PRICE $5.00

INSTRUCTION MANUAL
MODEL D-76A *
POWER AMPLIFIER

* Including Models D-76, D-75A, D-75, D-51.

audio research corporation
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MINNEAPOLIS, MINNESOTA 55406

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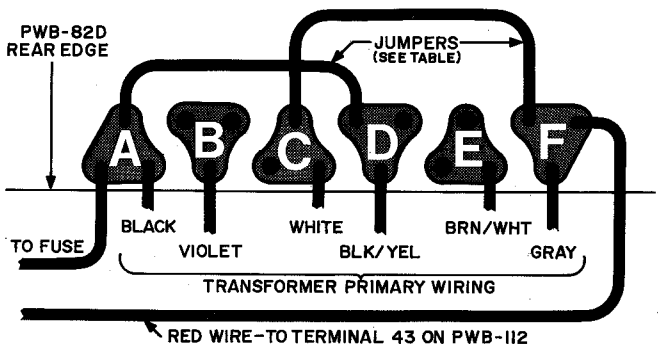
INTRODUCTION

Congratulations on your purchase. The D-76A dual channel audio frequency power amplifier was conceived and designed for audio perfectionists. It incorporates balanced cross-coupled vacuum tube circuitry for high definition music reproduction. Single ended input signals are phase inverted outside the overall feedback loops and together with their compliments drive push-pull inputs. Balanced negative feedback around the basic push-pull power amplifier is returned to these inputs – after the unity gain phase inverter and input amplifier. This, in addition to a partially cathode coupled output stage, results in "symmetrical" amplifier performance.

LINE VOLTAGE CONVERSION

This equipment can be wired for the following voltages: 100-120-200-220-240, 50-60 Hz. Check the line voltage in your locale. If it is different from that indicated on the yellow tag attached to the line cord, remove the bottom cover and re-solder the jumpers according to the diagram below. Secure the bottom cover and install the appropriate fuse as indicated below.



LINE VOLT.	FUSE VALUE	JUMPERS REQUIRED	RED WIRE CONNECTION
100	6.0A. S.B.	A TO D, B TO E	TERM. E
120	5.0A. S.B.	A TO D, C TO F	TERM. F
200	4.0A. S.B.	B TO D ONLY	TERM. E
220	4.0A. S.B.	C TO D ONLY	TERM. E
240	4.0A. S.B.	C TO D ONLY	TERM. F

NOTES

1. 120 VOLT TRANSFORMER PRIMARY WIRING SHOWN.
2. PRINTED WIRING BOARD DETAIL SHOWN AS VIEWED FROM BOTTOM OF CHASSIS.

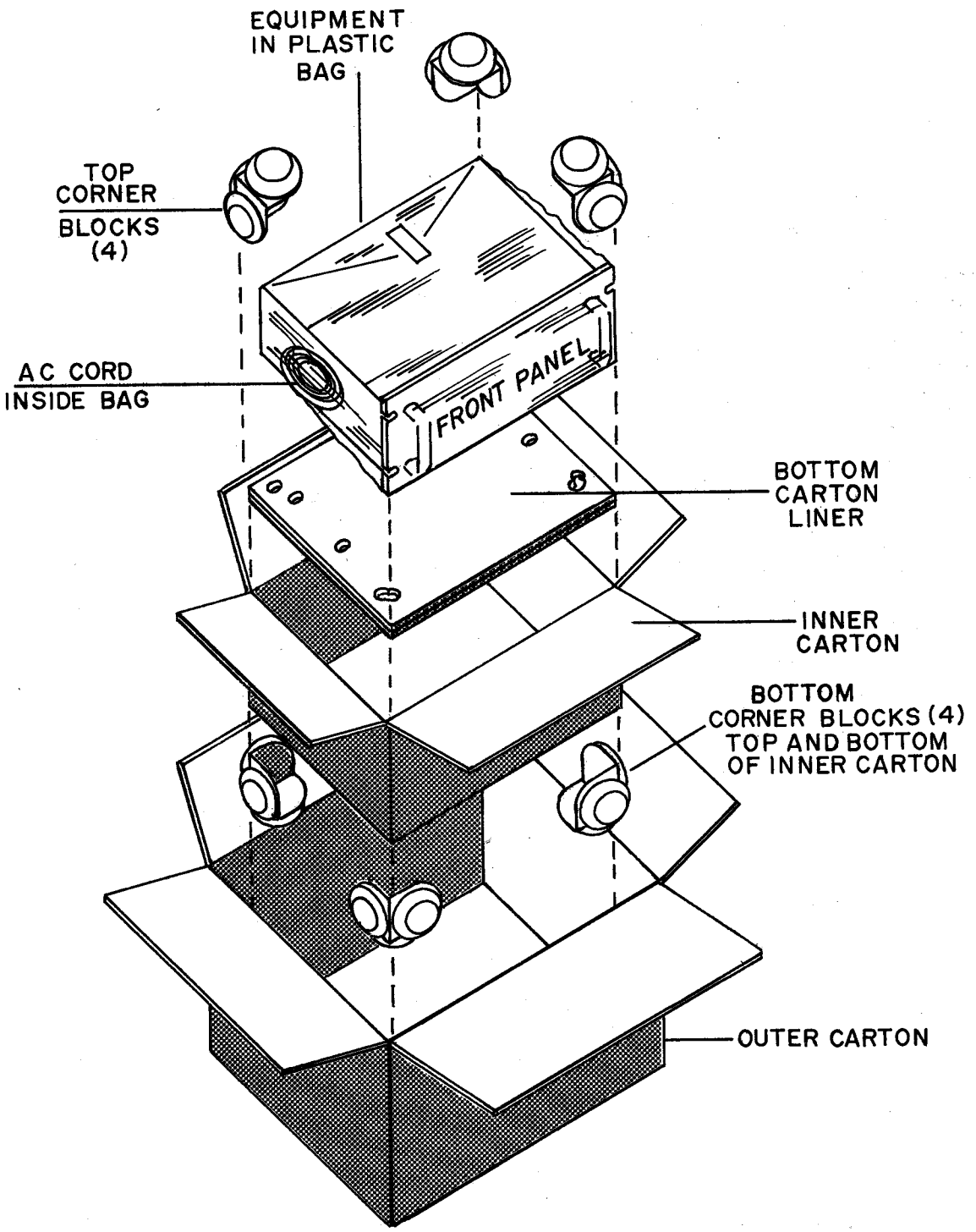
WARNING

To prevent fire or shock hazard, do not expose this equipment to rain or moisture.

This unit contains voltages which may be lethal. Do not operate this unit with covers removed. Refer servicing to qualified personnel.

EQUIPMENT PACKAGING

Save All The Packaging – Your Audio Research component is precision Electronic Equipment, and as such, deserves to be properly cartoned any time shipment is made. You may never have occasion to return it to the factory for service, but if such should be necessary, or other occasion to ship it occurs, the original packaging may save your investment from unnecessary damage or delay.



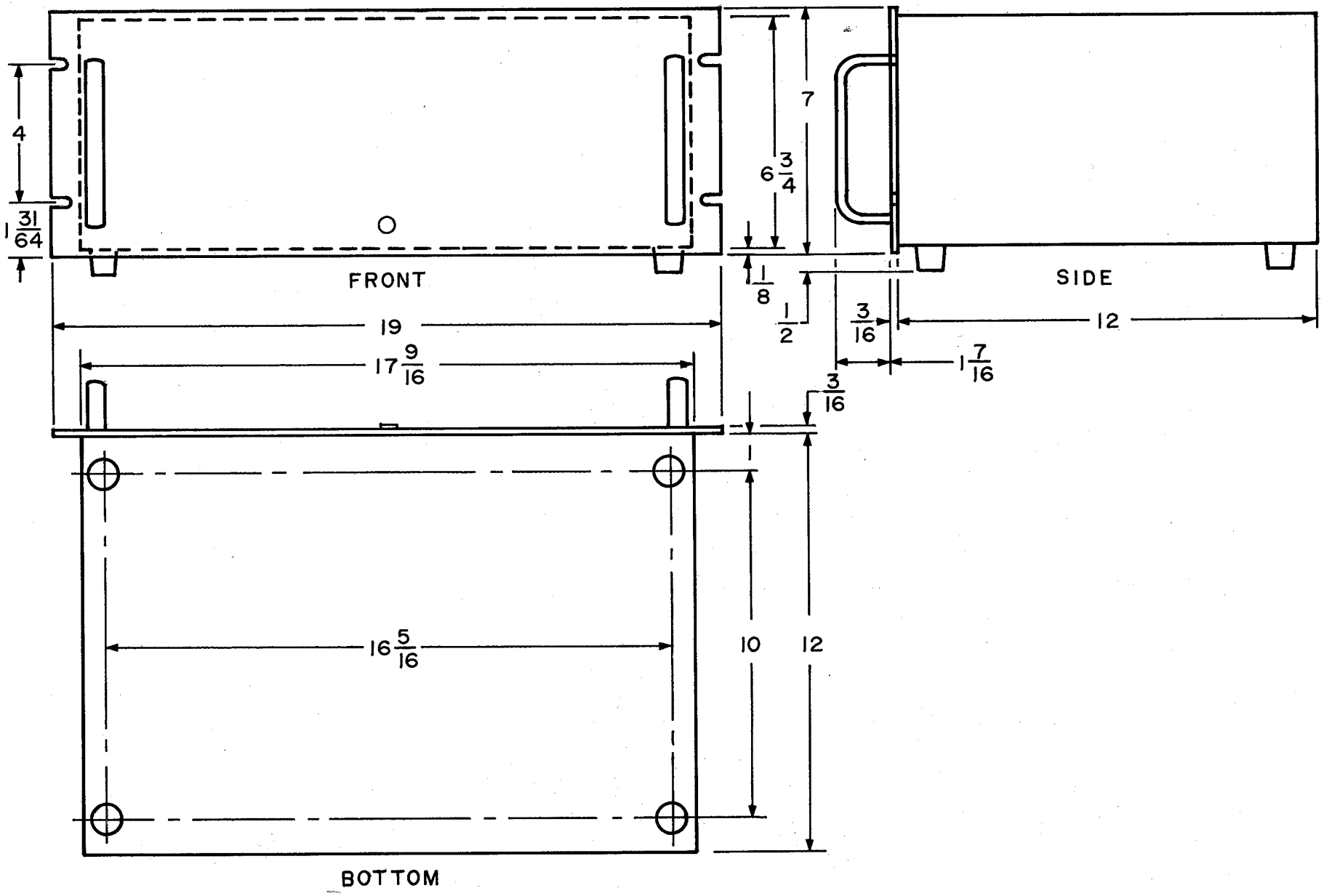
INSTALLATION & MOUNTING

To insure proper operation and normal component life, this equipment must receive proper ventilation. Never confine this device such as to inhibit proper cooling by natural convection through the ventilated enclosure. If this equipment is to be operated within a confined space or rack-type cabinet, forced air cooling should be provided. Audio Research Models FB-2 and RMV-2 (fan base and rack mount ventilator) are available for such configurations. It is recommended that the ambient operating temperature never exceed 120°F (49°C). The mechanical configuration of the D-76A permits two convenient methods of mounting. The mechanical drawing on page 4 shows the equipment dimensions necessary to assist in suitable mounting as outlined below:

Shelf Mount — The D-76A can rest directly upon a shelf or table. The four special elastomer feet prevent slipping on or marring of the mounting surface. In custom installations, it may be secured to the mounting shelf via the four holes used to fasten the feet to the bottom of the chassis. To accomplish this, remove the #8-32 x 1/2" pan head screw in the center of each foot. Locate the mounting holes on the shelf using the dimensions given on page 4. Drill four 1/4" clearance holes for the #8 mounting hardware. Insert the feet between the bottom of the chassis and the shelf — the feet serve as ventilation spacers. Secure the equipment to the shelf with four #8-32 screws and washers. The length of the mounting screws is determined by adding 3/4" to the thickness of the mounting shelf.

Panel Mount — The standard 19" width front panel enables "rack" mounting of the D-76A with other system components. A rack-type cabinet is a very convenient way for bi- and tri-amplified system equipment to be mounted. A suitable cabinet of this type is available as an Audio Research Model RC-1. The unit is of heavy gauge welded steel construction with a quality baked paint finish, pastel green, and standard rack mount spacing. It also has snap-on (and off) removable sides for ease of installation and wiring. The 52" rack opening will hold (3) D-76A, (3) FB-2, (3) RMV-2 plus any one of the Audio Research rack mount electronic crossovers.

The front panel of the D-76A may also be flush mounted against the panel of any equipment cabinet or other custom installation. If the unit is not to be supported by the front panel, a suitable "shelf" or bracket mount must be provided. Using the dimensions given on page 4, locate and make a cut-out for the chassis. Allow proper height between the bottom edge of the cut-out and top surface of the mounting shelf or bracket for the feet of the unit. Secure the unit to the mounting shelf or bracket via the four holes used to fasten the feet to the bottom of the chassis as explained in the "shelf mount" instructions above.



EQUIPMENT DIMENSIONS

INSTALLATION & MOUNTING

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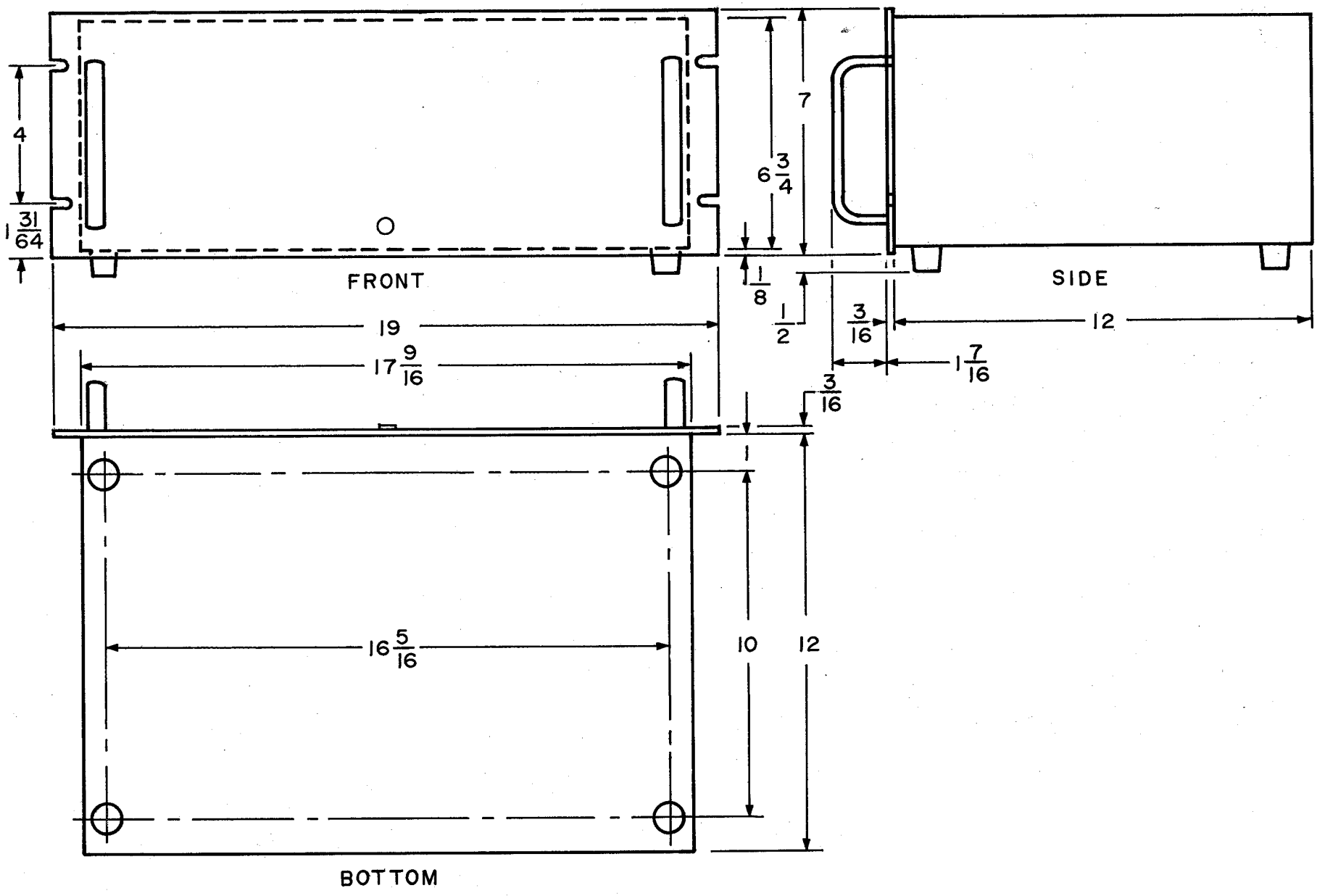
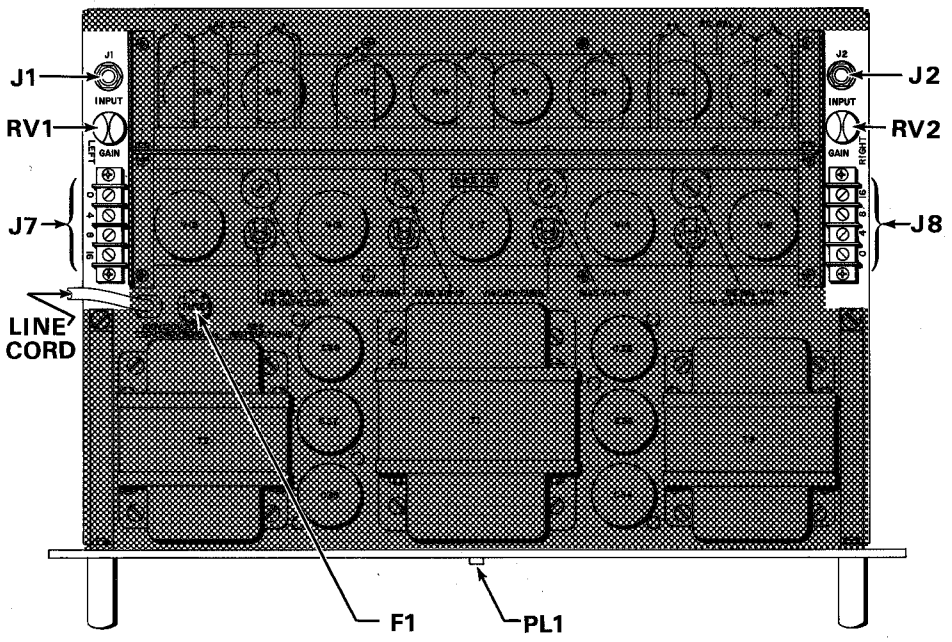


EQUIPMENT DIMENSIONS



D-76A OPERATIONAL CONNECTORS AND CONTROL LAYOUT

OPERATIONAL CONNECTORS & CONTROLS

Only those functions pertinent to general operation are shown above and described below. See the "Equipment Servicing" section (page 20) for description and use of the "internal" controls and jacks.

Inputs:

J1 — Left channel audio input

J2 — Right channel audio input

Connects to preamplifier or electronic crossover main output. Nominal input sensitivity is 1.5 volts for rated output with "gain" control (RV1, 2) full clockwise. See page 6 for a graph of input impedance versus frequency.

Controls:

RV1 — Left channel gain control

RV2 — Right channel gain control

Controls the amplifier input sensitivity. Full clockwise rotation gives maximum input sensitivity. Full counter-clockwise rotation reduces input sensitivity to zero, i.e. zero output. See page 6 for effects of gain control setting on input impedance.

Outputs:

J7 — Left channel speaker output terminals

J8 — Right channel speaker output terminals

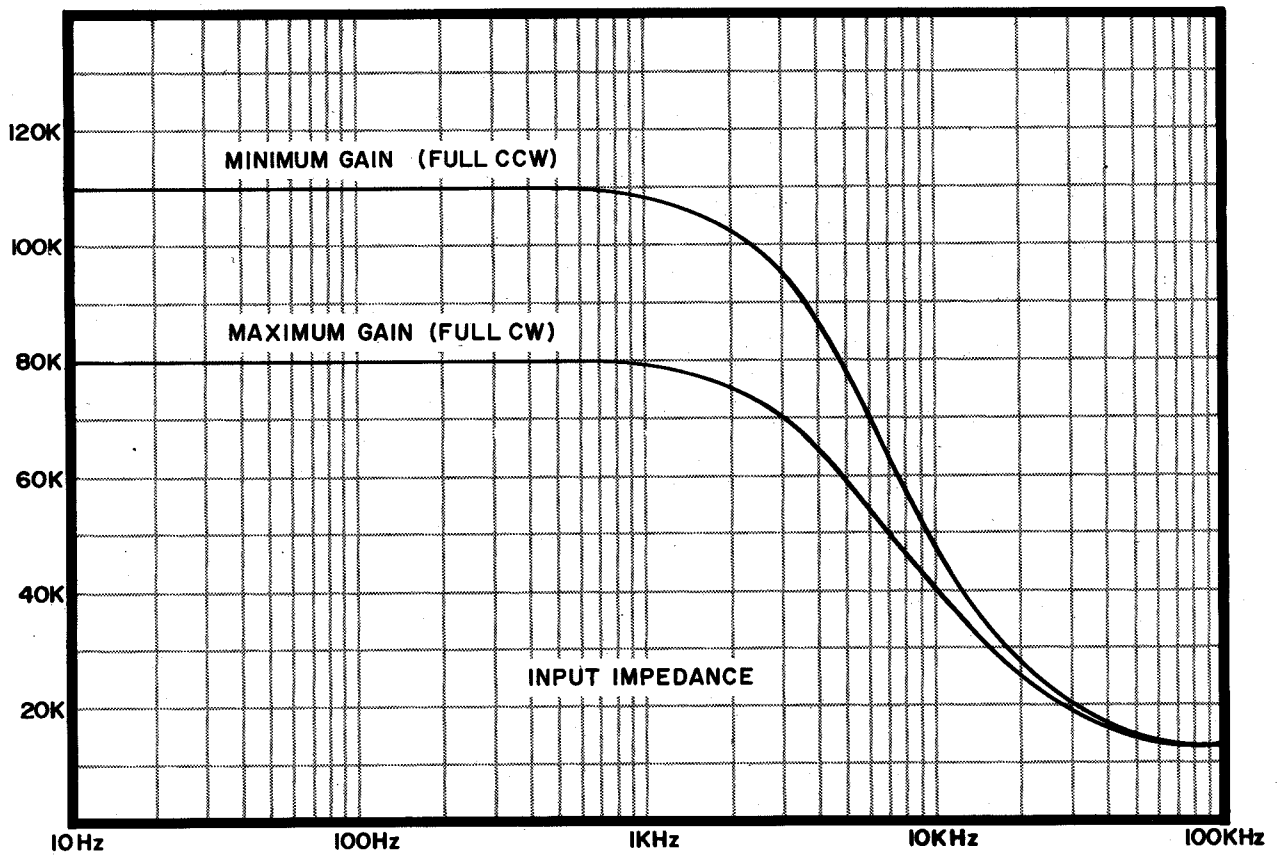
Connects to loudspeaker input terminals — utilizing appropriate impedance tap, i.e. one lead to the "0" ohm output terminal and the second lead to the "4", "8", or "16" ohm terminal as recommended by the speaker manufacturer.

Note: The above "0" ohm and "16" ohm outputs are "balanced" with respect to ground. This means that, unlike most amplifiers, the "4" ohm taps are the *common* or grounded taps, rather than the more conventional "0" or "C".

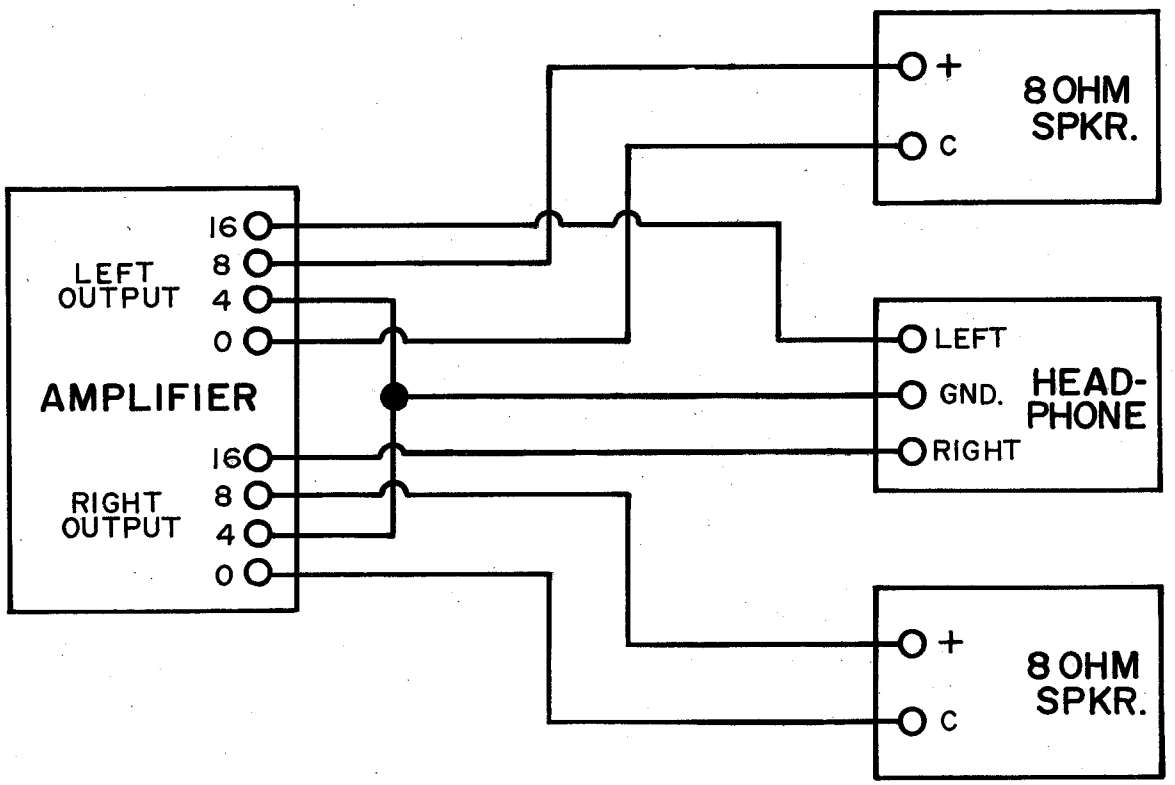
Indicator & Fuse:

PL1 — Pilot light, illuminated when amplifier is "on". Lamp is replaceable from the front panel by unscrewing (CCW) the "lens" and extracting the bulb from the lens base. See parts list for lamp type.

F1 — Line fuse holder, cover must be removed for access. See page 1 and the parts list for value and fuse type.



D-76A INPUT IMPEDANCE



TYPICAL SPEAKER/HEADPHONE CONNECTION

(Common Headphone Ground)

SYSTEM CONNECTION

Before connecting the D-76A into your system, familiarize yourself with the external connectors and controls by referring to the diagram and description in the previous section.

All necessary speaker wiring and input connections can be made with the protective (perforated) covers in place. DO NOT ATTEMPT TO MAKE CONNECTIONS OR OPERATE THIS DEVICE WITH THE TOP OR BOTTOM COVERS REMOVED WHILE POWER IS APPLIED. Lethal Voltages are exposed when the amplifier is operated with the top cover removed. Use the long insulated shank screwdriver supplied when making speaker wire connections. The speaker output terminal screws are accessible through the four holes of each end of the perforated top cover – directly above each terminal strip.

Proceed with system wiring as outlined below:

a) Connect the left and right channel loudspeakers to the amplifier left and right speaker output terminal strips respectively. Use lamp cord or two conductor wiring according to the following table:

Wire Gauge (AWG)	Maximum Distance Vs. Impedance (16Ω)	(8Ω)	(4Ω)
20	40 ft.	20 ft.	10 ft.
18	60 ft.	30 ft.	15 ft.
16	100 ft.	50 ft.	25 ft.
14	160 ft.	80 ft.	40 ft.

Select the appropriate amplifier output impedance as recommended by the speaker manufacturer. Connect one lead to the "0" ohm terminal and the second lead to the "4", "8", or "16" ohm terminal. Make sure that the left and right speakers are "phased" properly, i.e. identical wiring and connections for each channel between amplifier and speaker terminals.

Note: The D-76A is an INVERTING amplifier – the output signal is 180 degrees out of phase with the input signal. This is of no consequence except in bi- and tri-amplified systems where the amplifiers and their respective speakers must be phased properly.

The D-76A also has a "balanced" output – it is a requirement for the extremely high quality performance this equipment provides. This means that, unlike most amplifiers, the 4 ohm taps are the *common* or grounded taps, rather than the more conventional "O" or "C" taps. From a user standpoint, this is unimportant, except for the need to observe the following:

Avoid wiring and switching systems* (either for music distribution, such as background systems, or demonstration systems) that have common ground wiring or switching of the amplifier output.

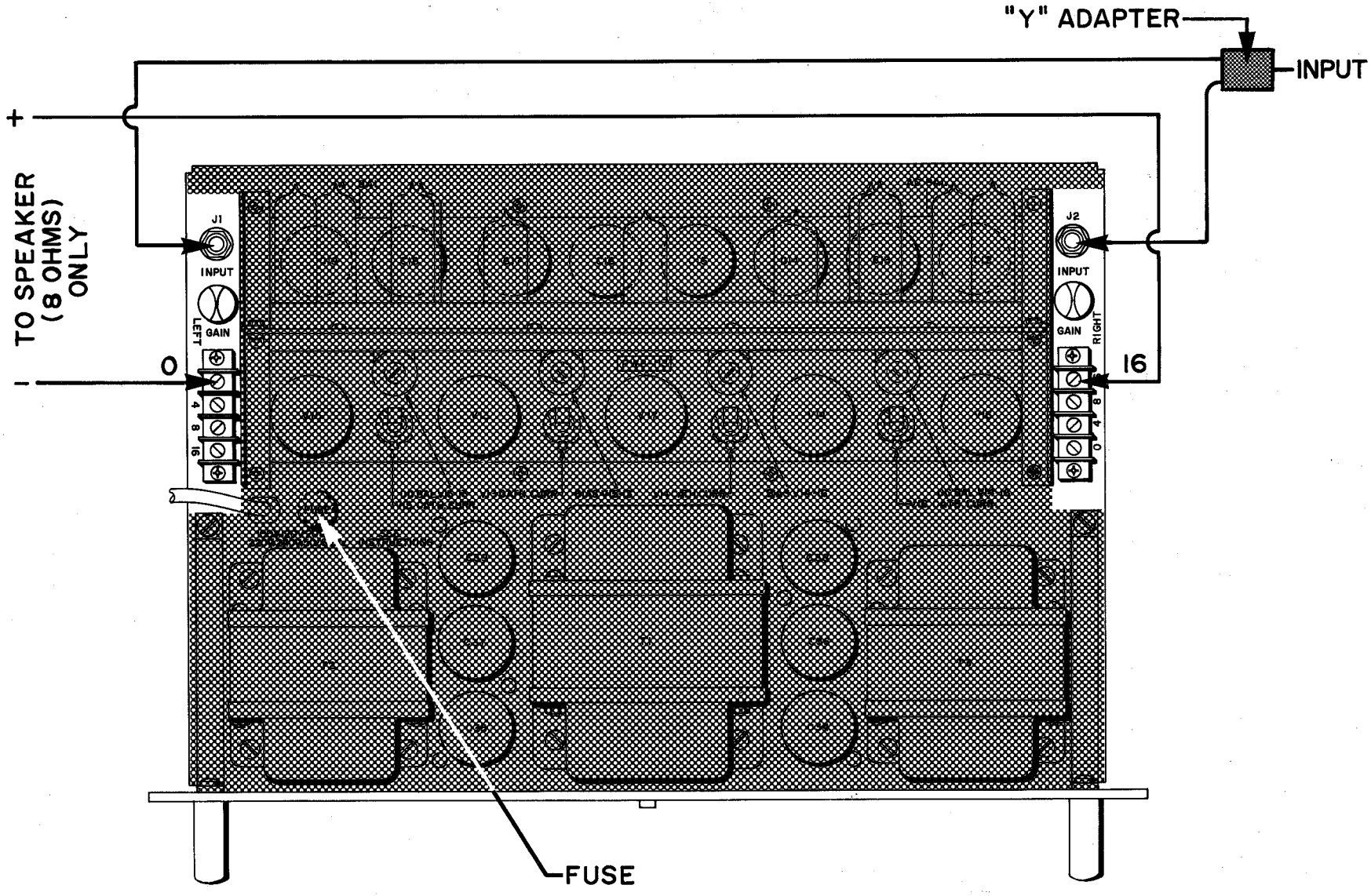
*Some headphone switching systems have a common ground. They must not be used except as shown on page 6. It is recommended that your speakers not be switched with headphone switchers.

b) Connect the left and right channel audio inputs of the amplifier to the main left and right outputs respectively of the preamplifier or electronic crossover. Use only high quality shielded phono cables. Avoid inexpensive cables which use "weak" or soft metal grounding shells as they may introduce hum and/or noise into the system.

c) Turn the input gain controls fully counterclockwise to reduce the input sensitivity to zero. Proper setting of these controls will be discussed in the following section (General Operation).

d) Finally, connect the line cord plug into a switched AC outlet of the preamplifier, electronic crossover, or power distribution strip such that the amplifier is turned on with the rest of the system (preamplifier, etc.). Make sure that the power in your locale is the same as that indicated on the yellow tag attached to the line cord. If not, refer to page 1 for "Line Voltage Conversion".

e) Monaural Connection: The outputs of the D-76A can be bridged for monaural operation with increased power output capability. An 8 ohm load only must be used because of the special circuitry employed. Connect as shown in the diagram on page 9. A slight loss of definition will result from the bridged operation; however, some individuals may feel that the extra power is worth the slight loss of definition.



MONAURAL OPERATION CONNECTIONS

GENERAL OPERATION

Once the D-76A has been properly connected into the system as instructed in the previous section, proceed to operate as follows:

1. Turn "system" power switch "on" – the green pilot light on the D-76A front panel should illuminate. Allow approximately 30 seconds for the amplifier to "warm up".

2. Turn on or select desired "source" while the power amplifier is warming up.

3. Set the preamplifier level or volume control to a "normal" listening position (approximately a one to two o'clock setting). Advance the left and right input "gain" controls on the amplifier clockwise until a "full" listening volume is reached. The gain controls should be in a full clockwise position when an Audio Research SP-3A-1 preamplifier is used in the system.

   If necessary, the amplifier gain controls can be used to correct any channel imbalance caused by speaker placement etc. This enables the preamplifier balance control to remain "centered" even though the channels are deliberately unbalanced.

   Once the gain controls of the amplifier have been set, there is no need for re-adjustment each time the system is used. The input impedance of the amplifier versus frequency and gain control setting is shown on page 6.

4. There is generally no need to "fuse" larger speaker systems when using this equipment. The output transformers in the D-76A inherently isolate the speakers from any high current "DC failure" or subsonic condition which could otherwise damage a speaker.

   If, however, protection for small speakers against sustained high power levels is deisred, an "in-line" fuse should be included in the speaker wiring. A suitable fuse value can be calculated using the following equation:

$$I = \sqrt{\frac{P}{Z}}$$

where; I = fuse value in amps
P = RMS power rating of speaker
Z = nominal speaker impedance

example: What value fuse is required to protect an 8 ohm speaker rated at 35 Watts, RMS?

$$I = \sqrt{\frac{35}{8}} = \sqrt{4.375} = 2.09 \text{ Amps}$$

Use a 2 Amp instrument type fuse ("Littelfuse" 361000 series) or equivalent.

SYSTEM DIAGNOSTICS

In case of difficulty after connecting the D-76A into your system, a list of common system problems and possible causes is provided below to aid in troubleshooting:

Symptom		Possible Cause
Both channels dead	—	Power not applied to amplifier
	—	Blown fuse
	—	Input gain controls not turned up (CW)
	—	Improper or defective interconnect wiring
	—	Defective signal source
One channel dead	—	Input gain control of dead channel not turned up
	—	Defective or improper interconnect wiring
	—	Balance control or mode switch on preamplifier not set properly
	—	Defective signal source
Hum or noise	—	System ground loop
	—	Poor interconnect wiring
	—	Defective audio cable
	—	Excessive lead length
	—	Defective signal source
High distortion	—	Low AC line voltage
	—	Incorrect speaker wiring
	—	Defective signal source

FACTORY SERVICE

In the event that service other than routine tube or fuse replacement becomes necessary, this equipment should be returned to the factory or franchised dealer. Should return to the factory be required, a return authorization form must be obtained. Please write or call customer service at Audio Research to obtain this.

NOTE: WE CANNOT ACCEPT EQUIPMENT THAT DOES NOT HAVE THIS RETURN AUTHORIZATION ATTACHED.

The original equipment packaging should be used any time shipment is made. Refer to page 2 for proper re-packaging of this equipment in the original carton.

All shipments to the factory must be prepaid and insured for full value. All factory-serviced equipment will be returned freight collect. In the event that chargeable repairs are required, you will be contacted prior to the return of your equipment.

Any service work performed on equipment that is not under warranty should be done by only competent electronic technicians equipped with the proper test equipment to insure performance to original specifications. All parts necessary for such service are available from the factory. When ordering any replacement part, include the part number and full description as found in the Parts List.

ROUTINE MAINTENANCE

Mechanical:

The model D-76A is of all aluminum construction with a two-color anodized front panel and chassis finish for life-time service. Periodic dusting can be done with a soft paint brush or dusting cloth. Cleaning should be limited to the use of a moist cloth and mild detergent. Abrasive or strong chemical cleaners should be avoided as they might damage or attack the finish. If desired, the surface lustre of the chassis and front panel can be maintained by wiping the surfaces with a treated polishing cloth. This leaves a fine film of oil on the surface which enhances its lustre.

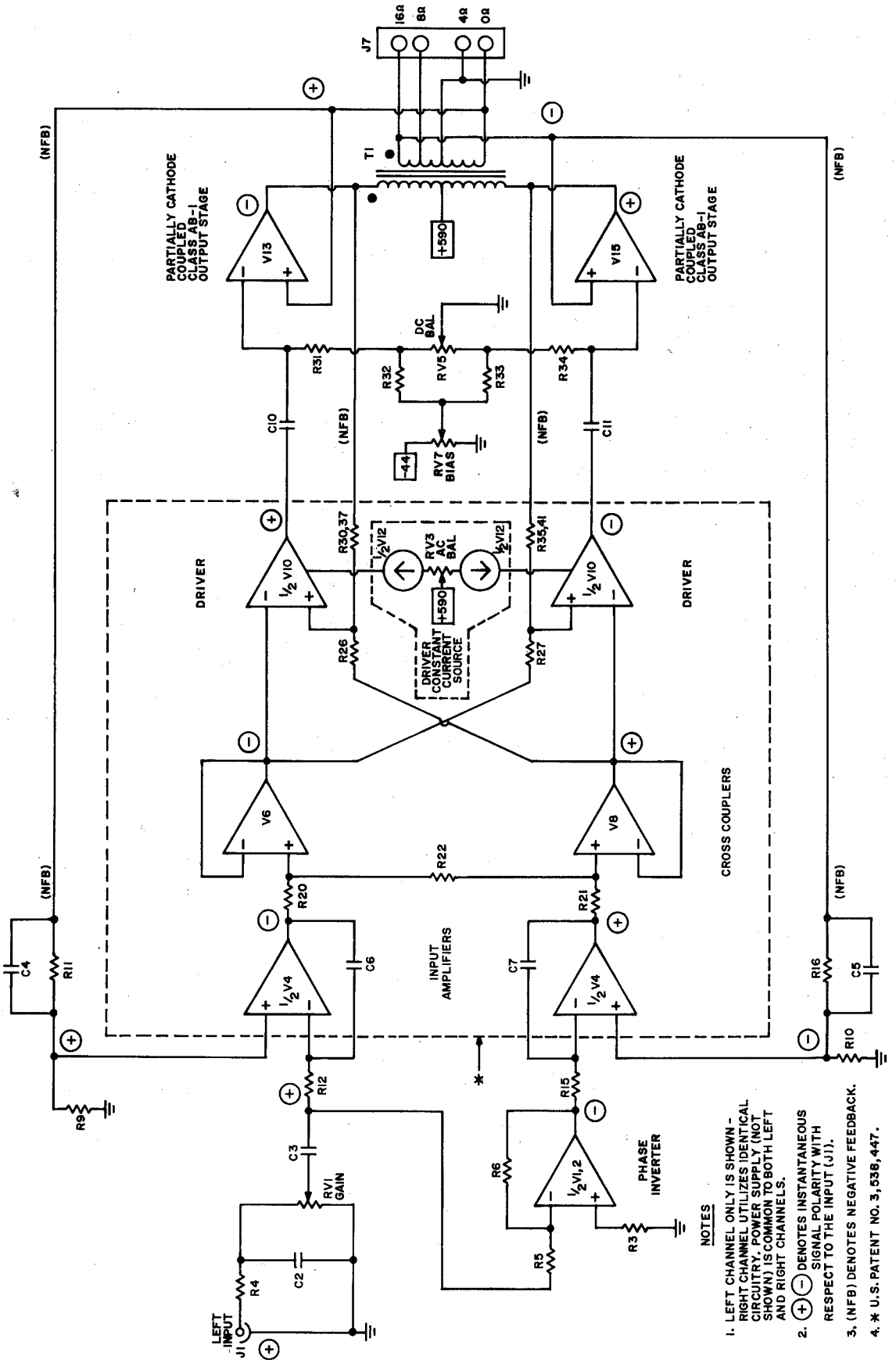
Electrical:

There is no routine electrical maintenance or adjustment required for the D-76A. The vacuum tubes used have a life expectancy of thousands of hours and therefore will not normally need any attention for many years under normal use. When replacement does become necessary, use only premium tubes of the type stated on the electrical schematic diagram or in the Parts List.

Output tubes should always be replaced as matched pairs. The "bias" and "DC balance" of the output stage must be re-adjusted after output tube replacement. Refer to the service section (page 21) for proper adjustment procedure of the output stage controls.

D-76A SPECIFICATIONS:

Power Output:	75 watts per channel minimum RMS (both channels operating) into a 4, 8, or 16 ohm load from 20 Hz to 15 kHz with less than 1% total harmonic distortion
Intermodulation Distortion:	Less than .5% at rated power
Output Impedance:	4, 8, 16 ohms
Input Sensitivity:	1.5 volts for rated output
Power Requirements:	100, 120, 200, 220, 240 VAC; 50-60 Hz, 550 watts at rated power output
Input Impedance:	80K ohms at 20 Hz; 30 K ohms at 15kHz
Damping Factor:	14 at 8 ohms (1 kHz)
Hum & Noise:	More than 80dB below rated output
Dimensions:	Rack Mount Front Panel; 19" wide x 7" high (12¼" deep chassis)
Weight:	52 lbs. net 63 lbs. shipping



NOTES

1. LEFT CHANNEL ONLY IS SHOWN - RIGHT CHANNEL UTILIZES IDENTICAL CIRCUITRY. POWER SUPPLY (NOT SHOWN) IS COMMON TO BOTH LEFT AND RIGHT CHANNELS.
2. ⊕ ⊖ DENOTES INSTANTANEOUS SIGNAL POLARITY WITH RESPECT TO THE INPUT (JI).
3. (NFB) DENOTES NEGATIVE FEEDBACK.
4. * U.S. PATENT NO. 3,538,447.

D-76A SIMPLIFIED SCHEMATIC

CIRCUIT DESCRIPTION

This circuit description will discuss the operational segments (vacuum tubes) and related components shown in the simplified schematic diagram on page 14. It should be noted that only pertinent components are shown and not those relating to biasing and interstage coupling, etc. A complete schematic diagram is shown on page 17 which will appendix the discussion if further technical insight is desired. Brief mention will be made, however, to the power supply components which are shown only in the complete schematic diagram.

The D-76A incorporates balanced cross-coupled vacuum tube circuitry. Single ended input signals are phase inverted outside the overall feedback loops and together with their compliments drive push-pull input amplifiers. Balanced negative feedback around the basic push-pull power amplifier is returned to these input amplifiers – after the unity gain phase inverter and input circuitry. This, in addition to a partially cathode coupled output stage, results in "symetrical" amplifier performance.

The basic signal processing functions (circuit blocks) of D-76A are grouped as shown in the simplified schematic diagram. Signal flow through the D-76A is consistent with the listed order of these functions (and respective description of each) as given below:

a. Phase Inverter (1/2V1,2)

Input signals from a preamplifier or electronic crossover output are applied to input connector J1 and subsequent input gain control RV1 through low pass filter R4, C2. The output of RV1 (wiper) is AC coupled by C3 to a unity gain phase inverting amplifier comprised of 1/2V1, 1/2V2, and feedback resistors R5, R6. Outputs from this amplifier are 180 degrees out of phase from the original signal present at the input. This gives rise to a push-pull input signal which in turn is coupled by R12 and R15 to the input amplifiers V4.

b. Input Amplifiers (V4)

Signals from the input coupling capacitor C3 and the phase inverter output (180° out of phase) are coupled by R12 and R15 to the inverting input of identical amplifiers, comprised of V4. High frequency rolloff of these stages is effected by C6 and C7. Balanced negative feedback from the output stage is coupled to the non-inverting inputs by networks R9, 11, C4 and R10, 16, C5. Thus, the balanced input stage of the overall power amplifier essentially consists of two identical voltage amplifiers, driven by push-pull imputs, and to which overall balanced (push-pull) negative feedback from the output stage is applied.

c. Cross Couplers (V6,8)

The high impedance push-pull outputs from the two input voltage amplifiers are direct coupled to cathode followers (first half of V6 and V8). Resistors R17, 18 and 19 represent the plate load network of the input amplifiers. The push-pull low impedance outputs of the cathode followers are "cross-coupled" with the inputs of the following push-pull driver stage (V10) thereby achieving "symmetrical" performance inside the overall negative feedback loops. The simplified schematic diagram shows all (both halves)

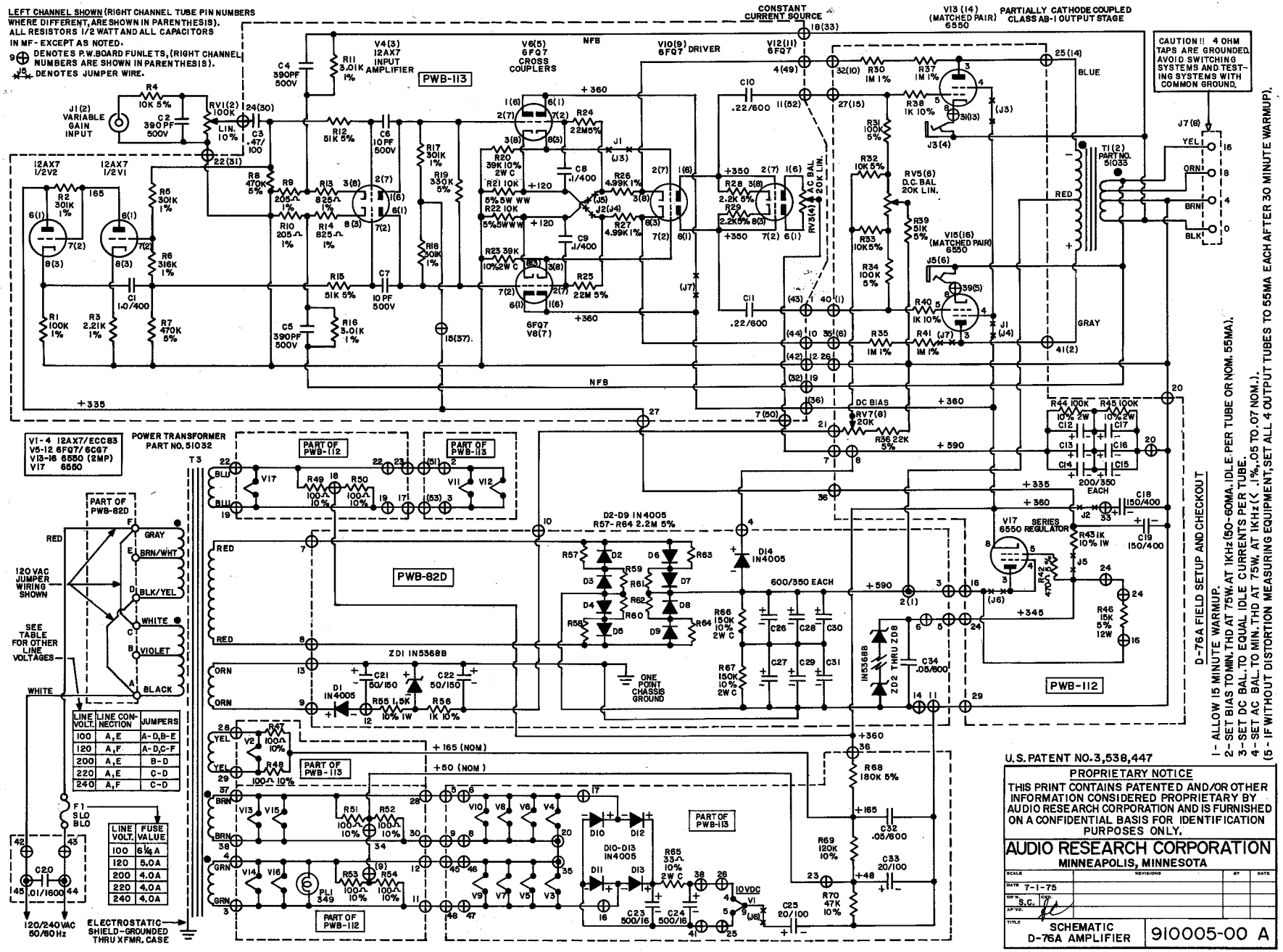
of V6 and V8 as a common element. In practice, both halves are used to provide level shifting for the driver stage inputs (see complete schematic diagram).

d. Driver (V10) and Constant Current Load (V12)

Push-pull voltage amplification prior to the final output stage is achieved with both halfs of V10. Inputs for this stage are developed by the cross couplers (V6,8) as described above. To achieve high voltage gain, active plate loads for each half of V10 are employed. They consist of constant current sources as provided by each half of V12. An adjustment for AC balance (symetry) of the overall amplifier is provided by RV3 in the plate circuit of V12. It should be noted that local negative feedback from the push-pull output stage is returned to each driver input by networks (R26, 30, 37) and (R27, 35, 41). Outputs from the driver stages are AC coupled (C10,11) to the control grids of the output stage (V13, 15).

e. Output Stage (V13, 15, T1)

Push-pull outputs from the preceding driver stage (V10) are applied to the control grids of a matched pair of pentode power output tubes (V13,15). Output transformer T1 matches the output tube impedance to either a 4, 8, or 16 ohm output load. It should be noted that the 0Ω and 16Ω secondary winding taps of T1 are essentially balanced with respect to ground through connection of the 4Ω output tap to ground. This scheme allows the generation of balanced push-pull output signals which are returned to the push-pull inputs through negative feedback networks R9, 11, C4, and R10, 16, C5. This output configuration also permits partial cathode coupling (local negative feedback) of the output tubes V13 and V15. The output stage is biased for class AB-1 operation by a regulated fixed bias supply. Bias for both tubes is adjusted by RV7 while balance between the two is provided by RV5.



D-76A SCHEMATIC DIAGRAM

D-76A PARTS LIST

Schematic Reference	Part Number	Description			
		RESISTORS			
R47-R54	40100203	Composition	100 Ohm	10%	½W
R38* R40* R56	40100303	Composition	1K	10%	½W
R43	40100304	Composition	1K	10%	1W
R44, R45	40100505	Composition	100K	10%	2W
R69	40120503	Composition	120K	10%	½W
R55	40150304	Composition	1.5K	10%	1W
R66, R67	40150505	Composition	150K	10%	2W
R65	40330105	Composition	33 Ohm	10%	2W
R20* R23*	40390405	Composition	39K	10%	2W
R70	40470403	Composition	47K	10%	½W
R4* R32* R33*	41100403	Composition	10K	5%	½W
R31* R34*	41100503	Composition	100K	5%	½W
R68	41180503	Composition	180K	5%	½W
R28* R29*	41220303	Composition	2.2K	5%	½W
R36*	41220403	Composition	22K	5%	½W
R57-R64	41220603	Composition	2.2M	5%	½W
R24* R25*	41220703	Composition	22M	5%	½W
		POTENTIOMETER			
RV1, (2)	45100518	Pot, 100K Linear			
RV3-RV8	45200411	Pot, 20K Linear			
		CAPACITORS			
C18, C19	50150801	Electrolytic	150 ufd	400V	
C25, C33	50200700	Electrolytic	20 ufd	100V	
C12-C17	50200800	Electrolytic	200 ufd	350V	
C21, C22	50500700	Electrolytic	50 ufd	150V	
C23, C24	50600800	Electrolytic	600 ufd	16V	
C26-C31	50600802	Electrolytic	600 ufd	350V	
C20	53100403	Film	.01 ufd	1600V	
C8* C9*	53100502	Film *	0.1 ufd	400V	
C10* C11*	53220503	Film +	.22 ufd	600V	
C3*	53470503	Film *	.47 ufd	100V	
C32, C34	53500400	Film +	.05 ufd	600V	
C1*	53100604	Film *	1.0 ufd	400V	
C6* C7*	57100100	Mica * *	10 pf	500V	
C2* C4* C5*	57390200	Mica * *	390 pf	500V	

*One for each channel.

+ CHANGED TO SPRAGUE 715P POLYPROPYLENE

* CHANGED TO TRW X363UW POLYPROPYLENE

** CHANGED TO

513253

D-76A PARTS LIST

Schematic Reference	Part Number	Description
		DIODES
ZD1-ZD8	30500100	IN5368B
D1-D14	30500400	IN4005
		TUBES
V1-V4	32000100	12AX7A
V5-V8	32000200	6FQ7 RCA
V9, V10	32000202	6FQ7 GE
V11, V12		6FQ7 GE or RCA
V17	32000501	6550 regulator
V13-V16	32000502	6550 Matched pairs
		TRANSFORMERS
T3	60001400	Power 100/120/200/220/240V, 50/60Hz primary
T1(2)	60001500	Output
		MISCELLANEOUS
	10004700	Cover, bottom
	10004900	Cover, top
	10005101	Front Panel, natural
	10005102	Front Panel, gold
	13000700	Knob, black
	13100300	Foot, elastomer
	20000900	Handle
	20001800	Strain Relief, line cord
	23000200	Fuseholder
	23000300	Socket, pilot lamps
	23000400	Socket, 9 pin tube
	23000600	Socket, 8 pin tube
J7 (8)	23100100	Connector, barrier strip
J1 (2)	23200100	Jack, phono
J3 (4) J5 (6)	23200200	Jack, phone
	23300100	Lens, green translucent
	25000600	Line cord, 18 x 2, 6 ft.
PL1	34000300	Bulb, incandescent, #349
F1	34500500	Fuse MDL 5, S.B. (120V)
	34500700	Fuse MDL 4, S.B. (220, 240V)
	34500100	Fuse MDL 6¼, S.B. (100V)
	80000100	Screwdriver R3166

*One for each channel.

EQUIPMENT SERVICING

This section contains service information and data for the Model D-76A. It is intended for use by the knowledgeable and experienced technician only. Before attempting any servicing of this device, the previous sections of this instruction manual should be studied to gain a thorough understanding of its operation. Only high quality test equipment and carefully executed test procedures should be employed when testing and evaluating performance. Refer to page 13 for technical specifications and pages 28-32 for "internal" control and parts location.

Recommended Test Equipment

Item	Requirements	Use
Audio Oscillator	Less than .01% of distortion	Sine wave source for THD measurement, response measurements, and trouble-shooting.
Harmonic Distortion Analyser	Less than .01% residual	THD measurement
Intermodulation Distortion Analyser	Less than .01% residual	IMD measurement
Oscilloscope	General purpose	Waveform analysis and trouble-shooting.
VTVM	General Purpose	AC & DC voltage measurements
DC Milliameter	100 ma. full scale, with phone plug connector	Output tube current monitor
Variable Auto Transformer	0-140 V., 3KVA	Adjust input line voltage for 120 VAC
Line Voltmeter	0-130 VAC	Monitors line voltage
Output Load	16 Ohm, 150 Watt, non-inductive	Output power measurement
Tube Extenders	8 and 9 pin	Tube socket voltage measurements

CAUTION

This amplifier contains voltages which may be lethal. Exercise extreme care when making voltage measurements or adjustments of "internal" controls.

DC Bias/Balance Adjustment:

Adjustment of the output stage DC bias/balance controls must be made after replacement of the output tubes or repair of associated circuitry, i.e. power supply, bias supply etc. An adjustment or "check" can also be made periodically if it is desired to "test" or "tweak" the output stage. Although the latter procedure is not manditory, it does monitor or compensate for the condition of the output tubes as they age.

Note: Output tubes (V13, V15) or (V14, V16) should be replaced only with *matched pairs* of 6550's. If only one output tube fails, *both* must be replaced with a matched pair.

1. Plug the amplifier into a 120 VAC power source.
2. If output tubes were replaced, adjust the appropriate bias control(s) RV7 and/or RV8 for 55 ma. nominal quiescent current per tube. Output tube current is monitored at J3, J4, J5, and J6 with a DC Milliameter and "phone plug" probe. See page 28 for location of output tubes, adjustment controls, and current monitoring jacks.
3. Allow the amplifier to warm-up for 30 minutes – a 24 hour "burn-in" is recommended before making a final adjustment with new output tubes.
4. Trim DC balance control(s) RV5 and/or RV6 for a 55 ma. reading per output tube – readjust bias control(s) RV7 and/or RV8 if necessary (the bias control affects both output tubes while the balance control provides an independent vernier trim of each tube).
5. This completes the DC bias/balance procedure.
6. Continue with the AC balance procedure as outlined below.

AC Balance Procedure:

Adjustment of the AC balance control must be made after replacement of the output tubes or any extensive repair.

This procedure involves measuring (monitoring) the total harmonic distortion (THD) of the amplifier while adjustment is made. To prevent erroneous readings, all test equipment should be isolated from the power line ground. Since the amplifier output is "balanced" with respect to signal ground, all measurements made at the amplifier output should be referenced to the 4 ohm tap only which is internally tied to circuit ground. Never externally ground, either with test cables or test equipment, the "0", "8", or "16" ohm output terminals as this would short out one half of the amplifier's balanced push-pull feedback loop. Use only "floating" loads or test equipment when referencing same to any terminal except the grounded "4" ohm terminal.

1. Make sure that the output stage bias and balance controls have been properly adjusted (see DC bias/balance procedure, above) before making the AC balance adjustment.
2. Connect a 16 ohm "dummy" load to the amplifier output of the channel under test.
3. Plug the amplifier into a 120 VAC power source.
4. Allow the amplifier to warm-up for 30 minutes.
5. Center the appropriate AC Balance Control RV3 or RV4.
6. With a low distortion oscillator ($\leqslant$ .01% residual THD) inject a 1KHz input signal. Adjust input level for full rated output – 75 Watts RMS.
7. Connect (float) a Harmonic Distortion Analyser ($\leqslant$ .01% residual) across the 16 ohm output.
8. Adjust the appropriate AC Balance Control for minimum THD:

   $<$ .1% @ 75 Watts RMS per channel @ 1KHz
   $<$ .3% @ 75 Watts RMS per channel @ 30 Hz
   $<$ 1% @ 75 Watts RMS per channel @ 15 KHz

Intermodulation Distortion (IMD)
Measurement Procedure:

Most IMD analysers (such as the Crown IMA) have a common signal ground between the generator output (60Hz & 7KHz, 4:1 ratio) and the analyser input. Since the D-76A has a "balanced" output, care must be exercised when attempting measurements with such intruments. It is recommended that a "bridging" transformer be used across the amplifier output ("0" and "16" ohms) to provide necessary isolation. The secondary of the bridging transformer can be referenced back (tied) to ground at the analyser "input". This precaution is in contrast to the THD measurement procedure where (in most cases) the oscillator is separate (isolated) from the analyser.

1. Connect a 16 ohm "dummy" load across the amplifier output ("0" and "16" ohm taps).
2. Connect IM analyser as described above.
3. Adjust line voltage for 120 VAC.
4. Adjust the IM analyser "output" (D-76A input signal) for 75 Watts RMS output.
5. The IMD should be $\leqslant$ .5%.

"POWER-UP" PROCEDURE:

In the event that this equipment is subjected to extensive repair, it is recommended that the following "power-up" procedure be observed:

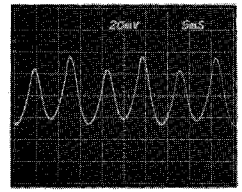
1. Do not plug in to power line.
2. Turn bias controls RV7 and RV8 full counterclockwise (as viewed from bottom) for maximum bias.
3. Center AC and DC balance controls RV3, RV4 and RV5, RV6 respectively.
4. Remove V16 and V17 – keep them identified.
5. Make the following resistance readings with respect to ground:
   a) V16, pin 5, approximately 120K
   b) V17, pin 3, reading should increase as capacitors charge
   c) V17, pin 5, reading should increase as capacitors charge
   d) V17, pin 8 reading should increase as capacitors charge

   The last three measurements check for printed circuit foil continuity and shorts to ground in the high voltage B+ circuits. If a DC filament circuit has been repaired, check in a similar fashion all associated diodes, filter capacitors, and printed circuit foil paths for continuity and shorts etc.
6. Plug in V17 – leave V16 out.
7. Plug power cord into Variac – set Variac for zero output before connnecting.
8. Connect line voltmeter to Variac output.
9. Adjust Variac for 25 Volts output.
10. Ascertain that negative bias exists at pin 5 of V16 – approximately minus 6 to 9 Volts.
11. Check for "some" B+ on either side of R42.
12. Bring Variac output up to approximately 60 Volts output – continue to monitor points in (10) and (11) above.
13. Check pin 4 of V16 for "some" screen voltage – approximately 50 to 200 Volts; this indicates if V17 is operative.
14. Plug in V16.
15. Re-check for "some" voltage (greater than in (11) above) on either side of R42.
16. Slowly increase Variac output while monitoring the voltage on either side of R42 – regulation should occur (i.e. no voltage increase when line voltage is increased) at this test point when approximately 340 Volts is reached. The reading will increase as the unit warms up due to a positive zener temperature coefficient.
17. Bring Variac up to a full 120 Volts output.
18. Measure output tube quiescent current at J3, J4, J5, and J6 in fairly rapid succession with a DC milliameter and "phone plug" probe – reading should be 15 to 40 ma. per tube.

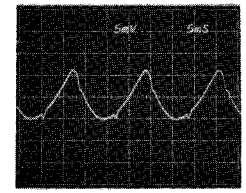
    Note: If above reading is abnormally high, check for defective tube socket, defective bias circuit component pertinent to the tube, or possible defective output tube.
19. If all measurements in (18) above appear to be normal, adjust bias controls RV7 and RV8 for 55 ma. nominal per output tube.
20. Make a final check of all voltages (per the schematic and/or voltage/resistance table) with the line voltage adjusted to 120 VAC.
21. This completes the "power-up" procedure.
22. Adjust the output stage DC bias/balance controls according to the procedure given on page 21.

D-76A TROUBLESHOOTING TABLE

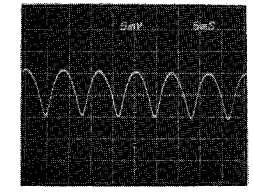
Symptom		Possible Cause
Dead, both channels	–	Blown fuse (F1)
	–	No power at plug
	–	Defective V17
	–	Defective DC filament supply
	–	Defective ZD1 (open)
	–	Defective transformer (T3)
Dead, one channel	–	Defective tube(s) V1 through V12
	–	Defective output tubes V13, 15 or V14, 16
	–	Defective plate or cathode resistor (open) associated with V1 through V4
Blows fuses	–	Wrong size and/or type fuse
	–	Defective diode(s) in high voltage bridge rectifier
	–	Defective V13 through V17
	–	Defective zener diode(s) in series regulator circuit. Note: If one or more are shorted, replace all zener diodes
Blows fuse at moderate to high signal levels only	–	Wrong size and/or type fuse
	–	Defective diode in high voltage bridge rectifier
	–	Defective output tube(s) V13 through V16 (internal arcing)
Low power output	–	Low B+ voltage(s)
	–	Low regulated screen voltage
Poor sound, one or both channels	–	Output tube(s) incorrectly biased
	–	AC balance incorrectly adjusted
	–	One or more output tubes defective. Note: Replace output tubes with factory matched pairs for lowest distortion
	–	Defective tube(s) V1 through V12
	–	Defective coupling capacitor C10 or C11
	–	Defective output transformer T1 or T2
Hum	–	Defective C25
	–	Defective input filter capacitor C19
	–	Defective tube(s) V1 through V12
	–	Open diode(s) in high voltage bridge rectifier
	–	Open diode in filament voltage bridge rectifier
Noise	–	Defective tube V1 through V4 or associated plate or cathode load resistor



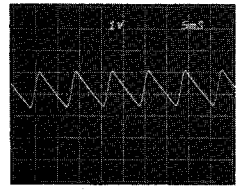
1 VERT. = 20MV/DIV.
HORIZ. = 5MSEC/DIV.



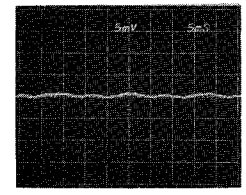
2 VERT. = 5MV/DIV.
HORIZ. = 5MSEC/DIV.



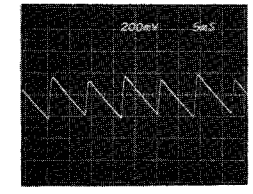
3 VERT. = 5MV/DIV.
HORIZ. = 5MSEC/DIV.



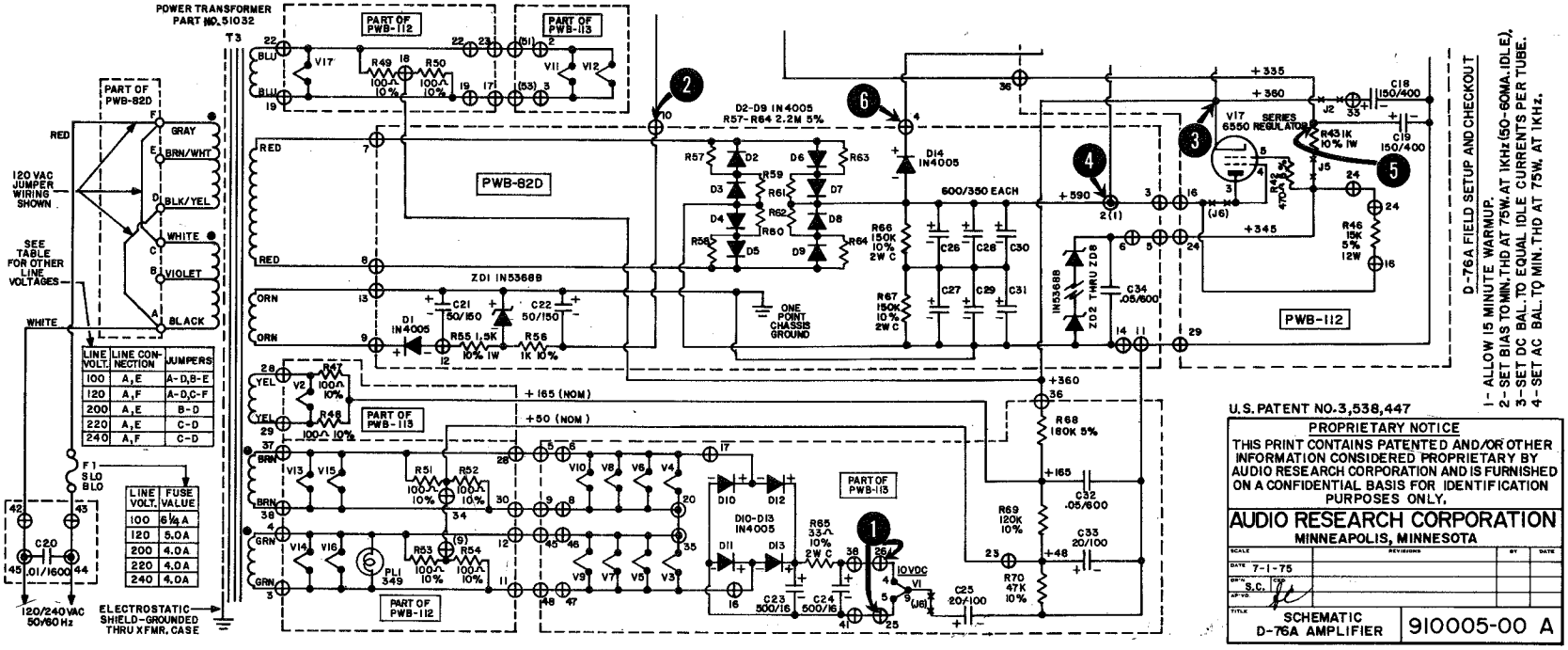
4 VERT. = 1V/DIV.
HORIZ. = 5MSEC/DIV.



5 VERT. = 5MV/DIV.
HORIZ. = 5MSEC/DIV.



6 VERT. = 200MV/DIV.
HORIZ. = 5MSEC/DIV.



D-76A NOMINAL POWER SUPPLY FILTER RIPPLE WAVEFORMS

D-76A VOLTAGE AND RESISTANCE TABLE

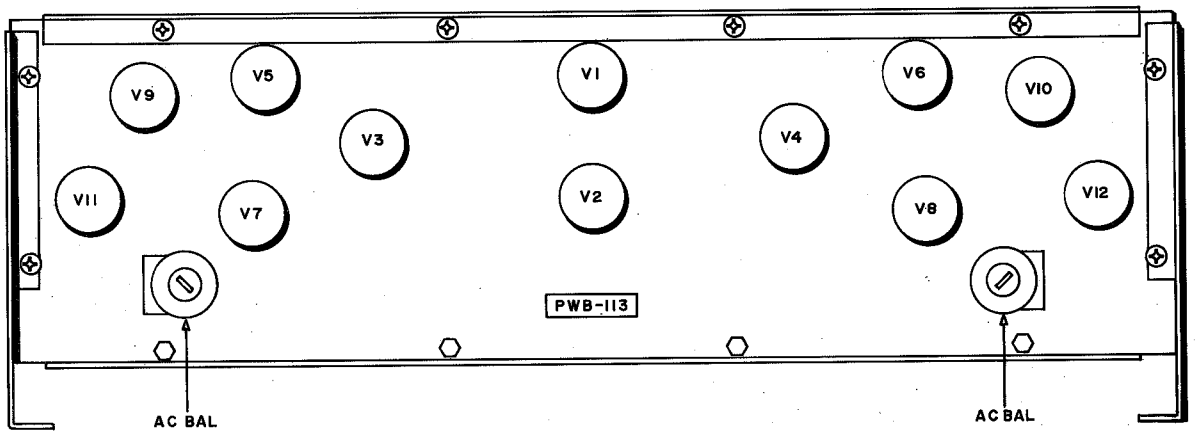
Tube Number	Pin Number	DC Voltage	Resistance
V1	6 (1)	165	301K*
	7 (2)	0	390K
	3 (8)	1.2	2.21K
	4	40	300K*
	5	50	300K*
	9	45	X
V2	6 (1)	335	X
	7 (2)	165	301K*
	3 (8)	166	100K
	4	165/6.3	72K*
	5	165/6.3	72K*
	9	165	∞
V4 (3)	1 (6)	115	204K*
	2 (7)	0	379K
	3 (8)	.8	1.02K
	4 (4)	50	47k†
	5 (5)	50	47K†
	6 (1)	115	204K*
	7 (2)	0	379K
	8 (3)	.8	1.02K
	9 (9)	50	47K†
V6 (5)	1 (6)	360	X
	2 (7)	115	X
	3 (8)	120	10K
	4 (4)	50	47K†
	5 (5)	50	47K†
	6 (1)	360	X
	7 (2)	–	22M
	8 (3)	128	39K
	9 (9)	0	∞
V8 (7)	1 (6)	360	X
	2 (7)	–	22M
	3 (8)	128	39K
	4 (4)	50	47K†
	5 (5)	50	47K†
	6 (1)	360	X
	7 (2)	115	X
	8 (3)	120	10K
	9 (9)	0	∞
V10 (9)	1 (6)	350	∞
	2 (7)	130	39K
	3 (8)	135	15K
	4 (4)	50	47K†
	5 (5)	50	47K†
	6 (1)	350	∞
	7 (2)	130	39K
	8 (3)	135	15K
	9 (9)	0	∞

D-76A VOLTAGE AND RESISTANCE TABLE

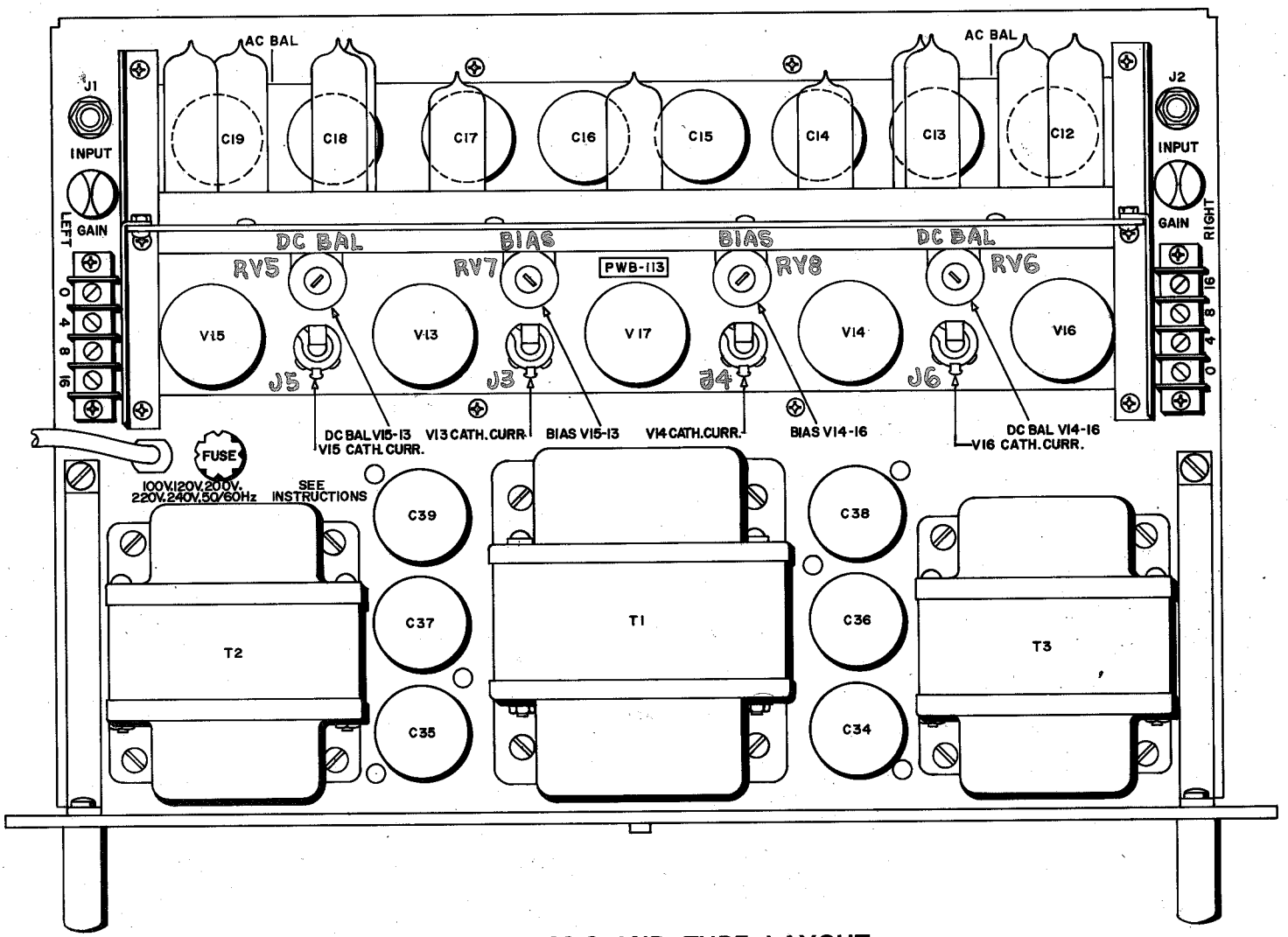
Tube Number	Pin Number	DC Voltage	Resistance
V12 (11)	1 (6)	510	X
	2 (7)	350	∞
	3 (8)	365	∞
	4 (4)	360	X
	5 (5)	360	X
	6 (1)	510	X
	7 (2)	350	∞
	8 (3)	365	∞
	9 (9)	0	∞
V13 (16)	1	0	∞
	2	50	47K†
	3	590	X
	4	360	X
	5	–35	120k†
	6	–	–
	7	50	57K†
	8	0.01	.4Ω
V14 (15)	1	0	∞
	2	50	47K†
	3	590	X
	4	360	X
	5	–35	120K†
	6	–	–
	7	50	47K†
	8	0.01	.4Ω
V17	1	360	X
	2	360	X
	3	590	X
	4	590	X
	5	345	X
	6	0	∞
	7	360	X
	8	360	X

Notes:

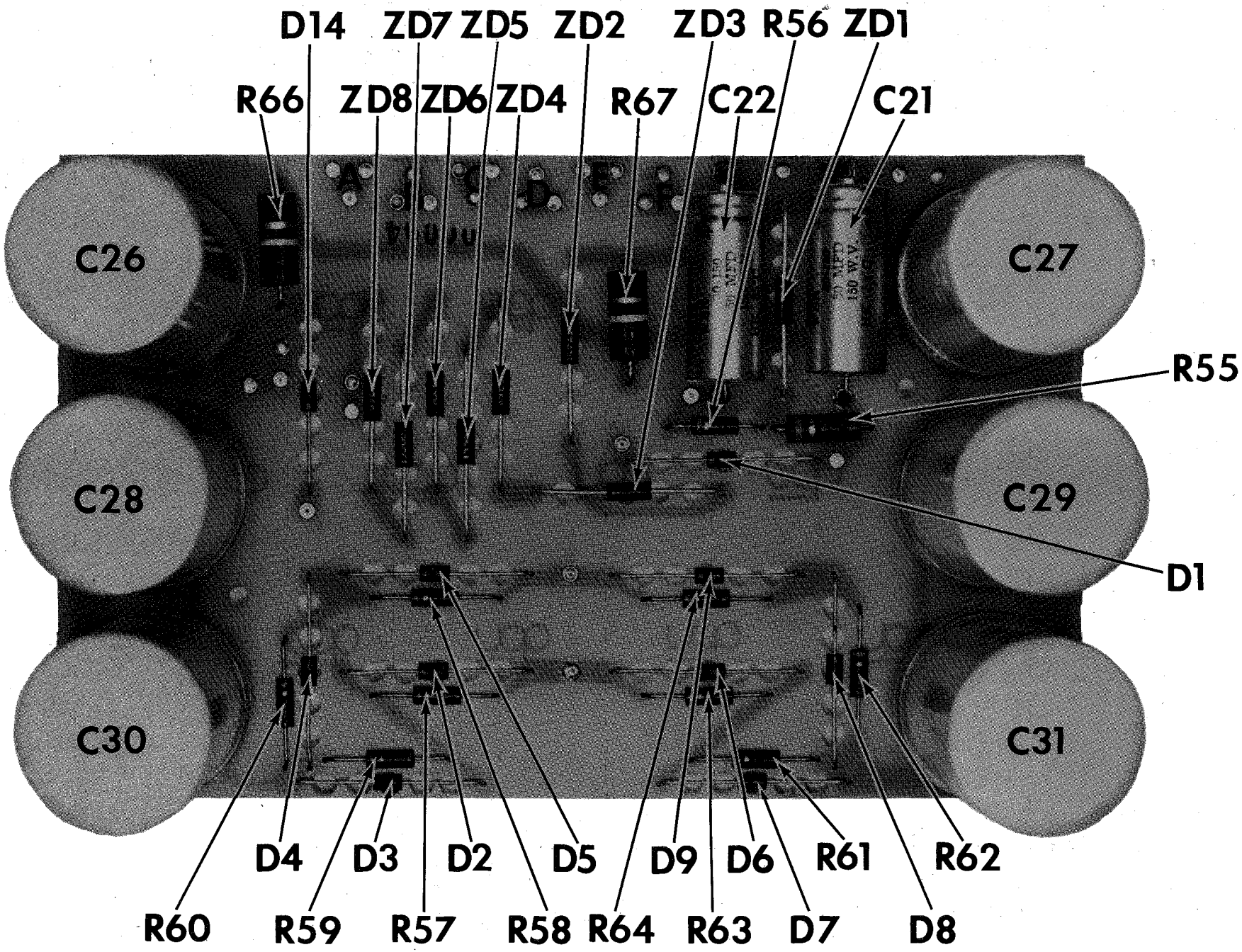
1. Readings are typical – taken at 120 VAC line with a FLUKE 8000A DVM.
2. All measurements are with respect to ground.
3. Allow all capacitors to fully discharge before measuring resistance.
4. Voltage readings taken with all tubes in place.
5. Resistance readings taken at socket with tube under test only removed.
6. * Typical initial reading – increases as capacitors charge.
7. † Typical value after capacitors charge.
8. X Low initial reading – increases as filter capacitors charge.



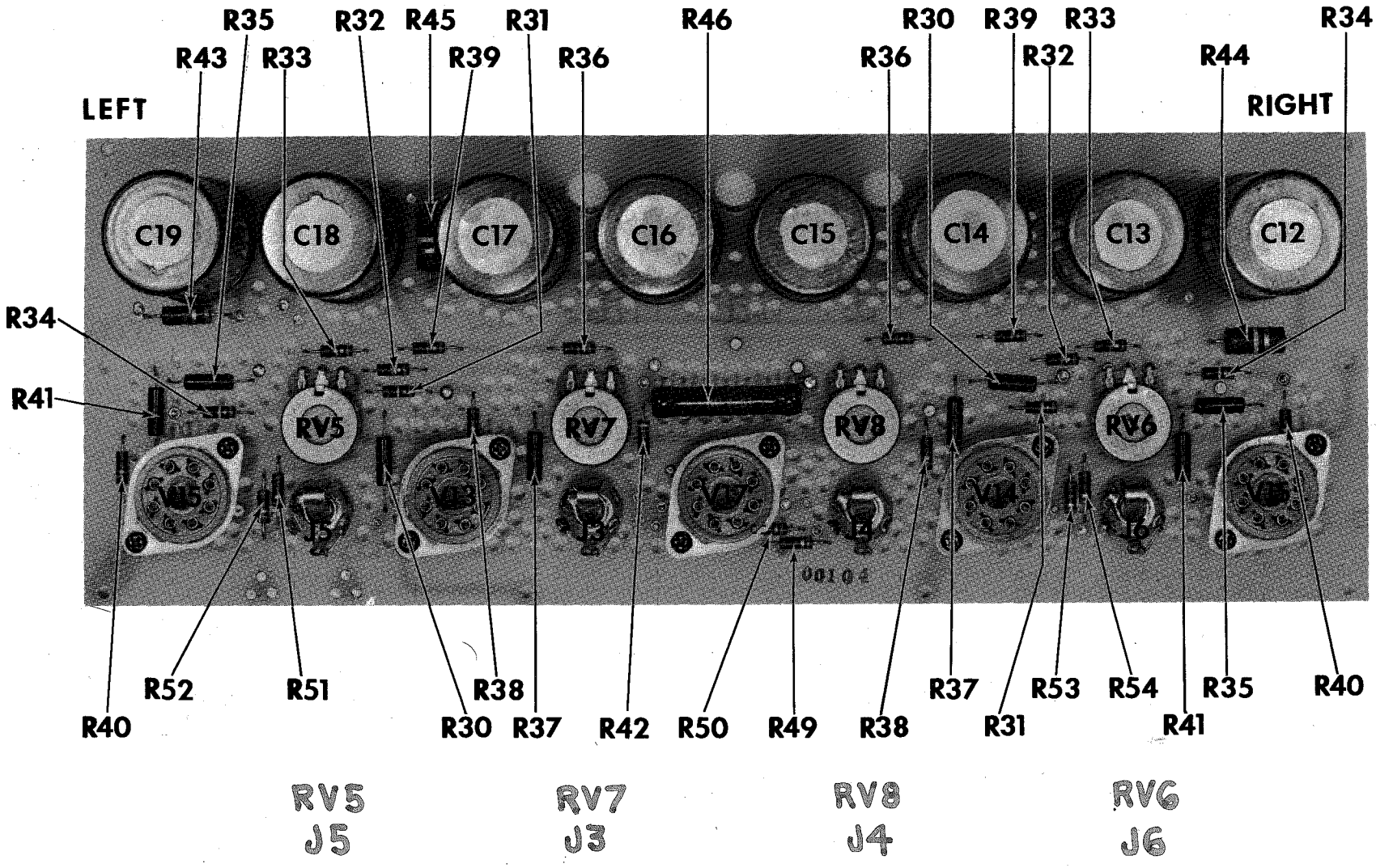
VERTICAL CIRCUIT BOARD-(REAR VIEW)



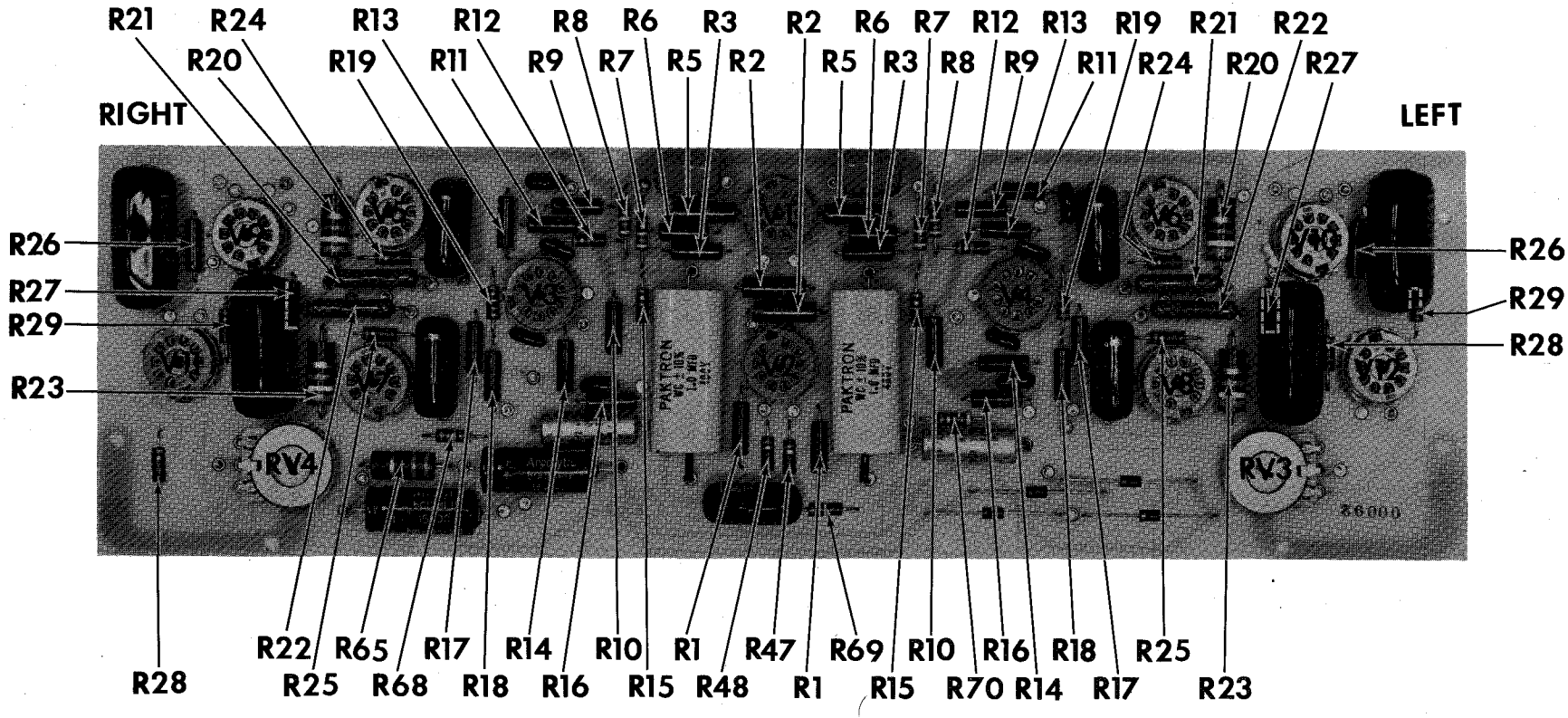
D-76A CHASSIS AND TUBE LAYOUT



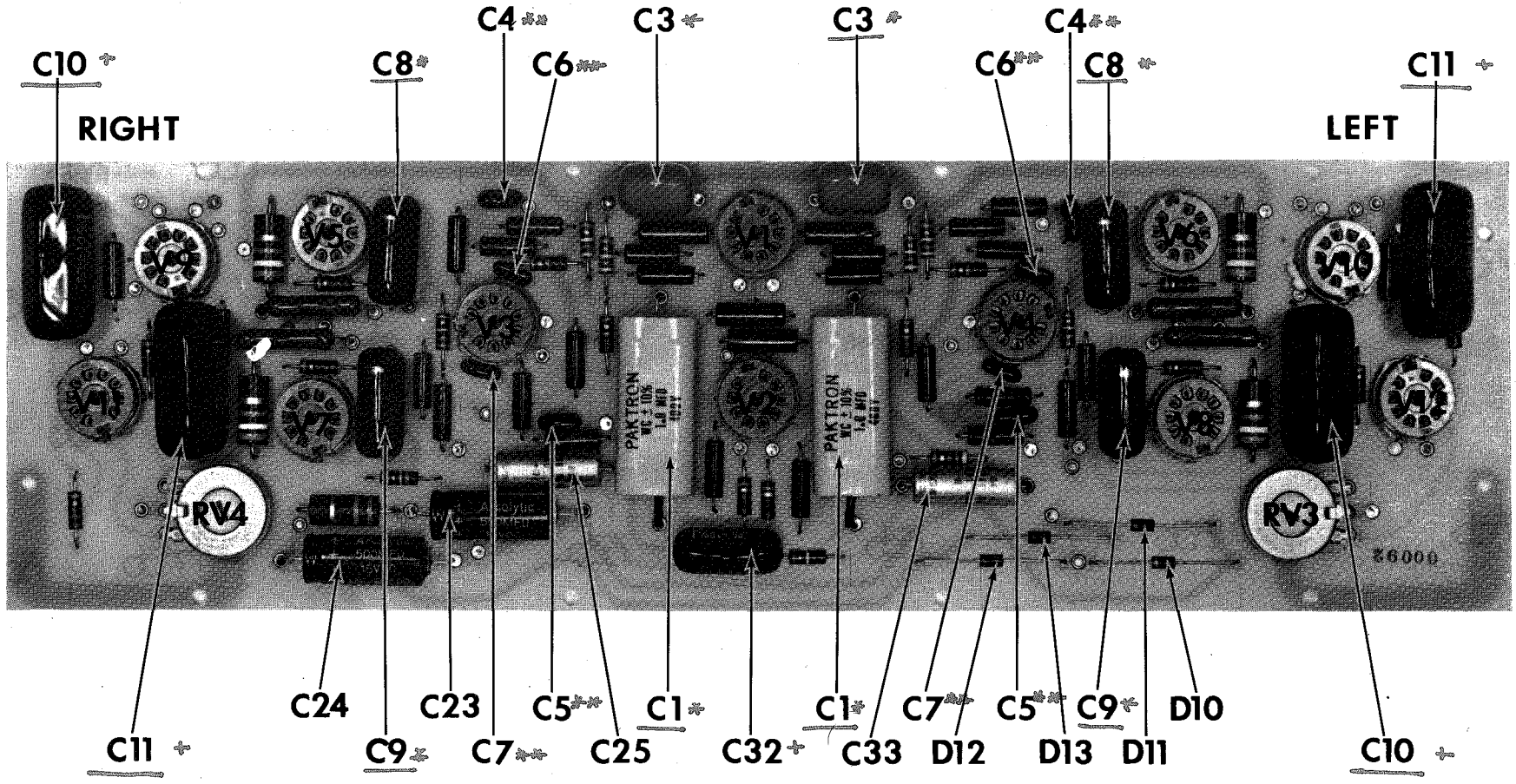
PWB-82D COMPONENT LAYOUT



PWB-112 COMPONENT LAYOUT



PWB-113 LAYOUT (Resistors)



CHANGED TO: + SPRAGUE 715P POLYPROPYLENE
* TRW X363 UW "
** "

PWB-113 LAYOUT (Capacitors)

NOTES

APPENDICES

The appendices of this manual contain technical and service information for Audio Research power amplifiers manufactured prior to the Model D-76A. The models included are:

Model D-76, Appendix A
Model D-75A, Appendix B
Model D-75, Appendix C
Model D-51, Appendix D

It should be noted that all of these amplifiers are similar to each other in circuit topology – all different, however, from the Model D-76A. All of the above models are NON-INVERTING amplifiers whereas the D-76A is INVERTING. This is of no consequence except in bi- and tri-amplified systems where the amplifiers and their respective speakers must be phased properly.

Detailed technical and service information is given in the first section for the Model D-76. Since the circuitry for the D-75A, D-75, and D-51 amplifiers is very similar, the information given for the D-76 generally applies to all the others.

The operational and general instructions contained in the beginning of this manual (for the D-76A) apply also to the D-76, D-75A, D-75, and D-51 since all of the amplifiers have a balanced output i.e., the 4 ohm taps are grounded.

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Power-Up Procedure	A11
Troubleshooting Table	A12
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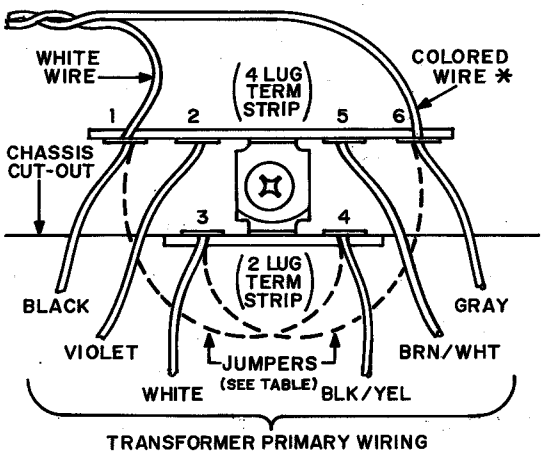
APPENDIX A

MODEL D-76
POWER AMPLIFIER
TECHNICAL INFORMATION

LINE VOLTAGE CONVERSION

The Model D-76 can be wired for the following voltages: 100-120-200-220-240, 50-60 Hz. Check the line voltage in your locale. If it is different from that indicated on the yellow tag attached to the line cord, remove the bottom cover and re-solder the jumpers according to the diagram below. Secure the bottom cover and install the appropriate fuse as indicated below.



LINE VOLT.	FUSE VALUE	JUMPERS REQUIRED	COLORED WIRE CONNECTION *
100	6.0A. S.B.	#1 TO #4, #2 TO #5	TERM. # 5
120	5.0A. S.B.	#1 TO #4, #3 TO #6	TERM. # 6
200	3.2A. S.B.	#2 TO #4 ONLY	TERM. # 5
220	3.2A. S.B.	#3 TO #4 ONLY	TERM. # 5
240	3.2A. S.B.	#3 TO #4 ONLY	TERM. # 6

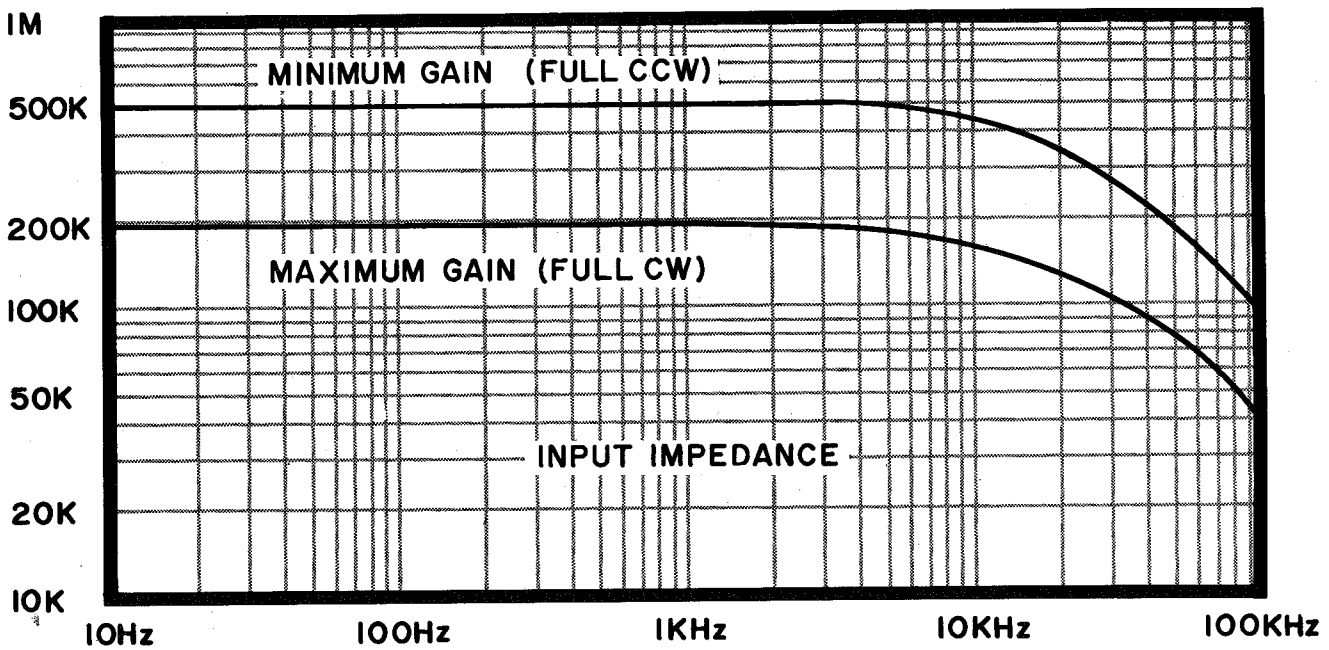
NOTES

1. 120 VOLT TRANSFORMER PRIMARY WIRING SHOWN.
2. TERMINAL LUG DETAIL SHOWN AS VIEWED FROM BOTTOM OF CHASSIS.

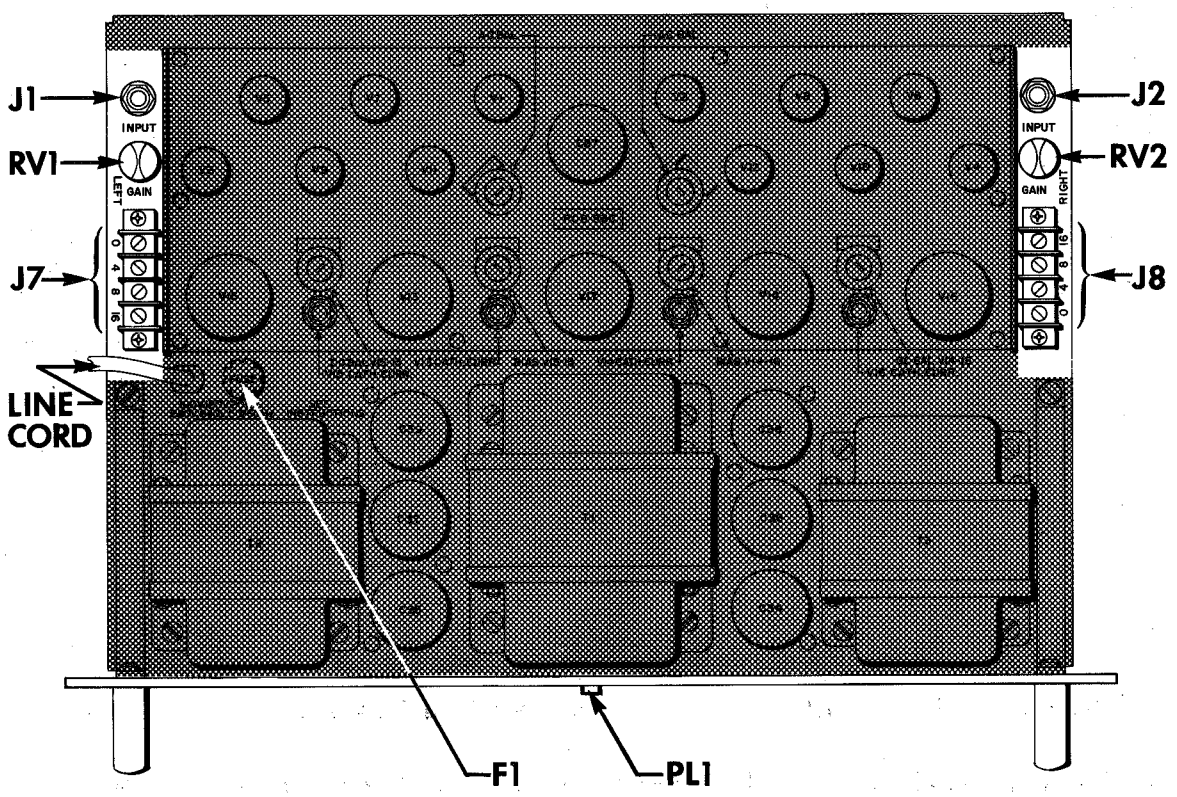
WARNING

To prevent fire or shock hazard, do not expose this equipment to rain or moisture.

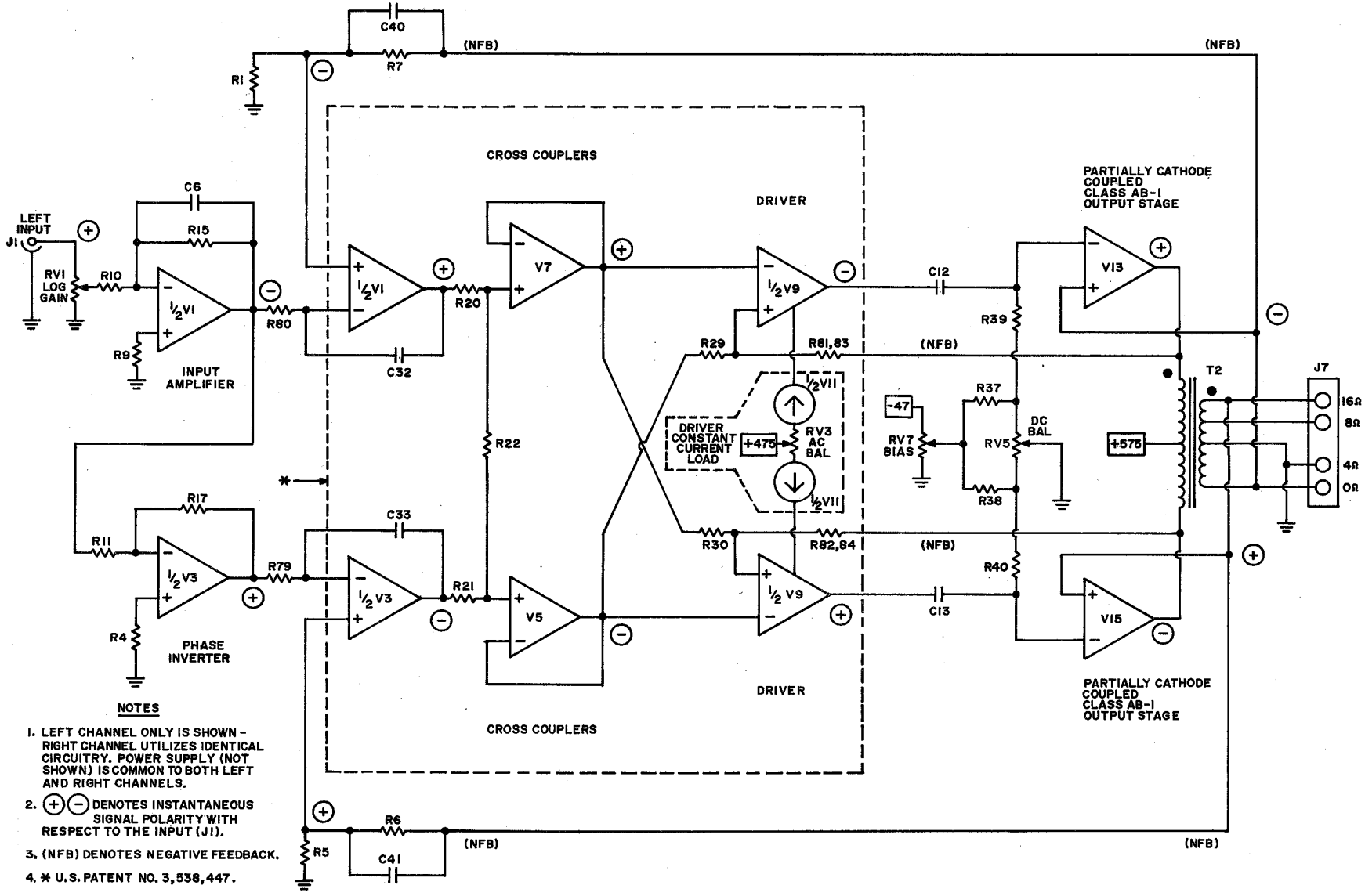
This unit contains voltages which may be lethal. Do not operate this unit with covers removed. Refer servicing to qualified personnel.



D-76 INPUT IMPEDANCE



D-76 OPERATIONAL CONNECTORS AND CONTROL LAYOUT



NOTES

1. LEFT CHANNEL ONLY IS SHOWN - RIGHT CHANNEL UTILIZES IDENTICAL CIRCUITRY. POWER SUPPLY (NOT SHOWN) IS COMMON TO BOTH LEFT AND RIGHT CHANNELS.
2. ⊕⊖ DENOTES INSTANTANEOUS SIGNAL POLARITY WITH RESPECT TO THE INPUT (J1).
3. (NFB) DENOTES NEGATIVE FEEDBACK.
4. * U.S. PATENT NO. 3,538,447.

A2

D-76 SIMPLIFIED SCHEMATIC

CIRCUIT DESCRIPTION

This circuit description will discuss the operational segments (vacuum tubes) and related components shown in the simplified schematic diagram on page A2. It should be noted that only pertinent components are shown and not those relating to biasing and interstage coupling, etc. A complete schematic diagram is shown on page A5 which will appendix the discussion if further technical insight is desired. Brief mention will be made, however, to the power supply components which are shown only in the complete schematic diagram.

The D-76 incorporates balanced cross-coupled vacuum tube circuitry. Single ended input signals are phase inverted outside the overall feedback loops and together with their compliments drive push-pull inputs. Balanced negative feedback around the basic push-pull power amplifier is returned to these inputs – after the unity gain phase inverter and input amplifier. This, in addition to a partially cathode coupled output stage, results in "symmetrical" amplifier performance.

The basic signal processing functions (circuit blocks) of the D-76 are grouped as shown in the simplified schematic diagram. Signal flow through the D-76 is consistent with the listed order of these functions (and respective description of each) as given below:

a. Input Amplifier (V1)

Input signals from a preamplifier or electronic crossover output are applied to input connector J1 and subsequent input gain control RV1 (log taper). The output of RV1 (wiper) is coupled to a unity gain inverting input amplifier comprised of ½V1 and feedback network R10, 15 and C6. Outputs from this amplifier are coupled via R80 to a voltage amplifier comprised of the second half of V1. High frequency rolloff of this stage is effected by C32. Overall negative feedback from the output is applied to the input of this amplifier via R1, 7, and C40. It should be noted that this voltage amplifier is one-half of the overall push-pull input section (see following phase inverter description).

b. Phase Inverter (V3)

Outputs from the unity gain input amplifier (1st half of V1) are also applied to a second unity gain inverting amplifier comprised of ½V3 and feedback network R11, 17. Outputs from this amplifier are essentially 180 degrees out of phase from the first input amplifier described in (a) above. This gives rise to a push-pull input signal which in turn is coupled via R79 to a "second" voltage amplifier, identical to that described in (a) above, and comprised of the second half of V3. High frequency rolloff of this stage is effected by C33. Overall negative feedback from the output is applied to the input of this "second" voltage amplifier via R5, 6, and C41.

Essentially, the entire input stage of the overall power amplifier consists of two identical voltage amplifiers, driven by push-pull inputs, and to which overall balanced (push-pull) negative feedback from the cross coupled outputs is applied.

c. Cross Couplers (V5, 7)

The high impedance push-pull outputs from the two input voltage amplifiers are direct coupled to cathode followers (first half of V5 and V7). Resistors R20, 21 and 22 represent the plate load network of the input amplifiers. The push-pull low impedance outputs of the cathode

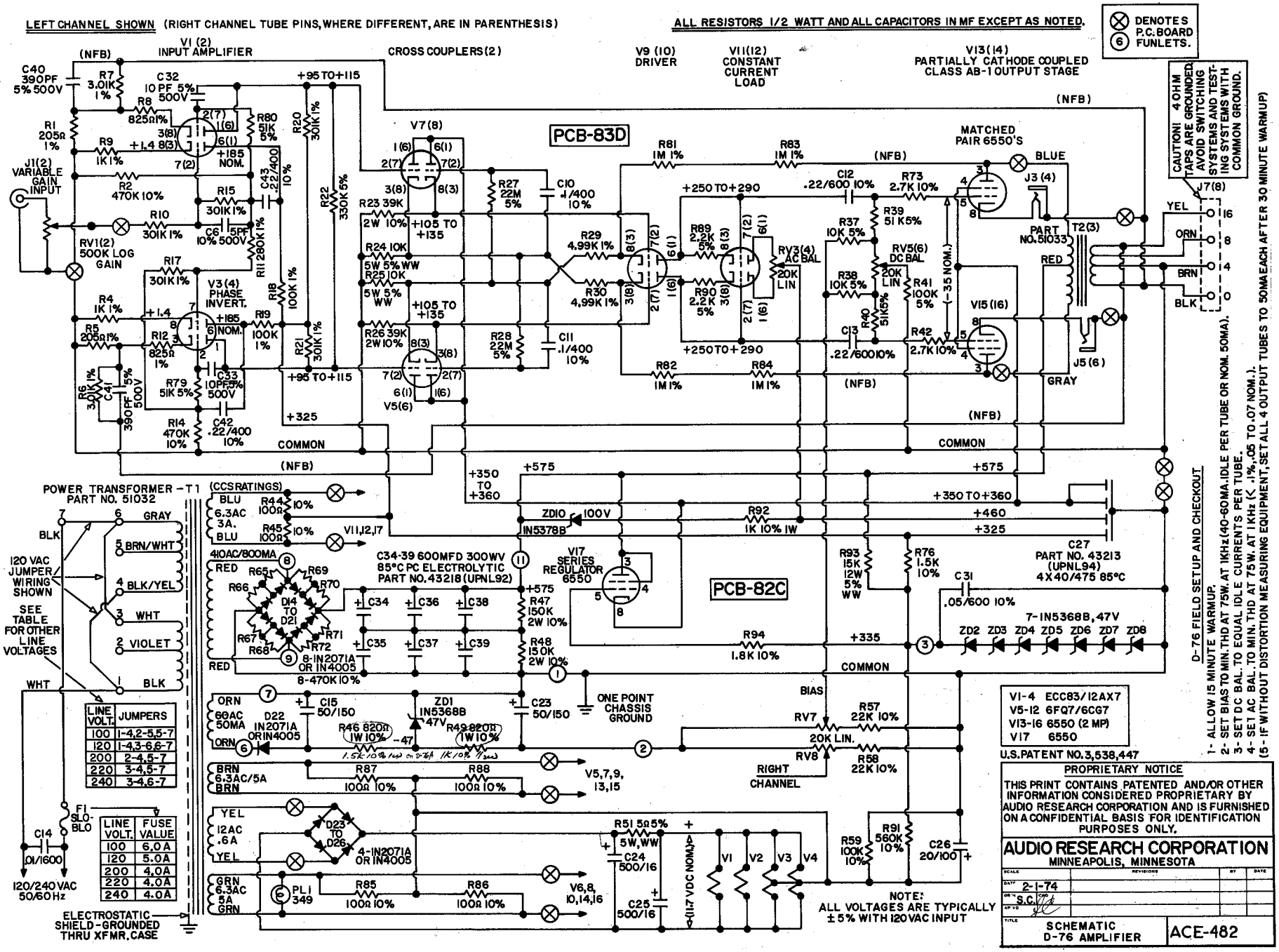
followers are "cross-coupled" with the inputs of the following push-pull driver stage (V9) thereby achieving "symmetrical" performance inside the overall negative feedback loops. The simplified schematic diagram shows all (both halves) of V5 and V7 as a common element. In practice, both halves are used to provide level shifting for the driver stage inputs (see complete schematic diagram).

d. Driver (V9) and Constant Current Load (VII)

Push-pull voltage amplification prior to the final output stage is achieved with both halves of V9. Inputs for this stage are developed by the cross couplers (V5, 7) as described above. To achieve high voltage gain, active plate loads for each half of V9 are employed. They consist of constant current sources as provided by each half of VII. An adjustment for AC balance (symmetry) of the overall amplifier is provided by RV3 in the plate circuit of VII. It should be noted that local negative feedback from the push-pull output stage is returned to each driver input by networks (R29, 81, 83) and (R30, 82, 84). Outputs from the driver stages are AC coupled (C12, 13) to the control grids of the output stage (V13, 15).

e. Output Stage (V13, 15, T2)

Push-pull outputs from the preceding driver stage (V9) are applied to the control grids of a matched pair of pentode power output tubes (V13, 15). Output transformer T2 matches the output tube impedance to either a 4, 8, or 16 ohm output load. It should be noted that the 0Ω and 16Ω secondary winding taps of T2 are essentially balanced with respect to ground through connection of the 4Ω output tap to ground. This scheme allows the generation of balanced push-pull output signals which are returned to the push-pull inputs through negative feedback networks R1, 7, C40, and R5, 6, C41. This output configuration also permits partial cathode coupling (local negative feedback) of the output tubes V13 and V15. The output stage is biased for class AB-1 operation by a regulated fixed bias supply. Bias for both tubes is adjusted by RV7 while balance between the two is provided by RV5.



D-76 SCHEMATIC DIAGRAM

D-76 PARTS LIST

Schematic Reference	Part Number	Description			
		RESISTORS			
R1, 5	42215	Metal Film	205 Ohm	1%	½W
R2, 14	41812	Composition	470K	10%	½W
R4, 9	42208	Metal Film	1K	1%	½W
R6, 7	42217	Metal Film	3.01K	1%	½W
R8, 12	42216	Metal Film	825 Ohm	1%	½W
R10, 15, 17, 20, 21	42213	Metal Film	301K	1%	½W
R11	42223	Metal Film	280K	1%	½W
R18, 19	42207	Metal Film	100K	1%	½W
R22	41816	Composition	330K	5%	½W
R23, 26	41002	Composition	39K	10%	2W
R24, 25	42002	Wire Wound	10K	5%	5W
R27, 28	41817	Composition	22M	5%	½W
R29, 30	42202	Metal Film	4.99K	1%	½W
R37, 38	41800	Composition	10K	5%	½W
R39, 40, 79, 80	41807	Composition	51K	5%	½W
R41	41809	Composition	100K	5%	½W
R42, 73	41411	Composition	2.7K	10%	½W
R44, 45, 85, 86, 87, 88	41415	Composition	100 Ohm	10%	½W
R46, 49	41206	Composition	820 Ohm	10%	1W
R47, 48	41011	Composition	150K	10%	2W
R51	42011	Wire Wound	5 Ohm	5%	5W
R57, 58	41808	Composition	22K	10%	½W
R59	41408	Composition	100K	10%	½W
R65, 66, 67, 68, 69, 70, 71, 72	41404	Composition	470K	10%	½W
R76	41416	Composition	1.5K	10%	½W
R81, 82, 83, 84	42209	Metal Film	1M	1%	½W
R89, 90	41801	Composition	2.2K	5%	½W
R91	41410	Composition	560K	10%	½W
R92	41420	Composition	1K	10%	1W
R93	42020	Wire Wound	15K	5%	12W
R94	41401	Composition	1.8K	10%	½W
Numbers not used:	R3, 13, 16, 31, 32, 33, 34, 35, 36, 43, 50, 52, 53, 54, 55, 56, 60, 61, 62, 63, 64, 74, 75, 77, 78				
		POTENTIOMETERS			
RV1, 2	45018	Logarithmic Taper	500K		
RV3 thru RV8	45011	Linear Taper	20K		
		CAPACITORS			
C6	43410	Silver Mica	5pf	500V	10%
C10, 11	43001	Mylar	.1MFD	400V	10%
C12, 13	43003	Mylar	.22MFD	600V	10%
C14	43028	Mylar	.01MFD	1600V	10%
C15, 23	43200	Electrolytic	50MFD	150V	
C24, 25	43210	Electrolytic	500MFD	16V	

Schematic Reference	Part Number	Description			
C26	43206	Electrolytic	20MFD	100V	
C27	43213	Electrolytic	4x40MFD	475V	
C31	43013	Mylar	.05MFD	600V	10%
C32, 33	43434	Silver Mica	10pf	500V	5%
C34, 35, 36, 37, 38, 39	43218	Electrolytic	600MFD	300V	
C40, 41	43435	Silver Mica	390pf	500V	5%
C42, 43	43010		.22MFD	400V	10%
Numbers not used:	C1, 2, 3, 4, 5, 7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 28, 29, 30				
		DIODES			
D14 thru D26	33006	1N4005	1A/600PIV		
ZD1 thru ZD8	33003	1N5368B		47V	5W
ZD10	33004	1N5378B		100V	5W
Number not used:	ZD9				
		TUBES			
V1 thru V4	32003	ECC83/12AX7			
V5 thru V12	32013	6FQ7/6CG7			
V13 thru V16	32001	6550 (matched pairs)			
V17	32000	6550			
		TRANSFORMERS			
T1	51032	100/120/200/220/240V., 50/60 Hz		Primary	
T2, 3	51033	Output			
		MISCELLANEOUS			
	10003	Handle			
	10531	Front Panel (Natural)			
	10531	Front Panel (Gold)			
	10387	Top Cover			
	10388	Bottom Cover			
FI	34000	For 240V, 3.2 amp MDL Slo-Blo			
	34006	For 120V, 5 amp. MDL Slo-Blo			
PL-1 Assy.	34008	Lamp assembly (without lamp)			
	34016	Lens, Green, Transluscent			
	34001	Lamp, #349, 6V.			
	34010	Fuse Holder			
TH1	47000	25 Ohm	20%		
	61003	Tube Sockets, 9 pin			
	61011	Tube Sockets, 8 pin			
J7, 8	61205	4 Terminal Barrier Block (Speaker Output)			
J1, 2	61416	Phono Jacks (Input)			
J3, 4, 5, 6	61419	Phone Jacks (Current Monitor)			
	72005	Line Cord			
	84003	Knob			
	85000	Feet			
	85030	Relief Bushing			

EQUIPMENT SERVICING

This section contains service information and data for the Model D-76. It is intended for use by the knowledgeable and experienced technician only. Before attempting any servicing of this device, the previous sections of this instruction manual should be studied to gain a thorough understanding of its operation. Only high quality test equipment and carefully executed test procedures should be employed when testing and evaluating performance. Refer to pages A15-A18 for "internal" control and parts location.

Recommended Test Equipment

Item	Requirements	Use
Audio Oscillator	Less than .01% of distortion	Sine wave source for THD measurement, response measurements, and trouble-shooting.
Harmonic Distortion Analyser	Less than .01% residual	THD measurement
Intermodulation Distortion Analyser	Less than .01% residual	IMD measurement
Oscilloscope	General purpose	Waveform analysis and trouble-shooting.
VTVM	General Purpose	AC & DC voltage measurements
DC Milliameter	100 ma. full scale, with phone plug connector	Output tube current monitor
Variable Auto Transformer	0-140 V., 3KVA	Adjust input line voltage for 120 VAC
Line Voltmeter	0-130 VAC	Monitors line voltage
Output Load	16 Ohm, 150 Watt, non-inductive	Output power measurement
Tube Extenders	8 and 9 pin	Tube socket voltage measurements

CAUTION

This amplifier contains voltages which may be lethal. Exercise extreme care when making voltage measurements or adjustments of "internal" controls.

DC Bias/Balance Adjustment:

Adjustment of the output stage DC bias/balance controls must be made after replacement of the output tubes or repair of associated circuitry, i.e. power supply, bias supply etc. An adjustment or "check" can also be made periodically if it is desired to "test" or "tweak" the output stage. Although the latter procedure is not manditory, it does monitor or compensate for the condition of the output tubes as they age.

Note: Output tubes (V13, V15) or (V14, V16) should be replaced only with *matched pairs* of 6550's. If only one output tube fails, *both* must be replaced with a matched pair.

1. Plug the amplifier into a 120 VAC power source.
2. If output tubes were replaced, adjust the appropriate bias control(s) RV7 and/or RV8 for 50 ma. nominal quiescent current per tube. Output tube current is monitored at J3, J4, J5, and J6 with a DC Milliameter and "phone plug" probe. See page A15 for location of output tubes, adjustment controls, and current monitoring jacks.
3. Allow the amplifier to warm-up for 30 minutes – a 24 hour "burn-in" is recommended before making a final adjustment with new output tubes.
4. Trim DC balance control(s) RV5 and/or RV6 for a 50 ma. reading per output tube – readjust bias control(s) RV7 and/or RV8 if necessary (the bias control affects both output tubes while the balance control provides an independent vernier trim of each tube).
5. This completes the DC bias/balance procedure.
6. Continue with the AC balance procedure as outlined below.

AC Balance Procedure:

Adjustment of the AC balance control must be made after replacement of the output tubes or any extensive repair.

This procedure involves measuring (monitoring) the total harmonic distortion (THD) of the amplifier while adjustment is made. To prevent erroneous readings, all test equipment should be isolated from the power line ground. Since the amplifier output is "balanced" with respect to signal ground, all measurements made at the amplifier output should be referenced to the 4 ohm tap only which is internally tied to circuit ground. Never externally ground, either with test cables or test equipment, the "0", "8", or "16" ohm output terminals as this would short out one half of the amplifier's balanced push-pull feedback loop. Use only "floating" loads or test equipment when referencing same to any terminal except the grounded "4" ohm terminal.

1. Make sure that the output stage bias and balance controls have been properly adjusted (see DC bias/balance procedure, above) before making the AC balance adjustment.
2. Connect a 16 ohm "dummy" load to the amplifier output of the channel under test.
3. Plug the amplifier into a 120 VAC power source.
4. Allow the amplifier to warm-up for 30 minutes.
5. Center the appropriate AC Balance Control RV3 or RV4.
6. With a low distortion oscillator ($\leqslant$ .01% residual THD) inject a 1KHz input signal. Adjust input level for full rated output – 75 Watts RMS.
7. Connect (float) a Harmonic Distortion Analyser ($\leqslant$ .01% residual) across the 16 ohm output.
8. Adjust the appropriate AC Balance Control for minimum THD:

   $<$ .1% @ 75 Watts RMS per channel @ 1KHz
   $<$ .3% @ 75 Watts RMS per channel @ 30 Hz
   $<$ 1% @ 75 Watts RMS per channel @ 15 KHz

Intermodulation Distortion (IMD)
Measurement Procedure:

Most IMD analysers (such as the Crown IMA) have a common signal ground between the generator output (60Hz & 7KHz, 4:1 ratio) and the analyser input. Since the D-76 has a "balanced" output, care must be exercised when attempting measurements with such intruments. It is recommended that a "bridging" transformer be used across the amplifier output ("0" and "16" ohms) to provide necessary isolation. The secondary of the bridging transformer can be referenced back (tied) to ground at the analyser "input". This precaution is in contrast to the THD measurement procedure where (in most cases) the oscillator is separate (isolated) from the analyser.

1. Connect a 16 ohm "dummy" load across the amplifier output ("0" and "16" ohm taps).
2. Connect IM analyser as described above.
3. Adjust line voltage for 120 VAC.
4. Adjust the IM analyser "output" (D-76 input signal) for 75 Watts RMS output.
5. The IMD should be $\leqslant$ .5%.

"POWER-UP" PROCEDURE:

In the event that this equipment is subjected to extensive repair, it is recommended that the following "power-up" procedure be observed:

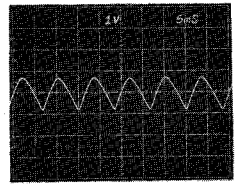
1. Do not plug in to power line.
2. Turn bias controls RV7 and RV8 full counter-clockwise (as viewed from bottom) for maximum bias.
3. Center AC and DC balance controls RV3, RV4 and RV5, RV6 respectively.
4. Remove V16 and V17 – keep them identified.
5. Make the following resistance readings with respect to ground:
   a) V16, pin 5, approximately 70-80K
   b) V17, pin 3, reading should increase as capacitors charge
   c) Both sides of ZD10, reading should increase as capacitors charge
   d) V17, pin 8 reading should increase as capacitors charge

   The last three measurements check for printed circuit foil continuity and shorts to ground in the high voltage B+ circuits. If a DC filament circuit has been repaired, check in a similar fashion all associated diodes, filter capacitors, and printed circuit foil paths for continuity and shorts etc.
6. Plug in V17 – leave V16 out.
7. Plug power cord into Variac – set Variac for zero output before connnecting.
8. Connect line voltmeter to Variac output.
9. Adjust Variac for 25 Volts output.
10. Ascertain that negative bias exists at pin 5 of V16 – approximately minus 6 to 9 Volts.
11. Check for "some" B+ on either side of R94.
12. Bring Variac output up to approximately 65 Volts output – continue to monitor points in (10) and (11) above.
13. Check pin 4 of V16 for "some" screen voltage – approximately 50 to 200 Volts; this indicates if V17 is operative.
14. Plug in V16.
15. Re-check for "some" voltage (greater than in (11) above) on either side of R94.
16. Slowly increase Variac output while monitoring the voltage on either side of R94 – regulation should occur (i.e. no voltage increase when line voltage is increased) at this test point when approximately 320 Volts is reached. The reading will increase as the unit warms up due to a positive zener temperature coefficient.
17. Bring Variac up to a full 120 Volts output.
18. Measure output tube quiescent current at J3, J4, J5, and J6 in fairly rapid succession with a DC milliameter and "phone plug" probe – reading should be 20 ma. per tube.

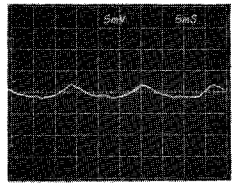
    Note: If above reading is abnormally high, check for defective tube socket, defective bias circuit component pertinent to the tube, or possible defective output tube.
19. If all measurements in (18) above appear to be normal, adjust bias controls RV7 and RV8 for 50 ma. nominal per output tube.
20. Make a final check of all voltages (per the schematic and/or voltage/resistance table) with the line voltage adjusted to 120 VAC.
21. This completes the "power-up" procedure.
22. Adjust the output stage DC bias/balance controls according to the procedure given on page A9.

D-76 TROUBLESHOOTING TABLE

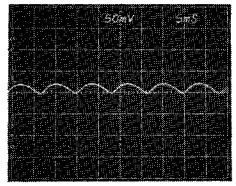
Symptom		Possible Cause
Dead, both channels	–	Blown fuse (F1)
	–	No power at plug
	–	Defective V17
	–	Defective DC filament supply
	–	Defective ZD1 (open)
	–	Defective thermistor TH-1 (open)
	–	Defective transformer (T1)
Dead, one channel	–	Defective tube(s) V1 through V12
	–	Defective output tubes V13, 15 or V14, 16
	–	Defective plate or cathode resistor (open) associated with V1 through V4
Blows fuses	–	Wrong size and/or type fuse
	–	Defective diode(s) in high voltage bridge rectifier
	–	Defective V13 through V17
	–	Defective zener diode(s) in series regulator circuit. Note: If one or more are shorted, replace all zener diodes
Blows fuse at moderate to high signal levels only	–	Wrong size and/or type fuse
	–	Defective diode in high voltage bridge rectifier
	–	Defective output tube(s) V13 through V16 (internal arcing)
Low power output	–	Low B+ voltage(s)
	–	Low regulated screen voltage
Poor sound, one or both channels	–	Output tube(s) incorrectly biased
	–	AC balance incorrectly adjusted
	–	One or more output tubes defective. Note: Replace output tubes with factory matched pairs for lowest distortion
	–	Defective tube(s) V1 through V12
	–	Defective coupling capacitor C12 or C13
	–	Defective output transformer T2 or T3
Hum	–	Defective C26 or C27
	–	Defective input filter capacitor(s) C34 through C39
	–	Defective tube(s) V1 through V12
	–	Open diode(s) in high voltage bridge rectifier
	–	Open diode in filament voltage bridge rectifier
Noise	–	Defective tube V1 through V4 or associated plate or cathode load resistor



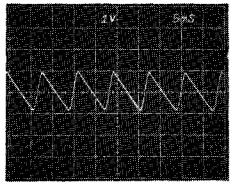
1 VERT. = 1V/DIV.
HORIZ. = 5MSEC/DIV.



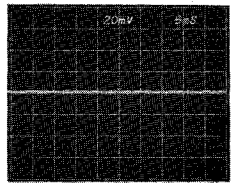
2 VERT. = 5MV/DIV.
HORIZ. = 5MSEC/DIV.



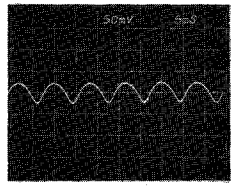
3 VERT. = 50MV/DIV.
HORIZ. = 5MSEC/DIV.



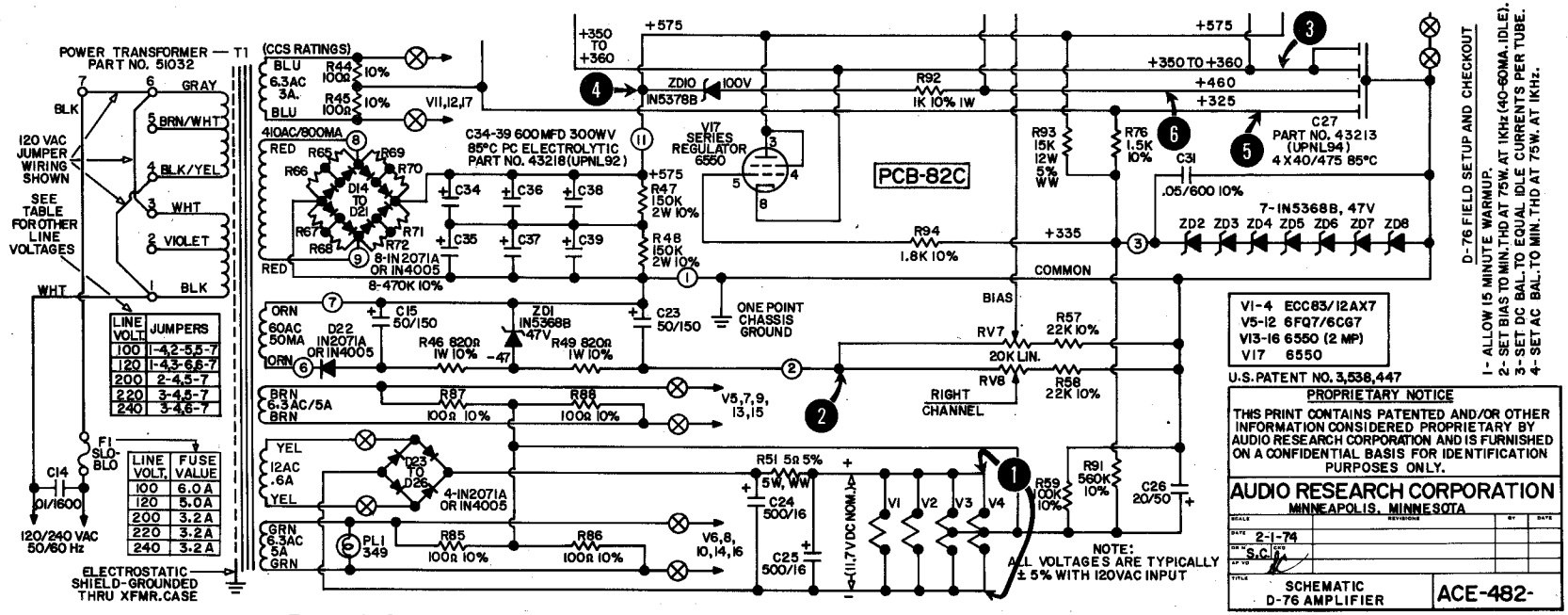
4 VERT. = 1V/DIV.
HORIZ. = 5MSEC/DIV.



5 VERT. = 20MV/DIV.
HORIZ. = 5MSEC/DIV.



6 VERT. = 50MV/DIV.
HORIZ. = 5MSEC/DIV.



D-76 NOMINAL POWER SUPPLY FILTER RIPPLE WAVEFORMS

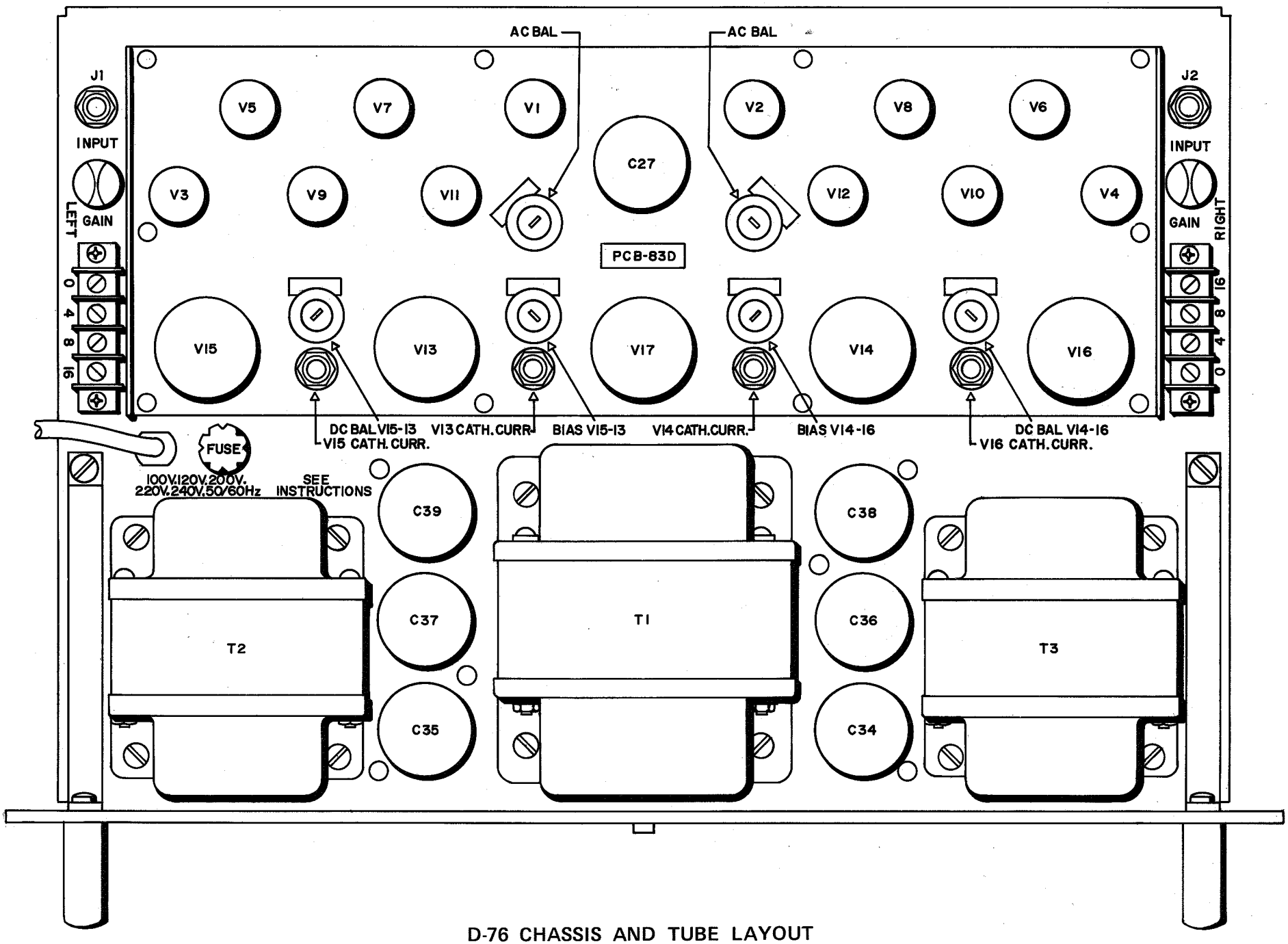
D-76 VOLTAGE/RESISTANCE TABLE

TUBE NUMBER	PIN NUMBER	DC/AC VOLTAGE	RESISTANCE	TUBE NUMBER	PIN NUMBER	DC/AC VOLTAGE	RESISTANCE
V1 (2)	1 (6)	105	200K*	V9 (10)	1 (6)	270	∞
V1 (2)	2 (7)	0	267K	V9 (10)	2 (7)	120	39K
V1 (2)	3 (8)	0.8	1.02K	V9 (10)	3 (8)	125	15K
V1 (2)	4 (4)	57	100K†	V9 (10)	4 (4)	51/3.1	100K†
V1 (2)	5 (5)	45	100K†	V9 (10)	5 (5)	51/3.1	100K†
V1 (2)	6 (1)	185	100K*	V9 (10)	6 (1)	270	∞
V1 (2)	7 (2)	0	203K	V9 (10)	7 (2)	120	39K
V1 (2)	8 (3)	1.4	1.0K	V9 (10)	8 (3)	125	15K
V1 (2)	9 (9)	51	∞	V9 (10)	9 (9)	0	∞
V3 (4)	1 (1)	105	200K*	V11 (12)	1 (6)	430	10K*
V3 (4)	2 (2)	0	353K	V11 (12)	2 (7)	270	∞
V3 (4)	3 (3)	0.8	1.02K	V11 (12)	3 (8)	277	∞
V3 (4)	4 (5)	57	100K†	V11 (12)	4 (4)	325/3.1	X
V3 (4)	5 (4)	45	100K†	V11 (12)	5 (5)	325/3.1	X
V3 (4)	6 (6)	185	100K*	V11 (12)	6 (1)	430	10K*
V3 (4)	7 (7)	0	319K	V11 (12)	7 (2)	270	∞
V3 (4)	8 (8)	1.4	1.0K	V11 (12)	8 (3)	277	∞
V3 (4)	9 (9)	51	100K†	V11 (12)	9 (9)	0	∞
V5 (6)	1 (6)	355	X	V13-16	1	0	0Ω
V5 (6)	2 (7)	—	22M	V13-16	2	51/3.1	100K†
V5 (6)	3 (8)	120	39K	V13-16	3	575	X
V5 (6)	4 (4)	51/3.1	100K†	V13-16	4	355	X
V5 (6)	5 (5)	51/3.1	100K†	V13-16	5	−35	77K
V5 (6)	6 (1)	355	X	V13-16	6	0	∞
V5 (6)	7 (2)	105	200K*	V13-16	7	51/3.1	100K†
V5 (6)	8 (3)	113	10K	V13-16	8	0.01	.4Ω
V5 (6)	9 (9)	0	∞				
V7 (8)	1 (6)	355	X	V17	1	0	0Ω
V7 (8)	2 (7)	105	200K*	V17	2	325/3.1	X
V7 (8)	3 (8)	113	10K	V17	3	575	X
V7 (8)	4 (4)	51/3.1	100K†	V17	4	575	X
V7 (8)	5 (5)	51/3.1	100K†	V17	5	335	X
V7 (8)	6 (1)	355	X	V17	6	0	∞
V7 (8)	7 (2)	—	22M	V17	7	325/3.1	X
V7 (8)	8 (3)	120	39K	V17	8	355	X
V7 (8)	9 (9)	0	∞				

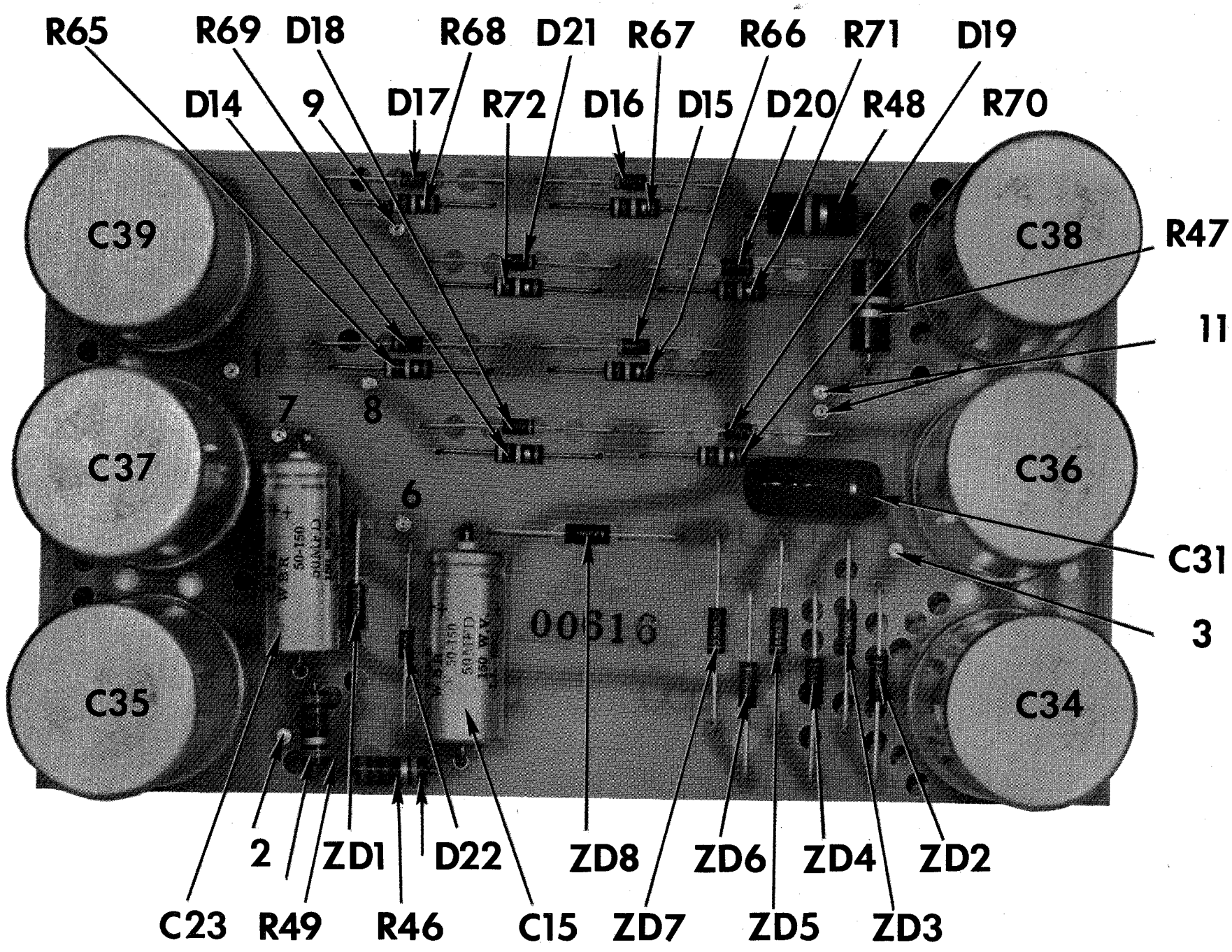
NOTES:

NOTES:

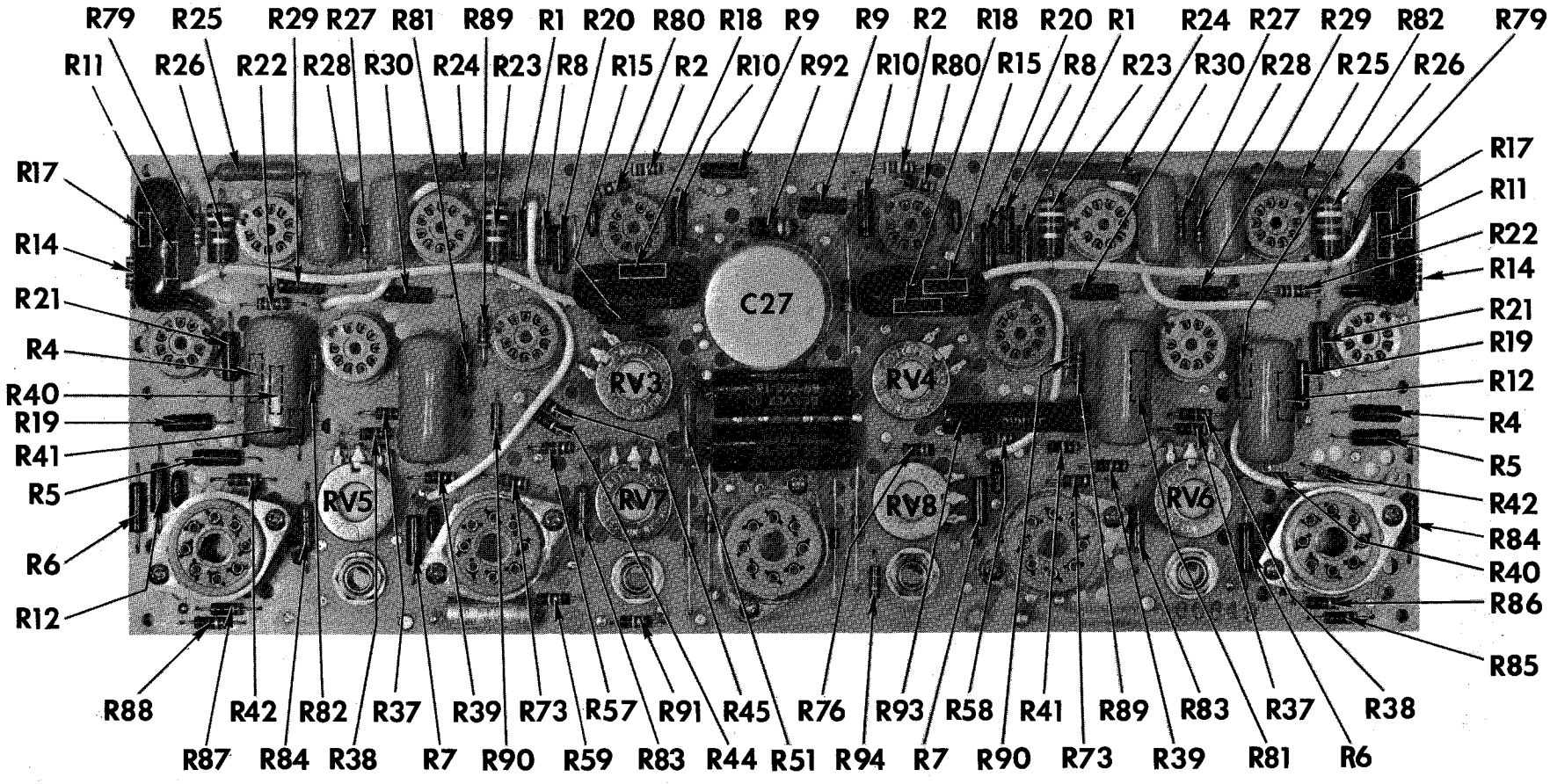
1. Readings are typical — taken at 120 VAC line with a FLUKE 8000A DVM.
2. All measurements are with respect to ground.
3. Allow all capacitors to fully discharge before measuring resistance.
4. Voltage readings taken with all tubes in place.
5. Resistance readings taken at socket with tube under test only removed.
6. * Typical initial reading — increases as capacitors charge.
7. † Typical value after capicitors charge.
8. X Low initial reading — increases as filter capacitors charge.
9. Input gain controls at min. (full CCW)



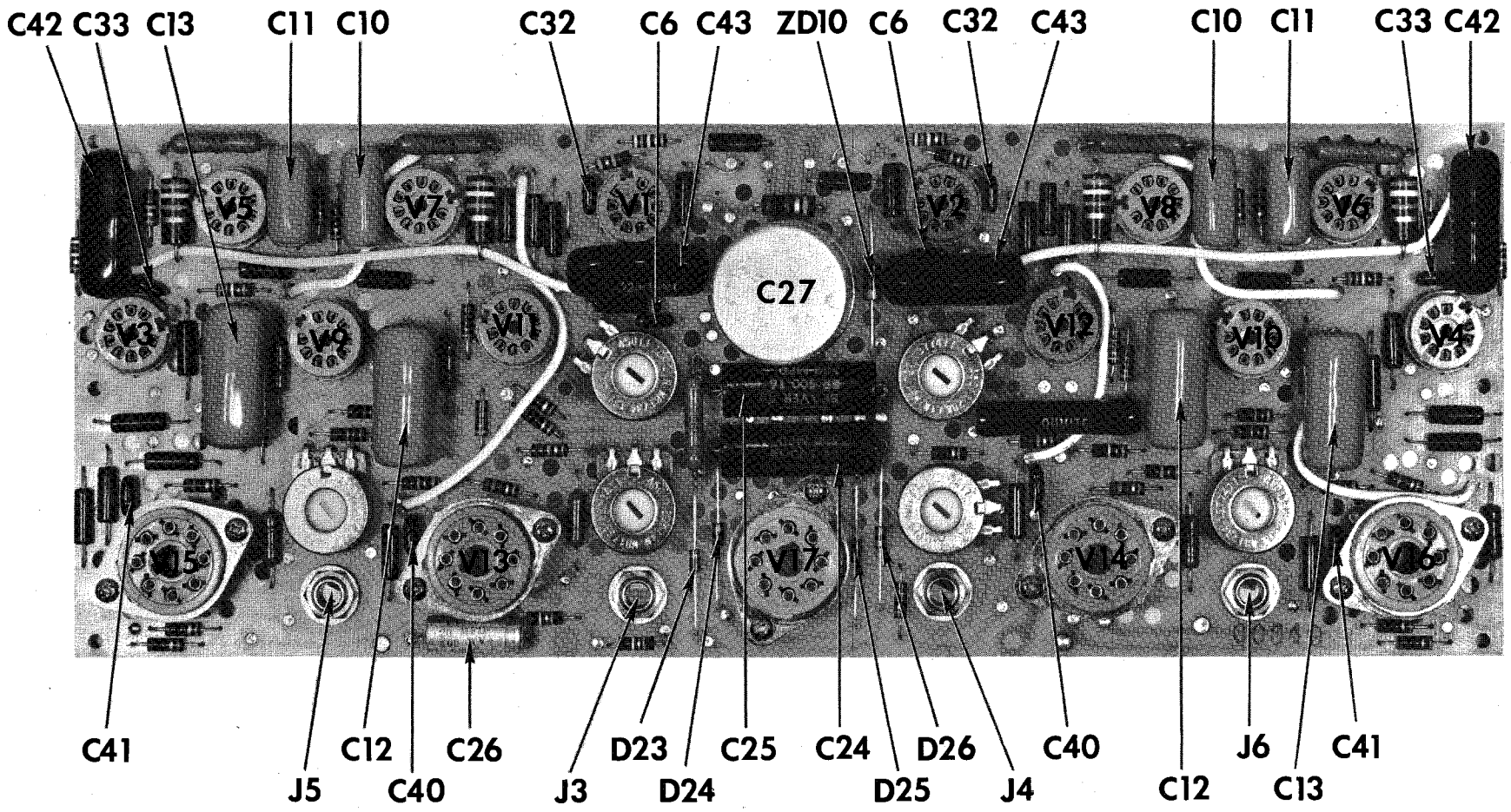
D-76 CHASSIS AND TUBE LAYOUT



PCB-82C COMPONENT LAYOUT



PCB-83C LAYOUT (Resistors)



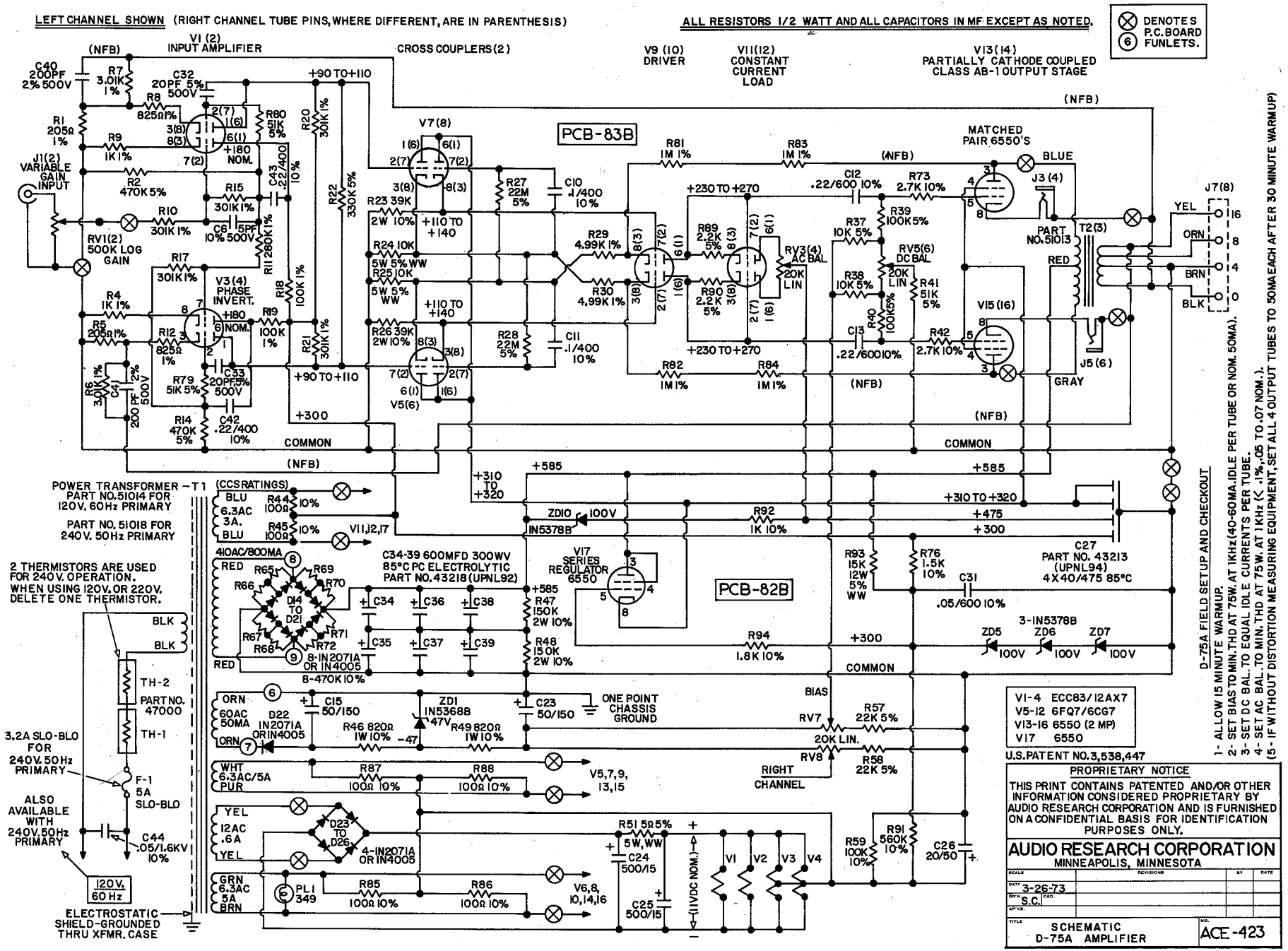
PCB-83C LAYOUT (Capacitors)

APPENDIX B

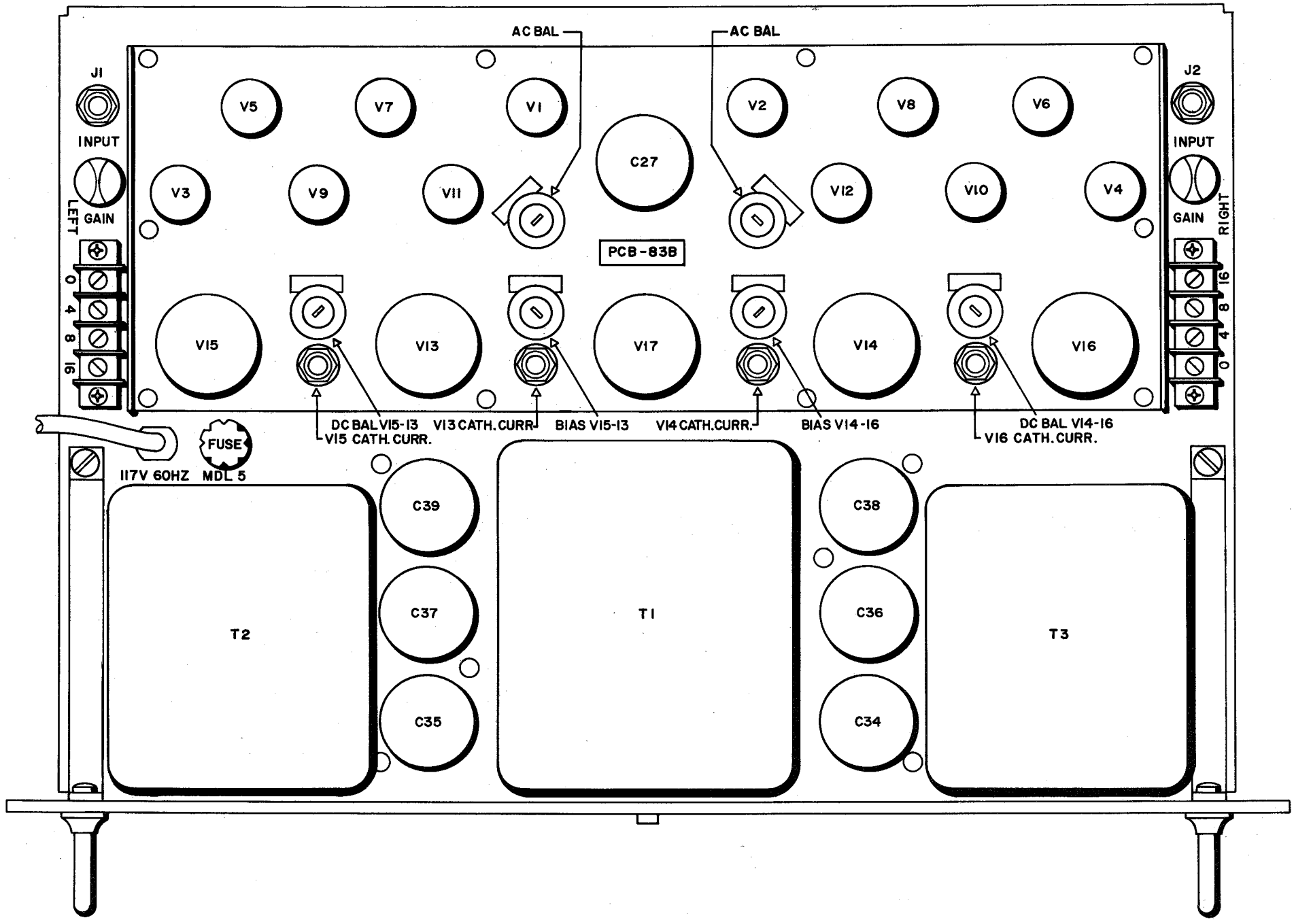
MODEL D-75A
POWER AMPLIFIER

CONTENTS:

SCHEMATIC DIAGRAM
TUBE AND CHASSIS LAYOUT



D-75A SCHEMATIC DIAGRAM



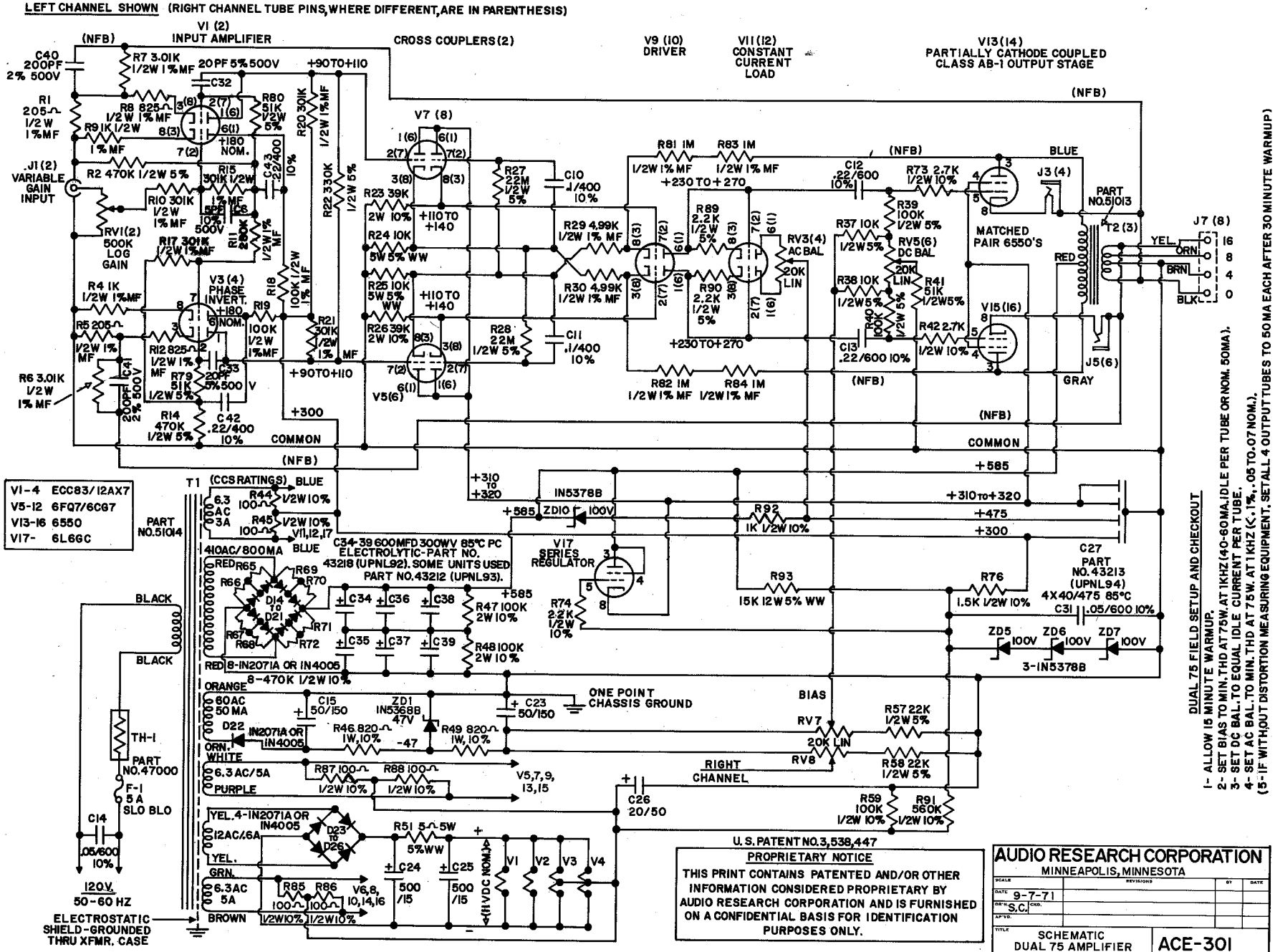
D-75A CHASSIS AND TUBE LAYOUT

APPENDIX C

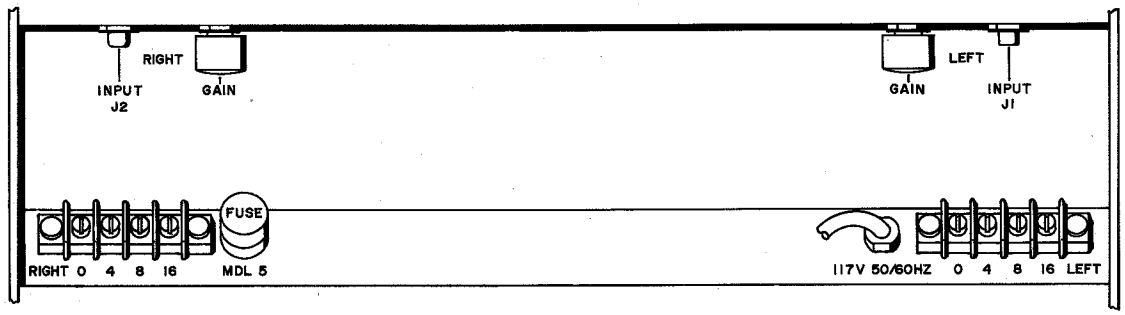
MODEL D-75
POWER AMPLIFIER

CONTENTS:

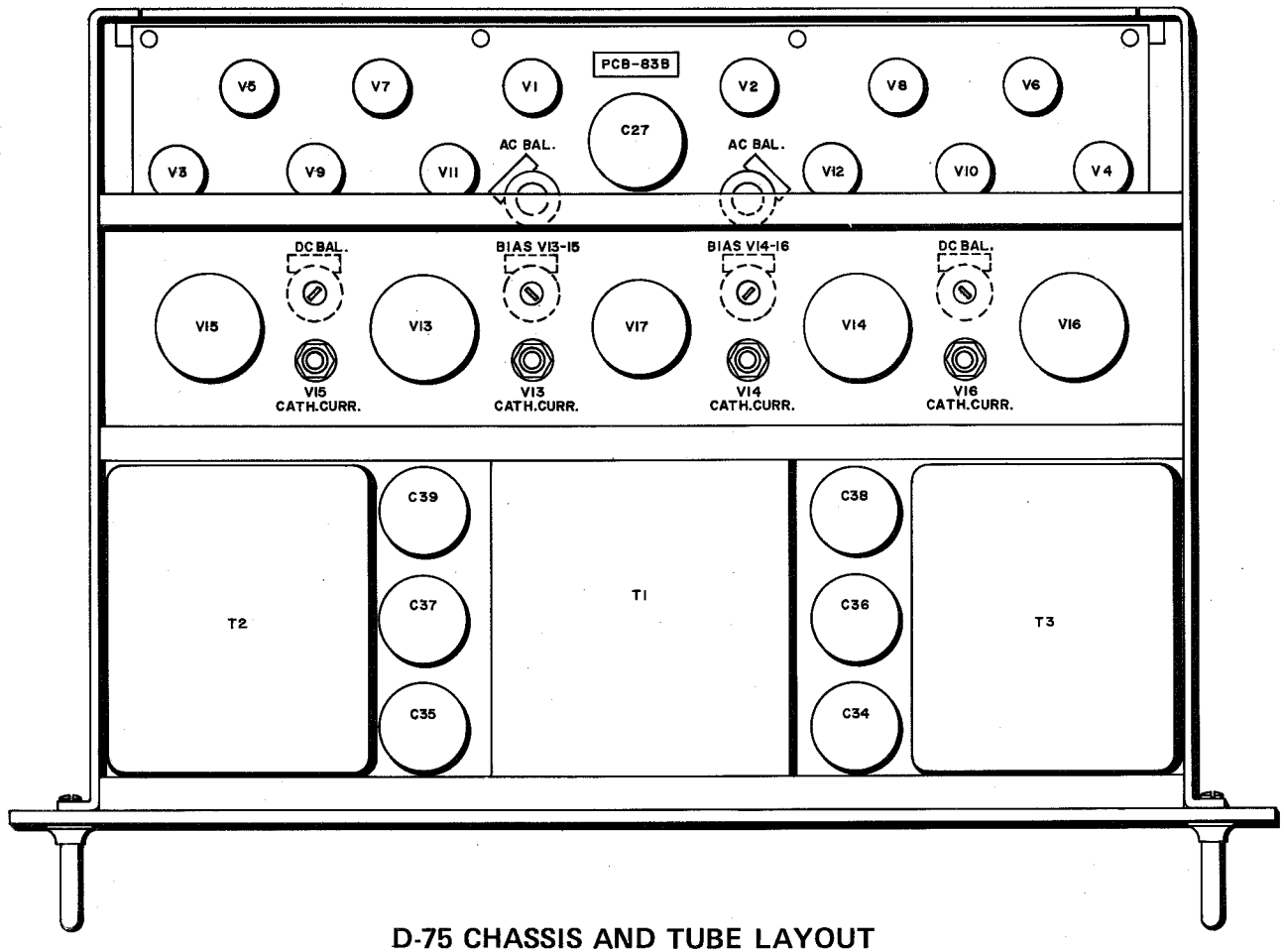
SCHEMATIC DIAGRAM
TUBE AND CHASSIS LAYOUT



D-75 SCHEMATIC DIAGRAM



"UNDERCHASSIS" CONTROLS & CONNECTIONS



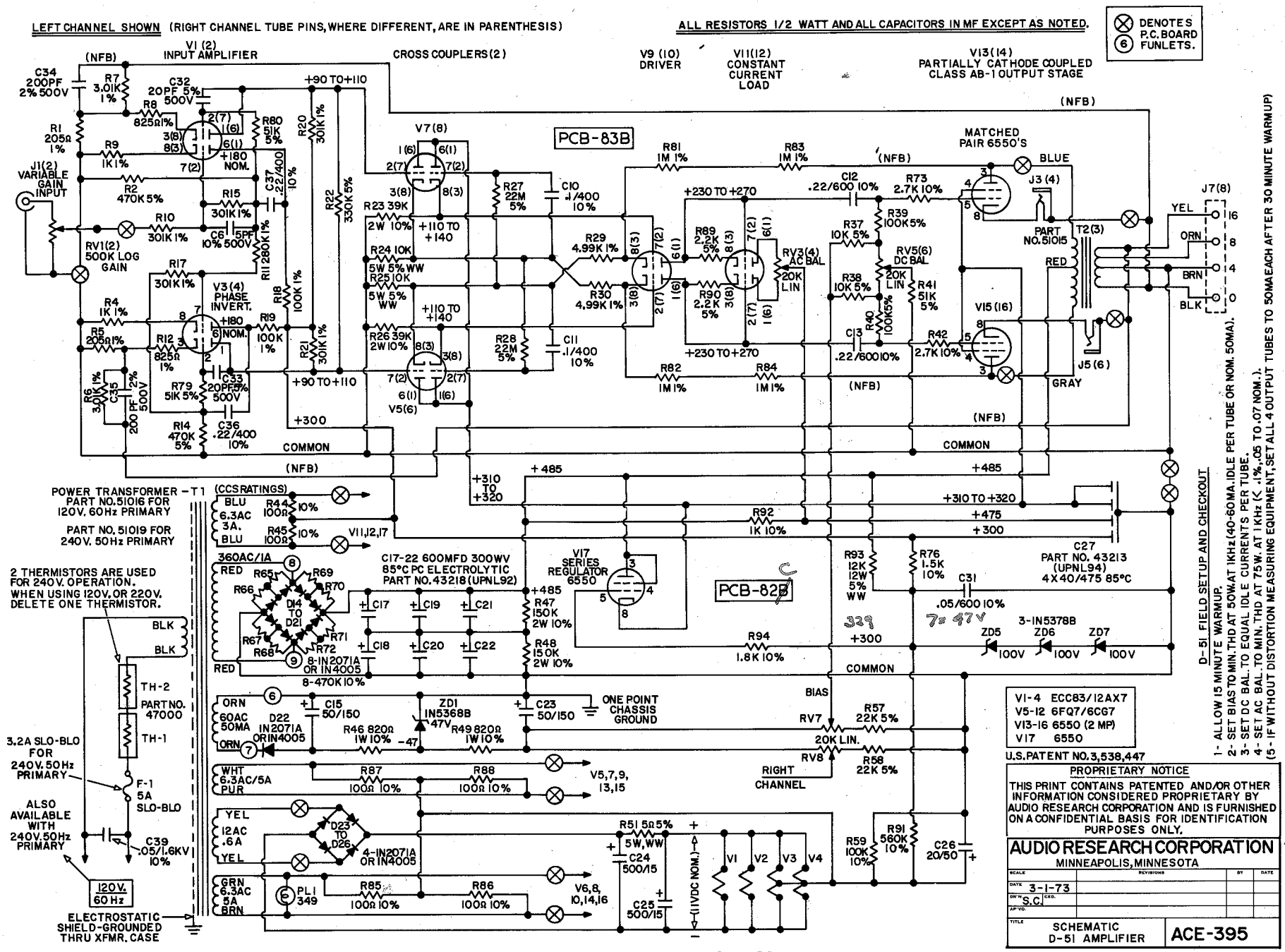
D-75 CHASSIS AND TUBE LAYOUT

APPENDIX D

MODEL D-51
POWER AMPLIFIER

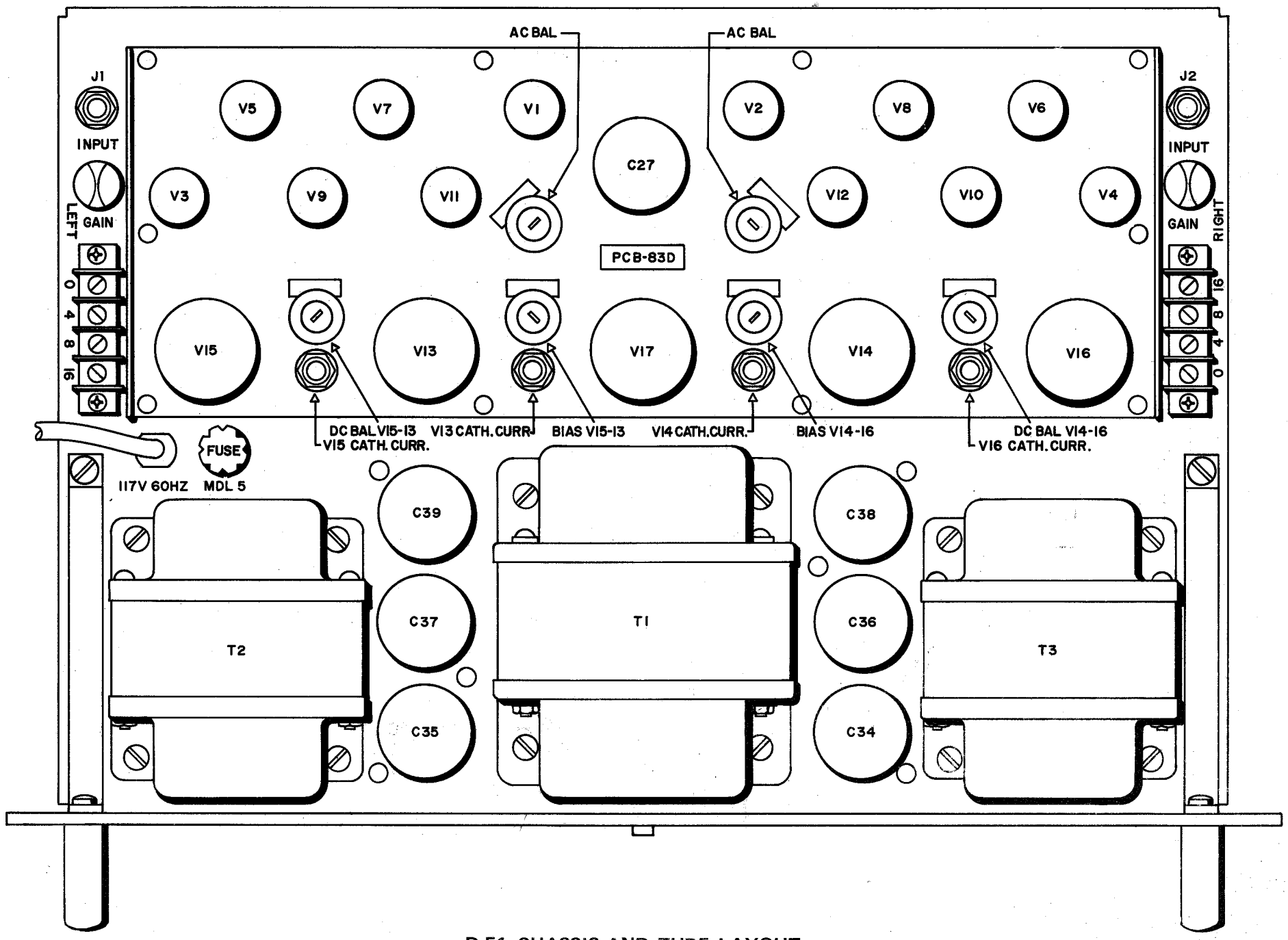
CONTENTS:

SCHEMATIC DIAGRAM
TUBE AND CHASIS LAYOUT



D1

D-51 SCHEMATIC DIAGRAM



D-51 CHASSIS AND TUBE LAYOUT

2 5W 330Ω Resistors Fan

SERIAL #

audio research corporation

HIGH DEFINITION
SOUND EQUIPMENT