

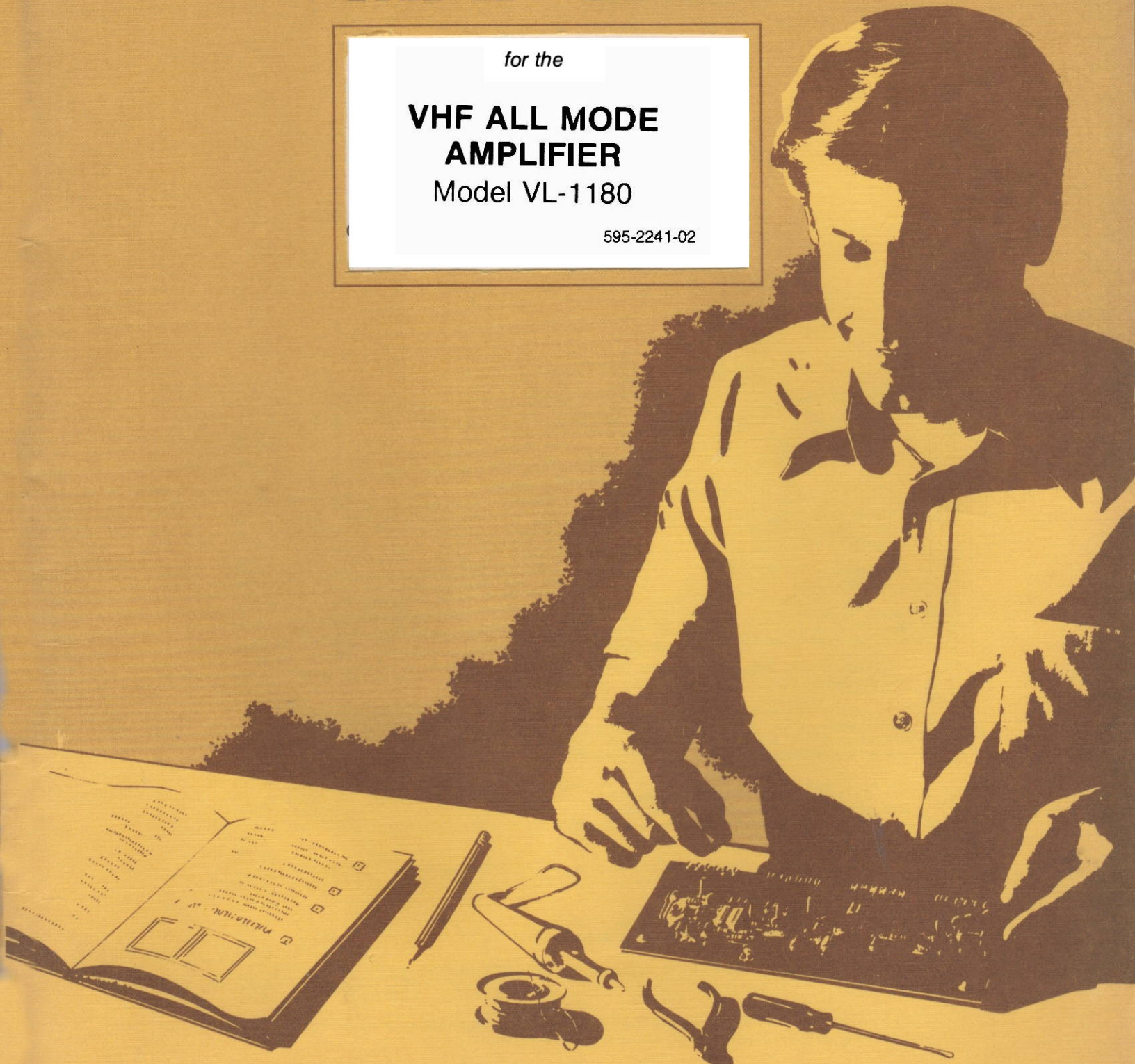
HEATHKIT[®] MANUAL

for the

VHF ALL MODE AMPLIFIER

Model VL-1180

595-2241-02



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

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Credit (616) 982-3561
Replacement Parts (616) 982-3571

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HEATH COMPANY
BENTON HARBOR, MI. 49022

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Heathkit® Manual

for the

VHF ALL MODE AMPLIFIER

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595-2241-02

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Model VL-1180 Amplifier is a compact, 2-meter amplifier designed for FM, CW, or SSB operation. It is intended for use with any exciter (transmitter or transceiver) capable of delivering 1 to 10 watts of driving power. The amplifier output power is 75 watts nominal with 10 watts of drive.

A built-in antenna change-over relay has been included in the Amplifier to place it in the transmit mode when you use the exciter keying circuitry or the

Amplifier RF sensing circuitry. It also has low intermodulation distortion and excellent harmonic rejection, which result in the transmission of an extremely clean signal on the 2-meter band. When the Amplifier is aligned at the center of the 2-meter band, the specified output will be delivered across the entire band without readjustment.

This exceptional Amplifier will give you a great deal of satisfaction and long, dependable service.

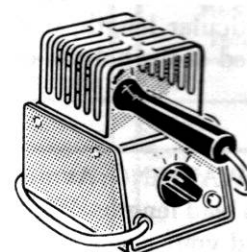
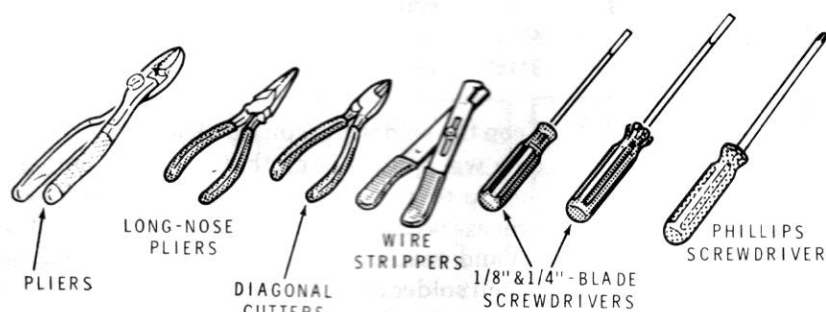
UNPACKING INSTRUCTIONS

The parts are packed inside a large shipping carton which is divided into compartments called packs. Refer to the Pack Index Sheet for the location of each pack. You will start working from Pack #1.

ASSEMBLY NOTES

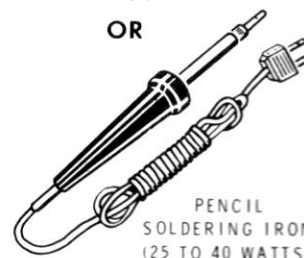
TOOLS

You will need these tools to assemble your kit.



HEATHKIT
SOLDERING
IRON

OR



PENCIL
SOLDERING IRON
(25 TO 40 WATTS)

OTHER HELPFUL TOOLS



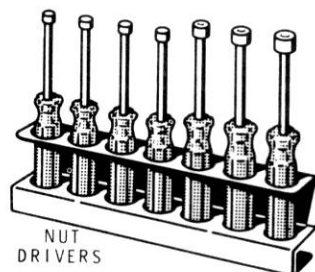
NUT STARTER
(MAY BE SUPPLIED
WITH KIT)



DESOLDERING
BULB*



DESOLDERING
BRAID*



NUT
DRIVERS

*TO REMOVE SOLDER FROM CIRCUIT CONNECTIONS.

ASSEMBLY

- Follow the instructions carefully. Read the entire step before you perform each operation.
- The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.
- Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
- Position all parts as shown in the Pictorials.
- Solder a part or a group of parts only when you are instructed to do so.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:
- In the Parts List,
 - At the beginning of each step where a component is installed,
 - In some illustrations,
 - In the Schematic,
 - In the section at the rear of the Manual.
- 7 When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excess lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

It is easy to make a good solder connection if you follow a few simple rules:

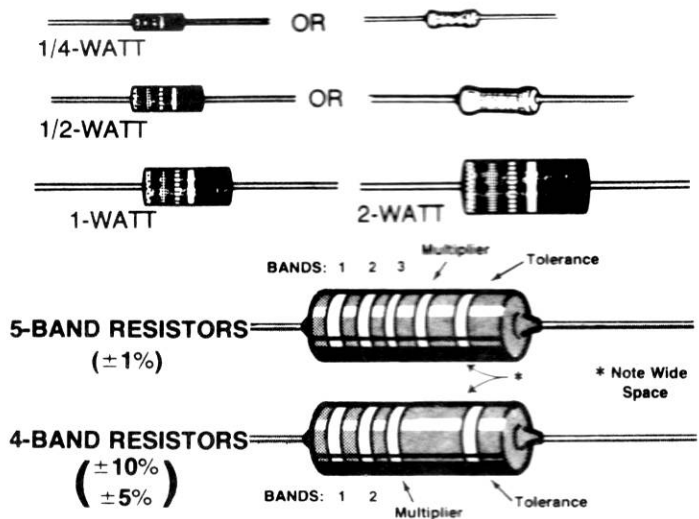
1. Use the right type of soldering iron. A 25 to 40-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called *tinning*, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.
3. If a circuit board hole should become filled with solder, especially on boards with foil on both the top and bottom, you may find it helpful to open the hole using a round toothpick as you heat the surrounding foil.

NOTE: Always use rosin core, radio, type solder (60:40 or 50:50 tin-lead content) for all of the soldering in this kit. This is the type we have supplied with the parts. The Warranty will be void and we will not service any kit in which acid core solder or paste has been used.

Heathkit®

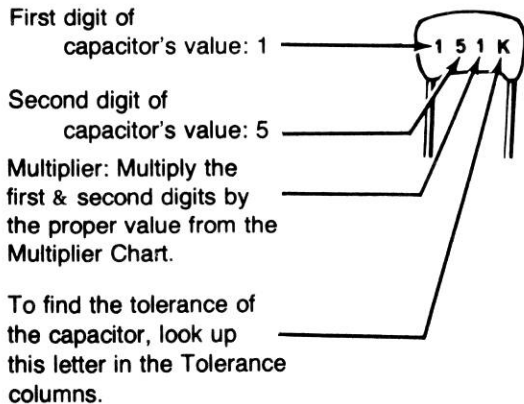
PARTS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). They are usually identified by a color code and four or five color bands, where each color represents a number. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.



Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	± 10%
Brown	1	Brown	1	Brown	1	Brown	10	Gold	± 5%
Red	2	Red	2	Red	2	Red	100	Brown	± 1%
Orange	3	Orange	3	Orange	3	Orange	1,000		
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000		
Green	5	Green	5	Green	5	Green	100,000		
Blue	6	Blue	6	Blue	6	Blue	1,000,000		
Violet	7	Violet	7	Violet	7	Silver	0.01		
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:



EXAMPLES:

$$151K = 15 \times 10 = 150 \text{ pF}$$

$$759 = 75 \times 0.1 = 7.5 \text{ pF}$$

NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (pF or μF).

MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	± 0.1 pF	B	
1	10	± 0.25 pF	C	
2	100	± 0.5 pF	D	
3	1000	± 1.0 pF	F	± 1%
4	10,000	± 2.0 pF	G	± 2%
5	100,000		H	± 3%
			J	± 5%
8	0.01		K	± 10%
9	0.1		M	± 20%

CHASSIS ASSEMBLY (Pack #1)

PARTS LIST

Open Pack #1 and check each part against the following Parts List. The key numbers correspond to the numbers on the Parts Pictorial (Illustration Booklet, Page 1). Any part that is packaged in an individual envelope with a part number on it should not be opened until that part is called for in a step.

Some parts are marked with a "171-" or "172-" packaging number. These numbers are used for packaging

only and do not appear in the Manual Parts List. Save all packaging material until all parts have been located.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form, furnished with this kit or at the rear of this Manual. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
------------	-------------------	------	-------------	----------------------

ELECTRONIC COMPONENTS

A1	3-1-22	1	39 Ω , 22-watt, wire-wound resistor	R1
A2	57-71	1	S-5A05 diode	D2
A3	60-639	1	Switch	SW1
A4	421-7	1	15-ampere fuse	F1
A5	423-2	1	Fuseholder	

CONNECTORS

B1	432-72	4	Male connector pin (1 extra)	
B2	432-73	4	Female connector pin (1 extra)	
B3	432-720	1	3-hole socket shell	S1
B4	432-723	1	3-hole plug shell	P1
B5	436-5	2	Coaxial socket	J1, J2

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
------------	-------------------	------	-------------	----------------------

HARDWARE

#4 Hardware

C1	250-213	8	4-40 \times 5/16" screw	
C2	252-2	8	4-40 nut	
C3	254-9	4	#4 lockwasher	

#6 Hardware

D1	250-475	4	#6 \times 3/8" hex head, self-tapping screw	
D2	250-1158	8	6-32 \times 3/4" stud	
D3	250-134	1	6-32 \times 3/4" brass screw	
D4	252-3	8	6-32 nut	
D5	259-1	4	#6 solder lug	

KEY No.	HEATH Part No.	QTY	DESCRIPTION
------------	-------------------	-----	-------------

CIRCUIT Comp. No.

#10 Hardware

E1	250-1256	4	10-32 × 1/4" screw
E2	254-3	4	#10 lockwasher

CHASSIS PARTS

G1	202-622-2	1	Output end panel
G2	202-623-2	1	Input end panel
G3	203-1981-1	1	Cover
G4	215-650	1	Heat sink

WIRE

340-2	12"	Small bare wire
340-3	33"	Large bare wire
343-19	1	13-1/4" Coaxial cable
343-29	1	Coaxial cable (approximately 15")

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
------------	-------------------	------	-------------

CIRCUIT Comp. No.

Wire (Cont'd.)

343-27	1	5-1/2" Coaxial cable
344-7	4"	Black wire
344-118	6"	Red wire
344-144	33"	Blue wire

MISCELLANEOUS

H1	431-1	2	Terminal strip
H2	346-20	5"	Heat shrinkable tubing
H3	475-23	1	Ferrite core
		1	Blue and white label
	489-1	1	Sandpaper
H4	490-5	1	Nut starter
H5	490-71	1	Alignment tool
H6	354-5	1	Cable tie
	597-260	1	Parts Order Form
		1	Assembly Manual (see Page 1 for the part number)
			Solder



STEP-BY-STEP ASSEMBLY

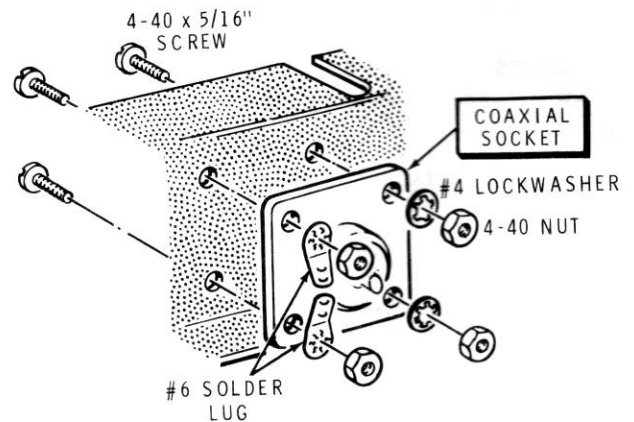
Refer to Pictorial 1-1 (Illustration Booklet, Page 2) for the following steps.

- () Locate the output end panel and position it as shown. This is the end panel with "OUTPUT" printed on it.

NOTE: Use the nut starter furnished with this kit to pick up and start 4-40 and 6-32 nuts on screws.

- () J2: Refer to Detail 1-1A and install a coaxial socket in the output end panel at J2. Use four 4-40 \times 5/16" screws, two #6 solder lugs, two #4 lockwashers, and four 4-40 nuts. Bend the lugs up and position them as shown.

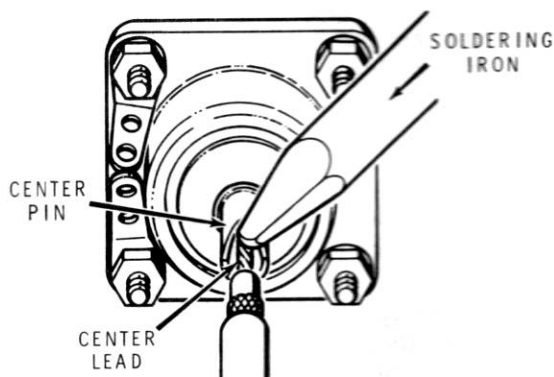
NOTE: The coaxial cable and blue wire used in this kit are Teflon* insulated and as such can not be damaged by heat from your soldering iron.



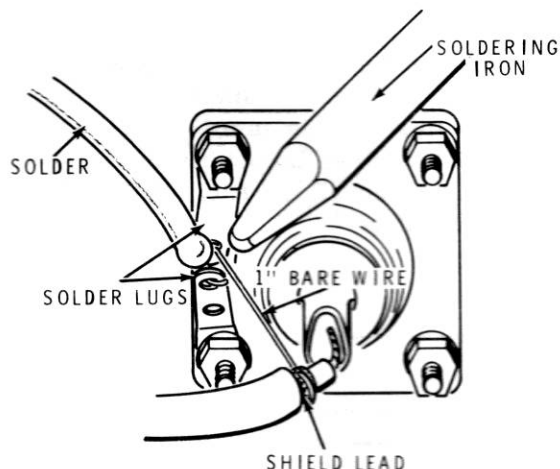
Detail 1-1A

() Connect one end of the 5-1/2" coaxial cable to socket J2 as directed in the following steps.

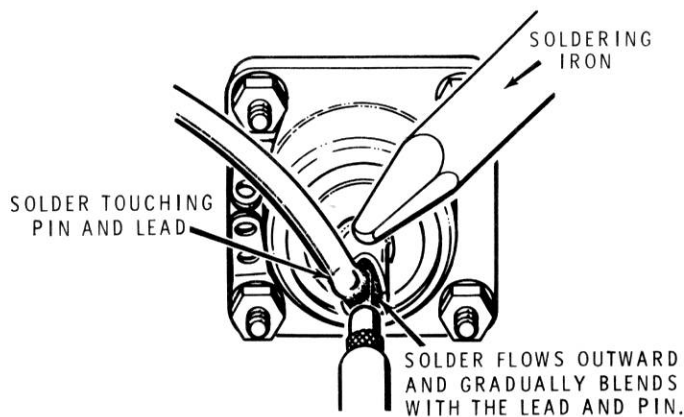
1. First apply solder to the pin opening. Then insert the center lead into the center pin of socket J2. Place the soldering iron against the lead and the pin, heating both the lead and pin for two or three seconds.



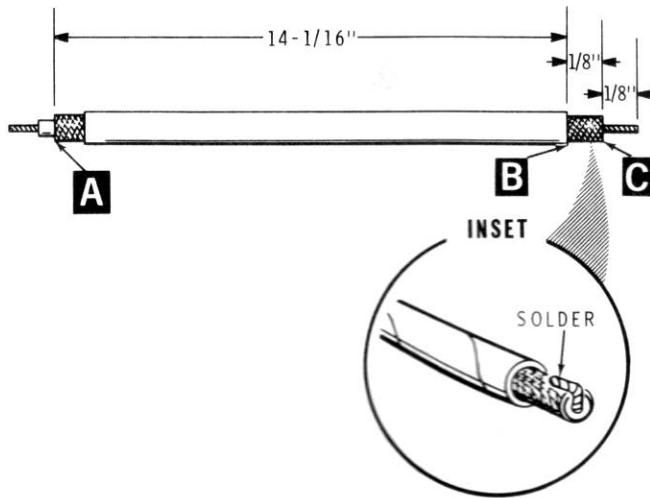
2. Apply more solder to the lead and the pin, **not** to the soldering iron. Hold the soldering iron on the connection until the solder flows smoothly.



3. Refer to inset drawing #1 on Pictorial 1-1 and solder a 1" length of small bare wire to the shield lead of the cable. Be careful that you do not bridge solder to the inner lead.
4. Solder the bare wire to the two solder lugs. Keep the bare wire as short as possible.



IMPORTANT: The $\frac{1}{4}\lambda$ trap that you will prepare next is very critical. The purpose of this trap is to filter out the second harmonic, and making the trap longer or shorter (even by the smallest amount) will diminish this filtering. Measure the cable carefully, using an accurate ruler. Do not use any of the scales printed in this Manual. Refer to Detail 1-1B as you prepare this cable.

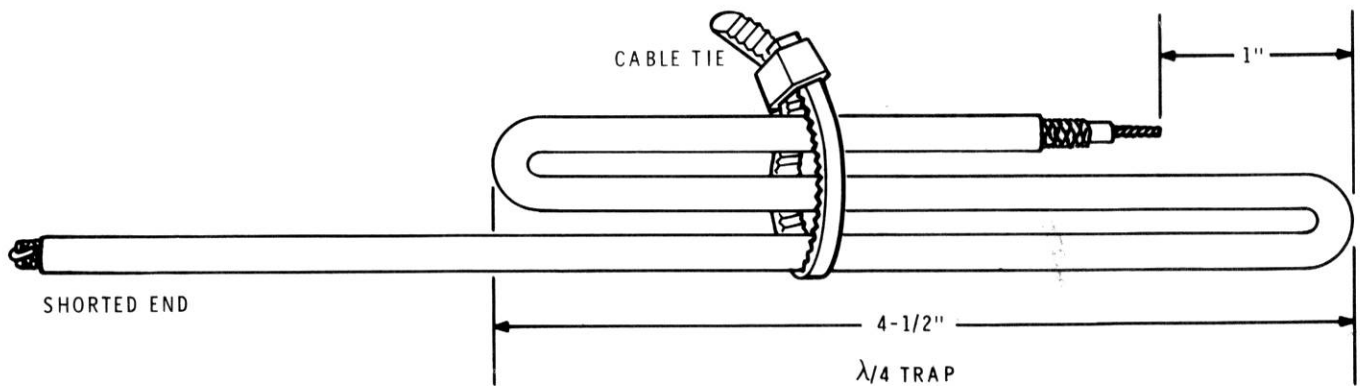
**Detail 1-1B**

2. From the end of the braid (point A) at the prepared end of the cable, measure exactly $14\frac{1}{16}$ " to point B. Mark the insulation at this point. Recheck your measurements.
3. Use a sharp knife or razor blade to cut through the outer insulation at point B. Be careful that you do not cut through the inner shield wires. Remove the outer insulation.
4. Carefully measure $\frac{1}{8}$ " from point B and mark the braid (point C).
5. Cut the shield braid back to point C. Then cut and remove the inner insulation even with the shield braid at point C. Be careful that you do not cut the inner wires.
6. Cut the inner wire so that it extends $\frac{1}{8}$ " beyond the shield braid.
7. Refer to the inset drawing at the end of the cable that you just prepared and bend the inner lead over against the shield braid. Solder it to the braid. This will be referred to as the shorted end of the cable.

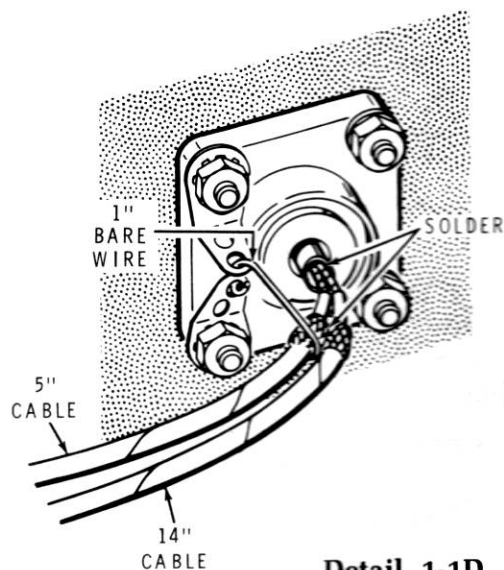
() Locate the 15" coaxial cable (prepared on one end). Prepare this cable as follows:

1. At the prepared end of the cable (end A), make sure the exposed braid is tightly wrapped around the inner insulation. Apply a small amount of solder to the braid.

() Refer to Detail 1-1C and inset drawing #2 on Pictorial 1-1 and fold the prepared coaxial cable as shown. Then install a cable tie in the middle of the cable.

**Detail 1-1C**

- () Solder the other end (not the shorted end) of this $1/4\text{-}\lambda$ trap coaxial cable to the center pin of socket J2 as follows. Refer to Detail 1-1D.



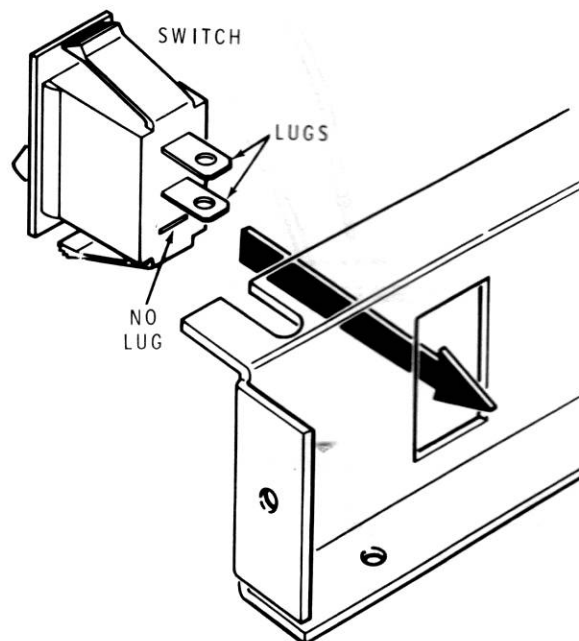
Detail 1-1D

1. Heat the center pin of J2 until the solder begins to flow. Then insert the center lead of the coaxial cable until the insulation of the center lead is even with the end of the center pin of J2.
2. Lay this coaxial cable along the other coaxial cable connected to J2, so that the shield braids are even. Then solder the shields together.

Refer to Pictorial 1-2 (Illustration Booklet, Page 2) for the following steps.

- () Locate the heat sink and position it as shown. Note the position of the screw holes in the heat sink.

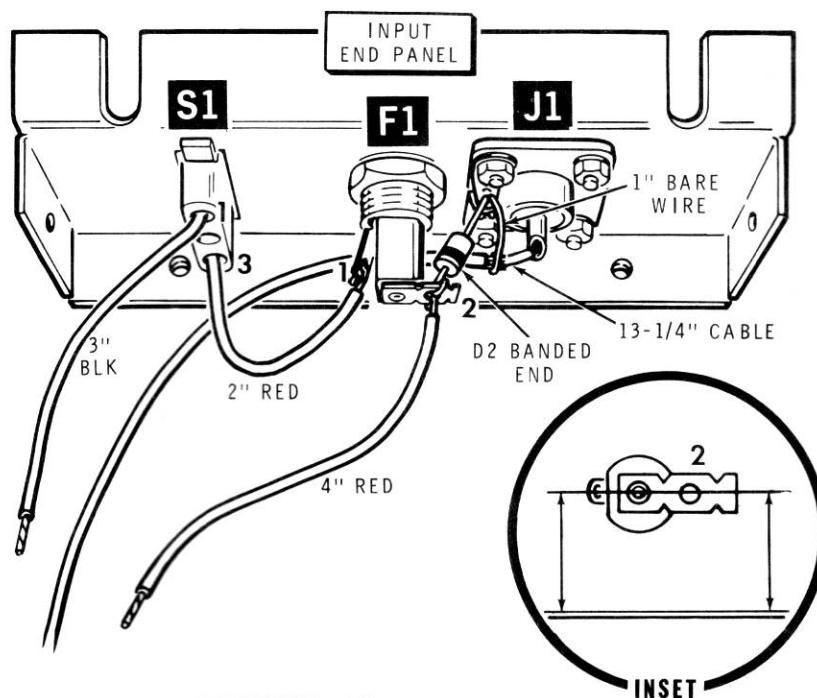
- () Mount the output end panel to the left end of the heat sink. Use two $10\text{-}32 \times 1/4\text{'}$ screws and two #10 lockwashers.
- () Refer to Detail 1-2A and push the switch into the output end panel until it snaps into place. Make sure the switch lugs are positioned as shown.



Detail 1-2A

- () Turn $6\text{-}32 \times 3/4\text{'}$ studs into the heat sink at AA, AB, AC, AD, AE, AF, AG and AH. Turn each stud in approximately four turns.
- () Turn 6-32 nuts onto all eight studs. Tighten each nut securely.

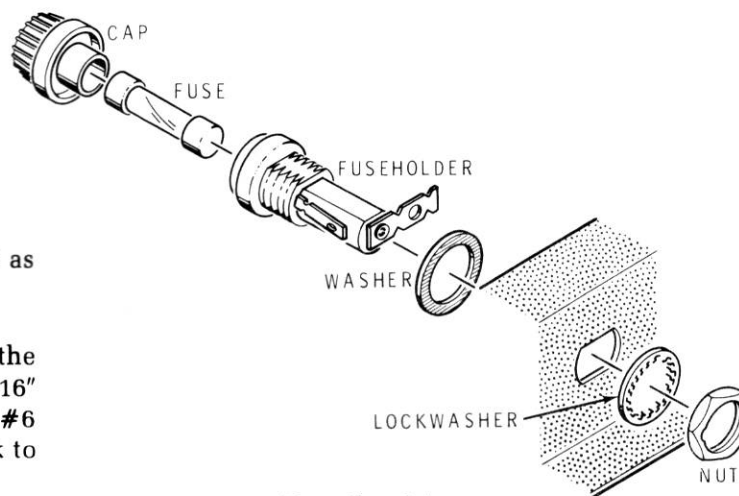
Set the heat sink aside temporarily.



PICTORIAL 1-3

Refer to Pictorial 1-3 for the following steps.

- () Locate the input end panel and position it as shown.
- () J1: In the same manner as before, install the other coaxial socket at J1 with four 4-40 × 5/16" screws, two #6 solder lugs, two #6 lockwashers, and four 4-40 nuts. Refer back to Detail 1-1A if necessary.
- () Locate the 13-1/4" coaxial cable.
- () Cut a 1" length of small bare wire. Then solder this to the shield at one end of the 13-1/4" coaxial cable.
- () Solder the inner lead to the center pin of socket J1. Then connect but do not solder the bare wire to the solder lugs. Keep this bare wire as short as possible.

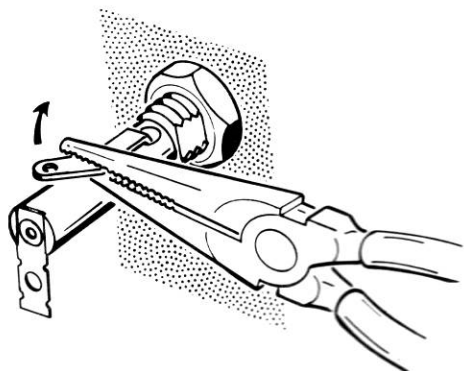


Detail 1-3A

NOTE: In the next step, be sure to position lug 2 of the fuseholder parallel to the bottom of the end panel as you tighten the hardware. See the inset drawing on Pictorial 1-3.

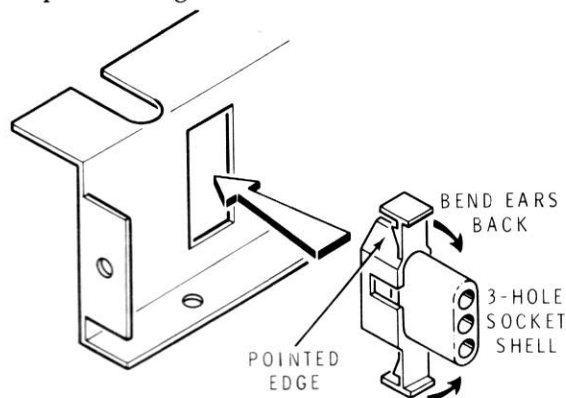
- () F1: Refer to Detail 1-3A and install the fuseholder at F1. Route the coaxial cable under the fuseholder and be sure to position the fuseholder lugs as shown.





Detail 1-3B

- () Remove the fuseholder cap by turning it counter-clockwise. Then install the 15-ampere fuse and replace the cap.
- () Refer to Detail 1-3B and bend lug 1 on the fuseholder out slightly. Be careful that you do not apply pressure to the lug where it comes out of the fuseholder.
- () Cut both leads of the S-5A05 diode (#57-71) to 1/4"
- () D2: Connect the diode between the end hole in one of the solder lugs and fuseholder F1 lug 2. Make sure you position the banded end of the diode as shown.
- () Solder the two solder lugs on socket J1. Make sure the diode lead and the bare wire are soldered.
- () S1: Refer to Detail 1-3C and install the 3-hole socket shell at S1. Be sure to position the pointed edge of the shell as shown.

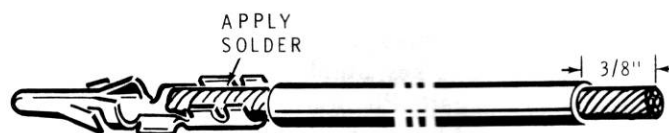


Detail 1-3C

- () Prepare the following wires. Remove 3/8" of insulation from both ends of each wire. Then twist together the fine wire strands and apply a small amount of solder to the bare ends to hold the strands in place.

3" black
2" red
4" red

MALE CONNECTOR
PIN



Detail 1-3D

- () Refer to Detail 1-3D and solder a male connector pin onto one end of the black wire as follows: First apply solder to the wire end of the connector pin. Then lay the wire into the pin and heat the wire and the pin with your soldering iron until the solder flows. Add more solder if necessary.
- () Insert the pin on the black wire into hole 1 of socket S1. Push the pin in until it locks in place.
- () In the same manner, solder a male connector pin onto one end of the 2" red wire. Insert this pin into hole 3 of socket S1.

NOTE: Solder all connections when you make them unless you are instructed not to solder.

- () Connect the other end of the red wire to fuseholder F1 lug 1.
- () Connect one end of the 4" red wire to fuseholder F1 lug 2. The other end of this red wire and the black wire will be connected later.

Set this end panel aside temporarily. Proceed to the "Amplifier Circuit Board."

AMPLIFIER CIRCUIT BOARD (Pack #2)

PARTS LIST

Open Pack #2 and check each part against the following Parts List. The key numbers correspond to the numbers on the Parts Pictorial (Illustration Booklet, Page 3). Any part that is packaged in an individual envelope with a part number on it should not be opened until that part is called for in a step.

Some parts are marked with a "171-" or "172-" packaging number. These numbers are used for packaging only and do not appear in the Manual Parts List.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

RESISTOR — DIODE

A1	6-100-12	1	10 Ω (brn-blk-blk) resistor	R101
A2	57-34	1	1N3491 diode	D101

CAPACITORS

A3	20-118	1	15 pF mica	C101
A3	20-173	1	20 pF mica	C102
A3	20-113	1	470 pF mica	C103
A4	20-730	1	25 pF mica	C121
A4	20-729	1	36 pF mica	C122
A4	20-728	1	60 pF mica	C105
A4	20-726	4	70 pF mica	C107, C108, C114, C115
A4	20-734	1	100 pF mica	C119
A4	20-725	2	250 pF mica	C111, C112
A5	20-727	1	500 pF mica	C113
A6	21-48	1	.05 μ F ceramic	C116
A6	21-17	2	270 pF ceramic	C109, C118
A7	25-864	1	10 μ F electrolytic	C117
A8	25-905	1	470 μ F electrolytic	C106
A9	31-52	2	8-60 pF trimmer	C123, C124
A10	31-93	1	4-40 pF trimmer	C104

Save all packaging material until all parts have been located.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit or at the rear of this Manual. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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COILS

B1	45-73	2	2.2 μ H RF choke	L101, L102
B2	45-53	1	3-turn RF choke	L104

MISCELLANEOUS

74-27	1-1/2"	Copper tape
85-2451-2	1	Amplifier circuit board
C1	204-2404	1 Diode bracket
C2	250-285	2 4-40 \times 1/4" screw
C3	252-3	6 6-32 nut
C4	254-1	6 #6 lockwasher
C5	257-21	50 Rivet (3-extra)
C6	352-31	1 Thermal compound*
C7	417-951	1 MRF247 transistor
C8	475-10	1 Ferrite bead

NOTE: You will have to obtain the items below if you plan to use the completed VHF Amplifier in your automobile.

One fuse block with mounting hardware.
One 15-ampere, 3AG fuse.
Four #10 sheet metal screws.
20 feet of #10 black stranded wire.
20 feet of #10 red stranded wire.

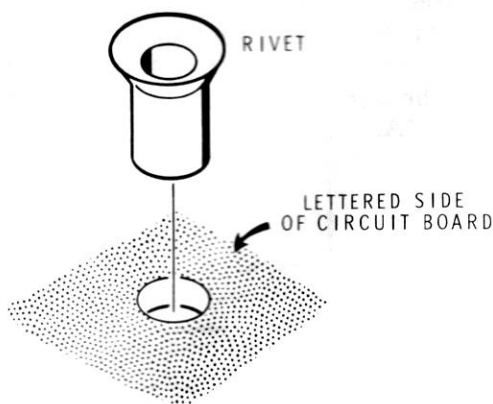
*Dow Corning thermal heat sink compound contains Zinc Oxides, SiO₂, and slight traces of CO₂.

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 2-1 (Illustration Booklet, Page 3) for the following steps.

- () Position the power amplifier circuit board as shown with the printed side up. The other side will be called the foil side.

NOTE: For better RF connection between the ground foils at very high frequencies, you will install rivets through the circuit board. The proper installation of these rivets is very important.



Detail 2-1A

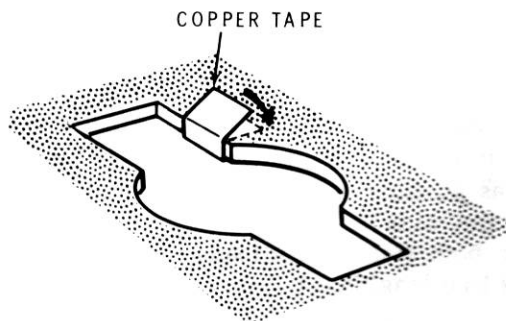
- () Refer to Detail 2-1A and install a rivet through the circuit board at AA. Insert the rivet through the board from the printed side. Then place the head of the rivet against a solid surface and flatten the other end with a small hammer. Solder both sides of the rivet to the foils. Be careful that you do not use too much solder.
- () In the same manner, install 46 more rivets at the indicated locations. Be sure to install rivets only where they are shown.

Refer to Detail 2-1B for the following steps.

- () 1. Locate the copper tape and remove the protective backing. Then rub the adhesive coating from the copper. Be careful, as the copper will tear easily.
- () 2. Cut three $1/4" \times 3/4"$ pieces of copper. Then cut each of these in half to make six $1/4" \times 3/8"$ pieces of copper.

The purpose of the following procedure is to form a continuous copper foil around the edge of the circuit board at various points. Before you install each piece of copper tape, apply a thin coat of solder to both sides of the circuit board at the place where the tape is to be installed.

- () 3. Wrap a piece of copper tape around the edge of the circuit board at M. Form the copper close to the edge of the board with equal lengths on both sides. Then solder the tape to the circuit board foil on both sides.

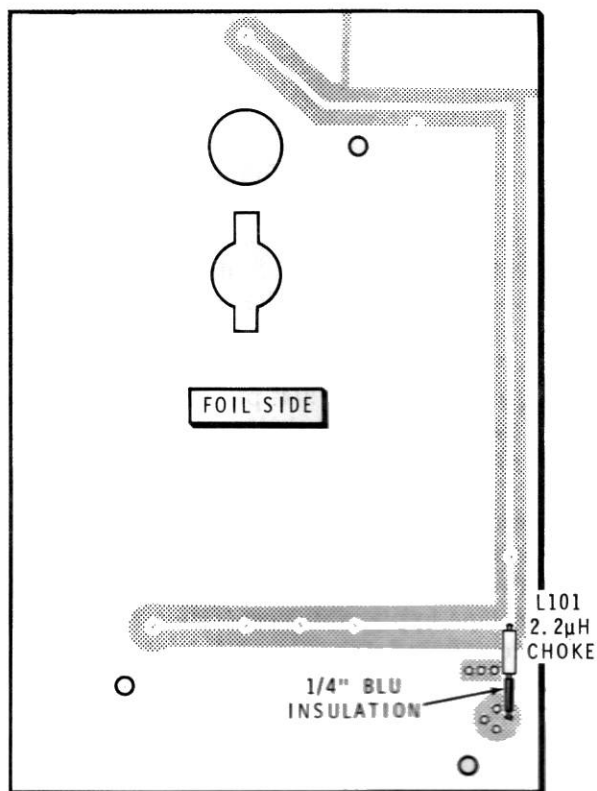


Detail 2-1B

- () 4. In the same manner, install copper tape around the edge of the circuit board at N, P, Q, R and S.

The remaining length of copper tape will not be used and may be discarded.



**PICTORIAL 2-2**

Refer to Pictorial 2-2 for the following steps.

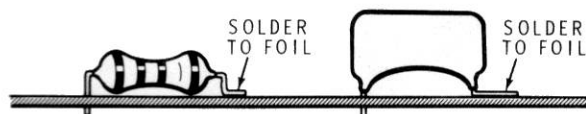
NOTE: As you install the following parts, position them close to the circuit board and keep the leads as short as possible. Wherever conveniently possible, solder the leads to both sides of the board if there is foil on both sides at the lead location. Cut off the excess lead lengths.

Position the circuit board printed side down (foil side up).

- () Locate a 2.2 μ H choke (#45-73) and the length of blue wire from pack #1. Remove a 1/4" length of insulation from the blue wire and slide it over one of the choke leads.
- () L101: Install the choke on the foil side (not the printed side) of the circuit board as shown. Solder one lead to the printed side of the circuit board, and solder the other lead to the foil side.
- () Turn the circuit board over so the printed side is up.

Refer to Pictorial 2-3 for the following steps.

In some cases you will be instructed to solder a lead directly to the foil on the printed side of the circuit board. To do this, cut the lead to 1/4" length and bend the lead at the component. Then solder it to the foil. See Detail 2-3A.

**Detail 2-3A**

START →

NOTE: Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have a plus (+) mark or a minus (-) mark near it. Be sure to install the positive lead in the positive-marked hole. Be careful; only the negative lead may be marked.

() C117: 10 μ F electrolytic.

() C116: .05 μ F ceramic.

() C118: 270 pF ceramic.

() L102: 2.2 μ H (red-red-gold-gold) choke (#45-73) and ferrite bead combination. Insert one lead through the circuit board and solder the other lead directly to the foil on the printed side. It is all right if the ferrite bead touches the foil.

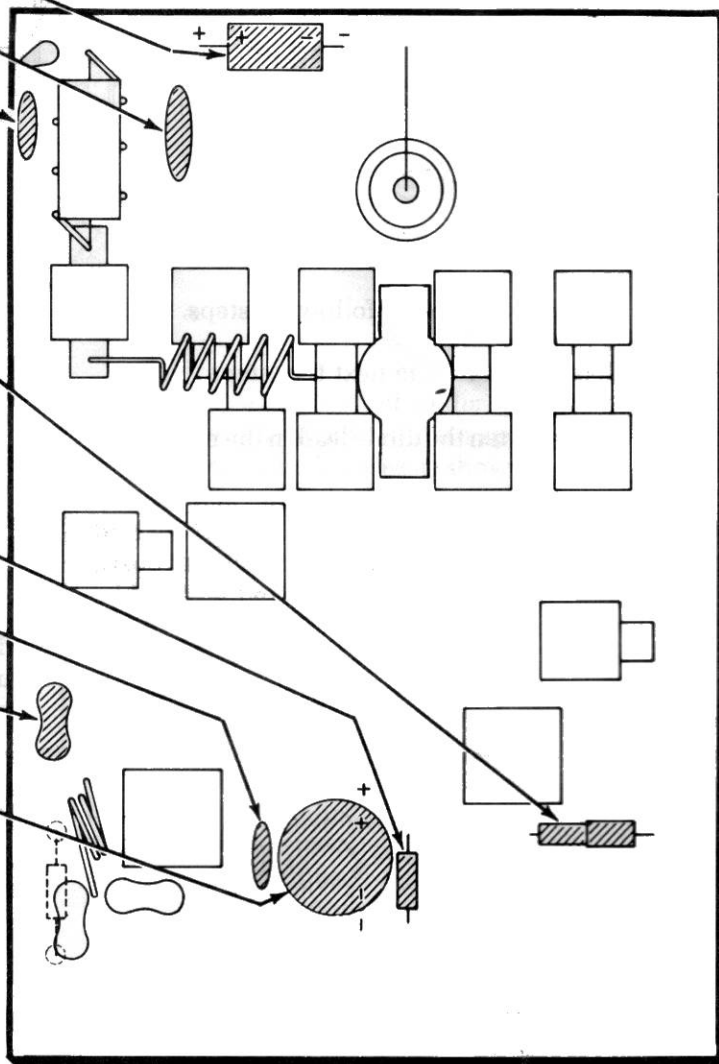


() R101: 10 Ω (brn-blk-blk) resistor. NOTE: The circuit board may be marked 2.7 at this location.

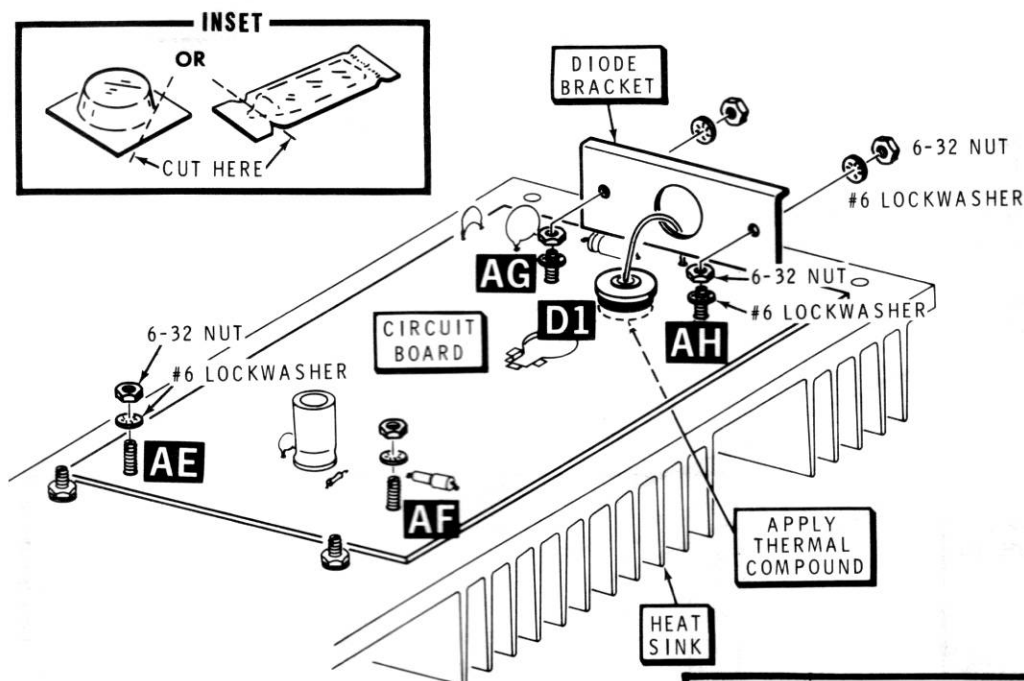
() C109: 270 pF ceramic.

() C103: 470 pF mica. Insert one lead through the circuit board and solder the other lead directly to the foil on the printed side.

() C106: 470 μ F electrolytic.



PICTORIAL 2-3



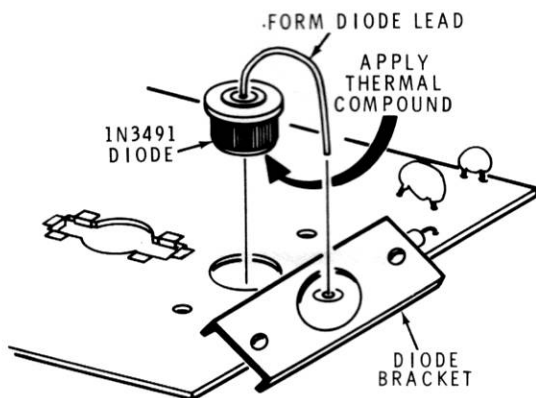
PICTORIAL 2-4

Refer to Pictorial 2-4 for the following steps.

Refer to Detail 2-4A for the next two steps.

NOTE: Do not shorten the diode lead in the next step.

- () Locate the 1N3491 diode (#57-34) and insert it into the circuit board at D1. Then form the lead as shown and insert it through the circuit board only far enough to be soldered to the foil side. DO NOT solder the lead at this time.
- () Remove the diode and place the diode bracket over the lead. Then reinstall the diode in the circuit board and solder the lead to the foil.



Detail 2-4A

WARNING:

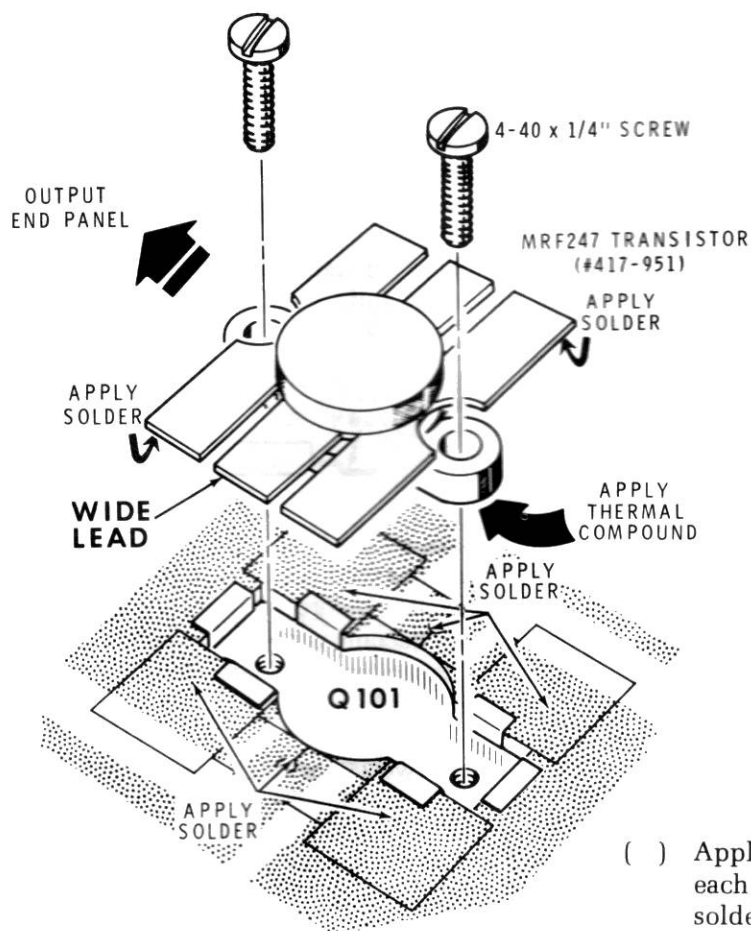
The thermal compound used in the following step (and later) can be injurious to both your eyes and your clothes. Handle it with utmost care.

KEEP THE COMPOUND AWAY FROM YOUR EYES. Wash your hands **immediately** after you use the compound. If you get any in your eyes, wash your eyes with water at once and see a doctor as soon as possible.

KEEP THE COMPOUND OFF YOUR CLOTHES. If you get the compound on your clothes, it may leave a permanent white stain.

- () Locate the container of thermal compound. Then refer to the inset drawing on Pictorial 2-4 and make a slit in one side. Squeeze the container to extract the compound.
- () Refer to Detail 2-4A and apply a coat of thermal compound to the flat side of the diode (on the foil side of the circuit board). Then place the circuit board onto the four studs at AE, AF, AG, and AH. Install a #6 lockwasher and a 6-32 nut on each stud.
- () Mount the diode bracket to the studs at AG and AH. Use two #6 lockwashers and two 6-32 nuts.

Do not overtighten this hardware.



PICTORIAL 2-5

Refer to Pictorial 2-5 for the following steps.

- () Position the heat sink assembly with the output end panel on your left as shown in the inset drawing.
- () Locate the sandpaper and place it rough side up on a **flat** surface. Then locate the MRF247 transistor (#417-951) and place it on the sandpaper with its metal side down. Rub the transistor across the sandpaper several times to prepare the metal surface for mounting. This is to ensure a good contact between the mounting surface and the heat sink.
- () Study the MRF247 transistor (#417-951) carefully. Note that one center lead is wider than the other center lead. The wider lead is the base lead. Be sure to position this base (wider) lead as shown in the inset drawing on Pictorial 2-5. **THIS IS VERY IMPORTANT.** This transistor will be destroyed if you do not install it properly.

- () Apply a thin coat of solder to the underside of each transistor lead. Also apply a thin coat of solder to the foil area as shown in the Pictorial.
- () Q101: Apply thermal compound to the flat metal side of the transistor. Then install the transistor at Q101 with two 4-40 x 1/4" screws.
- () Tighten the circuit board mounting hardware.

IMPORTANT: Incorrect soldering of the transistor leads in the next step could greatly affect the power output of your Amplifier. Make sure the leads are as flat as possible against the circuit board foil with no ripples or creases (see Detail 2-5A). Then apply solder to the top side of each lead. A lot of solder is not necessary; an even coat is best.

- () Flatten the transistor leads against the foil on the printed side of the circuit board and solder them to the foil.

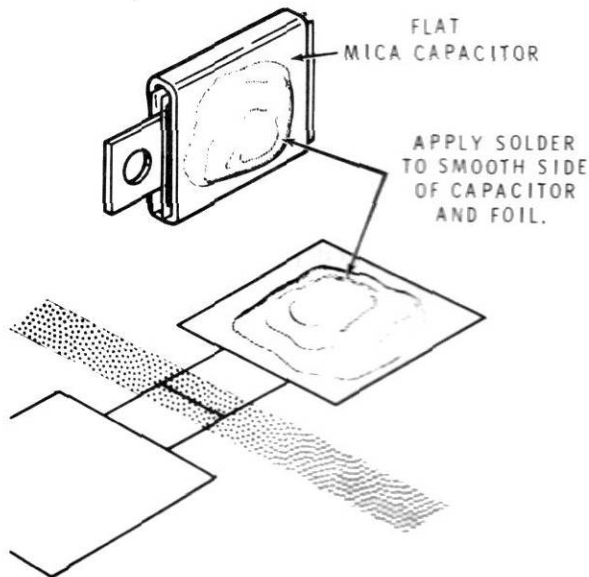


Detail 2-5A

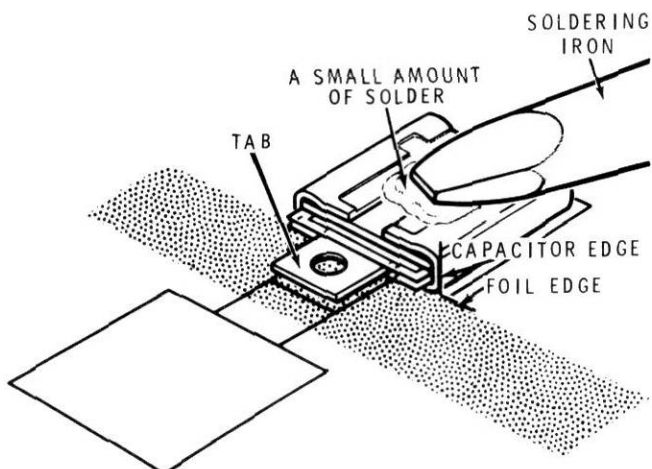
Refer to Pictorial 2-6 (Illustration Booklet, Page 4) for the following steps.

NOTE: Whenever you solder a flat mica capacitor to the circuit board, it is extremely important that you do it according to the following procedure. Any other way of soldering these capacitors to the foil may result in low power output.

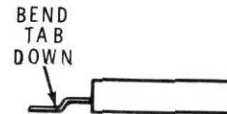
1. Apply a thin coat of solder to the smooth side of the capacitor.



2. Apply a thin coat of solder to the foil where the capacitor body will be mounted.
3. Lay the capacitor on the prepared foil so that the front edge of the capacitor is even with the edge of the foil it is on. Apply a small amount of solder to the top of the capacitor to help the heat transfer between the soldering iron and the capacitor.



4. Heat the capacitor from the top with your soldering iron until the solder under the capacitor melts to form a continuous bond between the bottom of the capacitor and the foil. Hold the capacitor down against the circuit board with a screwdriver while the solder cools.
5. Bend the capacitor tab down and solder it to the indicated foil.

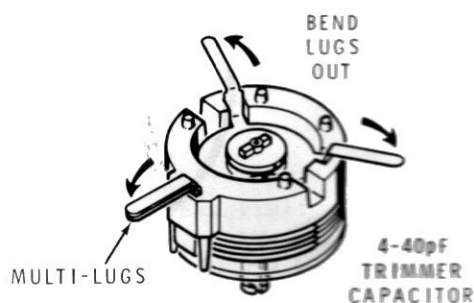


NOTE: Once solder is applied to a flat capacitor, its value cannot be read. Make sure you have the correct value capacitor before you apply solder to it. If it should ever become necessary to check the value of a flat mica capacitor, the solder can be removed with desoldering braid.

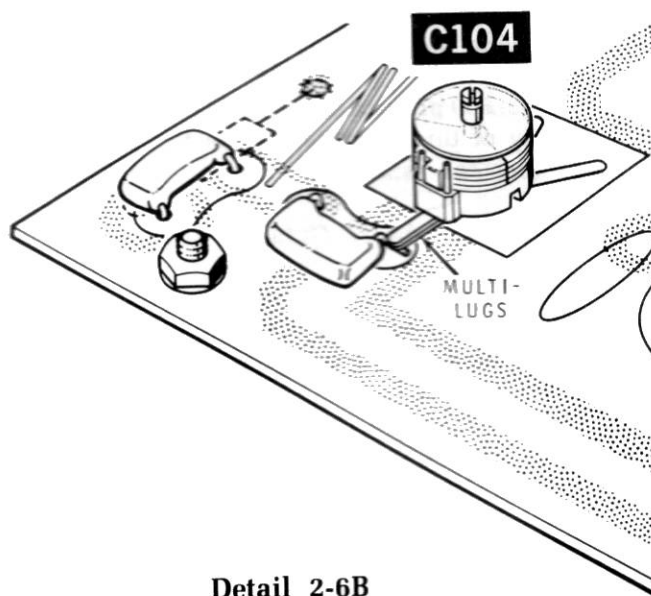
- () Locate two 250 pF mica capacitors. Install these in the following step.
- () C111, C112: Install the capacitors at C111, and C112. Position each capacitor as close as possible to the transistor body with the tab extending over the transistor lead.
- () C114, C115: In the same manner, install two 70 pF mica capacitors at C114 and C115.
- () Bend the tabs of the last four mica capacitors down and solder them to their respective foils and to the transistor leads.

In the same manner, install the following mica capacitors.

- () C119: 100 pF mica.
- () C121: 25 pF mica.
- () C122: 36 pF mica.
- () C107: 70 pF mica.
- () C108: 70 pF mica.
- () C105: 60 pF mica.
- () Locate a 15 pF and a 20 pF mica capacitor and cut the leads of each capacitor to 1/8"



Detail 2-6A



Detail 2-6B

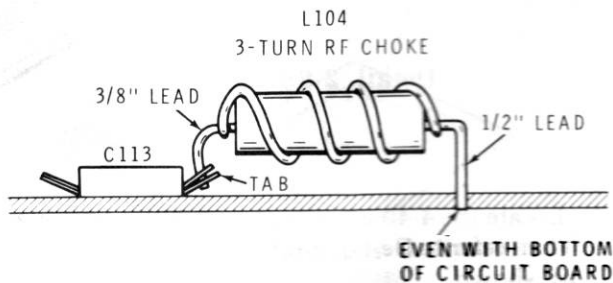
NOTE: When you install each of the following capacitors, insert its leads into the circuit board only until they are even with the underside of the board. Then bend the capacitor over against the circuit board. Solder the leads on the printed side of the circuit board.

- () C101: 15 pF mica capacitor at C101. NOTE: The circuit board may be marked "20" at this location.
- () C102: 20 pF mica capacitor at C102. Only one lead will go through the circuit board; bend the other lead over and solder it directly to the foil.
- () Locate the 4-40 pF trimmer capacitor (#31-93). Then refer to Detail 2-6A and bend the lugs out as shown.
- () C104: Refer to Detail 2-6B and position the capacitor at C104 with the multi-lug positioned as shown. Solder the lugs directly to the foil. Be sure to solder the multi-lugs thoroughly.

Refer to Pictorial 2-7 (Illustration Booklet, Page 4) for the following steps.

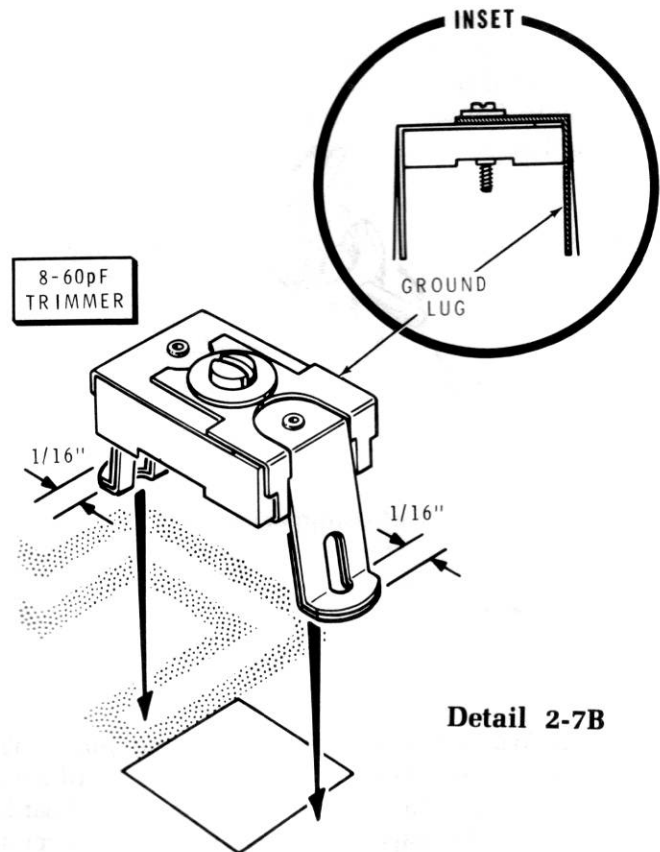
- () C113: 500 pF mica capacitor at C113. Solder the body of this capacitor to the foil but do not solder the tabs.
- () Bend the tabs of C113 up slightly.
- () Locate the 3-turn RF choke (#45-53). Cut one lead to 1/2" and the other lead to 3/8" Then bend both leads at right angles to the choke.

NOTE: In the next step, you will mount the 3-turn RF choke up off the board.



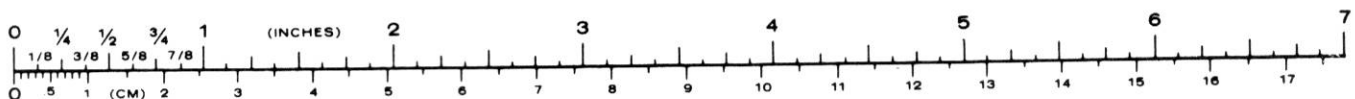
Detail 2-7A

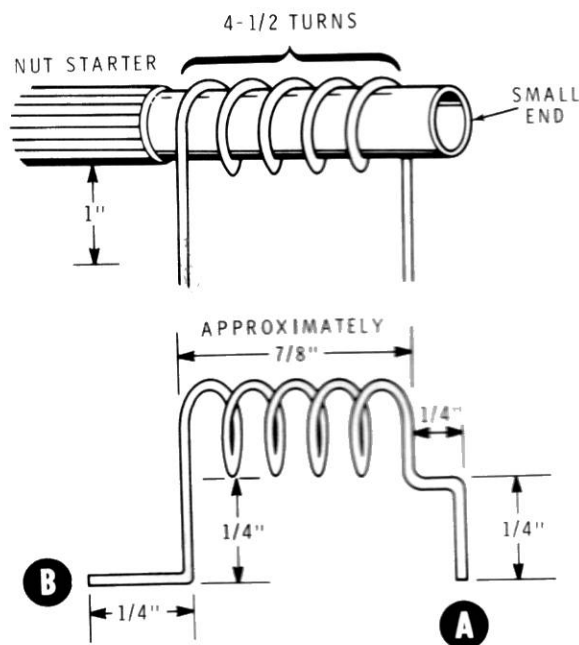
- () L104: Refer to Detail 2-7A and install this choke at L104. Insert the shorter lead through the hole in the tab of C113. Insert the other lead through the circuit board only until the end is even with the underside of the circuit board. Solder both leads.
- () Locate two 8-60 pF trimmers (#31-52). Then refer to Detail 2-7B and bend 1/16" of the lugs over as shown.
- () Turn the adjusting screw of each trimmer all the way in. Do not overtighten this screw.



Detail 2-7B

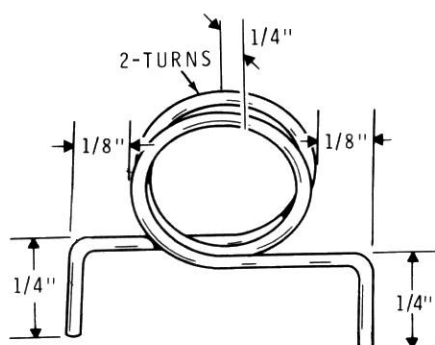
- () Refer to the inset drawing on Detail 2-7B and note that one set of lugs go directly to the plate under the screw on top of the trimmer. This lug will be called the ground lug. It is very important that you solder this ground lug as indicated in the following steps.
- () C124: 8-60 pF trimmer at C124. Position the trimmer over the outline and solder the lugs directly to the foils. Be sure to solder both leaves in each lug.
- () C123: 8-60 pF trimmer at C123. Solder this to the foil in the same manner.
- () Check both trimmers that you just installed. The ends of the adjusting screws should not touch the foil.





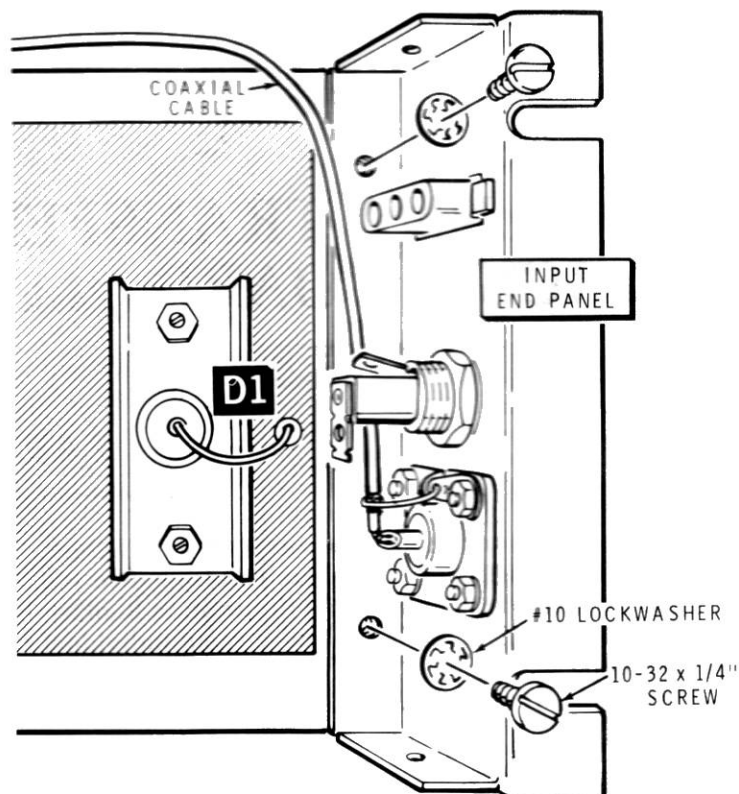
Detail 2-7C

- () Locate the heavy bare wire and the nut starter. Then refer to Detail 2-7C and form a 4-1/2-turn coil by wrapping the wire around the **small end** of the nut starter. Form the ends of the coil as shown.
- () L103: Solder lead A of the 4-1/2-turn coil to the tab on C113. Solder the other lead to the tabs of capacitors C114 and C115. Position the coil up off the board.



Detail 2-7D

- () Refer to Detail 2-7D and form a 2-turn coil of heavy bare wire around the **large end** of the nut starter.
- () L105: Solder the 2-turn coil at L105. Insert the coil leads into the circuit board holes only far enough to solder them to the foil on top of the board.



PICTORIAL 2-8

- () Refer to Pictorial 2-8 and mount the input end panel to the end of the heat sink assembly with two 10-32 × 1/4" screws and two #10 lockwashers. Route the coaxial cable as shown.
- () Make sure the lead of diode D1 does not touch the fuseholder lug or the diode bracket.

Set the heat sink assembly aside and proceed to "Antenna Transfer Circuit Board."

ANTENNA TRANSFER CIRCUIT BOARD (Pack #3)

PARTS LIST

Open Pack #3 and check each part against the following Parts List. The key numbers correspond to the numbers on the Parts Pictorial (Illustration Booklet, Page 5). Any part that is packaged in an individual envelope with a part number on it should not be opened until that part is called for in a step.

Some parts are marked with a "171-" or "172-" packaging number. These numbers are used for packaging

only and do not appear in the Manual Parts List. Save all packaging material until all parts have been located.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit or at the rear of this Manual. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS

NOTE: All resistors are 5% (gold fourth band) unless otherwise stated. The last band is not called out.

A1	6-391-12	1	390 Ω (org-wht-brn)	R203
A1	6-102-12	1	1000 Ω (brn-blk-red)	R201
A1	6-683-12	1	68 k Ω (blu-gry-org)	R202

CAPACITORS

A2	20-198	1	5 pF mica	C211
A3	20-730	2	25 pF mica	C209, C213
A3	20-729	1	36 pF mica	C212
A4	20-723	2	500 pF mica	C204, C208
A5	21-43	4	.001 μ F ceramic	C201, C203, C206, C215
A6	25-837	1	1.5 μ F tantalum	C207
A7	28-11	1	.47 pF (yel-viol-gry-gold) phenolic	C214
A8	28-9	1	3 pF (org-blk-wht-gold) phenolic	C205

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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TRANSISTORS

B1	417-881	1	MPSA13	Q201
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MISCELLANEOUS

C1	45-73	1	2.2 μ H choke	L203
C2	56-56	5	1N4149 diode	D201, D202, D203, D204, D205
C3	69-95	1	Relay	K201
	85-2519-1	1	Antenna transfer circuit board	
C4	252-3	4	6-32 nut	
C5	254-1	6	#6 lockwasher	
	343-26	2	2-3/4" Coaxial cable	

STEP-BY-STEP ASSEMBLY

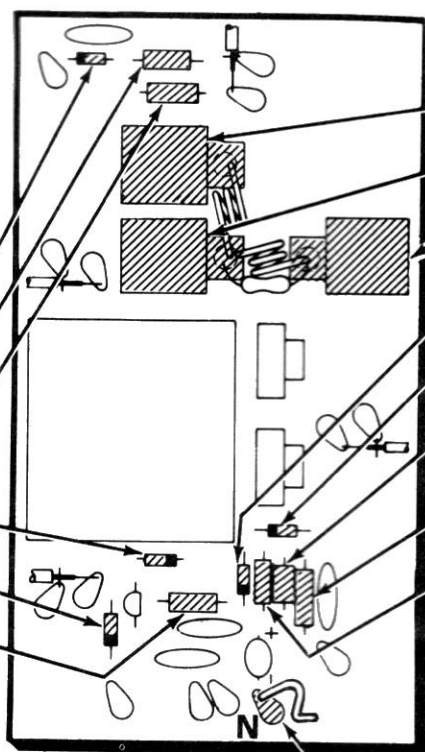
START

Position the antenna transfer circuit board printed side up as shown and complete the following steps.

NOTE: When you install a diode, always position the banded end as shown on the circuit board. A diode that is installed backward will not work properly.



- () D205: 1N4149 diode (#56-56).
- () R203: 390 Ω (org-wht-brn).
- () C214: .47 pF (yel-viol-gry-gold) phenolic.
- () D201: 1N4149 diode (#56-56).
- () D202: 1N4149 diode (#56-56).
- () R202: 68 k Ω (blu-gry-org).
- () Solder the leads to the foil and cut off the excess lead lengths.



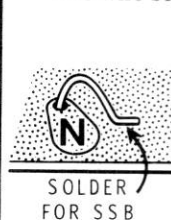
PICTORIAL 3-1

CONTINUE

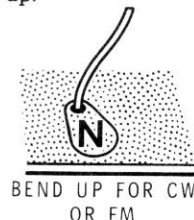
NOTE: Install the flat mica capacitors in the same way you installed them on the Amplifier circuit board. Make sure you line up the hole in the tab with the hole in the board.

- () C213: 25 pF mica.
- () C212: 36 pF mica.
- () C209: 25 pF mica.
- () D204: 1N4149 diode (#56-56).
- () D203: 1N4149 diode (#56-56).
- () C205: 3 pF (org-blk-wht) phenolic.
- () L203: 2.2 μ H (red-red-gold-silver) choke (#45-73).
- () R201: 1000 Ω (brn-blk-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

- () Insert one end of a 1/2" small bare wire through the circuit board at hole N and solder it to the foil. Then, if you intend to use your Amplifier for SSB operation, bend the other end of this wire over and solder it to the foil on the **printed** side of the circuit board. If you do not choose to operate SSB, leave this wire bent up.



SOLDER
FOR SSB

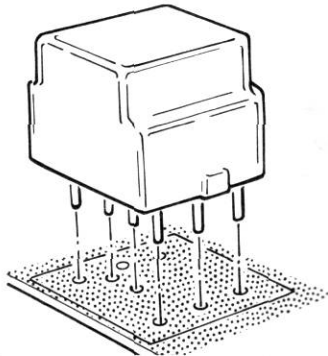


BEND UP FOR CW
OR FM

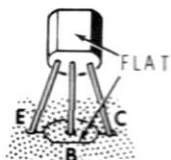
START ➡

- () C215: .001 μ F ceramic. Solder the leads and cut off the excess lead lengths.

- () K201: Relay. Insert the pins through the circuit board and solder them to the foil. Cut off the excess pin length.



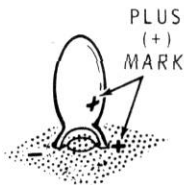
- () Q201: MPSA13 transistor (#417-881). Insert the leads into their correct E, B, and C holes. Solder the leads to the foil and cut off the excess lead lengths.



- () C206: .001 μ F ceramic.

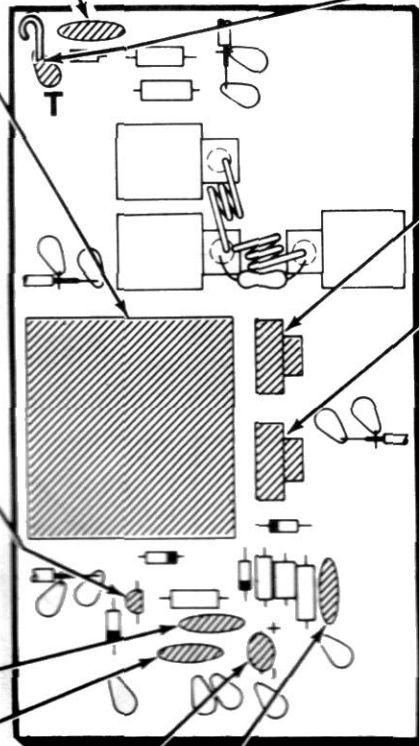
- () C201: .001 μ F ceramic.

- () C207: 1.5 μ F tantalum. Be sure to position the plus (+) marked lead toward the plus (+) marked hole on the circuit board.



- () C203: .001 μ F ceramic.

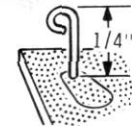
- () Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 3-2

CONTINUE ➡

- () Solder a 1" cut-off lead to the circuit board foil at T; it will be used as a test point. Form a loop in the top of this lead.



- () C208: 500 pF mica capacitor. Insert the lugs through the circuit board and solder them to the foil. Then cut off the excess lug lengths.

- () C204: 500 pF mica capacitor. Install this capacitor in the same manner.

CIRCUIT BOARD CHECKOUT**Visual Inspection**

Carefully inspect the foil side of the circuit board for the following most commonly made errors.

- () Unsoldered connections.
- () Poor solder connections.
- () Solder bridges between foil patterns.
- () Protruding leads which could touch together or touch the heat sink.

When you make the following visual checks, refer to the Pictorial where the part was installed and check it against the installation instructions.

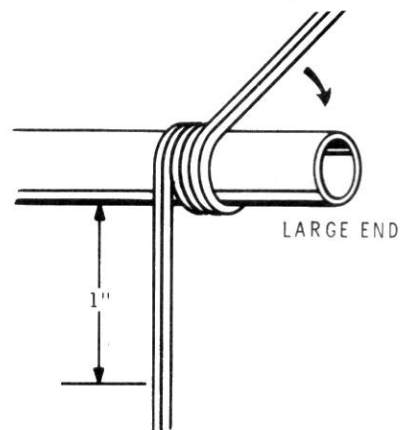
- () Check the transistor for proper installation.
- () Check the tantalum capacitor for the correct position of the positive (+) end.
- () Check the diodes for proper installation.

Refer to Pictorial 3-3 (Illustration Booklet, Page 5) for the following steps.

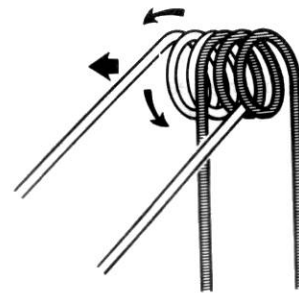
Although you will simultaneously wind two large 3-turn coils in the following steps, and then two small 3-turn coils, you will only use one **small** and one **large** coil. The second coil, in each case, is **only used so the coils have the proper spacing between turns**. Be sure to wind the coils in the **correct direction**.

- () Cut two 7" lengths of large bare wire. Then prepare the large coils as shown in Detail 3-3A.
- () Cut two 5" lengths of large bare wire.
- () Use these 5" wires to wind two small coils on the **small** end of the nut starter. Prepare these coils just as you prepared the large coils above. Be sure to observe the direction of the turns.

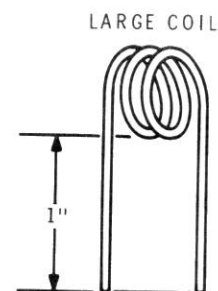
1. Hold the two lengths of wire at the ends and wind them around the **large end** of the nut starter. Start at least 1" from the end of the wire. Wrap the wires so that each turn touches the **preceding** turn. Wrap the wires three times around the nut starter.



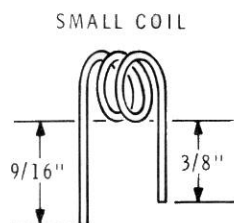
2. Carefully remove the coils from the nut starter and separate them by turning them apart. NOTE: Be careful that you do not bend the coils in any way.



3. Select one of these coils and cut the leads so they are exactly 1" from the bottom of the coil. Then set this coil aside. You may discard the other large coil.



Detail 3-3A

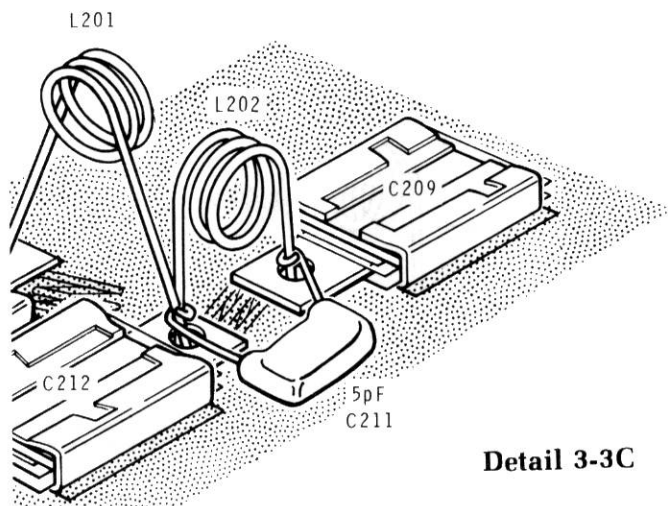


Detail 3-3B

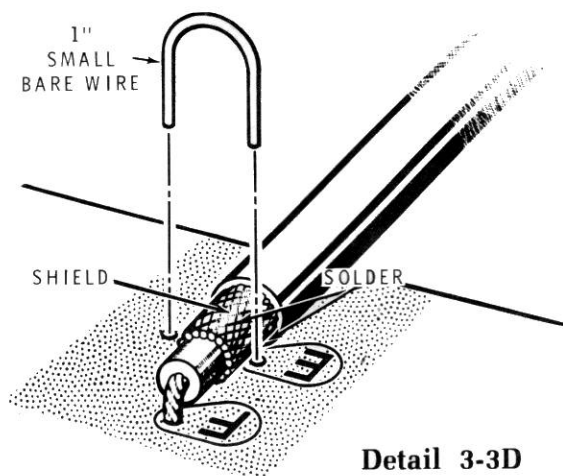
- () After you have separated the small coils, select one and cut the leads as shown in Detail 3-3B. You may discard the other small coil.
- () L201: Insert the leads of the large coil through the capacitor tabs and through the circuit board at L201. Position the bottom of the coil **exactly** 1/2" off the circuit board. Solder the coil to the capacitor tabs and to the foil side of the circuit board. Cut off any excess lead lengths.

NOTE: In the next step, one coil lead will go through the capacitor tab and the circuit board. Solder this lead as before. The other lead will be soldered directly to the other coil lead on top of the capacitor tab (see the inset drawing on Pictorial 3-3).

- () L202: Install the small coil at L202. Position the **top** of this coil **exactly** 3/4" above the board.
- () Locate a 5 pF mica capacitor and cut both leads to 5/16".
- () C211: Refer to Detail 3-3C and connect this capacitor between the leads of L201 and L202. Make sure the leads of this capacitor do not touch the metal body of capacitor C209 or C212.
- () Locate the two 2-3/4" coaxial cables.



Detail 3-3C



Detail 3-3D

- () Refer to Detail 3-3D and solder the inner lead at one end of the 2-3/4" coaxial cable to circuit board hole F. Then cut a 1" small bare wire and bend it over the shield. Insert the ends of this bare wire through the circuit board holes at E. Solder the bare wire to the shield and the shield to the foil on the printed side of the circuit board. Also solder the bare wire to the foil side of the circuit board. Cut off any excess.
- () In the same manner, solder one end of the other 2-3/4" coaxial cable to holes C and D.
- () Prepare the following lengths of blue wire. Remove 1/4" of insulation from each end of each wire. Then twist the bare wire strands at each end and apply just enough solder to hold the strands in place. NOTE: Too much solder will make it difficult to insert the wires through the circuit board holes.

2-3/4"
5-1/2"
5"
8-1/2"

Solder one end of the prepared blue wires to the foil side of the circuit board as follows:

- () 2-3/4" wire to hole G.
- () 5-1/2" wire to hole K.
- () 5" wire to hole J.
- () 8-1/2" wire to hole H.

Refer to Pictorial 3-4 (Illustration Booklet, Page 6) for the following steps.

- () Position the antenna transfer circuit board into the heat sink assembly but do not place it over the studs.

NOTE: In the next step, use the cable that does not have the inner lead soldered to the shield.

- () Connect the free end of the coaxial cable coming from socket J2 to circuit board holes P and R. Solder the inner lead and the shield as before, using a 1" small bare wire.
- () In the same manner, connect the free end of the coaxial cable coming from socket J1 to holes A and B on the circuit board.
- () Position the antenna transfer circuit board onto the studs and secure it at AA and AB with two #6 lockwashers and two 6-32 nuts.
- () Cut two 3/8" small bare wires. Use these in the next two steps to solder the shields of the coaxial cables to the foil. Solder the cables to the printed side of the board only.

Connect the next two coaxial cables coming from the antenna transfer circuit board to the amplifier circuit board as follows:

- () Cable coming from holes E and F: Solder the inner lead directly to the foil where the trimmer capacitor is soldered. Use one of the small bare wires to solder the shield to the other foil.
- () Cable coming from holes C and D: Solder the inner lead to the indicated foil pad (a hole is provided). Use the other small bare wire to solder the shield to the foil.
- () Secure the circuit board at AC and AD with four #6 lockwashers two terminal strips and two 6-32 nuts. Be sure to position the terminal strips and lockwashers as shown. Also position the cables as shown.
- () Connect the end of the other coaxial cable coming from jack J2 to the foil as shown. **NOTE:** Solder the inner lead as well as the shield lead.
- () Position the coaxial cables coming from J2 down next to the heat sink.

Refer to Pictorial 3-5 (Illustration Booklet, Page 6) for the following steps.

- () Crimp and solder a male connector pin onto the free end of the wire coming from hole H on the antenna transfer board. Then insert the pin into socket S1, hole 2.

Connect the blue wires coming from the antenna transfer circuit board as follows. Solder all connections as you make them unless you are instructed not to.

- () Wire from hole K to SW1 lug 2.
- () Wire from hole G to the outside lug of terminal strip AC.
- () Wire from hole J to the outside lug of terminal strip AD.
- () R1: Connect a 39Ω , 22-watt resistor between the center holes of terminal strips AC and AD.

- () Prepare a 10-1/2" blue wire. Use this in the next step.

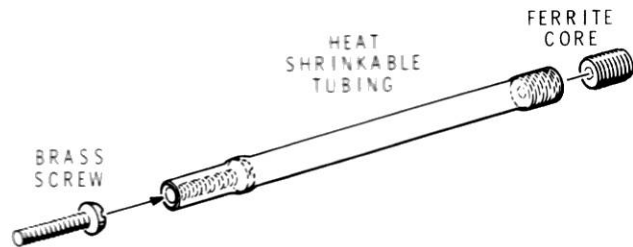
- () Connect this wire between switch SW1 lug 1 and hole A on the amplifier circuit board. Solder this wire to the printed side of the circuit board.

- () Look between the circuit boards and the heat sink. Make sure there are no leads or connections touching the heat sink.

NOTE: Solder the next two wires directly to the foil on the printed side of the circuit board. There are no holes in the circuit board for these wires.

- () Solder the large red wire coming from the fuseholder to the foil near hole A.
- () Solder the large black wire coming from socket S1 to the foil at the indicated location.

- () Locate the length of heat-shrinkable tubing, the ferrite core and the 6-32 \times 3/4" brass screw. Use these in the next step.
- () Refer to Pictorial 3-6 and insert the ferrite core into one end of the heat-shrinkable tubing until it is flush with the end.
- () In the same manner, insert the brass screw (head first) into the other end of the tubing. (Make sure the screw is completely inside the tubing.) Then hold the ends of the tubing near your soldering iron or a light bulb to shrink the tubing around the screw and core to hold them in place. This will be used as a coil tool in the next section to adjust coils.



PICTORIAL 3-6

This completes the assembly of your Amplifier. Proceed to "Initial Tests."

INITIAL TESTS

The following resistance measurements are only intended to show whether short circuits or open circuits exist which could damage the Amplifier when you first apply power to it. If you cannot obtain the correct ohmmeter indications in the following steps, refer to the "In Case of Difficulty" section. Do **NOT** proceed to the "Installation" section until the difficulty has been corrected.

NOTES:

1. The resistance readings in the following steps were taken with a Heathkit Vacuum Tube Voltmeter. Readings taken with other ohmmeters (because of different measuring voltages and currents) may be considerably different.

2. The internal wiring of most ohmmeters is such that the positive terminal of the meter battery is connected to the positive test lead, or probe, and the negative battery terminal is connected to the negative (black) or common test lead. In some ohmmeters, this wiring is interchanged and erroneous readings may result. Interchange the ohmmeter leads if the measurements do not check out correctly the first time.

() Turn on your ohmmeter and allow it to warm up, if necessary.

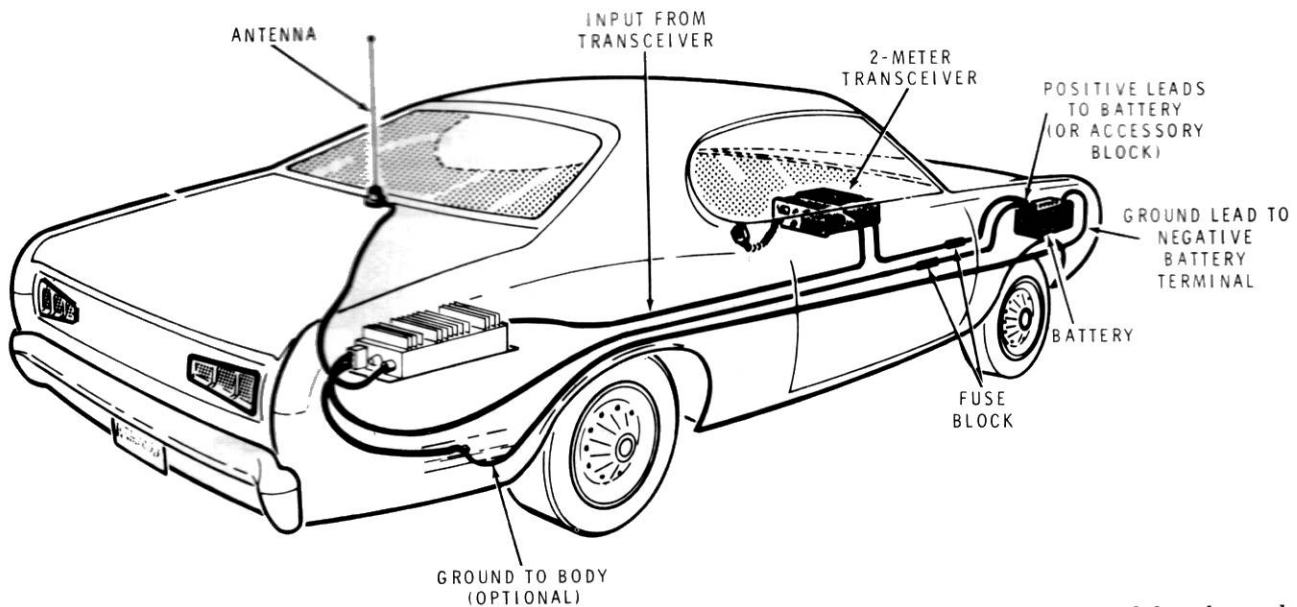
() Set the ohmmeter to the $R \times 10$ range.

Refer to Pictorial 4-1 (Illustration Booklet, Page 7) to identify the Amplifier test points called out in the following steps.

OHMMETER TEST POINTS		RESISTANCE IN OHMS
COMMON LEAD	POSITIVE (+) LEAD	
() Fuseholder F1 lug 2.	Collector (C) of transistor Q101.	0
() Fuseholder F1 lug 2.	Solder lug at J2.	50
() Set the ohmmeter to $R \times 1$		
() Solder lug at J2.	Base of Q101	Greater than 4
	Collector of Q101	Greater than 500
() Solder lug on jack J1.	Center lug on J1.	INFINITE

This completes the "Initial Tests" section of this Manual. Proceed to "Installation."

INSTALLATION



PICTORIAL 5-1

You may use this Amplifier in any vehicle that has a 12 VDC negative ground electrical system or with a 12-ampere, 13.6-volt DC supply.

Refer to Pictorial 5-1 for the suggested arrangement of components and their interconnections.

You will complete all installation steps before you align your VHF Amplifier, except for installing the amplifier cover and securing the completed Amplifier in place.

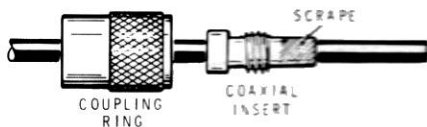
NOTE: Without excitation, this Amplifier draws less than 3 mA of current; therefore, on-off switching is not required. But an ON-OFF switch has been provided so you can turn the Amplifier off when it is not going to be used for an extended period.

- () Decide where the Amplifier will be installed. It should be located as close to the antenna as is convenient. **NOTE:** Do **NOT** install the Amplifier in the engine compartment of your automobile. During normal operation, temperatures as high as 260°F (125°C) can be expected there.
- () Mark the mounting holes for the Amplifier. Use the Amplifier assembly as a template.
- () Drill the mounting holes with a #21 or a 5/32" drill bit. These holes are the proper size to use for #10 sheet metal screws (not furnished) when you mount the Amplifier later.

PROCEDURE FOR INSTALLING A COAXIAL PLUG ON RG-58 CABLE

Use the following procedure to install a coaxial plug and insert on the end of a length of RG-58 cable. NOTE: Always start with a cable that is a few inches longer than you need. This gives you some extra cable in the event the connector needs to be replaced at some later date.

1. Lightly sand or scrape the indicated area of the coaxial insert. Then slide the coupling ring and the insert onto the cable as shown. Be sure the coupling ring and the insert are on the cable before you proceed.



2. Cut the end of the cable off even. Then remove 3/8" of the outer insulation. Do not be concerned at this time if you also cut off some of the shield wires.



3. Trim all the shield wires off even with the end of the outer insulation.



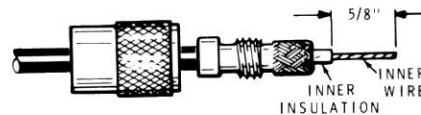
4. Taking care not to nick the outer shield of wires, remove another 3/8" of the outer insulation.



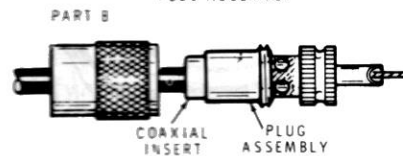
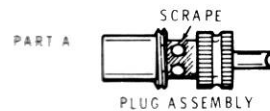
5. Position the coaxial insert even with the end of the outer insulation. Then carefully fold the shield wires back until they are neatly against the coaxial insert. It is not necessary to unbraid the shield wires.



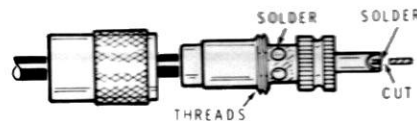
6. Taking care not to nick the inner wire (or wires), remove 5/8" of the inner insulation. NOTE: If your particular cable has more than one inner wire, twist them together tightly. Then melt a small amount of solder to their ends to hold them together.



7. Lightly sand or scrape the outside of the plug assembly in the area of the four holes. Then carefully screw the plug assembly onto the coaxial insert, while holding the insert so it doesn't turn.



8. Solder the plug assembly to the shield wires through each of the four holes. Be sure you do not get solder on the threads. NOTE: You will need plenty of heat to do this properly. Then solder the inner wire (or wires) to the plug assembly and cut off any excess wire end.



9. When the assembly is cool, screw the coupling ring onto the assembly.

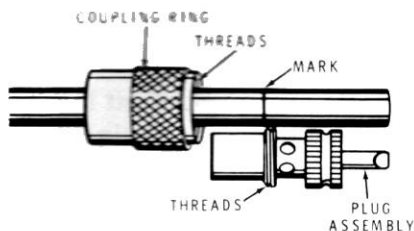


PICTORIAL 5-2

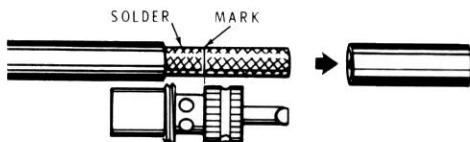
PROCEDURE FOR INSTALLING A COAXIAL PLUG ON RG-8 CABLE

Use the following procedure to install a coaxial plug and insert on the end of a length of RG-8 cable. **NOTE:** Always start with a cable that is a few inches longer than you need. This gives you some extra cable in the event the connector needs to be replaced at some later date.

1. Slide the plug coupling over the coaxial cable so the threaded end of the ring is toward the end of the cable.
2. Position the plug assembly even with the end of the cable and mark the cable at the back of the threads.



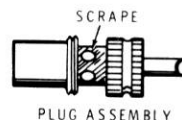
3. Cut the outer insulation at the mark and remove it from the cable. Be very careful that you do not cut the inner shield wires.
4. Position the plug assembly even with the end of the cable again and mark the shield wires at the back of the second knurled ridge.



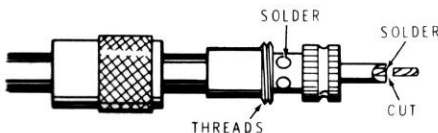
5. Apply a thin coat of solder to the shield wires behind the mark. Do not use too much heat or the inner insulation will be damaged. Also do not permit a build-up of solder, or installation into the plug will be difficult later.
6. Cut through the shield wires and the inner insulation at the mark. Be very careful that you do not cut into the inner lead. Twist the shield and insulation section off the end of the cable.



7. Carefully inspect the end of the coaxial cable. Trim off any small shield wires that could touch the inner lead.
8. Apply a light coat of solder to the inner lead.
9. Sand or scrape around the four hole area of the plug assembly to insure good solderability.



10. Insert the coaxial cable into the back of the plug. Make sure the inner lead of the cable is started through the center tip of the plug. Then grip the plug with a pair of pliers and turn the cable into the plug. The inner lead should extend slightly out of the end of the tip.



11. Solder the coaxial cable shield to the plug assembly through the four holes in the side of the plug assembly. Be sure you do not get solder on the threads.
12. Solder the inner lead to the tip of the plug assembly. Get as little solder as possible on the outside of the tip. Then cut off any excess inner lead.
13. Sand or scrape the plug tip to remove any rosin, which will act as an insulator. If you have solder on the outside of the tip, cut or scrape it off.
14. Turn the coupling ring onto the plug assembly.

PICTORIAL 5-2 (cont'd.)

TRANSMISSION LINES

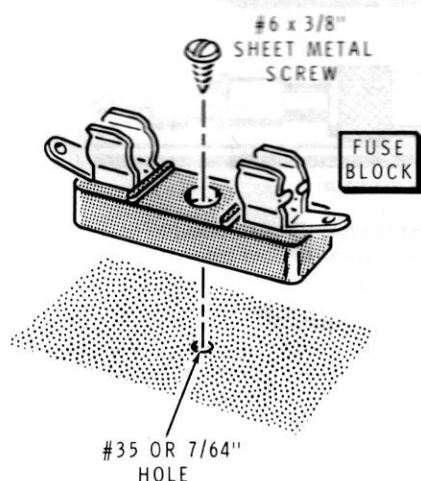
- () Carefully measure the lengths of transmission line required between the exciter and the Amplifier and between the Amplifier and the antenna.
- () Cut an RG-58A/U or RG-8 coaxial cable (not furnished) to the measured length.
- () Refer to Pictorial 5-2 and install a coaxial plug and a coaxial plug insert on one end of each cable.

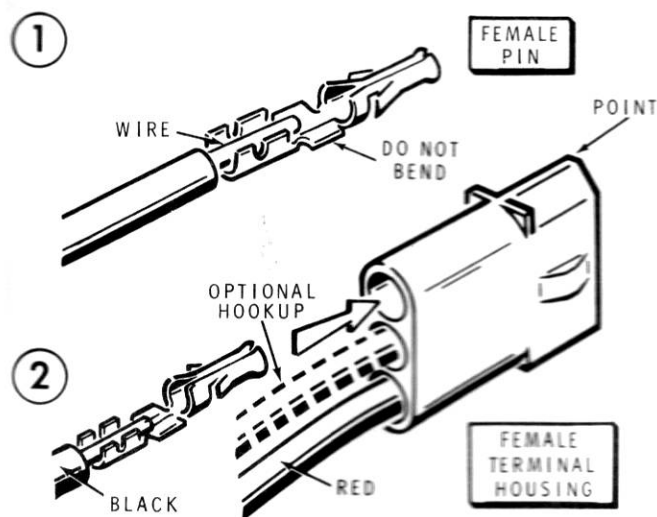
POWER LINES

NOTE: Complete the following ten steps if you intend to install your Amplifier in your automobile.

- () 1. Refer to Pictorial 5-3 and install a fuse block (not supplied) close to the battery.

- () 2. Cut the stranded red wire (not supplied) to the length that is necessary to reach from the fuse block to the positive battery terminal. Solder one end of this wire to the fuse block. Do **NOT** connect the free end of this wire until you are instructed to do so.
- () 3. Install a 15-ampere fuse (not supplied) in the clips on the fuse block.
- () 4. With the Amplifier temporarily in its permanent location, cut the red stranded wire to the length that is necessary to reach from socket S1 on the Amplifier to the fuse block.
- () 5. Cut the black stranded wire (not supplied) to reach from socket S1 on the Amplifier to the negative terminal on your battery.
- () 6. Remove 1/4" of insulation from both ends of the black and the red wires.

**PICTORIAL 5-3**



PICTORIAL 5-4

Refer to Pictorial 5-4 for the following steps.

- () 7 Refer to Part 1 of the Pictorial and solder a female connector pin to one end of the black wire and the red wires.
- () 8. Position the 3-hole plug shell with the pointed end up as shown in Part 2 of the Pictorial. Then push the female pin on the black wire into the upper hole, as shown, until the pin locks into place.
- () 9. Similarly, push the pin on the red wire into the lower hole, leaving the center hole open.

NOTE: Complete the following five steps only if you intend to use your Amplifier for your base station.

- () 1. Cut the black stranded and the red stranded wires to the length that is necessary to reach from socket S1 on the Amplifier to the power source you intend to use for the Amplifier.
- () 2. Remove 1/4" of insulation from both ends of both the black and the red wire.

Refer to Pictorial 5-4 for the following steps.

- () 3. Refer to Part 1 of the Pictorial and solder a female connector pin to one end of the black wire and the red wire.
- () 4. Position the 3-hole plug shell with the pointed end up as shown in Part 2 of the Pictorial. Then push the female pin on the black wire into the upper hole, as shown, until the pin locks in place.
- () 5. Similarly, push the pin on the red wire into the lower hole, leaving the center hole open.

NOTE: Complete the next three steps only if you ever intend to use the exciter keying circuitry to control your Amplifier.

- () 1. Cut a #22 wire to reach from socket S1 on the Amplifier to the "external antenna relay" connector on your exciter. Then remove 1/4" of insulation from each end of this wire.
- () 2. As before, solder a female connector pin to one end of the wire prepared in the previous step. Then push this pin into the center hole of the 3-hole plug shell.
- () 3. Connect the free end of this wire to the "external antenna relay" connector on your exciter.

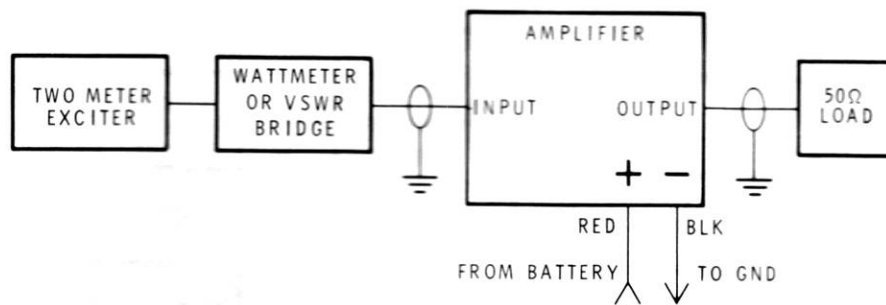
This completes the "Installation" of your VHF Amplifier. Proceed to the "Alignment" section of this Manual.

ALIGNMENT

CAUTION: Do not exceed the drive and duty cycle requirements listed in the "Specifications" section of this Manual. To do so can damage the Amplifier.

ALIGNMENT NOTES

1. If you use your battery as a power source, check the voltage across its terminals with the engine running and all accessory equipment and lights off. This Amplifier is designed for 15 volts DC maximum input, and if the voltage exceeds this figure, you should have your voltage regulator adjusted or replaced.
2. It is good practice to start the tuneup procedure at 11 to 12 volts DC input. If you are using your battery as a power source, leave the engine off during the initial alignment steps. Then start the engine (in a well-ventilated area) for the final tuneup.
3. The alignment of this Amplifier requires the following equipment:
 - a. A 2-meter exciter (transmitter) capable of delivering 1 to 10 watts of power.
 - b. A 50 Ω nonreactive load, capable of dissipating 150 watts, connected to the Amplifier's output.
 - c. An output indicator. A wattmeter (or VSWR bridge) is preferred, but you can use a voltmeter. The instructions and the connections for these two devices differ; therefore, separate alignment instructions are given below. Follow the appropriate set of instructions for the alignment equipment you have.



PICTORIAL 6-1

COIL ADJUSTMENT USING A WATTMETER OR A VSWR BRIDGE

If a wattmeter or SWR bridge is used for alignment, it is important that they are capable of accurate measurements at the operating frequency of the Amplifier. Otherwise, there may be a false indication of peak power output and possible misalignment.

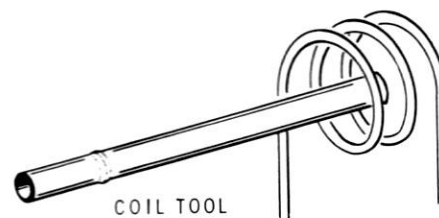
Refer to Pictorial 4-1 (Illustration Booklet, Page 7) for the location of the trimmer capacitors and coils in the following steps.

- () Turn trimmers C123 and C124 down until they are just snug without forcing them. Then turn them both 1/2-turn counterclockwise.
- () Refer to inset drawing on Pictorial 4-1 and pre-set trimmer C104 so that its plates are half meshed.
- () Before you start to align your Amplifier, tune your exciter for a maximum output at 146 MHz (not to exceed 10 watts) using a dummy load.
- () Connect your equipment as shown in Pictorial 6-1. Make sure you use RG-58A/U or RG-8A/U or similar 50 Ω coaxial cable for all leads that carry RF.
- () Connect your Amplifier to your power source, but do not turn the Amplifier on until you are instructed to.

NOTE: In the following steps, you will monitor the VSWR at the input of the Amplifier while you insert first one and then the other end of the coil tool into

coils L201, L202 and L105 and watch for a corresponding change in the wattmeter or VSWR bridge. A decrease in the VSWR or reflected power reading when the core end of the tool is inserted indicates too little inductance and the coil must be compressed slightly. A decrease in the meter reading when the screw (brass) end is inserted indicates too much inductance and the coil turns must be spread apart slightly. The objective is to achieve an increase in meter reading when either end of the tool is just inserted into the coil.

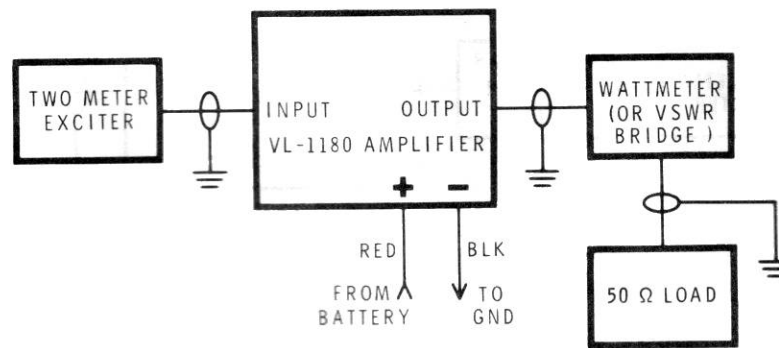
- () Key your exciter and insert the end of the coil tool into coil L201 (see Detail 6-1A). Then unkey the exciter and adjust the coil accordingly. Repeat this procedure until the coil is correctly adjusted.



Detail 6-1A

- () In the same manner, adjust coil L202.
- () Turn the Amplifier on and adjust coil L105 for the least VSWR or reflected power reading. NOTE: Be sure to turn the Amplifier power off before you make any adjustment to the coil.

This completes the coil adjustment. Proceed to "Trimmer Alignment With a Wattmeter or a VSWR Bridge."

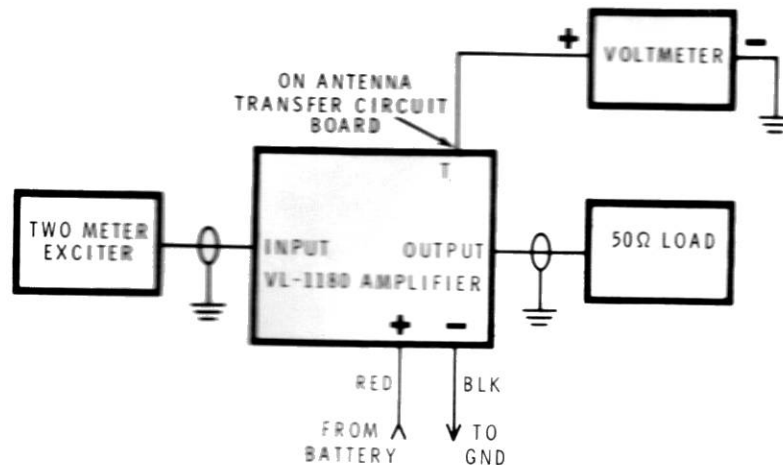


PICTORIAL 6-2

TRIMMER ALIGNMENT WITH A WATTMETER OR A VSWR BRIDGE

- () Connect your equipment as shown in Pictorial 6-2. Make sure you use RG-58A/U, RG-8A/U, or similar 50 Ω coaxial cable for all leads that carry RF.
- () Connect the Amplifier to your power source.
- () While you key the exciter 5 seconds on and 10 seconds off, use the alignment tool supplied to adjust trimmer capacitor C104 for maximum meter indication.
- () Adjust trimmer capacitors C123 and C124 for maximum meter indication.
- () Readjust C104, C123, and C124 for maximum meter indication.
- () Connect your VSWR or wattmeter to the input of your Amplifier (see Pictorial 6-1) and adjust C104 for minimum VSWR or reflect power.
- () Refer to Detail 6-1A (Page 41) and adjust coil L105 for the least VSWR or reflected power.
- () Disconnect the wattmeter, the 50 Ω load, and the power connectors.

This completes the "Alignment" of your VHF Amplifier. Proceed to "Final Assembly."



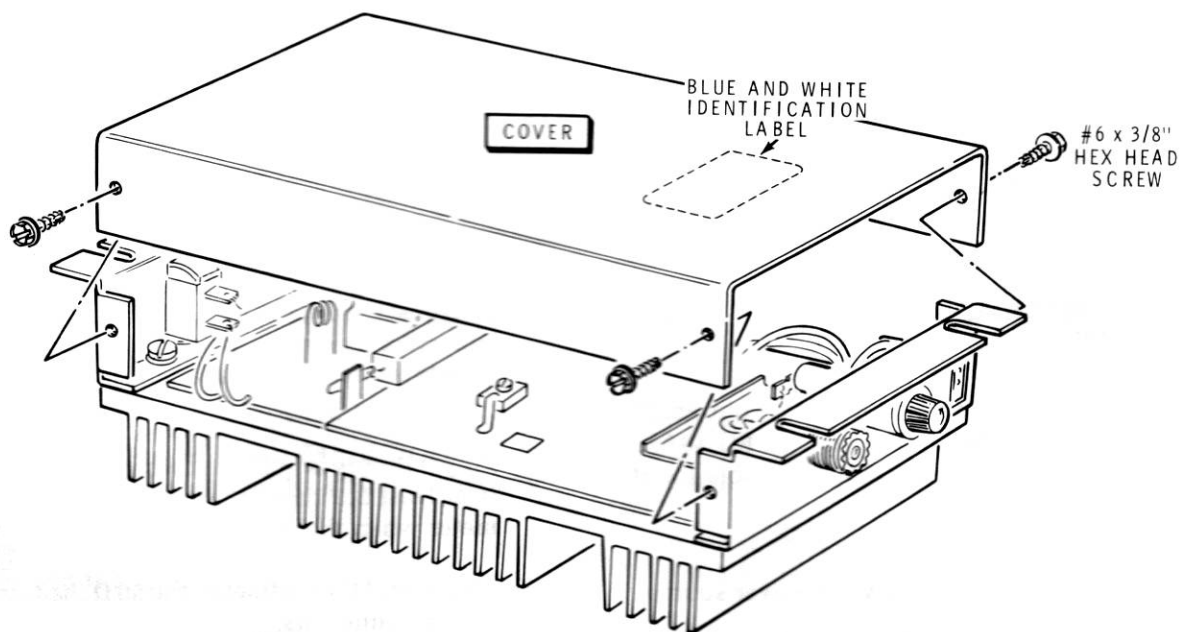
PICTORIAL 6-3

TRIMMER ALIGNMENT WITH A VOLTMETER

- () Refer to Pictorial 6-3 and connect your equipment as shown. **Make** sure you use RG-58A/U, RG-8A/U, or **similar** 50 Ω coaxial cable for all leads that carry RF.
- () Connect the Amplifier to your power source.
- () While you key the exciter 5 seconds on and 10 seconds off, use the alignment tool supplied to adjust trimmer capacitor C104 for maximum meter indication.
- () Readjust trimmer C104, C123, and C124 (in that order) for maximum meter indication. Then repeat this step at least once more for best results.
- () Proper tuning is indicated when the voltage at T is at least 2.5 times the voltage shown on the meter when the Amplifier is off.
- () Disconnect the voltmeter, the 50 Ω load, and the power connectors.

This completes the "Alignment" of your VHF Amplifier. Proceed to "Final Assembly."

FINAL ASSEMBLY



PICTORIAL 7-1

Refer to Pictorial 7-1 for the following steps.

- () Remove the protective paper backing from the blue and white label and press the label to the inside of the cover. Refer to the numbers on this label in any communications you have with the Heath Company concerning this kit.
- () Position the Amplifier on your work surface as shown. Then slide the cover over the heat sink and secure it with four #6 × 3/8" hex head, sheet metal screws. Be sure all wires and cables are positioned out of the way so they are not pinched between the cover and heat sink.

This completes the "Final Assembly" of your VHF Amplifier.

OPERATION

CAUTION

Do not exceed the drive and duty cycle requirements listed in the "Specifications" section of this Manual. To do so will cause the output power and heat dissipation to exceed the component rating. The Heath Company will not be responsible for component failure due to misuse.

Refer to Pictorial 8-1 (Illustration Booklet, Page 8) for the location and functions of input and output panel controls and connections.

GENERAL

Operation of this Amplifier is entirely automatic. When the exciter is keyed, the amplifier relay will transfer the exciter output to the amplifier output to the antenna. In the receive mode, the relay connects the exciter via a low-pass filter to the antenna. Current drain in the receive mode is negligible (less than 3 mA). If you wish to run VOX, the exciter may be used to key the relay. The exciter should be capable of switching 12 VDC, 100 mA, negative ground.

ON-OFF SWITCH

When this switch is in the ON position, the Amplifier will key. When it is in the OFF position, the input and output are connected together so that the exciter signal passes through the Amplifier with no amplification.

INPUT

Connect the output of your exciter to this INPUT jack with 50 Ω low loss coaxial cable.

FM-SSB JUMPER

This is a jumper wire that is between hole N and the ground foil on the antenna transfer circuit board. Connect this wire for SSB operation and cut it out for FM and CW operation.

When this wire is connected, and the exciter is in the SSB mode, the Amplifier will remain keyed for approximately one second whenever there is a speech interruption in the transmission. This delay therefore eliminates relay chatter when these modes are used.

OUTPUT

Connect this OUTPUT jack to your transmission line with 50 Ω low-loss coaxial cable.

EXTERNAL KEYING

With the Amplifier Power switch in the ON position, the Amplifier will key whenever you key the microphone.

IN CASE OF DIFFICULTY

NOTE: It is important that you read the entire "General Troubleshooting Information" and "Troubleshooting Precautions" sections, which follow, before you attempt to service your Amplifier.

This section of the Manual is divided into three parts. The first part, titled "General Troubleshooting Information," describes what to do about the difficulties that may occur right after your Amplifier is assembled.

The second part, titled "Troubleshooting Precautions," points out the care that you should use when

you service the Amplifier to prevent damage to the components.

The third part, titled "Troubleshooting Chart" calls out specific problems that could occur and list one or more conditions or components ("Possible Cause") that could cause each difficulty.

GENERAL TROUBLESHOOTING INFORMATION

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 57 for the physical location of parts on each circuit board.

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 kit builder.
2. About 90% of the kits that are returned for repair do not function properly because of poor soldering. Therefore, you can correct many troubles by making sure the connections are soldered as described in the "Soldering" section of this Manual. Reheat any doubtful connections.
3. Closely examine each circuit board foil to see that no solder bridges exist between adjacent foils. If you are not sure a solder bridge exists, compare the circuit board foil with the "Circuit Board X-Ray Views" (Pages 57 and 58) in this Manual. If a solder bridge exists, refer to the Assembly Notes on Page 5 in this Manual. Examine the component side of the circuit boards that have foil on both sides to check for solder that may have built-up on that side.
4. Be sure the transistors are in the proper locations (correct part number and type number). Be sure that each transistor lead is in the right hole and has a good solder connection.

5. Check capacitor values carefully. Be sure the proper part is wired into the circuit at each capacitor location. Check each electrolytic capacitor to be sure the positive (+) lead is at the correct position.
6. Check each resistor value carefully. A resistor that is discolored, or cracked, or shows any signs of bulging would indicate that it is damaged and should be replaced. Since damaged resistors are often the result of some other difficulty (such as faulty wiring), you should try to find out what caused the damage before you replace the part.
7. Be sure the correct diode is installed at each location and that the banded end is positioned correctly.
8. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the circuit board or switch wiring.
9. Check all component leads connected to each circuit board. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts.
10. A review of the "Circuit Description" may also help you determine where the trouble is.

If you still cannot locate and correct the trouble after you complete the above checks, and if a voltmeter is available, check the voltages in the Amplifier against the voltages shown on the "Schematic Diagram" (Illustration Booklet, Page 9).

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

TROUBLESHOOTING PRECAUTIONS

Observe the following precautions when you troubleshoot your Amplifier.

1. Make sure you do not short any adjacent terminals or foils when you make tests or voltage measurements. If a probe or test lead slips, for example, and shorts together two adjacent connections, it is very likely to damage one or more of the transistors or the diodes.
2. Be especially careful when you test any circuit that contains a transistor. Although these components have an almost unlimited life when used properly, they are much more vulnerable to damage from excess voltage and current than many other parts.
3. Do not remove any components while power is applied to the Amplifier. Disconnect the power source from the Amplifier before doing so.
4. When you repair the Amplifier, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you find a damaged resistor, be sure you find out what damaged the resistor. If the cause is not eliminated, the replacement resistor may also become damaged when you put the Amplifier back into operation.
5. In some areas of the circuit boards, the foil patterns are quite narrow. When you unsolder a part to check or replace it, avoid excessive heat while you remove the part. A suction-type desoldering tool makes part removal easier.

COMPONENT REPLACEMENT

To remove faulty resistors or capacitors; first clip them from their leads, then heat the solder on the foil and allow each lead to fall out of its hole. Preshape the leads of the replacement part and insert them into the holes in the circuit board. Solder the leads to the foil and cut off the excess lead lengths.

You can remove transistors the same way you remove resistors and capacitors. Make sure you install the

replacement transistor with its leads in the proper holes. Then solder the leads quickly to avoid heat damage. Cut off the excess lead lengths.

FOIL REPAIR

To repair a small break in a circuit board foil, bridge solder across the break. Bridge large gaps in the foil with a bare wire. Lay the wire across the gap and solder each end to the foil. Carefully trim off any excess bare wire.

CHECKING TRANSISTORS AND DIODES

TRANSISTORS

To check a transistor accurately, you should use a transistor tester. However, if one is not available, you can use an ohmmeter to determine the general condition of any one of the bipolar transistors in this kit. The ohmmeter you use must have at least 1 volt DC at the probe tips to exceed the threshold of the diode junctions in the transistor you are testing. Most vacuum tube voltmeters meet this requirement.

To check a transistor with an ohmmeter, proceed as follows:

1. Remove the transistor from the circuit.
2. Set the ohmmeter to the $R \times 1000$ range.
3. Connect one of the ohmmeter test leads to the base (B) of the transistor. Touch the other meter lead to the emitter (E) and then to the collector (C). Both readings should be the same, but may be either high or low. If one reading is high and the other low, the transistor should be replaced. (Use the Semiconductor Identification Chart on Page 56 to identify the transistor leads.)

4. Interchange the test leads and repeat step 3. The readings should now be both low if they were both high before or both high if they were both low before. If the readings are the same no matter which ohmmeter lead is connected to the base, the transistor should also be replaced.

DIODES

To check a diode, unsolder one end from the circuit board, pull the lead up and out of the circuit board hole, and proceed as follows:

1. Set the ohmmeter to the $R \times 1000$ range.
2. Connect one of the ohmmeter test leads to the lead at the cathode (banded) end of the diode. Connect the other test lead to the other diode lead. Note the meter reading. Then interchange the meter leads and take another reading. One reading should be high and the other low (at least 10:1). If both readings are either high or low, the diode should be replaced.

TROUBLESHOOTING CHART

The following chart lists the "Condition" and the "Possible Cause" or "Troubleshooting Procedure" of a large number of malfunctions. If a particular part or parts are mentioned (transistor Q101, for example, or diode D202) as a possible cause, check these parts to see if they are wired or installed incorrectly. Also

check to see if an improper part was installed at that location. It is also possible on rare occasions, for a part to be faulty.

AMPLIFIER PROBLEMS

CONDITION	POSSIBLE CAUSE
No power output.	1. Transistor Q101.
Low output power. (See "Low Output Power" on Page 50.)	1. Drive power is low. 2. Amplifier is misaligned. 3. Relay K201 is not activated. 4. Antenna VSWR is excessive. 5. Transistor Q101.
Relay does not close when RF is applied.	1. Drive power is low. 2. Capacitor C204. 3. Diodes D203 or D204. 4. Transistor Q202.
Relay does not close when external keying is used.	1. Diode D202.
Trimmer capacitors do not peak (capacitors fully open or fully compressed).	1. Trimmer capacitors C104, C123, or C124. 2. High VSWR. 3. Low excitation (drive) power.
Received signals weak with Amplifier in the line.	1. Contacts of relay K201 are not operating properly.

LOW OUTPUT POWER

The circuitry in this Amplifier is extremely critical to internal circuit impedance. Proper soldering, short leads, and correct wire routing can be an important factor in minimizing circuit impedance. For this reason, if you have low power output, check the following areas in your kit and refer to the indicated Page in the Manual. Make sure the part is installed and soldered according to the Manual instructions.

1. Correct flat capacitor soldering (Page 22).
2. Correct value of flat capacitor. **NOTE:** If it becomes necessary to check the value of a flat capacitor, remove the solder from the capacitor with desoldering braid.
3. Preparation and installation of transistor Q101 (Page 21).
4. Soldering of the coaxial cable shield lead to the solder lugs at J1 and J2.
5. Routing the black and red wires coming from the Amplifier circuit board (Illustration Booklet, Page 6).

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.

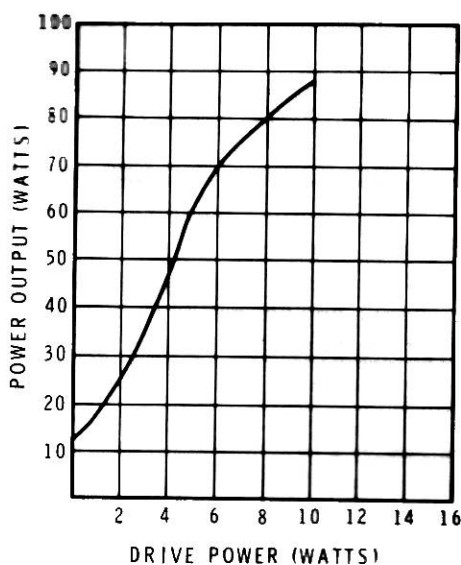
SPECIFICATIONS

Frequency Range

144 to 148 MHz. (aligned at 146 MHz)

Power Output

75 watts nominal, (@13.6 VDC) with 10 watts of drive. See the chart on this page.



**MRF-247 Transistor
Typical Output Power
Versus Drive Power**

Power Input

1 to 10 watts (maximum) CW, SSB, FM, RTTY
50% duty cycle — 10 minutes on (maximum) and 10 minutes off.

10 to 15 watts (maximum) CW, RM, RTTY
50% duty cycle — 2 minutes on (maximum) and 2 minutes off.

Input/Output Impedance

50 Ω .

Input VSWR

2:1 maximum.

Maximum Stable VSWR

2:1, referenced to 50 Ω .

Insertion Loss

0.6 dB.

Conducted Spurious and Harmonics

-60 dB or better.

Third Order Distortion	-24 dB referenced to one of two tones or -30 dB referenced to CW power.
Supply Voltage Range	11.5 to 15.0 VDC, negative ground.
Mode of Operation	SSB, FM, RTTY and CW.
Current Drain (@13.6 VDC and 75 watts output power)	11 amperes maximum.
Standby Current	3 mA.
Operating Temperature Range	-30°F to + 140°F (-34°C to + 60°).
Dimensions (overall)	2-3/4" high × 10-3/4" deep × 4-3/4" wide. (7.0 × 27.3 × 12.1 cm).
Net Weight	3-1/4 lbs. (1.5 kg).

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

CAUTION

Do not exceed the drive and duty cycle requirements listed in the "Specifications" section of this Manual. To do so will cause the output power and heat dissipation to exceed the component rating. The Heath Company will not be responsible for component failure due to misuse.

CIRCUIT DESCRIPTION

Refer to the Schematic (Illustration Booklet, Page 9) while you read this "Circuit Description." The part numbers are arranged in the following groups to help you locate specific parts on the Schematic, circuit boards, and chassis.

- 1-99 Parts mounted on the chassis.
- 101-199 Parts mounted on the amplifier circuit board.
- 201-299 Parts mounted on the antenna transfer circuit board.

AMPLIFIER CIRCUIT BOARD

The 50 ohm **amplifier** input impedance is transformed to the **low base impedance** of Q101 by micro-strip **transmission lines** Z1, Z2, and Z3 and by capacitors C104, C105, C107, C108, C111, and C112. Flat mica **capacitors** are used because of their low inherent **inductance** and power loss.

When relay K201 is energized, the 13.6 volt supply voltage is applied through resistor R1 to heat-sink mounted bias diode D1. The .65 volt potential across D1 tracks the voltage across the base-emitter junction

of transistor Q101 at all operating temperatures. This always results in linear amplifier operation and prevents thermal runaway of the amplifier.

The low collector impedance of Q101 is transformed to 50 ohms by micro-strip **transmission lines** Z4, Z5, and Z6 and capacitors C114, C115, C119, C121, C122, C123 and C124. Coils L103, L104, and capacitor C113 form a circuit that isolates the RF voltage on the collector of Q101 from the DC power source.

ANTENNA TRANSFER CIRCUIT BOARD

A portion of the drive signal is sampled by capacitor C205 and applied to diodes D203 and D204, which function as a voltage-doubler detector. The rectified voltage is filtered by capacitor C206 and then coupled through resistor R202 to the base of Darlington transistor Q202. The DC voltage drives Q202 into conduction.

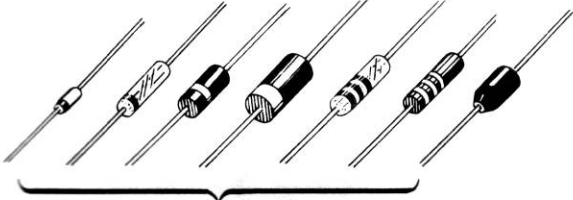
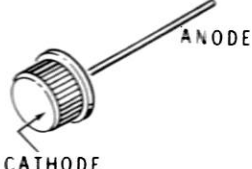
With Q201 conducting, relay K201 will energize and close. When closed, the relay connects the input jack to the amplifier input, and the amplifier output signal is passed through the low-pass filter to the Antenna jack. The low-pass filter, made up of capacitors C209, C211, C212, C213 and coils L202 and L203 attenuates harmonic emissions in the transmit mode. This filter also helps reduce harmonic emissions from the exciter.

Coaxial line T1 is a quarter wavelength long. This quarter-wave section has no effect at the operating frequency (a $1/4$ -wave section that is shorted on one end causes a **high** impedance on the other end). This section does, however, short out some of the second harmonic energy (a $1/2$ -wave section that is shorted on one end causes a **low** impedance on the other end).

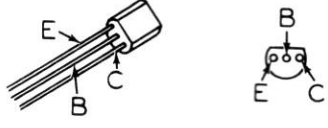
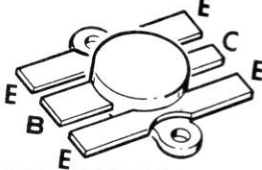
When relay K201 is de-energized, the low-pass filter helps attenuate received signals that are above the 2-meter band. The incoming signals pass from the Antenna jack, through the low-pass filter, via the relay contacts to the input of the receiver. Diode D201 protects transistor Q201 from the transient developed by the relay when it is switched off.

SEMICONDUCTOR IDENTIFICATION CHART

DIODES

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D201-D205	56-56	1N4149	<p>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</p>  <p>BANDED END</p>
D2	57-71	S-5A05	
D1	57-34	1N3491	

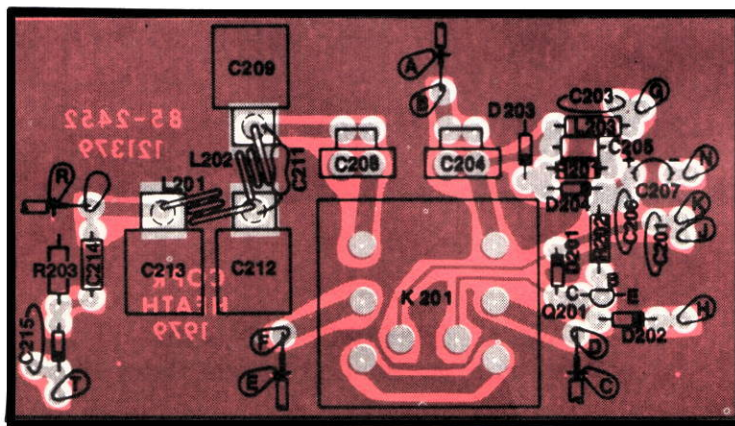
TRANSISTORS

CIRCUIT COMPONENT NUMBER	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
Q201	417-881	MPSA13	 The diagram shows two views of the MPSA13 transistor. On the left is a perspective view of the component, a small rectangular package with three leads extending from one end. The leads are labeled E (Emitter), B (Base), and C (Collector). On the right is a top-down view of the component, showing three circular solder pads arranged in a triangular pattern. The pads are labeled B (Base) at the top, E (Emitter) at the bottom left, and C (Collector) at the bottom right.
Q101	417-951	MRF247	 The diagram shows a top-down view of the MRF247 transistor. It is a circular component with several rectangular leads extending from its perimeter. The leads are labeled with their respective terminals: E (Emitter) at the top, C (Collector) at the top right, E (Emitter) at the bottom right, E (Emitter) at the bottom left, and B (Base) at the top left. There are also two small circular solder pads on the component, one near the top left and one near the bottom right.

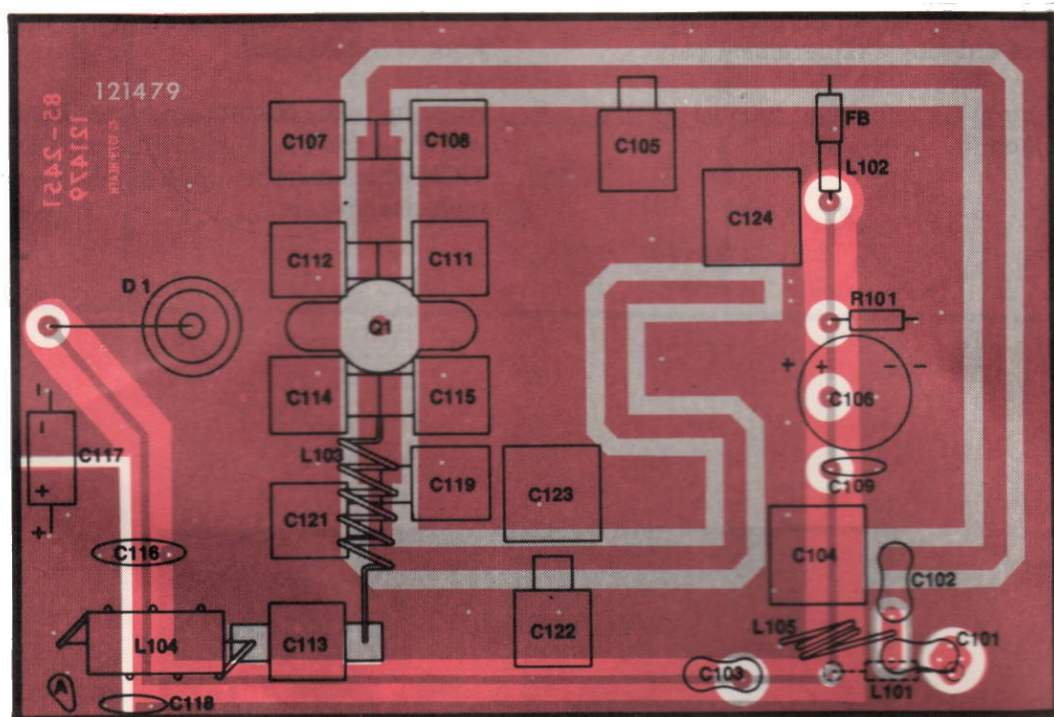
CIRCUIT BOARD X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R105, C103, etc.) on the "X-Ray View."
- B. Locate the same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



ANTENNA TRANSFER CIRCUIT BOARD
(Viewed From the Component Side)



AMPLIFIER CIRCUIT BOARD
(Viewed From the Component Side)

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

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 and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD 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. Do not include the kit Manual.) 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



HEATH COMPANY • BENTON HARBOR, MICHIGAN
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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