MICROWAVE ANTENNAS
KS-16320 PASSIVE REFLECTOR
MAINTENANCE
INSPECTION AND REPAIRS

CONTENTS PAGE

1. GENERAL

1.01 This section is reissued to refer to sections covering installation procedures if readjustment is necessary, to add references to mounting angle 2B, and to substitute zinc-rich paint for linseed oil and AT-7295X Primer.

1.02 This section describes procedures for the maintenance of KS-16320 passive reflectors.

1.03 The performance of specific maintenance tasks generally will be preceded by an inspection of the reflector assembly. Inspection will be performed in accordance with the maintenance routine which is described in Section 402-423-330 or whenever the need is indicated by a general decrease in the level of the received radio signal.

1.04 When maintenance is to be performed at stations which are operating in a transmission system, it is to be done only with the knowledge and consent of the responsible supervisory personnel. Monitor transmission at the station continuously during the inspection or maintenance period so that any resultant disturbances may be immediately detected and corrected.

1.05 Prepare for inspection or maintenance of the reflector by a thorough familiarization with the operating principles (described in Section 402-423-100) and mechanical details (portrayed in Fig. 1 and 3 or Fig. 2 and 4 in Section 402-423-400). Make notes of any dimensions to be used in checking the installation, e.g., spacings of attachments on pipe mounts, elevation and azimuth settings, etc. Required tools (described in Section 402-423-501) should be available.

1.06 Provide a means of communication between those aloft and those on the ground so that essential information regarding continuity of system operation, etc, can be relayed immediately.

2. ROUTINE INSPECTION AND PREVENTIVE MAINTENANCE

2.01 For list 1 reflectors (item numbers refer to Fig. 1 in Section 402-423-400) perform the following steps:

(1) ***Pipe mount, Item 26D.*** Inspect attachments to the supporting structure and attachments of mounting angles 2B, 3B, 4B, and 5B. Correct any indication of loosening or slipping of bolted connections as evidenced by changes from the original spacings of attachments, scoring of the pipe wall, or misalignment of U-bolts. Treat any indications of rusting or removal or loosening of the galvanized finish as described in 5.01 in this section.

(2) ***Mounting angles 2B, 3B, 4B, and 5B; top swivel 9B; and top mount 10B.*** Inspect all bolted connections and tighten where necessary. Treat any evidence of rusting as described in 5.01.

(3) ***Lower mount, Item 7B.*** Examine clamp assembly 11B which holds reflector; see that the clamp is in good condition with all nuts in place and tightened.

Caution: Do not loosen the clamp assembly unless the list 7 elevation adjusting tool, Fig. 5, Section 402-423-400, has been properly installed.

Examine welds for indication of cracks or separations. Treat any evidence of rusting as described in 5.01.

(4) ***Strut assembly, Item 32B.*** Check appearance of slip joint for any evidence of movement such as scoring or bright spots on the galvanized finish. If evidence of movement exists, check the adjustment of the bolts on the split clamp by the use of a torque wrench; set the bolts to a torque of 20 to 30 pound-feet.

Caution: Do not loosen the clamp assembly unless the list 8 azimuth adjusting tool, Fig. 6, Section 402-423-400, has been properly installed.

Check the tightness of the bolted connections at the reflector end and at the end which ties into the supporting structure. Treat any appearance of rusting as described in 5.01. Examine the grease packing in the cavity of each flexible joint. If the space is well filled and the grease is still pliable to finger touch, the joint is satisfactory for continued use. If portions of the cavity are exposed or if the grease has become hardened, fresh grease must be applied. In the latter case, remove enough of the old grease with a wooden probe to expose an adherent surface. Apply fresh grease per MIL-C-11796A, class 1 or 1a, packing it evenly around the circular cavity and pressing in firmly with a flat tool.

(5) ***Reflector assembly, Item 6B.*** Examine the reflecting surface, noting the presence of any irregularities or punctures. Examine the region along the upper edges of horizontal ribs and along the frame for evidence of loose rivets. Two small drain holes will be found in each panel of the face just above the horizontal rib members. Make certain that the holes are free of any obstructions. Examine all bolted connections for tightness and examine the welding for indications of cracks or separations. Treat any indications of corrosion as described in 5.02 in this section.

2.02 For list 2 reflectors (item numbers refer to Fig. 2 in Section 402-423-400) perform the following steps:

(1) ***Pipe mount, Item 26D.*** Proceed as outlined in (1) in 2.01 of this section.

(2) ***Mounting angles 2B, 3B, 4B, and 5B; top swivel 8B; and top mount 12B.*** Proceed as outlined in (2) in 2.01.

(3) ***Lower mount, Item 13B.*** Proceed as outlined in (3) in 2.01 (clamp assembly is numbered 9B).

(4) ***Strut assembly, Item 32B.*** Proceed as outlined in (4) in 2.01.

(5) ***Reflector assembly, Item 6B.*** In addition to following the procedure outlined in (5) in 2.01, examine the curvature adjusting screws which are located in the strut members connected to the center of the face. If a record of the previous setting has been preserved, compare the present settings for any indication of movement. See that the locknuts are tight and that the scales are firmly clamped.

2.03 Make note immediately of the need for any further maintenance work which is discovered as a result of the inspection, and refer such matters to supervision.

3. INSPECTION AND MAINTENANCE TO IMPROVE OR RESTORE SERVICE

3.01 The cause of fading or loss of a radio signal may, in some cases, be traced to the passive reflector equipment. Unless the cause is obvious, e.g., failure of (or apparent damage to) a part of the reflector assembly, a process of elimination will be required to determine the reason for signal impairment due to reflector malfunction.

Note: The following discussion is concerned only with causes of degraded transmission which are attributed directly to the passive reflector assembly. Other mechanical defects such as distortion or looseness in the supporting structure or misalignment of the paraboloidal antenna may also act to limit performance; however, they are not considered in this practice.

3.02 A passive reflector can disturb radio transmission because of:

(a) Shifting of the azimuth or elevation setting (discussed in 3.03 and 3.04).

(b) Movement within the reflector assembly (discussed in 3.05).

(c) Damage to the reflector assembly (discussed in 3.06).

3.03 An elevation scale is provided on the inside surface of one of the channel supports of the lower mount assembly (Item 7B in Fig. 1 or Item 13B in Fig. 2 in Section

402-423-400). An azimuth scale is provided on mounting angle 5B, as shown in either of the foregoing figures. If a record has been kept of the azimuth and elevation settings, the present positions can be compared with the recorded settings for indication of movement. If necessary to correct azimuth or elevation adjustments, proceed as outlined in Section 402-423-209 or -210, respectively.

3.04 If no record of azimuth and elevation settings has been kept, but there is evidence that either setting has shifted, readjust the reflector as outlined in Section 402-423-209 or -210, respectively. Examine the following parts (item numbers refer to Fig. 1 or Fig. 2, in Section 402-423-400) for evidence of shifted settings:

(a) The clamp assembly (Items 11B, 12B, and 13B in Fig. 1, or Items 9B, 10B, and 11B in Fig. 2 in Section 402-423-400) must be bolted firmly to the bottom member of the reflector frame. Look for any indication of movement, e.g., misalignment of the clamp and/or reflector with respect to the lower mount (Item 7B in Fig. 1 or Item 13B in Fig. 2), or scoring or chafing of the metal surfaces which are in contact. It is possible that the clamp assembly may have become loosened sufficiently to permit the reflector to shift. With such movement the clamp may have become jammed solidly enough to prevent further motion. Such an occurrence might be detected by the previous inspection; however, as a final check, tap the clamp assembly sharply at the bottom and sides to dislodge it and reveal movement if such jamming has occurred.

Caution: Have the list 7 elevation adjustment screw (Fig. 5, Section 402-423-400) in place when adjusting the clamp assembly.

(b) The top mount assembly (Item 10B in Fig. 1 or Item 12B in Fig. 2) must be solidly bolted to the reflector and to the top swivel assembly (Item 9B in Fig. 1 or Item 8B in Fig. 2).

(c) The strut assembly (Item 32B in either figure) must be tightly fastened to the reflector and to the supporting structure, and the double split clamp which joins the telescoping tubes must clamp the two tubes rigidly together. If necessary to adjust the split clamps, set the bolts to 20 pound-feet torque by torque wrench.

Caution: Have the list 8 azimuth adjustment screw in place when adjusting the strut assembly.

(d) The three 1-inch bolts which connect the reflector to angle assemblies 2B, 3B, and 5B must prevent any movement between the bolted parts. Evidence of looseness might appear as visible separation between the parts, as chafing or scoring of the surfaces in contact, or as apparent looseness of the bolt assembly.

(e) Examine U-bolts (Item 8B in Fig. 1 or Item 7B in Fig. 2) for indications of movement on pipe 26D, e.g., chafing or scoring of the pipe surface or misalignment of two bolts of a pair with respect to each other and/or with respect to the pipe. In a similar manner examine U-bolts 36D which connect the pipe to the supporting structure.

Any parts which are found loose must be tightened promptly. If mounting angles are adjusted, check that the dimensions given in Fig. 1 or 2, as applicable, are preserved. Examine the parts, including bolts, nuts, and washers, which have become loosened; replace any items which may have been seriously damaged. Realign the reflector in azimuth and/or elevation, as required, in accordance with Sections 402-423-209 and -210, respectively.

3.05 Indication of looseness and consequent movement within the reflector assembly (Item 6B in Fig. 1 or 2, Section 402-423-400) may be detected by observing the assembly over a short period of time in the presence of wind. In that case look for vibration or flutter of the reflecting surface or vibration of members within the supporting structure. Generally, any movement between parts also will be accompanied by some noise as the parts move with respect to each other. On list 2 reflectors check that the locknuts on the adjustment screws in center struts (Items 5 and 6 in enlarged View D-D, Fig. 4 in Section 402-423-400) are tightened. A further check on the tightness of the assembly may be made, if necessary, by examining all bolted joints within the reflector assembly, as shown in Fig. 3 or 4, as applicable, in Section 402-423-400.

Note: If it is necessary for the workman to move onto the reflector assembly, he must observe the precautions outlined in Section 402-423-501.

Loose bolts which may be discovered by this means must be tightened promptly. Examine the parts, including bolts, nuts, and washers, which have become loosened; replace any items which may have been seriously damaged.

3.06 Damage to the reflector assembly may consist of a dent or puncture in the reflecting surface or a structural failure. The existence of such a condition will be revealed by surface inspection of the assembly.

4. REPAIRS

4.01 Should the reflector surface be punctured or otherwise damaged after the reflector has been installed, the need for repair will depend upon the resulting effect on transmission or on the physical appearance or safety of the reflector. Transmission impairment as a result of a hole or surface deformation of 1 or 2 square feet, or less, will be hardly discernible, provided orientation of the reflector is unchanged by the incident causing the damage. In the case of transmission impairment as a result of damage to the reflecting surface, it may be feasible to check the reflector orientation and then give consideration to repair of the surface. The need for repair, in any case, should be the decision of the responsible supervisory personnel. The method of repair in more serious cases will depend upon the extent of the damage.

4.02 If the size and location of a hole is such that performance is not impaired to an extent sufficient to warrant a major repair, inspect the damage as soon as practicable, and take any steps which may be necessary to isolate it, such as:

(a) Careful removal of any loose metal.

(b) If any splits have been started in the reflecting surface, drill a 3/32-inch hole at the end of each split so that the hole extends from the split into the sound metal. A hand brace with sharpened drill bit is a suitable tool.

(c) If necessary to back up a split portion, fasten a strip of 14 GA aluminum in place over the damage, using a minimum number of No. 6 aluminum sheet metal screws, 1/4 inch long.

Note: If necessary to climb onto the back of the reflector, observe the precautions outlined in Section 402-423-501.

4.03 Holes large enough to affect the performance of the reflector must be completely closed. KS-16320, Lists 1 and 2 passive reflectors are manufactured to a surface tolerance of $\pm 1/16$ inch. In applying a patch make certain that the over-all smoothness of the reflecting surface is preserved. Small projections due to fastenings will be unavoidable in some instances, but by limiting the number of fastenings and keeping them as widely separated as possible their presence can be tolerated.

4.04 If the hole is within a reflector panel, i.e., not affecting the structural bracing of the reflecting surface, the repair procedure consists of replacing a portion of the aluminum sheet. In this case, the patch material need only be as stiff as the original reflecting surface. The preferred method of patching in such a case is to form an insert to fit into a prepared oepning in the reflector surface. ***Observe the precautions in Section 402-423-501 in moving onto the reflector framework.*** Steps in applying the patch are:

(1) Lay out a rectangular guide line around the hole to permit removal of all of the damaged metal.

(2) Cut away the damaged portion of the reflecting surface using a Stickleback Drilsaw or a keyhole type hacksaw (in the latter case, a starting hole will be required). Be careful when cutting to stay on the guide line and to avoid deforming the face of the metal.

(3) Carefully remove any slight curling or fretting at the edge of the opening by tapping the edge carefully with a hammer while holding a metal block against the opposite surface (this will require reaching through the opening since the front of the reflector is not accessible).

(4) Smooth the edges of the opening with a file (special files for aluminum are available).

(5) Prepare an insert of 14 GA, 6061 T6 aluminum, cut to the outline dimensions of the finished opening (+0, −1/16 inch) and mount it on another piece of the same material

of any convenient size large enough to provide a minimum 1/2-inch border around the insert. Use No. 6 aluminum sheet metal screws, 1/4-inch long, for the attachment and screw them in from the insert side, ie, so that the heads of the screws are visible when looking at the insert.

(6) Lay out a guide line on the mounting plate approximately 3/8 inch outside of the insert and locate a 1/16-inch hole at each corner. Locate additional holes, if necessary, approximately on 4-inch centers along each edge.

(7) Put the patch in place on the reflector and, using the mounting plate as a template, locate a set of matching holes on the reflector. Remove the patch and drill holes at the marked locations on the reflector using a sharp 1/16-inch bit in a hand brace.

Note: Do not use a center punch to locate holes on the reflector since the action tends to increase distortion of the face.

(8) Remove any burrs from the holes in the reflector face and fasten the patch in place using No. 6 aluminum sheet metal screws, 1/4-inch long.

Note: If the location of the opening prevents fastening the mounting plate on four sides because of interference of a structural member, arrange the patch for attachment in the above manner on the unobstructed sides. Allow sufficient extension of the mounting plate on the other sides and bevel the edges on those sides so that the plate can be clinched between the reflector and the adjacent member as the patch is installed. ***Be careful when applying such a patch that the clinching does not distort the reflector face.***

4.02 More extensive damage extending between panels of the reflecting surface or involving failure of structural members must be individually evaluated. When structural members are repaired or replaced, the integrity of the repair must equal or exceed that of the original member for the conditions of service. The feasibility of extensive in-place repairs must be weighed against removing the reflector for repair at ground level or replacing all or a portion of the assembly. In attempting to ascertain whether the reflector is salvageable, it may be advisable to make sufficient temporary minimum restoration to decide whether a significant portion of the assembly can be recovered. For example, in the case of extensive damage to the reflecting surface: After the portion which is obviously unusable has been removed, a temporary section can be installed (such as a piece of smooth plywood painted aluminum or covered with a metal foil) and a transmission test made to determine whether the remaining permanent surface is suitable for further use.

5. CORROSION

5.01 The corrosion of steel parts will be evidenced by the characteristic appearance of red iron rust or by loose or flaked galvanizing. Clean any rusted areas to bright metal, using a wire brush and/or chipping hammer to assure that all corrosion product and loose galvanize is removed. Coat the area with a zinc-rich paint, applying the protective covering well beyond the boundary of the rusted area to assure the continuity of protection.

5.02 The aluminum of the reflector assembly is corrosion-resistant in most environments. However, if any evidence is found of unusual surface deposits, e.g., a distribution of small individual spots which are characteristic of pitting, the condition must be carefully examined for evidence of progressive deterioration. If such deposits are thought to be corrosion products, remove specimens for chemical analysis and place in clean individual receptacles, e.g., fold into a clean paper or cloth. Examine the underlying metal carefully. If the part is found to have corroded to a point where its usefulness has been impaired, take immediate steps for replacement and provide temporary support, if required, to prevent failure until a permanent repair can be made. When inspecting for corrosion, give particular attention to regions in the vicinities of welds and at crevices formed at joints, i.e., where the face sheet is riveted to the supporting frame. In the latter case, see that the seams are free of dirt or other foreign matter which might retain moisture. Drain holes are provided in the face above each horizontal member, as shown in Fig. 2 and 4, respectively, in Section 402-423-400. Check that the holes are unobstructed. ***The preservation or replacement of corroded parts shall be done on the advice of a recognized corrosion engineer.***