SERVICE NOTES
RADAR

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

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MAINTENANCE OF RADAR DUPLEXERS

The following maintenance procedures are recommended for duplexers:

a. CLEANING OF DUPLEXING TUBES: In order to insure optimum operation of tubes which make contact with duplexing cavities by means of metallic fins, it is imperative that the fins be clean. This means that they must be free from any material, such as grease or corrosive products, which would interfere with low-resistance contact. New tubes which have gold-plated fins and are packed in sealed cellophane packages should not require any cleaning before installation. New tubes which have silver-plated fins will require cleaning to remove the silver sulfide or other corrosive products which may be present. Any tubes which have been used or which have been exposed to the atmosphere may be assumed to carry a film of grease, and will require cleaning. This cleaning is accomplished by gentle application of a neutral silver polish, followed by rinsing with hot water. Excess water may be shaken off, and the tube then dried with clean tissue paper. Lacking a suitable silver polish, tooth paste or toothpowder moistened with water may be used in similar fashion. The dentifrice used should be one containing a non-curdling detergent, such as Pepsodent. Extremely old tubes whose fins appear to be neither silver nor gold plated were probably originally silver plated but have lost their silver through chemical or abrasive action. Such tubes should not be used except in emergency, and when used should be cleaned as described. After having been cleaned, the fins of any tubes should not be allowed to come into contact with substances, such as the human skin, which will recontaminate them with grease or corrosive chemicals.

b. CLEANING OF DUPLEXING CAVITIES: Those portions of the cavity structures (herein called the cavity "lips") which come into contact with the fins of the tubes must be free from any foreign material which would interfere with good contact. In general, the same cleaning methods should be used on these parts as on the duplexer tube fins. However, certain mechanical features will in some cases interfere with efficient cleaning. In the SR-3, SR-6, and AN/SPS-6, the cavity cannot readily be cleaned without removing the duplexer assembly. If the assembly is removed for cleaning care must be exercised to keep water and other foreign matter out of the cavity, and care must also be taken to reinstall the assembly in its proper position. In the case of the SG-1b, the entire gold-plated waveguide assembly should be removed, after which the cavity lips can be cleaned easily. Rinsing can be done by putting the whole water faucet, if desired. After they have been thoroughly cleaned, cavity lips may be expected to stay clean, provided that—

1. They are not recontaminated by insertion of a dirty tube.
2. They are not exposed to airborne dirt.
3. They have not corroded nor tarnished.
4. They are not improperly handled.

c. INSTALLATION OF TUBES: Tubes must be carefully inserted in the cavities in such a manner that the fins make proper contact with the cavity lips. In the case of the SG-1b, it is possible to place the tube in such a position that one fin is on the outside of its corresponding lip and the other fin is on the inside of its lip. Duplexing action in such a case will be very poor. It is also possible to insert the tube properly in one-half of the split cavity and improperly in the other half. This also will result in very poor operation and probably in destruction of the tube. In the case of the AN/SPS-6, SR-3, and SR-6, care must be taken to insert the ball tip of the tube properly in the contractor inside the cavity. Undue sidewise pressure on the contact fingers may spread them so that they will not make firm contact with the ball tip. Experience shows that in many cases the fingers are not tight enough to make good contact. This condition, if present, should be corrected by slightly compressing the fingers. The rings which clamp the tube fins against the cavity lips must be screwed in tightly. It is generally insufficient to screw these in by hand. Therefore, a large pair of pliers ("water-pump" or "battery" pliers) and considerable force should be used to insure firm contact. In the case of the split cavities in the SG-1b, it is advisable, after preliminary tightening of the cavity clamps, to loosen the two cavity-joining screws one-quarter turn and then retighten the cavity clamps. The cavity-joining screws should then be retightened. The purpose of this latter procedure is to diminish the possibility that a burr in a thread will prevent the clamp from seating properly. In the case of SR-3, SR-6, and AN/SPS-6, it is important that Field Change 9, 11, or 5, respectively, be accomplished. This field change adds two spacers, one of metal and one of neoprene, which improve the contact between tube fin and cavity lip. It is essential that the spacers be inserted in their proper order; that is, the tube should be inserted first, then the neoprene spacer, then the metal spacer. (Note that the applicable field change bulletins provide for putting the spacers in the reverse order. However, it has been found in practice that installation of the neoprene spacer next to the clamp may result in rolling up or bunching of the spacer.) Some cases have been encountered where the spacers have been installed between the tube fin and the cavity lip, causing poor contact both at the cavity lip and at the ball tip.

d. PROCEDURES TO BE AVOIDED: Don't attempt to clean any part of a duplexer with rubber eraser. Rubber erasers may contain abrasive material which will injure the plating. They may contain sulfur which will corrode the metal. They are certain to leave a film of nonconducting material (rubber). (Note that NAVSHIPS 900,531, the final SG series instruction book, recommends use of rubber eraser.) DON'T use carbon tetrachloride or any other organic solvent as a final cleansing agent for contact surfaces. To do so will practically insure a thin coating of oil or grease, since these solvents are very apt to have picked up such soluble matter during storage or previous use. In addition, there is some reason to believe that use of carbon tetrachloride promotes corrosion of brass and copper. DON'T use crocus cloth to clean contact surfaces. Crocus cloth is apt to injure plated surfaces, and also leaves a film of nonconducting material (iron oxide). DON'T expect a TR cavity to tune properly unless the contacting surfaces are clean and tight. The sharpness of resonance of a tuned circuit goes down when Q goes down.

Q goes down when ohmic resistance goes up. Dirty or loose contact surfaces are bound to increase ohmic resistance.

WAVEGUIDE CONNECTIONS

A method for passing waveguides through bulkheads and decks has been suggested. This method will facilitate removal and reinstallation of waveguides for inspection and repairs. A frequent source of trouble in waveguide transmission lines is the collection of condensation in the horizontal sections. The adoption of this suggestion will reduce the amount of time necessary to correct this condition. In addition, it will reduce the amount of blistering of the paint inside waveguide walls which occurs during the brazing process.

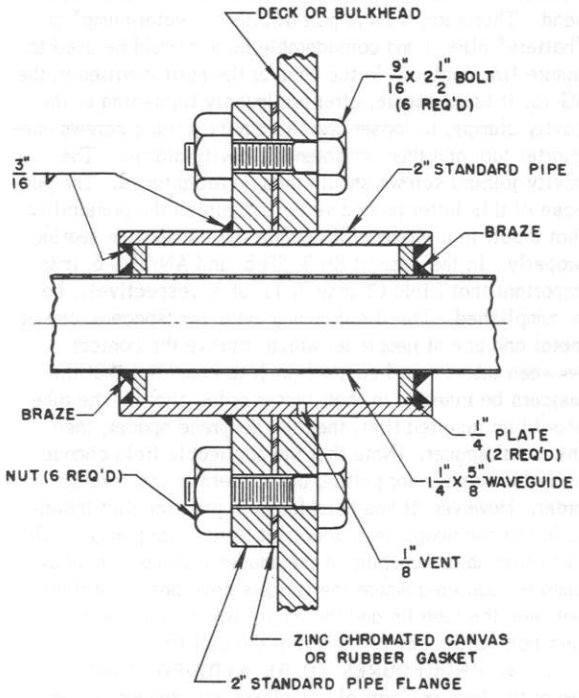


FIGURE 1.—Method of passing waveguide through bulkhead or deck.

RADAR JUNCTION BOXES

Numerous reports have been received stating that the junction boxes used with the radar antenna cable have have been found partially filled with water. This has resulted in severe corrosion of leads and terminals and in some cases, short and open circuits have occurred.

It is recommended that the junction box be inspected at the earliest opportunity for moisture, corrosion and defective leads. The junction box should be thoroughly cleaned and dried. If necessary, a new gasket should be installed and the cover made tight. In locations of high humidity this check should be made often, while in dryer and cooler climates the check may be made less frequently. In any case the junction boxes should be inspected periodically to prevent damage to the equipment.

PRECAUTIONS TO BE OBSERVED WHEN REMOVING RADAR ANTENNAS

Previous directives have authorized the removal of and stowage of all weather exposed electronic equipment installed on vessels of the Reserve Fleets in order to assure maximum preservation. Since this includes radar antennas, ComLanResFlt, in his letter S67/(56) rev serial 3065 of 5 June 1950, to the various Group Commanders of the Atlantic Reserve Fleet directs attention to certain precautions to be observed during removal operations. In view of their importance they are listed for such information as it may afford other repair and maintenance activities who may have similar antenna removal problems.

In cases where the radar antenna is being removed separately without the base pedestal, the following precautions must be observed to prevent damage to the interior mechanisms that protrude below the top of the pedestal base and rise with the antenna frame.

(a) Lifts must be centered to insure perpendicular lift, without side motion until protruding mechanisms have cleared top of base pedestal.

(b) Where perpendicular lift cannot be depended upon for proper clearance, guide bolts should be inserted in antenna and base flanges to prevent side motion until protruding mechanisms are clear of the top of the base pedestal.

Refer to the assembly figure: place the waveguide in the pipe and braze it to the one-fourth-inch plate which is welded to the pipe. Pass the pipe through the bulkhead and place a gasket and pipe flange over the pipe. Weld the pipe to the flange and bolt the flange to the bulkhead. The design will suit all sizes up to and including 1½-inch x 3-inch waveguides with a slight alteration in the size of the pipe and flange.

MARKING OF RADAR TUBE SOCKETS AND TUBE CONTACTS

In order to facilitate servicing of radar equipment, a quick method of identifying tube sockets and tube contacts has been devised. This method has been incorporated in the general specifications on radar equipment.

Important contacts of all radar tube sockets will be designated by colored dots as tabulated below. The dots will be located on the under side of the socket adjacent to the proper pin and will be readily discernible.

CONTACT	DOT COLOR
Plate	Blue
Grid	Green
Cathode	Black

This designation by colored dots applies only to the sockets in the equipment and not to those in spare parts. When a socket is replaced, the new socket should be marked similar to old one.

All tubes absolutely essential to system operation will

be identified by a green circle around the socket, this being stamped on the top of the chassis. In this connection it should be observed that a sweep generator tube would be considered essential, whereas, a range mark generator tube is not vital to the operation of the equipment.

These markings are to be incorporated on equipments in production.

TUBE TYPE 527

When type 527 tubes are installed they should be checked and adjusted so that the tubes in the cathode end are lined up with the slot in the cathode socket to insure proper ventilation.

NOTE: Reports indicate that type 527 tubes are fragile and liable to breakage at time of installation or removal. Personnel are cautioned against glass fracture and should handle this tube with care, wearing gloves and safety glasses when installing or removing the tube.

CHANGE IN RADAR CIRCUITS

Under certain conditions the Bureau acknowledges emergency measures must be taken at times to improve equipment operation. It is desired, however, that all radar changes originating in the Service be forwarded to the Bureau before definite action is taken, unless extreme emergencies exist.

The Bureau will consider as urgent and expedite the handling of all technical inquiries in order to prevent any changes which may prove detrimental to equipment operation.

In order to maintain efficient and uniform radar operating conditions, it is essential that the Bureau analyze and thoroughly investigate any engineering changes.

DUMMY LOAD FOR RADAR TRANSMITTERS

A dummy load may be used in place of magnetrons when setting up and adjusting radar modulators. A. H. Shapiro and Vincent Statuti, of Philadelphia Naval Shipyard, suggest a dummy load constructed as follows: Assemble ten 500-ohm 50-watt resistors in a metal box to simulate a load of 50 ohms, 500 watts. The resistors should be mounted in clips so that by changing all or part of the resistors, various values of dummy loads may be simulated. The use of this dummy load has been adopted by Shop 67 of the Philadelphia Naval Shipyard, and may be used at Shore Shop installations as needed.

Under the previous method of leaving the magnetron in place during adjustment periods, serious damage or complete ruin of the magnetron could result if trouble were present in the modulator. Use of a dummy load will eliminate this type of magnetron failure.

SURFACE SEARCH RADAR NOTE ON LARGE SHIP INSTALLATIONS

To obtain maximum possible surface search range on large ships, surface search radars are frequently installed as high as possible on a convenient mast. This, of course, also increases the minimum range and close-in sea return, reducing the close-in navigational features of the radar.

To compensate for the additional sea return close-in to the ship resulting from the necessary high mounting location, careful use of STC and careful attention to ATR tube condition will give optimum navigational operation. More frequent ATR tube checking, using the ATR tubes for only the best operating portion of their life spans, will help. But careful attention to STC preventive maintenance, checking waveforms with corrective maintenance, servicing block diagrams, will pay the highest dividends in optimum navigational operation.

RADAR RADIATION HAZARDS

Change 16 to Bureau of Ships Manual contains a new article for Chapter 67, "67-315 Radar Radiation Hazards," which is additionally published herein for the information and guidance of all personnel:

"1. The following is intended to warn personnel, particularly those engaged in test and installation work to exercise extreme care during radar operation to avoid hazards to personnel.

a. Based on an average radiation intensity of 0.01 watts/cm², the following minimum distances from the rotational center of radar antennas are tentatively established as limits beyond which constant exposure (one hour or more) is safe and within which there is a definite hazard from radiation:

RADAR	MINIMUM DISTANCE (FEET) in axis of primary beam of nonrotating antenna	MINIMUM DISTANCE (FEET) in horizontal plane of primary beam of rotating antenna
AN/BPQ-2	45	5
AN/BPS-2	40	8*
AN/SPS-2	340	35
AN/SPS-6	40	9*
AN/SPS-8	175	25
AN/SPS-12	40	9*
AN/SPS-17	35	11
AN/SPS-26	320	37
AN/SPS-28	10	9*
SA, SC Series	7	8*
SRa, SK Series	7	9*
SR-3, SR-6	40	9*

*These limits are the swing-circle safety radius.

The intensity level of 0.01 watts/cm² has been tentatively accepted as a working tolerance subject to further review by the Bureau of Medicine and Surgery. On board ship, normal radar use practices (scanning and tracking) are such that the likelihood of long exposure in the main beam is remote. However, during target examination or testing it could be anticipated that an antenna would remain on one bearing for an extended period.

b. Do not make a direct visual examination of any microwave radiator, reflector, waveguide opening or waveguide horn during periods of transmission.

c. Photographic personnel should be cautioned regarding the dangers of exposing photoflash bulbs to radar beams even at considerable distances.

"LOSS" PLATE FOR DIRECTIONAL COUPLERS

When direction couplers are delivered to the Navy by the manufacturer, the calibrated loss is painted on the coupler. After the coupler has been used aboard ship for a time, the calibrated loss is sometimes obliterated by paint applied to the coupler by the ship's crew or by shipyard painters. In order to determine the performance of the radar equipment, it is necessary, to remove the coupler, install a coupler in which the loss is known, test the equipment, replace the old coupler and repaint the calibrated loss thereon.

It has been suggested that the calibrated loss be engraved on a small plate and attached to the directional coupler. This should prevent obliteration of the calibrated loss and loss of considerable time and effort.

DUMMY LOAD FOR RADAR TRANSMITTERS

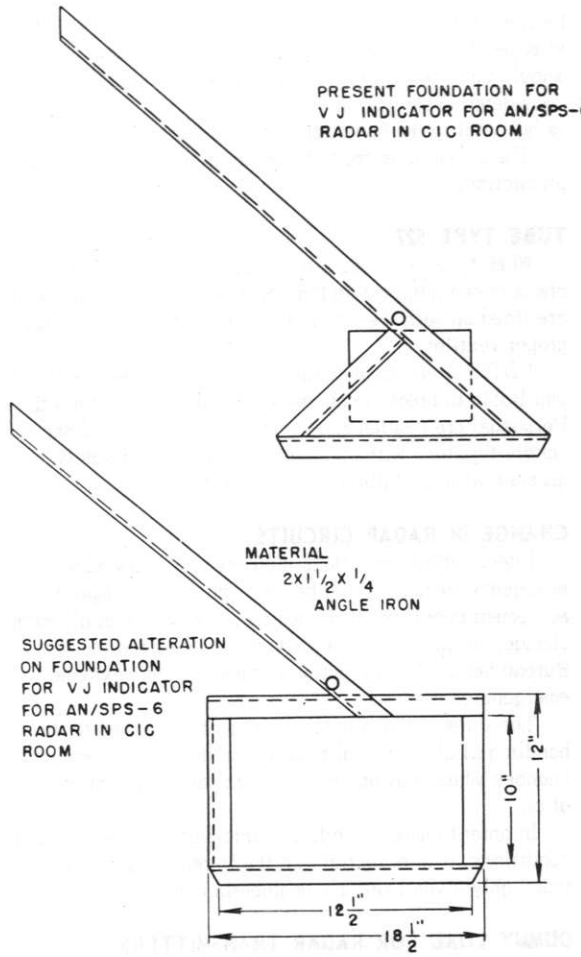
A dummy load may be used in place of magnetrons when setting up and adjusting radar modulators. A dummy load constructed as follows has been suggested: Assemble ten 500 ohm 50 watt resistors in a metal box to simulate a load of 50 ohms, 500 watts. The resistors should be mounted in clips so that by changing all or part of the resistors, various values of dummy loads may be simulated. The use of this dummy load has been adopted by Shop 67 of the Philadelphia Naval Shipyard, and may be used at Shore shop installations as needed.

Under the previous method of leaving the magnetron in place during adjustment periods, serious damage or complete ruin of the magnetron could result if trouble were present in the modulator. Use of a dummy load will eliminate this type of magnetron failure.

ALTERATION OF RADAR INDICATOR FOUNDATION

There have been several reports of radar indicators being installed on foundations in a manner that does not permit servicing access plates to be removed unless the indicator is removed from the foundation.

A method for altering the indicator foundation of the VJ equipment to permit removal of the access plates for servicing the unit without removing the complete unit has been suggested. The sketch illustrates the method as applied to a specific case.



The suggested foundation alteration, or a similar method, is recommended for activities which encounter this condition. Installation activities are cautioned to adhere closely to current installation practices when initial installations are made since this sort of thing should be avoided rather than cured.

ANTENNA HINTS

The Bureau has been informed that the bolts used to fasten radar antenna pedestals to the supporting structure corrode until it is impossible to remove them without cutting the nuts off. These same bolts shake their nuts loose and permit the antenna array to fall to the deck. These statements do not sound compatible, however, it is very possible that both statements are true.

The use of corrosion resistant bolts and nuts will overcome the first problem. The use of castellated nuts, drilled bolts and either cotter pins or a tie wire will decure the bolts in the second case.

In the interest of safety and to insure against corrosion and loosening of the bolts and nuts, it is recommended that radar antenna base pedestals be fastened to their supporting structure with corrosion resisting bolts that have their nuts locked in place.

SURFACE SEARCH RADAR NOTE ON SPECIAL CIRCUITRY

Obtain optimum operation from your surface search radar. Instead of being satisfied with merely having a fair PPI presentation, regularly check for optimum receiver performance, especially the Servicing Block Diagram waveforms from special circuitry such as STC, FTC and IAGC. Read again the "Theory of Operations" on these circuits. These features will help you most when they are most needed, in bad weather and under interference (or under jamming) conditions. But optimum performance of these features is necessary even during good weather conditions and when neither interference (nor jamming) is present.

RADAR PERFORMANCE

The following is an excerpt from ONR Report ACR-10.

"This probability of detection business would be somewhat more than livened in your minds if we considered the fact that our inaccuracy of estimating probabilities of detection with radar is inversely proportional to our probability of survival."

BUSHIPS NOTE

All ships should make tactical use of NAVAER 50-IP-527 "Meterorological Refractive Effects Upon Radar Wave Propagation", published by direction of the Chief of Naval Operation as an aid to predict radar detection probabilities in a given tactical situation. (Order copies through the nearest Forms and Publications Supply Point). Make use of equipment Performance Standard Sheets as they become available.

SWR CHECKS ON GFC RADARS

A review of NAVSHIPS 3878 (monthly P&O Reports) shows that perhaps 95% of ships reporting are not using the ever-useful Standing Wave Ratio (SWR) measurements to indicate wave-guide and antenna conditions. It's easy and simple. Get a TS-147 or TS-230, whichever is on board. Zero it as outlined in the technical manual. Insert a coaxia test lead from the TS-147 or TS-230 into the "D" jack of the directional coupler, then into the "R" jack. In each position read and record the db loss reading as taken from the test unit. Check the jack losses stamped on the "D" and "R" jacks of the directional coupler. If they are within one db of each other (and most are), then merely subtract the two meter readings and record the difference in db on your P&O Report. This is the SWR expressed in db. If the "R" jack loss is greater than the "D" Jack loss subtract their difference from the difference of the two meter reading (If "D" jack loss is greater than "R" jack loss, add the diference). The result should be at least fourteen db, which represents a VSWR of 1.5 to 1. As a guide, above fifteen db is good, 11–13 fair, and below 11 db, you had better begin looking for trouble. The above applies to all GFC's, except MK 56.

MARKING, STORING AND SHIPPING OF PULSE FORMING NETWORKS N5915–325–7519

ESO Notice 4050 of 19 September 1956, contains procedures for marking, storing and shipping of Pulse Forming Networks. These networks are failing because they are stored with the bushing facing up and then being operated with the bushing facing down. Gasses become trapped in capacitor element windings and low dielectric strength results. These networks are also found in sets of equipment spares for Radar Set AN/SPS-10, stock number F5840-642-8228.

It is requested the "F" and "N" cognizance stocking activities pack and mark pulse forming networks N5915-325-7519 (including those found in equipment spares for Radar Set AN/SPS-10), as follows:

a. Ensure that networks (N5915-325-7519) are unit packaged in individual containers with terminals in a downward position, with sufficient and proper blocking, bracing and cushioning to prevent damage to the terminals in handling and shipping.

b. Stencil on the top of each unit package and shipping container: "THIS SIDE UP" with arrows on the sides pointing to the top of the container.

c. Handle and store accordingly.

RADAR WAVEGUIDE MAINTENANCE

The Bureau has received numerous reports of discrepancies found in waveguides after overhaul. Items included chunks of grease in the waveguide, dents filled in with filler and painted over, and corrosion just below the oscillating rotating joint.

The Bureau requests that all maintenance personnel be required to read publication NAVSHIPS 900,171, Chapter 11, on "Rigid RF Transmission Lines". Inspection of the interior of the waveguide is most important.

Some radio frequency components have dents, such as found in the scanner on the AN/SPS-8 series radar equipment. These dents are put in carefully and deliberately at the factory to obtain special radio frequency properties in these components.

AM-420/U, AM-421/U ELECTRONIC CONTROL AMPLIFIERS

It has been determined that 170 to 180 milliamperes flow through power transformer T-102 and filter choke L-101. These components are each rated at only 150 milliamperes maximum and operate very hot to touch. However, replacement is not contemplated due to insufficient failures reported to the Bureau. For protection of the equipment, it is requested that field changes 1-AM-420/U and setting 1AM-421/U (fusing) be accomplished.

AN/BPS-2 – Z-1101 FAILURES

Oil leakage at the terminals in the pulse forming network has been traced to the overtightening of the terminal nuts. Upon completion of any repairs that require the removal of the terminal nuts, replace with knurled thumb or wing nuts. Hand tightening is sufficient.

AN/BPS-3 SUPPLEMENTARY INSTALLATION AND MAINTENANCE INFORMATION

The following information is an accumulation of miscellaneous findings acquired while installing or maintaining the AN/BPS-3 Radar:

1. Installation - The hydraulic components must be kept free of dirt and moisture during installation. Exposed connections should be plugged or masked off. The Navy installed lines should be flushed out before use. Trouble has been encountered by water entering the actuator tube through the air vent near the top of the actuator. This vent should be masked until the system is placed in operation. Temporary water-proof covering should be used to protect all mechanical devices from the time they are uncrated until the units are permanently installed, because the internal parts of the pendulum and actuators depend upon hydraulic fluid for lubrication and protection against corrosion.

The Navy installed bracket supporting the base of the actuators and the Navy supplied stuffing gland should be aligned as closely as is possible. If not, binding of the actuator piston in the stuffing gland may result in oscillation of the antenna.

2. Initial Maintenance - After the system has been in operation for two or three hours, the hydraulic fluid should be inspected for foreign matter and water. As little as 0.5% water will cause a cloudy or milky appearance. If this condition exists, drain system and replace hydraulic fluid. At approximately 24 hours operation, it will in all probability be necessary to drain and clean the system and replace all filters. (The two on the 15 HP unit, one on the replenisher and one on the Pendelum are the same size - one each per actuator the same size). At this time, remove the inspection plate located on the end of the Replenisher tank and remove the pump inlet screen. (The screen can best be removed by removing the connection and four bolt flange just under the pump proper - the inlet screen and associated plumbing will then come out as a unit.) Reverse flush the screen. Mop out the Replenisher tank to remove all insoluble grease, rust, water, etc. (Insoluble grease may be found on Serial Nos. 1 through 9, inclusive. The grease may have been washed down from the thrust bearings located in the base of the actuators.) After the system has been back in service for an indeterminate period of time, it may be necessary to repeat this operation. Watch the Replenisher pressure. If the regulating valve must be reset to provide 150 psi, it is probable that the system will have to be cleaned and the filters replaced.

3. Trouble Shooting Tips - If excessive oscillation or peculiar operation is present in Pitch or Roll, the trouble can be in any or all of three areas, hydraulic, mechanical or electrical. Three checks can be made to isolate the area of difficulty as follows:

a. Hydraulic - Deadband should preferably be a maximum of 0.020 inch but may be as much as 0.030 inch. Deadband is the total linear travel of the hydraulic pump booster rod required to yield 500 psi in each direction. Expressed another way, from the booster rod position where pressure on the 3000 psi side of the system is only Replenisher pressure (150 psi), approximately 0.010 inch movement of the booster rod should yield 500 psi in one direction. From this point, 0.020 inch movement in the opposite direction should yield 500 psi on the other pressure gage. To make this check, de-energize the stroke motor (kill the + 450 V) and disconnect the brake solenoid leads of the actuator in question. (This will allow the actuator, spring-operated brake to set and prevent movement of the actuator.) Set up a 1-inch travel dial indicator (use "C" clamps and fasten to the stroke motor reinforcing gusset) to read when the booster rod is in the middle of its travel. Start the Replenisher. Start the 15 HP unit. Slowly push the booster rod until one gage shows 500 psi. Pull booster rod back until the other gage shows 500 psi. If total indicator reading exceeds 0.030, it is reasonable to assume hydraulic troubles either in the pump, actuator motor or valves. (It is assumed that Replenisher pressure is a steady 150 psi.) Replack the pump and recheck the deadband. When replacing the pump, be sure that the booster rod does not bind when coupled to the stroke motor arm. Either rotate pump with respect to motor bell-housing or shim stroke motor assembly to eliminate binding of booster rod. Also, adjust travel of booster rod so that the stroke motor arm never allows the booster rod to strike internal stops in the hydraulic pump. The operating stroke of the pump is approximately 2-inches and the stroke motor assembly should control this dimension. If deadband results are out of limits, replace the hydraulic motor. Approximately 1/32-inch axial clearance must be maintained between the end of the motor coupling and the mating portion of the coupling in the actuator. Use extreme care in replacing motor to prevent motor coupling from damaging the precision bevel gear which is an integral part of the coupling assembly in the actuator. Lift motor straight up and down into the registering actuator diameter to prevent damage. Recheck the deadband. If results are negative, check four-way valve action by removing end-caps.

b. Mechanical Trouble in Actuator - To check mechanical troubles, connect the hand pump in the actuator plumbing. Release actuator brake by running down the three cap screws spaced 120 degrees apart on the actuator. If peak pressure to pump actuator out of stops exceeds 750 psi, the unit will not operate satisfactorily. (The best actuator to date requires 600 psi instantaneous and 450 psi average coming out of the stop.) If pressure is excessive, there are two possible causes - internal binding, rusting, etc, and binding due to misalinement of the piston with respect to the Navy supplied stuffing gland. Loosen the stuffing gland topside and repeat handpumping to determine if actuator supports and the stuffing tube are properly aligned. If pressure does not drop, the trouble will be found in the actuator.

c. Electrical Difficulties - To check electrical difficulties, the Stable Element should be inoperative. Set the S.D.I. at zero (no error correction). Start up the system. The stroke motor arm should oscillate or chatter so that the total linear travel should be on the order of 1/32-inch or less. (This is a general statement

and it may not apply if deadband is approximately 0.010-inch or less.) Chatter can best be checked by feel rather than measurement. The chatter is caused by constant reversal of the servo motor as it overshoots and corrects by moving in the opposite direction. The hand pressure required to overpower the motor is very high. Also, compare operation of Roll, Pitch, and Train stroke motors to determine if any difference exists. If the booster rod oscillates from limit to limit (2-inch total linear motion) check synchro phasing. If the servo motor action is sluggish, Roll and Pitch amplifiers may be interchanged. The gain potentiometer may also be readjusted. If the gain is too great, it is probable that the antenna will oscillate.

Another possible source of difficulty is the D.C. feedback generator located on the stroke motor casting which provides actuator damping. One volt D.C. Generator output is sufficient to saturate the amplifier and cause stroke motor movement. Relatively low rpm can allow the filter in the brushes to film-over the bars, resulting in low output. The generator's nominal voltage characteristic is 2-volts per 100 rpm's, and manufacturer's rated rpm is 1800. If generator output is questionable, clean the commutator by running the generator at 1800 rpm for a few minutes.

The D.C. tachometer generators in spares have been reworked so that commutator clogging will not occur.

RADAR SET AN/BPS-3 PERFORMANCE AND OPERATIONAL REPORTS

Discontinue the submission of Performance and Operational reports (NAVSHIPS 3878) on the AN/BPS-3 radar for the present time. If equipment is affected by a major field change in the future, instructions for re-submitting reports will be issued.

AN/CPN-4A--REPORT ON INVESTIGATION OF EXPLODED BATTERIES AND MOTOR-GENERATOR SET PU-220/GPN

An investigation into the cause of exploded batteries on Motor-Generator Set PU-220/GPN has been made by the Industrial Manager USN, Fourth Naval District, Philadelphia Naval Shipyard. The transcript of the report, with its findings and recommendations, is as follows:

1. The subject batteries, battery box, and motor-generator set PU-220/GPN serial No. 466 were received at this office for evaluation in accordance with reference BUSHIPS MSG 2921592 April 1960.

2. After extensive tests, this office concurs with paragraphs 4d and 5 of CO NAS Patuxent River letter AD-142 5100 Ser 186 of 6 Jun 1960 regarding the battery condition and probable cause of the explosion. Further tests on the PU-220/GPN serial No. 566 showned no malfunction in its operation.

3. A battery-box blower kit has been evaluated and is currently under procurement for all Navy AN/CPN-4A systems. This kit adds a blower to prevent explosions caused by an accumulation of hydrogen gas external to the battery. The blower cannot completely remove gas from the battery, hence maintenance personnel must keep their battery water-level high. Should water in the battery drop to a level below the top of the plates, continued charging can then warp the plates sufficiently to touch, causing an arc at contact. If the hydrogen-air mixture inside the battery is battery is critical at time of spark, an internal explosion will occur. In addition, during charging periods battery temperature should not exceed 110° F. Should it be necessary to charge batteries when ambient temperature is in this region, it is recommended that the filler caps be removed and additional ventilation be provided.

4. Furthermore, this office concurs with the recommendation that the Navy service-life of the batteries be reduced below the warranty period of the manufacturer, since the warranty stated by the manufacturer for the subject battery is for commercial on-the-road use rather than for continuous duty as encountered at RATC sites. The usual commercial warranty is reduced by one half for off-the-road usages. In view of the foregoing, it is recommended that all batteries in use at ASR/GCA/MATC/RATCC units be removed and given a cycling test discharge every six months. This is a standard-type test used in Navy battery shops for determining battery capacity and condition and is performed in accordance with NAVSHIPS 250-000 Bureau of Ships Technical Manual, Chapter 62, Section II, paragraph 62-264. Any battery showing marginal capability in such a test should be replaced immediately.

AN/GRD-6 BRASS COUPLINGS FOR DIRECTION FINDER

The original brass couplings for Ledex switches in the AN/GRD-6 synthesizer 0-311/GRD-6 show excessive wear. Stainless steel couplings to replace them were mailed during the summer of 1958 to all holders of this equipment.

The recipients were requested to change the couplings immediately upon receipt to reduce maintenance caused by excessive wear on the brass couplings. By now most of this work has been done. Reports received in the Bureau indicate the maintenance work on the radio direction finder AN/GRD-6 resulting from excessive wear of the brass couplings has been reduced.

General Tuning Procedure for Sperry SAL-89 Klystron

Introduction— This tuning procedure describes the application of the SAL-89 klystron to the AN/GRN-9A, AN/GRN-9B, AN/GRN-9C, AN/SRN-6, and AN/SRN-6A TACAN system. The procedure describes the means by which rated klystron output power and best spectrum can be achieved without creating dangerous voltages along the rf transmission line. Unless this procedure is followed carefully, damage can result in the SAL-89 klytron output connector and consequently ruin the tube.

SAL-89 Aging Procedure— This procedure to be followed for all new tubes and tubes which have not been operated for a period of more than 3 months.

1. Reduce the grid drive voltage to zero. (Do not change the bias voltage from its normal -125 v setting.)
2. Disconnect the rf drive at the input BNC jack on the klystron.
3. Apply rated filament voltage for 15 minutes.
4. Rearrange the main power transformer T1001 or T1002 primary from delta to wye.
5. Apply the resulting beam voltage (Approximately 7 kv. from step 4 above) for 15 minutes.
6. Increase the grid drive from zero to a value which gives 10 ma. of average beam current.
7. Increase the grid drive for an additional 10 ma. of average beam current every 5 minutes until 50 ma. of beam current is reached.
8. Reduce the beam voltage to zero and reconnect the power transformer in its original delta setting.
9. Apply the rated beam voltage and continue to increase the grid drive to values which provide 10 ma. beam current increases every 5 minutes until the current reaches 90 ma.

The tube now is considered to be properly aged and ready to be placed into service.

SAL-89 Tuning Procedure—The proper tuning procedure as outlined contains three basic steps (conditions A, B, and C):

A. Create a matched rf transmission line while operating at reduced klystron output power levels. (Follow steps 1 through 8 below.)

B. Apply rated klystron output power to this matched line by tuning the klystron to deliver maximum power at rated operating voltage. (Follow steps 9 through 12 below.)

C. Without retuning the klystron output cavity, adjust the matching transformer, filter cavities, and klystron input and middle cavity for best shape and spectrum with rated antenna power. (Follow step 13.)

When the following steps are applied, these conditions will be fulfilled, and no damage will occur to the SAL-89 klystron output connector from high transmission line voltages and rf arcing.

Condition A— Steps to follow:

1. To a tube which has been preset to the desired operating frequency range by the manufacturer's tuning curves, and properly aged as described above, turn grid drive control to minimum drive and reconnect the BNC input jack on the klystron.
2. Apply rf drive and increase the grid drive to a value corresponding to 30 ma. of average beam current.
3. Alternately tune the input cavity of the klystron and the rf exciter for maximum absorption of power from the exciter at the time in the rf pulse when the grid drive pulse is at its peak. This is observed at the reflected coupler on the rf drive line.
4. While viewing the center cavity monitor of the klystron (using a crystal detector and oscilloscope), adjust the center cavity of the klystron for maximum amplitude of the detected pulse.
5. Adjust the output cavity of the klystron for maximum detected voltage on the first incident coupler of the output transmission line.
6. Tune the first filter cavity for a minimum at the peak of the pulse when viewed at the reflected coupler.
7. Tune the second filter cavity for maximum on the second incident coupler.
8. Because some filter interaction may occur, repeat steps 6 and 7. On models where only one filter cavity exists, adjust it for the maximum signal on the incident coupler and minimum signal on the second reflected coupler.

Condition B— Steps to follow:

9. Adjust the shape of the grid drive voltage to that recommended by the manufacturer and increase its amplitude to a point just below the saturation level of the tube as indicated by a flattening of the pulse observed at the first incident coupler. (Do not operate with a pulse which appears to be saturating at the peak.)
10. Repeat step 3.
11. Adjust the center cavity of the klystron for maximum signal at the first incident coupler (taking care to maintain a smooth pulse on the center cavity monitor in the interest of good spectrum). The center cavity will now be slightly detuned to the high frequency side.
12. Alternately adjust the output cavity of the klystron and the matching transformer for maximum signal at the first incident coupler. Condition B has now been met, and the output cavity of the klystron must not be retuned.

Condition C.

13. Repeat steps 6 and 7 and make minor adjustments in the matching transformer and the klystron input and center cavities while viewing the second incident coupler for specified power and best pulse shape for spectrum.

The above SAL-89 klystron tuning procedures will replace the present SAL-89 klystron tuning procedures as outlined in these TACAN manuals: AN/GRN-9A, NAVSHIPS 92986(A); AN/SRN-6, NAVSHIPS 92986(A); AN/GRN-9B, NAVSHIPS 93177(A); AN/SRN-6A, NAVSHIPS 93177(A); AN/GRN-9C, NAVSHIPS 93208(A).

SAFETY NOTICE-PRECAUTIONS FOR INSTALLING GLASS FILTER GLOBES IN AN/SAT-2 AND US/X-3A INFRARED TRANSMITTING SETS

A potential safety hazard exists in Infrared Transmitting Set AN/SAT-2 and in Infrared Transmitting Set US/X-3A. A casualty occurred to a newly installed AN/SAT-2 equipment during its initial test. The glass filter globe on one yard arm beacon exploded violently after about two minutes of "locked-key" operation, scattering jagged glass fragments over a radius of 25 feet. Fortunately, no personnel injury resulted, however the flying glass could easily have caused serious harm to anyone within range. It is believed that the casualty resulted from a flaw in the glass combined with the pressure of heated air trapped inside the beacon which is watertight. The internal air pressure would account for the explosive violence of the failure.

The filter globe is identified as Part O-103 in NAVSHIPS 92169, Technical Manual for Infrared Transmitting Set AN/SAT-2. It is a hemisphere of thick, heat-treated, black glass about 11 inches in diameter which weighs about 12 pounds. The corresponding part in the US/X-3A equipment is identical. The possibility of one of these globes shattering spontaneously is greatest when it is first installed. Following an established safety procedure at that time will protect personnel from injury from this source.

The following safety precautions should be observed whenever a new AN/SAT-2 system is installed or whenever a filter globe is replaced for any reason:

a. Examine each globe carefully for flaws, chips, cracks, or deep scratches.

b. Install the globe exactly as shown in NAVSHIPS 92169. Make sure the gasket is straight and that the wing nuts are tightened down uniformly and only hand tight. Do not use a wrench.

c. Test the newly installed globe by burning the beacon lamp in the "steady source" position for at least three, ten-minute periods with a like time between periods for cooling.

d. Warn personnel to stand clear during the test.

e. Any casualties should be reported promptly to the Bureau of Ships.

MODEL AN/SPA SERIES TROUBLESHOOTING NOTES

Difficulty Encountered	Causes and Remedy
AN/SPA-1.-Intermittent operation of indicator scope.	R-201 decreased in value from 100,000 ohms to 4,000 ohms.
AN/SPA-1.-Power transformer T-201 burned out. Also tube V-108 was removed.	Found to be due to unexplained presence of a 2,500-ohm resistor in place of R-201, the required value of which is 100,000 ohms.

TUBE ENVELOPE FAILURE

Reports of miniature tube envelope failures in Range-Azimuth Indicator AN/SPA-4A have been received by the Bureau of Ships.

It has been determined that the envelope failures are caused by the sharp, rough edge on the end of the spring located in the top of the tube shield.

Failures of this type may be prevented by removing the spring from the shield and either filing off the rough, sharp edge or bending the end of the spring upward so the sharp edge does not contact the tube envelope, or by replacing the spring in the shield.

AN/SPA-4

The following information was obtained from tests on the AN/SPA-4: (1) The line filter is located in such a position that when the marker generator chassis is removed, the terminals of the filter will be shorted unless great care is exercised. In order to avoid any harm to the equipment or personnel, it is recommended that the power to the unit be turned off before the chassis is removed. The filter is still "hot" with the power switch on the indicator turned off, and with the interlocks open. (2) To set the precentering magnet, the unit should be allowed to reach operating temperature with the top in the operating (down) position before adjustment is attempted. If the magnet is set when it is cold, the center will drift as the magnet heats up. A half hour should be sufficient time for the unit to heat up when it is completely closed. It should be noted that the location of the center will probably shift between the open and closed position of the top of the unit. This is caused by the change in location of metal around the tube. (3) If the condition develops where the origin of the sweep describes a circle of pronounced size, probably the 815's sweep driver tubes are weak.

RADAR INDICATOR AN/SPA-4

Activities are authorized to procure for maintenance and overhaul purposes the complete flexible shaft assembly (monel flexible shafting and stainless steel hubs), part symbol 0-195, from its manufacturer the S.S. White Dental Manufacturing Company (Ind. Div), 10 East 40th Street, New York City, New York.

The Technical Manual for Range-Azimuth Indicator AN/SPA-4, NAVSHIPS 91659, Page 8-81 (Change 1) lists part 0-195 as local manufacture. This has been attempted by personnel at the Boston Naval Shipyard and was extremely difficult because the cut shafting tended to unravel. The Naval Shipyard has procured the complete assembly from the manufacturer for $12.08.

AN/SPA-4A AIR FILTER MAINTENANCE

The air filter (0-862), located beneath the low voltage power supply chassis, should be removed and checked regularly for dirt accumulation. Local operating conditions will determine the frequency of checks but once a week should be the minimum.

When cleaning is indicated, wash the filter using a dishwashing compound. Dry and re-oil with light machine oil. Before replacing, inspect the area beneath the equipment and clean if necessary. (A forthcoming revision of the equipment instruction book will include the above note.)

PRECAUTION FOR MARKER COIL ALIGNMENT IN AN/SPA-4

The Technical Manual for Range-Azimuth Indicator AN/SPA-4, NAVSHIPS 91659, Section 7, specifies removal of the range marker chassis when aligning the marker coil. Before taking this step, remove the AC power input to the equipment as a precautionary measure. A Shop 67 mechanic, following the instruction book directions for removing the range marker chassis, found himself with a hot, arcing chassis when removing it from the equipment. The result was a ruined line filter and a hole burned in the chassis.

Uninsulated terminals of Line Filter Z-101 are located directly below the marker chassis. These terminals are still hot with Switch S-108 (ON-OFF switch) in the OFF position. When the chassis mounting screws are removed and the chassis is lowered to disconnect the marker switch shaft, it will probably ground the AC line through the filter. A protective cover over the hot terminals does not appear feasible because of mechanical interference problems.

AN/SPA-4A LIGHT SHIELD FOR VIEWING HOOD

In open bridge installations of the AN/SPA-4A radar repeater, when the operator moves away from the viewing hood during daylight operation, sky-light tends to saturate the phosphor of the cathode-ray tube.

A remedy for this difficulty is to fit a cap over the eyepiece of the viewing hood while the repeater is not in actual use. The cap should be easy to put on and take off. Canvas or a similar material is suggested for local fabrication.

AN/SPA-4A MAIN GATE MULTIVIBRATOR CIRCUIT

Reports have been received to the effect that while servicing the main gate multivibrator circuit, V-101 (the stop-sweep cathode follower) was removed in order to isolate the multivibrator circuit (V-105). This resulted in the destruction of the cathode resistors of the sweep-driver tubes (R-243, 244, 246, 276, 277, 278, 279, and 280).

Removing V-101 permits multivibrator V-105 to run free, thus greatly overloading the sweep driver circuit.

Field changes presently being prepared will probably fuse the sweep driver circuit and increase the power rating of the sweep driver cathode resistors. Delivery of the field change is expected in the near future.

Also, the forthcoming revision of the instruction book for AN/SPA-4A (NAVSHIPS 91825(B)) will describe a

method of servicing the main gate multivibrator circuit isolating the circuit but maintaining the necessary degree of control to prevent free-running of the multivibrator.

Until this information and the field change is available, V-101 should not be removed without first disabling multivibrator V-105.

AN/SPA-4A AIR FILTER MOUNTING CHANGE

The following procedure is printed for activities desiring to effect a more convenient method of removing air filters from the Range-Azimuth Indicator AN/SPA-4A.

1. Remove the air filter (See para. 1, Section 6 of Technical Manual NAVSHIPS 91825 (B), and take the two metal brackets which hold down the sides of the air filter completely out.

2. Remount these two brackets at the rear of the equipment so that they will correctly position the rear edge of the air filter when it is replaced. Allow 3/16" play in the front-back direction to allow removal of the air filter by lifting the front edge up and sliding the filter forward and out. The quickest method of remounting is to place the upper edge of the brackets underneath the low voltage power supply drawer guide frame. Then, the brackets can be held in place (temporarily) by means of small wooden wedges (about 2-1/2" long and 3/8" wide, tapering from about 9/16" down to 5/16"), driven lightly between the upper bracket edge and the air filter frame. To permanently fasten these brackets, apply high early strength contact adhesive (as Goodyear "Pilobond") to both metal surfaces before final placement. The wooden wedges then serve as temporary clamps while the glue sets (1/2 to 1 hour).

3. To prepare the filter itself for the change, pass two loops of small stuff (as nylon shot line) through the front edge of the filter near its frame and about 1-1/2 inch from each side. The loops should be tied off to provide finger loops about 1 inch in diameter. These loops facilitate maneuvering the air filter out of its frame when the power supply chassis above it is not removed. The air filter can now be slipped into place, the rear edge of the filter being positively held down by the reinstalled brackets.

4. To hold the front edge of the air filter securely in place, cut a strip of galvanized iron (or metal of similar stiffness) 3/4 inch wide by 15-3/4 inches long (thickness about 14-16 gauge) and bend it slightly so that the center is permanently set about 3/8 inch above the ends on a flat surface. One end of the strip is slipped under the front of the drawer guide frame (over the filter rim). Holding this end in place, press down on the other end and guide it underneath the corresponding drawer frame guide on the other side. The spring action of the metal strip will hold the air filter securely in place.

FILTER REMOVAL INSTRUCTIONS AFTER MODIFICATION OF MOUNTING

To remove the filter with the power supply installed, grasp one end of the metal strip and pull it outward until the strip comes free. Now grasp the small loops and jockey the filter outward through the small slot formed by the power supply guide frame and the lip of the filter frame. By pulling forward on the filter, then up over the lip of the bottom frame, the filter will then come free of the rear hold-down brackets. The filter is now completely freed and can be drawn out of the slot.

NOTE: The space below the air filter can be cleaned with a long nozzled vacuum cleaner, although this area should be thoroughly cleaned whenever corrective maintenance requires removal of the power supply.

SYNCHROS FOR AN/SPA-4A

Range-Azimuth Indicator AN/SPA-4A is shipped without range and bearing synchros. The equipment technical manual shows the use of type 23TX6 synchros. However, type 23TX6A synchros may be used if the coupling is appropriately modified. The difference between type 23TX6 and 23TX6A synchros is that the former has a keyed shaft, while the latter has a spline shaft. Once the coupling is modified only the 23TX6A may be used unless a new coupling is fabricated.

If type 23TX6A synchros are used, in addition to modifying the coupling by filing out the key in the coupling to admit the spline shaft, an aluminum drive washer must be obtained, and the coupling drilled to accept the fingers on the drive washer.

The aluminum drive washer may be ordered from stock, simply by name, i.e., "Aluminum drive washer for type 23TX6A synchro". No federal stock number is assigned.

RANGE-AZIMUTH INDICATOR AN/SPA-4A

Much of the maintenance difficulty with the AN/SPA-4A equipment has resulted from incorrect time sharing adjustments. The correct adjustment for R-252 (Time Share Adj-PPI) and R-259 (Time Share Adj-Cursor) is a negative 170 volts between the center arm of the control and ground. Often this adjustment is prevented because the associated neon glow lamps have aged and are dropping excessive voltage. If the time share adjustment cannot be accomplished, check the voltage drop across each of the associated glow lamps (I-201, I-202 and I-203 in the PPI circuit; I-204, I-205, and I-206 in the Cursor circuit). Replace any glow lamp that has a voltage drop greater than 80 volts. The sum of the voltage drops across either set of 3 glow lamps should not be less than 175 volts nor greater than 240 volts. A WEEKLY check of time share adjustments is recommended.

AN/SPA-4A RADAR INDICATOR

When replacing control knobs on the AN/SPA-4A radar indicators, non-corrosive set screws should be used.

AN/SPA-4A SWITCH GUARD

It is possible to brush against the power switch on the AN/SPA-4A (Radar repeater), throwing power off unintentionally. This suggested that guards be fabricated, in accordance with figure 1, and installed to protect the exposed switches.

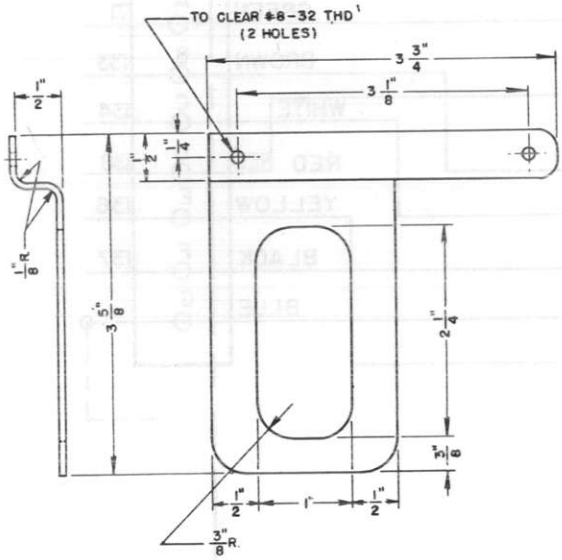


Figure 1

Figure 1 - SWITCH GUARD: Make from stock aluminum 4 1/8 in x 3 3/4 in x 1/16 in. Remove 2 Allen screws on left side of repeater switch panel and secure guard with 2 longer screws.

In general, every effort is made in installation planning to minimize the possibility of equipment being so located that controls may be accidentally operated. In view of the fact that the conditions described will be encountered in only a limited number of installations, issuance of field change is not economically justified.

The suggestion is recommended for adoption on an optional basis.

CRZ-6 RADAR CAMERA

Two copies of a handbook are supplied with each CRZ-6 radar camera for use in operation, maintenance, and repair of the camera. This handbook also outlines the modifications required to the VK radar indicator to permit the installation of the camera. Figure 1 supplements the information in the handbook.

When mounting the CRZ-6 camera on an AN/SPA-4A indicator, the connections are as shown in figure 2. It is to be noted that an externally mounted rotary switch may be used to control the range lights located in the data chamber. The operation positions of this switch are manually selected to correspond to settings of the range control of the AN/SPA-4A. If desirable, this switch may be omitted and the range data recorded on the data card.

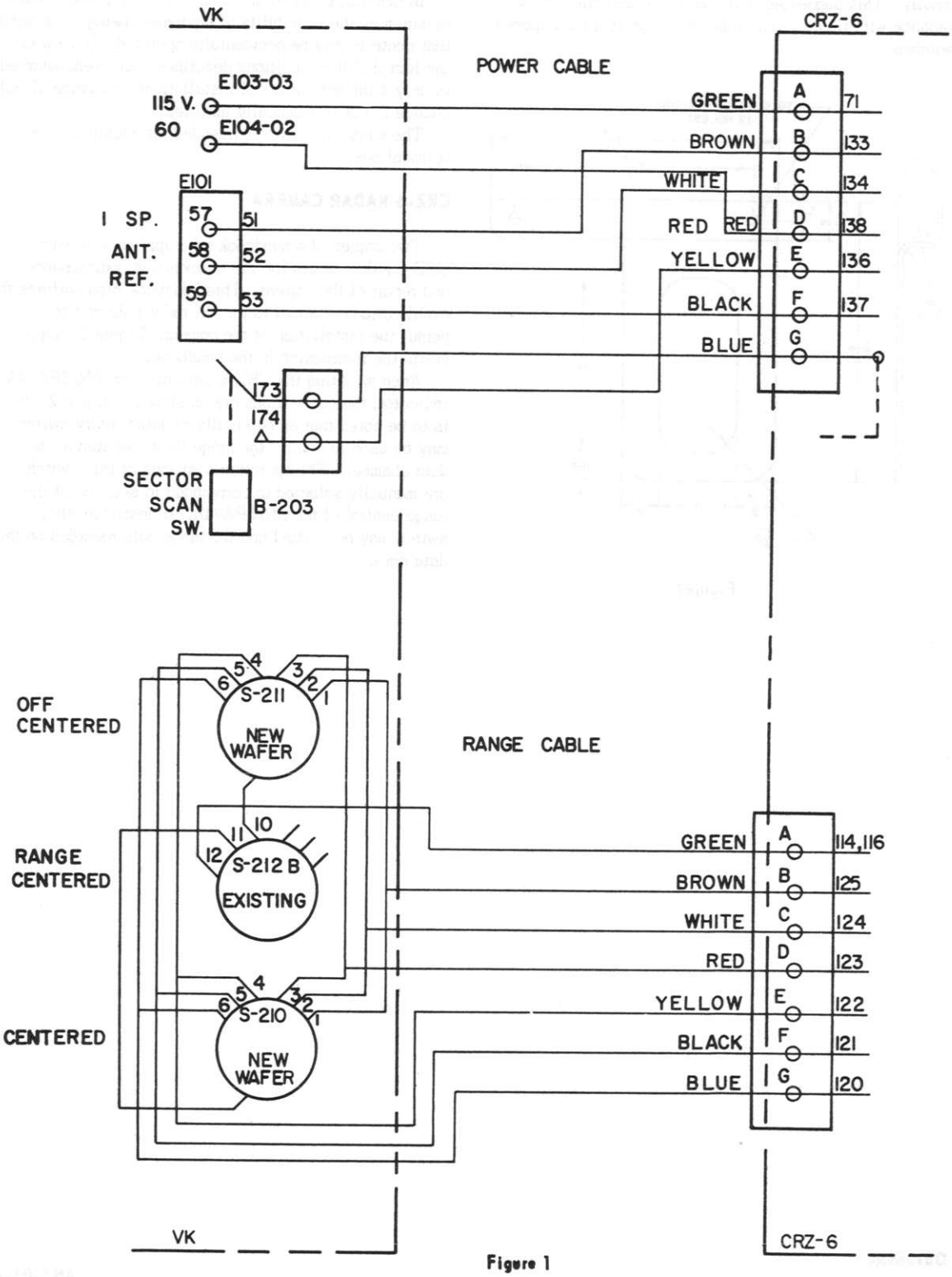

VK
CRZ-6
POWER CABLE
E103-03
115 V.
60
E104-02
E101
1 SP.
ANT.
REF.
57
58
59
51
52
53
GREEN
BROWN
WHITE
RED
YELLOW
BLACK
BLUE
A
B
C
D
E
F
G
71
133
134
138
136
137
173
174
SECTOR
SCAN
SW.
B-203
OFF
CENTERED
S-211
NEW
WAFER
RANGE
CENTERED
S-212 B
EXISTING
CENTERED
S-210
NEW
WAFER
RANGE CABLE
GREEN
BROWN
WHITE
RED
YELLOW
BLACK
BLUE
114,116
125
124
123
122
121
120
VK
CRZ-6

Figure 1

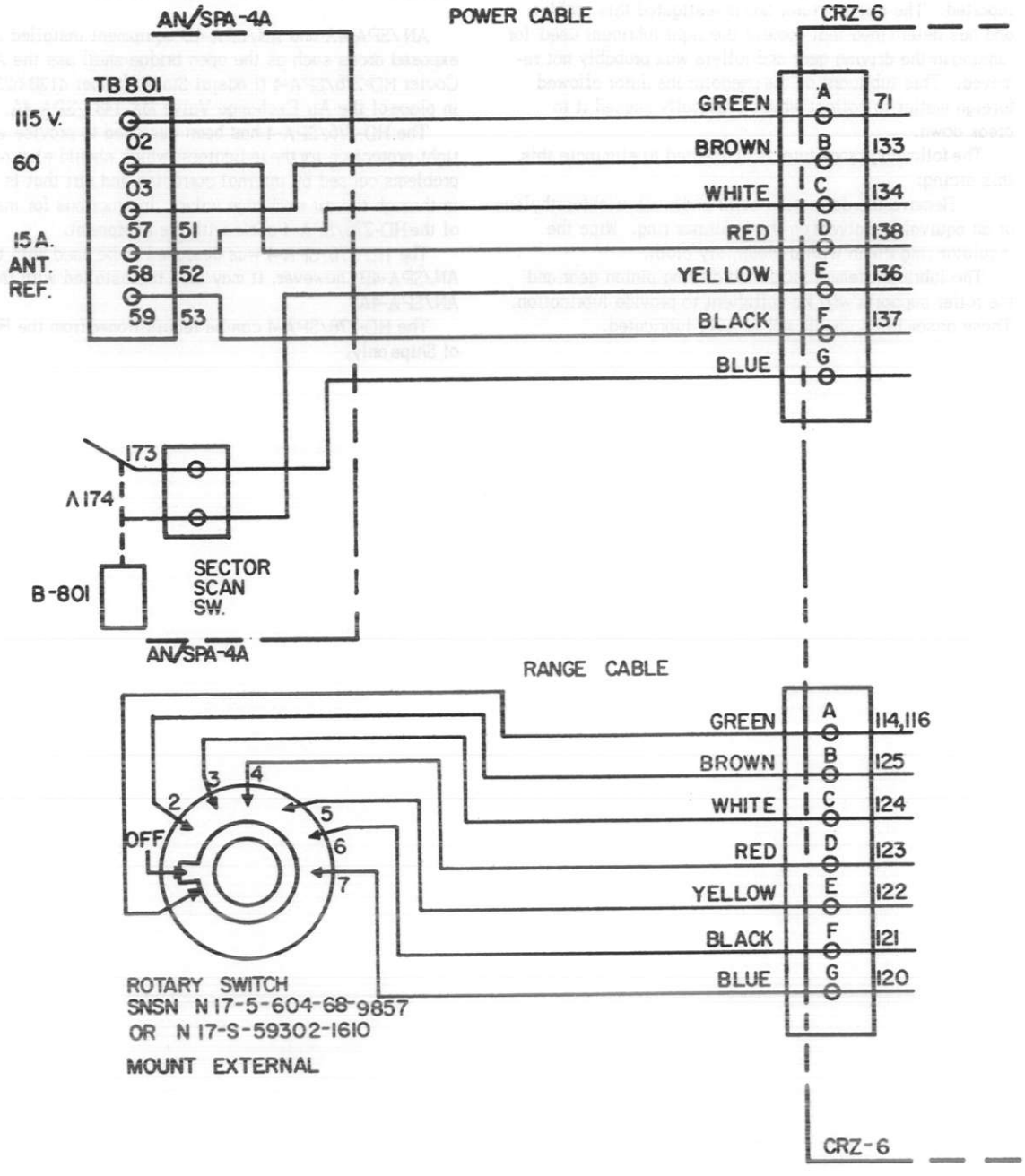

AN/SPA-4A
POWER CABLE
CRZ-6
TB 801
115 V.
60
15 A.
ANT.
REF.
02
03
57
58
59
51
52
53
GREEN
BROWN
WHITE
RED
YELLOW
BLACK
BLUE
A
B
C
D
E
F
G
71
133
134
138
136
137
173
A174
B-801
SECTOR
SCAN
SW.
AN/SPA-4A
RANGE CABLE
GREEN
BROWN
WHITE
RED
YELLOW
BLACK
BLUE
114,116
125
124
123
122
121
120
OFF
2
3
4
5
6
7
ROTARY SWITCH
SNSN N17-5-604-68-9857
OR N17-S-59302-1610
MOUNT EXTERNAL
CRZ-6

FIGURE 2

AN/SPA-4
ELIMINATING ARCING ON DEFLECTION COILS

Several cases of arcing from the slip rings on the deflection coils to the driving gear of the AN/SPA-4 have been reported. The manufacturer has investigated this problem and has determined that some of the light lubricant used for running in the driving gear and rollers was probably not removed. This lubricant on the phenolic insulator allowed foreign matter to collect which eventually caused it to break down.

The following procedure is suggested to eliminate this this arcing:

Remove the deflection coils and brush trichlorethylene or an equivalent solvent on the insulator ring. Wipe the insulator ring clean with a clean, dry cloth.

The lubricant remaining on the driving pinion gear and the roller supports will be sufficient to provide lubrication. These assemblies should not be over lubricated.

It is recommended that this be accomplished on new installations before applying power, and as soon as possible on those units presently installed.

AN/SPA-4A, -4B - RADAR INDICATORS

AN/SPA-4A and AN/SPA-4B equipment installed in exposed areas such as the open bridge shall use the Air Cooler HD-276/SPA-4 (Federal Stock Number 4120-623-3024) in place of the Air Exchange Valve MX-1487/SPA-4A.

The HD-276/SPA-4 has been designed to provide watertight protection for the indicators, which should eliminate the problems caused by internal corrosion and dirt that is sucked in through the air exchange valve. Instructions for installation of the HD-276/SPA-4 come with the equipment.

The HD-276/SPA-4 was designed to be used with the AN/SPA-4B; however, it may also be installed with the AN/SPA-4A.

The HD-276/SPA-4 can be requisitioned from the Bureau of Ships only.

ERRATIC OPERATION OF MODELS AN/SPA-8 AND AN/SPA-9 REPEATERS

In some installations of AN/SPA-8 and AN/SPA-9 radar repeaters, THFA-4 cable was used between the power supply and the indicator. Heating of the cable with resultant erratic operation of the repeaters has been reported to the Bureau of Ships.

It is recommended that in all insulations of AN/SPA-8 and AN/SPA-9 radar repeaters where THFA-4 cable was used between the power supply and the indicator, the THFA-4 cable be replaced with THFA-9 cable or TSGA-9 cable, whichever is available.

SWEEP CENTER SHIFT IN AN/SPA-8A

The answer to a problem which has cost many man-hours in the maintenance of Indicator Group AN/SPA-8A has been found.

A symptom of the trouble is excessive center movement of the sweep, either the north-south or east-west axis. The movement, in some cases, can exceed three-quarters of an inch shift.

The trouble was isolated in relay K-1551 in the north-south instance, and relay K-1552 in the east-west case.

The relays were found to be perfectly normal in the deenergized position, but when energized, a resistance of 0.8 to 1 megohm appeared between both pin 2 and pin 5 to the case or ground. The resistance should be infinity. Pin 2 and pin 5 were not shorted together. The measurements must be made with the leads to pins 2 and 5 disconnected. Remedy: replace relay.

This resistance paralleling the feedback network decreases the feedback permitting the sweep input amplitude to be larger than required - thus causing overdrive of the yoke driver and center shift of the sweep.

DRA SYNCHROS

The technical manual for the indicators advise the addition of jumpers to excite the Dead Reckoning Analyzer synchros and the connection of two stator leads independent of the DRA switch position if DRA is not used. (See NAVSHIPS 91411A, fig. 7-44, for AN/SPA-8. See NAVSHIPS 91737, fig. 7-39, for AN/SPA-8A.)

If an indicator should be connected later to a Data Converter (PU-155A/SP) without removing all the above jumpers, two stator leads of each data converter synchro will be short-circuited with DRA either switched ON or OFF. If DRA is switched ON the DRA synchros in the indicator may also be damaged.

Since there is the possibility of forgetting to remove the jumpers, it is suggested that jumpers D55 to D54 and D51 to D52 be omitted. As a result of this change the DRA switch must be OFF to prevent slipping of the manual offcentering controls with no DRA input. This is considered less important than possible equipment damage due to wiring errors.

USE OF TEST PROD SIMPLIFIES MEASUREMENT OF OFFCENTERING VOLTAGE IN AN/SPA-8,-8A, -9

Measurement of the voltage at E-1805-3 (E-1853-3 in the AN/SPA-9) in accordance with alignment instructions in NAVSHIPS 91737, page 7-48, paragraph 44b, has required excessive labor in many installations. This voltage should be checked before making other adjustments affected by it, although the voltage is expected to be stable and to require readjustment infrequently.

Access to E-1805-3 requires tilting the indicator forward almost to its maximum limit, and this may be impractical if the indicator is installed tilted forward. In any installation, vertical or tilted, the same voltage may be more easily measured at the front end of R-1820 on E-1816. This point may be reached by a test prod without having to tilt the upper section of the indicator forward. Remove the front cover and from the front of the indicator insert the test prod at the bottom left side under the servomotor, making contact with the bottom front resistor-mounting terminal on E-1816.

AN/SPA-8, -8A, -9-SWEEP CENTERING DIFFICULTIES

Inability of the N-S centering control R-1372 and E-W centering control R-1376 to center the sweep in normal PPI operation may be a difficult trouble to isolate. In the above case, the centering controls will move the sweep the normal distance but will not bring it to the center of the scope. If the forward bias adjustments can be accomplished as given in the instruction book, the trouble is probably a change in value of R-1807 for centering difficulties in the N-S direction and R-1814 in the E-W direction.

RANGE RING AND RANGE STROBE ADJUSTMENT OF AN/SPA-8A USING TS-573/UP

Range Ring and Range Strobe adjustment of AN/SPA-8A radar repeater as given in Technical Manual for Indicator Group AN/SPA-8A NAVSHIPS 91737, requires the use of an A and R scope, with the OS-5/U being recommended.

Many AN/SPA-8A equipments are being installed on vessels with an electronics-type allowance that does not call for such test equipment.

As an aid to the ships falling into the above category, the following was devised using test equipment normally found aboard the smaller vessels: Range Calibrators TS-358/UP or TS-573/UP.

RANGE RING ADJUSTMENT

If it is found that Range Ring adjustment is necessary, as determined by checks in paragraph 40-b on page 7-43 of technical manual NAVSHIPS 91737, proceed as follows:

1. Remove any incoming trigger or video to the repeater. (Turn radar selector switch to OFF.)

2. Connect plus trigger output of the TS-573/UP to test trigger jack (J-1201) of the repeater and connect a test cable between the strobe Output jack of TS-573/UP and test point TP-1011 of the repeater.

3. Set trigger repetition rate of the TS-573/UP to 160 PPS.

4. Set "Range Rings On " switch (S-1204) on repeater to "Video". (Located bottom right hand corner of front chassis).

5. Turn on TS-573/UP and allow it and repeater to warm up for one hour.

6. Adjust the range ring intensity, sweep intensity, video gain, and focus controls to give fine sharp range rings as viewed on scope. "Video Gain" control will vary the intensity of the strobe from the TS-573/UP.

7. In all future checks, set "Range Selector" so that range rings are approximately 1/2-inch apart. Also operate "Center-Off Center" switch in "Off Center" and position trace so that origin is at edge of scope with maximum sweep visible.

8. Set "Range Rings Miles" switch on AN/SPA-8A to 1 mile and set range dials of TS-573/UP so that strobe from TS-573/UP is in coincidence with the second 1-mile marker on AN/SPA-8A. This will occur at a dial setting of approximately, but not exactly, 004000 yards. Coincidence will be shown by brightening of the mark.

9. After coincidence with the 2nd range marker is obtained, change the dial reading on the TS-573/UP in steps of 2000 yards. The strobe should coincide with each 1-mile marker as range dial of TS-573/UP is progressively increased. Any deviation will be noted by noncoincidence at the greater ranges. Adjust L-1806 (1-mile) if necessary for coincidence over entire sweep. After any adjustments, recheck complete step 9. L-1806 is located directly under "Range Ring Miles" switch (unit must be tilted forward for access to coils.)

10. Set "Range Ring Miles" switch on AN/SPA-8A to 2-miles and set range dials of TS-573/UP so that strobe output of TS-573/UP is in coincidence with second 2-mile marker on scope. This will occur at dial setting of approximately 008000 yards.

11. After coincidence with second range marker is obtained, change the dial readings on the TS-573/UP in steps of 4000 yards. The strobe should coincide with each 2-mile marker as range dials of TS-573/UP are progressively increased. Any deviation should be corrected by adjustment of L-1805 (2-mile) located directly under "Range Ring Miles" switch. If any adjustment is made, repeat step 11.

12. Set "Range Ring Miles" switch to 5-miles and set Range dials on TS-573/UP so that the strobe is in coincidence with second 5-mile marker on Indicator. This will occur at dial setting of approximately 020000 yards.

13. After coincidence is obtained, change dial reading on TS-573/UP in steps of 10,000 yards. The strobe should coincide with each 5-mile marker as range dial of TS-573/UP is progressively increased. Any deviation should be corrected by adjustment of L-1706 (5-mile) located on right rear chassis.

14. Set "Range Ring Miles" switch to 10-miles and set range dials on TS-573/UP so that the strobe is in coincidence with second 10-mile marker on Indicator. This will occur at approximately 040000 yards.

15. Change dial reading on TS-573/UP in steps of 20,000 yards. The strobe should coincide with each 10-mile marker as range dial of TS-573/UP is progressively increased. Any deviation should be corrected by adjustment of L-1705 (10-mile) located on right rear chassis.

16. Set "Range Ring Miles" switch to 20-miles and set range dials on TS-573/UP so that the strobe is in coincidence with the second 20-mile marker on Indicator. This will occur at approximately 080000 yards.

17. Change dial reading of TS-573/UP in steps of 40,000 yards. The strobe should coincide with each 20-mile marker as range dial of TS-573/UP is progressively increased. Any deviation should be corrected by adjustment of L-1704 (20-mile) located on right rear chassis.

18. Set "Range Ring Miles" switch to 50-miles and set range dials on TS-573/UP so that strobe is in coincidence with second 50-mile marker on Indicator. This will occur at approximately 200,000 yards.

19. Change dial reading on TS-573/UP in step of 100,000 yds. The strobe should coincide with each 50-mile marker as the range dial of TS-573/UP is progressively increased. Any deviation should be corrected by adjustment of L-1703 (50-mile) located on right rear chassis.

20. Remove TS-573/UP trigger and marker cable from indicator.

RANGE STROBE ADJUSTMENT

(Range Rings Adjustment must have been completed before this adjustment is made).

1. Set "Range Rings On" switch on the front chassis on indicator to "Video". Set "Functions Control" switch to "Cursor Off". (This puts range strobe and range rings on the PPI sweep.) Turn "Manual OFF Center" switch to "Center".

2. Trigger Indicator from a radar or from TS-573/UP. If TS-573/UP is used, set Rep Rate to 160 PPS.

3. Set "Range Ring Miles" switch to 1-mile and set sweep intensity focus, strobe intensity, and range marks intensity controls to give sharp range marks and range strobe on Indicator.

4. Set "Range Selector" to 4-miles and set the Range Strobe Counter of AN/SPA-8A to 2000 yards. Always approach the counter settings from below in order to eliminate backlash error. Adjust R-1359 (Range Strobe Fast Zero) so that range strobe coincides with the first marker on PPI.

5. Direct sweep to 0 degrees north.

6. Turn on the "Manual-Off Center" switch and set Off Center Counter to 30-miles south and zero east-west. Set Range Strobe Counter to 60,000 yards. Adjust R-1361 (range strobe fast slope) so that the range strobe coincides with the marker at 30-miles. (Determine 30-mile

point by switching "Range Ring Miles" switch to 10-miles and back again to 1.)

7. Repeat steps (4), (5), and (6) until the range strobe lies exactly on the appropriate marker for both settings. Lock the adjustment.

8. Set the "Range Selector" to 45 miles and select 10-mile range rings. Set off centering to 70-miles south. Set Range Strobe Counter to 80,000 yards.

9. Adjust R-1362 (Range Strobe Slow Zero), so that the range strobe coincides with the fourth 10-mile range ring.

10. Set the range strobe counter to 200,000 yards. Adjust R-1364 (Range Strobe Slow Slope) so that the range coincides with the 10th 10-mile marker.

11. Repeat steps (8), (9), and (10) until the range strobe lies exactly on the appropriate marker for both settings. Lock the adjustments. Calibration is complete.

AN/SPA-8A RELAY TROUBLE

Two types of abnormal operation in the AN/SPA-8A involving relay SNSN N17-65155-6073 have been reported.

One repeater developed an east-west center shift which was corrected by changing relay K-1552. After a day of operation, a split sweep appeared on the same equipment and was corrected by changing the same relay (K-1552).

On another repeater, the range strobe could not be made to calibrate with the range rings on the low range (4 to 36 miles). It could be made to coincide with the zero (2000 yards) and the slope (60000 yards) adjustment as per instructions, but in between these ranges, calibration was off as much as from 800 yards low to 800 yards high. The range rings, OSC were found to be accurate, and it was therefore thought that the range potentiometer tracking was not linear. All possibilities that could cause the trouble in this circuit were checked; the relay K1202 (same type as K-1552) was changed. This corrected the nonlinearity of the strobe tracking.

RECOMMENDED METHODS FOR CLEANING RESOLVERS IN AN/SPA-8, -8A, -9, VK-4a AND VK-5 EQUIPMENTS

The Component Reliability Program included a study of failures in the resolvers used with Indicators Group AN/SPA-8, -8A -9, VK-4a and VK-5. The principal cause of failure was the dust produced by wear between brushes and slip rings. Studies reveal that the following cleaning procedure has been quite successful, and after cleaning, the output waveform for the resolvers tested was found to be free of noise. The report indicated that with the normal life of 1000 hours consumed prior to the first cleaning, 1200 to 1400 additional hours could be run without serious evidence of noise development. No report was made regarding a second cleaning, although it is worthy of trial.

A. Cleaning Directions for B-1801 and B-1804 of AN/SPA-8, -8A and -9 (Figure 1)

1. Remove support for stator terminals 2, 3, 4 and 7 (2 screws).

2. Immerse slip ring and brush end in Sovasol 5 until brushes and slip rings are completely covered. Rotate armature rapidly several times to effect cleaning. Remove from Sovasol and allow to drain. Blow out with air hose if possible. Replace stator terminal holder.

3. Remove three screws holding plate located in the center of name plate and lubricate bearing with No. 2135 General Purpose Lubricating Oil. Replace plate. Mark resolver with date of cleaning.

B. Cleaning Directions for B-102 and B-103 of VK-4a and VK-5 (Figure 2)

1. Remove plastic cover form resolver (2 screws).

2. Immerse slip ring-brush end in Sovasol 5 until brushes and slip rings are completely covered. Rotate armature rapidly several times to effect cleaning. Remove from Sovasol and allow to drain. Blow out with air hose if possible. Replace plastic cover.

3. Drop No. 2135 General Purpose Lubricating Oil in the hole at the terminal end of the resolver. Mark resolver with date of cleaning.

NOTE: To determine the effectivness of the cleaning, the various activities are requested to do the following:

(1). Inform the Material Laboratory of the dates of initial and second cleanings.

(2). Comment regarding any difficulties encountered with the cleaning method.

(3). Forward correspondence to the Commander, New York Naval Shipyard, Brooklyn 1, New York, Att: Material Lavoratory (Code 933).

AN/SPA-8A POTTING COMPOUND LEAKAGE

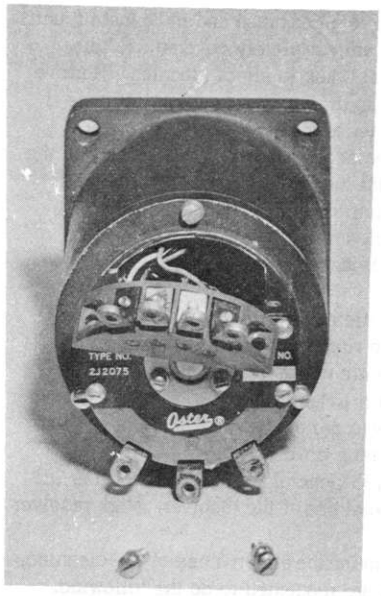
Transformer TF-129/SP, used in the AN/SPA-8A radar indicators, have been reported to leak the potting compound after several hours of use.

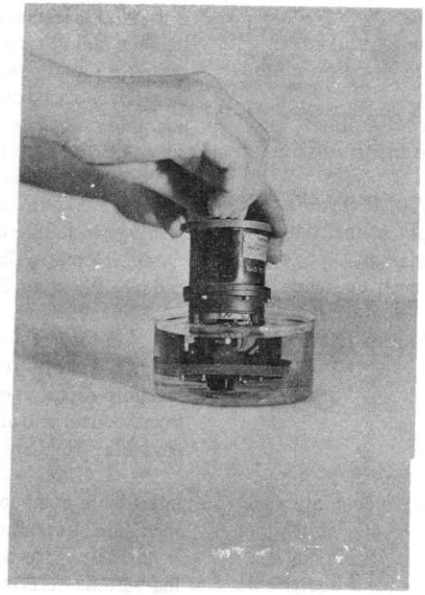
The leakage of the potting compound does not impair the operation of Transformer TF-129/SP. The potting compound used in this transformer is used for sound absorbtion.

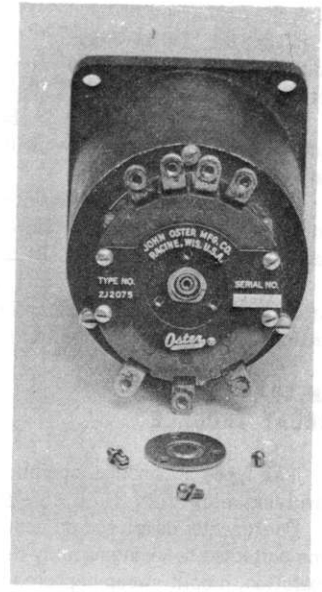
TF-129A/SP will not be authorized as replacement for TF-129/SP, unless they are otherwise defective or beyond repair.

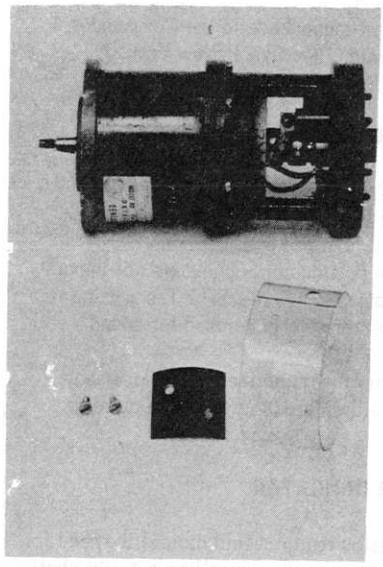
AN/SPA-8B, RADAR INDICATOR

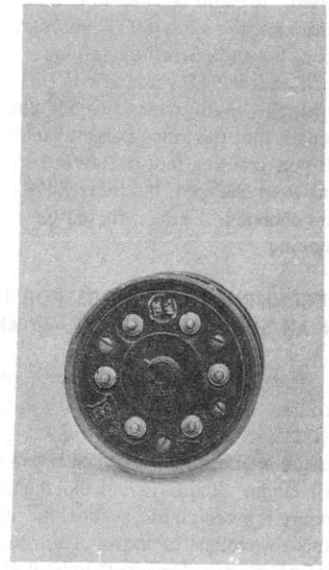
Where the installation requirements dictate the need for AEW inputs and transmission, the installing activity shall procure from stock the appropriate synchros and install them in the indicator. Delivery of the AN/SPA-8B without AEW synchros installed, was intentional.











Methods for Cleaning Resolvers.

AN/SPA-8C RADAR INDICATOR WIRING ERROR

A wiring error exists in Radar Indicator, AN/SPA-8C serials 1 through 6.

To correct this error, leads to C-1288, located in lower left corner of the front chassis, should be interchanged. The orange lead with blue tracer should be on the terminal marked common, the grey wire should be on the opposite terminal of C-1288.

The Technical Manual for the AN/SPA-8C, NAVSHIPS 93133, is correct.

RADAR INDICATOR AN/SPA-33 AND TECHINICAL MANUAL NAVSHIPS 93156

It has come to the Bureau's attention that the potentiometers (R-1831, R-1832, R-1833, R-1834) in the Manual and AEW off-centering circuits can be easily burned out during adjustment procedures if the improper multimeter is used to determine the minimum resistance readings.

The R times 10 scale of the AN/PSM-4 Multimeter should be used for performing the required adjustments described in section 6, NAVSHIPS 93156, Technical Manual for the AN/SPA-33.

Paragraph 6-19b, page 6-26 of NAVSHIPS 93156 shall be modified by pen and ink to indicate that the AN/PSM-4 Multimeter is required to perform the adjustments on the off-centering potentiometers.

Paragraphs 6-28g(2) and 6-29h(2), pages 6-39 and 6-40 of NAVSHIPS 93156 shall be modified by pen and ink to indicate that the R times 10 scale of the AN/PSM-4 Multimeter shall be connected to the potentiometers to obtain minimum resistance readings.

Page 7-109, section 7 of NAVSHIPS 93156, reference designations R-1831, R-1832, R-1833, the locating functions shall read "M-OC N-S off-centering control," "M-OC E-W off-centering control," and "AEW N-S off-centering control" respectively.

INDICATOR GROUP AN/SPA-33

Subsequent to delivery of initial quantities (approximately 100 units) of the AN/SPA-33, it came to the contractors attention through production testing that a failure will occur in the indicator when the relays as manufactured by the vendor malfunction. Correction of this possible malfunction has been eliminated in all later relay production.

The malfunctioning will be apparent in only those relays which have B plus or B minus across their terminals. Malfunctioning would become apparent to the operator if the following symptoms were viewed during operation:

The Bureau has notified ESO of this situtation so that sufficient replacements will be provided for the relay in the supply system.

SYMPTOM	COMPONENT FAILURE
The intensity of the sweep is decreased when the range selector crosses the 336 miles switch point.	Relay Symbol K-1202 (FSN N5945-666-0957) pins 2, 3 or 11 shorted to each other or to ground.
Range strobe loses calibration quickly or jitters when the strobe is below 34 miles. The yards counter may also start hunting.	Relay Symbol K-1203 (FSN N5945-666-0957) pins 2, 3, or 11 shorted to each other or to ground.

AN/SPN-6 STABILIZATION MOTOR

Many failures of stabilization motor B-801 in the AN/SPN-6 Radar have resulted from the breakdown of its oil seal. Inspection showed that this oil seal failed because of inadequate lubrication of the stator bearing.

In order to minimize motor and bearing failures, it is suggested to all ships and stations having AN/SPS-6 radar equipment that the lubrication check-off lists on pages 93 to 97 of NAVSHIPS 91810.41 be carefully followed and kept up-to-date.

AN/SPN-8 REDUCTION OF DAMAGE TO PLASTIC RADOMES

A revised method of installing the plastic radomes of the antennas of Radar Set AN/SPN-8 has been suggested.

This plastic radome is mounted and bolted in place by 24 bolts through a flange on the radome. Flat washers are used with the bolts to distribute the pressure of the bolts on the flange. However, these washers are so small that excessive tightening of the bolts causes cracking or strains in the plastic.

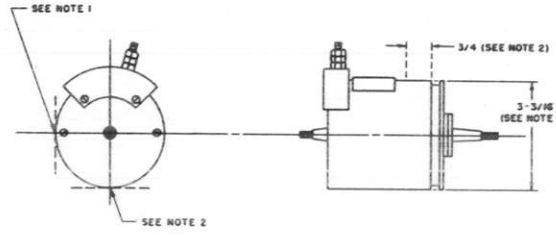
A metal bearing ring should be fabricated to fit the Radome flange with bolt holes appropriately located. This ring would give a more even distribution of the bolt pressure on the flange of the radome, and reduce the possibility of fracture or strain in the plastic.

The circumference of this metal ring would be about 254 inches, making it difficult and costly to fabricate and unwieldy to install in one piece. However, the ring can be made in 4 sections of 1/16 inch metal. This should make for easier production and handling, and would still give the desired protection for the radome.

This suggestion is for use by the various activities and ships at their discretion. There is no information available at this time to show the extent of radome damage. Therefore, no general modification instructions on this installation will be issued at this time.

AN/SPN-8 REPLACEMENT SCAN MOTOR

Scan motors for Radar Set AN/SPN-8 should be examined for conformance to figure 1 when withdrawn from stock. Milling may be performed by installing activity if necessary for proper fit.



NOTES:

1. PRODUCTION RUN TYPE D-15-12 IS OVERSIZE, BEING 3.250 INCH DIAMETER OVERALL. A FLAT OF 0.050 INCH SHOULD BE MILLED LENGTH OF BODY AT THIS POINT.
2. MILL FLAT OF 0.050 INCH FOR A LENGTH OF 3/4 INCH AT THIS POINT.
3. IF TOLERANCE HAS BEEN MAINTAINED DISREGARD NOTES 1 AND 2.
4. ROTATION - COUNTER CLOCKWISE WHEN VIEWED FROM TERMINAL BOARD END.

AN/SPN-8 SCAN MOTOR
D-2233

Figure 1

AN/SPN-12 QK-427 MAGNETRONS

A quantity of 400 Type QK-427 magnetrons (AN/SPN-12 radar equipment) has been shipped to the Electronic Supply Office for distribution to the fleet, less tube data sheets that specify point at which tube should be operated. Raytheon Manufacturing Company is providing data sheets in booklet form and they will distributed to all concerned.

Ships receiving Type QK-427 magnetrons, less tube data sheet, should refer to data sheet booklet by tube serial number for tube operating characteristics.

MODEL AN/SPN-12 RADAR INCREASING LIFE OF MAGNETRON QK-427

In order to prolong the life of magnetron QK-427 (V401), Operating personnel must fully understand the correct procedure for adjusting filament current. Two independent filament control circuits exist in the AN/SPN-12 - one for warm-up and standby, the other for radiating conditions. The first circuit is controlled by rheostat R509 located on the rear of the high voltage power supply door, and the second, by variable transformer T521 located on the high voltage meter panel and identified as magnetron heater control. Relay K502 switches between the two circuits when anode voltage is applied to the magnetron. During standby and radiating magnetron filament current must be maintained between 2.8 and 3.0 amperes.

However, during warm-up, to insure the starting of oscillations, R509 is adjusted to raise the filament current above the normal level. Once the oscillations have started, the current is adjusted by means of T521 on the front meter panel. When the unit is returned to standby condition for a prolonged period, R509 must be readjusted to bring the filament current to its proper level. Failure to follow this procedure will greatly shorten magnetron life. Reference - NAVSHIPS 92262 (A).

AN/SPN-12 (XN-1) SHIPMENT OF INCORRECT PEN ELEMENTS

The pen element provided in the equipment maintenance repair parts is not the correct part. The part (Esterline-Angus No. 9892, Raytheon No. 1946-1008P-9) should be forwarded to InsMat, Boston, for return to the contractor. The correct pen element can be obtained through normal channels under FSN N6625-171-4986.

AN/SPQ-5 RF RADIATION HAZARD DISTANCE

Recent measurements of the AN/SPQ-5 radar have shown the maximum RF radiation hazard (RAD-HAZ) distance to the safe tolerance level (10 MW/CM^2) is 10 feet from the AN/SPQ-5 antenna. Where RAD-HAZ warnings have been posted, on the basis of any previous distance, they are to be relocated in accordance with the new 10-foot distance.

COAXIAL COUPLER FOR AS-45A/SPR-2 ANTENNA

Delivery has just been completed under contract (NObsr 30117) with the Barlow Engineering Company, New York, N.Y., for 200 Navy type UG-340/U coupling units. These are coaxial units for connecting Navy type RF-8/U solid-dielectric coaxial cable, and are employed in the model AS-45A/SPR-2 "Y" waveguide antenna with which the model AN/SPR-2 receiver is used. A total of 87 of those couplers has been shipped to the Navy Supply Depot at Clearfield, Utah, and 100 have been sent to the Depot at Mechanicsburg, Pennsylvania.

It is recommended that those ships on which the AS-45A/SPR-2 is installed and the couplers are needed, should apply to the nearest Electronics Officer. The coaxial coupler can be installed by the ships crew in a matter of a few hours; Navy yard availability is not necessary. The type RF-8/U, solid-dielectric cable from the receiver to the coupler, should be kept as short as is practicable because of the attendant losses inherent in this type of cable.

A previous article on this coupler explained its function in the radar countermeasures system, and reproduced a drawing (BuShips Plan No. RE50F131A, entitled **Coupler, Coax RG-8/U to 1½" x 3" Wave Guide Assembly and Detail.** Attention is directed to the fact that this coupler was previously referred to as type 49890 but is now referred to as Navy type UG-340/U. The approved BuShips drawing is RE49F449A, entitled **Adapter, UG-340/U Coaxial Line to Wave Guide (RG-8/U to RG-48/U).**

It is recommended that Electronics Officers request these coupling units from either of the Naval supply depots previously referred to and have the units available for installation, distribution, or stock. 1/1/48

TUNING UNITS FOR AN/SPR-2 RECEIVER

Maintenance reports on AN/SPR-2 indicate an increasing number of oscillator-cavity failures. These cavities are in short supply and should be handled with the greatest of care and repaired if at all possible. The TN-56/SPR-2 tuning units have sliding-finger shorting rings for tuning, which cause wear on the cavity and noise during tuning if excessive wear has occurred. The majority of units have a plate cap soldered to the plate rod. Failure reports indicate that the plate cap becomes loose due to the melting of solder by the heat of the oscillator tube. Upon cooling, a cold solder joint is formed. Under such conditions, the cavity becomes noisy. This point should be thoroughly inspected when the cavity is being repaired. A few of the latest AN/SPR-2 equipments have a collar around the plate cap over the plate rod. No failures have been reported for this type of unit.

The TN-56B/SPR-2 tuning units have reactance-plunger cavities with no sliding fingers. The TN-57/SPR-2 tuning units, shown in the preliminary instruction books for the AN/SPR-2 equipment were not procured.

The present applicable instruction book for the AN/SPR-2 is NavShips 900,654. 1/1/50

AN/SPS-4 WAVEGUIDE GASKET

It has been pointed out that AN/SPS-4 waveguide flanges have failed to mate properly on all sides. Instead of remaining in the slot indentation provided, the neoprene gaskets, upon compression, crept over the ridge adjacent to the waveguide cavity and prevented metal-to-metal contact-resulting in RF leakage.

This condition was corrected by slightly trimming the inner edge of the gasket so that it could not (when compressed) slip between the raised flange faces. Improper fitting of the flanges may be a possible source of trouble in other AN/SPS-4 installations, and should be checked in cases of poor target range, low efficiency, low ringtime, or high-voltage standing wave ratio.

MD-132/SPS-4 MODULATOR F-109 FAILURE

Radar Modulator MD-132/SPS-4 has been reported, in some instances, to have frequent failure of F-109 fuse due to V-101, V-102, and V-103 tube (94B31 dual filament diode) failures.

In either V-101, V-102, or V-103 location, the 4B31 had one-half of the parallel filament open. The tube appeared to be "ON", as the filament glowed but the open half was not noticed. Replacement of the 4B31 that had failed corrected the condition of frequent F-109 fuse failure.

CRYSTAL DETECTOR REMOVAL AND INSERTION TOOL FOR AN/SPS-4

The mixer assembly (RE-201) for the AN/SPS-4 is a precision item. Periodic removal of the crystal (1N23B or equivalent) in this assembly is necessary. During this removal the crystal holder may become damaged if the crystal is removed or inserted at an angle with common tools. A special tool has been designed which will permit horizontal insertion of the crystal and which will prevent damage to the holder.

Figure 1 shows the complete tool which can be used to insure positive spring contact and to check these contacts without removing the complete sub-assembly. It will reduce the likelihood of damage and will greatly simplify the job of crystal removal and replacement.

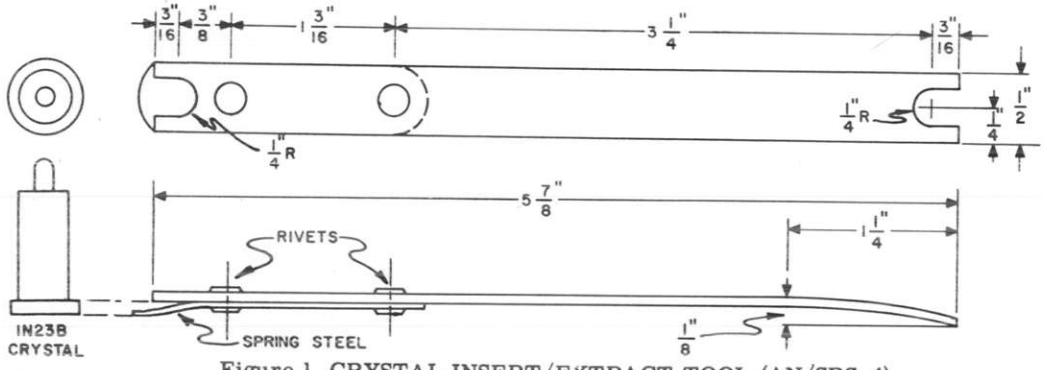


Figure 1 CRYSTAL INSERT/EXTRACT TOOL (AN/SPS-4)

RADAR INSTALLATION MOUNTING

A suggested method of mounting the AN/SPS-5 radar receiver-transmitter unit has been submitted to the Bureau. The construction data of figure 1 is sufficient to fabricate the mounting and it may be used for guidance in planning installation of AN/SPS-5 radar. This is in addition to information shown in the Bureau drawing for the AN/SPS-5 radar set. The drawing number is RE 65F 2194A, Outline and Mounting Dimensions.

REPLACING THE RANGE COUNTER ASSEMBLY

The following describes a method for removing and replacing the range counter assembly.

In this procedure, left and right will mean as viewed from the front of the indicator unit.

Remove the two machine screws that hold the range crank on the front of the indicator unit to the range counter assembly.

Withdraw the indicator from the cabinet and loosen the

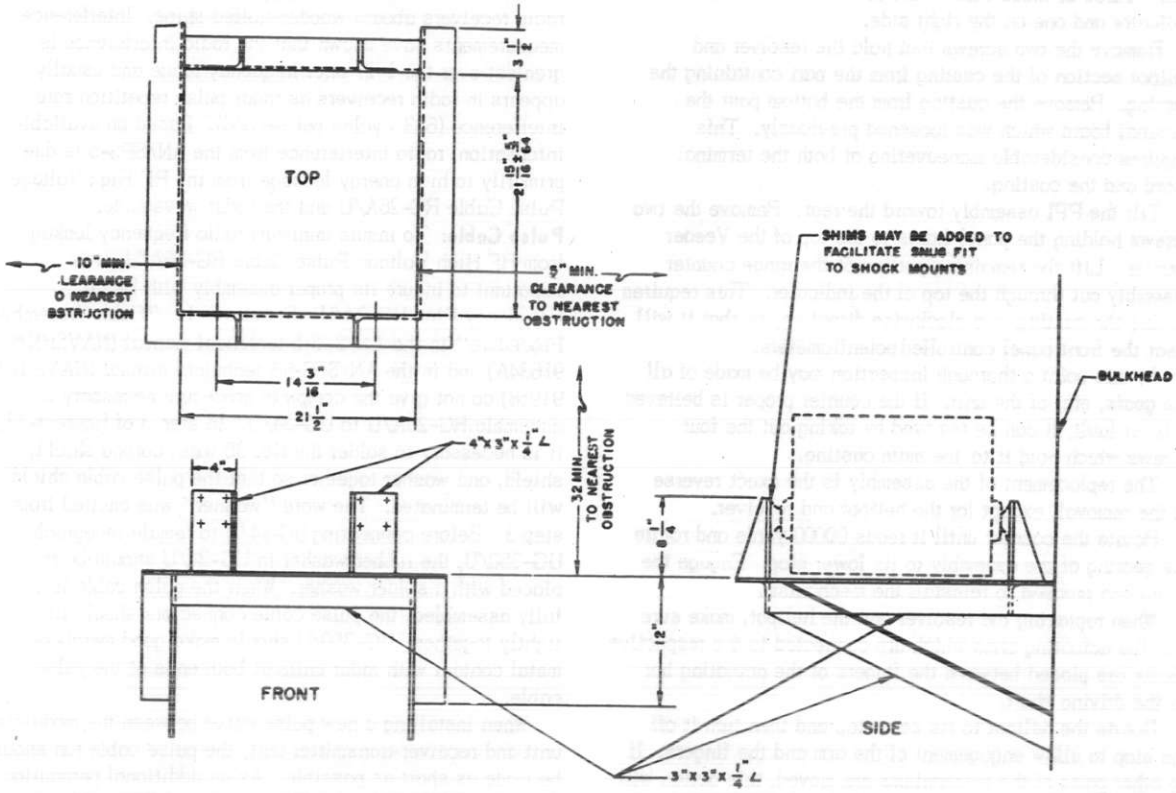


FIGURE 1.—Rack Mounting and Clearance Requirements for Receiver-Transmitter Unit of Model AN/SPS-5.

two knurled screws that hold the PPI assembly to the main frame. Tilt the PPI assembly to the rear and remove the front screw which holds the terminal board to the main chassis. This terminal board is located immediately to the left of the range counter assembly. Remove the two mounting screws which hold trimmer capacitor C-717 to the main frame. This capacitor is located to the right of the PPI assembly. Return the PPI assembly to its original position and secure one of the locking screws.

Rotate the entire indicator forward. This will enable removal of the rear screw holding the terminal board, the screw being almost hidden by the cabling at the extreme rear of the unit.

Remove the resolver by lossening the three holding clamps and allow it to hang on its wiring. Remove the three screws that hold the helipot to the assembly casting. Allow the helipot to hang on its wiring.

Remove the four casting mounting screws which hold the casting of the assembly to the main frame of the indicator unit. Three of these screws are located on the front of the indicator and one on the right side.

Remove the two screws that hold the resolver and helipot section of the casting from the part containing the gearing. Remove the casting from the bottom past the terminal board which was loosened previously. This requires considerable maneuvering of both the terminal board and the casting.

Tilt the PPI assembly toward the rear. Remove the two screws holding the panel lights to the top of the Veeder counter. Lift the remaining portion of the range counter assembly out through the top of the indicator. This requires turning the casting in a clockwise direction, so that it will clear the front panel controlled potentiometers.

At this point a thorough inspection may be made of all the gears, etc. of the unit. If the counter proper is believed to be at fault, it can be removed by taking out the four screws which hold it to the main casting.

The replacement of the assembly is the exact reverse of the removal, except for the helipot and resolver.

Rotate the counter until it reads 00000 yards and rotate the gearing of the assembly to its lower stop. Engage the gears and proceed to reinstall the mechanism.

When replacing the resolver and the helipot, make sure that the actuating arms which are connected to the respective shafts are placed between the fingers of the actuating bar on the driving shaft.

Rotate the helipot to its zero stop and then turn it off the stop to allow engagement of the arm and the fingers. If no other parts of the mechanisms are moved, this action will restore the helipot without a need for recalibration.

Do not tighten the three locking bars on the resolver at this time.

When a thorough check has been made to insure that all parts are properly aligned and free to turn, energize the equipment and after the appropriate time delay press the "Radiate On" button and check the resolver alignment. This may be accomplished very easily as follows:

(1) Set the range switch to the 10-mile position and the fixed markers switch to the 1-mile position. First, be sure that the range bug can be moved from zero range to its limit (20 miles) smoothly without disappearing or jumping back or forward.

(2) Then turn the range crank so that the bug and the fixed marker are in exact correspondence. This may be observed as a slight blooming on the PPI. Read the range dial. Any discrepancy in reading from an even mile is a measure of how far the resolver is out of zero. Then set the range counter to an even mile and turn the case of the resolver until the bug and fixed marker bloom. Tighten the three locking bars. If a check reveals that there is still a 10-or 20-yard difference in the position of the bug and the fixed marker, adjust C-730 for the bloom. Check at all ranges for linearity.

INTERFERENCE FROM AN/SPS-5

Background: Shipboard radio interference reports have listed frequently Radar Set AN/SPS-5 as a source of radio interference to radio receivers. The highest interference levels from the AN/SPS-5 equipment have been found in radio receivers aboard wooden-hulled ships. Interference measurements have shown that the radio interference is greatest over the 1-27 m.c. frequency range and usually appears in radio receivers as radar pulse repetition rate interference (683 cycles per second). Based on available information, radio interference from the AN/SPS-5 is due primarily to high energy leakage from the RF High Voltage Pulse Cable RG-26A/U and the radar waveguide.

Pulse Cable: To insure minimum radio frequency leakage from RF High Voltage Pulse Cable RG-26A/U, it is important to insure its proper assembly with Radio Frequency Plug UG-34/U. Figures 3-11, "Cable Assembly Procedure" in the AN/SPS-5 technical manual (NAVSHIPS 91634A) and in the AN/SPS-5B technical manual (NAVSHIPS 91958) do not give the complete procedure necessary to assemble RG-26A/U to UG-34/U. In step 3 of figure 3-11, it is necessary to solder the No. 30 wire, corona shield, shield, and washer together so that the pulse cable shield will be terminated. The word "washer" was omitted from step 3. Before connecting UG-34/U to female receptacle UG-350/U, the rubber washer in UG-34/U should be replaced with a solder washer. When the pulse cable is fully assembled, the pulse cable connectors should fit tightly together. UG-350/U should make good metal-to-metal contact with radar units at both ends of the pulse cable.

When installing a new pulse cable between the modulator unit and receiver-transmitter unit, the pulse cable run should be made as short as possible. As an additional percaution, the radar pulse cable should be separated from cable wireways so that radio interference from the pulse cable will not contaminate other ships' cables which in turn may carry interference to the vicinity of radio receiving antennas.

Waveguide: High-frequency energy leakage from Waveguide RG-106/U can be held to a minimum if the waveguide flange contacting surfaces are carefully cleaned, aligned, and assembled during the waveguide installation. The waveguide gasket should not prevent the waveguide flanges from mating properly, or serious radio interference will result. NAVSHIPS 9000,171, the Electronic Installation Practices

Manual, Chapter 11, "Rigid RF Transmission Lines," gives procedures for cleaning, assembling, and checking aluminum waveguides. To CHECK FOR WAVEGUIDE LEAKAGE: Chapter 11, page 11-41, states: "After the radar is operating, inspect every flange with a neon bulb such as Standard Navy Stock Number G17-L-6806-120. If the neon bulb can be lighted on any joint, remake the joint."

Trigger Cable: On several ships, interference surveys have also found that radio interference was due to improper connection of Radio Frequency Cable RG-12/U from Azimuth Range Indicator to remote PPI. Where this occurred it was found that the center conductor and cable shield terminations were connected in reverse at the Azimuth Range Indicator end of the trigger cable. The center conductor of trigger cable should be connected to H61 on terminal strip E710 and the shield should be connected to H01 on terminal strip E710. In addition, the trigger cable armor should be bonded to the frame of the radar equipment at both ends.

Detecting Interference: An interference test can be made with a high frequency radio receiver connected to a radio receiving antenna located in the vicinity of the antenna of the antenna of AN/SPS-5 to determine if the AN/SPS-5 is causing radio interference in the ship's radio receivers. A headset and multimeter should be connected to the radio receiver output so that readings of receiver output level may be taken while listening for radio interference. The Power Switch on the Radar Indicator Unit should be turned ON, leaving the Radiate Switch on the Indicator Unit OFF so that the high voltage pulse circuits will be de-energized. The radio receiver can then be used to check for radar pulse repetition rate interference (683 cycles) by turning Radiate Switch ON and OFF.

An increase in the multimeter reading (db scale) and in the headset (noise) when the Radiate Switch is ON, indicates that the radar is causing radio interference. All frequency bands of the radio receiver being used for test should be scanned for interference from the radar.

General Instructions: General interference reduction measures for AN/SPS-5 include proper grounding of all radar units (including waveguide) to the hull or ship's grounding system (wooden hull) using solid metal straps not less than one-half inch wide by 0.020 inch thick. The armor on all radar cable should be bonded to the equipment at both ends, using solid metal straps not less than one-half inch wide by 0.020 inch thick. The d-c resistance of ground and bond connections should be less than 0.01 ohm. The interference reduction measures should be accomplished if excessive radio interference from AN/SPS-5 is found in any of the ship's radio receivers.

ANTENNA NOISE

An inspection of the equipment disclosed that when the antenna was rotated in a clockwise direction a clicking noise developed—a sharp tick occurred with each revolution.

Upon further inspection, a cable was discovered rubbing against the slip ring assembly. This cable contains three wires attached to E607 and runs through the hole at the bottom of the drive motor housing into the slip ring chamber. The cable attaches to the brush block assembly, safety switch and terminal strips E602 and E603. Investigation showed that one of the screws which attaches the wires in the rotating section of the slip ring was loose and protruding about one-fourth inch. Under some conditions of operation, this screw apparently would pick up the stiff cable which was lying against the rotating slip rings and stretch it until the cable would snap loose and hit the side of the "flower pot" causing a ringing tick similar to a bad gear tooth. This condition was eliminated by securing the cable away from the slip rings and tightening down the loose 6/32 screws.

SOLUTION OF FAILURE PROBLEM

Over a period of three months a condition of slightly unstable targets has become worse to the extent that target bearings were entirely unreilable. The presentation on the scope appeared to move 5° to 10° from one sweep to the next and to return to a proper bearing. Eventually, targets would appear to fall off 5° to 10° at a time and then the deflection coil would reverse its direction of rotation. This apparently happened when the deflection coil was 180° behind the antenna. When the deflection coil was in alignment with the antenna, another reversal of direction would occur.

While the condition was intermittent, it was impossible to trace the difficulty to its source. A thorough check was made of the associated synchro system which was found to be normal in all respects. Friction was then suspected and after removal of the PPI tube, considerable accumulation of carbon dust was found in the gear housing of the deflection coil drive and the bearings were very dirty.

The instruction book does not have an exploded view of this assembly. However, the deflection coil gear was removed with a minimum of difficulty. Eight screws secure this assembly to the frames and slack should be given the electrical connections to the brushes by removing the wires at terminals 32 and 33 at E719.

After cleaning, lubricating, and replacing the bearings, operation was again normal.

AN/SPS-5 ANTENNA FEED HORN ALIGNMENT JIG

An alignment jig for the AN/SPS-5 equipment and a procedure for its use has been suggested. The jig may be constructed and used by shipyard and repair activities as locally authorized.

Procedure for Aligning Antenna Feed Horn:

To obtain the proper antenna radiation pattern, it is important that the antenna feed horn be correctly positioned with respect to the reflector. The slightest misalignment results in a radical change of radiation characteristics of the antenna. This rather critical adjustment is initially performed during the final testing of the equipment before shipment, and an antenna radiation pattern is made to insure proper performance.

Should the occasion arise in the field where an improper radiation pattern is suspected, the above mentioned adjustment should be checked. Misalignment of the feed horn could be caused by improper positioning during shop overhaul, a sharp blow, etc.

The following special equipment will be required:

(a) SPS-5 Feed Horn Adjustment Jig

(b) Flexible Steel Tape

NOTE: For these adjustments, the antenna mount does not necessarily have to be level. We are only concerned with the proper relationship between the feed horn and the reflector.

PROCEDURE: (See Figures 1, 2, and 3)

1. Insert the jig in a vertical position, end ring from the left side, between the reflector and the left side of the feed horn. (NOTE: All directions are given facing the front of the antenna.) The bracket on the left side of the jig should rest on the tenth horizontal reflector strut, counting from the bottom, and its outer edge should touch the inner side of the first vertical strut to the left of the vertical center line of the reflector. The vertical edge of the jig should be held flush with edges of the horizontal struts it touches.

The other end of the jig should now be held flush against the left side of the feed horn and the scribe line on the jig should be matched to the punch mark on the left side of the horn edge (this mark will be found 5-1/4" down from the top of the horn). Now, note whether or not this edge of the jig lines up properly with the corresponding edge of the feed horn. (NOTE: This is in reference to the metalic edge of the horn and not the protective covering. The protective covering will be found to be about 1/4" in thickness. Usually, it will not be found necessary to remove any paint in order to identify this metal edge).

Make no adjustments at this time. Since adjustments in any one plane will affect the adjustments in the other planes, it is advisable to first ascertain what adjustments are necessary in all planes, then make all adjustments at approximately the same time.

2. To check vertical alinement of the feed horn, proceed as follows: Locate the notch marks on the bottom horizontal strut of the reflector. (These two marks will be found approximately 12" from the outer edges of the reflector). Using the flexible steel tape, measure the distance from one of these notches to the closest top corner of the feed horn. Compare this measurement with a corresponding measurement of the distance between the notch on the other side of the reflector and its nearest top corner of the feed horn. These measurements should match to within 1/16". Repeat this procedure, using the lower corners of the feed horn and the corresponding notches on the reflector. Here again, they should match to within 1/16". Again, repeat this procedure, using the back corners of the horn (most forward portion of the antenna) and the same notches.

3. If incorrect adjustments are found, it will be necessary to reposition the horn as required. This is accomplished by loosening the various clamps and braces attached to the feed horn and the horizontal boom upon which it rests. Another available adjustment is the bracket which secures the very end of the rectangular wave-guide to the horizontal boom. By loosening the two securing bolts on this bracket, some play will be available.

To summarize, final adjustment is accomplished when the following four conditions are met:

(a) The vertical plane of the reflector is properly positioned with respect to the vertical edge of the feed horn, as noted by the use of the Adjustment Jig.

(b) The top corners of the feed horn are equidistant from their corresponding notches on the lower horizontal strut- allowable tolerance ± 1/16".

(c) The bottom corners of the feed horn are equidistant from their corresponding notches on the lower horizontal strut- allowable tolerance ± 1/16".

(d) The back corners of the horn (most forward portion of the antenna) are equidistant from their corresponding notches on the lower horizontal strut - allowable tolerance ± 1/16".

The above procedure is identical with that used in Final Test at the Plant and the end result has always been a correct radiation pattern. After the initial adjustment, yellow paint was put across each clamp so that any movement of these clamps would immediately become apparent at any future date. These yellow paint marks will prove helpful in the field.

While on the subject of this antenna, it might prove profitable to mention the following information. Should it ever become desirable to slew the antenna vertically (air search), always do so by normal electrical slewing or by cranking the extension shaft located on the gear box. NEVER attempt to force the reflector by hand as severe damage to the limiting microswitches will result.

SPS-5 equipment are herein compared with those of the radar equipment involved. One or both equipments may be off frequency; therefore, only a comparison is obtained by this method. However, this method will provide a check between periods when a calibrated standard range marker may be available during yard or tender overhaul.

AN/SPS-5 TEST FEATURE

The use of the AS-511/SPS-5 antenna tilt feature for ring time measurement when the radar is land-locked in port has been suggested. Targets do not saturate the video when the antenna beam is raised above the land targets. This method may be used by other maintenance personnel at their discretion.

AN/SPS-5B INSTALLATION ON MSC VESSELS

AN/SPS-5B equipments installed on MSC-type craft may cut-out whenever mine Detecting Set AN/UQS-1D mine locator equipment is energized unless the following precautions are taken:

1. Check the calibration of the 15KW controller voltmeter.
2. Adjust the 15KW generator output to provide 120 volts at the electronics power panel.
3. Mark the controller voltmeter to show the proper adjustment for this voltage (which should be approximately 123 volts at the controller).

NOTE: Mark the external surface of the voltmeter with a grease pencil or other nondamaging material.

AN/SPS-5, -5B ANTENNA LUBRICATION PROBLEM

In regions where the temperature is expected to fall below 50° F, MIL-L-6086, Grade L, Lubricating Oil, FSN W-9150-265-9417, should be used in the antenna pedestal main gear installed aboard vessels in lieu of using MIL-L-2015-90 oil.

AN/SPS-5C--OPERATIONAL NOTES

The following has been compiled from reports submitted by the forces afloat, field activities, and manufacturer's field representatives as the most commonly occurring malfunctions in the AN/SPS-5C and AN/SPS-5D radar sets.

1. Malfunction of the antenna-starting timer relay K511 may cause burn-up of antenna motor B801 or motor-starting capacitor C524. A check of the proper operation of this relay and relay K504 should be made immediately and as part of the monthly POMSEE routine. Particular attention should be directed to the accurate 1.5-second time setting of relay K511. The correct timing for this relay is usually obtained when the dial on relay K511 is set at position "1".

2. Care should be exercised to ensure that the antenna switch S714 at the control indicator is turned OFF when returning the antenna-disabling switch S901 to the ON position. Proper operation of the starting relays K511 and K504 and starting capacitor C524 occur only at the time that S714 is turned ON. Antenna-motor burn-up may occur if starting is attempted without the proper relay sequencing. A field change is under study which will permit safe starting of the antenna with the antenna disabling switch S901 or with antenna switch S714.

3. Several reports have been received that the time delay relay has been set for three minutes. Time-delay relay K204 should be set for a full five minutes.

4. In a number of installations the Receiver-Transmitter RT-510/SPS-5C has been mounted incorrectly on the bulkhead so that the unit is on its side (in this position the cover is removed in a horizontal direction). Arcing and apparent failure of pulse transformer T101 has occurred in these installations. Satisfactory operation was restored when the unit was remounted properly so that the transmitter waveguide-output flange is underneath. It has been noted in most of these cases that no permanent damage to pulse transformer T101 had resulted.

5. The spacing of the protective spark-gap E105 in the Receiver-Transmitter RT-510/SPS-5C is extremely critical. This device, which is mounted on pulse transformer T101, must prevent the magnetron pulse voltage from exceeding 35,000 volts, the spacing between the adjustable ball and the ground plate must never exceed 0.5 inch. Arcing at the spark gap when properly set to 0.5 inch is an indication of trouble which is causing the magnetron to misfire. This misfiring may be caused by an unsatisfactory magnetron, improper magnetron-filament voltage, improper modulator high-voltage adjustment, or incorrect pulse repetition-rate adjustment. Under no circumstances should the spark gap be increased to eliminate arcing. This gap should be carefully checked and adjusted to 0.5 inch whenever the pulse transformer T101 is moved or replaced. The handle of the magnetron-klystron tuning tool may be used as a handy gage for checking the 0.5-inch spacing.

6. The air flow through Radar Modulator MD-352/SPS-5C must not be impaired by dusty air filters. The proper cooling of the selenium high-voltage cartridge rectifiers CR401-408 and high-voltage regulator tube V402 depend on high air flow. The wire-mesh filter 0415 in the modulator front cover should be removed weekly (more often if the unit is located in oily machinery spaces) and thoroughly blown out with compressed air. Do not use water or solvents. Even with a properly functioning air filter, dust accumulation may occur. Dust accumulation must be controlled, particularly in the high-voltage areas immediately behind blower B401. Reports of charring and arcing at the socket of high-voltage regulator tube V402 indicate build-up of dust bridges around the high potential contacts and cooling fins of this tube. A monthly inspection should be made for dust around regulator tube V402, rectifiers CR401-408, and the resistor boards and tube components mounted above and alongside the high-voltage box.

> CAUTION: Whenever working within Radar Modulator MD-352/SPS-5C be sure that all power is OFF and that capacitors have been shorted to ground.

7. Many field failures occur when the proper countdown circuit adjustment within the control indicators is not

observed. The proper procedure for adjusting these circuits (V711-V715) is clearly described in Section 7 of the applicable technical manuals. It is absolutely necessary to use an oscilloscope AN/USM-32 or OS-8( )/U to aline these circuits and to follow the procedure in the proper order. Instability and misadjustment of the countdown circuits will have a deleterious effect on the pulse repetition rate and on the operation of the magnetron oscillator V101. While arcing at the magnetron protective spark gap may occur for several reasons, such as a weak magnetron, improper high-voltage adjustment, or regulation within the modulator, a major reason is improper countdown chain adjustment. When excessive pulse repetition rate is experienced and the console countdown circuits are functioning properly (disconnection of modulator trigger returns pulse repetition rate at console to normal) the blocking oscillator in the modulator should be checked for changed circuit values. Remove V421 and measure cathode pin voltage (pin 3 or 6 XV421). This voltage should be between 27 and 31 volts d.c. If it is not, check R421-2 for changed values. Trigger generator V717 should also be checked.

CAUTION: Whenever working within Radar Modulator MD-352/SPS-5C be sure that all power is OFF and that capacitors have been shorted to ground.

8. Doubt appears to exist concerning the correct magnetron current reading which should be observed at position "1" of meter M301 in Receiver-Transmitter RT-510/SPS-5C. With the system pulse repetition rate properly set at 683 p.p.s., the magnetron current should be adjusted to 87 microamperes. This value should be well within the adjustment of High-Voltage Adjust Control R413 in Radar Modulator MD-352/SPS-5C.

9. Several improperly performed AN/SPS-5C and 5D installations have been reported in which the modulator safety circuits failed to function. In these cases, the fault was failure to connect the interconnecting cabling, particularoy the circuit between terminal B1003 on E202 of the power-supply unit. A check for the proper operation of this safety circuit is as follows:

a. In Radar Modulator MD-352/SPS-5C remove thermal time-delay relay K403 from its socket.

b. Energize the radar set in the normal manner (all units closed; therefore all interlocks properly closed). Permit the set to warm up for the normal five-minute preheat period.

c. Check:

1. In the AN/SPS-5C, press the radiate button button S708. The transmitter should radiate only while the button is pressed and should stop radiating when the button is released. If radiation continues after release of button, shut down equipment **immediately.**

2. In the AN/SPS-5D, turn power switch S704 from "Standby" to "Radiate." The set should radiate for about 0.5 second and then stop radiating. If set continues to radiate, turn power switch S704 to OFF **immediately.**

d. If the radar radiates continuously with relay K403 removed, there is a fault in the safety circuits. Referring to the Primary Power-Distribution Diagram, figure 2-2, in the appropriate technical manual trace out the continuity of the radiate and safety circuits starting at terminal B03 of terminal board E205 of the power supply unit. This test also checks the proper operation and setting of time delay relay K505 in the AN/SPS-5D when the radar momentarily radiates for 0.5 seconds.

10. The minimum range of 75 yards in the POMSEE sheets is in error. The AN/SPS-5, 5A, and 5B equipments had a minimum range of 150 to 175 to 200 yards. Field change 1—AN/SPS-5C and field change 1—AN/SPS-5D for minimum range applies to equipment serials 1 through 99. Serials 100 and after were changed in production.

11. Reports from the Fleet indicate some confusion as to equipment nomenclature and serial number. When field change 18-AN/SPS-5 or field change 12-AN/SPS-5A has been accomplished, the equipment becomes an AN/SPS-5C equipment and the serial number of the AN/SPS-5C equipment is the serial number of the radar-set group OA-2237/SPS-5C which was used to make the change. When field change 11-AN/SPS-5B has been accomplished, the equipment becomes an AN/SPS-5D equipment and the serial number of this AN/SPS-5D equipment is the serial number of the radar-set group OA-2237/SPS-5C which was used to make the change. The equipment nameplate (AN/SPS-5C or AN/SPS-5D should be attached to the power-supply unit when the field change is made. The equipment serial number should be on this nameplate, and it should be the same as the serial number of the nameplate for the radar-set group OA-2237/SPS-5C which is attached to the modulator.

12. Field change 2—AN/SPS-5C and field change 2—AN/SPS-5D should be accomplished at the earliest opportunity. This field change was written up in EIB 556 and applies only to equipment serial numbers 1 through 168. Subsequent serial numbers already have this change.

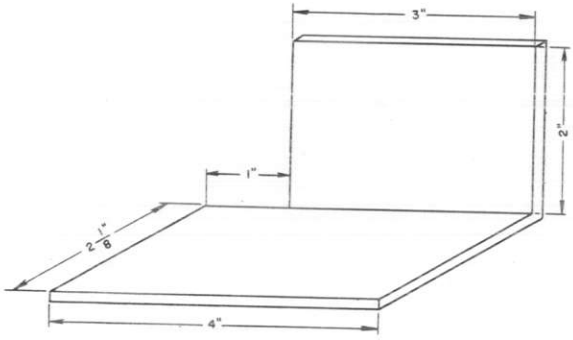
AN/SPS-5 PULSE CIRCUITRY ARCING

The lead running from terminal 6 of pulse transformer T103 to R116 on component panel "A" is a potential source of arcing. Improper spacing of this lead will result in arcing of the modulator pulse input to the pulse transformer. The lead should be "dressed" as far away as possible from the pulse line strap between J101 and Terminal 1 of T103.

If replacement is necessary, use high voltage insulated wire that is sufficiently rigid to remain clear of the pulse line strap under conditions of vibration.

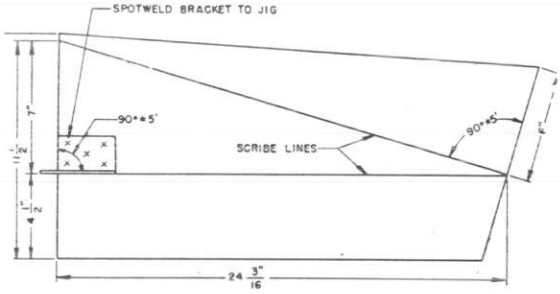
Figures 7-21 and 7-92 in NAVSHIPS 91634(A) (AN/SPS-5) or figures 7-22 and 7-74 in NAVSHIPS 91958(A) (AN/SPS-5B) will assist in pinpointing the lead when checking the equipment.

THERE IS NO MARGIN FOR ERROR HERE: Make certain all power is off and all capacitors discharged (with a grounding stick) before checking the equipment.



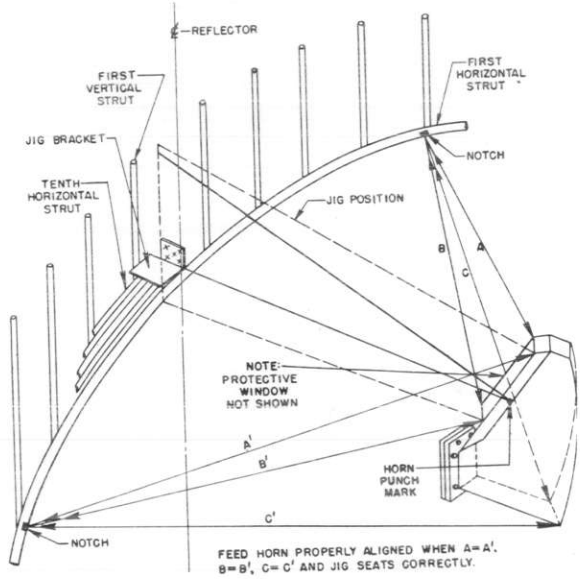
ISOMETRIC VIEW OF BRACKET

Figure 1



SPS-5 FEED HORN ALIGNMENT JIG

Figure 2



PERSPECTIVE VIEW SHOWING POSITION OF ALIGNMENT JIG

Figure 3

REPORT ON RADAR CONDITION AND MAINTENANCE

The following AN/SPS-6 radar report was forwarded to the Bureau:

Condition:

1. Very poor.
2. Receiver tuning unstable, breaks into oscillation occasionally.
3. Arcing at the waveguide shutter assembly.
4. Internal arcing in magnetron at lowest plate voltage. Magnetron current unstable.
5. No indication of T/R tuning.
6. The STC was full on, blocking all echoes out to 15 miles, overloading the rest of the sweep.

Action taken:

1. Inasmuch as the magnetron high voltage power supply was stable, the trouble was presumed to be in the R.F. system. A new magnetron was installed and baked, thereby removing unwanted gases that might cause instability.
2. A check was made of the waveguide run and it was found that the flexible section in the antenna was badly cracked, causing a loss in sensitivity and possible a change in the impedance match of the system. This section was removed and silver-soldered. Upon reassembly, the section cracked slightly again. As there were no spares available, Field Change 19, which consists of an improved type section, was ordered.
3. The entire receiver and I.F. preamplifier was removed to the shop for servicing. Four partially shorted capacitors, C-209, C-2006, C-2008, and C-2009 were replaced from spares. The receiver local oscillator cavity contained metal filings and foreign matter. Many of the tube fingers were bent out of shape. Four of them were broken off, and the remainder made poor contact in general. As the complete disassembly, cleaning, reassembly, and alignment of this unit requires considerable time, it was decided to clean the cavity as well as possible while still intact. An alcohol and ether solution was used for this purpose. The tube contact fingers were carefully straightened and the receiver preamplifier was installed.
4. The waveguide shutters were backed all the way out to prevent them from arcing. The equipment was then fired up and it was found that the new magnetron's frequency was unstable. The echo-box meter and the standing wavemeter varied constantly. As the new magnetron was considered to be at fault, a thorough search was made to obtain another. Although seven replacement magnetrons were listed as being on board, none was found. During the inspection of the installation, the ship rolled slightly and water was observed pouring out of the waveguide shutter assembly. The entire waveguide run was again inspected, but the water's point of entry could not be found. Due to the physical location of the flexible section, any water therein would merely run out of the drainage holes provided in the feed-horn assembly. In the installation the waveguide run is horizontal from just above the S.W.R. tuner until it goes up through the deck some 15 feet away. To remove the water already collected and to prevent further difficulties of this kind, a small slot was saved in the waveguide at the other end of the horizontal run. This allowed water to run out at the slot or the waveguide shutters with each movement of the ship. About a gallon of water was thus removed.
5. The T/R cavity was removed for cleaning while the waveguide was drying out. As it evidently had never been cleaned before, metal polish was necessary to remove all the oxidation. An alcohol and ether solution was then used to remove all traces of metal polish. The original T/R tube was cleaned and reinstalled, and the mixer crystal was replaced, having a low front to back ratio of 3 to 1.
6. A TS-34/AP synchroscope was hooked into the transmitter at the jacks provided. This evidently was not the custom on this ship as the coaxial fittings on the scope and the transmitter did not match, and some time elapsed before a proper fitting could be located.
7. The transmitter was fired up and found to be stable in all respects. The water, now removed, had been sloshing around in the waveguide and varying the impedance match, of the entire system, and causing it to be unstable. The equipment was then tuned up as the ship pulled out to sea. The T/R box now tuned sharply, but the local oscillator tuning was still critical. However, it was believed that it would operate satisfactorily as echoes could definitely be peaked. Saturated echoes were now received out to 190 miles. The S.T.C. control was adjusted so that most of the sea return was removed and nearby targets could be seen.
8. The equipment was now operating most efficiently.

Work to be done:

1. Field Change 19 should be installed as soon as it is received.
2. The local oscillator cavity should be completely disassembled, cleaned, and aligned at the earliest opportunity.

Many such reports are received each month by the Electronics Division of the Bureau of Ships and indicate only one thing—LACK OF PREVENTIVE AND CORRECTIVE MAINTENANCE.

A report of poor radar operation and performance can, in 98 percent of the cases, be directly traced to poor maintenance.

FALSE ECHO ON AN/SPS-6 SERIES RADARS

The presence of a false echo on an AN/SPS-6B Radar Set has been reported. The false echo appeared at a range of 4,500 yards with a width of 1,000 yards and remained fixed at all bearings. The trouble proved to be a defective pulse transformer, T109.

These defective pulse transformers were all supplied in one small lot to the manufacturer from the vender and were discovered almost immediately to be defective. Apparently, a few defective transformers have been shipped in radar sets and in maintenance repair parts.

The explanation for the false echo is that a voltage surge from the pulse transformer, caused by core material of the wrong characteristic, appears after the main pulse and causes the magnetron to oscillate.

In cases where the false echo is observed, the transformer should be installed.

In cases where the transformers in both the equipment and the maintenance repair parts are defective and a replacement is not available, the Bureau of Ships authorizes the following temporary modification to eliminate the false echo until a good transformer is available:

1. Install an 1,850-ohm resistor with a 50-watt rating between the pulse transformer terminal C and ground.

WAVEGUIDE FLANGE GASKETS

The waveguide gaskets inserted between the flanges of Radar Set AN/SPS-6 are fabricated so that electrical continuity is maintained throughout the entire waveguide run. Before the waveguide is installed, the gaskets should be cleaned bright with a cloth in order to assure good electrical contact between the flanges. The gasket should never be coated with glyptal, shellac, or any other material in order to hold the gaskets in position or to obtain a tight fit.

STANDING WAVE RATIO TUNER

Bureau of Ships Drawing RE 10F 627B gives details for fabrication of a Standing Wave Ratio Tuner (SWRT) for use with Radar Set AN/SPS-6. This drawing shows the SWRT installed adjacent to the directional coupler on the top side. In order to clarify any possible ambiguity as to the correct location in which to install the SWRT, Bureau of Ships Drawing RE 10F 627B has been altered. This drawing. RE 10F 627C, now shows the correct location of the SWRT immediately adjacent to the directional coupler, on the antenna side. The SWRT should not be installed in the waveguide near the antenna pedestal or between the transmitter and directional coupler.

FLEXIBLE WAVEGUIDE CLAMPS

Reports have been received that the flexible waveguide sections on AN/SPS-6, AN/SPS-6A, and AN/SPS-6B antennas are failing due to fatigue caused by vibration flexure.

Clamps are provided on the upper surface of the feed horn support at the spot where the flexible waveguide passes through this feed horn support. These clamps are designed to be attached rigidly to the feed horn support with the flexible waveguide clamped between them. A large bearing surface is provided on each clamp, and two through studs with elastic stop nuts on either end pass through holes at the ends of the clamp bearing surfaces.

With the flexible waveguide located between the clamps (the studs forming the short sides and the clamps forming the long sides of a rectangle surrounding the waveguide), the waveguide can be securely clamped between them by holding the studs with pliers while the nuts at each end are tightened. This, of course, shortens two sides of the rectangle and compresses the waveguide between the clamps which are the other sides. The clamps should be tightened as tight as possible without buckling the flexible waveguide.

Next, the clamps should be rigidly attached to the feed horn support using the four bolts provided. After the flexible waveguide clamps are installed properly, a check of the wedging of the waveguide in the clamps and of the tightness of the clamp attachment to the feed horn support should be made at least once a month. The clamping action can be increased by holding the stud with pliers and tightening the nuts at either end.

When the waveguide is properly clamped, it should not be possible to cause relative motion between the waveguide and the clamps by tugging at the waveguide.

In addition, the hardware connecting the flexible waveguide to the upper tube and to the feed horn and elbow, and the mounting bolts of the upper tube clamp should be tightened. The location of this hardware is shown correctly in figures 3-5, 3-6, and 3-7 of the technical manual. See points (A) and (B) and step (6).

LUBRICATION

All Antenna Mountings, AB-146/SPS-6, have red cardboard tags attached to remind installation personnel to lubricate the equipment properly prior to commencing operations. Some of these tags have been shipped with incorrect information on them.

By error the tags call for Navy Type—2190T Oil. They should specify U.S.A. 2-105 GR 90 Oil. All persons concerned with installation of this equipment please note.

REPLACEMENT OF MAIN DRIVE GEAR IN TYPE AB-146/SPS-6 ANTENNA MOUNTING USED WITH SR AND AN/SPS-6 SERIES RADARS

Reports received by the Bureau indicate that many main drive gears (symbol 0-1350) for Antenna Mounting AB-146/SPS-6 are being replaced as soon as they begin to show signs of wear.

The manufacturer of this equipment advises that this gear should not be replaced until the amount of wear, as shown in the sketch, amounts to three sixty-fourths of an inch. As wear in this gear is discovered, it can be compensated by the backlash adjustment described below. When a replacement is made, only a gear (symbol 0-1350) from spares should be used. Any substitution with gears manufactured locally will endanger the warranty provision of the contract for this equipment.

WEAR OF TEETH AS SHOWN BY DOTTED LINES IS REASONABLE AND CAN BE EXPECTED. DECREASE THICKNESS OF SHIM 0-1351 TO REDUCE BACKLASH AS WEAR INCREASES WHEN "W" ABOVE APPROACHES $\frac{3}{64}$. GEAR 0-1350 SHOULD BE REPLACED. WORN SURFACE SHOULD REMAIN SMOOTH AND POLISHED.

Since spare main drive gears (symbol 0-1350) are available upon request, substitution of this part will be authorized for emergency situations only. It is possible to use the gear until it is well worn by compensating as described in the following paragraphs. A gear with a scored or torn surface should be replaced regardless of the depth of wear.

Wear in the gear is compensated in the following manner—If the backlash is greater than 0.003", the thickness of shim 0-1351 must be decreased. Remove the motor from the mounting and examine shim 0-1351. It appears to be made of solid sheets, but is actually made up of 0.002" thick laminations which can be peeled off after one spot is loosened with a jack knife. Removal of one such lamination (0.002") will decrease the backlash by about 0.0018". Remove the number of laminations required to bring the backlash within the specified limits of 0.001" to 0.003". Reinstall the motor and again check the backlash. Repeat this process until a suitable reading of backlash is obtained.

If the difference is less than 0.001", the thickness of shim 0-1351 must be increased. To do this, laminations peeled from a shim taken from spare parts must be added to shim 0-1351 until the proper backlash is obtained. The same procedure for measuring backlash as that outlined above should be followed.

REMOVAL OF STANDING WAVE RATIO TUNERS

The tuning Iris assemblies, better known as the Standing Wave Ratio Tuners, installed in the wave guide runs of SR-3, SR-6, and AN/SPS-6 Series radar equipments, were provided to reduce high standing waves over portions of the operating frequency band.

Results of fleet tests indicate that the VSWR in well planned wave guide runs exceeds the permissible limits over only a small proportion of the operating frequency band. In addition the tuner assembly must be adjusted whenever the operating frequency is changed in order to obtain minimum standing waves in the wave guide. For the above reasons authorization is granted for removal or omission of subject tuners from installations where tests show a VSWR of 1.5:1 or better over 80 percent of the operating frequency band. It is requested that a note or graph of the test results be attached to the transmitter frame near the calibration charts. The note or graph should clearly indicate the frequency ranges that should be avoided. It is requested that a complete copy of the test results or resulting graph be forwarded by personnel conducting the tests to the Bureau of Ships for review and recording.

In cases where the above conditions of VSWR cannot be met, it is recommended that the wave guide run be redesigned with the guidance of Bureau of Ships restricted letter S67-(16)-(45) (981-982-504) Serial R-981-3668 of 11 May 1948.

Should it be necessary to retain the Standing Wave Ratio Tuner as part of the wave guide system it must be installed as shown on Bureau of Ships drawing RE 10F 627C or E1B No. 279.

RECOMMENDED ADJUSTMENT OF STC CONTROLS

Fleet tests on the subject equipment indicate that the tracking of small close-in targets can be greatly enhanced by an optimum setting of the STC circuit.

The following adjustment settings appear to give the best results:

a. Duration—Maximum setting.

b. Flat—One-fourth of full swing of the potentiometers.

c. Depression—One-fourth of full swing of the potentiometers.

Personnel responsible for this adjustment should be careful not to use too great a setting of the depression and flat controls as this will result in small targets such as buoys being suppressed. When making the adjustments, long range and close-in small targets should be observed and settings made accordingly to give optimum detection of both. In all cases, duration should be set at maximum.

REPLACING B-1303

The following is the approved procedure for replacing the drive motor, B-1303, in the antenna mounting AB-146/SPS-6 used with the following radars: AN/SPS-6 series, SR-3 with Field Change 6 and SR-6 with Field Change 5.

Unscrew the antenna mounting switch box cover and turn electrical stow switch to OFF. Mechanically stow the antenna. Drain the oil from the main and gearmotor housings. While the oil is draining, open the antenna mounting terminal box and disconnect leads 168 and 170 on terminal board E-1301 and 60 and 71 on E-1302.

Loosen the conduit tube at the motor and at the terminal box, and remove it, slipping out the four motor leads. Remove drive motor B-1303 from the main mounting housing by removing the eight hex bolts which retain it. Jacking screws are provided for loosening this motor in its seat. Note that a laminated shim, symbol 0-1351 is installed between the motor mounting flange and its seat in the main housing. Do not destroy this shim. It provides the necessary backlash adjustment between the gearmotor output pinion and the main drive gear 0-1350.

Remove the shim 0-1351 from the motor which has just been taken out of the mounting and place it in position on the replacement motor. With this shim in place install the new motor. Do not reinstall the conduit tube nor reconnect the motor leads yet. Wait until after the backlash has been properly adjusted.

Measure the backlash between the main drive gear 0-1351 and the output pinion of the drive motor as follows:

a. Lift the mechanical stowing lock, freeing the antenna for rotation.

b. Insert lead wire about one thirty-second of an inch in diameter into the mesh of the gears. Turn the antenna by hand, drawing the lead wire into one side of the gear mesh and forcing it out the other. The lead wire will be flattened in spots.

c. Measure the thickness of the wire at two adjacent flattened places with a micrometer. The sum of these two

thicknesses is the backlash of the gears. This backlash should not be more than 0.003 inch nor less than 0.001 inch. If the sum of the thicknesses of two adjacent flat points of the lead wire does not lie within these limits, the backlash must be adjusted.

If the backlash is greater than 0.003 inch, the thickness of shim 0-1351 must be decreased. Remove the motor from the mounting and examine shim 0-1351. It appears to be made of solid sheet, but is actually made up of 0.002 inch thick laminations which can be peeled off after one spot is loosened with a jackknife. Removal of one such lamination (0.002 inch thick) will decrease the backlash by about 0.0018 inch. Remove the number of laminations required to bring the backlash within the specified limits of 0.001 inch to 0.003 inch. Reinstall the motor and again check the backlash. Repeat this process until a suitable reading of backlash is obtained.

If the difference is less than 0.001 inch, the thickness of shim 0-1351 must be increased. To do this, laminations peeled from a shim taken from spare parts must be added to shim 0-1351 until the proper backlash is obtained. The same procedure for measuring backlash as that outlined in paragraph E should be followed.

When the proper backlash adjustment has been obtained, reinstall the motor conduit tube. Connect motor lead A2 to terminal 168, F2 to 170, A1 to 69 and F1 to 71. Close the terminal box cover, turn the electrical stow switch to ON, and screw the switch box cover on. The mounting is now ready for operation, except that it has not been refilled with oil. This is of the utmost importance. Fill both the oil reservoirs, the main housing reservoir and the gear motor reservoir, immediately. Operation of the mount, even for a few minutes, without lubrication will cause failure.

R-F LEAKAGE

Reports received in the Bureau indicate that R-F leakage from the transmitter of Model AN/SPS-6 radar causes considerable loss in equipment performance and creates serious interference with other equipments installed within the same compartment.

Upon investigation of such a report it was found that the transmitter compartment was so filled with radiation from the transmitter of Model AN/SPS-6B radar that arcs could be drawn from the cases of other equipments and a two watt neon bulb would light when held within two feet of the transmitter.

Further investigation revealed that the waveguide choke coupling UG-612/U, was one-eighth inch too low, one-eighth inch too far to one side and was canted at an angle to the transmitter. When the choke coupling was properly aligned, the R-F radiation in the transmitter compartment was reduced to a negligible amount.

In view of the above all AN/SPS-6 radars should be investigated for similar R-F leakage due to incorrect alignment of choke coupling UG-612/U. If this choke coupling is incorrectly aligned, immediate action should be taken. To further insure against R-F leakage and interference the present ground straps at the transmitter should be replaced with 2-inch copper straps.

ANTENNA FAILURE TO ROTATE IN HIGH WINDS

Many reports have been received by the Bureau concerning the inadequacy of AN/SPS-6( ) radar antenna to rotate in relatively high winds after Field Change 6-AN/SPS-6( ) has been installed.

The purpose of Field Change No. 6-AN/SPS-6( ) is to provide a proper aerodynamic balance of the antenna for improving its rotation in high winds. This is accomplished by installing a new antenna support beam and a wind vane assembly.

A letter received by the Bureau reported failure of the antenna (with Field Change 6-AN/SPS( ) installed) to rotate in winds greater than 40 knots. The letter further stated that upon examination it was noted that the antenna was approximately 10 inches farther from the rotational axis than a similar antenna aboard a neighboring vessel.

The above 10-inch difference in antenna distance from the rotational axis is due to partial installation of the field change aboard the reporting vessel. The wind vane assembly of the field change was installed without the new antenna support beam.

A far greater unbalance of the antenna would result from installation of a wind vane assembly on an old style antenna support beam than would exist before such an installation.

In view of the above, all AN/SPS-6( ) radar antennas should be inspected to insure that complete and proper installation of Field Change 6-AN/SPS-6( ) has been made.

Identification of antenna support beams should be made in sufficient light and with the beams on as level a surface as possible.

Any antennas found with an old style antenna support beam should be corrected as quickly as possible by installation of the correct beam or Field Change 6-AN/SPS-6( ).

It is to be noted that there are three different field change kits and that all are stocked by the Electronics Supply Office under one stock number (F5840-301-6500). A request for Field Change No. 6-AN/SPS-6( ) should contain correct identification of the antenna type for which the kit is desired.

Shipyards should review all antenna support beams presently on hand which are not part of a field change kit in stock, and all spare support beams of the new style should be reported to Bureau of Ships.

The diagrams in figure 1, and steps 1 through 4 are offered as a guide for identification of the antenna support beams.

1. Determine whether a particular beam is obsolete or redesigned by noting angle at "A" on print. NOTE.—The observer must look at the beam at eye level or the angle will be deceiving.

2 The lower edge should then be examined and compared with the sketch, paying particular attention to the direction in which the edge slopes at "B" (i.e., up level, or down).

3. The upper edge should then be examined and compared with the sketch, paying particular attention to the direction in which the edge slopes at "C."

4. Finally, the beam should be measured as indicated on the sketch; i.e., between the left end and the extended centerline of the splined hole. This centerline is the rotational axis.

ANTENNA PEDESTAL CORROSION

Antenna pedestal failures in Radar Set AN/SPS-6 due to entrance of water around the spline portion of the main drive shaft have been reported. The upper support bearing is immediately below the cover plate at the top of the pedestal and any water leakage here corrodes and quickly destroys the bearing. Water can also drain down the drive shaft and corrode the exposed portion of the drive gears. If a sufficient quantity of water enters, the pedestal heater thermostat can be damaged, causing too much or too little heat. Too much heat will burn the oil and deposit carbon.

Corrective action taken on the AN/SPS-6C equipment by applying a heavy, viscous gasket-forming material such as Permatex. No. 2 or Gasket Goo No. 2 around the spline shaft where it makes contact with the cover plate. The material is applied just before assembly with the Y-beam. When the Y-beam is pressed into position it forces the gasket material into the space between the spline on the shaft and the cover plate. This forms an effective seal against the entrance of moisture.

OIL LEAKAGE IN ANTENNA PEDESTALS

Several reports have been received about oil leaking around the "hard" gasket between the drive motor and the antenna pedestal of air search radar. The leakage occured after accomplishment of Field Changes 17-SR-3c, 19-SR-6a, 19-SR-6b, 21-AN/SPS-6, 21-AN/SPS-6A, or 21-AN/SPS-6B. Generally, the reports indicated that tightening of the associated bolts did not stop the leakage.

The "hard" gasket was replaced with a fiber gasket fabricated aboard ship from 1/16 inch material. The corrective measures taken have proven satisfactory after 2,400 hours' operation, and should be useful in other installations.

REPLACING HEATER ELEMENTS

A difficulty has been pointed out in replacing the heater element in Radar Set AN/SPS-6. The drive motor,

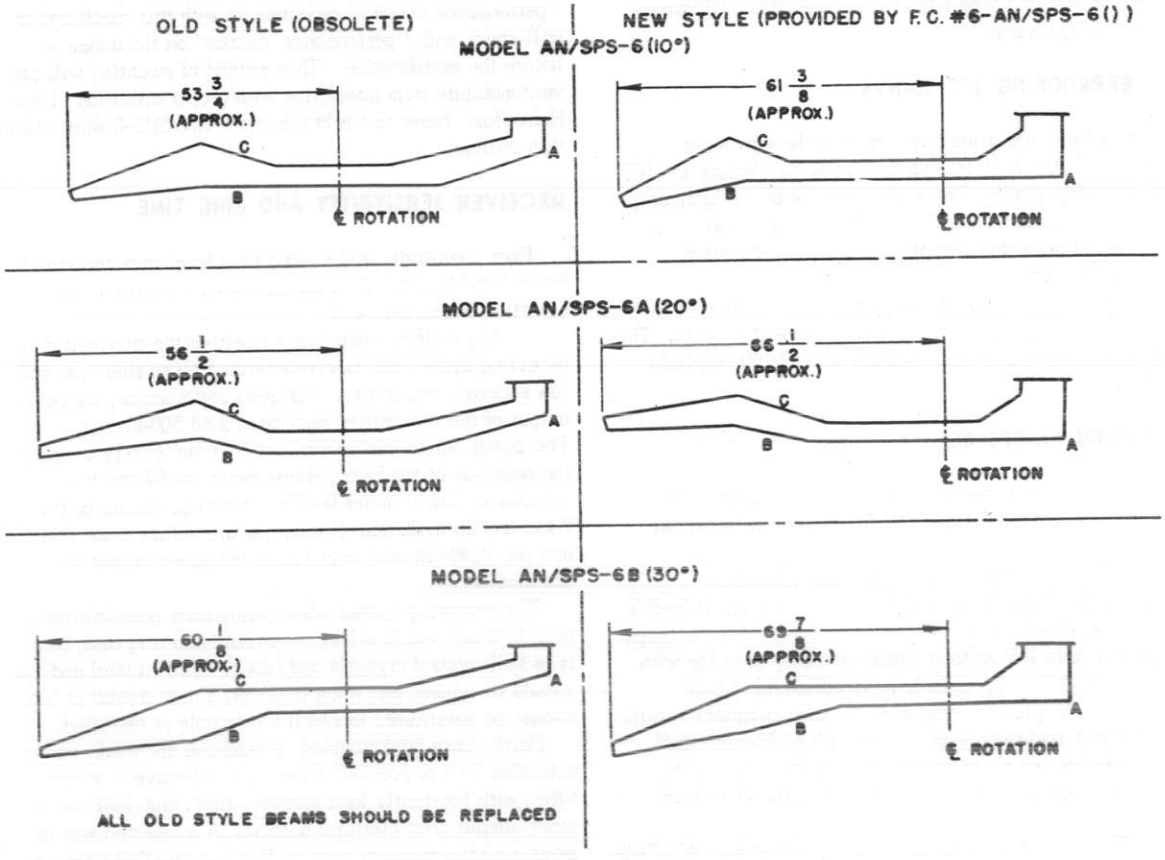


FIGURE 1.—Model AN/SPS-6( ) antenna support beams.

synchro generator and the spindle with its gears must be removed to get at the screws securing the heater clamp. They suggest that a hole be drilled in the center of the clamp and that holes (5/8-16) be drilled and tapped directly underneath in the pedestal. Using these holes to clamp the heater element will permit its removal without disassembly of the pedestal. This should be done only during antenna overhaul.

FAILURES IN AFC UNIT

The Bureau has received several reports of failures in the AFC unit of the AN/SPS-6 equipment. Generally, these reports do not state if Field Changes 20-AN/SPS-6, 20-AN-SPS-6A, 20-AN/SPS-6B and 25-AN/SPS-6, 25-AN/SPS-6A, 25-AN/SPS-6B have been accomplished. These field changes were designed to prevent most of the component failures in the AFC units. Therefore it is highly desirable to accomplish these field changes as soon as possible.

Field Change 20-AN/SPS-6, 20-AN/SPS-6A and 20-AN/SPS-6B (NAVSHIPS 98296) is a type II field change entitled, "Protection of AFC Unit." Field Change 25-AN/SPS-6, 25-AN/SPS-6A and 25-AN/SPS-6B (NAVSHIPS 98361) is a type I field change entitled, "Improvement of AFC Chassis".

WATERPROOFING IFF JOINTS

Some field activities have had trouble with water leaking into the AN/SPS-6 Series pedestal through the IFF coaxial cable joints. The water mixes with the lubricant, therefore causing the bearings and housing to corrode and rust. Water also gets into the waveguide and causes considerable damage.

An effective method for stopping this condition is to apply duck seal to all IFF cable and connector joints. This method has been used successfully by at least two field activities.

NOTES ON AN/SPS-6C

The following notes are from a "New Equipment Performance and Operation" (NEPO) report on Radar Set AN/SPS-6C:

1. Adjustment of the plus 150-volt regulated supply in the receiver of AN/SPS-6C is critical. If R-865 (plus 150-volt adjust) is inadvertently set so that the output voltage is plus 150 volts or higher (entirely possible with meter error of 3 to 4 percent), an objectionable ripple appears on the plus 150-volt bus. In late equipment serials, the stamped data near R-865 reads "plus 145-volt adj." Amend earlier serials to read as above, thus moving the adjustment further from the critical point, thereby minimizing the change for ripple generation.

2. The magnetron spanner wrench supplied with AN/SPS-6C must be used in very close quarters. Operation of this wrench is hampered by the length of its handle which causes it to strike obstructions. Remove 1 inch from the handle to allow sufficient clearance and greatly simplify its use.

3. Data stamped on the vertical edge of the chassis mounted on the antenna control unit identifies the adjacent tube and potentiometer For example, directly above V-1106 the daa. reads:

XV-1106 R 1127
V-1106 6AU6

It is suggested that "XV1106" be deleted and in its place be inserted "Bias Adj." The amended data will read:

Bias. Adj. R-1127
V-1106 6AU6 ·

This data would be useful to maintenance personnel and it is recommended that R-1111 and R-1135 be identified in a like manner, inserting their respective functions.

MOUNTING OF ECHO BOX ANTENNA

A suggestion by the New York Naval Shipyard, proposes that the reliability and life of Echo Box Antenna Type CAY-66 ALO for AN/SPS-6 be improved by mounting the antenna in an upside-down position. Small mounting brackets will have to be made so that the dipole elements of the antenna will be in the same position as they would be if the antenna were mounted right side up. This is necessary so that "performance checks" on antennas with this modification will check with "performance checks" on the antennas before the modification. This method of mounting will prevent moisture from interfering with proper operation of the Echo Box. Refer to Field Change 6-AN/SPS-6 when making this change.

RECEIVER SENSITIVITY AND RING TIME

Poor sensitivity and no ring time have been reported for Radar Set AN/SPS-6C. Proposed ways to correct this situation are as follows:

Any malfunctioning unit in either the transmitting or receiving system can be characterized by no ring time and low receiver sensitivity. For good performance, the power output of the transmitter must be around 500-kw. peak. The power output can be monitored within 2 db by observing the readings of the high voltage meter M-102 and the magnetron current meter M-103. Readings should be 6 to 7 kv. and 26 to 30 ma. If readings are within these limits and the VSWR is less than 1.5/1, the power output is satisfactory.

The receiving system offers many more possibilities for trouble which would affect sensitivity and ring time, since it is built around crystals and tubes. Each crystal and tube should be tested, and when in doubt, a new crystal or tube should be sutstituted to see if the trouble is remedied.

Particularly hard troubles to diagnose are weak, bad or defective T-R or pre-T-R tubes. By defective is meant tubes with inherently long recovery time, high leakage or other similar characteristic defects. A suggested way of measuring the recovery time of T-R and pre-T-R tubes involves a method of measuring minimum discernible signals as follows: The system is first tuned for optimum performance, preferably on distant targets. The pulse output of a Signal Generator TS-419/U is applied to the echo box

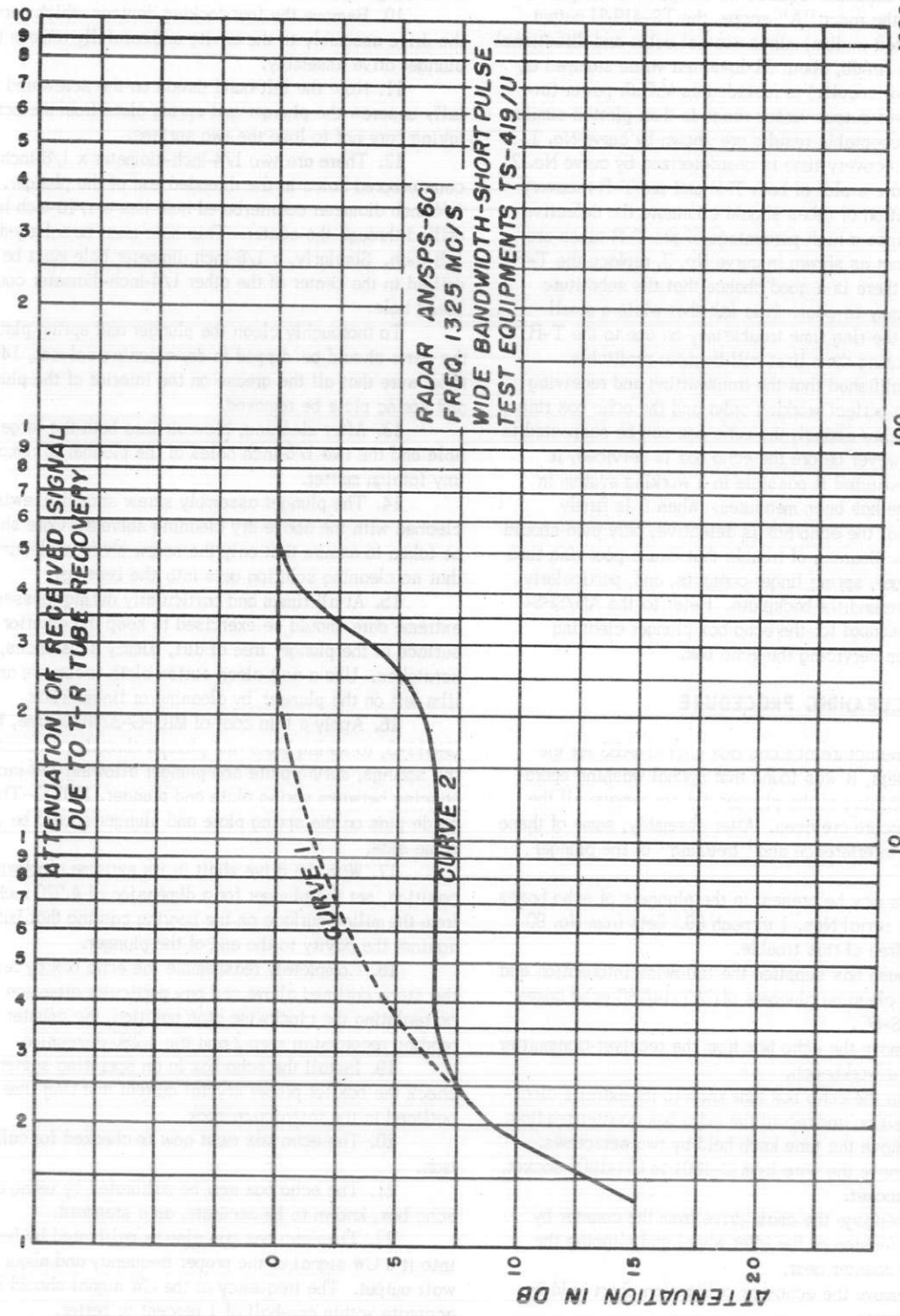

ATTENUATION OF RECEIVED SIGNAL DUE TO T-R TUBE RECOVERY
RADAR AN/SPS-6C
FREQ. 1325 MC/S
WIDE BANDWIDTH-SHORT PULSE
TEST EQUIPMENTS TS-419/U
CURVE 1
CURVE 2
ATTENUATION IN DB
0
5
10
15
20
RANGE IN THOUSANDS OF YARDS
1
2
3
4
5
6
7
8
9
10
100
1000

FIGURE 1.

connector of the directional coupler. With its output power reduced to the minimum required for the pulse to be just observable on the radar "A" scope, the TS-419/U output power (calibrated in-dbm) minus coaxial cable and directional coupler losses (in db, about 38 db-actual value stamped on each directional coupler) is recorded as M.D.S. power (in-dbm). The power output versus range is then plotted similar to figure 1. Acceptable results are shown by curve No. 1. Unacceptable recovery time is characterized by curve No. 2. These curves are a plot of both T-R and pre-T-R recovery time. Substitution of tubes should eliminate the defective component. Since a high percentage of pre-T-R tubes are believed to react as shown in curve No. 2, replace the T-R tube first, for there is a good chance that the substitute pre-T-R tube may be poor. It is felt that while a small percentage of the ring time trouble may be due to the T-R tubes, substituting them first will be more profitable.

If it is established that the transmitting and receiving systems are in perfect working order and the echo box ring time is still below normal, the echo box can be suspected to be faulty. However before the echo box is serviced, it should be substituted if possible in a working system in which ring time has been measured. When it is firmly established that the echo box is defective, only then should it be serviced. Sources of trouble that cause poor ring time are dirty plunger, spring finger contacts, and, particularly, poor contact around the backplate. Refer to the AN/SPS-6C technical manual for the echo box plunger cleaning procedure when servicing the echo box.

ECHO BOX CLEANING PROCEDURE

During manufacture of Echo Box CAY-14ABS for the AN/SPS-6C sets, it was found that normal washing operation after machining of the plunger did not remove all the chips from obscure crevices. After assembly, some of these chips caused interference and "freezing" of the plunger and shaft.

Some chips may be present in the plungers of echo boxes in radar sets, serial Nos. 1 through 89. Sets from No. 90 on should be free of this trouble.

Westinghouse has supplied the following information and procedure for cleaning plungers of CAY-14ABS echo boxes of the AN/SPS-6C.

1. Remove the echo box from the receiver-transmitter and place on a workbench.

2. Turn the echo box tune knob to its extreme clockwise stop position and record the echo box counter reading.

3. Remove the tune knob held by two setscrews.

4. Remove the wire from C-1601 to CR-1601 socket, at CR-1601 socket.

5. Disengage the chain drive from the counter by removing the tension of the idler wheel and slipping the chain off the counter gear.

6. Remove the echo box calibration chart held by four No. 4 screws.

7. Remove the eight No. 10 Phillips head screws which secure the angle braces to the back of the cavity.

8. Remove the four 1/4-inch hex. head screws which secure the front of the cavity and drive assembly to the echo box casting.

9. Carefully slide the cavity and drive assembly out of the angle braces.

10. Remove the four locking devices which secure the drive assembly to the cavity and carefully remove the plunger drive assembly.

11. Note the left-hand thread on the screw and carefully unscrew the plunger and spring plate from the screw, taking care not to lose the two springs.

12. There are two 1/4-inch-diameter x 1/8-inch-deep counterbored holes in the threaded end of the plunger. One 1/4-inch diameter counterbored hole has a 1/16-inch hole drilled through the center. This hole must be enlarged to 1/8 inch. Similarly, a 1/8-inch diameter hole must be drilled in the center of the other 1/4-inch-diameter counterbored hole.

To thoroughly clean the plunger and spring plate, the parts should be dipped in dry-cleaning solvent, 140-F. Make sure that all the grease on the interior of the plunger and spring plate be removed.

13. After cleaning, blow air into both the large tapped hole and the two 1/8-inch holes of the plunger to remove any foreign matter.

14. The plunger assembly screw should likewise be cleaned with the above dry cleaning solvent. Care should be taken to assure that only the screw shaft is cleaned and that no cleaning solution gets into the bearing.

15. At all times and particularly during reassembly, extreme care should be exercised to keep the exterior surface of the plunger free of dirt, gummy substances, and scratches. Use a soft clean cotton cloth to remove any film left on the plunger by cleaning or fingerprints.

16. Apply a thin coat of MIL-G-3278 Grease, W14-G-611-5, to spring plate and plunger threads. Reassemble the springs, spring plate and plunger allowing 1/8-inch spacing between spring plate and plunger. NOTE—The guide pins on the spring plate and plunger should be on the same side.

17. With the drive shaft in its extreme clockwise position, set the plunger for a dimension of 4.920 inches from the milled surface on the bearing casting that butts against the cavity to the end of the plunger.

18. Completely reassemble the echo box by reversing the steps outlined above and pay particular attention to correalating the clockwise stop position, the counter reading recorded in step 2 and the 4.290 dimension.

19. Install the echo box in an operating system and check the box for proper crystal current and ring time as outlined in the instruction book.

20. The echo box must now be checked for calibration.

21. The echo box may be calibrated by using another echo box, known to be accurate, as a standard.

22. The echo box can also be calibrated by feeding into it a CW signal of the proper frequency and about 1/4-watt output. The frequency of the CW signal should be accurate within one-half of 1 percent or better.

23. If the recalibration is off more than 15 counter divisions from the original calibration, the proper steps should be taken to bring the echo box within the 15 division limit.

24. The echo box should be checked to cover the frequencies from 1,250 to 1,400 MC.

AN/SPS-6C SIMPLIFIED POWER SUPPLY SCHEMATIC

The following simplified schematic of the power supply for the AN/SPS-6C may be useful as a means of saving time in circuit tracing and is published herewith for this purpose. (See fig. 1.)

NOTE.—This drawing is intended for use in isolating troubles. It is not a complete drawing.

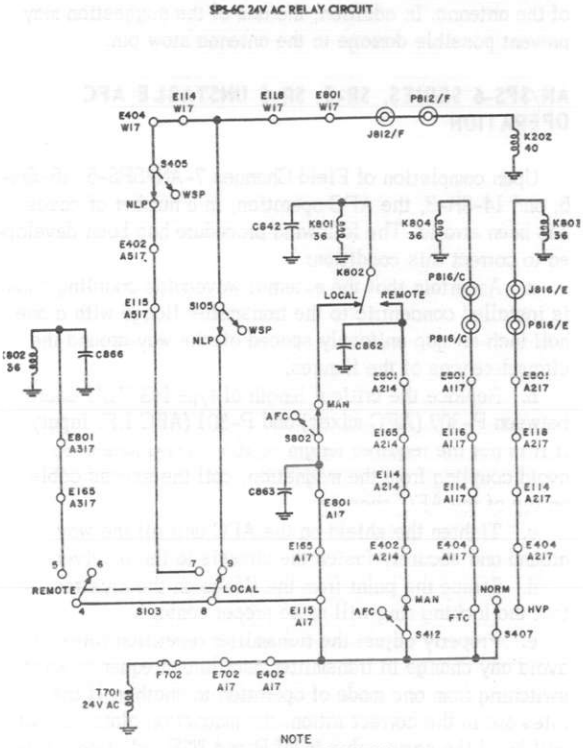


Figure1

HIGH-VOLTAGE HAZARD IN AN/SPS-6C

A statement of particular significance appeared in a report from the Coast Guard Training Station, Groton, Conn., concerning the AN/SPS-6C: "At this unit, it was noticed that high voltage was still present on the plate of the modulator tube (in the high-voltage compartment) 17 hours after the equipment was de-energized." (The high-voltage compartment is located in Radar Receiver-Transmitter RT-267/SPS-6C.

This potential is due to the charge on the pulse network Z-103 and suitable precautions must be taken, after the equipment is de-energized, before attempting to work on the transmitter and modulator circuits. Ground all capacitors, high-voltage insulators, tube plate caps, and tube grid caps with a shorting rod (see figure 1.) before servicing. Make certain that existing warning signs are not obstructed by paint or other materials.

Improper radar operation can cause the high voltage hazard. In turning equipment OFF, the radiation switch MUST be turned off before main power is secured to prevent a high voltage hazard. If main power is turned off without first turning off the radiation switch, operation of Relay K-111 and Relay K-107 opens the high voltage discharge network-preventing discharge of the radar pulse network.

Proper operation does not preclude routine precautions to be taken before any servicing is done.

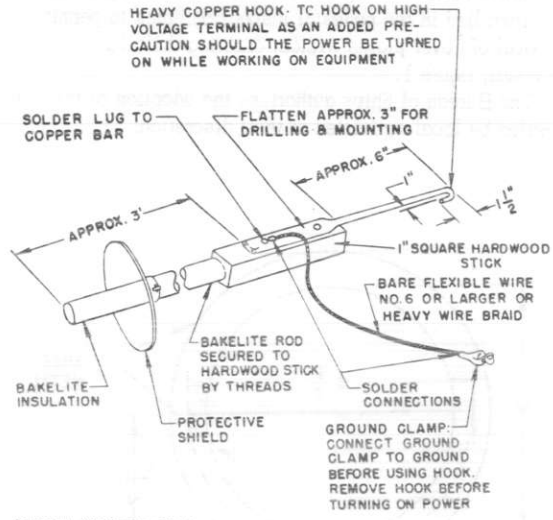


DIAGRAM of SHORTING STICK

AN/SPS-6, -6A, -6B REPLACEMENT OF 6G SYNCHROS IN ANTENNAS

Philadelphia Naval Shipyard has called attention to the fact that when Field Change No. 21-AN/SPS-6, -6A, and -6B is accomplished on Radar Set AN/SPS-6, -6A and -6B, the oil level in the pedestal is raised. If the correct physical size synchro is not installed, an oil leak will develop between oil seal U-1306 and the 6G Synchro B-1302. B-1302 should be a mark 2 Mod 3 synchro generator made by Ford Instruments Company. Other 6G or 6HG synchros are electrically interchangeable, but have a slightly different physical size and will not mate properly with U-1306.

As a temporary solution to the above problem, all naval activities and naval vessels having Radar Set AN/SPS-6, -6A, and -6B and requiring the synchro (B-1302) should requisition the 6G synchros (Mark 2 Mod 3 or Mark 2 Mod 5) and include the following statement on the requisition: "Substitutes Not Acceptable". This will insure receipt of the correct physical size synchro.

The Bureau is investigating the possibility of modifying the oil seals for use with all 6G and 6HG synchros. If the modification is feasible, a field change will be issued.

AN/SPS-6 SERIES BAFFLE PLATES FOR PEDESTAL INSPECTION HOLES

Field Change 21-AN/SPS-6, -6A and -6B has raised the pedestal oil level approximately two inches. This necessitates drainage of oil before inspection plates can be removed for purposes of setting ships heading marker, thermostat replacements, or inspection of wiring.

Baffle plates should be fabricated by local activities and installed in the pedestal inspection holes to permit removal of cover plates without draining the oil in the pedestal, figure 1.

The Bureau of Ships authorizes the adoption of this suggestion by local activities at their discretion.

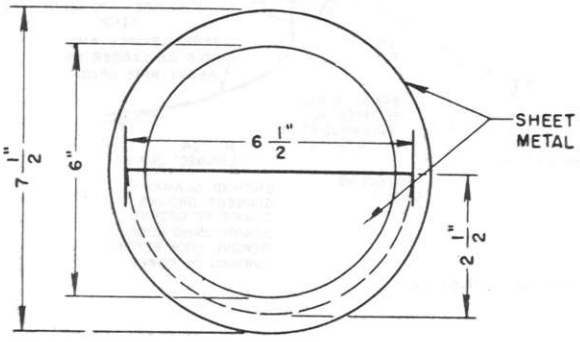


Figure 1

AN/SPS-6 SERIES ANTENNA STOW PIN POSITION INDICATOR

An indicating arrow and identification plate have been suggested for the antenna stow pin of the AN/SPS-6 Series equipment to show immediately if the antenna is locked or unlocked, figure 1. An indicating arrow is engraved on the stow pin knob, and plate of approximately 100 degrees arc is fastened by screws to the Y beam near the base of the stow pin. The plate is engraved "stow" and "unstow" as indicated in the sketch. The indicating arrow by alignment with either of these reference points shows the pin position. At present the pin position can be determined only by manually rotating the antenna.

The Bureau recommends this suggestion as a positive means for determining the "locked" or "unlocked" position of the antenna. In addition, the use of the suggestion may prevent possible damage to the antenna stow pin.

AN/SPS-6 SERIES, SR-3, SR-6 UNSTABLE AFC OPERATION

Upon completion of Field Changes 7-AN/SPS-6, 16-SR-6, and 14-SR-3, the AFC operation, in a number of cases, has been erratic. The following procedure has been developed to correct this condition:

a. Ascertain that the external waveguide coupling choke is installed concentric to the transmitter flange with a one-half inch air gap uniformly spaced all the way around the circumferences of the flanges.

b. Replace the critical length of type RG-71/U cable between P-307 (AFC mixer) and P-801 (AFC I.F. input) if it is not the required length of 163 ± 1/2-inches. To avoid coupling from the magnetron, coil the excess cable on top of the AFC chassis.

c. Tighten the shield on the AFC unit all the way around and securely fasten the chassis to the receiver.

d. Scrape the paint from the flange on the klystron, so that the locking ring will make proper contact.

e. Properly adjust the transmitter repetition rates to avoid any change in transmitter oscillator frequency when switching from one mode of operation to another. If the rates are in the correct ration, the magnetron plate current will be of the same value in NLP and WSP radiation. If the ESP repetition rate is appreciable above 600 pps, unstable AFC action in this mode may result.

f. Provide proper electrical bonding between the cable shield entering P-802 and the metal cover. If there are broken contact fingers adjacent to J-802 on the AFC chassis, solder a jumper wire to the cable shield at P-802 with a lug on the other end fastened securely to the chassis.

g. If there is sufficient leakage of transmitter energy through P801 and J801 to cause unstable operation, cover the plug and jack with a piece of shielded braid grounded to the AFC unit by a short jumper.

h. If operation of the Manual Tune Controls, R-2070 or R-409, affects AFC action, bypass either or both the arm and hot end of these controls, as may be necessary, with a .05 microfarad, 600-volt D.C.W. bathtub capacitor

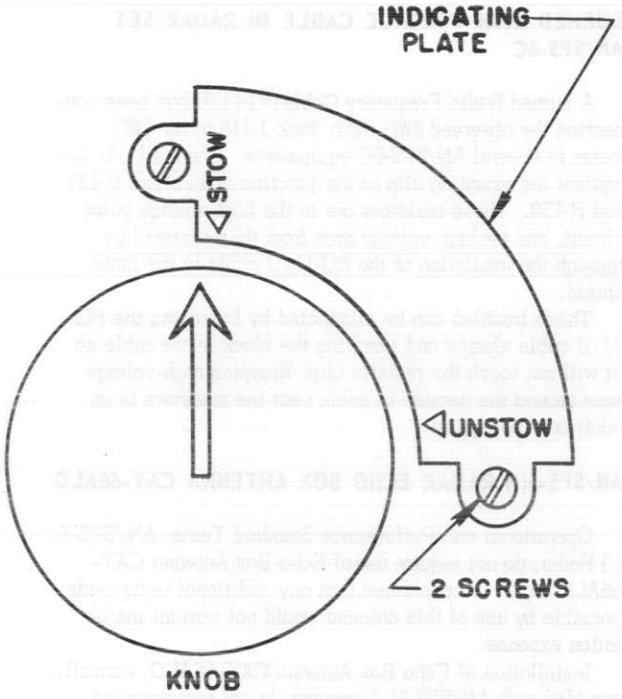


Figure I

mounted with the shortest leads and as close to either control as may be possible.

i. For maximum AFC stability, adjust the transmitter to a frequency where a VSWR of 1.5 or less can be measured. For the most accurate measurement of VSWR, take the adjacent maximum and minimum readings near the center portion of the slotted section of the waveguide.

j. The following is a simplified procedure for tuning the receiver:

(1) Throw AFC-MANUAL switch to manual operation.

(2) Turn the L.O. turning control to its maximum clockwise position.

(3) Set the Manual Tune Control to its approximately centered position.

(4) Set the I.F. gain so that noise is visible on the monitor scope.

(5) Turn L. O. TUNE control slowly counterclockwise to the first display of targets or echo box ringtime.

(6) Adjust the Manual Tune Control for maximum crystal current.

(7) Readjust L.O. TUNE Control for maximum targets or echo box ringtime.

(8) Repeat steps 6 and 7 until maximum crystal current coincides with maximum targets.

(9) Switch to AFC operation.

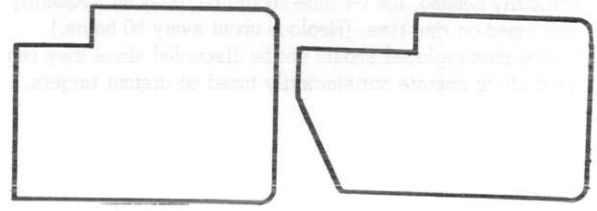
(10) If there is a difference in amplitude, adjust the AFC discriminator, L-803, for maximum targets with the alinement tool mounted on the side of the AFC chassis.

(11) Adjust TR tuning, receiver, and AFC crystal currents in accordance with the appropriate instruction books.

k. If the foregoing procedure has been correctly accomplished, there will be no change in receiver crystal current or target amplitude when the receiver is switched from MANUAL to AFC.

AN/SPS-6B, AN/SPS-6C NONINTERCHANGEABILITY OF ANTENNA ASSEMBLIES

Repair Facilities are cautioned NOT to interchange antenna assemblies of the AN/SPS-6B with those of the AN/SPS-6C. A number of AN/SPS-6C antennas have arrived at repair facilities, and such interchange of units might very well happen due to their similarity in appearance. However, an AN/SPS-6B antenna, even with Field Change 21-AN/SPS-6B installed, will not rotate on an AN/SPS-6C. Modifications provided by Field Change 21-AN/SPS-6B have been taken into consideration in the design of the AN/SPS-6C antenna assembly. To distinguish between units, SPS-6C antenna assembly. To distinguish between units, observe the difference in the wind vane structure shown in



AN/SPS-6B WIND VANE

AN/SPS-6C WIND VANE

The AN/SPS-6C antenna assembly will work on the AN/SPS-6B pedestal. It should be noted that AN/SPS-6B-type antennas are also used with the SR-3 and SR-6 equipments.

AN/SPS-6C PEDESTAL TERMINAL STRIP

A terminal strip on the cover of the AN/SPS-6C antenna pedestal, with contact studs large enough to terminate the DHFA-23 cable should be installed. A four-conductor harness would then be run to the original terminal strip. Interior connections to the pedestal would be easier to accomplish because of the greater flexibility of the new harness over the DHFA-23 cable.

This suggestion is approved for adoption by the various ships and activities at their discretion.

AN/SPS-6C INTERIM T-R TUBE TUNING

Investigation of poor range performance of the AN/SPS-6C (radar sets) indicates that the present t-r tube, BL-25, broadens in tuning range as the tube ages. Until a satisfactory tube is available, the following changes should be made in the tuning procedure:

(1) The use of echo-box ring time or targets at short range for t-r tube tune-up should be discontinued except for the first few hours after installation of a new t-r tube.

(2) When fixed targets at ranges of 50 or more miles are available, the t-r tube should be tuned on such targets and the tuning checked at intervals of 25 hours (operating time.) For this purpose, either an external A-scope should be provided at the transmitter console location or the small A-scope on the transmitter should be modified to have a 100-mile sweep.

(3) When fixed targets are not available, a signal generator capable of injecting a delayed pulse into the radar system is necessary for proper tune-up of a t-r tube which has been in use for a considerable length of time. If a signal generator is not available and top radar performance is critically needed, the t-r tube should be replaced frequently and tuned on ring time. (Replace about every 50 hours.) Tubes thus replaced should not be discarded since they can be made to operate satisfactorily tuned on distant targets.

BURNED HIGH VOLTAGE CABLE IN RADAR SET AN/SPS-6C

A burned Radio Frequency Cable RG-11/U has been connecting the observed SWD input Jack J-116 to the SWD meter in several AN/SPS-6C equipments. The RG-11/U lies against the mounting clip at the junction of resistors R-137 and R-138. These resistors are in the high voltage pulse circuit, and the high voltage arcs from the resistor clips through the insulation of the RG-11/U cable to the inner shield.

These troubles can be eliminated by loosening the RG-11/U cable clamps and removing the slack in the cable so it will not touch the resistor clip. Wrapping high-voltage tape around the section of cable near the resistors is an additional safeguard.

AN/SPS-6( ) RADAR ECHO BOX ANTENNA CAY-66ALO

Operational and Performance Standard Tests, AN/SPS-6 ( ) Radar, do not require use of Echo Box Antenna CAY-66ALO and it is considered that any additional tests made possible by use of this antenna would not warrant installation expense.

Installation of Echo Box Antenna CAY-66ALO, normally provided with AN/SPS-6( ) antenna, is not recommended and should be returned to stock.

RIG FOR HOISTING ANTENNA

For those yards and activities which are scheduled to receive AN/SPS-8 equipments in the near future, the following is extracted from a pending revision of the present technical manual. It pertains to the assembly and handling of the antenna unit during installation or removal for overhaul.

Unbolt the pedestal from the bottom of its box, and remove it as follows:

Pass slings under the upper flange of the subbase at the forward and aft ends. The sling on the aft end should be crossed above the lower roll drive and brought straight up both sides of the azimuth drive frame to a crane hook above the pedestal in a "figure eight", or "becket" hitch. The forward sling should also be crossed above the lower roll drive and brought straight up both sides of the azimuth drive frame in the same type hitch, and fastened to the same crane hook overhead. Ropes should be passed separately around the roll gear housing and aft sling, and around the upright tube structure and forward sling. Slings should be blocked away from azimuth drive frame, and two-by-four's should be used as spreaders between all cables above the drive frame.

NOTE

This same slinging arrangement may be used to lift the complete antenna mount also, provided special care is used to prevent the slings from crushing tubes on the scanner bracket and wave guides.

CAUTION

Complete mount weights approximately 3,948 pounds. 3/1/53

PREVENTING CORROSION ON SUBBASE MOUNTING

The Bureau concurs with a recommendation that a thin coat of Permatex grade 2 be applied to the bottom of the antenna subbase mounting bosses. Apply the Permatex just before the antenna is set in place so that it will not dry out. In addition, be sure that the surface is clean and free of any oil film so that the Permatex will adhere. Follow the directions on tube for application. The Permatex will spread evenly under pressure and will provide a tight bond to both surfaces, keeping out any moisture. Permatex is supplied with all AN/SPS-8A equipments (packed in box 17).

LUBRICATION OF ROTATING JOINTS

The rotating joints (azimuth and roll) of all AN/SPS-8A equipments should be lubricated quarterly with Grease, Military Specification MIL-G-3278.

The first joints manufactured were lubricated at the factory with a grease containing molybdenum disulfide which builds up and seals in depressions. Antennas lubricated with this grease will probably become stiff when stored. Apply a small amount of grease to free stiff rotating joints. Note that the rotating joints may appear to be stiff because of the O-ring which has been added. Use of the grease containing the molybdenum disulfide additive have been discontinued.

AN/SPS-8 ERROR IN MAGNETRON FILAMENT WIRING

Reports have indicated the possibility of a factory error in wiring plug P-3101, filament and pulse leads from the magnetron. Reversal of the leads would force the pulse through the filament, greatly shortening the life span of the magnetron and capacitor C-3103.

The plug wiring should be checked prior to applying power to equipment to see that the side labeled cathode does not flow through T3102. See technical manual, NAVSHIPS 91522A, Figure 7-142.

AN/SPS-8, AN/SPN-6 SYNCHRONIZING CABLE

On ships which have Models AN/SPS-8 and AN/SPN-6 radar, a RG-12/U cable is required from one of the trigger outputs of 50AJW-1 (AN/SPN-6) to the external trigger input circuit of the AN/SPS-8/8A (Terminal 6 on TB-5023 of Power Control Group OA-159/SPS-8 or OA-460/SPS-8A) to eliminate interference.

AN/SPS-8 TIGHTENING OF ANTENNA BOLTS

A recent case was reported in which an overhaul base failed to tighten AN/SPS-8 antenna bolts. Serious damage can result from such an oversight, which can be overcome only by more careful attention being paid by the individual doing the work and also by the inspector.

AN/SPS-8B – SCANNER OVERLOAD – REPORT OF DEFICIENCY AND CORRECTIVE ACTION ON SERIAL NUMBER 5 ANTENNA

Operation of the scanner at 720 and 970 RPM caused the overload relay to kick out. Current measurements indicated that approximately 4-amps were drawn by the scanner drive motor. The overload relay is rated at 3.2-amps. The scanner and scanner drive were removed from the ship and brought into the shop. The scanner was disassembled, examined, and reassembled. All bearings were cleaned and repacked. There was no evidence of malfunction in this unit. The rotary joint was disassembled and partially reassembled. The polyiron ring in this unit was grooved, apparently do to excessive force on the pressure seal. To remedy this situation the shim between the bearing and pressure seal was moved to the other side of the bearing. This would reduce the force on the pressure seal and increase the clearance between the rotating joint and bearing housing.

Bearings in the rotary joint assembly were cleaned, repacked, and reassembled. The unit was tested and it was found that scanner current had decreased to 3.5 amps. It

was decided to decrease finger pressure on the oil seal at the rotary joint. Reduction of finger pressure brought the scanner current down to 3.0 amps. The torque tube waveguide support bearing was cleaned, repacked and realigned. The scanner current dropped to 2.3 amps at 1100 RPM. Scanner, synchro, and commutators were aligned and the unit was remounted on the ship.

AN/SPS-8 ALINEMENT AND LEVELING

An alinement and leveling procedure for the AN/SPS-8 has been suggested.

It is recommended that this alinement procedure be accomplished in the electronics shop after the antenna has been assembled. This portion of the alinement may be performed aboard ship if necessary, but would require more time and effort. A 3/4-inch square bar is used on the antenna sub-base bosses. The bar, previously checked in the machine shop for trueness with regard to twist and bend, is centered on the antenna sub-base fore and aft leveling bosses so that the overhang at both ends is the same. A gunners' quadrant, placed on the bar with its center coinciding with bar's center, is leveled and read. The quadrant is reversed on the bar and again leveled; the two readings should be the same but opposite in sign. If not, either the quadrant is not properly adjusted, the quadrant is not properly centered on the bar, or the bar is not true. The bar is reversed and another set of quadrant readings taken; the second set of quadrant readings should agree with the first set. The bar and the quadrant must always be carefully centered to preclude errors caused by the bar's deflection.

The tilt of the antenna subbase leveling bosses is determined with the use of the bar and quadrant. The exact 90-degree and 270-degree bearing position is established and marked on the athwartship leveling bosses with a machinist's square. With the antenna in the electrical stow position, the plane of rotation is determined as outlined in the following paragraph. In the event that the pitch and roll scribe marks do not match in the electrical stow position, the plane of rotation is also checked with the scribes matched to ascertain which plane is more nearly parallel to the plane of the subbase bosses.

With the antenna at zero degree train, a transit, set in the plane of the subbase bosses, is placed aft of the antenna and sighted in a line parallel to the vertical faces of the fore and aft leveling bosses. This line, translated vertically to the top surface of the stabilized platform and scribed thereon, will be used as the fore and aft reference line whenever quadrant readings are taken on the stabilized platform. A quadrant clamped on the stabilized platform, is leveled and read at 0-degrees, 90 degrees, 180 degrees, and 270 degrees bearings of the antenna. The sum of the 0-degree and 180 degree readings will equal the sum of the 90 degree and 270 degree readings if the stabilized platform is rotating in a true plane. The tilt of the plane of rotation of the stabilized platform is computed and compared with the tilt of the plane through the subbase leveling bosses. The difference in tilts of the planes is noted for future use.

A transit, set-up so that its plate is exactly parallel to the antenna stabilized platform plane, is sighted into the starboard side of the antenna. The antenna elevation screws are then adjusted until the factory punch marks on the antenna frame coincide with the vertical hair of the transit. (If the antenna frame does not have the punch marks, use the centers of the ends of the top and bottom reflector grids.) The vernier in the elevation data box should then read zero degrees. A quadrant positioned perpendicular to the reflector elevation axis and with its pivot toward the reflector is clamped on an elevating member of the antenna. The quadrant bubble is leveled and the reading noted. To this reading, "T" degrees (stamped in elevation data box) is added and that result set on the quadrant. The antenna elevation screw is adjusted until the quadrant bubble is again level. The vernier in the elevation data box should now coincide with "T" degrees. Care should be exercised when using a quadrant that no extraneous weight, such as the hand of the quadrant observer, is allowed to rest on the antenna.

The antenna foundation should be accurately machined to the vessel's base plane as the stabilization generator, set to the antenna plane, can also be used to stabilize other equipment (not associated with AN/SPS-8) on the vessel. A line parallel to the ship's centerline is established and translated to the antenna foundation by transits to accurately position the fore and aft scribes of the drilling template. The same line is similarly translated to the stabilization generator and scribed nearby on the dock.

To maintain and ensure future alinement, the antenna sub-base can be dowelled after it has been bolted down on the foundation. The tile of the plane of the antenna sub-base leveling bosses should be checked for agreement with that of the foundation.

The stabilization generator must be installed and shimmed so that its fiducial line is paralled to the line scribed on the deck, and its plane is parallel to the plane of the antenna stabilized platform. The relation of planes can be obtained more easily by using the leveling bosses of the antenna subbase, corrected for deviation from the stabilized platform, and the stabilization generator leveling pads. The stabilization generator also can be dowelled to ensure alinement.

The preceding shipboard work is normally done in drydock. However, by taking simultaneous readings between transits and quadrants, it can be done accurately while the vessel is waterborne.

A final check afloat should be made with the antenna stabilized. For this, a quadrant is clamped on the stabilized platform and readings taken every 90 degrees. The calculated tilt from the horizontal is the summation of errors in alinement and in the servo system. The sum of the 0-degree and 180-degree readings will equal the sum of the 90-degree and 270-degree readings if the stabilized platform is rotating in a true plane.

AN/SPS-8 REPLACING RESISTORS IN SINE OR COSINE COMMUTATOR

Remove the cover over the resistors by removing the two screws which secure it. The two outside pieces will come off easily. Unsolder and remove the defective resistor using a soldering iron of about 300 watts (with small tip). Clean the slot from which the resistor was removed with a hacksaw blade which has been ground to proper thickness, or similar tool. Trim the leads on the new resistor to the proper length to fit in place properly. Tin the resistor leads. (Caution: Do not apply heat for long periods as this will melt the connection of the resistance wire to the pigtail.) Dip the leads in solder flux and place them in the proper slots. Force the leads to the bottom of the slot, being careful not to break the resistance wire. Apply heat to the commutator segment and flow solder into the slot. This should take 20 to 30 seconds. Do not use excessive solder. Then take a fine cut on the commutator to remove all excessive solder.

Check between each commutator segment with an ohmmeter to see that there is about 1000 ohms resistance between segments. Replace the cover and reinstall the assembly.

AN/SPS-8 INFORMATION AND OPERATING INSTRUCTIONS FOR QK-253 MAGNETRON

The following information and operating instructions were prepared jointly by General Electric Company and Raytheon Manufacturing Company. The Bureau of Ships concurs and recommends compliance.

Because of the substatial improvement in the QK-253 magnetron construction, greater stability and longer life can be expected. The first 300 of the improved QK-253 tubes do not have any identifying marks. However, those after the first 300 are identified by the letter "K" following the serial number. There are very few of the old tubes either in equipments or in stores. Therefore, after installing a new magnetron it should be operated as the new type, even the absence of the identifying letter "K".

The operating current limit of the new QK-253 is 50 ma, with the antenna feed system not scanning. After the proper installation of a new magnetron, normal operation should be possible without applying an aging procedure. (Simply apply standby filament voltage fro a minimum of 3 minutes prior to going into radiate. The operator should be certain that the magnetron current meter reads the lowest possible value when the high voltage is applied.) However, after several attempts to operate up the normal magnetron current, if severe installbility indicates that disabling of the protective circuit is necessary, the following procedure is recommended:

At Radar Set Control C-677/SPS-8, set the PULSE REP RATE switch at 1/1000 and the scan control to manual. Disable the Reverse-Current Control circuit by removing the lead on TB5101-8.

At Modulator Control C-910/SPS-8, press the HIGH-VOLTAGE switch to on. The operator should be certain that the magnetron current meter reads the lowest possible value when high voltage is applied. Using the Raise/Lower switch, gradually increase the magnetron current. Carefully observe the magnetron pulse on the oscilloscope and if more than slight arcing occurs, lower the high voltage until there is only a slight amount of arcing. Allow the magnetron to operate at this current for a few minutes. Again, gradually raise the high voltage and observe for magnetron arcing, using the above procedure. When stable operation is obtained at 50 ma, it is only necessary to maintain this value of current for a short time (ten or fifteen minutes) before the system can be returned to normal use.

It is not desirable to operate beyond the normal value of magnetron current (50 ma) unless the arcing rate is carefully controlled. Otherwise, more damage to the magnetron will result instead of the desired aging.

It has been definitely established that filament standby hours are much more likely to cause failure than radiate hours. For this reason, the recommended procedure of pulling the magnetron filament fuse, F-3602, during standby time and reinserting the fuse 3 minutes before radiating should be followed.

Local arcing of the RF coupling system will cause overheating of the output portion of the magnetron and result in failure of the glass-to-metal output seal. Therefore, particular care should be exercised when installing the output coupler, and air pressure in the pitput coupler should be checked and maintained. The bullet should be carefully examined and replaced if damaged.

It is possible to start an open filament magnetron radiating by constantly applying high voltage, but this will often result in arcing and damage to the transmitter. When trouble is encountered in going into radiate, check the filament immediately. A normal heater can usually be heard vibrating and will be warm to the touch.

Spark gaps, designed to protect transmitter components in the event that high voltage is applied to a magnetron with a open filament, have been distributed to General Electric field engineers and should be installed as soon as possible.

When reporting failures of QK-253 magnetrons, include the conditions under which the magnetron was operated such as magnetron current, scan speed, and pulse repetition rate.

AN/SPS-8 HANDLING & STORING QK-437 MAGNETRONS

Magnetrons should be stored in both the inner and outer shipping crates. These packages are designed to prevent mechanical shock and to enforce a minimum spacing such that adjacent magnets or magnetic materials will not interact. Although the magnets have been gap stabilized at the operating flux density, repeated close proximity of ferro-magnetic material will weaken the magnet. For this reason, magnetrons removed from the transmitter during maintenance should be stored in an empty shipping crate. If the tube is to be stored, the neoprene protective caps

must be replaced on the cathode bushing and output window. Non-magnetic tools must be used when installing or removing the magnetron. The 8-inch beryllium-copper "Crescent" wrench is schematic symbol H-3031, FSN N5120-311-9007.

The weight of the tube must never rest on the cathode bushing or heater terminals. The entire cathode structure of tube is suspended from one point on the bottom corona shield. Any stress or shock applied to the heater terminals can cause misalignment of the cathode in the interaction space with consequent degradation of performance, or complete destruction of the tube.

AN/SPS-8 ANTENNAS SIMPLIFIED METHOD FOR CHANGING BELLOWS

A simple method has been devised for changing the elevation drive screw bellows on the AN/SPS-8 antennas. Using this method, replacement can be accomplished without disturbing the drive mechanism or removing the fork.

Proceed as follows:

1. Remove the 12, No. 10, flat-head screws at the top and at the bottom which hold the bellows and retaining rings to the bellows supports.
2. Remove the 5, No. 10, filister-head screws holding the upper bellows support to the fork.
3. Carefully split the upper bellows support and remove it from the drive screw.

CAUTION: Do not lose the hydraulic rubber gasket by allowing it to slide into the old bellows.

4. Slide retaining rings and old bellows up over the fork.
5. Slide new bellows over the fork and down onto the drive screw.
6. Replace upper and lower bellows retaining rings.
7. Install the split bellows support using the 6, No. 10, filister-head screws. Permatex No. 2 may be used to insure an adequate moisture seal at the split edges.
8. Fasten bellows and retaining rings to the upper and lower supports using the 12, No. 10, flat-head screws.

This procedures is recommended for adoption by all over hauling activities.

AN/SPS-8, -8A ACCURACY OF ANTENNA LEVELING

The accuracy of AN/SPS-8 or the AN/SPS-8A as a height finding radar depends to a great extent on the care exercised during installation.

The mounting pads on the antenna subbase are machined to within 28 seconds of being in the same plane as the antenna base. This accuracy can be lost during installation if the antenna foundation and antenna mounting are not precise. The maximum error that should be accepted in either fore and aft or abeam should be two minutes. As can be seen from the Altitude Error Table, this represents an altitude error of 283 feet at 80 miles.

The accuracy to which the rotating platform is maintained level depends on the accumulated/accuracy of all the elements effecting the platform position. These elements are gear train error in the antenna stabilizing drive systems, servo systems, stable element mounting, stable-element gimbal-erecting drive systems, and antenna mounting. Additive errors in these elements can result in objectionable altitude error. This error, due to not maintaining the rotating platform level, will be high in one direction, low 180 degrees away, and will vary between the two directions. Therefore, simply applying a constant correction is not applicable.

The elements effecting platform level which are controlled to some extent during installation are servo system alighment, stable-element foundation level, and antenna foundation level. During installation, the leveling of the antenna base and stable-element base should be accomplished with the greatest degree of accuracy and in no case should the error exceed two minutes in either of the rotating axes. In any case, the antenna base plane and the stable-element base plane should be parallel within two minutes.

AN/SPS-8, -8A ANTENNA INSPECTION

If the rubber boots which cover the elevation-drive screws of the antenna become damaged, water may enter and cause corrosion and eventual freezing of this assembly. These boots should be carefully inspected when the rods are lubricated monthly as specified in NAVSHIPS 91522A, Page 6-35 - 6-36. As a further precaution, the antenna should be elevated through its limits at least once a week.

AN/SPS-8A PRECAUTIONS IN USE OF TRANSIL OIL WITH QK-437

After a newly installed QK-437 magnetron has been in operation five minutes, remove the Allen head screw from the bellows, open the reservoir petcock, and vent the trapped air and vapor from the filament well until the oil flows freely. Repeat this procedure after the first hour and at a minimum of 8-hour radiation intervals.

CAUTION:

1. Store Transil Oil in a space having nearly constant temperature.
2. Keep tightly capped in original container.
3. Do not shake a previously opened can.
4. Do not use the last one-half inch from a can.
5. Do not use any transil oil if absolute purity is in doubt.

AN/SPS-8A – PU-196/U BEARING FAILURES

As a result of analysis of failed AN/SPS-8A train amplidynes, it has been determined that the bearing failures were apparently due to improper seating of the neoprene mounting spacer, Symbol 0-8215, when the unit was assembled. Therefore, all repair activities are cautioned to insure that the neoprene spacer is fully inserted into the bearing mount when bearings are installed.

ALTITUDE ERROR TABLE

Height Error in Feet Versus Angular Error of Beam Position

Angular Error	Nautical Miles													
	10	20	25	30	35	40	45	50	55	60	65	70	75	80
30"	8.95	17.7	22.1	26.5	30.9	35.4	39.8	44.2	48.6	53.1	57.4	61.8	66.3	71.6
1.0'	17.7	35.4	44.3	53.2	62.0	70.9	79.6	88.5	97.4	106	115	124	113	142
1.5'	26.6	53.2	66.4	79.6	93.0	106	119	133	146	159	173	186	199	213
2.0'	35.4	70.8	88.5	106	124	142	159	177	195	212	230	248	265	283
2.5'	44.3	88.6	110	134	155	177	199	221	243	265	287	309	332	354
3.0'	53.1	106.2	133	159	186	212	239	265	292	318	344	372	390	425
4.0'	70.8	141	177	212	248	283	318	354	389	425	460	496	531	566
5.0'	88.5	177	221	265	310	354	398	442	486	531	575	619	664	708
6.0'	106	212	266	319	372	425	478	532	584	638	690	744	796	849
7.0'	124	248	310	372	434	495	557	620	682	744	805	866	929	993
8.0'	141	282	353	424	495	566	636	717	778	848	919	990	1060	1130
9.0'	159	318	398	477	557	636	716	795	875	955	1035	1115	1193	1270
10.0'	177	354	442	531	619	718	796	884	973	1060	1150	1240	1330	1420
11.0'	195	389	486	584	681	778	875	973	1070	1170	1260	1360	1460	1560
12.0'	212	424	531	637	743	850	956	1060	1170	1270	1380	1490	1590	1700
13.0'	230	460	575	690	805	920	1040	1150	1270	1380	1490	1610	1720	1840
14.0'	248	496	619	744	867	991	1120	1240	1360	1490	1610	1730	1860	1990
15.0'	266	532	664	796	928	1060	1200	1320	1450	1580	1720	1850	1980	2130
16.0'	283	566	707	849	990	1130	1270	1420	1560	1700	1840	1980	2120	2260
17.0'	301	602	752	902	1050	1200	1350	1500	1660	1800	1960	2110	2260	2410
18.0'	318	637	796	955	1120	1270	1430	1590	1750	1910	2070	2230	2390	2540
19.0'	336	672	840	1010	1180	1350	1510	1680	1850	2020	2180	2350	2520	2690
20.0'	354	708	784	1060	1240	1420	1590	1770	1940	2220	2300	2480	2650	2830

"= Angle in seconds, '= Angle in minutes

AN/SPS-8A OIL CONTAMINATION IN MAGNETRON HOUSING

Information and suggestions submitted to the Bureau of Ships indicate the possible existence of a maintenance problem as a result of contamination of the oil in the magnetron housing. Contamination of this oil is most likely caused by water, the entrance of which can happen either by accidentally dropping into the magentron well during a change of magnetron, or by breathing of the oil well during normal operation and by improper storage of the transil oil.

It is recommended that the steps listed below be followed in an effort to prevent the contamination of this oil:

1. Double flush the filament well bimonthly to remove any foreign material by plugging the drain hole and pouring a pint of transil oil into the well, removing plug and allowing the oil to drain out.
2. Remove the filament terminal plate annually and swab the well with a solvent.
3. Exercise precautions to prevent foreign material from entering the well during magnetron replacement.

AN/SPS-8A RELAY TROUBLE

Two types of abnormal operation has been reported which may aid other activities maintaining these radar repeaters. Both instances involved relay SNSN N17-R-65155-6073.

One repeater developed an east-west center shift which was corrected by changing relay K-1552. After a day of operation, a split sweep appeared on the same equipment and was corrected by changing the same relay (K-1552).

On another repeater, the range strobe could not be made to calibrate with the range rings on the low range (4 to 36 miles). It could be made to coincide with the zero (2000 yards) and the slope (60,000 yards) adjustment per instructions, but in between these ranges, calibration was off as much as from 800 yards low to 800 yards high. The range rings OSC was found to be accurate, and it was therefore thought that the range potentiometer tracking was not linear. All possibilities that could cause the trouble in this circuit were checked; the relay K-1202 (same type as K-1552) was changed as a last resort, although no apparent malfunctioning could be detected. This corrected the nonlinearity of the strobe tracking.

AN/SPS-8A TEFLON PRESSURE PLATE

Reports have been received concerning the unavailability in the supply system of Teflon pressure plate, Symbol 0-3066 in AN/SPS-8A (radar). The instruction book states that this item should be fabricated locally in case of failure.

In the absence of the 1/16-inch Teflon stock, required for this fabrication, the pressure plate may be ordered from supply by FSN N5985-295-9033. This stock number applies to Symbol 0-3093 for AN/SPS-8. Though the symbols are different, the parts are identical. These plates should be fabricated if materials are available.

AN/SPS-8A AVAILABILITY OF COMMUTATOR RESISTORS

Replacement resistors for the commutator assembly are available through the Navy Supply System using the following symbol Federal Stock Numbers. A color coded sleeve and pigtail identifies the value of each. All are rated at 1/2-watt with ± 1% resistance tolerance.

SINE RESISTORS

Resistance	Symbol	FSN	Color
1184 ohms	R-1001A	N5905-202-0361	Black
1172 ohms	R-1001B	N5905-202-0359	White
1160 ohms	R-1101C	N-5905-202-0364	Red
1148 ohms	R-1101D	N5905-202-0362	Yellow
1137 ohms	R-1001E	N5905-202-0363	Green

COSINE RESISTORS

R-1002A	Same as R-1001A
R-1002B	Same as R-1001B
R-1002C	Same as R-1101C
R-1002D	Same as R-1001D
R-1002E	Same as R-1001E

AN/SPS-8, -8A ANTENNA ASSEMBLIES PREVENTIVE MAINTENANCE

A Bureau of Ships investigation has determined that a recent failure by rupture of the AN/SPS-8 antenna assembly is an isolated case. However, in order to avoid similar occurrences, the following preventive maintenance procedures should be observed by ship's personnel at the indicated time intervals.

MONTHLY:

1. Fresh water and brush cleaning of all accessible parts of antenna pedestal and subbase assemblies.
2. Visual inspection for and drainage of water accumulation.
3. Visual inspection for deterioration and corrosion of welded joints and riveted surfaces.
4. Tighten all mounting bolts on pedestal and subbase assemblies.

QUARTERLY:

1. Wire brush and scraper cleaning of metal surfaces on pedestal and sub-base assemblies exhibiting corrosion or poorly adhered paint.
2. Inspect all welded joints on pedestal and subbase assemblies with the best method available to ships force, preferably magnafluxing. Failures of joints or incipient cracks are to be reported to the appropriate repair facility for immediate attention.
3. Inspect and test rivets for severe corrosion and wear. Replace if necessary.
4. All mounting bolts connecting pedestal and subbase assemblies must be tightened securely. Bolts exhibiting corrosion should be removed and cleaned.
5. Tighten all cable connections and clean if necessary.

6. Upon completion of the above procedure, the subbase unit and pedestal assembly are to be repainted where necessary with the proper paint.

AN/SPS-8 AND AN/SPS-8A RADAR REPLACEMENT BEARING FOR TYPE PU-197/U AMPLIDYNE MOTOR

Repeated failures of the bearings have been reported in type PU-197/U amplidyne motor generators of the AN/SPS-8 and 8A radars.

Investigation showed that both Marlin Rockwell types MRC 304-SZZC and MRC 304-SFFC had been issued as replacements. These bearings are dimensionally interchangeable - the difference being that the MRC 304-SZZC is sealed by pressure while the MRC 304-SFFC is sealed by a retaining ring. The report stated that the retaining ring of the MRC 304-SFFC bearing "hangs up" on the thrust absorbing device during operation. The thrust absorber then disintegrates as a result and loads the bearing until it overheats and eventually burns out.

Therefore, the proper bearing to be used in the PU-197/U is the Marlin Rockwell Type MRC 304-SZZC, available in stock under Federal Stock Number N3110-198-2856.

AN/SPS-8A SUPPORT FOR AN/SSQ-14 STABILIZATION DATA SET

The Electronics Supply Office has informed the Bureau that fleet units are constantly requesting ERPAL and Load List Support of the AN/SSQ-14 stabilization data set which is used with the AN/SPS-8A Radar Set.

The AN/SSQ-14 is not supported through the ERPAL because it is not under the program support responsibility of ESO. Support responsibility was transferred to the Ships Parts Control Center (SPCC) in 1954, inasmuch as this set is essentially identical to the Mark 4 Gyro Stabilizer, which was already supported by SPCC. Since that transfer, the AN/SSQ-14 is supported in the same manner as other Gyro and Navigation Equipment through the Coordinated Shipboard Allowance List. Ships whose allowances have not been reissued in the form of a COSAL may still have these repair parts listed in Group S24 of their Revised Individual Allowance List. If these parts are not listed in that allowance, the equipment should be reported to SPCC by means of form NAVSHIPS 4380 in order that an allowance modification may be issued.

AN/SPS-8A WAVEGUIDE REPAIR

This article is published to point out the necessity of reviewing the applicable technical manuals prior to commencing work.

During recent repair of the AN/SPS-8A on the USS SOUTHERLAND (DDR-743), the dimples in the interior of the waveguide were erroneously removed because it was believed the dimples were causing arcing in the waveguide. The installation section of the technical manual pointed out the fact that these dimples were the result of the waveguide tuning process. To obtain a VSWR of 1.05:1 or less, it was necessary to dimple the waveguide in the manner explained.

FORMATION OF ALUMINUM GLYCOLATE IN COOLING SYSTEM

Analysis of the material fouling the transmitter cooling system of the AN/SPS-8A revealed it to be aluminum glycolate - the reaction product between the aluminum components of the system and the anti-freeze used. To lessen the rate of glycolate formation and forestall future fouling of cooling system, brass quick-disconnect fittings were sent to all locations for replacement of aluminum fittings supplied within magnetrons. Current production of magnetrons will contain brass fittings.

To insure satisfactory operation, an anti-freeze with proper corrosion inhibitors must be used. Navy standard "anti-freeze", SNSN G-6850-285-4757 manufactured under specification MIL-C878 is recommended.

The following procedure is suggested for cleaning and refilling cooling systems which have become plugged with aluminum glycolate.

1. Make adapters so that the magnetron fittings can be connected together to close the system without the magnetron.
2. Drain the coolant from the system.
3. Fill the system with methyl alcohol and allow it to stand for twelve hours.
4. Disconnect the pump input and discharge lines.
5. Connect a source of steam or hot water to the line removed from the pump discharge and flush the system for fifteen minutes under 10 psi, with the reservoir drain open.
6. Remove the front of the pump and scrub out any residue with warm water.
7. Reassemble the cooling system and fill with the 60% - 40% mixture of anti-freeze and distilled water.

SAFETY WIRING, AS-484/SPS-8 ANTENNA

A suggestion for the use of safety wire in Antenna AS-484/SPS-8 has been submitted.

When Antenna AS-484/SPS-8 is in shop for overhaul, it is suggested that the eight cap screws securing retainer 0-1634 in scanner box and the four cap screws retaining bearing-bracket-piece No. 150 and tie-frame-piece No. 146 in azimuth-drive assembly, be drilled and safety wired.

AN/SPS-8B SCANNER ALINEMENT INDICES

A suggestion has been submitted for location of safer and more convenient indices for scanner adjustment.

By scribing degree lines on torque-tube-waveguide bearing 0-1050 to correspond with the degree lines of the scanner, adjustments made at scanner-commutator housing can be checked against the position of the waveguide feed in the organ-pipe scanner without moving out the scanner bracket.

If the scanner is removed and reinstalled, it is necessary to realine the scribed lines on 0-1050 and the degree lines of scanner.

AN/SPS-8 AND -8A WORN SECTOR AND COMPOUND GEAR MODIFICATION

A suggested method for machining operation for the worn pinion and sector gear of the AN/SPS-8 and -8A (0-1108 Sector Gear and 0-1107 Pinion Gear) submitted. For the detailed description of machining operation of pinion gear see figs. 1 and 3; for sector gear see figs. 1 and 2.

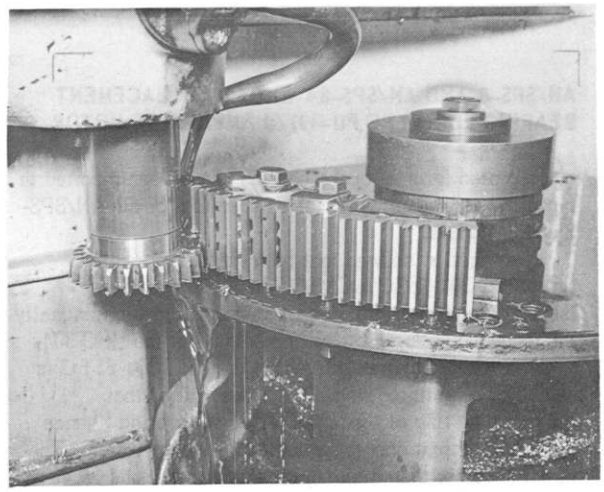
Proceed as follows:

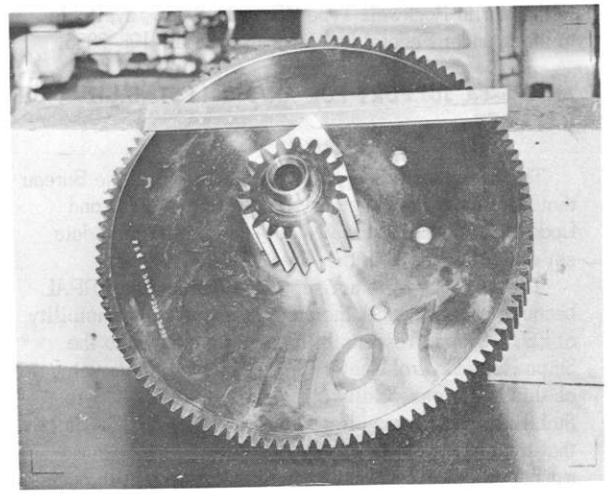
1. Use a No. 6 Fellows Gear Shaper and install an auxiliary table 24 inches in diameter, of 3/4-inch thick steel plate. Clean up the 18-tooth pinion gear PCO-1107 to the depth of the worst tooth. Indicate the pinion to run true and use a 6 D.P. 20° P deep recess Fellows Cutter (cutter teeth must project below fastening nut). After all teeth have been cleaned up, take measurements over .288 diameter wires, divide the amount of measurement less than 3.3952 (plan dimension) by K factor 2.23. This gives the exact amount the teeth have been reduced to correct the thickness. This is the oversize amount of tooth thickness to which the 26-tooth sector gear PCO-1108 will be machined.

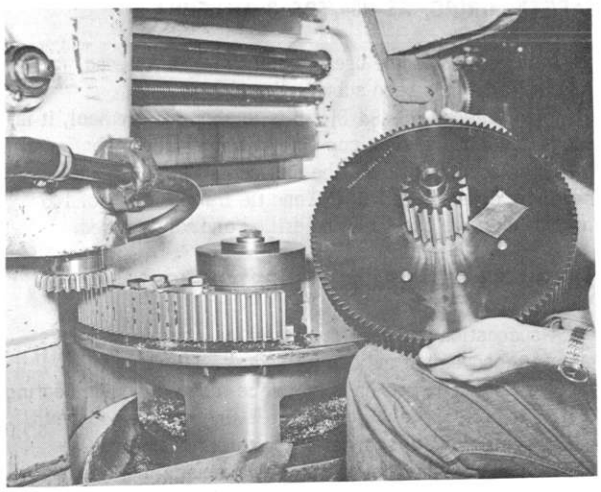
2. The 26-tooth sector gear PCO-1108 will be modified oversize as follows:

A suitable forging is provided. Finish I.D. equal to O.D. of sector gear after machining off gear sack portion. Machine forging 1/4-inch oversize, sides 1/8-inch oversize, cut rough machine ring into segments.

3. Clamp for welding and weld to sector gear hub. The sector gear PCO-1108 is machined to plan size on a bullard vertical turret lathe. The sector gear is then placed on the Fellows Gear Shaper, the teeth are machined oversize to a tooth thickness equal to the amount the pinion gear PCO-1107 was machined undersize.







ADJUSTING AN/SPS-8 POTENTIOMETER

A fixture has been developed for use in adjusting AN/SPS-8 scanner potentiometers.

The potentiometer has three arms touching the resistance wire. The resistance between these arms, as well as the resistance between the first arm and the end of the potentiometer, is critical.

The arms are adjusted by eccentric screws, and it is difficult to make adjustments accurately because the entire arm assembly moves and upsets previous settings.

To correct this problem, the potentiometer is set in a fixture that holds the shaft inplace while the screws are adjusted. Clamps holding the body of the potentiometer have thumb screws so that they can be loosened and the whole potentiometer rotated to check after arms have been adjusted.

CRYSTAL CURRENT LIMIT RAISED

Production testing of the AN/SPS-10 set has shown that occasions arise in which the Receiver and Radar automatic frequency control crystal current are not adjustable to 0.5 ma. due to one or more factors explained below. In making the adjustments described in the Technical Manual NAVSHIPS 91921A for Radar Set AN/SPS-10, it is recommended that the crystal current be allowed to exceed the stated 0.5 ma. However, in no case should the crystal current exceed 0.9 ma.

The current obtained from the receiver crystal or radar automatic frequency control depends upon the following factors:

1. Local Oscillator Power Output.
2. Mixer Coupling Window Size.
3. Crystal.
4. Crystal Meter Resistance.

The coupling window size and the meter resistance are specified to be within close manufacturing limits, but the local oscillator power and the crystals vary over wide limits. The figure of 0.5 ma. crystal current appearing in many places in the Instruction Book for the AN/SPS-10 was chosen because the mixer noise figure is generally best in the vicinity of 0.5 ma. Production tests have shown that the noise figure, system ring time, and crystal life are not materially affected by the recommended current increase. Note that the noise figure of the automatic frequency control crystal is not important.

AN/SPS-10 DUPLEXER MAINTENANCE

Poor spectrum of the RF output and magnetron pulling have resulted from arcing at the mounts of either of the two ATR tubes in the duplexer of AN/SPS-10 radar. In cases of poor performance, a trial replacement of ATR tubes may be included in the troubleshooting procedure, noting any improved performance, but particularly, noting if the replacement ATR tubes are seated properly with no end play between either ATR tube and its respective mounting. The effect of a slightly loose ATR tube on the duplexer of AN/SPS-10 radar may not be noticeable at first, but result later in arcing and resultant poor radar performance.

If either ATR tube cannot be seated without end play due to previous arcing, a repair can be affected by filing down to a smooth surface (and carefully removing all filings) the worn duplexer ATR mount contact and building up the duplexer ATR tube contact. From silver slab, file and/or grind to a smooth finish a silverwater of the diameter and thickness needed. With a high wattage or induction type soldering iron, carefully solder the silver-wafer neatly in place, using as thin a layer of solder as possible. Thoroughly clean up and smooth up the contact and surrounding area. The finished contact replacement should have a flat surface and not be rounded.

AN/SPS-10 RADAR OPERATOR'S MAINTENANCE ITEM

Excessive wear and noise in Antenna AS-615/SPS-10 of AN/SPS-10 radar has been found to be caused in some cases by excessive rapid switching from clockwise to counterclockwise rotation and back (CW to CCW positions) as in sector scanning. The antenna mechanical features were not constructed to meet sector scanning requirements.

Radar Operator: WAIT 5 SECONDS after switching from clockwise or counterclockwise rotation of the antenna to OFF before switching to rotation in the opposite direction, so that the antenna may slow down and stop before reversing direction, just as an automobile is normally stopped before throwing the gear into reverse.

AN/SPS-10 SPOKING OF PPI PRESENTATION

In some cases of long cable runs (100 or 200 feet or more) between Radar Set Control C-1134/SPS-10 and Radar Receiver-Transmitter RT-272/SPS-10, sixty-cycle ripple from ships primary power has caused interference in the form of spoking on the PPI presentation of the master indicator used in a particular installation. The solution, for an installation in which spoking occurs, is use of a separate cable (TTRSA-4) for leads 28, D90, D91, D92, and A14.

AN/SPS-10 WARNING-AVOID MAGNETRON BURNOUT

Check the air filter, A-3011, frequently and clean at least once a week. It is located next to the magnetron in the receiver-transmitter unit. A dirty filter prevents the blower from forcing air around the magnetron-first lighting the over-temperature alarm and, if not immediately corrected, burning out the magnetron.

AN/SPS-10 MODIFIED REPLACEMENT MOTOR B-801

Standard stock spares of B801 can replace any B801 antenna drive motor without modifying the motor mount bracket. Modified stock spares of B801 may possibly overheat when used in antennas of certain serial numbers unless the installing activity modifies the motor mount bracket to permit air flow in the cooling circulation path. Standard stock spare B801 motors should preferably not be used with a modified motor mount bracket without brazing solid the modification air-flow holes.

The modified B801 motor has bearings of closer tolerance to reduce antenna noise but requires motor fan ventilation to keep the closer tolerance bearings at acceptable temperatures.

The following AN/SPS-10 radar equipment serial numbers have B801 motors, motor mount brackets of equipment spare B801 motors, standard or unmodified: 1 through 230, 234, 235, 236, 238, 245, and 247. Stock spares with the contract label NObsr-49015 or NObsr-52166, are also standard or unmodified.

The following AN/SPS-10 radar equipment serial numbers have B801 motors, motor mount brackets and equipment spare B801 motors which are modified: 231-233, 237, 239-244, 246, 248-276 (with contract lable NObsr -52166), and 277-479 (under NObsr-52321). Stock spares with contract label NObsr-52321 have been modified.

Modification procedures for AN/SPS-10, B801 motor mounting vent holes: (Refer to Technical Manual for Radar Set AN/SPS-10-NAVSHIPS 91921A), figure 7-1111, pages 7-87 and 7-88; Figure 7-130, pages 7-155 and 7-156, and in B801 removal and replacement instructions of paragraph 5(a), page 7-86.

In accordance with the plan layout shown in figure 1 correct the end bell and motor mounting bracket drawing to show the 25/64" diameter ventilation holes. Although the motor holes may be matched to the brackets to ascertain the drilling location, the plan shown in figure 1 may be used.

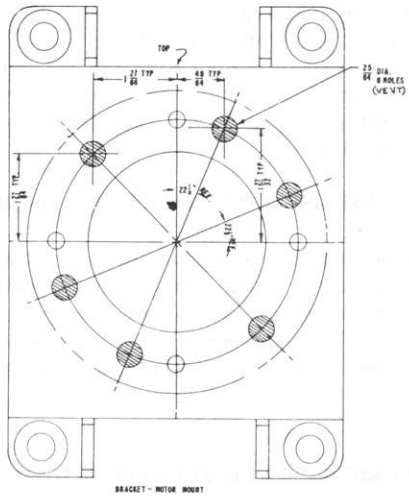


Figure 1

AN/SPS-10 RADAR ANTENNA REPLACEMENT OF "O" RINGS

The following replacement procedures for "O" rings eliminates having to lift the antenna (for removal of the lower rotary joint):

a. Disconnect the waveguide by removing screws on the right angle flange.

b. Remove main shaft lower "O" ring retainer by removing all screws and nuts on the under side of the antenna pedestal. This allows the lower rotary joint, W802, to be pulled downward from the pedestal. (Complete removal of rotary joint is prevented by the IFF coaxial line going through the main shaft and the IFF connector J805).

c. Raise the IFF coaxial line by unscrewing the IFF connector P803 and loosening the spanner nut on the upper rotary joint.

d. The IFF connector J805 under the lower rotary joint must then be removed.

e. The lower rotary joint may then be removed from the pedestal.

f. The "O" rings 0811, 0812 and 0853 may then be replaced.

g. The waveguide and lower rotary joint must then be cleaned to remove the oil contamination.

h. Re-assemble antenna components by reversing procedure described above.

AN/SPS-10 RADAR GASSY RECTIFIER TUBES

Gassy rectifier tubes (Type 4B31) V101, V102, V103 and V110 have been reported as a possible cause for F108, the protective fuse for T101, to blow. At the present time, no method of testing such tubes for gas is available. Visual inspection is not an infallible indication since the presence of gas in such a tube is not always of a conspicious nature.

The failure of Type 4B31 tubes is currently under investigation and corrective measures are expected to be taken in the near future.

AN/SPS-10 RADAR ANTENNA PEDESTAL OIL PUMP FAILURES

The lube oil pump, a positive displacement pump, is above the oil level of the sump and therefore, has a bottom ball check valve. Any dirt or lint accumulating on the ball check will cause the pump to lose its prime and eventually cause antenna failure. Replacement of pumps has resulted, although usually a cleaning of the ball check and sump, followed by priming and inspection of oil flow, would have sufficed. It is recommended that a monthly inspection of oil pump, observing oil flow, be accomplished.

AS-615/SPS-10 ANTENNA MAINTENANCE ITEMS

Upon noting from week to week the amount of noise which can be heard coming from the type AS-615/SPS-10 antenna, any increase in noise or abnormal noise can readily be noticed by the electronics technician.

Any increase or change in the kind of noise from the antenna should be investigated. Possible causes can be checked to some extent without going up the mast to the antenna:

With antenna rotating clockwise, note the sweep on the master indicator used. Note on paper, over a period of several sweeps, any variation in ships heading marker, marking down the maximum position in either direction and the average position. This variation should be less then 1/2 of one degree. Switch antenna rotation from clockwise (CW) position to off (OFF) position; wait five seconds and switch to counterclockwise (CCW) rotation. Mark down on paper the ship's heading marker maximum

position in either direction and average position on the master indicator. The average CCW and average CW positions should be less than one degree apart.

One possible cause of excessive noise and play in drive or synchro gearing which might be indicated in the above checking procedure, excessive wear in the antenna drive-motor flexible coupling, may be corrected by ship's force. Refer to Technical Manual for Radar Set AN/SPS-10, NAVSHIPS 91921(A), section 7, paragraph 5g, replacing the coupling cushion insert if necessary. In cases of antenna noise, or whenever changing or checking the lubrication of the antenna gear box, note the condition of any sludge or "mud" in the bottom of the gear box. If finely powdered metal "mud" is present, the oil may need changing, (to flush out the metal powder) and this condition should be reported. If powdered metal in any quantity or if any metal chips are present, gears should be observed to note any visible wear, and the oil pump and oil pump flexible coupling should be investigated. Note if the oil pump flexible coupling is broken, or if the setscrews are slipping on the shaft. WARNING - The oil pump shaft should turn freely and easily. If the oil pump clogs until oil flow is too slow, gear box oil temperatures may rise sufficiently, due to insufficient oil bath circulation, to decrease gear clearances to zero, causing the gears to wear excessively.

NOTE TO REPAIR ACTIVITIES: In perfect operating condition, with proper clearance between gears to permit expansion or contraction due to operating temperature changes, the antenna should give a little noise. Decreasing clearance between certain gears has been found to produce noiseless operation, as long as the temperature remains constant but does not permit radar operation over the operating-temperature range experienced in the fleet without excessive gear wear.

Observe also the synchro IX and 36X couplings and gear trains to determine if any excessive bearing errors noted in master indicator checking (see above) is due to worn gearing or coupling failures. If no antenna synchro gearing play is observed and the master indicator bearing checks noted bearing errors, the master indicator used in the equipment installation, the synchro capacitors' condition in the bearing junction box, and operation of the synchro signal amplifiers used should be checked. For optimum performance, keep your AN/SPS-10 radar in peak operating condition by proper preventive maintenance.

AS-615/SPS-10 OIL STRAINER 0-880

On failure of AS-615/SPS-10 radar antenna oil strainer (Symbol index No. 81 of figure 7-130 of Technical Manual for Radar Set AN/SPS-10, NAVSHIPS 91921A), uncleaned oil is circulated through the pedestal causing excessive gear wear. When checking antenna lubrication, also check the condition of oil strainer 0-880.

AS-615/ SPS-10 CAUTION NOTE

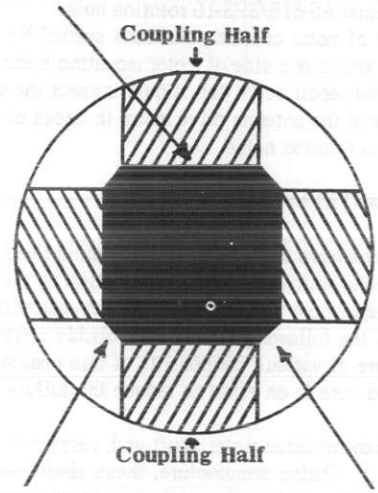
Avoid trouble. Do not apply grease to gears in gear box of Radar Antenna AS-615/SPS-10. Grease is washed into the forced oil gear cooling and lubricating bath, reducing the flow of oil through the oil filter and pump.

AS-615/SPS-10 EMERGENCY COUPLING REPLACEMENT

Replacement of the plastic coupling cushion insert of 0-832 coupling on the Antenna AS-615/SPS-10 has been successfully accomplished by ship's personnel prepared replacement inserts, (Item 173 of fig. 7-130, NAVSHIPS 91921-A). This replacement not only results in longer life but also reduces noise and resulting wear of gears and bearings in the gear box due to vibration resulting from the worn cushion inserts.

Cut 16

Rub Repl cushion insert (1/2" Thk) cut from bulk Matl Stk No 33-R-283 (ship batch Gskt Matl 1/2" Thk)



1/8" flat cut on Ea of 4 corners of Approx 1-1/4" Sq at 45° angle. These Dim are Approx. The cushion shall be cut to fit the Cplg w/o play Bet Cplg Halves.

Figure 1

The Standard Navy Stock Number for the replacement coupling, with plastic cushion insert is FSN N3010-294-5162. In an emergency when an 0-832 is not available, replace the cushion insert by cutting one from bulk material 33-R-283 and grind or sand with a fine emery cloth to get a smooth fit. When properly prepared, the coupling cushion should result in the coupling halves being 1/8-inch apart in the assembled position and the coupling halves should not touch when the halves are manually twisted.

AS-615/SPS-10 RADAR ANTENNA PRE-INSTALLATION INSPECTION NOTE

During the careful pre-installation inspection of the gear box of an AS-615/SPS-10 antenna approximately one-half inch of heavy grease was found in the bottom of the gearcase. (BuShips Note – The oil filter is one-half inch above the gear box bottom and might be clogged by grease.) This grease appeared to be residue of a preservative compound. It is evident that such a contaminant in the lube oil system could cause lube oil pump and bearing failures.

The lube oil system for this antenna was thoroughly flushed with solvent, wiped dry and refilled. The condition of the lube oil will be observed as closely as practicable after the equipment is installed to insure early detection of any additional contamination.

This report is being published for information to aid other ships and fleet activities to prevent possible failures to Radar Antenna AS-615/SPS-10.

AS-615/SPS-10 NOISE REDUCTION

The USS MEREDITH (DD-890) reports considerable reduction of Antenna AS-615/SPS-10 rotation noise upon replacement of motor coupling cushions symbol No. PO-0832 and shimming one side of motor mounting brackets.

Installation and repair activities should inspect the vibration mountings of the antenna drive motor in cases of excessive antenna rotation noise.

AS-615/SPS-10 ANTENNA FAILURES

Various failures have been reported concerning the AS-615/SPS-10 antenna which is under investigation by the Bureau and the equipment manufacturer. The investigation to date indicates the following factors as probably contributing to the failure of various components of this pedestal and are published here in an effort to reduce the failure rate.

1. Misalignment of drive motor shaft with respect to jack shaft (0-861). During manufacture, these shafts were aligned and the motor mounting bracket pinned to insure proper alignment after future motor replacement. Care should be exercised to assure that this alignment is maintained.

2. Insufficient clearance in coupling (0-832). Approximately 1/32-inch clearance was provided between coupling halves and the plastic coupling block to prevent end thrust on the motor. This clearance should be maintained. There should be no end play in the jack shaft (0-861).

3. Improper bearing replacement. Drive motors were supplied with bearings with the following requirements:

New Departure No. 77503 with an axial movement of .0045-.0055" and a radical movement of .0005-.0008". Bearings fit on rotorshaft .0006-.0009" loose. Bearings fit in end bell casting .001 - .0015" loose. Bearing lubricant Dow Corning Type 44, Silicone.

All bearing replacement for this drive motor should meet the above requirements.

4. Loose fan on motor shaft. Broken fan blades are probably the result of fan becoming loose on motor shaft and hitting the motor housing. Originally, the set screws holding fan in place were staked and coated with glyptol. Tightness of the fan on motor should be assured.

5. Replacement of worn gears 0-842 and 0-883. These gears were placed in supply system as matched gears. If the replacement of either gear is required, both should be replaced with a matched pair. A matched pair can be identified by a number stamped on both gears. The numbers should be the same. Also, Letters A and B are stamped on the gears for proper mating when installed. When installing gear 0-842, care should be exercised in assuring the Letters A and B are on the lower side of the gear nearest pedestal base and these letters are properly mated with the letters on worn gear 0-883. In production of the AS-615/SPS-10 antenna, the shimming of the worn shaft was such as to give zero end play. The shims are for adjustment of the end play and radical clearance in the bearings. The shims also serve for an adjustment of the critical alignment of the cone drive. In determining shim thickness, make sure the worn 0-883 and bearing 0-826 are properly seated by slight pressure applied from oil pump side. Study paragraph 9h(7)(b), page 7-112 of NAVSHIPS 91921(A) prior to the replacement of either gear or making changes in shim's thickness.

6. Antenna oil heater HR-801 circuit should be energized at all times when practicable. If de-energizing of this circuit is required for a extended period, the heaters should be re-energized at least 24 hours, if possible, prior to equipment operation in order to bring the temperature of lubricating oil up to its proper operating value.

7. After pedestals have been repaired and if flushing with a solvent is required do not wipe inside with a cloth to remove remaining solvent. Any small amount of lint will clog oil strainers resulting in insufficient lubrication.

8. A 20-degree error in bearing readings from this equipment will most likely be caused by a broken or lost spring between the Yoke 0-881 and Pawl 0-882. In an emergency, correct bearings can be obtained by reversing the direction of antenna rotation until spring can be replaced.

9. Reports have been received concerning looseness between reflector and apider and in one case, only one bolt was holding reflector in place. Tightness of the three bolts should be assured with bolts tightened to a torque of 45 foot pounds.

10. The antenna reflector and the spider were shipped from the equipment manufacturer as a matched pair, each with the same serial number. Note paragraph 2, page 3-3 of NAVSHIPS 91921(A). Reports have been received indicating a mismatch between reflector and spider. Under this condition, the proper beam pattern is not assured. To locate mismatched units and to initiate corrective action, it is requested that ships having an AN/SPS-10 installation with mismatched reflector and spider advise the Bureau by a note on its next monthly Performance and Operation Report (NAVSHIPS 3878) of the serial number of the reflector and serial number of the spider.

11. Oil leakage in waveguide. This leakage around O-ring 0-851 and into the waveguide appears to be the result of insufficient support of waveguide run at the pedestal resulting in a strain being placed on lower rotary joint W-802. A method of providing additional support of waveguide near pedestal is under consideration and will be disseminated to naval activities when developed in final form. As an interim measure, it is suggested that where additional support is required, a temporary installation of a support be made. It is also suggested that a small amount of Permatex between the upper surface of 0-815 and the O-ring retainer might assist in preventing leakage.

12. This pedestal, under normal operating conditions, will emit some noise, however, if excessive noise is encountered, it is suggested that motor alignment and worn motor coupler 0-832 be investigated since approximately 90% pedestal noise is found in this area.

During production of the AN/SPS-10 equipment, antenna pedestals were produced by two different equipment manufacturers identifiable only by serial numbers. To further assist the Bureau in its investigation of the pedestal failures, it is requested that ships with AN/SPS-10 installation indicate on their next monthly Performance and Operational Report the serial number of antennas; currently installed. In those cases where pedestals have been replaced since initial equipment installation and if data is available, it is requested that serial numbers of antennas removed and approximate removal dates by submitted. After initial report, no further report of antenna serial number is required unless present pedestal is replaced, at which time serial number of replacement pedestal should be reported.

Z-101 PULSE FORMING NETWORK (AN/SPS-10 RADAR)

Upon failure of the "A" Section of the pulse-forming network, Z-101, a temporary repair may be made using only the Z-101 "B" section connected directly to the charging circuit which allows normal operation when the radar is placed in NLP operation. The connections to both terminals of the "A" section are omitted.

The Bureau concurs with this modification as an emergency repair.

AN/SPS-10 PREVENTIVE MAINTENANCE ANTENNA PEDESTAL

At time of quarterly check of antenna pedestal oil level, remove access cover and inspect internal parts for wear, paying particular attention to plastic coupling, symbol 0832, at end of drive motor shaft. High failure rate of this item has caused excessive damage to drive motors, symbol B-801.

AN/SPS-10 RADAR INTERFERENCE FROM AND POTENTIAL SAFETY HAZARD

Potential safety hazards and sources of radiation, have been reported.

The following receiver-transmitter components have been found to be insulated by paint and in those cases where a resistance reading between the component and ground exceeds 0.01 ohms, corrective action should be accomplished by insuring a good metal-to-metal contact:
Duplexer Assembly, Power-On Indicator Light, TR Tube-Retaining Ring, Capacitor C-3009. Bonding of the hinged door to the cabinet should be insured to prevent arcing.

AN/SPS-10 RADAR INTERFERENCE FROM AND POTENTIAL SAFETY HAZARD

The Bureau has received a report of a potential safety hazard and source of interference radiation in the modulator. The filament transformer (T-102) was found to be at an RF potential of 300 plus volts above the modulator chassis, due to both the modulator and transformer case mating surfaces being completely painted. A check should be taken and in those cases where resistance readings between the transformer case and ground exceed 0.01 ohms, corrective action should be accomplished by insuring a good metal-to-metal contact.

A FIVE SECOND PAUSE OR A NEW INSERT MAY FIX THAT COUPLING – AN/SPS-10

The original cast coupling used in the AN/SPS-10, symbol 0-832, (no stock number) has been replaced by a stainless steel coupling, FSN NS3010-294-5162.
The plastic block floating insert used in this coupling is available under FSN NS3010-562-8927. In many instances, installation of a new insert, rather than a complete coupling, will satisfactorily repair the equipment.

Excessive wear on the coupling may be eliminated by pausing for 5 seconds after switching from clockwise or counterclockwise rotation of the antenna to OFF before switching in the opposite direction.

AN/SPS-10 RECEIVER LOCAL OSCILLATOR SYMBOL V-3005, TYPE 6115

The AN/SPS-10 receiver local oscillator tube, as furnished with original equipment, has a small brass cylindrical extension which slips over the end of the coaxial probe that extends downward from the bottom of the tube base. Since this extension is not furnished with tubes drawn from stock, it is necessary to remove the extension from the original tube and install it on successive tubes used as replacements. Without the extension, the receiver local oscillator will be unstable in operation and difficult to tune.

The accompanying figure 1 is for use in case the extension has been lost or discarded with the old tube.

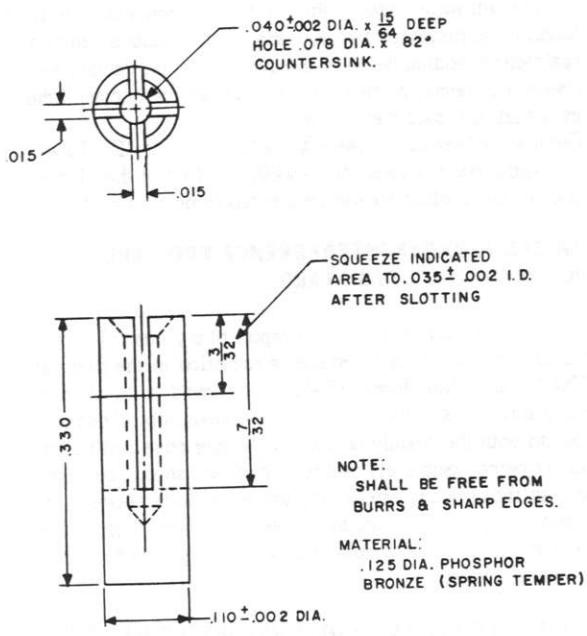


Figure 1

INSTALLATION OF WINDOW IN WAVE-GUIDE ON AN/SPS-10 RADAR SYSTEM

In the AN/SPS-10 radar antenna, there are frequent failures of the lower oil seal. This failure permits oil to leak into the waveguide and to run down to the transmitter. Removal and cleaning of the waveguide becomes necessary.

When an AN/SPS-10 antenna is installed or serviced, a teflon window could be installed at the flange connecting the waveguide to the antenna. This window (0-803) would prevent the oil from draining down through the waveguide and would help to eliminate the necessity for the removing and cleaning of the waveguide. This window could be a duplicate of the present window which is located at a point near the transmitter.

RADAR SET AN/SPS-10B – MAINTENANCE NOTES

Refer to the Complementary Technical Manual, NAVSHIPS 93159, and perform the following:

WARNING

DO NOT SERVICE ANY PORTION OF THE ANTENNA ASSEMBLY UNLESS THE RADAR SET IS DISCONNECTED FROM THE SHIP'S POWER SUPPLY, AND CONTROL ANTENNA SWITCH S1401 ON THE SHIPS MAST IS IN THE "OFF" POSITION.

a. Loosen the ten captive thumbscrews holding terminal board access cover plate to Antenna Pedestal AB-561/SPS-10B (Serial Numbers 2001 through 2202). Remove the cover plate.

b. Check the wiring at Terminal Board TB-1302 against figure 6-8 of NAVSHIPS 93159. If wiring is correct, proceed with step (d).

c. If both leads from Oil Heater HR-1301 are connected to Terminal F02 on Terminal Board TB-1302, remove one lead and reconnect it to Terminal A101 of the terminal board.

d. Replace the terminal board access cover plate.

LUBRICATION FOR AN/SPS-10 ANTENNA PEDESTAL AS-615/SPS-10

One reason for the failure of the AN/SPS-10 Antenna Pedestal AS-615/SPS-10 is lack of oil flow lubrication. Failure to periodically clean the oil strainer (0-880) will cause the pump to draw oil and foreign particles through the relief valve. Eventually the check valve will clog and the pump prime will be lost when the antenna is stopped. When the antenna is rotated again, the oil will not flow and failure within the pedestal is inevitable.

To assure proper oil flow, the following procedure for detailed inspection is recommended for AS-615/SPS-10 pedestals only.

1. Energize the antenna drive system at the console but do not radiate.
2. De-energize antenna drive system with the antenna safety switch which is located at the pedestal or underneath and on the mast.
3. Remove inspection plate opposite the motor.
4. ASSURE A POSITION WHEREBY THE ANTENNA MAY BE ROTATED CLEAR OF THE INSPECTOR.
5. Energize the safety antenna switch.
6. Note if oil is coming down from the upper bearing and fibre gears.
7. De-energize the antenna safety switch.
8. If the inspector observes lack of oil flow when the antenna is rotated (4 and 5 above), then a check must be made to see if any of the system has suffered damage or excessive wear. This may be done by shaking and rotating the reflector in an azimuth direction while observing the reflector should have a maximum amount of approximately worm shaft (0-883) and gear (0-842) for excess play. The two degrees and there should be no end play of the worm shaft (0-883) or its thrust bearing and very little (less than 1/32-inch) between the worm (0-883) and pinion (0-842).

EXTREME CARE MUST BE TAKEN TO ASSURE ALL SAFETY PRECAUTIONS ARE OBSERVED FOR THE FEW SECONDS THE ANTENNA IS ENERGIZED.

AN/SPS-10 DUPLEXERS (W3010)

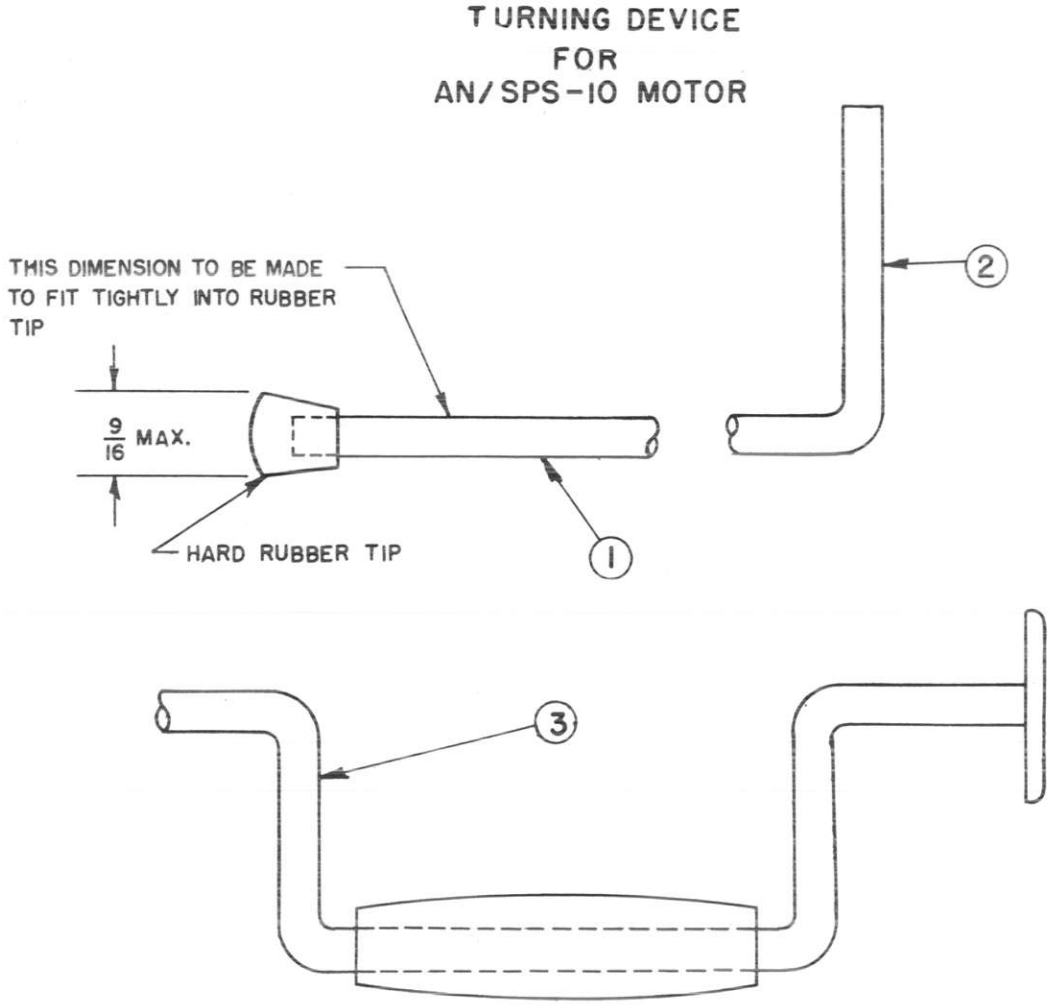
Ships procuring new duplexers from stock should inspect the resistance card in the AFC attenuator and, if necessary, replace it with the card from the original duplexer. The new card is made of light, clear plastic with a metallic coating on one side. The old card is made of a coarse black material. The defective cards are in duplexers manufactured by CWS Waveguide Corp., Lindenhurst, N.Y. Federal Stock Number of duplexer is FSN N5840-501-1521.

AN/SPS-10B, HAND ROTATION OF PEDESTAL AB-561/SPS-10B

A modification has been suggested that will permit manual rotation of AB-561/SPS-10B pedestal for alinement and adjustment purposes during overhaul and installation periods.

Beginning with pedestal serial number 2203, the equipment manufacturer has included a screwdriver slot in the end of rotor shaft to permit manual rotation. The screwdriver slot is accessible by removing head plug, item 4 of figure 6-4, NAVSHIPS 93159.

On pedestals prior to serial number 2203, the pedestal can be manually rotated by using the turning device and instructions shown on figure 1.



OPTIONS:

1. RUBBER TIP & STRAIGHT SHAFT FOR INSERTING INTO HAND DRILL.
2. RUBBER TIP & "L" HANDLE.
3. RUBBER TIP & BIT.

DIRECTIONS:

(A) REMOVE HEAD PLUG (ITEM 4 OF DWG. NO. 57713) (SEE FIG. 6-4 OF NAVSHIPS 93159)
(B) INSERT RUBBER TIP.
(C) APPLY PRESSURE IN AXIAL DIRECTION.
(D) TURN SHAFT REQUIRED AMOUNT.
(E) REMOVE RUBBER TIP & REPLACE HEAD PLUG.

Figure 1.

CORRECTION OF AN/SPS-10 DUPLEXER DEFECT

Some Duplexers, FSN N5840-501-1521, manufactured by CWS Waveguide Corp., have been reported with attenuator blocks located inside of the AFC section installed in reverse order. This defect allows the hole entering the waveguide to be uncovered with the result the AFC circuit will not lock-in and the crystal current is excessive. Decoupling of the crystal and maximum attenuation of the AFC attenuator does not decrease the crystal current.

Removal and reinstallation of the attenuator blocks in the correct order has been found to remedy this defect and restore the duplexer to satisfactory operating condition. For removal of the glued-in attenuator blocks it may be necessary to use steam or immerse in hot water.

AN/SPS-12 ALL REQUISITIONING ACTIVITIES, SHIP & SHORE

It should be noted that the AN/SPS-12 Radar is supplied less 5J26 Magnetrons. The Magnetrons are to be requisitioned from standard stock when equipment is requisitioned. (FSN N5960-107-8133).

AN/SPS-12 RADAR AC POWER FOR MASTER INDICATOR

Technical Manual for Radar Set AN/SPS-12, NAVSHIPS 91949(A) page 7-195, 7-196, Power Supply Control C-1081/SPS-12 schematic diagram shows terminals DO2 and DO3 as supplying 115 VAC power to PPI.

AC power for master indicator shall be obtained from separate local power source--"not from terminals DO2 and DO3 in AN/SPA-12 radar."

This allows independent operation of indicator for maintenance and operational purposes without disrupting operation of other equipment.

In AN/SPS-12 radar systems where the master indicator has been connected to Terminals DO2 and DO3, fuses F2302 and F2307 should be increased to 25 amps for AN/SPS-8A, 20 amps for AN/SPA-4A and 12 amps for VK-4A indicators. Present installations where the master indicator receives 115VAC power from radar equipment shall be changed to separate 115 VAC power source at first available opportunity.

TROUBLE SHOOTING THE AN/SPS-12 RADAR

The following method has been found useful in trouble shooting the AN/SPS-12 radars.

1. In the AN/SPS-12 thyratron protection relay K-505 operates when the magnetron misfires. When K-505 operates, it takes the equipment out of radiation for several seconds. Then if the magnetron continues to misfire, the cycle repeats. This prevents making checks because the equipment does not remain in operation. There are many reasons for the misfiring besides a faulty magnetron. Hence, if changing the magnetron does not correct the misfiring, the antenna and wave guide should next be checked for the trouble by switching the magnetron output into an RF dummy load. If this does not reveal the trouble, it is then necessary to check the units preceding the magnetron as the trouble source. Ships having the AN/SPS-8, -8A have the DA-37/U portable unit which is used as a dummy load for this radar.

2. To operate the AN/SPS-12 radar modulator into Dummy Load, DA-37/U remove the connector from the end of one of the pulse cables for the dummy load. Crimp a lug onto the center conductor and connect a ground strap to the shield.

a. In the AN/SPS-12 transmitter, disconnect the lead from the end of the pulse cable which connects to the pulse transformer. Connect the lugged end of the dummy load pulse cable to the AN/SPS-12 pulse connection (See figure 1). Position the dummy load pulse cable to keep maximum possible space between the center conductor and ground. Start the blower motor in the dummy load and the AN/SPS-12 radar can be placed in radiation.

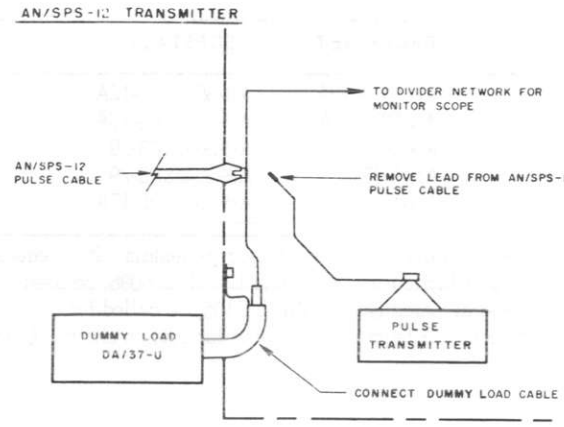


FIGURE 1

3. With this hook-up, the monitor scope on the receiver-transmitter is still connected, but the pulse shape can be analyzed much better if an external synchroscope is used.

4. Isolation of components within the modulator can be obtained as indicated in figures 2 and 3.

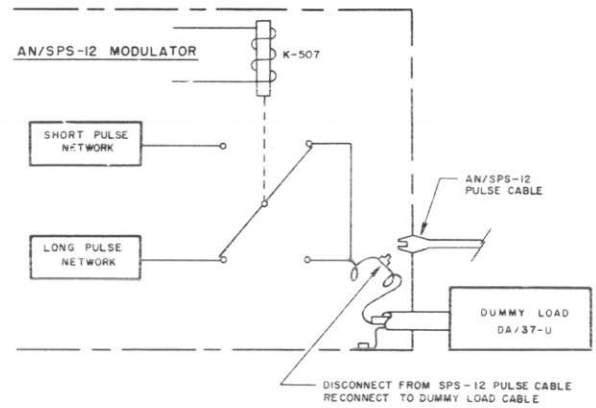


FIGURE 2

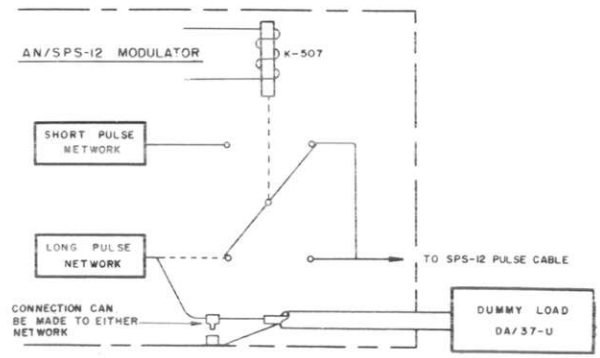


FIGURE 3

PEDESTAL LUBRICATING OIL CHANGE

RADAR SETS	PEDESTALS
AN/SPS-12A	AB-560/SPS-12A
AN/SPS-17A	AB-559/SPS-17A
AN/SPS-29	AB-564/SPS-29
AN/SPS-37	AB-564/SPS-29
AN/SPS-37A	AB-559/SPS-17A

All installations of the subject pedestals: It is requested that gear-lubricating oil, Grade L, MIL-L-6086, be used instead of Grade GO 80, MIL-L-2105, as called for in the applicable technical manuals and lubrication charts. Grade L, MIL-L-6086, gear-lubricating oil is available under the following federal stock numbers.

FSN 9150-265-9417 (1-gallon cans)
FSN 9150-223-4116 (5-gallon cans)

NOTE: Changeover to the MIL-L-6086 oil is to be accomplished immediate.

The oil-pump intake strainers are to be cleaned thoroughly with solvent, prior to filling. It is recommended that after the initial draining and filling with MIL-L-6086 oil, after 48 hours of operation, the pedestals be drained and refilled to remove all traces of MIL-L-2105 oil.

For AB-564/SPS-29 pedestals used with AN/SPS-29 radar sets, new lubrication charts and pedestal-heater modifications will be prepared.

AN/SPS-17 RADAR R-F TRANSFORMER ADJUSTMENT AND INSTALLATION

Reports indicate difficulties have been encountered with r-f transformers during installation of the AN/SPS-17 radar. The following procedures should be observed to insure proper operation:

The r-f transformer, TF-250, is designed to match a low final--amplifier impedance to the 50-ohm coax-line impedance. It has a standard quarter-wave matching transformer, located an integral number of half wavelengths from the Final Amplifier coupling loop.

The quarter-wave matching transformer is constructed of standard 3-1/8-inch coax with a movable sleeve over the inner conductor. The position of this sleeve is factory adjusted to obtain the best tuning condition. At the optimum position, the final amplifier output coupling loop may be readily adjusted for a power output peak on all channels. The inner conductor sleeve position should not have to be readjusted in the field.

An incorrect inner sleeve position could be obtained if the inner conductor were removed and then reinserted in the reverse direction. To check for proper orientation, observe the following:

1. The outer conductor of the matching section has a sleeve on one end which may be moved to open up adjustment slots in the outer conductor. This sleeve is properly positioned toward the antenna end of the matching section.
2. If the outer conductor slots are opened by moving the outer conductor sleeve, it is possible to observe set screws in the enlarged inner conductor sleeve. If the set screws do not show below the slots, the inner conductor has probably been reversed.
3. When properly oriented, the enlarged inner conductor is closer to the antenna end of the matching transformer section than to the transmitter end.

AN/SPS-17 DUPLEXER MAINTENANCE

In order to obtain maximum ranges with the AN/SPS-17 system, it is highly important that attention be given to Duplexer maintenance. It is suggested that the following program of maintenance procedures be used:

1. Check the spark gap settings once each watch. A normal gap setting will cause the spark to dance back and forth between the tungsten electrodes.
2. Check capacitor tuning of the ATR and TR arms after each adjustment of the gaps. The capacitors may require retuning when the gap spacing is changed.
3. Reposition the tungsten electrodes within the holders as required to maintain about 1/8-inch of electrode extending beyond the locking nuts.
4. Remove the gap electrodes and dress up the arching surfaces when it is observed that the surfaces have become uneven and pitted. Remove oxide powders which may have collected in the Duplexer.
5. Inspect the ATR and TR capacitor plates when the gap electrodes are being replaced and clean up arc damage to the plates.

It is convenient to use the 7/16 inch Spintite wrench supplied with the monitor panel chassis when removing the tungsten electrode locking nut on the center conductor side of each gap. This wrench may be inserted through the hole provided for the micrometer assembly. Care should be exercised to prevent dropping the locking nut inside the duplexer arm. The duplexer end plates may be removed when working on the gap assemblies.

The spark gap should be initially set to .010 prior to switching the system into radiate. The intial setting is obtained by running the movable electrode in until it just touches the fixed electrode and then backing out .010. A light directed through the oppositely positioned viewing window will permit inspection of this adjustment and prevent running the movable electrode beyond the point at which the electrodes just touch.

Final gap adjustment is made in radiate by spacing the gap electrodes until the arc dances back and forth between electrode faces.

Capacitor tuning can be checked by observing signal and noise video on the monitor oscilloscope while in radiate. The capacitors should tune as follows:

ATR Capacitor - Sharply for minimum noise (grass).
TR Capacitor - Sharply for maximum signal.
Auxiliary TR Capacitor - Sharply for maximum signal.

Use caution when tuning the capacitors to insure that the capacitor plates are not brought close enough to cause arcing between the plates. If this occurs, the movable plate should be backed off immediately. Arcing between plates will be evidenced by a change in pitch of the arc noise.

Capacitor tuning may also be accomplished out of radiate by inserting a pulse signal to the Receiver via the transmission line unidirectional coupler (CU-591). An AN/USN-26 Signal Generator may be used for this purpose.

If the ATR or TR capacitors do not tune sharply, there is probably too much or too little of the tungsten electrodes projecting beyond the electrode-holder locking nuts. This electrode length must be set to about 1/8-inch. A shorter or longer length may cause the locking nuts to add or subtract excessive capacitance from the tuned circuit.

When it is observed that the electrode faces have become uneven and pitted, they should be dressed by filing. It is necessary to remove the electrodes from the holders in order to accomplish this.

AN/SPS-17 RADAR INSTALLATION PROCEDURES AND PRACTICES

The following installation procedures and practices are supplementary to applicable instructions contained in the AN/SPS-17 technical manual, NAVSHIPS 92987(A).

1. Oil lines connecting the final amplifier and heat exchanger should be run along the deck to prevent possible restriction of oil flow due to excessive pressure head at the final amplifier cavity.
2. After the installation is completed, a flow meter should be inserted in the cavity and anode oil supply lines to determine the rate of oil flow through each line.

If the cathode heating supply is operated for 30 minutes, the oil will be near its operating temperature and the following minimum flow conditions should be measured:

(a) Cavity line - 4 pts/min at 5 lb/sq. in.

(b) Anode line - 8 pts/min at 14 lb/sq. in.

CAUTION: Do not exceed 6 lb/in² at the cavity input or damage to the final amplifier tube may result.

3. When pumping oil from the sump into the final amplifier cavity, leave one of the petcocks at the top of the cavity open. A hose may be run from the petcock to a container to catch overflow oil. Allow the oil to run into the container until all air bubbles are absent from the oil stream, then close off the petcock. Operate the cathode heating supply for about 30 minutes and again open the petcock to release any air which might be trapped in the top of the cavity.

4. Prior to inserting the final amplifier tube, check continuity between the external grid and screen connections and their respective contact rings inside the cavity. Zero ohms should be read in both bases.

CAUTION: Excessive tightening of the screen and grid connection assemblies may compress the teflon parts of these assemblies and prevent contact.

5. The duplexer spark gaps must be checked occasionally to insure that the electrodes project about 1/8 to 3/16 of an inch beyond the electrode clamps. If the projection is made too great or too small, it will not be possible to tune the duplexer capacitors. Note that the electrode spacing should be initially set for about .010 and then adjusted slightly while in radiate to obtain an arc which dances back and forth between the tungsten surfaces.

6. It is recommended that all coax connections between the frequency generator and the transmission line be checked for tightness prior to firing up for the first time. A loose coax connection may start an arcing condition which will damage system components. The RG-17 connectors should be tightened with channel lock pliers.

7. Precautions should be taken to insure that only clean oil is used in the system and oil contamination is not premitted while the cavity is partially disassembled.

INSTALLATION NOTES AND PRACTICES FOR AN/SPS-17 RADAR

1. Cabinet installation arrangement for Radar Equipment AN/SPS-17.

a. The Control-Monitor Group (OA-1472/SPS-17 should be located so that the Monitor Oscilloscope can be seen when tuning up the Frequency Generator and Power Amplifier stages (OA-1470, OA-1469 and AM-1649/SPS-17.) This allows operating personnel to watch the monitor oscilloscope, waveshape voltmeter M602, and power output meter while tuning up the transmitter stages.

b. The duplexer should be located so that the duplexer capacitors can be tuned while watching the monitor oscilloscope.

c. The duplexer auxiliary T-R arm should be located as near to the control-monitor group as possible so as to provide for a short lead between the duplexer and J110-A. The length of this lead will affect receiver MDS.

d. It would be desirable to position the Heat Exchanger (HD-286) and HPA (AM-1649) cabinets so that the pressure gauge in the HPA can be observed while adjusting the pressure regulator valves in the heat exchanger.

2. An external, salt-water filter for the cooling water supply to the heat exchanger is recommended for installation. Since it is highly desirable to maintain continuous operation of the AN/SPS-17, it is recommended that parallel filters be installed to provide for cleaning of one filter while the other is being used.

b. The oil lines connecting the HPA cavity and the Heat Exchanger should be run below the top level of the cavity. Do NOT run the lines via the compartment overhead.

3. Identification of Couplers. CU-592/SPS-17 is a bi-directional coupler and CU-591/SPS-17 is a dual unidirectional coupler. Coupler CU-592/SPS-17 should be located between the duplexers and the HPA transmitter, AM-1649/SPS-17. Note that both couplers are labeled as to Transmitter and load ends.

4. Frequency and Receiver Generator Control Locking. Each of the 40:1 gear ratio controls located on the frequency and receiver generator front panels has an Allen head locking screw. Failure to release the locking screw will result in damage to the control. The controls are normally locked prior to shipment from the factory.

5. Alignment of Pulleys. Alignment of blower and motor pulleys should be checked and adjusted if necessary. Early failures have indicated that alinement has not been checked at the contractor's plant.

6. Arcing in 2nd and 3rd IPA cavities. During installation, the 2nd and 3rd IPA cavities should be disassembled and carefully reassembled as indicated in NAVSHIPS 92987(A). Check for bent or broken contact fingers, arcing and dirt. In addition, particular notice should be given to insulators and feed-throughs for arcing, loose mounting, or rupture. NOTE: Improper installation of the tube is the primary cause of cavity troubles.

7. Safety Wiring. The Allen screws holding the subbase to the pedestal adapter should be checked for safety wiring. If the screws are not safety wired, drill, replace, and wire. CAUTION: Do not drill screws when installed.

AN/SPA-28 RADAR ANTENNA INSPECTION

A recent report of antenna failure of an AN/SPS-28 equipment installed on a DER revealed Antenna AS-839/SPS parted from the antenna pedestal, Type AB-488/SPS with hold down bolts being pulled through antenna pedestal flange or being sheared.

To avoid the possibility of a similar occurrence on other antenna installations, it is recommended that all mounting and hold down bolts be inspected bimonthly to insure that they are in a sound condition and properly secured. It is also recommended, at the time of this inspection, that a check be made of the antenna structure members to insure its soundness.

AN/SPS-17 RADAR WATER CONDENSATION IN ANTENNA LUBE OIL SYSTEM

To prevent water condensation, it is recommended that main circuit breaker switch (CB7001) be left in the ON position at all times EXCEPT when it is required to secure power for servicing. With this switch turned ON, power is supplied to the antenna oil heater element so that antenna thermoswitch (S8006) can operate to maintain a constant oil sump temperature. A constant temperature condition will prevent water condensation in the oil sump.

Personnel should be cautioned that switching the main circuit breaker to ON applies 440V AC to high voltage indication regulator (VR6001) in the heat exchanger cabinet and to the input side of relays K6001 and K6002 in the high voltage rectifier cabinet. Other control circuitry is also energized.

AN/SPS-17 RADAR STRAINERS FOR THE HEAT EXCHANGER SALT WATER SUPPLY

The flow switch used in the salt water input line to the heat exchanger is designed to contain a strainer screen if one is required. This screen **should not be used** in the AN/SPS-17 cooling system and has been removed from production equipments. Some early production equipments may have been shipped with the screen installed. If salt water flow to the heat exchanger is stopped due to an obstruction in the salt water line, the flow switch should be checked to insure that the screen removal has been accomplished. Breaking the union at the input side to the heat exchanger will permit a screen removal inspection to be made.

It is recommended that an external strainer unit be installed for the heat-exchanger cabinet. This may be a parallel system to permit cleaning one strainer while the other is being used, or a single unit which will permit cleaning without interrupting salt water flow longer than 2 minutes. If flow is stopped for a longer peroid, the system will go out of radiate. Some strainers may be cleaned without interruption of flow and others require only a momentary interruption. The strainer screen mesh should have perforations between 1/32 inch and 1/16 inch. Pressure drop through the strainer should not exceed that required to supply at least 30-lbs./in pressure at the cooler cabinet input.

AN/SPS-17 AN/SPS-28 PEDESTAL WATER ACCUMULATION

AN/SPS-17 and AN/SPS-28 Radar pedestal mounting platforms should be examined to see if proper water drainage has been provided for the pedestals. Holes must be drilled in solid platforms to prevent water accumulation in the bottom of the pedestals.

SUGGESTED PROCEDURE FOR EVALUATING GAIN PERFORMANCE OF THE AN/SPS-17 RECEIVER RF AMPLIFIER

If the AN/SPS-17 receiver is not performing normally, it may be questionable as to whether trouble exists in the RF amplifier section. A rapid check on the gain performance of the RF amplifier can be made using a signal generator plus facilities of the regular system. The reference signal generator is the AN/URM-26. The signal generator output reference level should be set in accordance with the test equipment technical manual. With power supplied to the receiver drawer and the RF amplifier plate current set for approximately 10 milliamperes, the LO input to the drawer should be disconnected.

The signal from the signal generator should then be fed in at the input jack from the duplexer. The selector switch on the face of the receiver drawer should be set to read forward crystal current. The attenuator on the signal generator should be set to approximately -25 db below one milliwatt before the signal generator is turned on.

While observing the crystal current meter, the signal generator power output should be increased until approximately 0.2 ma reading is obtained. The reading at this point on the signal generator attenuator should be observed. If the gain of the RF Amplifier is proper, this gain reading should be 16 db below one milliwatt or better. If this reading is less than 16 dbm, the RF amplifier tube should be replaced.

AN/SPS-17 CONTACT FINGER IDENTIFICATION

The following identification of finger contacts used in AN/SPS-17 cavities are listed for convenience in ordering replacement parts.

	Description	F.E. Dwg. No.	Technical Manual Identification	Spare Part Symbol
		1st and 2nd IPA Contact Fingers		
1.	Inner Filament Fingers	7023523P1	Fig. 7-115 P70	E2227
2.	Outer Filament Fingers	7030538P1	Fig. 7-115 P48	E2228
3.	Control Grid Contact Fingers	7030518P3	Fig. 7-115 P46	E3041 E2226
4.	Screen Grid Contact Fingers	7030518P2	Fig. 7-115 P15	E3038 E2223
5.	Plate Contact Fingers	7030518P1	Fig. 7-115 P4	E2222 E3037
6.	Grid Doop Inner Contact Fingers and Grid Loop Outer Contact Fingers	PL7200854G1	none	E3039

7.	Output Pick-up Fingers	7030571P2	Fig. 7-115 P52	E2229
8.	Plate Cavity Fingers (2nd IPA ONLY)	PL7720841G1	none	E3045

3rd IPA Contact Fingers

1.	Inner Filament Fingers	7030538P2	Fig. 7-124 P45	E3228
2.	Outer Filament Fingers	7065955G1	Fig. 7-124 P21	E3230
3.	Grid Contact Fingers	7030534P1	Fig. 7-124 P40	E3226
4.	Plate Contact Fingers	7040267P1	Fig. 7-124 P31	E3227
5.	Plate Capacitor Fingers	7035948P1	Fig. 7-124 P34&37	E3229
6.	Grid Loop Inner and Outer Contact Fingers	7711401P5	none	E3232
7.	Plate Loop Inner and Outer Contact Fingers	7716536G1	none	E3231
8.	Output Pick-up Fingers	7453914G1	none	E3233
9.	Output Fingers to Coaxial Inner Conductor	7030537P1	Fig. 7-124 P48	E3234

HPA Contact Fingers

1.	Inner Filament Fingers	7030695P1	none	E4004
2.	Outer Filament Fingers	7030694P1	Fig. 7-127 P17	E4005
3.	Cathode Collet Fingers	7029980P1	none	E4018
4.	Contact Ring (Control Grid)	7716127G1	Fig. 7-127 P82	E4002
5.	Contact Ring (Screen Grid)	7706915G1	Fig. 7-127 P81	E4001
6.	Sleeve Capacitor	7422038G1	Fig. 7-127 P7	E4040
7.	Contact Ring (Tube Top Casting)	7422589G1	none	E4042
8.	Loop Input Contact Fingers (rod) and Loop Input Contact Fingers (Cavity)	PL7036788G1	none	E4006
9.	Lower Cavity Shorting Ring Rod Contact Fingers	7711400P21	none	E4037
10.	Lower Cavity Shorting Ring Outer Wall Contact Fingers	7429011P1	none	E4025
11.	Lower Cavity Shorting Ring Outer Wall Contact Fingers	7429011P5	none	E4029
12.	Lower Cavity Shorting Ring Outer Wall Contact Fingers	7429011P6	none	E4030
13.	Lower Cavity Shorting Ring Inner Wall Contact Fingers	7429011P7	none	E4031
14.	Lower Cavity Shorting Ring Inner Wall Contact Fingers	74290011P2	none	E4026
15.	Loop Contact Fingers (Rod) and Loop Output Contact Fingers (Cavity)	PL7037609G1	none	E4020
16.	Upper Cavity Shorting Ring Outer Wall Contact Fingers	7429011P3	none	E4027
17.	Upper Cavity Shorting Ring Outer Wall Contact Fingers	7429011P8	none	E4032
18.	Upper Cavity Shorting Ring Outer Wall Contact Fingers (Segment Section)	7421524P3	none	E4039
19.	Upper Cavity Shorting Ring Side Support (Inner Wall and Outer Wall)	PL70337675G1	Fig. 7-127 P51	E4043
20.	Upper Cavity Shorting Ring Inner Wall Contact Fingers	7429011P9	none	E4033
21.	Upper Cavity Shorting Ring Inner Wall Contact Fingers	7429011P4	none	E4028
22.	Upper Cavity Shorting Ring Inner Wall Contact Fingers (Segment Section)	7421524P2	none	E4038

AN/SPS-17 PREVENTION OF ARCING DAMAGE AT THE HPA ANODE INSULATOR

The following conditions are primarily responsible for destructive arcing at the HPA anode insulator:

1. Corona erosion of the teflon insulation

Corona erosion is due to the presence of corona in small air spaces near the anode high voltage conducting rod. Corona is likely to occur between the teflon insulator and the cavity housing, between the center conducting rod and the teflon insulator, and at the joining surfaces of the teflon insulator sections. The result is free oxygen and high temperatures in the corona supporting spaces which burns away the teflon material until a dc voltage breakdown occurs.

2. Trapped air in top of the HPA Cavity

Trapped air in top of cavity is likely to result in voltage breakdown due to the low dielectric strength of air.

This condition is most likely to occur when the cavity is newly filled with oil. As the oil heats and becomes less viscous, air bubbles will rise to the top of the cavity and may collect there if venting procedures are not used. Prevention of this condition is accomplished by using the petcocks to vent the cavity often during filling, and to revent the cavity about once each week.

3. Abnormal rise in Modulator Voltage

If conditions within the cavity are favorable to voltage breakdown, arcing is likely to occur when the modulator voltage rises above the normal due to a mismatch between the modulator and HPA tube.

To prevent this condition from resulting in anode insulator damage, the equipment should not be permitted to operate for longer than necessary when HPA mismatch occurs. Evidences of a mismatch are:

a. Erratic plate current meter readings.
b. Unstable waveforms for monitored plate voltage, plate and screen current, screen voltage, or r-f output.
c. A high noise level within the HPA Cabinet.
d. Arcing external to the HPA cavity at the Plate or Screen connections.
e. HPA Modulator dc overload operation.
f. Modulator inverse-circuit operation.

AN/SPS-17 RECOMMENDATION FOR CHANGING INSULATING OIL

It is probable that some change in the insulating properties of FRACTOL A mineral oil will occur if the oil is used for an extended peroid. This may be due to arcing within the cavity, high temperature carbonization, or possibly contamination during cavity maintenance. To avoid troubles due to this condition, it is recommended that the system be drained and replenished after each 1,000 hours of operation or after each two months, whichever occurs earlier.

One installation is presently using a megger test to determine the oil condition. This may be done by removing the external lead to the HPA screen, and meggering the screen to ground (cavity housing). A reading less than 50 megohms indicates an unsatisfactory oil condition. It should be noted that a gassy tube may also produce a low megger reading to ground when the tube is installed in the cavity, and this should be checked by removing the tube and meggering it separately.

AN/SPS-17 INSULATING AND COOLING OIL SYSTEM MAINTENANCE

It is recommended that Fractol "A" cooling and insulating oil used in the final amplifier cavity be completely drained and replaced with fresh oil whenever the final amplifier tube is replaced, or at least, after each 1000 hours of radiate operation. This will minimize the possibility of oil contamination due to arcing within the final-amplifier cavity.

To drain the oil system completely, it is necessary to use drain valves at the bottom of the final-amplifier cavity and at the bottom of the oil sump. Approximately 20 gallons of Fractol "A" are required to refill the system.

When refilling, it is cautioned to observe the following procedures:

1. Do not operate the oil pump with an empty sump condition. Damage to the pump seals may result.

2. Frequently open a petcock at the center cavity section and one at the top cavity section during the filling operation. This allows trapped air to bleed out of the cavity.

3. Adjust the cavity-supply pressure-regulating valve to prevent the cavity pressure from exceeding 6lbs. Damage to the tube may result.

NOTE: The cavity oil pressure will rise sharply when the cavity is completely filled. Therefore the cavity pressure should be adjusted to about 3 lbs/sq. in. during filling to prevent a sudden buildup of excessive pressure.

4. Set operating oil pressures to the following gauge readings:

a. Anode Supply - 14 lbs/sq. in.
b. Cavity Supply - 5 to 6 lbs/sq. in.
c. Main Supply in Heat Exchanger - Set to a value between 40 and 60 lbs/sq. in. in order to obtain 14 lbs/sq. in. at the anode gauge.

After refilling the oil system, the radar should be operated with the cathode heating supply energized for about one hour prior to going into radiate. During this peroid, a small amount of oil should be drained out of a top petcock at frequent intervals to insure that all air has been bled out of the cavity.

It is recommended that oil filter cartridges in the anode line be inspected each time the oil is completely changed. Cartridge replacement should be made when the cartridges appear to have collected a large amount of carbon.

Maintain oil level in the sump to about 4 inches above the bottom of the site gauge.

Frequently inspect zinc pencils in the salt water section of the heat exchanger and replace as needed.

It is recommended that a continuous flow of water be maintained through the heat exchanger. Salt water

strainers should be cleaned at least once each week. Also, it is advisable to run fresh water through the heat exchanger when the ship is alongside a pier.

Occasionally, check the cooling system connections for oil and salt-water leaks.

AN/SPS-17, -28 ANTENNA SUPPORT BRACKET

The support bracket for AN/SPS-17, -28 antenna coaxial feed line has, in some cases, been installed incorrectly, or left out completely.

Figure 1 shows the correct location and mounting arrangement.

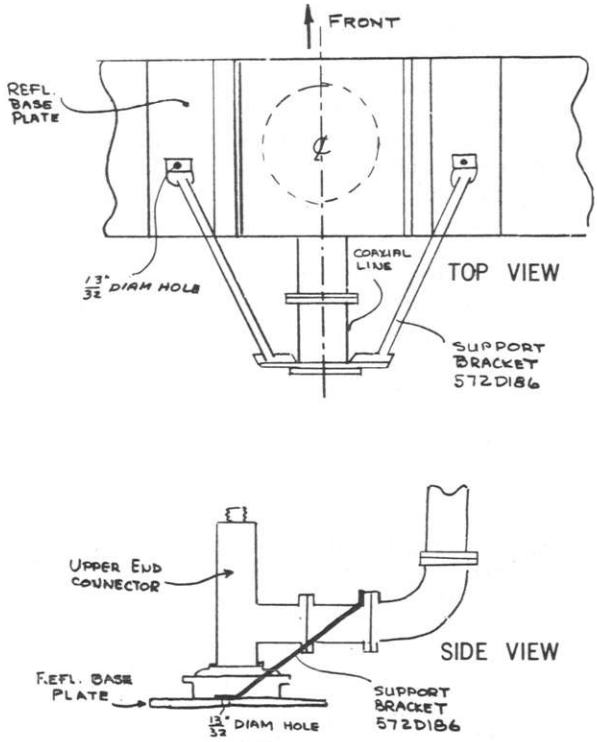


FIGURE 1

AN/SPS-17 AND AN/SPS-28 ANTENNA AS-839/SPS

Robert E. Hare, Charleston Naval Shipyard, the following suggestion has been submitted for improving the method of securing the center conductor of the main transmission line in the two junction boxes symbol CP-1303 (AN/SPS-28) or symbol CP-8003(AN/SPS-17) of antenna type AS-839/SPS. (See fig. 6-23 of NAVSHIPS 92896(A) for AN/SPS-28; fig. 7-177 of NAVSHIPS 92987(A) for AN/SPS-17.)

The center conductor is at present secured to the power divider by the use of a screw and lock washer. This screw loosens from vibration, and causes arcing and eventually severs the screw, thereby disabling the antenna. It is suggested that whenever the antenna is disassembled the present screw be replaced with a stud of the same diameter as the screw but longer, and the center conductor be firmly secured using a flat washer and two nuts. The second nut will serve as a locking nut.

AN/SPS-17 RADAR WATER CONDENSATION IN ANTENNA LUBE OIL SYSTEM

To prevent water condensation, it is recommended that main circuit breaker switch (CB7001) be left in the ON position at all times EXCEPT when it is required to secure power for servicing. With this switch turned ON, power is supplied to the antenna oil heater element so that antenna thermoswitch (S8006) can operate to maintain a constant oil sump temperature. A constant temperature condition will prevent water condensation in the oil sump.

Personnel should be cautioned that switching the main circuit breaker to ON applies 440 vac to high voltage indication regulator (VR6001) in the heat exchanger cabinet and to the input side of relays K6001 and K6002 in the high voltage rectifier cabinet. Other control circuitry is also energized.

AN/SPS-28 SERIALS 1 THROUGH 20 PROCEDURES FOR ALIGNMENT OF ROTATING JOINT

1. Uncrate the pedestal and remove the shipping cap that holds the rotating joint.

2. Place dial indicator as shown, figure 1, and rotate base, stopping at the highest indicator reading.

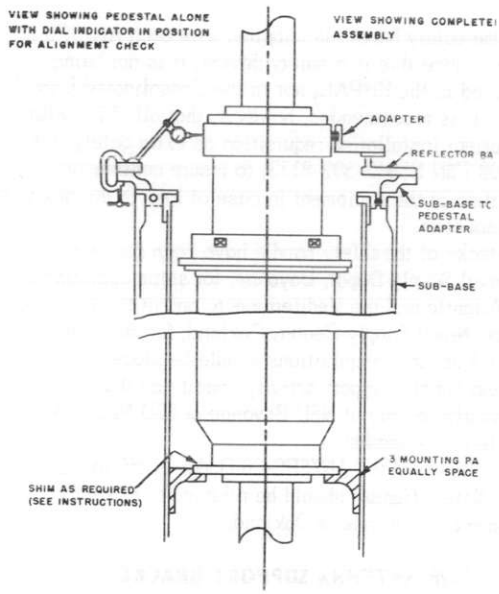


Figure 1

3. Manually rotate the joint and again stop at point of highest indicator reading.

4. Rotate base and note total deflection of dial indicator. If this reading is less than .015, no further action is required.

5. If reading is greater than .015, loosen the three mounting bolts and place a shim on the appropriate mounting pad. It is not necessary to remove the joint in order to perform this operation. The mounting bolts are accessible through the handhole and the joint can be tilted from above in order to provide clearance for the shims. Tighten the three mounting bolts before checking again, otherwise an incorrect reading will be obtained.

6. When rotating the base with the motor, assure that with terminal A1 of the motor positive and C2 negative the motor fan shall rotate CCW. If rotation is opposite, reverse leads at the terminal board of the motor. (With CCW motor fan rotation, the reflector rotates CW when viewed from above the antenna.)

TUNING OF AN/SPS-28 RADAR

Late delivery of R.F. Power Monitor IP-411/SPS-28 has caused a handicap in tuning of AN/SPS-28 radar.

An interim aid in tuning this radar, for minimum VSWR an optimum performance, can be assembled quickly. The circuit referenced is the Power and VSWR portion of R.F. Power Monitor IP-411/SPS-28 shown on Page 4-25, figure 4-14 of the AN/SPS-28 Technical Manual, NAVSHIPS 92896. A power supply capable of providing +250V DC and -150 VDC will also be required. Parts are available from standard navy stock.

Parts are available from standard navy stock.

Such a circuit was assembled and has been used very effectively in tuning of the AN/SPS-28 radar. This unit can be assemblied in one day without difficulty.

EXTENDING USEFUL LIFE OF TUBE TYPE 527

Ships having the SPS-28, SR-a or SR-b radar are aware that the tube type 527 FSN 5960-262-3770 is in critical short supply. This is due to the high failure rate being reported. Many ships report only 250 operating hours until 527 tube replacement is necessary. Information to prolong the life of the 527 is given below:

1. Break-in procedure.

a. One to two hours reduced filament voltage (3 volts).

b. Twenty-four hours just below normal filament voltage (9 volts).

c. One to two hours with one-half maximum plate voltage (2500 volts).

2. Tuning procedure.

a. Same as instruction book. This plays an important role in tube life. Tune for 5 - 10 ma of grid current.

3. Operating procedure.

a. Slightly reduce filament voltage (to 9 1/2 volts). This practically eliminates burn-outs during line voltage fluctuations.

4. Extending life procedure.

a. After tube has been in operation until such time as plate current drops below 20 ma, increase filament voltage to 10 or 10 1/2 volts in small increments (as needed to bring plate current up.)

b. Finally increase filament voltage to 10 1/2 and higher voltage until tube blows or plate current falls to 16 ma.

5. General.

a. Although standard value of plate current is 20 to 30 ma, satisfactory operation has been obtained from old tubes until plate current dropped to 16 ma.

b. To further reduce failures, the radar should be placed in standby when ship's generators are being shifted.

c. Due to the length of time required for proper break-in, it is recommended that this procedure be carried out prior to each expected extended operation of the radar on a pair of spare tubes. This would permit tube replacement without placing the radar in an operative condition for a long peroid of time. Spare tubes which have been baked-in should be marked with the date. If used in less than three weeks from that date, no re-baking is required. Extended storage does require re-baking.

d. It cannot be overemphasized that energizing and tuning the radar should be performed in accordance

with the instruction book, allowing sufficient warmup periods in standby before operation and insuring proper grid current is being drawn.

e. Check voltage and current meters for proper calibration periodically.

f. Using above procedures, average life of the 527 has increased to 300 and 400 hours, with some ships reporting up to 1000 of successful operation.

AN/SPS-28 SPARK GAP SETTING

Recent engineering tests have indicated that the proper spark gap setting on Duplexer CU-546/SPS-28 is 5/8-inch. A small bolt of the correct dimension makes a convenient gauge.

Qualified personnel should check the setting to insure proper operation.

AN/SPS-28 RADAR RG-27/U CABLE, ARCING AT TERMINALS

Reports from the field indicate that arcing has been experienced between the center conductor and the conductive rubber covering of an RG-27/U cable which is connected within the transceiver between J-108 and terminal 2 of T-110.

Arcing actually occurred between the center conductor and the conductive rubber covering at J-108 because the covering had not been skinned back from the lead in the proper manner.

Since the first fifty AN/SPS-28 systems were shipped without having the conductive covering stripped back, it is recommended that system serials 1 through 50 be checked for this condition and where applicable, the conductive covering be skinned back in accordance with Figure 1.

AN/SPS-28 GRID CONNECTION FOR V-805

A suggestion to assure a positive grid connection for V-805(6299) in the AN/SPS-28 radar receiver has been submitted.

A loss of receiver sensitivity, after a short period of operation resulting from a loss of grid connection as the tube crept out of proper seat, has been caused by uneven high spots on the teflon holder holder of V-805. After machining the high spots from the tube holder to permit a good mating fit, receiver sensitivity was maintained. When receiver sensitivity problems are experienced, this tube holder should be checked for high spots as a possible source of trouble.

SAFETY HANDLE FOR AN/SPS-28 RADAR

One safety handle is supplied with each AN/SPS-28 radar. Since this is a safety device, it is not being included in the ERPAL, nor in the Consolidated Load List. It is recommended, however, that all ships with this equipment installation requisition an extra Safety Handle, MP608 FSN N5840-592-8113, to insure continuous operation of the equipment in case of loss or damage to the original item.

Stocks of the safety handle have been concentrated at Naval Supply Depot, Bayonne, for ships operating in the Atlantic and the Mediterranean, and at the Ships Supply Depot, Naval Supply Center, Oakland, for ships operating in the Pacific. Requisitions should be placed on the nearest supply support activity specifying that stocks are available only at NSD Bayonne or SSD NSC Oakland, whichever is nearest.

In the event the AN/SPS-28 Radar is off-loaded, the extra Safety Handle should be returned to stock for shipment to Bayonne or Oakland.

AN/SPS-28 ANTENNA SUPPORT BRACKET

Refer to article in AN/SPS-17 section under same title.

AN/SPS-28 PEDESTAL WATER ACCUMULATION

Refer to article in AN/SPS-17 section under same title.

AN/SPS-28 RADARS ANTENNA INSPECTION

Refer to article in AN/SPS-17 section under same title.

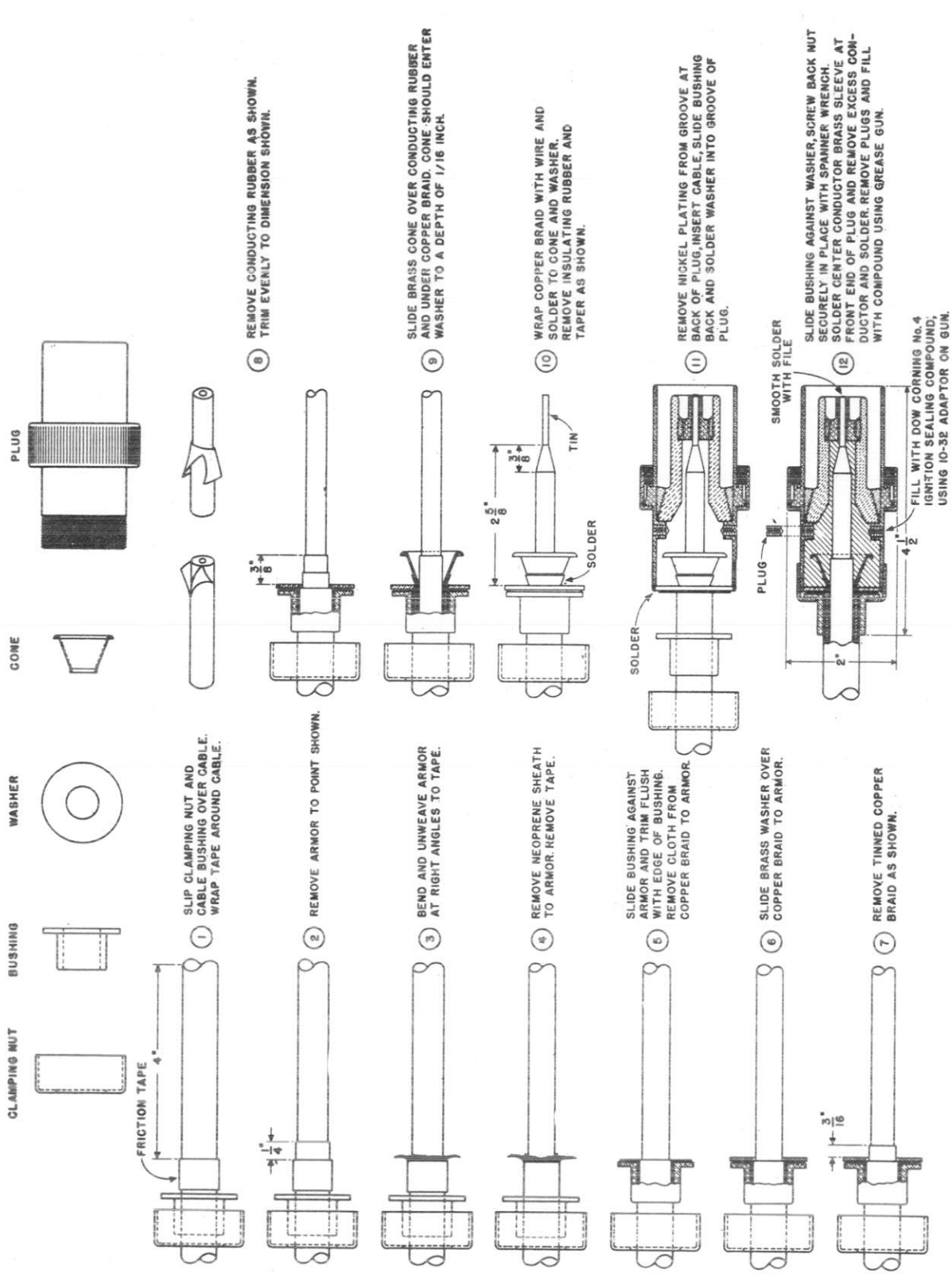

CLAMPING NUT
BUSHING
WASHER
CONE
PLUG
FRICTION TAPE
4"
1" 1/4
3" 16
1 SLIP CLAMPING NUT AND CABLE BUSHING OVER CABLE. WRAP TAPE AROUND CABLE.
2 REMOVE ARMOR TO POINT SHOWN.
3 BEND AND UNWEAVE ARMOR AT RIGHT ANGLES TO TAPE.
4 REMOVE NEOPRENE SHEATH TO ARMOR. REMOVE TAPE.
5 SLIDE BUSHING AGAINST ARMOR AND TRIM FLUSH WITH EDGE OF BUSHING. REMOVE CLOTH FROM COPPER BRAID TO ARMOR.
6 SLIDE BRASS WASHER OVER COPPER BRAID TO ARMOR.
7 REMOVE TINNED COPPER BRAID AS SHOWN.
8 REMOVE CONDUCTING RUBBER AS SHOWN. TRIM EVENLY TO DIMENSION SHOWN.
3/8"
9 SLIDE BRASS CONE OVER CONDUCTING RUBBER AND UNDER COPPER BRAID. CONE SHOULD ENTER WASHER TO A DEPTH OF 1/16 INCH.
10 WRAP COPPER BRAID WITH WIRE AND SOLDER TO CONE AND WASHER. REMOVE INSULATING RUBBER AND TAPER AS SHOWN.
2 5/8"
3/8"
TIN
SOLDER
SOLDER
11 REMOVE NICKEL PLATING FROM GROOVE AT BACK OF PLUG, INSERT CABLE, SLIDE BUSHING BACK AND SOLDER WASHER INTO GROOVE OF PLUG.
SMOOTH SOLDER WITH FILE
PLUG
12 SLIDE BUSHING AGAINST WASHER, SCREW BACK NUT SECURELY IN PLACE WITH SPANNER WRENCH. SOLDER CENTER CONDUCTOR BRASS SLEEVE AT FRONT END OF PLUG AND REMOVE EXCESS CONDUCTOR AND SOLDER. REMOVE PLUGS AND FILL WITH COMPOUND USING GREASE GUN.
FILL WITH DOW CORNING No. 4 IGNITION SEALING COMPOUND; USING 10-32 ADAPTOR ON GUN.
2"
4 1/2"

Figure I

RADAR SETS AN/SPS-29 AND AN/SPS-37 COMPRESSOR DEHYDRATOR HD-331/U

Removal of the glass cover of moisture indicator (DS-5103) with pressure on the line may cause the silica gel moisture indicating element to be blown out into the compartment. It is recommended that a safety decal be placed on the front panel such as:

CAUTION

Reduce line pressure before removing glass cover of moisture indicator.

MAINTENANCE HINTS:

Maintenance Hints for Radar Set AN/SPS-29, NAVSHIPS 93438 is now available and may be ordered from supply. This is a pocket-size volume containing many useful hints for operating and maintaining the radar set. A majority of the procedures are a result of field experiences of the manufacturer and Navy personnel.

ZINC ELECTRODES, SERVICING:

The heat exchanger of Liquid Cooler HD-332/SPS-29 is equipped with zinc electrodes designed to minimize damage by electrolysis. Two of the electrodes are located on top of the main head of the heat exchanger, one each in the inlet and outlet channels. The third electrode is is located on the right hand side near the bottom in what is known as the "floating hand" of the heat exchanger.

The manufacturer recommends replacement of these electrodes at intervals of six months. If replacement is required, the electrodes should be replaced with zinc electrodes, MIL-A-19521. If this material is not available, the electrodes must be procured directly from the manufacturer of the heat exchanger, Andle Company, Lansdale, Pennsylvania, referencing their part numbers, AN12-BEP-61H14298 for the upper two and AN12-DEP61H14298 for the lower one.

SEALING OF RF PLUMBING JOINTS IN RADAR ANTENNA ARRAYS

The use of Pro-Seal EP711 is recommended as a corrosion preventing sealer for radar antenna RF plumbing joints on AN/SPS-29 antennas and similar antennas. The coating, when applied externally to a tightened joint, will help prevent corrosion and air pressure leakage. Pro-Seal is not to be used directly on radiating elements such as dipoles. Pro-Seal is available from The Coast Pro-Seal & Manufacturing Company, 2235 Bexerly Road, Los Angeles, California.

AN/SPS-29--TESTING OF POWER AMPLIFIER TUBE 6952

The Edison current readings between the ranges of 4.5 to 5.5 milliamperes (control-grid current) and 7 to 10 microamperes (screen-grid current) as indicated in the Maintenance Hints for Radar Set AN/SPS-29, NAVSHIPS 93438, page 18 and 29, should not be used as a criteria to reject tube type 6952.

Until sufficient data have been accumulated to establish the exact significance of the Edison current readings, the only positive conclusion for rejecting a tube shall be a reading of zero current.

RADAR SETS AN/SPS-29 AND AN/SPS-37--ELIMINATION OF WATER FROM PLATE CAVITY

Recent reports indicate an increasing failure rate of the micarta bottom-plates for the plate cavities of Radar Sets AN/SPS-29 and AN/SPS-37. Failures are attributed to water leakage leading to internal arcing.

Water will leak into the bottom of the cavities during removal of the power-output tubes unless care is taken to purge the system as outlined in the technical manuals.

Reference for Technical Manual AN/SPS-29 for NAVSHIPS 93104(A), page 6-38, Section 6-3e(2), steps 2-5 and NAVSHIPS 93383(A) for Technical Manual AN/SPS-37 page 6-34, Section 6-3e(2), steps 2-5 for proper purging procedure.

RADAR SETS AN/SPS-37, 37A--REPLACEMENT OF HIGH-VOLTAGE CAPACITORS

High-Voltage Capacitors 1A3C1, 1A3C2, 1A3C3, and 1A3C4, used in the cavity of Radio-Frequency Amplifier AM-2156/SPS-37 as RF shorting capacitors are to be replaced with capacitors FSN N5910-839-1835 having a higher voltage rating. The next revision applicable IPL's will reflect this change.