

RESTRICTED

Section 6
COMBINATION TRANSMITTING AND
RECEIVING EQUIPMENT
M Series

SECTION 6. COMBINATION TRANSMITTING AND RECEIVING EQUIPMENT

MODEL MN SERIES TROUBLE SHOOTING NOTES

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
Audio output of receiver gradually became weaker and weaker. Fidelity perfect. All tubes and voltages checked perfectly.	Found both dual electrolytic audio bypass condensers C-28 and C-29 had "opened up." When replaced, good normal audio volume was secured.—U. S. S. <i>Preston</i> (DD-795)
The set became inoperative.	Before failing, it was observed that the power transformer T-1 was heating excessively and that the dual electrolytic filter condenser (in the power supply) C-64 was leaking. The components of this equipment became quite hot when used continually in hot weather. The bottom of this set was perforated to allow more ventilation to the elements and capacitor C-64 was replaced. The set operated satisfactorily after making the above modification and replacement.—U. S. S. <i>Fitch</i> (DMS-25)
Limited circuits in receiver could not be tuned, no squelch action, high plate and grid voltages.	Found heater circuit return to ground open, hence tube failed to warm up.—U. S. S. <i>Council</i> (AM-165)
In tuning the receiver, the r-f amplifier was very critical and unstable.	It was found that if the local oscillator was detuned slightly, the r-f amplifier would oscillate driving the second limiter to the maximum grid current. Careful tuning of the oscillator produced satisfactory operation.—U. S. S. <i>Melvin</i> (DD-680)
Receiver blocked and unable to receive signals.	Found to be due to insulation breakdown between the contacts of relay RL-1.—U. S. S. <i>Diploma</i> (AM-221)
MN.—Receiver inoperative and transmitter radiating r-f carrier normally, but with no modulation.	All voltages in receiver from 5 to 10 percent below specified value. Capacitors C-63 and C-64 found to be open-circuited. Replaced from spares.—U. S. S. <i>Los Angeles</i> (CA-135)
MN.—Signals intermittent and chopped. 60-cycle hum present with squelch ON or OFF.	Antenna transfer switch contact corroded and not making good electrical contact. Cleaned all contacts.—U. S. S. <i>Lind</i> (DD-703)
MN.—Receiving loudly and clearly but unable to transmit. Transmitter tuning normal. TT-1, TT-2, and TT-3 meter readings normal and peaked OK. TT-4 readings normal and coupling to load increased current. 6.3-volt dial lamp lit when placed in antenna jack.	With carrier 4.0, the modulator was assumed to be at fault. All socket voltages of oscillator-modulator tube checked OK as did all associated resistors and capacitors. Some parts were replaced, but all to no avail. Finally, as a long shot, C-64 was checked. The C and R bridge told the story. The capacitance had decreased from 8 to 0.015 mfd.—U. S. S. <i>Wren</i> (DD-568) <i>(Editor's note.—Since C-36 (8 mfd) is in parallel with C-64 it appears that C-36 may also be defective. C-36 and C-64 form the a-c return path to ground for audio signals in the plate circuit of the 6SL7 modulator section. This trouble might have been detected by connecting the vertical plates of a cathode-ray-oscilloscope from B+ to chassis, speaking into the microphone and noting if audio signals (other than slight 120-cycle hum) were present on the B+ supply. If present, C-36 and/or C-64 are defective.)</i>

DIFFICULTY ENCOUNTERED

CAUSE AND REMEDY

MN.—Recently the sensitivity of our receiver dropped so low that it was almost impossible to hear a station, unless it was almost alongside.

The trouble was finally traced to C-32, the local oscillator to first mixer coupling capacitor, which had become leaky under load. This capacitor checked good on the model OE-8 capacitor tester, but when replaced, equipment sensitivity became normal.—Carl A. Fisher RT2/c, U. S. S. *Deft* (AM-216)

→

MN.—Distortion and 60 cycle hum present in receiver output. T-R relay did not operate because of low B plus.

The dual electrolytic capacitor C-35, C-36 was leaky. Replaced the defective unit and operation returned to normal.

←

OPERATING PRECAUTIONS FOR THE MODELS MO-1/MAK EQUIPMENTS

Due to the high modulation capabilities of the MO-1/MAK equipments, it is essential to assure that the final amplifier is properly loaded at all times when modulation is applied. Otherwise, dangerously high voltages can be generated which may damage the insulation or the connector plugs. To eliminate the possibility of such damage to the equipments, the following precautions should be strictly observed:

- (1) Preliminary tuning should be accomplished with an unmodulated carrier.
- (2) Completely resonate the antenna circuit and adjust coupling so as to load the final amplifier to 95 to 100 ma. plate current.
- (3) Do not apply modulation under any circumstances unless there is a load of at least 95 ma. on the final amplifier.
- (4) With the final amplifier loaded from 95 ma. to 100 ma., 100 percent modulation is easily obtainable. If the plate current is allowed to drop below 95 ma., the transmitter can be easily overmodulated. If the plate current is more than 110 ma., the plate dissipation of the tube will be exceeded; also, the percentage modu-

lation will be low. Therefore, care should be taken to maintain proper loading on the final amplifier at all times.

(5) When using ICW, it is recommended that the ICW feed-back resistor, R-122, be adjusted so that the percentage of modulation does not exceed 80 percent with the power amplifier loaded to 95 ma.

(6) Never attempt to shift frequency with the key down, using ICW. Under these circumstances, during switching, the final amplifier is momentarily unloaded and the insulation can be damaged.

Since there have been several failures of connector plugs in these equipments which are directly attributable to improper operation, strictest compliance with the above precautions is recommended. In this connection, it is suggested that a notice be posted near the equipment, reading as follows:

WARNING

NEVER ATTEMPT TO MODULATE THIS EQUIPMENT WITH THE FINAL AMPLIFIER LOADED TO LESS THAN 95 MA. PLATE CURRENT.

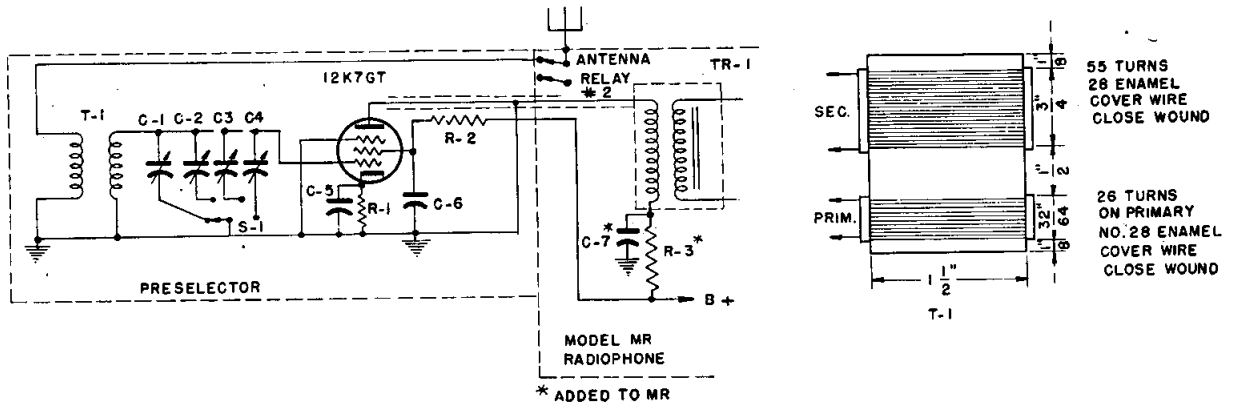


MODIFICATION TO PREVENT RADIATION FROM THE MODEL MR EQUIPMENTS

Tests have disclosed that Navy model MR, which is a converted commercial model as manu-

factured by the Gray Radio Company, produces a strong radiated signal and for security reasons should not be used on vessels employed on off-shore missions.

The Navy Yard, Charleston, has developed a



PARTS LIST	
SYMBOL	
C-1-2-3-4	VARIABLE CAPACITOR, 75 MMFD
C-5	CAPACITOR PAPER, 0.01MFD, 600 V.
C-6	SAME AS C-5
C-7	SAME AS C-5
R-1	RESISTOR 2000 OHM, 1 WATT
R-2	RESISTOR 50,000 OHM, 1 WATT
R-3	RESISTOR 5000 OHM, 1 WATT
S-1	SELECTOR SWITCH, 4P-1T.
T-1	TRANSFORMER, AIR CORE PRIMARY - 26 TURNS NO. 28 ENAMEL CLOSE WOUND. SECONDARY 55 TURNS NO. 28 ENAMEL CLOSE WOUND. COIL FORM 1-1/2" O.D. FIBER TUBING. SPACING BETWEEN PRIMARY AND SECONDARY - 1/2."

FIGURE 1.—Schematic of preselector for model MR radiophone.

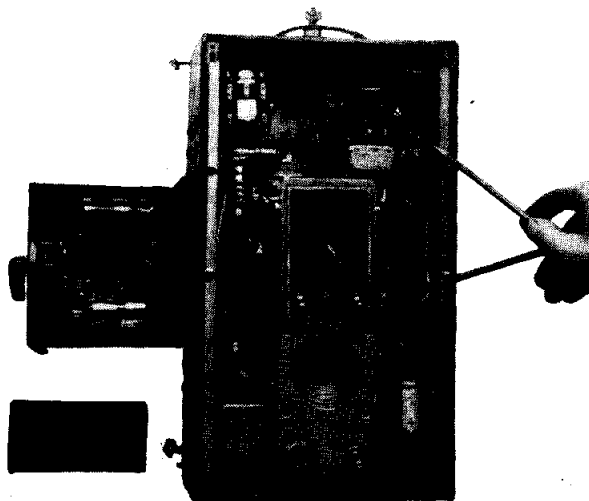


FIGURE 2.—Front view of MR with cover removed, showing connections to preselector.

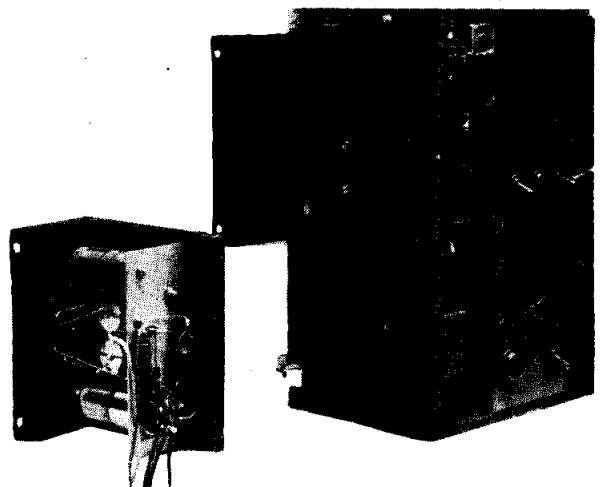


FIGURE 3.—Open view of preselector showing tube base connections.

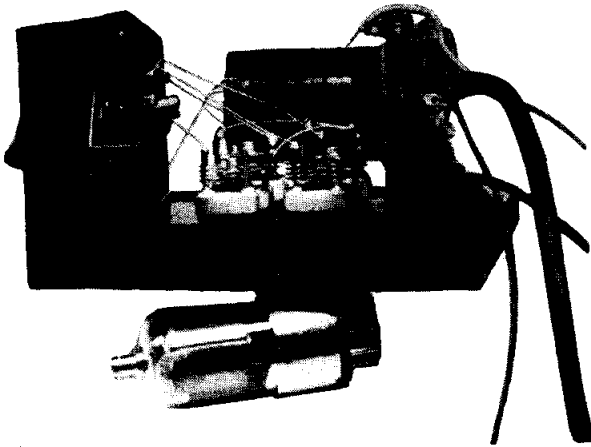


FIGURE 4.—Close-up of preselector with tube removed.

suitable preselector which prevents radiation of the local oscillator. When the preselector is incorporated in the equipment, the model MR may be used aboard ship. Figure 1 is the schematic diagram of the preselector. Figures 2 through 5 inclusive show constructional views of the preselector.

Switch S-1 provides for switching for the four fixed channels. The tuning condensers C-1, C-2, C-3, and C-4 are tuned on switch positions 1, 2, 3, and 4 respectively for any frequency in the range of the equipment. The tuning condensers have been so connected that the tuning of each channel is independent of all others. Adjustment

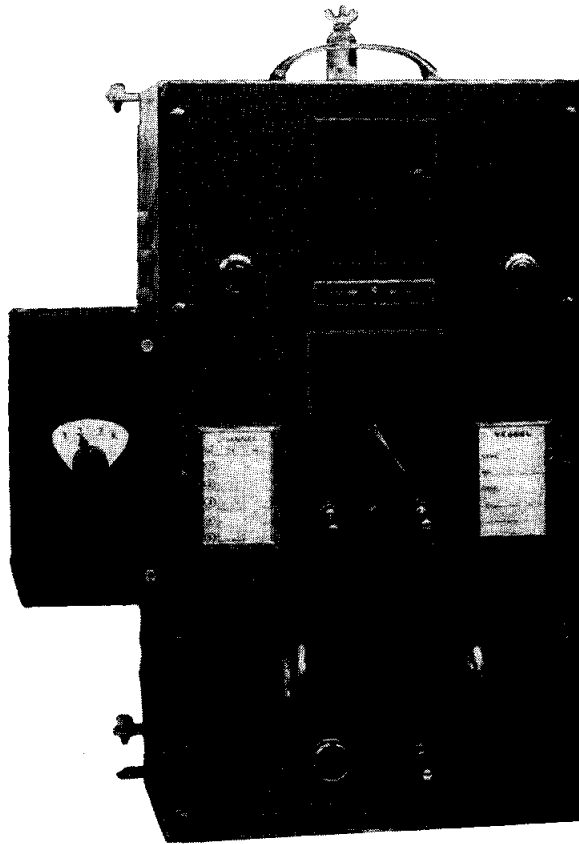


FIGURE 5.—Front view of MR.

of the tuning of one channel will not affect the tuning of the other three channels.

MODIFICATION OF MODEL MS (ABBOTT TR-4) EQUIPMENTS

One activity has reported that the performance of the MS (Abbott model TR-4) transmitting-receiving equipment was appreciably improved by making the following modifications:

(1) Substitution of a 5,000-ohm bias resistor for the 1,000-ohm bias resistor (R-1) now used in the grid circuit of the HY-75 oscillator to operate the grid nearer its rated voltage value.

(2) Substitution of a 0.00005-mfd. (50-mmfd.) low-loss midget capacitor for the 0.0001-mfd. (100-mmfd.) capacitor (C-3) now used in the grid circuit of the HY-615.

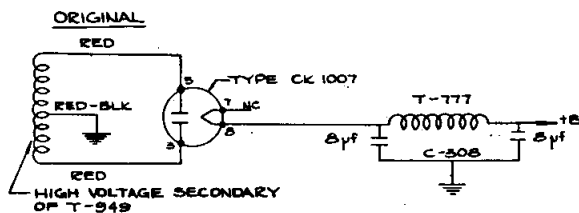


FIGURE 1.—Original socket connections.

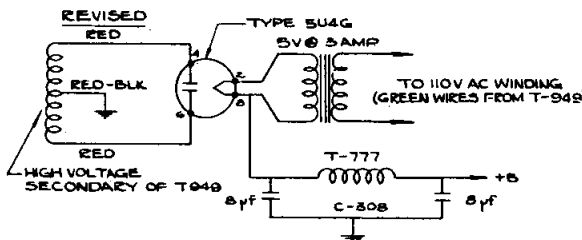


FIGURE 2.—Revised socket connections.

Further information concerning these modifications is not available in the Bureau. Accordingly, the accomplishment of them is left to the discretion of the individual users of the equipment.

In locations where there is considerable a-c line voltage fluctuation, it has been found that the life of the type CK 1007 gaseous rectifier tube in the model MS power supply is short.

The operation of the equipment may be improved by substituting a type 5U4G rectifier tube for the CK 1007 tube. Power is supplied to the filament of the 5U4G from a 110- to 5-volt step-down filament transformer. The secondary of the transformer should be capable of supplying 3 amperes continuously. Use of the 5U4G tube will require rearranging the socket connections as shown in Figures 1 and 2. Socket pin connections for the 5U4G are shown in Figure 3.

SOCKET CONNECTION 5U4G BOTTOM VIEW

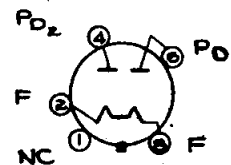


FIGURE 3.—Socket pin connections for the 5U4G.

It should be emphasized that this modification should be made only in equipments operating from 110 volts AC. It should NOT be made if there is any possibility of operating the equipment from 6 volts DC.

This last modification was devised by A. Gunther, CRM, Radio Laboratory, NOB, Adak, Alaska.

PREVENTION OF AMMETER BURNOUTS IN THE MODELS MAA AND MZ EQUIPMENTS

The possibility of burnout of the 60-0-60 ammeter and injury to the storage batteries of MAA and MZ equipments has been decreased by the manufacturer by improving the mechanical construction of certain generator connections. The improvements are described below, and may suggest solutions to maintenance problems in this circuit:

(1) The short screws furnished for fastening the slanted terminal cover have occasionally been replaced in the field with some that were long enough to cut into the cables and ground them. This process has been eliminated by changing the clinch nuts to welded nuts in the cable cover, and

by changing the holes in the terminal cover to slots.

(2) The possibility of fraying and shorting the leads from the generator terminal strip to the radio power strip has been decreased by lengthening the leads and by placing a Vinylite tube over each lead, covering as much of each lug as possible.

(3) The leads from the generator terminal block are now shipped disconnected and taped to prevent their vibrating loose during shipment.

(4) A fish paper insulator is being added to the inside of the generator terminal block (slanted) cover to aid in avoiding short circuits when applying or removing this cover.

OPERATING PRECAUTIONS FOR THE MODEL
MAK EQUIPMENTS

tions for the models MO-1/MAK Equipments”
on page MO:1.

See the article entitled “Operating Precau-



MODEL MAM WHIP ANTENNA MODIFICATION

The necessity for communication with aircraft 5 and 10 miles distant from the signal officer requires more radiation than is obtainable from the whip antennas furnished with model MAM equipments.

Experiments indicate that by supplanting the whip antenna furnished with a type BG-56A whip, or equivalent, the needed performance is obtained without interfering with other equipments at adjacent fields.

The photograph of Figure 1 shows a close-up of the method employed in mounting a complete type MP-37 whip assembly, including the spring base employed to prevent the whip from snapping off.

The above antenna modification may be made provided it is found necessary to maintain communication over distances greater than was originally intended.

—*U. S. Naval Air Station,
Jacksonville, Fla.*

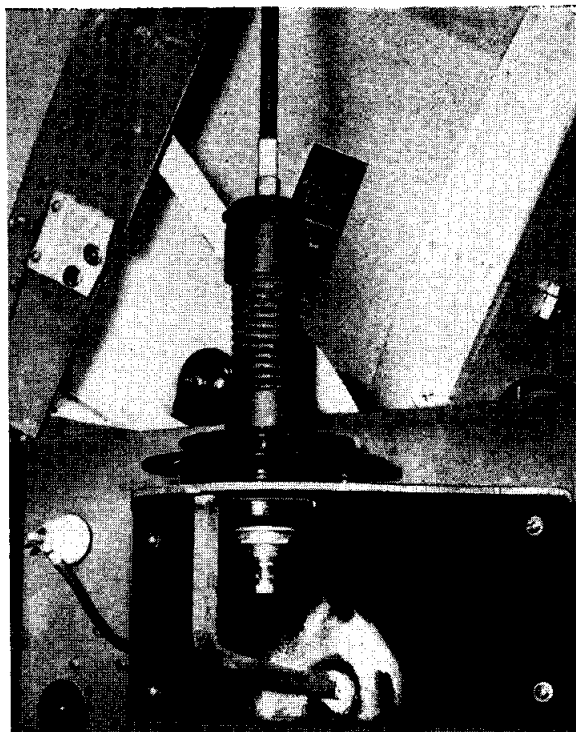


FIGURE 1.— Method of mounting a type MP-37 whip assembly on an MAM equipment.

NYPEARL MAN MODIFICATION TO PERMIT OPERATION ON 115-VOLT AC

NYPEARL has devised a circuit to modify the MAN radio communication equipment for 115-volt a-c operation. This is primarily an emergency measure, and necessitates the construction of a special transformer. This modification will be known as MAN Field Change No. 1. Inasmuch as this modification will not be required by all activities, a field change kit will not be procured.

The following instructions and diagrams were prepared by NYPEARL and are presented for information in the event that the modified equipment needs servicing at some other location.

A 10-wire connection box must be mounted within 3 feet of the transmitter and receiver (see fig. 1). This connection box is to splice

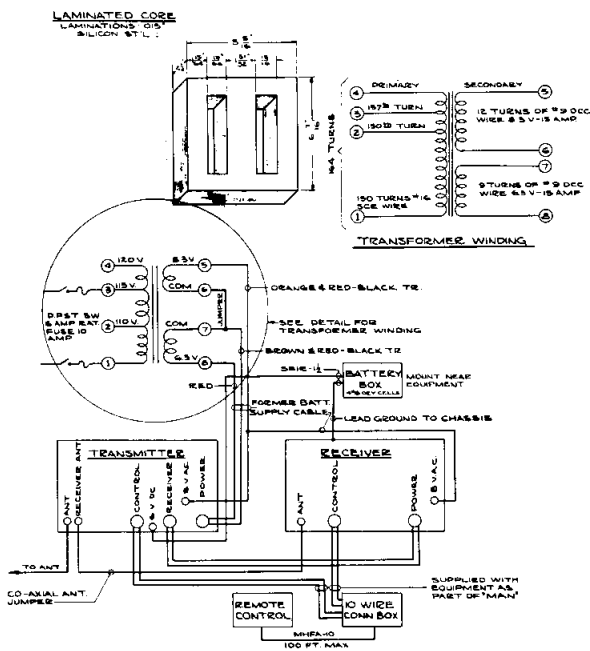


FIGURE 1.—Details of the transformer and interconnections needed for the modification.

the leads coming from the MAN equipment and the remote head if one is used. When wiring the remote, note that the numbers attached to the wires from the equipment correspond to numbers on the terminal board in the remote control head. Do not connect wire No. 1 to pin

No. 1 on the plug, that is, pins on plugs do not correspond to numbers taped on wires.

The following changes are made to the transmitter vibrator power unit, as shown in figure 2:

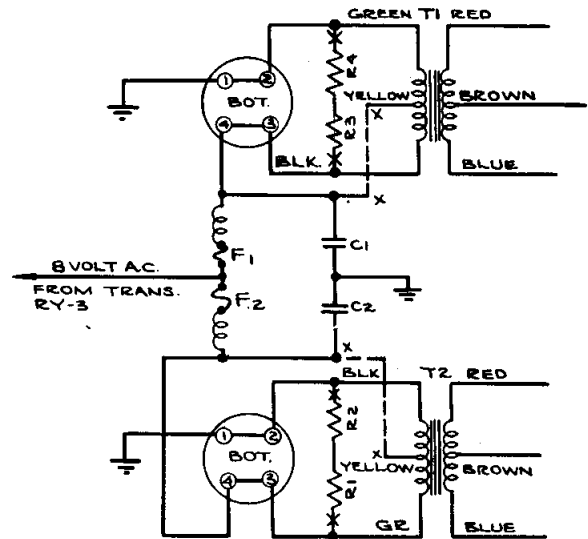


FIGURE 2.—FMT-25VW transmitter vibrator power unit modification.

- (1) Remove vibrators.
- (2) Remove R_1 , R_2 , R_3 , and R_4 .
- (3) Connect jumpers from pin No. 1 to pin No. 2, and from pin No. 3 to pin No. 4 on both vibrator sockets.
- (4) Disconnect the center tap of power transformer T-1 (two solid wires in yellow spaghetti). Solder together the two wires and tape up to insulate from the chassis. This connects the two halves of the primary in series. Power transformer T-2 is modified in the same manner.
- (5) Disconnect and tape six-volt power supply lead (copper rope). Run new lead from this point to 8-volt a-c supply.

(6) Replace 50-amp. main power fuse with a 15-amp. fuse.

(7) Replace 20-amp. receiver fuse with a 10-amp. fuse.

The following changes are made to the receiver vibrator power unit, as shown in figure 3:

- (1) Remove vibrators.
- (2) Remove R_1 and R_2 .
- (3) Disconnect and solder together center-tap leads (yellow) on primary of T_1 .

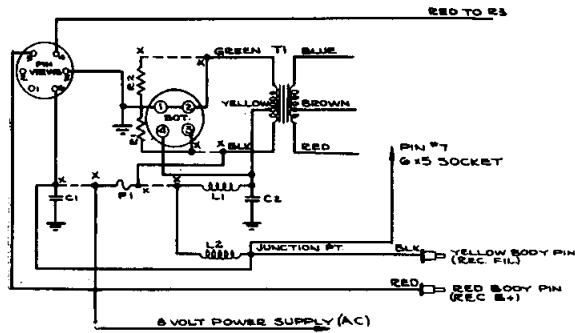


FIGURE 3.—FMR-13V receiver vibrator power unit modification.

- (4) Connect pins No. 1 and No. 2 on vibrator socket together.
- (5) Remove wires as indicated by dotted lines and "X."
- (6) Connect 8-volt a-c supply to F_1 ; remove black wire coming from transformer primary from vibrator pin No. 3, and connect it to remaining side of F_1 .
- (7) Run jumper, from the junction of pin No. 7 of 6X5 socket and yellow pin connector, to pin No. 6 of power plug.
- (8) Rec. tube 6K6 bypass condenser C-73 is changed from 0.02 to 0.002 mfd.

The following changes are made at the transmitter terminal strip, as shown in figure 4:

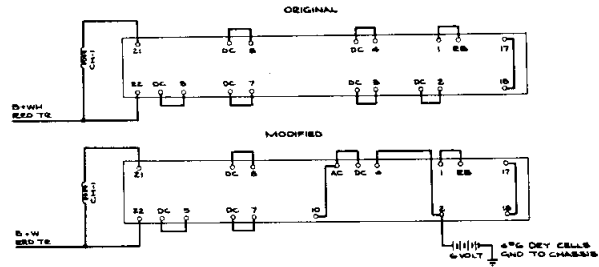


FIGURE 4.—Transmitter terminal strip modification.

- (1) Remove jumper between DC and 4. Connect DC to AC. Extend jumper to lug 10.
- (2) Connect lug 4 to lug 2.
- (3) Make up pair 24-inch leads. Connect one to lug 2, other to chassis. Connect free ends to 6-volt battery, made up of four No. 6 dry cells in series—dry cells to be placed in compartments inside equipment case.
- (4) Remove jumpers between lugs DC to 3, and DC to 2.

MODEL MAN SERIES TROUBLE SHOOTING NOTES

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
→ MAN.—Reports on transmitter output always less than the customary "Strength five, modulation good".	One-half of the high voltage series type power supply had no output. Check revealed no input to transformer. Fuse #1 tested open.—U. S. S. <i>Lind</i> (DD-703)
MAN.—Transmitter inoperative. No plate voltage. No input to the power supply.	Found one of the relays only partially operating. A small particle of iron filing was caught between the magnet and clapper arm.—U. S. S. <i>Lind</i> (DD-703)
MAN.—No power to equipment.	Six-volt a-c supply from transformer not getting to receiver or transmitter. 50-amp. fuse holder found to be making poor connection. This type of holder in which the fuse is pushed into a hole from the front and a bakelite cap is screwed down, relies only upon a metal capped spring at the opposite end for a good connection. Both corrosion of the cap and aging of the spring contribute toward poor contact.—U. S. S. <i>Lind</i> (DD-703) ←

CRYSTAL OVENS FOR MODEL MAR RADIO EQUIPMENT

See the article entitled "Crystal Ovens For Models RDZ, MAR and TDZ Radio Equipments" on page RDZ: 1 of this Bulletin. 6/1/46

MODEL MAR RADIO EQUIPMENT PANEL METER

The scale of the meter which is mounted on the front panel of the Navy type CRV-43067 Transmitter-Receiver unit is calibrated in arbitrary units. The basic range of all such meters is one milliampere and although some scales are marked "DC Milliamperes" this marking should be disregarded. Some of these meter scales are marked 0-.5-1 .0, others are marked 0-5-10. For either calibration, the deflection referred to in the MAR instruction book NAVSHIPS 900,719 should be used as though the meter scale read 0-5-10. 8/1/46

→ TYPE 2C39 TUBES IN MODEL MAR RADIO EQUIPMENT

See the article entitled "Type 2C39 Tubes in Models TDZ and MAR Radio Equipments" on page TDZ: 1 of this Bulletin. 8/1/47 ←

MAR RADIO EQUIPMENT FIELD CHANGE NO. 1

ADDITIONAL SHOCKMOUNTS FOR SHIPBOARD INSTALLATION KIT

"Model MAR Radio Equipment—Field Change No. 1—Additional Shockmounts for Shipboard Installation Kit," published in the Communication Equipment Maintenance Bulletin, Section 5, Supplement No. 13 dated August 1946 has been modified and is superseded by the following:

Equipments affected.—Model MAR radio equipment with a. c.-d. c. power supplies (Navy type CLG-20379) having serial numbers 1 through 1400. Beginning with power supply serial number 1401, the material in this field change kit will be supplied as part of the shipboard installation kit.

Purpose.—To furnish additional flexible

mounting support for the a. c.-d. c. power supply (Navy type CLG-20379).

Material required.—1. Each kit contains three (Barry Code C-2040) shockmounts, two of which are complete with mounting hardware. The remaining shockmount should be placed with the equipment spares.

2. The following material is required but is not furnished with the kit:

(a) Two bulkhead angle brackets, to be fabricated from 4-inch structural channel.

(b) Eight hex-head bolts, $\frac{1}{4}$ " x 1", complete with lockwashers and hex nuts, for fastening the shockmounts to the bulkhead brackets.

(c) Six bolts ($\frac{3}{8}$ " or larger) complete with lockwashers and nuts, of a length sufficient for fastening the brackets to the bulkhead. These bolts will not be required if the brackets are welded to the bulkhead.

Special tools required.—Metal cutting, bending, drilling, and welding equipment is required for fabrication of the bulkhead angle brackets.

General.—Field change kits are being made available in sufficient quantities to fill all requirements. Complete detailed instructions, which are included in the kit, should be kept with the instruction book (NAVSHIPS 900,719), for the modified equipment.

Vessels should contact an Electronics Officer at the first opportunity for installation of the shockmounts. Completion of this installation should be recorded in the applicable equipment record and reported on the field change report card (NAVSHIPS 2369) included in the kit. 12 1/46

MAR RADIO EQUIPMENT FIELD CHANGE No. 2

ADDING BALLAST RESISTOR (R-530) TO OPERATING SPARES

Equipments affected.—Model MAR radio equipments, serial numbers 1 through 500. Beginning with equipment serial 501 the material referenced in this field change has been supplied with the operating spares in the accessory compartment of the CRV-50248 modulator dynamotor unit.

Purpose.—To furnish ballast resistor, R-530, as operating spare for multiplier section of the Navy type CRV-43067 transmitter receiver unit.

Material required.—One (1) ballast resistor, symbol designation R-530, supplied in kit form with this field change. No other material required.

Procedure.—Remove ballast resistor, R-530, from field change kit. Place resistor in accessory compartment of the Navy type CRV-50248 modulator dynamotor unit of the MAR radio equipment.

General.—These field change kits are being made available in sufficient quantities to fill all requirements. The change is within the scope of the ship's force and should be accomplished at the earliest opportunity. Completion of this change should be recorded on the Machinery History card and reported on the NBS-383 failure report form. 10/1/46

CRYSTAL OVEN EXTRACTOR

It has been brought to the attention of the Bureau that considerable difficulty is being encountered in removing the crystal ovens from models TDZ, RDZ, MAR, and RDR UHF equipments when servicing is necessary.

In order to correct this condition, the Bureau

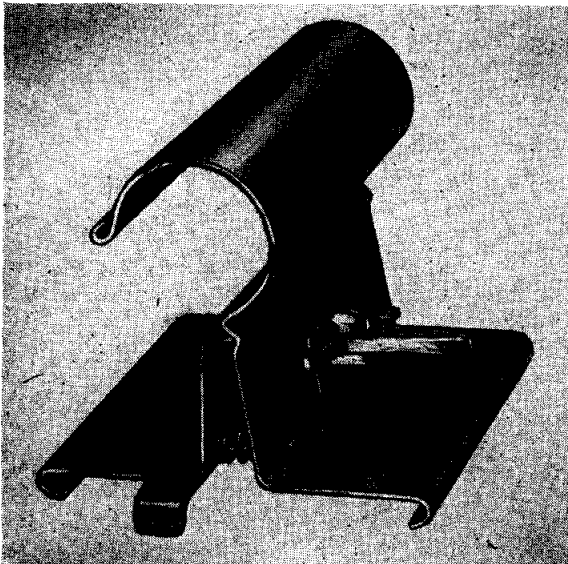


FIGURE 1.—Crystal oven extractor.

has procured a quantity of crystal oven extractors, Navy type 10552 depicted in the accompanying photograph, which will facilitate the extraction of the crystal ovens when necessary.

These extractors are now being shipped with the above UHF equipments, and a sufficient number of extractors will be stocked at a Naval Activity on each coast to take care of UHF equipments that have been shipped before the extractors became available. 12/1/46

MAR/RDR SERVICE INFORMATION

MAR

(1) Field information (resetability) indicates that it is necessary to seal the grid cathode trimmers C-117 and C-118 of the tripler and power output "cans" with Glyptol or similar cement. A small amount on the end of a toothpick is a convenient method. These trimmers usually require adjustment at the high end of the band upon changing 2C39 tubes. Adjust for maximum grid drive on meter positions 9 and 11.

(2) The following meter readings are now being used by the manufacturer for final test. These readings are for *OPERATE* position of the *IC/TEST/OPERATE* switch and not for the *TEST* position as previously indicated. Meter limits positions 1, 2, 4, 5, 6, and 7 in *RECEIVE*.

Meter switch position	Tune for	Normal scale reading
1	.....	5-7.
2	Peak.....	4.1-10.
3	.....	5-7.
4	Dip.....	4.5-8.5.
5	(*).....	7.7.
6	(*).....	7.1 d. c. 6.8 a. c.
7	(*).....	6.8 a. c.
8	Dip.....	4.5-7.5.
9	Peak.....	1.0-5.5.
10	Dip.....	1.5-3.5.
11	Peak.....	4-10.
12	Dip.....	4.5-5.

*Plus or minus one half scale division.

(3) The MCW oscillator in the Modulator unit has in some cases broken into a spurious high frequency oscillation (4000 cycles) key up on high (15 volts d. c.) line. Readjust R-725 as follows, viewed from the adjustment side:

Turn full clockwise, back off until oscillation starts (1200 cycles) key down. Continue rotation until H. F. oscillation occurs and will not stop if the key is released. Return control (R-725) about 30°. Check at low voltage (11) and readjust if necessary.

(4) The antenna compensator C-201 is now being adjusted at the factory at band #10 (highest frequency). Sets having this test adjustment will not require readjustment of this compensator (panel adjustment) when going to any lower frequency band. This permits the equipment to be operated from the remote position at practically maximum efficiency over its whole range, and well within the limits for receiver sensitivity. The following data is typical:

Channel	Ant. Adj. on No. 10 Channel UV	Ant. Adj. on each Channel UV
1.....	3.5	2.8
2.....	4.9	4.4
3.....	3.2	3.0
4.....	3.3	3.0
5.....	3.5	3.5
6.....	4.6	4.6
7.....	3.3	3.3
8.....	2.1	2.2
9.....	2.2	2.2
10.....	2.3	2.3

Units (MAR) having serial numbers above approximately 1200 will have had this alignment of the RF section made in the factory. Serials above 450 (RDR) also fall in this group. It will not be advisable to attempt to realign the RF unit in the field to make the early units meet specifications with the antenna compensator left at the point of maximum sensitivity on band No. 10. All RF units that have a spot of black paint on the nut that holds the antenna compensator will have been adjusted in the latest manner. Two or three hundred additional RF units were so adjusted prior to the marking of the trimmer nut, and may appear either in spares or equipments.

(5) The screws (3) holding the dynamotor in the modulator-dynamotor unit are now being staked after being securely tightened. Units found loose in the field should be so fastened. Do not open cases specifically for this check.

(6) Check for alignment, looseness, and condition of the 2C39 tube socket connections of

equipments that have seen intermittent and/or continual operation and report.

RDR

(1) The following meter readings are now being used for Final Test of the RDR. Filament balance has been adjusted in the factory there being no way of reading same on the panel test meter. A separate meter is placed across one-half the filament at the multiplier and R-524 adjusted for one half total filament voltage.

Meter switch position	Tune for	Normal scale reading
1.....	.....	6-8.5
2.....	Peak.....	4.1-10
3.....	Dip.....	4.5-8.5
4.....	.....	6.5-8.5
5.....	.....	7.5-8.5
6.....	.....	8-9
7.....	.....	8-9

2/1/47

MAR/RDR SERVICE HINTS

The greater number of cases of poor resetability has been traced directly to defects found in the 2d IPA and PA "cans." Other cases to a much lesser degree, have been traced to defects in the Selector system, Multiplier section and 1st IPA.

Before making any changes in "fixed" adjustments, carefully retune the Multiplier and Transmitter dials for the particular frequency in question. Make *final rotation* of each selector dial in the counter-clockwise direction. Check for normal output. If poor resetability still persists carefully retune each stage to determine which is responsible for the change in power output.

A. 2nd IPA and PA Failures—Check following:

1. Loose interelectrode capacity compensating condensers (C-117, C-118, C-112, C-120).
2. Intermittent contact of ground brushes on tuning condenser shafts.
3. Loose rotor set screws.
4. Inspect bakelite coupling shafts for cracks, splits or set screw grooving.
5. End play in rotor shaft.
6. Improper mechanical alignment of cans.

(Rotor shaft of can and bakelite shaft from universal coupling must be in perfect alignment without mechanical strain. This is extremely critical.)

7. Loose set screws in tuning rotors and shaft couplings.

8. Loose 2C39 tube clamp.

B. Selector system failure.—Check following:

1. Dial readings—approximately same reading between all dials except Ant. Coupling.

2. Individual dials should return to exactly the same reading upon reselection.

3. Check dials manually for even the slightest movement (dials should be locked).

4. Check for "overshoot" on return travel of selectors (excessive motor speed by high voltage).

5. Check recessed dials for binding on panel.

6. Check latches that are touching rim for firm locking. (Clearance between latch and rim should be approximately $\frac{1}{16}$ " with selector locked.)

C. Multiplier failure.—Check following:

1. Loose tube clamp (vibration causing intermittent grounding of shield). Effects particularly notice on higher channels.

2. Loose slug trimmers (bad retaining clips).

3. Loose capacitor trimmers.

D. Miscellaneous.—If 1st IPA is at fault check:

1. Gear mesh in 829 tuning.

2. Loose connections in link couplings.

LOW POWER OUTPUT

Trouble usually can be readily isolated and found by the equipment meter indications. The following are some of the possible causes for low output.

A. Filament balance:

Meter position	Meter reading
5..... DC.....	7.7
6..... DC.....	7.1
6..... AC.....	6.8
7..... AC.....	6.8

1. Balance potentiometer R-722 should be connected and set so balance should be within \pm one-half division. The closer the better. R-

720 (panel adjustment) filament control should be set to the above figures. Do not allow filament voltage to get too high or tube life will be seriously affected.

2. Check for low or burned out tubes especially 2C39's.

3. Check for shorted or low resistance "flower"—2C39 socket.

B. Multiplier section:

Meter position	Meter reading
1.....	5-7.
2.....	4.1 min. Receive.
2.....	4.8 min. Transmit.

1. Open choke—L-510—24 ohms d. c.

2. Weak or out-of-tune fixed oscillator V505.

3. Check converter stage V501 alignment.

4. Check alignment on low and high frequency ends of range. Readjust "C" on high, and "L" on low ends respectively.

5. Weak tubes or incorrect voltages.

C. 1st IPA Stage (829):

Meter position	Meter reading
8.....	4.5-7.5

1. Substitute 829 tube.

2. Check stage alignment.

3. Check operational voltage and current.

4. Check grid current for minimum 4.0 mils on all channels. (No meter position provided, reading is obtained by lifting one end of R-101.)

D. 2d IPA stage:

Meter position	Meter reading
9.....	1.0-5.5
10.....	1.5-10.0

1. Substitute 2C39 tube.

2. Check coupling of L-105.

3. Check over-all electrical alignment (with wand).

E. P. A. stage:

Meter position	Meter reading
11.....	4-9
12.....	4.5-5

F. Coaxial line:

1. Check K-101, antenna change over relay, for poor connection.

2. Check all coaxial lines and plug connections for opens and shorts.

INTERMITTENT POWER OUTPUT

- A. Poor RF ground where shield is grounded at L-105.
- B. Check for cracked Copalene permitting a short to the cable braid at L-105.
- C. Loose tube clamp on converter tube (V-501).
- D. Intermittent shorts in 2C39 tubes.
- E. Defective rotary joint at antenna coupling loop on PA can.
- F. Check all equipment connecting cables.

LOW OUTPUT—LOW END OF BAND
NORMAL OUTPUT—HIGH END

- A. Check Multiplier.
 - 1. Improper tracking—Align C for high end, L for low end.
- B. Check 2d IPA and PA.
 - 1. Improper tracking.
 No compensation provided except knifing of variable condenser plates.

NORMAL OUTPUT—LOW END OF BAND
LOW OUTPUT—HIGH END

- A. Check multiplier:
 - 1. Improper tracking—Align.
 - 2. Loose tube clamp (V-501) (critical high end).
- B. Check 2d IPA and PA:
 - 1. Improper tracking—Align.
 - 2. Interelectrode capacity compensators (C-117 and C-118) critical at high end. 2/1/47

MAR RADIO EQUIPMENT
FIELD CHANGE NO. 3REPLACEMENT OF THE TIME DELAY RELAY
IN UNIVERSAL POWER SUPPLY
UNIT, TYPE 20379

Equipment affected.—Model MAR equipment using Universal Power Supply Unit, Navy Type 20379 serial numbers 1 through 500.

Purpose.—To replace relay K903 type number 40262 in those Universal Power Supply Units which contain this particular relay.

Time required.—Approximately 5 minutes.

Action required.—Removal of relay K903 from power supply units where this relay bears stenciled type number 40262. For power units containing relay K903 bearing type number 40258, the relay shipped with this field change should be placed in equipment spares. This

change should be made by electronics installation or maintenance personnel.

Material required.—One time delay relay, symbol K903 type 40258, is supplied with each field change kit.

Procedure.—Follow the procedure described in the field change bulletin included in each kit.

Routine instructions.—Field change kits are being made available in sufficient quantities to fill all requirements. Completion of this change should be recorded in the Equipment Machinery History Card and reported by means of Field Change Report Card (NAVSHIPS 2369). Insert one copy of the field change bulletin in the front of the MAR Instruction Book, NAVSHIPS 900, 719. 4/1/47

MAR RADIO EQUIPMENT
FIELD CHANGE NO. 4ADDITION TO ALLOWANCE OF EQUIPMENT SPARE
PARTS FOR AC/DC UNIVERSAL POWER
SUPPLY UNIT

Equipments affected.—Model MAR radio equipments using AC/DC Universal Power Supply Unit type 20379, serial Nos. 501 and up.

Purpose.—To increase the allowance of equipment spare parts for the AC/DC Universal Power Supply Unit, serial Nos. 501 and up. This change is to be made as soon as possible by maintenance personnel of the activity or vessel to which the affected equipment is assigned.

Time required.—Approximately 5 minutes.

Material required.—All material required for this field change is furnished in a kit together with suitable instructions.

Procedure.—Stow all material with the original equipment spare parts.

Routine instructions.—A sufficient number of kits are being made available to satisfy all requirements.

As soon as the change has been made make the proper entry on the Equipment Machinery History Card, fill out and mail the self-addressed notification card, NAVSHIPS 2369, which is included as part of the field change and insert one copy of the field change bulletin in the front of the MAR Instruction Book, NAVSHIPS 900, 719. 6/1/47.

ADDITIONAL INFORMATION ON CRYSTAL OVENS FOR MODEL MAR RADIO EQUIPMENT

See the article entitled "Additional Information on Crystal Ovens for Models RDZ, MAR, and TDZ Radio Equipments" on Pages TDZ:4 and 5. 10/1/47

OBTAINING CRYSTALS FOR MODELS MAR, RDR, RDZ, AND TDZ

Several reports have reached the Bureau recently from ships indicating that difficulty had been met in obtaining crystals for u-h-f equipment. This really should be no problem at all. Crystals are now plentiful and distribution is regular.

U-h-f crystals are stocked by the Naval Gun Factory, Washington, D. C., and the Electronic Supply Center, Naval Supply Depot, Oakland, Calif. Distribution is made by means of Bureau shipment orders upon the request of the Electronics Officer of the installing activity. Admittedly, manufacture and distribution were slow during the early part of the u-h-f program, but now the difficulty has been alleviated.

In January, 1946, the Chief of Naval Operations established crystal allowances for Models TDZ, RDZ, MAR, and RDR equipments. In order that every ship would have available when needed a crystal for each operating frequency, complete sets of 100 crystals each are issued. For TDZ and RDZ equipment, one additional crystal will be furnished. This is for the common watch frequency of 243.0 Mc. Individual crystals can also be obtained to replace failures or breakage.

For TDZ, RDZ and MAR equipments, two sets of each type for each ship are allowed, regardless of the number of equipments installed.

For RDR equipment, two sets of crystals are allowed for each ship, regardless of the number of equipments installed, except in those cases where MAR equipment is also installed. In such cases no crystals are allowed for RDR equipment. Ships having u-h-f equipment installed and having less than the authorized

allowance of crystals should apply to the nearest Electronics Officer.

If an Electronics Officer is not near, a request should be forwarded to the Bureau of Ships giving the type of equipment installed and the number of sets of crystals aboard. Where ships have more than the allowed number of sets of crystals, they should be turned in to the nearest Electronics Officer for redistribution to those ships not having the required number. 1/1/48

→MODEL MAR V-H-F RADIO TRANSMITTING AND RECEIVING EQUIPMENT

NAVY FIELD CHANGE NO. 5

ADDITION OF NOISE-SUPPRESSION KIT FOR DYNAMOTOR AND BLOWER MOTOR

Equipment affected.—All Model MAR equipments.

Purpose.—To reduce radio-frequency noise radiated by the blower motor (symbol B-603) and the dynamotor (symbol D-801) in the MAR equipments, through additional filtering components supplied with this field change; and to furnish required additional equipment spares. This change is to be made at once by maintenance personnel of the activity or vessel to which the affected equipment is assigned.

Time required.—4 man-hours.

Material required.—All material required for this field change is furnished in a kit together with suitable instructions.

Tools and instruments required.—

- Drill, hand or electric, with numbers 8 and 17 steel twist drills.
- Soldering iron and solder.
- Center punch.
- Hammer.
- Two screwdrivers.
- File, small flat.
- Pliers, diagonal, wire-cutting.
- Pliers, long-nose.
- Emery cloth, medium to coarse grade.
- Wrench, socket, to fit 6-32 and 8-32 hex-head nuts.

Paint brush, small (Marine Corps equipment only).

Procedure.—

Follow the procedure described in the field change bulletin included in each kit.

Routine instructions.—

When this field change has been completed, personnel making the change shall:

- (1) Scrap all parts removed from the MAR Modulator-Dynamotor.
- (2) Make the proper entry on the equipment Machinery History Card.
- (3) Fill out and mail the self-addressed notification card, NAVSHIPS 2369, which is included as part of this field change.
- (4) Insert one copy of this field change in bulletin in the front of the MAR instruction book, NAVSHIPS 900,719.
- (5) The Technician's Record in both copies of the bulletin supplied in this kit should be filled out after completion of the change.

**MODEL MAR V-H-F RADIO TRANSMITTING AND RECEIVING EQUIPMENT
NOTES ON COMPONENT FAILURES**

The U. S. S. *Williamsburg* was recently issued a Model MAR V-H-F Transmitting and Receiving Equipment for installation by ship's force. Before the equipment was placed in operation, several causes of possible subsequent failure were located and corrected. These are listed below with the idea that they may be of benefit to other installation personnel:

- (1) One end of resistor R-914 on the mounting platform touched the chassis, causing a ground in the universal power supply.
- (2) The lead connecting terminal 10 of K-901 and terminal 4 of L-901 showed 500 ohms re-

sistance to ground when the lead was disconnected from both the relay and choke.

(3) Capacitors C-801 and C-811 in the modulator unit were breaking down within 15 minutes after the power was turned on, causing failure of F-907 in the universal power supply.

(4) The outside case of L-915 touched terminals 1 and 2 of L-901, causing a ground in the universal power supply.

Electronics personnel of all ships and installation activities are again reminded to make out failure report cards NAVSHIPS NBS 383 (Revised 3/45) for every electronic failure. These forms are proving invaluable for the preparation of the new lists of spare component parts, the design of new equipments and components, and the dissemination of maintenance information. 7/1/48

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→ **SHORTING OF CRYSTAL CONTACTS
IN MODEL MAR EQUIPMENT**

Severe field usage of Model MAR equipments may result in the shorting of the contacts of the five transmitting and receiving crystals to the end plates of the respective turret tuners.

This condition may be overcome by cementing a strip of fungi resistant insulating material on the bare metal end plates of the turret tuner closest to the crystal contacts. This applies to the wiring side of the chassis and is applicable to the five transmitter and five receiver crystals located there.

The insulator strip should be approximately $2\frac{3}{4}$ inches long, 1 inch wide and not over $\frac{1}{32}$ inch in thickness and should be applied with a good heat resistant cement. 7/1/51 ←

HALYARD TYPE ANTENNAS OF MODEL MBF EQUIPMENTS

Three hundred and twenty model MBF equipments have been shipped by Collins Radio Company as of 1 May 1945. These equipments contained halyard antennas and 75 feet of RG-8/U transmission line, consisting of 1 section of 50 feet and 1 section of 25 feet. The antennas, however, as determined by NRL tests, did not have the necessary broad-band characteristics. In order to tune the MBF transmitter to the antenna at the frequency of operation (in the frequency range of 60 mc. to 80 mc.) it may therefore be necessary to prune the transmission line, 3 inches at a time, until the transmitter loads properly. Collins Radio Company intends to replace these antennas later with halyard antennas of a satisfactory design.

The Magnavox Company is manufacturing antennas for permanent shipboard installation, to be used with the MBF equipment. The antennas are broad-band and the MBF will tune and load properly with these antennas without adjustment of transmission line length. These antennas (Navy type CMX-66143) will be shipped as soon as they become available.

SHORTING OF COAXIAL CABLE IN THE MODEL MBF EQUIPMENT

U. S. S. *LCI-546* and U. S. S. *Rocky Mount* have pointed out a source of failure in the model MBF equipment. A coaxial cable runs from C-199 to L-113 and passes under C-126 (tuning control #4). Occasionally the shield on the coaxial cable grounds out C-126 thus preventing the tuning of the r-f amplifier V-108. All ships and stations using model MBF equipment are urged to check their gear for this defect and if there is insufficient clearance between C-126 and the coaxial cable, insulate or reroute the cable.

CORRECTION TO THE MBF PRELIMINARY INSTRUCTION BOOK

A correction should be noted in section II, paragraph 2 (4) (h) of the preliminary MBF

instruction book. Control #1 should be substituted for control #2.

ALTERNATE METHOD FOR TUNING THE MBF TRANSMITTER

An alternate method may be used in tuning the MBF transmitter in addition to that outlined in the MBF instruction book, section II, paragraphs 2 (e) to 2 (t) and in the brief directions stenciled on the tuning control cover plates. With meter switch set on 6-7-8, tune #6 for maximum drive. If meter reads backwards, leave #6 at its approximate setting and tune #7 and #8 for maximum. Stages #6, #7, and #8 should then be tuned in that order for maximum in accordance with the instruction book. In the final stage of tuning, adjustments made to controls #9 and #11 can be accurately determined with the meter in the output r-f circuit. A state of maximum r-f absorption will occur at a point slightly below the red area on the meter scale. Maximum absorption can be determined using a pen lamp with a pick-up coil placed inside the final tank coil.

MBF TRANSMITTING-RECEIVING EQUIPMENT FIELD CHANGE NO. 1

IMPROVING THE SQUELCH SENSITIVITY (NO KIT)

Equipment affected.—Model MBF transmitting-receiving equipment, serials 1 through 1000 (approximately).

Purpose.—To improve the squelch sensitivity to 1.5 microvolts at the high sensitivity end of the range.

Material required.—

Item	Part and description	JAN type number
1	Resistor, carbon, 820-ohm $\pm 10\%$, 1/2-watt.	RC21BE821K
2	Resistor, carbon, 4700-ohm $\pm 10\%$, 1/2-watt.	RC21BE472K

Procedure.—(1) Replace R-135 (2nd detector cathode resistor) located under the receiver chassis with an 820-ohm 1/2-watt resistor (item #1). Label the new resistor R-135.

(2) Replace R-138 (a-f amplifier cathode resistor) located under the transmitter chassis with a 4700-ohm ½-watt resistor (item #2). Label the new resistor R-138. (It is suggested that the 4700-ohm resistor removed in step (1) be used to replace R-138 in step (2).)

General.—The model MBF receiver beginning with number 1000 (approx.) has a squelch sensitivity minimum threshold set at 3 microvolts maximum. Earlier equipments were found to have a 7- to 10-microvolt minimum threshold so that weak signals could not cut it out. The result was that many calls did not come through.

This change reduces the delay bias applied to the a-v-c detector from approximately 6 volts to 1.5 volts, developed across R-135. Reduction of R-138 from 10,000 ohms to 4700 ohms decreases the blocking potential applied to the a-f amplifier (V-105) just sufficiently to prevent audio output until the antenna input signal has attained approximately 1 microvolt.

Personnel should check their equipments to see if this change is necessary and contact an Electronics Officer for the necessary parts. The field change is within the scope of the ship's force and should be accomplished at the earliest opportunity.

The schematic diagrams and parts lists should be corrected accordingly. Parts removed should be tagged and retained for emergency use. A record of completion of this replacement should be made in the "Radio Equipment Log" NAVSHIPS 900,039. Completion of this replacement should be reported on the NBS-383 failure report card. 5/1/46

MBF TRANSMITTING-RECEIVING EQUIPMENT

FIELD CHANGE NO. 2

IMPROVING THE INTELLIGIBILITY (NO KIT)

→ *Equipments affected.*—Model MBF transmitting-receiving equipment, serials 1 through 1536.

← *Purpose.*—To improve the intelligibility when the speaker is used as the microphone.

Material required.—

Item	Quantity	Part and description	JAN type number
1	1	Capacitor, 0.002 mfd.	CM 35 B 202M

Procedure.—Replace C-119 (a-f amplifier output coupling capacitor) located under the transmitter chassis with a 0.002-mfd. capacitor, JAN type no. CM35B202M. Label the new capacitor C-119.

General.—An improved type speaker is installed on equipments above serial 750.

Personnel should contact an Electronics Officer for the new capacitor. The field change is within the scope of the ship's force and should be accomplished at the earliest opportunity. The schematic diagrams and parts lists should be corrected accordingly. Parts removed should be tagged and retained for emergency use. A record of completion of this replacement should be made in the "Radio Equipment Log", NAVSHIPS 900,039. Completion of this replacement should be reported on the NBS-383 failure report card. 5/1/46

→ DEFICIENCIES OF MODEL MBF RADIO TRANSMITTING-RECEIVING EQUIPMENT

Some deficiencies of model MBF equipment and the modifications required to correct these deficiencies are listed below for information of the field activities concerned. There are no kits furnished with any of these modifications.

(1) *Inadequate shockmounts.*—If it is determined that the shockmounts are not adequate for the particular installation, the shockmount supports should be replaced with supports of number 19 gauge stainless steel having adequate strength. This modification applies only to equipments with serial numbers 1 to 1824 inclusive.

(2) *Lack of intelligibility.*—This deficiency relates to a lack of intelligibility in using the loudspeaker as a microphone. To reduce the low frequency response of the audio amplifying system in the transmitting equipment and thus improve the intelligibility, the audio coupling condenser C-119 should be changed from 0.01 mf to 0.002 mf. This change applies only to equipments with serial numbers 1 to 1536 inclusive.

(3) *Modulation limiter ineffective.*—If it is found that the modulation limiter consisting of vacuum tube V-121 (6C4) and associated

components (refer to Figure 7-1A* of final instruction book) is ineffective and/or does not perform its function as required, it should be eliminated (Refer to Figure 7-1B or 7-1C of the final instruction book for proper circuit connections—Figure 7-1A shows the modulator limiter included in the equipment; Figure 7-1B or 7-1C shows the proper circuit connections after the modulator limiter has been eliminated). The modulator limiter was deleted beginning with equipment serial number 480.

(4) *Excessive hum.*—The excessive hum in the equipment can be minimized by inserting an RC network consisting of a resistor (100,000 ohms) and two capacitors (0.1 mf each) in the plate circuit of the first audio amplifier stage. (Refer to Figure 7-1B or 7-1C of the final instruction book and make circuit connections as shown; the R-C network, as shown, consists of R-157, C-122-B, and C-122-C. Do not use these symbols unless the modulator limiter is eliminated. Note that capacitors C-122-B and C-122-C are parts of capacitor C-122 (Refer to parts list of final instruction book) and may be used in the R-C network providing the modulator limiter is eliminated). This modification is applicable only to equipments with serial numbers 1 to 479 inclusive.

(5) *Squelch sensitivity inadequate.*—The squelch sensitivity can be improved by changing the audio amplifier grid resistor R-154 from 100,000 ohms to 270,000 ohms. This change applies only to equipments with serial numbers 1 to 1536 inclusive.

(6) *"Speaker on-off" markings inaccurate.*—The speaker on-off switch does not silence the speaker when in the OFF position. This deficiency came about because of a revised control circuit for the speaker talk circuit. It was corrected beginning with equipment serial number 1537. To correct this deficiency in equipments prior to 1537, the markings should be rectified to indicate the functions performed by the switch (See "NOTE" paragraph 2 (d), section 2 of final instruction book) or, if deemed more desirable, the speaker circuits should be modified as shown in figure 7-1C of final instruction book

(for the proper components used in the circuit modifications refer to the parts list of the final instruction book).

(7) *Excessive output in handset.*—This condition can be remedied by increasing the resistance of the receiver audio output limiting resistor R-107 (Individual judgment should be exercised in this modification).

(8) *Antenna pick-up loop likely to short to the power amplifier tank circuit or to ground.*—Under some conditions the antenna pick-up loop shorts to the final amplifier tank circuit or to ground. To remedy this situation, an insulating sleeve should be placed over the pick-up loop and the leads connecting to it. This modification is necessary only in the equipments with serial numbers 1 to 700 inclusive.

(9) *Light from tubes shows around speaker.*—If any light from the tubes is showing around the speaker and if this light proves objectionable, the speaker screen may be eliminated to alleviate this condition.

(10) *Plug-in electrolytics not easily removed.*—This deficiency can be corrected by replacing the present electrolytic hold-in clamps with clamps of a different type and design (Individual judgment should be exercised as to what types of clamps should be employed to effect the results desired). This deficiency was corrected beginning with equipment serial number 800 by a change in design of the electrolytic hold-in clamps.

(11) *Present alignment screw driver detunes circuits.*—The alignment screw driver supplied with the equipment will, under some conditions, detune the circuits as the necessary adjustments are made to the equipment. To prevent this from happening, an insulated screw driver should be employed instead of the one supplied with the equipment.

(12) *Corrections in final instruction book.*
(a) Page 2-6, paragraph 2 (d), NOTE, second line:—Change "700" to "1536".

(b) Page 6-4, parts list, power input lead by-pass capacitor C-157:—The rating of this capacitor should be 0.002 mf instead of 0.001 mf as shown. 6/1/46

EXCESSIVE RECEIVER RADIATION IN THE MODEL MBF RADIO EQUIPMENT

Field activities employing model MBF equipments having serial numbers below 1537 might experience excessive receiver radiation when the tuning meter and the power cable are plugged in. This excessive radiation can be reduced by providing the tuning meter circuits and the input power circuits with appropriate filters. The filter for the tuning meter circuits should consist of a choke coil of 2.7 micro-henrys and two capacitors of 0.002 micro-farads each; the filter for the input power circuits should consist of two capacitors of 0.002 micro-farads each. For proper connections of the filters refer to figure 7-1c of the final instruction book. (Note that the tuning meter-filter components are identified as L-127, C-177, and C-180 and the power cable filter components are identified as C-157 and C-175. These same symbol designations should be employed if the above modifications are made.) For pertinent data on the filter components refer to the parts list of the final instruction book. Winding data for the choke

coil (L-127) is given in the table on figure 1. 8/1/46

→ HANDSETS FOR MODEL MBF RADIO EQUIPMENTS

One Navy type-51064 hand telephone assembly (handset) is furnished with each model MBF transmitter-receiver at the time of original issue. These handsets contain the Navy standard five-wire (green) circuit and have a 20-foot cord. These handsets are not stocked, nor intended to be stocked, as separate items and therefore, are not and will not be available for replacement purposes.

For replacement purposes, the Navy standard shipboard handset type 51081, with a 4-foot cord attached, is stocked and supplied. This handset is described further in RIB No. 103.

In exceptional cases wherein the 4-foot cord of the type-51081 handset is insufficient, the short cord can be replaced with the proper length of standard handset cable, type MMOP-5. This cable is stocked at all electronic supply activities. 8/1/47 ←

Part name: R. F. Choke Approx. wt. ----- Number: 240 0012 00

Type: -----

Description: Radio Frequency Choke in accordance with Navy requirements.

Inductance: 2.7 microhenrys approx. Associated data: JAN-P-14 AN-QQ-S-91;

Max. Current: 300 ma.

Coil Form: 0.170" dia. x $\frac{5}{8}$ " long with molded-in leads, Speer Resistor Corp. No. CF .170 x $\frac{5}{8}$ " or equivalent. Phenolic material shall be Type MTS-E-2 in accordance with Joint Army-Navy Spec. JAN-P-14.

Leads: Hot tin dipped.

Wire: No. 30 AWG Enameled. Copper.

Number of Turns: 45 plus 0 minus 3 turns.

- NOTES: 1. Materials entering into the construction of this choke shall be fungi resistant, or the choke shall be treated to render it fungi resistant.
2. The choke shall withstand a 100-hour salt-spray test in accordance with Army-Navy Aeronautical Specification AN-QQ-S-91 without impairing its operation, and no part shall show evidence of approaching failure caused by corrosion.
3. Samples must be approved by Collins Radio Co. Engineering Department.

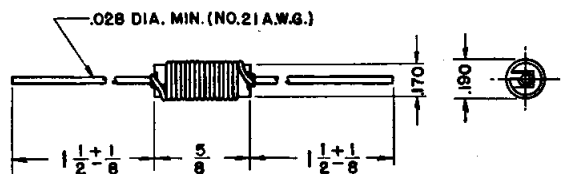


FIGURE 1.—Choke coil dimensions.

**FREQUENCY METER CONNECTIONS FOR MODEL
TDN EQUIPMENT INSTALLED IN THE MODEL
MBK TRAILER**

See the article of similar title on page
TDN: 1.

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