DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-284

TO 16-30GRC-3-6

# RADIO SETS AN/GRC-3, -4, -5, -6, -7, AND -8

*DEPARTMENTS OF THE ARMY AND THE AIR FORCE*

*MAY 1953*

# DEPARTMENT OF THE ARMY TECHNICAL MANUAL

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## RADIO SETS AN/GRC-3, -4, -5, -6, -7, AND -8

C 1, TM 11-284
TO 16-30GRC-3-6

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
WASHINGTON 25, D. C., *24 February 1954*

TM 11-284/TO 16GRC-3-6, 13 May 1953, is changed as follows:

### 9. General System Description

* * * * *

*c. Radio Set AN/GRC-7.* If Radio Receiver R-110/GRC with Power Supply PP-282/GRC or PP-281/GRC is added to Radio Set AN/GRC-8, the installation becomes a 24- or 12-volt Radio Set AN/GRC-7 (fig. 33).

* * * * *

### 10. Set 1 Receiver-Transmitter

*a.* One of Receiver-Transmitters RT-66/GRC, RT-67/GRC, or RT-68/GRC is used as Set 1 in each of the radio sets described in this manual. The particular systems in which each of the receiver-transmitters are employed are indicated in the following chart:

* * * * *

### 28. Wiring Change in Mounting MT-297/GR, Preparation of Special Purpose Cable WM-46/U and Connection to Mounting MG-297/GR

Cut 5 feet 5 inches of Special Purpose Cable WM-46/U. Prepare the ends * * * the M46 tank.)

### 28.1 Wiring Change in Mounting MT-297/GR for Vehicles without Intercommunication System

(Added)

When Radio Sets AN/GRC-3 through -8 are used in vehicles that do not have intercommunication systems, remove the slate lead (or leads) of Special Purpose Cable WM-46/U connected to terminal 8 of terminal strip E-6 in Mounting MT-297/GR (fig. 23), and connect it to terminal 13 of E-6. (This wiring change causes the output of Dynamic Loudspeaker LS-166/U, connected to Control Box C-375/VRC, to be muted when transmission from a handset at the control box is taking place. As a result, acoustical feedback (howling) is minimized.)

Figure 23: Add the following note.

4. FOR VEHICLES WHICH DO NOT HAVE INTERCOMMUNICATION SYSTEMS, REMOVE THE SLATE LEAD (OR LEADS) THAT IS CONNECTED TO TERMINAL 8 OF TERMINAL STRIP E-6 AND CONNECT IT TO TERMINAL 13 OF E-6.

### 32. Installation of Control C-435/GRC

* * * * *

*c.* (Added) If difficulty is encountered in installing Control C-435/GRC on the mounting, see paragraph 37.1.

Figure 32: The top line is changed to read as follows:

Radio Frequency Cable RG-62/U in Jack UG-261/U or UG-262/U.

### 37. Installation of Components on Mounting MT-297/GR

Mounting MT-297/GR contains * * * on figure 33. **When connecting Special Purpose Cable Assembly CX-1213/U between the POWER receptacle of Receiver-Transmitter RT-70/GRC and the RT-70 POWER receptacle of AF Amplifier AM-65/GRC, always connect to the POWER receptable of Receiver-Transmitter RT-70/GRC before connecting to the RT-70 POWER receptacle of the amplifier. (This prevents possible damage to tubes in the receiver-transmitter if power has been turned on at the mounting and at the amplifier.)** Lock the units * * * of fig. 26).

*Note.* In most installations, * * * 25 and 28.

### 37.1. Difficulty in Installation of Units of Local Control C-434/GRC and Control C-435/GRC

(Added)

Difficulty is experienced in installing some units of Local Control C-434/GRC and Control C-435/

GRC because of an incorrect wall taper of connector J1 in early productions of Mounting MT–297/GR. This incorrect wall taper does not permit easy mating of the connectors on the control units with connector J1 on the mounting. Where this difficulty is encountered proceed as follows:

*a.* Scrape the paint off the runners of Local Control C–434/GRC and Control C–435/GRC. Test whether these two control units can be easily installed and removed from the mounting. If difficulty still exists, remove the spring clips from the runners of the control units.

*b.* When inserting Local Control C–434/GRC or Control C–435/GRC in the mounting, firmly apply pressure to the upper left corner of the control unit, and simultaneously operate the locking lever of the mounting to the locked position.

## 38. Installation of Control Group AN/GRA–6

Control Group AN/GRA–6 * * * the radio set.

*a. Installation of Local Control C–434/GRC.* Local Control C–434/GRC * * * proceed as follows:

* * * * *

(9) (Added) If difficulty is encountered in installing Local Control C–434/GRC on the mounting, see paragraph 37.1.

* * * * *

## 59. Starting and Stopping

***Caution:*** (Added) Keep the radio set turned off when the vehicular engine is started. If the radio set has been in operation and it is desired to start the vehicular engine, turn the OFF-REMOTE-ON switch of the mounting to OFF before starting the engine. Otherwise, damage to tubes and blowing of fuses in the radio set may result.

* * * * *

## 137. Using Equipment Performance Checklist

* * * * *

*d. Equipment Performance Checklist.*

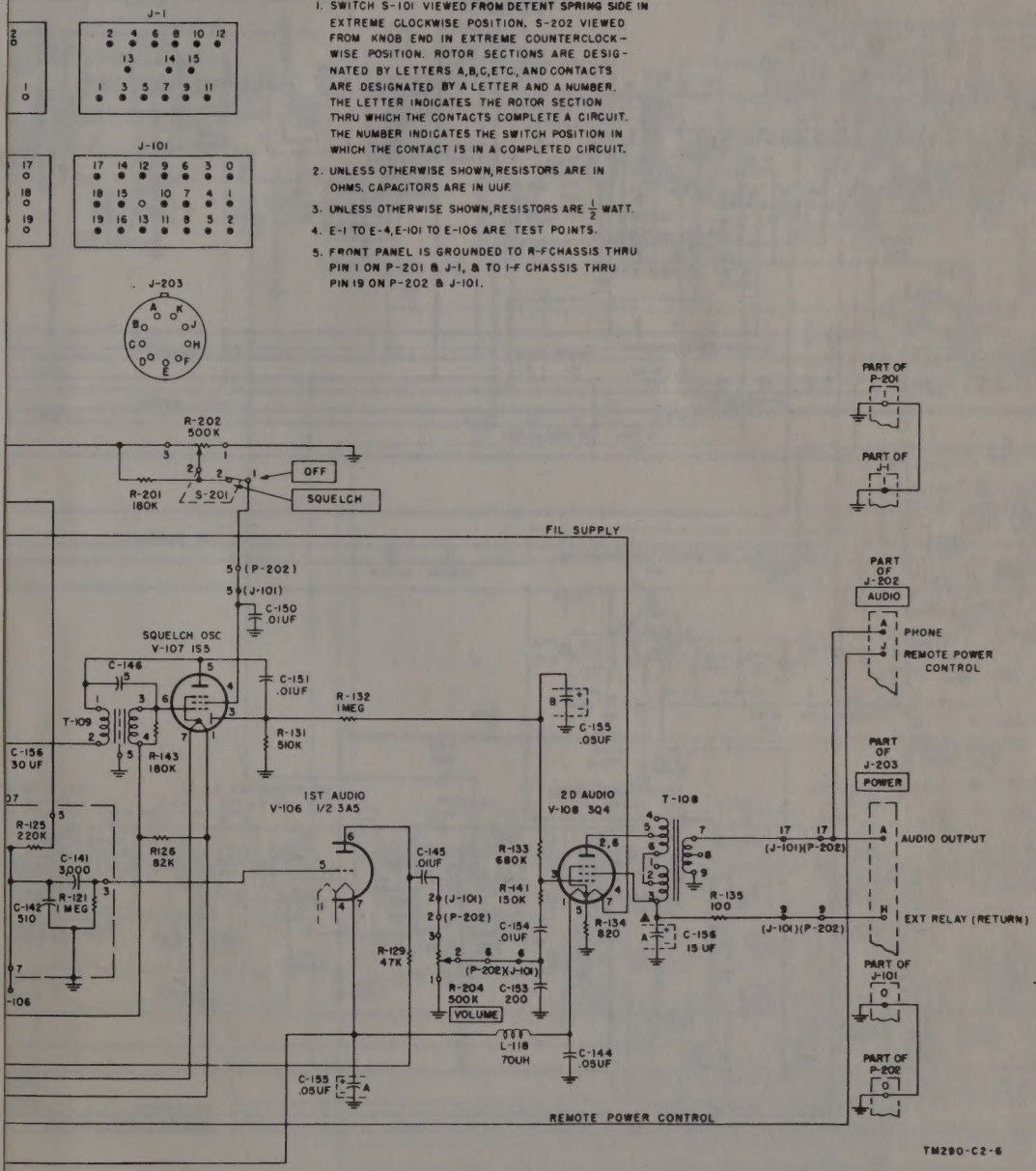
| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| * | * | * | * * * * * * * |
| 16 | Set OPERATE switch * * * position of switch. | Lamp on Set * * * of METER switch. | Control box (par. 150), mounting (par. 149), Set 1 power supply (par. 140), Set 1 (par. 141), **or Special Purpose Cable Assembly CX–1211/U (fig. 109.1).** |
| * | * | * | * * * * * * * |
| 24 | Set OFF-INT-RT–70 switch * * * on a-f amplifier at RT–70 position. | Lamp on Set 2 panel lights. | Interphone amplifier (par. 139), amplifier power supply (par. 139), Set 2 (par. 144), or **Special Purpose Cable Assembly CX–1213/U (fig. 109.2).** |
| * | * | * | * * * * * * * |

The title of table III is changed to read as follows:

*Table III. Continuity and Resistance Measurements, Control C–435/GRC*

NOTES:

1. SWITCH S-101 VIEWED FROM DETENT SPRING SIDE IN EXTREME CLOCKWISE POSITION. S-202 VIEWED FROM KNOB END IN EXTREME COUNTERCLOCKWISE POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A,B,C,ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT. THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.
2. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS. CAPACITORS ARE IN UUF.
3. UNLESS OTHERWISE SHOWN, RESISTORS ARE $\frac{1}{2}$ WATT.
4. E-1 TO E-4, E-101 TO E-106 ARE TEST POINTS.
5. FRONT PANEL IS GROUNDED TO R-F CHASSIS THRU PIN 1 ON P-201 & J-1, & TO I-F CHASSIS THRU PIN 19 ON P-202 & J-101.




TM290-C2-6

GRC because of an incorrect wall taper of connector J1 in early productions of Mounting MT–297/GR. This incorrect wall taper does not permit easy mating of the connectors on the control units with connector J1 on the mounting. Where this difficulty is encountered proceed as follows:

*a.* Scrape the paint off the runners of Local Control C–434/GRC and Control C–435/GRC. Test whether these two control units can be easily installed and removed from the mounting. If difficulty still exists, remove the spring clips from the runners of the control units.

*b.* When inserting Local Control C–434/GRC or Control C–435/GRC in the mounting, firmly apply pressure to the upper left corner of the control unit, and simultaneously operate the locking lever of the mounting to the locked position.

## 38. Installation of Control Group AN/GRA–6

Control Group AN/GRA–6 * * * the radio set.

*a. Installation of Local Control C–434/GRC.* Local Control C–434/GRC * * * proceed as follows:

* * * * *

(9) (Added) If difficulty is encountered in installing Local Control C–434/GRC on the mounting, see paragraph 37.1.

* * * * *

## 59. Starting and Stopping

***Caution:*** (Added) Keep the radio set turned off when the vehicular engine is started. If the radio set has been in operation and it is desired to start the vehicular engine, turn the OFF-REMOTE-ON switch of the mounting to OFF before starting the engine. Otherwise, damage to tubes and blowing of fuses in the radio set may result.

* * * * *

## 137. Using Equipment Performance Checklist

* * * * *

*d. Equipment Performance Checklist.*

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| * | * | * | * * * * * * * |
| 16 | Set OPERATE switch * * * position of switch. | Lamp on Set * * * of METER switch. | Control box (par. 150), mounting (par. 149), Set 1 power supply (par. 140), Set 1 (par. 141), **or Special Purpose Cable Assembly CX–1211/U (fig. 109.1).** |
| * | * | * | * * * * * * * |
| 24 | Set OFF-INT-RT–70 switch * * * on a-f amplifier at RT–70 position. | Lamp on Set 2 panel lights. | Interphone amplifier (par. 139), amplifier power supply (par. 139), Set 2 (par. 144), or **Special Purpose Cable Assembly CX–1213/U (fig. 109.2).** |
| * | * | * | * * * * * * * |

The title of table III is changed to read as follows:

*Table III. Continuity and Resistance Measurements, Control C–435/GRC*

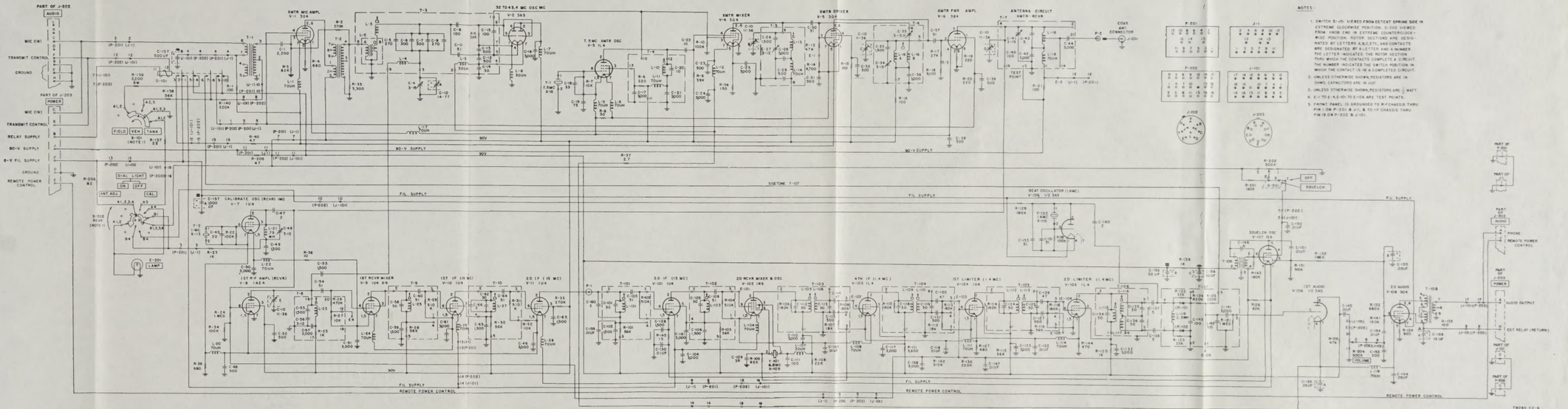



*Figure 120.1 (Added).—Receiver-transmitter RT-70A/GEC, schematic diagram.*

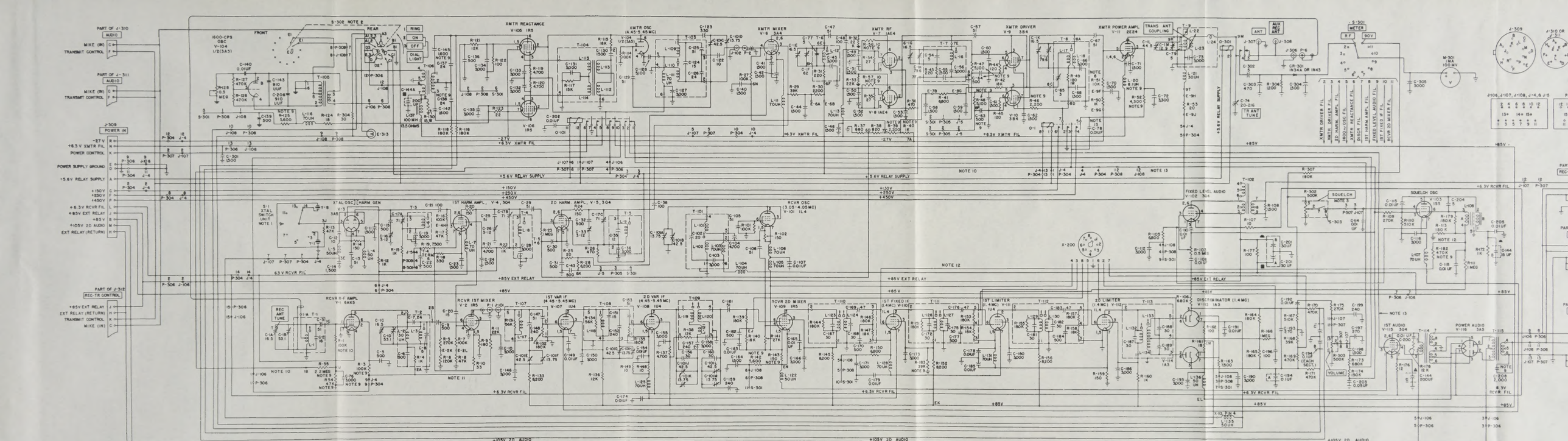


*Figure 121 (Superseded).—Receiver-transmitter RT-66/GRC, schematic diagram for all models except those bearing Order No. 18651-Phila-49.*

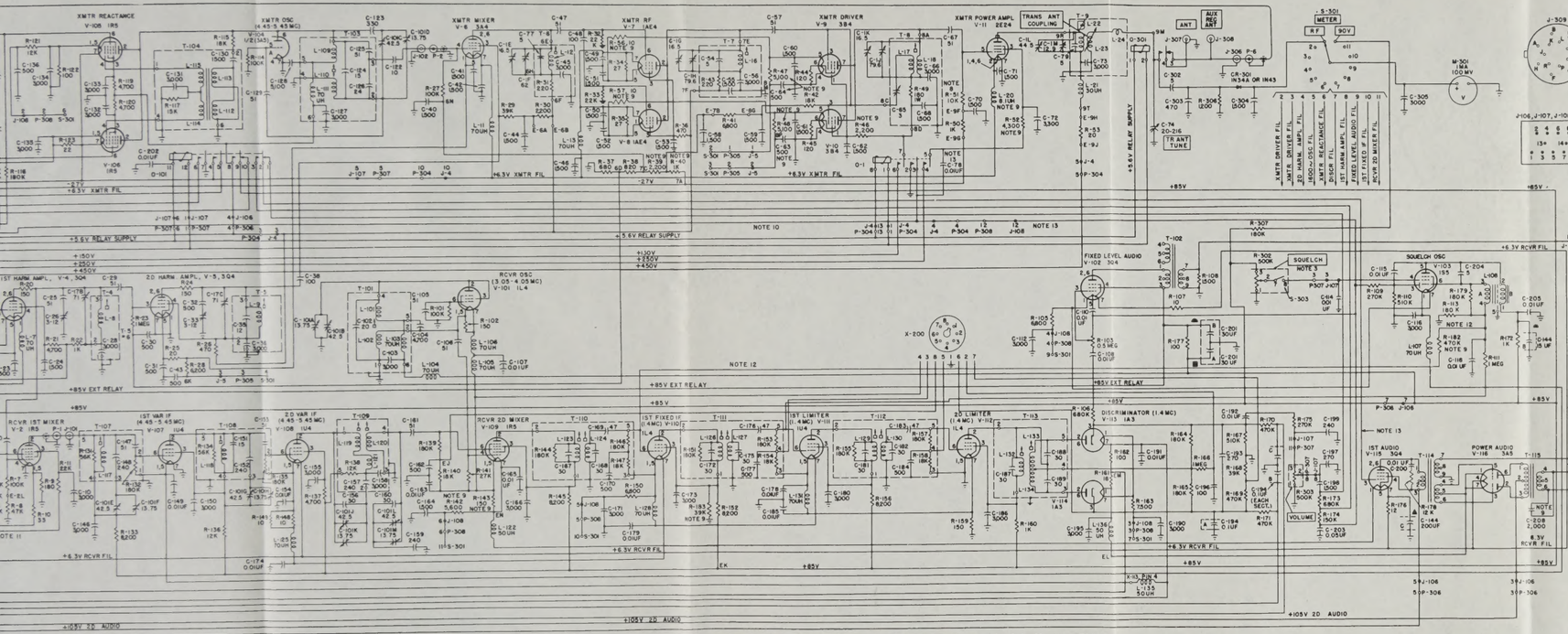



*Figure 121 (Superseded).—Receiver-transmitter RT-66/GRC, schematic diagram for all models except those bearing Order No. 18651-Phila-49.*

NOTES:

1. CRYSTAL SWITCH ASSEMBLY CHART:

| XTAL POS NO. | XTAL FREQ'S KC |
|---|---|
| 1 | |
| 2 | 7775.000 |
| 3 | 8275.000 |
| 4 | |
| 5 | 8775.000 |
| 6 | |
| 7 | 6183.333 |
| 8 | |
| 9 | 6516.666 |
| 10 | |
| 11 | 6850.000 |
| 12 | |
| 13 | 7183.333 |
| 14 | 7516.666 |
| 15 | |
| 16 | |
| 17 | |

2. SWITCH S-301 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, C, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT, THE NUMBER INDICATES THE STATOR POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

3. IN SOME SETS POTENTIOMETER R-302 IS A DUAL UNIT, ONLY 1 SECTION IS USED.

4. E-8X, E-2L, E-4H, E-8A, E-6B, E-7B, E-8S, E-9H, AND E-9J ARE TEST POINTS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, FOR EXAMPLE, E-2 IS ASSOCIATED WITH V-2; E-4H WITH V-4 ETC. LETTER INDICATES SEQUENCE.

5. 1A, 1B THROUGH 9R ARE TIE POINTS ON RF CHASSIS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, LETTER INDICATES SEQUENCE.

6. UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

7. THE FOLLOWING SECTIONS WITHIN CAPACITORS C-1, C-101, AND C-117 ARE GANGED: C-1, SECTIONS B, D, F, H, J, L. C-101, SECTIONS B, C, E, G, J, L. C-117, SECTIONS A, B, C.

8. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT.

9. THE FOLLOWING CHART INDICATES THE DIFFERENCES IN COMPONENTS IN ALL RT-66/GRC EXCEPT THOSE BEARING ORDER NO. 18651-PHILA-49.

| REF SYM | 1759-PHILA-51 | 21434-PHILA-50 | 32137-PHILA-51 | 32138-PHILA-51 |
|---|---|---|---|---|
| C-83 | | | | |
| C-84 | NOT USED | | | |
| C-78 | NOT USED SEE NOTE 10 | | | |
| C-137 C-138 | NOT USED | NOT USED | NOT USED IN SERIAL NO. 7075 AND UP | |
| C-208 | | NOT USED | NOT USED | NOT USED |
| R-3 | | 15K | | |
| R-39 | | | | 680 IN SERIAL NO. 3800 AND DOWN |
| R-40 | | | | 2,700 IN SERIAL NO. 3800 AND DOWN |
| R-48 | | | | 22K IN SERIAL NO. 3801 AND UP |
| R-47 R-48 | 6,200 | | | 6,200 |
| R-51 | | | | 1,800 IN SERIAL NO. 3800 AND DOWN |
| R-52 | | | | 3,300 IN SERIAL NO. 3800 AND DOWN |
| R-54 | NOT USED | | | 100K IN SERIAL NO. 2715 AND DOWN |
| R-55 | NOT USED SEE NOTE 10 | | | |
| R-56 R-57 | | | REPLACED WITH COILS L-14 AND L-15, RESPECTIVELY (5.3 UH EACH) | REPLACED WITH COILS L-14 AND L-15, RESPECTIVELY (5.3 UH EACH) |
| R-125 R-142 | 6,800 | | | 6,800 |
| R-143 | 470 | | | |
| R-182 R-183 | | | | NOT USED IN SERIAL NO. 2715 AND DOWN SEE NOTE 12 |
| L-20 | REPLACED WITH WIRE STRAP. | | REPLACED WITH WIRE STRAP IN SERIAL NO. 6840 AND UP | |

10. IN MODELS BEARING ORDER NO. 1759-PHILA-51, THE BOTTOM OF RESISTOR R-111 IS CONNECTED DIRECTLY TO GROUND. RESISTORS R-54 AND R-55 AND CAPACITOR C-78 ARE NOT USED, AND THE CIRCUIT CONSISTING OF RELAY O-1, TERMINALS 4 OF J-4 AND P-304, AND TERMINALS 12 OF P-308 AND J-108 IS NO LONGER ASSOCIATED WITH THE CONTROL GRID CIRCUIT (PIN 1) OF RECEIVER R-F AMPLIFIER V-1.

11. IN MODELS BEARING ORDER NO. 1759-PHILA-51, +85 VOLTS IS APPLIED TO THE SCREEN GRID CIRCUIT (PIN 3) OF RECEIVER FIRST MIXER V-2 THROUGH TERMINALS 6 OF P-304 AND J-4, INSTEAD OF THROUGH NORMALLY CLOSED CONTACTS 9-10 OF RELAY O-101, TERMINALS 1 OF J-108 AND P-308, AND TERMINALS 9 OF P-304 AND J-4.

12. IN MODELS BEARING ORDER NO. 32138-PHILA-51, SERIAL NUMBERS 1-2715, CONTROL VOLTAGE FOR SQUELCH OSCILLATOR V-103 (PIN 6) IS OBTAINED ONLY FROM THE GRID, PIN 6 OF FIRST LIMITER V-111, THROUGH RESISTOR R-111. THE CIRCUIT CONNECTING THE GRID, PIN 6 OF FIRST FIXED IF V-110, TO THE GRID (PIN 6) OF THE SQUELCH OSCILLATOR THROUGH RESISTOR R-182 IS NOT USED.

13. IN MODELS BEARING ORDER NO. 1759-PHILA-51, THE CIRCUIT CONTAINING CAPACITOR C-78, THE CONTACTS OF RELAY O-1, TERMINALS 12 OF J-108 AND P-308, AND TERMINALS 4 OF P-304 AND J-4 IS CONNECTED TO THE GRID, PIN 3 OF FIRST AUDIO V-115 THROUGH RESISTOR R-181, 470K (ADDED), INSTEAD OF TO THE JUNCTION OF RESISTORS R-109 AND R-174.

14. T-1, T-2, T-8, T-7, AND T-9 REPRESENT COILS AND ASSOCIATED COMPONENTS MOUNTED IN A MULTISECTION SHIELD COMPARTMENT LOCATED ON THE WIRING SIDE OF THE R-F CHASSIS. THE COILS ARE L-1, L-3, L-12, L-16, L-17 L-18, AND L-22 L-23. ACCESS TO THE COILS AND COMPONENTS CAN BE OBTAINED BY REMOVING A COVER AT THE BOTTOM OF THE R-F CHASSIS.

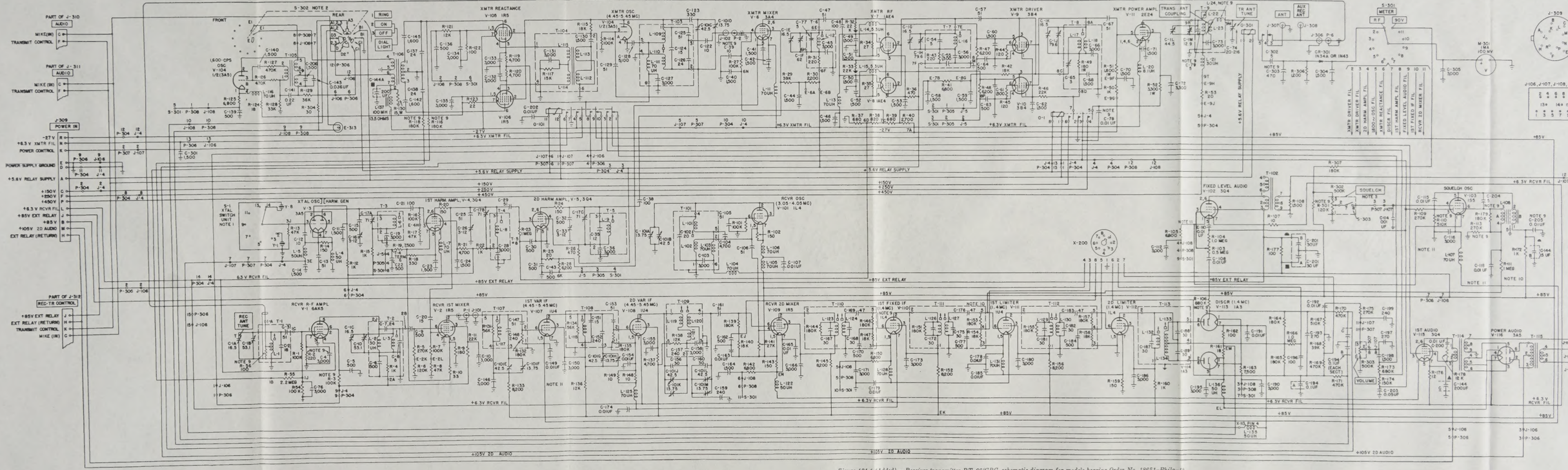


*Figure 131.1 (Added).—Receiver-transmitter RT-66/GRC, schematic diagram for models bearing Order No. 18651–Phila–4.*

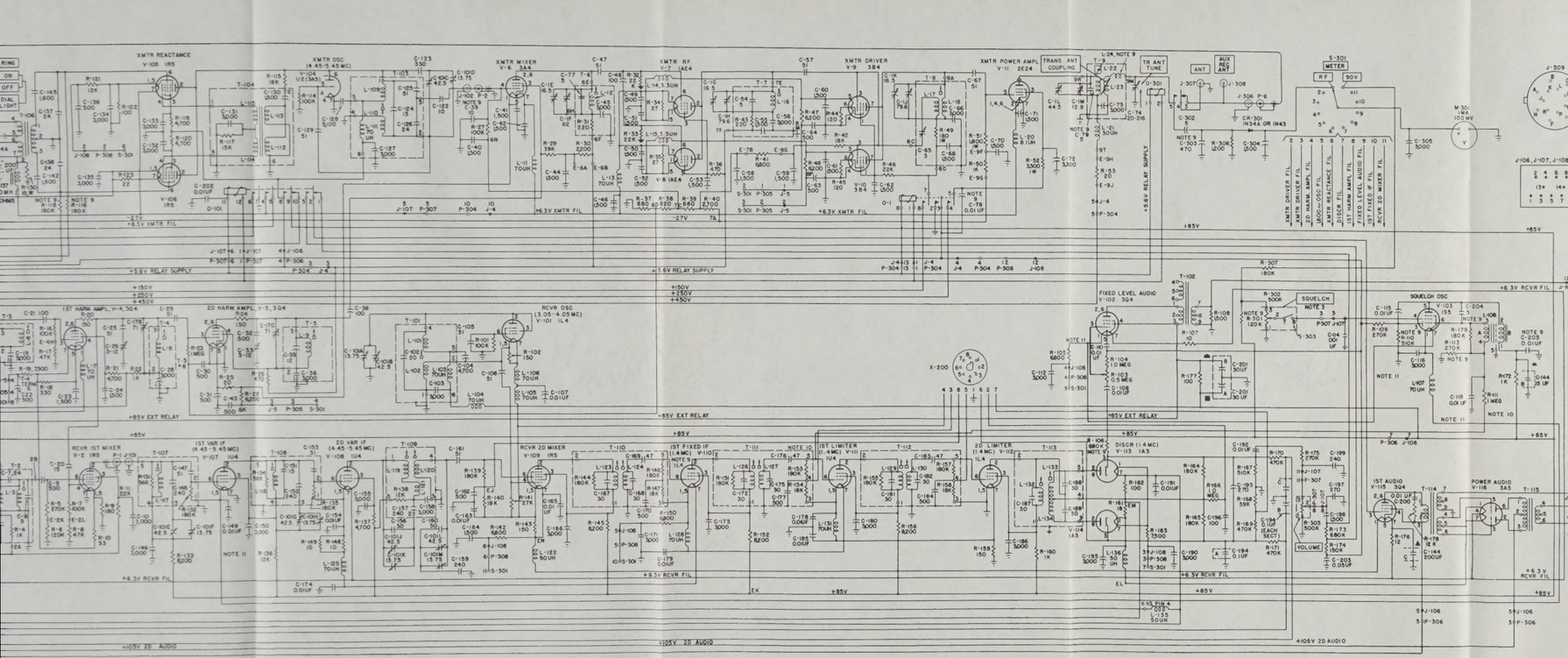



*Figure 181.1 (Added).—Receiver-transmitter RT-66/GRC, schematic diagram for models bearing Order No. 18651-Phila-49.*

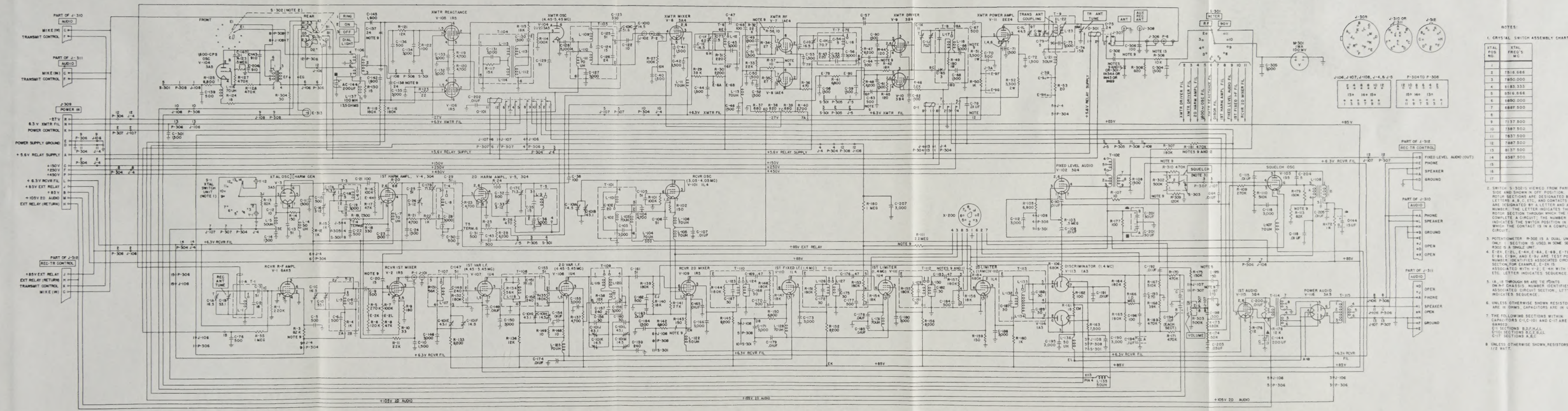


Figure 122 (Superseded).—Receiver-transmitter RT-67/GRC, schematic diagram.

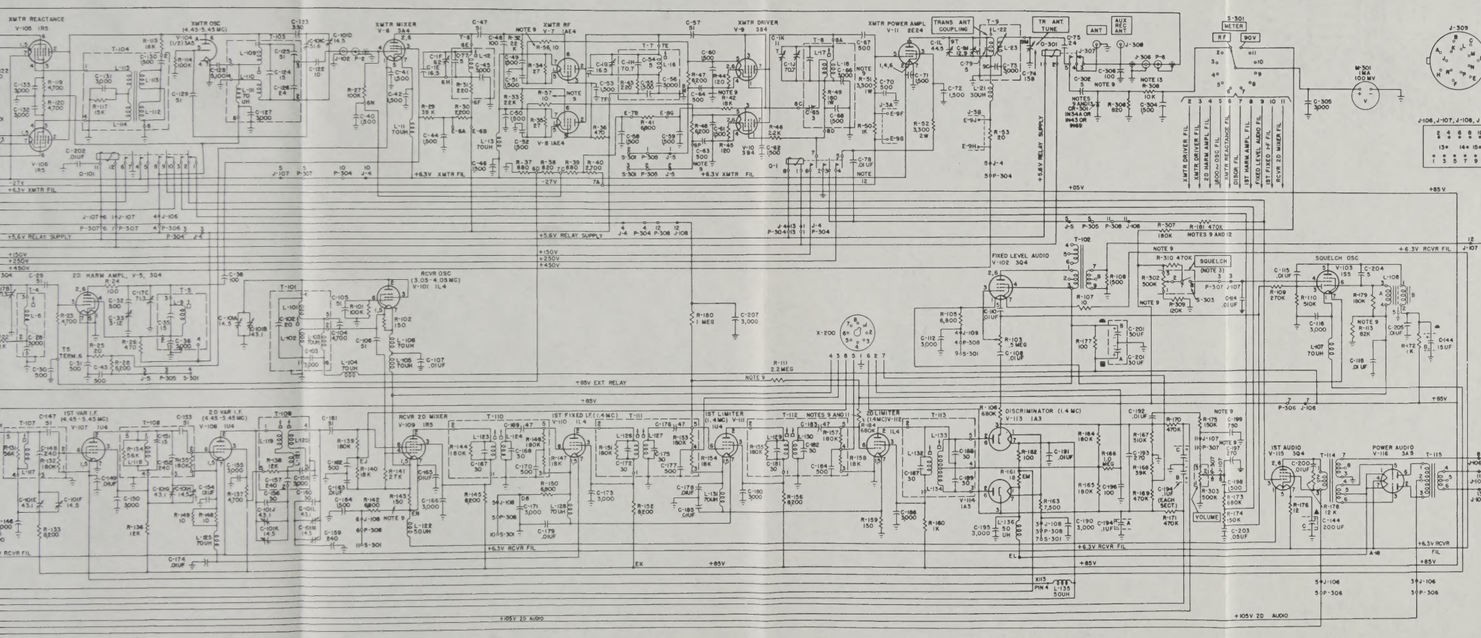



*Figure 122 (Superseded).—Receiver-transmitter RT-67/GRC, schematic diagram.*

NOTES:

1. CRYSTAL SWITCH ASSEMBLY CHART.

| XTAL POS. NO. | XTAL FREQ'S MC |
|---|---|
| 1 | |
| 2 | 7.516.666 |
| 3 | 7.850.000 |
| 4 | 8.183.333 |
| 5 | 8.516.666 |
| 6 | 8.850.000 |
| 7 | 9.183.333 |
| 8 | |
| 9 | 7.137.500 |
| 10 | 7.387.500 |
| 11 | 7.637.500 |
| 12 | 7.887.500 |
| 13 | 8.137.500 |
| 14 | 8.387.500 |
| 15 | |
| 16 | |
| 17 | |

2. SWITCH S-302 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, C, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS ARE CONNECTED. THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

3. POTENTIOMETER R-302 IS A DUAL UNIT, ONLY 1 SECTION IS USED IN SOME SETS R302 IS A SINGLE UNIT.

4. E-E1, E-E1, E-4A, E-8A, E-8B, E-7B, E-8S, E-9N, AND E-9J ARE TEST POINTS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION. FOR EXAMPLE, E-2K IS ASSOCIATED WITH V-2; E-4A WITH V-4 ETC. LETTER INDICATES SEQUENCE.

5. 1A, 1J THROUGH 9N ARE TIE POINTS ON R-F CHASSIS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, LETTER INDICATES SEQUENCE.

6. UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

7. THE FOLLOWING SECTIONS WITHIN CAPACITORS C-1, C-101 AND C-17 ARE GANGED:
C-1 SECTIONS B,D,F,H,J,L
C-17 SECTIONS B,D,F,H,J,L
ALL SECTIONS A,E,I.

8. UNLESS OTHERWISE SHOWN, RESISTORS ARE 1/2 WATT.

9. THE FOLLOWING CHART INDICATES THE DIFFERENCES IN COMPONENTS RT-67/GRC MODELS.

| REF SYM | 1759-PHILA-51 | 1683(-PHILA-51 | 1865(-PHILA-49 | 32111-PHILA-51 |
|---|---|---|---|---|
| C-20 | 51 | | | |
| C-43, C-64 | NOT USED | | | |
| C-137, C-138 | NOT USED | | | |
| C-197 | NOT USED | | | |
| C-199 | | 240 | 240 | |
| C-303 | | | 220, ADDED IN EARLY MODELS SEE NOTE 13 | |
| C-306 | NOT USED | NOT USED IN SERIAL NO. 3994 AND DOWN | NOT USED IN EARLY MODELS | NOT USED IN SOME MODELS. 82X IN SERIAL NO 5732 AND UP. |
| R-3 | | | | |
| R-51 | | | 5,100 IN EARLY MODELS | |
| R-56, R-57 | | REPLACED WITH COILS L-14 AND L-15(3.3 UH EACH) RESPECTIVELY | REPLACED WITH COILS L-14 AND L-15(3.3 UH EACH) RESPECTIVELY | |
| R-111 | | | 1 MEG | |
| R-113 | | 180X | 180X | 180X IN SERIAL NO 1347( AND DOWN |
| R-143 | | | | 470X IN SERIAL NO 14940 AND UP |
| R-175 | | 270X | 270X | |
| R-181 | | NOT USED SEE NOTE 12 | NOT USED SEE NOTE 12 | NOT USED SEE NOTE 12 |
| R-184 | | | NOT USED SEE NOTE 11 | |
| R-308 | | | NOT USED IN EARLY MODELS SEE NOTE 13 | |
| R-309 | | REPLACED WITH A WIRE STRAP | REPLACED WITH A WIRE STRAP | REPLACED WITH A WIRE STRAP IN SERIAL NO 1347( AND DOWN |
| R-340 | | NOT USED | NOT USED | NOT USED IN SERIAL NO. 1347( AND DOWN |

10. IN THE FOLLOWING MODELS, +85 VOLTS IS APPLIED TO THE SCREEN GRID CIRCUIT THROUGH NORMALLY CLOSED CONTACTS 9-10 OF RELAY O-106, TERMINALS 1 OF J-106 AND P-306, AND TERMINALS 9 OF P-304 AND J-4, INSTEAD OF THROUGH TERMINALS 8 OF P-304 AND J-4.

| ORDER NO. | SERIAL NO. |
|---|---|
| 1683(-PHILA-51 | ALL |
| 1865(-PHILA-49 | ALL |
| 32111-PHILA-51 | 1-1347( |

11. IN THE FOLLOWING MODELS, CONTROL VOLTAGE FOR SQUELCH OSCILLATOR V-103 IS OBTAINED ONLY FROM THE GRID, PIN 6 OF FIRST LIMITER V-111, THROUGH RESISTOR R-111. THE CIRCUIT THAT CONNECTS THE GRID, PIN 6 OF SECOND LIMITER V-112, TO THE SQUELCH OSCILLATOR THROUGH RESISTOR R-184 IS NOT USED.

| ORDER NO. | SERIAL NO. |
|---|---|
| 1683(-PHILA-51 | ALL |
| 1865(-PHILA-49 | ALL |
| 32111-PHILA-51 | 1-7249 |

12. IN THE FOLLOWING MODELS, THE CIRCUIT CONTAINING CAPACITOR C-78, THE CONTACTS OF RELAY O-1, TERMINALS 5 OF J-5 AND P-305, TERMINALS 11 OF P-308 AND J-108, AND RESISTOR R-181 IS CONNECTED TO THE JUNCTION OF RESISTORS R-108 AND R-176, INSTEAD OF TO THE WIRE, PIN 3 OF V-113. R-181 IS REPLACED WITH A WIRE STRAP.

| ORDER NO. | SERIAL NO. |
|---|---|
| 1683(-PHILA-51 | ALL |
| 1865(-PHILA-49 | ALL |
| 32111-PHILA-51 | 1-1347( |

13. IN EARLY MODELS BEARING ORDER NO 1865(-PHILA-49, CRYSTAL RECTIFIER CR-301 IS SUBSTITUTED FOR RESISTOR R-308, AND CAPACITOR C-303 (ADDED), 220 UUF, IS SUBSTITUTED FOR CRYSTAL RECTIFIER CR-301.

14. T-1, T-2, T-4, T-7, T-8 AND T-9 REPRESENT COILS AND ASSOCIATED COMPONENTS MOUNTED IN A MULTISECTION SHIELD COMPARTMENT LOCATED ON THE WIRING SIDE OF THE R-F CHASSIS. THE COILS ARE L-1, L-3, L-12, L-14, L-17, L-19, AND L-22. L-23, ACCESS TO THE COILS AND COMPONENTS CAN BE OBTAINED BY REMOVING A COVER AT THE BOTTOM OF THE R-F CHASSIS

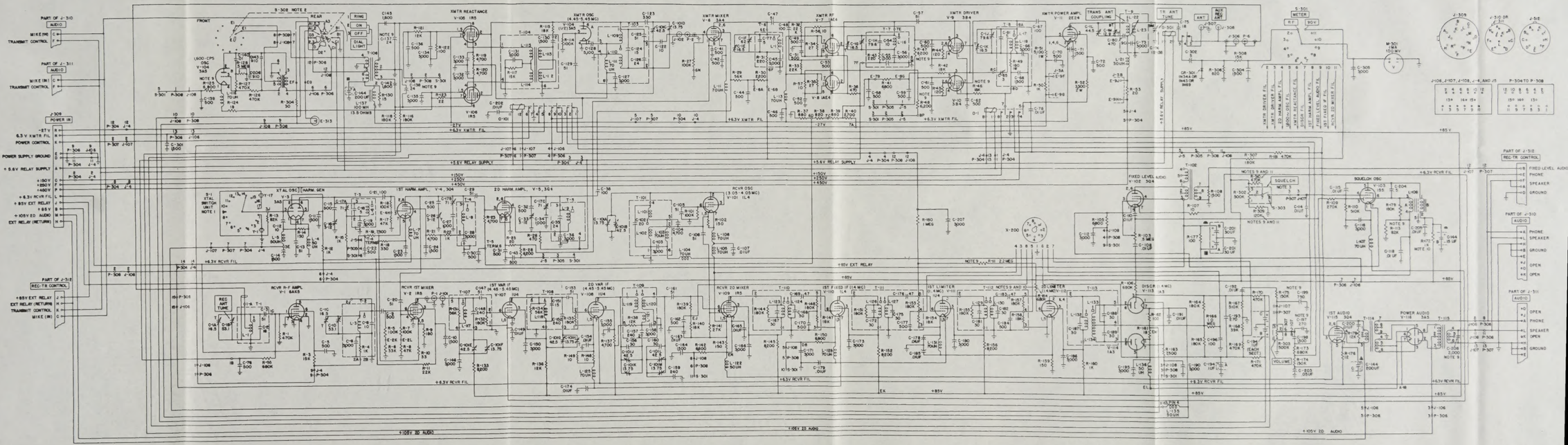


*Figure 123 (Superseded).—Receiver-transmitter RT-68/GRC, schematic diagram.*

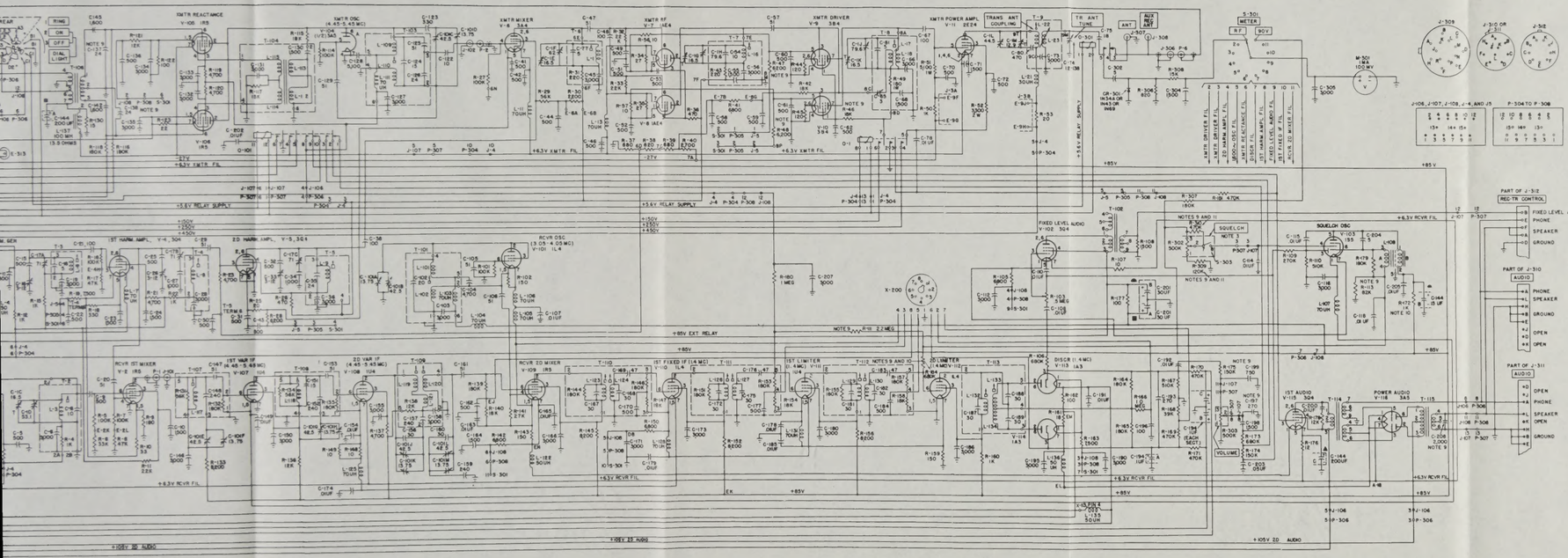


*Figure 183 (Superseded).—Receiver-transmitter RT-68/GRC, schematic diagram.*

NOTES

1. CRYSTAL SWITCH ASSEMBLY CHART.

| XTAL POS NO. | XTAL FREQ'S MC |
|---|---|
| 1 | 8387.500 |
| 2 | 8637.500 |
| 3 | 8887.500 |
| 4 | 6019.666 |
| 5 | 6258.333 |
| 6 | 6423.000 |
| 7 | 6591.666 |
| 8 | 6758.333 |
| 9 | 6925.000 |
| 10 | 7091.666 |
| 11 | 7258.333 |
| 12 | 7425.000 |
| 13 | 7591.666 |
| 14 | 7758.333 |
| 15 | 7925.000 |
| 16 | 8091.666 |
| 17 | 8258.333 |

2. SWITCH S-302 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, C, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

3. POTENTIOMETER R-308 IS A DUAL UNIT, ONLY 1 SECTION IS USED IN SOME SETS. R303 IS A SINGLE UNIT.

4. E-2N, E-2L, E-4N, E-8A, E-8B, E-7B, E-8Q, E-9H, AND E-9J ARE TEST POINTS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION. FOR EXAMPLE, E-2K IS ASSOCIATED WITH V-2 4N WITH V-4 ETC. LETTER INDICATES SEQUENCE.

5. 1A, 1B THROUGH 9R ARE THE POINTS OF TEST. THE NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, LETTER INDICATES SEQUENCE.

6. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT, CAPACITORS ARE IN UUF.

7. THE FOLLOWING SECTIONS IN CAPACITORS C-1, C-101, AND C-17 ARE GANGED:
C-1 SECTIONS B, D, F, H, J, L
C-101A SECTIONS B, C, E, G, J, L
C-17 SECTIONS A, B, C

8. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT.

9. THE FOLLOWING CHART INDICATES THE DIFFERENCES IN COMPONENTS IN RT-68/GRC MODELS.

| REF SYM | 7758-PHILA-51 | 16817-PHILA-51 | 16821-PHILA-51 | 19651-PHILA-49 | 32114-PHILA-51 | 32127-PHILA-51 |
|---|---|---|---|---|---|---|
| C-137 | NOT USED | | | | NOT USED | NOT USED |
| C-138 | | | | | | |
| C-197 | NOT USED | | | | NOT USED | NOT USED |
| C-199 | | 240 IN SERIAL NO 9675 AND DOWN | 240 IN SERIAL NO 16667 AND DOWN | 240 | | |
| C-208 | NOT USED | NOT USED | NOT USED | NOT USED | 2,000 ADDED IN SERIAL NO 38051 AND UP | NOT USED |
| R-5 | | | | 270K | | |
| R-88 | | | | 18K | 18K IN SERIAL NO 20350 AND UP | 18K |
| R-97 | | | | | 5,100 IN SERIAL NO 20350 AND UP. | 5,100 |
| R-98 | | | | | | |
| R-111 | | 1MEG IN SERIAL NO 9675 AND DOWN | 1 MEG IN SERIAL NO 16667 AND DOWN | 1 MEG IN SERIAL NO 8812 AND DOWN | | |
| R-113 | | 470K IN SERIAL NO 9675 AND DOWN | 470K IN SERIAL NO 16667 AND DOWN | 470K IN SERIAL NO 8812 AND DOWN | | |
| R-129 | | | | | 5,600 IN SERIAL NO 20350 AND UP. | 5,600 |
| R-142 | | | | | | |
| R-175 | | 270K IN SERIAL NO 9675 AND DOWN | 270K IN SERIAL NO 16667 AND DOWN | 270K | | |
| R-184 | | NOT USED IN SERIAL NO. 9675 AND DOWN SEE NOTES 10 AND 11 | NOT USED IN SERIAL NO. 16667 AND DOWN SEE NOTES 10 AND 11 | NOT USED IN SERIAL NO 8812 AND DOWN SEE NOTES 10 AND 11 | | |
| R-309 | | | | | | |
| R-310 | | | | | | |

10. IN THE FOLLOWING MODELS, CONTROL VOLTAGE FOR SQUELCH OSCILLATOR V-103 IS OBTAINED ONLY FROM THE GRID, PIN 6 OF FIRST LIMITER V-111, THROUGH RESISTOR R-111. THE CIRCUIT CONNECTING THE GRID, PIN 6 OF SECOND LIMITER V-112, TO SQUELCH OSCILLATOR THROUGH RESISTOR R-184 IS NOT USED.

| ORDER NO. | SERIAL NO. |
|---|---|
| 16817-PHILA-51 | 9675 AND DOWN. |
| 16821-PHILA-51 | 16667 AND DOWN |
| 19651-PHILA-51 | 8812 AND DOWN. |

11. IN THE MODELS LISTED IN NOTE 10 ABOVE, RESISTOR R-310 IS NOT USED, AND RESISTOR R-309 IS REPLACED WITH A WIRE STRAP.

12. T-1, T-2, T-6, T-7, T-8, AND T-9 REPRESENT COILS AND ASSOCIATED COMPONENTS MOUNTED IN A MULTISECTION SHIELD COMPARTMENT LOCATED ON THE WIRING SIDE OF THE R-F CHASSIS. THE COILS ARE L-1, L-3, L-12, L-16, L-17, L-18, AND L-22. ACCESS TO THE COILS AND COMPONENTS CAN BE OBTAINED BY REMOVING A COVER AT THE BOTTOM OF THE R-F CHASSIS.

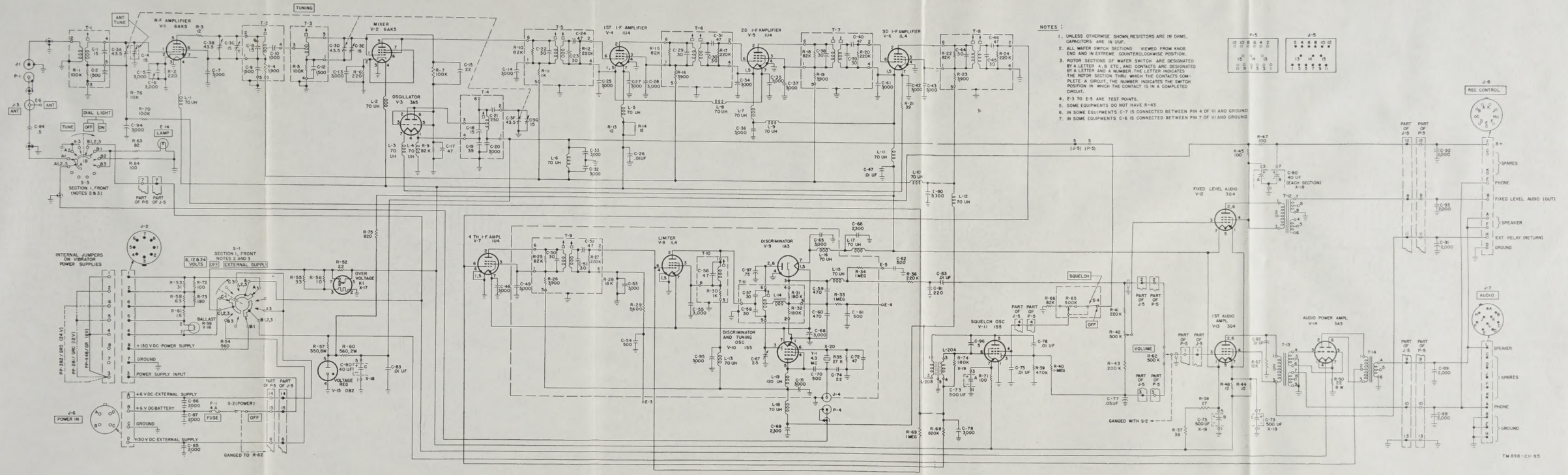
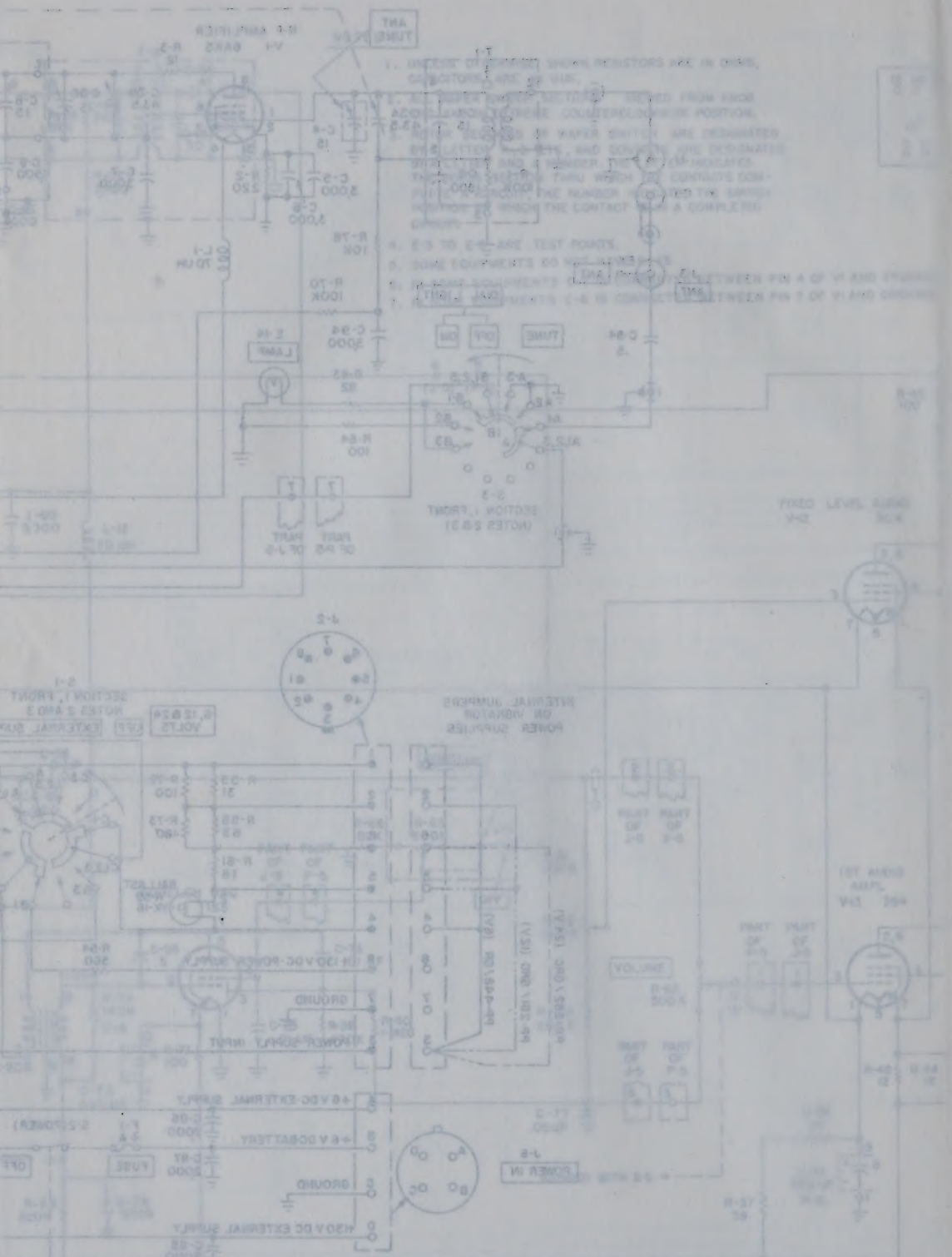



*Figure 124 (Superseded).—Radio receiver R-108/GRC, schematic diagram.*



# APPENDIX I
# REFERENCES

*Note.* For availability of * * * Corps Supply Manuals.

## 5. Other Publications

* * * * *

| | |
|---|---|
| SB 11–6 | Dry Battery Supply Data. |
| **SB 11–100–105** | **Serviceability Standards for Radio Sets AN/GRC–3 through –8.** |

* * * * *

| | |
|---|---|
| TB SIG 223 | Field Expedients for Wire and Radio. |
| **TB SIG 239** | **Maintenance Information for New Series Radio Sets.** |

* * * * *

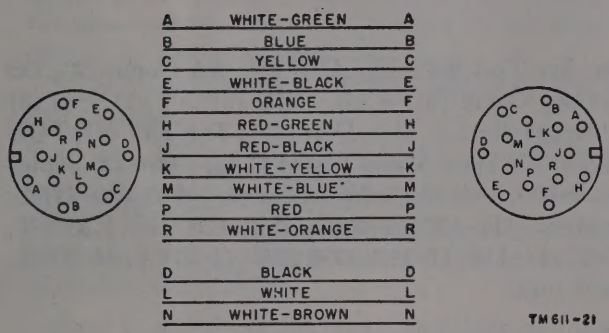



*Figure 109.1.* (Added) *Special purpose cable assembly CX–1211/U, schematic diagram.*

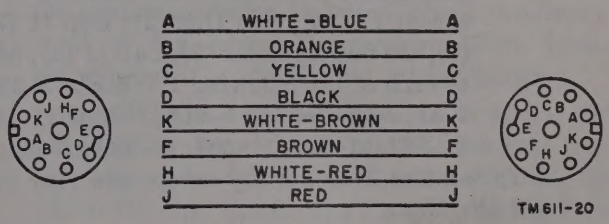



*Figure 109.2* (Added) *Special purpose cable assembly CX–1213/U, schematic diagram.*

[AG 413.44 (27 Jan 54)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

M. B. RIDGWAY,
*General, United States Army,*
*Chief of Staff.*

OFFICIAL:
WM. E. BERGIN,
*Major General, United States Army,*
*The Adjutant General.*

N. F. TWINING,
*Chief of Staff, United States Air Force.*

OFFICIAL:
K. E. THIEBAUD,
*Colonel, United States Air Force,*
*Air Adjutant General.*

DISTRIBUTION:

*Active Army:*

Tech Svc (1); Tech Svc Bd (1); AFF Bd (ea. Svc Test Sec) (1); AFF (5); AA Comd (2); OS Maj Comd (5); Base Comd (5); MDW (2); Log Comd (5); A (5); CHQ (2); FT (2); Sch (5) except 11 (25); Gen Dep (2); Dep 11 (20) except Sig Sec, Gen Dep (10); Tng Div (2); POE (2), OS Sup Agencies (2); Lab 11 (5); Mil Dist (1); Field Maint Shops 11 (3); Two (2) copies to each of the following T/O & E's: 5–226A; 6–200; 6–226A; 6–227A; 6–235; 6–237A; 6–416A; 7–11; 7–31; 7–32A; 7–34A; 7–36A; 11–107; 11–127; 11–128; 11–500A, KA, KB, KC, RA–RR; 11–587; 11–592; 11–597; 17–32A; 17–36; 17–37; 17–116; 17–117; 17–125A; 44–276A; 44–277A.

*NG:* Same as Active Army except one copy to each unit.

*USAR:* None.

For explanation of distribution formula, see SR 310–90–1.

# RADIO SETS AN/GRC–3, –4, –5, –6, –7, AND –8

TM 11–284
TO 31R2–2GRC–131
CHANGES No. 6

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *18 March 1958*

TM 11–284/TO 31R2–2GRC–131, 13 May 1953, is changed as follows:

*Page 1.* Add the following "Note" after the chapter heading.

*Note.* (As added by C 3, 4 February 1955.) Radio Sets AN/GRC–3X through –8X are similar to Radio Sets AN/GRC–3 through –8. All information in the manual applies to Radio Sets AN/GRC–3X through –8X as well as to Radio Sets AN/GRC–3 through –8, unless otherwise specified. All X models are the 12-volt counterparts of the unlettered 24-volt models.

*Page 2,* paragraph 3. Delete subparagraph *b* and substitute:

*b.* Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, United States Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700–38.

*Page 5,* paragraph 6*a.* Add the following after the last sentence: Control Group AN/GRA–6 is no longer supplied with Radio Sets AN/GRC–3, AN/GRC–5, AN/GRC–7, AN/VRQ–1, AN/VRQ–2, and AN/VRQ–3.

*Page 20,* paragraph 15. Make the following changes:

Subparagraph *d.* After the last line, add: On Mounting MT–297/GR which has been modified by MWO SIG 135, connector retainers, caps, and covers are provided on the front of the mounting to protect the unused cable connectors from dirt and moisture.

*f.* (As added by C 3, 4 February 1955, Superseded): On Radio Sets AN/GRC–3, –5, and –7 modified by MWO SIG 78, the audio outputs of *Set 1* and the *auxiliary receiver* may be monitored separately by disconnecting the jumper wire from terminals *E* and *E1* on terminal block E2 of Mounting MT–297/GR.

*Page 28,* paragraph 21*h.* (As changed by C 4, 16 Nov 56, and C 5, 23 Apr 57). In the substitute item column of the chart, delete "Chest Set TD–4 and Cords CD–307–A and CD–318."

*Page 30.* Add paragraph 22.1.

## 22.1. Modifications to Equipment

If the main schematic diagrams do not match the equipment being repaired, check the Department of the Army Modification Work Orders listed below for circuit and other changes:

*a.* MWO SIG 78, Modification of Radio Sets AN/GRC–3 through –8 and Radio Sets AN/VRC–13, –14, –15, –16, –17, –18, –20, –21, and –22 to Provide Monitoring Facilities at the Front Panels of the Radio Sets.

*b.* MWO SIG 135, Modification of Mounting MT–297/GR, MT–298/GR, MT–300/GR, and MT–327/GR to Provide Connector Retainers, Caps and Covers for Cable Connectors.

*c.* MWO SIG 143, Modification of Control Box C–375/VRC, Remote Control C–433/GRC, Local Control C–434/GRC, Control C–435/GRC and Interphone Control C–665/VIA–1 to Provide Connector Caps for the Audio Connectors.

*d.* MWO SIG 11–284–1, Modification of Control C–435/GRC to Eliminate False Meter Readings.

*e.* MWO SIG 11–284–2, Modification of Installation of Radio Sets AN/GRC–3 through –8 to Eliminate Acoustical Feedback in Noninterphone Vehicles.

*Page 31,* paragraph 23. Make the following changes:

* These changes supersede C 2, 22 March 1954, C 3, 4 February 1955, C 4, 16 November 1956, and C 5, 23 April 1957.

***Warning:*** (As added by C 3, 4 February 1955) Use extreme care when installing Special Purpose Cable Assembly CX–1211/U and Special Purpose Cable Assembly CX–1213/U (fig. 33). Make certain that the connectors are properly inserted and alined in the receptacles before tightening the handscrew.

*Note.* (As added by C 5, 23 April 1957; Superseded): Control Boxes C–375/VRC and C–435/GRC, Remote Control C–433/GRC, Local Control C–434/GRC and Interphone Control C–665/VIA–1, modified by MWO SIG 143, have aluminum covers added to the audio connectors to protect them from foreign matter and moisture when they are not used. A 3-inch beaded chain is riveted to each cover and attached to each unit.

### 23.1. (As added by C 3, 4 February 1955; Superseded) Receptacle Connector Failures

Various female receptacle connectors of the center-screw type have been breaking. The insert flanges of these female receptacles are unable to withstand the wheel-puller action of the male plug when the plug screws are tightened. As a result, the phenolic inserts often become damaged or broken. The connectors that terminate the cable assemblies have been improved by increasing the thickness of the insert flange. The improved receptacles are identified by the letter M molded on the face of the insert. New stock numbers have been assigned to the improved items and may be obtained through normal supply channels. The following chart lists the number of contacts, original stock numbers, and improved parts stock numbers:

| Number of contacts | Stock number of original part | Stock number of improved part |
|---|---|---|
| 4 | Fed. 5935–187–4502 | Fed. 5935–376–9334 |
| 9 | Sig. C. 2Z3070–49 | Sig. C. 2Z3070–64 |
| 14 | Sig. C. 2Z3075–26 | Fed. 5935–199–6693 |

*Page 32,* paragraph 28. (As changed by C 3, 4 February 1955) (Rescinded).

*Page 33,* figures 23 and 28 (facing page 36). Add the following to the notes as note 5 on figure 23 and note 4 on figure 28:

THE SLATE COLORED LEAD NORMALLY CONNECTED TO PIN NO. 8 OF THE TERMINAL STRIP IN MOUNTING MT–297/GR WILL BE CONNECTED TO PIN NO. 13 INSTEAD WHEN MODIFIED BY MWO SIG 11–284–2.

*Page 35,* paragraph 30. Make the following changes:

*a.1.* (Added) Check the connections of the insulated and bare leads of battery cable W–8 before installation. Some units have been received with these leads reversed at the battery. Disconnect the leads and reverse them if necessary. The bare lead of battery cable W–8 should be connected to the negative terminal of the battery and the insulated lead should be connected to the positive terminal.

Subparagraph *b.1* (As added by C 3, 4 February 1955 (Rescinded)).

*d.* (Added) Connect any unused cables to the connector retainers which are provided on the front of mountings modified by MWO SIG 135.

*Page 37,* paragraph 33*b*(6). (As changed by C 4, 16 November 1956.) Add the following at the end of subparagraph (6): RF Cable Assemblies CG–530/U and CG–568/U are very similar in appearance but may be identified by the identification bands attached to one end of each cable. If the identification bands are lost or destroyed, the cables may be identified by means of a continuity test between the shells of the connectors on the ends of each cable. RF Cable Assembly CG–530/U will have continuity between its connector shells; RF Cable Assembly CG–568/U will not.

***Caution:*** Be sure that RF Cable Assembly CG–530/U and RF Cable Assembly CG–568/U are used with the proper sets as stated above. Although the cables are similar in appearance, they are *not* electrically interchangeable. The sets will not function properly if they are accidentally interchanged.

*Page 40,* paragraph 36*b*.

(4) (Added) Unsolder and remove the slate colored lead from pin No. 8 of terminal board E–6 and solder it to pin No. 13 to eliminate acoustical feedback. The feedback is due to the proximity of the microphone unit to the loudspeaker when the loudspeaker is connected to Control Box C–375/VRC in noninterphone vehicles.

***Caution:*** The FIELD-VEH-TANK sidetone switch in set No. 2 (Receiver-Transmitter RT–70/GRC) must be set in the proper position. If the set is

installed in a noninterphone vehicle, the switch must be set to the VEH position. This reduces the sidetone level of set No. 2 and prevents acoustical feedback when the loudspeaker microphone combination of audio accessories is used. In interphone type vehicle installations, the switch must be set to the TANK position. This causes the sidetone output level of set No. 2 to be equal to the audio output of a received signal. Since headset-microphone combinations are used in the intercommunication vehicle installations, there is no feedback. If, however, the loudspeaker-microphone combination is used in interphone vehicles, the sidetone causes feedback. In such special cases, the switch must be set to the VEH position to reduce the sidetone level and effectively eliminate feedback.

*Page 46,* paragraph 39.1. (As added by C 3, 4 February 1955.)

### 39.1. Service Upon Receipt of Used or Reconditioned Equipment

*a.* Follow the instructions in paragraph 24 for uncrating, unpacking, and checking the equipment.

*b.* Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note them in this manual, preferably on the schematic diagram.

*c.* Check the operating controls for ease of rotation. If lubrication is required, refer to the lubrication instructions (par. 136*a*).

*d.* Perform the installation and connection procedures given in paragraphs 25 through 39, as applicable.

*e.* Check the condition of the decalcomania identification plates on components of the set. Loss of the data on the nameplate may impose a serious inconvenience to personnel charged with property accountability. It is recommended that the serial and order numbers be written or stamped upon the rear of the panel.

*Page 47,* paragraph 43. Add the following after subparagraph *b*:

*c.* Retransmission facilities are available with Radio Set AN ARC–27 when this set is modified by MWO SIG 91.

*d.* Retransmission facilities are available with Radio Set AN ARC–3 when this set is modified by MWO SIG 63.

*Page 65.* Add the following caution after the section heading:

***Caution:*** To prevent damage to tubes and parts, turn off the radio set before starting the vehicle engine.

*Page 70,* paragraph 65*b*. Make the following changes:

(2) (As superseded by C 4, 16 Nov 56) Turn the TRANS ANT COUPLING control on the Set 1 receiver-transmitter panel completely counterclockwise to obtain minimum coupling.

(4) (As changed by C 3, 4 February 1955; superseded) Remove the cap that covers the TR ANT TUNE control on the set 1 receiver-transmitter panel (fig. 42). Engage the control by pressing in on it with a screwdriver and adjust for a maximum RF reading on the panel meter. If it is impossible to obtain a reading, advance the setting of the TRANS ANT COUPLING control slightly and repeat the procedure. Keep the coupling as low as possible while adjusting the TRANS ANT TUNE control for a maximum RF reading. When the maximum reading is obtained, release the RADIO INT and LOCK ON push-to-talk switches on the chest set. The stop for the TRANS ANT COUPLING control, located at the rear of the front panel, may fail to stop the rotation of this control at the proper point. This may result in the shorting of movable antenna coil L23 to plate coil L22 and/or may cause breakage of the coil support. The short causes excessive current to flow through resistor R53 which may result in burning out the resistor. In general, malfunctioning of the stop mechanism is due to incorrect positioning of the control shaft with the coupling mechanism. Loose set screws on the stop mechanism

or on the coupling device may cause this defect. For further details concerning the repair and adjustment of this control, refer to TM 11–289, Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC.

*Page 78*, paragraph 72. Add the following after the end of the second sentence: Simultaneous monitoring of the Set 1 and the auxiliary receivers is possible if the equipment has been modified (par. 28).

*Page 83*, paragraph 75.1 (As added by C 2, 22 March 1954 and changed by C 4, 16 November 1956; Superseded):

### 75.1. Antijamming

If one of the three receivers (set 1, set 2, or the auxiliary receiver) is being jammed, notify your immediate superior officer. *Do not cease operating.* Follow the procedure in the order outlined below until signal read-through is re-established.

*a.* If the set 1 or set 2 receiver is being jammed, slowly vary the TENTH MCS tuning knob of that set, first to one side, then to the other side of the assigned frequency. (On set 1, first turn the TENTH MCS knob to its extreme counterclockwise position. This releases the detent and enables continuous tuning.) If the auxiliary receiver is being jammed, turn the TUNING control first to one side and then to the other side of the assigned frequency. This may re-establish read-through on one side or the other of the assigned frequency.

*b.* Vary the SQUELCH control. If this does not help, turn it OFF.

*c.* Note carefully the setting of the REC ANT TUNE control on the panel of Set 1 and the ANT TUNE control on the auxiliary receiver. Use a screwdriver or coin to adjust one or both of these controls (depending upon which set is being jammed) to the point at which the desired signal is heard with the least amount of interference from the jamming signal. This may permit copy of the desired signal. If not, return the control to its original setting. This procedure does not apply to Set 2.

*d.* Locate the radio set so that some object such as a truck, tank, jeep, or tree is between the source of jamming signal and the antenna of the radio set. This may reduce greatly or eliminate the jamming signal.

*e.* If the above steps fail, request a change in frequency and call sign.

*f.* If the above steps do not help to re-establish read-through, use some other means of getting the message through.

*g. Continue to Operate.* The enemy may be uncertain as to his jamming success and stop his jamming signal or switch to other frequencies. Read-through then will be re-established. Also, continued operation of the transmitter that is the source of the desired signal keeps the enemy in uncertainty as to his jamming success and may keep the jamming signal at what the enemy believes is your active communicating frequency.

*Page 128*, paragraph 134*h*. Add the following: Check the insulation of the conductors in Special Purpose Cable WM–46 U for cracking and flaking.

*Page 129*, paragraph 136.1 (As added by C 4, 16 November 1956):

### 136.1. Tools and Test Equipment (Superseded)

The tools and test equipment listed below are not furnished as part of the radio set but are authorized for organizational maintenance of Radio Sets AN/GRC–3 through –8.

*a.* Multimeter TS–297/U.

*b.* Tube Tester TV–7/U.

*c.* Adapter Kit MX–949/U.

*d.* Tools Equipment TE–41.

*Page 135*, paragraph 137.1.

### 137.1. (As added by C 3, 4 Feb 55) Modifications to Equipment

Rescinded. See paragraph 22.1.

*Page 135*, paragraph 138*d*, line 3. (As added by C 4, 16 November 1956). Add the following after the word "condition": or use the authorized test equipment (par. 136.1).

*Page 149*, paragraph 149.1. (As added by C 3, 4 February 1955.)

### 149.1 Fuse F2 Failure in Mounting MT–297/GR

Excessive burnouts of fuse F2 in Mounting MT–297/GR in many instances are caused by defective construction of OFF-REMOTE-ON

switch S1 (par. 48). The defect in the switch is the omission of the phenolic washers between the inside of the ceramic wafer and the spacer separating this part from the detent assembly. The omission of the washer eliminates the required clearance between the detent mechanism and the contacts on the wafer. As a result, the A+ lead may be shorted to ground, in turn, causing the fuse (F2) to burn out. To prevent excessive failure of fuse F2, follow the procedure outlined below:

*a. Bent or Damaged Switch S1.*

(1) Check to see that the power is disconnected.

(2) Remove the left junction box cover plate on this unit (fig. 26).

(3) Examine the lower contact (red wire) on switch S1. A dental mirror may be useful for this examination.

(4) If the switch contacts appear to be bent or distorted, replace the switch.

*b. Defective Manufacture of Switch S1.*

(1) Inspect the switch to see if the phenolic washers are present on both sides of the ceramic wafer and between each spacer.

(2) If the insulating washers are missing, obtain them through normal supply channels (Federal stock No. 5330–285–8336).

(3) Carefully withdraw the switch from the mounting with the wires intact.

(4) Back off the two No. 6–32 machine nuts and the metal and fiber washers that hold the ceramic wafer to the detent.

(5) Pull back the No. 6–32 screw to clear the spacer.

(6) Insert an insulating washer between the spacer and the ceramic wafer, and between the ceramic wafer and the metal washer.

(7) Replace the screw, assemble the nuts and tighten them.

(8) Be sure that the detent clears the contacts and that the contact fingers are not bent.

*Pages 158 and 160,* paragraphs 156*a* and 158*a*. (As changed by C 5, 23 April 1957.) Add the following after the first sentence: There are two types of fuseholders with caps that are not interchangeable. One type fuseholder has a hexagonal nut insert, while the other has a round nut insert. Caps for both types are supplied as maintenance spares.

*Page 166, figure 87.* Note as added by C 3, 4 February 1955 (Superseded):

NOTE

SOME MODELS DO NOT HAVE CAPACITOR C4

*Page 175,* paragraph 167. Make the following changes.

Add the following note before subparagraph *a*:

*Note.* In Cases CY–590/GRC manufactured by Kane Manufacturing Company on Order No. 3277–Phila-52, resistor R2 is a 39-ohm, ½-watt resistor. This value is incorrect and causes insufficient filament voltage in the receiver-transmitter. Replace the 39-ohm. resistor with a .39-ohm resistor.

Add the following caution after *a*(4):

***Caution:*** Do not connect Power Cable Assembly CX–1210/U to Generator G–8/GRC.

*Page 177,* paragraph 169. Add the following note before subparagraph *a*:

*Note.* In Cases CY–590/GRC manufactured by Kane Manufacturing Company on Order No. 3277-Phila-52, resistor R2 is a 39-ohm, ½-watt resistor. This value is incorrect and causes insufficient filament voltage in the receiver-transmitter. Replace the 39-ohm resistor with a .39-ohm resistor.

*Page 187,* paragraph 175.1. (As added by C 3, 4 February 1955.)

## 175.1. Field Packaging, Packing, and Marking Equipment for Zone of Interior and Intertheater Shipments

*a. General.* The contents of each box for original shipments of Radio Sets AN/GRC–3 through –8 are listed in paragraph 7*b* through *d* of this manual. Field repacking consists of packaging, packing, and marking equipment for zone of interior and intertheater shipments. The contents of the boxes listed in paragraph 7 are essentially the same as for field shipments except that the technical manual is packed in box No. 1.

*b. Material Requirements.* The material and quantity for field packaging Radio Sets AN/GRC–3 through –8 are given in the chart below:

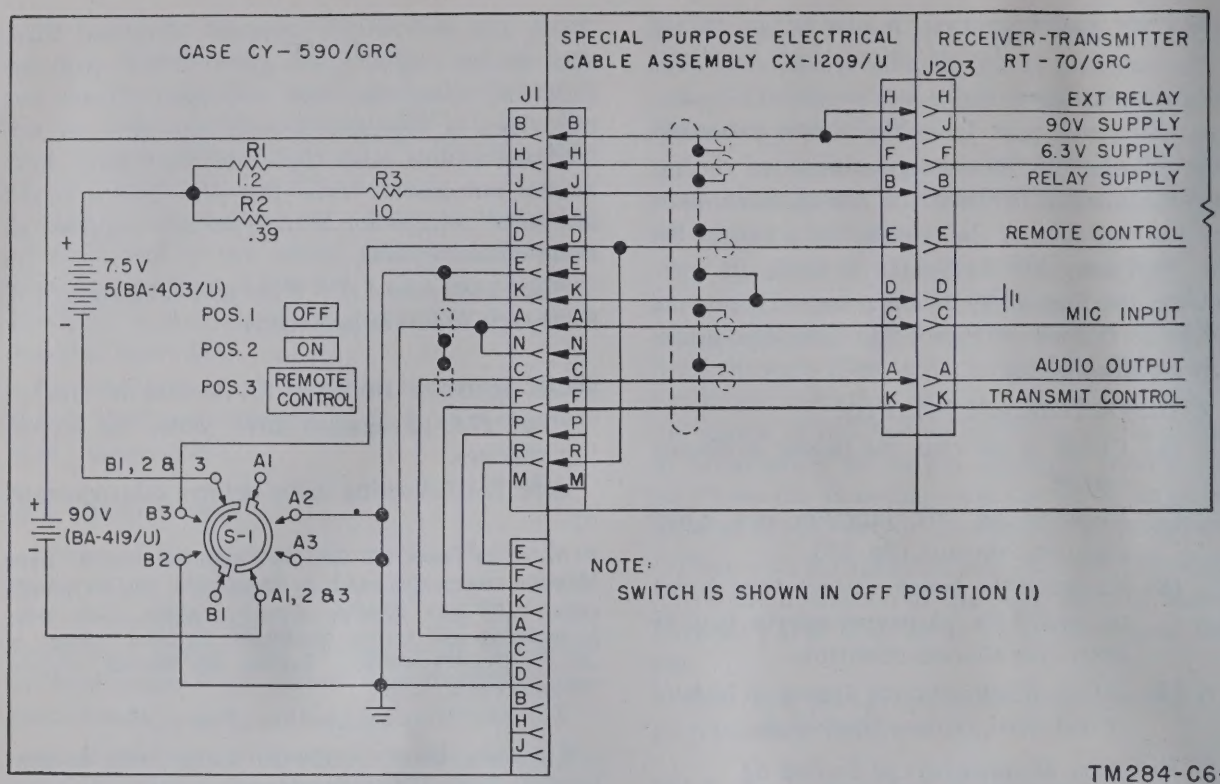



*Figure 103.* (Superseded) *Schematic diagram of connections between Case CY–590/GRC and Set 2.*

| Material requirements (estimated) | Quantity |
|---|---|
| Paper, corrugated, single face flexible | 168 sq. ft. |
| Barrier material, waterproof | 103 sq. ft. |
| Tape, cotton | 6 ft. |
| Tape, paper, gummed | 60 ft. |
| Tape, pressure-sensitive, water-resistant | 62 ft. |
| Strapping, flat steel | 44 ft. |
| Wooden boxes, shipping | 4 ea. |

*c. Packaging.*

(1) *Technical manuals.* Inclose each technical manual within a close-fitting bag made of waterproof barrier material. Seal the seams of the bag with water-resistant, pressure-sensitive tape.

(2) *Major components.* Cushion each major component (end item) on all surfaces with pads of single-faced, flexible corrugated paper (fig. 105.1). The cushioning material will absorb the shock of impact encountered in handling and transit. Place each cushioned component within a wrap of flexible, single-faced corrugated paper. Secure the wrap with gummed paper tape, and then place the component in a carton of suitable dimensions and seal the carton.

(3) *Spare parts and miscellaneous accessories.* Package spare parts and accessories for mechanical and physical protection by wrapping them with flexible, single-faced, corrugated paper. Secure the wrap with gummed paper tape. Consolidate spare parts and miscellaneous items within another wrap of single-faced, flexible corrugated paper. Secure the consolidated wrap with gummed paper tape. Reinforce accessories which require additional support as shown in figure 105.2. Fold the bags provided for accessories and secure them with their straps; then tie them with cotton tape. Items such as wires and cables may be wound in a coil of suitable diameter and then tied with cotton tape.

*d. Packing.* Pack the components of the set in wooden shipping containers for zone of inter-

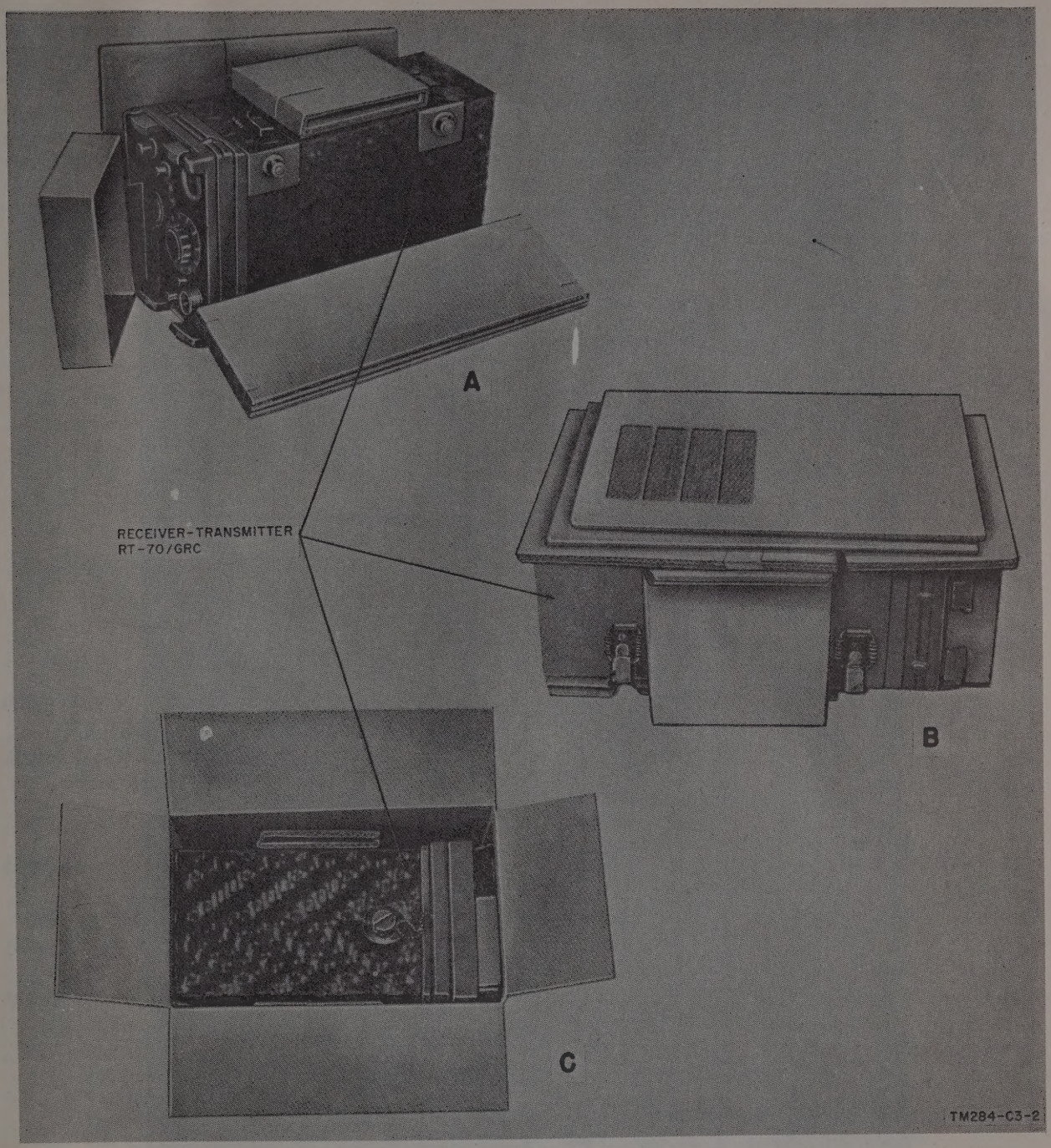



*Figure 105.1.* (As added by C 3, 4 Feb 55) *Cushioning Receiver-Transmitter RT–70/GRC prior to packaging.*

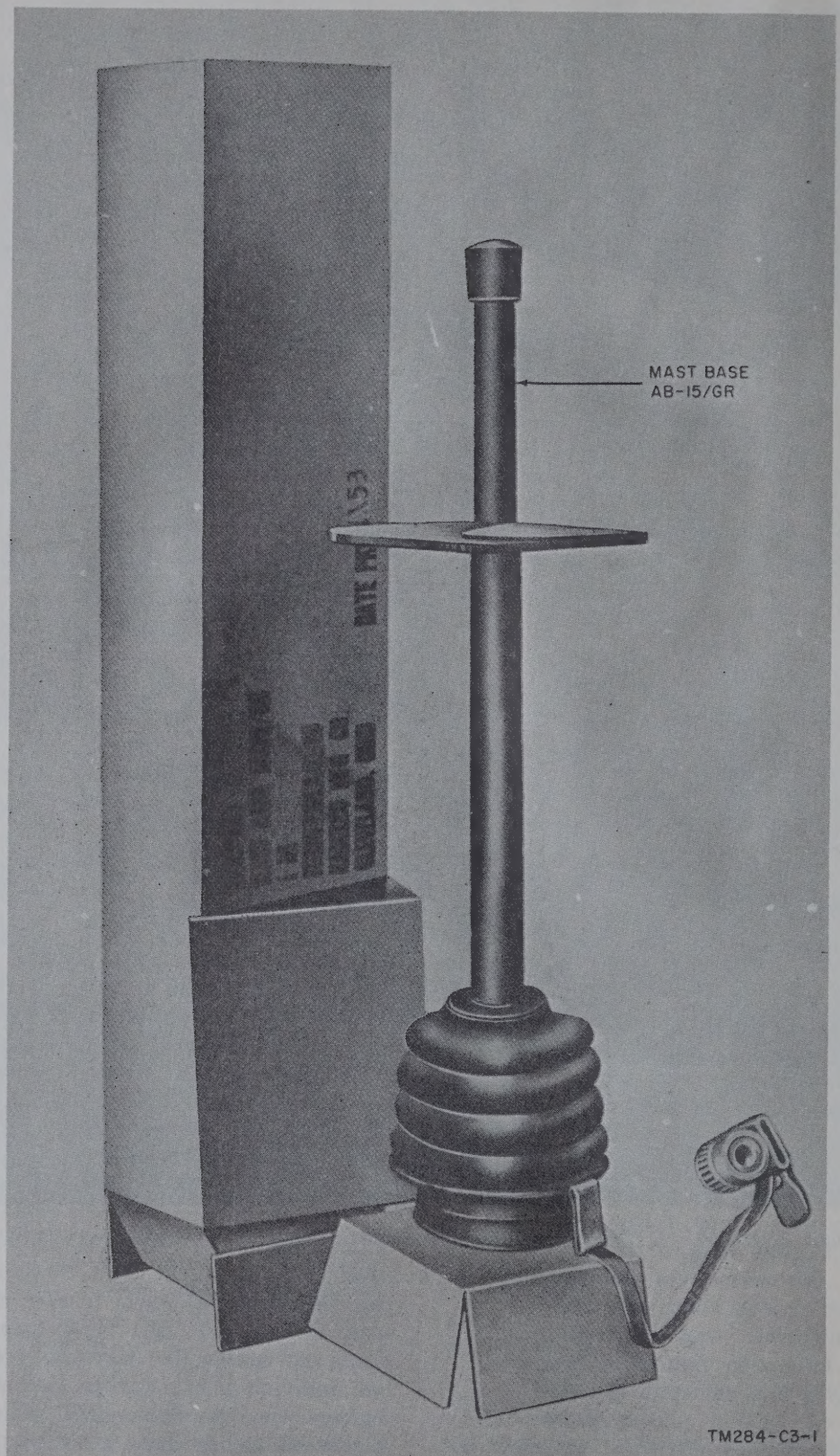



*Figure 105.2.* (As added by C 3, 4 Feb 55) *Packaging Mast Base AB–15/GR.*

ior or intertheater shipments. Fill the voids of shipping containers with pads of single-faced, flexible, corrugated paper to prevent shifting of equipment during transit. Line the shipping container with a waterproof case liner. Strap the shipping container with flat steel strapping for intertheater shipments only. The size, weight, and volume for each box are listed in the chart below:

| Box No. | Size (inside dimensions) (in.) | Quantity of lumber (bd ft) | Volume (cu ft) | Packed weight (lb) |
|---|---|---|---|---|
| 1/4 | 20⅜ x 18⅜ x 10____ | 15 | 3.1 | 97 |
| 2/4 | 22 x 18¼ x 9_____ | 15 | 3.0 | 91 |
| 3/4 | 43¼ x 16¾ x 11¾__ | 27 | 6.4 | 146 |
| 4/4 | 34½ x 14½ x 5¾___ | 13 | 2.5 | 98 |

*e. Marking.* Each box is identified by a device such as 1/4, 2/4, 3/4, and 4/4. The first digit represents the box number, the second the total number of boxes in the shipment. For example, box number 2/4 means that this is box number two in a shipment of four. Further information on marking can be obtained by referring to the appropriate regulation or manual.

*Page 216*, figure 109. Add the following note:

3. ON EQUIPMENTS MODIFIED BY MWO SIG 11-284-2, THE SLATE-COLORED LEAD CONNECTED TO TERMINAL NO. 8 ON TERMINAL BOARD E-6 IS DISCONNECTED AND RECONNECTED TO TERMINAL NO. 13 ON E-6.

Figure 118 (facing page 222). Note 6 as added by C 3, 4 February 1955 (superseded):

NOTE. 6: SOME MODELS DO NOT HAVE CAPACITOR C4.

*Page 190*, Appendix II was rescinded by C 2, 22 March 1954.

[AG 413.44 (31 Jan 58)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

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| | | |
|---|---|---|
| Yuma Test Sta | 6–525 | 17–22 |
| USA Sig Eqp Spt Agcy | 6–535 | 17–25 |
| USA Arty & Msl Cen | 6–536 | 17–26 |
| JBUSMC | 6–537 | 17–27 |
| Units org under fol TOE: | 6–545 | 17–32 |
| 5–15 | 6–558 | 17–35 |
| 5–16 | 6–575 | 17–36 |
| 5–215 | 6–576 | 17–37 |
| 5–217 | 7–1 | 17–45 |
| 5–218 | 7–2 | 17–46 |
| 5–225 | 7–11 | 17–51 |
| 5–226 | 7–12 | 17–52 |
| 5–315 | 7–14 | 17–53 |
| 5–316 | 7–15 | 17–55 |
| 6–100 | 7–16 | 17–56 |
| 6–125 | 7–25 | 17–57 |
| 6–126 | 7–26 | 17–62 |
| 6–127 | 7–27 | 17–87 |
| 6–135 | 7–31 | 17–115 |
| 6–136 | 7–32 | 17–116 |
| 6–137 | 7–34 | 17–117 |
| 6–200 | 7–35 | 17–125 |
| 6–225 | 7–36 | 17–126 |
| 6–226 | 7–95 | 17–127 |
| 6–227 | 7–96 | 39–61 |
| 6–235 | 9–65 | 44–35 |
| 6–237 | 9–66 | 44–36 |
| 6–300 | 9–67 | 44–37 |
| 6–315 | 11–7 | 44–75 |
| 6–316 | 11–16 | 44–76 |
| 6–317 | 11–57 | 44–77 |
| 6–325 | 11–127 | 44–275 |
| 6–327 | 11–128 | 44–276 |
| 6–415 | 11–500 (AA–AE) | 44–277 |
| 6–416 | 11–557 | 44–446 |
| 6–417 | 11–587 | 51–2 |
| 6–435 | 11–592 | 52–2 |
| 6–437 | 11–597 | 55–27 |
| 6–447 | 17–1 | 55–57 |
| 6–501 | 17–2 | 57–2 |
| 6–515 | 17–17 | 57–57 |

*NG:* State AG; units—same as Active Army.

*USAR:* None.

For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1958—440509

# RADIO SETS AN/GRC-3, -4, -5, -6, -7, AND -8

TM 11-284
TO 31R2GRC-131
CHANGES No. 7

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D.C., *3 October 1962*

TM 11-284/TO 31R2GRC-131, 13 May 1953, is changed as follows:

*Page 169.* Add chapter 5.1

## CHAPTER 5.1
## FOURTH ECHELON TESTING PROCEDURES FOR CONTROL C-435/GRC

### 160.1 General

*a.* Testing procedures are prepared for use by signal field maintenance shops and signal service organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide to test repaired equipment at third echelon if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 160.7.

*b.* Each test depends on the preceding one for certain operating conditions and, where applicable, for test equipment calibrations. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

### 160.2 Test Equipment and Other Equipment Required

All test equipment and other equipment required to perform the testing procedures given in this chapter are listed in the following charts and are authorized under TA 11-17 (Signal Field Maintenance Shops) and TA 11-100 (11-17) (Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States) or TOE 11-158D (Signal Depot Company) and TA 11-101 (11-158) (Allowances of Signal Corps Expendable Supplies for Signal Depot Company).

*a. Test Equipment.*

| Nomenclature | Federal stock No. | Technical manual |
|---|---|---|
| Signal Generator AN/URM-48. | 6625-545-7954 | TM 11-1257 |
| Power Supply PP-1104A/G. | 6130-542-6385 | TM 11-5126 |

*b. Other Equipment.*

| Nomenclature | Federal stock No. | Technical manual |
|---|---|---|
| Handset H-33(*)/PT[a] (2 rqr). | 5965-163-9947 | N/A |
| Dummy Load, Electrical DA-269/GRC[b]. | 5820-893-0095 | TM 11-6625-408-15. |
| Dummy Load, Electrical DA-270/GRC[a b]. | 5820-893-0094 | TM 11-6625-408-15. |
| Radio Set AN/GRC-3 | 5820-230-0459 | N/A |

[a] Indicates H-33D/PT, H-33E/PT, and H-33F/PT.
[b] Part of Test Facilities Kit, Radio, MK-153/GRC.

### 160.3 Special Requirements

*a.* The operational test utilizes a 24-volt power source. If necessary or desirable, a 12-volt power source may also be used by substituting (in Radio Set AN/GRC-3) Power Supply PP-109/GR for Power Supply PP-112/GR and Power Supply PP-281/GRC for Power Supply PP-282/GRC. Power Supplies PP-281/GRC and PP-282/GRC are plug-in units in AF Amplifier AM-65/GRC. If such a change is made, insure that Power Supply PP-1104A/G output selection terminal links are connected for 14-volt operation.

*b.* The terms Set 1 and Set 2 are used in these tests to distinguish between the two receiver-transmitters included in Radio Set AN/GRC-3.

Set 1 refers to Receiver-Transmitter RT–66/GRC. Set 2 refers to Receiver-Transmitter RT–70/GRC.

*c.* Radio Receiver R–108/GRC (part of Radio Set AN/GRC–3) is not required for the tests.

## 160.4 Modification Work Orders

There were no modification work orders in effect for this equipment as of the date of this change. Any MWO's pertaining to this equipment that may have been published since the date of this change will be listed in DA Pam 310–4 and changes thereto. Nonapplication of MWO's other than those classed URGENT should not be reason for rejection.

## 160.5 Physical Tests and Inspection

*a. Test Equipment and Materials.* None.

*b. Test Connections and Conditions.* Make no connections to Control C–435/GRC during these tests.

*c. Test Procedure.*

| Step No. | Test equipment control settings | Equipment under test control settings | Test procedure | Performance standard |
|---|---|---|---|---|
| | None | Controls may be in any position. | *a.* Check the front panel switches and controls for proper operation. | *a.* All switches and controls should operate smoothly without evidence of binding. |
| | | | *b.* Inspect all connectors, lamps, terminal boards, cover plates, etc. for damage or missing parts. | *b.* Equipment should be complete and undamaged. |
| | | | *c.* Inspect all metal surfaces for condition or finish. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable. | *c.* All metal surfaces intended to be painted should not show bare metal. |
| | | | *d.* Check the equipment for applicable MWO's and note any MWO's not performed. | *d.* See paragraph 160.4. |

## 160.6 Operational Tests

*a. Test Equipment and Materials.*

Radio Set AN/GRC–3

Signal Generator AN/URM–48

Handset H–33(*)/PT (2 required)

Dummy Load, Electrical DA–269/GRC (p/o Test Facilities Kit, Radio MK–153/GRC)

Dummy Load, Electrical DA–270/GRC (p/o Test Facilities Kit, Radio MK–153/GRC)

Power Supply PP–1104A/G

*b. Test Connections and Conditions.* This test assumes that the AN/GRC–3 has been pretuned and that receiver squelch circuits have been adjusted. Insure that Power Supply PP–1104A/G output selection terminal links are connected for 28-volt operation. Connect equipment as shown in figure 90.1.

*c. Test Procedure.*

| Step No. | Test equipment control settings | Equipment under test control settings | Test procedure | Performance standard |
|---|---|---|---|---|
| | | | SET 1. | REC SET 2 lamp on C–435/GRC should remain extinguished. |
| | | | *t.* Release C–435/GRC MANUAL switch to INT and set AUTO switch to OFF. | *t.* None. |
| | | | *u.* Disconnect AN/URM–48 rf output cable and Dummy Antenna DA–69/URM–48 from ANT jack of set 2. Connect DA–270/GRC in its place. | *u.* None. |
| 2 | Same as step 1 | AUTO switch: OFF<br>MANUAL switch: INT | *a.* Depress push-to-talk switch on Handset H–33(*)/PT at C–435/GRC and speak into mouthpiece. | *a.* Voice can be heard on Handset H–33(*)/PT at Control Box C–375/VRC. |
| | | | *b.* Depress push-to-talk switch on Handset H–33(*)/PT at Control Box C–375/VRC and speak into mouthpiece. | *b.* Voice can be heard on Handset H–33(*)/PT at C–435/GRC. |
| | | | *c.* Set and hold C–435/GRC MANUAL switch at SEND SET 1. | *c.* Set 1 transmitter should energize as indicated by meter deflection on DA–270/GRC. |
| | | | *d.* Release C–435/GRC MANUAL switch to INT | *d.* Set 1 transmitter should deenergize (meter indication on DA–270/GRC should fall). |
| | | | *e.* Set and hold C–435/GRC MANUAL switch at SEND SET 2. | *e.* Set 2 transmitter should energize. |
| | | | *f.* Release C–435/GRC MANUAL switch to INT | *f.* Set 2 transmitter should deenergize. |
| | | | *g.* Set C–435/GRC AUTO switch to DUPLEX | *g.* Set 1 transmitter should energize. |
| | | | *h.* Set C–435/GRC AUTO switch to OFF | *h.* Set 1 transmitter should deenergize. |
| | | | *i.* Set MT–297/GR OFF-REMOTE-ON switch to OFF. Remove power from all test equipment and disconnect. | *i.* None. |

Set 1 refers to Receiver-Transmitter RT–66/GRC. Set 2 refers to Receiver-Transmitter RT–70/GRC.

*c.* Radio Receiver R–108/GRC (part of Radio Set AN/GRC–3) is not required for the tests.

## 160.4 Modification Work Orders

There were no modification work orders in effect for this equipment as of the date of this change. Any MWO's pertaining to this equipment that may have been published since the date of this change will be listed in DA Pam 310–4 and changes thereto. Nonapplication of MWO's other than those classed URGENT should not be reason for rejection.

## 160.5 Physical Tests and Inspection

*a. Test Equipment and Materials.* None.

*b. Test Connections and Conditions.* Make no connections to Control C–435/GRC during these tests.

*c. Test Procedure.*

| Step No. | Test equipment control settings | Equipment under test control settings | Test procedure | Performance standard |
|---|---|---|---|---|
| | None | Controls may be in any position. | *a.* Check the front panel switches and controls for proper operation. | *a.* All switches and controls should operate smoothly without evidence of binding. |
| | | | *b.* Inspect all connectors, lamps, terminal boards, cover plates, etc. for damage or missing parts. | *b.* Equipment should be complete and undamaged. |
| | | | *c.* Inspect all metal surfaces for condition or finish. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable. | *c.* All metal surfaces intended to be painted should not show bare metal. |
| | | | *d.* Check the equipment for applicable MWO's and note any MWO's not performed. | *d.* See paragraph 160.4. |

## 160.6 Operational Tests

*a. Test Equipment and Materials.*

Radio Set AN/GRC–3

Signal Generator AN/URM–48

Handset H–33(*)/PT (2 required)

Dummy Load, Electrical DA–269/GRC (p/o Test Facilities Kit, Radio MK–153/GRC)

Dummy Load, Electrical DA–270/GRC (p/o Test Facilities Kit, Radio MK–153/GRC)

Power Supply PP–1104A/G

*b. Test Connections and Conditions.* This test assumes that the AN/GRC–3 has been pretuned and that receiver squelch circuits have been adjusted. Insure that Power Supply PP–1104A/G output selection terminal links are connected for 28-volt operation. Connect equipment as shown in figure 90.1.

*c. Test Procedure.*

| Step No. | Test equipment control settings | Equipment under test control settings | Test procedure | Performance standard |
|---|---|---|---|---|
| 1 | *PP–112/GR*<br>OPERATE: RECEIVE<br>TRANS POWER: LOW<br>*AM–65/GRC*<br>OFF INT–RT–70: RT–70<br>*MT–297/GR*<br>OFF-REMOTE-ON: OFF<br>*AN/URM–48*<br>POWER: ON<br>CORRECTOR: Align white mark on knob with mark on panel.<br>BAND SWITCH: A<br>DEVIATION RANGE: 25<br>OPERATION: B+<br>OFF<br>*PP–1104A/G*<br>INCREASE VOLTAGE: 1<br>Circuit breaker lever: ON | AUTO: OFF<br>MANUAL: INT<br>ADJUST METER TO CENTER: 1 and 2 controls fully counterclockwise. | *a.* Rotate PP–1104A/G INCREASE VOLTAGE control until 24 volts is indicated on dc voltmeter.<br>*b.* Set MT–297/GR OFF-REMOTE-ON switch to ON. Allow equipment to warm up for 5 minutes.<br>*c.* Adjust Signal Generator AN/URM–48 as follows:<br>(1) Adjust RF TUNING control to frequency of set 1.<br>(2) Set OPERATION switch to 1000∼.<br>(3) Adjust DEVIATION LEVEL control for 15-kc deviation as indicated on KILOCYCLES DEVIATION meter (15 on bottom scale).<br>(4) Adjust RF SET TO LINE control until right-hand meter deflects to redline on bottom scale.<br>(5) Rotate RF ATTENUATOR MICROVOLTS until 1,000-cycle tone is heard in Handset H–33(*)/PT.<br>(6) If necessary, readjust RF TUNING and RF SET TO LINE controls for maximum signal.<br>(7) Maintain RF ATTENUATOR MICROVOLTS control at point where 1,000-cycle tone overcomes receiver squelch.<br>*d.* Set and hold C–435/GRC AUTO switch at ADJUST METER. Rotate ADJUST METER TO CENTER 1 control for midscale (redline) deflection of meter.<br>*e.* Release C–435/GRC AUTO switch and set to RETRANS.<br>*f.* Set AN/URM–48 OPERATION switch to B+ OFF.<br>*g.* Set AN/URM–48 OPERATION switch to 1000 ∼.<br>*h.* Set and hold C–435/GRC MANUAL switch at SEND SET 2.<br>*i.* Release C–435/GRC MANUAL switch to INT. Set AUTO switch to OFF.<br>*j.* Disconnect AN/URM–48 rf output cable and Dummy Antenna DA 69/URM–48 from ANT jack of set 1. Connect DA–269/GRC in its place (as shown by dotted line in figure 1).<br>*k.* Disconnect DA–270/GRC from ANT jack of set 2 and connect Dummy Antenna DA–69/URM–48 in its place.<br>*l.* Connect AN/URM–48 rf output cable to Dummy Antenna DA–69/URM–48.<br>*m.* Adjust AN/URM–48 as follows:<br>(1) Set BAND switch to D.<br>(2) Adjust RF TUNING control to frequency of set 2.<br>(3) Repeat *c*(2) through (7) above.<br>*n* Set PP–112/GR OPERATE switch to TRANS & RECEIVE.<br>*o.* Set and hold C–435/GRC AUTO switch at ADJUST METER. Rotate ADJUST METER TO CENTER 2 control for midscale (redline) deflection of meter.<br>*p.* Release C–435/GRC AUTO switch and set to RETRANS.<br>*q.* Set AN/URM–48 OPERATION switch to B+ OFF.<br>*r.* Set AN/URM–48 OPERATION switch to 1000 ∼.<br>*s.* Set and hold C–435/GRC MANUAL switch at SEND SET 1.<br>*t.* Release C–435/GRC MANUAL switch to INT and set AUTO switch to OFF.<br>*u.* Disconnect AN/URM–48 rf output cable and Dummy Antenna DA–69/URM–48 from ANT jack of set 2. Connect DA–270/GRC in its place. | *a.* None.<br>*b.* None.<br>*c.* None.<br>*d.* Set 2 transmitter should energize as indicated by meter deflection on DA–270/GRC. SIGNAL REC SET 1 lamp on C–435/GRC should light.<br>*e.* Same as *d* above.<br>*f.* Set 2 transmitter should deenergize (meter indication on DA–270/GRC should fall to Ø). SIGNAL REC SET 1 lamp on C–435/GRC should extinguish.<br>*g.* Same as *d* above.<br>*h.* Set 2 transmitter should energize. SIGNAL REC SET 1 lamp on C–435/GRC should remain extinguished.<br>*i.* None.<br>*j.* None.<br>*k.* None.<br>*l.* None.<br>*m.* None.<br>*n.* None.<br>*o.* Set 1 transmitter should energize as indicated by meter deflection on DA–269/GRC. SIGNAL REC SET 2 lamp on C–435/GRC should light.<br>*p.* Same as *o* above.<br>*q.* Set 1 transmitter should deenergize (meter indication on DA–269/GRC should fall to Ø). SIGNAL REC SET 2 lamp on C–435/GRC should extinguish.<br>*r.* Same as *o* above.<br>*s.* Set 1 transmitter should energize. SIGNAL REC SET 2 lamp on C–435/GRC should remain extinguished.<br>*t.* None.<br>*u.* None. |
| 2 | Same as step 1 | AUTO switch: OFF<br>MANUAL switch: INT | *a.* Depress push-to-talk switch on Handset H–33(*)/PT at C–435/GRC and speak into mouthpiece.<br>*b.* Depress push-to-talk switch on Handset H–33(*)/PT at Control Box C–375/VRC and speak into mouthpiece.<br>*c.* Set and hold C–435/GRC MANUAL switch at SEND SET 1.<br>*d.* Release C–435/GRC MANUAL switch to INT.<br>*e.* Set and hold C–435/GRC MANUAL switch at SEND SET 2.<br>*f.* Release C–435/GRC MANUAL switch to INT.<br>*g.* Set C–435/GRC AUTO switch to DUPLEX.<br>*h.* Set C–435/GRC AUTO switch to OFF.<br>*i.* Set MT–297/GR OFF-REMOTE-ON switch to OFF. Remove power from all test equipment and disconnect. | *a.* Voice can be heard on Handset H–33(*)/PT at Control Box C–375/VRC.<br>*b.* Voice can be heard on Handset H–33(*)/PT at C–435/GRC.<br>*c.* Set 1 transmitter should energize as indicated by meter deflection on DA–270/GRC.<br>*d.* Set 1 transmitter should deenergize (meter indication on DA–270/GRC should fall).<br>*e.* Set 2 transmitter should energize.<br>*f.* Set 2 transmitter should deenergize.<br>*g.* Set 1 transmitter should energize.<br>*h.* Set 1 transmitter should deenergize.<br>*i.* None. |

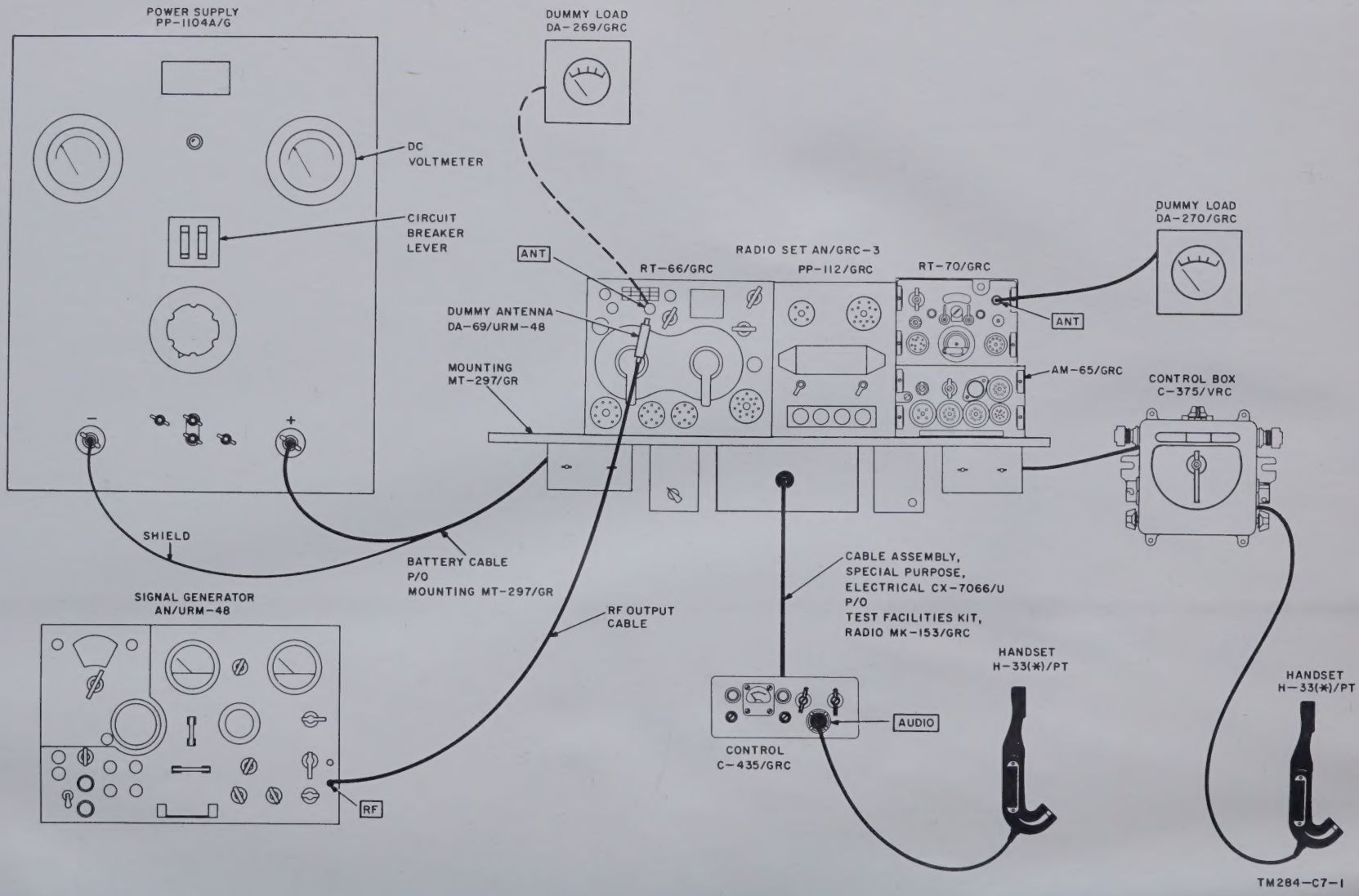



*Figure 90.1 Equipment connections for operational tests.*

## 106.7 Summary of Performance Standards

*a.* With the switches in the following positions, Control C–435/GRC should provide the following:

| Switch positions | Type of operation |
|---|---|
| (1) AUTO: OFF<br>MANUAL: INT | (1) Interphone communication. |
| (2) AUTO: OFF<br>MANUAL: SEND SET 1. | (2) Set 1 transmitter operation.<br>Set 2 receiver operation. |
| (3) AUTO: OFF<br>MANUAL: SEND SET 2. | (3) Set 2 transmitter operation.<br>Set 1 receiver operation. |
| (4) AUTO: DUPLEX<br>MANUAL: INT | (4) Set 1 transmitter operation (continuous).<br>Set 2 receiver operation. |
| (5) AUTO: ADJUST METER.<br>MANUAL: INT | (5) Allows operator to adjust audio level input to set 1 and set 2 for retransmission operation, by adjusting ADJUST METER TO CENTER controls 1 and 2. |
| (6) AUTO: RETRANS<br>MANUAL, INT.<br>MANUAL: INT | (6) Automatic two-way retransmission. |
| (7) AUTO: RETRANS<br>MANUAL: SEND SET 1. | (7) Manual retransmission (set 1 transmitter and set 2 receiver). |
| (8) AUTO RETRANS<br>MANUAL: SEND SET 2. | (8) Manual retransmission (set 2 transmitter and set 1 receiver). |

*b.* Other provisions include—

| Item | Purpose |
|---|---|
| SIGNAL REC SET 1 and SIGNAL REC SET 2 lamps. | Indicate which set is receiving during automatic retransmission operation. |

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USMA (5)
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Atlanta GENDEP (none)
Sig Sec, GENDEP (5)
Sig Dep (12) except
Sacramento Sig Dep (17)
WRAMC (1)
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Army Tml (1)
POE (1)
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USAEPG (2)
AFIP (1)
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EMC (1)
USA Strat Comm Comd (4)
USASSA (25)
USASSAMRO (1)
USARCARIB Sig Agcy (1)
USA Sig Msl Spt Agcy (13)
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USA Corps (3)
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*NG:* State AG (3); units—same as active Army except allowance is one copy each unit.
*USAR:* None.
For explanation of abbreviations used, see AR 320-50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1969/390-935/787

# RADIO SETS AN/GRC–3, –4, –5, –6, –7, AND –8

TM 11–284
TO 31R2–2GRC–131
CHANGES No. 9

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D.C., *9 April 1963*

TM 11–284/TO 31R2–2GRC–131, 13 May 1953, is changed as follows:

*Note.* The parenthetical reference to previous changes (example: "page 1 of C 6") indicates that pertinent material was published in the changes.

*Page 2,* paragraph 3 (page 1 of C 6).

Delete paragraph 3 and substitute.

### 3. Index of Publications

Refer to the latest issue of DA Pam 310–4 to determine whether there are new editions, changes, or additional publications pertaining to your equipment. DA Pam 310–4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (–10, –20, –35P, etc.) and the latest changes to and revisions of each equipment publication.

Add paragraph 3.1 after paragraph 3.

### 31.1. Forms and Records

*a. Reports of Maintenance and Unsatisfactory Equipment.* Use equipment forms and records in accordance with instructions in TM 38–750.

*b. Report of Damaged or Improper Shipment.* Fill out and forward DD Form 6 (Report of Damaged or Improper Ship ment) as prescribed in AR 700–58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71–4 (Air Force).

*c. Comments on Manual.* Forward all comments on this publication direct to: Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N.J. (DA Form 1598 (Record of Comments on Publications), DA Form 2496 (Disposition Form), or letter may be used.)

*Page 83.* Add Chapter 3.1 after chapter 3.

## CHAPTER 3.1

## OPERATOR'S PREVENTIVE MAINTENANCE

### 79.1. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

*a. Systematic Care.* The procedure given in in paragraphs 79.2 through 79.5 cover systematic care essential to proper upkeep and operation of the equipment. The cleaning operations (par. 79.5) should be performed once a day. If the equipment is not used daily, the cleaning operations must be performed before operation after any extended shutdown, or once a week while the equipment is kept in a *standby* condition. The other items must be checked before the equipment is placed into operation after shutdown, during operation, or after the equipment is turned off, as specified in the applicable paragraphs.

*b. Maintenance Service and Inspection.* The Maintenance Service and Inspection Charts (pars. 79.3 and 79.4) outline inspections to be made at specific intervals. The inspections are

made to maintain Army equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceablility, the charts indicate what to inspect, how to inspect, and what the normal conditions are; the *References* column lists the paragraph or figure that contains additional information. If the defect cannot be remedied by the operator, higher echelon repair or maintenance is required. Records and reports of these inspections must be kept in accordance with TM 38–750.

## 79.2. Maintenance Service and Inspection Periods

Maintenance service and inspections of Radio Sets AN/GRC–3 through AN/GRC–8 are required on a daily and weekly basis.

*a.* Paragraph 79.3 specifies services and inspections that must be accomplished daily and under special conditions listed below.

(1) Before a vehicle starts on a mission.

(2) When the equipment is initially installed.

(3) When the equipment is reinstalled after removal for any reason.

(4) At least once a week if the equipment is maintained in standby condition.

*b.* Paragraph 79.4 specifies additional maintenance services and inspections that must be performed once each week. If the equipment is being maintained in a standby condition, the daily (par. 79.3) and weekly (par. 79.4) services and inspections should be accomplished at the same time.

## 79.3. Daily Maintenance Service and Inspection Chart

| Item No. | Procedure | | References |
|---|---|---|---|
| | Item | Normal indication or result | |
| 1 | SET (exterior): Inspect the equipment for— | | |
| | *a.* Completness | *a.* Equipment is complete | *a.* Pars. 6, 20–22, and 39. |
| | *b.* Proper installation | *b.* Installation is in accordance with ch. 2. | *b.* Pars. 25–39. |
| | *c.* Cleanliness | *c.* Units are clean and dry; free of grease, dirt, rust, corrosion, and fungus. | *c.* Par. 79.5. |
| 2 | CONNECTIONS: Check the headset, microphone, all plugs, sockets, connectors, and interconnecting cables, for proper connections. | Plugs and sockets are clean, intact, and not loose-fitting; cables are clean with no breaks or fraying. | Fig. 33. |
| 3 | KNOBS, DIALS, and SWITCHES: Check for proper mechanical action by setting each control to each of its settings. | Action is positive, without backlash, binding, or scraping. | Pars. 47–58. |
| 4 | ANTENNAS: | | |
| | *a.* Inspect antenna Mast Sections MS–116–A, MS–117–A, MS–118–A, AB–22/GR, and AB–24/GR. | *a.* Sections are secure, and not bent or damaged. They are free of cracks, dirt, grease, and fungus. | *a.* Par. 33. |
| | *b.* Inspect both antenna Mast Bases AB–15/GR. | *b.* Both antenna Mast Bases AB–15/GR are tightly secured and have good ground connections. Insulators are free of dirt, dust, grease, and fungus. | *b.* Fig. 30. |
| 5 | OPERATION: Perform the preliminary adjustment and operating instruction procedures. | All equipment operates normally | Pars. 59–75. |

## 79.4. Weekly Maintenance Service and Inspection Chart

| Item No. | Procedure | | References |
|---|---|---|---|
| | Item | Normal indication or result | |
| 8 | SPART PARTS: Check all spare parts for general condition and method of storage. | All spare parts are in good condition and properly stored. There is no evidence of overstock, and all shortages are on valid requisitions. | Pars. 22 and 39. |
| 9 | MOUNTINGS: Inspect seating and condition of mountings. Check for loose or missing hardware. | All bolts, nuts, and washers are present and properly tightened. Mounting MT–297/GR shows no evidence of weakness or deformity. | Par. 30. |
| 11 | FUSES: Check for proper fuses----- | Spares and fuses in use are of the indicated value and located as follows: | |
| | | *a.* Mounting MT–297/GR, under mounting chassis: 1 ea 50-amp (F–1), 1 ea 2-amp (F–2). *Note.* Secure Mounting MT–297/GR after checking its fuses. | *a.* Fig. 26. |
| | | *b.* AF Amplifier AM–65/GRC (interphone amplifier), front panel: 1 ea 5-amp. | *b.* Par. 154*a* and fig. 39. |
| | | *c.* Power Supply PP–109/GR, front panel: 2 ea 10-amp, 2 ea 5-amp. Power Supply PP–112/GR, front panel: 3 ea 5-amp, 1 ea 3-amp. | *c.* Pars 11 and 156*a*. |
| | | *d.* Auxiliary receivers, front panel: 1 ea 4-amp. | *d.* Pars. 14, 158*a*, and fig. 43. |

## 79.5. Cleaning

Inspect the exteriors of the receiver, transmitter, and remote units. The exterior surfaces should be clean and free of dust, dirt, grease, and fungus.

*a.* Remove dust and loose dirt with a clean soft cloth.

***Warning:*** **Cleaning Compound (Federal stock No. 7930–395–9542) is flammable and its fumes are toxic. Provide adequate ventilation.** ***NEVER*** **use near flame!**

*b.* Remove grease, fungus, and ground-in-dirt with a cloth dampened (not wet) with cleaning compound.

*c.* Remove dust and dirt from all plugs and jacks with a clean brush.

***Caution:*** **Do not press on glass meter faces when cleaning them or meters may become damaged.**

*d.* Clean the front panels, meters, and control knobs with a clean soft cloth. If dirt is difficult to remove, dampen the cloth in mild soap and water for more effective cleaning.

*Page 125,* section I (page 4 of C 6).
Delete section I and substitute.

## Section I. PREVENTIVE MAINTENANCE

### 131. Preventive Maintenance

*a.* Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all echelons concerned with the equipment and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance service and inspections of Radio Sets AN/GRC–3 through AN/GRC–8 at the second echelon level are made at quarterly intervals unless otherwise directed by the commanding officer. The maintenance services should be scheduled concurrently with the periodic service schedule of the carrying vehicle for all vehicular installations.

*b.* Maintenance forms and records to be used for this equipment are specified in TM 38–750. Paragraph 3 contains information concerning submission of additional forms.

*c.* Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to applicable cleaning and refinishing practices specified in TM 9–2851.

*d.* The tools and test equipment required for second echelon maintenance are listed below.

(1) Multimeter TS–297/U.
(2) Electron Tube Test Set TV–7/U.
(3) Adapter Kit MX–949/U.
(4) Tool Equipment TE–41.

## 132. Quarterly Maintenance

Quarterly maintenance on Radio Sets AN/GRC–3 through AN/GRC–8 will be scheduled in accordance with the requirements in TM 38–750. If the equipment is part of a vehicular installation, the quarterly maintenance should be scheduled concurrently with the periodic service schedule of the carrying vehicle to reduce out-of-service time to a minimum. All deficiencies or shortcomings will be recorded, and those not corrected during the inspection and service will be immediately reported to a higher echelon by use of the forms and procedures specified in TM 38–750. Equipment that has a deficiency that cannot be corrected by second echelon personnel should be deadlined in accordance with TM 38–750. Perform all the services listed in the quarterly maintenance service and inspection chart (par. 133) in the sequence listed. Whenever a *normal condition or result* is not observed, take corrective action in accordance with the paragraph or figure listed under *references.*

## 133. Quarterly Maintenance Service and Inspection Chart

| Item No. | Procedure | | References |
|---|---|---|---|
| | Item | Normal indication or result | |
| 1 | SET (exterior): Inspect the equipfor— | | |
| | *a.* Completeness | *a.* Equipment is complete | *a.* Pars. 6, 20–22, and 39. |
| | *b.* Proper installation | *b.* Equipment is properly installed | *b.* Pars. 25–39. |
| | *c.* Cleanliness | *c.* Units must be clean and dry; free of grease, dirt, rust, corrosion, and fungus. | *c.* Par. 79.5. |
| | *d.* Preservation | *d.* Painted surfaces must be free of spots, rust, and corrosion. | *d.* Par. 131c |
| 2 | PUBLICATIONS: Make sure that all pertinent publications are available. | *a.* TM 11–284 is complete, and in good condition. | *a.* None. |
| | | *b.* All current changes to TM 11–284 are on hand. | *b.* DA Pam 310–4. |
| 3 | MODIFICATION WORK ORDERS: Check DA Pam 310–4 to determine if new applicable MWO's have been published. | All URGENT MWO's have been applied to the equipment. All ROUTINE MWO's have been scheduled. | DA Pam 310–4. |
| 4 | CONNECTIONS: Check the headset, microphone, all plugs, sockets, connectors, and interconnecting cables for proper connections. | Plugs and sockets are clean, intact, and not loose-fitting; cables are clean with no breaks or fraying. | Fig. 33. |
| 5 | KNOBS, DIALS, AND SWITCHES: Check for proper mechanical action by setting each control to each of its settings. | Action is positive, without backlash, binding, or scraping. *Note.* Replace setscrews in knobs that require frequent tightening. | Pars. 47–58. |
| 6 | ANTENNAS: | | |
| | *a.* Inspect antenna Mast Sections MS–116–A, MS–117–A, MS–118–A, AB–22/GR, and AB–24/GR. | *a.* Sections are secure, and not bent or damaged. They are free of cracks, dirt, grease, and fungus. | *a.* Par. 33. |

| Item No. | Procedure | | References |
|---|---|---|---|
| | Item | Normal indication or result | |
| | *b.* Inspect both antenna Mast Bases AB–15/GR. | *b.* Both antenna Mast Bases AB–15/GR are tightly secured and have good ground connections. Insulators are free of dirt, dust, grease, and fungus. | *b.* Fig. 30. |
| 7 | OPERATION: Perform the preliminary adjustment and operating instruction procedures. | All equipment operates normally_____ | Pars. 59–75. |
| 8 | SPARE PARTS: Check all spare parts for general condition and method of storage. | All spart parts are in good condition and properly stored. There is no evidence of overstock, and all shortages are on valid requisitions. | Pars. 22 and 39. |
| 9 | MOUNTINGS: Inspect seating and condition of mountings. Check for loose or missing hardware. | All bolts, nuts, and washers are present and properly tightened. Mounting MT–297/GR shows no evidence of weakness or deformity. | Par. 30. |
| 10 | LUBRICATION: Lubricate Mounting MT–297/GR. | Parts requiring lubrication show no signs of overlubrication or underlubrication. | Par. 134. |
| | *Note.* Perform item 11 below before securing Mounting MT–297/GR. | | |
| 11 | FUSES: Check for proper fuses_____ | Spares and fuses in use are of the indicated value and located as follows: | |
| | | *a.* Mounting MT–297/GR, under mounting chassis: 1 ea 50-amp (F–1), 1 ea 2-amp (F–2). *Note.* Secure Mounting MT–297/GR after checking its fuses. | *a.* Fig. 26. |
| | | *b.* .AF Amplifier AM–65/GRC (interphone amplifier), front panel: 1 ea 5-amp, and 1 ea 5-amp spare. | *b.* Par. 154*a* and figs. 39 and 74. |
| | | *c.* Power Supply PP–109/GR, front panel: 2 ea 10-amp, 2 ea 5-amp. Power Supply PP–112/GR, front panel: 3 ea 5-amp, 1 ea 3-amp. | *c.* Fig. 41. |
| | | *d.* Auxiliary receivers, front panel: 1 ea 4-amp. | *d.* Fig. 43. |
| | *Note.* Perform steps 12 through 20 below for each major component in turn. | | |
| 12 | GASKETS: Inspect gaskets of immersionproof cases for breaks, wear, or loose edges. | Gaskets are clean, flexible, and apparently in good condition. | Par. 153. |
| 13 | PLUCKOUT ITEMS: Inspect clamps and seating of pluckout items. | All items are properly seated and clamps are in proper position and correctly tightened. | Pars. 153–159. |
| 14 | INTERIORS OF CHASSIS AND TERMINALS: Inspect interiors of chassis and terminals for dirt, corrosion, and loose contacts. | Interiors of chassis are free of dirt and corrosion. All contacts are tight or properly soldered. | Figs. 22 and 74–88. |
| 15 | ELECTRON TUBES AND SOCKETS: Inspect electron tubes for loose envelopes and cap connectors. Inspect sockets for dust, dirt, cracks, and insufficient socket tension. | Electron tube envelopes and cap connectors are tight. Sockets are free of dust, dirt, and cracks, and have sufficient socket tension. | Figs. 74–86. |
| 16 | RELAYS: Inspect relays for loose mountings and burned, pitted, or corroded contacts. | Relay mountings are tight. Contacts are clean and no evidence of burning, pitting, or corrosion is present. | Figs. 26, 74, 79, 80, and 85. |
| 17 | FIXED CAPACITORS: Inspect fixed capacitors for leaks, bulges, and discoloration. | No evidence of leaks, bulges, or discoloration is present. | Figs. 74–88. |

| Item No. | Procedure | | References |
|---|---|---|---|
| | Item | Normal indication or result | |
| 18 | VARIABLE CAPACITORS: Inspect variable capacitors for dirt, moisture, misalignment of plates, and loose mountings. | Variable capacitors are free of dirt and moisture. Plates are properly aligned and mountings are tight. | Figs. 77, 82–85. |
| 19 | RESISTORS–TERMINAL BOARDS, AND INSULATORS: Inspect resistors, terminal boards, and insulators for cracks, chips, blisters, discoloration, and moisture. | No evidence of cracks, chips, blisters, discoloration, or moisture is present. | Figs. 74–88. |
| 20 | TRANSFORMERS, CHOKES, and POTENTIOMETERS: Inspect transformers, chokes, and potentiometers for proper mounting, overheating, and oil leakage. | Transformers, chokes, and potentiometers are securely mounted. No signs of overheating or oil leakage is present. | Figs. 74–88. |
| 21 | EQUIPMENT PERFORMANCE CHECKS: Perform the equipment performance checks. | All indications given in the *Normal indications* column of the equipment performance checklist are normal. | Par. 137. |

## 134. Lubrication

(figs. 9 and 26)

*a.* The only component that requires lubrication is Mounting MT–297/GR. Graphite or a similar lubricant can be used on all of the parts mentioned below. These five points will be lubricated semiannually (every other quarterly inspection period), or sooner if necessary.

*b.* The following parts on Mounting MT–297/GR are to be lubricated:

(1) Metal rack hinges.
(2) Wingnut fasteners.
(3) Rails on inner part of U-shaper castings.
(4) Locking connector for slide-in control unit.
(5) Locking levers and locking strips.

*Page 189*, appendix I, paragraph 5. Add the following:

| | |
|---|---|
| DA Pam 310–4 | Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders. |
| TM 9–2851 | Painting Instructions for Feld Use. |
| TM 38–750 | The Army Equipment Record System and Procedures. |

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*NG:* State AG (3); units—same as Active Army except allowance is one copy to each unit.

*USAR:* None.

For explanation of abbreviations used, see AR 320–50.

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*TM 11–284 — TO 16–30GRC–3–6*

*This manual supersedes TM 11–284, 29 November 1950, C. 1, 28 December 1950, C. 2, 12 October 1951, and C. 3, 12 February 1952.*

# RADIO SETS AN/GRC-3, -4, -5, -6, -7, AND -8







*United States Government Printing Office*
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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE

WASHINGTON 25, D. C., *13 May 1953*

TM 11-284/TO 16-30GRC-3-6 is published for the information and guidance of all concerned.

[AG 413.44 (22 Apr 53)]

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*NG:* Same as Active Army, except one copy to each unit.

*Army Reserve:* Same as Active Army, except one copy to each Unit. For explanation of distribution formula, see SR 310-90-1.

## WARNING

### HIGH VOLTAGE

is used in the operation
of this equipment.

### DEATH ON CONTACT

may result if operating personnel fail
to observe safety precautions.

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# ARTIFICIAL RESPIRATION

## GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!

2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward;* the chin shouldn't sag, since obstruction of the respiratory passages may occur.

3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.

4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.

5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.

6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.

7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

## BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.

2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A)

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B)

4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders.

Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now repeat the cycle.

5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts of about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.

6. *Changing Position or Operator.*

(*a*) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

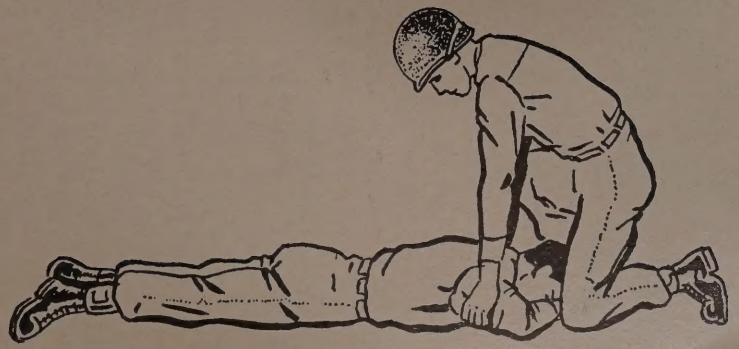
(*b*) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.



**A** Position of operator and victim



**B** Compression phase



**C** Expansion phase (arm lift)



**D** Expansion phase (arm release)

TM AR-4

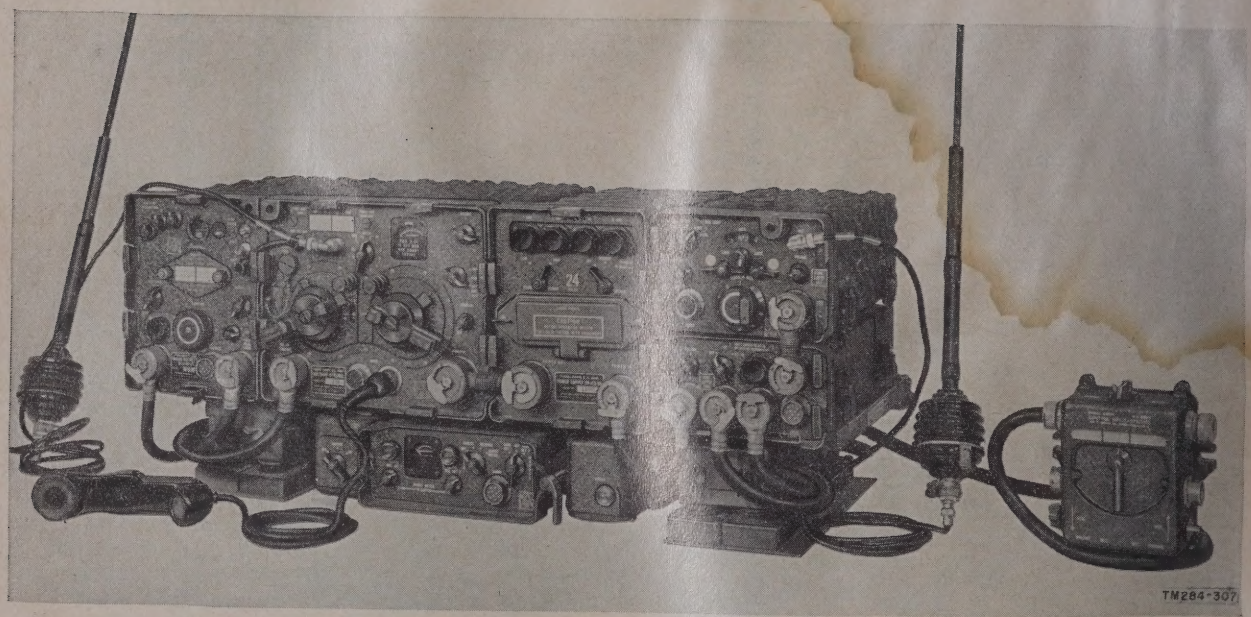



*Figure 1. Radio Set AN/GRC-7 less Control Group AN/GRC-6.*

*This manual supersedes TM 11–284, 29 November 1950, including C. 1, 28 December 1950, C. 2, 12 October 1951, and C. 3, 12 February 1952.*

# CHAPTER 1

# INTRODUCTION

## Section I. GENERAL

### 1. Scope

This manual contains instructions for the installation, operation, and organizational maintenance of Radio Sets AN/GRC–3, –4, –5, –6, –7, and –8. The information is intended primarily for operators and organizational maintenance personnel and, therefore, is restricted to system considerations. Detailed information on the various units that comprise the several systems is presented only to the extent that system applications are involved. Detailed field maintenance instructions for the individual major components are available in separate manuals (app. I). In addition to these instructions, there are three appendixes covering a list of references, an identification table of parts, and related radio sets.

### 2. Nomenclature

The basic similarities of Radio Sets AN/GRC–3, –4, –5, –6, –7, and –8 permit simultaneous treatment of these sets for most cases in this manual. In order to present this simultaneous treatment more efficiently, a collective nomenclature has been devised. This system of nomenclature is explained in *a* through *g* below.

*a.* Radio Sets AN/GRC–3, –4, –5, –6, –7, and –8 are referred to collectively as the *basic radio sets.* Wherever instructions are limited to a particular set, specific reference is made to that set and full nomenclature (for example, Radio Set AN/GRC–3) is used for that set. Differences between the basic radio sets are indicated in paragraph 6, table I.

*b.* The term *system* refers to an installed radio set. Each of the basic radio sets may be installed in a variety of vehicles (par. 8). A different *installation unit* is required for each vehicle. An installation unit consists of items such as audio accessories, cables, junction boxes, and mounting hardware. The combination of a basic radio set and an installation unit in a particular vehicle constitutes a system.

*c.* The terms *Set 1* and *Set 2* are used in this manual to distinguish between the two receiver-transmitters included in each of the radio sets.

(1) Set 1 refers to Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC. The chief difference between these receiver-transmitters is their frequency ranges which are shown on figure 2.

(2) Set 2 refers to Receiver-Transmitter RT–70/GRC which is common to all the radio sets. Its frequency coverage is shown on figure 2.

*d.* The term Set 1 power supply is used to designate Power Supply PP–109/GR or Power Supply PP–112/GR. Either of these power supplies will furnish operating voltages for a Set 1 receiver-transmitter. The vehicular battery voltage available, 12 or 24 volts, determines which power supply must be used. In 12-volt systems, Power Supply PP–109/GR is provided as part of the basic radio set; in 24-volt systems, Power Supply PP–112/GR is provided.

*e.* Power Supply PP–281/GRC or PP–282/GRC is used in AF Amplifier AM–65/GRC (*f*, below). One of these power supplies is also used in the auxiliary receiver (*g*, below). The vehicular battery voltage available again determines which power supply is to be used. In 12-volt systems Power Supply PP–281/GRC must be used; in 24-volt systems, Power Supply PP–282/GRC must be used.

*f.* The term *interphone amplifier* refers to AF Amplifier AM–65/GRC, a common component of the basic radio sets.

*g.* The term *auxiliary receiver* refers to any one of Radio Receivers R–108/GRC, R–109/GRC,

and R–110/GRC which are components of Radio Sets AN/GRC–3, –5, and –7, respectively. These auxiliary receivers differ from each other chiefly in their operating frequency ranges (fig. 2) and in those components of the receivers which determine the frequency range.

*Note.* The only difference between Radio Sets AN/GRC–4, –6, and –8 and Radio Sets AN/GRC–3, –5, and –7, respectively, is that the former do not contain auxiliary receivers.

*h.* To identify the various control units of the radio sets in a functional manner, the following terms are used:

(1) Control Box C–375/VRC is referred to as the *control box.*
(2) Local Control C–434/GRC is referred to as the *local control unit.*
(3) Remote Control C–433/GRC is referred to as the *remote control unit.*
(4) Control C–435/GRC is referred to as the *retransmission unit.*

## 3. Forms and Records

The following forms are to be used for reporting unsatisfactory conditions of Army materiel and equipment.

*a.* DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army) Navy Shipping Guide, Article 1850–4, and AFR 71–4 (Air Force).

*b.* DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

*c.* DA AGO Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

*d.* DA AGO Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

*e.* Use other forms and records as authorized.

# Section II. DESCRIPTION AND DATA

## 4. Purpose of Equipment

*a.* Radio Sets AN/GRC–3, –4, –5, –6, –7, and –8 provide f-m (frequency-modulated) radiotelephone facilities within the frequency range of 20 to 58.4 mc (megacycles). The frequency ranges of each set and of other radio equipment with which the set can communicate are indicated in the frequency spectrum chart (fig. 2). As indicated on the chart, each radio set covers two bands. One band is covered by the Set 1 receiver-transmitter (Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC); the other band is covered by the Set 2 receiver-transmitter (Receiver-Transmitter RT–70/GRC). In Radio Sets AN/GRC–3, –5, and –7, the frequency range of the Set 1 receiver-transmitter is duplicated by the auxiliary receiver (Radio Receiver R–108/GRC, R–109/GRC, or R–110/GRC, respectively).

*b.* The radio sets can be installed and operated in trucks, personnel carriers, tanks, armored utility vehicles, weapons carriers, and other authorized vehicles (par. 8). They are designed primarily for short-range operation within and between armored, artillery, and infantry units. Radio Sets AN/GRC–3, and –4 are intended for armored use; Radio Sets AN/GRC–5 and –6 for artillery use; and Radio Sets AN/GRC–7 and –8 for infantry use. Liaison between divisions is provided by Receiver-Transmitter RT–70/GRC (Set 2) which is common to all of these radio sets and by an overlap in frequency between the Set 1 receiver-transmitters (RT–66/GRC, 67/GRC, and 68/GRC).

## 5. Technical Characteristics

Type of transmission and reception ---------- Voice and 1,600-cycle ringing, f-m signals.

Frequency range ---------- 20 to 58.4 mc in the following bands:

| *Radio set* | *Set 1* | *Set 2* | *Auxiliary receiver* |
|---|---|---|---|
| AN/GRC–3 | 20 to 28 mc. | 47 to 58.4 mc. | 20 to 28 mc. |
| AN/GRC–4 | 20 to 28 mc. | 47 to 58.4 mc. | Not used. |
| AN/GRC–5 | 27 to 39 mc. | 47 to 58.4 mc. | 27 to 39 mc. |
| AN/GRC–6 | 27 to 39 mc. | 47 to 58.4 mc. | Not used. |
| AN/GRC–7 | 38 to 55 mc. | 47 to 58.4 mc. | 38 to 55 mc. |
| AN/GRC–8 | 38 to 55 mc. | 47 to 58.4 mc. | Not used. |

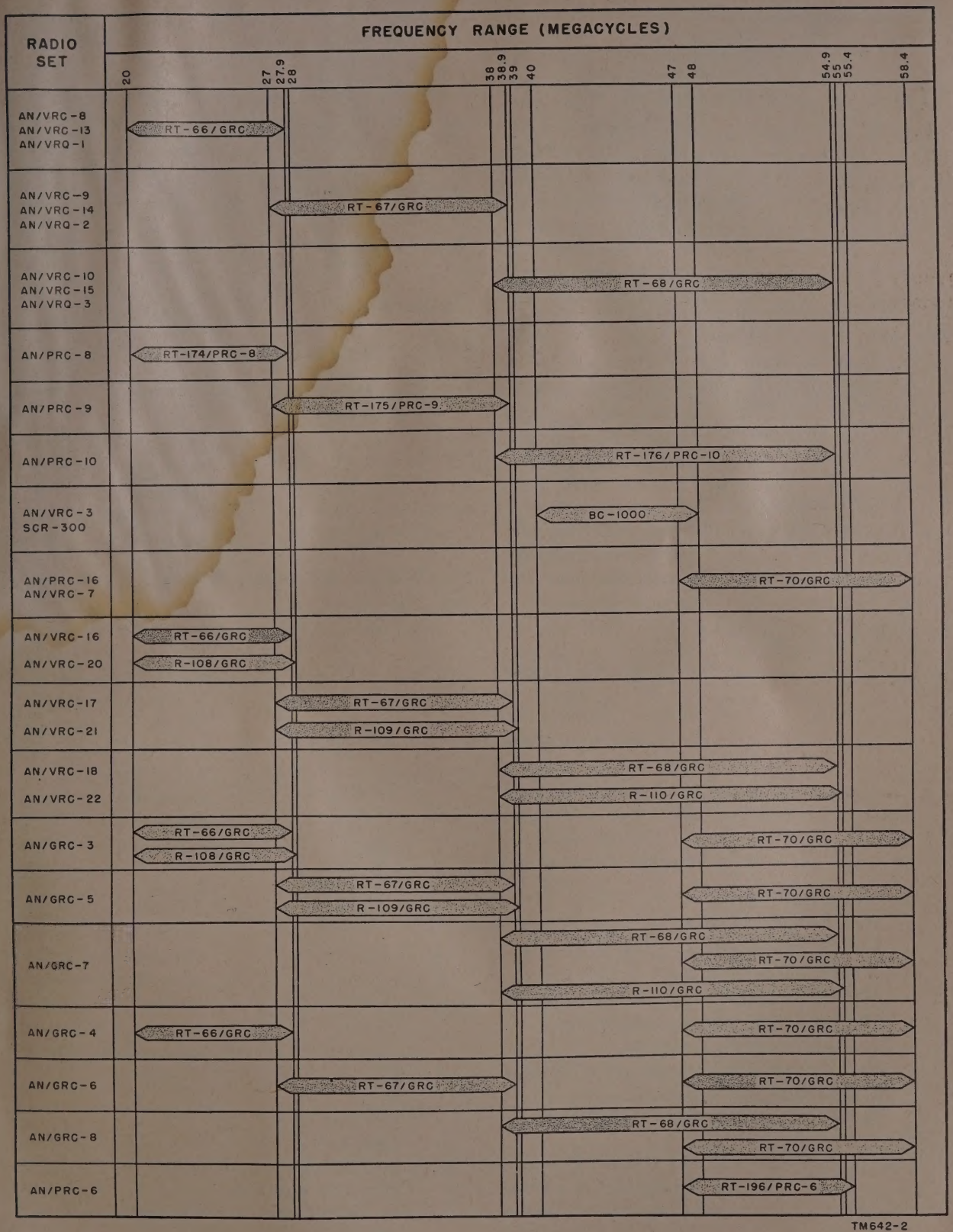



*Figure 2. Frequency spectrum chart.*

Type of tuning:

Set 1 ---------- Choice of detented channels (80, 120, and 170 for Receiver-Transmitters RT-66/GRC, RT-67/GRC, and RT-68/GRC, respectively) at every 100 kc (kilocycles) of the tuning range; detent provisions for presetting any two channels; continuous tuning.

Set 2 ---------- Continuous tuning with detent provisions for preselection of any two frequencies.

Auxiliary receiver ------ Continuous tuning with detent provisions for preselection of any three frequencies.

Communication range -------- Approximately 10 miles on Set 1; approximately 1 mile on Set 2. These distances are approximate, since the range will vary according to frequency, terrain, and atmospheric conditions.

Operating facilities:

Monitoring.
Push-to-talk operation from local or remote control stations.
Interphone communication.
Automatic two-way retransmission.
Full duplex radio operation.
Full duplex telephone operation between local and remote control units.
Local and remote power control.

Total power drain --- From 110 to 280 watts, depending on mode of operation; power drains for individual units as follows:

| Unit | Input voltage | Input amperage | |
|---|---|---|---|
| | | Stand-by | Transmission |
| Set 1 | 12.6 | 2.4 | 11.5 |
| | 25.2 | 1.5 | 7.0 |
| Set 2 + interphone amplifier | 12.6 | 4.1 | 4.3 |
| | 25.2 | 2.6 | 2.5 |
| Interphone amplifier | 12.6 | 2.4 | 3.0 |
| | 25.2 | 1.2 | 1.6 |
| Auxiliary receiver | 12.6 | 2.5 | |
| | 25.2 | 1.5 | |

Transmitter r-f (radio-frequency) power output:

Set 1 ---------- Approximately 16 watts on high power. Approximately 2 watts on low power.

Set 2 ---------- Approximately .5 watt.

Receiver a-f (audio-frequency) power output:

Set 1 ---------- Approximately 1 watt and 50 mw (milliwatts) at speaker and headset output terminals respectively; approximately 20 mw at fixed-level (retransmission) output terminals.

Set 2 ---------- Approximately 75 mw.

Auxiliary receiver ------ Approximately 1 watt and 50 mw at speaker and headset output terminals respectively; approximately 20 mw at fixed-level output terminals.

Interphone a-f power output:

Set 1 + Interphone --- 350 mw.
Set 1 + Set 2 + Interphone --- 1,200 mw.
Set 2 + Interphone --- 350 mw.

Microphone input impedance ------150 ohms.

Audio output impedance ------150 and 600 ohms at the Set 1 + Set 2 + Interphone output of the interphone amplifier; 600 ohms at all other audio output terminals.

Receiver bandwidth:

Set 1 ----------Approximately 80 kc 6 db (decibels) down; 140 kc 30 db down; 200 kc 60 db down.

Set 2 ----------Approximately 80 kc 6 db down; 120 kc 20 db down; not over 180 kc 40 db down.

Auxiliary receiver --Approximately 85 kc 6 db down; not over 120 kc 20 db down.

Receiver sensitivity (½ μv (microvolt) input):

*Signal plus noise-to-noise ratio*

Set 1:
- RT–66/GRC ----- 30 db.
- RT–67/GRC ----- 20 db.
- RT–68/GRC ----- 20 db.

Set 2 ---------- 20 db.

Auxiliary receiver:
- R–108/GRC ----- 25 db.
- R–109/GRC ----- 25 db.
- R–110/GRC ----- 20 db.

## 6. Table of Components

*a.* A composite table of components for all the basic radio sets is shown in Table I. All dimensions and weights are approximate. Although there is only one listing of components for each of the radio sets, the availability of Power Supply PP–109/GR or PP–112/GR and of Power Supply PP–281/GRC or PP–282/GRC indicates that there are two variations of each radio set. Power Supplies PP–109/GR and PP–281/GRC are used with a 12-volt vehicular storage battery; Power Supplies PP–112/GR and PP–282/GRC are used with a 24-volt vehicular storage battery.

*b.* As indicated in paragraph 2, a basic set does not in itself constitute an operating system. For installation and operation in particular vehicles, the additional equipment listed in paragraph 8 is required.

*Table I. Table of Components*

| Component | Radio sets | | | | | | Dimensions of components | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radio Set AN/GRC–3 | Radio Set AN/GRC–4 | Radio Set AN/GRC–5 | Radio Set AN/GRC–6 | Radio Set AN/GRC–7 | Radio Set AN/GRC–8 | Height (in.) | Depth (in.) | Length (in.) | Volume (cu ft) ea | Unit weight (lb) |
| Receiver-Transmitter RT–66/GRC | 1 | 1 | | | | | 9 | 13 | 11¼ | .76 | 38 |
| Receiver-Transmitter RT–67/GRC | | | 1 | 1 | | | 9 | 13 | 11¼ | .76 | 38 |
| Receiver-Transmitter RT–68/GRC | | | | | 1 | 1 | 9 | 13 | 11¼ | .76 | 38 |
| Receiver-Transmitter RT–70/GRC | 1 | 1 | 1 | 1 | 1 | 1 | 4¾ | 13 | 7⅞ | .31 | 17 |
| Radio Receiver R–108/GRC | 1 | | | | | | 9 | 13 | 7¼ | .50 | 28 |
| Radio Receiver R–109/GRC | | | 1 | | | | 9 | 13 | 7¼ | .50 | 28 |
| Radio Receiver R–110/GRC | | | | | 1 | | 9 | 13 | 7¼ | .50 | 28 |
| AF Amplifier AM–65/GRC | 1 | 1 | 1 | 1 | 1 | 1 | 4¼ | 13 | 7⅞ | .30 | 15.5 |
| Power Supply PP–281/GRC or PP–282/GRC | 2 | 1 | 2 | 1 | 2 | 1 | 4½ | 6 | 3 | .05 | 6 |
| Power Supply PP–109/GR or PP–112/GR | 1 | 1 | 1 | 1 | 1 | 1 | 9 | 13 | 7¼ | .70 | 33 |
| Control Box C–375/VRC | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 4 | 7 | .1 | 3 |
| Control Group AN/GRA–6: | | | | | | | | | | | |
| Local Control C–434/GRC | 1 | 1 | 1 | 1 | 1 | 1 | 3½ | 10⅛ | 8¾ | .17 | 10½ |
| Remote Control C–433/GRC | 1 | 1 | 1 | 1 | 1 | 1 | 3½ | 7$\frac{3}{32}$ | 8¼ | .12 | 7 |

*Table I. Table of Components—Continued*

| Component | Radio sets | | | | | | Dimensions of components | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radio Set AN/GRC-3 | Radio Set AN/GRC-4 | Radio Set AN/GRC-5 | Radio Set AN/GRC-6 | Radio Set AN/GRC-7 | Radio Set AN/GRC-8 | Height (in.) | Depth (in.) | Length (in.) | Volume (cu ft) ea | Unit weight (lb) |
| Control Group AN/GRA-6—*Continued.* | | | | | | | | | | | |
| Handset H-33/PT | 1 | 1 | 1 | 1 | 1 | 1 | 2 1/16 | 3 | 7 7/8 | .03 | 1 1/8 |
| Bag CW-189/GR | 1 | 1 | 1 | 1 | 1 | 1 | 11 | 7 3/4 | 10 5/8 | .52 | 2 1/2 |
| Control C-435/GRC | 1 | 1 | 1 | 1 | 1 | 1 | 3 1/2 | 10 1/2 | 8 3/4 | .18 | 8 |
| Mounting MT-297/GR | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 12 | 34 | 1.06 | 58 |
| Adapter UG-273/U | 2 | 2 | 2 | 2 | 2 | 2 | | | | .006 | .36 |
| Adapter UG-306/U | 2 | 2 | 2 | 2 | 2 | 2 | 7/16 (dia.) | 1 | 1 | .006 | .36 |
| Bag CW-206/GR | 1 | 1 | 1 | 1 | 1 | 1 | 3 (thk.) | 5 wd. | 40 | .34 | 3.5 |
| Special Purpose Cable WM-46/U | 1 | 1 | 1 | 1 | 1 | 1 | .6 (dia.) | | 120 | .4 | 9 |
| RF Cable Assembly CG-568/U | 1 | 1 | | | | | | | 50 | .01 | .5 |
| RF Cable Assembly CG-530/U | 1 | 1 | 2 | 2 | 2 | 2 | | | 50 | .01 | .5 |
| Special Purpose Cable Assembly CX-1211/U | 1 | 1 | 1 | 1 | 1 | 1 | | | | .25 | .4 |
| Special Purpose Cable Assembly CX-1213/U | 1 | 1 | 1 | 1 | 1 | 1 | | | | .25 | .4 |
| Case CY-684/GR | 1 | 1 | 1 | 1 | 1 | 1 | | | | .17 | 3 |
| Connector and bondnut, Appleton Electrical Company No. 61007 and BL-50, or equal. | 1 | 1 | 1 | 1 | 1 | 1 | | | | .01 | .5 |
| Mast Section MS-116-A | 2 | 2 | 2 | 2 | | | | | 39.5 | .046 | 1.6 |
| Mast Section MS-117-A | 2 | 2 | 2 | 2 | 2 | 2 | | | 39.5 | .042 | 1.4 |
| Mast Section MS-118-A | 2 | 2 | 2 | 2 | | | | | 39.5 | .016 | .5 |
| Mast Section AB-22/GR | 2 | 2 | 2 | 2 | 2 | 2 | | | 23.5 | .04 | 1.36 |
| Mast Section AB-24/GR | 2 | 2 | 2 | 2 | 4 | 4 | | | 23.5 | .005 | .13 |
| Mast Base AB-15/GR | 2 | 2 | 2 | 2 | 2 | 2 | 15 | 3 1/8 | | .12 | 3.36 |
| Wire W-142 | 1 | | 1 | | 1 | | | | 12 | .001 | .043 |
| Technical Manual TM 11-284 | 2 | 2 | 2 | 2 | 2 | 2 | 8 | 1/2 | 10 | .08 | 1 |
| Total | | | | | | | | | | 9.11 | 322 |

*Note.* This list is for general information only.

## 7. Packaging Data

The basic components of each of the radio sets (par. 6) are packed for shipment in four wooden boxes. The components first are packaged individually in moisture-vaporproof containers, and then distributed in the four wooden boxes. Weights and volumes of the four overall containers are listed in *a* below; the contents of each box are listed in *b*, *c*, and *d*, below.

*Note.* Items may be packaged in a manner different from that shown, depending on the supply channel.

*a. Weight and Volume of Boxes.*

| Box No. | Weight (lb) | Volume (cu ft) |
|---|---|---|
| 1 | 100 | 2 |
| 2 | 90 | 1.70 |
| 3 | 131 | 4.1 |
| 4 | 120 | 2.68 |
| Total | 441 | 10.48 |

*b. Contents of Each Box for Radio Sets AN/GRC–3 and –4.* The components contained within boxes numbered 1 and 4 are used in both Radio Sets AN/GRC–3 and –4. Boxes numbered 2 and 3 also contain components used in Radio Sets AN/GRC–3 and –4 with certain exceptions noted.

| Box No. | Item | Quantity | Notes |
|---|---|---|---|
| 1 | Receiver-Transmitter RT–66/GRC. | 1 ea | PP–109/GR supplied for 12-volt systems; |
| | Power Supply PP–109/GR | | PP–112/GR supplied for 24-volt systems. |
| | or | | |
| | Power Supply PP–112/GR | 1 ea | |
| 2 | Receiver-Transmitter RT–70/GRC. | 1 ea | |
| | Radio Receiver R–108/GRC | 1 ea | R–108/GRC supplied only with AN/GRC–3. |
| | AF Amplifier AM–65/GRC | 1 ea | |
| 3 | Wire W–142 | 1 ft | Wire W–142 supplied only with AN/GRC–3. |
| | Mast Base AB–15/GR | 2 ea | |
| | Mast Section MS–116–A | 2 ea | |
| | Mast Section MS–117–A | 2 ea | |
| | Mast Section MS–118–A | 2 ea | |
| | Mast Section AB–22/GR | 2 ea | |
| | Mast Section AB–24/GR | 2 ea | |
| | Control Group AN/GRA–6 | 1 ea | |
| | Adapter UG–273/U | 2 ea | |
| | Adapter UG–306/U | 2 ea | |
| | Special Purpose Cable Assembly CX–1211/U. | 1 ea | |
| | Special Purpose Cable Assembly CX–1213/U. | 1 ea | |
| | Bag CW–206/GR | 1 ea | |
| | Case CY–684/GR | 1 ea | |
| 3 Con. | Power Supply PP–281/GRC | | PP–281/GRC supplied with 12-volt systems. |
| | or | | |
| | Power Supply PP–282/GRC | 2 ea | PP–282/GRC supplied for 24-volt systems. |
| | Technical Manual TM–11–284. | 2 ea | Only one power supply is used with AN/GRC–4. |
| 4 | Special Purpose Cable WM–46/U. | 10 ft | |
| | Control Box C–375/VRC | 1 ea | |
| | Control C–435/GRC | 1 ea | |
| | Mounting MT–297/GRC | 1 ea | |
| | RF Cable Assembly CG–530/U. | 1 ea | |
| | RF Cable Assembly CG–568/U. | 1 ea | |
| | Connector and bondnut, Appleton Electrical Company No. 61007 and BL–50, or equal. | 1 ea | |

*c. Contents of Each Box for Radio Sets AN/GRC–5 and –6.* The components contained within boxes numbered 1 and 4 are used in both Radio Sets AN/GRC–5 and –6. Boxes numbered 2 and 3 also contain components used in Radio Sets AN/GRC–5 and –6, with certain exceptions noted.

| Box No. | Item | Quantity | Notes |
|---|---|---|---|
| 1 | Receiver-Transmitter RT–67/GRC. | 1 ea | PP–109/GR supplied for 12-volt systems; |
| | Power Supply PP–109/GR | | PP–112/GR supplied for 24-volt systems. |
| | or | | |
| | Power Supply PP–112/GR | 1 ea | |
| 2 | Receiver-Transmitter RT–70/GRC. | 1 ea | |

| Box No. | Item | Quantity | Notes |
|---|---|---|---|
| 2 Con. | Radio Receiver R–109/GRC | 1 ea | R–109/GRC supplied only with AN/GRC–5. |
| | AF Amplifier AM–65/GRC | 1 ea | |
| 3 | Wire W–142 | 1 ft | Wire W–142 supplied only with AN/GRC–5. |
| | Mast Base AB–15/GR | 2 ea | |
| | Mast Section MS–116–A | 2 ea | |
| | Mast Section MS–117–A | 2 ea | |
| | Mast Section MS–118–A | 2 ea | |
| | Mast Section AB–22/GR | 2 ea | |
| | Mast Section AB–24/GR | 2 ea | |
| | Control Group AN/GRA–6 | 1 ea | |
| | Adapter UG–273/U | 2 ea | |
| | Adapter UG–306/U | 2 ea | |
| | Special Purpose Cable Assembly CX–1211/U. | 1 ea | |
| | Special Purpose Cable Assembly CX–1213/U. | 1 ea | |
| | Bag CW–206/GR | 1 ea | |
| | Case CY–684/GR | 1 ea | |
| | Power Supply PP–281/GRC | | PP–281/GRC supplied with 12-volt systems; |
| | or | | |
| | Power Supply PP–282/GRC | 2 ea | PP–282/GRC supplied for 24-volt systems. |
| | Technical Manual TM–11–284. | 2 ea | Only one power supply is used with AN/GRC–6. |
| 4 | Special Purpose Cable WM–46/U. | 10 ft | |
| | Control Box C–375/VRC | 1 ea | |
| | Control C–435/GRC | 1 ea | |
| | Mounting MT–297/GR | 1 ea | |
| 4 Con. | RF Cable Assembly CG–530/U. | 2 ea | |
| | Connector and bondnut, Appleton Electrical Company No. 61007 and BL–50, or equal. | 1 ea | |

*d. Contents of Each Box for Radio Sets AN/GRC–7 and –8.* The components contained within boxes numbered 1 and 4 are used in both Radio Sets AN/GRC–7 and –8. Boxes numbered 2 and 3 also contain components used in Radio Sets AN/GRC–7 and –8, with certain exceptions noted.

| Box No. | Item | Quantity | Notes |
|---|---|---|---|
| 1 | Receiver-Transmitter RT–68/GRC. | 1 ea | PP–109/GR supplied for 12-volt systems; |
| | Power Supply PP–109/GR | | PP–112/GR supplied for 24-volt systems. |
| | or | | |
| | Power Supply PP–112/GR | 1 ea | |
| 2 | Receiver-Transmitter RT–70/GRC. | 1 ea | |
| | Radio Receiver R–110/GRC | 1 ea | R–110/GRC supplied only with AN/GRC–7. |
| | AF Amplifier AM–65/GRC | 1 ea | |
| 3 | Wire W–142 | 1 ft | Wire W–142 supplied only with AN/GRC–7. |
| | Mast Base AB–15/GR | 2 ea | |
| | Mast Sections MS–117–A | 2 ea | |
| | Mast Section AB–22/GR | 2 ea | |
| | Mast Section AB–24/GR | 4 ea | |
| | Control Group AN/GRA–6 | 1 ea | |
| | Adapter UG–273/U | 2 ea | |
| | Adapter UG–306/U | 2 ea | |
| | Special Purpose Cable Assembly CX–1211/U. | 1 ea | |

| Box No. | Item | Quantity | Notes |
|---|---|---|---|
| 3 Con. | Special Purpose Cable Assembly CX–1213/U. | 1 ea | |
| | Bag CW–206/GR | 1 ea | |
| | Case CY–684/GR | 1 ea | |
| | Power Supply PP–281/GRC | | PP–281/GRC supplied with 12-volt systems; |
| | or | | |
| | Power Supply PP–282/GRC | 2 ea | PP–282/GRC supplied for 24-volt systems. |
| | Technical Manual TM–11–284. | 2 ea | Only one power supply is used with AN/GRC–8. |
| 4 | Special Purpose Cable WM–46/U. | 10 ft | |
| | Control Box C–375/VRC | 1 ea | |
| | Control C–435/GRC | 1 ea | |
| | Mounting MT–297/GR | 1 ea | |
| | RF Cable Assembly CG–530/U. | 2 ea | |
| | Connector and bondnut, Appleton Electrical Company No. 61007 and BL–50, or equal. | 1 ea | |

## 8. Additional Equipment Required

*a.* To install and operate the basic radio sets (par. 6), a vehicular installation unit is required. The vehicular storage battery voltage determines whether a 12-volt or a 24-volt basic set is required. The type of vehicle determines which installation unit is supplied (or must be requisitioned), since such items as audio accessories, cables, junction boxes, and mounting hardware vary with the type of vehicle.

*b.* Table II indicates many of the vehicular installation units which can be used with each basic radio set. For example, a basic Radio Set AN/GRC–3 installed in a ¼-ton 4x4 truck, which has a 12-volt storage battery, utilizes installation unit 2S12–3–V26/50. The stock number for the basic radio set (2S12–3/12) indicates that a 12-volt power supply is provided. A complete system (basic set and installation unit) also is designated by a separate stock number; in this example, 2S12–3/V26 is the complete system or equipment stock number.

*c.* The complete contents of the installation units are not listed, but the audio accessories (any of which may be supplied, depending upon the particular vehicular requirements) are described in paragraph 21.

*d.* In addition to the equipment included in the basic units and installation units, the following dry cells are required for Control Group AN/GRA–6 (par. 38).

(1) Four 1½-volt Batteries BA–30.

(2) One 45-volt Battery BA–414/U.

*Table II. Vehicular Installation Units*

| Radio set | Type of vehicle | Stock No. | | |
|---|---|---|---|---|
| | | Complete equipment | Basic unit | Installation unit |
| AN/GRC–3 | Car, Armored, Utility M20 | 2S12–3–V63 | 2S12–3/12 | 2S12–3–V63/50 |
| AN/GRC–3 | Carrier, Cargo, Amphibious, T46E1 | 2S12–3–V129 | 2S12–3/24 | 2S12–3–V129/50 |
| AN/GRC–3 | Carrier Personnel Half-track, M3A1 | 2S12–3–V68 | 2S12–3/12 | 2S12–3–V68/50 |
| AN/GRC–3 | General Purpose (12-volt) | 2S12–3–GP | 2S12–3/12 | 2S12–3–GP/50 |
| AN/GRC–3 | Tank, Flame Thrower, M42 | | 2S12–3/24 | |
| AN/GRC–3 | Vehicle, Armored Infantry, Full-track, T18E1 | 2S12–3–V57 | 2S12–3/24 | 2S12–3–V57/50 |
| AN/GRC–3 | Vehicle, Armored Utility M39 | 2S12–3–V91 | 2S12–3/24 | 2S12–3–V91/50 |
| AN/GRC–3 | Truck, 2½-ton, 6 x 6, Cargo M34, M35 & M36 (24-volt) | 2S12–3–V56 | 2S12–3/24 | 2S12–3–V56/50 |

*Table II. Vehicular Installation Units—Continued*

| Radio set | Type of vehicle | Stock No. | | |
|---|---|---|---|---|
| | | Complete equipment | Basic unit | Installation unit |
| AN/GRC–3 | Landing Vehicle Tracked LVT–4 (Army only) | 2S12–3–V89 | 2S12–3/12 | 2S12–3–V89/50 |
| AN/GRC–3 | Tank Light M24 | 2S12–3–V85 | 2S12–3/24 | 2S12–3–V85/50 |
| AN/GRC–3 | Tank, Medium, M4 Series 105-mm Howitzer and 75-mm Gun Wet. | 2S12–3–V8.3 | 2S12–3/24 | 2S12–3–V8.3/50 |
| AN/GRC–3 | Tank, Medium, M4 Series 76-mm Gun Wet | 2S12–3–V8.2 | 2S12–3/24 | 2S12–3–V8.2/50 |
| AN/GRC–3 | Tank, Medium, M46 or M46A1 | 2S12–3–V98 | 2S12–3/24 | 2S12–3–V98/50 |
| AN/GRC–3 | Tank, 90-mm Gun, M47 | 2S12–3–V110 | 2S12–3/24 | 2S12–3–V110/50 |
| AN/GRC–3 | Tank, 76-mm Gun, T41E1 | 2S12–3–V109 | 2S12–3/24 | 2S12–3–V109/50 |
| AN/GRC–3 | Tank, 120-mm Gun, T43 | 2S12–3–V80 | 2S12–3/24 | 2S12–3–V80/50 |
| AN/GRC–3 | Tank, 90-mm Gun, T48 | | 2S12–3/24 | |
| AN/GRC–3 | Truck, ¼-ton, 4x4 (12-volt) | 2S12–3–V26 | 2S12–3/12 | 2S12–3–V26/50 |
| AN/GRC–3 | Truck, ¼-ton, 4x4, Utility, M38 (24-volt) | 2S12–3–V76 | 2S12–3/24 | 2S12–3–V76/50 |
| AN/GRC–3 | Truck, ¾-ton, 4x4, Cargo, M37 (24-volt) or Truck, ¾-ton, 4x4, Utility, M42 (24-volt). | 2S12–3–V74 | 2S12–3/24 | 2S12–3–V74/50 |
| AN/GRC–3 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–3–V36 | 2S12–3/12 | 2S12–3–V36–1/5 |
| AN/GRC–3 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–3–V36–1 | 2S12–3/12 | 2S12–3–V36–2/50 |
| AN/GRC–4 | Tank, Light M24 | 2S12–4–V85 | 2S12–4/24 | 2S12–3–V85 |
| AN/GRC–4 | Tank, Medium, M4 Series 105-mm Howitzer and 75-mm Gun Wet. | 2S12–4–V8.3 | 2S12–4/24 | 2S12–3–V8.3/50 |
| AN/GRC–4 | Tank, Medium, M4 Series 76-mm Gun Wet | 2S12–4–V8.2 | 2S12–4/24 | 2S12–3–V8.2/50 |
| AN/GRC–4 | Tank, Medium M46 or M46A1 | 2S12–4–V98 | 2S12–4/24 | 2S12–3–V98/50 |
| AN/GRC–4 | Tank, 90-mm Gun, M47 | 2S12–4–V110 | 2S12–4/24 | 2S12–3–V110/50 |
| AN/GRC–4 | Tank, 76-mm Gun, T41E1 | 2S12–4–V109 | 2S12–4/24 | 2S12–3–V109/50 |
| AN/GRC–4 | Tank, 120-mm Gun, T43 | 2S12–4–V80 | 2S12–4/24 | 2S12–3–V80/50 |
| AN/GRC–4 | Tank, 90-mm Gun, T48 | S/N REQ | 2S12–4/24 | S/N REQ–*1 |
| AN/GRC–4 | Truck, ¼-ton, 4x4 (12-volt) | 2S12–4–V26 | 2S12–4/12 | 2S12–3–V26/50 |
| AN/GRC–4 | Truck, ¼-ton, 4x4 Utility, M38 (24-volt) | 2S12–4–V76 | 2S12–4/24 | 2S12–3–V76/50 |
| AN/GRC–4 | Truck, ¾-ton, 4x4, Cargo, M37 (24-volt) or Truck, ¾-ton, 4x4, Utility M42 (24-volt). | 2S12–4–V74 | 2S12–4/24 | 2S12–3–V74/50 |
| AN/GRC–4 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–4–V36 | 2S12–4/12 | 2S12–3–V36/50 |
| AN/GRC–4 | Carrier, Cargo, Amphibious, T46E1 | 2S12–4–V129 | 2S12–4/24 | 2X12–3–V129/50 (See Note 26) |

*Table II. Vehicular Installation Units—Continued*

| Radio set | Type of vehicle | Stock No. | | |
|---|---|---|---|---|
| | | Complete equipment | Basic unit | Installation unit |
| AN/GRC–4 | Carrier, Personnel, Half-track, M3A1 | 2S12–4–V68 | 2S12–4/12 | 2S12–3–V68/50 |
| AN/GRC–4 | Truck, 2½-ton, 6x6, Cargo, M34, M35, M36 (24-volt) | 2S12–4–V56 | 2S12–4/24 | 2S12–3–V56/50 |
| AN/GRC–4 | Vehicle, Armored, Infantry, Full-track, T18E1 | 2S12–4–V57 | 2S12–4/24 | 2S12–3–V57/50 |
| AN/GRC–4 | Vehicle, Armored, Utility, M39 | 2S12–4–V91 | 2S12–4/24 | 2S12–3–V91/50 |
| AN/GRC–4 | Vehicle Tank Recovery, M32 Series | 2S12–4–V79 | 2S12–4/24 | 2S12–3–V79/50 |
| AN/GRC–5 | Car, Armored, Utility M20 | 2S12–5–V63 | 2S12–5/12 | 2S12–3–V63/50 |
| AN/GRC–5 | Carrier, Cargo, Amphibious, T46E1 | 2S12–5–V129 | 2S12–5/24 | 2S12–3–V129/50 (See Note 26) |
| AN/GRC–5 | Carrier, Personnel, Half-track, M3A1 | 2S12–5–V68 | 2S12–5/12 | 2S12–3–V68/50 |
| AN/GRC–5 | General Purpose (12-volt) | 2S12–5–GP | 2S12–5/12 | 2S12–3–GP/50 |
| AN/GRC–5 | Landing Vehicle Tracked, LVT–A–4 (Army only) | 2S12–5–V88 | 2S12–5/12 | 2S12–3–V88/50 |
| AN/GRC–5 | Landing Vehicle Tracked, LVT–A–5 (Army only) | 2S12–5–V113 | 2S12–5/12 | 2S12–3–V113/50 |
| AN/GRC–5 | Tank, Light, M24 | 2S12–5–V85 | 2S12–5/24 | 2S12–3–V85/50 |
| AN/GRC–5 | Tank, Medium M4 Series 105-mm Howitzer and 75 mm Gun Wet. | 2S12–5–V8.3 | 2S12–5/24 | 2S12–3–V8.3/50 |
| AN/GRC–5 | Tank, Medium M4 Series 76 mm Gun Wet | 2S12–5–V8.2 | 2S12–5/24 | 2S12–3–V8.2/50 |
| AN/GRC–5 | Tank, 90-mm Gun, T48 | ---------- | 2S12–5/24 | ---------- |
| AN/GRC–5 | Truck, ¼-ton, 4x4, (12-volt) | 2S12–5–V26 | 2S12–5/12 | 2S12–3–V26/50 |
| AN/GRC–5 | Truck, ¼-ton, 4x4, Utility, M38 (24-volt) | 2S12–5–V76 | 2S12–5/24 | 2S12–3–V76/50 |
| AN/GRC–5 | Truck, ¾-ton, 4x4, Cargo, M37 (24-volt) or Truck, ¾-ton, 4x4 Utility, M42 (24-volt). | 2S12–5–V74 | 2S12–5/24 | 2S12–3–V74/50 |
| AN/GRC–5 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–5–V36 | 2S12–5/12 | 2S12–3–V36/50 |
| AN/GRC–5 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–5–V36–1 | 2S12–5/12 | 2S12–3–V36–2/50 |
| AN/GRC–5 | Truck, 2½-ton 6x6, Cargo, M34, M35, M36 (24-volt) | 2S12–5–V56 | 2S12–5/24 | 2S12–3–V56/50 |
| AN/GRC–5 | Vehicle, Armored, Utility, M39 | 2S12–5–V91 | 2S12–5/24 | 2S12–3–V91/50 |
| AN/GRC–5 | Vehicle, Armored, Infantry, Full-track, T18E1 | 2S12–5–V57 | 2S12–5/24 | 2S12–3–V57/50 |
| AN/GRC–5 | Carriage, Motor, Multiple Gun, M16A1 | ---------- | 2S12–5/12 | ---------- |
| AN/GRC–6 | Truck, ¼-ton, 4x4 (12-volt) | 2S12–6–V26 | 2S12–6/12 | 2S12–3–V26/50 |
| AN/GRC–6 | Truck, ¼-ton, 4x4, Utility, M38 (24-volt) | 2S12–6–V76 | 2S12–6/24 | 2S12–3–V76/50 |
| AN/GRC–6 | Landing Vehicle Tracked, LVT–A–4 | 2S12–6–V88 | 2S12–6/12 | 2S12–3–V88/50 |
| AN/GRC–6 | Truck, ¾-ton, 4x4, Cargo, M37, (24-volt), or Truck, ¾-ton, 4x4 Utility, M42 (24-volt). | 2S12–6–V74 | 2S12–6/24 | 2S12–3–V74/50 |

*Table II. Vehicular Installation Units—Continued*

| Radio set | Type of vehicle | Stock No. | | |
|---|---|---|---|---|
| | | Complete equipment | Basic unit | Installation unit |
| AN/GRC–6 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–6–V36 | 2S12–6/12 | 2S12–V36/50 |
| AN/GRC–6 | Landing Vehicle Tracked LVT–A–5 | 2S12–6–V113 | 2S12–6/12 | 2S12–3–V113/50 |
| AN/GRC–6 | Truck, 2½-ton, 6x6, Cargo, M34, M35, M36 (24-volt) | 2S12–6–V56 | 2S12–6/24 | 2S12–3–V56/50 |
| AN/GRC–6 | Vehicle, Armored, Infantry, Full-track, T18E1 | 2S12–6–V57 | 2S12–6/24 | 2S12–3–V57/50 |
| AN/GRC–6 | Vehicle, Armored, Utility M39 | 2S12–6–V91 | 2S12–6/24 | 2S12–3–V91/50 |
| AN/GRC–6 | Tank, 90-mm Gun, T48 | ---------- | 2S12–6/24 | ---------- |
| AN/GRC–6 | Vehicle, Tank Recovery, M32 Series | 2S12–6–V79 | 2S12–6/24 | 2S12–3–V79/50 |
| AN/GRC–6 | Carrier, Cargo, Amphibious, T46E1 | 2S12–6–V129 | 2S12–7/24 | 2S12–3–V129/50 |
| AN/GRC–7 | Car, Armored, Utility M20 | 2S12–7–V63 | 2S12–7/12 | 2S12–3–V63/50 |
| AN/GRC–7 | Car, Armored, Utility M20 | 2S12–7–V63–1 | 2S12–7/12 | 2S12–3–V63–1/5 |
| AN/GRC–7 | Carrier, Cargo, Amphibious, T46E1 | 2S12–7–V129 | 2S12–7/24 | 2S12–3–V129/50 (See Note 26) |
| AN/GRC–7 | Carrier, Personnel, Half-track, M3A1 | 2S12–7–V68 | 2S12–7/12 | 2S12–3–V68/50 |
| AN/GRC–7 | General Purpose (12-volt) | 2S12–7–GP | 2S12–7/12 | 2S12–3–GP/50 |
| AN/GRC–7 | Landing Vehicle, Tracked LVT–3 (Navy and Marine Corps only). | 2S12–7–V87N | 2S12–7/12 | 2S12–3–V87N/50 |
| AN/GRC–7 | Landing Vehicle, Tracked, LVT–4 (Army only) | 2S12–7–V89 | 2S12–7/12 | 2S12–3–V89/50 |
| AN/GRC–7 | Landing Vehicle, Tracked, LVT–A–4 (Army only) | 2S12–7–V88 | 2S12–7/12 | 2S12–3–V88/50 |
| AN/GRC–7 | Landing Vehicle, Tracked, LVT–A–5 (Army only) | 2S12–7–V113 | 2S12–7/12 | 2S12–3–V113/50 |
| AN/GRC–7 | Tank, Light, M24 | 2S12–7–V85 | 2S12–7/24 | 2S12–3–V85/50 |
| AN/GRC–7 | Tank, Medium, M4 Series 105-mm Howitzer and 75-mm Gun Wet. | 2S12–7–V8.3 | 2S12–7/24 | 2S12–3–V8.3/50 |
| AN/GRC–7 | Tank, Medium, M4 Series, 76-mm Gun Wet | 2S12–7–V8.2 | 2S12–7/24 | 2S12–3–V8.2/50 |
| AN/GRC–7 | Tank, Medium, M46 or M46A1 | 2S12–7–V98 | 2S12–7/24 | 2S12–3–V98/50 |
| AN/GRC–7 | Tank, 120-mm Gun, M47 | 2S12–7–V110 | 2S12–7/24 | 2S12–3–V110/50 |
| AN/GRC–7 | Tank, 90-mm Gun, T48 | ---------- | 2S12–7/24 | ---------- |
| AN/GRC–7 | Tank, 76-mm Gun, T41E1 | 2S12–7–V109 | 2S12–7/24 | 2S12–3–V109/50 |
| AN/GRC–7 | Tank, 120-mm Gun, T43 | 2S12–7–V80 | 2S12–7/24 | 2S12–3–V80/50 |
| AN/GRC–7 | Truck, ¼-ton, 4x4 (12-volt) | 2S12–7–V26 | 2S12–7/12 | 2S12–3–V26/50 |
| AN/GRC–7 | Truck, ¼-ton, 4x4, Utility, M38 (24-volt) | 2S12–7–V76 | 2S12–7/24 | 2S12–3–V76/50 |
| AN/GRC–7 | Truck, ¾-ton, 4x4 Cargo, M37 (24-volt) or Truck, ¾-ton, 4x4 Utility, M42 (24-volt). | 2S12–7–V74 | 2S12–7/24 | 2S12–3–V74/50 |

*Table II. Vehicular Installation Units—Continued*

| Radio set | Type of vehicle | Stock No. | | |
|---|---|---|---|---|
| | | Complete equipment | Basic unit | Installation unit |
| AN/GRC–7 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–7–V36 | 2S12–7/12 | 2S12–3–V36/50 |
| AN/GRC–7 | Truck, ¾-ton, 4x4, Weapons Carrier, (12-volt) | 2S12–7–V36–1 | 2S12–7/12 | 2S12–3–V36–1/5 |
| AN/GRC–7 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–7–V36–2 | 2S12–7/12 | 2S12–3–V36–2/50 |
| AN/GRC–7 | Truck, 2½-ton, 6x6 Cargo M34, M35, M36 (24-volt) | 2S12–7–V56 | 2S12–7/24 | 2S12–3–V56/50 |
| AN/GRC–7 | Vehicle, Armored, Infantry, Full-track, T18E1 | 2S12–7–V57 | 2S12–7/24 | 2S12–3–V57/50 |
| AN/GRC–7 | Vehicle, Armored Utility, M39 | 2S12–7–V91 | 2S12–7/24 | 2S12–3–V91/50 |
| AN/GRC–8 | Tank, Light M24 | 2S12–8–V85 | 2S12–8/24 | 2S12–3–V85/50 |
| AN/GRC–8 | Tank, Medium, M46 or M46A1 | 2S12–8–V98 | 2S12–8/24 | 2S12–3–V98/50 |
| AN/GRC–8 | Tank, Medium, M4 Series 105-mm Howitzer and 75-mm Gun Wet. | 2S12–8–V8.3 | 2S12–8/24 | 2S12–3–V8.3/50 |
| AN/GRC–8 | Tank, 90-mm Gun, M47 | 2S12–8–V110 | 2S12–8/24 | 2S12–3–V110/50 |
| AN/GRC–8 | Tank, Med M4 Series 76-mm Gun Wet | 2S12–8–V8.2 | 2S12–8/24 | 2S12–3–V8.2/50 |
| AN/GRC–8 | Tank, 76-mm Gun, T41E1 | 2S12–8–V109 | 2S12–8/24 | 2S12–3–V109/50 |
| AN/GRC–8 | Tank, 120-mm Gun, T43 | 2S12–8–V80 | 2S12–8/24 | 2S12–3–V80/50 |
| AN/GRC–8 | Tank, 10-mm Gun, T48 | S/N REQ | 2S12–8/24 | S/N REQ–*1 |
| AN/GRC–8 | Truck, ¼-ton, 4x4 (12-volt) | 2S12–8–V26 | 2S12–8/12 | 2S12–3–V26/50 |
| AN/GRC–8 | Truck, ¼-ton, 4x4, Utility M38 (24-volt) | 2S12–8–V76 | 2S12–8/24 | 2S12–3–V76/50 |
| AN/GRC–8 | Truck, ¾-ton, 4x4, Cargo M37 (24-v) or Truck ¾-ton 4x4 Utility M42 (24-volt). | 2S12–8–V74 | 2S12–8/24 | 2S12–3–V74/50 |
| AN/GRC–8 | Truck, ¾-ton, 4x4, Weapons Carrier (12-volt) | 2S12–8–V36 | 2S12–8/12 | 2S12–3–V36/50 |
| AN/GRC–8 | Truck, 2½-ton, 6x6, Cargo, M34, M35, M36 (24-volt) | 2S12–8–V56 | 2S12–8/24 | 2S12–3–V56/50 |
| AN/GRC–8 | Vehicle Armored, Infantry, Full-track, T18E1 | 2S12–8–V57 | 2S12–8/24 | 2S12–3–V57/50 |
| AN/GRC–8 | Carrier, Cargo, Amphibious, T46E1 | 2S12–8–V129 | 2S12–8/24 | 2S12–3–V129/50 (See Note 26) |
| AN/GRC–8 | Carrier, Personnel Half-track, M3A1 | 2S12–8–V68 | 2S12–8/12 | 2S12–3–V68/50 |
| AN/GRC–8 | Landing Vehicle, Tracked, LVT–4 (Army only) | 2S12–8–V89 | 2S12–8/12 | 2S12–V89/50 |
| AN/GRC–8 | Vehicle, Armored, Utility M39 | 2S12–8–V91 | 2S12–8/24 | 2S12–3–V91/50 |
| AN/GRC–8 | Landing Vehicle, Tracked, LVT–A–4 | 2S12–8–V88 | 2S12–8/12 | 2S12–3–V88/50 |
| AN/GRC–8 | Vehicle, Tank Recovery, M32 Series | 2S12–8–V79 | 2S12–8/24 | 2S12–3–V79/50 |
| AN/GRC–8 | Landing Vehicle Tracked, LVT–A–5 | 2S12–8–V113 | 2S12–8/12 | 2S12–3–V113/50 |

## 9. General System Description

*a. Introduction.* All of the basic radio sets have the following items in common:

(1) Two receiver-transmitters, an interphone amplifier, and suitable power supplies.
(2) A mounting.
(3) Four control units.
(4) Suitable antenna systems.
(5) Suitable interconnecting cables.
(6) In addition to the foregoing items in common, three of the radio sets (Radio Sets AN/GRC–3, –5, and –7) have an auxiliary receiver as part of their basic radio set components. The nomenclature outlined in paragraph 2 and information given in the table of components (par. 6) will help in the understanding and adaptation of the following general description to a particular radio set. The system cordage diagram (fig. 33) which is essentially a composite illustration of all sets, also is helpful in understanding the various systems.

*b. Radio Set AN/GRC–8.*

(1) *24-Volt System.* Figure 3 shows the major components of Radio Set AN/GRC–8 interconnected to simulate an operating installation. Receiver-Transmitter RT–68/GRC is used as Set 1; Power Supply PP–112/GR furnishes the operating voltages for Set 1; Receiver-Transmitter RT–70/GRC is Set 2; and AF Amplifier AM–65/GRC is the interphone amplifier. Operating voltages for Set 2 and the amplifier are furnished by a plug-in power-supply unit installed within the amplifier. The installation shown is a 24-volt system which utilizes Power Supply PP–112/GR as the Set 1 power supply and Power Supply PP–282/GRC as the Set 2 power supply. All of the above-mentioned units are secured on Mounting MT–297/GR which normally is bolted to a vehicular mounting surface. The mounting also accommodates one of the control units (either Local Control C–434/GRC (fig. 3.), or Control C–435/GRC (fig. 1)) as a plug-in unit. From the mounting, connections are made to the vehicular battery, to the major units supported on the mounting, and to one or more Control Boxes C–375/VRC. Connection is made from the local control unit to Remote Control C–533/GRC by interconnecting telephone wires. Connections to the antenna systems are made directly from the panels of the Set 1 and Set 2 receiver-transmitters (fig. 33).

(2) *12-Volt System.* In 12-volt systems, Power Supplies PP–109/GR and PP–281/GRC are used instead of Power Supplies PP–112/GR and PP–282/GRC, respectively.

*c. Radio Set AN/GRC–7.* If Radio Receiver R–110/GRC with Power Supply PP–282/GRC or PP–281/GRC is added to Radio Set AN/GRC–8, the installation becomes a 24- or 12-volt Radio Set AN/GRC–3 (fig. 33).

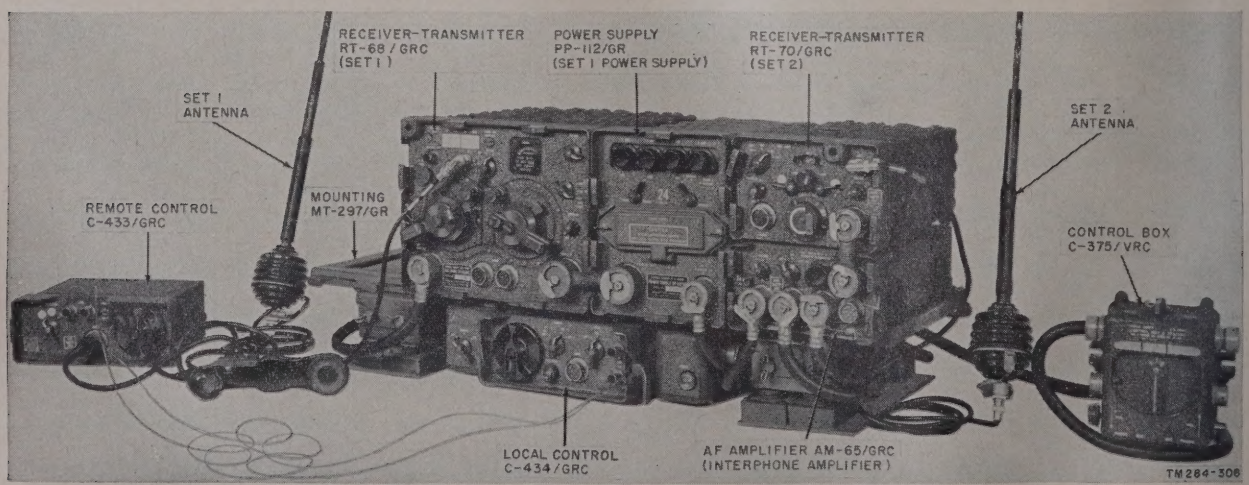



*Figure 3. Radio Set AN/GRC–8 less Control C–435/GRC.*

*d. Radio Sets AN/GRC–4 and –6.* If, in the radio set described in *b*, above, Receiver-Transmitter RT–66/GRC or RT–67/GRC is used as Set 1 and the antenna system for Set 1 is modified as indicated in the table on figure 33, the basic installation becomes Radio Set AN/GRC–4 or AN/GRC–6, respectively.

*e. Radio Sets AN/GRC–3 and –5.* The addition of Radio Receiver R–108/GRC or R–109/GRC to the equipment described in *d* above changes the system to Radio Set AN/GRC–3 or Radio Set AN/GRC–5, respectively. Proper antenna and Set 1 substitutions also must be made (fig. 33).

*f. Summary.* To summarize the similarities and differences among the various radio sets, the following classifications are suggested. Reference to the table of components (par. 6) and to figure 33 will aid in comparative understanding of the systems and in a study of any one particular system.

(1) Radio Sets AN/GRC–3, –5, and –7 are similar except for those components which determine frequency ranges.

(2) Radio Sets AN/GRC–4, –6, and –8 are similar except for those components which determine frequency ranges These sets all differ from Radio Sets AN/GRC–3, –5, and –7 in that they do not contain an auxiliary receiver.

## 10. Set 1 Receiver-Transmitter

*a.* One of Receiver-Transmitters RT–66/GRC, RT–66/GRC, RT–67/GRC, or RT–68/GRC is used as Set 1 in each of the radio sets described in this manual. The particular systems in which each of the receiver-transmitters are employed are indicated in the following chart:

| Radio sets | Set 1 |
|---|---|
| AN/GRC–3 and –4 | Receiver-Transmitter RT–66/GRC |
| AN/GRC–5 and –6 | Receiver-Transmitter RT–67/GRC |
| AN/GRC–7 and –8 | Receiver-Transmitter RT–68/GRC |

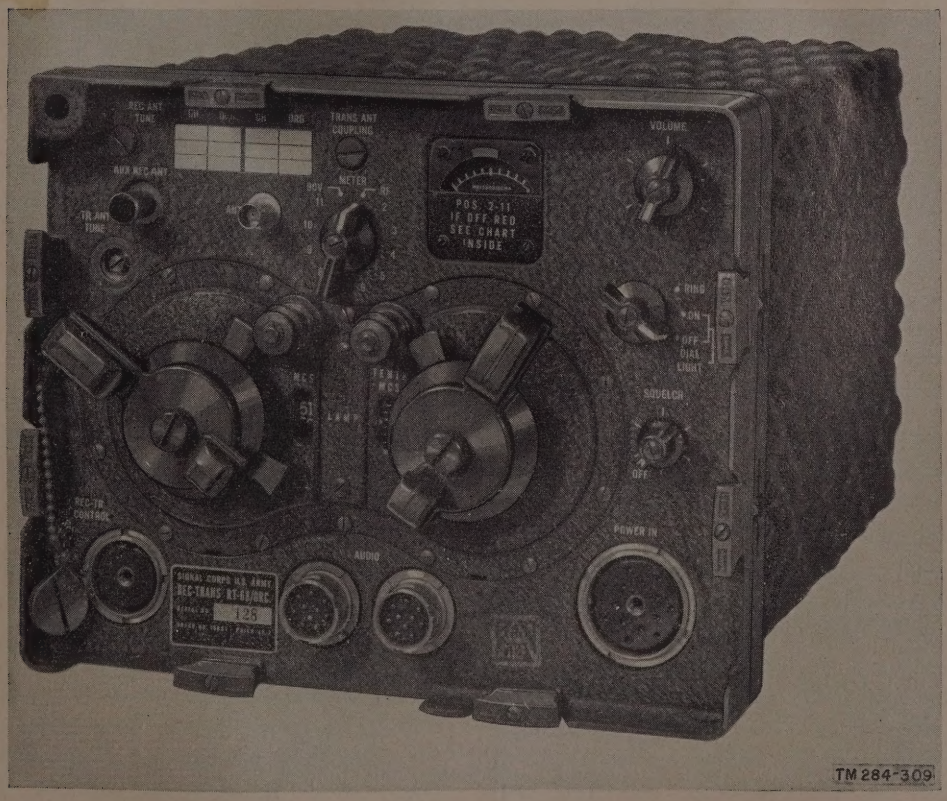



*Figure 4. Receiver-Transmitter RT–68/GRC.*

*b.* All Set 1 receiver-transmitters are very similar in structure, function, detailed circuitry, and mechanical arrangement. They differ from each other only in their operating frequency ranges and in those components which determine the frequency ranges. Receiver-Transmitter RT–68/GRC (fig. 4) is externally similar to the other Set 1 receiver-transmitters except for the calibration of the tuning dial. Characteristics pertinent to system operation are listed in paragraph 5. Detailed information on the receiver-transmitter is contained in TM 11–289.

*c.* Each Set 1 consists of a crystal-controlled, double-conversion type superheterodyne f-m receiver and an f-m transmitter using a common antenna. A built-in 1,600-cycle ringing source is provided to serve as a calling signal. Panel-mounted metering facilities are provided to allow rapid spot checking of filaments, transmitter r-f power, and B+ power. The tuning mechanism of each receiver-transmitter is detented mechanically at every 100 kc of its range to provide the channel selections indicated in the chart at the end of this subparagraph. To allow rapid selection of any two of the detented channels, a preset mechanism (stopping device) is provided (par. 61). Provision also is made to disengage the 100-kc detent mechanism. This permits continuous tuning between preset channels.

| Receiver-Transmitter | Frequency coverage | No. of channels |
|---|---|---|
| RT–66/GRC | 20 to 28 mc | 80 |
| RT–67/GRC | 27 to 39 mc | 120 |
| RT–68/GRC | 38 to 55 mc | 170 |

*d.* Panel-mounted AUDIO receptacle connectors are provided for the use of a chest set (with headset and microphone), a handset, microphone, headset, or loudspeaker.

*e.* Structurally, the receiver-transmitters are panel-chassis assemblies inclosed in a metal case (fig. 4). The bottom of the case is fitted with channel rails which are used to secure the unit to the vehicular mounting. When the case is removed, the r-f and i-f (intermediate-frequency) chassis assemblies are available at either side of the unit (figs. 82, 83, and 84). All tubes are mounted on these vertical chassis.

*f.* In vehicular installations, Set 1 is installed on Mounting MT–297/GR (fig. 3) and is energized by a vehicular power supply such as Power Supply PP–112/GR. Field operation of Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC (ch. 6) is possible through use of a hand generator alone or a hand generator and a battery box.

## 11. Set 1 Power Supply

*a.* Either Power Supply PP–109/GR or PP–112/GR (fig. 5) is used to furnish operating voltages for Set 1, depending on whether the vehicular storage battery supplies 12 or 24 volts. Externally, the two units are similar. Internally, they differ only in the input circuits necessary to adapt the power supply to the particular battery voltage (12 or 24 volts). Detailed information on the power supplies is contained in TM 11–5036.

*b.* The power supplies develop plate, screen, bias, filament, and relay potentials for the receiver-transmitters. The plate, screen, and bias voltages are developed by vibrator-type power-supply circuits. Input battery voltage is supplied through a POWER IN receptacle on the front panel (fig. 5), and all output voltages are available at the POWER OUT receptacle on the front panel. A switching arrangement permits selection of high or low power of Set 1 (par. 5).

*c.* Structurally, the power-supply units are panel-chassis assemblies inclosed in a metal case. Channel rails on the bottom of the case permit it to be secured on Mounting MT–297/GR. When the case is removed (figs. 79, 80, and 81), the replaceable parts on the chassis are accessible.

## 12. Set 2 Receiver-Transmitter

*a.* Set 2 Receiver-Transmitter RT–70/GRC (fig. 6) is a small lightweight radio set, which is included in all the radio sets described in this manual. It is referred to as Set 2 (par. 2). A complete description is given in TM 11–290. Characteristics pertinent to system operation are listed in paragraph 5.

*b.* Set 2 consists of a double-conversion type, superheterodyne f-m receiver and an f-m transmitter linked through a common antenna circuit. Tuning is continuous over a range of 47 to 58.4 mc. A detent mechanism is provided for presetting any two frequencies (par. 62). Built-in calibrating and beat oscillators permit alinement of




*Figure 5. Power Supply PP–112/GR.*

Set 2 without the use of an external signal generator. Both receiver and transmitter are tuned simultaneously by one control.

*c.* Structurally, the Set 2 receiver-transmitter is a panel-chassis assembly contained in a metal case. Mounting feet on the bottom of the receiver-transmitter fit in the recesses on top of AF Amplifier AM–65/GRC. Snap catches are provided on the sides of the Set 2 receiver-transmitter to secure it when placed on top of the amplifier (fig. 3). When the case is removed (figs. 76, 77, and 78) the r-f and i-f chassis are exposed. All tubes are mounted on these vertical chassis.

*d.* In vehicular installations, Set 2 obtains its operating voltages from a plug-in power-supply unit (Power Supply PP–281/GRC or PP–282/GRC) installed within AF Amplifier AM–65/GRC (par. 13). In field applications the receiver-transmitter is powered by dry batteries contained in Case CY–590 (ch. 6).

## 13. AF Amplifier AM–65/GRC

*a.* AF Amplifier AM–65/GRC (fig. 7) is a common component of all the radio sets described in this manual. It is generally referred to as the interphone amplifier, because of its function in the interphone system of the radio sets. It serves

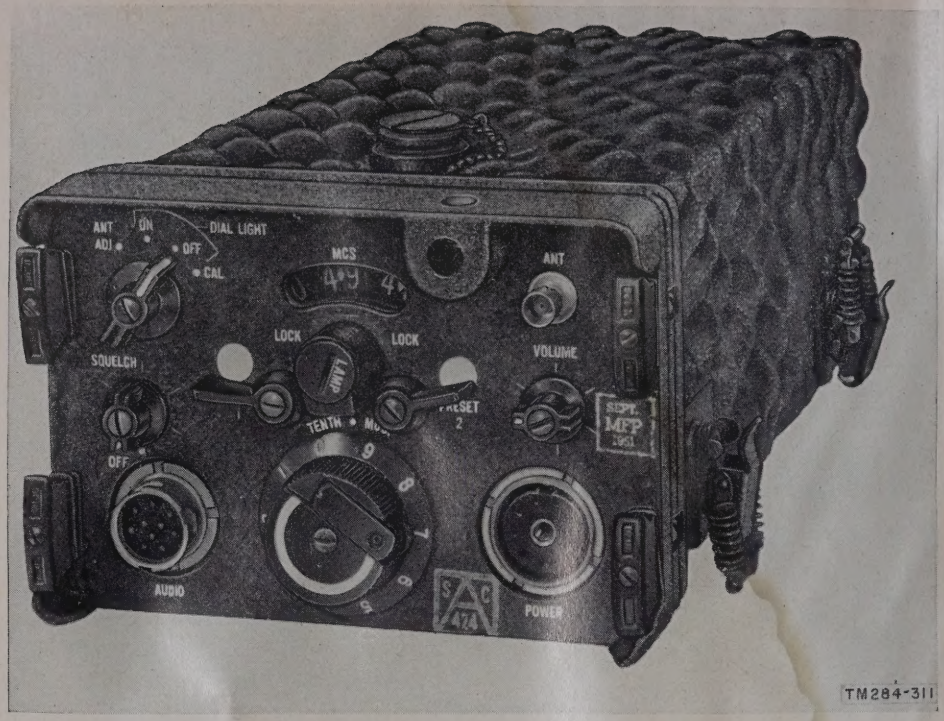



*Figure 6. Receiver-Transmitter RT–70/GRC.*

an additional function as a monitor amplifier for the two receiver-transmitters and the auxiliary receiver. Detailed information on the amplifier is contained in TM 11–5039.

*b.* Electrically, the interphone amplifier is a 3-channel electronic mixer and a-f amplifier. The three channels provide a *Set 1 + Interphone output*, a *Set 1 + Set 2 + Interphone output*, and a *Set 2 + Interphone output*. The nomenclature given above indicates where the signals in each channel originate. The interphone signal predominates on the Set 1 + Set 2 + Interphone channel. The audio output signals from Set 1 and Set 2 are approximately equal to the interphone signal on the other two channels.

*c.* Structurally, the interphone amplifier is a panel-chassis assembly inclosed in a metal case. Channel rails on the bottom of the case permit the unit to be installed on Mounting MT–297/GR. Hooks on the case engage the snap catches of Receiver-Transmitter RT–70/GRC which rests on top of the amplifier in a vehicular installation (fig. 3). When the case is removed (fig. 74), all replaceable parts are accessible.

*d.* A compartment within the amplifier (fig. 74) accommodates a plug-in power-supply unit (Power Supply PP–281/GRC or PPI–282/GRC) for either 12- or 24-volt operation. These units supply operating voltages for both the amplifier and the Set 2 receiver-transmitter. The voltages for Set 2 are made available at the RT–70 POWER receptacle on the front panel.

## 14. Auxiliary Receiver

*a.* Radio Receivers R–108/GRC, R–109/GRC, and R–110/GRC are used as auxiliary receivers in Radio Sets AN/GRC–3, –5, and –7, respectively. The auxiliary receiver is used as an additional monitoring receiver. The receivers are very similar in structure, function, and detailed circuit and mechanical arrangement; they differ only in their operating frequency ranges and in those components which determine the frequency range. Hence, Radio Receiver R–110/GRC (fig. 8) is similar externally to the other receivers except for the calibrations of the tuning dial. Receiver characteristics pertinent to system operation are listed in paragraph 5. Detailed information on the receivers is contained in TM 11–898.

*b.* Each receiver uses a single-conversion type, superheterodyne f-m circuit with continuous tuning over the ranges indicated in the following

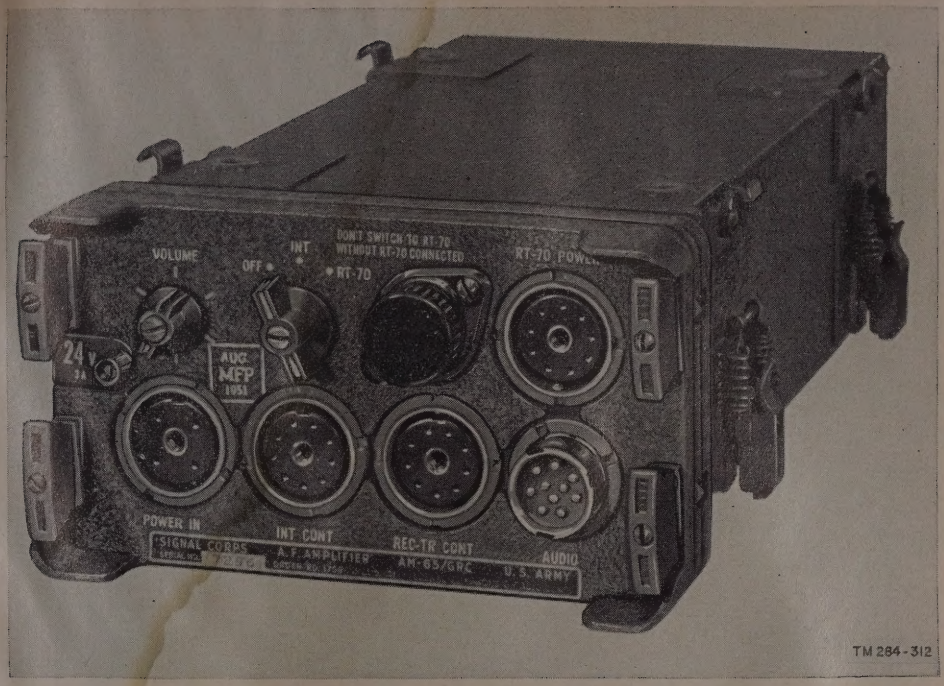



*Figure 7. AF Amplifier AM–65/GRC.*

chart. A built-in crystal-controlled oscillator provides means for calibrating the receiver without the use of external test equipment. A detent mechanism is provided on each receiver for presetting any three frequencies (par. 63). It should be noted that the receivers duplicate the frequency coverage of the Set 1 receiver-transmitters with which they are used.

| Radio receiver | Frequency coverage |
|---|---|
| R–108/GRC | 20 to 28 mc |
| R–109/GRC | 27 to 39 mc |
| R–110/GRC | 38 to 55 mc |

*c.* Structurally, the receivers are panel-chassis assemblies inclosed in a metal case (fig. 8). The bottom of the case is fitted with channel rails which are used to secure the unit to the vehicular mounting. When the case is removed, the replaceable parts on the receiver chassis are made accessible (figs. 85 and 86).

*d.* A compartment on the receiver chassis (fig. 85) accommodates a plug-in power-supply unit (Power Supply PP–281/GRC or Power Supply PP–282/GRC for 12- or 24-volt operation, respectively) which normally furnishes the operating voltages for the receiver.

## 15. Mounting MT–297/GR

*a.* Mounting MT–297/GR (fig. 9) serves as a support for the major units of the radio set and as a junction box for interconnecting the various units.

*b.* At either end of the mounting are two shock-mounted supports which normally are bolted to a vehicular mounting surface. A hinged mounting table is secured to these supports and a junction box is suspended from the under surface of the table near the center of the unit (fig. 9).

*c.* The mounting table is channeled to engage the rails on the bottom of the auxiliary receiver, Set 1 receiver-transmitter, Set 1 power supply, and interphone amplifier. Locking levers are provided on the front edge of the mounting table to secure the units on the table.

*d.* The U-shaped junction box at the center of the unit contains the main line fuses, main power switch, the terminal boards, and electrical circuits which serve to interconnect the units in an operating system. Cables are provided on either side of the junction box to connect the mounting

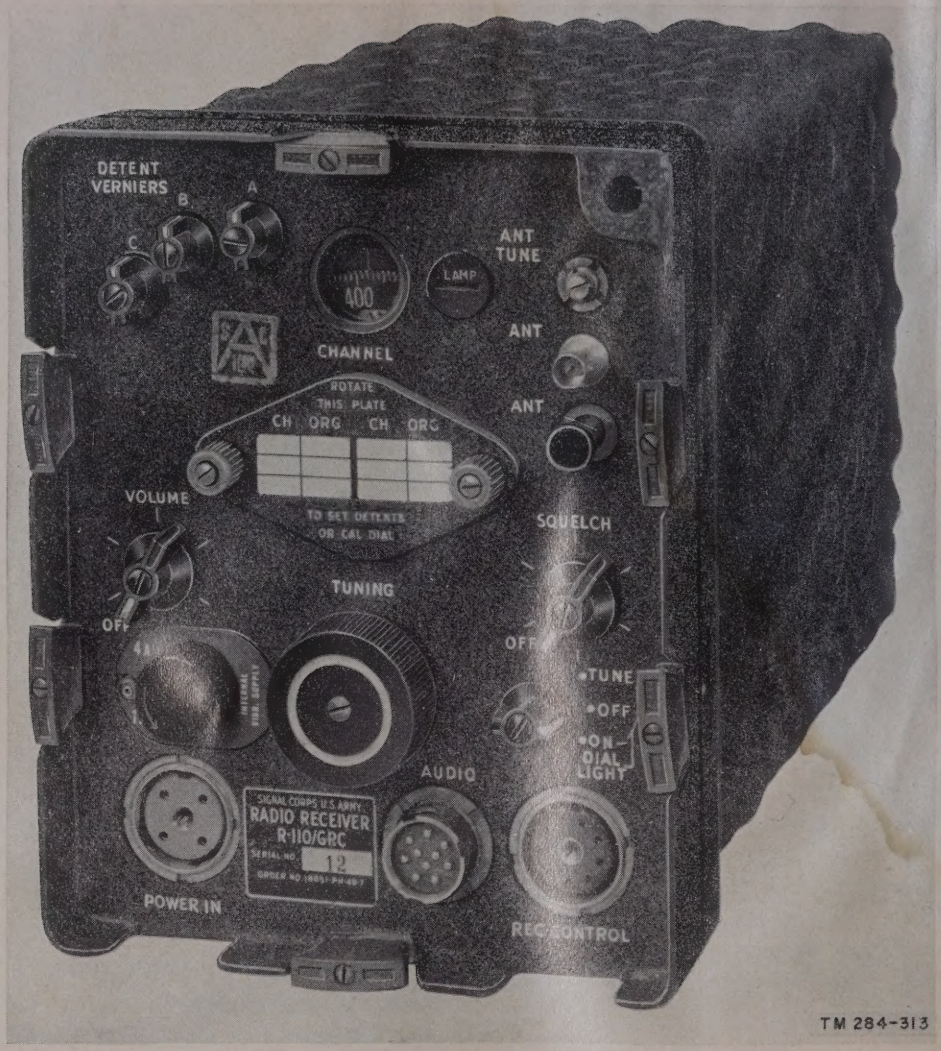



*Figure 8. Radio Receiver R–110/GRC.*

to the vehicular battery and to the major units. The cables which are to join the various units bear approximately the same identifying nomenclature as the panel receptacle to which they should connect. For example, the plug on the end of cable W–3 is designated REC-TR CONTROL, and is intended to connect to the REC-TR CONTROL connector on the Set 1 receiver-transmitter. A receptacle on the rear inner surface of the junction box accommodates a mating connector either on Local Control C–434/GRC or on Control C–435/GRC. This receptacle establishes all electrical connections between the control unit and the rest of the system. A lever on the right side of the junction box locks either control unit in the receptacle to effect a watertight connection.

*e.* Figure 26 shows the mounting table swung back on its hinges and the cover plates removed from the junction box to provide access to the interior of the junction box for installation and maintenance purposes.

## 16. Control Box C–375/VRC

*a.* At least one Control Box C–375/VRC (fig. 10) is used in every installation of the radio sets described in this manual. It is supplied with the basic radio set; additional units are supplied in the vehicular installation kits (par. 8).

*b.* Control Box C–375/VRC is a remote junction point and switching unit for the control and audio lines to Sets 1 and 2, the auxiliary receiver,

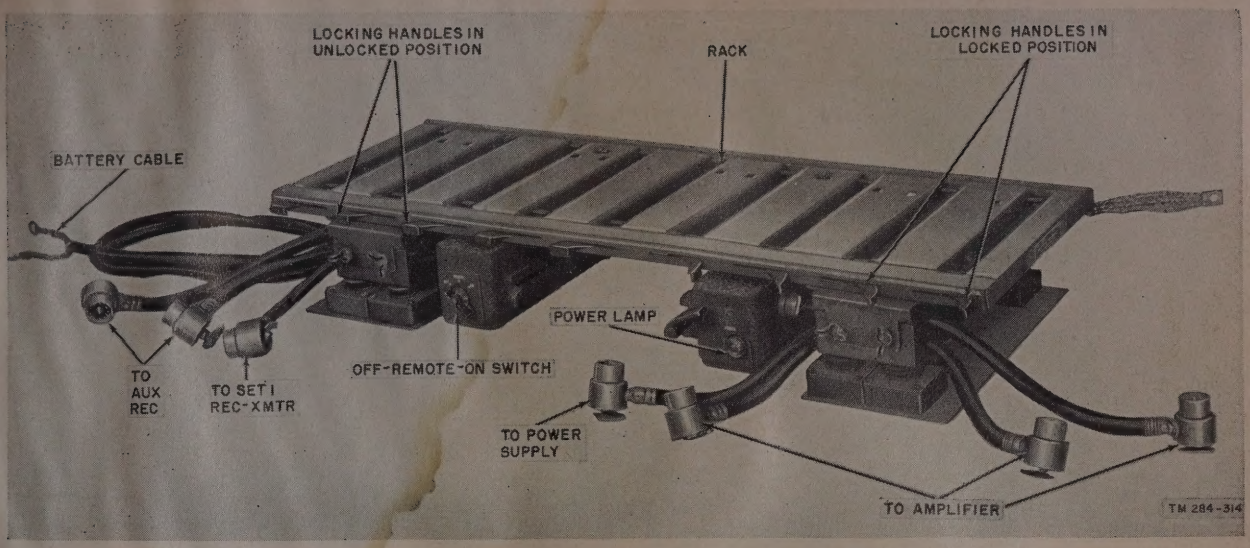



*Figure 9. Mounting MT–297/GR, top view.*

and the interphone amplifier. Switches on the control box connect these lines to the 10-pin audio connectors on either side of the box (fig. 89) and to MIC and PHONE jacks on the bottom of the box. Suitable audio accessories can be connected for monitoring, interphone operation, or push-to-talk control of the radio sets.

*c.* The control boxes usually are installed at some distance from Mounting MT–297/GR (in locations convenient for driver, gunner, commander, or other operator), and are connected to the mounting either directly or through a vehicular junction box by means of Special Purpose Cable WM–46/U. Cable entries are provided at either side of the control box (fig. 89).

## 17. Control C–435/GRC
(fig. 11)

*a.* Control C–435/GRC plugs into Mounting MT–297/GR and extends the operational facilities of the radio sets to include duplex operation and retransmission. It is not essential to the normal push-to-talk operation of the sets from Control Box C–375/VRC. If duplex operation and retransmission facilities are not required, Control C–435/GRC may be removed from the mounting and replaced by Local Control C–434/GRC (par. 18).

*b.* Electrically, Control C–435/GRC is a junction box and switching unit for the control and audio lines of the receiver-transmitters and auxiliary receiver. Both automatic and manual switching facilities are provided. Structurally, the unit is a panel-chassis assembly inclosed in a metal case. When the case is removed (figs. 87 and 88), the chassis is accessible for servicing.

## 18. Control Group AN/GRA–6
(fig. 12)

Control Group AN/GRA–6 is used to provide local or remote monitoring, push-to-talk facilities, and remote control of power for the radio set. Provision for 2-way telephone communication and ringing between the remote and local control operators is provided. The control group includes Local Control C–434/GRC, Remote Control C–433/GRC, and Handset H–33/PT with its cable connector plug and push-to-talk switch. In addition, Bag CW–189/GR is provided as a carrying or storing container. Connection between the local and remote control positions is provided by a pair of telephone wires not supplied as part of this equipment. Complete information on the control group is contained in TM 11–5038.

*a. Local Control C–434/GRC.*

(1) The local control unit is a compact, lightweight panel-and-chassis assembly in an immersionproof case. The outer case is held to the panel by means of two wing type thumbscrews. Channel rails are fitted to the sides of the case to permit plugging the unit into the compartment provided for this purpose on the mounting (in place of Control C–435/GRC).

The connector at the rear of the control unit (fig. 29) plugs into a mating connector on the mounting, establishing a connection between the control unit and the radio set installed on the mounting.

*b. Remote Control C–433/GRC.*

(1) The remote control unit is a compact, lightweight panel-and-chassis assembly in an immersionproof outer case. The case is held to the panel by means of two snap catches. The unit may be carried by a shoulder strap provided for the purpose. Rings on the sides of the panel are provided for engaging the strap.

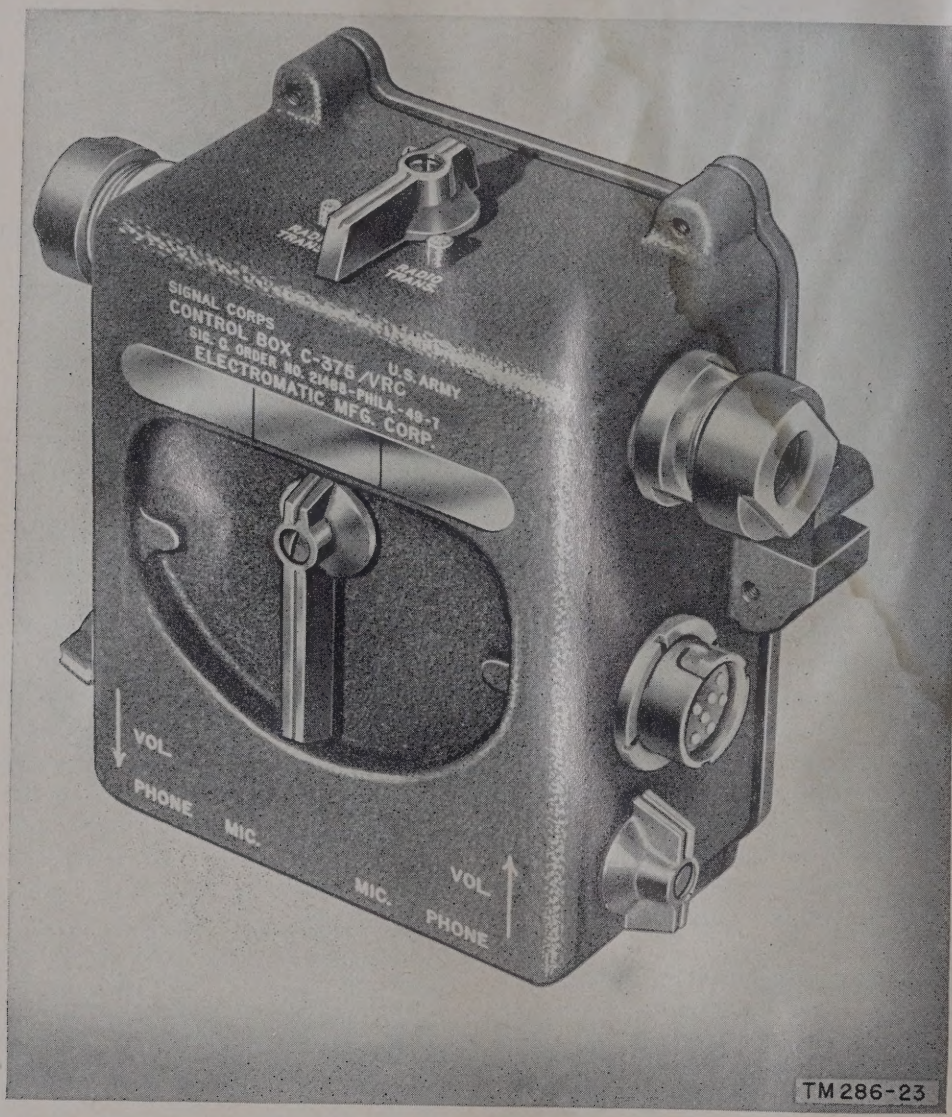



*Figure 10. Control Box C–375/VRC.*

(2) The local control also may be connected directly to the panel of Set 1 and Set 2 by means of plug-terminated cords at the rear of the unit (fig. 34).

(3) In either case, the switching facilities of the unit allow for push-to-talk transmission over either or both sets from a handset or chest set plugged into the AUDIO receptacle on the front panel.

(2) The remote control may be as much as 2 miles distant from the local unit. A telephone line is used to interconnect the two units. The combined switching actions of the two units make it possible to

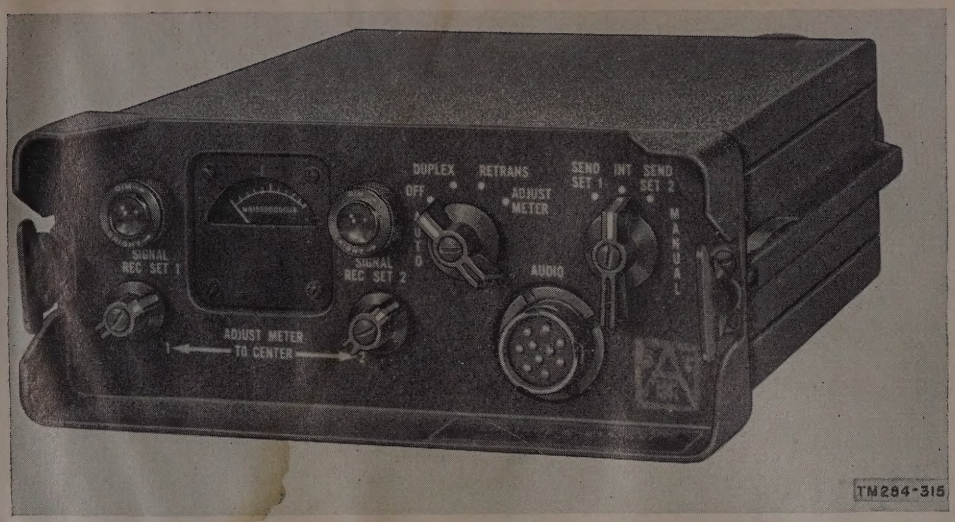



*Figure 11. Control C–435/GRC.*

extend both power control and push-to-talk facilities to the remote unit. The remote unit accommodates a handset or a chest set.

*c. Handset H–33/PT.* The handset includes a 40-ohm carbon-type microphone, a 300-ohm earpiece, a nonlocking push-to-talk switch, and a 5-foot cord terminating on a 10-pin connector. This connector mates with any of the AUDIO connectors on the various units. The push-to-talk switch is a DPST (double-pole, single-throw) switch which closes when the rubber-covered bar on the side of the handset is depressed.

*d. Bag CW–189/GR.* This bag is a dust and waterproof canvas container provided for storing and carrying purposes. It is equipped with a carrying strap. The units may be stored in the bag when not in use or when being transported. In addition, Control C–435/GRC may be stored in the bag if Local Control C–434/GRC is plugged into the mounting.

*e. Miscellaneous.* Provisions for simple tele-




*Figure 12. Control Group AN/GRA–6.*

phone communication (including ringing) also are provided in the control units. This facility makes the control group adaptable for field telephone usage.

## 19. Power Supplies PP–281/GRC and PP–282/GRC

(fig. 13)

*a.* Power Supplies PP–281/GRC and PP–282/GRC are small, light, vibrator-type plug-in units which derive power from 12- or 24-volt vehicular storage batteries, respectively.

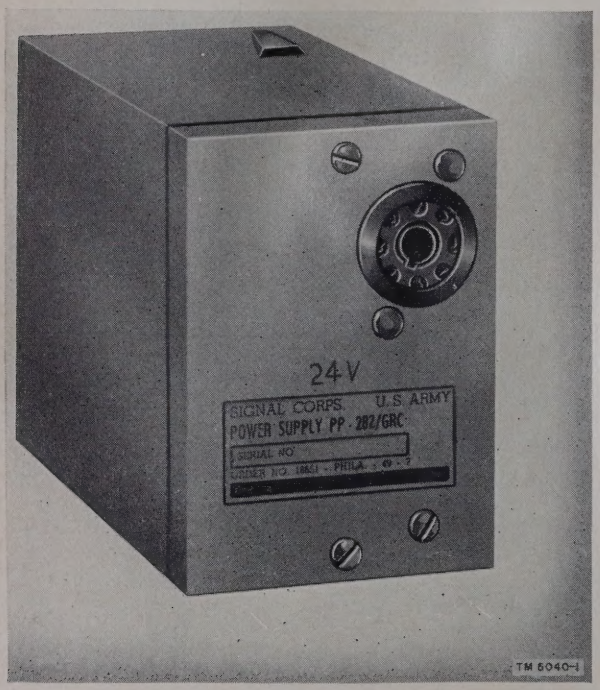



*Figure 13. Power Supply PP–282/GRC.*

*b.* These units are designed for plugging into the power-supply compartments of the interphone amplifier and the auxiliary receiver (figs. 74 and 85). The unit, when plugged into the amplifier, supplies operating voltages for Receiver-Transmitter RT–70/GRC, as well as the amplifier.

## 20. Minor Components

*a. Antenna System.* The vehicular antenna system consists essentially of a quarter-wave whip antenna with antenna mounting base, mounting adapters, and connecting cables. The manner in which these components are used with the different radio sets is shown on figure 33. The following components of the antenna system are illustrated on figure 14:

(1) Mast Base AB–15/GR.
(2) Mast Sections MS–116–A, MS–117–A, and MS–118–A.
(3) Mast Sections AB–22/GR and AB–24/GR.
(4) Adapters UG–273/U and UG–306/U.
(5) RF Cable Assembly CG–568/U.
(6) RF Cable Assembly CG–530/U.

*b. Other Minor Components.* The other minor components of the radio set are illustrated on figure 14 as follows:

(1) Special Purpose Cable Assembly CX–1211/U.
(2) Special Purpose Cable Assembly CX–1213/U.
(3) Wire W–142.
(4) Special Purpose Cable WM–46/U.
(5) Connector and Bondnut, Appleton, Electrical Company No. 61007 and BL–50, or equal.
(6) Case CY–684/GR.
(7) Bag CW–206/GR. This bag is not shown in figure 14. It is the antenna mast section roll.
(8) Bag CW–189/GR.

*Note.* With the exception of the last three items listed, all of the above components are represented functionally on the system cordage diagram (fig. 33).

*c. Minor Component Application.*

(1) In older vehicles, the connector and bondnut are used for feeding the power cable of the radio set (W–8 on fig. 33) to the vehicular power terminal board. The connector is of the feedthrough type and is locked in place by the bondnut. In later vehicles, a 3-prong connector, supplied with the vehicular installation kit, is connected to the end of cable W–8. This connector plugs into a mating receptacle on the vehicular junction box.
(2) Case CY–684/GR is a metal box provided for storage of running spares. Compartments are provided for tubes, lamps, fuses, and other replaceable parts. The case will not accommodate all the running spares that are supplied with the various units (par. 22), but will accommodate some of each type. Refer to

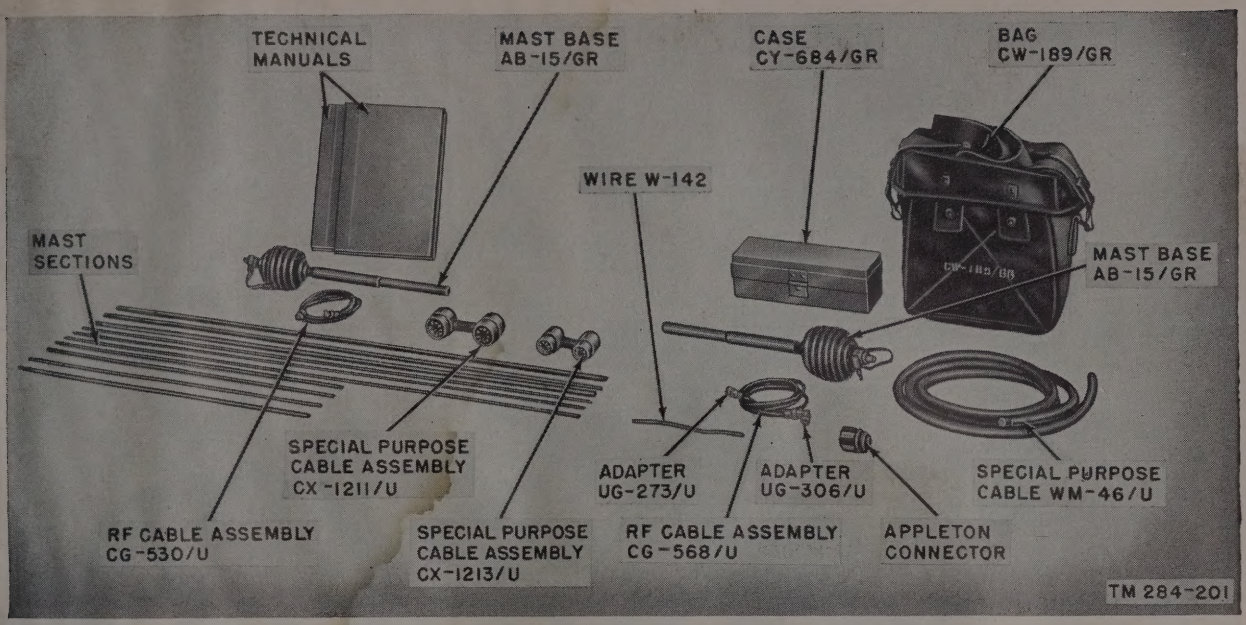



*Figure 14. Minor components of Radio Set AN/GRC–3.*

paragraph 39 for recommendations on the selection of spares to be stored in Case CY–684/GR.

(3) Bag CW–206/GR is provided for storage of spare antenna masts, Case CY–684/GR, audio accessories (not in use), and technical manuals.

## 21. Audio Accessories

*a. Type.* Audio accessories for operating the radio sets are supplied in the installation units and vary in type and number according to the type of vehicular installation. Some or all of the following items may be supplied.

(1) Chest Set Group AN/GSA–6 and Headset-Microphone H–63/U.
(2) Dynamic Loudspeaker LS–166/U.
(3) Handset H–33/PT.
(4) Microphone M–29/U.
(5) Headset, Navy type CW–49507 and Headset Cord CX–1334/U.

*Note.* The audio accessories listed above are the only types which can be connected to the 10-pin audio receptacles on the radio sets. Control Box C–375/VRC is the only unit equipped with jacks, which will accommodate any substitute accessories (*h* below).

*b. Chest Set Group AN/GSA–6.* Chest Set Group AN/GSA–6 (fig. 15), in conjunction with Headset-Microphone H–63/U (*c* below), is the audio accessory most generally used with the radio sets. The chest set group consists of chest-mounting Switchbox SA–142/GSA–6 and a 5-foot cord which terminates in a 8-contact receptacle and a 10-pin audio plug. The receptacle mates with the plug on one end of the switch box, and provides a quick-disconnecting feature for the chest set. The audio plug will mate with any one of the 10-pin AUDIO receptacles on the control units, the receiver-transmitters, the auxiliary receiver, and the interphone amplifier. Two plugs provided on the switch box will mate with the jacks on Headset-Microphone H–63/U. Two push-to-talk buttons are provided on one side of the switch box. A push-button RADIO-INT switch is provided on the other side of the box. The push-to-talk buttons are electrically identical, but one provides a hold-on contact position and the other a lock-on contact position. The lock-on button may be disabled by means of an internal adjustment (fig. 48) when desired. The RADIO-INT switch is a hold-on type switch normally in the INT position. An internal adjustment is provided (fig. 48) to lock the switch in either the RADIO or INT position.

*c. Headset-Microphone H–63/U.* Headset Microphone H–63/U (fig. 16) consists of two series-connected 300-ohm earpieces and a 40-ohm microphone. The microphone is mounted on an adjustable boom attached to the receiver head-

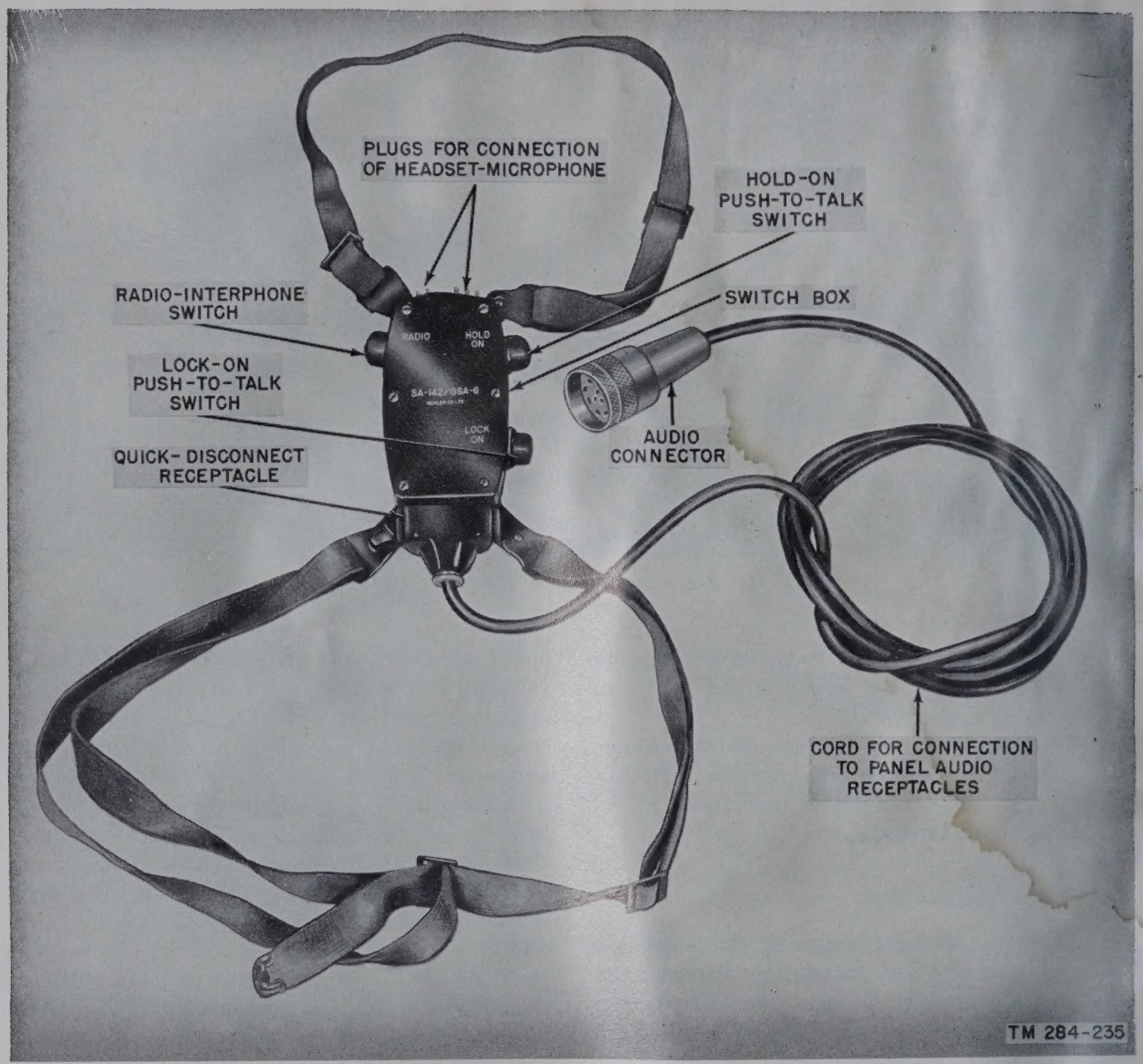



*Figure 15. Chest Set Group AN/GSA–6.*

band. Two 14-inch conductors from the microphone and headset are terminated in 2-pin and 3-pin jacks. These jacks will mate with the plugs on Chest Set Group AN/GSA–6.

*d. Dynamic Loudspeaker LS–166/U.* Dynamic Loudspeaker LS–166/U (fig. 17) is a 4-inch permanent magnet dynamic loudspeaker, with a voice-coil impedance of 8 ohms, and a matching transformer to provide a 600-ohm input impedance. A 5-foot cord, terminating in a 10-pin audio plug, is provided for connecting the speaker to audio receptacles wired for loudspeaker or headset operation. A rotary switch on the side of the speaker may be used to switch the units from speaker to headset output. The speaker and headset output positions are designated VEHICULAR SET and FIELD OR PACK SET, respectively. A universal-type clamp is provided on the speaker case for mounting purposes.

*e. Handset H–33/PT.* In addition to Handset H–33/PT (par. 18*c*) supplied with Control Group AN/GRA–6, another handset is provided with the basic radio set.

*f. Microphone M–29/U.* Microphone M–29/U (fig. 19) consists of a 100-ohm carbon-microphone element in a plastic case with a push-to-talk

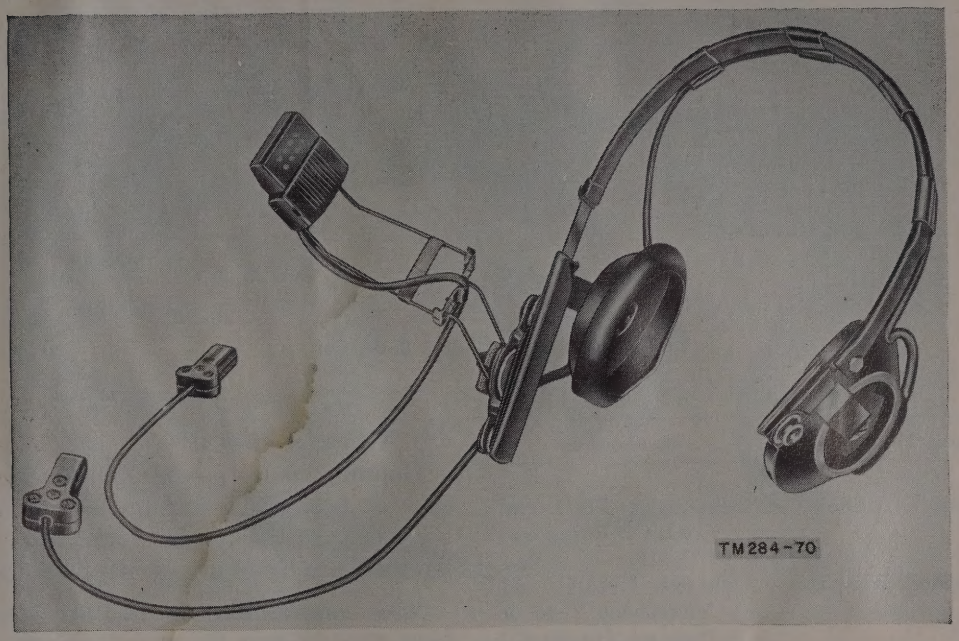



*Figure 16. Headset-Microphone H–63/U.*

switch and connecting cord attached. The push-to-talk control is a nonlocking DPST switch. The connecting cord is 5 feet long, and terminates in a 10-pin audio connector. This connector will mate with the AUDIO receptacles on the two receiver-transmitters, the interphone amplifier, and the control units.

*g. Headset Navy Type CW–49507 and Headset Cord CX–1334/U.* Headset Navy Type CW–49507 (fig. 20) consists of two series-connected 300-ohm receivers. A 14-inch cord is connected to the receivers and is terminated in Plug PL-54. The plug will mate with Jack JK–26 on one end of Headset Cord CX–1334/U. Headset Cord CX–1334/U is 5 feet long. It is terminated in a 10-pin audio connector which is used to connect the headset to the audio connectors on the two receiver-transmitters, the auxiliary receiver, the interphone amplifier, and the control units.

*h. Substitute Accessories.* The substitute accessories listed in the following chart are to be used only when the standard audio accessories described above are not available. Performance will be inefficient, however, because of impedance mismatches. These substitute audio accessories can be plugged in only at Control Box C–375/VRC.

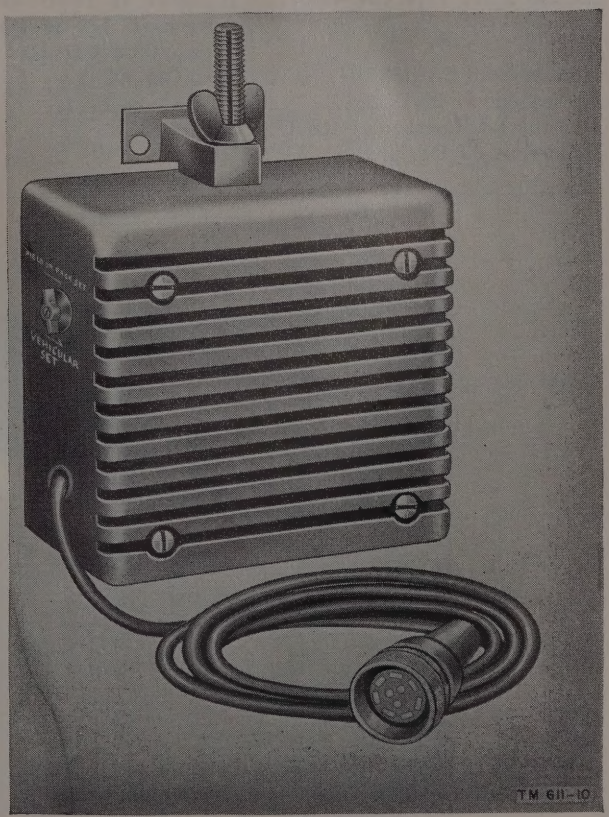



*Figure 17. Dynamic Loudspeaker LS–166/U.*

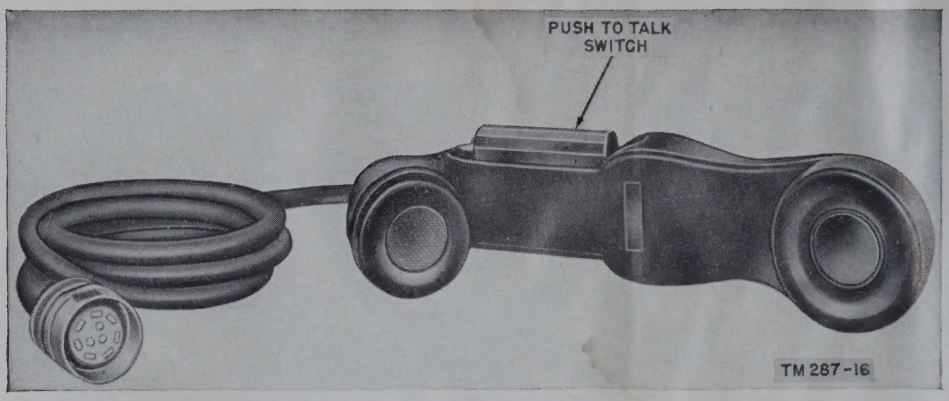



*Figure 18. Handset H–33/PT.*

| Standard item | Substitute item |
|---|---|
| Chest Set Group AN/GSA–6 | Chest Set TD–4 and Cords CD–307–A and CD–318. |
| Headset-Microphone H–63/U | Headset H–16/U and Microphone T–45 or Headset HS–30–(*) with Cord CD–933 and Microphone T–45. |
| Headset Navy Type CW–49507 | Headset H–16/U or Headset HS–30–(*) with Cord CD–933. |
| Headset Cord CX–1334/U | Cord CD–307–A. |
| Microphone M–29/U | Microphone T–17. |
| Dynamic Loudspeaker LS–166/U | None. |
| Handset H–33/PT | None. |

## 22. Running Spares

Running spares for normally expendable items, such as tubes, fuses, and vibrators are supplied with some of the system components. The spares supplied are listed in *a* through *i* below.

*Note.* Case CY–684/GR, used for carrying the spare parts, does not have the space for all of the parts supplied; therefore it will be necessary to make a selection of those parts most likely to be needed. A suggested list of such parts is given in paragraph 39.

*a. Spare Parts for Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC.* The spare parts supplied for each of these components are identical.

2 tubes, electron, type 1A3.
2 tubes, electron, type 1AE4.

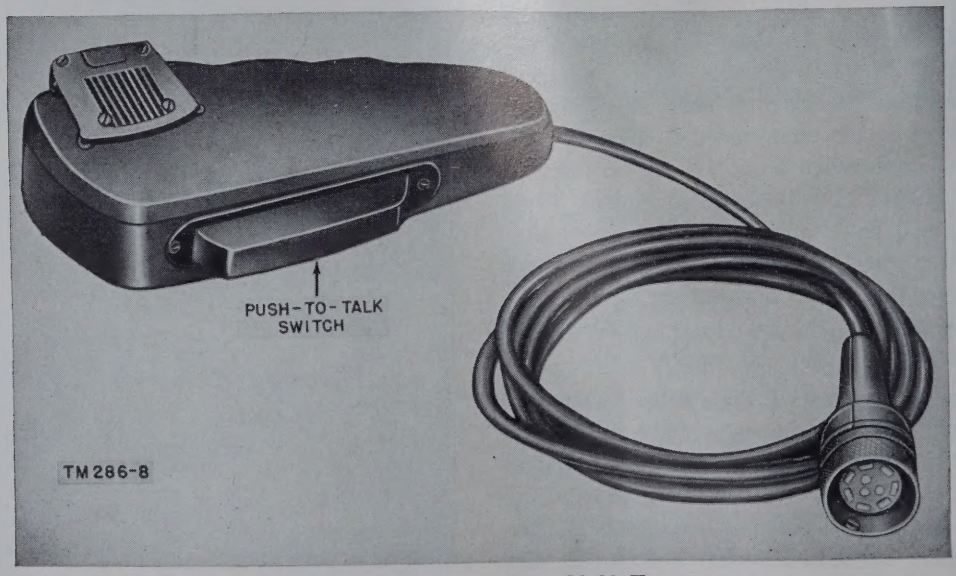



*Figure 19. Microphone M–29/U.*

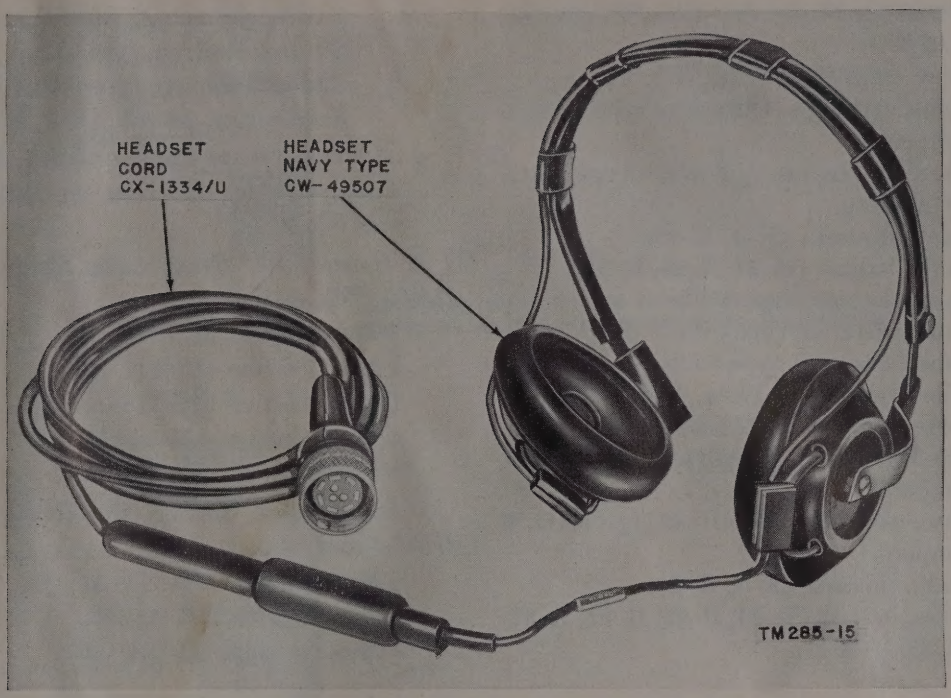



*Figure 20. Headset Navy Type CW–49507 and Headset Cord CX–1334/U.*

2 tubes, electron, type 1L4.
4 tubes, electron, type 1R5.
1 tube, electron, type 1S5.
6 tubes, electron, type 1U4.
3 tubes, electron, type 2E24.
1 tube, electron, type 3A4.
5 tubes, electron, type 3A5.
2 tubes, electron, type 3B4.
6 tubes, electron, type 3Q4.
2 tubes, electron, type 6AK5

*b. Spare Parts for Receiver-Transmitter RT–70-GRC.* The following spare parts are provided for Receiver-Transmitter RT–70/GRC:

1 lamp, incandescent, 1.35-volt, .06 ampere, GE type #331.
1 tube, electron, type 1AE4.
2 tubes, electron, type 1L4.
2 tubes, electron, type 1R5.
1 tube, electron, type 1S5.
10 tubes, electron, type 1U4.
2 tubes, electron, type 3A5.
1 tube, electron, type 3B4.
6 tubes, electron, type 304.

*c. Spare Parts for Radio Receivers R–108/GRC, R–109/GRC, and R–110/GRC.* Spare parts supplied for each of these receivers are identical.

1 fuse, cartridge, 4 ampere.
1 relay, thermal, single-pole, single-throw (K–1).
1 tube, ballast (R–59).
2 tubes, electron, type 0B2.
1 tube, electron, type 1A3.
1 tube, electron, type 1I4.
2 tubes, electron, type 1S5.
6 tubes, electron, type 1U4.
4 tubes, electron, type 3A5.
3 tubes, electron, type 3Q4.
4 tubes, electron, type 6AK5.

*d. Spare Parts for AF Amplifier AM–65/GRC.*

1 fuse, cartridge, 4 ampere (F–1).
1 fuse, cartridge, 10 ampere (F–1).
1 tube, ballast (R–32).
1 relay, thermal (K–1).
2 tubes, electron, type 6AK6.
3 tubes, electron, type 12AU7.
2 tubes, electron, type 0B2.

*e. Spare Parts for Power Supplies PP–281/GRC and PP–282/GRC.*

(1) *Power Supply PP–281/GRC.*
2 vibrators, plug-in type, 6-volt input.
(2) *Power Supply PP–282/GRC.*
2 vibrators, plug-in type, 24-volt input.

*f. Spare Parts for Power Supplies PP–109/GR and PP–112/GR.*

(1) *Power Supply PP–109/GR.*

2 fuses, cartridge, Littelfuse type 5AG, 5 ampere.
2 fuses, cartridge, Littelfuse type 5AG, 10 ampere.
1 relay, thermal (K–1, K–2).
2 tubes, ballast (R–24, R–25, R–31).
1 tube, electron, type 1007.
2 tubes, electron, type 0B2.
2 tubes, electron, type 0A2.
3 vibrators, 6-volt (E–1, E–2, E–3).

(2) *Power Supply PP–112/GR.*

3 fuses, cartridge, Littelfuse type 5AG, 5 ampere.
1 fuse, cartridge, Littelfuse type 5AG, 3 ampere.
1 relay, thermal (K–1, K–2).
3 tubes, ballast (R–24, R–25, R–31, R–37, R–38, R–40).
1 tube, electron, type 1007.
2 tubes, electron, type 0B2.
2 tubes, electron, type 0A2.
3 vibrators, 24-volt (E–1, E–2, E–3).

*g. Spart Parts for Control Group AN/GRA–6.*

4 lamps, glow, 125-volt, $\frac{1}{25}$ watt, GE lamp #NE–51.

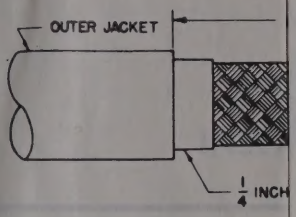
*h. Spare Mast Section for Radio Sets AN/GRC–3, –4, –5, and –6.*

1 Mast Section MS–116–A.
1 Mast Section MS–117–A.
1 Mast Section MS–118–A.
1 Mast Section AB–22/GR.
1 Mast Section AB–24/GR.

*i. Spare Mast Section for Radio Sets AN/GRC–7 and –8.*

1 Mast Section MS–117–A.
1 Mast Section AB–22/GR.
2 Mast Sections AB–24/GR.

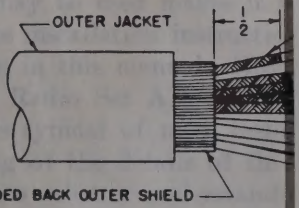
FIGURE 1




NOTE:
1 - HOOK-UP WIRE TYPE WL-1(7) 20-00 PER SPEC JAN-C-76.
2 - HOOK-UP WIRE NOT USED ON CONNECTORS U-113/U, U-115/U, & U-117/U.

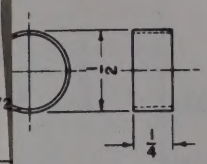
STEP 1 - CUT CABLE TO DESIRED
STEP 2 - CUT BACK OUTER JA
SHOWN IN TABLE I.
STEP 3 - PLACE 1/4 INCH BUSH

FIGURE 4

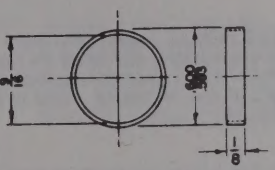



STEP 6 - CUT BACK 5 INNER SHIELDS TO 1/2

DETAIL 1




DETAIL 2

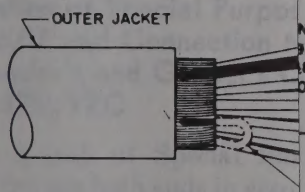



MAY BE DEVELOPED FROM 5/8 STOCK, NO. 20 B.& S. GAUGE

BUSHING
BRASS, CONDITION LIGHT ANNEAL,
PER SPEC 57-191
MAY BE # 155-484-03 AS SUPPLIED BY AMERICAN PHENOLIC CORP, CHICAGO ILL OR EQUAL.

N LIGHT ANNEAL,
91
184-02 AS SUPPLIED BY
OLIC CORP, CHICAGO, ILL OR

FIGURE 7




BLACK CONDUCTOR (FOR BENDIX SCINTILLA CO
BLACK COND

(ONE GROUND CONDUCTOR FOR BENDIX SC
(TWO GROUND CONDUCTORS FOR ALL O

STEP 9 - CUT LENGTH OF HOOK-UP WIRE TO
STRIP OFF INSULATION 3/8 INCH F
OUTER & INNER SHIELDS.

*f. Spare Parts for Power Supplies PP–109/GR and PP–112/GR.*

(1) *Power Supply PP–109/GR.*

2 fuses, cartridge, Littelfuse type 5AG, 5 ampere.
2 fuses, cartridge, Littelfuse type 5AG, 10 ampere.
1 relay, thermal (K–1, K–2).
2 tubes, ballast (R–24, R–25, R–31).
1 tube, electron, type 1007.
2 tubes, electron, type 0B2.
2 tubes, electron, type 0A2.
3 vibrators, 6-volt (E–1, E–2, E–3).

(2) *Power Supply PP–112/GR.*

3 fuses, cartridge, Littelfuse type 5AG, 5 ampere.
1 fuse, cartridge, Littelfuse type 5AG, 3 ampere.
1 relay, thermal (K–1, K–2).
3 tubes, ballast (R–24, R–25, R–31, R–37, R–38, R–40).
1 tube, electron, type 1007.
2 tubes, electron, type 0B2.
2 tubes, electron, type 0A2.
3 vibrators, 24-volt (E–1, E–2, E–3).

*g. Spart Parts for Control Group AN/GRA–6.*

4 lamps, glow, 125-volt, $\frac{1}{25}$ watt, GE lamp #NE–51.

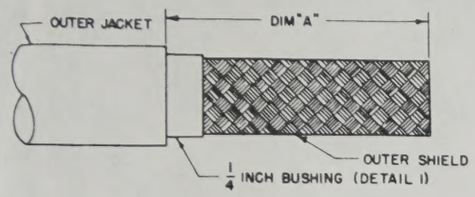
*h. Spare Mast Section for Radio Sets AN/GRC–3, –4, –5, and –6.*

1 Mast Section MS–116–A.
1 Mast Section MS–117–A.
1 Mast Section MS–118–A.
1 Mast Section AB–22/GR.
1 Mast Section AB–24/GR.

*i. Spare Mast Section for Radio Sets AN/GRC–7 and –8.*

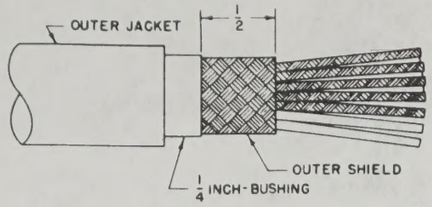
1 Mast Section MS–117–A.
1 Mast Section AB–22/GR.
2 Mast Sections AB–24/GR.

FIGURE 1



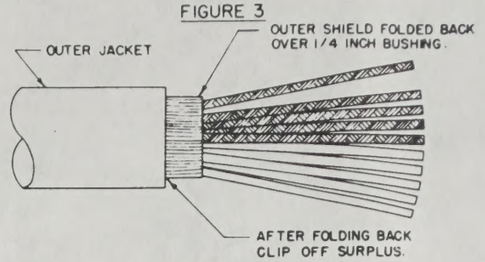

STEP 1 - CUT CABLE TO DESIRED LENGTH.
STEP 2 - CUT BACK OUTER JACKET TO DIM "A" SHOWN IN TABLE I.
STEP 3 - PLACE 1/4 INCH BUSHING OVER OUTER SHIELD.

FIGURE 2



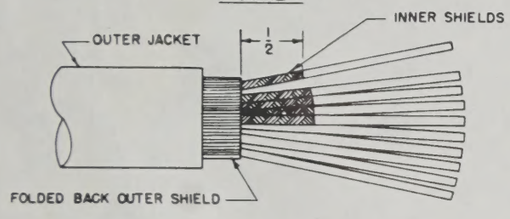

STEP 4 - CUT OUTER SHIELD TO 1/2 INCH FROM 1/4 INCH BUSHING.

FIGURE 3



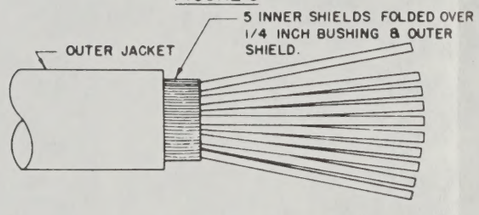

STEP 5 - UNBRAID OUTER SHIELD AND FOLD BACK OVER 1/4 INCH BUSHING, CLIP OFF SURPLUS EVEN WITH OUTER JACKET.

FIGURE 4



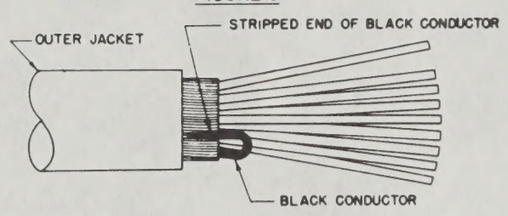

STEP 6 - CUT BACK 5 INNER SHIELDS TO 1/2 INCH FROM 1/4 INCH BUSHING.

FIGURE 5



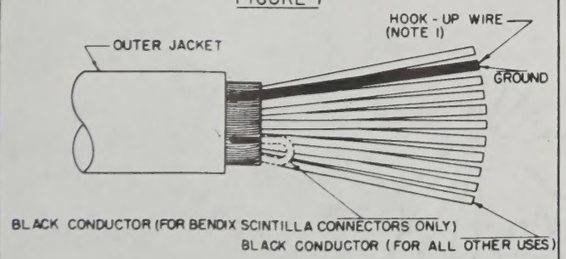

STEP 7 - UNBRAID 5 INNER SHIELDS AND FOLD BACK OVER 1/4 INCH BUSHING AND FOLDED OUTER SHIELD.
CLIP OFF SURPLUS AS IN STEP 5.
(CAUTION SHOULD BE TAKEN TO BRING ALL STRANDS OF INNER SHIELDS TO THE OUTSIDE, THUS ALLOWING NO SHORT STRANDS TO REMAIN BETWEEN THE CONDUCTORS.)

FIGURE 6




STEP 8 - (FOR BENDIX-SCINTILLA CONNECTORS ONLY.)
CUT BLACK CONDUCTOR 1 INCH FROM 1/4 INCH BUSHING AND STRIP OFF INSULATION 3/8 INCH FROM END.
BEND BACK AND LAY ON TOP OF OUTER AND INNER FOLDED SHIELDS.

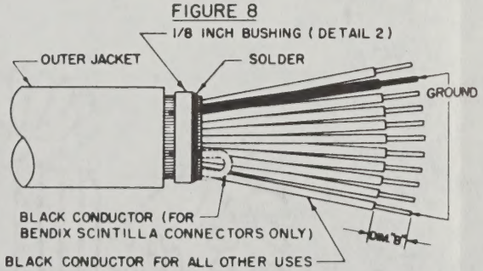
FIGURE 7




(ONE GROUND CONDUCTOR FOR BENDIX SCINTILLA CONNECTORS
TWO GROUND CONDUCTORS FOR ALL OTHER USES)

STEP 9 - CUT LENGTH OF HOOK - UP WIRE TO DIM "A", TABLE I.
STRIP OFF INSULATION 3/8 INCH FROM END AND PLACE OVER OUTER & INNER SHIELDS.

FIGURE 8



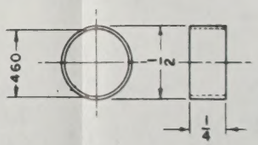

STEP 10 - PLACE 1/8 INCH BUSHING OVER FOLDED - BACK SHIELDING, HOOK - UP WIRE AND BLACK CONDUCTOR (IF USED)
SOLDER ALONG FRONT EDGE OF 1/8 INCH BUSHING, MAKING CERTAIN SOLDER PENETRATES SHIELDING.
ASSEMBLY MUST NOT EXCEED OUTSIDE DIAMETER OF OUTER RUBBER JACKET.
STEP 11 - STRIP ENDS OF CONDUCTORS TO DIM. "B", TABLE I, AND TIN.

TABLE I

| | DIM. "A" | DIM. "B" |
|---|---|---|
| CONTROL BOX C-375/VRC | 5 | 3/8 |
| MOUNTINGS MT-300/GR MT-297/GR, MT-298/GR, MT-299/GR, MT-327/GR, | 6 | 1/2 |
| BENDIX-SCINTILLA CONNECTORS SIZE 28 SHELL | 1 3/8 | 5/16 |
| TURRET TERMINAL BOX IN MEDIUM TANK M 46 | 10 | 3/8 |
| BENDIX-SCINTILLA CONNECTORS SIZE 22 SHELL | 1 1/4 | 1/4 |
| TERMINAL BOX SC-D-5319 | 8 | 3/8 |
| CONNECTOR U-113/U, U-115/U, U-117/U, (NOTE 2) | 2 1/4 | ——— |

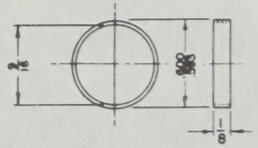
NOTE:
1 - HOOK-UP WIRE TYPE WL-1 (7) 20-00 PER SPEC JAN-C-76.
2 - HOOK-UP WIRE NOT USED ON CONNECTORS U-113/U, U-115/U, & U-117/U.

DETAIL 1




BUSHING
BRASS, CONDITION LIGHT ANNEAL,
PER SPEC 57-191
MAY BE #155-484-02 AS SUPPLIED BY AMERICAN PHENOLIC CORP, CHICAGO, ILL OR EQUAL.

DETAIL 2




MAY BE DEVELOPED FROM 3/8 STOCK, NO. 20 B.& S. GAUGE

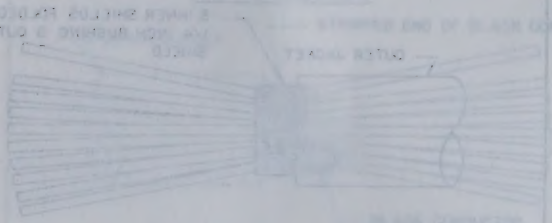
BUSHING
BRASS, CONDITION LIGHT ANNEAL,
PER SPEC 57-191
MAY BE #155-484-03 AS SUPPLIED BY AMERICAN PHENOLIC CORP, CHICAGO ILL OR EQUAL.

TM 284-303

*Figure 21. Preparation of Special Purpose Cable WM-46/U.*

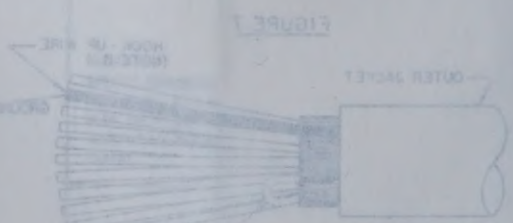

OUTER JACKET
OUTER SHIELD


OUTER JACKET
OUTER SHIELD


OUTER JACKET


OUTER JACKET


OUTER JACKET


OUTER JACKET

# CHAPTER 2

# INSTALLATION INSTRUCTIONS

## Section I. INTRODUCTION

### 23. General

Each of the installation units listed in paragraph 8 contains instructions for installing the radio set in a particular vehicle. The large variety of vehicles in which Radio Sets AN/GRC–3 through –8 may be used makes it impracticable to include the installation instructions for all of these vehicles in this manual. However, the installation of Radio Set AN/GRC–3 in Medium Tank M46 is typical of most installations. An understanding of the details of this installation is conducive to a better understanding of all installations.

### 24. General Unpacking Instructions

Take the usual precautions against damage to equipment during the unpacking procedure. The following points of procedure should be observed whenever possible:

*a.* First unpack only the installation unit and box No. 4 of the radio set. After the equipment in these two cartons has been installed, unpack boxes No. 1, 2, and 3 in the order needed to complete the installation as described in these instructions. Packing slips on each box (or carton) indicate the contents of that box.

*b.* As each box is unpacked, check its contents aganist the master packing slip.

*c.* Use cutters to clip the metal bands.

*d.* Do not pry off the tops or sides of boxes; use a nail puller to remove the nails and lift off the sides and/or the tops.

*e.* Save the boxes, containers, and other packaging material, if practicable, for possible use for storage or reshipment.

## Section II. INSTALLATION OF RADIO SET AN/GRC–3 IN MEDIUM TANK M46

### 25. Preparation of Special Purpose Cable WM–46/U and Connection to Commander's and Gunner's Control Box C–375/VRC

Cut 7 feet 1 inch of Special Purpose Cable WM–46/U. Prepare both ends in accordance with figure 21. Remove the back cover from Control Box C–375/VRC. With the control box lying face down, as shown in figure 22, remove the cable clamp on the left side of the box and insert one end of the prepared cable through this cable clamp and into the box. Solder the cable leads to terminal strip E–2 of the control box in accordance with figure 23. Also see that a jumper is connected between terminals 13, 14, and 15 of E–2. When all connections have been soldered, replace the cable clamp and tighten it with a wrench to effect a watertight seal. Solder the terminal lugs provided in the hardware kit to the leads on the other end of the cable. (This end will be connected to the turret radio terminal box in the M46 tank.)

### 26. Preparation of Special Purpose Cable WM–46/U and Connection to Loader's Control Box C–375/VRC

Cut 7 feet 8 inches of Special Purpose Cable WM–46/U. Prepare both ends in accordance with figure 21. Repeat the procedure described in paragraph 25 for connecting one end of this cable

to Control Box C–375/VRC. Solder the terminal lugs provided in the hardware kit on the other end of the cable.

## 27. Preparation of Special Purpose Cable WM–46/U and Connection to Driver's and Co-driver's Control Box C–375/VRC

*a.* Cut 7 feet 4 inches of Special Purpose Cable WM–46/U. Prepare both ends in accordance with figure 21. Repeat the procedure described in paragraph 25 for connecting one end of this cable to Control Box C–375/VRC.

*b.* The other end of the cable is connected to the Bendix connector as shown on figure 24. Disassemble the connector and slide its parts over the cable in the order shown on the figure. Solder the leads to the solder lugs on the connector as shown in the lower right-hand corner of figure 25. Connect the red lead to E, the green lead to C, etc.

## 28. Wiring Change in Mounting MT–297/GR, Preparation of Special Purpose Cable WM–46/U and Connection to Mounting MT–297/GR

Cut 5 feets 5 inches of Special Purpose Cable WM–46/U. Prepare the ends in accordance with figure 21. Loosen the four wingnut fasteners which hold the mounting table firm against the shock mounts. Swing the mounting table back on its hinges to make the junction box accessible. Remove the three cover plates from the junction box (fig. 26). Remove the bondnut, metal ring, and rubber washer from one of the unused cable entries at the lower right side of the junction box. Also remove the rubber plug from this cable entry and discard it. (This plug is used to maintain a watertight seal at an unused cable entry). Slip the nut, metal ring, and washer over Special Purpose Cable WM–46/U and insert the cable through the entry

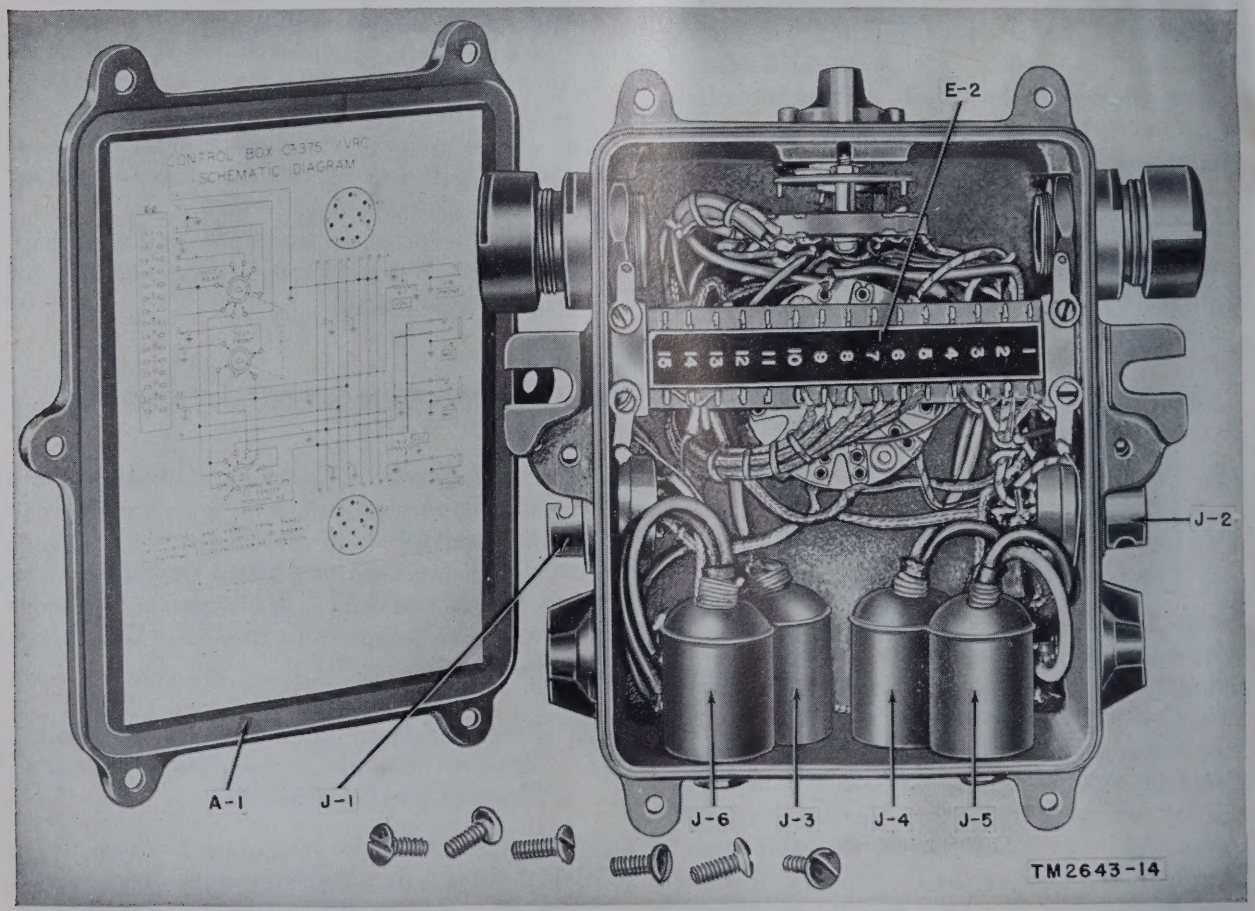



*Figure 22. Control Box C–375/VRC, internal view.*

into the junction box. Solder the individual leads to the lugs on terminal board E–6 of the mounting (fig. 23). Remove the jumpers between terminals 14, 15, and 16, and between terminals 17 and 18. (These jumpers are used only with vehicles having 12-volt batteries.) If it is desired to parallel the phone audio outputs at the panel AUDIO connectors of the auxiliary receiver and Set 1, this change can be affected easily in the junction box of Mounting MT–297/GR. To make the change, connect terminals E and E1 of terminal block E–2 in the mounting (fig. 109) with No. 20 wire, color coded slate. After the solder connections are completed, tighten the bondnut on the cable clamp with a wrench. Solder the terminal lugs provided in the hardware kit to the other end of Special Purpose Cable WM–46/U. (This end of the cable will be connected to the turret radio terminal box in the M46 tank.)

## 29. Installation of Control Boxes C–375/VRC

*a.* Secure the three control boxes to the brackets provided in the tank in accordance with figure 27. On the composition strips above the selector switch on the front panel of each control box, write the following designations from left to right respec-

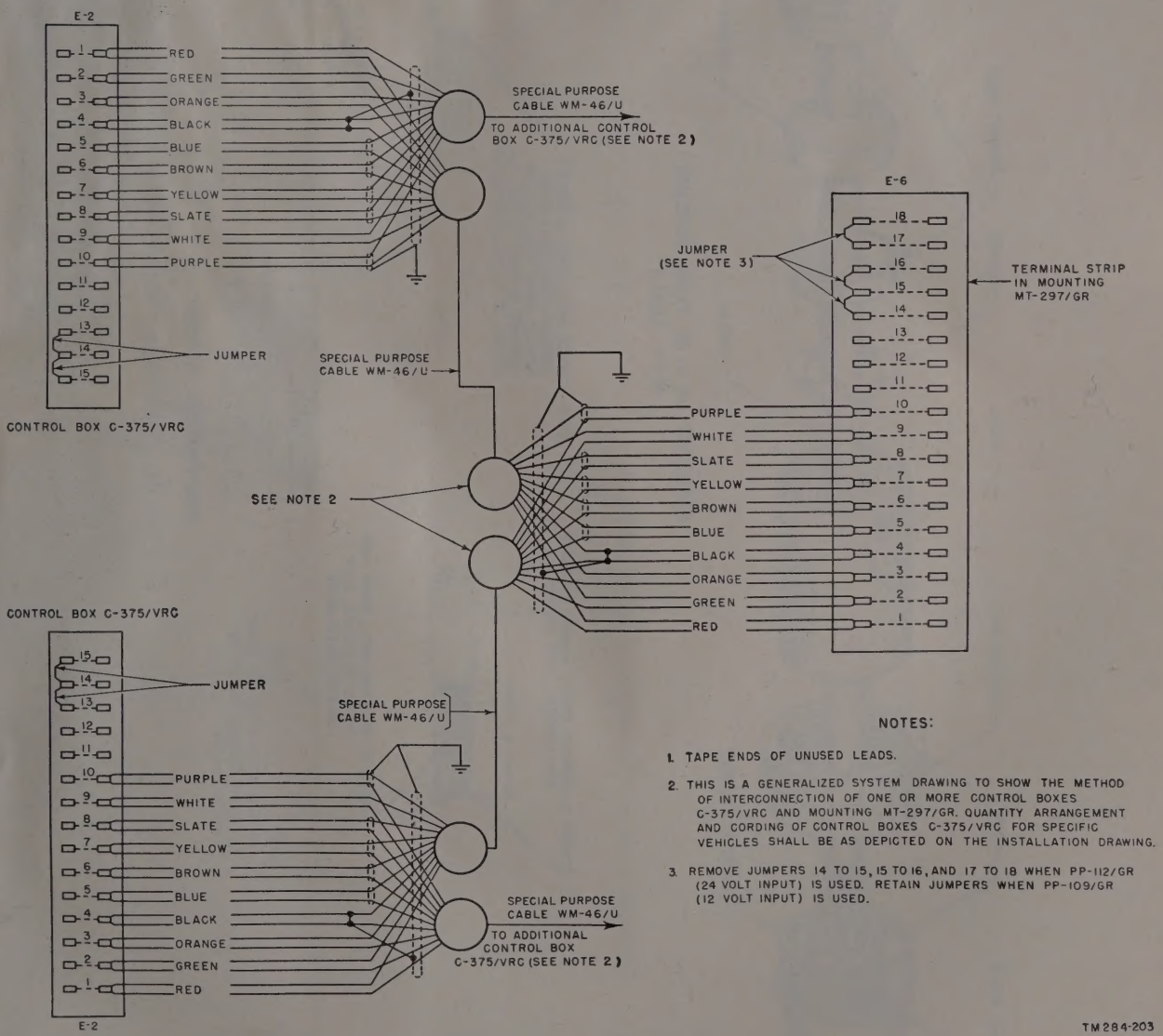
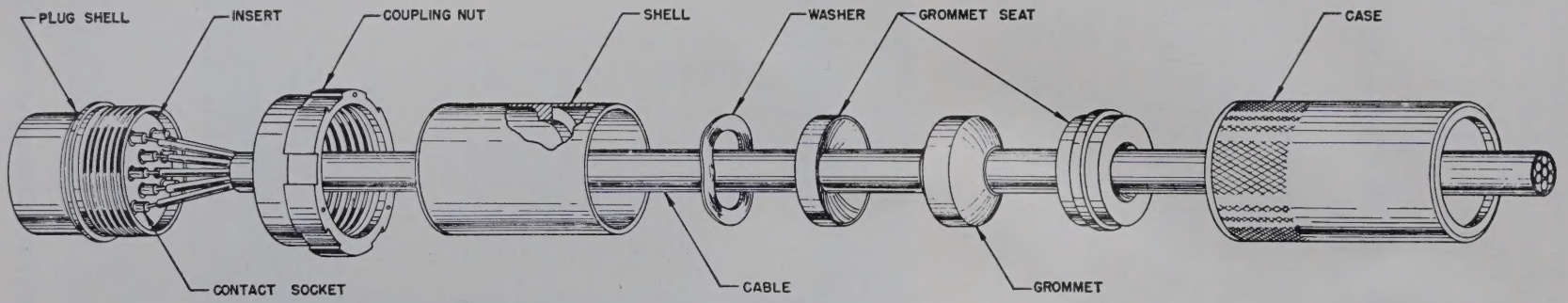
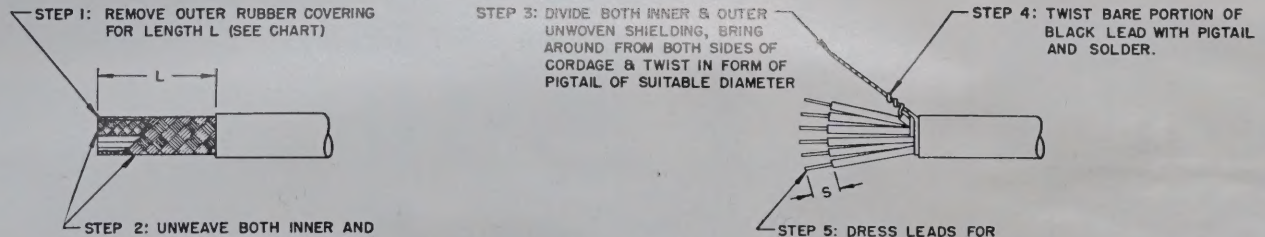



*Figure 23. Wiring connections between two Control Boxes C–375/VRC and Mounting MT–297/GR.*




EXPLODED VIEW OF PLUG ASSEMBLY
WITH CABLE



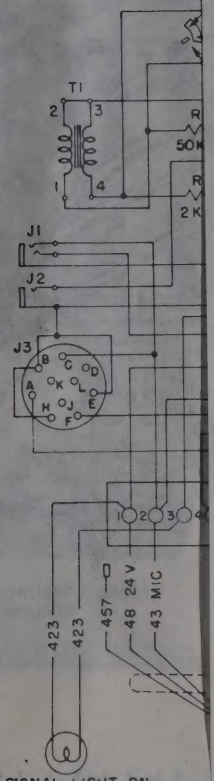

| SHELL SIZE | CONTACT SIZE | L | S |
|---|---|---|---|
| 28 | 12 | 1 3/8 | 5/16 |
| 22 | 20 | 1 1/4 | 1/4 |
| 22 | 8 | 1 9/16 | 5/8 |

NOTE:
STEPS 2, 3 & 4 DO NOT APPLY TO POWER CORDAGE (SUCH AS CORDAGE CO-212)

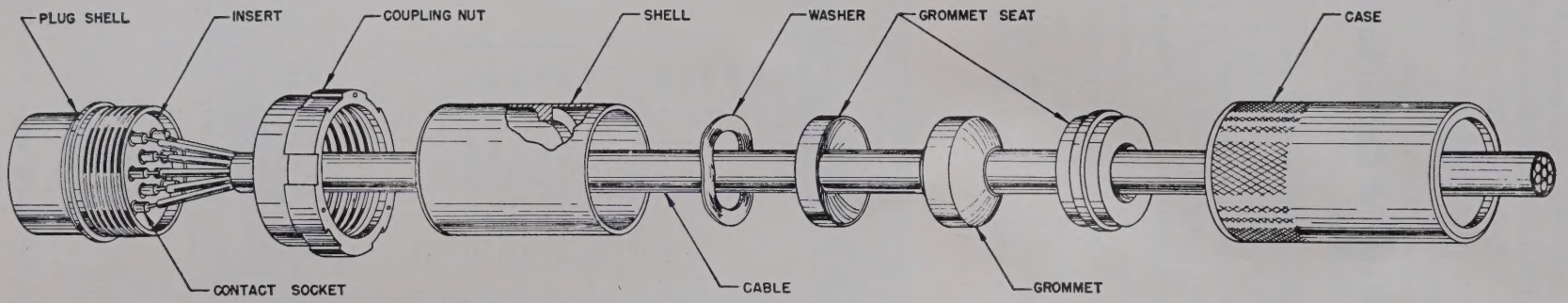
PREPARATION OF CORDAGE

TM 284-302

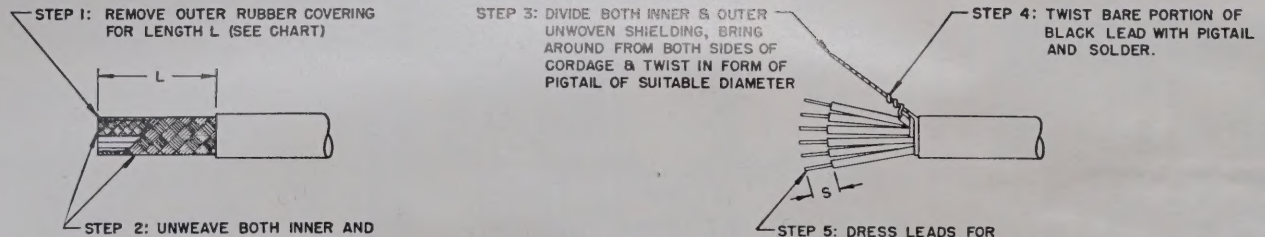
*Figure 24. Bendix plug connector, exploded view.*




BOX ASSEMBLY
AUXILIARY INTERPHONE S
ORDNANCE NO. C7730




EXPLODED VIEW OF PLUG ASSEMBLY
WITH CABLE



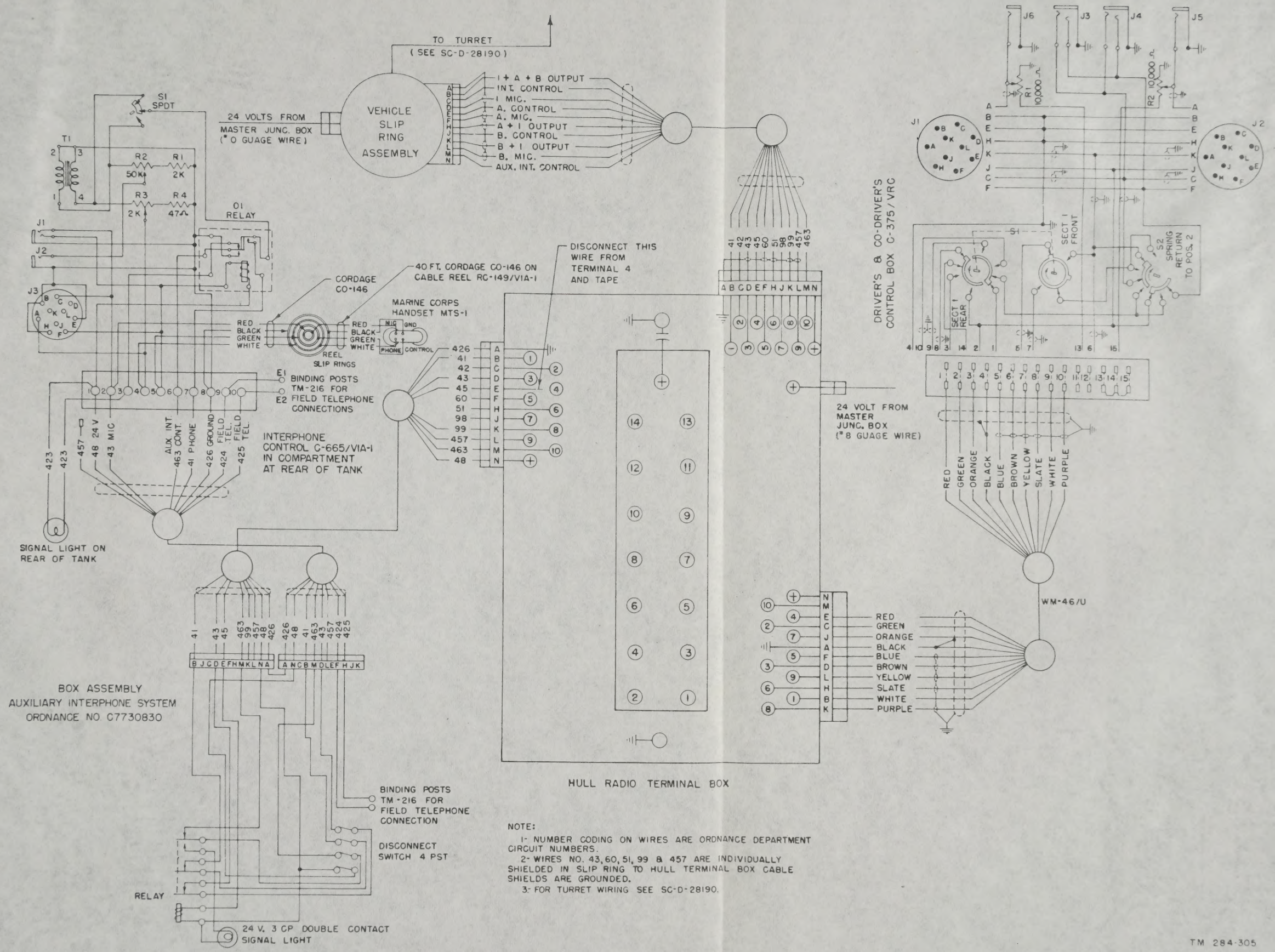

| SHELL SIZE | CONTACT SIZE | L | S |
|---|---|---|---|
| 28 | 12 | 1 3/8 | 5/16 |
| 22 | 20 | 1 1/4 | 1/4 |
| 22 | 8 | 1 9/16 | 5/8 |

NOTE:
STEPS 2, 3 & 4 DO NOT APPLY TO POWER CORDAGE (SUCH AS CORDAGE CO-212)

PREPARATION OF CORDAGE

TM 284-302

*Figure 24. Bendix plug connector, exploded view.*




NOTE:

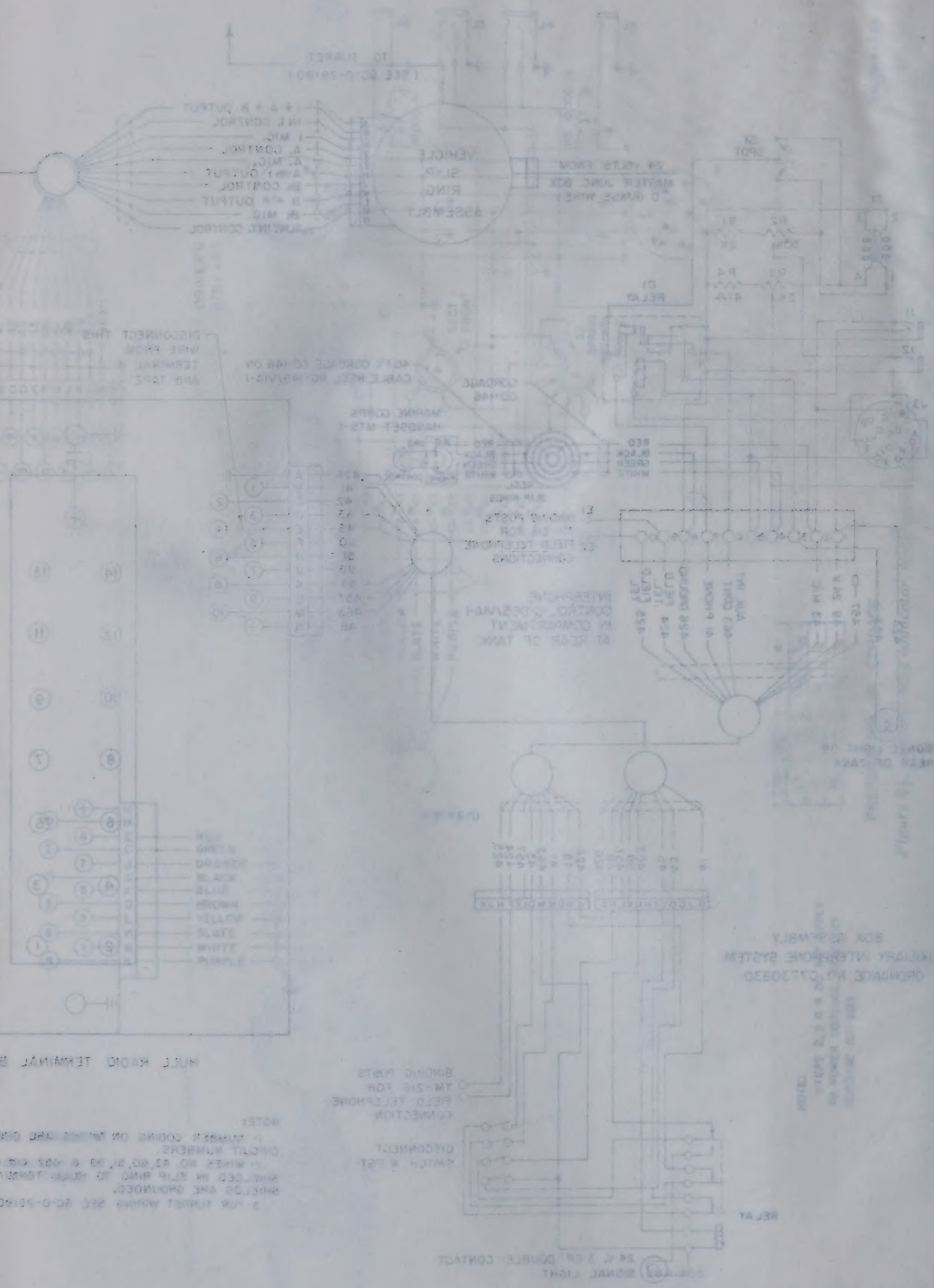
1- NUMBER CODING ON WIRES ARE ORDNANCE DEPARTMENT CIRCUIT NUMBERS.

2- WIRES NO. 43, 60, 51, 99 & 457 ARE INDIVIDUALLY SHIELDED IN SLIP RING TO HULL TERMINAL BOX CABLE SHIELDS ARE GROUNDED.

3- FOR TURRET WIRING SEE SC-D-28190.

TM 284-305

*Figure 25. Wiring connections to hull radio terminal box in M46 tank.*



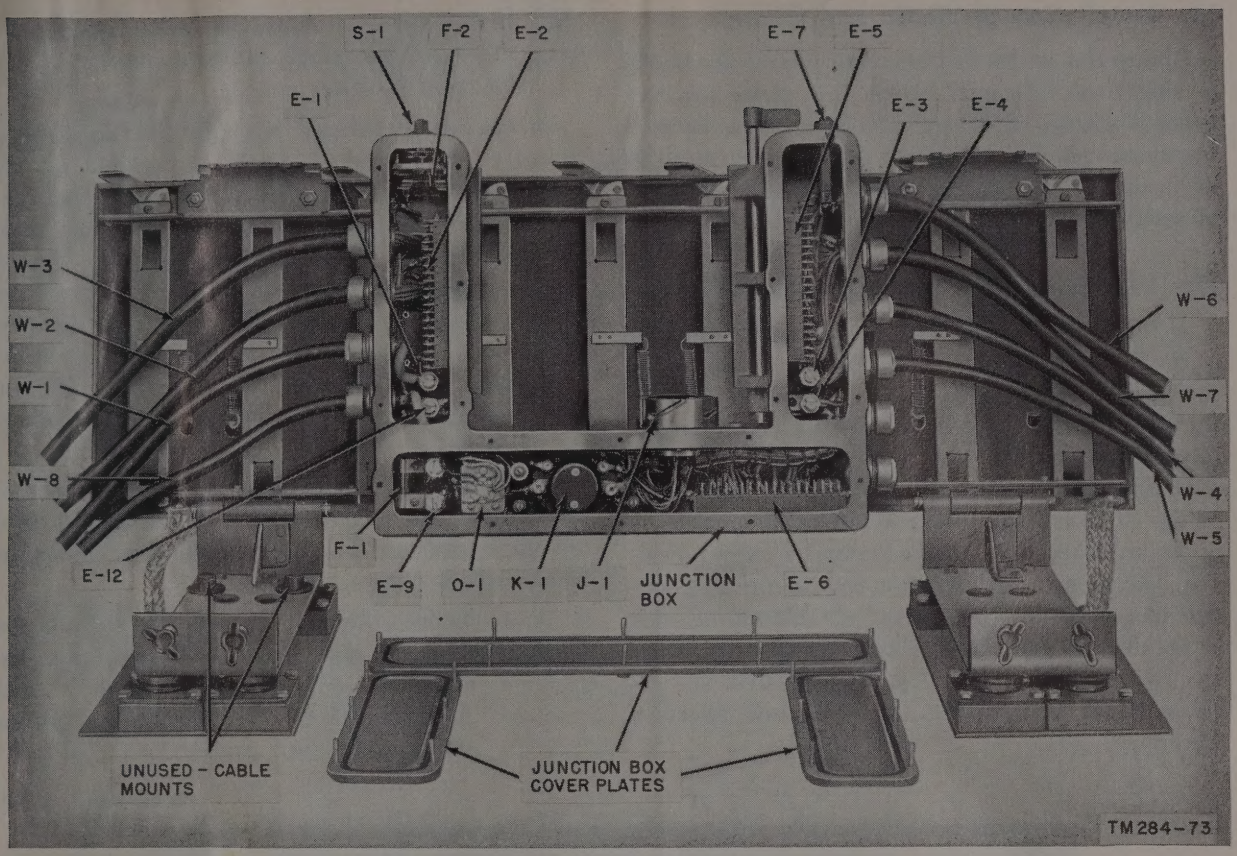



*Figure 26. Mounting MT–297/GR, open view.*

tively: Set 1 + Int, Set 1 + Set 2 + Int, and Set 2 + Int.

*b.* Connect the free ends of the cables of the commander's and loader's control boxes to the turret radio terminal box in accordance with figure 28. Use the waterproof connectors specified in item 30 of figure 27 through the knock-outs on the turret radio terminal box.

*c.* Connect the Bendix plug assembly, located on the end of the driver's control box cable, to the receptacle on the hull radio terminal box as shown on the right side of figure 25. Make sure that all threaded connections are screwed tight to insure waterproofing.

## 30. Installation of Mounting MT–297/GR

*a.* Secure the mounting to the supports in the turret bulge of the tank as shown on figure 27. Secure the free ends of the two grounding straps of the mounting under the rear left and right mounting screws. Make sure that the OFF-REMOTE-ON switch on the mounting is at OFF. In vehicular installations where the mounting is not bolted to a good vehicular ground, connect one of the grounding straps to a convenient vehicular ground.

*b.* Insert the free end of the power cord (W–8 on fig. 26) of the mounting through the knock-out of the turret radio terminal box, using the conduit connector specified in note 2 of figure 27. Connect the insulated lead to the + terminal and the bare lead to the — terminal of the terminal box.

*c.* Connect the free end of Special Purpose Cable WM–46/U from the mounting to the turret radio terminal box in accordance with figures 27 and 28. (Fig. 27 indicates routing of cable; fig. 28 indicates wiring connection.) Use the connector specified in item 30 of figure 27 for the cable entry through the knock-out of the terminal box.

*Note.* In later model tanks such as the M47, all connections to the turret radio terminal box are made through Bendix connectors and receptacles similar to those used at the hull radio terminal box of Medium Tank M46 (fig. 25).

## 31. Installation of Hooks and Clamps

Clamp the cables in place and install the hooks as shown on figure 27. Note that there are five types of clamps, distinguished by color, to be used in various places in the tank. Items 34 through 40 of figure 27 list the quantity of hooks and the quantity of each type of cable clamp to be used.

## 32. Installation of Control C–435/GRC

*a.* Remove the cover from the 14-pin connector at the back of the retransmission unit (fig. 29) by turning it in a counterclockwise direction. Fasten the cover in the cover holder which is next to the connector by turning it in a clockwise direction.

*b.* See that the locking lever, located to the left of the POWER lamp on the mounting (fig. 9) is in its unlocked (extreme counterclockwise) position. Slide the retransmission unit along the channels located below the mounting table as far back as possible. Turn the locking lever to its extreme clockwise position (fig. 1.). This secures the retransmission unit to the mounting and effects a watertight seal.

## 33. Installation of Antenna Mast Bases AB–15/GR, Mast Sections, and Lead-in Cables

*a. General.* The mast bases for Set 1 and Set 2 usually are placed as high as possible on the vehicle with a spacing of at least 40 inches between them. The maximum cable length from mast base to receiver-transmitter is 4 feet 2 inches. The location of the mast bases on top of Medium Tank M46 is shown on figure 27. On this tank, Adapter UG–306/U is used only at the radio set panel but not below the mast base. On other vehicles this adapter may be used both below the mast base and at the radio set panel.

*b. Installing Mast Bases AB–15/GR and Lead-in Cables.* The mast bases for the Set 1 and Set 2 receiver-transmitters and their lead-in cables are mounted as follows (fig. 30) :

(1) Loosen the ground clamp on the adapter which is supplied on the mast base. Remove the adapter and replace it with Adapter UG–273/U. Tighten the ground clamp on the new adapter.

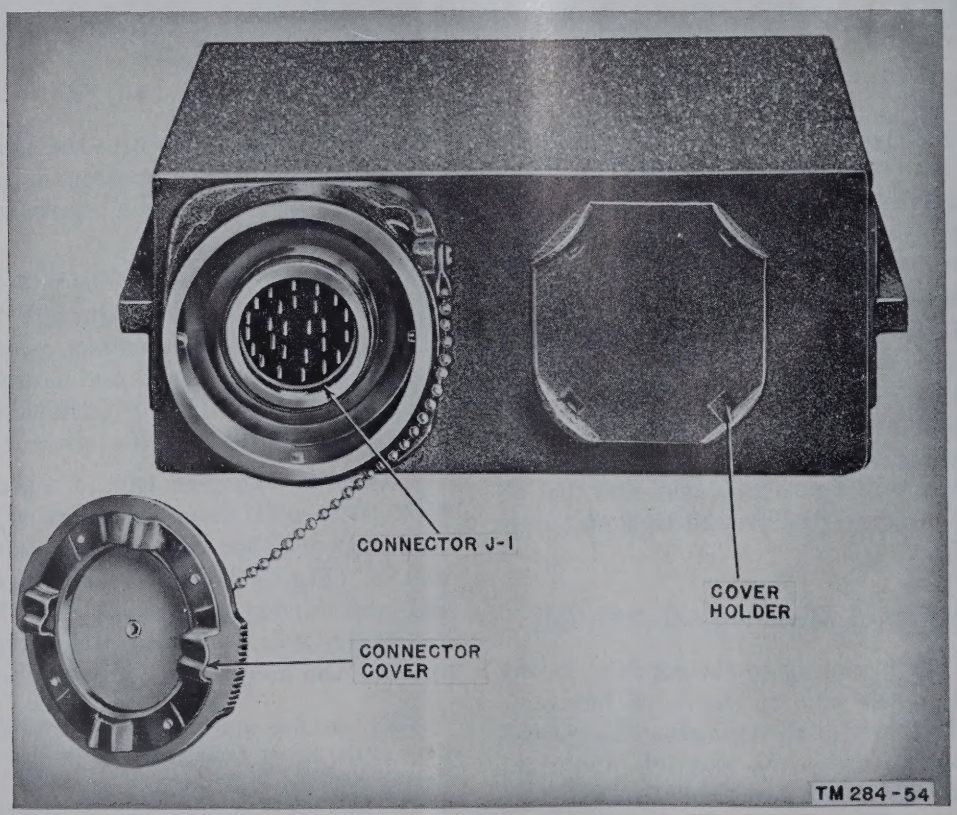
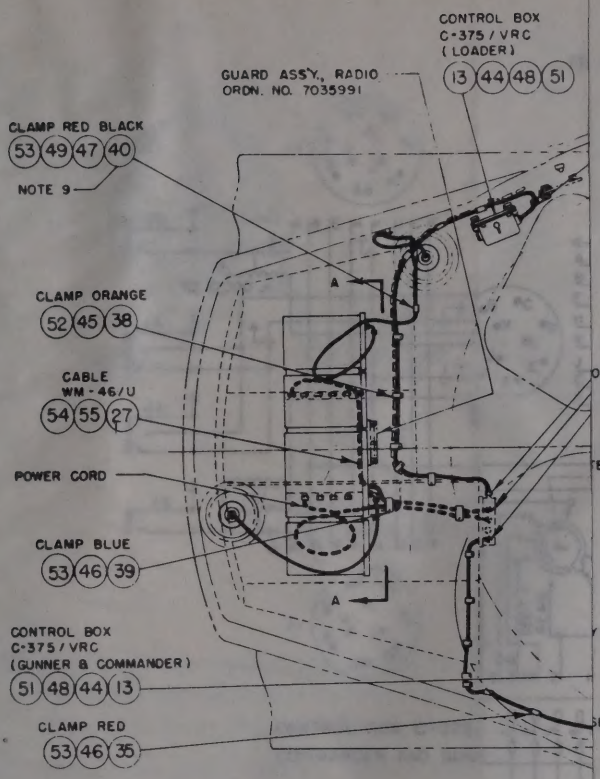
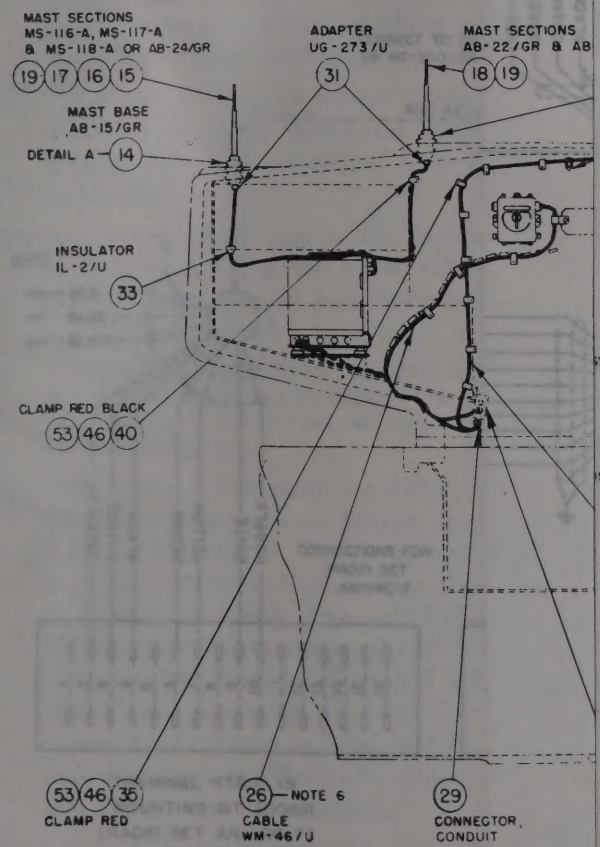



*Figure 29. Control C–435/GRC, rear view.*




RADIO SET AN/GRC-8
RADIO SET AN/GRC-7
RADIO SET AN/GRC-6
RADIO SET AN/GRC-5
RADIO SET AN/GRC-4
RADIO SET AN/GRC-3

| ITEM NO. | NAME OF ITEM | QUAN. REQ'D. | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | RECEIVER TRANSMITTER RT-66/GRC | 1 | 1 | | | | |
| 2 | RECEIVER TRANSMITTER RT-70/GRC | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | RECEIVER TRANSMITTER RT-67/GRC | | | 1 | 1 | | |
| 4 | RECEIVER TRANSMITTER RT-68/GRC | | | | | 1 | 1 |
| 5 | RADIO RECEIVER R-108/GRC | 1 | | | | | |
| 6 | RADIO RECEIVER R-109/GRC | | | 1 | | | |
| 7 | RADIO RECEIVER R-110/GRC | | | | 1 | | |
| 8 | POWER SUPPLY PP-112/GR | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | POWER SUPPLY PP-282/GRC | 2 | 1 | 2 | 1 | 2 | 1 |
| 10 | AF AMPLIFIER AM-65/GRC | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | MOUNTING MT-297/GR | 1 | 1 | 1 | 1 | 1 | 1 |
| 12 | CONTROL C-435/GRC | 1 | 1 | 1 | 1 | 1 | 1 |
| 13 | CONTROL BOX C-375/VRC | 3 | 3 | 3 | 3 | 3 | 3 |
| 14 | MAST BASE AB-15/GR | 2 | 2 | 2 | 2 | 2 | 2 |
| 15 | MAST SECTION MS-116-A | 1 | 1 | 1 | 1 | | |
| 16 | MAST SECTION MS-117-A | 1 | 1 | 1 | 1 | 1 | 1 |
| 17 | MAST SECTION MS-118-A | 1 | 1 | 1 | 1 | | |
| 18 | MAST SECTION AB-22/GR | 1 | 1 | 1 | 1 | 1 | 1 |
| 19 | MAST SECTION AB-24/GR | 1 | 1 | 1 | 1 | 2 | 2 |
| 20 | RF CABLE ASSEMBLY CG-568/U (4FT.-2IN.) | 1 | 1 | | | | |
| 21 | RF CABLE ASSEMBLY CG-530/U (4FT.-2 IN.) | 1 | 1 | 2 | 2 | 2 | 2 |
| 22 | SPECIAL PURPOSE CABLE ASSY CX-1213/U | 1 | 1 | 1 | 1 | 1 | 1 |
| 23 | SPECIAL PURPOSE CABLE ASSY CX-1211/U | 1 | 1 | 1 | 1 | 1 | 1 |
| 24 | WIRE W-142 (6 IN. LG.) | 1 | | 1 | | 1 | |
| 25 | CABLE WM-46/U (7FT.-11IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | CABLE WM-46/U (7FT.-8 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 27 | CABLE WM-46/U (5FT.-5 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 28 | CABLE WM-46/U (7FT.-4 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 29 | CONNECTOR, CONDUIT NOTE 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30 | CONNECTOR, PER SC-C-16576 GP IV | 3 | 3 | 3 | 3 | 3 | 3 |
| 31 | ADAPTER UG-273/U | 2 | 2 | 2 | 2 | 2 | 2 |
| 32 | ADAPTER UG-306/U | 3 | 3 | 3 | 3 | 3 | 3 |
| 33 | INSULATOR IL-2/U | 1 | 1 | 1 | 1 | 1 | 1 |
| 34 | HOOK | 3 | 3 | 3 | 3 | 3 | 3 |
| 35 | CLAMP RED | 10 | 10 | 10 | 10 | 10 | 10 |
| 36 | CLAMP BLACK | 6 | 6 | 6 | 6 | 6 | 6 |
| 37 | CLAMP GREEN | 1 | 1 | 1 | 1 | 1 | 1 |
| 38 | CLAMP ORANGE | 9 | 9 | 9 | 9 | 9 | 9 |
| 39 | CLAMP BLUE | 1 | 1 | 1 | 1 | 1 | 1 |
| 40 | CLAMP RED BLACK | 3 | 3 | 3 | 3 | 3 | 3 |
| 41 | PLUG ASSEMBLY NOTE 3 & 7 | 1 | 1 | 1 | 1 | 1 | 1 |
| 42 | ACCESSORY ASSEMBLY NOTE 4 & 7 | 1 | 1 | 1 | 1 | 1 | 1 |
| 43 | HEX HD MACH SCR 5/16-24 X 3/4 LG. | 8 | 8 | 8 | 8 | 8 | 8 |
| 44 | HEX HD MACH SCR 5/16-24 X 1 1/2 LG. | 6 | 6 | 6 | 6 | 6 | 6 |
| 45 | HEX HD MACH SCR 1/4-28 X 1/2 LG. | 15 | 15 | 15 | 15 | 15 | 15 |
| 46 | RD HD MACH SCR NO 8-32 X 1/2 LG | 18 | 18 | 18 | 18 | 18 | 18 |
| 47 | RD HD MACH SCR NO. 8-32 X 3/4 LG. | 2 | 2 | 2 | 2 | 2 | 2 |
| 48 | HEX NUT 5/16-24 STD | 6 | 6 | 6 | 6 | 6 | 6 |
| 49 | HEX NUT NO. 8-32 STD | 2 | 2 | 2 | 2 | 2 | 2 |
| 50 | LOCKWASHER 5/16 I.E.T. (NOTE 5) | 8 | 8 | 8 | 8 | 8 | 8 |
| 51 | LOCKWASHER 5/16 I.T. (NOTE 5) | 12 | 12 | 12 | 12 | 12 | 12 |
| 52 | LOCKWASHER 1/4 I.E.T. (NOTE 5) | 15 | 15 | 15 | 15 | 15 | 15 |
| 53 | LOCKWASHER NO. 8 I.E.T. (NOTE 5) | 18 | 18 | 18 | 18 | 18 | 18 |
| 54 | TERMINAL (NOTE 10) | 3 | 3 | 3 | 3 | 3 | 3 |
| 55 | TERMINAL (NOTE 10) | 27 | 27 | 27 | 27 | 27 | 27 |

## 31. Installation of Hooks and Clamps

Clamp the cables in place and install the hooks as shown on figure 27. Note that there are five types of clamps, distinguished by color, to be used in various places in the tank. Items 34 through 40 of figure 27 list the quantity of hooks and the quantity of each type of cable clamp to be used.

## 32. Installation of Control C–435/GRC

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*b.* See that the locking lever, located to the left of the POWER lamp on the mounting (fig. 9) is in its unlocked (extreme counterclockwise) position. Slide the retransmission unit along the channels located below the mounting table as far back as possible. Turn the locking lever to its extreme clockwise position (fig. 1.). This secures the retransmission unit to the mounting and effects a watertight seal.

## 33. Installation of Antenna Mast Bases AB–15/GR, Mast Sections, and Lead-in Cables

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*b. Installing Mast Bases AB–15/GR and Lead-in Cables.* The mast bases for the Set 1 and Set 2 receiver-transmitters and their lead-in cables are mounted as follows (fig. 30) :

(1) Loosen the ground clamp on the adapter which is supplied on the mast base. Remove the adapter and replace it with Adapter UG–273/U. Tighten the ground clamp on the new adapter.

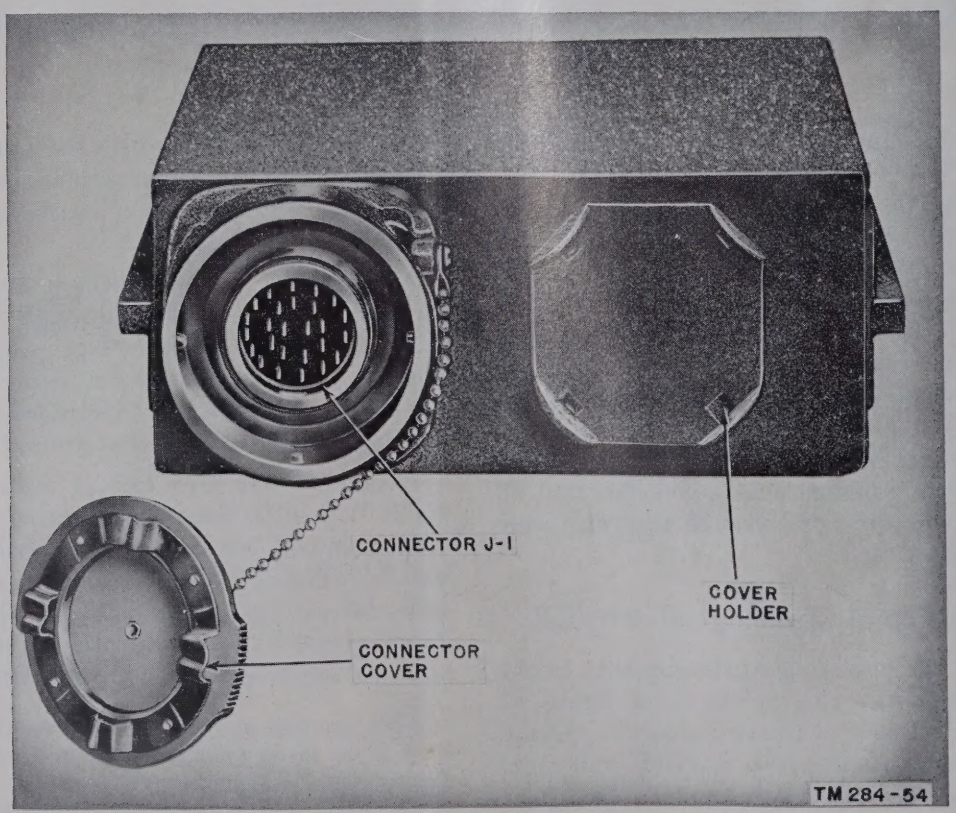
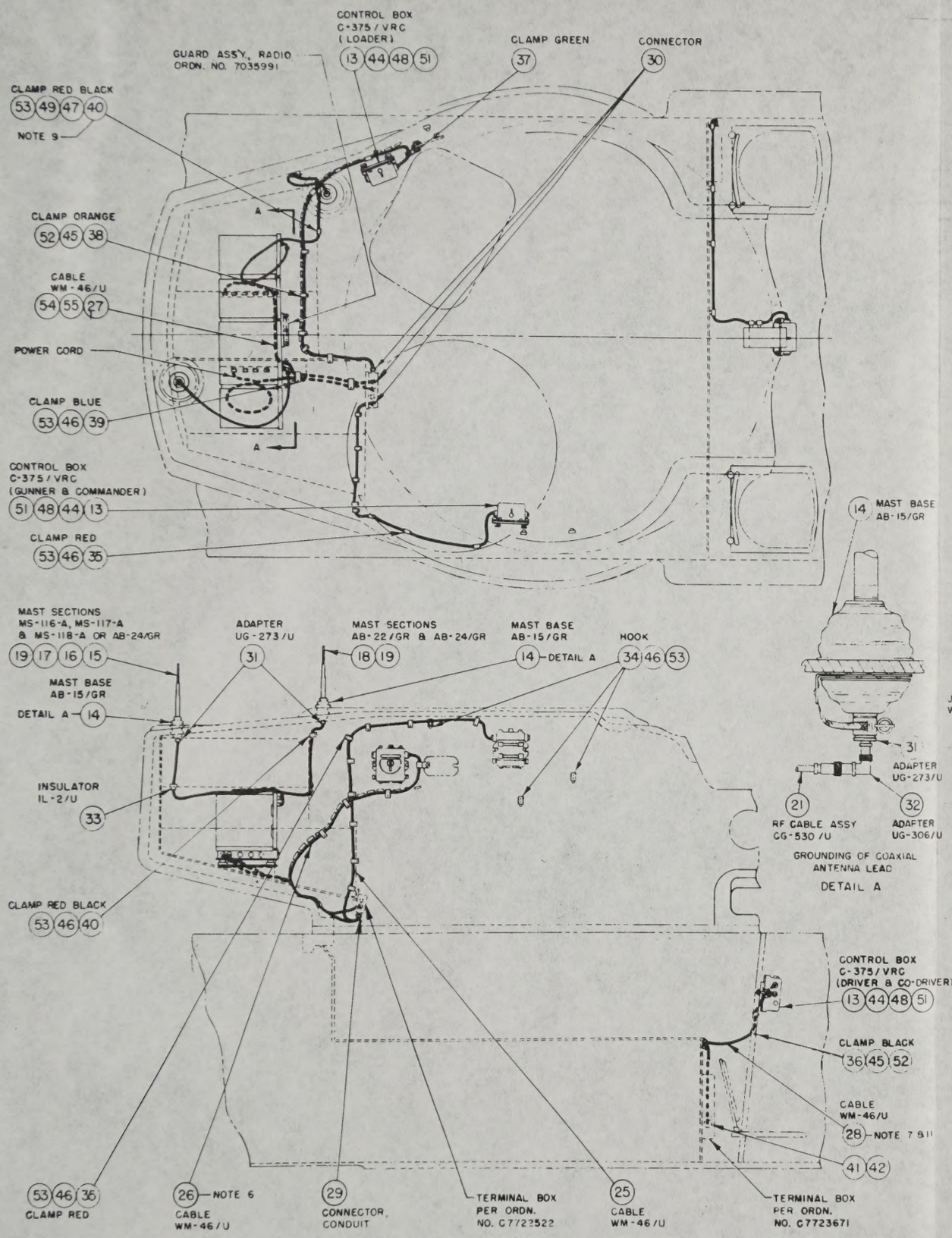
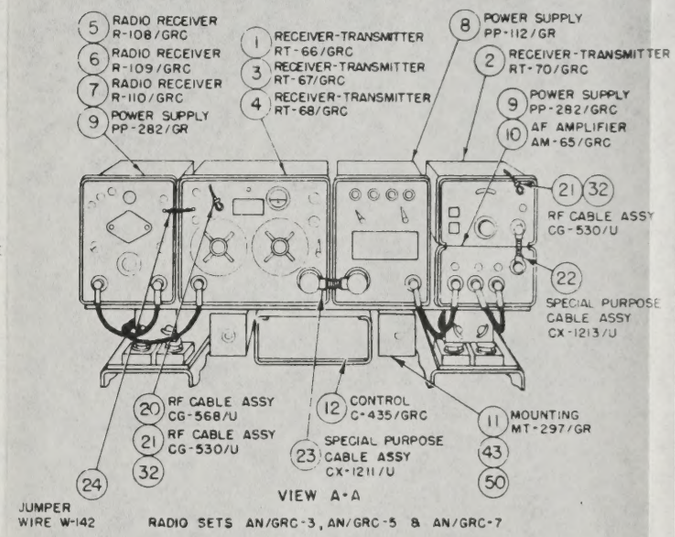


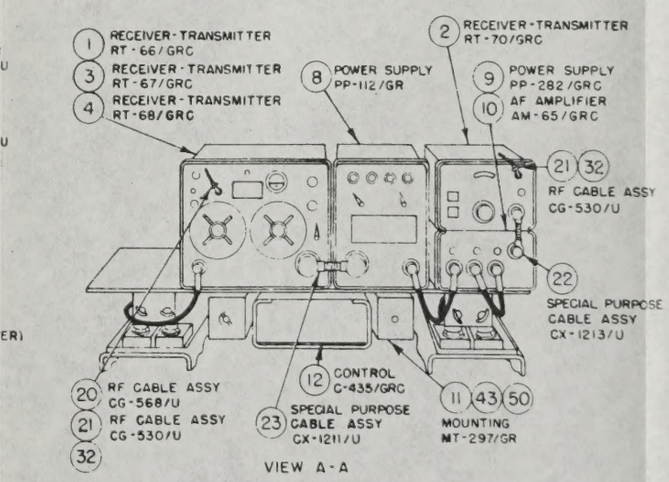

*Figure 29. Control C–435/GRC, rear view.*




NOTES:

1. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
2. (29) IS CONNECTOR NO. 61007 WITH BONDNUT BL-50 (SIG. CORPS STOCK NO. 623147) AS SUPPLIED BY APPLETON ELECTRIC CO., CHICAGO, ILL., OR EQUAL.
3. & 4. FOR M46 USE PLUG ASSY. NO. 10-42628-515 & ACCESSORY ASSY. NO. 10-35998-284 FOR M46A1 USE PLUG ASSY. NO. 10-42622-19P ACCESSORY ASSY. NO. 10-35998-222 ALL AS SUPPLIED BY SCINTILLA MAGNETO DIVISION, BENDIX AVIATION CORP. SIDNEY, N.Y. OR EQUAL.
5. (50) NO. 4018-24, (51) NO. 1218, (52) NO. 4014-22, (53) NO. 4008-14, AS SUPPLIED BY SHAKEPROOF INC. CHICAGO, ILL., OR EQUAL.
6. CORDAGE (26) PARALLELS AN/VIA-1 CABLE (SHOWN IN PHANTOM) AND IS SECURED WITH CLAMPS PROVIDED WITH THIS INSTALLATION.
7. PREPARE (28) PER SC-C-28209 & ASSEMBLE (41) & (42) PER SC-C-28185
8. DRILLING DETAIL PER SC-B-28191.
9. (54) NO. 2050 FOR 1/4 SCREW (55) NO. 1054 FOR NO. 10 SCREW BOTH AS SUPPLIED BY PATTON-MAC GUYER CO., PROVIDENCE, R.I. OR EQUAL.
10. DRAWING REFERENCES: WIRING DIAGRAMS FOR M46: HULL SC-D-28189, TURRET SC-D-28190. FOR M46A1: HULL SC-D-28539, TURRET SC-D-28540
11. FOR M46A1 LENGTH OF (28) IS 5 FT. 4 IN. (APPROX.) AND (41) CONNECTS TO CURB SIDE OF TERMINAL BOX.



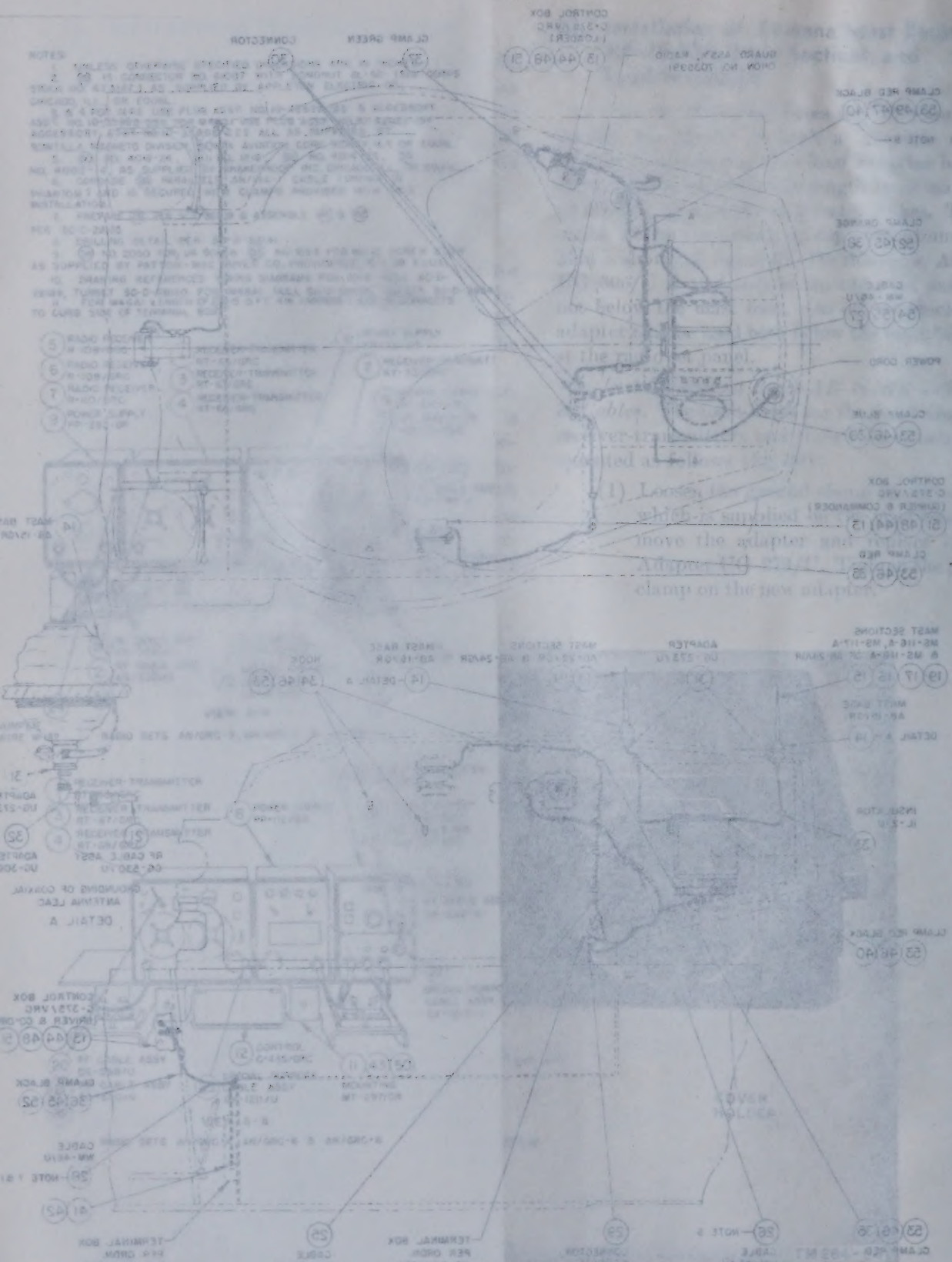

RADIO SET AN/GRC-8
RADIO SET AN/GRC-7
RADIO SET AN/GRC-6
RADIO SET AN/GRC-5
RADIO SET AN/GRC-4
RADIO SET AN/GRC-3

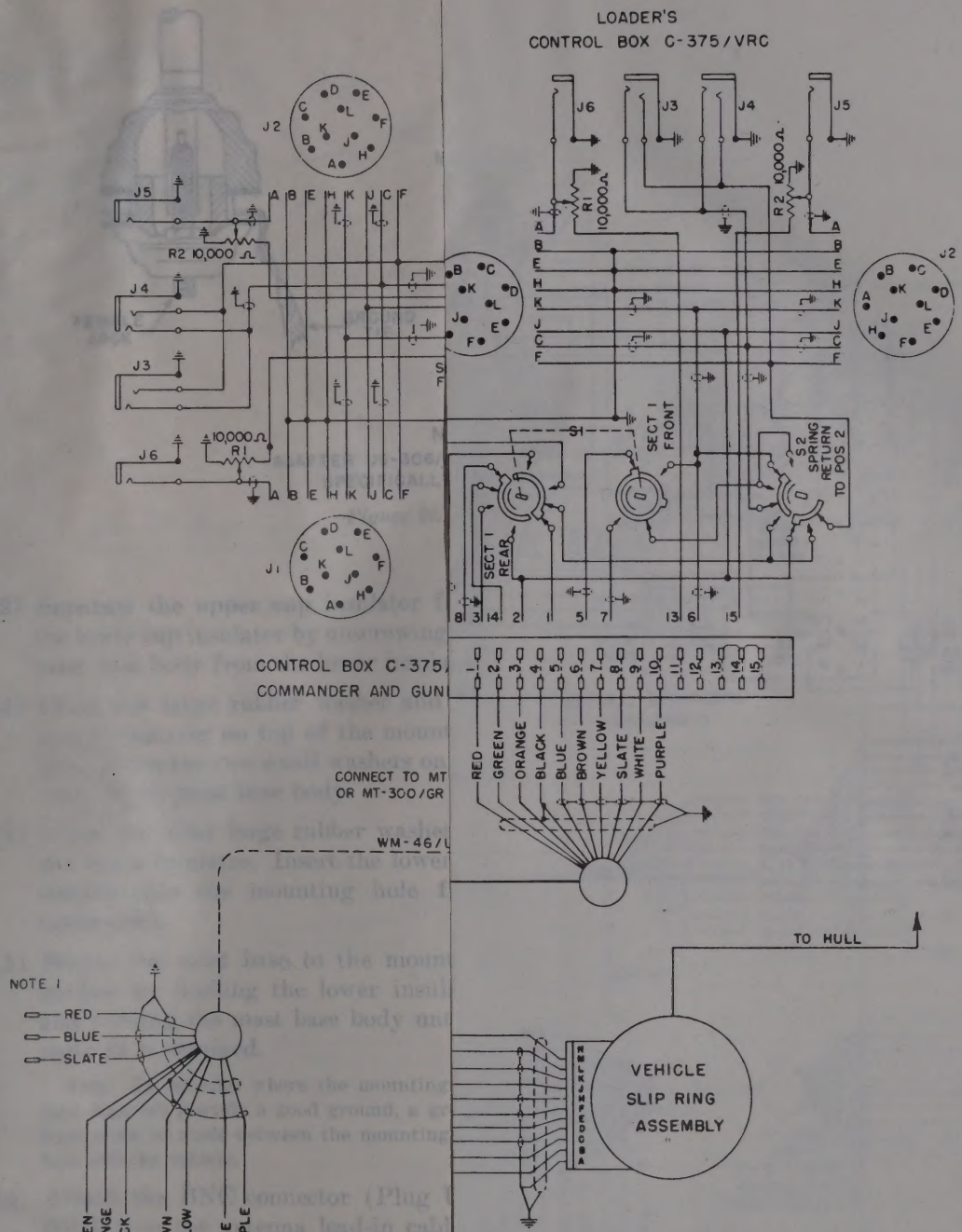
| ITEM NO. | NAME OF ITEM | QUAN. REQ'D. | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | RECEIVER TRANSMITTER RT-66/GRC | 1 | 1 | | | | |
| 2 | RECEIVER TRANSMITTER RT-70/GRC | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | RECEIVER TRANSMITTER RT-67/GRC | | | 1 | 1 | | |
| 4 | RECEIVER TRANSMITTER RT-68/GRC | | | | | 1 | 1 |
| 5 | RADIO RECEIVER R-108/GRC | 1 | | | | | |
| 6 | RADIO RECEIVER R-109/GRC | | | 1 | | | |
| 7 | RADIO RECEIVER R-110/GRC | | | | | 1 | |
| 8 | POWER SUPPLY PP-112/GR | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | POWER SUPPLY PP-282/GRC | 2 | 1 | 2 | 1 | 2 | 1 |
| 10 | AF AMPLIFIER AM-65/GRC | 1 | 1 | 1 | 1 | 1 | 1 |
| 11 | MOUNTING MT-297/GR | 1 | 1 | 1 | 1 | 1 | 1 |
| 12 | CONTROL C-435/GRC | 1 | 1 | 1 | 1 | 1 | 1 |
| 13 | CONTROL BOX C-375/VRC | 3 | 3 | 3 | 3 | 3 | 3 |
| 14 | MAST BASE AB-15/GR | 2 | 2 | 2 | 2 | 2 | 2 |
| 15 | MAST SECTION MS-116-A | 1 | 1 | 1 | 1 | | |
| 16 | MAST SECTION MS-117-A | 1 | 1 | 1 | 1 | | |
| 17 | MAST SECTION MS-118-A | 1 | 1 | 1 | 1 | | |
| 18 | MAST SECTION AB-22/GR | 1 | 1 | 1 | 1 | 1 | 1 |
| 19 | MAST SECTION AB-24/GR | 1 | 1 | 1 | 1 | 2 | 2 |
| 20 | RF CABLE ASSEMBLY CG-568/U (4FT.-2 IN.) | 1 | 1 | | | | |
| 21 | RF CABLE ASSEMBLY CG-530/U (4FT.-2 IN.) | 1 | 1 | 2 | 2 | 2 | 2 |
| 22 | SPECIAL PURPOSE CABLE ASSY CX-1213/U | 1 | 1 | 1 | 1 | 1 | 1 |
| 23 | SPECIAL PURPOSE CABLE ASSY CX-1211/U | 1 | 1 | 1 | 1 | 1 | 1 |
| 24 | WIRE W-142 (6 IN. LG.) | 1 | | 1 | | 1 | |
| 25 | CABLE WM-46/U (7FT.-1 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | CABLE WM-46/U (7FT.-8 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 27 | CABLE WM-46/U (5FT.-5 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 28 | CABLE WM-46/U (7FT.-4 IN. APPROX.) | 1 | 1 | 1 | 1 | 1 | 1 |
| 29 | CONNECTOR, CONDUIT NOTE 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30 | CONNECTOR, PER SC-C-16576 GP IV | 3 | 3 | 3 | 3 | 3 | 3 |
| 31 | ADAPTER UG-273/U | 2 | 2 | 2 | 2 | 2 | 2 |
| 32 | ADAPTER UG-306/U | 3 | 3 | 3 | 3 | 3 | 3 |
| 33 | INSULATOR IL-2/U | 1 | 1 | 1 | 1 | 1 | 1 |
| 34 | HOOK | 3 | 3 | 3 | 3 | 3 | 3 |
| 35 | CLAMP RED | 10 | 10 | 10 | 10 | 10 | 10 |
| 36 | CLAMP BLACK | 6 | 6 | 6 | 6 | 6 | 6 |
| 37 | CLAMP GREEN | 1 | 1 | 1 | 1 | 1 | 1 |
| 38 | CLAMP ORANGE | 9 | 9 | 9 | 9 | 9 | 9 |
| 39 | CLAMP BLUE | 1 | 1 | 1 | 1 | 1 | 1 |
| 40 | CLAMP RED BLACK | 3 | 3 | 3 | 3 | 3 | 3 |
| 41 | PLUG ASSEMBLY NOTE 3 & 7 | 1 | 1 | 1 | 1 | 1 | 1 |
| 42 | ACCESSORY ASSEMBLY NOTE 4 & 7 | 1 | 1 | 1 | 1 | 1 | 1 |
| 43 | HEX HD MACH SCR 5/16-24 X 3/4 LG. | 8 | 8 | 8 | 8 | 8 | 8 |
| 44 | HEX HD MACH SCR 5/16-24 X 1 1/2 LG. | 6 | 6 | 6 | 6 | 6 | 6 |
| 45 | HEX HD MACH SCR 1/4-28 X 1/2 LG. | 15 | 15 | 15 | 15 | 15 | 15 |
| 46 | RD HD MACH SCR NO 8-32 X 1/2 LG | 18 | 18 | 18 | 18 | 18 | 18 |
| 47 | RD HD MACH SCR NO. 8-32 X 3/4 LG. | 2 | 2 | 2 | 2 | 2 | 2 |
| 48 | HEX NUT 5/16-24 STD | 6 | 6 | 6 | 6 | 6 | 6 |
| 49 | HEX NUT NO. 8-32 STD | 2 | 2 | 2 | 2 | 2 | 2 |
| 50 | LOCKWASHER 5/16 I.E.T. | 8 | 8 | 8 | 8 | 8 | 8 |
| 51 | LOCKWASHER 5/16 I.T. | 12 | 12 | 12 | 12 | 12 | 12 |
| 52 | LOCKWASHER 1/4 I.E.T. | 15 | 15 | 15 | 15 | 15 | 15 |
| 53 | LOCKWASHER NO. 8 I.E.T. | 18 | 18 | 18 | 18 | 18 | 18 |
| 54 | TERMINAL } NOTE 10 | 3 | 3 | 3 | 3 | 3 | 3 |
| 55 | TERMINAL } NOTE 10 | 27 | 27 | 27 | 27 | 27 | 27 |

NOTE 5

TM 284-304

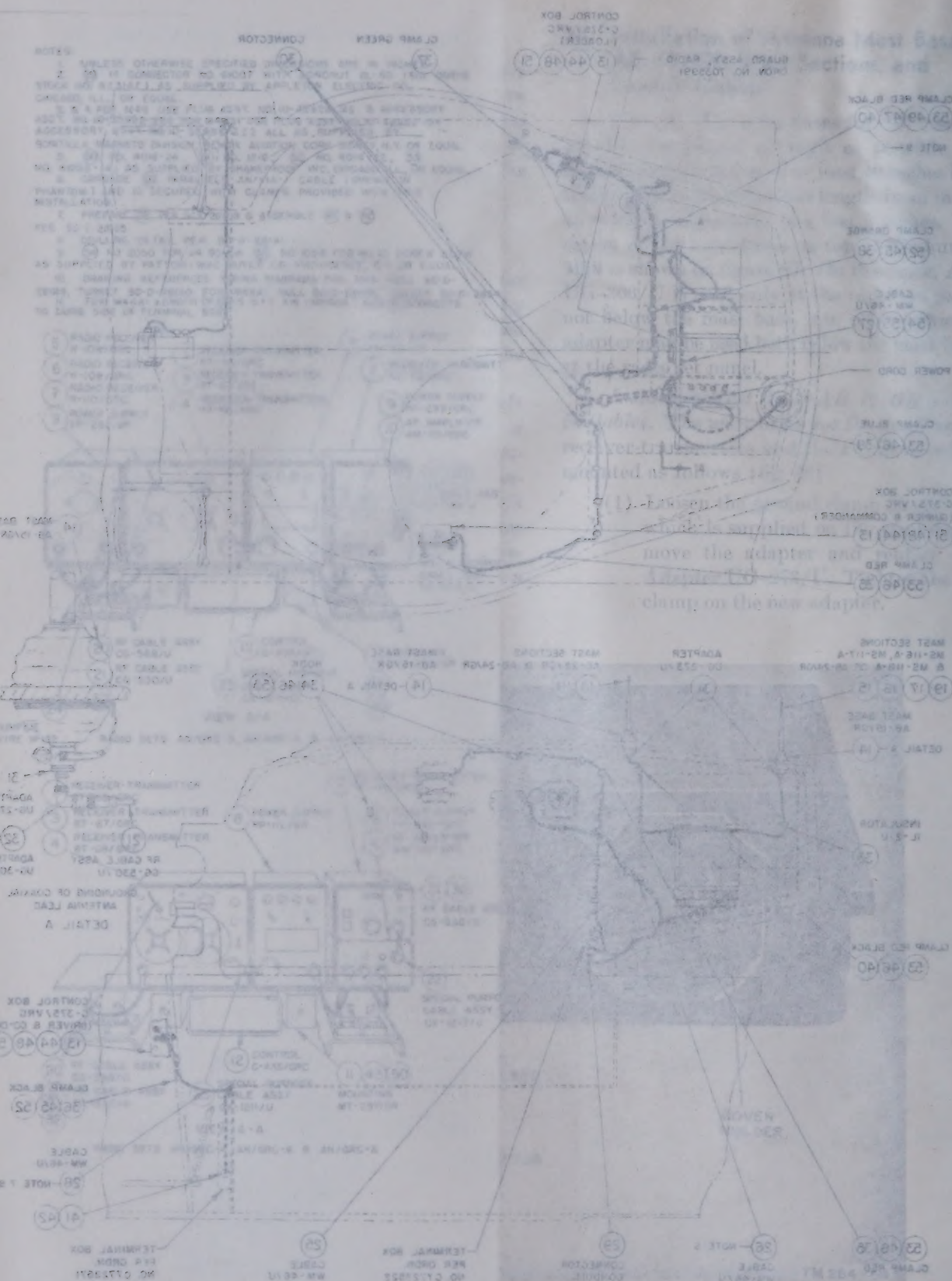
*Figure 27. Installation of Radio Sets AN/GRC-3 through -8 in M46 tank.*






NOTE:
1. TAPE ENDS OF UNUSED LEADS
2. FOR HULL WIRING SEE SC-D-28189
3. REMOVE JUMPERS 14 TO 15 TO 16 AND 17 TO 18

TM 284-306



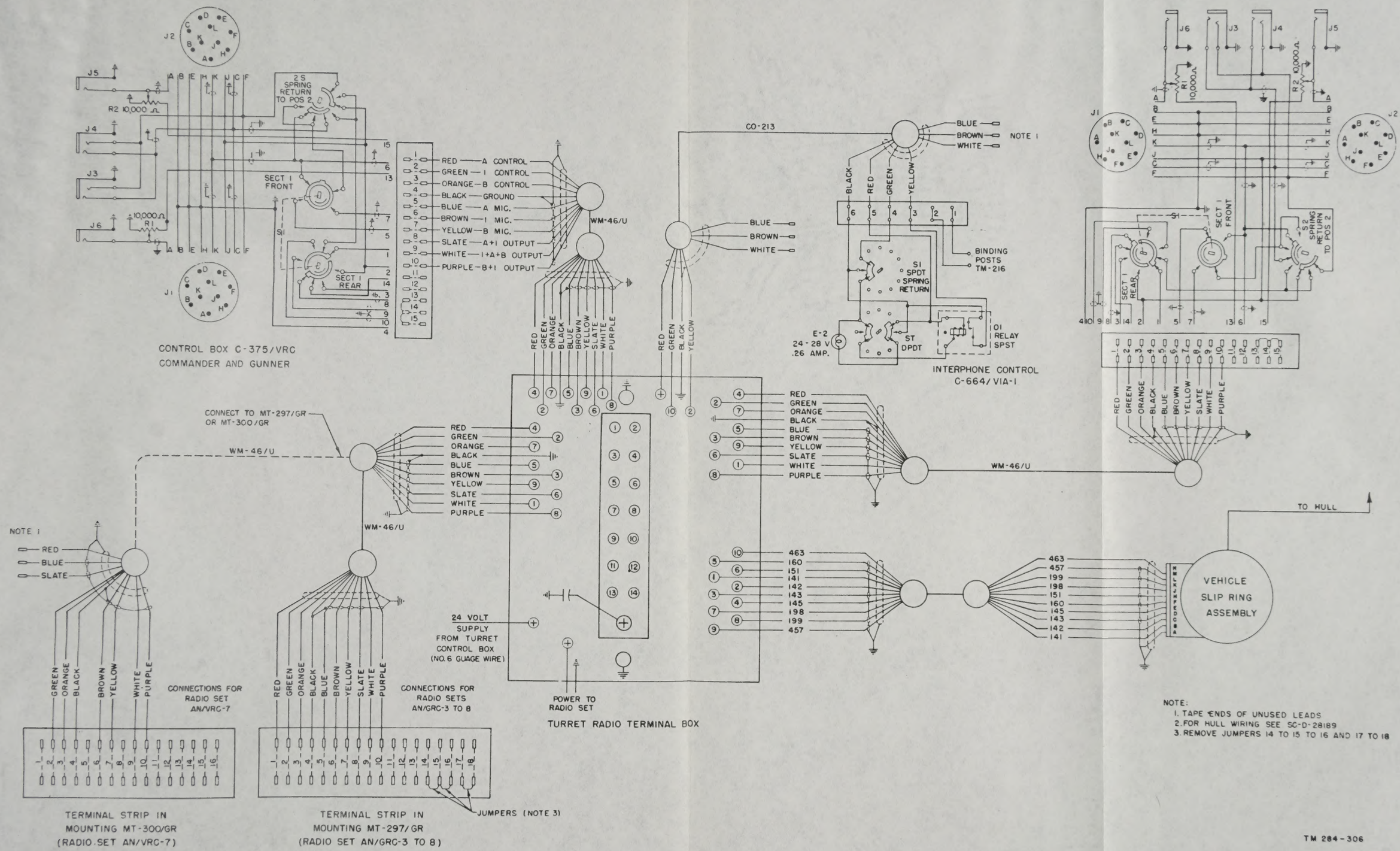
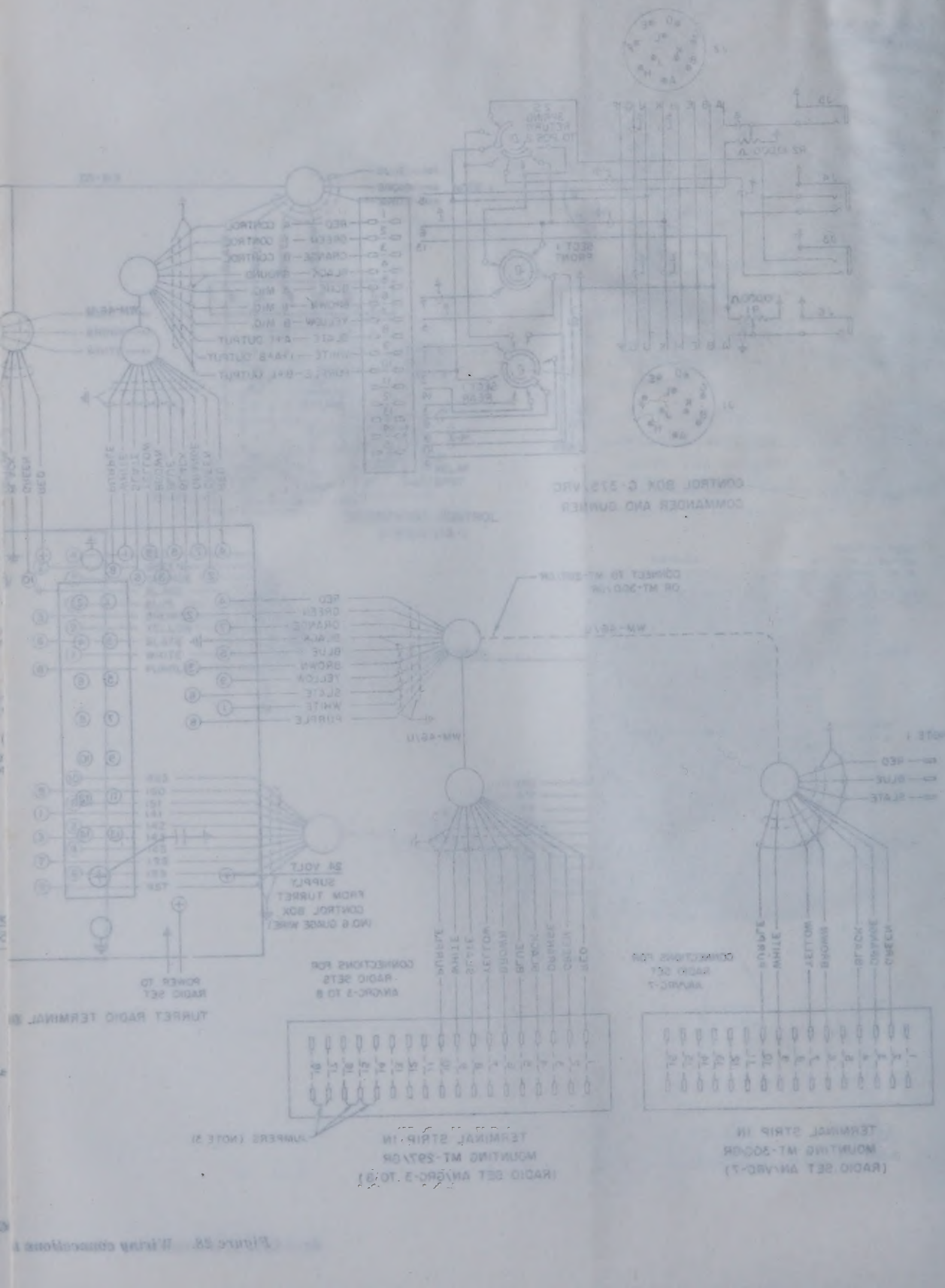



*Figure 28. Wiring connections to turret radio terminal box in M46 tank.*



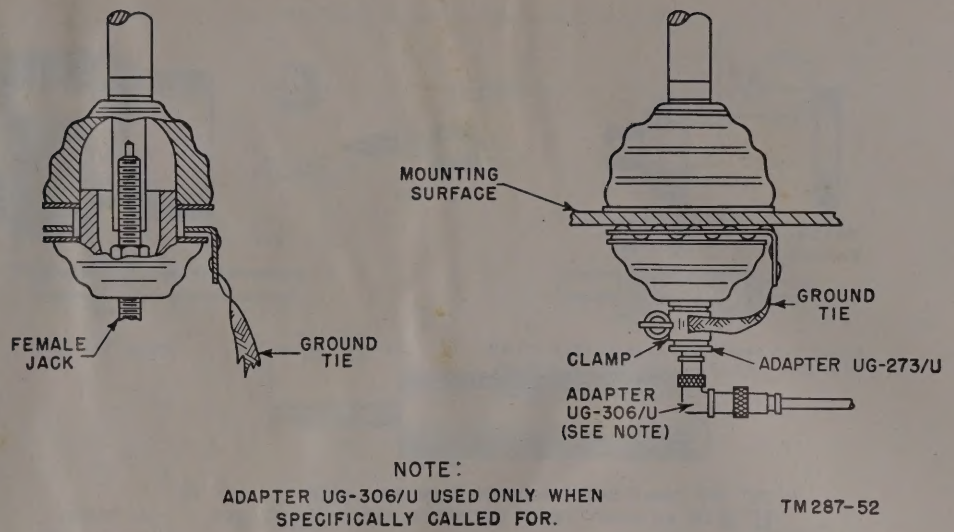



*Figure 30. Mast Base AB–15/GR.*

(2) Separate the upper cup insulator from the lower cup insulator by unscrewing the mast base body from the lower insulator.

(3) Place one large rubber washer and the upper insulator on top of the mounting hole. Place the two small washers on the stem of the mast base body.

(4) Place the other large rubber washer on the lower insulator. Insert the lower insulator into the mounting hole from underneath.

(5) Secure the mast base to the mounting surface by holding the lower insulator and turning the mast base body until a tight fit is obtained.

*Note.* In vehicles where the mounting surface does not provide a good ground, a ground bond must be made between the mounting surface and the vehicle.

(6) Attach the BNC connector (Plug UG–260/U) on the antenna lead-in cable to Adapter UG–273/U. Figure 33 indicates that only Receiver-Transmitter RT–66/GRC uses RF Cable Assembly CG–568/U. Receiver-Transmitters RT–67/GRC, RT–68/GRC, and RT–70/GRC all use RF Cable Assembly CG–530/U. The free ends of the lead-in cables will be connected to Set 1 and Set 2 after these units are installed on the mounting.

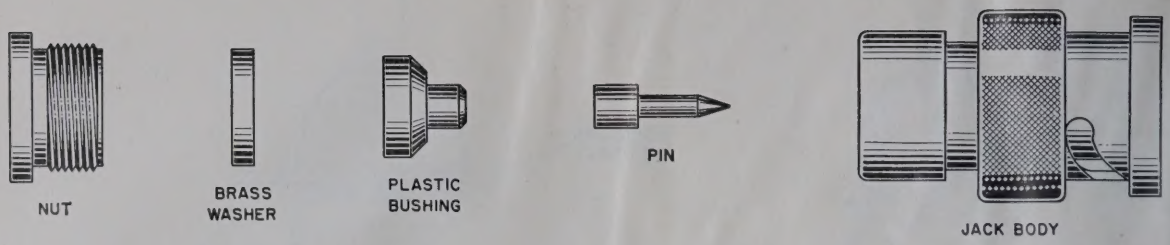
*c. Installing Antenna Mast Sections.* As shown in the table on figure 33, Receiver-Transmitter RT–66/GRC and RT–67/GRC use one each of Mast Sections MS–116–A, MS–117–A, and MS–118–A. Receiver-Transmitter RT–68/GRC uses one each of Mast Sections MS–117–A and AB–24/GR. Receiver-Transmitter RT–70/GRC uses one each of Mast Sections AB–22/GR and AB–24/GR. Screw the required mast sections together for the Set 1 mast base and then screw the assembly into the Set 1 mast base. Screw Mast Sections AB–22/GR and AB–24/GR together and then screw the assembly into the Set 2 mast base.

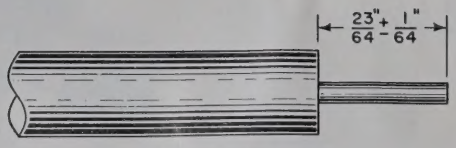
*Note.* In most cases the 50-inch antenna cables supplied with the radio sets are sufficiently long. In those cases where a longer length is required, cable and connectors will be supplied in the installation units. If the connectors are not already assembled to the cables, terminate the cables in accordance with instructions given on figures 31 and 32.

## 34. Installation of Power Supply in Interphone Amplifier

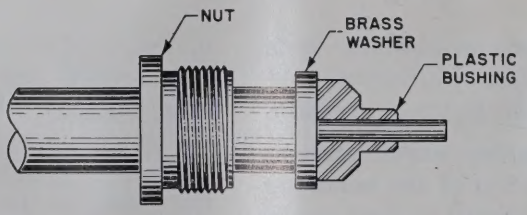
*a.* A plug-in power supply must be inserted inside the amplifier. In vehicles with a 12-volt storage battery, Power Supply PP–281/GRC is used. In vehicles such as Medium Tank M46, which use a 24-volt storage battery, Power Supply PP–282/GRC is used.

*b.* Loosen the Dzus fasteners on the front edges of the amplifier and remove the panel-chassis assembly from the outer case.

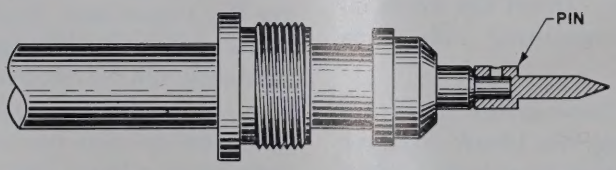


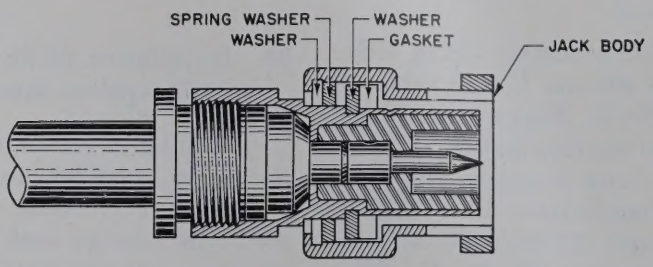

1. CUT OFF CABLE SHARP AND SKIN BACK INSULATION CLEANLY TO $\frac{23}{64} + \frac{1}{64}$ OF AN INCH. TWIST THE WIRES AND DIP IN SOLDER.




2. SLIP NUT, BRASS WASHER, AND PLASTIC BUSHING ON CABLE AS SHOWN.




3. SLIP PIN ON WIRE AND PUSH BACK AS FAR AS POSSIBLE. HEAT PIN WITH SOLDERING IRON AND FLOW SOLDER INTO THE HOLE IN THE PIN TO MAKE A GOOD CONNECTION. TAKE CARE NOT TO OVERHEAT THE PLASTIC BUSHING.

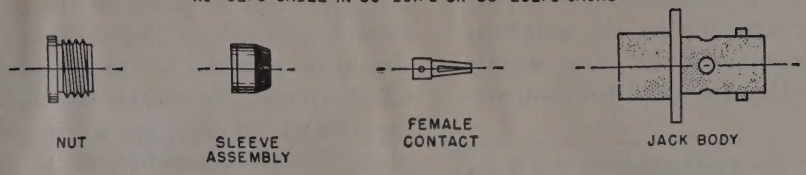


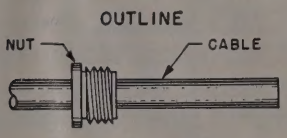

4. PLACE JACK BODY ON CABLE AND RUN NUT UP TO SECURE A TIGHT FIT.

TM 611-14

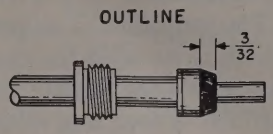
*Figure 31. Termination of RF Cable Assembly CG-568/U.*

RG-62/U CABLE IN UG-261/U OR UG-262/U JACKS

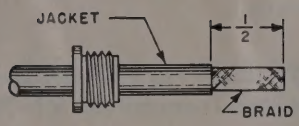


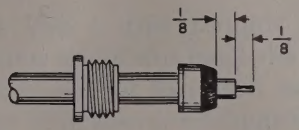

1. CUT OFF SHARP



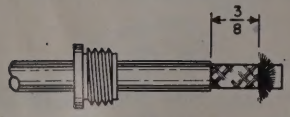

6. WITH SLEEVE IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN, AND TRIM TO $\frac{3}{32}$ INCH FROM END.



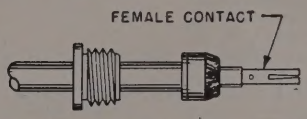

2. CUT OFF JACKET $\frac{1}{2}$ INCH FROM END BEING CAREFUL NOT TO NICK BRAID



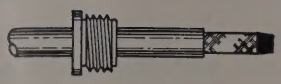

CUT INNER DIELECTRIC $\frac{1}{8}$ INCH FROM BRAID, BEING CAREFUL NOT TO NICK INNER CONDUCTOR AND CUT OFF INNER CONDUCTOR $\frac{1}{8}$ INCH FROM END OF DIELECTRIC.



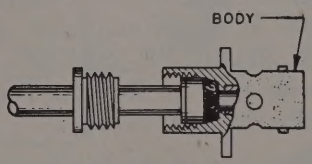

3. CUT OFF INNER INSULATION AND WIRE UNDER BRAID $\frac{3}{8}$ INCH FROM END OF JACKET.



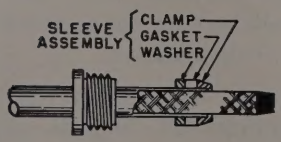

8. TIN INSIDE HOLE OF FEMALE CONTACT, TIN CENTER CONDUCTOR OF CABLE, SLIP FEMALE CONTACT IN PLACE AND SOLDER, REMOVE EXCESS SOLDER. BE SURE CABLE DIELECTRIC IS NOT HEATED EXCESSIVELY AND SWOLLEN SO AS TO PREVENT DIELECTRIC ENTERING BODY.



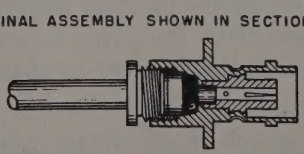
4. TAPER BRAID




9. PUSH INTO BODY AS FAR AS IT WILL GO, THEN SLIDE NUT INTO BODY AND SCREW INTO PLACE, WITH WRENCH, UNTIL MODERATELY TIGHT. HOLD CABLE AND SHELL RIGIDLY AND ROTATE NUT.




5. SLIDE SLEEVE OVER TAPERED BRAID TO FIT TIGHT AGAINST JACKET. BE SURE INNER SHOULDER OF SLEEVE FITS SQUARELY AGAINST END OF CABLE JACKET.




10. THE ASSEMBLY FOR PLUGS IS THE SAME EXCEPT FOR THE USE OF MALE CONTACTS AND A UG-260/U BODY.

TM284-204

*Figure 32. Termination of RF Cable Assembly CG-530/U.*

*c.* Insert and clamp the plug-in power supply (fig. 13) in the compartment on the amplifier chassis so that the receptacle on the power supply mates with the plug within the amplifier compartment.

*d.* Check the fuse in the fuseholder on the front panel of the amplifier. The amplifier is shipped with a 4-ampere fuse which is suitable for operation in a 24-volt system with Power Supply PP–282/GRC. When the amplifier is used in a vehicle with a 12-volt battery supply, replace the 4-ampere fuse with a 10-ampere fuse from the running spares supplied with the unit (par. 22*d*). Place a spare fuse, of the same value as the one in use in the clips, on the chassis (fig. 74).

*e.* The amplifier is shipped with a 24V 4A marker in place on the left-hand side of the amplifier panel. This marker is correct for use in 24-volt vehicles. When the amplifier is used in 12-volt vehicles, replace this marker by a 12V 10A marker which is located on the reverse side of the 24V 4A marker.

*f.* Turn the internal switch (S–1) on the amplifier chassis (fig. 74) to the 24V position (12V for a 12-volt vehicle).

*g.* Replace the panel-chassis assembly in the case and turn the OFF–INT–RT–70 switch to OFF.

## 35. Installation of Power Supply in Auxiliary Receiver

*a.* Insert the same type of plug-in power supply in the auxiliary receiver as in the amplifier. In 12-volt vehicles, Power Supply PP–281/GRC is used. In 24-volt vehicles such as Medium Tank M46, Power Supply PP–282/GRC is used.

*b.* Loosen the Dzus fasteners on the front edges of the receiver and remove the panel-chassis assembly from the outer case.

*c.* Insert and clamp the plug-in power supply (fig. 13) in the compartment on the receiver chassis so that the receptacle on the power supply mates with the plug within the receiver compartment.

*d.* Turn the internal switch (S–1) on the right-hand side of the receiver chassis to the 6, 12, & 24 VOLTS position (fig. 85).

*e.* The receiver is shipped with a 24V 4A marker in place. In Medium Tank M46, this marker should be left in place on the panel. When the receiver is used in 12-volt vehicles, the marker should be reversed so that the face marked 12V 4A is exposed. To reverse the marker, remove the fuse cap and knurled nut which secure the marker plate. Then reverse the marker plate so that the face with 12V 4A is exposed. Secure the plate by replacing and tightening the knurled nut and the fuse cap. The marker serves as a reminder to use the proper plug-in power-supply unit (PP–281/GRC or PP–282/GRC), depending on the voltage supply of the vehicle.

*f.* Replace the panel-chassis assembly in the case and place the combined power and VOLUME control of the receiver in the OFF position (extreme counterclockwise).

## 36. Setting FIELD-VEH-TANK Switch in Receiver-Transmitter RT–70/GRC

*a.* Loosen the Dzus fasteners on the front edges of the receiver-transmitter and remove the panel-chassis assembly from the outer case.

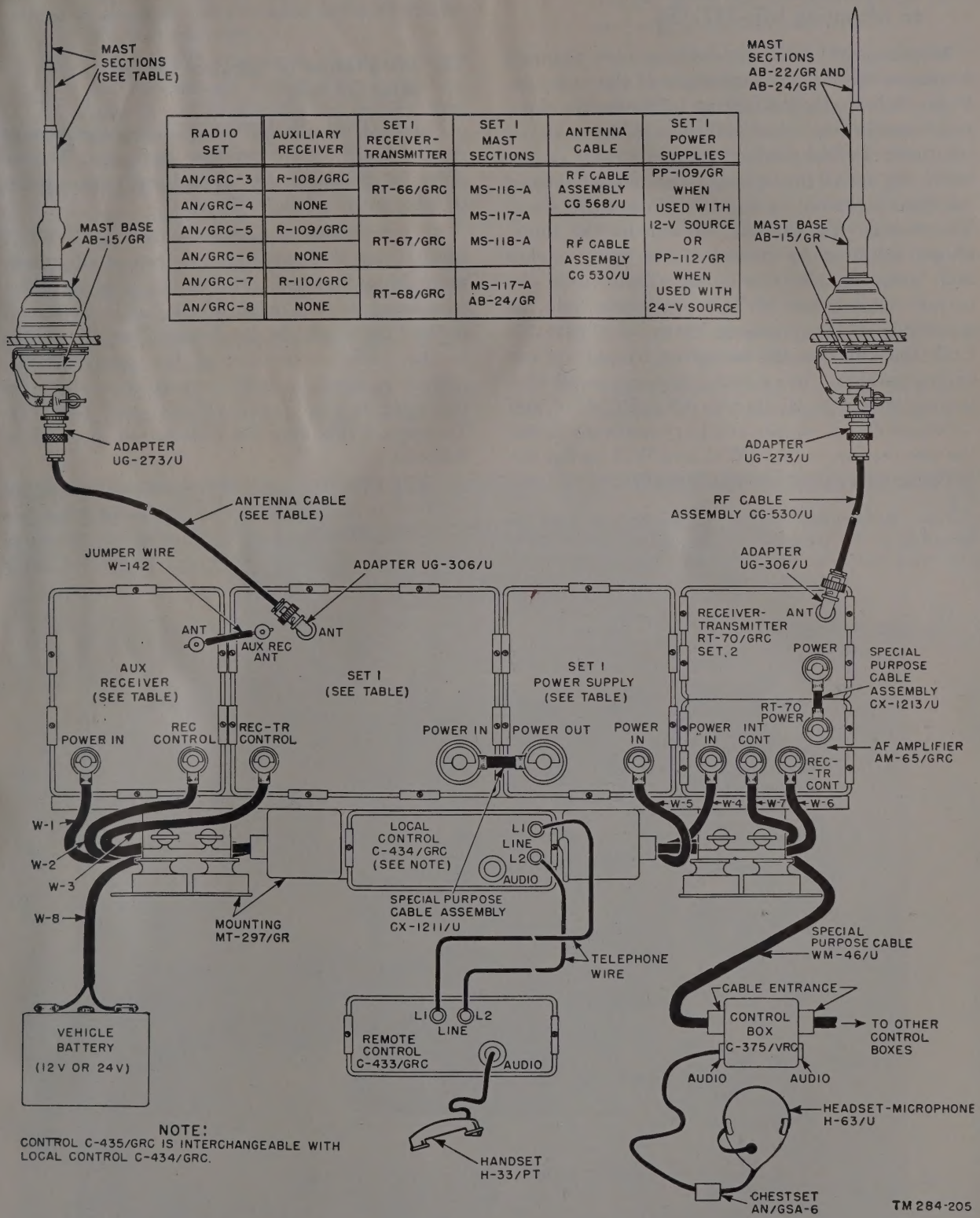
*b.* Set the FIELD-VEH-TANK switch, on the chassis of the Set 2 receiver-transmitter (fig. 78), as follows:

(1) In tanks and all installations containing more than one control position, set the switch at TANK. Use headsets and microphones rather than handsets. Otherwise, an interfering howl will occur during transmission. The TANK position of the switch allows transmission over Set 2 to be monitored at other control positions of the radio set.

(2) In vehicular installations where there is only one control position and where a handset and loudspeaker are used, set the switch at VEH. This allows the speaker to monitor but makes the speaker output inaudible during transmission over Set 2. It also prevents howl due to acoustic feedback between the earpiece and mouthpiece of the handset.

(3) In a field installation where Receiver-Transmitter RT–70/GRC is powered by Case CY–590/GRC (par. 169), set the switch at FIELD. This prevents unnecessary drain being put on the battery.

*c.* Replace the panel-chassis assembly in the case.




| RADIO SET | AUXILIARY RECEIVER | SET I RECEIVER-TRANSMITTER | SET I MAST SECTIONS | ANTENNA CABLE | SET I POWER SUPPLIES |
|---|---|---|---|---|---|
| AN/GRC-3 | R-108/GRC | RT-66/GRC | MS-116-A | RF CABLE ASSEMBLY CG 568/U | PP-109/GR WHEN USED WITH 12-V SOURCE OR PP-112/GR WHEN USED WITH 24-V SOURCE |
| AN/GRC-4 | NONE | | MS-117-A | | |
| AN/GRC-5 | R-109/GRC | RT-67/GRC | MS-118-A | RF CABLE ASSEMBLY CG 530/U | |
| AN/GRC-6 | NONE | | | | |
| AN/GRC-7 | R-110/GRC | RT-68/GRC | MS-117-A AB-24/GR | | |
| AN/GRC-8 | NONE | | | | |

NOTE:
CONTROL C-435/GRC IS INTERCHANGEABLE WITH LOCAL CONTROL C-434/GRC.

*Figure 33. Generalized installation of Radio Sets AN/GRC-3 through -8.*

## 37. Installation of Components on Mounting MT–297/GR

Mounting MT–297/GR contains nine channels to receive the major components of the radio set. Figure 9 indicates the locking levers for the channels, some in the locked and some in the unlocked positions. Before placing the components on the mounting, set all the locking levers in the unlocked positions retracted to the left. Fasten Receiver-Transmitter RT–70/GRC on top of the interphone amplifier by means of the snap catches and hooks on the two units. Then place the major components in the channels on the mounting in the positions shown on figure 33. Lock the units on the mounting by pulling out and to the right (in a circular motion) on all nine locking levers. In Radio Sets AN/GRC–4, –6, and –8, which do not contain auxiliary receivers, fasten the two receiver cables (W–1 and W–2 on fig. 26) to the unused cable mounts (lower left of fig. 26).

*Note.* In most installations, the connections from the mounting to the vehicular storage battery (cable W–8) and from the mounting to Control Boxes C–375/VRC (Special Purpose Cable WM–46/U) are made through vehicular junction boxes as shown on figures 25 and 28.

## 38. Installation of Control Group AN/GRA–6

Control Group AN/GRA–6 is used when remote control facilities are required (par. 45). It provides for remote power control and remote push-to-talk control of the radio set.

*a. Installation of Local Control C–434/GRC.* Local Control C–434/GRC is connected underneath Mounting MT–297/GR in the place otherwise occupied by Control C–435/GRC. A second method by which the local control unit is cabled to the audio receptacles of the receiver-transmitters is used in field installations where no mounting is used (pars. 167*a*(8) and 169*a*(7)). To prepare this unit for installation, proceed as follows:

(1) Open the cover of the cable compartment at the rear (fig. 34) and extend the two cables. Loosen the thumbscrew fasteners on the panel of Local Control C–434/

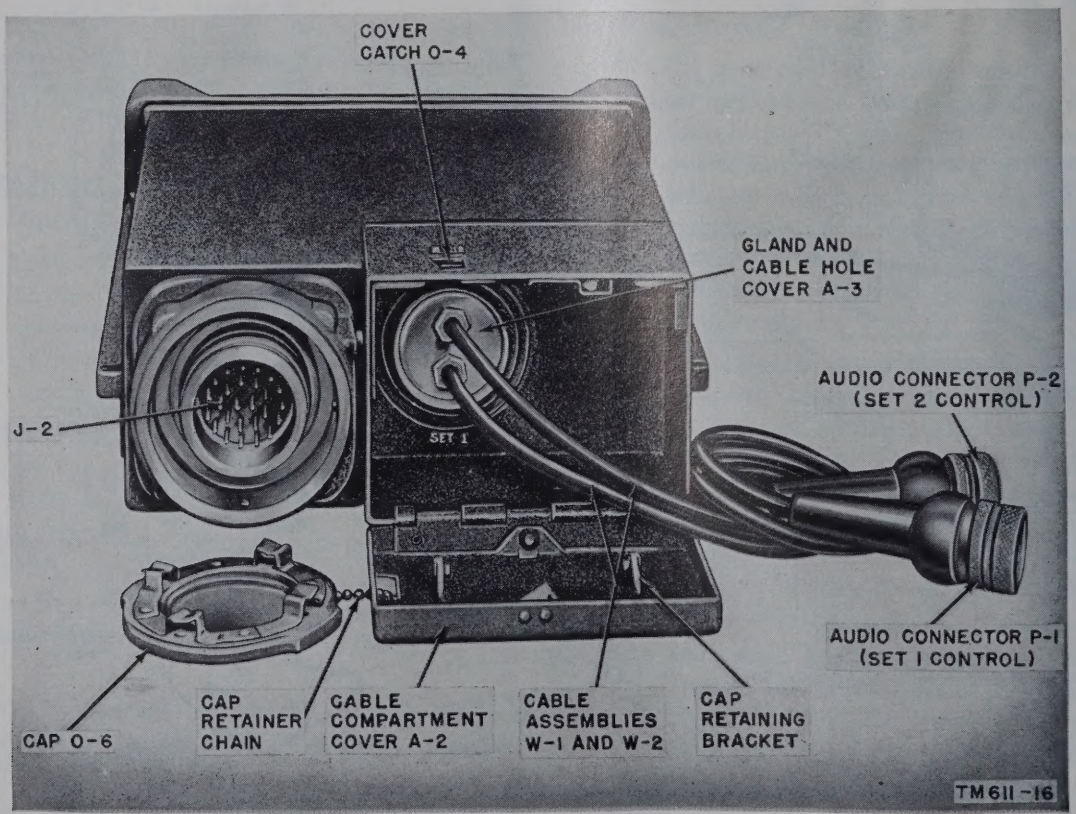



*Figure 34. Local Control C–434/GRC, rear view.*

GRC and remove the panel-chassis assembly from the case.

(2) To install the batteries, place the panel-chassis assembly bottom side up and release the catch holding the battery compartment cover in place. Remove the cover (fig. 35).

(3) Install one Battery BA–30 so that the outer metal base rests on the spring on the floor of the container.

(4) Install the other Battery BA–30 so that its base faces up, and the center electrode (the positive terminal) rests against the flat battery contact on the floor of the compartment.

(5) Replace the compartment cover, making sure that the batteries make proper connection with the contacts on the cover and within the compartment.

(6) Set the BELL-LAMP switch, mounted on a bracket attached to the panel-chassis assembly, in the BELL position if an audible indication of the ringing signal is desired, or to the LAMP position if a visual signal indication is desired. Check to see whether the pilot lamp is installed in its holder. The pilot lamp is reached from the rear of the panel by pulling the lamp socket out of its holder. Pull straight toward the rear of the unit.

(7) Replace the panel-chassis assembly in the case, and tighten the screw fasteners.

(8) Insert the local control unit in the mounting below the mounting table. Lock it in

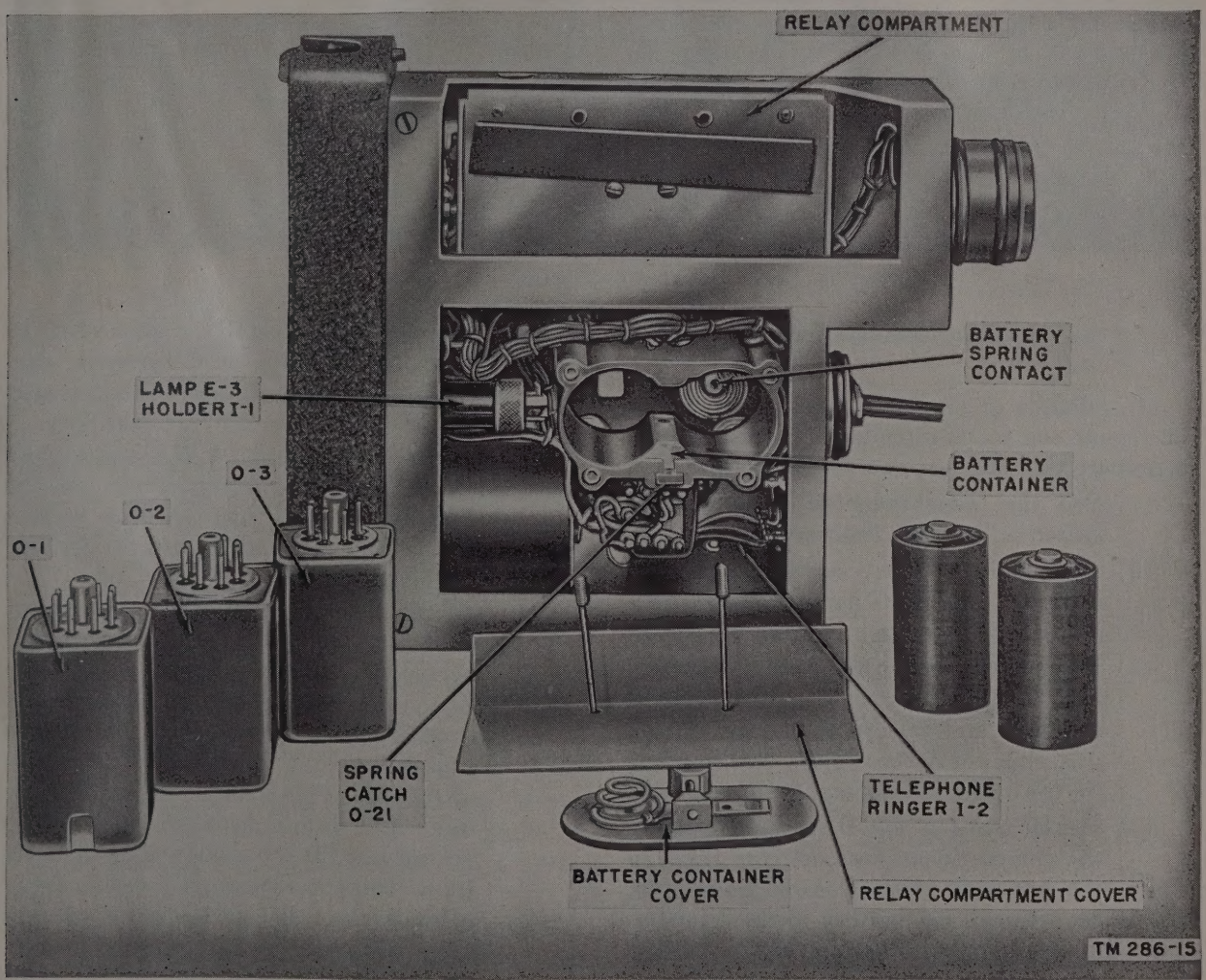



*Figure 35. Local Control C–434/GRC, bottom view of chassis.*

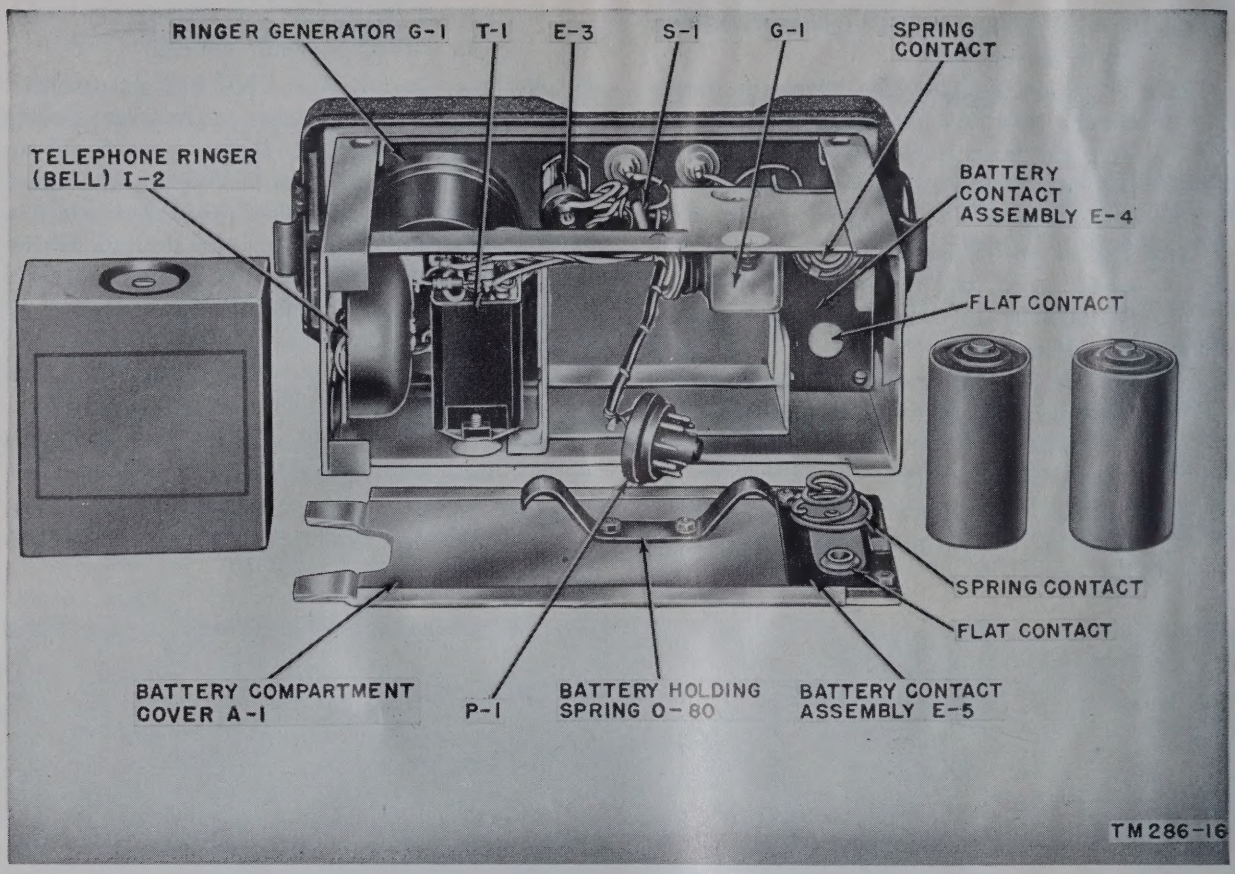



*Figure 36. Remote Control C–433/GRC, rear view of chassis.*

place with the locking lever on the mounting.

*b. Installation of Remote Control C–433/GRC.* The remote control is intended for portable use. To prepare the unit, proceed as follows:

(1) Set the panel-mounted SELECTOR switch to the TEL position (fig. 36).

(2) Release the two snap catches which hold the outer case to the panel-chassis assembly, and remove the unit from the case.

(3) Remove the tape which secures the battery compartment cover to the sides of the unit, and remove the cover. To do this, slide the cover slightly back to clear the tab on one side; then lift the cover off.

(4) Install two 1½-volt Batteries BA–30 in the compartment provided for them in the left rear of the chassis frame (fig. 36). Install one battery in the compartment so that the bottom of the battery outer case (negative electrode) rests over the spring contact on the battery compartment floor. Install the second battery so that the center post (positive electrode) of the battery rests on the flat contact on the battery compartment floor.

(5) Insert 45-volt Battery BA–414/U into the large battery compartment in the chassis frame, so that the octal sockets on the battery faces up (towards the rear of the unit).

(6) Insert octal male plug P–1 at the end of the battery cable into the battery socket. Do not twist the battery cord excessively.

(7) To restore the battery compartment cover, insert the two projections at one edge of the cover under the bracket angles on the side of the chassis. Press the cover down and slide it forward until the lip (or tab) at the other edge of the chassis frame slides over the corresponding notch in the cover. Release the pressure, and check to see that the tab is locked properly, and that the batteries are positioned properly.

(8) Set the internal BELL-LAMP switch to the BELL position if audible indication of the ringing signal is desired. Set this switch to the LAMP position if a visual indication of the ringing signal is desired.

(9) Check to see if the pilot lamp is installed in its holder. The pilot lamp is reached from the rear of the panel by pulling the lamp socket out of its holder. Pull straight toward the rear of the unit.

(10) Restore the panel-chassis assembly in the case and fasten it to the panel with the snap catches.

(11) Attach the carrying strap (stored in Bag CW–189/GR) to the D rings on the outer case of the unit.

*c. Interconnections.*

(1) Interconnect Local Control C–434/GRC and Remote Control C–433/GRC over the distance required. This distance can be as much as 6 to 8 miles. Field type WD–1/TT or an equivalent 2-wire telephone line may be used for the interconnection. Strip the insulation from the ends before clamping them in the binding posts (designated L–1 and L–2) on each of the units.

(2) Similarly designated posts should be interconnected (L1 on local control unit to L1 on remote control unit, etc.) Make a continuity check to insure proper connections.

*d. Installation of Audio Accessories.*

(1) Handset H–33/PT usually is used at the remote unit. To install the handset, attach the connector plug at the end of the handset cord to the AUDIO receptacle on the remote control unit. To do this, line up the key of the cable connector and the slot of the panel-mounted audio receptacle. Then rotate the cable connector clockwise to lock it in place. A clip provided on the handset permits attaching it to the pocket or belt of the operator, the rim of the front panel of the remote control unit, or the carrying strap when not in use.

(2) Chest Set Group AN/GSA–6 with Headset-Microphone H–63/U usually is used at the local control unit. If the chest set is used, lock the RADIO-INT switch in the RADIO position by the internal lock (fig. 48). Connect the cable from the chest set to the AUDIO receptacle on the control unit, and the cable from Headset-Microphone H–63/U to the corresponding receptacle on the chest set. (Usually, only one audio accessory is provided for each Control Group AN/GRA–6.)

*Note.* Remove the batteries from the local and remote control units unless it is expected that they will be used within 24 hours.

## 39. Storage of Equipment Not in Use

Equipment not immediately required for operation, such as running spares, audio accessories, Control Group AN/GRA–6, or Control C–435/GRC, should be packed in the containers provided and stored in a convenient place within the vehicle.

*a. Running Spares.* All spare mast sections should be placed in the pockets of Bag CW–206/GR. Since Case CY–684/GR may not hold all the spare parts provided, a careful selection should be made from the spares available. It is suggested that the following list be used as a guide in selecting the spares for packaging in Case CY–684/GR.

| Spare part | Quantity |
|---|---|
| Vibrator (6-volt or 24-volt for 12- and 24-volt systems, respectively). | 1 |
| Relay, Raytheon CK–118 | 1 |
| Ballast tube, 800 ma | 1 |
| Ballast tube, 600 ma | 1 |
| Tube type 0A2 | 1 |
| Tube type 0B2 | 1 |
| Tube type 2E24 | 1 |
| Tube type 6AK6 | 1 |
| Tube type 6AK5 | 2 |
| Tube type 3A5 | 2 |
| Tube type 3A5 | 2 |
| Tube type 3Q4 | 2 |
| Tube type 3A4 | 1 |
| Tube type 3B4 | 1 |
| Tube type 1L4 | 2 |
| Tube type 1S5 | 1 |
| Tube type 1A3 | 2 |
| Tube type 1U4 | 3 |
| Tube type 1R5 | 3 |
| Tube type 1AE4 | 1 |
| Tube type 12AU7 | 1 |
| Tube, type 1107 | 1 |
| Lamp, GE NE–51 | 1 |
| Lamp, Mazda #331 | 2 |
| Fuse (10-ampere or 4-ampere for 12- and 24-volt systems, respectively). | 3 |

*b. Audio Accessories and Technical Manuals.* Audio accessories not required for operation can be stored in Bag CW–206/GR. Technical manuals can be stored in the same bag.

*c. Control Group AN/GRA–6.* When Control Group AN/GRA–6 is not required for operation, it should be stored in Bag CW–189/GR. If the control group is in use, and Control C–435/GRC is not being used, the bag can be used to accommodate the unused unit.

# CHAPTER 3

# OPERATION

## Section I. OPERATIONAL FACILITIES

### 40. Monitoring

Listening in on a conversation entering the radio set or being transmitted through the set from any of the control positions constitutes monitoring Each of the receivers in the radio set can be operated individually as a monitor. Usually all receivers are monitored simultaneously at the control boxes (par. 71). They also can be monitored at their own panel AUDIO connectors and the panel AUDIO connectors of the retransmission unit, and the interphone amplifier. When Control Group AN/GRA–6 is used, the monitoring facilities can be extended to both the local and the remote control units.

### 41. Push-To-Talk Operation

*a.* Push-to-talk operation utilizes one-way reversible communication facilities. Receiving facilities are available provided that power is supplied to the equipment, but transmission requires closure of one or more switches (generally the push-to-talk switch of a chest set, handset, or microphone). Communication is possible only in one direction at a time, and it is impossible for the receiving party to interrupt the sending party.

*b.* Push-to-talk operation of either Set 1 or Set 2 may be selected at the control box, the retransmission unit, the local control unit, the remote control unit, or at the panels of Set 1 and Set 2 (pars. 71 through 74). The control box is most commonly used. The use of Control Group AN/GRA–6 makes it possible to extend push-to-talk power control facilities from the local installation to a control station as far as 6 to 8 miles away.

### 42. Interphone Communication

Duplex interphone facilities are available to the operators at each control box, at the retransmission unit, and at the interphone amplifier. Duplex operation means simultaneous two-way or *break-in* communication.

### 43. Retransmission

*a.* Facilities are provided for retransmission of any received signal. When these facilities are used, the radio set acts as a relay or repeater station between two other radio sets (fig. 37). Retransmission facilities are important tactically since they provide extension of communication range.

*b.* The retransmission unit (Control C–435/GRC) provides for automatic retransmission of signals received by either Set 1 or Set 2. The signal which arrives first controls the direction of retransmission, that is, whether the signal is received on Set 1 and transmitted on Set 2 or vice versa. Operating details are described in paragraph 73. In Radio Sets AN/GRC–3, –5, and –7, which have an auxiliary receiver, it is also possible to retransmit manually the output of the auxiliary receiver over the transmitter portion of the Set 2 receiver-transmitter.

### 44. Duplex Radio Communication

*a.* Duplex radio operation utilizes separate transmitting and receiving circuits to provide simultaneous communication in two directions. In the block diagram shown on figure 38, Receiver-Transmitter RT–68/GRC is used for transmitting while Set 2 or Radio Receiver R–110/GRC is used for receiving. Frequency allocations of the receiver-transmitter and the range limitations of Set 2 limit the duplex facilities available. Both stations involved in the duplex network must have separate transmitting and receiving facilities (with proper frequency arrangement of the units)

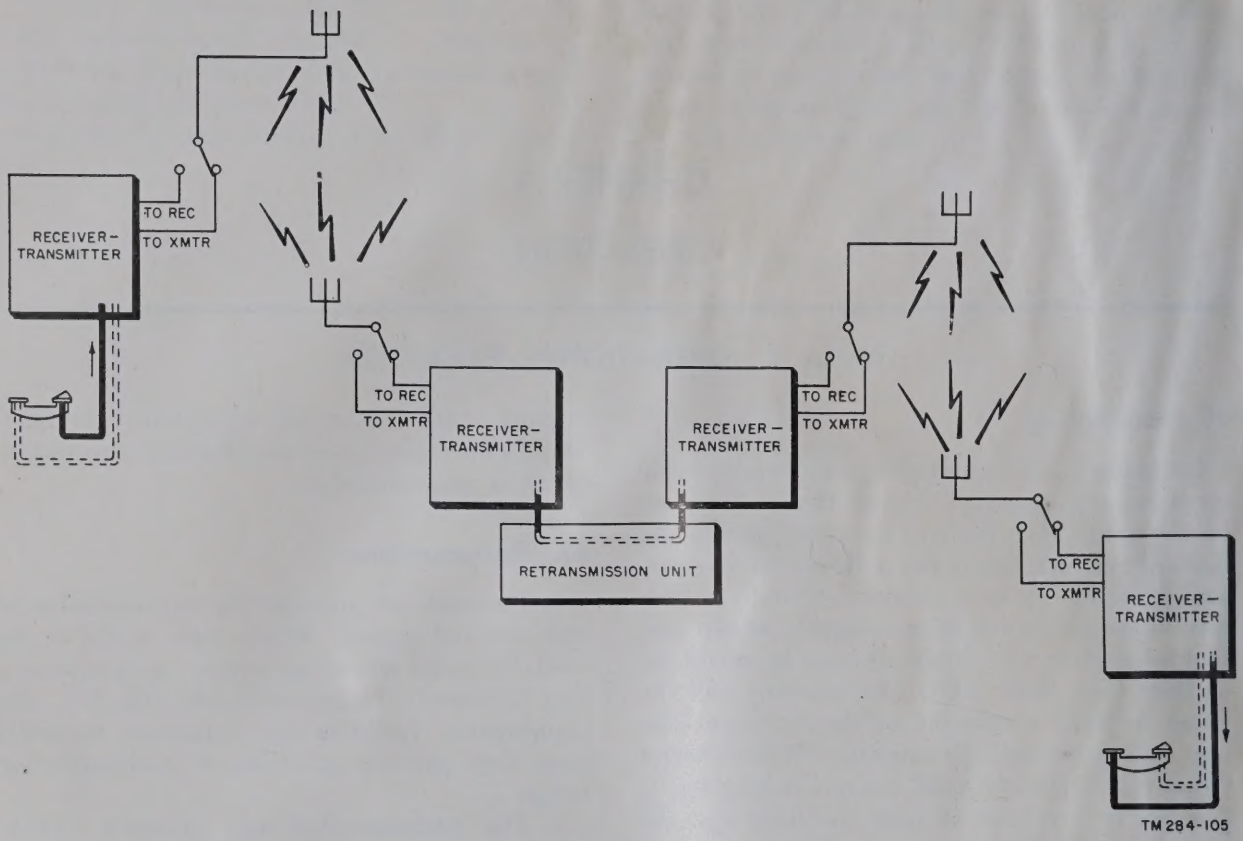



*Figure 37. Retransmission system, block diagram.*

to make this simultaneous two-way or *break-in* operation possible.

*b.* The retransmission unit of the radio sets provides the switching circuits required for duplex operation. The duplex operation uses Set 1 for transmitting and Set 2 for receiving (par. 73). In Radio Sets AN/GRC–3, –5, and –7, which have an auxiliary receiver, it is possible to use the auxiliary receiver and Set 1 in a duplex set-up. For this type of operation, however, a separate antenna must be connected to the auxiliary receiver.

## 45. Remote Control

The use of Control Group AN/GRA–6 allows application of power for the radio sets and push-to-talk operation of either Set 1 or Set 2 to be controlled from a control station up to 6 to 8 miles from the major installation. Refer to paragraph 74 for operating details.

## 46. Duplex Telephone Operation

When Control Group AN/GRA–6 is used for remote control of the radio sets, duplex telephone facilities (including ringing) are available for communication between local and remote control units. The control group also can be used as a field telephone without the radio sets.

# Section II. CONTROLS AND INSTRUMENTS

## 47. Introduction

Paragraphs 48 through 58 indicate the functions of the internal and panel controls, connectors, and instruments of the various units. An understanding of the functions of these controls, connectors, and instruments is necessary to operate the radio sets.

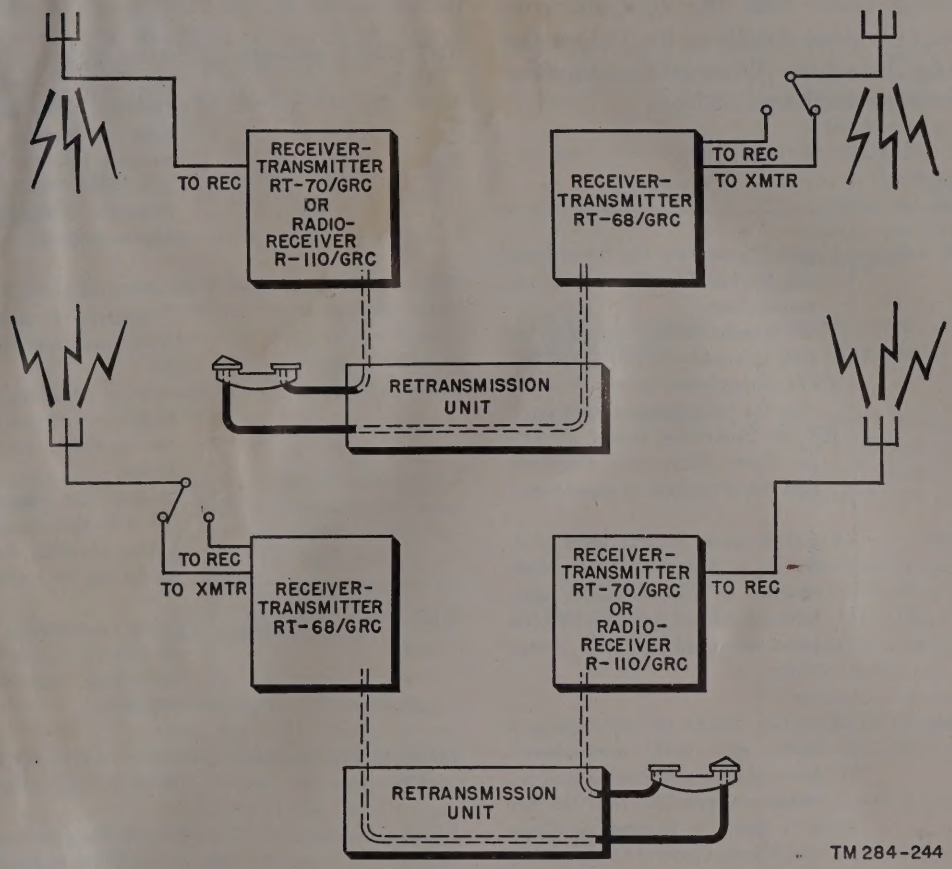



*Figure 38. Duplex operation, block diagram.*

## 48. Mounting

The main power switch (OFF-REMOTE-ON) for the radio sets and a POWER lamp are mounted on the junction box portions of Mounting MT–297/GR (fig. 9). The following chart explains their functions:

| Control, instrument, or connector | Function |
|---|---|
| OFF-REMOTE-ON switch (S–1). | Controls battery power to the radio sets.<br>OFF: Opens battery circuit in the mounting.<br>REMOTE: Places power control in hands of operator at Control Group AN/GRA–6. |
| OFF-REMOTE-ON switch (S–1)—*Cont'd* | ON: Connects battery power to the input terminals of the interphone amplifier, Set 1 power supply, and, in the case of Radio Sets AN/GRC–3, –5, and –7, to the input terminals of the auxiliary receiver. |
| POWER lamp (E–7) | When lit, indicates that power has been made available at the input terminals of the interphone amplifier, Set 1 power supply, and, in the case of Radio Sets AN/GRC–3, –5, and –7, at the input terminals of the auxiliary receiver. Dimmer control provides for masking the glow of the lamp. |

## 49. Interphone Amplifier

The following chart lists the controls, connectors, fuses, and other facilities located on the front panel (fig. 39) or the chassis of the amplifier (fig. 74) and describes their functions:

| Control, instrument, or connector | Function |
|---|---|
| OFF–IN–RT–70 switch (S–2). | Controls power for the interphone amplifier and the Set 2 receiver-transmitter.<br>OFF: Breaks battery circuit at input terminals of the amplifier.<br>INT: Completes power circuits only for interphone amplifier.<br>RT–70: Completes power circuits for both interphone amplifier and Set 2 receiver-transmitter. |
| VOLUME control (R–26). | Controls audio output level from Set 1 + Set 2 + Interphone channel to retransmission unit, or local control unit, and to the panel-mounted AUDIO receptacle. |
| AUDIO receptacle (J–1). | Provides means for connecting a chest set (with microphone-headset) for monitoring and interphone operation over the Set 1 + Set 2 + Interphone channel. Local Control C–434/GRC also can be connected at this receptacle for remote interphone control, via telephone wire and Remote Control C–433/GRC. |
| INT CONT connector (J–2). | Permits monitoring the output of Set 1, Set 2, and the auxiliary receiver (when used). Also permits monitoring and talking over the interphone system from a control station. Cable W–7 from the mounting connects to this receptacle. |
| RT–70 POWER connector (J–3). | Provides for the connection of Set 2 circuits through Special Purpose Cable Assembly CX–1213/U.<br>Serves as a junction point for microphone and control circuits between Set 2 and the control boxes.<br>Connects the receiver output of Set 2 to the amplifier for monitoring through J–4 and to the mounting for retransmission. |
| REC–TR CONT receptacle. | Permits monitoring and talking over Set 2. Cable W–6 from the mounting connects to this receptacle. |
| POWER IN receptacle (J–6). | Provides d-c power input connections through cable W–4. |
| FUSE | In fuseholder, protects battery ircuits from overloading. |
| 6–12–24–VOLTS switch (S–1) (located on chassis). | Adjusts amplifier power supply to operate from a 6-, 12-, or 24-volt vehicular storage battery. |

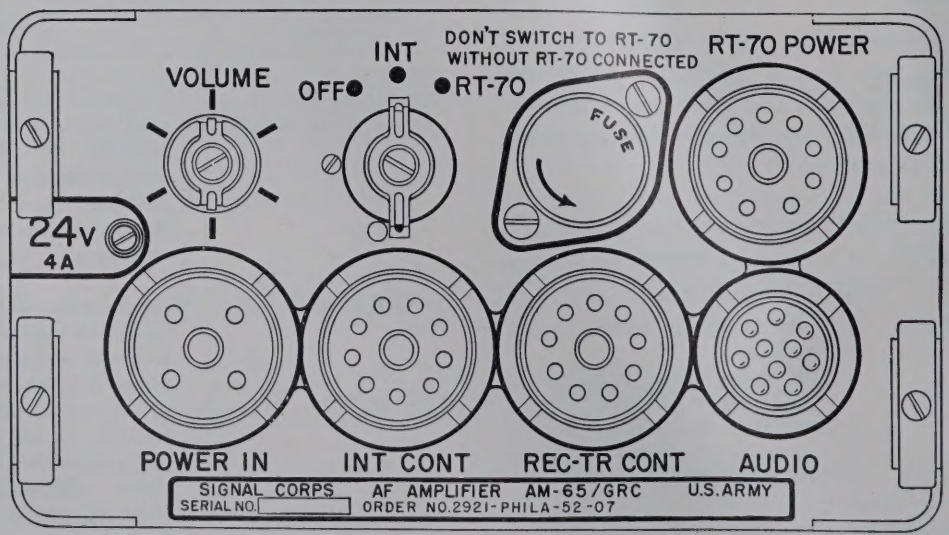



*Figure 39. AF Amplifier AM–65/GRC, control panel.*

## 50. Set 2

The following chart lists the controls, external connectors, and instruments mounted on the panel (fig. 40) or the chassis (fig. 78) of Receiver-Transmitter RT–70/GRC (Set 2) and describes their functions:

| Control, instrument, or connector | Function |
|---|---|
| VOLUME control (R–204). | Adjusts receiver audio-output level to the interphone amplifier and interphone box, retransmission unit, Control Group AN/GRA–6, and panel-mounted AUDIO receptacle. |
| SQUELCH control (R–202 and S–201). | Controls noise suppression and determines minimum level of input signal required for receiver operation. In OFF position, it provides for no noise suppression and allows receiver to operate at maximum sensitivity. |
| AUDIO receptacle (J–202). | Provides means for connecting a chest set (with headset-microphone), a headset, a microphone, or a speaker, for separate local monitoring or push-to-talk operation of the receiver-transmitter. Also used for one of the connections to the local control. |
| ANT connector (J–201). | Connects the lead from the common receiver and transmitter antenna to the antenna circuit within the set. |
| POWER connector (J–203). | Connects external plate, screen, filament relays, and microphone voltages to the set from power-supply circuits in the interphone amplifier through Special Purpose Cable Assembly CX–1213/U.<br>Parallels push-to-talk control connections and microphone input from AUDIO connector. This permits push-to-talk operation from any control unit, or from interphone amplifier. |
| MCS dial and TENTH MCS tuning control. | MCS dial: Calibrations are in megacycles from 47 to 58 and indicate the integral portion of the operating frequency. |
| MCS dial and TENTH MCS tuning control—*Cont'd* | TENTH MCS tuning control: Selects the operating frequency. The integral portion of the selected frequency is indicated on the MCS dial; the decimal portion of the selected frequency is indicated by the .1-mc calibrations on the TENTH MCS tuning control. |
| PRESET 1 and PRESET 2 levers. | Provide means of presetting any two frequencies (par. 62). |
| Dial LAMP (E–201) | Illuminates tuning dial and tuning knob except when dial light switch (below) is in DIAL LIGHT-OFF position. |
| ANT ADJ DIAL LIGHT ON-OFF-CAL switch (S–202). | Controls antenna-tuning, dial light, and calibrating circuits.<br>ANT ADJ: Turns on internal test signal for tuning antenna (par. 62); turns on dial LAMP; is spring-loaded to return to DIAL LIGHT-ON position.<br>DIAL LIGHT-ON: Turns on dial LAMP.<br>DIAL LIGHT OFF: Turns off dial LAMP.<br>CAL: Turns on internal test signals for calibrating tuning dial (par. 62); is spring-loaded to return to DIAL LIGHT-OFF position. |
| Antenna tuning control (C–41). | Provides means of tuning receiver-transmitter antenna circuit. (Internal control accessible through the top of the case when protective cap is removed; not an operational control (fig. 6).) |
| TANK-VEH-FIELD switch (S–101) (located on i-f chassis, fig. 78). | Equalizes loads in filament and plate supply sources, and adjusts sidetone level for different modes of operation.<br>TANK position: Used when more than one control box is in operation.<br>VEH position: Used when the radio set is operated by only one operator and no interphone communication is required.<br>FIELD position: Used in field installations with Case CY–590/GRC. |

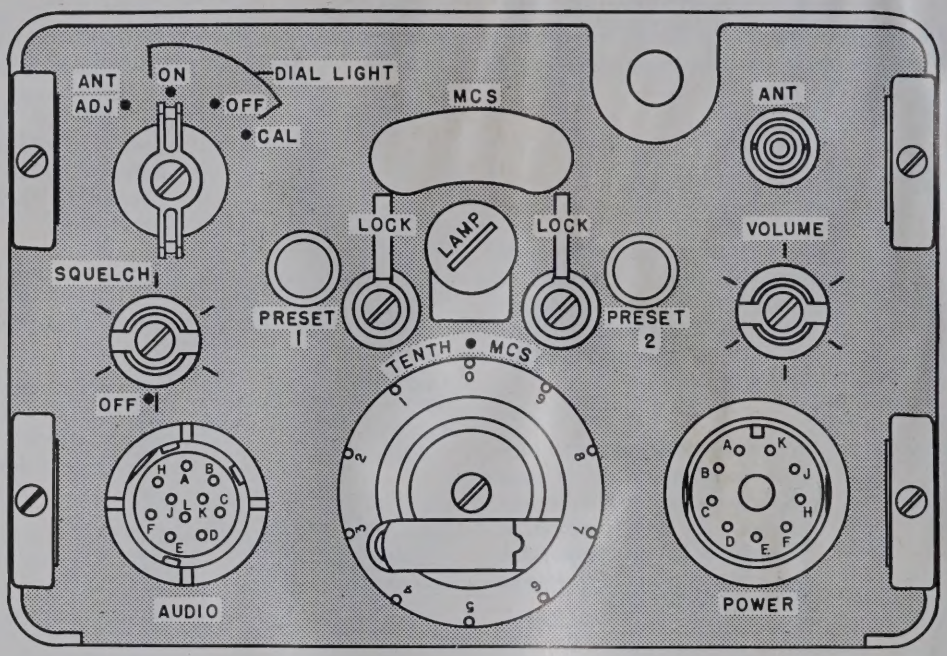



*Figure 40. Receiver-Transmitter RT–70/GRC, control panel.*

## 51. Set 1 Power Supply

The controls, instruments, and connectors for both the 12-volt and the 24-volt Set 1 power supply (Power Supplies PP–109/GR and PP–112/GR, respectively) are the same. Figure 41 illustrates the panel layout of controls. Functions are described in the following chart:

| Control, instrument, or connector | Function |
|---|---|
| OPERATE switch (S–1) | Controls power to Set 1 receiver-transmitter power supply.<br>OFF: Opens battery circuit at input terminals of power supply.<br>RECEIVE: Completes battery circuit to receiver power-supply circuits and to receiver-transmitter relay-supply circuit.<br>TRANS & RECEIVE: Completes battery circuit to transmitter power-supply circuits, in addition to those circuits listed under the RECEIVE position. The transmitter supply circuits are not energized until the microphone push-to-talk button is closed. |
| TRANS POWER switch (S–2). | Provides for HIGH or LOW r-f power operation of the transmitter in the HIGH and LOW positions, respectively. |
| Fuses (F–1, F–2, F–3, and F–4). | Protects battery circuits from short circuits or other overloads. |
| POWER IN connector (J–1). | Provides for the storage battery input connections through cable W–8. |
| Spare fuseholder | Stores spare fuses. |
| POWER OUT connector (J–2). | Makes power-supply output voltages and power control leads available for cable connection (through Special Purpose Cable Assembly CX–1211/U) to Set 1. |

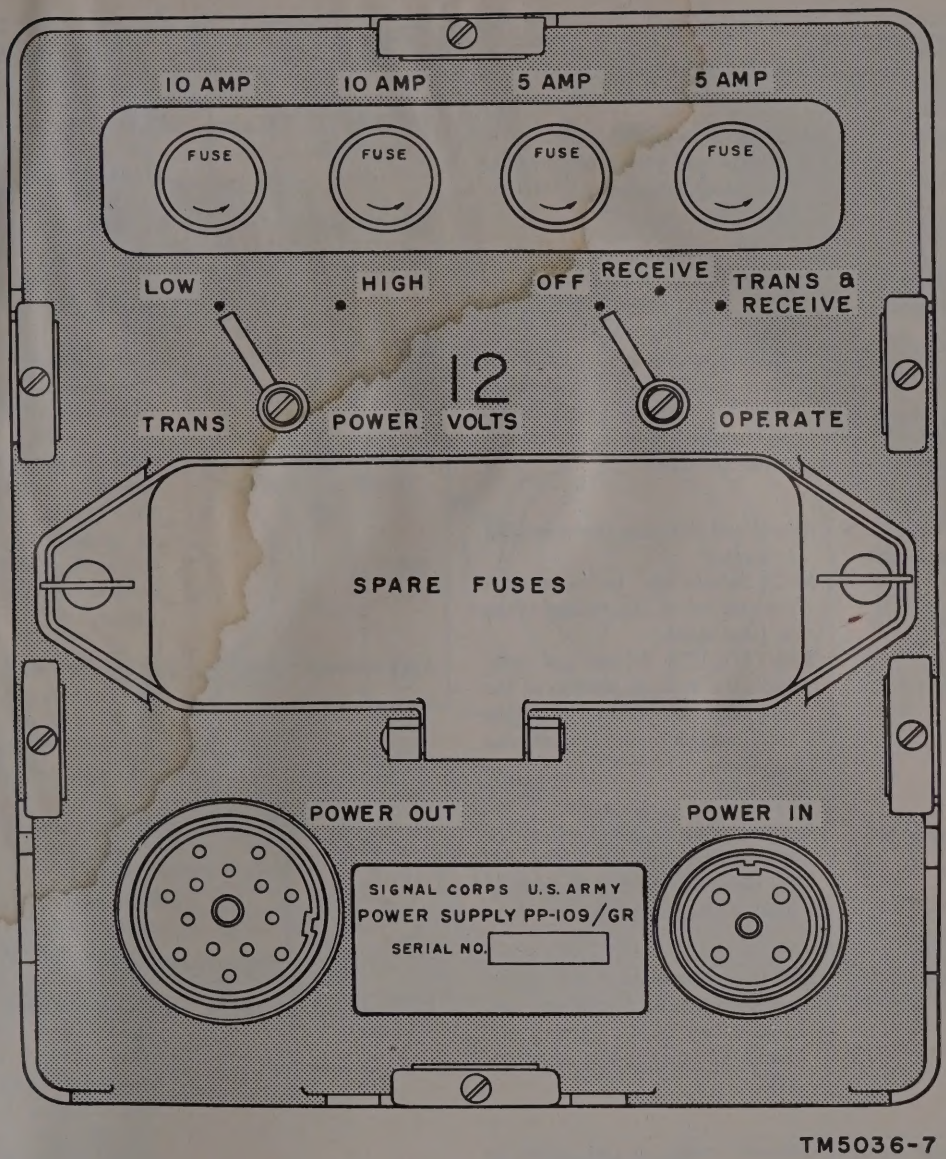



*Figure 41. Power Supply PP–109/GR, control panel.*

## 52. Set 1 Receiver-Transmitter

The controls, instruments, and connectors for the Set 1 receiver-transmitter (Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC) are illustrated in figure 42. Functions are described in the following chart:

| Control, instrument, or connector | Function |
|---|---|
| Dial LAMP (E–313) | Illuminates tuning dials except when DIAL LIGHT OFF-ON-RING switch is OFF. |
| DIAL LIGHT OFF-ON-RING switch (S–302). | Controls dial LAMP, microphone, and ringing oscillator circuits.<br>OFF: Completes microphone circuit and turns dial LAMP off.<br>ON: Completes microphone circuit and turns dial LAMP on.<br>RING: Breaks microphone circuit, and turns on ringing oscillator and dial LAMP. Energizes transmitter to initiate transmission of the ringing signal. |

| Control, instrument, or connector | Function |
|---|---|
| VOLUME control (R–303). | Adjusts the audio output level to speaker and phone terminals of the panel-mounted AUDIO receptacles. |
| SQUELCH-OFF control (R–302 and S–303). | Controls the noise suppression circuits of the receiver and determines minimum level of input signal required for operation of the receiver. In OFF position, provides no noise suppression and makes receiver audio circuits operative. |
| MCS and TENTH MCS tuning controls and dials. | Selects and indicates the operating frequency.<br>MCS: Selects and indicates each integral mc of the tuning range in 1-mc steps.<br>TENTH MCS: Selects and indicates the decimal portion of the operating frequency in either 100-kc steps or in a continuous sequence. |
| Detent channel preset levers. | Provide means of presetting one or two detented channels (par. 61) for quick selection of desired operating frequency. |
| METER (M–301)------ | Indicates transmitter r-f power output filament continuity, and availability of d-c (direct current) (85-volt) operating potential. |
| METER selector switch (S–301). | Connects meter to test points as indicated below:<br>RF position: Connects meter to transmitter r-f output circuit.<br>Positions 2 through 11: Connects meter to various filament circuits.<br>90 V position: Connects meter to 85-volt d-c supply circuit. |
| TR ANT TUNE control (C–74). | Adjusts transmitter antenna-circuit tuning. (This is not an operational control.) |
| TRANS ANT COUPLING control (L–23). | Adjusts coupling between transmitter output stage and the antenna. (This is not an operational control.) |
| REC ANT TUNE control (C–1A). | Adjusts receiver antenna-circuit cuit tuning. (This is not an operational control.) |
| AUDIO connectors (J–310 and J–311). | Provide means of connecting chest set (with headset-microphone), microphone, headset, handset, or speaker, for separate local monitoring or push-to-talk operation of the receiver-transmitter. |
| ANT connector (J–307)-- | Routes the common transmitter and receiver antenna to contacts on the antenna switch-over relay in the set. Mates with Adapter UG–306/U. |
| AUX REC ANT (J–308). | When an auxiliary receiver is used it usually uses the same antenna as Set 1. This binding post connects with the antenna circuit of that receiver (by means of jumper Wire W–142). |
| POWER IN receptacle (J–309). | Connects external plate screen, bias, filament, microphone, and relay voltages to the receiver-transmitter circuits through Special Purpose Cable Assembly CX–1211/U from the Set 1 power supply or through Power Cable Assembly CX–1210/U from Generator G–8/GRC. See chapter 6. |
| REC TR CONTROL receptacle (J–312). | Serves to make connection between the control circuits in the receiver-transmitter through cable W–3 to external positions. |

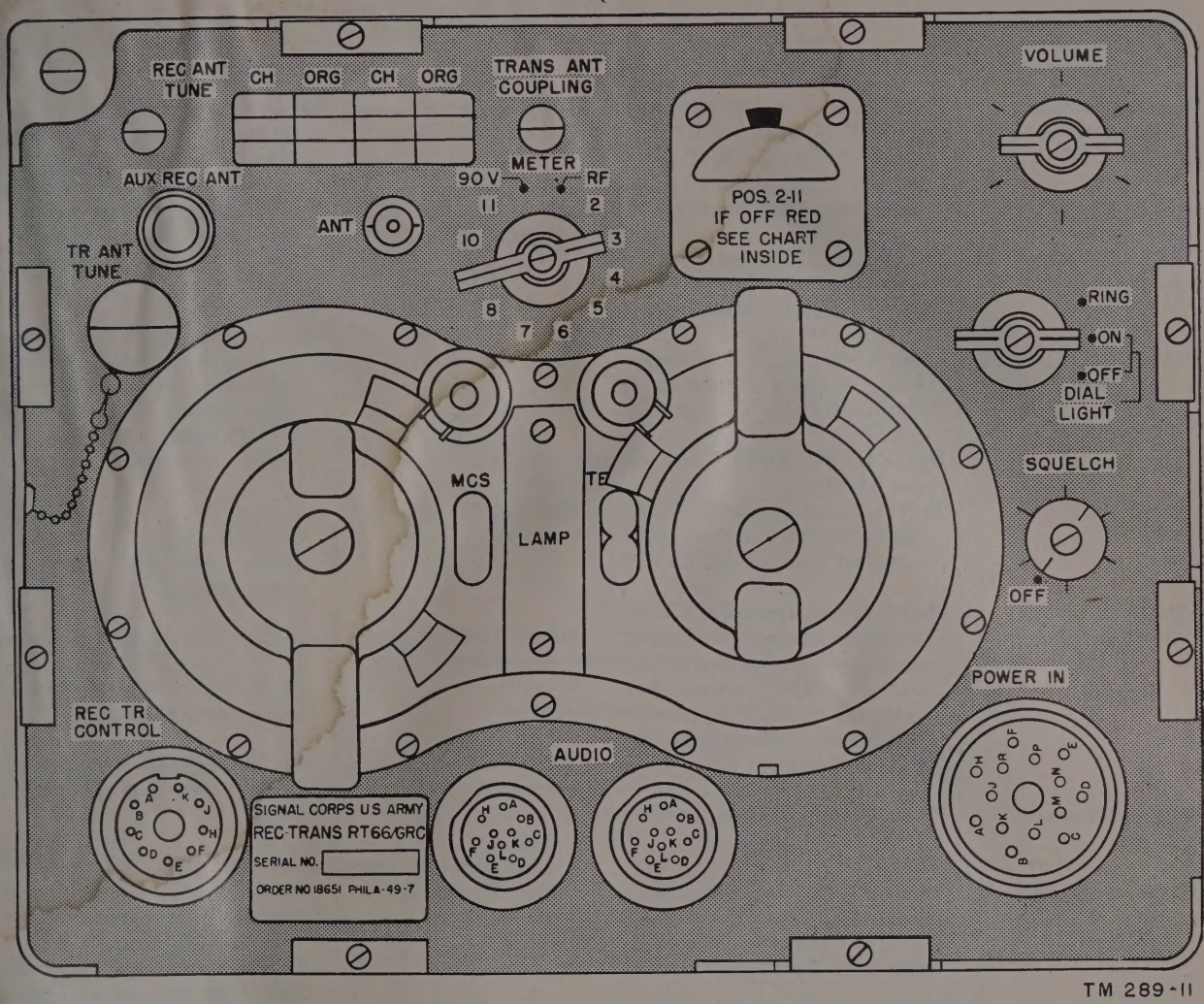



*Figure 42. Receiver-Transmitter RT–66/GRC, control panel.*

## 53. Auxiliary Receiver

The controls, connectors, and instruments on all the auxiliary receivers (Radio Receivers R–108/GRC, R–109/GRC, and R–110/GRC) are the same. The following chart lists the controls, connectors, and instruments mounted on the panel (fig. 43) or the chassis (fig. 85) and describes their functions:

| Control, instrument, or connector | Function |
|---|---|
| Power switch and VOLUME control (S–2 and R–62). | Controls application of battery power to the receiver and adjusts audio output level to speaker and phone terminals. Battery circuit is broken at the input terminals of the unit when control is at OFF position. |
| Dial LAMP (E–14) | Illuminates channel dial except when DIAL LIGHT ON-OFF-TUNE switch is in OFF position. |
| TUNING control | Selects the operating frequency. |
| CHANNEL dial | Indicates the operating frequency selected by the TUNING control. Major calibrations are in mc and minor calibrations are indicated at 100-kc (.1-mc) intervals. |

| Control, instrument, or connector | Function |
|---|---|
| Detent adjustment screws DET A, DET B, and DET C. | Provide means of presetting any three frequencies within the range of the receiver (located beneath diamond-shaped plate near center of the panel). |
| DETENT VERNIERS A, B, C. | Provide a fine adjustment on the setting of each of the three detent frequency settings. |
| DIAL LIGHT ON-OFF-TUNE switch (S–3). | Controls operation of the internal tuning oscillator and dial light.<br>DIAL LIGHT ON: Turns on dial LAMP.<br>DIAL LIGHT OFF: Turns off dial LAMP.<br>TUNE: Turns on oscillator and couples oscillator output to r-f amplifier; turns on dial LAMP. |
| SQUELCH control (R–65 and S–4). | Controls noise suppression and determines minimum level of input signal required for receiver operation. In OFF position, provides for no noise suppression and allows receiver audio circuits to operate. |
| ANT TUNE control (C–4). | Provides means of tuning antenna circuit. |
| AUDIO receptacle (J–7). | Provides means for connecting a headset or speaker for separate local monitoring of the receiver. (Set 1 also is monitored here.) |
| DIAL adjustment screw. | Permits adjustment of the dial calibration by shifting the dial plate with respect to the tuning capacitor. (This adjustment screw is located beneath the diamond-shaped plate near the center of the panel.) |

| Control, instrument, or connector | Function |
|---|---|
| ANT connector (upper connector) (J–3). | Serves as a connector to connect the lead from an antenna to the antenna circuit within the receiver. (Used when receiver operates with its own antenna, apart from Set 1. Also may be used to feed test signals to receiver.) |
| ANT receptacle (E–6) (lower connector). | Parallels J–3 and serves to interconnect the antenna circuit of Set 1 with the antenna circuit of the auxiliary receiver. Wire W–142 makes the connection between the two sets. |
| POWER IN connector (J–6). | Connects either the vehicular storage battery or the external power supply to the receiver power-supply circuits. |
| REC CONTROL connector (J–8). | Parallels the audio connector (J–7). Also provides for connection of the fixed-level audio output of the receiver. |
| Fixed-level output gain control (R–42). | Adjusts the audio output level from the fixed-level audio amplifier. |
| Voltage selector switch (S–1) (located on chassis). | 6, 12, & 24 VOLTS: Connects the output voltages of the plug-in vibrator power supplies to the receiver circuits.<br>OFF: Disconnects the receiver circuits from the internal plug-in vibrator supply and from the external power supplies.<br>EXTERNAL SUPPLY: Connects the external power supplies (6v and 130-v) to the receiver circuits. |

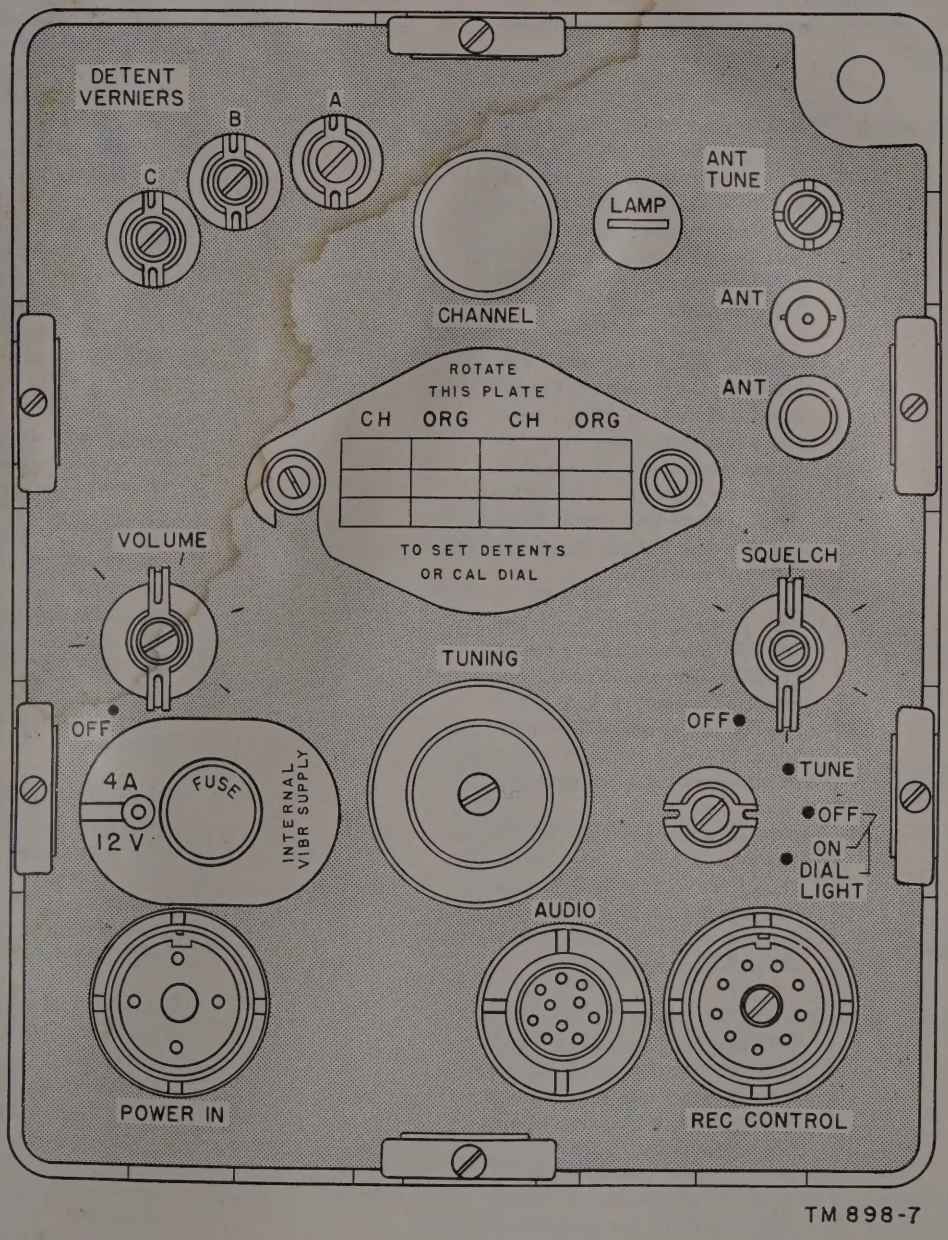



*Figure 43. Radio Receiver R–108/GRC control panel.*

## 54. Control Box

The controls and connectors on the control box (Control Box C–375/VRC) are illustrated in figure 44. Functions are described in the following chart:

| Control, instrument, or connector | Function |
|---|---|
| RADIO TRANS switch (S–2). | Controls push-to-talk operation. Spring-loaded to return to the center position if not held in either of the RADIO TRANS positions. A locking device is provided to hold the switch in either one of the RADIO TRANS positions.<br><br>Clockwise and counterclockwise positions: Completes Set 1 push-to-talk circuit to MIC. jacks and audio receptacles when the selector switch is in the counterclockwise position. Completes Set 2 push-to-talk circuit when the selector switch is in the clockwise position.<br><br>Center position: Opens Set 1 and Set 2 push-to-talk circuits. (This position need not be used because the Set 1 and Set 2 push-to-talk circuits are open when the RADIO-INT button on the chest set is not pressed.) |
| VOL. controls (R–1 and R–2). | Determine signal levels at PHONE jacks and audio connectors. (Level at each PHONE jack and audio connector is affected by the VOL. control nearest the jack or connector.) |
| Audio receptacles (J–1 and J–2). | Provide for connection of Chest Set Group AN/GSA–6 (with Headset-Microphone H–63/U) for operation of the receiver-transmitters, interphone amplifier, and auxiliary receiver. |
| MIC. jacks (J–3 and J–4). | Provide for connection of Microphone T–17–(*) for operation of receiver-transmitters. (Efficiency of operation will be affected by such usage and it is not normally advisable if the standard audio accessories are available.) |
| PHONE jacks (J–5 and J–6). | Provide for connection of Headset H–16/U or Headset HS–30–(*) in combination with Cord CD–933 for monitoring the receiver-transmitters. (Efficiency of operation will be affected by such usage and is not normally advisable if the standard audio accessories are available. |
| Selector switch (S–1) | Completes monitoring circuits to PHONE jacks and audio receptacles. In conjunction with RADIO TRANS switch, completes push-to-talk circuits to MIC: jacks and audio receptacles.<br><br>Counterclockwise position: Completes monitoring circuits for the output of Set 1, the interphone amplifier, and the auxiliary receiver regardless of position of RADIO TRANS switch. Completes Set 1 push-to-talk circuits when RADIO TRANS and push-to-talk switches are operated. Provides for interphone operation when RADIO TRANS switch is not set in position.<br><br>Center position: Completes monitoring circuits for Set 1, Set 2, the interphone amplifier, and the auxiliary receiver. Also completes interphone push-to-talk circuits to MIC. jacks and audio receptacles.<br><br>Clockwise position: Completes monitoring circuits for the output of Set 2 and the interphone amplifier, regardless of position of RADIO TRANS switch. Completes Set 2 push-to-talk circuit when RADIO TRANS and push-to-talk switches are operated. Provides interphone operation when RADIO TRANS switch is not set in position. |

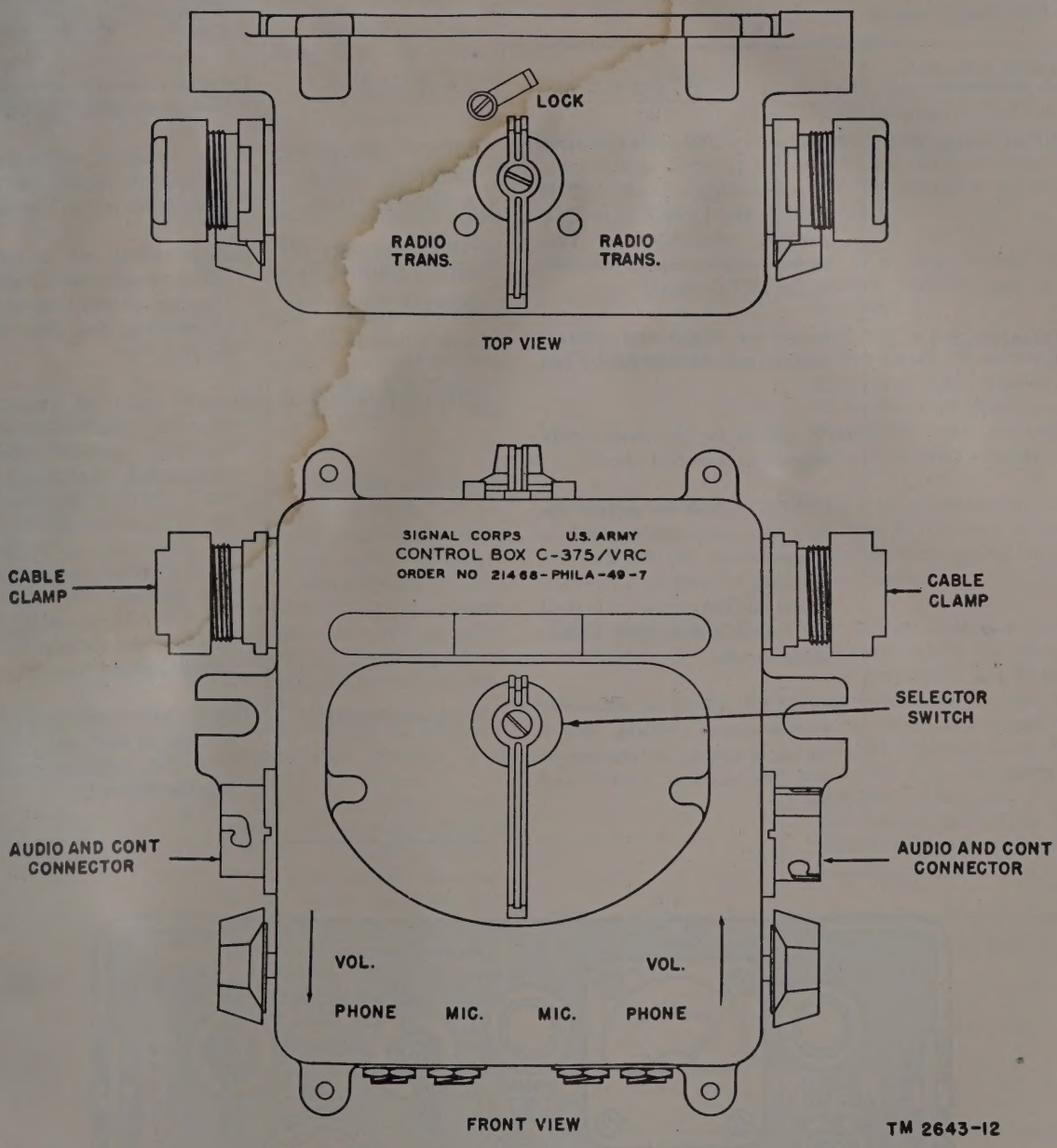



*Figure 44. Control Box C–375/VRC, control panel.*

## 55. Retransmission Unit

The control panel of the retransmission unit (Control C–435/GRC) is illustrated in figure 45. Functions of the panel-mounted controls, connectors, and instruments are described in the following chart:

| Control, instrument, or connector | Function |
|---|---|
| MANUAL switch (S–2) | Provides for push-to-talk operation over Set 1, Set 2, or the interphone amplifier in the SEND SET 1, SEND SET 2, or INT position, respectively. This switch is spring-loaded to return to the INT position. |
| AUTO switch (S–1) | Provides for duplex and retransmission operation of Sets 1 and 2.<br><br>OFF: Allows for the push-to-talk operation described above.<br><br>DUPLEX: Allows for normal duplex operation utilizing Set 1 as a transmitter and Set 2 or the auxiliary receiver as a receiver. If the auxiliary receiver is used for duplex, it must have a separate antenna.<br><br>RETRANS: Allows for automatic retransmission utilizing Sets 1 and 2, or manual retransmission with the auxiliary receiver and Set 2. |
| AUTO switch (S–1)—*Cont'd* | ADJUST METER: Connects panel-mounted meter to act as a level indicator to adjust output of receiver to input of transmitter. |
| METER (M–1) | Provides means of monitoring the level of retransmitted signals. |
| ADJUST METER TO CENTER controls 1 & 2 (R–4 and R–5). | Provide means of setting the level of received signals for proper modulation of the transmitter. |
| SIGNAL REC SET 1 or SIGNAL REC SET 2 lamps (E–1 and E–2). | Indicate which set is receiving during retransmission operation. Dimmer controls provide means of masking the glow of the lamps. |
| AUDIO receptacle (J–2) | Provides means of connecting a chest set (with headset and microphone) for monitoring and push-to-talk operation of Set 1, Set 2, and the interphone amplifier. This receptacle also is used for connecting a headset or speaker when monitoring retransmission. (In Radio Sets AN/GRC–3, –5, and –7, it also provides the facility for montoring auxiliary receiver.) |
| O-ring connector (J–1) | This is a 14-pin connector, located at back of unit and is used to plug the retransmission unit into the mounting. |

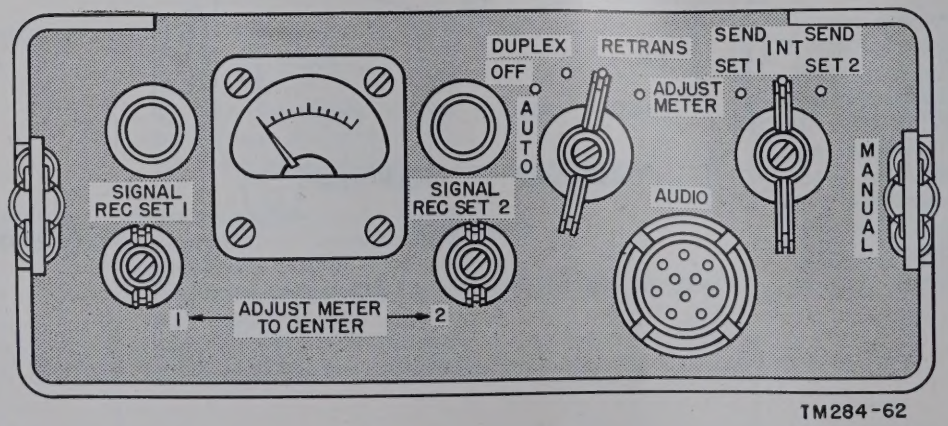



*Figure 45. Control C–435/GRC, control panel.*

## 56. Local Control C–434/GRC

The following chart lists the controls, instruments, and connectors on the panel (fig. 46) and the chassis (fig. 34) of Local Control C–434/GRC and describes their functions:

| Control, instrument, or connector | Function |
|---|---|
| LOCAL switch (S–3) | Provides for push-to-talk operation of either Set 1 or Set 2 and for duplex telephone operation with the remote unit; spring-loaded to return to TEL position.<br>SET 1: Allows push-to-talk operation of Set 1.<br>SET 2: Allows push-to-talk operation of Set 2.<br>TEL: Allows telephone operation with, and radio monitoring at the remote unit. (Monitoring circuit is broken if REMOTE switch is at TEL ONLY position.) |
| REMOTE switch (S–1) | In conjunction with controls at remote unit, provides for remote power control and remote push-to-talk control of Sets 1 and 2. Also provides for telephone communication between local and remote control units. (OFF-REMOTE-ON switch on mounting should be at REMOTE).<br>TEL ONLY: Allows for telephone communication between local and remote control units.<br>SET 1 & 2: Provides for remote push-to-talk operation of Sets 1 and 2. Gives choice of Set 1 or Set 2 push-to-talk operation to the remote operator's SELECTOR switch. Does not allow remote power control.<br>SET 1: Provides for remote power control and remote push-to-talk control of Set 1.<br>SET 2: Provides for remote power control and remote push-to-talk control of Set 2. |
| LINE L1 and L2 | Binding posts for telephone line connection. |
| Ringing generator | Provides means of sending a 20-cycle ringing signal to the remote unit. |
| CALL LIGHT (E–3) | When lit, indicates that a ringing signal is being received from the remote unit. (CALL LIGHT indication can be replaced by a bell, by means of an internal switch.) |
| Dimmer | This is a ring around CALL LIGHT which dims CALL LIGHT. |
| AUDIO receptacle (J–1) | Provides means of connecting a chest set (with headset and microphone) for telephone communication and push-to-talk operation of the radio set. |
| O-ring connector (J–2) | This is a 14-pin connector, located at back of unit and is used to plug the local control unit into the mounting. |
| Cable connectors (P–1 and P–2). | These cables, located in the rear compartment of the unit, are used only when the 14-pin O-ring connector is not used. These cables are connected to AUDIO receptacles on Set 1 and Set 2 or the interphone amplifier. The type of operation desired determines which AUDIO receptacle or receptacles to connect them to. |
| BELL-LAMP switch (S–1) (located on top of chassis). | Selects visual (call light) or audible (bell) reception of 20-cycle ringing signal. |

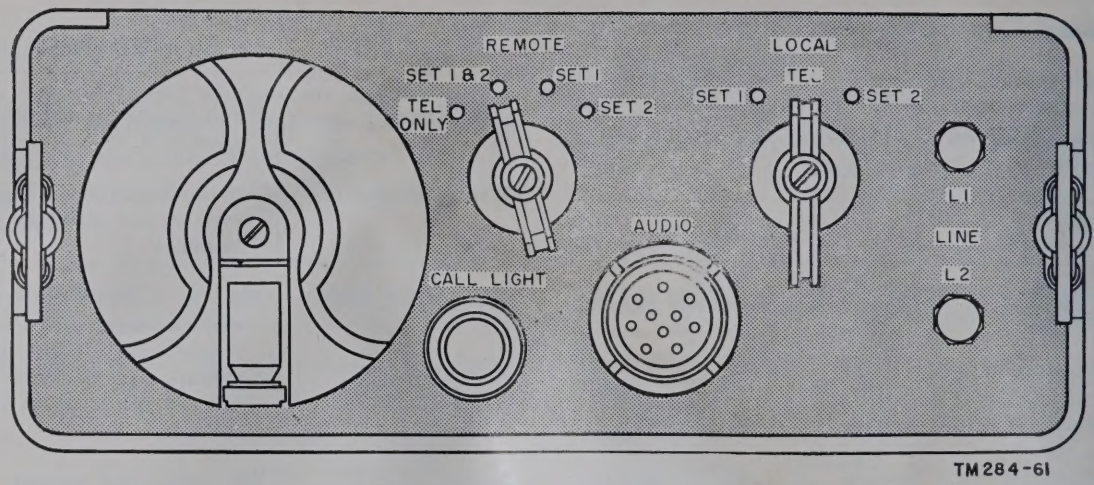



*Figure 46. Local control C–434/GRC, control panel.*

## 57. Remote Control C–433/GRC

The following chart lists the controls, instruments, and connectors on the panel (fig. 47) and the chassis (fig. 36) of Remote Control C–433/GRC and describes their functions:

| Control, instrument, or connector | Function |
|---|---|
| SELECTOR switch----- | Provides for remote power and/or push-to-talk control in conjunction with REMOTE switch of the local control unit; also provides for telephone communication between the local and remote control units.<br>*Note.* OFF-REMOTE-ON switch (on mounting) must be at REMOTE.<br>Left-hand write-in position: When REMOTE switch (on local control unit) is at TEL ONLY, this position has no function.<br>When REMOTE switch is at SET 1 & 2, this position allows push-to-talk operation of Set 1 and monitoring of all receivers. Remote power control is not possible.<br>When REMOTE switch is at SET 1, setting the SELECTOR switch at the left-hand write-in position and then momentarily pressing the handset push-to-talk button turns power on in the radio set. Push-to-talk operation of Set 1 and monitoring of all receivers then is possible. |
| SELECTOR switch—*Cont'd* | *Note.* The functions of the write-in positions are reversed by the reversal of the telephone line connections at either the local or remote control unit. When REMOTE switch is at SET 2, setting the SELECTOR switch at the left-hand write-in position and then momentarily pressing the push-to-talk button turns power on in the radio set. Push-to-talk operation of Set 2 and monitoring of all receivers then is possible.<br>Right-hand write-in position: When REMOTE switch (on local control unit) is at TEL ONLY, this position has no function.<br>When REMOTE switch is at SET 1 & 2, this position allows push-to-talk operation of Set 2 and monitoring of all receivers. Remote power control is not possible.<br>When REMOTE switch is at SET 1, setting the SELECTOR switch at the right-hand write-in position and then momentarily pressing the handset push-to-talk button turns all power off in the radio set.<br>When REMOTE switch is at SET 2, setting the SELECTOR switch at the right-hand write-in position and then momentarily pressing the handset push-to-talk button turns all power off in the radio set. |

| Control, instrument, or connector | Function |
|---|---|
| SELECTOR switch—*Cont'd* | TEL position: Provides for telephone communication between the remote and local control units. (REMOTE switch at local control unit should be set at TEL ONLY.) |
| LINE binding posts L1 and L2. | Binding posts for telephone line connection. |
| Ringing generator | Provides means of sending a 20-cycle ringing signal to the local control unit. |
| CALL LIGHT (E–3) | When lit, indicates that a ringing signal is being received from the local unit. (CALL LIGHT indication can be replaced by a bell by means of internal BELL-LAMP switch.) Dimmer control provides for masking the glow of the lamp. |
| AUDIO receptacle (J–1) | Provides means of connecting a handset for telephone communication and push-to-talk operation of the radio set. |

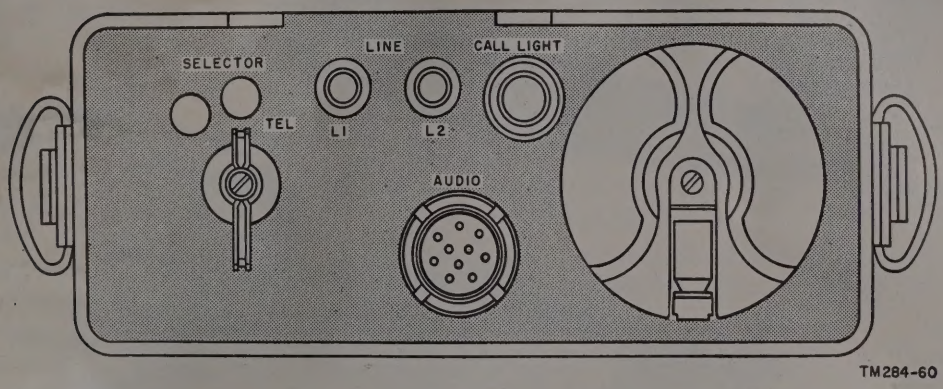



*Figure 47. Remote Control C–433/GRC, control panel.*

## 58. Chest Set Group AN/GSA–6

The following chart lists the controls on Chest Set Group AN/GSA–6 (fig. 15) and describes their functions:

| Control | Function |
|---|---|
| HOLD ON push-to-talk switch. | Allows interphone push-to-talk operation; returns to unoperated position when pressure is released. |
| LOCK ON push-to-talk switch. | Allows interphone push-to-talk operation; remains in operated position until released by pressure on the HOLD ON push-to-talk switch. |
| RADIO-INT switch | When both this switch and either the HOLD ON or LOCK ON push-to-talk switches are operated, transmission over either Set 1 or Set 2 is provided for. When the selector switch on the control box is in the counterclockwise position, transmission over Set 1 is effected. When the selector switch on the control box is in the clockwise position, transmission over Set 2 is effected. When the selector switch on the control box is in its center position, only interphone communication is possible. (This latter mode of communication can be more easily effected by pressing only the HOLD ON or LOCK ON push-to-talk switch. Therefore, the RADIO-INT switch should not be pressed when interphone communication is desired.) |

NOTES

1. A LOCK ON push-to-talk switch disabling mechanism which disables the LOCK ON push-to-talk switch, and a lock-on

control which locks the RADIO-INT switch in either the RADIO or the INT position, are shown on figure 48. In most cases, these locking adjustments should not be used.

2. An improved design of Chest Set Group AN/GSA–6 now is being procured. This chest set has two buttons instead of the three on the present models. One button is an interphone button; the other is a radio button. Both buttons are spring-returned. For push-to-talk interphone operation, press the interphone button. To lock this button in the operated position, press and turn it in a clockwise direction. To release, turn the button in a counterclockwise direction. For radio transmission, press the radio button. (Do not press the interphone button too, as on the older chest set.) This button cannot be locked in either position.

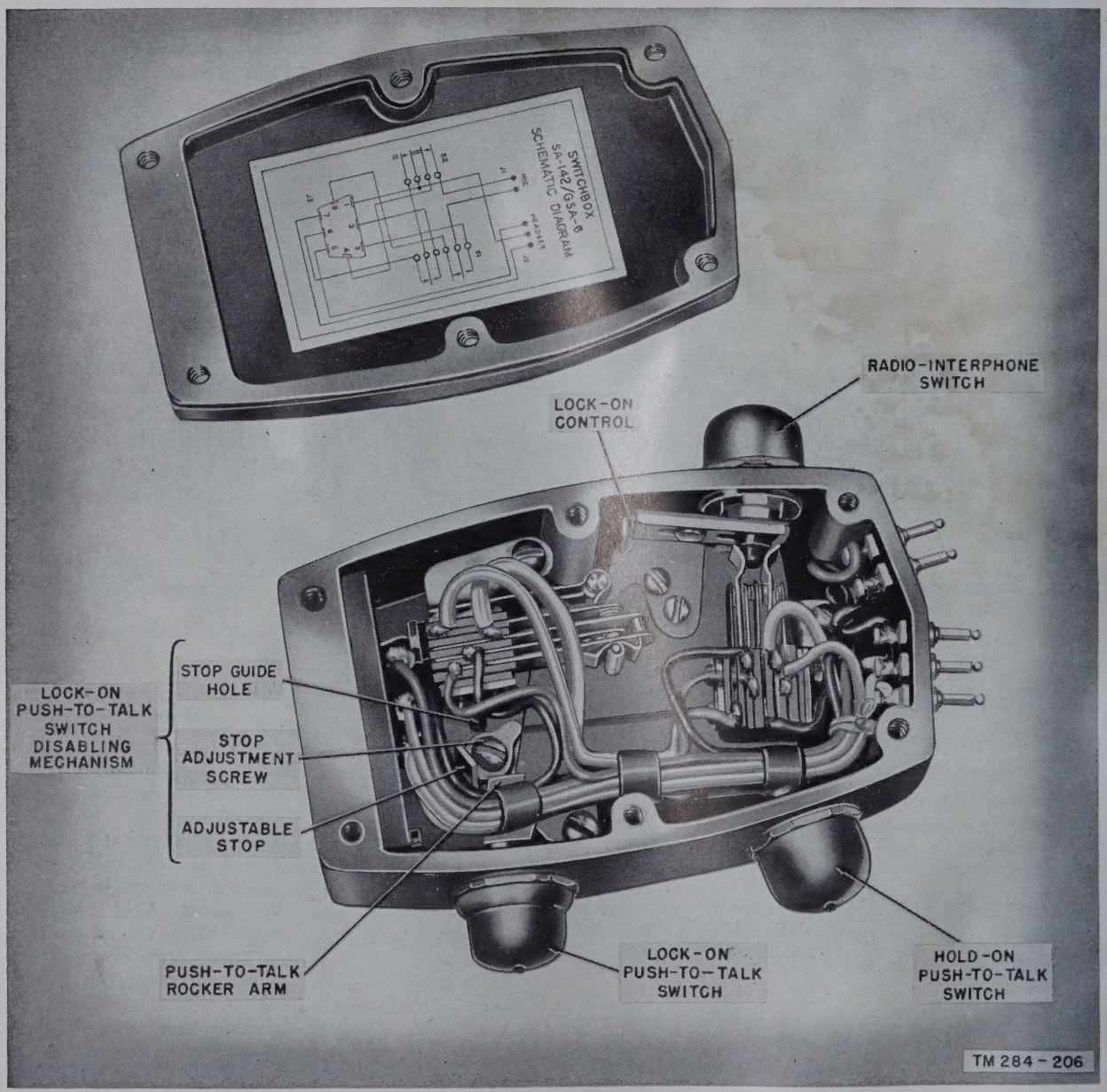



*Figure 48. Switchbox SA–142/GSA–6, internal view.*

## Section III. PRELIMINARY ADJUSTMENTS

### 59. Starting and Stopping

*a. Starting.*

(1) Set the OFF-REMOTE-ON switch on the mounting at ON. This applies battery voltage from the mounting to the terminals of the auxiliary receiver, the Set 1 power supply, and the interphone amplifier. This is indicated by the lighting of the POWER lamp on the mounting.

(2) Set the OFF-INT-RT–70 switch on the interphone amplifier at RT–70. This applies power to the interphone amplifier and Receiver-Transmitter RT–70/GRC (Set 2). (When the switch is set at INT, power is applied only to the amplifier.)

***Caution:*** Do not set the OFF-INT-RT–70 switch at RT–70 unless Set 2 is connected to the interphone amplifier by Special Purpose Cable Assembly CX–1213/U. If Set 2 is not connected, set this switch at INT. Otherwise, excessive filament voltage will be applied to the interphone amplifier tubes and shorten the life of these tubes.

(3) Set the OPERATE switch of the Set 1 power supply at TRANS & RECEIVE. This turns power on in the Set 1 power supply and in Set 1. Set the TRANS POWER switch at HIGH. This sets the Set 1 transmitter circuits for high power output.

(4) In Radio Sets AN/GRC–3, –5, and –7 (which have auxiliary receivers), turn the VOLUME control of the auxiliary receiver clockwise from the OFF position. This turns power on in the auxiliary receiver.

*b. Stopping.*

(1) To turn all power off on the radio set, set the OFF-REMOTE-ON switch (on the mounting) at OFF.

(2) To turn the power off on the auxiliary receiver, keep the OFF-REMOTE-ON switch on the mounting at ON. Turn the VOLUME control on the auxiliary receiver to OFF.

(3) To turn power off on Set 1, set the OPERATE switch of the Set 1 power supply at OFF.

(4) To turn power off on Receiver-Transmitter RT–70/GRC (Set 2), set the OFF-INT-RT–70 switch (on the interphone amplifier) at INT. To turn power off on both Set 2 and the interphone amplifier, set the OFF-INT-RT–70 switch at OFF.

### 60. Squelch and Volume-Level Adjustments

*a.* Turn the power on in all units of the radio set as described in paragraph 59*a*.

*b.* Connect chest set and headset combinations to one of the audio connectors on each of the control boxes. Adjust the VOL. control (the one located on the same side of the control box as the audio connector which is being used) to the approximate midpoint of its range. Set the selector switch on the front panel of the control box to its center position.

*c.* Set the SQUELCH controls on the auxiliary receiver, Set 1, and Set 2 at their maximum clockwise positions.

*d.* Perform the following on the auxiliary receiver and then on Set 1. Turn the SQUELCH control of the auxiliary receiver in a counterclockwise direction until a rushing noise is heard in the headset. Adjust the VOL. control on each control box to obtain a comfortable noise level. Then slowly turn the SQUELCH control in a clockwise direction just enough to squelch the rushing noise. (Do not turn the SQUELCH control beyond the point necessary to squelch because this would reduce the receiver sensitivity.)

*e.* Turn the VOLUME control on Set 2 to the approximate midpoint of its range. Turn the SQUELCH control in a counterclockwise direction until a rushing noise is heard. Adjust the VOLUME control on Set 2 until this noise level is about equal to that obtained from Set 1 (*d* above). Then slowly turn the SQUELCH control on Set 2 in a clockwise direction just enough to squelch the rushing noise.

*Note.* Repeat the SQUELCH adjustments whenever the tuning of the auxiliary receiver Set 1, or Set 2 is changed. Also check the squelch settings repeatedly during operation of the set because changes in background noise and supply voltage require changes in SQUELCH control settings.

## 61. Tuning Set 1

*a. Detent Tuning.* Detent tuning is possible at every 100-kc interval between the lower and upper ends of the tuning range.

(1) Turn the MCS control until the MCS dial indicates the whole number of the desired frequency; for example, until the dial indicates 24 when the desired frequency is 24.3 mc.

(2) If the detent for the TENTH MCS control is not already engaged, engage it by turning the control to its extreme clockwise position. Then turn the TENTH MCS control until the TENTH MCS dial indicates the decimal portion of the desired frequency; for example, until the dial indicates 3 when the desired frequency is 24.3 mc.

*b. Presetting Detented Channels.* Presetting is obtained by stops which limit the rotation of the tuning knobs (fig. 49). The stops can be swung into place for presetting (or removed when presetting is not desired) by adjusting the knobs. When in place for presetting, the stops engage the green and red levers on the tuning controls as the controls are rotated. The positions of the red and the green levers can be changed so that the stops will function for any desired frequency. Figure 49 illustrates an example of the preselection of two channels.

*Note.* In illustrating the presetting procedure, the green preset levers have been used for the higher frequency and the red levers for the lower frequency. The opposite convention is equally suitable, but consistency in using either procedure is necessary.

*c. Continuous Tuning.* Continuous tuning throughout the range of Set 1 is possible by releasing the channel-detent mechanism of the TENTH MCS dial.

(1) Turn the MCS control (as for detent tuning) until the MCS dial indicates the whole portion of the desired frequency.

(2) Turn the TENTH MCS control to the extreme counterclockwise position to release the detent mechanism.

(3) Turn the TENTH MCS control clockwise until the TENTH MCS dial indicates the decimal portion of the desired frequency. Calibration marks between the 100-kc (.1-mc) divisions represent 25-kc (.025-mc) intervals. For example, when the MCS dial indicates 24, a frequency of 24.85 mc is selected by turning the TENTH MCS control until the second calibration mark between 8 and 9 appears opposite the indicator on the TENTH MCS dial.

## 62. Tuning Set 2

*a. Tuning and Calibrating.* When tuning Set 2, the tuning dial always should be calibrated at the nearest megacycle calibration. Perform (1) through (5) below.

(1) Apply power to the set by placing the OFF-INT-RT–70 switch of the interphone amplifier in the RT–70 position, and the OFF-REMOTE-ON switch of the mounting in the ON position.

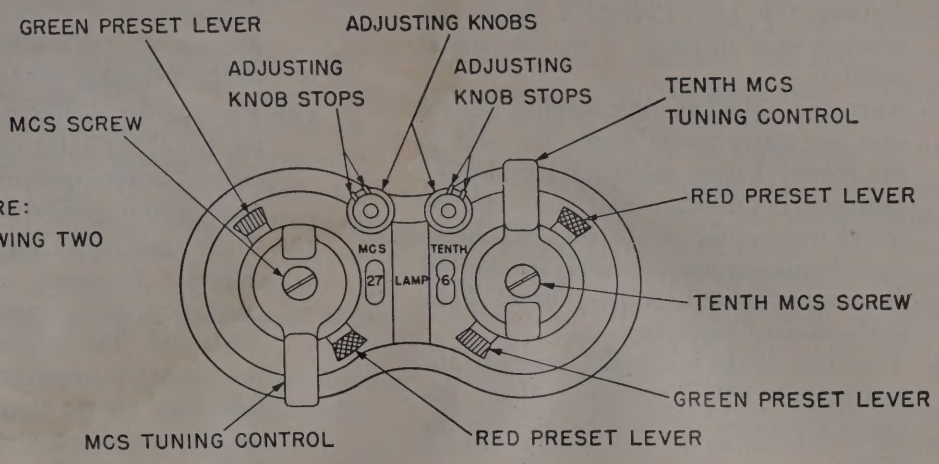
(2) Provide for monitoring. (A headset at the panel AUDIO receptacle, at a convenient interphone box, or at the retransmission unit will be adequate.)

(3) Turn the TENTH MCS tuning control until the integral megacycle calibration nearest the desired frequency is indicated on the MCS dial.

(4) Turn the VOLUME control clockwise as described in paragraph 60*e*; turn the SQUELCH control to OFF to obtain noise output in the headset.

(5) Hold the ANT ADJ DIAL LIGHT ON-OFF-CAL switch in the CAL position and listen for a beat note or zero-beat indication on the headset. Adjust the TENTH MCS tuning control slightly, if necessary, until the zero-beat indication is obtained. The zero beat is an indication that the receiver-transmitter is tuned to the integral megacycle indicated on the MCS dial. Then, if necessary, move the circular dial until the zero on the plate lines up with the calibration marker on the panel.

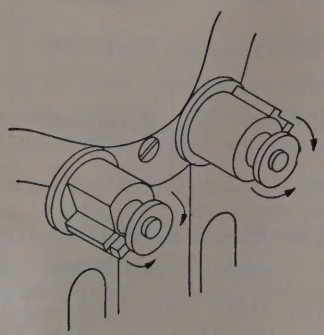
*b. Presetting.* The two locking levers designated PRESET 1 and PRESET 2 on the panel of Set 2 (figs. 6 and 40) may be used to preset (detent) any two frequencies. When the frequencies have been preset, as outlined in (1) through (5) below, they may be selected rapidly by turning the TENTH MCS control until the desired detent is engaged. To preset any two frequencies initially, perform (1) through (5) below.



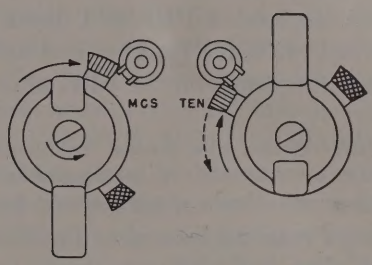

EXAMPLE PROCEDURE:
PRESET THE FOLLOWING TWO FREQUENCIES,

1. 27.6MC
2. 21.2MC

1. SET THE HIGHER OF THE TWO FREQUENCIES ON THE MCS AND TENTH MCS TUNING DIALS.

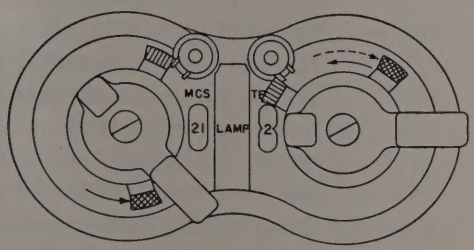


2. PULL UP ON AND TURN THE TWO STOP ADJUSTING KNOBS SO THAT THE STOPS WILL BE POSITIONED TO ENGAGE THE GREEN AND RED PRESET LEVERS. THESE KNOBS SHOULD LOCK IN POSITION.




3. LOOSEN MCS SCREW AND TURN GREEN LEVER CLOCKWISE UNTIL IT STRIKES STOP. HOLD LEVER IN THAT POSITION AND TIGHTEN THE MCS SCREW.

4. LOOSEN TENTH MCS SCREW. TURN GREEN LEVER CLOCKWISE* UNTIL IT STRIKES STOP. HOLD LEVER IN THAT POSITION AND TIGHTEN THE TENTH MCS SCREW.




* IF TENTH PORTION OF HIGHER FREQUENCY IS LOWER THAN THE TENTHS PORTION OF LOWER FREQUENCY THEN THE TENTH MCS PRESET LEVERS SHOULD BE TURNED IN AN OPPOSITE DIRECTION.

5. SET 21.2 ON THE MCS AND TENTH MCS DIALS. HOLD THE FIRST GREEN PRESET LEVER IN PLACE AND LOOSEN THE MCS SCREW. TURN THE RED PRESET LEVER COUNTERCLOCKWISE UNTIL IT STRIKES STOP. HOLD BOTH LEVERS IN POSITION AND RETIGHTEN MCS SCREW.

6. HOLD GREEN PRESET LEVER IN PLACE AND LOOSEN THE TENTH MCS SCREW. TURN THE RED PRESET LEVER COUNTER-CLOCKWISE* UNTIL IT STRIKES STOP. HOLD BOTH LEVERS IN POSITION AND RETIGHTEN TENTH MCS SCREW.

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*Figure 49. Preselection of Set 1 frequencies.*

(1) Release the two PRESET levers by turning each of them to the horizontal position.

(2) Turn the TENTH MCS tuning control over its entire range (from one end to the other) before selecting the desired frequency. Calibrate and tune the receiver-transmitter at the integral megacycle frequency nearest one of the desired frequencies as outlined in *a* above. Tune to the desired frequency.

(3) Turn one of the PRESET levers to the vertical (LOCK) position. Mark the preset frequency on the label next to the lever.

(4) Calibrate and tune the receiver-transmitter to the second desired frequency. Follow the procedure outlined in (2) above.

*Note.* Both detent flag indicators are visible until detents are set.

(5) Turn the second PRESET lever to the vertical (LOCK) position and mark the preset frequency on the label next to the lever.

*Note.* Unless the preset frequencies are labeled or recorded, it is impossible to tell which lever controls which detented frequency.

*c. Changing Preset Frequencies.* To change the frequency which a preset lever controls, perform (1) through (3) below.

(1) Turn the TENTH MCS control until the original preset frequency is engaged.

(2) Remove the detent by turning the associated lever (PRESET 1 or PRESET 2 as indicated on the marker) to the horizontal position.

(3) Calibrate and tune the receiver-transmitter to the new frequency and return the preset lever to the LOCK position. It is not necessary to sweep across the dial (*b*(2) above) if the preset lever is unlocked while the dial is set at the preset frequency.

## 63. Tuning Auxiliary Receiver

*a. Tuning and Calibrating.* When the auxiliary receiver is tuned, it should be calibrated at the nearest calibration point. (Calibration points are 4.3 mc apart.) Perform (1) through (3) below.

(1) Apply power to the receiver by turning the receiver VOLUME control (figs. 8 and 43) in a clockwise direction and placing the OFF-REMOTE-ON switch of the mounting in the ON position.

(2) Provide for monitoring. (A headset at the panel AUDIO connector, at a convenient interphone box, or at the retransmission unit is adequate.)

(3) Turn the TUNING control until the calibrate frequency nearest the desired frequency is indicated on the CHANNEL dial. The calibrate frequencies for the respective receivers are shown in the following chart; they are indicated on the dial by red dots above the dial calibrations on the panel.

| Radio Set | Radio Receiver | Calibrate frequencies |
|---|---|---|
| AN/GRC–3 | R–108/GRC | 21.5 and 25.8 mc. |
| AN/GRC–5 | R–109/GRC | 30.1, 34.4, and 38.7 mc. |
| AN/GRC–7 | R–110/GRC | 38.7, 43.0, 47.3, and 51.6 mc. |

(4) Adjust the SQUELCH control to obtain noise output in the headset.

(5) Hold the DIAL LIGHT OFF-ON-TUNE switch to the TUNE position and listen for a beat note or zero-beat indication in the headset. Adjust the TUNING control slightly, if necessary, until the zero-beat indication is obtained. The zero beat is an indication that the receiver is tuned to the calibrate frequency. (If the dial setting is incorrect, it can be corrected mechanically by turning the DIAL calibration correction screw which holds the dial index. The correction screw is located under the diamond-shaped plate beneath the channel dial.)

(6) Turn the TUNING control until the desired frequency is indicated on the CHANNEL dial.

*b. Presetting.* Provisions are available for presetting any three frequencies. Perform (1) through (5) below.

(1) Loosen both thumbscrews on the diamond-shaped plate beneath the channel dial. Swing the plate out of the way to

allow access to the detent lockscrews beneath the plate.

(2) The detent lockscrews are labeled DET A, DET B, and DET C. Turn each of these screws in a counterclockwise direction to release all previous adjustments. Turn the TUNING control from one end of its range to the other to make all of the detents available.

(3) Calibrate and tune the receiver to one of the desired frequencies as outlined in *a* above.

(4) Turn the DET A lockscrew in a clockwise direction to set the detent mechanism for the frequency selected.

(5) Check the tuning at the detented frequency when a signal is received. If the signal is distorted it may be possible to refine the tuning by adjustment of DETENT VERNIER A on the panel of the receiver.

(6) Repeat (3), (4), and (5) above for each of the other desired frequencies, using the DET B and DET C controls and DETENT VERNIER B and C controls.

*Note.* When the dial is set to a detented channel, a small flag drops down into position in the upper part of the window. The flag is identified by the letter (A, B, or C) of the detent adjustment which has been used to preset that particular frequency.

## 64. Tuning Set 2 Antenna Circuit

Receiver-Transmitter RT–70/GRC (Set 2) is shipped completely alined, but the antenna circuit must be tuned when the set is connected to a particular antenna system.

*a.* Set the OFF-REMOTE-ON switch (on the mounting) at ON, and set the OFF-INT-RT–70 switch on the amplifier (fig. 39) at RT–70. This applies power to the amplifier and to Set 2. Set the selector switch of one of the control boxes at its center position and monitor from the chest set-headset connected to this control box. Perform the squelch and volume-level adjustments described in paragraph 60*e*.

*b.* Calibrate the receiver-transmitter at 58 mc (par. 62).

*c.* In some vehicles, such as the M47 tank, the space above Set 2 is so small that the antenna tuning control (located on top of Set 2) is not accessible. In such cases, set the OFF-REMOTE-ON switch (on the mounting) to OFF and disconnect all cables connected to Set 1 and the Set 1 power supply. Remove Set 1 and the Set 1 power supply from the mounting. Disconnect all cables from the amplifier and from Set 2. Turn these two units over on their sides so that the top of Set 2 is now facing to the left. Reconnect all cables to the amplifier and to Set 2 and return the OFF-REMOTE-ON switch (on mounting) to ON. OMIT THIS SUBPARAGRAPH IN VEHICLES OR FIELD INSTALLATIONS WHERE THE ANTENNA TUNING CONTROL IS ACCESSIBLE.

*d.* Remove the cap, which covers the antenna tuning control (fig. 6), on the top of the receiver-transmitter.

*e.* Insert an insulated screw driver or alinement tool through the opening in the case and engage the screw driver slot of the antenna tuning control. Turn the SQUELCH control to OFF and hold the ANT ADJ DIAL LIGHT ON-OFF-CAL switch (fig. 40) in the ANT ADJ position. Adjust the tuning control for a minimum noise in the headset. If the point of adjustment for minimum noise level is too broad, turn the tuning control (TENTH MCS) to slightly below 58.0 mc until the noise level increases, and then retune the antenna tuning control for minimum noise level. If the antenna adjustment is still too broad, further detune the TENTH MCS control until a very definite and sharp quieting point is obtained by adjustment of the antenna tuning control. If it was necessary to perform the steps outlined in *c* above, set the OFF-REMOTE-ON switch at OFF and replace the amplifier and Set 2 in their normal positions on the mounting; replace Set 1 and the Set 1 power supply; and reconnect all cables.

## 65. Tuning Set 1 Antenna Circuit

The Set 1 receiver-transmitter is shipped completely alined, but the receiving and transmitting antenna circuits must be adjusted separately after the set is connected to its particular antenna system. Once the antenna circuits are adjusted for a particular system antenna, it is unnecessary to readjust during normal operation.

*a. Receiver Tuning.* Set the OFF-ON-REMOTE switch (on the mounting) at ON; set the OPERATE switch (on the Set 1 power supply) to TRANS & RECEIVE. Set the receiver SQUELCH control at OFF.

(1) Tune for a signal in the top 900 kc of the tuning range. If practicable, arrange to have this signal supplied by another radio set. If another set is not available, radiate the output of an f-m signal generator (tuned to the top 900 kc of the Set 1 tuning range) to the Set 1 receiver. The signal must be weak to avoid overloading the receiver. Tune the auxiliary receiver to a frequency at least 4 mc below Set 1 during the following steps:

(2) Using a screw driver, adjust the REC ANT TUNE control (fig. 42) on the receiver panel for maximum noise quieting and maximum signal strength in the headset. Reduce the r-f input signal strength as the strength of the a-f signal increases. Repeat the adjustment.

*b. Transmitter Tuning.* Set the selector switch (on the control box) to its counterclockwise position. Lock the RADIO TRANS switch (on top of the control box) in either one of its RADIO TRANS positions. Tune the transmitter antenna as follows:

(1) Tune the receiver-Transmitter (par. 61) to the extreme low end of its tuning range (MCS control at lowest mc calibration, TENTH MCS control at zero). Leave the TENTH MCS control at zero throughout the tuning procedure.

***Caution:*** Do not turn the TENTH MCS control while the TR ANT TUNE control is being adjusted. Serious damage to the tuning mechanism can result.

(2) Remove the cap which covers the TRANS ANT COUPLING control on the Set 1 receiver-transmitter panel, and turn the control completely counterclockwise to obtain minimum coupling.

(3) Press and hold the RADIO-INT and the LOCK ON and push-to-talk switches on the chest set.

***Caution:*** If the adjustments require more than 15 minutes, turn the transmitter off for a 5-minute period to avoid excessive heat dissipation in the power supply. Excessive battery drain also must be avoided if the vehicular generator is not working.

(4) Remove the cap which covers the TR ANT TUNE control on the Set 1 receiver-transmitter panel. Engage the control by pressing in on it with a screw driver and adjust for a maximum r-f reading on the panel meter. (Views of this control are shown in TM 11–289.) If it is impossible to obtain a reading, advance the setting of the TRANS ANT COUPLING control slightly and repeat the procedure. Keep the coupling as low as possible while adjusting the TR ANT TUNE control for a maximum r-f reading. When the maximum reading is obtained, release the RADIO-INT and LOCK ON push-to-talk switches on the chest set.

(5) Repeat steps 3 and 4 for each whole number mc calibration on the MCS dial and for the highest detented frequency of the Set 1 receiver-transmitter (27.9, 38.9, and 54.9 mc for Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC, respectively).

(6) When adjustments are complete for each setting of the MCS control, turn the MCS control to the approximate center of the tuning range, operate push-to-talk switch, and adjust the TRANS ANT COUPLING control for a maximum r-f reading.

(7) Repeat the steps outlined in (3) through (6) above.

## 66. Tuning Auxiliary Receiver Antenna Circuit

The antenna circuit of the auxiliary receiver must be tuned for the particular antenna system with which the receiver is used. The tuning procedure is outlined in *a* through *d* below.

*a.* Set the OFF-ON-REMOTE switch (on mounting) at ON; turn the VOLUME control on the auxiliary receiver clockwise to turn power on; listen at a headset connected to a control box whose selector switch is at its counterclockwise position.

*b.* Tune the receiver at the highest calibrate frequency of its range (par. 63).

*Note.* Tune Set 1 at least 4 mc below the auxiliary receiver during this operation.

*c.* With the DIAL LIGHT OFF-ON-TUNE switch held in the TUNE position, tune off the calibrate frequency until the beat note no longer can be heard but so that the quieting effect of the tuning signal is still apparent.

*d.* With the DIAL LIGHT OFF-ON-TUNE switch still in the TUNE position, use an ordinary screw driver to adjust the ANT TUNE control for maximum quieting in the headset.

## 67. Minimizing Interference Between Set 1 and Auxiliary Receiver

The following procedure minimizes interference between the receiver of Set 1 and the auxiliary receiver to enable these units to be operated at frequencies as close as 1 mc from each other. This interference is noticeable in both receivers only in Radio Set AN/GRC–7 when weak signals are being received. If the two receivers are adjusted to produce maximum mutual interference (weakening of received signal) when they are tuned to the same frequency, the interference will be reduced sufficiently to produce satisfactory operation, when the two receivers are tuned to frequencies one or more megacycles apart.

*a.* Set up a signal source which puts out a weak f-m signal at some frequency between 54 and 54.9 mc. One signal source may be a signal generator with a short length of wire connected as an antenna to the signal generator output. A second source may be a Receiver-Transmitter RT–68/GRC operating at low power, with its TRANS ANT COUPLING control adjusted to lower its power output, and with the DIAL LIGHT OFF-ON-RING switch held at RING.

*b.* Tune the auxiliary receiver and Set 1 to the frequency (between 54 and 54.9 mc) of the weak signal source. Turn the VOLUME control of Set 1 to its extreme counterclockwise position. (This cuts off the Set 1 audio output.)

*c.* Turn up the VOLUME on the auxiliary receiver and listen to a headset (or handset) connected to the AUDIO connector of this unit. While listening on this headset, adjust the REC ANT TUNE control on Set 1 to that point where the weakest signal is received in the headset. This adjustment will be close to the setting obtained in paragraph 65 (approximatly ½ turn).

## 68. Interference Charts for Sets 1 and 2

*a. Interference Problems.* The tuning of Sets 1 and 2 involves not only the simple mechanics of tuning control settings (pars. 61 and 62), but also the problem of frequency selection. Frequency selections must be made to avoid interference between the two receiver-transmitters. Interference charts (figs. 50 through 55) have been prepared to indicate those frequencies at which interference-free operation can be expected with Set 1 transmitting and Set 2 receiving or vice versa. Figures 50 and 51 pertain to Radio Sets AN/GRC–3 and –4 which utilize Receiver-Transmitter RT–66/GRC as Set 1; figures 52 and 53 pertain to Radio Sets AN/GRC–5 and –6 which utilize Receiver-Transmitter RT–67/GRC as Set 1; and figures 54 and 55 pertain to Radio Sets AN/GRC–7 and –8 which utilize Receiver-Transmitter RT–68/GRC as Set 1.

*b. Nature of Charts.* Each square on the interference charts represents the intersection of two frequencies, one plotted from left to right for Set 2, the other plotted from bottom to top for Set 1. On figure 50, for example, Set 2 transmitting frequencies are plotted from left to right across the chart and Set 1 receiving frequencies are plotted from bottom to top of the chart. The *filled-in squares* represent those frequencies at which *interference can be expected* for the particular mode of operation indicated on the chart; the blank squares represent the frequencies at which interference-free operation can be expected. (Note that the spaces, not the lines, are calibrated.)

*c. Use of Charts.* To illustrate the use of the charts, assume that Set 1 is to be used for push-to-talk operation at 28 mc (in Radio Sets AN/GRC–5 or –6) and Set 2 is to be used for monitoring at 49.5 mc. Reference to figure 53 reveals that the intersection of the 28-mc squares (set 1 transmitting) and the 49.5-mc squares (Set 2 receiving) is a filled-in square. Those particular frequencies, therefore, cannot be used simultaneously. If the transmitting frequency is changed to 28.1 mc, however, the intersection is a blank square. Therefore, monitoring at 49.5 mc on Set 2, with push-to-talk operation at 28.1 mc on Set 1, is possible without interference.

## 69. Set 1 and Set 2 Frequency Selections

*a.* Frequency selections on Set 1 and 2 should be made with the aid of the interference charts described above (par. 68). The mode of operation desired (for example, push-to-talk operation of Set 2 or duplex operation on Sets 1 and 2) should first be determined. Then the appropriate chart or charts should be consulted to determine which interference-free frequencies are available for the particular tactical application involved. The operational modes and the charts which apply to each mode are listed below.

*b.* For retransmission, each set may be used

| Operational modes | Radio sets | Chart |
|---|---|---|
| Push-to-talk operation of Set 1; monitoring on Set 2 | AN/GRC–3 and –4 | Fig. 51 |
| Duplex operation, with Set 1 transmitting and Set 2 receiving | AN/GRC–5 and –6 | Fig. 53 |
| | AN/GRC–7 and –8 | Fig. 55 |
| Push-to-talk operation of Set 2; monitoring on Set 1 | AN/GRC–3 and –4 | Fig. 50 |
| | AN/GRC–5 and –6 | Fig. 52 |
| | AN/GRC–7 and –8 | Fig. 54 |
| Retransmission involving Set 1 transmitting and Set 2 receiving, and vice versa | AN/GRC–3 and –4 | Figs. 50 and 51 |
| | AN/GRC–5 and –6 | Figs. 52 and 53 |
| | AN/GRC–7 and –8 | Figs. 54 and 55 |

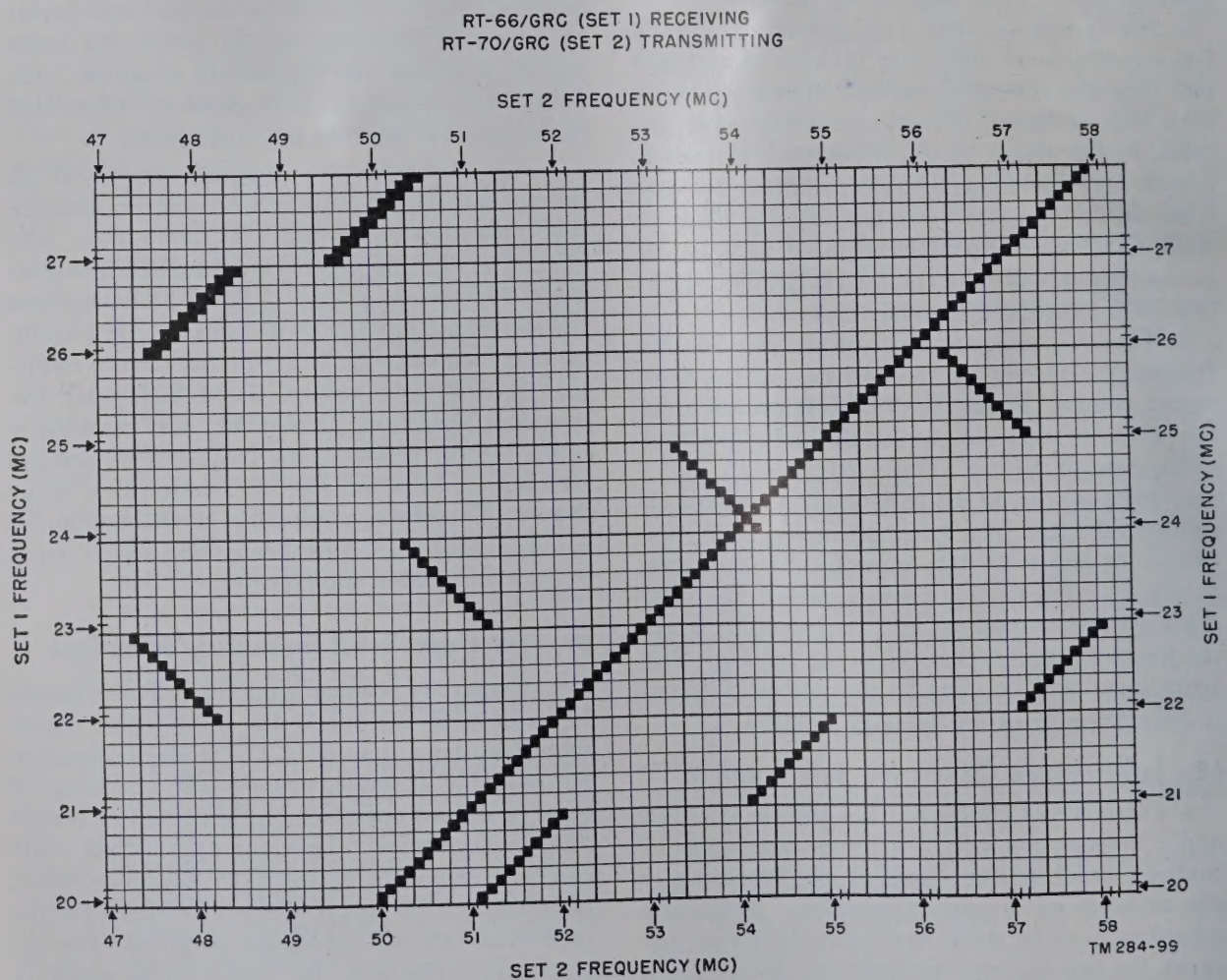



*Figure 50. Chart showing interference between receiver of Receiver-Transmitter RT–66/GRC and transmitter of Receiver-Transmitter RT–70/GRC.*

alternately as a receiver and as a transmitter. It is necessary, therefore, that the possibility of interference be checked for both conditions of operation. For example, when Radio Sets AN/GRC–3 or –4 are being used for retransmission operation, the frequencies of operation for the Set 2 transmitting and Set 1 receiving condition must be checked on figure 50, and for the Set 2 receiving and Set 1 transmitting condition on figure 51.

## 70. Interference With Auxiliary Receiver

In Radio Sets AN/GRC–3, –5, and –7, which utilize auxiliary receivers, additional interference problems are present. Trial-and-error methods will have to be used to determine what transmitting frequencies are possible without interference. If the auxiliary receiver is not needed, it can be turned off so that the Set 1-Set 2 interference problems will be the only ones to solve.

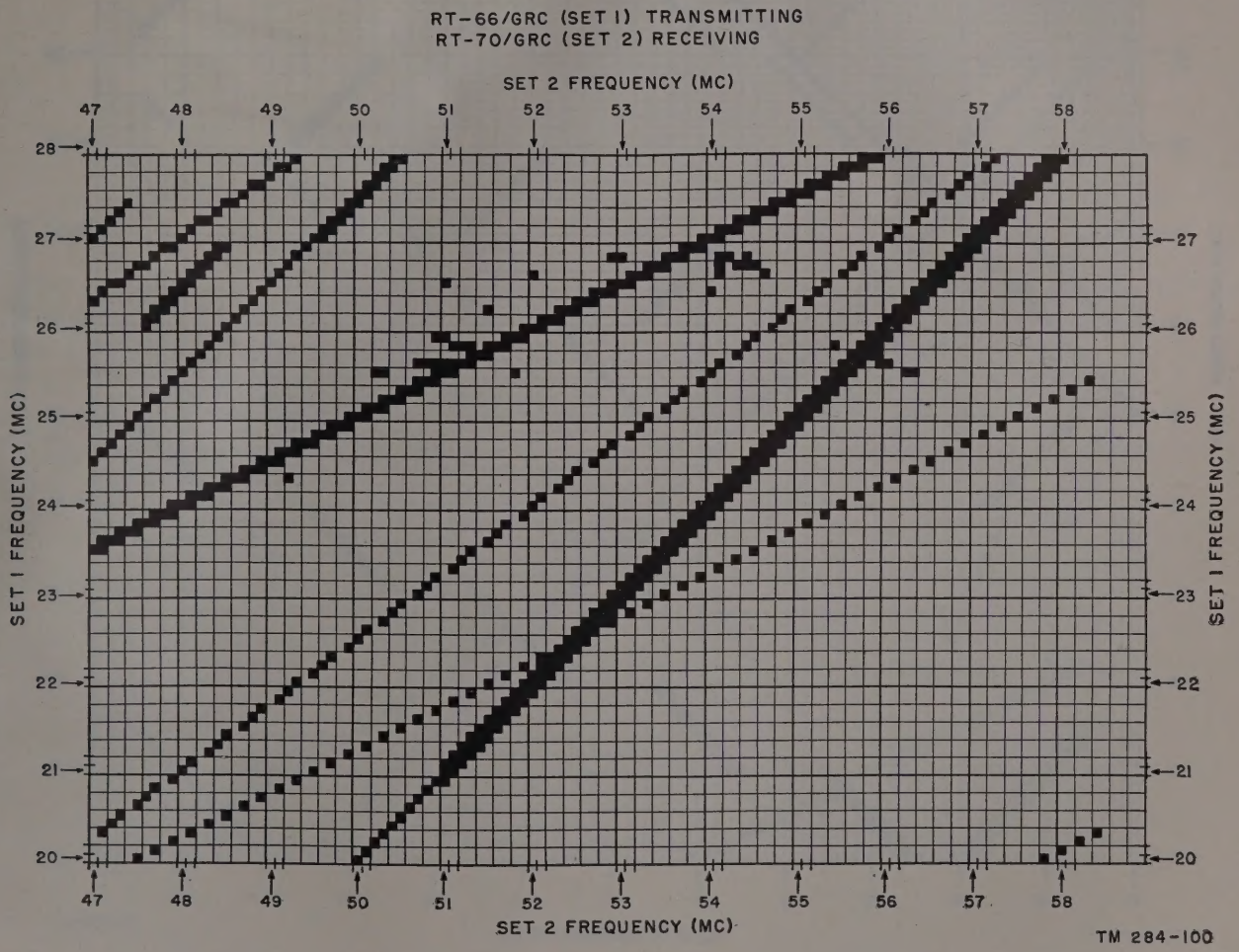



*Figure 51. Chart showing interference between transmitter of Receiver-Transmitter RT–66/GRC and receiver of Receiver-Transmitter RT–70/GRC.*



254722°—53——6

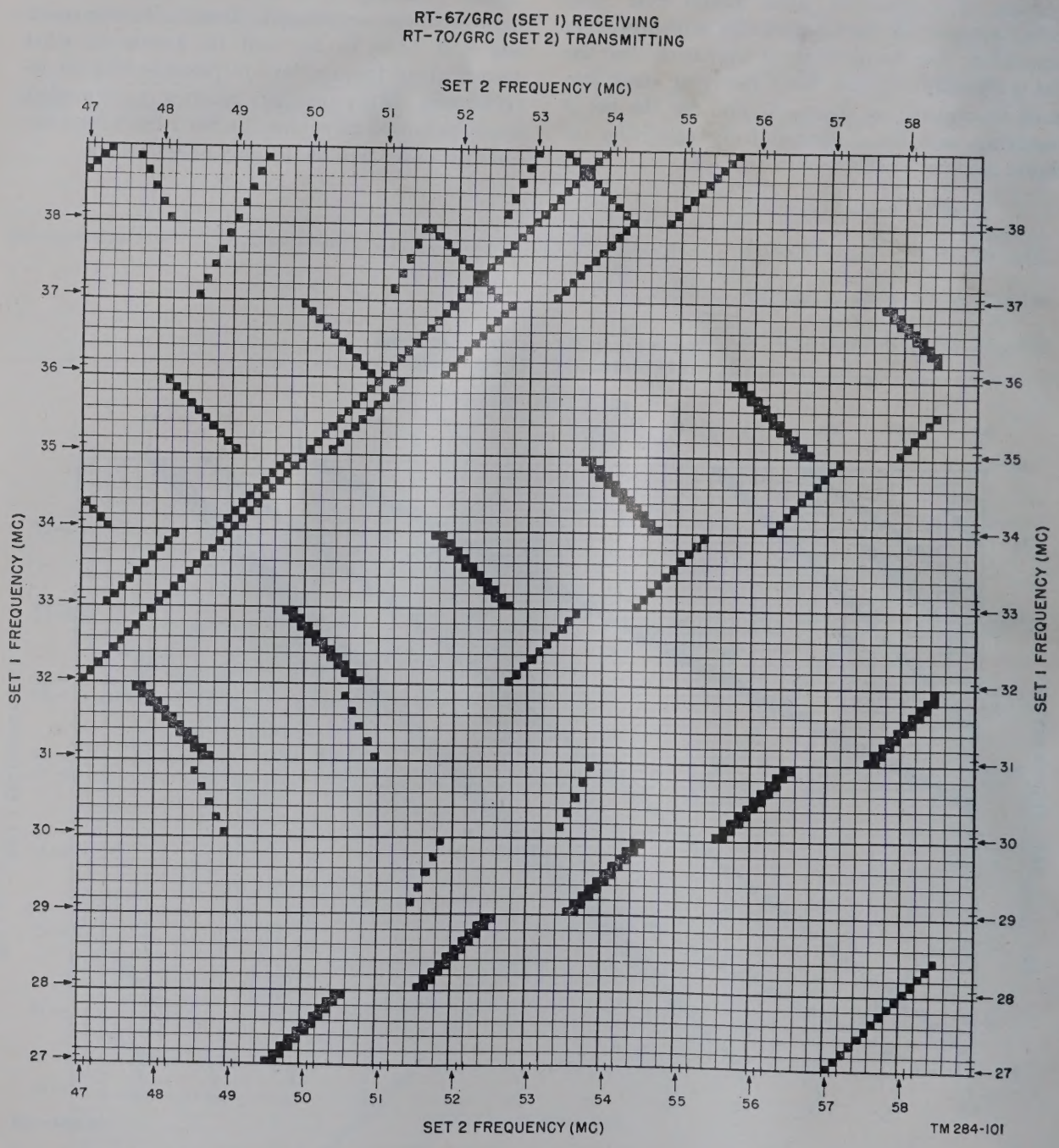



*Figure 52. Chart showing interference between receiver of Receiver-Transmitter RT–67/GRC and transmitter of Receiver-Transmitter RT–70/GRC.*

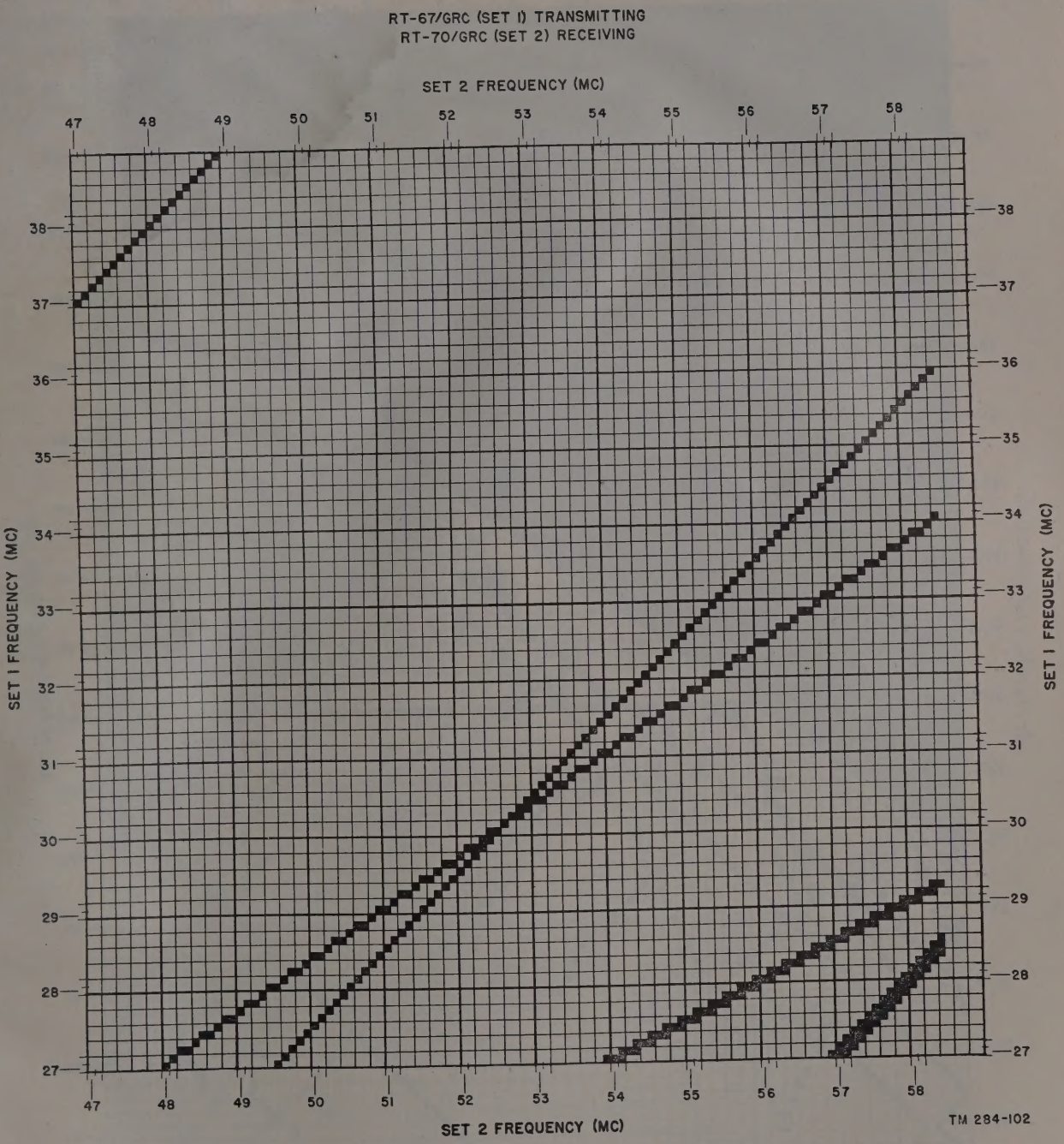



*Figure 53. Chart showing interference between transmitter of Receiver-Transmitter RT-67/GRC and receiver of Receiver-Transmitter RT-70/GRC.*

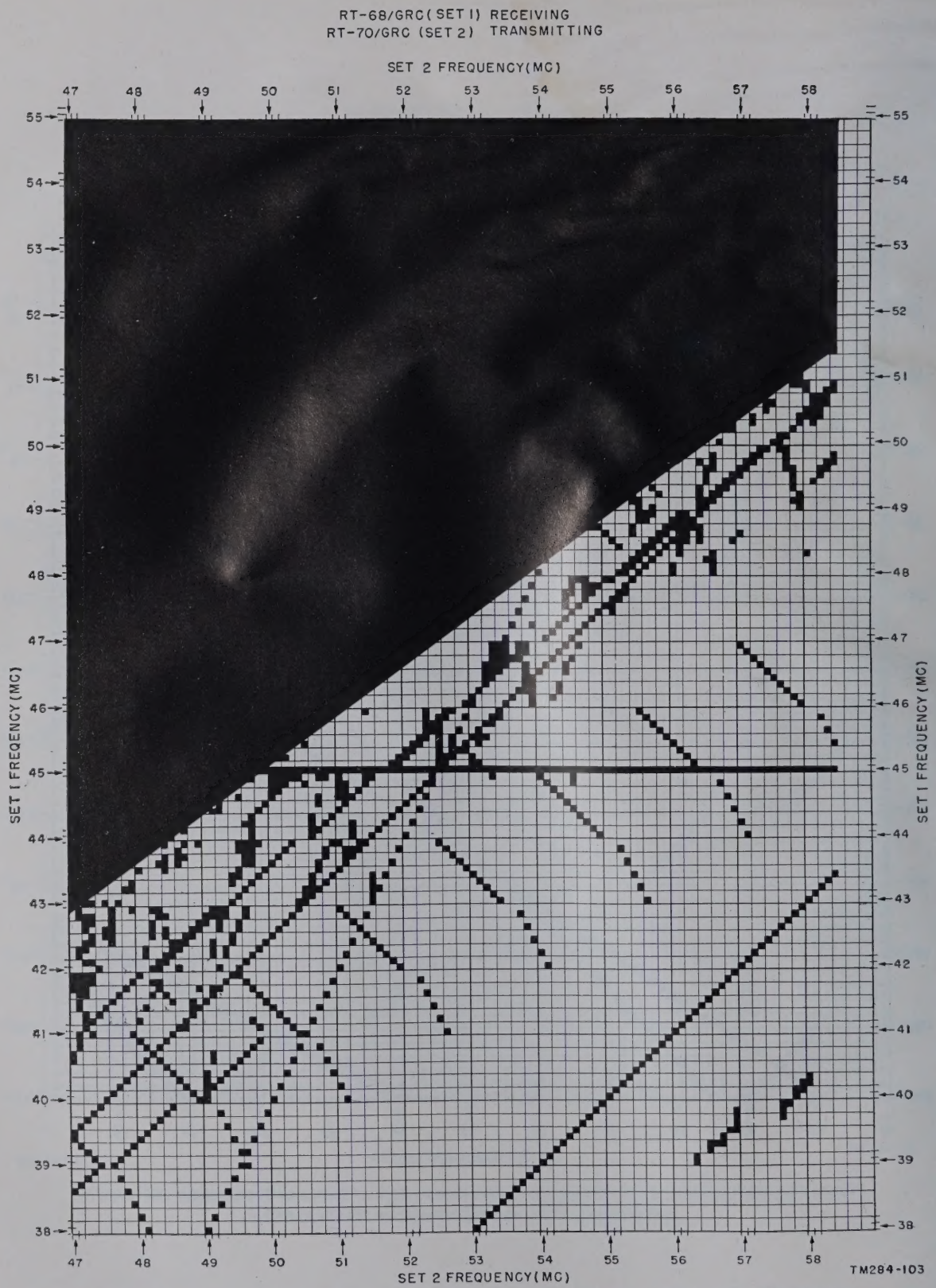



*Figure 54. Chart showing interference between receiver of Receiver-Transmitter RT–68/GRC and transmitter of Receiver-Transmitter RT–70/GRC.*

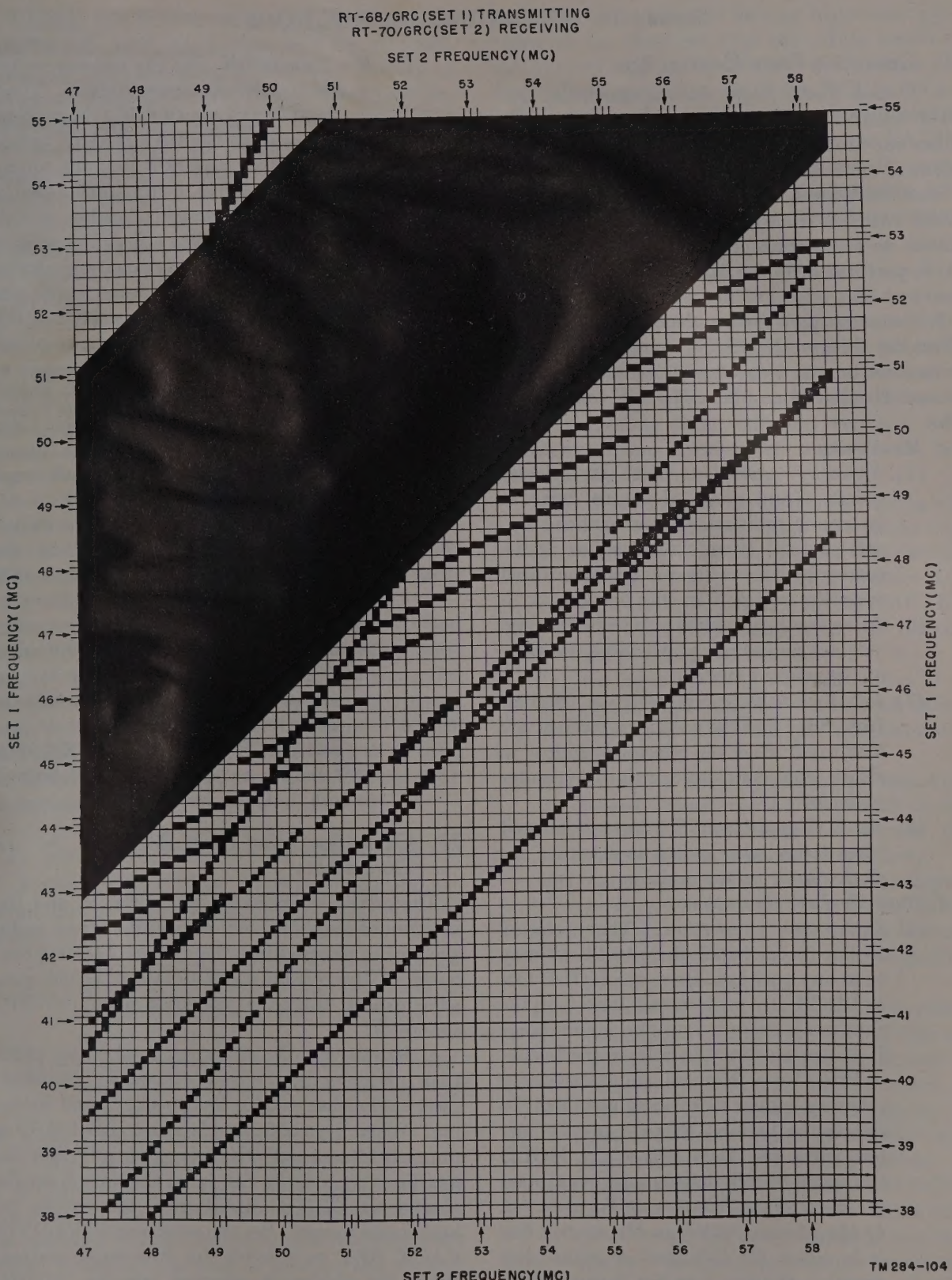



*Figure 55. Chart showing interference between transmitter of Receiver-Transmitter RT-68/GRC and receiver of Receiver-Transmitter RT-70/GRC.*

## 71. Operation From Control Box

*a. Setting Radio Trans Switch.* Lock the RADIO TRANS switch (top of control box) in either one of its RADIO TRANS positions. This makes it unnecessary to operate this switch when a chest set is used. (The function of this switch, which switches from interphone push-to-talk operation to radio transmission (over Set 1 or Set 2), is performed by the RADIO-INT switch on the chest set.)

*b. Connection of Audio Accessories.* Connect Chest Set Group AN/GSA–6 to one of the audio connectors on the side of each control box and connect Headset-Microphone H–63/U to the chest set.

*c. Monitoring.*

(1) *Stand-by operation.* Set the selector switch (front panel of control box) at its center position. All interphone signals and all signals received or transmitted by the radio set are monitored when the switch is in this postion.

(2) *Interphone operation.* Interphone signals are monitored at all three positions of the selector switch.

(3) *Set 1 and auxiliary receiver.* Signals from Set 1 and the auxiliary receiver are monitored when the selector switch is in either the counterclockwise or center position.

(4) *Set 2.* Signals from Set 2 are monitored when the selector switch is in either the clockwise or center position.

*d. Push-To-Talk Operation.*

(1) *Interphone operation.* The selector switch (front panel of control box) may be in any position. Press the HOLD ON or LOCK ON push-to-talk button on the chest set and talk into the microphone. It is not necessary to release the button to listen for a response. Simultaneously two-way communication is possible. To release the LOCK ON push-to-talk button, press and then release the HOLD ON push-to-talk button. *Do not press the RADIO-INT button on the chest set. If the selector switch on the control box is in either the left-hand or right-hand position, the Set 1 or Set 2 transmitter will be operated.*

(2) *Set 1 operation.* Set the selector switch in the counterclockwise position. Press the HOLD ON or LOCK ON push-to-talk button and the RADIO-INT button simultaneously and talk into the microphone. The signal being transmitted is heard in the operator's headset and at any other control box where the selector switch is in either the counterclockwise or center position. Release either the RADIO-INT button or the HOLD ON button, or both, to listen for a response.

*Note.* Unless it is absolutely necessary, do not transmit on Set 1 for more than 15 minutes without a break. Overheating in the Set 1 power supply results and shortens the life of its components. After each 15-minute transmitting period, wait 5 minutes before resuming transmission.

(3) *Set 2 operation.* Set the selector switch in the clockwise position. Press the HOLD ON or LOCK ON push-to-talk button and the RADIO-INT button simultaneously and talk into the microphone. The signal being transmitted is heard in the operator's headset and at any other control box where the selector switch is in either the clockwise or center position. Release either the RADIO-INT button or the HOLD ON button, or both, to listen for a response.

## 72. Operation From Panel AUDIO Connectors

The auxiliary receiver, Set 1, Set 2, and the interphone amplifier may be operated from audio accessories plugged into their panel AUDIO connectors. Interphone communication is not possible except from the amplifier panel AUDIO connector.

*a. Monitoring.* No operation is necessary other than plugging in the audio accessory (handset, chest set-headset and/or loudspeaker) and listening. When Dynamic Loudspeaker LS–166/U is plugged into an AUDIO connector of either the auxiliary receiver or Set 1, set the switch on the speaker at VEHICULAR SET to provide for high audio output. Set the switch at FIELD OR PACK SET to provide for low audio output. When the speaker is plugged into the AUDIO connector on Set 2, the speaker switch must be set

at FIELD OR PACK SET. If it is set at VEHICULAR SET, no output will be obtained. When an audio accessory is connected directly to the panel of Set 1, Set 2, or the auxiliary receiver, monitoring only of the signal received by that unit is possible. At the panel of the interphone amplifier, however, monitoring of all received signals is possible.

*b. Set 1 and Set 2.* Use either a handset or a chest set and headset-microphone combination at the Set 1 or Set 2 panel. When a handset is used, press the push-to-talk button to transmit; release to listen. When a chest and headset-microphone combination is used, press the HOLD ON or LOCK ON push-to-talk button and the RADIO-INT button on the chest set to transmit; release either one or both buttons to listen.

*c. Ringing.* To transmit a 1,600-cycle ringing signal from Set 1, hold the DIAL LIGHT OFF-ON-RING switch in the RING position. Release the switch to listen for a response. Ring for 5-second intervals; listen for 5-second intervals. When the ringing signal is acknowledged, proceed with push-to-talk operation.

*d. Interphone Communication.* Interphone communication is possible from an audio accessory plugged into the panel AUDIO connectors of the retransmission unit and the interphone amplifier. Press the HOLD ON or LOCK ON and RADIO-INT buttons on the chest set to talk. It is not necessary to release the buttons to hear a response.

## 73. Operation From Retransmission Unit

*a. Introduction.* The following facilities are available at the retransmission unit (Control C–435/GRC):

(1) Retransmission by Set 2 of signals received by Set 1 and the auxiliary receiver or retransmission by Set 1 of signals received by Set. 2.
(2) Duplex operation using Set 1 as a transmitter and Set 2 or the auxiliary receiver as a receiver.
(3) Interphone operation.
(4) Operation of Set 1 and Set 2.

*b. Connection of Audio Accessories.* Connect the chest set and headset-microphone combination to the AUDIO connector on the retransmission unit. When the chest set is used on the retransmission unit, the RADIO-INT button may be locked, for convenience, in the RADIO position by means of the internal locking adjustment provided in the chest set (fig. 48). This makes it unnecessary to press the RADIO-INT button for push-to-talk operation. Only the HOLD ON or LOCK ON push-to-talk button need be pressed if the RADIO-INT button is locked in the RADIO (pressed in) position. When push-to-talk operation is not required, Dynamic Loudspeaker LS–166/U may be connected to the AUDIO connector.

*c. Retransmission.* The retransmission facilities provide a radio link between two radio sets which are either too widely separated to permit direct communication or which cannot be tuned to the same frequency. The retransmission generally is initiated by a push-to-talk contact from one of the distant stations. When such a contact is made, requesting communication facilities with another station, proceed as outlined in (1) through (8) below.

(1) When a signal (preferably a ringing signal) is received from the contacting party, turn and hold the AUTO switch at the ADJUST METER position and turn the appropriate ADJUST METER TO CENTER control (No. 1 if the signal is being received on Set 1, No. 2 if the signal is being received on Set 2) to obtain approximately center scale deflection (red line) on the retransmission unit meter.
(2) When the level adjustment has been completed, release the AUTO switch to the RETRANS position and request the calling station to stand by (*f* below).
(3) Set the MANUAL switch at the appropriate position (SEND SET 1 or SEND SET 2) and make push-to-talk contact with the other distant station, requesting that station to call in.
(4) Adjust the level for the second receiver-transmitter as outlined for the first set in (1) above. When the adjustment is complete, release the AUTO switch to the RETRANS position and request the second station to stand by to await communication from the calling station.
(5) Again contact the first station to inform the operator there that the retransmission circuit has been completed and that he can communicate with the second station. Stand by with the AUTO switch in the RETRANS position and the MAN-

UAL switch in the INT position to allow the retransmission to proceed.

(6) The two-way conversation can be monitored in the headsets at both the retransmission unit and the control boxes. The SIGNAL REC SET 1 and SIGNAL REC SET 2 lamps will indicate which station is being monitored at any particular time.

(7) If reception occurs on the auxiliary receiver while Set 2 is transmitting, the auxiliary receiver signal will be retransmitted along with the Set 1 signal. To avoid such interference (if it is not desired), turn the auxiliary receiver off (VOLUME control to OFF).

(8) To interrupt the retransmission, set the AUTO switch at OFF. Hold the MANUAL switch at SEND SET 1, press the HOLD ON and RADIO-INT buttons on the chest set, and inform the station tuned to the Set 1 signal of the reason for the interruption. Then set and hold the MANUAL switch at SEND SET 2, press the HOLD ON and RADIO-INT buttons on the chest set, and inform the station tuned to Set 2 of the reason for the interruption. Release the MANUAL switch to INT, or release one or both buttons on the chest set (whichever is more convenient) to listen for a response.

*d. Monitoring.* The outputs of each receiver and the interphone system are present in the headset at all times except when the AUTO switch is in the RETRANS or ADJUST METER position and retransmission is occurring. (During retransmission, the receiver audio circuits are open in the set acting as a transmitter.)

*e. Interphone Operation.* Full duplex interphone operation is possible except when the AUTO switch is in the DUPLEX position. For communication with an operator at any interphone station, press the HOLD ON or LOCK ON button and the RADIO-INT button (if it is not already locked in the RADIO position) and talk into the microphone. The output circuits of the interphone system are connected to the headset at all times.

***Caution:*** If interphone operation is attempted while the AUTO switch is at DUPLEX, the message will be transmitted over Set 1.

*f. Communication Over Set 1 and Set 2.* Place the AUTO switch in the OFF position and operate as outlined in (1) and (2) below.

(1) For push-to-talk operation of Set 1, hold the MANUAL switch in the SEND SET 1 position, press the HOLD ON or LOCK ON button and the RADIO-INT button (if it is not already locked in the RADIO position), and talk into the microphone. Release the buttons or the MANUAL switch or all three (whichever is more convenient) to listen for a response.

(2) For push-to-talk operation of Set 2, hold the MANUAL switch in the SEND SET 2 position, press the HOLD ON or LOCK ON button and the RADIO-INT button (if it is not already locked in the RADIO position), and talk into the microphone. Release the buttons or the MANUAL switch or all three (whichever is more convenient) to listen for a response.

*g. Duplex Operation.* Normal duplex operation utilizes Set 1 as a transmitter and Set 2 as a receiver. Operate as follows: Set the AUTO switch at DUPLEX. This puts the Set 1 transmitter on the air regardless of the push-to-talk and RADIO-INT buttons on the chest set. Press the HOLD ON or LOCK ON button and the RADIO-INT button (if it is not already locked in the RADIO position) on the chest set and talk into the microphone. Reception over Set 2 is always available regardless of the positions of the chest set switches. *Do not keep the transmitter in operation for more than 15 minutes at a time as overheating of the Set 1 power supply and damage to its components will result. Allow a 5-minute rest period after each 15-minute transmitting period by setting the AUTO switch at OFF and releasing any one or both of the chest set buttons.*

## 74. Operation From Control Group AN/GRA-6

*a. Modes of Operation.* Although Control Group AN/GRA-6 is provided mainly to allow remote operation of the radio sets from points as far as 5 to 10 miles away from the installation, local as well as remote operating facilities are available. The complete facilities are indicated in (1) through (6) below.

(1) Simultaneous monitoring at local and remote control units of all signals.
(2) Local push-to-talk operation of Set 1 and Set 2.
(3) Telephone communication, including ringing, between local and remote units.
(4) Remote push-to-talk operation of Set 1 and Set 2.
(5) Remote power control of the radio set and remote push-to-talk operation of Set 1.
(6) Remote power control of the radio set and remote push-to-talk operation of Set 2.

*b. Installation.* Set the OFF-REMOTE-ON switch of the mounting at OFF and install Control Group AN/GRA–6 as outlined in paragraph 38. When the installation is completed, apply power to the set, make the squelch and volume-level adjustments, and select the operating frequencies as outlined in paragraph 69. Leave the OFF-REMOTE-ON switch at ON except as directed for remote power control in *g* and *h* below.

*c.* Monitoring. To monitor the output of the ceivers at both the local and remote control units, set the REMOTE switch of the local control unit at any position except TEL ONLY. This allows all signals including interphone as well as signals received or transmitted by Set 1 and Set 2 to be heard at the local and remote control units.

*d. Local Push-To-Talk Operation.*

(1) For push-to-talk operation of Set 1, hold the LOCAL switch in the Set 1 position, press the HOLD ON or LOCK ON button and the RADIO-INT button on the chest set, and talk into the microphone. Release the LOCAL switch and chest set buttons to listen for a response.

*Note.* For convenience the RADIO-INT switch on the chest set should be locked in the RADIO position by means of the internal locking adjustment (fig. 48).

(2) For push-to-talk operation of Set 2, hold the LOCAL switch in the Set 2 position, press the HOLD ON or LOCK ON button on the chest set and talk into the microphone. Release the LOCAL switch to listen for a response.

*e. Telephone Communication.* For normal telephone communication between local and remote units, place the REMOTE switch of the local unit in the TEL ONLY position and the SELECTOR switch of the remote unit in the TEL position. These are the normal positions of the switches when accidental push-to-talk operation of the Set 1 or Set 2 transmitters by an operator at the remote control unit is not desired.

(1) To send a ringing signal in either direction, turn the crank of the ringing generator at the sending unit (local or remote). Either a CALL LIGHT will glow or a bell will ring at the other unit, depending on the setting of the internal BELL-LAMP switches in the local and remote control units.

*Note.* A ringing signal may be sent at any time in either direction without interfering with radio operations.

(2) To communicate, press the push-to-talk switch on the handset (at the remote unit) or the HOLD ON and RADIO-INT buttons on the chest set (at the local unit) and talk into the mouthpiece or microphone. Full duplex operation is possible. Release the button while listening, to conserve the battery.

*f. Remote Push-To-Talk Operation.* If the remote operator is to select Set 1 or Set 2 as transmitting medium, the procedure is outlined in (1) through (3) below.

(1) The operator at the remote unit must inform the local operator to set the REMOTE switch of the local unit in the Set 1 and 2 position.
(2) For remote push-to-talk operation of Set 1, set the SELECTOR switch of the remote control unit in the left-hand write-in position, press the push-to-talk switch on the handset, and talk into the mouthpiece. Release the push-to-talk switch to listen.
(3) For remote push-to-talk operation of Set 2, place the SELECTOR switch of the remote unit in the right-hand write-in position, press the push-to-talk switch on the handset, and talk into the mouthpiece. Release the push-to-talk switch to listen.

*Note.* If the telephone line connections at either unit are reversed, the right-hand write-in position will control Set 1 and the left-hand write -in position will control Set 2.

*g. Remote Power Control and Push-To-Talk Operation of Set 1.* For operation with remote power control, frequency selections, squelch and volume-level adjustments, and local control switch settings must be made at the radio set. If two operators are available, the telephone facilities between the remote and local control units can be used for directions from the remote unit.

(1) Set the OFF-REMOTE-ON switch (on the mounting) in the REMOTE position.

(2) Set the REMOTE switch of the local control unit in the SET 1 position.

(3) Set the SELECTOR switch at the remote control unit in the left-hand write-in position. Press the push-to-talk switch on the handset momentarily. If power is not applied to the radio set (as determined through telephone communication), reverse the line connections to terminals L1 and L2 on either (but not both) the local or remote control unit and press the push-to-talk button on the handset momentarily.

(4) To transmit, press the push-to-talk switch on the handset and talk into the microphone. To receive, release the push-to-talk switch and listen for a response.

(5) To remove power from the radio set, turn the SELECTOR switch to the right-hand write-in position and press the push-to-talk switch momentarily.

*Note.* The use of the left-hand write-in position as an ON position and the right-hand write-in position as an OFF position is chosen for convenience. If the telephone line is reversed, the functions of the left-hand and right-hand switch positions are reversed.

*h. Remote Power Control and Push-To-Talk Operation of Set 2.*

(1) Set the REMOTE switch of the local control unit in the SET 2 position.

(2) Set the SELECTOR switch at the remote unit in the left-hand write-in position. Press the push-to-talk switch on the handset momentarily. This applies power to the radio set.

(3) To transmit, press the push-to-talk switch on the handset and talk into the microphone. To receive, release the push-to-talk switch and listen for a response.

*i. Remote Control of Set 2 in Field Installations.* Control Group AN/GRA–6 also is used for remote control of Set 2 when used with Case CY–590/GRC in a field installation. For installation and operation, refer to paragraph 169.

## 75. Miscellaneous Applications

*a. Low-Power Operation of Set 1.* If it is desired to operate Set 1 for short range communication, the power output can be reduced by placing the TRANS POWER switch of the Set 1 power supply in the LOW position.

*b. Manual Retransmission.* If retransmission is erratic, as indicated by chattering of the relays in the retransmission unit and interrupted flashing of the SIGNAL REC SET 1 and SIGNAL REC SET 2 lamps, the MANUAL switch may be used in place of the automatic switching circuits to complete the retransmission. If the signal is being received on Set 1, hold the MANUAL switch at SEND SET 2; if the signal is being received on Set 2, hold the MANUAL switch at SEND SET 1.

*c. Retransmission of Auxiliary Receiver Output.* The output of the auxiliary receiver may be retransmitted manually over Set 2 with the AUTO switch at either the DUPLEX or RETRANS position. If the DUPLEX position is used, a separate antenna is required for the receiver and connecting Wire W–142 must be removed from the front panels. Connect the antenna (when required) and proceed as in (1) and (2) below.

(1) Turn the AUTO switch of the retransmission unit to either the RETRANS or the DUPLEX position.

(2) Hold the MANUAL switch at the SEND SET 2 position.

*d. Duplex Operation With Set 1 and Auxiliary Receiver.* The auxiliary receiver may be used with Set 1 for duplex operation if a separate antenna is provided for the receiver. Disconnect Wire W–142, connect the antenna, and proceed as in (1) through (3) below.

(1) Connect a chest set (with headset and microphone) to the AUDIO connector on the retransmission unit.

(2) Turn the AUTO switch to the DUPLEX position.

(3) To transmit, press the RADIO-INT and push-to-talk switches on the chest set, and talk into the microphone. The received signal is always available in the headset. However, release the chest set buttons when receiving. This prevents overheating and damage to the Set 1 power supply and also conserves the vehicular storage battery.

## Section V. OPERATION UNDER UNUSUAL CONDITIONS

### 76. General

Operation of Radio Sets AN/GRC–3 through –8 may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given for minimizing the effects of these unusual operating conditions.

### 77. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follows:

*a.* Handle the equipment carefully.

*b.* If possible, try to keep the equipment warm and dry.

*c.* Heavy coatings of frost gather on mouth-type microphones in extreme cold weather when the microphones are used in the open air or in a cold room. Frost forms from the breath in the small holes of the cap and affects transmitter modulation. Rubber diaphragms have been designed to protect some types of microphone; use them when available. Have a spare microphone ready, if possible, in case the one in use fails to function properly.

*d.* Wear a knitted woolen cap over the headset when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber earcaps, since this action may render them useless. If water gets into the headset receivers, or if moisture condenses within them, it may freeze and impede the actuation of the diaphragm. When this happens, remove the bakelite cap and remove the ice and moisture from the receiver.

*e.* When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

*f.* Use any improvised means to protect dry batteries, since they will fail if not protected against the cold. Preheat the batteries. To prevent heat loss, place them in bags lined with kapok, spun glass fiber materials, animal skins, or woolen clothing. Refer to TB SIG 66 for further information.

### 78. Operation in Tropical Climates

When operated in tropical climates, the equipment is subject to extreme conditions of moisture and fungus growth. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment. Refer to TB SIG 72 for further information.

### 79. Operation in Desert Climates

*a.* Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

*b.* The main problem which arises with the equipment operation in desert areas is the large amount of sand, dust, and dirt which enters the moving parts of radio equipment, such as motors and power units. Try to keep the radio sets within their dustproof containers as much as possible.

*c.* Take care to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (pars. 131–136). Pay particular attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit which damages the equipment. Refer to TB SIG 75 for information.

# CHAPTER 4

# THEORY OF OPERATION

## Section I. INTRODUCTION

### 80. General

*a.* System theory is presented to provide an understanding of how the several units are interrelated in the various operations of the radio set. Such an understanding should be effective in trouble shooting the equipment to isolate a defective unit and, in some cases, to isolate a defective part within a unit.

*b.* Detailed circuit theory of each unit is not discussed, except where units are interconnected in a common circuit. For example, the microphone circuits of Set 1 are described, since they are interconnected with the control units through the mounting. Many details, such as those of the Set 1 i-f amplifier, are not important for *system* understanding and, therefore, are not discussed. Most of the information presented in this chapter concerns system applications of the several units. Complete details on the individual units are available in separate technical manuals (app. I). To provide a general acquaintance with the individual units, however, block diagrams of the major units are included and schematic diagrams of all the units will be found at the end of the manual.

### 81. Basic System Block Diagram

*a.* Each of the radio sets consists of two receiver-transmitters and an interphone amplifier, with speech-input and monitoring facilities as shown in figure 56. In Radio Sets AN/GRC–3, –5, and –7, the output of an auxiliary receiver is paralleled with the output of the Set 1 receiver. These basic units are the essentials of the systems. Power supplies, cables, mountings, and miscellaneous equipment are supplied to make the basic units perform their function of transmitting, receiving, or monitoring.

*b.* In an actual system installation, microphone and headset facilities are provided at each control box (Control Box C–375/VRC). Switches on the control box and audio accessories allow selection of the method of operation; namely, transmission on Set 1, interphone operation, transmission on Set 2, or monitoring. The control facilities are extended from the individual units to the control boxes through Mounting MT–297/GR and the interconnecting cables (fig. 33).

*c.* An adaptation of the basic system (fig. 37) allows the radio set to function as a relay station to extend the range of another radio set or to provide a link between two sets whose different frequency ranges make communication otherwise impossible. As indicated in figure 37, the signal picked up by one receiver-transmitter is retransmitted over the other receiver-transmitter. Retransmission can take place in either direction. In this application, the microphone input of figure 56 is replaced by a signal received from a distant set. The retransmission unit (Control C–435/GRC) provides the necessary switching facilities for these functions; it also provides facilities for the basic mode of operation illustrated in figure 56.

*d.* Another facility provided by Control C–435/GRC adapts the basic system for duplex operation (fig. 38). In this adaptation, a dual channel of communication is established with another radio set, with transmission taking place over one receiver-transmitter at one frequency while reception takes place over the other receiver-transmitter at a different frequency. Simultaneous two-way or *break-in* operation is possible. If the microphone in figure 56 is switched to Set 1 while the headset is switched to monitor Set 2, the basic duplex function is

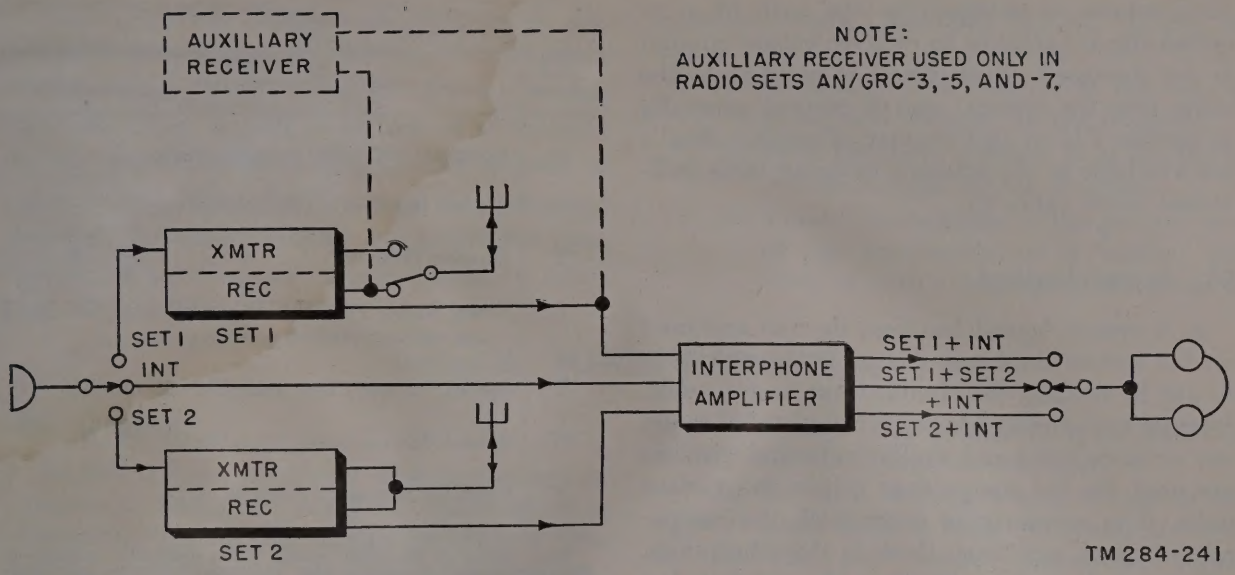



*Figure 56. Basic system block diagram.*

illustrated. (This switching can be done only at the retransmission unit; microphone and headset switching occurs simultaneously at the interphone boxes.)

*e.* Another adaptation of the basic system is the extension of the microphone and monitoring facilities to a remote point by telephone lines. Control Group AN/GRA–6 is provided to accomplish this function. The extension of power control facilities to a remote point (another function of the control group) is not illustrated on the block diagram since power supply circuits are not shown.

## 82. System Diagrams

*a.* Four diagrams (figs. 127, 128, 129, and 130) are used to illustrate system interconnections and functioning. The diagrams make it possible to follow, on a single schematic, a circuit which originates in one unit and passes through one or more other system units. System control circuits including power distribution are shown on figures 127, 128, and 129. For simplicity, the monitoring circuits are not shown on these three figures but are shown on a separate figure (fig. 130).

*b.* A different control unit has been shown on each of the three system control circuit diagrams to illustrate how the transmitter control and audio input (microphone) circuits are switched and connected for the various modes of operation. Figure 127 illustrates push-to-talk control circuits utilizing the control box (Control Box C–375/VRC). Figure 128 illustrates push-to-talk, duplex, and retransmission circuits utilizing the retransmission unit (Control C–435/GRC). Figure 129 illustrates the local and remote push-to-talk facilities, the remote power control facilities, and the telephone facilities which are provided by the local (Local Control C–434/GRC) and remote (Remote Control C–433/GRC) units of Control Group AN/GRA–6.

*c.* Although the retransmission unit and the local and remote control unit control circuits are illustrated separately from the functions available at the control box, it should be realized that the control box is always available. Generally, either the retransmission unit or the local and remote control units are used in conjunction with the control boxes. The separation is made only to simplify the system control circuit and its explanation.

*d.* Figure 130 illustrates all of the monitoring facilities that are available in the radio sets and the interconnections and switching that are necessary to utilize these facilities.

*e.* Partial schematic diagrams (figs. 57 through 66) are used to clarify the circuit descriptions. These diagrams are portions of the system control circuit diagrams. References are made on the partial diagrams to those sections of the system diagrams that have been included. The passage of a signal through the transmitter

(microphone to antenna) or the path of a received signal (antenna to receiver output circuit) is not discussed. Such detail is peculiar to the units (not the system) and is covered generally in section VII of this chapter. Complete details are available in the manuals covering these individual units (app. I).

## 83. System Legend

*a.* A system legend has been devised and used on the system diagrams (figs. 127 through 130) to aid in tracing the circuit from unit to unit. Because each circuit usually is completed through one or more units and similar reference symbols are used for the components within the various units, it is necessary to distinguish the components in each unit from those in the other units.

*b.* As indicated on the legends, a letter has been used to identify each unit. This letter has been prefixed to the reference symbol of the component in a particular unit. Thus, in the reference symbol H/P–5B at the upper left-hand corner of figure 127, H indicates Mounting MT–297/GR, P–5 is the reference symbol for a plug on the mounting (the termination of one of the mounting cables), and B indicates terminal B of the plug. Interconnection of H/P–5B and D/J–6B indicates that the circuit is continued to terminal B of receptacle J–6 in AF Amplifier AM–65/GRC. The legend, which appears on figures 127, 128, 129, and 130, is listed below.

| Legend | |
|---|---|
| Unit symbol | Unit symbolized |
| A | Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC (Set 1). |
| C | Receiver-Transmitter RT–70/GRC (Set 2). |
| D | AF Amplifier AM–65/GRC (interphone amplifier). |
| E | Power Supply PP–109/GR or PP–112/GR (Set 1 power supply). |
| G | Radio Receiver R–108/GRC, R–109/GRC, or R–110/GRC (auxiliary receiver). |
| H | Mounting MT–297/GR. |
| M | Remote Control C–433/GRC } Control Group |
| N | Local Control C–434/GRC } AN/GRA–6. |
| P | Control C–435/GRC (retransmission unit). |
| R | Control Box C–375/VRC (control box). |
| T | Handset H–33/PT. |
| U | Power Supply PP–281/GRC or PP–282/GRC (Set 2 and auxiliary receiver power supplies). |
| V | Special Purpose Cable Assembly CX–1211/U. |
| W | Special Purpose Cable Assembly CX–1213/U. |
| Y | Chest Set Group AN/GSA–6. |

*Note.* Several of the letters missing in the alphabetical sequence of these unit symbols are used for other units in other technical manuals on related radio sets in the standardized series.

*c.* The following chart gives the correlation between the physical and electrical interconnections made between the mounting and other units. These are shown on figures 26 and 33.

| Mounting cable | Cable termination | Mating connector | | |
|---|---|---|---|---|
| | | Receptacle | Unit | Receptacle designation |
| W–1___ | P–1 | J–1 | Auxiliary receiver | POWER IN |
| W–2___ | P–2 | J–8 | Auxiliary receiver | REC CONTROL |
| W–3___ | P–3 | J–312 | Set 1 | REC-TR CONTROL |
| W–4___ | P–4 | J–6 | Interphone amplifier | POWER IN |
| W–5___ | P–5 | J–6 | Set 1 power supply | POWER IN |
| W–6___ | P–6 | J–4 | Interphone amplifier | REC-TR CONT |
| W–7 | P–7 | J–2 | Interphone amplifier | INT CONT |
| W–8___ | E–8, E–11 | | Battery or vehicular terminal box | |

*d.* To facilitate location of components discussed in text, the system control circuit diagrams incorporate a coordinate system similar to that used on maps. A part to be located is followed by the coordinate letter and number inclosed in parentheses. Through the use of the letter and number, the reader readily can locate the component on the diagram. For example, to locate contacts 6 and 7 of relay H/O–1 (G–16) on figure 127—

(1) Find the index letter *G* at the left- or right-hand margin of the diagram.
(2) Find the index number *16* at the top or bottom margin of the diagram.
(3) Locate the contacts in the general area of the intersection of a vertical line from *16* with a horizontal line from *G*.

## Section II. POWER DISTRIBUTION

### 84. General

In this section, the power distribution system common to Radio Sets AN/GRC–3 through –8 is discussed. The system circuit is divided into several sections which are discussed separately.

### 85. Primary Power Application (fig. 57)

The OFF-REMOTE-ON switch (H/S–1) in the mounting controls application of power to the entire radio set. When this switch is at ON, a circuit is completed from the battery, through fuses H/F–1 and H/F–2, the front section of the OFF-REMOTE-ON switch, the coil of relay H/K–1, resistor H/R–3, and the rear section of the OFF-REMOTE-ON switch to ground. The negative side of the battery is grounded through H/E–11 and H/E–12. When the OFF-REMOTE-ON switch is set at REMOTE, the circuit is the same except that the second section of the switch completes the circuit to terminal H/J–1M. This terminal is connected to ground through Control Group AN/GRA–6 when the controls on that equipment are set to turn power on. H/R–3 is a voltage-dropping resistor which allows 12 volts to be applied to the relay coil when a 24-volt battery is used as the voltage source. When a 12-volt battery is used, a jumper is placed across H/R–3. This allows the coil of H/K–1 to receive the full 12 volts necessary to operate it. The coil of relay H/K–1 is energized and its contacts close to complete the positive side of the battery to four branch circuits.

*a.* In the first branch, battery voltage is applied through H/E–1, cable W–1, and H/P–1B to G/J–6B (on auxiliary receiver).

*b.* In the second branch, battery voltage is applied through H/E–3, cable W–4, and H/P–5B to D/J–6B (on interphone amplifier).

*c.* In the third branch, battery voltage is applied through H/E–3, cable W–5, and H/P–4B to E/J–1B (on receiver-transmitter power supply).

*d.* In the fourth branch, the battery circuit is completed to ground through H/E–3 and H/E–7. H/E–7, the POWER lamp on the mounting, lights to indicate the voltage is available at the terminals of the mounting.

### 86. Set 1 Power Distribution Circuits (figs. 58, 59, and 60)

The circuits in figures 58, 59, and 60 follow the circuit in figure 57.

*a. Power Input Circuits.* Four-section OPERATE switch E/S–1 on the panel of the Set 1 power supply acts as a power (on-off) switch for Set 1. Battery potential is supplied to the switch through H/P–4B and E/J–1B. When the switch is set in either the RECEIVE or the TRANS & RECEIVE position, Set 1 is ready for monitoring. Operation is the same for both positions as long as no transmit control switch (such as a push-to-talk switch) is operated.

*Note.* With most models of the Set 1 power supply, when the OPERATE switch is at RECEIVE, pressing the push-to-talk switch (on a handset or chest set) energizes transmit-control relay A/0–101. This operates the transmitter reactance modulator stage (V–105 and V–106), the oscillator (V–104A), the mixed (V–6), and the transmitter r-f stage (V–7 and V–8). (If the TRANS POWER switch on the power supply is at LOW, the transmitter driver stage (V–9 and V–10) also operates.) This makes it possible to transmit accidentally by pressing the push-to-talk button even when the OPERATE switch of the power supply is in the RECEIVE position. With some of the later models of the receiver-transmitter power supply, pressing the push-to-talk switch does not energize the transmit-

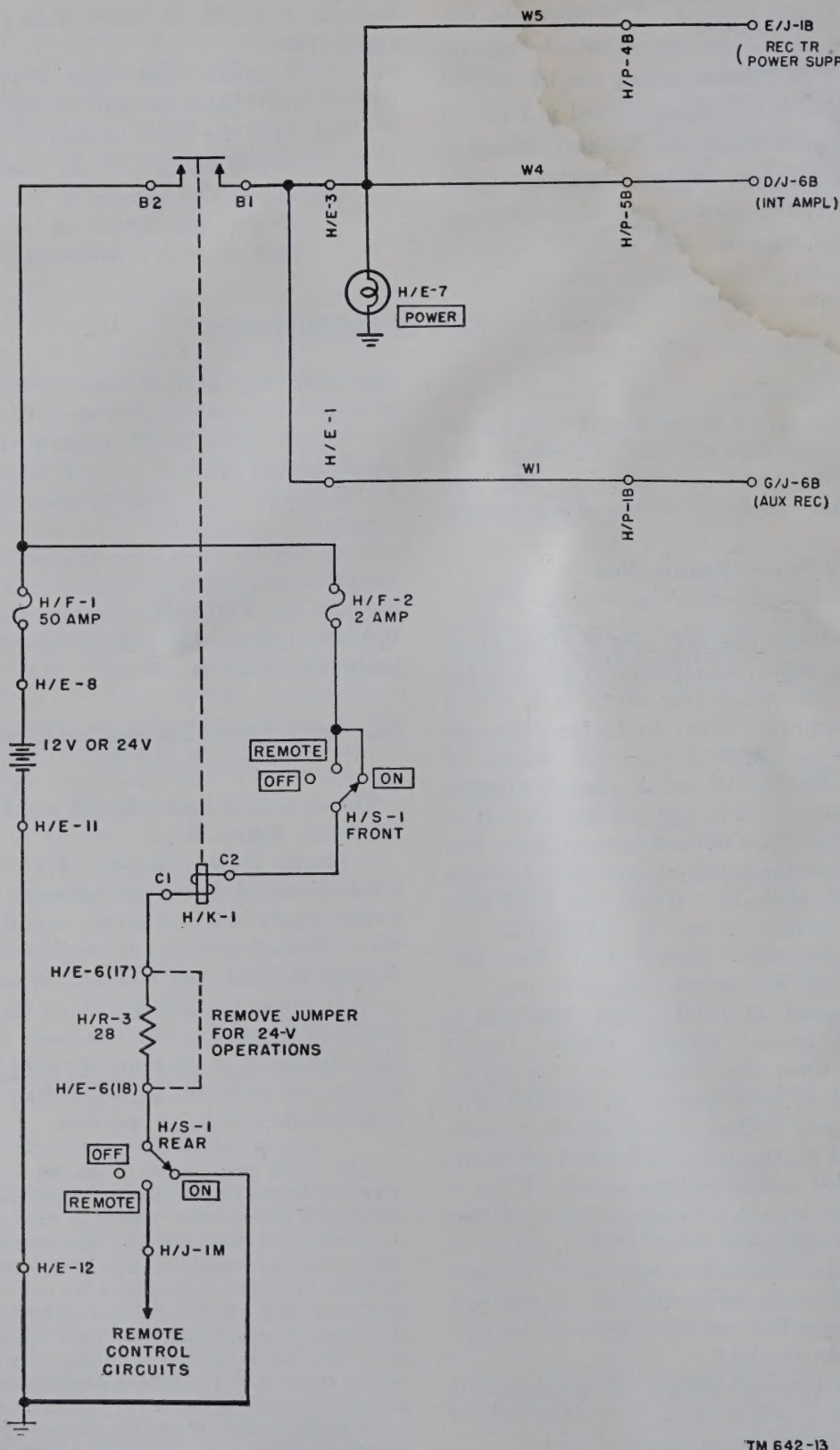



*Figure 57. Primary power application.*

control relay and it is impossible to transmit when the OPERATE switch is in the RECEIVE position (TM 11-5036).

*b. Filament Circuits* (fig. 58). Switch E/S–1D extends battery potential to four circuits originating in the Set 1 power supply. Two of the circuits, that of relay coil E/O–1 and that of the receive-transmit relays, do not contain filament elements, but are concerned with the application of power to the transmitter filaments. The operations and functions of the relays are discussed in connection with the transmit-control circuits (pars. 99 and 102). The remaining two circuits contain the Set 1 filaments and the dial light circuit.

(1) Current is supplied to the filaments of the receiver tubes, the crystal oscillator-harmonic generator, and the first harmonic amplifier through a protection circuit within the Set 1 power supply. The filament circuits completed are those of tubes A/V–1 through V–4, A/V–101 through V–103, and A/V–107 through V–116. Complete circuit details of the series-parallel filament arrangement are shown in figure 106.

(2) The filament protection circuit for the receiver filaments is similar in design and operation to the protection circuits used throughout the system. The protection circuit prevents damage to the tubes caused by excessive applied input voltage and provides a constant 6.3-volt potential drop for the filament. The circuit contains a thermal relay, E/K–2, which adds a resistance in series with the filaments when a dangerous voltage increase occurs. The added resistance is sufficient to drop the filament voltage to a safe level. The action of the ballast tubes, E/R–40 and E/R–31, within the protection circuit tends to maintain a constant current through the circuit, and, therefore, a constant voltage available for the filaments. The tubes act as variable resistors, their resistance varying with the voltage applied. If the source voltage decreases, the tube resistance and voltage drop decrease, resulting in a more constant filament potential. Power Supplies PP–109/GR and PP–112/GR are used for 12- or 24-volt operation, respectively. The arrangement of circuit components is shown on figure 58.

(3) The dial light circuit is connected in parallel with the filaments of A/V–113 and V–114. In the OFF position of DIAL LIGHT OFF-ON-RING switch A/S–302, a dummy load resistor, A/R–304, is inserted in place of the LAMP to maintain a constant drain on the filament circuit. This is necessary to insure system stability.

(4) Current is supplied to the filament circuits of the transmitter through contacts 2 and 3 or relay E/O–1, through ballast tubes E/R–37, E/R–38, E/R–24, and E/R–25, through a protection circuit within the power supply (thermal relay E/K–1), and through normally open contacts 5 and 4 of relay A/O–101. The ground line of relay E/O–1 is completed through normally open contacts 6 and 7 of transmit-control relay A/O–101. This arrangement allows the application of potential to the transmitter filaments only when the transmitter is operated. The filament circuits completed are those of tubes A/V–5 through V–11 and A/V–104 through V–106. The Set 1 microphone control line which parallels the transmitter filament circuits is discussed in paragraph 106.

(5) The protection circuit for the transmitter filaments is similar to that used for the receiver filaments. The parallel ballast tubes are necessary because of the greater current flow through the transmitter filaments.

*c. Plate and Screen Circuits* (figs. 59 and 60). The plate and screen potentials of Set 1 are supplied by three vibrators within the Set 1 power supply. Two of the vibrators, with output voltages of 150 and 300 volts, supply transmitter tube circuits only (fig. 60). The l-v (low-voltage) or 85-volt vibrator supplies both transmitting and receiving tube circuits (figs. 59 and 60). The 150-volt vibrator input circuit includes the TRANS & RECEIVE position of E/S–1B, fuse E/F–3, r-f filter choke E/L–6, normally open contacts 7 and 8 of E/O–1, and voltage-dropping resistor E/R–15. The 300-volt vibrator input circuit is completed only for high-power trans-



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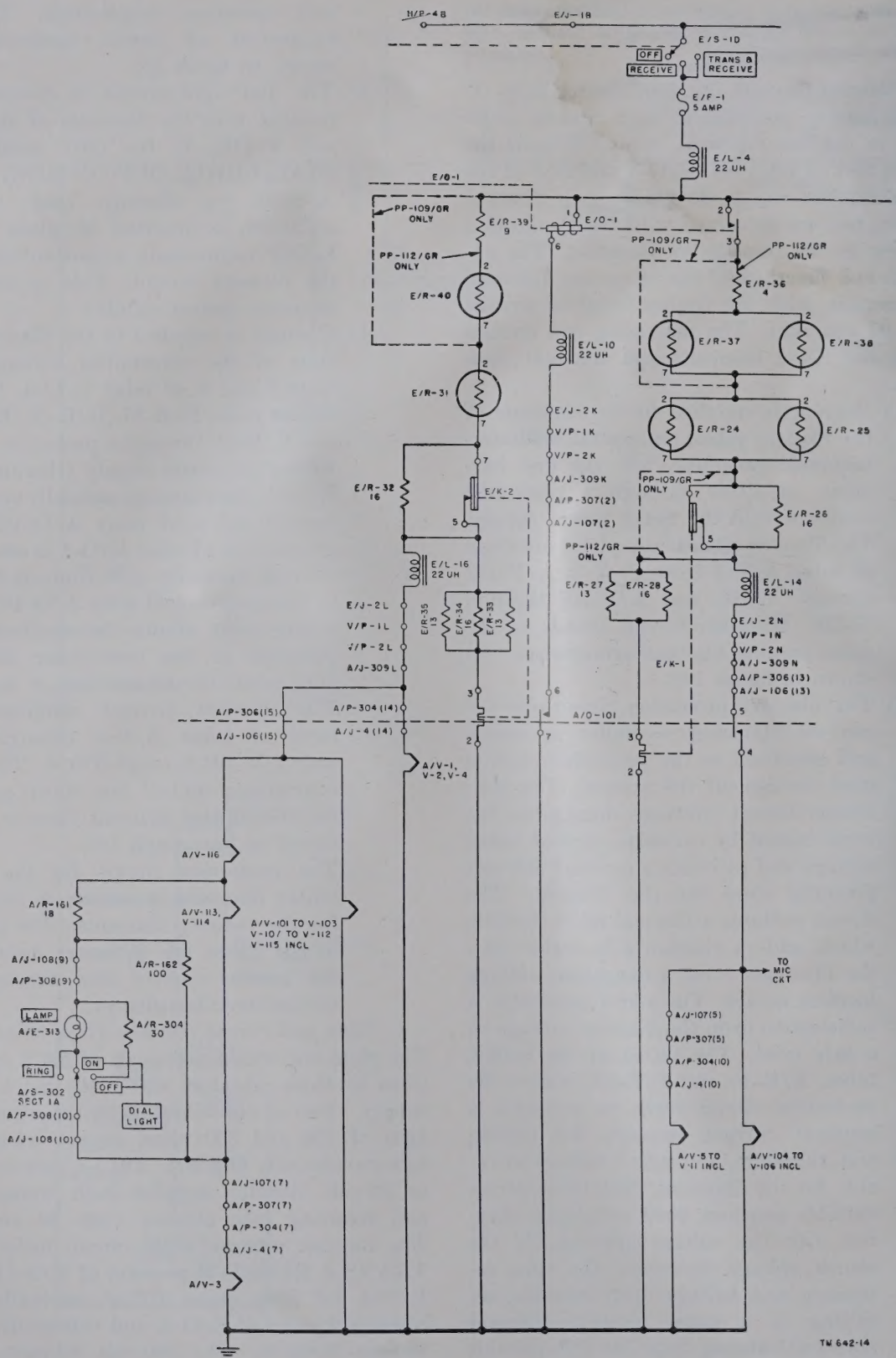
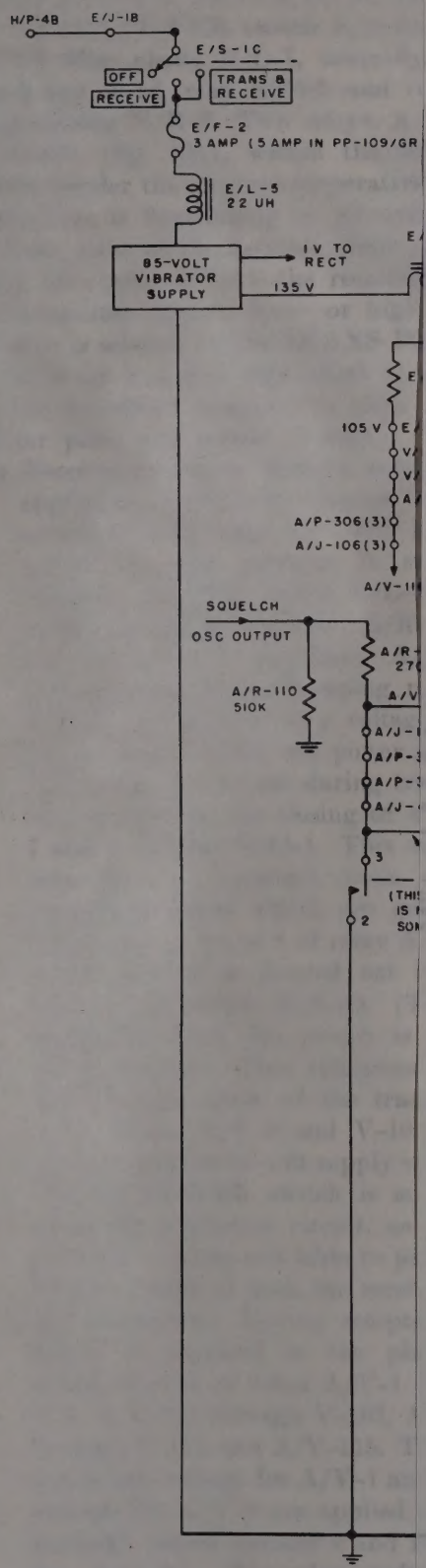



*Figure 58. Power distribution to Set 1 filament circuits.*


H/P-4B
E/J-1B
E/S-1C
OFF
RECEIVE
TRANS & RECEIVE
E/F-2
3 AMP (5 AMP IN PP-109/GR
E/L-5
22 UH
85-VOLT VIBRATOR SUPPLY
1 V TO RECT
135 V
105 V
A/P-306(3)
A/J-106(3)
SQUELCH
OSC OUTPUT
A/R-110
510K
3
2

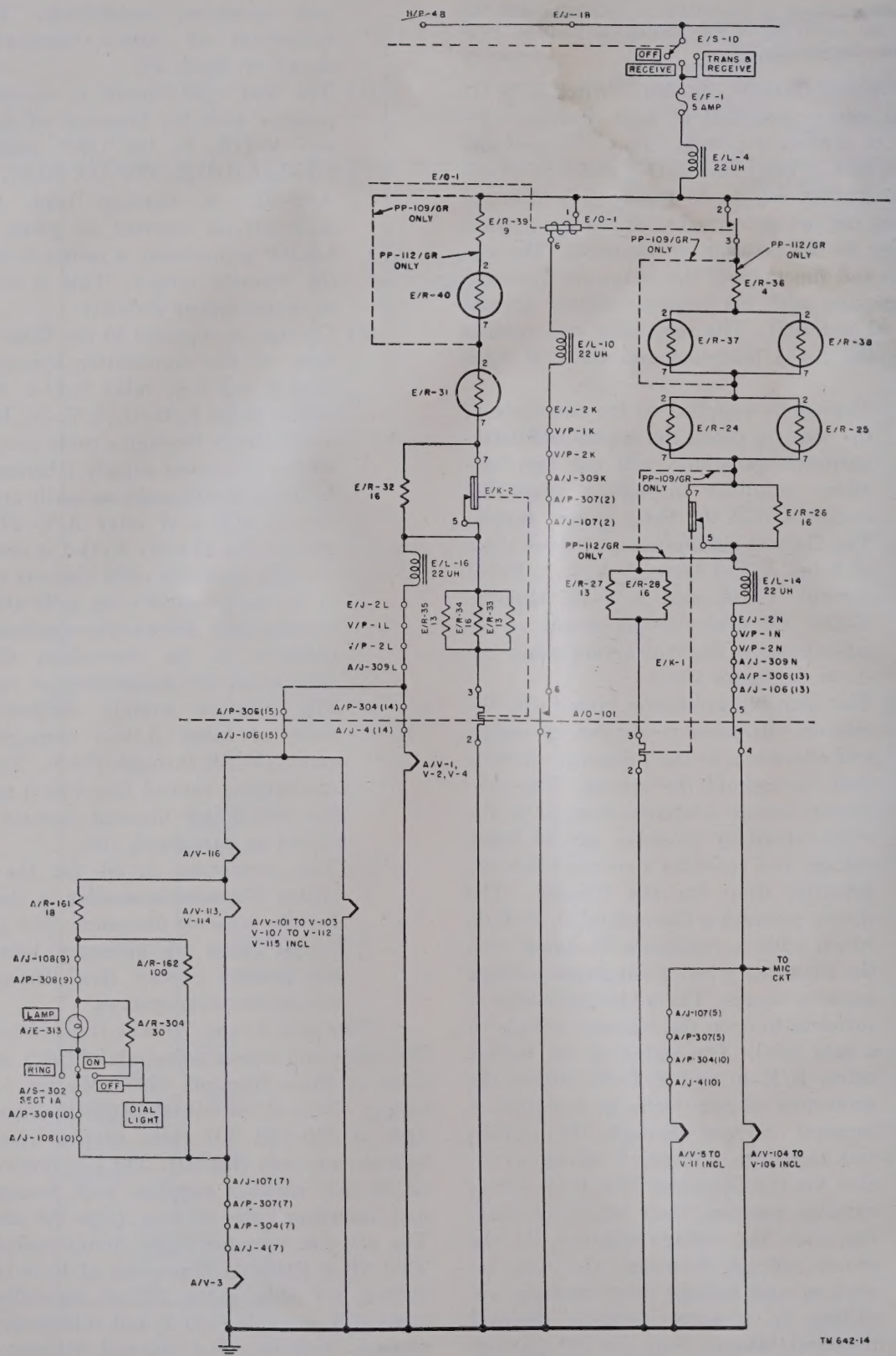



*Figure 58. Power distribution to Set 1 filament circuits.*

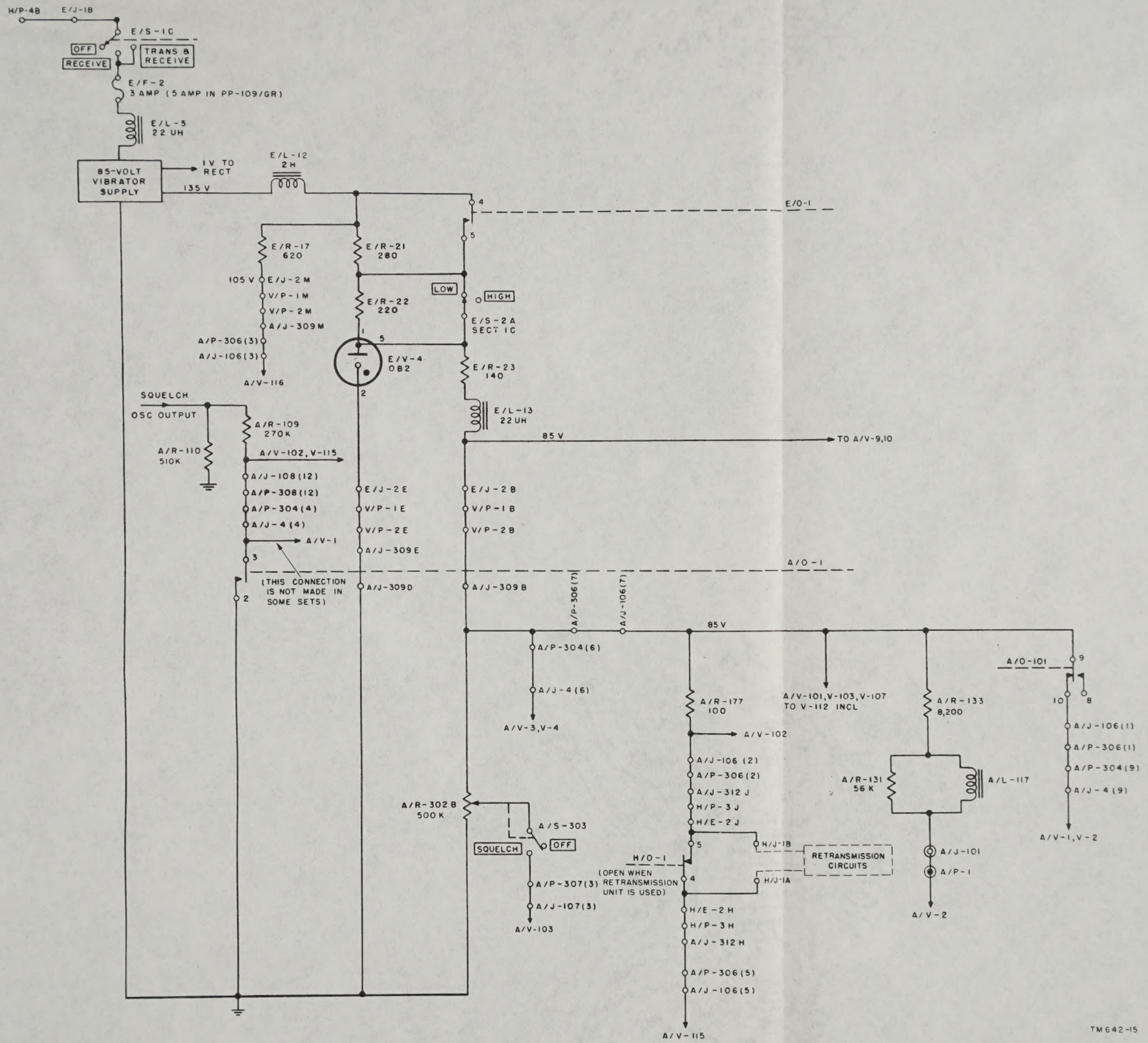
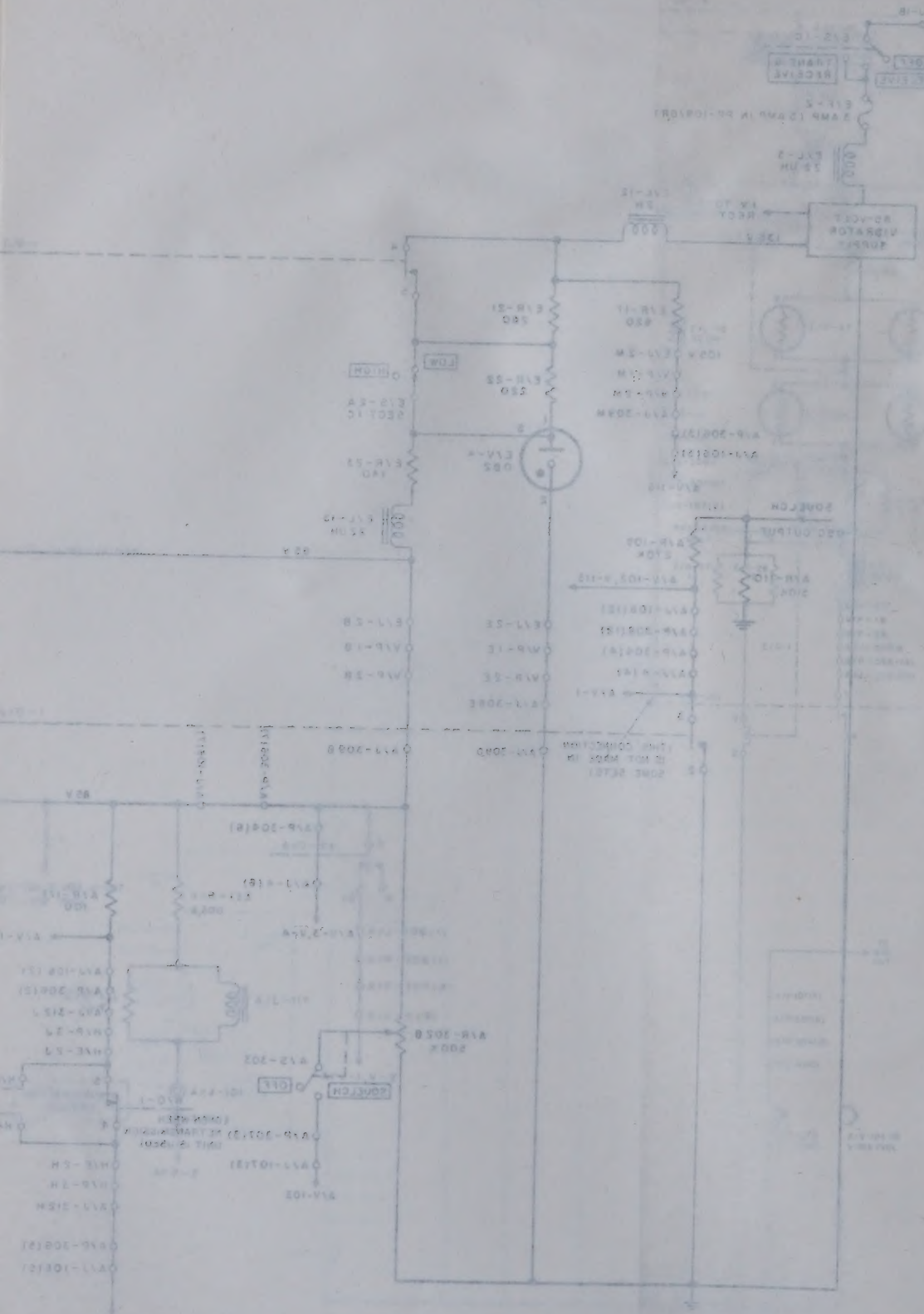



*Figure 59. Power distribution to Set 1 receiver plate and screen circuits.*



mission. The circuit includes the TRANS & RECEIVE position of E/S–1A, the HIGH position of TRANS POWER switch E/S–2B, fuse E/F–4, r-f filter choke E/L–7, normally open contacts 9 and 10 of relay E/O–1, and voltage-dropping resistor E/R–3. Two relays, A/O–101 and A/O–301 (fig. 121), within the receiver-transmitter render the receiver inoperative when the transmitter is functioning by removing potential from some of the receiver tubes and by switching the antenna from the receiver input to the transmitter output. Low- or high-power transmission is selected by the TRANS POWER switch (E/S–2A and E/S–2B) which is used to change the potentials supplied to some of the transmitter plate and screen circuits.

(1) *Receiving circuits.* Battery potential is applied to the 85-volt vibrator through switch E/S–1C (fig. 59). The 135-volt output of this vibrator is supplied through r-f filter choke E/L–12 and voltage-dropping resistor E/R–17 to the second a-f amplifier, A/V–116, and through voltage-dropping resistors E/R–21 and E/R–22 to a voltage regulation circuit within the power supply. E/R–21 is shorted out during transmitting periods by the closing of contacts 4 and 5 of relay E/O–1. This compensates for the increased drain of the transmitter tubes which are energized when contacts 9 and 8 of relay A/O–101 close. E/R–22 is shorted out by section 1C of switch E/S–2A (TRANS POWER) when this switch is in the LOW position. This compensates for the increased drain of the transmitter driver tubes, A/V–9 and V–10, which operate from the 85-volt supply when the TRANS POWER switch is at LOW. From the regulation circuit, an 85-volt potential is made available to plate and screen circuits of both the receiver and the transmitter. During reception, potential is supplied to the plate and screen circuits of tubes A/V–1 through V–4, A/V–101 through V–103, A/V–107 through V–112, and A/V–115. The plate and screen voltage for A/V–1 and screen voltage for A/V–2 are applied through normally closed contacts 9 and 10 of relay A/O–101. The plate voltage for A/V-2 is routed through dropping resistor A/R–133, the plate load (A/R–131 and A/L–117), and interchassis coaxial cable connectors A/J–101 and A/P–1. Screen voltage for squelch oscillator A/V–103 is applied through SQUELCH potentiometer A/R–302B and the contacts of SQUELCH switch A/S–303. Adjustment of the potentiometer changes the screen potential of A/V–103, which varies the output level of the squelch oscillator. The extreme counterclockwise position of A/S–303 is the OFF position. In this position, switch A/S–303 is open, screen voltage is not applied to A/V–103, and the squelch circuit is disabled. The plate and screen potentials for retransmit (fixed level) audio amplifier A/V–102 and first audio amplifier A/V–115 are supplied through voltage-dropping resistor A/R–177. The circuit for A/V–115 passes through normally closed contacts 5 and 4 of relay H/O–1 when the retransmission unit (Control C–435/GRC) is not plugged into the mounting. When the retransmission unit is used, relay H/O–1 is energized, and contacts 5 and 4 open. Controls in the retransmission unit complete the circuit to A/V–115 across open contacts 5 and 4 of relay H/O–1.

(2) *Transmitting circuits* (fig. 60). The plates and screens of all transmitting tubes are supplied with potential after relays E/O–1, A/O–101, and A/O–1 have been energized. Crystal oscillator-harmonic generator A/V–3 and first harmonic amplifier A/V–4 which are common to both the receiver and transmitter stages are supplied with potential whenever the set is operating (fig. 121). When relay A/O–101 is energized, contacts 9 and 10 open to disable the input circuits of the receiver (the plate and screen of r-f amplifier A/V–1 and the screen of first receiver mixer A/V–2). The other tubes in the receiver remain operative to permit completion of the sidetone circuit. When relay A/O–101 is energized, contacts 8 and 9 close to energize all tubes of the transmitter except transmitter drivers A/V–9 and V–10 and

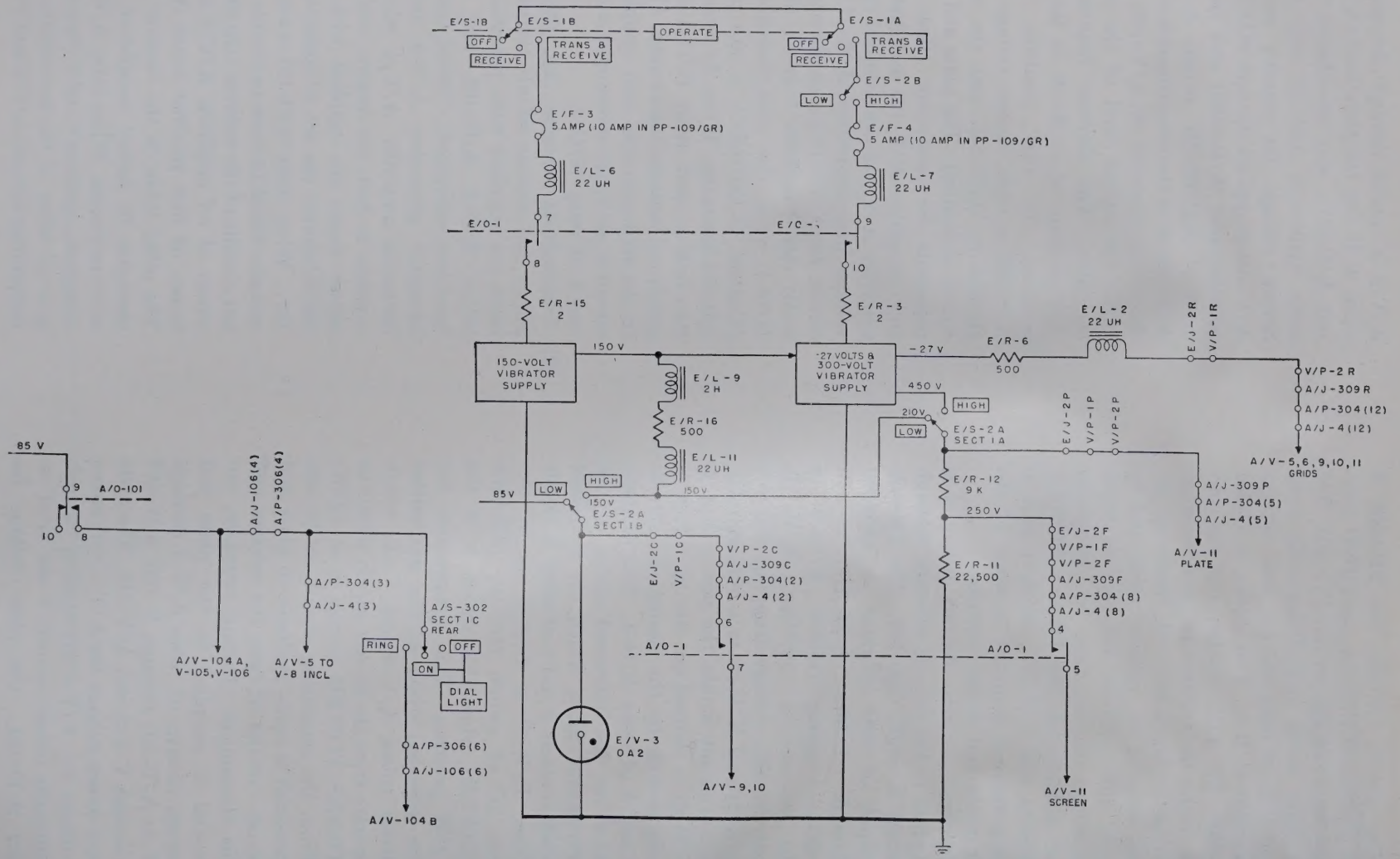



*Figure 60. Power distribution to Set 1 transmitter plate and screen circuits.*

power amplifier A/V–11. The circuits to the driver and power amplifier stages of the transmitter are described in (*a*) and (*b*) below.

(*a*) *High-power transmission.* When TRANS POWER switch E/S–2 is placed in the HIGH position, the plate circuit of the power amplifier, A/V–11, is supplied with a 450-volt potential obtained by the series connection of the 150- and 300-volt vibrators. Resistors E/R–12 and E/R–11 form a voltage divider which applies 250 volts to the screen of A/V–11 through contacts 4 and 5 of A/O–1. The 150-volt vibrator output is applied, through E/L–9, E/R–16, E/L–11, the HIGH position of section 1B of E/S–2A, and contacts 6 and 7 of A/O–1, to transmitter drivers A/V–9 and V/10. A —27-volt potential from the 300-volt vibrator supplies grid bias through E/R–6 and E/L–2 to tube A/V–5 (second harmonic amplifier), A/V–6 (transmitter mixer), A/V–9, A/V–10, and A/V–11 during high-power transmission.

(*b*) *Low-power transmission.* If the TRANS POWER switch (E/S–2) is set at LOW, the following circuit changes are effected: the input to the 300-volt vibrator supply is broken (E/S–2B); tube A/V–11 is switched from the 450-volt supply to the 150-volt supply by section 1A of switch E/S–2A; tubes A/V–9 and A/V–10 are switched from the 150-volt supply to the 85-volt supply; resistor E/R–22 in the 85-volt supply lead (fig. 59) is short-circuited to compensate for the increased drain of A/V–9 and V–10 on that supply.

## 87. Interphone Amplifier Power Distribution Circuits

(figs. 61 and 62)

*a. Power Input.* OFF-INT-RT-70 switch D/S–2 controls the power input to the filament, plate and screen, and control circuits of both the interphone amplifier and Set 2 (fig. 61). The INT position of the switch applies power to the interphone amplifier only. The RT–70 position completes the power circuits to the interphone amplifier and Set 2. When switch D/S–2 is placed in the INT position, battery voltage is extended from the POWER IN receptacle, D/J–6B, on the panel of the interphone amplifier to the amplifier filaments and the 135-volt plug-in power supply.

*b. Filament Circuits.* When 6–12–24 VOLTS switch D/S–1 is in the 24-volts position, sections 1B and 1A of the switch place the filament protection circuit for Set 2 in series with the filaments of tubes D/V–1 through D/V–5. For 12-volt operation, sections 1B 1D, and 1A of D/S–1 place the filament and protection circuits in parallel directly across the battery. Section 1A of D/S–2, when in the INT position, places dummy load resistor D/R–36 in parallel with a section of the filament protection circuit in place of the load Set 2 places on the circuit when the OFF-INT-RT-70 switch (D/S–2) is set at RT–70.

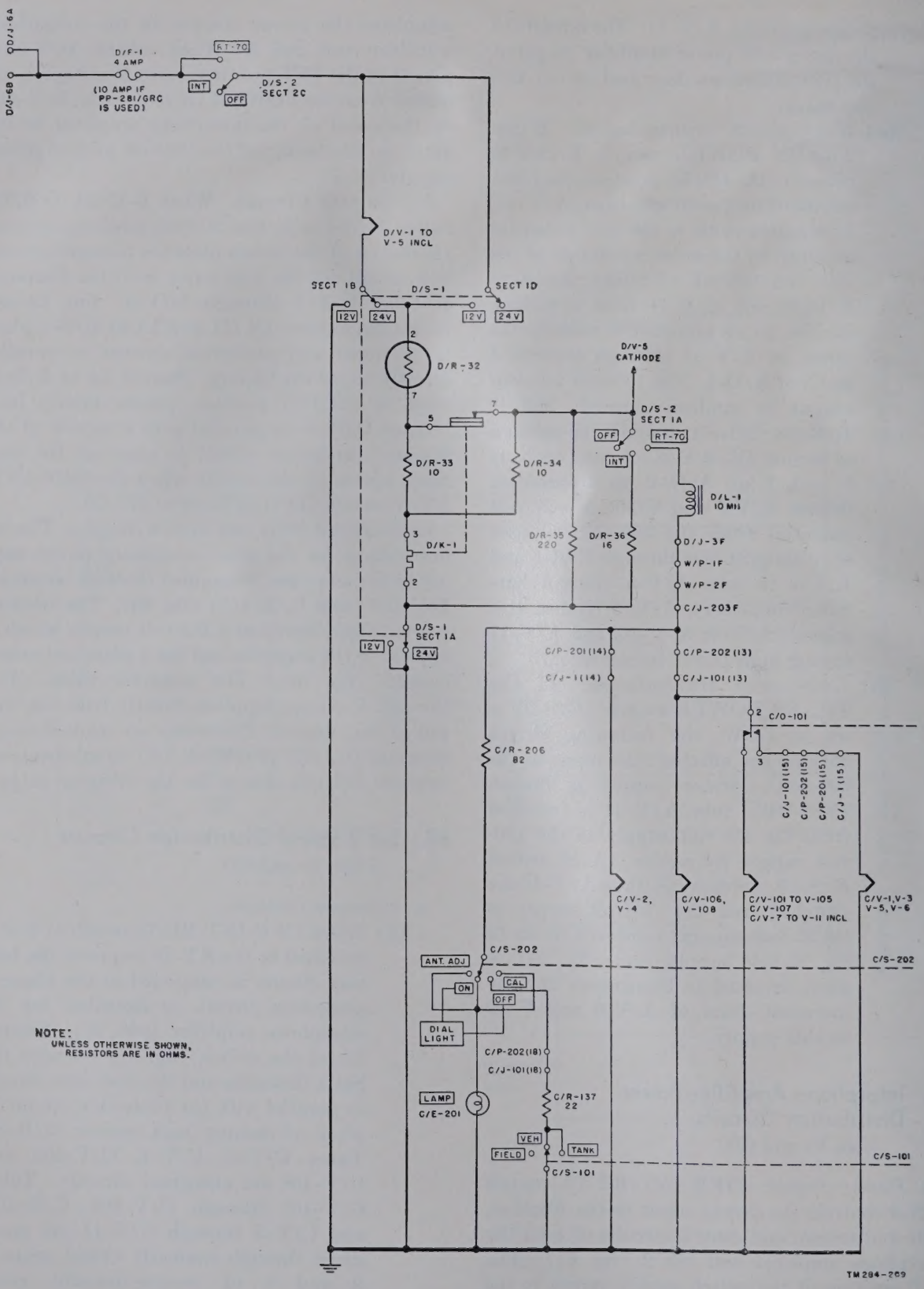
*c. Amplifier Plate and Screen Supply.* The input voltage for the plug-in vibrator power supply in the amplifier is supplied through terminals D/J–5(3) and U/X–1(3) (fig. 62). The vibrator power supply develops a 135-volt output which is applied to the amplifier and Set 2 plate and screen circuits (fig. 62). The amplifier tubes (V–1 through V–5) are supplied directly from the output of the vibrator. Provisions are made through terminal D/J–6D (POWER IN) to substitute an external 135-volt source for the vibrator output.

## 88. Set 2 Power Distribution Circuits

(figs. 61 and 62)

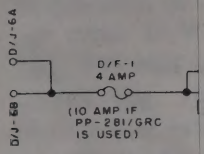
*a. Filament Circuits.*

(1) When OFF-INT-RE-70 switch D/S–2 is switched to the RT–70 position, the battery circuit is completed to the filament protection circuit, as described for the interphone amplifier (par. 87). Section 1A of the switch (fig. 61) connects the Set 2 filaments and the dial light circuit in parallel with the protection circuit in place of dummy load resistor D/R–36. Tubes C/V–2, C/V–4, C/V–106 and C/V–108 are energized directly. Tubes C/V–101 through C/V–105, C/V–107, and C/V–7 through C/V–11 are energized through normally closed contacts 2 and 1 of receive-transmit relay C/O–101. Normally open contacts 2 and




NOTE:
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.

*Figure 61. Power distribution to interphone amplifier and Set 2 filament circuits.*

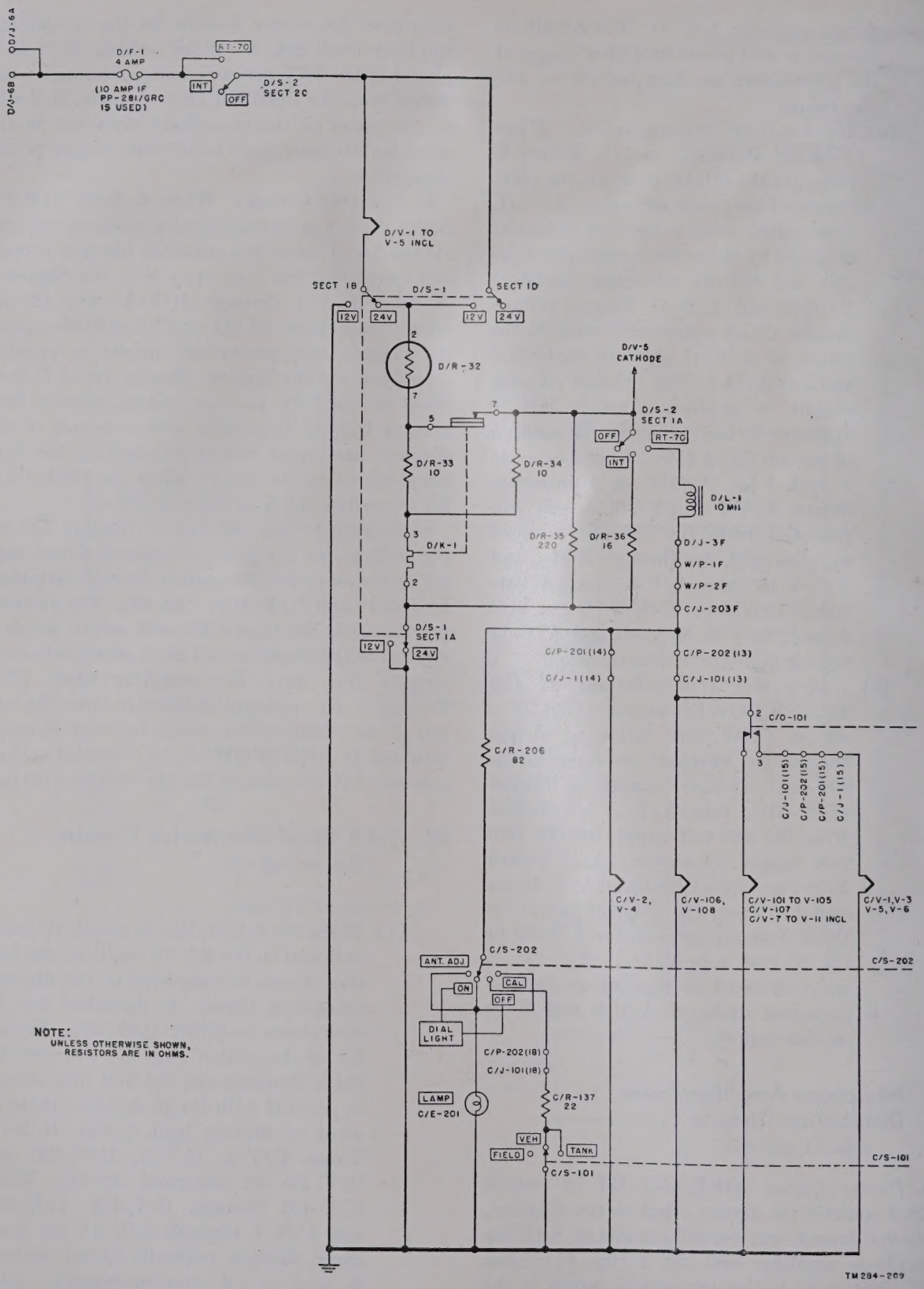



C/O-101

C/S-202

C/S-101

NOTE:
UNLESS OTHER
RESISTORS A




NOTE:
UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.

*Figure 61. Power distribution to interphone amplifier and Set 2 filament circuits.*

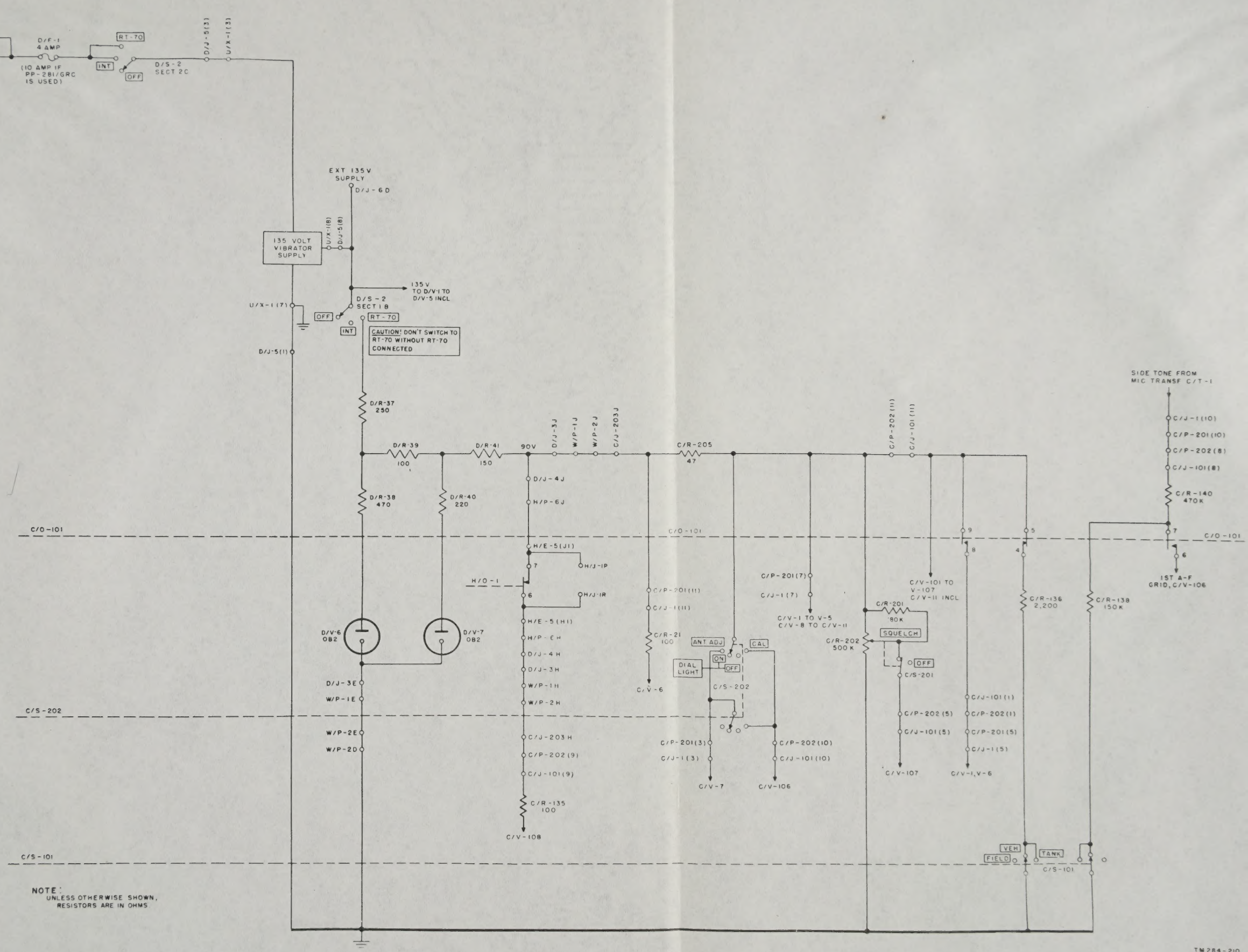



*Figure 62. Power distribution to interphone amplifier and Set 2 plate and screen circuits.*



3 of the same relay control application of potential to the filaments of transmitter tubes C/V–1, V–3, V–5, and V–6 (fig. 61) and to the Set 2 microphone circuit (fig. 127). The operation and functions of relay C/O–101 are discussed in paragraphs 100 and 103. The microphone circuit is discussed in paragraph 107.

(2) The filament protection circuit is similar in design and operation to the circuit discussed in connection with the Set 1 filaments (par. 86).

(3) The dial light circuit taps off from below choke coil D/L–1 and is in parallel with the tube filaments. C/R–206 drops the voltage from about 6.3 to about 1.4 volts which is applied across the pilot lamp. The circuit extends from C/R–206 through switch C/S–202 and through the pilot lamp to ground when the switch is at any position other than OFF. When the switch is at OFF, dummy load resistor C/R–137 is inserted in the circuit in place of the lamp to maintain a constant load on the power supply. C/R–137 is completed to ground only when the FIELD-VEH-TANK switch (C/S–101) is at VEH or TANK. When the switch is at FIELD, C/R–137 is not inserted in the circuit. The FIELD position of the switch is used in field installations of Set 2 which use a dry-cell power supply (case CY–590/GRC). A dry-cell power supply does not require the regulation of a constant load and would have its life shortened by the insertion of a dummy load resistor.

*b. Plate and Screen Supply.*

(1) A 90-volt potential supplies the plate and screen requirements of Set 2. The output of the vibrator in the power supply within the amplifier is applied to a protection circuit through the RT–70 contacts of section 1B of OFF-INT-RT–70 switch D/S–2 (fig. 62). The output of the protection circuit is distributed to the plates and screens of all tubes. If ANT ADJ DIAL LIGHT ON-OFF-CAL switch C/S–202 is in the ANT ADJ position, potential also is supplied to calibrate oscillator C/V–7. When the switch is in the CAL position, both calibrate oscillator C/V–7 and beat oscillator C/V–106 are supplied.

(2) The 90-volt potential is supplied to C/V–108 through normally closed contacts 6 and 7 of relay H/O–1 in the mounting when the retransmission unit is not used. For circuit details when the retransmission unit is plugged into the mounting, refer to figure 127 and paragraphs 109 through 112.

(3) Bleeder resistor C/R–136 is connected across the 90-volt supply during the receiving condition through normally closed contacts 5 and 4 of relay C/O–101 and the VEH and TANK contacts of FIELD-VEH-TANK switch C/S–101. The bleeder serves as a dummy load during receiving to insure that the drain on the supply is the same for both conditions of operation. The resistor is not required in field installations since the dry batteries used (case CY–590/GRC) do not require regulation. Furthermore, the resistor would put an added drain on the battery and shorten its life. Transmitting tubes C/V–1 and V–6 are supplied through normally open contacts 9 and 8 of transmit-control relay C/O–101. The operation and functions of the relay are described in paragraphs 100 and 103.

(4) The voltage protection circuit contains voltage regulator tubes D/V–6 and D/V–7 and resistors D/R–37 through D/R–41. The components are arranged to prevent the voltage at terminal D/J–3J from exceeding 90 volts. Should the voltage put out by the 135-volt vibrator power supply run high, V–6 and V–7 will draw more current and so keep the voltage at terminal D/J–3J from exceeding 90 volts. The ground return for the voltage regulator tubes is made externally to the amplifier (through Special Purpose Cable Assembly CX–1213/U) to the case of Set 2. Should the OFF-INT-RT–70 switch on the amplifier be set (in error) at RT–70 when Set 2 (Receiver-Transmitter RT–70/GRC) is not connected to the amplifier, the circuit through D/V–6 and D/V–7 will be open and these tubes will not operate.

## 89. Auxiliary Receiver Power Distribution Circuits

(fig. 63)

*a. Power Input.* Switch G/S–2, ganged to the VOLUME control on the panel of the auxiliary receiver, controls power application to the circuits within that unit. Turning the control clockwise from the OFF (extreme counterclockwise) position closes the switch and completes the battery circuit from POWER IN receptacle G/J–6B, through 4-ampere fuse G/F–1 and the switch, to the auxiliary receiver plug-in power supply (135-volt vibrator) and through two branches of voltage-dropping resistors to the tube filaments. Potential from the power supply is supplied to the plate and screen circuits.

*b. Filament and Dial Light Circuits.* The filament of G/V–14 is supplied through one circuit. The filaments of the remaining tubes and the dial light are supplied through a second circuit.

(1) One circuit extends through resistors G/R–58, G/R–53, section 1A of switch G/S–1, the filament of G/V–14, and resistor G/R–50. When a 24-volt battery supply is used, plug-in Power Supply PP–282/GRC is used with the auxiliary receiver. This power supply is connected from terminal G/J–2(3) through U/X–1(3), U/X–1(6), and G/J–2(6) to resistor G/R–58. This resistor drops the voltage from approximately 24 volts to approximately 12 volts. When a 12-volt battery supply is used, plug-in Power Supply PP–281/GRC is used with the auxiliary receiver. Connections in this power supply from G/J–2(3) through U/X–1(3) and U/X–1(2) to G/J–2(2) bypass resistor G/R–58. Thus approximately 12 volts is supplied to the same point in the receiver as when a 24-volt battery supply is used. The 12 volts at terminal G/J–2(2) is dropped through G/R–53 to approximately 6 volts at section 1A of switch G/S–1. (Provision is made for connecting an external 6-volt supply to this point in the receiver through terminal G/J–6A. However, the 6-volt supply is not used with Radio Sets AN/GRC–3 through –8.) When this switch is at the 6-, 12-, and 24-volts position, the 6 volts is applied through the two halves of the filament of G/V–14 (in parallel) and resistor G/R–50 to ground. G/R–50 produces a drop of approximately 4.5 volts, leaving approximately 1.5 volts to be applied across each half of the filament of G/V–14.

(2) The second circuit extends through resistors G/R–61 and G/R–59 (ballast tube) to section 1C of switch G/S–1. When a 24-volt battery supply is used, plug-in Power Supply PP–282/GRC is used. This makes connections to the receiver through resistor G/R–61 which drops the voltage to about 12 volts. When a 12-volt battery supply is used, plug-in power Supply PP–281/GRC is used. This makes connections which effectively bypass G/R–61 and thus 12 volts is applied to the same point in the receiver as when a 24-volt battery supply is used. Ballast tube resistor G/R–59 drops the 12 volts to about 6 volts. It regulates against changes in current or voltage in this branch by increasing in resistance when the current tends to rise, and dropping in resistance when the current tends to fall. The 6 volts is applied through the 6-, 12-, and 24-volts position of section 1C of switch G/S–1 through a filament protection circuit to the filaments of G/V–1 through G/V–13 and through section 1B of switch G/S–3 (the DIAL LIGHT OFF-ON TUNE switch), voltage-dropping resistor G/R–63, and dial light G/E–14 to ground. The dial light is connected in the circuit when the switch is either at ON or TUNE. When the switch is at OFF, the lamp is cut out of the circuit and dummy load resistor G/R–64 is inserted in place of it to maintain a constant drain on the supply.

*c. Plate and Screen Supply.* Turning the VOLUME control clockwise from the OFF position closes G/S–2 and applies battery voltage to the vibrator of the plug-in power supply. The vibrator furnishes the plate and screen requirements of the auxiliary receiver tubes.

(1) The 135-volt output of the vibrator is connected through voltage-dropping resistor G/R–54 and section 1B of switch G/S–1 to the plate and screen circuits of G/V–14 and to a voltage-regulation net-

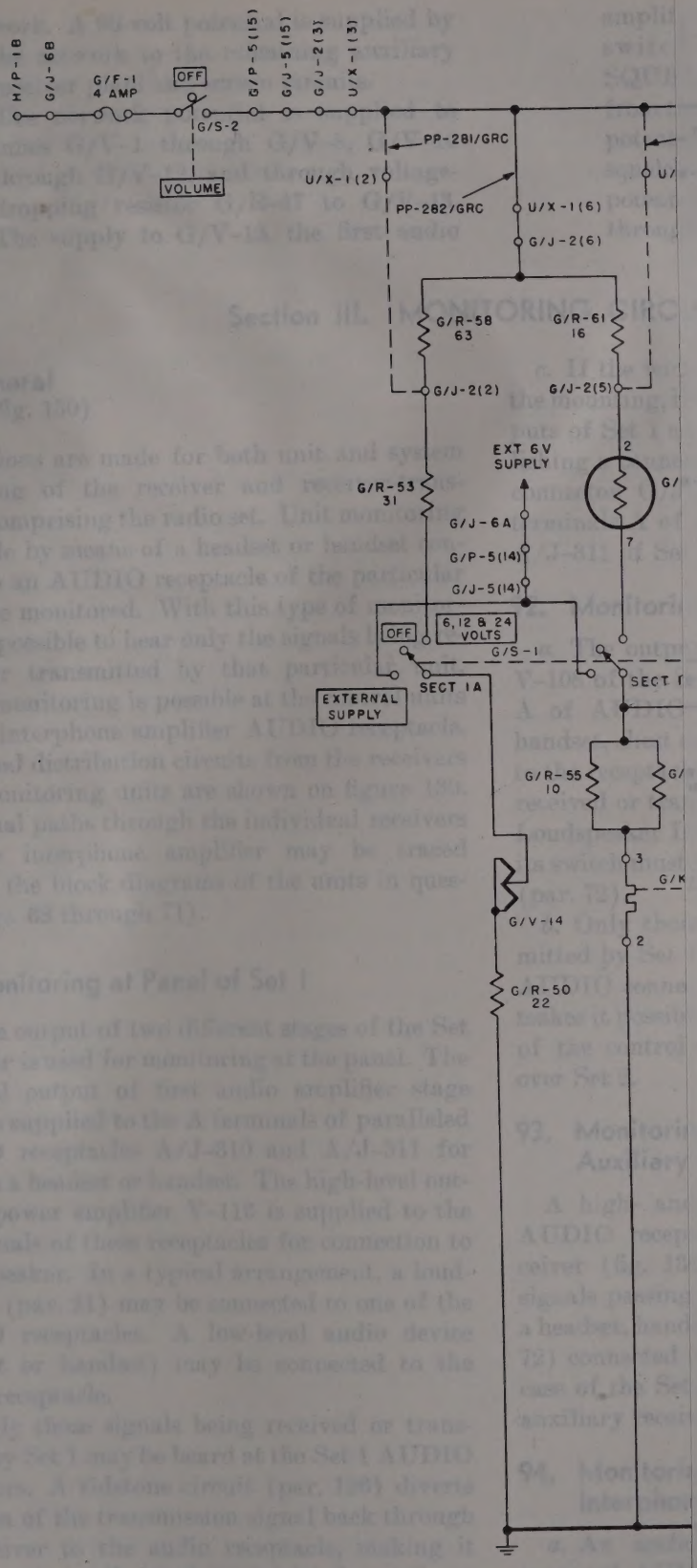



*Figure 63. Auxiliary r*

## 89. Auxiliary Receiver Power Distribution Circuits

(fig. 63)

*a. Power Input.* Switch G/S–2, ganged to the VOLUME control on the panel of the auxiliary receiver, controls power application to the circuits within that unit. Turning the control clockwise from the OFF (extreme counterclockwise) position closes the switch and completes the battery circuit from POWER IN receptacle G/J–6B, through 4-ampere fuse G/F–1 and the switch, to the auxiliary receiver plug-in power supply (135-volt vibrator) and through two branches of voltage-dropping resistors to the tube filaments. Potential from the power supply is supplied to the plate and screen circuits.

*b. Filament and Dial Light Circuits.* The filament of G/V–14 is supplied through one circuit. The filaments of the remaining tubes and the dial light are supplied through a second circuit.

(1) One circuit extends through resistors G/R–58, G/R–53, section 1A of switch G/S–1, the filament of G/V–14, and resistor G/R–50. When a 24-volt battery supply is used, plug-in Power Supply PP–282/GRC is used with the auxiliary receiver. This power supply is connected from terminal G/J–2(3) through U/X–1(3), U/X–1(6), and G/J–2(6) to resistor G/R–58. This resistor drops the voltage from approximately 24 volts to approximately 12 volts. When a 12-volt battery supply is used, plug-in Power Supply PP–281/GRC is used with the auxiliary receiver. Connections in this power supply from G/J–2(3) through U/X–1(3) and U/X–1(2) to G/J–2(2) bypass resistor G/R–58. Thus approximately 12 volts is supplied to the same point in the receiver as when a 24-volt battery supply is used. The 12 volts at terminal G/J–2(2) is dropped through G/R–53 to approximately 6 volts at section 1A of switch G/S–1. (Provision is made for connecting an external 6-volt supply to this point in the receiver through terminal G/J–6A. However, the 6-volt supply is not used with Radio Sets AN/GRC–3 through –8.) When this switch is at the 6-, 12-, and 24-volts position, the 6 volts is applied through the two halves of the filament of G/V–14 (in parallel) and resistor G/R–50 to ground. G/R–50 produces a drop of approximately 4.5 volts, leaving approximately 1.5 volts to be applied across each half of the filament of G/V–14.

(2) The second circuit extends through resistors G/R–61 and G/R–59 (ballast tube) to section 1C of switch G/S–1. When a 24-volt battery supply is used, plug-in Power Supply PP–282/GRC is used. This makes connections to the receiver through resistor G/R–61 which drops the voltage to about 12 volts. When a 12-volt battery supply is used, plug-in power Supply PP–281/GRC is used. This makes connections which effectively bypass G/R–61 and thus 12 volts is applied to the same point in the receiver as when a 24-volt battery supply is used. Ballast tube resistor G/R–59 drops the 12 volts to about 6 volts. It regulates against changes in current or voltage in this branch by increasing in resistance when the current tends to rise, and dropping in resistance when the current tends to fall. The 6 volts is applied through the 6-, 12-, and 24-volts position of section 1C of switch G/S–1 through a filament protection circuit to the filaments of G/V–1 through G/V–13 and through section 1B of switch G/S–3 (the DIAL LIGHT OFF-ON TUNE switch), voltage-dropping resistor G/R–63, and dial light G/E–14 to ground. The dial light is connected in the circuit when the switch is either at ON or TUNE. When the switch is at OFF, the lamp is cut out of the circuit and dummy load resistor G/R–64 is inserted in place of it to maintain a constant drain on the supply.

*c. Plate and Screen Supply.* Turning the VOLUME control clockwise from the OFF position closes G/S–2 and applies battery voltage to the vibrator of the plug-in power supply. The vibrator furnishes the plate and screen requirements of the auxiliary receiver tubes.

(1) The 135-volt output of the vibrator is connected through voltage-dropping resistor G/R–54 and section 1B of switch G/S–1 to the plate and screen circuits of G/V–14 and to a voltage-regulation net-

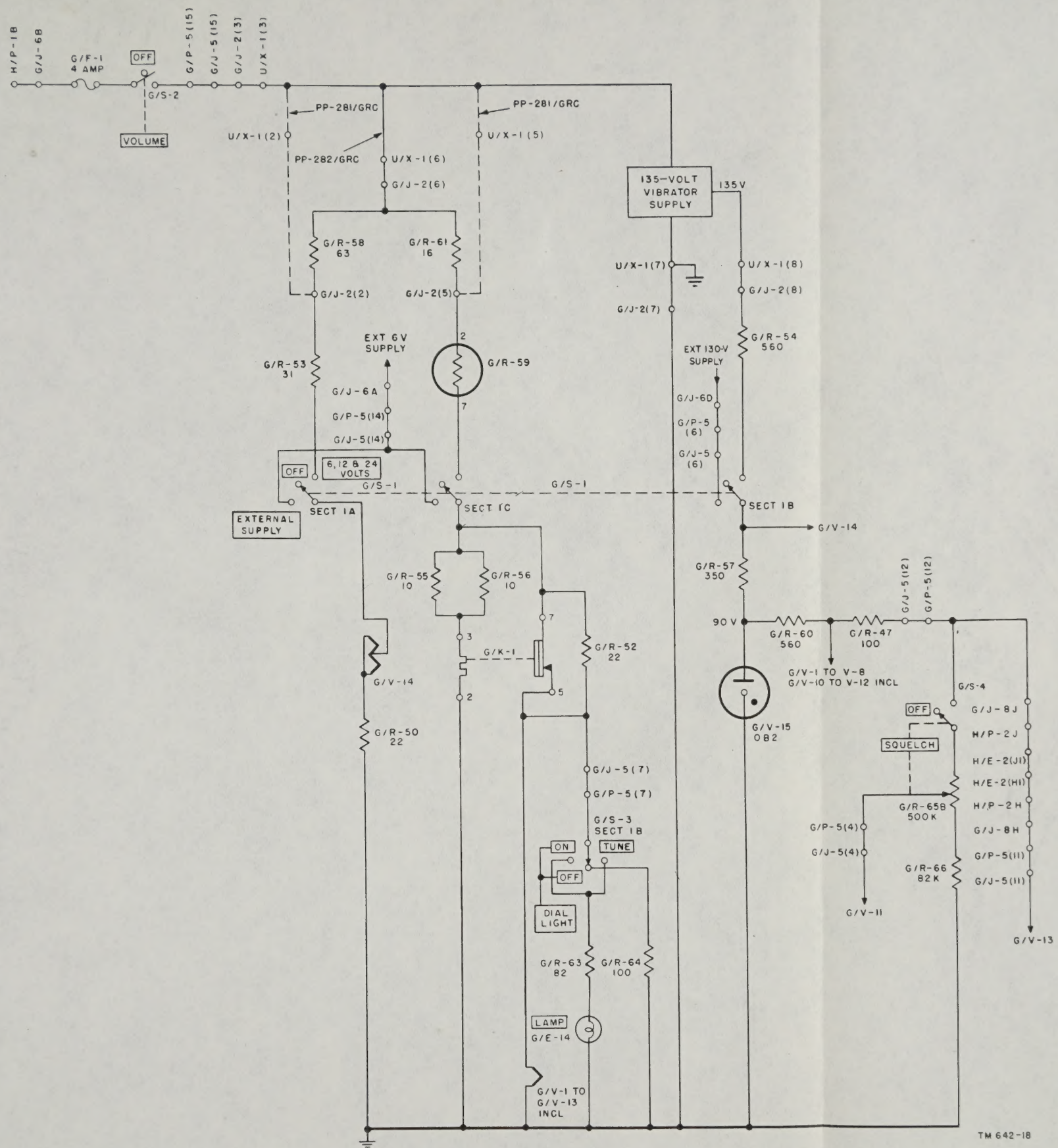
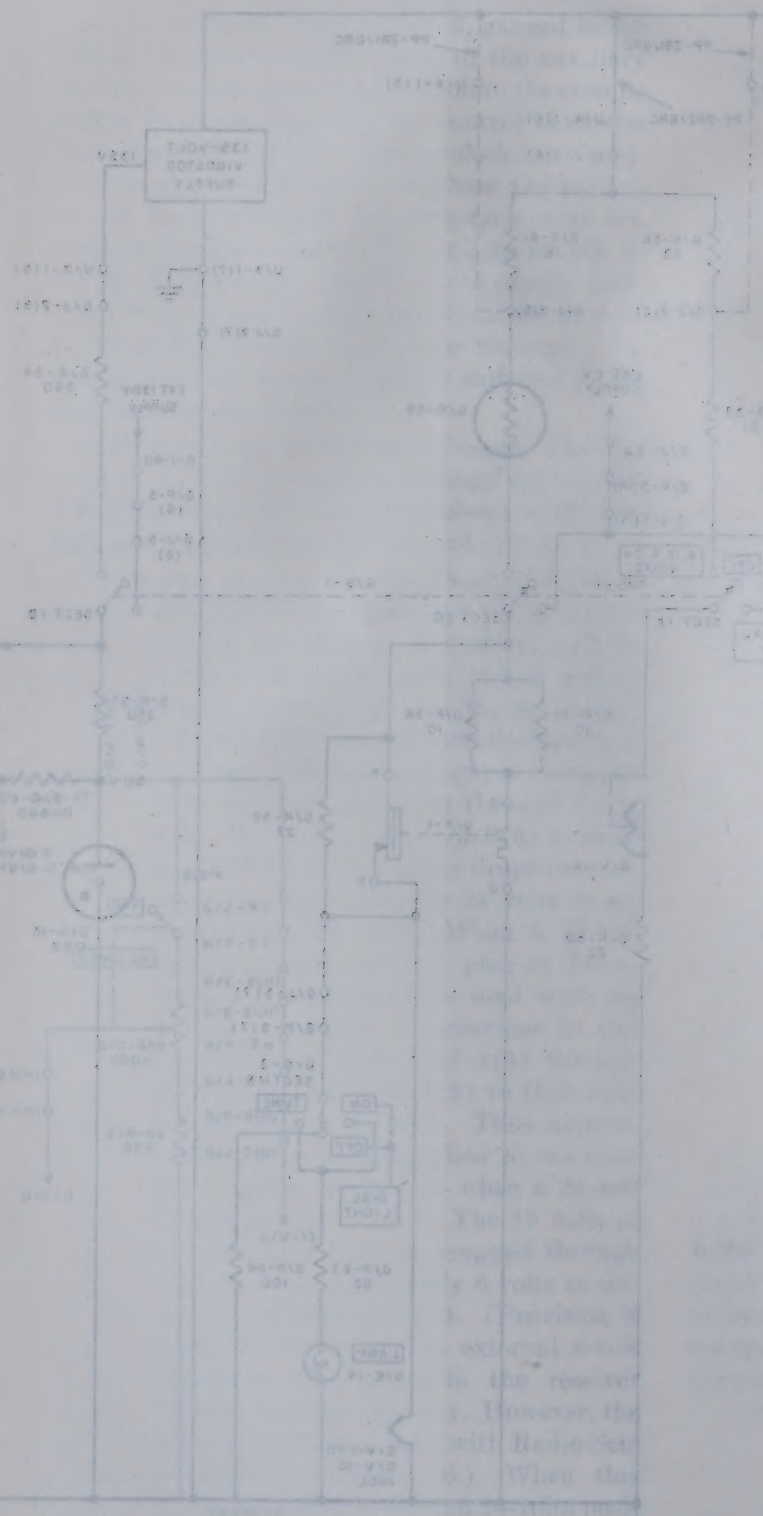



*Figure 63. Auxiliary receiver power distribution circuits.*



work. A 90-volt potential is supplied by the network to the remaining auxiliary receiver plate and screen circuits.

(2) The network potential is supplied to tubes G/V–1 through G/V–8, G/V–10 through G/V–12, and through voltage-dropping resistor G/R–47 to G/V–13. The supply to G/V–13, the first audio amplifier, also is connected through switch G/S–4 (closed when the SQUELCH control is turned clockwise from the OFF position) and SQUELCH potentiometer G/R–65B to the screen of squelch oscillator G/V–11. The squelch potentiometer is also connected to ground through resistor G/R–66.

## Section III. MONITORING CIRCUITS

### 90. General
(fig. 130)

Provisions are made for both unit and system monitoring of the receiver and receiver-transmitters comprising the radio set. Unit monitoring is possible by means of a headset or handset connected to an AUDIO receptacle of the particular unit to be monitored. With this type of monitoring it is possible to hear only the signals being received or transmitted by that particular unit. System monitoring is possible at the control units and the interphone amplifier AUDIO receptacle. The signal distribution circuits from the receivers to all monitoring units are shown on figure 130. The signal paths through the individual receivers and the interphone amplifier may be traced through the block diagrams of the units in question (figs. 68 through 71).

### 91. Monitoring at Panel of Set 1

*a.* The output of two different stages of the Set 1 receiver is used for monitoring at the panel. The low-level output of first audio amplifier stage V–115 is supplied to the A terminals of paralleled AUDIO receptacles A/J–310 and A/J–311 for use with a headset or handset. The high-level output of power amplifier V–116 is supplied to the L terminals of these receptacles for connection to a loudspeaker. In a typical arrangement, a loudspeaker (par. 21) may be connected to one of the AUDIO receptacles. A low-level audio device (headset or handset) may be connected to the second receptacle.

*b.* Only those signals being received or transmitted by Set 1 may be heard at the Set 1 AUDIO connectors. A sidetone circuit (par. 126) diverts a portion of the transmission signal back through the receiver to the audio receptacle, making it possible to hear all signals transmitted over Set 1.

*c.* If the wiring change (par. 28) was made in the mounting, it effectively parallels the audio outputs of Set 1 and the auxiliary receiver by establishing a connection from terminal A of AUDIO connector G/J–7 on the auxiliary receiver to terminals A of AUDIO connectors A/J–310 and A/J–311 of Set 1.

### 92. Monitoring at Panel of Set 2

*a.* The output of second audio amplifier stage V–108 of the Set 2 receiver is routed to terminal A of AUDIO receptacle C/J–202. A headset, handset, chest set group, or loudspeaker connected to the receptacle permits monitoring of all signals received or transmitted by Set 2. When Dynamic Loudspeaker LS–166/U is used to monitor Set 2, its switch must be set at FIELD OR PACK SET (par. 72).

*b.* Only those signals being received or transmitted by Set 2 may be heard at the Set 2 panel AUDIO connector. A sidetone circuit (par. 129) makes it possible to hear signals originating at one of the control positions, which are transmitted over Set 2.

### 93. Monitoring at Panel of Auxiliary Receiver

A high- and low-level output is supplied to AUDIO receptacle G/J–7 of the auxiliary receiver (fig. 130). It is possible to monitor all signals passing through the receiver by means of a headset, handset earpiece, or a loudspeaker (par. 72) connected to the receptacle. Again, as in the case of the Set 1 panel, monitoring of Set 1 and auxiliary receiver signals is possible.

### 94. Monitoring at Panel of Interphone Amplifier

*a.* An audio accessory connected to panel-mounted AUDIO receptacle D/J–1 of the inter-

phone amplifier permits system monitoring at that point. The *all channel* circuit (containing the signals of all of the system units) supplies the amplfier receptacle. Terminals A and L provide circuit connections for a headset or a loudspeaker, respectively. A volume control on the panel permits adjustment of the signal-level of the interphone amplifier output.

*b.* The signal paths from the fixed level amplifiers of Set 1 and the auxiliary receiver to the interphone amplifier are indicated on figure 130. These paths join within the mounting (terminals B1 and B of H/E–2) and are common throughout the remainder of the monitoring circuit. That portion of the circuit within the mounting includes contacts 2 and 3 of relay H/O–1 or a parallel circuit through the retransmission unit. Insertion of the retransmission unit opens normally closed contacts 2 and 3 of H/O–1. The theory and circuits of the retransmission unit are discussed in paragraphs 109 through 112. The signal path from the second a-f amplifier of Set 2 is routed through Special Purpose Cable Assembly CX–1213/U to the Set 2 input channel of the amplifier (fig. 130).

*c.* Terminals C of AUDIO receptacle D/J–1 and D/J–2 and INT CONT receptacle provide the input connections to the amplifier microphone. The path of the signals through the amplifier may be traced on the block diagram of that unit (fig. 69).

## 95. Monitoring at Control Box C–375/VRC

*a.* An operator monitoring at one of the control boxes has a choice of three output channels of the amplifier (par. 128). If selector switch R/S–1 on the control box is in the center position, the operator can hear the interphone, Set 1, auxiliary receiver, and Set 2 signals (the all channel position). If the switch is in the clockwise position, only the Set 2 and interphone signals can be heard. If it is in the counterclockwise position, only the Set 1, auxiliary receiver, and interphone signals can be heard. Provisions are made for using headsets (jacks) or the usual audio accessories (receptacles) at the control boxes. The level of the signal appearing at the earpiece of the audio device may be adjusted by VOLUME controls R/R–1 (when AUDIO connector R/J–1 is used) and R/R–2 (when AUDIO connector R/J–2 is used).

*b.* The path of the three amplifier output channels to the monitoring position at one of the control boxes is shown on figure 130. For further information concerning the signal channels, refer to the interphone amplifier unit theory (par. 128) or to TM 11–5039.

## 96. Monitoring at Control C–435/GRC

When Control C–435/GRC is connected to the mounting, the all channel output of the interphone amplifier is supplied to AUDIO connector P/J–2 of the retransmission unit as shown on figure 130. This permits monitoring of all the system units at that point. Provisions are made (terminals A and L) for connecting either a headset or a loudspeaker.

## 97. Monitoring at Control Group AN–GRA/6

*a.* It is possible to monitor all the units comprising the system at both Local Control C–434/GRC and Remote Control C–433/GRC. The Set 1 + Set 2 + Interphone output circuit from the amplifier is completed to the local control unit as shown on figure 130. At the local control unit, an audio accessory connected to AUDIO receptacle N/J–1 permits monitoring of the system.

*b.* The circuit to the remote unit is coupled through two transformers (N/T–1 in the local unit and M/T–1 in the remote unit) and the telephone pair (fig. 129). An audio device connected to panel-mounted AUDIO receptacle M/J–1 of Remote Control C–433/GRC permits monitoring of the system.

# Section IV. PUSH-TO-TALK CIRCUITS

## 98. General

The push-to-talk circuits are those circuits which enable transmission over Set 1 or Set 2, or interphone communication through the amplifier. With the exception of a ringing circuit in Set 1, these circuits are all completed by the closing of a push-to-talk switch on a chest set, handset, or microphone. Each push-to-talk switch controls two circuits. One circuit is the control relay circuit. The other circuit is the microphone circuit.

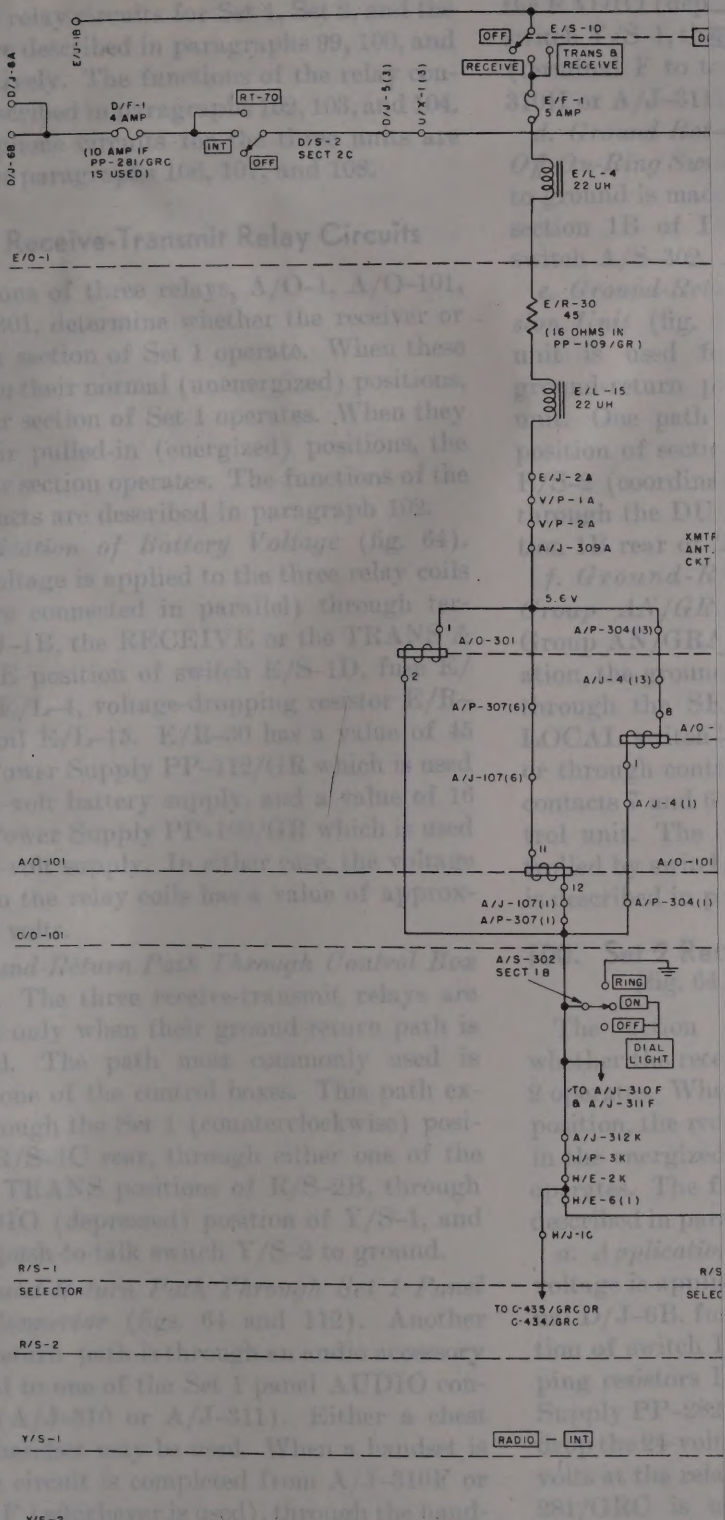



*Figure 64. Power distrib*

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phone amplifier permits system monitoring at that point. The *all channel* circuit (containing the signals of all of the system units) supplies the amplfier receptacle. Terminals A and L provide circuit connections for a headset or a loudspeaker, respectively. A volume control on the panel permits adjustment of the signal-level of the interphone amplifier output.

*b.* The signal paths from the fixed level amplifiers of Set 1 and the auxiliary receiver to the interphone amplifier are indicated on figure 130. These paths join within the mounting (terminals B1 and B of H/E–2) and are common throughout the remainder of the monitoring circuit. That portion of the circuit within the mounting includes contacts 2 and 3 of relay H/O–1 or a parallel circuit through the retransmission unit. Insertion of the retransmission unit opens normally closed contacts 2 and 3 of H/O–1. The theory and circuits of the retransmission unit are discussed in paragraphs 109 through 112. The signal path from the second a-f amplifier of Set 2 is routed through Special Purpose Cable Assembly CX–1213/U to the Set 2 input channel of the amplifier (fig. 130).

*c.* Terminals C of AUDIO receptacle D/J–1 and D/J–2 and INT CONT receptacle provide the input connections to the amplifier microphone. The path of the signals through the amplifier may be traced on the block diagram of that unit (fig. 69).

## 95. Monitoring at Control Box C–375/VRC

*a.* An operator monitoring at one of the control boxes has a choice of three output channels of the amplifier (par. 128). If selector switch R/S–1 on the control box is in the center position, the operator can hear the interphone, Set 1, auxiliary receiver, and Set 2 signals (the all channel position). If the switch is in the clockwise position, only the Set 2 and interphone signals can be heard. If it is in the counterclockwise position, only the Set 1, auxiliary receiver, and interphone signals can be heard. Provisions are made for using headsets (jacks) or the usual audio accessories (receptacles) at the control boxes. The level of the signal appearing at the earpiece of the audio device may be adjusted by VOLUME controls R/R–1 (when AUDIO connector R/J–1 is used) and R/R–2 (when AUDIO connector R/J–2 is used).

*b.* The path of the three amplifier output channels to the monitoring position at one of the control boxes is shown on figure 130. For further information concerning the signal channels, refer to the interphone amplifier unit theory (par. 128) or to TM 11–5039.

## 96. Monitoring at Control C–435/GRC

When Control C–435/GRC is connected to the mounting, the all channel output of the interphone amplifier is supplied to AUDIO connector P/J–2 of the retransmission unit as shown on figure 130. This permits monitoring of all the system units at that point. Provisions are made (terminals A and L) for connecting either a headset or a loudspeaker.

## 97. Monitoring at Control Group AN–GRA/6

*a.* It is possible to monitor all the units comprising the system at both Local Control C–434/GRC and Remote Control C–433/GRC. The Set 1 + Set 2 + Interphone output circuit from the amplifier is completed to the local control unit as shown on figure 130. At the local control unit, an audio accessory connected to AUDIO receptacle N/J–1 permits monitoring of the system.

*b.* The circuit to the remote unit is coupled through two transformers (N/T–1 in the local unit and M/T–1 in the remote unit) and the telephone pair (fig. 129). An audio device connected to panel-mounted AUDIO receptacle M/J–1 of Remote Control C–433/GRC permits monitoring of the system.

# Section IV. PUSH-TO-TALK CIRCUITS

## 98. General

The push-to-talk circuits are those circuits which enable transmission over Set 1 or Set 2, or interphone communication through the amplifier. With the exception of a ringing circuit in Set 1, these circuits are all completed by the closing of a push-to-talk switch on a chest set, handset, or microphone. Each push-to-talk switch controls two circuits. One circuit is the control relay circuit. The other circuit is the microphone circuit.

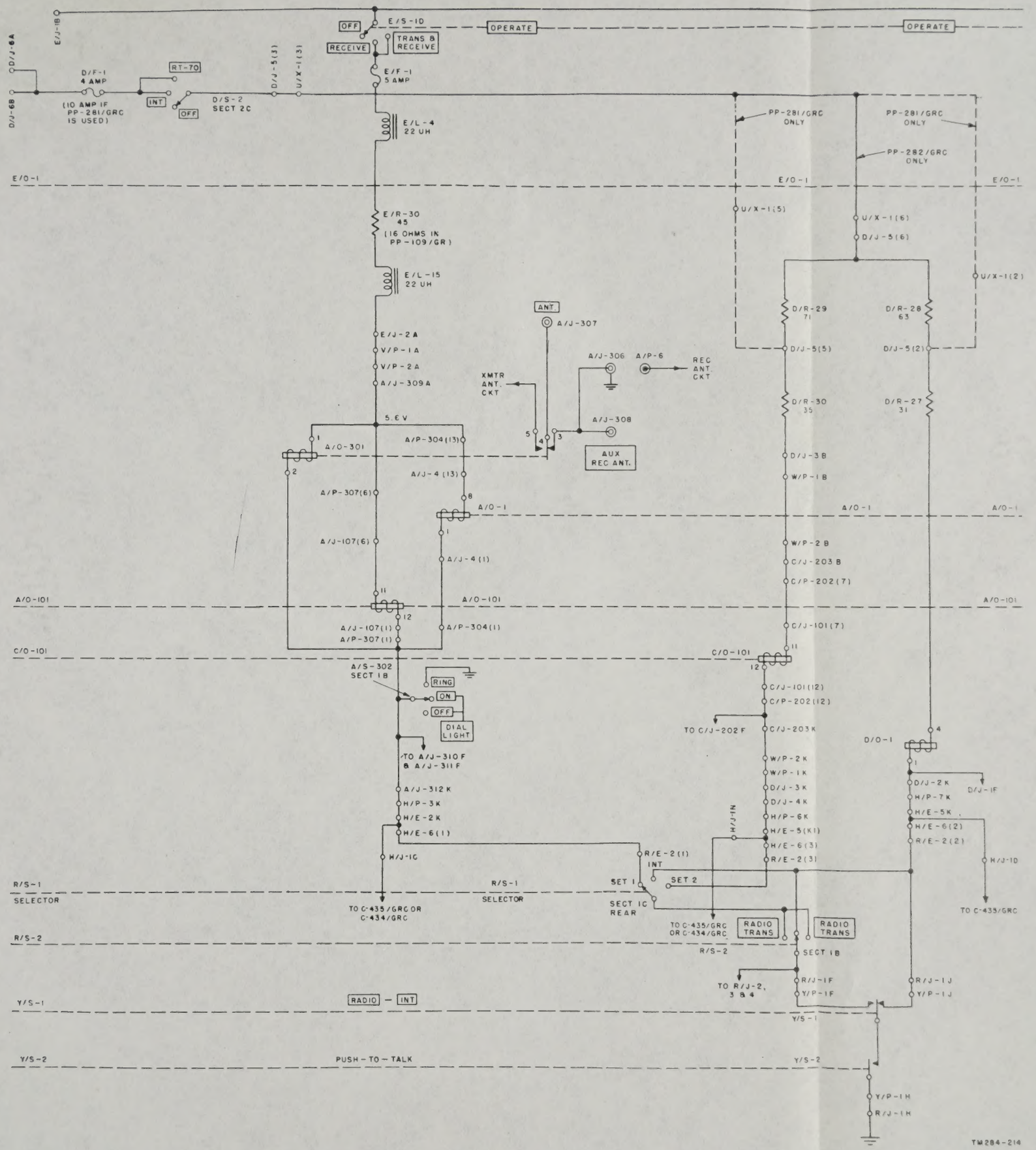
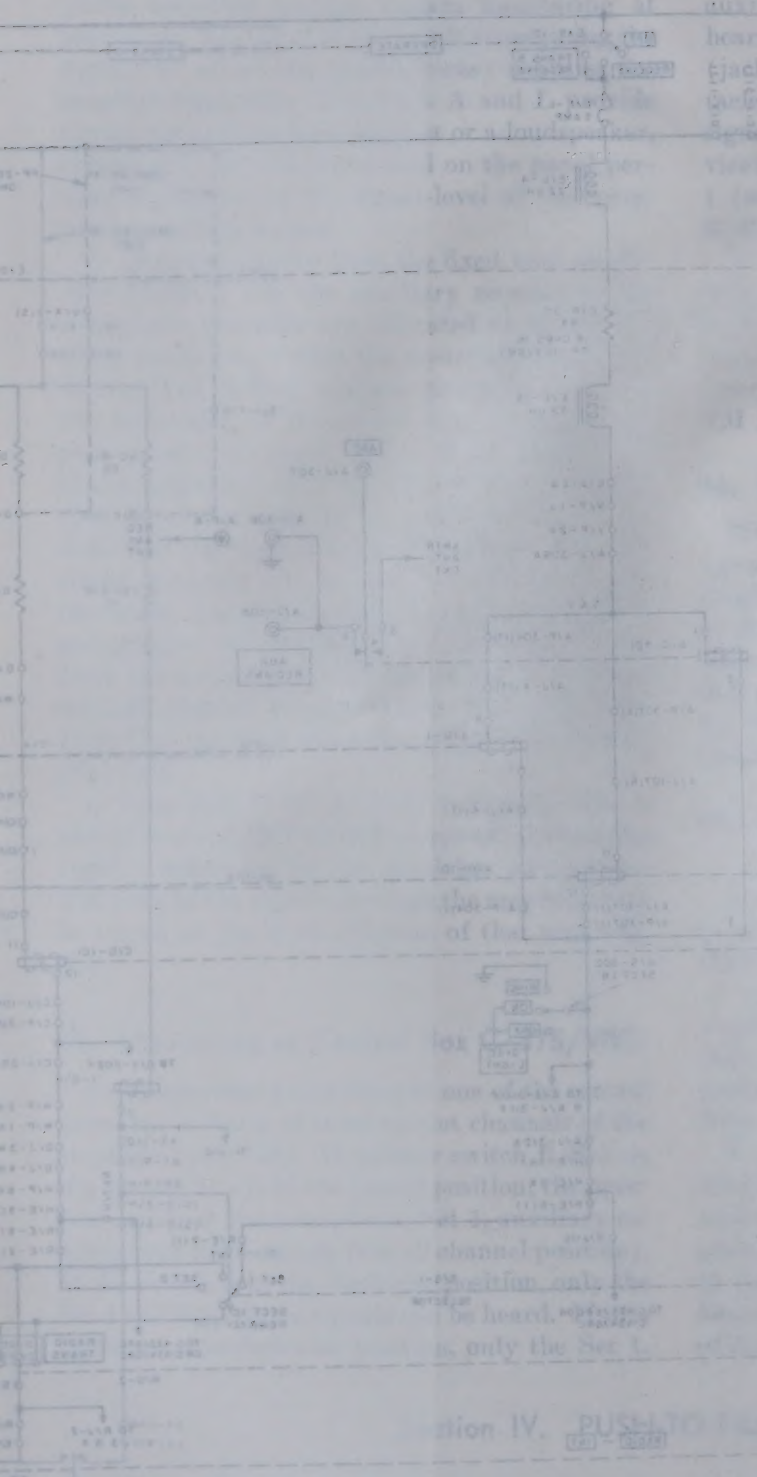



*Figure 64. Power distribution to control relay circuits.*



The control relay circuits for Set 1, Set 2, and the amplifier are described in paragraphs 99, 100, and 101, respectively. The functions of the relay contacts are described in paragraphs 102, 103, and 104. The microphone circuits for the three units are described in paragraphs 106, 107, and 108.

## 99. Set 1 Receive-Transmit Relay Circuits

The actions of three relays, A/O–1, A/O–101, and A/O–301, determine whether the receiver or transmitter section of Set 1 operate. When these relays are in their normal (unenergized) positions, the receiver section of Set 1 operates. When they are in their pulled-in (energized) positions, the transmitter section operates. The functions of the relay contacts are described in paragraph 102.

*a. Application of Battery Voltage* (fig. 64). Battery voltage is applied to the three relay coils (which are connected in parallel) through terminal E/J–1B, the RECEIVE or the TRANS & RECEIVE position of switch E/S–1D, fuse E/F–1, coil E/L–4, voltage-dropping resistor E/R–30, and coil E/L–15. E/R–30 has a value of 45 ohms in Power Supply PP–112/GR which is used with a 24-volt battery supply, and a value of 16 ohms in Power Supply PP–109/GR which is used with a 12-volt supply. In either case, the voltage applied to the relay coils has a value of approximately 6 volts.

*b. Ground-Return Path Through Control Box* (fig. 64). The three receive-transmit relays are energized only when their ground-return path is completed. The path most commonly used is through one of the control boxes. This path extends through the Set 1 (counterclockwise) position of R/S–1C rear, through either one of the RADIO TRANS positions of R/S–2B, through the RADIO (depressed) position of Y/S–1, and through push-to-talk switch Y/S–2 to ground.

*c. Ground-Return Path Through Set 1 Panel Audio Connector* (figs. 64 and 112). Another ground-return path is through an audio accessory connected to one of the Set 1 panel AUDIO connectors (A/J–310 or A/J–311). Either a chest set or a handset may be used. When a handset is used, the circuit is completed from A/J–310F or A/J–311F (whichever is used), through the handset push-to-talk switch (terminal F to terminal H), and through A/J–310H or A/J–311H to ground. When a chest set is used, the circuit is completed from A/J–310F or A/J–311F through the RADIO (depressed) position of RADIO-INT switch Y/S–1, through push-to-talk switch Y/S–2 (terminal F to terminal H), and through A/J–310H or A/J–311H to ground.

*d. Ground-Return Path Through Dial Light Off-On-Ring Switch* (fig. 64). A direct connection to ground is made through the RING position of section 1B of DIAL LIGHT OFF-ON-RING switch A/S–302.

*e. Ground-Return Path Through Retransmission Unit* (fig. 128). When the retransmission unit is used for push-to-talk operation, two ground-return paths are possible through this unit. One path is through the SEND SET 1 position of section 1A rear of MANUAL switch P/S–2 (coordinates (J, 38) ). The other path is through the DUPLEX (second) position of section 1B rear of AUTO switch P/S–1 (J, 37).

*f. Ground-Return Path Through Control Group AN/GRA–6* (fig. 66). When Control Group AN/GRA–6 is used for push-to-talk operation, the ground-return path is completed either through the SET 1 position of section 1B of LOCAL switch N/S–3 in the local control unit, or through contacts 4 and 6 of relay N/O–2 and contacts 7 and 6 of relay N/O–1 in the local control unit. The operation of these relays is controlled by switches in the remote control unit and is described in paragraphs 118 through 123.

## 100. Set 2 Receive-Transmit Relay Circuits (fig. 64)

The action of relay C/O–101 determines whether the receiver or transmitter section of Set 2 operates. When this relay is in the unenergized position, the receiver section operates. When it is in the energized position, the transmitter section operates. The functions of the relay contacts are described in paragraph 103.

*a. Application of Battery Voltage.* Battery voltage is applied to the relay coil through terminal D/J–6B, fuse D/F–1, the INT or RT–70 position of switch D/S–2, and through voltage-dropping resistors D/R–29 and D/R–30 when Power Supply PP–282/GRC is used. These two resistors drop the 24-volt supply voltage to approximately 6 volts at the relay coil. When Power Supply PP–281/GRC is used, D/R–29 is shorted out by jumpers on the power supply input connector. D/R–30 drops the 12-volt supply voltage (used with Power Supply PP–281/GRC) to approximately 6 volts at the relay coil.

*b. Ground-Return Path Through Control Box* (fig. 64). Set 2 receive-transmit relay C/O–101 is energized only when its ground-return path is completed. The most commonly used path is through one of the control boxes. This path extends through the Set 2 (clockwise) position of R/S–1C rear, through either one of the RADIO TRANS positions of R/S–2B, through the RADIO (depressed) position of Y/S–1, and through push-to-talk switch Y/S–2 to ground.

*c. Ground-Return Path Through Set 2 Panel Audio Connector* (figs. 112 and 127). Another ground-return path is through an audio accessory connected to the Set 2 panel AUDIO connector (C/J–202). Either a chest set or a handset may be used. When a handset is used, the circuit is completed from C/J–202F through the handset push-to-talk switch (terminal F to terminal H) and through C/J–202H to ground. When a chest set is used, the circuit is completed from C/J–202F through the RADIO (depressed) position of RADIO-INT switch Y/S–1, through push-to-talk switch Y/S–2 (terminal F to terminal H), and through C/J–202H to ground.

*d. Ground-Return Path Through Retransmission Unit* (fig. 128). When the retransmission unit is used for push-to-talk operation, the circuit is completed through the SET 2 position of section 1A rear of MANUAL switch P/S–2 (J, 38) to ground.

*e. Ground-Return Path Through Control Group AN/GRA–6* (fig. 66). When Control Group AN/GRA–6 is used for push-to-talk operation, the ground-return path is completed either through the SET 2 position of section 1B of LOCAL switch N/S–3 in the local control unit, or through contacts 7 and 6 of relay N/O–2 and contacts 7 and 6 of relay N/O–1 in the local control unit. The operation of these relays is controlled by switches in the remote control unit and is described in paragraphs 118 through 123.

## 101. Interphone Amplifier Control Relay Circuit

It is necessary that relay D/O–1 be energized in order to complete the microphone input circuit of the amplifier for push-to-talk interphone operation.

*a. Application of Battery Voltage* (fig. 64). Battery voltage is applied to the coil of relay D/O–1 through terminal D/J–6B, fuse D/F–1, the INT or RT–70 position of switch D/S–2, and through voltage-dropping resistors D/R–28 and D/R–27 when Power Supply PP–282/GRC is used. These two resistors drop the 24-volt supply voltage to approximately 6 volts at the relay coil. When Power Supply PP–281/GRC is used, D/R–28 is shorted out by jumpers on the power supply input connector. D/R–27 drops the 12-volt supply voltage (used with Power Supply PP–281/GRC) to approximately 6 volts at the relay coil.

*b. Ground-Return Path Through Control Box* (fig. 64). Relay D/O–1 is energized only when its ground-return path is completed. The most commonly used path is through one of the control boxes and a chest set. This path extends through the INT (unoperated) position of RADIO-INT switch Y/S–1, and through push-to-talk switch Y/S–2 to ground. Two alternate ground-return paths are available through the control box for use when a handset is connected to the control box instead of a chest set. One of these paths is through the INT (center) position of R/S–1C rear, through either one of the RADIO TRANS positions of section 1B of RADIO TRANS switch R/S–2, through the push-to-talk switch of the handset (terminal F to terminal E), and through terminal R/J–1E (or R/J–2E, R/J–3, or R/J–4) to ground. A second alternate path is available through the center position of section 1B of RADIO-TRANS switch R/S–2, through the handset (terminal F to terminal E), and through terminal R/J–1E (or R/J–2E, R/J–3, or R/J–4) to ground. (R/J–1 and R/J–2 are the two audio connectors on the control box. R/J–3 and R/J–4 are the MIC. input jacks.)

*c. Ground-Return Path Through Amplifier Panel Audio Connector* (figs. 64 and 112). Another ground-return path is through an audio accessory connected to the amplifier panel AUDIO connector (D/J–1). Either a chest set or a handset may be used. When a handset is used, the circuit is completed from D/J–1F, through the handset push-to-talk switch (terminal F to terminal H), and through D/J–1H to ground. When a chest set is used, the circuit is completed from D/J–1F through the RADIO (depressed) position of RADIO-INT switch Y/S–1, through push-to-tal kswitch Y/S–2 (terminal F to terminal H), and through D/J–1H to ground.

*d. Ground-Return Path Through Retransmission Unit* (fig. 128). When the retransmission unit is used for push-to-talk interphone operation,

the circuit is completed through any position except the DUPLEX position of section 1C front of AUTO switch P/S–1 (I, 38), through the push-to-talk switch (terminal F to terminal H), and through the INT (center) position of section 1A rear of MANUAL switch P/S–2 to ground. (When a chest set is used instead of a handset, closing of both the RADIO-INT and push-to-talk switches on the chest set is necessary to complete the circuit.)

## 102. Set 1 Receive-Transmit Relay Functions
(fig. 127)

When switches are operated which complete the Set 1 receive-transmit relay circuit (par. 99) the relays coordinates (E, 33) operate and perform the following functions.

*a. Relay A/O–301.* Contacts 3 and 4 open and 4 and 5 close to switch the Set 1 antenna from the auxiliary receiver and the receiver section of Set 1 to the transmitter section.

*b. Relay A/O–1.*

(1) Contacts 2 and 3 close to ground the squelch output voltage which is used during no-signal receiving periods to reduce gain of receiver r-f amplifier A/V–1, and to cut off fixed level audio amplifier A/V–102 and first audio amplifier A/V–115.

(2) Contacts 6 and 7 close to connect the B+ supply to the plates of transmitter driver tubes A/V–9 and A/V–10.

(3) Contacts 4 and 5 close to connect the B+ supply to the screen grid of A/V–11.

*c. Relay A/O–101.*

(1) Contacts 6 and 7 close to complete the circuit for relay E/O–1 in the Set 1 power supply. The functions of this relay are described in *d* below.

(2) Contacts 5 and 4 close to complete the voltage supply circuit to the filaments of tubes A/V–5 through A/V–11 and A/V–104 through A/V–106 and to the microphone circuit.

(3) Contact 2 switches from contact 3 to contact 1. This reduces the value of the audio signal applied to the control grid of A/V–115 to about a fifth of the strength put out by the discriminator. This prevents too high a sidetone signal from reaching the panel AUDIO connector of Set 1 during transmitting periods.

(4) Contact 9 switches from contact 10 to contact 8. This switches the 85-volt supply from receiver tubes A/V–1 and A/V–2 to transmitter tubes A/V–104A, A/V–105, A/V–106, A/V–5 through A/V–8, and (when DIAL LIGHT OFF-ON-RING switch is held in the RING position) to A/V–104B.

*d. Relay E/O–1.*

(1) Contacts 2 and 3 close to connect the battery circuit to the filament protection circuit.

(2) Contacts 4 and 5 close to short out resistor E/R–21. This maintains a constant 85-volt supply by compensating for the increased drain on the power supply during transmission.

(3) Contacts 7 and 8 close to complete the circuit to the 150-volt vibrator input in the Set 1 power supply.

(4) Contacts 9 and 10 close to complete the circuit to the 300-volt vibrator input in the Set 1 power supply.

## 103. Set 2 Receive-Transmit Relay Functions
(fig. 127)

When switches are operated which complete the Set 2 receive-transmit relay circuit (par. 100), relay C/O–101 (F, 37) operates and performs the following functions.

*a.* Contact 2 switches from contact 1 to contact 3. This breaks the circuit to the filaments of the Set 2 receiver tubes and completes the circuit to the filaments of the transmitter tubes and to the microphone circuit.

*b.* Contacts 9 and 8 open to break the 90-volt circuit to the plates of C/V–1 and C/V–6.

*c.* Contacts 5 and 4 open to break the circuit to dummy load resistor C/R–136 which draws current during receiving periods.

*d.* Contacts 7 and 6 close to complete the sidetone circuit to the grid of first audio amplifier C/V–106.

## 104. Interphone Amplifier Control Relay Function
(fig. 127)

When switches are operated which complete the amplifier control relay circuit (par. 101), re-

lay D/O–1 (H, 38) operates. Contacts 2 and 3 close to complete the microphone circuit of the amplifier.

## 105. Microphone Circuits (fig. 127)

A circuit in which sound (speech) is converted into an electrical signal and applied to the input of a communication unit is called a microphone circuit. The microphone circuits associated with Set 1, Set 2, and the amplifier each contain a microphone which converts sound into an electrical signal, a microphone input transformer which applies the electrical signal to the particular unit, and appropriate switches. Set 1 also includes a 1,600-cycle oscillator whose output also can be applied to the microphone input transformer. The microphone circuits of Set 1, Set 2, and the amplifier are described in paragraphs 99, 100, and 101, respectively.

## 106. Set 1 Microphone Circuits

The Set 1 transmitter tube filament section (fig. 127) receives a 6-volt d-c energizing potential when the Set 1 receive-transmit relays are energized (par. 99). This potential is applied across a voltage divider consisting of audio choke coil A/L–137 (H, 27) and resistor A/R–130 (I, 28). The reduced voltage across A/R–130 (about 2.5 volts) is applied to the microphone circuit consisting of the primary of microphone transformer A/T–106 in series with the microphone. A/R–130 also acts as the audio ground return for the primary of A/T–106, and, together with choke coil A/L–137, acts as an audio filter which isolates the audio signal from the transmitter filaments. To complete the microphone circuit, it is necessary to connect the primary of microphone transformer A/T–106 to one end of the microphone and to ground the other end of the microphone. Several paths are available for completing the microphone circuit from various control positions in the radio set. A ringing circuit which applies a 1,600-cycle signal to the microphone input transformer and is controlled from the Set 1 panel, also is available. These paths are described in *a* through *e* below.

*a. Control Box* (fig. 127). The path most commonly used for completing the microphone circuit is through the control box. This path extends from A/T–106 (H, 28) through the ON or OFF position of section 1D of DIAL LIGHT ON-OFF-RING switch A/S–302 (I, 29), through the Set 1 (counterclockwise) position of section 1A front of selector switch R/S–1 (I, 32), through either one of the RADIO TRANS positions of section 1A of RADIO TRANS switch R/S–2 (I, 33), through the RADIO (depressed) position of RADIO-INT switch Y/S–1 (J, 33), through the microphone, and through push-to-talk switch Y/S–2 to ground.

*b. Set 1 Panel Audio Connector* (figs. 112 and 127). This path extends from A/T–106 (H, 28) through the ON or OFF position of section 1D of DIAL LIGHT ON-OFF-RING switch A/S–302, through A/J–310C or A/J–311C (whichever AUDIO connector is used), through the microphone of the audio accessory (terminal C to terminal E) when the push-to-talk switch and RADIO-INT switch are pressed (fig. 112), and through A/J–310E or A/J–311E to ground. (When a handset is used instead of a chest set, only the push-to-talk switch need be pressed to complete the circuit.)

*c. Ringing Circuit* (fig. 127). The ringing circuit is not a microphone circuit but consists of a 1,600-cycle oscillator (instead of a microphone) in series with audio input transformer A/T–106. When DIAL LIGHT OFF-ON-RING switch A/S–302 is held at RING, four sections of this switch operate as follows:

(1) Section 1B (G, 34) completes the ground return for the three Set 1 receive-transmit relays and puts Set 1 in the transmit condition.

(2) Section 1D (H, 29) breaks the connection between the microphone and the microphone winding of input transformer A/T–106.

(3) Section 1C rear (G, 49) connects the 85-volt supply to the plate of 1,600-cycle ringing oscillator A/V–104B and puts this oscillator into operation.

(4) Section 1E (G, 29) completes the circuit between the output of A/V–104B and the ringing signal primary (terminals 4 and 5) of audio input transformer A/T–106. A 1,600-cycle audio signal then is transmitted by Set 1.

*d. Retransmission Unit* (fig. 128). This path extends from A/T–106 (H, 28) through the ON or OFF position of section 1D of DIAL

LIGHT OFF-ON-RING switch A/S–302 (H, 30), through section 1C rear of the Set 1 position of MANUAL switch P/S–2 (J, 34), through the microphone, and through push-to-talk switch of the handset to ground. In a tank installation, a chest set and headset-microphone is used instead of a handset. With this audio accessory, the circuit is essentially the same as with the handset except that the RADIO-INT switch is inserted in the circuit just above the microphone. (With the chest set, an operator is directed to press not only the push-to-talk button but also the RADIO-INT button.)

*e. Control Group AN/GRA–6* (fig. 129).

(1) *Local control unit.* This path extends from the primary of A/T–106 (H, 28) through the ON or OFF position of switch A/S–302 (H, 29), through the Set 1 position of section 1C of LOCAL switch N/S–3 (J, 32), and through the handset microphone and push-to-talk switch to ground. In a tank installation, a chest set and headset-microphone is used at the local control unit instead of a handset. As in *d* above, this adds a RADIO-INT switch in series with the microphone. This switch must be in the RADIO (depressed) position.

(2) *Remote control unit.* A circuit extends from the microphone at the remote control unit (I, 47) through terminals 5 and 6 of transformer M/T–1 (I, 42), through a 3-volt battery (I, 46), through the handset push-to-talk switch (J, 46), and back to the microphone. This circuit enables an audio signal developed at the microphone to be applied across terminals 5 and 6 of transformer M/T–1. This audio voltage is induced across terminals 1 and 2 of transformer M/T–1. A circuit extends from terminal 1 of M/T–1, through binding post L–1, through one lead of the telephone line to terminal 1 of transformer N/T–1 (I, 39), through audio coupling capacitor N/C–1B, through terminals 3 and 4 of transformer N/T–1, through binding post L–2, through the second lead of the telephone line, through terminal 4 of transformer M/T–1, through audio coupling capacitor M/C–1B, and back to terminal 2 of transformer M/T–1. Through this circuit, a portion of the audio voltage developed across terminals 1 and 2 of M/T–1 is applied across terminals 1 and 2 of N/T–1 (J, 39). This voltage is induced across terminals 5 and 6 of N/T–1. From terminal 5 of M/T–1, a circuit extends through contacts 8 and 5 of relay N/O–1 (I, 32), through audio coupling capacitor N/C–2B (I, 31), through the SET 1 & 2 or the SET 1 position of section 2E rear of REMOTE switch N/S–2 (J, 31), through the ON or OFF position of section 1D of DIAL LIGHT ON-OFF-RING switch A/S-302 (I, 29), to the primary of microphone input transformer A/T–106, and back through A/R–130 to ground. This completes the circuit from the microphone in the remote control unit to the microphone input transformer in Set 1. Detailed operation of the switches and relays in Control Group AN/GRA–6 is described in section VI of this chapter.

## 107. Set 2 Microphone Circuits

The Set 2 transmitter tube filament section (fig. 127) receives a 6-volt energizing potential when receive-transmit relay C/O–101 is energized (par. 100). This potential is applied from contacts 2 and 3 of relay C/O–101 (G, 12) through current-limiting resistor C/R–1 (G, 31) to the primary (terminal 7) of microphone input transformer C/T–1 (G, 32). C/R–1 also isolates the audio signal developed in the microphone circuit from the set transmitter tube filament section. To complete the microphone circuit, it is necessary to connect the primary of C/T–1 to ground through a microphone. The paths available for completing this circuit from the various control positions are described below.

*a. Control Box* (fig. 127). The path most commonly used for completing a microphone circuit is through the control box. This path extends from C/T–1 (G, 32) through the Set 2 (clockwise) position of section 1A front of selector switch R/S–1 (H, 32), through the RADIO TRANS position of section 1A of RADIO TRANS switch R/S–2, through the RADIO position of RADIO-INT switch Y/S–1, through the microphone, and through push-to-talk switch Y/S–2 to ground.

*b. Set 2 Panel Audio Connector* (figs. 112 and 127). This path extends from C/T–1 (G, 32) through panel AUDIO connector C/J–202C (H, 32), through a handset or chest set plugged into this AUDIO connector, and through C/J–202E to ground. When a handset is used (fig. 112), the circuit is from terminal C of the handset connector through the microphone of the handset and through a pair of contacts of the push-to-talk switch to terminal E of the handset connector. This terminal is connected to C/J–202E of Set 2 which connects to ground. When a chest set is used (fig. 112), the circuit is from terminal C of the chest set connector through the RADIO (depressed) position of RADIO-INT switch S–1, through a microphone which is plugged into receptacle J–1 of the chest set, and through the push-to-talk switch back to terminal E of the chest set connector. As with the handset, terminal E is connected to C/J–202E of Set 2 which connects to ground.

*c. Retransmission Unit* (fig. 128). This path extends from C/T–1 (G, 32) through the SET 2 position of section 1C rear of MANUAL switch PS–2 (I, 34) and through the handset microphone and push-to-talk switch to ground. In a tank installation, a chest set and headset-microphone is used instead of a handset. With this audio accessory, the circuit is essentially the same as with the handset except that the RADIO-INT switch is inserted in the circuit just above the microphone. (With the chest set, an operator is directed to press not only the push-to-talk button but also the RADIO-INT button.)

*d. Control Group AN/GRA–6* (fig. 129).

(1) *Local control unit.* This path extends from the primary of C/T–1 (G, 32) through the SET 2 position of section 1C of LOCAL switch N/S–3 (J, 32) and through the handset microphone and push-to-talk switch to ground. As in *c* above, a chest set and headset-microphone is used instead of a handset in a tank installation.

(2) *Remote control unit.* This circuit is the same as that for Set 1 (par 106*e*(2)) from the microphone in the remote control unit to contacts 8 and 5 of relay N/O–1 (I, 32). From this point, the Set 2 microphone circuit extends up through capacitor N/C–2A and through the SET 1 & 2 or the SET 2 position of section 2D rear of REMOTE switch N/S–2 to the primary of C/T–1 (G, 32).

## 108. Interphone Amplifier Microphone Circuit

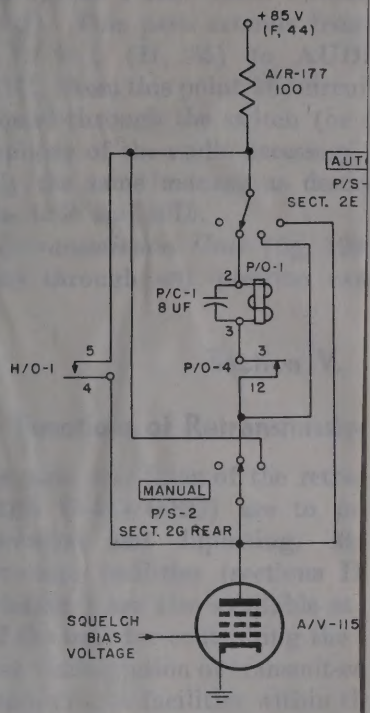
The d-c potential for the amplifier microphone circuit is obtained from a connection to resistor D/R–27 (fig. 127 (D, 38)). The d-c potential at this point is applied through current-limiting resistor D/R–2 (G, 36) and through audio choke coil D/L–2 to the primary of microphone input transformer D/T–1 (G, 34). To complete the microphone circuit, it is necessary to connect the primary of D/T–1 to ground through a microphone. The paths available for completing this circuit from the various control positions are described in *a*, *b*, and *c* below.

*a. Control Box* (fig. 127).

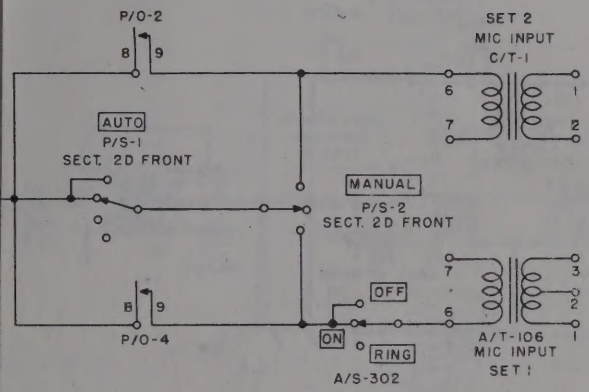
(1) The path most commonly used for completing the microphone circuit is through the control box. This path extends from the primary of D/T–1 (G, 34) through contacts 2 and 3 of control relay D/O–1, through the INT (unoperated) position of RADIO-INT switch Y/S–1 (J, 33), and through the microphone and push-to-talk switch Y/S–2 of the chest set to ground. This path is independent of switch settings on the control box.

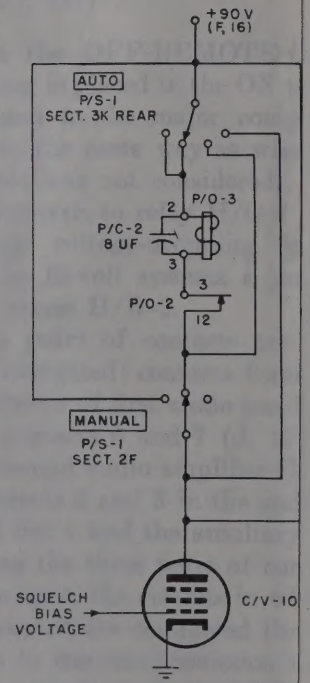
(2) If a handset, instead of a chest set, is used at a control box, the path through RADIO-INT switch Y/S–2 is not available. Two other paths are available. One path extends through the center position of section 1A of RADIO TRANS switch R/S–2 (I, 32), through terminal R/J–1C or R/J–2C (whichever receptacle is used), through the handset microphone and push-to-talk switch, and back to terminal R/J–1E or R/J–2E, which are grounded. (Jacks R/J–3 and R/J–4 are used for the older substitute audio accessories described in paragraph 21*h*.)

(3) A second path available for the handset extends through the INT (center) position of section 1A front of selector switch R/S–1 (I, 32), through the RADIO TRANS position of section 1A of RADIO TRANS switch R/S–2, and through R/J–1, R/J–2, R/J–3, or R/J–4 as described in (2) above.




A SET 1 PRIMARY RELAY CIRCUIT




B SET 2 PRIMARY RELAY CIRCUI

NOTES:

1. AUTO SWITCH P/S-1 HAS FOUR POSITIONS. THE SWITCH IS SHOWN IN THE RETRANS POSITION. THE FOUR POSITIONS ARE IDENTIFIED IN A CLOCKWISE DIRECTION AS FOLLOWS:
   1. OFF
   2. DUPLEX
   3. RETRANS
   4. ADJUST METER
2. MANUAL SWITCH P/S-2 HAS THREE POSITIONS. THE SWITCH IS SHOWN IN THE INT POSITION. THE THREE POSITIONS ARE IDENTIFIED IN A CLOCKWISE DIRECTION AS FOLLOWS:
   1. SEND SET 1
   2. INT
   3. SEND SET 2
3. COORDINATES IN BRACKETS, SUCH AS (F,44) IN SECTION A, INDICATE LOCATION OF CIRCUIT ON THE MAIN SYSTEM CONTROL CIRCUIT WHICH CONTAINS THE RETRANSMISSION UNIT CIRCUITS.
4. CONTACTS OF ALL RELAYS EXCEPT THOSE OF H/O-1 ARE SHOWN IN UNENERGIZED CONDITION OF RELAYS.
5. UNLESS OTHERWISE SHOWN; RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

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*b. Set 2 Panel Audio Connector* (figs. 112 and 127). This path extends from C/T–1 (G, 32) through panel AUDIO connector C/J–202C (H, 32), through a handset or chest set plugged into this AUDIO connector, and through C/J–202E to ground. When a handset is used (fig. 112), the circuit is from terminal C of the handset connector through the microphone of the handset and through a pair of contacts of the push-to-talk switch to terminal E of the handset connector. This terminal is connected to C/J–202E of Set 2 which connects to ground. When a chest set is used (fig. 112), the circuit is from terminal C of the chest set connector through the RADIO (depressed) position of RADIO-INT switch S–1, through a microphone which is plugged into receptacle J–1 of the chest set, and through the push-to-talk switch back to terminal E of the chest set connector. As with the handset, terminal E is connected to C/J–202E of Set 2 which connects to ground.

*c. Retransmission Unit* (fig. 128). This path extends from C/T–1 (G, 32) through the SET 2 position of section 1C rear of MANUAL switch PS–2 (I, 34) and through the handset microphone and push-to-talk switch to ground. In a tank installation, a chest set and headset-microphone is used instead of a handset. With this audio accessory, the circuit is essentially the same as with the handset except that the RADIO-INT switch is inserted in the circuit just above the microphone. (With the chest set, an operator is directed to press not only the push-to-talk button but also the RADIO-INT button.)

*d. Control Group AN/GRA–6* (fig. 129).

(1) *Local control unit.* This path extends from the primary of C/T–1 (G, 32) through the SET 2 position of section 1C of LOCAL switch N/S–3 (J, 32) and through the handset microphone and push-to-talk switch to ground. As in *c* above, a chest set and headset-microphone is used instead of a handset in a tank installation.

(2) *Remote control unit.* This circuit is the same as that for Set 1 (par 106*e*(2)) from the microphone in the remote control unit to contacts 8 and 5 of relay N/O–1 (I, 32). From this point, the Set 2 microphone circuit extends up through capacitor N/C–2A and through the SET 1 & 2 or the SET 2 position of section 2D rear of REMOTE switch N/S–2 to the primary of C/T–1 (G, 32).

## 108. Interphone Amplifier Microphone Circuit

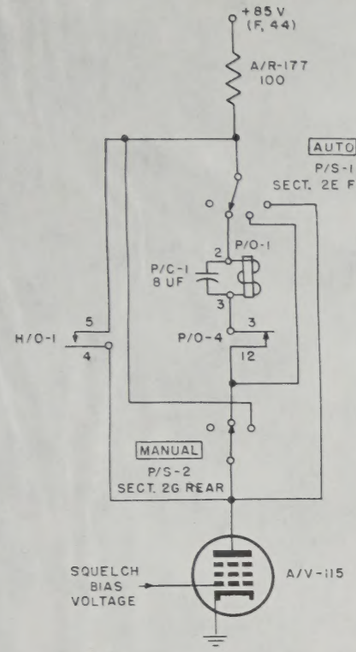
The d-c potential for the amplifier microphone circuit is obtained from a connection to resistor D/R–27 (fig. 127 (D, 38)). The d-c potential at this point is applied through current-limiting resistor D/R–2 (G, 36) and through audio choke coil D/L–2 to the primary of microphone input transformer D/T–1 (G, 34). To complete the microphone circuit, it is necessary to connect the primary of D/T–1 to ground through a microphone. The paths available for completing this circuit from the various control positions are described in *a*, *b*, and *c* below.

*a. Control Box* (fig. 127).

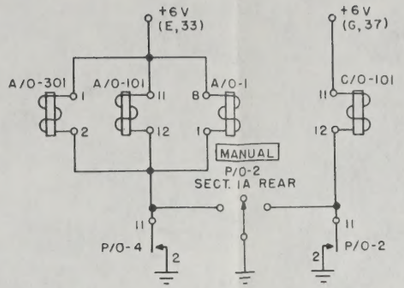
(1) The path most commonly used for completing the microphone circuit is through the control box. This path extends from the primary of D/T–1 (G, 34) through contacts 2 and 3 of control relay D/O–1, through the INT (unoperated) position of RADIO-INT switch Y/S–1 (J, 33), and through the microphone and push-to-talk switch Y/S–2 of the chest set to ground. This path is independent of switch settings on the control box.

(2) If a handset, instead of a chest set, is used at a control box, the path through RADIO-INT switch Y/S–2 is not available. Two other paths are available. One path extends through the center position of section 1A of RADIO TRANS switch R/S–2 (I, 32), through terminal R/J–1C or R/J–2C (whichever receptacle is used), through the handset microphone and push-to-talk switch, and back to terminal R/J–1E or R/J–2E, which are grounded. (Jacks R/J–3 and R/J–4 are used for the older substitute audio accessories described in paragraph 21*h*.)

(3) A second path available for the handset extends through the INT (center) position of section 1A front of selector switch R/S–1 (I, 32), through the RADIO TRANS position of section 1A of RADIO TRANS switch R/S–2, and through R/J–1, R/J–2, R/J–3, or R/J–4 as described in (2) above.

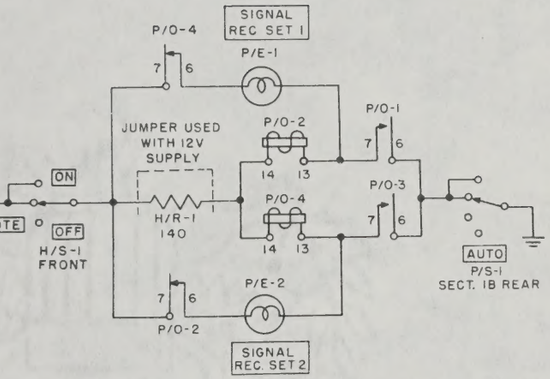



A SET 1
PRIMARY RELAY CIRCUIT

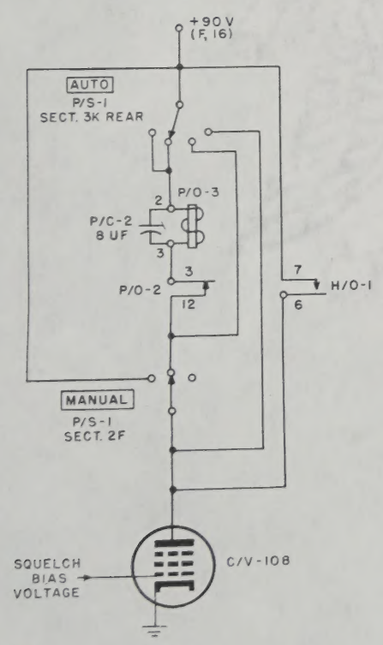



D SET 1
RECEIVE-TRANSMIT
RELAY CIRCUIT

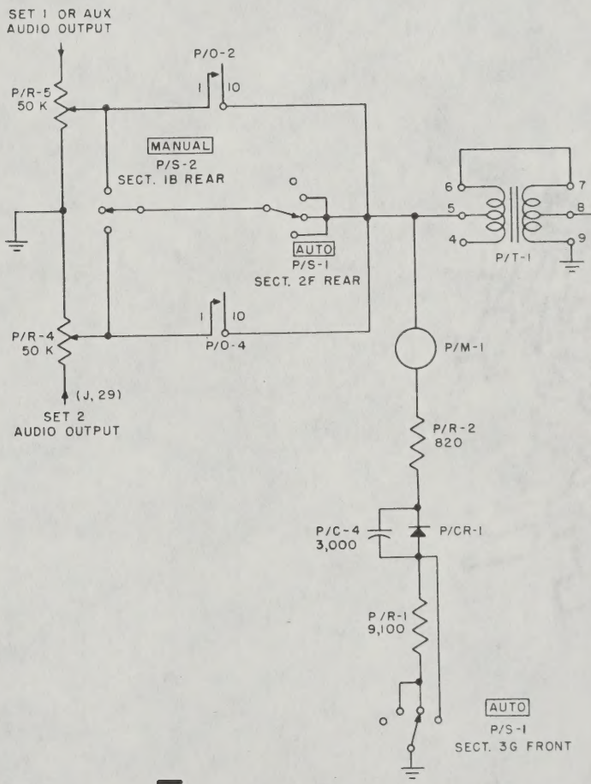
SET 2
RECEIVE-TRANSMIT
RELAY CIRCUIT



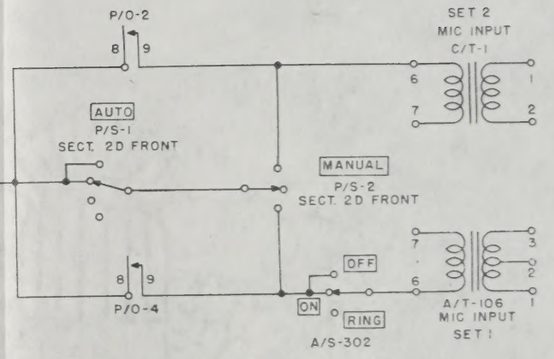

C SET 1 AND SET 2
SECONDARY RELAY AND LAMP CIRCUITS




B SET 2
PRIMARY RELAY CIRCUIT




E AUDIO RETRANSMISSION CIRCUITS

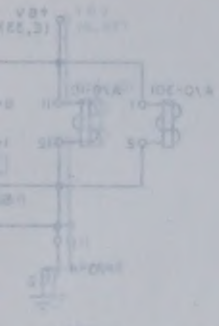


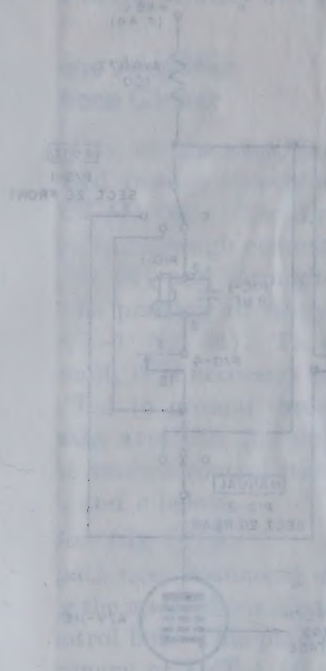

NOTES:

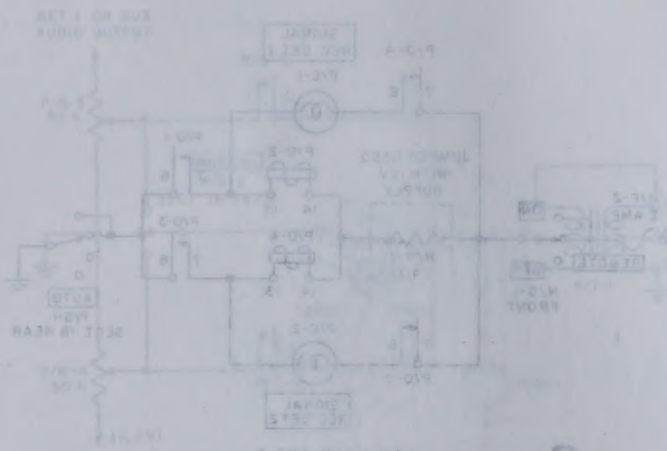
1. AUTO SWITCH P/S-1 HAS FOUR POSITIONS. THE SWITCH IS SHOWN IN THE RETRANS POSITION. THE FOUR POSITIONS ARE IDENTIFIED IN A CLOCKWISE DIRECTION AS FOLLOWS:
   1. OFF
   2. DUPLEX
   3. RETRANS
   4. ADJUST METER
2. MANUAL SWITCH P/S-2 HAS THREE POSITIONS. THE SWITCH IS SHOWN IN THE INT POSITION. THE THREE POSITIONS ARE IDENTIFIED IN A CLOCKWISE DIRECTION AS FOLLOWS:
   1. SEND SET 1
   2. INT
   3. SEND SET 2
3. COORDINATES IN BRACKETS, SUCH AS (F,44) IN SECTION A, INDICATE LOCATION OF CIRCUIT ON THE MAIN SYSTEM CONTROL CIRCUIT WHICH CONTAINS THE RETRANSMISSION UNIT CIRCUITS.
4. CONTACTS OF ALL RELAYS EXCEPT THOSE OF H/O-1 ARE SHOWN IN UNENERGIZED CONDITION OF RELAYS.
5. UNLESS OTHERWISE SHOWN;
   RESISTORS ARE IN OHMS,
   CAPACITORS ARE IN UUF.

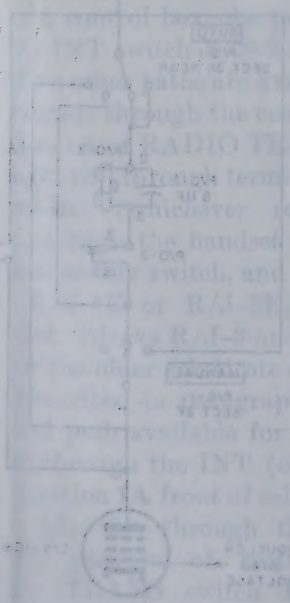
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*Figure 65. Retransmission circuits.*









*b. Amplifier Panel Audio Connector* (figs. 112 and 127). This path extends from contact 3 of relay D/O–1 (H, 35) to AUDIO connector D/J–1C. From this point, the circuit is completed to ground through the switch (or switches) and microphone of the audio accessory being used in exactly the same manner as described in paragraphs 106*b* and 107*b*.

*c. Retransmission Unit* (fig. 128). This path extends through any position except the DUPLEX position of section 1A front of AUTO switch P/S–1 (I, 34), through the INT (center) position of section 1C rear of MANUAL switch P/S–2, and through the handset microphone and push-to-talk switch to ground. When a chest set is used instead of a handset (in tanks), the RADIO-INT switch is in the circuit between the MANUAL switch and the microphone. (Both the RADIO-INT switch and the push-to-talk switch must be pressed to complete this circuit.)

## Section V. RETRANSMISSION AND DUPLEXING

### 109. Functions of Retransmission Unit

The main functions of the retransmission unit (Control C–435/GRC) are to provide for retransmission and duplexing. Monitoring and push-to-talk facilities (sections III and IV of this chapter) are also available at the unit. The use of the unit for controlling the radio sets constitutes a substitution of transmit-control switches and audio input facilities within the unit for the control switches and microphone of the control box.

### 110. Power Distribution with Retransmission Unit (fig. 128)

*a.* When the OFF-REMOTE-ON switch of the mounting is placed in the ON position, power is distributed to the major components of the radio set in the same way as when the retransmission unit was not considered. Power also is applied, however, to relay H/O–1 in the mounting through voltage-dropping resistor H/R–2 (G, 02); in 12-volt systems a jumper must be connected across H/R–2.

*b.* Three pairs of contacts are opened when H/O–1 is energized; contacts 4 and 5 (J, 45) in the plate circuit of first audio amplifier A/V–115 in Set 1; contacts 6 and 7 (J, 17) in the plate circuit of second audio amplifier C/V–108 in Set 2; and contacts 2 and 3 in the audio monitoring circuits of Set 1 and the auxiliary receiver (fig. 130). When the three pairs of contacts of relay H/O–1 are open, the circuits in which these contacts are located are completed through switches and relays in the retransmission unit. This enables these circuits to be controlled by switches and relays in the retransmission unit. Control of these circuits makes possible retransmission and duplexing.

### 111. Retransmission Circuits (fig. 65)

The retransmission circuits enable the radio set to retransmit in either of two directions. When a signal is received by Set 1, it is retransmitted automatically by Set 2. When a signal is received by Set 2, it is retransmitted automatically by Set 1. The circuits which make this possible are described below. Note that for retransmission, the AUTO switch must be at RETRANS and the MANUAL switch must be at INT.

*a. Set 1 and Set 2 Primary Relay Circuits* (A and B, fig. 65). When no signal is being received, both Set 1 and Set 2 are in the receive condition. Also, a bias voltage from the squelch circuits of these sets is applied to the control grids of first audio amplifier A/V–115 in Set 1 and to second audio amplifier C/V–108 in Set 2. This squelch bias voltage cuts off the plate current through these tubes. When a signal is received by either Set 1 or Set 2, the squelch bias voltage in that set is removed and A/V–115 or C/V–108 conducts. This completes a circuit through primary relay P/O–1 and A/V–115 in Set 1, or through primary relay P/O–1 and A/V–115 in Set 1, or through primary relay P/O–3 and C/V–108 in Set 2. The d-c current through this circuit (which is also the d-c plate current through the tube) pulls in the relay. The tube operates like a *switch*. When no signal is received, the tube is biased to cutoff and the *switch* is open. When a signal is received, the cutoff (squelch) bias voltage is removed and the *switch* closes to complete the primary relay circuit. The received signal is the *trigger* for the *switch*.



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*b. Set 1 Secondary Relay and Lamp Circuit* (C, fig. 65).

(1) When Set 1 receives a signal, relay P/O–1 pulls in and contacts 7 and 6 of this relay close. This completes a circuit from the 24-volt (or 12-volt) supply through fuse H/F–2, the ON position of OFF-REMOTE-ON switch H/S–1, through voltage-dropping resistor H/R–1 (shorted out by a jumper in 12-volt systems), through the coil of secondary relay P/O–2, through the now closed contacts 7 and 6 of P/O–1, and through the RETRANS position of section 1B rear of AUTO switch P/S–1 to ground. A parallel circuit also is completed through normally closed contacts 7 and 6 of relay P/O–4 and SIGNAL REC SET 1 lamp P/E–1. Relay P/O–2 pulls in and the lamp lights, indicating that a signal is being received by Set 1.

(2) When relay P/O–2 pulls in, it operates five pairs of contacts. Two pairs of normally closed contacts are opened and three pairs of normally open contacts are closed. Contacts 3 and 12 (B, fig. 65) open to break the Set 2 primary relay (P/O–3) circuit. This prevents relay P/O–3 from being operated by the sidetone signal from Set 1. Contacts 7 and 6 (C, fig. 65) also open to break the circuit through SIGNAL REC SET 2 lamp P/E–2. Contacts 2 and 11 (D, fig. 65) close to complete a circuit through Set 2 receive-transmit relay C/O–101. This relay operates to put Set 2 in the transmit condition. Contacts 1 and 10 and 8 and 9 (E, fig. 65) close to complete a circuit from the audio output of Set 1 (or the auxiliary receiver) to the microphone input of Set 2. This circuit is described in *d* below.

*c. Set 2 Secondary Relay and Lamp Circuit* (C, fig. 65). When Set 2 receives a signal, relay P/O–3 pulls in and contacts 7 and 6 of this relay close. This completes the 24-volt (or 12-volt) circuit through secondary relay P/O–4 and through SIGNAL REC SET 2 lamp P/E–2. Relay P/O–4 pulls in and the lamp lights, indicating that a signal is being received by Set 2. The functions of the contacts of relay P/O–4 correspond to those of relay P/O–2, described in *b* above. Contacts 3 and 12 (A, fig. 65) open to break the Set 1 primary relay circuit. Contacts 7 and 6 (C, fig. 65) also open to break the circuit through SIGNAL REC SET 1 lamp P/E–1. Contacts 2 and 11 (in section D, fig. 65) close to complete the circuit through the Set 1 receive-transmit relays A/O–301, A/O–101, and A/O–1. These relays operate to put Set 1 in the transmit condition. Contacts 1 and 10 and 8 and 9 (E, fig. 65) close to complete a circuit from the audio output of Set 2 to the microphone input of Set 1. This circuit is described in *d* below. Contacts 4 and 5 open in the Set 1 and auxiliary receiver audio output circuit (fig. 130). This prevents sidetone in Set 1 from being applied to the mounting and to the various monitoring positions of the radio set where it could possibly interfere with the Set 2 audio output.

*d. Audio Retransmission Circuits* (E, fig. 65). The audio retransmission circuits consist of two alternate paths for an audio signal, only one of which is completed at a time. The two circuits are arranged symmetrically, one path extending from the Set 1 (or auxiliary) receiver output to the Set 2 microphone input, and the other path extending from the Set 2 receiver output to the Set 1 microphone input. As described in *b* above, when Set 1 receives a signal, primary relay P/O–1 is energized. This causes secondary relay P/O–2 to be energized. Two pairs of contacts of this relay, 1 and 10 and 8 and 9, complete the first path for a signal from the receiver of Set 1 to the microphone input of Set 2. As described in *c* above, when Set 2 receives a signal, primary relay P/O–3 is energized. This causes secondary relay P/O–4 to be energized. Two pairs of contacts of this relay, 1 and 10 and 8 and 9, complete the second (alternate) path for a signal from the receiver of Set 2 to the microphone input of Set 1.

(1) The audio output of Set 1 (or the auxiliary receiver) is applied across volume control P/R–5. This control, located just below SIGNAL REC SET 1 lamp on the control panel of the retransmission unit, is adjusted to apply an audio signal of the proper strength for retransmission. A voltmeter circuit, described in (3) below, is calibrated to read center scale when the proper level of audio signal is applied through this cir-

cuit. From P/R–5, the audio path extends through closed contacts 1 and 10 of P/O–2, through audio transformer P/T–1, through coupling capacitor P/C–3, and through closed contacts 8 and 9 of P/O–2 to Set 2 microphone input transformer C/T–1. The signal then is retransmitted by Set 2.

(2) Because of the symmetry of the circuit, the path from the audio output of Set 2 is similar to that of Set 1. This path extends through volume control P/R–4, through closed contacts 1 and 10 of P/O–4, through audio transformer P/T–1, through coupling capacitor P/C–3, through closed contacts 8 and 9 of P/O–4, and through the ON or OFF position of DIAL LIGHT OFF-ON-RING switch A/S–302 to Set 1 microphone input transformer A/T–106. The signal then is retransmitted by Set 1.

(3) An audio voltmeter circuit measures the signal level at terminal 5 of transformer P/T–1. This circuit extends from the transformer through meter P/M–1, through current limiting resistor P/R–2, through rectifier P/CR–1 which is paralleled by capacitor P/C–4, through current limiting (multiplier) resistor P/R–1, and through the RETRANS position of section 3G front of AUTO switch P/S–1 to ground. When the AUTO switch is held at ADJUST METER (fourth position), P/R–1 is shorted out and the sensitivity of the voltmeter circuit is increased greatly. It is at this setting of the switch that the volume controls, P/R–5 and P/R–4, are adjusted to cause the output signals of Set 1 and Set 2, respectively, to produce a center scale reading on the meter. After these adjustments are made, the AUTO switch is released from the ADJUST METER position and allowed to return to the RETRANS position. The decreased sensitivity of the voltmeter prevents damage to the meter when strong audio signals are applied, but allows the meter to indicate the passage of normal audio signals through the retransmission unit. Meter P/M–1 is a d-c meter and does not respond to a-c (alternating current). Rectifier P/CR–1 converts the audio a-c current to a direct current. The function of capacitor P/C–4 is to bypass r-f signals around rectifier P/CR–1. These r-f signals are picked up in this circuit because of stray coupling, and if they were allowed to be rectified, they would cause spurious deflections of the meter.

*e. Manual Retransmission* (fig. 65). In manual retransmission, the AUTO switch is in the RETRANS position just as for automatic transmission, but the MANUAL switch now is set at either the SEND SET 1 or the SEND SET 2 position, depending on the desired direction of retransmission. Setting the MANUAL switch at either one of these two positions de-energizes both primary retransmit relays P/O–1 and P/O–2. This results in both secondary retransmit relays P/O–3 and P/O–4 also being de-energized. Details of the circuits involved are described in (1) and (2) below.

(1) *MANUAL switch at SEND SET 1.* When the MANUAL switch is set at SEND SET 1, section 2G rear of this switch (A, fig. 65) breaks the circuit through primary relay P/O–1. Section 2F of the switch (B, fig. 65) shorts out primary relay P/O–3 and completes the B+ circuit to C/V–108. P/O–1 and P/O–3 therefore are de-energized. Contacts 7 and 6 of both of these relays therefore are open (C, fig. 65), and relays P/O–2 and P/O–4 also are de-energized. Section 1A rear of the switch (D, fig 65) completes the ground return for the Set 1 receive-transmit relays and puts Set 1 in the transmit condition. The circuit through C/O–101 is open, and Set 2 is in the receive condition. Section 1B rear of the switch (E, fig. 65) completes a circuit from P/R–4 to transformer P/T–1, and section 2D front completes a circuit from capacitor P/C–3 to Set 1 microphone input transformer A/T–106. This completes the audio retransmission circuit from the output of Set 2 to the input of Set 1.

(2) *MANUAL switch at SEND SET 2.* When the MANUAL switch is set at SEND SET 2, section 2F (B, fig. 65) breaks the circuit through primary relay P/O–3. Section 2G rear (A, fig. 65) shorts out primary relay P/O–1 and

completes the B+ circuit to A/V–115. (The audio output of A/V–115 is applied to the panel AUDIO connector of Set 1, but is not used in the retransmission circuits. Fixed level audio amplifier A/V–102 supplies the audio output for retransmission.) P/O–3 and P/O–1, therefore, are de-energized, and the circuits through relays PO–2 and P/O–4 (C, fig. 65) are opened by contacts 7 and 6 of relays P/O–1 and P/O–3, respectively. Section 1A rear (D, fig. 65) completes the ground return for Set 2 receive-transmit relay C/O–101 and puts Set 2 in the transmit condition. The ground return for the Set 1 receive-transmit relays is open, and Set 1 is in the receive condition. Section 1B rear (E, fig. 65) completes a circuit from P/R–5 to transformer P/T–1, and section 2D front completes a circuit from capacitor P/C–3 to Set 2 microphone input transformer C/T–1. This completes the audio retransmission circuit from the output of Set 1 to the input of Set 2.

*f. Retransmission Via Auxiliary Receiver and Set 2.* The audio output of the auxiliary receiver is routed through the same path as the audio output of Set 1. However, since the retransmit relays are not controlled by signals received by the auxiliary receiver, manual retransmission is necessary. When the MANUAL switch is set at SEND SET 2, Set 2 is put in the transmit condition (*e*(2) above). The signal path from the auxiliary receiver output to the Set 2 input is the same path as the signal path from Set 1 to Set 2.

## 112. Duplex Operation
(fig. 128)

*a. General.* For duplex operation, the AUTO switch is set in the DUPLEX position. This switch keeps Set 1 in the transmit condition and Set 2 in the receive condition. When the input of the auxiliary receiver is disconnected from the Set 1 antenna (by the removal of Wire W–142) and a separate antenna is connected to the auxiliary receiver, this unit may be used instead of Set 2 for duplex operation. This increases the receiving range.

*b. Circuit Analysis* (fig. 128). The DUPLEX position of section 1B rear of AUTO switch P/S–1 (J, 37) completes the ground return for the Set 1 receive-transmit relays. This puts Set 1 in the transmit condition, independent of the operation of a push-to-talk switch. The Set 1 microphone circuit is completed from transformer A/T–106 (H, 28) through the ON or OFF position of section 1D of OFF-ON-RING switch A/S–302, through the DUPLEX position of section 1A front of AUTO switch P/S–1 (I, 34), through the INT position of section 1C rear of MANUAL switch P/S–2, and through the microphone and push-to-talk switch of a handset to ground. When a chest set is used instead of a handset, the RADIO-INT switch of the chest set is inserted in this circuit just above the microphone. The completion of the Set 1 receive-transmit relay circuit and the Set 1 microphone circuit provides for transmission over Set 1. The monitoring circuits for the signal received by Set 2 or the auxiliary receiver (fig. 130) are the same as for simple monitoring from these units.

# Section VI. CONTROL GROUP AN/GRA–6

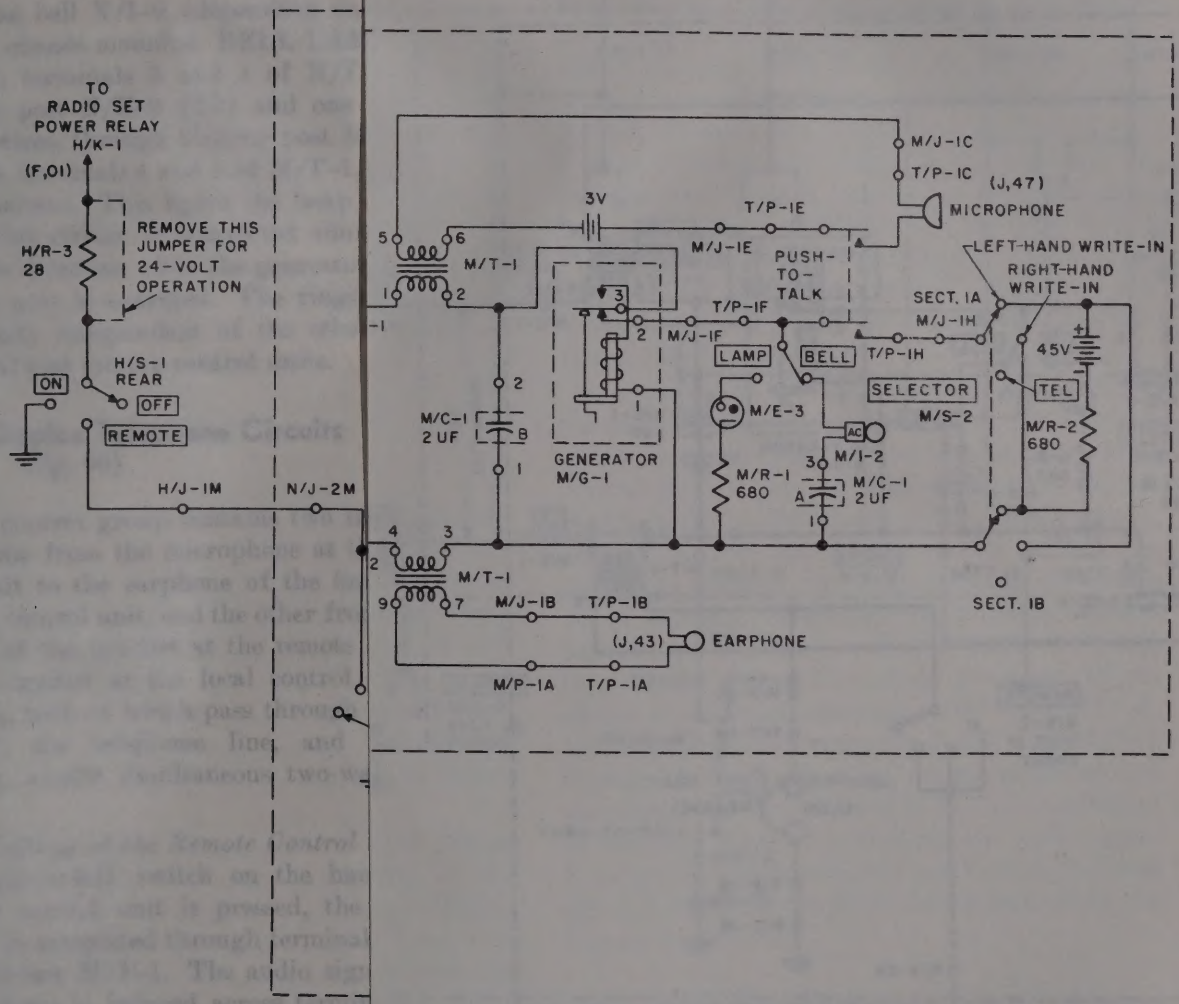
## 113. General

Control Group AN/GRA–6 may be classified functionally into five circuits. These circuits are a ringing generator circuit (par. 114), a duplex telephone circuit (par. 115), monitoring circuits (par. 116), local push-to-talk circuits (par. 117), and remote push-to-talk circuits (pars. 118 through 123).

## 114. Ringing Generator Circuit
(fig. 66)

A ringing generator (G–1) is located in the local control unit and in the remote control unit. These generators are identical. They are hand-operated to put out a 20-cycle voltage at approximately 95 volts with no load and approximately 50 volts when loaded by the bell or neon lamp which they excite. When the generator is not being operated, a normally open pair of contacts in the generator isolates this unit from the other control group circuits. When the crank on the front panel of the local or remote control unit is operated, the generator contacts transfer; that is, the normally open contacts close and the normally closed contacts open. When the generator at the remote control unit is operated, a circuit is estab-

# REMOTE CONTROL C-433/GRC




1. ALL SWITCHES VIEWED FROM KNO
2. REMOTE SWITCH N/S-2 IS SHOW
   WISE POSITION VIEWED FROM FRO
   OF THIS SWITCH, AS IT IS MOVED
   AS FOLLOWS:
   1. TEL ONLY
   2. SET 1 & 2
3. LOCAL SWITCH N/S-3 IS SHOWN I
   POSITIONS OF THE SWITCH, AS IT IS
   DIRECTION, ARE AS FOLLOWS:
   1. SET 1
   2. TEL
   3. SET 2

completes the B+ circuit to A/V–115. (The audio output of A/V–115 is applied to the panel AUDIO connector of Set 1, but is not used in the retransmission circuits. Fixed level audio amplifier A/V–102 supplies the audio output for retransmission.) P/O–3 and P/O–1, therefore, are de-energized, and the circuits through relays PO–2 and P/O–4 (C, fig. 65) are opened by contacts 7 and 6 of relays P/O–1 and P/O–3, respectively. Section 1A rear (D, fig. 65) completes the ground return for Set 2 receive-transmit relay C/O–101 and puts Set 2 in the transmit condition. The ground return for the Set 1 receive-transmit relays is open, and Set 1 is in the receive condition. Section 1B rear (E, fig. 65) completes a circuit from P/R–5 to transformer P/T–1, and section 2D front completes a circuit from capacitor P/C–3 to Set 2 microphone input transformer C/T–1. This completes the audio retransmission circuit from the output of Set 1 to the input of Set 2.

*f. Retransmission Via Auxiliary Receiver and Set 2.* The audio output of the auxiliary receiver is routed through the same path as the audio output of Set 1. However, since the retransmit relays are not controlled by signals received by the auxiliary receiver, manual retransmission is necessary. When the MANUAL switch is set at SEND SET 2, Set 2 is put in the transmit condition (*e*(2) above). The signal path from the auxiliary receiver output to the Set 2 input is the same path as the signal path from Set 1 to Set 2.

## 112. Duplex Operation
(fig. 128)

*a. General.* For duplex operation, the AUTO switch is set in the DUPLEX position. This switch keeps Set 1 in the transmit condition and Set 2 in the receive condition. When the input of the auxiliary receiver is disconnected from the Set 1 antenna (by the removal of Wire W–142) and a separate antenna is connected to the auxiliary receiver, this unit may be used instead of Set 2 for duplex operation. This increases the receiving range.

*b. Circuit Analysis* (fig. 128). The DUPLEX position of section 1B rear of AUTO switch P/S–1 (J, 37) completes the ground return for the Set 1 receive-transmit relays. This puts Set 1 in the transmit condition, independent of the operation of a push-to-talk switch. The Set 1 microphone circuit is completed from transformer A/T–106 (H, 28) through the ON or OFF position of section 1D of OFF-ON-RING switch A/S–302, through the DUPLEX position of section 1A front of AUTO switch P/S–1 (I, 34), through the INT position of section 1C rear of MANUAL switch P/S–2, and through the microphone and push-to-talk switch of a handset to ground. When a chest set is used instead of a handset, the RADIO-INT switch of the chest set is inserted in this circuit just above the microphone. The completion of the Set 1 receive-transmit relay circuit and the Set 1 microphone circuit provides for transmission over Set 1. The monitoring circuits for the signal received by Set 2 or the auxiliary receiver (fig. 130) are the same as for simple monitoring from these units.

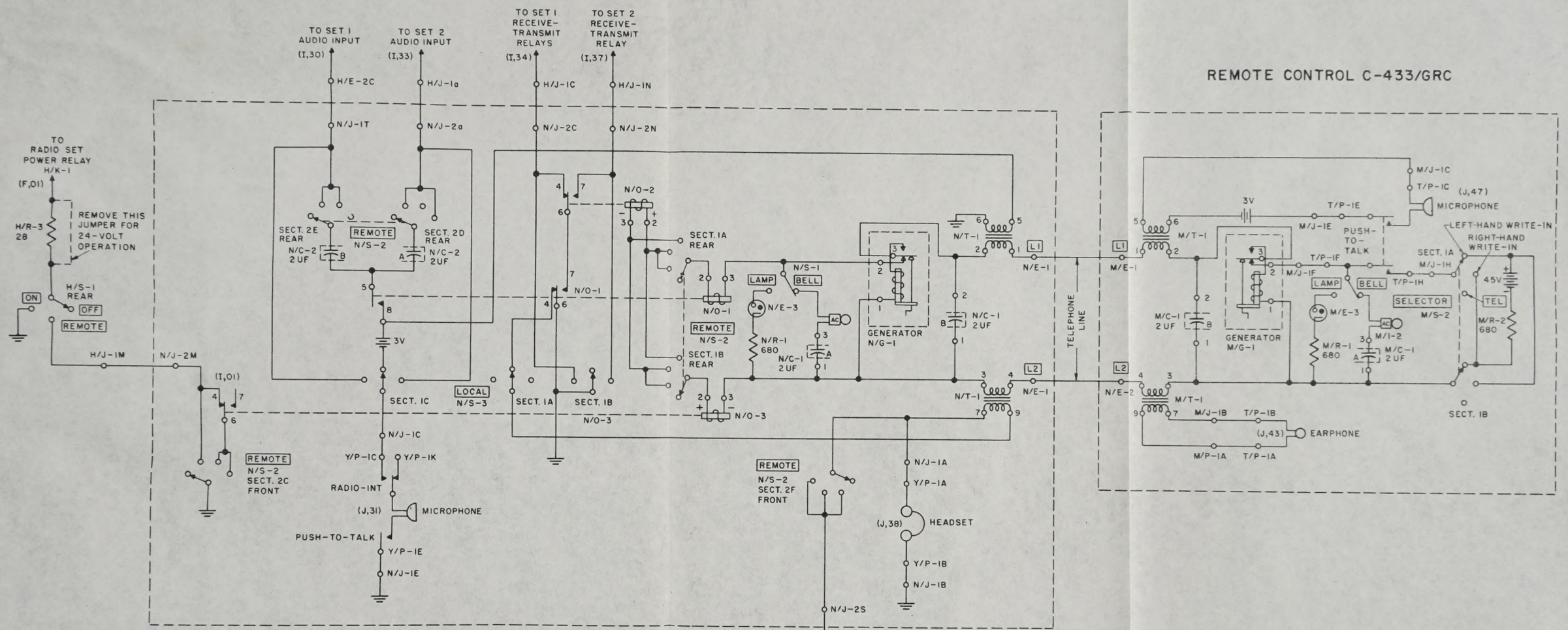
# Section VI. CONTROL GROUP AN/GRA–6

## 113. General

Control Group AN/GRA–6 may be classified functionally into five circuits. These circuits are a ringing generator circuit (par. 114), a duplex telephone circuit (par. 115), monitoring circuits (par. 116), local push-to-talk circuits (par. 117), and remote push-to-talk circuits (pars. 118 through 123).

## 114. Ringing Generator Circuit
(fig. 66)

A ringing generator (G–1) is located in the local control unit and in the remote control unit. These generators are identical. They are hand-operated to put out a 20-cycle voltage at approximately 95 volts with no load and approximately 50 volts when loaded by the bell or neon lamp which they excite. When the generator is not being operated, a normally open pair of contacts in the generator isolates this unit from the other control group circuits. When the crank on the front panel of the local or remote control unit is operated, the generator contacts transfer; that is, the normally open contacts close and the normally closed contacts open. When the generator at the remote control unit is operated, a circuit is estab-

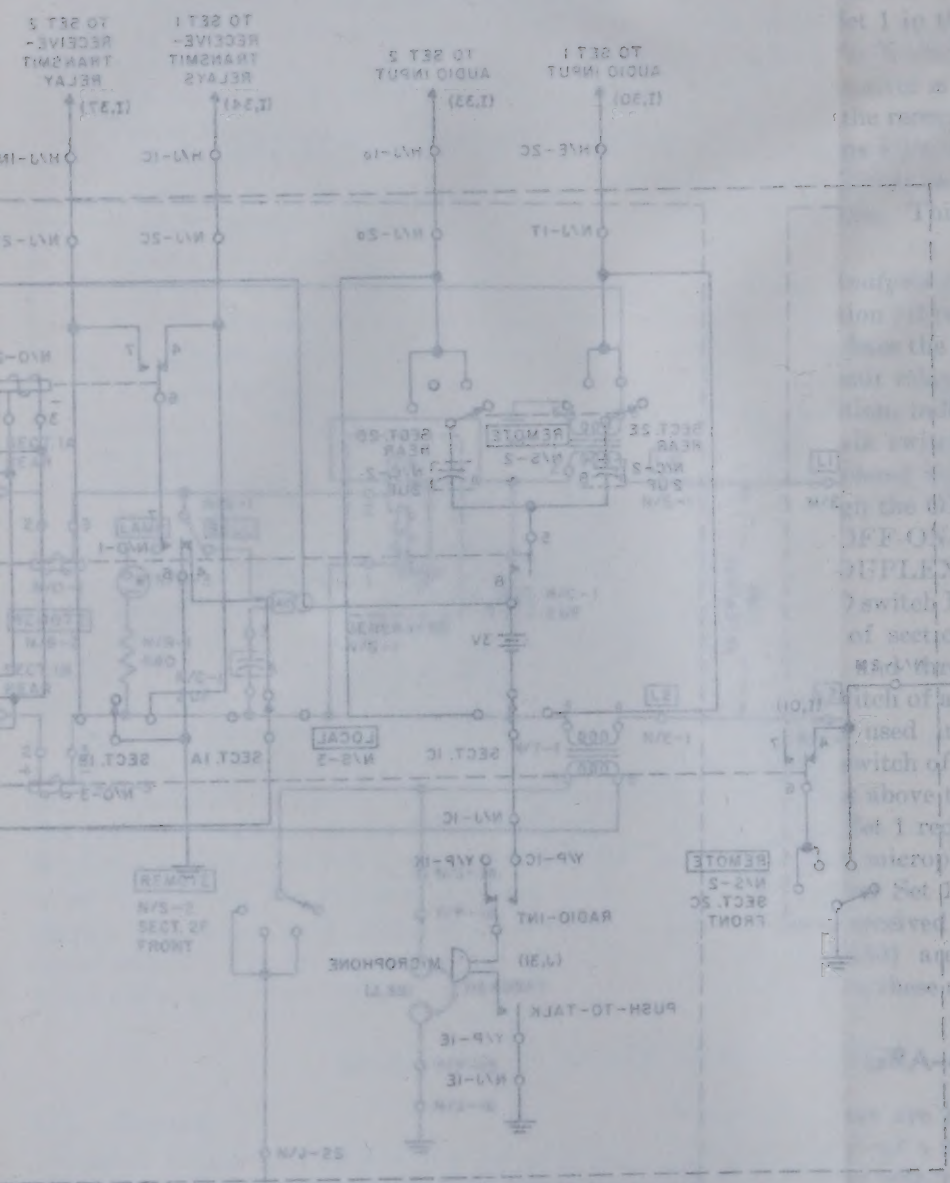



NOTES:

1. ALL SWITCHES VIEWED FROM KNOB END.
2. REMOTE SWITCH N/S-2 IS SHOWN IN EXTREME COUNTERCLOCKWISE POSITION VIEWED FROM FRONT PANEL. THE FOUR POSITIONS OF THIS SWITCH, AS IT IS MOVED IN A CLOCKWISE DIRECTION, ARE AS FOLLOWS:
   1. TEL ONLY
   2. SET 1 & 2
   3. SET 1
   4. SET 2
3. LOCAL SWITCH N/S-3 IS SHOWN IN CENTER POSITION. THE THREE POSITIONS OF THE SWITCH, AS IT IS MOVED IN A CLOCKWISE DIRECTION, ARE AS FOLLOWS:
   1. SET 1
   2. TEL
   3. SET 2
4. SELECTOR SWITCH M/S-2 IS SHOWN IN EXTREME COUNTERCLOCKWISE POSITION VIEWED FROM FRONT PANEL. THE THREE POSITIONS OF THIS SWITCH AS IT IS MOVED IN A CLOCKWISE DIRECTION, ARE AS FOLLOWS:
   1. LEFT-HAND WRITE-IN
   2. RIGHT-HAND WRITE-IN
   3. TEL
5. RELAY N/O-1 SHOWN IN UNENERGIZED POSITION.
6. RELAYS N/O-2 AND N/O-3 SHOWN AFTER APPLICATION OF A VOLTAGE WHICH MAKES TERMINAL 2 POSITIVE WITH RESPECT TO TERMINAL 3.
7. COORDINATES IN BRACKETS, SUCH AS (F,01) AT UPPER LEFT OF DIAGRAM, INDICATE LOCATION OF CIRCUIT ON THE MAIN SYSTEM CONTROL CIRCUIT WHICH CONTAINS THE LOCAL AND REMOTE CONTROL CIRCUITS.
8. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.

TM 284-322

*Figure 66. Control group AN/GRA-6, schematic diagram.*




NOTES:

1. ALL SWITCHES VIEWED FROM KNOB END.
2. [REMOTE] SWITCH MS-2 IS SHOWN IN EXTREME COUNTERCLOCK-WISE POSITION VIEWED FROM FRONT PANEL. THE FOUR POSITIONS OF THIS SWITCH, AS IT IS MOVED IN A CLOCKWISE DIRECTION, ARE AS FOLLOWS:
   1. [SET 1]
   2. [TEL ONLY]
   3. [SET 1 & 2]
   4. [SET 2]
3. [LOCAL] SWITCH MS-3 IS SHOWN IN CENTER POSITION. THE THREE POSITIONS OF THE SWITCH, AS IT IS MOVED IN A CLOCKWISE DIRECTION, ARE AS FOLLOWS:
   1. [SET 1]
   2. [TEL]
   3. [SET 2]

lished from the generator through terminals 2 and 1 of transformer M/T–1, through binding post M/E–1 (L1) and one of the telephone line wires, through binding post N/E–1 (L1), through terminals 1 and 2 of N/T–1, through the normally closed contacts of the generator in the local control unit, through BELL-LAMP switch N/S–1, through either the neon lamp N/E–3 or telephone bell N/I–2 (depending on the setting of the chassis-mounted BELL-LAMP switch), through terminals 3 and 4 of N/T–1, through binding post N/E–2 (L2) and one of the telephone wires, through binding post M/E–2 (L2), through terminals 4 and 3 of M/T–1, and back to the generator. This lights the lamp or rings the bell. This circuit is completed similarly in the opposite direction when the generator at the local control unit is operated. The ringing circuit is completely independent of the other circuits in the local and remote control units.

## 115. Duplex Telephone Circuits (fig. 66)

The control group contains two telephone circuits, one from the microphone at the local control unit to the earphone of the handset at the remote control unit, and the other from the microphone of the handset at the remote control unit to the headset at the local control unit. These circuits, both of which pass through transformer N/T–1, the telephone line, and transformer M/T–1, enable simultaneous two-way conversation.

*a. Talking at the Remote Control Unit.* When the push-to-talk switch on the handset at the remote control unit is pressed, the microphone circuit is completed through terminals 5 and 6 of transformer M/T–1. The audio signal from the microphone is induced across terminals 1 and 2 of M/T–1. This voltage is applied across the closed a-c circuit consisting of one lead of the telephone line (upper lead shown on the diagram), terminals 1 and 2 of N/T–1, capacitor N/C–1B, terminals 3 and 4 of N/T–1, the lower lead of the telephone line, terminals 5 and 3 of M/T–1, capacitor M/C–1B, and back to terminals 2 and 1 of M/T–1. Through this circuit, a portion of the audio signal at terminals 1 and 2 of M/T–1 is applied at terminals 3 and 4 of N/T–1. From this winding of the transformer, the signal is induced across terminals 7 and 9 of N/T–1. This signal is applied across the closed a-c circuit extending from terminal 9 of N/T–1 through the TEL position of section 1A of LOCAL switch N/S–3, through normally closed contacts 4 and 6 of relay N/O–1, through ground, up from ground to the headset at the local control unit, and back to terminal 7 of N/T–1. If the LOCAL switch is not in the TEL position, the ground return from terminal 9 of N/T–1 is broken. This breaks the circuit to the headset and no telephone reception is possible. The ground return also passes through normally closed contacts 4 and 6 of relay N/O–1. If this relay is energized, contacts 4 and 6 open to break the circuit to the headset. To prevent relay N/O–1 from being energized, it is necessary either that SELECTOR switch M/S–2 (at the remote control unit) be at the TEL position or that REMOTE switch N/S–2 (at the local control unit) be at the TEL ONLY position (pars. 118 through 123).

*b. Talking at the Local Control Unit.* When the push-to-talk switch (and RADIO-INT switch of the chest set if used) of the handset at the local control unit is pressed, and when the LOCAL switch is in the TEL position, a circuit is completed from the microphone of the handset (or chest set) through the TEL position of section 1C of LOCAL switch N/S–3, through a 3-volt battery, and through terminals 5 and 6 of N/T–1 to ground. The audio voltage from the microphone is transmitted through transformer N/T–1, and applied across terminals 3 and 4 of M/T–1 through the path consisting of the telephone line and capacitors N/C–1B and M/C–1B as described in *a* above. From this winding, the audio signal is induced across terminals 7 and 9 of M/T–1 and applied across the earphone of the handset at the remote control unit.

## 116. Monitoring Circuits (fig. 66)

When REMOTE switch N/S–2 is at any position except TEL ONLY, a circuit is completed from the Set 1 plus Set 2 plus interphone output of the amplifier through section 2F front of REMOTE switch N/S–2 to the headset at the local control unit and to terminals 7 and 9 of N/T–1. From this winding, the audio signal is passed by the telephone line to terminals 7 and 9 of M/T–1 and to the earphone of the handset at the remote control unit.

## 117. Control Circuits from Local Control Unit
(fig. 66)

*a. Radio Set On-Off Power Control.* When the OFF-REMOTE-ON switch (on the mounting) is at REMOTE, on-off power control of the radio set from the local control unit is possible. When the REMOTE switch is set at SET 1 & 2, the circuit through the radio set power relay H/K–1 is completed to ground through the REMOTE position of H/S–1 and through the SET 1 & 2 position of section 2C front of REMOTE switch N/S–2. This pulls in H/K–1 and applies power to the radio set. An operator located at the local control unit also is located at the mounting. Therefore, it is more convenient for such an operator to turn power on by setting the OFF-REMOTE-ON switch (on the mounting) at ON.

*b. Transmission Over Set 1.* When the push-to-talk switch and the RADIO-INT switch at the chest set of the local control unit are pressed and the LOCAL switch is held at the SET 1 position, two circuits are completed.

(1) One circuit is completed from the Set 1 receive-transmit relays through section 1B of LOCAL switch N/S–3 to ground. This energizes the Set 1 receive-transmit relays and puts Set 1 in the transmit condition.

(2) A second circuit is completed from the Set 1 audio input transformer through section 1C of LOCAL switch N/S–3, through the microphone, and through the push-to-talk switch to ground. Through this circuit the audio signal developed at the microphone of the local control unit is applied to the Set 1 audio input circuit and is transmitted.

*c. Transmission Over Set 2.* When the push-to-talk switch and the RADIO-INT switch at the chest set of the local control unit are pressed and the LOCAL switch is held at the SET 2 position, two circuits similar to the Set 1 circuits described in *a* above are completed. The Set 2 receive-transmit relay circuit is completed to ground through the SET 2 position of section 1B of LOCAL switch N/S–3. The Set 2 audio input circuit is completed to ground through the SET 2 position of section 1C of LOCAL switch N/S–3, the RADIO-INT switch, the microphone, and the push-to-talk switch. This puts Set 2 in the transmit condition and the audio signal developed at the microphone of the local control unit is applied to the Set 2 audio input circuit and is transmitted.

## 118. Control Circuits from Remote Control Unit
(fig. 66)

Three relays, N/O–1, N/O–2, and N/O–3, in the local control unit can be controlled by an operator at the remote control unit. These relays, together with REMOTE switch N/S–2 in the local control unit, complete circuits which provide on-off power control of the radio set, transmission over Set 1, or transmission over Set 2.

## 119. Control Group Relays
(fig. 66)

When relay N/O–1 is unenergized, contacts 4 and 6 are closed, and contacts 6 and 7 and 5 and 8 are open. When the relay is energized, contacts 4 and 6 open, and 5 and 8 and 6 and 7 close. Relays N/O–2 and N/O–3 are identical. Each is a polarized relay equipped with a magnetic latch. When the polarity of the voltage across these relays is such that terminal 2 is positive with respect to terminal 3, as shown on figure 66, contacts 4 and 6 are closed, and contacts 6 and 7 are open. Because these contacts are magnetically latched, they remain in position after the energizing voltage is removed. In order for the contacts to transfer so that 4 and 6 open, and 6 and 7 close, a voltage which makes terminal 2 negative with respect to terminal 3 (opposite polarity) must be applied to these relays. The polarity of the voltage applied to these relays is controlled by the settings of the SELECTOR switch (in the remote control unit) and the REMOTE switch (in the local control unit).

## 120. Function of SELECTOR Switch

The function of SELECTOR switch M/S–2 (in the remote control unit) is to reverse the polarity of the voltage supplied by the 45-volt battery (in the remote control unit) to the three control relays in the local control unit. A pair of contacts of the push-to-talk switch on the handset located at the remote control unit keeps the 45-volt battery circuit open except when the push-to-talk switch is pressed. Resistor M/R–2, in

series with the negative terminal of the 45-volt battery, limits the current supplied to the control relays.

*a. Left-Hand Write-In Position.* When the SELECTOR switch is in this position, the polarity of the voltage applied across binding posts L1 and L2 is such that L1 is positive with respect to L2.

*b. Right-Hand Write-In Position.* When the SELECTOR switch is in this position, the polarity of the voltage applied across binding posts L1 and L2 is such that L1 is negative with respect to L2.

*c. TEL Position.* When the SELECTOR switch is in this position, the 45-volt battery circuit is open.

## 121. REMOTE Switch at SET 1 & 2
(fig. 66)

When the REMOTE switch is at SET 1 & 2, remote control of transmission over either Set 1 or Set 2 is possible. Remote control of power to the radio set is not possible. Power is applied to the radio set when the circuit from relay H/D–1 (in the mounting) is completed to ground either through the ON position of OFF-REMOTE-ON switch H/S–1 (on the mounting) or through the REMOTE position of this switch and the SET 1 & 2 position of section 2C front of REMOTE switch N/S–2 (on local control unit).

*a. Selector Switch at Left-Hand Write-In Position (Remove Transmission Over Set 1).* When the SELECTOR switch (on remote control unit) is turned to the left-hand write-in position and the push-to-talk switch on the handset at the remote control unit is pressed, binding post L1 is made positive with respect to L2. The circuit from L1 (in the local control unit) extends through relay N/O–1 (nonpolarized), through the SET 1 & 2 position of section 1A rear of REMOTE switch N/S–2, through terminals 2 and 3 of relay N/O–2 (terminal 2 being positive with respect to terminal 3), through the SET 1 & 2 position of section 1B rear of REMOTE switch N/S–2, through terminals 2 and 3 of relay N/O–3 (terminal 2 being positive with respect to terminal 3), and back to binding post L2. This energizes the three relays, terminal 2 being positive with respect to terminal 3 on relays N/O–2 and N/O–3. The relay contacts complete circuits as follows:

(1) *Relay N/O–1.* Contacts 4 and 6 open to break the ground return from terminal 9 of transformer N/T–1. This prevents sidetone from the Set 1 transmitter from being applied through N/T–1 and the telephone line to the handset at the remote control unit where regenerative howling would result. Contacts 6 and 7 close to bring ground up to terminal 6 of relay N/O–2. Contacts 5 and 8 close to complete the circuit from the microphone of the handset at the remote control unit through the SET 1 & 2 position of section 2E rear of REMOTE switch N/S–2 to the Set 1 audio input transformer and through the SET 1 & 2 position of section 2D rear of REMOTE switch N/S–2 to the Set 2 audio input transformer.

(2) *Relay N/O–2.* Contacts 6 and 7 open to break the ground return from the Set 2 receive-transmit relay. This puts Set 2 in the receive condition. (Although a circuit is completed from the microphone of the handset at the remote control unit to the Set 2 audio-input transformer, as described in (1) above, the microphone signal will not be transmitted by Set 2.) Contacts 4 and 6 close to complete the ground return for the Set 1 receive-transmit relays. This puts Set 1 in the transmit condition, and the signal from the microphone ((1) above) is transmitted by Set 1.

(3) *Relay N/O–3.* Contacts 6 and 7 close. When REMOTE switch N/S–2 is at SET 1 & 2, this pair of contacts has no function because the path from these contacts to ground is open. The ground return for relay H/K–1 is made through the SET 1 & 2 position of section 2C front of REMOTE switch N/S–2.

*b. Selector Switch at Right-Hand Write-In Position (Remote Transmission Over Set 2).* When the SELECTOR switch is at the right-hand write-in position and the push-to-talk switch on the handset at the remote control unit is pressed, binding post L1 is negative with respect to L2. The circuit through the three control relays is the same as that described in *a* above except that the polarity of the voltage across relays N/O–2 and N/O–3 is reversed and the

contacts of these relays transfer. This opens contacts 4 and 6 of N/O–2, breaking the ground return from the Set 1 receive-transmit relays and putting Set 1 in the receive condition. Contacts 6 and 7 of N/O–2 close to complete the ground return from the Set 2 receive-transmit relay and put Set 2 in the transmit condition. Since the microphone circuit to Set 2 is complete (as described in *a*(1) above), voice signals from the microphone of the handset at the remote control unit are now transmitted over Set 2. Contacts 4 and 6 of N/O–3 open, but this does not turn power off on the set because, as described in *a*(3) above, the ground return for relay H/K–1 still is completed through the SET 1 & 2 position of section 2C front of REMOTE switch N/S–2.

## 122. REMOTE Switch at SET 1
(fig. 66)

When the REMOTE switch is at SET 1, remote control of power (on-off) to the radio set and remote control of transmission over Set 1 is possible. In this position of the switch, the ground return for relay H/K–1 (in the mounting) is not completed directly through section 2C front of the switch (as it was when the switch was at SET 1 & 2) but must pass through contacts 4 and 6 of relay N/O–3 and then through section 2C front of the REMOTE switch. Since control of relay N/O–3 is in the hands of an operator at the remote control unit, remote control of power to the radio set is possible.

*a. Selector Switch at Left-Hand Write-In Position (Remote Transmission Over Set 1).*

(1) When the SELECTOR switch is turned to the left-hand write-in position and the push-to-talk switch on the handset at the remote control unit is pressed, binding post L1 is made positive with respect to L2. The circuit through the three control group relays is the same as that described in paragraph 121*a* (REMOTE switch at SET 1 & 2). Relay N/O–1 pulls in closing contacts 5 and 8, and 6 and 7. The polarity of terminals 2 of relays N/O–2 and N/O–3 is positive with respect to terminals 3. This closes contacts 4 and 6 of each of these relays. The ground return for relay H/K–1 is completed through contacts 4 and 6 of N/O–3 and section 2C front of the REMOTE switch. This applies power to the radio set. The ground return for the Set 1 receive-transmit relays is completed through contacts 4 and 6 of N/O–2 and contacts 7 and 6 of N/O–1. This puts Set 1 in the transmit condition. The circuit from the microphone of the handset at the remote control unit is completed through contacts 5 and 8 of N/O–1 and the Set 1 position of section 2E rear of the REMOTE switch to the Set 1 audio input circuit. This enables voice signals of the remote operator to be transmitted over Set 1. Note that the SET 1 position of section 2D rear of the REMOTE switch is open. This breaks the path to the Set 2 audio input circuit.

(2) When the operator at the remote control unit releases the push-to-talk button on the handset, the circuit from the 45-volt battery in the remote control unit to the relays is broken. Relays N/O–2 and N/O–3 remain locked in position but relay N/O–1 releases, opening contacts 5 and 8, and 6 and 7, and closing contacts 4 and 6. Since contacts 4 and 6 of relay N/O–3 remain closed, the ground return from relay H/K–1 is maintained and power is maintained in the radio set. The opening of contacts 6 and 7 breaks the ground return for the Set 1 receive-transmit relays and returns Set 1 to the receive condition. The closing of contacts 4 and 6 of this relay completes the ground return from terminal 9 of transformer N/T–1. This enables signals received by the radio set to be passed through this transformer and through the telephone line to the receiver of the handset at the remote control unit. The opening of contacts 5 and 8 breaks the circuit from the microphone of the handset at the remote control unit to the Set 1 audio input circuit.

*b. Selector Switch at Right-Hand Write-In Position (Power Off).* When the SELECTOR switch is turned to the right-hand write-in position and the push-to-talk switch on the handset at the remote control unit is pressed, the polarity of the voltage applied to the three relays is reversed and the contacts of relays N/O–2 and N/O–3 transfer. Contacts 4 and 6 of NO/3 open

to break the ground return for relay H/K–1 (in the mounting). This turns off all power in the radio set.

## 123. REMOTE Switch at SET 2 (fig. 66)

When the REMOTE switch is at SET 2, remote control of power (on-off) to the radio set and remote control of transmission over Set 2 is possible. In this position of the switch, the ground return for relay H/K–1 (in the mounting) is completed through contacts 4 and 6 of relay N/O–3 and through section 2C front of the REMOTE switch.

*a. Selector Switch at Left-Hand Write-In Position (Remove Transmission Over Set 2).*

(1) When the SELECTOR switch is turned to the left-hand write-in position and the push-to-talk switch on the handset at the remote control unit is pressed, binding post L1 is made positive with respect to L2. The circuit through the three control relays is the same as that described in paragraph 122 except that the polarity of the voltage across relay N/O–2 is reversed, terminal 2 being negative with respect to terminal 3. This opens contacts 4 and 6, and closes contacts 6 and 7 of this relay. The opening of contacts 4 and 6 breaks the ground return for the Set 1 receive-transmit relays. The closing of contacts 6 and 7 completes the ground return for the Set 2 receive-transmit relay and puts this set in the transmit condition. Contacts 6 and 7 of N/O–3 close to complete the ground return for relay H/K–1 (in the mounting). Contacts 5 and 8 of N/O–1 close to complete the circuit from the microphone of the handset at the remote control unit to the audio input circuit of Set 2, and contacts 6 and 7 of N/O–1 close to bring ground up to contact 6 of N/O–2 and complete the Set 2 receive-transmit relay circuit. This enables voice signals of the remote operator to be transmitted over Set 2.

(2) When the operator at the remote control unit releases the push-to-talk button on the handset, the circuit from the 45-volt battery in the remote control unit to the relays is broken. Relays N/O–2 and N/O–3 remain locked in position but relay N/O–1 releases, opening contacts 5 and 8, and 6 and 7, and closing contacts 4 and 6. The opening of contacts 6 and 7 breaks the ground return for the Set 2 receive-transmit relay and puts Set 2 in the receive condition. The opening of contacts 5 and 8 breaks the circuit from the microphone of the handset at the remote control unit to the Set 1 audio input circuit. The closing of contacts 4 and 6 completes the ground return from terminal 9 of transformer N/T–1 and enables signals received by the radio set to be passed through this transformer and through the telephone line to the receiver of the handset at the remote control unit.

*b. Selector Switch at Right-Hand Write-In Position (Power Off).* When the SELECTOR switch is turned to the right-hand write-in position and the push-to-talk switch on the handset at the remote control unit is pressed, the polarity of the voltage applied to the three relays is reversed and the contacts of relays N/O–2 and N/O–3 transfer. Contacts 4 and 6 of N/O–3 open to break the ground return for relay H/K–1 (in the mounting). This turns off all power in the radio set.

# Section VII. UNIT THEORY

## 124. General

The discussion of unit theory is limited to block diagram analyses of the major units. Although the maintenance information included in this manual is at an organizational level only, familiarity with the block diagrams of the units should be helpful in trouble shooting. A knowledge of which tubes are receiving tubes and which tubes are transmitting tubes, for example, will aid in the replacement of parts for which the operator has running spares. The block diagrams are shown in figures 67 through 71. Complete schematic diagrams for all units are included as additional information for maintenance personnel (figs. 109 through 126).

## 125. Set 1 Power Supply
(fig. 67)

*a.* Figure 67 is a functional block diagram of Power Supply PP–109/GR or Power Supply PP–112/GR. It shows the three h-v (high-voltage) circuits and the three l-v circuits supplied from the storage battery input terminals. The h-v circuits provide the plate, screen, and bias voltages for the receiver and transmitter circuits of Set 1. The l-v circuits supply the Set 1 filament and relay potentials.

*b.* The 85-volt circuit (E–3 and T–3) is energized whenever OPERATE switch S–1 is in the RECEIVE or the TRANS & RECEIVE position. The other two h-v circuits E–2 and T–2, E–1 and T–1, and the transmitter filament supply circuit, are energized when switch S–1 is in the TRANS & RECEIVE position and relay O–1 is energized. E–1 and T–1 are controlled also by TRANS POWER switch S–2, which must be in the HIGH position for E–1 and T–1 to operate.

*c.* The l-v circuits include the receiver filament supply circuit with output at terminal L of J–2, the transmitter filament supply circuit with output at terminal N of J–2, and the relay supply circuit with output at terminal A of J–2.

*d.* The h-v and l-v circuits are equipped with r-f noise suppression filters in both the input and output leads, and a-c ripple filters in the output leads.

*e.* TRANS POWER switch S–2 consists of two sections, both of which are used in the h-v circuit. One section of S–2 is used to provide full or reduced voltages as required for HIGH or LOW power operation, respectively. The other section of S–2 opens the input to the transmitter h-v and bias supply circuit when the TRANS POWER switch is in the LOW position.

## 126. Set 1 Transmitting Circuits
(fig. 68)

The block diagram shown in figure 68 refers to Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC. The transmitter circuits include a microphone input transformer, a reactance modulator (V–105 and V106), a transmitter oscillator (V–104A), the common crystal oscillator-harmonic generator and first harmonic amplifier (V–3 and V–4), the transmitter harmonic amplifier (V–5), a mixer stage (V–6), an r-f stage (V–7 and V–8 in parallel), a driver stage (V–9 and V–10 in parallel), and the power amplifier stage (V–11), the transmitter antenna circuit, and the common receiver-transmitter antenna.

*a. Transmitter Signal Path.* Voice signals from an external source are applied through a microphone transformer to the input of the transmitter reactance modulator. Under control of the audio signals, the reactance modulator causes the frequency generated by section A of transmitter oscillator V–104A to vary up or down in accordance with the amplitude and frequency of audio signals. Modulation is represented by a shift in the frequency generated by the transmitter oscillator and ultimately by a corresponding shift of the over-all carrier frequency. The output of oscillator V–104A and the output of harmonic amplifier V–5 are combined in transmitter mixer stage V–6. A tuned circuit, using one section of tuning capacitor C–1, selects the desired sum frequency at the output of the transmitter mixer and applies it to transmitter r-f amplifier stage V–7 and V–8. The output of this stage is tuned to resonance at the carrier frequency by capacitor C–1. Further amplification is provided by transmitter driver stages V–9 and V–10 (using a section of r-f tuning capacitor C–1) and by transmitter power amplifier stage V–11. The amplified output then is routed through a tuned circuit to the antenna. The output circuit of the power amplifier uses a section of main tuning capacitor C–1, while the antenna circuit is tuned to resonance by the TR ANT TUNE capacitor (figs. 121 through 123).

*b. Automatic Frequency Control.* The afc (automatic frequency control) circuit maintains a constant transmitter-oscillator carrier frequency. The output of transmitter oscillator V–104A is picked up by the variable i-f stages in the receiver through stray coupling and fed to the remainder of the receiver circuit. If the difference between the receiver-oscillator frequency (used as the standard) and the transmitter-oscillator frequency varies from the fixed i-f frequency, a voltage is developed in the discriminator circuit. This voltage is used as the afc voltage and is fed to transmitter reactance tubes V–105 and V–106. The transmitter reactance stage then corrects the transmitter-oscillator frequency. The time constant of the afc coupling circuit from the discriminator is such

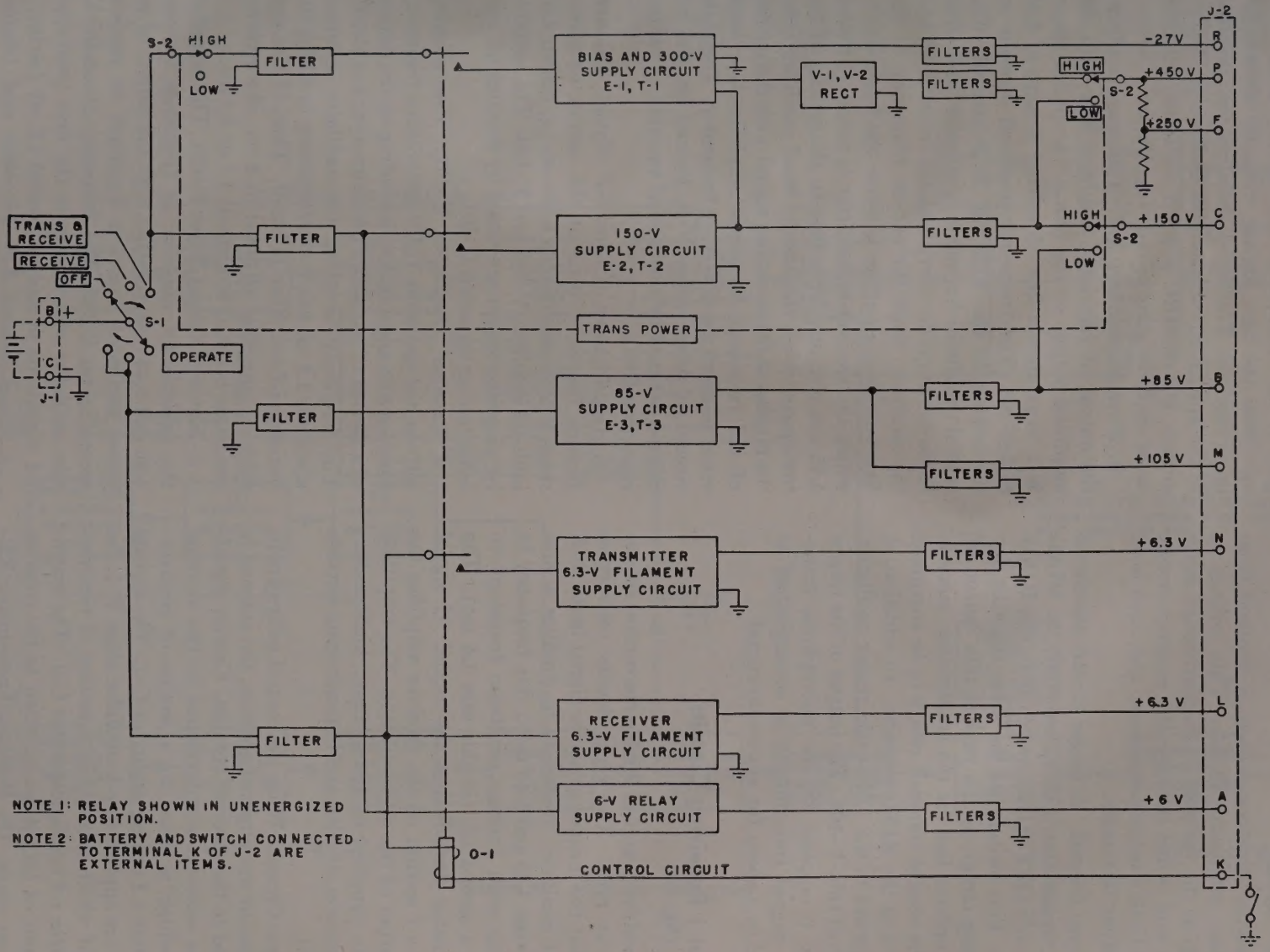



*Figure 67. Set 1 power supply, block diagram.*

that normal modulation of the i.f. does not appear in the afc voltage.

*c. Sidetone.* Sidetone voltage is obtained from transmitter oscillator V104A. This voltage is picked up by the variable i-f stages through stray coupling and is fed through the receiver circuit to the AUDIO output connector and fixed-level audio output terminals.

*d. Ringer Circuit.* A ringer circuit associated with the transmitter is energized when the DIAL LIGHT ON-OFF-RING switch is in the RING position. This switch has the same function for the ringing circuit as the push-to-talk button of the microphone has for the transmitter, since it causes the receive-transmit relays to be energized when it is in the RING position. In addition, it applies power to the 1,600-cycle ringer oscillator, section B of tube V–104. The output of the ringer oscillator is applied to the microphone transformer. Signal transmission is accomplished as described in *a* above for any audio signal.

## 127. Set I Receiving Circuits
(fig. 68)

The receiver is an f-m double-conversion superheterodyne type. The term double conversion means that the incoming carrier signal beats with one local oscillator frequency to produce a first i.f. (between 4.45 and 5.45 mc); this frequency in turn beats with another oscillator frequency to produce a second i.f. (in this case 1.4 mc). The discriminator demodulates the second i-f signal and the a-f section of the receiver amplifies the audio output of the discriminator. The amplified output is supplied to headphones, loudspeaker, retransmission circuits, and to monitoring circuits (fig. 130).

*a. Input Circuit.* When the control relays are in the normal or unenergized position, the antenna is connected to the receiver circuits. Carrier signals from the antenna are developed in the antenna circuit which is tuned by a section of receiver-transmitter r-f tuning capacitor C–1. The signals selected are applied to r-f amplifier stage V–1, the output of which is tuned by a section of receiver-transmitter r-f tuning capacitor C–1. The amplified output of this stage is routed to the receiver first mixer stage. On Receiver-Transmitter RT–66/GRC the gain of the r-f amplifier stage is reduced by a bias voltage from the squelch circuit when no signals are being received. On Receiver-Transmitters RT–67/GRC and RT–68/GRC, the gain of the r-f amplifier is reduced by a bias voltage from the first limiter when no signals are being received. This action stabilizes the operation of the squelch circuit and also, in Receiver-Transmitters RT–66/GRC and RT–67/GRC, provides more uniform gain in individual units.

*b. First Mixer Stage V–2.* This stage combines the output of harmonic amplifier V–4 with the amplified output of the first r-f amplifier stage, V–1, to produce a first i.f. having a range of 4.45 to 5.45 mc. The frequency produced depends on the setting of the TENTH MCS control. The crystal oscillator-harmonic generator and first harmonic amplifier serve both the transmitter and the receiver. Since the output frequency of the first harmonic amplifier is below the frequency to which the receiver-transmitter is tuned (between 4.45 and 5.45 mc, depending on the setting of the tuning controls), the first i-f band resulting from the mixing of the incoming signal with the output of the frequency harmonic amplifier is a band centered about the difference frequency. The plate circuit of mixer stage V–2, located on the r-f chassis, is tuned by a section of variable i-f tuning capacitor C–101.

*c. Amplification of First I-F Signal.* The difference frequency band at the output of mixer stage V–2 is amplified in a two-stage, tuned, variable i-f amplifier V–107 and V–108. The variable i-f amplifier stages are tuned by sections of variable tuning capacitor C–101.

*d. Receiver Oscillator V–101.* Free-running self-excited oscillator V–101 generates a frequency between 3.05 and 4.05 mc, depending on the setting of a section of variable i-f tuning capacitor C–101. The frequency to which the oscillator is tuned always is 1.4 mc below the frequency to which the variable i-f amplifier is tuned. Thus, if the variable i-f amplifier is tuned to 5 mc, the receiver oscillator is tuned to 5 minus 1.4 or 3.6 mc.

*e. Receiver Second Mixer V–109.* The output of the variable i-f amplifier (a frequency between 4.45 and 5.45 mc), together with the output of receiver oscillator V–101 is combined in receiver second mixer V–109. The frequency generated by the oscillator subtracts from the first (variable) i-f signals to produce a second i.f. of 1.4 mc.

*f. Fixed Second I-F Amplifier and Limiter.* The i.f. of 1.4 mc is amplified by a three-stage, fixed-tuned amplifier. The first stage, V–110, is a conventional i-f amplifier. The second and third

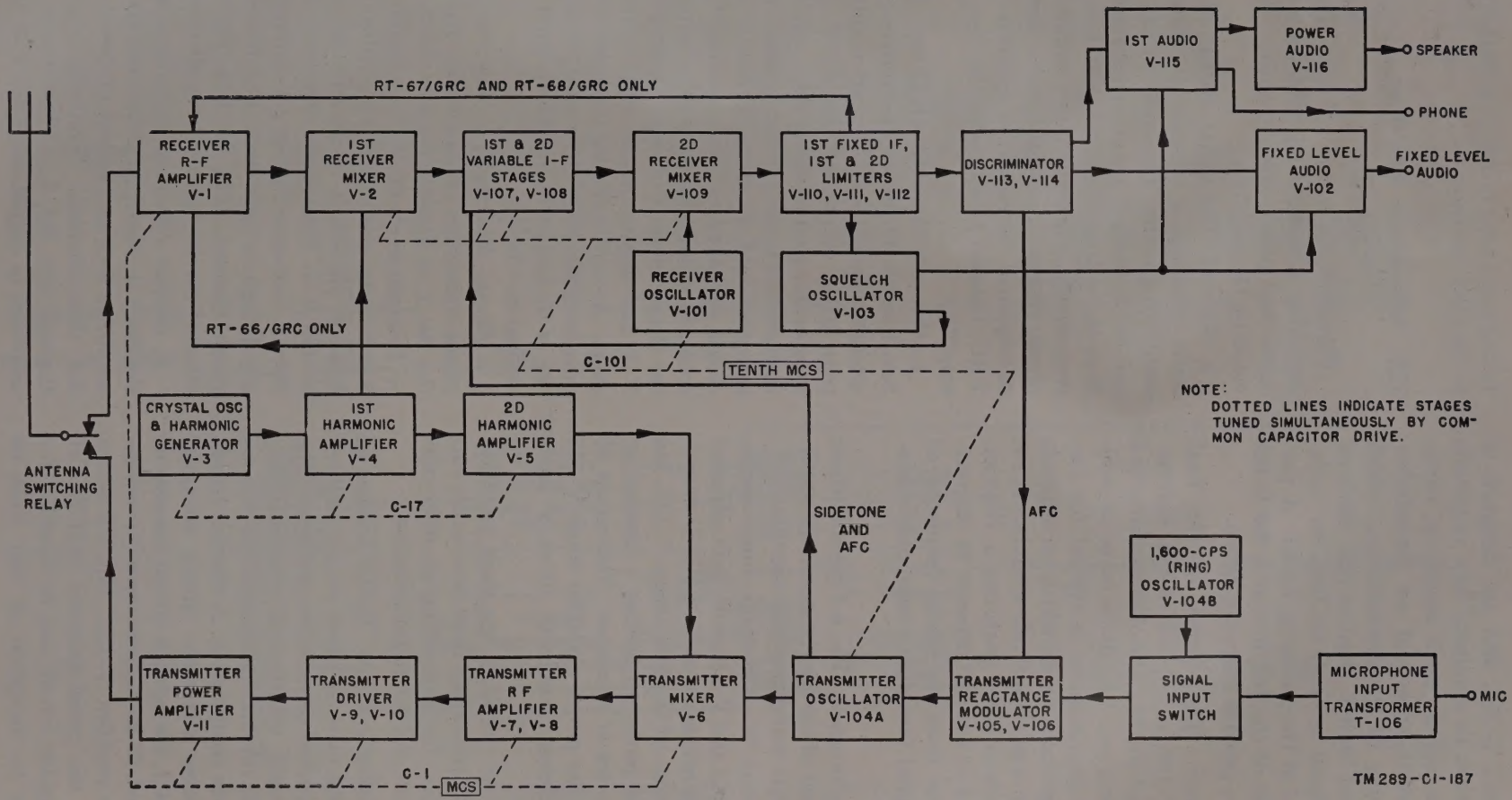



*Figure 68. Set 1, block diagram.*

stages, V–111 and V–112, also are designed to function as limiters to eliminate any amplitude variations of the signal. Such amplitude variations may represent noise and are undesirable. Proper functioning of the discriminator, which follows the second limiter, requires that the level of the applied signal be fairly uniform for variations in the level of the incoming signal. A portion of the output of the first limiter is fed to the squelch circuit to provide silencing action.

*g. Discriminator.* The output of the final limiter stage, V–112, is applied to the discriminator, V–113 and V–114. This discriminator is a tuned circuit using two 1A3 diode tubes as rectifiers. The term discriminator is typical for f-m receivers and signifies a circuit which corresponds to the detector in a-m (amplitude-modulated) receivers. The discriminator performs a function analogous to that of the a-m detector by converting the variations from the center frequency of the incoming signal into audio amplitude variations.

*h. Audio Amplification.* The a-f signals which appear at the input of the discriminator are amplified in two separate audio amplifier circuits.

(1) One circuit is a two-stage audio amplifier, V–115 and V–116, with gain adjusted by the panel-mounted VOLUME control. The output of the first stage, V–115, has sufficient power to operate a headset or the earpiece of a handset. The output of final audio power amplifier stage V–116 has sufficient power to drive a loudspeaker.

(2) The other circuit, a one-stage amplifier (V–102), provides a fixed-level audio output signal for monitoring at other control units and for retransmission.

*i. Squelch Oscillator V–103.* In the absence of signals, a rushing noise is heard in the receiver phones or loudspeaker of sensitive receivers. The noise is the result of external electrical disturbances and the thermal agitation in the vacuum tubes and receiver components. A squelch circuit is used to suppress this noise during no-signal intervals. In Set 1, the squelch circuit consists of a carrier-switched, 20-kc (approximately) oscillator and a diode rectifier, V–103. Squelch action is adjusted by the panel-mounted SQUELCH control. The squelch circuit can be disabled for test purposes or for reception of very weak or fading signals by turning the SQUELCH control to the OFF position.

## 128. Interphone Amplifier (fig. 69)

Figure 69 is a functional block diagram of AF Amplifier AM–65/GRC. The diagram shows the signal and power-supply circuits which are provided by the amplifier.

*a. General.* The signal circuits consist of three input channels, a common amplifier, and three amplifying paths. The input circuits of the Set 1 and Set 2 channels are arranged to receive signals from the output of the Set 1 and Set 2 receivers, respectively, while the input circuit of the interphone channel receives signals directly from a microphone connected to Control Box C–375/VRC, Control C–435/GRC, or the panel of the amplifier.

*b. Common Channel Amplifier.* Signals from Sets 1 and 2 are routed over separate paths to the common channel amplifier, are amplified, and appear in the output circuits of that stage. When an operator presses the push-to-talk button on an interphone-connected microphone, relay O–1 is energized and its contacts close to complete the circuit to the external microphone. Speech signals from the microphone enter the amplifier through the closed contacts of relay O–1, are amplified by V–1, and appear in the output circuits of that stage. An audio-mixing arrangement in the common amplifier stage distributes the signals appearing at its output to the three output channels described in *c* below.

*c. Signal Distribution.* The Set 1 and interphone signals are applied at the required levels to the Set 1 + Interphone and the Set 1 + Set 2 + Interphone channels. In a similar manner, Set 2 and interphone signals are applied at the proper levels to the Set 2 + Interphone and the Set 1 + Set 2 + Interphone channels. Signals from Set 1 do not enter the Set 2 + Interphone channel nor do signals from Set 2 enter the Set 1 + Interphone channel. The Set 1 + Set 2 Interphone channel carries signals from all three sources.

*d. Output Circuits.* Signals passing through the Set 1 + Interphone channels are amplified in amplifier V–2, and appear at the output terminal for that channel. Similarly, signals passing through the Set 2 + Interphone channel are amplified in output amplifier V–3, and appear at

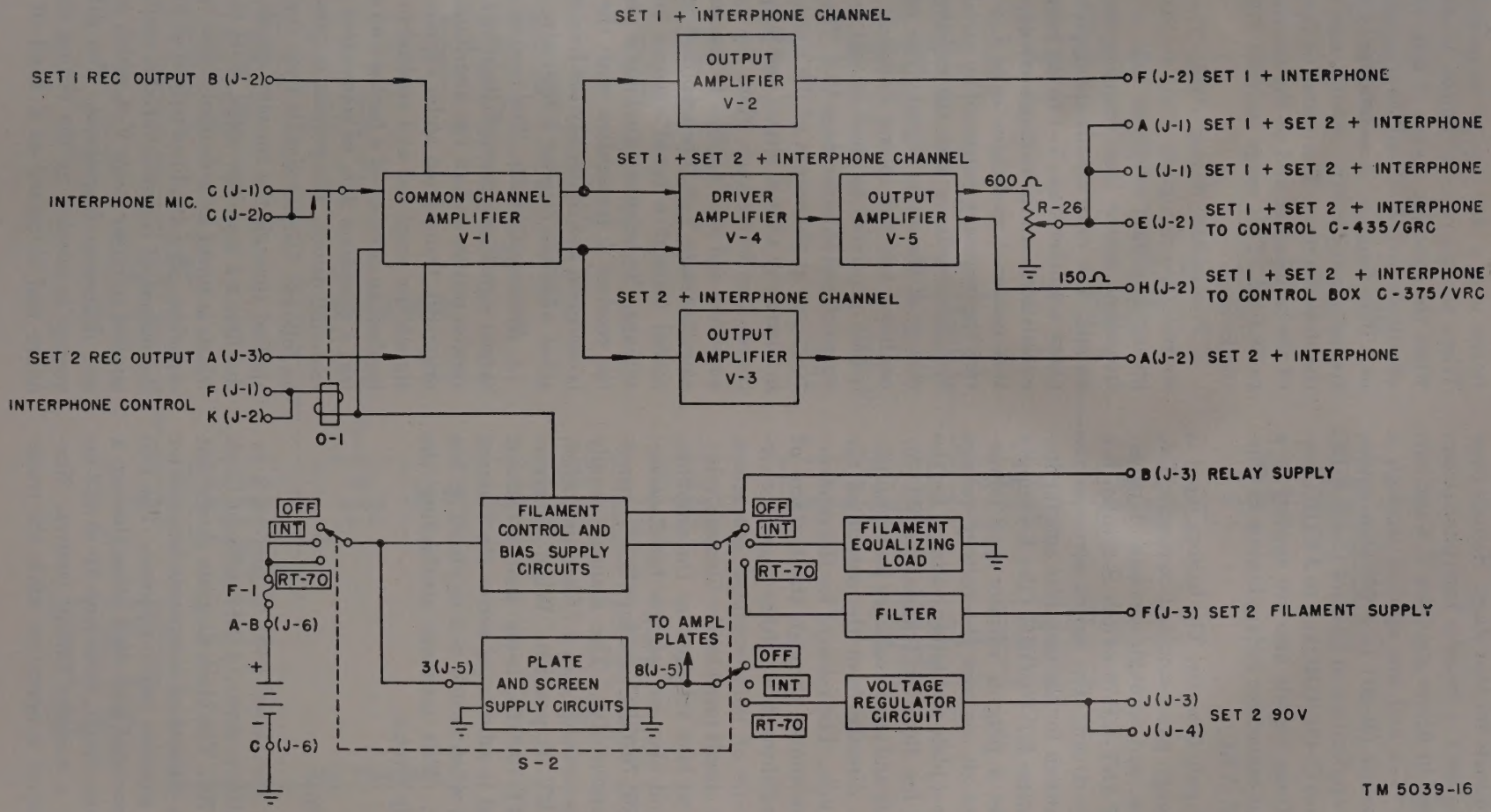



*Figure 69. AF Amplifier AM-65/GRC, block diagram.*

the output terminals for that stage. Signals passing through the Set 1 + Set 2 + Interphone channel are amplified by driver amplifier V–4 and output amplifier V–5 and are applied through a VOLUME control (R–26) to a 600-ohm output connector for application to Control C–435/GRC or Local Control C–434/GRC and to AUDIO connector J–1. These signals also are applied to a 150-ohm output connection for application to Control Box C–375/VRC.

*e. Power-Supply Circuits.* The battery input is connected through panel-mounted connector J–6, through a fuse, and through contacts of panel-mounted OFF-INT-RT-70 switch S–2 to an h-v and l-v supply circuit. The switch serves as the power on-off switch for the amplifier and for Receiver-Transmitter RT–70/GRC. The h-v supply circuit includes a plug-in vibrator-type power-supply unit which converts the battery voltage into the required plate and screen voltages for the amplifier and for Receiver-Transmitter RT–70/GRC. The plate and screen voltages for the amplifier are taken directly from the output of the power-supply unit. The voltages for the receiver-transmitter are routed through the contacts of switch S–2, and through a voltage regulator circuit to terminals of panel-mounted connectors. The l-v supply circuit provides the filament, relay, microphone, and bias voltages for the amplifier. The control and filament voltages for Receiver-Transmitter RT–70/GRC are supplied to panel-mounted connector J–3. The filament supply circuit includes contacts of an a-f filter and switch S–2, in the RT–70 position. When Receiver-Transmitter RT–70/GRC is not used, a filament equalizing load is substituted across the filament supply circuit when switch S–2 is placed in the INT position. This prevents overloading the filament supply circuit.

## 129. Set 2
(fig. 70)

*a. General.* The signal path of the Set 2 receiver-transmitter is shown in the functional block diagram (fig. 70). The block diagram shows that the equipment consists of a separate transmitter circuit and a separate receiver circuit. The two circuits are associated with each other through a common antenna circuit, a common 32- to 42.3-mc oscillator and a common tuning control. Normally, the receiver is operative while the transmitter is in a stand-by, or inoperative condition. When the microphone button is closed, that is, when the operator desires to talk, the receiver is effectively turned off and the transmitter is turned on. This function is accomplished by a receive-transmit relay control circuit, also indicated on the block diagram. The operating frequency range of the transmitter and of the receiver is from 47 to 58.4 mc. This range includes 115 channels of 100 kc each.

*b. Transmitter Signal Path.* The transmitter converts speech signals from an external microphone, amplifier, telephone line, or other audio frequency source into frequency-modulated r-f signals. The voice signals are amplified by microphone amplifier stage V–1 to the proper value for modulation. Audio voltages are applied to variable reactance modulator coils L–2 and L–3 to vary the frequency generated by variable oscillator V–2, in accordance with the amplitude and frequency of the audio signal. The output of the oscillator and the second harmonic of the frequency generated by fixed crystal oscillator V–3 are combined in mixer stage V–4. The desired sum frequency at the output of the transmitter mixer is selected by a tuned circuit and is applied to the transmitter driver stage. Here, the signal again is amplified and then applied to transmitter power amplifier stage V–6. The amplified output then is routed through a tuned antenna circuit to the antenna. No antenna switching is provided since the receiver is inoperative when the transmitter is energized and conversely the transmitter is disabled when the receiver is operative.

*c. Receiver Circuits.* The receiver accepts f-m carrier signals and converts them by a double-conversion process and an f-m discriminator into the originally transmitted audio signals. The audio signals are amplified and applied to an external headset, an earpiece of a handset, an audio amplifier, a telephone line, or some other suitable a-f receiving device. The process, in greater detail, is as follows: Carrier signals from the antenna are applied through the common antenna circuit to the first r-f amplifier stage, V–8, the output of which is tuned by a section of the variable gang capacitor. The amplified output of this stage and the output of common variable oscillator V–2 is applied to mixer stage V–9, which produces sum and difference frequencies. The difference frequency is selected by the tuning circuit of the mixer and is routed as a band of frequencies

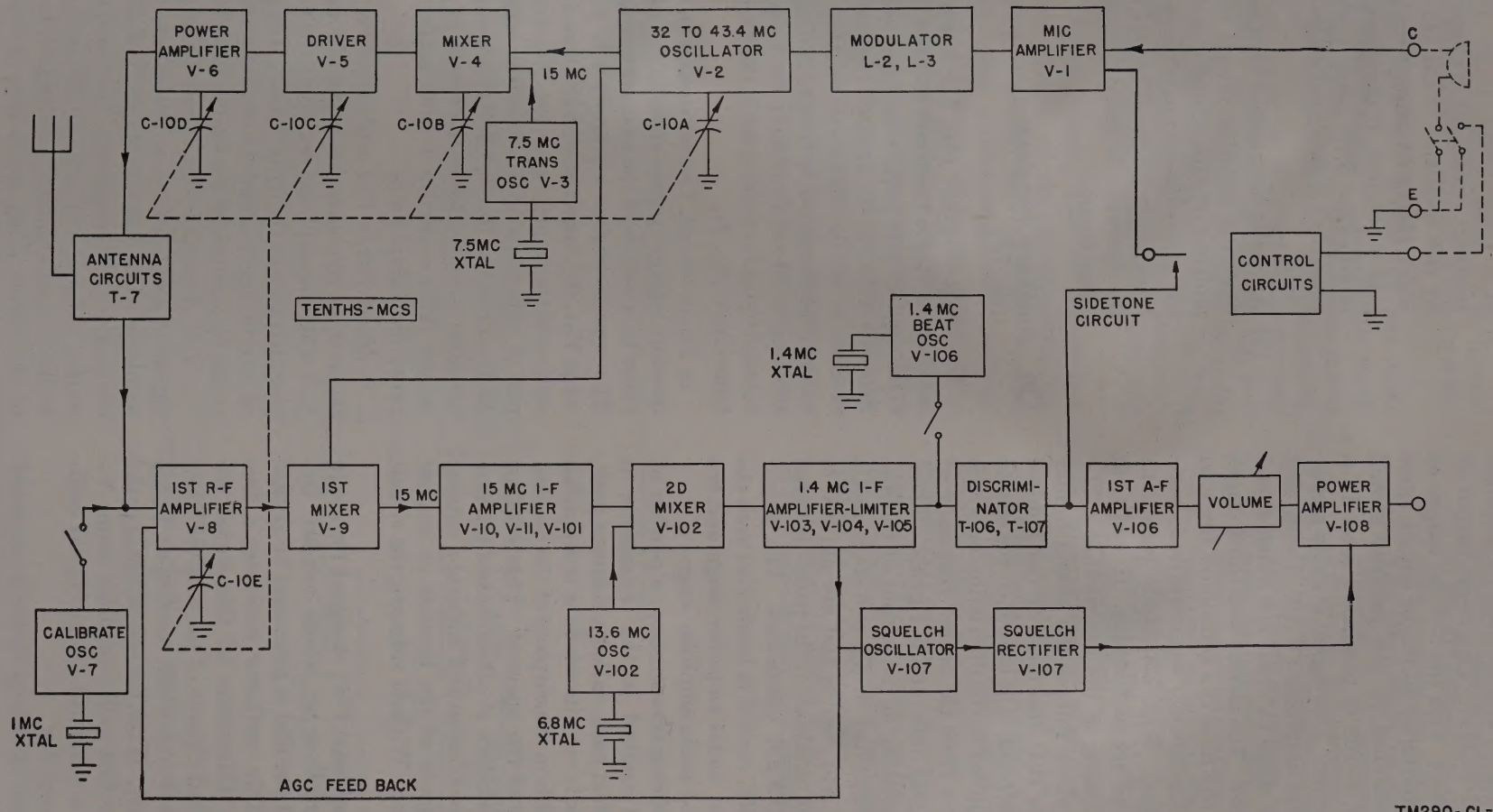



*Figure 70. Receiver-transmitter RT–70/GRC, block diagram.*

centered about 15 mc to a three-stage i-f amplifier (V–10, V–11, and V–101). The 15-mc output of V–101, in conjunction with the 13.6-mc output of a second crystal-controlled oscillator circuit (part of V–102) is combined in the receiver second mixer portion of V–102 to produce a second i.f. centered about 1.4 mc. This signal is again amplified in a three-stage amplifier (V–103, V–104, and V–105). The first stage (V–103) is a conventional 1.4-mc i-f amplifier. The second and third stages (V–104 and V–105) have the additional function of limiting (or eliminating) any amplitude variations of the signal. Such amplitude variations represent noise and are undesirable. In addition, the proper functioning of the discriminator (T–106 and T–107) which follows the second limiter (V–105), requires that the level of the applied signal be fairly uniform. The output of the second limiter stage is applied to the discriminator which converts variations from the center frequency of the incoming signal into audio signals. These audio signals, appearing at the output of the discriminator, are amplified in the two-stage audio amplifier, V–106 and V–108, and are applied to the receiver output terminals of the panel-mounted AUDIO and POWER connectors. The panel-mounted VOLUME control is located between the output of the first audio amplifier stage and the input of the second audio amplifier stage.

*d. Sidetone.* During transmission, a portion of the audio signal applied to the transmitter is routed over a special path, called a sidetone path, to the receiver audio circuits where it is amplified and becomes audible in the earpiece of the handset or in the headset of the operator. This sidetone signal permits operators at other control stations to monitor the transmission and imparts a natural effect in the earpiece of the handset or headset which is being used. Without sidetone, the circuit would seem dead.

*e. Calibrate Oscillator V–7.* A signal for use in calibrating the receiver at whole number frequency settings of the dial is generated by crystal oscillator V–7. This oscillator generates a frequency of 1 mc. Harmonics of this signal are selected by the tuned circuits of the receiver when the receiver is tuned to a whole number mc point.

*f. Beat Oscillator.* When the test switch is in the CAL position, the first audio amplifier stage, V–106, functions as a combined 1.4-mc crystal oscillator and audio amplifier.

(1) The output of this oscillator is connected at a point ahead of the discriminator rectifiers. Since the frequency generated by this oscillator is the same as that to which the 1.4 i-f amplifier is tuned, a zero beat is obtained at the output of the discriminator. This zero beat is obtained when the 1.4-mc signal enters the discriminator.

(2) An audio beat note is obtained when the incoming signal to the r-f stage is not a multiple of 1 mc, thereby causing the signal at the discriminator input to be different than 1.4 mc. This a-f beat enables the operator to make precise frequency adjustments.

## 130. Auxiliary Receiver (fig. 71)

The block diagram (fig. 71) is equally representative of Radio Receivers R–108/GRC, R–109/GRC, and R–110/GRC which are used in Radio Sets AN/GRC–3, –5, and –7, respectively. Each receiver is of the single-conversion, superheterodyne type, designed to receive f-m signals. Differences in the receivers lie in the frequency range covered by each, as indicated in the frequency spectrum chart (fig. 2).

*a. Input Circuit.* Carrier signals on the antenna develop voltages in the antenna circuit, which is tuned by a section of the receiver tuning capacitor. The signals selected are applied to r-f amplifier stage V–1, the output of which is tuned by another section of the tuning capacitor. The amplifier output of this stage is fed to mixer stage V–2. In Radio Receiver R–108/GRC, the gain of the r-f amplifier is controlled by the fourth i-f and limiter stages. This results in a more uniform gain between individual units.

*b. Mixer Stage V–2 and Oscillator V–3.* The mixer stage combines the output of local oscillator V–3 with the amplified output of the r-f amplifier stage to produce the i.f. of 4.3 mc. The grid circuit of mixer stage V–2 and the oscillator stage are also tuned by sections of the tuning capacitor.

*c. I-F Amplifier and Limiter Stages.* The i-f signal is amplified by a four-stage, fixed-tuned amplifier. The first two stages, V–4 and V–5, are conventional i-f amplifiers; the third and fourth stages, V–6 and V–7, are also designed to function as limiters to eliminate any amplitude variations of the signal. They act mainly to limit the vari-

ations of the very strong signals. The limiter stage (V–8) also provides limiting action on weak signals.

*d. Discriminator.* The output of the final limiter stage, V–8, is applied to the discriminator and squelch oscillator V–11. This discriminator uses a type 1A3 diode tube, V–9, and one section of a type 1S5 tube, V–10. This discriminator performs a function analogous to that of the a-m detector, since it extracts the intelligence or audio modulation from the incoming carrier signal. The discriminator converts the variation in frequency (the intelligence) of the incoming signals into audio signals.

*e. Audio Amplification.* The a-f signals that appear at the output of the discriminator are amplified in two separate audio amplifier circuits.

(1) One circuit is a two-stage audio amplifier, V–13 and V–14, with gain adjusted by the panel-mounted VOLUME control. The output of the first stage, V–13, is connected to pin 7 of the AUDIO connectors, and provides enough volume to operate a headset or the earpiece of a handset. The output of the final audio power amplifier stage, V–14, is connected to pin L of the audio connector and provides a signal for a loudspeaker.

(2) The other amplifier circuit, a one-stage amplifier, V–12, provides an audio output signal for monitoring at other control units and for retransmission. No panel adjustment of volume is provided. However, an internal potentiometer provides screw driver adjustment of the gain of the amplifier to obtain the required output level. The output of this stage is connected to pin B of J–8.

*f. Squelch Oscillator V–11.* A squelch circuit is used to suppress the noise that is heard during no-signal intervals. This noise is a result of external electrical disturbances and thermal agitation in the vacuum tubes and receiver components. Squelch action is adjusted by the panel-mounted SQUELCH control. The squelch circuit can be disabled for test purposes or for reception of very weak or fading signals by turning the SQUELCH control to the OFF position.

*g. Tuning Oscillator V–10.* The pentode section of this tube is used as a crystal-controlled oscil-

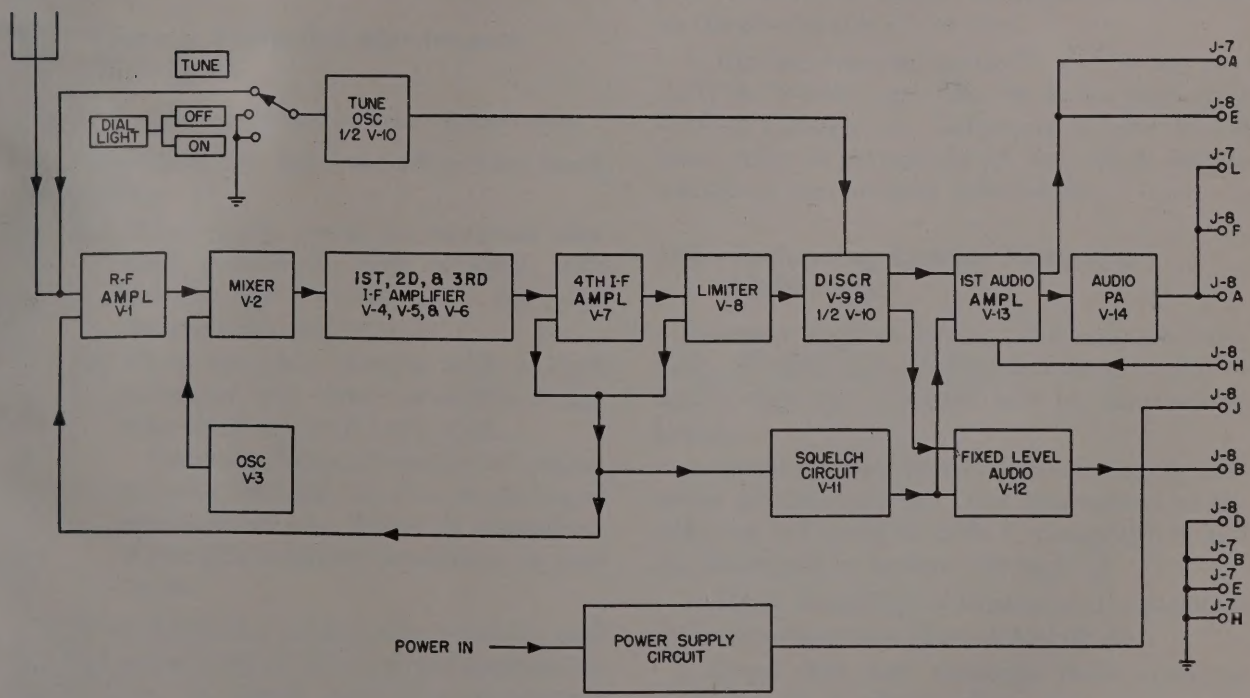



*Figure 71. Auxiliary receiver, block diagram.*

lator for calibration purposes. Its fundamental frequency (4.3 mc) is coupled within the tube to the discriminator circuit, since the dual-purpose 1S5 tube is used as a discriminator and a tuning oscillator. Harmonics of the crystal oscillator are fed to the r-f amplifier, which is tuned to a frequency which is a multiple of 4.3 mc. If a zero beat is obtained, the dial is correct. Otherwise the dial must be adjusted mechanically.

*h. Power Supply.* For vehicular operation, power is obtained from the battery of the vehicle and the vibrator power supply. The input to the vibrator power supply is 12 or 24 volts. An external source of power also may be used.

# CHAPTER 5

# ORGANIZATIONAL MAINTENANCE

## Section I. PREVENTIVE MAINTENANCE

### 131. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5.

### 132. General Preventive Maintenance Techniques

*a.* Use #000 sandpaper to remove corrosion.

*b.* Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD) and wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride and wipe them dry with a dry cloth.

***Caution:*** Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

*c.* If available, dry compressed air may be used at a line pressure not exceeding 60 psi (pounds per square inch) to remove dust from inaccessible places. Be careful, however, or mechanical damage from the air blast may result.

*d.* For further information on preventive maintenance techniques, refer to TB SIG 178.

### 133. Use of Preventive Maintenance Forms (figs. 72 and 73)

*a.* The decision as to which items on DA AGO Forms 11–238 and 11–239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

*b.* Circled items in figures 72 and 73 are partially or totally applicable to Radio Sets AN/GRC–3 through –8. References in the ITEM block refer to paragraphs in text which contain additional maintenance information.

### 134. Performing Exterior Preventive Maintenance

***Caution:*** Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

*a.* Check for completeness and satisfactory condition of the radio set. The components of the radio set are listed in table I, paragraph 6, and are illustrated in figures 4 through 14.

*b.* Check suitability of location and installation for normal operation (par. 4*b* and fig. 33).

*c.* Clean dirt and moisture from antennas, microphones, headsets, chest sets, connectors, carrying bags, and all control panels.

*d.* Inspect seating of items readily accessible from the exterior of the set such as pilot lamps, fuses, connectors, and switches.

## OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

**RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR**

*INSTRUCTIONS: See other side*

| EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO. |
|---|---|
| | |

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

**DAILY**

| NO. | ITEM | CONDITION S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|---|---|
| 1 | COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR 134a | | | | | | | |
| 2 | LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR 134 b | | | | | | | |
| 3 | CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. | | | | | | | |
| 4 | INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. | | | | | | | |
| 5 | INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. | | | | | | | |
| 6 | CHECK FOR NORMAL OPERATION. | | | | | | | |

**WEEKLY**

| NO. | ITEM | CONDITION | NO. | ITEM | CONDITION |
|---|---|---|---|---|---|
| 7 | CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR 134f | | 13 | INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. | |
| 8 | INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. | | 14 | CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. | |
| 9 | INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. | | 15 | INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR 134 m | |
| 10 | INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. | | 16 | INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. | |
| 11 | INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. | | 17 | CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. | |
| 12 | INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. | | 18 | CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. | |

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

**DA** AGO FORM 1 MAY 51 **11-238** REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 284-317

*Figure 72. DA AGO Form 11–238.*

## SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

### RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

*INSTRUCTIONS: See other side*

EQUIPMENT NOMENCLATURE | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ① Defect corrected.
NOTE: Strike out items not applicable.

| NO | ITEM | CONDITION |
|---|---|---|
| 1 | COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR 134a | |
| 2 | LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR 134b | |
| 3 | CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. | |
| 4 | INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. | |
| 5 | INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. | |
| 6 | CHECK FOR NORMAL OPERATION. | |
| 7 | CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR 134f | |
| 8 | INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. | |
| 9 | INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. | |
| 10 | INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. | |
| 11 | INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. | |
| 12 | INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. | |
| 13 | INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES. | |
| 14 | CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. | |
| 15 | INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR 134m | |
| 16 | INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING. | |
| 17 | CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION. | |
| 18 | CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE. | |
| 19 | ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. | |
| 20 | INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION. | |
| 21 | INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. | |
| 22 | INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS. | |
| 23 | INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. | |
| 24 | INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. | |
| 25 | INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. | |
| 26 | CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. | |
| 27 | INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. | |
| 28 | CHECK SETTINGS OF ADJUSTABLE RELAYS. | |
| 29 | LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER. | |
| 30 | INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR. PAR 135i | |
| 31 | CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. | |
| 32 | INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. | |
| 33 | BEFORE SHIPPING OR STORING - REMOVE BATTERIES. PAR 135l | |
| 34 | INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS. | |
| 35 | INSPECT BATTERIES FOR SHORTS AND DEAD CELLS. | |
| 36 | INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS. | |
| 37 | MOISTURE AND FUNGIPROOF. | |
| 38 | IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. | |

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TM 284-318

*Figure 73. DA AGO Form 11-239.*

*e.* Inspect controls for binding, scraping, excessive looseness, worn or chipped gears, misalinement, and positive action.

*f.* Clean and tighten exterior of components and cases, shock mounts, antenna mounts, coaxial transmission lines leading from Set 1 and Set 2 to their respective antennas, and all cable connections.

*g.* Inspect cases, mountings, antennas, and all exposed metal surfaces for rust, corrosion, and moisture.

*h.* Inspect cords, cables, wires, and shock mounts, for fraying, deterioration, kinks, and strains.

*i.* Inspect the Set 1 and Set 2 antennas for eccentricities, corrosion, loose fit, and damaged insulators.

*j.* Inspect canvas bags, technical manuals, and cabling for mildew, tears, and fraying.

*k.* Inspect for looseness, accessible items such as knobs, switches, volume and squelch controls, and pilot light assemblies.

*l.* Inspect storage batteries for dirt, loose terminals, electrolyte level, specific gravity of electrolyte and damaged cases.

*m.* Inspect meter on Set 1 on retransmission unit, and all dial windows for damaged glass.

*n.* Clean nameplate, dial and meter windows, and pilot light assemblies.

*o.* Inspect shelters and covers for adequacy of weatherproofing.

## 135. Performing Interior Preventive Maintenance

***Caution:*** Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

*a.* Inspect electron tubes for loose envelopes, loose cap connectors, cracked sockets, and insufficient socket tension; clean dust and dirt carefully; if a tube checker is available, check emission of receiver type tubes.

*b.* Inspect fixed capacitors for leaks, bulges, and discoloration.

*c.* Inspect relay assemblies for loose mountings, burned, pitted, or corroded contacts, misalinement of contacts and springs, insufficient spring tension, and binding of armatures and hinged parts.

*d.* Inspect variable capacitors for dirt, moisture, misalinement of plates, and loose mountings.

*e.* Inspect resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and moisture.

*f.* Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.

*g.* Clean and tighten switches, relay cases, and interior of chassis, and cabinets not readily accessible.

*h.* Lubricate equipment in accordance with applicable Department of the Army Lubrication Order.

*i.* Inspect Generator G–8/GRC (used for field installations) for brush wear, spring tension, arcing, and fitting of commutator (see TM 11–5037).

*j.* Clean and tighten connections and mountings for transformers, chokes, and potentiometers.

*k.* Inspect transformers, chokes, and potentiometers for overheating, and oil leakage.

*l.* Before shipping or storing, remove batteries from Remote Control C–433/GRC, Local Control C–434/GRC, and from Case CY–590/GRC.

*m.* Inspect for leaking waterproof gaskets or for worn and loose parts of gaskets.

*n.* Check to see that components have received adequate moistureproof and fungiproof treatment.

## 136. Lubrication, Weatherproofing, Rustproofing, and Painting

*a. Lubrication.* The only component of Radio Sets AN/GRC–3 through –8 which may require lubrication in the field is Mounting MT–297/GR. Graphite or another suitable lubricant should be used on the following parts:

(1) Metal rack hinges.
(2) Wingnut fasteners.
(3) Rails on inner part of U-shaped castings.
(4) Locking connector for slide in control unit.
(5) Locking levers and locking strips.

*b. Weatherproofing.*

(1) *General.* When operated under the severe climatic conditions of tropical, arctic, and desert regions, this equipment requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperature are harmful to most materials.

(2) *Tropical maintenance.* A special moistureproofing and fungiproofing treatment has been given to all components of these radio sets at the factory. This treatment provides a reasonable degree of protection. See TB SIG 13 and TB SIG 72.

(3) *Winter maintenance.* Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are fully explained in TB SIG 66 and TB SIG 219.

(4) *Desert maintenance.* Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are fully explained in TB SIG 75.

*c. Rustproofing and Painting.*

(1) When the finish on the units has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use #00 or #000 sandpaper to clean the surface down to the bare metal. Obtain a bright smooth finish.

***Caution:*** Do not use steel wool. Minute particles frequently enter the units and cause harmful internal shorting or grounding of circuits.

(2) When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. Refer to TM 9–2851.

## Section II. TROUBLE SHOOTING

### 137. Using Equipment Performance Checklist

*a. Scope.*

(1) Trouble shooting at an organizational level is limited to the sectionalizing of trouble to defective units which must be replaced as a unit, or to the localizing of defective parts such as tubes, lights, and fuses. When running spares are provided for these defective parts, their replacement can be made in the field. The defective units which must be replaced as a unit should be sent to a maintenance depot for repair.

(2) An equipment performance checklist is included primarily as an operational check for the radio set to determine whether the various units perform their functions properly. As a result of these checks, a group of normal indications should be obtained. If in any check the set does not perform as required, the trouble symptoms obtained will point to a faulty component or group of components in the system.

(3) Paragraphs 138 through 151 analyze the troubles found by these operational checks and sectionalize these defects to individual components, defective parts, or faulty circuit sections. When trouble is found as a result of an operational check, refer to the paragraph indicated in the checklist and perform the additional checks indicated. The trouble possibilities will narrow down to a related group of circuits, and in some cases to an individual circuit or part.

(4) Actual localization procedure, which further pinpoints the troubles within the system, is confined mainly to the taking of resistance measurements. These measurements are presented in tabular form for the mounting, the retransmission unit, the control box, the chest set group, and the handset.

*b. Purpose.*

(1) The equipment performance checklist provides a detailed logical procedure for checking the operation of the radio sets. If the set performs satisfactorily for each check, it may be assumed that the set is in proper operating condition. If the set does not perform satisfactorily as indicated by the checks, a reference is indicated in the checklist to a paragraph which will narrow the troubles down to a smaller number of possibilities or to a specific defect in the system.

(2) The checklist should be used after the initial installation of the equipment, before the equipment is placed in service, and periodically thereafter as an aid in trouble shooting.

*c. Use.* The checklist is arranged in the same sequence the operator follows when initially applying power to the equipment. *Each check is made after the preceding checks have been made and after the troubles thus discovered have been eliminated.* The operator should start with Item 1 and proceed in the indicated order. When he has become familiar with the operation of the equipment the operator can adapt the list to his own advantage, omitting those steps which do not pertain to the particular unit he wishes to check. The checklist includes the following columns:

(1) *Item No.* This column assigns a numerical sequence to the particular check to facilitate further reference to it.

(2) *Action.* This column lists the switches and controls to be operated and, in effect, represents an action to be taken to check the normal indications given in the normal indications column.

(3) *Normal indications.* This column describes the results which should be obtained from a normally operating set. If the actual results differ from those decribed in this column, some component or unit of the radio set is defective.

(4) *Possible defective units.* This column lists the units or components which may be defective.

*d. Equipment Performance Checklist.*

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| 1 | See that all cables are connected properly (fig. 33). | | |
| 2 | Set OFF-REMOTE-ON switch (on mounting) at OFF. | | |
| 3 | Set AUTO switch (retransmission unit) at OFF. | | |
| 4 | Set OFF-INT-RT–70 switch (a-f amplifier) at OFF. | | |
| 5 | On Set 2, turn VOLUME control to midpoint of its range; turn SQUELCH control completely clockwise; set ANT ADJ DIAL LIGHT ON-OFF-CAL switch at DIAL LIGHT ON. | | |
| 6 | On Set 1 power supply, set OPERATE switch at OFF; set TRANS POWER switch at HIGH. | | |
| 7 | On Set 1, turn SQUELCH control completely clockwise; set DIAL LIGHT OFF-ON-RING switch at DIAL LIGHT ON. | | |
| 8 | On auxiliary receiver, turn SQUELCH control completely clockwise; set VOLUME control at OFF; set TUNE DIAL LIGHT OFF-ON switch at DIAL LIGHT ON. | | |
| 9 | Connect chest set and headset-microphone to each control box; turn VOL. control (the one below the connector which is being used) to the midpoint of its range; lock RADIO TRANS switch at RADIO TRANS. | | |
| 10 | On mounting, set OFF-REMOTE-ON switch at ON. Turn BRIGHT-DIM control on POWER lamp to BRIGHT. | POWER lamp lights---------- | Battery, battery cable, or mounting (par. 149). |

*d. Equipment Performance Checklist*—Continued.

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| 11 | On a-f amplifier, set OFF-INT-RT-70 switch at INT. | | |
| 12 | Set selector switch (on front panel of each control box) at its counterclockwise position; press HOLD ON button at chest set of one of the control boxes and talk into microphone; adjust VOL. controls at all control boxes to obtain comfortable volume; then set selector switches at receiving control boxes first at their center and then their clockwise positions. | Speech from the sending control box is heard at receiving control boxes for all three positions of their selector switches. | Control box (par. 150), mounting (par. 149), interphone amplifier (par. 139), or cables. |
| 13 | Set selector switch at sending control box at its center position; press HOLD ON button at chest set of this control box and talk into microphone; set selector switches at receiving control boxes successively at their three positions. | Speech from the sending control box is heard at receiving control boxes for all three positions of their selector switches. | Control box (par. 150), mounting (par. 149), interphone amplifier (par. 139), or cables. |
| 14 | Set selector switch at sending control box at its clockwise position; press HOLD ON button at chest set of this control box and talk into microphone; set selector switches at receiving control boxes successively at their three positions. | Speech from the sending control box is heard at receiving control boxes for all three positions of their selector switches. | Control box (par. 150), mounting (par. 149), interphone amplifier (par. 139), or cables. |
| 15 | Repeat steps 12, 13, and 14, using each control box, in turn, for sending and the remaining control boxes for receiving. | Speech from the sending control box is heard at receiving control boxes for all three positions of their selector switches. | Control box (par. 150), mounting (par. 149), or cables. |
| 16 | Set OPERATE switch on Set 1 power supply at TRANS & RECEIVE; turn METER switch on Set 1 to positions 7, 8, 9, 10, 11, and 90V. Observe meter at each position of switch. | Lamp on Set 1 panel lights. Meter reads approximately center scale (shaded area) for each position of METER switch. | Control box (par. 150), mounting (par. 149), Set 1 power supply (par. 140), or Set 1 (par. 141). |
| 17 | Turn SQUELCH control on Set 1 to OFF; turn selector switch at each control box to its counterclockwise position. | Rushing noise is heard in headset. | Set 1 (par. 142) mounting (par. 149), or cables. |
| 18 | Turn SQUELCH control on Set 1 clockwise to the point at which the rushing noise is squelched. | Rushing noise is squelched | Set 1 squelch circuit (par. 142). |
| 19 | Tune Set 1 to pick up signal from another set. | Signal is heard | Set 1 (par. 141). |
| 20 | Press RADIO-INT and HOLD ON buttons on chest set, and turn METER switch successively to positions 2 through 6. | Meter on Set 1 panel reads in shaded area for each position of METER switch. | Set 1 (par. 141), Set 1 power supply (par. 140), mounting (par. 149), control box (par. 150), or cables. |
| 21 | Have another radio set tuned to frequency of Set 1; set METER switch on Set 1 at RF; press RADIO-INT and HOLD ON buttons on chest set and talk into microphone. | Meter on Set 1 panel deflects; sidetone is heard in headset; distant set picks up signal. | Set 1 (par. 143). |
| 22 | Repeat step 18 with selector switch at transmitting control box first at center and then at clockwise position. | Set 1 does not transmit | Control box (par. 150), mounting (par. 149), or cables. |

*d. Equipment Performance Checklist*—Continued.

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| 23 | Set selector switch on control box at counterclockwise position; hold DIAL LIGHT OFF-ON-RING switch on Set 1 at RING. | Ringing signal is heard in headset; meter on Set 1 deflects. | Set 1 (par. 143). |
| 24 | Set OFF-INT-RT–70 switch on a-f amplifier at RT–70 position. | Lamp on Set 2 panel lights | Interphone amplifier (par. 139), amplifier power supply (par. 139), Set 2 (par. 144), or cables. |
| 25 | Set selector switch on each control box at its clockwise position; turn SQUELCH control on Set 2 to OFF; adjust VOLUME control on Set 2 to obtain the same level of rushing noise in the headset as was obtained with Set 1 (item 14). Do not change positions of VOL. controls on control boxes. | Rushing noise is heard in headset. | Set 2 (par. 144), control box (par. 150), mounting (par. 149), or cables. |
| 26 | On Set 2, hold ANT ADJ DIAL LIGHT ON-OFF-CAL switch at CAL and tune over entire range of dial. | A zero beat is obtained at each whole number mc point on dial. | Set 2 (par. 144). |
| 27 | Turn SQUELCH control on Set 2 clockwise to the point at which the rushing noise is squelched. | Rushing noise is squelched | Set 2 squelch circuit (par. 144). |
| 28 | Tune Set 2 to pick up signal from another set | Signal is heard | Set 2 tuning circuits. |
| 29 | Press RADIO-INT and HOLD ON buttons on chest set and talk into microphone; have another radio set tuned to frequency of Set 2. | Sidetone is heard at each control box and at AUDIO connector of Set 2; signal is picked up by distant radio set. | Mounting (par. 149), interphone amplifier (par. 139), Set 2 (par. 145), or cables. |
| 30 | On auxiliary receiver, turn VOLUME control clockwise to the midpoint of its range; turn SQUELCH control to OFF; turn selector switch on control box to counterclockwise position. | LAMP on auxiliary receiver panel lights; rushing noise is heard in headset. | Mounting (par. 149), auxiliary receiver power supply (par. 146), auxiliary receiver power supply (par. 146), or cables. |
| 31 | Tune auxiliary receiver over entire range of tuning dial while holding DIAL LIGHT ON-OFF-TUNE switch at TUNE. | Zero beat is obtained at each red dot on dial (multiple of 4.3 mc). | Auxiliary receiver (par. 146). |
| 32 | Turn SQUELCH control on auxiliary receiver just sufficiently clockwise to squelch receiver. | Rushing noise ceases | Auxiliary receiver squelch circuit. |
| 33 | Set DIAL LIGHT ON-OFF-TUNE switch at ON; tune auxiliary receiver to signal transmitted by another set. | Signal is heard in headset at control box. | Auxiliary receiver tuning circuits. |
| 34 | Turn VOLUME control on auxiliary receiver to OFF. | LAMP on auxiliary receiver panel extinguishes. | Auxiliary receiver on-off switch. |
| 35 | Set selector switch on control box at center position; tune Set 1 and Set 2 to frequencies which do not interfere with each other (par. 69); attach chest set and headset-microphone to AUDIO connector on retransmission unit. | | |

*d. Equipment Performance Checklist*—Continued.

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| 36 | Press RADIO-INT and HOLD ON buttons on chest set and talk into microphone for a few seconds, first with the AUTO switch on retransmission unit at OFF, then at DUPLEX, then at RETRANS, and finally at ADJUST METER. | Signal is heard at all control boxes and at the retransmission unit for all positions for all positions of the AUTO switch except the DUPLEX position. | Retransmission unit (par. 147) or mounting (par. 149). |
| 37 | Arrange to have a distant radio set tuned to frequency of Set 1; set AUTO switch on retransmission unit to OFF; hold MANUAL switch at SEND SET 1, press RADIO-INT and HOLD ON buttons on chest set and talk into microphone. | Deflection is observed on Set 1 meter (in RF position), distant radio set picks up transmission of Set 1, sidetone is heard in headset at retransmission unit. | Retransmission unit (par. 147) or mounting (par. 149). |
| 38 | Arrange to have a distant radio set tuned to frequency of Set 2; hold MANUAL switch on retransmission unit at SEND SET 2, press RADIO-INT and HOLD ON buttons on chest set and talk into microphone. | Distant radio set picks up transmission of Set 2; sidetone is heard in headset at retransmission unit. | Retransmission unit (par. 147) or mounting (par. 149). |
| 39 | Set AUTO switch on retransmission unit at DUPLEX. | Deflection is observed on Set 1 meter. | Retransmission unit (par. 147). |
| 40 | Arrange for duplex radio operation as described in paragraph 73. | Two-way radio operation with break-in facilities is possible. | Retransmission unit (par. 147). |
| 41 | Set AUTO switch on retransmission unit at RETRANS. Arrange for retransmission between two other radio sets as described in paragraph 73. | Signals are automatically retransmitted in both directions when Set 1 and Set 2 are used; signals are retransmitted in one direction (by Set 2) when the auxiliary receiver is used. | Retransmission unit (par. 147). |
| 42 | Set OFF-REMOTE-ON switch (on mounting) at OFF; remove retransmission unit from mounting and insert local control unit; set REMOTE switch on local control unit at TEL ONLY; connect local and remote control units by telephone line (par. 74); connect a chest set-headset combination to the local control unit, and a handset to the remote control unit. | | |
| 43 | Crank ringing generator at local control unit | If BELL-LAMP switch (inside remote control unit) is at BELL, ringing signal is heard at remote control unit; if switch is at LAMP, a flashing is observed on CALL LIGHT. | Local control unit, remote control unit, or telephone line (par. 148). |
| 44 | Set SELECTOR switch on remote control unit at TEL; press push-to-talk switch on handset, talk into mouthpiece and acknowledge ringing signal; then crank generator. | Ringing signal (either bell or lamp is received at local control unit). | Local control unit, remote control unit, or telephone line (par. 148). |
| 45 | Press RADIO-INT and HOLD ON buttons on chest set at local control unit and talk into microphone. Release to listen to operator at remote control unit. | Duplex two-way telephone communication is maintained between operators at local and remote control units. | Local control unit, remote control unit, or telephone line (par. 148). |

*d. Equipment Performance Checklist*—Continued.

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| 46 | Set OFF-REMOTE-ON switch on mounting at REMOTE. | Power remains off on radio set. | Mounting (par. 149) or local control unit (par. 148). |
| 47 | Set REMOTE switch on local control unit at SET 1 & 2. | Panel lamps on mounting, auxiliary receiver, Set 1, and Set 2 light. | Mounting (par. 149) or local control unit (par. 148). |
| 48 | Press RADIO-INT and HOLD ON buttons on chest set at local control unit, hold LOCAL switch at SET 1, and talk into microphone. (***Caution:*** This puts Set 1 transmitter on air.) | Set 1 meter (at RF position) deflects, sidetone is heard at local and remote control units and at all control boxes. | Mounting (par. 149) or local control unit (par. 148). |
| 49 | Press RADIO-INT and HOLD ON buttons on chest set at local control unit, hold LOCAL switch at SET 2, and talk into microphone; arrange to have a distant radio set tuned to frequency of Set 2. (***Caution:*** This puts Set 2 transmitter on air.) | Distant rdio set picks up transmission of Set 2; sidetone is is heard at the Set 2 panel AUDIO connector, at local and remote control units and at all control boxes. | Mounting (par. 149) or local control unit (par. 148). |
| 50 | Release LOCAL switch on local control unit; set SELECTOR switch on remote control unit at left-hand write-in position, press push-to-talk switch on handset and talk into mouthpiece. (***Caution:*** This puts Set 1 transmitter on air.) | Set 1 meter deflects, sidetone is heard at local and remote control units and at all control boxes. | Local or remote control units (par. 148). |
| 51 | Set SELECTOR switch on remote control unit at right-hand write-in position, press push-to-talk button on handset and talk into mouthpiece; arrange to have a distant radio set tuned to frequency of Set 2. (***Caution:*** This puts Set 2 transmitter on air.) | Distant radio set picks up Set 2 transmission and sidetone is heard at Set 2 panel AUDIO connector; sidetone is heard at local and remote control units and at all control boxes. | Local or remote control units (par. 148). |
| 52 | Set REMOTE switch on local control unit at Set 1; set SELECTOR switch on remote control unit at right-hand write-in position; press push-to-talk switch on handset momentarily, then release. | Power is maintained in radio set until push-to-talk switch is pressed; then all power is turned off. | Mounting (par. 149), local or remote control units (par. 148), or reversed connection on telephone line. |
| 53 | Set SELECTOR switch on remote control unit at left-hand write-in position; press push-to-talk switch on handset momentarily. | Radio set power is turned on---- | Mounting (par. 149) local or remote control units (par. 148). |
| 54 | Press push-to-talk switch on handset at remote control unit and talk into mouthpiece. (***Caution:*** This puts Set 1 transmitter on air.) | Set 1 meter deflects; sidetone is heard at local and remote control units and at all control boxes. | Mounting (par. 149), local or remote control units (par. 148). |
| 55 | Release push-to-talk switch---------- | Set 1 meter shows no deflection; radio set power remains on. | Mounting (par. 149), local or remote control units (par. 148). |
| 56 | Set SELECTOR switch on remote control unit at right-hand write-in position and press push-to-talk switch on handset momentarily, then release. | All power is turned off on radio-- | See item 58. |
| 57 | Set REMOTE switch on local control unit at SET 2; set SELECTOR switch on remote control unit at left-hand write-in position; press push-to-talk switch on handset at remote control unit momentarily, then release. | Radio set power is turned on---- | Mounting (par. 149), local or remote control units (par. 148). |

*d. Equipment Performance Checklist*—Continued.

| Item No. | Action | Normal indications | Possible defective units |
|---|---|---|---|
| 58 | Press push-to-talk switch on handset at remote control unit and talk into mouthpiece. (***Caution:*** This puts Set 2 transmitter on air.) Arrange to have a distant radio set tuned to frequency of Set 2. | Distant radio set picks up Set 2 transmission; sidetone is heard at local and remote control units and at all control boxes. | Mounting (par. 149), local or remote control units (par. 148). |
| 59 | Set SELECTOR switch on remote control unit at right-hand write-in position; press push-to-talk switch on handset at remote control unit momentarily, then release. | Radio set power is turned off---- | Local or remote control units (par. 148). |

## 138. General Sectionalization or Localization Procedures

*a.* The following paragraphs include sectionalization or localization procedures indicated on the equipment performance checklist to remedy defects in the radio set.

*b.* Most abnormal indications are caused by a specific unit or circuit within the system. The following paragraphs will help the operator analyze the defective condition and narrow down the possible causes of trouble. This analysis of operating defects takes the form of additional checks the operator should perform to disclose the source of an abnormal indication.

*c.* The additional checks should be performed in a detailed and logical manner. Once the defective condition is corrected, the original operating check again should be performed. If the operation then is normal, the system should be considered in proper working order up to the next item in the checklist.

*d.* Whenever the procedure calls for checking a part, substitute, if possible, an identical part known to be in good condition. A running spare, if provided, should be substituted when a particular part is suspected. Paragraphs 152 to 160 describe procedures to be followed when replacing parts.

## 139. Interphone Circuits, Sectionalization Procedure

(items 12 through 15)

If speech is not heard in the headset when items 12 through 15 of the equipment performance checklist are performed, the following procedures will aid in locating the trouble. Refer to the main control circuit (fig. 127) for an understanding of the procedures which are described.

*a.* Turn VOL. control on the control box (the knob near the audio receptacle into which the cable is plugged) in a clockwise and then in a counterclockwise direction. If speech is heard when the knob is turned in a clockwise direction, the VOL. control was probably set too low initially. If speech is heard when the VOL. control is turned in a counterclockwise direction, a defective VOL. control potentiometer is indicated. If neither of these operations results in speech being heard, remove the cable from the audio receptacle on the interphone box and connect it to the audio receptacle on the opposite side of the interphone box. With the VOL. control on that side of the interphone box set at maximum (extreme clockwise), listen for speech signals. If speech is heard, the first VOL. control used is probably defective. If speech signals still are not heard, replace the chest set, headset, and microphone with others known to be operative. If speech now is heard, one of these (originally used) audio accessories is defective. If speech still is not heard, continue with *b* below.

*b.* Set the RADIO-INT switch on the chest set in the RADIO position. Lock the RADIO TRANS switch on the control box at the clockwise RADIO TRANS position. Set the selector switch at the center position. If speech now is heard, a defective RADIO-INT switch is indicated, or the wiring to this switch is incorrect. If speech still is not heard, the selector switch or the RADIO TRANS switch or the wiring to these two switches is defective. Proceed with *c* below.

*c.* Connect a chest set, headset, and microphone (known to be operative) to the AUDIO connector on the panel of the interphone amplifier. If speech now is heard, there is some defect in the

wiring to the previously operated switches or in the switches themselves. If speech still is not heard, there is a defect in the interphone amplifier or in its plug-in power supply. Proceed with *d* below.

*d.* Check fuse F–1 (fig. 7) and tubes V–1, V–4, and V–5 in the amplifier (fig. 74). Also check to see that the power supply is plugged firmly into the amplifier and check vibrator E–1 (fig. 75). If speech still is not heard after the above mentioned parts have been replaced, refer to TM 11–5039 and TM 11–5040 respectively for detailed checks of the interphone amplifier and its plug-in power supply.

## 140. Set 1 Power Supply Sectionalization
(par. 137*d*, item 16)

*a.* When normal indications are not obtained for item 16 (par. 137*d*) perform the following:

(1) Turn the meter switch on Set 1 to position 7 (par. 141). If a normal indication is obtained on the meter, replace lamp E–313 (par. 157). If the meter reads zero, replace tube A/V–116.

(2) Check fuse F–1 in the Set 1 power supply (fig. 5).

*Note.* If the tube filament of V–116 is defective (par. 141), the pilot light will not go on for any position of the DIAL LIGHT OFF-ON-RING switch. The circuit to the filaments of tubes V–113, V–114, and V–3 also will be open.

(3) Check the mounting wiring to the Set 1 power-supply circuits (cable W–5, terminals B and C (par. 149)).

(4) If this fails to clear the trouble, a point-to-point check of the lamp circuit in Set 1 is necessary. See TM 11–289.

*b.* When normal indications are not obtained for item 21 (par. 137*d*), make the squelch check (items 17 and 18).

(1) If noise is heard, there is a defective meter circuit in Set 1. Refer to TM 11–289 for detailed checks of the metering circuit.

(2) If noise is not heard, the trouble may be in the Set 1 power supply. Try replacing vibrator E–3 (fig. 81) and voltage regulator V–4. If this fails to clear the trouble, refer to TM 11–5036 for detailed checks of the 85-volt supply circuits in the Set 1 power supply.

## 141. Set 1 Filament Check
(items 16 and 20 par. 137*d*)

If an abnormal indication is obtained in any position of the METER switch, there must be a defective tube filament or filament circuit component.

*a.* The following chart lists the Set 1 tubes checked for each position of the METER switch on the panel. A center-scale reading is the normal reading for all positions of the switch. If the normal reading is not obtained, the probable defective tubes (that is, a defective tube filament) is listed under the type of reading obtained.

| METER switch position | Zero reading | Too low but not zero reading | Too high but not full-scale reading | Full-scale reading |
|---|---|---|---|---|
| 2 | V–7 | V–7 | V–9 | V–9 |
| 3 | V–8 | V–8 | V–10 | V–10 |
| 4 | V–6 | | | V–5 |
| 5 | V–106 | V–106 | | V–104 |
| 6 | V–105 | | | |
| 7 | V–116 | V–114 | V–113, V–3 | V–3 |
| 8 | V–4 (one-half of filament) | V–4 (other half of filament) | V–2 | V–2 |
| 9 | V–102 | | | V–107, V–103 |
| 10 | V–108, V–110 | | V–112 | V–111, V–112 |
| 11 | V–115 | | V–109, V–101 | V–109, V–101 |

*Note.* If the pilot light on Set 1 is on when the DIAL LIGHT OFF-ON-RING switch is in the DIAL-LIGHT-ON position, the filament of V–116 is normal. This may be an additional check. If the filament of V–116 is defective, the circuit to the filaments of tubes V–113, V–114, and V–3 also will be open.

*b.* The filaments of the transmitter power amplifier tube V–11 and the first r-f amplifier tube V–1 are not checked by the METER switch. These tubes must be checked by visual inspection. Observe whether (with power applied) the tubes light. The filament of V–11 is energized when the microphone push-to-talk button is operated.

*c.* Because of the series-parallel arrangement of the tube filaments (fig. 106), a break in the filament of one tube in a string of tubes will cause all the other tubes in the string to go out and will produce indications of a faulty stage involving those tubes.

*d.* An l-v reading on the meter for tubes in positions 7 through 11 (par. 137*d*, item 16) may be due to faulty ballast tubes R–31 and R–40 or to a faulty K–2 thermal relay in the Set 1 power supply. Check these by substitution.

*e.* Failure to obtain a reading at some but not all filament meter switch positions indicates that a filament string is defective. Refer to the filament check chart (*a* above).

*f.* Failure to obtain a reading at switch positions 2 through 6 of the METER switch (par. 137*d*, item 20) indicates that the transmit control circuits within Set 1 or in the mounting, control box, or Set 1 power supply may be defective.

(1) Connect a handset (known to be good) to an AUDIO receptacle on the Set 1 panel. Operate the push-to-talk switch. If meter readings are now obtained, the trouble is in the control box or the mounting.

(*a*) Disconnect the REC TR CONTROL cable (W–3) from Set 1 (fig. 33).

(*b*) Check the continuity of the Set 1 receive-transmit relay circuit in the control box (terminal 1 of E–2 to ground) with the push-to-talk switch operated (par. 150).

(*c*) Check the connection between terminal K of P–3 on W–3 to terminal 1 of E–2 in the control box. An infinity (open circuit) reading between these points indicates a broken wire in Special Purpose Cable WM–46/U.

(2) If METER readings on positions 2 through 6 still are not obtained with the push-to-talk switch operated at the AUDIO receptacle of Set 1, the trouble is in the Set 1 power supply or in the Set 1 receive-transmit relay control circuits.

(*a*) Check ballast tubes R–24 and R–25 in Power Supply PP–109/GR. In Power Supply PP–112/GR, check ballast tubes R–24, R–25, R–37, and R–38 (figs. 79 and 80).

(*b*) Check thermal relay K–1 in the Set 1 power supply.

(*c*) Check the transmitter relay supply circuits in the Set 1 power supply (TM 11–5036).

(*d*) Check the transmitter filament circuits in Set 1 (fig. 103).

(*e*) Check the continuity of lead N in Special Purpose Cable Assembly CX–1211/U.

## 142. Set 1 Receiver Operation

*a. Over-All Receiver Operation.* If a check of item 19 (par. 137*d*) shows a trouble condition, proceed as follows until the defect is located:

(1) Plug an audio accessory (known to be in proper working order) into one of the AUDIO receptacles on the Set 1 panel. If noise now is heard, check the wiring within the mounting which links the fixed-level audio output of the receiver-transmitter to the Set 1 output of the a-f amplifier (terminal 8 of E–6 to terminal F of E–5) (par. 149). Check tube V–102 in Set 1.

(2) Check the wiring in the mounting which goes to terminals H and J of P–3 (fig. 149). Check connections from P–3 to E–6 (fig. 25).

(3) Make the sidetone check (par. 137*d*, item 21). If sidetone is heard, check tubes V–2, V–107, and V–108 (figs. 83 and 84). If sidetone is not heard, check tubes V–109 through V–114 and V–101, V–3, and V–4. If a signal is heard at an AUDIO receptacle on the panel of the receiver-transmitter but not at the control box, check V–102 only. If a signal is heard at the control box but not at an AUDIO receptacle, check tube V–115 only. If a signal is heard in the headphones but not in a loudspeaker connected to an AUDIO receptacle, check tube V–116 only.

*b. Squelch Circuit Operation.* If the rushing noise is heard in the headset (par. 137*d*, item 17) but does not disappear when the SQUELCH control is advanced in a clockwise direction (item 18), check squelch oscillator tube V–103 and the components of the squelch circuit (TM 11–289).

*c. Over-All Receiver Operation, Listening*

*Check.* If no signals are heard in the check of item 19 (par. 137*d*), trouble exists in the Set 1 receiver r-f or i-f circuits. To isolate the trouble between these two portions of the receiver, perform the ringing check of item 20.

(1) If a ringing sidetone is heard, check tubes V–1, V–2, V–107, and V–108. If tube substitutions fail to clear the trouble, the r-f and variable i-f parts of the receiver circuits must be checked in detail (TM 11–289).

(2) If a ringing sidetone is not heard, check tubes V–107 through V–114, V–101, and V–103. Repeat the listening check.

*Note.* A no-sidetone condition also may be the result of a fault in the low-frequency portions of the transmitter, the transmitter control circuits, or the transmitter power-supply circuits. Proceed with paragraph 143.

## 143. Set 1 Transmitter Operation (item 21)

Failure to obtain a reading of the r-f meter may be due to a fault in any of the transmitter power-supply circuits (90-volt, 150-volt, or 300-volt supply circuits), the Set 1 receive-transmit relay control circuits (relays A/O–301, A/O–1, or A/O–101), Special Purpose Cable Assembly CX–1211/U, or the transmitter section of Set 1.

*a.* Check fuses F–2, F–3, and F–4 in the Set 1 power supply (fig. 79 and par. 156).

*b.* Make a sidetone check by talking into the microphone and listening for sidetone. If sidetone is heard, perform the following steps:

(1) Check tubes V–3 through V–11 (by replacement).

(2) Check the h-v power-supply contacts of relays A/O–1 and E/O–1 in Set 1 and the Set 1 power supply respectively. Refer to TM 11–289 and TM 11–5036.

(3) Check leads B, R, P, F, and C (on V/P–1 and V/P–2) in Special Purpose Cable Assembly CX–1211/U.

(4) Check vibrators E–1 and E–2 in the Set 1 power supply (fig. 81).

*c.* If no sidetone is heard, check tubes V–104 through V–106. Refer to TM 11–289 and TM 11–5036 to make detailed checks of the l-v supply circuits in the Set 1 power supply and the l-v supply circuits in Set 1.

## 144. Set 2 Receiver Operation

Failure to obtain a rushing noise when checking item 25 (par. 137*d*) of the checklist may be the result of a faulty Set 2 receiver or a defect in Special Purpose Cable Assembly CX–1213/U.

*a.* If no rushing noise is heard check all the Set 2 receiver tubes (figs. 76, 77, and 78) except V–7.

*b.* Check the Set 2 input from the receiver through the mounting (terminal B of W–6 to terminal Y of J–1) (par. 149).

*c.* Connect a handset to the AUDIO receptacle on Set 2.

(1) If noise is heard, check lead A in Special Purpose Cable CX–1213/U and the Set 2 input circuits to the a-f amplifier.

(2) If noise is not heard at the AUDIO receptacle, check the Set 2 power leads in the interphone amplifier.

(3) Check tubes V–6 and V–7 in the interphone amplifier (fig. 74).

## 145. Set 2 Transmitter Operation (item 29, par. 137*d*)

*a. Equipment Set-Up.*

(1) Press the push-to-talk switch on the handset and talk into the mouthpiece.

(2) If possible, arrange for a monitor to check transmission from Set 2.

*b. Sidetone Check.*

(1) If the radio monitor does not respond, but sidetone is heard, check transmitter tubes V–1, and V–3 through V–6.

(2) If sidetone is not heard, check tubes V–8 through V–11 and V–101 through V–105.

(3) Check the Set 2 microphone and relay circuits in the interphone amplifier (TM 11–5039) and in the interphone box.

## 146. Auxiliary Receiver Operation

Connect a chest set to the AUDIO receptacle of the auxiliary receiver.

*a. Filament Supply Circuits.* The lighting of the dial lamp indicates that filament voltage is being made available to all receiver tubes (fig. 43). Refer to item 30 (par. 137*d*). If the lamp does not light, make the following checks:

(1) Check fuse F–1 in the receiver (par. 158 and fig. 85).

(2) Check dial LAMP E–14.

(3) Turn DIAL LIGHT OFF-ON-TUNE switch to the TUNE position. If the lamp lights in that position, the ON position of the switch is defective or wired incorrectly.

(4) Check the continuity of lead B in cable W–1 and in the mounting.

(5) If the lamp still does not light, refer to TM 11–898 (filament supply circuits).

*Note.* Make sure that the proper plug-in power supply is inserted.

*b. Over-All Receiver Operation* (par. 137*d*, item 30). If no noise is present, if the dial LAMP is lit, and if the filament of each tube has been checked for continuity, make the following checks:

(1) Check thermal relay K–1 in the receiver (fig. 85).

(2) Check continuity of terminals H and B of cable W–2 (par. 158).

(3) Check vibrator E–1 in plug-in power supply.

(4) Refer to TM 11–898 for receiver trouble sectionalizing checks.

*c. Squelch Operation* (par. 137*d*, item 32). If the rushing noise does not disappear, check tube V–11. If it still does not disappear, refer to TM 11–898 (receiver trouble sectionalizing checks).

*d. Calibration Check* (par. 137*d*, item 31). If beat note signal is not heard at the calibration points listed below, check tube V–10. If beat note still is not heard, check tubes V–1 through V–10.

| Radio receiver | Calibration frequency (mc) |
|---|---|
| R–108/GRC | 21.5, 25.8 |
| R–109/GRC | 30.1, 34.4, 38.7 |
| R–110/GRC | 38.7, 43, 47.3, 51.6 |

## 147. Sectionalization Checks, Control C–435/GRC

*a. Manual Push-To-Talk Circuits.* When Set 1 is transmitting (par. 137*d*, item 44), the meter on Set 1 should read and sidetone should be heard at the retransmission unit and the control boxes. When Set 2 is transmitting (par. 137*d*, item 45), sidetone should be heard at the Set 2 panel AUDIO connector and at the retransmisison unit.

(1) If the meter on Set 1 reads (par. 137*d*, item 44) but sidetone is not heard at the retransmission unit AUDIO receptacle, trouble in the Set 1 audio output (sidetone) circuit and/or the microphone circuit is indicated.

(*a*) To determine which section of the audio output circuit (fig. 130) is at fault, connect a handset to the interphone amplifier AUDIO receptacle and listen for sidetone.

(*b*) If sidetone is heard, check that section of the circuit from the amplifier to the retransmission unit AUDIO receptacle. Perform the checks given in table III under audio output circuits. Check the mounting for continuity between terminal E of P–7 (INT CONTROL at amplifier) and terminal S of J–1.

(*c*) If sidetone is not heard at the interphone amplifier AUDIO receptacle, make the checks given in table III under manual control microphone circuits.

(2) If the meter on Set 1 does not read (par. 137*d*, item 37) and sidetone is not heard, an open in the receive-transmit relay control circuit is indicated.

(*a*) Perform the checks give in table III under receive-transmit relay control circuits.

(*b*) Check the mounting for continuity between terminal C of J–1 and pin K of P–3.

(3) If Set 2 sidetone is heard at the interphone amplifier AUDIO receptacle but not at the retransmission unit AUDIO receptacle, trouble lies in the connection from the amplifier to the retransmission unit. Check this circuit (fig. 130) and also make the audio output continuity measurements listed in table III.

(4) If sidetone is not heard at the interphone amplifier AUDIO receptacle, the defect lies either in the Set 2 microphone circuit or the Set 2 receive-transmit relay circuit.

(a) Make the checks given in table III under manual control microphone circuits.

(*b*) Make the checks given in table III under receive-transmit relay control circuits.

(*c*) To check the portion of the microphone circuit which passes through the mounting, check for continuity between terminal Z of J–1 and terminal C of P–7.

(*d*) To check the portion of the receive-transmit relay control circuit which passes through the mounting, check for continuity between terminal N of J–1 and terminal K of P–6.

*b. Duplex Circuits.* When the radio set is arranged for duplex operation (par. 137*d*, items 39 and 40), the meter on Set 1 (RF position) should read and sidetone and received signals (if arrangements for a second duplex station were made) should be heard at the retransmission unit and the control boxes.

(1) If the Set 1 meter reads (par 137*d*, item 40) but sidetone is not heard, an open in the Set 1 microphone and/or audio output circuit is indicated.

(*a*) If all the checks given in table III under manual control microphone circuits were not performed, making them should reveal any fault in the microphone input circuit.

(*b*) Repeat the checks given in table III under audio output circuits.

(2) If the Set 1 meter does not read (par. 137*d*, item 40), an open in the receiver-transmit relay control circuit is indicated. Repeat the checks given in table III under receive-transmit relay control circuits. Check section 1B of switch S–1.

(3) If the Set 1 meter reads (par. 137*d*, item 40) but the meter on the retransmission unit does not, trouble in the meter circuit is indicated. Perform the checks given in table III under meter and T–1 circuits.

*c. Retransmission Circuits.* When the radio set is arranged for retransmission (par. 137*d*, item 41), the meters on the panels of the retransmission unit and Set 1 (if transmitting) should read, the SIGNAL REC SET 2 or SIGNAL REC SET 1 lamp should glow, and receiver output should be heard at the retransmission unit and the control boxes.

(1) If the meters on Set 1 and the retransmission unit read and the SIGNAL REC SET 2 lamp glows but receiver output (signal or noise) is not heard, trouble in the Set 2 receiver output is indicated.

(*a*) Perform the checks given in table III for automatic microphone control circuits (*a*) and (*b*).

(*b*) Check the mounting for continuity from terminal E of P–7 to S of J–1.

(2) If the meter on Set 1 does not read (par. 137*d*, item 41) the Set 1 automatic receive-transmit relay control or Set 2 retransmit control circuits may be at fault.

(*a*) Perform the checks given in table III under Set 2 retransmit control circuits.

(*b*) Perform the checks given in table III under receive-transmit relay control circuits.

(3) If the meter on retransmission unit does not read and sidetone is not heard when a signal is received by Set 1, the Set 2 receive-transmit relay control or Set 1 retransmit control circuits may be at fault.

(*a*) Perform the checks given in table III under Set 1 retransmit control circuits.

(*b*) Repeat the checks given in table III under receive-transmit relay control circuits.

(4) If manual or duplex operation of Set 1 and Set 2 is normal but retransmission operation is not, perform the checks given on table III under battery and signal lamp circuits.

(5) If interphone conversation from the retransmission unit is not heard at the control boxes when AUTO switch S–1 is in the RETRANS or ADJUST METER position but operation is normal otherwise, the microphone input circuit to the amplifier and/or the interphone amplifier relay control circuit may be at fault.

(*a*) Perform the checks given in table III under manual control microphone circuits.

(*b*) Perform the checks given in table III under interphone amplifier relay control circuits.

*d. Control C–435/GRC, Continuity and Resistance.* Table III gives continuity and resistance measurements within Control C–435/GRC. These measurements are intended to localize trouble

within the retransmission unit after the preceding trouble-shooting checks (par. 137) have indicated it as a possible source of trouble. The data are so arranged that only those circuit sections within the retransmission unit associated with the nonoperating radio set component (or a particular function of that component) need be checked. For example, if the trouble sectionalization checks show that the Set 1 power control circuits are defective, only those measurements within the retransmission unit associated with the Set 1 power control circuit need be checked.

TABLE III. *Continuity and Resistance Measurements, Controls C–435/GRC*

| Circuit section | Point of measurement | | Reading (ohms) | Probable trouble |
|---|---|---|---|---|
| Audio output (receiving). | From term. A of J–2 to term. S of J–1 | | 3,300 | R–3. |
| | From term. L of J–2 to term. S of J–1 | | 0 | Wiring. |
| A-f amplifier relay control circuit. | From term. F of J–2 to term. D of J–1 | | | S–1C. |
| | S–1 in OFF position | | 0 | |
| | S–1 in DUPLEX position | | infinity | |
| | S–1 in RETRANS position | | 0 | |
| | S–1 in ADJUST METER position | | 0 | |
| Set 1 retransmit control. | From term. A of J–1 to term. B of J–1; switch settings as follows: | | | |
| | S–1 | S–2 | | |
| | OFF | INT | 0 | S–1E. |
| | DUPLEX | INT | 0 | S–1, S–2. |
| | | SEND SET 1 | infinity | S–2. |
| | | SEND SET 2 | 0 | S–2. |
| | RETRANS | INT | 800 | S–1, contacts 3–12 of O–4, coil of O–1, shorted C–1. |
| | ADJUST METER | INT | 800 | S–1, O–1, O–4, C–1. |
| Set 2 retransmit control. | From term. R of J–1 to term. P of J–1; switch settings as follows: | | | |
| | S–1 | S–2 | | |
| | OFF | INT | 0 | S–1K. |
| | DUPLEX | INT | 0 | S–1K, S–2F. |
| | | SEND SET 1 | 0 | S–2F. |
| | | SEND SET 2 | infinity | S–2F. |
| | RETRANS | INT | 800 | S–2F contacts 3–12 of O–2, O–3 coil, S–1K. |
| | ADJUST METER | INT | 800 | S–2F, S–1K, O–2, O–3. |

TABLE III. *Continuity and Resistance Measurements, Controls C–N435/GRC—Continued*

| Circuit section | Point of measurement | Reading (ohms) | Probable trouble |
|---|---|---|---|
| Receive-transmit relay control circuits. | From term. H of J–2 to chassis: | ---------- | S–2A. |
| | S–2 in INT position | 0 | |
| | S–2 in SEND SET 1 position | infinity | |
| | S–2 in SEND SET 2 position | infinity | |
| | From term. C of J–1 to chassis; with S–1 in OFF position, and | ---------- | S–2A, or contacts 2–11 of O–2. |
| | S–2 in INT position | infinity | |
| | S–2 in SEND SET 1 position | 0 | |
| | S–1 in DUPLEX position<br>S–2 in SEND SET 2 position | 0<br>infinity | S–1B. |
| | From term. N of J–1 to chassis: | ---------- | S–A, or contacts 2–11 of O–4 |
| | S–2 in INT position<br>S–2 in SEND SET 1<br>S–2 in SEND SET 2 | infinity<br>infinity<br>0 | |
| | From term. 11 of O–4 to chassis<br>From term. 11 of O–2 to chassis | 0<br>0 | Wiring.<br>Wiring. |
| Battery and signal lamp circuits. | From term. E of J–1 to term. F of J–1 | 75 | Defective coils or contacts 6–7 of O–2 or O–4; or burned out E–1 or E–2. |
| | From term. E of J–1 to chassis, for any position of S–1. | infinity | Contacts 6–7 of O–1 or O–3. |
| | From term. 6 of O–1 to term. 6 of O–3 | 0 | Wiring. |
| | From term. 6 of O–1 to chassis | ---------- | S–1B contacts or wiring. |
| | S–1 in OFF | infinity | |
| | S–1 in DUPLEX | infinity | |
| | S–1 in RETRANS | 0 | |
| | S–1 in ADJUST METER | 0 | |
| | From term. E of J–1 to term. 7 of O–1 (lamp E–1 out of socket). | 145 | Relay O–2 coil. |
| | From term. E of J–1 to term. 7 of O–3 (lamp E–2 out of socket). | ---------- | Relay O–4 coil. |
| Manual control microphone circuits. | From term. T of J–1 to term. C of J–2: | | |
| | S–2 in SEND SET 1 | 0 | S–2C. |
| | S–2 in SEND SET 2 | infinity | S–2C. |

TABLE III. *Continuity and Resistance Measurements, Controls C–N435/GRC—Continued*

| Circuit section | Point of measurement | Reading (ohms) | Probable trouble |
|---|---|---|---|
| Manual control microphone circuits—*Cont'd* | S–2 in INT and S–1 in DUPLEX | 0 | S–2C and S–1A. |
| | S–2 in INT and S–1 in either OFF, RETRANS, or ADJUST METER position. | infinity | S–2C and S–1A or wiring. |
| | From term. A of J–1 to term. C of J–2 | | S–2C. |
| | S–2 in SEND SET 1 | infinity | |
| | S–2 in SEND SET 2 | 0 | |
| | From term. Z of J–1 to term. C of J–2 | | S–1A or S–2C. |
| | S–2 in INT and S–1 in OFF, RETRANS, or ADJUST METER position. | 0 | |
| | S–2 in INT and S–1 in DUPLEX position | infinity | |
| | From E of J–2 to chassis | 0 | Wiring. |
| Automatic control microphone circuits. *a*. Set 1. | From term. U of J–1 to chassis | 50,000 | R–5. |
| | From term. U of J–1 to term. 1 of O–2, R–5 in extreme clockwise position. | 0 | R–5. |
| | From term. U of J–1 to term. 1 of O–2, (S–2 in INT, S–1 in OFF). R–5 in extreme clockwise position. | infinity | Shorted contact. |
| | Same as above (S–2 in SEND SET 1 and S–1 in any position except OFF). | 0 | S–2B or S–1F. |
| | From term. 10 of O–2 to term. (—) of M1 | 0 | |
| | From T of J–1 to term. 9 of O–4 | 0 | Wiring. |
| | From T of J–1 to 8 of O–2 | 0 | |
| | From term. T of J–1 to term. 8 of O–4 (S–2 in INT and S–1 in OFF position). | infinity | Shorted contacts 8–9 of O–4. |
| | From term. T of J–1 to term. 8 of O–4 (S–2 in SEND SET 1 and S–1 in any position except the OFF position). | 0 | S–2D and S–1D contacts. |
| *b*. Set 2. | From Y of J–1 to chassis | 50,000 | R–4. |
| | From Y of J–1 to term. 1 of O–4 (R–4 in extreme clockwise position). | 0 | R–4. |
| | From term. Y of J–1 to term. 10 of O–4 (S–2 in INT, S–1 in OFF); R–4 in extreme clockwise position. | infinity | Shorted contacts 1–10 of O–4. |
| | Same as above (S–2 in SEND SET 2 and S–1 in any position except the OFF position). | 0 | S–2B or S–1F. |

TABLE III. *Continuity and Resistance Measurements, Controls C–N435/GRC—Continued*

| Circuit section | Point of measurement | Reading (ohms) | Probable trouble |
|---|---|---|---|
| Automatic control microphone circuits. *b.* Set 2 *Cont'd* | From term. 10 of O–4 to term. (–) of M–1 | 0 | Wiring. |
| | From term. a of J–1 to term. 9 of O–2 | 0 | Wiring. |
| | From term. a of J–1 to term. 8 of O–4 (S–2 in SEND SET 2 and S–1 in any position except the OFF position). | 0 | S–2D or S–1D contacts. |
| | From term. T of J–1 to term. a of J–1 (for any position of S–1 and S–2). | infinity | Shorted contacts of O–2. |
| *c.* Meter and T–1 circuits. | From term. (–) of M–1 to chassis (S–1 in OFF position). | 715 | T–1. |
| | From term. (+) of M–1 to chassis (S–1 in ADJUST METER position). | 0 | S–1C. |
| | From term. (+) of M–1 to junction of R–2 and CR–1. | 820 | R–2. |
| | From junction of CR–1 and S–1 to chassis (S–1 in DUPLEX or RETRANSMIT position). | 0 | S–1C. |
| *d.* Retransmission disconnect circuit. | From term. V of J–1 to term. U of J–1 (S–2 in INT or SEND SET 2 position, and S–1 in any position except the OFF position). | 0 | Contacts 4–5 of O–4 or S–2E. |
| | From term. V of J–1 to term. U of J–1 (S–1 in OFF position, S–2 in SEND SET 1 position). | 0 | Contacts of S–1H or S–2E. |
| | From term. V of J–1 to term. U of J–1 (S–1 in any except the OFF position, S–2 in SEND SET 1 position). | infinity | Shorted S–1H or S–2E contacts. |

## 148. Sectionalization Checks, Control Group AN/GRA–6

*a. Ringing checks.* A signal transmitted from either the local or remote control units (par. 137*d*, items 43 and 44) should be heard in the earpiece of the transmitting operator and in the earpiece of the receiving operator. The transmitted signal should ring the bell or light the CALL LIGHT at the receiving unit, depending on the setting of the internal CALL LIGHT switch.

(1) If the local operator cannot hear his transmission of a ringing signal, a faulty generator or line transformer T–1 within the local unit is indicated.

(*a*) Check that the chest set and headset-microphone cables are properly installed.

(*b*) Inspect the cable connectors and the panel AUDIO receptacles for proper contact.

(*c*) Check the ringing generator and T–1 within the local unit. Refer to TM 11–5038.

(2) If at the remote unit the ringing signal is heard in the earpiece of the handset but the bell does not ring (par. 137*d*, items 43 and 44), check the bell and the internal BELL-LAMP switch of the unit. Refer to TM 11–5038.

(3) If at the remote unit the bell rings but the signal is not heard in the headset, either line transformer T–1 within the remote unit or the earpiece of the handset is defective. To isolate the trouble between the two items:

(*a*) Disconnect the line wires from the remote unit binding posts and connect them directly to terminals A and B of the handset connector.

***Caution:*** Do not touch line wires while a ringing signal is coming in. A potential up to 70 volts may exist at the wires. Wait until the ringing stops, disconnect and reconnect the wires, and then resume the ringing check.

(*b*) If the ringing signal now is heard in the earpiece, check the line transformer T–1 circuits within the remote unit. Refer to TM 11–5038.

(*c*) If the ringing signal is not heard in the earpiece, check the handset. Refer to paragraph 151 for point-to-point resistance data.

(4) If at the remote unit the bell does not ring and the signal is not heard in the earpiece, the line wires are probably defective.

(*a*) Check the line wire connections at the binding posts of both the local and remote units.

(*b*) Check as described in (3)(*a*) above. If no signal is heard in the earpiece, check the line wires for continuity.

(5) If the bell rings when the internal BELL-LAMP switch is set at BELL, but the CALL LIGHT does not light when the switch is set at LAMP, replace CALL LIGHT E–3 in the local or remote control units. If this fails to clear the trouble, check the BELL-LAMP switch, wiring, and generator within the local or remote control unit. Refer to TM 11–5038.

*b. Duplex Telephone Circuit.* Failure to obtain the indications of paragraph 137*d*, item 45, may be caused by a defective microphone, handset, headset, chest set, or cable leads to control unit is defective. Other portions of the transmission path from these audio accessories at either the local or remote control units.

(1) Check that the cable connections from the handset to the AUDIO connector on the remote unit panel and from the headset-microphone and chest set to the AUDIO connector at the local control unit are made properly.

(2) Operate the push-to-talk switch several times to insure that the handset switch is not stuck. Do the same with the RADIO-INT and HOLD ON buttons on the chest set.

(3) Check the voltages of the two Batteries BA–30 within each local and remote control unit battery compartments. These are the small flashlight-type batteries BT–1 and BT–2. If a measuring instrument is not available, try replacing the batteries with units known to be in good condition. Replacement procedure is described in paragraph 159.

(4) If another handset or headset-microphone is available, try substituting it for the one being used or make continuity checks as described in paragraph 151. Refer to TM 11–5038.

*c. Local Operation of Set 1.* The checks in paragraph 137*d*, item 48, determine whether the microphone input, audio output, or receive-transmit relay control circuits, extending from the local control unit through the mounting to Set 1, through the amplifier, and back through the mounting to the local control unit, operate satisfactorily.

(1) Failure of the meter on the Set 1 panel to deflect when the METER switch is in the RF position shows that the receive-transmit relay control circuit may be defective. Refer to figure 129 and make the following checks:

(*a*) With the LOCAL switch held at Set 1, check for continuity from ground to N/J–2C. If the ohmmeter does not show 0, either the LOCAL switch or the wiring is defective.

(*b*) Check for continuity (0 ohms) from H/J–1C to H/P–3K. If there is no continuity, the wiring in the mounting is defective.

*Note.* The power supply circuits and the circuits within Set 1 are assumed to be in operating condition because of the checks previously made.

(2) Failure to hear sidetone shows that the microphone input circuits from the local control unit to Set 1 or the audio output circuits from Set 1 to the local control unit may be defective. Make the ringing check for Set 1 (par. 137*d*, item 23). If sidetone is heard, the microphone input circuits are defective. Check the following items:

(*a*) While holding the LOCAL switch at Set 1, check for continuity between N/J–1C and N/J–2T.

(*b*) Check for continuity from H/J–1T (on mounting) to H/P–3C (on cable W–3).

(3) If ringing sidetone is not heard, check the audio output circuits as follows (fig. 130).

(*a*) Check for continuity from H/P–38 (on cable W–3) to H/P–7B (on cable W–7). This path connects the Set 1 receiver output to the a-f amplifier input. The path includes contacts 2–3 of mounting relay O–1. A reading of infinity shows a defective relay or wiring. (If terminals on local control connector J–2 or mounting connector J–1 are shorted to ground, no sidetone will be heard.)

(*b*) Check for continuity from D/J–1A (on amplifier) to N/J–1A (on local control unit). This path makes the connection from the Set 1 + Set 2 + interphone output of the amplifier (fig. 130) to the local control unit when the REMOTE switch is not at TEL ONLY. Refer to TM 11–5038.

*d. Local Operation of Set 2.* The checks in paragraph 137*d*, item 49, determine whether the microphone input, audio output, or receive-transmit relay control circuits, extending from the local control unit through the mounting and amplifier to Set 2, and back through the amplifier and mounting to the local control unit, operate satisfactorily.

(1) Failure to obtain sidetone at the Set 2 panel AUDIO connector indicates a defective receive-transmit relay control circuit. Refer to figure 129 and make the following checks:

(*a*) With the LOCAL switch held at SET 2, check for continuity from ground to C/J–202F (Set 2 panel AUDIO connector). This establishes the ground return from Set 2 receive-transmit relay C/O–101. If continuity is not obtained, proceed with the steps in (*b*) and (*c*) below.

(*b*) With the LOCAL switch held at SET 2, check for continuity from ground to N/J–2N.

(*c*) Check for continuity from H/J–1N to H/P–6K, from D/J–4K to D/J–3K, and from W/P–1K to W/P–2K.

(2) If sidetone still is not obtained at the Set 2 panel AUDIO connector, make the following checks (fig. 129):

(*a*) While holding the LOCAL switch at SET 2, checks for continuity from N/J–1C to C/J–202C. This establishes the connection from the microphone of the local control unit to the microphone input transformer of Set 2.

(*b*) If continuity is not obtained, check from N/J–1C to N/J–2a, from H/J–1a to H/P–6C, from D/J–4C to D/J–3C, and from W/P–1C to W/P–2C.

(3) If sidetone is obtained at the Set 2 panel AUDIO connector but not at the local control unit, make the following checks (fig. 129):

(*a*) Check for continuity from W/P–2A to W/P–1A (Special Purpose Cable Assembly CX–1213/U).

(*b*) Check for continuity from D/J–1A (amplifier panel AUDIO connector) to N/J–1A (local control panel AUDIO connector) when REMOTE switch is not at TEL ONLY.

(*c*) If continuity is not obtained as described in (*b*) above, check for continuity from D/J–1A to N/J–2S. If continuity now is obtained, a probable defect is indicated in the REMOTE switch.

*e. Remote Control of Set 1 with Local Control of Power* (par. 137*d*, item 50).

(1) If the Set 1 meter does not deflect, a defect exists in the Set 1 receive-transmit relay control circuit. Check as follows (fig. 129):

(*a*) Check the voltage of the 45-volt battery (BT–3) in the remote control unit. If voltage is low, replace battery.

(*b*) With SELECTOR switch (on remote control unit) at left-hand write-in position, measure voltage across binding posts L1 and L2 in the remote control unit. If no voltage is obtained, a defect exists in the SELECTOR switch or in the wiring of the remote control unit. If the polarity of L1 is negative with respect to L2, a defect exists in the SELECTOR switch or the wiring.

(*c*) Check voltage across binding posts L1 and L2 in the local control unit. If no voltage is obtained, there is a break in the telephone line. If the polarity of L1 is negative with respect to L2, the telephone line is crossed. To correct, reverse the connections of the telephone line between L1 and L2 of the local control unit only.

(*d*) While an operator at the remote control unit presses the push-to-talk switch on the handset, check for continuity from A/J–310F or A/J–311F (Set 1 panel AUDIO connector) to ground. If this circuit is incomplete, check for continuity from A/J–310F or A/J–311F to H/J–1C. This checks the wiring in the mounting. Then check the continuity from N/J–2C (while the push-to-talk switch on the handset at remote control unit is pressed). If this circuit is incomplete, a defect exists either in relay N/O–1, N/O–2, or the wiring in the local control unit.

(2) If the Set 1 meter deflects (par. 137*d*, item 50) but no sidetone is obtained, a defect exists either in the microphone circuit or in the audio output circuit. Possible defects in the microphone circuit may be found in the REMOTE switch, capacitor N/C–2B, or relay N/O–1. (The remaining portions of the microphone circuit and the sidetone circuit were checked under duplex telephone operation (*b* above).)

*f. Remote Control of Set 2 With Local Control of Power* (par. 137*d*, item 51). If sidetone is not heard at the Set 2 panel AUDIO connector and the distant radio set does not pick up Set 2 transmission, either the Set 2 receive-transmit relay control circuit is defective or the microphone or audio output circuits are defective.

(1) To check the Set 2 receive-transmit relay control circuit, refer to figure 129 and proceed as follows:

(*a*) Check the voltage of the 45-volt battery (BT–3) in the remote control unit. If voltage is low, replace the battery.

(*b*) Set SELECTOR switch (on remote control unit) at right-hand write-in position; press push-to-talk button on handset and measure voltage across binding posts L1 and L2 in the remote control unit. If no voltage is obtained, a defect exists in the SELECTOR switch or in the wiring of the remote control unit. If the polarity of L1 is positive with respect to L2, a defect exists in the SELECTOR switch or the wiring.

(*c*) Check the voltage across binding posts L1 and L2 in the local control unit. If no voltage is obtained, there is a break in the telephone line. If the polarity of L1 is positive with respect to L2, the telephone line is crossed. To correct, reverse the connections of the telephone line between L1 and L2 of the local control unit only.

(*d*) While an operator at the remote control unit presses the push-to-talk switch on the handset, check for continuity from C/J–202F (Set 2 panel AUDIO connector) to ground. This establishes the ground return from the Set 2 receive-transmit relay.

(*e*) If continuity is not obtained as described in (*d*) above, check for continuity from C/J–202F to C/J–203K, from W/P–2K to W/P–1K, from D/J–3K to D/J–4K, and from H/P–6K to H/J–1N. Failure to obtain continuity indicates a wiring defect.

(*f*) If continuity is obtained as described in (*e*) above, have an operator at the remote control unit press the push-to-talk switch on the handset, and check for continuity from N/J–2N to ground. Failure to obtain continuity indicates a defect in either relay N/O–1 or N/O–2.

(2) If there are no defects in the Set 2 receive-transmit relay control circuit, a

defect exists in the microphone circuit. (The sidetone circuit was checked under duplex telephone operation. Any signal put out by the microphone of the handset at the remote control unit is passed through transformer M/T–1 directly back to the earpiece of the handset.) Possible defects in the microphone circuit may be found in the REMOTE switch, capacitor N/C–2A, or relay N/O–1. (The remaining portions of the microphone circuit were checked under duplex telephone operation (*b* above).)

*g. Remote Control of Set 1 With Remote Power Control* (par. 137*d*, items 52 through 56).

(1) If power is not turned off on the radio set when item 52 is performed, or is not turned on when item 53 is performed, a defect exists in relay N/O–3 or in the REMOTE switch (fig. 129 (I, 01)).

(2) To check item 54, perform the checks described in *e* above.

(3) If the Set 1 meter still shows a deflection (item 55), relay N/O–1 is defective. If radio set power does not remain on, relay N/O–3 is defective.

*h. Remote Control of Set 2 With Remote Power Control* (par. 137*d*, items 57, 58, and 59).

(1) If the radio set power is not turned on (item 57), relay N/O–3 is defective.

(2) To check item 58, perform the checks described in *f* above.

(3) If the radio set power is not turned off (item 59), relay N/O–3 is defective.

## 149. Localization Measurements in Mounting MT–297/GR

*a.* Table IV lists the continuity measurements which can be made in the mounting. These measurements are arranged according to individual circuits or stages of operation within the system. This arrangement simplifies the checking of specific wiring in the mounting.

*b.* Electrically disconnect all components from the mounting.

*c.* When making continuity measurements, refer to the schematic diagram of the mounting (fig. 109).

*Table IV. Point-to-Point Resistance Measurements, Mounting MT–297/GR*

| Circuit or stage | Point of measurement | Normal reading (ohms) | Probable trouble |
|---|---|---|---|
| Set 1 circuits for operation from control box. | | | |
| Transmission | From term. 5 of E–6 to term. C of P–3 | 0 | Wiring. |
| | From term. 1 of E–6 to term. K of P–3 | 0 | Wiring. |
| | From term. D of P–3 to chassis | 0 | Wiring. |
| Reception | From term. B of P–3 to term. B of P–7 | 0 | Wiring, contacts 2–3 of relay O–1. |
| | From term. H to term. J of P–3 | 0 | Wiring, contacts 4–5 of relay O–1. |
| | From term. 8 of E–6 to term. F of P–7 | 0 | Wiring. |
| Auxiliary receiver operation from control box. | From term. H to term. J of P–2 | 0 | Broken strap connection between terminals H–1 and J–1 of terminal strip E–2. |
| | From term. B of P–2 to term. B of P–7 | 0 | Wiring, contacts 2–3 of relay O–1. |
| Interphone operation from control box. | | | |
| Transmission | From term. 6 of E–6 to term. C of P–7 | 0 | Wiring. |
| | From term. 2 of E–6 to term. K of P–7 | 0 | Wiring. |
| Reception | From term. 9 of E–6 to term. H of P–7 | 0 | Wiring. |
| | From term. 8 of E–6 to term. F of P–7 | 0 | Wiring. |
| | From term. 10 of E–6 to term. A of P–7 | 0 | Wiring. |
| Miscellaneous | From term. 4 of E–6 to chassis | 0 | Wiring. |

*Table IV. Point-to-Point Resistance Measurements, Mounting MT-297/GR—Continued*

| Circuit or stage | Point of measurement | Normal reading (ohms) | Probable trouble |
|---|---|---|---|
| Power input circuits. | | | |
| Battery connections | From + term. of battery cable to term. B2 of relay K–1. | Almost zero | Wiring, open fuse F–1. |
| | From + term. of battery cable to − term. of battery cable. | | |
| | S–1 in OFF position | Infinity | Wiring, grounded switch S–1, contacts of K–1 stuck. |
| | S–1 in REMOTE position | Infinity | Wiring, grounded switch S–1, contacts of K–1 stuck. |
| | S–1 in ON position | 55.5 (24 v)<br>27.5 (12 v) | Wiring, broken battery cable, open or shorted R–3, open or shorted coil of K–1, open fuse F–1. |
| | From − term. of battery cable to chassis | 0 | Broken battery cable. |
| Auxiliary receiver power input circuit. | From term. B of P–1 to term. B1 of relay K–1. | 0 | Wiring. |
| | From term. C of P–1 to chassis | 0 | Wiring. |
| | From term. B of P–1 to chassis | 165 | Wiring, defective lamp E–7. |
| Set 1 power input circuit | From term. B of P–5 to term. B1 of relay K–1. | 0 | Wiring. |
| | From term. C of P–5 to chassis | 0 | Wiring. |
| | From term. B of P–5 to chassis | 165 | Wiring, defective E–7. |

## 150. Localization Measurements in Control Box C–375/VRC

Table V lists point-to-point resistance measurements within Control Box C–375/VRC. These measurements are intended to localize trouble within that unit after the preceding trouble-shooting checks have pointed to it as a possible source of trouble. The data are arranged in such a manner that only those circuits within the control box associated with the nonoperating radio component, or a particular function of that component, need be checked. In addition, the checks are grouped according to the type of audio accessory (handset, chest set, or jack-connected audio accessory) used for making the checks. Thus, if the trouble sectionalization checks show that with a handset used as an audio accessory the Set 1 transmit control circuits are faulty, check only those circuit sections grouped under the title *Set 1 transmission (handset connections)*.

*Table V. Point-to-Point Resistance Measurements, Control Box C–375/VRC*

| Circuit section | Point of measurement | Test conditions | Nominal reading (ohms) | Probable trouble |
|---|---|---|---|---|
| Set 1 circuits (handset connections). | From term. C of J–1 or J–2 to term. 5 of E–2. | S–2 in either RADIO TRANS position, S–1 in SET 1 + INTERPHONE. | 0 | Defective S–2 (A–1 or A–3) or S–1 (A–1). |
| | From term. F of J–1 or J–2 to term. 1 of E–2. | Same as above | 0 | Defective S–2 (B–1 or B–3 or S–1 (C1). |
| | From term. A of J–1 to term. 8 of E–2. | Same as above, VOL. control R–1 in extreme clockwise position. | 0 | Defective R–1, strap connection between terminals 13 and 14 of E–2 missing; or defective S–1 (B1). |

*Table V. Point-to-Point Resistance Measurements, Control Box C-375/VRC—Continued*

| Circuit section | Point of measurement | Test conditions | Nominal reading (ohms) | Probable trouble |
|---|---|---|---|---|
| Set 1 circuits (handset connections)—*Cont'd* | From term. A of J–2 to term. 8 of E–2. | Same as above, VOL. control R–2 in extreme clockwise position. | 0 | Defective R–2, strap connection between terminals 13 and 15 of E–2 missing, or defective S–1 (B1). |
| | From term. A of J–1 to term. 13 of E–2. | Rotate VOL. control R–1 in counterclockwise direction. | Resistance increases from 0 to 10K. | Defective R–1. |
| | From term. A of J–2 to term. 13 of E–2. | Rotate VOL. control R–2 in counterclockwise direction. | Resistance increases from 0 to 10K . | Defective R–2. |
| | From term. E of J–1 to J–2 to chassis. | ---------- | 0 | Open ground connection. |
| | From term. H of J–1 or J–2 to chassis. | ---------- | 0 | Open ground connection. |
| | From term. B of J–1 or J–2 to chassis. | ---------- | 0 | Open ground connection. |
| | From term. 4 of E–2 to chassis. | ---------- | 0 | Open ground connection. |
| Interphone circuits (handset connections). | From term. C of J–1 or J–2 to term. 6 of E–2. | S–2 in interphone position. | 0 | Defective S–2 (A2). |
| | From term. F of J–1 or J–2 to term. 2 of E–2. | S–2 in either RADIO TRANS position, S–1 in center position. | 0 | Defective S–2 (B1 or B3) or S–1 (C2). |
| | From term. F of J–1 or J–2 to term. 2 of E–2. | S–2 in interphone position. | 0 | Defective S–2 (B2). |
| | From term. A of J–1 (or J–2) to term. 9 of E–2. | VOL. control R–1 (or R–2) in extreme clockwise position, S–1 in center position. | 0 | Defective R–1 (or R–2), S–1 (B2), missing strap between terminals 13 and 14 (or 13 and 15) of E–2. |
| | Check volume controls as in fifth and sixth items under *Set 1 circuits (handset connections)* above. | | | |
| | Check ground connections as in last four items under Set 1 circuits above. | | | |
| Interphone circuits (chest set connections). | From term. K of J–1 or J–2 to term. 6 of E–2. | ---------- | 0 | Wiring. |
| | Repeat the six items under *Interphone circuits (handset connections)* above. | | | |
| | From term. J of J–1 or J–2 to term. 2 of E–2. | ---------- | 0 | Wiring. |
| Set 1 circuits (chest set connections). | Check the 10 items under *Set 1 circuits (handset connections)* above. | | | |

*Table V. Point-to-Point Resistance Measurements, Control Box C–375/VRC—Continued*

| Circuit section | Point of measurement | Test conditions | Nominal reading (ohms) | Probable trouble |
|---|---|---|---|---|
| Jack connections | From tip of J–3 or J–4 to term. C of J–1 and J–2. | | 0 | Wiring or defective jack. |
| | From ring of J–3 or J–4 to term. F of J–1 and J–2. | | 0 | Defective jack or lead. |
| | From sleeve of J–3 or J–4 to chassis. | | 0 | Open ground connection. |
| | From tip of J–6 to A of J–1. | | 0 | Defective jack or lead. |
| | From tip of J–5 to A of J–2. | | 0 | Defective jack or lead. |
| | Check the connections made for the *Set 1 circuits* or the *Interphone circuits* above, depending on whether the Set 1 or the interphone circuits are to be checked. | | | |

## 151. Continuity Measurements in Handset H–33/PT and Chest Set Group AN/GSA–6

Tables VI and VII give resistance measurements for the principal audio accessories used with Radio Sets AN/GRC–3 through –8.

*a.* These measurements are intended to locate defects within these units after the preceding trouble-shooting checks have pointed to them as a possible source of trouble.

*b.* Refer to figure 112 when taking the measurements.

*Table VI. Point-to-Point Resistance Measurements, Handset H–33/PT*

| Point of measurement | Required reading (ohms) | Test condition |
|---|---|---|
| Between terminals A and B | 30 ohms, approximately; click heard when making or breaking ohmmeter connection. | None. |
| Between terminals F and H | 0 | Push-to-talk switch operated. |
| Between terminals F and H | Infinity | Push-to-talk switch unoperated. |
| Between terminals E and D | 0 | Push-to-talk switch operated. |
| Between terminals E and D | Infinity | Push-to-talk switch unoperated. |
| Between terminals D and C | 150 ohms, approximately; click heard when making or breaking ohmmeter connection. | None. |
| Between terminals F and D | Infinity | Push-to-talk switch operated or unoperated. |

*Table VII. Point-to-Point Resistance Measurements, Chest Set Group AN/GSA–6 With Headset-Microphone H–63/U*

| Circuit section | Point of measurement | Test condition | Nominal reading (ohms) | Probable trouble |
|---|---|---|---|---|
| Headset | From term. A to term. B of cable connector plug. | Headset-microphone H–63/U connected for all measurements in this table. | 60 ohms, approximately; click heard when making or breaking ohmmeter connections. | Defective headset or wiring. |
| Microphone | From term. K to term. E of cable connector. | Push-to-talk rocker arm unoperated; RADIO-INT switch in INT position. | Infinity | Defective push-to-talk switch. |
| | | Push-to-talk rocker arm in each of two operate positions; RADIO-INT switch in INT position. | 150 ohms, approximately; click heard when making or breaking ohmmeter connections. | Defective push-to-talk switch, RADIO-INT switch, or microphone. |
| | From term. C to term. E of cable connector. | Same as above; RADIO-INT switch in RADIO position. | 150 ohms, approximately; click heard when making or breaking test connections. | Defective RADIO-INT switch. |
| Push-to-talk control circuit. | From term. J to term. H of cable connector. | Push-to-talk switch unoperated; RADIO-INT switch in INT position. | Infinity | Defective push-to-talk switch. |
| | | Push-to-talk switch operated to each of two positions; RADIO-INT switch in INT position. | 0 | Defective push-to-talk switch or RADIO-INT switch. |
| | From term. F to term. H of cable connector. | Same as above; RADIO-INT switch in RADIO position. | 0 | Defective RADIO-INT switch. |

## Section III. REPLACEMENT OF PARTS

### 152. General

After trouble has been sectionalized to a particular unit, it must be localized to a particular component part or circuit of this unit. This section lists procedures for the replacement of parts. Running spares for each unit are listed in paragraph 22.

### 153. Removing Immersionproof Cases

The replacement of pluck-out parts (except fuses) requires removal of immersionproof cases which house the panel-chassis assemblies of the various units. To remove the case of the receiver-transmitter, the interphone amplifier, the receiver-transmitter power supply, or the auxiliary receiver, perform the following steps:

*a.* Remove all external connections from the unit involved.

*b.* Remove the unit from the mounting.

*c.* Loosen the Dzus fasteners located at th edges of the unit.

*d.* Slide the panel-chassis assembly out of th case. Be careful not to damage any wiring o components while removing and handling th panel-chassis assembly.

### 154. Interphone Amplifier

The replacement of pluck-out parts for whic running spares are available is described in through *d* below.

*a. Fuse.* The panel-mounted fuse is removed b unscrewing the fuse cap, which also serves as fuse extractor. A spare fuse is located in a fus clip on the amplifier chassis (fig. 74).

*b. Thermal Relay and Ballast Tube.* Therm relay K–1 and ballast tube R–32 are mounted i a horizontal position at the rear of the amplifie chassis (fig. 74). After removing the pane chassis assembly from the case, remove the rela

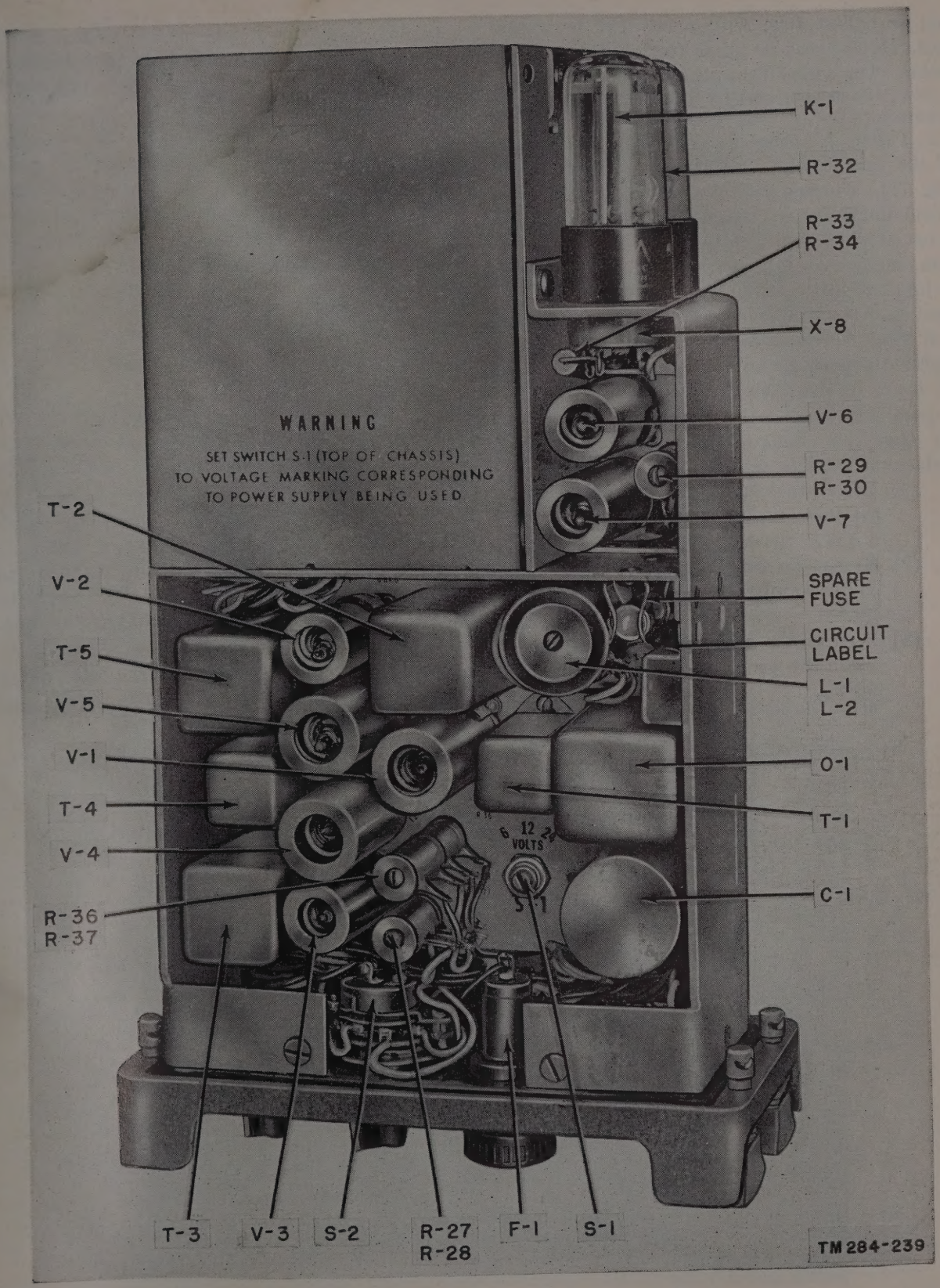



*Figure 74. AF Amplifier AM–65/GRC, top view of chassis.*



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and/or ballast tube with a straight horizontal pull. Do not rock or jiggle the component in its socket. The socket prongs may be damaged.

*Note.* Electrolytic capacitor C–1 (fig. 74) also may be removed.

*c. Tubes.* All tubes are accessible from the top of the chassis when the case has been removed (fig. 74). To remove a tube, first remove the tube shield and then use a tube puller. If a tube puller is not available, pull up the tubes with your fingers, using a straight upward pull. Do not rock or jiggle a tube in its socket. The tubes are damaged easily by careless handling.

*d. Plug-In Power Supply.* Although it can be replaced as a single unit, the plug-in power supply is not furnished as a running spare. However, a spare vibrator is provided with the power supply (fig. 75). Remove the amplifier case and replace the vibrator as follows:

(1) Loosen the clamp bracket at the rear of the power supply compartment and swing it out of the way.

(2) Grasp the handle at the rear of the power supply unit and pull it straight out.

(3) Remove the three green screws which fasten the top cover on the power supply chassis.

(4) Using the handle on the cover, lift the cover off with a straight upward movement. If the cover is stuck, pry gently with a small screw driver.

(5) Pull vibrator E–1 (fig. 75) from its socket with a straight upward movement. Do not rock or jiggle the vibrator while attempting to remove it. If necessary, use a small screw driver to pry the vibrator gently from its socket. Be careful not to enlarge the ring clip which holds the vibrator near the base.

## 155. Set 2

The only replaceable parts in Set 2 are the dial lamp and the tubes. The tubes are located on the vertical r-f and i-f chassis (figs. 77 and 78). The dial lamp is set in the front panel.

*a.* To gain access to the tubes, remove the panel-chassis assembly from the case (par. 153). To remove any tube, first remove the tube shield and then use a tube puller. Do not rock or jiggle the tube. It is damaged easily by careless handling. Tube locations are shown on figures 77 and 78.

*b.* The lamp is accessible from the front panel. Remove the screw just below the tuning dial

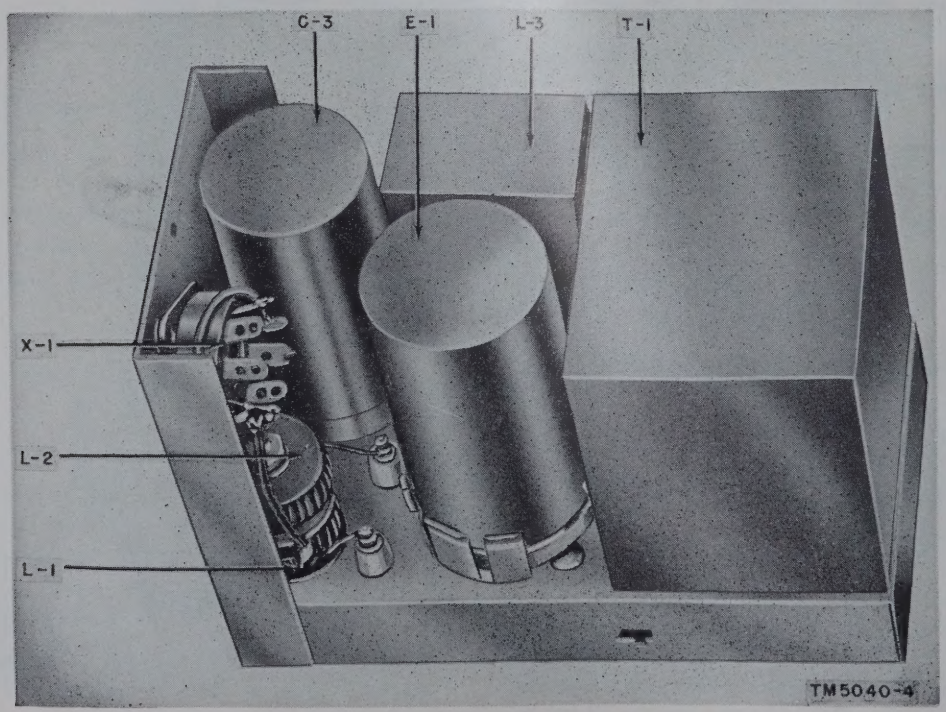



*Figure 75. Power Supply PP–282/GRC, top view of chassis.*

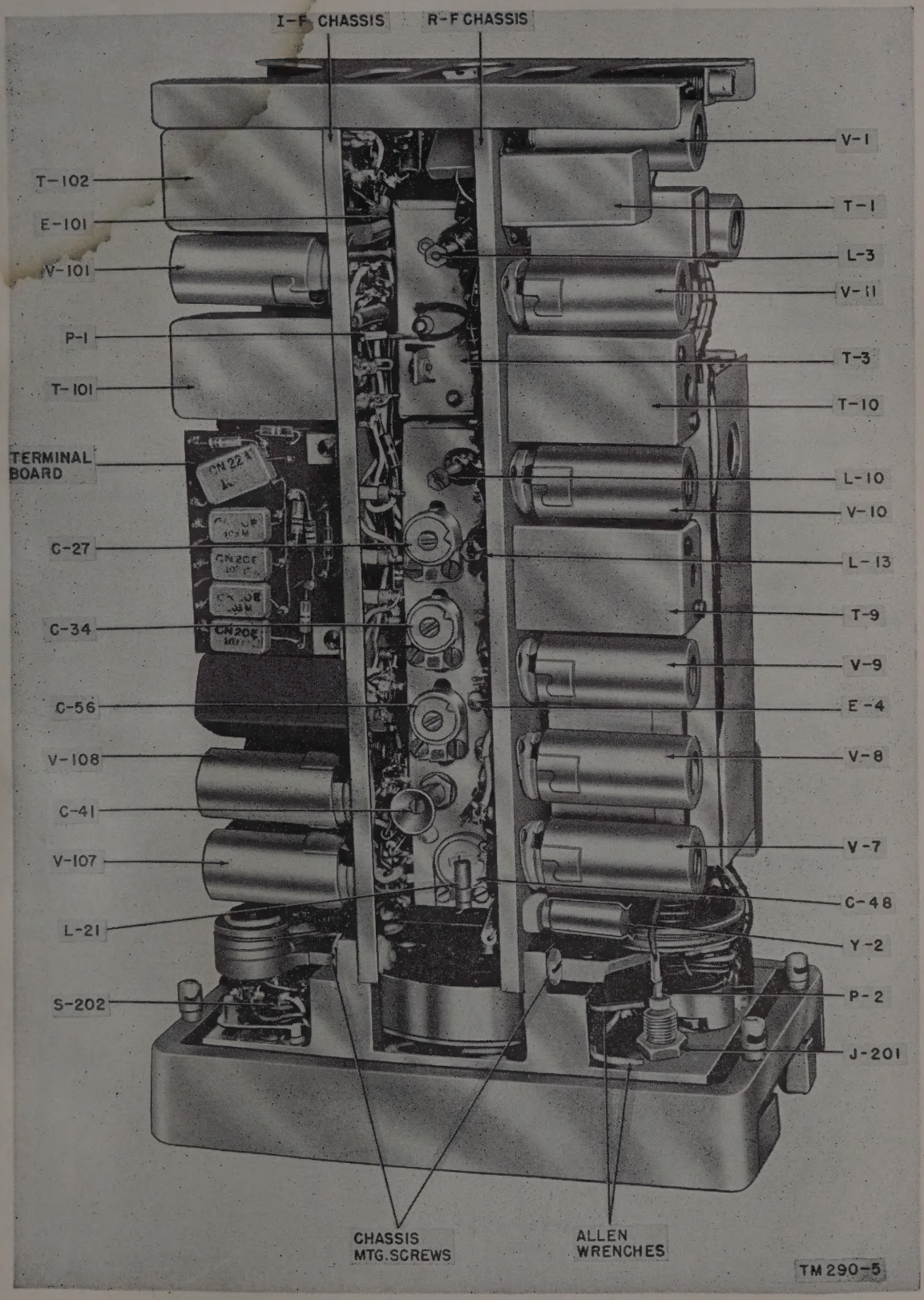



*Figure 76. Receiver-Transmitter RT-70/GRC, top view of panel-chassis assembly.*

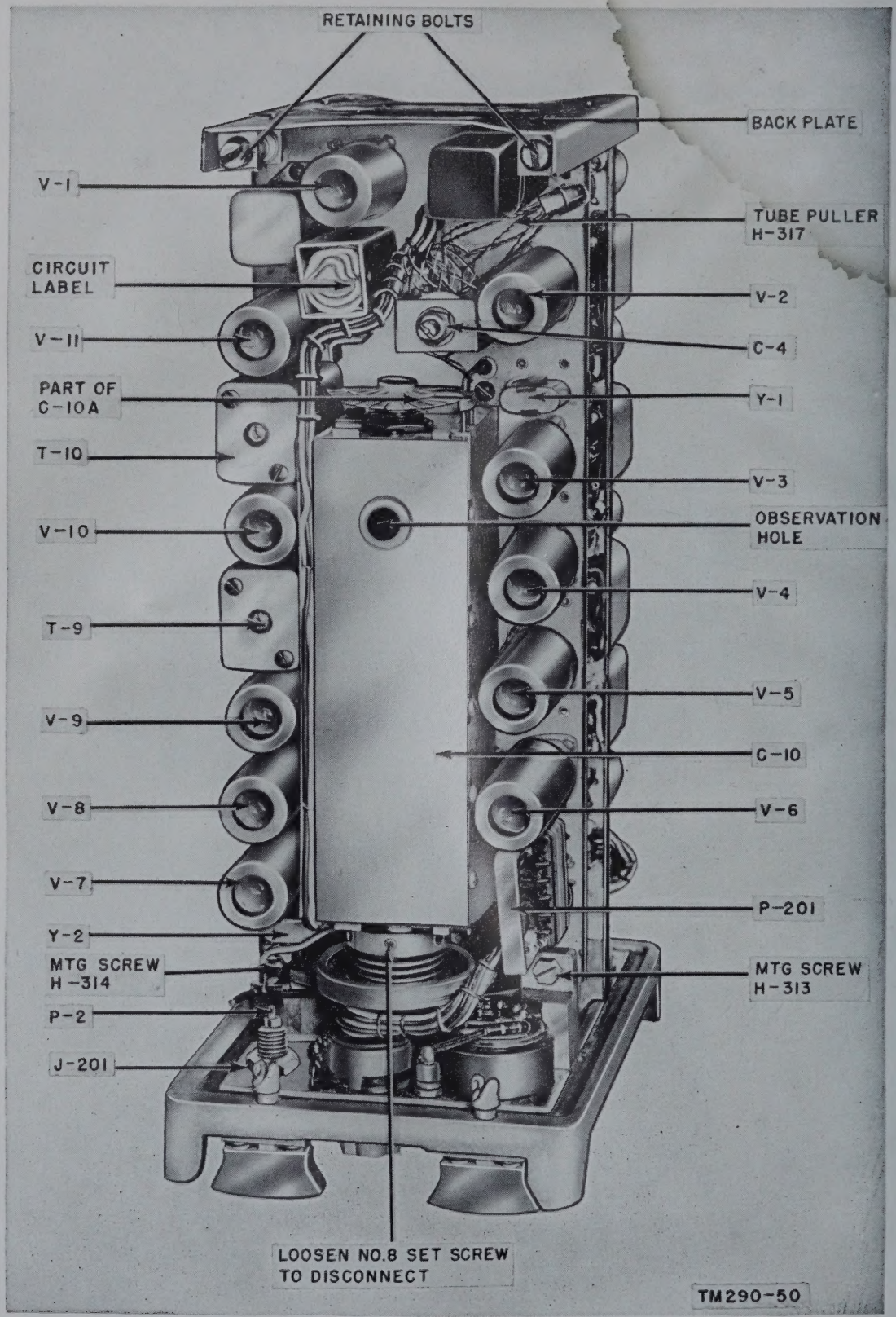



*Figure 77. Receiver-Transmitter RT-70/GRC, view of r-f chassis.*

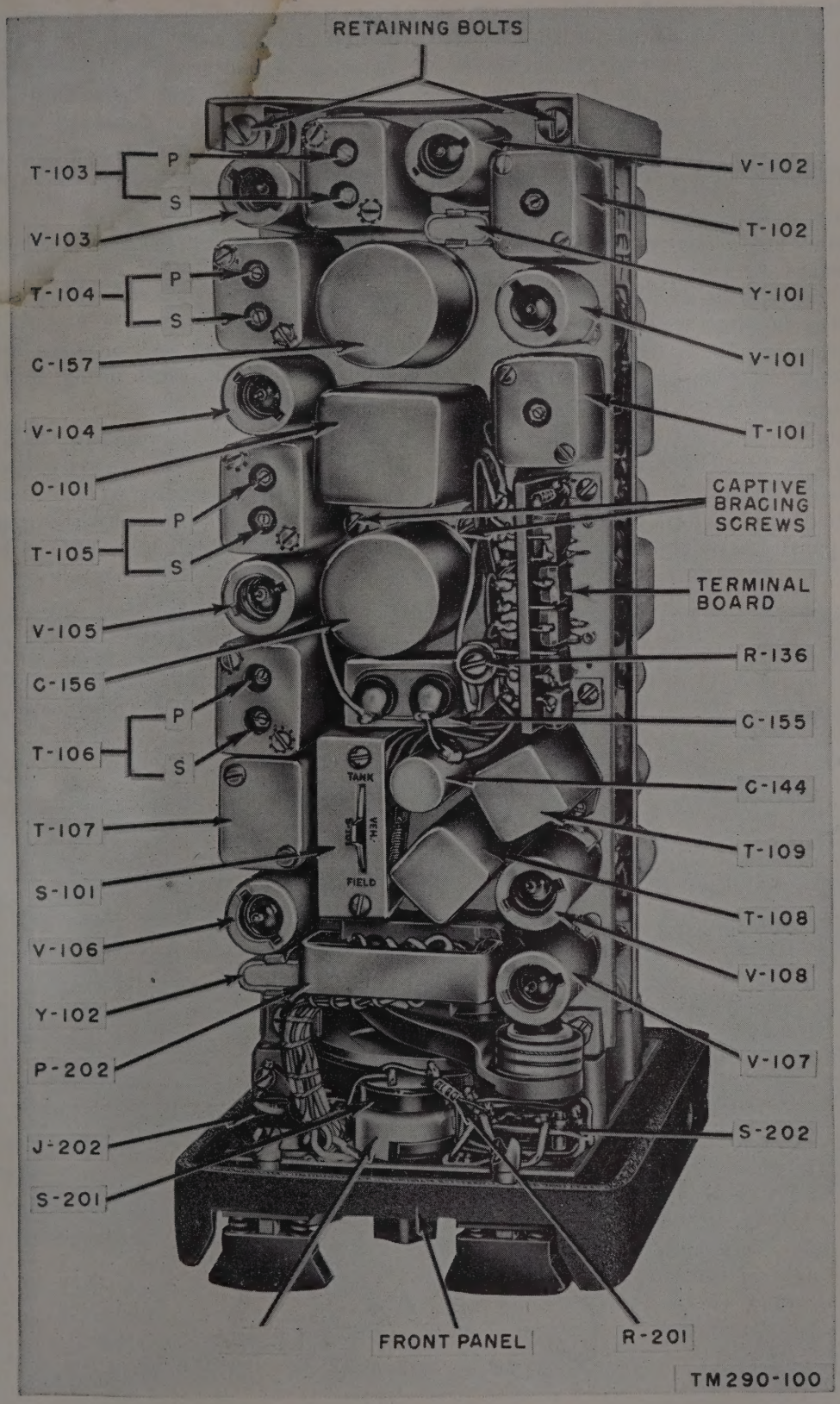



*Figure 78. Receiver-Transmitter RT-70/GRC, view of i-f chassis.*

which holds the lamp in its socket against a spring tension. When replacing the lamp, insert the glass forward in the socket so that the retaining screw supplies a contact at the base of the bulb.

## 156. Set I Power Supply

The replacement of pluck-out parts for which running spares are available is described in *a* through *d* below.

*a. Fuses.* The panel-mounted fuses are removed by unscrewing the fuse caps, which also serve as fuse extractors. Spare fuses are located in the front panel compartment marked SPARE FUSES. To gain access to the spares, loosen the two wingnuts which hold the cover plate of the compartment. Remove the plate.

*b. Thermal Relays and Ballast Tubes.* To gain access to the thermal relays and ballast tubes, remove the panel-chassis assembly from the case (par. 153). All of these parts are accessible from the top of the chassis (figs. 79 and 80). Remove the relays or ballast tubes in the same manner as any standard octal-base tube. Pull straight upward. Do not rock or jiggle the components in their sockets. (Note that similarly designated parts are located differently in the 12- and 24-volt supplies.)

*c. Tubes.* The four power supply tubes are also accessible from the top of the chassis. To remove V–1 or V–2, pull the tube with a straight upward movement. To remove V–3 or V–4, use a tube puller. Do not rock or jiggle the tubes in their sockets. The socket prongs and tubes are damaged easily.

*d. Vibrators.* Three vibrators, E–1, E–2, and E–3, are located on the right-hand side of the power supply chassis (fig. 81). To remove a vibrator, pull straight upward without jiggling. If necessary, use a small screw driver to pry the

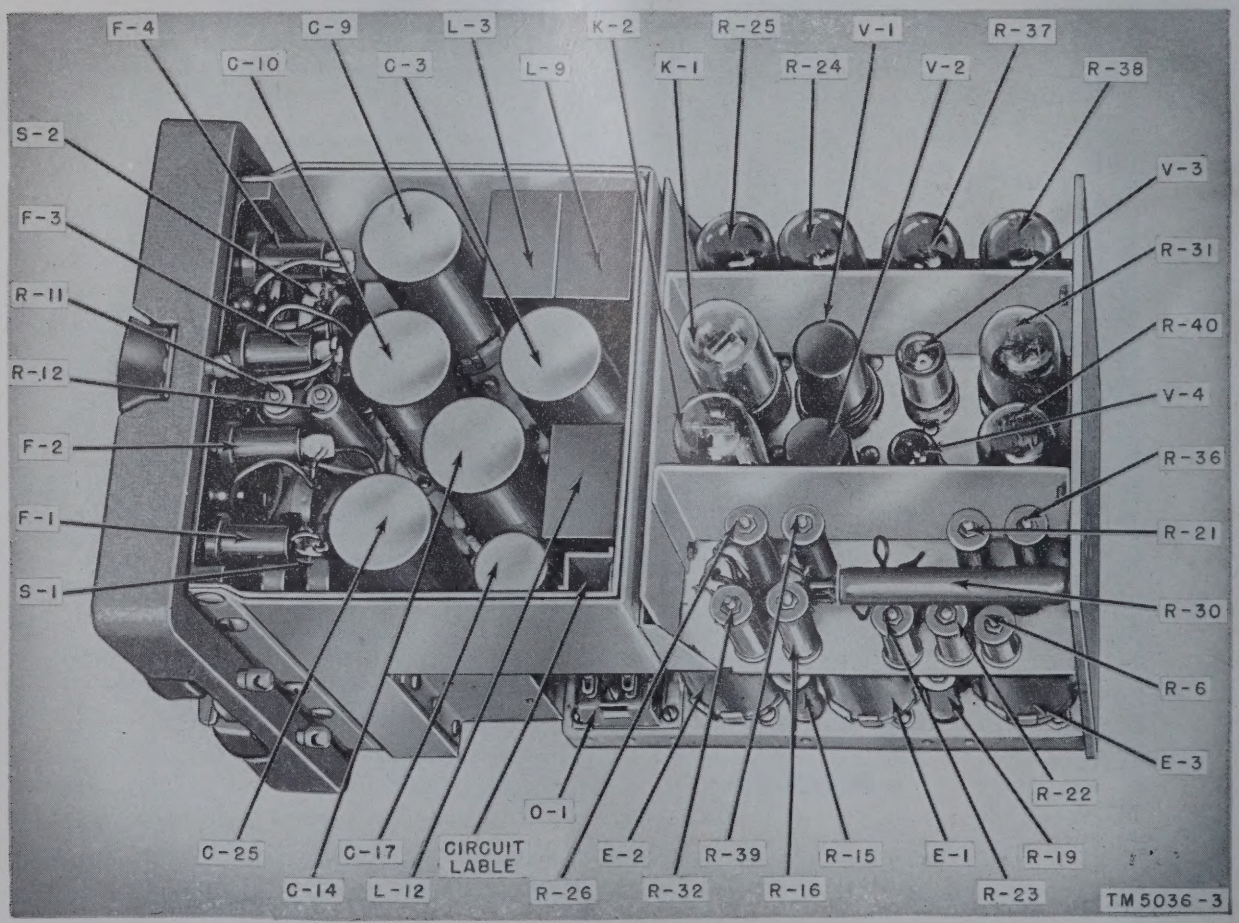



*Figure 79. Power Supply PP–112/GR, top view of chassis.*

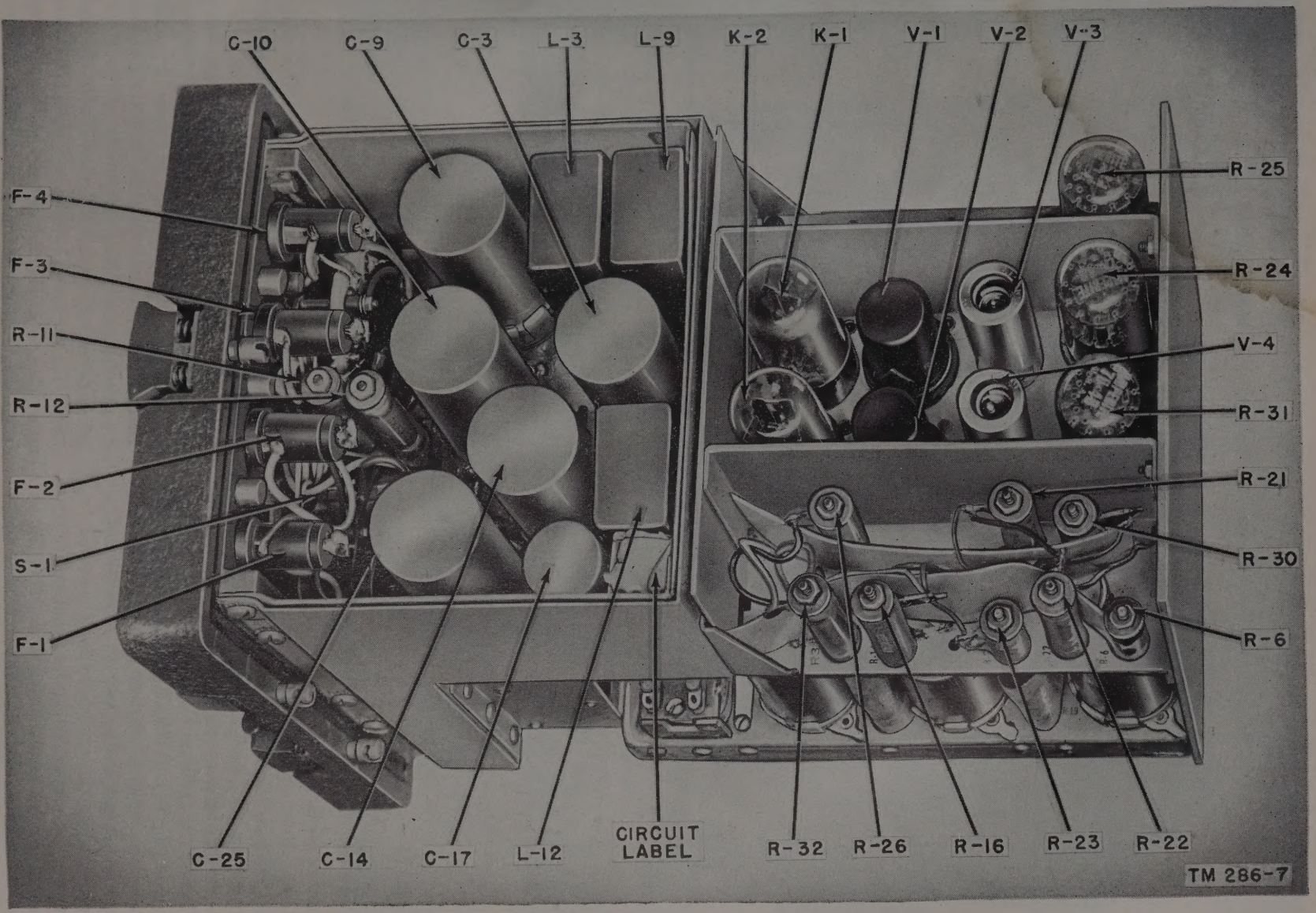



*Figure 80. Power Supply PP-109/GR, top view of chassis.*

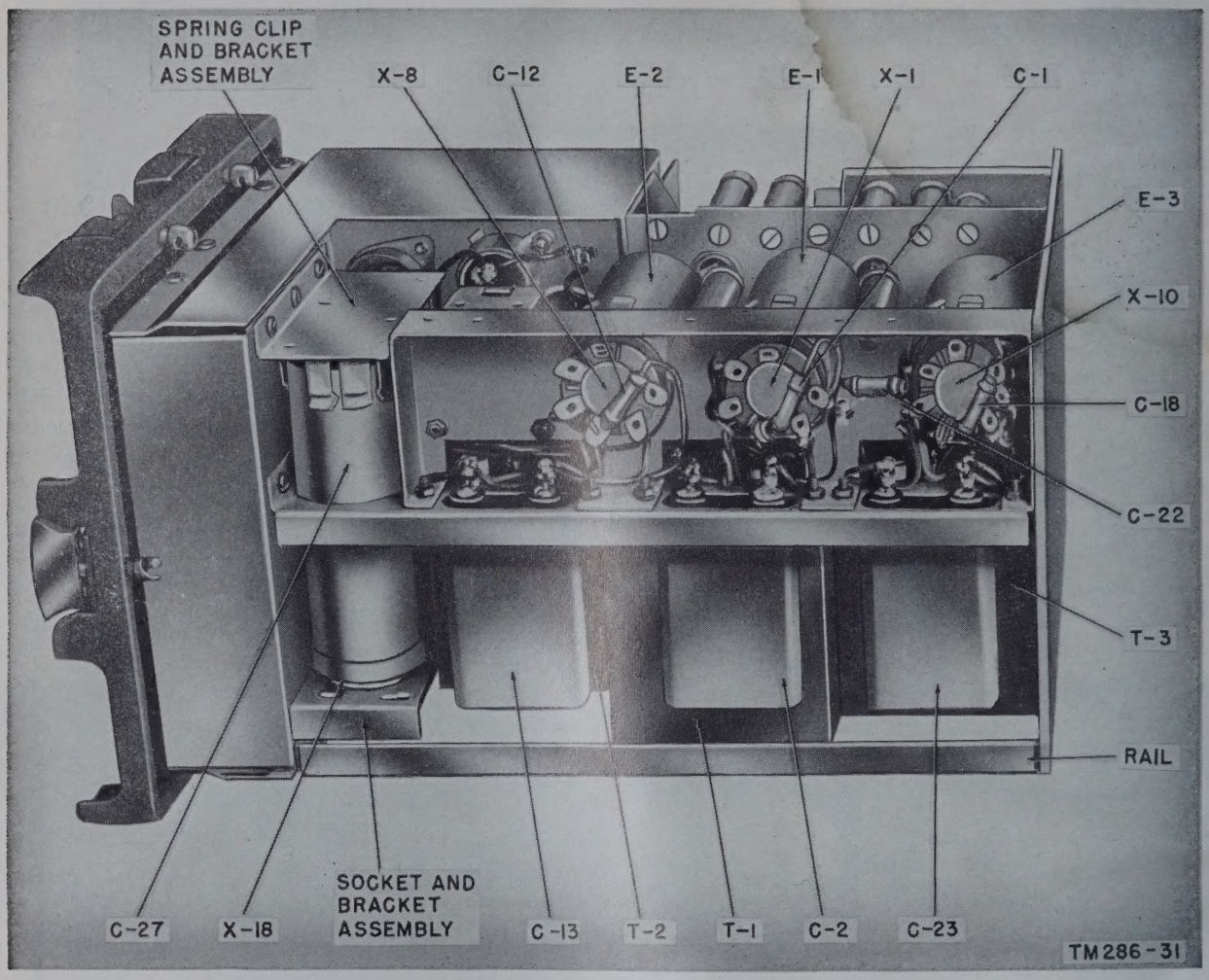



*Figure 81. Power Supply PP–112/GR, bottom view of chassis.*

vibrator from its socket. Take care not to spread the ring clip at the base of the vibrator.

## 157. Set 1

The only replaceable parts in Set 1 are the tubes and lamp. Both are mounted on the vertical r-f and i-f chassis (fig. 82). To gain access to the tubes or lamp, the panel-chassis assembly must be removed from its case (par. 153).

*a.* Tubes V–1 through V–11 are mounted on the r-f chassis (fig. 83). Tubes V–101 through V–116 are mounted on the i-f chassis (fig. 84). Each of these tubes, except V–11, may be removed with a tube puller after the shield has been removed.

*b.* Before removing V–11 it is necessary to disconnect the plate cap at the top of the tube. When the cap is disconnected, the tube can be removed with a straight upward pull. Do not rock or jiggle the tube in its socket. Careless handling may damage the sockets and tubes.

## 158. Auxiliary Receiver

The replacement of pluck-out parts for which running spares are available is described in *a* through *d* below.

*a. Fuse.* The panel-mounted fuse is removed by unscrewing the fuse cap, which also serves as a fuse extractor. A spare fuse is located in a fuse clip within the receiver, at the upper right-hand side of the panel-chassis assembly.

*b. Thermal Relay and Ballast Tube.* To gain access to the thermal relay and ballast tube, remove the panel-chassis assembly from the case (par. 153). Both the relay and ballast tube are

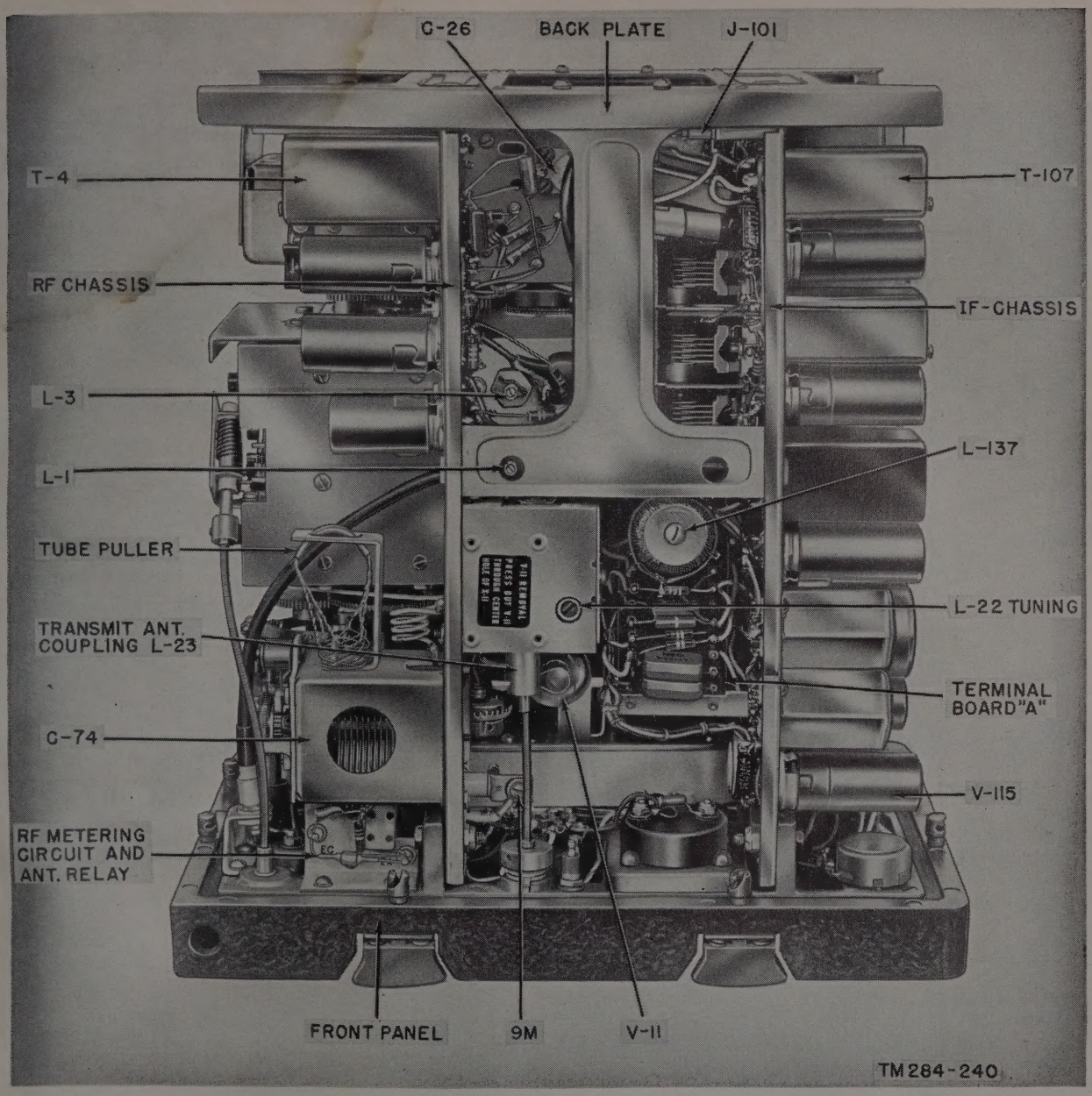



*Figure 82. Set 1, top view of panel-chassis assembly.*

located at the top of the chassis (fig. 85). Either component can be removed in the same manner as any standard octal-base tube. Pull straight upward. Do not rock or jiggle the tube in its socket.

*c. Tubes.* All of the tubes are accessible from the top of the chassis when the case is removed (fig. 85). To remove any tube, first remove the shield and then use a tube puller. Do not rock or jiggle the tubes. They are damaged easily by careless handling.

*d. Plug-In Power Supply.* Although it can be replaced as a single unit, the plug-in power supply is not furnished as a running spare. However, a spare is provided for the vibrator within the power supply (fig. 75). Remove the receiver case and replace the vibrator as follows:

(1) Loosen the clamp bracket at the rear of the power supply compartment and swing it out of the way.

(2) Grasp the handle at the rear of the power supply unit and pull straight out.

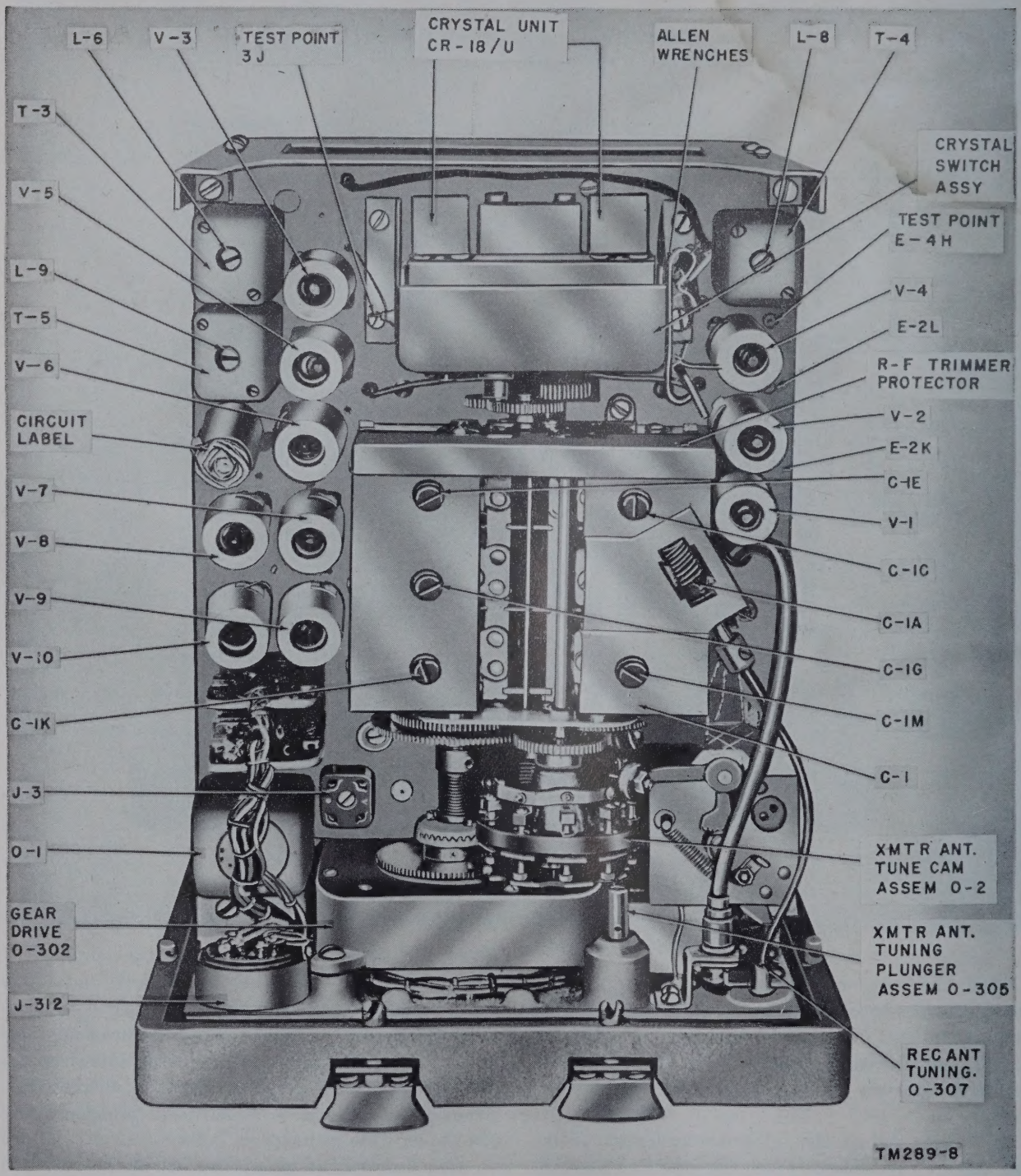



*Figure 83. Set 1, view of r-f chassis.*

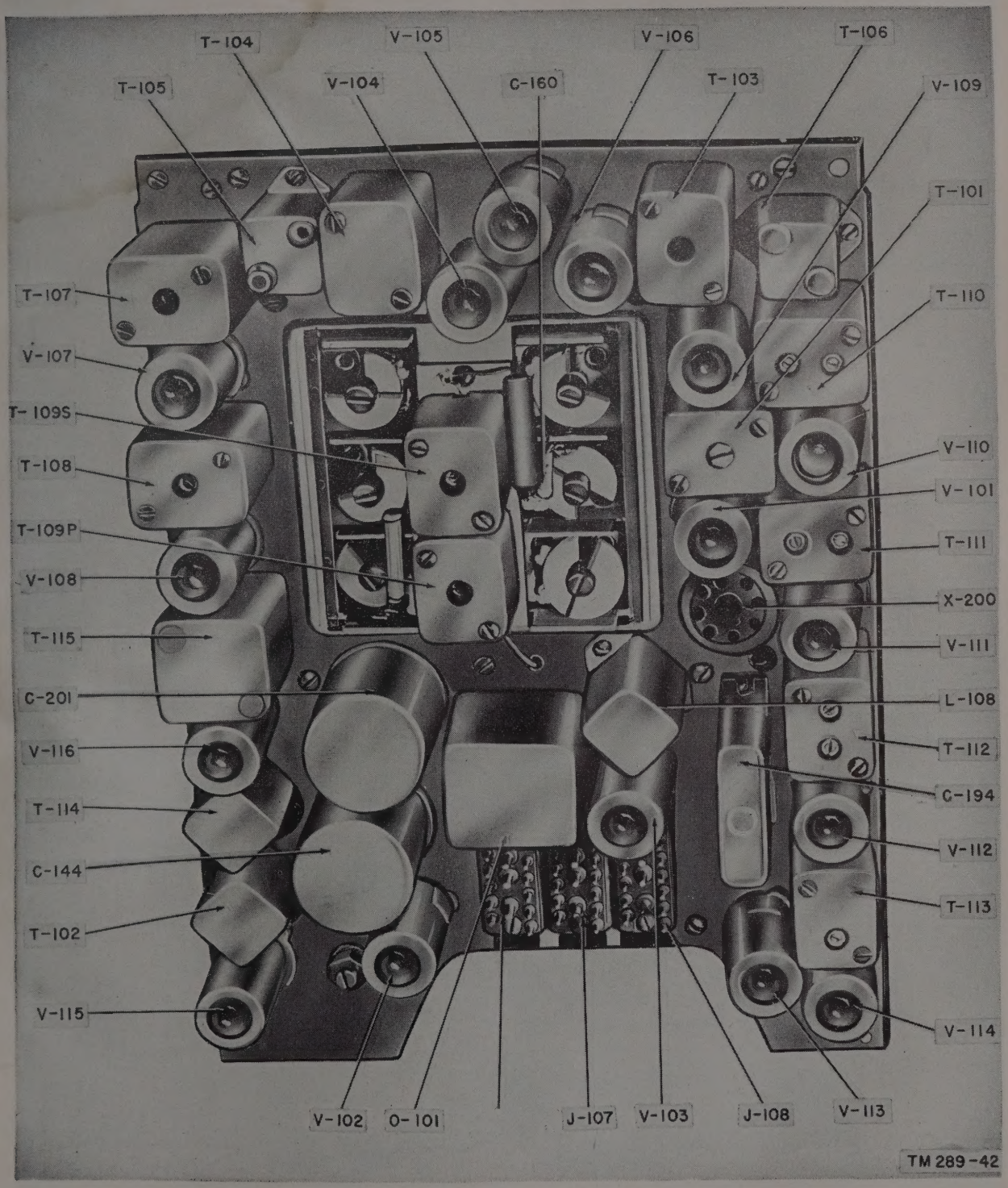



*Figure 84. Set 1, view of i-f chassis.*

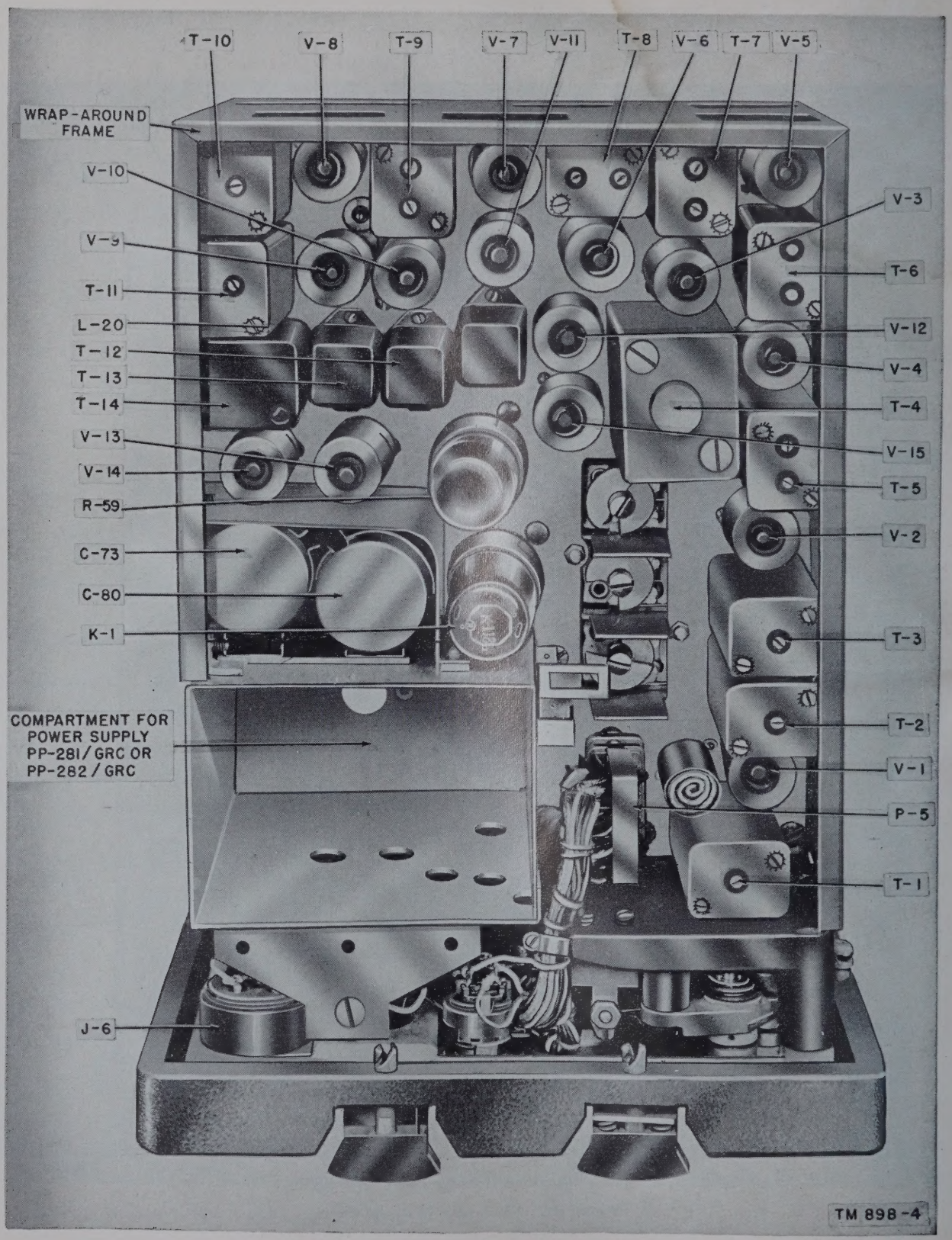



*Figure 85. Auxiliary receiver panel-chassis assembly, top view.*

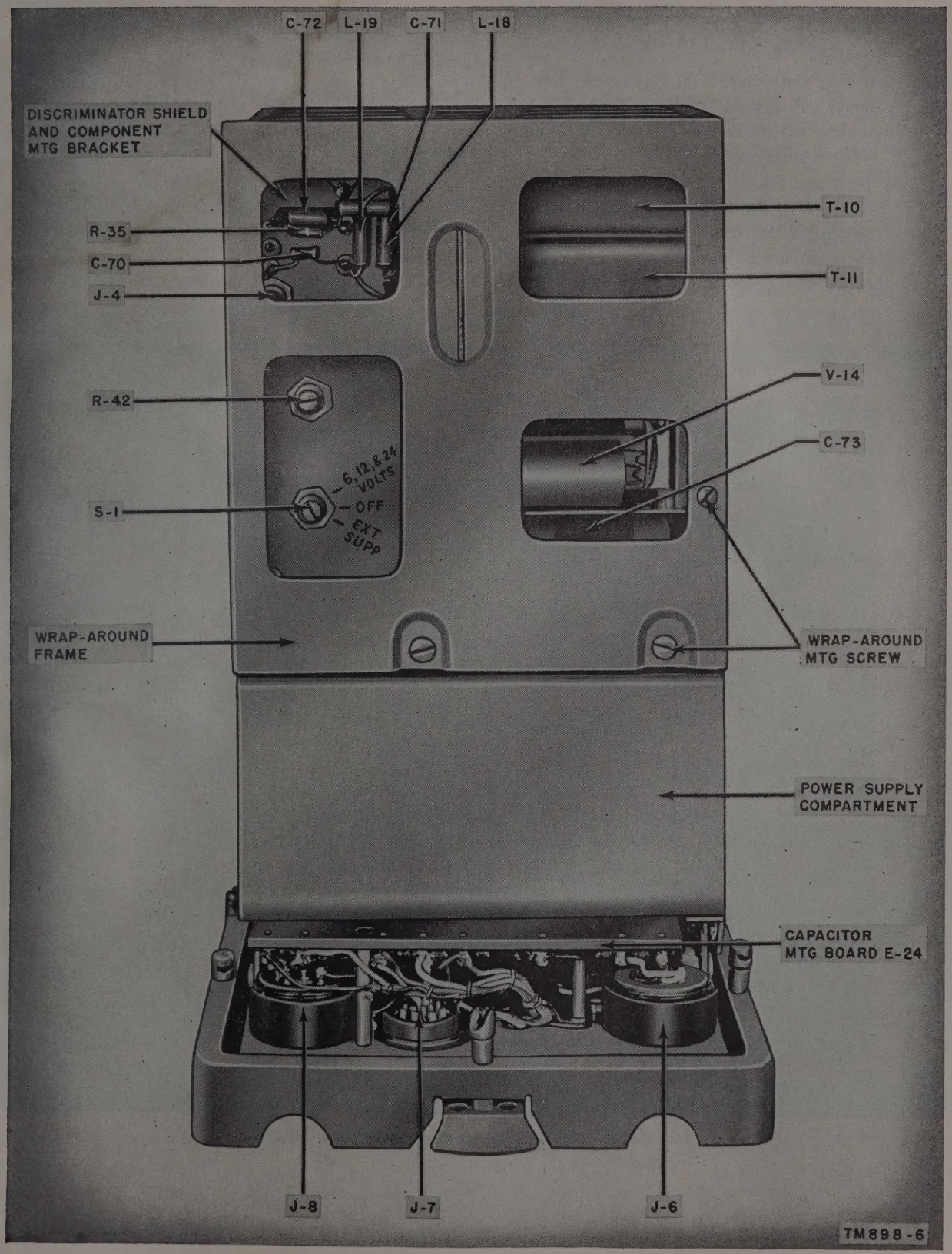



*Figure 86. Auxiliary receiver panel-chassis assembly, bottom view.*

(3) Remove the three green screws which fasten the top cover on the power supply chassis.

(4) Using the handle on the cover, lift the cover off with a straight upward movement. If the cover is stuck, pry gently with a small screw driver.

(5) Pull the vibrator from its socket with a straight upward movement. Do not rock or jiggle the vibrator while attempting to remove it. If necessary, use a small screw driver to pry the vibrator gently from its socket, but be careful not to enlarge the ring clip which holds the vibrator near the base.

## 159. Control Group AN/GRA–6

The lamps are the only pluck-out parts in either the local or remote control units for which running spares are supplied. The lamps are accessible from the rear of the front panels after the panel-chassis assemblies have been removed from the cases.

*a.* To gain access to the lamp in the local con-

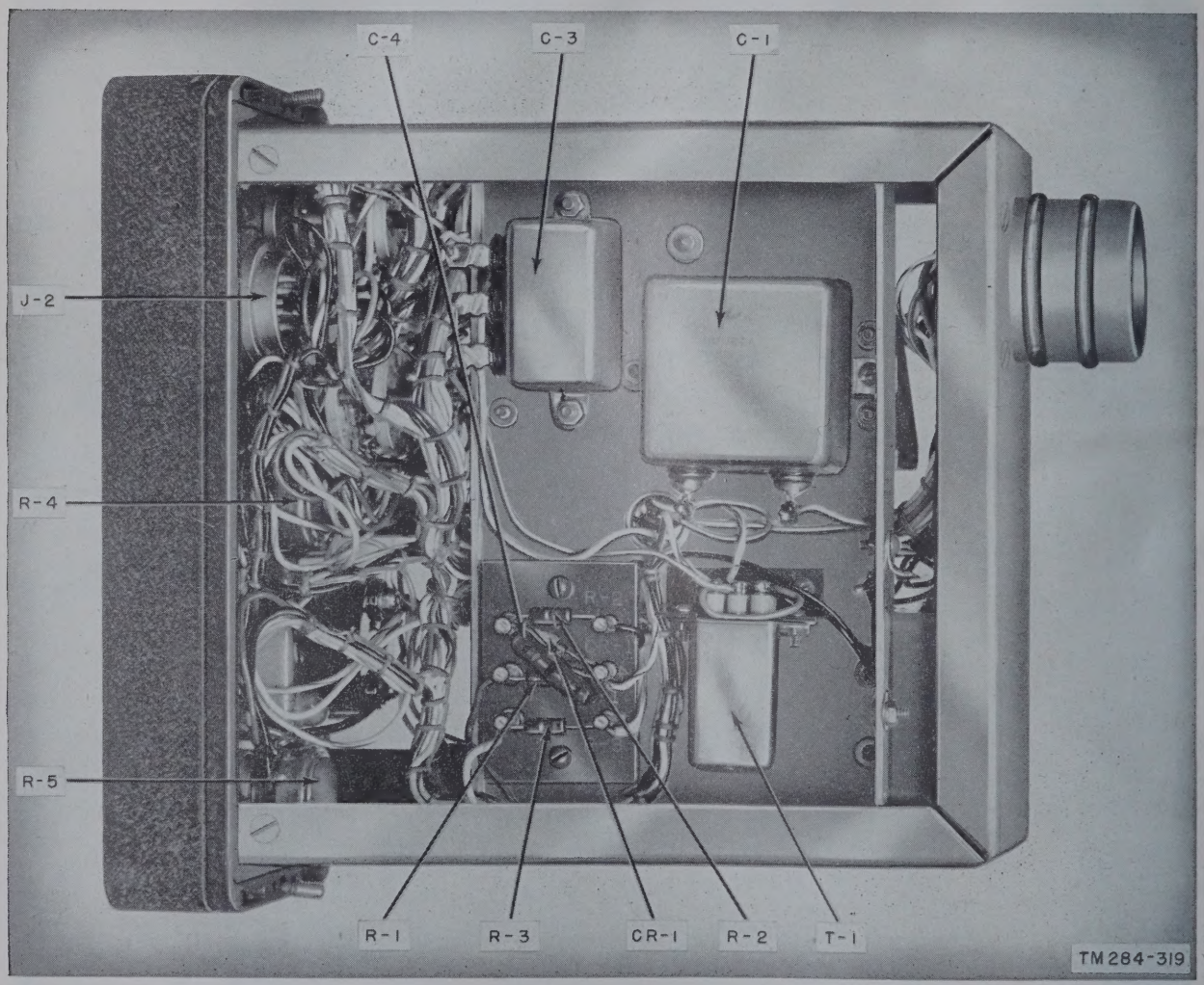



*Figure 87. Control C–435/GRC, bottom view of chassis.*

trol unit, unscrew the two wingnut fasteners at the edge of the front panel. Slide the unit out of its case. Slide the lamp socket (with lamp) out of the bakelite sleeve. The lamp then may be replaced.

*b.* To gain access to the lamp in the remote control unit, loosen the spring clips which secure the panel-chassis assembly in the case. Slide the unit out of its case. Replace the lamp as directed for the local unit in *a* above.

## 160. Control Box C–375/VRC and Control C–435/GRC

*a.* Control C–435/GRC has no pluck-out parts for which running spares are supplied. Refer to figures 87 and 88 and the parts lists in appendix II for minor repairs such as the removal of a lamp.

*b.* Figures 89 and 90 show two views of Control Box C–375/VRC. Refer to appendix II for descriptions of the called-out parts.

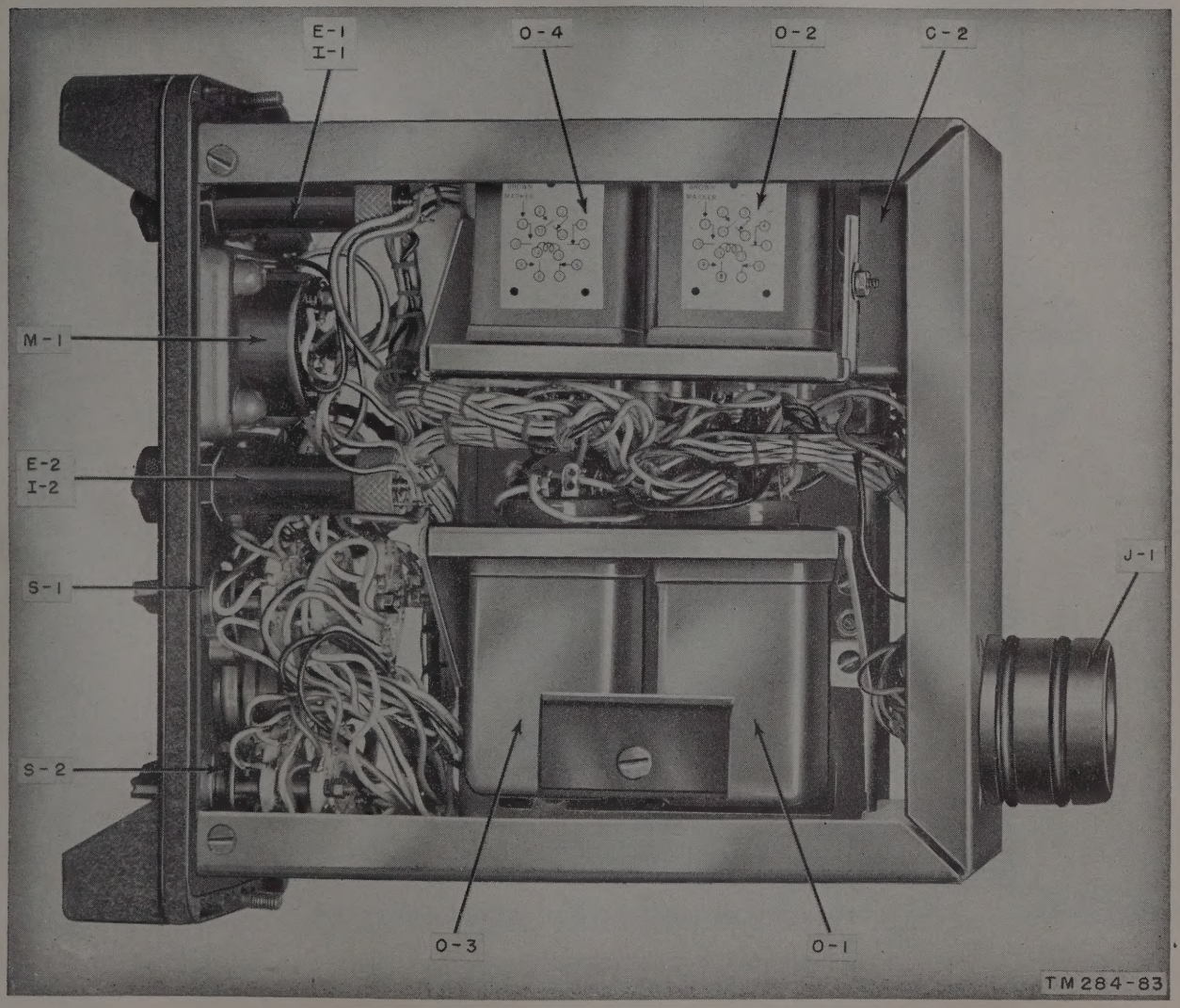



*Figure 88. Control C–435/GRC, top view of chassis.*

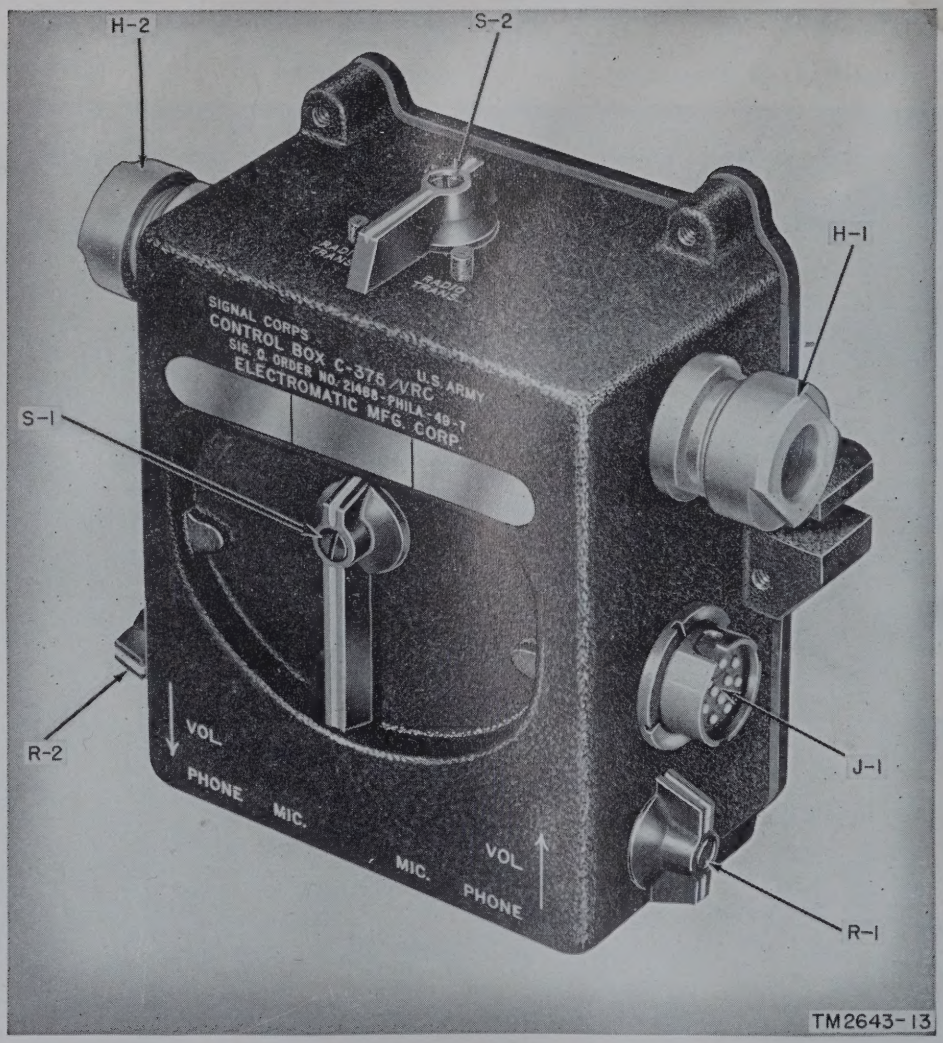



*Figure 89. Control Box C-375/VRC, right oblique view.*

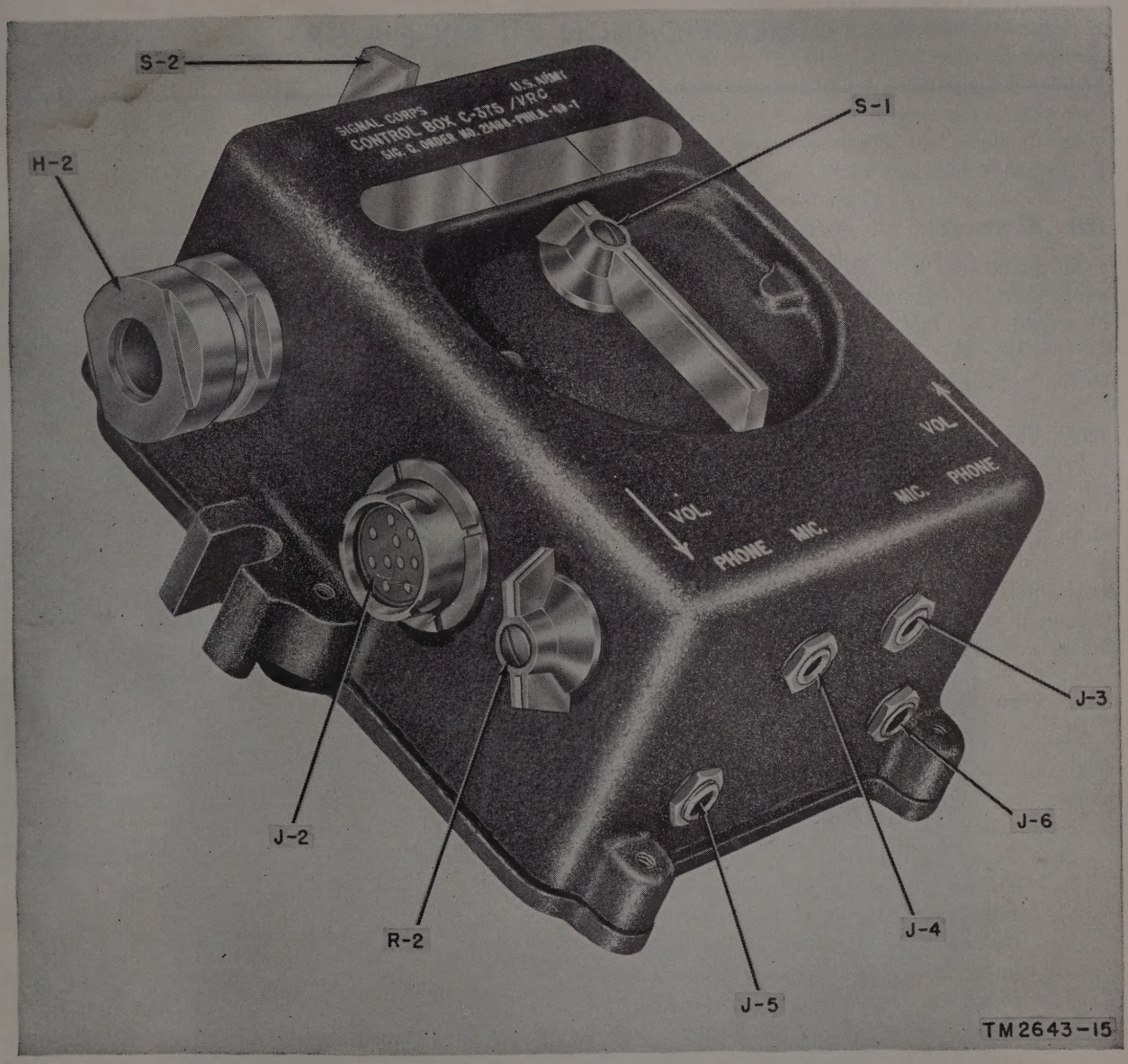



*Figure 90. Control Box C-375/VRC, left oblique view.*



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# CHAPTER 6

# MODIFICATION KIT MX–898/GR

## Section I. DESCRIPTION

### 161. General

Modification Kit MX–898/GR is auxiliary equipment which is not supplied as part of a basic radio set, but which extends the application of the set. For procurement information, refer to the appropriate Army Supply Manual.

### 162. Purpose and Use

Modification Kit MX–898/GR provides the components necessary for temporary operation of an individual receiver-transmitter when it is used in a field location or when vehicular power is not available. If Control Group AN/GRA–6 is used, remote as well as local operation of Set 2 is possible in a field installation.

### 163. Components

The components of Modification Kit MX-898/GR are listed and briefly described in *a* through *i* below.

*a. Generator G–8/GRC* (fig. 91).

(1) Generator G–8/GRC is a hand-operated source of power. It is a three-commutator generator with an actuating gear-train, radio-noise filter, and voltage regulator. The components are shock-mounted inside a waterproof, cast-magnesium case. The outside of the case contains openings for the operating cranks, the power connector, and the necessary straps for attachment to the mounting legs.

(2) The generator is capable of supplying all the voltages required for operation of the Set 1 receiver-transmitter when the hand crank is rotated at a rate of 50 to 70 rpm (revolutions per minute). The power output (85 watts) at the above speed is slightly lower than that delivered by the vehicular power supplies normally used as power sources. High voltages (400, 250, and 145 volts) and bias voltage (—20 volts) are obtained from one of the three independent armature windings. A second winding provides a medium voltage output (90 volts), and a third winding provides a low voltage output (6.3 volts).

(3) The crank of the generator is rotated




*Figure 91. Generator G–8/GRC.*

by a single operator seated on the seat leg (fig. 91). The generator should not be operated unless properly connected to Set 1 either directly to the Set 1 panel or through the battery box (Case CY–590/GRC) (fig. 92). Refer to TM 11–5037 for detailed information on the generator.

*b. Case CY–590/GRC* (fig. 92).

(1) Case CY–590/GRC is a metal battery box which can be used with several of the units comprising Radio Sets AN/GRC–3 through –8. The facilities provided by the various installations are given in the chart in paragraph 164*a*.

(2) The battery box contains five series-connected 1.5-volt Batteries BA–403/U and one 90-volt Battery BA–419/U which are held by a tray fastener to the case panel (fig. 94). To reach the battery tray, loosen the Dzus fasteners which connect the panel to the case. Slide the panel-tray assembly from the case (fig. 95).

(3) Two receptacles and a switch are provided on the front panel of the battery box (fig. 92). The receptacles are used for interconnecting the battery box with a receiver-transmitter (Set 1 or Set 2) and, in the case of Set 1, to the hand generator. The OFF-ON-REMOTE CONTROL switch makes or breaks the battery circuits to the receiver-transmitter in use. The REMOTE CONTROL position permits remote power control of the receiver-transmitter (Set 2 only) when Set 2 and Control Group AN/GRA–6 are used.

*c. Power Cable Assembly CX–1209/U.* This cable, one of the two supplied with Modification Kit MX-898/GR, is used in field installations of Set 1 which use both Generator G–8/GRC and Case CY–590/GRC and in field installations of Set 2. The cable contains a 9-pin and a 14-pin male plug. In Set 1 installations, the 9-pin plug mates with the receptacle of the battery box, the 14-pin plug, with the receptacle of the generator. In Set 2 installations the 9-pin plug mates with

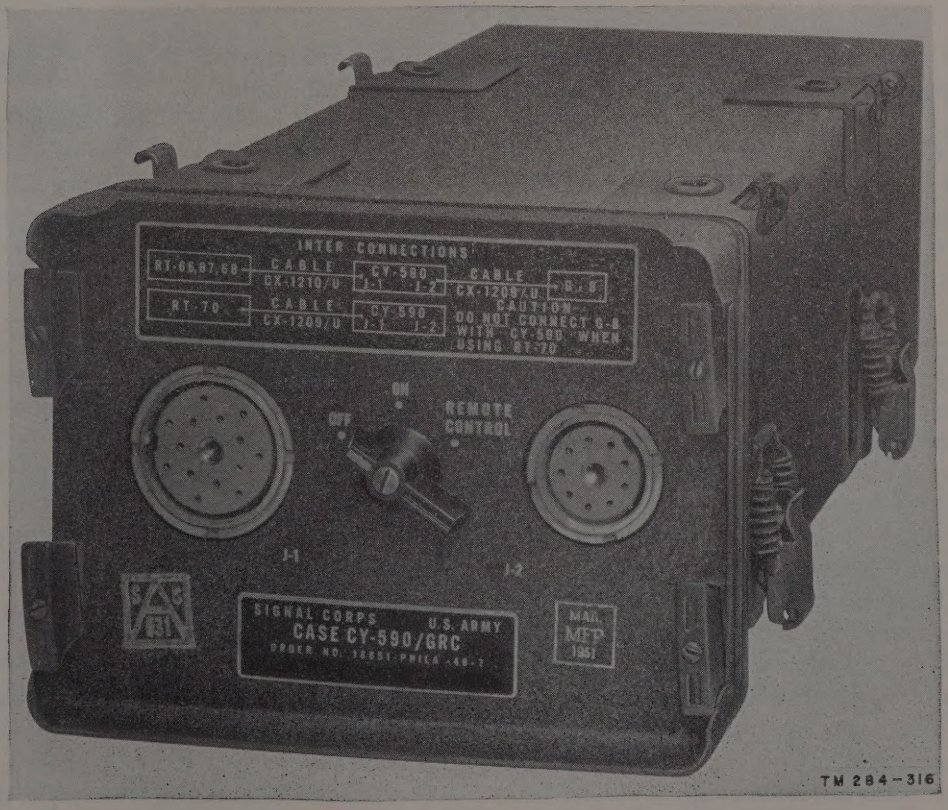



*Figure 92. Case CY–590/GRC.*

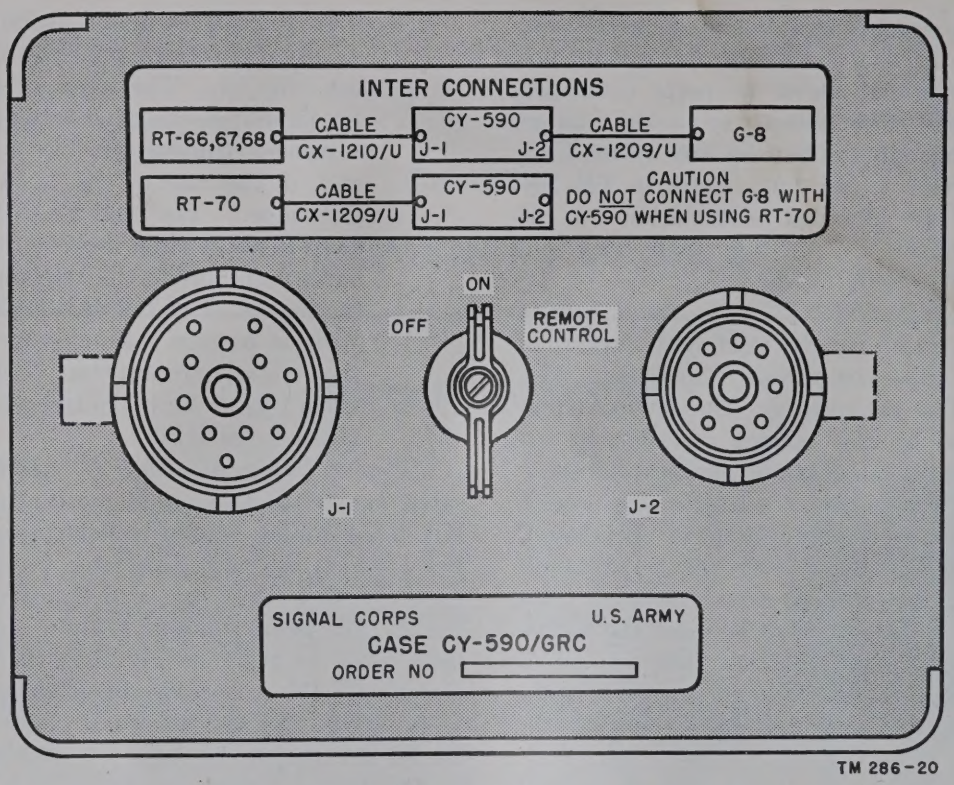



*Figure 93. Case CY–590/GRC, front panel.*

the POWER receptacle of Set 2; the 14-pin plug mates with the 14-terminal receptacle of the battery case.

*d. Power Cable Assembly CX–1210/U. This* cable is used in field installations of Set 1. The cable contains two 14-pin male plugs. Either plug is connected to the POWER IN receptacle of Set 1. The other plug is connected to the 14-terminal receptacle on the battery box (or on the generator if the battery box is not used).

*e. Mounting MT–652/GR.* Mounting MT–652/GR holds the antenna masts used in field installations. A raised section of the overhanging flange of the receiver-transmitter panel contains a socket which will fit the base of Mounting MT–652/GR. The base is held by a pin within the socket which engages a Dzus fastener slot on the bottom of the mounting. Two sockets are provided at right angles to allow alternate methods of securing the mast, depending on the more convenient position for the receiver-transmitter (right-side up or panel up). When the mounting is secured, the mast sections supplied with the modification kit can be screwed into the mounting. A rubber-covered lead-in wire, which is part of the mounting, connects the antenna to the ANT post on the receiver-transmitter.

*f. Handset H–33/PT.* Handset H–33/PT normally is used as the audio device of the receiver-transmitter. A cord permanently attached to the handset is terminated by a multiconnector which connects to the AUDIO receptacle on the receiver-transmitter. A description of the handset is given in paragraph 21.

*g. Mast Sections AB–22/GR, AB–23/GR, and AB–24/GR.* These antenna sections in various combinations, depending on the units being used, fit into Mounting MT–652/GR for field operation. The sections consist of copper-plated chrome-molybdenum steel tubes covered with a lusterless olive drab enamel. Each section is approximately 23 inches long, and can fit into any of the other sections.

*h. Bag CW–187/GR.* Canvas Bag CW-187/GR is supplied with the modification kit to accommodate the handset, antenna mounting, mast sections, cables, generator legs, and the technical manuals supplied with the generator. Web straps are provided for closing and carrying the bag.

*i. Bag CW–188/GR.* Two canvas Bags CW-

188/GR generally are supplied with each kit. (One bag is packed in the other.) One bag is used to carry the battery case and hand generator; the other, a receiver-transmitter.

## 164. Applications

*a.* Modification Kit MX–898/GR makes it possible to operate Set 1 and Set 2 as temporary, portable ground stations. The following chart lists the operational applications of the modification kit with the units of Radio Sets AN/GRC–3 through –8.

| Unit | Components | Cables required | Facilities |
|---|---|---|---|
| Set 1 | Generator and battery box*. | CX–1209/U and CX–1210/U. | Transmit and receive. |
| | Generator | CX–1210/U | Transmit and receive. |
| | Battery box | CX–1210/U | Receive. |
| Set 2 | Battery box | CX–1209/U | Transmit and receive. |

* When Set 1 is used with the generator and battery box, the generator should not be cranked during receiving.

*b.* If Control Group AN/GRA–6 is available, remote push-to-talk operation of Set 1 and remote push-to-talk and power control of Set 2 are possible.

## 165. Unpacking

The components of Modification Kit MX–898/GR are packed individually in cardboard containers and are shipped together in a single wooden case. Unpack as follows:

*a.* Remove the components from the case and remove the wrappings. Store the generator and cables in their original containers or wrappings.

*b.* Loosen the Dzus fasteners on the panel of the battery case. Remove the battery tray from the case (fig. 95).

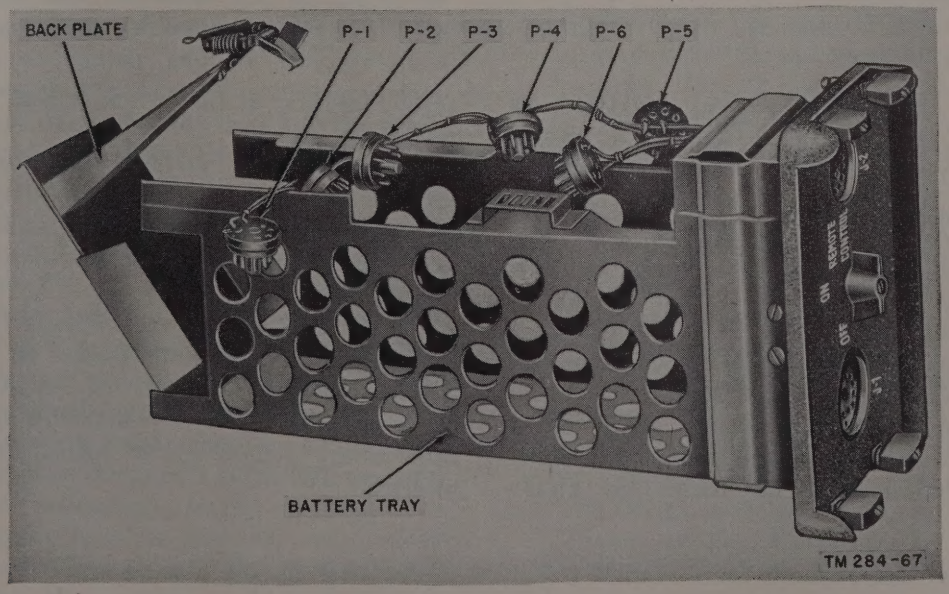
*c.* Install five 1.5-volt Batteries BA–403/U and one 90-volt Battery BA–419/U in the case. Connect the batteries as indicated in figure 95. Replace the battery tray.

*d.* Store the handset, antenna mounting, mast sections, and Power Cable Assembly CX–1209/U in Bag CW–189/GR. Store the bag in any convenient location in the vehicle.

*e.* Store the battery case and one Bag CW–188/GR in the other Bag CW–188/GR. Store the packed bag in some convenient location in the vehicle.

## 166. Controls (fig. 93)

The only operational controls for the field installation (exclusive of controls on the receiver-




*Case 94. Case CY–590/GRC, case and batteries removed.*

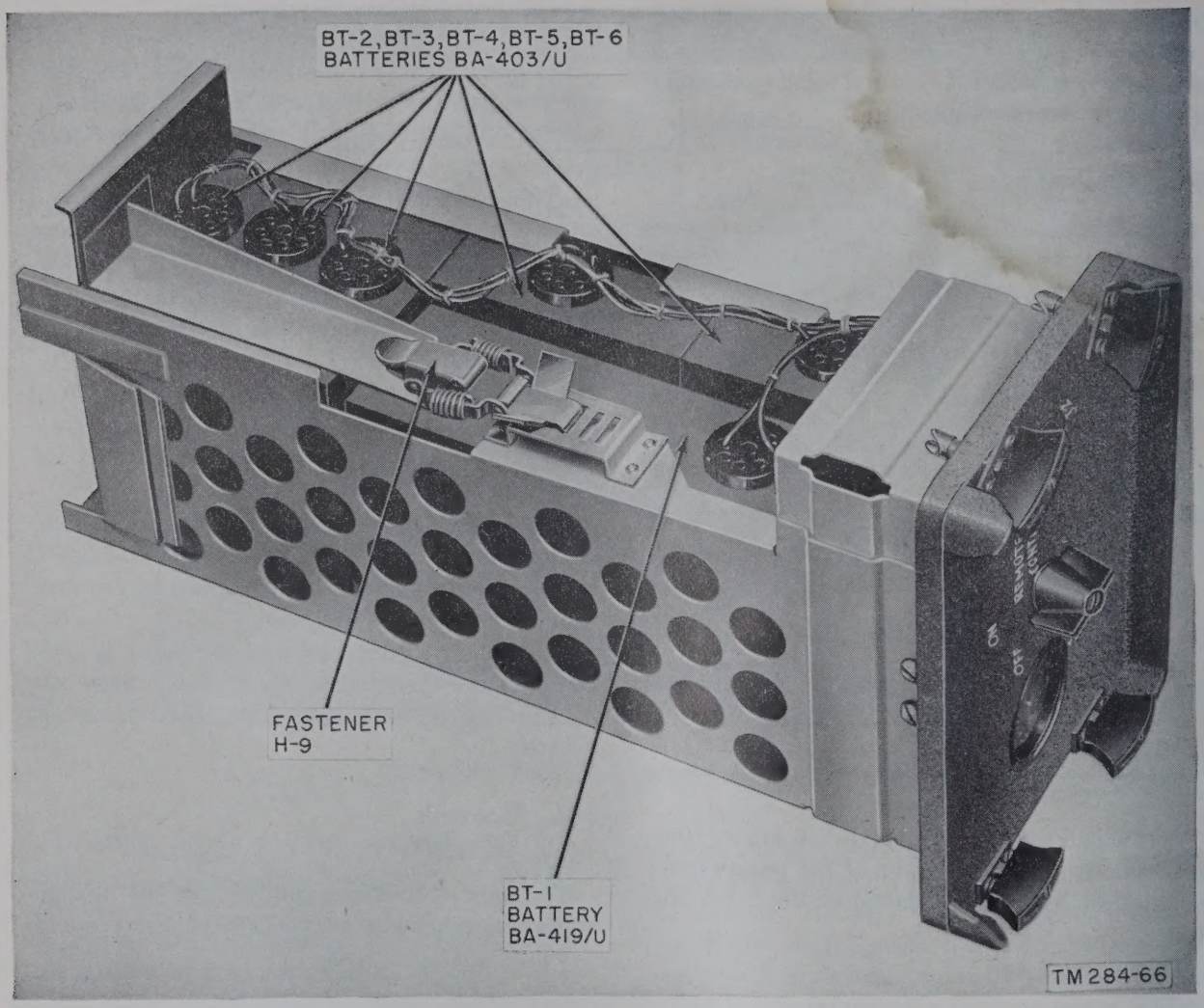



*Figure 95. Case CY–590/GRC, case removed and batteries installed.*

transmitters and Control Group AN/GRA–6) are the OFF-ON-REMOTE CONTROL switch of the battery box, the hand crank of the generator, and the push-to-talk switch of the handset.

*a. Off-On-Remote Control Switch* (fig. 93). When the switch is at OFF, the battery case supplies no power to the receiver-transmitter. When the switch is at ON, power is supplied to the receiver-transmitter. When the switch is at REMOTE CONTROL, power is supplied to Set 2 when the required switch settings are made at the local and remote control units of Control Group AN/GRA–6. (The REMOTE CONTROL position of the switch is used only with Set 2.)

*b. Crank GC–7.* Two hand cranks are supplied with the generator. They are inserted into the shaft of the geartrain and turned at a rate of 50 to 70 rpm whenever the operator desires to generate power.

*c. Push-To-Talk Button in Handset H–33/PT.* Pressing the push-to-talk button on a handset which is plugged into one of the AUDIO receptacles on the receiver-transmitter operates the transmitter. Releasing the button operates the receiver.

## 167. Set 1 With Generator G–8/GRC and Case CY–590/GRC
(fig. 96)

When Set 1 is used with the generator and battery box, push-to-talk operation is possible. If Control Group AN/GRA–6 is available, remote push-to-talk operation of the receiver-transmitter is also possible. However, since an operator must remain with the equipment to crank the generator, no provisions are made for remote control of power.

*a. Installation.* To install Set 1 for field operation using Generator G–8/GRC, proceed as follows:

(1) Remove Set 1 from Mounting MT–297/GR and pack it in the unused Bag CW–188/GR. Carry the three bags (two Bags CW–188/GR and one Bag CW–187/GR) to the location selected for field operation of the set.

(2) Set up the generator, battery case, and Set 1 receiver-transmitter as illustrated in figure 96. Refer to TM 11–5037 for detailed information about the generator. Turn the OFF-ON-REMOTE CONTROL switch of the battery case to the OFF position.

(3) Connect the 14-pin connector of Power Cable Assembly CX–1209/U to the generator and the other end to the 9-pin connector on the battery case.

(4) Connect either end of Power Cable Assembly CX–1210/U to the 14-pin connector on the battery case and the other end to the POWER IN receptacle on Set 1.

(5) Insert the antenna mounting into the hole at the top front of the receiver-transmitter. Turn the mounting clockwise to lock it in place. Connect the lead-in wire to the ANT connector. For Receiver-Transmitters RT–66/GRC and RT–67/GRC, assemble the five mast sections (one mast Section AB–22/GR, three Mast Sections AB–22/GR, and one Mast Section AB–24/GR) and screw the assembly into the antenna mount. For Receiver-Transmitter RT–68/GRC, assemble three of the mast sections (one each of Mast Sections AB–22/GR, AB–23/GR, and AB–24/GR) and screw the assembly into the antenna mount.

(6) Connect the handset to one of the AUDIO receptacles on the front of the receiver-transmitter.

(7) Set the OFF-ON-REMOTE CONTROL switch of the battery case to ON. The receiver section of Set 1 is then ready for operation.

(8) If Control Group AN/GRA–6 is to be used, connect the Set 1 cable (in the bank of Local Control C–434/GRC) to one of the Set 1 AUDIO receptacles. Disconnect the handset from the AUDIO receptacle of Set 1 ((6) above) and connect it to the AUDIO receptacle of the local control unit. Connect Remote Control C–433/GRC to the local unit by means of a telephone pair as described in paragraph 38. Connect a handset to the AUDIO receptacle of the remote unit.

*b. Operation at Panel.*

(1) When the above installation has been completed, signals received by Set 1 are heard by the operator. It is not necessary to crank the generator while receiving.

(2) To transmit, crank the generator at a speed of 50 to 70 rpm (approximately 1 revolution per second), press the push-to-talk switch, and speak into the mouthpiece. Release the switch (button) and stop cranking to listen.

*c. Operation with Control Group AN/GRA–6.*

(1) When the control group is used, it is possible to transmit from either the local or remote control unit if the proper switching is performed.

(2) To transmit from the local control unit, hold the LOCAL switch in the SET 1 position, signal an aide to begin cranking the generator, press the push-to-talk switch, and speak into the mouthpiece.

(3) To listen, release the push-to-talk and LOCAL switches and signal the aide to stop cranking the generator.

(4) To transmit from the remote control unit, signal the local operator to place the

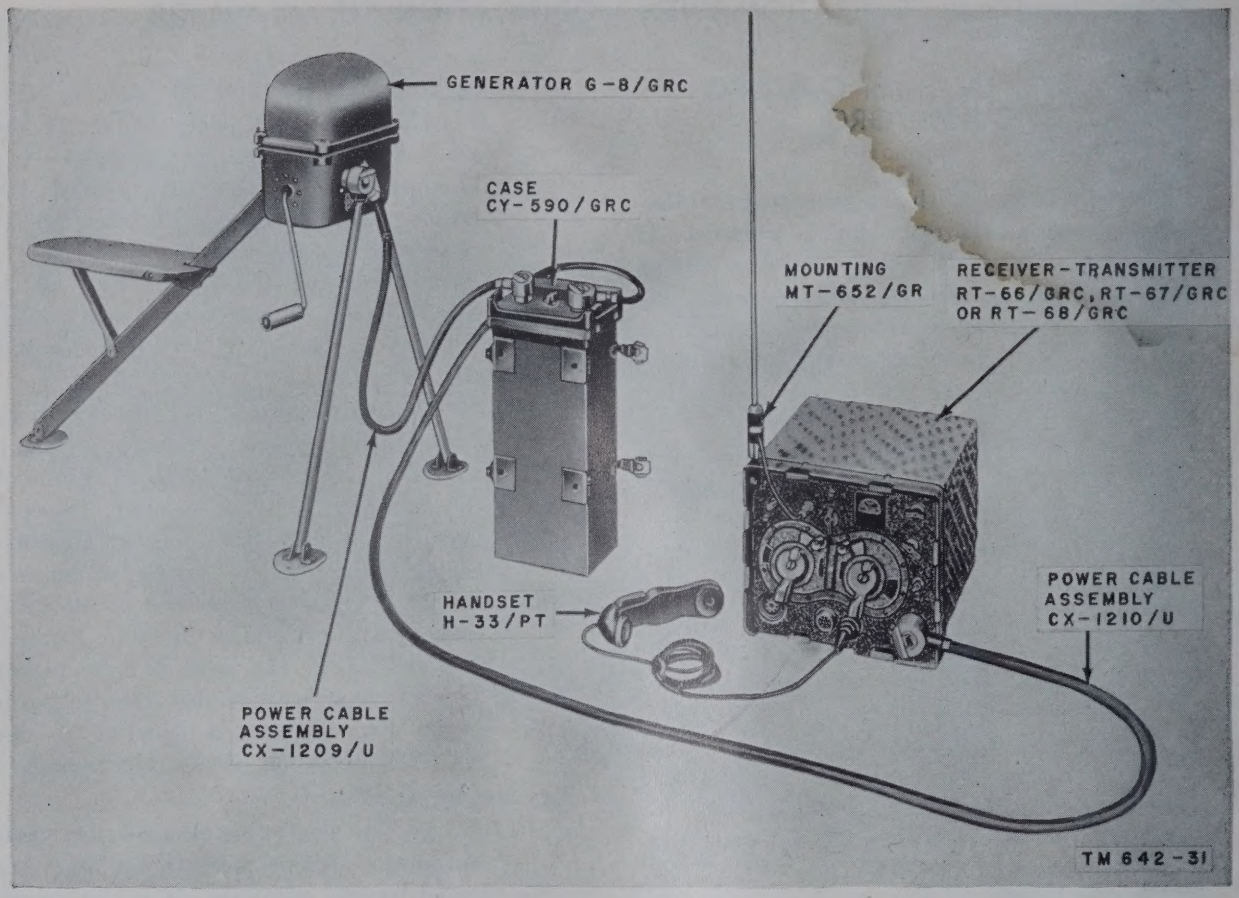



*Figure 96. Field installation of Set 1 with Generator G–8/GRC and Case CY–590/GRC.*

REMOTE switch in the SET 1 & 2 position and to begin cranking the generator. Set the SELECTOR switch of the remote control unit in the left-hand write-in position, press the push-to-talk switch on the handset, and speak into the mouthpiece.

(5) To listen, release the push-to-talk switch and signal the local operator to stop cranking the generator.

(6) To turn off power on the set, turn the OFF-ON-REMOTE CONTROL switch on the battery box to the OFF position.

## 168. Set 1 With Generator G–8/GRC
(figs. 95 and 96)

When Set 1 is supplied with power from Generator G–8/GRC alone, the operational facilities available are the same as those given in paragraph 167. However, this installation has the disadvantage of requiring constant cranking when the set is in operation, since the generator supplies both the receiver and transmitter voltages.

*a. Installation.* To install Set 1 for field operation using Generator G–8/GRC, proceed as outlined below:

(1) Remove Set 1 from Mounting MT–297/GR and pack it in Bag CW–188/GR. If the battery case is not going to be used, it can be removed from the other Bag CW–188/GR to lighten the burden. Take the three bags to the location selected for field operation of the set.

(2) Set up the generator and Set 1 as indicated in figure 98. Connect either end of Power Cable Assembly CX–1210/U to the generator and the other end to the POWER IN connector on Set 1. (When Set 1 is used with Generator G–8/GRC alone, the generator supplies all the operating voltages for both the receiver

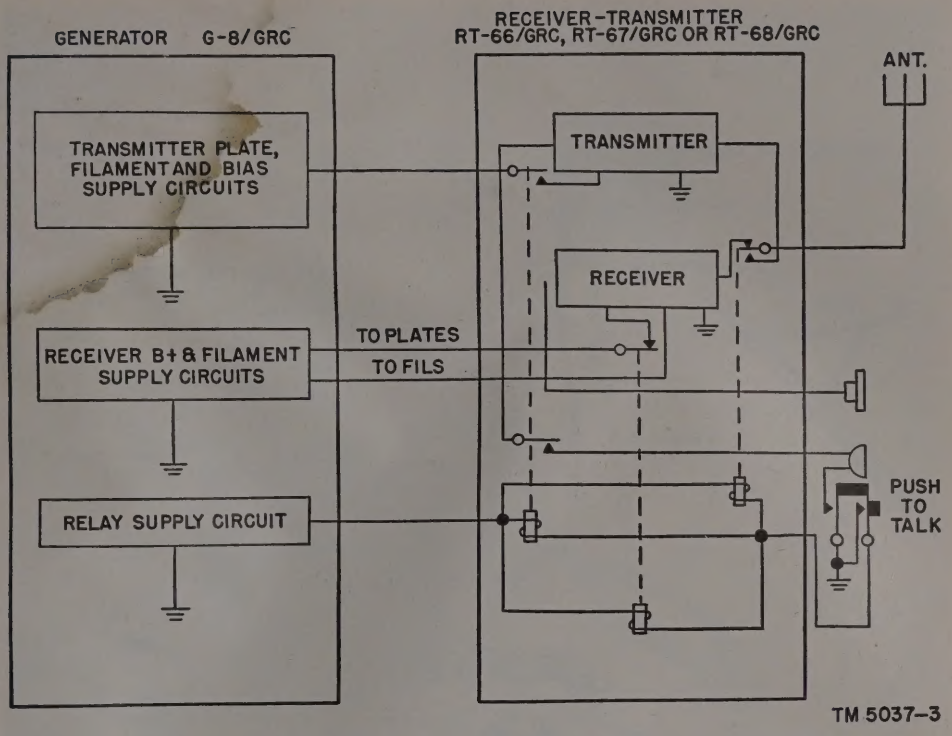



*Figure 97. Block diagram of Set 1 with Generator G–8/GRC.*

and the transmitter. The block diagram (fig. 97) illustrates the function of the generator).

(3) Connect the antenna mount and mast sections as directed in paragraph 167*a*(5). Connect the handset to an AUDIO connector on the Set 1 panel.

(4) If Control Group AN/GRA–6 is available, connect it to the installation as described in paragraph 167*a*(8).

*b. Operation.*

(1) When the installation has been completed as directed above and the generator is cranked, signals received by Set 1 may be heard by the operator.

(2) To transmit from the panel, crank the generator, press the push-to-talk button, and talk into the microphone.

(3) To turn off the equipment, stop cranking the generator.

(4) Operation with Control Group AN/GRA–6 is the same as given in paragraph 167.

## 169. Operation of Set 2 With Case CY–590/GRC
(fig. 99)

When Set 2 is operated as a temporary field installation with the battery box as a power supply, local push-to-talk operation is possible. If Control Group AN/GRA–6 is available, push-to-talk and power control of the receiver-transmitter is possible at either the local or remote unit (fig. 100).

*a. Installation.* To install Set 2 and Case CY–590/GRC for field operation, proceed as follows:

(1) Remove Set 2 from the vehicular mounting and pack it in Bag CW–188/GR. The generator unit and legs may be removed from the other two bags. Take the three bags to the location selected for field operation of the set. If remote control is desired, Control Group AN/GRA–6, packed in Bag CW–189/GR, also must be carried to the field site.

(2) Remove Set 2 from its case (par. 155)

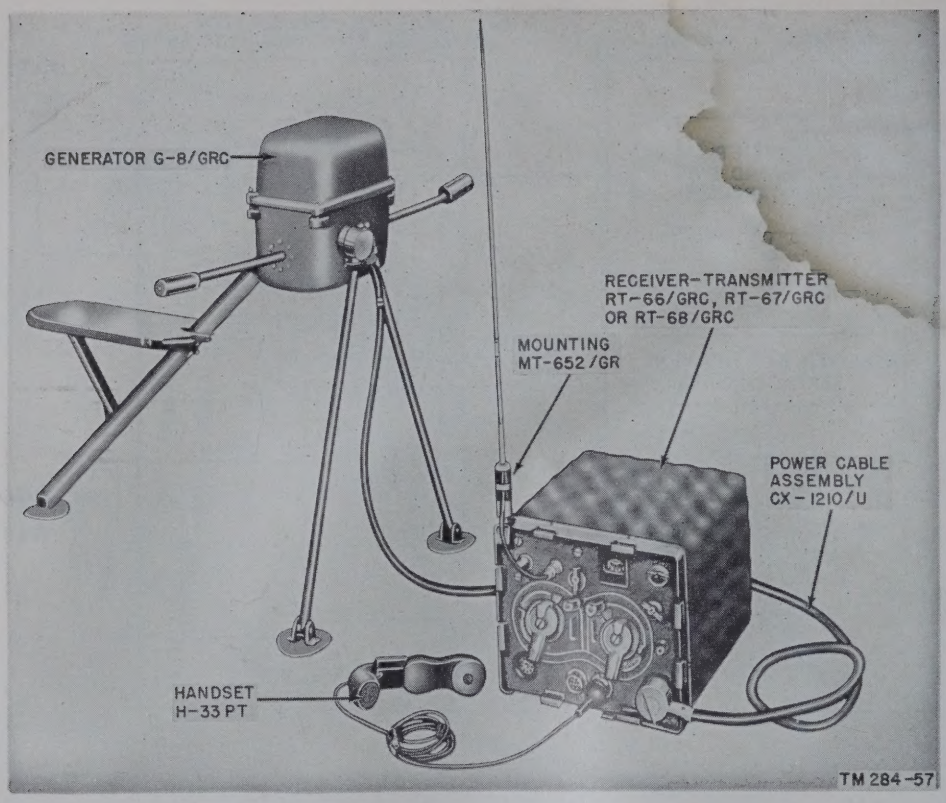



*Figure 98. Field installation of Set 1 with Generator G–8/GRC.*

and set the FIELD-VEH-TANK switch in the FIELD position (fig. 78). Replace the unit in its case.

(3) Set up the battery case and Set 2 at the desired location. Turn the OFF-ON-REMOTE CONTROL switch to OFF. Connect the 14-pin connector of Power Cable Assembly CX–1209/U to the 14-pin connector on the battery case; connect the 9-pin connector of the cable to the POWER receptacle on Set 2.

(4) Insert the antenna mount into the hole at the top right-hand corner of the Set 2 case and turn the mounting 90° to lock it in place. Connect the lead-in wire to the ANT connector on the Set 2 panel. Assemble Mast Sections AB–24/GR and AB–22/GR, and screw the assembly into the antenna mount.

(5) Connect the handset to the AUDIO connector on the front of the receiver-transmitter.

(6) Turn the OFF-ON-REMOTE CONTROL switch to ON. Tune the antenna circuit as outlined in paragraph 64. The receiver-transmitter is then ready for operation.

(7) If remote control is desired, adjust the receiver-transmitter SQUELCH control to the point where the receiver quiets. If squelch control is not desired, set the SQUELCH control to OFF.

(*a*) Remove the handset and connect Local Control C–434/GRC to the AUDIO connector with the Set 2 cable and plug (located in the compartment at the rear of the unit (fig. 34)). Connect the handset to the AUDIO receptacle on the local control unit.

(*b*) Connect the local and remote units by telephone wire as outlined in paragraph 38.

(*c*) Connect the handset to the AUDIO receptacle on the remote unit.

(*d*) Set the REMOTE switch on the local control unit in the SET 2 position and the OFF-ON-REMOTE CON-

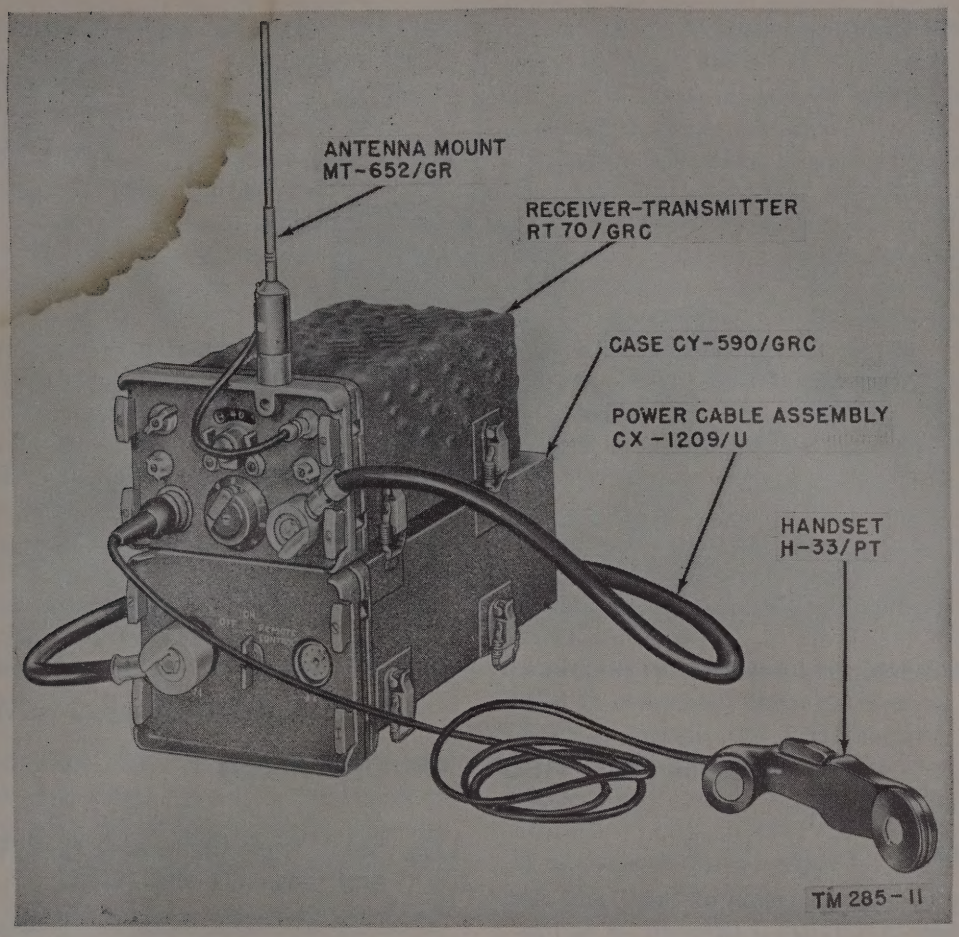



*Figure 99. Field installation of Set 2 with Case CY-590/GRC.*

TROL switch on the battery box in the REMOTE CONTROL position.

***Caution:*** Do not leave the switch on the battery case at REMOTE CONTROL when the set is not being used. This results in a slow battery drain.

*b. Operation at Panel.*

(1) When the above installation and switching have been completed, signals received by Set 2 may be heard at the panel and at the local and remote units (if used).

(2) To transmit from the panel, press the push-to-talk switch and speak into the mouthpiece.

(3) To remove power, turn the OFF-ON-REMOTE CONTROL switch to the OFF position.

*c. Operation With Control Group AN/GRA-6.*

(1) To transmit from Local Control C-434/GRC, hold the LOCAL switch in the SET 2 position, press the push-to-talk switch, and speak into the mouthpiece.

(2) To transmit from the remote control unit, turn the SELECTOR switch of the remote unit to the left-hand write-in position, press the push-to-talk switch, and speak into the mouthpiece. To monitor, release the push-to-talk switch.

(3) To remove power from the receiver-transmitter, turn the SELECTOR switch to the right-hand write-in position and press the push-to-talk switch for an instant, then release.

*Note.* Reversal of the telephone line connections will reverse the functions of the write-in positions on the SELECTOR switch.

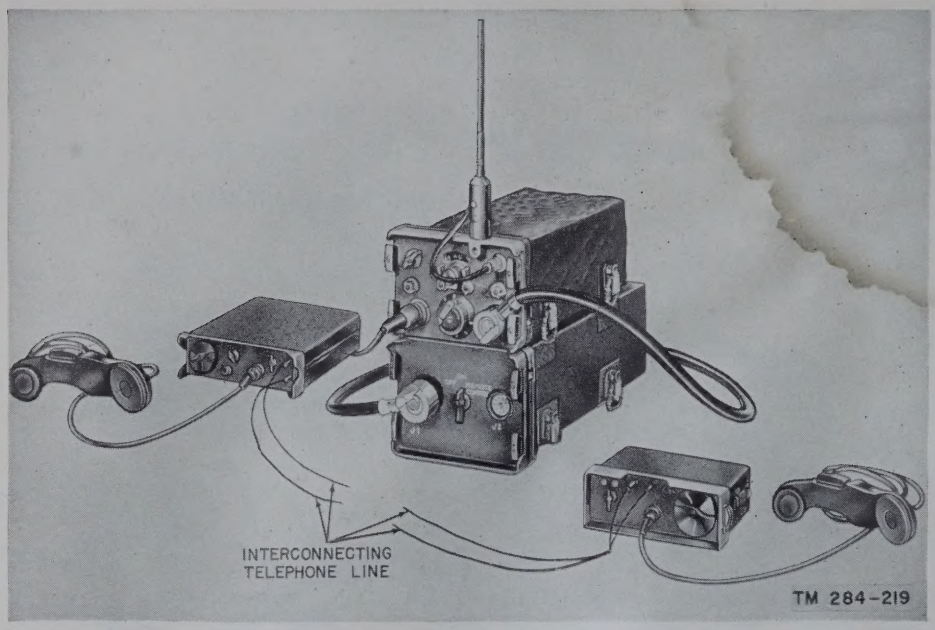



*Figure 100. Field installation of Set 2 with Case CY–590/GRC and Control Group AN/GRA–6.*

## Section III. THEORY OF OPERATION

### 170. General

The theory of field operation of Set 1 and Set 2 of Radio Sets AN/GRC–3 through –8 is limited to a discussion of the three interconnection diagrams for the various installations. Refer to paragraphs 167, 168, and 169 for information pertaining to the facilities available and to the installational and operational procedures. The theory and circuitry of Set 1, Set 2, and Control Group AN/GRA–6 which are the same for both the field and the vehicular installations are not repeated.

### 171. Set 1 With Generator G–8/GRC

The generator supplies the same voltages to receptacle J–309 of Set 1 in a field installation as the power supply (PP–109/GR or PP–112/GR) in a vehicular installation. Terminals H and J of receptacle J–309 in the receiver-transmitter are shorted by a jumper in Power Cable Assembly CX–1210/U. This duplicates the connection made in Mounting MT–297/GR in vehicular installations. Power Cable Assembly CX–1210/U is wired symmetrically so that either end may be plugged into the generator of Set 1.

### 172. Set 1 With Generator G–8/GRC and Case CY–590/GRC

Case CY–590/GRC serves two functions: First, it powers the receiver section of Set 1, the filament circuits at terminal L of J–309, and the plate circuits at terminal B of J–309. Second, it connects only those voltages from Generator G–8/GRC to the receiver-transmitter that power the transmitter section.

*a.* Resistor R–2 is a voltage-dropping resistor in series with the 7.5-volt battery (BA–403/U) in Case CY–590/GRC, which drops the voltage to 6.3 at the receiver filaments. (Resistors R–1 and R–3 do not function in this installation.) Switch S–1 (OFF-ON-REMOTE CONTROL) is a three-position switch. In the OFF position of this switch, the ground returns of the 90-volt battery (BA–419/U) and the 7.5-volt battery are open. In the ON position, these ground returns are completed. In the REMOTE CONTROL position (not used in this installation), these returns are set up for completion by switches and relays in Control Group AN/GRA–6.

*b.* The output voltages of Generator G–8/GRC are applied to the Set 1 receiver-transmitter through Power Cable Assembly CX–1209/U,

wiring connections between receptacles J–2 and J–1 of Case CY–590/GRC, and Power Cable Assembly CX–1210/U. The wiring in Power Cable Assembly CX–1209/U and between receptacles J–2 and J–1 has two functions: It establishes circuits from the generator to the transmitter section of the receiver-transmitter, and leaves open the circuits from the generator to the receiver section of the receiver-transmitter. The circuits left open are the receiver filament supply (terminal L of J–1 on the generator) and the receiver plate supply (terminal B of J–1 on the generator). These generator outputs are replaced by voltages supplied by the batteries in Case CY–590/GRC. The combination of voltages supplied by the batteries and those which are wired through from the generator appear at receptacle J–1 of Case CY–590/GRC. From there they are applied through Power Cable Assembly CX–1210/U to the receiver-transmitter.

## 173. Set With Case CY–590/GRC

*a. General.* Case CY–590/GRC (the battery box) is used as a power source for transmission and reception with Set 2. Power Cable Assembly CX–1209/U is used to connect the battery box to the Set 2 receiver-transmitter POWER receptacle (par. 169). If Control Group AN/GRA–6 is available, remote control of transmission and power is possible.

*b. Power Circuits.* The battery box supplies the following potentials: 90 volts for the Set 2 plate and screen circuits, 6.3 volts for the filaments, and 5.6 volts (approximately) for the receive-transmit relay. The circuits to the Set 2 POWER receptacle are shown on the interconnection diagram (fig. 103).

*c. Remote Control.* When Control Group AN/GRA–6 has been connected as directed under installation (par. 169), remote push-to-talk and power control is possible. The push-to-talk operation is the same as that described for the vehicular installation. However, the operator has only Set 2 available. Remote power control is possible because, with the ON-OFF-REMOTE CONTROL switch in the REMOTE position, the ground-return line for batteries BT–2 through BT–6 is completed through contacts of a relay (N/O–3) within the local control unit which can be controlled by the remote operator. These batteries are used to supply the filament, relay, and push-to-talk circuits. The control of the relay is the same as described for the vehicular in-

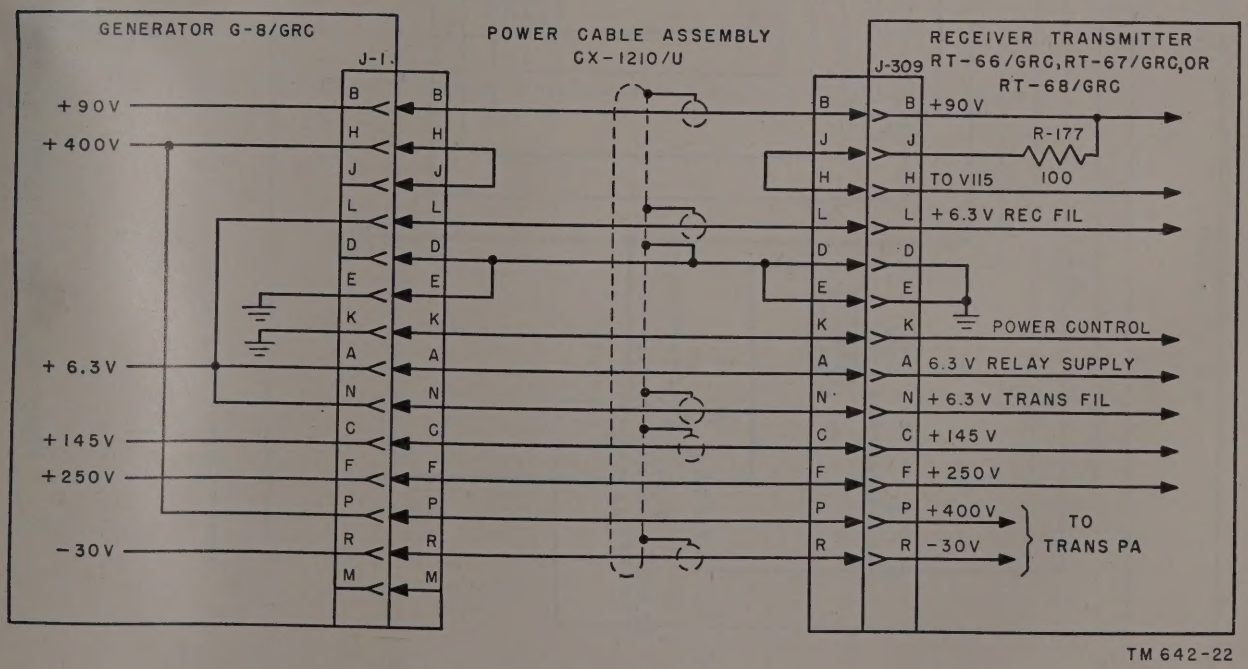



*Figure 101. Schematic diagram of connections between Generator G–8/GRC and Set 1.*

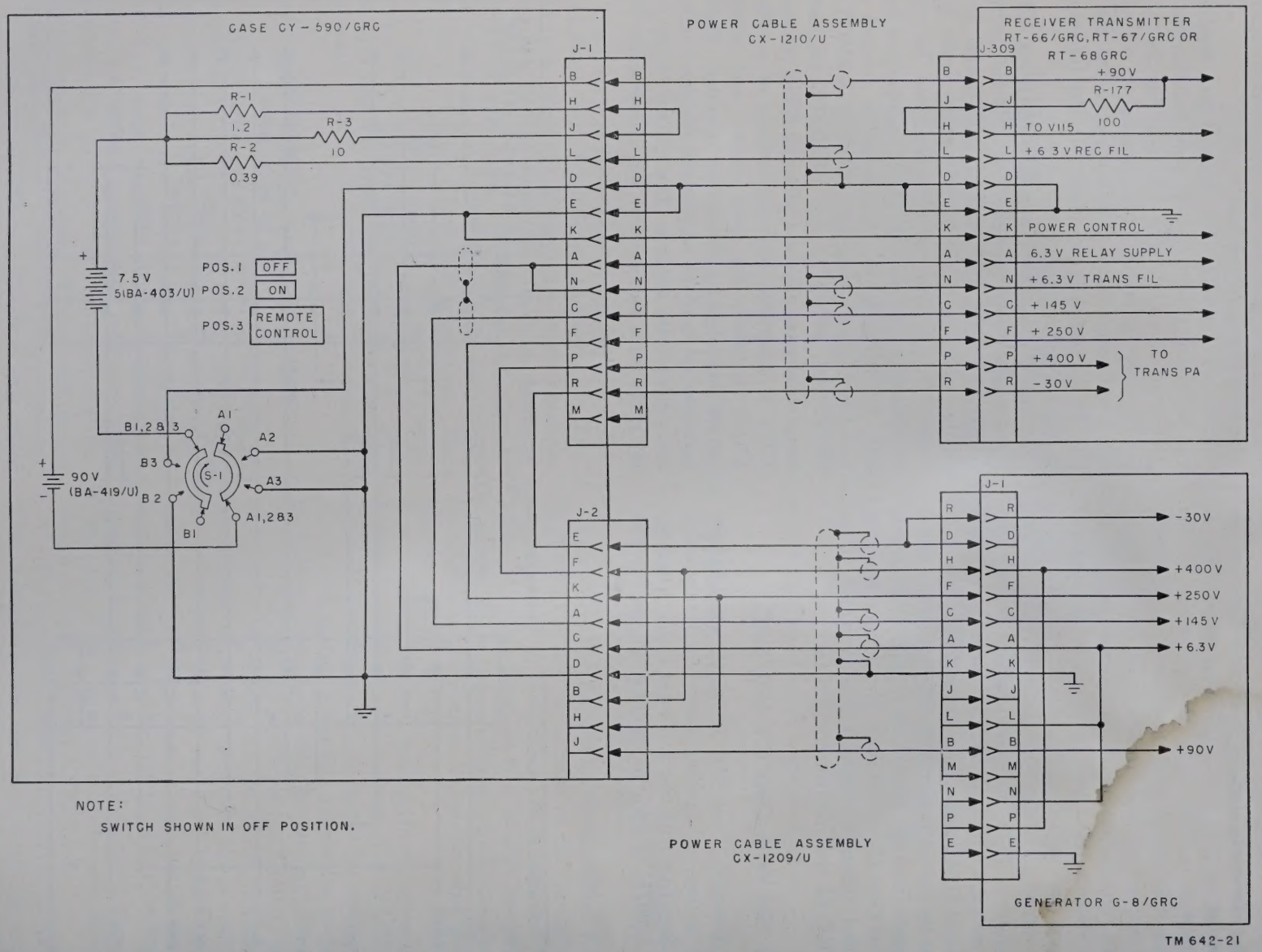



*Figure 102. Schematic diagram of connections between Generator G-8/GRC, Case CY-590/GRC, and Set 1.*

stallation (pars. 118 through 123). The ground-return line for 90-volt battery BT–1 is completed to a ground within the battery box through the ON and REMOTE CONTROL positions of switch S–1, section A. This ground is connected to the ground within the receiver-transmitter through terminals K and D of Power Cable Assembly CX–1209/U.

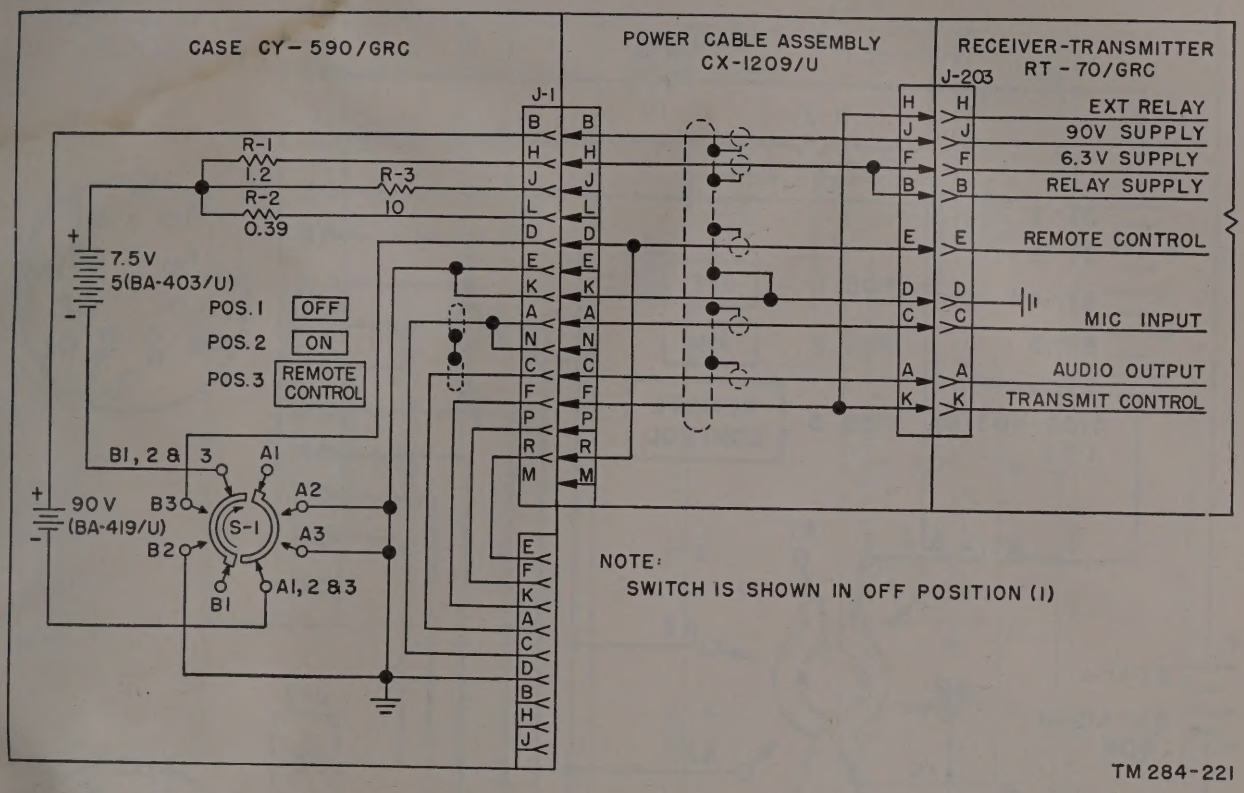
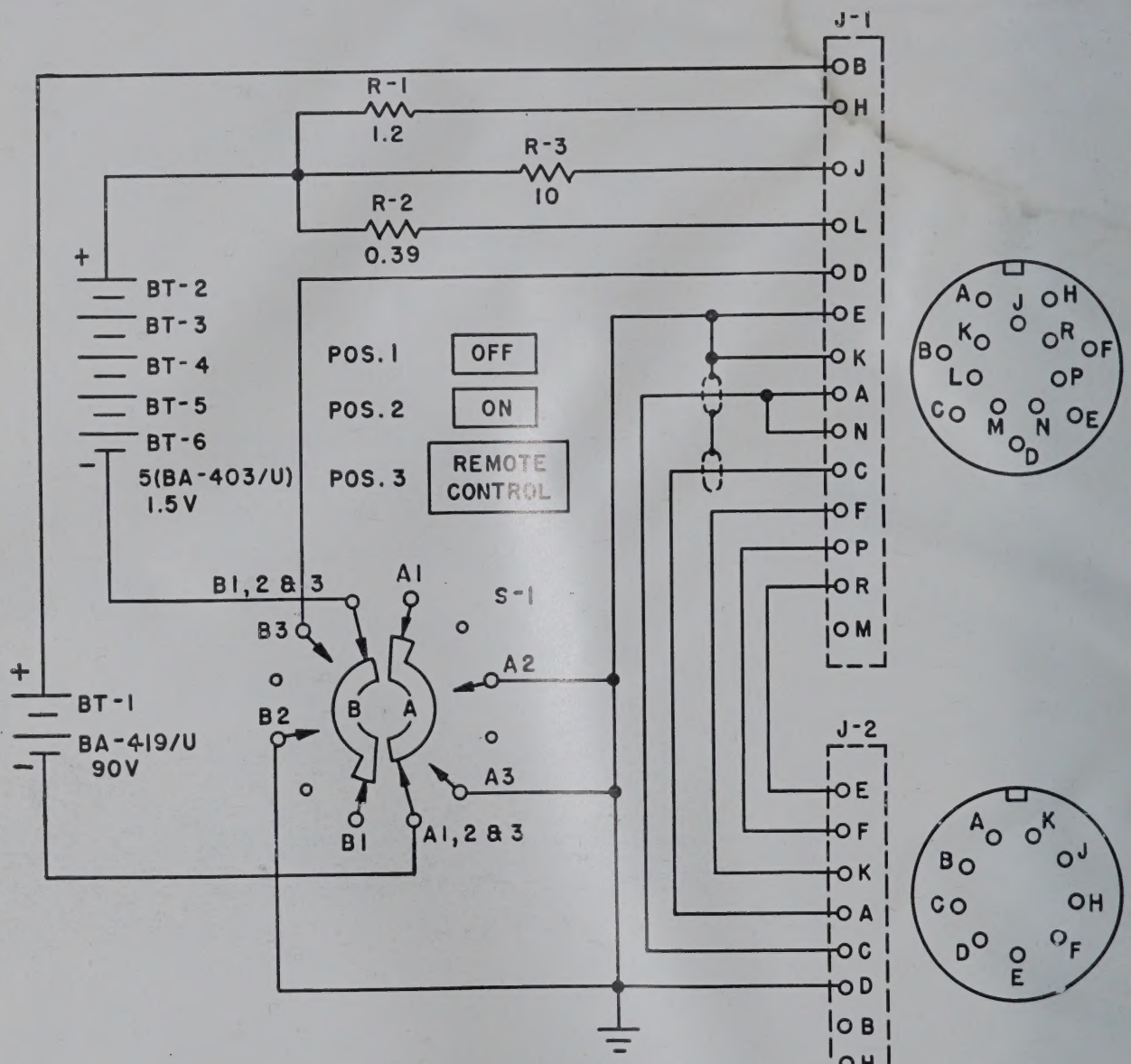


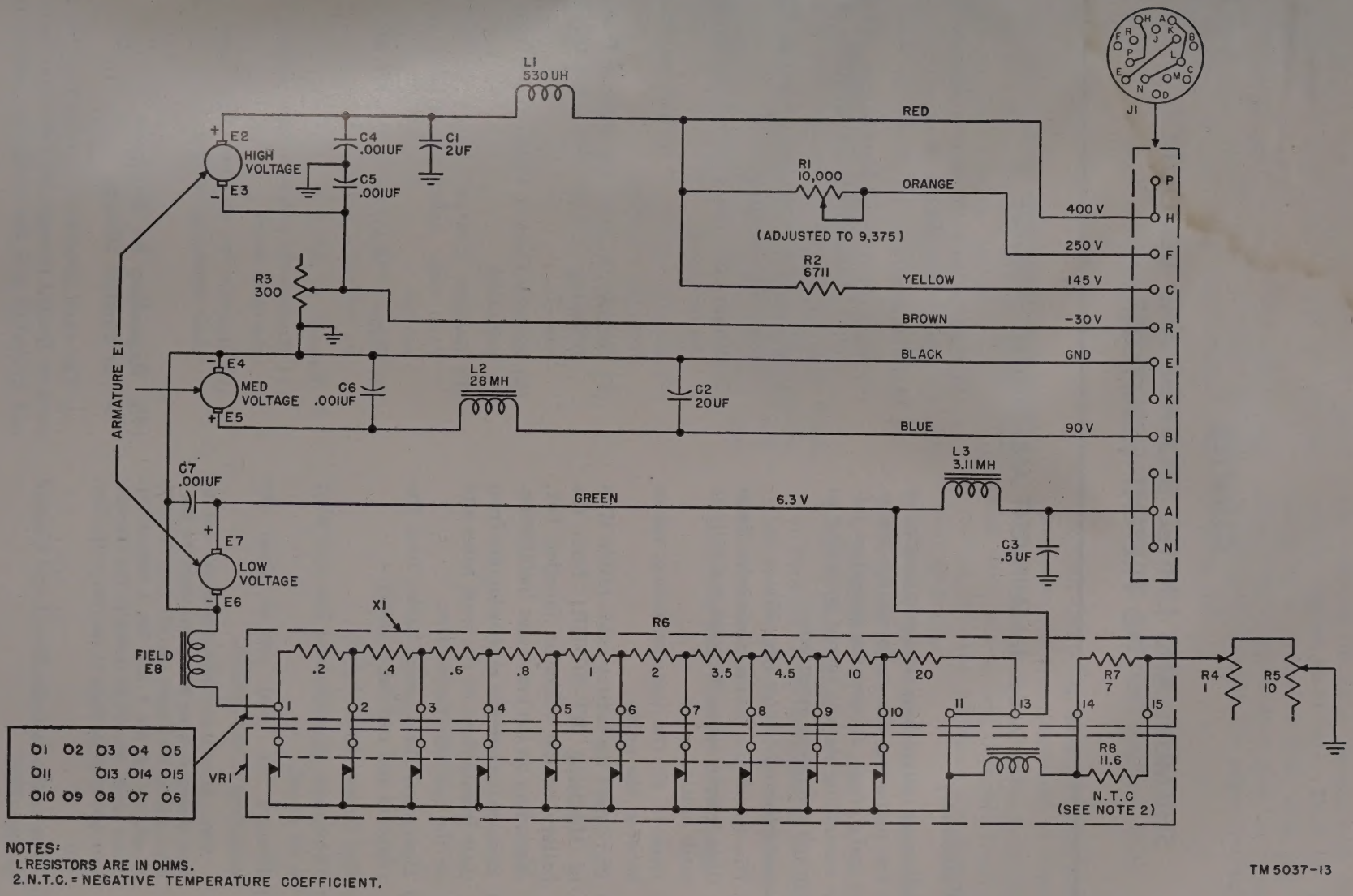

*Figure 103. Schematic diagram of connections between Case CY–590/GRC and Set 2.*




NOTE:
ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A, B ETC. AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

TM286-18

*Figure 104. Case CY–590/GRC, schematic diagram.*




NOTES:
1. RESISTORS ARE IN OHMS.
2. N.T.C. = NEGATIVE TEMPERATURE COEFFICIENT.

TM 5037-13

*Figure 105. Generator G–8/GRC, schematic diagram.*

# CHAPTER 7

# SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

## Section I. SHIPMENT AND LIMITED STORAGE

### 174. Disassembly

The following instructions are recommended as a guide for preparing the radio set for transportation and storage. Reverse the procedure followed in assembling the equipment according to the paragraph references given below.

*a. Disconnection of Cables* (fig. 33).

(1) Disconnect all audio accessories from their receptacles on the units and coil the cords neatly.

(2) Remove all the interconnecting cables between the units.

(3) Disconnect the battery cable (cable W–8 of Mounting MT–297/GR) from the battery or the vehicular junction box, depending on the particular installation.

(4) Remove the antenna cable adapters from their installations on the mast bases and on the receiver-transmitters.

(5) Disconnect the antenna cables from the adapters and coil them neatly.

*b. Control Group AN/GRA–6.*

(1) Disconnect the telephone line and wind it on a reel.

(2) Remove the local control from the mounting if so installed.

*Note.* If both the transmission unit and the local control unit are used, disconnect the Set 1 cable and the Set 2 cable (fig. 34) from the audio receptacles on Set 1 and Set 2 respectively. These cables should be stored in the compartment provided for them at the rear of the local unit.

(3) Remove the batteries from Local Control C–434/GRC.

(4) Remove the batteries from Remote Control C–433/GRC.

*c. Removal of Units.*

(1) Remove Receiver-Transmitter RT–70/GRC on the top of AF Amplifier AM–65/GRC.

(2) Remove AF Amplifier AM–65/GRC from the mounting.

(3) Remove the Set 1 power supply from the mounting.

(4) Remove the Set 1 receiver-transmitter from the mounting.

(5) Remove the auxiliary receiver from the mounting (in Radio Sets AN/GRC–3, –5, and –7).

(6) Remove Control C–435/GRC from the mounting.

(7) Remove Control Boxes C–375/VRC from their mounting surfaces on the vehicle.

(8) Remove Mounting MT–297/GRC from its vehicular installation.

*d. Removal of Antenna.*

(1) Remove the antenna mast sections from the mast bases.

(2) Remove the antenna mast bases from their mounting surface.

### 175. Repacking for Shipment or Limited Storage

*a.* The exact procedure in repacking for shipment or limited storage depends upon the material available and the conditions under which

the equipment is to be shipped or stored. Refer to paragraph 7 for a description of the original packing.

*b.* Whenever practicable, place a dehydrating agent such as silica gel inside the chests. Protect the chests with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

## Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

### 176. General

The demolition procedures outlined in paragraph 177 will be used to prevent the salvaging of this equipment by the enemy. Demolition of the equipment will be undertaken *only* upon order of the commander and will be as complete as time, equipment, and personnel permit.

### 177. Methods of Destruction

*a. Smash.* Smash the crystals, controls, tubes, coils, switches, capacitors, transformers, microphones, and headsets, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or any other heavy tools available.

*b. Cut.* Cut cords, cables, headsets, and wiring, using axes, handaxes, machetes, or bayonets.

*c. Burn.* Burn cords, cables, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary grenades.

*d. Bend.* Bend panels, cases, chassis, mounting, and antenna mast sections.

*e. Explosives.* If explosives are necessary use firearms, grenades, or TNT.

*f. Disposal.* Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

*g. Destruction.* Destroy everything.

# APPENDIX I

# REFERENCES

*Note.* For availability of items listed, check the SR 310–20 series. Check Department of the Army Supply Manual SIG 1 for Signal Corps Supply Manuals.

## 1. Army Regulations

| | |
|---|---|
| AR 380–5 | Military Security (Safeguarding Military Information). |
| AR 750–5 | Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation). |

## 2. Auxiliary Equipment and Test Equipment

| | |
|---|---|
| TM 11–289 | Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC. |
| TM 11–290 | Receiver-Transmitter RT–70/GRC. |
| TB 11–2627–2 | Tube Test Data Cards for Use with Tube Testers I–177, I–177A, I–177B, and with Tube Socket Adapter Kit MX–949/U. |
| NAVSHIPS 91269 | Electronic Multimeter ME–6A/U. |
| TM 11–300 | Frequency Meter Sets SCR–211–A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL. |
| TM 11–303 | Test Sets I–56–C, I–56–D, I–56–H, and I–56–J. |
| TM 11–307 | Signal Generators I–72–G, H, J, K, and L. |
| TM 11–321 | Test Set I–56–E. |
| TM 11–898 | Radio Receivers R–108/GRC, R–109/GRC, and R–110/GRC. |
| TM 11–2524 | Oscillators I–151–A and I–151–E. |
| TM 11–2526 | Oscilloscope BC–1060–A. |
| TM 11–2613 | Voltohmmeter I–166. |
| TM 11–2624B | Voltohmmeters, TS–294/U, TS–294B/U, and TS–294C/U. |
| TM 11–2626 | Test Unit I–176, I–176–A, and I–176–B. |
| TM 11–2627 | Tube Tester I–177 and I–177–A. |
| TM 11–2684A | Audio Oscillator TS–382A/U. |
| TM 11–4700 | Electrical Indicating and Measuring Instruments. Repair Instructions. |
| TM 11–5018 | Signal Generator TS–588A/U. |
| TM 11–5036 | Power Supplies PP–109/GR and PP–112/GR. |
| TM 11–5037 | Generator G–8/GRC. |
| TM 11–5038 | Control Group AN/GRA–6. |
| TM 11–5039 | AF Amplifier AM–65/GRC. |
| TM 11–5040 | Power Supplies PP–281/GRC, PP–282/GRC, and PP–448/GRC. |
| TM 11–5044 | Frequency Meter TS–174B/U. |
| TM 11–5527 | Multimeter TS–352/U. |

## 3. Painting, Preserving, and Lubrication

| | |
|---|---|
| TB SIG 13 | Moistureproofing and Fungiproofing Signal Corps Equipment. |
| TB SIG 69 | Lubrication of Ground Signal Equipment. |

| | |
|---|---|
| TB SIG 212 | Low Temperature Lubricants for Meteorological Equipment. |
| TM 9–2851 | Painting Instructions for Field Use. |

## 4. Camouflage, Decontamination, and Demolition

| | |
|---|---|
| FM 5–20 | Camouflage, Basic Principles. |
| FM 5–25 | Explosives and Demolitions. |
| TM 3–220 | Decontamination. |

## 5. Other Publications

| | |
|---|---|
| FM 24–18 | Field Radio Techniques. |
| FM 72–20 | Jungle Warfare. |
| SB 11–6 | Dry Battery Supply Data. |
| SR 310–20 Series | Indexes of Military Publications. |
| SR 725–405–5 | Preparation and Submission of Requisitions for Signal Corps Supplies. |
| SR 700–45–5 | Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247). |
| SR 745–45–5<br>NAVY SHIPPING GUIDE, ARTICLE 1850–4<br>AFR 71–4 | Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army) and AF–MC–U2 (Air Force)). |
| TB SIG 4 | Methods for Improving the Effectiveness of Jungle Radio Communication. |
| TB SIG 25 | Preventive Maintenance of Power Cords. |
| TB SIG 54 | Working through Jamming with Frequency Modulated Radio Sets. |
| TB SIG 66 | Winter Maintenance of Signal Equipment. |
| TB SIG 72 | Tropical Maintenance of Ground Signal Equipment. |
| TB SIG 75 | Desert Maintenance of Ground Signal Equipment. |
| TB SIG 123 | Preventive Maintenance Practices for Ground Signal Equipment. |
| TB SIG 178 | Preventive Maintenance Guide for Radio Communication Equipment. |
| TB SIG 219 | Operation of Signal Equipment at Low Temperatures. |
| TB SIG 223 | Field Expedients for Wire and Radio. |
| TM 9–2857 | Storage Batteries, Lead-Acid Type. |
| TM 11–314 | Antennas and Antenna Systems. |
| TM 11–415 | Dry Batteries. |
| TM 11–430 | Batteries for Signal Communication, except those pertaining to Aircraft. |
| TM 11–455 | Radio Fundamentals. |
| TM 11–466 | Radar Electronic Fundamentals. |
| TM 11–483 | Suppression of Radio Noises. |
| TM 11–496 | Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets. |
| TM 11–660 | Introduction to Electronics. |
| TM 11–661 | Electrical Fundamentals (Direct Current). |
| TM 11–681 | Electrical Fundamentals (Alternating Current). |
| TM 11–4000 | Trouble Shooting and Repair of Radio Equipment. |

# APPENDIX II

# IDENTIFICATION TABLE OF PARTS

## 1. General

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis such as a specific T/O&E, T/A, SIG 7&8, list of allowances of expendable material, or other supply basis. The Department of the Army Supply Manuals applicable to the equipment covered in this manual are SIG 7&8–MT–297/GR and SIG 7&8–C–375/VRC. For an index of available supply manuals in the Signal portion of the Department of the Army Supply Manual, see the latest issue of SIG 1.

## 2. Identification Table of Parts for Radio Set AN/GRC–3

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO SET AN/GRC–3: gnd and vehicular radio comm equip; fm voice; xmtr output 20 w; 20.0 to 27.9 mc, 80 channels and 47 to 58.4 mc, 115 channels; 12 v dc; Sig dwg No. SC–D–28083–C. | F-m receiver-transmitter (12-volt). | 2S12–3/12 |
| | RADIO SET AN/GRC–3: gnd and vehicular radio comm equip; fm voice; xmtr output 20 w; 20.0 to 27.9 mc, 80 channels and 47 to 58.4 mc, 115 channels; 24 v dc; Sig dwg No. SC–D–28083–C. | F-m receiver-transmitter (24-volt). | 2S12–3/24 |
| | TECHNICAL MANUAL TM 11–284 | | Order thru AGC |
| | ADAPTER UG–273/U: 1 round male cont 1 end, 1 split female cont other end; straight type; Navy dwg No. RE49F389. | Connector for r-f (antenna) cable. | 2Z308–273 |
| | ADAPTER UG–306/U: 1 round male cont 1 end, 1 round female cont other end; 90° angle type ANRFCCC dwg No. RE49F429. | Connector for r-f (antenna) cable. | 2Z308–306 |
| | AF AMPLIFIER AM–65/GRC: 350 ma output; oper from 6 v, 12 v, 24 v bat. or 135 v dc input; Sig dwg No. SC–DL–40826. | Audio amplifier | 2C449–65 |
| | CABLE, special purpose: electrical; Cordage Co–212; portable installation; 1 inner cond No. 8 AWG, 1 concentric cond No. 8 AWG; Army spec No. 71–1618. | Connecting cable from battery (or vehicular junction box) to mounting. | 3E2212 |
| | CABLE, special purpose: electrical; Special Purpose Cable WM–46/U; audio components interconnecting; 8 No. 20 AWG and 2 No. 16 AWG stranded tinned copper cond; spec MIL–S–2486. | Connecting cable from mounting to control box. | 1B3020–10 |
| | CABLE ASSEMBLY, power: electrical; RF Cable Assembly CG–568/U; uses Wire W–142; 6′ 6″ lg o/a; Sig dwg No. SC–C–23605. | Connecting cable from RT–66/GRC to mast base. | 3E6015–568.1 |

## 2. Identification Table of Parts for Radio Set AN/GRC–3—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | CABLE ASSEMBLY, RF: RF Cable Assembly CG–530/U; uses Radio Frequency Cable RG–62A/U; 6′ lg o/a; Sig dwg No. SC–C–23604. | Connecting cable from RT–67/GRC, RT–68/GRC, and RT–70/GRC to mast bases. | 3E6015–530.72 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1211/U; uses 11 cond JAN type WL1(7)20C and 3 cond JAN type WL2–½(19)16C; ¼″ lg excluding terminations Sig dwg No. SC–C–23607. | Connecting cable from Set 1 power supply to Set 1. | 3E6000–1211.1 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1213/U; uses 8 cond JAN type WL1(7)20C; 1″ lg excluding terminations; Sig dwg No. SC–C–23606. | Connecting cable from interphone amplifier to Set 2. | 3E6000–1213.1 |
| | CONTROL C–435/GRC: manual control; power requirements 90 v, or 24 v dc; Sig dwg No. SC–D–41596. | Retransmission unit | 2C684–135 |
| | CONTROL BOX C–375/VRC: interphone and radio push-to-talk opn 7″ lg x 6 13/16″ wd x 3¼″ d; Sig spec No. 71–3327. | Control box | 2C666–375 |
| | CONTROL GROUP AN/GRA–6: for local and remote control of radio sets; Army Spec No. 71–3329. | Local and remote control units | 2C684A–6 |
| | HANDSET H–33/PT, H–33A, B, C/PT: receiver impedance 300 ohms; mike impedance 40 ohms; freq 300–4000 cyc. | Talking and monitoring | 2B620–33 |
| | MAST BASE AB–15/GR: ant. support; 15¼″ lg x 3⅛″ dia o/a; Sig dwg No. SC–D–12517. | Antenna support | 2A2081–15 |
| | MAST SECTION AB–22/GR: ant. sect.; 23½″ lg, tapers from 11/32″ to 7/32″ OD .012″ thk wall; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–22 |
| | MAST SECTION AB–24/GR: ant. sect.; 23½″ lg x 7/32″ dia x .012″ wall thk w/3/16″ steel ball on tapered end; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–24 |
| | MAST SECTIONS MS–116, MS–116–A: ant. sect.; 39½″ lg x .393″ dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2416 |
| | MAST SECTIONS MS–117, MS–117–A: ant. sect.; 39½″ lg, tapers from .373″ to .252″ dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2417 |
| | MAST SECTIONS MS–118, MS–118–A: ant. sect.; 39½″ lg, tapers from .246″ to .130″, 3/16″ dia round steel ball on .130″ end; Sig dwg No. SC–D–12521. | Antenna sections | 2A2418 |
| | MOUNTING MT–297/GR: for radio set components; 33 5/8″ lg x 13 3/8″ wd x 4 13/16″ h o/a; Army spec No. 71–3326. | Mounting for radio set | 2Z6763–297 |
| | POWER SUPPLY PP–109/GR: vibrator type; dc output for low and h power xmtr and rec open; input 12.6 v, 11 amp dc; 12 7/8″ lg x 7 5/16″ wd x 9¼″ h o/a; Sig dwg No. SC–D–40891, group No. 1. | Power supply for Set 1 (12-volt system). | 3H4497–109 |

## 2. Identification Table of Parts for Radio Set AN/GRC–3—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | POWER SUPPLY PP–112/GR: vibrator type; dc output for low and h power xmtr and rec opn; input 25.2 v, 7.5 amp dc; 12⅞″ lg x 7⅝″ wd x 9¼″ h o/a; Sig dwg No. SC–D–40891, group No. 2. | Power supply for Set 1 (24-volt system). | 3H4497–112 |
| | POWER SUPPLY PP–281/GRC: sync vibrator type; output 138 v, .12 amp dc; input 12.6 v, 2.14 amp dc; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg No. SC–DL–40653. | Power supply for interphone amplifier and for auxiliary receiver (12-volt system). | 3H4497–281 |
| | POWER SUPPLY PP–282/GRC: sync vibrator type; output 138 v, .12 amp dc; input 25.2 v, 1.17 amp dc; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg No. SC–DL–40654. | Power supply for interphone amplifier and for auxiliary receiver (24-volt system). | 3H4497–282 |
| | RADIO RECEIVER R–108/GRC: fm; for comm; freq range 20 to 28 mc, 1 band; input 6 v, 12 v, 24 v or 6.3, 90 v dc; 12 13/16″ lg x 7¼″ wd x 9″ h o/a; Army spec No. 71–3321. | F-m receiver | 2C4180–108 |
| | RECEIVER-TRANSMITTER RT–66/GRC: vehicular, gnd; fm; freq range 20 to 27.9 mc; output approx 22 w max; input 5.6 v, 6.3 v, 27 v, 85 v, 105 v, 250 v; and 450 v dc; 12⅞″ lg x 11¼″ wd x 9¼″ Army spec No. 71–3320. | F-m receiver-transmitter | 2C5130–66 |
| | RECEIVER-TRANSMITTER RT–70/GRC: vehicular, gnd; fm; freq range 47 to 58.4 mc; output approx 400 mw; input 6 v and 90 v dc; 7⅜″ wd x 4 13/16″ h x 12 15/16″ d o/a; Army spec No. 71–3323. | F-m receiver-transmitter | 2C5130–70 |
| | STUFFING TUBE: feedthru type; steel; 1 11/32″ lg x 1 3/16″ dia o/a; Appleton part No. CGB–61007. | Feedthrough on some vehicular junction boxes for battery cable W–8. | 6Z3147 |
| | WIRE, electrical: Buna S ins and jacket; single cond No. 14 AWG stranded tinned copper; IPCEA std S–19–81 modified per Army spec No. 71–4945. | | 1B814.140 |

## 3. Identification Table of Parts for Radio Set AN/GRC–4

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO SET AN/GRC–4: gnd and vehicular radio comm equipment; fm voice; xmtr output 20 w; 20.0 to 27.9 mc, 80 channels and 47 to 58.4 mc, 115 channels; 12 v dc; Sig dwg No. SC–D–28407. | F-m receiver-transmitter (12-volt). | 2S12–4/12 |
| | RADIO SET AN/GRC–4: gnd and vehicular radio comm equipment; fm voice; xmtr output 20 w; 20.0 to 27.9 mc, 80 channels and 47 to 58.4 mc, 115 channels; 24 v dc; Sig dwg No. SC–D–28407. | F-m receiver-transmitter (24-volt). | 2S12–4/24 |
| | TECHNICAL MANUAL TM 11–284 | | Order thru AGC |
| | ADAPTER UG–273/U: 1 round male cont 1 end and 1 split female cont other end; straight type; Navy dwg No. RE49F389. | Connector for r-f (antenna) cable | 2Z308–273 |

## 3. Identification Table of Parts for Radio Set AN/GRC–4—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | ADAPTER UG–306/U: 1 round male cont 1 end, 1 round female cont other end; 90° angle type; ANRFCCC dwg RE49F429. | Connector for r-f (antenna) cable | 2Z308–306 |
| | AF AMPLIFIER AM–65/GRC: 1800 mw and 350 mw output; oper from 6 v, 12 v, 24 v bat. or 135 v dc input; Sig dwg No. SC–DL–40826. | Audio amplifier | 2C449–65 |
| | CABLE, special purpose: electrical; Cordage CO–212; portable installation; 1 inner cond No. 8 AWG and 1 concentric cond No. 8 AWG; Army spec No. 71–1618. | Connecting cable from battery (or vehicular junction box) to mounting. | 3E2212 |
| | CABLE, special purpose: electrical; Special Purpose Cable WM–46/U; af interconnecting; 8 No. 20 AWG and 2 No. 16 AWG stranded copper tinned cond; spec MIL–S–2486. | Connecting cable from mounting to control box. | 1B3020–10 |
| | CABLE ASSEMBLY, power: electrical; RF Cable Assembly CG–568/U; uses Wire W–142; 6′ 6″ lg o/a; Sig dwg No. SC–C–23605. | Connecting cable from RT–66/GRC to mast base. | 3E6015–568.1 |
| | CABLE ASSEMBLY, RF: RF Cable Assembly CG–530/U; uses Radio Frequency Cable RG–62A/U; 6′ lg o/a; Sig dwg No. SC–C–23604. | Connecting cable from RT–67/GRC, RT–68/GRC, and RT–70/GRC to mast bases. | 3E6015–530.72 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1211/U; uses 11 cond JAN type WL1(7)20C and 3 cond JAN type WL2–½(19)16C; ¾″ lg excluding terminations; Sig dwg No. SC–C–23607. | Connecting cable from Set 1 power supply to Set 1. | 3E6000–1211.1 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1213/U; uses 8 cond WL1(7) 20C; 9/16″ lg excluding terminations; Sig dwg No. SC–C–23606. | Connecting cable from interphone amplifier to Set 2. | 3E6000–1213.1 |
| | CONTROL C–435/GRC: manual control; power requirements 90 v, 12 v, or 24 v dc; Sig dwg No. SC–D–41596. | Retransmission unit | 2C684–435 |
| | CONTROL BOX C–375/VRC: 7″ lg x 6 13/16″ wd x 3¼″ h; Sig Spec No. 71–3327. | Control box | 2C666–375 |
| | CONTROL GROUP AN/GRA–6: for local and remote control of radio sets; Army Spec No. 71–3329. | Local and remote control units | 2C684A–6 |
| | HANDSET H–33/PT, H–33A,B,C/PT: bat. powered; 300 ohms impedance; freq range 300–4000 cyc; Army spec No. 71–3331. | Talking and monitoring | 2B620–33 |
| | MAST BASE AB–15/GR: ant. support; 15¼″ lg x 3⅛″ dia o/a; Sig dwg No. SC–D–12517. | Antenna support | 2A2081–15 |
| | MAST SECTION AB–22/GR: ant. sect.; 23½″ lg, tapers from 11/32″ to 7/32″ OD: Sig dwg No. SC–D–13614. | Antenna section | 2A2450–22 |
| | MAST SECTION AB–24/GR: ant. sect.; 23½″ lg x 1/32″ dia x .012″ wall thick; w/3/16″ steel ball on tapered end; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–24 |

## 3. Identification Table of Parts for Radio Set AN/GRC–4—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | MAST SECTIONS MS–116, MS–116–A: ant. sect.; 39½″ lg x .393 dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2416 |
| | MAST SECTIONS MS–117, MS–117–A: ant. sect.; 39½″ lg, tapers from .373 to .252 dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2417 |
| | MAST SECTIONS MS–118, MS–118–A: ant. sect.; 39½″ lg, tapers from .246″ to .130″, 3/16″ dia round steel ball on .130 end; Sig dwg No. SC–D–12521. | Antenna sections | 2A2418 |
| | MOUNTING MT–297/GR: for radio set components; 33⅝″ lg x 13⅜″ wd x 4 13/16″ h o/a; Army spec No. 71–3326. | Mounting for radio set | 2Z6763–297 |
| | POWER SUPPLY PP–109/GR: vibrator type; dc output for low and h power xmtr and rec open; input 12.6 v, 11 amp dc; 12⅞″ lg x 7 5/16″ wd x 9¼″ h; Sig dwg No. SC–D–40891 group No. 1. | Power supply for Set 1 (12-volt system). | 3H4497–109 |
| | POWER SUPPLY PP–112/GR: vibrator type; dc output for low and h power xmtr and rec opn; input 25.2 v, 7.5 amp dc; 12⅞″ lg x 7 5/16″ wd x 9¼″ h; Sig dwg No. SC–D–40891 group No. 2. | Power supply for Set 1 (24-volt system). | 3H4497–112 |
| | POWER SUPPLY PP–281/GRC: sync vibrator type; output 138 v, .12 amp dc; input 12.6 v, 2.14 amp dc; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h o/a Sig dwg No. SC–D–40653. | Power supply for interphone amplifier (12-volt system). | 3H4497–281 |
| | POWER SUPPLY PP–282/GRC: sync vibrator type; output 138 v, .12 amp dc; input 25.2 v, 1.17 amp dc; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg SC–DL–40654. | Power supply for interphone amplifier (24-volt system). | 3H4497–282 |
| | RECEIVER-TRANSMITTER RT–66/GRC: vehicular, gnd; fm; output approx 22 w max; freq range 20 to 27.9 mc; input 5.6 v, 6.3 v, 27 v, 85 v, 105 v, 250 v; and 450 v dc; 12⅞″ lg x 11¼″ wd x 9¼″ h o/a; Army Spec No. 71–3320. | F-m receiver-transmitter | 2C5130–66 |
| | RECEIVER-TRANSMITTER RT–70/GRC: vehicular, gnd; fm; output approx 400 mw; freq range 47 to 58.4 mc; input 6 v and 90 v dc; 7⅜″ wd x 4 13/16″ h x 12 15/16″ d o/a; Army spec No. 71–3323. | F-m receiver-transmitter | 2C5130–70 |
| | STUFFING TUBE: feedthru type; steel; 1 11/32″ lg x 1 3/16″ dia o/a; Appleton part No. CGB–61007. | Feedthrough on some vehicular junction boxes for battery cable W–8. | 6Z3147 |
| | WIRE, electrical: Buna S ins and jacket; single cond No. 14 AWG stranded tinned copper; IPCEA std S–19–81 modified per Army spec No. 71–4945. | ---------- | 1B814.140 |

## 4. Identification Table of Parts for Radio Set AN/GRC–5

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO SET AN/GRC–5: gnd and vehicular radio comm equip; fm voice; xmtr output 20 w; 27 to 38.9 mc, 120 channels, and 47 to 58.4 mc, 115 channels; 12 v dc. | F-m receiver-transmitter (12-volt). | 2S12–5/12 |
| | RADIO SET AN/GRC–5: gnd and vehicular radio comm equip; fm voice; xmtr output 20 w; 27 to 38.9 mc, 120 channels and 47 to 58.4 mc, 115 channels; 24 v. | F-m receiver-transmitter (24-volt). | 2S12–5/24 |
| | TECHNICAL MANUAL TM 11–284 | | Order thru AGC |
| | ADAPTER UG–273/U: 1 round male cont 1 end, 1 split female cont other end; straight type; 1 7/32″ lg x 23/32″ OD o/a less cont; Navy dwg No. RE49F389. | Connector for r-f (antenna) cable. | 2Z308–273 |
| | ADAPTER UG–306/U: 1 round male cont 1 end, 1 round female cont other end; 90° angle type; ANRFCCC dwg No. 49F429. | Connector for r-f (antenna) cable. | 2Z308–306 |
| | AF AMPLIFIER AM–65/GRC: oper from 6 v, 12 v, 24 v bat. or 135 v dc input; 350 mw output Sig dwg No. SC–DL–40826. | Audio amplifier for interphone and sidetone signals. | 2C449–65 |
| | CABLE, special purpose: electrical; Cordage CO–212; portable installation; 1 inner cond No. 8 AWG and 1 concentric cond No. 8 AWG; Army spec No. 71–1618. | Connecting cable from battery (or vehicular junction box) to mounting. | 3E2212 |
| | CABLE, special purpose: electrical; Special Purpose Cable WM–46/U; audio components interconnecting; 8 No. 20 AWG and 2 No. 16 AWG stranded tinned copper cond; spec MIL–S–2486. | Connecting cable from mounting to control box. | 1B3020–10 |
| | CABLE ASSEMBLY, RF: RF Cable Assembly CG–530/U; uses Radio Frequency Cable RG–62A/U; 6′ lg o/a; Sig dwg SC–C–23604. | Connecting cable from RT–67/GRC and RT–70/GRC to mast bases. | 3E6015–530.72 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1211/U; uses 11 cond JAN type WL1(7)20C and 3 cond JAN type WL2–½(19)16C; ¾″ lg less terminations; Sig dwg SC–C–23607. | Connecting cable from Set 1 power supply to Set 1. | 3E6000–1211.1 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CS–1213/U; uses 8 cond JAN type WL1(7)20C; 9/16″ lg excluding term; Sig dwg No. SC–C–23606. | Connecting cable from interphone amplifier to Set 2. | 3E6000–1213.1 |
| | CONTROL C–435/GRC: manual control; power requirements 90 v, 12 v, or 24 v dc; Sig dwg No. SC–D–41596. | Retransmission unit | 2C684–435 |
| | CONTROL BOX C–375/VRC: 7″ lg x 6 13/16″ wd x 3¼″ h; Sig spec No. 71–3327. | Control box | 2C666–375 |
| | CONTROL GROUP AN/GRA–6: for local and remote control of radio sets; Army spec No. 71–3329. | Local and remote control units | 2C684A–6 |
| | HANDSET H–33/PT, H–33A,B,C/PT: bat. powered; 300 ohms; freq range 300–4000 cyc; Army spec No. 71–3331. | Talking and monitoring | 2B620–33 |
| | MAST BASE AB–15/GR: ant. support; 15¼″ lg x 3⅛″ dia o/a; Sig dwg No. SC–D–12517. | Antenna support | 2A2081–15 |

## 4. Identification Table of Parts for Radio Set AN/GRC–5—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | MAST SECTION AB–22/GR: ant. sect.; 23½″ lg, tapers from 11/32″ to 7/32″ OD; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–22 |
| | MAST SECTION AB–24/GR: ant. sect.; 23½″ lg x 7/32″ dia x .012″ wall thk w/3/16″ steel ball on tapered end; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–24 |
| | MAST SECTIONS MS–116, MS–116–A: ant. sect.; 39½″ lg x .393″ dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2416 |
| | MAST SECTION MS–117, MS–117–A: ant. sect.; 39½″ lg, tapers from .373″ to .252″ dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2417 |
| | MAST SECTIONS MS–118, MS–118–A: ant. sect.; 39½″ lg, tapers from .246″ to .130″, 3/16″ dia round steel ball on .130 end; Sig dwg No. SC–D–12521. | Antenna sections | 2A2418 |
| | MOUNTING MT–297/GR: for radio set components; 33 5/8″ lg x 13 3/8″ wd x 4 13/16″ h o/a; Army spec No. 71–3326. | Mounting for radio set | 2Z6763–297 |
| | POWER SUPPLY PP–109/GR: vibrator type; dc output for low and h power xmtr and rec open; input 12.6 v, 11 amp dc; 12 7/8″ lg x 7 5/16″ wd x 9¼″ h o/a; Sig dwg No. SC–D–40891 group No. 1. | Power supply for Set 1 (12-volt system). | 3H4497–109 |
| | POWER SUPPLY PP–112/GR: vibrator type; dc output for low and h power xmtr and rec open; input 25.2 v, 7.5 amp dc; 12 7/8″ lg x 7 5/16″ wd x 9¼″ h o/a; Sig dwg No. SC–D–40891 group No. 2. | Power supply for Set 1 (24-volt system). | 3H4497–112 |
| | POWER SUPPLY PP–281/GRC: sync vibrator type; output 138 v, .12 amp dc; input 12.6 v, 2.14 amp dc; 5 7/8″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg No. SC–DL–40653. | Power supply for interphone amplifier and for auxiliary receiver (12-volt system). | 3H4497–281 |
| | POWER SUPPLY PP–282/GRC: sync vibrator type; output 138 v, .12 amp dc; input 25.2 v, 1.17 amp dc; 5 7/8″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg No. SC–DL–40654. | Power supply for interphone amplifier and for auxiliary receiver (24-volt system). | 3H4497–282 |
| | RADIO RECEIVER R–109/GRC: fm; for comm; freq range 27 to 39 mc in 1 band; input 6, 12, 24 v or 6.3 and 90 v dc; 12 13/16″ lg x 7¼″ wd x 9″ h o/a; Army spec No. 71–3321. | F-m receiver | 2C4180–109 |
| | RECEIVER-TRANSMITTER RT–67/GRC: vehicular, gnd; fm; freq range 27 to 38.9 mc; output approx 22 w max; 12 7/8″ lg x 11¼″ wd x 9¼″ h o/a; Army spec No. 71–3320. | F-m receiver transmitter | 2C5130–67 |
| | RECEIVER-TRANSMITTER RT–70/GRC: vehicular, gnd; fm; freq range 47 to 58.4 mc; output approx 22 w max; input 6 v and 8 v dc; 7 3/8″ wd x 4 13/16″ h x 12 15/16″ dia o/a; Army spec No. 71–3323. | F-m receiver-transmitter | 2C5130–70 |
| | STUFFING TUBE: feedthru type; steel; 1 11/32″ lg x 1 3/16″ dia o/a; Appleton part No. CGB–61007. | Feedthrough on some vehicular junction boxes for cable W–8. | 6Z3147 |
| | WIRE, electrical: Buna S ins and jacket; single cond No. 14 AWG stranded tinned copper; IPCEA std S–19–81 modified per Army spec No. 71–4945. | ---------- | 1B814.140 |

## 5. Identification Table of Parts for Radio Set AN/GRC–6

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO SET AN/GRC–6: vehicular and gnd radio comm equip; fm voice; xmtr output 20 w; 27 to 38.9 mc and 47 to 58.4 mc; 12 v. | F-m receiver-transmitter (12-volt). | 2S12–6/12 |
| | RADIO SET AN/GRC–6: vehicular and gnd radio comm equip; fm voice; xmtr output 20 w; 27 to 38.9 mc and 47 to 58.4 mc; 24 v. | F-m receiver-transmitter (24-volt). | 2S12–6/24 |
| | TECHNICAL MANUAL TM 11–284: ea | | Order thru AGC |
| | ADAPTER UG–273/U: 1 round male cont 1 end and 1 split female cont other end; straight type; Navy dwg RE49F389. | Connector for r-f (antenna) cable. | 2Z308–273 |
| | ADAPTER UG–306/U: 1 round male cont 1 end, 1 round female cont other end; 90° angle type; ANRFCCC dwg RE49F429. | Connector for r-f (antenna) cable. | 2Z308–306 |
| | AF AMPLIFIER AM–65/GRC: 1800 mw and 350 mw outputs; 12⅞″ lg x 7⅞″ wd x 4¼″ h o/a. | Audio amplifier for interphone and sidetone signals. | 2C449–65 |
| | CABLE, special purpose: electrical; Cordage CO–212; bat. cable; 1 inner cond No. 8 AWG, copper stranded; concentric cond No. 8 AWG copper stranded; Army spec No. 71–1618. | Connecting cable from battery (or vehicular junction box) to mounting. | 3E2212 |
| | CABLE, special purpose: electrical; Special Purpose Cable WM–46/U; 8 No. 20 AWG and 2 No. 16 AWG stranded cond; spec MIL–S–2486. | Connecting cable from mounting to control box. | 1B3020–10 |
| | CABLE ASSEMBLY, RF: RF Cable Assembly CG–530/U; uses Radio Frequency Cable RG–62/U; 5′ 10″ lg excluding term. | Connecting cable from RT–67/GRC and RT–70/GRC to mast bases. | 3E6015–530.72 |
| | CABLE ASSEMBLY, special purpose: Special Purpose Cable Assembly CX–1211/U; uses 11 cond JAN type WL1(7)20C and 3 cond Jan type No. WL2–1/2(19)16C; ¾″ lg excluding terminations. | Connecting cable from Set 1 power supply to Set 1. | 3E6000–1211.1 |
| | CABLE ASSEMBLY, special purpose: Special Purpose Cable Assembly CX–1213/U; uses 8 cond JAN type WL1(7)20C; 1″ lg excluding terminations. | Connecting cable from interphone amplifier to Set 2. | 3E6000–1213.1 |
| | CONTROL C–435/GRC: manual; operating power 90 v, 12 v, or 24 v dc; Sig dwg No. SC–D–41596. | Retransmission unit | 2C684–435 |
| | CONTROL BOX C–375/VRC: interphone and radio push-to-talk operation; Sig spec No. 71–3327. | Control box | 2C666–375 |
| | CONTROL GROUP AN/GRA–6: for local and remote control of radio sets. | Local and remote control units | 2C684A–6 |
| | HANDSET H–33/PT, H–33A,B,C/PT: receiver impedance 300 ohms; freq range 300–4000 cyc; Army spec No. 71–3331; uses carbon-button mike. | Talking and monitoring | 2B620–33 |
| | MAST BASE AB–15/GR; mast sect. support; Sig dwg SC–D–12517. | Antenna support | 2A2081–15 |

## 5. Identification Table of Parts for Radio Set AN/GRC–6—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | MAST SECTION AB–22/GR: 23½″ lg x 7/32″ dia, .012″ thk wall; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–22 |
| | MAST SECTION AB–24/GR: 23½″ lg x 7/32″ dia, .012″ wall thk. | Antenna section | 2A2450–24 |
| | MAST SECTION MS–116: ant.; Sig dwg SC–D–12521 | Antenna section | 2A2416 |
| | MAST SECTION MS–117: ant.; Sig dwg SC–D–12521 | Antenna section | 2A2417 |
| | MAST SECTION MS–118: ant.; Sig dwg SC–D–12521 | Antenna section | 2A2418 |
| | MOUNTING MT–297/GR: for radio sets components; US Army Spec No. 71–3326. | Mounting for radio set | 2Z6763–297 |
| | POWER SUPPLY PP–109/GR: vibrator type; dc output; low and high power xmtr and dc open; input, 12.6 v, 11 amp dc; 7 5/16″ wd x 12 7/8″ d x 9¼″ h. | Power supply for Set 1 (12-volt system). | 3H4497–109 |
| | POWER SUPPLY PP–112/GR: vibrator type; dc output; low and high power xmtr and rec opn; input dc, 25.2 v, 7.5 amp; 7 5/16″ wd x 12 7/8″ d x 9¼″ h. | Power supply for Set 1 (24-volt system). | 3H4497–112 |
| | POWER SUPPLY PP–281/GR: sync vibrator type; output 138 v dc, .12 amp; input 12.6 v dc, 2.14 amp; approx 5 7/8″ lg x 2 15/16″ wd x 4 1/16 h. | Power supply for interphone amplifier (12-volt system). | 3H4497–281 |
| | POWER SUPPLY PP–282/GRC: sync vibrator type; output 138 v dc .12 amp; input 25.2 v dc 1.17 amp; approx 5 7/8″ lg x 2 15/16″ wd x 4 1/16″ h. | Power supply for interphone amplifier (24-volt system). | 3H4497–282 |
| | RECEIVER-TRANSMITTER RT–67/GRC: vehicular, gnd; fm; output approx 22 w max; freq range 27 to 38.9 mc; nom input 5.6 v, 6.3 v, neg 27 v, 85 v, 105 v, 250 v and 450 v dc; 12 7/8″ lg x 11¼″ wd x 9¼″ h o/a. | F-m receiver-transmitter | 2C5130–67 |
| | RECEIVER-TRANSMITTER RT–70/GRC: vehicular, gnd; fm; output approx 400 mw; freq range 47 to 58.4 mc; US Army spec 71–3323. | F-m receiver-transmitter | 2C5130–70 |
| | STUFFING TUBE: straight type; for .375″ to .500″ dia cable; Appleton part #GCB–61007. | Feedthrough on some vehicular junction boxes for battery cable W–8. | 6Z3147 |
| | WIRE, electrical: Buna 2 ins and jacket; single cond No. 14 AWG stranded tinned copper. | | 1B814.140 |

## 6. Identification Table of Parts for Radio Set AN/GRC–7

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO SET AN/GRC–7: gnd and vehicular radio comm equip; FM voice; xmtr output 20 w; 38 to 54.9 mc, 170 channels and 47 to 58.4 mc, 115 channels; 12 v dc. | F-m receiver-transmitter (12-volt). | 2S12–7/12 |
| | RADIO SET AN/GRC–7: gnd and vehicular radio comm equipment; FM voice; xmtr output 20 w; 38 to 54.9 mc, 170 channels and 47 to 58.4 mc, 115 channels; 24 v dc. | F-m receiver-transmitter (24-volt). | 2S12–7/24 |

## 6. Identification Table of Parts for Radio Set AN/GRC–7—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | TECHNICAL MANUAL TM 11–284: ea | | Order thru AGC |
| | ADAPTER UG–273/U: 1 round male cont 1 end, 1 split female cont other end; straight type; 1 7/32″ lg x 2 3/32″ OD o/a less cont; Navy dwg #RE49F389. | Connector for r-f (antenna) cable | 2Z308–273 |
| | ADAPTER UG–306/U: 1 round male cont 1 end, 1 round female cont other end; 90° angle type; 1″ lg x 1″ wd x 7/16″ h o/a; ANRFCCC dwg #RE49F429. | Connector for r-f (antenna) cable | 2Z308–306 |
| | AF AMPLIFIER AM–65/GRC: oper from 6 v, 12 v, 24 v bat. or 135 v dc input; Sig dwg No. SC–DL–40826. | Audio amplifier for interphone and sidetone signals. | 2C449–65 |
| | CABLE, special purpose: electrical; Cordage CO–212; portable installation; 1 inner cond No. 8 AWG and 1 concentric cond No. 8 AWG; Army spec No. 71–1618. | Connecting cable from battery (or vehicular junction box) to mounting. | 3E2212 |
| | CABLE, special purpose: electrical; Special Purpose Cable WM–46/U; audio components interconnecting; 8 No. 20 AWG and 2 No. 16 AWG stranded tinned copper cond; spec MIL–S–2486. | Connecting cable from mounting to control box. | 1B3020–10 |
| | CABLE ASSEMBLY, RF: RF Cable Assembly CG–530/U; uses Radio Frequency Cable RG–62A/U; 6′ lg o/a; Sig dwg No. SC–C–23604. | Connecting cable from RT–68/GRC and RT–70/GRC to mast bases. | 3E6015–530.72 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1211/U; uses 11 cond JAN type WL1(7)20C and 3 cond JAN type WL2–1/2(19)16C; 3/4″ lg excluding term; Sig dwg No. SC–C–23607. | Connecting cable from Set 1 power supply to Set 1. | 3E6000–1211.1 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1213/U; uses 8 cond JAN type WL1(7)20C; 9/16″ lg excluding term.; Sig dwg No. SC–C–23606. | Connecting cable from interphone amplifier to Set 2. | 3E6000–1213.1 |
| | CONTROL C–435/GRC: manual control; oper power requirements 90 v, 12 v, or 24 v dc; 10 7/16″ lg x 8 11/16″ wd x 3 7/16″ h o/a; Sig dwg No. SC–D–41596. | Retransmission unit | 2C684–435 |
| | CONTROL BOX C–375/VRC: interphone and radio push-to-talk opn Sig spec No. 71–3327. | Control box | 2C666–375 |
| | CONTROL GROUP AN/GRA–6: for local and remote control of radio sets; Army spec No. 71–3329. | Local and remote control units | 2C684A–6 |
| | HANDSET H–33/PT, H–33A,B,C/PT: bat. powered mike; 300 ohms; freq range 300–4000 cyc; Army spec No. 71–3331. | Talking and monitoring | 2B620–33 |
| | MAST BASE AB–15/GR: ant support; 15 1/4″ lg x 3 1/8″ dia o/a; Sig dwg No. SC–D–12517. | Antenna support | 2A2081–15 |
| | MAST SECTION AB–22/GR: ant. sect.; 23 1/2″ lg, tapers from 11/32″ to 7/32″ OD; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–22 |
| | MAST SECTION AB–24/GR: ant. sect.; 23 1/2″ lg x 7/32″ dia x .012″ wall thk; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–24 |

## 6. Identification Table of Parts for Radio Set AN/GRC–7—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | MAST SECTION MS–117, MS–117–A: ant. sect.; 39½″ lg, tapers from .373″ to .252″ dia; Sig dwg No. SC–D–12521. | Antenna section | 2A2417 |
| | MOUNTING MT–297/GR: for radio set components; 33⅝″ lg x 13⅜″ wd x 4 13/16″ h o/a; Army spec No. 71–3326. | Mounting for radio set | 2Z6763–297 |
| | POWER SUPPLY PP–109/GR: vibrator type; output, dc; input, dc, 12.6 v, 11 amp; 7 5/16″ wd x 12⅞″ lg x 9¼″ h o/a; Sig dwg No. SC–D–40891 group No. 1. | Power supply for Set 1 (12-volt system). | 3H4497–109 |
| | POWER SUPPLY PP–112/GR: vibrator type; output, dc; input dc, 25.2 v, 7.5 amp; 7 5/16″ wd x 12⅞″ lg x 9¼″ h o/a; Sig dwg No. SC–D–40891 group No. 2. | Power supply for Set 1 (24-volt system). | 3H4497–112 |
| | POWER SUPPLY PP–281/GRC: output 138 v dc, .12 amp; input 12.6 v dc, 2.14 amp; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h; Sig dwg No. SC–DL–40653. | Power supply for interphone amplifier and for auxiliary receiver (12-volt system). | 3H4497–281 |
| | POWER SUPPLY PP–282/GRC: sync vibrator type; output 138 v dc, .12 amp; input 25.2 v dc 1.17 amp; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h; Sig dwg No. SC–D–DL–40654. | Power supply for interphone amplifier and for auxiliary receiver 24-volt system). | 3H4497–282 |
| | RADIO RECEIVER R–110/GRC: vehicular; fm; for comm; freq range 38 to 55 mc 1 band; input 6 v, 12 v, 24 v or 6.3 v, 90 v dc; 12 13/16″ lg x 7¼″ wd x 9″ h o/a; Army spec No. 71–3321. | F-m receiver | 2C4180–110 |
| | RECEIVER-TRANSMITTER RT–68/GRC: vehicular gnd; fm; output approx 22 w max; freq range 38 to 54.9 mc; Army spec No. 71–3320. | F-m receiver-transmitter | 2C5130–68 |
| | RECEIVER-TRANSMITTER RT–70/GRC: vehicular, gnd; fm; output 22 w max; freq range; 47 to 58.4 mc; input 6 and 90 v dc; 7⅜″ wd x 4 13/16″ h x 12 15/16″ d o/a; Army spec No. 71–3323. | F-m receiver-transmitter | 2C5130–70 |
| | STUFFING TUBE: feedthru type; steel; 1 11/32″ lg x 1 3/16″ dia o/a; Appleton part No. CGB–61007. | Feedthrough on some vehicular junction boxes for cable W–8. | 6Z3147 |
| | WIRE, electrical: Buna S ins and jacket; single cond No. 14 AWG stranded tinned copper; IPCEA std S–19–81 modified per Army spec No. 71–4945. | | 1B814.140 |

## 7. Identification Table of Parts for Radio Set AN/GRC–8

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | RADIO SET AN/GRC–8: gnd and vehicular radio comm equip; fm voice; xmtr output 20 w; 38 to 54.9 mc, 170 channels and 47 to 58.4 mc, 115 channels; 12 v dc. | F-m receiver-transmitter (12-volt). | 2S12–8/12 |
| | RADIO SET AN/GRC–8: gnd and vehicular radio comm equip; fm voice; xmtr output 20 w; 38 to 54.9 mc, 170 channels and 47 to 58.4 mc, 115 channels; 24 v dc. | F-m receiver-transmitter (24-volt). | 2S12–8/24 |
| | TECHNICAL MANUAL TM 11–284 | | Order thru AGC |

## 7. Identification Table of Parts for Radio Set AN/GRC–8—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | ADAPTER UG–273/U: 1 round male cont 1 end, 1 split female cont other end; straight type 17/32″ lg x 23/32″ OD o/a less cont; Navy Dwg No. RE49F389. | Connector for r-f (antenna) cable | 2Z308–273 |
| | ADAPTER UG–306/U: 1 round male cont 1 end, 1 round female cont other end; 90° angle type; 1″ lg x 7/16″ dia x 1″ h o/a; ANRFCCC Dwg No. RE49F429. | Connector for r-f (antenna) cable | 2Z308–306 |
| | AF AMPLIFIER AM–65/GRC: oper from 6 v, 12 v, 24 v bat. or 135 v dc input; Sig dwg No. SC–DL–40826. | Audio amplifier | 2C449–65 |
| | CABLE, special purpose: electrical; Cordage CO–212; portable installation; 1 inner cond No. 8 AWG and 1 concentric cond No. 8 AWG; Army spec No. 71–1618. | Connecting cable from battery (or vehicular junction box) to mounting. | 3Z2212 |
| | CABLE, special purpose; electrical; Special Purpose Cable WM–46/U; audio components interconnecting; 8 No. 20 AWG and 2 No. 16 AWG stranded tinned copper cond; spec MIL–S–2486. | Connecting cable from mounting to control box. | 1B3020–10 |
| | CABLE ASSEMBLY, RF: RF Cable Assembly CG–530/U; uses Radio Frequency Cable RG–62A/U; 6′ lg o/a; Sig dwg No. SC–C–23604. | Connecting cable from RT–68/GRC and RT–70/GRC to mast bases. | 3E6015–530.72 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1211/U; uses 11 cond JAN type WL1(7)20C and 3 cond JAN type WL2–1/2(19)16C; 3/4″ lg excluding terminations; Sig Dwg No. SC–C–23607. | Connecting cable from Set 1 power supply to Set 1. | 3E6000–1211.1 |
| | CABLE ASSEMBLY, special purpose: electrical; Special Purpose Cable Assembly CX–1213/U; uses 8 cond JAN type WL1(7)20C; 9/16″ lg excluding terminations; Sig dwg No. SC–C–23606. | Connecting cable from interphone amplifier to Set 2. | 3E6000–1213.1 |
| | CONTROL C–435/GRC: manual control power requirements 90 v, 12 v, or 24 v dc; Sig dwg No. SC–D–41596. | Retransmission unit | 2C684–435 |
| | CONTROL BOX C–375/VRC: 7″ lg x 6 13/16″ wd x 3 1/4″ h; Sig spec No. 71–3327. | Control box | 2C666–375 |
| | CONTROL GROUP AN/GRA–6: for local and remote control of radio sets; Army spec No. 71–3329. | Local and remote control units | 2C684A–6 |
| | HANDSET H–33/PT, H–33A,B,C/PT: bat. powered mike; 300 ohms freq range 300–4000 cyc; Army Spec. No. 71–3331. | Talking and monitoring | 2B620–33 |
| | MAST BASE AB–15/GR: ant. support; 15 1/4″ lg x 3 1/8″ dia o/a; Sig dwg No. SC–D–12517. | Antenna support | 2A2081–15 |
| | MAST SECTION AB–22/GR: ant. sect.; 23 1/2″ lg, tapers from 11/32″ to 7/32″ OD; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–22 |
| | MAST SECTION AB–24/GR: ant. sect.; 23 1/2″ lg x 7/32″ dia x .012″ wall thk w/3/16″ steel ball on tapered end; Sig dwg No. SC–D–13614. | Antenna section | 2A2450–24 |



254722°—53——14

## 7. Identification Table of Parts for Radio Set AN/GRC–8—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | MAST SECTIONS MS–117, MS–117–A: ant. sect.; 39½″ lg, tapers from .373″ to .252″ dia; Sig dwg No. SC–D–12521. | Antenna sections | 2A2417 |
| | MOUNTING MT–297/GR: for radio set components; 33⅝″ lg x 13⅜″ d x 4 13/16″ h o/a; Army Spec No. 71–3326. | Mounting for radio set | 2Z6763–297 |
| | POWER SUPPLY PP–109/GR: vibrator type; dc output for low and h power xmtr and rec open; input 12.6 v, 11 amp dc; 12⅞″ lg x 7 5/16″ wd x 9¼″ h o/a; Sig dwg No. SC–D–40891 group No. 1. | Power supply for Set 1 (12-volt system). | 3H4497–109 |
| | POWER SUPPLY PP–112/GR: vibrator type; dc output for low and h power xmtr and rec open; input 25.2 v, 7.5 amp dc; 12⅝″ lg x 7 5/16″ wd x 9¼″ h o/a; Sig dwg No. SC–D–40891 group No. 2. | Power supply for Set 1 (24-volt system). | 3H4497–112 |
| | POWER SUPPLY PP–281/GRC: sync vibrator type; output 138 v, .12 amp dc; input 12.6 v, 2.14 amp dc; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg No. SC–DL–40653. | Power supply for interphone amplifier (12-volt system). | 3H4497–281 |
| | POWER SUPPLY PP–282/GRC: sync vibrator type; output 138 v, .12 amp dc; input 25.2 v, 1.17 amp dc; 5⅞″ lg x 2 15/16″ wd x 4 1/16″ h o/a; Sig dwg No. SC–DL–40654. | Power supply for interphone amplifier (24-volt system). | 3H4497–282 |
| | RECEIVER-TRANSMITTER RT–68/GRC: vehicular, gnd; fm; output approx 22 w max; freq range 38 to 54.9 mc; Army spec No. 71–3320. | F-m receiver-transmitter | 2C5130–68 |
| | RECEIVER-TRANSMITTER RT–70/GRC: vehicular, gnd; fm; output approx 400 mw; freq range 47 to 58.4 mc; Army Spec No. 71–3323. | F-m receiver-transmitter | 2C5130–70 |
| | STUFFING TUBE: feedthru type; steel; 1 11/32″ lg x 1 3/16″ dia o/a; Appleton part No. CGB–61007. | Feedthrough on some vehicular junction boxes for battery cable W–8. | 6Z3147 |
| | WIRE, electrical: Buna S ins and jacket; single cond No. 14 AWG stranded tinned copper; IPCEA std S–19–81 modified per Army spec No. 71–4945. | | 1B814.140 |

## 8. Identification Table of Parts for Mounting MT–297/GR

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | MOUNTING MT–297/GR: metal rack w/8 metal rack surface plates and 9 metal channels ea w/locking strips; olive drab finish; main power ckt term. 80 amp cap.; 33⅝″ lg x 13⅜″ d x 4 13/16″ h; moistureproof and fungiproof. | | 2Z6763–297 |
| | TECHNICAL MANUAL TM 11–284 | | Order thru AGC. |
| E–2, E–5 | BOARD, terminal: general purpose; 18 solder type term.; 5⅜″ lg x 2 5/16″ wd x 1⅛″ h o/a; term. marked from A to K and from A–1 to K–1, omitting G and I, mtg bkt on ea end. | Cable terminating board | 3Z770–18.46 |

## 8. Identification Table of Parts for Mounting MT–297/GR—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| E–6 | BOARD, terminal: general purpose; 18 solder type term. 5⅜″ lg x 2 5/16″ wd x 1⅛″ h o/a; term. marked from 1 to 18, mtg bkt on ea end. | Cable terminating board | 3Z770–18.45 |
| H–11 | BUTTON, plug: fits 19/32″ dia hole; .587″ dia x 1⅜″ lg o/a | Cable clamp plug | 4Z3152 |
| W–4 | CABLE ASSEMBLY, power: uses Cordage CO–212; 1′ 6½″ lg excluding terminations. | Power cable | 3E7350.1–18.3 |
| W–1 | CABLE ASSEMBLY, power: uses Cordage CO–212; 1′ 7½″ lg excluding terminations. | Power cable | 3E7350.1–19.3 |
| W–5 | CABLE ASSEMBLY, power: uses Cordage CO–212; 1′ 8″ lg excluding terminations. | Power cable | 3E7350.1–20.4 |
| W–8 | CABLE ASSEMBLY, power: uses Cordage CO–212; 8′ 6″ lg excluding terminations. | Battery cable | 3E7350.1–102.1 |
| W–6 | CABLE ASSEMBLY, special purpose: uses Special Purpose Cable WM–46/U; 1′ 9″ lg excluding terminations. | Control cable | 3E7350–1.21.1 |
| W–7 | CABLE ASSEMBLY, special purpose: uses Special Purpose Cable WM–46/U; 1′ 11″ lg excluding terminations. | Control cable | 3E7350–1.23.1 |
| W–2 | CABLE ASSEMBLY, special purpose: uses Special Purpose Cable WM–46/U; 1′ 11″ lg excluding terminations. | Control cable | 3E7350–1.23.2 |
| W–3 | CABLE ASSEMBLY, special purpose: uses Special Purpose Cable WM–46/U; 2½′ lg excluding terminations. | Control cable | 3E7350–1.24 |
| O–13 | CAM: connector locking cam | Connector locking cam | 4Z3185–2 |
| O–4 thru O–12 | CAM: mtg plate locking cam | Locking cams | 4Z3185–1 |
| H–7 thru H–10 | CLAMP: cable; accom. 516″ dia cable | Cable clamps | 2Z2642.300 |
| H–1 thru H–6 | CLAMP: cable; accom .61″ dia cable | Cable clamps | 2Z2642.305 |
| O–15 thru O–18 | COLLAR, spacing: rack mtg spacer | Rack to bracket mounting spacers. | 2Z8552–71 |
| J–1 | CONNECTOR, receptacle: 26 round female cont; straight | Receptacle control unit connector. | 2Z3082–84 |
| F–2 | FUSE, cartridge: 2 amp | Circuit fuse | 3Z2602.23 |
| F–1 | FUSE, cartridge: 50 amp | Overload protection, battery | 3Z2650.11 |
| E–10 | FUSEHOLDER: block type; for single type 5AG cartridge fuse; 30 amp, 32 v dc max. | Fuseholder | 3Z3282–20.6 |

## 8. Identification Table of Parts for Mounting MT–297/GR—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| E–9 | FUSEHOLDER: block type; for single type 5AG cartridge fuse; 80 amp, 32 v dc max. | Fuseholder | 3Z3282–1.1 |
| O–29, O–30 | GASKET: cover to junction box wp gasket; JW60 crude rubber compound; single hole; cir w/round cross sect., 6¾″ OD x 6½″ ID x ⅛″ thk. | Cover to junction box waterproof gasket. | 2Z4868.786 |
| O–28 | GASKET: cover to junction box wp gasket; JW60 crude rubber compound; single hole; cir w/round cross sect., 10¼″ OD x 10″ ID x ⅛″ thk. | Cover to junction box waterproof gasket. | 2Z4868.785 |
| H–12 thru H–20 | HANDLE: mtg strip locking handle; 2 5/16″ lg x 1½″ wd x 7/16″ h o/a. | Mounting strip locking handles | 4Z4691 |
| E–13, E–14 | INSULATOR, plate: rectangular shape; type No. LTS–E–3 natural phenolic per spec JAN–P–13; 1½″ lg x 1 1/16″ wd x .062″ thk, two .169″ dia mtg holes on 1″ mtg/c. | Terminal assembly mounting insulators. | 3G320–165 |
| E–16 | INSULATOR, plate: rectangular shape; type No. LTS–E–3 natural phenolic per spec JAN–P–13; 1 5/8″ lg x ⅝″ wd x .062″ thk, two .169″ dia mtg holes on .313″ x .25″ mtg/c. | Fuseholder mounting insulator | 3G320–167 |
| E–15 | INSULATOR, plate: rectangular shape; type No. LST–E–3 natural phenolic per spec JAN–P–13; 1 13/16″ lg x 1 11/16″ wd x .062″ thk, two .169″ dia mtg holes on 1″ mtg/c. | Fuseholder mounting insulator | 3G320–166 |
| E–17 | JUNCTION BOX: cable terminating and connector, term. board, fuseholder, and sw mtg box; ten .828″ dia outlet holes. | Cable terminating junction box | 2Z5687–35 |
| E–18 | KNOB: bar; zinc alloy, olive drab finish; for ¼″ dia double flatted shaft; 2 white luminous lines. | Switch knob | 2Z5822–401 |
| N–1 | LABEL: ckt label; 1 13/16″ wd x 9⅞″ lg x .007″ thk | Circuit label for Mounting MT–297/GR. | 6D16777–9 |
| E–7 | LAMP LM–38: 28 v, .17 amp; miniature bayonet base | Pilot light | 2Z5938 |
| W–9, W–10 | LEAD, electrical: flat ribbon shape approx ⅝″ wd x ⅛″ thk; 5½″ lg excluding terminations. | Grounding straps | 3E7998–5.9 |
| I–1 | LIGHT, indicator: w/lens; for miniature bayonet base | Pilot light socket | 2Z5991–184 |
| O–2, O–3 | MOUNTING: for mtg plug connector not in use | Mount connector not being used | 2Z1409–191 |
| H–21 | NUT, castellated: ⅜″–32 NS–2 | Switch mounting nut | 6L3006–32S |
| H101 thru H–108 | NUT, hexagon: 5/16″–24 NF–2 | | 6L3505–24–8.3S |
| E–4, E–12 | POST, binding: compression screw type; 1½″ lg x ½″ wd x 1 7/32″ h. | Ground terminals | 3Z741–2 |
| E–1, E–3 | POST, binding: compression screw type; 1½″ lg x 1 1/16″ wd x 1½″ h. | Cable terminals | 3Z741–2.1 |

## 8. Identification Table of Parts for Mounting MT–297/GR—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| O–1 | RELAY, armature: cont arrangement 3B; 12.6 v dc nom pull in voltage 8 v dc, max oper voltage or 16 v dc. | Control relay | 2Z7599A–251 |
| K–1 | RELAY, solenoid: SPST, normally open; operates on 10 v dc, continuously withstands 16 v dc. | Power relay | 2Z7586–193 |
| R–3 | RESISTOR, fixed: WW; 28 ohms ±5%; 12 w; JAN type RW32F280. | Voltage-dropping resistor | 3RW15006 |
| R–1, R–2 | RESISTOR, fixed: WW; 140 ohms ±5%; 8 w; JAN type RW29F141. | Voltage-dropping resistors | 3RW19207 |
| H–24 thru H–27 | SCREW, cap: slotted hex. head drive; hex. head; ¼″–20 NC–2; ⅜″ lg. | Rack to bracket mounting screws. | 6L4904–20–6 |
| H–38 thru H–47 | SCREW, cap: slotted drive; hex. head, 5/16″–24 NF–2; ¾″ lg | Equipment installation screws | 6L4905–12S |
| H–28 thru H–37 | SCREW, cap: slotted drive; hex. head; 5/16″–24 NF–2; 1¼″ lg. | Equipment installation screws | 6L4905–20S |
| H–48 thru H–67 | SCREW, captive: slotted drive; fillister Bind H; No. 10–24 NC–2; .937″ lg. | Junction box cover mounting screws. | 6L4770–15.21SF |
| H–77 thru H–85 | SCREW, dowel: handle and cam assy screw | Handle and cam assembly screws. | 6L5014–6–1 |
| H–68 thru H–76 | SCREW, dowel: handle, cam and locking strip assy screws | Handle, cam, and locking strip assembly screws. | 6L5014–10 |
| H–86 thru H–89 | SCREW, thumb: wing head; 5/16″–18 NC–2; 1¼″ lg | Stand assembly (hinged) locking screws. | 6L17504–4 |
| O–14 | SHAFT ASSEMBLY: connector locking cam oper shaft | Connector locking cam operating shaft. | 2Z8201.69 |
| A–1 thru A–8 | SHOCKMOUNT M–449: sq mtg; 2⅜″ sq o/a | Shock mounts | 2Z8415–449 |
| O–19 thru O–27 | SPRING: helical extension type; locking strip tension spring; 1.86″ lg x .375″ dia o/a; 27½″ turns close wnd. | Locking strip tension springs | 2Z8879–323 |
| S–1 | SWITCH, rotary: 2 pole 3 position; single sect | Control switch | 3Z9825–62.516 |
| E–8, E–11 | TERMINAL, lug: ring type; for No. 8 AWG wire | Battery cable terminals | 3Z12073–53 |
| H–90, H–91 | WASHER, flat: round, 13/16″ OD x 13/32″ ID x ⅛″ thk | Unused cable connector mounting shock absorbing washers. | 6L54006–21 |
| H–109 thru H–116 | WASHER, lock: cir, .326″ nom ID x .890″ nom OD x .035″ thk. | | 6L72218–24C |

## 9. Identification Table for Parts for Control Box C–375/VRC

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | CONTROL BOX C–375/VRC: interphone and radio push-to-talk operation. | Remote control for interphone amplifier and radio sets. | 2C666–375 |
| | BOARD, terminal: general purpose; 2 solder lug term., copper silver pl; 15/16″ lg x 29/32″ h x 5/16″ thk o/a. | Junction point for interunit connections. | 3Z770–2.49 |
| H–1, H–2 | CLAMP: used to hold cable and wp cable entrance; wp | Secure interconnecting Special Purpose Cables WM–46/U. | 2Z2642.241 |
| J–1, J–2 | CONNECTOR, receptacle: Receptacle Connector U–79/U; 10 cont, pol; straight. | Connectors for audio input, output, and control circuits. | 2Z7250–79 |
| A–2 | COVER | Used to waterproof Jacks JK–33–C and JK–34–C. | 2Z3352.224 |
| J–3, J–4 | JACK JK–33–C: for 3 cond plug .2065″ dia x 1.093″ lg | Connect microphone to audio input circuit. | 2Z5533C |
| J–5, J–6 | JACK JK–34–C: for 2 cond plug .250″ dia x 17/32″ lg | Connect headset to output of audio circuit. | 2Z5534C |
| | KNOB: bar; aluminum, olive drab finish; for 1/4″ dia double flatted shaft; luminous ctr line; 13/16″ lg x 7/8″ wd x 15/32″ thk. | For shaft of volume controls | 2Z5821–147 |
| | KNOB: bar; aluminum, olive drab finish; for 1/4″ dia double flatted shaft; luminous ctr line; 1 15/16″ lg x 7/8″ wd x 15/32″ thk. | For shaft to switch S–2 (RADIO TRANS). | 2Z5821–148 |
| | KNOB: bar; aluminum, olive drab finish; for 1/4″ dia double flatted shaft; luminous ctr line; 2 15/16″ lg x 7/8″ wd x 7/16″ thk. | For shaft of selector switch S–1 | 2Z5821–149 |
| R–1, R–2 | RESISTOR, variable: comp, 10,000 ohms ±10%; 2.25 w | Volume controls for audio output | 2Z7410–149 |
| S–2 | SWITCH, rotary: 2 pole, 3 position | Selects interphone amplifier and radio sets for transmitting. | 3Z9825–34.2 |
| S–1 | SWITCH, rotary: 3 pole, 3 position | Selects interphone amplifier and radio sets for monitoring and transmitting. | 3Z9825–34.1 |

## 10. Identification Table of Parts for Control C–435/GRC

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| | ARMY-NAVY CONTROL C–435/GRC: p/o Army-Navy Radio Sets AN/GRC–3 thru –8 AN/VRQ–1 thru –3; c/o wp metal case, cast aluminum panel w/controls, etc., and metal chassis w/elect parts; olive drab finish; rectangular box shape; 8 11/16″ wd x 3 7/16″ h x 10 7/16″ lg o/a. | Radio set control unit | 2C684–435 |
| E–3 | BOARD, terminal: 6 solder type silver pl brass stud term; term. 1″ between centers and 1/2″ c to c apart; laminated phenolic board; 2 1/4″ lg x 1 9/16″ wd x 1/2″ thk o/a; two .169″ dia mtg holes on 1 3/4″ mtg/c. | Resistor and crystal mounting board. | 3Z770–6.62 |

## 10. Identification Table of Parts for Control C–435/GRC—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| O–5 | CAP: p/o Army-Navy Control C–435/GRC and Local Control C–434/GRC; consists of 1 Fed Tele & Rad GB–2702–2 cap, 4 GB–2750–12 springs, 1 GA–25392–2 chain assem, and 5 rivets; aluminum cap, olive drab finish; round; 2¾″ dia x ¾″ thk o/a, has 4 spring clips on under side of cap for mtg, clips are 90° apart; has bead retaining chain for attaching to case, straight knurl on outside edge; Fed & Tele & Rad part/dwg No. GA–2756–2. | Waterproof cap for connector aperture. | 2Z1619–57 |
| C–1, C–2 | CAPACITOR, fixed: metallized paper dielectric; 8 μf ±20%; 150 vdcw; BS metal can; 2″ lg x 2″ wd x 1″ h; mineral oil impregnated; two solder lug term. on side of case. | Audio bypass | 3DB8–218 |
| C–3 | CAPACITOR, fixed: metallized paper dielectric; 2 sect; 2 μf ±20% term. 1 to 2, 2 μμf ±20% term. 1 to 3; 200 vdcw; BS metal can; 1 13/16″ lg x 1″ wd x ⅞″ h; mineral oil impregnated; three solder lug term. on side of case; no internal ground connection; two mtg feet w/3/16″ dia hole in ea on 2⅛″ ctr. | D-c blocking capacitor | 3DB2–249 |
| C–4 | CAPACITOR, fixed: ceramic dielectric; 3000 μμf ±20%; Sig C dwg SC–B–40687. | Meter r-f bypass | 3DA3–137 |
| H–2 | CLAMP: steel; cad pl and iridited; 1 screw used to mount; u-shaped, 1½″ wd x 1 17/32″ lg x ⅜″ d o/a, material .047″ thk; one .343″ wd x .587″ mtg hole in ctr. | O–2 and O–4 relay holding clamp. | |
| H–1 | CLAMP: steel; cad pl and olive drab iridited; 1 screw used to mount; u-shaped angle, 1⅞″ lg x 1″ wd x 3/16″ h o/a, .0598″ thk material, single .205″ dia mtg hole. | O–1 and O–3 relay holding clamp. | |
| J–2 | CONNECTOR, receptacle: 10 round button contacts; straight; 1.286″ max OD x 1.197″ max lg; cyl stainless steel body, sand blast finish, locking; molded phenolic insert; single hole mtg, 1″–32 NS–2 x 5/16″ lg mtg bushing; has "O" ring wp seal on mtg flange, supplied w/spanner type mtg nut, immersion and salt spray resistant, has index flat on mtg bushing. | Audio connector | 2Z3030–27 |
| J–1 | CONNECTOR, receptacle: 26 round male cont; straight; 1.852″ dia x 1.312″ lg excluding term.; cyl aluminum body; molded phenolic insert; mts in single hole when used w/retainer plate not supplied as part of connector; has two grooves in outer circumference for "O" ring seals which are supplied w/connector, flange on rear end 1.852″ diam x .093″ thk. | Chassis connector | 2Z3045–57 |
| CR–1 | CRYSTAL UNIT, rectifying: plastic case; .83 ma max inverse current at —50 v, 5 ma min forward current at +1 v, shunt capacity 1.0 μμf; .5″ lg x .24″ dia o/a; two axial wire leads; marked IN–43; RMA type IN–43; WECo catalog No. IN–43. | Meter rectifier | 2J1N43 |
| | OR ALTERNATE | OR ALTERNATE | |
| CR–1 | CRYSTAL UNIT, rectifying: glass case; .8 ma max inverse current at —50 v, 5 ma min forward current at +1 v, shunt capacity 1.0 μμf ⅞″ lg x ¼″ dia; two axial wire leads; Sylvania Prod catalog No. IN–34A. | Meter rectifier | 2J1N34A |

## 10. Identification Table of Parts for Control C–435/GRC—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| O–8 | GASKET: Buna N; 1 hole; circular w/circular cross sect.; 1½″ OD x 1¼″ ID x ⅛″ thk; p/o Army-Navy Control C–435/GRC and Receiver-Transmitters RT–66, 67, 68/GRC; Linear Inc part No. 1820–23; Fed Tele & Rad part/dwg No. GS–1948–1–14. | Meter mounting waterproof gasket. | 2Z4868.737 |
| O–9 | GASKET, neoprene; 1 hole; rectangular, 7.937″ lg x 3.312″ wd x .187″ thk, hole 7.563″ lg x 2.938″ wd; 50–60 durometer hardness; p/o Army-Navy Control C–435/GRC and Local Control C–434/GRC; Fed Tele & Rad part/dwg No. GR–1378–2. | Panel to case waterproof gasket | 6Z4051–22 |
| O–10 | GASKET: JW60 crude rubber compound; 1 hole circular w/circular cross sect.; 3¼″ OD x 3″ ID x ⅛″ thk; p/o Army-Navy Control C–435/GRC and Local Control C–434/GRC; Linear Inc part No. 1866–12; Fed Tele & Rad part/dwg No. GS–1946–1–7. | Connector guide block mounting gasket. | 6Z4049–6 |
| E–4<br>E–5 | KNOB: round; olive drab zinc alloy; for ¼″ dia double flatted shaft; single No. 6–32 screw thru hole in face of knob screw into axially tapped hole in end of shaft; two white luminous lines; $^{23}/_{32}$″ max dia at bottom tapers to $^{21}/_{32}$″ max dia at top, $^{15}/_{32}$″ h o/a; shaft hole .359″ d from bottom surface; luminous markings. | E–4: R–4 variable resistor knob<br>E–5: R–5 variable resistor knob. | 2Z5822–403 |
| E–6 | KNOB: round, w/bar; olive drab zinc alloy; for ¼″ dia double flatted shaft; single No. 6–32 screw thru hole in face of knob screws into axially tapped hole in end of shaft; two luminous white lines on bar portion; $^{17}/_{16}$″ lg x ⅞″ wd x $^{15}/_{32}$″ h o/a; shaft hole .359″ d from bottom surface; luminous markings. | S–1 switch knob | 2Z5822–401 |
| E–7 | KNOB: round w/bar; olive drab zinc alloy; for ¼″ dia double flatted shaft; single No. 6–32 screw thru hole in face of knob screws into axially tapped hole in end of shaft; two white luminous lines on bar portion; $1^{13}/_{16}$″ lg x ⅞″ wd x $^{15}/_{32}$″ h o/a; shaft hole .359″ d from bottom surface; luminous markings. | S–2 switch knob | 2Z5822–402 |
| N–1 | LABEL: decalcomania; 2¾″ wd x $4^{7}/_{16}$″ lg x .007″ thk; white print on black background; individually packed. | Circuit label | 6016777–6 |
| E–1,<br>E–2 | LAMP, incandescent: Sig C Lamp LM–38; 28 v, .17 amp; bulb T–3–¼ clear; 1⅛″ lg o/a; miniature bayonet base; C–2 filament; burn any position. | E–1: "Set 1" carrier indicator<br>E–2: "Set 2" carrier indicator. | 2Z5938 |
| I–1,<br>I–2 | LIGHT, indicator: with lens; $^{9}/_{16}$″ dia clear lens; for miniature bayonet base, T–3–¼ bulb; 110 v, ¼ amp; inclosed shell; aluminum alloy, olive drab; $2^{7}/_{8}$″ lg x $^{13}/_{16}$″ dia o/a; $^{9}/_{16}$″ dia mtg hole required, ¼″ max panel thk; vertically mtd socket, lamp replaceable from rear of panel; threaded jewel; 2 solder lug term. located together on rear end of socket; built in mechanical dimmer, two clear wp internal lenses, wp seal between bushing and panel. | Indicator lampholders | 2Z5991–184 |

## 10. Identification Table of Parts for Control C–435/GRC—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| M–1 | METER, arbitrary scale: Sig C type MR13S500DCUA or MR155500DCUA; DC; range 0 to 500 μa; round plastic or metal panel mtg case, w/59 mtg flange; 1½″ max dia case, 13/16″ d behind flange, 1¾″ sq flange .334″ thk; accuracy ±3%; 2.57.5 mv drop across term.; calibrated for non-magnetic panel; 10 white scale divisions on black background, first center and last scale mark and ¼″ tip of pointer are luminescent; self-contained; four .122″ dia mtg holes on 1.312″ x 1.312″ mtg/c, four No. 4–40 machine screws are included, one in ea mtg hole, screws extend ¼″ .000–.03125″ behind flange, nut and lockwasher on ea screw to hold face plate on meter for shipment, to be removed at assembly. | Audio level | 3F3312–6.6 |
| H–3 thru H–6 | NUT, castellated: steel, cad pl and olive drab iridite; finished per drawing; 3/8″–32 NS–2; 1/8″ thk; 9/16″ OD; 4 slots 3/32″ wd x 3/64″ d; spaced 90° apart. | R–4 mounting nut. R–5 mounting nut. S–1 mounting nut. S–2 mounting nut. | 6L3006–32S |
| O–6, O–7 | PLATE, retainer: p/o Fed Tele & Rad No. GA–2140–12 front panel assem; zinc plate and zinc chromated steel; rectangular w/round ends; 15/16″ lg x 5/16″ wd x .0897″ thk; two .154 dia csk mtg holes on 5/8″ mtg/c; has tapped retaining hole centered between mtg holes; No. 10–32 NF–2 thd. | Panel thumbscrew retaining plates. | 2Z7093–243 |
| O–11 | PLATE, retainer: aluminum, caustic etch and water dip lacquer finish; circular; 2½″ dia x 3/16″ thk; mts on connector flange by means of shouldered hole in ctr 1 9/13″ dia mts on chassis by means of four .159″ dia holes on 1 1/16″ rad, 45° apart; marked J–1 in black ink. | Connector retaining plate | 2Z7093–242 |
| O–1, O–3 | RELAY, armature: SPDT; contact rating 1 amp, 28 v DC; silver contacts, 1/8″ dia; 2 single windings, operates at 3 ma DC max, releases at .75 ma DC min, 800 ohms, inductive, insulated coil; coil and contact leads terminate in octal base; 2 9/16″ lg x 1 19/32″ sq excluding octal base; mts by standard octal base; fast acting; HS metal case. | Retransmit control, SET 1 to SET 2.<br>Retransmit control, SET 2 to SET 1. | 2Z7586–182 |
| O–2, O–4 | RELAY, armature: 3A3B; contact rating 100 ma at 150 v DC; 1/16″ dia, palladium cont; single winding, coil voltage 12.6 v DC nominal, pull-in voltage 8 v DC, max operating voltage 16 v DC, 144 ohms ±10%, insulated coil; coil and contact leads terminate in 14 pin round male miniature plug on bottom of case; 2 9/16″ lg x 1 5/8″ wd x 1 1/16″ d o/a; 3 plain or No. 6–32 thd mtg studs on 15/16″ x 1.187″ mtg/c fast acting; HS metal case. | Retransmit control, SET 1 to SET 2 (slave).<br>Retransmit control, SET 2 to SET 1 (slave). | 2Z7599A–226 |
| R–2 | RESISTOR, fixed: comp; JAN type RC20BF821J; 820 ohms ±5%; ½ w; spec JAN–R–11. | Meter multiplier | 3RC20BF821J |
| R–3 | RESISTOR, fixed: comp; JAN type RC20BF332K; 3300 ohms ±10%; ½ w; spec JAN–R–11. | Audio dropping resistor | 3RC20BF332K |
| R–1 | RESISTOR, fixed: comp; JAN type RC20BF912J; 9100 ohms ±5%; ½ w; spec JAN–R–11. | Meter multiplier | 3RC20BF912J |

## 10. Identification Table of Parts for Control C–435/GRC—*Continued*

| Ref. symbol | Name of part and description | Function of part | Signal Corps stock No. |
|---|---|---|---|
| R–4, R–5 | RESISTOR, variable: comp; 50,000 ohms ±20%; 2w, 70° max cont operation; 3 solder lug term. metal case 1 1/16″ dia x 21/32″ d, inclosed; round metal shaft 1/4″ dia x 23/32″ lg w/ double D flats 5/16″ lg, tapped hole in end of shaft No. 6–32 thd, 1/4″ d; A taper; insulated cont arm, w/o off position. | SET 1 audio level adjust. SET 2 audio level adjust. | 3Z7450–129 |
| H–7 | SCREW, captive: slot drive; finished fillister Bind H per dwg; cold finished steel, cad pl and olive drab iridite; No. 10–32 NF–2; 2″ lg; thd portion 3/4″ lg; head .313″ dia .136″ thk max; cone pointed end. | Relay clamp holding screw | 6L4770–32.21S |
| H–8 | SCREW, captive: slot drive; finished fillister Bind H per dwg; cold finished steel, cad pl and olive drab iridite; No. 10–32 NF–2; 2 3/4″ lg; thd portion 3/4″ lg; head .313″ dia, .136″ thk max; cone pointed end. | Relay clamp holding screw | 6L4770–44.21S |
| H–9, H–10 | SCREW, thumb: winghead; steel, cad pl and olive drab iridited; No. 10–32 NF–2; 7/8″ lg; thd portion 5/16″ lg; flat point; head 15/16″ wd x 9/16″ h; shoulder 3/8″ dia. | Panel to case fastenings | 6L17110–14S |
| X–1, X–3 | SOCKET, tube: octal; one piece molded in mtg plate; two .156″ dia mtg holes on 1 1/2″ mtg/c; round molded plastic body, 1.14 dia x .49″ h excluding term; beryllium copper silver plated contacts. | Relay socket, O–1 relay. Relay socket, O–3 relay. | 2Z9678.289 |
| X–2, X–4 | SOCKET, tube: 14 contact miniature; one piece saddle mtg; two .125″ dia mtg holes on 1 1/8″ mtg/c; round molded plastic body, .93″ dia x .326″ h excluding term; silver plated phosphor bronze contacts; No. 1 cont marked w/identification button; w/o metal shock and center shield. | Relay socket, O–2 relay. Relay socket, O–4 relay. | 2Z8684–24 |
| S–2 | SWITCH, rotary: 7 pole, 3 position; 2 sect.; silver pl brass cont; ceramic wafers; 1 5/16″ wd x 1 1/4″ h x 1 1/8″ d from mtg surface; nonshorting type contacts; momentary action, spring loaded to return to ctr position; solder lug term.; single hole mtg, 3/8″–32 thd bushing 5/16″ lg, shaft 1/4″ dia x 11.16″ lg from mtg surface, flush mtg; shaft has double D flat and is tapped No. 6–32 x 1/4″ d on end, tropicalized, wp seal between shaft and bushings, and bushing and mtg surface. | Manual selector switch | 3Z9825–62.474 |
| S–1 | SWITCH, rotary: 9 pole, 4 position; 3 sect; spring silver cont, coin silver blades; ceramic wafers; 1 5/16″ wd x 1 1/4″ h x 1 3/4″ d from mtg surface; shorting type cont; locking action positions 1, 2, and 3, momentary action position 4 w/spring loaded return to position 3; solder lug term. single hole mtg, 3/8″–32 thd bushing, 5/16″ lg, shaft 1/4″ dia x 11/16″ lg from mtg surface flush mtg; shaft has double D flat and is tapped No. 6–32 x 1/4″ d on end, tropicalized, wp seal between shaft and bushing, and bushing and mtg surface. | Audiomatic selector switch | 3Z9825–62.473 |
| T–1 | TRANSFORMER, AF: plate coupling type; pri 22,000 ohms impedance CT, .006 amp DC, secd No. 1, 600 ohms impedance CT, 160 mw, secd No. 2, 5,200 ohms impedance CT, 140 mw, 500 v RMS; HS steel case, silicon steel core; 1 3/8″ lg x 7/8″ wd x 2 1/16″ h o/a; 160 mw output; turns ratio pri to secd No. 1 6.28:1, to secd No. 2 2.03:1; freq response +2 to − 2 db between 250 and 2500 cps. | Retransmission coupling transformer. | 2Z9632.562 |

# APPENDIX III

# RELATED RADIO SETS

## 1. Basis of Relationship

The major components of the radio sets discussed in this manual are common to numerous other sets which use common or overlapping frequency ranges. The frequency spectrum chart (fig. 2) indicates the relationship of the sets with regard to frequency coverage. Physical similarities among the sets are indicated in the comparison chart included below.

## 2. Comparison Chart

The following chart lists the components of the radio sets discussed in this manual and the components of related radio sets. Analysis of the chart and figure 131 reveals the high degree of similarity which exists among the sets.

| Components | Radio Sets | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radio Set AN/GRC-3 | Radio Set AN/GRC-5 | Radio Set AN/GRC-7 | Radio Set AN/GRC-4 | Radio Set AN/GRC-6 | Radio Set AN/GRC-8 | Radio Set AN/VRC-8 | Radio Set AN/VRC-9 | Radio Set AN/VRC-10 | Radio Set AN/VRC-13 | Radio Set AN/VRC-14 | Radio Set AN/VRC-15 | Radio Set AN/VRC-16 | Radio Set AN/VRC-17 | Radio Set AN/VRC-18 | Radio Set AN/VRC-20 | Radio Set AN/VRC-21 | Radio Set AN/VRC-22 | Radio Set AN/VRQ-1 | Radio Set AN/VRQ-2 | Radio Set AN/VRQ-3 | Radio Set AN/VRC-7 | Radio Set AN/PRC-16 | Intercommunication Set AN/UIC-1 | Modification Kit MX-898/GR |
| Case CY-684/GR | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | --- | --- | --- |
| Case CY-590/GRC | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | 1 |
| Mounting MT-297/GR | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- |
| Mounting MT-299/GR | --- | --- | --- | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mounting MT-298/GR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | --- |
| Mounting MT-300/GR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | 1 | --- |
| Mounting MT-327/GR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Mounting MT-673/UR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | --- |
| Antenna Mounting MT-652/GR. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | 1 |
| Receiver-Transmitter RT-66/GRC. | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 2 | --- | --- | --- | --- | --- | --- |
| Receiver-Transmitter RT-67/GRC. | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 2 | --- | --- | --- | --- | --- |

| Components | Radio Sets | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radio Set AN/GRC-3 | Radio Set AN/GRC-5 | Radio Set AN/GRC-7 | Radio Set AN/GRC-4 | Radio Set AN/GRC-6 | Radio Set AN/GRC-8 | Radio Set AN/VRC-8 | Radio Set AN/VRC-9 | Radio Set AN/VRC-10 | Radio Set AN/VRC-13 | Radio Set AN/VRC-14 | Radio Set AN/VRC-15 | Radio Set AN/VRC-16 | Radio Set AN/VRC-17 | Radio Set AN/VRC-18 | Radio Set AN/VRC-20 | Radio Set AN/VRC-21 | Radio Set AN/VRC-22 | Radio Set AN/VRQ-1 | Radio Set AN/VRQ-2 | Radio Set AN/VRQ-3 | Radio Set AN/VRC-7 | Radio Set AN/PRC-16 | Intercommunication Set AN/UIC-1 | Modification Kit MX-898/GR |
| Receiver-Transmitter RT-68/GRC. | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 2 | --- | --- | --- | --- |
| Receiver-Transmitter RT-70/GRC. | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | 1 | --- | --- |
| AF Amplifier AM-65/GRC. | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | 1 | --- | --- | --- | 1 | --- | 1 | --- |
| Power Supply PP-282/GRC or PP-281/GRC. | 2 | 2 | 2 | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | --- | --- | --- | 1 | --- | 1 | --- |
| Power Supply PP-448/GR. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | --- | --- |
| Radio Receiver R-108/GRC. | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Radio Receiver R-109/GRC. | --- | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | --- | --- | --- | --- | --- | --- | --- |
| Radio Receiver R-110/GRC. | --- | --- | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | --- | 1 | --- | --- | --- | --- | --- | --- | --- |
| Power Supply PP-109/GR or PP-112/GR. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | --- | --- | --- | --- |
| Control Group AN/GRA-6. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | 1 | 1 | --- | --- | --- |
| Control C-435/GRC | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | 1 | 1 | 1 | --- | --- | --- |
| Control Box C-375/VRC | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | --- | 2 | --- |
| Mast Base AB-15/GR | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | --- | --- | --- |
| Mast Section MS-116-A | 2 | 2 | --- | 2 | 2 | --- | 2 | 2 | --- | 2 | 2 | --- | 2 | 2 | --- | 2 | 1 | --- | 4 | 4 | --- | --- | --- | --- | --- |
| Mast Section MS-117-A | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 4 | 4 | 4 | --- | --- | --- | --- |
| Mast Section MS-118-A | 2 | 2 | --- | 2 | 2 | --- | 2 | 2 | --- | 2 | 2 | --- | 2 | 2 | --- | 1 | 1 | --- | 4 | 4 | --- | --- | --- | --- | --- |
| Mast Section AB-22/GR | 2 | 2 | 2 | 2 | 2 | 2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 2 | 2 | --- | 1 |
| Mast Section AB-24/GR | 2 | 2 | 4 | 2 | 2 | 4 | --- | --- | 2 | --- | --- | 2 | --- | --- | 2 | --- | --- | 1 | --- | --- | 4 | 2 | 2 | --- | 1 |
| Mast Section AB-23/GR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 3 |
| Generator G-8/GRC | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 |

| Components | Radio Sets | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Radio Set AN/GRC-3 | Radio Set AN/GRC-5 | Radio Set AN/GRC-7 | Radio Set AN/GRC-4 | Radio Set AN/GRC-6 | Radio Set AN/GRC-8 | Radio Set AN/VRC-8 | Radio Set AN/VRC-9 | Radio Set AN/VRC-10 | Radio Set AN/VRC-13 | Radio Set AN/VRC-14 | Radio Set AN/VRC-15 | Radio Set AN/VRC-16 | Radio Set AN/VRC-17 | Radio Set AN/VRC-18 | Radio Set AN/VRC-20 | Radio Set AN/VRC-21 | Radio Set AN/VRC-22 | Radio Set AN/VRQ-1 | Radio Set AN/VRQ-2 | Radio Set AN/VRQ-3 | Radio Set AN/VRC-7 | Radio Set AN/PRC-16 | Intercommunication Set AN/UIC-1 | Modification Kit MX-898/GR |
| Handset H-33/PT | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | ---- | 1 |
| Special Purpose Cable Assembly CX-1211/U. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | --- | --- | ---- | ---- |
| Special Purpose Cable Assembly CX-1213/U. | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | --- | ---- | ---- |
| Special Purpose Cable WM-46/U. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | --- | 1 | ---- |
| RF Cable Assembly CG-568/U. | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 1 | --- | --- | 2 | --- | --- | --- | --- | ---- | ---- |
| RF Cable Assembly CG-530/U. | 1 | 2 | 2 | 1 | 2 | 2 | --- | 1 | 1 | --- | 1 | 1 | --- | 1 | 1 | --- | 1 | 1 | --- | 2 | 2 | 1 | --- | ---- | ---- |
| Power Cable Assembly CX-1209/U. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | ---- | 1 |
| Power Cable Assembly CX-1210/U. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---- | 1 |
| Bag CW-187/GR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---- | 1 |
| Bag CW-188/GR | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---- | 2 |
| Adapter UG-273/U | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | --- | --- | ---- | ---- |
| Installation kit | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | --- | ---- | ---- |
| Wire W-142 | 1 | 1 | 1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | --- | --- | ---- | ---- |
| Adapter UG-306/U | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | --- | ---- | ---- |
| Bag CW-206/GR | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | --- | ---- | ---- |
| Connector and bond nut (Appleton). | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | --- | --- | --- | --- | --- | 1 | ---- |

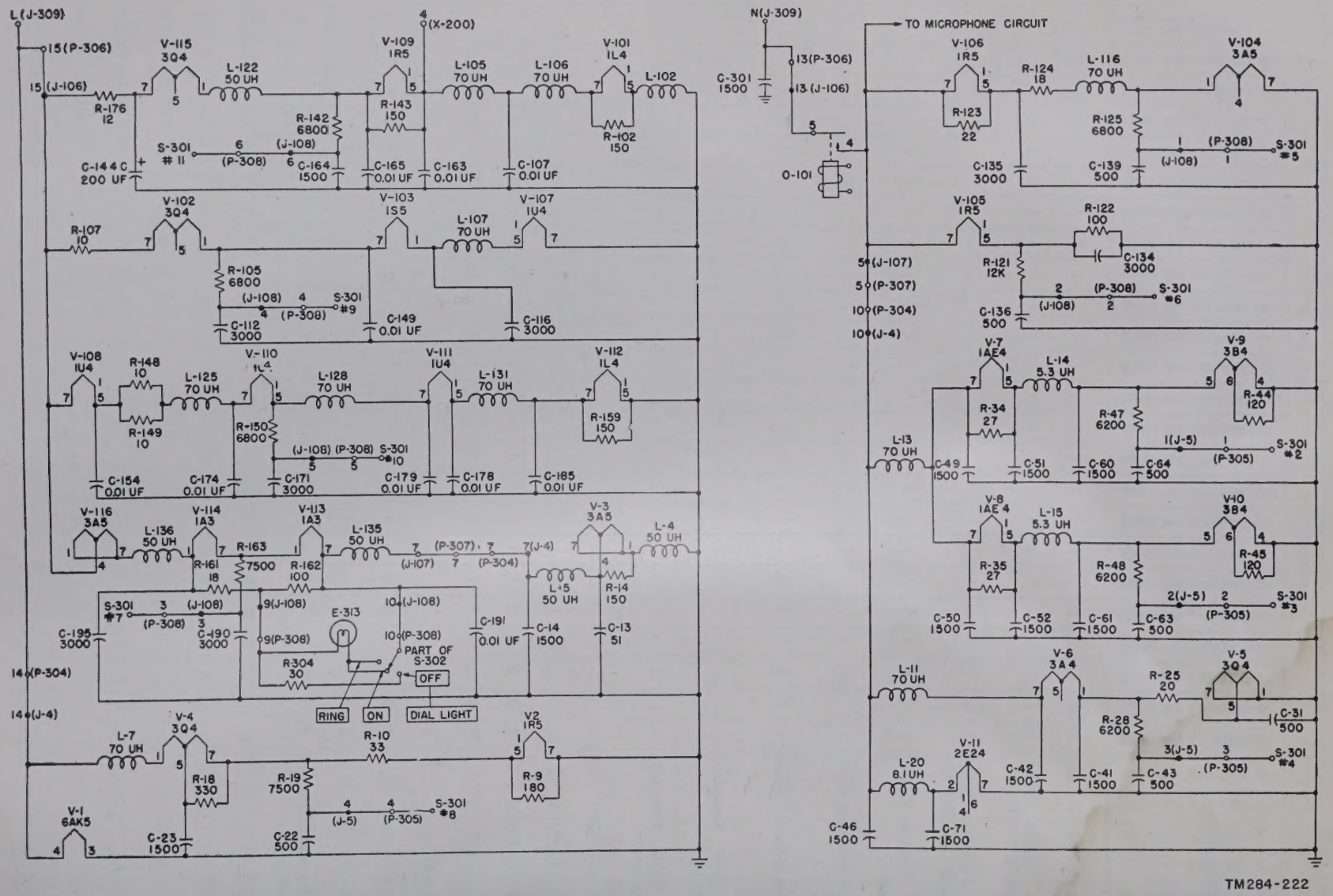
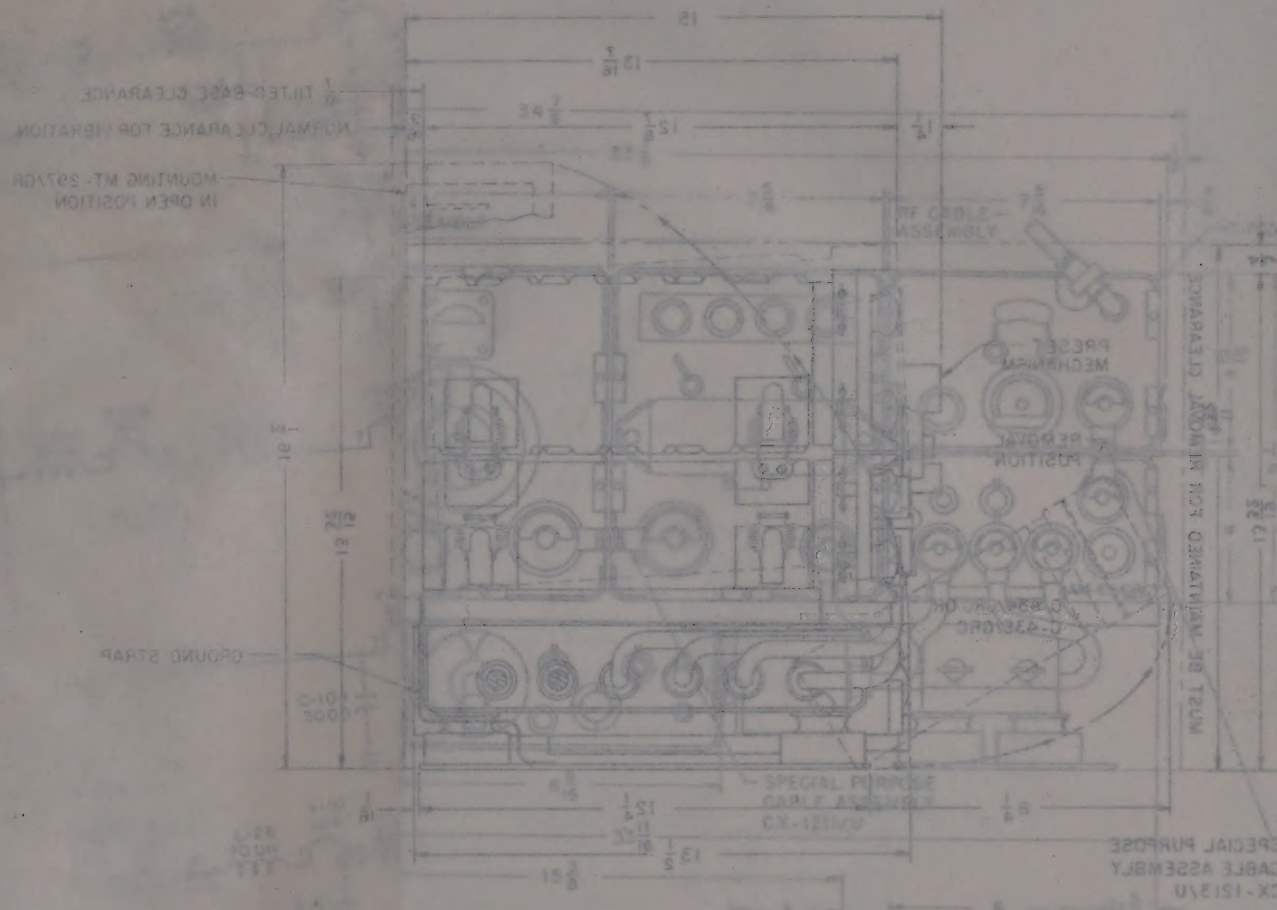
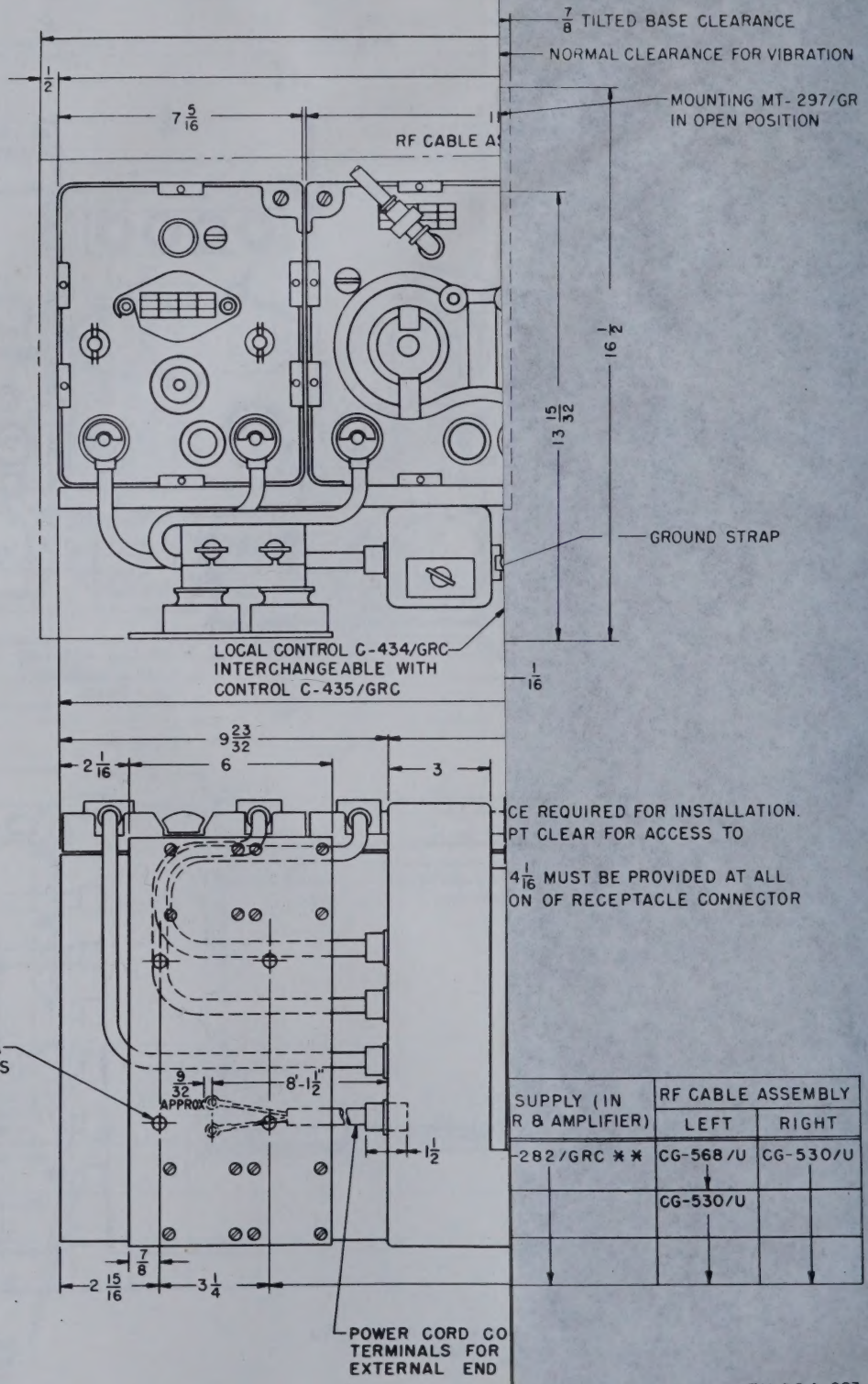



*Figure 106. Set 1 filament circuit, schematic diagram.*



| RADIO SET | RECEIVER TRANSMITTER (SET 1) | RECEIVER TRANSMITTER (SET 2) | POWER SUPPLY (SET 1) | RECEIVER TRANSMITTER (SET 2) | AF AMPLIFIER (RECEIVER & AMPLIFIER) | POWER SUPPLY (TM AMPLIFIER) | RF CABLE ASSEMBLY LEFT | RF CABLE ASSEMBLY RIGHT |
|---|---|---|---|---|---|---|---|---|
| AN/GRC-3 | RT-66/GRC | RT-10/GRC | PP-112/GR | AM-65/GRC | PP-282/GRC * * | | CG-588/U | CG-330/U |
| AN/GRC-4 | NONE | | | | | | | |
| AN/GRC-5 | R-103/GRC | RT-67/GRC | | | | | CG-330/U | |
| AN/GRC-6 | NONE | | | | | | | |
| AN/GRC-7 | R-104/GRC | RT-68/GRC | | | | | | |
| AN/GRC-8 | NONE | | | | | | | |

* FOR 12 VOLT OPERATION SUBSTITUTE POWER SUPPLY PP-109/GRC
** FOR 12 VOLT OPERATION SUBSTITUTE POWER SUPPLY PP-281/GRC




| SUPPLY (IN R & AMPLIFIER) | RF CABLE ASSEMBLY | |
|---|---|---|
| | LEFT | RIGHT |
| -282/GRC ** | CG-568/U | CG-530/U |
| | CG-530/U | |
| | | |

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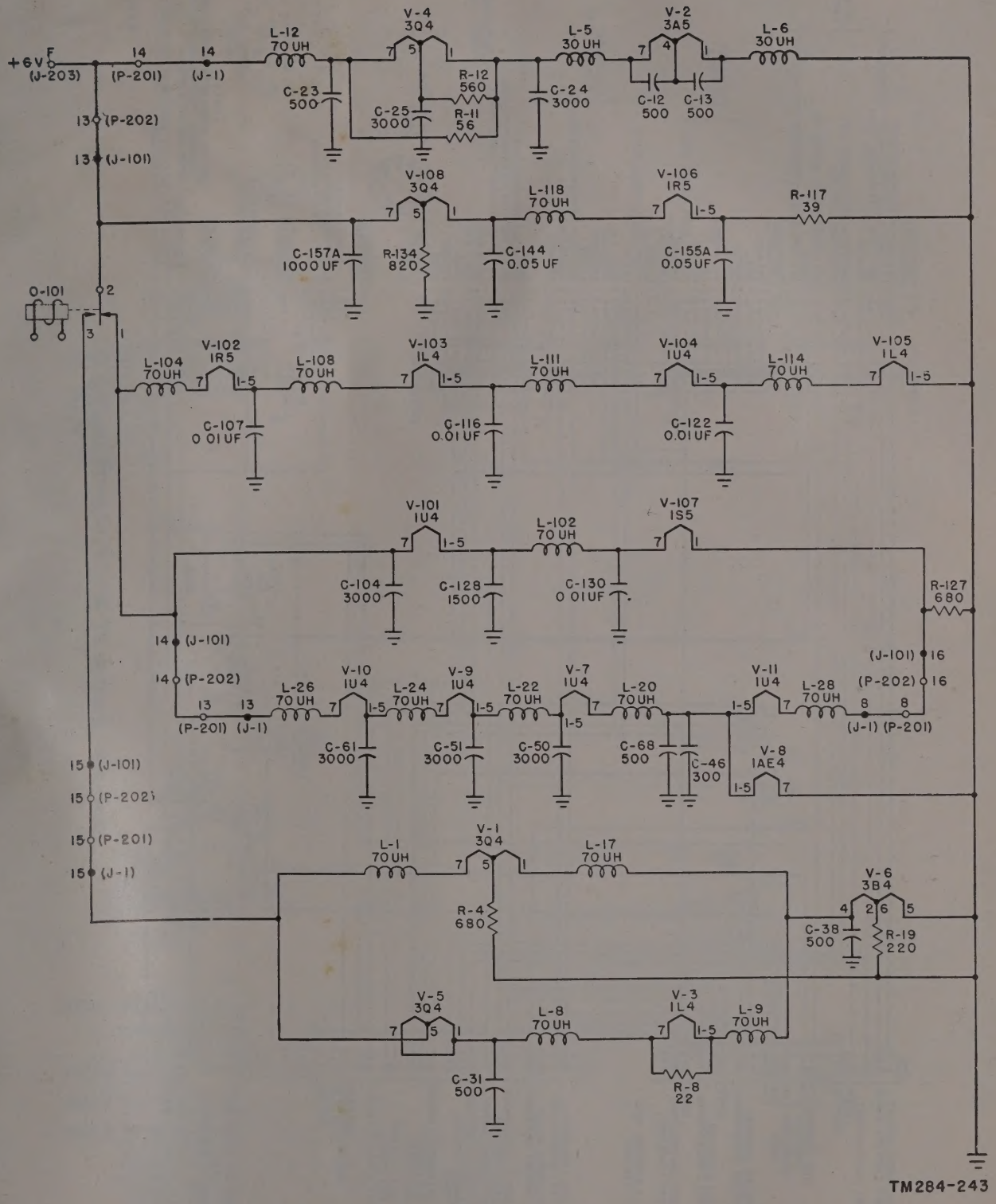
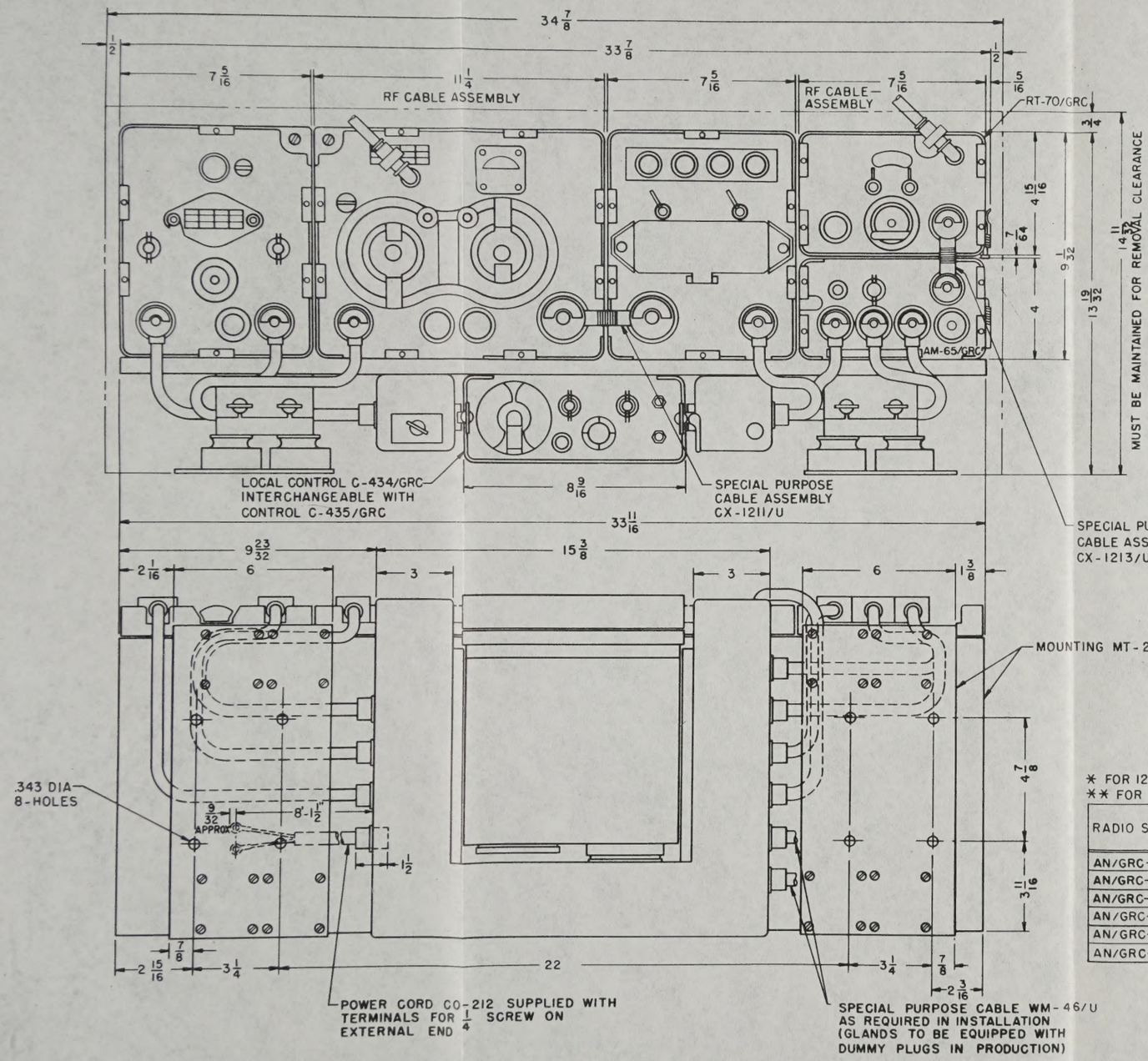
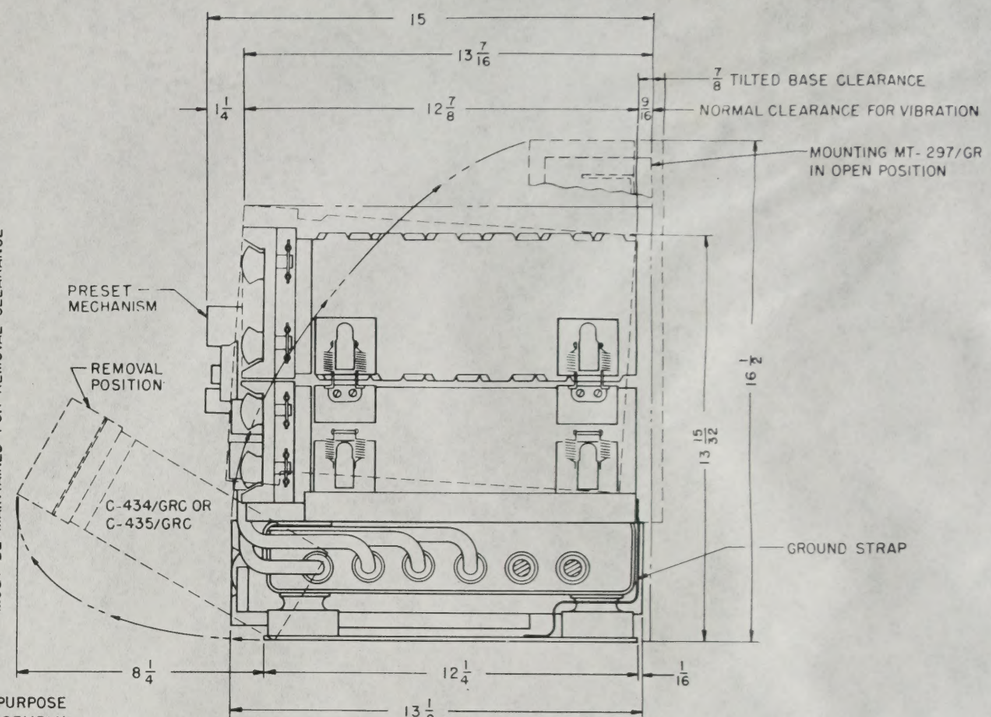



*Figure 107. Receiver-Transmitter RT-70/GRC filament circuit, schematic diagram.*




NOTE:
PHANTOM LINES INDICATE SPACE REQUIRED FOR INSTALLATION. FACE OF RADIO SET TO BE KEPT CLEAR FOR ACCESS TO CONTROLS.
A MINIMUM CLEARANCE OF $4\frac{1}{16}$ MUST BE PROVIDED AT ALL JACKS TO PERMIT THE INSERTION OF RECEPTACLE CONNECTOR U-77/U

* FOR 12 VOLT OPERATION SUBSTITUTE POWER SUPPLY PP-109/GRC
** FOR 12 VOLT OPERATION SUBSTITUTE POWER SUPPLY PP-281/GRC

| RADIO SET | RECEIVER | RECEIVER TRANSMITTER (SET 1) | POWER SUPPLY (SET 1) | RECEIVER TRANSMITTER (SET 2) | AF AMPLIFIER | POWER SUPPLY (IN RECEIVER & AMPLIFIER) | RF CABLE ASSEMBLY | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | LEFT | RIGHT |
| AN/GRC-3 | R-108/GRC | RT-66/GRC | PP-112/GR * | RT-70/GRC | AM-65/GRC | PP-282/GRC ** | CG-568/U | CG-530/U |
| AN/GRC-4 | NONE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| AN/GRC-5 | R-109/GRC | RT-67/GRC | ↓ | ↓ | ↓ | ↓ | CG-530/U | ↓ |
| AN/GRC-6 | NONE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| AN/GRC-7 | R-110/GRC | RT-68/GRC | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| AN/GRC-8 | NONE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

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254-722 O - 53 (Face p. 215)

*Figure 108. Radio Sets AN/GRC-3 through -8, outline drawing.*

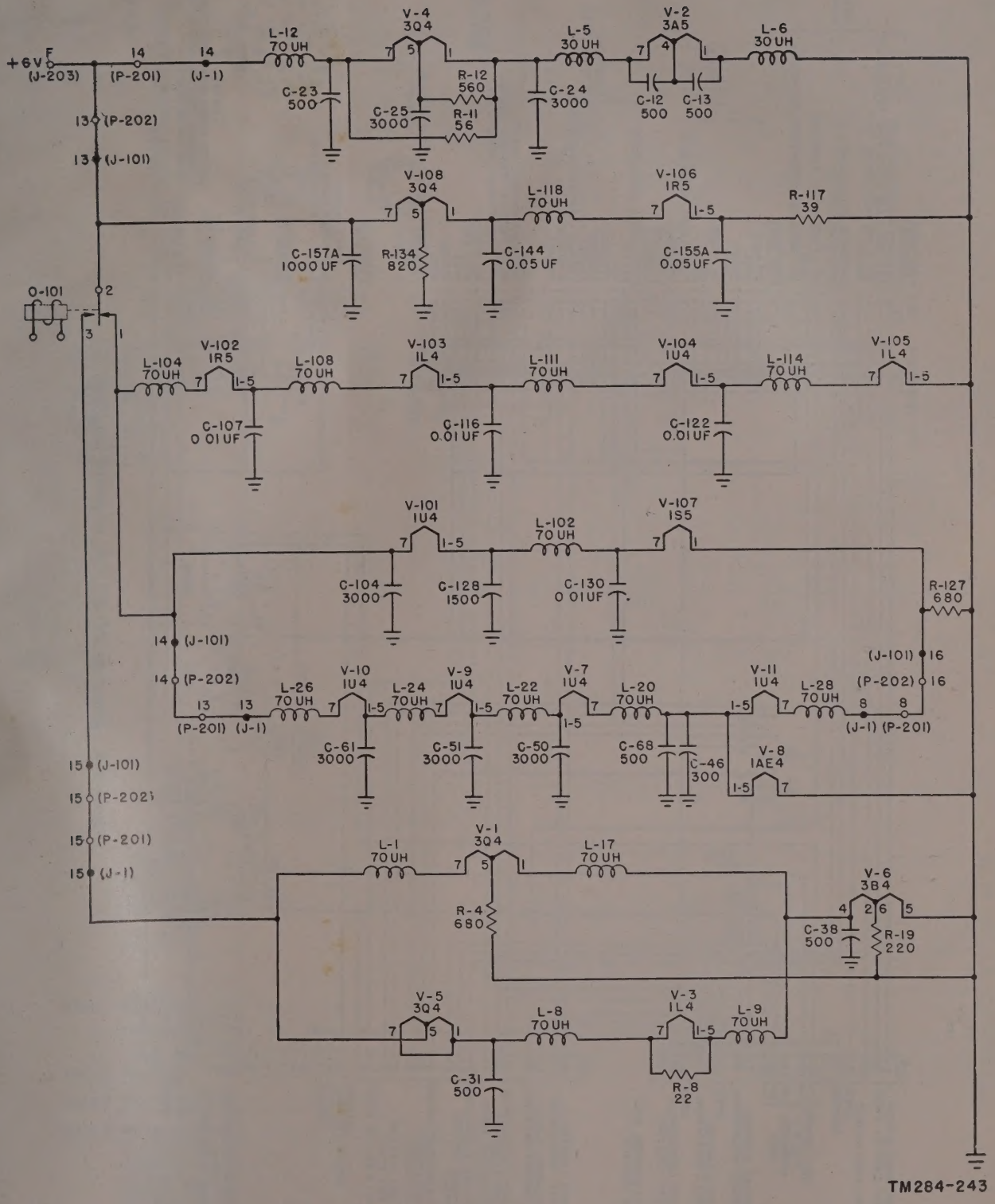



*Figure 107. Receiver-Transmitter RT-70/GRC filament circuit, schematic diagram.*

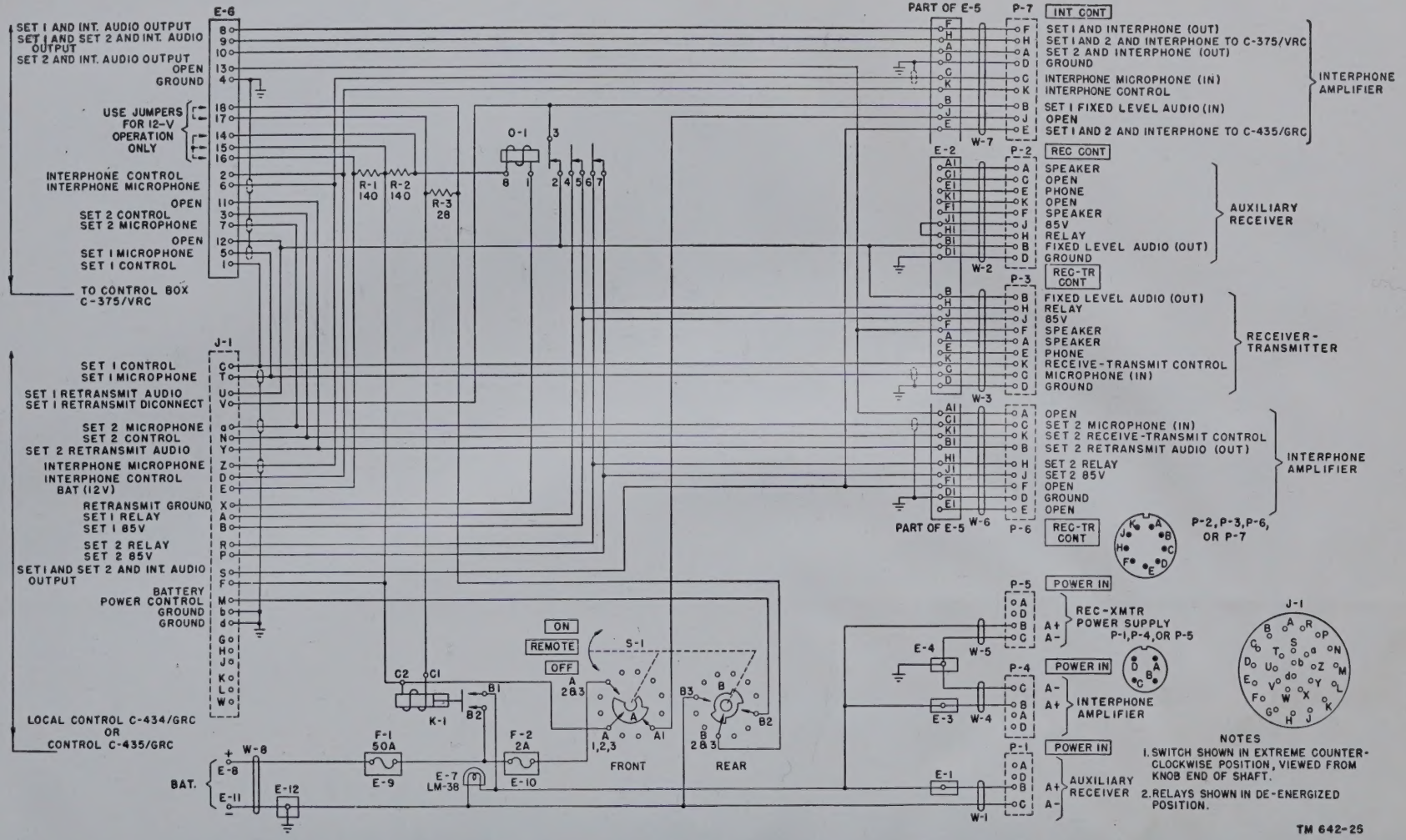
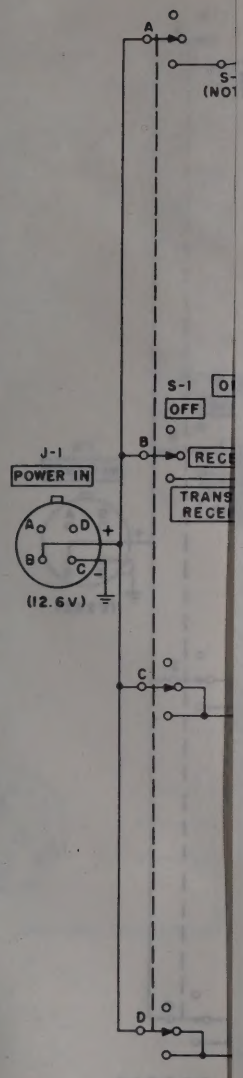
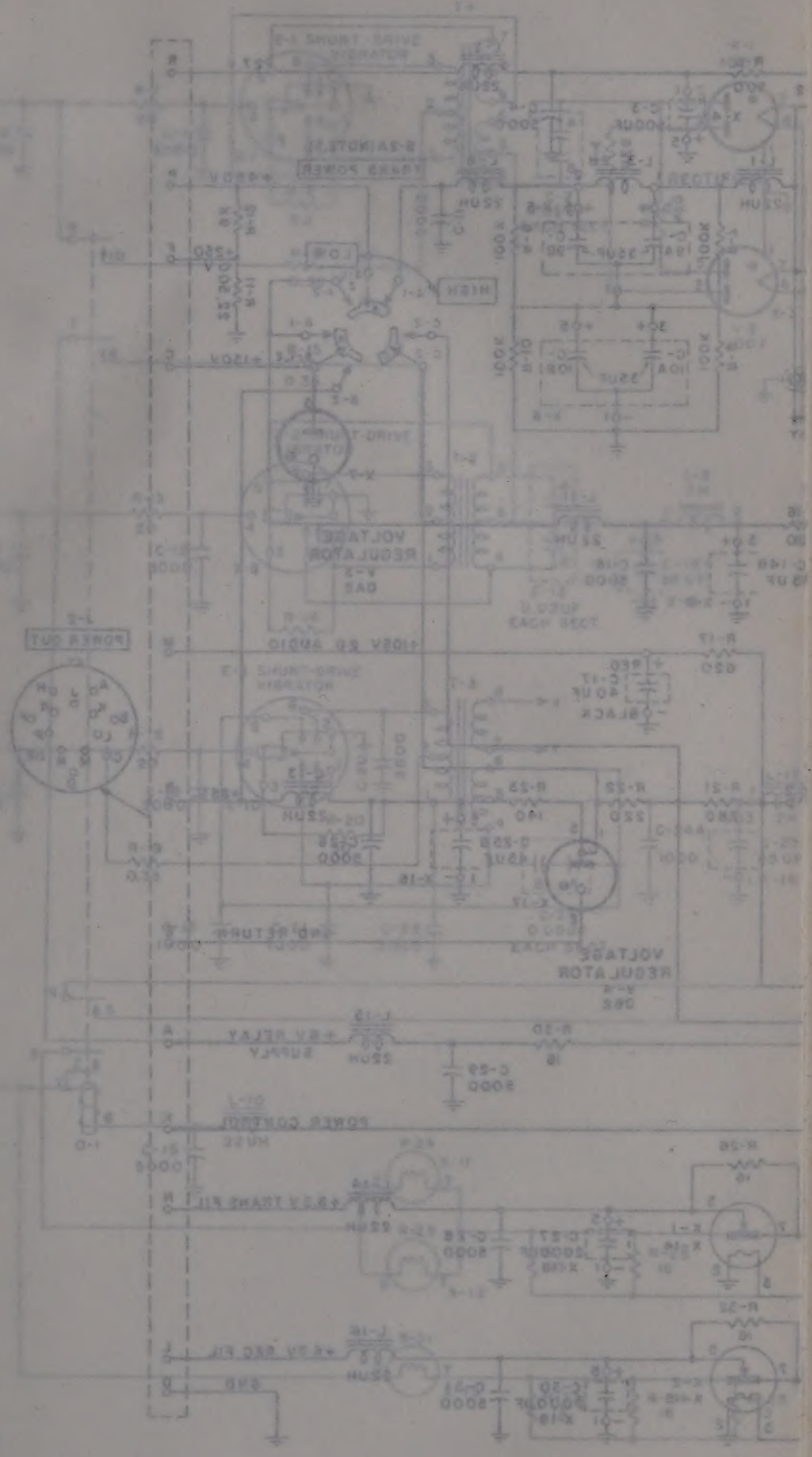



*Figure 109. Mounting MT-297/GR, schematic diagram.*









NOTE 1: SWITCH S-2A & S
S-2 IS SHOWN I
POSITION VIEWED
S-2B IS CLOSED
POWER POSITION.

NOTE 2: RELAY O-1 SHOWN
POSITION.

NOTE 3: UNLESS OTHERWI
ARE IN OHMS, CA

NOTE 4: ROTOR SECTIONS
BY LETTERS A, B,
A LETTER AND A
ROTOR SECTION TH
A CIRCUIT; THE NU
IN WHICH THE CON
LETTERS AND NUM
BUT ARE USED O

NOTE 5: VOLTAGE READINGS

Figure 110. Power Supply PP-193/U, Schematic

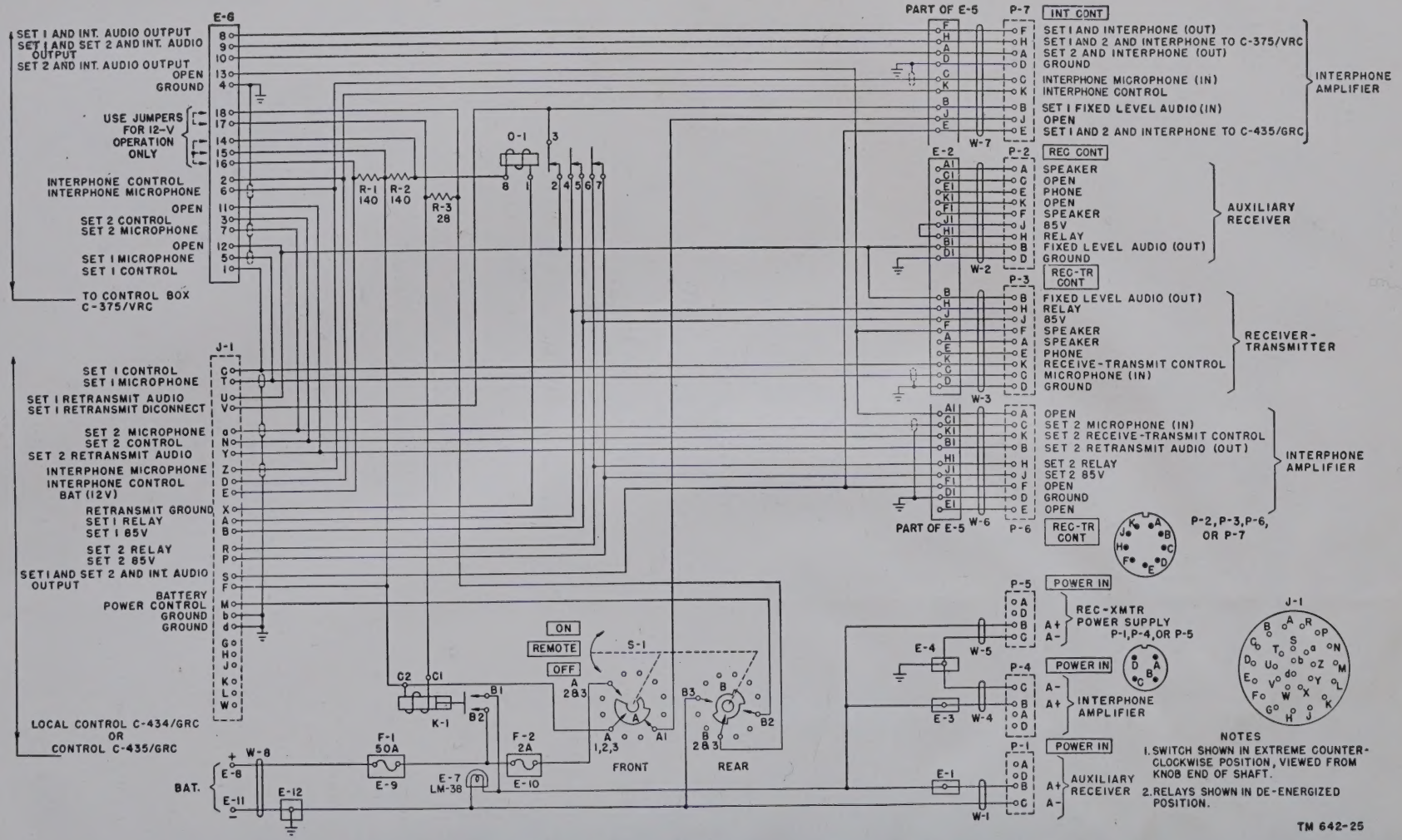
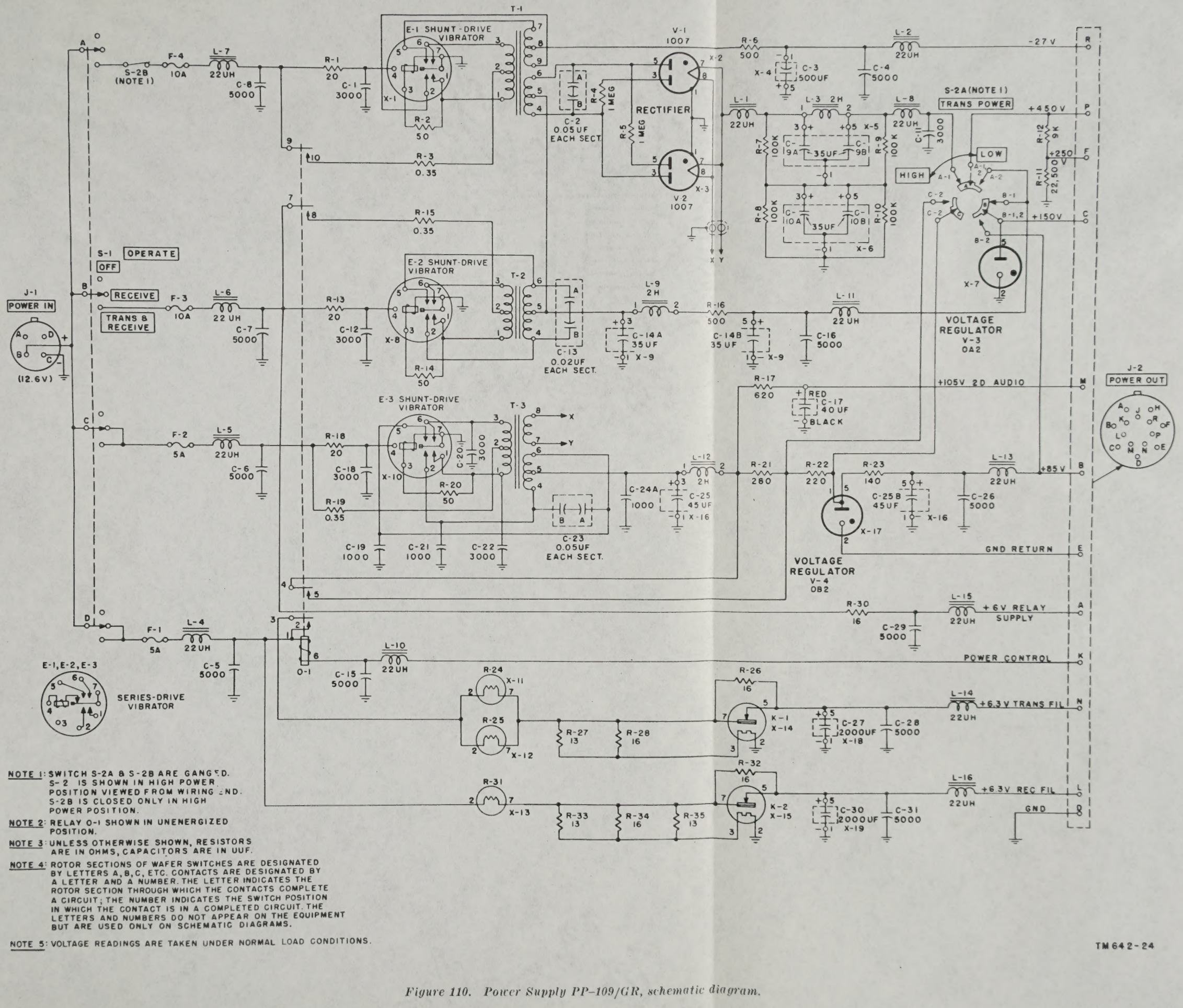



*Figure 109. Mounting MT–297/GR, schematic diagram.*




NOTE 1: SWITCH S-2A & S-2B ARE GANGED. S-2 IS SHOWN IN HIGH POWER POSITION VIEWED FROM WIRING END. S-2B IS CLOSED ONLY IN HIGH POWER POSITION.

NOTE 2: RELAY O-1 SHOWN IN UNENERGIZED POSITION.

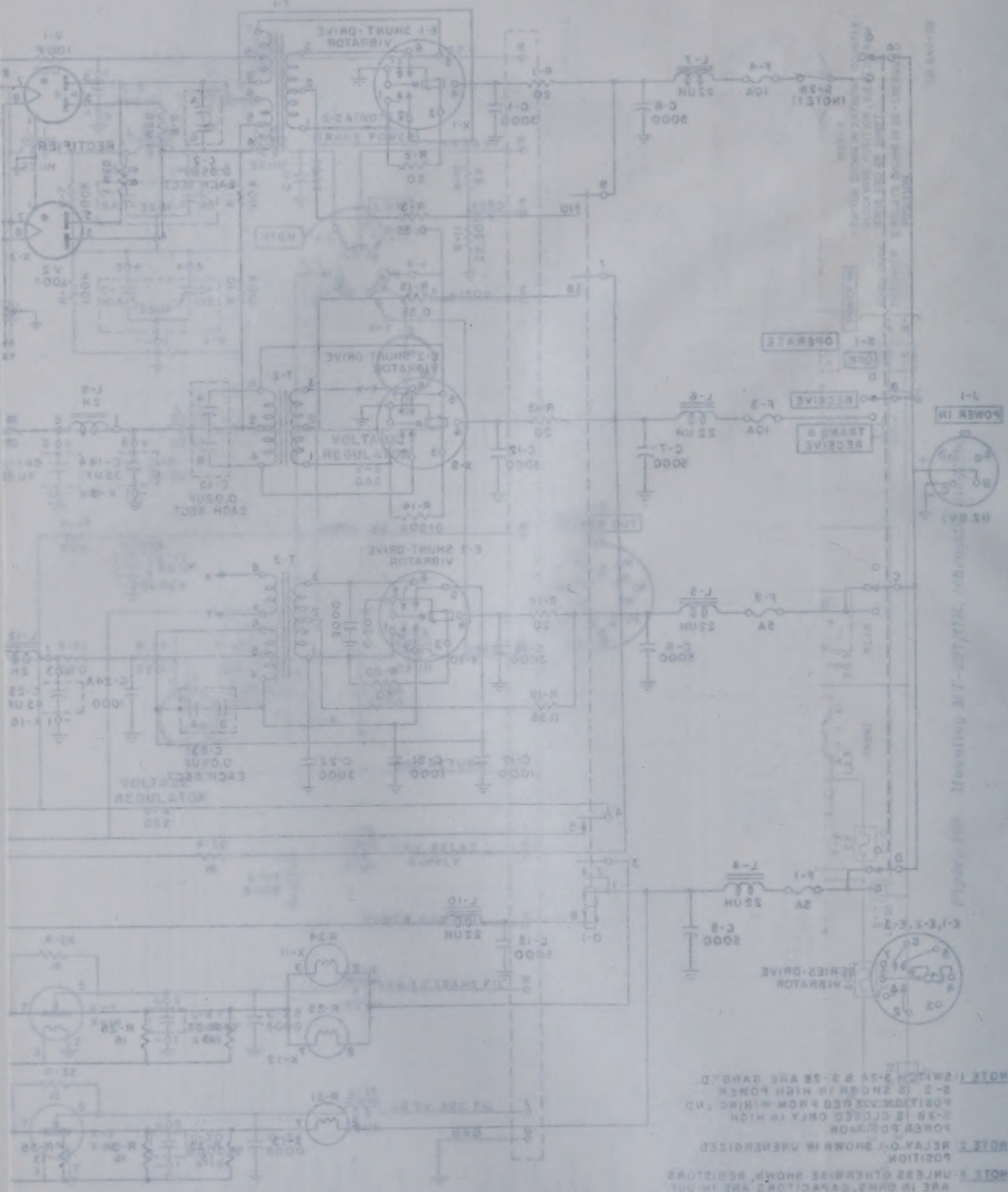
NOTE 3: UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

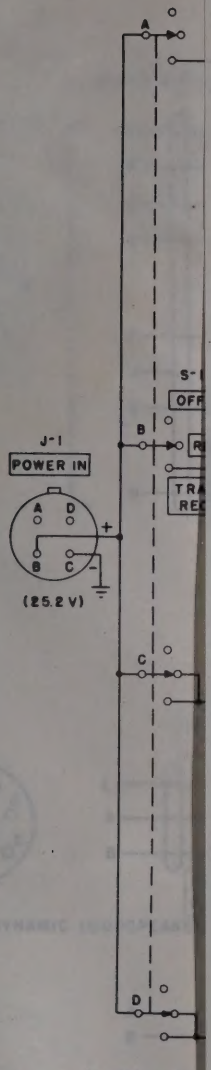
NOTE 4: ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A, B, C, ETC. CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT. THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS.

NOTE 5: VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS.

TM 642-24

*Figure 110. Power Supply PP-109/GR, schematic diagram.*


VIBRATOR
VOLTAGE REGULATOR
POWER IN
RECEIVE
TRANS &
OPERATE
SERIES-DRIVE
VIBRATOR



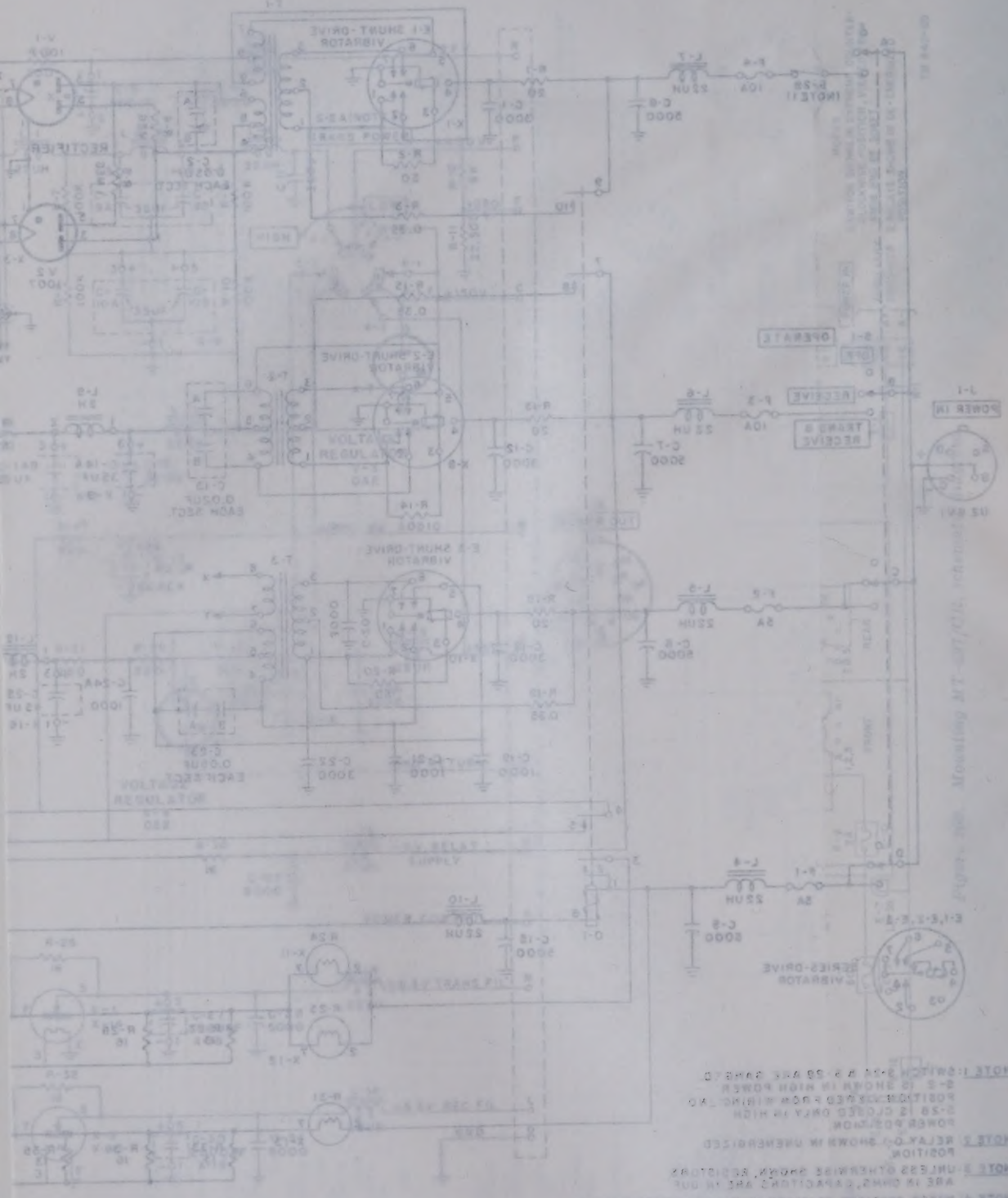

NOTE: 1 SWITCH S-2A &
SHOWN IN HIGH
FROM WIRING
IN HIGH-POWE

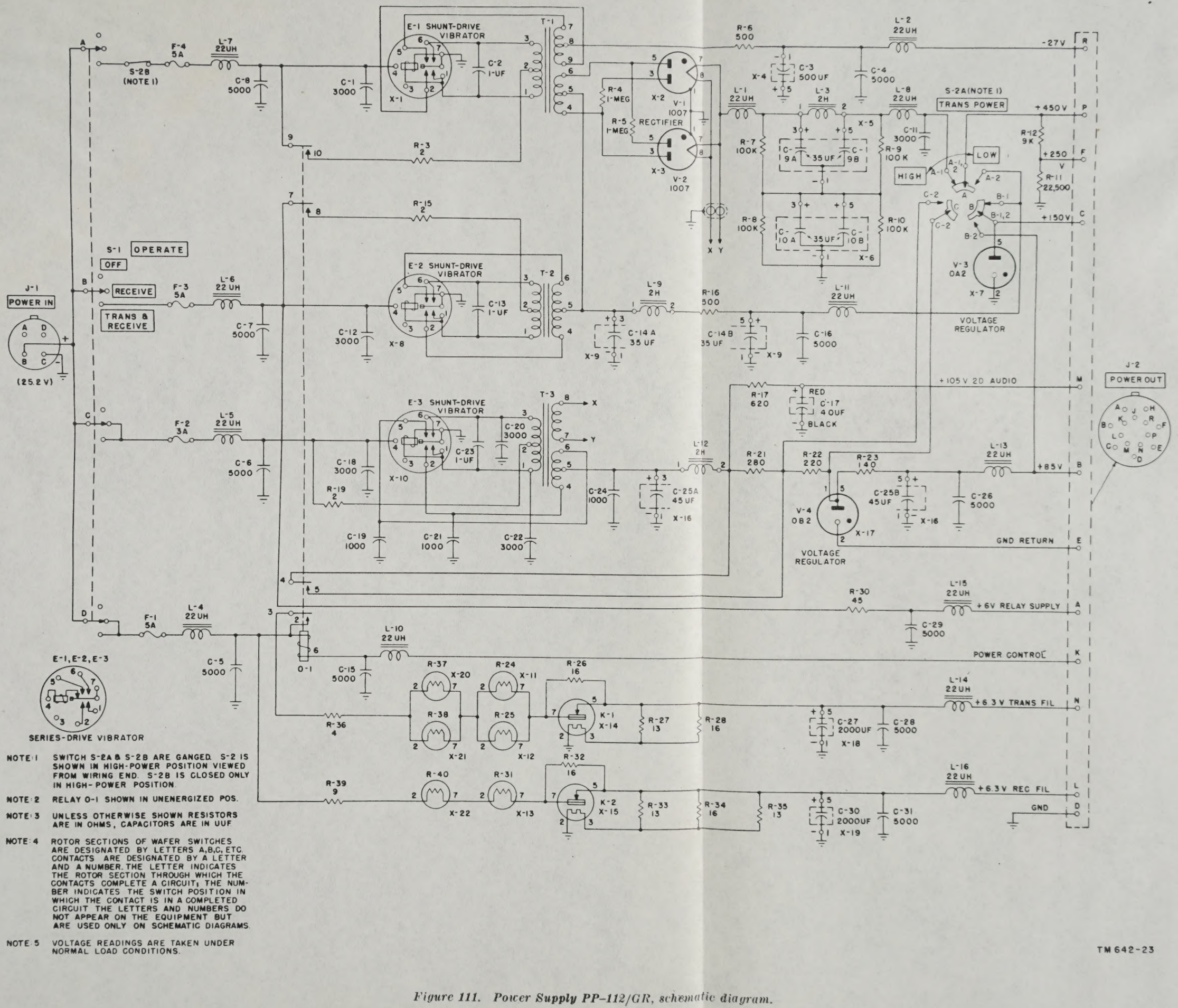
NOTE: 2 RELAY O-1 SHO

NOTE: 3 UNLESS OTHER
ARE IN OHMS,

NOTE: 4 ROTOR SECTION
ARE DESIGNATE
CONTACTS ARE
AND A NUMBER.
THE ROTOR SEC
CONTACTS COMP
BER INDICATES
WHICH THE CON
CIRCUIT THE L
NOT APPEAR ON
ARE USED ONLY

NOTE: 5 VOLTAGE READI
NORMAL LOAD






NOTE: 1 SWITCH S-2A & S-2B ARE GANGED. S-2 IS SHOWN IN HIGH-POWER POSITION VIEWED FROM WIRING END. S-2B IS CLOSED ONLY IN HIGH-POWER POSITION.

NOTE: 2 RELAY O-1 SHOWN IN UNENERGIZED POS.

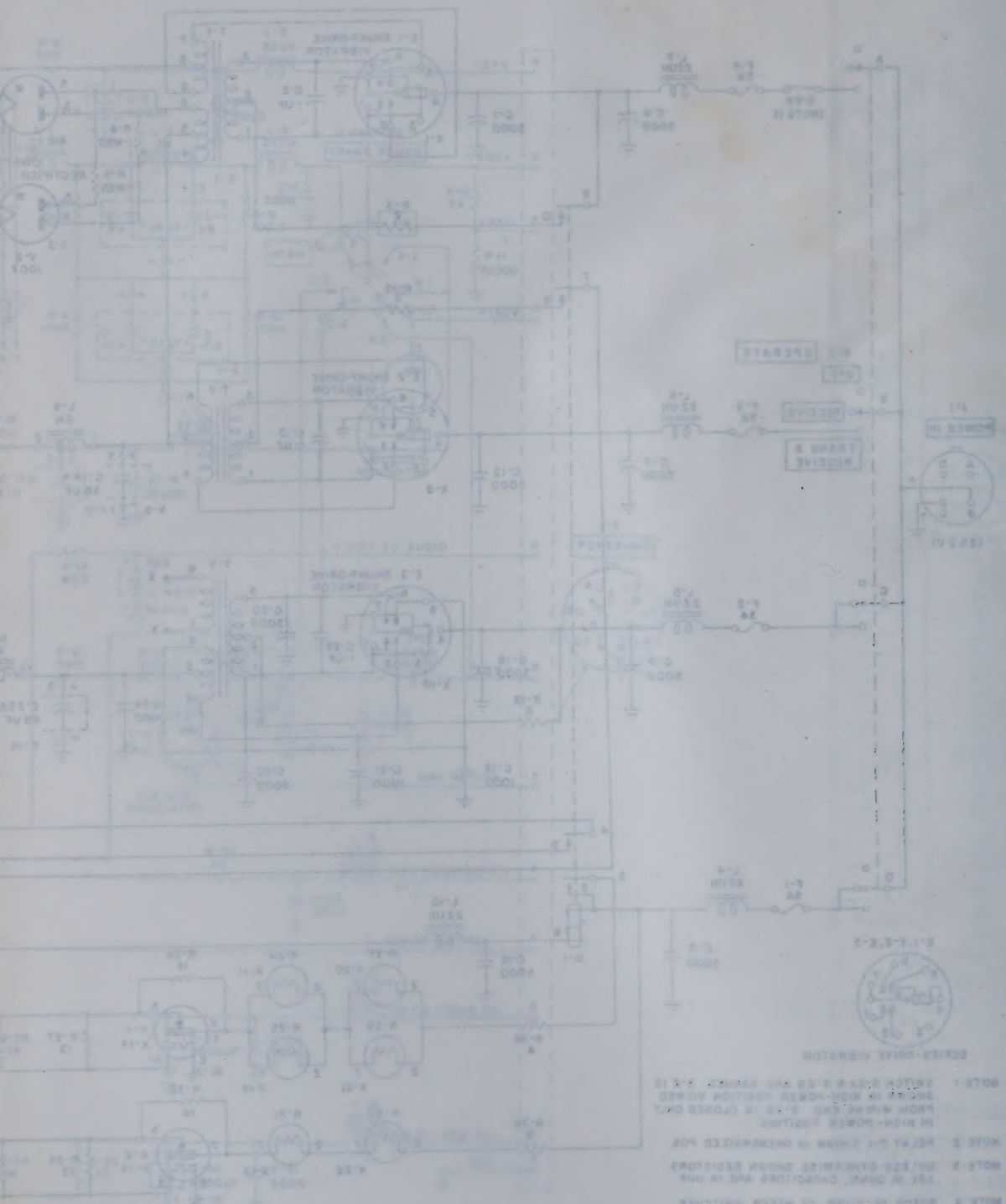
NOTE: 3 UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

NOTE: 4 ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A,B,C, ETC. CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT. THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS.

NOTE: 5 VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS.

TM 642-23

*Figure 111. Power Supply PP–112/GR, schematic diagram.*



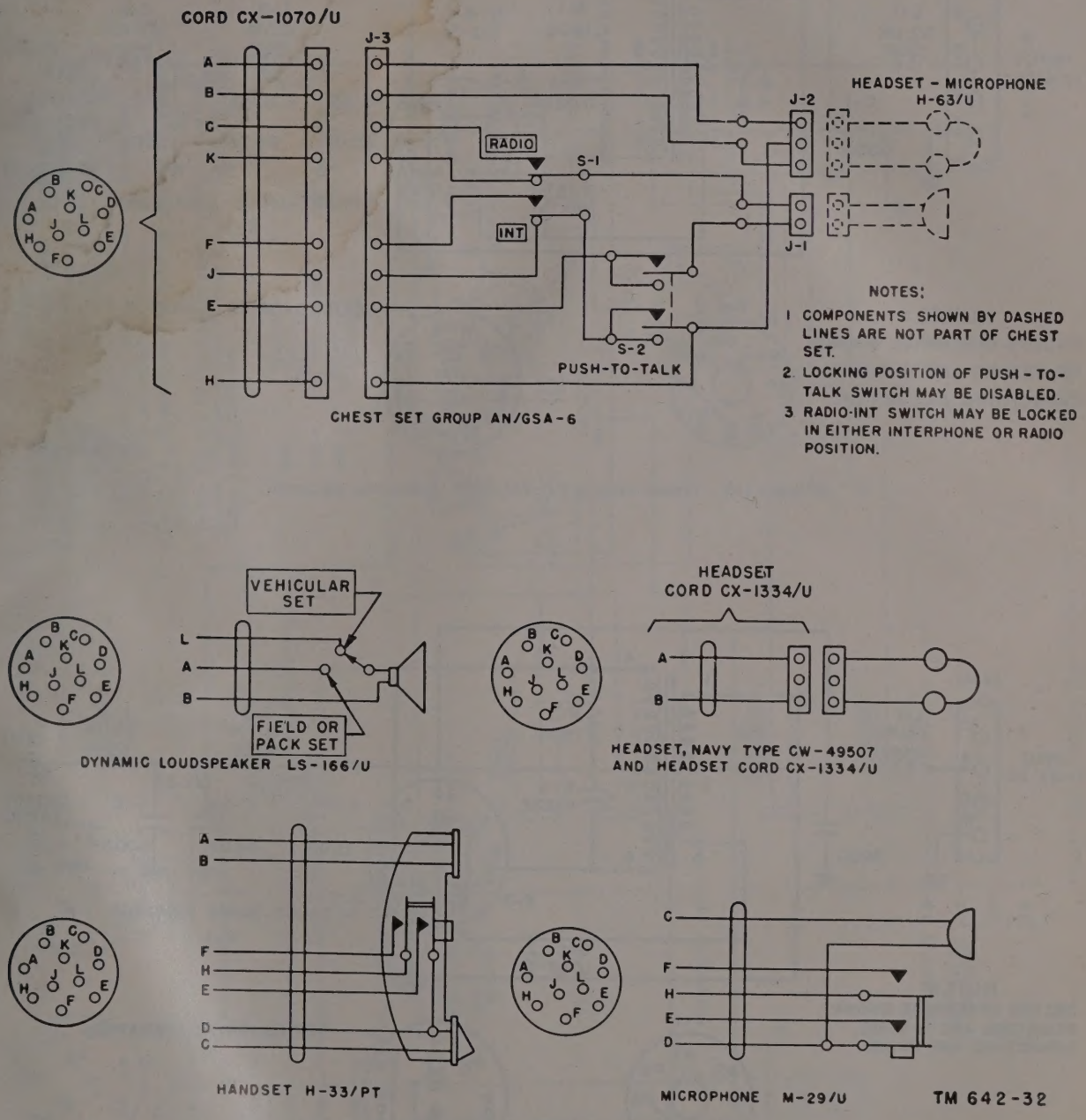



*Figure 112. Audio accessories, schematic diagrams.*

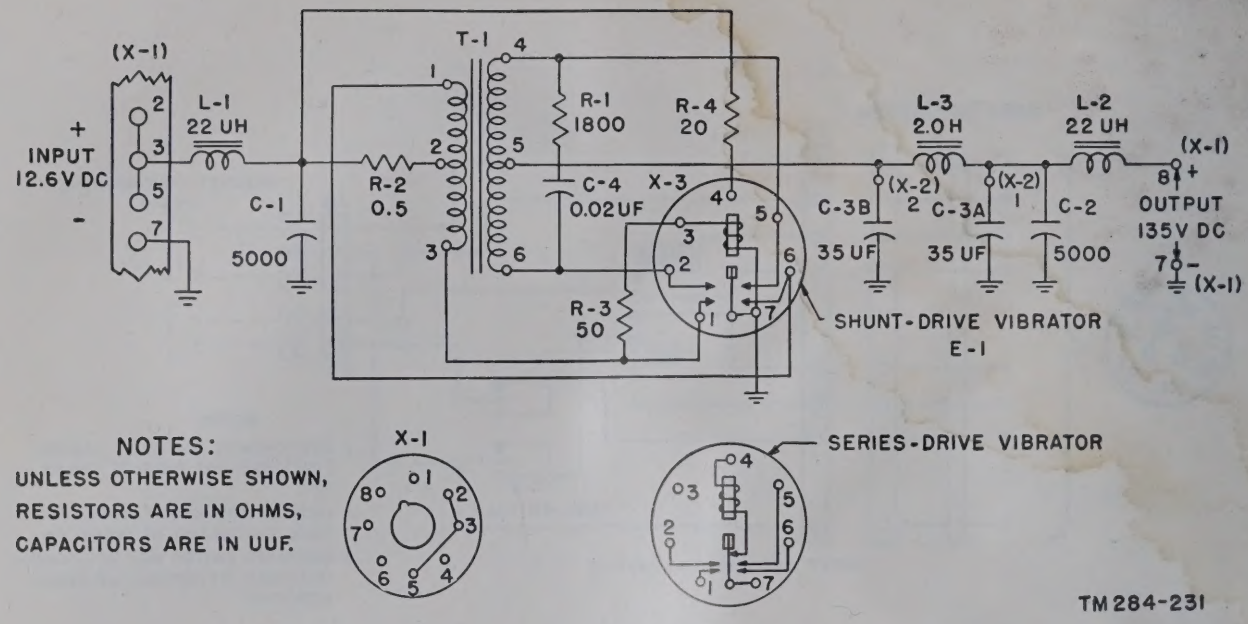



*Figure 113. Power Supply PP-281/GRC, schematic diagram.*

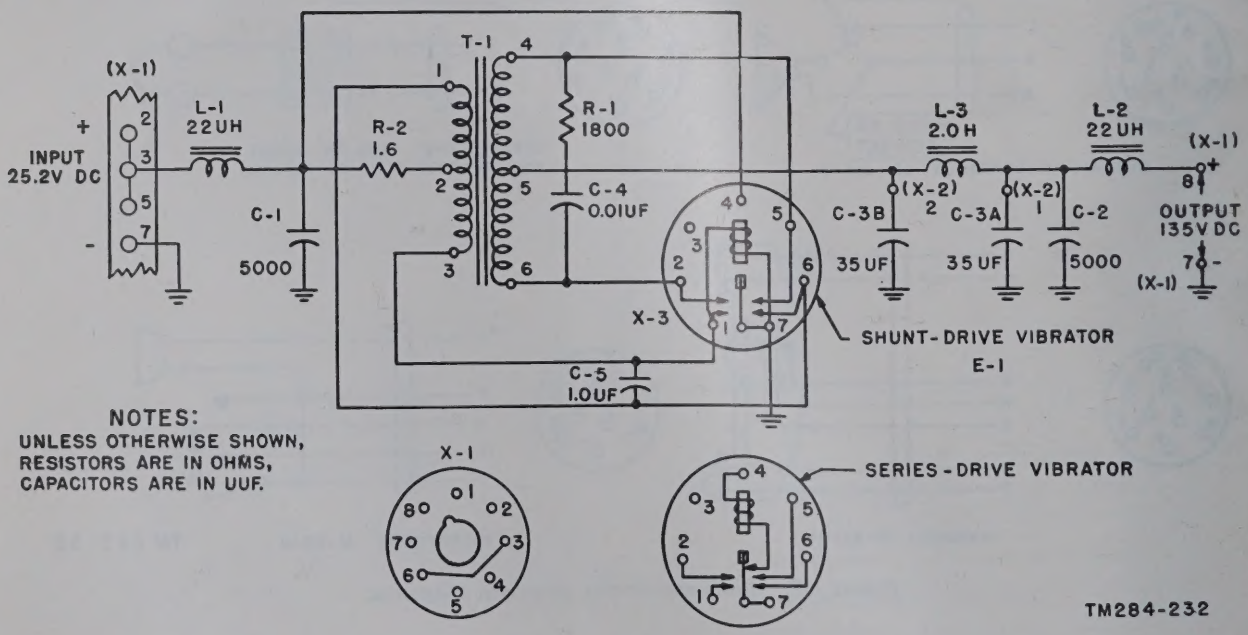



*Figure 114. Power Supply PP-282/GRC, schematic diagram.*

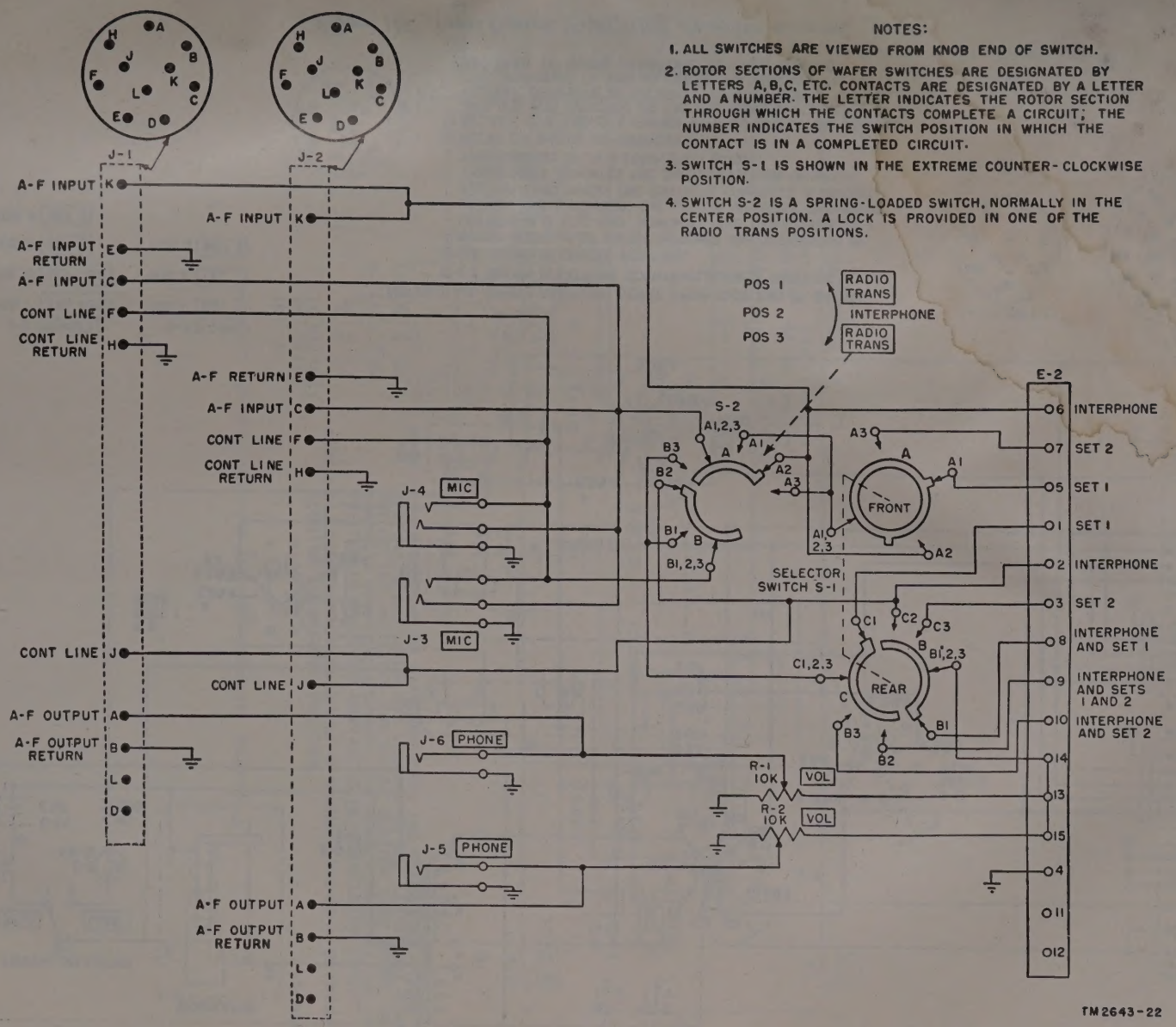
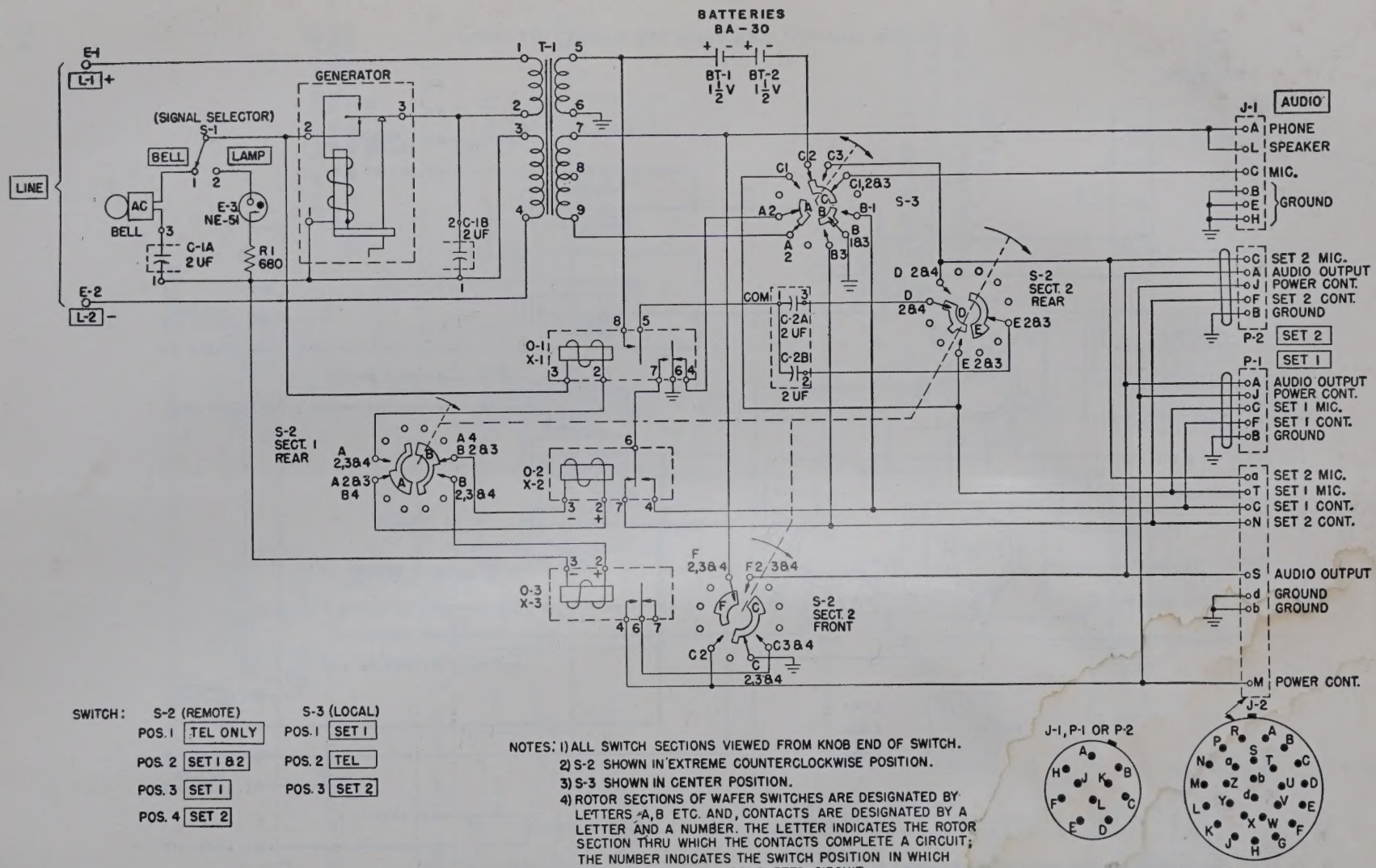



*Figure 115. Control Box C-875/VRC, schematic diagram.*




SWITCH:

| S-2 (REMOTE) | S-3 (LOCAL) |
|---|---|
| POS. 1 TEL ONLY | POS. 1 SET 1 |
| POS. 2 SET 1 &2 | POS. 2 TEL |
| POS. 3 SET 1 | POS. 3 SET 2 |
| POS. 4 SET 2 | |

NOTES:
1) ALL SWITCH SECTIONS VIEWED FROM KNOB END OF SWITCH.
2) S-2 SHOWN IN EXTREME COUNTERCLOCKWISE POSITION.
3) S-3 SHOWN IN CENTER POSITION.
4) ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A, B ETC. AND, CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.
5) RELAY O-1 SHOWN DE-ENERGIZED
6) RELAYS O-2 AND O-3 SHOWN WITH NO OPERATING VOLTAGE APPLIED, AND LATCHED BY THE PREVIOUS APPLICATION OF A VOLTAGE OPPOSITE IN POLARITY TO THAT SHOWN ON COIL. COIL MARKINGS (+ AND −) REFER TO VOLTAGE POLARITY REQUIRED TO SWING ARMATURE TO OPEN CONTACT.

TM 284-91

*Figure 116. Local Control C-434/GRC, schematic diagram.*

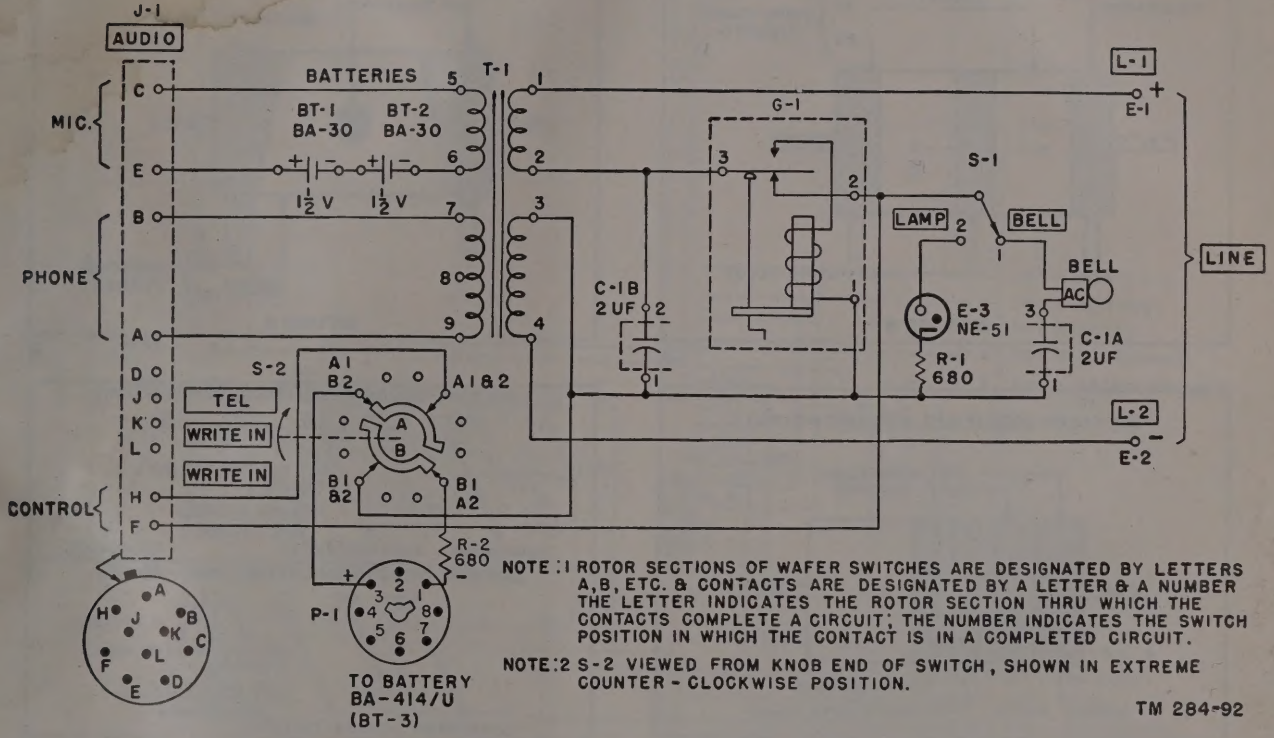
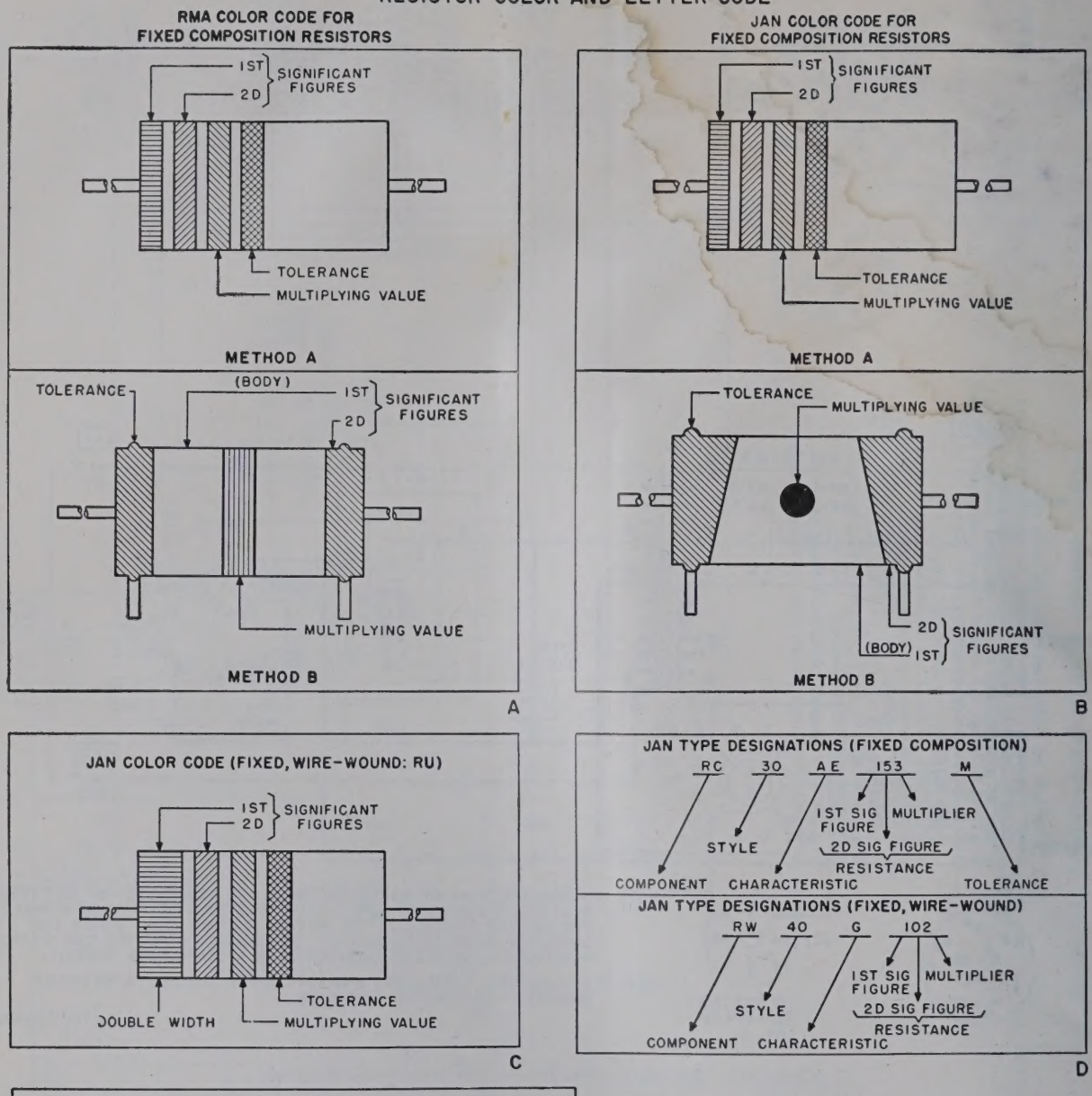



*Figure 117. Remote Control C–433/GRC, schematic diagram.*

## RESISTOR COLOR AND LETTER CODE



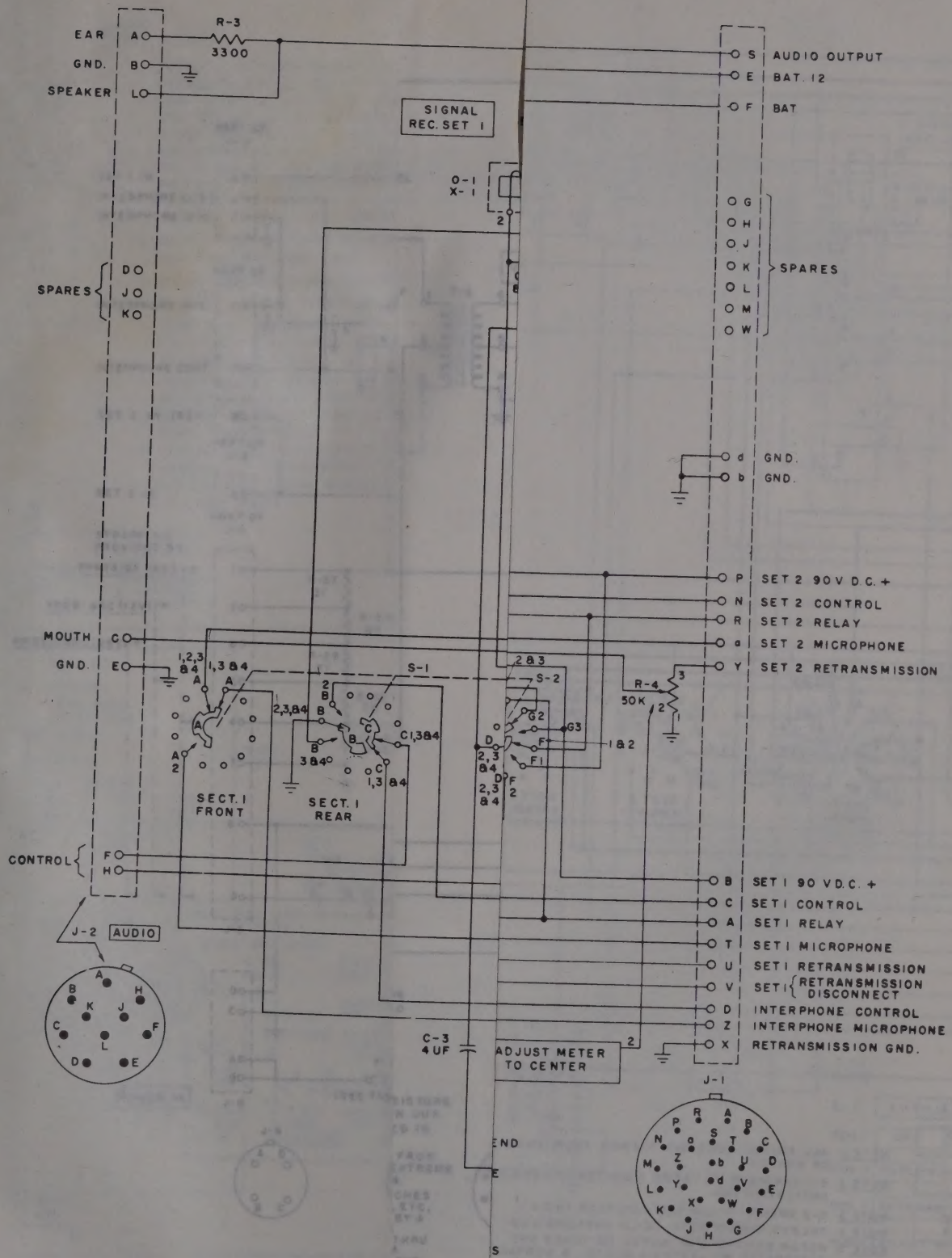

| STANDARDS | | | | |
|---|---|---|---|---|
| COLOR | SIGNIFICANT FIGURE | MULTIPLYING VALUE | TOLERANCE (%) | JAN LETTER TOLERANCE |
| BLACK | 0 | 1 | — | — |
| BROWN | 1 | 10 | ± 1 | F |
| RED | 2 | 100 | ± 2 | G |
| ORANGE | 3 | 1,000 | ± 3 | — |
| YELLOW | 4 | 10,000 | ± 4 | — |
| GREEN | 5 | 100,000 | ± 5 | — |
| BLUE | 6 | 1,000,000 | ± 6 | — |
| VIOLET | 7 | 10,000,000 | ± 7 | — |
| GRAY | 8 | 100,000,000 | ± 8 | — |
| WHITE | 9 | 1,000,000,000 | ± 9 | — |
| GOLD | — | 0.1 | ± 5 | J |
| SILVER | — | 0.01 | ±10 | K |
| NO COLOR | — | — | ±20 | M |

**NOTES:**

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

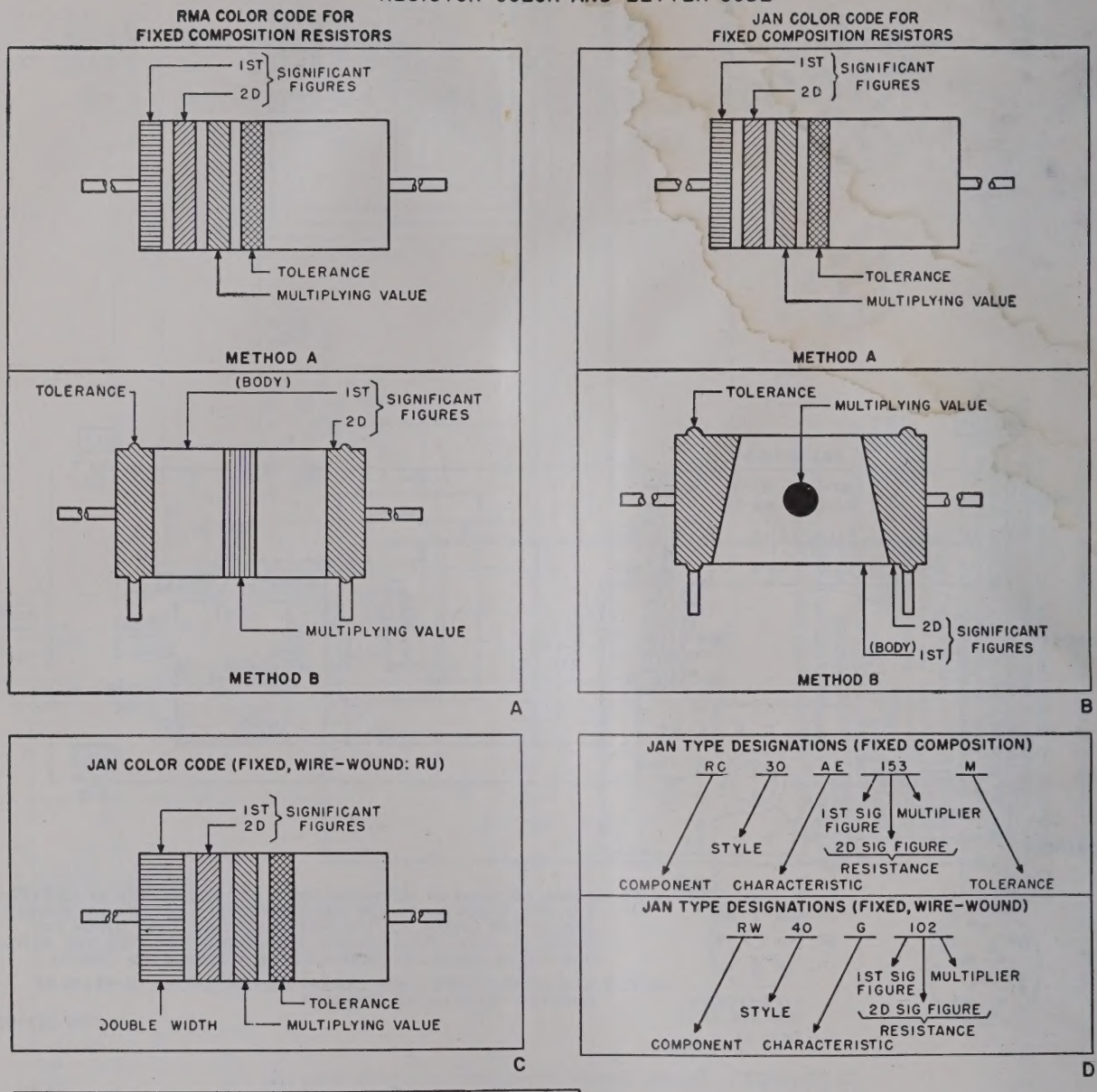
TM RC

*Figure 132. Resistor color and letter codes.*


EAR
GND.
SPEAKER
R-3
3300
SIGNAL REC. SET 1
AUDIO OUTPUT
BAT. 12
BAT
SPARES
SPARES
GND.
GND.
SET 2 90 V D.C. +
SET 2 CONTROL
SET 2 RELAY
SET 2 MICROPHONE
SET 2 RETRANSMISSION
MOUTH
GND.
S-1
S-2
R-4
50K
SECT. 1 FRONT
SECT. 1 REAR
CONTROL
SET 1 90 V.D.C. +
SET 1 CONTROL
SET 1 RELAY
SET 1 MICROPHONE
SET 1 RETRANSMISSION
SET 1 RETRANSMISSION DISCONNECT
INTERPHONE CONTROL
INTERPHONE MICROPHONE
RETRANSMISSION GND.
J-2 AUDIO
J-1
C-3
4 UF
ADJUST METER TO CENTER

TM 284-320

## RESISTOR COLOR AND LETTER CODE




| STANDARDS | | | | |
|---|---|---|---|---|
| COLOR | SIGNIFICANT FIGURE | MULTIPLYING VALUE | TOLERANCE (%) | JAN LETTER TOLERANCE |
| BLACK | 0 | 1 | – | – |
| BROWN | 1 | 10 | ± 1 | F |
| RED | 2 | 100 | ± 2 | G |
| ORANGE | 3 | 1,000 | ± 3 | – |
| YELLOW | 4 | 10,000 | ± 4 | – |
| GREEN | 5 | 100,000 | ± 5 | – |
| BLUE | 6 | 1,000,000 | ± 6 | – |
| VIOLET | 7 | 10,000,000 | ± 7 | – |
| GRAY | 8 | 100,000,000 | ± 8 | – |
| WHITE | 9 | 1,000,000,000 | ± 9 | – |
| GOLD | – | 0.1 | ± 5 | J |
| SILVER | – | 0.01 | ±10 | K |
| NO COLOR | – | – | ±20 | M |

**NOTES:**

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

*Figure 132. Resistor color and letter codes.*

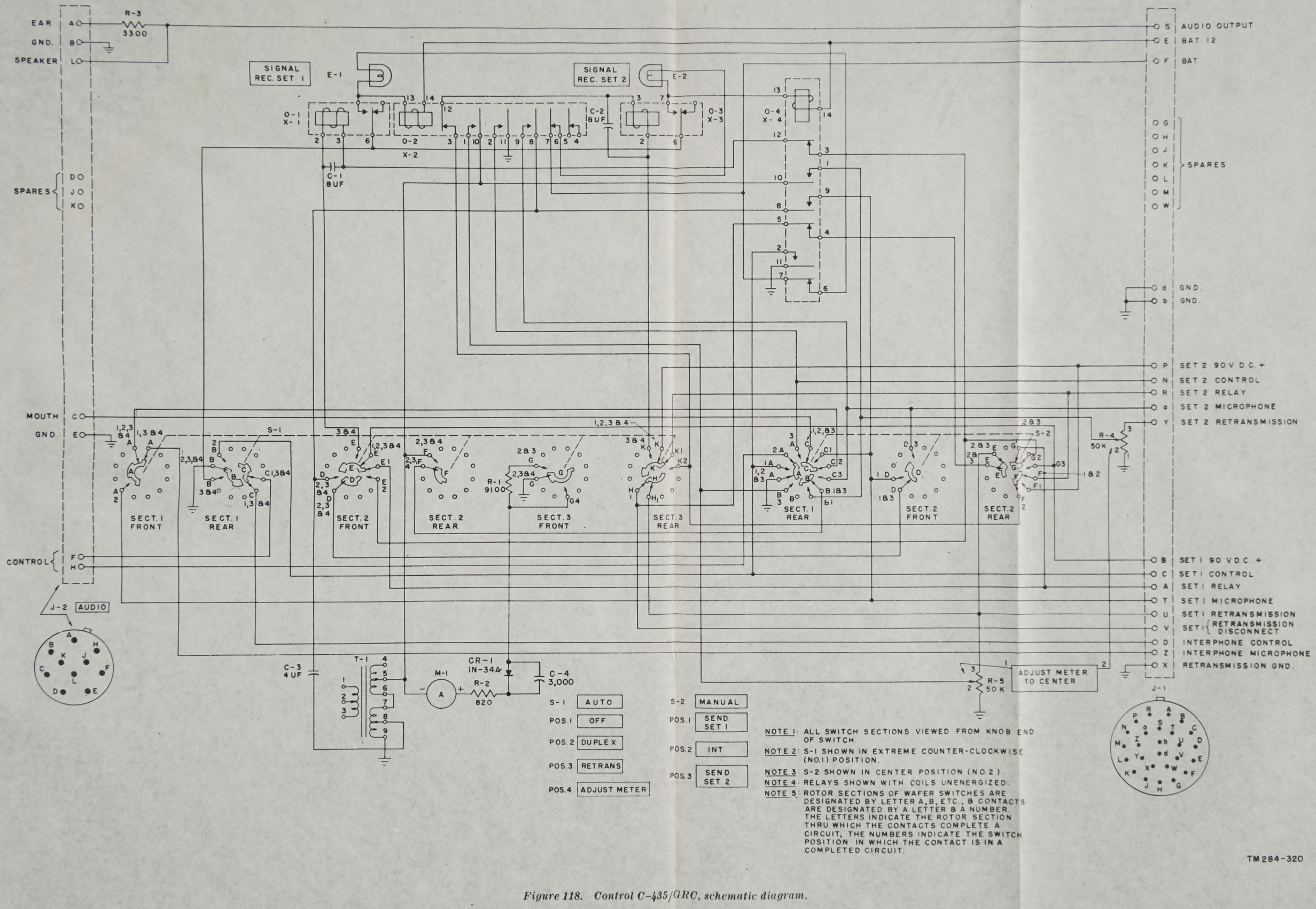



*Figure 118. Control C-435/GRC, schematic diagram.*

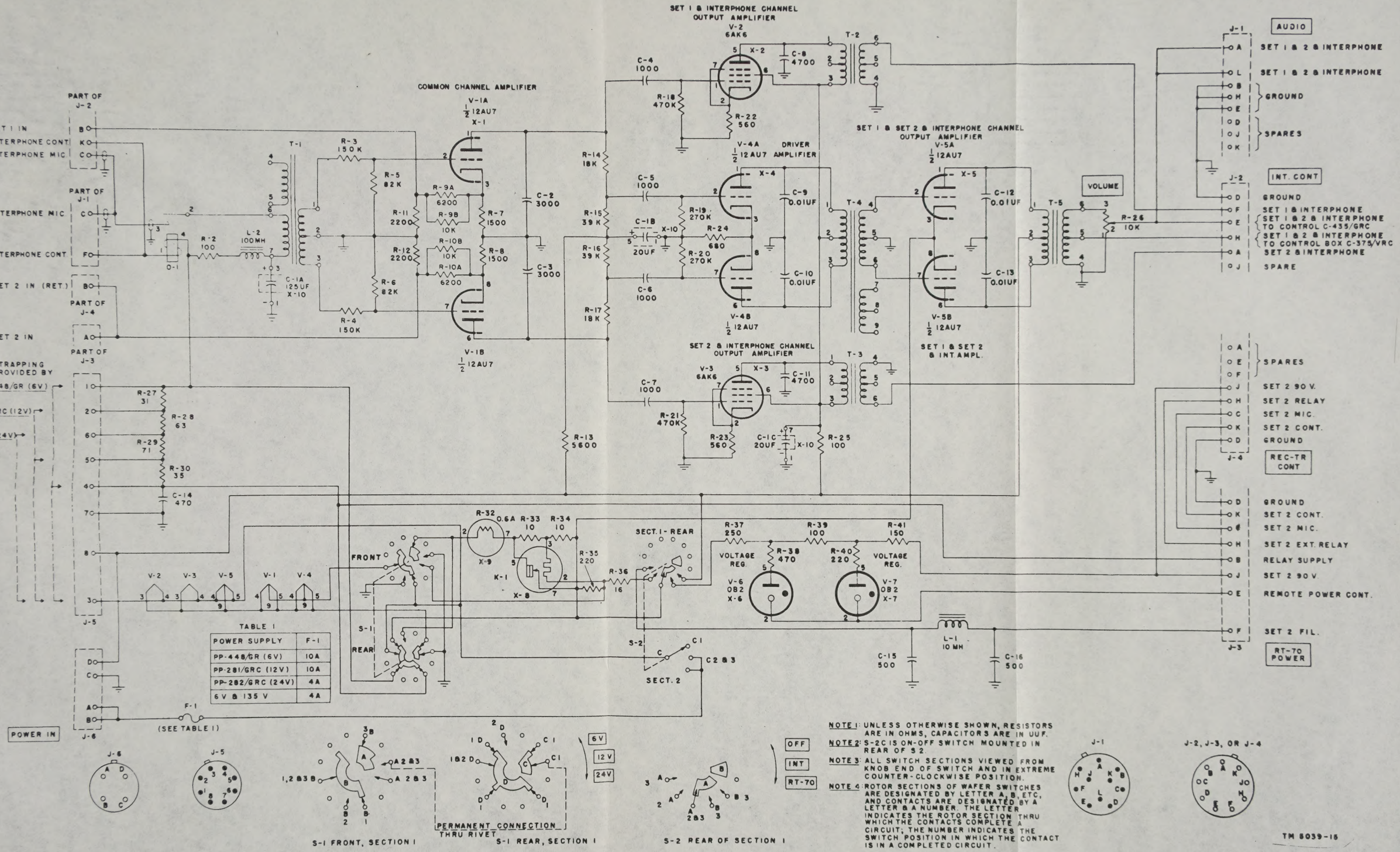



*Figure 119. AF Amplifier AM-65/GRC, schematic diagram.*

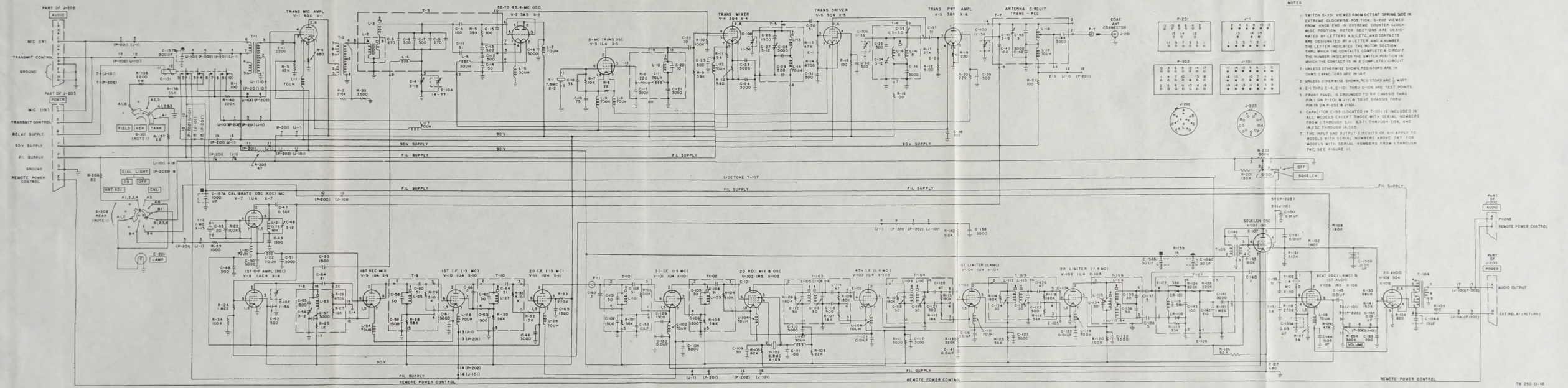



*Figure 120. Receiver-Transmitter RT-70/GRC, schematic diagram.*

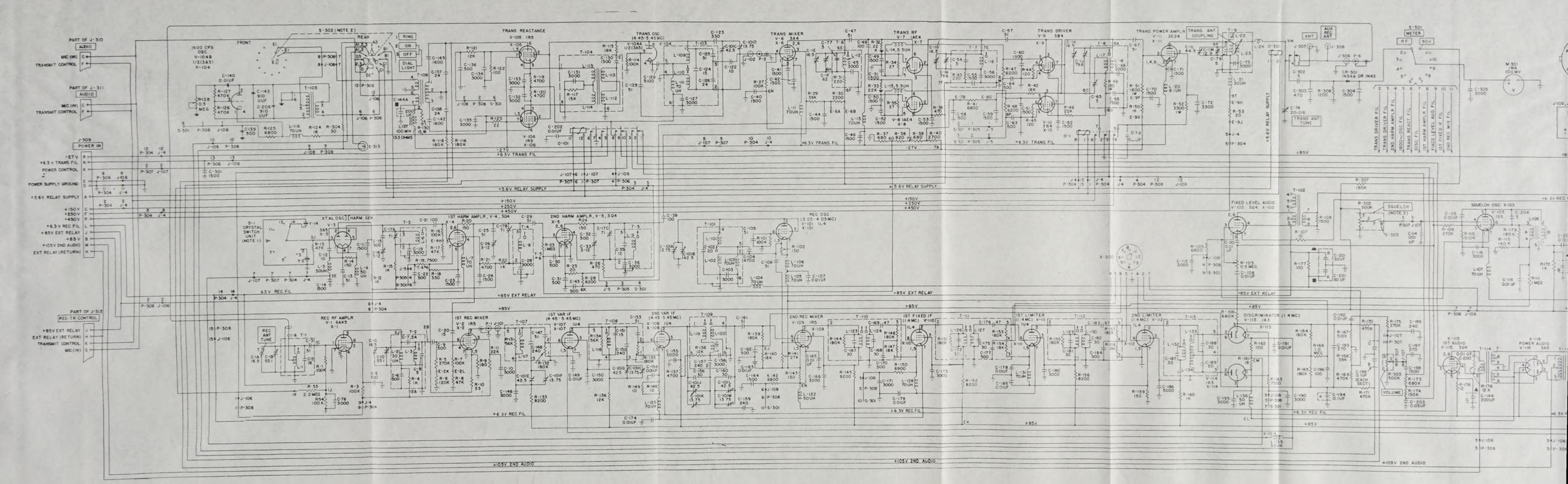



*Figure 121. Receiver-Transmitter RT-66/GRC, schematic diagram.*

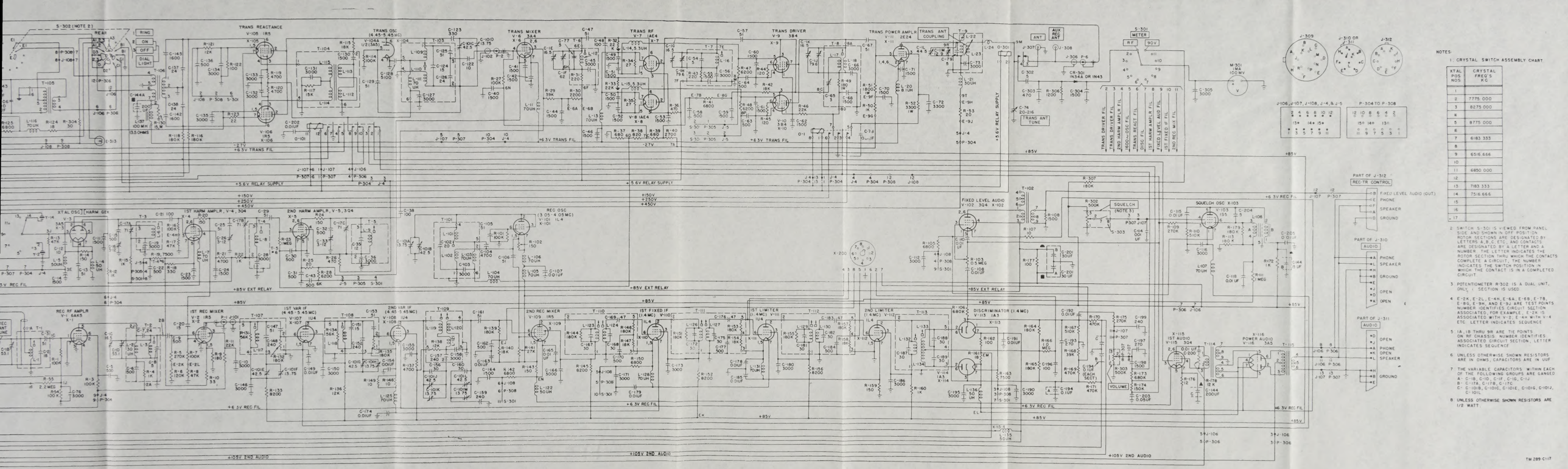


*Figure 121. Receiver-Transmitter RT-66/GRC, schematic diagram.*

NOTES:

1. CRYSTAL SWITCH ASSEMBLY CHART

| XTAL POSN. NOS. | CRYSTAL FREQ'S KC |
|---|---|
| 1 | |
| 2 | 7775.000 |
| 3 | 8275.000 |
| 4 | |
| 5 | 8775.000 |
| 6 | |
| 7 | 6183.333 |
| 8 | |
| 9 | 6516.666 |
| 10 | |
| 11 | 6850.000 |
| 12 | |
| 13 | 7183.333 |
| 14 | 7516.666 |
| 15 | |
| 16 | |
| 17 | |

2. SWITCH S-301 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, C, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT. THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

3. POTENTIOMETER R-302 IS A DUAL UNIT, ONLY 1 SECTION IS USED.

4. E-2K, E-2L, E-4K, E-6A, E-6B, E-7B, E-8G, E-9H, AND E-9J ARE TEST POINTS NUMBER IDENTIFIES CIRCUIT SECTION ASSOCIATED FOR EXAMPLE, E-2K IS ASSOCIATED WITH V-2; E-4H WITH V-4 ETC. LETTER INDICATES SEQUENCE.

5. 1A, 1B THRU 9R ARE TIE POINTS ON RF CHASSIS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, LETTER INDICATES SEQUENCE.

6. UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

7. THE VARIABLE CAPACITORS WITHIN EACH OF THE FOLLOWING GROUPS ARE GANGED
A- C-1B, C-1D, C-1F, C-1G, C-1J
B- C-1-7A, C-1-7B, C-1-7C
C- C-1001B, C-1001C, C-1001E, C-1001G, C-1001J, C-1001L

8. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT.

TM 289-C117

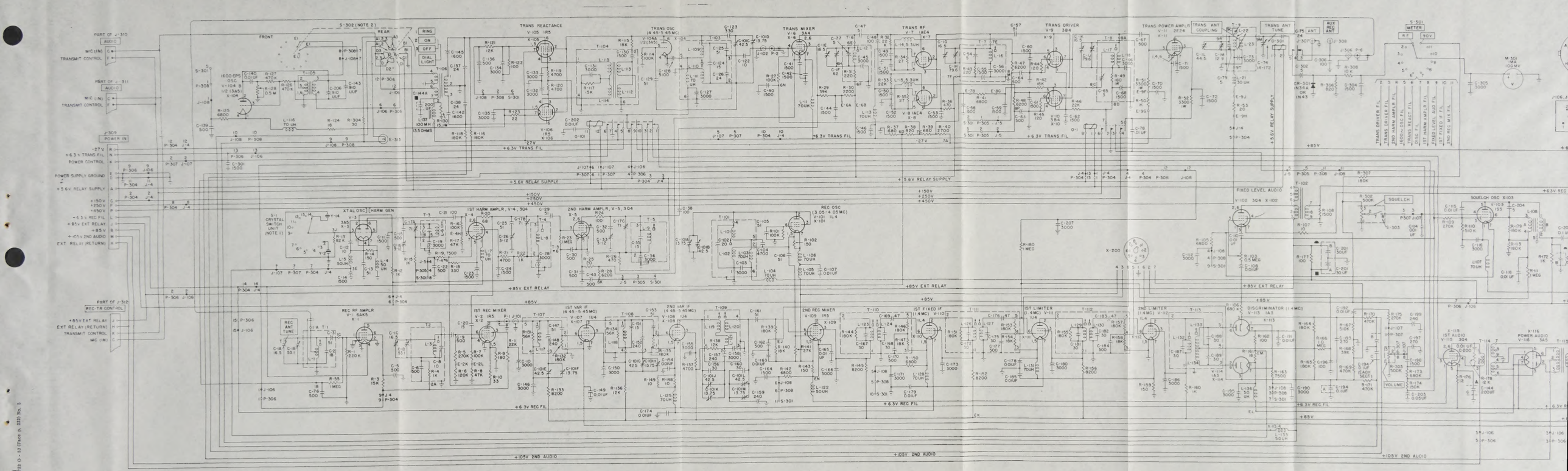
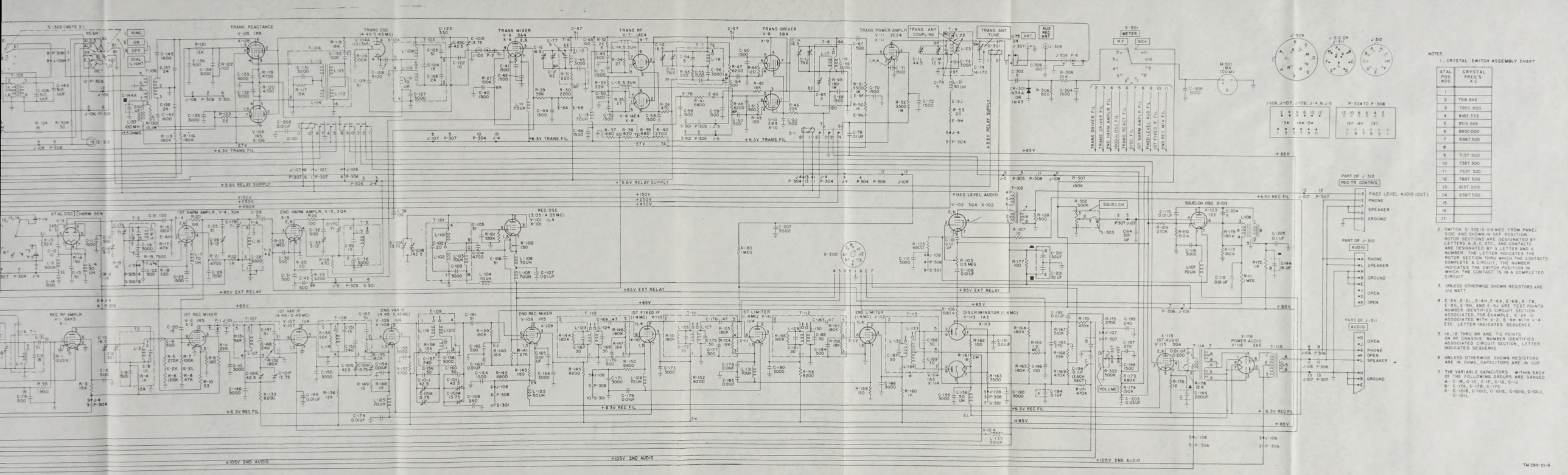



*Figure 122. Receiver-Transmitter RT-67/GRC, schematic diagram.*




NOTES

1. CRYSTAL SWITCH ASSEMBLY CHART

| XTAL POS NOS | CRYSTAL FREQ'S KC |
|---|---|
| 1 | |
| 2 | 7516.666 |
| 3 | 7850.000 |
| 4 | 8183.333 |
| 5 | 8516.666 |
| 6 | 8850.000 |
| 7 | 6887.500 |
| 8 | |
| 9 | 7137.500 |
| 10 | 7387.500 |
| 11 | 7637.500 |
| 12 | 7887.500 |
| 13 | 8137.500 |
| 14 | 8387.500 |
| 15 | |
| 16 | |
| 17 | |

2. SWITCH S-302 IS VIEWED FROM PANEL SIDE AND SHOWN IN OFF POSITION. ROTOR SECTIONS ARE DESIGNATED BY LETTERS A, B, C, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT. THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.
3. UNLESS OTHERWISE SHOWN RESISTORS ARE 1/2 WATT.
4. E-2K, E-2L, E-4H, E-6A, E-6B, E-7B, E-8G, E-9H, AND E-9J ARE TEST POINTS. NUMBER IDENTIFIES CIRCUIT SECTION ASSOCIATED. FOR EXAMPLE, E-2K IS ASSOCIATED WITH V-2. E-4H WITH V-4 ETC. LETTER INDICATES SEQUENCE.
5. 1A, 1B THRU 9R ARE TIE POINTS ON RT CHASSIS. NUMBER IDENTIFIES ASSOCIATED CIRCUIT SECTION, LETTER INDICATES SEQUENCE.
6. UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
7. THE VARIABLE CAPACITORS WITHIN EACH OF THE FOLLOWING GROUPS ARE GANGED.
   A: C-1B, C-1D, C-1F, C-1G, C-1J
   B: C-17A, C-17B, C-17C
   C: C-101B, C-101G, C-101K, C-101G, C-101J, C-101L

*Figure 122. Receiver-Transmitter RT-67/GRC, schematic diagram.*

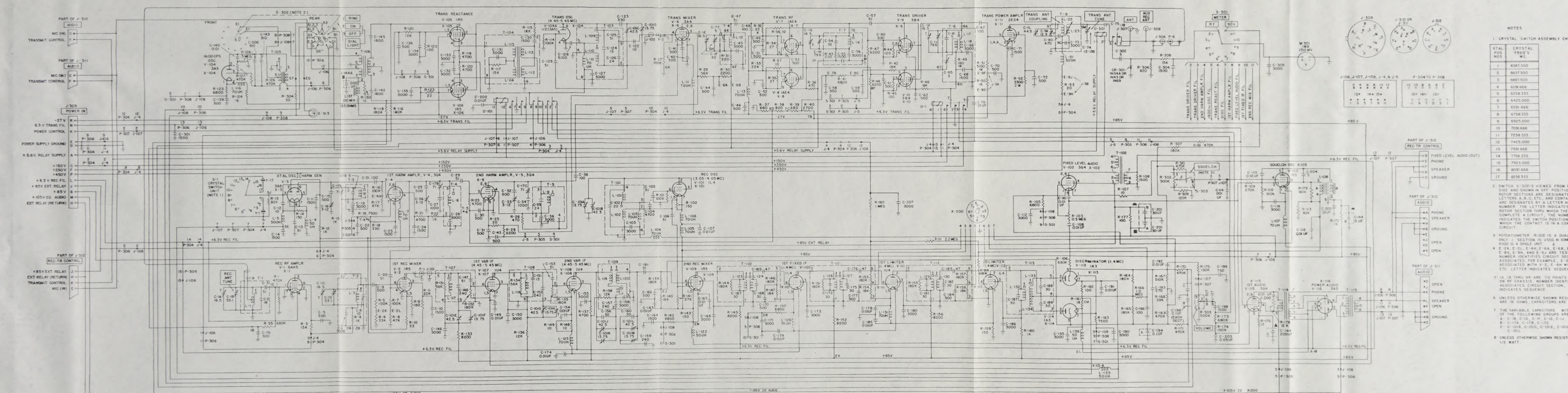
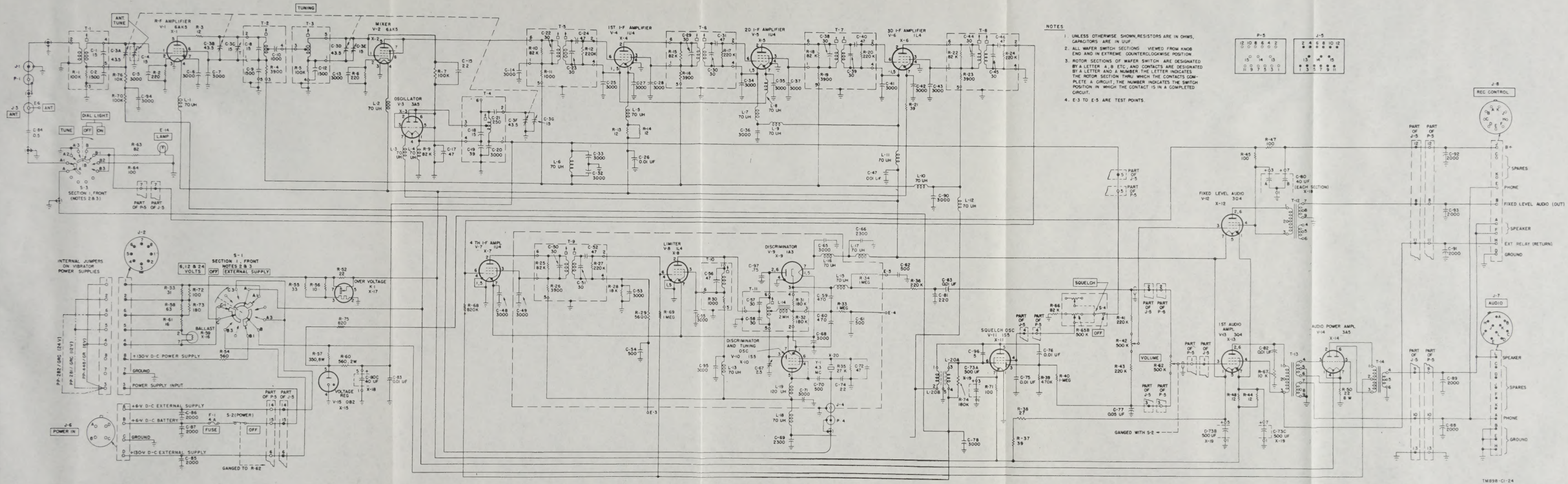


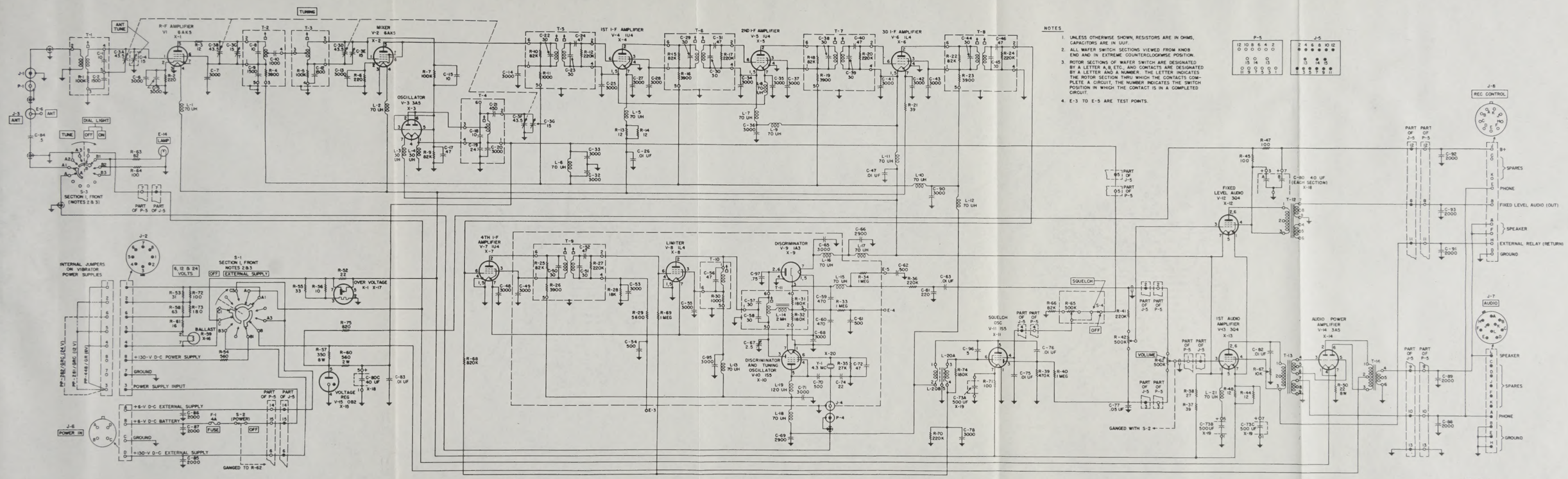

*Figure 123. Receiver-Transmitter RT-68/GRC, schematic diagram.*




NOTES

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. ALL WAFER SWITCH SECTIONS VIEWED FROM KNOB END AND IN EXTREME COUNTERCLOCKWISE POSITION.
3. ROTOR SECTIONS OF WAFER SWITCH ARE DESIGNATED BY A LETTER A, B ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT, THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.
4. E-3 TO E-5 ARE TEST POINTS.

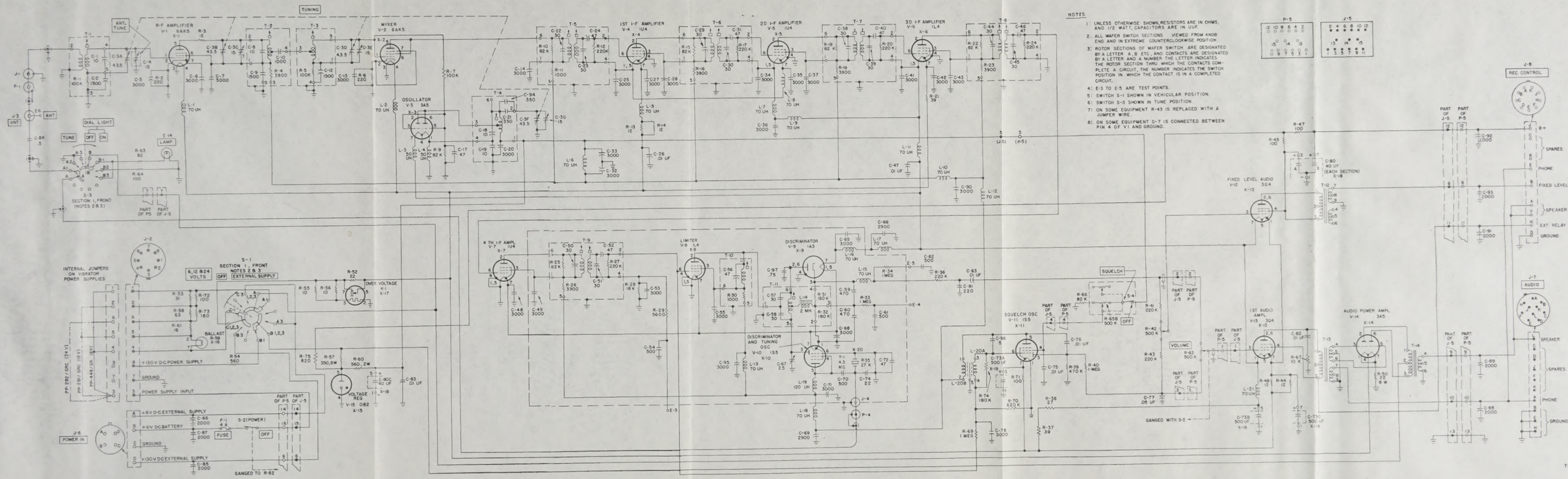
*Figure 124. Radio Receiver R-108/GRC, schematic diagram.*




NOTES

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. ALL WAFER SWITCH SECTIONS VIEWED FROM KNOB END AND IN EXTREME COUNTERCLOCKWISE POSITION.
3. ROTOR SECTIONS OF WAFER SWITCH ARE DESIGNATED BY A LETTER A, B, ETC., AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT, THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.
4. E-3 TO E-5 ARE TEST POINTS.

*Figure 125. Radio Receiver R-109/GRC, schematic diagram.*




NOTES

1: UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, AND 1/2 WATT, CAPACITORS ARE IN UUF.

2: ALL WAFER SWITCH SECTIONS VIEWED FROM KNOB END AND IN EXTREME COUNTERCLOCKWISE POSITION.

3: ROTOR SECTIONS OF WAFER SWITCH ARE DESIGNATED BY A LETTER A, B ETC, AND CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER THE LETTER INDICATES THE ROTOR SECTION THRU WHICH THE CONTACTS COMPLETE A CIRCUIT, THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT.

4: E-3 TO E-5 ARE TEST POINTS.

5: SWITCH S-1 SHOWN IN VEHICULAR POSITION.

6: SWITCH S-3 SHOWN IN TUNE POSITION.

7: ON SOME EQUIPMENT R-43 IS REPLACED WITH A JUMPER WIRE.

8: ON SOME EQUIPMENT C-7 IS CONNECTED BETWEEN PIN 4 OF V1 AND GROUND.

*Figure 126. Radio Receiver R-110/GRC, schematic diagram.*

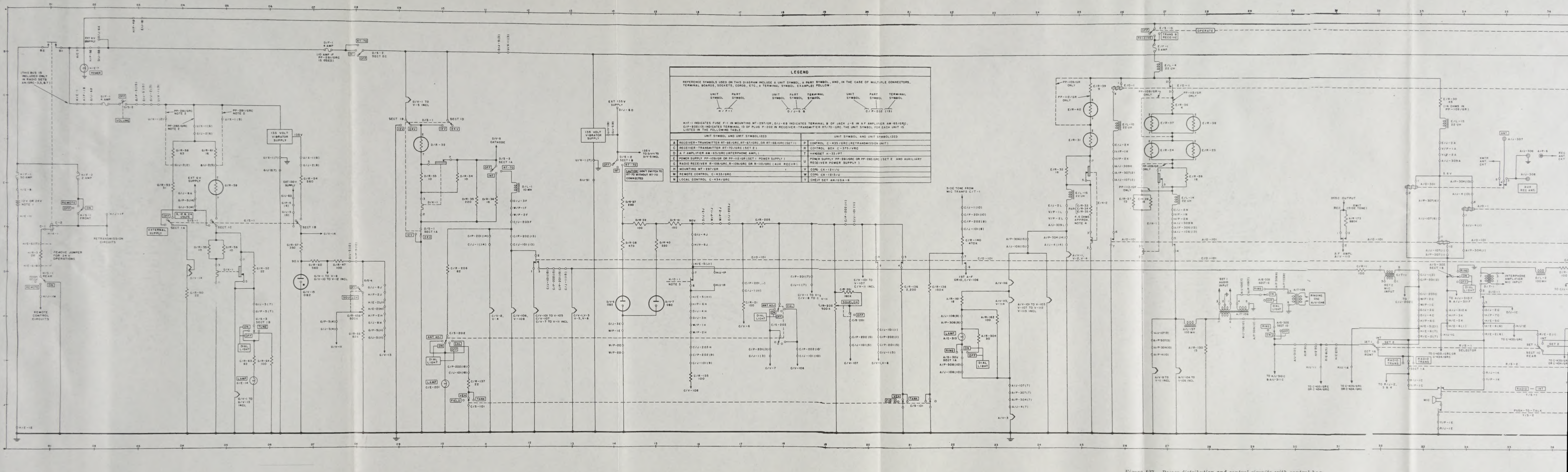



*Figure 127. Power distribution and control circuits with control box.*

-722 O - 53 (Face p. 322) No. 10

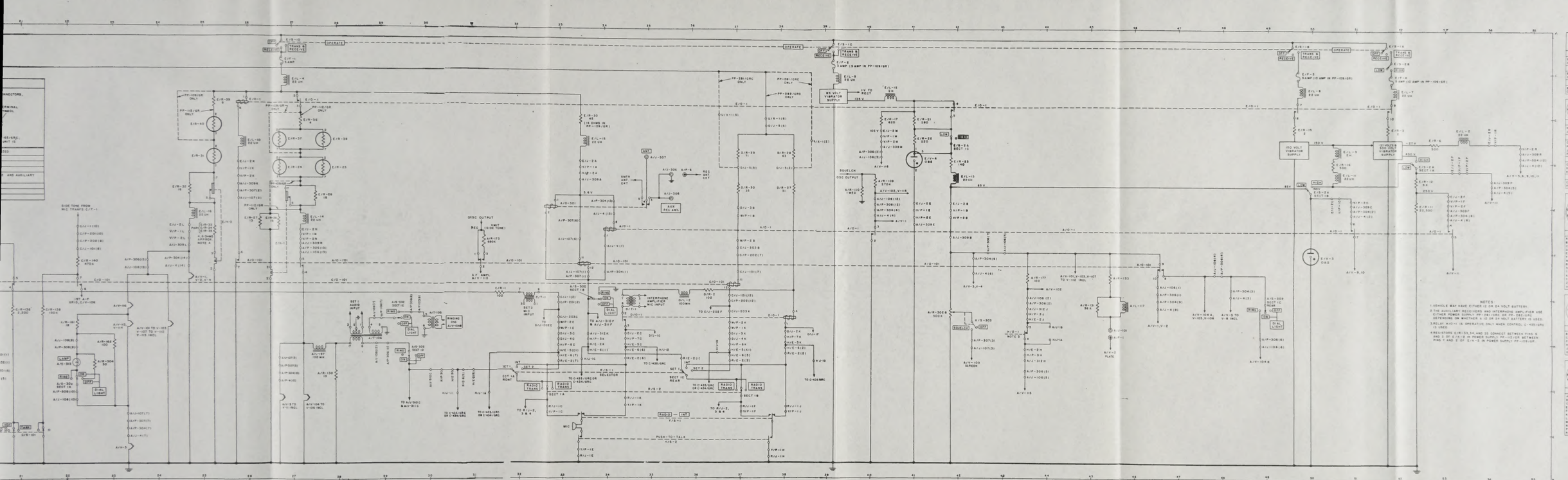


*Figure 127. Power distribution and control circuits with control box.*

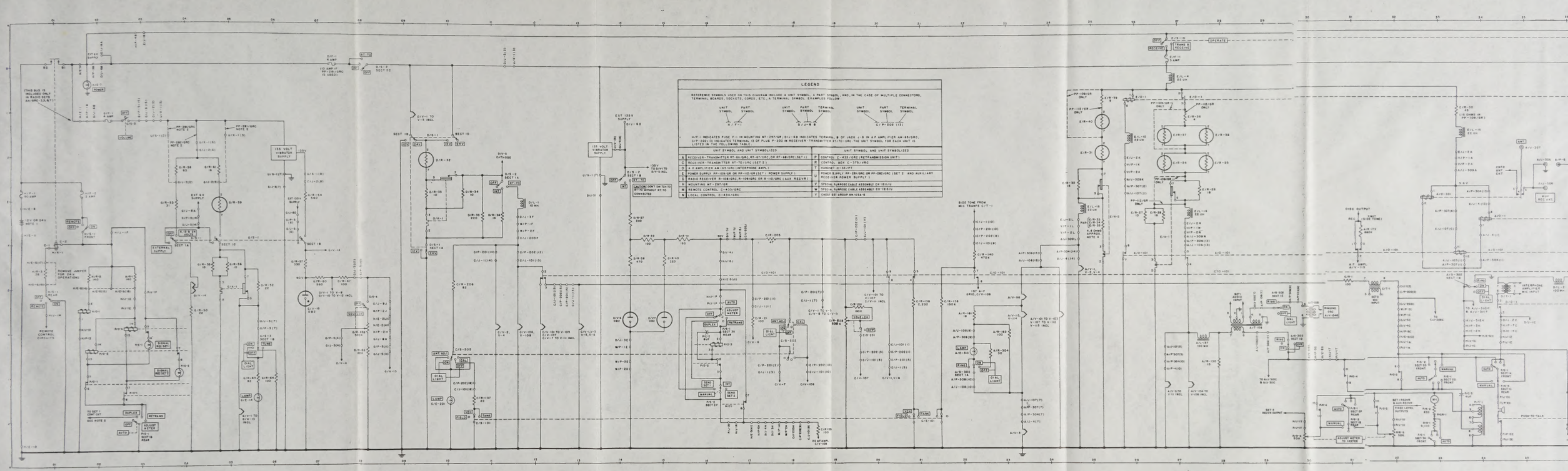



*Figure 128. Power distribution and control circuits with retransmission unit.*

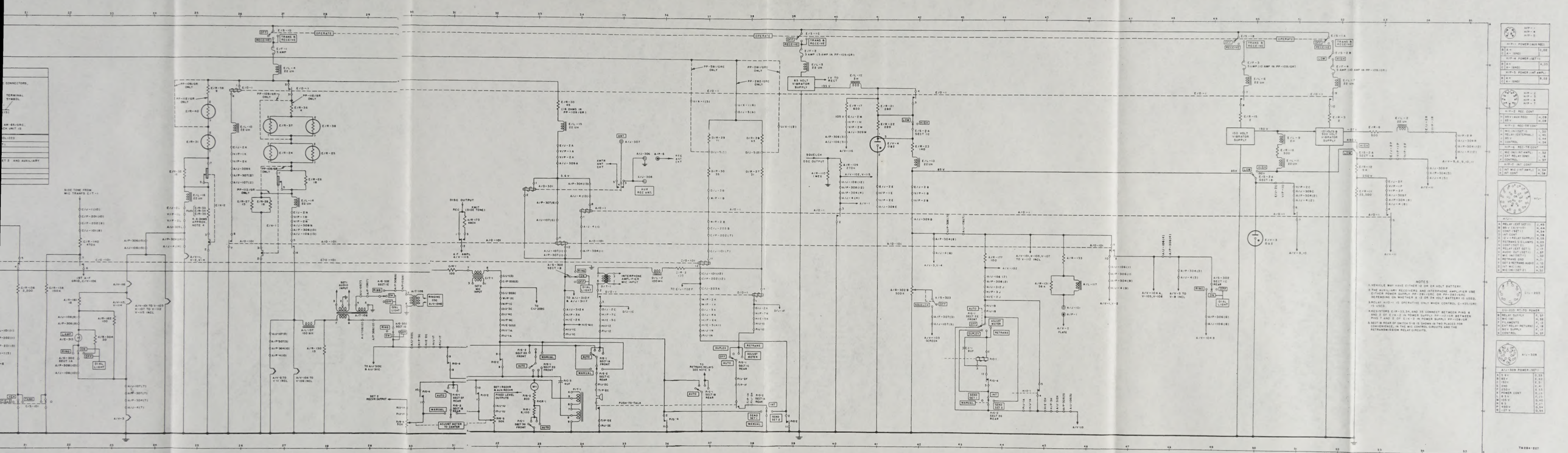


*Figure 128. Power distribution and control circuits with retransmission unit.*

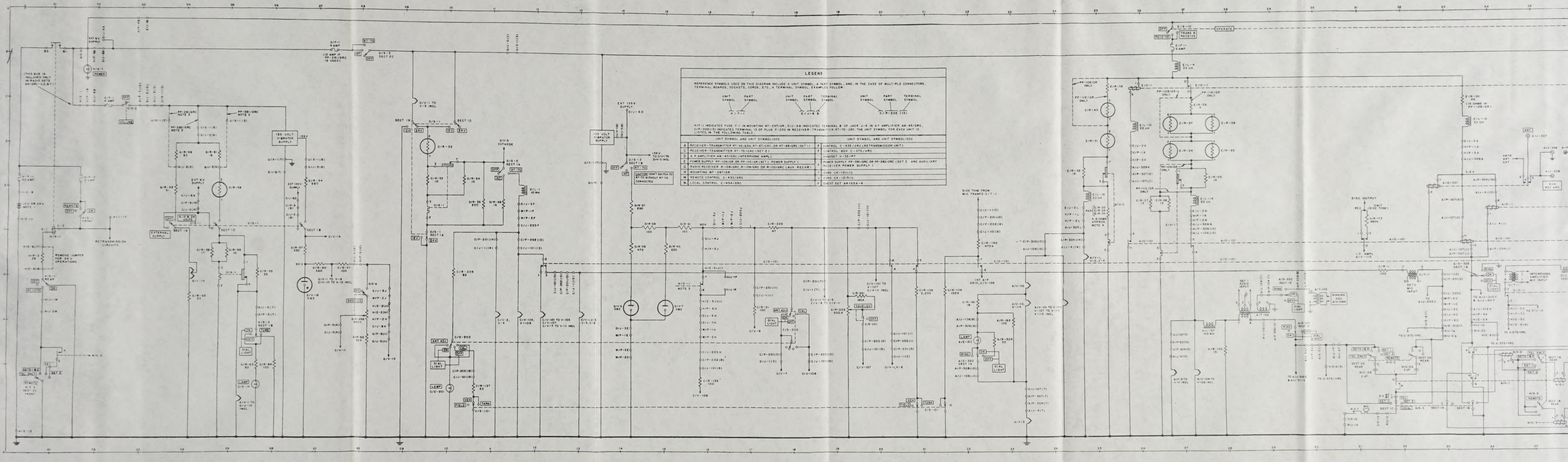



Figure 129. Power distribution and control circuits with local and remote control units.

334-723 O - 55 (Face p. 322) No. 12

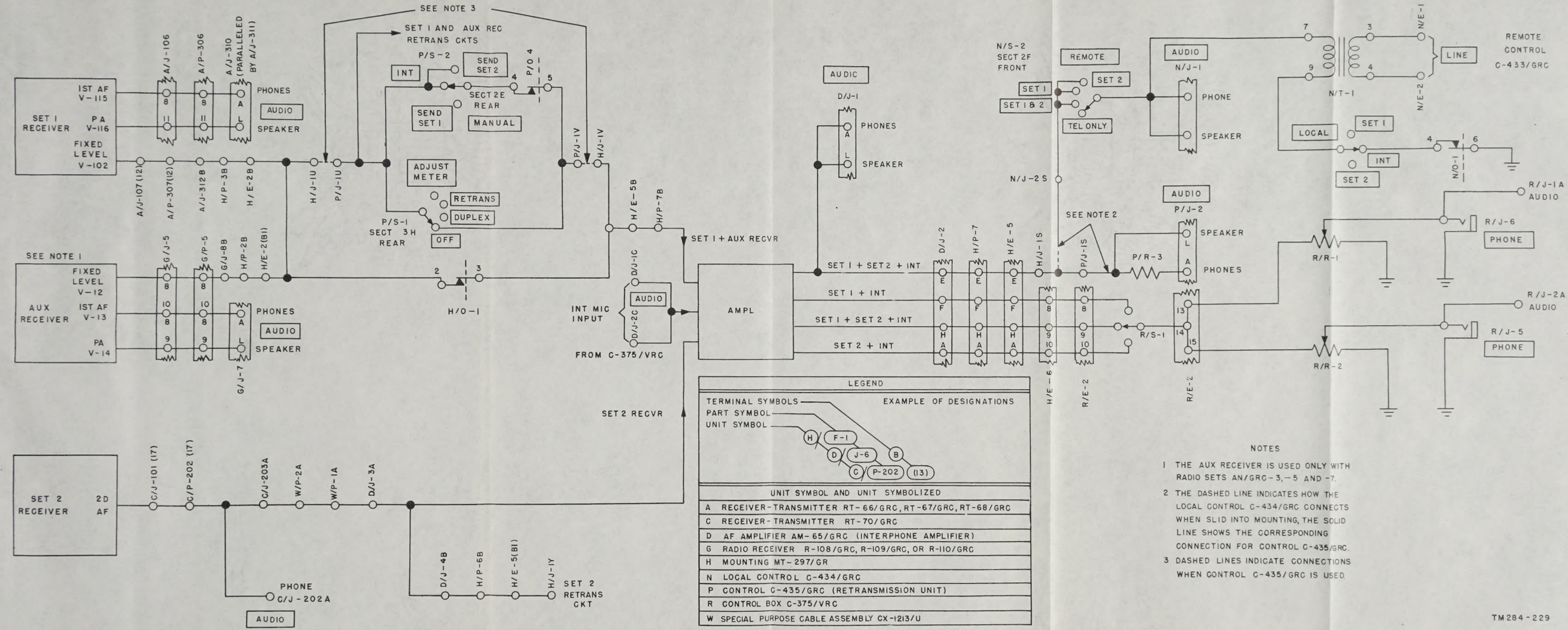



*Figure 130. Monitoring circuits.*

54-722 O - 53 (Face p. 222) No. 13

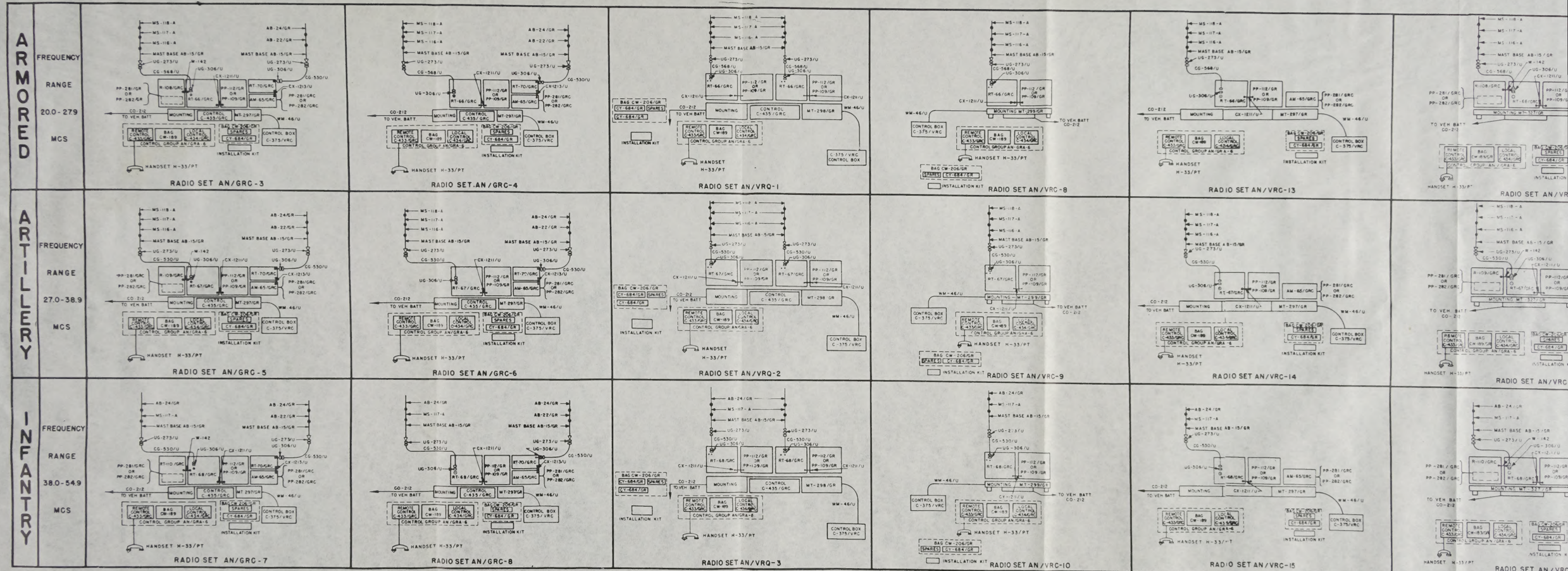



*Figure 131. Standardized series of f-m sets.*

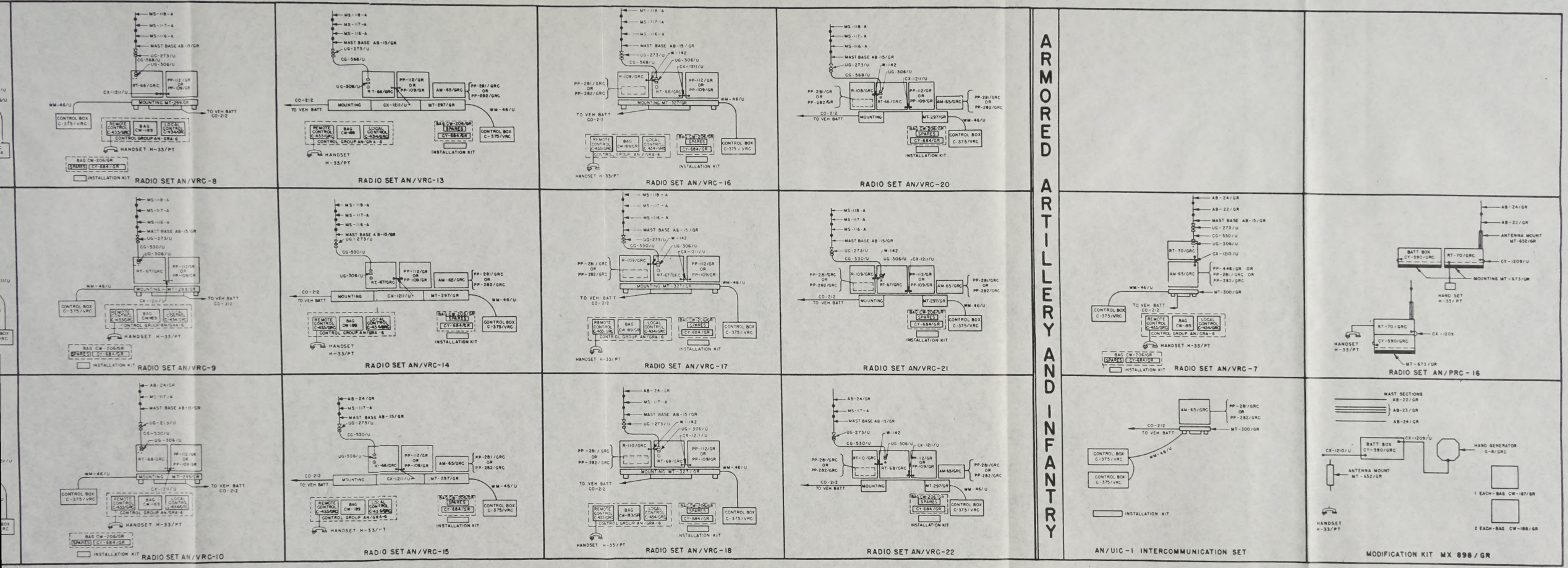
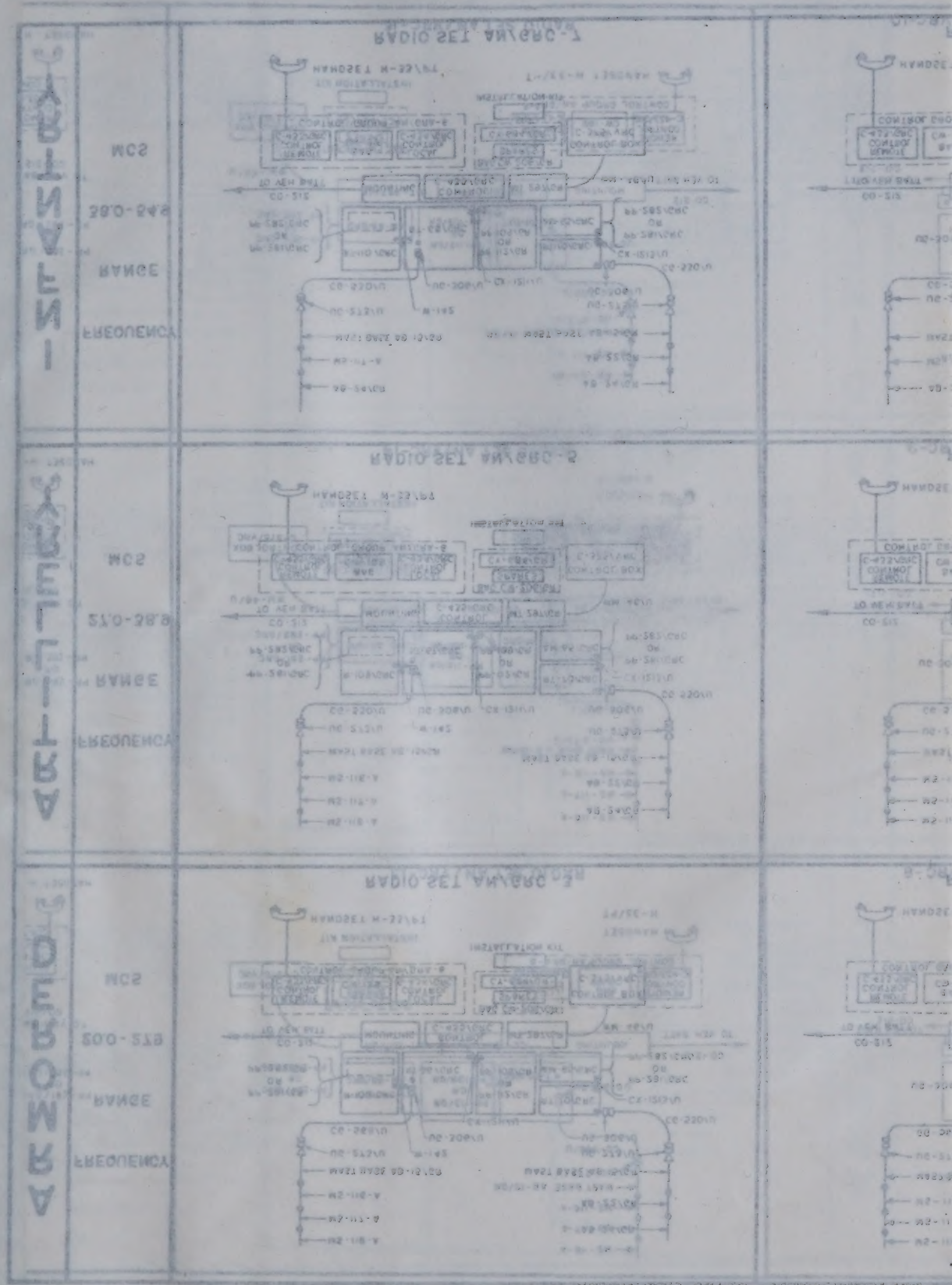
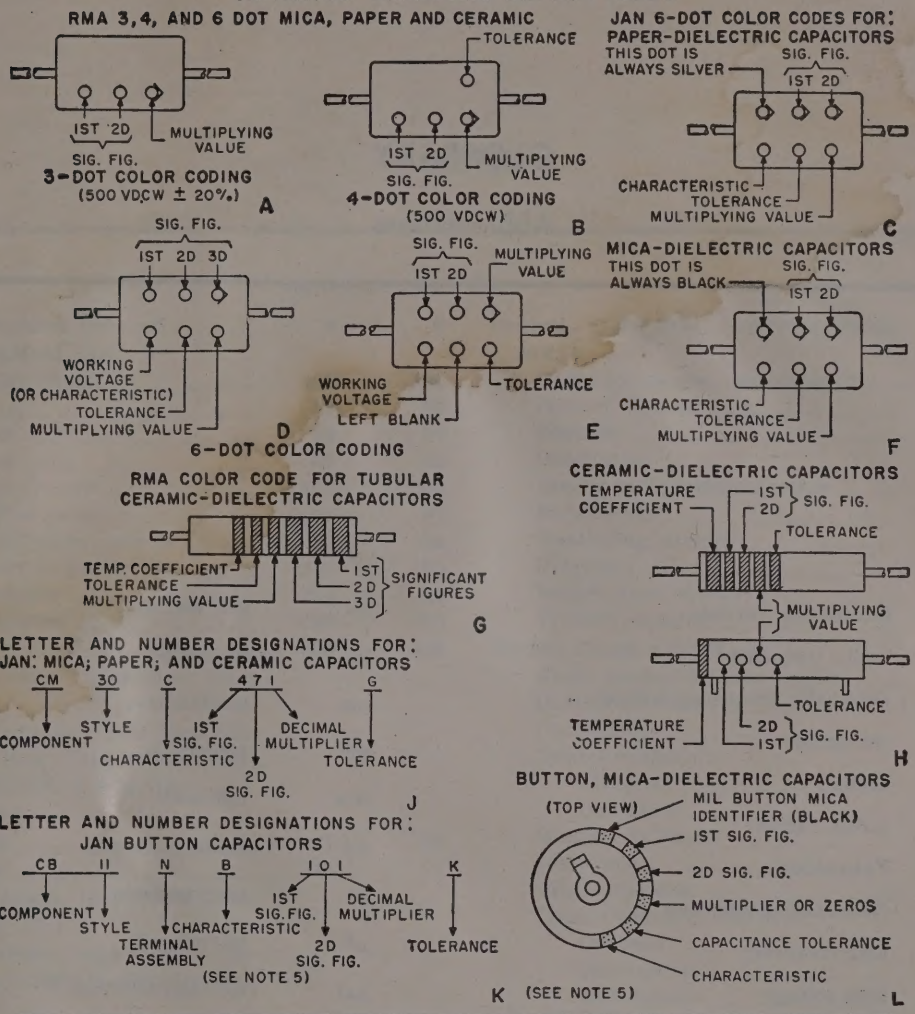



*Figure 131. Standardized series of f-m sets.*


AN/GRC-1
AN/GRC-2
AN/GRC-3
FREQUENCY
RANGE
MCS

## CAPACITOR COLOR AND LETTER CODES




| - STANDARDS - | | | | | JAN MICA-CM | | JAN PAPER-CM | | JAN CERAMIC-CC | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | CAP. TOL. FOR MORE THAN 10 UUF | | CAP. TOL. FOR 10 UUF OR LESS | | |
| COLOR | SIG. FIG. | DECIMAL MULTIPLIER | % TOL. | VDCW | LETTER TOL. | CHARAC-TERISTIC | LETTER TOL. | CHARAC-TERISTIC | DEC. MULT. | % | LETTER DESIG-NATION | UUF | LETTER DESIG-NATION | CHARAC-TERISTIC |
| BLACK | 0 | 1 | ±20 | 500 | M | A | M | A | 1 | ±20 | M | ±2.0 | G | C |
| BROWN | 1 | 10 | ± 1 | 100 | - | B | - | E | 10 | ± 1 | F | - | - | H |
| RED | 2 | 100 | ± 2 | 200 | G | C | - | H | 100 | ± 2 | G | - | - | L |
| ORANGE | 3 | 1,000 | ± 3 | 300 | - | D | N* | J | 1,000 | - | - | - | - | P |
| YELLOW | 4 | 10,000 | ± 4 | 400 | - | E | - | P | - | - | - | - | - | R |
| GREEN | 5 | 100,000 | ± 5 | 500 | - | F | - | R | - | ± 5 | J | ±0.5 | D | S |
| BLUE | 6 | 1,000,000 | ± 6 | 600 | - | G | - | S | - | - | - | - | - | T |
| VIOLET | 7 | 10,000,000 | ± 7 | 700 | - | - | - | T | - | - | - | - | - | U |
| GRAY | 8 | 100,000,000 | ± 8 | 800 | - | - | - | - | 0.01 | - | - | ±0.25 | C | B |
| WHITE | 9 | 1,000,000,000 | ± 9 | 900 | - | - | - | - | 0.1 | ± 10 | K | ±1.0 | F | SL |
| GOLD | - | 0.1 | ± 5 | 1,000 | J | - | - | - | - | - | - | - | - | A |
| SILVER | - | 0.01 | ±10 | 2,000 | K | - | K | - | - | - | - | - | - | - |
| NO COLOR | - | - | ±20 | 500 | - | - | - | - | - | - | - | - | - | - |

* THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±2%

NOTES

JAN: JOINT ARMY-NAVY
RMA: RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   *CB* MICA BUTTON: *CC* CERAMIC; *CM* MICA MOULDED: *CN* PAPER MOULDED

TM CC

*Figure 133. Capacitor color and letter codes.*

# GLOSSARY

## Abbreviations

| | |
|---|---|
| a-c | alternating current |
| a-f | audio frequency |
| afc | automatic frequency control |
| C | centigrade |
| db | decibel |
| d-c | direct current |
| F | Fahrenheit |
| f-m | frequency modulation |
| h-f | high frequency |
| h-v | high voltage |
| if | intermediate frequency |
| l-v | low voltage |
| kc | kilocycle |
| ma | milliampere |
| mc | megacycle |
| mw | milliwatt |
| r-f | radio frequency |
| $\mu$a | microampere |
| $\mu$f | microfarad |
| $\mu\mu$f | micromicrofarad |
| $\mu$v | microvolt |

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