

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-5070

TO 31R2-2GRC9-21

POWER SUPPLIES
PP-327/GRC-9Y AND
PP-327A/GRC-9Y



DEPARTMENTS OF THE ARMY AND THE AIR FORCE
SEPTEMBER 1955

TECHNICAL MANUAL
No. 11-5070
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THE AIR FORCE

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POWER SUPPLIES PP-327/GRC-9Y AND PP-327A/GRC-9Y

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CHAPTER 1

INTRODUCTION

Section I, GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, maintenance, and repair of Power Supply PP-327/GRC-9Y and Power Supply PP-327A/GRC-9Y. Both power supplies are discussed together. Where differences exist, the power supplies are discussed separately.

b. Official nomenclature followed by (*) indicates all models of the equipment covered in this manual. Thus, Power Supply PP-327(*)/GRC-9Y represents Power Supply PP-327/GRC-9Y and Power Supply PP-327A/GRC-9Y and Receiver-Transmitter RT-77(*)/GRC-9 represents Receiver-Transmitter RT-77/GRC-9 and Receiver-Transmitter RT-77A/GRC-9.

c. Comments on this publication will be forwarded directly to the Commanding Officer, Signal Corps Publications Agency, Fort Monmouth, New Jersey, Attn: Standards Division.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army Equipment and in performing preventive maintenance:

a. DD Form 6, Report of Damage or Improper Shipment, will be filled out and forwarded as prescribed in SR 745-45-5 (Army); Navy Shipping Guide, Article 1850-4 (Navy); 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. DD Form 535, Unsatisfactory Report, will be filled out and forwarded as prescribed in SR 700-45-5 and AF TO 00-35D-54.

d. DA 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 (fig. 9).

e. DA 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 (fig. 10).

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Power Supply PP-327(*)/GRC-9Y (fig. 1) is used to supply all voltages required for the operation of Receiver-Transmitter RT-77(*)/GRC-9, which is the main component of Radio Set AN/GRC-9. The power supply may also be used in any other application that requires the output of Power Supply PP-327/GRC-9Y, if provision is made for controlling the unit (par. 14d). The receiver and transmitter filament voltages and the receiver plate voltages are available when the power input switch on the power supply is turned on. The

transmitter plate voltage is not available until the OFF-SEND-STAND BY switch on Receiver-Transmitter RT-77(*)/GRC-9 is turned to the SEND position. Refer to TM 11-263, Radio Set AN/GRC-9.

4. Technical Characteristics

Power Supply PP-327/GRC-9Y:

Power input 100 to 130 or 200 to 260 volts, 50 to 450 cps, single phase; 200 watts.



Figure 1. Power Supply PP-327(*)/GRC-9Y.

Power output:

- Transmitter plate ... 570 volts at 105 ma.
- Receiver plate 108 volts at 32 ma.
- Receiver filament ... 1.6 volts at 500 ma.
- Control voltage 6.7 volts at 670 ma.
- Transmitter filament 6.5 volts at 1.9 amp.

Power Supply PP-327A/GRC-9Y:

Power input 100 to 130 or 200

to 260 volts, 60
to 450 cps, single
phase; 200 watts.

Power output:

- Transmitter plate ... 540 volts at 100 ma.
- Receiver plate 105 volts at 45 ma.
- Receiver filament ... 1.5 volts at 500 ma.
- Control voltage 6.6 volts at 575 ma.
- Transmitter filament 6.6 volts at 2 amp.

5. Components

a. Power Supply PP-327/GRC-9Y.

Component	Required No.	Height (in.)	Width (in.)	Length (in.)	Volume (cu ft)	Unit weight (lb)
Power Supply PP-327/GRC-9Y, including Power Cable Assembly CX-112/U.	1	8½	15¼	20⅝	1.55	90
Cord CD-1086.....	1			44		1½
Tube puller.....	1					
Running spares (par. 8).....	1 set					

b. Power Supply PP-327A/GRC-9Y.

Component	Required No.	Height (in.)	Depth (in.)	Length (in.)	Unit weight (lb)
Power Supply PP-327A/GRC-9Y, including Power Cable Assembly CX-112/U.	1	10½	16½	14¼	95
Cord CD-1086.....	1			44	1½
Running spares (par. 8).....	1 set				

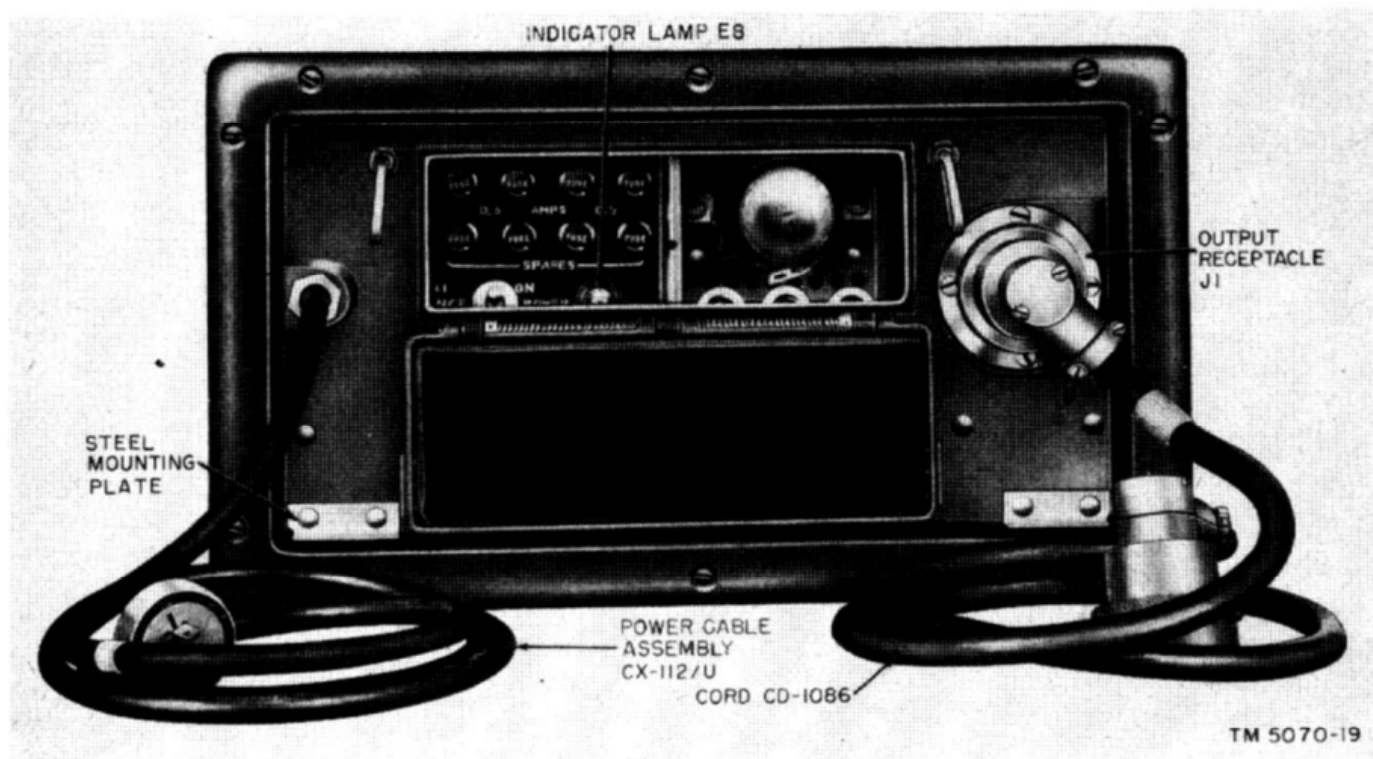


Figure 2. Power Supply PP-327/GRC-9Y, panel door open.

6. Description of Power Supply PP-327/ GRC-9Y

(fig. 2)

Power Supply PP-327/GRC-9Y is inclosed in an aluminum case, which is corrugated to prevent the set from overheating during operation. All components are mounted on the front panel, control panel, tube subchassis, and main chassis. The control panel and the tube subchassis are mounted on the main chassis behind the front panel and can be removed for the replacement of any parts mounted on them. A spring-loaded hinged door is provided on the front panel so that the controls, fuses, and tube subchassis can be reached. When the door is locked, the power supply is completely waterproof. Input Power Cable Assembly CX-112/U is permanently attached to the equipment through an opening on the front panel. The output receptacle located on the front panel terminates the output circuits of the power supply. Cord CD-1086 is an eight-conductor power output cable supplied with the equipment.

7. Description of Power Supply PP-327A/ GRC-9Y

(fig. 3)

Power Supply PP-327A/GRC-9Y consists of a panel-chassis assembly and a metal cabinet. Dzus fasteners on the panel secure the assembly in the cabinet. The controls, tubes, and fuses are mounted on a subchassis assembly, which is fastened to the panel. A door, fastened by Dzus fasteners, can be opened so that the tubes, fuses, and controls can be reached. The equipment is waterproof when the panel door is locked. A blower in the equipment is used for cooling purposes. The output cable, Cord CD-1086, mates with the receptacle on the front of the equipment.

8. Running Spares

a. Power Supply PP-327/GRC-9Y.

- 1 tube 5R4WGY
- 1 tube 6X4W
- 2 tubes OA2
- 1 lamp, incandescent, 6- to 8-volt, .15-ampere, bayonet base

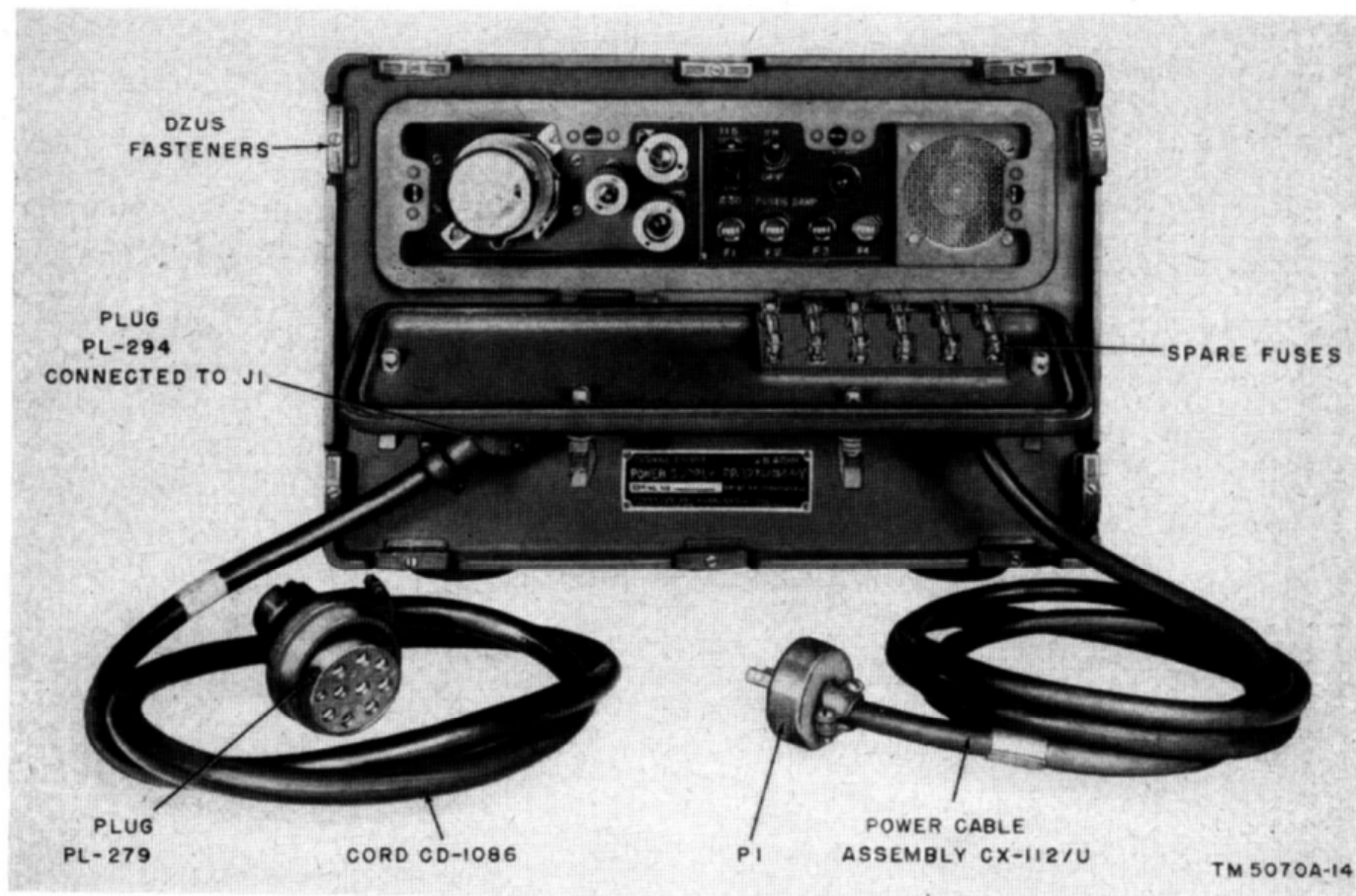


Figure 3. Power Supply PP-327A/GRC-9Y, panel door open.

4 fuses, .5-ampere, slow-blow, 1¼ inches long by ¼ inch diameter.

b. Power Supply PP-327A/GRC-9Y.

24 fuses, 2-ampere, 1¼ inches long by ¼ inch diameter

1 tube 5R4WGY

1 tube 6X4W

1 tube 991

1 tube 5751

1 tube 6216

1 current-regulating resistor, RT1

2 current-regulating resistors, RT2 and RT3.

9. Differences in Models

Power Supply PP-327/GRC-9Y and Power Supply PP-327A/GRC-9Y are both designed for use with Receiver-Transmitter RT-77(*)/GRC-9 and are interchangeable; however, they differ greatly in

Characteristics	Power Supply PP-327/GRC-9Y	Power Supply PP-327A/GRC-9Y
Cooling method.....	Corrugated case.	Blower.
Fuses.....	.5 amp.	2 amp.

10. Packaging Data

When packed for export shipment, the components of Power Supply PP-327(*)/GRC-9Y are placed in a moisture-vaporproof container and are packed in a wooden export case. Figure 4 is an exploded view of a Power Supply PP-327(*)/GRC-9Y packed for export shipment. The size, weight, and volume of a typical case are indicated in the chart below:

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

Equipment	Number of cases	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Weight (lb)
Power Supply PP-327/GRC-9Y.....	1	17½	22	10	2.3	123
Power Supply PP-327A/GRC-9Y.....	1	18½	17¾	21½	4.1	130

many respects. The following table summarizes the major differences:

Characteristics	Power Supply PP-327/GRC-9Y	Power Supply PP-327A/GRC-9Y
Output voltages.....	570 v—105 ma 108 v— 32 ma 6.7 v—670 ma 6.5 v— 1.9 amp 1.6 v—500 ma	540 v—100 ma 105 v— 45 ma 6.6 v—575 ma 6.6 v— 2 amp 1.5 v—500 ma
Regulation.....	Only receiver plate supply.	All circuits except transmitter plate supply.
Adjustable outputs.....	None.	Receiver plate, receiver filament, and transmitter filament.

11. Additional Equipment Required

When used with Receiver-Transmitter RT-77(*)/GRC-9, no additional equipment is required to install and operate Power Supply PP-327(*)/GRC-9Y. When used with other equipment, switching must be provided to complete the circuit of the transmitter plate voltage supply. The switching arrangement will depend on the particular installation (par. 14). One male connector Plug PL-294 will be required in addition to Cordage CO-139, or equivalent. The connection at the opposite end of the cable will be determined by the individual requirements.

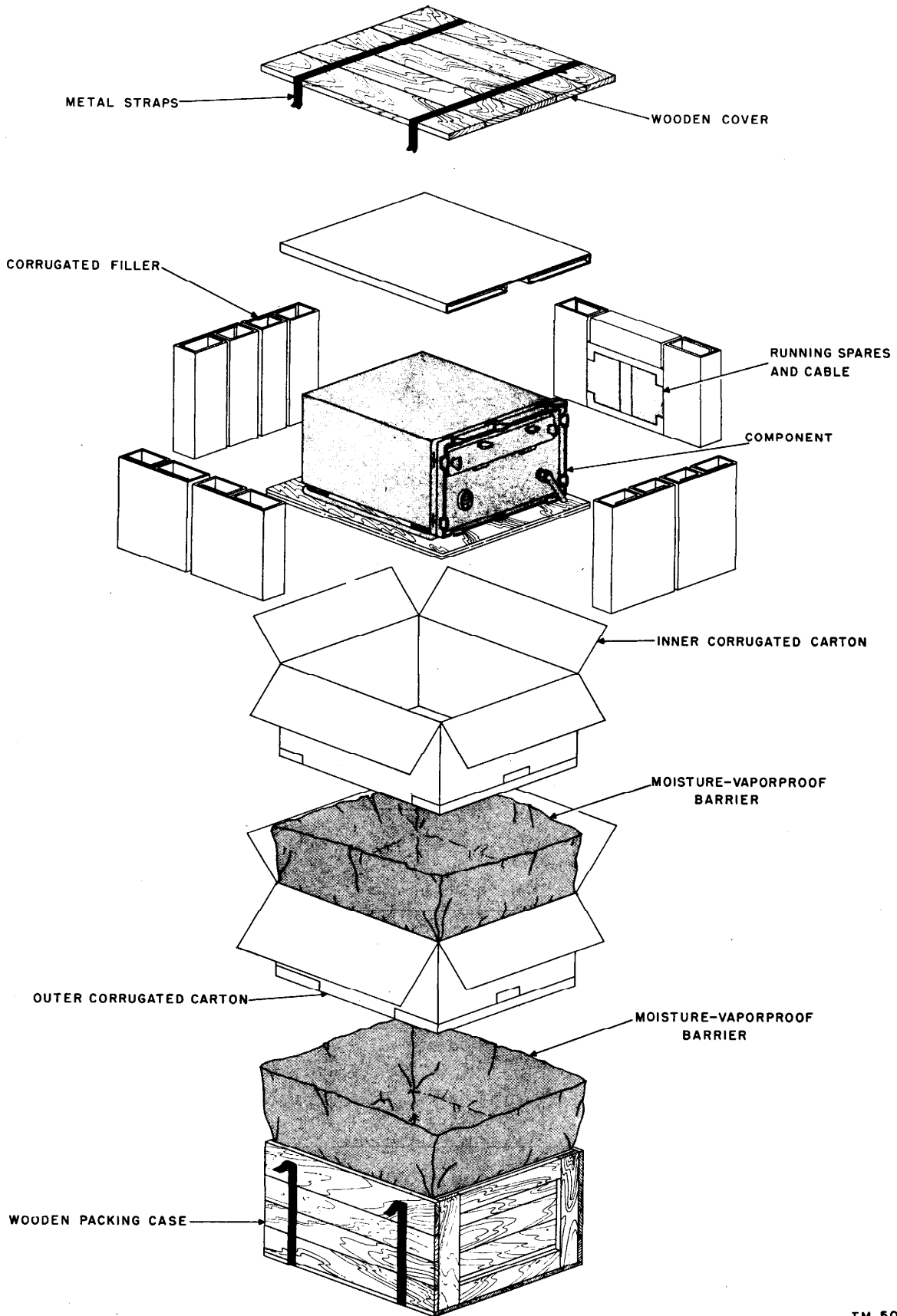


Figure 4. Power Supply PP-327(*)/GRC-9Y, packaging diagram.

TM 5070A-2I

CHAPTER 2

INSTALLATION AND OPERATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

12. Siting

When used as part of Operations Center AN/MTQ-1 (TM 11-5550), the power supply is installed in the mounting bracket provided (fig. 5). When used in any other installation, the power supply should be installed as close as possible to Receiver-Transmitter RT-77(*)/GRC-9 and the power source.

13. Checking New Equipment

a. Tubes. The power supplies are shipped with all operating tubes installed in their sockets. Check to see that each tube is firmly seated. Tube locations for Power Supply PP-327/GRC-9Y are shown in figure 6. Figure 7 shows tube location for Power

Supply PP-327A/GRC-9Y. Tube V5 (in the A model) is located on the chassis (fig. 29) and can be reached by releasing the Dzus fasteners that hold the panel to the cabinet and by drawing out the panel with the chassis.

b. Fuses. The location of all operating fuses is shown in figures 6 and 7. Check to see that all fuses are in operating condition and of the proper value. Power Supply PP-327/GRC-9Y uses .5-ampere fuses and Power Supply PP-327A/GRC-9Y uses 2-ampere fuses.

14. Installation

a. Mounting.

(1) To install the power supply unit in Op-

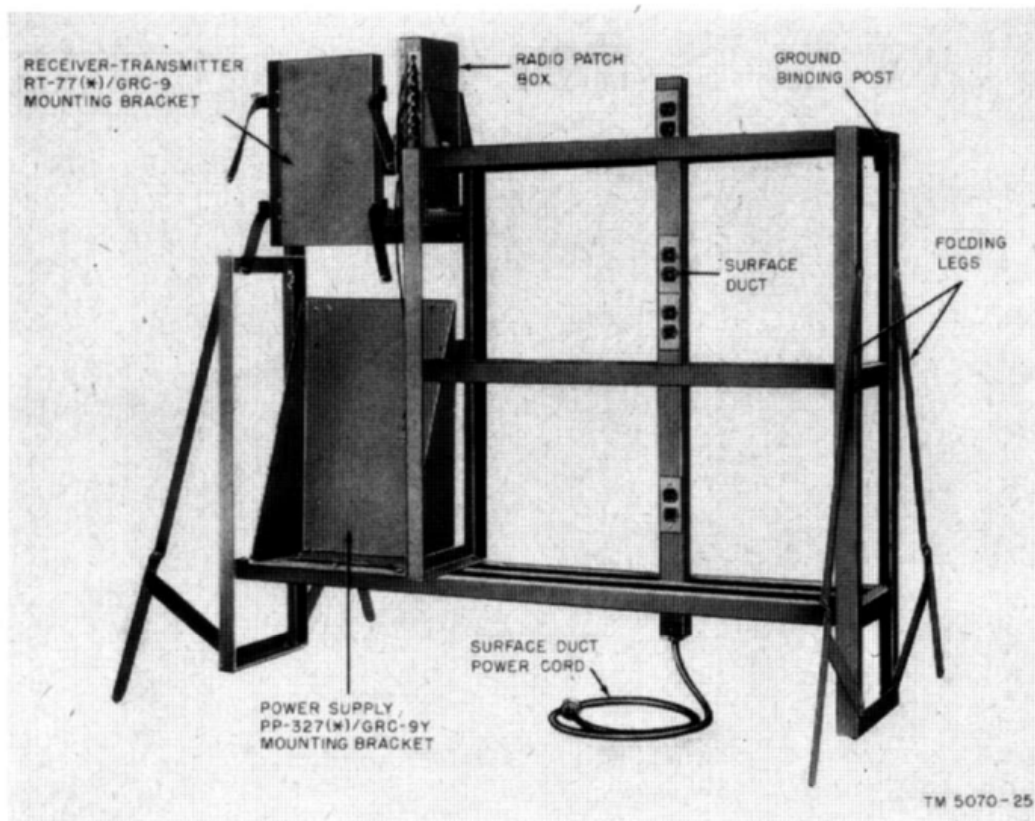


Figure 5. Radio rack used in Operations Center AN/MTQ-1.

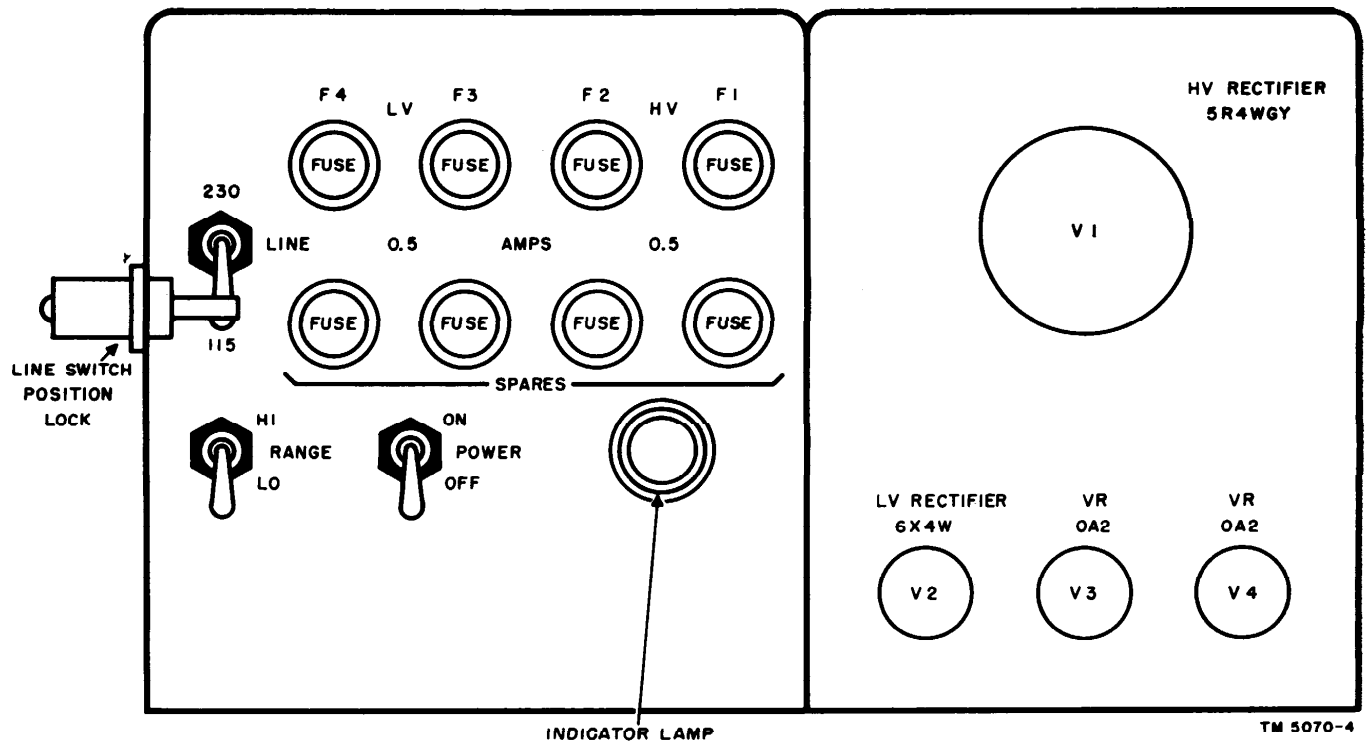


Figure 6. Power Supply PP-327/GRC-9Y, controls and tube location.

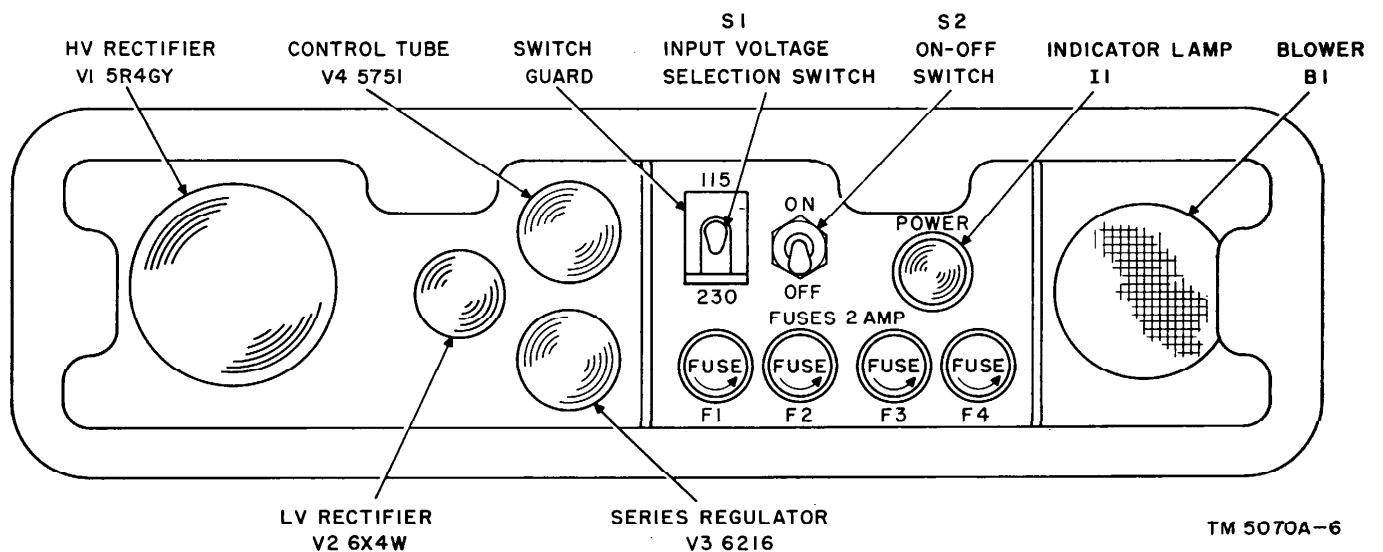


Figure 7. Power Supply PP-327A/GRC-9Y, controls and tube location.

erations Center AN/MTQ-1 (fig. 5), proceed as follows:

- (a) Set the power supply in a vertical position with the front panel on top and the output receptacle on the left side.
- (b) Set the power supply into the bracket and be sure that the two mounting studs enter the two mounting holes in the power supply case.

- (c) Push the power supply firmly against the radio rack, and secure it in place with the clamps and wing nuts provided.

- (2) For other installation, the unit may be mounted horizontally with four $\frac{1}{4}$ -20 bolts on 10- by 10-inch centers.

b. Power Input Connections. Connect Power Cable Assembly CX-112/U to either a 115- or 230-volt alternating current (ac) power source of 50 to

450 cycles per second (cps) that is capable of supplying at least 200 watts.

c. *Connections to Receiver-Transmitter RT-77 (*)/GRC-9.* Connect the female plug of Cord CD-1086 to the power input receptacle on Receiver-Transmitter RT-77(*)/GRC-9. Connect the male plug on the output cable to the power output receptacle on the front of the power supply.

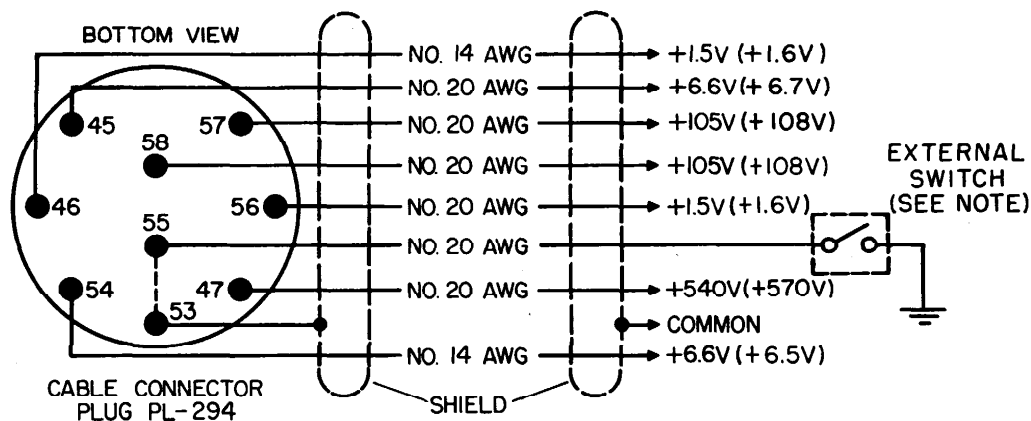
d. *Connections to Other Equipment.* Make up an auxiliary cable according to the diagram given in figure 8; use Plug PL-294 on one end. Connect the other ends of the wires to the required terminals, depending on the equipment used. All voltages, except the transmitter plate voltage, are present when the power supply is turned on. To activate the transmitter plate voltage supply, connect a jumper from pin 53 to pin 55 of Plug PL-294 or

provide an external shorting switch between the lead from pin 55 of Plug PL-294 and the common ground (pin 53).

15. Service Upon Receipt of Used or Reconditioned Equipment

If used or reconditioned equipment is received, proceed as follows:

- a. Check the equipment tubes and fuses (par. 13).
- b. Check the equipment for tags or other indications of changes. Note the changes in this manual, preferably on the schematic diagram; and include the order and serial numbers of modified equipments.
- c. Install and connect the equipment (par. 14).



NOTE:
TO OBTAIN TRANSMITTER PLATE VOLTAGE WITHOUT USE OF EXTERNAL SWITCH, CONNECT JUMPER BETWEEN PIN 53 AND PIN 55.
VOLTAGES IN PARENTHESES ARE FOR POWER SUPPLY PP-327/GRC-9Y.

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Figure 8. Auxiliary cable diagram.

Section II. CONTROLS

16. General

Improper setting of the controls can cause damage to this equipment. Therefore, it is important to know the function of every control. Actual operation of the power supply is discussed in paragraphs 18 and 19.

17. Controls and Their Uses

a. Power Supply PP-327/GRC-9Y (fig. 6).

Control	Function
POWER ON-OFF switch (S1).	In ON position, connects power supply to power source.
LINE 230-115 switch (S3).	Connects power supply for 115- or 230-volt power source operation.
RANGE HI-LO switch (S2).	Adjusts power supply for operation from line voltages that vary below or above 115 to 230 volts.
FUSE F1 and FUSE F2.	Protect 570-volt circuits from overload damage.
FUSE F3 and FUSE F4.	Protect remaining circuits from overload damage.

Control	Function
Output receptacle (J1).	Power supply output connector.
Indicator lamp (I 1).	Indicates when power is on.

b. Power Supply PP-327A/GRC-9Y (fig. 7).

Control	Function
Power ON-OFF switch (S2).	In ON position, connects power supply to power source.
115-230 switch (S1).	Makes proper internal connections for 115-volt or 230-volt operation. Protected by a switch guard to prevent switch from being improperly operated.
FUSE F1 and FUSE F2.	Protects hv circuits from overloads.
FUSE F3 and FUSE F4.	Protects lv circuits from overloads.
Indicator lamp (I 1).	Indicates when power is on.

Section III. OPERATION UNDER USUAL CONDITIONS

18. Preliminary Starting Procedure

a. Check the condition and value of all fuses. Power Supply PP-327/GRC-9Y uses .5-ampere fuses, and Power Supply PP-327A/GRC-9Y uses 2-ampere fuses.

b. Place the input voltage selection switch in the 115- or 230-volt position, according to the input source voltage.

c. For Power Supply PP-327/GRC-9Y only, set the RANGE HI-LO switch in the LO position for line voltages of 100 to 120 volts and 200 to 240

volts; for line voltages of 110 to 130 volts and 220 to 260 volts, set the RANGE switch in the HI position.

19. Starting and Stopping Procedure

a. To turn on the set, set the power switch to the ON position.

Caution: Leave the door on the front panel open during operation of the power supply to prevent the power supply from overheating.

b. To stop the power supply, turn the power switch to the OFF position.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

20. General

The operation of Power Supply PP-327(*)/GRC-9Y may be difficult in regions where extreme cold, heat, moisture, and sand conditions prevail. Procedures for minimizing the effect of these un-

usual operating conditions are outlined in 21 through 23.

21. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient op-

eration of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Keep the equipment warm and dry. If it is not in a heated inclosure, construct an insulated box for the set.

b. When equipment that has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. This condition also occurs when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

c. Handle the equipment carefully.

22. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or when necessary, in underground dugouts. Equipment that is installed below ground or set up in swampy areas is subjected to more acute moisture conditions than those that are normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever its temperature becomes lower than that of the surrounding air. To minimize this condition, place lighted electric bulbs under it. Keep these lamps lighted whenever the power supply is not in operation.

23. Operation in Desert Climates

a. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, or dirt that enters the moving parts of radio equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Such a building is seldom available and would require air conditioning; therefore, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and door, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

b. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls, which may jerk the connections loose or break the lines.

c. Keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (par. 28).

d. The drastic decrease in temperature at night often causes condensation of moisture on the equipment. For protection, cover it with a tarpaulin or similar material when not in use.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE

Section I. PREVENTIVE MAINTENANCE SERVICES

24. Tools and Material Required for Power Supply PP-327(*)/GRC-9Y

Tools and materials required for organizational maintenance of the power supply are listed in *a* and *b* below. Items contained in Tool Equipment TE-41 are listed in Department of the Army Supply Manual SIG 6-TE-41.

a. Tools.

- 1 Tool Equipment TE-41
- 1 No. 4 hexagonal socket-head, set screw wrench
- 1 Multimeter TS-297/U

b. Materials.

- Orange stick
- Cheesecloth, bleached, lint-free
- Carbon tetrachloride
- Sandpaper, flint, No. 000
- Solvent, Dry Cleaning (SD) (Fed spec No. P-S-661a)

25. 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 interruption in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair since its object is to prevent certain troubles from occurring.

26. General Preventive Maintenance Techniques

- a.* Use No. 000 sandpaper to remove corrosion.
- b.* Use a clean, dry, lint-free cloth or a dry brush for cleaning. If the dry cloth or brush will not remove the dirt, use one of the following techniques, as applicable:

- (1) When cleaning electrical contacts, use a cloth or brush moistened with carbon tet-

rachloride; when the contacts are clean, wipe them dry with a cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Be sure adequate ventilation is provided.

- (2) When cleaning surfaces that perform no electrical function, use a cloth or brush moistened with solvent (SD); after cleaning, wipe the parts dry with a cloth.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch (psi) to remove dust from inaccessible places. Be careful, however, or mechanical damage from the air blast may result.

Caution: When using compressed air, always direct the first blast from the air line toward the floor. This procedure is necessary to clear condensed moisture from the line.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

27. Use of Preventive Maintenance Forms

a. The decision concerning the items on DA Forms 11-238 and 11-239 that are to be applied to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communications officer/chief or his designated representative, and in the case of second or 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 on figures 9 and 10 are partially or totally applicable to Power Supply PP-327(*)/GRC-9Y. Items not applicable have been crossed out. References in the ITEM column are to paragraph 28, which contains additional detailed information on performing preventive maintenance.

28. Performing Preventive Maintenance

Perform the preventive maintenance operations at the interval indicated on the DA Form 11-238 unless these intervals are reduced by the commanding officer.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Connectors should be finger-tight only. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Exterior Items.

- (1) Check for completeness and the general condition of the power supply. The components of the set are listed in paragraph 5.
- (2) Check the suitability of the location and the installation for normal operation.
- (3) Remove dirt and moisture from the panels, which are exposed when opening the access door. Remove dirt and moisture from the plugs on Cord CD-1086.
- (4) Inspect the seating of fuses F1, F2, F3, and F4 (figs. 6 and 7).
- (5) Inspect the seating of the indicator lamp on the front panel (figs. 6 and 7).
- (6) Inspect the output connector for dirt, moisture, and looseness.
- (7) Check for normal operation of the power supply (par. 37).
- (8) Clean the cabinet; check and tighten the four shock mounts. Inspect them for rust, corrosion, and moisture.
- (9) Inspect Cord CD-1086 and Power Cable Assembly CX-112/U (figs. 2 and 3) for cracks, breaks, fraying, kinks, and mildew.
- (10) Inspect the power switch and the input voltage selection switch for looseness and positive action. On Power Supply PP-327/GRC-9Y, inspect the RANGE switch.

Caution: Do not change the position of the input voltage selection switch when the power switch is on.

- (11) Clean the name plate and the warning plate.

b. *Interior Items.* Disconnect Power Cable Assembly CX-112/U and Cord CD-1086 and withdraw the panel and the attached chassis from the cabinet.

- (1) Remove any accumulated dirt and moisture from the chassis.
- (2) Inspect the tubes and tube sockets for cracks, moisture, socket spring tension, and positive soldered connections.
- (3) Check all capacitors for tightness of mounting, properly soldered connections, and leaks or corrosion.
- (4) Inspect all resistors for cracks, chipping, blistering, discoloration, and positive soldered connections.
- (5) Clean and tighten the connections and mountings of the transformers and chokes; inspect for properly soldered connections and for evidence of overheating or leakage.
- (6) Inspect the panel gasket, blower gasket, and connector gasket for positive seal and corrosion.
- (7) Tighten the mountings and inspect relays for dirt, corrosion, and properly soldered connections.
- (8) Tighten the mountings and inspect the rectifiers for dirt, corrosion, and properly soldered connections.
- (9) Tighten the blower mount (for Power Supply PP-327A/GRC-9Y only).
- (10) Inspect the blower for dirt accumulation, evidence of overheating, and positive connections (for Power Supply PP-327A/GRC-9Y only).
- (11) Inspect all wiring for mildew, dirt, or fraying.
- (12) Inspect the soldered connections to J1 for positive connection.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE

POWER SUPPLY PP-327A/GRC-9Y

EQUIPMENT SERIAL NO.

1-632

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; ⊕ 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. 28a (1)							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 28a (2)							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 28a (3)(6)(11)							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, BRISTLES, FUSES, CONNECTORS, WINDATORS, PLUG-IN COILS AND RESISTORS. PAR. 28a (4)(5)(9)							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.							
6	CHECK FOR NORMAL OPERATION. PAR. 28a (7)							

WEEKLY

NO.	ITEM	CONDI- TION	NO.	ITEM	CONDI- TION
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 28a (8)		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 28a (11)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 28a (9)		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER-PROOFING.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR WILDER, 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, POWER-STATS, RELAYS, RELAYS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 28a (6)(10)		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 FORM 11-238
 1 MAY 51

REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

Figure 9. DA Form 11-238.

TM 5070-15

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	NO	ITEM
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (connections, connections, connecting cables, wire and cable, accessories, tubes, spare parts, technical manuals and accessories). PAR. 28a (1)	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. PAR. 28b (2)
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 28a (2)	20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, HEADSETS, HEADS, JACKS, PLUGS, TELEPHONE, CARRYING BAGS, COMPONENT PANELS. PAR. 28a (3)(6)	21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 28b (3)
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: SWAGE, LAMPS, BRUSHES, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 28a (4)(5)(9)	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. PAR. 28b (7)
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENTS, POSITIVE ACTION.	23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.
6	CHECK FOR NORMAL OPERATION. PAR. 28a (7)	24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 28b (4)
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 28a (8)(9)	25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 28b (3)(4)
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 28a (8)	26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 28b (9)(10)
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 28a (9)	27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.	28	CHECK SETTINGS OF ADJUSTABLE RELAYS.
11	INSPECT CANNAS ITEMS, LEATHER, AND CABLING FOR WILDER, TEARS, AND FRAYING.	29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, GENERATORS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 28a (6)(10), b(10)	30	INSPECT GENERATORS, ANTILOTTINES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ANCHOR, AND FITTING OF COMMUTATORS
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 28b (5)
14	CLEAN AND FILTERS , BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 28a (11)	32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 28b (5)
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.	34	INSPECT CATHODE RAY TUBES FOR BURNT GREEN SPOTS.
17	CHECK ANTENNA BUY PLACES FOR LOOSENESS AND PROPER TENSION.	35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS. PAR. 28a (16)
		37	MOISTURE AND FUNGIPROOF. PAR. 30b
28	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.		

DA FORM 11-239
 1 MAY 53

REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

48-16-64203-1

TM 5070A-16

Figure 10. DA Form 11-239.

Section II. LUBRICATION AND WEATHERPROOFING

29. Lubrication

No lubrication is required for Power Supply PP-327(*)/GRC-9Y. The blower motor, used in Power Supply PP-327A/GRC-9Y, is lubricated at the factory.

30. Weatherproofing

a. *General.* Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to materials.

b. *Tropical Maintenance.* A special moisture-proofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. *Arctic Maintenance.* Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. *Desert Maintenance.* Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

31. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 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 case and cause harmful internal shorting or grounding of circuits.

b. 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.

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

32. General

a. The troubleshooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, etc.

b. The paragraphs that follow in this section help to determine which of the circuits, such as the ac control circuits or high-voltage (hv) supply circuit, are at fault. Localizing the fault in that circuit to the defective part is described in paragraph 58.

33. Visual Inspection

a. Failure of this equipment to operate properly will usually be caused by one or more of the following faults:

- (1) Worn, broken, or disconnected cords and plugs.
- (2) Burned-out fuses (generally an indication of some other fault).
- (3) Wires broken because of excessive vibration.
- (4) Defective tubes or other items.
- (5) Defective component in Receiver-Transmitter RT-77(*)/GRC-9 (TM 11-263).

b. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the power supply. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

c. Visually inspect each tube while the equipment is operating to check for burned-out filaments.

d. Check the cables and connectors that complete the circuits from the power supply to the radio set and to the ac line.

34. Interchangeable Tubes

A preferred type electron tube, type 5R4WGA, has been developed as a direct replacement for tube type 5R4WGY. These tubes may be used interchangeably in the hv rectifier stage. The older-type tube should be used until stocks are exhausted.

35. Tube Replacement Procedure

a. Inspect all cabling and connectors before attempting to remove the electron tubes.

b. Isolate the trouble, if possible, to a particular stage of the power supply.

c. If a tube tester is available, remove and test one tube at a time. *Do not discard tubes* merely because they indicate *on or slightly below* the minimum acceptable value when checked with a tube tester. These tubes may provide satisfactory service at this *near limit* value.

d. If a tube tester is not available, troubleshoot by tube substitution.

- (1) Replace the suspected tubes, one at a time, with new tubes. Note the sockets from which the original tubes were removed. If the equipment becomes operative, discard the last tube replaced.

Caution: *Be careful when withdrawing the miniature tubes from their sockets. Do not rock or rotate the miniature tubes when removing them from their sockets; pull them straight up.*

- (2) Reinsert the remaining original tubes, one at a time, in their original sockets. If equipment failure occurs during this step, discard the original tube that caused the equipment failure.

Caution: *Do not leave a new tube in a socket, if the equipment operates satisfactorily with the original tube.*

- (3) If tube substitution does not correct the trouble, *reinsert the original tubes in the original sockets* before forwarding the equipment for higher echelon repair.

e. *Discard* tubes when a test in a tube tester and in the equipment indicates that the tube is defective, or when there is an obvious defect, such as a broken envelope, open filament, or broken pin.

f. *Do not discard* any tubes merely because they have been used for some time. *Satisfactory operation in the equipment is the final and best proof of tube quality.*

36. Troubleshooting by Using Equipment Performance Check List

a. *General.* The equipment performance check list (par. 37) will help the operator locate trouble in the equipment. The list gives the item to be checked, the normal indications of correct operation, and the corrective measures the operator can take.

b. *Action or Condition.* For some items, the information given in the *Action or condition* column consists of various switch settings under which the item is to be checked. It represents an action that must be taken to check the normal indication given in the *Normal indications* column.

c. *Normal Indications.* The normal indications listed include the visible signs that the operator should perceive when he checks the item. If the indications are not normal, the operator should apply the recommended corrective measures.

d. *Corrective Measures.* The corrective measures listed are those that the operator can make without turning in the equipment for repairs. A reference in the table to paragraphs 53 through 70 indicates that the trouble cannot be corrected during operation and that troubleshooting by an experienced repairman is necessary. If the power supply is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary. If the tactical situation, however, requires that communication be maintained and if the power supply is not completely inoperative, the operator must maintain the unit in operation as long as it is possible to do so.

37. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indications	Corrective measures
P R E P A R A T O R Y	1	Power switch.	Turn to OFF position.		
	2	Input voltage selection switch.	For an ac power source of 115 volts, place in 115 position. For an ac power source of 230 volts, place in 230 position.		
	3	RANGE switch (Power Supply PP-327/GRC-9Y only).	Place in HI position for line voltages of 110 to 130 volts or 220 to 260 volts. Place in LO position for line voltages of 100 to 120 volts or 200 to 240 volts.		
	4	Cord CD-1086.	Connect between power receptacle on power supply and POWER receptacle on Receiver-Transmitter RT-77(*)/GRC-9.		
	5	Power Cable Assembly CX-112/U.	Connect to ac source.		
E Q U I P M E N T P E R F O R M A N C E	6	Power switch.	Set to ON position.	Indicator lamp lights.	Check power source, fuses, switch, and lamp (par. 56).
	7	Control Ⓢ on Receiver-Transmitter. RT-77(*)/GRC-9.	Set at STAND BY position.	Receiver operates.	Check tubes in power supply. Refer to TM 11-263 for possible receiver trouble.
	8	Control Ⓢ on Receiver-Transmitter RT-77(*)/GRC-9.	Set to SEND position.	Relay K1 operates in power supply.	Refer to paragraph 58.
	9	Key or microphone on Receiver-Transmitter RT-77(*)/GRC-9.	Depress key or press microphone push-to-talk button.	Transmitter operates.	Check tube VI. Refer to TM 11-263 for possible transmitter trouble.
	10	Power switch.	Set to OFF position.	Indicator lamp goes out.	Check power switch.

CHAPTER 4

THEORY

Section I. THEORY OF POWER SUPPLY

PP-327/GRC-9Y

38. Block Diagram

(fig. 11)

a. Ac Control Circuit. The ac control circuit controls the ac input power to the windings of two power transformers (T1 and T2), which furnish all the operating potentials for the five rectifier circuits. The ac control circuit contains three switches and a relay, which function as follows:

- (1) POWER switch S1 controls the application of ac power to the equipment.
- (2) LINE switch S3 connects the primary windings of the two power transformers for 115- or 230-volt operation, depending on the voltage source.
- (3) RANGE switch S2 selects the correct taps on the primary windings of power transformer T2 for operation from input voltages of 100 to 130 volts, or 200 to 260 volts.
- (4) Relay K1 provides external on-off control for the transmitter plate supply.

b. Transmitter Plate Supply. The transmitter plate supply uses a type 5R4WGY rectifier tube (V1). The output of tube V1 is filtered in a capacitor-input filter. The output from the transmitter plate supply is +570-volt direct current (dc). This output is used as plate and screen grid voltage by tubes V102 and V103 of Receiver-Transmitter RT-77(*)/GRC-9.

c. Receiver Plate Supply. The receiver plate supply uses a type 6X4W rectifier tube (V2). The output from tube V2 is filtered in a capacitor-input filter and applied across voltage-regulator tubes V3 and V4. The output of the receiver plate supply is +108 volts dc. This output is used as plate and screen grid voltage by tubes V1 through V7,

and V101 and V105 of Receiver-Transmitter RT-77(*)/GRC-9.

d. Receiver Filament Supply. The receiver filament supply uses selenium rectifier CR1 and a two-section inductive-input filter. The output from the receiver filament supply is +1.6-volt dc. This output is used as filament voltage by tubes V1 through V7 of Receiver-Transmitter RT-77(*)/GRC-9.

e. Control Voltage Supply. The control voltage supply uses selenium rectifier CR2 and an inductive filter. The output from the control voltage supply is +6.7-volt dc. This output is used as operating voltage for keying relay K101 of Receiver-Transmitter RT-77(*)/GRC-9 and for transmitter plate supply control relay K1 of the power supply.

f. Transmitter Filament Supply. The transmitter filament supply uses two selenium rectifiers (CR3 and CR4). The output from CR3 and CR4 is filtered by a two-section inductive-input filter. The output from the transmitter filament supply is +6.5-volt dc and is used as filament voltage by tubes V101, V102, V103, and V105 of Receiver-Transmitter RT-77(*)/GRC-9. The output also is used to operate indicator lamp I 102 of the receiver-transmitter. A step-voltage regulator circuit is used in this supply section to limit the open-circuit output voltage.

39. Ac Input Circuits

(fig. 12)

a. Power transformers T1 and T2, which supply the operating potentials for the five rectifier circuits, are provided with split primary windings for operation from nominal line voltages of 115 or 230 volts. Overload protection for the five supply circuits is provided by four .5-ampere fuses, one connected in series with one side of each primary

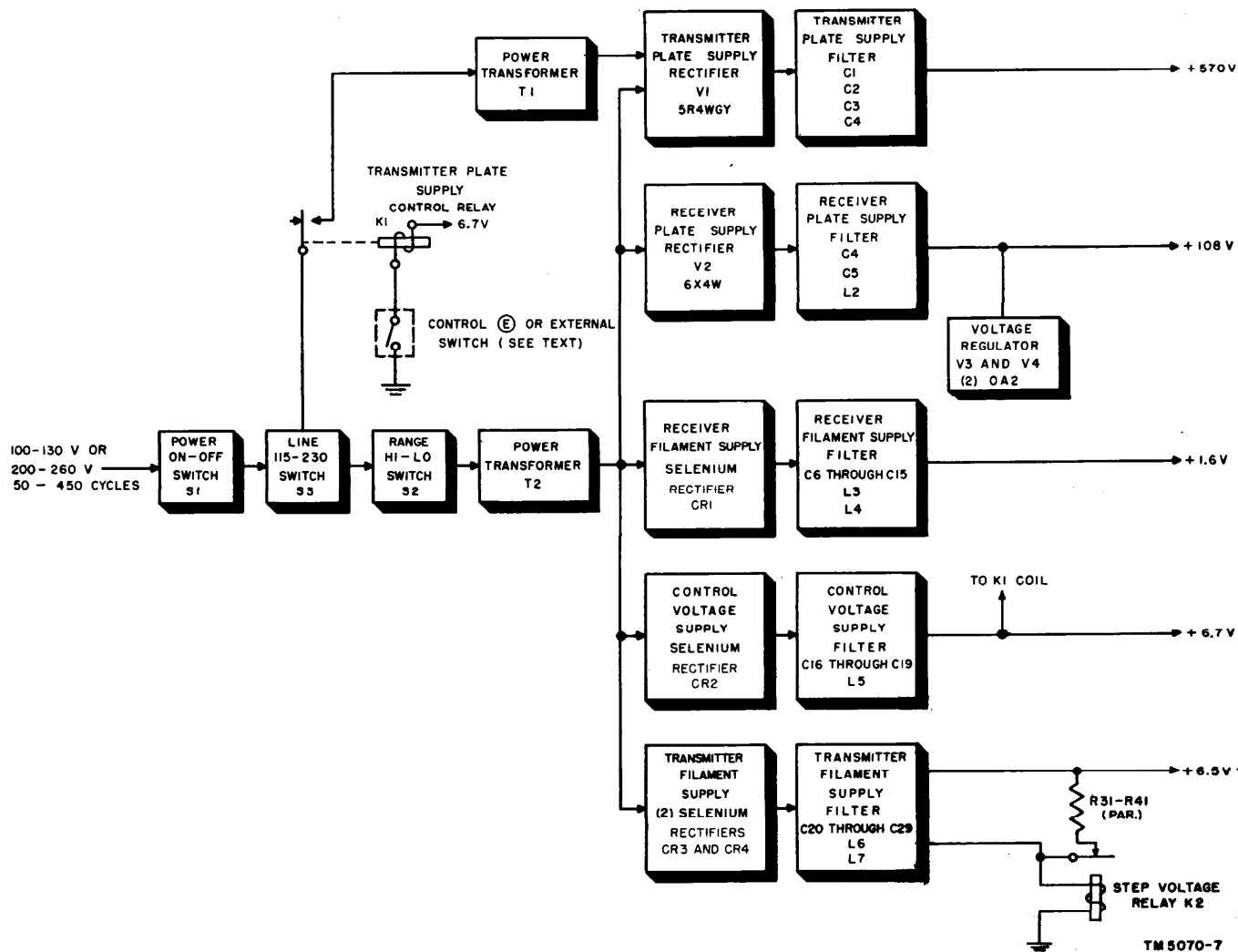


Figure 11. Power Supply PP-327/GRC-9Y, block diagram.

winding of T1 and T2. Fuses F1 and F2 protect the transmitter plate supply; fuses F3 and F4 protect the four remaining supplies.

b. When POWER switch S1 is in the ON position, the ac line voltage is applied to the primary circuits. LINE switch S3 connects the primary windings of each transformer in parallel for 115-volt operation and in series for 230-volt operation. RANGE switch S2 selects the correct taps on transformer T2. When switch S2 is in the LO position, T2 will function satisfactorily on input voltages of 100 to 120 volts and 200 to 240 volts. When switch S2 is in the HI position, T2 will function satisfactorily on input voltages of 110 to 130 volts and 220 to 260 volts.

c. External on-off control of the transmitter plate supply is provided by relay K1, which controls two single-pole, double-throw (spdt) microswitches (part of K1). One set of contacts on

each microswitch is not used. The normally open contacts of the microswitches are connected in series with the ac line and the primary windings of T1. The coil of K1 is connected between the output of the control voltage supply and pin 35 of output receptacle J1 (par. 43). When K1 is energized, the normally open contacts of the microswitches close and complete the ac circuit to the primary windings of T1; this turns on the transmitter plate supply. When the power supply is used with Receiver-Transmitter RT-77(*)/GRC-9, the coil of K1 is energized when control (E) on the receiver-transmitter is in the SEND position. When the power supply is used with other equipment and external control of the transmitter plate supply is required, a single-pole, single-throw (spst) switch can be connected between pins 35 and 24 (ground) of receptacle J1 to operate K1. If external control is not required, a jumper can be

connected between pins 24 and 35 of J1 (figs. 38 and 39); relay K1 then will operate when the power supply is turned on (par. 43).

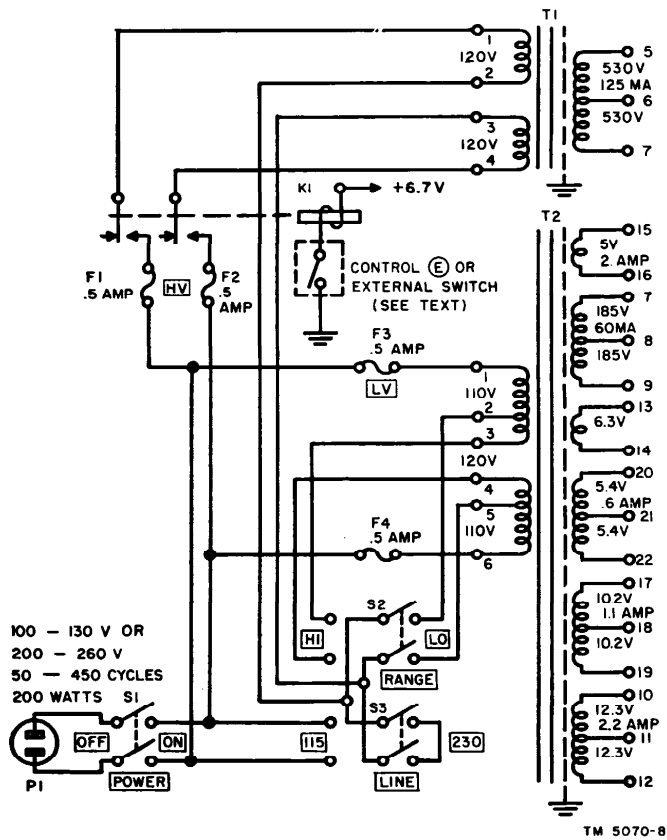


Figure 12. Power Supply PP-327/GRC-9Y, ac input circuit

40. Transmitter Plate Supply

(fig. 13)

a. The secondary winding of power transformer T1 is connected to the plates of hv rectifier V1, which uses a type 5R4WGY tube connected for full-wave operation. The filament of V1 is connected across the 5-volt secondary winding of power transformer T2. Thus, the filament of V1 is energized at all times, permitting the transmitter plate voltage to be immediately available when control ⓔ of Receiver-Transmitter RT-77(*)/GRC-9 is placed in the SEND position.

b. The output of tube V1 is filtered in a single pi-section filter that consists of capacitors C1, C2, and C3, and reactor L1. Bleeder resistors R1 through R15 are connected in series across the output of the filter and discharge the filter capacitors when the equipment is shut down. The 570-volt dc output from the transmitter plate supply is connected to pin 32 of output receptacle J1.

41. Receiver Plate Supply

(fig. 14)

a. The low voltage (lv) rectifier uses a type 6X4W tube (V2). Plate voltage is obtained from the hv secondary winding of power transformer T2. Filament power for V2 is supplied by the 6.3-volt secondary winding (terminals 13 and 14) of T2. Indicator lamp E8 also is connected across this

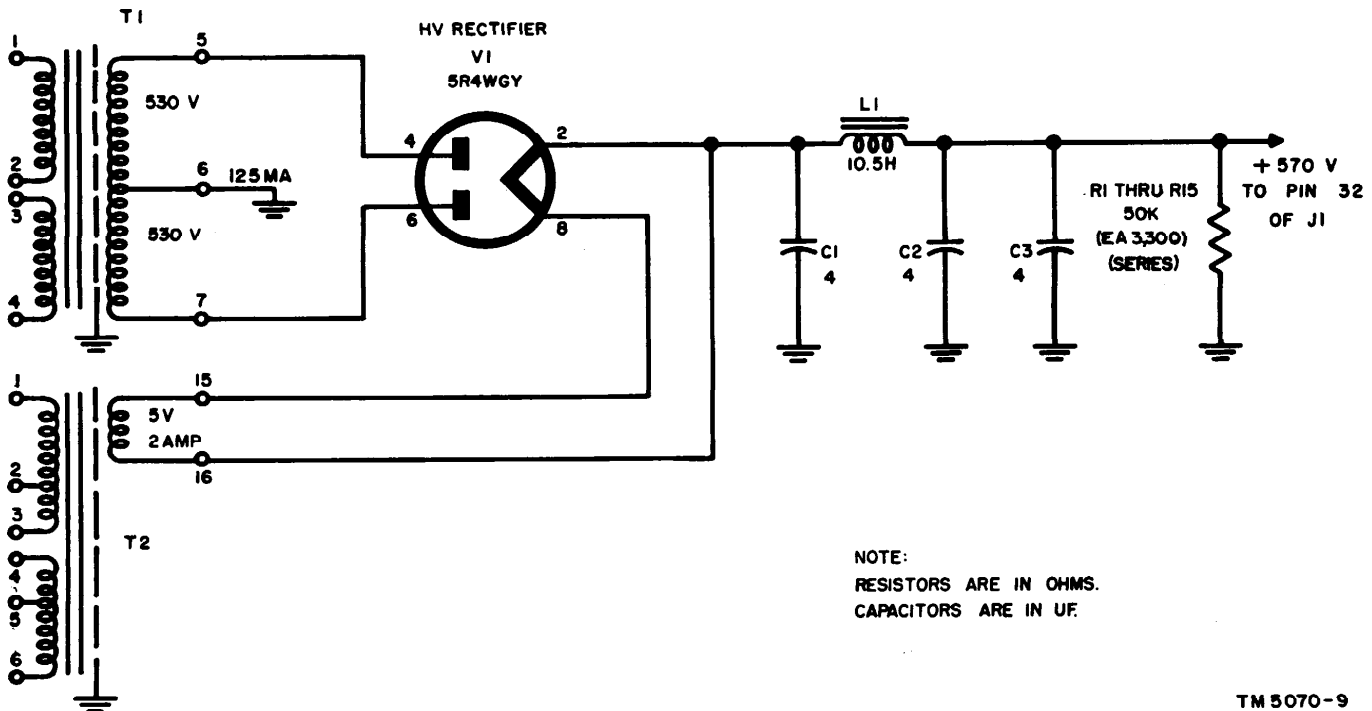


Figure 13. Power Supply PP-327/GRC-9Y, transmitter plate supply.

winding. The cathode (pin 7) of tube V2 is connected to a single pi-section filter through current-limiting resistors R16 and R17. These resistors prevent abnormally high currents from flowing through tube V2.

b. The pi-section input filter consists of capacitors C4 and C5 and reactor L2. Bleeder resistors R18 and R19 are connected in parallel across the output of the filter and discharge the filter capacitors when the equipment is shut down. The output from the filter is connected to a voltage-regulator circuit through current-limiting resistors R20 and R21.

c. The voltage-regulator circuit maintains the output of the supply within a narrow range of voltages. The output voltage range is maintained under all conditions of line voltage and varying load presented by the circuits of Receiver-Transmitter RT-77(*)/GRC-9, and it is within the limits required by the OC3-type voltage-regulator tube (V104) of the receiver-transmitter.

d. Two type OA2 glow-discharge voltage-regulator tubes (V3 and V4) are connected in parallel

to carry the current necessary for regulating action. Each voltage-regulator tube has two pin connections to each element. The plate voltage secondary winding for V2 is center-tapped and connected to ground through the jumper between pins 2 and 7 within V3. The filter output is connected through the jumper between pins 1 and 5 within V4 to current-limiting resistors R23, R24, and R25. If either tube V3 or V4 is removed, an open circuit will exist, which will prevent the total current from flowing through the remaining tube and causing damage.

e. Resistors R22 and R26 are current-balancing resistors; they insure that V3 and V4 draw approximately equal currents. The output from the regulator circuit is connected through limiting resistors R23, R24, and R25 to pins 21 and 33 of output receptacle J1. Resistors R23, R24, and R25, with resistors R16, R17, R20, and R21, limit the output current of the supply to a value within the current-operating range of tube V104. Thus, V104 in Receiver-Transmitter RT-77(*)/GRC-9 will function properly and maintain a constant output voltage.

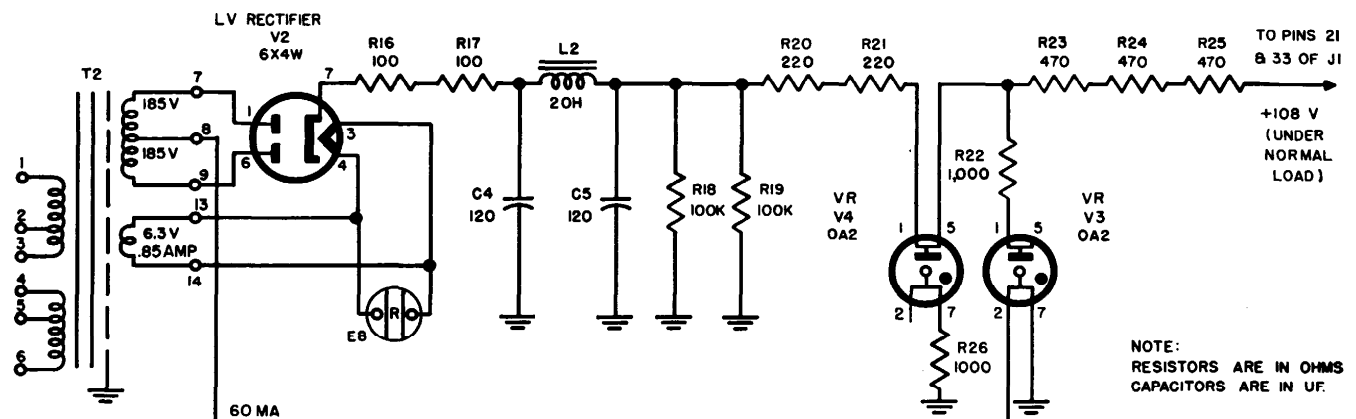


Figure 14. Power Supply PP-327/GRC-9Y, receiver plate supply.

TM 5070-10

42. Receiver Filament Supply

(fig. 15)

The receiver filament supply uses a dry-disk selenium rectifier (CR1) connected for full-wave operation. The 10.8-volt secondary winding (terminals 20 and 22) of power transformer T2 furnishes operating voltage for CR1. The center tap of the secondary winding is connected to a two-section inductive-input filter that consists of capacitors C6 through C15 and reactors L3 and L4. Bleeder resistors R27 and R28 present a more constant load across the output of the filter and limit

the open-circuit output voltage. Each of the resistors can be removed to adjust the output voltage when the rectifier has aged to the extent that the output voltage is too low (par. 60). The 1.6-volt dc output is connected to pins 22 and 23 of output receptacle J1.

43. Control Voltage Supply

(fig. 16)

The control voltage supply uses a dry-disk selenium rectifier (CR2) connected for full-wave operation. The cathodes of CR2 are connected across

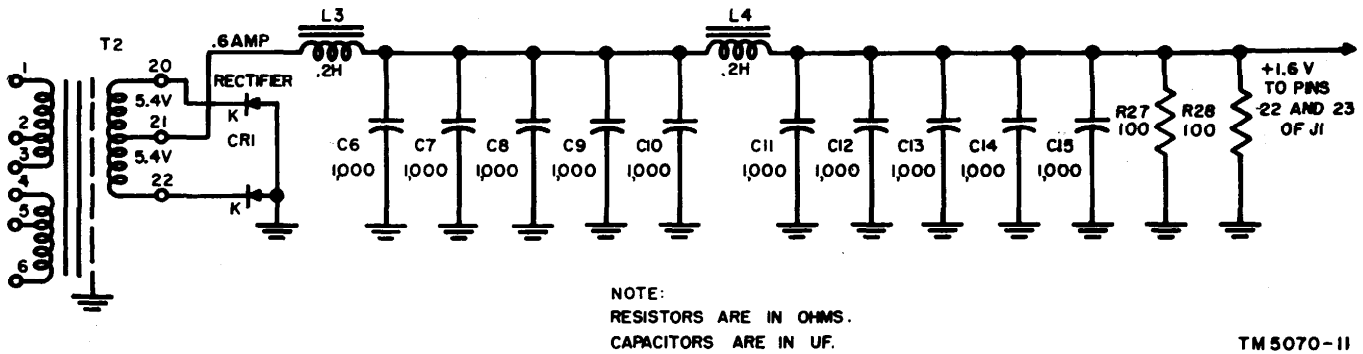


Figure 15. Power Supply PP-327/GRC-9Y, receiver filament supply.

the 20.4-volt secondary winding (terminals 17 and 19) of power transformer T2; the anodes are connected to ground. The center tap (terminal 18) of the secondary winding is connected to an inductive-input filter that consists of capacitors C16 through C19 and reactor L5. Bleeder resistors R29

and R30 are connected in parallel across the output of the filter and function the same as resistors R27 and R28 (par. 42). The 6.7-volt dc output from the filter is connected to pin 34 of output receptacle J1 and to one side of the coil of relay K1.

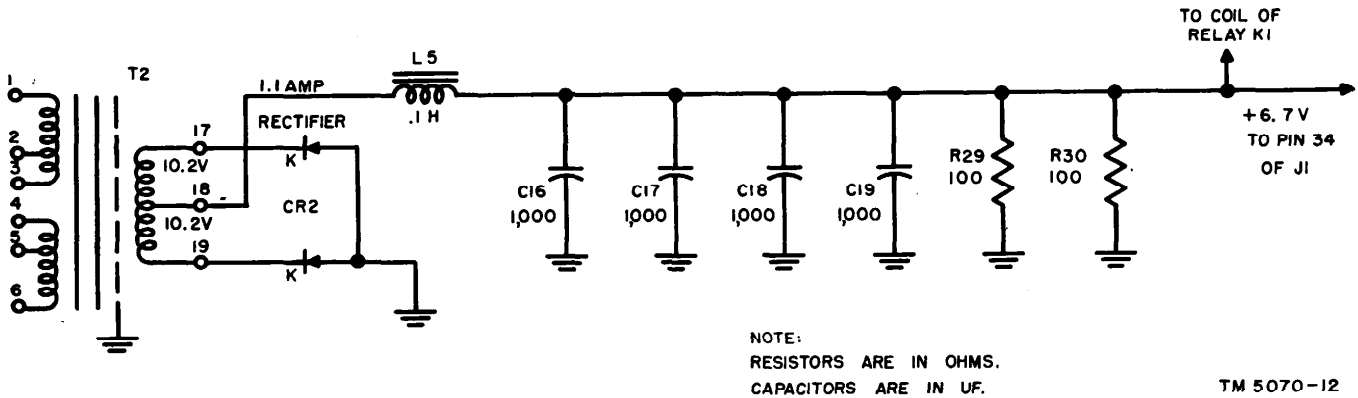


Figure 16. Power Supply PP-327/GRC-9Y, control voltage supply.

44. Transmitter Filament Supply (fig. 17)

a. The transmitter filament rectifiers, CR3 and CR4, are connected in a full-wave circuit. Rectifiers CR3 and CR4 are each made up of two cells in parallel for greater current-carrying capacity.

The 24.6-volt secondary winding (terminals 10 and 12) of power transformer T2 furnishes operating voltage for CR3 and CR4. The positive voltage output from the center tap of the secondary winding (terminal 11) is connected to a two-section inductive-input filter that consists of capacitors C20 through C29 and reactors L6 and L7.

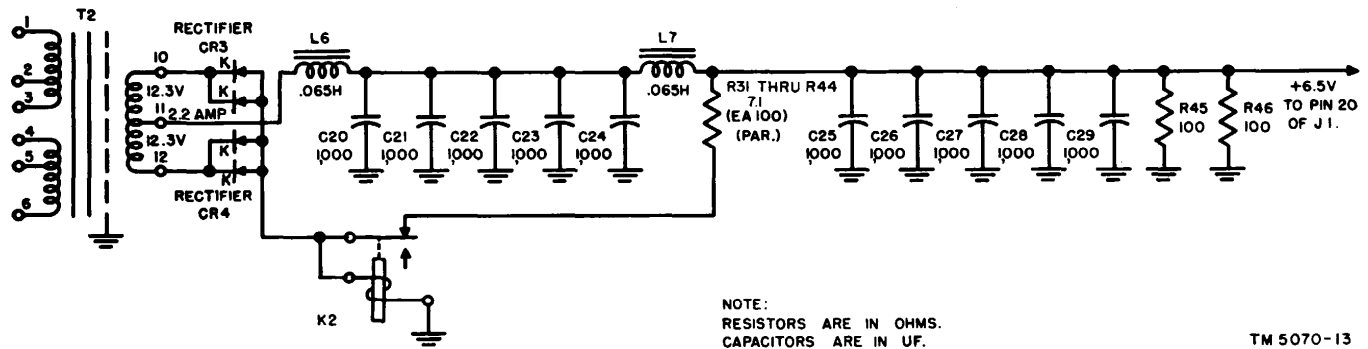


Figure 17. Power Supply PP-327/GRC-9Y, transmitter filament supply.

b. The transmitter filament supply contains a step-voltage regulator circuit that consists of relay K2 and resistors R31 through R44. Relay K2 controls an armature-operated spdt microswitch (part of K2), which is in series with bleeder resistors R31 through R44. This circuit maintains an output voltage of +10 volts or less when the transmitter filaments are off; this prevents damage to the coil of relay K102B in the transmitter, and also prevents high instantaneous voltages from damaging the filaments when they are turned on. Maintaining the output voltage at this level also is necessary for the operation of indicator lamp I 102 of Receiver-Transmitter RT-77(*)/GRC-9.

c. The coil of K2 is connected in the ground-return circuit of rectifiers CR3 and CR4. Bleeder resistors R31 through R44 are connected in parallel

across the output circuit of the filter through the normally closed contacts of K2. When the transmitter filaments are on and a current of 1.4 amperes or more flows through the coil of K2, the relay is energized, which opens the normally closed contacts and disconnects resistors R31 through R44 from the output circuit. When K2 is energized, the output of the supply is 6.5 volts. When the load current falls below .5 ampere, K2 is de-energized and the contacts close to connect resistors R31 through R44 across the output. The resistors then draw sufficient current to maintain the output voltage at +10 volts or less. Bleeder resistors R45 and R46 are connected in parallel across the output and can be used to adjust the output voltage (par. 62). The output of the transmitter filament supply is connected to pin 20 of output receptacle J1.

Section II. THEORY OF POWER SUPPLY PP-327A/GRC-9Y

45. Block Diagram

(fig. 18)

a. *Ac Power Input Circuit.* The ac power input circuit consists of power ON-OFF switch S2, input voltage selection switch S1, high-voltage transformer T1, and low-voltage transformer T2. High-voltage transformer T1 is activated through the contacts of transmitter plate control relay K1. The circuit through the coil of relay K1, which causes its contacts to close, is not completed until control Ⓢ of Receiver-Transmitter RT-77(*)/GRC-9 is in the SEND position.

b. *Transmitter Plate Supply Circuit.* This circuit consists of the output from high-voltage transformer T1, high-voltage rectifier V1, and filter circuit C1, L1, and C2. This circuit provides a dc voltage of 540 volts.

c. *Receiver Plate Supply Circuit.* This circuit consists of the output from one winding of low-voltage transformer T2, rectifier V2, and filter C3-L2. The output from this rectifier is fed to a voltage-regulator circuit (d below).

d. *Receiver Voltage-regulator Circuit.* The output from the C3-L2 filter is fed to a voltage-regulator circuit, which is made up of tubes V3, V4, and V5. Its output provides a dc regulated voltage of 120 volts.

e. *Filament Voltage Circuit.* Filament voltages for both the receiver and the transmitter are taken from another winding of low-voltage transformer

T2. Rectification takes place at selenium rectifier CR2, and filtering is accomplished by the C6, L3, C7, L4, and C8 filter circuit, the output of which feeds a current-regulator circuit (f below). A dc voltage of 6.6 volts for the transmitter keying relay and voltage for the operation of transmitter plate control relay K1 are also taken from the output of rectifier CR2.

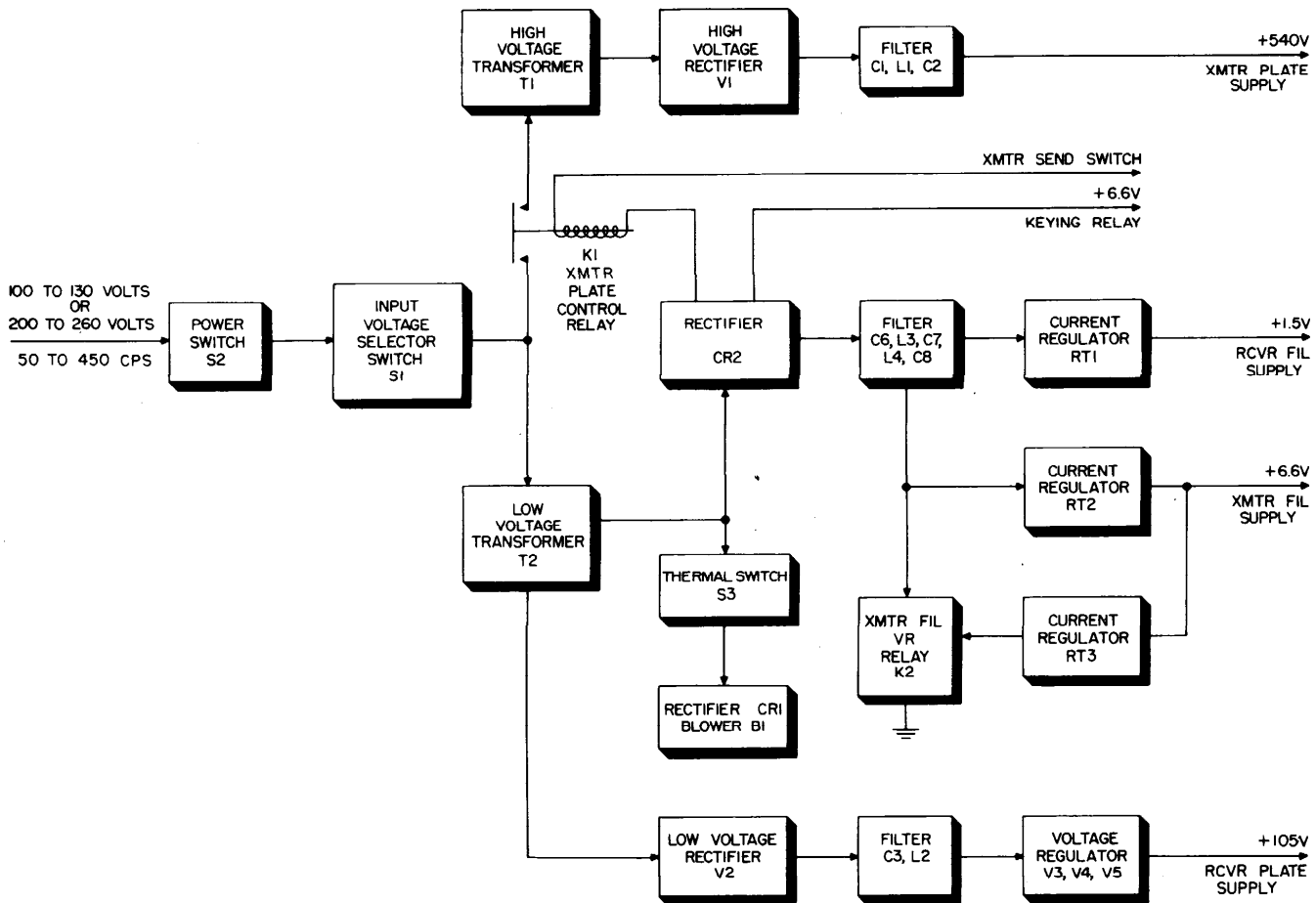
f. *Current-regulator Circuits.* There are two current-regulator circuits; one for the receiver filament supply and one for the transmitter filament supply. The receiver filament supply circuit has one current-regulating resistor, RT1, the output of which provides 1.5 volts dc for the receiver filaments. The transmitter filament supply circuit has two current-regulating resistors, RT2 and RT3, which are connected in parallel. Transmitter filament voltage-regulator relay K2 is also included in this circuit. A dc output voltage of 6.6 volts is provided for the transmitter filaments.

g. *Blower Circuit.* The same winding of low-voltage transformer T2 that supplies the filament voltages also supplies voltage for rectifier CR1 through thermal switch S3. The output from rectifier CR1 operates blower B1.

46. Ac Power Input Circuit

(fig. 19)

a. The ac power input may be either 100 to 130 volts or 200 to 260 volts at a frequency of 50 to



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Figure 18. Power Supply PP-327A/GRC-9Y, block diagram.

450 cps. Two transformers are used; one for high-voltage supply T1 and one for low-voltage supply T2. Each of these transformers has a split primary winding. The two halves are connected in parallel for nominal 115-volt operation and in series for nominal 230-volt operation by the action of double-pole, double-throw (dpdt) input voltage selection switch S1. The positions are marked 115 and 230 on the panel. A switch guard prevents the switch from being accidentally thrown from one position to the other during actual operation. A 2-ampere protective fuse (F1 through F4) is placed in the lead to each half of the primary windings of each transformer. The input to high-voltage transformer T1 goes through the normally open contacts of transmitter plate control relay K1. This relay will not receive its actuating voltage until control Ⓢ of Receiver-Transmitter RT-77(*)/GRC-9 is in the SEND position because the high-voltage transformer can not be energized until this is done. Low-

voltage transformer T2 will be energized immediately when turning on the power supply.

b. If the power supply is used with other equipment, the control for transmitter plate supply high-voltage transformer T1 must be provided. A single-pole, single-throw switch can be connected from pin 35 to pin 24 (ground) of receptacle J1 to operate relay K1. An alternative method is to short pin 35 to pin 24 of J1. Relay K1 will then operate immediately when the power supply is turned on.

47. Transmitter Plate Supply Circuit

(fig. 20)

a. The secondary winding of high-voltage transformer T1 is connected to rectifier tube V1; a type 5R4WGY tube is used as a full-wave rectifier. The filament of tube V1 is supplied from the 5-volt winding of low-voltage transformer T2. Because transformer T2 is energized when the power is on,

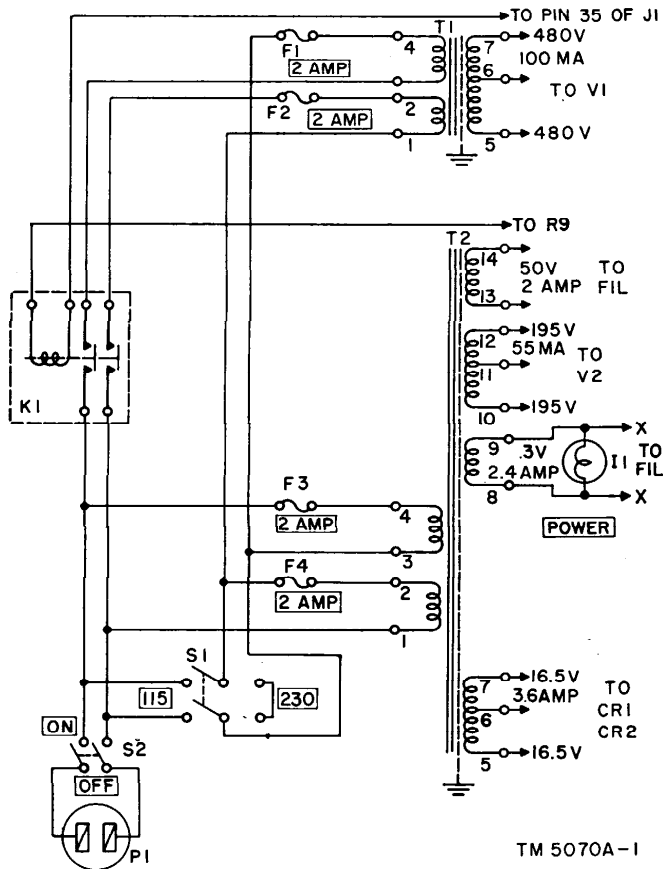


Figure 19. Power Supply PP-327A/GRC-9Y, ac input circuit.

the filament of V1 is also energized and makes the transmitter plate voltage immediately available

when control Ⓔ of Receiver-Transmitter RT-77 (*)/GRC-9 is in the SEND position.

b. The output of tube V1 is filtered by a pi-section filter made up of capacitors C1 and C2 and choke L1. Bleeder resistors R1, R2, and R3 are connected in series across the output of the filter to discharge the capacitors when the equipment is turned off. The dc output of 540 volts at 100 milliamperes (ma) is fed to the pin 32 of output receptacle J1.

48. Receiver Plate Supply Circuit

(fig. 21)

Two of the secondary windings of low-voltage transformer T2 are connected to rectifier tube V2, a type 6X4W tube, used as a full-wave rectifier. The filament of tube V2 is supplied from the 6.3-volt winding of the same transformer. The output of the rectifier is filtered by a pi-section filter that is made up of two halves of dual capacitor C3 (C3A and C3B) and choke L2. Its output is fed to the receiver voltage regulator.

49. Receiver Voltage Regulator

(fig. 22)

a. The output from the filter in the receiver plate supply is fed to a voltage-regulator circuit made up of tubes V3, V4, and V5. In this circuit, V3, a type 6216 tube, acts as a series regulator controlled by V4, a type 5751 twin-triode control tube.

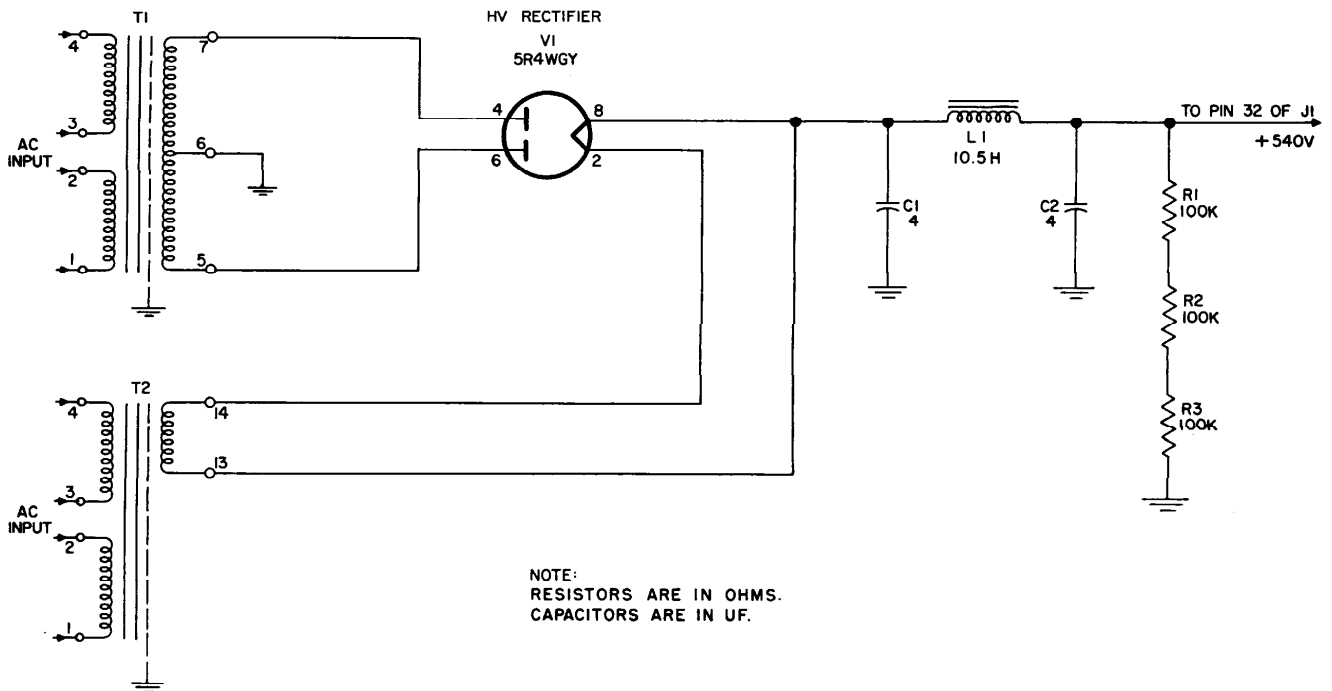


Figure 20. Power Supply PP-327A/GRC-9Y, transmitter plate supply.

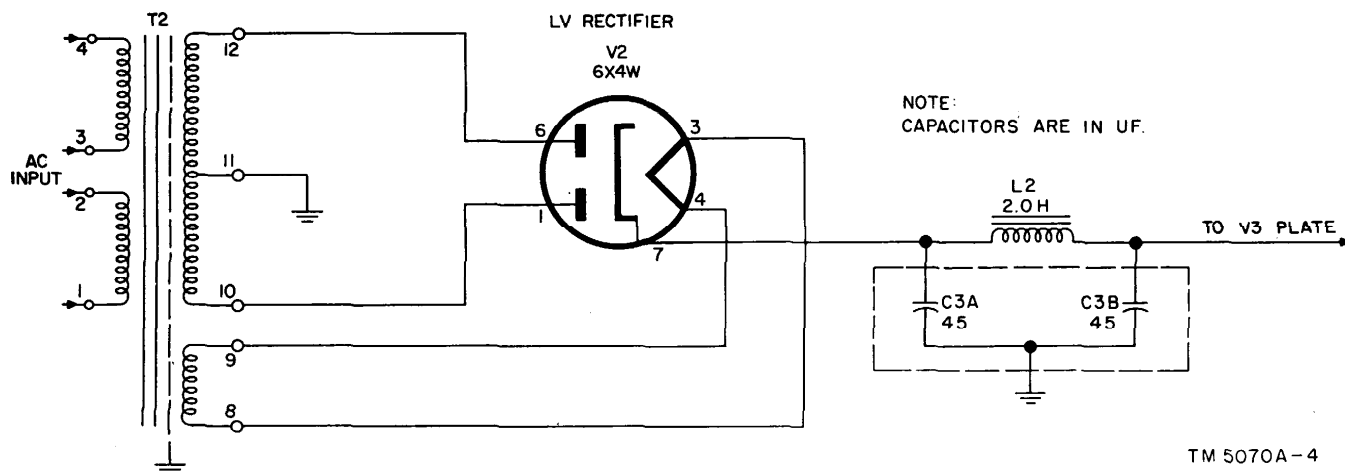


Figure 21. Power Supply PP-327A/GRC-9Y, receiver plate supply.

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The two halves of V4 are connected in parallel. Tube V5, a type 991 voltage-regulator tube, keeps the cathode of V4 at a constant potential. The grids of V4 are connected to a tap on resistor R7, which is part of the bleeder. The bias on V4 is the difference between the positive potential of the cathodes and the positive potential of the grids. Resistor R7 is adjusted so that the grids are less positive than the cathodes by the amount of the required bias.

b. Variations in the output voltage that are caused by either input voltage variations or load changes are compensated for as follows: An increase in output voltage will cause the tap on R7 to be

more positive and reduce the difference in voltage between the grid and cathode because the cathode voltage is held constant by V5. The bias on V4 will decrease and allow V4 to conduct more current. This causes an increase in voltage drop across resistor R4, which is connected between the grid and cathode of V3 and provides bias for V3; this increases the grid bias on V3. Increased grid bias causes the dc resistance of V3 to increase with a resultant increase in the voltage drop across the tube. This compensates for the original output voltage rise and keeps the output voltage constant. A similar action causes the dc resistance of V3 to decrease, if the output voltage decreases, and the

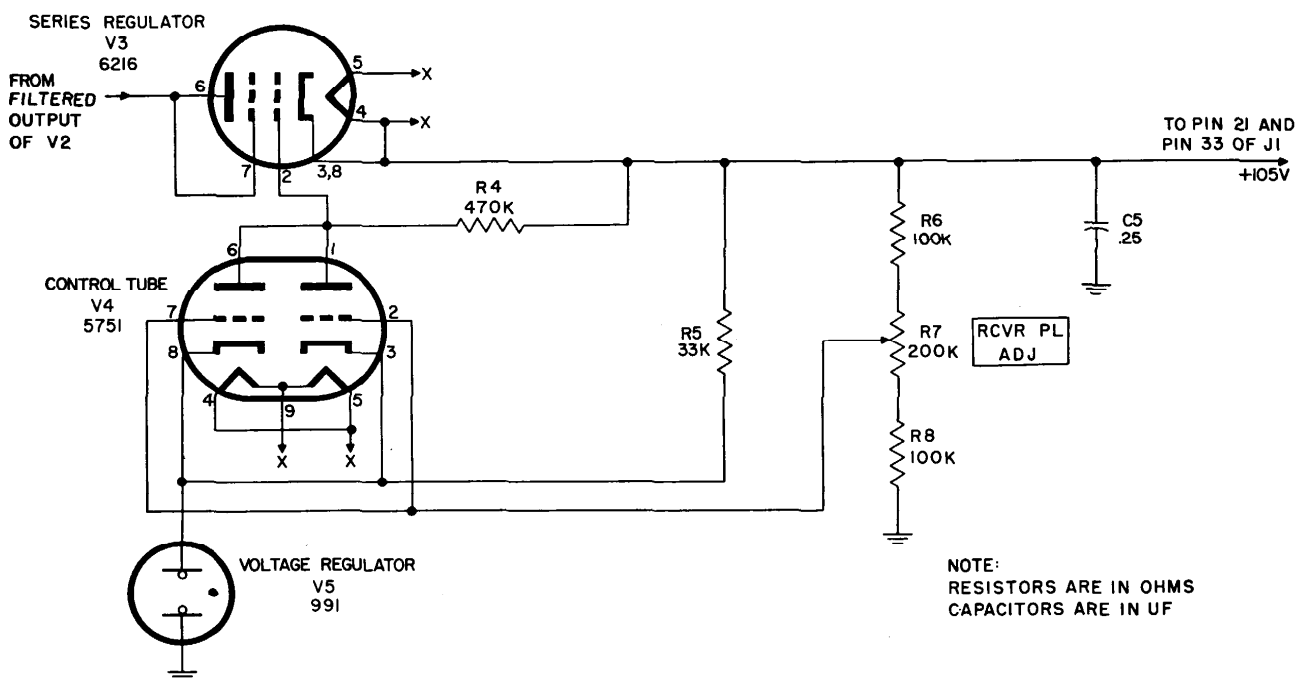


Figure 22. Power Supply PP-327A/GRC-9Y, receiver voltage regulator.

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resulting voltage drop across V3 is much less. The voltage that the system tries to maintain can be adjusted within limits by RCVR PL ADJ control R7 in the voltage-divider network of R6, R7, and R8. The drop across resistor R5 provides the correct operating voltage for tube V5 when the power supply is turned on. Capacitor C5, in the output, provides further filtering action. The regulated dc output of 105 volts at 45 ma is fed to pins 21 and 33 of output receptacle J1 for the receiver plate supply.

50. Filament Voltage Circuit

(fig. 23)

a. Another secondary winding of transformer T2 is connected to selenium rectifier CR2, which is used as a full-wave rectifier. A part of the output of this rectifier is fed to double pi-section filter C6, L3, C7, L4, and C8. The filtered output is then fed to the current-regulator circuit (par. 49), which supplies filament power for the receiver and transmitter.

b. Another portion of the output of rectifier CR2

is passed through voltage-dropping resistance-capacitance filter R9-C10 to provide voltage to operate the relay K1. The circuit to this relay is not completed until control ⓔ on the receiver-transmitter is in the SEND position (par. 44).

c. A portion of the output of rectifier CR2 is passed through the voltage-dropping resistance-capacitance filter R10-C9 and is fed to pin 34 of output receptacle J1 for use as keying relay voltage by the transmitter of Receiver-Transmitter RT-77(*)/GRC-9.

51. Current-regulating Circuits

(fig. 24)

a. A schematic diagram for the current-regulating circuit is shown in figure 24. The first of these circuits provides a voltage of 1.5 volts at a current of 500 ma. The regulating portion of the circuit is fed from the filter through voltage-dropping resistor R11. It consists of current-regulating resistor RT1, which is shunted by resistor R12. Current-regulating resistor RT1 changes its resist-

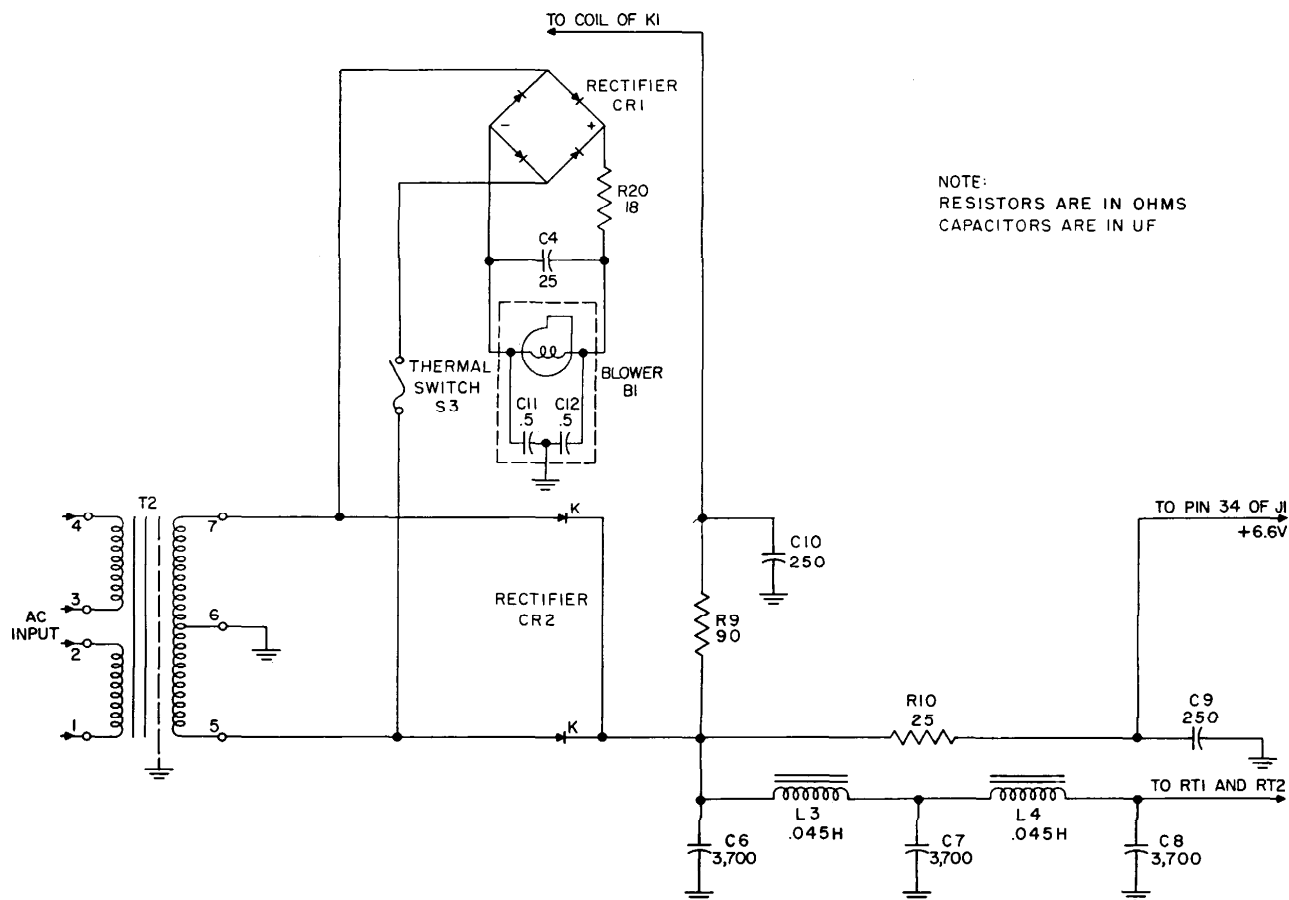


Figure 23. Power Supply PP-327A/GRC-9Y, filament voltage circuit.

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ance when the applied voltage changes and, therefore, keeps the current through it substantially constant over its operating range. Shunting RT1 by resistor R12 enables it to control larger currents than it can normally conduct. The voltage dividing circuit, which is composed of the RCVR FIL ADJ resistor R13 and resistor R14, enables the voltage output to be adjusted to the nominal operating value of 1.5 volts. This supplies the receiver filaments of Receiver-Transmitter RT-77(*)/GRC-9. This output is connected to pins 22 and 23 of output receptacle J1.

b. The second of the two current-regulating circuits provides a voltage of 6.6 volts at a current of 2 amperes. The regulating portion consists of two current-regulating resistors, RT2 and RT3, which function exactly as RT1. Resistor RT2 is shunted by resistor R15, and RT3 is shunted by resistor R16 to increase the current carrying capacity of the system. The RT3-R16 pair is connected in parallel with the RT2-R15 pair through the normally closed contacts of transmitter filament voltage-regulator relay K2. The coil of K2 is connected across the output of the regulator and, at normal voltage (transmitter operating), there is insufficient current through the coil of relay K2 to operate it.

c. When the transmitter filaments are off, however, the load drops to approximately 100 ma, drawn by the coil of relay K102B in the receiver-transmitter, with a resulting increase in output voltage. This voltage increase is sufficient to operate relay K2 and open its normally closed contacts, which results in replacing the parallel circuit of RT2-R15 and RT3-R16 by the RT2-R15 pair only. The normally closed contacts of K2 will open and shunt a part of the circuit output to ground through the RT3-R16 pair and resistor R17. This current drain causes the voltage across the coil of K102B to decrease to a safe value. The instant the transmitter filaments are turned on (push-to-talk button pushed or control D of the receiver-transmitter in either CW or MCW position), relay K2 will remain energized and provide the shunt to ground through RT3, R16, and R17. This prevents the initial instantaneous high voltage from being applied directly to the filaments. The increased load current that is furnished by the filaments will cause the output voltage to drop enough to allow relay K2 to become de-energized and establish the normal operating transmitter filament circuit. The voltage-divider circuit, which is composed of XMTR FIL ADJ resistor R18 and resistor R19, enables the voltage output to be ad-

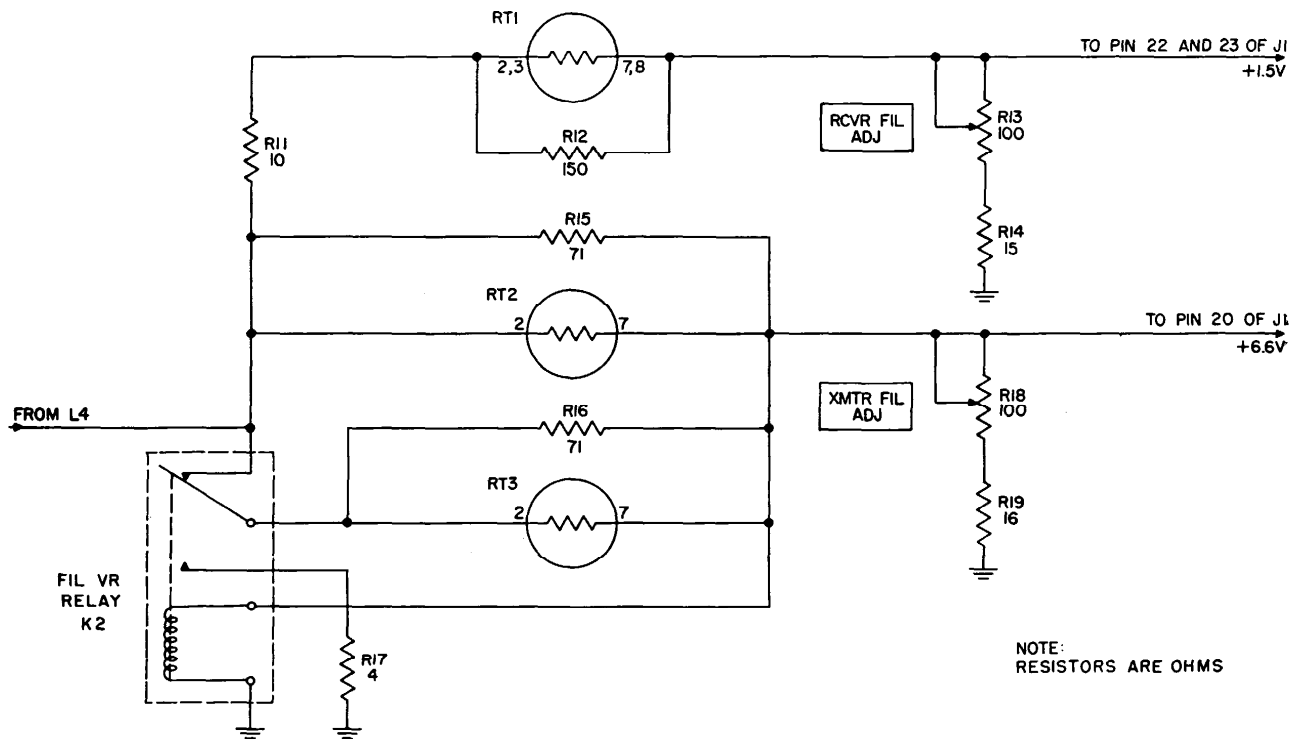


Figure 24. Power Supply PP-327A/GRC-9Y, current-regulator circuits.

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justed to the nominal operating value of 6.6 volts. This supplies the filaments of the transmitter portion of Receiver-Transmitter RT-77(*)/GRC-9. This output is connected to pin 20 of output receptacle J1.

52. Blower Circuit

(fig. 23)

The same winding of low-voltage transformer T2 that supplies the operating voltage for rectifier CR2 also supplies voltage to rectifier CR1. Recti-

fier CR1 is a selenium bridge-type rectifier that provides a dc voltage to operate blower B1. The input power to CR1 is controlled by thermal switch S3, which closes and completes the circuit to CR1 when the temperature within the cabinet reaches 115° F. It opens again when the temperature has dropped to 95° F. Blower B1 has a built-in radio-frequency (rf) filter and external resistance-capacitance filter R20 and C4. The blower is driven by a motor that uses permanent magnet field coils. The bearings are lubricated for the life of the blower and require no further attention.

CHAPTER 5

FIELD MAINTENANCE

Note. This chapter contains information pertinent to field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and the skill of the repairmen.

Section I. GENERAL TROUBLESHOOTING INFORMATION

Warnings:

1. When servicing the power supply, be extremely careful because of the high voltages exposed. Always disconnect Power Cable Assembly CX-112/U and output power Cord CD-1086 before testing. Potentials greater than 500 volts may be present in filter capacitors of the high-voltage section even with the power off. Ground these capacitors before proceeding with the tests. Ground any terminal before touching it. Keep one hand in the pocket when making the tests.

2. Arc-overs in selenium rectifiers cause the release of poisonous fumes and the deposit of poisonous selenium compounds. If arc-over occurs, avoid inhaling the poisonous fumes. Ventilate the unit and do not handle the damaged rectifier until it has cooled; then avoid direct skin contact with the damaged part.

53. Troubleshooting Techniques

a. General. Troubleshooting at field maintenance level includes all the techniques that are outlined for organizational maintenance (par. 24-37) and any other techniques that may be required to isolate a defective part. The field maintenance instructions are not complete in themselves but supplement the instructions given in paragraphs 24 through 37. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that are performed at an organizational level (par. 37), must be completed by means of sectionalizing, localizing, and isolating techniques as described. To be effective, troubleshooting must be systematic. Generally, it is necessary to perform a sequence of operational checks, observations, and measurements before a fault is revealed. If the proper sequence

is used, the trouble will be traced first to a portion of the unit and finally to the defective part.

b. Sectionalization and Localization. The following tests are given to help in isolating the trouble. They should be performed in the given order.

- (1) *Visual inspection.* Through visual inspection, it is sometimes possible to discover the faulty component; it may be a discolored resistor, leaky capacitor, broken wire, or poorly soldered connection.
- (2) *Resistance measurements.* An outline for resistance measurements is given in paragraph 56. These measurements may give an indication of the condition of the input and output circuits.
- (3) *Operational test.* If everything appears satisfactory and the resistance measurements are normal, the next step is to make an operational test as outlined in paragraphs 37 and 58. Voltage measurements at output receptacle J1 should indicate the specific circuit that is at fault. Normal values for these voltages are given in figure 37.
- (4) *Troubleshooting charts.* Detailed symptoms of the trouble are listed in the troubleshooting charts (par. 58). These charts list the failure symptoms and corrective procedure by circuits, and they should be used with paragraphs 56 and 57 to aid in localizing the trouble.
- (5) *Intermittent.* Look for troubles that appear when the unit is tapped. These are symptoms of poorly soldered joints or defective components.

54. Troubleshooting Data

a. Power Supply PP-327/GRC-9Y.

Fig. No.	Par. No.	Description
25		Power Supply PP-327/GRC-9Y, top view.
26		Power Supply PP-327/GRC-9Y, top view, control panel and tube subchassis removed.
27		Power Supply PP-327/GRC-9Y, bottom view.
28		Power Supply PP-327/GRC-9Y, bottom view, resistor boards removed.
33		Test set-up diagram.
36		Power Supply PP-327/GRC-9Y, voltage and resistance diagram.
38		Power Supply PP-327/GRC-9Y, schematic diagram.
	56	Resistance measurements (checking filament and B + circuits for shorts).
	57	Operational test and voltage measurements.
	58	Troubleshooting charts.
	56c	Dc resistance of transformers, reactors, and relays.
	60	Replacement of parts in Power Supply PP-327/GRC-9Y.

b. Power Supply PP-327A/GRC-9Y.

Fig. No.	Par. No.	Description
29		Power Supply PP-327A/GRC-9Y, top view.
31		Power Supply PP-327A/GRC-9Y, top view, chassis removed from panel.
32		Power Supply PP-327A/GRC-9Y, bottom view.
33		Test set-up diagram.
37		Power Supply PP-327A/GRC-9Y, voltage and resistance diagram.
39		Power Supply PP-327A/GRC-9Y, overall schematic diagram.
	56	Resistance measurements.

Fig. No.	Par. No.	Description
	56d	Dc resistance of transformers, reactors, and relays.
	57	Operational test and voltage measurements.
	58	Troubleshooting charts.
	61	Replacement of parts in Power Supply PP-327A/GRC-9Y.

55. Test Equipment Required for Troubleshooting

When troubleshooting Power Supply PP-327(*)/GRC-9Y, use Multimeter TS-352/U and Electron Tube Test Set TV-7/U. The technical manuals associated with the test equipment are TM 11-5527 and TM 11-5083, respectively.

56. Resistance Measurements

a. *General.* Trouble within the power supply may often be located by checking the resistance of certain key circuits and components. Damage to the equipment may be prevented by making sure that no shorts exist. Remove V1, V2, and the pilot lamp on both models and remove V3 and V4 on Power Supply PP-327A/GRC-9Y. Disconnect the input and output cables.

b. *Dc Resistance Measurements at J1.* The following chart lists resistance measurements between each pin on J1 and ground (pin 24).

Pin No.	Power Supply PP-327/GRC-9Y	Power Supply PP-327A/GRC-9Y
20.....	6.4	10
21.....	52K	400K
22.....	50	10
23.....	50	10
24.....	0	0
32.....	50K	300K
33.....	52K	400K
34.....	50	32
35.....	70	200

c. *Dc Resistance of Transformers, Reactors, and Relays of Power Supply PP-327/GRC-9Y.* The dc resistance of the transformers, reactors, and relay windings is listed on following page:

Component	Terminals	Resistance (ohms)
T1	1 to 2	6.5
	3 to 4	6
	5 to 6	65
	6 to 7	75
T2	1 to 2	8.8
	2 to 3	.8
	4 to 5	.9
	5 to 6	9.9
	7 to 8	78
	8 to 9	78
	10 to 11	.4
	11 to 12	.4
	13 to 14	.5
	15 to 16	.2
	17 to 18	.3
	18 to 19	.3
	20 to 21	.4
	21 to 22	.4
L1		100
L2		300
L3		2.2
L4		2.2
L5		1.1
L6		.62
L7		.62
K1		30
K2		.25

d. *Dc Resistance of Transformers, Reactors, and Relays of Power Supply PP-327A/GRC-9Y.* The dc resistance of the transformers, reactors, and relay windings is listed below:

Component	Terminals	Resistance (ohms)
T1	1 to 2	6.8
	3 to 4	6.8
	5 to 6	97
	6 to 7	97
T2	1 to 2	3.7
	3 to 4	3.7
	5 to 6	.2
	6 to 7	.2
	8 to 9	.2
	10 to 11	97
	11 to 12	97
13 to 14	.2	

Component	Terminals	Resistance (ohms)
L1		150
L2		50
L3		.6
L4		.6
K1		63
K2		80

e. *Resistance Measurements at Other Points.* Resistance measurements at other points are shown in figure 36 or 37.

57. Operational Test and Voltage Measurements

a. If no abnormal readings are found in the checks given in paragraph 56, the equipment may be connected for normal operation. Operate the power supply as described in the equipment performance check list (par. 37). Check the power supply for smoke or odor of overheated parts.

Note. If one of the primary windings on either transformer is open, the power supply can be operated from a 115-volt source, but cannot be operated from a 230-volt source.

b. With the equipment operating, make the voltage measurements indicated in figure 36 or 37. Because of the low resistance of some of the windings tabulated in paragraph 56, the voltage measurement across these windings may be more useful in determining faulty operation.

58. Troubleshooting Charts

The following charts are supplied as an aid in locating trouble in the power supply. The charts list the symptoms which the repairman observes while making a few simple tests. The charts show how to isolate the trouble to a particular section, circuit, or part. When the trouble has been localized to a particular section or circuit, a tube check and voltage and resistance measurements of this section or circuit should be sufficient to isolate the defective part. Normal voltage and resistance measurements are shown in figures 36 and 37.

a. Power Supply PP-327/GRC-9Y.

(1) General.

Symptom	Probable trouble	Correction
1. Power supply inoperative; pilot lamp not lighted.	1. Defective lv fuse F3 or F4. Defective ac source. Defective power cord or plug. Defective power switch.	1. Check position of LINE switch. Replace fuse. If replaced fuse blows, proceed with step 2 below. Check ac input voltage. Replace or repair cord or plug. Replace switch.
2. Fuse F3 or F4 blows.	2. Defective component in one of supply circuits.	2. Disconnect input and output cords. Make resistance checks (fig. 36). Refer to c through f below.
3. Transmitter plate supply does not come on when control ⑤ on Receiver-Transmitter RT-77(*)/GRC-9 is set at SEND.	3. Relay K1 inoperative. Defect in Receiver-Transmitter RT-77(*)/GRC-9.	3. Proceed with (2) below. See TM 11-263.
4. Fuse F1 or F2 blows when control ⑤ on Receiver-Transmitter RT-77(*)/GRC-9 is set at SEND.	4. Shorted capacitor or other component in transmitter plate supply. Defect in Receiver-Transmitter RT-77(*)/GRC-9.	4. Make resistance checks (fig. 36). Replace defective part. See TM 11-263.

(2) Transmitter plate supply.

Symptom	Probable trouble	Correction
1. No transmitter plate voltage at pin 32 of J1.	1. Relay K1 not energized when control ⑤ on receiver-transmitter is set at SEND. Defective tube V1. Open reactor L1. Defective transformer T1.	1. Check operation of K1. If it is not energized, check relay coil for open circuit. Check operation of control ⑤ (TM 11-263). Replace V1. Check resistance. Replace L1 if defective. Make resistance check. Replace T1 if defective.
2. Low transmitter plate voltage at pin 32 of J1.	2. Weak tube V1. High leakage in capacitor C1, C2, or C3. Transmitter section of Receiver-Transmitter RT-77(*)/GRC-9 drawing excess current.	2. Replace V1. Make resistance check. Replace capacitor if defective. See TM 11-263.
3. High transmitter plate voltage at pin 32 of J1.	3. Reactor L1 shorted. One of resistors R1 through R15 open.	3. Check resistance. Replace L1 if defective. Make resistance check. Replace open resistor.

(3) Receiver plate supply.

Symptom	Probable trouble	Correction
1. No receiver plate voltage at pins 21 and 33 of J1.	1. Defective tube V2. Open reactor L2. Defective winding on transformer T2. Tube V3 or V4 not in socket. One of resistors R16, R17, R20, R21, R23, R24, or R25 open.	1. Replace V2. Make resistance check. Replace L2 if defective. Make resistance check. Replace T2 if defective. Replace V3 or V4. Make resistance check. Replace open resistor.
2. Low receiver plate voltage at pins 21 and 33 of J1.	2. Weak tube V2. High leakage in capacitor C4 or C5.	2. Replace V2. Make resistance check. Replace capacitor if defective
3. High receiver plate voltage at pins 21 and 33 of J1.	3. Shorted reactor L2. Resistor R18 or R19 open.	3. Make resistance check. Replace L2 if shorted. Make resistance check. Replace open resistor.

(4) Receiver filament supply.

Symptom	Probable trouble	Correction
1. No receiver filament voltage at pins 22 and 23 of J1.	1. Defective winding on transformer T2. Defective rectifier CR1. Open reactor L3 or L4.	1. Check ac voltage across terminals 20 and 22. Replace T2 if defective. If ac voltage exists across winding, check dc voltage at input to filter. Replace CR1 if defective. If dc voltage appears at input to L3 but not at output, replace L3. If voltage appears at input to L4 but not at output, replace L4.
2. Low receiver filament voltage at pins 22 and 23 of J1.	2. High leakage in capacitors C6 through C15. High-voltage drop across CR1 because of aging.	2. Check resistance. Replace leaky capacitor. Remove either R27 or R28, or both (par. 60) or replace CR1.
3. High receiver filament voltage at pins 22 and 23 of J1.	3. Shorted reactor L3 or L4. Open resistor R27 or R28.	3. Check resistance. Replace L3 or L4 if defective. Make resistance check. Replace open resistor.

(5) Control voltage supply.

Symptom	Probable trouble	Correction
1. No control voltage at pin 34 of J1.	1. Defective winding on transformer T2. Defective rectifier CR2. Open reactor L5.	1. Check ac voltage across terminals 17 and 19. Replace T2 if defective. Check dc voltage at input to filter. Replace CR2 if defective. If voltage appears at input to L5 but not at output, replace L5.

Symptom	Probable trouble	Correction
2. Low control voltage at pin 34 of J1.	2. High leakage in one of capacitors C16 through C19. High-voltage drop across CR2 because of aging.	2. Check resistance. Replace leaky capacitor. Remove either R29 or R30, or both (par. 60), or replace CR2.
3. High control voltage at pin 34 of J1.	3. Shorted reactor L5. Open resistor R29 or R30.	3. Check resistance. Replace L5 if defective. Make resistance check. Replace open resistor.

(6) *Transmitter filament supply.*

Symptom	Probable trouble	Correction
1. No transmitter filament voltage at pin 20 of J1.	1. Defective winding on transformer T2. Defective rectifier CR3 or CR4. Open reactor L6 or L7. Coil of relay K2 open.	1. Check ac voltage across terminals 10 and 12. Replace T2 if defective. Check dc voltage at input to filter. Replace CR3 or CR4 if defective. If dc voltage appears at input of L6 but not at output, replace L6. If dc voltage appears at input of L7 but not at output, replace L7. If voltage appears at contacts of K2 but not at output, check K2 coil for continuity; replace K2 if defective.
2. Low transmitter filament voltage at pin 20 of J1.	2. High leakage in one of capacitors C20 through C29. High-voltage drop across CR3 or CR4 because of aging. Points of relay K2 stuck in closed position.	2. Check resistance. Replace leaky capacitor. Remove either R45 or R46, or both (par. 60); or replace CR3 or CR4. Replace relay K2.
3. High transmitter filament voltage when K2 is energized.	3. Reactor L6 or L7 shorted. Open resistor R45 or R46.	3. Check resistance. Replace L6 or L7 if defective. Check resistance. Replace open resistor.
4. High transmitter filament voltage when K2 is de-energized.	4. Reactor L6 or L7 shorted. One of resistors R31 through R44 open.	4. Proceed as in step 3 above. Check resistance. Replace open resistor.

b. *Power Supply PP-327A/GRC-9Y.*

(1) *General.*

Symptom	Probable trouble	Correction
1. Power supply inoperative. Indicator lamp does not light.	1. Defective fuse F3 or F4. Defective ac source. Defective power cord or plug. Defective power switch.	1. Check position of input voltage selection switch. Replace fuse. If replaced fuse blows, proceed with step 2 below. Check ac input voltage. Replace or repair cord or plug. Replace switch.

Symptom	Probable trouble	Correction
2. Fuse F3 or F4 blows.	2. Defective component in supply circuits.	2. Disconnect input and output cords. Make resistance checks (par. 56). Refer to <i>c</i> through <i>f</i> below.
3. Transmitter plate supply does not come on when control ⑤ on Receiver-Transmitter RT-77(*)/GRC-9 is at SEND.	3. Relay K1 inoperative. Open resistor R9. Defect in Receiver-Transmitter TR-77(*)/GRC-9.	3. Proceed with subparagraph <i>b</i> below. Check resistance. Replace if defective. Refer to TM 11-263.
4. Fuse F1 or F2 blows when control ⑥ on Receiver-Transmitter RT-77(*)/GRC-9 is at SEND.	4. Shorted capacitor or other component in transmitter plate supply. Defect in Receiver-Transmitter RT-77(*)/GRC-9.	4. Make resistance checks (par. 56). Replace defective part. Refer to TM 11-263.

(2) *Transmitter plate supply.*

Symptom	Probable trouble	Correction
1. No transmitter plate voltage at pin 32 of J1.	1. Relay K1 not energized when control ⑤ on the receiver-transmitter is at SEND. Defective tube V1. Open reactor L1. Defective transformer T1.	1. Check operation of K1. If it is not energized, check resistance of relay coil (par. 56). Check operation of control ⑤ (TM 11-263). Check resistor R9. Replace V1. Check resistance of L1. Replace, if defective. Check resistance of T1. Replace, if defective.
2. Low voltage at pin 32 of J1.	2. Weak tube V1. High leakage of capacitor C1 or C2.	2. Replace V1. Check resistance. Replace defective capacitor.
3. High voltage at pin 32 of J1.	3. Open resistor R1, R2, or R3.	3. Check resistance. Replace defective resistor.

(3) *Receiver plate supply.*

Symptom	Probable trouble	Correction
1. No receiver plate voltage at pins 21 and 33 of J1.	1. Defective tube V2. Open reactor L2. Defective winding on transformer T2. Defective tube V3.	1. Replace V2. Check resistance of L2. Replace if defective. Check resistance of T2. Replace if defective. Replace V3.
2. Low voltage at pins 21 and 33 of J1.	2. Weak tube V2 or V3. Defective tube V4 or V5. RCVR PL ADJ resistor R7 not properly set. High leakage in capacitor C3 or C5.	2. Replace V2 or V3. Replace V4 or V5. Adjust RCVR PL ADJ control. Check resistance. Replace defective capacitor.
3. High voltage at pins 21 and 33 of J1.	3. RCVR PL ADJ resistor R7 not properly set. Defective tube V4 or V5. Open resistor R6, R7, or R8.	3. Adjust RCVR PL ADJ control. Replace V4 or V5. Check resistance. Replace defective resistor.

(4) Receiver filament supply.

Symptom	Probable trouble	Correction
1. No voltage at pins 22 and 23 of J1.	1. Defective winding on transformer T2. Defective rectifier CR2. Open reactor L3 or L4. Open resistor R11.	1. Check ac voltage across terminals 5 and 7. Replace T2 if defective. Check input voltage to filter. Replace CR2 if defective. Make voltage check at input and output of each reactor. Replace defective reactor. Check resistance of R11. Replace if defective.
2. Low voltage at pins 22 and 23 of J1.	2. High leakage in capacitors C6 through C10. High-voltage drop across CR2 because of aging. Defective current regulator RT1. Open resistor R12. RCVR FIL ADJ resistor R13 not properly set.	2. Check resistance. Replace defective capacitor. Replace CR2. Replace RT1. Check resistance. Replace R12 if defective. Adjust RCVR FIL ADJ control.
3. High voltage at pins 22 and 23 of J1.	3. RCVR FIL ADJ resistor R13 not properly set. Open resistor R13 or R14.	3. Adjust RCVR FIL ADJ control. Check resistance. Replace defective resistor.

(5) Transmitter filament supply.

Symptom	Probable trouble	Correction
1. No voltage at pin 20 of J1.	1. Repeat first three steps in <i>d</i> above.	1. Refer to first three steps in subparagraph <i>d</i> above.
2. Low voltage at pin 20 of J1.	2. XMTR FIL ADJ resistor R18 not properly set. High leakage in capacitors C6 through C10. High-voltage drop across CR2 because of aging. Defective overload relay K2. Defective current regulator RT2 or RT3. Open resistor R15 or R16.	2. Adjust XMTR FIL ADJ control. Check resistance. Replace defective capacitor. Replace CR2. Replace K2. Replace RT2 or RT3. Check resistance. Replace defective resistor.
3. High voltage at pin 20 of J1 insufficient to operate relay K2.	3. XMTR FIL ADJ resistor R18 not properly set.	3. Adjust XMTR FIL ADJ control.
4. High voltage at pin 20 of J1. Relay K2 operates.	4. Open resistor R18 or R19.	4. Check resistance. Replace defective resistor.
5. High voltage at pin 20 of J1, and K2 fails to operate.	5. Defective relay K2 or open resistor R18 or R19.	5. Replace K2 or resistor R18 or R19.

(6) Control voltage supply.

Symptom	Probable trouble	Correction
1. No voltage at pin 34 of J1, but normal voltage at pins 22 and 23.	1. Open resistor R10.	1. Check resistance. Replace R10 if defective.
2. Low voltage at pin 34 of J1, but normal voltage at pins 22 and 23.	2. High leakage in capacitor C9.	2. Check resistance. Replace C9 if defective.

(7) Blower circuit.

Symptom	Probable trouble	Correction
1. Blower does not operate, but voltages normal at receiver and transmitter filament terminals.	1. Defective rectifier CR1. Open resistor R20. Defective blower B1. Shorted capacitor C4. Defective thermal switch S3.	1. Replace CR1. Check resistance. Replace R20 if defective. Replace B1. Check resistance. Replace C4 if defective. Replace S3.
2. Blower does not operate up to normal speed.	2. High-voltage drop across CR1 because of aging. High leakage in capacitor C4.	2. Replace CR1. Check resistance. Replace C4 if defective.
3. Unit becomes excessively hot before blower operates.	3. Defective thermal switch S3.	3. Replace S3.

Section II. REPAIRS AND ADJUSTMENTS

59. General Precautions

Whenever the power supply is serviced, carefully observe the following precautions:

- a. When the power supply is removed from its cabinet, dangerous voltages may be exposed.
- b. Careless replacement of parts often makes new faults inevitable. Note the following points:
 - (1) Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.
 - (2) Be careful not to damage the other leads by pushing or pulling them out of the way.
 - (3) Do not allow drops of solder to fall into the power supply as they may cause short circuits.
 - (4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints because a poorly

soldered joint is one of the most difficult faults to find.

60. Replacement of Parts in Power Supply PP-327/GRC-9Y

a. *General.* Most of the parts in the power supply can be easily reached and replaced if found to be faulty. A certain amount of disassembly, however, is required to replace the parts mounted on the control panel, the tube subchassis, and those parts which are covered by resistor boards E9 and E10. When replacing switches, tube sockets, transformers, or any part that requires the disconnection of numerous wires, tag the wires carefully to avoid misconnection when the new part is installed.

b. *Control Panel.* To replace the pilot light assembly or any of the switches or fuse holders mounted on the control panel, proceed as follows:

- (1) Remove the screw that holds the control panel and the tube subchassis together. The screw can be reached through the hole

in the left side of the control panel near the top (fig. 25).

- (2) Remove the three screws that secure the control panel to the main chassis.
- (3) Remove the control panel and place it in a position so that the part to be replaced (fig. 26) can be reached.
- (4) Remove the defective part. Tag the disconnected wires.
- (5) To replace the control panel after the defective part has been replaced, reverse the procedure in (1) through (3) above.

c. Tube Subchassis. To replace any of the sockets mounted on the tube subchassis, proceed as follows:

- (1) Remove the screw that holds the control panel and the tube subchassis together.

- (2) Remove the four screws that secure the tube subchassis to the main chassis.
- (3) Remove the tube subchassis and place it in a position so that the socket to be replaced (fig. 26) can be reached.
- (4) Remove the defective socket. Tag the disconnected wires.
- (5) To replace the tube subchassis after the socket has been replaced, reverse the procedures outlined in (1) through (3) above.

d. Resistor Boards. Resistor boards E9 and E10, which are located in the bottom of the unit, cover or partially cover some of the parts of the power supply (fig. 27). Resistor board E9 covers reactors L3 and L4 and capacitor sockets X5 and X30. Resistor board E10 covers capacitors C1, C2, and C3 and relays K1 and

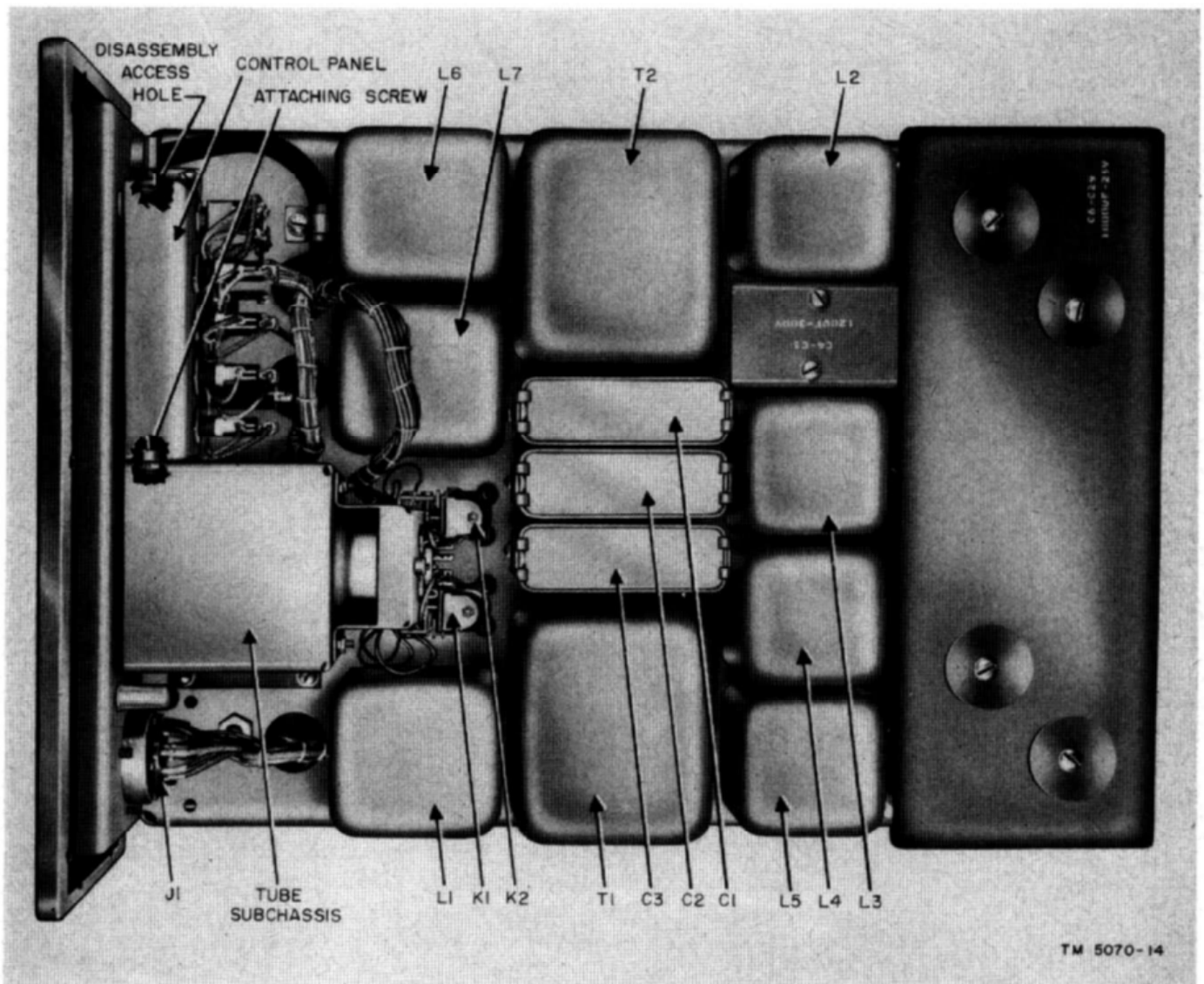


Figure 25. Power Supply PP-327/GRC-9Y, top view.

K2. Both resistor boards must be removed to replace C1, C2, or C3 because the retaining clamps for the capacitors extend under each resistor board. To remove each resistor board, remove the four screws that secure the resistor board to its mounting. The resistor board can then be placed to the side so that the defective part (fig. 28) can be reached. After replacing the defective part, return the resistor board to its mounting and replace the four screws.

61. Replacement of Parts in Power Supply PP-327A/GRC-9Y

a. *General.* Most of the parts can be easily reached and replaced if defective. To reach these

parts, release the 10 Dzus fasteners around the edge of the panel and withdraw the panel-chassis assembly from the cabinet. When replacing switches, sockets, transformers, or other parts with numerous wires, be sure to tag the wires so that they may be correctly reconnected.

b. *Parts Attached to Panel.* The parts on the panel (figs. 3 and 31) are mounted on brackets or subchassis. Do not remove these brackets or subchassis to replace the attached parts.

- (1) Release the Dzus fasteners and open the access door.
- (2) To replace indicator lamp holder XII, fuse holders XF1 through XF4, or toggle

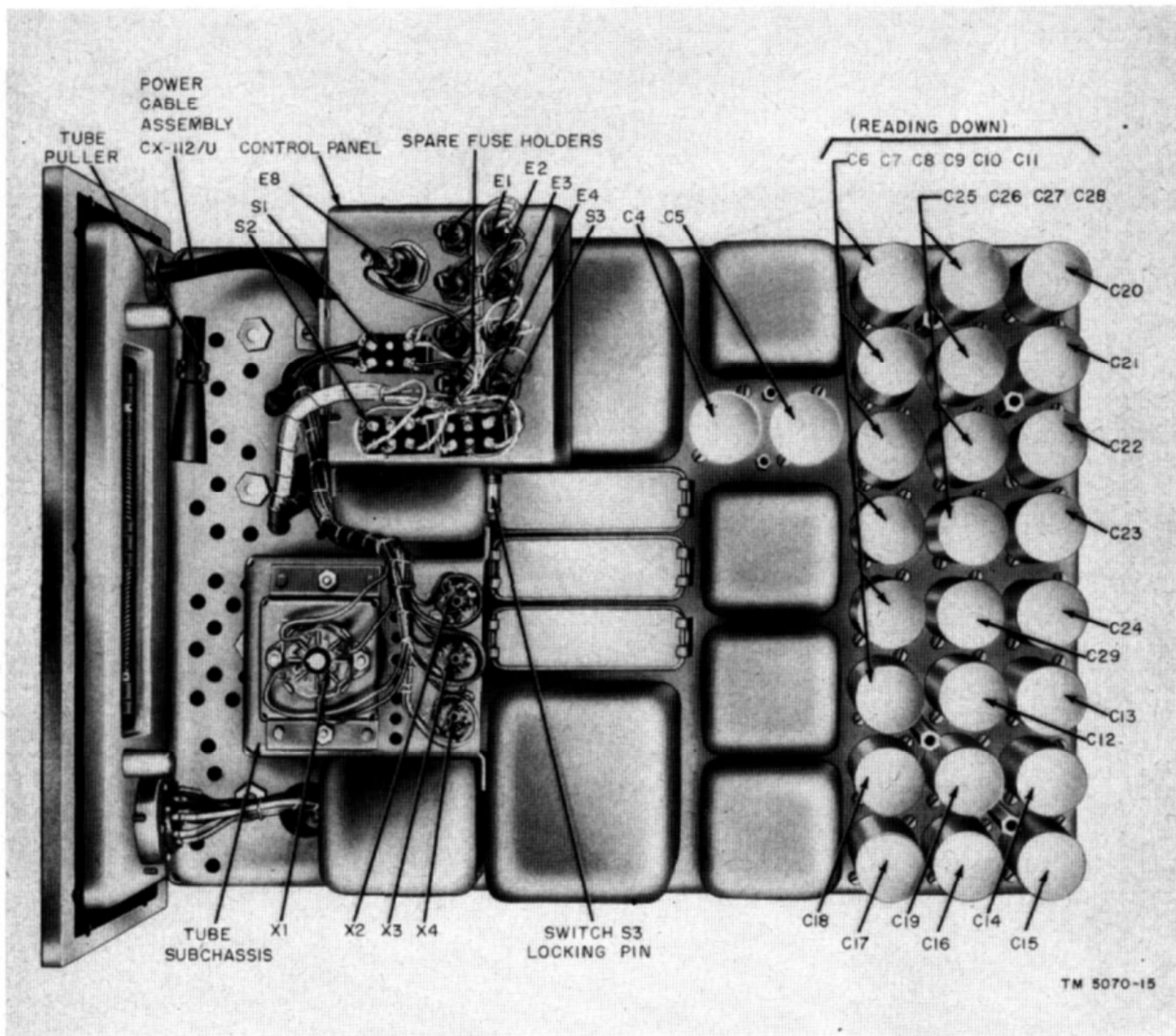


Figure 26. Power Supply PP-327/GRC-9Y, top view, control panel and tube subchassis removed.

switches S1 and S2, remove the check nut that secures them to the mounting panel and withdraw them from the rear.

- (3) To replace tube socket XV1, remove the two screws that hold it to the mounting, and remove the socket from the rear.
- (4) To replace tube sockets XV2, XV3, and XV4, remove the screws that hold them to the subchassis, and lift the item out through the access door. Unsolder the connections to the item before doing this.
- (5) To replace blower B1, the four screws that hold the B1 to its mounting can be reached through the access door. Remove these screws and remove B1 from the rear.
- (6) To replace power output receptacle J1, remove the chassis from the panel (*c* below)

to reach J1. Unsolder the leads to J1 and remove the six screws that couple it to the panel.

c. Parts Attached to Chassis. Most of the parts on the chassis (figs. 29, 30, 31, and 32) can be easily reached and replaced by normal procedures. Remove the seven screws that hold the chassis to the panel and the two screws that hold each supporting bracket to the panel. Separate the panel from the chassis to replace relays K1 and K2, capacitors C9 and C10, rectifier CR1, and reactor L2, because these components are located directly below the brackets and subchassis that are mounted on the panel.

- (1) To replace capacitors C6, C7, and C8, remove the nuts on each end of the three mounting studs at the corners of the

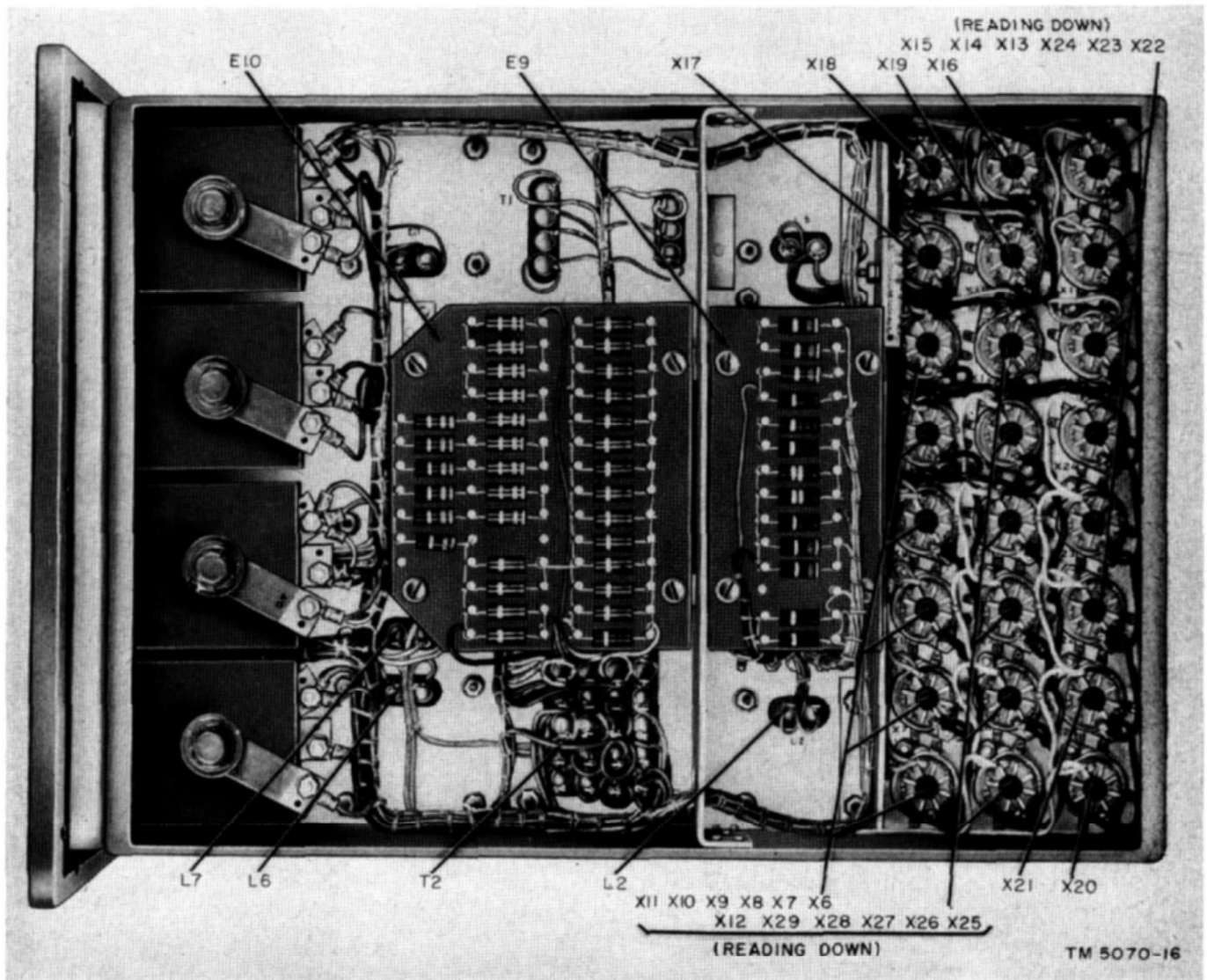


Figure 27. Power Supply PP-327/GRC-9Y, bottom view.

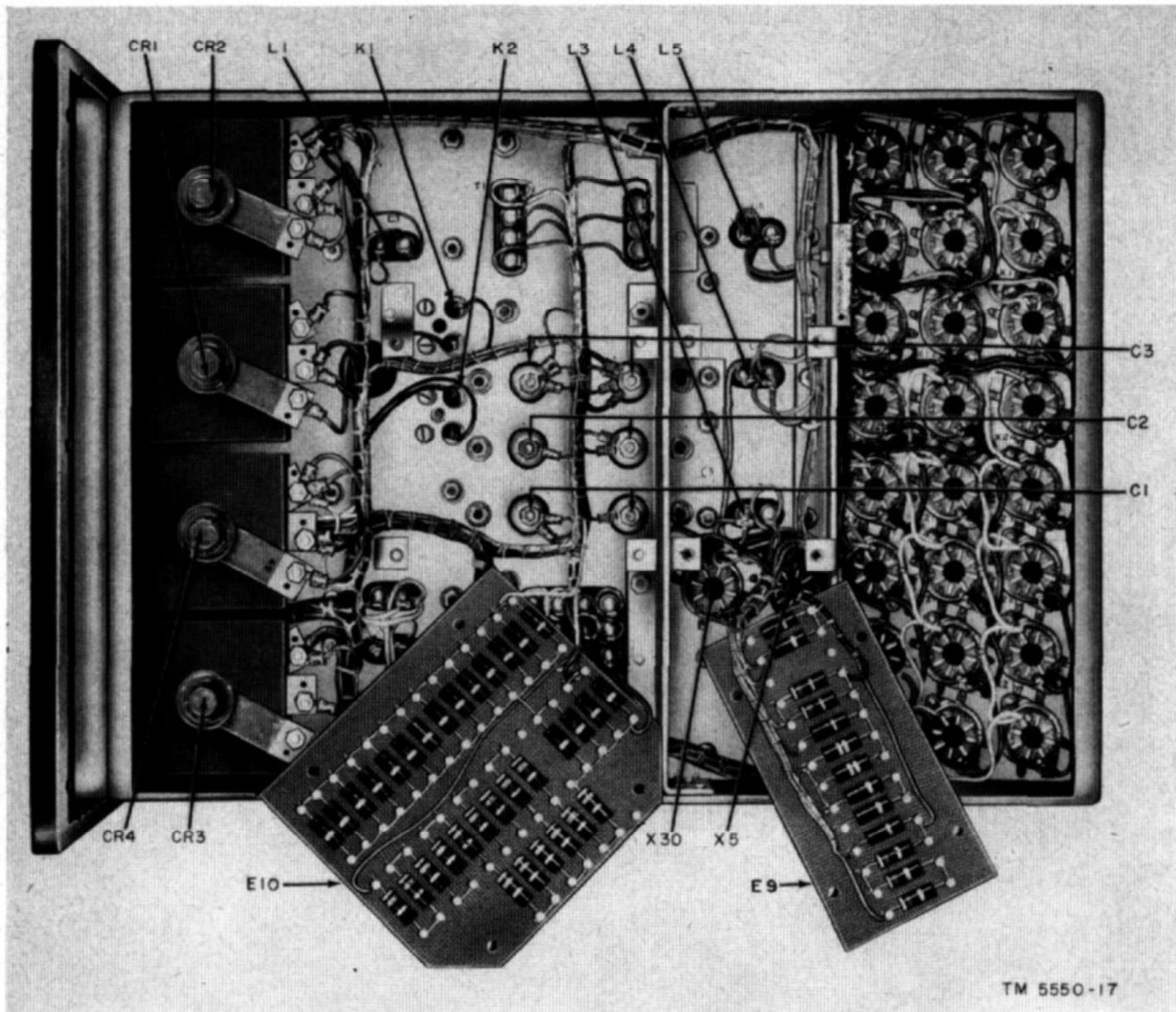


Figure 28. Power Supply PP-327/GRC-9Y, bottom view, resistor boards removed.

mounting plate. Remove the mounting plate and the studs. Unsolder the connections to the capacitor and remove the capacitor. Replace it with the new capacitor and resolder the connections to the proper terminals. Reinstall the studs and the top mounting plate. Be sure that the studs go through the ears on the capacitor clamp. If the replacement capacitor does not have the same height, adjust the check nuts until the top plate holds the capacitor firmly in position.

- (2) To replace thermal switch S3, remove the nuts on the screws that hold S3 in place; they are located beneath terminal board

TB1. Remove the two mounting bolts that hold TB1 to the chassis. This allows TB1 to be folded back so that the bolts that hold S3 in place can be reached. Return TB1 to its original position and fasten it after replacing thermal switch S3.

d. Replacement of Parts in Blower. The parts that make up the blower are shown in an exploded view in figure 30. Completely disconnect the blower from the unit before attempting disassembly.

(1) *Disassembly of blower.*

- (a) Loosen the two hexagonal socket-head setscrews that hold the fan blade to its shaft; use a No. 4 hexagonal socket-head

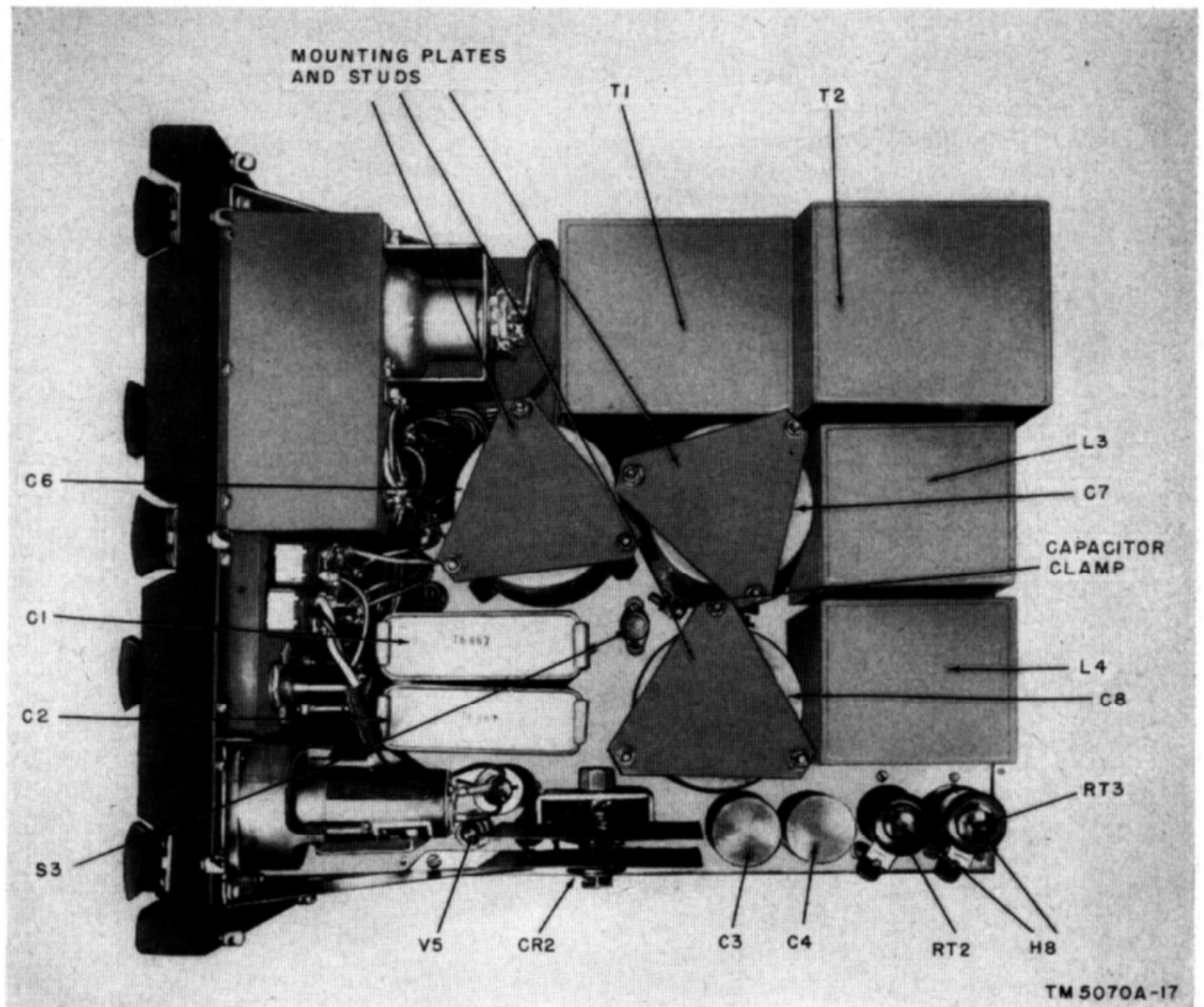


Figure 29. Power Supply PP-327A/GRC-9Y, top view.

setscrew wrench. These setscrews are reached from the rear of the blower through openings in the fan housing. Guide holes in the hub of the fan blade indicate the position of the setscrews, which are approximately 120° apart on the hub. Remove the fan blade.

- (b) Remove the two screws (exposed when the fan blade is removed) that hold the fan housing to the motor frame. Remove the fan housing.
- (c) Remove the two hexagonal nuts and washers that secure the terminals at the rear plate.
- (d) Remove the two screws that go through the rear plate and remove the rear cover

and rear plate. This exposes the filter circuit and brush mounting plate and motor.

- (e) Remove the tape from around the magnets.
- (f) Mark the position of the two magnets with respect to the frame so that they may be correctly replaced; remove the two magnets. They are held in position by magnetic force only. If new magnets only are required, they may be installed at this point and the blower reassembled. Reversing the polarity of the magnets when installed will reverse the direction of rotation of the motor.
- (g) Slide the insulating disk back on the

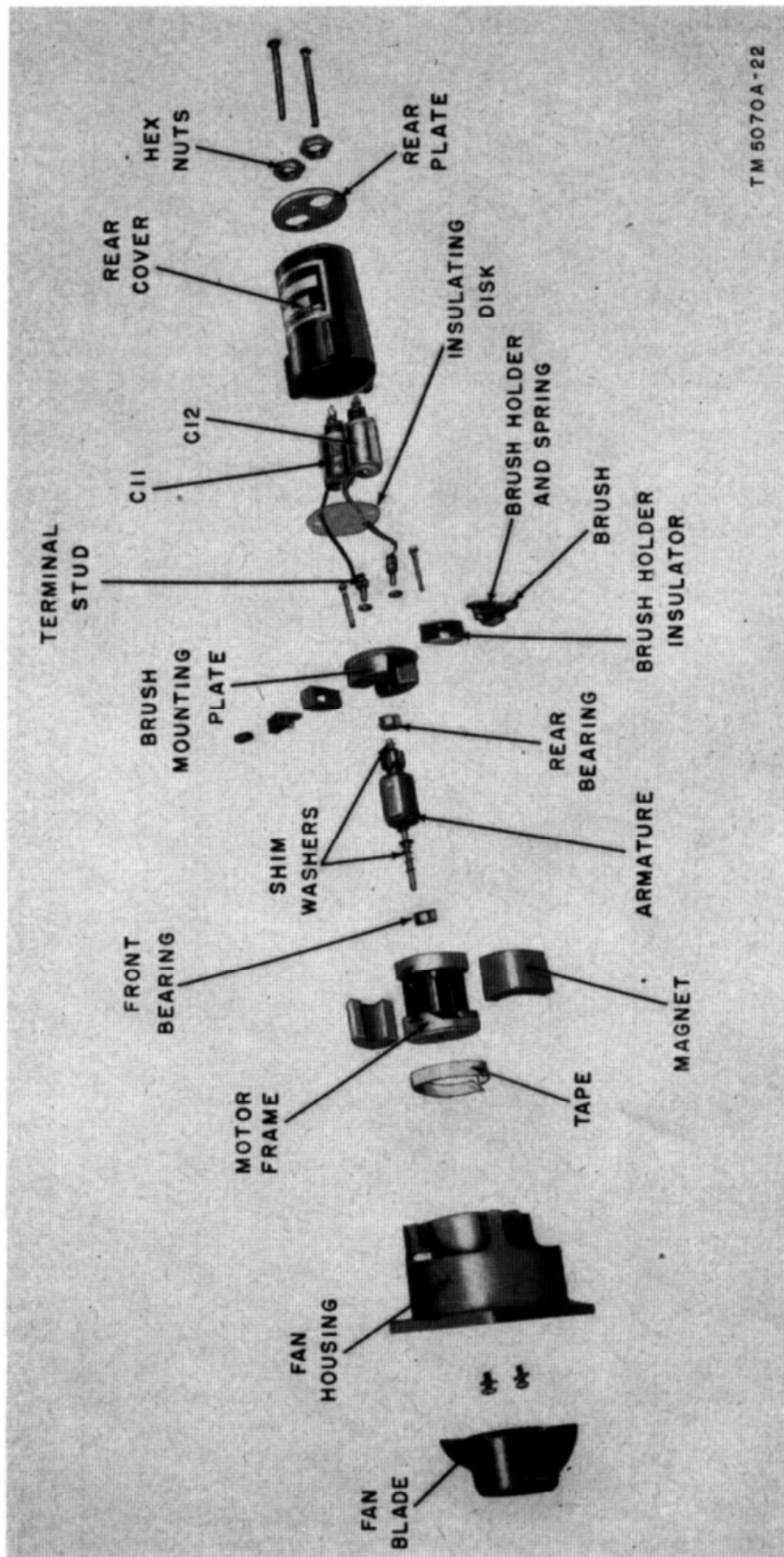
wires and remove the two screws that go through the brush mounting plate. Note the pair of holes through which these screws fit.

- (h) Carefully lift the brush mounting plate, complete with the attached brushes and filter circuit, off the commutator. Watch for small shim washers between the commutator and the rear bearing. Note how many there are and the order in which they are placed so that they may be replaced in their original position.
- (i) Press or tap out the rear bearing from its position in the brush mounting plate. Be careful not to rough up the edges of the bearing. Use fiber, rubber, or wooden protection on the surface of the bearing before applying pressure. If only the rear bearing is defective, it may be replaced at this point and the blower reassembled.
- (j) Withdraw the armature from the motor frame. Watch for small shim washers between the armature and front bearing. Different types and amounts of washers are used in different motors. Note the number, type, and relative position of the washers so that they may be replaced in the correct order. If the armature is defective, it may be replaced at this point, and the blower reassembled. When installing a new armature, position the commutator with enough shim washers so that the brushes are centered with no overhang, and that the armature will turn freely with no binding and no end play.
- (k) Press or tap out the front bearing from its position in the motor frame; use the same procedure and cautions given in (i) above. If the front bearing is defective, it may be replaced at this point.
- (l) Unsolder the components (C11 and C12) of the filter circuit from the top of each of the terminal studs and remove the insulating disk. The terminal studs are identified by a plus and a minus sign marked on the brush mounting plate. The red lead goes to the plus terminal.
- (m) Unscrew the terminal studs at their hexagonal bases. Remove the brush holder insulators and the brush holders.

- (n) Unsolder the brush pigtailed, lift the brush springs off the brushes, and withdraw the brushes.
- (o) Lift the brush springs off their supports. Disassembly of the blower is now complete.

(2) *Assembly of blower.*

- (a) Place the brush springs on their support and be sure that they are in the proper position to supply tension for the brushes.
- (b) Solder the brush pigtailed to their contacts and place the brushes in position. The chamfer on the brush should be toward the spring. Retain the brushes with the brush springs.
- (c) Press the rear bearing in position in the brush mounting plate and the front bearing in the motor frame; be sure that each is properly seated.
- (d) Place each brush, spring, and brush holder in its insulator and secure them to the brush mounting plate with the terminal studs that were removed in the disassembly procedure ((1)(m) above).
- (e) Slide the armature into the motor frame; be sure that the same number and type of shim washers are included and are placed in the same order as when removed ((1)(j) above).
- (f) Place the magnets in position in the motor frame; be sure that they are oriented the same as when removed. The magnetic field will hold the armature and its washers in position. Replace the tape around the magnets.
- (g) Replace the same number and type of shim washers on the commutator end of the armature shaft that were removed in the disassembly procedure ((1)(h) above).
- (h) Place the brush mounting plate, complete with brushes and springs, over the commutator. Lifting the brush springs off the brushes and hooking them over the edges of the insulator enables the brushes to retract enough to engage the commutator. When properly positioned, return the brush springs to position and secure the brush mounting plate to the



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Figure 30. Blower, exploded view.

motor frame with the two screws that were removed in the disassembly procedure ((1) (g) above). Be sure that the screws fit through the same pair of holes from which they were removed.

- (i) Reconnect the filter circuit (C11 and C12); be sure that the red lead goes to the positive terminal stud and the leads go through the correct holes in the insulating disk. The other holes should be properly oriented to take the screws that hold the rear cover to the motor frame. The circuit diagram for this filter is shown in figures 23 and 39.
- (j) Fasten the motor to the fan housing with the two screws that were removed in the disassembly procedure ((1) (b) above).
- (k) Slide the rear cover over the motor and line it up with the fan housing.

- (l) Bring the two filter capacitor terminals through the holes in the rear plate; the capacitor with the red lead should connect to the red input lead to the blower. Secure the terminals with the hexagonal nuts.

- (m) Secure the rear plate to the motor frame with the two screws that were removed in the disassembly procedure ((1) (f) above). These screws should pass through the two holes in the insulating disk.

- (n) Replace the fan blade on its shaft; be sure that there is enough clearance between the fan blade and housing so that no rubbing occurs. Secure it with the two setscrews. The assembly is now complete.

(3) *Replacement of brushes and brush springs only.*

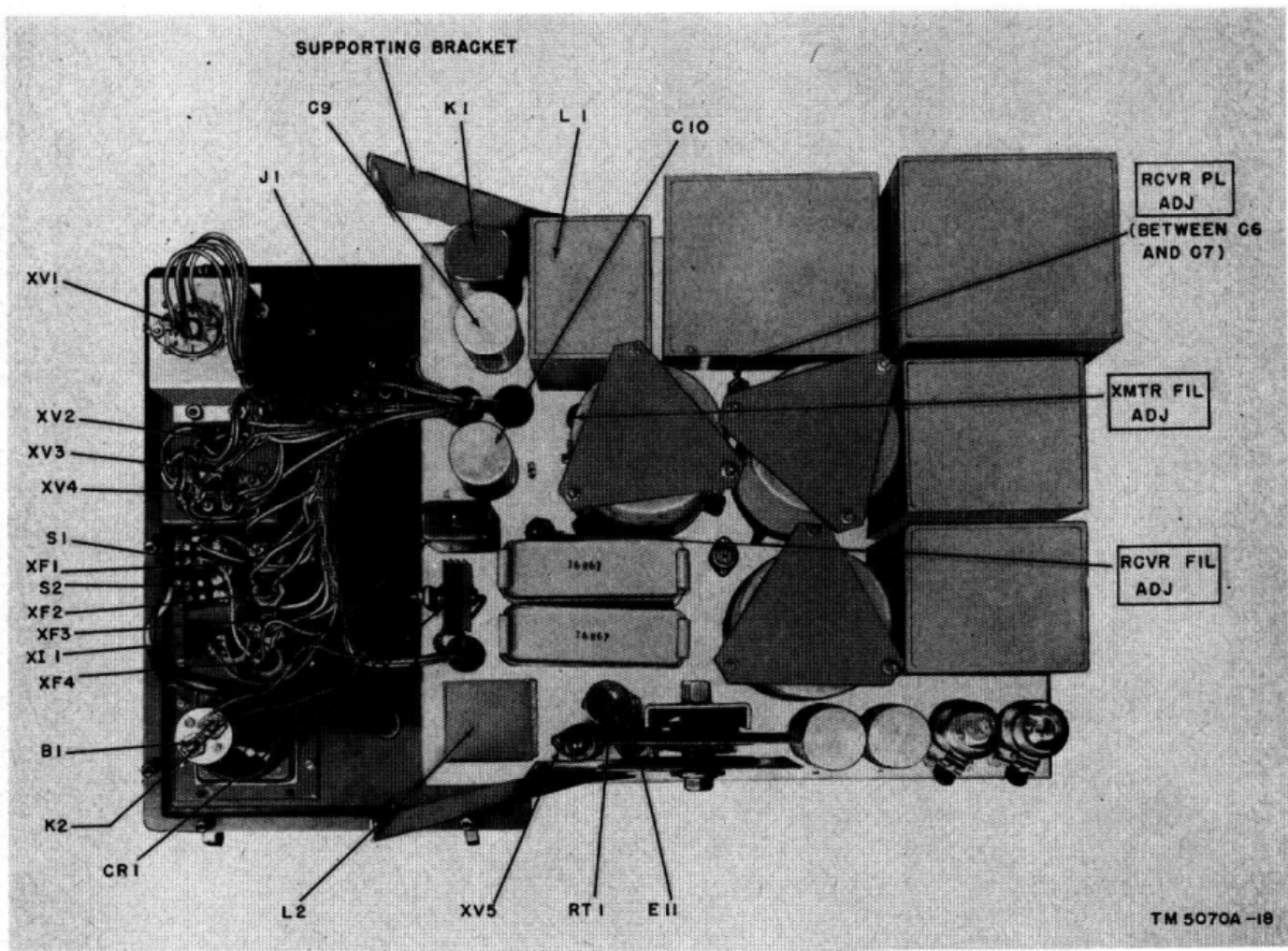


Figure 31. Power Supply PP-327A/GRC-9Y, top view, chassis removed from panel.

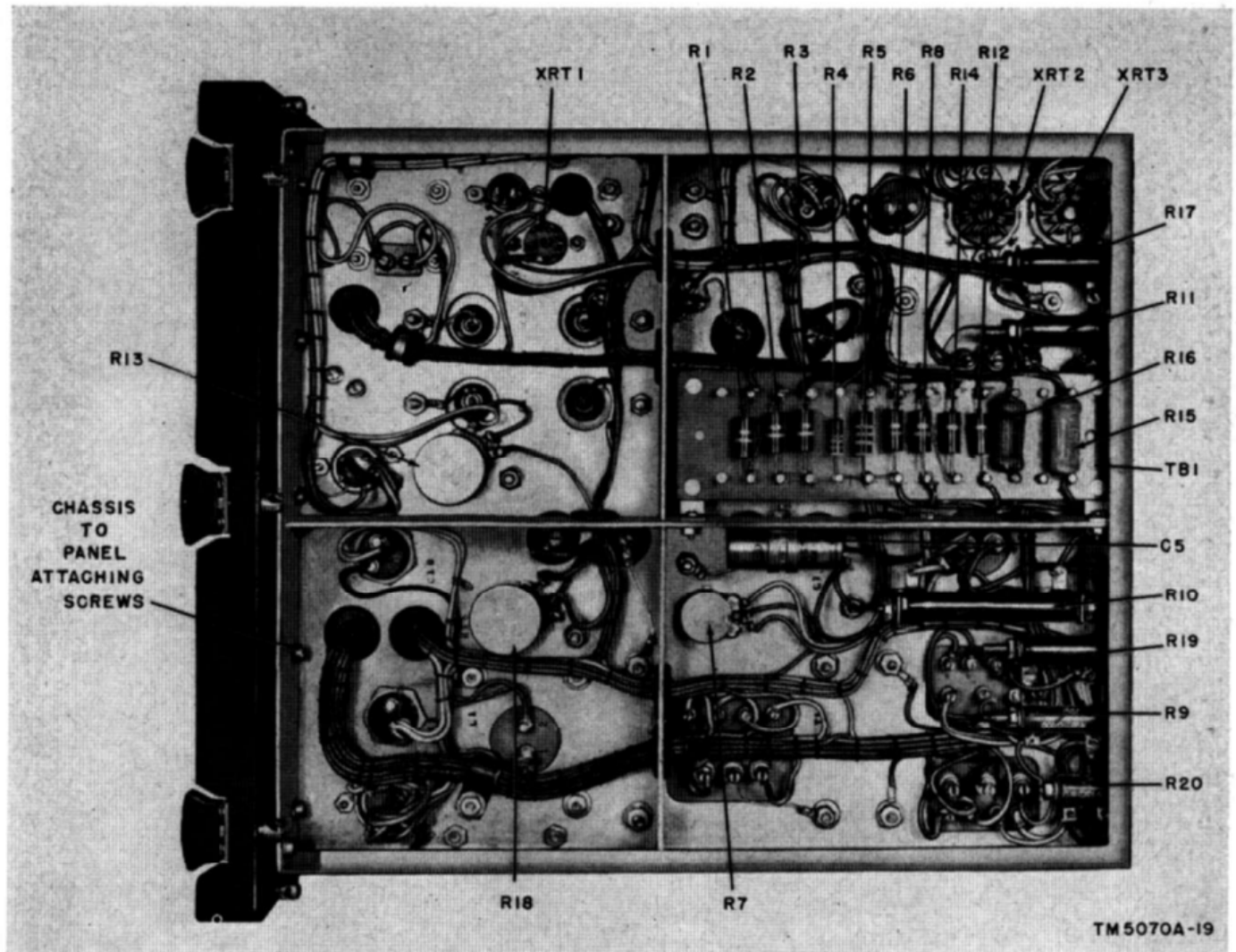


Figure 32. Power Supply PP-327A/GRC-9Y, bottom view.

- (a) Remove the two hexagonal nuts that secure the terminals at the rear plate.
- (b) Remove the two screws through the rear plate and remove the rear plate and cover.
- (c) Follow the disassembly procedures in (1) (g), (h), (l), (m), (n) and (o) above. Follow the assembly procedure in (2) (a), (b), (d), (g) through (i), and (l) through (n) above.

62. Voltage Adjustments for Power Supply PP-327/GRC-9Y

One or both of the bleeder resistors used across the output circuits of the receiver and transmitter filament supplies and the control voltage supply can be removed when the rectifiers have aged to the extent that the output voltage is below the nominal value. Connect the power supply to Receiver-

Transmitter RT-77(*)/GRC-9 operated as described in paragraph 67. Proceed as follows to increase the output voltage:

a. *Receiver Filament Supply.* Measure the output voltage of the receiver filament supply (pin 22 of connector J1 to ground). If the voltage under load is below 1.6 volts, clip the leads to resistor R27 on terminal board E9 (figs. 27 and 36) and remove the resistor. If the voltage is still low, remove resistor R28. If removal of both resistors does not result in sufficient output voltage, replace rectifier CR1.

b. *Control Voltage Supply.* Measure the output voltage of the control voltage supply (pin 34 of connector J1 to ground). If the voltage under load is below 6.7 volts, clip the leads to resistor R29 on terminal board E10 (figs. 27 and 36) and remove the resistor. If the voltage is still low, remove resistor

R30. If removal of both resistors does not result in sufficient output voltage, replace rectifier CR2.

c. Transmitter Filament Supply. Measure the output voltage of the transmitter filament supply (pin 20 of connector J1 to ground). If the voltage under load is below 6.5 volts, clip the leads to resistor R45 on terminal board E10 (fig. 27 and 36) and remove the resistor. If the voltage is still low, remove resistor R46. If removal of both resistors does not result in sufficient output voltage, replace rectifiers CR3 and CR4.

Caution: When replacing a rectifier unit, tag the leads *before* disconnecting them from the unit. Connect the leads to the new unit exactly as on the original.

63. Voltage Adjustments for Power Supply PP-327A/GRC-9Y

Three adjustments are provided. RCVR PL ADJ in the receiver plate supply, RCVR FIL ADJ in the receiver filament supply, and XMTR FIL ADJ in the transmitter filament supply. The power supply should be operating into a Receiver-Transmitter RT-77(*)/GRC-9, or its equivalent, when the adjustments are made.

a. Receiver Plate Voltage Supply. Loosen the check nut on RCVR PL ADJ control R7 and adjust R7 until the voltage between pin 21 (or 33) of output receptacle J1 and ground reads 105 volts while operating the receiver-transmitter. When properly adjusted, tighten the check nut; be careful not to disturb the adjustment.

b. Receiver Filament Supply. Loosen the check nut on RCVR FIL ADJ control R13 and adjust R13 until the voltage between pin 22 or 23 of output receptacle J1 and ground reads 1.5 volts while operating the receiver-transmitter. When properly adjusted be sure and tighten the check nut, but be careful not to disturb the adjustment.

c. Transmitter Filament Supply. Loosen the check nut on XMTR FIL ADJ control R18 and adjust R18 until the voltage between pin 20 of output receptacle J1 and ground reads 6.6 volts while operating the transmitter at full output. When properly adjusted, be sure to tighten the check nut. Be careful not to disturb the adjustment.

64. Refinishing

Instructions for refinishing badly marred panels on exterior cabinets are given in TM 9-2851.

Section III. FINAL TESTING

65. Purpose

Equipment that has been repaired must meet definite minimum performance standards before it is returned to service. The tests outlined in this section are designed to measure the performance of a repaired Power Supply PP-327(*)/GRC-9Y. Equipment that meets the standards stated in the tests will furnish satisfactory operation.

66. Test Equipment Required for Final Testing

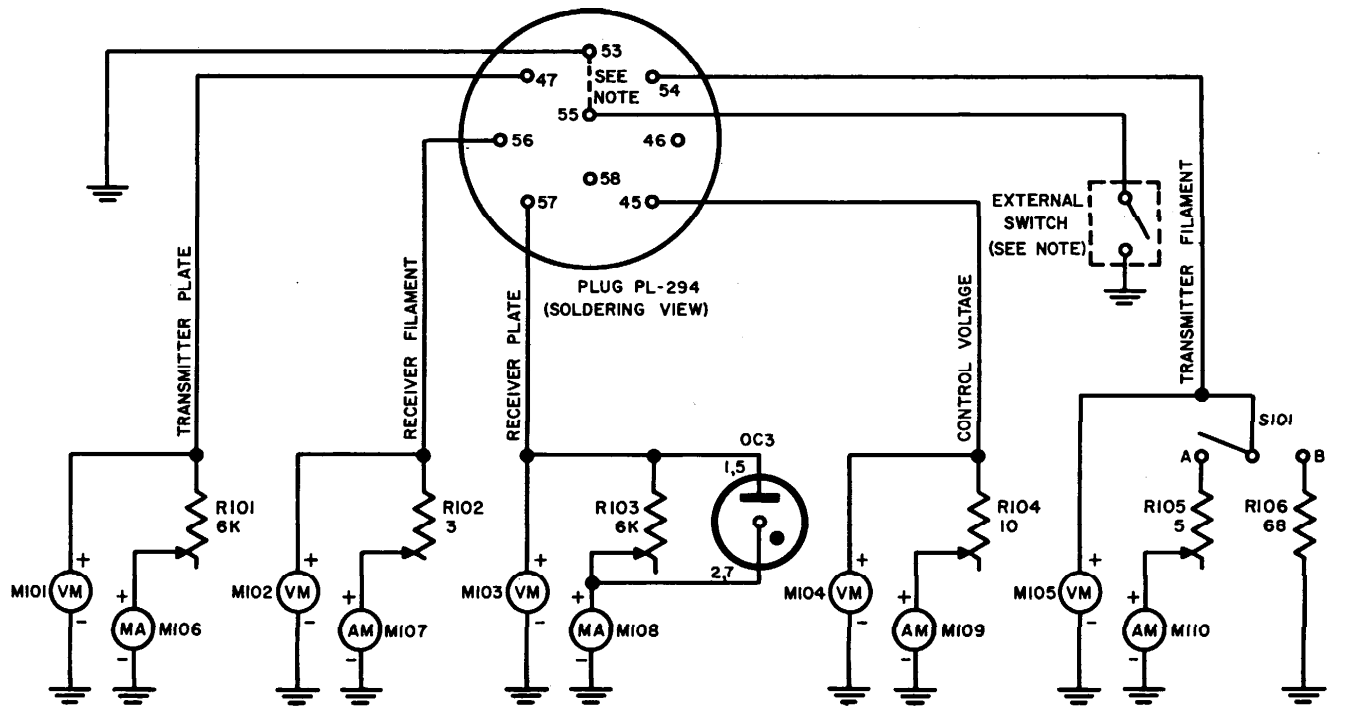
a. The test equipment required for final testing (in addition to those listed in par. 55) and the applicable technical manual are listed below.

Test equipment	Technical manual
Electronic Multimeter ME-6A/U	TM 11-5549
Electronic Multimeter TS-505/U	TM 11-5511
Variable transformer (variac)	

Note. Electronic Multimeter ME-30/U may be used, if available, in place of Electronic Multimeter ME-6A/U.

b. The components listed below are also required if testing is to be done with a dummy load instead of using Receiver-Transmitter RT-77(*)/GRC-9 for the load. Slide-wire resistors must be used and adjusted to obtain the required current for each load voltage. The test set-up diagram is shown in figure 33 and the reference symbols refer to that figure.

Ref Symbol	Component	Nominal value	
		Ohms	Watts
R101	Resistor (slide-wire)	6,000	100
R102	Resistor (slide-wire)	3	10
R103	Resistor (slide-wire)	6,000	10
R104	Resistor (slide-wire)	10	25
R105	Resistor (slide-wire)	5	25
R106	Resistor (composition)	68	2
S101	Spdt toggle switch		
	Spst toggle switch		
	Tube, type OC3 (for Power Supply PP-327/GRC-9 only).		
	7-wire cable terminated with Plug PL-294 (fig. 8).		



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS.
2. TO OBTAIN TRANSMITTER PLATE VOLTAGE WITHOUT USE OF EXTERNAL SWITCH, CONNECT JUMPER BETWEEN PIN 53 AND PIN 55.
3. TUBE OC3 IS NOT USED FOR POWER SUPPLY PP-327A/GRC-9Y.

METER REQUIREMENTS		
REF SYMBOL	DC METER	RANGE
M101	VOLTMETER	0-1000V
M102	VOLTMETER	0-5V
M103	VOLTMETER	0-150V
M104, M105	VOLTMETER	0-15V
M106	MILLIAMMETER	0-150 MA
M107	AMMETER	0-1 AMP
M108	MILLIAMMETER	0-50 MA
M109	AMMETER	0-2 AMP
M110	AMMETER	0-3 AMP

RESISTOR REQUIREMENTS		
REF SYMBOL	NOMINAL RESISTANCE (OHMS)	RATING (WATTS)
R101	6000	100
R102	3	10
R103	6000	10
R104	10	25
R105	5	25
* R106	68	2

* COMPOSITION RESISTOR

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Figure 33. Test set-up diagram.

67. Output Voltage Test with Receiver-Transmitter RT-77(*)/GRC-9

The purpose of this test is to determine if the power supply can furnish the required operating voltages under actual load conditions as presented by Receiver-Transmitter RT-77(*)/GRC-9. Proceed as follows:

- a. Connect the power supply to the receiver-transmitter; use Cord CD-1086.
- b. Set the receiver-transmitter controls as follows:
 - (1) Control ⓔ to the SEND position.
 - (2) Control ⓓ to the HI-CW position.
- c. Connect the receiver plug.
- d. Close the transmitter key.

e. Connect the power supply through the variable transformer to a nominal 115-volt ac source. Set the power supply controls as follows:

- (1) Input voltage selection switch to the 115-volt position.
- (2) RANGE switch to the HI position. (Used only on Power Supply PP-327/GRC-9Y.)

f. Turn on the power supply and adjust the variable transformer output for 115 volts ac as read with Multimeter TS-352/U. (The last stage of the transmitter should be drawing 100 ma.) Allow sufficient time for the equipment to warm up before making any voltage measurement.

g. Measure the voltages at output receptacle J1 with Electronic Multimeter TS-505/U. All voltages are positive and are measured with respect

to ground (pin 24). The following chart lists the correct output voltages:

Supply circuit	Pin on J1	Dc output (volts)	
		Power supply PP-327/GRC-9Y	Power supply PP-327A/GRC-9Y
Transmitter plate	32	570	540
Receiver plate	21 or 33	108	105
Receiver filament	22 or 23	1.6	1.5
Control voltage	34	6.7	6.6
Transmitter filament	20	6.5	6.6

h. After completing the voltage measurements, set control D of the receiver-transmitter to either PHONE position, and measure the output of the transmitter filament supply. (Do not press the microphone push-to-talk button.) The voltage reading obtained should not be greater than 10 volts.

i. The output voltages for 230-volt operation should be the same as for 115-volt operation. To check the power supply output voltages under load conditions as presented by Receiver-Transmitter RT-77(*)/GRC-9 when operating from a 230-volt source, repeat the procedure in *a* through *h* above with the following exceptions:

Supply circuit	Pin on Plug PL-274	Power Supply PP-327/GRC-9Y		Power Supply PP-327A/GRC-9Y	
		dc load (current)	dc output (volts)	dc load (current)	dc output (volts)
Transmitter plate	47	100 ma	570	100 ma	540
Receiver plate	57	45 ma	108	45 ma	105
Receiver filament	56	500 ma	1.6	500 ma	1.5
Control voltage	45	650 ma	6.7	575 ma	6.6
Transmitter filament	54	2 amp	6.5	2 amp	6.6

69. Voltage Regulation Test

The purpose of this test is to determine if the output voltages are within the required limit when the input voltage is varied from 100 to 130 or 200 to 260 volts ac.

a. With the test conditions as described in paragraph 57, check each output circuit to see that it is delivering its rated current.

- (1) Place the input voltage selection switch in the 230-volt position.
- (2) When the power supply is turned on, adjust the variable transformer output for 230 volts as read with Multimeter TS-352/U.

68. Output Voltage Test with Resistance Loads (fig. 33)

Set up the equipment as shown in figure 33; use the equipment listed in paragraph 66. Individual meters may be used, but if they are not available, the voltages and currents at the points indicated may be measured with Multimeter TS-352/U.

a. Set switch S101 to the A position.

b. Turn on the power supply and adjust the variable transformer output for 115 volts ac as read with Multimeter TS-352/U. Allow the power supply to warm up before making any adjustments.

c. Adjust the slide-wire resistors with Multimeter TS-352/U for the current readings shown in the table. The output voltages shown in the following table should be obtained:

b. Turn off the power supply and adjust the variable transformer until its output reads 100 volts as read with Multimeter TS-352/U.

c. Turn on the power supply and measure the output voltages from the pins of Plug PL-294 to ground; use Electronic Multimeter TS-505/U. These voltages should not be less than the minimum output voltage as listed in the following chart:

Supply circuit	Pin on Plug PL-294	Power Supply PP-327/GRC-9Y		Power Supply PP-327A/GRC-9Y	
		Minimum output (volts)	Maximum output (volts)	Minimum output (volts)	Maximum output (volts)
Transmitter plate.....	47	530	630	450	630
Receiver plate.....	57	105	140	105	140
Receiver filament.....	56	1.4	1.7	1.4	1.7
Control voltage.....	45	6.4	7.4	5.0	9.3
Transmitter filament.....	54	6.2	7.4	6.0	7.1

d. Turn off the power supply and adjust the variable transformer to read 130 volts as read with Multimeter TS-352/U.

e. Turn on the power supply and measure the output voltages again from the pins of Plug PL-294 to ground; use Electronic Multimeter TS-505/U. These voltages should not be greater than the maximum output voltage as listed in the chart above.

f. After making these readings, set switch S101 to position B, and measure the transmitter filament supply output again (pin 54 to ground); use Electronic Multimeter TS-505/U. The voltage reading should not be greater than 10 volts.

g. If the voltage values fall within the required limits, it indicates that the power supply is working properly and it should not be necessary to repeat the test over the 200- to 260-volt range. If the voltage values do not fall within the required limits, refer to the troubleshooting charts (par. 58).

70. Ripple Test

The purpose of this test is to determine whether

the ripple voltage at a specified load is within the requirements of the equipment.

a. With the test conditions as described in paragraph 57, adjust the slide-wire resistors to get the correct output voltage from each supply circuit.

b. Connect the ground side of Electronic Multimeter ME-6A/U to pin 53 of Plug PL-294 (ground).

c. Observe the ripple voltage at each supply circuit as shown by the multimeter. The ripple voltage should not be greater than that listed in the following chart:

Supply circuit	Pin on plug PL-294	Power supply PP-327/GRC-9Y maximum ac ripple voltage	Power supply PP-327A/GRC-9Y maximum ac ripple voltage
Transmitter plate	47	4	4
Receiver plate.....	57	.1	.1
Receiver filament..	56	Less than .1	Less than .1
Control voltage...	45	.3	.3
Transmitter filament.....	54	Less than .1	Less than .1

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

71. Repacking Power Supply PP-327/GRC-9Y for Shipment or Limited Storage

a. Material Requirements. The following materials are required:

Material	Quantity
Waterproof barrier material.....	13 sq ft
Paper, single-faced, corrugated, flexible.....	46 sq ft
Tape, pressure-sensitive.....	4 ft
Tape, paper, gummed.....	10 ft
Tape, cotton.....	3 ft
Lumber (wooden box).....	11 bd ft

b. Packaging. Package Power Supply PP-327/GRC-9Y as follows:

- (1) Pack the manuals in a close-fitting bag made from the waterproof barrier material. Seal the seams with the pressure-sensitive tape.
- (2) Wrap each spare tube individually in the corrugated paper. Seal the packages of tubes with the gummed paper tape.
- (3) Wrap the lamp in the corrugated paper and seal the package with the gummed paper tape.
- (4) Wind the cable into a coil. Tie it in three places with the cotton tape; tie the connectors. Wrap the coil in the corrugated paper and seal it with the gummed paper tape.
- (5) Mount the fuses in the spaces provided behind the front panel.
- (6) Close and lock the power supply panel door. Wind the input cable around the power supply and fasten it with the gummed paper tape. Wrap corrugated paper around the power supply and seal it with the paper tape.

- (7) Wrap the tube, lamp, and cable packages in corrugated paper. Seal the package with paper tape.

c. Packing. Line the wooden box with the waterproof barrier material. Place the power supply and the consolidated package in the box. Place the manuals between the sealed case liner and the lid of the box.

d. Strapping. Strap shipping containers in inter-theater movement only.

e. Marking. Mark shipping containers in accordance with SR 55-720-1.

72. Repacking Power Supply PP-327A/GRC-9Y for Shipment and Limited Storage

a. Material Requirements. The following materials are required:

Material	Quantity
Waterproof barrier material.....	12 sq ft
Paper, single-faced, corrugated, flexible.....	38 sq ft
Tape, pressure-sensitive.....	4 ft
Tape, paper, gummed.....	6 ft
Tape, cotton.....	3 ft
Lumber (wooden box).....	15 bd ft

b. Packaging. Package Power Supply PP-327A/GRC-9Y as follows:

- (1) Wrap the manuals in the waterproof barrier material and seal the package with the pressure-sensitive tape.
- (2) Wrap each tube individually in the corrugated paper and then seal together with the gummed paper tape.
- (3) Wind the output cable in a coil. Tie it in three places with cotton tape, and secure the connectors. Wrap the coil in corru-

gated paper and seal it with the gummed paper tape.

- (4) Package the spare fuses individually in the corrugated paper. Seal the package with gummed paper tape.
- (5) Place the tubes, fuses, and cable in corrugated paper and seal the package with gummed paper tape.
- (6) Close the power supply panel and wind the input cable around the power supply; fasten it with gummed paper tape. Wrap the unit in corrugated paper.

- (7) Wrap the tube, cable, and fuse packages together in corrugated paper. Seal the combined package with gummed paper tape.

c. Packing. Place the combined package and the power supply in the wooden box lined with the waterproof barrier. Place the manuals on top and seal the box.

d. Strapping. Strap shipping containers in inter-theater movements only.

e. Marking. Mark shipping containers in accordance with SR 55-720-1.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

73. Authority for Demolition

The demolition procedures outlined in paragraph 74 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

74. Methods of Destruction

a. Smash. Smash the controls, tubes, switches, capacitors, and transformers; use sledges, axes, handaxes, pickaxes, hammers, crowbars or any heavy tools.

b. Cut. Cut the cords and wiring; use axes, handaxes, or machetes.

c. Burn. Burn cords, resistors, capacitors, wiring, and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

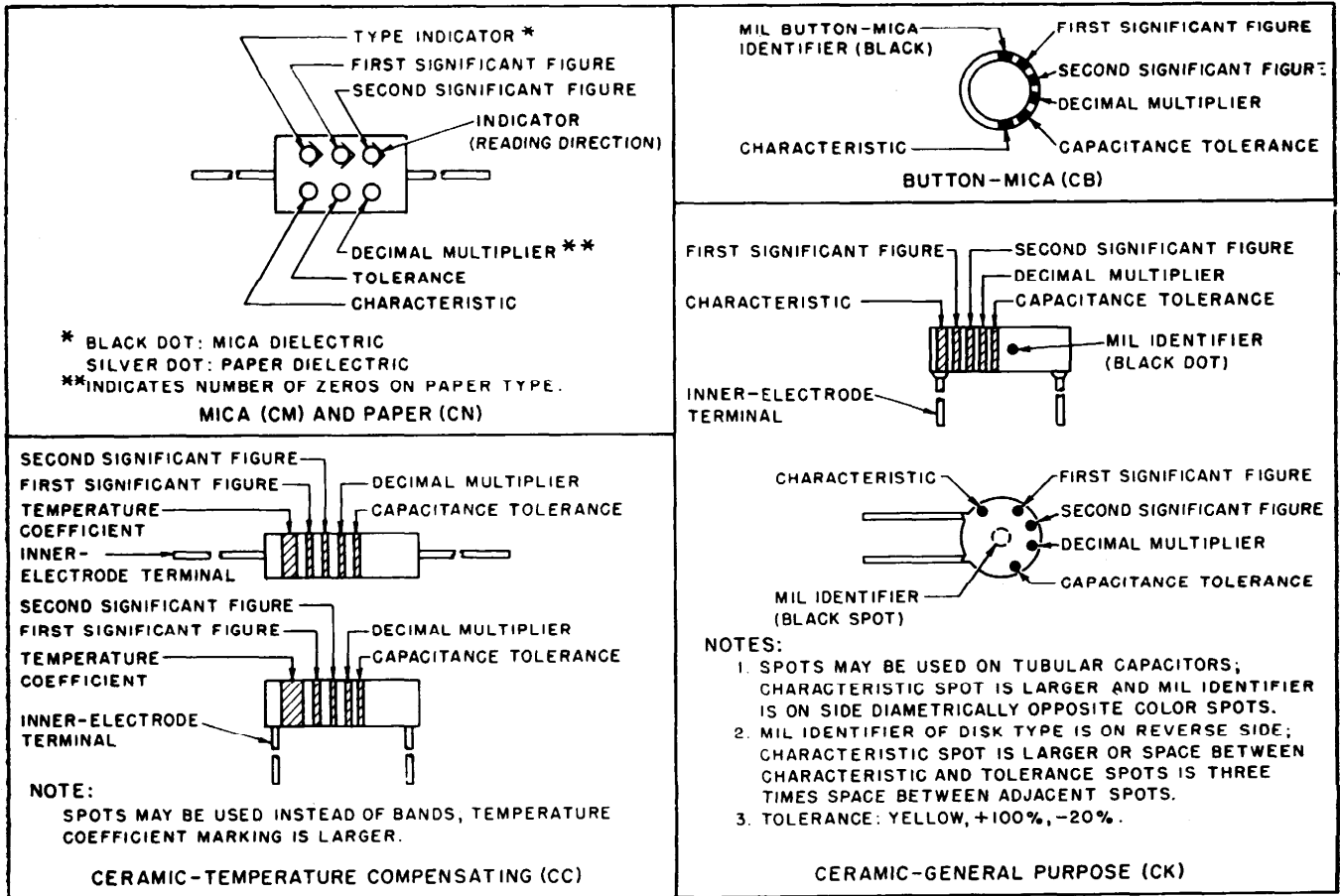
d. Bend. Bend the cover and chassis.

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.

CAPACITOR COLOR CODE MARKING (MIL-STD CAPACITORS)



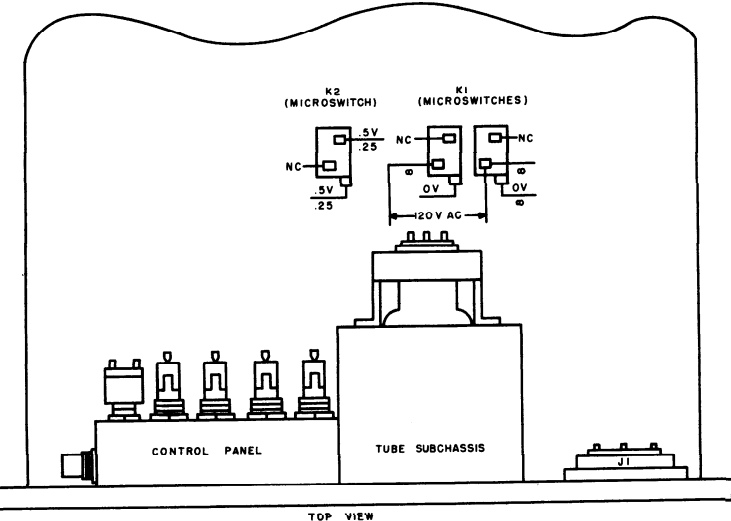
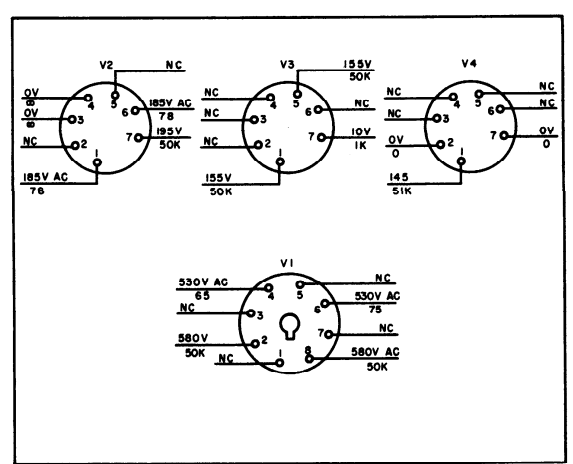
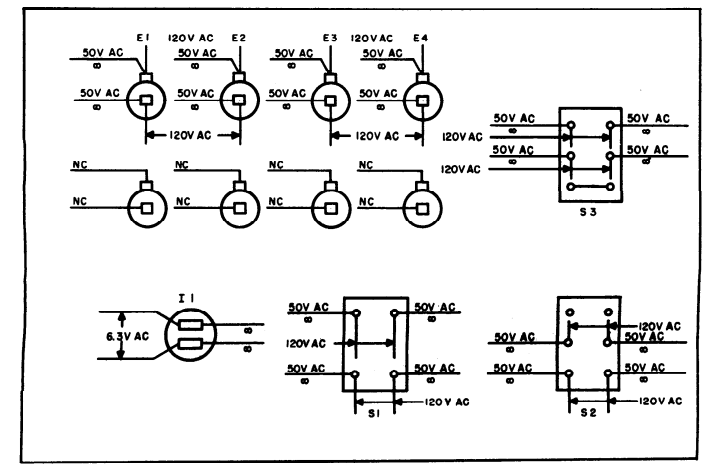
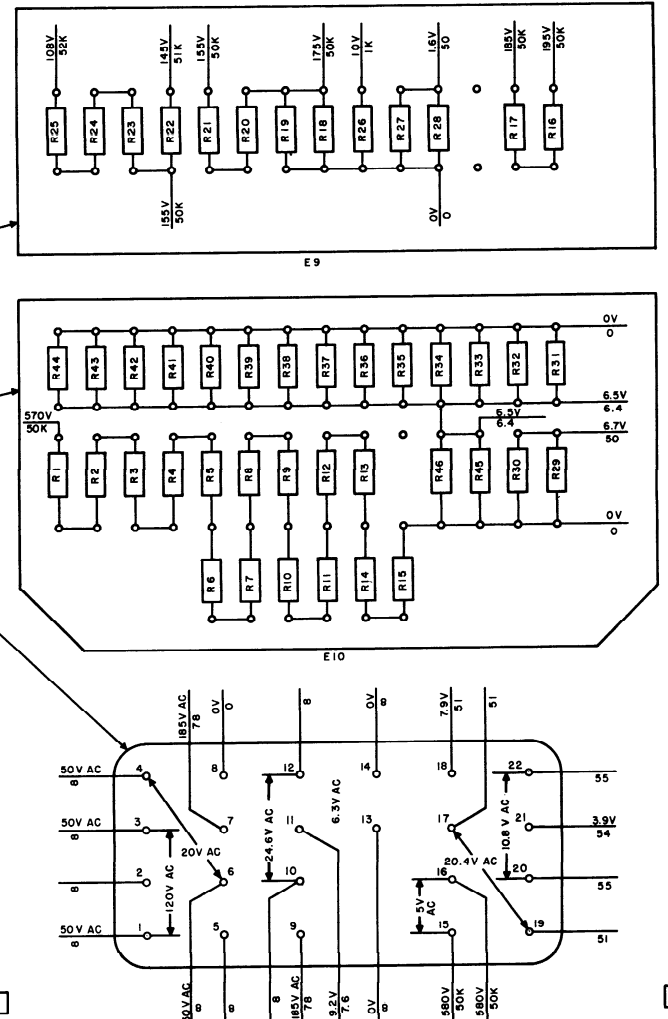
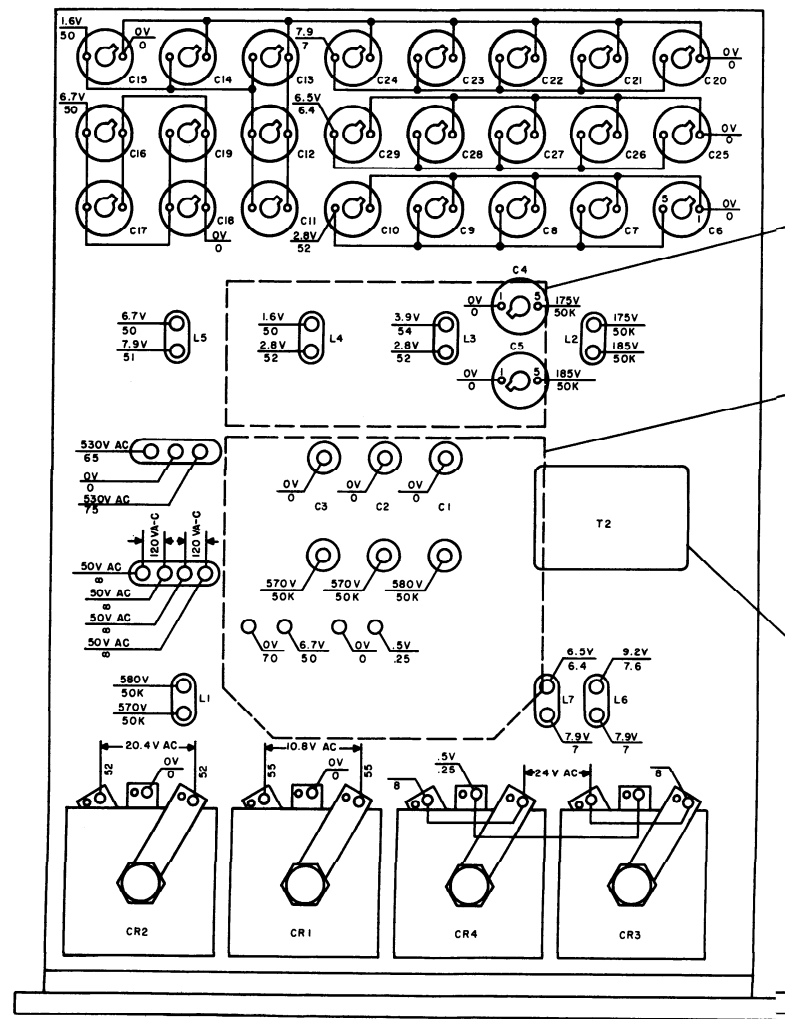
CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC ¹				TOLERANCE ²				TEMPERATURE COEFFICIENT (UUF/UF/°C)	
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC OVER 10UUF OR LESS		
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) ³
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 34. MIL-STD capacitor color codes.



- NOTES:
1. ALL MEASUREMENTS OBTAINED WITH VACUUM TUBE VOLTMETER.
 2. ALL MEASUREMENTS TO GROUND (CHASSIS) UNLESS OTHERWISE NOTED.
 3. ALL VOLTAGES DC UNLESS OTHERWISE NOTED.
 4. ALL VOLTAGE MEASUREMENTS OBTAINED WITH POWER SUPPLY CONNECTED TO RECEIVER-TRANSMITTER RT-77/GRC-9 BY CORD CD-1086.
 5. ALL VOLTAGES OBTAINED WITH RECEIVER-TRANSMITTER RT-77/GRC-9 OPERATING AS FOLLOWS:
 - A. CONTROL (E) IN **[SEND]** POSITION.
 - B. CONTROL (D) IN **[HI-CW]** POSITION.
 - C. RECEIVER PHONE PLUG IN.
 - D. TRANSMITTER KEY DOWN, LAST STAGE OF TRANSMITTER DRAWING 100MA.
 6. ALL VOLTAGES OBTAINED WITH POWER SUPPLY OPERATING AS FOLLOWS:
 - A. AC POWER INPUT VOLTAGE 110/120V AC (TRANSMITTER PLATE SUPPLY VOLTAGES OBTAINED WITH 115V INPUT).
 - B. SWITCH S3 IN **[115V]** POSITION.
 - C. SWITCH S2 IN **[LO]** POSITION FOR 110V INPUT OR IN THE **[H]** POSITION FOR 120V INPUT (FOR 115V INPUT SWITCH S2 CAN BE IN EITHER POSITION).
 7. ALL RESISTANCE READINGS OBTAINED WITH POWER SUPPLY DISCONNECTED FROM AC SUPPLY AND RECEIVER-TRANSMITTER RT-77/GRC-9.
 8. RESISTANCE MEASUREMENTS ABOVE 3 MEGOHMS INDICATED AS INFINITY (∞).
 9. NC INDICATES NO CONNECTION.

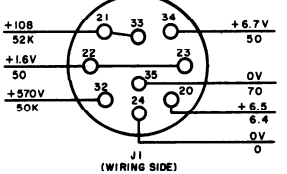
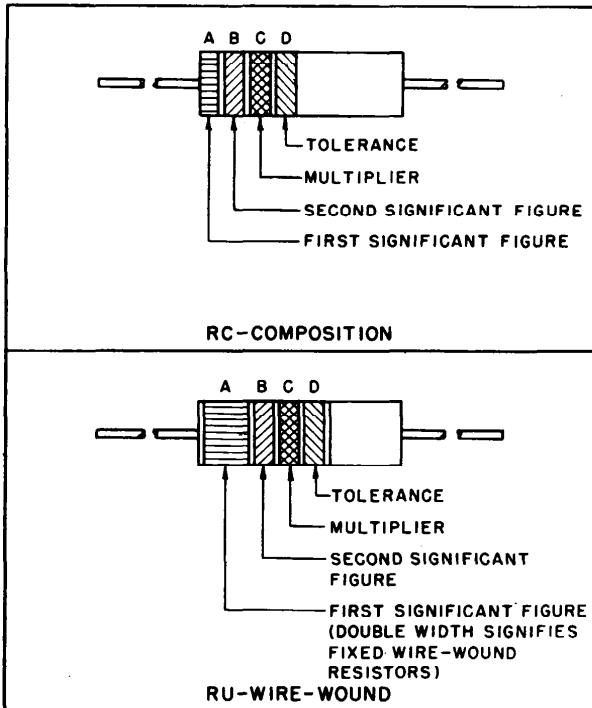


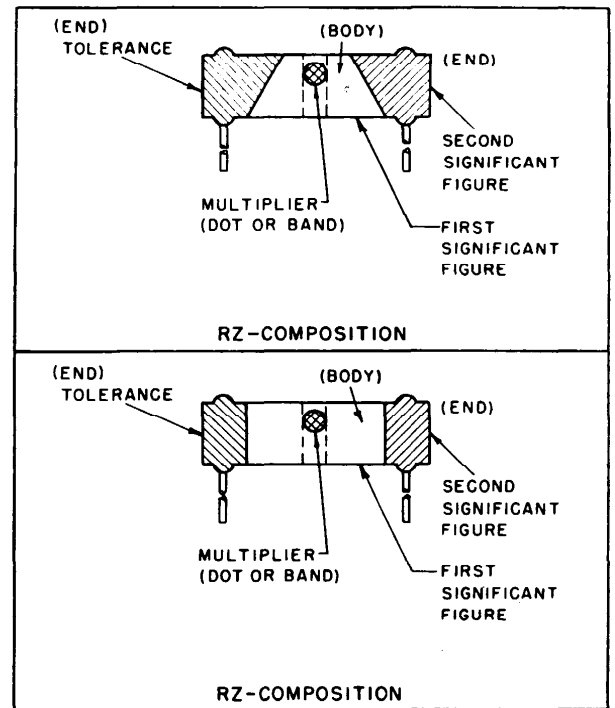
Figure 36. Power Supply PP-327/GRC-9Y, voltage and resistance diagram.

RESISTOR COLOR CODE MARKING (MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

* FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

EXAMPLES (BAND MARKING):

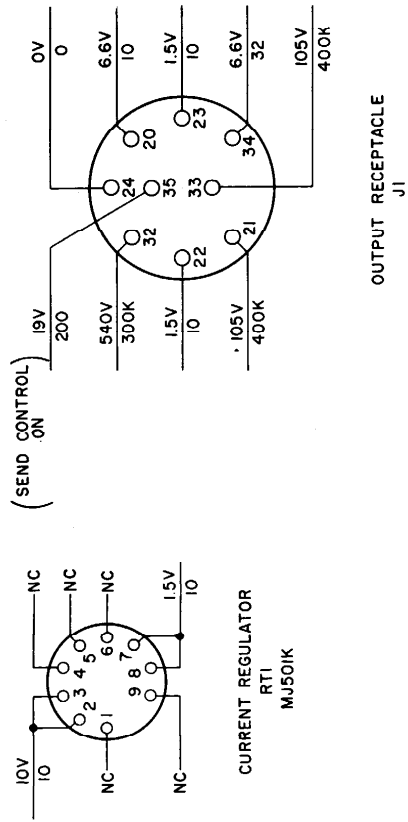
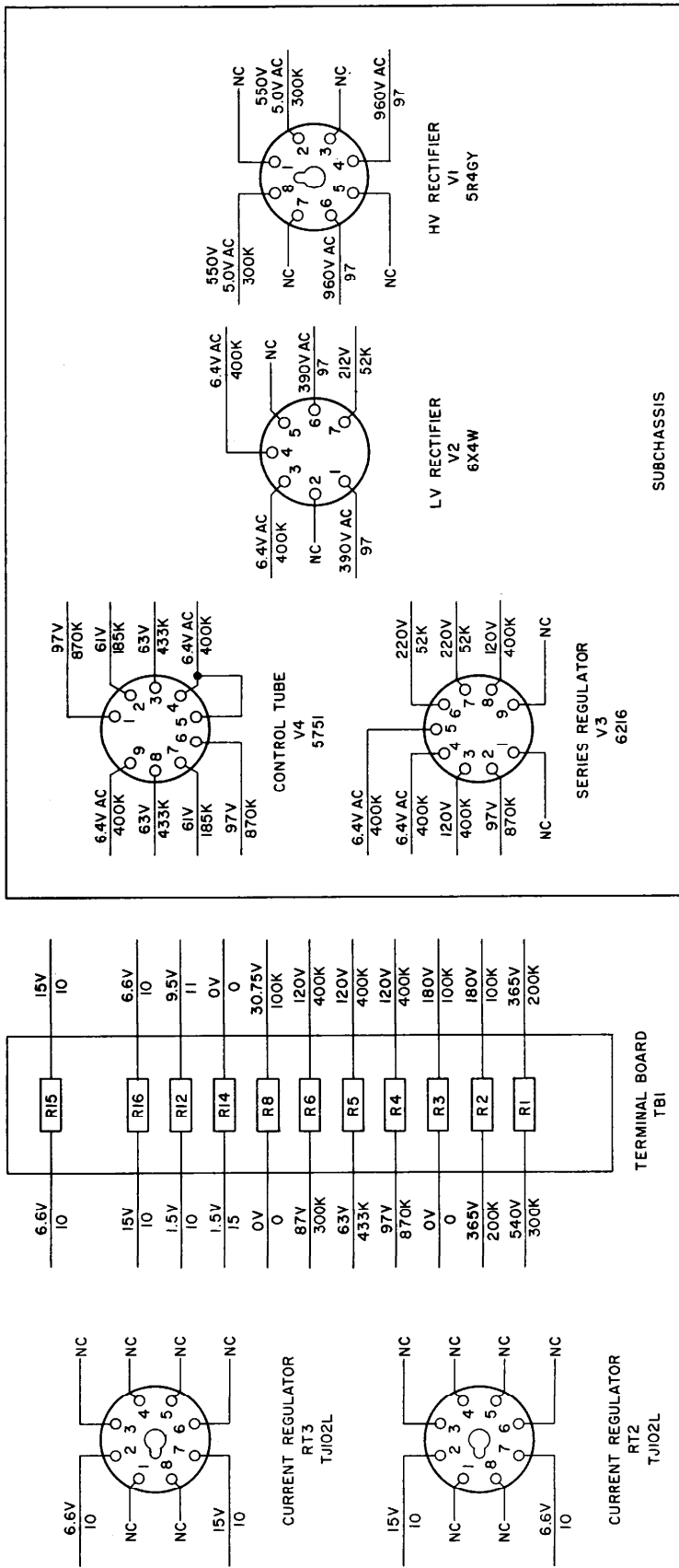
10 OHMS ± 20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ± 5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):

10 OHMS ± 20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ± 10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

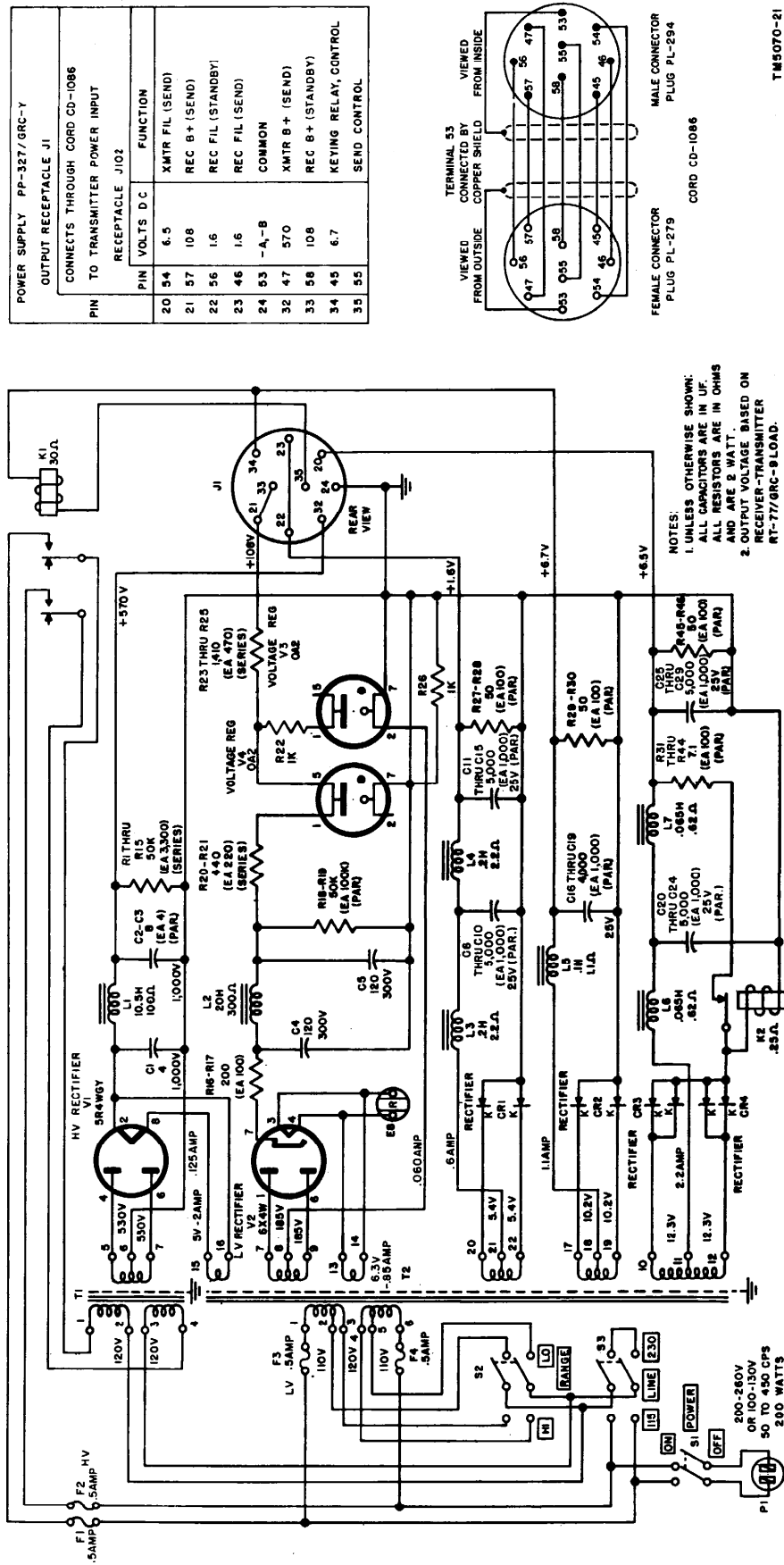
Figure 35. MIL-STD resistor color codes.



- NOTES:**
1. ALL VOLTAGES ARE MEASURED WITH CONTROLS SET TO GIVE RATED VOLTAGE WITH THE POWER SUPPLY OPERATING ON 115V AC INPUT INTO RECEIVER-TRANSMITTER RT-77(*)/GRC-9.
 2. ALL VOLTAGES ARE DC AND MEASURED WITH RESPECT TO GROUND UNLESS OTHERWISE STATED.
 3. ALL AC VOLTAGES ARE MEASURED WITH RESPECT TO CORRESPONDING PIN WITHIN THE COMPONENT. (CORRESPONDING PINS SHOW SAME VOLTAGE VALUE)
 4. MEASUREMENTS ARE MADE WITH A METER HAVING 20,000 OHMS-PER-VOLT DC AND 5,000 OHMS-PER-VOLT AC RATING.
 5. VOLTAGE READINGS ABOVE LINE.

- RESISTANCE**
1. ALL RESISTANCES ARE IN OHMS.
 2. ALL RESISTANCES ARE MEASURED WITH RESPECT TO GROUND WITH UNIT NOT ENERGIZED.
 3. RESISTANCE READINGS BELOW LINE.
 4. RESISTANCE MEASURED WITH CONTROLS SET FOR NORMAL OPERATION.

Figure 37. Power Supply PP-327A/GRC-9Y, voltage and resistance diagram.



TW5070-21

Figure 98. Power Supply PP-327/GRC-Y, schematic diagram.

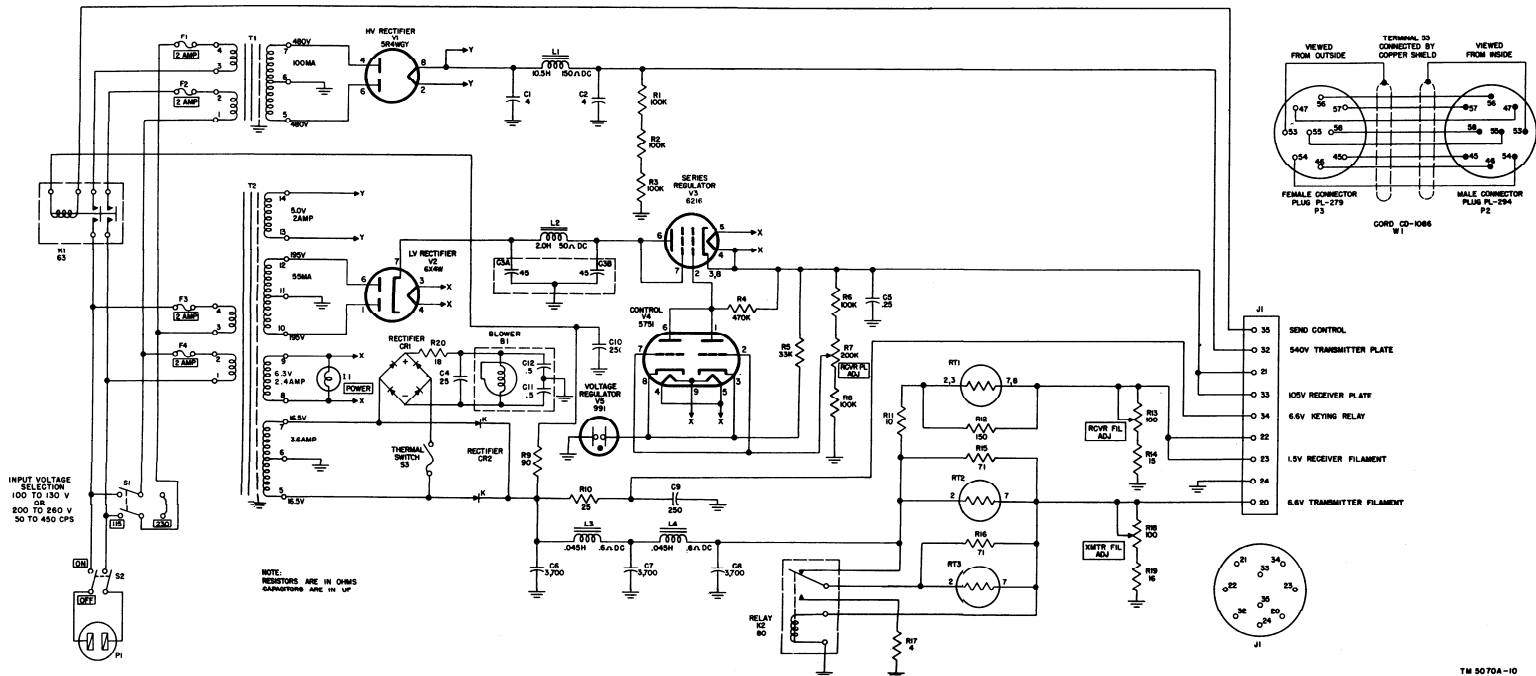


Figure 39. Power Supply PP-387A/GRC-8Y, over-all schematic diagram.

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OS Maj Comd (5)	7-2R (2)	7-11R (2)	7-12R (2)
OS Base Comd (5)	7-13R (2)	7-14R (2)	7-15R (2)
Log Comd (5)	7-16R (2)	7-31R (2)	7-32R (2)
MDW (1)	7-33R (2)	7-34R (2)	7-35R (2)
Armies (5)	7-36R (2)	7-45R (2)	7-46R (2)
Corps (2)	7-47R (2)	7-95R (2)	7-96R (2)
Div (2)	8-15R (2)	8-16R (2)	8-18R (2)
Tng Div (2)	9-25R (2)	9-26R (2)	9-35R (2)
Ft & Cp (2)	9-36R (2)	9-167R (2)	10-17R (2)
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Gen & Br Svc Sch (5) except	11-117R (2)	11-127R (2)	11-128R (2)
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Gen Depots (2) except	11-557R (2)	11-587R (2)	11-592R (2)
Atlanta Gen Depot (None)	11-597R (2)	17-2R (2)	17-115R (2)
SigC Sec, Gen Depots (10)	17-116R (2)	17-125R (2)	17-126R (2)
SigC Depots (20)	19-35R (2)	19-36R (2)	19-37R (2)
POE (2)	19-55R (2)	19-56R (2)	19-57R (2)
OS Sup Agencies (2)	20-45A (2)	20-47A (2)	20-300R (2)
SigC Fld Maint Shops (3)	20-511R (2)	20-512R (2)	33-2R (2)
SigC Lab (5)	33-510R (AA-AB) (2)	44-12R (2)	
Mil Dist (1)	44-15R (2)	44-16R (2)	44-17R (2)
Mil Msn (2)	44-25R (2)	44-26R (2)	44-27R (2)
Units organized under following TOE:	44-35R (2)	44-36R (2)	44-37R (2)
5-15R (2)	5-16R (2)	5-17R (2)	44-75R (2)
5-35R (2)	5-36R (2)	5-37R (2)	44-76R (2)
5-192R (2)	5-315R (2)	5-316R (2)	44-77R (2)
5-317R (2)	5-348R (2)	5-412R (2)	44-101R (2)
5-415R (2)	5-416R (2)	5-417R (2)	44-115R (2)
6-100R (2)	6-101R (2)	6-115R (2)	44-117R (2)
6-116R (2)	6-125R (2)	6-126R (2)	44-127R (2)
6-135R (2)	6-136R (2)	6-200R (2)	44-145R (2)
6-201R (2)	6-225R (2)	6-226R (2)	44-146R (2)
			44-147R (2)
			44-275R (2)
			44-276R (2)
			44-277R (2)
			44-315R (2)
			44-316R (2)
			44-317R (2)
			44-415R (2)
			44-416R (2)
			44-417R (2)
			52-2R (2)
			55-68R (2)
			57-2R (2)
			57-57R (2)

NG: State AG (6); Units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320-50-1.

POWER SUPPLIES PP-327/GRC-9Y, PP-327A/GRC-9Y
AND PP-327B/GRC-9Y

TM 11-5070
TO 31R2-2GRC9-21 }
CHANGES No. 1

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., 11 July 1956

TM 11-5070/TO 31 R2-2GRC9-21, 22 September 1955, is changed as follows:

The title of the manual is changed to read: POWER SUPPLIES PP-327/GRC-9Y, PP-327A/GRC-9Y, AND PP-327B/GRC-9Y.

The following information changes TM 11-5070/TO 31R2-2GRC9-21 so that the manual also applies to the following equipment:

Nomenclature	Order No.	Serial No.
Power Supply PP-327B/GRC-9Y.	33704-Phila-55.	1 and above

Page 2, chapter 1. Add the following note at the beginning.

NOTE. The power supply procured on Order No. 33704-Phila-55 is similar to Power Supply PP-327A/GRC-9Y covered in the manual. Information in the technical manual applies to all Power Supplies PP-327B/GRC-9Y unless otherwise specified.

Change "Power Supply PP-327A/GRC-9Y" to read Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y in the following places in the manual:

Page 3, figure 1. Caption for lower half of figure 1.

Page 3, paragraph 4. Heading for characteristics list.

Page 4, paragraph 5b. Paragraph heading.

Page 14, paragraph 28b(9) and (10). Within parentheses.

Page 17, paragraph 29. Line 3.

Page 25. Heading for Section II.

Page 26, figure 18. Caption.

Page 28, figure 21. Caption.

Page 28, figure 22. Caption.

Page 30, figure 24. Caption.

Page 33, paragraph 54b. Heading.

Page 33, paragraph 54b. In the chart under "Description" column, adjacent to figures 29, 31, 32, 37, and 39, and paragraph 61.

Page 33, paragraph 56b. Heading in the third column of the chart.

Page 34, paragraph 56d. Second line of heading.

Page 37, paragraph 58b. Heading.

Page 42, paragraph 61. Heading.

Page 45, figure 29. Caption.

Page 49, figure 32. Caption.

Page 50, paragraph 63. Heading.

Page 51, figure 33. Note 3.

Page 52, paragraph 67g. Fourth column heading in chart.

Page 52, paragraph 68c. Last main column heading in chart.

Page 53, paragraph 69c. Last main column heading in chart.

Page 53, paragraph 70c. Fourth column heading in chart.

Page 54, paragraph 72. Heading.

Page 54, paragraph 72b. Line 1.

Page 58, figure 37. Figure caption.

Page 2, paragraph 1a. Make the following changes:

Line 4. Add Power Supply PP-327B/GRC-9Y after "PP-327A/GRC-9Y."

Second sentence. Change "Both" to read: All three.

Page 2, paragraph 1b, line 5. Add Power Supply PP-327B/GRC-9Y after Power Supply PP-327A/GRC-9Y.

Page 4, table in paragraph 5b, line 1. Change the first line under "Component" column to read: Power Supply PP-327A/GRC-9Y or PP-327B/GRC-9Y including Power Cable Assembly CX-112/U.

Page 5. Change the heading for paragraph 7 to read: Description of Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y (fig. 3).

Page 5, paragraph 7. Change the first sentence of the paragraph to read: Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y are similar in overall appearance and construction. Each consists of a panel-chassis assembly and a metal cabinet.

Page 5, figure 3.

Change the caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, panel door open.**

NOTE. (Added) FUSE F5 IS LOCATED TO THE RIGHT OF THE INDICATOR LAMP IN POWER SUPPLY PP-327B/GRC-9Y.

Page 6, paragraph 8b:

- c. (Added) *Power Supply PP-327B/GRC-9Y*.
 13 fuses, ¼ ampere, slow-blow, 1¼ inches long by ¼ inch diameter.
 1 tube 5R4WGA
 1 tube 6X4W
 1 tube 991
 1 tube 5751
 1 tube 6216
 1 current-regulating resistor MJ-501K, for RT1
 1 current-regulating resistor TJ-102L, for RT2 and RT3
 2 sets blower motor brushes
 1 lamp, incandescent, 6- to 8-volt, .2-ampere, bayonet base

Page 6, paragraph 9. Make the following changes:

Change the first sentence of the paragraph to read: **Power Supplies PP-327/GRC-9Y, PP-327A/GRC-9Y, and PP-327B/GRC-9Y are all designed for use with Receiver-Transmitter RT-77(*)/GRC-9 and are interchangeable; however, there are some differences between them.**

Chart. Add the second column shown below to the chart. Position items as indicated in first column.

Characteristics	Power supply PP-327B/GRC-9Y
Output voltages.....	540 v—100 ma 105 v—45 ma 6.6 v—575 ma 6.6 v—2 amp 1.5 v—500 ma
Regulation.....	All circuits except transmitter plate supply and keying relay voltage.
Adjustable outputs..	Receiver plate, receiver filament, and transmitter filament.
Cooling method.....	Blower.
Fuses.....	.75 amp slow-blow.

Page 6, paragraph 10, chart. Add the following line to the chart:

Equipment	Number of cases	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Weight (lb)
Power Supply PP-327B/GRC-9Y..	1	12½	15¾	25¾	2.94	122

Page 8, paragraph 13. Make the following changes:

- a. Line 6. After "PP-327A/GRC-9Y" add: and Power Supply PP-327B/GRC-9Y. Change the fifth sentence to read: Tube V5 (in the **A and B models**) is located on the chassis (fig. 29) and can be reached by releasing the Dzus fasteners that hold the panel to the cabinet and by drawing out the panel with the chassis.
- b. Add the following: Power Supply PP-327B/GRC-9Y uses .75 ampere slow-blow fuses.

Page 9, figure 7.

Change the caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, controls and tube locations.**

NOTE. (Added) FUSE F5, ¼ AMPERE, IS LOCATED TO THE RIGHT OF THE INDICATOR LAMP IN POWER SUPPLY PP-327B/GRC-9Y.

Page 11, paragraph 17b. Make the following changes:

Change heading to read: **Power Supply PP-327A/GRC-9Y and Power Supply PP-327B/GRC-9Y (fig. 7).**

Add the following to the chart:

Control	Function
FUSE F5 (PP-327B/GRC-9Y)	Protects blower motor circuit from overloads

Page 11, paragraph 18. Make the following changes:

- a. Add the following:
 Power Supply PP-327B/GRC-9Y uses .75-ampere fuses.

d. (Added) For Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, set the 115-230 switch to the proper value according to the line voltage applied to the power supply. Set the switch at 115 for line voltages of 100 to 130 volts, or at 230 for line voltages of 220 to 260 volts.

Page 14, paragraph 28. Change a(4) to read: **For Power Supplies PP-327/GRC-9Y and PP-327A/GRC-9Y, inspect the seating of fuses F1, F2, F3, and F4 (fig. 6 and 7). For Power Supply PP-327B/GRC-9Y, inspect the seating of fuses F1, F2, F3, F4, and F5 (fig. 7).**

Page 18, paragraph 34. Add the following: Tube type 5R4WGA is furnished as both the original part and the running spare for Power Supply PP-327B/GRC-9Y.

Page 25, paragraph 45g. Add the following: In Power Supply PP-327B/GRC-9Y only, fuse F5 protects the blower motor circuit.

Page 26, paragraph 46a, line 11. Change "A 2-ampere protective fuse (F1 through F4) is placed in the lead to each half of the primary windings of each transformer." to read: **In Power Supply PP-327A/GRC-9Y, a 2-ampere protective fuse (F1 through F4) is placed in the lead to each half of the primary windings of each transformer. In Power Supply PP-327B/GRC-9Y, a .75-ampere slow-blow fuse (F1 through F4) is placed in the lead to each half of the primary windings of each transformer.**

Page 26, paragraph 47, line 2. Change "a type 5R4WY tube is used as a full-wave rectifier." to read: **a type 5R4WGY tube may be used as a full wave-rectifier in Power Supply PP-327A/GRC-9Y, or this may be replaced with the preferred type 5R4WGA. Tube V1 in Power Supply PP-327B/GRC-9Y is a type 5R4WGA.**

Page 27, figure 19.

Change caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, ac input circuit.**

NOTE. (Added) **FUSES F1, F2, F3, AND F4 ARE 3/4 AMPERE IN POWER SUPPLY PP-327B/GRC-9Y.**

Page 27, figure 20.

Change the caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, transmitter plate supply.**

Change "NOTE" to read NOTES. Number the existing Note 1 and add Note 2.

2. **HV RECTIFIER V1 MAY BE A 5R4WGY OR A 5R4WGA.**

Page 29, figure 23.

Change the caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, filament voltage circuit.**

Change the word "NOTE" to read NOTES. Number the existing Note 1 and add Note 2:

2. **FUSE F5, ¼ AMPERE, IS CONNECTED BETWEEN THE JUNCTION OF RESISTOR R20 AND CAPACITOR C4 AND THE BLOWER MOTOR IN POWER SUPPLY PP-327B/GRC-9Y.**

Page 31, paragraph 52. Change the heading to read: **Blower Circuit, Power Supply PP-327A/GRC-9Y (fig. 23).**

Page 31.

52.1. Blower Circuit, Power Supply PP-327B/GRC-9Y

(fig. 23)

(added)

The same winding of low-voltage transformer T2 that supplies the operating voltage for rectifier CR2 also supplies voltage to rectifier CR1. Rectifier CR1 is a selenium bridge-type rectifier that provides a dc voltage to operate blower B1. The input power to CR1 is controlled by thermal switch S3, which closes and completes the circuit to CR1 when the temperature within the cabinet reaches 125° F. It opens again when the temperature has dropped to 100° F. Fuse F5, in series with the blower, protects the blower circuit from electrical overloads. Blower B1 has a built-in radio-frequency (rf) filter and external resistance-capacitance filter R20 and C4. The blower is driven by a motor that uses permanent magnet field coils. The bearings are lubricated for the life of the blower and require no further attention.

Page 33, paragraph 56a. Change the third sentence to read: **Remove V1, V2, and the pilot lamp on all models, and remove V3 and V4 on Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y.**

Page 38, paragraph 58b(1). Under "Correction" column. Make the following changes:

Item 2. Third line. Change "c through f" to read "**(3) through (6).**"

Item 3. Change "Proceed with subparagraph b below" to read "**Proceed with (2) below.**"

Page 39, paragraph 58b(5). Under "Probable

trouble" column. First item. Change to read:
1. Repeat the steps in (4) above.

Page 39, paragraph 58b(5) Under "Correction" column. First item. Change to read:
1. Refer to the steps in (4) above.

Page 40, paragraph 58b(7). Add the following information at the end of item number 1 in the chart under "Probable trouble" and "Correction" columns.

Probable trouble	Correction
Defective fuse F5 (for PP-327B/GRC-9Y).	Replace fuse. If replaced fuse blows, replace B1 or CR1 if defective.

Page 42, paragraph 61b(2), line 2. After "through XF4" add "(through XF5 in the B model)."

Page 43, paragraph 61c, line 2. Add "30.1" after "30."

Page 44, paragraph 61d. Add for Power Supply PP-327A/GRC-9Y to the heading.

Page 47, figure 30. Change the caption to read:
Blower for Power Supply PP-327A/GRC-9Y, exploded view.

Page 48, figure 31.

Change the caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, top view, chassis removed from panel.**

NOTE. (Added) FUSE HOLDER XF5 IS LOCATED TO THE LEFT OF THE FUSE HOLDER, XF4, IN POWER SUPPLY PP-327B/GRC-9Y.

Page 49, paragraph 61d.

e. (Added) *Replacement of Brushes in Blower for Power Supply PP-327B/GRC-9Y.* The only replaceable parts in the blower motor for Power Supply PP-327B/GRC-9Y (fig. 30.1) are the brushes, which are mounted permanently in brush holders. The mounted brushes are furnished in pairs; both are the same and they are interchangeable. Replace both brushes at the same time. Use the following procedure.

- (1) Remove the two screws from the end of the rear cover.
- (2) Pull the rear cover straight back to expose the rear end of the motor frame.
- (3) Remove the two screws through the rear of the motor frame which hold the wire-lead terminals. Be sure to keep the screws and the flat washers for reassembly.
- (4) Remove the brushes and their holders from

the recesses in the motor frame Do not remove the brush-holder insulators.

- (5) Place one new brush holder, with its brush in place, in position in the recess under the + mark on the rear of the motor frame. Place it so the threaded hole through the flange of the brush holder faces the rear of the motor.
- (6) Fasten the flat washer and the terminal for the red wire lead to the + brush holder, placed in its recess in (5) above, with the screw which was removed in (3) above.
- (7) Place the other new brush holder, with its brush in place, in position in the recess under the — mark on the rear of the motor frame. Place it so the threaded hole through the flange of the brush holder faces the rear of the motor.
- (8) Fasten the flat washer and the terminal for the black wire lead to the — brush holder, placed in the recess in (7) above, with the screw which was removed in (3) above.
- (9) Slide the rear cover in position over the motor frame. Be careful to prevent damage to either of the wire leads or their terminals at the rear of the motor frame.
- (10) Fasten the two long screws through the end of the rear cover. These extend through into pilot holes in the rear of the motor frame. The assembly is now complete.

Page 58, figure 37. Change tube type "5R4GY" to read: **5R4WGA OR 5R4WGY.**

Page 60, figure 39.

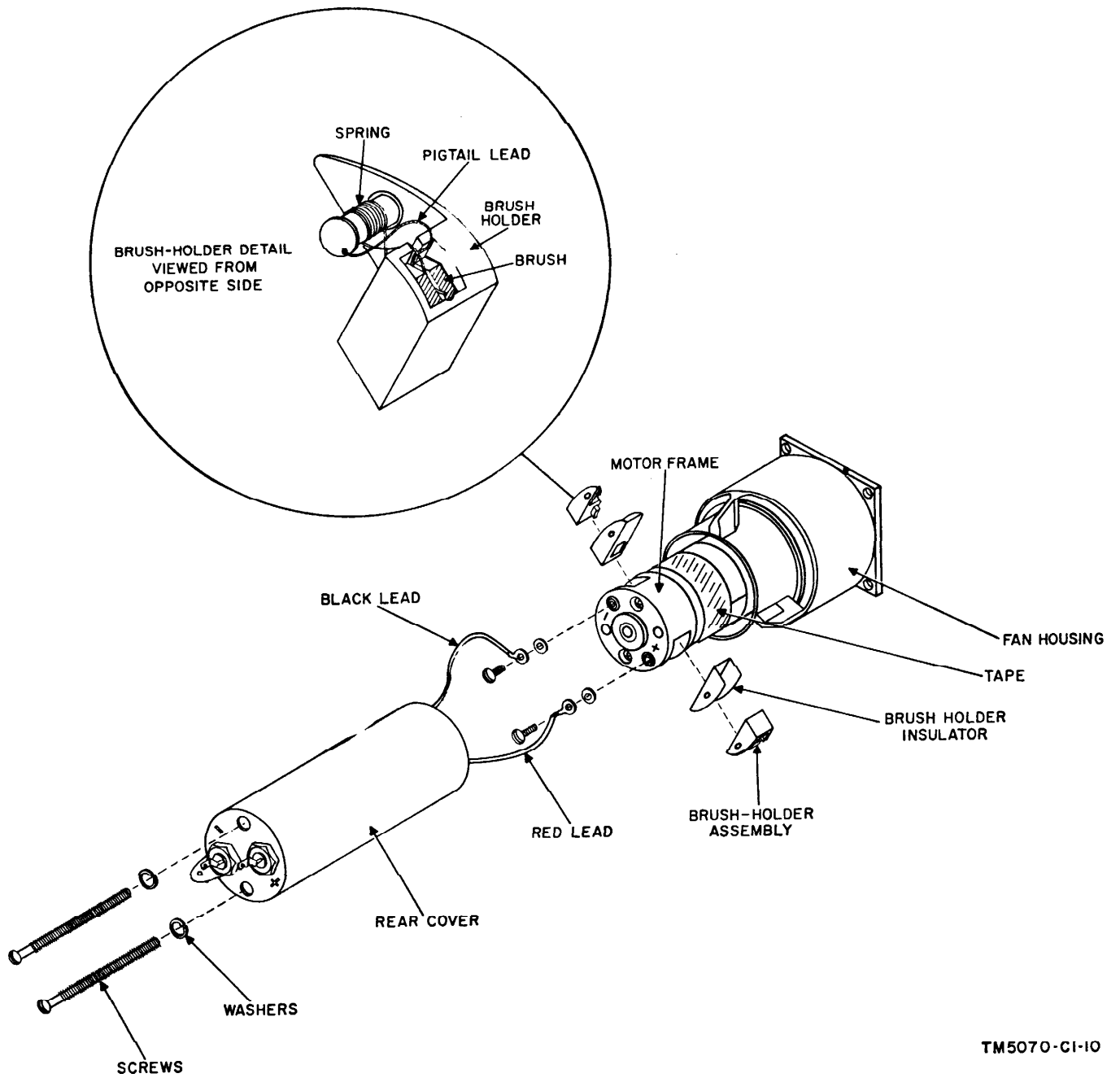
Change figure caption to read: **Power Supplies PP-327A/GRC-9Y and PP-327B/GRC-9Y, overall schematic diagram.**

Add SEE NOTE 3 near fuses F1, F2, F3, F4, and F5.

Change "NOTE" to read: NOTES and number the existing note 1.

Add the following notes.

2. IN POWER SUPPLY PP-327B/GRC-9Y FUSE F5 IS LOCATED BETWEEN THE JUNCTION OF RESISTOR R20 AND CAPACITOR C4 AND BLOWER B1.
3. IN POWER SUPPLY PP-327B/GRC-9Y, FUSES F1, F2, F3, F4, AND F5 ARE ¼ AMPERE.



TM5070-CI-10

Figure 30.1. (Added) Blower for Power Supply PP-327B/GRC-9Y, exploded view.

[AG 413.44 (5 Jul 56)]

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

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

OFFICIAL:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

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

OFFICIAL:

E. E. TORO,
Colonel, United States Air Force,
Air Adjutant General.

DISTRIBUTION:

Active Army:

CNGB (1)	3-267R (2)	6-501C (2)	11-57C (2)	44-27C (2)
ASA (3)	5-15C (2)	6-515R (2)	11-117R (2)	44-35R (2)
Tec Svc, DA (1) except CS1GO (30)	5-16C (2)	6-525C (2)	11-127R (2)	44-36R (2)
Tec Svc Bd (1)	5-17C (2)	6-535R (2)	11-128R (2)	44-37R (2)
Hq CONARC (5)	5-35R (2)	6-536R (2)	11-500R (AA-AE) (2)	44-75C (2)
CONARC Bd (incl ea test sec) (1)	5-36R (2)	6-537R (2)	11-537R (2)	44-76C (2)
Army AA Comd (2)	5-37R (2)	6-575C (2)	11-557C (2)	44-77C (2)
OS Maj Comd (5)	5-55R (2)	6-576C (2)	11-587R (2)	44-101R (2)
OS Base Comd (5)	5-138C (2)	6-577C (2)	11-592R (2)	44-115R (2)
Log Comd (5)	5-192C (2)	6-615R (2)	11-597R (2)	44-116R (2)
MDW (1)	5-315R (2)	6-626C (2)	17-2R (2)	44-117R (2)
Armies (5)	5-316R (2)	7-2R (2)	17-35C (2)	44-145R (2)
Corps (2)	5-317R (2)	7-11R (2)	17-115R (2)	44-146R (2)
Div (2)	5-348R (2)	7-12R (2)	17-116R (2)	44-147R (2)
Ft & Cp (2)	5-367C (2)	7-13R (2)	17-125R (2)	44-275C (2)
Army Cml Cen (4)	5-412R (2)	7-14R (2)	17-126R (2)	44-276C (2)
Sp Wpn Comd (2)	5-415R (2)	7-15R (2)	19-35R (2)	44-277C (2)
USMA (5)	5-416R (2)	7-16R (2)	19-36R (2)	44-315C (2)
Gen & Br Svc Sch (5) except Sig Sch (25)	5-417R (2)	7-31C (2)	19-37C (2)	44-316C (2)
Gen Depots (2) except Atlanta Gen Depot (none)	6-100C (2)	7-32C (2)	19-55R (2)	44-317C (2)
	6-101C (2)	7-33C (2)	19-56R (2)	44-415C (2)
	6-115R (2)	7-34C (2)	19-57R (2)	44-416C (2)
Sig Sec Gen Depots (10)	6-116R (2)	7-35C (2)	19-500R (AA-AE) (2)	44-417C (2)
Sig Depots (17)	6-125C (2)	7-36C (2)	20-45R (2)	52-2C (2)
US Army Tng Cen (2)	6-126C (2)	7-95R (2)	20-47R (2)	55-68R (2)
POE (OS) (2)	6-135C (2)	7-96R (2)	20-300R (2)	57-2C (2)
Trans Terminal Comd (2)	6-136C (2)	8-15C (2)	20-511R (2)	57-57C (2)
Army Terminals (2)	6-200C (2)	8-16C (2)	20-512R (2)	
OS Sup Agencies (2)	6-201C (2)	8-18C (2)	30-600C (AA-AE) (2)	
Army Elct Pg (1)	6-225C (2)	9-25C (2)	32-500R (2)	
PSYWAR Cen (5)	6-226C (2)	9-26C (2)	33-2C (2)	
Sig Fld Maint Shops (3)	6-235C (2)	9-35C (2)	33-510R (2)	
Sig Lab (5)	6-236C (2)	9-36C (2)	44-12R (2)	
ACS (3)	6-300C (2)	9-167R (2)	44-15R (2)	
Mil Dist (1)	6-401C (2)	10-17C (2)	44-16R (2)	
Mil Msn (2)	6-415R (2)	11-7C (2)	44-17R (2)	
Units organized under following TOE's: 3-266R (2)	6-416R (2)	11-16C (2)	44-25C (2)	
	6-435R (2)	11-18C (2)	44-26C (2)	

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320-50-1.

POWER SUPPLIES PP-327/GRC-9Y, PP-327A/GRC-9Y, AND PP-327B/GRC-9Y

TM 11-5070
TO 31R2-2GRC9-21
CHANGES No. 2

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., 19 June 1957

TM 11-5070/TO 31R2-2GRC9-21, 22 September 1955, is changed as follows:

Insert the following "Caution" in the places listed below.

Caution: Power Supplies PP-327/GRC-9Y, PP-327A/GRC-9Y, and PP-327B/GRC-9Y should not be turned on unless a suitable load is connected to the output. This load may consist of either:

1. Receiver - Transmitter RT-77/GRC-9Y with all controls set for normal operation. The associated audio accessories must be plugged in.
2. A dummy load. (Test setup diagram for dummy load shown in fig. 33.)

If the Power Supplies PP-327/GRC-9Y, PP-327A/GRC-9Y, and PP-327B/GRC-9Y are operated without a load, an above-normal voltage will be impressed across R13 and R14 (receiver filament resistors) and will burn them out.

Page 11, paragraph 18, before *a*.

Page 19, paragraph 37, below paragraph heading.

[AG 413.44 (3 Jun 57)]

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

OFFICIAL:

HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

OFFICIAL:

J. L. TARR,
Colonel, United States Air Force,
Air Adjutant General.

Page 50, paragraph 65, below paragraph heading.

Change "2-ampere" to: ".75-ampere slow-blow" in the following places in the manual.

Page 6, paragraph 8b, line 1.

Page 8, paragraph 13b, line 6.

Page 11, paragraph 18a, line 4.

Add the following note in the places listed below:

NOTE. ALTHOUGH THE PANEL MARKING SHOWS 2 AMP FUSES, F1 THROUGH F4 ARE .75 AMPERE SLOW-BLOW FUSES.

Page 9, figure 7.

Page 27, figure 19.

Page 60, figure 39 (page 4 of C 1), add after note 3.

Page 6, paragraph 9, chart. In the "Power Supply PP-327A/GRC-9Y" column, last line delete "2-amp" and add: .75 amp. slow-blow.

Page 26, paragraph 46a, line 11 (page 3 of C 1, line 5).

Change "2-ampere protective fuse" to: ".75-ampere slow-blow fuse."

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

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

DISTRIBUTION:

Active Army:

CNGB	Mil Dist	6-575	19-55
ASA	Mil Mis	6-576	19-56
Technical Svc, DA	JBUSMC	6-577	19-57
Technical Svc Bd	Units organized under	6-625	19-500 (AA-AE)
USCONARC	following TOE's:	6-026	20-45
USA Arty Bd	3-266	7-2	20-47
USA Armor Bd	3-267	7-11	20-300
USA Inf Bd	5-15	7-12	20-511
USA Air Def Bd	5-16	7-13	20-512
USA Abn & Elct Bd	5-17	7-14	30-600 (AA-AE)
USA Avn Bd	5-35	7-15	32-500
USA Arctic Test Bd	5-36	7-16	33-2
USA Armor Bd Test Sec	5-37	7-31	33-510
USA Air Def Bd Test	5-55	7-32	39-61
Sec	5-138	7-33	44-7
USARADCOM	5-192	7-34	44-12
OS Maj Comd	5-315	7-35	44-15
OS Base Comd	5-316	7-36	44-16
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Div	5-367	8-18	44-35
USATC	5-412	9-25	44-36
Ft & Camp	5-415	9-26	44-37
AMS	5-416	9-35	44-75
Sp War Cen	5-417	9-36	44-76
Sp Wpn Comd	6-100	9-167	44-77
Engr Maint Cen	6-101	10-17	44-101
Army Pictorial Cen	6-115	11-7	44-115
WRAMC	6-116	11-16	44-116
AFIP	6-125	11-18	44-117
USMA	6-126	11-57	44-145
Svc Colleges	6-135	11-117	44-146
Br Svc Sch	6-136	11-127	44-147
Gen Depots	6-200	11-128	44-275
Sig Sec, Gen Depots	6-201	11-500	44-276
Sig Depots	6-225	11-537	44-277
Port of Emb (OS)	6-226	11-557	44-315
Trans Terminal Comd	6-235	11-587	44-316
Army Terminals	6-236	11-592	44-317
OS Sup Agencies	6-300	11-597	44-415
Army Sig Sup Agency	6-401	17-2	44-416
Army Sig Pub Agency	6-415	17-51	44-417
Army Sig Comm Engr	6-416	17-52	44-446
Agency	6-435	17-115	52-2
Army Comm Agency	6-501	17-116	55-27
White Sands Sig Agency	6-515	17-125	55-68
Yuma Test Sta	6-525	17-126	55-157
Army Elct PG	6-535	19-35	57-2
Sig Fld Maint Shops	6-536	19-36	57-57
Sig Lab	6-537	19-37	

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

USAR: None.

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