NAVSHIPS 900,719

OPERATOR'S MAINTENANCE

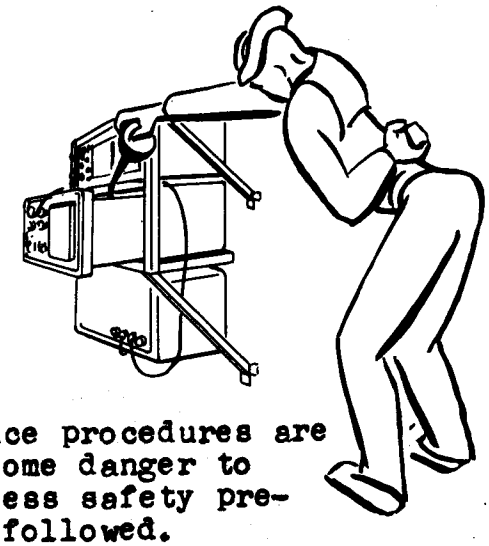
SECTION 5

M-A-R

RADIO TRANSMITTING AND
RECEIVING EQUIPMENT

RESTRICTED

SAFETY



All maintenance procedures are attended by some danger to personnel unless safety precautions are followed.

In brief - see that power is off circuits before touching them.

Use resistance and continuity tests wherever possible in preference to voltage tests.

Read the instructions carefully and know just what has to be done before dismantling equipment.

Read over Chapter 67 of Bureau of Ships manual or superseding instructions on Radio Safety precautions.

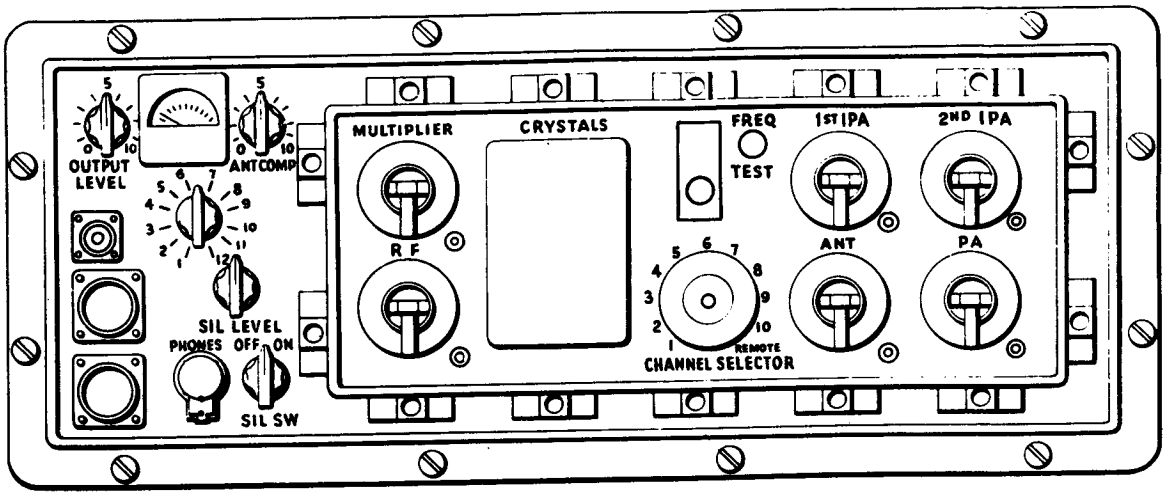
OPERATOR'S MAINTENANCE

In common with all electronic apparatus, the MAR radio equipment is subject to minor derangement and tube deterioration that can be located and corrected by the operator without requiring the services of a radio technician. Despite every precaution in manufacture, it is the attention and care given the equipment by the operator that determines the degree of satisfactory operation and the life of the equipment and accessories.

The operator should then be constantly alert for symptoms of minor defects that can become major difficulties if permitted to take their course. The adoption of a checking routine when taking over the equipment is recommended as the simplest and surest way of locating and correcting improper functioning to avoid failures. The following routine check is recommended as a quick method of locating trouble before it becomes serious. References are given to the page in this section on which full details of causes and necessary corrections are given when the test indicates trouble requiring more information than given in the limited space in the chart.

ROUTINE CHECK

Inspect	For
Cables	Loose connectors, worn insulation or kinks.
Control Panels	Broken or loose knobs or switches.
Headset and Microphone	Broken or loose parts, broken plugs or cords.

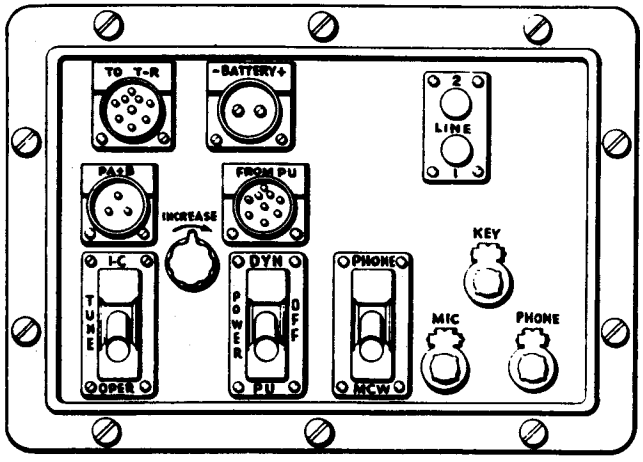


WHAT TO CHECK	HOW TO CHECK
CHECK POWER SUPPLY	With Silence and Output Level at 0, switch power onto the equipment. Panel light should glow on 13V d-c. Dynamotor can be heard operating by placing ear close to modulator-dynamotor panel. If light is off and dynamotor runs, replace bulb. On 115-230V d-c, vibrators may be heard operating in power unit. Note any unusual symptoms as excessive hum or noise in the equipment.
CHECK HEATER VOLTAGES	On 13V d-c, move meter selector switch to positions 5 and 6. On Universal power supply, positions 6 and 7 are used for this check. Reading of 7.5 should be obtained on the meter at both positions of the switch for both types of power supply. Should readings be alike but other than 7.5, adjust Fil knob on modulator-dynamotor panel.

WARNING– Keep heater voltages balanced and with meter reading never exceeding 7.5 on either branch. Higher voltages shorten tube life. See page 5-12.

Keep PA plate current reading at 4.5 on the meter. Higher currents reduce tube life.

WHAT TO CHECK	HOW TO CHECK
CHECK PHONE RADIATION	Place meter switch on position 12 and to read PA plate current and close press-to-talk switch on microphone cord. A meter reading of 4.5 should be obtained if the transmitter is operating properly. Operation of the blower can be checked by placing ear to panel covering selectors.
CHECK CHANNEL SELECTION	Release press-to-talk switch and rotat channel selector switch to another position. Selector mechanism should complete the cycle of changing the operating channel in 10 seconds or less.



CHECK INTERCOM-MUNICATION	Set IC-Operate switch on IC and MCW-Phone switch on Phone. Hold press-to-talk switch closed and tap microphone with finger. The tapping should be heard in the headset as a check on the speech modulator circuits.
CHECK MCW OPERATION	Move MCW-Phone switch to MCW and close key. The modulator note should be heard in the headset thus checking audio oscillator circuits. A reading of 4.5 should be obtained on the meter with the meter switch in position 12 indicating correct radiation.

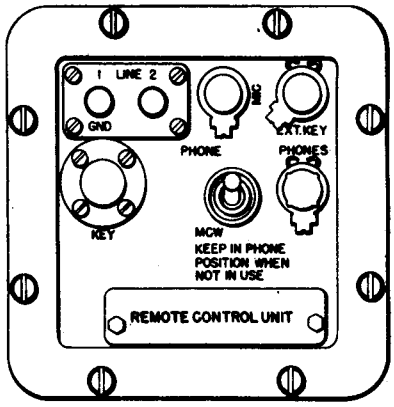
CHECK RECEPTION	Place IC-Operate switch on Operate and turn Output Level control to right.
	Background noise should gradually increase and can be brought up quite loud to pick up any signals in the vicinity. Several channels may be tried, to pick up signals as a check on the receiver.

FIELD EQUIPMENT

The auxiliary units furnished with the field application kit should be checked over daily to assure they are in operating condition. The following routine is recommended to locate defects and prevent failure of the equipment.

WHAT TO CHECK	HOW TO CHECK
Check level of electrolyte in storage batteries. Examine cases for signs of leakage and make certain connecting cables are tight.	Refill if necessary with distilled water to cover separators to a depth of 1/4 inch. Wipe off any water spilled and replace caps securely.
Check gas engine, examining carefully for loose parts or fittings. Check fuel supply and oil l vel in engine.	Tighten any loose bolts. Fill fuel tank. Add oil if necessary to bring up to proper level. Excessive use of oil should be noted as it indicates leaks in the crankcase or worn piston rings.
Start engine and note operation under load. Make sure starting rope is in place on spark plug shield.	Erratic operation may be due to leaks in the intake fittings or defective spark plug. Change plug if showing signs of burning or heavy carbon deposits. Governor may be defective. Inspect linkage.

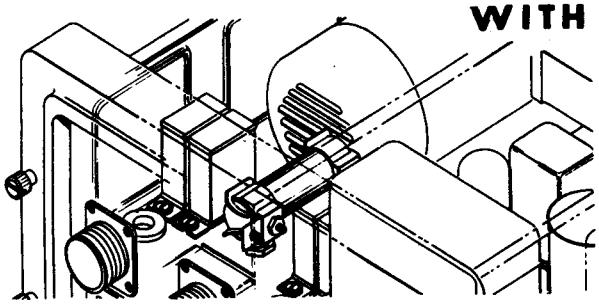
REMOTE CONTROL BOX

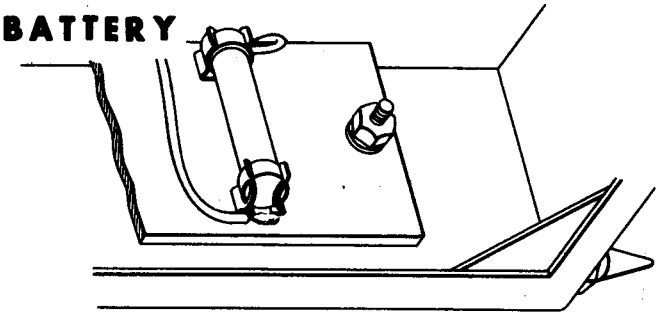


WHAT TO CHECK	HOW TO CHECK
Connections to line.	
Plug headset and microphone into proper jacks. With radio equipment switched off, close press-to-talk switch at remote box and top microphone with finger.	Tapping sound should be heard in headset, indicating battery and speech circuits in remote box are functioning.
Place MCW-Phone switch on MCW and press key on panel of remote box.	Modulating tone will be heard in headset as check on hummer and keying circuits of remote box.

FUSE FAILURE

WITH BATTERY





SYMPTOMS:

On 13V d-c. panel light out.

Dynamotor not operating.

No meter reading on positions 5 and 6 of meter switch.

CAUSE:

Low voltage fuse, F801, defective.

CORRECTION:

Switch off power, loosen screws around panel of modulator-dynamotor and withdraw chassis, half way. Replace with 40A fuse from spares.

SYMPTOMS:

Panel light on.

Dynamotor operating.

Channel selector motor will not function.

CAUSE:

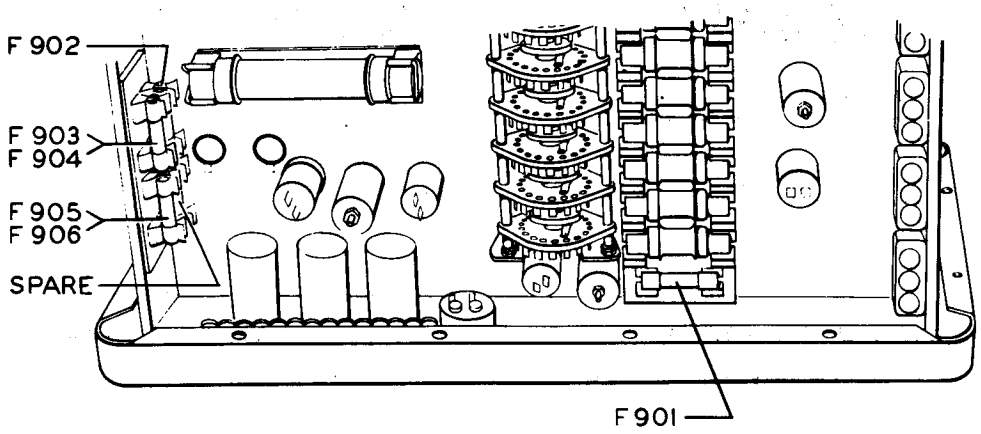
High voltage fuse, F802, defective.

CORRECTION:

Switch off power, withdraw chassis of modulator-dynamotor. Fuse is located on terminal board beneath chassis at the left. Replace with 1A fuse from spares.

FUSE FAILURE

WITH POWER SUPPLY UNIT



SYMPTOMS:	CORRECTION:
ON DIRECT CURRENT	
No power on equipment.	Switch off power, loosen screws around panel and withdraw chassis to stops, allowing access to fuses beneath the chassis.
Vibrators not operating in power supply.	On 26V - replace F901 with 25A cartridge fuse.
	On 115V d-c - replace F902 or F905 - F906 with 10A fuse.
	On 230V d-c - replace F905 -F906 with 5A fuse.
ON ALTERNATING CURRENT	
No power on equipment.	Withdraw chassis as described above.
	On 115V a-c replace F902 or F903 - F904 with 10A fuse.
	On 230V a-c replace F903 - F904 with 5A fuse.

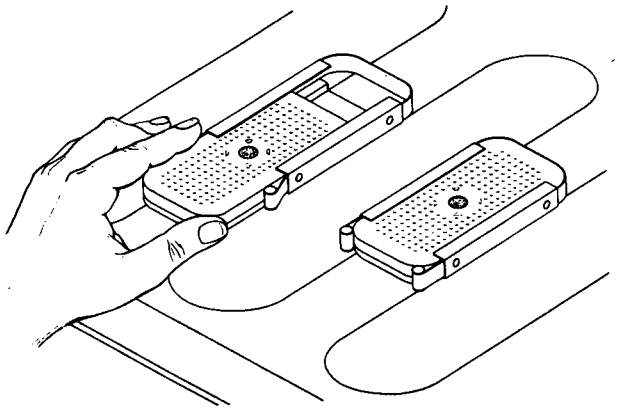
NOTE: Fuse F902 is common to all 115V and 230V supply circuits and should always be 10 amps.

Fuses F905 and F906 are used in 115V and 230V d-c supply circuits respectively.

Fuses F903 and F904 are used in 115V and 230V a-c supply circuits respectively.

Ratings on these fuses, 5 amp. for 230V and 10 amps. for 115V supply.

SILICA GEL DRYER UNIT



Whenever there is occasion to remove the chassis of any MAR radio equipment from the case it is advisable to check the dryer units clipped to the bottom of the cases. Each case contains two units fitting into clips, and spare units in sealed packages are provided in the accessory compartment.

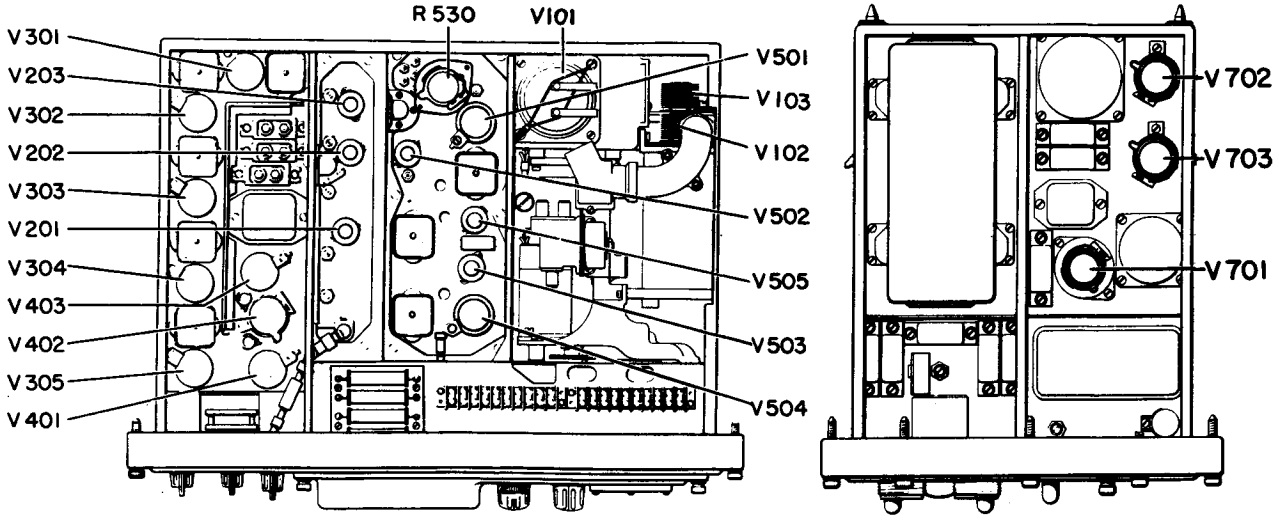
Remove the dryer cartridge from the clip and inspect th small mica window on one side of the unit. The contents of the cartridge will be visible and if a light blue or grayish color, the unit is still effective and will continue to keep the air in the cases dry and protect the radio equipment from corrosion.

Should the grains show a faint pink color it indicates they are saturated with moisture and the unit should be replaced. Remove one of the spare dryer cartridges from its container by pulling loose the sealing strip around the edge of the tin box enclosing cartridge. Insert the fresh dryer cartridge into the clip in the bottom of the equipment case. Save the used cartridge and can.

The dryer cartridge can be reclaimed by heating in an oven at a temperature of 300°F for a period of three hours. This will drive all the moisture from the silica gel granules and the cartridge can be placed in the can and the whole sealed with the tape around the can for future use.

TUBE FAILURE

The most common cause of tube failure is the decrease of electronic emission from the cathode with prolonged use. This is usually accompanied by a gradual reduction in signal strength, both in reception and transmission. To obtain maximum tube life, it is necessary to hold the heater voltages at their rated values and avoid over-voltages that shorten the life of th tubes by causing abnormal cathode

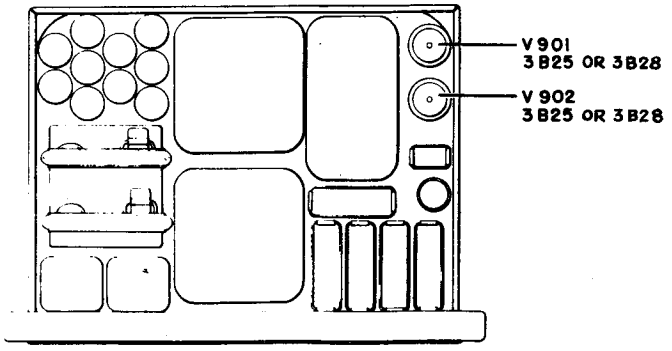


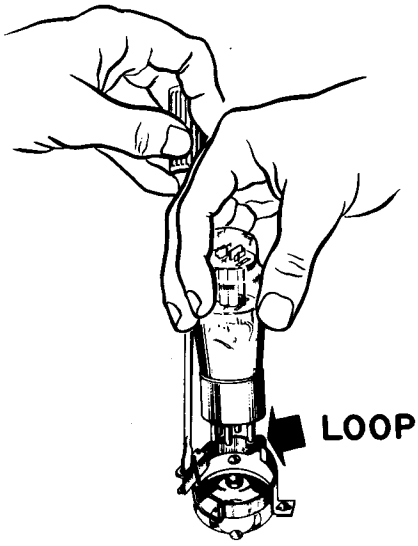
emission. Maintaining proper balance of the heater circuit voltages is an important factor in the proper operation of the equipment.

Normal loss of cathode emission is usually detected and corrected by the checking routine of preventive maintenance. Under some conditions, particularly from extreme shock, a tub may fail suddenly, either from opening of heater circuit or other mechanical disturbance of its elements. In such cases, the defective tube can often be located by checking the readings of the meter at the various meter switch positions as given on page 7-2, an incorrect reading indicating the section of the equipment at fault.

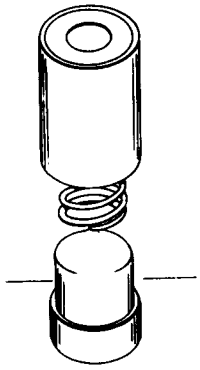
The illustrations show the symbol designation and location of all tubes used in the equipment. Tube types are listed in the parts list, Section 8. The spare tubes furnished with the equipment consists of one tube of each type used and when more than one tube of the same type is suspected as the cause of trouble it will be necessary to replace them one at a time until the defective tube is located.

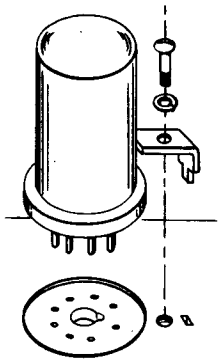
A ballast tube controlling the current to the heaters in the two tripler tubes V502 and V503 in the multiplier is indicated on the tube location illustration. Failure of this ballast will result in the multiplier tubes not functioning and this unit should be checked before replacing the multiplier tubes.





REPLACING TUBES





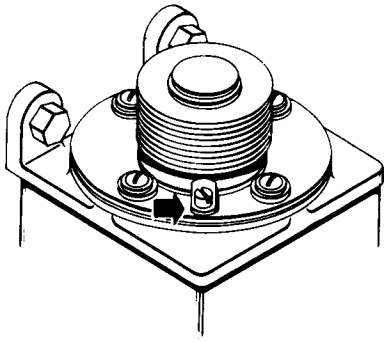
Several methods of clamping the tubes in place in their respective sockets are employed in the MAR equipment. It is important in replacing tubes to replace or tighten the clamps when tubes are replaced to prevent vibration loosening the tubes in the sockets.

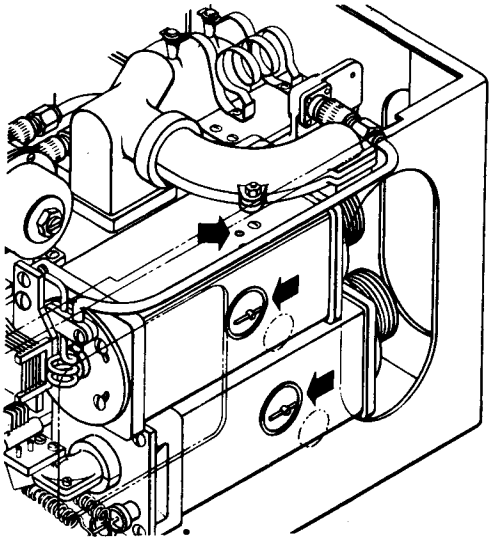
The smaller tubes, particularly in the R-F and Multiplier sections should be handled carefully to prevent damage to the wire prongs. These tubes are held in place by springs enclosed in the tube shield. The shields are fitted with a bayonet joint and are removed by rotating the shield to the left till it can be removed from the base. After inserting the tube, the shield should always be replaced before testing the operation of the equipment.

The larger tubes and the heater ballast resistor in the multiplier section are held in place by spring clamps that fit around the base of the component. To release the clamp for removal of the tube, a screwdriver blade is inserted in the slot in the hinged portion of the clamp as shown in the illustration. When the screwdriver is twisted to the left, the hinged portion swings out and releases the clamp. The tube may then be removed and replaced. The clamp is tightened by inserting the screwdriver blade and turning the blade to the right to spring the clamp into place around the tube base.

The metal enclosed tubes are clipped into place by L shaped clamps that are held in place by a machine screw. To release the clamp, the machine screw is loosened by a screwdriver till the clamp will raise far enough to free the lower end from the hole in the chassis and permit the clamp to be turned a quarter turn to free it from the tube base. The tube may then be withdrawn from its socket and tested or replaced as necessary. The clamp is again swung back into position and the screw tightened to lock the tube in place.

REPLACING POWER TUBES





In the power amplifier section, the first intermediate power amplifier tube V101 is held in place by a spring tensioned cord that passes over the top of the tube. To remove this tube, the straps connecting to the terminals on the top of the tube are first disconnected by slipping the clips off the pins. The cord tension is released by unhooking the spring on the end of the cord from the hook on the socket base. The tube can then be withdrawn from the socket for testing or replacement. The cord should be carefully replaced and connectors to the pins on the tube replaced.

Replacement of the tubes in the 2nd intermediate amplifier and power amplifier stages is a little more difficult and should preferably be done by a radio technician, rather than the operator. But for guidance in emergencies, the following procedure is given.

The chassis is withdrawn from the case and placed on its left hand end with the power amplifier at the top. The cables should be reconnected to the equipment. Release the tube by loosening the knurled nut on the stud in the end of the tube housing adjacent to the tube cooling fins and swing the flat retaining strip free of the lower tube plate. The tube may then be grasped by the cooling fins and withdrawn from the end of the metal case.

The new tube is slipped carefully into place and the locking device replaced and tightened. Switch on the equipment and check radiation of the transmitter with the meter switch in position 12. A reading of 4.5 should be obtained on the meter. The change in tubes may have disturbed the tuning of the circuits because of minute difference in the interelectrode capacities of the tubes, which must be corrected by adjusting the trimmer capacitors provided for the purpose.

To make this adjustment on the 2nd intermediate amplifier, place the meter selector switch on position ten and switch power onto the equipment. After allowing th tubes to warm for a few minutes switch off power. Insert a narrow bladed

screwdriver into the small hole in the amplifier case toward the end of the chassis, and turn the adjusting screw inside the case slightly. Then switch power on again and check the emission of the quipment. By repeated trials in the above manner the circuit can be readjusted to resonance. This is indicated when a maximum reading is obtained.

Now place the meter switch in position 11 and make a similar adjustment to the screw, on the top of the tripler case, adjacent to the stud holding the airduct in place. Adjust the screw, as previously described, to obtain a minimum reading on the meter. The equipment will then be ready for operation.

To replace the power amplifier tube, the method used is identical to that described above with the exception that position 11 of the meter switch is used when the grid-cathode trimmer on the side of the power amplifier case is adjusted to obtain maximum reading on the meter. Position 12 of the switch is used and a minimum reading on the meter obtained by adjustment of the grid-plate trimmer located on the bottom of the tube enclosure. A hole in the bracket on the bottom of the chassis allows of access to the adjusting screw. The cables are then disconnected and the chassis replaced in the case and reconnected.

It is very important that the front panel 2nd IPA and PA selector dials not be touched until the adjustment screws are set properly, otherwise it will be nearly impossible to set the dials correctly in the field.

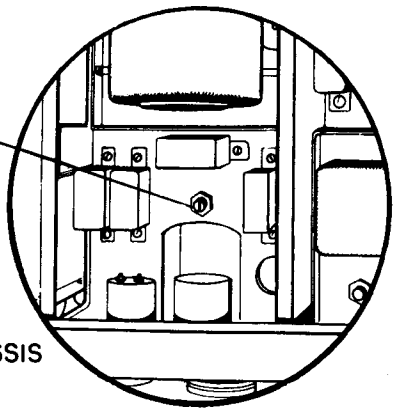
REPLACING RECTIFIER TUBES

The two high voltage rectifier tubes in the power supply are of the half wave type, JAN-3B25 tubes being used. These tubes are to be replaced with JAN-3B25 tubes until all spare tubes furnished in Spare Parts are used, after which time they may be replaced with JAN-3B28 tubes from Navy Stores.* Do not attempt to use the two types of tubes together; always install tubes of the same type when making replacements.

To replace tubes, slide the chassis of the unit out of the case until the tubes are accessible. Remove the clips from the tube caps, loosen the two thumbscrews and remove the yoke over the tubes. After the tubes are replaced, fit the yoke in place, and tighten thumbscrews. Do not tighten the thumbscrews sufficiently to draw the turns of the springs together, but leave the springs slightly extended. Reconnect clips to tube caps and refasten chassis in case.

*This change in replacement procedure is necessitated by a change in standardization and stock planning. As a result of this change JAN-3B28 tubes will be found in Navy Stores, but JAN-3B25 tubes will not.

BALANCING TUBE HEATER CIRCUITS



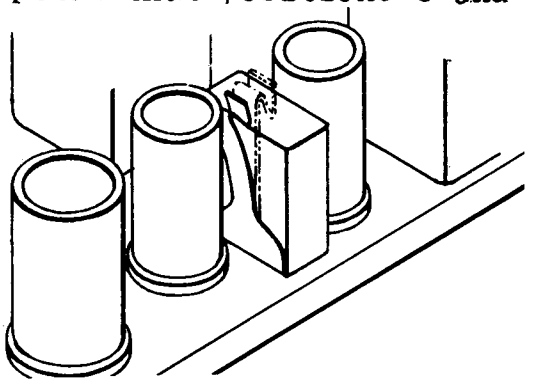
The voltage across the two branches of the split filament supply circuit may be readily checked by means of the meter and meter switch on the transmitter panel. When operating on a 13-volt direct current source, with power switched on the equipment, the meter switch should be moved to positions 5 and 6 successively. The readings at both these settings should be 7.5 since the meter at this setting has a full scale value of 8.4 volts. Should the readings differ it indicates an unbalanced filament circuit.

To balance the circuit, shut off the power to the equipment and loosen screws holding modulator chassis in case. Withdraw case till it is possible to reach the resistor R722 with a screwdriver. Switch on power to equipment and adjust R722 till a reading of 7.5 is obtained with meter switch in both positions 5 and 6.

The modulator chassis may be shoved back into the case and the panel screws replaced.

When operating from a shipboard supply, where the universal power unit is used with the equipment, the filaments are operated on alternating current. The checking and adjustment of the filament circuits in this case are exactly the same as given above with the exception that positions 6 and 7 of the meter switch are used.

REPLACING CRYSTAL IN FIXED OSCILLATOR

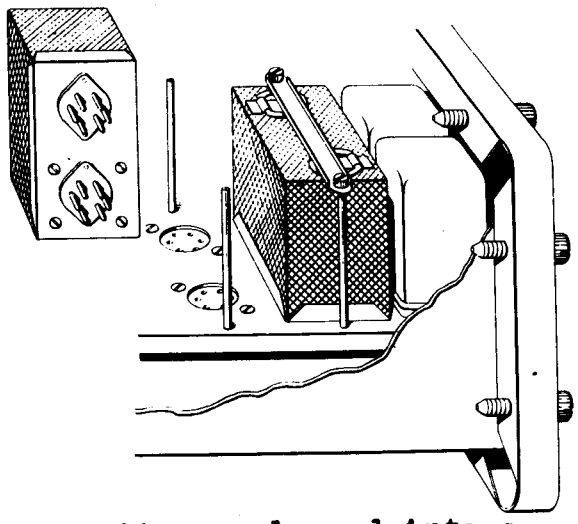


Failure to obtain grid excitation on the 1st IPA tube when all the tubes check satisfactorily may be due to a defective crystal in the fixed oscillator in the multiplier. This condition is indicated when there is no increase in plate

current on the 1st IPA tube (meter switch in position 8) when the frequency test switch is operated and the tubes are known to be good.

Replacing the crystal is a simple matter and should be made the first procedure, after tubes have been checked, when the transmitter fails to radiate with the receiver functioning properly.

To remove the crystal holder, the spring clip holding the crystal in place is pressed towards the front of the receiver and the crystal holder withdrawn from the socket. The new crystal holder can then be slipped into place with its nameplate toward the panel of the equipment. Then slip the spring clip back on top of the crystal holder to clamp it in place in the socket.



REPLACING VIBRATORS

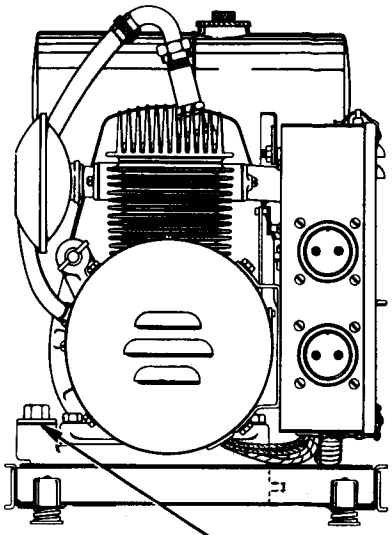
The vibrators in the power supply unit are plugged into a pair of sockets similar to those employed with tubes, so their renewal in case of failure is a simple operation.

To replace a vibrator, the chassis of the power unit is slid out to the stops on the case and the threaded rods holding the strap across the top of the vibrator case loosened. The clamp is lifted off and the vibrator unplugged from the sockets by grasping the wire handles on top of the vibrator housing. A slight rocking motion will assist in freeing the unit from the sockets.

A new vibrator is then inserted in the sockets. The sockets are arranged so the unit can only be plugged into place in the correct position and there is no chance of improper insertion. The plug on the bottom of the vibrator case at the end with the four screw heads, goes to the right in inserting the vibrator unit. The holding strap is replaced and attached by tightening the two holding screws. The equipment is then ready for operation. Spare vibrators must be kept in the moistureproof shipping package till required for use.

LUBRICATION CHART

GAS ENGINE GENERATOR



ENGINE

Check level of crankcase oil after eight hours operation or at least daily. Keep filled to level of filler plug on engine base on muffler side of the engine.

Drain crankcase after 25 hours operation by removing filler plug and tilting engine. Refil crankcase with oil of the proper viscosity for operating temperatures, as given in the table. Drain engine only when warm to assure the removal of all sludge and dirt in the crankcase.

Do not mix lubricating oil with gasoline.

GENERATOR

Bearing of the generator requires no lubrication for the life of the machine.

CRANKCASE LUBRICANT

ND Spec 14-0-13

Navy Code	Stock No.	Comm. Desig.	Temperature
No. 9250	14-0-2187 5 gal	SAE 30	Summer
No. 9110	14-0-2162 5 gal	SAE 10	Winter 0°F
No. 9110	14-0-2162 5 gal	*SAE 10 Diluted 10%	-10°F
No. 9110	14-0-2162 5 gal	*SAE 10 Diluted 20%	-20°F
No. 9110	14-0-2162 5 gal	*SAE 10 Diluted 30%	-30°F

* Use wax free kerosene to dilute oil for use at sub zero temperatures.