INSTALLATION

LOCATION

The amplifier should not be operated in excessively warm locations or near heating vents or radiators. Free air circulation around and through the amplifier cabinet, and an unobstructed air inlet for the blower should be provided. No books, magazines, or equipment should be placed on top of the cabinet to impede the free flow of air.

POWER CONSIDERATIONS

Because of the power involved, this Amplifier should preferably be served by its own 240 VAC electric service line, having three 12 gauge conductors and fused in each "hot" wire for 10 amperes. However, if a single 240 VAC line must serve the entire station, make an effort to connect your equipment so the load will be balanced between the two "hot" wires as nearly as possible.

If only 120 VAC can be provided, use a separate line having 10 gauge conductors and 20 ampere fuses.

DO NOT use this Amplifier at its full ratings on a regular house wiring circuit, as the ratings of the wire will almost certainly be exceeded.

Avoid excessively long runs of wire from your service entrance. A heavy flow of current in such a line results in a voltage drop which can affect the performance of your equipment.

The plug on the power cord for this kit is for standard 120 VAC outlets. For 240 VAC operation in the U.S.A., cut off and replace this plug with a permanent plug that matches your 240 VAC receptacle in a manner such that your power connection conforms with section 210-21 (b) of the National Electric Code, which reads, in part:

> "Receptacles connected to circuits having different voltages, frequencies, or types of current (AC or DC) on the same premises shall be of such design that attachment plugs used on such circuits are not interchangeable."

When you install the new plug, make sure it is connected according to your local electrical code. Keep in mind that the green line cord wire is connected to the amplifier chassis.

For your convenience in identifying conductors, one edge of the heavy line cord is beaded. The other edge is smooth.

ANTENNA

The output circuit of the Amplifier is designed for connection to an unbalanced transmission line of 50 Ω characteristic impedance. Lines of other characteristic impedance may be used providing the SWR (standing wave ratio) does not exceed 2:1.

The antenna connector is a UHF type SO-239. A mating PL-259 plug is furnished for your transmission line. See "Equipment Interconnections" for information on how to install this plug.

Coaxial cables RG-8/U, RG-11/U, or similar types, should be used for the transmission line. The smaller types RG-58/U and RG-59/U are not recommended because of the power level.

The "A.R.R.L. Antenna Book" is commonly available and includes comprehensive reference work on transmission lines and antennas. Other similar handbooks for the amateur are offered for sale and can often be found in a public library.

GROUNDING

A good earth or water pipe ground should be connected to the ground post on the rear apron of the Amplifier. Use the heaviest and shortest connection possible.

Before using a water pipe ground, inspect the connections around your water meter and make sure that no plastic or rubber hose connections are used which interrupt electrical continuity to the water supply line. Install a jumper around any insulating water connectors found. Use heavy copper wire and pipe clamps. It is best to ground all equipment to one point at the operating position and then ground this point as discussed above.

EQUIPMENT INTERCONNECTIONS

Interconnections between this Amplifier and other Heath equipment are shown in the Figure 2 series of illustrations. Other makes of equipment will usually follow the same general pattern.

CABLES FURNISHED

Two phono cables are furnished. These are shielded cables which heve a phono plug molded at each end. Use one cable to connect the amplifier ALC output to the exciter ALC input. Use the second cable to connect the amplifier antenna relay sockat to the exciter antenna relay socket.

An RG-58A/U coaxial cable was made up earlier. This cable is used to connect the exciter RF output to the amplifier RF input.

Antenna Relay

OPERATION

The antenna relay circuit in the Amplifier must be grounded in the transmit mode. Heath exciters contain a provision to accomplish this action. If a relay terminal, or other switching provision is not available, this function must be provided by other means. If a separate coaxial send-receive relay is used in your station, it may have external contacts available. A separate switch can also be used.

HEATH TRANSCEIVERS WITH 11-PIN POWER PLUGS

If you will use your Amplifier with a Heath transceiver which has an 11-pin power plug on the rear panel, refer to Pictorial 5 and perform the following steps to accomplish the Antenna Relay connection.

However, if you have previousiy changed the interior wiring of the transceiver to use one of the spare phono sockets to bring out the exterior antenna relay connection, disregard the following steps and proceed to the "Operations" section.

( ) Cut off and discard the phono plug from one end only of one of the phono cables furnished.

( ) Remove 3/4" of the gray outer insulation of the cable.

( ) Unwind the shield wires from the inner insulation. Then twist the shield wires tightly together and melt a small amount of solder on the ends of the wires.

( ) Remove 1/4" of insulation from the inner conductor, twist the exposed bare wires tightly, and melt a small amount of solder on the wire ends.

( ) Remove the transceiver power cable socket cap and slide it back on the power cable. Then push the prepared end of the phono cable through the socket cap as shown in the Pictorial.

NOTE: When soldering the power socket in the following steps, be very careful thet you do not get the hot soldering iron against the clear sleeving already installed on the adjacent lugs.

( ) Connect the center conductor of the phono cable to lug 11 (S-1), and the shield wires to lug 5 (S-1) of the power socket.

( ) Snap the power socket cap back into place.

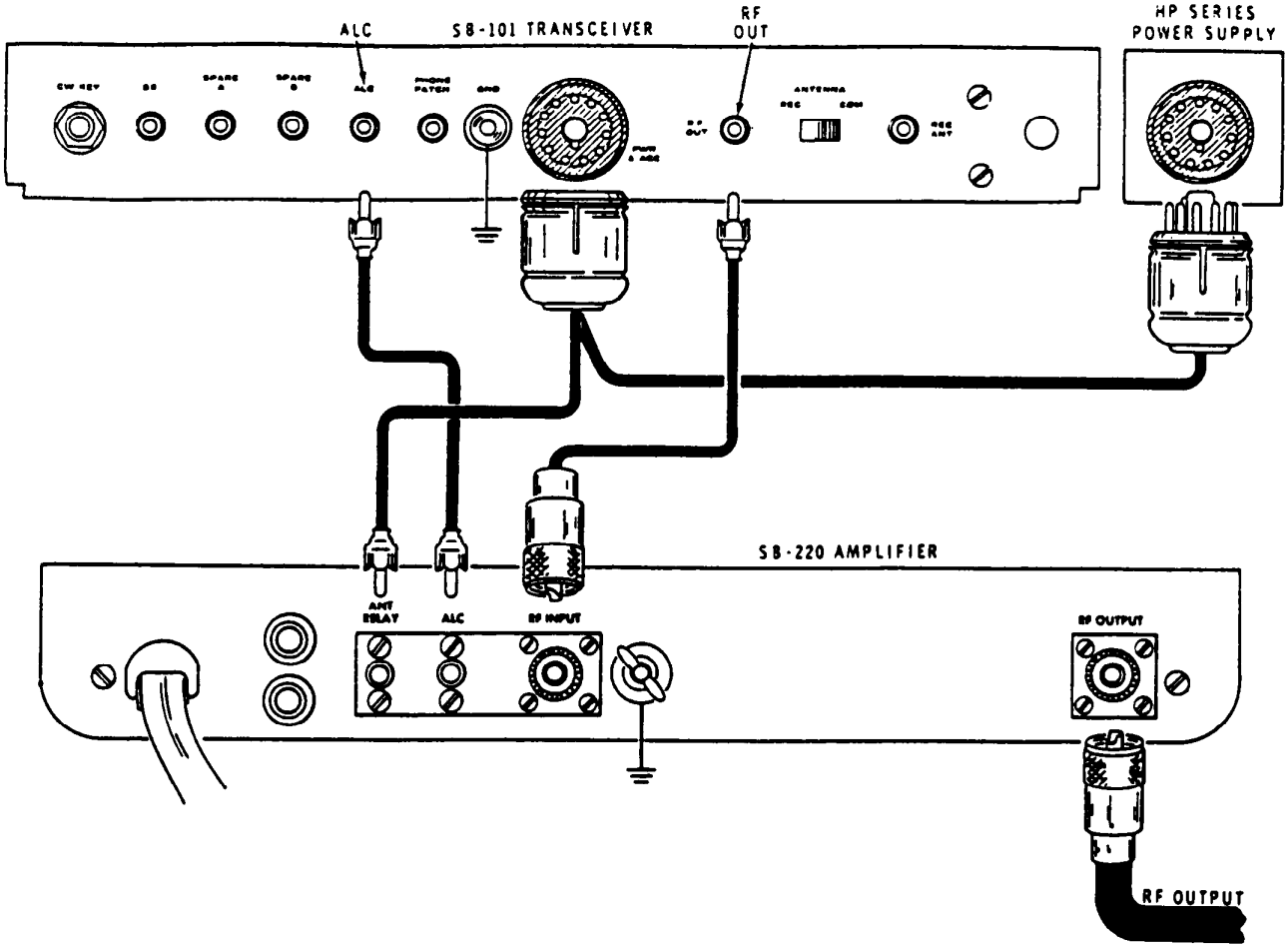
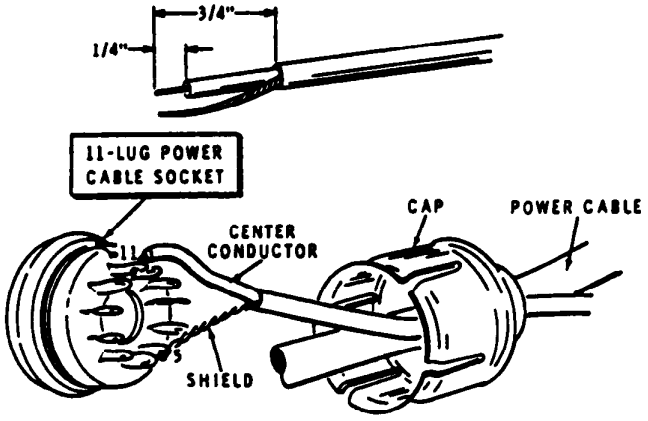


Figure 2-1



PICTORIAL 5

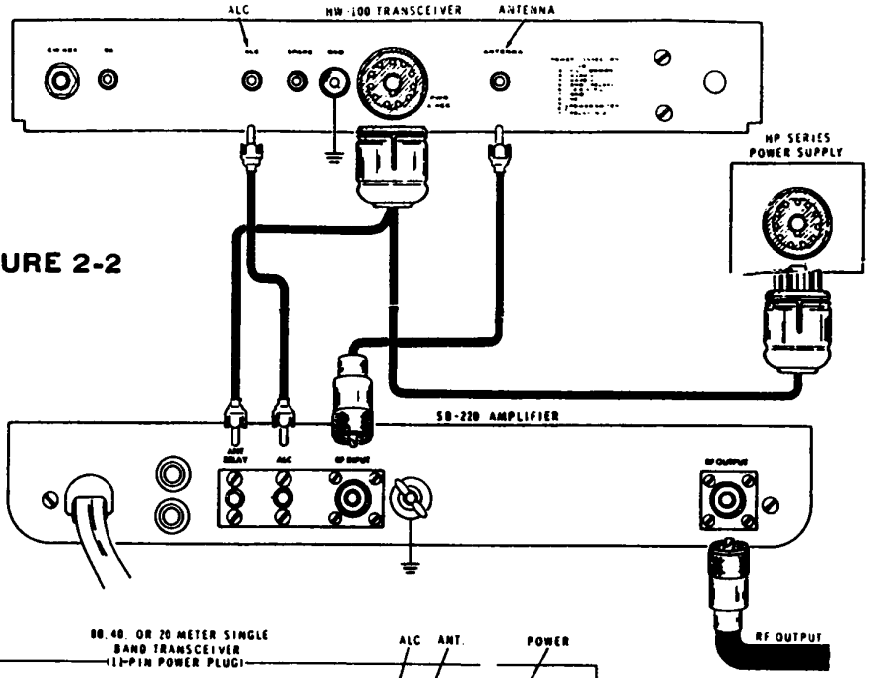


FIGURE 2-2

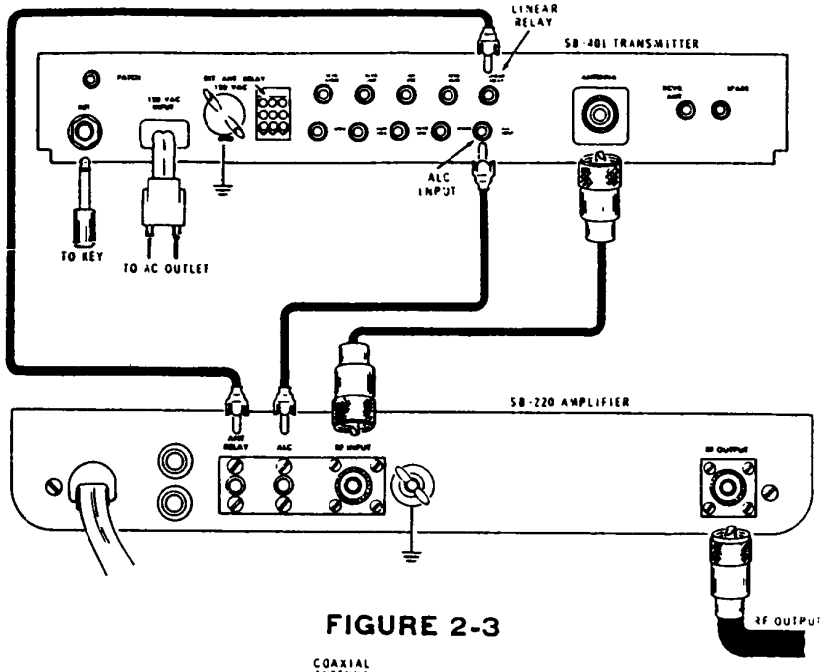


FIGURE 2-3

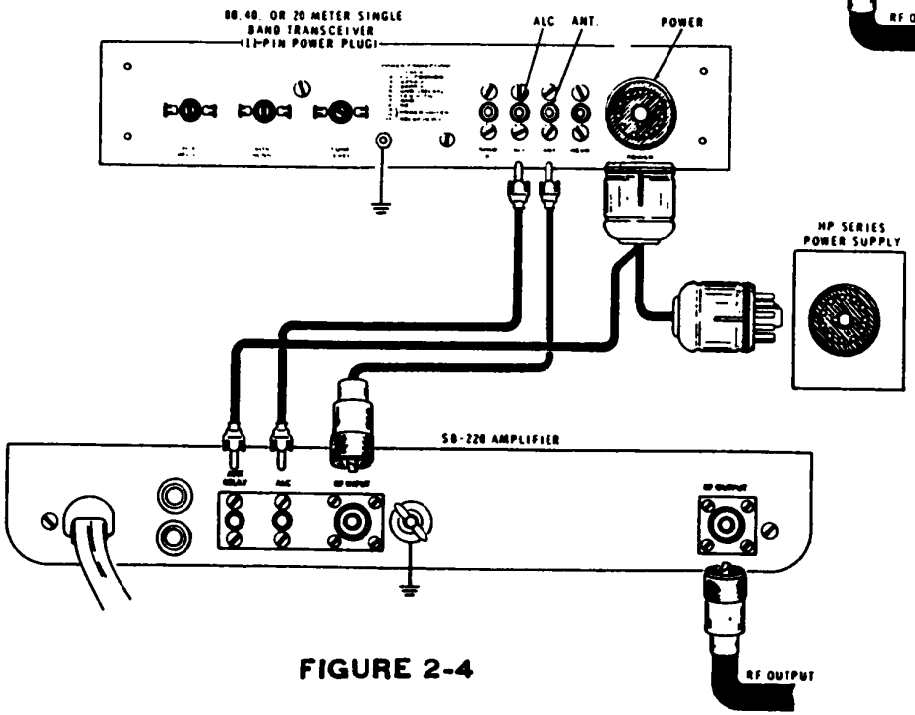


FIGURE 2-4

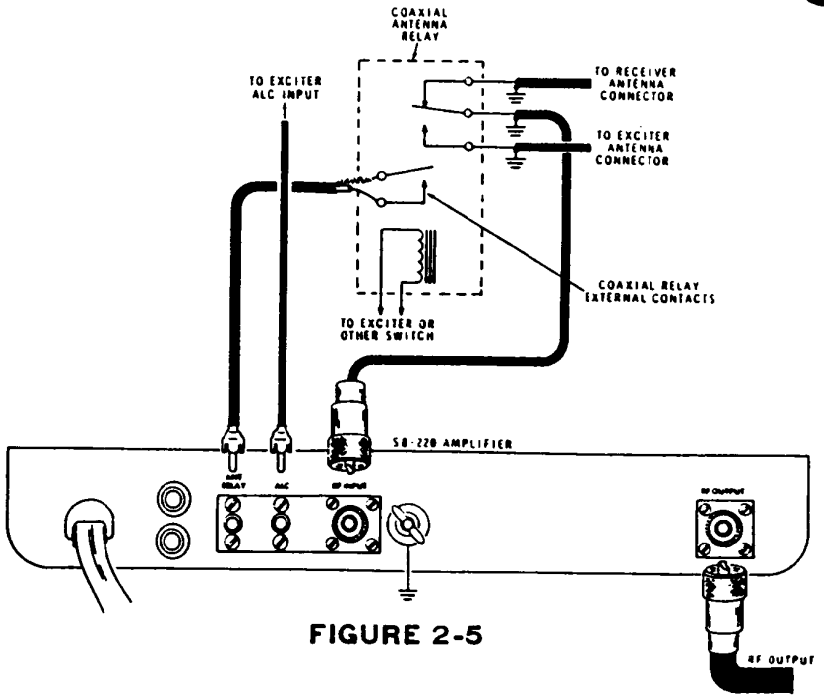


FIGURE 2-5

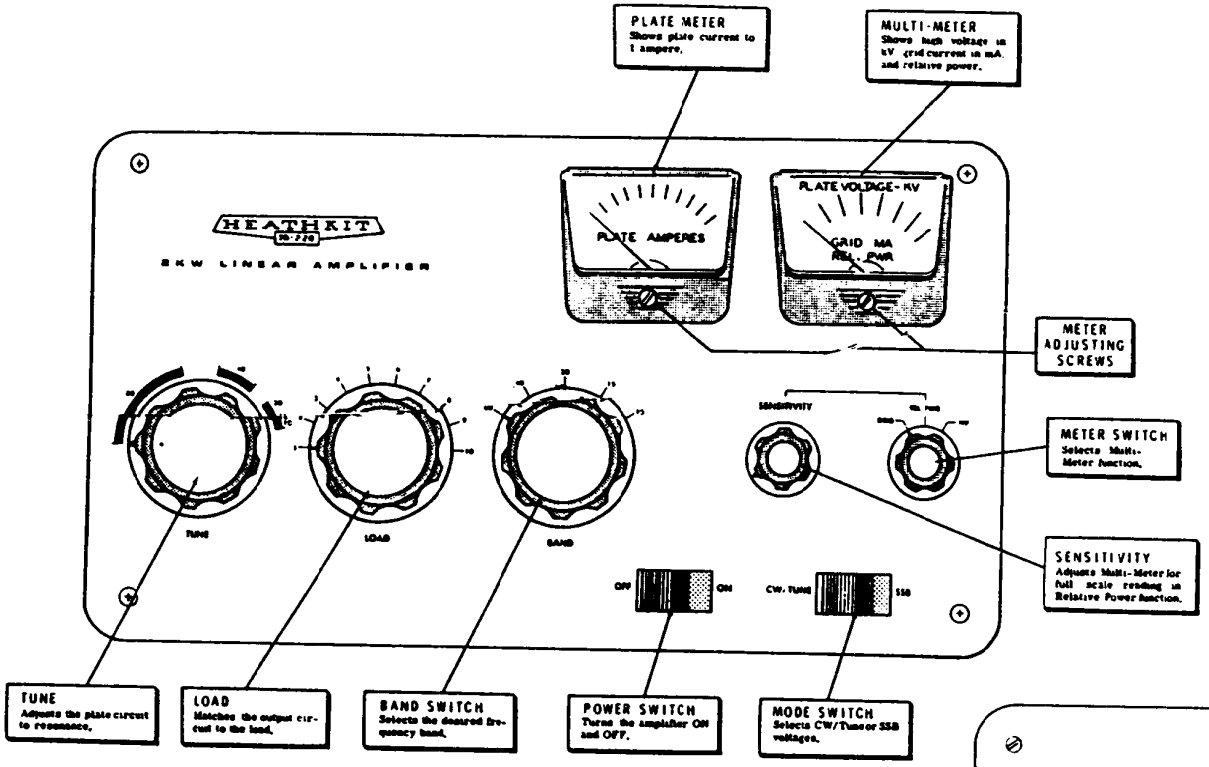


FIGURE 3-1

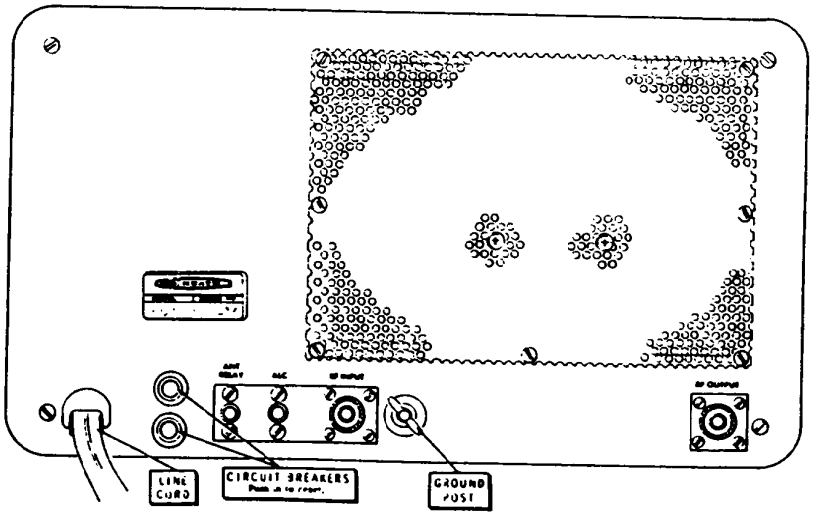


Figure 3-2

OPERATION

CONTROLS, CONNECTORS, AND METERS

Refer to Figure 3-1 (fold-out from Page 68) for identification of the front panel controls and a concise description of the functions of each.

Refer to Figure 3-2 for rear panel connections.

READING THE METER

Refer to Figure 3-3 for illustrations of the two panel meters.

Plate Meter

The Plate Meter is calibrated from 0 to 1 ampere. Note that by adding the proper number of zeros and dropping the decimal point, each scale number may be read as milliamperes. Thus .5 amperes would become 500 milliamperes.

Multi-Meter

Read the Multi-Meter scale which corresponds to the setting of the METER SWITCH:

METER SWITCH POSITION	MEASURES	SCALE READING
GRID	Grid current	0-350 milliamperes (lower scale)
REL PWR	Relative power output	0-350 (lower scale) (Adjust needle deflection to full scale with SENSITIVITY control after tune-up)
HV	High voltage	0-3.5 kilovolts (upper scale)

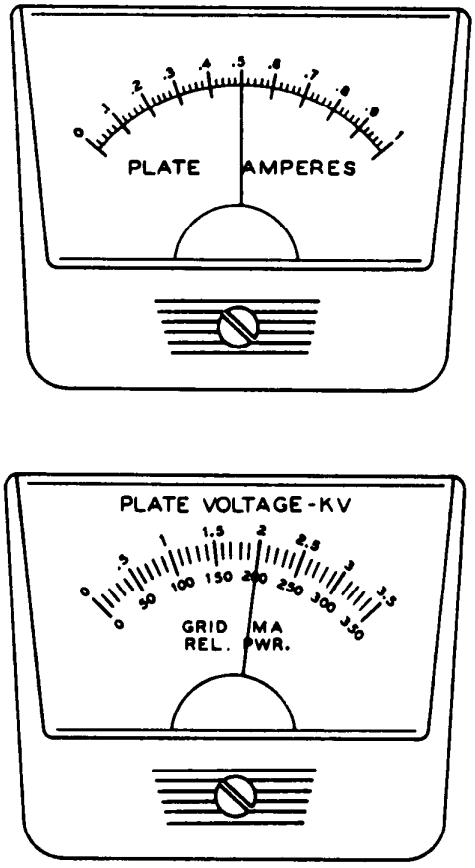


Figure 3-3

GENERAL

SAFETY INTERLOCK

Refer to the Chassis Photograph (Page 87) for the location of the interlock. When the amplifier top cover is in place, the insulator on the underside of the cover opens the interlock, and the high voltage circuit is operational. When the top cover is removed, the interlock closes and connects the high voltage circuit to chassis. This connection will discharge the filter capacitor bank and eliminate a shock hazard.

WARNING: *If the Amplifier is turned ON when the amplifier cover is removed, the high voltage power supply will be short circuited and may be damaged. If this occurs, DO NOT touch any part of the high voltage supply with your hands until all possible high voltage points have been checked with a separate voltmeter.*

CIRCUIT BREAKERS

Push in the red buttons on the two circuit breakers and note their position. When a circuit breaker opens, the red buttons will protrude farther and will be easily noticed.

If one or both circuit breakers open during operation of the Amplifier, turn the amplifier POWER switch OFF; then push the red buttons in to their former position, wait a few seconds, and push the POWER switch to ON. If the breakers will not stay closed, push the POWER switch OFF and locate the reason for the overload.

TUBES

The Amplifier uses "instant heating" type tubes. Therefore, after tune-up, you can use the Amplifier immediately after it is turned on.

It is not abnormal for the tube plates to show a dull red color. If the plates show a bright orange or yellow color, tuning and drive conditions should be investigated immediately, and necessary corractions should be made.

After prolonged usage, let the Amplifier run for several minutes without excitation, so the fan will cool the tubes before the Amplifier is turned off.

DC INPUT POWER

In grounded grid amplifier operation, a considerable portion of the driving power is fed through the amplifier tube. The Amplifier output is the approximate sum of the driver output and the power added by the Amplifier. Both the driver and amplifier input powers must therefore be considered when calculating DC input power.

DRIVING POWER

This Amplifier is designed to operate at full ratings (see Specifications) when driven by an exciter delivering approximately 100 watts of RF output. An exciter of lower power output may be used as a driver, but the Amplifier's output will be less. If you use an exciter that delivers more than 100 watts, carefully adjust the driving power to avoid "over-drive" and the creation of spurious signals which create needless interference to others. The use of the Heathkit Model 610 Monitor Scope is highly recommended for continuous output monitoring. The display on an oscilloscope is the best readily available way of determining the amplitude of the voice peaks which, if excessive, can cause "flat topping" and the radiation of distortion products.

IMPORTANT: In no case should the MIC/CW Level of your exciter be advanced beyond the point where the Amplifier REL. PWR. indication ceases to increase. If the level control is turned past this point, nonlinear operation may be produced.

ALC (Automatic Level Control)

When the Amplifier is overdriven, the ALC circuitry creates a negative voltage which is fed back to the exciter to reduce its gain and help prevent "flat topping."

Protective circuitry of this nature is a valuable circuit element, but it is not a substitute for proper adjustment of the exciter drive.

TUNE-UP

The current and voltage figures given in this section are approximations. Actual readings will vary at each installation with such factors as line voltage, exciter drive, and load impedance.

The following procedure for tuning the Amplifier should take only a few seconds after you go through it a few times. Note the LOAD control position so it can be preset the next time a particular band is used.

CW AND RTTY PROCEDURE

Make sure the Amplifier has been installed as described and illustrated in the "Installation" section. IMPORTANT: Before proceeding, make sure you have a dummy load (such as the Heathkit Cantenna) or an appropriate antenna connected to the Amplifier output.

( ) Set the Amplifier controls as follows:

SWITCH OR CONTROL	POSITION	COMMENTS
TUNE	Desired band segment	
LOAD	1 (80 and 40 bands) 4 (20, 15, and 10 bands)	After tune-up, note position so control can be preset in the future.
BAND	Desired band	
SENSITIVITY	12 o'clock	Keep needle on scale with SENSITIVITY control. After tune-up, adjust as desired.
METER	REL. PWR.	
POWER	OFF	
MODE	CW/TUNE	

( ) Tune your exciter for full CW output at the desired frequency. The MULTI-METER on the Amplfiier, when switched to indicate REL. PWR., will show the relative power output of the exciter and may be used even though the Amplifier is off.

( ) Reduce the exciter output to 0 by placing its controls in the receive mode; also turn its MIC/CW Level control fully counterclockwise.

( ) Turn the Amplifier on.

( ) Place the exciter in the tune mode. The amplifier plate meter should read approximately .12 ampere resting plate current. Then advance the Level control until the PLATE METER shows .3 ampere.

( ) Peak (adjust) the amplifier TUNE and LOAD controls for maximum REL. PWR. meter indication.

( ) Advance the drive to .4 ampere plate current and repeak the TUNE and LOAD controls. The Meter readings should then be approximately:

Plate amperes = .35
High voltage = 2100
Grid mA = 110

( ) Alternately adjust the TUNE, LOAD, and exciter drive controls for the desired input. Refer to Figure 3-4. The meter readings at 1 kw input will be approximately:

Plate amperes = .5
High voltage = 2000
Grid mA = 100-200

( ) Advance the SENSITIVITY control for the desired REL. PWR. meter reading.

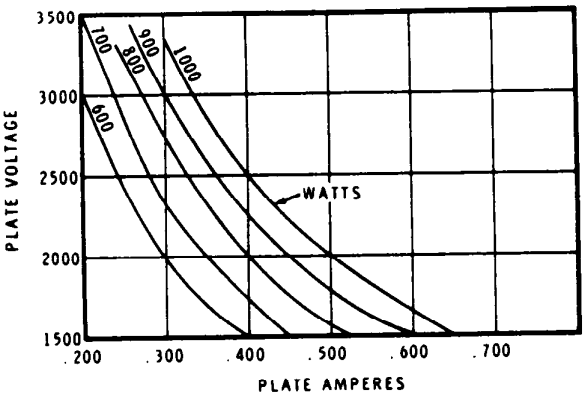


Figure 3-4

( ) Turn the exciter Mode switch to Standby or the desired transmission mode.

The Linear Amplifier is now loaded for operation on CW or RTTY. If an oscilloscope is being used for monitoring, a display similar to that shown in Figure 3-5 should be obtained. If you have a Heathkit Model 610 Monitor Scope, you may find that its optional trapezoid display pattern is more easily interpreted for voice patterns.

CAUTION: While actually transmitting, DO NOT switch between CW/TUNE and SSB modes.

SSB PROCEDURE

( ) Tune up the exciter and Amplifier as for CW operation. NOTE: In the absence of the recommended oscilloscope monitor, either the PLATE METER or the REL. PWR. indication can be used to monitor SSB transmission. The PLATE METER indications are easier to follow.

Low Power SSB

( ) For 1000 watts P.E.P. operation, switch the exciter only to the SSB mode. Leave the amplifier MODE switch at CW/TUNE.

( ) Adjust the exciter drive control so the PLATE METER will indicate between .12 and .2 ampere with average speech. Hard voice peaks should not exceed .250 ampere.

High Power SSB

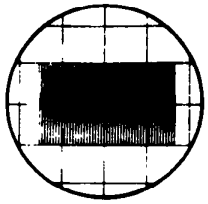
( ) For 2000 watts P.E.P. operation, switch both the exciter and the amplifier MODE switch to SSB.

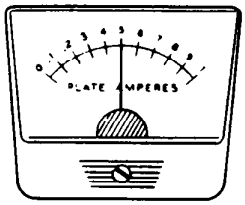
( ) Advance the exciter drive level until the PLATE METER reads from .2 to .3 ampere with average speech and no higher than .33 ampere on hard voice peaks. A higher drive level will cause "flat topping."

An example of a proper SSB oscilloscope pattern is shown in Figure 3-6. Note that there are sharp, distinct peaks. The number of patterns or "christmas trees" will depend upon the operator's voice characteristics and the scope sweep speed. Set the scope for approximately 30 Hz sweep.

Note that the meter reading on voice peaks will not be high, due to meter inertia and voice characteristics; however, the height of the oscilloscope pattern is greater than that shown in Figure 3-5.

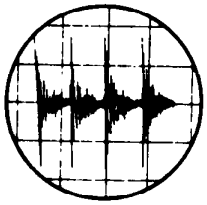
Figure 3-7 shows the same voice pattern but with extreme "flat topping." The oscilloscope shows that no more useful power is being developed. When the drive level is too high the meter reads higher, but only distortion is developed.

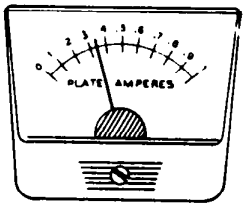




Oscilloscope pattern and plate meter reading resulting from carrier or "single tone" modulation. The meter indicates CW plate current input.

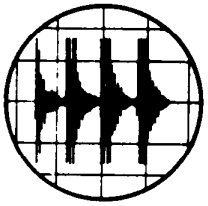
Figure 3-5

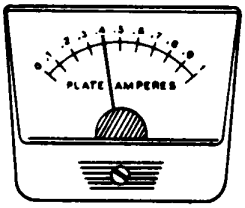




Oscilloscope pattern and plate meter reading in 2000 watt SSB mode. Notice the peaks on the oscilloscope pattern. They are sharp, indicating a clean signal, and they will attain a height greater than the "single tone" pattern of Figure 3-5, indicating maximum power input.

Figure 3-6





Oscilloscope pattern and plate meter reading resulting from overdrive. The meter reads higher, but the scope indicates peak flattening. Operation in this manner causes distortion and severe interference to edjacent frequencies.

Figure 3-7

PERIODIC MAINTENANCE

Remove the top cover of the Amplifier and remove the dust at least once a year. This can be done by using the blower connection on a vacuum cleaner, or by a soft bristle brush.

While the top cover is removed, add one drop of light machine oil to each fan bearing.

IN CASE OF DIFFICULTY

Refer to the Kit Builders Guide for Service and Warranty information.

NOTE: Operating the Amplifier outside the specified power or frequency range (or both) may damage components. Such damage is not covered by the Heath warranty.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.

2. The majority of the kits that are returned for repair, do not function properly due to poor connections and soldering. Many troubles can be eliminated by carefully reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of the "Kit Builders Guide."

3. Make sure that the tubes light up properly. If they do not, remove the tubes from their sockets and check for continuity between pins 1 and 5 with an ohmmeter. An infinite resistance will indicate a faulty tube filament.

4. Check the values of the parts. Be sure that the proper part has been wired into the circuit as shown in the Pictorial Diagrams and as called out in the wiring instructions.

5. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

6. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

TROUBLESHOOTING CHART

DIFFICULTY	POSSIBLE CAUSE
1. No AC power	A. Circuit breakers open. B. Jumpers missing on terminal strip AE. C. Terminal strip AE wired wrong.
2. Meter inoperative in one position: A. GRID. B. REL. PWR. C. HV.	A. Resistor R1, R3. B. D17, R25, R24, C54, R26. C. R6, R7, R8, R9. D. Meter switch.
3. Meter circuits inoperative	A. Meter jumper wire not removed. B. R2, C3, C8. C. Meter switch.
4. Idle current over .15A in CW/TUNE position.	A. ZD1.
5. No idle current	A. Relay. B. ZD1. C. V1 - V2.
6. No high voltage	A. D1 - D14. B. C10 - C17. C. R12 - R19. D. T1. E. R1 or R3. F. C29. G. Top cover off (interlock).
7. Relay will not activate	A. D16. B. C4. C. Ant-Relay jack. D. T2. E. RL-1.
8. Final tune has no effect	A. Bandswitch wafer #2 180 degrees out of position. B. L7 installed wrong. C. Improper load on the Linear Amplifier. D. V1, V2.

DIFFICULTY	POSSIBLE CAUSE
9. No RF output	A. Relay wired wrong. B. L7 installed wrong. C. Coax shorted. D. C29.
10. ALC inoperative	A. Wiring error or component failure on terminal strip BE. B. ALC jack.
11. Amplifier hard to drive.	A. Coaxial leads to the input bandswitch reversed.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

SPECIAL SHIPPING INSTRUCTIONS FOR U.S. AND CANADA

DO NOT ship an assembled Model SB-220 amplifier unless it is packed in the Model 220 Service Pack. Due to the weight of the transformers, shipment without special packaging will almost certainly result in damage.

OVERSEAS SHIPMENT NOTE: Shipment from overseas sources with the transformers mounted is not recommended.

SPECIFICATIONS

Band Coverage	80, 40, 20, 15 and 10 meter amateur bands.
Driving Power Required	100 watts.
Maximum Power Input	SSB: 2000 watts P.E.P. CW: 1000 watts. RTTY: 1000 watts.
Duty Cycle	SSB: continuous voice modulation. CW: Continuous (maximum key-down 10 minutes). RTTY: 50% (maximum transmit time 10 minutes).
Third Order Distortion	-30 dB or better.
Input Impedance	52 Ω unbalanced.
Output Impedance	50 Ω unbalanced; SWR 2:1 or less.
Front Panel	Tune. Load. Bandswitch. Sensitivity. Meter switch. Power. CW/Tune – SSB. Plate meter. Multi-meter (Grid mA, Relative Power, and High Voltage).
Rear Panel	Line cord. Circuit breakers (two 10 A). Antenna Relay (phono). ALC (phono). RF Input (SO-239). Ground post. RF output (SO-239).

Tubes	Two 3-500Z.
Power Required	120 VAC, 50/60 Hz, at 20 amperes maximum. 240 VAC, 50/60 Hz, at 10 amperes maximum.
Cabinet Size	14-7/8" wide, 8-1/4" high, 14-1/2" deep.
Net Weight	50 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic (fold-out from Page 87) to identify the circuit components while reading this section.

POWER SUPPLY

The power supply uses high voltage transformer, T1, and a filament and bias transformer, T2. Each transformer has dual primary windings which are connected in parallel for 120 VAC operation, or in series for 240 VAC electric service. The transformers are protected by two 10 ampere circuit breakers, wired so they provide appropriate overload protection for either primary voltage.

The fan motor is connected across one of the primary windings on the high voltage transformer and always operates on 120 VAC.

The AC input line is by-passed for RF by capacitors C1 and C2.

HIGH VOLTAGE SUPPLY

The primary windings of the high voltage transformer, T1, are tapped, and the six leads are connected to the Mode and Power switches.

When the Mode switch is in the CW/Tune position, the entire portion of each primary winding is connected to the power line. When this switch is in the SSB position, only the tapped portion of each primary winding is connected to the power line.

When the tapped windings (fewer turns) are connected to the power source, a higher secondary-to-primary turns ratio is being used and a higher secondary voltage for SSB operation results.

The transformer secondary is connected in a full-wave, voltage-doubling circuit. The AC voltage is rectified by diodes, D1 through D14, and it is filtered by series-connected electrolytic capacitors C10 through C17. Resistors R12 through R19 parallel the filter capacitors and equalize the voltage drop across each capacitor in the series. They also act to discharge the filter capacitors after the power switch is turned off.

The red-yellow transformer lead is connected to the junction of capacitors C13 and C14. During the half-cycle when this lead is positive, capacitors C14 through C17 are charged. During the other half-cycle, the red lead is positive and capacitors C10 through C13 are charged. These two capacitor strings are in series across the load, and the voltages of each group add together.

Resistors R1 and R3 are discussed under "Metering Circuits."

Chokes RFC 1 and RFC 2 and bypass capacitors C6 and C7 are used to keep RF energy out of the power supply circuits.

The interlock grounds the output of the high voltage supply when the top cover of the Amplifier is removed. This feature protects the user against a shock from undischarged filter capacitors. The Amplifier must not be turned on while the top cover is removed as the high voltage supply is short-circuited under these circumstances.

FILAMENT AND BIAS SUPPLY

Transformer T2 has two secondary windings. One winding furnishes 5 VAC at 30 amperes for the amplifier tube filaments. The two #47 pilot lamps for meter illumination are also connected across the filament line.

Filament supply is fed to the two tubes through RFC 3, a coil which is bifilar wound on a ferrite core. This coil forms a choke to raise the tube filaments above RF ground so the driving voltage will not be short-circuited.

The second winding on transformer T2 is used in a half-wave rectifier circuit for the bias supply voltage, to operate relay RL1, and to furnish ALC threshold voltage. The AC voltage from this winding is rectified by D16 and filtered by C4. This DC voltage is connected to lugs 3 and 11 of relay RL1. In the receive mode, this voltage is applied through lug 9 to the center-tap of the filament winding. This positive voltage increases the voltage difference between the tube grids (which are grounded for DC) and the tube filaments, which now carry the positive DC voltage in addition to the AC filament voltage. The tube grids are consequently biased beyond cutoff and no plate current flows.

In the transmit mode, the center-tap of the filament winding is connected to ground through lugs 9 and 6 of the relay, the 5.1 volt zener diode ZD1, and R3. The plate current through the zener develops 5.1 VDC operating bias for the tubes and limits the idling plate current.

RELAY

The relay has three sets of single-pole, double-throw contacts. When the relay coil circuit is open the contacts are in the receive mode.

Approximately 120 VDC is connected to one side of the relay coil at lug 11. Lug 10 connects the other side of the relay coil to the Antenna Relay jack on the rear panel. This jack is usually connected to normally open relay contacts in the exciter (such as a VOX or PTT relay). When these relay contacts close, they must connect the amplifier relay coil circuit to ground. The amplifier relay will then close and its contacts will be in the transmit mode.

The function of amplifier relay contacts 3, 6, and 9 was discussed in the "Bias Supply" section.

Relay contact 7 is connected to the RF INPUT connector. In the receive mode the incoming signal is transferred directly to the RF Input through relay contacts 8, 2, 1, and 7. In the transmit mode, the RF Input voltage is connected through relay contacts 7 and 4 to lug 1 of Band-switch wafer 1F.

In the transmit mode, the RF Output is connected through relay contacts 5 and 8 to the pi network output circuit of the Amplifier.

RF CIRCUITS

INPUT CIRCUIT

An input impedance-matching pi network circuit for each band is connected by Band-switch wafer 1. After passing through the matching circuit, the RF driving power is coupled to the tube filaments by C32. Capacitor C21 equalizes any RF voltage difference between the filament leads.

TUBES

The amplifier tubes are connected in parallel in a class B grounded grid· circuit. RF driving power is applied to the filaments in the normal cathode-driven configuration. As mentioned in "Power Supply" section, RFC 3 holds the filaments above RF ground.

Pins 2, 3, and 4 of each tube are connected together internally. Each of the three grid pins is bypassed to ground. This combination of RF chokes and capacitors provides a predetermined level of negative feedback at the tube grids to further reduce intermodulation distortion.

PC-1 and PC-2 are parasitic chokes in each tube plate lead to suppress any VHF parasitic oscillations.

The positive side of the power supply is connected in parallel to the tubes through RFC 1.

Cooling air is circulated around the tubes by the fan.

OUTPUT CIRCUIT

The tuned output circuit of the Amplifier is a pi network composed of plate tuning capacitor C55, loading capacitors C56 and C57, and coils L6 and L7.

Band-switch wafer 2 progressively shorts out the unused portions of coils L6 and L7. The coil turns in use are tuned to resonance by Tune capacitor C55. Load capacitor C57 is tuned to complete the impedance match between the tubes and the load connected to the RF OUTPUT. On the 80 meter band, fixed capacitor C58 is switched in parallel with C57 to provide the additional capacitance required on this bend.

If a DC voltage is unintentionally applied to the plate output circuit, RFC 6 will provide a DC path to ground, thus short-circuiting the high voltage supply and opening the circuit breakers.

ALC CIRCUIT

Approximately 60 VDC ALC threshold voltage is available at the junction of resistors R4 and R5, which form a voltage divider across the bias supply winding of transformer T2. C5 is an RF bypass, and R11 is an isolation resistor.

C47 couples some RF driving voltage to voltage divider R21-R22. C48 and C49 are frequency compensating capacitors for R21 and R22, respectively.

When the RF driving voltage at the junction of R21-R22 exceeds the ALC threshold voltage, D18 will rectify the negative half-cycles. C51 and C53 act as filters and RF bypasses: R23 is an isolation resistor.

The negative voltage appearing at the ALC connector may be coupled back to the exciter to reduce its gain and help reduce "flat-topping" of voice peaks due to overdrive.

METERING CIRCUITS

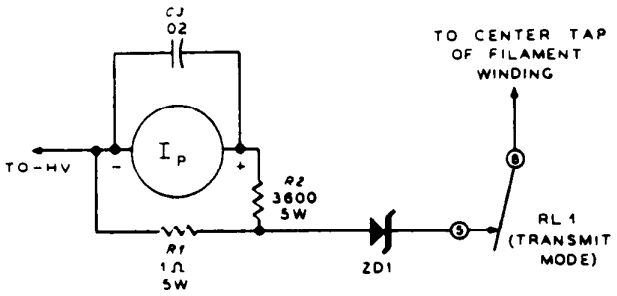


Figure 4-1

PLATE METER (Figure 4-1)

The Plate Meter reads the total plate current drawn by both tubes from 0 to 1 ampere. It is placed in series with a multiplier resistor, R2, and it measures the voltage drop across shunt resistor R1 through which the plate current passes.

MULTI-METER

Grid Current (Figure 4-2)

To read grid current, the Multi-Meter is switched in parallel with shunt resistor R3. The grid circuit return is to the center tap of the filament winding of transformer T2. Note that grid current only passes through R3, as the return for the high voltage circuit is through R1, R2, and the Plate Meter.

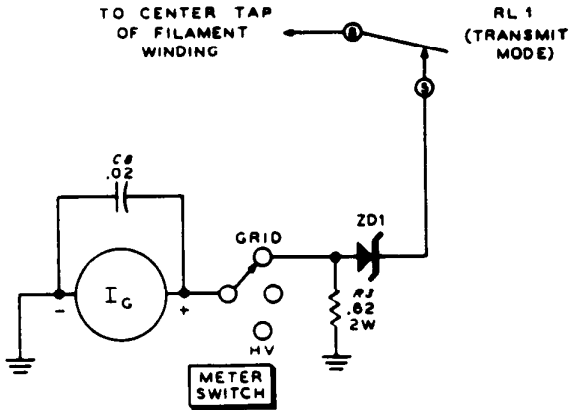


Figure 4-2

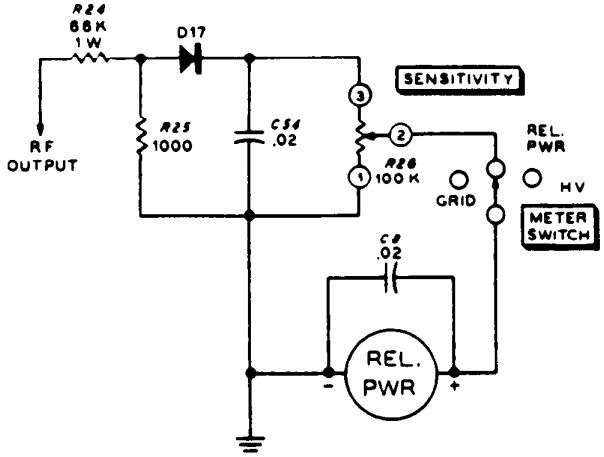


Figure 4-3

Relative Power (Figure 4-3)

Voltage divider R24 and R25 is connected across the RF OUTPUT. The voltage at the junction of these resistors is rectified by diode D17, filtered by C54, and applied through Sensitivity control R26 to the Multi-Meter. The Sensitivity control adjusts the Multi-Meter for the desired reading.

High Voltage (Figure 4-4)

High voltage is measured by switching the Multi-Meter to the junction of the multiplier resistors (R6, R7, and R8) and the shunt resistor R9. The meter scale is calibrated to indicate voltage, based upon the current flowing through the meter and R9 in parallel, the combination being in series with the multiplier resistors R8, R7 and R6.

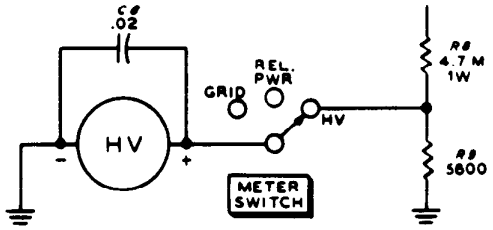
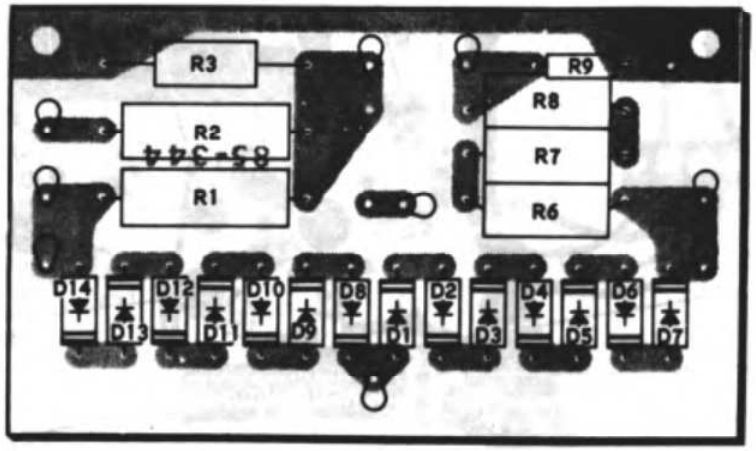


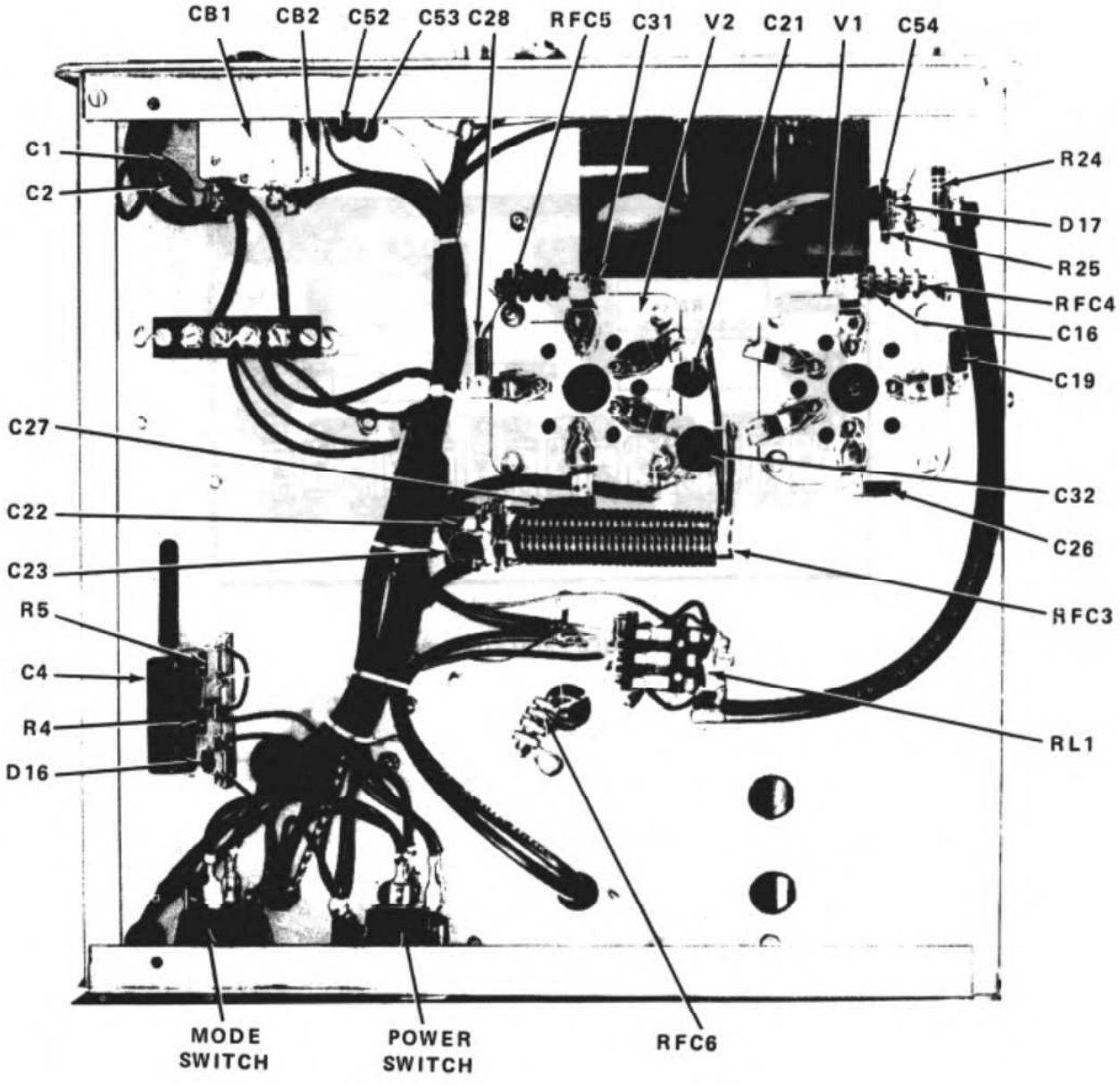
Figure 4-4

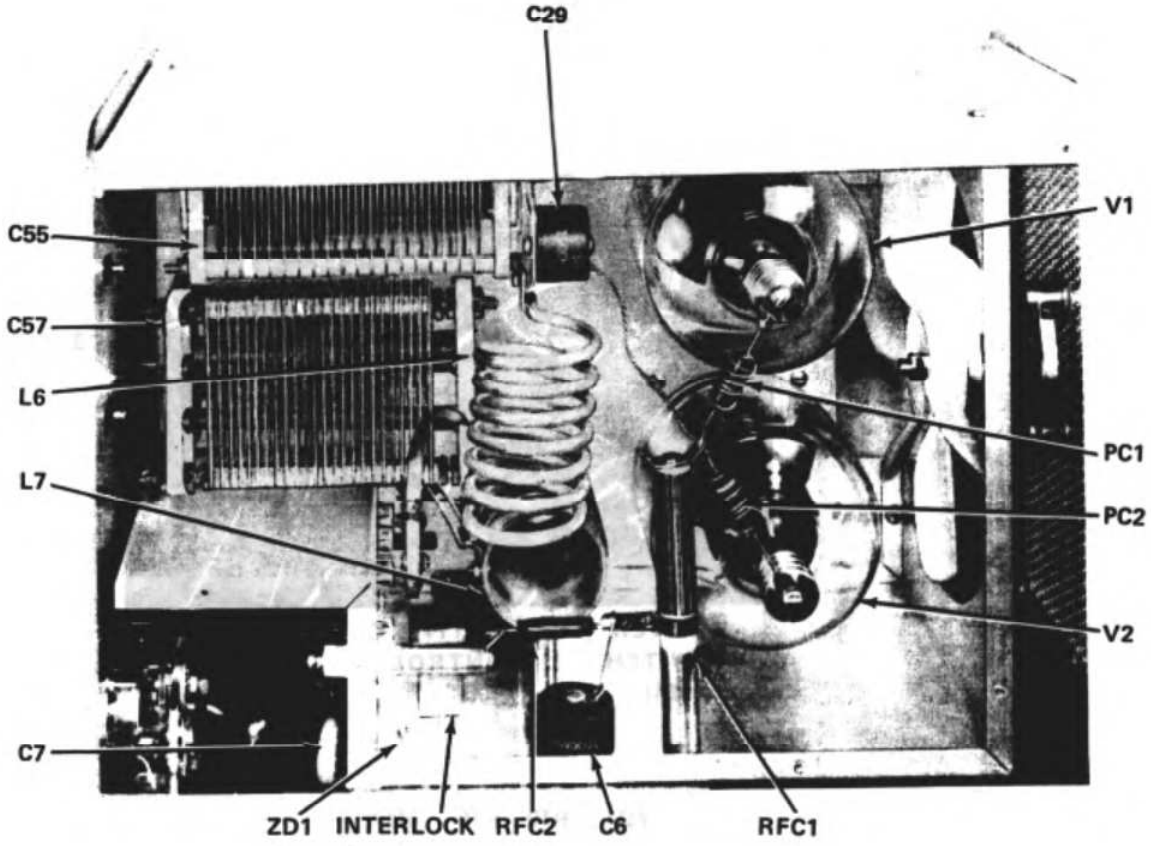
CIRCUIT BOARD X-RAY VIEW

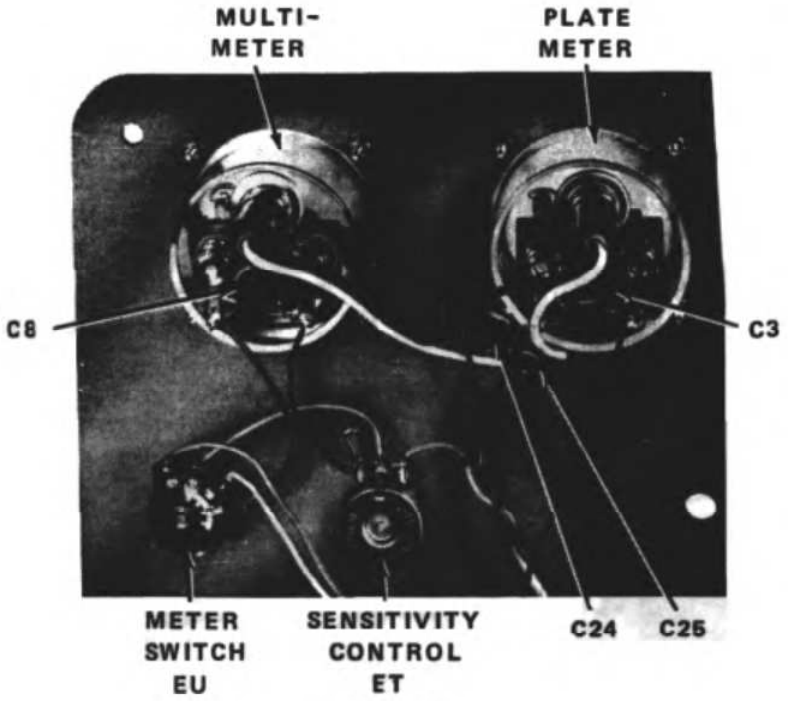


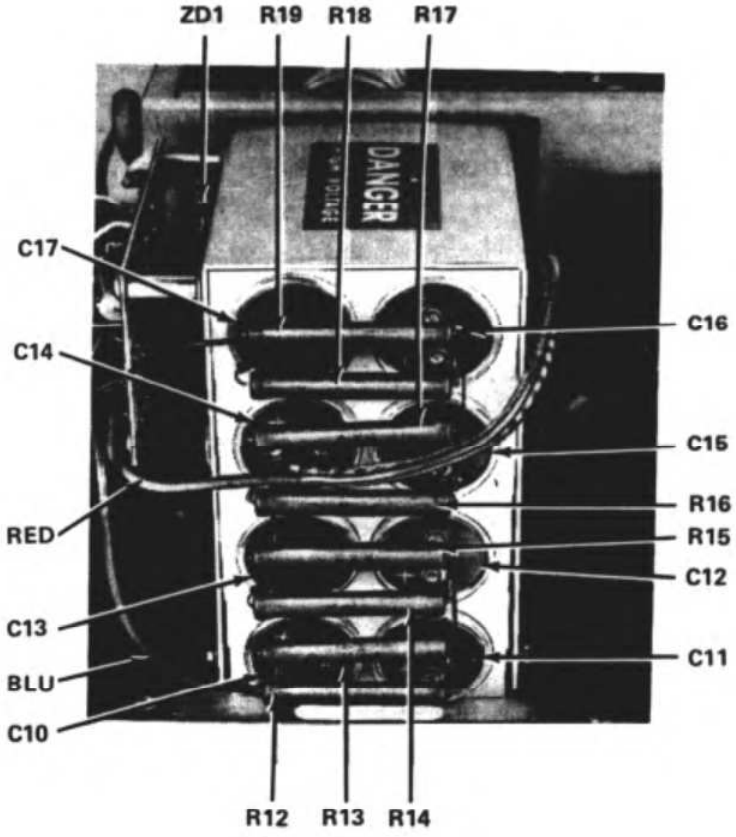
(VIEWED FROM FOIL SIDE)

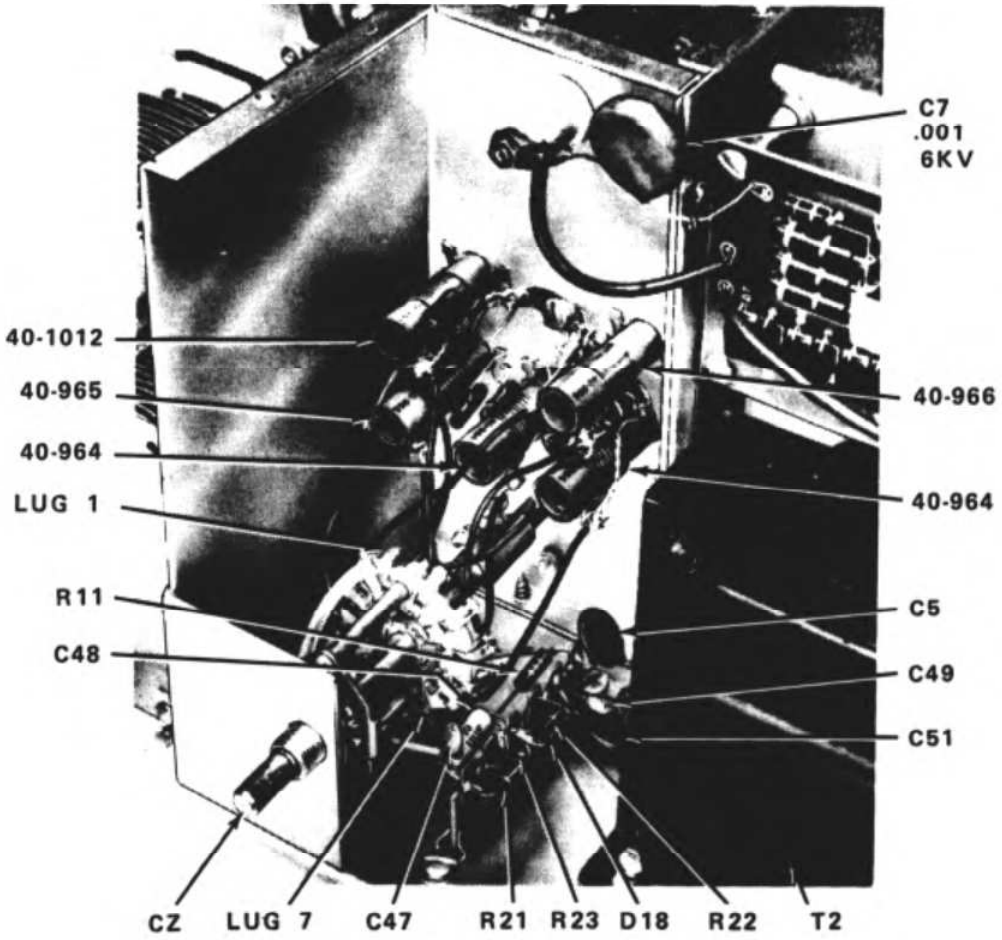
CHASSIS PHOTOGRAPHS

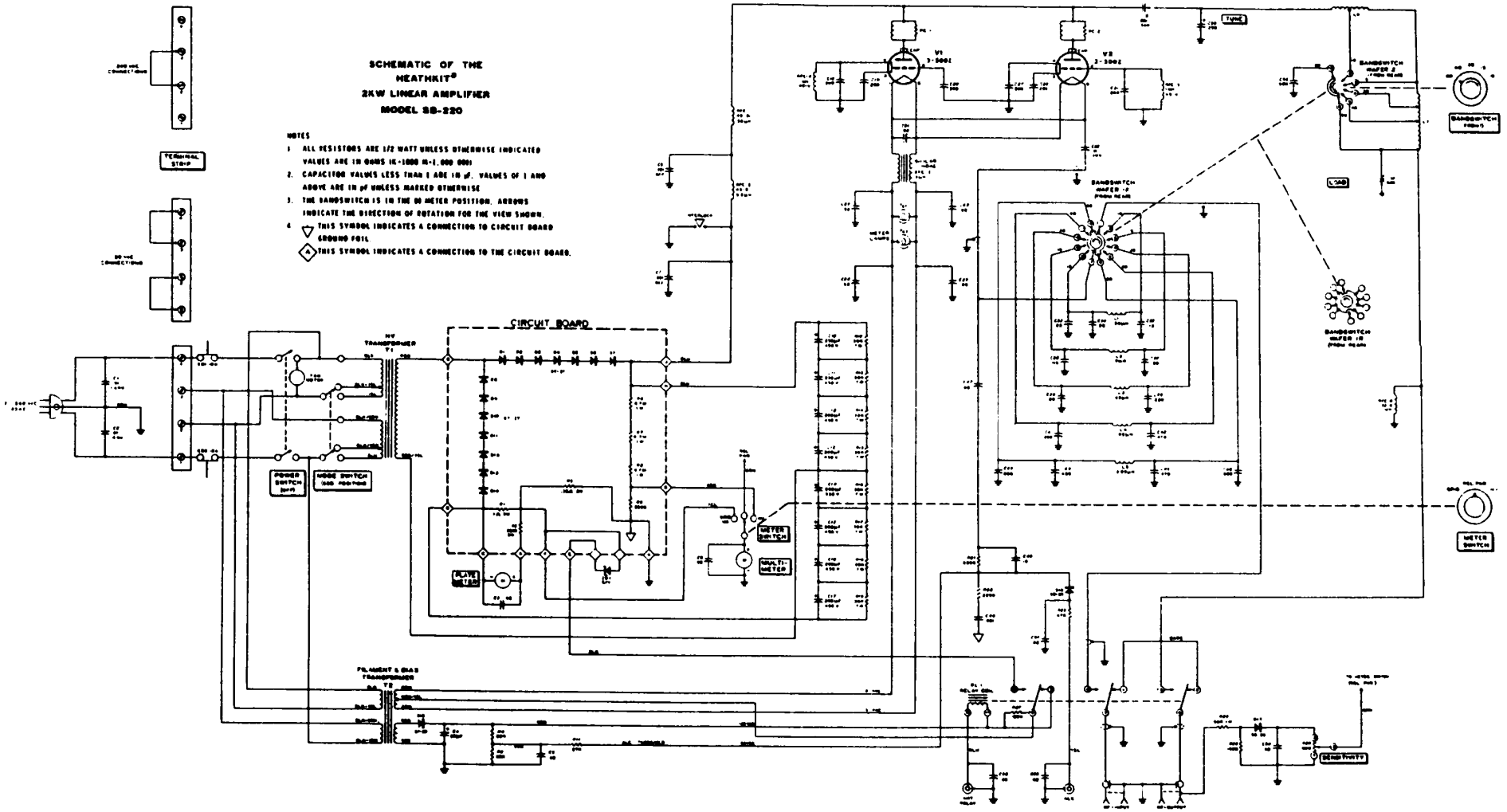



C29
C55
C57
L6
L7
C7
V1
PC1
PC2
V2
ZD1
INTERLOCK
RFC2
C6
RFC1


MULTI-
METER
PLATE
METER
C8
C3
METER
SWITCH
EU
SENSITIVITY
CONTROL
ET
C24
C25


ZD1
R19
R18
R17
DANGER
C17
C16
C14
C15
R16
RED
R15
C12
C13
C11
BLU
C10
R12
R13
R14


C7
.001
6KV
40-1012
40-965
40-964
LUG 1
R11
C48
40-966
40-964
C5
C49
C51
CZ
LUG 7
C47
R21
R23
D18
R22
T2


SCHEMATIC OF THE
HEATHKIT®
2KW LINEAR AMPLIFIER
MODEL SB-220
NOTES
1. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE INDICATED
VALUES ARE IN OHMS (K=1000 M=1,000,000)
2. CAPACITOR VALUES LESS THAN 1 ARE IN µF. VALUES OF 1 AND
ABOVE ARE IN pf UNLESS MARKED OTHERWISE
3. THE BANDSWITCH IS IN THE 80 METER POSITION. ARROWS
INDICATE THE DIRECTION OF ROTATION FOR THE VIEW SHOWN.
4. THIS SYMBOL INDICATES A CONNECTION TO CIRCUIT BOARD
GROUND FOIL
THIS SYMBOL INDICATES A CONNECTION TO THE CIRCUIT BOARD.
CIRCUIT BOARD
TUNE
LOAD
METER SWITCH
METER SWITCH
POWER SWITCH
MODE SWITCH
PLATE METER
MULTI-METER

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- Use a separate letter for all correspondence.
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  Total enclosed $_____
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CITY _____

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TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

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BENTON HARBOR
MICHIGAN 49022
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Phone (Replacement parts only): 616 982-3571

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HANDLING AND SHIPPING			
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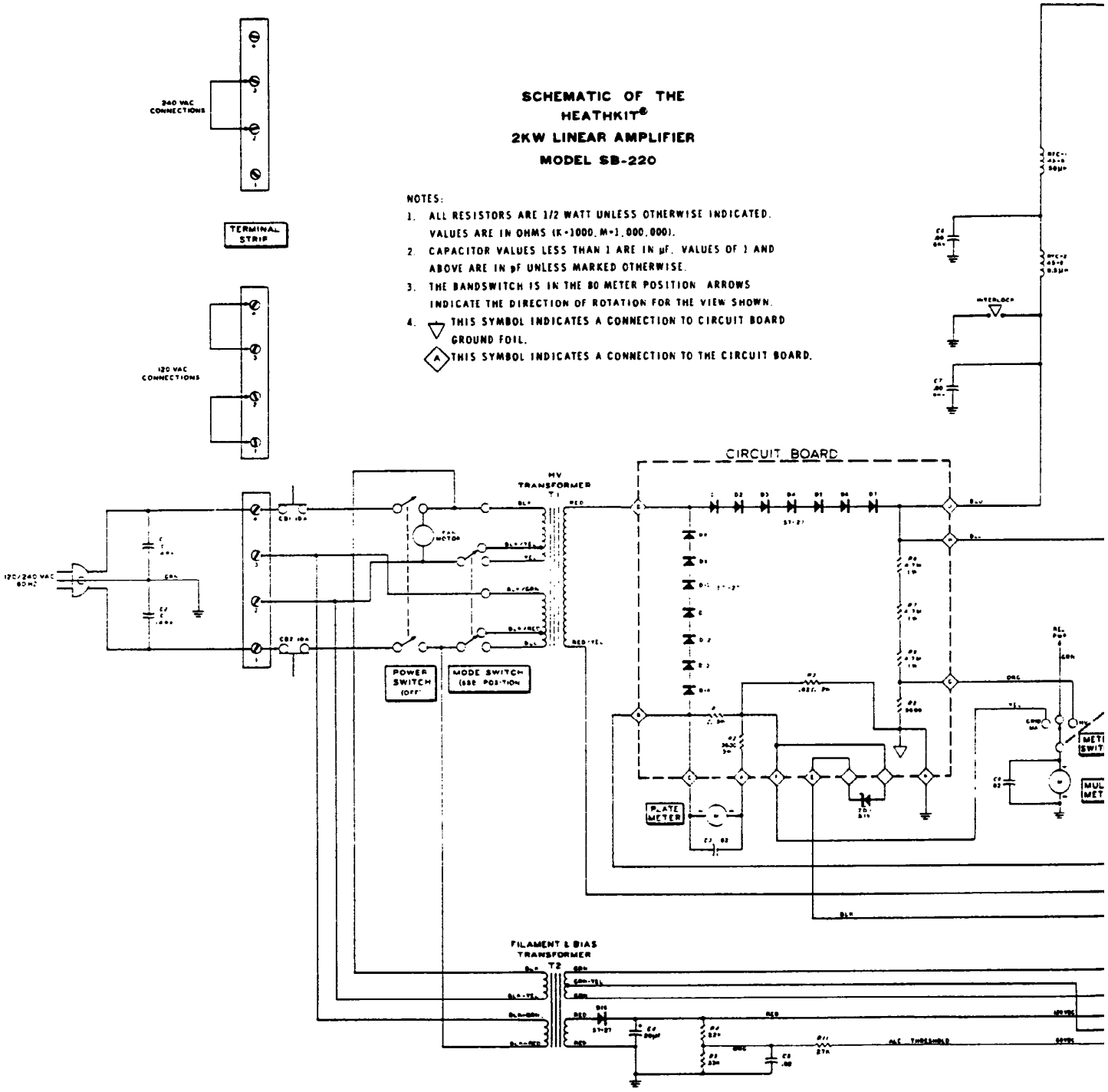
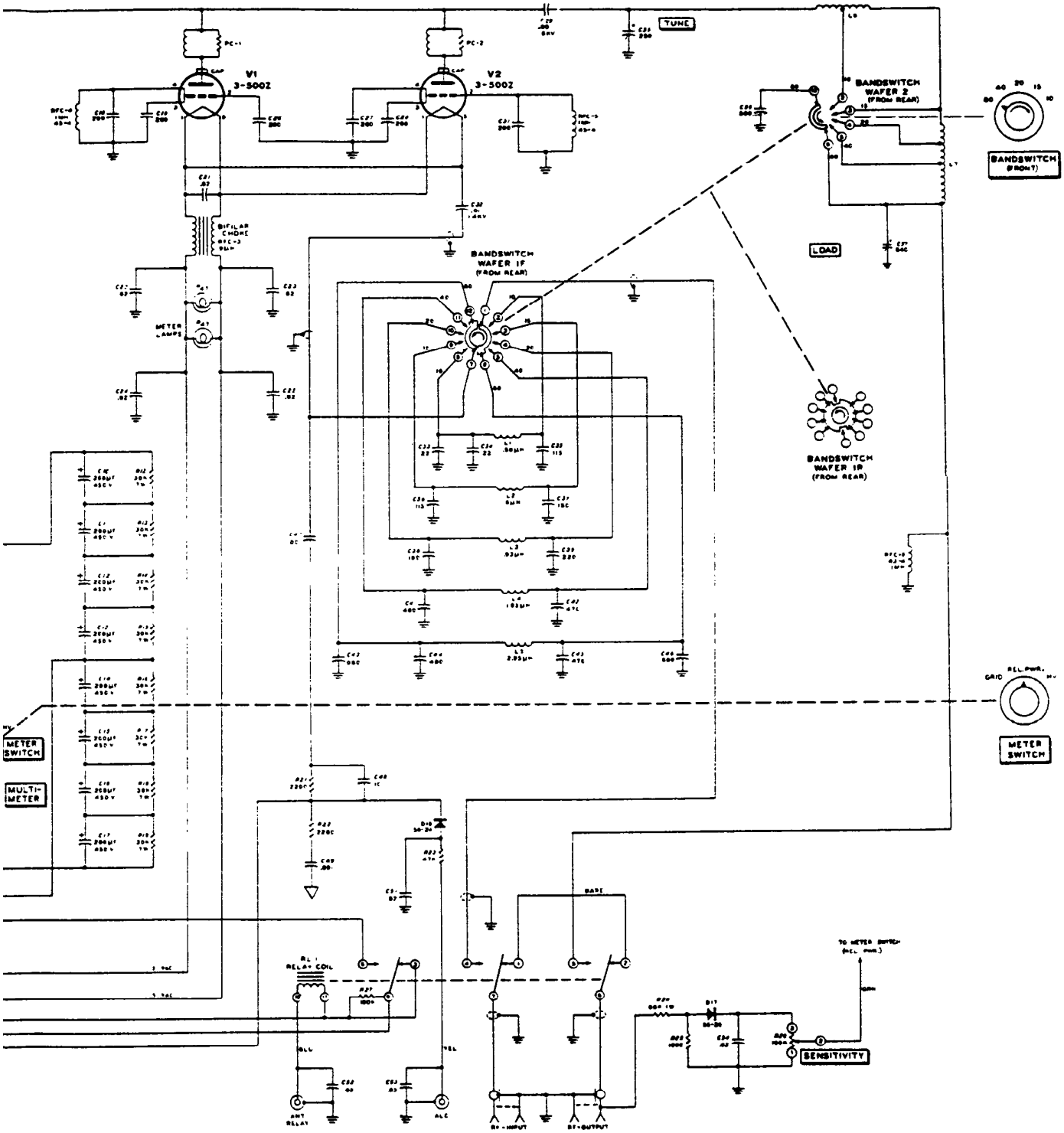
SCHEMATIC OF THE HEATHKIT® 2KW LINEAR AMPLIFIER MODEL SB-220

NOTES:

1. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE INDICATED. VALUES ARE IN OHMS (K=1000, M=1,000,000).
2. CAPACITOR VALUES LESS THAN 1 ARE IN µF. VALUES OF 1 AND ABOVE ARE IN pF UNLESS MARKED OTHERWISE.
3. THE BANDSWITCH IS IN THE 80 METER POSITION. ARROWS INDICATE THE DIRECTION OF ROTATION FOR THE VIEW SHOWN.
4. ▽ THIS SYMBOL INDICATES A CONNECTION TO CIRCUIT BOARD GROUND FOIL.
   Ⓐ THIS SYMBOL INDICATES A CONNECTION TO THE CIRCUIT BOARD.




TUNE
V1
3-500Z
V2
3-500Z
BANDSWITCH
WAFER 2
(FROM REAR)
BANDSWITCH
(FRONT)
LOAD
BANDSWITCH
WAFER 1F
(FROM REAR)
BANDSWITCH
WAFER 1R
(FROM REAR)
METER
SWITCH
MULTI-
METER
METER
SWITCH
SENSITIVITY
BAND
RELAY COIL
ANT
RELAY
ALC
RF-INPUT
RF-OUTPUT

CUSTOMER SERVICE

REPLACEMENT PARTS

If you need a replacement part, please fill in the Parts Order Form that is furnished and mail it to the Heath Company. Or, if you write a letter, include the:

- **Part number and description** as shown in the **Parts List.**
- Model number and Series number from the blue and white label.
- Date of purchase.
- Nature of the defect.

Please do not return parts to the factory unless they are requested. Parts that are damaged through carelessness or misuse by the kit builder will not be replaced without cost, and will not be considered in warranty.

Parts are also available at the Heathkit Electronic Centers listed in your catalog. Be sure to provide the Heath part number. Bring in the original part when you request a warranty replacement from a Heathkit Electronic Center.

NOTE: Replacement parts are maintained specifically to repair Heathkit products. Parts sales for other reasons will be declined.

TECHNICAL CONSULTATION

Need help with your kit? . . . . Self-Service? . . . . Construction? . . . . Operation? . . . . Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek. . .please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

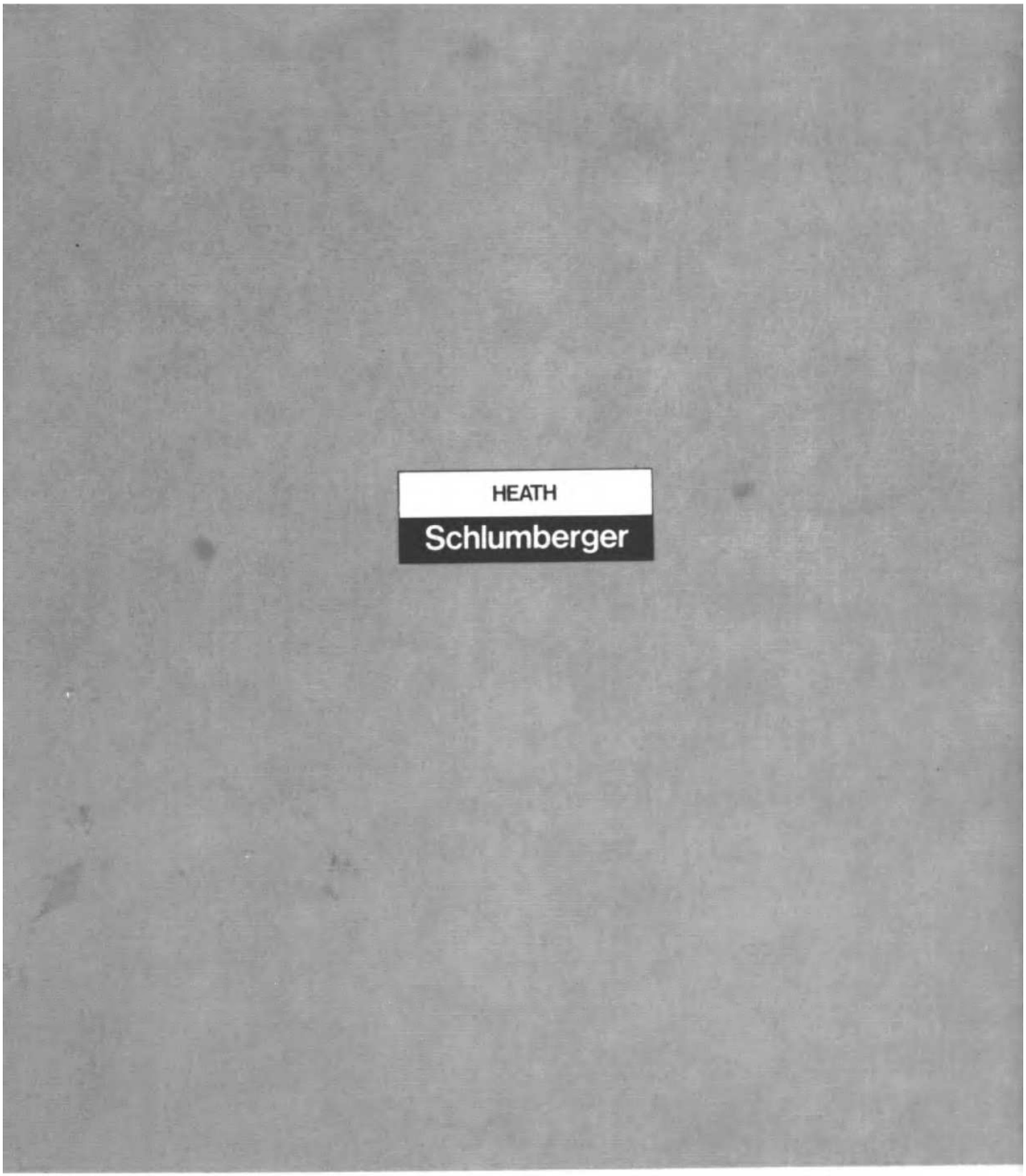
If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit C.O.D. for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022



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