REGULATED POWER SUPPLY
TYPE 580-D

MI-21523-C

RADIO CORPORATION OF AMERICA
ENGINEERING PRODUCTS DEPARTMENT CAMDEN, N. J.

IB-36078

REGULATED POWER SUPPLY

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INSTRUCTIONS

RADIO CORPORATION OF AMERICA
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Camden, New Jersey, U. S. A.

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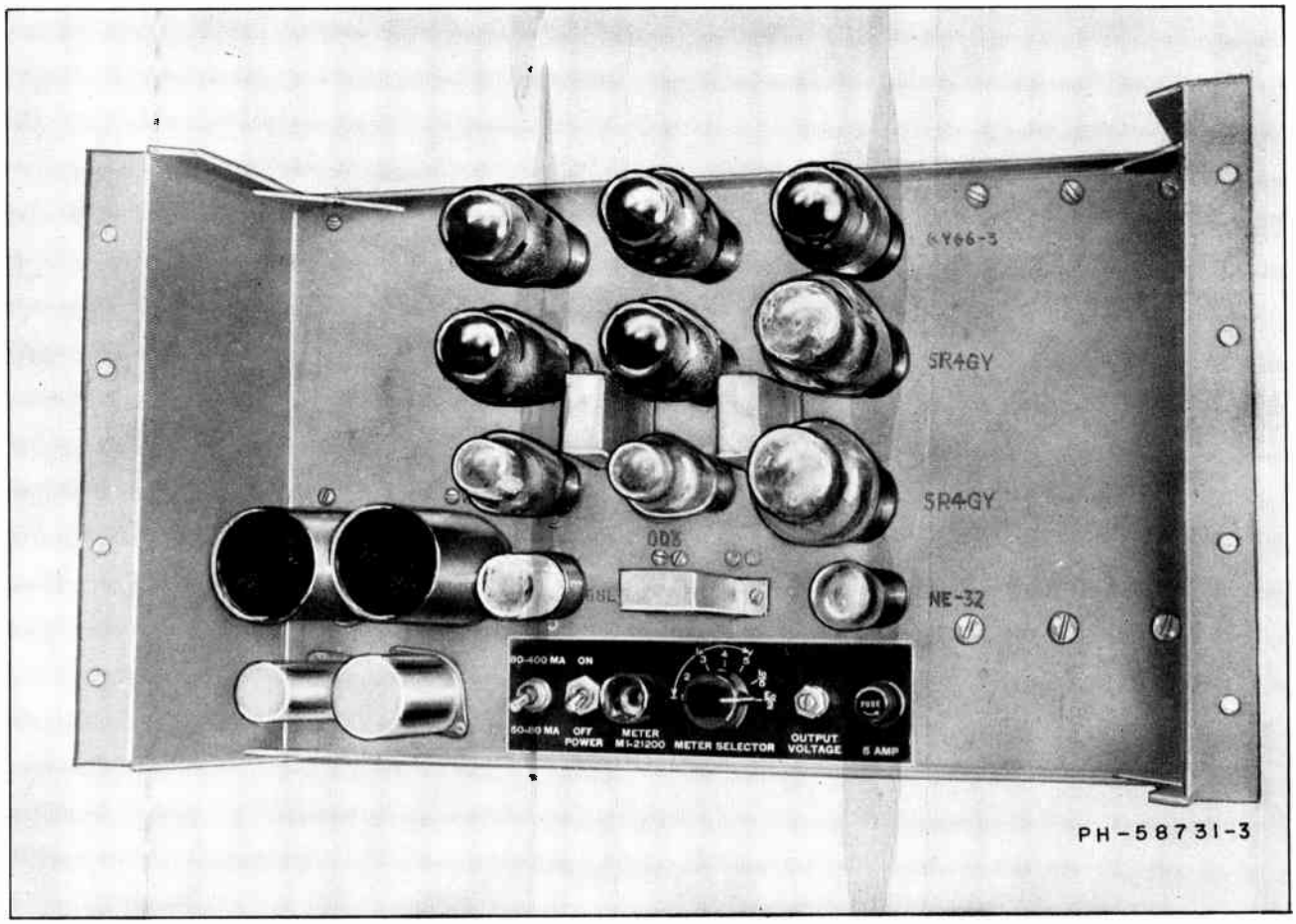


Figure 1—Type 580-D Regulated Power Supply, Front View

SECTION I

TECHNICAL SUMMARY

ELECTRICAL CHARACTERISTICS

A-C Power Requirements

Voltage.....105-115 and 115-125 volts, 50-60 cycles

Power Consumption (maximum) 370 watts

D-C Output Characteristics

Voltage Range.....250-300 volts

Current Range.....50-400 milliamperes

Regulation.....less than 0.5 volt variation from minimum to maximum load

Ripple Voltage.....less than 0.015 volt peak to peak

TUBE COMPLEMENT

2 RCA-5R4GY.....Rectifier, V6 and V9

5 RCA-6Y6G.....Voltage Regulators (vacuum type), V1 to V5, inclusive

1 RCA-6SL7GT.....D-C Amplifier, V10

2 RCA-OD3.....Voltage Regulators (gas type), V7 and V8

1 Type NE-32 (RCA Stock No. 16864) Starting Protector (neon lamp), V11

MECHANICAL CHARACTERISTICS

Over-all Dimensions (Inches) Height 10½, Width 19, Depth 12½

Weight.....58 pounds

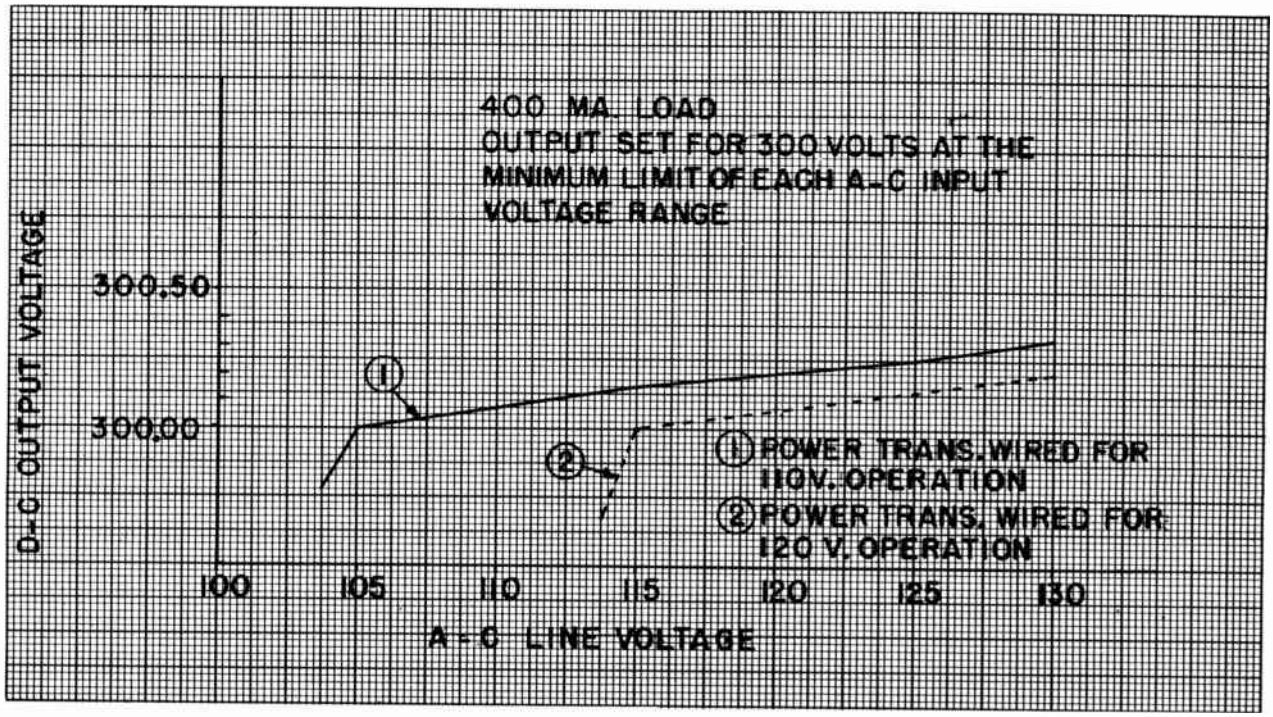


Figure 2—Regulation Curve of a Typical Unit Showing Output Voltage Versus Line Voltage

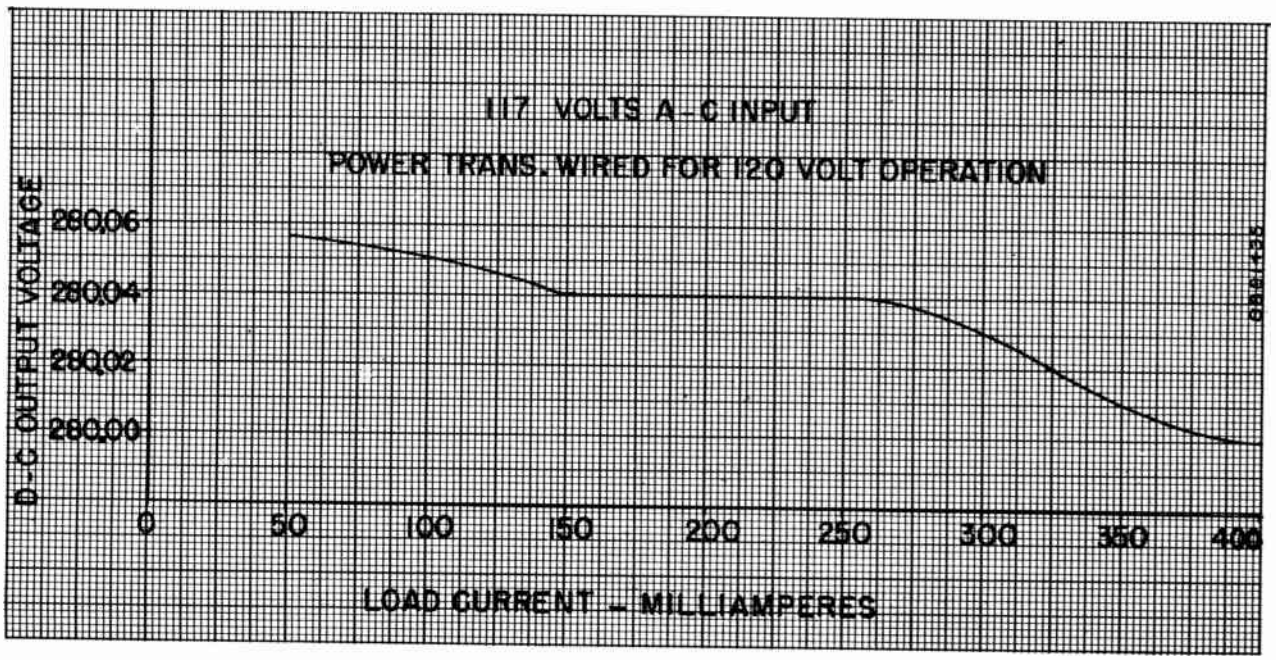


Figure 3—Regulation Curve of a Typical Unit Showing Output Voltage Versus Load Current

SECTION II

DESCRIPTION

1. PURPOSE OF UNIT.

Type 580-D Regulated Power Supply is a general purpose d-c power source with exceptionally good voltage regulation, supplying constant output voltage over wide variations in load current and line voltage. It is designed for television, laboratory or any other application in which a well regulated d-c power supply is required. The output voltage regulating characteristics of a typical unit at various load currents and line voltages are shown in Figures 2 and 3.

2. EQUIPMENT SUPPLIED.

a. Items supplied with the equipment and identified by RCA Stock No. MI-21523-C are as follows:

1 580-D Regulated Power Supply
1 Instruction Book (1B-36077)
1 Set of RCA tubes (see Section 1, Tube Complement)

b. Additional available items which may be required in certain installations are as follows:

1 Cover Panel, MI-21205-B6
1 Meter, MI-21200-C1. (For measuring current and voltage)

3. PHYSICAL CHARACTERISTICS.

Physically, the unit is designed primarily for mounting in a standard mounting rack. A steel chassis of the recessed panel type is used, with all component parts arranged and assembled for maximum accessibility during maintenance and operation.

Tubes are inserted and controls adjusted from the front of the unit as shown by Figure 1. Other components are mounted at the rear of the unit, including the a-c power input receptacle and the power output receptacle, as shown by Figures 7 and 8. Five $\frac{1}{4} \times \frac{3}{8}$ elongated mounting holes are provided in the flanges on each side of the unit for mounting to the standard mounting rack. For installations requiring the front of the unit to be closed, a snap-on type, black finished, steel cover panel (RCA Part No. MI-21205-B6) is available. Two mounting brackets are provided with the panel.

4. CIRCUIT DESCRIPTION.

a. The portion of the circuit which includes the power transformer, the two RCA-5R4GY rectifiers, and the choke-input filter is conventional except that each RCA-5R4GY tube has its two plates connected together and is used as a half-wave rectifier, providing full-wave rectification. Voltage regulation is accomplished by the use of five RCA-6Y6G voltage regulating tubes controlled by an RCA-6SL7GT d-c amplifier, and two RCA-OD3 gaseous voltage regulators.

b. A simplified diagram of the voltage regulating circuit is shown in Figure 4. V1 to V5 in this diagram represents the five RCA-6Y6G voltage regulating tubes. In the equipment, these tubes operate in parallel and their common cathode and plate terminals are connected in series with the positive output of the filter. They function collectively as a variable resistor, operating at maximum plate dissipation when the output is 250 volts at a load current of 300 milliamperes. Operating at 250 volts with currents greater than 300 ma. will slightly reduce the life of tubes V1 to V5.

c. Operation of the circuit can be readily understood by considering the action of the d-c amplifier (V10) when a variation in output voltage occurs across the load terminals C and D. Assuming the voltage across these terminals to be reduced for an instant, the resultant voltage between points A and B is also reduced, thus decreasing the grid bias on tube V10A and causing its plate current to increase. Since the two sections of the twin triode (V10A and V10B) are directly coupled, this increase in plate current of V10A causes more negative grid bias to be applied to V10B; decreasing its plate current. The decreased plate current of V10B causes less voltage drop across resistor R30. This results in a reduction of the bias applied to the grids of tubes V1 to V5 inclusive, decreasing their plate-to-cathode resistance and thereby increases the output voltage between C and D to its former value. Increased output voltage is prevented by operation of the control circuits in a manner which is the opposite to that just described. The voltage level, about which the d-c amplifier operates, is determined by the setting of the "VOLTAGE OUTPUT" control R34.

d. The gas regulator tube V7 minimizes the voltage change between the cathode of V10A and the high side of the output. The gas regulator tube V8 maintains both the grid of V10A and the cathode of V10B at fixed potentials with respect to ground. This is accomplished by virtue of the characteristics of the gaseous regulator tubes whereby the tube voltage drop remains practically constant irrespective of variations in current through the tube.

e. Because the action of the voltage-regulating circuit occurs at a very rapid rate, it functions on ripple voltage with the result that the output is almost entirely free of hum.

f. A neon tube V11 connected between grid and cathode of the 6Y6G voltage-regulating tubes protects their grids when the instrument is first turned on.

In operation, this tube will glow when the line voltage is high and a load of less than 80 milliamperes at 250 volts is present at the output. In this case, the toggle switch (S3) on the panel should be switched to the "50-80 MA" position. Never operate the equipment with a load exceeding 80 milliamperes with the switch in this position.

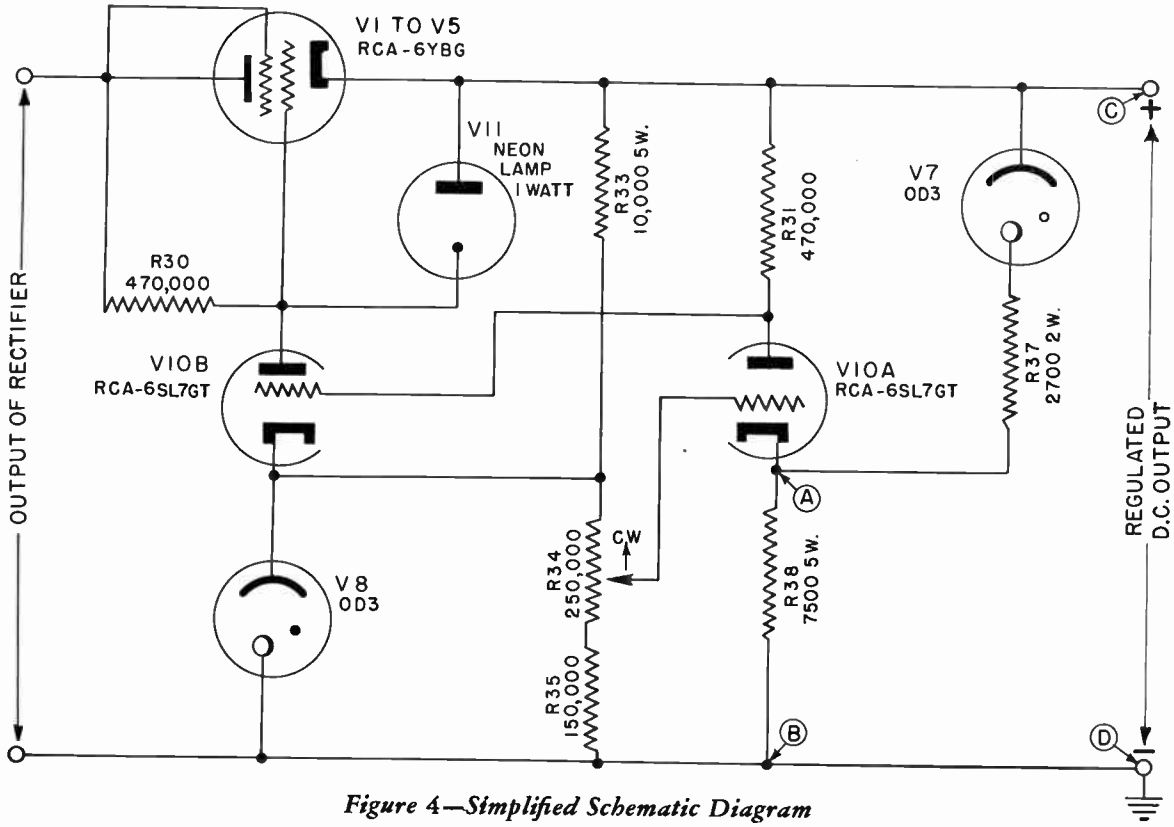


Figure 4—Simplified Schematic Diagram

SECTION III
INSTALLATION

1. MOUNTING UNIT IN RACK.

Insert the unit into a standard mounting rack with the control panel vertical and facing the front of the rack. Bolt mounting flanges of the unit to the front mounting channels of the rack, using $^{10}/_{32}$ nuts and bolts. Place tubes in their respective sockets as labeled on the front of the unit. If the installation requires the front of the unit to be closed, a cover panel (RCA Stock No. MI-21205-B6) should be used. This panel is of the snap-on type, and can be easily removed when controls are to be adjusted or tubes are to be tested. Two brackets are supplied with the panel for mounting to the channels of the rack.

2. POWER SOURCE CONNECTIONS.

A 50 to 60 cycle a-c power source with a voltage range of either 105 to 115 volts or 115 to 125 volts is required for operation of the unit. Before the power source is connected to the unit, the power transformer must be correctly wired for the voltage range of the power source to be used. This is important for proper regulation of the d-c output voltage. Two leads are provided on the primary of the power transformer for this purpose, a "red and black" lead for 105 to 115 volt operation, and a "black with red tracer" lead for 115 to 125 volt operation. These leads are terminated on terminals 4 and 5 of the terminal board adjacent to the power transformer as shown in Figure 5. Either primary lead may be connected to one side of the power source through the red with black tracer lead from the fuse holder receptacle. When shipped from the factory, the power transformer is wired for a 115 to 125 volt power source (red with black tracer lead from fuse holder connected to terminal 4). If the voltage reading of the power source to be used is within 105 to 115 volts, then disconnect the red with black tracer lead from terminal 4, and reconnect it to terminal 5. After the power transformer primary is properly connected, the power source should be connected through a cable and a-c plug to the a-c receptacle, J3, shown in Figures 7 and 8.

A protective interlock switching circuit, operated through the power switch S1, is provided for disconnecting the power to other equipment of the installation, when repairs or adjustments are to be made. One side of the power source feeding the other equipment should be connected to the circuit through terminals 7 and 8 of the d-c plug and receptacle located on the rear of the unit as shown in Figures 7 and 8.

3. D-C OUTPUT CONNECTIONS (Figure 6).

D-C power output is obtained from the terminals of the d-c plug and receptacle J2 on the rear of the unit. Referring to Figure 6 unregulated d-c voltage is supplied at terminal 9. Regulated d-c voltage in the range from 250 to 300 volts, at 50 to 400 milliamperes, is supplied at terminal 10. If the unit is to supply power to television monitor units, horizontal centering voltage can be obtained by removing the jumper across C-6 and connecting a low resistance potentiometer between terminals

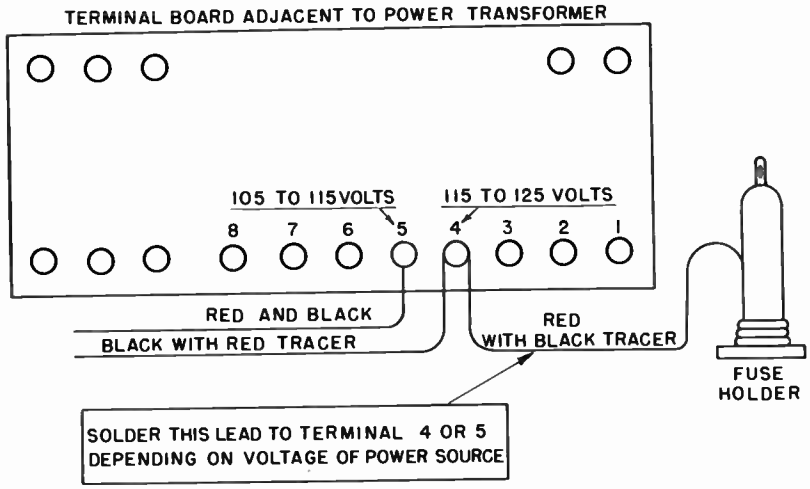


Figure 5—Terminal Board Connections for 105 to 115 Volts or 115 to 125 Volts Operation

11 and 12. The entire output current of the unit will then pass through the potentiometer.

4. PRELIMINARY ADJUSTMENTS.

Before the unit is ready for use, certain adjustments must be made to provide the required output voltage and load current for operation of the associated equipment. With the equipment connected to the unit, proceed as follows to make these adjustments:

a. Plug an RCA MI-21200-C1 meter into the "METER" jack on the chassis. Meter shunts and multipliers of the proper value for use with the low-range meter are built into the power supply unit, and are automatically connected into the meter circuit by the "METER SELECTOR" switch. $\frac{Io}{5}$ is the total rectified output current. When no current is supplied through the unregulated voltage terminals, $\frac{Io}{5}$ will indicate the regulated load current plus approximately 20 ma. due to the bleeder current in the regulated section.

b. With a screwdriver, turn the "VOLTAGE OUTPUT" control (R36) fully counterclockwise. Place the toggle switch (S3) in either the "80-400 MA." or "50-80 MA." position, depending upon the anticipated load current. Turn the "METER SELECTOR" switch to the $\frac{\text{"Io"}}{5}$ position to provide for reading the output current.

c. Turn on the power supply by setting the "POWER" switch in the "ON" position. After a 10-second warm-up period, the panel meter will indicate the current being drawn by the load. See that the "80-400 MA.", "50-80 MA." toggle switch (S3) is in the proper position.

d. Turn the "METER SELECTOR" switch to the $\frac{\text{"Eo"}}{2}$ position to read the voltage being delivered to the load. Adjust the "VOLTAGE OUTPUT" control (R36) until the desired voltage (within the limits 250-300 volts) is obtained. Then turn the "METER SELECTOR" to the $\frac{\text{"Io"}}{5}$ position to recheck the output current and to be certain the 80-400 MA., 50-80 MA. toggle switch (S3) is in the proper position. The power supply is now ready for operation.

NOTE: For some applications it may be desirable to have the a-c line voltage available at terminals 7 and 8 of the D-C Output Receptacle instead of the interlock switching circuit normally provided. To make the necessary changes, proceed as follows:

1. Remove the white with yellow and red tracer wire from terminal 7 on J2 and connect this wire to terminal 1 on J3 (this terminal has a red with black tracer wire connected to it).
2. Connect a No. 14 stranded wire lead from terminal 7 on J2 to terminal 2 on J3 (this terminal has a white with red and green tracer wire connected to it).

With these alterations the a-c line voltage will be available across terminals 7 and 8 of the output receptacle J2, and will be controlled by the power switch S1. Not over 12 amperes should be drawn from these terminals when this connection is used.

CAUTION

Do not operate the power supply at a load current exceeding 80 milliamperes with the toggle switch S3 in the "50-80 MA." position. Also, $\frac{Io}{5}$, the sum of the regulated and unregulated output currents should never exceed 450 milliamperes.

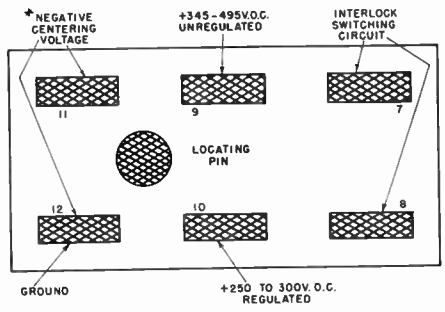


Figure 6—D-C Output Receptacle Connections

SECTION IV

OPERATION

1. APPLYING POWER.

After preliminary adjustments have been made as described in Section III, Paragraph 4, the power unit is ready for use. Turn on the power supply by throwing the "POWER" switch to the "ON" position.

A 10-second warm-up period is required, after which d-c voltage will be delivered to the load.

2. CHECKING VOLTAGE OUTPUT AND LOAD CURRENT.

a. The "METER" jack on the top of the chassis provides a convenient means for connecting an RCA meter, stock No. MI-21200-C1, into the circuits to measure voltage output and load current while the power unit is operating. Turn the "METER SELECTOR" switch to $\frac{\text{"Eo"}}{2}$ when measuring output voltage, and to $\frac{\text{"Io"}}{5}$ when measuring load current.

b. Any output voltage between 250 and 300 volts can be obtained by adjusting the "VOLTAGE OUTPUT" control.

3. CENTERING VOLTAGE FOR TELEVISION EQUIPMENT.

If the unit is being used with television equipment and centering voltage is required, remove the jumper across C6 then connect a low resistance potentiometer between terminals 11 and 12 on the output receptacle, J3. Centering voltage is obtained by connecting between the center arm of the potentiometer and the ground terminal of the receptacle.

SECTION V

MAINTENANCE

1. PERIODIC TUBE CHECK.

a. All tubes should be checked periodically and when found defective should be replaced with standard RCA types.

b. The plate circuits of the five voltage-regulating tubes V1 to V5 carry the entire output current drawn by the load. Since these tubes are operated in parallel, the plate current of each tube should be approximately one-fifth of the total load current, or about 80 milliamperes when the power supply is operated under maximum load. Inasmuch as the failure of any one of these five tubes may produce an overload on the plates of the others, it is advisable to check the plate current of each tube periodically by placing the 80-400 MA., 50-80 MA. toggle switch in the "80-400 MA." position and then rotating the "METER SELECTOR" switch to positions "1", "2", "3", "4" and "5".

c. A ten percent reduction in plate current usually indicates a loss of cathode emission. Replace the suspected tube and recheck the plate current.

2. EXCESSIVE HUM.

a. Excessive hum will develop when the power supply is operated outside its regulating limits. The curves of Figures 2 and 3 show the limits for operation. As shown by Figure 2, for example, poor regulation will be obtained (which can result in excessive hum) if the power transformer is improperly connected for the line voltage being supplied (see Section III, Paragraph 2). Figure 3 shows maximum and minimum load currents for proper operation.

b. Excessive hum accompanied by high voltage can be caused by a defective d-c amplifier tube V10.

3. ABNORMAL OUTPUT VOLTAGE.

a. High output voltage which cannot be reduced by the "VOLTAGE OUTPUT" control may be caused by a defective gaseous voltage regulator tube, V7 or V8.

b. Low output voltage which cannot be increased by the "VOLTAGE OUTPUT" control may be caused by low-emission rectifier tubes V6 or V9, or by low-emission voltage regulator tubes, V1 to V5.

4. TUBE SOCKET VOLTAGES.

The operating voltages of each tube are shown on the tube-socket diagram of Figure 10. When checking voltages, use a meter with an internal resistance of at least 1000 ohms per volt.

5. VOLTAGE-REGULATION CURVES.

Voltage regulation characteristics of the power supply are shown graphically in Figures 2 and 3. Figure 2 shows the output voltage with varying line voltage. Figure 3 shows the output voltages with constant line voltage and varying load.

6. FUSE REPLACEMENT.

Should the supply line fuse F1 blow out, check the circuit carefully for grounded connections or shorted output. Always replace the fuse with one of the same rating.

SECTION VI
REPLACEMENT PARTS

When ordering replacement parts, please give Symbol, Description, and Stock Number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part; however, it will be a satisfactory replacement, differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

MI-21523-B2
REGULATED POWER SUPPLY

Symbol No.	Description	Stock No.
C1, 2	Capacitor—Fixed, oil filled, 9 mfd. +20% −10%, 600 volts	51593
C3, 4	Capacitor—Fixed, oil filled, 1 mfd. ±10%, 600 volts	56124
C5	Capacitor—Fixed, paper oil, 0.5 mfd. ±10%, 600 volts	59892
C6	Capacitor—Fixed, dry electrolytic, 1,000 mfd. −10% +50%, 25 volts	59891
C7	Same as C3	
C8	Capacitor—Fixed, dry electrolytic, 20-20 mfd. −10% +50%, 450 volts	34889
F1	Fuse—5 amps	44812
J1	Jack—Single circuit	18466
J2	Connector—6 contact, female	51594
J3	Connector—2 contact, male	48743
P2	Connector—6 contact, male	51595
R1	Resistor—Fixed, carbon film, spiral cut, 200,000 ohms ±1%, 1 watt	56085
R2	Resistor—Fixed, wire wound, 50 ohms ±2%, 1 watt	51596
R3	Resistor—Fixed, wire wound, 2 ohms ±2%, 1 watt	51597
R4, 5, 6, 7, 8	Resistor—Fixed, wire wound, 10 ohms ±2%, 1 watt	51598
R9, 10, 11, 12, 13	Resistor—Fixed, comp., 47 ohms ±10%, 1 watt	45884
R14, 15, 16 17, 18	Resistor—Fixed, comp., 100 ohms ±10%, ½ watt	34765
R19	Resistor—Fixed, comp., 560 ohms ±10%, 1 watt	38884
R20	Resistor—Fixed, comp., 56 ohms ±10%, 1 watt	71992
R21	Same as R19	
R22	Same as R20	
R23	Same as R19	
R24	Same as R20	
R25	Same as R19	
R26	Same as R20	
R27	Same as R19	
R28	Same as R20	
R29	Resistor—Fixed, comp., 27,000 ohms ±10%, 1 watt	71990
R30, 31	Resistor—Fixed, comp., 470,000 ohms ±10%, 1 watt	72521
R32	Resistor—Fixed, comp., 1,000 ohms ±10%, 1 watt	71916
R33	Resistor—Fixed, wire wound, 10,000 ohms ±10%, 5 watt	45354
R34	Resistor—Variable, carbon, 250,000 ohms	51589
R35	Resistor—Fixed, comp., 150,000 ohms ±10%, 1 watt	31895
R36	Same as R30	
R37	Resistor—Fixed, comp., 2,700 ohms ±10%, 2 watt	33855
R38	Resistor—Fixed, wire wound, 7,500 ohms ±10%, 5 watt	51995
R39	Resistor—Fixed, comp., 100,000 ohms ±10%, 2 watt	28738
R40	Resistor—Fixed, wire wound, 500 ohms ±10%, 10 watt	48201
S1	Switch—Toggle, D.P.S.T.	69949
S2	Switch—Rotary, 2 section, 1 pole, 7 position, non-shorting	52132
S3	Switch—Toggle, D.P.D.T.	52133
T1	Transformer—Power	54289
L1	Reactor—Filter	18437
V11	Lamp—Neon lamp, 1 watt	16864
X1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Socket—Tube socket	68590
X11	Socket—2 contacts for neon lamp	48250
XF1	Holder—Fuse	48551
	Insulator cup for Jack J1	56177
	Knob—Control knob	30075
	Plate—Mounting for C6, phenolic	18469
	Plate—Mounting for C8, steel ..... Dwg. No. 85559-2	

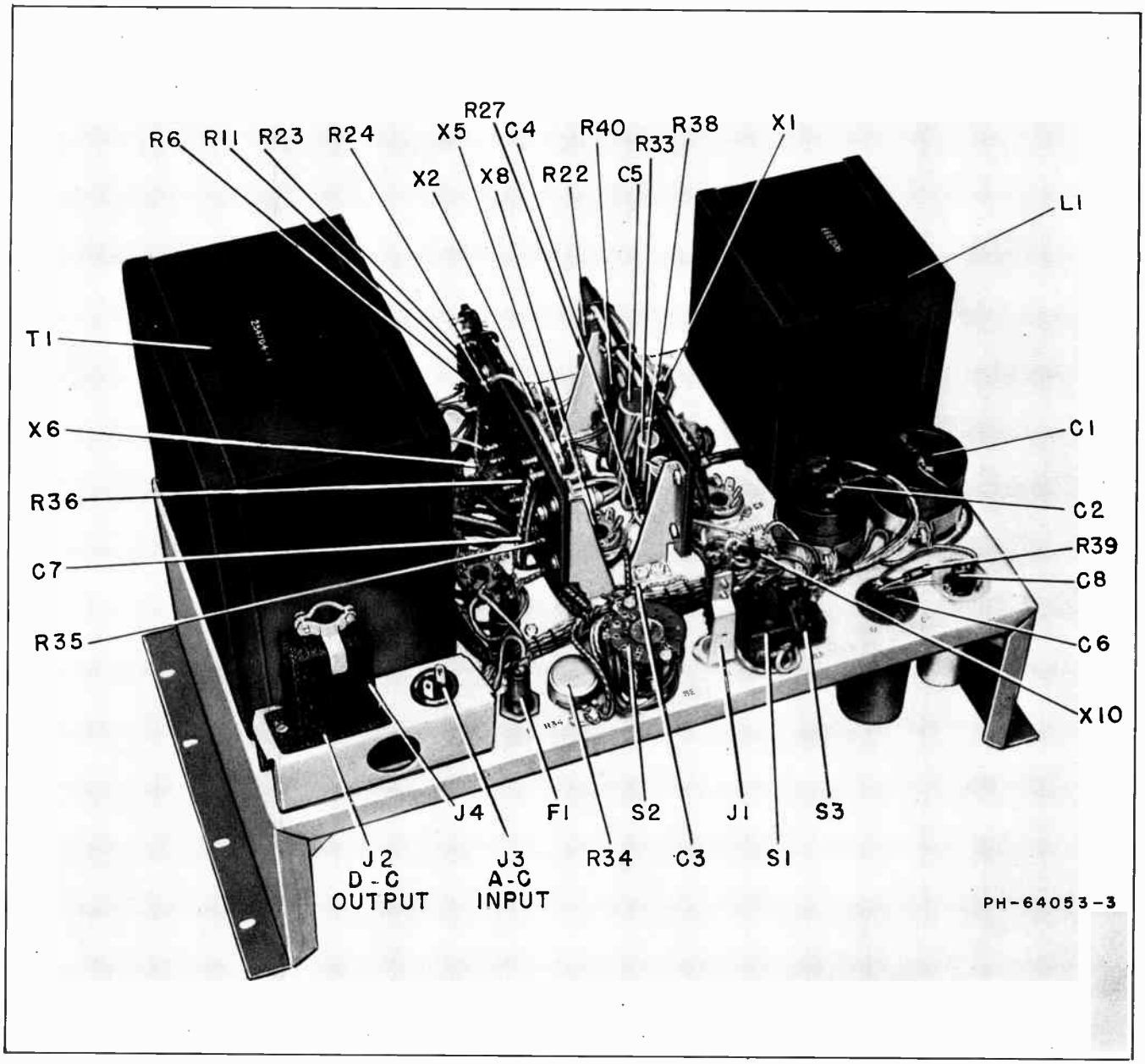


Figure 7—Type 580-D Regulated Power Supply, Rear Left Oblique View

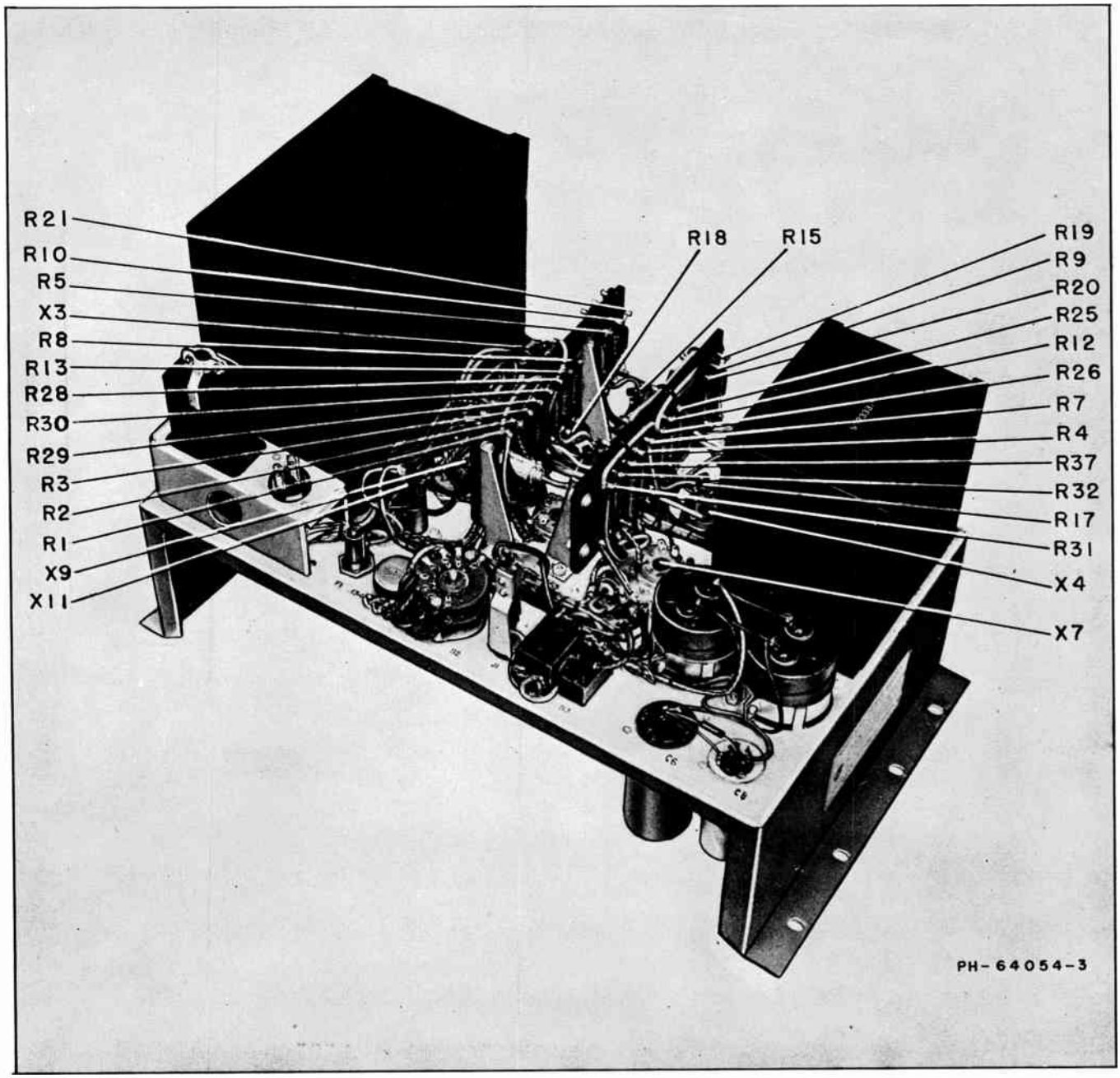


Figure 8—Type 580-D Regulated Power Supply, Rear Right Oblique View

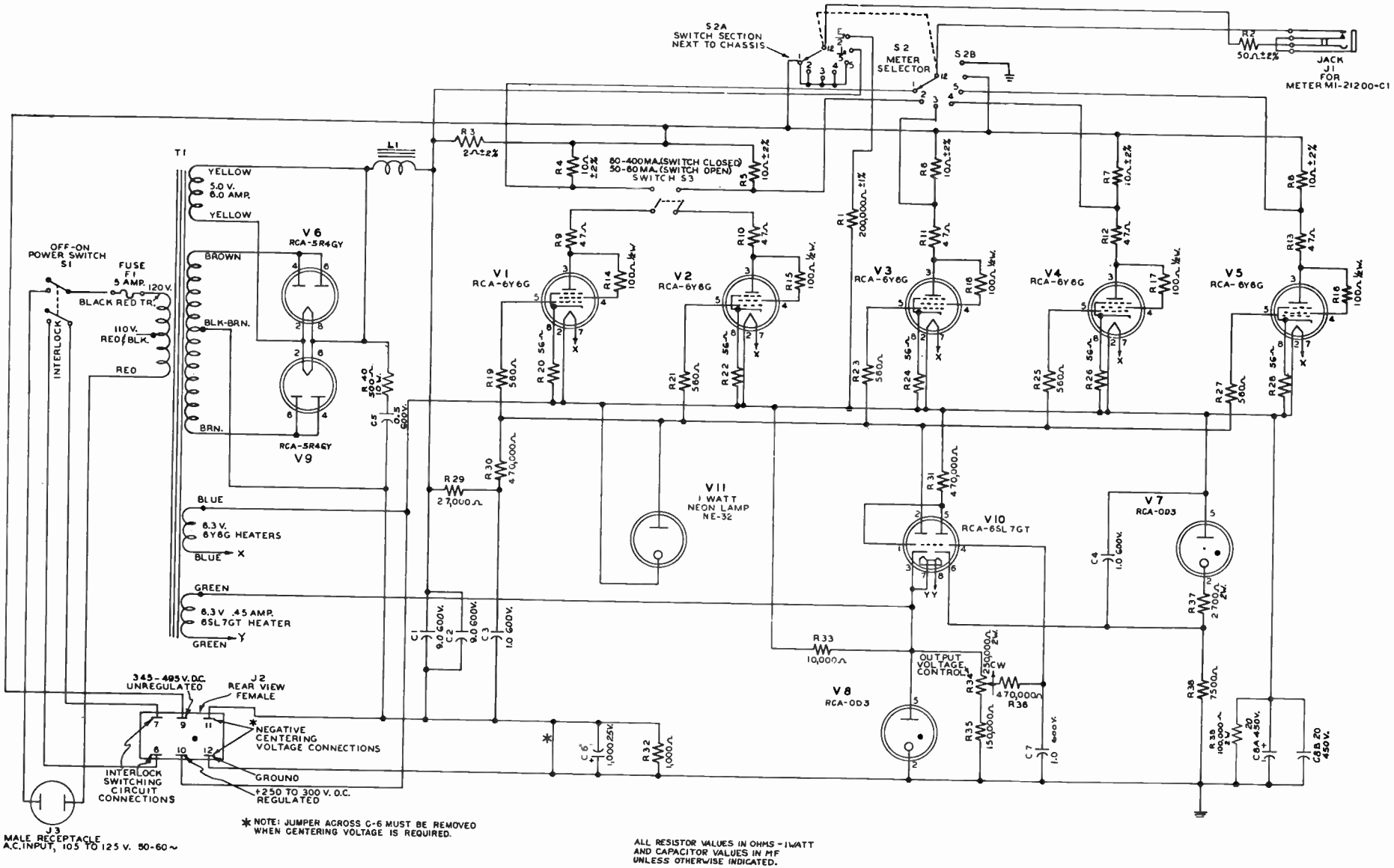
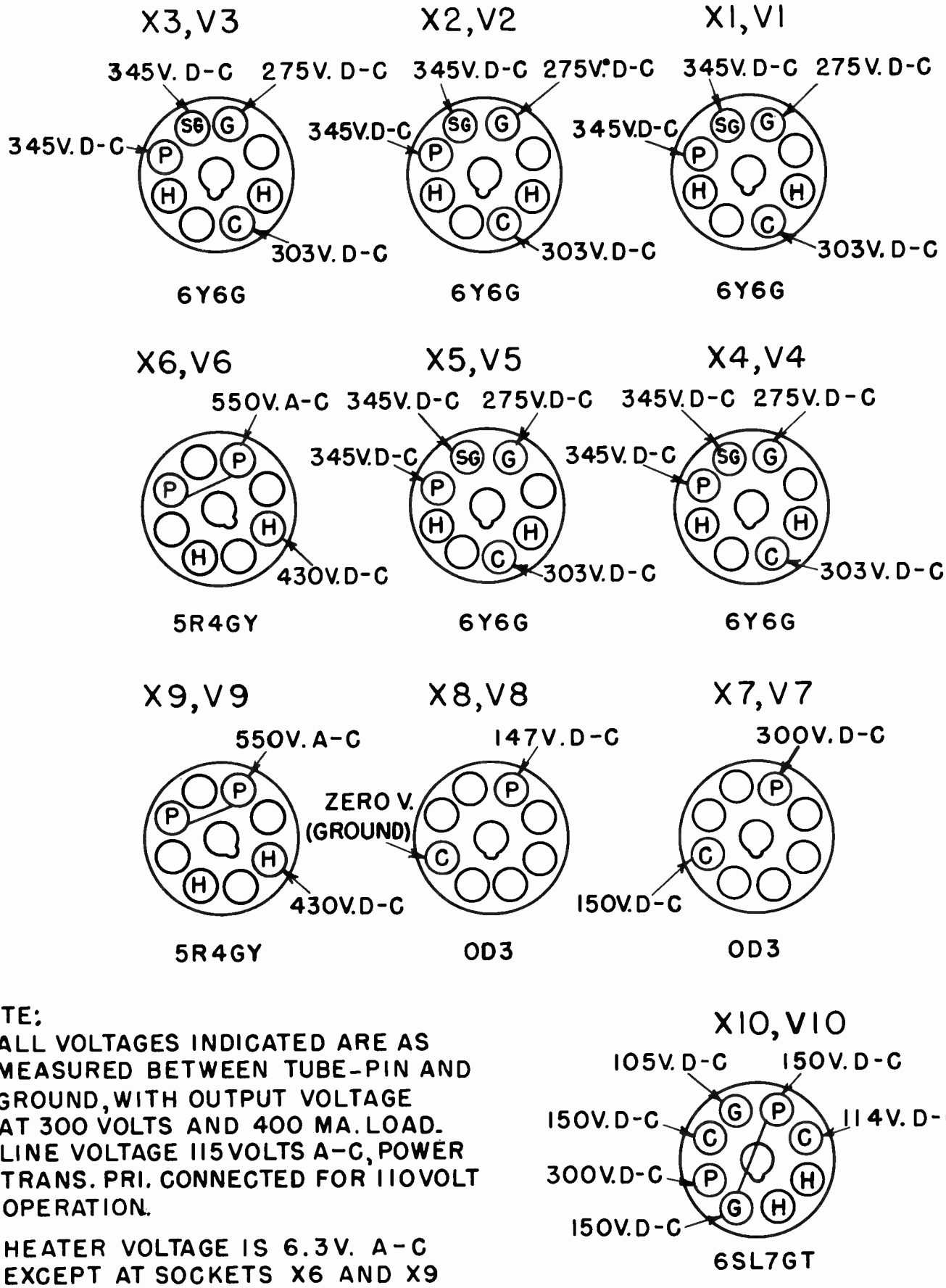


Figure 9—Type 580-D Regulated Power Supply, Schematic Diagram



NOTE:

ALL VOLTAGES INDICATED ARE AS MEASURED BETWEEN TUBE-PIN AND GROUND, WITH OUTPUT VOLTAGE AT 300 VOLTS AND 400 MA. LOAD. LINE VOLTAGE 115 VOLTS A-C, POWER TRANS. PRI. CONNECTED FOR 110 VOLT OPERATION.

HEATER VOLTAGE IS 6.3V. A-C EXCEPT AT SOCKETS X6 AND X9 WHERE IT IS 5V. A-C.

Figure 10—Type 580-D Regulated Power Supply, Typical Tube Socket Voltages

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