TECHNICAL MANUAL

(FURNISHED IN LIEU OF TM-11-5036)

POWER SUPPLIES PP-109 FR/GR AND PP-112 FR/GR

FRENCH PRODUCTION

Le Matériel Téléphonique

46-47, Quai de Boulogne - BOULOGNE-BILLANCOURT (Seine) FRANCE

JANUARY 1956

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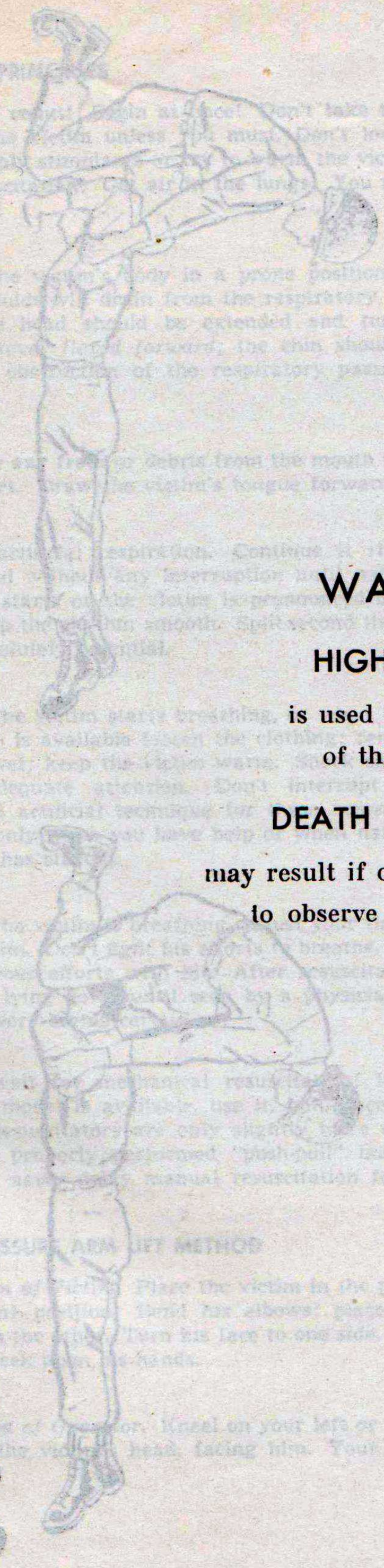
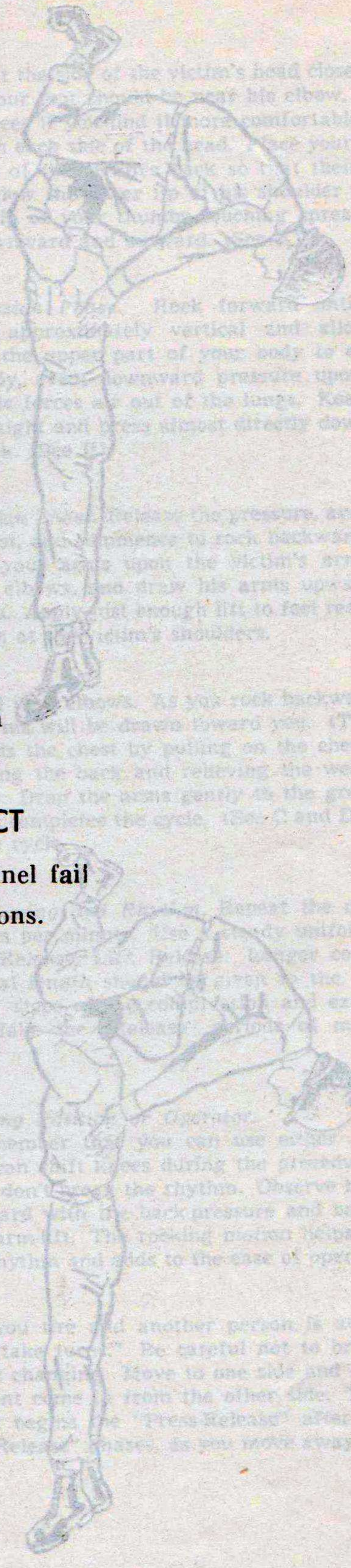
The text of this manual has been revised exactly to reflect the production of the Power supplies PP-109-FR/GR and PP-112-FR/GR made by the French Company " Le Materiel Telephonique ", Paris (France).

CONTENTS





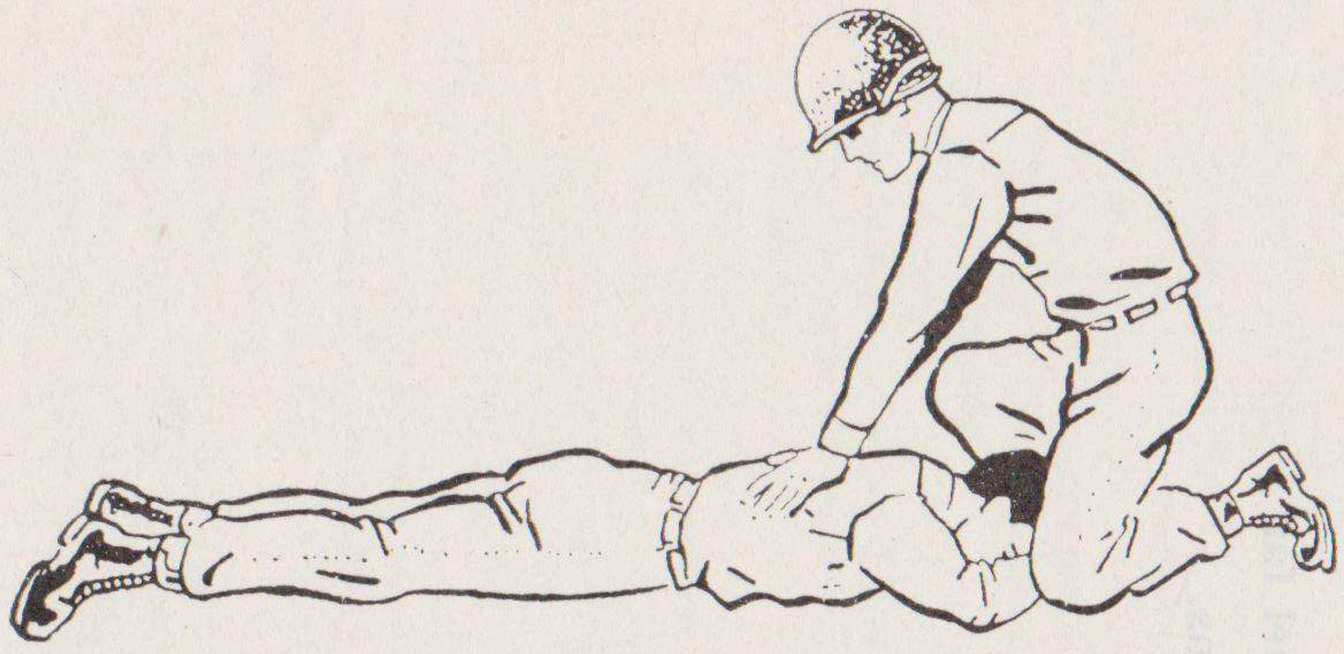
WARNING

HIGH VOLTAGE

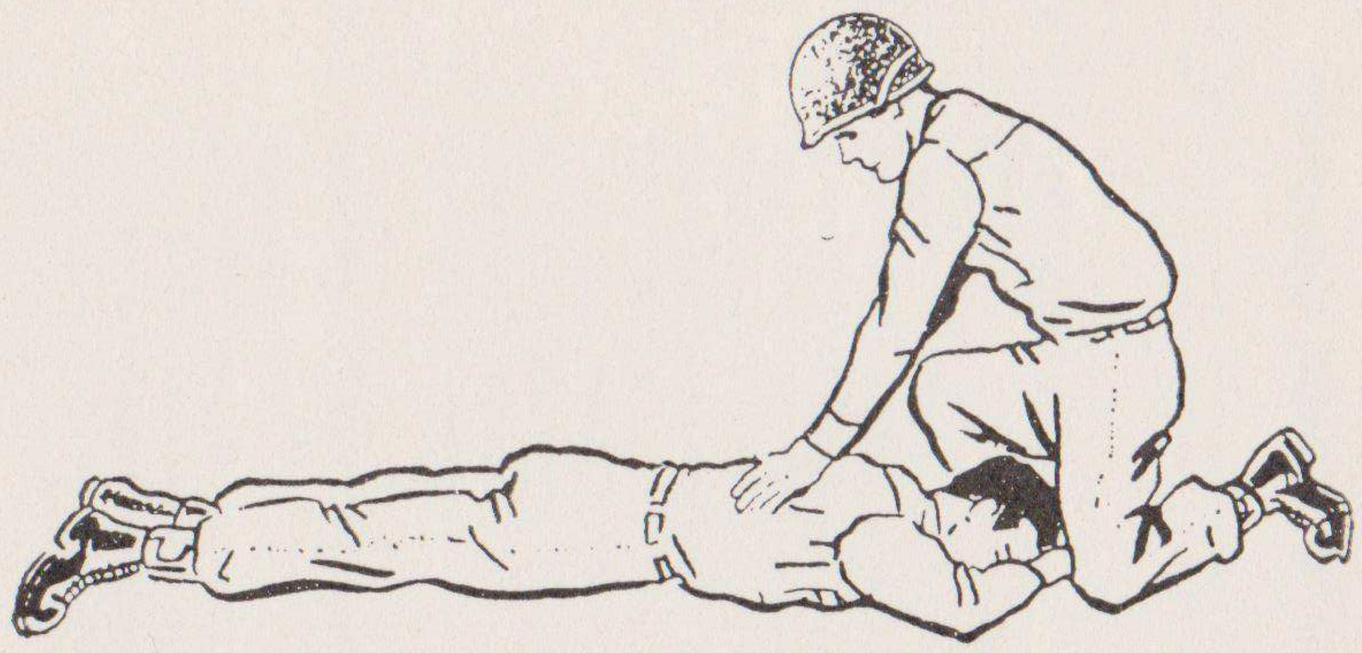
is used in the operation
of this equipment.

DEATH ON CONTACT

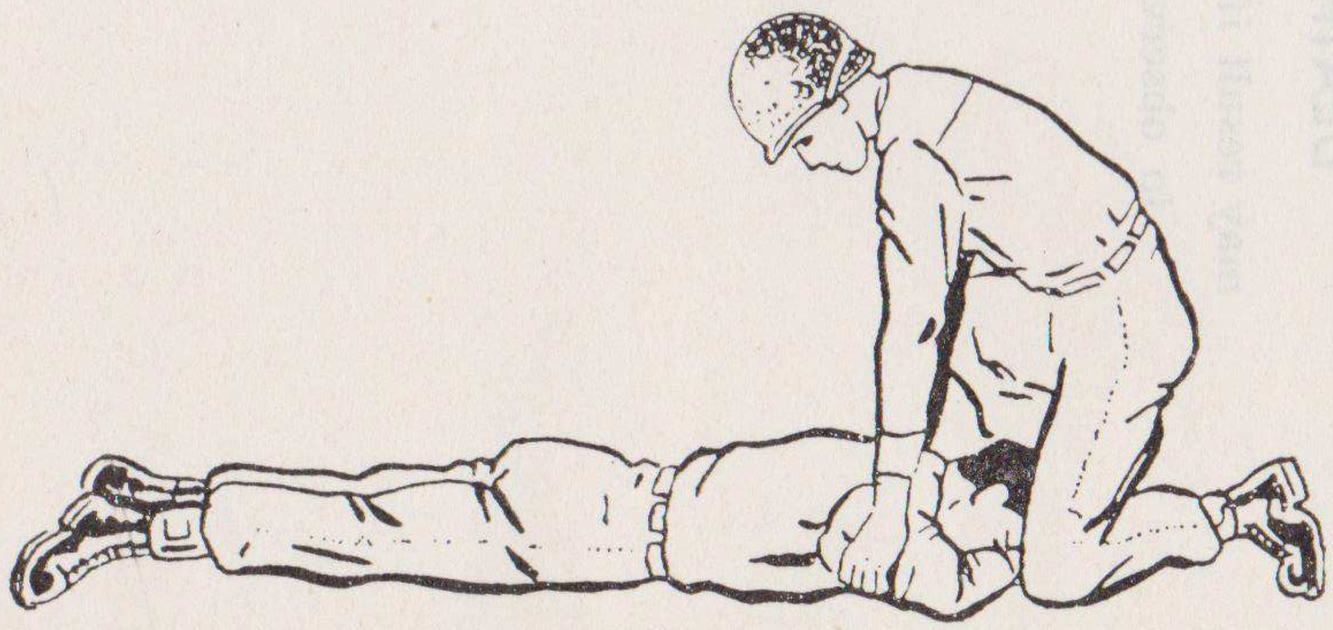
may result if operating personnel fail
to observe safety precautions.



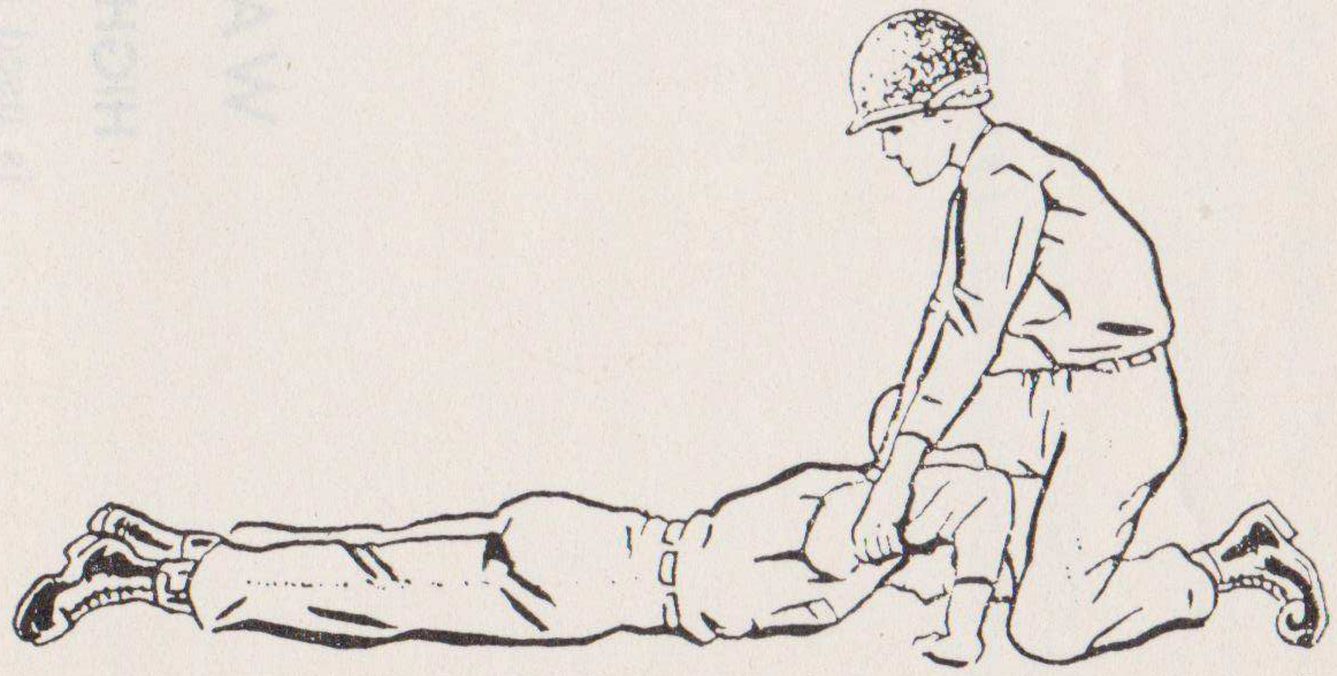
A Position of operator and victim



B Compression phase



C Expansion phase (arm lift)



D Expansion phase (arm release)

ARTIFICIAL RESPIRATION

GENERAL PRINCIPLES

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

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

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

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

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

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

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

BACK-PRESSURE ARM LIFT METHOD

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

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

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

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

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

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

6. *Changing Position or Operator.*

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

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

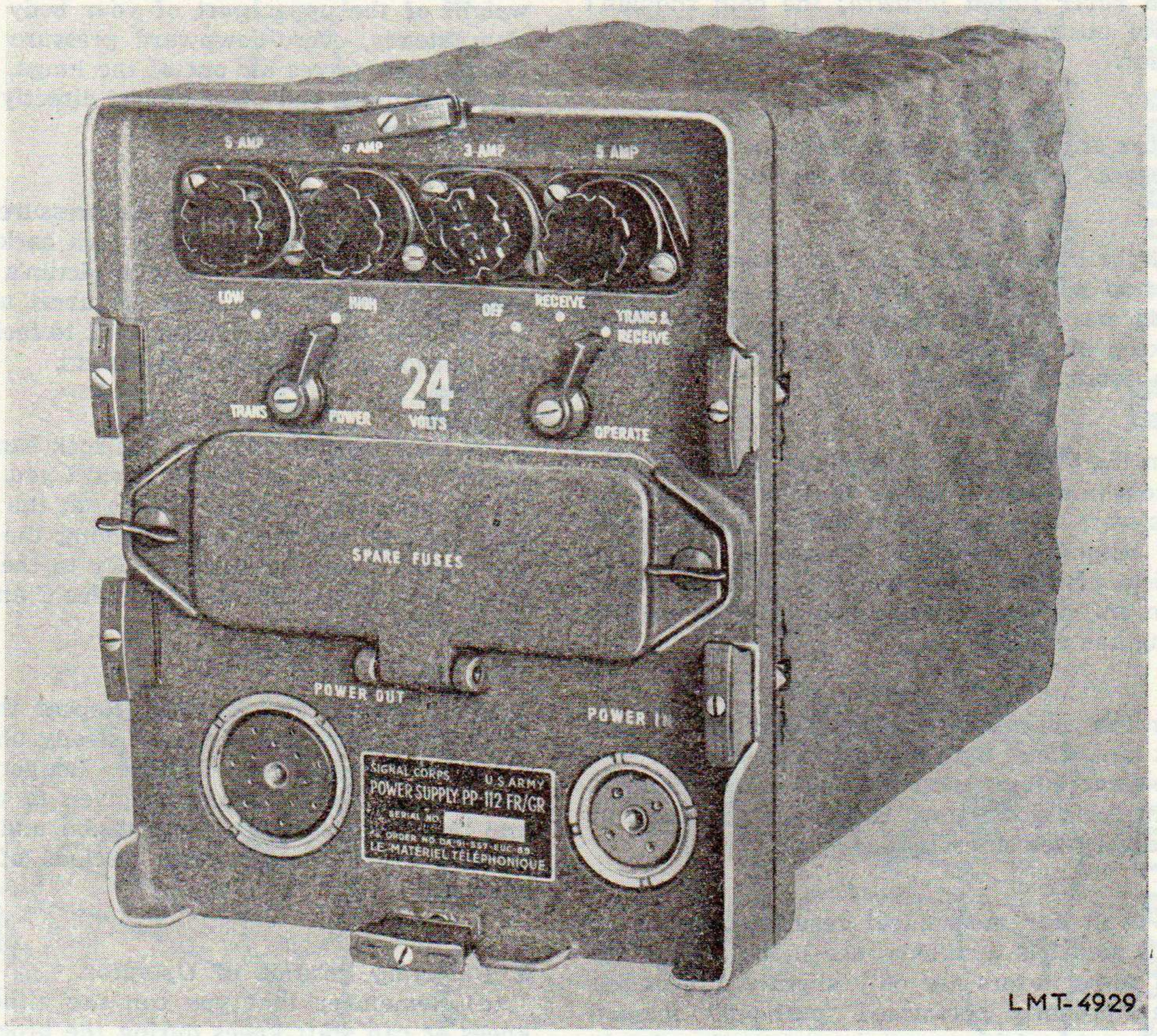


Figure 1. Power Supply PP-112/GR, front view.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Purpose and Scope

a. This technical manual contains information pertaining to the description and theory of Power Supplies PP-109/GR and PP-112/GR, and provides instructions for the maintenance, repair, and test of these units. Two appendixes furnish a list of references and an identification table of parts.

b. The two power supplies referred to above are alike in most respects, and they are discussed simultaneously in this manual. Where specific differences exist between the units, these differences are discribed with specific reference to the particular unit involved.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of matériel and equipment, or improper preservation, packaging, packing, marking, loading, stowage, or handling thereof.

a. DD Form 6, Report of Damaged or Improper Shipment (Reports Control Symbol CS GLD-66), will be filled out and forwarded as prescribed in SR 745-45-5.

b. DA AGO Form 468, Unsatisfactory Equipment Report (Reports Control Symbol CS GLD-247), will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700-45-5.

c. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use
(fig. 1)

a. Power Supplies PP-109/GR and PP-112/GR are vibrator type power supplies which derive power from 12-and 24-volt storage batteries, respectively, to supply the plate, filament, bias, and relay voltages (paragraph 5).

b. The units are designed specifically to provide operating power for any one of Receiver-Transmitters RT-66/GRC, RT-67/GRC, and RT-68/GRC (TM 11-289). Means are provided for supplying power for the receiver only, or for both the receiver and the transmitter. In addition, provisions are made to allow either high- or low-power operation of the transmitter section of the receiver transmitter.

c. When used to supply power for receiving only, the power supplies can be operated continuously. When used alternately for transmitting and receiving, the power supplies should not be used for more than 5 minutes of continuous operation. If the power supplies are used to furnish transmitter power continuously for 5 minutes, an interval of at least 15 minutes should be allowed before transmitting again. During the 15-minute interval, the power supplies can be used to furnish power for reception. The intervals between transmissions may be shorter than 15 minutes when transmission has not been continuous for 5 minutes.

4. System Application

a. Power Supply PP-109/GR or PP-112/GR is used in conjunction with Receiver-Transmitter RT-66/GRC, RT-67/GRC, or RT-68/GRC in any storage battery installation. Figure 2 is a simplified block diagram of a system in which the power supply is used to provide the necessary operating potentials.

b. The OPERATE switch controls the application of battery power to the power supply. When this switch is on RECEIVE or TRANS & RECEIVE, plate and filament voltages for the receiver are available at the POWER OUT connector terminals.

c. When the power supply is turned on, a relay supply voltage and a control lead voltage are made available at the POWER OUT connector. The relay supply voltage is used to energize control relays in the receiver-transmitter when an external control is closed.

d. Plate and filament voltage for the transmitter are controlled by the OPERATE switch and

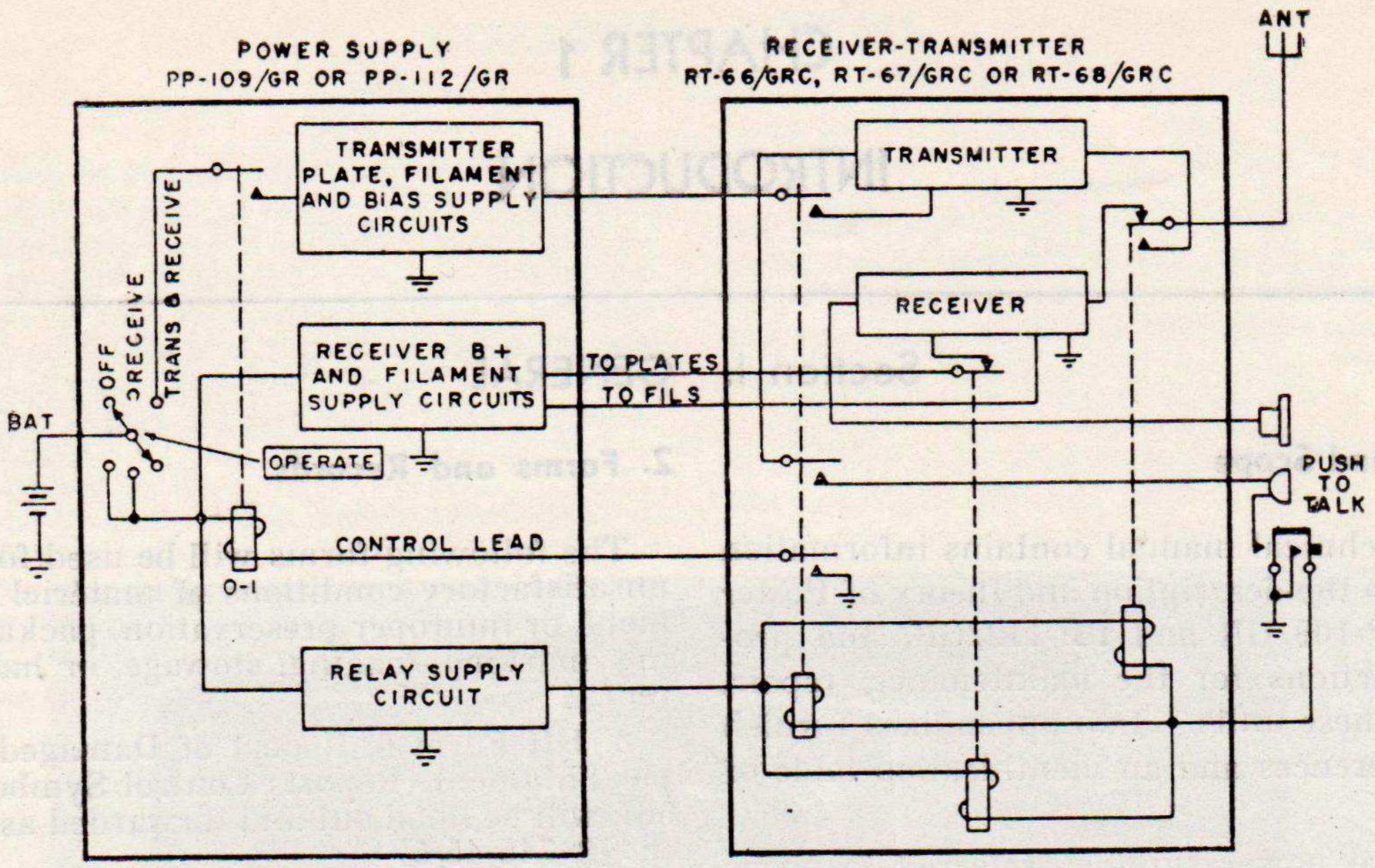


Figure 2. Power Supply PP–112/GR or PP–109/GR, system application, simplified diagram.

another switch on the operator's microphone or control board. When the OPERATE switch is in the TRANS & RECEIVE position, and the external control is activated, first the receiver-transmitter relays are energized and then the transmitter power supply relay is energized. This causes transmitter plate and filament voltages to become available (fig. 2). The operation of the power supply in any system is described in the technical literature for the particular system. Details for the operation of the controls for the power supply are given in chapter 2.

5. Technical Characteristics

Rated input voltage:

Power Supply PP–112/GR	25.2 volts dc (direct current).
Power Supply PP–109/GR	12.6 volts dc.

Rated input current:

Power Supply PP–112/GR	7.0 amperes.
Power Supply PP–109/GR	11.5 amperes.

Filament and control circuit power drains:

	High power	*Low power*
Receiver filaments	6.3 volts dc (595 ma (milliamperes))	6.3 volts dc (595 ma)
Transmitter filaments	6.3 volts dc (1.415 amperes)	6.3 volts dc (1.415 amperes)
Relay control circuits	5.6 volts dc (431 ma)	5.6 volts dc (431 ma)

Plate, screen, and bias power drains:

Transmit		*Receive*	
HIGH	LOW	HIGH	LOW
450 volts dc (75 ma)	200 volts dc (33.5 ma)	0 volts	0 volts
250 volts dc (11.5 ma)	105 volts dc (4.8 ma)	0 volts	0 volts
150 volts dc (37.5 ma)	90 volts dc (22.5 ma)	0 volts	0 volts
100 volts dc (19 ma)	90 volts dc (17 ma)	105 volts dc (20 ma)	105 volts dc (20 ma)
85 volts dc (70.7 ma)	90 volts dc (75 ma)	85 volts dc (50.5 ma)	85 volts dc (50.5 ma)
−27 volts dc (2 ma)	0 volts	0 volts	0 volts

Adaptability to service conditions:

Altitude	10,000 feet, maximum.
Shocks and vibration	Will stand shocks, strains, and vibration in a vehicle operating over rugged terrain.
Weather and climate	Immersionproofed and fungiproofed.
Normal operating temperature	From −40°C (−40°F) to +55°C (+130°F).

6. Description

a. GENERAL. Power Supply PP-112/GR (fig. 1) is a vibrator type power supply. It consists of a panel-and-chassis assembly inclosed in an immersionproof metal case. The panel-and-chassis assembly is fastened to the case by six Dzus fasteners, which are accessible from the front. The over-all dimensions of the unit are 9¼ inches high by 7¼ inches wide by 12 7/8 inches long. The total weight of the unit with case is about 35 pounds. The exterior of the unit is finished with an olive drab wrinkle paint. The information in this paragraph applies equally to Power Supplies PP-112/GR and PP-109/GR except where mechanical and electrical differences in the latter unit require special description.

b. CASE. The metal case consists of an aluminum outer skin welded to an aluminum box. The outer skin has been corrugated to increase its resistance to shock. Runners on the bottom of the case permit it to be installed and locked on the mounting base of the equipment with which the power supply is to be used.

c. FRONT PANEL. The front panel is an aluminum casting finished in an olive drab wrinkle paint. All operating controls, fuse holders, cable connectors, and Dzus fasteners are mounted on the front of the panel. The panel is recessed to prevent damage to the controls due to impact.

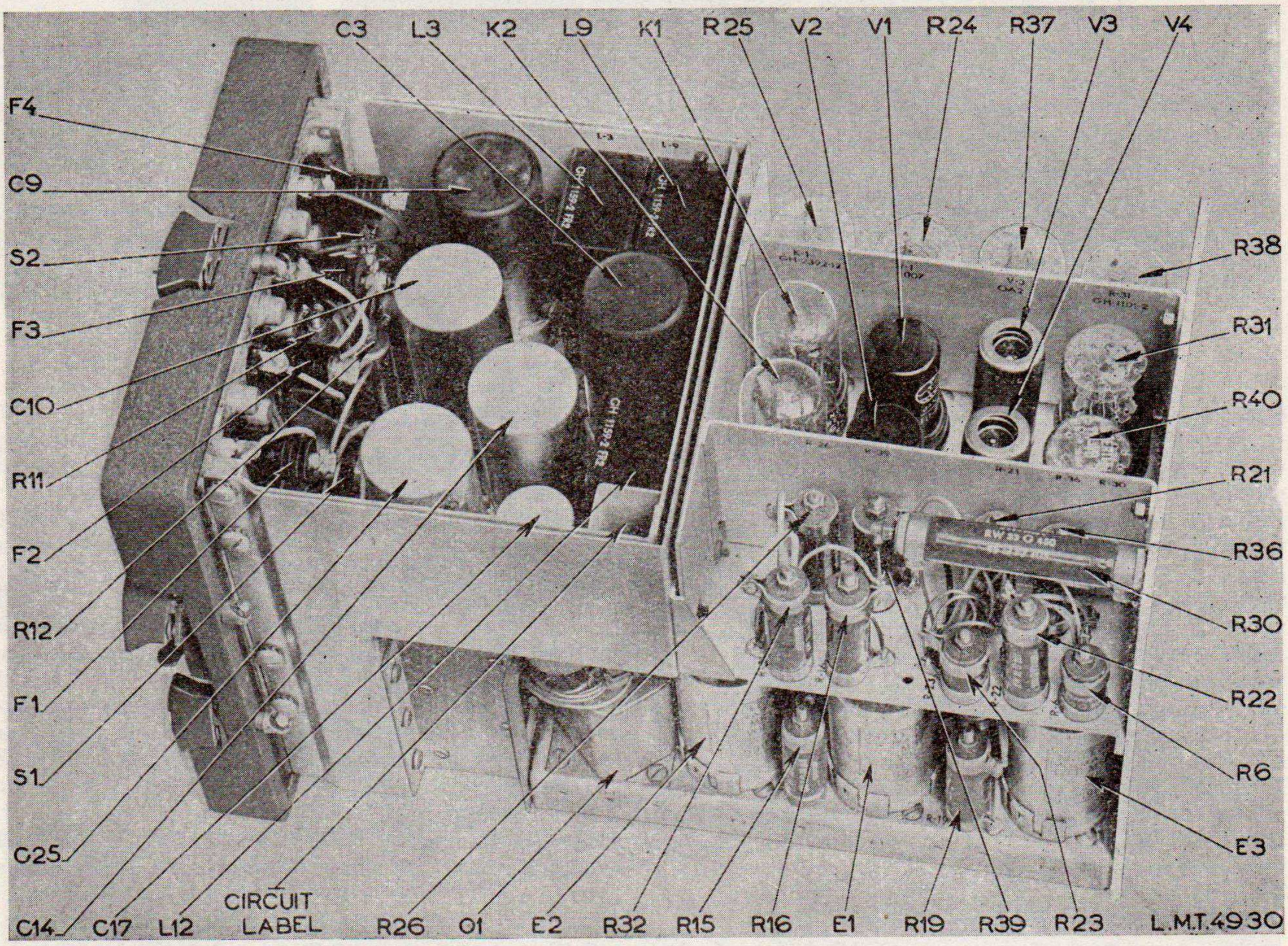


Figure 3 Power Supply PP-112/GR, top of chassis.

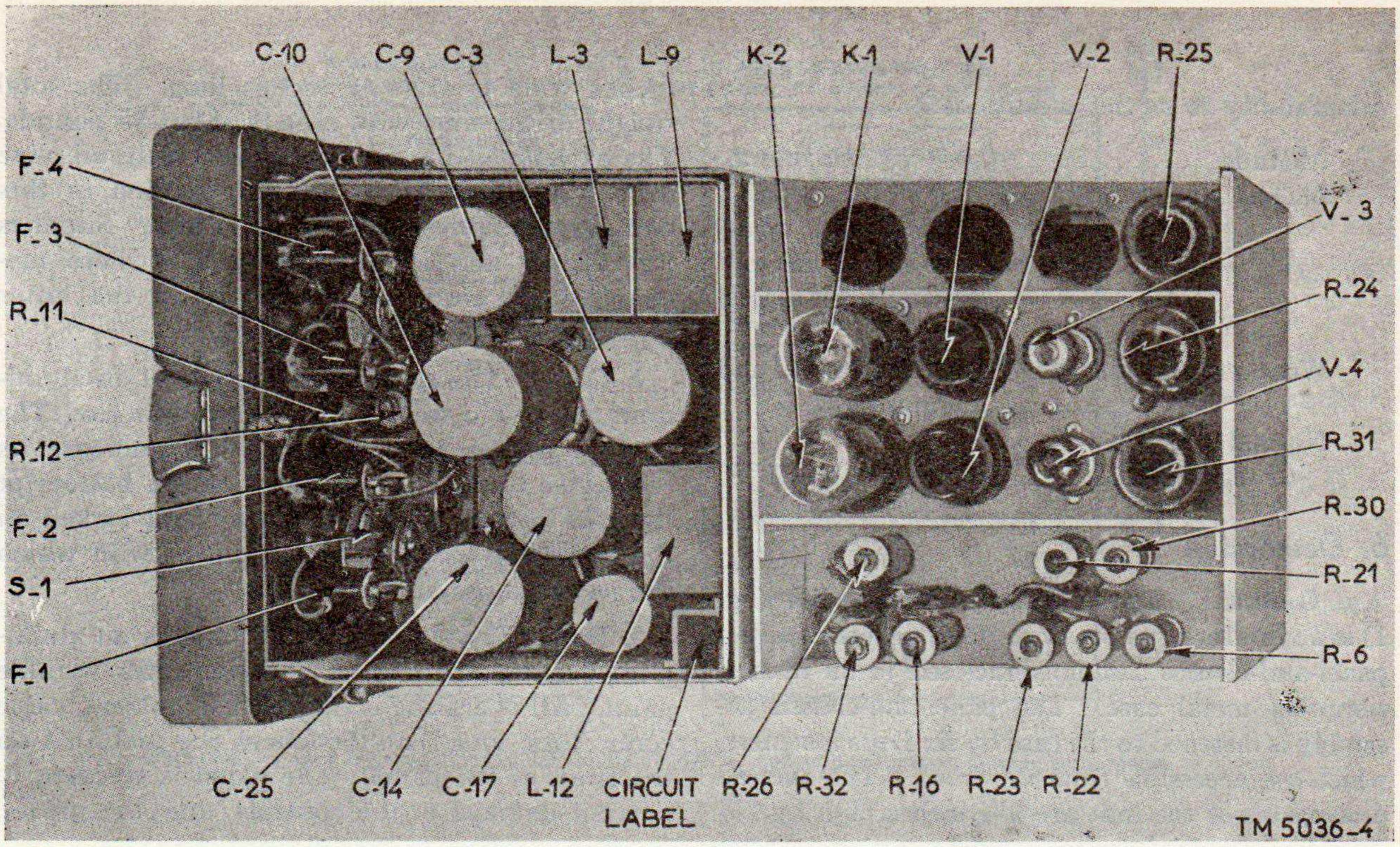


Figure 4. Power Supply PP-109/GR, top of chassis.

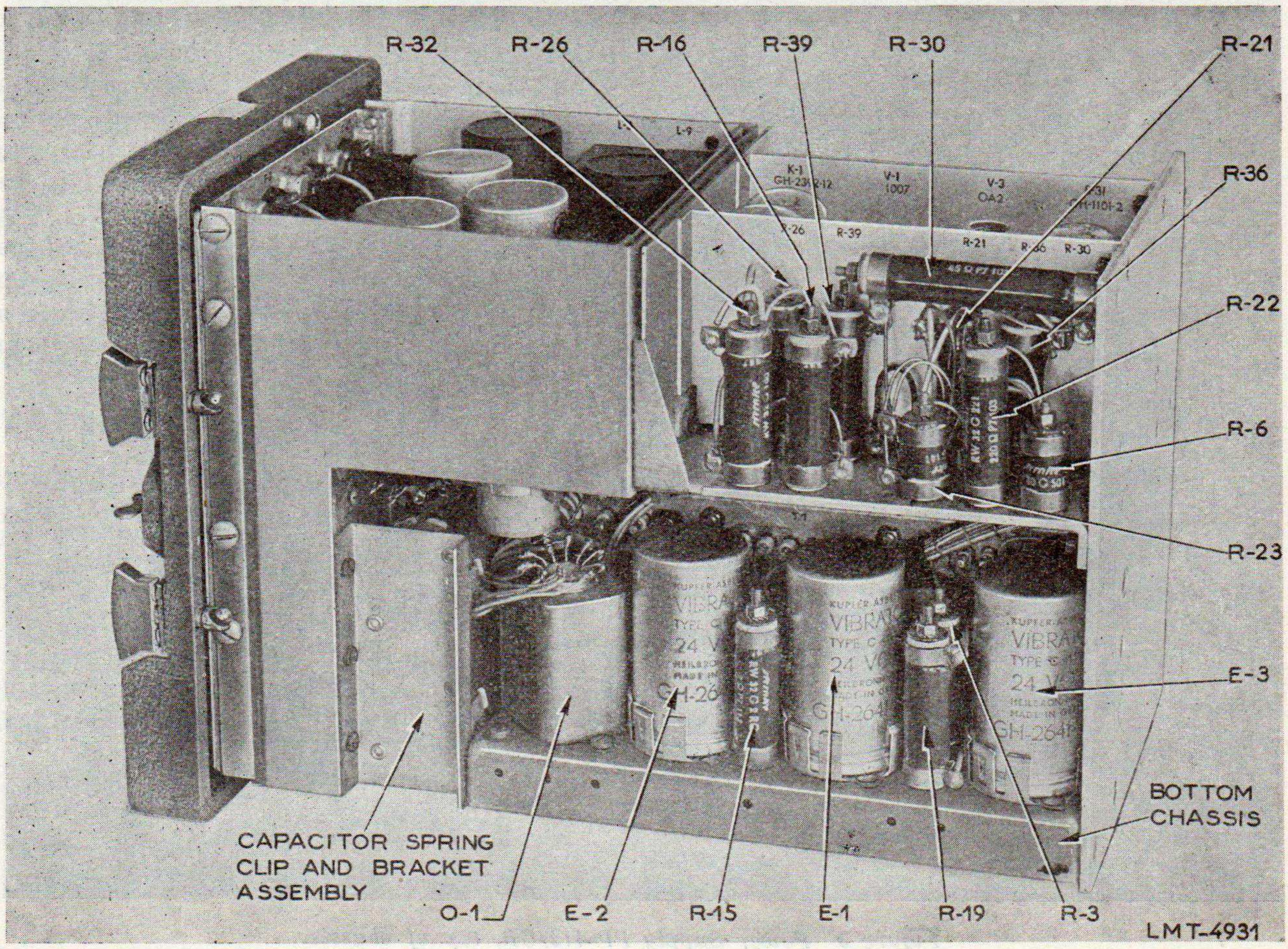


Figure 5. Power Supply PP-112/GR, right-hand side view.

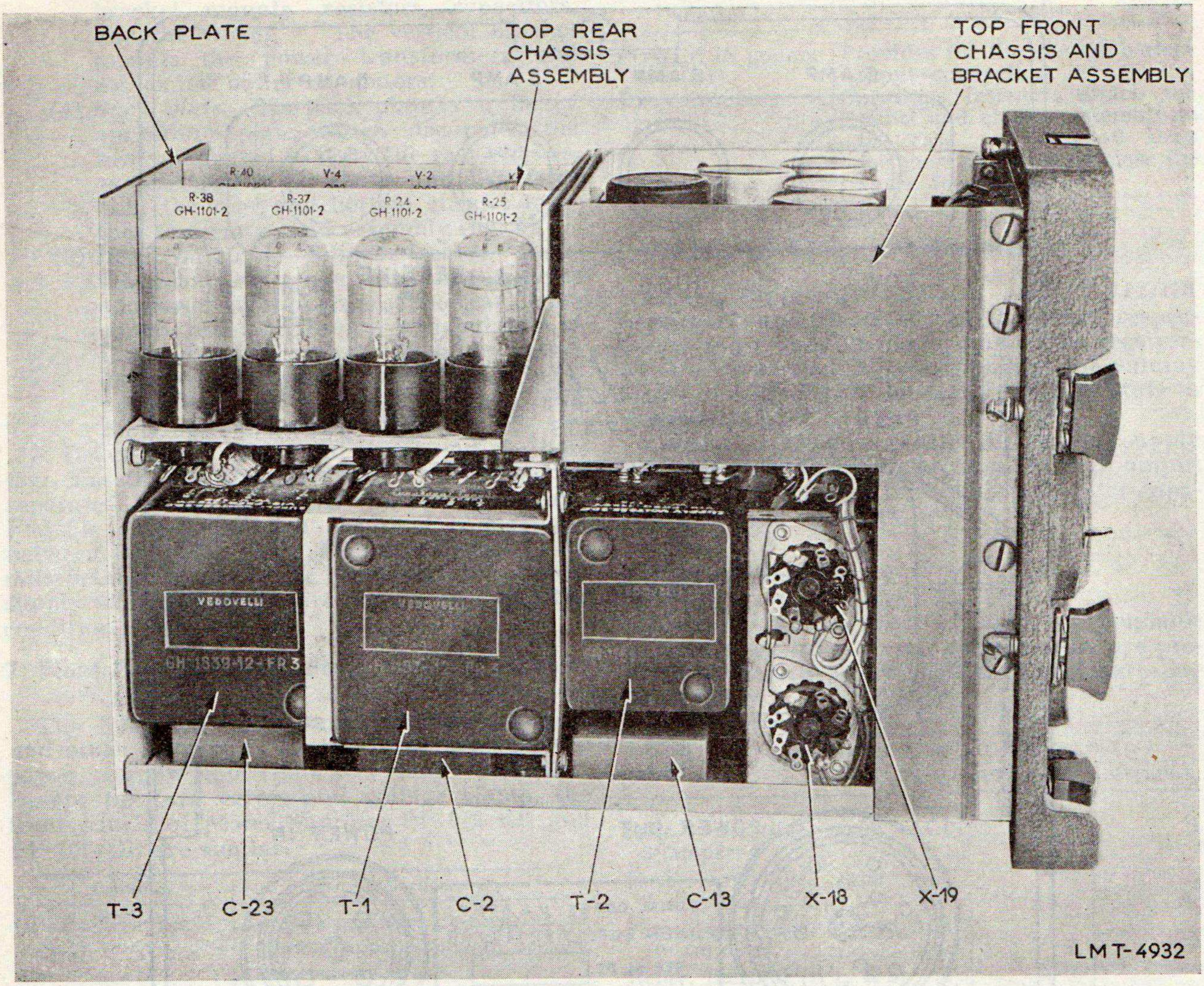


Figure 6. Power Supply PP-112/GR, left-hand side view.

The use of controls, connectors, and other components mounted on the front panel is explained in detail in paragraph 7.

d. CHASSIS ASSEMBLY (figs. 3 through 6, 10, and 11). A top view of Power Supply PP-112/GR without cover is shown in figure 3. A similar view of Power Supply PP-109/GR is shown in figure 4. A comparison of these two figures shows that the two units are nearly alike in appearance, except for the number of ballast tubes and the number and size of resistors. The side views of Power Supply PP-112/GR (figs. 5 and 6) are equally representative of Power Supply PP-109/GR, except for the differences noted in figures 3 and 4. Bottom views of the two power supplies are shown in figures 10 and 11. The chassis assembly is composed of several sections, as follows:

(1) *Front chassis assembly.* The front chassis assembly consists of a chassis and an outer bracket (fig. 6). On the chassis are mounted the large electrolytic capacitors and the chokes composing the a-c (alternating-current) ripple filter assembly (fig. 3). The bracket mounts a shelf for two large plug-in type electrolytic capacitors (C-27 and C-30) and a removable clamp assembly for retaining these capacitors in their sockets under vibration stresses (figs. 10 and 11). The chassis and the outer bracket provide air space around the filter components to insulate them from the heat produced by the tubes and large resistors mounted on the rear of the chassis assembly. A recess in the portion of the bracket facing the front panel serves to inclose the panel-mounted components and to mount the r-f (radio-frequency) filter assembly (fig. 12).

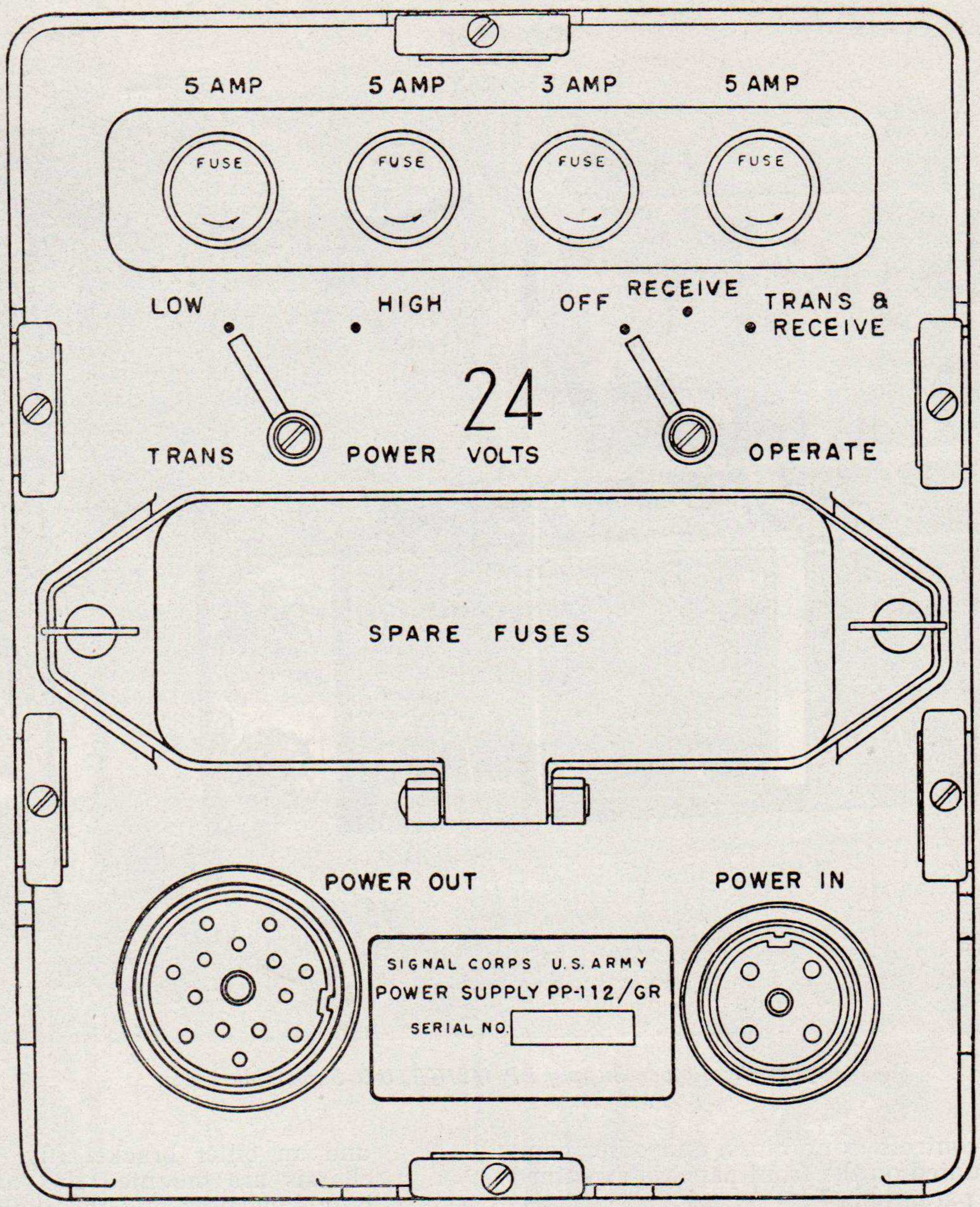


Figure 7. Power Supply PP-112/GR, controls, fuses, and connectors.

(2) *Rear chassis assembly.* The rear chassis assembly consists of a chassis and rear plate (figs. 3, 6, and 12). The chassis mounts the heat-producing parts of the power supply, namely, the ballast tubes, thermal relays, rectifier tubes, voltage regulator tubes, and most of the large resistors. Small angle brackets attach the chassis to the bracket around the front chassis (see (1) above). The chassis is made of heavy aluminum and is attached to the back plate to facilitate heat conduction toward the rear of the unit and away from the front chassis components The top of the rear chassis is separated into three compartments by aluminum walls or baffles, for the purpose of reflecting heat toward the outer case and facilitating heat dissipation toward the back plate and the power supply case.

(3) *Bottom chassis assembly.* The removable bottom chassis assembly, mounted below the front and rear chassis, is attached by means of machine screws to the lower vertical portion of the outer bracket and to the back plate. The bottom chassis consists of a horizontal bracket and a vertical bracket (figs. 5, 6, and 12). The top of the horizontal bracket mounts the vibrators, the relay, and some resistors. The bottom of this

bracket mounts resistors, capacitors, and the wiring. The vertical bracket mounts the power transformers and associated buffer capacitors.

(4) *Back plate.* The back plate is a heavy aluminum plate which dissipates the heat conducted to it by the rear chassis, as described in (2) above, and also helps hold the rear and bottom chassis together to form a rigid assembly (fig. 6).

(5) *Heat barriers.* Silicone-treated glass-fabric barriers are provided in the upper and lower right shelves at the rear of the chassis assembly to prevent insulation of the connecting wires from becoming damaged by contact with the large, heat-producing, wire-wound resistors and the vibrators.

e. DISASSEMBLY. The front panel and the bottom chassis, described in *c* and *d* above, can be separated from the front chassis assembly. Flexible cables establish electrical connections between them (fig. 12). This arrangement permits detailed tests to be made on the power supply while all of its circuits are in operating condition.

7. Front Panel Controls, Fuses, and Connectors (fig. 7)

The following chart lists the controls, fuses and other connectors on the front panel of the power supply and indicates their functions. Except for fuse valves and voltage stamp, the front panels of power Supplies PP-112/GR and PP-109/GR are similar.

Control	Function
OPERATE switch (S–1).	In OFF position, de-energizes all power supply circuits by opening the battery circuit.
	In RECEIVE position, closes the battery circuit and energizes the receiver power supply and receiver-transmitter relay supply circuit.
	In the TRANS & RECEIVE position, accomplishes the same functions as in RECEIVE position and, in addition, makes power available for the transmitter power supply circuits. (Completion of the transmitter power supply circuit depends on the operation of external control circuits.)
TRANS POWER switch (S–2).	Provides for high- or low-power operation of the transmitter in the HIGH and LOW positions, respectively.
Fuses (F–1, F–2, F–3, and F–4).	Protect battery circuits from short circuits or other overloads.
Spare fuse holder	Stores spare fuses.
POWER OUT connector (J–2).	Makes power supply output voltages available for cable connection to the receiver-transmitter.
POWER IN connector (J-1).	Provides for the storage battery input connection.
Dzus fasteners	Six Dzus fasteners attach the panel and chassis assembly to the case. Two small Dzus fasteners are used to close the spare fuse holder.

8. Additional Equipment Required

Power Supplies PP-109/GR and PP-112/GR require 12- and 24-volt storage batteries, respectively, and a suitable load. Any of the receiver-transmitters listed in paragraph 3 or the dummy load resistors shown in figure 14 constitute a suitable load.

Caution : Do not operate the power supply with-out a suitable load, because the high output voltages will damage the electrolytic filter capacitors and the vibrators.

9. Running Spares

Running spares for normally expendable items such as tubes, fuses, and vibrators are provided with each power supply. These parts are listed below:

Part	Power supply	
	PP-109/GR	PP-112/GR
Fuse, cartridge, type AGU, 5 amperes	6	8
Fuse, cartridge, type AGU, 3 amperes		4
Fuse, cartridge, type AGU, 10 amperes	6	
Relay, thermal (K-1, K-2)	1	1
Resistor, thermal (R-24, R-25), R-31, R-37, R-38, R-40).	2	3
Tube type 1007, electron	1	1
Tube type OB2, electron	2	2
Tube type OA2, electron	2	2
Vibrator, 6-volt (E-1, E-2, E-3).	2	
Vibrator, 24-volt (E-1, E-2, E-3).		2

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of new parts.

10. Difference in Models

Power Supplies PP–109/GR and PP–112/GR are very similar. They differ mainly in their input voltage requirements and in the type of vibrators used. Power Supply PP–112/GR uses 24-volt vibrators; Power Supply PP–109/GR utilizes 6-volt vibrators. The power supplies differ also in those components, for example, resistors, transformers, and capacitors, which are necessary to accommodate the different input voltages. Specific differences are discussed in paragraph 20.

CHAPTER 2

THEORY OF POWER SUPPLIES PP-109/GR AND PP-112/GR

11. Block Diagram
(fig. 8)

a. Figure 8 is a functional block diagram typical of either power supply. It shows that three h-v (high-voltage) circuits and three l-v (low-voltage) circuits are supplied from the common storage battery input terminals. The h-v circuits are vibrator supplies used to provide the plate, screen, and bias voltages for the receiver and transmitter circuits in Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC. The l-v circuits are used to supply the receiver-transmitter filament and relay potentials.

b. The 85-volt circuit (E–3 and T–3) is energized whenever the OPERATE switch is in either the RECEIVE or the TRANS & RECEIVE position. The 150-volt circuit (E–2 and T–2) is energized when the OPERATE switch is in the TRANS & RECEIVE position and relay O–1 is energized. To energize the transmitter h-v supply (E–1 and T–1) the OPERATE switch must be in the TRANS & RECEIVE position, relay O–1 must be energized, and TRANS POWER switch S-2 must be in the HIGH position.

c. TRANS POWER switch S–2, in addition to breaking or making the battery circuit to the transmitter h-v supply (*b* above), connects the vibrator output circuits for HIGH or LOW power operation of the receiver-transmitter.

d. The l-v circuits include: the receiver filament supply circuit with output at terminal L of J–2; the transmitter filament supply circuit with output at terminal N of J–2; and the control relay supply circuit with output at terminal A of J–2. The transmitter filament circuit is completed only when relay O–1 is energized.

e. Each of the h-v and l-v circuits is equipped with r-f noise suppression filters in both the input and output leads. Similarly, a-c ripple filters are included in the output lead of each circuit.

12. Battery Input Circuit
(fig. 17)

The 24-volt storage battery input required for the operation of Power Supply PP–112/GR is brought in on terminals B (+) and C (—) of POWER IN connector J-1. The voltage is applied through the contacts of a four-pole, three-position switch (OPERATE switch S-1) to four branch circuits, each of which is equipped with a fuse and a battery supply filter. OPERATE switch S-1 serves as the power on-off switch for the receiver and transmitter circuits operated from this power supply (pars. 13 through 18).

13. Receiver Filament Supply Circuit (fig. 17)

The filament supply circuit for the receiver is completed from the POWER IN connector to terminal L of J-2 through section D of S-1, fuse F-1, choke L-4, resistor R-39, ballast tubes R-40 and R-31, contacts 7 and 5 of K-2, and choke L-16.

a. Battery input filter L-4 and C-5 prevents h-f (high-frequency) interference from reaching the battery circuit.

b. Ballast tubes R-40 and R-31 are essentially variable resistors, the resistances of which vary according to the voltage supplied. If the input voltage decreases, the voltage drop across the ballast tubes decreases, causing a decrease in the resistance of the tubes. This action results in a constant current through the circuit and a constant voltage available for the filament circuit.

c. The thermal relay K-2 serves as protection against excessive increases in filament voltages which might be caused by variations in the output load. For example, if tube filaments in the receiver open, the contacts of the relay open and insert R-32 in series with the filament supply circuit and in series with the heater element of K-2. The value of this resistor is sufficiently high to drop the output voltage to a value which will not damage the tube filaments and render the receiver completely inoperative. Resistors R-33, R-34, and R-35 drop the heater element voltage to a value which will permit K-2 to open its contacts under overload conditions.

d. Capacitor C-30 removes l-f (low-frequency), a-c ripple from the d-c voltage.

e. The filter circuit consisting of choke L-16 and capacitor C-31 serves to filter h-f, a-c voltages from the d-c output.

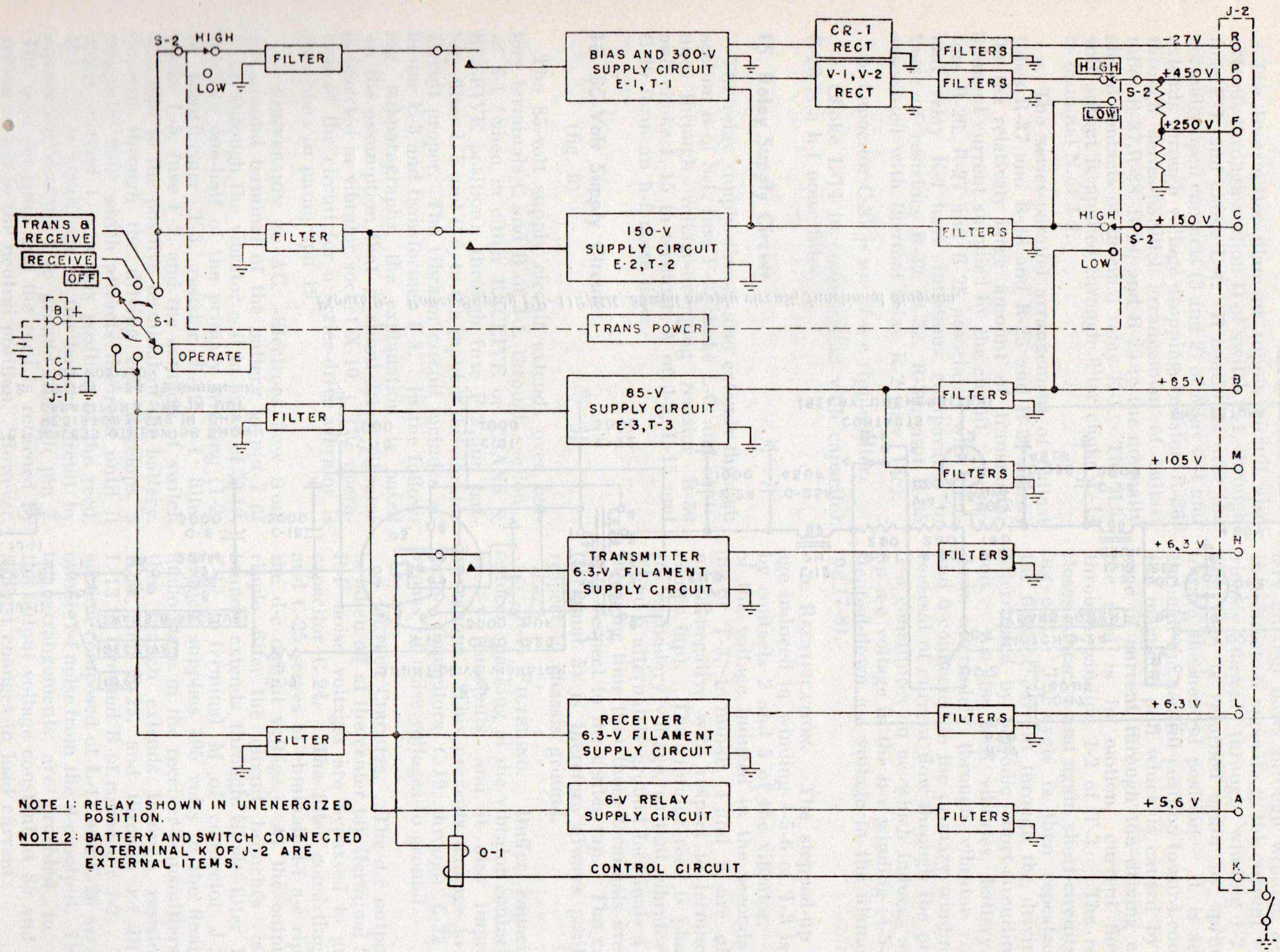
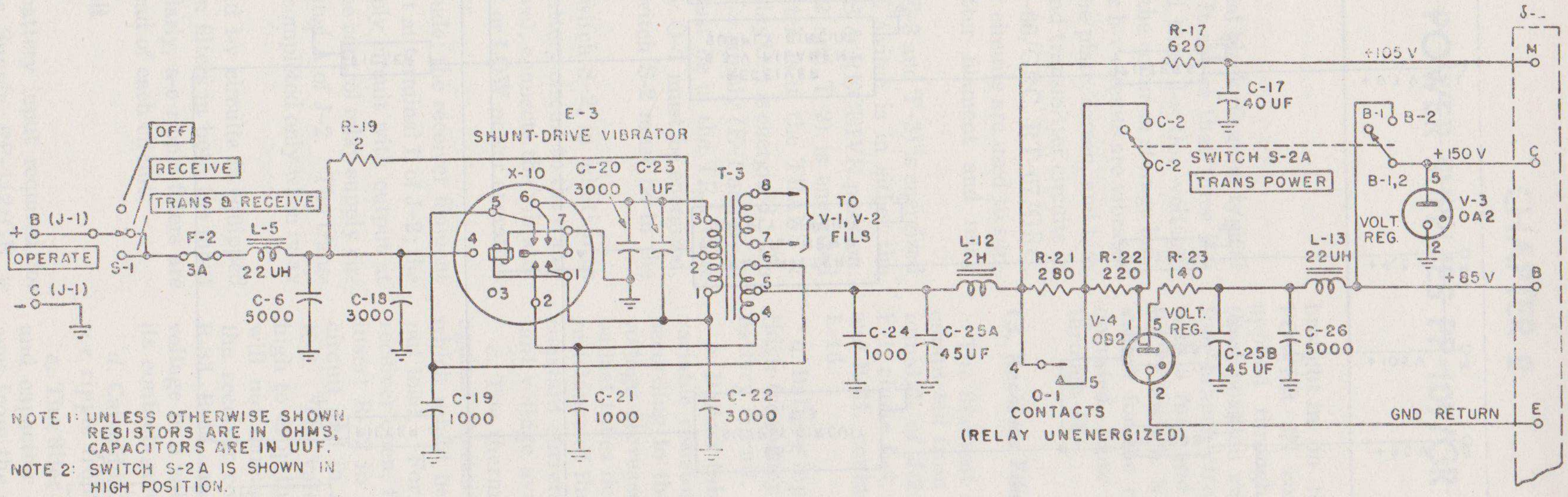


Figure 8. Typical power supply, functional block diagram.



NOTE 1: UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

NOTE 2: SWITCH S-2A IS SHOWN IN HIGH POSITION.

Figure 9. Power Supply PP-112/GR, 85-volt supply circuit, functional diagram.

14. Transmitter Filament Supply Circuit
(fig. 17)

The transmitter filament supply circuit also extends through section D of switch S-1, through fuse F-1, and choke L-4. It continues over the normally open contacts (3 and 2) of relay O-1 and extends through voltage-dropping resistor R-36, through series-parallel arrangement of ballast tubes R-37,R-38, R-24, and R-25 to the normally closed contacts of thermal relay K-1. The 6.3-volt output is applied through filter choke L-14 to terminal N of J-2.

a. The series-parallel arrangement of ballast tubes R-37 and R-38 and R-25 and R-24 allows for the relatively large amount of transmitter filament current supplied by the circuit. Resistors R-26, R-27 and R-28 associated with thermal relay K-1 have functions comparable to those of resistors R-32, R-33, R-34, and R-35 associated with thermal relay K-2 (par. 13*c*).

b. Capacitor C-27 is an l-f a-c ripple filter.

c. Choke L-14 in combination with capacitor C-28 is a h-f noise filter.

15. Relay Supply Circuit

The relay supply circuit also extends through section B of S-1, fuse F-3, choke L-6, and continues through voltage-dropping resistor R-30 and choke L-15 to terminal A of J-2, L-15 and C-29 form an h-f noise filter.

16. 85-Volt Supply Circuit
(fig. 9)

The 85-volt supply circuit extends over battery terminals C and B of J-1, through section C of S-1 (when in either RECEIVE or TRANS & RECEIVE position), through fuse F-2 and battery filter L-5 and C-6, to the input of the vibrator circuit proper. The vibrator circuit includes vibrator E-3 and transformer T-3. In the following subparagraphs, the explanation is based on the assumption that a shunt-drive vibrator is inserted in vibrator socket X-10. The operation of the circuit for a series-drive vibrator is described in paragraph 19.

a. Conversion to AC. Electrons flow from the ground terminal of the battery to pin 7 of X-10, through the vibrator coil to pin 1 of X-10, through one-half of the primary winding (1-2) of transformer T-3, resistor R-19, r-f filter choke L-5, fuse F-2, and the contacts of switch S-1, and to the positive terminal of the battery. Current through the driving coil develops a magnetic field which attracts the reed until it closes contact 1. In this position of the reed, the coil is taken out of the battery circuit by connecting contact 1 to ground through pin 7. The field collapses and the reed is returned by spring action to the neutral position. However, the reed inertia carries it through the neutral position and causes it to close contact 6. Battery current flows through winding 3-2 of T-3, in a direction opposite to the current which previously flowed through winding 1-2 of T-3. The reed is returned again by spring action toward the neutral position. It is accelerated through the neutral position toward contact 1 by the magnetic pull which is caused by the passage of current through the driving coil while the reed is in motion, current flows again through winding 1-2 of T-3. The reed then closes contact 1 and again short-circuits the driving coil. The cycle is then repeated. Thus the flow of current through the driving coil is interrupted by periodic short-circuiting of the coil. As the reed vibrates, battery current flows alternately through vibrator contacts 1 and 6 connected to the primary winding. This reversal of current flow through the primary of T-3 constitutes an ac which induces a stepped-up a-c voltage in the h-v winding (4-5-6) and a stepped-down a-c voltage in the filament winding (7-8).

b. Rectification. The stepped-up a-c voltage induced in winding 4-5-6 of T-3 is rectified by contacts 2 and 5 of the vibrator. Because of the voltage induced in the secondary winding of T-3, terminals 4 and 6 are alternately made negative with respect to terminal 5 (the center tap). The vibrator reed is phased with the secondary voltage, so that vibrator contacts 2 and 5 alternately ground terminals 4 and 6 at the same time that those terminals are negative with respect to the center tap. The center tap (terminal 5) is therefore always positive with respect to chassis ground.

c. R-F Filtering. Buffer capacitor C-23 reduces sparking at the vibrator contacts caused by h-v transients, and it also improves the waveshape. This prevents damage to the contacts. Capacitors C-19 through C-22 serve to bypass r-f noise voltages to ground.

d. Output Circuits. The d-c output voltage is taken off at the center tap (terminal 5) of T-3. R-F noise voltages are bypassed to ground by capacitor C-24. The filter consisting of L-12 and C-25 serves to eliminate l-f a-c ripple from the d-c output voltage. At the output of the ripple filter the circuit branches off. One branch extends through ripple filter R-17 and C-17 to terminal M of connector J-2. This branch supplies 105 volts to the final receiver audio stage in the receiver-transmitters. Another branch extends through resistors R-21, R-22, and R-23, and through r-f filter choke L-13 to terminal B of connector J-2. The filter section composed of L-13 and C-26 serves to eliminate r-f noise from the d-c output. The following arrangements are provided to maintain the output voltage constant at 85 and 105 volts against changes in load current:

(1) The normally open contacts (4 and 5) of relay O-1 short out R-21 when the relay is energized to turn on the transmitter power supply circuit.

(2) Voltage regulator tube V-4 is connected from the junction of R-22 and R-23 to termina E of J-2 and serves to limit the maximum output voltage of the power supply when terminal E is grounded externally.

(3) A connection from terminal B of J-2 through section B of switch S-2A substitutes the output of the 85-volt vibrator circuit for the output of the 150-volt vibrator-circuit (E-2 and T-2) at terminal C of J-2 when the TRANS POWER switch is in the LOW position. V-3, which is permanently connected to terminal C, does not fire when the lower potential is applied. To maintain a constant output on the 85-volt supply under the additional load condition, resistor R-22 is short circuited when S-2 is in the LOW position.

17. 150-Volt Supply Circuit
(fig. 17)

a. The 150-volt supply circuit extends from the input terminals of J-1 through section B of switch S-1 (in the TRANS & RECEIVE position), to fuse F-3 and r-f choke L-6 to vibrator-transformer circuit E-2 and T-2.

b. The operation of this circuit is similar to that described for the 85-volt circuit (par. 16). In the 150-volt supply circuit, however, the vibrator circuit is completed through the normally open contacts (7 and 8) of relay O-1. When this relay is energized, vibrator E-2 functions in the same manner as described for E-3 (par. 16), and an output voltage is developed across the secondary winding of T-2. Note that terminal 5 is positive with respect to ground for the d-c output voltage. Buffer capacitor C-13 serves to suppress transformer transients. Capacitor C-12 suppreses r-f noise voltages.

c. The rectified output voltage at terminal 5 of T-2 is routed through the l-f a-c ripple filter (L-9, R-16, C-14A, and C-14B) and through the r-f noise voltage filter, L-11 and C-16, to sections A and B of TRANS POWER switch S-2A.

d. When S-2 is in the HIGH position, the circuit is completed through section B of S-2A to terminal C of J-2. In the HIGH position, V-3 serves to limit the maximum voltage appearing at terminal C to the required value. When the switch is in the LOW position, the connection through section B of S-2A is broken, V-3 is removed from the 150-volt circuit, and the output of the 150-volt supply circuit is connected through section A of S-2A to terminal P of J-2, in place of the 450-volt supply which is normally connected to the terminal. With V-3 no longer in the circuit, it is possible for the output voltage to rise above 150 volts. The LOW position of S-2 (section B) also connects the 85-volt supply to terminal C of J-2, in place of the output of the 150-volt supply circuit, E-2 and T-2.

e. A connection from terminal 5 of T-2 to terminal 5 of T-1 arranges the voltages appearing across these two transformers in series with each other and serves as a basis for deriving the 450-volt supply (par. 18).

18. 450-Volt Supply Circuit
(fig. .17)

a. D-C voltage from the storage battery is routed through section A of switch S-1 (in the TRANS & RECEIVE position), over contacts of S-2B (when in the HIGH position), through fuse F-4 and r-f noise filter L-7 and C-8 to the vibrator-transformer circuit (E-1 and T-1). The battery circuit is completed to the center tap (terminal 2) of T-1 through contacts 9 and 10 of relay O-1 when the relay is energized.

b. The process of converting the d-c voltage to an a-c voltage across the secondary windings of transformer T-1 is the same as that described in paragraph 16. Contacts 2 and 5 of vibrator E1 are connected in parallel with contacts 1 and 6, respectively, and the vibrator operates nonsynchronously. Paralleling the contacts in this manner permits longer contact life. The ac voltage is developed across the 300-volt secondary winding (4-5-6) of T1 and across the 27-volt winding (7-8-9) of T1.

c. To produce a d-c output voltage from the secondary winding (7-8-9) a full wave selenium rectifier CR-1 is used. Taps 7 and 9, of T1 are connected to the positive leads of CR-1. The negative lead is grounded to the chassis. Upon conduction through either side, CR-1 grounds the positive end of the secondary (with respect to the center tap) and the center tap 8 is always negative with respect to the chassis.

The —27-volt bias voltage is taken off at terminal 8 of that winding, routed through ripple filter R-6 and C-3 and r-f filter L-2 and C-4 and applied as a negative bias potential to terminal R of J-2.

d. The a-c voltage (300 volts) developed across winding 4-5-6 of T-1 is rectified by a circuit consisting of two duo diode tubes, V-1 and V-2, type 1007 gasfilled full-wave rectifiers. The h-v winding of T-1 is connected to one plate in V-1 and to one plate in V-2. The remaining plates are bridged from one tube to the other by resistors R-4 and R-5. These resistors permit conduction through each tube at all times. The center tap of the winding is raised approximately 150 volts above ground by its connection to the center tap of the secondary winding

of T-2. In this manner the two voltages add and the output voltage becomes 450 volts. The filament supply for V-1 and V-2 is obtained from winding 8-7 of transformer T-3. The rectified output of V-1 and V-2 is taken from the filaments and is filtered by the network consisting of r-f noise voltage filter L-1, L-8, and C-11 and a-c ripple filter L-3, C-9A, C-9B, C-10A, and C-10B. Resistors R-7, R-8, R-9, and R-10 are bleeder resistors which insure an equal division of voltages across capacitors C-9 and C-10.

e. With switch S-2 in the HIGH position and relay O-1 energized, the 450-volt output voltage is applied through section A of S-2A to voltage divider R-12 and R-11. A 450-volt potential is then available at terminal P of J-2. The voltage divider provides a 250-volt potential at terminal F. With switch S-2 in the LOW position, the 450-volt output circuit is disconnected from P of J-2. The input circuit is broken by the switch (S-2B). When either of these conditions exists, the power circuit is not energized and no output voltage exists. However, since the filaments are energized from secondary winding 7-8 of T-3, which is in operation whenever switch S-1 is on (par. 16), the filaments remain lit as long as E-3 is operative.

19. Operation of Power Supply PP-112/GR with Series-Drive Vibrators

The operation of Power Supply PP-112/GR using series-drive vibrators in the 85-, 150-, and 450-volt supply circuits is generally the same as described in paragraphs 16, 17, and 18, respectively. In the series-drive vibrators, however, a separate contact is connected in series with the driving coil to periodically interrupt the battery circuit through the coil.

a. 85-Volt Supply Circuit. The battery circuit extends from pin C of J-1 to pin 7 of X-10 through the series arrangement of the vibrator reed and the additional driving contact, through the driving coil connected to pin 4 of X-10, and through filter choke L-5, fuse F-2, and contacts of switch S-1 in either the RECEIVE or TRANS & RECEIVE positions and back to terminal B of J-1.

b. 150-Volt Supply Circuit. When a series-drive vibrator is used in this circuit, the circuit similarly extends from pin 7 of X-8, through the series arrangement of the vibrator reed and the additional driving contact, through the driving coil connected to pin 4 of X-8, and through filter choke L-6 and fuse F-3 and over the contacts of switch S-1 in the TRANS & RECEIVE position to terminal B of J-1. Only the load circuit of the vibrator is completed through contacts of relay O-1.

c. 450-Volt Supply Circuit. The circuit arrangement for the 450-volt supply circuit when a series-drive vibrator is used is the same as described in *a* and *b* above, except that the circuit to terminal B of J-1 extends through choke coil L-7, fuse F-4, contacts of switch S-2 in the HIGH position, and contacts of switch S-1 in the TRANS & RECEIVE position. Only the load circuit of the vibrator is completed through contacts of relay O-1.

20. Power Supply PP-109/GR

(fig. 18)

a. Power Supply PP-109/GR is very similar to Power Supply PP-112/GR, but is designed for use with a 12-volt storage battery. Since 6-volt vibrators are used, however, voltage-dropping resistors R-18, R-20, R-13, R-14, R-1, and R-2 are used to drop the driving voltage to 6 volts. Resistors R-20, R-14,, and R-2 are effective when shunt-drive vibrators are used in the 85-, 150-, and 450-volt supply circuits, respectively. Resistors R-18, R-13, and R-1 are in the circuit when series-drive vibrators are used in the corresponding supply circuits.

b. In the case of the 6-volt shunt- or series-drive vibrator, the battery circuits for the 85-, 150-, and 450-volt supply circuits are very similar to those described for Power Supply PP-112/GR when using a corresponding vibrator.

c. The values of current-limiting resistors R-19, R-15, and R-3 differ from those of the corresponding parts in Power Supply PP-112/GR. In Power Supply PP-109/GR, buffer capacitors C-23, C-13, and C-2 are shunted across the secondary windings of transformers T-3, T-2, and T-1, respectively. The reason for this is that the values of capacitance which would be needed across the primary winding to accomplish the same purpose would be impracticable. These capacitors are dual units arranged in series to provide the proper voltage rating.

d. The filament supply circuit for the receiver is completed from the POWER IN connector to terminal L of J-2 through section D of S-1, fuse F-1, choke L-4, ballast tube R-31, contacts 7 and 5 of K-2, and choke L-16.

(1) Battery input filter L-4 and C-5 prevents h-f interference from reaching the battery circuit.

(2) Ballast tube R-31 will compensate for variations of the input source by changing resistance as the voltage varies and thereby regulating the amount of filament current.

(3) The function of the terminal relay is described in paragraph 13*c*. Note that voltage-dropping resistors R-33, R-34, and R-35 are placed in the circuits so that there is a greater voltage drop across the heater element of the thermal relay in Power Supply PP-109/GR

than in Power Supply PP-112/GR. The higher voltage is necessary because of the tendency of the relay to open and close too readily when operated from the lower voltage supply.

e. The transmitter filament supply circuit extends through contacts D of switch S-1, through fuse F-1, and choke L-4. It continues over the normaly open contacts (3 and 2) of relay O-1 and extends through parallel ballast tubes R-24 and R-25 to the normally closed contacts of thermal relay K-1. The 6.3-volt output is applied through filter choke L-14 to terminal N of J-2.

(1) Capacitor C-27 is an l-f a-c ripple filter.

(2) Choke L-14 in combination with capacitor C-28 is an h-f noise filter.

(3) The parallel arrangement of ballast tubes R-24 and R-25 is used to allow for the relatively large amount of transmitter filament current supplied by the circuit. Resistors R-26, R-27, and R-28 have functions comparable to those of resistors R-32, R-33, R-34, and R-35 associated with thermal relay K-2.

f. The value of resistor R-30 in the relay supply circuit differs from that of the corresponding part in Power Supply PP-112/CR.

CHAPTER 3

FIELD MAINTENANCE INSTRUCTIONS

Section I. PREREPAIR PROCEDURES

Note. This chapter contains information for 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 by the skill of the repairman.

21. Tools and Cleaning Equipment

Tools and cleaning materials needed for repairing and cleaning the power supplies are contained in Tool Equipment TE–113.

22. Test Equipment

The following equipment is required for making the tests described in this chapter:

1 Storage battery (24- or 12-volt for Power Supply PP–112/GR or PP–109/GR, respectively).
1 Voltohmmeter, such as Electronic Multimeter TS–505/U or equal.
1 D-C ammeter (ranges 0 to 10 and 0 to 20 amperes), Multimeter TS–352/U.
1 Vacuum-tube voltmeter, Electronic Multimeter ME–6/U or equal.
1 Voltammeter I–50.
10 Load resistors, wire wound, ±5% tolerance. For values see figure 14.
1 Tube Tester I–177.
1 Fuse, 20 amperes, 25–30 volts.
1 Fuse, 15 amperes, 25–30 volts.
1 Capacitor, paper, 2 uf ±10%, 600 vdcw.
1 Resistor, composition, 5,000 ohms ±10%, 1 watt.
1 Test Lead Set CX–1331/U.
1 On-off switch.

Caution: Do not operate the power supply without the suitable loads. The output voltage of the power supply when operated without output loads is considerably higher than normal, because of the inherent regulation of the unit.

23. Removal of Pluck-Out Parts

(figs. 3 through 6, 10, and 11)

a. Fuses. All fuses in the power supply are accessible from the front panel. Unscrew the fuse caps at the top of the front panel. Removal of the caps will also cause the fuses to come out of their holders, as the caps are also fuse extractors.

b. Removing Immersionproof Case. Before the other pluck-out parts can be reached, the immersionproof case must be removed. Loosen the Dzus fasteners around the edges of the front panel. Stand the unit on the front panel and lift off the case. Be careful not to damage any wiring or components while removing the case. Place the panel-and-chassis assembly on a flat surface so that the front panel hangs over the edge and the bottom chassis rests on the surface. This precaution is necessary to prevent damage to switches and wiring.

c. Removing Heat Barriers. Heat barriers, consisting of flexible sheets of heat-insulating material, have been inserted in various locations in the units to protect wire insulation from high heat sources. This material usually must be removed when the unit is being disassembled, but must be replaced on reassembly. It is extremely important for the operating life of the equipment that these barriers be in place at all times.

d. Removing Vibrators. The three vibrators used in the power supply (E-1, E-2, and E-3) are located on the bottom chassis (fig. 5). Pull the vibrators from their sockets. Do not rock or jiggle the vibrator in its socket, since this may spread the vibrator socket contacts and damage the vibrator. Use a straight upward pull. If necessary, pry the vibrator out of the socket by means of a screw driver In doing so, be careful not to damage the socket, spread the vibrator-retaining spring clip, or break the rubber seal at the base of the vibrator. Once the vibrator is free from its socket it can be removed by tilting it toward the side of the unit.

e. Removing Electrolytic Capacitors.

(1) The two large plug-in type electrolytic capacitors, C-27 and C-30, are held in place by spring clips on a bracket attached to the right side of the front chassis assembly (fig. 5). Remove the screws which hold the bracket and spring-clip assembly in place. Save the screws and associated washers; they will be needed for reassembly purposes. Lift off the bracket and spring-clip assembly. Re-

move the electrolytic capacitors by a straight pull (lateral or upward, depending on the position of the power supply unit). Do not rock or jiggle the capacitors in their sockets; the capacitors or socket prongs may be damaged.

(2) Remove electrolytic capacitors C-3, C-9, C-10, C-14, and C-25 from the top front chassis (fig. 3). Observe the precautions noted in (1) above.

Note. Electrolytic capacitor C-17 is not a plug-in part.

f. Removing Rectifier Tubes, Ballast Tubes, Thermal Relays, and Voltage Regulator Tubes. These parts are located on the rear chassis, at the top of the unit (figs. 3 and 4). While removing these parts, be careful not to damage socket contacts at the prongs on the part.

24. Disassembly for Inspection and Cleaning

(figs. 10, 11, and 12)

a. General. Save all screws and washers removed during the following disassembly procedure; they will be needed for reassembly of the unit. Place the screws in their original holes; this will prevent them from being lost and will serve as a reminder as to where they belong.

Caution: Once the front panel has been loosened, be careful not to pull on the wires or to otherwise damage any of the exposed parts or wiring Do not pull on the panel while the chassis is being disassembled or moved about.

b. Panel. Place the unit, less case and pluck-out parts, on the edge of a flat surface, so that the

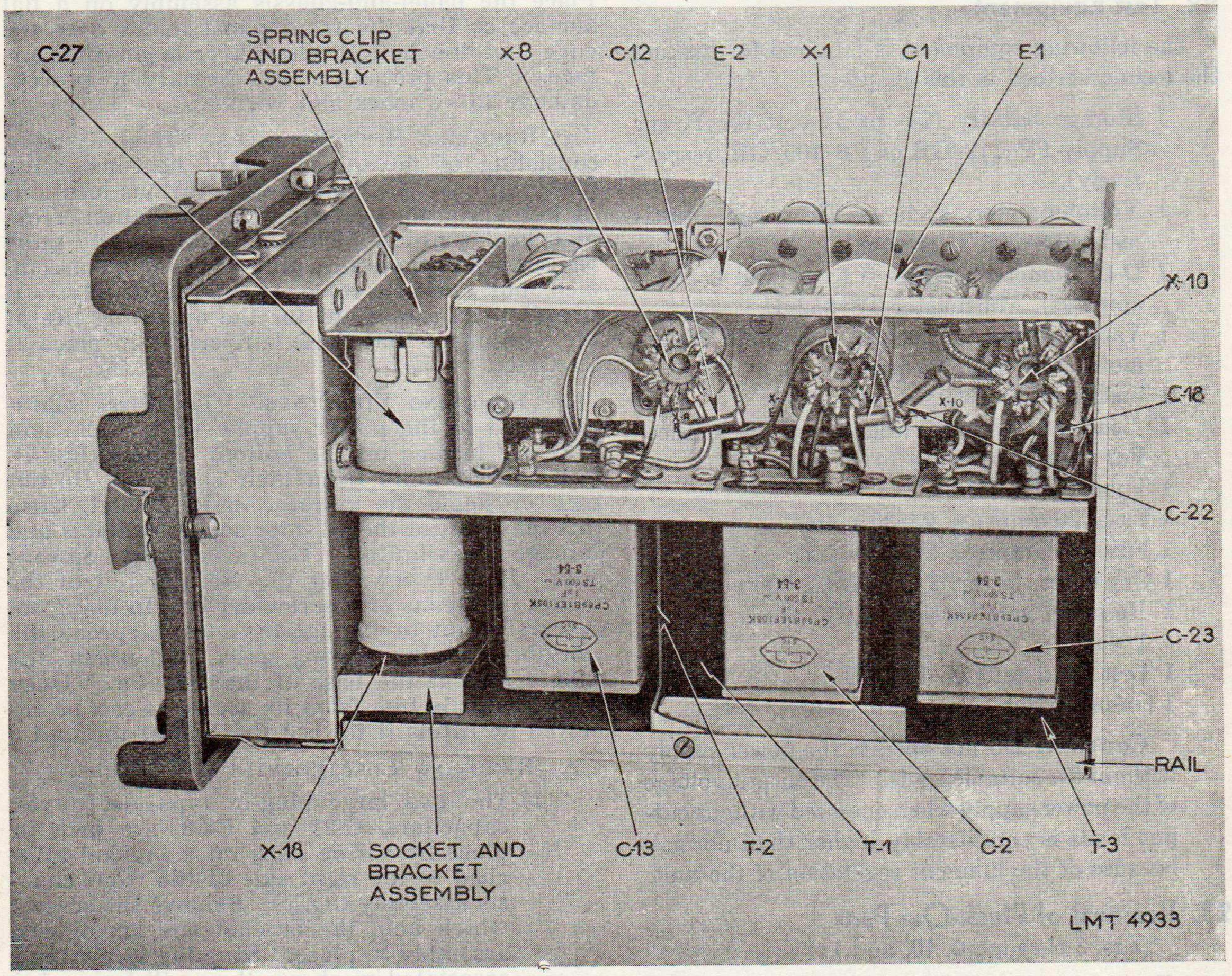


Figure 10. Power Supply PP-112/GR, bottom view.

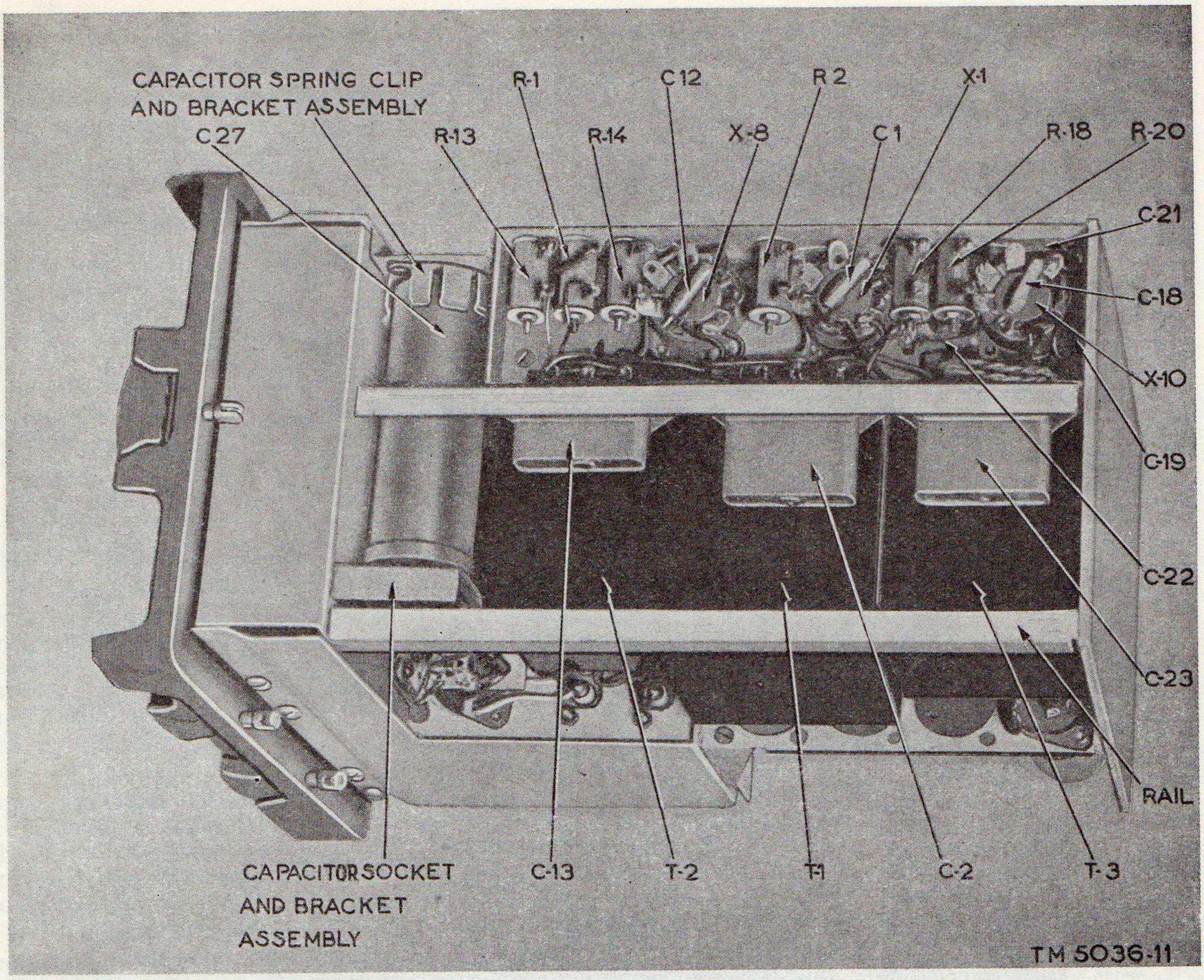


Figure 11. Power Supply PP-109/GR, bottom view.

front panel hangs over the edge of the surface and the bottom chassis rests on the surface. Proceed as follows:

(1) Remove the eight screws and shakeproof washers wich hold the panel to the main chassis assembly.

(2) Carefully pull the panel away from the chassis as for as the cable wiring will permit. Do not loosen any of the soldered connections. Do not place undue strain on the cable. Handle switch assemblies only when necessary.

(3) Rest the panel on the surface; do not strain the cable wires.

c. Bottom Chassis. To disengage the bottom chassis, proceed as follows:

(1) Turn the unit upside down. Facing the rear of the power supply unit, remove of the rail in the upper left-hand corner of the unit, and remove the rail (fig. 11).

(2) Remove the nut which fasten the bracket of the transformer T-1 on the upper chassis assembly.

(3) Place the unit on its side, so that the vibrator shelf is uppermost, the rear plate to the right, and the front panel to the left (fig. 10).

(4) Remove the three hexagonal-head screws which fasten the transformer and buffer capacitor mounting bracket to the front of the assembly.

(5) Remove the five flat-head screws which hold the bottom chassis to the rear plate.

(6) The bottom chassis assembly can now be disengaged from the upper chassis and rear plate assembly. Pull the bottom chassis away from the rest of the unit. Do not loosen any soldered connections or place undue strain on the two connecting cables.

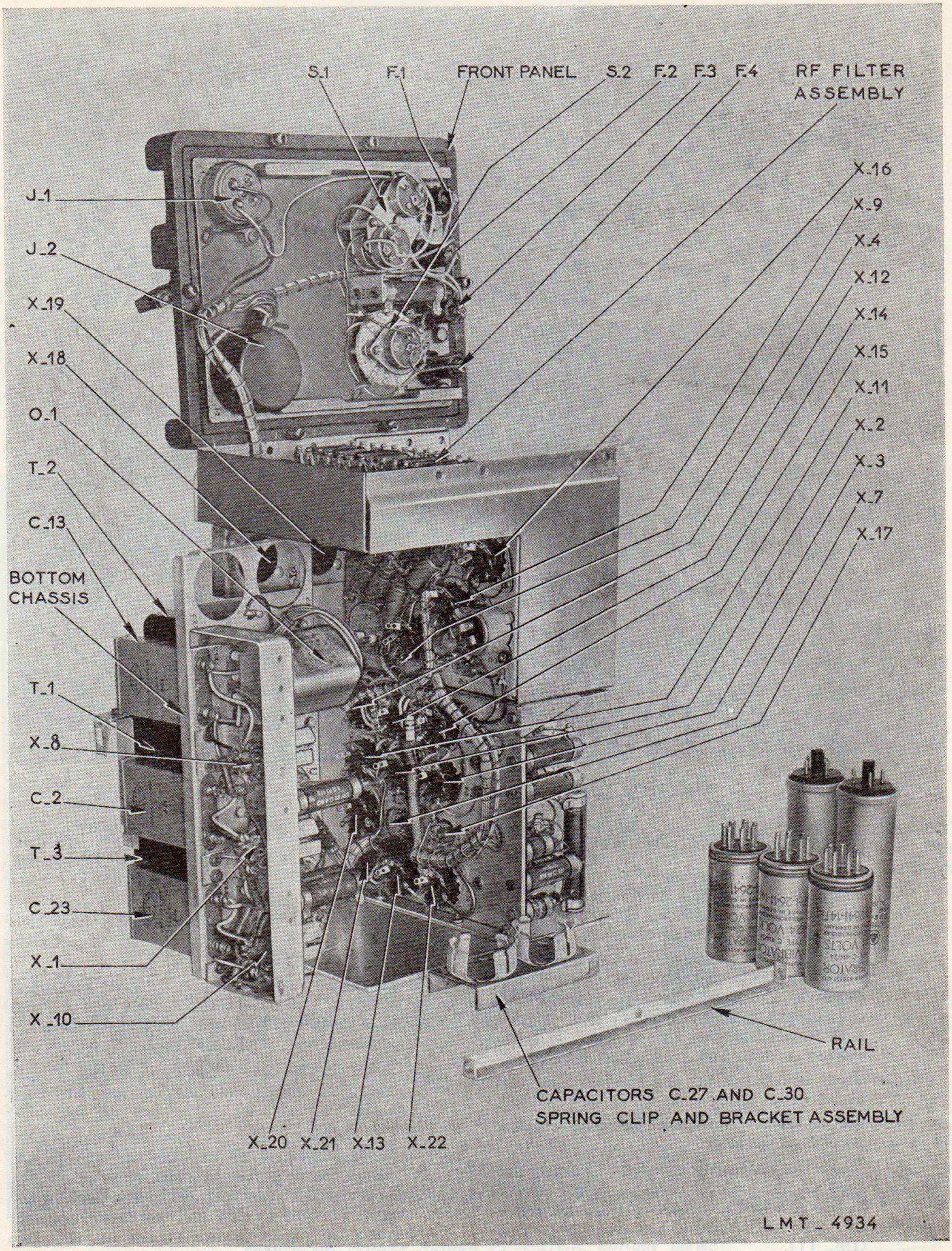


Figure 12. Power Supply PP-112/GR, disassembled view.

d. Upper Chassis Assembly. After the disassembly procedure described in *b* above has been accomplished, the upper chassis assembly can be moved away from the bottom chassis. Rotate the assembly to expose the wiring on the socket terminals (fig. 12).

25. Visual Inspection

After the unit has been disassembled (pars. 23 and 24), inspect all parts and wiring. Inspect the unit thoroughly for any abnormal conditions. If any are found, the cause of such conditions should be determined and the defects remedied before proceeding with trouble shooting and other tests (pars. 28 through 34). Repair instructions are given in paragraphs 35 through 38.

a. Chassis. Examine the chassis for bent or broken plates, defective welds or rivets, dirt, corrosion, or other defects.

b. Wiring. Examine the unit for loose, defective, or broken wiring. Look for charring, loose connections breaks in the insulation, or other damage. Examine especially the lugs on the sockets for capacitors, vibrators, and tubes, and on transformers, chokes, switches, and connectors.

c. Mounting Hardware. Examine all nuts, bolts, and other mounting hardware on the chassis to make sure that they are not loose. Loose mounting hardware may cause intermittent noises in the set which is operated from the power sunpply.

d. Sockets. Inspect tube, vibrator, and electrolytic capacitor sockets for broken or excessively spread contacts. Examine the contacts for corrosion, dirt and grease. Check socket mounting hardware to make sure that the sockets are secured firmly to the chassis. Check the condition of all wiring to the sockets.

e. Plugs and Connectors. Examine plugs and connectors for improper contact tension, loose mounting hardware, or corrosion. Check wiring to the connectors for improper connection, breaks, or damage to insulation.

The panel connectors at the rear of the front panel are packed with a silicone grease and covered with rubber caps. Do not remove the caps or disturb the grease pack unless there is good reason to believe that the connector is damaged or unless it is necessary to repair a wire connection to the connector terminal.

f. Capacitors. Examine capacitors for signs of discoloration, leaks, bulges, dirt, loose mounting, or loose connections. Check for swelling or leaky electrolytic capacitors. Melted or oozing wax or other dielectric is a sign of damage to the part. Such capacitors should be removed for an electrical check and replaced with good ones. Metal encased capacitors should be cleaned and the mounting hardware should be tightened.

g. Resistors. Examine resistors for blistering, discoloration, or other signs of overheating. Inspect leads and all other connections for corrosion, dirt, dust, looseness, or broken or trailing strands in the connecting wires. Discoloration of a resistor usually indicates that it has been overheated or operated under overload; this indicates a defect in another component. (Power resistors may discolor due to the heating of the fungicidal lacquer; this does not indicate a defective resistor.) Do not wiggle resistors that have pigtail connections. These connections may break at the point of entry into the body of the resistor and thus make the resistor useless.

h. Transformers and Chokes. Leakage of potting compound from chokes and transformers usually indicates a short-circuited or overloaded coil winding and possibly a defective resistor or capacitor.

i. Relay. Check for broken connecting leads.

j. Fuse Holders. Check fuse holders and fuse caps for signs of burning, charring, or corrosion, and for poor contact with the fuse.

Note. A burned-out fuse is usually a sign of failure in another part of the circuit. When a fuse in one of the four main circuit branches is found to be burned out, the trouble is automatically localized to that particular branch, that is, the 1-v filament and relay supplies, the 85-volt supply, the 150-volt supply, or the 450-volt supply.

k. Spring Clips. Check for tension and breakage.

l. Switches. Operate the switches on the front panel to each of their operating positions, to determine that they work easily with no searching for contacts. Examine switch contacts for evidences of corrosion, improper contact, and dirt.

26. Cleaning

a. Dirt or corrosion will interfere with electrical continuity and mechanical efficiency of the parts of the unit by causing circuits to be shorted or insulated, or by causing switches to be jammed. For these reasons, it is important to clean all parts of the chassis and panel carefully and thoroughly.

b. Cleaning means the removal of dust, grease, rust, corrosion, moisture, wax, or soot. No set method can be given for removal of dirt because of the many ways and places in which it can collect. Cleaning should be done with a lintless cloth, fine (#000) sandpaper, crocus cloth, or a soft brush. In more difficult cases, carefully clean the affected parts with the sharp edge of a screw driver. Dust and grease can usually be removed with a cloth or brush moistened with solvent (SD). Never use gasoline for cleaning. Use extra care in cleaning spots which

are difficult to reach or parts which are delicate, to avoid damage to wiring or parts. Where it is necessary to remove portions of the moisture-proof-fungiproof coating to clean a part properly, refinishing is essential. Refinishing information is given in paragrah 42.

c. Use an air hose if available to blow out dust and lint from the chassis. Make sure, however, that no oil or water is carried along with the air stream, and that the air stream is controlled so that damage to small resistors and capacitors does not result. Always direct the first blast of air toward the floor to clear moisture from the hose.

d. Clean cases of all capacitors, contact pins on electrolytic capacitors, and dirty or corroded connections. A dry cloth will do the job. If the dirt is hard to remove, moisten the cloth with solvent (SD).

e. Remove loose dirt from resistors with a small brush.

f. Clean dirty or corroded socket and switch contacts. Clean vibrator and capacitor spring clips. Use fine sandpaper or crocus cloth to remove corrosion, oxidation, or dirt.

27. Inspecting and Cleaning Pluck-Out Parts

a. Inspect the vibrator shells for discoloration caused by overheating, and inspect the bases for dirty or loose pins. If the vibrator is in bad condition, check as described in paragraph 28*a*. If defective, discard it and substitute a vibrator known to be in good condition. Inspect the electrolytic capacitors for corrosion, or bulging. If any of these conditions are observed, test as described in paragraph 28*b*. If capacitor is defective, substitute an electrolytic capacitor known to be in good condition. Clean the base pins of the vibrators and electrolytic capacitors by rubbing them lightly with fine crocus cloth, them dust them with a small clean brush. Clean the base, shell, and pins with a clean lint-free cloth moistened with solvent (SD). Dry in an air dratt.

Note. The vibrators are hermetically sealed into their shells; they should never be opened.

b. Inspect glass and metal envelopes of tubes, thermal relays, ballast tubes, and voltage regulators for dirt and corrosion. Replace any of these items which have loose envelopes. Inspect the bases and pins of these items for damage. Clean dirty and corroded pins, use fine sanspaper to remove corrosion, oxidation, and dirt, then wipe off moisture with a clean, dry cloth.

c. Clean fuse ends and clips with fine sandpaper. Wipe with a clean cloth.

28. Testing Pluck-Out Parts

The tests for the pluck-out parts (*a* through *g* below) require the use of an ohmmeter. These tests are continuity checks and they do not test the part for actual performance. Substitution of the part in a set known to be operating properly is a more reliable test procedure. However, this substitution test should not be attempted if continuity checks indicate a faulty part. For rectifier tubes, ballast tubes, and voltage regulators, use a suitable tube checker to test the part for proper functioning.

a. Vibrators. Using an ohmmeter, test each vibrator for normal electrical continuity, as shown in the chart below:

Pins	24-volt vibrator (Power Supply PP-112/GR)		6-volt vibrator (Power Supply PP-109/GR)	
	Series-drive (ohms)	Shunt-drive (ohms)	Series-drive (ohms)	Shunt-drive (ohms)
4 and 7	480 to 540	Infinity	12	Infinity.
3 and 7	Infinity	Infinity	Infinity	40.
1 and 7	Infinity	430 to 540	Infinity	Infinity.
2 and 7	Infinity	Infinity	Infinity	Infinity.
5 and 7	Infinity	Infinity	Infinity	Infinity.
6 and 7	Infinity	Infinity	Infinity	Infinity.

b. Electrolytic Capacitors. Before making any measurements or repeating a measurement, discharge the capacitor by shorting the positive and negative terminals.

(1) The plug-in electrolytic capacitors can be tested by using an ohmmeter. For testing the capacitors which have a h-v rating (C-9, C-10, C-14, and C-25), use the high-resistance scale (at least 5 megohms) of the ohmmeter. For the l-v capacitors

(C–3, C–27, and C–30), use the 50,000-ohm range of the ohmmeter. Test each section of dual electrolytic capacitors separately.

(2) Connect the positive lead of the ohmmeter to the positive terminal of the capacitor. Connect the negative lead of the meter to the negative terminal of the capacitor. The ohmmeter first should indicate a very low value of resistance. The pointer then should move toward the high-resistance readings on the scale.

(3) The final resistance reading should be about 1 megohm for h-v capacitors C–9, C–10, C–14, and C–25 and about 15,000 ohms for each section of l-v capacitors C–3, C–27, and C–30.

(4) If the final reading for either section of the h-v capacitors is less than 250,000 ohms, the part probably is defective and should be replaced. If the final resistance reading for any l-v capacitor is less than 15,000 ohms, the capacitor is faulty and should be replaced. The measurement data is summarized in the following chart:

Circuit symbol	Capacity (uf)	Voltage rating (volts)	Ohmmeter range	Terminal connection		reading (ohms)
				Positive	Negative	
C–9, C–10, C–14:						
Section A	35	350	5 megohms	3	1	250,000
Section B	35	350	5 megohms	5	1	250,000
C–25:						
Section A	45	300	5 megohms	3	1	250,000
Section B	45	300	5 megohms	5	1	250,000
C–3	500	50	50,000 ohms	5	1	15,000
C–27, C–30	2,000	15	50,000 ohms	5	1	15,000

c. Thermal Relays (K–1 and K–2). Use an ohmmeter to check continuity as follows:

Pins	*Meter reading (ohms)*
5 and 7	0
2 and 3	28

d. Ballast Tubes. An ohmmeter connected between pins 2 and 7 of the ballast tube should show a continuity reading. The actual resistance is very small and depends on the current through the tube.

e. Voltage Regulator Tubes. Use an ohmmeter to make the measurements indicated as follows:

Pins	*Reading*
1 and 5	continuity
2 and 4	continuity
2 and 7	continuity
2 and 5	open

Note. An emission check can be obtained by means of a tube checker.

f. Rectifier Tubes. Using a tube checker (such as Tube Tester I-177) capable of measuring the type 1007 rectifier tubes, check tubes V-1 and V-2. If this is not possible, use an ohmmeter to make the following continuity checks:

Pins	*Reading*
1 and shell	continuity
7 and 8	continuity
3 and 7	infinity
5 and 7	infinity

g. Fuses. Use an ohmmeter to check the fuses for continuity.

29. Reassembly

The arrangement of Power Supplies PP-109/GR and PP-112/GR is such that even though the units are disassembled as described in the preceding paragraphs, electrical continuity exists between all parts of the unit. Because of the complexity of the mechanical arrangement, the unit should be left unassembled for the tests and repairs which are described in the following sections. The trouble-shooting procedures (sec. II) and the repair procedures (sec. III) are based on the assumption that the units are in a disassembled condition. Do not reassemble the unit until the required results are obtained after making the checks (pars. 31 and 32) and necessary repairs. The reassembly procedure is given in paragraph 37.

Caution: When power is applied to the unit in a disassembled condition, very high voltages exist at various points in the circuit. Be extremely careful to avoid touching any exposed part, since the voltages are high enough to cause severe injury or death.

Section II. FIELD TROUBLE SHOOTING

Warning: a. When servicing Power Supply PP-109/GR or PP-112/GR, be extremely careful because of the high voltages exposed. Always turn the OPERATE switch, S-1, to the OFF position before making resistance measurements or before touching parts or wiring in the unit. Even with the power source disconnected from the unit, potentials as high as 600 volts may still be present across capacitors, particularly the electrolytic capacitors. Before touching any part or repairing the unit when the voltage is shut off, short the part to ground. When making voltage measurements on exposed parts or terminals, use heavily insulated test probes. Keep one hand in pocket.

b. Never connect the battery to the power supply unless suitable output loads are connected across each pair of output terminals (fig. 14).

30. Trouble-Shooting Procedures

The test procedures for locating trouble in the power supply are outlined in the following steps:

a. SHORT-CIRCUIT CHECKS. Resistance measurement are made to locate short circuits which may damage the battery or the equipment when power is applied (par. 31).

b. OPERATIONAL CHECKS. Measurements of the input voltage, the battery current drain in the input circuit, and the voltage delivered in the output circuits are made as a rapid check of the operating conditions of the power supply (par. 32).

c. RESISTANCE MEASUREMENTS. These tests are made to locate faults or defective components and wiring (par. 33).

d. VOLTAGE MEASUREMENTS. Voltage measurements (par. 34) at significant points of the circuit may disclose faults not observed during previous tests.

31. Short-Circuit Checks

Restore good fuses into the proper fuse holders on the panel, replace the fuse caps, and using Electronic Multimeter Ts-505/U, make the resistance measurements listed in the following subparagraphs. To make these measurements, it is assumed that the other pluck-out parts are not in their sockets, that the unit has not yet been reassembled, and that all external cables have been disconnected. Use an ohmmeter range suitable for the particular resistance reading to be obtained.

a. Make the measurements indicated in figure 13. The readings at POWER IN connector J-1 should be taken for all three positions of OPERATE switch S-1. The readings at POWER OUT connector J-2 should be taken for both positions of TRANS POWER switch S-2. The readings shown in figure 13 should be obtained.

b. Make the measurements indicated in the following table. All measurements are made to ground.

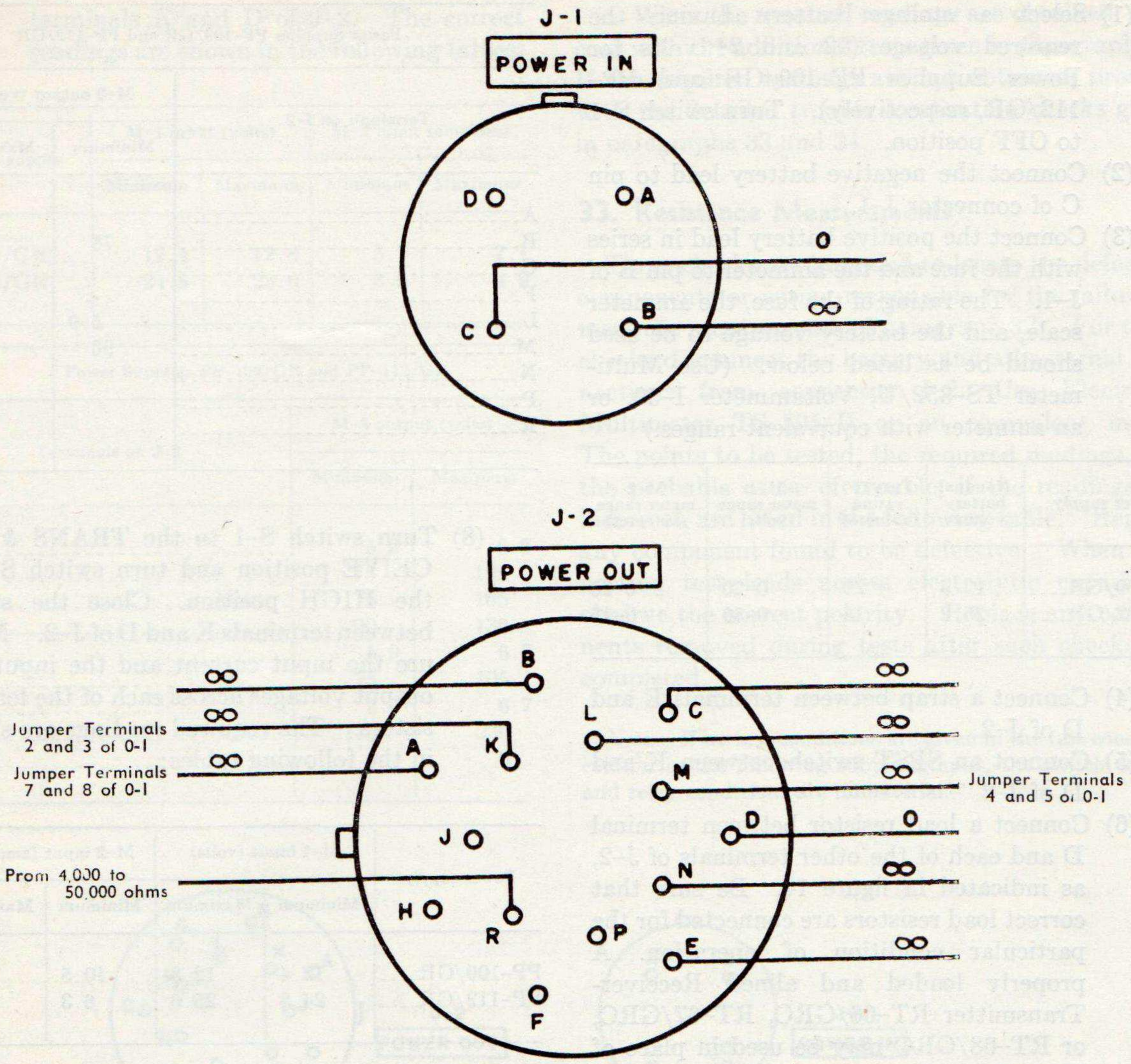
Terminal	On part	Typical reading (ohms)	Test conditions
F	J-2	22,500	S-2 in LOW position.
P	J-2	31,500	S-2 in LOW position.
F	J-2	18,650	S-2 in HIGH position.
P	J-2	24,000	S-2 in HIGH position.
8	T-1	4,000 to 50,000 *	S-2 in HIGH position.
5	T-1	Infinity	S-2 in HIGH position.
7	T-3	24,000	S-2 in HIGH position.
5	T-3	Infinity	S-2 in HIGH position.

* For this reading connect the negative lead of the ohmmeter to the chassis for this measurement.

c. Do not apply power to the unit until the tests of *a* and *b* above have been made and until the indicated readings are obtained. Incorrect readings may indicate a shorted or leaky capacitor, or a wire or a lug shorted to the chassis. Check each capacitor in the affected circuit section for leakage or a short, and replace if necessary. Check wires and lugs on component parts, particularly on switches. Repair if necessary. Refer to the schematic diagrams of figures 17 and 18.

32. Operational Tests and Procedures

a. The purpose of the operational checks described in this paragraph is to determine whether the power supply delivers the proper output voltages and draws the required amount of current from the storage battery when loads simulating actual operating conditions are connected across the output terminals. The tests are made for the various conditions under which the unit may be operated, namely, for each position of switch S-2 and for the RECEIVE or TRANS & RECEIVE position of switch S-1. Based upon the results of these measurements, the trouble in the power supplies may be sectionalized di-



NOTE 1 : CONNECTORS VIEWED FROM WIRING SIDE.

NOTE 2 : ALL MEASUREMENTS MADE TO CHASSIS.

NOTE 3 : RESISTANCE DATA APPLY FOR ALL POSITIONS OF OPERATE SWITCH S-1 AND TRANS POWER SWITCH S-2.

NOTE 4 : MEASUREMENT ON J-2 TAKEN WITH JUMPERS WHERE INDICATED.

NOTE 5 : FOR VALUES NOT GIVEN SEE TEXT.

NOTE 6 : ALL PLUCK-OUT PARTS ARE REMOVED FOR THESE MEASUREMENTS.

Figure 13. *Resistance tests at connectors J-1 and J-2.*

rectly to one of the circuit sections. Refer to the detailed checks outlined in paragraphs 33 and 34 to trace the fault to a specific part within the particular circuit section.

b. Refer to the operational test set-up shown in figure 14 and proceed as follows, using the test equipment listed in paragraph 22. Insert all plug-in parts.

(1) Select a storage battery having the required voltage (12 and 24 volts for Power Supplies PP-109/GR and PP-112/GR, respectively). Turn switch S-1 to OFF position.

(2) Connect the negative battery lead to pin C of connector J-1.

(3) Connect the positive battery lead in series with the fuse and the ammeter to pin B of J-1. The rating of the fuse, the ammeter scale, and the battery voltage to be used should be as listed below. (Use Multimeter TS-352/U, Voltammeter I-50, or an ammeter with equivalent ranges.)

Power supply	Nominal battery voltage	Fuse (F) rating (amperes)	M-1 meter range (volts)	M-2 meter range (amperes)
PP-109/GR----	12.6	20	0-20	0-20
PP-112/GR----	25.2	15	0-50	0-15

(4) Connect a strap between terminals E and D of J-2.

(5) Connect an SPST switch between K and D of J-2.

(6) Connect a load resistor between terminal D and each of the other terminals of J-2, as indicated in figure 14. Be sure that correct load resistors are connected for the particular condition of operation. A properly loaded and alined Receiver-Transmitter RT-66/GRC, RT-67/GRC, or RT-68/GRC may be used in place of the load resistors.

(7) Turn switch S-1 to the RECEIVE position and turn switch S-2 to the HIGH position. Using Electronic Multimeter TS-505/U, measure the input and output voltages across each of the load resistors as indicated by meters M-1 and M-3 in figure 14. Also note the ammeter reading. The required readings are shown in the following tables. For this check, keep the switch between terminals K and D of J-2 open.

Power Supplies PP-109/GR and PP-112/GR

Power supply	M-1 input (volts)		M-2 input (amperes)	
	Minimum	Maximum	Minimum	Maximum
PP-109/GR----	12.4	12.8	2.05	2.55
PP-112/GR----	24.8	25.6	1.40	1.60

Power Supplies PP-109/GR and PP-112/GR

Terminals on J-2	M-3 output (volts)	
	Minimum	Maximum
A		
B	78	92
C		
F		
L	5.9	6.7
M	96	114
N		
P		
R		

(8) Turn switch S-1 to the TRANS & RECEIVE position and turn switch S-2 to the HIGH position. Close the switch between terminals K and D of J-2. Measure the input current and the input and output voltages across each of the load resistors. The required readings are shown in the following tables:

Power supply	M-1 input (volts)		M-2 input (amperes)	
	Minimum	Maximum	Minimum	Maximum
PP-109/GR----	12.4	12.8	10.5	13.2
PP-112/GR----	24.8	25.6	6.3	8.0

Power Supplies PP-109/GR and PP-112/GR

Terminals on J-2	M-3 output (volts)	
	Minimum	Maximum
A	5.2	6.0
B	78	92
C	138	161
F	215	285
L	5.9	6.7
M	85	115
N	5.9	6.7
P	415	485
R	−23	−31

(9) Keep switch S-1 in the TRANS & RECEIVE position and set switch S-2 in the LOW position. Close the switch between

terminals K and D of J–2. The correct readings are shown in the following tables:

Power supply	M–1 input (volts)		M–2 input (amperes)	
	Minimum	Maximum	Minimum	Maximum
PP–109/GR	12.4	12.8	5.7	7.1
PP–112/GR	24.8	25.6	3.9	4.9

Power Supplies PP–109/GR and PP–112/GR

Terminals on J–2	M–3 output (volts)	
	Minimum	Maximum
A	5.2	6.0
B	75	105
C	75	105
F	90	130
L	5.9	6.7
M	75	105
N	5.9	6.7
P	170	230
R	0	0

c. When the required readings are obtained, proceed with the additional tests given in paragraph 39. If the required readings are not obtained, proceed with the detailed trouble localization checks given in paragraphs 33 and 34.

33. Resistance Measurements

These checks are intended to locate the defective components or wiring responsible for the failure to meet the requirements of paragraph 32. For these checks disconnect the battery and all external connections from connector J–2. Use Electronic Multimeter TS–505/U or an equivalent meter. The points to be tested, the required readings, and the probable cause of trouble, if the readings are incorrect, are listed in the following table. Replace any component found to be defective. When connecting test leads across electrolytic capacitors, observe the correct polarity. Replace any components removed during tests after such checks are completed.

Note. If no test conditions are given in the test condition column in the following subparagraphs, the switch setting and relay conditions are immaterial.

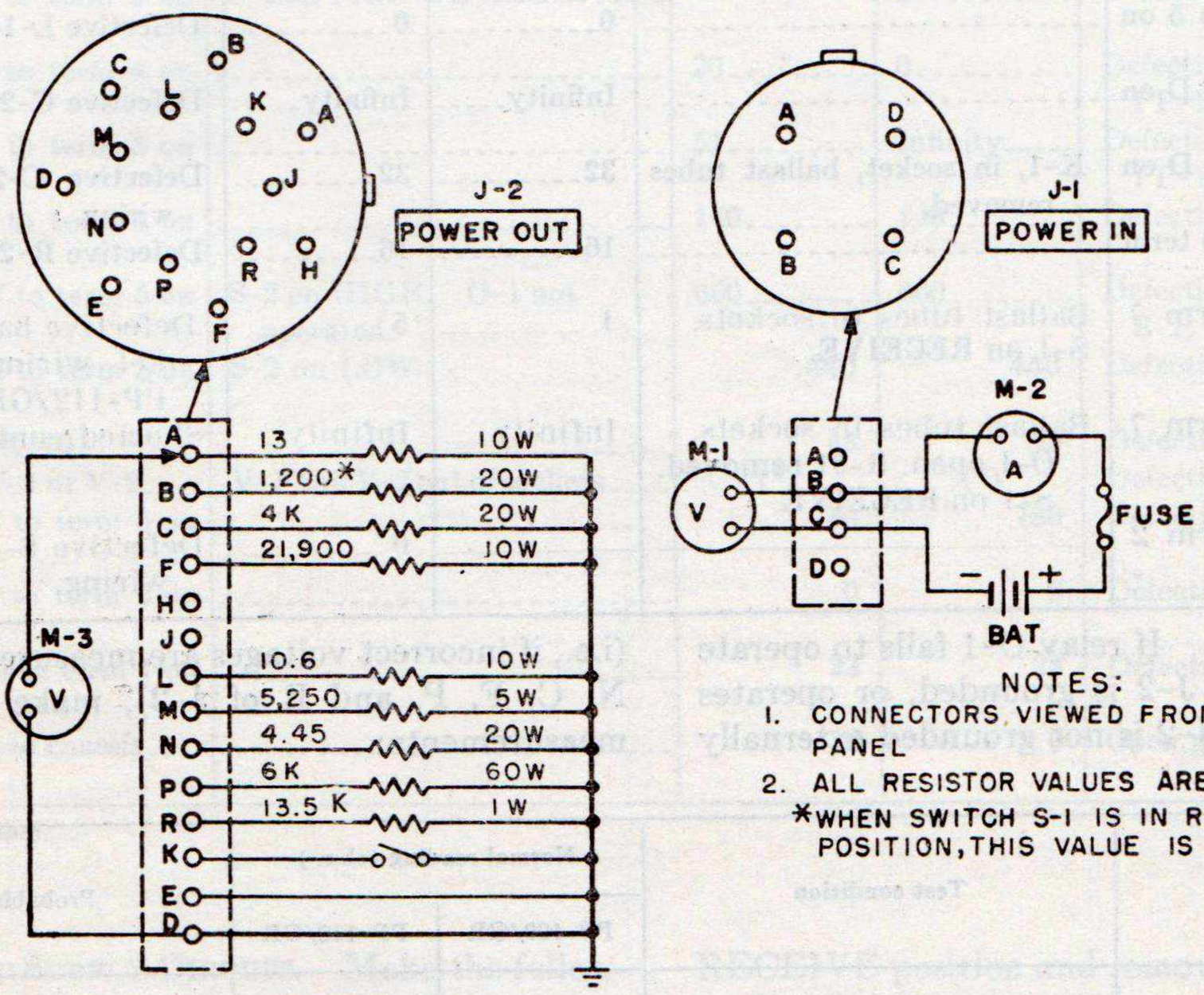


Figure 14. Power Supplies PP–109/GR and PP–112/GR, operational test set-up.

a. RECEIVER FILAMENT SUPPLY CIRCUIT. If incorrect or no output voltage is measured at terminal L of J–2, make the following measurements. In Power Supply PP–112/GR, remove R–31, K–2, and R–40 from their sockets.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B on J–1 to t rm 2 on R–40 (or R–31) socket.	S–1 on RECEIVE	0	9	Defective S–1, F–1, L–4, or R–39 in Power Supply PP–112/GR only.
Term 7 on R–40 to term 2 on R–31 socket.			0	Defective wire.
Term 7 on R–31 socket to term L on J–2.	K–2 plugged in	16	16	Defective R–32 or L–16.
		0	0	Defective K–2, or wiring.
Term L on J–2 to term D on J–2.		Infinity	Infinity	Defective wiring, C–30, or C–31.
Term L on J–2 to term D on J–2.	K–2 plugged in	32	32	Defective K–2, R–33, R–34, R–35, or wiring.

b. TRANSMITTER FILAMENT SUPPLY CIRCUIT. If incorrect or no output voltage is measured at terminal N of J–2, make the following measurements. For these measurements, remove thermal relay K–1 from its sockets.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term N on J–2 to term 5 on K–1 socket.		0	0	Defective L–14.
Term N on J–2 to term D on J–2.		Infinity	Infinity	Defective C–27 or C–28.
Term N on J–2 to term D on J–2.	K–1, in socket, ballast tubes removed.	32	32	Defective C–27, or C–28, or wiring.
Term 5 on K–1 socket to term 7 on K–1.		16	16	Defective R–26.
Term 3 on O–1 to term 7 on K–1 socket.	Ballast tubes in sockets. S–1 on RECEIVE.	1	5	Defective ballast tube socket wiring, or R–36 in PP–112/GR only.
Term B on J–1 to term 7 on K1.	Ballast tubes in sockets. O–1 open. R–31 removed. S–1 on RECEIVE.	Infinity	Infinity	Shorted contacts of O–1.
Term B on J–1 to term 2 on O–1			0	Defective S–1, F–1, L–4, or wiring.

c. RELAY CIRCUIT. If relay O–1 fails to operate when terminal K of J–2 is grounded, or operates when terminal K of J–2 is not grounded externally (i.e., if incorrect voltages are measured at terminals N, C, F, P, and R of J–2), make the following measurements:

Point of measurement	Test condition	Normal reading (ohm)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B on J–1 to term K on J–2.	S–1 on RECEIVE	63	285	Defective S–1, F–1, L–4, coil of O–1, L–10.

d. RELAY SUPPLY CIRCUIT. If incorrect or no output voltage is measured at terminal A of J–2, make the following measurements:

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term A on J-2 to term 7 of O-1.	S-1 on RECEIVE	16	45	Defective L-15 or R-30
Term A on J-2 to term B of J-1.	S-1 on TRANS & RECEIVE	16	45	Defective L-15, R-30, L-6, F-3, or S-1.

e. 85-VOLT SUPPLY CIRCUIT. Make the following measurements if incorrect or no output voltage is measured at terminal B or M of J–2. For these measurements, remove vibrator E–3 from its socket.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B to C on J-1	S–1 on RECEIVE. R–31 removed.	Infinity	Infinity	Defective C–6 or C–18, C–20 or C–22.
Term B on J-1 to term	S–1 on RECEIVE	(*)	2.7	Defective S–1, F–2, L–5, R–19, or T–3.
1 on X–10	S–1 on TRANS & RECEIVE	(*)	2.7	Defective S–1 or wiring on S–1.
Term B on J-1 to term 6 on X-10.	S–1 on TRANS & RECEIVE	(*)	2.7	Defective T–3.
Term B on J-1 to term 4 on X-10.		20	0	Defective wiring or R–18 in PP–109/GR only.
Term B on J-1 to term 3 on X-10.		51	Infinity	Defective wiring or R–20 in PP–109/GR only.
Term B on J-2 to term 5 on X-17.		140	140	Defective L–13 or R–23.
Term 5 on X-17 to term 5 on T-3.	S–2 on HIGH. O–1 not operated.	660	660	Defective L–12, R–21, R–22, S–2, O–1 contacts, or T–3.
Term 5 on X-17 to term 5 on T-3.	S–2 on LOW.	440	440	Defective S–2 or L–12.
Term 5 to 2 on X–10		45	45	Defective T–3.
Term 7 to 8 on V–1 or V–2	V–1 and V–2 out of sockets	(*)	(*)	Defective T–3.
Term M on J-2 to term 5 on T-3.		780	780	Defective R–17 or L–12
Term E on J-2 to term 2 on X-17.		0	0	Defective wire.
Term 2 on X–10 to term 1 on L–12.		23	23	Defective T–3 or wiring
Term 7 on X–10 to chassis		0	0	Open ground connection.

* Less than 1 ohm.

f. 150-VOLT SUPPLY CIRCUIT. Make the following measurements if the voltage readings at terminal C of J–2 are found to be incorrect. For these measurements, set switch S–1 in the TRANS & RECEIVE position and remove vibrator E–2 from its socket. Set switch S–2 as directed in the test condition column.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP-109/GR	PP-112/GR	
Term B on J-1 to term 4 on X-8.		20	0	Defective S-1, F-3, L-6, or R-13 in PP-109/GR.
Term B on J-1 to term 2 on T-2.	O-1 unoperated	Infinity	Infinity	Defective contacts of O-1.
Term 8 on O-1 to term 2 on T-2.		(*)	2	Defective R-15, or wiring.
Term 8 on O-1 to term 1 on X-8.		(*)	3	Defective T-2.
Term 8 on O-1 to term 6 on X-8.		0.75	3	Defective T-2.
Term 6 to term 3 on X-8		51	Infinity	Defective T-2 or R-14 in PP-109/GR.
Term 7 on X-8 to chassis		0	0	Open ground connection.
Term 5 on X-8 to term 2 on X-8.		125	110	Defective T-2, or in PP-109/GR, C-13.
Term C on J-2 to term 5 on X-7 (V-3).		0	0	Defective wiring.
Term 2 on X-7 to chassis		0	0	Defective ground connection.
Term 2 on X-8 to term 3 on X-3 (V-2).		135	135	Defective T-2, T-1, or wiring.
Term C on J-2 to term 5 on T-2.	S-2 in HIGH position	660	660	Defective S-2, L-11, R-16, or L-9.
Term C to B on J-2	S-2 in HIGH position	Infinity	Infinity	Defective S-2 or wiring.
Term C to B on J-2	S-2 in LOW position	0	0	Defective S-2 or wiring.
Term 5 on T-2 to term 5 on T-1.		0	0	Defective wiring between T-1 and T-2.

g. 450-VOLT SUPPLY CIRCUIT. **Make the following measurements if incorrect voltage readings are obtained at terminal R, P, or F of J-2. For these measurements, remove vibrator E-1 from its socket, and set switch S-1 to the TRANS & RECEIVE position. Operate switch S-2 as directed in the test condition column.**

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP-109/GR	PP-112/GR	
Term B on J-1 to term 4 on X-1.	S-2 on HIGH	20	0	Defective S-1, F-4, L-7, or R-1 in PP-109/GR.
Term B on J-1 to term 4 on X-1.	S-2 on LOW	Infinity	Infinity	Defective S-2
Term B on J-1 to term 1 on X-1.	S-2 on HIGH. O-1 unoperated.	Infinity	Infinity	Defective O-1 contacts 9-10
Term 10 on O-1 to term 1 on X-1.	S-2 on HIGH.	(*)	3	Defective R-3, or T-1.
Term 10 on O-1 to term 6 on X-1.	S-2 on HIGH.	(*)	3	Defective T-1.
Term 6 to 3 on X-1		51	Infinity	Defective T-1 or R-2 in PP-109/GR
Term 7 on X-1 to chassis		0	0	Open ground connection.
Term 7 to 9 on T-1		12	12	Defective winding 7-8-9 of T-1.
Term R on J-2 to term 8 on T-1.		500	500	Defective L-2 or R-6.

* Less than 1 ohm.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP-109/GR	PP-112/GR	
Term 5 on X-2 to term 3 on X-3.		150	160	Defective winding 4-5-6 of T-1.
Term 3 on X-2 to term 3 on X-3.		1 megohm	1 megohm	Defective R-4.
Term 5 on X-2 to term 5 on X-3.		1 megohm	1 megohm	Defective R-5.
Term 5 on T-1 to term 5 on T-2.		0	0	Open wire.
Term 7 to 8 on X-2	V-1 and V-2 out of sockets	(*)	(*)	Defective winding 7-8 of T-3.
Term 7 to 8 on X-3	V-1 and V-2 out of sockets	(*)	(*)	Defective wiring.
Term P to D on J-2	S-2 on LOW	31,500	31,500	Defective S-2, R-12, or R-11.
Term P to D on J-2	S-2 on HIGH	24,000	24,000	Defective S-2, L-8, L-3, R-7 through R-10, C-9, C-10, or C-11.
Term P on J-2 to term 5 on T-2.	S-2 on HIGH	Infinity	Infinity	Defective S-2.
Term P on J-2 to term 5 on T-2.	S-2 on LOW	660	660	Defective S-2, L-11, R-16, or L-9.
Term P on J-2 to term 7 on X-2.	S-2 on HIGH	160	160	Defective L-1, L-3, L-8, or S-2.
Term F to term D on J-2	S-2 on LOW	22,500	22,500	Defective R-11.
Term 1 on X-3 to chassis		0	0	Open ground connection.
Term 1 on X-2 (V-1) to chassis.		0	0	Open ground connection.

* Less than 1 ohm.

34. Voltage Measurements

The voltage checks in this paragraph supplement the resistance measurements of paragraph 33 and are intended to find defects which are not readily determined by resistance measurements, that is, defective capacitors or partially shorted windings. For these measurements, reinsert all plug-in parts. Connect storage battery (+) to pin B on J-1 and storage battery (—) to pin C on J-1. Connect the load resistors, switch, and ground connection as described in paragraph 32. Refer to the schematics in figures 17 and 18 to identify the points measured with the component involved. Use Electronic Multimeter TS-505/U or an equivalent meter. The following table lists measurements at significant points in the circuits of the power supplies. All measurements are made to ground with TRANS POWER switch in the HIGH position and relay O-1 operated, the measurements apply to both power supplies.

Caution: High voltages are present at some of the measuring points.

Point of measurement	Normal reading (volts)	Probable trouble
Term 8 on T-1	−28	Defective T-1, shorted C-3, C-4.
Term 5 on T-1	175	Defective T-1, shorted C-14, C-9.
Term 5 on T-3	135	Defective T-3, shorted C-17, C-24, C-25, L-12.
Term 7 on T-3	467	Defective L-1, L-3, C-9, or C-10, or defective wiring.
Term 2 on L-9	170	L-9, R-16 grounded.
Term 2 on L-12	115	L-12 grounded, defective wiring.
Term 5 on V-4	95	Defective wiring, R-23 grounded.
Term 3 on K-2	5	Defective R-33, R-34, R-35.
Term 3 on K-1	5.4	Defective R-27, R-28.
Term 7 on R-40	12.6	Defective R-31, R-39, R-40.
Term 7 on R-38	12.6	Defective R-37, R-38, R-24, R-25 (and R-36 in PP-112/GR).

Section III. REPAIRS

35. Replacement of Parts

When replacing parts in Power Supplies PP-109/GR and PP-112/GR, observe the precautions given below.

a. TAGGING WIRES. If a wire is disconnected from any junction it should be tagged to make sure that correct rewiring will be done when a part is replaced. Before unsoldering any leads, tie together the leads that are attached to each part. Use small tags or short pieces of adhesive tape to identify all wires in accordance with their numbered connections. Identify every lead that is to be removed.

b. PARTS AND SUBSTITUTIONS. When damaged parts must be replaced, identical parts should be used. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must have identical electrical properties and must be of equal or higher voltage and current rating, than the original part.

c. LOCATION. Relocation of substituted parts may cause hum and is not recommended.

d. MOUNTING. Mount the new or replaced part in the same mounting as that formerly occupied by the damaged part. Fasten all mountings securely.

e. SOLDERING. Before soldering any connections, carefully scrape all parts that will be touched by the solder, until all traces of rust, corrosion, paint, or varnish are removed. Remove the craped parts with a small, clean brush. Tin all surfaces to be soldered. Wrap the wire around the lug to obtain mechanical support. Use a small amount of solder to make the connection and sufficient heat to make the solder flow evenly around the tinned surfaces.

f. RETROPICALIZATION. If the parts to be replaced require special treatment, such as retropicalization, follow the instructions given in the appropriate publication referred to in section V of this chapter.

36. Special Repair Procedures

Most of the parts in these power supplies are readily accessible and can be easily replaced without special instructions. Special repair procedures required for repairing or replacing sockets, r-f chokes, panel connectors, switch S-1, relay O-1, and the transformers are given in that order in the following subparagraphs.

a. SOCKETS. All sockets are attached to the chassis by means of rivets. To change a socket:

(1) Remove the part plugged into the socket.
(2) Unsolder the wires connected to the socket.
(3) Drill out the two rivets which fasten the socket to the chassis.
(4) Substitute a new socket and fasten it with rivets or machine screws, lockwashers, and nuts.
(5) Resolder the wires to the socket.
(6) Clean the unit thoroughly to remove solder drops and metal chips.
(7) Check the new connections with those shown in the schematic for that unit.

b. R-F CHOKES. All r-f chokes, except choke L–1, are located in the recess of the lower portion of the front chassis and bracket assembly behind the front panel (fig. 12). To gain access to the chokes, proceed as follows.

Note. The r-f chokes are made of heavy wire and are not easily damaged. Do not attempt the following procedures unless it is absolutely certain that an r-f choke or C–11 is defective.

(1) Separate the panel from the chassis assembly (par. 24).
(2) Remove the eight screws which fasten the terminal board to the filter assembly.
(3) Carefully unsolder all ground leads from the capacitors to the metal strip.
(4) Remove all connections to the front panel cable from the terminal board.
(5) Remove the metal ground strip by removing the mounting screws.
(6) Carefully tilt the terminal board back toward the top of the unit. This exposes the r-f chokes and C–11.
(7) Remove the screw which fastens the defective choke to the terminal board.
(8) Unsolder the wires from the choke to the terminals on the terminal board.
(9) Remove the choke and repair or replace if necessary.
(10) Reassemble the choke on the axial screw and tighten the nut.
(11) Remount the terminal board and resolder the wires, being careful not to damage the wires or to short them to the chassis.

c. PANEL CONNECTORS. To remove panel connectors, it is necessary to use a spanner wrench or long-nose pliers.

(1) Insert the teeth on the spanner wrench into the notches in the rim of the connector on the front panel.

(2) Turn the spanner wrench in the counter-clockwise direction until the rim is removed. Remove the lockwasher.

(3) Remove the connector from the rear of the panel.

(4) Unsolder all wires.

(5) Resolder the wires to the new connector. Make sure that the new part has a rubber gasket.

(6) Clean thoroughly to remove solder drops.

(7) Check the new connections with those shown in the schematic for that unit.

(8) Reinsert the connector from the rear of the panel.

(9) Reinsert the lockwasher and rim and, using the spanner wrench, screw the rim back on to the connector. Check the assembly for tightness.

(10) To prevent vapors formed within the power supply from condensing around metallic parts of the connector, repack the connectors with grease. This is necessary to prevent possible equipment breakdown caused by short circuit. Use compound, insulating and sealing, electrical connections, U. S. Army type 62-2 (U.S. Navy type AN-C-218*a*). Be sure to pack the grease tightly over all parts of the connector, connector insulating material, metal rim, and connecting lead ends in the immediate vicinity of the connector pins. Apply at least 1/8-inch thickness of grease over the connectors. Pack the grease down tightly until the entire surface of the connector is covered, and there are no air pockets between any parts of the connector and the grease.

(11) After the grease has been applied, replace the rubber cap. A proper size cap is provided for each connector. In each case, the cap has two projections: a hole just over the projections to accommodate the connector cable, and a rubber button with an undercut near its head. When properly assembled over the connector, the cap grips the connector tightly.

(12) To assemble, insert the rubber button through the hole in one of the cap projections so that it fits into the undercut on the button. Place the cap over the rear of the connector, and fit the connector cable into the cutout just above the projections. Insert the free end of the button through the hole in the other cap projection, and push the projection toward the head of the button until it snaps into the undercut.

d. SWITCH S-1. To replace switch S-1, it is necessary to separate the panel from the chassis assembly.

(1) Unsolder all wires from the top deck of the switch.

(2) Remove the two nuts which fasten the top deck of the switch to the remainder of the switch assembly.

(3) Lift off the top deck.

(4) Unsolder all wires from lower deck.

(5) Remove the castellated nut on the front of the panel.

(6) Replace the switch by reversing the above procedure, being careful to aline the red dot on the upper deck of the switch with the red dot on the lower deck. Make sure that the locating lug goes into the hole provided for it on the front panel.

(7) When resoldering the connections, be careful to remove solder drops and to check all connections with those shown in the schematic for that unit.

e. RELAY O-1. Relay O-1 is mounted on the bottom chassis by means of four screws (fig. 12).

(1) Unsolder all wires from the terminals on top of the relay.

(2) Remove the four screws which mount the relay to the bottom chassis.

(3) Replace the relay by reversing the above procedure. Use a 12 volt relay for Power supply PP-109/GR or a 24 volt relay for Power supply PP-112/GR.

(4) Reconnect all wires to their proper terminals on top of the relay.

f. TRANSFORMERS. The transformers are mounted on the vertical bracket attached to the bottom chassis. To replace these parts—

(1) Remove the vibrators.

(2) Remove the six screws and lockwashers which fasten the transformer bracket to the bottom chassis. Separate the transformers from the bottom chassis, being careful not to damage connecting wires.

(3) Disconnect all wires from the part being replaced.

(4) Remove the four nuts and washers and remove the part from the rear of the transformer bracket.

(5) When remounting the new transformer, make sure that the soldering terminals clear the chassis.

(6) Fasten with the lockwashers and nuts.

(7) Resolder all wires and check the connections against the schematic for that unit.

(8) Reassemble the transformer bracket to the bottom chassis, using the six screws and lockwashers.

37. Reassembly

(figs. 5, 6, 10, or 11, and 12)

After the inspection and tests and repairs have been made, the unit is ready for reassembly. To reassemble the unit, reverse the procedure described in paragraph 24. Proceed as follows:

a. Bring the bottom and top chassis assemblies close together, and line them up so that the bottom chassis can be pushed into place. Make sure that the flexible cables are back in their original positions, and that wires are not pinched, stretched, or damaged during reassembly.

b. Replace and tighten the screws and lockwashers which hold the bottom chassis to the top chassis assembly.

c. Insert electrolytic capacitors C-27 and C-30. These capacitors fit through the chassis. Reattach the capacitor spring clip assembly.

d. Reattach the rail and the bracket of the transformer T-1.

e. Replace the vibrators, arranging them correctly in their sockets.

f. Replace the front panel, being careful not to damage wiring. Tuck the cable carefully in place and tighten the eight mounting screws.

g. Check that all plug-in parts are firmly seated in their sockets.

h. Replace the silicone-treated glass-fabric barrier as follows:

(1) On the upper shelf of the chassis (right rear compartment), place one section of the barrier along the row of resistors including R26 and R21. Place the other section of the barrier along the row of resistors including R23, R16, R32, and R22. The connecting wires between the two rows of resistors should be channeled between the two barrier sections so that the insulation of the leads does not touch any of the large resistors.

(2) On the lower shelf (right rear), snake the barrier around the vibrator cans E1, E2, and E3) and around the large resistors so that the barrier is always between the wire insulation and any of the heat-producing parts. This is important because excessive heat is generated by the resistors and it may damage the wires and cause equipment breakdowns.

i. Replace the outer case. Tighten the Dzus fasteners.

Section IV. FINAL TESTING

38. General

If the unit does not meet the requirements of paragraph 32, repeat the trouble-shooting procedures given in paragraphs 31, 33, and 34 to locate other faults. Make the necessary repairs. Il the unit operates as required in paragraph 32, perform the test outlined in paragraph 39.

39. A-C Ripple Voltage Measurements

a. Connect the equipment as indicated in section II of this chapter, with the following exceptions:

(1) Substitute an a-c voltemeter (Electronic Multimeter ME-6/U or equivalent meter) for M-3, and connect it in series with a 2-uf (microfarad), 600 vdcw capacitor across each of the load resistors in turn.

(2) Connect a 5,000-ohm resistor across the meter terminals.

(3) Set switch S-1 to the TRANS & RECEIVE position and set switch S-2 to the HIGH position. Close the external switch connected between terminals K and D.

b. With the a-c voltmeter on a suitable range check that the readings at output terminals B, C, F, M, P, and R are less than 5 percent of the nominal output voltage. If a higher reading is indicated, it is probable that the electrolytic filter capacitors or chokes in the circuit section measured need replacement. Note paragraph 40. Refer to the schematic diagram (fig. 17 or 18) to identfy the electrolytic filter capacitors.

40. Output Voltage Variations

Normal changes in battery voltage and changes in output loads will affect the output voltage of the power supply. Hence, output voltage variations up to 10 percent will not necessarily indicate a faulty condition.

Section V. LUBRICATION AND WEATHERPROOFING

41. Lubrication

The power supplies described in this manual do not require lubrication. Never apply oil or grease to any part of these units, except connectors J1 and J2, which, in some units, are packed with silicone grease. This grease is used to prevent vapor condensation around connector parts within the unit. A rubber cap holds the grease against the connector. Normally, the grease will not have to be replaced, and should provide adequate protection for the life of the equipment. However, if it becomes necessary to disconnect any of the wires, or if the connector must be removed for repair or replacement, apply a grease pack to the replacement connector.

42. Weatherproofing and Rustproofing

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 temperature are harmful to most materials.

b. TROPICAL MAINTENANCE. A special moisturepoofing 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.

The grease pack and rubber cap around the rear of connector J1 and J2 are particularly important if the equipment is to be used under high humidity conditions such as prevail in tropical climates.

c. ARTIC MAINTENANCE. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66.

d. DESERT MAINTENANCE. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperaturess, low humidity, and excessive sant and dust are explained in TB SIG 75.

e. RUSTPROOFING. Rust and corrosion can be prevented by touching up bared surfaces. Clean where necessary with fine sandpaper. Never use steel wool.

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

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

43. Repacking for Shipment or Limited Storage

Wrap and pack securely according to directions given in JAN–P–100, or as directed by commanding officer.

44. Demolition of Matériel to Prevent Enemy Use

The demolition procedures outlined below 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.

a. SMASH. Smash capacitors, transformers, resistors, sockets, terminal board, plugs, and vibrators, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. CUT. Cut wiring, using axes, handaxes, or machetes.

c. BURN. Burn technical literature, resistors, capacitors, transformers, and vibrators, using gasoline, kerosene, oil, flame throwers, and incendiary grenades.

d. BEND. Bend chassis, panels, and covers.

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. DESTROY EVERYTHING.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 and SR 310–20–4.

1. Army Regulations

AR 380–5	Safeguarding Military Information.

2. Supply Publications

SIG 1	Introduction and Index.
SIG 5	Stock List of All Items.
SIG 7 & 8	Organizational Maintenance Allowances and Field and Base Maintenance Stockage Guide.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Preserving

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.

4. Packaging and Packing Instructions

JAN–D–169	Desiccants, Activated.
JAN–P–100	General Specifications.
JAN–P–106A	Boxes, Wood, Nailed.
JAN–P–116	Preservation, Methods of.
JAN–P–125	Barrier Material, Waterproof, Flexible.
JAN–P–131	Barrier-Material, Moisture-Vaporproof, Flexible.

5. Other Publications

FM 24–18	Field Radio Techniques.
SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TM 1–455	Electrical Fundamentals.
TM 9–2857	Storage Batteries Lead-Acid Type.
TM 11–430	Batteries for Signal Communication. Except those pertaining to Aircraft.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.
TM 38–650	Basic Maintenance Manual.

6. Abbreviations

ac	alternating current
C	centigrade
dc	direct current
F	Fahrenheit
hf	high frequency
h-v	high-voltage
l-f	low-frequency
l-v	low-voltage
ma	milliampere
rf	radio frequency
uf, uuf	microfarad, micromicrofarad

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note: The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O&E, TA, T/BA, SIG 7–8–10, SIG 7&8, SIG 10, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalogs applicable to the equipment covered in this manual are SIG 7&8–PP–109/GR and SIG 7&8–PP–112/GR. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

I. Identification Table of Parts for Power Supply PP-109/GR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	POWER SUPPLY PP-109/GR: vibrator and electronic type; sync; outputs 6.3 v DC, 595 ma; 6.3 v DC, 1415 ma; 5.6 v DC, 431 ma; —27 v DC, 2 ma; 85 v DC, 71 ma; 105 v DC, 20 ma; 150 v DC, 37.5 ma; 250 v DC, 11.5 ma; 450 v DC, 75 ma; input 12.6 v DC, amp. LMT part/dwg GA-2394-14 GR-1-FR.		3H4497-109-FR
C-19, C-21, C-24.	CAPACITOR, fixed: mica; 1000 uuf ±10 %; 500 vdcw; JAN type CM25A102M. LMT part/dwg PL: 775636. 1000 uuF.	R-F hash filters	3K2510214
C-1, C-12, C-18, C-20, C-22 ...	CAPACITOR, fixed: ceramic.; 3000 uuf ±20 %; 500 vdcw. LMT part/dwg GH-2094-2-5. FR.	R-F hash filters	3DA3-137-FR
C-11	CAPACITOR, fixed: paper; 3000 uuf ±20 %; 1000 vdcw; JAN type CP28A1EG302M. LMT part/dwg PL: 775618. 3000 uuF.	R-F hash filters	3DA3-138-FR
C-4 through C-8. C-15, C-16, C-26, C-28, C-29, C-31.	CAPACITOR, fixed: ceram.; 5000 uuf ±20 %; 500 vdcw. LMT part/dwg GH-2094-2-6. FR.	R-F hash filters	3DA5-215-FR
C-13	CAPACITOR, fixed: paper; 2 sect; 20,000 uuf +20 % —10 % ea sect; 1000 vdcw ea sect; JAN type CP69B4EG203V. LMT part/dwg LMT 402139.	Buffer, secondary, T-2	3DA20-234-FR
C-2, C-23	CAPACITOR, fixed: paper; 2 sect; 50,000 uuf +20 % —10 % ea sect; 1000 vdcw ea sect JAN type CP69B4EG503V.LMT part/dwg LMT 402.140.	C-2: Buffer, secondary, T-1. C-23: Buffer, secondary, T-3.	3DA50-433-FR
C-9, C-10, C-14.	CAPACITOR, fixed: electrolytic; 2 sect; 35 uf —10 % +150 % ea sect; 350 vdcw ea sect; JAN type CE52C350P. LMT part/dwg GH-4203-1. FR.	C-9: Filter, 450 volts ..... C-10: Filter, 450 volts ..... C-14: Filter, 150 volts	3DB35-5-FR
C-17	CAPACITOR, fixed; electrolyt.; 40 uf —10 % +150 %; 300 vdcw; JAN type CE31C400N. LMT part/dwg PL: 775617. 40 uF.	Filter, 150 volts	3DB40-76-FR
C-25	CAPACITOR, fixed: electrolytic; 2 sect; 45 uf —10 % +150 % ea sect; 300 vdcw ea sect; JAN type CE52C450N. LMT part/dwg PL: 775606. 45 uF.	Filter, 85 volts	3DB45-11-FR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C-3	CAPACITOR, fixed: electrolytic; 500 uf —10 % +150 %; 50 vdcw; JAN type CE51C501G. LMT part/dwg PL-775607. 500 uF.	Filter, 27 volts	3DB500-38-FR
C-27, C-30	CAPACITOR, fixed: electrolytic; 2000 uf —10 % +150 %; 15 vdcw; JAN type CE51C202E. LMT part/dwg PL-775608. 2000 uF.	Filters, filament	3DB2000-18-FR
H-1	CLAMP: capacitor mtg. LMT part/dwg GH-2367-2. FR.	Capacitor holding clamp ..	6Z1885-FR
O-1 through O-5.	CLIP: capacitor (for holding capacitor in socket). LMT part/dwg GB-1428-2-1. FR.	Capacitor holding clips ...	2Z2712.163-FR
O-6, O-7	CLIP: capacitor. LMT part/dwg GB-1428-2-2. FR.	Capacitor holding clip	2Z2712.162-FR
O-8, O-9, O-10..	CLIP: vibrator. LMT part/dwg GB-1429-2. FR.	Vibrator holding clips	2Z2712.132-FR
L-1, L-2, L-4 through L-8, L-10, L-11, L-13 through L-16.	COIL, RF: choke; unshielded. LMT part/dwg GA-1945-2. FR.	R-F hash filters	3C315-126-FR
J-1	CONNECTOR, receptacle: 4 round female cont; straight. LMT part/dwg GH-2081-12. FR.	POWER IN connector	2Z3065-126-FR
J-2	CONNECTOR, receptacle: 14 round femal cont; straight. LMT part/dwg GH-2083-12.	POWER OUT connector ..	2Z3075-45-FR
H-2	FASTENER, Dzus: 1 5/8" lg x 1 5/16" wd x 5/16" thk o/a. LMT part/dwg GA-2178-2. FR.	Panel to case fastener	6Z3809-27-FR
H-3	FASTENER, Dzus: 7/8" lg x 3/4" wd x 7/16" thk o/a. LMT part/dwg GB-1365-2. FR.	Cover fastener	6Z3809-28-FR
E-4, E-5, E-6, E-7.	FUSEHOLDER: extractor post type; for single 13/32" x 1 1/2" lg cartridge fuse. LMT part/dwg GH-2365-2. FR.	Fuse holders	3Z3282-42.3 Fr
F-1, F-2	FUSE, cartridge: 5 amp. LMT part/dwg PL-775741-4.	F-1: Fuse, relay and filament circuits. F-2:Fuse, 85-volt circuit.	3Z2605.7-FR
F-3, F-4	FUSE, cartridge: 10 amp. LMT part/dwg PL-775741-5.	F-3: Fuse, 150-volt circuit. F-4: Fuse, 450-volt circuit.	3Z2610.-FR
O-24	GASKET: JW60 crude rubber compounds. LMT part/dwg GS-1946-1-4-FR.	Cover gasket	3H2154.1-25-FR
O-23	GASKET: Buna N or neoprene. LMT part/dwg GR-1443-12-1-FR.	Panel to case waterproof gasket.	3H2154.12-27-FR
E-18, E-19, E-23, E-24.	INSULATOR, Bushing: round shouldered type; natural, LTS-E-4 plastic, per JAN-P-13; .085" lg; .265" OD, .154" ID. LMT part/dwg GP-3023-2-FR.	Clip mounting insulating bushings.	3G100-141-FR
E-8	INSULATOR, bushing: round tubr shape; natural, type LTS-H-1 phenolic, per JAN-P-13; 7/16" lg; 5/16" OD, 5/32" ID. LMT part/dwg GP-2418-2-FR.	Toroid coil insulating bushing.	3G100-142-FR
E-9 through E-14.	INSULATOR, bushing: round tubr shape; natural, type LTS-H-1 phenolic, per JAN-P-13; 27/32" lg; .312" OD, .25" ID. LMT part/dwg GP-1983-2-FR.	Toroid coil insulating bushings.	3G100-143-FR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
E-20, E-25	INSULATOR, disk: round w/ears for mtg holes; natural, LTS-E-4 plastic, per JAN-P-13; .031" h; 1 5/8" OD; 1.141" ID. LMT part/dwg GP-3024-2-FR.	Clip mounting insulator spacer.	3G280-25-FR
E-15	INSULATOR, standoff: round post shape; natural or black, grade LTS-E-4 phenolic, per JAN-P-13; 13/16" lg o/a; 5/16" diam o/a, single 6-32 NC-2 thd x 1/4" lg mtg stud. LMT part/dwg GN-2198-2-FR.	Wiring terminal post	3G350-106-FR
E-16, E-17	KNOB: lever type; olive drab zinc alloy; for 1/4" double flatted shaft. LMT part/dwg GC-1164-2-FR.	E-16: Switch knob, S-1 .... E-17: Swich knob, S-2	2Z5822-422-FR
N-1	LABEL: 14 1/8" wd x 18 1/4" lg x .004" thk. LMT part/dwg GD-1023-14-FR.	Circuit label	6D16778-2-FR
H-4, H-5	NUT, castellated: 3/8"—32 NS-2. LMT part/dwg GB-1106-2-FR.	H-4: TRANS POWER switch mounting nut. H-5: OPERATE switch mounting nut.	6L3006-32S-FR
L-3, L-9, L-12..	REACTOR: 2 hy, .13 amp; 170 ohm DC resistance HS metal case. LMT part/dwg GH-1159-2-FR.	L-3: Ripple filter, 450 volt circuit. L-9: Ripple filter, 150 volt circuit. L-12: Ripple filter, 85 volt circuit.	3C315-127-FR
O-1	RELAY, armature: 4PST normally open; 12.6 v DC nom, 10 v DC min, 16 v DC max. LMT part/dwg GH-4175-14-1-FR.	Transmit control	2Z7592-103-FR
K-1, K-2	RELAY, thermal: SPST normally closed; operates at 6.9 v DC w/1 amp continuous load, releases at 2 to 3.5 v, heater cur 250 ma w/6.9 v applied. LMT part/dwg GH-2392-1-FR.	Overvoltage protection, filaments.	2Z7598-129-FR
R-3, R-15, R-19 .	RESISTOR, fixed: WW; .35 ohm ±10 %; 8 w; JAN type RW30GR35. LMT part/dwg PL-775576-0.35 ohm.	Transformer current limiting	3RW3602-FR
R-27, R-33, R-35.	RESISTOR, fixed: comp; 13 ohms ±5 %; 1 w; JAN type RC30AE130J. LMT part/dwg PL-775600-13 ohms.	Voltage dropping, thermal relay heaters.	3RC30AE130JFR
R-28, R-34	RESISTOR, fixer: comp; 16 ohms ±5 %; 1 w; JAN type RC30AE160J. LMT part/dwg PL-775600-16 ohms.	Voltage dropping, thermal relay heaters.	3RC30AE160JFR
R-26, R-32	RESISTOR, fixed: WW; 16 ohms ±5 %; 12 w; JAN type RW32G160. LMT part/dwg PL-775577-16 ohms.	Voltage dropping, filaments	3RW13501-FR
R-30	RESISTOR, fixed: WW; 16 ohms ±5 %; 18 w; JAN type RW31G160. LMT part/dwg LMT 402142.	Voltage dropping, relay supply.	3RW13504-FR
R-1, R-13, R-18.	RESISTOR, fixed: WW; 20 ohms ± 5 %; 8 w; JAN type RW30G200. LMT part/dwg PL-775576-20 ohms.	Vibrator coil current limiting (series drive).	3RW14102-FR
R-2, R-14, R-20.	RESISTOR fixed: WW; 50 ohms ±5 %; 8 w; JAN type RW30G500. LMT part/dwg PL 775576-50 ohms.	Vibrator coil current limiting (shunt drive).	3RW16507-FR
R-23	RESISTOR, fixed: WW; 140 ohms ±5 % 8 w; JAN type RW30G141. LMT part/dwg PL-775576-140 ohms.	Voltage dropping, 85-volt circuit.	3RW19203-FR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R-22	RESISTOR, fixed: WW; 220 ohms ±5 %; 12 w; JAN type RW32G221. LMT part/ dwg PL-775577-220 ohms.	Voltage dropping, 85-volt circuit.	3RW20409-FR
R-21	RESISTOR, fixed: WW; 280 ohms ±5 %; 12 w; JAN type RW32G281. LMT part/ dwg PL-775577-280 ohms.	Voltage dropping, 85-volt circuit.	3RW21006-FR
R-6	RESISTOR, fixed: WW; 500 ohms ±5 %; 8 w; JAN type RW30G501. LMT part/ dwg PL-775576-500 ohms.	Filter, bias	3RW22506-FR
R-16	RESISTOR, fixed: WW; 500 ohms ±5 %; 12 w; JAN type RW32G501. LMT part/ dwg PL-775577-500 ohms.	Filter, 150 volts	3RW22508-FR
R-17	RESISTOR, fixed: comp; 620 ohms ±5 %; 2 w; JAN type RC40AE621J. LMT part/ dwg GH-4204-1-1-FR.	Filter, 105 volts	3RC40AE621J-FR
R-12	RESISTOR, fixed: WW; 9000 ohms ±5 %; 12 w. LMT part/dwg GH-2330-2-1-FR.	Bleeder and voltage divider, 450-volt circuit.	3Z6590-27-FR
R-11	RESISTOR, fixed: WW; 22,500 ohms ±5 %; 12 w. LMT part/dwg GH-2330-2-2-FR.	Bleeder and voltage divider, 450-volt circuit.	3Z6622E5-7-FR
R-7 through R-10.	RESISTOR, fixed: comp; 100,000 ohms ±10 %; 2 w; JAN type RC40AE104K. LMT part/dwg GH-4204-1-2-FR.	Voltage dividers and bleeders for 450 volts.	3RC40AE104K-FR
R-4, R-5	RESISTOR, fixed: comp; 1 meg ±10 %; 1 w; JAN type RC30AE105K. LMT part/ dwg PL-775619-1 meg.	Ionization controls	3RC30AE105K-FR
R-24, R-25, R-31.	RESISTOR, thermal: maintains cur between .76 amp and .825 amp over range of 4 to 9.5 v; T-9 bulb, 2 7/8" lg o/a. LMT part/ dwg GH-1101-2-FR.	Voltage regulation filaments	3Z6925-3.20-FR
E-21, E-22	SHIELD, tube: bayonet type mtg; .810" ID x .930" max OD x 2.250" h. LMT part/dwg PL-775575.	Tube shields	2Z8304.277-FR
X-7, X-17	SOCKET, tube: 7 cont miniature; 1 piece saddle mtg; JAN type TSE7T101. LMT part/dwg PL-775581.	Regulator tube sockets	2Z8677.94-FR
X-1, X-8, X-10..	SOCKET, tube: 7 cont small; 1 piece molded in mtg plate. LMT part/dwg GH-2098-2-FR.	Vibrator sockets	2Z8677.153-FR
X-2 through X-6, X-9, X-11 through X-16, X-18, X-19.	SOCKET, tube: octal; 1 piece molded in mtg plate. LMT part/dwg GH-2039-2-FR.	X-2: Tube socket, V-1 .... X-3: Tube socket, V-3. X-4: Socket, C-3. X-5: Socket, C-9. X-6: Socket, C-10, X-9: Socket, C-14. X-11: Socket, R-24. X-12: Socket, R-25. X-13: Socket, R-31. X-14: Socket, K-1. X-15: Socket, K-2. X-16: Socket, C-25. X-18: Socket, C-27. X-19: Socket, C-30.	2Z8678.338-FR
O-15 through O-20.	SPRING: loop type; for Dzus fastener; 1 3/8" lg x 5/32" wd x .08" thk o/a. LMT part/dwg GB-2414-2-FR.	Panel to case fastener strike.	6Z8377-10-FR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
O-21, O-22 ...	SPRING: loop type; 1 1/8" lg x 3/8" wd x .062" thk o/a. LMT part/dwg GB-1366-2-FR.	Cover fastener strikes	6Z8377-9-FR
S-1	SWITCH, rotary: 4 pole, 3 position; 2 sect, ea w/2 snap sw mtd on metal plate. LMT part/dwg GH-2075-2-FR.	OPERATE switch	3Z9825-62.503 FR
S-2	SWITCH, rotary: 4 pole, 3 position; 2 sect, 1 wafer and 1 snap sw sect. LMT part/ dwg GH-2074-2-FR.	TRANS POWER switch ...	3Z9825-62.502-FR
T-1	TRANSFORMER, power: vibrator; input 12.6 v DC, 3.45 amp CT; output secd 1, 300 v CT at .1 amp; secd 2, 27 v CT at 2 ma; 115 cyc output; HS metal case. LMT part/ dwg GH-1153-12-FR.	300-volt section transformer.	2Z9625-71-FR
T-2	TRANSFORMER, power: vibrator; input 12.6 v DC, 2.55 amp CT; output secd 150 v CT at .14 amp; 115 cyc output; HS metal case. LMT part/dwg GH-1151-12-FR.	150-volt section transformer.	2Z9625-70-FR
T-3	TRANSFORMER, power: vibrator; input 12.6 v DC, .7 amp CT; output secd 1, 85 v CT at 0.120 amp; secd 2, 1 v at 2.4 amp; 115 cyc output; HS metal case. LMT part/ dwg GH-1837-12-FR.	85-volt section transformer.	2Z9625-72-FR
V-3	Tube, electron: OA2.	Voltage regulator, 150-volt supply.	2J0A2-FR
V-4	Tube, electron: OB2.	Voltage regulator 85-volt supply.	2J0B2-FR
V-1, V-2	Tube électron: 1007.	Rectifiers, 450-volt supply.	2J1007-FR
E-1, E-2, E-3 ..	VIBRATOR, synchronous: input 6.3 v DC; 4.3 amp. LMT part/dwg GH-1661-14-FR.	E-1: Vibrator, 450-volt supply. E-2: Vibrator, 150-volt supply. E-3: Vivrator, 85-volt supply.	3H6690-15-FR
CR-1	DRY selenium rectifier. LMT part/dwg GH-4231-2-FR.	Rectifier, 27-volt supply.	3H4860-250-FR

2. Identification Table of Parts for Power Supply PP-112/GR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	POWER SUPPLY PP-112/GR : vibrator and electronic type; sync; outputs 6.3 v DC, 595 ma; 6.3 v DC, 1415 ma; 5.6 v DC, 431 ma; —27 v DC, 2 ma; 85 v DC, 71 ma; 105 v DC, 20 ma; 150 v DC. 37.5 ma; 250 v DC, 11.5 ma; 450 v DC, 75 ma; input 25,2 v DC, 7 amp. LMT part/dwg GA-2394-14 GR-II-FR.		3H4497-112-FR
C-19, C-21, C-24..	CAPACITOR, fixed: mica; 1000 uuf ±10%; 500 vdcw; JAN type CM25A102M. LMT part/dwg PL: 775636. 1000 uuF.	R-F hash filters	3K2510214

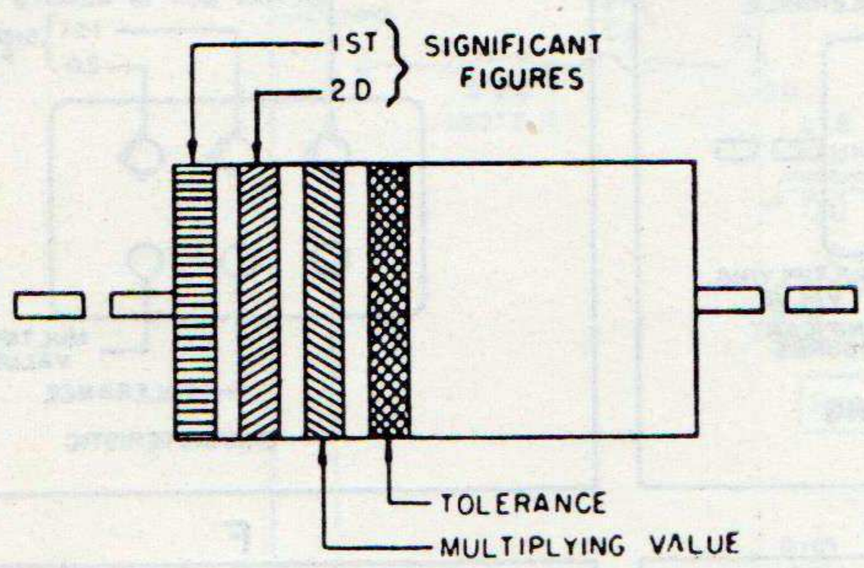
Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C-1, C-12, C-18, C-20, C-22.	CAPACITOR, fixed: ceram.; 3000 uuf ±20%; 500 vdcw. LMT part/dwg GH-2094-2-5. FR.	R-F hash filters	3DA3-137-FR
C-11	CAPACITOR, fixed: paper; 3000 uuf ±20%; 1000 vdcw; JAN type CP28A1EG302M. LMT part/dwg PL: 775618. 3000 uuF.	R-F hash filters	3DA3-138-FR
C-4 through C-8, C-15, C-16, C-26, C-28, C-29, C-31.	CAPACITOR, fixed: ceram.; 5000 uuf ±20%; 500 vdcw. LMT part/dwg GH-2094-2-6. FR.	R-F hash filters	3DA5-215-FR
C-2, C-13, C-23.	CAPACITOR, fixed: paper; 1 uf ±10%; 600 vdcw; JAN type CP69B1EF105K. LMT part/dwg PL: 775599. 1 uF.	C-2: Buffer, primary, T-1. C-13: Buffer, primary, T-2. C-23: Buffer, primary, T-3.	3DB1-219-FR
C-9, C-10, C-14.	CAPACITOR, fixed: electrolytic; 2 sect; 35 uf —10% +150% ea sect; 350 vdcw ea sect; JAN type CE52C350P. LMT part/dwg GH-4203-1. FR.	C-9: Filter, 450 volts C-10: Filter, 450 volts C-14: Filter, 150 volts	3DB35-5-FR
C-17	CAPACITOR, fixed; electrolyt.; 40 uf —10% +150%; 300 vdcw; JAN type CE31C400N. LMT part/dwg PL: 775617. 40 uF.	Filter, 105 volts	3DB40-76-FR
C-25	CAPACITOR, fixed: electrolytic; 2 sect; 45 uf —10% +150% ea sect; 300 vdcw ea sect; JAN type CE52C450N. LMT part/dwg PL: 775606. 45 uF.	Filter, 85 volts	3DB45-11-FR
C-3	CAPACITOR, fixed: electrolytic; 500 uf —10% +150%; 50 vdcw; JAN type CE51 C501G. LMT part/dwg PL-775607. 500 uF	Filter, 27 volts	3DB500-38-FR
C-27, C-30	CAPACITOR, fixed: electrolytic; 2000 uf —10% +150%; 15 vdcw; JAN type CE51 C202E. LMT part/dwg PL-775608. 2000 uF	Filters, filament	3DB2000-18-FR
H-1	CLAMP: capacitor mtg. LMT part/dwg GH-2367-2. FR.	Capacitor holding clamp	6Z1885-FR
O-1 through O-5.	CLIP: capacitor (for holding capacitor in socket). LMT part/dwg GB-1428-2-1. FR.	Capacitor holding clips	2Z2712.163-FR
O-6, O-7	CLIP: capacitor. LMT part/dwg GB-1428-2-2. FR.	Capacitor holding clip	2Z2712.162-FR
O-8, O-9, O-10	CLIP: vibrator. LMT part/dwg GB-1429-2. FR.	Vibrator holding clips	2Z2712.132-FR
L-1, L-2, L-4 through L-8, L-10, L-11, L-13 through L-16.	COIL, RF: choke; unshielded. LMT part/dwg GA-1945-2. FR.	R-F hash filters	3C315-126-FR
J-1	CONNECTOR, receptacle: 4 round female cont; straight. LMT part/dwg GH-2081-12. FR.	POWER IN connector	2Z3065-126-FR
J-2	CONNECTOR, receptacle: 14 round female cont; straight. LMT part/dwg GH-2083-12. FR.	POWER OUT connector	2Z3075-45-FR
H-2	FASTENER, Dzus: 1 5/8" lg x 1 5/16" wd x 5/16" thk o/a. LMT part/dwg GA-2178-2. FR.	Panel to case fastener	6Z3809-27-FR
H-3	FASTENER, Dzus: 7/8" lg x 3/4" wd x 7/16" thk o/a. LMT part/dwg GB-1365-2. FR.	Cover fastener	6Z3809-28-FR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
E-4, E-5, E-6, E-7.	FUSEHOLDER: extractor post type; for single 13/32" x 1 1/2" lg cartridge fuse. LMT part/dwg GH-2365-2. FR.	Fuse holders	3Z3282-42.3 FR
F-2	FUSE, cartridge: 3 amp. LMT part/dwg PL-775741-2.	Fuse, 85-volt circuit	3Z2603.19-FR
F-1, F-3, F-4	FUSE, cartridge: 5 amp. LMT part/dwg PL-775741-4.	F-1: Fuse, relay and filament circuits. F-3: Fuse, 150-volt circuit. F-4: Fuse, 450-volt circuit.	3Z2605.7-FR
O-24	GASKET: JW60 crude rubber compounds. LMT part/dwg GS-1946-1-4-FR.	Cover gasket	3H2154.1-25-FR
O-23	GASKET: Buna N or neoprene. LMT part/dwg GR-1443-12-1-FR.	Panel to case waterproof gasket.	3H2154.12-27-FR
E-18, E-19, E-23, E-24.	INSULATOR, bushing: round shouldered type; natural, LTS-E-4 plastic, per JAN-P-13; .085" lg; .265" OD, .154" ID. LMT part/dwg GP-3023-2-FR.	Clip mounting insulating bushings.	3G100-141-FR
E-8	INSULATOR, bushing: round tubr shape; natural, type LTS-H-1 phenolic, per JAN-P-13; 7/16" lg; 5/16" OD, 5/32" ID. LMT part/dwg GP-2418-2-FR.	Toroid coil insulating bushing.	3G100-142-FR
E-9 through E-14.	INSULATOR, bushing: round tubr shape; natural, type LTS-H-1 phenolic, per JAN-P-13; 27/32" lg; .312" OD, .25" ID. LMT part/dwg GP-1983-2-FR.	Toroid coil insulating bushings.	3G100-143-FR
E-20, E-25	INSULATOR, disk: round w/ears for mtg holes; natural, LTS-E-4 plastic, per JAN-P-13; .031" h; 1 5/8" OD; 1.141" ID. LMT part/dwg GP-3024-2-FR.	Clip mouting insulator spacer.	3G280-25-FR
E-15	INSULATOR, standoff: round post shape; natural or black, grade LTS-E-4 phenolic, per JAN-P-13; 13/16" lg o/a; 5/16" diam o/a, single 6-32 NC-2 thd x 1/4" lg mtg stud. LMT part/dwg GN-2198-2-FR.	Wiring terminal post	3G350-106-FR
E-16, E-17	KNOB: lever type; olive drab zinc alloy; for 1/4" double flatted shaft. LMT part/dwg GC-1164-2-FR.	E-16: Switch knob, S-1 E-17: Switch knob, S-2	2Z5822-422-FR
N-1	LABEL: 14 1/8" wd x 18 1/4" lg x .004" thk. LMT part/dwg GD-1024-14-FR.	Circuit label	6D16778-1-FR
H-4, H-5	NUT, castellated: 3/8" —32 NS-2. LMT part, dwg GB-1106-2-FR.	H-4: TRANS POWER switch mounting nut. H-5: OPERATE switch mounting nut.	6L3006-32S-FR
L-3, L-9, L-12	REACTOR: 2 hy, .13 amp; 170 ohm DC resistance HS metal case. LMT part/dwg GH 1159-2-FR.	L-3: Ripple filter, 450 volt circuit. L-9: Ripple filter, 150 volt circuit. L-12: Ripple filter, 85 volt circuit.	3C315-127-FR
O-1	RELAY, armature: 4PST normally open; 25.2 v DC nom, 20 v DC min, 32 v DC max LMT part/dwg GH-4175-14-1-FR.	Transmit control	2Z7599A-365 FR
K-1, K-2	RELAY, thermal: SPST normally closed; operates at 6.9 v DC w/1 amp continuous load, releases at 2 to 3.5 v, heater cur 250 ma w/6.9 v applied. LMT part/dwg GH-2392-1-FR.	Overvoltage protection, filaments.	2Z7598-129-FR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
X-1, X-8, X-10	SOCKET, tube: 7 cont small; 1 piece molded in mtg plate. LMT part/dwg GH-2098-2-FR.	Vibrator sockets	2Z8677.153-FR
X-2 through X-6, X-9, X-11 through X-16, X-18 through X-22.	SOCKET, tube: octal; 1 piece molded in mtg plate. LMT part/dwg GH-2039-2-FR.	X-2: Tube socket, V-1 X-3: Tube socket, V-3. X-4: Socket, C-3. X-5: Socket, C-9. X-6: Socket, C-10. X-9: Socket, C-14. X-11: Socket, R-24. X-12: Socket, R-25. X-13: Socket, R-31. X-14: Socket, K-1. X-15: Socket, K-2. X-16: Socket, C-25. X-18: Socket, C-27. X-19: Socket, C-30. X-20: Socket, R-37. X-21: Socket, R-38. X-22: Socket, R-40.	2Z8678 338-FR
O-15 through O-20.	SPRING: loop type; for Dzus fastener; 1 3/8" lg x 5/32" wd x .08" thk o/a. LMT part/dwg GB-2414-2-FR.	Panel to case fastener strike	6Z8377-10-FR
O-21, O-22	SPRING: loop type; 1 1/8" lg x 3/8" wd x .062" thk o/a. LMT part/dwg GB-1366-2-FR.	Cover fastener strikes	6Z8377-9-FR
S-1	SWITCH, rotary: 4 pole, 2 position; 2 sect, ea w/2 snap sw mtd on metal plate. LMT part/dwg GH-2075-2-FR.	OPERATE switch	3Z9825-62.503 FR
S-2	SWITCH, rotary: 4 pole, 3 position; 2 sect, 1 wafer and 1 snap sw sect. LMT part/dwg GH-2074-2-FR.	TRANS POWER switch	3Z9825-62.502 FR
T-1	TRANSFORMER, power: vibrator; input 25.2 v DC, 1.33 amp CT; output secd 1, 300 v CT at .1 amp; secd 2, 27 v CT at 2 ma; 115 cyc output; HS metal case. LMT part/dwg GH-1157-12-FR.	300 volt section transformer	2Z9625-71-FR
T-2	TRANSFORMER, power: vibrator; input 25.2 v DC, 1.33 amp CT; output secd 150 v CT at 0.160 amp; 115 cyc output; HS metal case. LMT part/dwg GH-1155-12-FR.	150-volt section transformer	2Z9625-70-FR
T-3	TRANSFORMER, power: vibrator; input 25.2 v DC. .7 amp CT; output secd 1, 85 v CT at 0.120 amp; secd 2, 1 v at 2.4 amp; 115 cyc output; HS metal case. LMT part/dwg GH-1839-12-FR.	85-volt section transformer	2Z9625-72-FR
V-3	Tube, electron: OA2	Voltage regulator, 150-volt supply.	2J0A2-FR
V-4	Tube, electron, OB2	Voltage regulator 85-volt supply.	2J0B2-FR
V-1, V-2	Tube electron: 1007	Rectifiers, 450-volt supply	2J1007-FR
E-1, E-2, E-3	VIBRATOR, synchronous: input 25.2 v DC; 1.3 amp. LMT part/dwg GH-2641-14-FR.	E-1: Vibrator, 450-volt supply. E-2: Vibrator, 150-volt supply. E-3: Vibrator, 85-volt supply.	3H6690-16-FR
CR-1	DRY selenium rectifier. LMT part/dwg GH-4231-2-FR.	Rectifier, 27-volt supply.	3H4860-250-FR

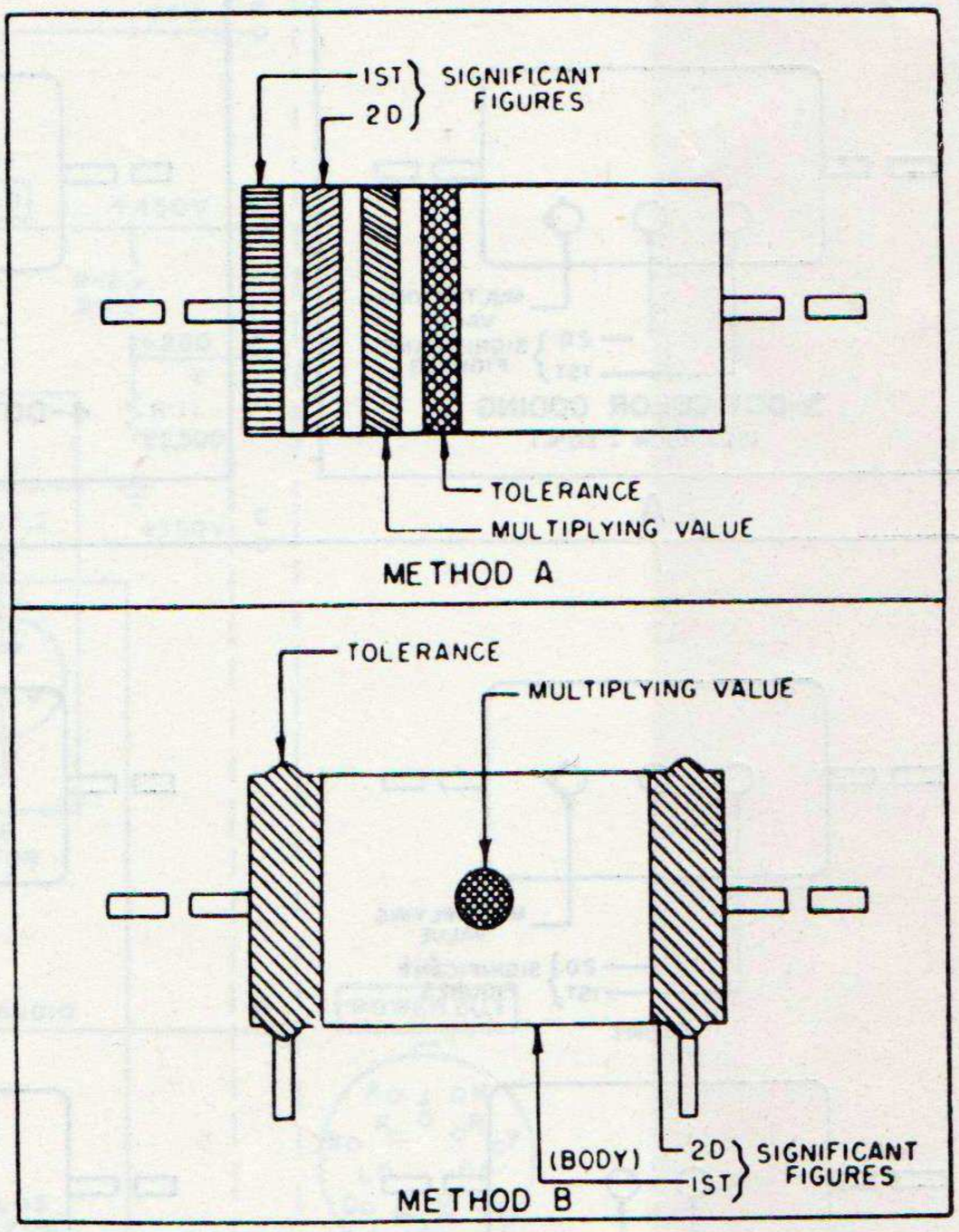
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



A

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS†



B

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± -
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	01	± 5
SILVER	–	001	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND

† RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED

RMA RADIO MANUFACTURERS ASSOCIATION

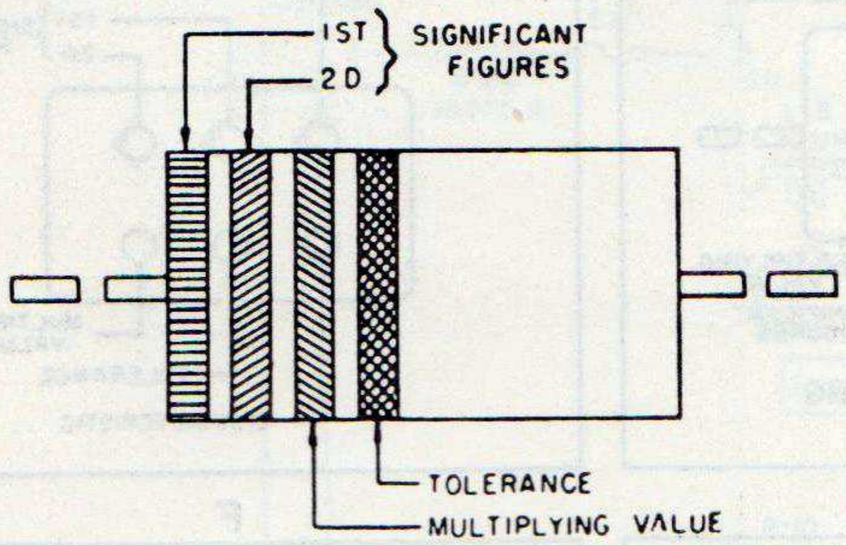
JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

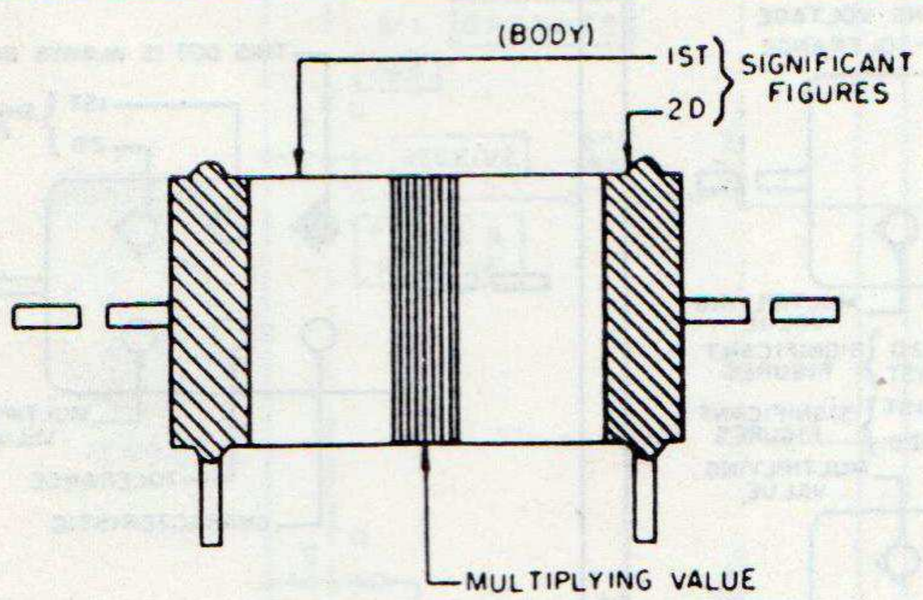
Figure 15. Resistor color codes.

RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



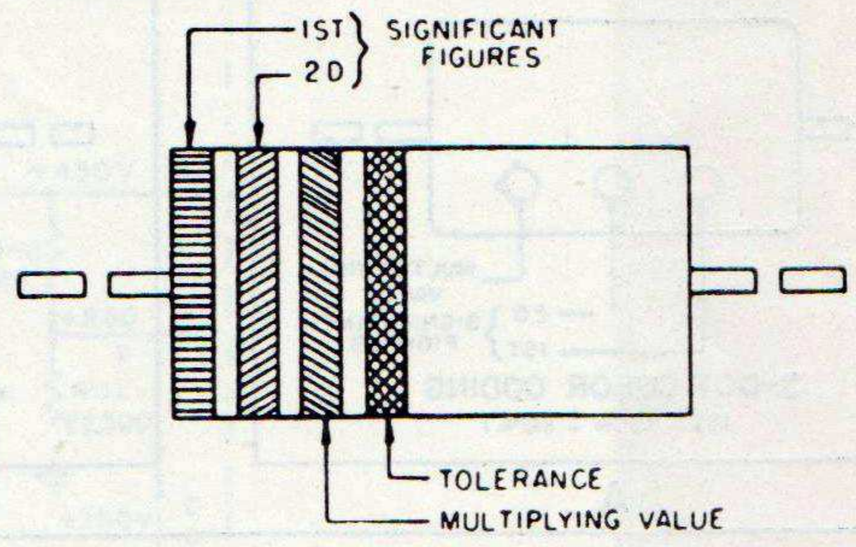
METHOD A



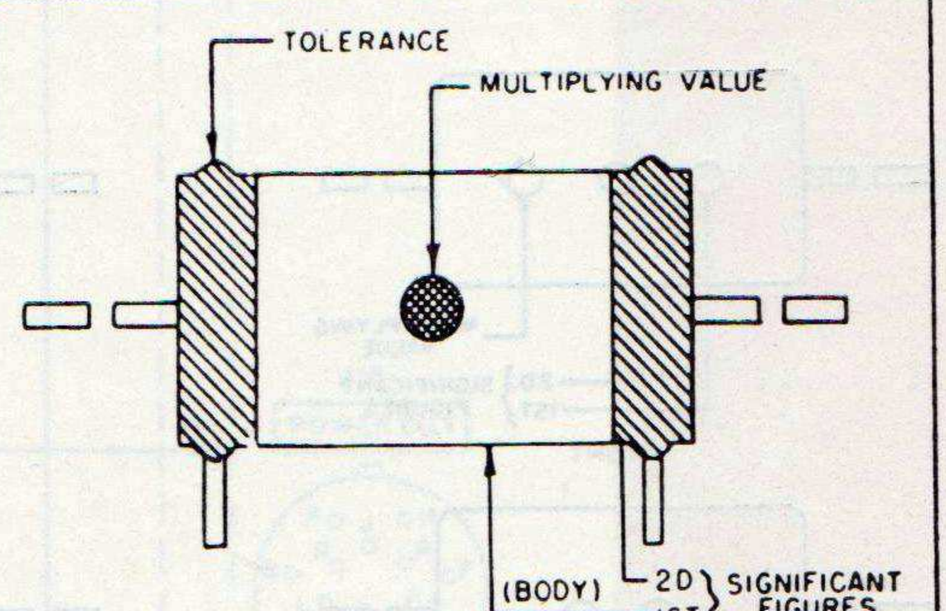
METHOD B

A

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS†



METHOD A



METHOD B

B

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± -
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	-	0.1	± 5
SILVER	-	0.01	± 10
NO COLOR	-	-	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND

† RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED

RMA RADIO MANUFACTURERS ASSOCIATION

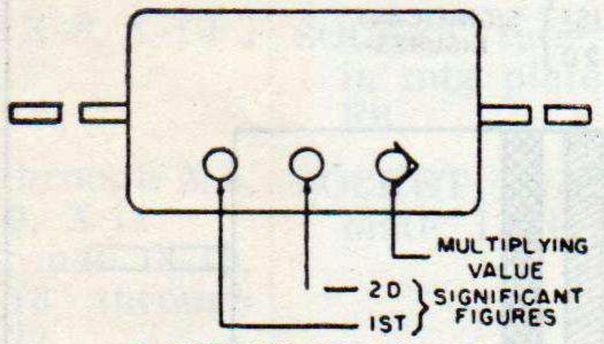
JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

Figure 15. Resistor color codes.

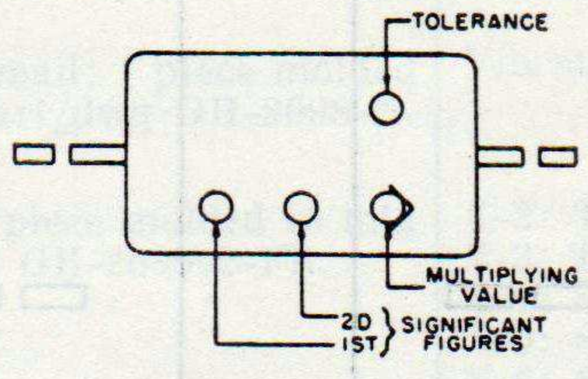
CAPACITOR COLOR CODES

RMA 3-,4-,5-,& 6-DOT COLOR CODES FOR MICA-DIELECTRIC CAPACITORS



3-DOT COLOR CODING
(500 VDCW ± 20%)

A

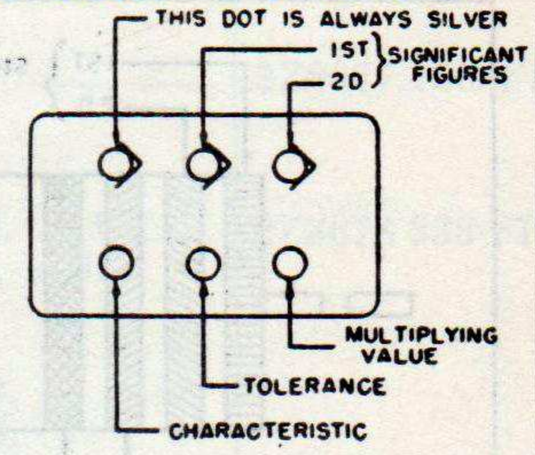


4-DOT COLOR CODING
(500 VDCW)

B

JAN 6-DOT COLOR CODES FOR:

PAPER-DIELECTRIC CAPACITORS *



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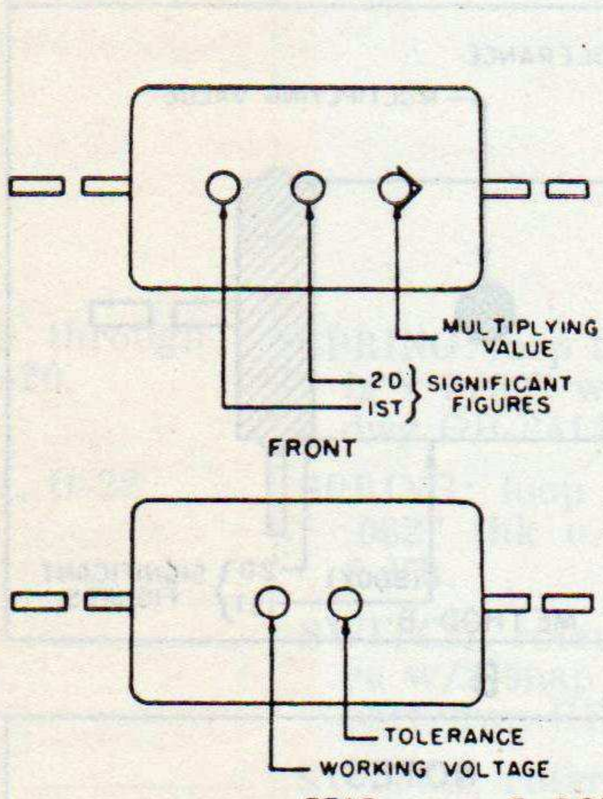
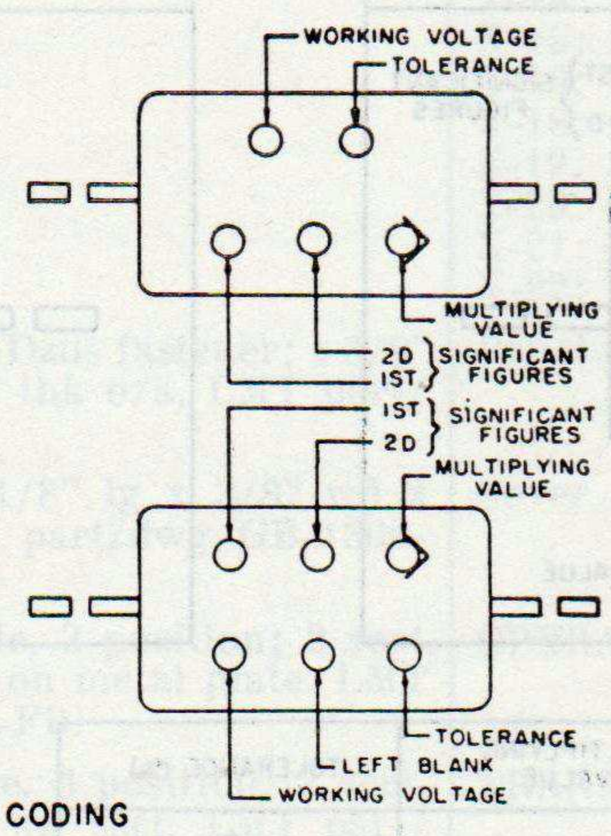
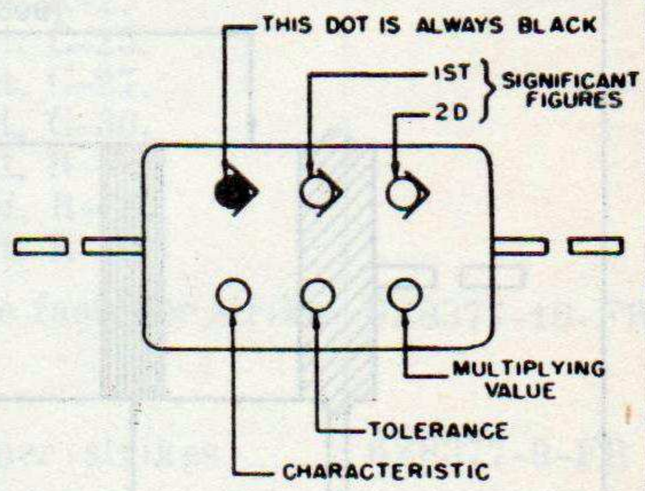




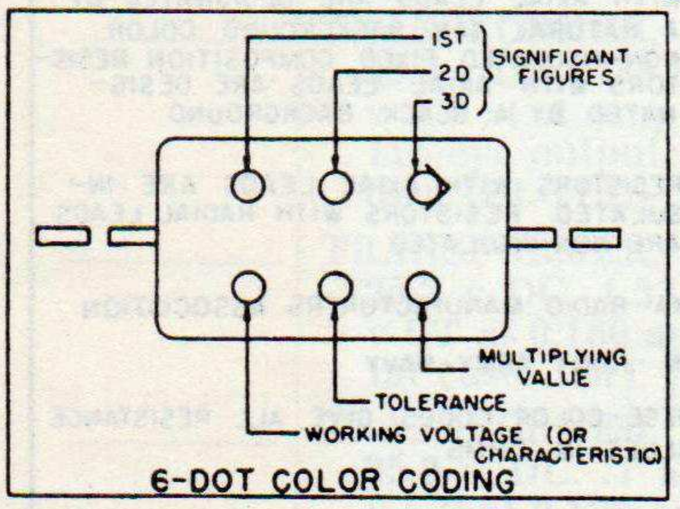
5-DOT COLOR CODING

C

MICA-DIELECTRIC CAPACITORS +



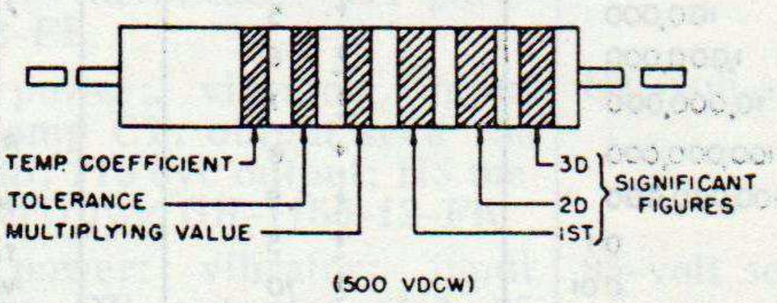
G



6-DOT COLOR CODING

D

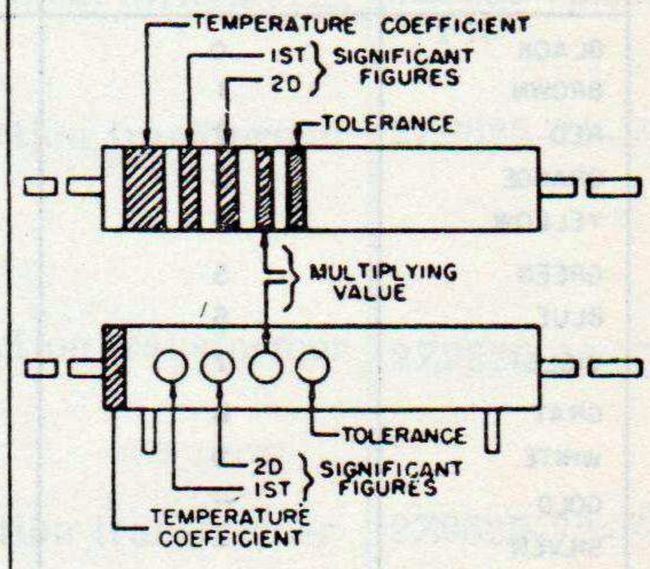
RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



(500 VDCW)

E

CERAMIC-DIELECTRIC CAPACITORS **



H

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

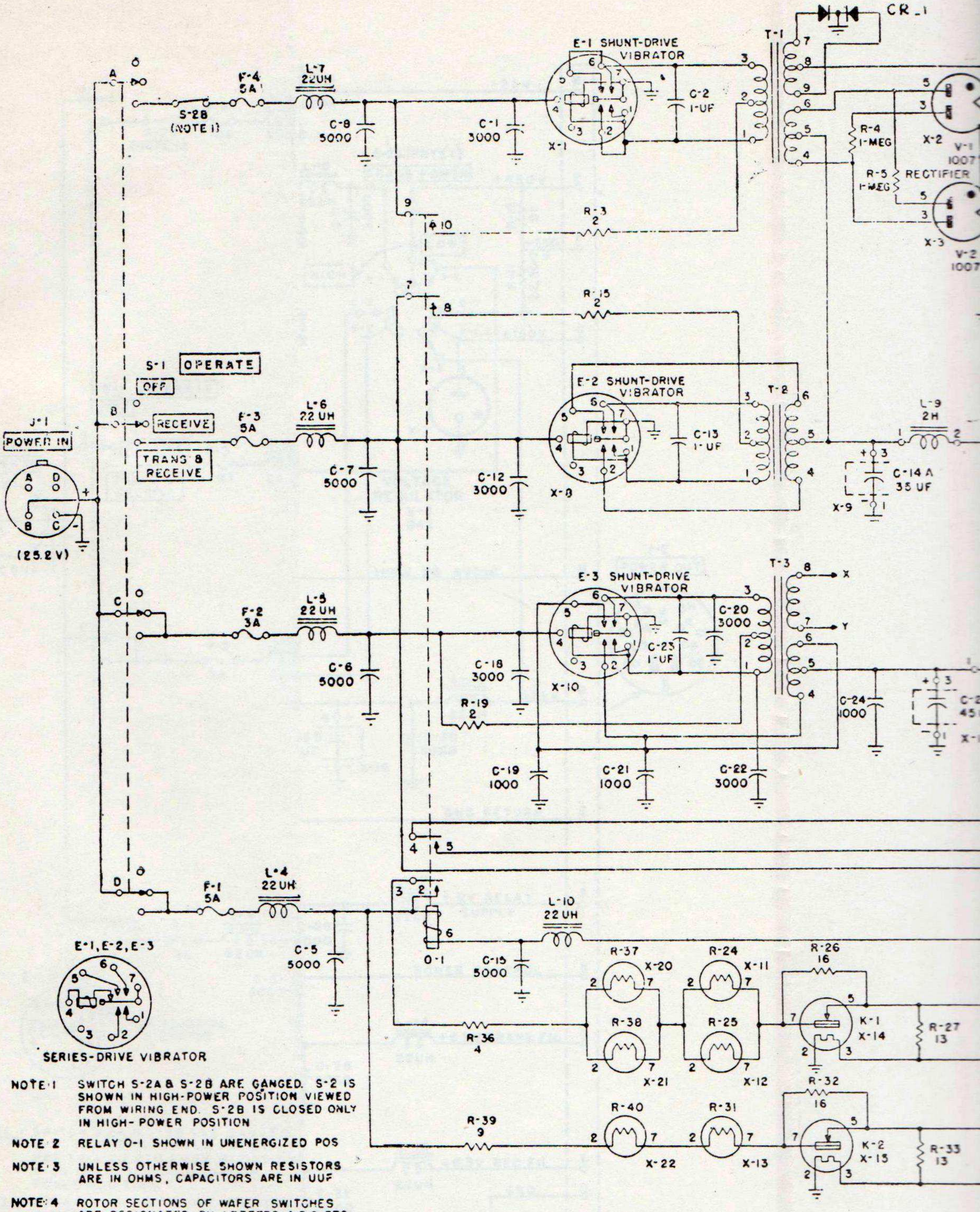
** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS

RMA RADIO MANUFACTURERS ASSOCIATION

JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS

Figure 16. Capacitor color codes.



NOTE 1 SWITCH S-2A & S-2B ARE GANGED. S-2 IS SHOWN IN HIGH-POWER POSITION VIEWED FROM WIRING END. S-2B IS CLOSED ONLY IN HIGH-POWER POSITION

NOTE 2 RELAY O-1 SHOWN IN UNENERGIZED POS

NOTE 3 UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF

NOTE 4 ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A,B,C, ETC CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS

NOTE 5 VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS

Figure 17. Power supply

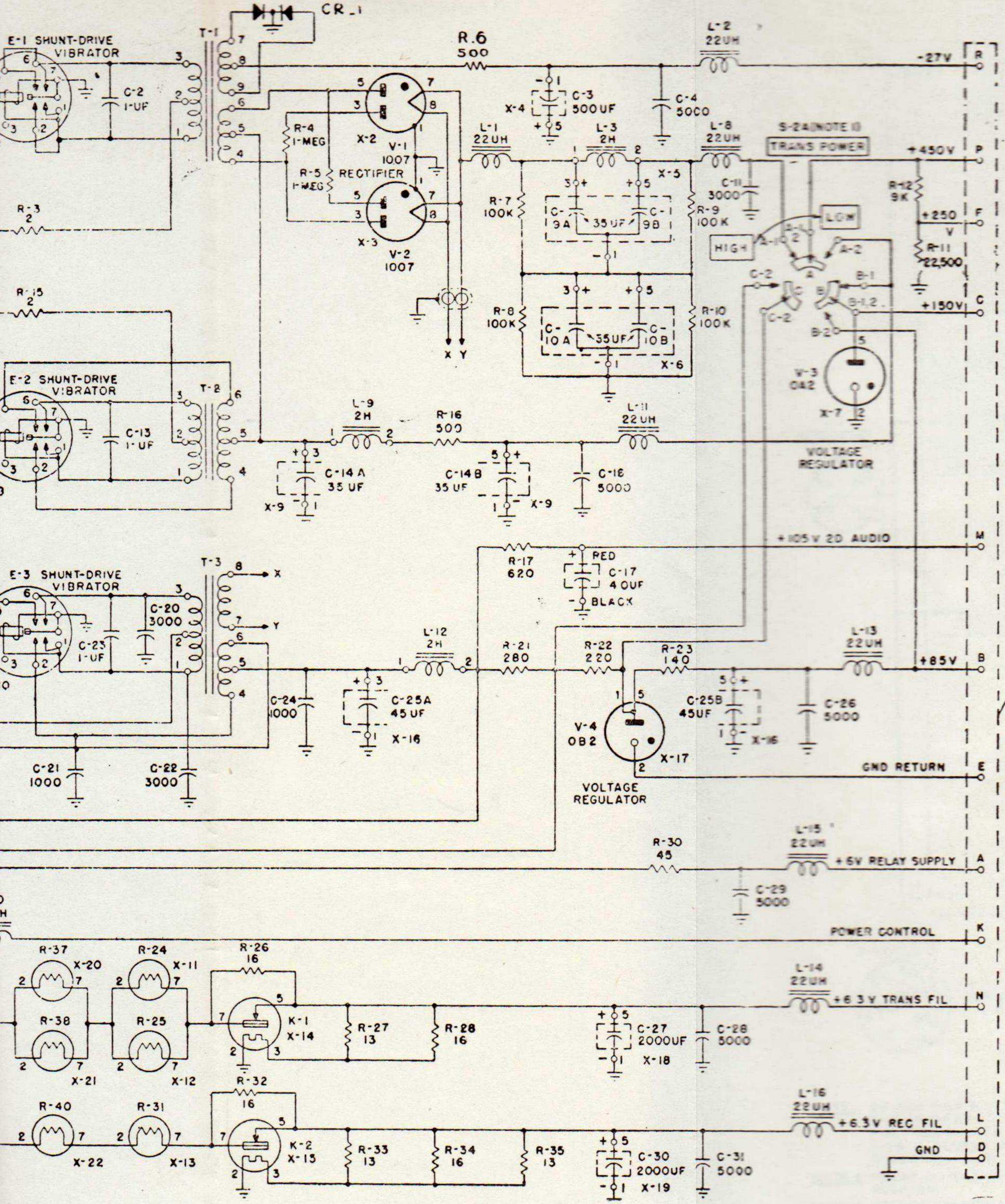


Figure 17. Power supply PP-112/GR. Schematic diagram.

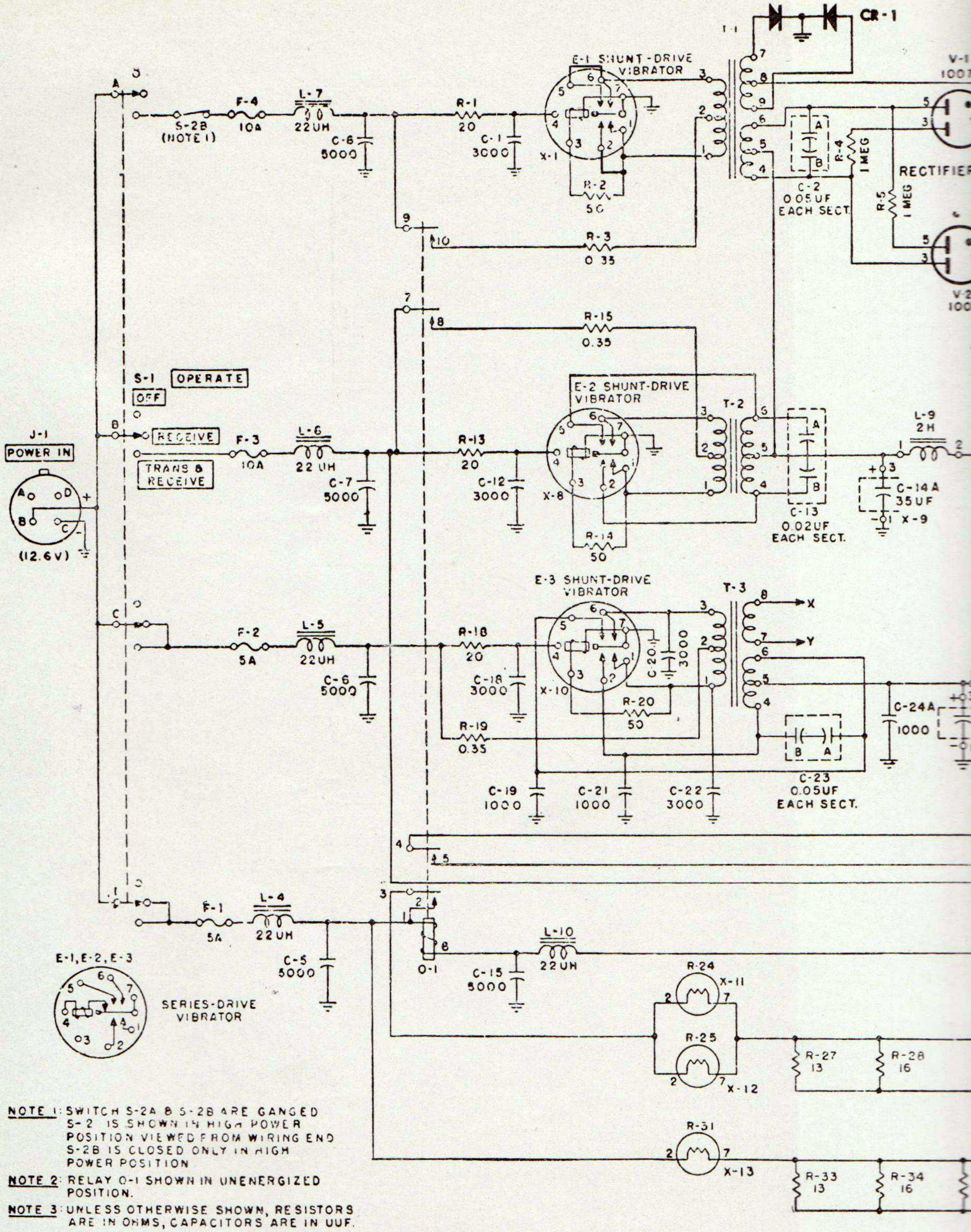


Figure 18. Po

NOTE 1: SWITCH S-2A & S-2B ARE GANGED S-2 IS SHOWN IN HIGH POWER POSITION VIEWED FROM WIRING END S-2B IS CLOSED ONLY IN HIGH POWER POSITION

NOTE 2: RELAY O-1 SHOWN IN UNENERGIZED POSITION.

NOTE 3: UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

NOTE 4: ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A, B, C, ETC CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT. THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS.

NOTE 5: VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS.

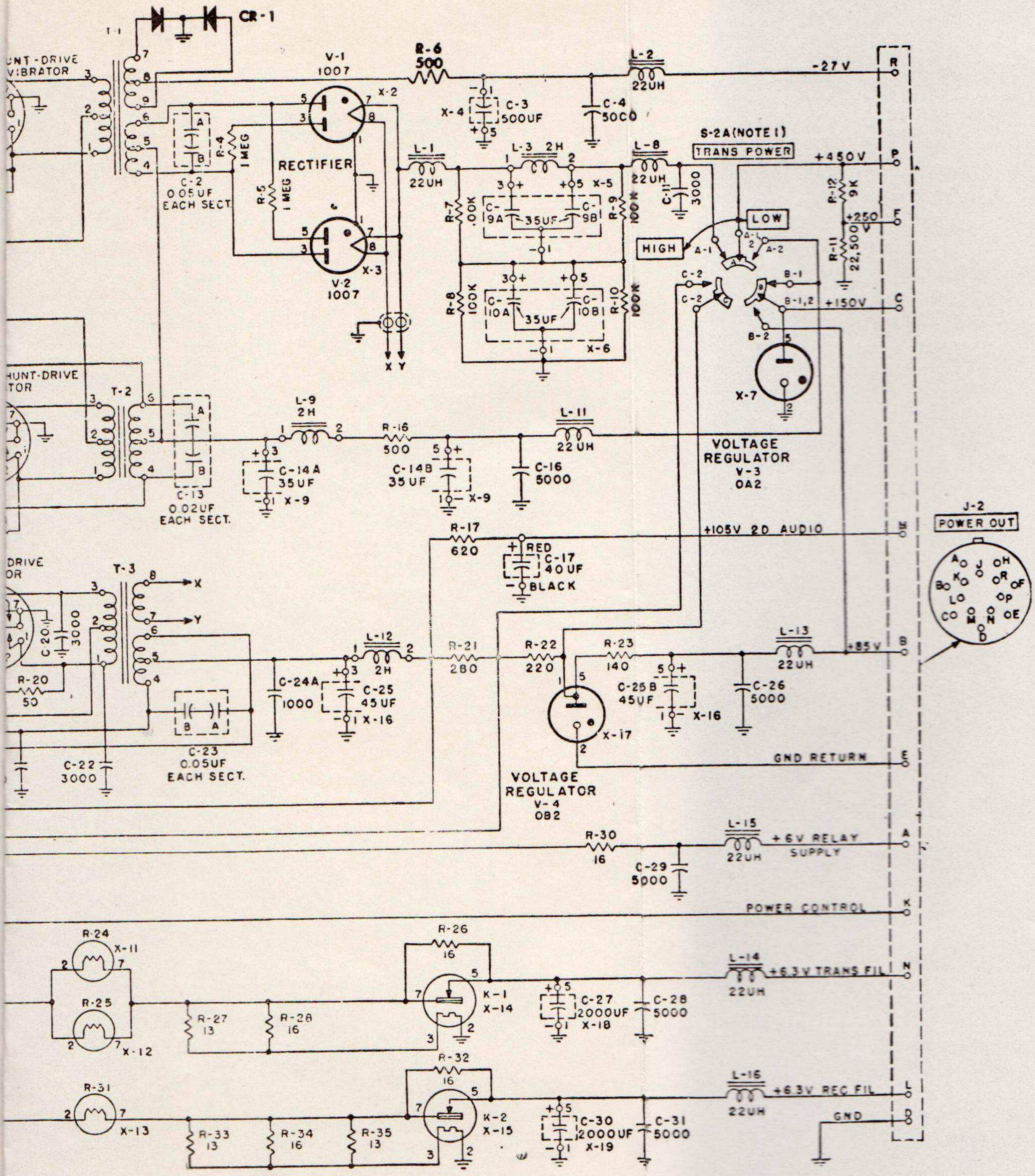


Figure 18. Power supply PP-109/GR. Schematic diagram.