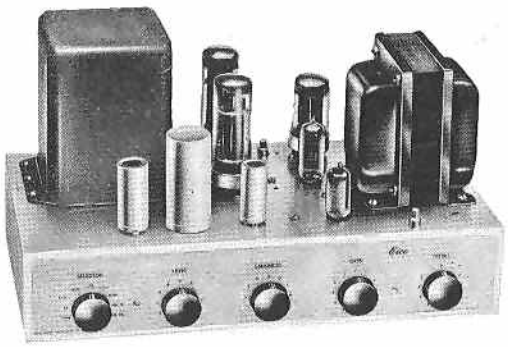
MODEL HF 52
50 WATT INTEGRATED
HIGH FIDELITY AMPLIFIER

MANUAL OF INSTRUCTIONS

ELECTRONIC INSTRUMENT CO., INC.
84 Withers St. • Brooklyn 11, N. Y.

Price $1.00

HF 52-1



MODEL HF 52

50 WATT INTEGRATED

HIGH FIDELITY AMPLIFIER

general description

GENERAL

The Model HF52 is the least expensive means of achieving the highest audio quality, resulting from high power obtained without distortion throughout the full audio spectrum, virtually absolute stability, and flawless transient response. Despite the fact that the preamplifier-control section is placed on the same chassis with a high power amplifier, engineering of the layout has eliminated any undesirable couplings. The hum and noise level achieved is on a par with that of well-designed lower power intergrated amplifiers and will be found entirely satisfactory even by critical listeners. The output stage and the output transformer, the type of power amplifier circuit, and the power supply components are identical to that used in the Model HF50 power amplifier.

FEATURES

1. Extremely low distortion preamplifier-equalizer circuit, equalizing entirely by feedback. Selection from five equalizations permits correct compensation for practically any microgroove or 78 rpm recording.

2. Extremely low distortion printed circuit feedback bass and treble tone controls. These controls do not affect the volume or interact with each other, and also provide a true "flat" position. Turnover frequency in both bass and treble varies with the degree of boost or cut, making it possible to bring up the extreme lows or extreme highs affecting the mid-range as well.

3. DC superimposed on all tube filaments to eliminate cathode-heater leakage as a source of hum.

4. A Centralab printed-circuit, prewired loudness control (Compentrol) plus a separate level control, both on the front panel, permits an infinite selection of loudness "contours" at any desired listening level. By pre-setting the panel level control as instructed, the loudness control will automatically provide correct Fletcher-Munson loudness compensation at the setting which gives the desired listening level.

5. Four high level and two low-level inputs enable this amplifier to accomodate tv, tape recorder, AM-FM tuner (or separate AM and FM tuners), ceramic or crystal cartridge, as well as any leading magnetic or FM phono pickup without the necessity of component changes. No cross-talk; selector switch grounds all inputs but one selected.

6. Low impedance cathode follower tape-output unaffected by any controls.

7. The use of a cathode follower at the high level inputs makes it possible to provide the high input impedance required for flat frequency response and high output from the new, high quality, self-equalizing ceramic cartridges.

8. The output of the preamplifier-control section and the input to the power amplifier section have been brought out to separate receptacles on the rear chassis apron for the use of people who wish to employ an electronic cross-over network and an additional amplifier (or amplifiers).

9. The level control is placed at a low-impedance point in the amplifier (after the tone controls) so that the square wave response is unaffected by the level setting. This is possible because the cathode follower input circuit will not distort the signal even at peak signal voltages far in excess of the value of signal that will develop rated output power. Another benefit of this arrangement is a high signal-to-noise ratio in the tone control stage.

10. The power amplifier features a cathode-coupled phase inverter, which provides drive for the output stage from equal and comparatively low impedances and direct coupling from the preceding first voltage amplifier stage. The importance of the cathode-coupled phase inverter is that it provides forced balance over the entire frequency and dynamic range.

11. EL34/6CA7 output pentodes in a push-pull Ultra-Linear output stage operating with fixed bias.

12. Extremely high quality output transformer*, employing grain-oriented steel, extensively interleaved windings, and fully potted in a seamless steel case. 4, 8, and 16 ohm speaker connections are provided. (*Chicago Standard)

13. Heavy-duty power transformer. 125 and 117 volt primary taps permit trouble-free operation in high line voltage areas.

14. Extra-rugged GZ34 rectifier tube with indirectly heated cathode to eliminate high starting voltage on electrolytic filter capacitors, and to delay the application of the full B+ voltage to the amplifier tubes until they have warmed up.

15. Fuse and panel mounted fuse holder.

16. Control of bias voltage for output tubes.

17. DC balance adjustment of output tubes; convenient metering terminals provided.

18. Switched and unswitched convenience outlets.

19. Heavy gauge cadmium plated steel chassis; baked metal-lustre statuary bronze finish. Brushed brass control plate.

20. Premium quality audio and rectifier tube types used exclusively.

21. Optional matching decorative cover.

SPECIFICATIONS

Output Power: 50 watts continuous; 100 watts peak

* IM Distortion (60 & 6000 cps at 4 : 1): below 1% at 50 w; 1/2% at 20 w

* Total Harmonic Distortion: below 1% 20 cps - 20 kc within 1 db of 50 w

* Frequency Response: 1w: ±0.5 db 6 cps - 60 kc; ±1.5 db 6 cps - 100 kc
50w: ±0.5 db 15 cps - 60 kc; ±1.5 db 15 cps - 100 kc
± 0.1 db 20 cps - 30 kc at any level from 1 mw to 50 watts
No peaking or raggedness outside the audio range.

* Square Wave Response: 20 cps - 20 kc essentially undistorted; 3.5 us rise-time.

Inverse Feedback: 20 db

Stability Margin: 15 db (virtually absolute stability)

Damping Factor: above 12, 20 cps - 20 kc; 17 at 1 kc.

Speaker Connections: 4, 8, and 16 ohms.

Tone Control Range: at 10 kc - 15 db boost and 15 db cut; at 50 cps - 15 db boost and 15 db cut.

Phono Equalizer Curves: RIAA (New AES, NARTB, ORTHO, RCA), Columbia (original LP), London, American 78, European 78.

Sensitivity: Phono (magnetic) — 8 millivolts for rated output on PHONO LO input; 27 millivolts on PHONO HI input.
Tuner, TV, Tape, Auxiliary — 0.6 volt for rated output.

Input Impedances: PHONO LO & PHONO HI - 47K; AUX, TUN, TV, TAPE - 2.2 meg.

Tape Recorder Output: 1000 ohms; unaffected by tone, loudness, or level controls.

Hum & Noise Level: Mag. Phono — ** 60 db below rated output (RIAA, max. gain, and tone controls set at flat position).
Tuner, etc. — 75 db below rated output (max. gain and tone controls set at flat positions).

Power Source: 117 V, 60 cps; draws 150 VA at no signal, 200 VA at signal developing rated 50 w output; 250 VA at signal developing peak 100 w out (overload).

Tubes: 2- EL34/6CA7, 2- ECC83/12AX7, 1- ECC90/6C4, 1- 6CG7, 1- GZ34.

Size: HWD: 8 1/2" X 15" X 10".

Weight: 30 lbs.

* Measured from high level inputs with tone controls set at "flat" positions and loudness control at maximum (no effect).
** Includes effect of 16 db boost at 60 cps due to RIAA compensation.

mechanical installation

GENERAL

a) HEAT DISSIPATION (VENTILATION): In common with other electronic equipment, the HF-52 produces a great deal of heat in normal operation. Unless continuous and adequate air flow is obtained around the heat producing elements, these elements will over-heat and their useful life will be greatly curtailed.

It is useful to understand the process of connection whereby heat is removed in judging the suitability of a location. Air heated by the heat-producing elements expands and rises; cool air is drawn from beneath to take the place of the heated air. In this manner, a stream of air is set in motion which continually removes heat from the amplifier. (In particular, we are mainly concerned with the major heat-producing elements; the two EL34 output tubes and the GZ34 rectifier tube.) If there is any impediment to or constriction of the air flow, the essential process of heat removal will be adversely affected.

Adequate ventilation will be provided if the amplifier is installed in an open-back console provided that the top of the amplifier is spaced at least two inches below any shelf mounted above it. If the cabinet is enclosed at the rear, provide several large holes or slots as low down and as high up in the cabinet back as possible. As an alternate, holes may be provided in the sides, bottom, or top of the cabinet. The important thing to remember is that effective ventilation requires provision for cool air to enter at the bottom and hot air to leave at the top.

If the amplifier is not installed in a console, it should be situated preferably on an open surface, not on a shelf of a bookcase. An attractively finished matching cover* for the HF-52 is available which will provide a "finished" appearance as well as protection when the amplifier is not installed in a console. Four rubber feet are also provided so that the amplifier will not mar the surface of furniture on which it is placed. (*Model E-1)

b) EASY ACCESS TO CONTROLS: Mount the amplifier at a height which will permit easy manipulation of the controls. Tuner controls should be located nearby.

c) ACCESSIBILITY TO PARTS: Tubes are the most frequently replaced items in electronic equipment. If the amplifier is installed in a console, sufficient space should be alloted to reach and remove any tube in the amplifier. Furthermove, input and output terminals of the amplifier should be accessible to permit easy interchanging of system components for comparison, and connection or disconnection of a portable tape recorder which is stored away when not in use. If antennas are strung around the back of the console in which the amplifier is installed, arrange them so they will not interfere with access to the amplifier.

d) ACOUSTICAL ISOLATION: If amplifier and speaker are installed in the same cabinet (not recommended), provide sufficient separation to minimize mechanical speaker vibration reaching the amplifier. The minimum separation is about one foot.

CONSOLE MOUNTING

a) Operations on console front panel preliminary to amplifier mounting: (1) Tape the panel template provided to the face of the console so that the top of the mounting surface line on the template is level with the top of the amplifier mounting shelf. (2) Use an awl or a nail to pierce the centers of the five 5/8" diameter holes for the controls and the two small holes for mounting the control plate, to transfer their locations to the console panel beneath. (3) Remove the panel template. (4) Drill the holes for the panel controls only (the two small holes which have been marked are for wood screws).

b) Amplifier mounting in console: (1) Pull off the control knobs (a second set of knobs with long shanks has been provided for console installation). (2) Remove the control plate, which is attached to the chassis apron by two screws. (These may be discarded since they are unsuitable for attaching the control plate to the console panel and two #4 X 3/8 wood screws have been supplied for this purpose.) (3) Fasten the control plate to the console panel with the 2 #4 X 3/8 wood screws. (4) If the rubber feet have been inserted in the bottom plate, remove them. (They may be pried out with a thin screwdriver.) (5) Place the unit on the mounting shelf and slide it as far forward as possible, so that the controls penetrate the panel holes as for as possible. (6) Place a long shank knob on each control, pressing each knob toward the chassis firmly so that each control shaft enters fully into its knob. (7) Draw the chassis back evenly and carefully until the back rims of all the knobs are equally spaced from the control plate about 1/8". (8) With a sharp pencil, placed with its point directly against the edge of the lower surface of the bottom plate, draw the outline of the bottom plate on the chassis shelf. (9) Now remove the knobs and take the chassis off the shelf. (10) Remove the 10 screws which fasten the bottom plate to the chassis. (11) Place the bottom plate exactly in the outline drawn on the shelf (bumps facing up) and mark the positions of the two holes on the left side and the two holes on the right side. (12) Remove the bottom plate and drill each of the marked holes on the shelf to a diameter of 1/4". (13) Refasten the bottom plate to the chassis, with the 6 #8 X 3/8 screws previously removed, using the 3 holes at the rear and the 3 holes at the front of the chassis. (14) Replace the chassis on the shelf, positioning it exactly in the outline previously drawn, and restore the knobs. This time make sure that the indicator dot on each knob agrees with the control position. (15) From the bottom side of the shelf, insert a #8 X 1" screw with a 1/2" flat washer against the head through each of the four left and right side holes. These screws engage the stamped nut over each hole on the chassis flange and when tightened secure the chassis to the shelf.

electrical installation

GENERAL

a) SPEAKER CONNECTIONS: To connect your speaker to the amplifier properly, you must know its rated impedance. This may be read off the speaker nameplate. Connect one speaker lead to the terminal on the rear apron marked "G" and the other speaker lead to the nearby terminal designated by the rated speaker impedance (4, 8, or 16 ohms). Plastic-covered lamp cord may be used for distances up to 50 ft. with little power loss. For shorter distances, TV antenna lead can be used, particularly if it is desired to run the speaker lead under a rug.

If it is desired to use two similar or identical full-range speakers of the same rated impedance (either 8 or 16 ohms only) for better sound distribution, connect one speaker lead of each pair to "G" and the two remaining leads to the terminal with a number equal to half of one of the speaker's rated impedance. (It may be necessary to "phase" the two speakers by reversing both of the leads from one of the speakers.) This may not be done if each of the speakers is designed for reproduction of a different part of the audio spectrum (woofer-tweeter combinations) in which case a cross-over network is required which connects to the amplifier with only one pair of leads.

b) PHONO INPUT: The shield lead from your phonograph should be provided with a shielded "phono-type" plug. The input jack on the amplifier into which this plug should be inserted depends on the type of cartridge employed. Specific instructions follow.

GE Variable Reluctance or Professional, Audak, Recoton, Electrosonic & transformer, Fairchild & transformer, Electro-Voice 84SM: Connect to LO phono input.

All Pickering, Miracord, Fentone, Weathers & Adaptor plug P631 (Weathers): Connect to HI phono input.

Sonotone 3P or 3T, Electro-Voice EV84S, or any high quality ceramic or crystal cartridge self-equalizing as per the RIAA curve: Connect to AUXiliary phono input. Note that the equalizer preamplifier circuit is not effective in this case.

c) HIGH LEVEL INPUTS: Four high level input jacks designated as Tuner, TV, Tape, and Auxiliary are provided for connection of tuners, tv receivers, tape recorded playback, and ordinary or RIAA equalizing crystal or ceramic phono cartridges without adaptor. A shielded cable with a shielded "phono-type" plug should be used to connect each of these sources to the corresponding amplifier input jack. Unless the source has a low-impedance output such as a cathode follower (with which up to 50 ft. of cable can be used), use the shortest possible connection and low capacity shielded cable (cable having as low as 25 mmfd capacitance per foot is available).

If the tuner employed has a volume control to adjust the output, set this control as follows. Turn the amplifier LEVEL control to minimum and the LOUDNESS control to maximum. Play any recording on your phonograph and turn up the level control to obtain an ordinary listening level. Without touching the LEVEL or LOUDNESS controls, turn the SELECTOR to TUNER and adjust the volume control on the tuner to obtain approximately the same loudness level as was obtained from the recording. In the case where the tuner has no output level control and also in the case of the other high level inputs, the independent LEVEL control on the front panel of the amplifier permits adjustment of the level when changing inputs.

c) TAPE OUTPUT: A shielded cable (up to 50 ft. may be used) with a shielded "phono-type" plug should be used to connect from the TAPE OUTPUT jack to the input of the tape recorder. Any input chosen by the SELECTOR is fed out to the tape recorder through this jack. Phono inputs fed in at PHONO LO and PHONO HI are of course equalized according to the equalization selected but none of the inputs are affected by the level, loudness, and tone controls.

d) POWER CONNECTIONS: The power cord of the turntable and tuner may be inserted in the convenience outlets provided on the rear chassis apron. The receptacle marked 117 VAC is intended for use primarily with a phonograph and provides 117 VAC regardless of whether the power switch of the amplifier is turned on or off in order to protect the phonograph mechanism. The receptacle marked 117 VAC SWitched 150 watts is "live" or "dead" depending on whether the amplifier power switch is turned on or off and is intended primarily for use with tuners. Equipment drawing in excess of 150 watts should not be plugged into this outlet.

HUM ADJUSTMENT

a) After checking the amplifier for proper operation, remove all input cables to the amplifier and make the following control settings which hold throughout the process of hum adjustment: SELECTOR at RIAA, LEVEL & LOUDNESS to 10, TREBLE control at -5, BASS control at 0. Next procede as follows: With your ear held close to the speaker, insert the amplifier power plug into the wall outlet and listen to the hum level. Now pull out the plug and reinsert it with the prongs reversed and listen again. Choose the prong position which gives the least hum. Now connect the tuner input connector to the amplifier input jack, and with tuner set between stations and the tuner volume control set a minimum, do the same with the power plug of the tuner, using the 117 VAC SW convenience outlet on the amplifier if desired. Finally connect the phono input connector to the amplifier PHONO LO or PHONO HI input as is required (turntable off and pickup arm at rest position) and do the same with the power plug of the turntable, using the 117 VAC convenience outlet on the amplifier if desired. When all of this is completed, adjust the hum balance control on top of the amplifier chassis for least hum.

PRELIMINARY: Be sure all tubes are firmly seated in their sockets and that the tube shields are making good contact with their bases. As initial adjustments, set these controls as follows: LEVEL at zero, LOUDNESS at ten, BASS at zero. Turn the amplifier on by turning the TREBLE control clockwise from OFF and set it at zero initially. Note that the LEVEL, LOUDNESS, BASS and TREBLE controls have no effect on the TAPE OUTPUT.

LISTENING TO PHONOGRAPH: Set the SELECTOR to one of the record equalization positions on the dial. Doing so automatically selects the phonograph input plugged into the PHONO LO or PHONO HI input. For help in choosing the recording curve appropriate to any particular record, refer to the chart titled "RECORD EQUALIZATION SELECTION". When in doubt as to which equalization is most appropriate, use RIAA, which is the best compromise for all records. Keep in mind that while the positions offered cover most recording curves likely to be encountered, additional separate and variable bass and treble response adjustments are necessary for fully satisfactory results. These may be necessary to compensate for the over-all characteristics of your audio system (including room acoustics), inexact matching of the actual recording characteristic by any of the equalizations provided, and above all, the particular tastes of the listener.

LEVEL & LOUDNESS CONTROLS: Simply stated, the purpose of the LOUDNESS control is to provide compensation for the increasing inefficiency of the human ear in hearing bass and treble with decreasing volume level. The LOUDNESS control, as it is turned counter-clockwise from maximum clockwise rotation, not only decreases the volume but increasingly emphasizes the bass and treble according to the Fletcher-Munson curves (curves developed from a statistical study of this effect). An uncompensated LEVEL control is also provided to "set" the LOUDNESS control for proper operation in any system, and also for the purpose of adjusting the listening level when going from quiet program material to loud program material or the reverse without occasioning a change in the loudness compensation. To "set" the LOUDNESS control at any time, perform these operations in the order given to avoid blasting or possible damage to speakers of low power-handling capacity: a) Turn the LEVEL control to zero; b) Turn the LOUDNESS control to ten; c) With high level orchestral program material being fed to the amplifier from your phonograph or tuner, advance the LEVEL control setting until a relatively loud listening level is obtained. d) Turn down the LOUDNESS control until your normal listening level is obtained with the LEVEL control set as just described. Proper loudness compensation should now be obtained at any listening level adjusted to with the LOUDNESS control. The same reference LEVEL control setting will be suitable for both phonograph and tuner listening if the volume control of the tuner has been adjusted as described in the "High Level Inputs" sub-section of the "Electrical Connections" section. When selecting inputs which do not have level adjusts, such as tv or a crystal cartridge connected to the AUX. input, it may be desirable to set the LEVEL control to zero beforehand and then bring up the LEVEL control to obtain the desired listening level to avoid blasting.

BASS CONTROL: The plus sign on the right side of the dial indicates that clockwise rotation from the mid-point (0) increases (boosts) bass response; the minus sign on the left side indicate that counter-clockwise rotation from the mid-point decreases (cuts) bass response. There is no interaction with the TREBLE control. Start all adjustments with this control set at the mid-point (0), which is called the "flat" position since bass response is neither cut nor boosted at this etting.

TREBLE CONTROL: The plus sign on the right side of the dial indicates that clockwise rotation from the mid-point (0) increases (boosts) treble response; the minus sign on the left side indicates that counter-clockwise rotation from the mid-point decreases (cuts) treble response. There is no interaction with the BASS control. Start all adjustments with this control set at the mid-point (0), which is called the "flat" position since treble response is neither cut nor boosted at this position.

LISTENING TO TUNERS, TV, TAPE RECORDERS: With the SELECTOR switch set at TUNER, TV, TAPE or AUXILIARY, the corresponding high level input from a radio tuner, tv, tape recorder, second tuner or crystal cartridge will feed through the amplifier. Adjustment of the volume control on each source is discussed in the "Electrical Connections" section under "High Level Inputs" and again under "Level & Loudness Control" in this section.

MAKING RECORDINGS: Tape recordings may be made by connecting the recorder to the TAPE OUTPUT jack. See "Tape Output" under "ELECTRICAL CONNECTIONS". With the output of the recorder connected to the TAPE INPUT jack, turning the SELECTOR switch to TAPE readies the amplifier for playback of the recording.

RECORD EQUALIZATION SELECTION

Records are made with boosted volume in the treble range to mask surface noise and reduced volume in the bass range to conserve groove space and reduce distortion. As there was no universally accepted standard of treble boost and bass cut in recording before Spring 1954, records of which the masters were made before this date may require any one of several different equalizations (amounts of bass boost and treble cut) by the amplifier to restore the original balance. The specific equalization required depends upon the brand of the record, and the equalization which should be used for each record brand (for recordings made before 1954) is listed in the first column to the right of the company's name in the chart below. In some cases, additional adjustment is required with the BASS control to match the

equalization employed by the particular company more exactly.

Since Spring 1954, the RIAA (new AES) recording curve has been adopted by almost all record companies and records of which the masters were made after this date will be properly equalized at the RIAA position unless the company involved has not made the change (see second column in chart).

ELECTRONIC XOVER (CROSSOVER) CONNECTIONS: The jack marked "INPUT" is the termination of the pre-amplifier-control section. The jack marked "OUTPUT" is the input to the power amplifier section. In conventional operation of the HF52, these jacks are internally shorted together by a jumper to permit normal operation of the entire amplifier as a single unit. (Note: The shorting jumper is intact in factory-wired units and in kits built as instructed. The jumper remains in place and the ELECTRONIC XOVER "INPUT" and "OUTPUT" jacks are not used at all for conventional operation.) If it is desired to use an electronic crossover and an additional amplifier in a "biamplification" system (see "Why Biamplify" by Roy F. Allison, "High Fidelity" magazine, Nov. '56), it will be necessary to remove the amplifier bottom plate and cut the jumper between the ELECTRONIC XOVER "INPUT and "OUTPUT" jacks. Using low capacity shielded cable, connect the ELECTRONIC XOVER "INPUT" jack on the amplifier to the input of the electronic crossover unit; connect one of the outputs of the electronic crossover (usually the low frequency output) to the ELECTRONIC XOVER "OUTPUT" of the HF52; connect the other output of the electronic crossover (usually the high frequency output) to the input of the second power amplifier. In addition to optimizing the crossover frequency and adjusting the gain in each channel to equalize for different woofer and tweeter efficiencies, it will be necessary to adjust the level controls throughout the system to minimize any increase in noise and hum. Please note that "biamplification" has nothing to do with stereophonic reproduction; it has to do only with possibly improving performance in a single channel. Furthermore keep in mind that "biamplification" is by no means necessary or always useful, particularly for two-way systems in which only a high pass filter is used (woofer connects directly to amplifier). Finally, it should be realized that "biamplification" is in the province of audio experimentation; persons undertaking a biamplification system should be adequately good judges of sound quality to determine the optimum crossover frequency, balance, and whether an overall improvement is being obtained. The article in "High Fidelity" magazine referred to previously provides valuable criterions for determining whether biamplification is worthwhile for a particular system.

RECORD EQUALIZATION SELECTION

Record Label	Equalization	Since Spring 1954	Record Label	Equalization	Since Spring 1954	Record Label	Equalization	Since Spring 1954
Allied	RIAA	RIAA	Cook	RIAA *	RIAA	Philharmonic	RIAA, Bass +1	RIAA
Angel	RIAA	RIAA	Decca	COL	RIAA	Polymusic	COL, Bass +2*	RIAA
Atlantic	COL, Bass +2*	RIAA	EMS	RIAA, Bass +1	RIAA	RCA Victor	RIAA, Bass +2.5	RIAA
Amer. Rec. Soc.	RIAA	RIAA	Elektra	COL, Bass +2	no change	Remington	COL, Bass +2	RIAA
Bartok	COL, Bass +2	no change	Epic	COL	RIAA	Riverside	RIAA	RIAA
Blue Note Jazz	RIAA, Bass +1	RIAA	Esoteric	RIAA	RIAA	Romany	RIAA	RIAA
Boston	COL	RIAA	Folkways (most)	COL, Bass +2	no change	Savoy	RIAA	RIAA
Caedmon	RIAA	RIAA	Good-Time Jazz	RIAA, Bass +1	RIAA	Tempo	RIAA	RIAA
Camden	RIAA	RIAA	Haydn Society	COL	RIAA	Urania, most	COL, Bass +2	RIAA
Canyon	RIAA, Bass +1	RIAA	L'Oiseau-Lyre	LON	RIAA	Urania, some	RIAA, Bass +2	RIAA
Capitol	RIAA, Bass +1	RIAA	London (ffrr)	LON	RIAA	Vanguard	COL	RIAA
Capitol-Cetra	RIAA, Bass +1	no change	Lyrichord, old	COL or RIAA	RIAA	Bach Guild	COL	RIAA
Cetra-Soria	COL	no change	Lyrichord, new	COL, Bass +2	RIAA	Vox	COL	RIAA
Collosseum	COL	RIAA	Mercury	RIAA, Bass +1	RIAA	Walden	RIAA	RIAA
Columbia	COL	RIAA	MGM	RIAA	RIAA	Westminster	COL, Bass +2	no change
Concert Hall	RIAA, Bass +1	RIAA	Oceanic	COL, Bass +2	RIAA	European 78's	Eur 78	
Contemporary	RIAA, Bass +1	RIAA	Pacific Jazz	RIAA	RIAA	Older Amer. 78's		

* Except use EUR for binaural, inside band only.

maintenance

OUTPUT STAGE BIAS & BALANCE ADJUSTMENTS

The BIAS ADJ. and the BALANCE ADJ. for the output stage must be adjusted by kit builders before initial use of the amplifiers—factory wired units will have had these adjustments made. The BALANCE ADJ. will have to be re-adjusted by all users whenever one or both of the EL34 output tubes is replaced or if it is suspected that dc unbalance in the output tubes has occured in the course of use. It is strongly recommended that both EL34 output tubes be replaced at the same time, preferably with a matched pair.

a) PRELIMINARY BIAS & BALANCE ADJUSTMENTS: Before applying power, set both the BIAS ADJ. control and the BALANCE ADJ. control at the approximate center of their ranges of rotation. Then connect to AC power, turn the amplifier on, and allow about one minute for warm-up. If the plates of the EL34 output tubes turn cherry-red during warm-up, turn the BIAS ADJ. control counter-clockwise until redness is just barely visible (normal condition). If the redness does not disappear even at full

GENERAL INSTRUCTIONS

The section of the manual beginning with this page is the CONSTRUCTION section. All pages in this section have page numbers followed by "C" (1C, 2C, etc.). The INSTRUCTION section resumes on the pages following the CONSTRUCTION section. Note that the CONSTRUCTION section is located centrally in the book and may be removed without desrupting the INSTRUCTION section that both precedes it and follows it.

Care taken in the construction of this instrument will reward the constructor with many years of satisfactory service and greater confidence in his instrument. We urge you to not rush the construction, but to take all the time necessary for proper assembly and wiring.

Furthermore, we urge strongly that you follow the wire and parts layout shown in the pictorial diagrams as closely as possible. Very often wires are placed as shown for a good reason, and certainly the appearance of the completed instrument will be improved and the difficulty of finding a wiring error will be reduced by the following the wire and parts layout shown.

UNPACKING THE KIT: Unpack the kit carefully and check each part against the parts list including those parts that are mounted to the chassis. If you have trouble identifying any parts refer to the pictorial diagrams or the color code chart.

You will find that the value of a component will vary within the allowable circuit tolerance. For example, the 4.7KΩ, ±10% resistor may measure anywhere between 4.2KΩ and 5.2KΩ. Tolerances on paper capacitors are substantially greater, and the tolerance for electrolytics is usually +100% and -50%.

CONSTRUCTION HINTS: USE THE BEST GRADE OF ROSIN CORE SOLDER ONLY, preferably one containing the new activated fluxes such as Kester "Resin-Five", Ersin "Multicore" or similar types. UNDER NO CIRCUMSTANCES USE ACID CORE SOLDER OR ACID FLUX since acid flux can cause serious corrosion. Before soldering make a certain of a good mechanical connection. Use a clean, freshly tinned soldering iron, no smaller than 100 watts, and place the solder on the joint (not on the iron) so that the solder is melted by the heat from the joint itself. Do not remove the soldering iron until the solder flows and check to see that the resulting joint is smooth and shiny when the solder has cooled. There are two extremes to be avoided; too little heat and too much heat. If too little heat is supplied, the joint will appear pitted and grey, indicating a rosin joint which is unsatisfactory. On the other hand, if too much heat is applied to a joint, the parts connected to it may either change value, loose their protective coating, or break down. If you are soldering close to a part, hold the lead between the part and the joint being soldered with the tip of a pair of longnose pliers. The pliers will conduct the heat away and prevent the component from being unduly overheated. If for any reason it is necessary to resolder a joint, be sure to use new solder.

It should also be noted that the leads on resistors, capacitors, and transformers are often longer than required. These leads should be trimmed to the proper length when necessary. Do not cut any lead until you have determined the required length when the lead is routed as shown in the diagrams.

BASIC TOOLS REQUIRED: These basic tools are required for the construction of the amplifier.

1. Screwdriver - 3/16" to 1/4" blade
2. Screwdriver - 1/8" blade
3. Longnose pliers - 5 or 6"
4. Diagonal cutters
5. Soldering iron (100 watts), or soldergun, or pencil iron (35 watts)
6. Gas pliers
7. High quality rosin or equivalent synthetic flux core solder. Do not use acid or paste flux under any circumstances.

A set of spintites and a wire stripper are also very useful supplementary tools.

PARTS IDENTIFICATION: Please note that very many of the parts for which color coding is given may not be color coded, but have their values and ratings printed. The letter K is a multiplier (X1000) and on resistors or capacitors indicates that the printed numerical value must be multiplied by one thousand to obtain the value in ohms or micro-micro farads respectively. Note also that one microfarad (mf) is equal to one million; micro-microfarads (mmf). To aid in rapid identification, keep in mind that 5%, 10%, and 20% resistors are color coded whereas 1% resistor have their values printed; also that molded tubular capacitors may or may not be color coded, whereas disc capacitors and electrolytics will always have their values printed. Please note the following relationships between the units used to express resistance or capacity.

1,000,000 ohms (Ω) = 1000 kilohms (KΩ) = 1 megohm (MΩ)
1,000,000 micro-micro farads (mmf) = 1 micro farads (mf)

CONSTRUCTION PROCEDURE: The complete step-by-step mounting and wiring procedure follows. To keep the drawings uncrowded, unnecessary repetition of mounting or wiring details may be omitted. Note: The abbreviation (C) means connect but do not solder (until other leads have been connected). The abbreviation (S) means connect and solder.
Bend the ground lug tabs on the sockets toward the chassis to prevent accidental shorting to the socket pins.

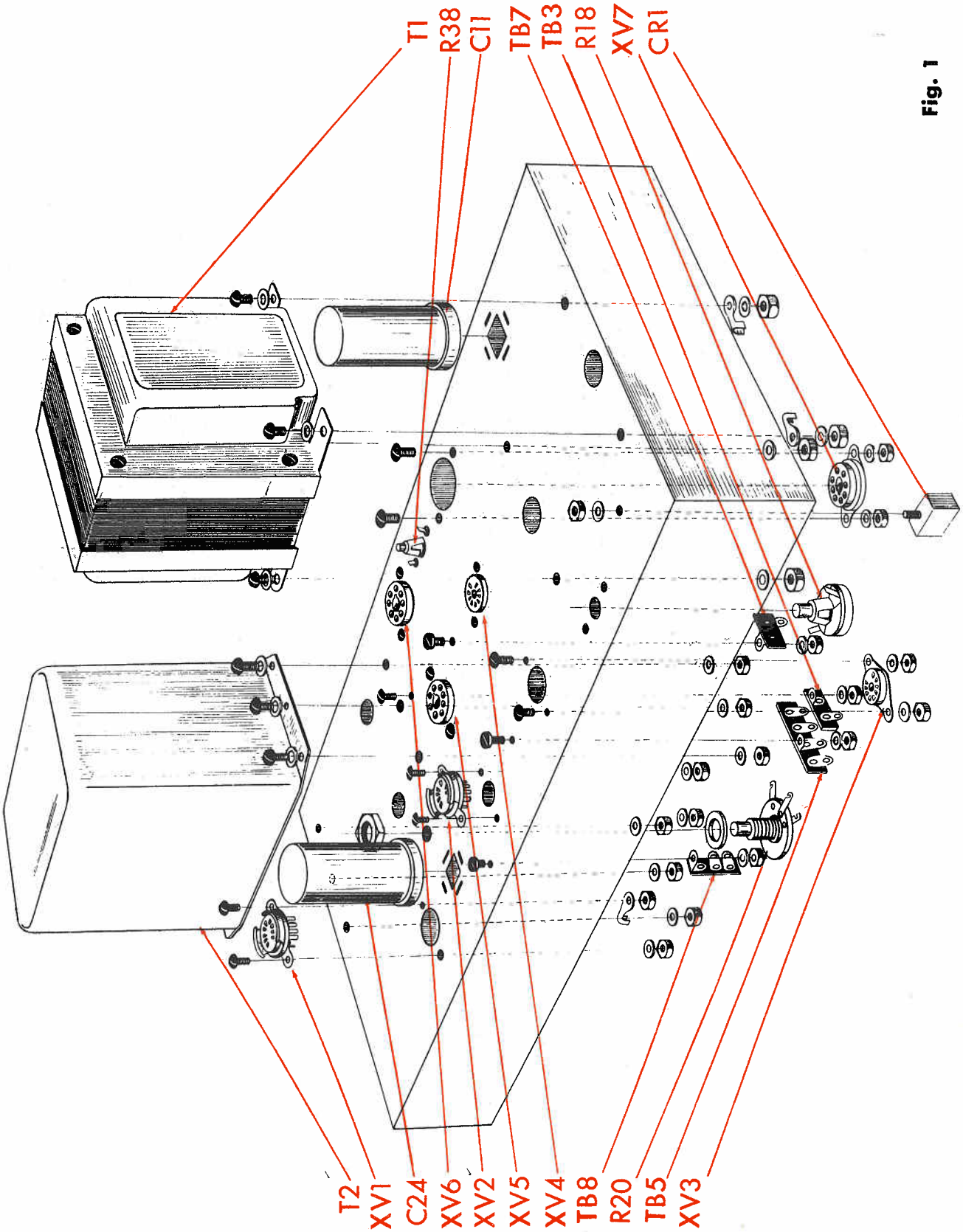

T1
R38
C11
TB7
TB3
R18
XV7
CR1
T2
XV1
C24
XV6
XV2
XV5
XV4
TB8
R20
TB5
XV3

Fig. 1

1. (✓) Fig. 1. Mount 9 and 7 pin sockets with shield support, XV1 and XV2 respectively, as shown. Use two #4-40 screws and two #4 hex nuts on each. Use two #4 lockwashers on XV2. Use one #4 lockwasher and one #4 ground lug on XV1.

2. (✓) Fig. 1. Mount socket XV3 and XV4 as shown. Use two #4-40 screws, two #4 lockwashers and two #4 hex nuts on each.

3. (✓) Fig. 1. Mount sockets XV5, XV6 and XV7 as shown. Use two #6-32 X 1/4 screws, two #6 lockwashers and two #6 hex nuts on each.

4. (✓) Fig. 1. Press 10KΩ pot, R18 and 50KΩ pot, R38 through holes in chassis, noting direction in Fig. 4. Press pots firmly toward chassis until a click is heard.

3C

5. (✓) Fig. 1. Mount open 100Ω pot., R20 as shown. Use 3/8" lockwasher and a 3/8" hex nut.

6. (✓) Fig. 1. Mount the 50 ma rectifier, CR1, near 10KΩ snap in pot, R18. Note CR1 orientation so that the positive (+) side is located toward the front of the chassis. Use one #6 nut and one #6 lockwasher for mounting.

7. (✓) Fig. 1. Mount the output transformer, T2, as shown; oriented so that the leads emerge from the holes. Use six each of the following: #10-24 X 3/8 screws, #10 flat washers, #10 lockwashers, and #10 hex nuts. Add cable clamp under one of the nuts and pull the four wires emerging from the hole near the rear of the chassis through this clamp. See Fig. 4.

8. (✓) Fig. 1. Mount the power transformer, T1, as shown; oriented so that the two black, two green and one yellow leads are near the side of the chassis. Use four each of the following: #10-24 X 3/8 screws, #10 flat washers, #10 lockwashers and #10 hex nuts. Use two #10 ground lugs under two of the nuts, oriented as shown. See Fig. 4.

9. (✓) Fig. 1. Mount the 40-20 mfd electrolytic condenser, C11, near the power transformer. Note position of capacitor terminals on Fig. 4. The mounting taps are inserted into the slots provided on the chassis and twisted somewhat less than a quarter turn. DO NOT twist the tabs excessively or they will shear off. Solder one mounting tab to chassis ground.

10. (✓) Fig. 1. Similarly, mount and solder the 20-20-10-10 mfd electrolytic capacitor, C24, between V1 and V2. Note position of capacitor terminals on Fig. 4.

11. (✓) Fig. 1 & Fig. 4. Mount one post right terminal strip, TB3, as shown on Fig. 4. Use one each #6-32 X 1/4 screws, #6 hex nut, and #6 lockwasher.

12. (✓) Fig. 1 & Fig. 4. Similarly, mount three post-two left with ground terminal strip, TB5, as shown on Fig. 4.

13. (✓) Fig. 1 & Fig. 4. Similarly, mount one post right terminal strip, TB7, as shown on Fig. 4.

14. (✓) Fig. 1 & Fig. 4. Similarly, mount two post upright terminal strip, TB8, as shown on Fig. 4.

15. (✓) Fig. 4. Likewise, mount three post - two left with ground terminal strip, TB6, as shown.

16. (✓) Fig. 4. Similarly, mount one post left terminal strip, TB4, as shown.

SWITCH WIRING

1. (✓) Fig. 2. Connect an 850 mmf capacitor, C3, and a 90KΩ (white, black, orange, gold) 5% resistor, R9, from 1B (S) to 1C (S).

2. (✓) Fig. 2. Connect a 500 mmf capacitor, C4, and a 100KΩ (brown, black, yellow, gold) 5% resistor, R10, from 5C (S) to 5B (S)

3. (✓) Fig. 2. Connect a 5000 mmf 10% capacitor, C5, and a 4.7 meg (yellow, violet, green, gold) 5% resistor, R11, from 7C (C) to 8A (S).

4. (✓) Fig. 2. Connect a 2700 mmf capacitor, C7, and a 2.2 meg (red, red, green, gold) 5% resistor, R13, from 8D (S) to 9B (S).

5. (✓) Fig. 2. Connect a 3300 mmf capacitor, C6, and a 560KΩ (green, blue, yellow, gold) 5% resistor, R12, from 11D (S) to 11A (S).

6. (✓) Fig. 2. Connect a grey lead from 4D (S) to 7C (S).

7. (✓) Fig. 2. Connect a 2" green lead to 12C (S). Leave the other end free.

8. (✓) Fig. 2. Connect one end of a .1 mfd (brown, black, yellow, black, yellow) 20% capacitor, C25, to 2D (C). This lead should be only 1" long. Cut the other end to 1 1/2" leaving it free.

9. (✓) Fig. 2. Connect a 1 1/4" bare lead from 2D (S) to 3E (S).

10. (✓) Fig. 2. Connect a 2" grey lead from 10E (C) to 6E (S).

11. (✓) Fig. 2. Cut a 5 1/2" length of the 4 conductor shielded cable. On both ends, the outer insulation is stripped back 1". The spiral shield is unwound and each lead insulation stripped back 3/8". Connect the inner leads on one end of the cable, so that one lead connects to each of the following four switch terminals:

(✓) shield to 8F (S)
(✓) orange to 1F (S)
( ) yellow to 2F (S)
(✓) brown to 11F (S)
(✓) red to 12F (S)

12. (✓) Fig. 2. Cut a 6" length of shielded cable. On one end, strip back the outer insulation 3/4", unwrap and cut the spiral shield and strip back the inner insulation 3/8". (Call this end "A".) On the other end (end "B") the outer insulation is stripped back 3/4", the spiral shield is unwrapped and twisted and the inner insulation stripped back 3/8". Connect the inner lead of end "A" to 10E (S).

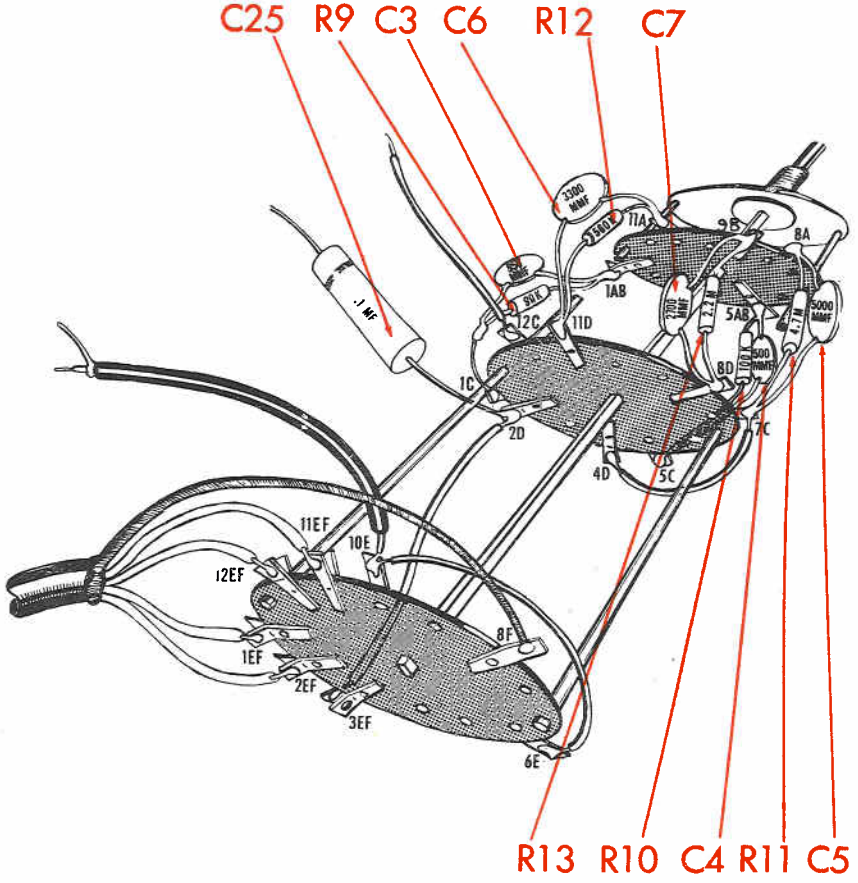


Fig. 2

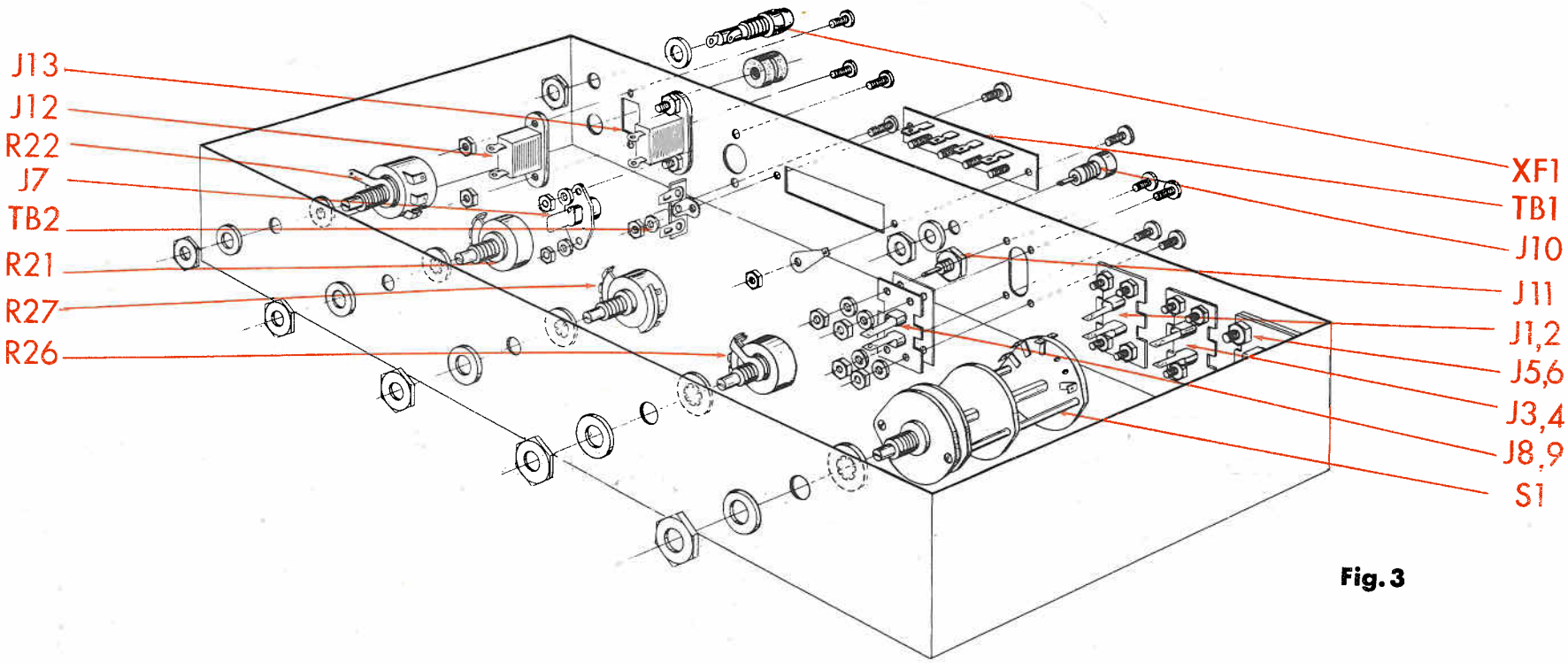


Fig. 3

5C

1. ( ) Fig. 3. Mount the 500KΩ pot with switch, R22; the 1MΩ pot, R21; the 500KΩ pot with printed circuit plate PC2, R27; and the 100KΩ pot, R26. Mount a 3/8 hex nut on the bushing first. (This nut to be adjusted for proper mounting. Next, follow with a pot ground lug on R26 and R22. Complete assembly as shown in diagram with a 3/8 lock washer, 3/8 flat washer and 3/8 hex nut for each unit.

2. (✓) Fig. 3. Mount the fuse holder through the bottom of the two holes at the rear of the chassis, opposite the pot with the switch. Use the rubber washer and the nut provided. Do not tighten nut too much or holder will crack.

3. (✓) Fig. 3. Force a 3/8" rubber grommet through the hole above the fuse-holder.

4. (✓) Fig. 3. Mount the two convenience outlets, J12 and J13 as shown. Use two #6-32 X 1/4 screws and two #6 hex nuts and two #6 lockwashers.

5. (✓) Fig. 3. Mount the single jack, J7, as shown. Use two #6-32 X 1/4 screws, two #6 lockwashers and two #6 hex nuts.

6. (✓) Fig. 3. Mount the terminal board, TB1, as shown. Use two #6-32 screws, one #6 lockwasher and two #6 hex nuts. Mount a twopost terminal board, TB2, under one nut and lockwasher and 2 #6 ground lug under the other nut.

7. (✓) Fig. 3. Mount the two pin jacks (METER) J10, J11, with the hardware supplied on same. Remove the nut and fibre washer from the threaded portion of the jack. Pass same through hole provided. Attach the fiber washer and hex nut on the inside of the chassis. The small shoulder on the fibre washer should seat itself into the mounting hole. If the assembly is properly made the lug on the jack will be insulated from the chassis.

8. (✓) Fig. 3. Mount the two dual input jacks, J8-9 and J5-6 as shown. Use four #6-32 screws, four #6 lockwashers and 4 #6 hex nuts. Use an insulating bakelite between the dual jack and the chassis.

9. (✓) Fig. 3. Mount the remaining two dual input jacks, J1-2 and J3-4 as shown. Use four #6-32 screws, four #6 lockwashers and four #6 hex nuts. Do not use any insulating bakelite.

10. (✓) Fig. 3. Mount the selector switch, S1, as shown. Use a 3/8" lockwasher, a 3/8" flat washer and a 3/8" hex nut.

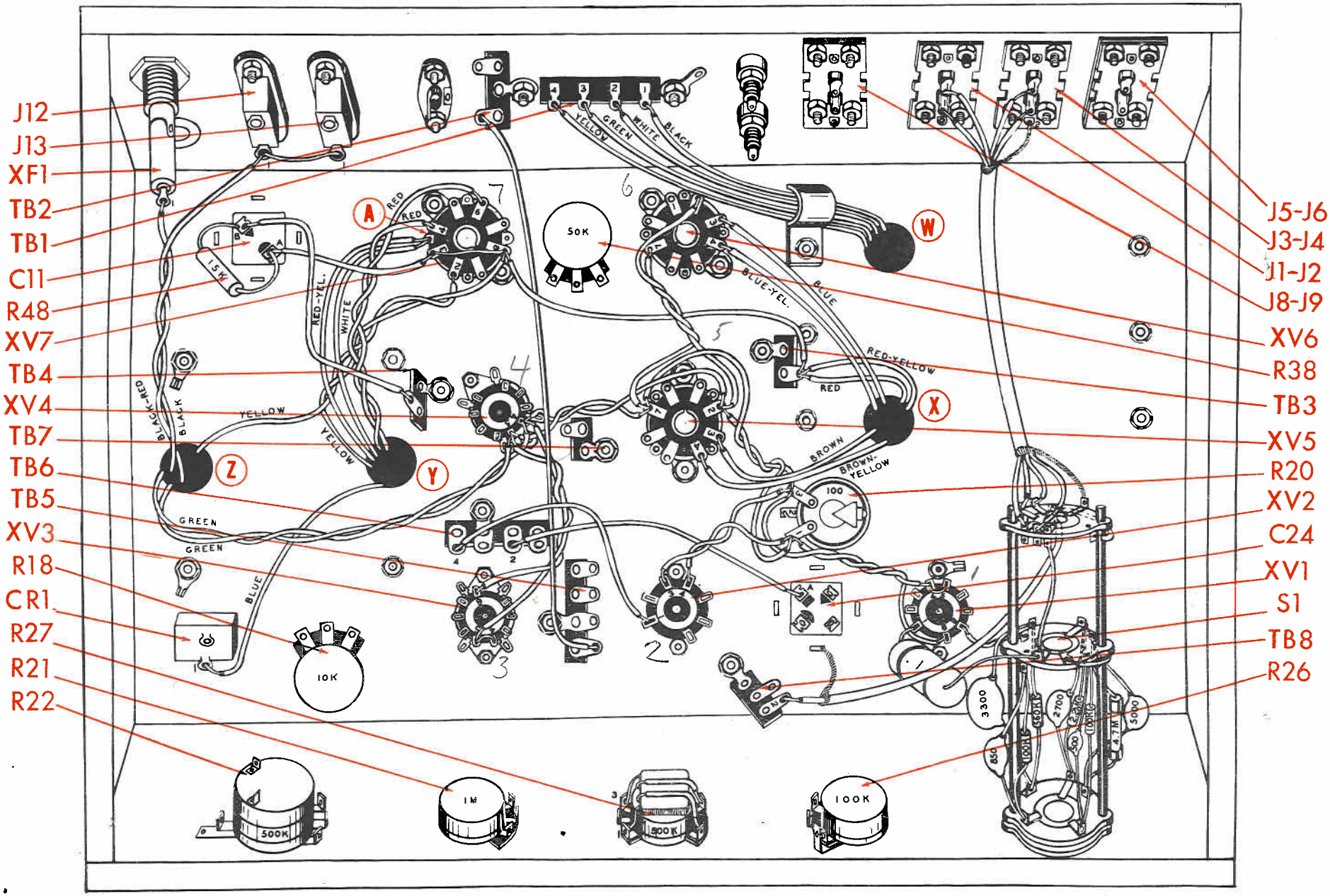

J12
J13
XF1
TB2
TB1
C11
R48
XV7
TB4
XV4
TB7
TB6
TB5
XV3
R18
CR1
R27
R21
R22
J5-J6
J3-J4
J1-J2
J8-J9
XV6
R38
TB3
XV5
R20
XV2
C24
XV1
S1
TB8
R26
A
W
X
Y
Z
50K
15K
10K
500K
1M
500K
100K
RED
RED-YEL.
WHITE
YELLOW
GREEN
WHITE
BLACK
BLUE-YEL.
BLUE
RED-YELLOW
BROWN
BROWN-YELLOW
BLACK-RED
BLACK
YELLOW
GREEN
BLUE
100
3300
2700
500
4.7M
5000
850
100K

Fig. 4

WIRING

1. ( ) Fig. 4. Cut the black red lead from hole "Z" to 5" and the black lead to 5". Twist the leads as shown. Connect the black red lead to XF1-1 (S) and the black lead to J12-1 (C). Insulate the end of the black green lead with tape and secure to the black red lead so that the lead cannot short out against the chassis.

2. ( ) Fig. 4. Connect a 1 1/2" piece of bare wire from J12-1 (C) to J13-1 (S).

3. ( ) Fig. 4. Cut one green lead from hole "Z" to 6" and the other green lead to 6 1/2". Twist leads as shown. Connect one lead to XV4-4 (C) and the other lead to XV4-5 (C).

4. ( ) Fig. 4. Cut the yellow lead from hole "Z" to 7" and the yellow lead from hole "Y" to 6 1/2". Twist leads as shown. Connect one lead to XV7-2 (S) and the other lead to XV7-8 (C).

5. ( ) Fig. 4. Cut the red-yellow and white leads from hole "Y" to 4 1/2". Twist leads. Connect both leads to ground lug "A" (C) on XV7.

6. ( ) Fig. 4. Cut one red lead from hole "Y" to 5" and the other red lead to 6". Connect one lead to XV7-4 (S) and the other lead to XV7-6 (S).

7. ( ) Fig. 4. Cut the blue lead from hole "Y" to 5 1/2" and connect to the plus side of the rectifier CR1-1 (S).

8. ( ) Fig. 4. Cut the yellow and the green leads from hole "W" to 6" and the white and black leads to 5 1/2". Connect the yellow lead TB1-4 (C), the green lead to TB1-3 (S), the white lead to TB1-2 (C) and the black lead to TB1-1 (C).

9. ( ) Fig. 4. Cut the red and the red-yellow leads from hole "X" to 3" and connect to TB3 (C).

10. ( ) Fig. 4. Cut the brown and brown-yellow leads to 3 1/2" and twist. Connect the brown lead to XV5-3 (C) and the brown-yellow lead to XV5-4 (S).

11. ( ) Fig. 4. Cut the blue and blue-yellow leads to 4 1/2" and twist. Connect the blue lead to XV6-3 (S) and the blue-yellow lead to XV6-4 (S).

12. ( ) Fig. 4. Connect one end of a 3 1/2" brown lead to XV4-4 (C) and one end of a 5 1/2" black lead to XV4-5 (C). Twist the leads. Connect the other end of the brown lead to XV5-7 (C) and the other end of the black lead to XV5-2 (C).

13. ( ) Fig. 4. Connect one end of a 6" brown lead to XV4-4 (S) and one end of the 5" black lead to XV4-5 (S). Twist the leads. Connect the other end of the brown lead to XV3-5 (C) and the other end of the black lead to XV3-9 (S).

14. ( ) Fig. 4. Connect a 1/2" piece of bare wire from XV3-4 (S) to XV3-5 (S).

15. ( ) Fig. 4. Connect one end of a 4" brown lead to XV5-7 (C) and one of a 6" black lead to XV5-2 (C). Twist the leads. Connect the other end of the brown lead to XV6-7 (S) and the other end of the black lead to XV6-2 (S).

16. ( ) Fig. 4. Connect one end of a 5 1/2" brown lead to XV5-7 (S) and one end of a 3" black lead to XV5-2 (S). Twist the leads. Connect the other end of the brown lead to R20-1 (C) and the other end of the black lead to R20-3 (C).

17. ( ) Fig. 4. Connect one end of a 3" brown lead to XV2-3 (S) and one end of a 3 1/2" black lead to XV2-4 (S). Twist the leads. Connect the other end of the brown lead to R20-1 (C) and the other end of the black lead to R20-3 (C).

18. ( ) Fig. 4. Connect one end of a 3 1/2" brown lead to R20-1 (S) and one end of a 6" black lead to R20-3 (S). Twist the leads. Connect the other end of the brown lead to XV1-4 (C) and the other end of the black lead to XV1-9 (S).

19. ( ) Fig. 4. Connect a 1/2" piece of bare wire from XV1-4 (S) to XV1-5 (S).

20. ( ) Fig. 4. Connect a 5" red lead from C11-B (C) to TB4 (C).

21. ( ) Fig. 4. Connect a 3" red lead from C11-A (C) to XV7-3 (C).

22. ( ) Fig. 4. Connect a 15KΩ (brown, green, orange, silver) 10% 1W resistor, R48, from C11-B (S) to C11-A (S).

23. ( ) Fig. 4. Connect a 1 1/4" piece of bare wire from XV7-3 (S) to XV7-8 (C).

24. ( ) Fig. 4. Connect a 6 1/2" red lead from XV7-8 (S) to TB3 (C).

25. ( ) Fig. 4. Connect an 8" black lead from TB2-1 (C) to TB5-4 (C).

26. ( ) Fig. 4. Connect a 5 1/2" red lead from TB6-4 (C) to XV2-1 (S).

27. ( ) Fig. 4. Connect a 5 1/2" red lead from TB6-2 (C) to C24A (S).

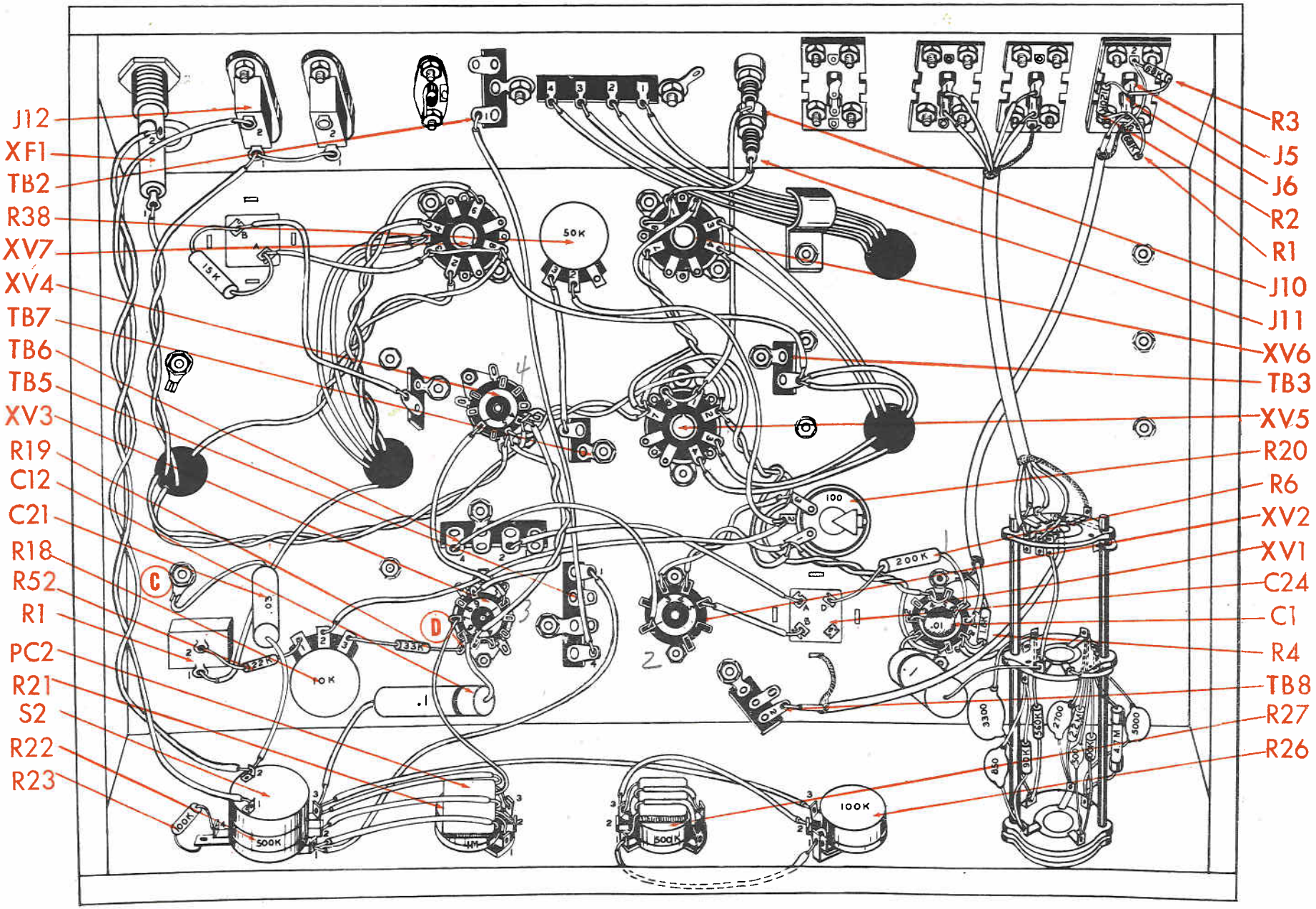

J12
XF1
TB2
R38
XV7
XV4
TB7
TB6
TB5
XV3
R19
C12
C21
R18
R52
R1
PC2
R21
S2
R22
R23
R3
J5
J6
R2
R1
J10
J11
XV6
TB3
XV5
R20
R6
XV2
XV1
C24
C1
R4
TB8
R27
R26
50K
15K
100
200K
.01
.1
10K
22K
133K
100K
500K
3300
2700
3000
C
D

Fig. 5

1. ( ) Fig. 5. Connect an 8" yellow lead from R18-2 (C) to R20-2 (C).

2. ( ) Fig. 5. Connect a 6 1/2" yellow lead from R20-2 (S) to R38-2 (S).

3. ( ) Fig. 5. Connect a 4" green lead from XV3-1 (C) to XV4-7 (C).

4. ( ) Fig. 5. Connect a 3" green lead from R38-3 (C) to TB7 (C).

5. ( ) Fig. 5. Connect a 3" yellow lead from J10 (S) to XV5-1 (C).

6. ( ) Fig. 5. Connect a 2" yellow lead from J11 (C) to XV6-1 (C).

7. ( ) Fig. 5. Connect a 3/4" piece of bare wire from XV6-1 (S) to XV6-8 (S).

8. ( ) Fig. 5. Connect a 3/4" piece of bare wire from XV5-1 (C) to XV5-8 (S).

9. ( ) Fig. 5. Connect a 2" red lead from XV2-5 (S) to C24B (C).

10. ( ) Fig. 5. Connect an 7" green lead from R22-1 (C) to TB5-1 (C).

11. ( ) Fig. 5. Connect an 8" green lead from R22-3 (C) to R26-3 (S).

12. ( ) Fig. 5. Connect one end of a 10" black lead to S2-1 (S) and one end of a 9" grey lead to S2-2 (C). Twist the leads. Connect the other end of the black lead to J12-2 (C) and the other end of the grey lead to XF1-2 (C).

13. ( ) Fig. 5. Connect a 100KΩ (brown, black, yellow, silver) 10% resistor, R23, from R22-4 (S) to pot ground lug "B" (S). Cut both leads to 1/2".

14. ( ) Fig. 5. Connect a .03 mfd (orange, black, orange, black, blue) molded capacitor, C21, from S2-2 (S) to ground lug "C" (S). Cut both leads to 1 1/4". Use spaghetti. Condenser gets placed vertically in chassis.

15. ( ) Fig. 5. Connect a .1 mfd (brown, black, yellow, white, yellow) 400 volt molded capacitor, C12, from R22-3 (C) to XV3-6 (C). Use spaghetti on the 1 1/2" lead to R22. Cut the other lead to 1" using spaghetti.

16. ( ) Fig. 5. Connect a 22KΩ (red, red, orange, silver) resistor, R52, from R18-1 (S) to CR1-2 (C). Cut both leads to 3/4".

17. ( ) Fig. 2. Connect a 33KΩ (orange, orange, orange, silver) resistor, R19 from R18-3 (S) to ground lug "D" (S) on tube socket XV3. Cut both leads to 3/4".

18. ( ) Fig. 5. Connect a 4" green lead from R27-3 (S) to R26-2 (S).

19. ( ) Fig. 5. Connect a 4" black lead from R26-1 (C) to R27-1 (C).

20. ( ) Fig. 5. Solder the ground lug under R26 to R26-1 (S).

21. ( ) Fig. 5. Connect a 1800Ω (brown, grey, red, silver) resistor, R4, from XV1-8 (C) to ground lug "D" (C). Cut both leads to 1/2". (D.)?

22. ( ) Fig. 5. Cut an 8" length of single conductor shielded wire. On both ends, strip the outer insulation back 3/4", twist shield braid strands, strip the inner insulation back 1/4". Connect one end of the inner wire to XV1-7 (S) and one end of the braid to ground lug "D" (S). Connect the other end of the inner wire to J6-1 (C) and the braid to J6-2 (C).

23. ( ) Fig. 5. Connect a 2" black lead from J6-2 (C) to J5-2 (C).

24. ( ) Fig. 5. Connect a 68KΩ (blue, grey, orange, silver) resistor, R1, from J6-2 (S) to J6-1 (C). Cut both leads to 1/2".

25. ( ) Fig. 5. Connect a 120KΩ (brown, red, yellow, silver) resistor, R2, from J6-1 (S) to J5-1 (C). Cut both leads to 1/2".

26. ( ) Fig. 5. Connect a 68KΩ (blue, grey, orange, silver) resistor, R3, from J5-1 (S) to J5-2 (S). Cut both leads to 1/2".

27. ( ) Fig. 5. Connect a 200KΩ (red, black, yellow, gold) resistor, R5, from XV1-6 (C) to C24D (C). Cut both leads to 1".

28. ( ) Fig. 5. Connect a .01 mfd disc capacitor, C1, from XV1-6 (S) to XV1-2 (C). Cut both leads to 1/2".

29. ( ) Fig. 5. Cut leads #2, #3 and #6 on the tone control printed circuit board, PC-2, to 1/2". Cut lead #5 to 1 3/4" and leads #1, #4 and #7 to 3". Lay the board flat against the bass control, R21 with the number on the printed circuit board facing away from the pot. Connect the lead #2 to R21-1 (S), lead #3 to R21-2 (S) and lead #6 to R21-3 (S). Be sure that none of the leads short against the controls.

30. ( ) Fig. 5. Using 2 1/2" of spaghetti over each of the following 3 leads, connect lead #7 to R22-3 (S), lead #4 to R22-2 (S) and lead #1 to R22-1 (C).

31. ( ) Fig. 5. Connect lead #5 directly to XV3-7 (S).

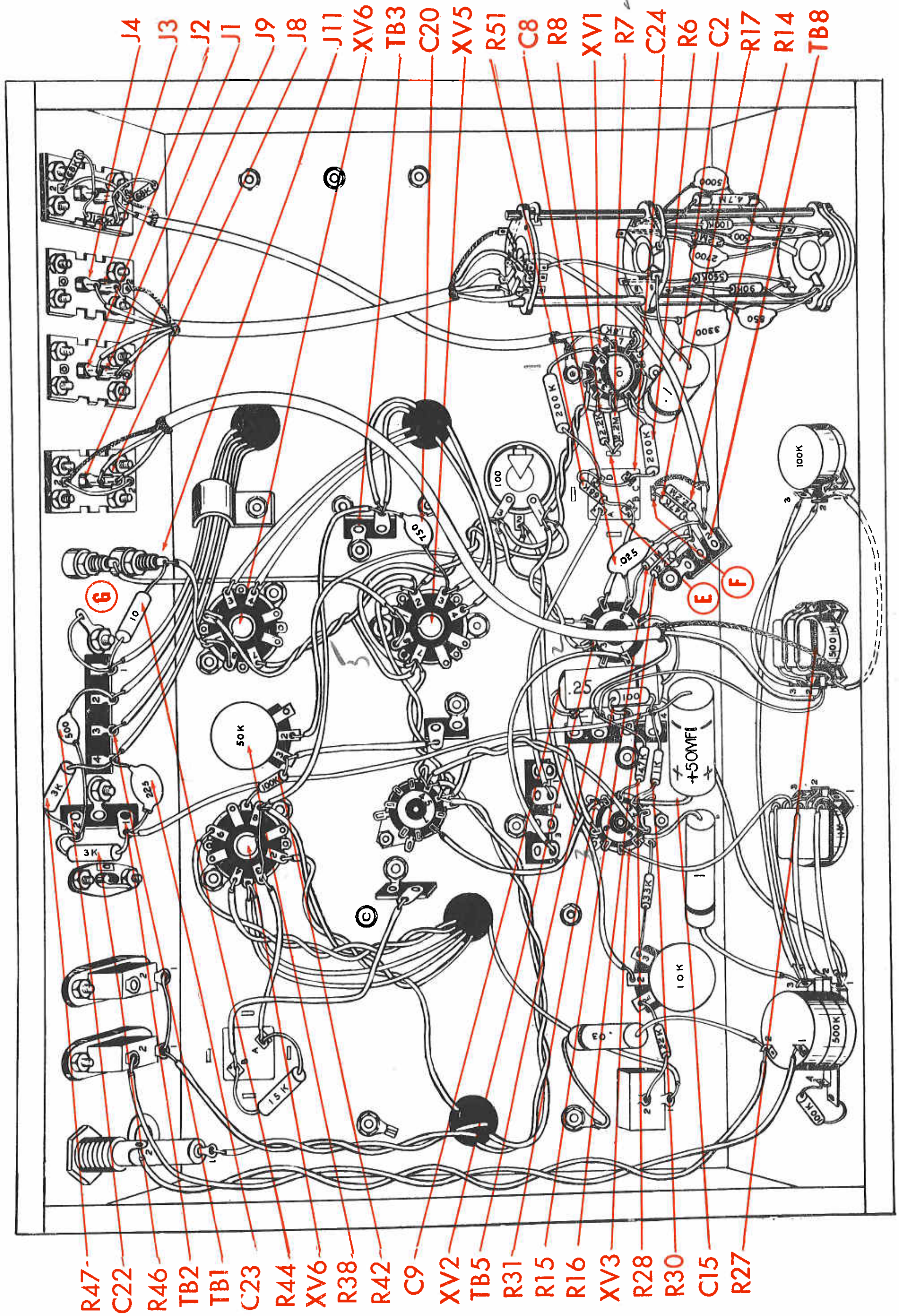

J4
J3
J2
J1
J9
J8
J11
XV6
TB3
C20
XV5
R51
C8
R8
XV1
R7
C24
R6
C2
R17
R14
TB8
G
E
F
R47
C22
R46
TB2
TB1
C23
R44
XV6
R38
R42
C9
XV2
TB5
R31
R15
R16
XV3
R28
R30
C15
R27

Fig. 6

1. ( ) Fig. 6. Connect a 2.2MΩ (red,red,green,silver) resistor, R7, from XV1-2 (S) to ground lug "E" (C) on C24. Cut both leads to 1/2".

2. ( ) Fig. 6. Connect a 200KΩ (red,black,yellow,gold) resistor, R6, from XV1-1 (C) to C24C (C). Cut both leads to 1/2".

3. ( ) Fig. 6. Connect a 2.2KΩ (red,red,red,silver) resistor, R8, from XV1-3 (S) to ground lug "E" (S) on C24. Cut both leads to 1/2".

4. ( ) Fig. 6. Connect the green lead from S1-12C to XV1-8 (S).

5. ( ) Fig. 6. Connect the .1 mfd capacitor, C2, from S1-2D to XV1-1 (S).

6. ( ) Fig. 6. Connect the 4 conductor shielded cable from S1F as follows:
Shield to J3-2 (S)
Orange to J3-1 (S)
Yellow to J4-1 (S)
Brown to J1-1 (S)
Red to J2-1 (S)

7. ( ) Fig. 3. Connect a 3/4" piece of bare wire from C24C (S) to C24D (C).

8. ( ) Fig. 6. Connect a 68KΩ (blue,grey,orange,silver) 10% resistor, R51, from C24B (S) to C24D (S). Cut both leads to 1/2".

9. ( ) Fig. 6. Connect a 47KΩ (yellow,violet,orange,silver) resistor, R17, TB8-1 (C) to ground lug "F" (C) on C24. Cut both leads to 1/2".

10. ( ) Fig. 6. Connect a 2.2MΩ (red,red,green,silver) resistor, R14, from TB8-2 (C) to ground lug "F" (C) on C24. Cut both leads to 1/2".

11. ( ) Fig. 6. Connect the outer shield from the shielded lead from S1-10E to ground lug "F" (S) on C24 and the inner conductor to TB8-2 (C).

12. ( ) Fig. 6. Connect a 2.2KΩ (red,red,red,silver) resistor, R16, from XV2-7 (C) to TB8-1 (C). Cut both leads to 3/4".

13. ( ) Fig. 6. Connect a .25 mfd (red,green,yellow,black,blue) 400 volt capacitor, C9, from XV2-7 (S) to TB5-1 (S). Cut both leads to 1 1/4" and use spaghetti on lead to XV2.

14. ( ) Fig. 6. Connect a 1MΩ (brown,black,green,silver) resistor, R15, from XV2-6 (C) to TB8-1 (S). Cut both leads to 3/4".

15. ( ) Fig. 6. Connect a .025 mfd disc capacitor, C8, from XV2-6 (S) to TB8-2 (S). Cut both leads to 3/4".

16. ( ) Fig. 6. Connect a 100Ω (brown,black,brown,gold) 5% resistor, R31, from TB5-3 (S) to TB5-4 (C).

17. ( ) Fig. 6. Connect a 50 mfd, 25V electrolytic capacitor, C15, from XV3-3 (C) to TB5-4 (C). Cut both leads to 1" and use spaghetti on both ends. Plus end goes to XV3.

18. ( ) Fig. 6. Connect a 1KΩ (brown,black,red,silver) resistor, R30, from XV3-3 (S) to TB5-4 (S). Cut both leads to 3/4".

19. ( ) Fig. 6. Connect a 4.7KΩ (yellow,violet,red,silver) resistor, R28, from XV3-2 (S) to TB5-2 (C). Cut both leads to 3/4".

20. ( ) Fig. 6. Connect a black lead from J8-2 (S) to J9-2 (C).

21. ( ) Fig. 6. Cut a 9" piece of 2 conductor cable. Strip one side of the rubber insulation back 1 1/2". Strip the metal braided shield back 1 1/4". Call this end "A". Strip the rubber insulation on end "B" (the remaining end) back 3/4", and the metal braid 1/2". Solder a 2 1/2" piece of bare wire on the metal braid of end "A" and a 1 1/4" piece of bare wire on the metal braid of end "B". Cover both with spaghetti. Connect the yellow lead on end "A" to R27-2 (C), the black lead to TB5-2 (C) and the bare wire to R27-1 (S). Connect the yellow lead of end "B" to J8-1 (S), the black lead to J9-1 (S) and the bare wire to J9-2 (S).

22. ( ) Fig. 6. Connect a 2" piece of bare wire from TB5-2 (S) to R27-2 (S).

23. ( ) Fig. 6. Connect a 750 mmf disc capacitor, C20, from XV5-3 (S) to TB3 (S). Cut leads to 3/4".

24. ( ) Fig. 6. Connect a 10Ω, 1W, 1% resistor, R44, from J11 (S) to TB1-1 (C). Cut both leads to 1/2".

25. ( ) Fig. 6. Connect a 1" piece of bare wire from TB1-1 (S) to ground lug "G" (S).

26. ( ) Fig. 6. Connect a 225 mmf disc capacitor, C23, from TB1-4 (C) to TB2-1 (C). Cut both leads to 3/4".

27. ( ) Fig. 6. Connect a 3KΩ (orange,black,red,gold) resistor, R46, from TB2-1 (S) to TB2-2 (C). Cut both leads to 1/2".

28. ( ) Fig. 6. Connect a 3KΩ (orange,black,red,gold) resistor, R47, from TB1-4 (S) to TB2-2 (C). Cut both leads to 1/2".

29. ( ) Fig. 6. Connect a 500 mmf disc capacitor, C22, from TB1-2 (S) to TB2-2 (S). Use spaghetti on both leads and cut them both to 1".

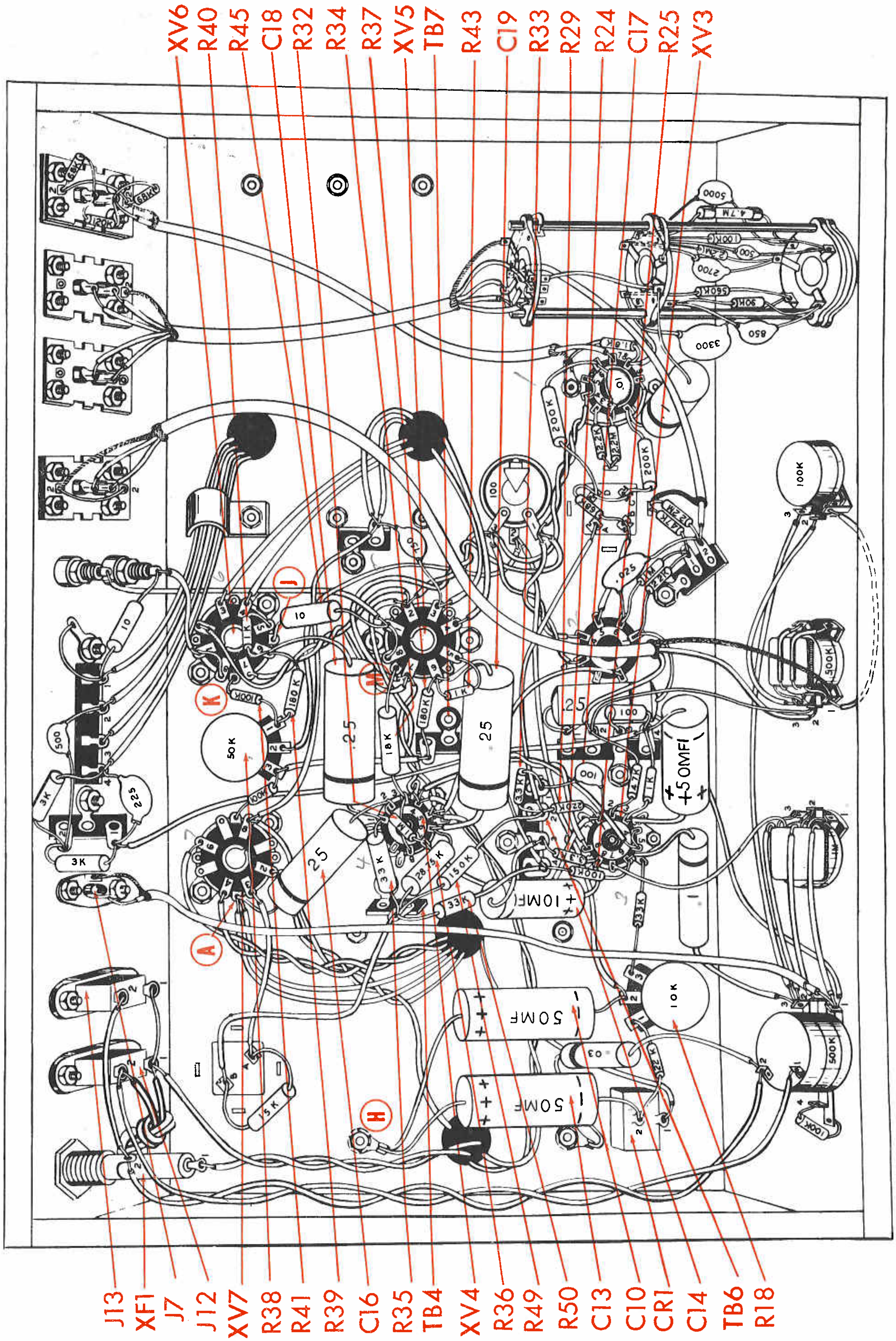

XV6
R40
R45
C18
R32
R34
R37
XV5
TB7
R43
C19
R33
R29
R24
C17
R25
XV3
J
K
M
A
H
J13
XF1
J7
J12
XV7
R38
R41
R39
C16
R35
TB4
XV4
R36
R49
R50
C13
C10
CR1
C14
TB6
R18

Fig. 7

1. ( ) Fig. 7. Connect a 2 3/4" grey lead from XF1-2 (S) to J13-2 (S).

2. ( ) Fig. 7. Connect a 50 mfd, 150V electrolytic capacitor, C13, from CR1-2 (S) to ground lug "H" (C). The negative (-) side is 1" and is connected to CR1. The plus (+) side is 1 1/2" long.

3. ( ) Fig. 7. Connect a 50 mfd, 150V electrolytic capacitor, C10, from R18-2 (S) to ground lug "H" (S). The minus (-) side is 1" and is connected to R18. The plus (+) side is 2 1/2" long.

4. ( ) Fig. 7. Connect the plus (+) side of the 10 mfd, 6V capacitor, C14, to XV3-8 (C) and the other side to TB6-3 (C). Cut both leads to 1" and use spaghetti on both.

5. ( ) Fig. 7. Connect a 100KΩ (brown, black, yellow, silver) resistor, R25, from XV3-6 (S) to TB6-4 (C). Cut both leads to 1" and use spaghetti on each.

6. ( ) Fig. 7. Connect a 3.3KΩ (orange, orange, red, silver) resistor, R24, from XV3-8 (S) to TB6-3 (S). Cut both leads to 3/4".

7. ( ) Fig. 7. Connect a 220KΩ (red, red, yellow, silver) 10% resistor, R29, from XV3-1 (C) to TB6-2 (C). Cut both leads to 3/4".

8. ( ) Fig. 7. Connect a 100Ω mmf disc capacitor, C17, from XV3-1 (S) to TB6-1 (C). Cut both leads to 3/4".

9. ( ) Fig. 7. Connect a 3.3KΩ (orange, orange, red, silver) resistor, R33, from TB6-1 (S) to TB6-2 (C). Cut both leads to 1/2".

10. ( ) Fig. 7. Connect a 1MΩ (brown, black, green, silver) resistor, R32, from XV4-2 (C) to XV4-7 (S). Cut both leads to 1/2".

11. ( ) Fig. 7. Connect a .25 mfd (red, green, yellow, black, yellow) 400V molded capacitor, C16, from XV4-2 (S) to ground lug "A" (S) on XV7. Cut both leads to 1 1/2" and use spaghetti on lead going to XV4.

12. ( ) Fig. 7. Connect a 10Ω, 1W, 1% resistor, R45, from XV5-1 (S) to ground lug "J" (S) on XV6. Cut both leads to 3/4".

13. ( ) Fig. 7. Connect a 100KΩ (brown, black, yellow, gold) 5% resistor, R41, from R38-1 (C) to ground lug "K" (S) on XV6. Cut both leads to 1/2".

14. ( ) Fig. 7. Connect a 180KΩ (brown, grey, yellow, gold) 5% resistor, R39, from R38-1 (S) to XV6-6 (C). Cut both leads to 1/2".

15. ( ) Fig. 7. Connect a .25 mfd (red, green, yellow, white, blue) 600V molded capacitor, C18, from XV4-1 (C) to XV6-6 (C). Cut both leads to 1 1/4".

16. ( ) Fig. 7. Connect a 1KΩ (brown, black, red, silver) resistor from XV6-6 (S) to XV6-5 (S). Cut both leads to 1/2".

17. ( ) Fig. 7. Connect a 100KΩ (brown, black, yellow, gold) 5% resistor, R42, from R38-3 (S) to ground lug "L" (S) on XV7. Cut both leads to 1/2".

18. ( ) Fig. 7. Connect a 1" piece of bare wire from XV4-8 (S) to XV4-3 (C).

19. ( ) Fig. 7. Connect an 18KΩ (brown, grey, orange, gold) 1W, 5% resistor, R34, from XV4-3 (S) to ground lug "M" (S) on XV5. Cut both leads to 3/4".

20. ( ) Fig. 7. Connect a 180KΩ (brown, grey, yellow, gold) 5% resistor, R37, from TB7 (S) to XV5-6 (C). Cut both leads to 1/2".

21. ( ) Fig. 7. Connect a 1KΩ (brown, black, red, silver) resistor, R43, from XV5-6 (C) to XV5-5 (S). Cut both leads to 1/2".

22. ( ) Fig. 7. Connect a .25 mfd (red, green, yellow, white, blue) 600V molded capacitor, C19, from XV5-6 (S) to XV4-6 (C). Cut both leads to 1 1/4" and use spaghetti.

23. ( ) Fig. 7. Connect a 150KΩ (brown, green, yellow, silver) resistor, R49, from TB4 (C) to TB6-2 (S). Cut both leads to 1".

24. ( ) Fig. 7. Connect a 33KΩ (orange, orange, orange, silver) 1W resistor, R50, from TB4 (C) to TB6-4 (S). Cut both leads to 1/2".

25. ( ) Fig. 7. Connect a 28.75KΩ, 1W, 5% resistor, R36, from TB4 (C) to XV4-6 (S). Cut the lead at TB4 to 1/2" and the other lead to 3/4".

26. ( ) Fig. 7. Connect a 33KΩ (orange, orange, orange, gold) 1W, 5% resistor, R35, from TB4 (S) to XV4-1 (S). Cut both leads to 1".

27. ( ) Fig. 7. Strip the insulation back 3/4" on an 8" piece of shielded single conductor cable. On one end, twist the shield braid strands, and on the other end, cut off the shield braids. Strip the inner insulation back 1/4". Connect the shield braid to J7-2 (S) and the inner wire to J7-1 (S). Connect the other end of the inner wire to R22-1 (S).

28. ( ) Fig. 7. Pass the line cord through the grommet at the rear of the chassis. Knot the line cord inside the chassis 3" from the end. Connect one lead to J12-1 (S) and the other lead to J12-2 (S).

FINAL STEPS

You have now completed the assembly and wiring of your amplifier. When you have completed the following steps your amplifier will be ready for use.

1) To catch any wiring errors, it is suggested that the entire wiring be checked point-by-point against the wiring instructions (and preferably also against the schematic wiring diagram in order to become more familiar with the component layout and circuitry). While doing so, check for rosin joints, loose lumps of solder, poor lead dress, and accidental shorts or leakage paths arising from the flow of rosin between contacts (remove with a stiff brush dipped in carbon tetrachloride, being carefully not to spring contacts when cleaning switches).

2) Clean socket XV1 with carbon tetrachloride using a stiff brush. It is also advisable to remove the tube and shield from XV1, and clean the socket and pins on top of the chassis.

3) Insert V1 through V7 in their correct sockets. Place shields over V1 and V2.

4) IMPORTANT: BE SURE TO MAKE THE FOLLOWING RESISTANCE CHECKS AND BIAS ADJ., BALANCE ADJ. CONTROL ADJUSTMENTS BEFORE CONNECTING TO THE AC LINE: Check for a cold dc resistance of 1.2 ohms across the AC plug; check for a resistance of at least 45 ohms between ground and pins 4 and 6 of XV7, and 9 ohms between ground and the positive terminal of rectifier, CR1; check for a resistance of at least 200K ohms between pin 8 of the rectifier tube V7 and ground. Allow sufficient time for the electrolytic capacitors to be charged by the ohmmeter battery in this last measurement. These measurements constitute a reasonable check of the power supply components and wiring before applying power. If you fail to obtain these resistance values, do not procede to the next step until the cause is discovered and the condition remedied. If the measurements are satisfactory, procede to OUTPUT STAGE BIAS & BALANCE ADJUSTMENTS in the MAINTENANCE section of the book. DO NOT CONNECT TO THE AC LINE until you have completed the preliminary BIAS ADJ. and BALANCE ADJ. control adjustments, at which point you will be instructed to do so. When you have completed the OUTPUT STAGE BIAS & BALANCE ADJUSTMENTS, procede to the step following this one.

5) Press a speed nut in place over each hole on the bottom flange of the chassis (see Fig. 8).

6) Mount the bottom plate on the chassis, using 10 #8-32 X 3/8" screws. Do not use the 1" long screws for this purpose.

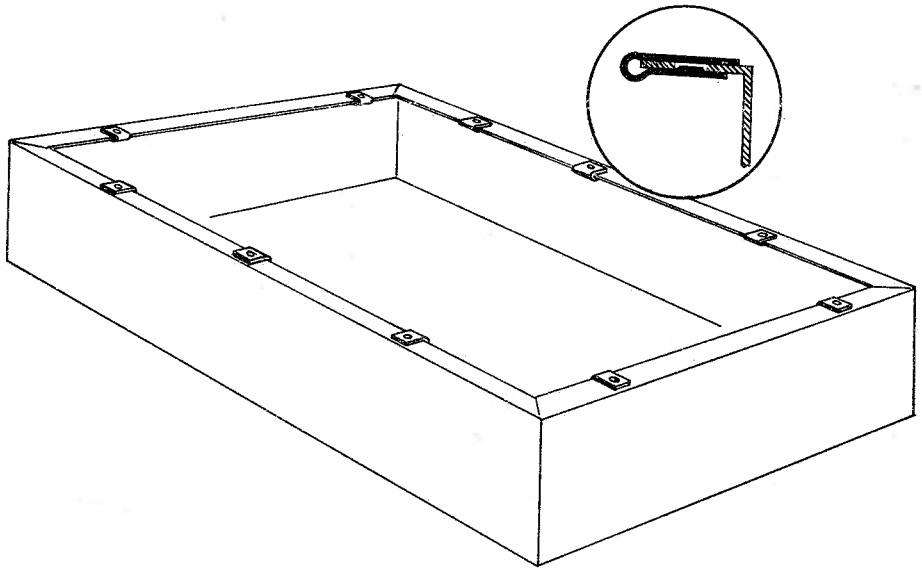


Fig. 8

7) Mount the control plate by slipping it over the control shafts and using two #4-40 X 1/8 B.H. screws to fasten it to the front chassis apron (see Fig. 9).

8) Mount the knobs on the front panel (short shank set). All controls should be set at their most counter-clockwise position. The knobs are pushed onto the shafts with the dot pointing to the following markings.

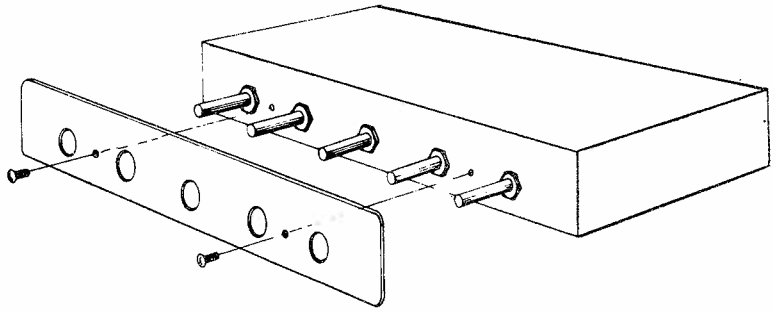


Fig. 9

9) OPERATIONAL CHECKS ON COMPLETED KITS: In the Instruction part of this manual, you will find a sub-section in the Installation section titled "Electrical Connections". Read this carefully and connect your speaker, phonograph, and tuner to the amplifier in accordance with the instructions given. Then read the section titled "Operating Instructions" and operate all the controls, checking aurally for the results described. If the amplifier does not operate at all or operates incorrectly, use the trouble shooting chart and the Voltage and Resistance chart to discover and remedy the difficulty. As the Trouble Shooting chart presumes a properly wired amplifier, which may not be the case, recheck the wiring for errors or reversed connections and continuity.

10) If the amplifier is not going to be installed in a console, insert the rubber feet in the opening provided in the bottom plate. They will provide a resting surface that will not mar furniture surfaces. An optional matching cover, Model E1, is available. Refer to the "General Factor" part of the INSTALLATION section of the instructions for information as to placement.

11) If the amplifier is to be mounted in a console, refer to the MECHANICAL INSTALLATION section of the instructions and read the "General Factors" part and then follow exactly the "Chassis Mounting in Console" instructions (including operations on console front panel and amplifier mounting in console).

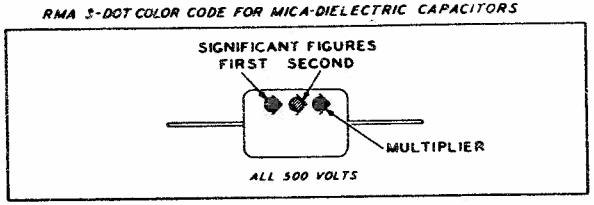
12) Detailed information as to connection of phonograph, tuner, etc, to the amplifier inputs and speaker systems to the amplifier output, as well as line plug connections and use of the hum adjustment control, is given in the ELECTRICAL INSTALLATION section.

SERVICE

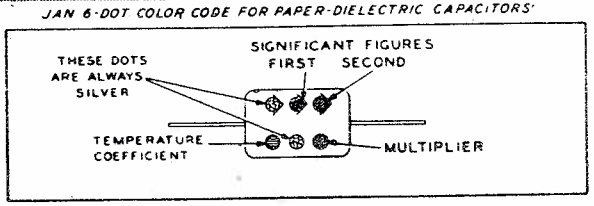
If you are still having difficulty, write to our service department listing all possible indications that might be helpful. If desired, you may return the instrument to our factory where it will be placed in operating condition for $10.00 plus the cost of parts replaced due to their being damaged in the course of construction. This service policy applies only to completed instruments constructed in accordance with the instructions as stated in the manual. Instruments that are not completed or instruments that are modified will not be accepted for repair. Instruments that show evidence of acid core solder or paste fluxes will be returned not repaired. NOTE: Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material is inserted to keep the instrument immovable. Ship by prepaid Railway Express, if possible, to the Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, New York. Return shipment will be made by express collect. Note that the carrier cannot be held liable for damages in transit if packing, IN HIS OPINION, is insufficient.

CAPACITOR COLOR CODES

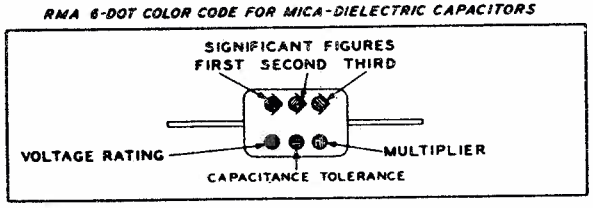
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



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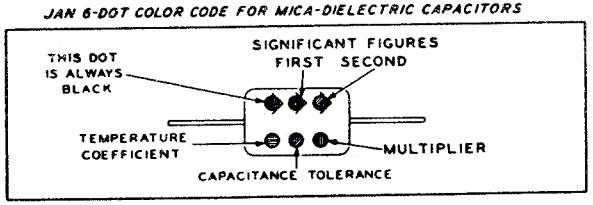
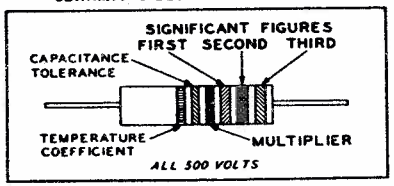


RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

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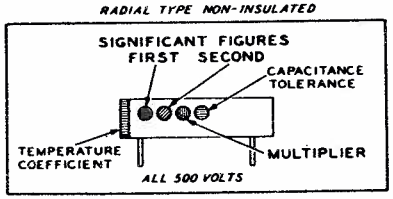
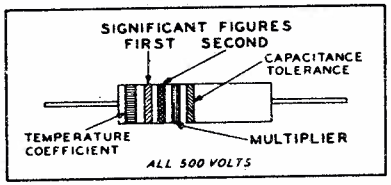


AXIAL TYPE INSULATED



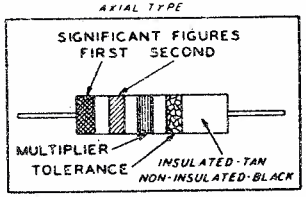
RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS		CAPACITORS						
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1000	3	ORANGE	1000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

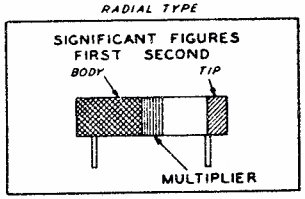
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

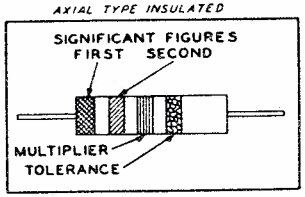


RADIAL TYPE

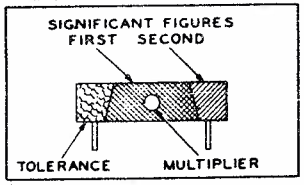


JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED



clockwise rotation, which indicates an abnormal condition, turn off the power and recheck the amplifier wiring and components.

b) SETTING BIAS ADJ. control (BIAS VOLTAGE ADJUSTMENT): Use either a VOM of at least 20,000Ω per volt sensitivity and ±3% accuracy on dc voltage measurement or a VTVM. Set the instrument at the minus or negative DC volts functions and a range of not less than 50 volts or more than 150 volts (the closer the point on the scale at which the reading is made is to full scale, the more accurate it is). Rest the amplifier on either short side and remove the bottom plate. Locate the arm (center contact lug) of the BIAS ADJ. control and connect the "hot" meter lead to it. Touch the common or ground meter lead to any unpainted point on the chassis (ground) and read the negative dc voltage on the meter. Adjust the BIAS ADJ. control for a reading of -47 dc volts (negative). Disconnect the meter leads when this is completed.

c) SETTING BALANCE ADJ. CONTROL: Set the VOM or VTVM at either the plus or minus DC voltage function and select the lowest DC voltage range. Connect the meter leads to the two METER pins jacks on the rear chassis apron. If the meter pointer deflects to the left of zero, reverse the leads. Adjust the BALANCE ADJ. control for a zero or minimum reading. This completes the balance adjustment, whereupon the meter leads can be removed from the METER pin jacks.

d) Set the VOM or VTVM at the plus DC voltage function and select the lowest DC voltage range (not higher than 3 volts full scale). Insert the "hot" meter lead into either one of the METER pin jacks and touch the common or ground meter lead to any unpainted point on the chassis (ground). Readjust the BIAS ADJ. control for a meter reading of 0.65 volt.

e) Repeat step c

f) Repeat step d

TROUBLE SHOOTING and OPERATING NOTES

Your amplifier should require little service except for normal tube replacement. We recommend no substitutions for the tube types used in this amplifier except as stated. The EL34 and GZ34 types are distributed nationally by the Amperex Electronic Corporation (230 Duffy Ave., Hicksville, L.I., N.Y.) and Mullard Ltd. (International Electronics Corp., 81 Spring St., N.Y. 12, N.Y.) If necessary, replacements can be obtained directly from EICO.

It should be noted that slight red coloring of the EL34 output tube plates in operation is not abnormal and does not indicate that the amplifier is operating improperly.

The HF-52 is intended for operation at a line voltage of 117VAC. To afford conservative operation of the unit in areas of high line voltage, both 117V and 125V taps have been provided on the primary of the power transformer. The normal connection in both kit and wired units is the 117V tap. The amplifier components will be operating within their ratings with the 117V tap so long as the line voltage does not exceed 124V. If the line voltage in your location exceeds 124V, it will be necessary to rewire the power transformer primary connections for 125V operation. To do this, it will be necessary to remove the bottom plate and connect the black-green lead (125V power transformer primary tap) to the fuse post terminal XF1-1 instead of the black-red lead (117V primary tap). If you have built the kit according to instructions or purchased a wired unit, you will find the black-green lead strapped back on the black-red lead. Of course you must remove the line cord plug from the outlet before rewiring. The rewiring procedure is as follows:

1. Unsolder the black-red lead from fuse post terminal XF1-1 (terminal at end of the post).
2. Remove electrical tape holding black-green lead to black-red lead.
3. Strip 1/2" insulation from end of black-green lead.
4. Cut off the stripped end of the black-red lead. Bend the end of this lead back on itself (about an inch) and tape it very carefully to the black-green lead so that the end of the black-red lead is entirely insulated and can not short out against the chassis. This is very important.
5. Connect and solder the black-green lead to fuse post terminal XF1-1.

To facilitate servicing, remedial and trouble-shooting procedures have been provided in the TROUBLE SHOOTING CHART that follows. A VOLTAGE AND RESISTANCE CHART is also provided as an aid in locating defective components. DC operating voltages are given both at no signal and a signal developing 50 watts output as well as the corresponding 1 dc signal voltages.

TROUBLE-SHOOTING PROCEDURES

Connect a phonograph and speaker to the amplifier as described in "Electrical Connections" and set controls for phono listening. Play a known high quality LP recording on the phonograph. If there is no output to the speaker or if the output is low or audibly distorted, procede to the checks for those symptoms. If there is excessive hum in the output, disconnect the phono input cable from the amplifier and short the phono input jack to chassis. If the hum disappears, the trouble is not in the amplifier but in the phonograph or in the connection to the amplifier.

The cause of phonograph hum may be a metal pick-up arm not grounded to the cable shield (try a good single ground connection to the cable shield from turntable frame, pick-up arm, and cartridge case), direct hum pick-up by the magnetic cartridge from the record player motor (try using a rubber mat on the turntable to increase the separation of the pick-up from the motor), or pick-up from a power transformer or other magnetic field in the vacinity (try moving phonograph away from suspected source). Check also that the phono input cable shielding is grounded to the amplifier chassis at one point only through the skirt of the input connector where it plugs into the amplifier. Finally, try

a good building ground such as a connection from a cold water pipe terminated under speaker terminal "G" on the amplifier. Do not connect such a ground wire to other components in the system.

Excessive hum on other inputs may be checked in a similar manner. Disconnect the input cable in question and short the particular input jack to the chassis. If the hum disappears, the trouble is external to the amplifier. Note that on all inputs, the braid of the input cable should connect to the amplifier only through the skirt of the input connector. The cause and remedies for the following symptoms are then based on the assumption that checks made in the manner described above have eliminated the possibility of the trouble being external to the amplifier.

If the trouble is no output or low output, check AC signal voltages and DC operating voltages starting at the input and working step-by-step toward the output. Set LEVEL & LOUDNESS controls to maximum (10) and BASS and TREBLE controls to their mid-points (0). Use a 1000 cycle sine-wave signal, such as supplied by the EICO 377 Sine & Square Wave Audio Generator. In addition, use a precision 100:1 attenuator to permit obtaining a level of 0.008 volt fed into PHONO input 1 from an audio generator output of 0.8 volts, which can easily be measured on the lowest AC volts range of your VTVM (also improves signal to hum from generator). Use a high input impedance VTVM for all AC signal voltage measurements (such as the EICO 232, 249, 221, or 214 and a VTVM or 20,000 Ω/volt VOM for DC voltage measurements.

If the trouble is an excessively distorted output, try tube replacement, signal tracing, or procede directly to voltage and resistance measurements.

When the defective stage is localized, procede to a resistance and voltage check of the stage, using the data in the VOLTAGE and RESISTANCE chart. Disconnect the amplifier from the power line and discharge capacitors prior to making any resistance check and prior to removing either or both of the EL34 output tubes V3 and V4 or disabling the bias supply. Do not turn the amplifier on with either of the output tubes removed or the bias supply disabled.

TROUBLE-SHOOTING TYPICAL TUBE STAGE

1. Check tube.
2. Check plate and cathode resistors.
3. Check coupling capacitors for leakage or short.
4. For output stage, check dc resistance of transformer windings.
5. Check grid leak resistor for open.
6. Check cathode by-pass capacitors for short.
7. If no or low B+ voltage on tube, check decoupling path for open or defective R48, R49, R50, R51 and filter capacitor C25 or C24. Check also for excessive bias voltage from fixed bias supply.
8. If wiring and circuit components including the tube check O.K. and B+ voltage is excessive, check the decoupling path for short or defective R48, R49, R50, R51. Also check for low bias voltage from fixed bias supply.

Suspected trouble in the equalization, tone, loudness, and level controls and networks should lead to specific resistance and capacitance checks to localize the trouble. In general, if the user suspects poor frequency response, defective equalization, or defective operation of the tone or loudness controls, the amplifier should be tested thoroughly with audio generator, vtvm, and scope.

SERVICE

If trouble developes in your instrument which you can not remedy yourself, write to our service department listing all possible indications that might be helpful. If desired, you may return the instrument to our factory where it will be placed in operating condition for $10.00 plus the cost of parts replaced due to their being damaged in the course of construction. NOTE: Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material is inserted to keep the instrument immovalbe. Ship by prepaid Railway Express, if possible, to Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, New York. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damages in transit if packing IN HIS OPINION, is insufficient.

TERMINALS OF SELECTOR SWITCH S1 CONNECTED AT EACH SETTING
(AID TO READING SCHEMATIC DIAGRAM)

SELECTOR SWITCH	SECTION	TAPE	TV	TUNER	AUX	COL	LON	RIAA	AM-78	EUR-78
	A	NC	1-8	8-11	NC	1-11	5-11	NC	NC	5-8
	B	NC	NC	5-9	1-5	NC	NC	1-9	5-9	NC
	C	NC	1-12	NC	1-12	1-12	5-12	1-12	5-12	5-12
	D	2-8	2-8	2-4-11	2-4-11	2-11	2-11	2-8	2-8	2-4
	E	6-10-11	6-10-12	1-6-10	2-6-10	3-6-10	3-6-10	3-6-10	3-6-10	3-6-10
	F	1-2-3-8-12	1-2-3-8-11	2-3-8-11-12	1-3-8-11-12	1-2-8-11-12	1-2-8-11-12	1-2-8-11-12	1-2-8-11-12	1-2-8-11-12

Entries are numbers of those switch contacts which are connected together by the rotors at the particular position. NC means no connection.

TROUBLE SHOOTING CHART

SYMPTOM	CAUSE	REMEDY
House power line fuse blows; fuse, F1, remains intact.	Short in line cord, J12, J13 associated equipment plugged into J12 or J13.	Repair
Fuse, F1, blows.	If the amplifier causes a replacement fuse to blow with rectifier tube V7 is removed, the primary or high voltage secondary windings of T1 are incorrectly wired or shorted.	Check and repair or replace.
	If the amplifier does not cause F1 to blow when V7 is out of the socket, but does cause F1 to blow when V7 is placed back in the socket, then check for bias supply failure, short in B+ circuits, defective V7, C10, C24, C25.	Check and repair or replace.
V7 filament not lit.	Incorrect wiring of fil. leads to V7 socket. 5V fil. winding of T1 open.	Repair Replace T1.
Any or all other tube filaments not lit.	Open lead from 6.3 V winding of T1. 6.3 V winding of T1 open.	Repair Replace T1.
DC voltage at V7 cathode (pin 8) is incorrect as specified below.		
a) No voltage	Defective V7. C25, C24 shorted internally or externally.	Replace Replace or repair.
b) High voltage	Connection to C25 from pin 8 of V7 broken. Connection to center tap of h.v.sec. winding of T1 open. Output tubes V5 & V6 over-biased or not drawing current.	Repair Repair See trouble-shooting typical stage; adjust bias and balance control.
c) Low voltage.	Excessive current drain in amplifier.	See trouble-shooting typical stage; adjust bias and balance controls.
	Defective V7.	Replace
Excessive phono hum	V1 defective Fil. leads dressed too close to grid lead. C24 defective Tube shield not making electrical contact to base or base not making electrical contact to chassis. Outer braid connection on phono hi or phono lo input jacks accidentally shorting to chassis at the jack. Outer braid of shielded lead going from phono hi and lo jacks to switch not grounded at switch as required. Shielded lead contacting chassis ground at other than required point.	Replace Dress fil. leads away from grid lead. Replace C24. Check and correct Clear short at input jack. Repair Repair
Excessive phono noise	V1 socket and contacts dirty.	Clean thoroughly with carbon tetrachloride.
Sustained oscillations	Poor dress of output transformer T2 leads.	Dress all input leads and T2 leads away from each other. Keep T2 leads away from input jacks.
Sustained phono microphonics	V1 defective	Replace 12AX7 (V1) with selected new 12AX7 or with premium 12AD7.
Hum on all inputs	V2 defective, not properly shielded or dirty socket and contacts. Dress of power transformer T1 leads.	See below Correct

VOLTAGE AND RESISTANCE CHART

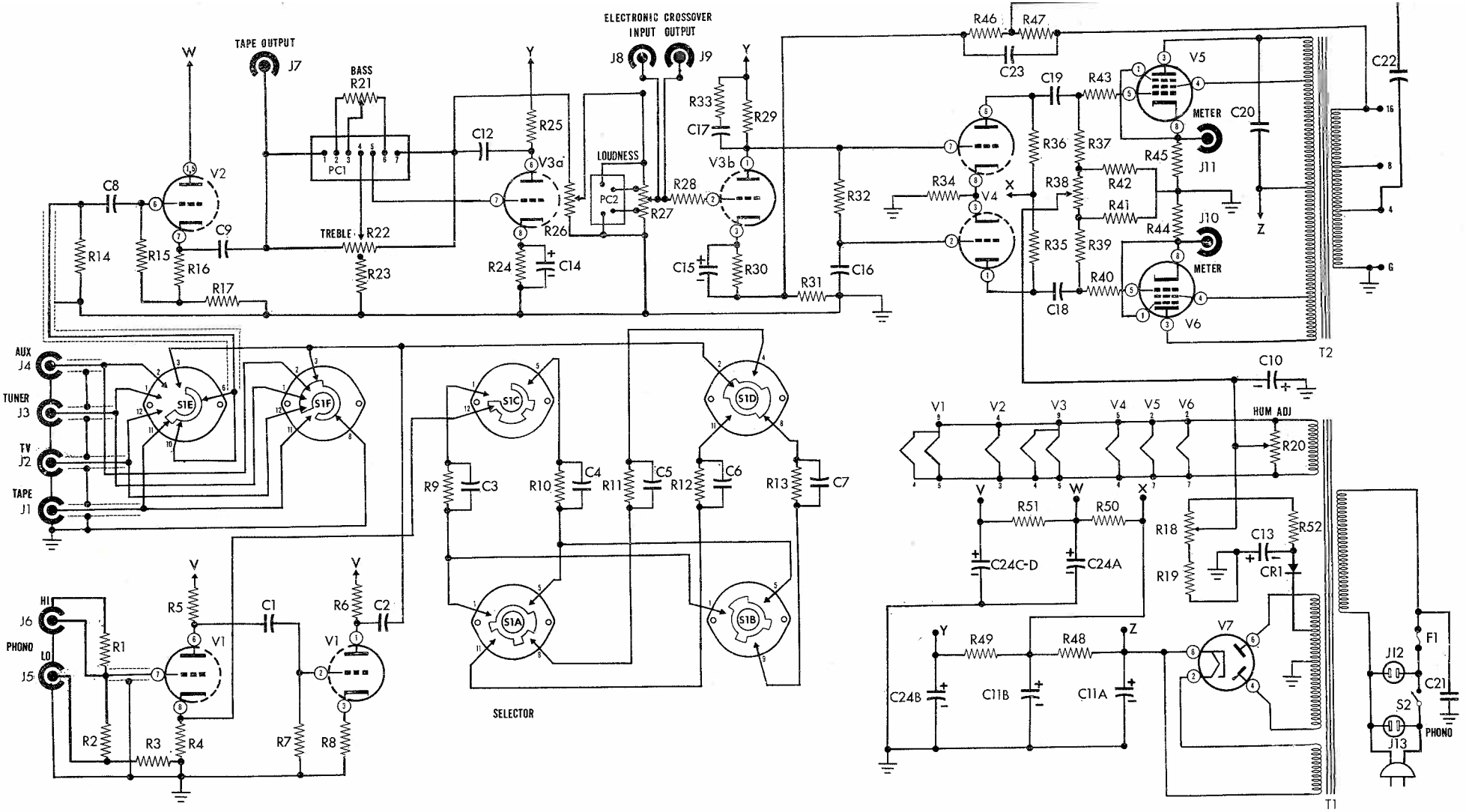
TUBE	PIN#	DC VOLTS NO SIGNAL	DC VOLTS 50W OUT	AC VOLTS (1 kc) 50W OUT	RESISTANCE UNIT OFF
ECC83/12AX7	1	77	77	.65	315 KΩ
	2	-0.3	-0.3	.032	2.2 MΩ
V1	3	0.6	0.6	.017	2.2 KΩ
	4 & 5	filament (-47 VDC; 6.3 VAC to pin 9)			40 KΩ
	6	66	64	.032	315 KΩ
	7	0	0	.0095	47 KΩ
	8	0.7	0.7	.0088	1.6 KΩ
	9	filament			40 KΩ
EC90/6C4	1,5	190	180	0	50 KΩ
	2	-	-	-	
V2	3 & 4	filament (-47 VDC; 6.3 VAC between)			38 KΩ
	6	54	50	0.65	1.05 MΩ
	7	98	92	0.61	50 KΩ
ECC83/12AX7	1	98	92	4.4	365 KΩ
	2	00	-	.54	500 KΩ
V3	3	0.75	0.7	.48	1.1 KΩ
	4 & 5	filament (-47 VDC; 6.3 VAC to pin 9)			38 KΩ
	6	144	135	.54	150 KΩ
	7	0	0	.026	650 KΩ
	8	1.5	1.35	0	3.3 KΩ
	9	filament	-	-	40 KΩ
6CG7	1	230	200	32.	45 KΩ
	2	90	82	.0044	1.37 MΩ
V4	3 & 8	102	96	2.2	18 KΩ
	4 & 5	filament (-47 VDC; 6.3 VAC to pin 9)			38 KΩ
	6	230	200	32.	45 KΩ
	7	98	90	4.4	365 KΩ
	9	filament	-	-	40 KΩ
EL34/6CA7	1	0.65	1.2	1.4	10 Ω
	2 & 7	filament (-47 VDC; 6.3 VAC between)			38 KΩ
V5	3	470	435	240	44 Ω
	4	470	435	100	20 Ω
	5	-37.5	-38.5	32	220 KΩ
	6	-38	-38	32	220 KΩ
	8	0.65	1.2	1.4	10 Ω
EL34/6CA7	1	0.65	1.2	1.4	10 Ω
	2 & 7	filament (-47 VDC; 6.3 VAC between)			38 KΩ
V6	3	470	435	240	50 Ω
	4	470	435	100	18.5 Ω
	5	-37.5	-38.5	32	220 KΩ
	6	-38	-38	32	220 KΩ
	8	0.65	1.2	1.4	10 Ω
GZ34	1	-	-	-	-
	2	fil. 470 (5.0 VAC to pin 8; remove tube to measure)			above 200 KΩ
V7	3	470	440	-	-
	4	-	-	393	50 Ω
	5	-	-	-	-
	6	-	-	393	50 Ω
	7	-	-	-	-
	8	fil. & cath. 470	440	-	above 200 KΩ

All resistance measurements except those from pins 2 and 8 of the GZ34 are made with pin 8 of the GZ34 grounded. All voltages and resistances are measured to chassis with the LEVEL & LOUDNESS controls set to 10 on their dials and the TREBLE & BASS controls set to 0. For voltage measurements at 50 W output, set the input selector to the RIAA position and feed a .0095 volt (9.5 mv). 1 kc signal to the PHONO LO input jack; connect a resistive (preferably non-inductive) load of equal resistance to the tap selected (±20%) and capable of handling 100 watts. Voltage measurements are made with a VTVM. Operating line voltage at which voltage measurements are made is 117 V AC, 60 cps. NOTE: ALL VOLTAGE & RESISTANCE VALUES MAY VARY NORMALLY BY ±15%.

PARTS LIST

Stk.#	Sym.	Description	Am't.
22505	C1	cap., disc, .01 mfd	1
20039	C2,12	cap., molded, .1 mfd - 400 V, ±10%	2
22514	C3	cap., disc, 850 mmf, ±10%	1
22515	C4,22	cap., disc, 500 mmf, ±10%	2
22513	C5	cap., disc, 5000 mmf, ±10%	1
22508	C6	cap., disc, 3300 mmf, ±10%	1
22518	C7	cap., disc, 2700 mmf, ±10%	1
22517	C8	cap., disc, .025 mfd	1
20044	C9,16	cap., molded, .25 mfd - 400 V, ±10%	2
23015	C10,13	cap., elec., 50 mfd - 150 V	2
24008	C11	cap., elec., 40-20 mfd - 500 V	1
23001	C14	cap., elec., 10 mfd - 25 V	1
23007	C15	cap., elec., 50 mfd - 25 V	1
22509	C17	cap., disc., 100 mmf, ±10%	1
20041	C18,19	cap., molded, .25 mfd - 600 V, ±10%	2
22542	C20	cap., disc, 750 mmf - 1000 V, ±10%	1
20043	C21	cap., molded, .03 mfd - 600 V, ±20%	1
22543	C23	cap., disc, 225 mmf, ±10%	1
24003	C24	cap., elec., 2 X 20 mfd - 450 V & 2 X 10 mfd - 350 V	1
93003	CR1	rectifier, 50 ma	1
91005	F1	fuse, 3A	1
50011	J1-2,3-4, 5-6, 8-9	jack, input, dual	4
50014	J7	jack, input, single	1
50007	J10,11	jack, pin	2
50016	J12,13	outlet, convenience	2
29751	PC1	printed circuit plate	1
10422	R1,3,51	res., 68KΩ, 1/2W, ±10%	3
10444	R2	res., 120KΩ, 1/2W, ±10%	1
10414	R4	res., 1.8KΩ, 1/2W, ±10%	1
11526	R5,6	res., 200KΩ, 1/2W, ± 5%	2
10434	R7,14	res., 2.2MΩ, 1/2W, ±10%	2
10423	R8,16	res., 2.2KΩ, 1/2W, ±10%	2
11504	R9	res., 90KΩ, 1/2W, ± 5%	1
11527	R10,41,42	res., 100KΩ, 1/2W, ± 5%	3
11536	R11	res., 4.7MΩ, 1/2W, ± 5%	1
11511	R12	res., 560KΩ, 1/2W, ± 5%	1
11518	R13	res., 2.2MΩ, 1/2W, ± 5%	1
10407	R15,32	res., 1MΩ, 1/2W, ±10%	2
10428	R17	res., 47KΩ, 1/2W, ±10%	1
18015	R18	pot., 10KΩ, linear (bias adj.)	1
10426	R19	res., 33KΩ, 1/2W, ±10%	1
19009	R20	pot., 100Ω (hum bal.)	1
18020	R21	pot., 1MΩ, linear (bass)	1
18008	R22	pot., 500KΩ, CT., w/sw. (treble)	1
10410	R23,25	res., 100KΩ, 1/2W, ±10%	2
10420	R24,33	res., 3.3KΩ, 1/2W, ±10%	2
18031	R26	pot., 100KΩ, audio (level)	1
18021	R27	pot., 500KΩ, w/PC2	1
10430	R28	res., 4.7KΩ, 1/2W, ±10%	1
10417	R29	res., 220KΩ, 1/2W, ±10%	1
10432	R30,40,43	res., 1KΩ, 1/2W, ±10%	3
11505	R31	res., 100Ω, 1/2W, ± 5%	1
11600	R34	res., 18KΩ, 1W, ± 5%	1
11602	R35	res., 33KΩ, 1W, ± 5%	1
11601	R36	res., 28.75KΩ, 1W, ± 5%	1
11537	R37,39	res., 180KΩ, 1/2W, ± 5%	2
18029	R38	pot., 50KΩ, linear (bal. adj.)	1
11703	R44,45	res., 10Ω, 1W,	2
11513	R46,47	res., 3KΩ, 1/2W, ± 5%	2
10852	R48	res., 15KΩ, 1W, ±10%	1
10435	R49	res., 150KΩ, 1/2W, ±10%	1
10850	R50	res., 33KΩ, 1W, ±10%	1
10424	R52	res., 22KΩ, 1/2W, ±10%	1

Stk.#	Sym.	Description	Am't.
60038	S1	switch, 6P - 9 Posn (selector)	1
30020	T1	transformer, power	1
32007	T2	transformer, output	1
54500	TB1	terminal board, 4 screw	1
54003	TB2	terminal strip, 2 post	1
54001	TB3,7	terminal strip, 1 post right	2
54000	TB4	terminal strip, 1 post left	1
54015	TB5,6	terminal strip, 3 post 2 left w/gnd	2
54010	TB8	terminal strip, 2 post upright	1
90034	V1, 3	tube, 12AX7/ECC83	2
90002	V2	tube, 6C4/EC90	1
90043	V4	tube, 6CG7	1
90040	V5, 6	tube, 6CA7/EL34	2
90044	V7	tube, GZ34	1
97800	XF1	fuseholder	1
97027	XV1	socket, 9 pin w/shield base	1
97033	XV2	socket, 7 pin w/shield base	1
97025	XV3, 4	socket, 9 pin miniature	2
97032	XV5,6,7	socket, octal	3
40000		nut, hex, #6-32	45
40001		nut, hex, 3/8	11
40005		nut, hex, #10-24	10
40007		nut, hex, #4-40	8
40016		nut, hex, 1/2-24	1
40017		nut, tin., #8-32	10
41000		screw, #6-32 X 1/4	41
41003		screw, #8-32 X 3/8	10
41006		screw, #10-24 X 3/8	10
41016		screw, #4-40 X 1/4	8
41026		screw, #4-40 X 1/4, brass	2
41027		screw, wood, #4 X 3/8, brass	2
41028		screw, #8-32 X 1	4
42000		washer, 3/8 lock	6
42001		washer, 3/8 flat	5
42002		washer, #6 lock	45
42004		washer, #10 lock	10
42007		washer, #4 lock	8
42011		washer, #10 flat	10
42029		washer, rubber, 1/21.D.	1
42032		washer, #8	4
43000		lug, #6 ground	1
43001		lug, pot, 3/8	2
43002		lug, #10 ground	2
43006		lug, gnd #4	1
46000		grommet, 3/8	1
46006		feet, rubber	4
50012		spacer for 50011	2
51006		plug, RCA phono	9
53007		knobs, round	5
53008		knobs, round, long shank	5
57000		line cord	1
58000		wire, hook-up	length
58300		spaghetti	length
58408		cable, 1 cond	length
58410		cable, 4 cond	length
58411		cable, 2 cond	length
58501		wire, bare #22	length
80043		panel	1
81078		bottom plate	1
81093		clamp	1
81100		chassis	1
97300		shield, 9 pin miniature	1
97301		shield, 7 pin miniature	1
66303		manual of instruction (kit)	1
66051		manual of instruction (wired)	1



SELECTOR SWITCH S1 POSITIONS
(shown on schematic in furthest counter-clockwise position, position 1)

POSITION	SETTING
1	TAPE
2	TV
3	TUNER
4	AUX.
5	COL.
6	LON.
7	RIAA
8	AM-78
9	EUR-78

Sym.	Description	Sym.	Description	Sym.	Desctiption	Sym.	Description	Sym.	Description	Sym.	Description
C1	cap., .01 mfd	C16	cap., .25 mfd - 400 V	R4	res., 1.8KΩ, 1/2W, ±10%	R19	res., 33KΩ, 1/2W, ±10%	R34	res., 18KΩ, 1W, ± 5%	R49	res., 150KΩ, 1/2W, ±10%
C2	cap., .1 mfd - 400 V	C17	cap., 100 mmf, 10%	R5	res., 200KΩ, 1/2W, ± 5%	R20	pot., 100Ω, (hum bal.)	R35	res., 33KΩ, 1W, ± 5%	R50	res., 33KΩ, 1W, ±10%
C3	cap., 850 mmf, 10%	C18	cap., .25 mfd - 600 V, 10%	R6	res., 200KΩ, 1/2W, ± 5%	R21	pot., 1MΩ, linear (bass)	R36	res., 28.75KΩ, 1W, ± 5%	R51	res., 68KΩ, 1/2W, ±10%
C4	cap., 500 mmf, 10%	C19	cap., .25 mfd - 600 V, 10%	R7	res., 2.2MΩ, 1/2W, ±10%	R22	pot., 500KΩ, C.T. w/sw. (treble)	R37	res., 180KΩ, 1/2W, ± 5%	R52	res., 22KΩ, 1/2W, ±10%
C5	cap., 5000 mmf, 10%	C20	cap., 750 mmf - 1000 V, 10%	R8	res., 2.2KΩ, 1/2W, ±10%	R23	res., 100KΩ, 1/2W, ±10%	R38	pot., 50KΩ, linear (bal. adj.)	S1	switch, 6P-9Posn. (selector)
C6	cap., 3300 mmf, 10%	C21	cap., .03 mfd - 600 V	R9	res., 90KΩ, 1/2W, ± 5%	R24	res., 3.3KΩ, 1/2W, ±10%	R39	res., 180KΩ, 1/2W, ± 5%	S2	switch, SPST, (off) on R22
C7	cap., 2700 mmf, 10%	C22	cap., 500 mmf, 10%	R10	res., 100KΩ, 1/2W, ± 5%	R25	res., 100KΩ, 1/2W, ±10%	R40	res., 1KΩ, 1/2W, ±10%	T1	power transformer
C8	cap., .025 mfd	C23	cap., 225 mmf, 10%	R11	res., 4.7MΩ, 1/2W, ± 5%	R26	pot., 100KΩ, audio (level)	R41	res., 100KΩ, 1/2W, ± 5%	T2	output transformer
C9	cap., .25 mfd - 400 V	C24	cap., 2 X 20 mfd - 450 V & 2 X 10 mfd - 350 V	R12	res., 560KΩ, 1/2W, ± 5%	R27	pot., compentrol	R42	res., 100KΩ, 1/2W, ± 5%	V1	tube, 12AX7/ECC83
C10	cap., 50 mfd - 150 V			R13	res., 2.2MΩ, 1/2W, ± 5%	R28	res., 4.7KΩ, 1/2W, ±10%	R43	res., 1KΩ, 1/2W, ±10%	V2	tube, 6C4/EC90
C11	cap., 40-20 mfd - 500 V	CR1	rectifier, 50 ma	R14	res., 2.2MΩ, 1/2W, ±10%	R29	res., 220KΩ, 1/2W, ±10%	R44	res., 10Ω, 1W, ± 1%	V3	tube, 12AX7/ECC83
C12	cap., .1 mfd - 400 V	F1	fuse, 3A	R15	res., 1MΩ, 1/2W, ±10%	R30	res., 1KΩ, 1/2W, ±10%	R45	res., 10Ω, 1W, ± 1%	V4	tube, 6CG7
C13	cap., 50 mfd - 150 V	R1	res., 68KΩ, 1/2W, ±10%	R16	res., 2.2KΩ, 1/2W, ±10%	R31	res., 100Ω, 1/2W, ± 5%	R46	res., 3KΩ, 1/2W, ± 5%	V5	tube, 6CA7/EL34
C14	cap., 10 mfd - 25 V	R2	res., 120KΩ, 1/2W, ±10%	R17	res., 47KΩ, 1/2W, ±10%	R32	res., 1MΩ, 1/2W, ±10%	R47	res., 3KΩ, 1/2W, ± 5%	V6	tube, 6CA7/EL34
C15	cap., 50 mfd - 25 V	R3	res., 68KΩ, 1/2W, ±10%	R18	pot., 10KΩ, linear (bias adj.)	R33	res., 3.3KΩ, 1/2W, ±10%	R48	res., 15KΩ, 1W, ±10%	V7	tube, GZ34

EICO

MODEL HF 52 50 WATT INTEGRATED HIGH FIDELITY AMPLIFIER

Electronic Instrument Co., Inc.
Brooklyn 11, N.Y.