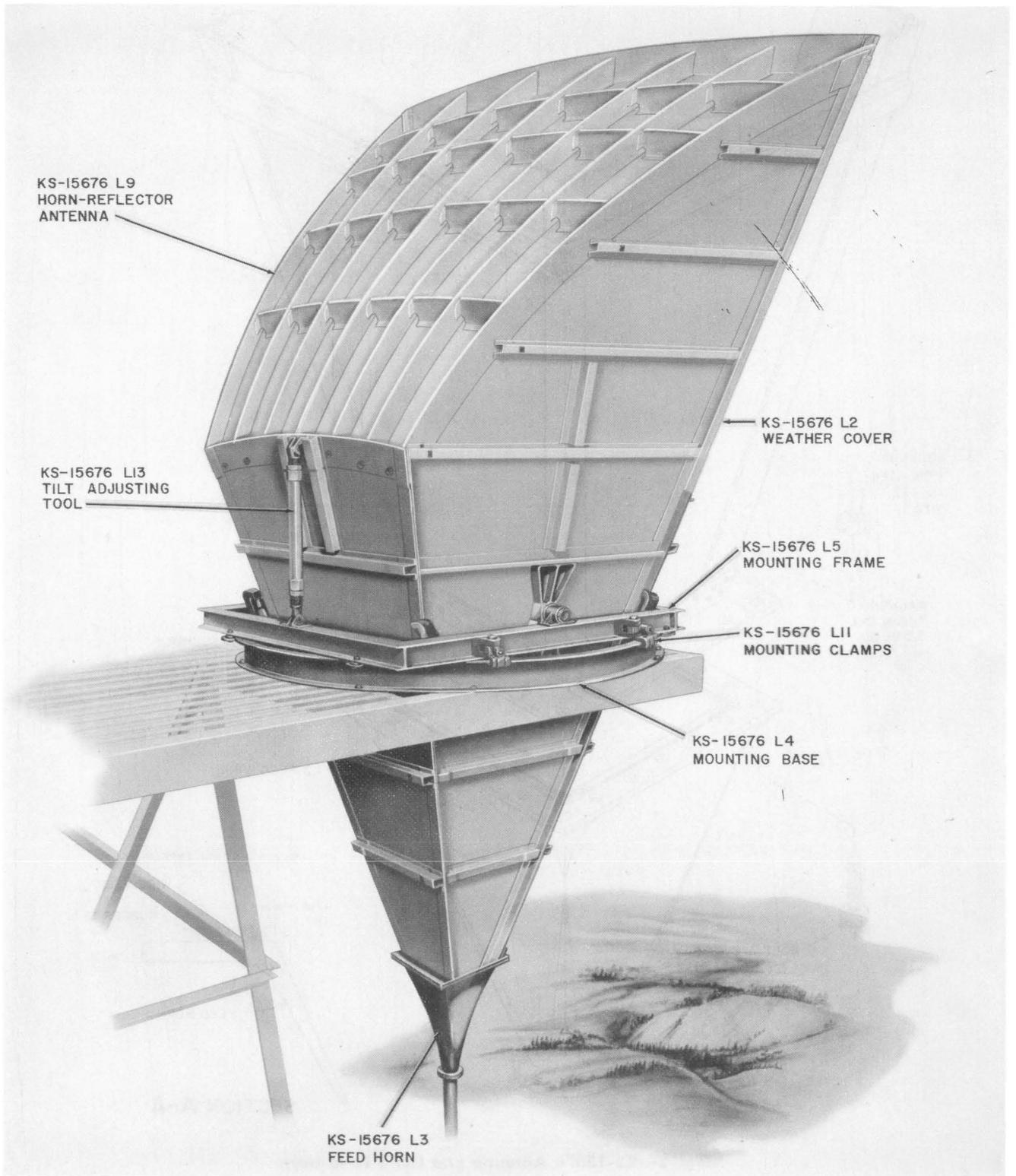


Fig. 1—KS-15676 Horn-Reflector Antenna

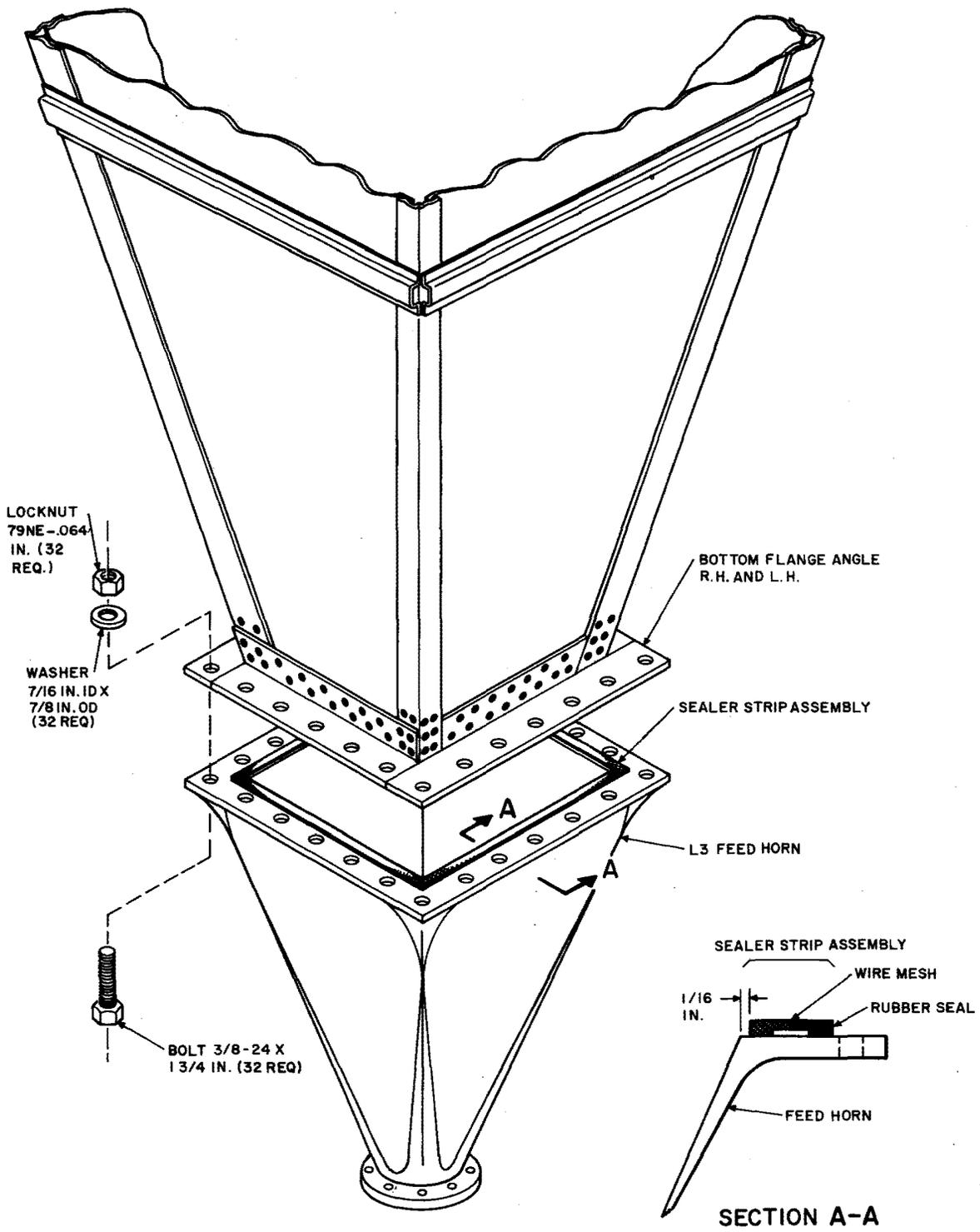


Fig. 2—KS-15676 Antenna and List 3 Feed Horn

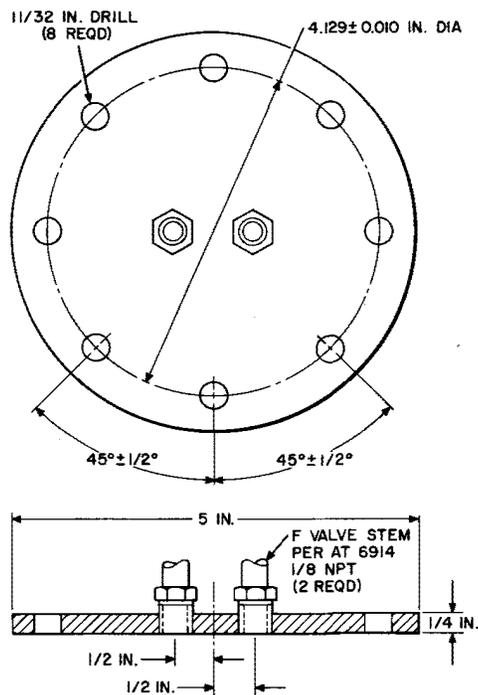


Fig. 3—Test Plate

If the method described in 3.04 is used, the flowrator (or gas meter) will not be required. The assembly and operation of the gas cylinder, both regulators, and hose are covered in Section 081-601-101 entitled Pressure-Testing Tools—B Gas Regulator. Connect a pressure-testing hose between the outlet of the B gas regulator and the inlet of the flowrator (or gas meter) and a second pressure-testing hose between the outlet of the flowrator (or gas meter) and the gas admission valve of the test plate. Connect a gas pressure-measuring instrument to the other valve in the test plate. This instrument may be either a B flow indicator or a water manometer in accordance with Fig. 5.

- (a) Use a B flow indicator, when available, in a vertical position, following general instructions on leveling and maintenance in Section 081-603-100 entitled B Flow Indicator. Add fluid to the tubes, if required, until the level in both tubes falls between 80 and 90 on the regular manometer scale. Prepare a scale on 20 lines-per-inch graph paper in accordance with Fig. 5, and mount it on the instrument scale alongside the left-hand tube with the zero reading on the scale at fluid level, using a clear plastic adhesive tape. Before gas flow is started, close the center valve and

open the two outside valves. Pressure is applied to the hose connected to the right tube. An F pressure testing valve should be inserted into the other hose chuck to keep the chuck open to the atmosphere, and the hose should be coiled near the base of the instrument. Pressure is read directly on the new scale at the fluid level in the left tube; ignore the fluid level in the right tube.

- (b) If the B flow indicator is not available, construct locally a water manometer as shown in Fig. 5.

### 3.03 Test the antenna for gas leakage as follows.

- (1) With the B flow indicator (or the water manometer) in the vertical position, attach the hose chuck to the pressure-measuring valve before charging is started. Feed the flowrator (or gas meter) from the nitrogen cylinder through the regulators. Adjust the regulator slowly to maximum output to avoid damaging the flowrator as the float rises to the top of the tube. This pressure is about 5 psi as measured on the outlet valve of the AT-7324 regulator in accordance with Fig. 4. Watch the fluid level in the B flow indicator (or water manometer), and as it approaches 0.2 psi (5.5 inches of water), reduce the regulator feed pressure. Adjust the regulator further, as required, until 0.2 psi (5.5 inches of water) is maintained, and then record the gas usage shown by the flowrator.

**Caution:** To avoid accidental damage to the antenna, do not exceed a pressure of 0.33 psi (9.3 inches of water) during leakage tests.

**Note:** Large variations in pressure may occur when the sun emerges from or goes behind clouds.

- (2) If an equalized pressure of 0.2 psi (5.5 inches of water) can be obtained, the antenna leakage is determined by reading the gas meter over a measured period of time; or if a flowrator is used in place of the gas meter, the leakage is determined by direct reading of the flowrator. An approximation of the leakage at 0.2 psi (5.5 inches of water) can be obtained by gas meter or flowrator readings at lesser pressure, if it is impractical to bring the pressure up to 0.2 psi (5.5 inches of water), by using the following

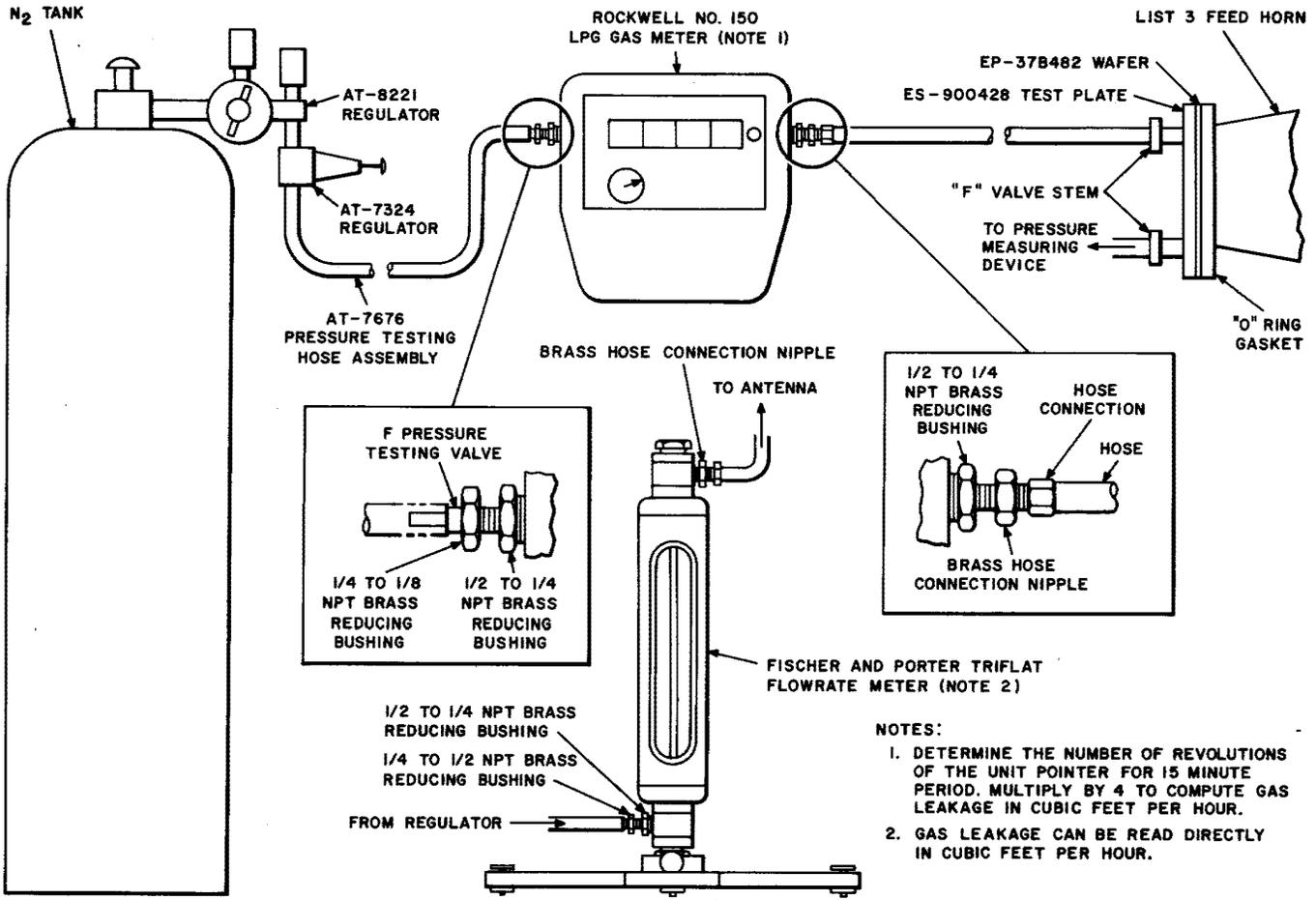


Fig. 4—Gas Leakage Test

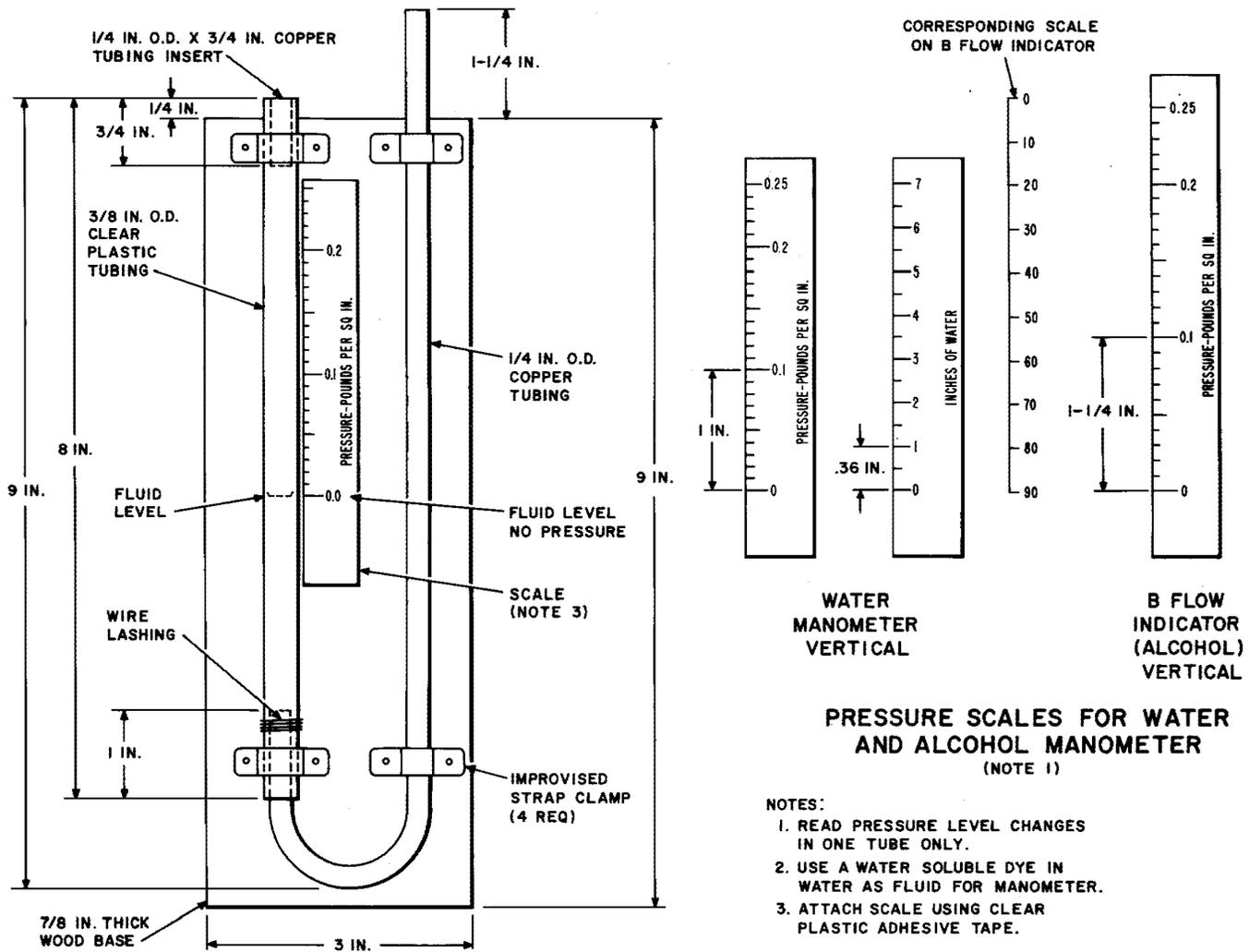


Fig. 5—Water or Alcohol Manometer

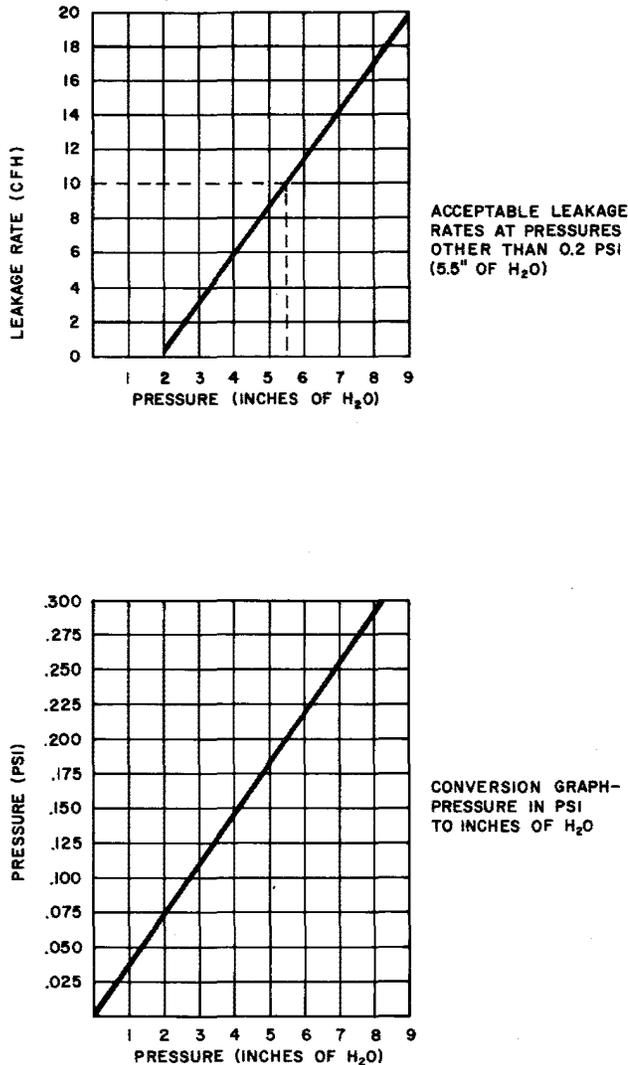
relationship or by using the graph shown in Fig. 6.

$$CFH \text{ (at 0.2 psi)} = \frac{0.2}{P} \times CFH \text{ (at observed pressure, } p\text{)}$$

Antennas having a gas loss not greater than 10 cubic feet per hour at 0.2 psi are considered satisfactory for installation.

**3.04** To determine antenna leakage by the pressure drop method, proceed as follows.

(1) Feed nitrogen to the antenna in the manner described in 3.03 (1), except that the flowrator (or gas meter) will not be required when this method is used. When the pressure in the antenna has stabilized at 0.2 psi (5.5 inches of water) as indicated by the B flow indicator, the water manometer, or a U.S. gauge No. 6336 hand gauge, stop feeding gas to the antenna by closing the nitrogen tank valve and removing the hose from the gas admission valve of the test plate. Observe the decrease in antenna pressure, as read on the pressure-measuring device, for a period of 4 minutes. A loss in pressure of 0.6 inch of water or less during this period is considered satisfactory and approximates a leakage rate of 10 cubic feet per hour from the antenna.



**Fig. 6—Acceptable Leakage Rates and Conversion Graphs**

**Caution:** Avoid making antenna leakage measurements during periods of changing ambient temperature, such as on partly cloudy days, as sudden changes from overcast to sunshine will give false results.

(2) Antennas leaking at a rate exceeding 10 cubic feet per hour at 0.2 psi should be examined with pressure-testing soap solution to determine the points of leakage. Retighten the bolts in these areas and retest. If the leakage is not reduced to a satisfactory rate, the case should be referred to supervision. Section 402-421-501 describes repair procedures.

**3.05** Remove the pressure-testing connections. Remove the test plate. Replace the original protecting cover on the end of the feed horn.

#### 4. LEAKAGE TEST FOR INSTALLED ANTENNA

**4.01** The approximate leakage rate of an antenna in an operating system may be determined by an air-flow measurement made at the waveguide pressure window.

**4.02** Disconnect the tubing from the manifold to the waveguide near the pressure window. With a second length of tubing, insert a flow-measuring device, such as a flowrator (Fischer and Porter A6405-A1644A2—2 to 18 CF/HR) or a Rockwell No. 150 LPG gas meter, in the line. If there is a water trap or a drain tube at the bottom of the network, this must be sealed during the measurement or excessive leakage will be recorded. The bleed point in the waveguide pressure window, used for pressure sensing, must also be sealed. If, after these precautions have been taken, excessive leakage (more than 15 CF/HR) is recorded, the antenna should be soap-tested to ensure that it is the source of the leakage and to determine the areas of leakage. Repairs, if necessary, can be made according to Section 402-421-501. The pressure drop method in accordance with 3.04 may be used as an alternate method. Acceptable leakage rates for the antenna are shown in Fig. 6.

#### 5. INSTALLING THE 14-EDGE BLINDERS AND SUPPORTS

**5.01** The antenna is shipped lying on a side. In this position, one side is not accessible. To permit access for attaching the 14-edge blinders, the antenna must be raised approximately 2 feet and supported on sawhorses. When supporting the antenna, the supports must be positioned to permit removal of the weather cover edge seal angles and access to the bolts and nuts that secure the front weather cover clamping angle to the antenna. Detailed instructions for raising the antenna are covered in Section 402-421-202.

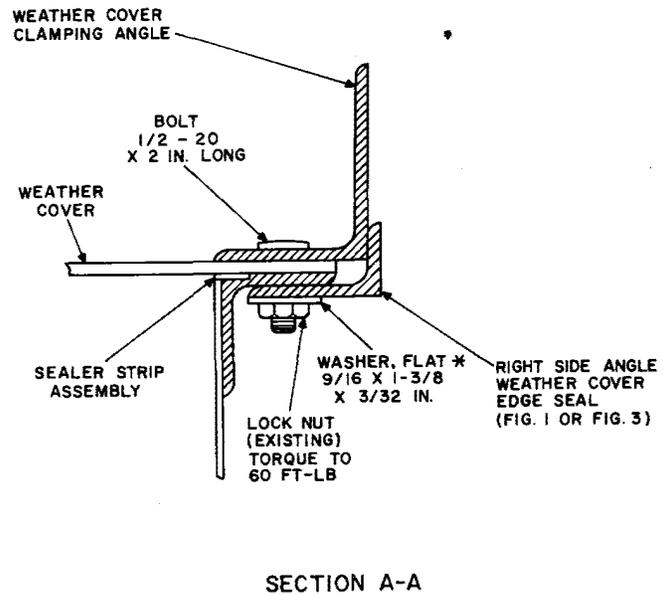
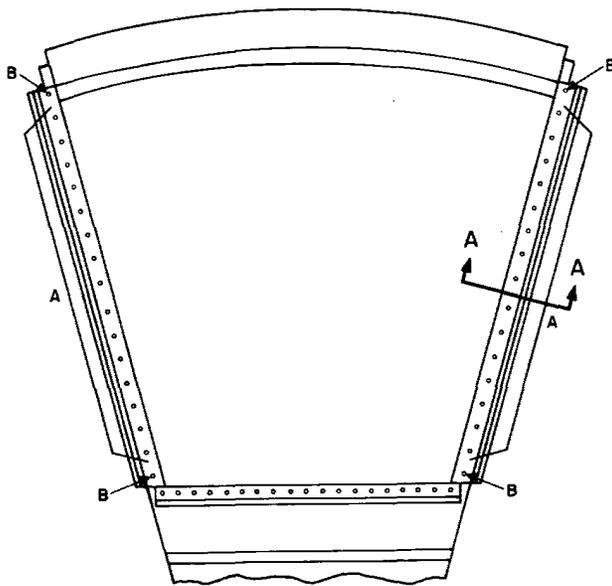
**5.02** After the antenna has been raised and supported, remove the nuts and washers from the bolts marked A and B shown in Fig. 7. Retain the hardware, for it will be reused. Do not remove the bolts from the antenna. Remove and discard the weather cover edge seal angle, and install the 14-edge blinder in its place. Figure 8 shows the proper placement and position of the

bolts, nuts, and washers. Tighten the bolts and nuts to a torque of 60 foot-pounds.

**5.03** Secure the blinder support to the blinder and also to the front weather cover clamping angle as shown in Fig. 8 and 9. Use the three 3/8- by 1-inch bolts to secure the support to the blinder and the three 1/2 by 1-1/2 inch bolts to secure the support to the front weather cover

clamping angle. Apply a coat of KS-19094 antiseize compound to the threads of all bolts and nuts before using. Tighten the bolts and nuts to a torque of 60 foot-pounds.

**5.04** After both blinders and supports have been added to the antenna, perform the antenna leakage test in accordance with Part 3 of this section.



**Fig. 7—KS-15676 Antenna With Weather Cover Edge Seal Angles**

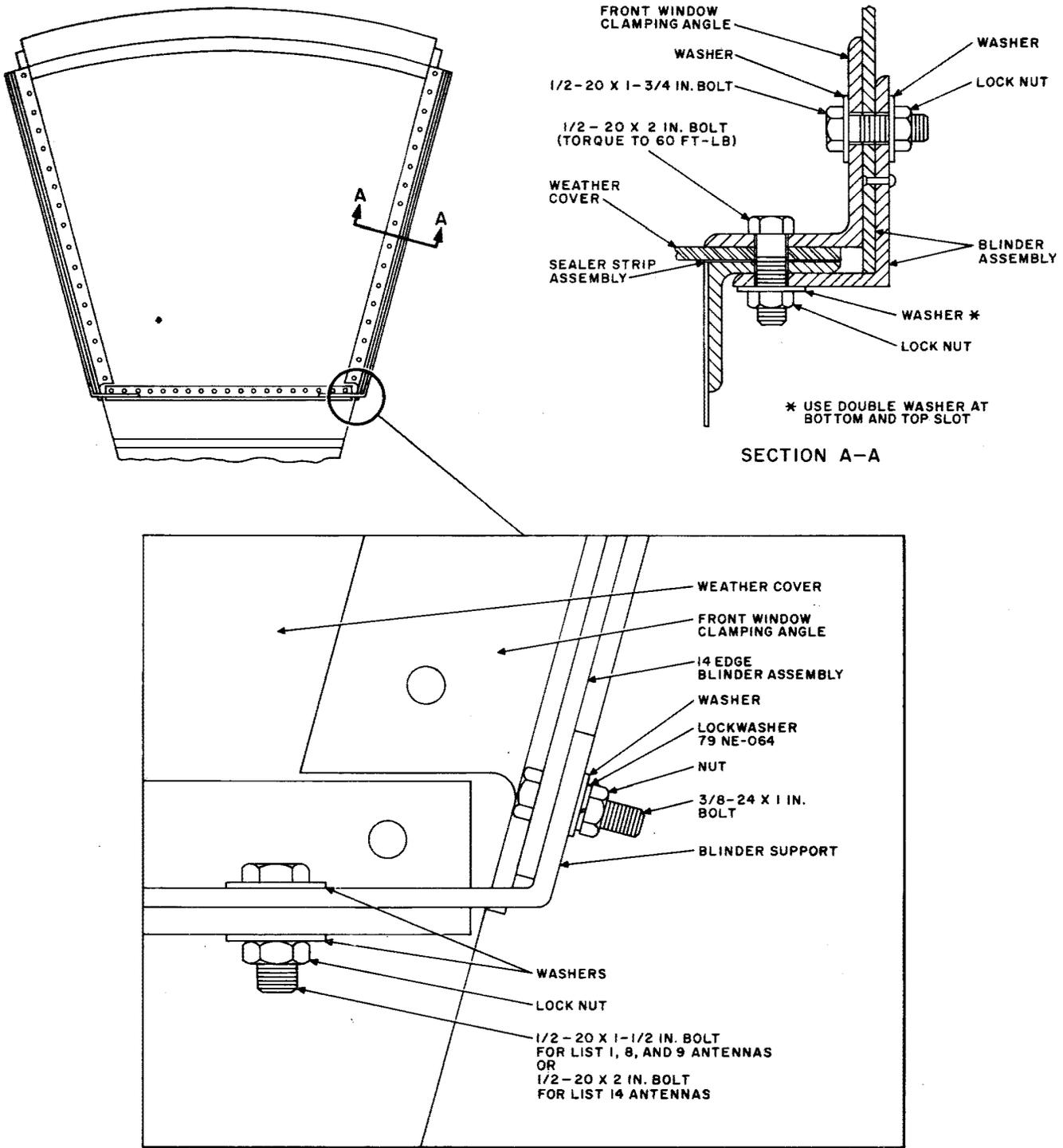


Fig. 8—Front View of KS-15676 Antenna With 14 Edge Blinders

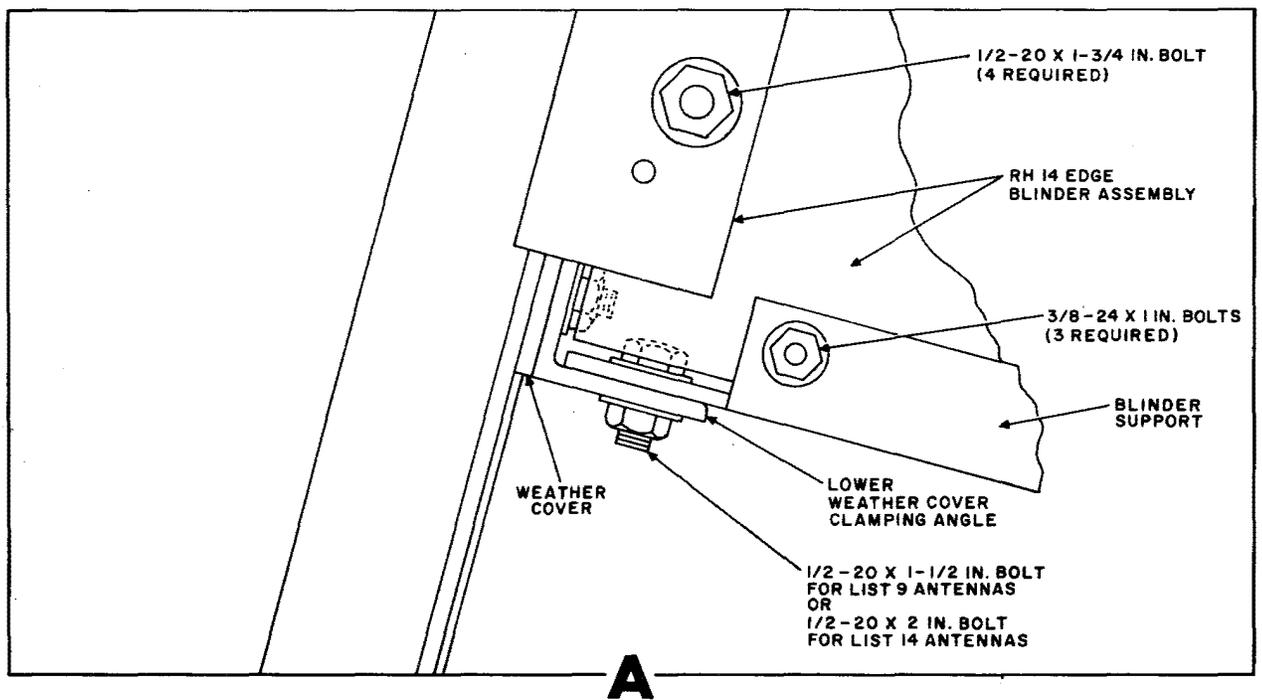
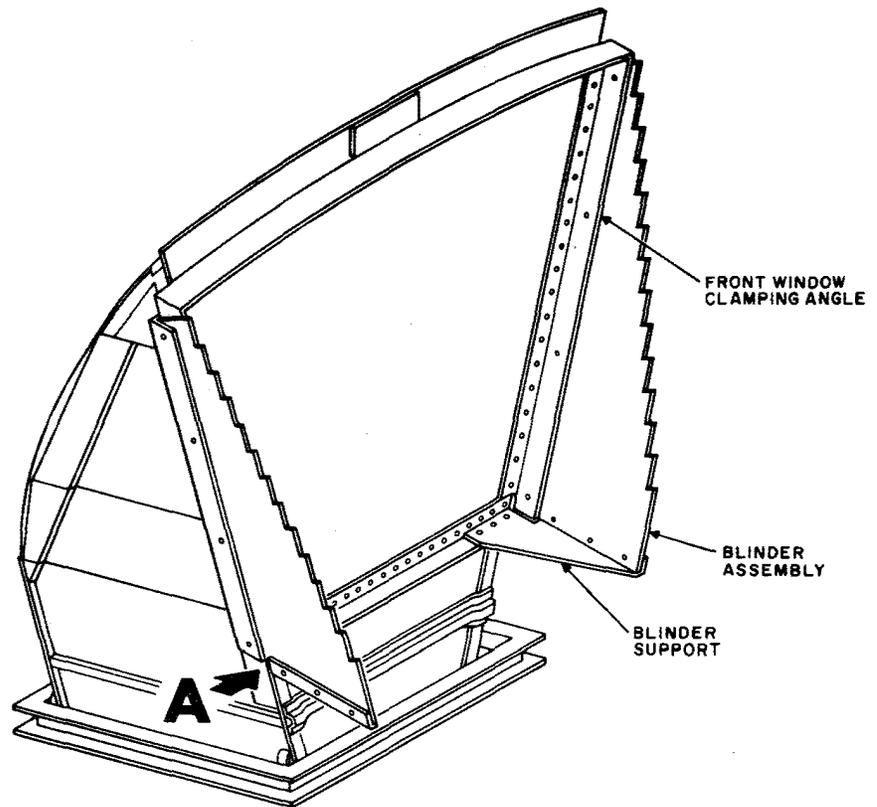


Fig. 9—Side View of KS-15676 Antenna With 14 Edge Blinders