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NAVSHIPS 93285.61 (Non-Registered)

OVERHAUL
AND
REPAIR INSTRUCTIONS
for
RADIO SET AN/URC-32

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

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DEPARTMENT OF THE NAVY
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From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation, and Maintenance of the Subject Equipment

Subj: Overhaul and Repair Instructions for Radio Set AN/URC-32, NAVSHIPS 93285.61

1. This is the Overhaul and Repair Instructions for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

4. Errors found in this publication (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes should be reported. Such report should include the complete title of the publication and the publication number (short title); identify the page and line or figure and location of the error; and be forwarded to the Electronics Publications Section of the Bureau of Ships.

5. Due to the nature of this publication only a limited quantity has been produced for major overhaul and repair facilities. Accordingly, requests from other activities should be forwarded via chain of command justifying the reason for obtaining the book.

R. K. JAMES
Chief of Bureau

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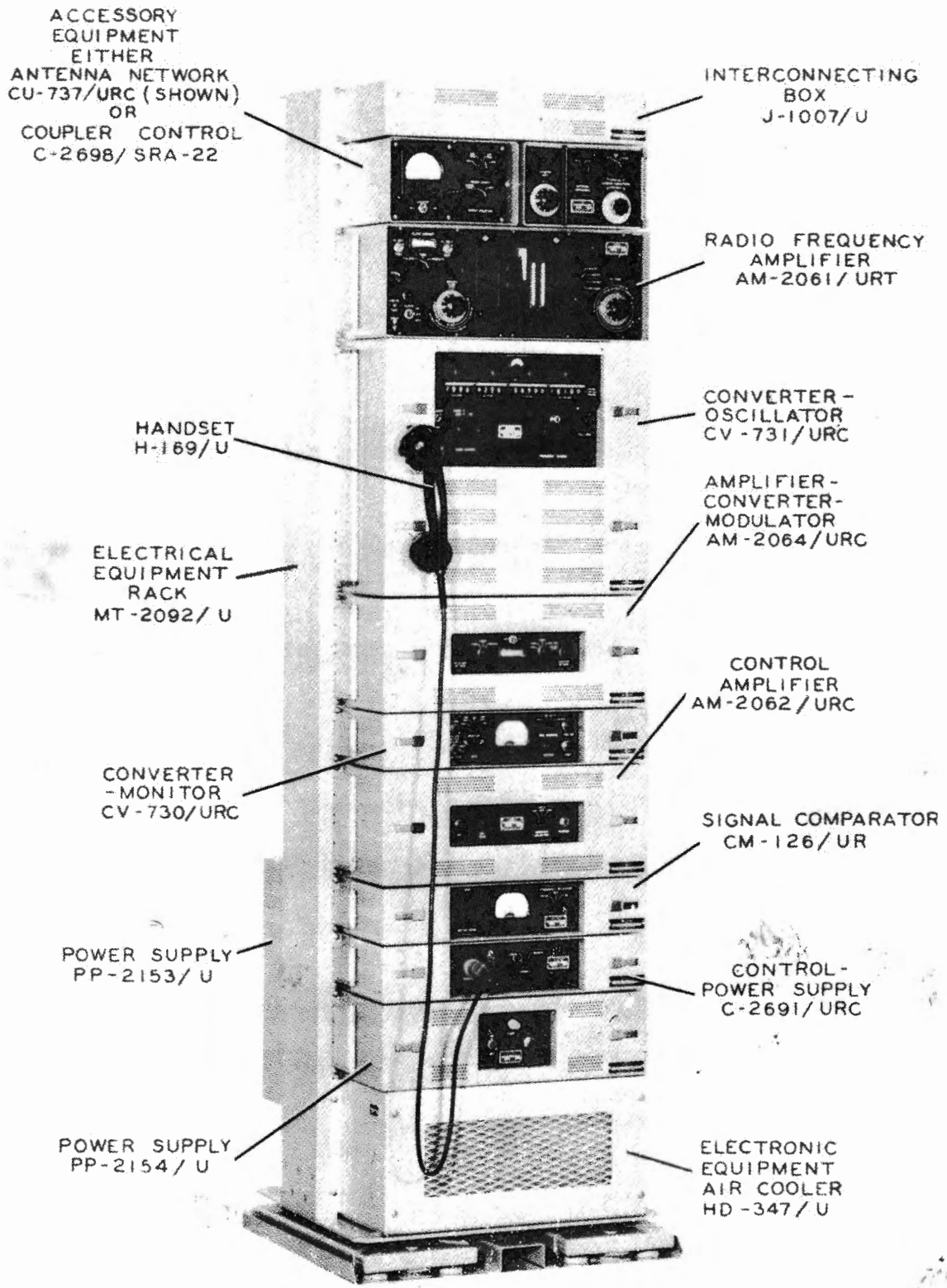

Figure 1-1. Radio Set AN/URC-32

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

This overhaul handbook is prepared for use by Overhaul and Repair Departments and Depots (Department of the Navy, Bureau of Ships) as an aid in understanding and performing service and maintenance procedures for Radio Set AN/URC-32. Reference is made to publications NAVSHIPS 93285 Technical Manual for Radio Set AN/URC-32 and NAVSHIPS 93285.42 Maintenance Standards Book for Radio Set AN/URC-32 for all installation, maintenance, and service procedures not found in this handbook. For information concerning any detail part of this equipment, reference is made to publication NAVSHIPS 93285 Technical Manual for Radio Set AN/URC-32.

The dismantling of the units and subunits not covered in this book is considered obvious and requires no special tools other than the ones supplied in the service and tool kit. Careful handling of the units and subunits is necessary, particularly to prevent damage to exposed parts such as tubes, relays, and connectors. To aid the technician in removing a subunit, the screws which secure the subunits are colored red. They must be loosened, but need not be completely removed to free the subunits. It is important that a screwdriver of the proper size be used to prevent damage to the heads of the screws. To avoid bending pins on the subunit plugs, rock the plugs loose from their chassis sockets as the subunit is taken out.

The following specifications were used in the preparation of this manual.

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MIL-M-16616 (Ships)	- Manual, Technical Electronic Equipment
MIL-L-17192	- Lubrication design lubricants and lubrication information for electronic equipment, general specifications
MIL-STD-8	- Dimensioning and Tolerancing
MIL-STD-280	- Definition of Terms for Equipment Division

1-2. REFERENCE DATA.

a. EQUIPMENT SPECIFICATIONS. - The following information is supplied to familiarize overhaul shop personnel with the characteristics of Radio Set AN/URC-32.

Frequency range	2.0 to 30.0 megacycles
Frequency range increments	1 kc all modes, except A1, F1
Mode.	CW telegraphy (A1) Double sideband, full carrier (A3) on receive Single sideband, reduced carrier (A3a) Two independent sidebands, reduced carrier (A3b) Composite transmission (A9) Single sideband, full carrier (A9a) on transmit Frequency-shift telegraphy (F1)

Frequency stability		1 part in 10^6 per month and 1 part in 10^8 per day under all ambient conditions, using the equipments internal frequency standard
Receiver sensitivity		1 microvolt for 10-db signal plus noise-to-noise ratio
Receiver selectivity		3 kc bandwidth on either sideband 6 kc bandwidth on AM
Receive audio distortion		Less than 5 percent
Transmit power output		(A1) 500 watts (A9a) 125 watts carrier power (A3a) 500 watts PEP (A3b) 500 watts PEP total (A9) 500 watts PEP total (F1) 500 watts
Distortion on transmit		35 db below PEP output (3rd order distortion)
Carrier suppression		45 db below PEP output
Undesired sideband suppression		40 db below PEP output
Audio inputs	USB line	-38 to +8 dbm into 600 ohms balanced
	LSB line	-38 to +8 dbm into 600 ohms balanced
	Microphone	Standard high impedance dynamic microphone
Audio outputs	USB line	+14 to -34 dbm (adjustable) into 600 ohms balanced
	LSB line	+14 to -34 dbm (adjustable) into 600 ohms balanced
	Phones	Standard 600-ohm headphones
	Speaker	3 watts maximum into 3-4-ohm or 600-ohm speaker
Receiver r-f input impedance		50 ohms unbalanced
Transmit r-f output impedance		50 ohms unbalanced
Power source requirements		115/230 v a-c, single phase, 60 cps, 1500 watts
Weight		390 lb
Volume		20 cubic feet
Floor space required		3.3 square feet
Dimensions		73 in. high, 21-7/8 in. wide, 20-7/8 in. deep

b. NOMENCLATURE CROSS-REFERENCE. - Throughout the technical manual for Radio Set AN/URC-32, NAVSHIPS 93285, reference is made to major units by commercial name and type numbers. Since Army-Navy nomenclature has been assigned not only to the radio set but also to each major unit, table 1-1 is provided to cross-reference commercial name and type number with military name and type number. The cross-reference table also includes accessory items which, while not a part of Radio Set AN/URC-32, are referenced in the technical manual by commercial name and type number.

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TABLE 1-1. NOMENCLATURE CROSS-REFERENCE LIST

COMMERCIAL NOMENCLATURE	ARMY/NAVY NOMENCLATURE
Power Amplifier 367A-3	Amplifier, Radio Frequency AM-2061/URT
Frequency Generator 786E-1	Converter-Oscillator CV-731/URC
Sideband Generator 786F-1	Amplifier-Converter-Modulator AM-2064/URC
Audio and Control Unit 159B-1	Amplifier-Control AM-2062/URC
High-Voltage Power Supply 428B-1	Power Supply PP-2153/U
Low-Voltage Power Supply 429B-1	Power Supply PP-2154/U
Blower 199G-3	Cooler, Air, Electronic Equipment HD-347/U
Dynamic Handset	Handset H-169/U and Cord CX-1846( )/U
Handset Adapter	Control - Power Supply C-2691/URC
Frequency Comparator 54Q-1	Comparator, Signal CM-126/UR
CW and FSK Unit	Converter-Monitor CV-730/URC
Dummy Antenna 172J-1	Dummy Load, Electrical DA-218/U
Junction Box 153H-2	Interconnecting Box J-1007/U
Mounting Rack and Shockmount	Rack, Electrical Equipment MT-2092/U
H-V Power Supply Bulkhead Mounting Kit	Installation Kit, Electrical Equipment MK-446A/URC-32
Service Repair Tool Kit	Maintenance Kit, Electrical Equipment MK-447/URC-32
Antenna Network 180U-2	Coupler-Monitor CU-737/URC

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SECTION II

TEST EQUIPMENT AND SPECIAL TOOLS

2-1. TEST EQUIPMENT.

All alignment and testing of overhauled equipment is performed at the module test stations or the final test station. See the following paragraphs for a list of the test equipment required at each test station.

2-2. SPECIAL TEST EQUIPMENT AND TOOLS.

The following special test equipment is required for the module test stations. Numbers are Collins Radio Co. part numbers.

Stabilized master oscillator test panel	029-4348-123
Sidestep oscillator test panel	029-4326-123
Carrier generator test panel	029-4532-123
Reference oscillator test panel	029-4474-123
Frequency comparator	522-1074-00
R-f tuner test panel	029-2312-124
Slug rack positioner	029-0340-001
TGC test panel	029-4325-123
Balance modulator test panel	029-4343-123
I-f/a-f amplifier test panel	029-4318-123
Mike, line, and speaker amplifier test fixture	029-4232-122
Low-voltage power fixture	029-1455-122
Voltage divider	029-7342-121

SECTION III

DISMANTLING AND DISASSEMBLY

3-1. INTRODUCTION.

This section describes the procedures preparatory to overhaul, including dismantling of the equipments into its assemblies or subassemblies, and disassembly into parts. The extent to which the dismantling processes are carried will be determined by the authority in charge of overhaul, according to the condition of the equipment. In most instances, it probably will not be necessary to dismantle the equipment to the extent covered by these instructions. Disassembly is limited to the removal of mechanical items, such as gears, bearings, shafts, and variable inductors. Internal wiring, resistors, or capacitors are not removed unless such action is necessary for access to a part requiring overhaul.

Extreme caution must be used when disassembling any of the assemblies or subassemblies to prevent loss of small parts, washers, and gears. Always provide several containers to hold small parts, washers, screws, etc., before starting the disassembly procedure.

NOTE

Considerable time should be spent in trouble-shooting and adjustment procedures before attempting to disassemble a component to correct a malfunction. In most cases, trouble can be corrected by adjustment procedures and intelligent application of operational theory. If trouble is known to exist in a detail part, or a small assembly of parts, which is not readily accessible, the following disassembly and reassembly instructions are supplied as a step-by-step guide to completely dismantle the equipment. These instructions are not to infer that a unit should be disassembled regularly, since the operation will disturb factory aligned adjustments, and reassembly procedures must be strictly observed.

3-2. DISMANTLING RADIO FREQUENCY AMPLIFIER AM-2061/URT.

a. REMOVING FROM RACK.

(1) Turn power OFF.

(2) To remove Radio Frequency Amplifier AM-2061/URT from the rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the radio frequency amplifier to swing out, since the left side of the unit is hinge mounted.

(3) Disconnect coaxial connectors from J1, J2, J3, and plug from J6. These connectors and plug are located on the back of the radio frequency amplifier.

(4) Grasp the unit firmly and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to connector J6, the unit should not be laid on its back.

3-3. DISMANTLING CONVERTER-OSCILLATOR CV-731/URC.

a. REMOVING FROM RACK.

(1) To remove Converter-Oscillator CV-731/URC from the rack, remove the four screws that mount the right side of the rear panel to the rack. This will allow the converter-oscillator to swing out since the left side of the unit is hinge mounted.

(2) Disconnect coaxial connectors from J10, J11, J12, J13, J14, J15, and plugs from J16 and J17. These connectors and plugs are located on the back of the converter-oscillator.

(3) Release the four thumb fasteners, and remove dust cover.

(4) Grasp the unit firmly and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

b. REMOVING SMO MODULE.

(1) Set BAND CHANGE knob (located on front panel of converter-oscillator) to band 1, and frequency to approximately 1700 kc.

(2) Loosen the two captive screws at top, and lower the control panel. This will give access to three of the modules.

(3) Turn dial (with control panel lowered) so that a Bristo wrench may be inserted in the screw securing the left half of the Oldham coupler on the drive to the smo. Loosen the clamp on the left half of the coupler, and slide it back on the shaft.

(4) Loosen the four redheaded captive screws securing the smo to the chassis.

(5) Pull the module from the chassis and carefully lay it on a bench. To prevent damage to the connectors, the smo should not be laid on its bottom side.

c. REMOVING R-F TUNER MODULE.

(1) Loosen the left half of the Oldham coupler, and remove loading spring from left side and leave attached to right side of coupler.

(2) Slide the left half of the coupler to the left, disengaging the coupler.

(3) Loosen the four captive screws, and pull the module from the chassis and carefully lay it on a bench.

d. REMOVING THE REMAINING MODULES FROM CONVERTER-OSCILLATOR CV-731/URC.

(1) Loosen the two redheaded captive screws on each module.

(2) Pull the modules from the chassis, and carefully lay them on a bench.

3-4. DISMANTLING AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

a. REMOVING FROM RACK.

(1) To remove Amplifier-Converter-Modulator AM-2064/URC from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the amplifier-converter-modulator to swing out, since the left side of the unit is hinge mounted.

(2) Disconnect coaxial connectors from J8, J9, J10, and plugs from J11, J12, and J13. These connectors and plugs are located on the back of the amplifier-converter-modulator.

(3) Release the two thumb fasteners, and remove dust cover.

(4) Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

b. REMOVING MODULES FROM AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

(1) Loosen the two redheaded captive screws on each module.

(2) Pull the modules from the chassis, and carefully lay them on a bench.

3-5. DISMANTLING CONVERTER-MONITOR CV-730/URC.

a. REMOVING FROM RACK.

(1) To remove Converter-Monitor CV-730/URC from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the converter-monitor to swing out, since the left side of the unit is hinge mounted.

(2) Disconnect coaxial connectors from J2 and J3, and plug from J1. These connectors and plug are located on the back of the converter-monitor.

(3) Release the two thumb fasteners, and remove dust cover.

(4) Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

3-6. DISMANTLING AMPLIFIER-CONTROL AM-2062/URC.

a. REMOVING FROM RACK.

(1) To remove Amplifier-Control AM-2062/URC from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the amplifier-control to swing out, since the left side of the unit is hinge mounted.

(2) Disconnect coaxial connector from J7, and plugs from J8 and J9. These plugs and connector are located on the back of the amplifier-control.

(3) Release the two thumb fasteners, and remove dust cover.

(4) Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

b. REMOVING MODULES FROM AMPLIFIER-CONTROL AM-2062/URC.

(1) Loosen the two redheaded captive screws on each module.

(2) Pull the modules from the chassis, and carefully lay them on a bench.

3-7. DISMANTLING SIGNAL COMPARATOR CM-126/URC.

a. REMOVING FROM RACK.

(1) To remove Signal Comparator CM-126/U from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the signal comparator to swing out, since the left side of the unit is hinge mounted.

(2) Disconnect coaxial connectors from J1 and J2, and plug from J4. This plug and the connectors are located on the back of the signal comparator.

(3) Release the two thumb fasteners and remove dust cover.

(4) Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

3-8. DISMANTLING CONTROL-POWER SUPPLY C-2691/URC.

a. REMOVING FROM RACK.

(1) To remove Control-Power Supply C-2691/URC from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the control-power supply to swing out, since the left side of the unit is hinge mounted.

(2) Disconnect coaxial connector from J2, and plug from J3. This connector and plug is located on the back of the unit.

(3) Release the two thumb fasteners, and remove dust cover.

(4) Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connector and plug, the unit should not be laid on its back.

3-9. DISMANTLING POWER SUPPLY PP-2154/U (LOW VOLTAGE).

a. REMOVING FROM RACK.

(1) To remove Power Supply PP-2154/U from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the power supply to swing out, since the left side of the unit is hinge mounted.

(2) Disconnect plug from J1 and J2. These plugs and connectors are located on the back of the power supply.

(3) Release the two thumb fasteners, and remove dust cover.

(4) Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

3-10. DISMANTLING POWER SUPPLY PP-2153/U (HIGH VOLTAGE).

a. REMOVING FROM RACK.

(1) To remove Power Supply PP-2153/U from rack, remove three of the four screws from each side that mount the rear panel to the rack.

(2) Release the two thumb fasteners, and remove dust cover.

(3) Remove the two screws that mount the cover marked DANGER HIGH VOLTAGE over the terminal strip TB-1.

(4) Remove wires from terminal strip TB-1, and coaxial plug from connector J1.

(5) Grasp the unit firmly, and remove the mounting screw from each side of the unit. Lay the unit carefully on a bench. To prevent damage to the terminal strip and connector, the unit should not be laid on its back.

3-11. DISMANTLING ELECTRONIC EQUIPMENT AIR COOLER HD-347/U.

a. REMOVING FROM RACK.

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(1) To remove Electronic Equipment Air Cooler HD-347/U from rack, remove the four screws that mount the air duct to the top of the air cooler.

(2) Disconnect plug from connector J1. This plug is located on the top side of the unit.

(3) Using a flat-blade screwdriver, loosen the four fasteners, and remove the cover with the filter.

(4) Grasp the unit firmly, and remove the two mounting screws from each side of the unit. Lay the unit carefully on a bench.

(5) Loosen the two fasteners that hold the filter to the cover, and lift filter from cover.

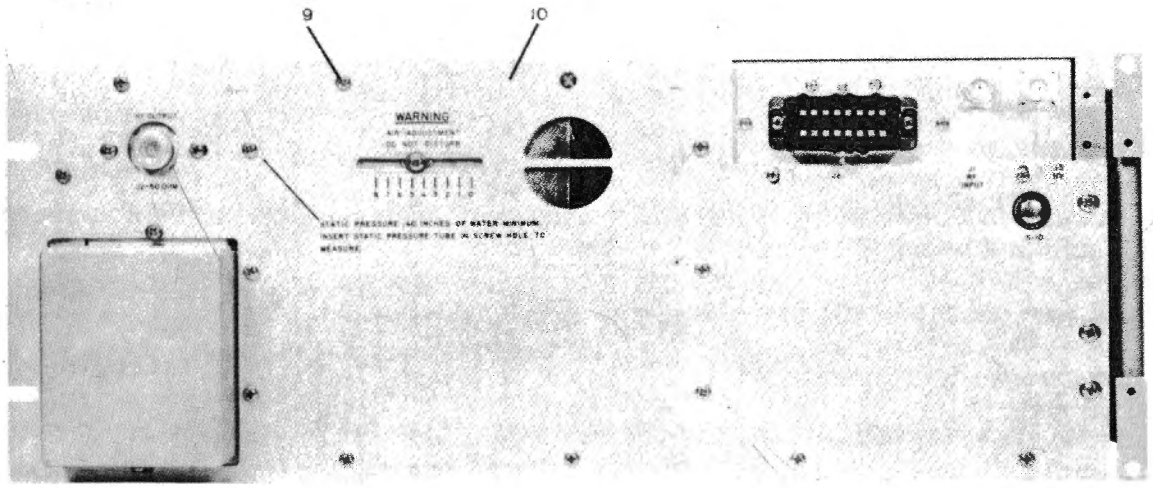
3-12. DISASSEMBLY, RADIO FREQUENCY AMPLIFIER AM-2061/URT.

a. FRONT AND REAR PANELS FROM CHASSIS. - Refer to figure 3-1 for component location and proceed as follows:

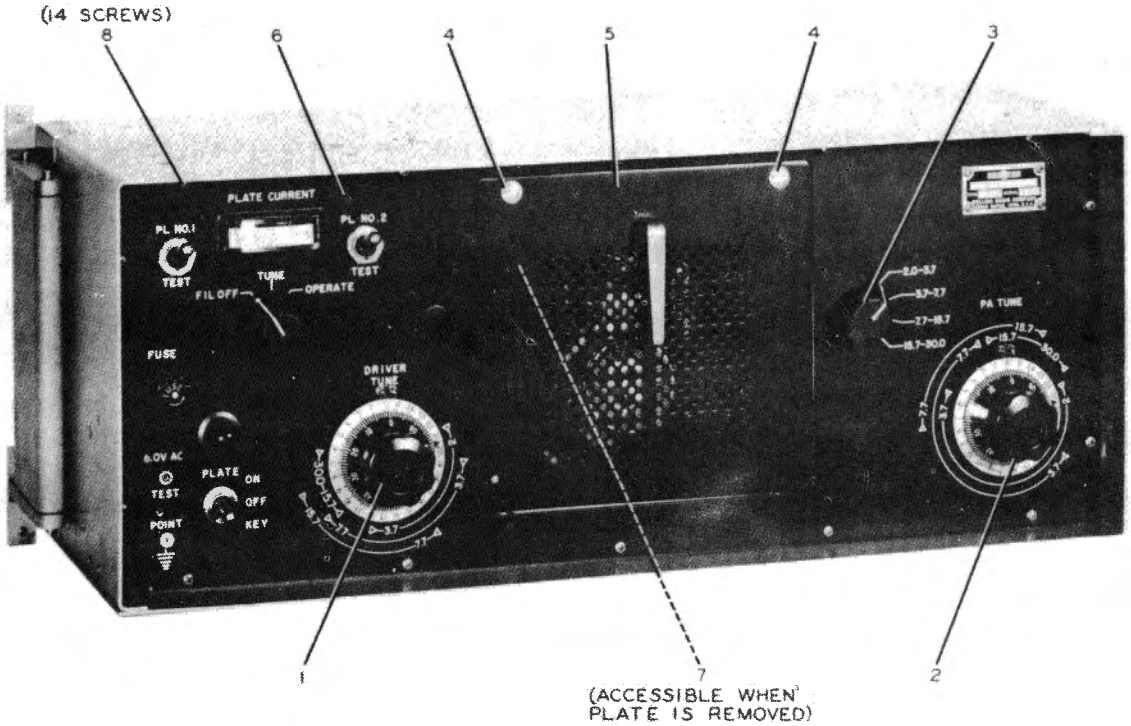
(1) Loosen setscrews in DRIVER TUNE knob (1), P.A. TUNE knob (2), and band switch knob (3). Remove the knobs.

(2) Loosen the two fasteners (4) that holds plate (5) to front panel (6). Remove plate (5).

(3) Remove the two screws (7) on the left bracket, which is made accessible when the plate (5) on the front panel (6) is removed.



REAR VIEW



FRONT VIEW

Figure 3-1. Radio Frequency Amplifier AM-2061/URT, Front and Rear Views

(4) Remove the fourteen binder-head screws (8) that mount the front panel (6) to the chassis.

(5) Pull out and swing the front panel (6) down; be careful to avoid damage to cable and wiring to front panel (6).

(6) Remove the twenty-three screws (9) that mount the back panel (10) to the unit. Remove back panel (10).

b. BAND SWITCH ASSEMBLY FROM CHASSIS. - Refer to figure 3-2 for component location and proceed as follows:

(1) Unsolder and remove straps and wires that are connected to the front switch wafer S6-B (1).

NOTE

Use special care when unsoldering wires and straps from switch terminals. Use the soldering tool aid to straighten the end of the bus wires that are wrapped around the switch terminals. Care should be taken not to change the shape of the bus wires and straps when disconnecting from switch.

(2) Unsolder and remove bus wires that are connected to the center switch wafer, S5 (2).

(3) Unsolder and remove straps from switch terminals of back switch wafer S6-A (3).

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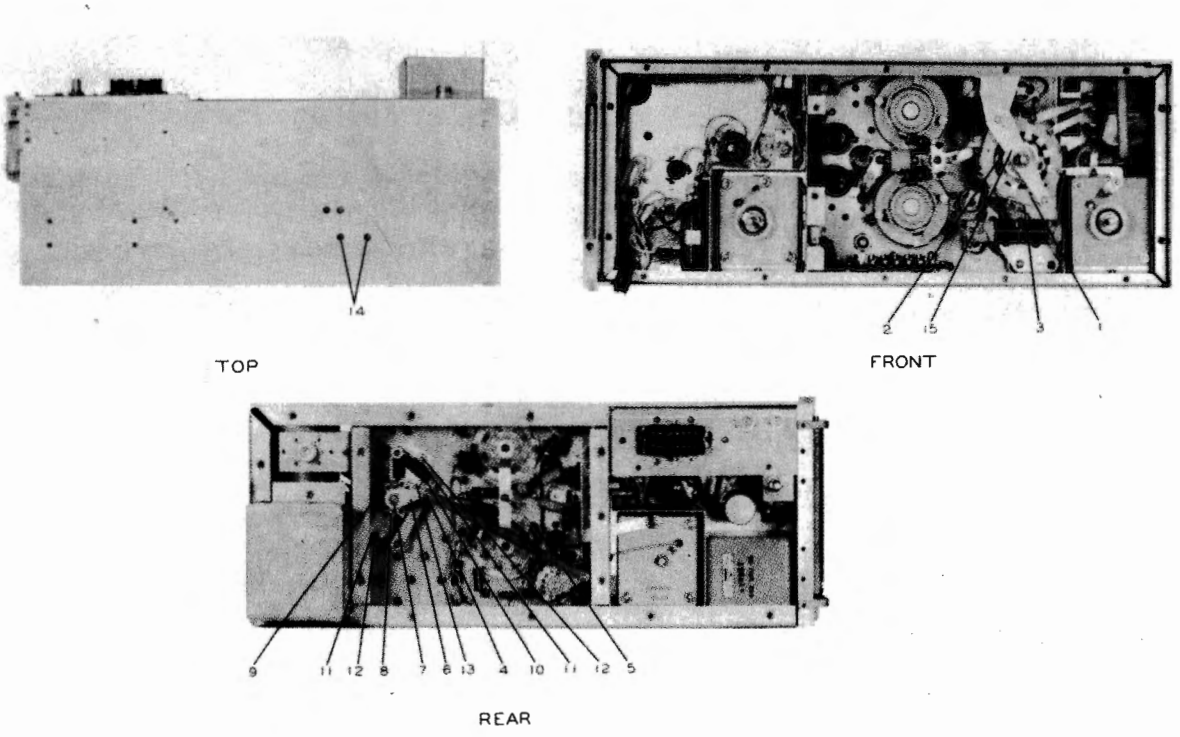

Figure 3-2. Radio Frequency Amplifier AM-2061/URT, Front, Rear, and Top Views

(4) Viewing the radio frequency amplifier from the rear, remove the retainer ring (4) that holds the link (5) to the P. A. band switch detent arm (6). Remove the link (5) from the detent arm (6).

(5) Loosen the two Bristo setscrews (7) in the detent arm (6), and remove arm from shaft.

NOTE

Setscrews and screws that are staked with blue varnish may be difficult to remove. If this is the case, it may be necessary to heat the setscrews or screws slightly, using a soldering iron to loosen the varnish.

(6) Loosen the three Bristo setscrews (8) in the detent wheel (9).

(7) Pry the detent arm (10), using a screwdriver, to clear the detent wheel (9) and slide detent wheel off of shaft.

(8) Remove two nuts (11) and lock washers (12) that mount the detent assembly (13) and back end of switch (S6).

(9) Lift the detent assembly (13) off shaft.

(10) Remove the two flathead screws (14) that mount switch assembly S6 (15) front bracket to the front top of the chassis.

(11) Carefully remove switch assembly (15) by pulling forward and rocking the assembly at the same time. Care should be taken not to bend the disconnected bus wires and strips.

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c. BAND SWITCH ASSEMBLY. - To disassemble band switch assembly, refer to figure 3-3 and proceed as follows: Disassemble band switch in order of index numbers starting with number 1.

NOTE

Index numbers 26, 29, and 32 are groove pins which must be removed with great care to prevent damage to the switch wafers. Rest the hub of the switch on a solid block, and carefully drive the groove pin out of the hub with a small punch.

d. DETENT ASSEMBLY. - To disassemble detent assembly, refer to figure 3-4 and disassemble detent assembly in order of index numbers starting with number 1.

e. VARIABLE INDUCTOR (L10) FROM CHASSIS. - Refer to figure 3-5 and proceed as follows:

(1) Remove nut (1) and lock washers (2) from variable inductor L10 (3) that mount the strap from switch S6 (4). Bend the strap back enough to clear the variable inductor (3).

(2) Unsolder and remove strap from switch wafer of switch S6 (4). This strap is the one from the rear of variable inductor L10 (3).

(3) Remove the two flathead screws (5) that mount the front end of the variable inductor (3) to the chassis.

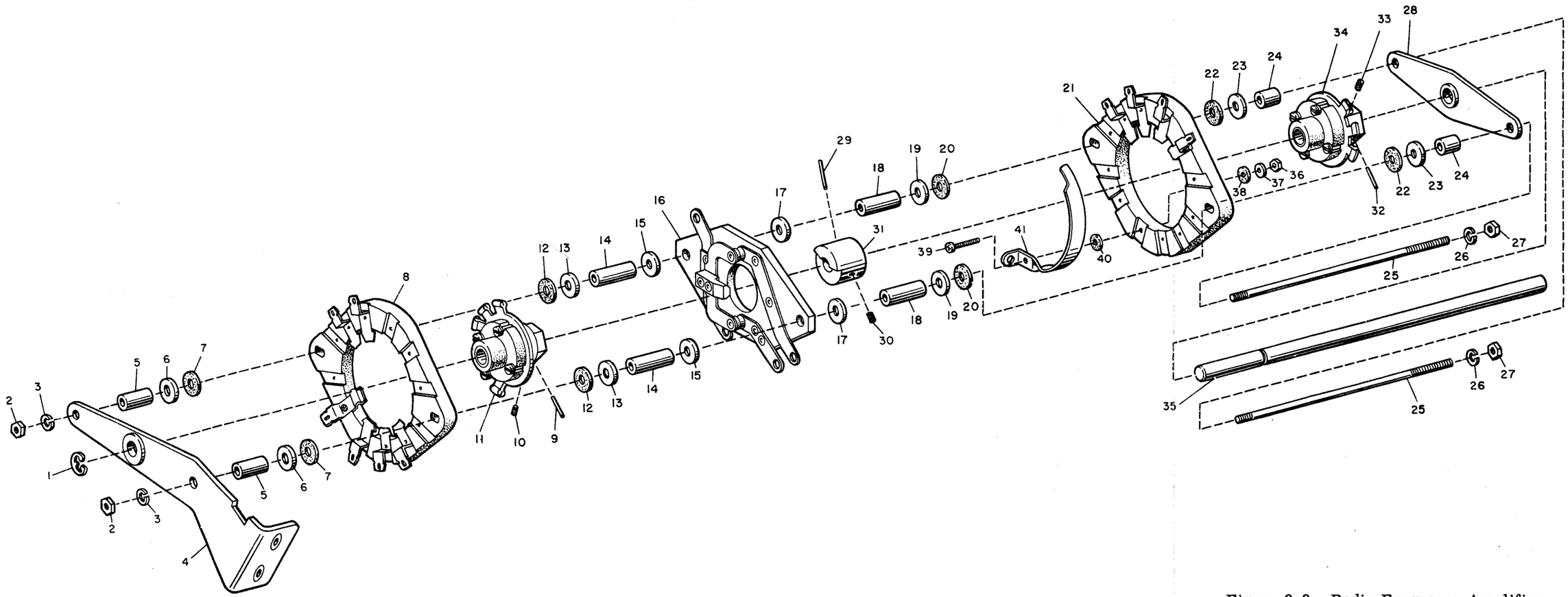

Figure 3-3. Radio Frequency Amplifier AM-2061/URT, Band Switch, Exploded View

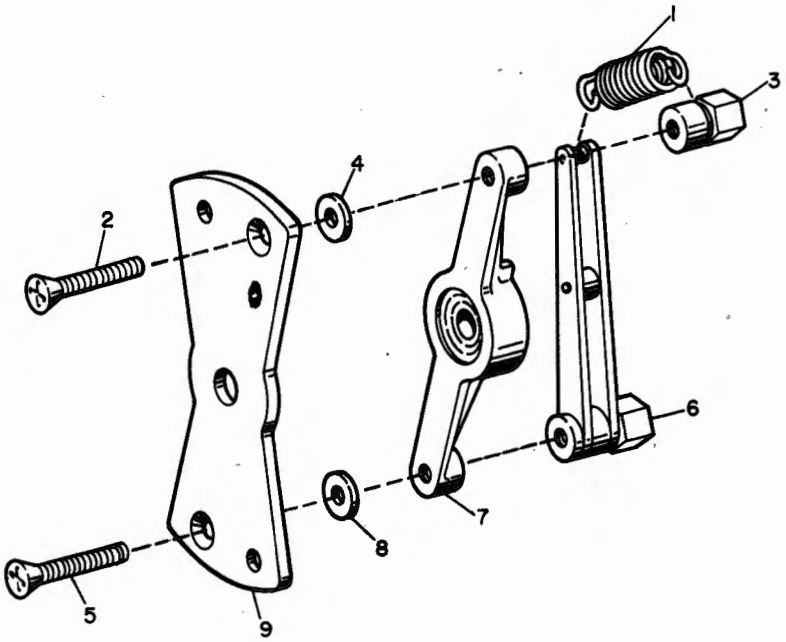

Figure 3-4. Radio Frequency Amplifier AM-2061/URT, Detent Assembly, Exploded View

(4) Remove the binder-head screw (6), lock washer (7), and flat washer (8), that mount the rear of the variable inductor (3) to the chassis. The mounting hardware is located on the bottom of the enclosed section which extends beyond the back of the chassis.

(5) Carefully lift the front end of variable inductor L10 (3) to clear the lower lip of the chassis, at the same time pull the assembly forward to remove it.

f. VARIABLE INDUCTOR (L4) FROM CHASSIS. - Refer to figure 3-6 and proceed as follows:

(1) Viewing the radio frequency amplifier from the rear, remove nut (1) and lock washer (2) that mount the strap to variable inductor L4 (3).

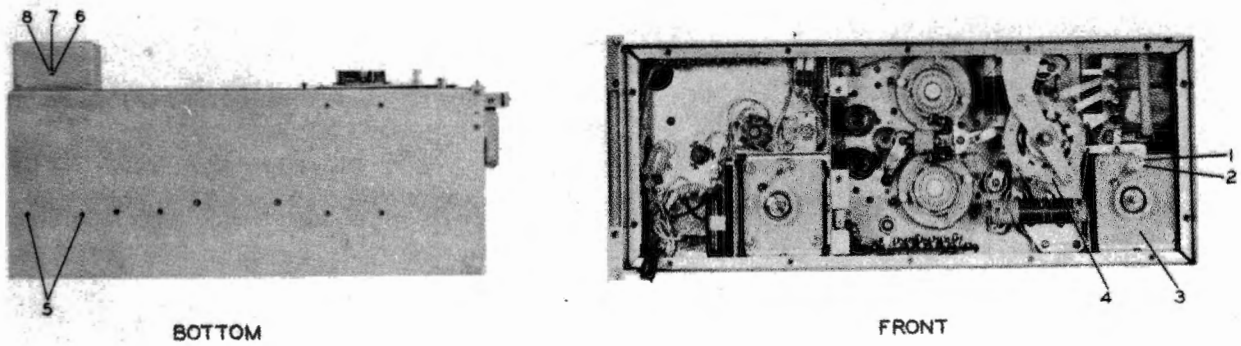

Figure 3-5. Radio Frequency Amplifier AM-2061/URT, Front and Bottom View

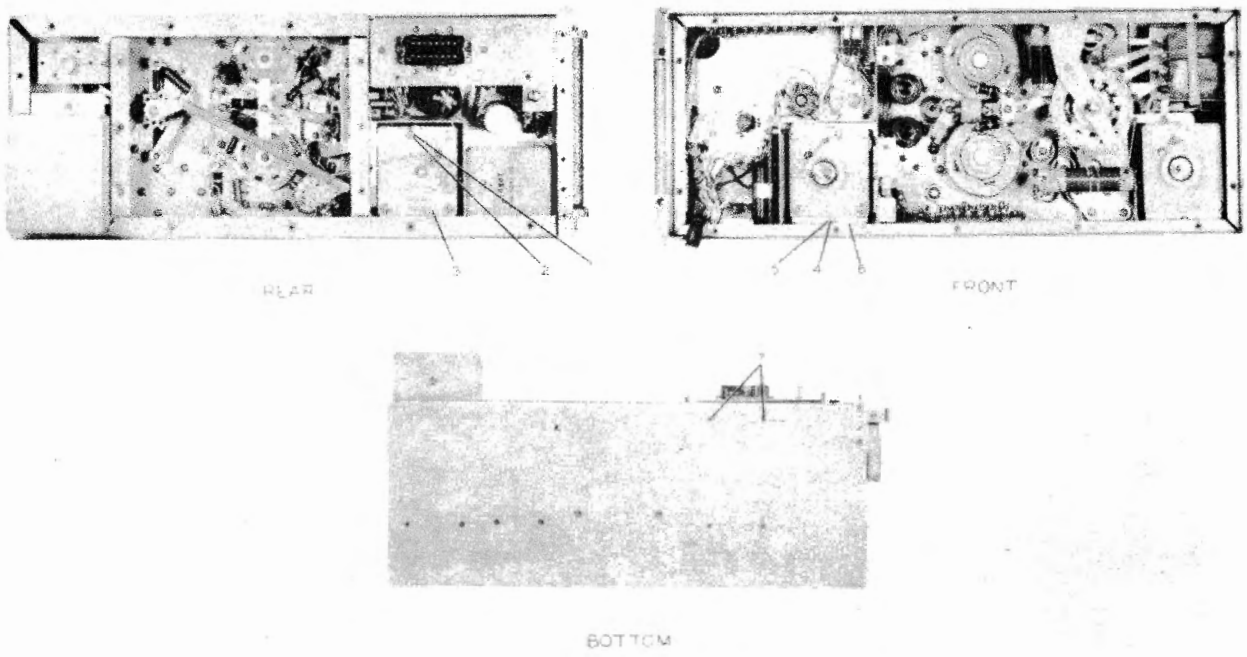

Figure 3-6. Radio Frequency Amplifier AM-2061/URT, Front, Rear, and Bottom Views

(2) Unsolder and remove the bus wire from terminal on variable inductor L4 (3). (This is the bus wire from switch S4.)

(3) Viewing the radio frequency amplifier from the front, remove the binder-head screw (4) and lock washer (5) that mount the front bracket of the variable inductor (3) to the block (6).

(4) Remove the two flathead screws (7) that mount the rear of variable inductor L4 (3) to the bottom of chassis.

(5) Carefully lift the front end of the variable inductor (3) to clear the lower lip of the chassis, at the same time pull the assembly forward to remove.

3-13. DISASSEMBLY, CONVERTER-OSCILLATOR CV-731/URC.

a. REMOVING SMO SUBASSEMBLIES. - Refer to figure 3-7 and proceed as follows:

(1) Remove the seven flathead screws (1) that mount the shield cover (2) on smo module.

(2) Remove the four captive mounting screws (3) on the 4-kc spectrum generator (4), i-f mixer, and signal i-f amplifier (5), and pull the subassemblies out carefully.

(3) Turn the interpolation oscillator (6) shaft (7) clockwise to the low-frequency end stop.

(4) Disconnect the coaxial leads (8) from pin E (shield) and pin F (center conductor) of J8 (9) and pin D (shield) and pin E (center conductor) of J5 (10). Remove the two ties holding the coaxial leads to the standoff (11).

(5) Loosen the two captive mounting screws (12) in the interpolation oscillator (6).

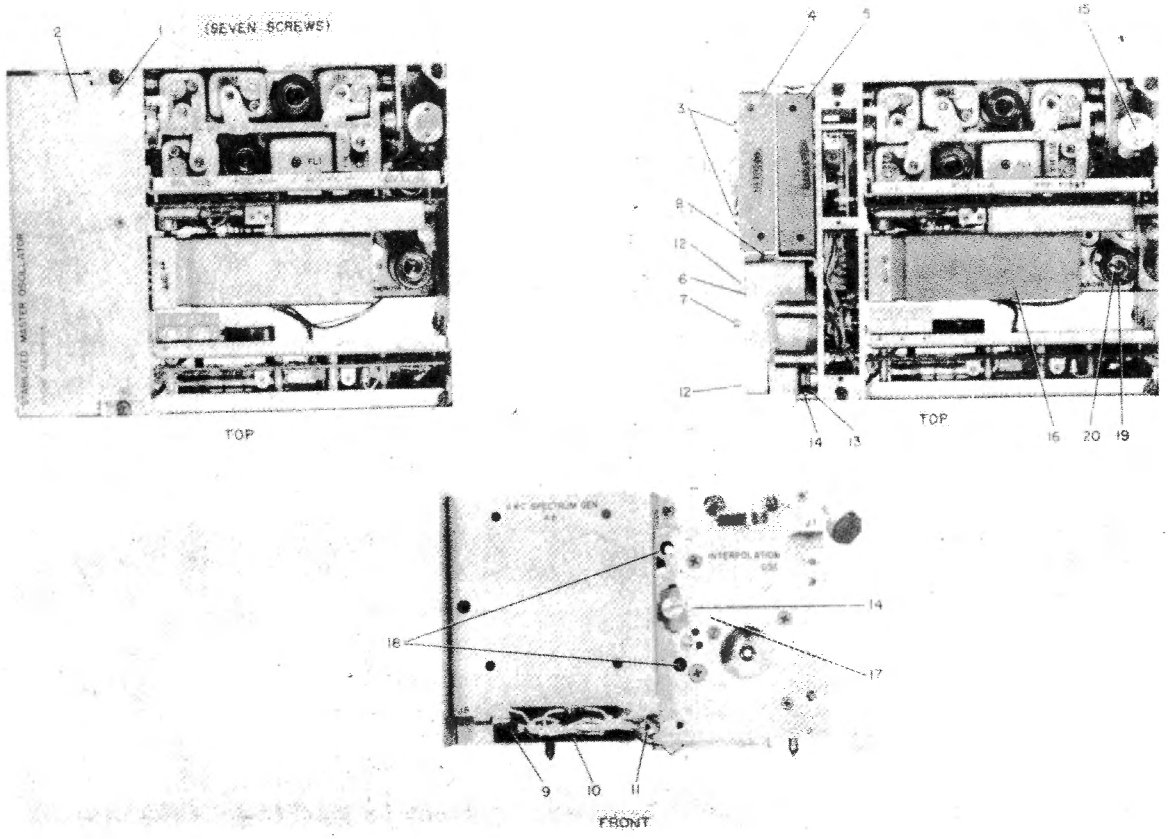

Figure 3-7. Stabilized Master Oscillator, Front and Top Views

(6) Disconnect A5P1 (13) from J7 (14). Be careful not to twist plug pins; this may damage plug. Using a small flat-bladed screwdriver, gently pry the plug and jack apart.

CAUTION

No attempt should be made to disassemble the interpolation oscillator. This is a sealed unit and should be replaced as a unit if replacement is necessary.

(7) To remove the master oscillator (16), remove the gear support tool (15) secured by two screws in the upper left rear corner of the smo, and insert it into the large hole in the gear plate opposite the master oscillator shaft end. Align the two small wing clips on the tool with the hole notches in the gear plate, insert, and turn to lock. The small end ot the plunger should be pressed against the master oscillator (mo) shaft end. This gear support tool holds the shaft gear meshed with the gear train to prevent misalignment of end-stop adjustment.

(8) Loosen the Bristo screw (17) in the mo shaft gear clamp. Remove the two screws (18) securing the mo to the gear plate by inserting the Allen wrench through access holes in the gear plate (the top mounting screw also mounts a solder lug). Remove shield (19) and tube V3 (20). Remove the master oscillator (15); make certain the plunger of gear support tool enters mo shaft gear hub as mo shaft is pulled out.

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CAUTION

The mo cover is a special material. Do not drop or strike the cover as this may destroy its shielding properties. No attempt should be made to disassemble the mo. This assembly should be replaced as a unit if replacement is necessary.

b. REMOVE SMO GEAR ASSEMBLY AND SLUG RACK. - Refer to figure 3-8 and proceed as follows:

(1) Remove the 4-kc spectrum generator bracket (1) by removing two flathead screws (2) from left side plate, one binder-head screw (3) and lock washer (4) from front, and one standoff (5) from front.

(2) Remove the four screws (6), nuts (7), and lock washers (8) that mount plugs J5 and J8 to spectrum generator bracket.

(3) Remove the rear panel (9) by removing the thirteen flathead screws (10).

(4) Remove the three screws (11) that mount board (12) to bracket (13).

(5) Remove the two flathead screws that mount the right center bracket (13) to the gear plate (14).

(6) Remove the top binder-head screw (15) and lock washer (16) that mounts the left center bracket to the gear plate (14) (the lower screw and lock washer will be removed later).

(7) Remove the two binder-head screws (17) and lock washers (18) that mount the tube chassis to the gear plate.

(8) Remove the three flathead screws (19) that mount the rear bottom edge of gear plate (14) to the block (20) between the gear plates, (block on which P1 plug is mounted).

(9) Remove the two binder-head screws (21), lock washers (22), and solder lugs (23) from front lower edge of gear plate (24).

(10) Remove the two retaining rings (25) and washers (26) that mount plug J1 (27) to rear gear plate (14).

(11) Unsolder and remove the two wires (28) that are connected to the feedthrough capacitors (29).

(12) Remove the ten Allen-head screws (30) which mount the slug holders (31). Lift the holders (31) with their slugs from the coils.

(13) Remove left side panel (32) by removing the eight flathead screws (33).

(14) Remove each coil by loosing the screw (34) which is accessible through the core of the coil, and pull coil assembly out. All of the coils are mounted this way except FL-1 (35), which is mounted by two binder-head screws (36) and lock washers (37) from the bottom of chassis.

(15) Remove retaining ring (38) which will release spring (39) on slug rack (40).

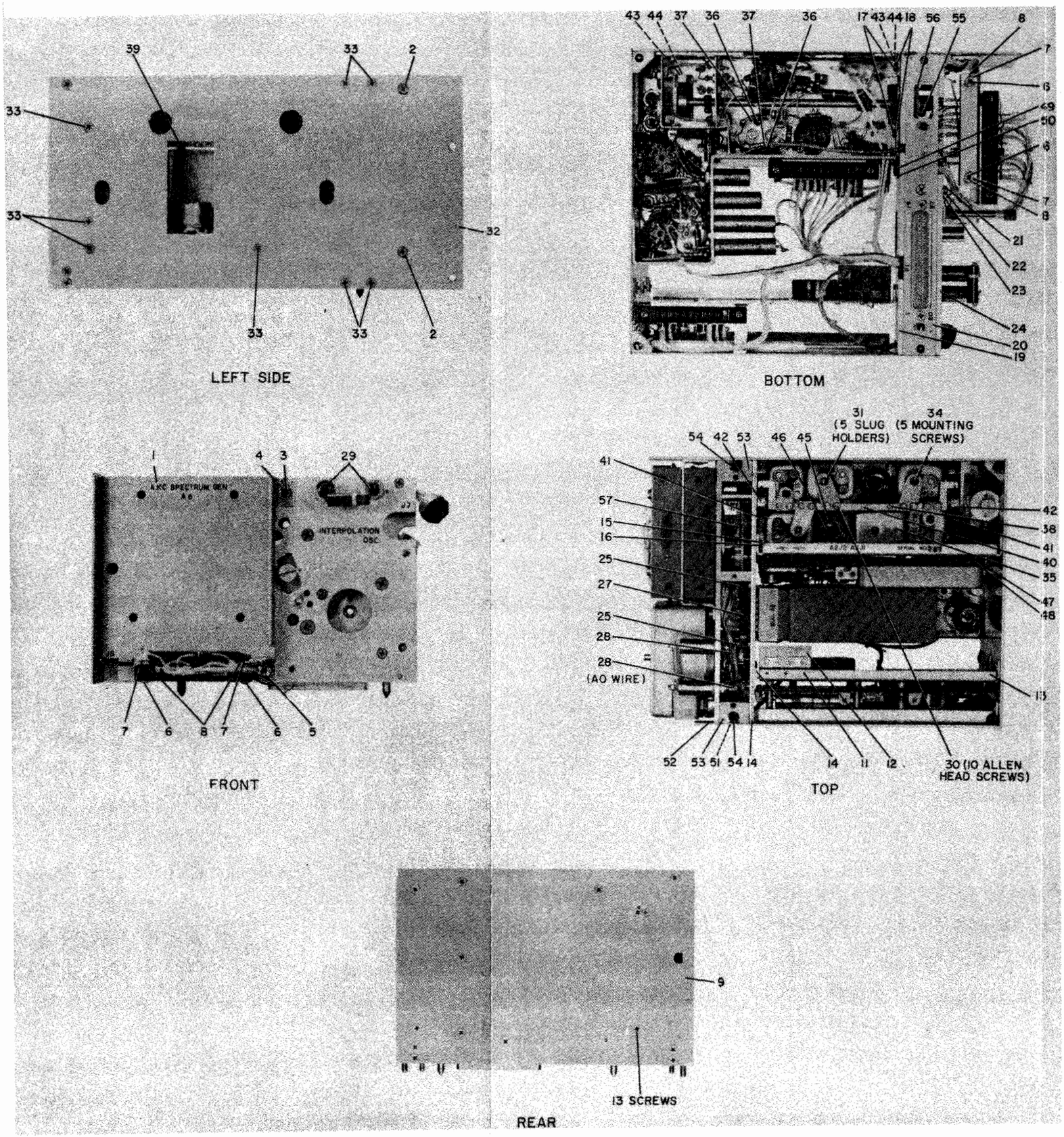

Figure 3-8. Stabilized Master Oscillator, Front, Left Side, Top, and Bottom Views

(16) Using long-nosed pliers, grip spring (41) on the tape (42) of the front slug rack drive near the hook end, and remove from tape. Remove spring (41) from tape (42) on rear rack driver.

(17) Remove the flathead screw (43) and the special nut (44) that secures the slug rack (40) to each tape (42). Remove slug rack (40) and tapes (42).

(18) Remove tube shield (45) and tube (46).

(19) Remove tube shield (47) and tube (48).

(20) Remove one binder-head screw (49) and lock washer (50) which mount left center bracket to gear plate (14).

(21) Remove the five flathead screws (51) that mount the right side plate panel (52) to the corner block (53) the block strip (20) and the rear gear plate (14). Remove the two front capacitive screws (54).

(22) Loosen clamp (55) and slide gear (56) forward off shaft while removing gear assembly (57) from chassis. Slide block (20) from between the gear plates (24) and (14) at the same time.

c. SMO GEAR ASSEMBLY. - To disassemble gear train assembly, refer to figure 3-9 and disassemble gear train assembly in order of index numbers starting with number 1.

d. REMOVING SMO TUNER GEAR ASSEMBLY.

(1) Loosen the two captive mounting screws on the sidestep oscillator and remove this unit.

(2) Loosen the two setscrews in the belt pulley, which is mounted on the drive shaft from the front panel assembly.

(3) Loosen the screws which mount the large idler. This will allow the belt to become loose.

(4) Refer to figure 3-11 and loosen screw (25) in clamp (31) and setscrew (27) in bearing (29). Slide shaft (34) from the pulley and gear assembly of the smo tuner gear train.

(5) Remove the four binder-head screws, lock washers, and flat washers that mount the two large brackets of the gear assembly to the chassis.

(6) Remove the one binder-head screw, lock washer, and flat washer that mount the small bracket to the chassis.

(7) Carefully lift gear assembly from chassis.

e. SMO TUNER GEAR ASSEMBLY. - To disassemble gear train assembly, refer to figure 3-10 and disassemble gear train assembly in order of index numbers starting with number 1.

f. REMOVING FRONT PANEL.

(1) Obtain a couple of blocks and lay the Converter-Oscillator CV-731/URC on its back on the blocks. This will prevent the unit from resting on the plugs and connectors.

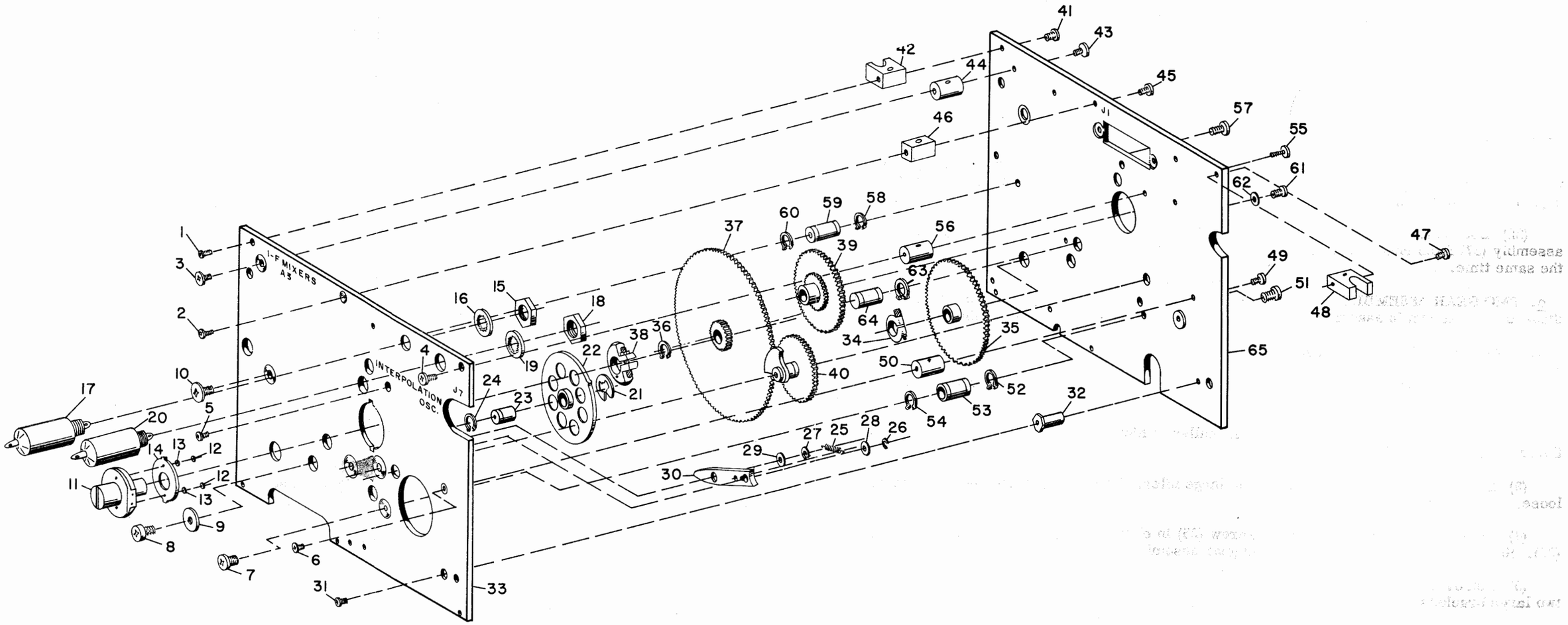

Figure 3-9. Stabilized Master Oscillator, Gear Assembly, Exploded View

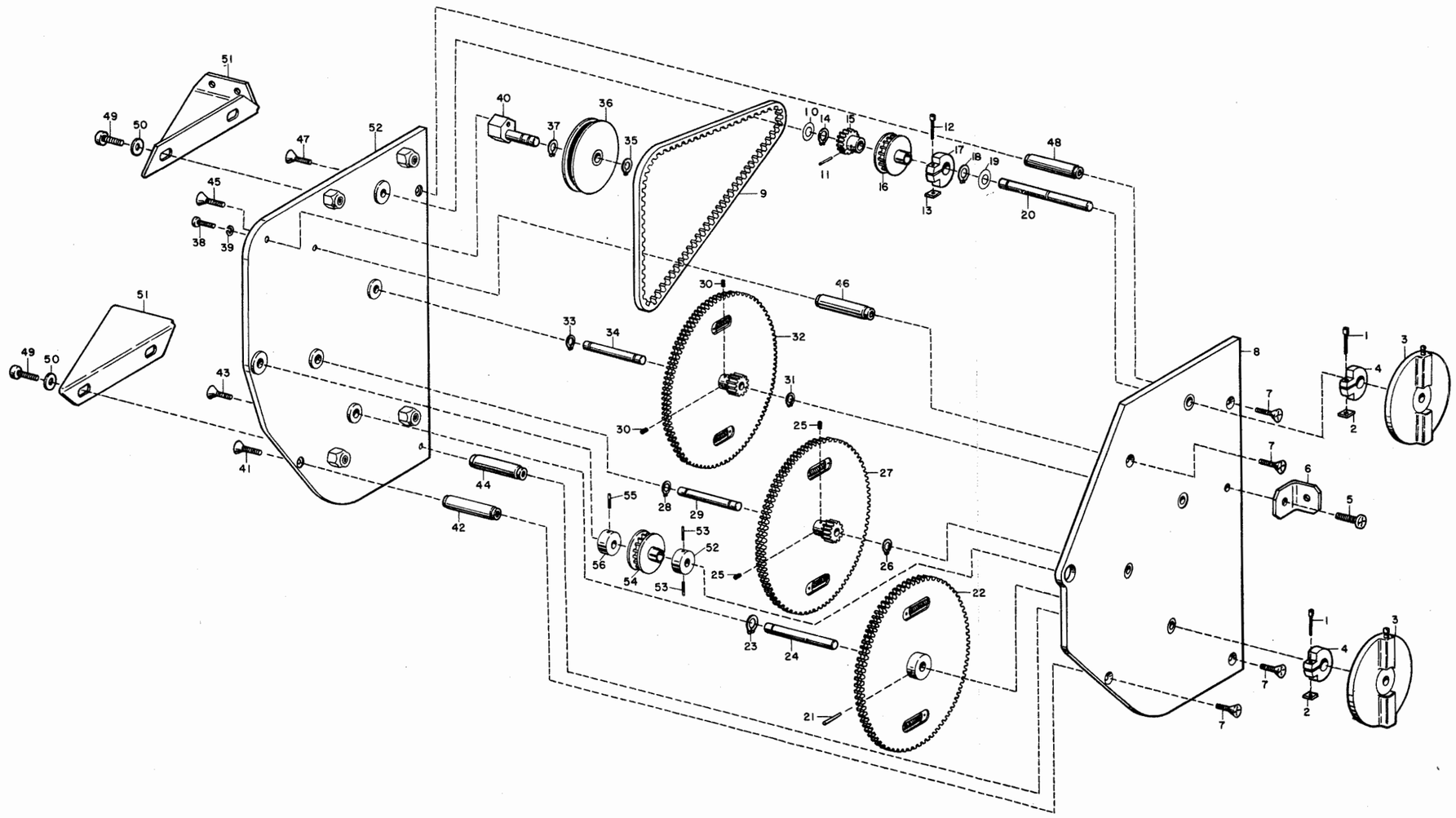

Figure 3-10. Stabilized Master Oscillator, Tuner Gear Assembly, Exploded View

(2) Loosen setscrews in DRIVER TUNE knob and PA TUNE knob. Remove knobs.

(3) Remove the eight flathead screws that mount front panel.

(4) Swing front panel to left; be careful not to damage cable.

g. FRONT PANEL GEAR ASSEMBLY AND COUNTER. - The front subpanel, on which the gear assembly and counter is mounted, should not be removed from the oscillator converter chassis. To remove this subpanel, it will be necessary to disconnect all wires from the components on the front panel as well as the wires to switch S1 on the subpanel. To remove the counter assembly and to disassemble gear assembly, refer to figure 3-11 and disassemble gear assembly in order of index numbers starting with number 1.

h. REMOVING R-F TUNER SLUG RACK AND TAPE ASSEMBLY. - Refer to figure 3-12 and proceed as follows:

(1) Run slug rack to full up position.

(2) Remove screws (1) and remove slug racks (2).

(3) Loosen the tape tension adjusting nuts (3).

(4) Using long-nosed pliers, grip spring (4), on the tape of the front slug rack drive near the hook end, and remove from tape. Remove spring (4) from rear tape in like manner.

(5) Remove short tapes (5) by removing nut (3) securing it to the slug rack end support (6

(6) Remove long tapes (7) by removing screws (8), (9), and (10) that secure the tape to the roller (11), slug rack end support (6), and tape drive shaft (12).

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i. REMOVING R-F TUNER BAND SWITCH MOTOR AND SWITCHES. - Refer to figure 3-13 and proceed as follows:

(1) Remove retaining ring clip (1) at the end of the band switch shaft (2).

(2) Remove the four screws (3), lock washers (4), and nuts (5) that secure the front mount of the band switch motor (6) to the chassis.

(3) Remove the two screws (7), lock washers (8), and nuts (9) that secure the rear mount of band switch motor (6) to the chassis.

(4) Disconnect wire (10) from motor (6) by unsoldering.

(5) The band switch motor (6) may be removed by withdrawing from the motor end of the chassis.

(6) To remove band switch shaft (2) remove roll pin (11) from coupler (12).

(7) Remove coupler (12) from band switch shaft (2).

(8) Slide band switch shaft (2) out rear end of tuner.

NOTE

EQUIPMENT WITH SERIAL NUMBERS 1 THROUGH 112
HAVE POSTS WITH RETAINING RINGS NEXT TO PANEL

Figure 3-11. Front Panel Assembly, Exploded View

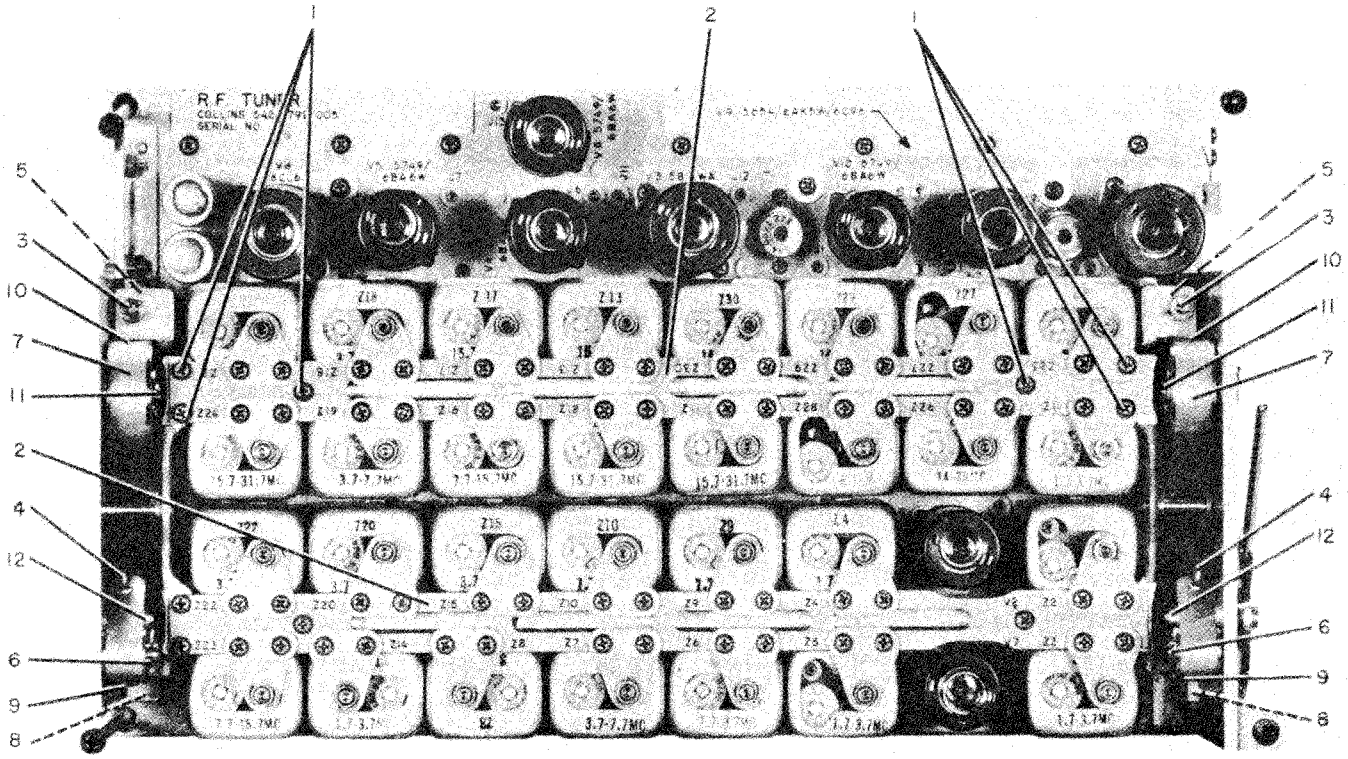

Figure 3-12. R-F Tuner, Top View

(9) Any of the band switches (S1 through S17) may be removed by unsoldering any connecting wires, expanding the spring clips mounts, and removing the switch.

j. DISASSEMBLY BAND SWITCH MOTOR. - Refer to figure 3-14 and disassemble motor in order of index numbers starting with number 1.

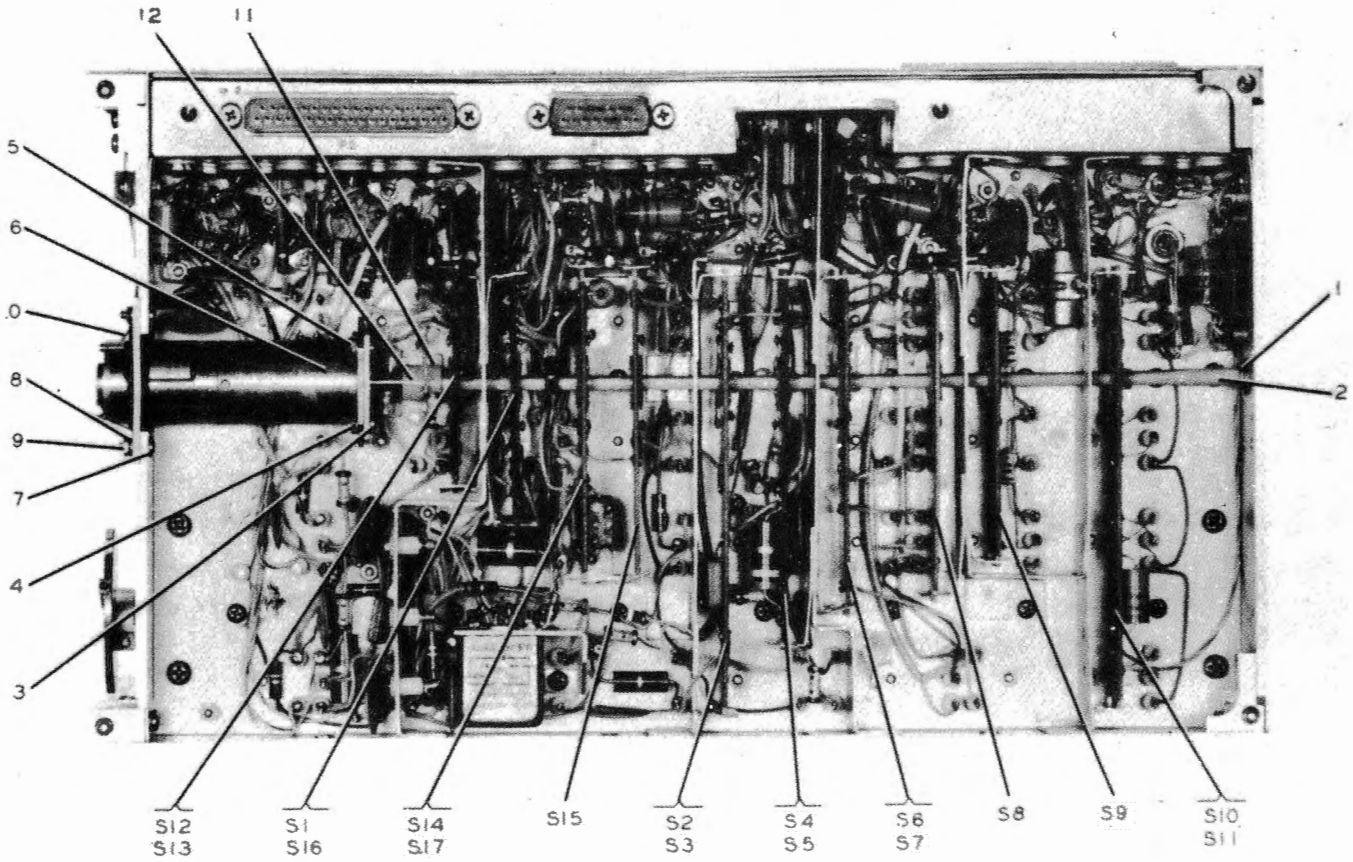

Figure 3-13. R-F Tuner, Bottom View

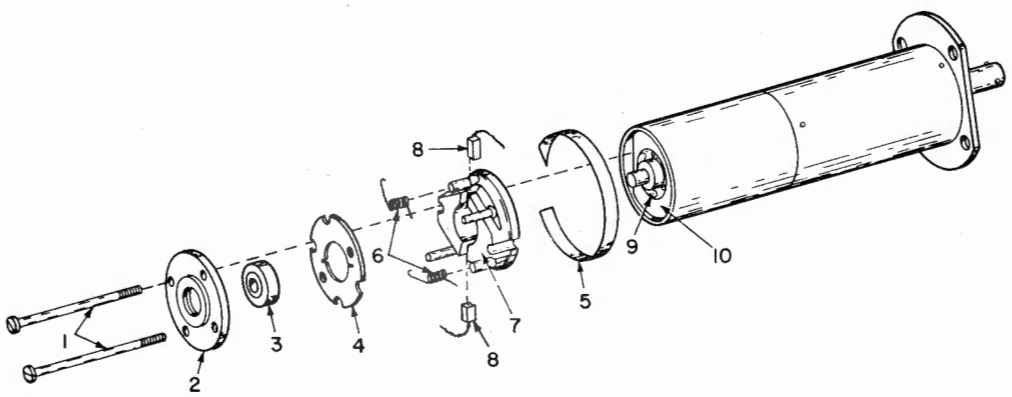

Figure 3-14. R-F Tuner, Band Motor, Exploded View

SECTION IV

CLEANING

4-1. INTRODUCTION.

This section contains instructions and procedures for cleaning the dismantled and disassembled components, assemblies, subassemblies, and parts of Radio Set AN/URC-32.

Component cleaning instructions and procedures are given in paragraph 4-3. Instructions are in tabular form, arranged to facilitate reference by paragraph to the procedure for cleaning the various parts and assemblies.

All parts requiring particular methods of cleaning are considered separately, and parts which are of such similar nature as to permit identical cleaning procedures are grouped in paragraph 4-3. Instructions are given for cleaning finished surfaces, in order to permit immediate repairs to minor finish damage by brush touch-up after the surface has been cleaned.

Reference to the word solvent should be understood as indicating a mixture comprising methylene chloride, 25 percent; perchloroethylene, 5 percent; and dry-cleaning solvent, Federal Spec P-S-661a, 70 percent, by volume. All referenced cleaning materials and protective agents are listed and identified in table 4-1.

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TABLE 4-1. CLEANING MATERIALS AND PROTECTIVE AGENTS

MATERIAL	SPECIFICATION
Solvent; a mixture by volume of:	
Methylene chloride, 25 percent	ANA Spec AN-M-37
Perchloroethylene, 5 percent	Fed. Spec 0-T-236
Solvent, dry-cleaning, 70 percent	FED. Spec P-S-661A
Chamois skin	
Cloth, cotton: lintless	
Detergent, power	
Oil, lubricating	
Lubriplate	MIL-L-7870 105
Paper, lens tissue	
Solvent, dry-cleaning	Fed. Spec P-S-661a
Trichloroethylene	AN-0-T-631

WARNING

Perform operations involving cleaning solvent under a ventilated hood. Avoid breathing solvent vapor; wear a suitable mask when necessary. Avoid continuous contact with a solvent. Use goggles, gloves, and apron to prevent irritation due to prolonged contact.

References to air jet, frequently made in section IV, signify a hand-operated air nozzle supplied with clean, dry, compressed air at a pressure of 25 to 28 psi maximum.

Goggles should be worn when using air jet to blow dust and dirt from equipment parts. Other persons should be warned away from hazardous area or working enclosure.

4-2. ASSEMBLIES.

The following paragraphs contain instructions and procedures for cleaning the various parts of the dismantled and disassembled equipment, preparatory to inspection procedures found in section V. Cleaning instructions are listed for each assembly and subassembly in tabular form; reference is made by paragraph to the proper procedure. These procedures are found in paragraph 4-3.

a. INTERCONNECTING BOX J-1007/U.

To clean Interconnecting Box J-1007/U, remove dust cover and proceed as directed in table 4-2.

TABLE 4-2. CLEANING INTERCONNECTING BOX J-1007/U

ITEM	PARAGRAPH
Wired Chassis	4-3.b.

b. RADIO FREQUENCY AMPLIFIER AM-2061/URT.

To clean Radio Frequency Amplifier AM-2061/URT, proceed as directed in table 4-3.

TABLE 4-3. CLEANING RADIO FREQUENCY AMPLIFIER AM-2061/URT

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Knobs	4-3.e.
Covers and Shields	4-3.d.
Switches	4-3.i.
Variable Inductors	4-3.p.
Mechanical Metal Parts	4-3.f.
Lamps	4-3.m.
Lamp Holders	4-3.l.

c. CONVERTER-OSCILLATOR CV-731/URC.

Clean disassembled Converter-Oscillator CV-731/URC assemblies and subassemblies as directed in table 4-4.

TABLE 4-4. CLEANING CONVERTER-OSCILLATOR CV-731/URC

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Covers and Shields	4-3.d.
Dials and Knobs	4-3.e.
Metallic or Fabric Gears	4-3.f.
Jacks	4-3.k.
Mechanical Metal Parts	4-3.f.
Receptacles	4-3.c.
Tube Sockets	4-3.h.
Switches	4-3.i.
Electron Tubes	4-3.j.
Motor	4-3.a.
Bearings	4-3.t.

d. AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

To clean Amplifier-Converter-Modulator AM-2064/URC, remove the rear panel and proceed as directed in table 4-5.

TABLE 4-5. CLEANING AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Covers and Shields	4-3.d.
Knobs	4-3.e.
Jacks	4-3.k.
Receptacles	4-3.c.
Tube Sockets	4-3.h.
Switches	4-3.i.
Electron Tubes	4-3.j.

e. CONVERTER-MONITOR CV-730/URC.

To clean Converter-Monitor CV-730/URC, remove rear panel and proceed as directed in table 4-6.

TABLE 4-6. CLEANING CONVERTER-MONITOR CV-730/URC

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Covers and Shields	4-3.d.
Knobs	4-3.e.

TABLE 4-6. CLEANING CONVERTER-MONITOR CV-370/URC (Cont)

ITEM	PARAGRAPH
Jacks	4-3.k.
Tube Sockets	4-3.h.
Switches	4-3.i.
Electron Tubes	4-3.j.

f. AMPLIFIER CONTROL AM-2062/URC.

To clean Amplifier-Control AM-2062/URC, remove rear panel and proceed as directed in table 4-7.

TABLE 4-7. CLEANING AMPLIFIER-CONTROL AM-2062/URC

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Covers and Shields	4-3.d.
Knobs	4-3.e.
Jacks	4-3.k.
Tube Sockets	4-3.h.
Switches	4-3.i.
Electron Tubes	4-3.j.

g. SIGNAL COMPARATOR CM-126/UR.

To clean the Signal Comparator CM-126/UR, remove rear panel and proceed as directed in table 4-8.

TABLE 4-8. CLEANING SIGNAL COMPARATOR CM-126/UR

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Covers and Shields	4-3.d.
Knobs	4-3.e.
Tube Sockets	4-3.h.
Switches	4-3.i.
Electron Tubes	4-3.j.

h. CONTROL-POWER SUPPLY C-2691/URC.

To clean Control-Power Supply C-2691/URC, remove rear panel and proceed as directed in table 4-9.

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TABLE 4-9. CLEANING CONTROL-POWER SUPPLY C-2691/URC

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connectors	4-3.c.
Covers and Shields	4-3.d.
Knob	4-3.e.
Jacks	4-3.k.
Relay	4-3.g.
Switch	4-3.i.
Diodes	4-3.q.

i. POWER SUPPLY PP-2154/U.

To clean Power Supply PP-2154/U, remove rear panel and proceed as directed in table 4-10.

TABLE 4-10. CLEANING POWER SUPPLY PP-2154/U

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Covers and Shields	4-3.d.
Connectors	4-3.c.
Switch	4-3.i.
Diodes	4-3.q.
Lamps	4-3.m.
Lamp holder	4-3.l.

j. ELECTRONIC EQUIPMENT AIR COOLER HD-347/U.

To clean Electronic Equipment Air Cooler HD-347/U, proceed as directed in table 4-11.

TABLE 4-11. CLEANING ELECTRONIC EQUIPMENT AIR COOLER HD-347/U

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Cover and Shield	4-3.d.
Connector	4-3.c.
Air Filter	4-3.r.
Pressure Switch	4-3.d.
Blower Fan	4-3.d.
Blower Motor	4-3.d.

k. POWER SUPPLY PP-2153/U.

To clean Power Supply PP-2153/U, proceed as directed in table 4-12.

TABLE 4-12. CLEANING POWER SUPPLY PP-2153/U

ITEM	PARAGRAPH
Wired Chassis	4-3.b.
Connector	4-3.c.
Terminal Strip	4-3.c.
Ceramic Insulators	4-3.o.
Relay	4-3.g.
Switch	4-3.i.
Covers and Shields	4-3.d.
Lamps	4-3.m.
Lamp Holder	4-3.l.
Diodes	4-3.q.

l. ELECTRICAL EQUIPMENT RACK MT-2092/U.

To clean Electrical Equipment Rack MT-2092/U, proceed as directed in table 4-13.

TABLE 4-13. ELECTRICAL EQUIPMENT RACK CLEANING MT-2092/U

ITEM	PARAGRAPH
Connectors	4-3.c.
Rack and Shockmounts	4-3.s.

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4-3. SIMILAR PARTS.

a. MOTOR ARMATURE.

CAUTION

To prevent damage, armatures should not be rolled, or permitted to rest on their coils or commutators. They should be handled by the armature shafts whenever possible.

(1) With air jet, blow dust and dirt from all surfaces and crevices.

WARNING

When using flammable materials for cleaning purposes, observe all fire precautions. These materials should be used outside only, or in a ventilated booth provided with explosion-proof electrical equipment and an exhaust fan having spark-proof blades.

(2) Observing WARNING, remove any lubricants and remaining dirt by immersing armature in a washing bath of detergent powder and wash clean with soft-bristled brush having no metallic parts. Remove from bath at once when clean, and drain.

CAUTION

Carbon tetrachloride, trichloroethylene, solvent or other cleaning agents with chlorine content should not be used for cleaning armatures, since poor commutation and excessive brush wear may result.

(3) Immerse in rinse bath of an approved solution; rinse, remove from bath, and drain.

(4) Rest on suitable metal screen in ventilated oven, and dry at approximately 105°C (221°F) for four hours.

(5) Remove from oven, and lightly coat shaft with MIL-L-7870 oil.

(6) Rest on shaft, and protect from dust and moisture until inspection.

b. WIRED CHASSIS.

The following cleaning procedure is used for wired chassis containing terminal boards, resistor and capacitor assemblies and subassemblies, r-f coils, switches, tube sockets, inductors, transformers, relays, or other wired parts.

(1) Remove dust and dirt from all surfaces, including parts and wiring, using soft-bristled brushes in conjunction with an air jet.

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CAUTION

Avoid air-blasting small coils, leads, and other delicate parts by too close an approach with air jet nozzle. Use caution in use of brushes on delicate parts.

NOTE

When necessary to disturb the dress of wiring and cables, dressing should be noted, and upon completion of cleaning operations, wiring and cables should be restored to their proper positions or dress.

(2) Clean jacks as instructed in paragraph 4-3k.

(3) Clean lamp holders as directed in paragraphs 4-3m and 4-3n.

(4) With minimum possible disturbance of wiring, clean connectors as prescribed in paragraph 4-3c.

(5) Disturbing wiring as little as possible, clean tube sockets as directed in paragraph 4-3h.

(6) Clean relays according to paragraph 4-3g; and with minimum disturbance of wiring.

(7) Clean switches as directed in paragraph 4-3i. Disturb wiring dress as little as possible.

(8) Clean ceramic insulators by method prescribed in paragraph 4-3o.

(9) Complete chassis cleaning by wiping down all finished surfaces with solvent-moistened, lintless cloth.

(10) Dry and polish these surfaces, using dry, clean, lintless cloth.

(11) Make touch-up repairs on minor damage to finish.

(12) Protect from dust, moisture, and physical damage, until inspection.

c. CONNECTORS AND TERMINAL STRIPS.

(1) Wipe dust and dirt from bodies, shells, and cable clamps using solvent-moistened, lintless cloth. Wipe dry with clean, dry, lintless cloth.

(2) Remove dust from inserts, using small, soft-bristled brush in conjunction with air jet.

(3) Wash dirt and any traces of lubricant from insert, insulation, and contacts with solvent applied sparingly with small camel's-hair brush.

CAUTION

Do not allow solvent to run into sleeves (or conduit) covering any wires or cables connected to contact terminals of the insert.

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(4) Dry the insert with air jet.

d. COVERS AND SHIELDS.

The following cleaning procedure is used for all unfinished, partly finished, and finished sheet metal covers and shields, such as dust covers and chassis covers.

(1) Remove bulk of any surface grease with rags.

(2) Blow dust from surfaces, holes, and recesses with air jet.

(3) Immerse in washing bath or solvent and scrub until clean, working over all surfaces and into all holes and recesses with suitable nonmetallic brushes. Flat, wood-backed brushes with soft fiber bristles are recommended for surfaces; round brushes similar to those used for washing bottles and test tubes are recommended for holes and recesses.

(4) Raise from bath, and permit solvent to drain into bath.

(5) Immerse in rinsing bath of clean solvent, rinse, and raise from bath. Position to drain dry, i.e., so that solvent is not trapped in holes or recesses. Where practical positioning will not permit complete drainage, use air jet to remove any trapped solvent.

(6) When thoroughly dry, touch up minor damage to finish. Extensive damage to finish may require complete refinishing.

(7) Protect from dust and moisture until inspection.

e. DIALS AND KNOBS.

(1) Clean all dials and knobs by gently wiping their surfaces with clean, soft, lintless cloth which has been slightly moistened with solvent. When clean, polish with tissue paper.

f. MACHINED METAL PARTS.

Detached gears, shafts, pins, collars, springs, and similar machined parts, should be cleaned. Proceed as follows.

(1) Clean as directed in steps 1, 3, 4, and 5 of paragraph 4-3d, and in steps 2, 3, and 4 of this paragraph.

NOTE

Split-gear assemblies of spring-loaded type require cleaning between the twin gears. Accomplish this white washing, by moving gears with fingers.

CAUTION

To prevent corrosion, avoid touching any machined or unfinished surfaces with bare hands after cleaning.

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(2) Dry in dust-free, dry area or suitable enclosure. The use of radiant heat in a ventilated enclosure is recommended for drying, particularly wherever atmospheric humidity is high.

(3) When dry, immediately apply light coat of MIL-L-7870 lubricating oil to any bare steel surfaces.

(4) Protect from dust and moisture until inspection.

g. RELAYS.

(1) Clean dirty (not pitted or burned) contacts, using burnishing tool. Before using tool, clean its burnishing surface with alcohol. Do not allow fingers to touch this surface after cleaning, or prior to use.

CAUTION

Contact supporting members should not be bent or forced beyond their normal operating limits while burnishing contacts.

(2) Remove dust and dirt by careful use of air jet and soft-bristled brush. Direct air jet onto contacts, operating the relay armature with fingers while blowing, so that dust will be blown from contact surfaces as they open and close.

(3) Wash all surfaces of all contacts with trichloroethylene (AN-0-T-631) applied with clean camel's-hair brush.

(4) Dry contacts with air jet, then remove any whitish film residue by passing small strips of clean white writing paper back and forth between each pair of contacts while holding them with light-fingered pressure in their closed position.

h. TUBE SOCKETS.

Mica-filled bakelite sockets are cleaned as follows:

(1) Remove any rosin adhering to silver-plated contacts, using orange sticks dressed to wedge ends.

CAUTION

Do not use metal tools to remove foreign matter from these contacts, as damage to contact plating invites corrosion, which ultimately may result in equipment failure. Existing corrosion on contacts should not be disturbed.

(2) Wash contacts with solvent lightly applied with small, soft-bristled brush.

(3) Using solvent-moistened, lintless cloth, remove any foreign matter adhering to socket body or wafer.

(4) Dry all parts with air jet.

i. SWITCHES.

Clean all special switches with button contacts and switches of the phenolic-wafer type as follows:

(1) Remove all dust with air jet, turning switch rotor back and forth several times while blowing.

(2) Wash all contacts and insulation with solvent lightly applied with small camel's-hair brush.

(3) Dry with air jet, then repeat wash, using clean solvent, and rotating switch rotor several times during this wash.

(4) Dry gently but thoroughly with air jet.

j. ELECTRON TUBES.

(1) Remove dust and dirt from surface of glass or metal envelope and side of tube base with solvent-moistened, lintless cloth lightly applied to avoid obliterating type markings or loosening tube-cap terminals.

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(2) Dry and polish these surfaces by gently wiping them with dry, clean, lintless cloth.

(3) Clean bottom of base and all tube contacts with soft-bristled brush.

NOTE

Abrasives or metal tools should not be used to remove corrosion deposits occasionally present on tube contacts.

(4) Protect from dust and breakage until inspection.

k. JACKS.

(1) Remove dust from exteriors with camel's-hair brush and air jet.

(2) Blow dust from interior of single female contact with air jet.

l. LAMP HOLDERS.

(1) Clean exteriors with soft-bristled brush and air jet.

(2) Clean interiors of socket types with air jet.

m. LAMPS.

(1) Clean all lamps by wiping with solvent-moistened, lintless cloth; then dry and polish with clean, dry, lintless cloth.

n. LAMP-HOLDER LENS.

(1) Wipe all surfaces clean with solvent-moistened, lintless cloth.

(2) Wipe all surfaces dry with dry, clean, lintless cloth.

(3) Polish glass lens with clean, fine, tissue paper or lens tissue paper.

o. CERAMIC INSULATORS.

Clean all terminal mounting insulators as follows:

(1) Wipe clean with solvent-moistened, clean, lintless cloth.

(2) Dry and polish, using dry, clean, lintless cloth.

p. VARIABLE INDUCTORS.

Clean variable inductors as follows:

(1) Wipe ceramic form, wire, roller, and end plates with solvent-moistened, clean, lintless cloth.

(2) Dry and polish, using dry, clean, lintless cloth.

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(3) Apply thin coat of grease to the rod on which the roller wheel rides, and one drop of coil to the end bearings of the coil shafts.

q. DIODES.

Remove diodes from clips and clean as follows:

(1) Wipe clips and mounting board clean with solvent-moistened clean, lintless cloth.

(2) Dry and polish, using dry, clean, lintless cloth.

(3) Wipe diodes clean with solvent-moistened clean, lintless cloth.

(4) Dry and polish using dry, clean, lintless cloth.

r. AIR FILTER.

(1) Always clean the filter before the air-outlet side becomes dirty.

(2) To clean, gently immerse filter in cool water, dirty side up, to float out dirt and lint. A gentle up-and-down motion dislodges any stubborn particles. If a large amount of grease or oil has accumulated on the filter, use a mild detergent in the water. If it is impossible to immerse the filter, pass a fine spray of water through it in the direction opposite to that of airflow. Shake gently to remove water, and replace in equipment.

s. RACK AND SHOCKMOUNTS.

(1) Wipe dust and dirt from rack and shockmounts using solvent-moistened, lintless cloth. Wipe dry with clean, dry, lintless cloth.

(2) Remove dust from inserts, using small, soft-bristled brush in conjunction with air jet.

(3) Wash dirt and any traces of lubricant from inserts, and insulation with solvent applied sparingly with small, camel's-hair brush.

t. SEALED OR SHIELDED BEARINGS AND BRONZE OILITE BEARINGS.

Normal, sealed or shielded bearings require no cleaning or lubrication, since they are lubricated and sealed by the manufacturer for lifetime operation. It is recommended that sealed bearings be replaced if faulty.

Normally, cleaning of Oilite bearings are unnecessary, and service is limited to application of a small amount of MIL-L-7870 oil with a dropper. Bronze Oilite bearings are impregnated with oil by the manufacturer.

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SECTION V

INSPECTION

5-1. INTRODUCTION.

This section presents instructions and directive procedures designed to determine, by inspection, the condition of the dismantled, disassembled, and cleaned components, sub-assemblies, assemblies, and parts of Radio Set AN/URC-32. Defects resulting from wear, physical damage deterioration or other such causes, are brought to light by these inspection procedures.

Component inspection instructions are given in paragraph 5-2. Detailed inspection procedures are under paragraph 5-3 or 5-4, depending upon whether the nature of the part involved is mechanical or electrical and electronic. Wherever feasible, inspection procedures are listed in tabular form. Table 5-13 contains information which is useful for comparative purposes when inspecting the gears.

5-2. COMPONENTS.

The following paragraphs contain instructions for inspecting the various parts of this equipment. Inspection instructions are listed for each component in tabular form, and opposite each part to be inspected, reference is made to the proper procedure.

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a. INTERCONNECTING BOX J-1007/U.

Remove the dust cover from Interconnecting Box J-1007/U and inspect as directed in table 5-1.

TABLE 5-1. INSPECTING INTERCONNECTING BOX J-1007/U

ITEM	PARAGRAPH
MECHANICAL PARTS	
Cover and shields Mechanical metal parts	5-3.a. 5-3.b.
ELECTRICAL PARTS	
Soldered terminal connections Wiring	5-4.q. 5-4.w.

b. RADIO FREQUENCY AMPLIFIER AM-2061/URT.

Inspect the dismantled and disassembled Radio Frequency Amplifier AM-2061/URT as directed in table 5-2.

TABLE 5-2. INSPECTING RADIO FREQUENCY AMPLIFIER AM-2061/URT

ITEM	PARAGRAPH
MECHANICAL PARTS	
Knobs and dials	5-3.b.
Mechanical metal parts	5-3.e.
ELECTRICAL PARTS	
R-f coils	5-4.d.
Variable resistor	5-4.o.
Receptacle	5-4.l.
Relay	5-4.m.
Soldered terminal connections	5-4.q.
Tube sockets	5-4.p.
Rotary switches	5-4.s.
Electronic tubes	5-4.v.
Wiring	5-4.w.
Meter	5-4.z.
Variable inductors	5-4.x.
Toggle switches	5-4.t.
Lamp	5-4.h.
Lamp holder	5-4.i.
Lamp holder lens	5-4.j.
Fixed capacitors	5-4.c.
Covered cable	5-4.b.
Jacks	5-4.g.
Transformer	5-4.u.

c. CONVERTER-OSCILLATOR CV-731/URC.

Inspect the dismantled and disassembled Converter-Oscillator CV-731/URC and the subassemblies as directed in table 5-3.

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TABLE 5-3. INSPECTING CONVERTER-OSCILLATOR CV-731/URC

ITEM	PARAGRAPH
MECHANICAL PARTS	
Dials and knobs	5-3.b.
Covers and shields	5-3.a.
Gears	5-3.d.
Bearings, sealed or shielded	5-3.ae.
Bearings, bronze Oilite	5-3.af.
Mechanical metal parts	5-3.e.
Shim washers	5-3.c.
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Meter	5-4.z.
Fixed capacitors	5-4.c.
Toggle switch	5-4.t.
R-f coils	5-4.d.
Printed circuit boards	5-4.ab.
Connectors	5-4.e.
Jacks	5-4.g.
Molded plastic parts	5-4.k.
Receptacles	5-4.l.
Motor	5-4.a.
Soldered terminal connections	5-4.q.
R-f switches	5-4.r.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Tube sockets	5-4.p.
Electron tubes	5-4.v.
Transistors	5-4.y.
Relays	5-4.m.

d. AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

Inspect the dismantled and disassembled Amplifier-Converter-Modulator AM-2064/URC and the subassemblies as directed in table 5-4.

TABLE 5-4. INSPECTING AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Knobs	5-3.b.
Mechanical metal parts	5-3.e.
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Molded plastic parts	5-4.k.
Receptacles	5-4.l.
Soldered terminal connections	5-4.q.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Tube sockets	5-4.p.
Electron tubes	5-4.v.
Transistors	5-4.y.
Relay	5-4.m.
Meter	5-4.d.
Toggle switch	5-4.t.
Variable resistors	5-4.o.
Jacks	5-4.g.
Transformers and reactors	5-4.u.
Printed circuit boards	5-4.ab.

e. CONVERTER-MONITOR CV-730/URC.

Inspect the dismantled and disassembled Converter-Monitor CV-730/URC as directed in table 5-5.

TABLE 5-5. INSPECTING CONVERTER-MONITOR CV-730/URC

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Knobs	5-3.b.
Mechanical metal parts	5-3.e.

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TABLE 5-5. INSPECTING CONVERTER-MONITOR CV-730/URC (Cont)

ITEM	PARAGRAPH
ELECTRICAL AND ELECTRONIC PARTS	
Toggle switches	5-4.t.
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Molded plastic parts	5-4.k.
Receptacles	5-4.l.
Relay	5-4.m.
Variable resistors	5-4.o.
Soldered terminal connections	5-4.q.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Tube sockets	5-4.p.
Electron tubes	5-4.v.
Rotary switches	5-4.s.
Jacks	5-4.g.
Meter	5-4.z.
Transistor	5-4.y.
Diodes	5-4.aa.

f. AMPLIFIER-CONTROL AM-2062/URC.

Inspect the dismantled and disassembled Amplifier-Control AM-2062/URC and the subassemblies as directed in table 5-6.

TABLE 5-6. INSPECTING AMPLIFIER-CONTROL AM-2062/URC

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Knobs	5-3.b.
Mechanical metal parts	5-3.e.
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Molded plastic parts	5-4.k.
Printed circuit board	5-4.ab.
Receptacles	5-4.l.

TABLE 5-6. INSPECTING AMPLIFIER-CONTROL AM-2062/URC (Cont)

ITEM	PARAGRAPH
ELECTRICAL AND ELECTRONIC PARTS (Cont)	
Relay	5-4.m.
Variable resistors	5-4.o.
Soldered terminal connections	5-4.q.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Tube sockets	5-4.p.
Electronic tubes	5-4.v.
Rotary switch	5-4.s.
Jack	5-4.g.
Transistors	5-4.y.
Transformers and reactors	5-4.u.

g. SIGNAL COMPARATOR CM-126/UR.

Inspect the dismantled and disassembled Signal Comparator CM-126/UR as directed in table 5-7.

TABLE 5-7. INSPECTING SIGNAL COMPARATOR CM-126/UR

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Knobs	5-3.b.
Mechanical metal parts	5-3.e.
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Molded plastic parts	5-4.k.
Receptacles	5-4.l.
Variable resistors	5-4.o.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Tube sockets	5-4.p.
Electronic tubes	5-4.v.
Rotary switch	5-4.s.
Jack	5-4.g.
Transformers and reactors	5-4.u.
Soldered terminal connections	5-4.q.
Meter	5-4.z.

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h. CONTROL-POWER SUPPLY C-2691/URC.

Inspect the dismantled and disassembled Control-Power Supply C-2691/URC as directed in table 5-8.

TABLE 5-8. INSPECTING CONTROL-POWER SUPPLY C-2691/URC

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Knob	5-3.b.
Mechanical metal parts	5-3.e.
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Receptacles	5-4.l.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Rotary switch	5-4.s.
Jacks	5-4.g.
Transformers and reactors	5-4.u.
Soldered terminal connections	5-4.q.
Relay	5-4.m.
Diodes	5-4.aa.

i. POWER SUPPLY PP-2154/U.

Inspect the dismantled and disassembled Power Supply PP-2154/U as directed in table 5-9.

TABLE 5-9. INSPECTING POWER SUPPLY PP-2154/U

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Mechanical metal parts	5-3.e.

TABLE 5-9. INSPECTING POWER SUPPLY PP-2154/U (Cont)

ITEM	PARAGRAPH
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Receptacles	5-4.l.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Toggle switch	5-4.t.
Transformers and reactors	5-4.u.
Soldered terminal connections	5-4.q.
Diodes	5-4.aa.
Lamp	5-4.h.
Lamp holder	5-4.i.
Lamp holder lens	5-4.j.

j. POWER SUPPLY PP-2153/U.

Inspect the dismantled and disassembled Power Supply PP-2153/U as directed in table 5-10.

TABLE 5-10. INSPECTING POWER SUPPLY PP-2153/U

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Mechanical metal parts	5-3.e.
ELECTRICAL AND ELECTRONIC PARTS	
Covered cable	5-4.b.
Fixed capacitors	5-4.c.
Connectors	5-4.e.
Receptacles	5-4.l.
Wiring	5-4.w.
Fixed composition resistors	5-4.n.
Transformers and reactors	5-4.u.
Soldered terminal connections	5-4.q.
Diodes	5-4.aa.
Lamp	5-4.h.
Lamp holder	5-4.i.
Lamp holder lens	5-4.j.
Relay	5-4.m.
Jack	5-4.g.
Interlock switch	5-4.ac.

k. ELECTRONIC EQUIPMENT AIR COOLER HD-347/U.

Inspect the dismantled and disassembled Electronic Equipment Air Cooler HD-347/U as directed in table 5-11.

TABLE 5-11. INSPECTING ELECTRONIC EQUIPMENT AIR COOLER HD-347/U

ITEM	PARAGRAPH
MECHANICAL PARTS	
Covers and shields	5-3.a.
Mechanical metal parts	5-3.e.
Shockmounts	5-3.f.
ELECTRICAL PARTS	
Covered cable	5-4.b.
Connectors	5-4.e.
Receptacles	5-4.l.
Wiring	5-4.w.
Air hose	5-4.ad.

l. ELECTRICAL EQUIPMENT RACK MT-2092/U.

Inspect the dismantled Electrical Equipment Rack MT-2092/U as directed in table 5-12.

TABLE 5-12. ELECTRICAL EQUIPMENT RACK MT-2092/U

ITEM	PARAGRAPH
MECHANICAL PARTS	
Mechanical metal parts	5-3.e.
Shockmounts	5-3.f.

5-3. MECHANICAL PARTS.

a. COVERS AND SHIELDS.

Inspect covers and shields for deformation, punctures, deep dents, and badly worn surfaces. Also check for damaged fastener devices. Examine them for corrosion and damage to finish requiring work in finishing department.

b. DIALS AND KNOBS.

Inspect all dials and knobs for physical damage and deformation, marred surfaces, and impairment of markings.

c. SHIM WASHERS.

Inspect the shim washers for deformation, and for damage such as rough surfaces, imbedded foreign matter, and other abnormal conditions.

d. GEARS.

Inspect gears as follows:

(1) Inspect all gears for broken, chipped, or badly worn teeth.

(2) Inspect bore of gears for excessive wear.

(3) Inspect surfaces for corrosion or other abnormal condition.

NOTE

Wear of gear bore and teeth, except in instances where it is sufficiently severe to be apparent on visual inspection, is determined best by gauge measurement. Bore wear can be ascertained by comparing plug-gauged diameter with diameter given for a new gear in table 5-13. Presence of a sharp burr on one side of gear edges of teeth is an indication of wear of teeth.

TABLE 5-13. GEAR DATA

GEAR	TYPE	NO. OF TEETH	DIAMETRAL PITCH	BORE OR SHAFT (in.)	FACE WIDTH (in.)	MATERIAL
SMO GEAR TRAIN (SEE FIGURE 5-1)						
MP1	Spur Pinion	135 22	48 48	0.250 +.0005, -.0000	0.064 0.140	Aluminum Stainless steel
MP2	Spur	30	48	bore 0.2500	0.125	Stainless steel
MP3	Idler	52 22	48 64	0.1242 +.0005, -.0000	0.093 0.108	Aluminum
MP5	Spur Pinion	88 18	64 48	0.2500 +.0005, -.0000	0.091 0.1875	Aluminum Stainless steel
MP6	Spur	88	48	0.1875 +.0005, -.0000	0.062	Aluminum
MP12	Cam	1	NA	0.375 +.001, -.000		Aluminum

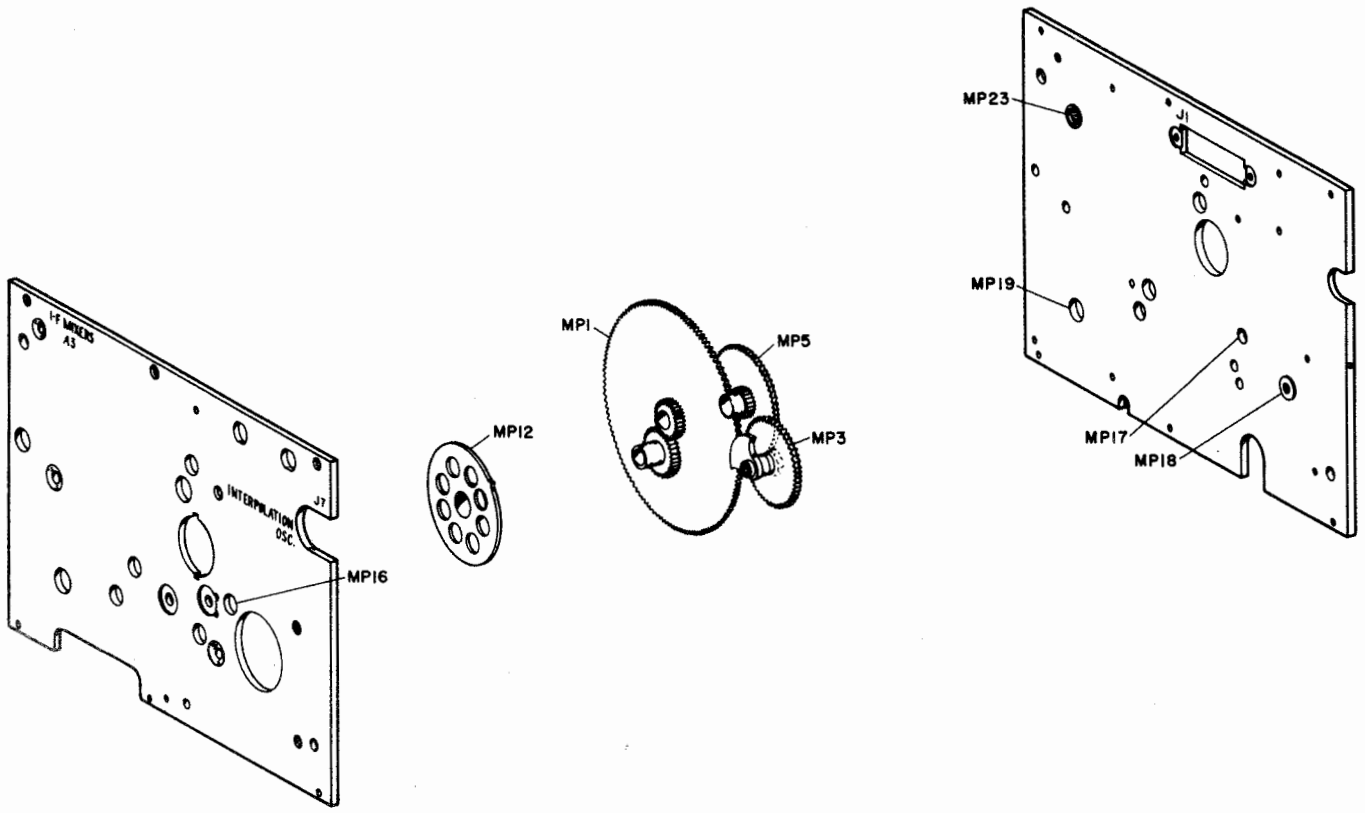

Figure 5-1. Stabilized Master Oscillator, Gear and Bearing Location

TABLE 5-13. GEAR DATA (Cont)

GEAR	TYPE	NO. OF TEETH	DIAMETRAL PITCH	BORE OR SHAFT (in.)	FACE WIDTH (in.)	MATERIAL
SMO TUNER GEAR TRAIN (SEE FIGURE 5-2)						
MP39	Groove Pully	10 grooves at 36°	NA	0.1875 +.0010, -.0000	0.1875	Stainless steel
MP46	Groove Pully	10 grooves at 36°	NA	0.1875 +.0010, -.0000	0.1875	Stainless steel
MP48	Spur	18	48	0.1872 +.0003, -.0000 hub	0.265	Stainless steel
MP52	Spur	159	48	0.1880 +.0007, -.0000	0.040	Aluminum
MP55	Spur	159	48	0.1880 +.0007, -.0000	0.040	Aluminum
MP60	Spur	159	48	NA	0.040	Aluminum
MP61	Spur	159	48	NA	0.040	Aluminum

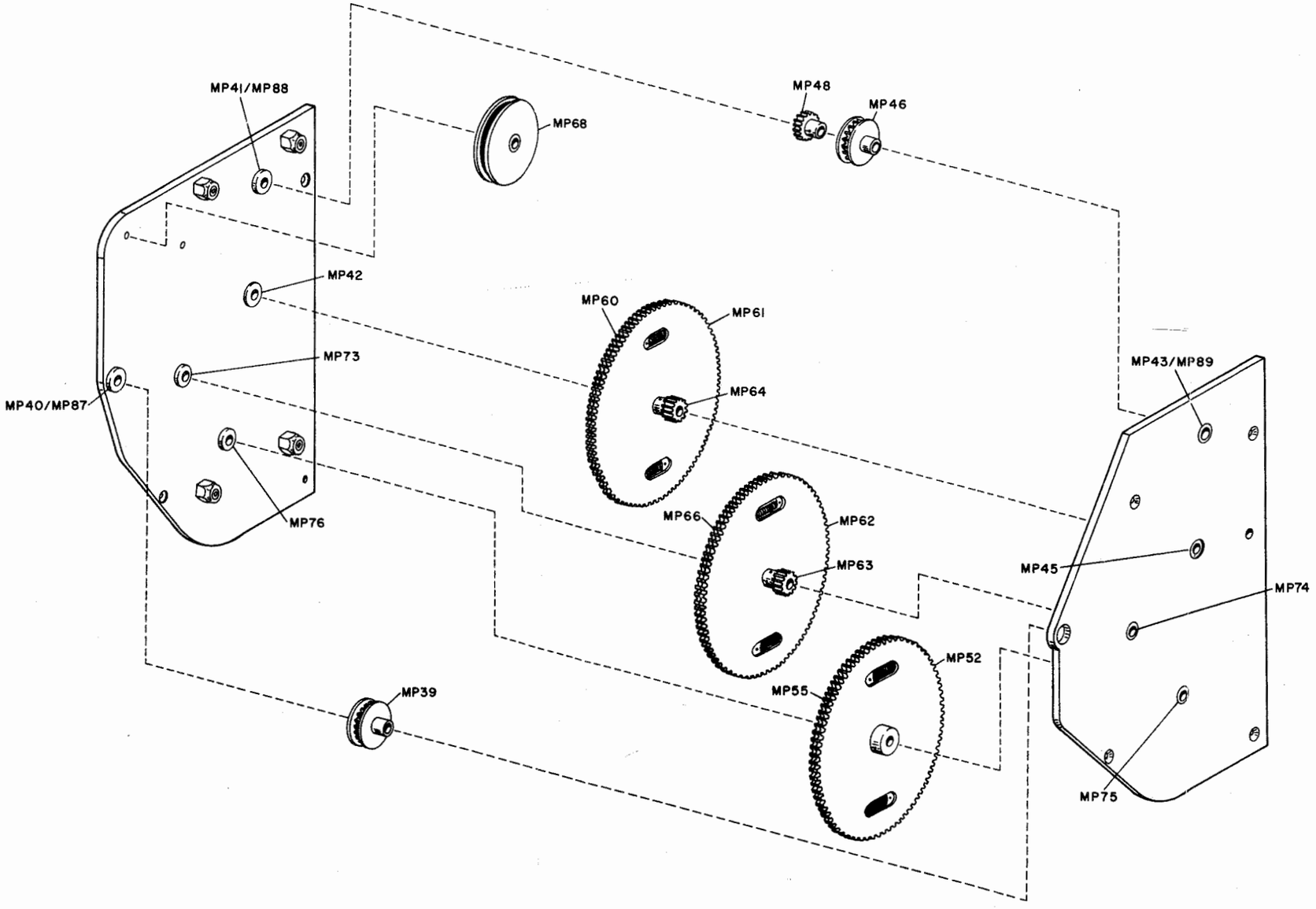

Figure 5-2. Stabilized Master Oscillator, Tuner Gear and Bearing Location

TABLE 5-13. GEAR DATA (Cont)

GEAR	TYPE	NO. OF TEETH	DIAMETRAL PITCH	BORE OR SHAFT (in.)	FACE WIDTH (in.)	MATERIAL
SMO TUNER GEAR TRAIN (SEE FIGURE 5-2) (Cont)						
MP62	Spur	159	48	NA	0.040	Aluminum
MP63	Spur	18	48	0.1250 +.0003, -.0000	0.421	Stainless Steel
MP64	Spur	18	48	0.1250 +.0003, -.0000	0.421	Stainless Steel
MP66	Spur	159	48	NA	0.040	Aluminum
MP68	Idler	none	NA	0.1875 +.0010, -.0000	0.281	Aluminum
FRONT PANEL GEAR ASSEMBLY (SEE FIGURE 5-3)						
MP10	Spur	161	48	0.2505 +.0015, -.0000	0.064 0.064	Aluminum
MP12	Cluster	90 36	48 48	0.1875 +.0005, -.0000	0.040 0.040	Aluminum Stainless steel
MP17	Spur	180	48	0.2505 +.0003, -.0000	0.062	Stainless steel
MP18	Spur	16 17	48 48	0.2500 +.0002, -.0000 0.1885 +.0010, -.0000	0.156	Stainless steel
MP23	Spur Bevel	36 16	48 32	0.1875 +.0005, -.0000	0.147	Brass
MP25	Spur	36	48	0.3755 +.0005, -.0000	0.250	Stainless steel
MP27	Spur	36	48	NA	0.090	Aluminum
MP30	Spur	36	48	NA	0.25	Stainless steel
	Spur	36	48	NA	0.125	Stainless steel
	Spur	18	48	0.1875 +.0005, -.0000	0.250	Bronze
MP33 MP78	Spur Bevel	36 16	48 32	NA 0.1872 +.0008, -.0000	0.235 0.125	Aluminum Brass

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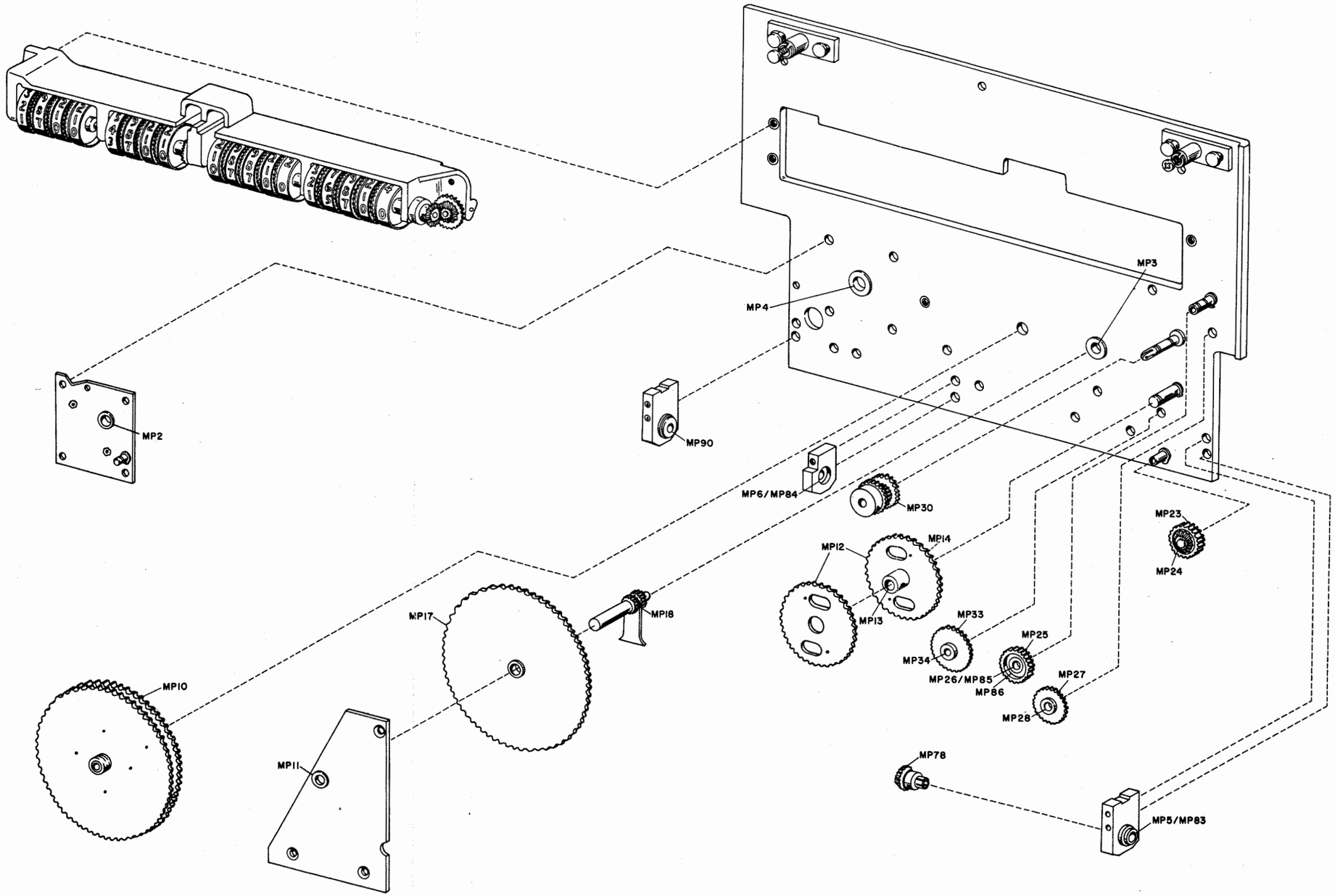

Figure 5-3. Front Panel Gear and Bearing Location

e. MECHANICAL METAL PARTS.

Inspect the mechanical metal parts, including ventilating grilles, mounting plates, panels, chassis, mounting clamps and brackets, blower fans, nuts, bolts, screws, washers, fasteners, and hardware for physical damage and deformation. Also check these parts for corrosion and any damage which would require replating or refinishing beyond practical touch-up.

f. SHOCKMOUNTS.

(1) Inspect metal parts for corrosion, damaged surface, and deformation.

(2) Inspect the elastic members for deep cracks or other physical damage.

5-4. ELECTRICAL AND ELECTRONIC PARTS

a. MOTOR ARMATURE.

Inspect motor armature for defects listed in table 5-14.

TABLE 5-14. INSPECTING MOTOR ARMATURE (MOTOR USED IN R-F TUNER)

DEFECT	SHAFT	LAMI-NATIONS	BANDS	WINDINGS	INSU-LATION	COMMU-TATOR
Corrosion	X	X	X			
Roughness, grooving or pitting						X
Out of round						X
Burning						X
Loss of solder						X
High mica						X
Physical damage	X	X	X	X	X	X
Looseness			X	X	X	X
Open coils				X		
Grounded coils				X		
Shorted coils				X		
Low insulation					X	

NOTE

To determine open coils, use grower test or continuity test. To determine grounded coils, use megger test. To determine shorted coils, use grower test. To determine low insulation, use the baking megger test. Condition usually is due to moisture, but is sometimes due to charred insulation under coils.

b. COVERED CABLE.

Inspect wires in cables for frayed or cut insulation, defective ties, pinched wires, broken wires, and wires pulled tight.

c. FIXED CAPACITORS.

Inspect capacitors for defects listed in table 5-15.

TABLE 5-15. INSPECTION OF FIXED CAPACITORS

DEFECT	METAL CASE	MOLDED TYPE	CERAMIC TYPE
Oil leakage (at case seams or around terminal insulation).	X		
Cracked, broken, or charred terminal insulation	X		
Case damage (dents of holes)	X		
Case damage (cracks or breakage)		X	
Loose, broken or corroded terminal studs, lugs, or leads	X	X	X
Loose, broken, or poorly soldered terminal connections	X	X	X
Loose mountings	X	X	X
Body damage (cracks or breakage)			X

d. R-F COILS.

Inspect r-f coils (used in smo and r-f tuner) for broken leads, loose, poorly soldered, or broken terminal connections, and loose mountings. Also check for crushed, scratched, cut, bruised, or charred windings, for corrosion on windings, leads, terminals, and connections, and for physical damage to forms and tuning-slug adjustment screws.

e. CONNECTORS.

(1) Inspect connector body for broken parts, deformed shell, clamp, and other abnormal conditions, depending upon its type.

(2) Inspect connector for cracked, broken insulation, and for contacts which are broken, deformed, or out of alignment. Check also for corroded or damaged plating on contacts, and for loose, poorly soldered, broken, or corroded terminal connections.

f. CERAMIC INSULATORS.

Inspect insulators for cracked, chipped, or broken ceramic. Also check for signs of burning, looseness, and other abnormal conditions.

g. JACKS.

Inspect all jacks for corrosion, rust, loose or broken parts, cracked insulation, poor contacts, and other abnormal conditions.

h. LAMPS.

Inspect lamps for loose, cracked, or broken glass envelope. Also check for internal darkening, corrosion of base, and damage to insulation of base.

i. LAMP HOLDERS.

Inspect the lamp holders for corrosion, weak contacts, damaged insulation, and loose or broken parts. Also check for other conditions which are not normal.

j. LAMP-HOLDER LENS.

Inspect the lamp-holder lenses for cracks, looseness, deformation, and loss of color.

k. MOLDED PLASTIC PARTS.

Inspect these plastic parts, such as terminal boards, mounting blocks, and insulating members for signs of corrosion, cracked, broken or charred insulation, and for loose or missing mounting hardware. Also check these parts for other abnormal conditions which might be a source of future breakdown.

l. RECEPTACLES.

Inspect receptacles for cracked, broken, or charred insulation. Also check for physical damage to all parts, loose or bent contacts, damage to contact plating, corrosion, and other abnormal conditions.

m. RELAYS.

(1) Inspect relay contacts for burned or pitted areas, welds, misalignment, and improper separation.

(2) Check contact support members for deformation, causing contact misalignment or improper contact operation.

(3) With the finger, test movable contacts for sluggish action or sticking at any point of travel in either direction. Examine for physical damage to armature. Also check for foreign matter between end of pole piece and armature.

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(4) Inspect for loose coil, corrosion, loose leads or terminals, and for cuts and damage to coil.

(5) Inspect for loose, broken, brittle, or charred insulation on coil or leads, between contact support members, and between terminals of relay.

(6) Inspect for bent, loose, or broken terminals.

(7) Check relay mountings and mechanical parts for looseness and physical damage or corrosion.

n. FIXED COMPOSITION RESISTORS.

Inspect resistors for cracked, broken, blistered, or charred bodies, and loose, broken, poorly soldered, or corroded terminal connections.

o. VARIABLE RESISTORS.

Inspect variable resistors for corrosion of shafts, cases, and other visible parts, loose mountings, and physical damage. Rotate the shaft to determine whether action is too rough, too loose, or too tight.

p. TUBE SOCKETS.

Mica-filled bakelite sockets should be inspected as follows:

(1) Inspect for loose, broken, missing, or improperly seated mounting rings. Also check for cracked, broken, or charred insulation.

(2) Inspect for broken, deformed, or corroded contacts, and loose, poorly soldered, broken, or corroded terminal connections.

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q. SOLDERED TERMINAL CONNECTIONS.

(1) Inspect for cold-solder or rosin joints. These joints present a porous or dull, rough appearance. Check for strength of bond with the point of a tool.

(2) Examine for excess solder, protrusions from the joint, pieces adhering to adjacent insulation, and particles lodged between joints, conductors, or other parts.

(3) Inspect for insufficient solder, and unsoldered strands of wire protruding from conductor at joint. Also look for insulation that is stripped back too far from joint, or badly frayed at joint.

(4) Inspect for corrosion on copper conductor at joint.

r. R-F SWITCHES.

(1) Inspect for bent, weak, broken, or deformed contacts.

(2) Check for corrosion and damage to contact plating.

(3) Inspect for cracked or broken contact insulation and other abnormal conditions.

(4) Make certain that movable contacts are free to rotate properly throughout entire excursion without binding.

s. ROTARY SWITCHES.

(1) Inspect insulation for cracks or breakage, and for charring.

(2) Check movable and stationary contacts for deformation, breakage, and wear, and for burning, pitting, and corrosion.

(3) Inspect terminals for loose, poorly soldered, broken or corroded connections.

(4) Examine mechanical parts for damage or corrosion, and for irregular or rough action.

(5) If applicable, examine switch for proper detent action.

t. TOGGLE SWITCHES.

Inspect switches for rough or loose action, cracked, broken, or charred body, loose, poorly soldered, broken, or corroded terminal connections, and loose or missing mounting screws, nuts, and other parts.

u. TRANSFORMERS AND REACTORS.

Check these parts for signs of excessive heating, physical damage to case, cracked or broken ceramic insulators, and other abnormal conditions. Also check for corroded, poorly soldered, or loose terminals, and loose, broken, or missing mounting hardware.

v. ELECTRON TUBES.

(1) Inspect envelope for cracked glass or dented metal, separation from base, and obliterated markings.

(2) Check base for cracked, chipped, or broken body or key, and for charring of base between contacts.

(3) Inspect for loose tube caps and deformed, broken, or misaligned base contacts. Also check for corrosion or other damage to contact plating and for loose or missing solder at tips of tubular-type contacts.

w. WIRING.

Inspect open and laced wiring of chassis, terminal boards, and parts of equipment, by checking insulation for physical damage and charring, and check wires for breakage and for improper dress in relation to adjacent wiring or chassis.

x. VARIABLE INDUCTORS.

(1) Inspect rotor rod springs for a pressure that will ensure a good contact of the rotor wheel to the coil.

(2) Check wire of coil for wear, nicks, pitting, burns, and corrosion.

(3) Check roller, roller rod, spacer rods, shafts, and all hardware for nicks, pitting, burning, and corrosion.

(4) Check coil form and end plates for cracked, chipped, or broken ceramic. Also check for signs of burning, looseness, and other abnormal conditions.

(5) Make certain that the coil will rotate throughout the entire excursion without binding.

y. TRANSISTORS.

(1) Inspect transistors for cracked or broken insulation (where the leads feed out).

(2) Check case for signs of burning and for signs of corrosion, loose, poorly soldered, or broken leads.

z. METERS.

(1) Inspect for cracked, chipped, or broken case or glass.

(2) Check for burning, corrosion of the terminals, and bent scale indicator.

aa. DIODES.

Inspect diodes for cracked insulation, corrosion of terminals, and other abnormal conditions.

ab. PRINTED CIRCUIT BOARDS.

(1) Inspect for cracked, broken, or charred spots on the board.

(2) Check for signs of burning, corrosion, and poorly soldered joints at the eyelets.

ac. INTERLOCK SWITCHES.

Inspect for rough or loose action, cracked, broken, or charred body, loose, poorly soldered, broken, or corroded terminal connections, and loose or missing mounting screws, nuts and other parts.

ad. AIR HOSE.

Inspect for cracks, loose connections, and any other abnormal condition.

ae. SEALED OR SHIELDED BEARINGS.

Normally, sealed or shielded bearings require no cleaning or lubrication since they are lubricated and sealed by the manufacturer for life time operation. It is recommended that sealed bearings be replaced if faulty.

af. BRONZE OILITE BEARINGS.

Bronze Oilite bearings are impregnated with oil by the manufacturer. Normally, cleaning is unnecessary and service is limited to application of a small amount of MIL-L-7870 oil with a dropper.

Inspect Oilite bearings as follows:

(1) Inspect Oilite bodies for cracks and deformation.

(2) Inspect bore of Oilite for excessive wear.

NOTE

Wear of Oilite bearings, except in instances, where it is sufficiently severe to be apparent on visual inspection, is best determined by gauge measurement. Bore wear can be ascertained by comparing plug-gauged diameter given for a new Oilite bearing given in table 5-16.

(3) Inspect surfaces for corrosion or other abnormal conditions.

TABLE 5-16. BEARING DATA

BEARING	TYPE	ID (inch)	OD (inch)	MATERIAL
SMO GEAR ASSEMBLY AND CHASSIS (SEE FIGURE 5-1)				
MP8	Ball	0.1875	0.3125	Stainless Steel
MP14	Ball	0.2500	0.6250	Stainless Steel
MP16	Ball	0.1250	0.2500	Stainless Steel
MP17	Ball	0.1250	0.2500	Stainless Steel
MP18	Ball	0.1250	0.2500	Stainless Steel
MP19	Ball	0.1875	0.3125	Stainless Steel
MP23	Ball	0.2500	0.6250	Stainless Steel
MP27	Ball	0.1875	0.5000	Stainless Steel
MP28	Ball	0.1875	0.5000	Stainless Steel
SMO TUNER GEAR ASSEMBLY (SEE FIGURE 5-2)				
*MP40	Oilite	0.1885	0.3595	Bronze
*MP41	Oilite	0.1885	0.3595	Bronze
MP42	Oilite	0.125	0.252	Bronze
*MP43	Oilite	0.1885	0.3595	Bronze
MP45	Oilite	0.126	0.252	Bronze
MP73	Ball	0.1250	0.3750	Stainless Steel
MP74	Ball	0.1250	0.3750	Stainless Steel
MP75	Ball	0.1875	0.3750	Stainless Steel
MP76	Ball	0.1875	0.3750	Stainless Steel
**MP87	Ball	0.1875	0.3750	Stainless Steel
**MP88	Ball	0.1875	0.3750	Stainless Steel
**MP89	Ball	0.1875	0.3750	Stainless Steel

TABLE 5-16. BEARING DATA (Cont)

BEARING	TYPE	ID (inch)	OD (inch)	MATERIAL
FRONT PANEL GEAR ASSEMBLY AND COUNTER (SEE FIGURE 5-3)				
MP2	Oilite	0.251	0.3595	Bronze
MP3	Oilite	0.1885	0.3595	Bronze
MP4	Oilite	0.251	0.3595	Bronze
*MP5	Oilite	0.1885	0.3595	Bronze
*MP6	Oilite	0.1885	0.3595	Bronze
MP11	Oilite	0.251	0.3595	Bronze
MP13	Oilite	0.182	0.317	Bronze
MP14	Oilite	0.182	0.317	Bronze
MP24	Oilite	0.1885	0.251	Bronze
*MP26	Oilite	0.1885	0.3595	Bronze
MP28	Ball	0.1875	0.5000	Stainless Steel
MP34	Ball	0.1875	0.5000	Stainless Steel
**MP83	Ball	0.1875	0.3750	Stainless Steel
**MP84	Ball	0.1875	0.3750	Stainless Steel
**MP85	Ball	0.1875	0.3750	Stainless Steel
MP86	Ball	0.1875	0.3750	Stainless Steel
MP90	Ball	0.1875	0.3750	Stainless Steel
RADIO FREQUENCY TUNER (SEE FIGURE 5-4)				
MP1 MP2 MP3 MP4	Bearing and flat pulley	1/4 shaft	0.593	Stainless Steel
MP5 MP6	Bearing and flat pulley	1/4 shaft	1.1220 1.1205	Stainless Steel
MP12	Ball	0.2500	0.3750	Stainless Steel
MP13	Ball	0.2500	0.3750	Stainless Steel

* Used only on serial number 112 and below
** Used only on serial number 113 and above

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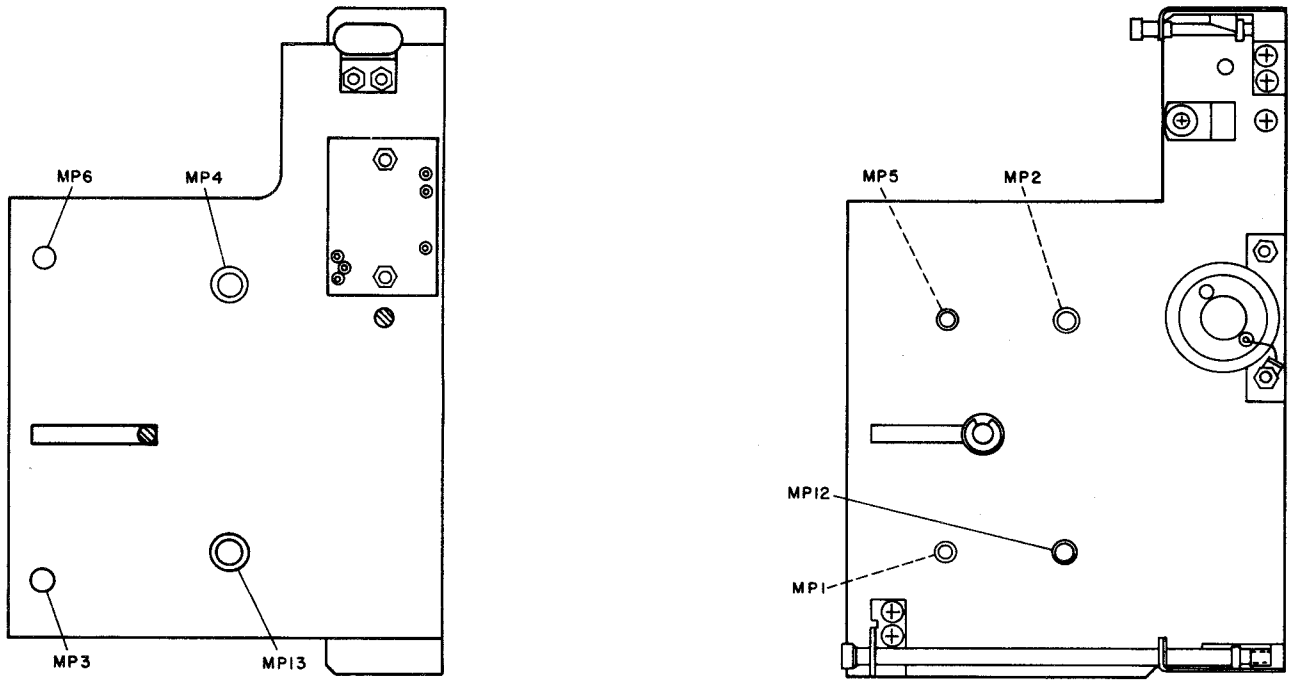

Figure 5-4. R-F Tuner Bearing Location

SECTION VI

REPAIR AND REPLACEMENT

6-1. INTRODUCTION.

This section contains essential instructions for the repair or replacement of worn, damaged or defective parts.

Faulty parts usually are detected by inspection in section V, by tests performed during reassembly in sections VII and VIII, or by tests given in section IX. When the faulty part is repaired or replaced, the new part should be inspected and tested as described in sections V, VI, VII, VIII, and IX.

Repair instructions are not given for items that are replaced as a unit, when they cannot be repaired or overhauled economically. Replacement instructions are not given where the method is obvious, or are dismantling or disassembly instructions given in section III and repeated in this section.

The repair or replacement instructions contained in this section apply to disassembled equipment. For dismantling and disassembling instructions, refer to section III.

A wiring diagram should be drawn before removal of any part requiring unsoldering of several wires. This diagram should show any color coding or markings of the wires, and the approximate location and identity of the terminals to which they are connected. In cases where lacing is to be removed, or where the dress is important, this also should be shown.

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6-2. RADIO FREQUENCY AMPLIFIER AM-2061/URT.

a. BAND-SWITCH ASSEMBLY. - Refer to figure 6-1 and assembly band switch as follows:

(1) Slide rotor (34) onto shaft (35) and align the hole in the hub of the rotor (34) with the groove pin hole in the shaft (35).

(2) Carefully press groove pin (32) into hub of rotor (34).

(3) Screw setscrew (33) into hub of rotor (34). Tighten setscrew (33).

(4) Mount strip (41) to switch (21) using bolt (39), washers (40)(38)(37) and nut (36).

(5) Insert rotor (34) into switch (21) and turn until rotor (34) will stay in switch (21).

(6) Place switch cam (31) on shaft (35) and align the groove pin hole in the switch cam (31) with the hole in the shaft (35).

(7) Carefully press groove pin (29) into switch cam (31).

(8) Screw setscrew (30) into switch cam (31). Tighten setscrew (30).

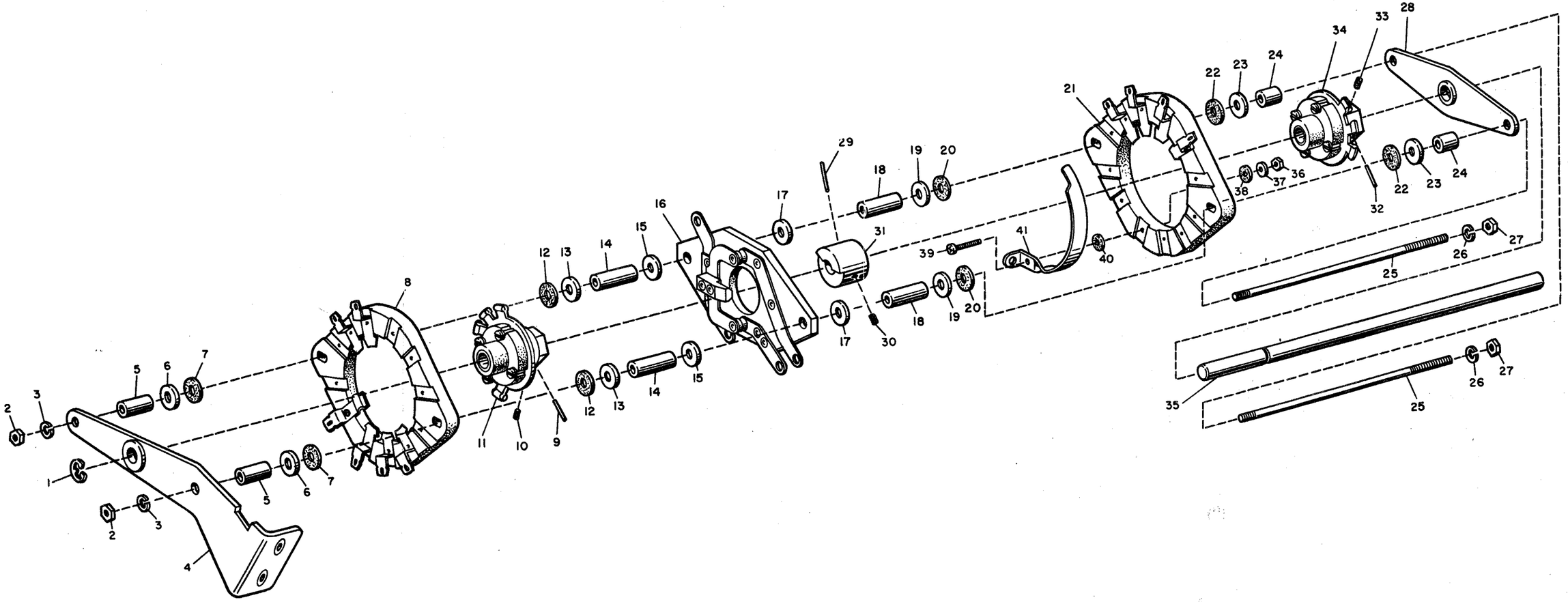

Figure 6-1. Radio Frequency Amplifier AM-2061/URT Band Switch, Exploded View

(9) Place switch (16) over shaft (35) and over cam (31).

(10) Place rotor (11) on shaft (35) and align the groove pin hole in the rotor (11) with the hole in the shaft (35).

(11) Carefully press groove pin (9) into rotor (11).

(12) Screw setscrew (10) into rotor (11). Tight setscrew (10).

(13) Place switch (8) over shaft (35) and rotor (11).

(14) Place lock washers (3) and nuts (2) on end of studs (22).

(15) Place studs (22) into mounting holes in switch plate (4).

(16) Feed studs (22) through spacers (5) and washers (6) and (7).

(17) Feed end of shaft (35) through bearing in switch plate (4).

(18) Feed studs (22) through mounting holes in switch (8) and washers (12) and (13), spacers (14), and washer (15).

(19) Feed studs through switch (16) washers (17), spacers (18) and washers (19) and (20).

(20) Feed studs (22) through mounting holes in switch (21).

(21) Feed studs (22) through washers (22)(23), spacers (24) and switch plate (28) with end of shaft (35) through bearing in switch plate (22).

(22) Place lock washers (26) and nuts (27) on end of studs (25) and tighten nuts (27) making certain that the switch assembly is not twisted.

b. DETENT ASSEMBLY. - Refer to figure 6-2 and reassemble the detent assembly as follows:

(1) Place bolts (2) and (5) through holes shown in plate (9).

(2) Place washers (4) and (8) over bolts (2) and (5).

(3) Feed bolts (2) and (5) through holes in support (7).

(4) Place arm (6) on end of bolt (5) and tighten bolt.

(5) Place special nut (3) on end of bolt (2) and tighten bolt.

(6) Hook spring (1) around special nut (3) and other end of spring (1) around arm (6) as shown.

c. RELAYS.

(1) Damaged relays usually are replaced as individual units, because they can not be repaired economically. However, for some types of relays, minor faults such as stickiness, sluggishness, poor contact, etc., can be remedied by cleaning or adjustment. Refer to paragraph 5-4.m. and table 6-1 for relay adjustment data.

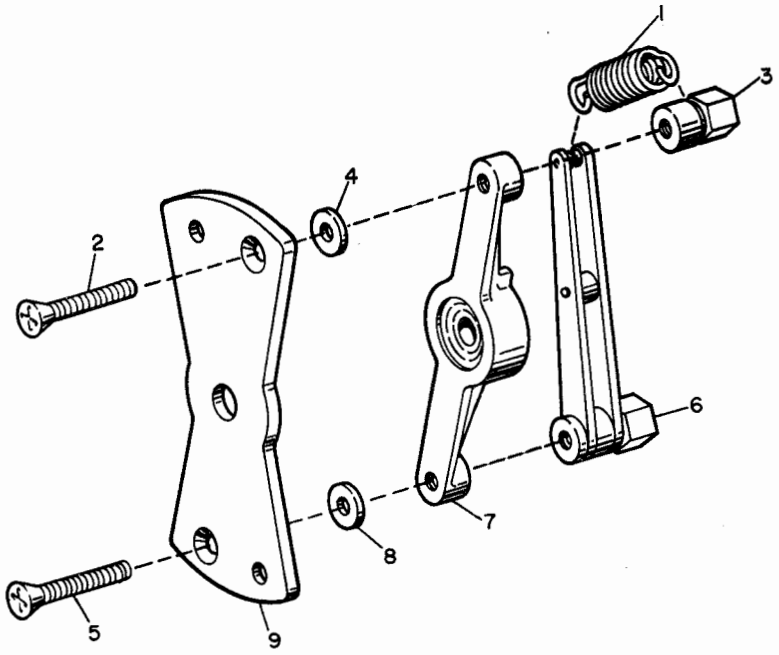

Figure 6-2. Radio Frequency Amplifier AM-2061/URT, Detent Assembly, Exploded View

(2) There are three relays in Radio Frequency Amplifier AM-2061/URT. Relay K1 is the circuit breaker. No attempt should be made to adjust the contacts since this is a sealed unit. Relays K2 and K3 are open-type relays and may be adjusted. Removing the mounting screws of relays K2 and K3 will allow the relays to swing away from the chassis giving access to the contacts. Care should be exercised in handling the relays, since the wires are still connected. If, at this point, it is found that either of the relays must be replaced due to burned contacts or for other reasons, the wires connecting to the relay should be labeled to ensure that they will be connected to the correct contacts on the new relay.

(3) When a relay is replaced, the new relay should be tested before installation. It should be subjected to a dielectric test, as follows:

(a) Apply a 60-cycle, rms voltage of twice-rated coil voltage plus 1000 volts between one coil terminal and relay frame.

(b) Apply a 60-cycle, rms voltage of twice-rated coil voltage plus 1000 volts between contacts when open.

(c) Apply a 60-cycle, rms voltage of 2500 volts between coil circuit and each contact terminal.

6-3. CONVERTER-OSCILLATOR CV-731/URC.

a. SMO GEAR ASSEMBLY - Refer to table 5-13 and paragraph 5-3d. for inspection of gears. Refer to figure 6-3 and assembly gear train as follows:

(1) Place retaining ring (63) on post (64).

(2) Mount post (64) to gear plate (65) using washer (62) and bolt (61).

(3) Place retaining rings (58) and (60) on post (59).

(4) Mount post (59) to gear plate (65) with bolt (57).

(5) Mount spacer (56) to gear plate (65) with bolt (57).

(6) Place retaining rings (52) and (54) on post (53).

(7) Mount post to gear plate (65) using bolt (51).

(8) Mount spacer (50) to gear plate (65) using bolt (49).

(9) Mount block (48) to gear plate (65) using bolt (47).

(10) Mount block (46) to gear plate (65) using bolt (45).

(11) Mount spacer (44) to gear plate (65) using bolt (43).

(12) Mount block (42) to gear plate (65) using bolt (41).

(13) Place gear (37) over post (64) and secure with retaining ring (36).

(14) Lay gear plate (65) on flat surface and set gear (39) over the large hole in gear plate. Slide clamp (38) over hub of gear (39).

(15) Place clamp (34) over hub of gear (35).

(16) Set gear (35) over hole in gear plate (65) as shown.

(17) Place gear assembly (40) with the bearing on the gear shaft into holes, as shown, on gear plate (65).

(18) Place stop arm (30) over the two posts on gear plate (33).

(19) Place washers (28) and (29) over the mounting posts of the stop arm (30).

(20) Secure stop arm (30) and washers (28) and (29) to gear plate (33) with retaining rings (27) and (26).

(21) Hook spring (25) from post on stop arm (30) to the one mounting post which has the groove on the outer end.

(22) Mount spacer (32) to gear plate (33) with screw (31).

(23) Place post (23) into hub of cam (22) and secure with retaining ring (21).

(24) Place retaining ring (24) on post (23).

(25) Mount cam assembly (22) to gear plate (33) using washer (9) and bolt (8).

(26) Mount capacitors (17) and (20) to gear plate (33) using lock washer (16) (19) and nuts (15) and (18).

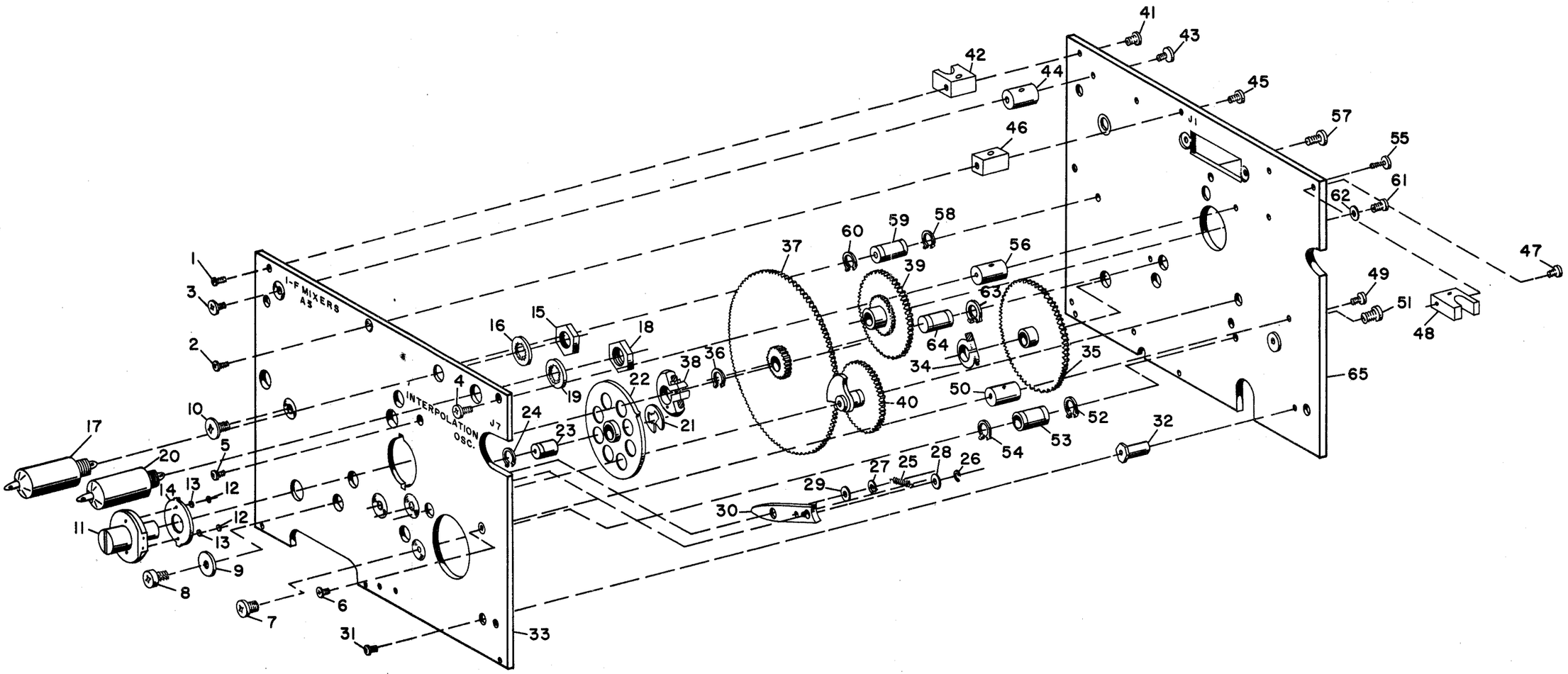

Figure 6-3. Stabilized Master Oscillator Gear Assembly, Exploded View

(27) Carefully fit gear plate (33) onto the spacers that are mounted on gear plate (65) and at the same time mesh the gear on cam (22) with gear (37), also pull back on the arm lock (30) allowing the end of the arm lock (30) to ride on the cam (22). The bearing on the shaft of gear (40) should also fit the hole in gear plate (33).

(28) Secure gear plate (33) with bolts (1), (2), (3), (4), (5), (6), (7), and (10).

(29) Place ring (14) on hub (11) and secure with washers (13) and drive pins (12). Place this assembly into hole in gear plate (33) as shown, into the shaft hole in gear (39). This will hold the gear in place until gear assembly is mounted on the smo and the master oscillator is installed.

(30) Place a 1/4-inch shaft or secure with wire gear (35) until the gear assembly is being mounted on the smo.

b. SMO TUNER GEAR ASSEMBLY. - Refer to table 5-13 and paragraph 5-3d. for inspection of gears. Refer to figure 6-4 and assemble gear train as follows:

(1) Mount brackets (51) to gear plate (52) with bolts (49) and lock washers (50).

(2) Mount spacer (48) to gear plate (52) with bolt (47).

(3) Mount spacer (46) to gear plate (52) with bolt (45).

(4) Mount spacer (44) to gear plate (52) with bolt (43).

(5) Mount spacer (42) to gear plate (52) with bolt (41).

(6) Mount shaft (40) to gear plate (52) with bolt (38) and lock washer (39). Leave bolt loose.

(7) Secure retaining ring (37) onto shaft (40).

(8) Place pulley (36) on shaft (40) and secure with retaining ring (35).

(9) Place retaining ring (33) on shaft (34) and place shaft (34) into bearing on gear plate (52).

(10) Screw setscrews (30) into hub of gear (32).

(11) Load gear (32) two teeth and, using a suitable clamp, hold the gear loading while mounting on gear plate (52).

(12) Place gear (32) over shaft (34); do not tighten the setscrews in gear hub (32).

(13) Place retaining ring (31) on shaft (34).

(14) Place retaining ring (28) on shaft (29) and place shaft (29) in bearing on gear plate (52).

(15) Screw setscrews (25) into hub of gear (27).

(16) Load gear (27) two teeth and, using a suitable clamp, hold the gear loading while mounting on gear plate (52).

(17) Place gear (27) over shaft (29) do not tighten the setscrews in gear hub (27).

(18) Place retaining ring (26) on shaft (29).

(19) Place gear (22) on shaft (24) and line up the hole in the hub of gear (22) and the hole in the shaft (24), making certain that the side with the large hole in the hub of gear (22) is aligned with the side of the shaft (24) with the large hole. Drive taper pin (21) into hub and shaft.

(20) Place retaining ring (23) on shaft (24).

(21) Load gear (22) two teeth and, using a suitable clamp, hold the gear loading while mounting on gear plate (52).

(22) Place end of shaft (24) into bearing of gear plate (52).

(23) Pin gear (15) to shaft (20) with roll pin (11).

(24) Place retaining ring (14) on shaft (20).

(25) Place shim (10) on end of shaft (20) and place shaft into bearing on gear plate (52).

(26) Place bolt (12) in clamp (17) and nut (13).

(27) Place pulley (16) on shaft (20) and clamp (17) on end of pulley (16).

(28) Place retaining ring (18) on shaft.

(29) Place shim (19) on shaft (20).

(30) Slide gear (32) upon shaft (34) until the teeth will ride approximately center of the teeth of gear (15). Tighten setscrews in hub of gear (32).

(31) Slide gear (27) upon shaft (29) until the teeth will ride approximately center of the teeth of gear (32). Tighten setscrews in hub of gear (27).

(32) Place belt (9) over pulleys (36) and (16) and around spacer (46).

(33) Place gear plate (8) in place and line up shafts and spacers and secure with bolts (7).

(34) Remove the clamps from the three gears (32)(27) and (22).

(35) Place bolts (1) into clamps (4) and nuts (2).

(36) Slide clamps (4) into couplers (3) and slide coupler (3) onto shaft (20). Leave coupler loose.

(37) Slide coupler (3) onto shaft (24) and tighten bolt (1) in coupler (4).

(38) Turn gear train and carefully check for binding and rough spots.

(39) Mount bracket (6) to gear plate (8) with bolt (5).

NOTE

Pulley (54), clamp (52) and bearing retainer (56) will be assembled when gear train is mounted on the chassis and the drive shaft from the front panel connected through the pulley, clamp and gearing retainer.

c. FRONT PANEL GEAR ASSEMBLY AND COUNTER. - Refer to table 5-13 and paragraph 5-3d. for inspection of gears. Refer to figure 6-5 and assemble front panel gear assembly as follows:

(1) Mount block (134) to panel (138) using bolts (131) lock washers (133) and washers (132).

(2) Mount block (137) to panel (138) using bolts (135) and lock washers (136).

(3) Mount block (130) to panel (138) using bolts (127), lock washers (129) and washers (128).

NOTE

It is suggested that the panel (138) be mounted in position on the chassis using the bracket, smo tuner gear train, and the two standoffs as supports. Tighten bolts in blocks (134) and (130) when secured to bracket and smo tuner gear train.

(4) Mount the three posts (125) to panel (138) with bolts (123) and lock washers (124).

(5) Place sleeving (126) on posts (125) as shown.

(6) Mount the three posts (144) to panel (138) with bolts (112) and lock washers (113).

(7) Mount post (111) to panel (138) with bolt (109) and lock washer (110).

(8) Run nut (119) onto bolt (118) and screw bolt (118) into panel (138) until end of bolt (118) is flush with rear of panel (138). Tighten nut (119) against panel (138). Hook spring (49) around threads of bolt (118) just under head of bolt.

(9) Place grommet (97) in panel (138).

(10) Mount ground lug (100) to panel (128) with bolt (101), lock washer (99), and nut (98)

(11) Place shim or shims (54) (be sure to use the same shims removed) over shaft. Place gear (53) on shaft and secure with retaining ring (52).

(12) Mount post (87) to panel (138) using bolt (84), lock washer (85), and washer (86).

(13) Place gear (91) on post (87), meshing it with gear (53).

(14) Place shim washers (90) and (89) on post (87) and secure gear assembly on post (87) with retainer ring (88).

(15) Place washer (71) on hub of gear (72) and place gear (70) in place on hub.

(16) Mount spring (69) in gears (70) and (72).

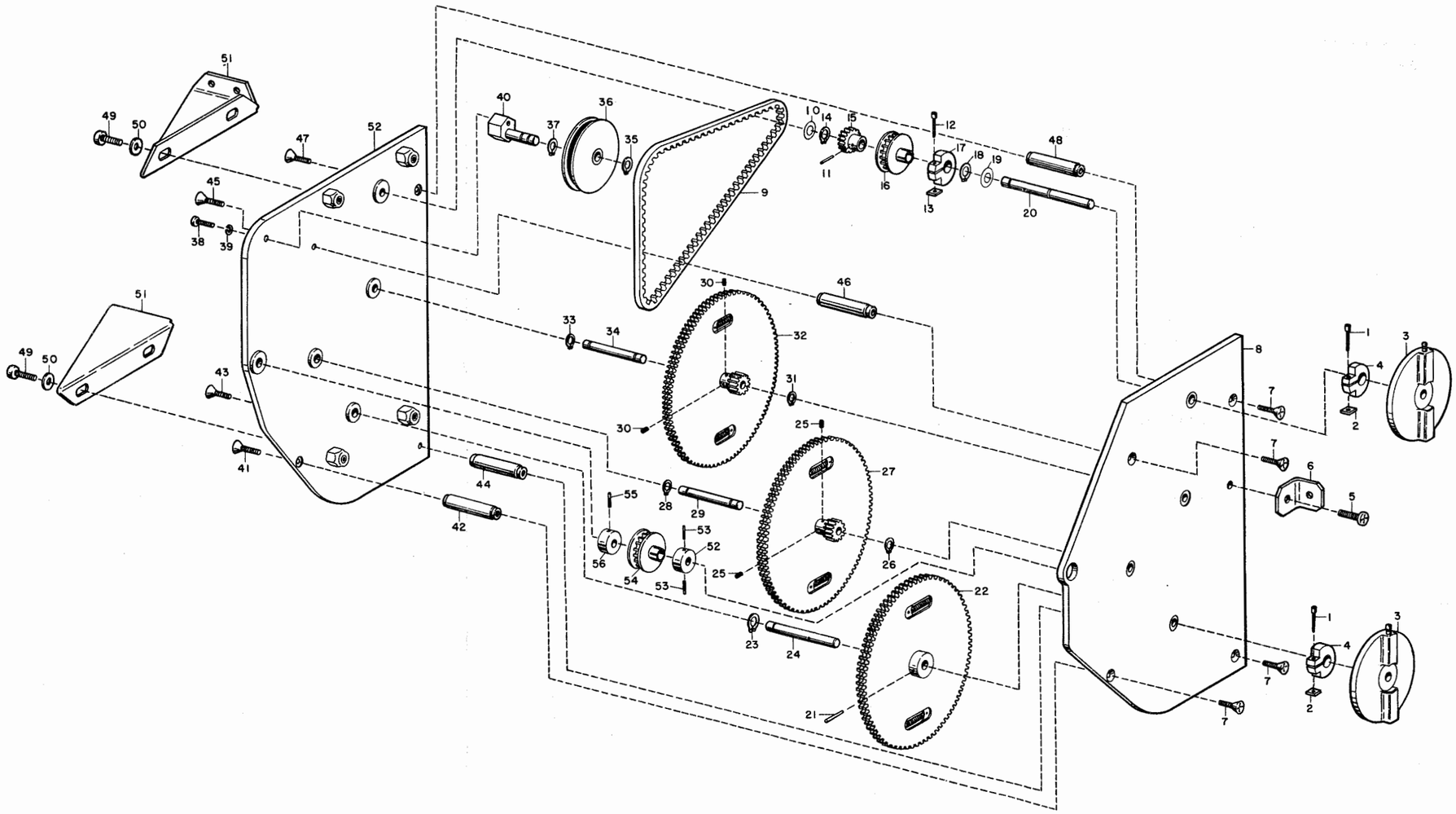

Figure 6-4. Stabilized Master Oscillator Tuner Gear Assembly, Exploded View

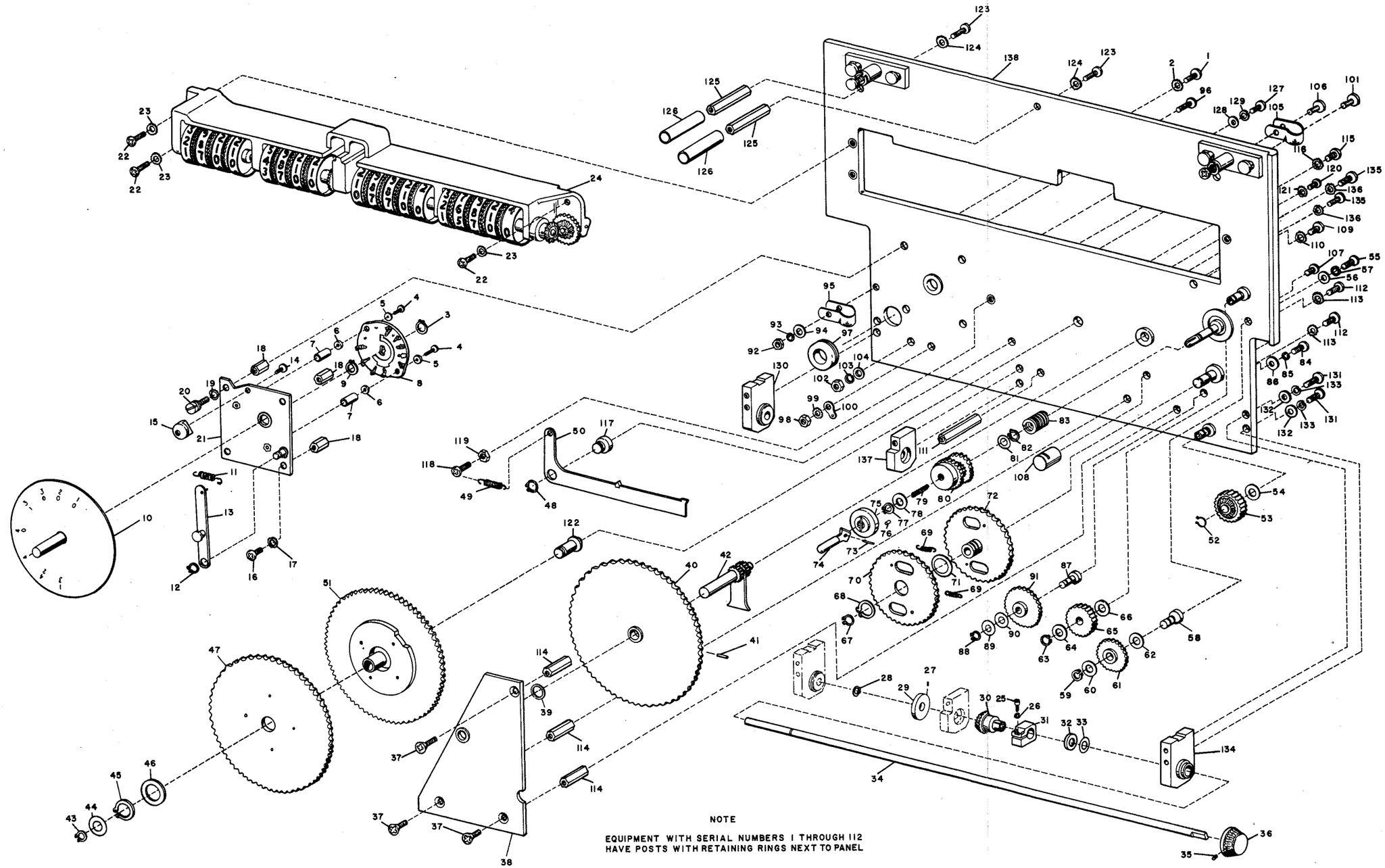

Figure 6-5. Front Panel Assembly, Exploded View

(17) Secure gear (70) to hub with retaining ring (68).

(18) Place shim (81) over shaft of cluster and mount retaining ring (82).

(19) Place spring (83) over shaft of cluster.

(20) Mesh the spring load gears (70) and (72) and the cluster gear (80). (Take up slack in the springs (69) and then move the floating gear (70) through one full tooth before meshing the gears.) Hold the gears meshed and carefully put in place on their shafts. Secure load gears (70) and (69) to shaft with retaining ring (67).

(21) Place shims (78) and retaining ring (77) in place on shaft.

(22) Insert spring (79) and plunger (76) into hole of shaft and at the same time insert the cross bar of the pressure disc (75) in the slot of the shaft and pin the brake actuator (74) with roll pin (73). The narrowest dimension from pin center to the flat of the brake actuator (74) should be normal to the pressure disc (75) center bar.

(23) Place washer (66) over shaft.

(24) Place gear (65) on shaft and washer (64) on top of gear (65).

(25) Mount retaining ring (63) on end of shaft.

(26) Mount post (58) to panel (138) using bolt (55), lock washer (57) and washer (56).

(27) Place washer (62) over shaft (58).

(28) Place gear (61) over shaft (58).

(29) Place washer (60) over shaft (58) and secure with retaining ring (59).

(30) Mount post (122) to panel (138) using bolt (120) and washer (121).

(31) Place gear (51) on shaft (122).

(32) Mount post (117) to panel (138) using bolt (115) and lock washer (116).

(33) Connect spring (49) to pawl (50).

(34) Mount pawl (50) to post (117) and secure with retaining ring (48).

(35) Mount pawl guide (108) to panel (138) with bolt (107) so that pawl arm passes through slot. Tighten bolt (107).

(36) Move gear (51) so that pawl (50) is centered in notch of gear (51).

(37) Place gear (47) on shaft (122) and position gear (47) so that the notch is in line with the notch of gear (51).

(38) Place shim (46) over hub of gear (47) and (51) and secure with retaining ring (45).

(39) Place shim (44) over end of shaft (122) and secure with retaining ring (43).

(40) Place gear (40) on shaft of gear (42), aligning the holes in shaft and gear hub so that roll pin (41) may be pressed into the holes.

(41) Mount gear shaft (42) in place so that its stop arm is in contact with pawl. (Make certain that the notches in gears (51) and (47) are still in line.)

(42) Place shims (39) over shaft of gear (42). (Make certain that the same shim or shims removed from this position is replaced.)

(43) Mount top plate (38) to standoffs (114) using screws (37). Check end play of shaft. The end play should not be more than 15 thousandths.

(44) Place shaft (34) through bearing in block (134).

(45) Place washer (32) over end of shaft (34) and place the same shims (33) over end of shaft (34).

(46) Mount screw (25) and lock washer (26) to clamp (31).

(47) Place clamp (31) over end of shaft (34).

(48) Place gear (30) over end of shaft (34).

(49) Slide clamp (30) over end of gear (31). Leave loose and slide gear (30) next to bearing in block (134).

(50) Feed shaft (34) through bearing in block (137).

(51) Slide bearing clamp (29) over end of shaft (34).

(52) Place retaining ring (28) on shaft (34) and push shaft (34) through bearing in block (130) until the retaining ring (28) is against bearing in block (130).

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(53) Screw setscrew (27) into bearing clamp (29).

(54) Slide bearing clamp (29) against bearing in block (137).

(55) Mount setscrew (35) in knob (36).

(56) Place knob (36) on end of shaft (34) and tighten setscrew (35).

(57) Loosen mounting bolts for gear (61), (91), and (51)(47).

(58) Adjust each gear (61)(91), and (51)(47) for maximum mesh (minimum backlash) with other gears without binding of gears. Tighten the mounting bolts.

(59) Mesh gear (30) with gear (53) and tighten bolt (25) in clamp (31).

(60) Carefully turn knob (36) and note any binding or rough spots. The gear train should operate smoothly over the entire travel of the gear train.

(61) Rotate gear train from drive shaft (knob end) counterclockwise until the stop is engaged. Lock gear train by pushing down on lever (74).

(62) Set the counter (24) so that the left-hand bank of wheels read 1695 at 12 o'clock, relative to the mounting surface.

(63) Place counter (24) into mounting position and mount with bolt (22) and lock washer (23). (Leave bolts loose.)

(64) Adjust the mesh of gear on counter (24) and gear (53) for minimum backlash and optimum running. Tighten the mounting bolts (22).

(65) Lubricate all gears with Lubriplate 105.

(66) Mount spacer (18) to plate (21) with special bolt (20) and lock washers (19).

(67) Mount the remaining three spacers (18) to plate (21) with bolts (16) and lock washers (17).

(68) Mount arm (13) to plate (21) and secure with retaining ring (12).

(69) Mount detent arm guide (15) to plate (21) with screw (14). Turn slot in guide (15) so that detent arm (13) will fit. Tighten bolt (14).

(70) Hook spring (11) over special bolt (20) and hook other end of spring (11) to detent arm (13).

(71) Feed shaft of assembly (10) through bearing in plate (21).

(72) Pull detent arm (13) out to clear detent cam and let detent arm (13) slide in notch of detent cam after detent cam is mounted into place.

(73) Secure shaft of assembly (10) to plate (21) with retaining ring (9).

(74) Turn assembly (10) counterclockwise until the number 1-0 turns to 12 o'clock. The switch (8) should then be oriented with contact number one place next to the notch in the plate (21). The rotator should also be set at position one.

(75) Place phenolic washers (5) over bolts (4) and slide bolts (4) through mounting holes in switch (8). Place phenolic washers (6) over end of bolts (4). Place spacers (7) over end of bolts (4).

(76) Slide switch (8) over shaft of assembly (10) and secure switch (8) to plate (21) with bolt (4), phenolic washers (5)(6), and spacer (7), using care not to damage the wiring to the switch. Do not tighten too much, since excessive pressure may damage the phenolic washers or switch.

(77) Secure retaining ring (3) to end of shaft.

(78) Place clamp (95) around cable and secure to panel (138) with bolt (96), washer (94), lock washer (93), and nut (92).

(79) Place clamp (105) around cable and secure to panel (138) with bolt (106), washer (104), lock washer (103), and nut (102).

(80) Mount the switch assembly to the panel (138) using the four bolts (1) and four lock washers (2).

(81) Mount front panel using the eight flathead bolts, and mount the BAND CHANGE knob and FREQUENCY CHANGE knob.

d. R-F TUNER SLUG RACK AND TAPE ASSEMBLY. - To replace the long or short tapes and slug rack, refer to figure 6-6 and proceed as follows.

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(1) Slug rack end supports should be in full up position.

(2) Insert new long tape(s) (7), where applicable, and replace the screws (8) that secure it to the tape roller (11) and slug rack end support (6).

CAUTION

Do not tighten the tape roller screws(8) until the slug rack has been remounted and tension adjusted.

(3) Replace the short tape(s) (5) and secure with screws (9) to slug rack end support (6).

(4) Reconnect the tape tension spring (4) between the ends of the long and short springs (5) and (7).

(5) Adjust tape tension by adjusting nut (3) against the slug rack end support (6).

(6) Tighten tape roller screws (10).

e. R-F TUNER BAND-SWITCH MOTOR.

(1) RESURFACING ARMATURE. - If a commutator is out of round, or is deeply grooved or pitted, turning in a lathe is required to restore it to a true round, or to remove defects noted.

After the commutator has been turned down, undercut the insulation with a mica-cutting saw that will give a cut of 0.020 to 0.025 inch less than the exact width of the insulation thickness. Carefully remove any slivers of insulation remaining in the slots of the commutator bars. A piece of hack saw blade having all but one tooth ground off, and dressed to fit the commutator slots, will serve as a tool for this purpose. Friction-taping part of the blade to form a handle is helpful. Carefully remove any burrs from edges of the bars, taking care not to scratch their faces. Polish the commutator by gentle applications of No. 0000 or finer sandpaper to its surface, while rotating in the lathe at a moderate speed commensurate with its size. Blow all dust and particles from slots, winding, and surfaces of entire armature with clean, dry, compressed air.

CAUTION

Do not use emery cloth to polish the commutator.

(2) RELACQUERING POLE SURFACES. - If the pole surfaces of the armature of field assemblies are corroded, or if the lacquer finish is damaged, proceed as follows:

(a) Remove all defective finish from pole surfaces, using clean, lintless cloth dampened with lacquer thinner.

(b) Remove spots of corrosion from pole surfaces, using a fine grade of crocus cloth.

CAUTION

Do not contact bare pole surfaces with bare hands. Wear rubber gloves.

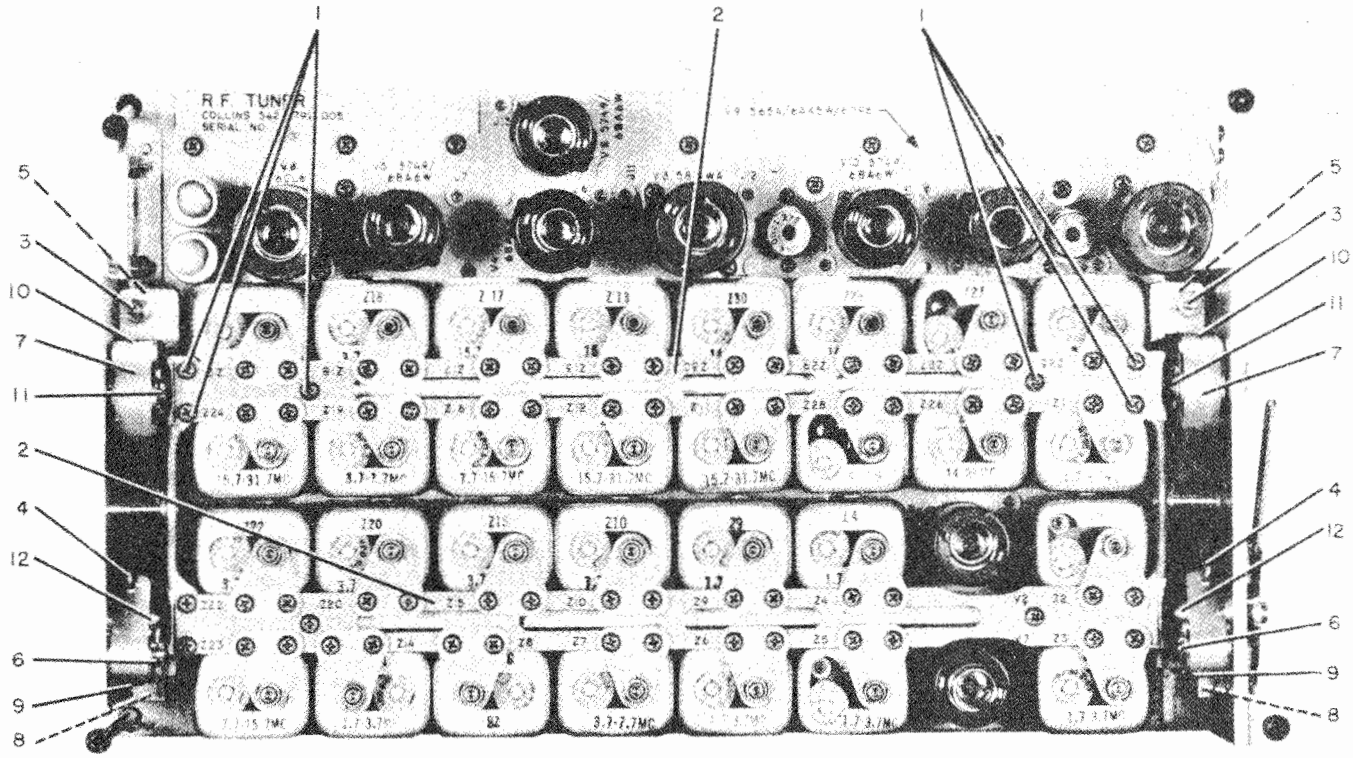

Figure 6-6. R-F Tuner, Top View

(c) Carefully remove dirt with clean, dry, compressed air.

(d) Using clean, lintless cloth dampened with lacquer thinner, carefully wipe cleaned pole surfaces only.

(e) Mask all surfaces not to be treated, then heat assembly to approximately 15 degrees C (27 degrees F) above room temperature.

(f) Spray while warm with thin coat of air-drying varnish mixed with enough lacquer thinner to prevent cobwebbing of sprayed surfaces.

(g) Bake in ventilated oven at approximately 121 degrees C (250 degrees F) for one hour.

NOTE

When oven is not available, drying may be done at room temperature.

(h) Remove armature assembly from oven, and allow it to cool to room temperature. Remove all masking material carefully.

CAUTION

Protect the lacquered surface from damage. Scratching this surface exposes the metal to corrosion

(3) ASSEMBLING. - Refer to figure 6-7 and assembly band-switch motor as follows:

(a) Place brush holder (7) over end of field assembly (10).

(b) Place brushes (8) in brush holder (7) with the curved facing of the brush fitting the curved surface of the commutator.

(c) Place springs (6) on brush holder (7) securing brushes (8).

(d) Place insulator (4) over end of brush holder (7).

(e) Place bearing (3) on shaft of armature (9).

(f) Place end plate (2) in position and secure with mounting bolts (1).

(4) REPLACING BRUSHES. - Brushes should be replaced in their brush holders with the curved facing of the brush fitting the curved surface of the commutator. When brushes are replaced, the springs must not be distorted. Brushes should be seated on 100 percent of the arc, and at least 75 percent of the area of the brush. To obtain this brush seating, connect the motor to a voltage source and allow the motor to run under no lead conditions until the proper seating has been attained. Run-in time should be from 3 to 5 hours. When satisfactory seating is arranged, remove the brushes from their holders and remove all carbon dust from the motor by careful and thorough use of an air jet. Replace all brushes in their respective holders.

f. R-F TUNER BAND SWITCHES.

(1) REPLACING BAND SWITCHES. - Any defective band switches (S1 through S17) may be replaced by expanding the spring clip mounts, and sliding the switch into place.

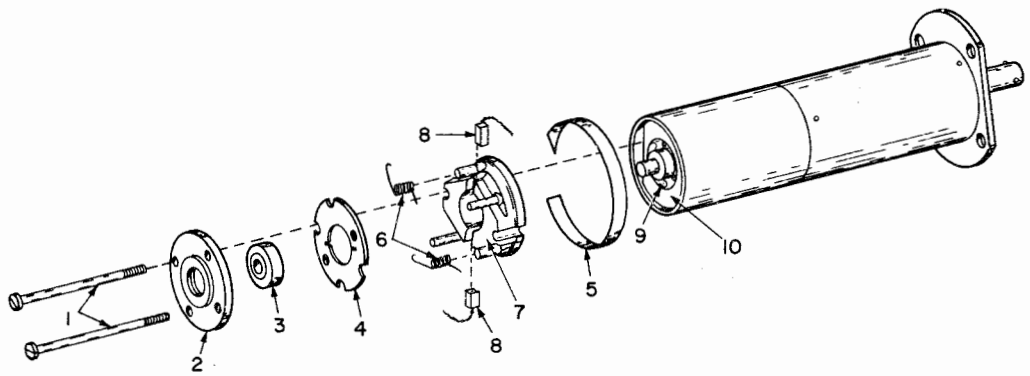

Figure 6-7. R-F Tuner Band Motor, Exploded View

CAUTION

Carefully resolder connecting wires to the switch using a low-voltage soldering iron (25 to 30 watts) and resin core solder. Make sure that no solder drops onto the printed circuit switch faces.

Orientation of the rotor assemblies is important; note the order and the way that the rotors are assembled. Also, do not contaminate the printed-circuit switch faces with oil; even a fingerprint may cause the unit to malfunction. Refer to paragraph 4-3.i., and clean the replaced switch or switches.

g. REPLACING SEALED OR SHIELDED BEARINGS AND OILITE BEARINGS. - No attempt should be made to remove bearings from gear plates unless, after inspection, it is found necessary because of a defective bearing. To remove an Oilite bearing proceed as follows:

(1) Lay the gear plate on a flat plate with a hole large enough to clear the shoulder of the bearing being removed.

(2) Select a punch slightly smaller than the diameter of the bearing hole in the gear plate and carefully punch the bearing from the gear plate.

(3) To replace an Oilite bearing, lay the gear plate on a flat plate under a press. Use a tool in the press with a flat end a little larger than the diameter of the bearing being pressed. Use no more pressure than necessary to press the bearing into place.

(4) An Oilite bearing that has been pressed will be distorted, making it necessary to burnish the bored hole to the required size for the shaft. Select a burnishing tool approximately 0.002 inch larger than the shaft and burnish the bored hole to that size, making sure that all of the burrs are removed from the bore.

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(5) Sealed or shielded bearings can be removed and replaced with the fingers since a press fit should not be made with this type bearing.

6-4. AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC, CONVERTER-MONITOR CV-730/URC, AMPLIFIER-CONTROL AM-2062/URC, CONTROL-POWER SUPPLY C-2691/URC, AND POWER SUPPLY PP-2153/U.

a. RELAYS.

(1) Damaged relays usually are replaced as individual units, because they cannot be repaired economically. However, minor faults such as stickiness, sluggishness, poor contact, etc., can be remedied by cleaning or adjustment. Refer to paragraph 5-4.m. and table 6-1 for relay adjustment data.

(2) Removing the mounting screws from the relays will allow them to swing away from the chassis, giving access to the contacts. Care should be exercised in handling the relays since the wires are still connected. If, at this point, it is found that any of the relays must be replaced due to burned contacts or for other reasons, the wires connecting to them should be labeled to ensure that they will be connected to the correct contacts on the new relay.

(3) Refer to paragraph 6-2.c.(3) and perform that test on the new relays.

NOTE

The pressure between the normally closed contacts and those that are closed when the relay is engaged should be approximately the same as that given in table 6-1.

TABLE 6-1. RELAY ADJUSTMENT DATA

RELAY DESIGNATION	PRESSURE BETWEEN CLOSED CONTACTS (grams)	CLEARANCE BETWEEN OPEN CONTACTS (inch)
RADIO FREQUENCY AMPLIFIER AM-2061/URT		
K2	38 to 55	Approximately .03125
K3	13 to 16	Approximately .03125
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC		
K1	40 to 55 grams for all contacts except the two small center contacts which should be between 25 and 31 grams	Approximately .03125
K2	34 to 45	Approximately .03125
CONVERTER-MONITOR CV-730/URC		
K1	34 to 45	Approximately .03125
AMPLIFIER-CONTROL AM-2062/URC		
K1	34 to 45	Approximately .03125
CONTROL-POWER SUPPLY C-2691/URC		
K1	29 to 31	Approximately .03125
POWER SUPPLY PP-2153/U		
K1	This is a normally open relay	Approximately .125

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SECTION VII

ASSEMBLY AND TESTING OF ASSEMBLIES AND SUBASSEMBLIES

7-1. INTRODUCTION

This section contains instructions for the reassembly of parts into subassemblies and assemblies, and specifies tests to be made prior to reassembly into rack.

Only those subassemblies disassembled in section III will be considered in this section.

7-2. RADIO FREQUENCY AMPLIFIER AM-2061/URT.

a. BAND-SWITCH ASSEMBLY.

Refer to figure 7-1 and proceed as follows:

(1) Viewing the band switch from the panel end, turn switch to the maximum counterclockwise position.

(2) Carefully replace switch assembly (15) by placing into place on the chassis. Care should be taken not to bend the disconnected bus wires and straps.

(3) Replace the two flathead screws (14) that mount the switch assembly (15 front bracket to the front top of the chassis.

(4) Turn detent to maximum counterclockwise position.

(5) Replace detent assembly (13) onto band switch shaft and mounting studs.

(6) Replace the two lock washers (12) and two nuts (11) that mount the detent assembly (13) and back end of switch.

(7) Tighten the three Bristo setscrews (8) in the detent wheel (9).

(8) Place detent arm (6) on switch shaft.

(9) Place link (5) onto detent arm (6).

(10) Replace retainer ring (4).

(11) Tighten the two Bristo setscrews in the detent arm (6).

(12) Solder straps back to the back switch pie S6-A (3) being careful not to bend the straps any more than necessary when making the connections.

(13) Connect bus wires back to the center switch pie S5 (2).

(14) Connect straps and wires back to the front switch pie S6-B (1).

b. VARIABLE INDUCTOR (L4).

Refer to figure 7-3 and proceed as follows:

(1) Place variable inductor (3) into position on the chassis and mount with the two flat-head screws (7) and lock washer (5) and binder-head screw (4).

(2) Solder the bus wire to variable inductor (3).

(3) Connect strap to variable inductor (3) using mounting lock washer (2) and nut (1).

c. VARIABLE INDUCTOR (L10).

Refer to figure 7-4 and proceed as follows:

(1) Place variable inductor (3) into position on the chassis, and mount with the two flat-head screws (5) and flat washer (8), lock washer (7), and binder-head screw (6).

(2) Solder strap to switch pie of switch (4). This strap is the one from the rear of variable inductor (3).

(3) Connect strap to variable inductor (3) using mounting lock washer (2) and nut (1).

d. FRONT AND REAR PANELS.

Refer to figure 7-2 and proceed as follows:

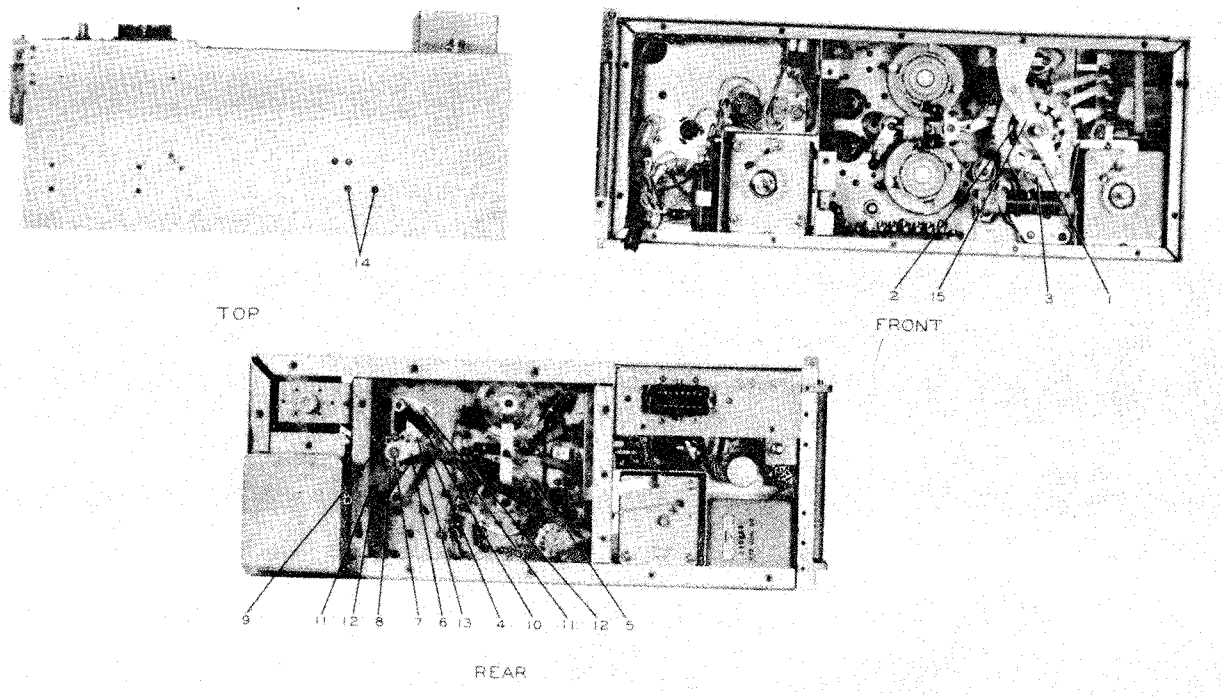

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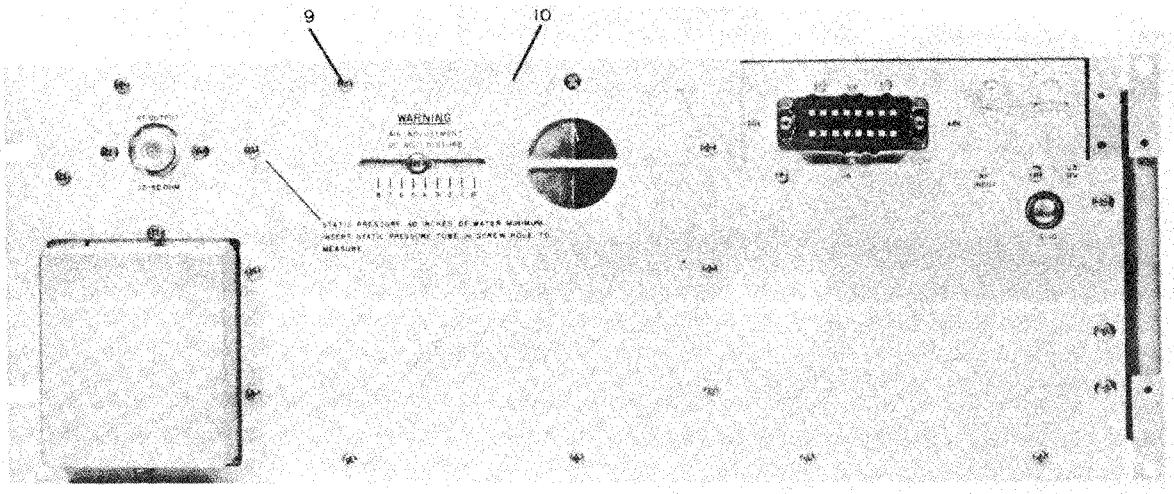
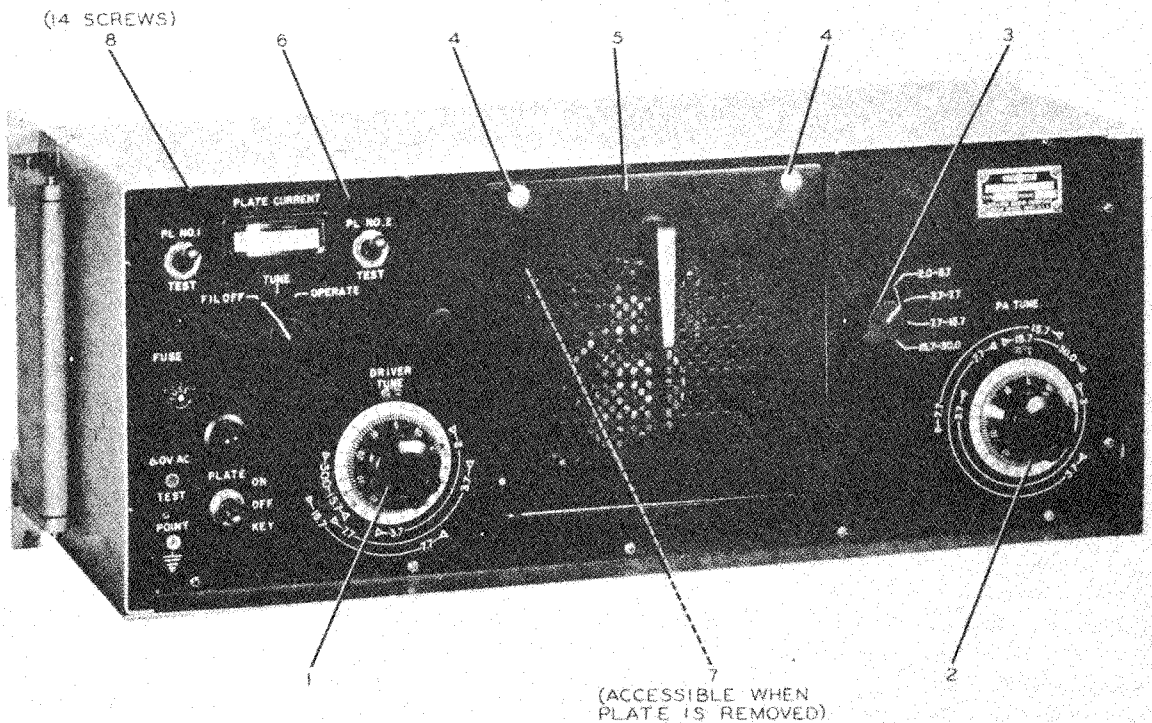
Figure 7-1. Radio Frequency Amplifier AM-2061/URT Front, Rear, and Top Views



REAR VIEW



FRONT VIEW

Figure 7-2. Radio Frequency Amplifier AM-2061/URT, Front and Rear Views

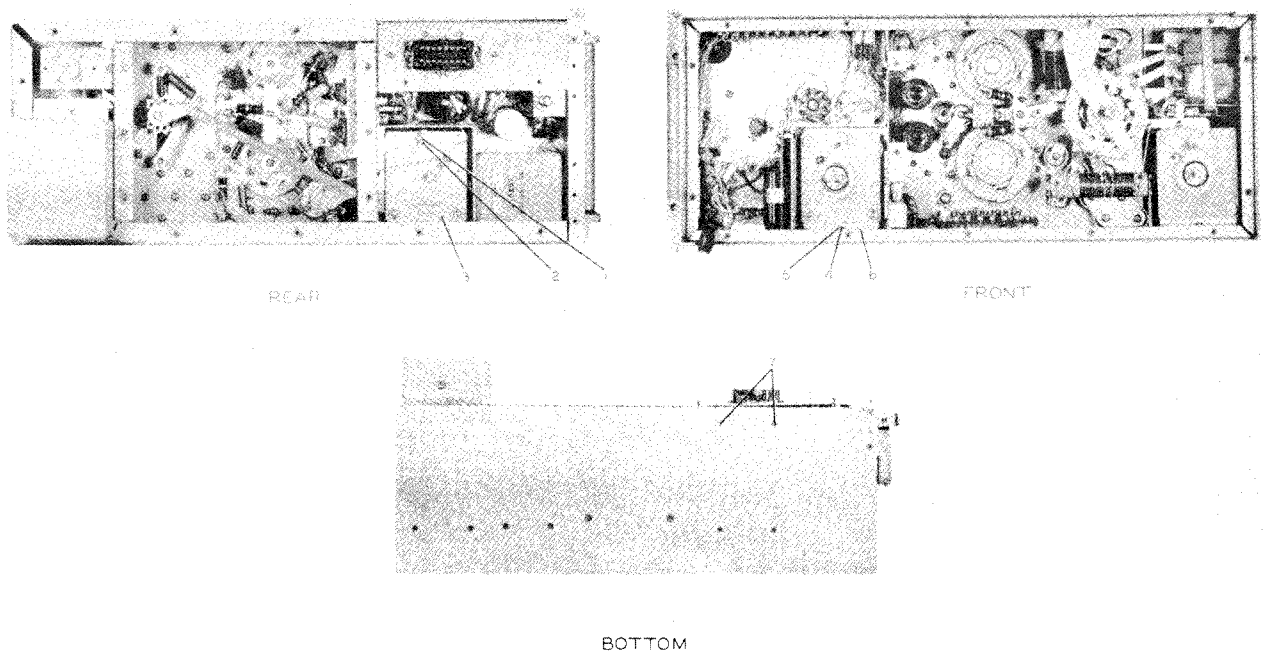


Figure 7-3. Radio Frequency Amplifier AM-2061/URT, Front, Rear, and Bottom Views

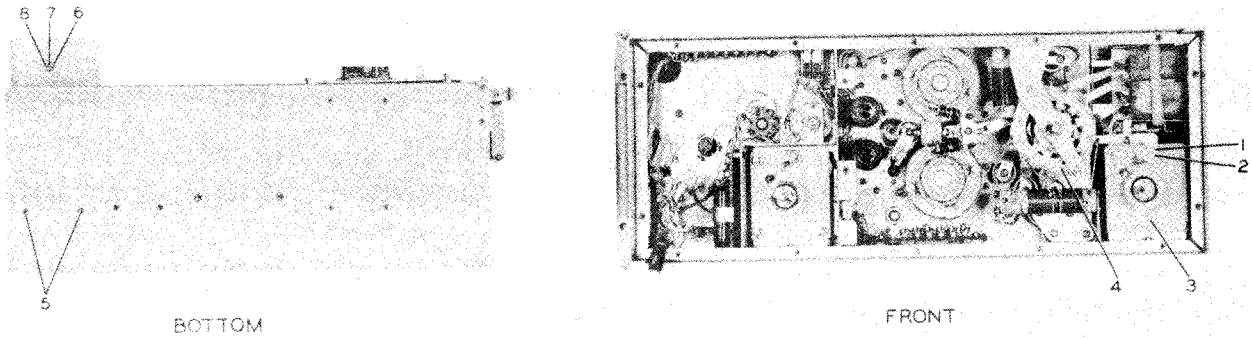


Figure 7-4. Radio Frequency Amplifier AM-2061/URT, Front and Bottom Views

(1) Replace the rear panel (10) and mount with twenty-three screws (9).

(2) Swing the front panel (6) into place; be careful to avoid damage to cable and wiring to front panel (6).

(3) Mount the front panel (6) to the chassis with the fourteen binder-head screws (8).

(4) Replace the two screws (7) on the left bracket.

(5) Replace plate (5) to front panel (6).

(6) Line pointer of band switch knob (3) with the silk-screening marking 2.0 - 3.7; tighten the setscrews.

(7) With the variable inductor turned to maximum counterclockwise position, mount the DRIVER TUNE knob (1) with the 0 of the knob in line with the indicator on the panel and tighten the setscrews.

(8) With the variable inductor turned to maximum counterclockwise position, mount the P. A. TUNE knob (2) with the 0 of the knob in line with the indicator on the panel and tighten the setscrews.

e. TESTING MECHANICAL OPERATION OF CONTROLS.

Refer to figure 7-2 and proceed as follows:

(1) Turn band switch knob (3) to each of its four positions, and note detent action. Each position should be positive without binding.

(2) Rotate DRIVER TUNE knob (1) clockwise over the range, and note any roughness or binding.

(3) Rotate P. A. TUNE knob (2) clockwise over the range and note any roughness or binding.

7-3. CONVERTER-OSCILLATOR CV-731/URC.

a. REPLACING SMO GEAR ASSEMBLY AND SLUG RACK.

Refer to figure 7-5 and proceed as follows:

(1) Place gear assembly (57) into position on chassis and at the same time slide gear (56) onto shaft and block (20) between gear plates (24) and (14).

(2) Place the two front captive screws (54) into position and replace the five flathead screws (51) that mount the right side panel (52) to the corner block (53), the block strip (20) and the rear gear plate (14).

(3) Mount the left center bracket to gear plate (14) with binder-head screw (49) and lock washer (50).

(4) Replace tube (48) and tube shield (47).

(5) Replace tube (46) and tube shield (45).

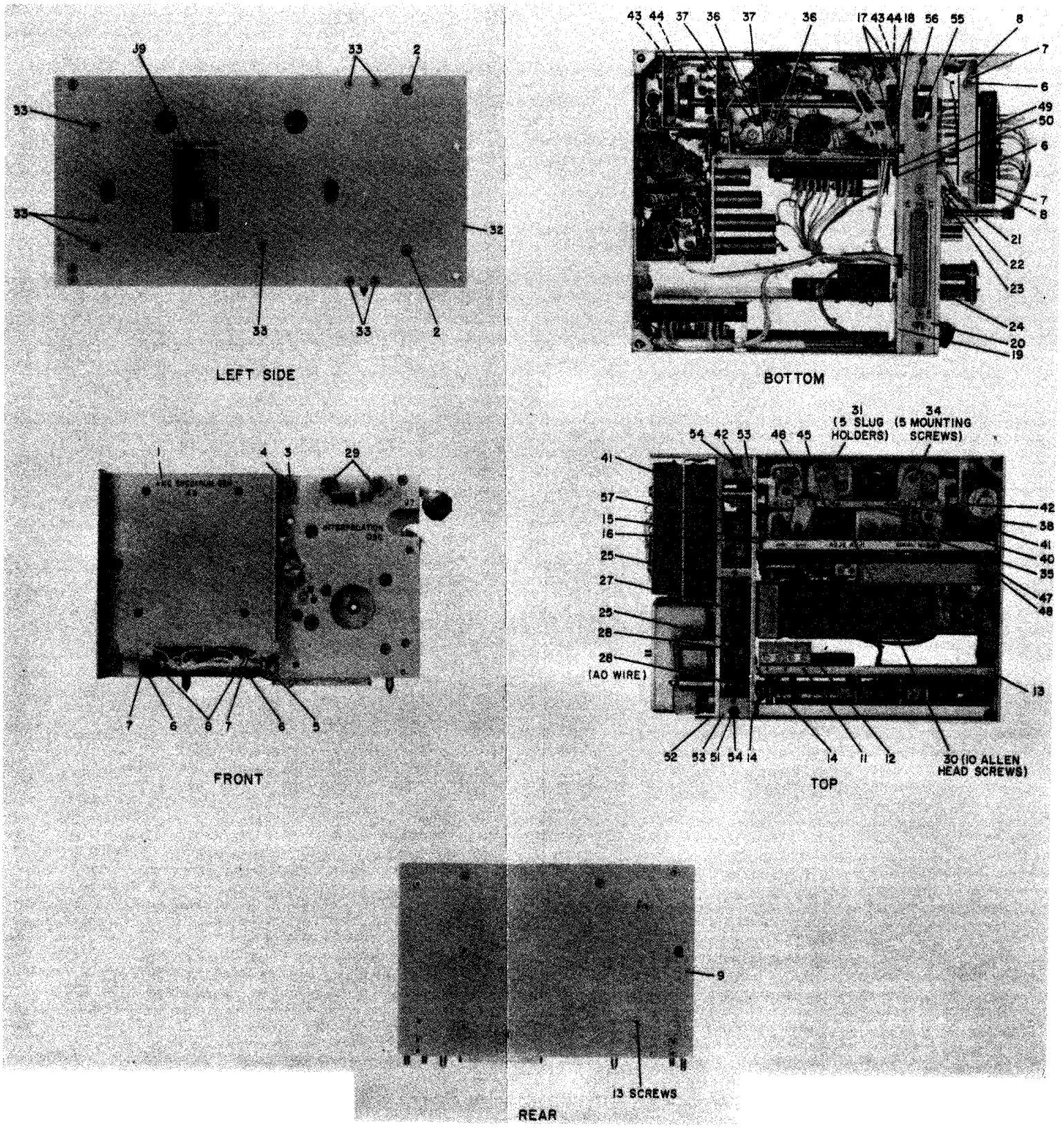


Figure 7-5. Stabilized Master Oscillator, Front, Left Side, Top, and Bottom Views

(6) Insert tapes (42), making certain that guide pins are engaged on both top and bottom of the slug rack rollers.

(7) Secure tapes with springs (41).

CAUTION

Care must be exercised that tapes are not bent, twisted, kinked, or torn during replacement.

(8) Secure slug rack (40) to each tape (42) with flathead screw (43) and special nut (44).

(9) Before tightening the tape roller screws, insert the blade of a screwdriver, or similar tool, between the tape roller and the chassis. Exert moderate pressure to remove any slack from the tapes. Maintain tension and tighten the tape roller screws.

(10) Place fastening stud on spring (39) through the slug rack (40) and secure with retaining ring (38).

(11) Plug each coil into the proper mounting position and secure each with mounting screw (34), which is accessible through the core of each coil. All coils are mounted this way except FL-1(35), which is mounted with two binder-head screws (36) and lock washers (37) from the bottom of chassis.

CAUTION

Use only moderate pressure to tighten coil hold-down screws, or the coil assembly may may be pulled from the cam.

(12) Place the five slug holders in their proper position on the slug rack (40) and mount in place with the ten Allen-head screws (30).

(13) Mount the left-side panel (32) using the eight flathead screws (33).

(14) Solder the two wires (28) to feedthrough capacitors (29).

(15) Place plug J1 (27) in position on rear gear plate (14) and secure with the two washers (26) and retaining rings (25).

(16) Replace the two binder-head screws (21), lock washers (22), and solder lugs (23) on the front lower edge of gear plate (24).

(17) Replace the three flathead screws (19) that secure the rear bottom edge of gear plate (14) to the block (20) between the gear plates, (block on which P1 plug is mounted).

(18) Replace two lock washers (18) and two binder-head screws (17) that secure the tube chassis to gear plate (14).

(19) Replace the top lock washer (16) and binder-head screw (15) that secure the left center bracket to gear plate (14).

(20) Replace the two flathead screws that secure the right center bracket (13) to gear plate (14).

(21) Place the rear panel (9) in position and secure with the thirteen flathead screws (10).

(22) Mount board (12) to bracket (13) using the three flathead screws (11).

(23) Mount plugs J5 and J8 to spectrum generator bracket (1) using the four screws (6), nuts (7), and lock washers (8).

(24) Replace the 4-kc spectrum generator bracket (1) by replacing the two flathead screws (2) in left side plate, one lock washer (4), one binder-head screw (3) in front, and one standoff (5) in front.

b. REPLACING SMO SUBASSEMBLIES.

Refer to figure 7-6 and proceed as follows:

(1) MASTER OSCILLATOR.

NOTE

Before replacing the master oscillator, turn the gear, in which the gear support tool is inserted, clockwise to the gear stop. At this point the slug rack should be all the way down (slugs all the way in).

(a) To replace the master oscillator (Mo), insert the shaft through the hole in the gear plate and mate the plug and jack. Hold in place with the shaft end, pressing the spring-loaded plunger of the gear support tool, and remove gear support tool.

(b) Secure the mo (16) to the gear plate with the two binder-head screws (15). Do not tighten smo clamp at this time.

(c) Place the gear support tool in its mounting clip at the rear left inside top corner of the smo.

(d) Replace tube V3 (20) and tube shield (19).

(2) INTERPOLATION OSCILLATOR.

Refer to figure 7-6 and proceed as follows:

(a) Turn the interpolation oscillator (6) shaft (7) clockwise to the low-frequency end stop.

(b) Carefully place the interpolation oscillator in place on the smo gear plate engaging the gear drive with the gear train and A5P1 (14) to J7 (13) being careful not to twist plug pins.

(c) Tighten the two captive mounting screws (11) in the interpolation oscillator (6).

(d) Connect the coaxial leads (8) to pin F of J8 (9) and pin D of J5 (10). Lace these two leads into the cable.

(3) I-F MIXER AND SIGNAL I-F AMPLIFIER AND 4-KC SPECTRUM GENERATOR.

Refer to figure 7-6 and proceed as follows:

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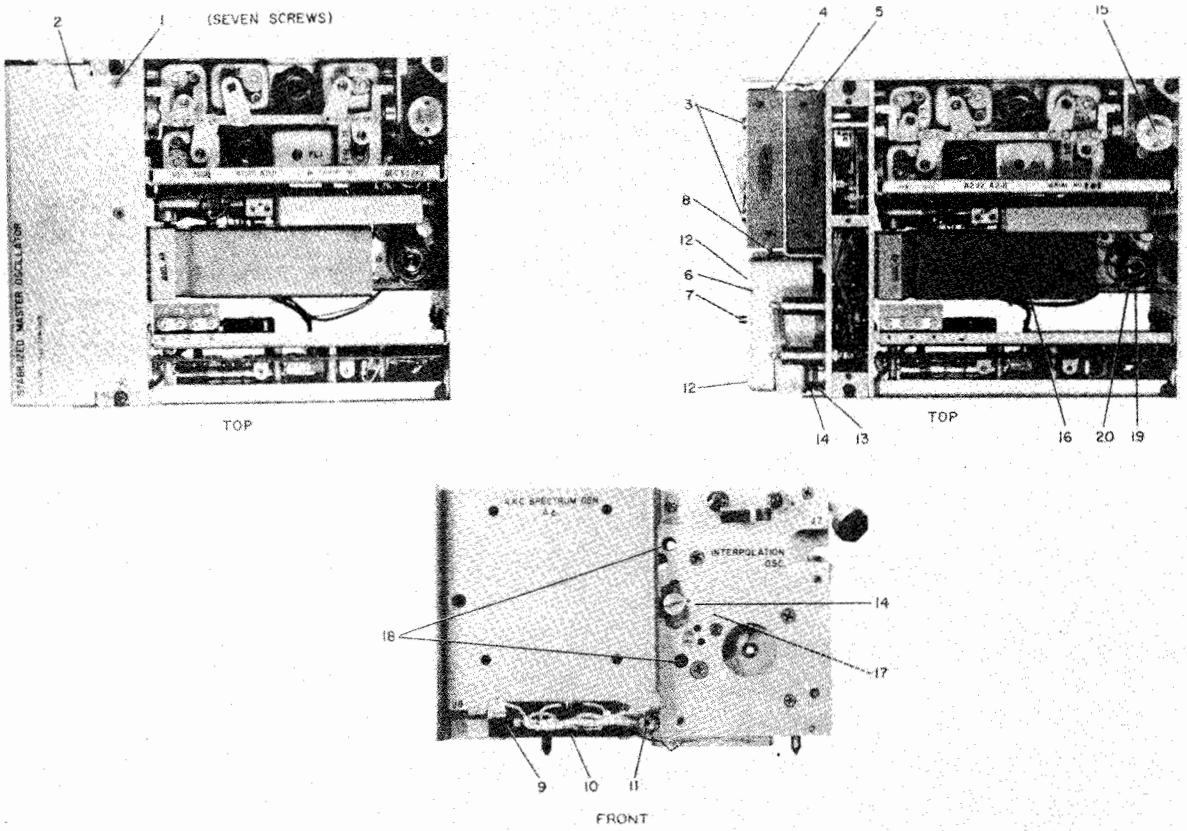

Figure 7-6. Stabilized Master Oscillator, Front and Top Views

(a) Carefully plug the i-f mixer and signal i-f amplifier (5) into place.

(b) Plug the 4-kc spectrum generator (4) into place, and secure the two assemblies with captive screws (3).

(4) TESTING SMO.

Refer to section VIII of this manual for testing and alignment procedures.

c. REPLACING FRONT PANEL.

(1) Swing the front panel into place; be careful not to damage the cable.

(2) Secure the front panel with the eight flathead screws.

(3) Place the BAND CHANGE and FREQUENCY CHANGE knobs on the shafts. (The large knob is the FREQUENCY CHANGE knob.) Tighten the setscrews in each knob; be careful not to let the knob set close enough to the panel to rub.

d. REPLACING SMO TUNER GEAR ASSEMBLY.

(1) Feed shaft from front panel assembly through bearing in smo tuner gear plate by rocking the smo tuner gear assembly back and forth slightly. Place belt drive gear over shaft with the belt in place on the gear. Feed shaft on through the belt gear and bearing on the rear SMO tuner gear plate. Do not tighten the setscrews in the belt gear at this time.

(2) Position the smo tuner gear assembly on the chassis and secure with one flat washer, lock washer, and binder-head screw that mount the small bracket to the chassis. Secure the two large brackets of the gear assembly to the chassis with the four flat washers, lock washers, and binder-head screws.

(3) Tighten the belt by loosening the screw in the block of the assembly, holding the idle belt gear and swinging the block to the position that will tighten the belt. At this point, tighten the screw in the block.

7-4. TESTING OF REFERENCE OSCILLATOR MODULE.

a. SCOPE. - This test procedure applies to the reference oscillator module which is used in Converter-Oscillator CV-731/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Vtvm	Hewlett-Packard 410B.
A-C Vtvm	Hewlett-Packard 400D.
Test oscillator	Hewlett-Packard 650A.
Oscilloscope	Tektronic Model 541.
Decade capacity box.	Cornel Dub. CDA-5.
Reference oscillator panel	Collins part no. 029-4474-123.
Frequency multiplier	Collins part no. 029-2214-123.
Special module cover	Collins part no. TR569-0538-00.
Frequency comparator	CM-126/UR (Collins 54Q-1).
Frequency standard.	100 kc.
Power supplies	100 to 150 v dc, 25 ma, unregulated, 27.5 v dc, 300 ma, unregulated, 6.3 v ac, 1.5 amp, unregulated.
100-kc output load	200-ohm carbon resistor in parallel with a 100-uuf capacitor.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

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Power supply voltages	130 v dc, 27.5 v dc, 6.3 v ac.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none.
Operational duty cycle	continuous.
Warmup period	15 minutes minimum.

d. PRELIMINARY TESTS.

(1) BANDWIDTH CHECK. - The following preliminary test is used to check the bandwidth of the frequency dividers.

(a) Install special module side cover. Jumper crystal Y1 to ground at L1. Plug module into reference oscillator test panel and turn on 115 v ac and 130 v dc. Connect the vertical input of the oscilloscope to junction of C11 and C12.

(b) Connect the test oscillator (TPA on test fixture) to the junction of C6 and R15 (Q6 base). Use input level of 0.1 v ac. Connect horizontal input of oscilloscope to the test oscillator output. Allow a minimum of 10 minutes warmup before proceeding with next step.

(c) Tune C26 and C11 for ±100 kc bandwidth on the first divider. The oscilloscope patter (5:1 Lissajous) should remain stable as the test oscillator frequency is varied from 2.9 mc to 3.1 mc.

(d) Connect the horizontal input of the oscilloscope to the 100-kc output. Tune C3(or a 6:1 Lissajous pattern. Vary the test oscillator frequency from 2.9 to 3.1 mc and adjust C17 and C30 so the oscilloscope pattern remains stable over this range.

(e) Set the test oscillator to 3.0 mc at a level of 0.1 v ac. Vary the B+ from 100 v dc to 150 v dc. If the oscilloscope pattern does not remain constant, repeat (c) and (d).

(f) Remove test voltages. Remove jumper from L1 to ground.

(2) SELECTING VALUE OF C38. - When C38 is installed at the factory, its value is determined by production test. When C38 is found defective, replace with the same value as the defective part. If the defective part is damaged beyond recognition, the following procedure is used to select the proper value.

(a) Connect decade capacity box (set to 470 uuf) in place of C38. Jumper crystal Y1 to ground at L1.

(b) Check bandwidth using procedure of paragraph 7.8d(1) above.

(c) Adjust the decade capacity box to obtain 1.0 v rms or more at the 100-kc output The value of C38 is normally in the range of 300 to 500 uuf and is usally 470 uuf. Replace C38 using value indicated on decade capacity box.

(d) Recheck bandwidth. Check for stable oscilloscope pattern as B+ is varied from 100 to 150 v dc. Remove test oscillator and the crystal ground and repeat stability check.

(3) SELECTING VALUE OF C20. When C20 is installed at the factory, its value is determined by production test. When C20 is found defective, replace with the same value as the defective part. If the defective part is damaged beyond recognition, the following procedure is used to select the proper value.

(a) Connect the decade capacity box (set to 7500 uuf) in place of C20 (from pin 6 of T3 to the +28 v dc). Connect the a-c vtvm across R12 (brown and green wires from oven). Turn on 28 v dc and allow a minimum of 10 minutes warmup.

(b) Adjust the decade capacity box for minimum voltage on a-c vtvm. Replace C20 using the value indicated on decade capacity box. The value of C20 will usually be from 6800 to 8200 uuf and is nominally 7500 uuf.

e. INITIAL ADJUSTMENTS.

(1) Install special cover and plug module into test fixture. Turn on 130 v dc and 28 v dc. The oven current should be more than 700 ma when cold.

f. TEST REQUIREMENTS. - Perform the following test procedures and record results on test data sheet (see table 7-1 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. Allow a minimum of 10 minutes warmup time before performing tests.

(1) OVEN OUTPUT VOLTAGE. - Measure the a-c oven voltage across terminals 4 and 6 of T3.

(2) COLLECTOR CURRENT. - Measure collector current.

(3) CRYSTAL FREQUENCY CALIBRATION. - Connect the 100-kc output to the frequency comparator. Adjust L1 until the 100-kc output is zero beat with the 100-kc frequency standard.

(4) 600-KC FREQUENCY DIVIDER.

(a) Connect the vertical input of the oscilloscope to the junction of C11 and C12 and horizontal input to the junction of C6 and R15. The 5:1 Lissajous pattern should remain stable as the B+ is varied from 100 to 150 v dc.

(b) Jumper crystal Y1 to ground at L1. Connect the test oscillator (TPA on test fixture) to the junction of C6 and R15 (Q6 base). Vary the test oscillator (0.1 v rms output) above 3.0 mc and not the frequency at which the scope pattern disappears. The difference between this frequency and 3.0 mc is the plus (+) bandwidth. Measure the minus (-) bandwidth by varying the test oscillator below 3.0 mc. Remove crystal ground and test oscillator.

(5) 100-KC FREQUENCY DIVIDER.

(a) Connect the vertical input to the oscilloscope to the junction of C11 and C12 and the horizontal input to the 100-kc output. The 6:1 Lissajous pattern should remain stable as the B+ is varied from 100 to 150 v dc.

(b) Repeat 7-8f(4)(b) above. Divider bandwidth frequency obtained in this step by 5 in order to obtain the frequencies appearing at the input to the 100-kc divider.

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TABLE 7-1. SAMPLE TEST DATA SHEET FOR REFERENCE OSCILLATOR MODULE

TEST DATA SHEET
for
REFERENCE OSCILLATOR MODULE OF CONVERTER-OSCILLATOR CV-731/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Oven output voltage	____ v dc	*NMT 10 v ac
Collector current	____ ma	8 ±2 ma
Crystal frequency calibration	____ parts in 10^7	±1 part in 10^7
600-kc frequency divider:		
Low and high voltage operation	____ OK	Steady 5:1 Lissajous
Plus bandwidth	____ kc	**NLT 100 kc
Negative bandwidth	____ kc	NLT 100 kc
100-kc frequency divider:		
Low and high voltage operation	____ OK	Steady 6:1 Lissajous
Plus bandwidth	____ kc	NLT 20 kc
Negative bandwidth	____ kc	NLT 20 kc
2.4-mc output	____ v ac	1.0 ±.5 v ac
100-kc output	____ v ac	1.5 ±.5 v ac
Line voltage coefficient	____ parts in 10^7	±2 parts in 10^7

*Not more than

**Not less than

(6) 2.4-MC OUTPUT. - Measure the output voltage at the 2.4-mc test point.

(7) 100-KC OUTPUT. - Measure the output voltage at the 100-kc test points.

(8) LINE VOLTAGE COEFFICIENT. - Vary the line voltage ±10 percent and measure the frequency change by comparing the 100-kc output of the module with the 100-kc frequency standard, using the frequency comparator.

7-5. TESTING OF ISOLATION AMPLIFIER.

a. SCOPE. - This test procedure applies to the isolation amplifier module which is used on Converter-Oscillator CV-731/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Vtvm	Hewlett-Packard 410B.
Reference oscillator test panel	Collins part no. 029-4474-123.
Frequency standard signal	100 kc, 1.30 v ac.
Power supplies	130 v dc, 240 ma, 6.3 v ac, 60 cps.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	130 v dc, 6.3 v ac.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none.
Operational duty cycle	continuous.
Warmup period	1-minute minimum.

d. PRELIMINARY TESTS. - The only preliminary test required is a visual inspection of the module.

e. INITIAL ADJUSTMENTS.

(1) Install the module in the reference oscillator test panel and apply 6.3 v ac and 130 v dc from the external power supply. Connect the 100-kc signal and adjust its level so that an indication of 1.30-v rms is measured at J1 on the module with the vtvm.

(2) Measure the signal voltage at J4 and adjust C5, C11, and C15 for a maximum indication.

(3) Measure the d-c voltage at J5 and adjust the external supply for 130-v d-c indication.

f. TEST REQUIREMENTS. - Perform the following test procedure and record results on the test data sheet((see table 7-2 for sample). Test limits are listed on test data sheet. Record model serial number on test data sheet.

(1) 2.4-MC OUTPUT. - Measure the signal voltage at J4 of the module.

(2) 100-KC OUTPUT. - Measure the signal voltage at TP1 on the test fixture.

TABLE 7-2. SAMPLE TEST DATA SHEET FOR ISOLATION AMPLIFIER MODULE

TEST DATA SHEET
for
ISOLATION AMPLIFIER MODULE OF CONVERTER-OSCILLATOR CV-731/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
100-kc input	_____ v ac	1.28 to 1.30 v ac
Adjust C5, C11, and C15	_____ OK	Maximum at J4
2.4-mc output	_____ v ac	1.5 to 2.0 v ac
100-kc output	_____ v ac	1.57 to 1.93 v ac

7-6. TESTING OF FREQUENCY DIVIDER MODULE.

a. SCOPE. - This test procedure applies to the frequency divider module which is used in Converter-Oscillator CV-731/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Vtvm	Hewlett-Packard 410B.
Test oscillator	Hewlett-Packard 650A (4-kc to 120-kc frequency range required).
Oscilloscope	DuMont 304H.
Electronic counter	Hewlett-Packard 522B (not required if test oscillator is calibrated to 0.1 percent).
Power supply	0 to 35 v dc at 30 ma
Reference oscillator test panel	Collins part no. 029-4474-123.
Resistors (one each)	1500 ohms, 1/2-watt carbon, 8200 ohms, 1/2-watt carbon, 330K ohms, 1/2-watt carbon.
Capacitors (one each)	.0047 uf paper .003 uf paper

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power source	27.5 v dc ±10 percent unregulated.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none required.
Operation duty cycle	continuous.
Warmup period	5 minutes minimum.

d. PRELIMINARY TESTS. - The only preliminary test required is a visual inspection of the module.

e. INITIAL ADJUSTMENTS.

(1) Connect a load consisting of a .0047-uf paper capacitor in series with a 1500-ohm resistor across the 4-kc output.

(2) Connect a load consisting of a .003-uf capacitor in parallel with an 8200-ohm resistor across the 1-kc output.

(3) Connect an input signal of 1.0 v ac at 100 kc ±1 percent to the divider.

f. TEST PROCEDURES. - Perform the following test procedures and record results on test data sheet (see table 7-3 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet.

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(1) COLLECTOR CURRENT.

(a) Measure collector current.

(2) DIVIDER OPERATION.

(a) Connect the oscilloscope X-axis to the 100-kc input (J1). Connect the Y-axis to the collector of transistor Q2 or Q3 (20 kc) through a series 330 K resistor. Check for steady 5:1 Lissajous pattern.

(b) Move X-axis oscilloscope lead to 4-kc output (J2). Check for steady 5:1 Lissajous pattern.

(c) Move Y-axis oscilloscope lead to 1-kc output (J3). Check for steady 4:1 Lissajous pattern.

(3) DIVIDER SYNCHRONIZING VOLTAGE.

(a) Connect the oscilloscope X-axis to the 100-kc input (J1). Connect the Y-axis to the collector of transistor Q2 or Q3 (20 kc) through a series 330 K resistor.

(b) Raise the 100-kc input voltage from 0 v ac, noting the level at which a steady 5:1 Lissajous pattern is obtained.

(4) DIVIDER OUTPUT.

(a) Return the 100-kc input signal to 1.0 v ac.

(b) Measure the 4-kc output (J2).

(c) Measure the 1-kc output (J3).

(5) DIVIDER OPERATION FOR SUPPLY VOLTAGE VARIATION.

(a) COMPARISON METHOD. - Connect the test oscillator to the 100-kc inputs of a reference divider (a frequency divider module having a known performance) and the frequency divider module under test. Connect the X-axis of the oscilloscope to the 1-kc output of reference frequency divider and connect the Y-axis of the oscilloscope to the 1-kc output of the test frequency divider. Raise the supply voltage from zero volts dc to determine the level at which a steady Lissajous pattern is obtained. Continue to raise the supply voltage to +35 v dc. Check for operation with no abrupt phase shifts over this supply variation. Return supply to 27.5 v dc.

(b) ALTERNATE METHOD WITHOUT REFERENCE FREQUENCY DIVIDER. - Connect the oscilloscope X-axis to the 100-kc input (J1) and the Y-axis to the 1-kc output (J3). Adjust the oscilloscope gain to obtain a well-defined portion of the 100:1 Lissajous pattern. Raise the supply voltage from zero volt dc to determine the level at which a steady 100:1 Lissajous pattern is obtained. Continue to raise the supply voltage to +35 v dc. Check for operation with no abrupt phase shifts over this supply variation. Return supply to 27.5 v dc.

(6) DIVIDER LOCK-IN RANGE. - The divider lock-in range is that region of frequency about the nominal divider frequency for which a steady Lissajous pattern is obtained between the input the the output.

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(a) Connect the oscilloscope X-axis to the 100-kc input (J1) and the Y-axis to the 1-kc output (J3). Adjust gain of oscilloscope to obtain a well-defined portion of the 100:1 Lissajous pattern.

(b) Raise the frequency of the input signal and note the highest frequency at which a steady 100:1 Lissajous pattern can be obtained.

(c) Lower the frequency of the input signal and note the lowest frequency at which a steady 100:1 Lissajous pattern can be obtained.

7-7. TESTING OF SIDESTEP OSCILLATOR MODULE.

a. SCOPE. - This test procedure applies to the sidestep oscillator module which is used in Converter-Oscillator CV-731/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Vtvm	Hewlett-Packard 410B.
Spectrum analyzer	Collins 478R-1.
Signal generator	Measurements Corp Model 82.
A-c vtvm	Hewlett-Packard 400D.

TABLE 7-3. SAMPLE TEST DATA SHEET FOR FREQUENCY DIVIDER MODULE

TEST DATA SHEET
FOR
FREQUENCY DIVIDER MODULE OF CONVERTER-OSCILLATOR CV-731/URC

SERIAL NUMBER _____ TEST LIMITS _____OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Collector current	_____ ma	25 ±5 ma
Divider operation:		
100- to 20-kc division	_____ OK	5:1 Lissajous
20- to 4-kc division	_____ OK	5:1 Lissajous
4- to 1-kc division	_____ OK	4:1 Lissajous
Synchronizing voltage	_____ v ac	*NMT 0.6 v ac
Divider output voltage:		
4-kc output	_____ v ac	**NLT 1.0 v ac
1-kc output	_____ v ac	NLT 1.0 v ac
Supply voltage variation:		
Steady pattern	_____ v dc	NMT 20 v dc
Operation to +35 v dc	_____ OK	Steady pattern
Lock-in range:		
Upper	_____ %	10% min
Lower	_____ %	10% min

*Not More Than

**Not Less Than

Sidestep oscillator test Panel . . .	Collins part no. 029-4326-123.
Power supplies	6.3 v ac, 60 cps, 600 ma 28 v dc, 76 ma (70 ma for relays) 130 v dc, 15 ma
Receiver	R-390/URR with attenuator calibrated against avc voltage for reading 0.5 to 1.0 v rms.
Dummy load	1700 ohms and 50 uuf with attenuator for receiver.

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c. TEST CONDITIONS - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	6.3 v ac ±5 percent, 28 v dc ±5 percent, 130 v dc ±5 percent.
Input signals:	
1-kc input	1 to 4 v rms.
2400-kc input	1.2 to 2.0 v rms.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none.
Operational duty cycle	continuous.
Warmup period	30 seconds minimum.

d. PRELIMINARY TESTS. - The only preliminary test required is a visual inspection of the module.

e. INITIAL ADJUSTMENTS.

(1) Insert module in sidestep oscillator test panel and apply power and signal voltages listed in 7-7c above. Check input current and relay operation.

(2) Adjust tuning of C21, L2, and T2 for maximum output. Then turn slug of L2 1/4 turn clockwise.

(3) The 2.4 mc output level should be adjusted to a value between 0.5 and 1.0 v rms by selecting the proper value of R15 (between 27k and 560k). It is perferable to keep the output near 1.0 v rms to allow for effects of attenuation caused by higher temperatures.

f. TEST PROCEDURES. - Perform the following test procedures and record results on test data sheet (see table 7-4 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet.

(1) INPUT CURRENT. - Record total input current for 130-v d-c line.

(2) SIGNAL OUTPUT LEVEL FOR ROOM AMBIENT. - Connect spectrum analyzer to output (receiver jack and test fixture). Record levels of the following frequencies noting correct sequence of crystal selection: 2.397 mc, 2.398 mc, 2.399 mc, and 2.400 mc. Also, record the highest level of the three unused spectrum points as shown on the data sheet. Compute levels in db relative to desired frequency level.

(3) SPURIOUS OUTPUT LEVEL. - Remove spectrum analyzer and connect receiver input to receiver jack on test fixture. Tune receiver to 1.035 mc for maximum agc reading on vtvm. Remove module from test fixture. Connect signal generator to input of test fixture through a 50-ohm load. (Input of test fixture is connected to ac vtvm.) Tune signal generator 1.035 mc for same agc reading obtained from module. Read ac vtvm. Compute db down and record. Repeat above procedure for 2.275 mc and 2.525 mc.

TABLE 7-4. SAMPLE TEST DATA SHEET FOR SIDESTEP OSCILLATOR MODULE

TEST DATA SHEET
FOR
SIDESTEP OSCILLATOR MODULE OF CONVERTER-OSCILLATOR CV-731/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Total plate current	___ ma	*NMT 12 ma
Signal output (room ambient):		
2.400-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	**NLT 55 db down
2.399-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	NLT 55 db down
2.398-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	NLT 55 db down
2.397-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undersired signal	___ db, ___ mc	NLT 55 db down
Spurious output:		
1.035 mc	___ db	NLT 50 db below
2.275 mc	___ db	2.4-mc level
2.525 mc	___ db	
High temperature test:		
2.400-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	NLT 55 db down
2.399-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	NLT 55 db down
2.398-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	NLT 55 db down
2.397-mc output:		
desired signal	___ v rms	0.5 to 1.3 v rms
undesired signal	___ db, ___ mc	NLT 55 db down
Noise measurement	___ OK	skirt spurious at least 50 db down

*Not More Than
**Not Less Than

(4) SIGNAL OUTPUT LEVEL FOR HIGH TEMPERATURE. - After the module has been exposed to a temperature of 60°C (140°F) for 30 minutes, perform procedure in 7-7f(2) above. The high temperature tests combine five separate tests into one fairly simple test; i.e., excessive drift of one of the crystals, excessive drift of the pass-band frequency in the mechanical filter pass band, drift in the tuned circuits and temperature sensitive transistors.

(5) NOISE MEASUREMENTS. - With the spectrum analyzer set for 30 cycles, 1/2 bandwidth, observe the skirts of each spectrum point for any spurious output that is not at least 50-db down from the main output level.

7-8 TESTING OF STABILIZED MASTER OSCILLATOR MODULE.

a. SCOPE. - This test procedure applies to the stabilized master oscillator module which is used in Converter-Oscillator CV-731/URC. Paragraph 7.8h covers the testing of the stabilized master oscillator module using the portable smo tester.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Vtvm	Hewlett-Packard 410B.
A-c vtvm	Ballantine 314 with probe.
A-c vtvm	Hewlett-Packard 400D with 1000 uuf bypass across terminals.
Signal generator	General Radio 1001A.
Electronic counter	Hewlett-Packard 524B.
Spectrum analyzer	Collins 478R-1.
Frequency monitor	R-390/URR.
Milliameter (2 required)	25 ma.
Stabilized master oscillator test panel	Collins part no. 029-4348-123.
Power supplies	130 v dc, 50 ma 12.6 v ac C.T., 60 cps, 1 amp 28 v dc unfiltered, 500 ma 27.5 v dc filtered, 60 ma 115 v ac, 60 cps, 500 ma

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	130 v dc ±10%, ripples less than 0.1% 12.6 v rms ±5%, 50-60 cps. 28 v dc ±10%, (full-wave rectified, no filter required). 27.5 v dc ±5%, ripple less than 0.1% 115 v rms ±10%, 50-60 cps.

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Ambient temperature . . . . . normal room ambient.

Ambient humidity . . . . . normal room ambient.

Operational duty cycle . . . . . continuous.

Warmup period . . . . . 15 minutes minimum.

d. PRELIMINARY TESTS.

(1) TUNING MECHANISM OPERATION. - Remove the interpolation oscillator. Loosen the clamps on the master oscillator. Check the mechanical end stops. Cam rider must be equidistant from peak of cam contour at each end of travel. Check slug rack for undesirable side or end play and proper vertical travel. When rack is at downward end of travel, spacing between lower edge or rack and lower edge of the chassis shall be 1/16 ±1/64.

(2) FILAMENT OPERATION. - Connect power supply and terminations to P1. Apply heater voltage and check all possible tube heaters.

(3) POWER SUPPLY VOLTAGE AND CURRENT. - Apply 115 v a-c and measure current. This current on the ON portion of the master oscillator heater cycle should be 380 ma ±10 percent; on the OFF portion of the master oscillator heater cycle the current should be approximately zero. The master oscillator heater will operate only below 30°C ±3° (86°F ±8.6°). Apply 130 v d-c and measure the total plate current drawn. This plate current should be 37 ma ±10 percent. Apply 28 v d-c unfiltered and measure the current during an ON period of the cycle. This current should be 385 mc ±10 percent. Apply the 27.5 v d-c filtered and measure the current required. This current should be 36 ma ±10 percent.

e. INITIAL ADJUSTMENTS.

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(1) MASTER OSCILLATOR POSITIONING. - Move the gear train by pushing gears with fingers to the low frequency end stop Ground the Signal AGC at A2J2. Couple the R390/URR to the master oscillator by clipping the antenna to the chassis. Set and lock master oscillator to 1.990 mc as indicated on the R-390/URR monitor. Advance master oscillator and gear train to the high frequency end stop and measure frequency. This frequency should be between 4.006 mc and 4.022 mc.

(2) INTERPOLATION OSCILLATOR INSTALLATION. - Set the master oscillator frequency to 3.006 mc. Connect the interpolation oscillator plug. Set the interpolation oscillator frequency to 597 kc. Monitor and maintain each oscillator to these frequencies as the interpolation oscillator is installed. After installation when the master oscillator is set accurately to 3.006 mc, the interpolation oscillator frequency should be 597 kc ±4 kc.

(3) FREQUENCY MULTIPLIER ALIGNMENT. - Master oscillator frequencies 2.206 mc and 3.806 mc. Align coils Z1 and Z2, using normal procedure for linear coils, and with Hewlett-Packard 410B measuring maximum -d-c voltage at test jack J3, record voltage. Align coil Z3 using normal procedure for linear coils, and with Hewlett-Packard 410B measuring a-c voltage at test jack J12, record voltage.

(4) 100-KC COIL TUNING. - Tune L3 for maximum a-c voltage at J2 as indicated on Hewlett-Packard 410B.

(5) ALIGNMENT OF 100-KC SPECTRUM COILS. - Use the standard procedure for alignment of linear coils with tracking points at 2.206 mc and 3.806 mc. Connect Hewlett-Packard 400D to pin A of J4 and tune Z4 and Z5 for maximum indication.

(6) I-F MIXER AND SIGNAL I-F AMPLIFIER. - After completion of paragraph (5) the stabilizing loop of the smo should function when the ground is removed from A2J2. With the unit in this condition, connect the Hewlett-Packard 400D to pin A of J4 (use 6-inch coaxial lead) and recheck the alignment of Z1, Z2, Z3, Z4, and Z5. Tune L1 and L4 of FL1 for maximum on the vtvm at a selected smo frequency of 3.806 mc. Lock and seal jam nuts. After alignment and tuning have been optimized, check the following. These voltages must meet the requirements indicated on the data sheet (table 7-5).

(a) Input to second mixer at pin L of J5 using the Ballantine 314 with probe (at 3.3 mc).

(b) Input to signal i-f amplifier at pin A of J4 using the Hewlett-Packard 400D (at 3.3 mc).

(c) Interpolation oscillator voltage at pin D of J5 (use 410B).

(d) Signal i-f amplifier AGC at A2J2 using d-c vtvm.

(7) 4-KC SPECTRUM GENERATOR AND REFERENCE I-F AMPLIFIER. - Check the following at the low, middle and high end of interpolation oscillator range. These voltages must meet the requirements as indicated on the data sheet.

(a) Reference i-f amplifier input signal at A7J1 using Hewlett-Packard 400D.

(b) Interpolation oscillator voltage at pin F of J8.

(c) Reference i-f amplifier AGC at A7J2.

f. TEST REQUIREMENTS.

(1) MASTER OSCILLATOR TEST. - Ground A2J2 and measure master oscillator frequency at 150-kc intervals from 2.00 to 3.95 mc. Check master oscillator frequency twice: once when the desired frequency is approached from the clockwise direction, and again from the counterclockwise direction. Record the larger error at each frequency. Measure output voltage across the 50-ohm output termination for every 400 kc from 2 to 4 mc.

(2) INTERPOLATION OSCILLATOR TEST. - Adjust the interpolation oscillator pads at the frequencies listed below:

A = 637 kc + 400

B = 617 kc + 400

C = 597 kc + 400

D = 577 kc + 400

E = 557 kc + 400

Check interpolation oscillator frequency at:

645 kc and 629 kc

625 kc and 609 kc

TABLE 7-5. SAMPLE TEST DATA SHEET FOR STABILIZED MASTER OSCILLATOR MODULE

TEST DATA SHEET
FOR
STABILIZED MASTER OSCILLATOR MODULE OF CONVERTER-OSCILLATOR CV-731/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Initial adjustments:		
multiplier grid bias (TP J3)	____ v dc	4 to 8 v dc
1st mixer injection (TP J12)	____ v rms	0.9 to 2.0 v rms
100-kc test point (TP J2)	____ v dc	-1.0 to -2.5 v dc
2nd mixer signal input (J5) (L)	____ mv	*NLT 15 mv
signal i-f ampl input (J4) (A)	____ mv	NLT 5 mv
3rd mixer interpolation oscillator voltage (J5) (D)	____ v rms	0.8 to 1.5 v rms
signal i-f ampl agc (A2J2)	____ v dc	**NMT 0.5 v dc
ref i-f ampl signal (A7J1)	____, ____, ____ mv	NLT 2.0 mv
4th mixer interpolation oscillator voltage (J8F)	____, ____, ____ v rms	1.0 to 1.5 v rms
ref i-f ampl agc (A7J2)	____, ____, ____ v dc	NMT 0.5 v dc

Master oscillator error and output:

freq.	error	output	freq	error	output	
2.006	____	____	3.056	____	X	error not to
2.156	____	X	3.206	____	____	exceed ±1100 cps
2.306	____	X	3.356	____	X	
2.406	X	____	3.506	____	X	output from
2.456	____	X	3.606	X	____	1.4 to 3.0 v rms
2.606	____	X	3.656	____	X	
2.756	____	X	3.806	____	X	
2.806	X	____	3.956	____	X	
2.906	____	X	3.9935	X	____	

Interpolation oscillator error:

637 kc	____ cps	+350 to +450 cps
597 kc	____ cps	
557 kc	____ cps	
Instability check:	____ OK	no instability
Low-voltage check:	____ OK	at 24.0 v dc

*Not less than
**Not more than

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TABLE 7-5. SAMPLE TEST DATA SHEET FOR STABILIZED MASTER OSCILLATOR MODULE (Cont)

TEST DATA SHEET
FOR
STABILIZED MASTER OSCILLATOR MODULE OF CONVERTER-OSCILLATOR CV-731/URC

TEST	TEST DATA		TEST LIMITS
Discriminator pull-in at 4.00 mc:			
MO error (kc)	freq discr	phase discr	freq discr pull-in:
-2.5	____ cps	_____ OK	0 to -100 cps
-2.0	____ cps	_____ OK	
0.0	____ cps	_____ OK	must phase lock
+1.5	____ cps	_____ OK	from +1.5 kc to
+2.0	____ cps	_____ OK	-2.0 kc
Stabilized master oscillator distortion:			
smo frequency (mc)	spurious (mc)	level (db)	
2.000	1.935	_____ db	NLT 55 db down
2.400500	2.400	_____ db	
3.000500	3.000	_____ db	
3.411250	3.411250 ±1.25 kc	_____ db	
3.455500	3.455500 ±0.5 kc	_____ db	
Meter operation:		_____ OK	NMT 100 ua

605 kc and 589 kc

585 kc and 569 kc

565 kc and 549 kc

These frequencies should be +350 to +450 cps. Record the interpolation oscillator frequency at positions 3, 13 and 23.

(3) INSTABILITY CHECK. - Set the frequency selector to 2.000 mc and let the stabilizing loop phase lock the master oscillator. Increase the 27.5 v dc, filtered, to 31.0 volts. Monitor the output of the smo with the R-390/URR receiver and determine whether the output signal has any undesired sidebands. The signal should be as clean with the 31.0 volts as with 27.5 volts.

(4) LOW-VOLTAGE CHECK. - Set the frequency selector to 3.300 mc and monitor the smo output frequency with the Hewlett-Packard 524B counter. Decrease the 27.5 v dc filtered to 24.0 and check for proper operation of the stabilizing loop.

(5) DISCRIMINATOR PULL-IN. - Set frequency selector to 4.000 mc. Unlock the stabilizing loop by grounding A2J2 and A7J1. Measure and note the master oscillator error at this point using the Hewlett-Packard 524B counter. Check the discriminator pull-in as follows:

(a) Set the master oscillator frequency to 4.000 mc ±20 cps using the master oscillator and point trimmer A1L2 after letting the frequency discriminator correct the new setting at least one time.

(b) Remove the ground from A2J2 and record the master oscillator frequency with a frequency lock only.

(c) Set the master oscillator frequency to 1.5 kc above 4.000 mc after letting the frequency discriminator correct the new setting at least one time. Remove the ground from A2J2 and record the master oscillator frequency with the frequency lock. Remove the ground from A7J1 and indicate on the data sheet whether the phase lock does occur.

(d) Repeat the above check at 2.0 kc above 4.0 mc and 2.0 and 2.5 kc below 4.0 mc. At each setting, let the frequency discriminator correct the new setting at least once before the final setting is made.

(e) Reset the master oscillator to zero error, let the discriminator correct once and then set the end point frequency noted at the beginning of this test.

(6) SPURIOUS MODULATION. - Connect the smo output to the 478R-1 distortion analyzer. With the frequency selector set at the following frequencies, measure and record the level of the indicated spurious modulation.

Desired Freq. (mc)	Spurious (mc)
2.000000	1.935000 (3 x 10)
2.400500	2.400000 (Side Step)
3.000500	3.000000 (Standard)
3.411250	3.411250 ±1.25 kc (Master Oscillator Crossover)
3.455500	3.455500 ±0.50 kc (Master Oscillator Crossover)

(7) METER OPERATION. - Note whether the meter (smo Correction Current) is indicating. The smo frequency might have to be changed to get a reading on the meter.

g. PORTABLE SMO TESTER. - The main function of the test fixture is to facilitate easy trouble shooting and alignment of the Stabilized Master Oscillator(smo) and its subassemblies.

(1) Meters M2, M3 and M4 are used in tuning the signal if. and discriminator with the board plugged into jack J2.

(2) Meters M2 and M3 may be used independently to test the discriminator circuit in the smo through the use of jacks J11, J12, J13 and J14 on the front panel and test leads.

(3) Meter M1 serves the same function as the panel meter on the exciter and is used to check mo calibration.

(4) Switch S2 is Tune-Operate switch.

(5) Switch S3 in the NORMAL position connects meters M2, M3 and M4 to jack J2 for use in tuning the discriminator of a reactor type smo.

(6) Switch S3 in the bias position removes the meters M2, M3 and M4 from jack J2 and applies bias to pin E to tune and check the discriminator from a vari-cap type smo.

(7) Switch S4 is the frequency selector for the sidestep module and is used to check the smo operation with changing sidestep injection. It may also be used to check the sidestep switching relays.

(8) Switch S5 in the external position is used to connect meters M2 and M3 to the front panel jacks for use in checking the discriminator circuit in the smo.

(9) Switch S5 in the NORMAL position removes the meters M2 and M3 from the front panel jacks and returns them to the internal fixture circuit for discriminator tuning.

(10) Switch S6 in the normal position applies the +130 v d-c supply to the smo. In the off position it is used to remove the +130 v d-c supply to the smo.

(11) Jack J1 is used to couple the 100-kc output to the electronic counter external standard.

(12) Jack J7 is used to connect the smo to the test fixture with the extension cable.

(13) Jack J8 is used to measure the smo output.

(14) Jack J9 is used to couple the smo output to the electronic counter.

(15) Jack J10 is used to inject an external 455-kc signal to signal i-f and discriminator board under test.

(16) Jack J15 is used to measure the signal i-f amplifier agc.

(17) Jacks J16 and J17 are used to measure the output from the bias type discriminator.

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h. TESTING OF STABILIZED MASTER OSCILLATOR MODULE USING PORTABLE SMO TESTER.

(1) SCOPE. - This test procedure applies to the stabilized master oscillator when tested in the portable stabilized master oscillator (smo) tester.

(2) TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Signal generator	Hewlett-Packard 606.
Vtvm	Hewlett-Packard 410B.
Electronic counter	Hewlett-Packard 524B.
A-c vtvm	Ballantine 314.
Vtvm	Kaylab 202A.
Power supplies	130 v dc 50 ma, 12.6 v ac c.t. 60 cps 1 amp, 28 v dc unfiltered, 500 ma, 27.5 v dc filtered, 60 ma, 115 v ac, 60 cps, 500 ma.

(3) TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	130 v dc ±10% ripple less than 0.1%. 12.6 v rms ±5% 50-60 cps. 28 v dc ±10% (full-wave rectified, no filter required). 27.5 v dc ±5%, ripple less than 0.1%. 115 v rms ±10%, 50-60 cps.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Operational duty cycle	continuous.
Warmup period	15 minutes minimum.

(4) STABILIZED MASTER OSCILLATOR ALIGNMENT.

(a) ALIGNMENT OF COILS Z1, Z2, Z3, Z4, Z5, AND L3.

1. Connect equipment as follows:

a) Connect electronic counter to jack J8 on smo tests.

b) Using extension cables connect stabilized master oscillator to jack J7 on smo tester.

c) Adjust stabilized master oscillator to 2.206 mc as indicated on the electronic counter.

d) Connect Ballantine Model 314 A-C VTVM between J5 pin L and ground.

e) Set switches on test panel as follows:

1) Power switch to ON.

2) +130 volt switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

NOTE

Switches not listed may be left in any position.

2. Adjust tuning slugs of coils for maximum indication on a-c vtvm. The vtvm should indicate between 15 and 30 mv.

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NOTE

FL1 may also be aligned at this time but is necessary only if replaced. Tighten jam nuts after tuning.

3. Set stabilized master oscillator to 3.806 mc as indicated on electronic counter. Adjust trimmers in the coils for a maximum indication on the a-c vtvm.

4. Repeat steps b and c until all coils track.

(b) ALIGNMENT OF SECOND AND THIRD MIXERS.

1. Connect equipment as follows:

a) Remove i-f mixer unit from stabilized master oscillator and connect it on extension card from jack J5.

b) Connect Ballantine Model 314 A-C VTVM between J4 pin A and ground.

c) Connect electronic counter (524B) to jack J8 on smo tester.

d) Set switches on test panel as follows:

1) Power switch to ON.

2) +130-switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

5) Adjust stabilized master oscillator to 2.209 mc as indicated on electronic counter.

2. Adjust A3T1 tuning core for maximum indication on a-c vtvm.

NOTE

A3F1 may also be aligned at this time but is necessary only if replaced or if A3V1 or A3V2 have been replaced.

(c) ALIGNMENT OF SIGNAL I-F AMPLIFIER WITH D-C AMPLIFIER TYPE DISCRIMINATOR.

1. Connect equipment as follows:

a) Remove signal i-f amplifier from stabilized master oscillator and plug it into jack J2 on smo tester.

b) Connect signal generator to jack J10 and set its frequency to 455 kc ±100 cps.

c) Connect vtvm 410B between ground and jack J15.

d) Set switches on test panel as follows:

1) Switch S3 - d-c amplifier.

2) Switch S5 - internal.

3) Switch S6 - OFF.

NOTE

Switches not listed may be left in any position.

2. ALIGNMENT PROCEDURE.

a) Adjust the level of the injected signal to a value that causes a slight decrease in agc voltage at A2J2 (point of agc threshold) and output current indication appears on the output meters.

NOTE

There are two possible tuning points on each transformer. Use the tuning point with the slug farthest into the coil.

b) Adjust A2R3 for mechanical center. Make sure that the oven has been on for at least five minutes, remove oven cover, adjust A2L1 for minimum indication on the meter M3, and adjust A2L2 for minimum on the meter M2. Repeat these adjustments twice.

c) Recheck the agc voltage, and if necessary, adjust the level of the injected signal to bring the agc voltage to just below threshold.

d) Adjust A2T1, A2T2, A2T3, and A2L3 for minimum agc voltage. Repeat at least once; then repeat adjustment of A2L1 and A2L2 in step 2.

e) Change the injection frequency to 465 kc, and adjust the level to obtain an indication on the meters M2 and M3.

f) Adjust A2L1 for maximum on the output meter M3. Adjust the injection level to keep this maximum below 8.0 milliamperes.

g) Change the injection frequency to 445 kc, and adjust A2L2 for maximum on the output meter M2. Adjust the injection level to keep this maximum below 8.0 milliamperes.

h) Repeat steps (5) (6) and (7) at least twice.

i) Set the injection frequency to 455 kc ±50 cps at a level of 10,000 microvolts. Adjust A2R3 for equal currents in the output meters M2 and M3. Use the zero-center meter M4 for the final adjustment of A2R3. The resulting currents on the output meters should be not more than seven milliamperes with the injection level set at 100,000 microvolts and not less than four milliamperes with the injection level set at 1000 microvolts. If the final currents (at balance) for 100,000 microvolts are greater than 7.0 ma, the tuning frequencies in steps 5) and 6) must be moved closer to 455 kc (447 and 463 kc) and the tuning procedure repeated until the final currents at balance are within the limits specified. Similarly, if the

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currents at balance for 1000 microvolts are less than 4 ma, the tuning frequencies must be moved farther from 455 kc (443 and 467 kc) and the tuning procedure repeated until the final currents at balance are within the limits specified.

j) Set injection to 457 kc at a level of 10,000 microvolts. Check for a difference reading of no less than 4 milliamperes between the two 0-25 milliammeters. Set injection to 453 kc at a level of 10,000 microvolts. Check for a difference reading of no less than 4 milliamperes. If difference of 4 milliamperes cannot be obtained, repeat steps 5), 6), and 7) with tuning frequency moved closer to 455 kc (447 kc and 463 kc).

(d) ALIGNMENT OF SIGNAL I-F AMPLIFIER WITH BIAS TYPE DISCRIMINATOR. (Used in Model B Stabilized Master Oscillator.)

1. Connect equipment as follows:

a) Remove signal i-f amplifier from stabilized master oscillator and plug it into jack J2 on smo tester.

b) Connect signal generator to jack 10 and set its frequency to 455 kc ±100 cps.

c) Connect VTVM 410B between jack J15 and ground.

d) Connect VTVM 202A across jacks J16 and J17.

e) Set switches on test panel as follows:

1) Switch S3 - bias discriminator.

2) Switch S6 - OFF.

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NOTE

Switches not listed may be left in any position.

2. SIGNAL I-F AMPLIFIER AND DISCRIMINATOR TUNING. (Bias type discriminator.)

a) Set the signal generator to 462.5 kc ±100 cps at 100 mv output. Connect the d-c vtvm to J16 (minus) and J17 (plus).

NOTE

There are two possible tuning points on each transformer. Use the tuning point with the slug farthest into the coil.

b) Adjust L1 for maximum positive indication on the d-c vtvm.

c) Set the signal generator to 447.5 kc ±100 cps at 10-mv output and adjust L2 for maximum negative indication on the d-c vtvm. Repeat steps b) and c).

d) Set the signal generator to 455 kc ±100 cps and reduce the output until the agc voltage (+dc at J15) is just below its maximum level (point of threshold).

e) Adjust A2T1, A2L3, A2L2 and A2T3 for minimum agc voltage, decreasing the signal generator output to maintain the agc voltage at threshold.

f) Repeat step e) at least once.

g) Repeat steps b) and c) above at least twice noting which peak is higher 447.5 or 462.5 kc.

h) Set the signal generator to 455 kc ±50 cps. The discriminator output as indicated on the d-c vtvm at J16 and J17 should now be no more than ±100 mv. If the unbalance is more than the above limit, adjust either L1 or L2 to obtain balance - whichever had the higher output as noted in step g) above.

i) Repeat step d) and check the tuning of T3 as indicated by the agc at J15.

(e) ALIGNMENT OF 4-KC SPECTRUM GENERATOR.

1. Connect equipment as follows:

a) Connect VTVM 410B between test jack A7J2 and ground.

b) Connect electronic counter (524B) to jack J8 on smo tester.

c) Set frequency of stabilized master oscillator at 2.200 mc as indicated on electronic counter.

d) Set switches on test panel as follows:

1) Power switch to ON.

2) +130-volt switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

NOTE

Switches not listed may be left in any position.

2. 4-KC SPECTRUM GENERATOR.

a) Adjust A6T1 for minimum agc voltage at A7J2.

b) Set smo frequency to 2.212 mc and note agc voltage at A7J2. If this voltage is not within 10 percent of the voltage noted in step a) adjust A6T1 for increase or decrease of A7J2. Repeat adjustment at 2.000 mc and 2.212 mc until the above limit is obtained.

NOTE

A6FL1 input and output tuning cores may also be adjusted for minimum agc at 2.210 mc. This is necessary only if A6FL1, A6T1 or A6V1 are replaced.

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(f) ALIGNMENT OF REFERENCE I-F AMPLIFIER.

1. Connect equipment as follows:

a) Remove reference i-f amplifier from stabilized master oscillator and connect it on extension card from J9.

b) Connect signal generator thru 0.1 uf and 1K ohm resistor in series to A7J1 and set it to 455 kc ±100 cps.

c) Connect vtvm 410B between test jack A7J2 and ground.

d) Set switches on test panel as follows:

1) Switch S6 - OFF.

NOTE

Switches not listed may be left in any position.

2. ALIGNMENT PROCEDURE.

a) Increase the amplitude of the injection signal until the agc voltage at A7J2 starts to decrease (point of agc threshold).

b) Adjust A7T1, A7L2 and A7T2 for minimum agc voltage at A7J2.

c) Repeat step b) decreasing the signal generator output to maintain the agc voltage at threshold.

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(g) ALIGNMENT OF INTERPOLATION OSCILLATOR.

1. Connect equipment as follows:

a) Connect electronic counter to jack J8 pin F on 4-kc spectrum generator.

b) Set interpolation oscillator to 645.4 kc as indicated on the electronic counter.

c) Set switches on test panel as follows:

1) Power switch to ON.

2) +130-volt switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

NOTE

Switches not listed may be left in any position.

2. ALIGNMENT PROCEDURE.

a) Set the interpolation oscillator at 645.4, 641.4, 637.4, 633.4 and 629.4 kc ±100 cps, and record the frequencies of the frequency counter. If the error at 645.4 kc is more or less than that at 629.4 kc, adjust A5L2 (through hole A in the interpolation oscillator cover) to divide the error evenly between these two points. Near zero error should occur at 633.4 kc.

b) Check the interpolation oscillator frequency for 625.4, 621.4, 617.4, 613.4, and 609.4 kc ±100 cps. If the error at 625.4 kc differs from that at 609.4 kc, adjust A5L7 (through hole B in the interpolation oscillator cover) to divide the error evenly between these two points. Near zero error should occur at 617.4 kc.

c) Check the interpolation oscillator frequency for 605.4, 601.4, 597.4, 593.4, and 589.4 kc ±100 cps. If the error at 605.4 kc differs from that at 589.4 kc, adjust A5L12 (through hole C in the interpolation oscillator cover) to divide the error evenly between these two points. Near zero error should occur at 597.4 kc.

d) Check the interpolation oscillator frequency for 585.4, 581.4, 577.4, 573.4, and 569.4 kc ±100 cps. If the error at 585.4 kc differs from that at 569.4 kc, adjust A5L17 (through hole D in the interpolation oscillator cover) to divide the error evenly between these two points. Near zero error should occur at 577.4 kc.

e) Check the interpolation oscillator frequency for 565.4, 561.4, 557.4, 553.4, and 549.4 kc ±100 cps. If the error at 565.4 kc differs from that at 549.4 kc, adjust A5L22 (through hole E in the interpolation oscillator cover) to devide the error evenly between these two points. Near zero error should occur at 557.4 kc. Recheck the interpolation oscillator frequency at 645.4 kc.

(h) ALIGNMENT OF FREQUENCY DISCRIMINATOR BALANCE. (D-c Amplifier Type Discriminator.)

1. Connect equipment as follows:

a) Remove signal i-f amplifier from stabilized master oscillator and connect it to extension card from jack J4 of stabilized master oscillator.

b) Connect electronic counter to jack J8 on smo tester.

c) Adjust stabilized master oscillator to 4.0 mc as indicated on the electronic counter.

d) Set switches on test panel as follows:

1) Power switch to ON.

2) +130-volt switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

NOTE

Switches not listed may be left in any position.

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2. ALIGNMENT PROCEDURE. - Adjust interpolation oscillator to 645.4 kc ±50 cps. With A2J2 grounded, note master oscillator error. Adjust master oscillator frequency to 4.000 mc +20, -0 cps using A1L2. Ground A7J2. Remove the ground from A2J2 and note master oscillator error from 4.000 mc. This error should be -50 cps. If not, adjust A2R3 until the master oscillator with frequency lock is 4.000 mc -50 cps. Remove the ground from A7J2 and the smo should phase lock to 4.000 mc. Ground A2J2 and set mo error as noted before adjustment of A1L2.

NOTE

If A2R3 after adjustment is more than ±450 from mechanical center the discriminator must be retuned.

(i) ALIGNMENT OF MASTER OSCILLATOR.

1. Connect equipment as follows:

a) Connect electronic counter to jack J8 on smo tester.

b) Set stabilized master oscillator to 2.0 mc as indicated on electronic counter.

c) Set switches on test panel as follows:

1) Power switch to ON.

2) +130-volt switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

NOTE

Switches not listed may be left in any position.

2. ALIGNMENT PROCEDURE - Turn smo through its frequency range (2-4 mc) observing afc meter on front panel of tester. Note the amount of deflection of the meter from zero (center scale). If the interpolation oscillator is sitting in the proper position with respect to the mo, the average deflection either side of zero should be equal across the band. If the average deflection is concentrated to one side or the other the mo should be disengaged by loosening mo shaft gear. Turn shaft of mo slightly (as in ±) in the direction that causes the afc meter to move in the direction for balance. That is, if the average deflection is concentrated to the right, turn the mo shaft so that the meter deflection moves to the left. Tighten mo shaft gear clamp and recheck afc deflection across band. If at any point across the frequency range of the smo, the afc meter indicates 80 microamperes or more, loosely couple a communications receiver to the smo output (J13). Turn the interpolation oscillator shaft to change the smo frequency. Distinct frequency steps should be heard (500-cps increments). If the steps are not distinct or tend to warble, this indicates that the smo is not phase locking at this point. Loosen mo shaft gear clamp, and turn mo in a direction to decrease reading of afc meter a few microamperes. Tighten clamp and listen to the smo output around this point again. Repeat until distinct 500-cps steps are heard in the smo output. Recheck the afc meter excursions across the rest of the band.

(j) ALIGNMENT OF PHASE DISCRIMINATOR BALANCE. (Bias type discriminator.) This is the type used in stabilized master oscillator model B.

1. Connect equipment as follows:

a) Remove signal i-f amplifier from stabilized master oscillator and connect extension card from jack J4 to signal i-f amplifier.

b) Connect electronic counter to jack J8 of smo tester.

c) Set stabilized master oscillator to 4.0 mc as indicated by electronic counter.

d) Set switches on test panel as follows:

1) Power switch to ON.

2) +130-volt switch to ON.

3) Sidestep switch to first position.

4) Switch S5 to jacks.

NOTE

Switches not listed may be left in any position.

2. ALIGNMENT PROCEDURE.

a) Ground A2J2 and note the mo error.

b) Ground A7J1 and note whether or not a change in mo error occurs.

c) If a change in mo error occurs, remove the ground from A7J1 and adjust A2T4 until the mo error remains the same with A7J1 grounded or ungrounded.

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7-9. TESTING OF R-F TUNER MODULE.

a. SCOPE. - This test procedure applies to the r-f tuner module which is used in Converter-Oscillator CV-731/URC.

b. DEFINITIONS.

(1) LOW-FREQUENCY ALIGNMENT POINT. - The low-frequency alignment point corresponds to the following signal and injection frequencies.

band	signal	injection
1	1.9 mc	2.2 mc
2	4.1 mc	2.2 mc
3	8.5 mc	2.2 mc
4	17.3 mc	2.2 mc

(2) HIGH-FREQUENCY ALIGNMENT POINT. - The high-frequency alignment point corresponds to the following signal and injection frequencies:

band	signal	injection
1	3.5 mc	3.8 mc
2	7.5 mc	3.8 mc
3	14.9 mc	3.8 mc
4	30.1 mc	3.8 mc

c. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Vtvm	Hewlett-Packard 410B
A-c vtvm	Ballantine 300
Multimeter	Triplett 630
Signal generator	Measurements Corp. Model 82 (with 60-db attenuator, 802H3)
50-ohm dummy load	Bird Model 80M
Dial gauge	1.0-inch range calibrated in .001-inch increments.
Radio receiver	R390/URR.
R-f tuner test panel	Collins part no. 029-2312-124.
Slug rack positioning device	Collins part no. 029-0340-00.
Power supplies	250 v dc, 45 ma 130 v dc, 50 ma 28 v dc 6.3 v ac, 50 to 60 cps.

d. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	250 v dc ±10%, ripples less than 0.1% 130 v dc ±10%, ripples less than 0.1% 28 v dc ±10%, (full-wave rectified, no filter required). 6.3 v ac, 50 to 60 cps.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.

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Shielding and isolation . . . . . module shielded from stray fields.

Operational duty cycle . . . . . continuous.

Warmup period . . . . . 5 minutes minimum.

e. PRELIMINARY TESTS.

(1) FILAMENT OPERATION. - Connect cables to P1 and P2 of the r-f tuner module. Apply power. Plate current drain under maximum gain conditions in either transmit or receive should be approximately 50 milliamperes. The transmit output amplifier tube should draw approximately 45 milliamperes in the transmit position only.

(2) BAND SWITCH OPERATION. - Switch band switch and observe incremental positioning of the rotary switches in the chassis. Switching from 1 to 2 to 3 to 4 should cause rotor contacts to move from one contact to the next through about 20 degrees of rotation. Switching from 4 to 3 to 2 to 1 should cause rotor contacts to rotate through approximately 160 degrees.

(3) MECHANICAL ALIGNMENT OF R-F SLUG RACK.

(a) Mount the slug rack positions (Collins part no. 029-0340-00) by use of the two captive screws. Pull the "stop pin" and rotate the jig handle ccw. Insert the "stop pin" and rotate the jig handle CW until the lower dowel pin is encountered. Push the lug rack against its lower mechanical end stop. Tighten the Bristo screw on the clamp of the positioning jig.

(b) The low end alignment point is reached by pulling the "stop pin" and rotating the jig handle cw until the "stop pin" can be inserted between the lower two dowel pins.

(c) The high end alignment point is reached when the "stop pin" is against the bottom edge of the top dowel pin.

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f. INITIAL ADJUSTMENTS.

(1) ALIGNMENT PROCEDURE.

(a) Rotate the band switch on the test rack to band 1. Rotate TRANSMIT-RECEIVER switch to TRANSMIT and the REC. RF GAIN, REC. AGC and the EXC. TGC control to zero (maximum clockwise rotation).

(b) Connect signal generator output to the EXCITER INPUT connector on the test rack. Terminate the EXCITER OUTPUT connector in 50 ohms.

(c) Set the signal generator to 300 kc. Check the frequency accuracy with the R-390/URR receiver. Calibration accuracy should be within plus or minus 500 cps.

(d) Adjust all the variable capacitors inside the transformer cans midway between maximum and minimum capacitance. This is done by adjusting all the trimmers in the straight slotted cans so that the screwdriver slots are straight across the unit, and adjusting all the trimmers in the T-slotted cans so the screwdriver slots are parallel with the chassis.

NOTE

It is important that the circuits are aligned in the order listed.

(e) Position the slug rack to the low end alignment point. Adjust the VFO to 2.2 mc.

(f) Place the r-f probe in J14 and adjust Z25 slug for maximum output. (about 40v)

(g) Place thr r-f probe in R-390/URR and select band 2. There should be 1-1/2 volts at this point. Select band 3 and adjust Z27 for slug for maximum output.

(h) Select band 4 and adjust Z26 for slug for maximum output and then adjust the upper trimmer in Z27 for maximum output. (about 0.6 v)

(i) Place the probe in J11 and select band 2. Adjust Z28 for maximum output (about 1-1/2 volts). Select band 3 and adjust the top trimmer of Z28 for maximum output (about 2.0 v).

(j) Select band 4 and adjust Z29 and Z30 slugs for maximum output (about 3.0 v).

(k) Select band 1. Tune R-390/URR to 1.9 mc and attach the antenna to the exciter output. Tune slugs of Z21, Z14, Z6, Z5, Z4, Z3, Z2 and Z1 for maximum indication on the "S" meter of the 51J backing off the 300-kc input as necessary.

(l) Select band 2. Tune R-390/URR to 4.1 mc. Tune the slugs of Z22, Z20, Z19, Z18, Z15, Z8, Z7 and T1 for maximum indication on the "S" meter of the R-390/URR backing off the 300-kc input as necessary.

(m) Select band 3. Tune R-390/URR to 8.5 mc. Tune the slugs of Z23, Z16, Z10 and Z9 for maximum indication on the "S" meter of the 51J backing off the 300-kc input as necessary.

(n) Select band 4. Tune R-390/URR to 17.3 mc. Tune the slugs of Z24, Z17, Z13, Z12 and Z11 for maximum indication on the "S" meter of the R-390/URR backing off the 300-kc input as necessary.

(o) Select band 1. Remove the R-390/URR. Connect the 410B r-f probe across the 50-ohm termination (on the Exciter output). Increase the 300-kc input until an output of 1.5 v is noted on the 410B. Tune the slugs of Z21, Z14, Z6, Z5, Z4, Z3, Z2, and Z1 for maximum output.

NOTE

Decrease the 300-kc input as necessary to keep the output below 2.0 v throughout the alignment procedure.

(p) Select band 2. Tune the slugs of Z22, Z20, Z19, Z18, Z15, Z8, Z7, and T1 for maximum output. Turn the unit over and adjust C25 for maximum output.

(q) Select band 3. Tune the slugs of Z23, Z16, Z10 and Z9 for maximum output.

(r) Select band 4. Tune the slugs of Z24, Z17, Z13, Z12 and Z11 for maximum output.

The exciter output on all four bands should be 2.0 volts with less than 1000-uv input.

(s) Select band 1. Switch to receive and move the signal generator output from exciter in to the receiver antenna. Tune the R-390/URR to 1.9 mc and connect its antenna to the tuner chassis. Tune the signal generator to 1.9 mc and adjust the attenuator for -1 v dc of agc. Tune T2 for maximum agc.

The agc should be -1 v dc or more (above the no signal level) with an input of 5 uv.

NOTE

T-2 tunes extremely broad.

Connect signal generator output to the exciter input and set the frequency to 300 kc.

(2) TRACKING PROCEDURE.

(a) Select the high end alignment point. Change vfo on rack to 3.8 mc. Tune coils in order listed.

(b) Switch to band 1 and maintain probe across the output load. Note output reading for a reference. Rotate capacitor in Z21 until the output indication peaks and drops back to the reference value. Adjust the core for maximum indication. Repeat this procedure with Z14, Z6, Z5 Z4, Z3, Z2 and Z25. Hold output level below 3.0 volts a-c.

(c) Switch to band 2 and repeat tuning procedure with Z22, Z20, Z19, Z18, Z15, Z8 and Z7.

(d) Switch to band 3 and repeat tuning procedure with Z23, Z16, Z10, Z9 and Z28.

(e) Switch to band 4 and repeat tuning procedure with Z24, Z17, Z13, Z12, Z11, Z30, Z29, Z26 and Z27.

(f) Select the low frequency alignment point. Change vfo to 2.2 mc. Switch to band 1 and note output for a reference. Rotate the core in Z21 until the output indication peaks and then drops back to the referenced value. Then adjust the capacitor for maximum indication. Repeat this procedure with Z14, Z6, Z5, Z4, Z3, Z2, Z1 and Z25.

(g) Switch to band 2 and repeat with Z22, Z20, Z19, Z18, Z15, Z8 and Z7.

(h) Switch to band 3 and repeat with Z23, Z16, Z10, Z9 and Z28.

(i) Switch to band 4 and repeat with Z24, Z17, Z13, Z12, Z11, Z30, Z29, Z27 and Z26.

(j) Switch back to band 2 and adjust bottom capacitor in Z28 for a maximum a-c output at the h-f mixer (V3) cathode test point J11.

(k) Repeat procedures 7-9f(2)(a) through (j) until satisfied that no further improvement in tracking can be obtained.

(l) Select the high frequency alignment point. Switch to band 3. Tune bottom capacitor in Z27 for maximum output at test point on HF MIXER cathode J11.

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(m) Switch to band 1. Place a-c vtvm probe across 50-ohm output termination. Apply 300-kc signal to exciter input. Adjust T1 for maximum output.

g. TEST REQUIREMENTS. - Perform the following test procedures and record results on test data sheet (see table 7-6 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet.

(1) INJECTION VOLTAGES.

(a) Place probe of the a-c vtvm in the L-F MIXER (V1) cathode test point J9 and record the voltage at the low and high end of the band.

(b) Place probe into the H-F MIXER (V3) cathode test point J11 and record the voltage at the low and high end of each of the four bands.

(2) RECEIVE TUBE BIAS VOLTAGE. - Place probe of the vtvm into the grid test points of each of the three receive tubes V7-J10, V3B-J12 and V8-J13, and measure the d-c voltage when the REC. TRANS. switch is placed in the TRANSMIT position. Check for zero voltage in the RECEIVE position. Repeat the measurement with the probe on the grid of V1B.

(3) TRANSMIT GAIN. - Switch to transmit. Connect signal generator to Exciter Input and tune to 300 kc. Select the high end alignment point. Record the input required to produce 2.0 volts a-c across the 50-ohm termination on each band. Select the low end alignment point and repeat.

(4) TRANSMIT GAIN CONTROL. - Select the low end alignment point and switch to band 1. Record the input required to provide 2.3 volts a-c across the transmit load. Adjust the tgc control on the panel for a -7 volts d-c at the tgc test point. Measure and record the input required to produce the 2.3 v output.

(5) TRANSMIT SELECTIVITY. - Select the high end alignment point. Set the tgc to zero by turning control in maximum clockwise position. Adjust signal generator to provide 2.0 volts of r-f tuner output for a reference. Couple the R-390/URR receiver antenna to the tuner chassis. Measure the 3-db bandwidth by increasing the signal generator output by 2 and tuning each side of the channel frequency until the reference output is obtained. Measure the change in the i-f frequency with the R-390/URR receiver. Repeat for each band. Select the low end alignment point and measure bandwidth on each band again.

(6) RECIEVER GAIN. - Set REC.-TRANS. switch to receiver position, the band switch to band 1 and select the low end alignment point. Connect generator to the RECEIVER INPUT and tune to 1.9 mc. Adjust attenuator to provide -1 v d-c agc above the "no signal" level and record. Repeat for bands 2, 3, and 4. Select the high end alignment point and repeat measurements for all four bands.

(7) RECEIVER RF GAIN CONTROL. - Select the low end alignment point and set the band switch to band 1. Tune signal generator to 1.9 mc and measure input required to produce a -2 v d-c agc reading at the if. Rotate REC. RF GAIN control to maximum counterclockwise position. Measure and record input required to obtain the -2 v d-c reference voltage.

(8) RECEIVER AGC. - With band switch on band 1, select the low end alignment and set the RF GAIN for maximum gain, measure input required to obtain a -2 v d-c agc reading on if. Rotate RECEIVER AGC control on test panel counterclockwise until -10 v d-c is applied to the tuner. Measure and record the input required to obtain the -2 v d-c reference voltage.

TABLE 7-6. SAMPLE TEST DATA SHEET FOR R-F TUNER MODULE

TEST DATA SHEET
FOR
R-F TUNER MODULE OF CONVERTER-OSCILLATOR CV-731/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Injection voltages:		
i-f mixer injection:		
low end of slug rack	____ v rms	*NLT 2.0 v rms
high end of slug rack	____ v rms	NLT 2.0 v rms
h-f mixer injection:		
band 1 (high end and	____ v, ____ v	0 v rms
band 2 low end of	____ v, ____ v	NLT 1.0 v rms
band 3 slug rack)	____ v, ____ v	NLT 1.5 v rms
band 4	____ v, ____ v	NLT 1.5 v rms
Receive tube bias voltage:		
transmit position:		
V1B	____ v dc	NLT 88 v dc
V7 (test point (J10)	____ v dc	
V3B (test point J12)	____ v dc	
V8 (test point J13)	____ v dc	
receiver position:		
V1B	____ v dc	**NMT ±1 v dc
V7 (test point J10)	____ v dc	
V3B (test point J12)	____ v dc	
V8 (test point J13)	____ v dc	
Transmit gain: (input for 2.0-v output)		
low end of tap switch		
band 1	____ mv	NMT 1.0 mv rms
band 2	____ mv	
band 3	____ mv	
band 4	____ mv	
high end of tap switch:		
band 1	____ mv	NMT 8.0 mv rms
band 2	____ mv	
band 3	____ mv	
band 4	____ mv	

*Not Less Than
**Not More Than

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TABLE 7-6. SAMPLE TEST DATA SHEET FOR R-F TUNER MODULE (Cont)

TEST	TEST DATA	TEST LIMITS
Transmit gain control: (band 1 input for 2.3-v output)		
A. input with 0 v dc tgc	_____ v rms	
B. input with -7 v dc tgc	_____ v rms	
ration of B/A		10 ±5
Transmit selectivity: (3 db bandwidth)		
band 1 (high and low end)	_____ kc, _____ kc	NLT ±8 kc
band 2	_____ kc, _____ kc	NLT ±8 kc
band 3	_____ kc, _____ kc	NLT ±10 kc
band 4	_____ kc, _____ kc	NLT ±10 kc
Receiver gain: (input for -1 v dc agc)		
band 1 (high and low end)	_____ uv, _____ uv	NMT 4 uv rms
band 2	_____ uv, _____ uv	NMT 4 uv rms
band 3	_____ uv, _____ uv	NMT 5 uv rms
band 4	_____ uv, _____ uv	NMT 6 uv rms
Receiver r-f gain control: (band 1 input for -2 v d-c agc)		
A. maximum r-f gain	_____ uv	
B. minimum r-f gain	_____ uv	
ratio of B/A		1500 to 2200
Receive agc: (band 1 input for -2 v d-c agc)		
A. agc control maximum cw	_____ uv	
B. agc set to -10 v	_____ uv	
ratio of B/A		100 to 200
Receive selectivity: (3 db bandwidth)		
band 1 (high and low end)	_____ kc, _____ kc	NLT ±8 kc
band 2	_____ kc, _____ kc	NLT ±8 kc
band 3	_____ kc, _____ kc	NLT ±10 kc
band 4	_____ kc, _____ kc	NLT ±10 kc
Receive sensitivity: (S/N ratio for 2-uv input)		
band 1 (high and low end)	_____ db, _____ db	NLT 10 db
band 2	_____ db, _____ db	
band 3	_____ db, _____ db	
band 4	_____ db, _____ db	

(9) RECEIVE SELECTIVITY. - Select the low frequency alignment point, and set the agc control on the test panel to zero, (maximum clockwise position). Place a-c vtvm on the link coupling the 300-kc tuner output to the 300-kc if module. Adjust signal generator to produce about 0.5 v a-c reference. Loosely couple the R-390/URR receiver to the variable i-f tube, V7, and tune to the 1.9-mc i-f frequency. (Set input exactly on frequency: do not tune for peak.) Measure the 3-db bandwidth by increasing the generator output by 2 and tuning each side of the channel frequency until the reference output is obtained. Repeat for other three bands. Select the high end alignment point and repeat.

(10) RECEIVER SENSITIVITY (AM). - Select the high end alignment point and modulate the signal generator 30 percent with the 1000-cps modulating frequency and adjust generator attenuator for a 2-microvolt output. Switch the modulation on and off and note the difference in audio output as measured with the a-c voltmeter. The difference in output with and without modulation is the signal plus noise-to-noise ratio and is expressed in db. Repeat for the other three bands. Select the low end alignment point and repeat.

7-10. TESTING OF USB I-F/A-F AMPLIFIER MODULE AND LSB I-F/A-F AMPLIFIER MODULE.

a. SCOPE. - This test procedure applies to the USB i-f/a-f amplifier module and the LSB i-f/a-f amplifier module which are used in Amplifier-Converter-Modulator AM-2064/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

I-f/a-f amplifier test panel	Collins part no. 029-4318-123.
Output meter	Daven OP-182
Distortion analyzer	Hewlett-Packard 330B
Signal generator	Measurements Corp 65B
Vtvm	Hewlett-Packard 410B
Oscilloscope	DuMont 208B
Frequency counter	Hewlett-Packard 522B
Audio oscillator	Hewlett-Packard 200AB

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Line voltage	115 v, 60 cps
Ambient temperature	normal room ambient
Ambient humidity	normal room ambient
Operational duty cycle	continuous
Warmup period	30 seconds minimum
Standard input	reinjected carrier, 2.5 v rms at 300 kc LSB input signal, 100 uv at 301.5 kc USB input signal, 100 uv at 298.5 kc
Audio output load.	150 ohms
Audio output	20 mw

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d. PRELIMINARY TESTS.

(1) Rotate i-f gain control (R1 on module) clockwise until it is against the stop.

(2) Connect module to i-f/a-f amplifier test panel and apply power. Note that audio current does not exceed 50 ma.

e. INITIAL ADJUSTMENTS.

(1) Inject standard input signal and carrier. Disable Agc at J2 and connect a-c vtvm to J1. Tune L1 and T1 for maximum output. Unground Agc and connect d-c vtvm to J2. Tune T4 for maximum agc voltage.

(2) Adjust i-f gain control (R1 on module) counterclockwise until agc voltage at J2 is minus one volt.

(3) Check voltage at gated Agc output. It should be 1.0-1.5 volts negative.

f. TEST REQUIREMENTS. - Perform the following test procedures and record results on the test data sheet (see table 7-7 for USB module sample and table 7-8 for LSB module sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. Allow a minimum of 30 second warmup time before performing tests.

(1) AUDIO OUTPUT. - Inject standard sideband and carrier signals and record audio output with audio gain control set for maximum output. Ground Agc at J2 and increase input signal until audio clipping level is reached. Record audio output.

(2) SELECTIVITY. - Disable agc by grounding at J2. Inject standard carrier and signal and note detector output at J1. Increase the input 1000 time (60 db) and tune the signal generator above and below the center frequency until the reference detector output voltage is obtained. Record the upper and lower 60-db frequencies.

(3) OVER-ALL AUDIO RESPONSE. - Apply standard carrier and adjust standard input signal to produce 1500-cps output. Using output at 1500 cps as a reference, vary input signal frequency to produce output from 400 to 3000 cps and record maximum plus and minus deviations from the reference value. Record peak-to-valley ratio in db.

(4) AUDIO DISTORTION. - Using 20-mw output at 1500 cps as a reference, record over-all audio distortion as output frequencies of 400 to 3000 cps.

(5) HUM AND NOISE LEVEL. - Inject standard carrier and input signal. Disable agc and note audio output. Remove the input signal and record the decrease in audio output.

(6) AGC CHARACTERISTICS. - Inject standard carrier and sideband signals. Record agc voltage. Using 20-mw output as a zero-db reference, increase the input in 20-db steps to 1.0 volt and record the agc voltage and audio output in db at each input level.

(7) SIDETONE AUDIO GAIN. - Inject standard signal and carrier and adjust audio gain control for 20-mw output at 1500 cps. Remove input signal and inject 1500-cps audio signal at sidetone input. Record sidetone input necessary to give 20-mw output.

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TABLE 7-7. SAMPLE TEST DATA SHEET FOR USB I-F/A-F AMPLIFIER MODULE

TEST DATA SHEET
FOR
USB I-F/A-F AMPLIFIER MODULE OF
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST		TEST DATA	TEST LIMITS
Audio output:			
with standard input		_____ mw	*NLT 40 mw
maximum audio output		_____ mw	NLT 200 mw
Selectivity:			
upper 60 db frequency		_____ kc	**NMT 301.0 kc
lower 60 db frequency		_____ kc	NMT 293.5 kc
Over-all audio response:			
maximum increase		_____ db	NMT 3 db
maximum decrease		_____ db	NMT 3.5 db
total deviation		_____ db	NMT 4 db
Audio distortion:			
400 cps		_____ %	NMT 5%
3000 cps		_____ %	NMT 5%
Hum and noise level:			
decrease in output		_____ db	NMT 35 db
Agc characteristics:			
input level	agc voltage	audio output	
100 uv	_____v dc	0 db	NMT 10 db
1000 uv	_____v dc	_____ db	
10,000 uv	_____v dc	_____ db	
100,000 uv	_____v dc	_____ db	
1.0 volt	_____v dc	_____ db	
Sidetone audio gain:			
input for 20-mw output		_____ v rms	NMT 0.4 v rms

*Not Less Than
**Not More Than

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TABLE 7-8. SAMPLE TEST DATA SHEET FOR LSB I-F/A-F AMPLIFIER MODULE

TEST DATA SHEET
FOR
LSB I-F/A-F AMPLIFIER MODULE OF
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST		TEST DATA	TEST LIMITS
Audio output:			
with standard input		_____ mw	*NLT 40 mw
maximum audio output		_____ mw	NLT 200 mw
Selectivity:			
upper 60-db frequency		_____ kc	**NMT 306.5 kc
lower 60-db frequency		_____ kc	NMT 299.0 kc
Over-all audio response:			
maximum increase		_____ db	NMT 3 db
maximum decrease		_____ db	NMT 3.5 db
total deviation		_____ db	NMT 4 db
Audio distortion:			
400 cps		_____ %	NMT 5%
3000 cps		_____ %	NMT 5%
Hum and noise level:			
decrease in output		_____ db	NLT 35 db
Agc characteristics:			
input level	agc voltage	audio output	
100 uv	_____ v dc	0 db	NMT 10 db
1000 uv	_____ v dc	_____ db	
10,000 uv	_____ v dc	_____ db	
100,000 uv	_____ v dc	_____ db	
1.0 volt	_____ v dc	_____ db	
Sidetone audio gain:			
input for 20-mw output		_____ v rms	NMT 0.4 v rms

*Not Less Than
**Not More Than

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7-11. TESTING OF AM I-F/A-F AMPLIFIER MODULE.

a. SCOPE. - This test procedure applies to the AM i-f/a-f amplifier module which is used in Amplifier-Converter-Modulator AM-2064/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

I-f/a-f amplifier test panel	Collins part no. 029-4318-123.
Output meter	Daven OP-182.
Distortion analyzer	Hewlett-Packard 330B.
Signal generator	Measurements Corp 65B.
Vtvm	Hewlett-Packard 410B.
Oscilloscope	DuMont 208B.
Audio oscillator	Hewlett-Packard 200AB.
Frequency counter	Hewlett-Packard 522B.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Line voltage	115 v, 60 cps, single phase.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Operational duty cycle	continuous.
Warmup period	30 seconds minimum.
Standard input	100 uv, 300 kc.
Standard modulation	30 percent at 1000 cps.
Audio output load	150 ohms.
Audio output	20 milliwatts.

d. PRELIMINARY TESTS.

(1) Rotate i-f gain control (R_1 on module) clockwise until it is against the stop.

(2) Connect module to i-f/a-f amplifier test panel and apply power. Note that audio current does not exceed 50 ma.

e. INITIAL ADJUSTMENTS.

(1) Inject 100-uv signal at 300 kc and disable agc at J2. Tune L1, T1 for T2 for maximum diode load voltage at J1. Unground agc and tune T4 for maximum agc voltage at J2.

(2) Adjust i-f gain control (R1 on module) in a counterclockwise direction until the agc voltage at J2 is minus one volt.

(3) Check voltage at gated agc output. It should be between 1 and 1.5 volts negative.

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f. TEST REQUIREMENTS. - Perform the following test procedures and record results on the test data sheet (see table 7-9 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. Allow a minimum of 30 seconds warmup time before performing tests.

(1) DIODE LOAD VOLTAGE AND AUDIO OUTPUT. - Inject a standard signal at the i-f input and record diode load voltage. Apply standard modulation and record audio output with audio gain control adjusted for maximum output. Ground agc at J2 and increase input signal until audio clipping level is reached. Record audio output.

(2) SELECTIVITY. - With a standard input signal, ground the Agc output at J2 and note the diode load voltage (J1). Increase the input 1000 times (60 db) and tune the generator above and below 300-kc until the reference diode load voltage is obtained. Record the upper and lower 60-db bandwidth frequencies.

(3) OVER-ALL AUDIO RESPONSE. - Ground agc output at J2 and inject a standard signal at the i-f input. Using standard modulation as a reference, vary the modulating frequency over the range 300 to 2500 cps and record the maximum plus and minus output deviation in db. Record peak-to-valley ratio.

(4) AUDIO DISTORTION. - Using standard output and modulation as a reference, measure audio distortion at 300 and 2500 cps.

(5) HUM AND NOISE LEVEL. - Inject a standard signal with standard modulation. Disable the agc and note audio output level. Remove the input signal and record the db decrease in audio output.

(6) AGC CHARACTERISTICS. - Inject a standard input signal with standard modulation. Record agc voltage and diode load voltage. Using 20-mw audio output as a zero-db reference, increase the input in 20-db steps to 1.0 volt and record the voltages and audio output in db at each input level.

(7) SIDETONE AUDIO GAIN. - Inject standard signal with standard modulation and adjust audio gain control for 20-mw output. Remove i-f signal and inject 1000-cps audio signal at sidetone input. Record sidetone input necessary to obtain 20-mw audio output.

7-12. TESTING OF CARRIER GENERATOR MODULE.

a. SCOPE. - This test procedure applies to the carrier generator module which is used in Amplifier-Converter-Oscillator AM-2064/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Carrier generator test panel	Collins part no. 029-4532-123.
Vtvm	Hewlett-Packard 410B.
A-c vtvm	Hewlett-Packard 400D.
Power supplies	130 v dc. 20 ma, filtered 0 to 10 v dc, negligible current 12.6 v ac C.T., 50-60 cps, 1 amp.
Frequency standard signal	1.5 v rms, 100 kc.

TABLE 7-9. SAMPLE TEST DATA SHEET FOR AM I-F/A-F AMPLIFIER MODULE

TEST DATA SHEET
FOR
AM I-F/A-F AMPLIFIER MODULE OF
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

SERIAL NUMBER_____ TEST LIMITS_____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Diode load voltage and audio output:		
diode load voltage	_____ mw	
audio output (standard input)	_____ mw	
audio output (clipping level)	_____ mw	*NLT 200 mw
Selectivity:		
upper 60 db frequency	_____ kc	**NMT 306.6 kc
lower 60 db frequency	_____ kc	NMT 293.0 kc
Over-all audio response:		
maximum increase	_____ db	NMT 3 db
maximum decrease	_____ db	NMT 3 db
total deviation	_____ db	NMT 4 db
Audio distortion:		
300 cps	_____ %	NMT 5%
2500 cps	_____ %	NMT 5%
Hum and noise level:		
decrease in output	_____ db	NLT 40 db

Agc characteristics:

input level	agc voltage	diode load	audio output	
100 uv	_____v dc	_____v dc	_____db	NMT 10 db
1000 uv	_____v dc	_____v dc	_____db	
10,000 uv	_____v dc	_____v dc	_____db	
100,000 uv	_____v dc	_____v dc	_____db	
1.0 volt	_____v dc	_____v dc	_____db	

Sidetone audio gain:		
input for 20-mw output	_____ v rms	NMT 0.4 v rms

*Not Less Than
**Not More Than

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	130 v dc, 12.6 v ac (center tapped at 6.3 v).
100-kc input signal	1.5 v rms.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none required.
Operational duty cycle	continuous.
Warmup period	5 minutes minimum.

d. PRELIMINARY TESTS. - None.

e. INITIAL ADJUSTMENTS.

(1) Plug module into carrier generator test panel and apply power.

(2) Adjust trimmer capacitor C5 for maximum 300-kc r-f output.

(3) If necessary, substitude values of R2 (usually between 10K and 27K) until the 300-kc r-f output is within specification (2.75 ±0.15 v rms).

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f. TEST REQUIREMENTS. - Perform the following test procedures and record results on the test data sheet (see table 7-10 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. Allow a minimum of 5 minutes warm-up time before performing tests.

(1) 300-KC R-F OUTPUTS.

(a) Record r-f output voltage on pin A.

(b) Record r-f output voltage on pin C.

(2) ACC-CONTROLLED 300-KC R-F OUTPUT.

(a) Record 300-kc r-f output voltage on pin M for zero volts of applied acc.

(b) Record 300-kc r-f output voltage on pin M for -5 volts of applied acc.

7-13. TESTING OF BALANCED MODULATOR MODULE.

a. SCOPE. - This test procedure applies to the balanced modulator module which is used in Amplifier-Converter-Oscillator AM-2064/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required.

TABLE 7-10. SAMPLE TEST DATA SHEET FOR CARRIER GENERATOR MODULE

TEST DATA SHEET
FOR
CARRIER GENERATOR MODULE OF AMPLIFIER-CONVERTER-MODULATOR
AM-2064/URC

SERIAL NUMBER _____ TEST LIMITS _____OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
300-kc r-f output:		
pin A	_____v rms	2.75 ±0.15 v rms
pin C	_____v rms	2.75 ±0.15 v rms
ACC-controlled 300-kc output:		
0 v ACC	_____mv	50 ±20 mv
-5 ACC	_____mv	
db change with respect to 0 v	_____db	*NLT -15 db

*Not Less Than

Balance modulator test panel. . . . Collins part no. 029-4343-123.

Spectrum analyzer . . . . . Collins 478R-1.

Vtvm . . . . . Ballantine 310A.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Line voltage . . . . . 115 v, 50 to 60 cps, single phase.

Ambient temperature . . . . . normal room ambient.

Ambient humidity . . . . . normal room ambient.

Shielding and isolation . . . . . module enclosed with cover.

Operational duty cycle . . . . . continuous.

Warmup period . . . . . none.

Standard input signals:

Carrier . . . . . 2.4 v rms, 300 kc.
One-tone test. . . . . 1.0 v rms, 1500 cps.
Two-tone test . . . . . 1.0 v rms, 1200 cps and 1900 cps.

Output load. . . . . 5600 ohms.

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d. PRELIMINARY TESTS. - None

e. INITIAL ADJUSTMENTS.

(1) Connect module to balanced modulator test panels and apply standard one-tone signal and carrier input signal.

(2) Adjust balance adjustments for minimum carrier leak, as observed on spectrum analyzer.

f. TEST REQUIREMENTS. - Perform the following test procedures and record results on the test data sheet (see table 7-11 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. No warmup time is required.

(1) CARRIER LEAK AND OUTPUT LEVEL. - Inject standard carrier and one-tone audio inputs into each modulator, in turn, and record the level of carrier leak. Record the value of output level for each modulator.

(2) SELECTIVITY. - Using the standard one-tone level from f. (1) as reference, vary the audio frequency, simultaneously tuning the spectrum analyzer, and note when the response drops to -60 db. Record the 60-db banwidth frequencies for each modulator. (See note below).

(3) OVER-ALL AUDIO RESPONSE. - For each modulator, using the standard one-tone level f. (1) as reference, vary the audio frequency from 400 cps to 3000 cps and record the maximum plus and minus output deviation in db. Record the peak-to-valley ratio.

(4) DISTORTION. - Inject standard carrier and two-tone audio test inputs. Record for each modulator the level of third-order intermodulation distortion products and the level of second-harmonic distortion prodcuts, as observed on the spectrum analyzer scope.

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NOTE

The -60-db bandpass frequency farthest from the carrier frequency can be found without difficulty. However, nearest the carrier, the -60-db frequency will not be found on the same side of the carrier as the major portion of the filter passband. That is, the upper sideband filter will have a -60-db response a few hundred cycles below the carrier frequency, and the lower sideband filter will have a -60-db response a few hundred cycles above the carrier frequency. These are the frequencies required to determine the 60-db passband.

(5) REJECTED SIDEBAND. - Inject standard carrier input and a 1000-cps audio input at standard input level. For each modulation record the level of rejected sideband as observed on the spectrum analyzer scope.

7-14. TESTING OF TGC AMPLIFIER MODULE.

a. SCOPE. - This test procedure applies to the tgc amplifier module which is used in Amplifier-Converter-Oscillator AM-2064/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

R-f signal generator	Measurements Corp Model 82.
D-c vtvm	Hewlett-Packard 410B.

TABLE 7-11. SAMPLE TEST DATA SHEET FOR BALANCE MODULATOR MODULE

TEST DATA SHEET
FOR

BALANCE MODULATOR MODULE OF AMPLIFIER-CONVERTER-MODULATOR
AM-2064/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA		TEST LIMITS
	Modulator A	Modulator B	
Carrier leak and output level:			
carrier leak	____db	____db	*NLT 60 db down
output level	____mv	____mv	NLT 2.0 mv
			mod A mod B
Selectivity			**NMT NMT
upper 60 db	300 kc +____kc	+____kc	+1.0 kc +6.5 kc
lower 60 db	300 kc -____kc	-____kc	-6.5 kc -1.0 kc
60-db bandwidth	____kc	____kc	
Over-all audio response:			
maximum increase	____db	____db	NMT 3 db
maximum decrease	____db	____db	NMT 3.5 db
total deviation	____db	____db	NMT 4 db
Distortion:			
third order IM product:			
300 kc ±500 cps	____db	____db	NLT 40 db down
±700 cps	____db	____db	NLT 40 db down
±2600 cps	____db	____db	NLT 40 db down
second harmonic product:			
300 kc ±2400 cps	____db	____db	NLT 40 db down
Rejected sideband	____db	____db	NLT 60 db down

*Not Less Than
**Not More Than

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A-c vtvm (2 required)	Hewlett-Packard 400D.
Tgc test panel	Collins part no. 029-4325-123.
Electronic counter	Hewlett-Packard 522B.
Power supplies	130 v dc, 6.3 v ac, 50-60 cps.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltages	130 v dc, 6.3 v ac, 50-60 cps.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Operational duty cycle	continuous.
Warmup period	30 seconds minimum.

d. PRELIMINARY TESTS. - None.

e. INITIAL ADJUSTMENTS.

(1) Mount the module to the tgc test panel and apply power.

(2) Connect the a-c vtvm and electronic counter across the tgc output.

(3) Connect the r-f signal generator to the tgc input; set the frequency for 300 kc at 5 mv input (a-c vtvm at TP1).

(4) Turn the alc bias in the test fixture to OFF, the TGC ANTI-TRIP to TGC, and the TGC VOX to TGC.

(5) Tune transformers T1 and T2 (slug tuned and accessible from the side of the module) by peaking for maximum output on the a-c vtvm.

f. TEST REQUIREMENTS. - Perform the following test procedure and record results on the test data sheet (see table 7-12 for sample). Test limits are listed on test data sheet. Record model number and date on test data sheet.

(1) TGC GAIN. - With the r-f signal generator connected to the TGC INPUT (frequency 300 kc) measure and record the output voltage for a 5-mv signal input at TP1 on the test fixture (zero alc bias).

(2) TGC SELECTIVITY. - Increase the signal level for a rise of 3 db on the output meter. Detune the r-f signal generator above and below 300 kc to obtain the same reference output level and record the 3-db bandwidth.

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TABLE 7-12. SAMPLE TEST DATA SHEET FOR TGC AMPLIFIER MODULE

TEST DATA SHEET
FOR
TGC AMPLIFIER MODULE OF AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

SERIAL NUMBER _____ TEST LIMITS _____OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
Over-all gain (5-mv input)	_____mv	*NLT 85-mv output
Selectivity (3-db bandwidth):		
upper 3 db frequency	_____kc	
lower 3 db frequency	_____kc	
bandwidth	_____kc	16 ±2 kc
Gain characteristics (gain change from 0 volt bias):		
0 volt bias	_____db	
-5 volts bias	_____db down	NLT 12 db down
-10 volts bias	_____db down	NLT 20 db down
Time constant:	_____sec	NLT 5 sec **NMT 10 sec

*Not Less Than
**Not More Than

(3) TGC GAIN CHARACTERISTICS. - Connect the a-c vtvm to TP1. Set the r-f signal generator to 5 mv and 300 kc. Connect d-c vtvm to ALC FAST jack on test fixture. Turn the alc bias control to yield maximum signal output. Vary the alc bias from zero to maximum. Note that the output decreases continually. Measure the db output change from 0 to -5 volts bias and from 0 to -10 volts bias.

(4) TGC TIME CONSTANT. - Connect the d-c vtvm to ALC SLOW jack on test fixture. Set alc bias control for -10 volts. Set TGC ANTI-TRIP switch to ANTI-TRIP position and record time for voltage to decay to -3 volts.

7-15. TESTING OF MIKE OR LINE AMPLIFIER MODULE.

a. SCOPE. - This test procedure applies to the mike or line amplifier module which is used in Amplifier-Control AM-2062/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

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Audio oscillator	Hewlett-Packard 200AB.
A-c vtvm	Hewlett-Packard 400D.
Noise and distortion meter	Hewlett-Packard 330B.
Power output meter	Daven OP-182.
Multimeter	Triplett 630.
Line, mike, and speaker amplifier test panel	Collins part no. 029-4232-122.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltage	27.5 v dc.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none.
Operational duty cycle	continuous.
Warmup period	none.
Input impedance	100 ohms.
Output impedance	500 ohms.

d. PRELIMINARY TESTS. - Visual inpsection only.

e. INITIAL ADJUSTMENTS.

(1) Plug module into line, mike, and speaker amplifier test panel. Set power output meter for 500 ohms and connect to module output. Connect audio oscillator and a-c vtvm to module input.

(2) Apply power to test fixture. Set audio oscillator for a signal input of 35 mv at 1000 cps. Adjust gain control R109 on the module for 150-mw output.

f. TEST REQUIREMENTS. - Perform the following test procedures and record results on test data sheet (see table 7-13 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. No warmup time is required.

(1) D-C CURRENT DRAIN. - Record d-c current drain with 150-mw output.

(2) DISTORTION. - Measure and record distortion with 150 mw (1000 cps) output.

(3) SUPPLY VOLTAGE VARIATIONS. - With supply voltage set at 27.5 volts, adjust signal input (1000 cps) for 150-mw output. Increase supply voltage to 31 volts and measure the distortion and db change in output level. Decrease supply voltage to 22 volts and measure the distortion and the db change in output level (using 27.5-volt level as reference).

TABLE 7-13. SAMPLE TEST DATA SHEET FOR MIKE OR LINE AMPLIFIER MODULE

TEST DATA SHEET
FOR
MIKE OR LINE AMPLIFIER MODULE OF AMPLIFIER-CONTROL AM-2062/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
D-c current drain (150-mw output)	_____ ma	60 to 115 ma
Distortion (150-mw, 1000-cps output)	_____ %	*NMT 15%
Supply voltage variation (1000 cps):		
output change at 31 v dc	_____ db	NMT +3.3 db
distortion at 31 v dc	_____ %	NMT 15%
output change at 22 v dc	_____ db	NMT -5.5 db
distortion at 22 v dc	_____ %	NMT 15%
Frequency response:		
300 cps	db	NMT 6 db
1000 cps	0 db	variation
3000 cps	db	300-3000 cps
Ripple susceptibility (200-15,000 cps) ripple below 150 mw	_____ db	**NLT 50 db
Noise level and microphonics:		NLT 50 db
noise level below 150 mw	_____ db	
microphonics	_____ OK	

*Not More Than
*Not Less Than

(4) FREQUENCY RESPONSE. - Adjust 1000-cps input signal for 150-mw output. Adjust distortion meter to some reference point and note input signal voltage. Change input frequency to 300 cps, adjust input voltage to reference level, and note the db change in output level. Repeat for 3000-cps input.

(5) RIPPLE SUSCEPTIBILITY. - Adjust 1000-cps input voltage for 150-mw output. Adjust distortion meter to 0-db reference. Move the audio oscillator and a-c vtvm to the RIPPLE IN and RIPPLE OUT jacks respectively. Sweep the input voltage from 200 cps to 15,000 cps and note maximum audio output, expressed in db below rated output. Remove audio oscillator and a-c vtvm.

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(6) NOISE LEVEL AND MICROPHONICS. - Insert terminating plug in module input jack and measure noise level, expressed in db below 150-mw output. Check unit for microphonics by tapping with a rubber mallet.

7-16. TESTING OF SPEAKER AMPLIFIER MODULE.

a. SCOPE. - This test procedure applies to the speaker amplifier module which is used in Amplifier-Control AM-2062/URC.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Audio oscillator	Hewlett-Packard 200AB.
A-c vtvm	Hewlett-Packard 400D.
Noise and distortion meter	Hewlett-Packard 330B.
Power output meter	Daven OP-182.
Multimeter	Triplett 630.
Line, mike, and speaker amplifiers test panel	Collins part no. 029-4232-122.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltage	27.5 v dc.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	none.
Operational duty cycle	continuous.
Warmup period	none.
Input impedance	500 ohms.
Output impedance	30 ohms.

d. PRELIMINARY TESTS. - Visual inpsection only.

e. INITIAL ADJUSTMENTS. - Set gain control R205 to maximum. Plug module into line, mike, and speaker amplifier test panel. Set power output meter to 30 ohms and connect to output of module. Connect audio oscillator and a-c vtvm to input of module.

f. TEST REQUIREMENTS. - Perform the following test procedures and record results on test data sheet (see table 7-14 for sample). Test limits are listed on test data sheet. Record model serial number and date on test data sheet. No warmup time is required.

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TABLE 7-14. SAMPLE TEST DATA SHEET FOR SPEAKER AMPLIFIER MODULE

TEST DATA SHEET
FOR
SPEAKER AMPLIFIER MODULE OF AMPLIFIER-CONTROL AM-2062/URC

SERIAL NUMBER _____ TEST LIMITS _____ OK

DATE _____ TECHNICIAN _____

TEST	TEST DATA	TEST LIMITS
D-c current drain:		
no signal	_____ ma	15 to 50 ma
2 watts output	_____ ma	120 to 200 ma
Gain (1000 cps):		
input for 2 watts output	_____ v ac	*NMT 7.0 v ac
input for 3 watts output	_____ v ac	NMT 8.7 v ac
Distortion (1000 cps):		
at 2 watts output	_____ %	NMT 15%
at 3 watts output	_____ %	NMT 15%
Supply voltage variation:		
output change at 31 v dc	_____ db	NMT +1.0 db
distortion at 31 v dc	_____ %	NMT 15%
output change at 22 v dc	_____ db	NMT -2.5 db
distortion at 22 v dc	_____ %	NMT 15%
Frequency response:		
300 cps	_____ db	NMT 6 db
1000 cps	0 db	variation
3000 cps	_____ db	300-3000 cps
Ripple susceptibility (200-15,000 cps)		
rippler below 2 watts	_____ db	**NLT 25 db
Noise level and microphonics:		
noise level below 2 watts	_____ db	NLT 70 db
microphonics	_____ OK	

*Not More Than
**Not Less Than

(1) D-C CURRENT DRAIN. - Apply power to test fixture and adjust supply voltage to 27.5 v dc. Record current drain with no signal output. Set audio oscillator to 1000 cps and adjust input level for 2 watts output. Record current drain with 2 watts output.

(2) GAIN. - Record input voltage (1000 cps) required to obtain 2 watts of output. Repeat for 3 watts of output.

(3) DISTORTION. - With audio oscillator set to 1000 cps, record distortion with 2 watts output. Repeat with 3 watts output.

(4) SUPPLY VOLTAGE VARIATIONS. - With supply voltage set at 27.5 volts, adjust signal input (1000 cps) for 2 watts output. Increase supply voltage to 31 volts and measure the distortion and db change in output level. Decrease supply voltage to 22 volts and measure the distortion and the db change in output level (using 27.5-volt level as reference).

(5) FREQUENCY RESPONSE. - Adjust 1000-cps input signal for 2 watts output. Adjust distortion meter to some reference point and note input signal voltage. Change input frequency to 300 cps, adjust input voltage to reference level, and note the db change in output level. Repeat for 3000-cps input.

(6) RIPPLE SUSCEPTIBILITY. - Adjust 1000-cps input voltage for 2 watts output. Adjust distortion meter to 0 db reference. Move the audio oscillator and a-c vtvm to the RIPPLE IN and RIPPLE OUT jacks respectively. Sweep the input voltage from 200 cps to 15,000 cps and note maximum audio output, expressed in db below rated output. Remove audio oscillator and a-c vtvm.

(7) NOISE LEVEL AND MICROPHONES. - Insert terminating plug in module input jack and measure noise level, expressed in db below 2 watts output. Check unit for microphonics by tapping with a rubber mallet.

7-17. TESTING POWER SUPPLY PP-2154/U.

a. SCOPE. - This production test procedure applies to Power Supply PP-2154/U.

b. EQUIPMENT REQUIRED. - The following equipments or their equivalents are required to perform the specified tests:

PP-2154/U Power Supply test fixture, 029-1455-001.

c. TEST CONDITIONS.

Power source, frequency and phase	115 v ±1 v, 60 cps, 1 phase.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Ambient atmospheric pressure	normal ambient.
Operational duty cycle	continuous.
Warmup period	none.

d. PRELIMINARY TESTS. - Check the following prior to connecting the unit to power source:

Fuse Value:
Installation of Pilot Light

e. INITIAL ADJUSTMENTS. - None.

f. INITIAL SETTINGS.

(1) Power Supply PP-2154/U: ON-OFF switch to ON.

(2) Test Fixture:

Filament load - ON
Filament meter switch to position 1.
DC meter switch to +250 v position.
B+ load switch to low.
28 v load switch to low.
A-c power switch on control panel to OFF.
Variac on control panel to zero.

g. TEST REQUIREMENTS.

(1) Connect plugs from Test fixture to J-1 and J-2.

(2) Turn on the a-c control panel and adjust the variac for 115 v. The input current should not exceed 2 amperes.

(3) Measure the following voltages:

NOTE

The dc meter (test fixture) reads 300 v full scale for the +250 v, +130 v and -90 v positions. It reads 60 v full scale for all other positions.

+250 v dc
+130 v dc
-90 v dc
+28 v dc Unfiltered
+28 v dc Filtered
+28 v dc Partly Filtered

(4) Turn B+ and 28 v load switches to HIGH and repeat step j. Also measure the ripple voltage.

(5) With switches set as in step j, record the lowest reading as the filament switch on the test fixture is rotated through its 8 positions. Turn the filament load switch OFF and record the highest reading on the a-c meter as the filament switch is rotated through its 8 positions.

h. LOW-VOLTAGE REGULATION. - Measure the 28 v d-c regulated voltage (high load) with line voltage set at 103.5 v ac and 126.5 v ac.

i. BLOWN FUSE INDICATOR. - Remove fuse on front panel and check to see that blown fuse indicator lights.

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TABLE 7-15. SAMPLE TEST DATA SHEET FOR POWER SUPPLY PP-2154/U

TEST DATA
FOR
POWER SUPPLY PP-2154/U

Tech. _____
Date _____
Serial No. _____

Preliminary Tests:

Fuse Value, 3 Amp. _____ OK
Pilot Lite _____ OK

Low Load Voltages		High Load Voltages	Ripple	Limits	Ripple NMT
+250 v dc	_____	_____	_____	225 to 275	0.25 VRMS
+130 v dc	_____	_____	_____	117 to 143 v	0.130
-90 v dc	_____	_____	_____	-85 to 110 v	0.090
+28 v dc (UF)	_____	_____	_____	27.5 to 32 v	15.000
+28 v dc (F)	_____	_____	_____	25 to 29 v	0.025
+28 v dc (PF)	_____	_____	_____	27.5 to 32 v	0.250

Filament Voltage:

Minimum Voltage: _____ NLT 6.0 v

Maximum Voltage: _____ NMT 7.0 v

Low-Voltage Regulation:

Line Voltage	28 v dc Filtered	Limits
103.5 v ac	_____ v	25 to 29 v
126.5 v ac	_____ v	25 to 29 v

Blown Fuse Indicator: _____ OK

7-18. TESTING OF I-F MIXER BOARD.

a. SCOPE. - These test procedures apply to the i-f mixer board.

b. TEST EQUIPMENT REQUIRED. - The following equipment or their equivalents are required to perform the specified tests.

I-f mixer board test panel 029-2207-00.
2.4-mc oscillator 0.5 v a-c output (adjustable).
549- to 645-kc variable frequency oscillator 1.0-v output (adjustable).
3.37- to 3.53-mc variable frequency oscillator 0.015-v output (adjustable).
6.3 v a-c at 300 ma supply.
130 v d-c at 10 ma supply.
Hewlett-Packard VTVM 400D with minimum capacity leads.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltage	6.3 volts a-c at 300 ma. 130 volts d-c at 10 ma.
Ambient temperature	normal room ambient.
Ambient humidity.	normal room ambient.
Ambient atmospheric pressure . . .	normal room ambient.
Shielding and isolation requirements .	normal shielding of r-f signals required. Special care in shielding the low level output signal is required.
Operational duty cycle	continuous.
Warmup period	30 seconds.

d. PRELIMINARY TESTS.

Power supply current requirements: d-c current from 130-v supply 6 to 8 ma.
Filament operation: Visual inspection for normal operation.

e. INITIAL ADJUSTMENTS.

(1) FILTER ALIGNMENT.

(a) Plug i-f mixer board into test Jig. Set test Jig for i-f. mixer operation.

(b) Set 3.37-3.53 mc oscillator to 3.428 mc 0.015 v a-c.

(c) Set 2.4-mc signal to 0.5 v a-c.

(d) Set 549- to 645-kc oscillator to 565 kc at 1.0 v a-c.

(e) Adjust end section alignment slugs of A3FL1 for maximum output as indicated on Hewlett-Packard 400D.

TABLE 7-16. SAMPLE TEST DATA SHEET FOR I-F MIXER

TEST DATA
FOR
I-F MIXER
Part of CV-465/URC

Tech. _____
Date _____

I-F Mixer Output - Serial No. _____-

3.37-3.53 mc Oscillator 0.015 v ac	2.4 mc 0. v ac	549-645 kc Oscillator 1.0 v ac	Output	NLT db
3.404	0.5 v ac	549 kc	_____	5
3.452	0.5 v ac	597	_____	5
3.500	0.5 v ac	645	_____	5
3.450	0.5 v ac	Varied 549 to 645 kc	Max._____ Min._____ NMT 10 db Variation	

Serial No. _____

3.404	0.5 v ac	549 kc	_____	5
3.452	0.5 v ac	597	_____	5
3.500	0.5 v ac	645	_____	5
3.450	0.5 v ac	Varied 549 to 645 kc	Max._____ Min._____ NMT 10 db Variation	

Serial No.

3.404	0.5 v ac	549 kc	_____	5
3.452	0.5 v ac	597	_____	5
3.500	0.5 v ac	645	_____	5
3.450	0.5 v ac	Varied 549 to 645 kc	Max._____ Min._____ NMT 10 db Variation	

(f) Set 549- to 645-kc oscillator to 573 kc. Put a variable C in input and output of Mech. Filter, tuning and measure C- then replace with proper C.

f. TEST REQUIREMENTS.

(1) I-F MIXER OUTPUT. - Set oscillators to frequencies and voltages given on the test data sheet and record output.

7-19. TESTING OF 4-KC SPECTRUM GENERATOR.

a. SCOPE. - These test procedures apply to the 4-kc spectrum generator.

b. TEST EQUIPMENT REQUIRED. - The following equipment or their equivalents are required to perform the specified tests.

Supply of 6.3 v a-c of 150 ma.
Supply of 27.5 v d-c 4 ma d-c, metered 5 ma ±5 percent.
Supply of 130 v d-c 4 ma d-c, metered 5 ma ±5 percent.
Supply of 4 kc at 4 v rms ±5 percent.
Supply of 1.4 v rms ±5 percent, 549 to 645 kc variable and calibrated in 4-kc steps, frequency error less than ±0.5 kc.
A Mechanical Filter F455Q-2, 455-kc narrow band voltmeter, Hewlett-Packard 400D VTVM.
Oscilloscope, DuMont 304H.
Test jig connecting meters and power supplies to a 10-contact printed board connector, part no. 029-2207-00.
Hewlett-Packard 410B VTVM.

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltage	6.3 v a-c 60-400 ohm at .150 ma 130 v d-c 4 ma 27.5 v d-c 2.4 ma.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Ambient atmospheric pressure . . .	normal room ambient.
Shielding and isolation requirements .	leads for in- and out-going signals must be shielded and grounded.
Operational duty cycle	continuous.
Warmup period	30 seconds.

d. PRELIMINARY TESTS.

Power supply current requirements .	d-c from 27.5 v supply, 2.4 ma ±10 percent. d-c from 130 v supply, 4.0 ma ±10 percent.
Filament operation	visual inspection for normal operation.

e. INITIAL ADJUSTMENTS.

(1) PULSED OSCILLATOR ADJUSTMENT.

(a) Connect board to test fixture.

(b) Connect oscilloscope to output of A6T1 and observe pulse. Oscillator must produce 6 to 10 cycles at 6 v to 8 v peak to peak. Record number of cycles and peak-to-peak volts.

(c) Pulse length may be changed if required by changing A6R5 (33K, 39K, 47K or 56K).

(2) FILTER ALIGNMENT.

(a) Set variable oscillator to 581 kc with 1.0 v ac out. Rock slightly for maximum indication on the 400D.

(b) Adjust slugs on filter for maximum indication on the 400D.

(3) OSCILLATOR COIL ADJUSTMENT.

(a) Set variable oscillator to 549 kc 1.0 v and rock for maximum output. Note output.

(b) Set variable oscillator to 645 kc 1.0 v and rock for maximum output. Note output.

(c) Adjust oscillator coil A6T1 until the readings taken by repeating steps a and b are equal within 10 percent.

f. TEST REQUIREMENTS.

(1) PULSED OSCILLATOR OUTPUT. - Measure oscillator output, pulse amplitude, and duration. Check repetition rate, one pulse every 1/4000 second.

(2) FOURTH MIXER OUTPUT. - Adjust Variable Oscillator to 645, 593, and 549 kc maintaining oscillator at 1.0 v ac, and record the output for each point.

7-20. TESTING OF REFERENCE AMPLIFIER.

a. SCOPE. - These test procedures apply to the 455-kc reference i-f amplifier used in the stabilized master oscillator.

b. TEST EQUIPMENT REQUIRED. - The following equipments or their equivalent are required to perform the specified tests:

28 v d-c power supply.
A-c vtvm, Ballantine Model 314 with probe.
Signal Generator, Measurements Model 65B.
Vtvm, Hewlett-Packard 410B.
Frequency monitor, Type R-390/URR Receiver.
D-c ammeter, 0 - 25 ma.
Tuning tool (nonmetallic).
Reference amplifier test panel 029-2208-00.

TABLE 7-17. SAMPLE TEST DATA SHEET FOR 4-KC SPECTRUM GENERATOR

TEST DATA
FOR
4-KC SPECTRUM GENERATOR CV-465/URC

Tech._____
Date _____

Serial No. _____

1. Oscillator Pulse: Duration _____ cycles (6 to 10); Amplitude _____ v
(P-P6-8V)

2. Fourth Mixer Output:

Variable Osc. Freq.	Spectrum Point	
645 kc	1.1 mc _____ mv	
593 kc	1.048 mc _____ mv	(NLT 1.5 mv and NMT 6 db
549 kc	1.0 mc _____ mv	variation)

3. Power Supply Currents

27.5-v supply _____ ma (1.92 to 2.88 ma)
130-v supply _____ ma (2.88 to 4.32 ma)

Serial No. _____

1. Oscillator Pulse: Duration _____ cycles (6 to 10); Amplitude _____ v
(P-P6-8V)

2. Fourth Mixer Output:

Variable Osc. Freq.	Spectrum Point	
645 kc	1.1 mc _____ mv	
593 kc	1.048 mc _____ mv	(NLT 1.5 mv and NMT 6 db
549 kc	1.0 mc _____ mv	variation)

3. Power Supply Currents:

27.5-v supply _____ ma (1.92 to 2.88 ma)
130-v supply _____ ma (2.88 to 4.32 ma)

Serial No. _____

1. Oscillator Pulse: Duration _____ cycles (6 to 10); Amplitude _____ v
(P-P6-8v)

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TABLE 7-17. SAMPLE TEST DATA SHEET FOR 4-KC SPECTRUM GENERATOR (Cont)

TEST DATA
FOR
4-KC SPECTRUM GENERATOR CV-465/URC

2. Fourth Mixer Output:

Variable Osc. Freq.	Spectrum Point
645 kc	1.1 mc _____ mv
593 kc	1.048 mc _____ mv (NLT 1.5 mv and NMT 6 db variation)

3. Power Supply Currents:

27.5-v supply _____ ma (1.92 to 2.88 ma)
130-v supply _____ ma (2.88 to 4.32 ma)

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltage and frequency: .	27.5 v +5 percent with not more than 0.1 percent ripple.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Ambient atmospheric pressure . . .	normal room ambient.
Operational duty cycle	continuous
Warmup period	none.

d. PRELIMINARY TESTS. - Current Drain Check. With the test jig and test equipment connected, plug in the amplifier to be tested and, immediately after turning on the power supply, observe and record the total current drawn by the amplifier. If this total current is 12 ±1 ma, proceed with the tuning.

e. INITIAL ADJUSTMENTS. - Tuning. Set signal generator to 455 kc using the R390/URR receiver as a frequency standard. Increase the signal generator output until the agc voltage (test point A7J2) starts to decrease. With the nonmetallic tuning tool adjust A7T1, A7L2, and A7T2 for a dip of the agc voltage. As each transformer is tuned, keep decreasing the signal generator output so that the tuning adjustments are all made just above agc threshold.

NOTE

There should be two possible tuning points on each transformer. Use that tuning point with the slug farthest away from the top of the transformer can.

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TABLE 7-18. SAMPLE TEST DATA SHEET FOR REFERENCE AMPLIFIER

TEST DATA
FOR
REFERENCE AMPLIFIER CV-465/URC

Serial No. _____
Tech._____
Date_____

Current Drawn From Power Supply:

D-c current _____ ma 12 ±1 ma

Gain:

Input for 0.1 v rms output_____uv (NMT 4 k uv)
Input at A7J1 for 0.1 v rms output_____uv (NMT 55 uv)

Noise Level:

_____ db down (NLT 20 db)

AGC Threshold:

_____uv (NMT 7 k uv)

AGC Characteristics:

Input Level mv	AGC Voltage		Output Voltage	
		Volts	db	
8	_____	_____	_____	NMT 3 db down
80	_____	_____	_____0	
800	_____	_____	_____	NMT 1 db up

Selectivity:

Upper 6 db	_____		(NLT 455.8 kc)
Upper 6 db		_____	(NMT 457.8 kc)
Lower 6 db	_____		(NMT 454.2 kc)
Lower 60 db		_____	(NLT 452.2 kc)

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f. TEST REQUIREMENTS.

(1) GAIN. - Measure and record the signal generator output for 0.1-volt rms output from the amplifier. Measure and record the input necessary (using generator matching network) at test point A7J1 for 0.1-volt rms output from the amplifier.

(2) NOISE LEVEL. - With all settings as used in step 7-20f.(1), turn the signal generator output to zero and record the db decrease in the amplifier output.

(3) AGC THRESHOLD. - Increase the signal generator output until the agc voltage at A7J2 just begins to decrease. Record the output level of the signal generator.

(4) AGC CHARACTERISTICS. - Increase the signal generator output to 8 mv. Record the agc voltage and output voltage. Use the output for 80-mv signal as a zero-db reference. Increase the amplifier input 20 db to 0.8 volt and record the agc voltages and output in db at each input level.

(5) SELECTIVITY. - Adjust the signal generator output to give 50 mv output. Increase the signal generator output 2 times (6 db) and tune the signal generator above and below 455 kc until the reference level of 50 mw is obtained. Record the upper and lower 6-db bandwidth frequencies. Repeat the above procedure for an increased signal generator output of 1000 times (60 db).

7-21. TESTING OF SIGNAL I-F AMPLIFIER.

a. SCOPE. - These test procedures apply to the 455-kc signal i-f amplifier and discriminator, used in the stabilized master oscillator.

b. TEST EQUIPMENT REQUIRED. - The following equipments or their equivalent are required to perform the specified tests:

Test fixture 029-2208-00.
Two signal generators, Measurements Model 65 B.
Vtvm, Hewlett-Packard 410B
A-c vtvm, Ballantine Model 314.
Frequency monitor: Type R-390/URR Receiver.
Tuning tool (nonmetallic).
D-c vtvm, Scientific Specialties Corporation, Model VM82.
Signal Generator matching network (1000 ohms in series with 0.1 uf).

c. TEST CONDITIONS. - Unless otherwise specified, all tests shall be performed under the following conditions:

Power supply voltage and frequency	27.5 ±5 percent dc.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Ambient atmospheric pressure	normal room ambient.
Operational duty cycle	continuous.
Warmup period	5 minutes.

d. PRELIMINARY TESTS. - Current Drain Check. With equipment connected to test fixture, turn on power supply and immediately observe and record the amplifier current. If the amplifier current is approximately 13.5 ma proceed with tuning the amplifier (no signal input to amplifier). Measure the resistance of the oven winding by measuring the resistance from pin F to pin J on the connector.

e. INITIAL ADJUSTMENTS.

(1) I-F AMPLIFIER TUNING. - Set the signal generator to 455 kc, using the R-390/URR Receiver as a frequency standard. Increase the signal generator output until the agc voltage decreases and output current appears on one or both of the output current meters $A2Q_1$ and $A2Q_2$.

(a) Adjust A2R3 for its mechanical center.

(b) Adjust A2L1 for a minimum on output meter $A2Q_1$.

(c) Adjust A2L2 for a minimum on output meter $A2Q_2$.

(d) Repeat the two preceding steps two times.

(e) Check the agc voltage at A2J2 and, if necessary, adjust the signal generator input so that the agc is just below its maximum reading.

(f) Adjust A2T1, A2L3, A2L2 and A2T3 for a minimum on agc voltage.

(g) Repeat the last step at least once and also repeat steps b and c.

(2) DISCRIMINATOR TUNING. - Check to verify the amplifier tuning as outlined above. Verify that the discriminator oven has been on for at least five minutes.

(a) Set signal generator frequency to 465 kc and adjust output so that an indication of current flow is obtained on output meters A2Q1 and A2Q2.

(b) Adjust A2L1 for a maximum on output meter A2Q2, keeping the maximum below 8 ma by adjustment of the signal generator output.

(c) Set signal generator frequency to 445 and adjust A2L2 for a maximum on output meter A2Q1 keeping the maximum below 8 ma by adjustment of the signal generator output.

(d) Repeat the preceding two steps at least three times.

(e) Return the signal generator to 455 kc and set output to 10,000 microvolts. Adjust A2R3 for equal currents in output meters A2Q1 and A2Q2. This adjustment is very critical and must be made with the Balance meter at maximum sensitivity. The final setting of the balance control A2R3 should be within ±45° of the electrical center for proper operation.

(f) The resulting currents on the output meters must be less than 7 ma with the signal generator output set at 100,000 microvolts, and not less than 4 ma with the signal generator output set at 1,000 microvolts.

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(g) Should the final currents at balance for 100,000 microvolts be greater than 7 ma, the tuning frequencies noted in steps c and a must be moved closer to 455 kc (for example, 447 and 463) and the tuning procedure repeated until the final currents at balance are within the limits specified.

(h) Similarly, if the currents at balance for 1,000 microvolts are less than 4 ma, the tuning frequencies must be moved wider from 455 kc (for example, 443 and 467) and the tuning procedure repeated until the final currents at balance are within the limits specified.

NOTE

Current unbalance with no signal applied should be less than 10 ua i.e., negligible.

Output current rise together after ground on agc line is removed.

As the frequency of the signal input to the amplifier is charged from 425 to 485 kc, there should be no d-c amplifier saturation (indicated by pulsating output current) within the range of 450 to 460 kc.

There should be two possible tuning points on each transformer. Use that tuning point with the slug farthest away from the top of the transformer can.

f. TEST REQUIREMENTS.

(1) INITIAL ADJUSTMENTS. - Tune as outlined in section e. Record output currents for 1,000-microvolt and 100,000-microvolt input.

(2) GAIN. - Set signal generator frequency to 455 kc and measure and record the signal generator output for 1-volt rms output from the amplifier A2J1. Measure the gain of the last two stages, using the signal generator matching network. It is desirable to have the gain of the last two stages equal but not more than 6 db greater than the gain of the first two stages.

(3) NOISE LEVEL. - With all settings as used in the first part of step (2), turn the signal generator output to zero and record the db decrease in the amplifier output A2J1.

(4) AGC THRESHOLD. - Increase the signal generator output until the agc voltage at A2J2 just begins to decrease. Record the output level of the signal generator.

(5) AGC CHARACTERISTICS. - Set the signal generator frequency at 455 kc and the level at 1000 uv. Record the agc voltage amplifier output voltage at A2J1, the output current on each of the output current meters A2Q1 and A2Q2, and the balance meter M2. Increase the amplifier input in 20-db steps to 0.1 volt and record the agc voltage, amplifier output voltage at A2J1, the output currents, and the frequency unbalance of the frequency discriminator.

(6) FREQUENCY DISCRIMINATOR. - Set the signal generator output to 10,000 microvolts and record the current unbalance on meter M2 for the following frequencies in the order listed: 455 kc, 457 kc, 455 kc, and 453 kc.

(7) PHASE DISCRIMINATOR. - With both the signal i-f amplifier and discriminator board and the reference i-f amplifier board plugged into their respective test sockets, connect one signal generator to the input of the reference amplifier and the other into the input of the signal amplifier. Set the reference amplifier input at 10 mv and at 455 kc ±.05 kc. Set the

TABLE 7-19. SAMPLE TEST DATA SHEET FOR SIGNAL I-F AMPLIFIER AND DISCRIMINATOR

TEST DATA
FOR
SIGNAL I-FAMPLIFIER AND DISCRIMINATOR CV-465

Serial No. _____
Tech. _____
Date _____

Preliminary Tests:

Amplifier Current _____ma dc (13 to 14.5 ma)
Oven Resistance _____ohms (67 to 82 ohms)

Initial Adjustments:

Input (uv)	Output Current (ma)		
1,000	A2Q1____,	A2Q2 _____	(NLT 4 ma)
100,000	A2Q1____,	A2Q2 _____	(NMT 7 ma)

Gain: Input required to 1 v rms output.

At 455 kc _____ (NMT 20 uv)

Noise Level:

_____ db down (NLT 10 db)

AGC Threshold:

_____ uv (NMT 75 uv)

AGC Characteristics:

Input (uv)	Agc (volts)	Output (db)	Output (volts)	Output Current A2Q1	Output Current A2Q2	Freq. Unbalance (cycles)
100	_____	___	_____	____ma	____ ma	_____
1,000	_____	___	_____	____	____	_____
10,000	_____	___	0 Ref.	____	____	_____
100,000	_____	___	_____	____	____	_____

Limits: 100 uv NMT 5 db down; 1000 uv NMT 1 db down; 10,000 uv 0 Ref.; 100,000 uv NMT 1 db up. Unbalance 1000 uv to 100,000 uv NMT 250 cps.

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TABLE 7-19. SAMPLE TEST DATA SHEET FOR SIGNAL I-F AMPLIFIER AND DISCRIMINATOR (Cont)

TEST DATA
FOR
SIGNAL I-F AMPLIFIER AND DISCRIMINATOR CV-465

Serial No. _____
Tech. _____
Date _____

Frequency Discriminator:

At 455 kc _____ma unbalance (NLT 4 ma)
At 457 kc _____ma unbalance (NLT 4 ma)
At 455 kc _____ma unbalance (NLT 4 ma)
At 453 kc _____ma unbalance (NLT 4 ma)

Phase Discriminator:

Output current beats _____ (OK)

signal amplifier input to 1 mv. Adjust the signal generator frequency to give a very low frequency between the two signals.

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7-22. REPLACING MODULES ON UNIT CHASSIS. - All Modules, except the stabilized master oscillator module and the r-f tuner module, are replaced by plugging the module into the proper unit chassis jack and tightening the captive mounting screws. Refer to the CV-731/URC section of Technical Manual for Radio Set AN/URC-32, (NAVSHIPS 93285A), for replacement of the stabilized master oscillator module and the r-f tuner module. Mechanical alignment of these modules is covered in the final test procedure of paragraph 9-2.

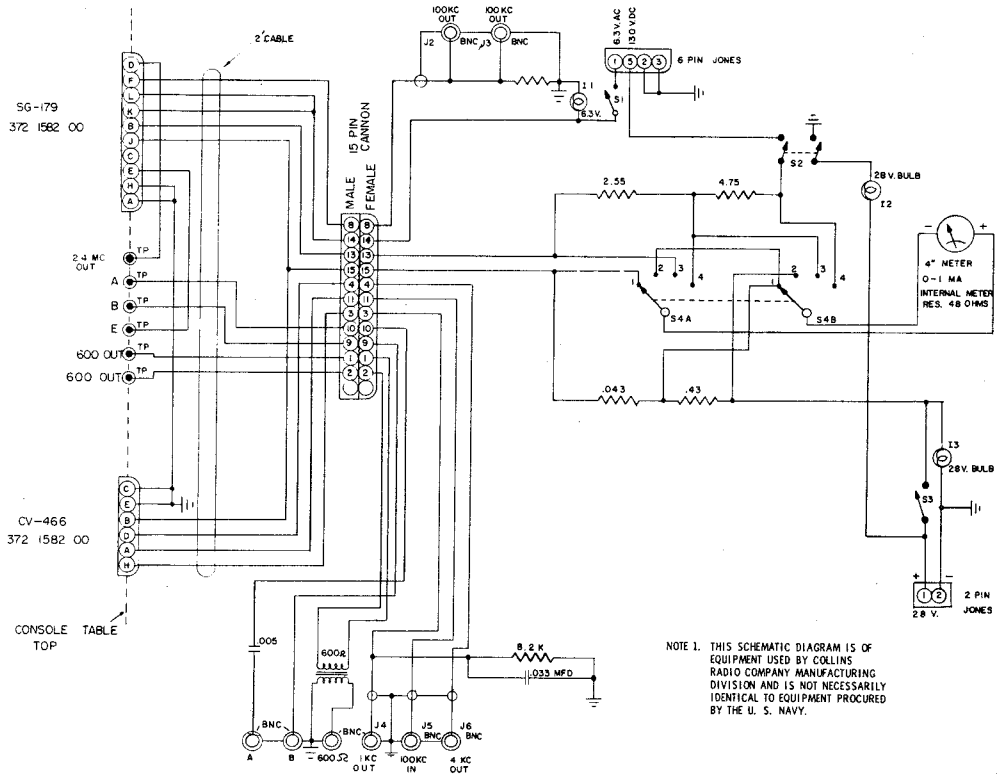

Figure 7-7. Reference Oscillator Test Panel, Schematic Diagram

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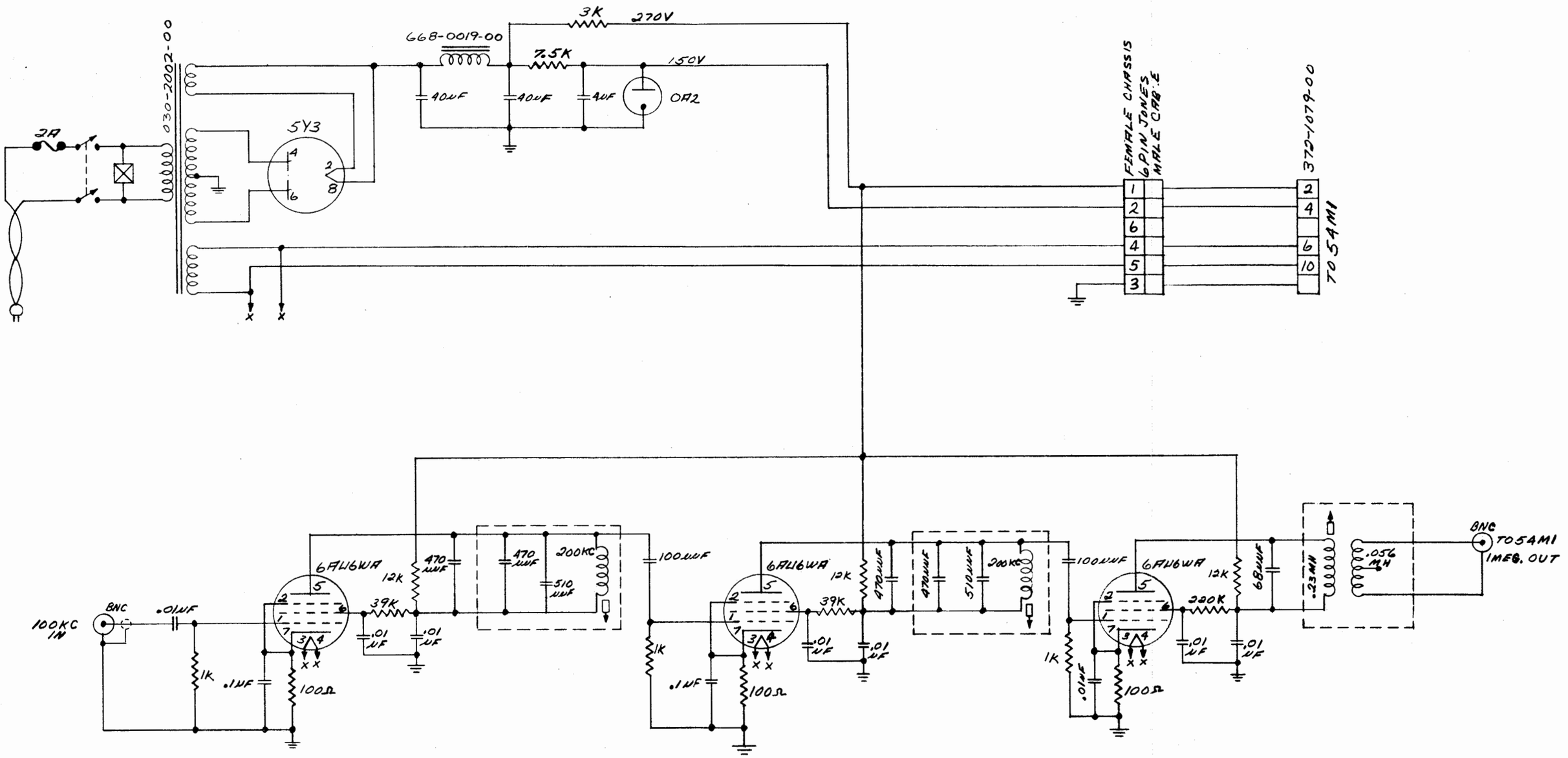
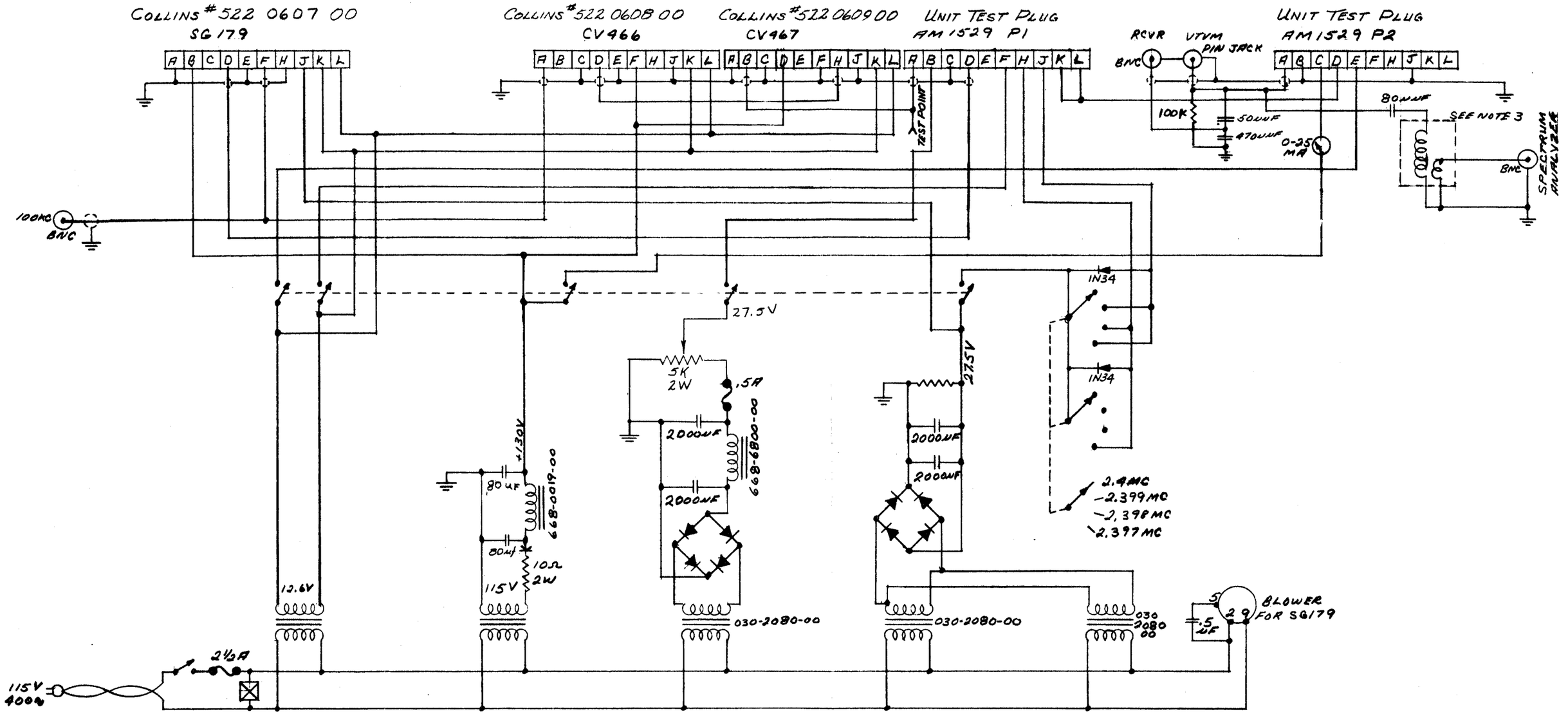


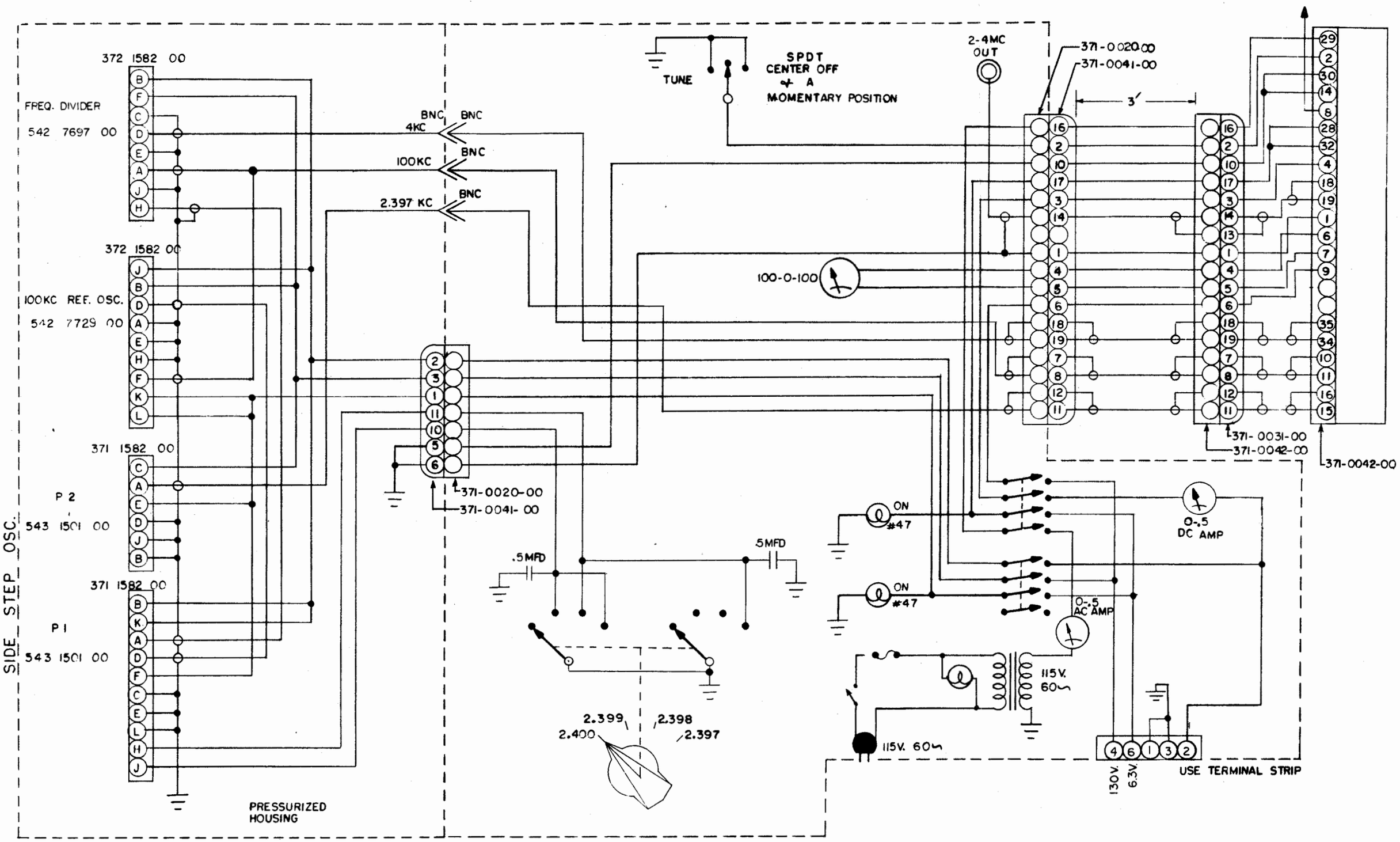
NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-8. Frequency Multiplier, Schematic Diagram



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-9. Sidestep Oscillator Test Panel, Schematic Diagram



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-10. Stabilized Master Oscillator Test Panel, Schematic Diagram

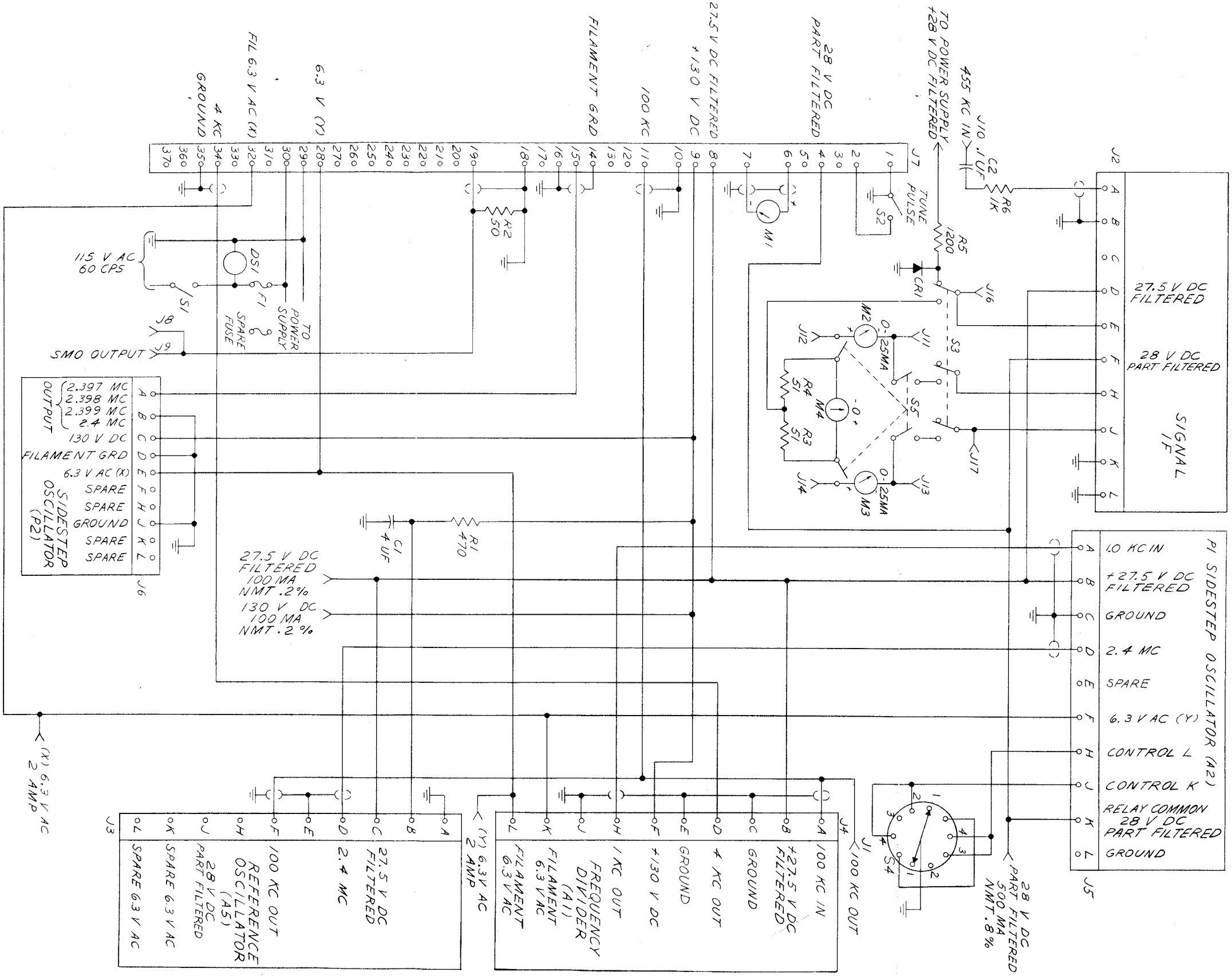


Figure 7-11. Portable SMO Tester, Schematic Diagram

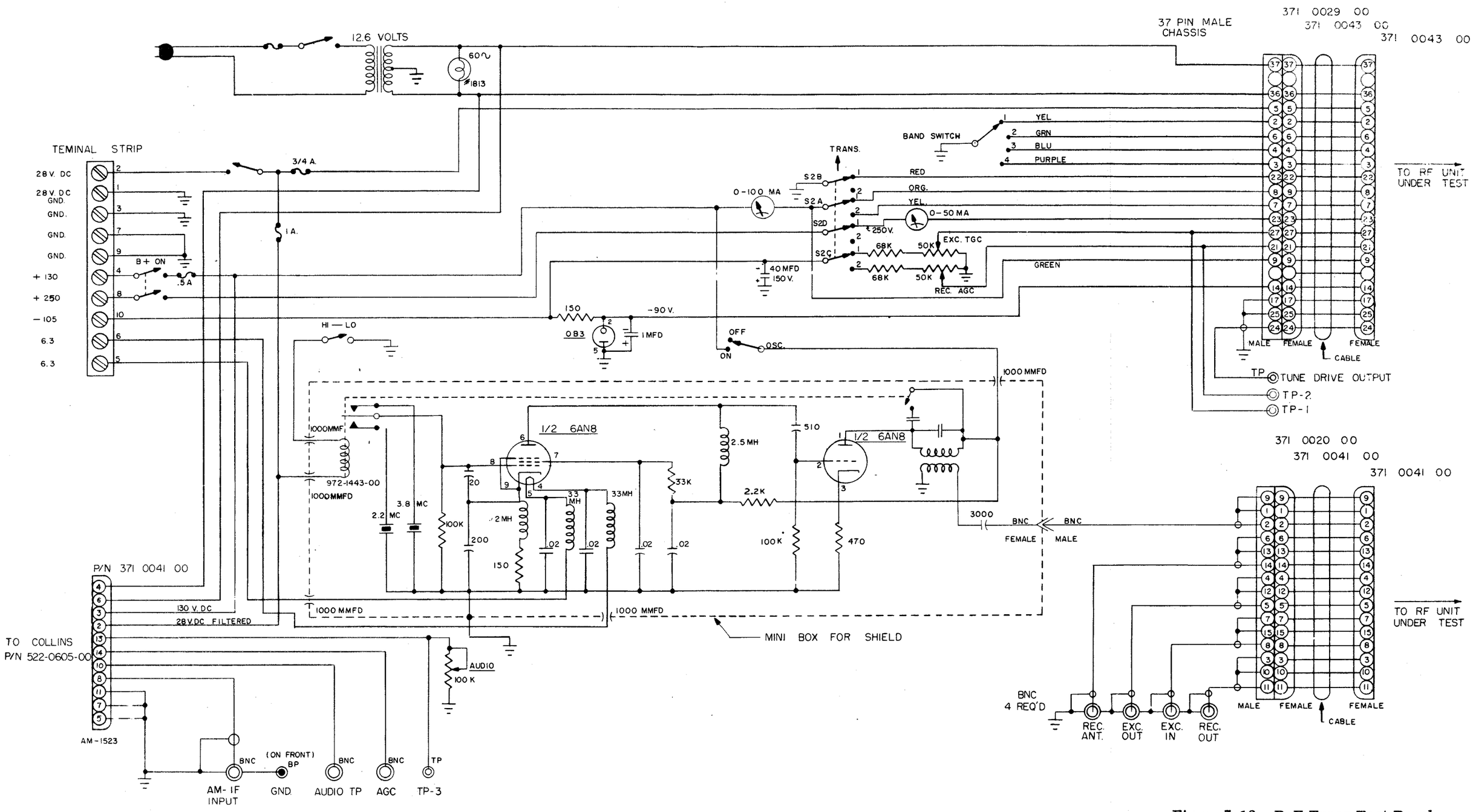


Figure 7-12. R-F Tuner Test Panel, Schematic Diagram

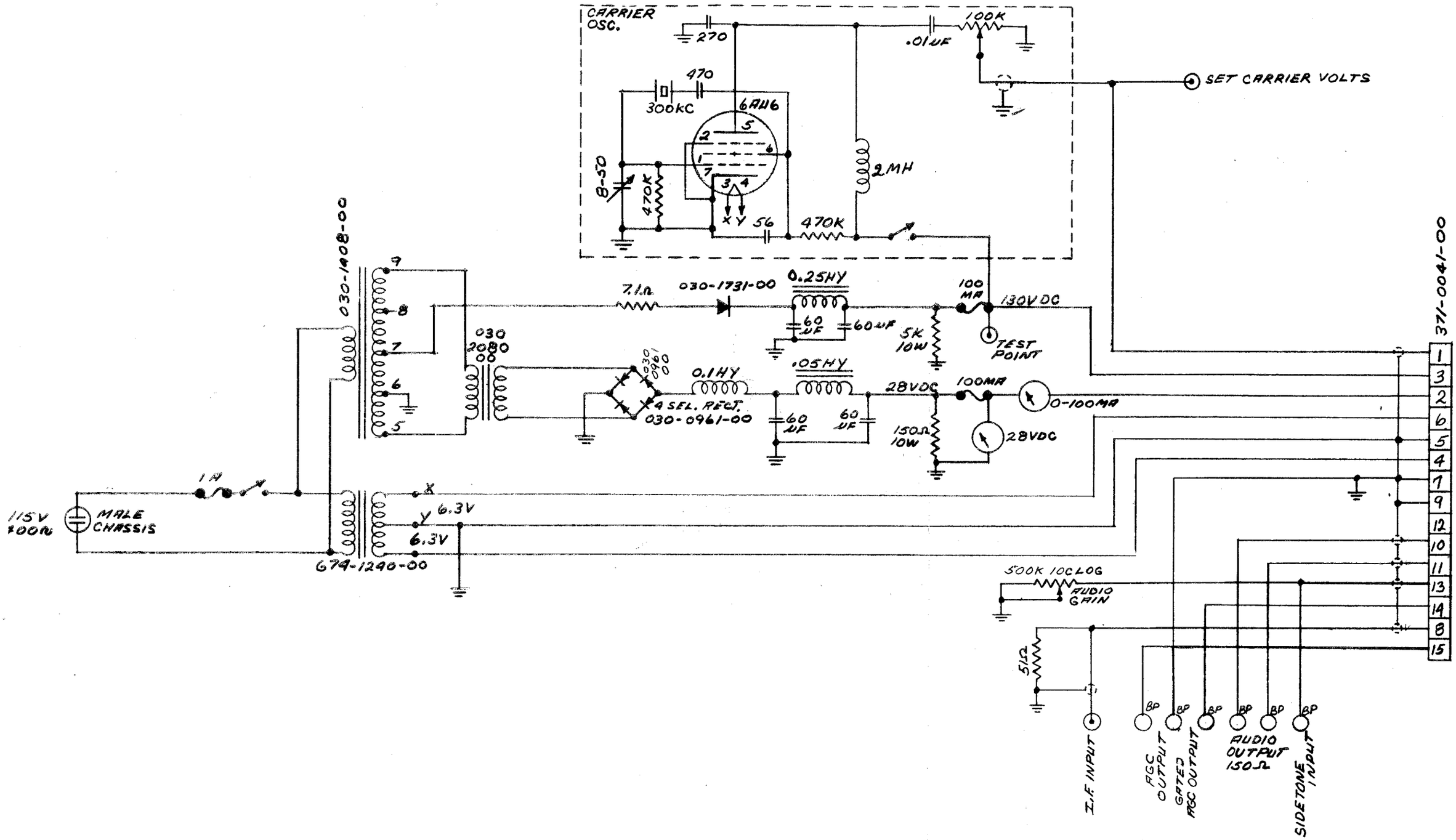


Figure 7-13. I-F/A-F Amplifier Test Panel, Schematic Diagram

NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

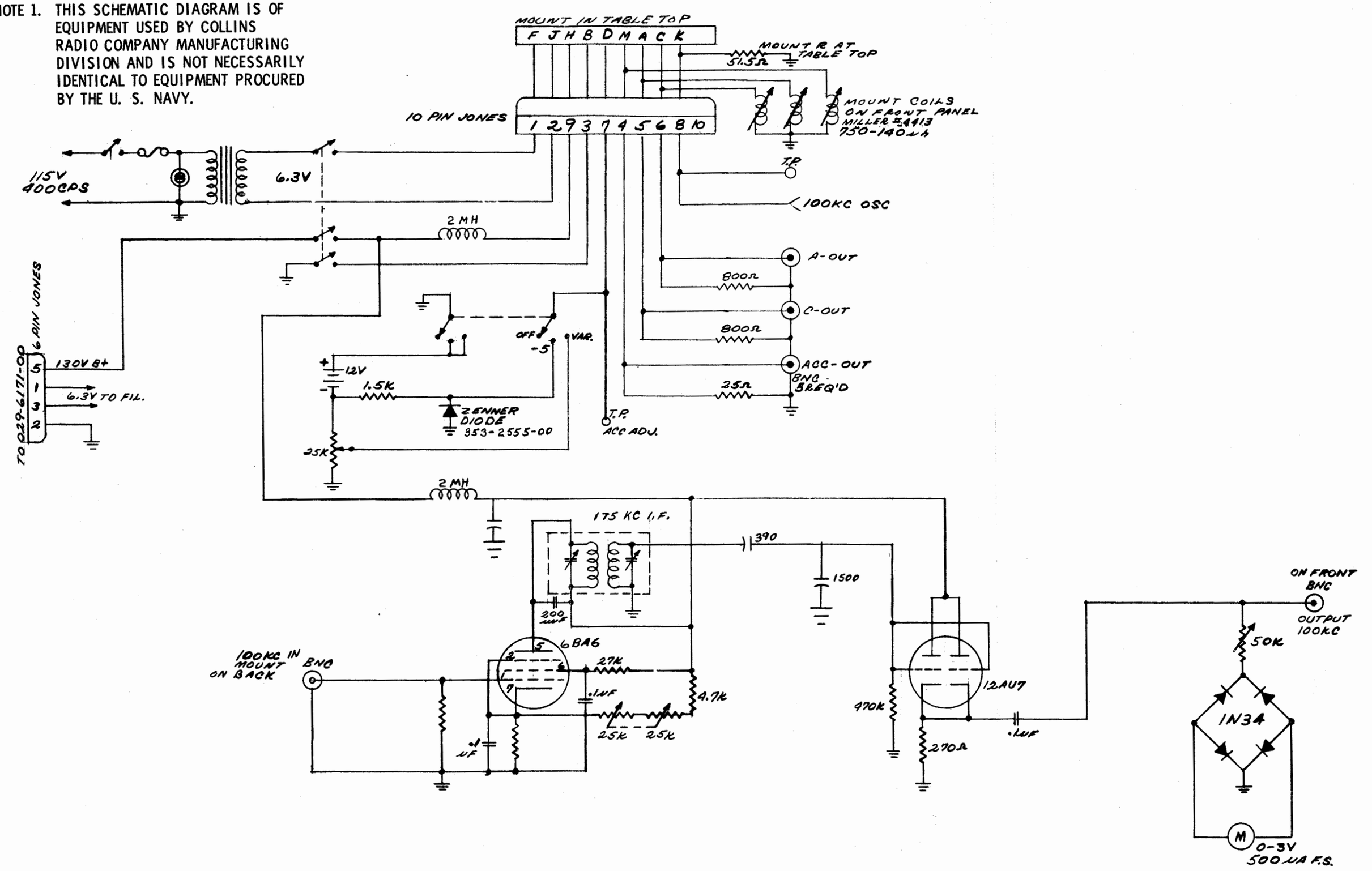
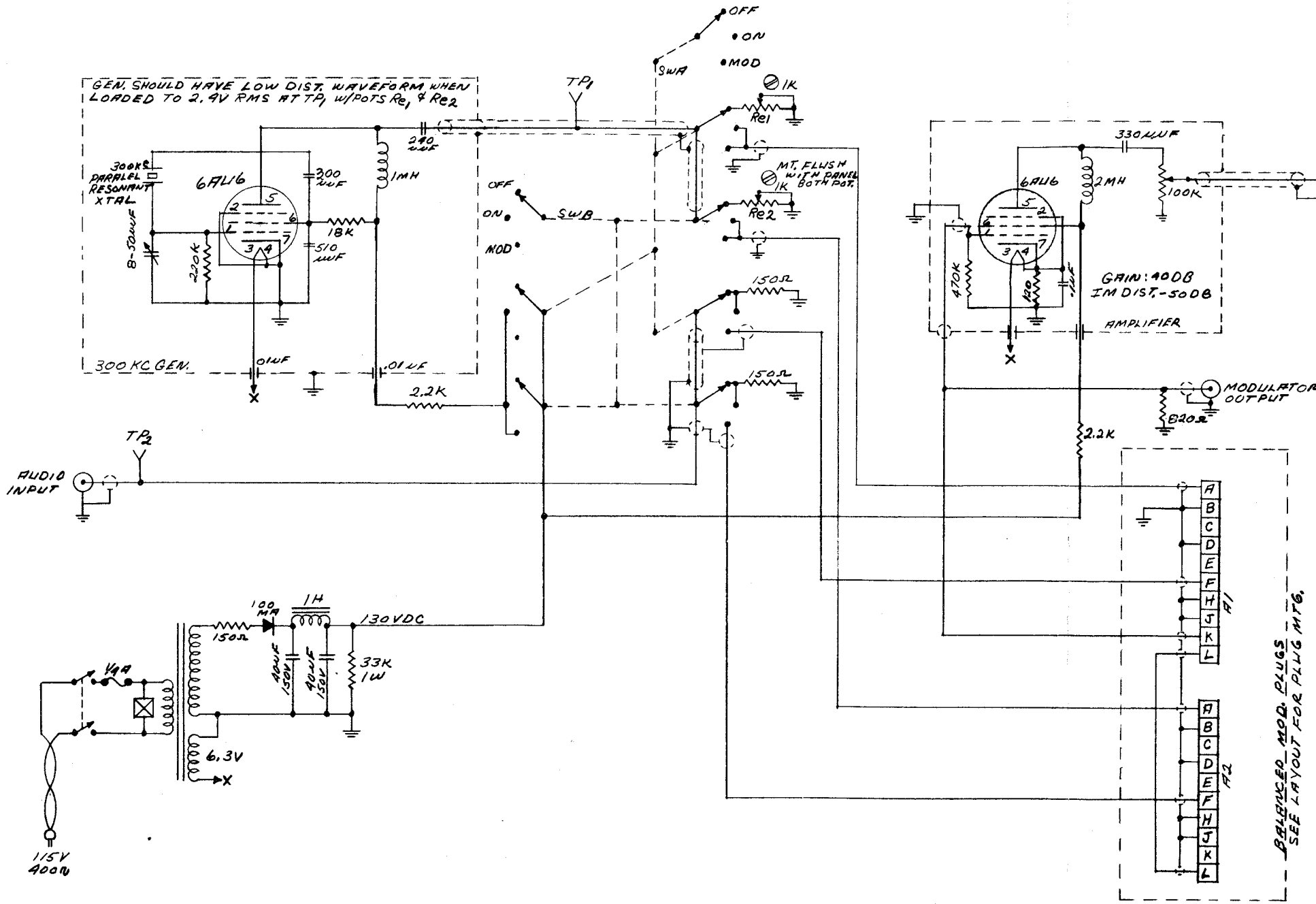
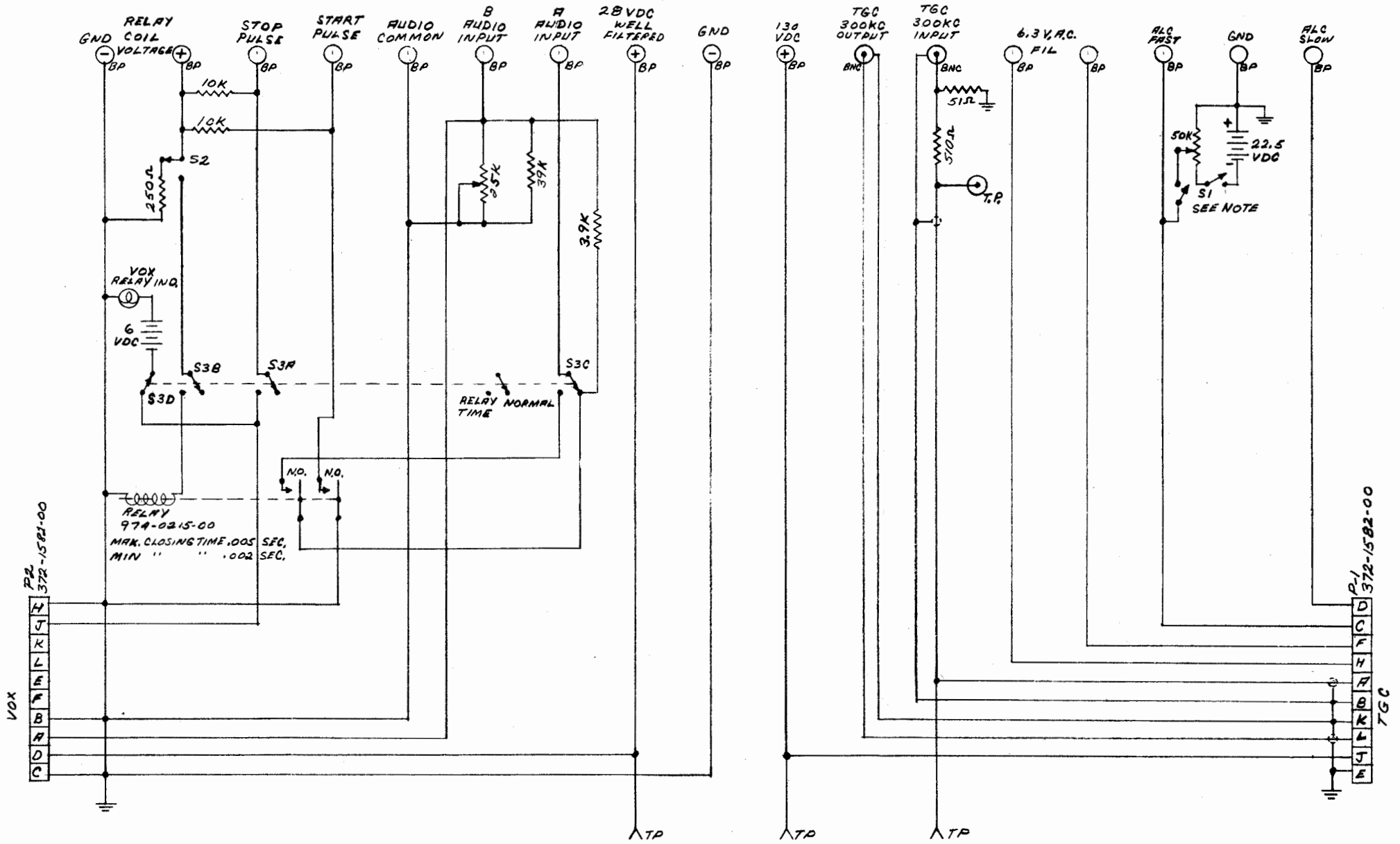


Figure 7-14. Carrier Generator Test Panel, Schematic Diagram



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-15. Balance Modulator Test Panel, Schematic Diagram



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-16. TGC Test Panel, Schematic Diagram

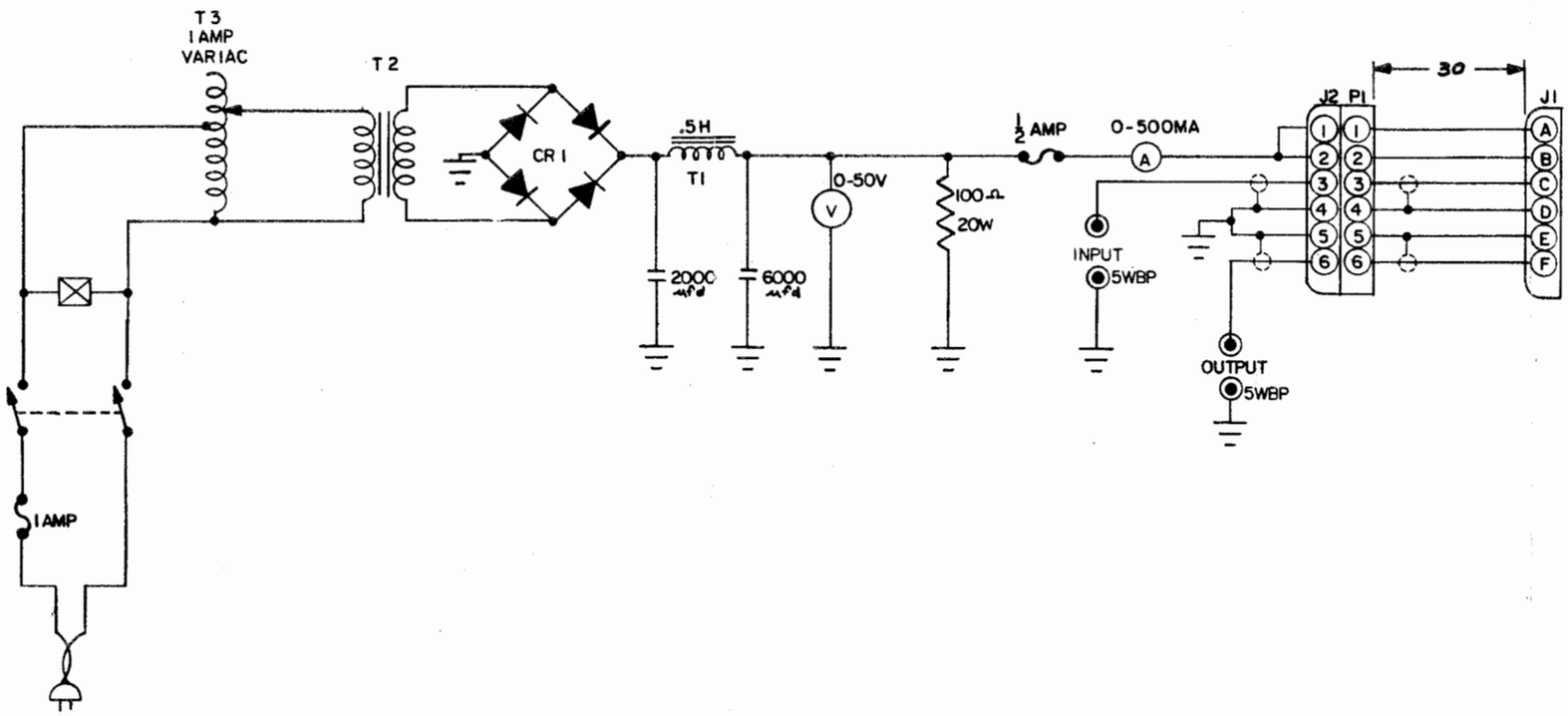
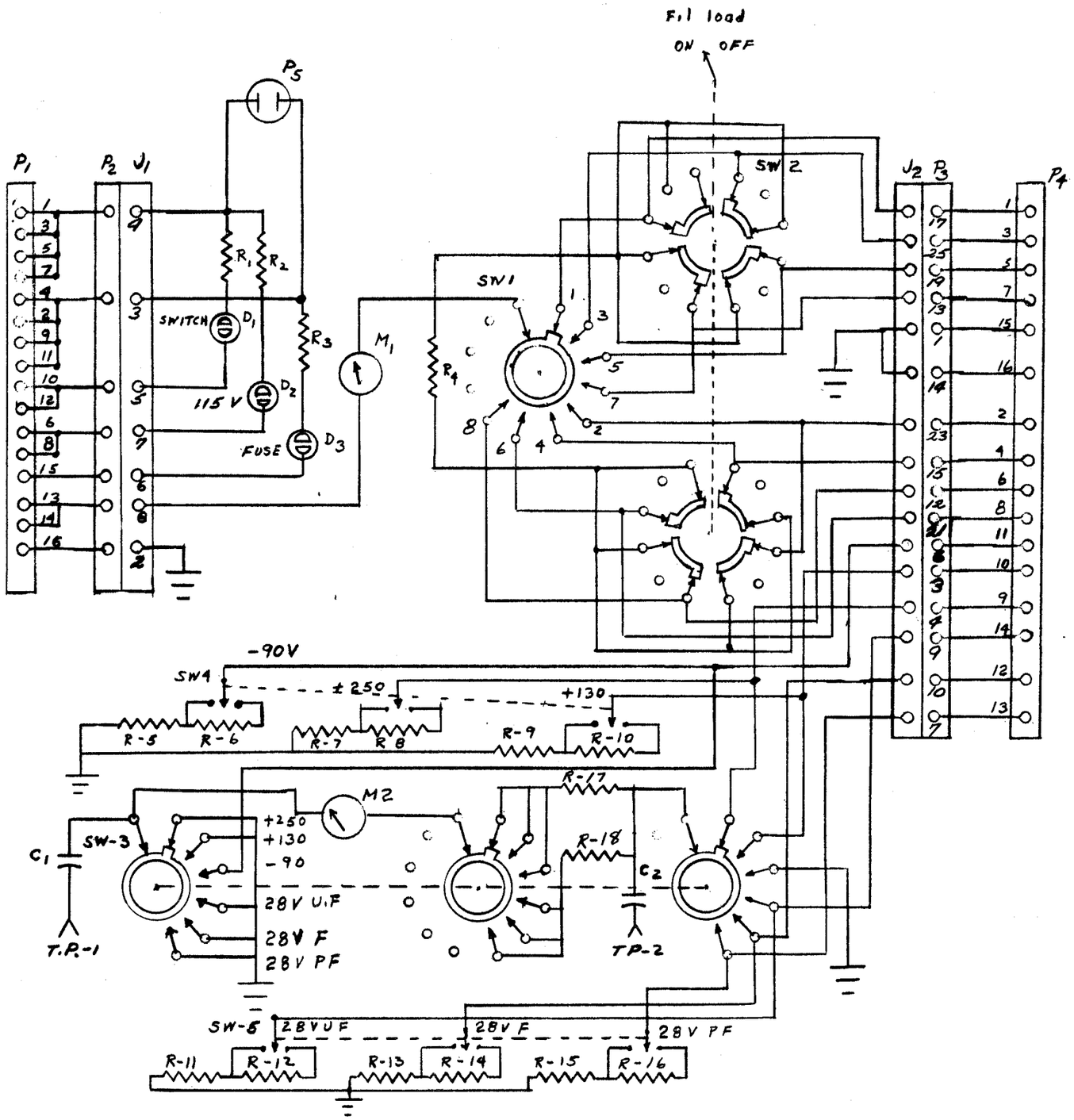


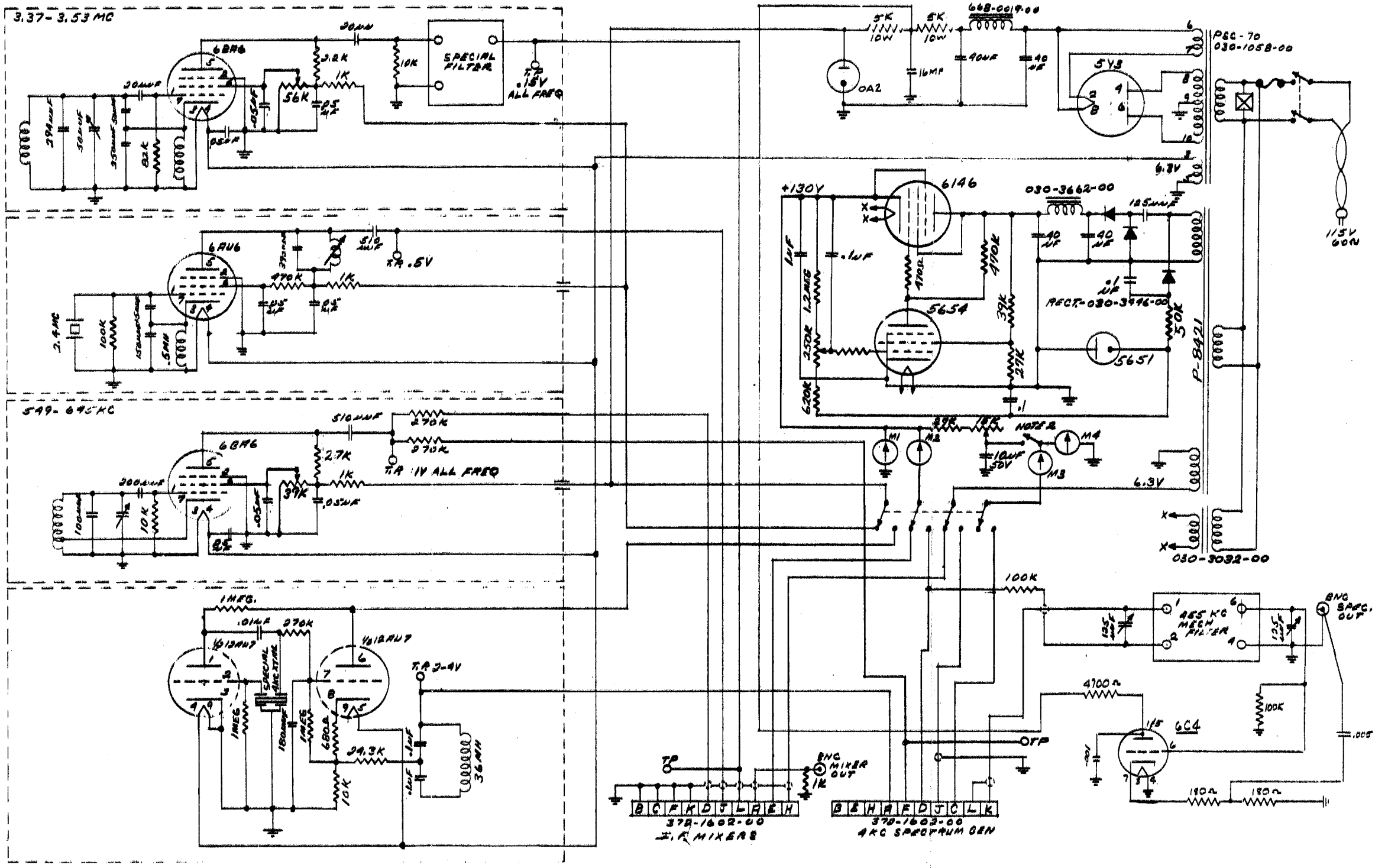
Figure 7-17. Line, Mike, and Speaker Amplifier Test Panel, Schematic Diagram



ITEM NO.	QUANTITIES ARE FOR ONE ASSEMBLY			
	COLLINS PART NO.	M'F'G PART NO.	GOV'T PART NO.	PART NAME
C-1				.5 mfd 600 Volt
C-2				.5 mfd 600 Volt
D1				Pilot LAMP
D2				Pilot LAMP
D3				Pilot LAMP
J1				8 PIN JONES MALE CHASSIS
J2				25 PIN MALE CANNON
M-1				0-15 VAC 4" SIMPSON
M-2				0-300VDC 4" SIMPSON
P1				AMPHENOL CONNECTOR
P2				8PIN JONES FEMALE CABLE
P3				25 PIN FEMALE CANNON
P4				AMPHENOL CONNECTOR
P5				MALE AC CONNECTOR
R1				50K 1/4 WATT
R2				50K 1/4 WATT
R3				50K 1/4 WATT
R4				2.4Ω 125 WATT
R5				15K 2 WATT
R6				7.5K 2 WATT
R7				6.3K 10 WATT
R8				3.7K 10 WATT
R9				590Ω 30 WATT
R10				710Ω 15 WATT
R11				18.3Ω 45 WATT
R12				91.7Ω 10 WATT
R13				47.5Ω 20 WATT
R14				109.5Ω 10 WATT
R15				153.Ω 5 WATT
R16				307.Ω 10 WATT
R17				300,000 1%
R18				30,000 1%
SW-1				1 POLE 8 POS WAFER
SW-2				8 POLE 2 POS WAFER
SW3				3 POLE 6 POS WAFER
SW4				3 POLE 3 POS TOGGLE
SW5				3 POLE 3 POS TOGGLE
TP-1				TIP JACK
TP-2				TIP JACK

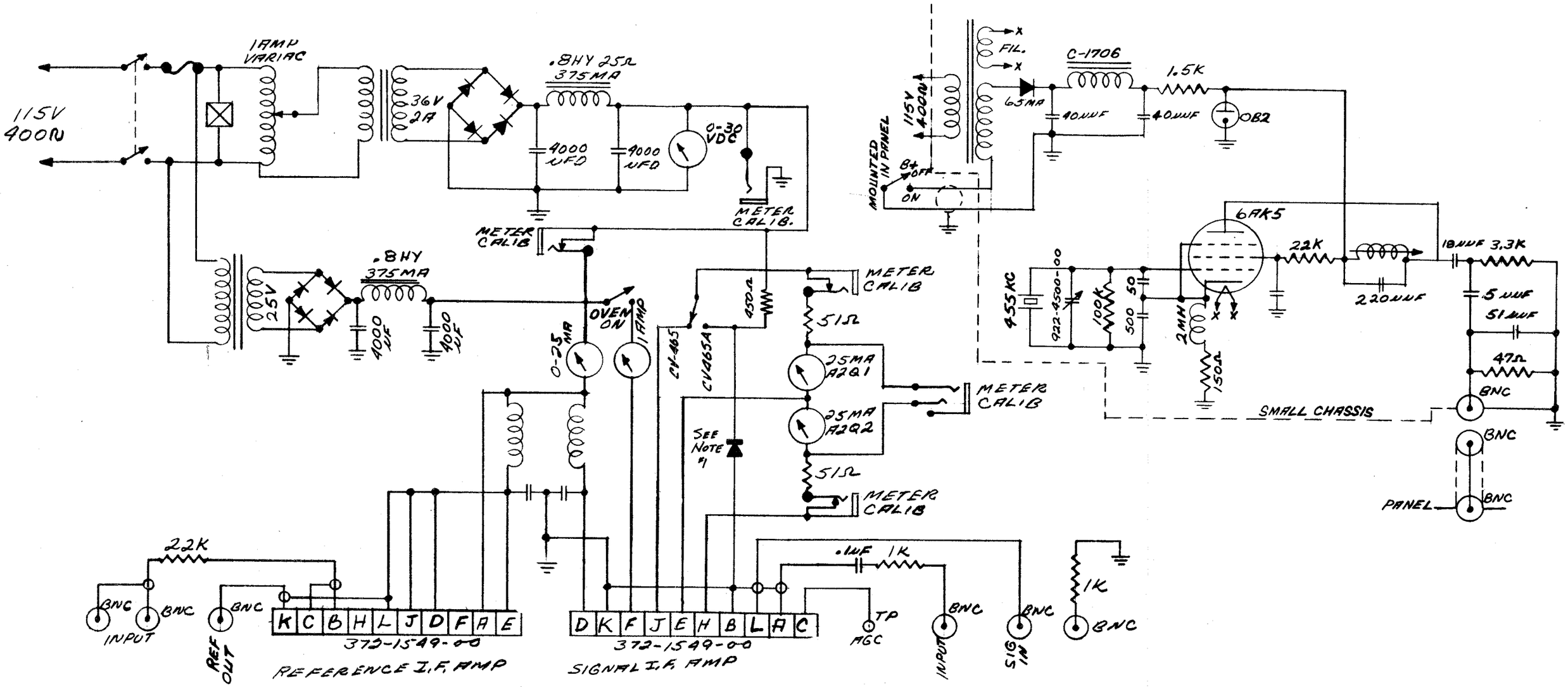
NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-18. Low Voltage Power Supply Test Panel, Schematic Diagram



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-19. 4-Kc Spectrum Generator and I-F Mixer Board, Schematic Diagram



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 7-20. Signal I-F Amplifier and Reference Amplifier, Schematic Diagram

SECTION VIII

REASSEMBLY AND TESTING OF UNITS AND FINAL REASSEMBLY

8-1. INTRODUCTION.

This section contains instructions for the reassembly of units into the rack. Because of the physical make-up of this equipment, the section on final reassembly is combined with this section since it is necessary to completely reassemble the units in the rack before performing performance tests on the individual units.

Only those units disassembled in section III will be considered in this section.

8-2. RADIO FREQUENCY AMPLIFIER AM-2061/URT.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect coaxial connectors to J1, J2, J3, and plug to J6.

(3) Swing the unit into place and secure the right side of the rear panel to the rack with the two mounting screws.

b. TESTING. - See paragraph 9-2f(5).

8-3. AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold on position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect coaxial connectors to J8, J9, J10 and plugs to J11, J12, and J13. The connector and plugs are located on the rear of the unit.

(3) Swing the unit into place and secure the right side of the rear panel to the rack with the two mounting screws.

(4) Secure the dust cover to the unit.

b. TESTING. - See paragraph 9-2f(4).

8-4. AMPLIFIER-CONTROL AM-2062/URC.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect coaxial connector to J7 and plugs to J8 and J9. The connectors and plugs are located on the rear of the unit.

(3) Swing the unit into place and secure the right side of the rear panel to the rack with the two mounting screws.

(4) Secure the dust cover to the unit.

b. TESTING. - See paragraph 9-2f(3).

8-5. SIGNAL COMPARATOR CM-126/URC.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect coaxial connector to J1 and J2 and plug to J4. The connectors and plug are located on the rear of the unit.

(3) Swing the unit into place, and secure the right side of the rear panel to the rack with the two mounting screws.

(4) Secure the dust cover to the unit.

8-6. ELECTRONIC EQUIPMENT AIR COOLER HD-347/U.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the air duct to the top of the unit with the four bolts.

(2) Secure the rear panel of the chassis to the rack with the four screws.

(3) Connect plug to J1. This plug is located on the top of the chassis next to the air duct.

(4) Secure the air filter plate to the unit.

b. TESTING. - See paragraph 9-2f(1).

8-7. CONTROL-POWER SUPPLY C-2691/URC.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect coaxial connector to J2 and plug to J3. This connector and plug is located on the rear of the unit.

(3) Swing the unit into place, and secure the right side of the rear panel to the rack with the two mounting screws.

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(4) Secure the dust cover to the unit.

b. TESTING. - See paragraph 9-2f (9).

8-8. POWER SUPPLY PP-2154/U.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect plugs to J1 and J2. The plugs are located on the rear of the unit.

(3) Swing the unit into place, and secure the right side of the rear panel to the rack with the mounting bolts.

(4) Secure the dust cover to the unit.

b. TESTING. - See paragraph 9-2f (1).

8-9. POWER SUPPLY PP-2153/U.

a. REPLACING IN RACK.

(1) Before securing the unit to the rack, connect the wires to terminal strip TB-1 and coaxial connector to J1.

(2) Secure the cover marked DANGER HIGH VOLTAGE over the terminal strip with the two mounting bolts.

(3) Because this is a heavy unit, it is suggested that help be obtained when securing it to the rack. First, place a mounting bolt in the top mounting hole on one side of the rear panel, and another one in the bottom holes of the other side of the rear panel. This will hold the unit in place for mounting of the remaining bolts.

(4) Secure the dust cover to the unit.

b. TESTING. - See paragraph 9-2f(5).

8-10. CONVERTER-OSCILLATOR CV-731/URC.

a. REPLACING IN RACK.

(1) Grasp the unit firmly, and hold in position while securing the hinge to the rack with the two mounting bolts. Obtain help if necessary.

(2) Connect coaxial connectors to J10, J11, J12, J13, J14, J15, and plugs to J16 and J17. The connectors and plugs are located on the rear of the unit.

(3) Swing the unit in place and secure the right side of the rear panel to the rack with the two mounting bolts.

b. TESTING. - See paragraph 9-2f (2).

SECTION IX

INSPECTION, TESTING, AND PACKAGING

9-1. INSPECTION.

The reassembled equipment is inspected visually as follows:

a. Check each unit for scratches, dents, and other damage which may have occurred during reassembly.

b. Check to see that the units are secured to the rack with all of the mounting bolts and that they are tight.

c. Make certain that all of the fasteners on the dust covers operate properly.

9-2. FINAL TESTING OF AN/URC-32.

a. SCOPE. - This test procedure applies to the final testing of Radio Set AN/URC-32.

b. TEST EQUIPMENT REQUIRED. - The following test equipment or its equivalent is required:

Dummy load	Bird model 82C
Vtvm	Hewlett-Packard 410B
A-C vtvm	Ballantine 310A
Multimeter	Triplett 630
Radio receiver	R-390/URR
R-F signal generator	Measurements Corp 82
Distortion analyzer	Hewlett-Packard 330D
Spectrum analyzer	Collins 478R-1
Electronic counter	Hewlett-Packard 524A
Microphone	high impedance dynamic
Earphones	high impedance magnetic
Neutralization detector	Collins part no. 029-1417-00
Linear detector	Collins part no. 029-7371-00
Voltage divider	Collins part no. 029-7342-00

Remote checker	Collins part no. 029-7345-00
J-6 tester	Collins part no. 029-4565-001 USN
Line voltage control	Variac, 115 v ac, 60 cps, 20 amp
Resistor	56,000 ohms, ±10 percent, 1/2 watt
Output meter	Daven OP-182

c. TEST CONDITIONS. - Unless otherwise specified, all tests are to be performed under the following conditions:

Power source	115 v ac, 60 cps, fused for 20 amp.
Ambient temperature	normal room ambient.
Ambient humidity	normal room ambient.
Shielding and isolation	away from strong r-f fields.
Operational duty cycle	continuous.
Warmup period	5 minutes minimum, 15 minutes for accurate frequency measurements.

d. PRELIMINARY TESTS. - None.

e. INITIAL ADJUSTMENTS.

(1) Connect the three-wire power cable to Interconnection Box J-1007/U as follows:

(a) Ground wire (white) to chassis.

(b) Common wire of 115 v ac (green) to terminal 1 of FB1.

(c) Hot wire of 115 v ac (black) to terminal 3 of FB1.

(2) Connect the remote checker to J-1007/U as follows:

(a) Remote r-f gain to D12 (red) and B14 (black).

(b) Remote agc to B13 (red) and ground (black).

(c) USB audio into C11 and C12.

(d) LSB audio into C1 and C2.

(e) USB audio out to C15 and C16.

(f) LSB audio out to C13 and C14.

(g) Tuner drive meter to B1 and B2.

(3) Set controls and adjustments as follows:

(a) CONVERTER-OSCILLATOR AM-2164/URC.

BAND CHANGE switch	BAND 1
FREQUENCY CHANGE control . . .	1700
air adjustment (rear)	position no. 3

(b) AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

USB AUDIO GAIN control subpanel	fully clockwise
LSB AUDIO GAIN control. . . . . subpanel	fully clockwise
METER BALANCE control . . . . (subpanel)	approximately center
CARRIER REINSERT ADJUST . . . (subpanel)	fully clockwise
AM-SSB switch	SSB
air adjustment (rear)	position no. 2

(c) AMPLIFIER-CONTROL AM-2062/URC.

MIC GAIN control	fully counterclockwise
USB LINE INPUT GAIN control. . . (subpanel)	fully counterclockwise
LSB LINE INPUT GAIN . . . . . control (subpanel)	fully counterclockwise
USB LINE OUTPUT GAIN . . . . control (subpanel)	fully counterclockwise
LSB LINE OUTPUT GAIN . . . . control (subpanel)	fully counterclockwise
SPEAKER GAIN control . . . . . (on module)	fully counterclockwise
air adjustment (rear)	position no. 2

(d) POWER SUPPLY PP-2154/U.

ON-OFF switch	OFF
air adjustment (rear)	position no. 3.5

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(e) POWER SUPPLY PP-2153/U.

air adjustment (rear)	position no. 4

(f) RADIO FREQUENCY AMPLIFIER AM-2061/URT.

FIL OFF-TUNE-OPERATE switch . . .	FIL OFF
PLATE switch	OFF
air adjustment (rear)	position no. 8

(g) SIGNAL COMPARATOR CM-126/UR.

GAIN control	fully counterclockwise
FREQUENCY SELECTOR switch . .	OFF

(h) CONVERTER-MONITOR CV-730/URC.

OSC CONTROL	OFF
OUTPUT control	fully counterclockwise
XMIT-REC-CW TEST switch . . .	REC
MONITOR switch	OFF
METER MULTR switch	+8 DBM
CW KEYING RELEASE TIME (subpanel) . . .	fully clockwise
air adjustment (rear)	position no. 2

(i) CONTROL-POWER SUPPLY C-2691/URC.

HANDSET switch	LOCAL

f. TEST REQUIREMENTS. - Perform the following test procedures and record results on test data sheet (see table 9-1 for sample). Test limits are listed on test data sheet. Record model serial number of complete set and of each major unit.

(1) BLOWER AND LOW VOLTAGE SUPPLY OPERATION.

(a) AIR PRESSURE SWITCH. - Turn on the PP-2154/U and check operation of pressure switch in the HD-347/U. The indicator light on the PP-2154/U will come on if the pressure switch operates. Block the air inlet to the HD-437/U with a piece of paper and check to see if the indicator light on the PP-2154/U goes off.

(b) RECEIVE VOLTAGES. - Measure the following voltages with equipment in receive condition, BAND CHANGE switch to BAND 3 ADD 1, SSB-AM switch to SSB, and line voltage set at 115 v ac.

VOLTAGE	MEASURING POINT J-1007/U
130 v dc	N-10
-90 v dc	N-11
28 v dc unfiltered	N-14
28 v dc partly filtered	N-13
28 v dc regulated	N-12
6.3 v ac (Y)	N-2
6.3 v ac (X)	N-1

(c) TRANSMIT VOLTAGES. - Measure the following voltages in transmit condition:

VOLTAGE	MEASURING POINT J-1007/U
130 v dc	N-10
250 v dc	N-9

(d) LOW-VOLTAGE REGULATION. - Measure the 28 v dc regulated at N-12 (J-1007/U) with line voltage set at 103.5 v ac and 126.5 v ac.

(e) BLOWN FUSE INDICATOR. - Remove fuse on front panel and check to see that blown fuse indicator lights.

(f) AM-2064/URC METER. - Place the meter switch on AM-2064/URC to -90-, +130- and +250-volt position. The meter on AM-2064/URC should read between 35 and 50 db.

(2) CONVERTER OSCILLATOR CV-731/VRC.

(a) TIMING BELT TENSION. - Check timing belt tension and adjust if necessary. Excessive tension will cause the frequency knob to turn hard. Insufficient tension will result in excessive backlash.

(b) MECHANICAL END STOPS. - Loosen Oldham coupler clamps on smo and r-f tuner modules and rotate the FREQUENCY CHANGE knob first to one end and then to the other. Record both the low and high frequency end stops using the figures on band 1 dial. While at the ends of the counter dial, check to see if the dials read correctly. When band 1 is set at 1700 kc, the remaining bands should read 3700, 0700, and 15700. Tighten Oldham coupler on smo.

(c) MECHANICAL ALIGNMENT OF SMO.

1. Adjustments should be made with panel in place, not hinged open. Loosen gear clamp on under side of hinged panel. Use receiver to monitor the smo frequency (J9 on tuner). Turn smo alignment knob (on right side of hinged panel) until smo output frequency is zero beat 300 kc above band 1 dial reading. The smo output frequency will vary in steps if it is functioning properly. Tighten gear clamp.

2. Check to see if the smo is centered on the counter dial. This is done by rotating the FREQUENCY CHANGE knob clockwise one complete turn (so as to check all 25 positions of the IO (interpolation oscillator) at the low end of the smo and observing the position of the dial on band 4 when frequency suddenly changes. Do the same in the counter-clockwise direction. If the dial is not centered on the smo interpolation oscillator pad so that there are equal spaces either side of the dial figure, repeat centering process. It should be centered to within one-half of a figure space.

3. Check counter dial centering at the high end of smo through one clockwise and one counterclockwise turn of the FREQUENCY CHANGE knob. Measure the d-c voltage at A2J2 and A7J2 at the high end of the smo.

(d) MECHANICAL ALIGNMENT OF R-F TUNER MODULE. - Set band 1 dial reading to 1900 kc. Connect a 50-ohm, 1/2-watt noninductive resistor to J10 of CV-731/URC. Set the receiver to 1900 kc and loosely couple to J10. With the slug rack at the bottom of its travel (coupler extreme ccw) the extended arm on the coupler should clear the upper left hold-down screw by at least 1/8 of an inch. Place TUNE-LOCAL-REMOTE switch of AM-2064/URC to TUNE position and meter function switch in R-F OUT position. Key unit and beginning with slug rack at bottom of its travel, move coupler cw until peak reading is obtained on AM-2064/URC. Place TUNE-LOCAL-REMOTE switch to LOCAL. The meter reading should go to zero if the proper point has been peaked and SSB-AM switch on AM-2064/URC is on SSB. It is possible to peak on the 2200-kc smo injection frequency. Tighten clamp on tuner.

(e) CARRIER REINSERT ADJUSTMENT. - Place LSB-OFF-USB switch on AM-2062/URC to OFF and the TUNE-LOCAL-REMOTE switch to LOCAL. Apply a 1000-cps signal to the USB IN (on remote checker) and adjust the level to 1/2 volt at test point A1J2 on the balanced modulator. Note the voltage at J9 of AM-2064/URC. Place TUNE-LOCAL-REMOTE switch to TUNE and adjust level of R3 (carrier reinsert) to obtain same value of voltage at J9. Lock R3 in this position.

(f) AGC-TGC METER BALANCE ADJUSTMENT. - Turn RECEIVER RF GAIN fully clockwise and remove the connector from J8 (AM-2064/URC). Set meter function switch to AGC-TGC and adjust METER BALANCE potentiometer (on subpanel of AM-2064/URC) for 10 db on AM-2064/URC meter. Tighten locking nut and replace connector on J-8.

(g) ELECTRICAL ALIGNMENT OF THE R-F TUNER.

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1. Set trimmers to midrange. The trimmers in the cans having T-shaped openings should be set horizontally. All other trimmers are midrange when they are vertical.

2. Set the TUNE-LOCAL-REMOTE switch to TUNE and the multimeter switch to RF OUT. Connect dummy load and r-f probe of vtvm to J10 of the CV-731/URC. During alignment of the tuner keep the output below 20 db (meter on AM-2064/URC). On the first time through the alignment procedure, overshoot the slug adjustment 100 percent. Also to assure tuning on the slugs to the proper frequency, a receiver should be loosely coupled to the dummy load. Use the "S" meter indication for tuning the first time through the alignment procedure. The RF OUTPUT meter may be used for final adjustment.

3. Select BAND 1 and a frequency of 1.900 mc. Adjust slugs of Z21, Z14, Z5, Z4, Z3, Z2, Z1, Z25.

4. Select BAND 2. Adjust slugs of Z22, Z20, Z19, Z18, Z15, Z8, Z7 and T1.

5. Select BAND 3 ADD 0. Adjust slugs Z23, Z16, Z10, Z9, Z28.

6. Select BAND 4 ADD 0. Adjust slugs Z24, Z17, Z13, Z12, Z11, Z30, Z29, Z26, and Z27.

NOTE

If a level of 2.5 v r-f cannot be obtained at J11 (tuner) some of these slugs (Z26, Z27, Z28, Z29, and Z30) may be adjusted to the wrong harmonic of the smo frequency. Readjust these slugs to obtain peak output (at J-11) where slug is farthest into the coil.

7. Select BAND 1 and adjust frequency to 3.500 mc. Peak trimmers of Z21, Z14, Z6, Z5, Z4, Z3, Z2, Z1 and Z25.

8. Select BAND 2 and peak trimmers of Z22, Z20, Z19, Z18, Z15, Z8 and Z7.

9. Select BAND 3 ADD 0. Peak trimmers of Z23, Z16, Z10, Z9, and Z28. Select BAND 2 and peak C176 (located down in Z28).

10. Select BAND 4 ADD 0. Peak Z24, Z17, Z13, Z12, Z11, Z30, Z29, Z26 and C129 located at top of Z27. Select BAND 3 ADD 0 and peak C91 (down in Z27).

11. Repeat steps 3 through 10 as necessary to obtain optimum performance. (Not less than 3.3 v output from 2.0 to 30.0 mc.)

12. Operate the equipment on receive and tune T2 for maximum noise output at the high end of any band.

(h) TUNE - OPERATE SWITCH (CV-731/URC). - The afc current should drop to zero when this switch is moved to the TUNE position. This switch should be operated momentarily every time the frequency is changed to prevent the smo from locking on a spurious frequency.

(i) SMO OPERATION. - Observe the afc meter as the CV-731/URC is tuned across band 2. Record the greatest deflection. Note the output frequency of the smo (J9 on the tuner). Move the TUNE-OPERATE switch (CV-731/URC)to TUNE and note smo frequency. Record the difference between these two frequencies as the smo frequency error without correction current being applied to the master oscillator.

(j) R-F OUTPUT VOLTAGE. - Adjust the exciter gain to 20 db on AM-2064/URC meter at 2.0 mc. Measure and record the voltage at J10 of the CV-731/URC with the dummy load connected.

(k) EXCITER R-F GAIN CONTROL. - Place CV-731/URC to 4100-kc band 2. With unit keyed, TUNE-LOCAL-REMOTE switch in TUNE, and meter reading r-f out, check the operation of the exciter r-f gain in controlling r-f out. Be sure that r-f out can be reduced to zero when ccw and go to full scale when tuned cw.

(l) R-F TUNER BACKLASH. - Approach 4100-kc band 2 from one direction and then the other, observing the r-f output indication. No more than 6-db variation in output should exist. Check bands 2, 3, and 4.

(m) 100 KC OUTPUT. - Record voltage of the 100-kc signal at J15 of CV-731/URC.

(n) 1 KC OUTPUT. - Record the amplitude and the distortion of the 1-kc signal at A7 of J-1007/UR.

(o) BAND SWITCHING. - Check to see whether the correct indicator light operates when the band switch is in each of its eight positions. Check sidestep oscillator operation as follows:

1. BAND 3 ADD 1 KC. - Set the frequency to 8.5 mc and zero beat the receiver to this frequency. Rotate the BAND CHANGE to BAND 3 ADD 1 KC. A 1-kc beat note should now be heard which can be nulled by increasing the frequency of the receiver by 1 kc.

2. BAND 4 ADD 1 KC. - Set the frequency to 17.3 mc and zero beat the receiver. Rotate the BAND CHANGE to BAND 4 ADD 1 KC. Null out the 1-kc beat note by increasing the frequency of the 51J receiver.

3. BAND 4 ADD 2 KC. - Rotate the BAND CHANGE to BAND 4 ADD 2 KC. Null out the 1-kc beat note by increasing the frequency of the receiver.

4. BAND 4 ADD 3 KC. - Rotate the BAND CHANGE to BAND 4 ADD 3 KC. Null out the 1-kc beat note by increasing the frequency of the receiver.

(p) RECEIVE AGC ACTION. - Set the CV-731/URC to 14.9 mc band 3. Apply a 5-uv signal to the receiver input (J11) on USB. Observe the audio output on the a-c vtvm. Increase the input signal to 200,000 uv and record the decibel increase in voltage. Repeat for LSB.

(q) AGC THRESHOLD. - Tune receiver to 2,000 mc and place on USB. Connect vtvm to test point J2 on USB i-f/a-f amplifier module. Set meter on one-volt range. Turn r-f gain fully CW and apply 2,001 mc from signal generator beginning with zero output and increase gradually until vtvm shows definite increase. Record the signal generator level. Repeat at 29.000 mc using test point J2 on LSB i-f/a-f amplifier module and 28.999-mc signal generator frequency.

(r) SPURIOUS, IMAGE, AND I-F REJECTION. - Apply a 5-microvolt signal at the frequency indicated on the data sheet. Note agc voltage level. Without changing the frequency of the CV-731/URC, tune the signal source to the spurious frequencies listed and increase level to obtain the same agc output as the reference. Record db below 5 microvolt signal. Repeat at indicated image and i-f frequencies. Set signal source level to 50,000 microvolts and vary the signal frequency from 2.0 to 50.0 mc. Record any unlisted spurious frequencies that are less than 80 db down (omit harmonics of signal source).

(s) RECEIVE SENSITIVITY. - Record input in uv required to produce 1 volt agc on either sideband. Measure S+N/N ratio for 1-uv input to receiver. Make above measurements at the following frequencies with RECEIVER RF GAIN on AM-2064/URC fully cw. Use distortion analyzer for S+N/N.

BAND 1	BAND 2	BAND 3	BAND 4
2.000 mc	3.700 mc	7.700 mc	15.700 mc
2.700	5.700	11.700	23.700
3.700	7.700	15.700	30.000

(t) INTERNAL SIGNALS. - Ground the antenna terminals and tune the AN/URC-32 across the frequency range. Record frequency of signals heard and note agc meter reading. Detune receiver 10 kc from internal signal and apply a signal from signal generator of a level that will result in the same agc reading. Record this level.

(u) FREQUENCY STANDARD ACCURACY. - Set frequency generator to 17.300 mc. Place TUNE-LOCAL-REMOTE switch on AM-2064/URC to TUNE and key AN/URC-32. Measure output frequency at J10 with frequency counter.

(3) AMPLIFIER-CONTROL AM-2062/URC.

(a) SPEAKER-EARPHONE OPERATION. - Check to see that speaker operates when SIDEBAND SELECTOR switch is in LSB and USB positions and is inoperative in the OFF position of the switch. Set audio gain control on the speaker amplifier module for a normal noise level in the speaker. Place SIDEBAND SELECTOR on either sideband and check to see that noise is present on both sidebands when earphones are plugged into front panel PHONES jack. Check to see that speaker is disabled when earphones are inserted.

(b) GAIN ADJUSTMENT AND DISTORTION OF LINE OR MICROPHONE AMPLIFIER MODULES.

1. USB LINE. - Place SIDEBAND SELECTOR to LSB. Key unit and turn input gain control on AM-2062/URC subpanel fully CW. Apply a 10-mv 1000-cps signal to USB IN on remote checker. Adjust gain control PHONES on USB module until one volt is obtained at A1J2 on balanced modulator in AM-2064/URC. Measure audio distortion at A1J2 with signal increased to 50 mv and line input gain control (R1) adjusted for one v rms at A1J2.

2. LSB LINE. - Place SIDEBAND SELECTOR to USB. Apply a 10-mv 1000-cps signal to LSB IN on remote checker. Adjust gain control R109 on LSB line amplifier for one volt at A2J2 on balanced modulator module of AM-2064/URC. Measure audio distortion at A2J2 with signal increased to 60 mv and line gain control (R2), adjusted for one v rms at A2J2.

3. MICROPHONE AMPLIFIER. - Replace LSB line amplifier with microphone amplifier and repeat step 2 above. Place original LSB line amplifier in microphone amplifier location. Lock line input gain controls.

(c) REMOTE AUDIO INPUT. - Place SIDEBAND SELECTOR on USB and apply a 20-mv 1000-cps signal to J7 (BNC connector at rear). Increase MIC GAIN and check to see that one volt can be obtained at A1J2 on balanced modulator AM-2064/URC. Place SIDEBAND SELECTOR to OFF and check to see that no signal is present on either A1J2 or A2J2 of balanced modulator. Place SIDEBAND SELECTOR to LSB and check for a one-volt signal at A2J2 of balanced modulator.

(d) MICROPHONE INPUT DISTORTION. - Apply a 1000-cps signal through a 56K 1/2-watt resistor to the MIC jack (right hand pin). Set level at input to MIC jack at 50 mv. Increase MIC gain until one v rms is obtained at A1J2 of balanced modulator with SIDEBAND SELECTOR in USB position. Measure distortion of audio signal at A1J2.

(4) AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

(a) TRANSMITTER GAIN CONTROL.

1. Set the TUNE-LOCAL-REMOTE switch to LOCAL and the SIDEBAND SELECTOR switch to OFF. Set exciter gain clockwise (maximum). Connect the a-c vtvm to J9 of AM-2064/URC and apply 1000 cps to USB IN on the remote checker. Adjust level to obtain one volt at A1J2 (balanced modulator). Note the level at J9. Reduce this level 10 db by applying a negative voltage (from external battery) to B11 of J1007/UR. Record the negative voltage.

2. Record db reading on AGC-TGC meter.

3. Record dc voltage at B12 of J-1007/UR. Remove external battery from B11.

(b) TRANSMITTER FREQUENCY RESPONSE.

1. Measure and record minimum and maximum level at J9 as the USB audio input frequency is varied from 350 to 3000 cps, maintaining the audio input level at A1J2 of balanced modulator at one volt.

2. Repeat for LSB audio input with one volt at A2J2.

(c) RECEIVER GAIN AND DISTORTION. - Place RECEIVER RF GAIN fully CW and SIDEBAND SELECTOR on to OFF.

1. Set audio load to 600 ohms and connect to LSB OUT on the remote checker. Set LSB LINE OUTPUT GAIN on AM-2062/URC subpanel fully CW. Apply 100 uv, 301-kc signal to J8 on AM-2064/URC and adjust LSB AUDIO GAIN control on AM-2064/URC subpanel for 20-mw output. Measure distortion.

2. Increase signal input level to 0.8 v and record; audio output level, AGC meter reading, distortion, and voltage at B13 of J-1007/URC. Return signal input to 100 uv.

3. Check to see that the LSB LINE OUTPUT GAIN will vary the output smoothly from 0 dbm to +7 dbm. Set LSB LINE OUTPUT GAIN fully clockwise.

4. Place SIDEBAND SELECTOR on AM-2062/URC to LSB. Adjust SPEAKER GAIN control on speaker amplifier module for 5 v rms across 600 ohm at the AM-2062/URC PHONES jack. Measure distortion. Return LSB LINE OUTPUT GAIN control to ccw position. Lock SPEAKER GAIN control on speaker amplifier module.

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5. Terminate USB OUT (on remote checker) with 600-ohm audio load. Set SIDEBAND SELECTOR to OFF and OUTPUT GAIN control AM-2062/URC subpanel fully clockwise. Apply a 100-uv, 299-kc signal to J8 on AM-2064/URC and adjust USB AUDIO GAIN control on AM-2064/URC subpanel for 20-mw output. Measure distortion.

6. Increase signal input level to 0.8 v and record audio output level, agc meter reading, distortion, and voltage at B13 of junction box. Return signal input level to 100 uv.

7. Check to see that the USB LINE OUTPUT GAIN control will vary the output smoothly from 0 dbm to +7 dbm. Place USB LINE OUTPUT GAIN control fully ccw.

8. Remove r-f input signals. Rotate RECEIVER R-F GAIN control to extreme counterclockwise position. Record voltage at B13 on J-1007/U and agc meter reading.

(d) REMOTE OPERATION - AGC METER. - Turn TUNE-LOCAL-REMOTE switch to REMOTE. Connect a 0-1 ma meter between B1 and B2 of J-1007/U. Vary the potentiometer on the remote checker and note whether the current through the milliammeter varies. The audio output from the equipment should also vary.

(e) AM OPERATION.

1. Place SSB-AM toggle switch (AM-2064/URC) to AM. Set TUNE-LOCAL-REMOTE switch to LOCAL.

2. Place AM i-f/a-f amplifier module in position provided (J14).

3. Remove carrier generator module from AM-2064/URC and measure voltage at pin H of module jack (J5). Should be zero in receive position and 130 v d-c in transmit position. Replace module.

4. Remove LSB and USB i-f/a-f amplifier modules and measure voltage at pin 2 of J1 and J2. Should be zero. Replace modules.

5. With unit keyed observe reading on AM-2064/URC meter in R-F OUT position. Turn EXCITER RF GAIN if necessary.

6. Listen to USB audio output as 100 uv 301 kc is applied to J8. No CW beat note should be heard. Then turn on 1000 cps, 30 percent modulation; a single tone should be heard.

7. Remove AM i-f/a-f amplifier module, place AM-SSB switch to SSB and measure voltage at pin 2 of J14. Should be zero. Replace AM i-f/a-f amplifier module and check remote AM operation.

(5) RADIO FREQUENCY AMPLIFIER AM-2061/URT.

(a) ROLLER COIL END STOPS. - Turn DRIVER TUNER and PA TUNE knobs fully ccw and check to see that end stop agrees with zero dial reading.

(b) FRONT PANEL INTERLOCK. - Remove front access door and check operation of front panel interlock by measuring resistance from HV lead to ground. Should be zero ohms.

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(c) CONTROL FUNCTIONS. - The following checks should be made with the drive disconnected at J1.

1. Measure the filament voltage at the test points on the front panel of the AM-2061/URT with the FIL OFF-TUNE-OPERATE switch in the FIL OFF position. The voltage should be zero.

2. Place FIL OFF-TUNE-OPERATE switch to OPERATE and measure the voltage.

3. Place FIL OFF-TUNE-OPERATE switch to OPERATE and measure the voltage.

WARNING

2000-volt hazard precautions must now be observed.

4. Turn the FIL OFF-TUNE-OPERATE switch to TUNE. Place the PLATE switch to ON and note time delay before the red light goes on indicating plate voltage.

5. Place the PLATE switch to KEY position. Check to see that the unit is keyed and HV is present (indicated by red light).

(d) REAR INTERLOCK AND FUSED CIRCUIT. With FIL OFF-TUNE-OPERATE switch in TUNE position, swing AM-2061/URT out from rack so as to release rear interlock and note if primary power is removed from AM-2061/URT. This can be noted by visual check of 6CL6 filaments or by measuring filament voltage at front panel test points. Close interlock and remove front panel fuse and check to see that primary power is removed. Check value of fuse.

(e) NEUTRALIZATION. - With filament power applied, but with the PLATE power turned OFF (remove h-v fuse as an added safety precaution), feed the output (J10) of the CV-731/URC into the r-f output connector, J2, of AM-2061/URT. A frequency of 24 mc is satisfactory. Connect the neutralization detector (Collins part number 029-1417-00) across L4, the PA grid tank inductor. The leads for the detector can be fed through the air hole in the rear plate.

NOTE

The rear plate must be on while the PA is being neutralized. Connect a ua meter to read the output of the detector. Tune the PA plate tank inductor (L10) for a dip in the RF output of the CV-731/URC. Tune the PA grid tank (L4) for maximum output from the detector. Adjust the neutralizing capacitor, C12, for minimum output from the detector. Remove the detector and the coaxial from J2. Replace HV fuse.

(f) POWER AMPLIFIER TUBE BALANCE. - Adjust the bias of the power amplifier tubes by means of R19 until a static current reading of 150 ma is reached. By operating in turn switches S2 and S3, check the static balance of the PA tubes. If unbalance is too great, tube selection may be required.

NOTE

A pair of tubes which give reasonably good static balance may yield poor dynamic balance.

WARNING

2000-volt hazard precautions must now be observed.

(6) SYSTEMS CHECK. - Connect 50-ohm coaxial from J2 on AM-2061/URT to voltage divider (Collins part number 029-7342-00), "T" adapter for vtvm r-f probe, and dummy load.

(a) CONTINUITY OF ANTENNA COUPLER PLUG. - Connect J-6 tester (Collins part number 029-4565-00) to the antenna tuner plug. The 115-v a-c 28-v d-c lamps should be energized when the AN/URC-32 is turned on. The key on the test fixture should key the AN/URC-32 system. The interlock switch should disable the system when on transmit. The keyed 115-v lamp should energize when the unit is keyed. Check for audio output at the PHONES jack.

(b) SIDETONE OPERATION (2.0 mc). - Place SIDETONE switch on subpanel of AM-2064/URC to ON. Place SIDEBAND SELECTOR on AM-2062/URC to LSB. Insert microphone into AM-2062/URC MIC jack. Key and talk into microphone. Note that noise can be heard in earphones inserted in AM-2062/URC PHONES jack. Repeat for USB.

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(c) BALANCED MODULATOR ADJUSTMENT.

NOTE

Refer to paragraph 9-3 for SSB measurements utilizing the Collins 478R-1 spectrum analyzer. Unless otherwise specified, the EXCITER RF GAIN CONTROL shall be adjusted to obtain 80 v across the r-f load (125 watts) with the TUNE-LOCAL-REMOTE switch in the TUNE position.

Operate the equipment at 2.0 mc. Connect the spectrum analyzer RF INPUT to the voltage divider (Collins part number 029-7342-00). Connect the 600 OHM output of the two-tone mixer panel to the USB IN terminals on the remote checker. Set up the 478R-1 as per paragraph 7-19 using 1200- and 1900-cps tones. With the AM-2062/URC SIDEBAND SELECTOR in the OFF position apply a 0 dbm (0.77 v across 600 OHMS) two-tone test signal. This 0 dbm signal should drive the PA to TGC threshold. Adjust the USB LINE INPUT GAIN control to obtain the exact level for TGC threshold. Locate the carrier on the spectrum analyzer and adjust A1R7, A1R8, A2R7 and A2R8 on balanced modulator for maximum carrier suppression.

(d) TGC ACTION. - With the equipment operating as in step (c) above, record the third order distortion and power output as the level of the two tones is increased 10 db above threshold value in 2-db steps. See paragraph 7-19 for method of measuring third order distortion.

(e) SUPPRESSION, DISTORTION, AND RF POWER OUTPUT.

1. With the equipment set up to 2.0 mc on USB measure the following while operating at TGC threshold: carrier suppression, third and fifth order distortion above and below the two tones, opposite sideband suppression, power output (vtvm across r-f load), plate current no. 1, no. 2 and total plate current. Remove one tone and measure maximum power output and total plate current.

2. Repeat step 1 above at 4.1 mc on LSB.

3. Repeat step 1 above at 14.90 mc on USB. Also measure noise level as follows: Place the SSB-AM switch on AM-2064/URC to AM. Check level for 125 watts output. Connect the linear detector (Collins part number 029-7371-00) to the r-f load. Measure the input to the detector at the test point with a vtvm. The level should be about 10 v rms due to the voltage divider built into the detector. Measure the output of the linear detector with the a-c vtvm. Compute the noise level (in db) from the ratio of the vtvm reading to a-c vtvm reading.

4. Repeat step 1 above at 30.0 mc.

(7) SIGNAL COMPARATOR CM-126/UR.

(a) INITIAL ADJUSTMENTS. - Set switches and controls as follows:

CM-126/UR.

GAIN control . . . . . fully clockwise.

FREQUENCY SELECTOR switch . OFF.

AM-2062/URC.

SIDEBAND SELECTOR switch . . LSB.

CV-731/URC.

BAND CHANGE switch . . . . . BAND 1.

FREQUENCY CHANGE control . . 2.000.

AM-2064/URC.

RECEIVER R-F GAIN control . . fully clockwise.

(b) 1 KC COMPARING. - Place FREQUENCY SELECTOR to 1 KC. Apply a 5 uv, 1.999 signal from r-f signal generator to receive input of CV-731/URC (J11). Insert earphones into PHONES jack on AM-2062/URC. Change frequency on r-f signal generator until beat note is heard. Adjust meter GAIN and METER ZERO on CM-126/UR to obtain meter variation at beat note rate centered about center scale. Note that meter variation can be centered about zero. Note maximum deflection (centered) that can be obtained by appropriate adjustment of GAIN and METER ZERO controls. It will be difficult to maintain a steady beat note because of the r-f signal generator drift. Place FREQUENCY SELECTOR to OFF and note that beat note is not heard in earphones, but a steady 1-kc tone (assuming r-f signal generator is 1 kc below 2.000 mc). Repeat meter check for r-f signal generator of 1 uv and 100 uv.

(c) 100 KC COMPARING. - Check to see that 100 kc from CV-731/URC is connected by coaxial to 100-kc input of CM-126/UR (J1). Place FREQUENCY SELECTOR to 100-kc position. Apply .6 v rms 100-kc signal from a frequency standard to EXT. 100-kc input (J2) on CM-126/UR. By adjustment of the 100-kc frequency from the CV-731/URC, GAIN, and METER ZERO controls, note maximum deflection centered about zero that can be obtained on the meter of the CM-126/UR.

(8) CONVERTER-MONITOR CV-730/URC.

(a) INITIAL ADJUSTMENTS. - Set switches and controls as follows:

CV-730/URC.

METER MULTR switch . . . . +8 DBM

XMIT-REC-CW TEST switch . . REC

OSC CONTROL switch . . . . . OFF

OUTPUT control . . . . . fully ccw

CW KEYING RELEASE TIME (subpanel) . . fully ccw

MONITOR switch . . . . . USB XMIT

AM-2064/URC.

TUNE-LOCAL-REMOTE switch . local

(b) CW KEYING RELEASE TIME. - Key unit by placing XMIT-REC-CW TEST switch to CW TEST with OSC CONTROL in CW 1 KC position. Release switch and measure time that elapses between removal of the ground and the XMIT light going off. Turn CW KEYING RELEASE TIME (subpanel) fully ccw and check to see that time delay is reduced. Reset CW KEYING RELEASE TIME for 0.5 seconds release time. See figure 9-1.

(c) FSK FREQUENCY ADJUSTMENT.

1. Place CV-731/URC on 1.998 mc, band 2. Feed r-f output of CV-731/URC into 50-ohm input of frequency counter. Place OSC CONTROL to FSK position. Key unit by placing switch to XMIT and adjust OUTPUT control for "0" reading on dbm meter.

2. Adjust EXCITER RF GAIN on AM-2064/URC as necessary to obtain operating level for counter. Apply +100 v dc between pin 1 or J1 and ground. Adjust MARK (HI) (C6 on subpanel) for a frequency of 2.000425 mc ±5 cps on counter. Remove voltage from pin 1. Adjust SPACE (LOW) (C4 on subpanel) for a frequency of 1.999575 mc ±5 cps.

NOTE

As a precautionary measure, check output of CV-731/URC with carrier reinserted to ensure that it is on 1.998 mc. Measure with counter.

(d) BFO FREQUENCY ADJUSTMENT. - Turn the BFO control knob to center position. Connect the counter to J1 of the carrier generator module. Adjust L1 (L1 is a hex head slug accessible through hole at bottom of BFO subassembly) for an output frequency of 300.550 kc ±25 cps. Turn the BFO control cw to 1 KC position and measure the frequency at J1. Turn BFO control ccw to 1 KC position and measure frequency.

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(e) DBM METER CALIBRATION.

1. USB TRANSMIT. Remove power from equipment and remove connector from J1 at rear of unit. Place METER MULTR to +8 DBM and MONITOR on USB XMIT. Apply a 1000-cps, 2-v rms tone to pins 5 and 6 of J1 from the audio oscillator terminated by a 619-ohm resistor. Measure voltage with a-c vtvm. Record dbm meter reading (add +8 dbm to meter indication).

2. USB RECEIVE. - Repeat step 1 above with MONITOR switch on USB REC position and apply audio signal to pins 17 and 18 of J1.

3. LSB TRANSMIT. - Repeat step 1 above with MONITOR switch on LSB XMIT position and apply audio signal to pins 9 and 10 of J1.

4. LSB RECEIVE. - Repeat step 1 above with MONITOR switch on LSB REC position and apply audio signal to pins 13 and 14 of J1.

(f) CW/FSK OUTPUT LEVEL.

1. FSK (SPACE). - With power again applied to equipment, place a-c vtvm across pins 5 and 6 of J1 of CV-730/URC. Place OSC CONTROL on FSK and METER to +8 DBM. Key unit. Increase output control and check to see that at least 3 v rms can be obtained as indicated on a-c vtvm.

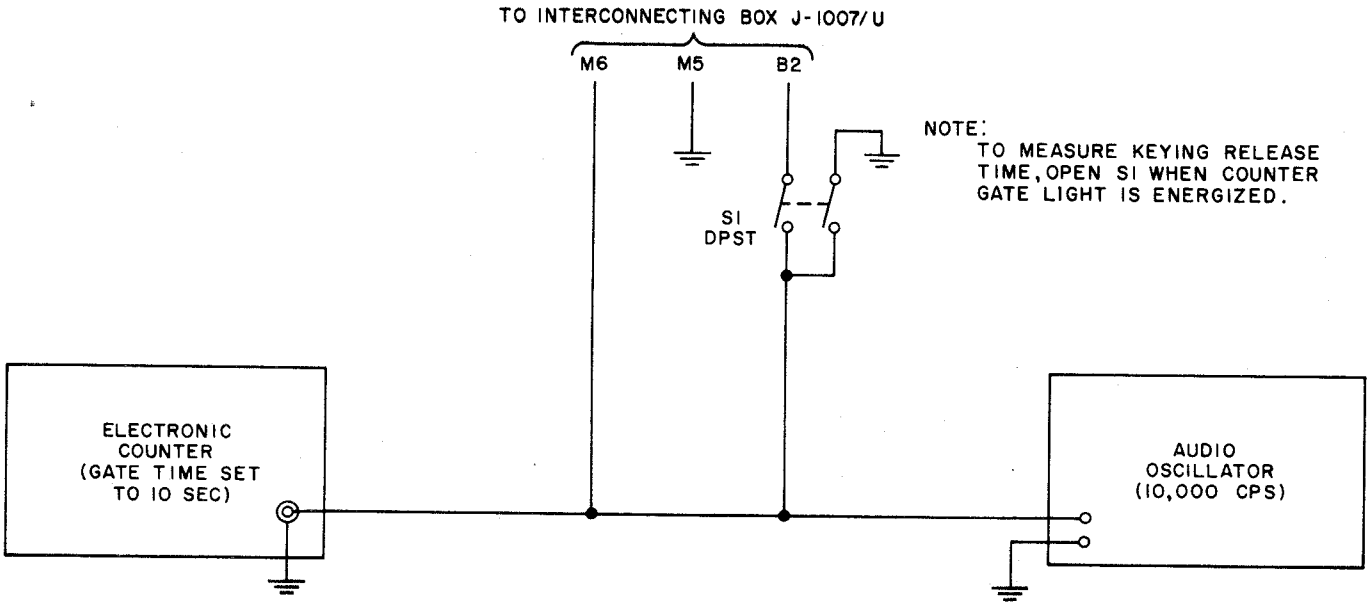

Figure 9-1. Keying Release Time Test Circuit

2. FSK (MARK). - Repeat step 1 above with +100 v d-c applied between pin 1 of J1 and ground.

3. CW 1 KC. - Repeat step 1 above with OSC CONTROL on CW 1 KC position.

4. CW 1.5 KC. - Repeat step 1 above with OSC CONTROL on CW 1.5 KC position.

(g) CW FREQUENCY ACCURACY. - Set CV-731/URC on 2.000 mc and feed r-f output into 50-ohm input of frequency counter. Place OSC CONTROL in CW 1 KC position and adjust output for a 0 reading on dbm meter with METER MULTR on +8 DBM position. Measure r-f output frequency of CV-731/URC. Repeat measurement with OSC CONTROL in CW 1.5 KC position.

(h) CARRIER GENERATOR ADJUSTMENT. - If CV-730/URC is being tested with a system, perform the following adjustments on carrier generator module of AM-2064/URC. With same setup as in (d) above, place vtvm probe on test point J2 of carrier generator. With BFO tuning control set straight up on index line, adjust trimmer (C5) on carrier generator module for maximum indication on vtvm.

(9) CONTROL-POWER SUPPLY C-2691/URC.

(a) LOCAL HANDSET OPERATION. - Connect coaxial from J2 on C-2691/URC to J7 on AM-2062/URC. Place HANDSET switch to LOCAL and connect handset plug to HANDSET jack on front panel.

1. TRANSMIT NOISE LEVEL. - Connect a-c vtvm across pins 7 and 8 of J9 on AM-2062/URC with SIDEBAND SELECTOR on USB position. While talking into handset, adjust MIC GAIN so that peaks of 2 v rms are indicated on the a-c vtvm. Stop talking and place hand over the mouthpiece so as not to pick up room noise. Record a-c vtvm reading.

2. RECEIVE OPERATION. - Apply a 1-v rms, 1000-cps signal to pins 15 and 16 of J9. Note that the tone is heard on the handset receiver.

(b) REMOTE HANDSET OPERATION. - Place HANDSET switch on C-2691/URC to REMOTE.

1. TRANSMIT. - Apply a 50-mw, 1000-cps signal to pins 9 and 10 of J3 on the C-2691/URC. With the a-c vtvm connected across pins 7 and 8 of J9 on AM-2062/URC, check to see that a signal is present on meter. Adjust MIC GAIN on AM-2062/URC as necessary to obtain an indication on meter.

2. RECEIVE. - Apply a 1-v rms, 1000-cps signal to pins 15 and 16 of J9. Listen for tone in earphones placed across pins 11 and 12 of J3 on C-2691/URC.

3. 12 V D-C OUTPUT. - With HANDSET switch in REMOTE, measure voltage from pin 13 (+) to 14 of J3 on C-2691/URC. Key local handset to provide loading.

(c) KEYLINE. - Connect multimeter from pin 7 of J3 on C-2691/URC to ground. Meter should indicate +28 v dc. With HANDSET switch on LOCAL position, depress button on handset and note that meter reading goes to zero. Place HANDSET switch to REMOTE and connect pin 8 of J3 to ground. Note that meter reading changes from 28 v dc to zero when ground is applied.

(10) TALK OUT. - Operate the equipment on at least one frequency on each band. Talk out the equipment on upper and lower sideband on both transmit and receive. Use another SSB transceiver to check for proper operation.

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TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32

TEST DATA SHEET
FOR
RADIO SET AN/URC-32

SYSTEM AND MAJOR UNIT SERIAL NUMBERS

AM/URC-32 _____
AM-2061/URT _____ C-126/UR _____
CV-731/URC _____ C-2691/URC _____
AM-2061/URC _____ PP-2153/U _____
CV-730/URC _____ HD-347/U _____
AM-2062/URC _____ PP-2154/U _____

TEST LIMITS ____ OK

TECHNICIAN _____

DATE _____

TEST	TEST DATA	TEST LIMITS
(1) Blower and Low-Voltage Supply		
(a) Pressure switch operation	____ OK	
(b) Receive voltages		
130 v dc	____ v dc	117 to 143 v dc
-90 v dc	____ v dc	-85 to -120 v dc
28 v dc unfiltered	____ v dc	27.5 to 32 v dc
28 v dc partly filtered	____ v dc	27.5 to 32 v dc
28 v dc regulated	____ v dc	25.1 to 28.9 v dc
6.3 v ac (Y)	____ v dc	6 to 7 v ac
6.3 v ac (X)	____ v ac	6 to 7 v ac
(c) Transmit voltages		
130 v dc	____ v dc	117 to 143 v dc
250 v dc	____ v dc	225 to 275 v dc
(d) 28 v dc regulation		
at 103.5 v ac	____ v dc	25 to 29 v dc
at 126.5 v ac	____ v dc	25 to 29 v dc
(e) Blown fuse indicator	____ OK	
(f) AM-2064 meter indication	____ OK	25 to 50 db
(2) Converter-Oscillator CV-731/URC		
(a) Timing belt tension	____ OK	
(b) Mechanical end stops		
low-frequency end	____ OK	1692 to 1698 kc
high-frequency end	____ OK	2702 to 3708 kc
low-end band readings	____ OK	

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TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST	TEST DATA	TEST LIMITS
(c) Mechanical alignment of SMO	____ OK	
A2J2 voltage	____ v	0.4 to 0.6 v
(d) Mechanical alignment of r-f	____ OK	
tuner A7J2 voltage	____ v	0.2 to 0.5 v
(e) Carrier reinsert adjustment	____ OK	
(f) AGC-TGC meter balance	____ OK	
(g) Electrical alignment of r-f tuner	____ OK	
(h) TUNE-OPERATE switch operation	____ OK	
(i) SMO operation		
maximum AFC	____ ua	*NMT ±80 ua
SMO error	____ cps	NMT ±2500 cps
(j) R-F output voltage	____ v rms	0.8 to 1.4 v rms
(k) EXCITER RF GAIN control	____ OK	
(l) R-f tuner backlash	____ OK	
(m) 100-kc output voltage (J15)	____ v rms	1 to 2 v rms
(n) 1-kc output (A7 of J-1007/U)		
output voltage	____ v rms	0.2 to 1.0 v rms
distortion	____ %	NMT 5 percent
(o) Band switching		
band indicator lights	____ OK	
sidestep oscillator		
band 3 add 1 kc	____ OK	
band 4 add 1 kc	____ OK	
band 4 add 2 kc	____ OK	
band 4 add 3 kc	____ OK	
(p) Receiver agc action (14.900 mc)		
LSB db increase	____ db	NMT 8 db
LSB db increase	____ db	NMT 8 db
(q) AGC threshold		
USB (2.000 mc)	____ uv	NMT 1.0 uv
LSB (29.00 mc)	____ uv	NMT 4.0 uv

*Not more than

TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST	TEST DATA		TEST LIMITS
(r) Spurious, image, and i-f rejection			
3.699 mc operation:			
undesired frequency:	7.698 mc	____ db	NLT 80 db down
	8.298 mc	____ db	
	11.687 mc	____ db	
	12.297 mc	____ db	
	4.2995 mc	____ db	
	0.300 mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	
7.699 mv operation:			
undesired frequency:	8.299 mc	____ db	*NLT 70 db down
	11.6985 mc	____ db	NLT 80 db down
	15.698 mc	____ db	NLT 80 db down
	7.849 mc	____ db	NLT 60 db down
	4.2995 mc	____ db	NLT 70 db down
	3.6995 mc	____ db	NLT 80 db down
	0.300 mc	____ db	NLT 80 db down
	_____ mc	____ db	NLT 80 db down
	_____ mc	____ db	NLT 80 db down
	_____ mc	____ db	NLT 80 db down
	_____ mc	____ db	NLT 80 db down
15.699 mc operation:			
undesired frequency:	20.295 mc	____ db	NLT 80 db down
	27.693 mc	____ db	
	33.292 mc	____ db	
	39.670 mc	____ db	
	4.2995 mc	____ db	
	8.298 mc	____ db	
	3.6997 mc	____ db	
	0.300 mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	
29.999 mc operation:			
undesired frequency:	23.002 mc	____ db	NLT 70 db down
	26.809 mc	____ db	NLT 80 db down
	33.783 mc	____ db	NLT 80 db down
	49.531 mc	____ db	NLT 80 db down
	_____ mc	____ db	NLT 80 db down
	_____ mc	____ db	
	_____ mc	____ db	
	_____ mc	____ db	

*Not less than

TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST			TEST DATA		TEST LIMITS
(s) Receiver sensitivity					
band	frequency	sensitivity	LSB S+N/N	USB S+N/N	
1	2.000 mc	_____ uv	X db	_____ db	sensitivity NLT
2	3.700	_____	X	_____	8 uv for 1 volt
3	7.700	_____	X	_____	agc
4	15.700	_____	X	_____	
4	23.700	_____	_____	X	S+N/N ratio NLT
3	11.700	_____	_____	X	10 db with 1 uv
2	5.700	_____	_____	X	input
1	2.700	_____	_____	X	
1	3.700	_____	_____	X	
2	7.700	_____	_____	X	
3	15.700	_____	_____	X	
4	30.000	_____	_____	_____	
(t) Internal signals:	2.400 mc		_____ uv		NMT 0.2 uv
	3.000 mc		_____ uv		
	_____ mc		_____ uv		
	_____ mc		_____ uv		
	_____ mc		_____ uv		
(u) Frequency standard accuracy					NMT +0 cps and
	3,7000,000		_____ cps		-1.7 cps
(3) Amplifier-Control AM-2062/URC					
(a) Speaker-earphone operation			_____ OK		
(b) Gain adjustment and distortion:					
USB gain adjust	_____ OK, distortion		_____ percent		NMT 5 percent
LSB gain adjust	_____ OK, distortion		_____ percent		NMT 5 percent
mike gain adjust	_____ OK, distortion		_____ percent		NMT 5 percent
(c) Remote audio input:					
USB (A1J2 on balanced modulator)			_____ v rms		adjust to 1 v rms
OFF (A1J2 on balanced modulator)			_____ OK		no signal
LSB (A2J2 on balanced modulator)			_____ v rms		adjust to 1 v rms
(d) Mike input distortion			_____ percent		NMT 5 percent
(4) Amplifier-Converter-Modulator AM-2064/URC					
(a) Transmitter gain control:					
tgc voltage			_____ v dc		2.0 to 4.2 v dc
tgc meter reading			_____ db		20 to 30 db
terminal B12 of J-1007/U			_____ v dc		65 to 90 percent of tgc voltage

TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST	TEST DATA	TEST LIMITS
(b) Transmitter frequency response		
LSB level min _____ v, max _____ v		min/max ratio
LSB level min _____ v, max _____ v		NMT 3 db
(c) Receiver gain and distortion		
1. 100 uv LSB r-f input:		
LSB audio gain adjustment	_____ OK	20 mw output
audio distortion	_____ percent	NMT 5 percent
2. 0.8 v LSB r-f input:		
audio output level	_____ mw	NMT 125 mw
agc meter reading	_____ db	NLT 75 db
terminal B13 of J-1007/U	_____ v dc	12 to 20 v dc
audio distortion	_____ percent	NMT 15 percent
3. LSB line output gain adjustment	_____ OK	0 to +7 dbm
4. Speaker gain adjustment	_____ OK	
audio distortion	_____ percent	NMT 5 percent
5. 100 uv USB r-f input		
USB audio gain adjustment	_____ OK	20 mw output
audio distortion	_____ percent	NMT 5 percent
6. 0.8 v USB r-f input		
audio output level	_____ mw	NMT 125 mw
agc meter reading	_____ db	NLT 75 db
terminal B13 of J-1007/U	_____ v dc	12 to 20 v dc
audio distortion	_____ percent	NMT 15 percent
7. USB line output gain adjustment	_____ OK	0 to +7 dbm
8. Zero r-f input		
terminal B13 of J-1007/U	_____ v dc	-25 to -50 v dc
agc meter reading	_____ db	NLT 80 db
(d) Remote operation of agc meter	_____ OK	
(e) AM operation	_____ OK	
(5) Radio Frequency Amplifier AM-2061/URT:		
(a) Roller coil end stops	_____ OK	
(b) Front panel interlock	_____ OK	

TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST	TEST DATA	TEST LIMITS
(c) Control functions:		
filament voltages	_____ v ac	5.8 to 6.2 v ac
time delay	_____ sec	17 to 25 sec
keying and h-v light	_____ OK	
(d) Rear interlock and fuse	_____ OK	1 amp, 250 v dc
(e) Neutralization	_____ OK	
(f) PA tube balance:		
plate current no. 1	_____ ma	60 to 90 ma
plate current no. 2	_____ ma	
(6) Systems Check:		
(a) Continuity of antenna coupler plug	_____ OK	
(b) Sidetone operation	_____ OK	
(c) Balanced modulator adjustment	_____ OK	
(d) Tgc action:		
audio level threshold	third order _____ db	PEP _____ watts
2 db	_____	_____
4 db	_____	_____
6 db	_____	_____
8 db	_____	_____
10 db	_____	_____

third order NLT 30 db at threshold

PEP NMT 1 db increase

(e) Suppression, distortion and r-f output

frequency (mc)	2.000	4.100	14.900	30.000	
carrier suppression	_____	_____	_____	_____	NLT 45 db
opposite sideband	_____	_____	_____	_____	NLT 35 db
intermodulation distortion:					
5th order	_____	_____	_____	_____	NLT 30 db
3rd order	_____	_____	_____	_____	
3rd order	_____	_____	_____	_____	
5th order	_____	_____	_____	_____	

TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST	TEST DATA	TEST LIMITS
(e) Suppression, distortion and r-f output (Cont)		
two tone test:		
r-f output		
volts	_____ _____ _____ _____	
watts	_____ _____ _____ _____	*NLT 500 w PEP
PA plate current		
no. 1	_____ _____ _____ _____	NMT 30 ma
		difference
no. 2	_____ _____ _____ _____	between no. 1 and 2
total	_____ _____ _____ _____	NMT 600 ma
single tone test:		
r-f output		
volts	_____ _____ _____ _____	
watts	_____ _____ _____ _____	NLT 450 w
PA plate current		
total	_____ _____ _____ _____	NMT 600 ma
(f) transmitter noise level		
r-f reading	_____ v	
audio reading	_____ v	
noise level	_____ db	NMT 45 db
(7) Signal Comparator CM-126/UR		
(a) Initial adjustments	_____ OK	
(b) 1 kc comparing:		
5 uv signal input:		
beat note in phones	_____ OK	
centered meter deflection	_____ ua	NLT 30 ua
frequency selector off	_____ OK	
1 uv signal input		
centered meter deflection	_____ ua	NLT 30 ua
100 uv signal input:		
centered meter deflection	_____ ua	NLT 30 ua
(c) 100 kc comparing:		
centered meter deflection	_____ ua	NLT 30 ua
(8) Converter-Monitor CV-730/URC		
(a) Initial adjustments	_____ OK	
(b) CW keying release time	_____ sec	0.45 to 0.55 sec

*NLT 450 w PEP at 30.000 mc

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TABLE 9-1. SAMPLE TEST DATA SHEET FOR RADIO SET AN/URC-32 (Cont)

TEST	TEST DATA	TEST LIMITS
(c) FSK frequency adjustment	_____ OK	
(d) BFO frequency adjustment		
clockwise 1 kc	_____ cps	299,5500 ±100 cps
counterclockwise 1 kc	_____ cps	301,5500 ±100 cps
(e) DBM meter calibration:		
USB transmit	_____ dbm	+8 ±1 dbm
USB receive	_____ dbm	
LSB transmit	_____ dbm	
LSB receive	_____ dbm	
(f) CW and FSK output level:		
FSK mark	_____ OK	
FSK space	_____ OK	
CW 1 kc	_____ OK	
CW 1.5 kc	_____ OK	
(g) CW frequency accuracy:		
CW 1 kc (2.001 mc)	_____ mc	-40 to +50 cps
CW 1.5 kc (2.0015 mc)	_____ mc	-50 to +60 cps
(h) Carrier generator adjustment	_____ OK	
(9) Control-Power Supply C-2691/URC		
(a) Local handset operation:		
transmit noise level	_____ mw	NMT 100 mv
receive operation	_____ OK	
(b) Remote handset operation:		
transmit	_____ OK	
receive	_____ OK	
12 v dc output	_____ v dc	11 to 17 v dc
(c) keyline operation:		
local	_____ OK	
remote	_____ OK	
(10) Talkout check	_____ OK	

9-3. SSB MEASUREMENTS UTILIZING THE COLLINS 478R-1 SPECTRUM ANALYZER.

a. TWO-TONE MIXER. - Turn both filter switches on. TONE A switch on, TONE B switch off. Set attenuators to zero. Connect 410B a-c probe and external load (input Z of equipment under test) to 600-ohm output. Set OSC. A to desired frequency and level (i.e., 600 at 1.0 volt). TONE A switch off, TONE B switch on. Set OSC. B to desired frequency and level (i.e., 1700 at 1.0 volt). TONE A switch on. Set attenuators to obtain desired level of two tone signal (i.e., 1.0 volt).

b. MIXER NO. 2. - Turn ADVANCE-RECORD switch and FORWARD-REVERSE switch to off. Turn AUTO-MANUAL switch to AUTO, OUTPUT ATTENUATOR to 0 db, CENTER FREQUENCY switch to 280 kc, SWEEP to 8 kc, FINE TUNING to 0, INJECTION GRID CURRENT to 60 ua, and SPEED control to 5.

c. VOLTMETER 410B. - Select 3 v a-c scale. Insert a-c probe into its receptacle.

d. SELECTIVE AMPLIFIER. - Set CPS 1/2 BANDWIDTH to 145. Negative feedback to 0.

e. OSCILLOSCOPE. - Set SWEEP MAG. control off. Set DRIVEN-RECURRENT switch to RECURRENT. Adjust intensity and focus for clear trace. Set VERT VOLTS/inch to OFF. Set VERT MULT. to 10 (CCW). Adjust VERT POS. to set trace on 0-db line. HORIZ. VOLTS/inch to .1. Adjust HORIZ. POS. and HORIZ. MULT. to obtain a centered trace that just covers the width of the screen. Set VERT VOLTS/inch to .1.

f. MIXER NO. 1 (i.e., set up for a test frequency of 5.7 mc). - MULTIPLIER INPUT to VFO. Connect external 50-ohm load to r-f input. Add or subtract 300 kc to the desired frequency. Then divide by 1, 2, 4, 8, or 16 to obtain a frequency in the 2- to 4-mc range of the VFO. (i.e., 5.7 +.3 = 6.0 mc +2 = 3 mc). Set VFO dial to calculated frequency. Select proper MULT. RANGE (i.e., B). Adjust tuning control for maximum grid current at the desired multiple of the VFO frequency (i.e., 6.0 mc). Adjust multiplier output to 35 microamperes.

g. FINAL ADJUSTMENTS (i.e., test frequency of 5.7 mc).

(1) Connect the signal (level should be from .02 v to not more than 3.0 v) to r-f input on meter panel. Adjust FINE TUNING control (mix. no. 2) to center the response on the screen.

NOTE

It may be necessary to readjust the VFO (mix. no. 1) slightly if previous step is not possible. Set AUTO-MANUAL switch to off. Adjust the MANUAL SCAN control to tune to the peak of the major response.

(2) Adjust the pushbutton attenuators until the spot is on the 0-db line.

(3) Use the following procedure for vertical calibration of scope.

(a) Set mixer no. 2 attenuator to 60 db.

(b) Adjust VERT. MULT. (scope) so the spot is on the 60-db line.

(c) Return attenuator to 0.

(d) Check linearity by moving mixer no. 2 attenuator in 10-db steps to 60 db. The spot should drop in 10-db steps ±1 db to 60 db. If this does not occur, it will be necessary to calibrate the logarithmic amplifier (located on the back of the rack) according to the 478R-1 instruction book.

h. MAKING MEASUREMENTS.

(1) CARRIER SUPPRESSION. - Apply a two-tone signal to unit under test and note the level of the carrier in db down from either of the equal tones.

(2) 3RD AND 5TH ORDER DISTORTION. - Apply two-tone signal. Move spot to the 3rd and 5th order distortion to take measurements.

NOTE

The following check will determine if the response being observed is actually a distortion product. Turn off TONE A, response should drop. Turn on TONE A and turn off TONE B. Response should drop again. Turn on TONE B. If the above does occur, then the response is a distortion product.

(3) OPPOSITE SIDEBAND SUPPRESSION. - Apply a two-tone signal. Move spot to TONE A and select the opposite sideband on the equipment under test. The level of the spot (in db) is the opposite sideband suppression.

(4) NOISE LEVEL. - Apply a two-tone signal to equipment under test. Measure alc voltage. Connect an external voltage to keep alc at this level. Move spot on scope to TONE A, adjust OSC. A so spot is down 20 db. Move spot to TONE B, adjust OSC. B so the spot is down 35 db. Couple transmitter output through capacitive voltage divider to r-f input of 330D HP Distortion Analyzer. Tune 330D to transmitter frequency and adjust level to read 0 db in the noise position. Remove TONE E and record drop in db on 330D. Add 29 db to this figure to obtain the noise level. Reset tones to original level.

i. When a new frequency is selected, it is necessary to repeat only steps f. and g.

9-4. EIGHT-HOUR OPERATING TEST.

a. After the performance checks have been completed and all indications are normal, the equipment then should be operated for a period of not less than eight hours, four hours in transmit position and four hours in receive position. To place the equipment in operation, refer to section III, operation, of Technical Manual for Radio Set AN/URC-32; tune the equipment to 2.0 mc; and load into the dummy antenna when in transmit position. A new eight-hour test must be made if any part is repaired or replaced before the original eight-hour test is completed.

b. During the eight-hour test, the equipment should be checked for intermittent, erratic, or unstable operation, or any other condition indicating faulty operation. Lightly jar the chassis to check for loose connections, intermittent shorts, microphonic tubes, and similar faults by tapping it from several directions with a rubber mallet, observing indications of intermittent or unstable operation. Perform this test in both transmit and receive conditions.

c. After the eight-hour test has been completed, refer to the Maintenance Standards Book for Radio Set AN/URC-32, part I and perform all of the steps. This will indicate if the equipment is still performing within the required limits.

NOTE

Marking of equipments, required by Government technical orders or other instructions, to indicate overhaul or the incorporation of changes is applied during inspection and test (if not applied previously to subassemblies, assemblies or components during overhaul and assembly).

9-5. PACKAGING.

After the eight-hour operating test has been performed and the equipment is found to be in normal operating condition, package the equipment as follows:

(1) Using the base on which the equipment was shipped, place a piece of corrugated material on the base. (This corrugated material should be approximately the size of the base.)

(2) Place a length of vapor barrier material over the corrugated material. This vapor barrier material should be long enough to wrap over the back side of the equipment, over the top and down the front to the base.

(3) Place a length of corrugated material over the vapor barrier material. This corrugated material should be the same length as the vapor barrier material.

(4) Place a length of Kimpak material over the corrugated material. The Kimpack material should be the same length as the corrugated and vapor barrier materials.

(5) Punch four holes in the four layers of material using the four bolts in the shipping base as the punch.

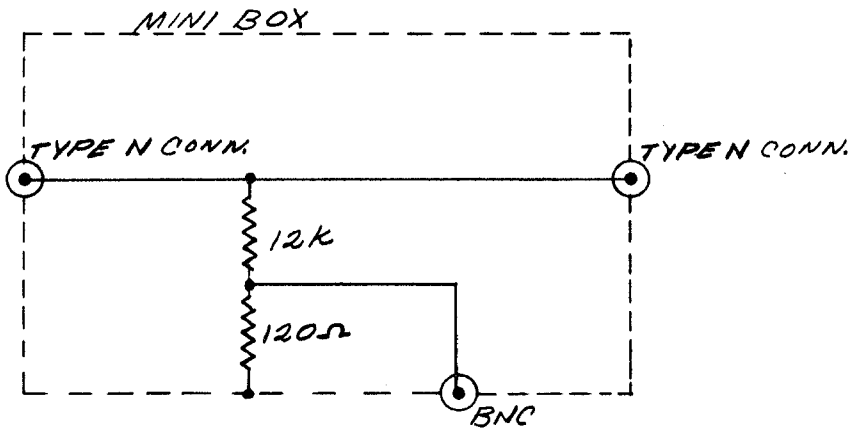
(6) Carefully set the equipment of the Kimpak with the mounting bolts in the shipping base through the mounting holes in the equipment rack base.

(7) Secure the equipment to the shipping base with four mounting nuts. With a sharp tool, place a small nick in the thread of each bolt just above the nut to prevent the nuts from becoming loose.

(8) In a corrugated box at the front base of the equipment, place ten 16-unit bags of desiccant.

(9) Fold the Kimpak, corrugated, and vapor barrier materials over the top and down the front of the equipment, at the same time fold the materials to cover the sides of the equipment. Hold in place by masking tape or by some other suitable method.

(10) Assemble a crate around the equipment starting from the shipping base. If possible, use the same material in which the equipment was shipped.



NOTE 1. THIS SCHEMATIC DIAGRAM IS OF EQUIPMENT USED BY COLLINS RADIO COMPANY MANUFACTURING DIVISION AND IS NOT NECESSARILY IDENTICAL TO EQUIPMENT PROCURED BY THE U. S. NAVY.

Figure 9-2. Voltage Divider, Schematic Diagram

SECTION X

DIFFERENCE DATA SHEET

10-1. INTRODUCTION.

Field maintenance instructions for the model included in this section is the same as the procedures given in sections I through IX of this manual.

10-2. PRODUCTION LINE CHANGES.

For each modification, the serial number of the first radio set to receive the modification is listed, except for modules.

The only correct way of knowing if the modification in question has been performed on a certain module is to observe the module and see if the modification has been accomplished.

No modification effects the interchangeability of any of any of the modules or chassis.

LIST OF MAJOR ELECTRICAL AND MECHANICAL CHANGES THAT HAVE BEEN INCORPORATED IN THE PRODUCTION OF RADIO SET AN/URC-32

a. Frequency Comparator (54Q-1), Collins part no. 522-1074-00.
Chassis: Accomplished on all units starting with radio set serial no. 91
Changed: Resistor R7, 1470 ohms - 1/4 watt, Collins part no. 705-7264-00, was 2210 ohms - 1/4 watt, Collins part no. 705-7264-00.

b. Frequency Generator (786H-1), Collins part no. 522-0860-00.
Chassis: Accomplished on all units starting with radio set serial no. 113.
Post - Collins part no. 543-3153-002 changed to 545-7747-002.
Post - Collins part no. 543-3170-002 changed to 545-7748-002.
Post - Collins part no. 543-3179-002 changed to 545-7749-002.
Block - Collins part no. 543-3070-002 changed to 545-7586-002.
Shaft - Collins part no. 543-3139-002 changed to 545-7584-002.
Gear "B" - Collins part no. 543-3155-002 changed to 545-7740-002.
Gear "F" - Collins part no. 543-3158-002 changed to 545-7743-002.
Post - Collins part no. 543-3156-002 changed to 545-7741-002.
Gear "C" - Collins part no. 543-3173-002 changed to 545-7745-002.
Add:
6 each - Gears, Collins part no. 309-0661-00.
2 each - Retainers, Collins part no. 545-7585-002.
Chassis: Accomplished on all units starting with radio set serial no. 286.
Chassis: Accomplished on all units starting with radio set serial no. 322.
Resistors R1, 2, 3, 4, 150 ohm - 1 watt, Collins part no. 745-3317-00 changed to to 470 ohms - 1 watt, Collins part no. 745-3338-00.
Reference Oscillator, Collins part no. 542-7729-004.
Modification A:
Rechanged by Modification E.

Modification B:
Transistor Q13, type 2N118, Collins part no. 352-0049-00 changed to type J213, Collins part no. 352-0087-00.
Modification C:
Resistor R36, 39000 ohms - 1/2 watt, Collins part no. 745-1419-00 changed to 18000 ohms - 1/2 watt, Collins part no. 745-1405-00.
Modification D:
Resistor R20, 22000 ohms - 1/2 watt, Collins part no. 745-1408-00 changed to 10000 ohms - 1/2 watt, Collins part no. 745-1394-00.
Modification E:
Transistor Q3, type 2N525, Collins part no. 352-0094-00 changed to type 2N527, Collins part no. 352-0124-00.
Transistors Q1, 2 4 type 2N538, Collins part no. 352-0024-00 changed to type 2N540, Collins part no. 352-0026-00.
Modification F:
Resistor R2, 47 ohms - 1/2 watt, Collins part no. 745-1296-00 changed to 100 ohms - 1/2 watt, Collins part no. 745-1310-00.
Tie Emitters of Q2 and Q4 together.
Modification G:
Add diodes CR1 and CR2 type 1N91, Collins part no. 542-7742-005.
Modification H:
Resistor R6, 22 ohms - 2 watt, Collins part no. 747-5155-00 changed to 5 ohms - 2 watt, Collins part no. 747-5314-00.
Modification J:
Add CR3, type 1N721A, Collins part no. 353-2741-00.
Add Resistor R40, 33000 ohms - 1/4 watt, Collins part no. 745-0803-00.
Resistor R29, 12000 ohms - 2 watt, Collins part no. 745-5698-00 changed to 7500 ohms - 5 watt, Collins part no. 747-9399-00.

Frequency Divider, Collins part no. 542-7697-004.
Capacitor C3, 1500 mmfd, Collins part no. 912-1922-00 changed to 2000 mmfd, Collins part no. 912-1931-00.
Resistor R5, 23700 ohms - 1/4 watt, Collins part no. 705-4500-00 changed to 19600 ohms - 1/4 watt, Collins part no. 705-4501-00.
Resistor R2, 4700 ohms - 1/2 watt, Collins part no. 745-1380-00 changed to 5100 ohms - 1/2 watt, Collins part no. 745-1382-00.
Resistor R18, 2200 ohms - 1/2 watt, Collins part no. 745-1366-00 changed to 2700 ohms - 1/2 watt, Collins part no. 745-1369-00.

c. R.F. Tuner, Collins part no. 542-7792-005.
Accomplished on all units starting with radio set serial no. 137.
Chassis, Collins part no. 543-3008-004, changed to Collins part no. 544-2772-004.
Coil Z18, Collins part no. 543-2995-003, changed to Collins part no. 544-2765-003.
Coil Z19, Collins part no. 543-2996-003, changed to Collins part no. 544-2766-003.
Coil Z20, Collins part no. 543-2997-003, changed to Collins part no. 544-2767-003.
Accomplished on all units starting with radio set serial no. 116.
Add choke L34, Collins part no. 240-0198-00.
Add choke L33, Collins part no. 240-0313-00.
Add capacitor C183, Collins part no. 913-3159-00.
Add resistor R65, Collins part no. 745-5701-00.
Delete resistor R14, Collins part no. 745-1436-00.

d. Sideband Generator (786F-1), Collins part no. 522-0861-004.
Chassis: Accomplished as all units starting with radio set serial no. 235.
Add Resistor R31, 1000 ohms - 2 watt, Collins part no. 745-5694-00.

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Change switch S1 from one wafer to two wafers.
Carrier Generator Module, Collins part no. 543-1500-004.
Modification A.
Choice of values for R2 increased as follows:
33,000 ohms - 1/2 watt, Collins part no. 745-1414-00.
39,000 ohms - 1/2 watt, Collins part no. 745-1418-00.
43,000 ohms - 1/2 watt, Collins part no. 745-1420-00.
Choice of values for C3 increased as follows:
270 mmfd - 0.1 percent, Collins part no. 912-3471-00.
260 mmfd - 0.1 percent, Collins part no. 912-3492-00.
Modification B.
Change L1 - 1 MH, Collins part no. 240-0591-00 to 1 MH (changed to meet specifications), Collins part no. 240-0595-00.

e. Power Amplifier (367A-3), Collins part no. 522-0864-00.
Chassis: Accomplished on all units starting with radio set serial no. 261 Tube Duct.
Delete: 2 each, Collins part no. 543-0456-003 - duct.
Add: 2 each, Collins part no. 544-9112-002 - duct.
2 each, Collins part no. 544-9113-003 - clamp.

f. Low-Voltage Power Supply (429B-1), Collins part no. 522-0862-003.
Chassis: Accomplished on all units starting with radio set serial no. 286.
Smo discriminator heater modification:
Add wire from T1 Pin 7 to J2 Pin 15.

g. High-Voltage Power Supply (428B-1), Collins part no. 522-0863-006.
Chassis: Accomplished on all units starting with radio set serial no. 329.
Changed: Fuse F2, normal blow, Collins part no. 264-4021-00, was Slo Blo, Collins part no. 264-4250-00.

h. Handset Adapter, Collins part no. 543-6094-00.
Chassis: Accomplished on all units starting with radio set serial no. 333.
Add: Transformer and bracket, Collins part no. 677-1446-00.

i. Sideband Generator 786F-1 begin with serial no. 360.
Chassis, Mod B (R-F Gain Control Mod)
Added CR6, CR7 (p/n 353-0204-00, 1N457). Relocated CR1.
Change silkscreen "Remote" to "External Control."

j. Sidestep Oscillator, Collins part no. 543-1501-004.
Modification A:
Final test selected value of R19 was 18000 ohms - 1/2 watt, Collins part no. 745-1405-00.
Choice values for R15 changed to 1800 ohms - 1/2 watt to 82000 ohms - 1/2 watt.
Resistor R16, 100000 ohms - 1/2 watt, Collins part no. 745-0436-00 added.
Modification B:
Capacitor C1, 10 uuf, Collins part no. 912-1776-00 changed to 33 uuf, Collins part no. 912-1797-00.
Capacitor C7, 0.01 uf, Collins part no. 931-4481-00 changed to 0.033 uf, Collins part no. 931-5297-00.
Capacitor C9, 0.01 uf, Collins part no. 931-9078-00 changed to 6800 uuf, Collins part no. 931-9094-00.

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Resistor R2, 68000 ohms - 1/2 watt, Collins part no. 745-1429-00 changed to 33000 ohms - 1/2 watt, Collins part no. 745-1415-00.

Modification C:

Resistor R22, 27000 ohms - 1/4 watt, Collins part no. 745-0800-00 added across C25.

Modification D:

Capacitor C27, 0.033 uf, Collins part no. 931-5344-00 changed to 200 uuf, Collins part no. 912-1854-00.

k. Stabilized Master Oscillator, Collins part no. 542-7791-005.
Add Resistor R33, 22000 ohms - 1/2 watt, Collins part no. 745-1408-00.

l. 153H-2 Junction Box
Replace 153H-2 with 153H-2A
153H-2A will include Receiver Input Protector Relay Assembly and new fuseholders.

m. 159B-1 Audio and Control Unit.
Replace phone jack J6 with new phone jack p/n 358-1040-00.

n. 428B-1 HVPS
Change F1 to 15 amp p/n 264-0005-00 (for 220 volts 8 amp p/n 264-0002-00).

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