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Heathkit® Manual

for the
**BATTERY
ELIMINATOR**
Model IP-2715

595-1845-04

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS INSTRUMENT TO RAIN OR MOISTURE.

Read all parts of this manual before attempting to assemble or use the instrument. This manual is copyrighted by Heath Company and is printed on acid-free paper. A small hole is punched in the upper right corner of the manual for use with a hole punch. The manual is printed on acid-free paper. The numbers on the parts list are for your reference only and do not appear in the Manual "Parts List" form. All packaging material and you receive at the time.

The only way to be sure that the instrument is assembled correctly is to read the manual. There are many things to be done before you can use the instrument. In order to be sure that the instrument is assembled correctly, read the "Parts List" and "Notes" before you begin. The following are the instructions for the instrument.

RESISTORS

RESISTOR	QTY	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS

NOTE: The values of the resistors in this manual are given in ohms, kilohms, and megohms. The values are given in the form of a number followed by a multiplier. For example, 10K means 10,000 ohms, 100K means 100,000 ohms, and 1M means 1,000,000 ohms.

RESISTOR	QTY	DESCRIPTION	CIRCUIT Comp. No.
100K	1	100,000 ohm 1/2W	R1
10K	1	10,000 ohm 1/2W	R2
1K	1	1,000 ohm 1/2W	R3
100	1	100 ohm 1/2W	R4
10	1	10 ohm 1/2W	R5

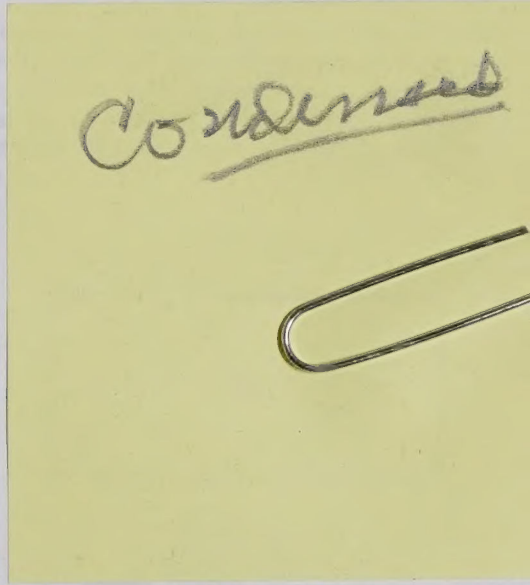


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PARTS LIST

Unpack all parts and check each part against the following list. The parts may vary slightly from the illustration. Keep any part that is individually packaged with a part number on it in its package after you identify it until you actually use it. Some parts are marked with a "171-" packaging number. These numbers are used for packaging only and do not appear in the Manual "Parts List." Save all packaging material until you locate all the parts.

The key numbers in the Parts List correspond to the numbers in the parts pictorial. These numbers are to help you identify parts.

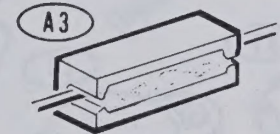
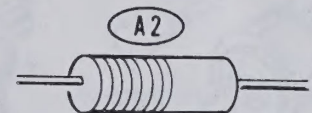
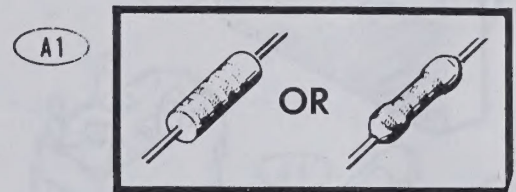
To order a replacement part use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. NOTE: Never use a "171-" packaging number if you must order replacement parts; use only the part numbers listed in the following list.

KEY PART	QTY.	DESCRIPTION	CIRCUIT
No. No.	_____	_____	Comp. No.

RESISTORS

NOTE: The resistors may be packed in more than one envelope. Open all the resistor envelopes before you check the resistors against the Parts List.

A1	6-220	1	22 Ω, 1/2-watt, 5% (red-red-black)	R1 ✓
A1	6-302	1	3000 Ω, 1/2-watt, 5% (orange-black-red-gold)	R9 ✓
A1	6-332	1	3300 Ω, 1/2-watt, 5% (orange-orange-red-gold)	R7 ✓
A2	1-30-2	1	270 Ω, 2-watt (red-violet-brown)	R6 ✓
A3	3-11-5	16	.33 Ω, 5-watt	R2, R3, R4, R5 (4 each) ✓



KEY PART No.	QTY.	DESCRIPTION
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CIRCUIT Comp. No.

CAPACITORS

B1	21-140	1	.001 μ F disc
B2	27-47	2	.1 μ F Mylar*
B3	25-95	1	10 μ F electrolytic
B3	25-199	1	500 μ F electrolytic
B3	25-154	1	2500 μ F electrolytic
B4	25-263	2	10,000 μ F electrolytic

C8 ✓
C4, C7 ✓
C5 ✓
C6 ✓
C3 ✓
C1, C2 ✓

RECTIFIER-DIODE-TRANSISTORS-INTEGRATED CIRCUIT (IC)

C1	57-88	1	MDA990-2 bridge rectifier
C2	57-65	1	1N4002 diode

BR1 ✓
D1 ✓

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers, the letters may be different or missing.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

C3	417-233	1	2N3643 transistor
C4	417-215	1	2N3055 transistor
C4	417-139	4	40411 transistor
C5	442-626	1	μ A78MG IC

Q1 ✓
Q2 ✓
Q3, Q4, ✓
Q5, Q6 ✓
IC1 ✓

OTHER CIRCUIT COMPONENTS

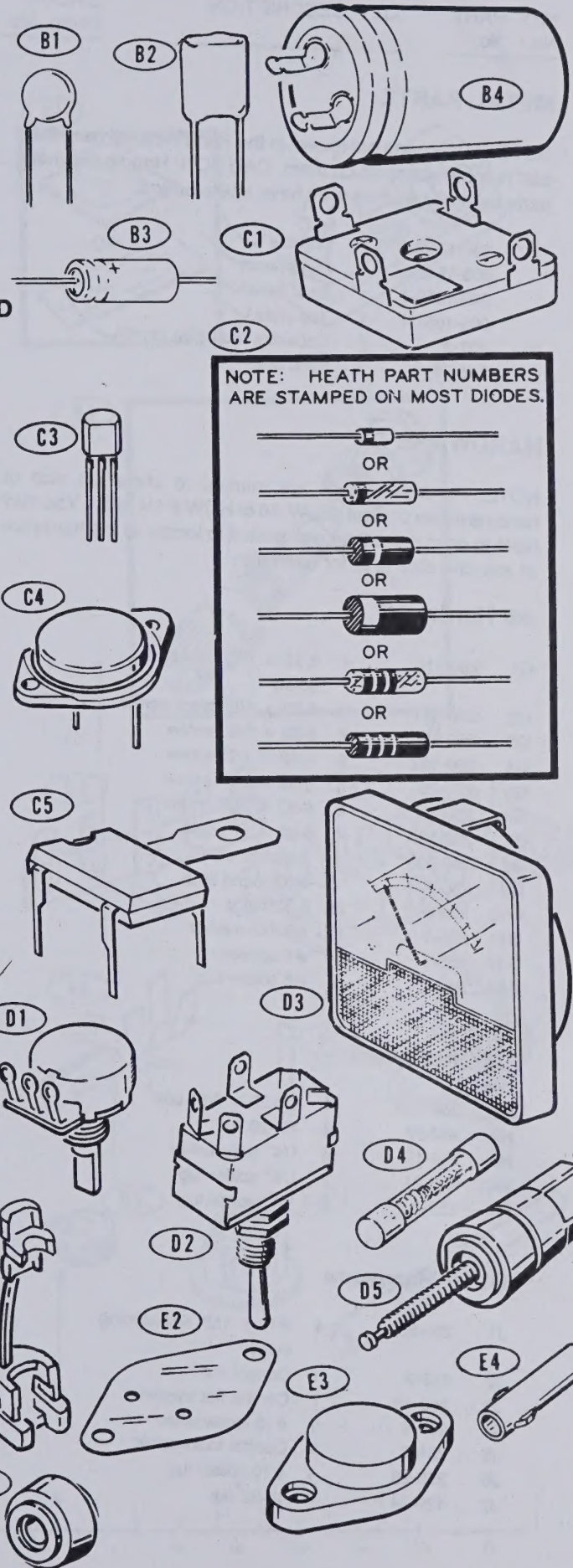
D1	10-1053	1	3000 Ω (3k) control
	54-848	1	Power transformer
D2	61-3	2	Toggle switch (with hardware)
D3	407-723	1	Voltmeter (with hardware)
D3	407-722	1	Ammeter (with hardware)
D4	421-9	1	7-ampere slow-blow fuse
D4	421-18	1	20-ampere fuse
D5	426-10	1	Black binding post
D5	426-11	1	Red binding post

R8 ✓
T1 ✓
SW1, SW2 ✓
M1 ✓
M2 ✓
F1 ✓
F2 ✓
J2 ✓
J1 ✓

STRAIN RELIEF-INSULATORS

E1	75-723	1	Line cord strain relief
E2	75-44	5	Mica insulator (Packed between two pieces of cardboard)
E3	75-88	5	Transistor insulator
E4	432-790	4	Female connector insulator
E5	426-12	1	Black binding post insulator
E5	426-13	1	Red binding post insulator

*DuPont Registered Trademark



NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES.

KEY PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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METAL PARTS

NOTE: Metal parts not shown in the Parts Pictorial have their part number stamped on them. CAUTION: Handle the metal parts carefully as they may have sharp edges.

	200-1259	1	Chassis ✓
	203-1849-1	1	Front panel ✓
	203-1850-1	1	Rear panel ✓
	205-1657-1	1	Top plate ✓
F1	207-2	2	Capacitor mounting clamp ✓
	215-76	2	Heat sink ✓

HARDWARE

NOTE: Hardware packs are marked to show the size of hardware they contain (HDW #6 or HDW #1/4, etc.). You may have to open more than one packet to locate all the hardware of any one size (#6, for example).

#6 Hardware

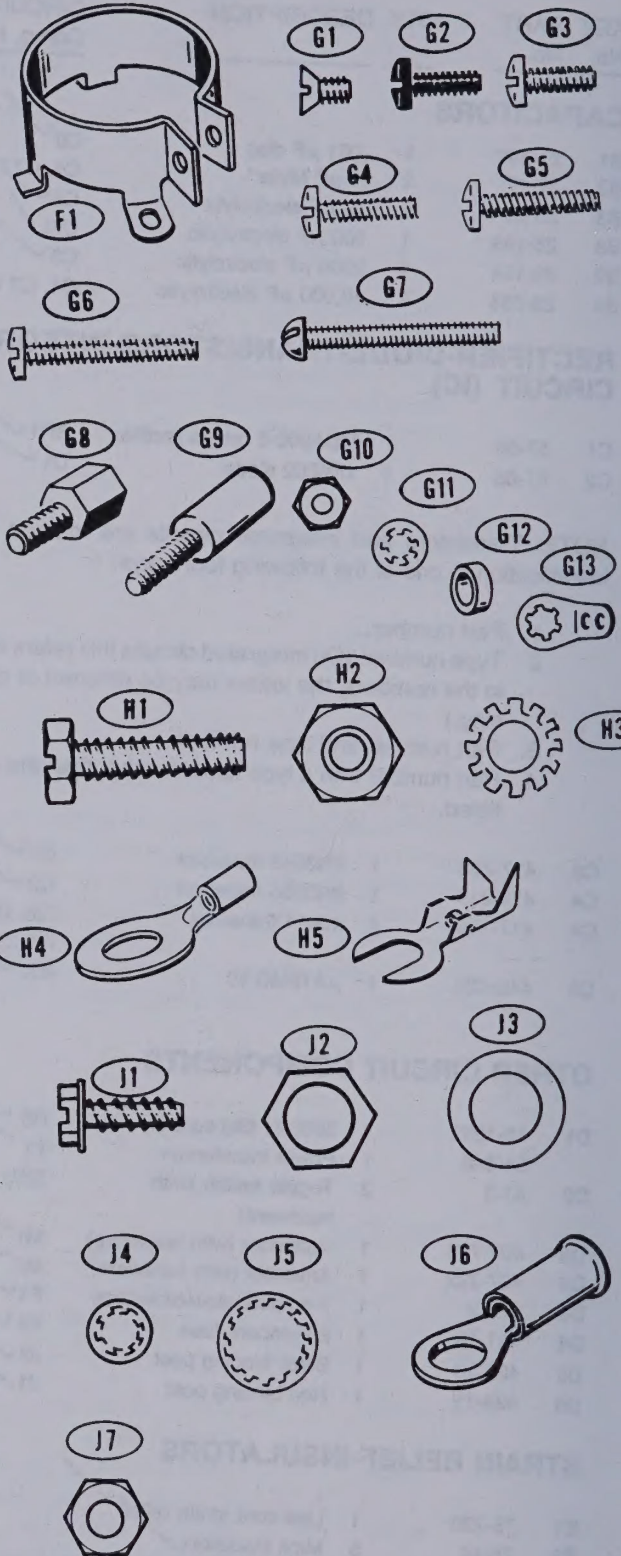
G1	250-416	4	6-32 × 1/4" flat head screw
G2	250-381	14	6-32 × 3/8" black screw
G3	250-89	8	6-32 × 3/8" screw
G4	250-162	9	6-32 × 1/2" screw
G5	250-26	5	6-32 × 5/8" screw
G6	250-1173	8	6-32 × 7/8" screw
G7	250-13	4	6-32 × 1" screw
G8	250-305	4	6-32 hex-stud
G9	250-271	2	6-32 round stud
G10	252-3	22	6-32 nut
G11	254-1	27	#6 lockwasher
G12	255-1	10	#6 spacer
G13	259-1	3	#6 solder lug

1/4" Hardware

H1	250-253	4	1/4-20 × 7/8" bolt
H2	252-57	4	1/4-20 nut
H3	254-12	6	1/4" lockwasher
H4	259-21	2	1/4" solder lug
H5	259-7	2	1/4" spade lug

Other Hardware

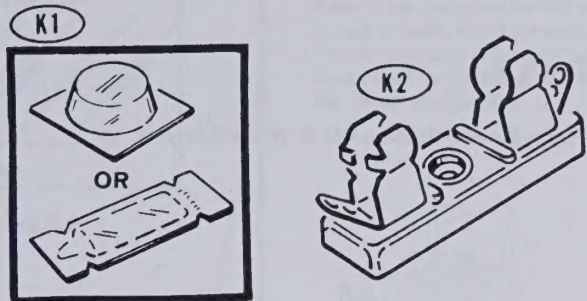
J1	250-83	4	#10 × 1/2" self-tapping screw
J2	252-7	1	Control nut
J3	253-10	1	Control flat washer
J4	254-3	8	#10 lockwasher
J5	254-5	1	Control lockwasher
J6	259-26	4	#10 solder lug
J7	426-14	4	10-32 nut



KEY PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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WIRE-SLEEVING-CABLE

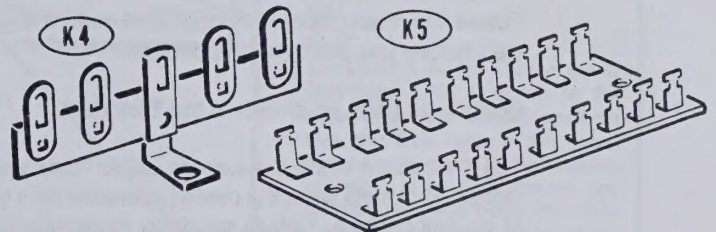
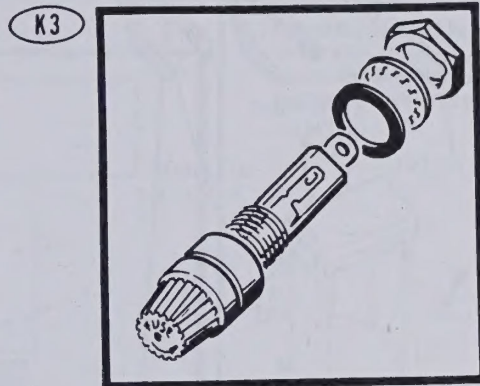
89-50	1	Line cord
340-1	7'	Bare wire
344-3	1'	Red wire
344-7	4'	Black wire
344-28	1'	Yellow wire
344-29	5'-6"	Blue wire
344-44	1'	Violet wire
346-4	5'-6"	Sleeving
347-13	6'	2-wire cable



MISCELLANEOUS

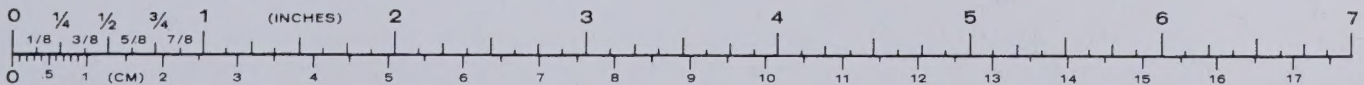
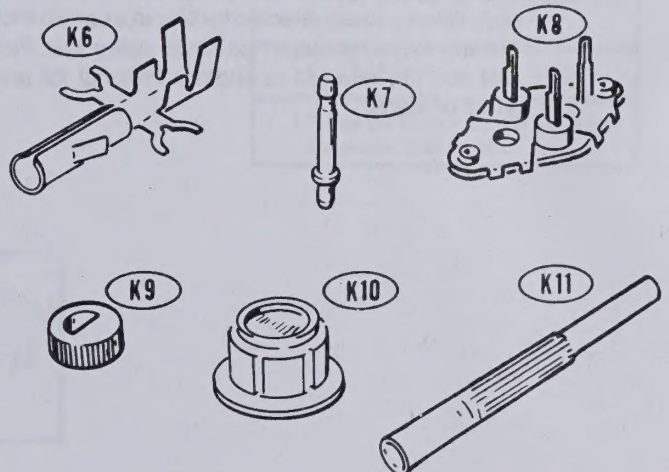
85-1752-1	1	Circuit board
211-15	2	Plastic handle
261-21	4	Rubber foot
K1 352-31	1	Dow Corning thermal compound
K2 422-1	1	Fuse block
K3 423-1	1	Fuseholder (with hardware)
K4 431-42	1	5-lug terminal strip
K5 431-67	2	20-lug terminal board
K6 432-851	4	Female connector
K7 432-772	4	Connector pin
K8 434-189	5	Transistor socket
K9 455-619	1	Knob bushing
K10 462-920	1	Knob
K11 490-5	1	Nut starter

Solder



PRINTED MATERIAL

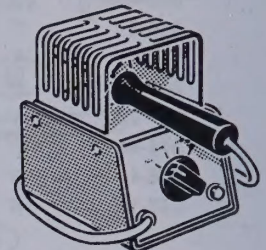
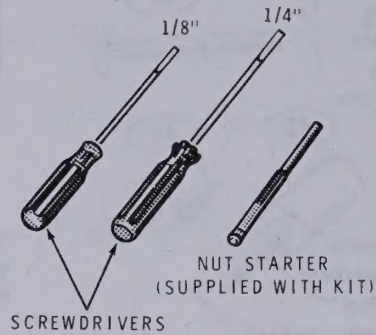
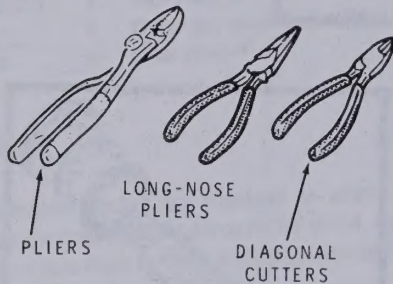
390-1255	1	Fuse replacement label
391-34	1	Blue and white label
597-260	1	Parts Order Form
		Assembly Manual (See front cover for part number.)



ASSEMBLY NOTES

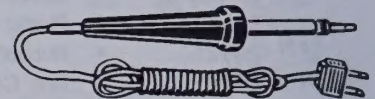
TOOLS

You will need these tools to assemble your kit.



SOLDERING
IRON

OR



PENCIL SOLDERING IRON
(40 WATTS)

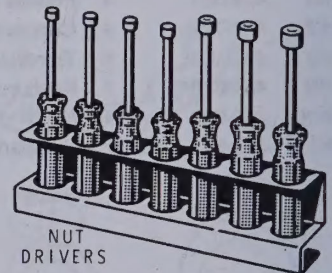
ASSEMBLY

1. Follow the instructions carefully, and read the entire step before you perform the operation.
2. Position all parts as shown in the Pictorials.
3. 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.

OTHER HELPFUL TOOLS



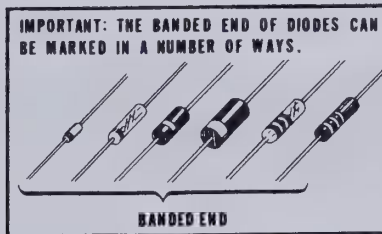
WIRE
STRIPPERS



NUT
DRIVERS



SOLDERING AID



Detail 1-2A

START

(✓) R6: 270 Ω 2-watt (red-violet-brown).

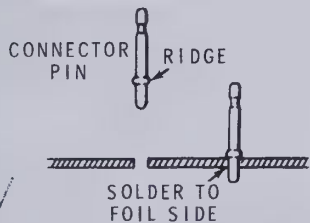
NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. A DIODE WILL NOT WORK IF INSTALLED BACKWARDS. See Detail 1-2A.



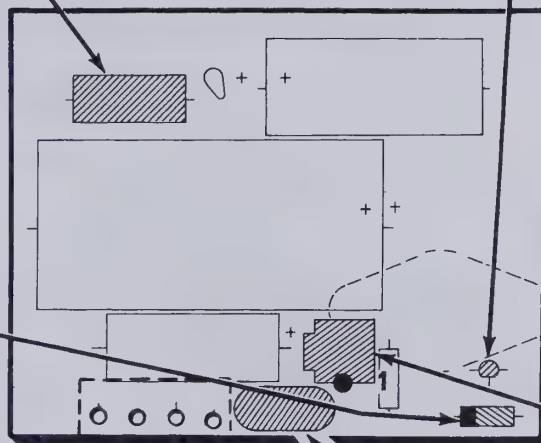
(✓) D1: IN4002 diode (#57-65).

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

NOTE: When you install a connector pin, push the pin into the hole until the ridge is down against the circuit board. Then solder the pin to the foil. Use enough heat to make a good solder connection.



(✓) Install connector pins in the holes marked YEL, RED, VIOL, and BLU.



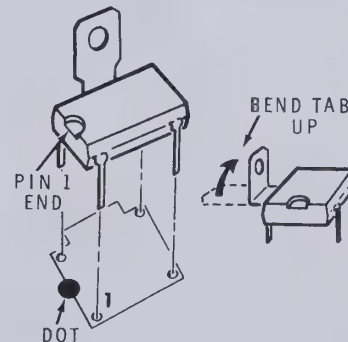
PICTORIAL 1-2

CONTINUE

(✓) Q1: 2N3643 transistor (#417-233). Refer to the Detail and identify the E, B, and C leads. Insert the leads into the indicated holes in the circuit board. Solder each lead to the foil and cut off the excess lead lengths.



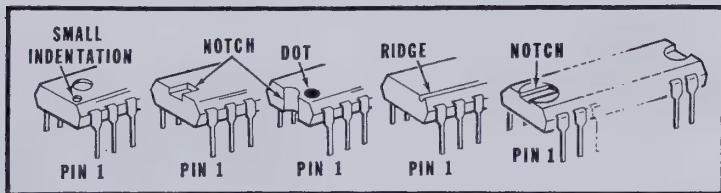
(✓) Locate the μA78MG integrated circuit (#442-626). Grip the IC between your thumb and finger (do not use pliers) and bend the tab up as shown.



(✓) IC1: Position the pin 1 end of the IC (see Detail 1-2B) at the dot on the circuit board and carefully insert the pins into their holes in the circuit board. Do not use the tab for mounting orientation of the IC, as the tab may exit from either side. Solder the pins to the foil and cut off any excess pin lengths.

(✓) C4: .1 μF Mylar.

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

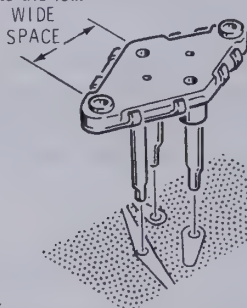


Detail 1-2B

START

Turn the circuit board over and position it as shown.

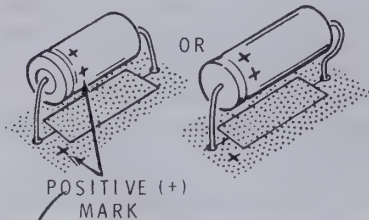
NOTE: When you install the following transistor socket, insert the pins into their holes in the circuit board **only** until the ends of the socket pins are flush with the surface on the other side of the circuit board. Note the wide space between the socket holes. If necessary, twist the socket to position it parallel to the side of the circuit board. Then solder the pins to the foil.



Transistor socket.

Turn the circuit board over and position it as shown.

NOTE: When you install an electrolytic capacitor, match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board. Since capacitor lengths vary, it may be necessary to form the negative lead on a longer capacitor as shown below. Be sure the positive lead does not touch the capacitor body.

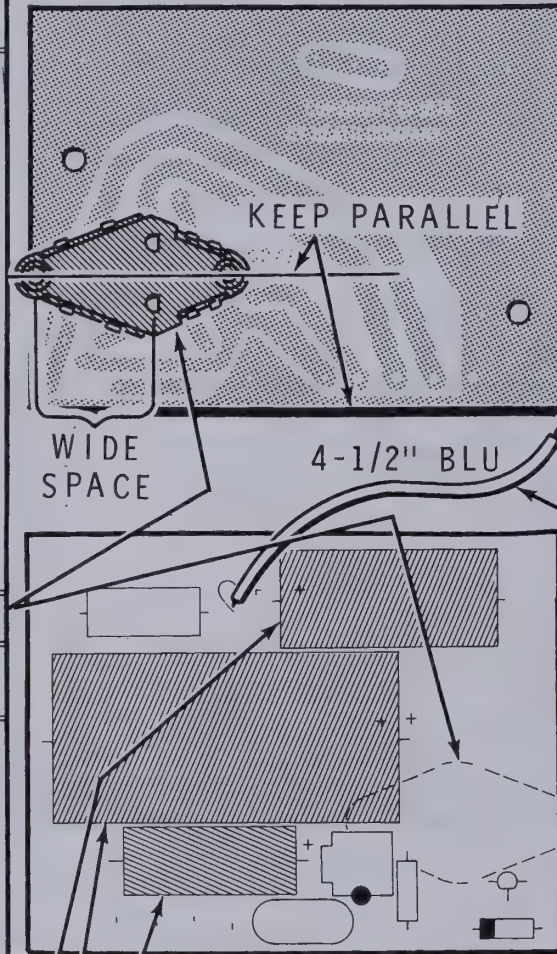


C6: 500 μ F electrolytic.

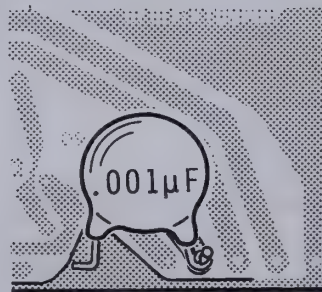
C3: 2500 μ F electrolytic.

C5: 10 μ F electrolytic.

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



PICTORIAL 1-3



Detail 1-3A

CONTINUE

NOTE: To prepare a wire, remove 1/4" of insulation from each end of the specified length and color of wire. Twist together the fine strands of wire and melt a small amount of solder on the exposed wire ends.

Prepare a 4-1/2" blue wire. Solder one end of this wire in hole A. Cut off the excess lead length. The free end of this wire will be connected later.

Cut both leads of the .001 Ω F disc capacitor to 1/2".

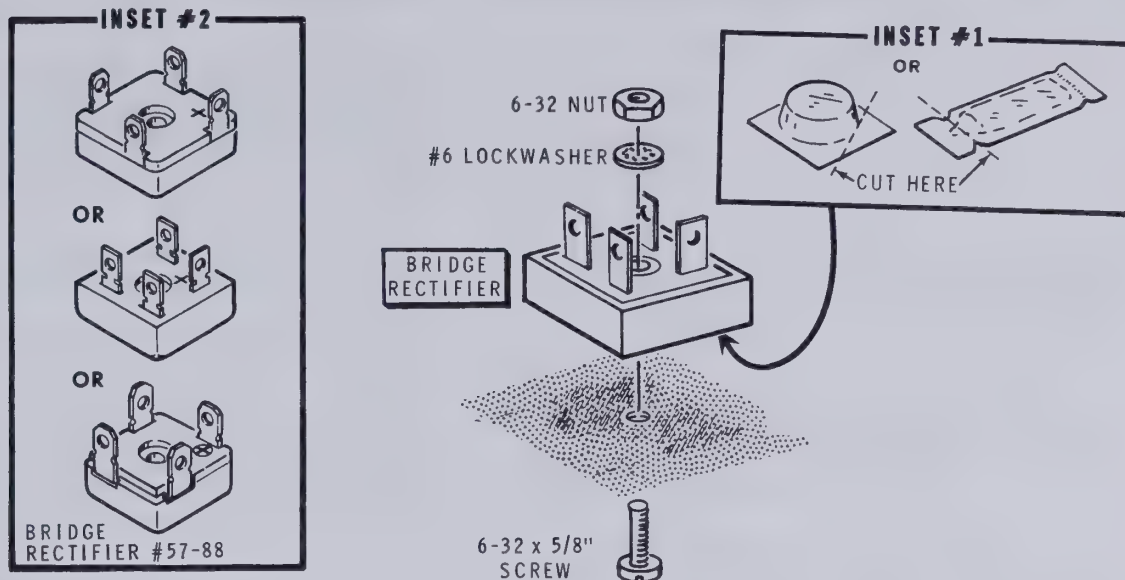
Turn the circuit board over. Then refer to Detail 1-3A and solder the .001 μ F disc as shown between the BLU connector pin and the nearby ground foil. Press the capacitor flat against the circuit board.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- Unsoldered connections.
- Poor solder connections.
- Solder bridges between foil patterns.
- Protruding leads which could touch together.
- Transistor for the proper type and installation.
- Integrated circuit for the correct position of pin 1.
- Diode for the correct position of the banded end.
- Electrolytic capacitors for the correct position of the plus (+) marked lead.

Set the circuit board aside until it is called for later.



WARNING: You will be using Dow Corning 340 thermal compound in the next step. Although the compound is not caustic, it may cause discomfort if it gets into your eyes. If this happens, rinse your eyes with warm water. If the compound gets onto your clothing, the clothing may require professional cleaning. The compound contains Zinc Oxides, SiO₂, and slight traces of CO₂.

Detail 2-1E

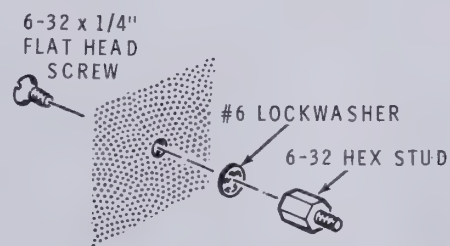
- () Refer to Detail 2-1F and mount a 6-32 hex stud at location AA with a 6-32 x 1/4" flat head screw and a #6 lockwasher.
- () In the same manner, mount 6-32 hex studs at locations AB, AC, and AD.

Set the chassis aside temporarily.

- () Refer to inset drawing #1 in Detail 2-1E and carefully open the thermal compound.

NOTES:

1. Refer to inset drawing #2 on Detail 2-1E to correctly identify the type of bridge rectifier you received, and to identify the location of the positive (+) lug.
2. You can use the blade of a screwdriver to spread the thermal compound, as in the next step, if you wish. This will prevent getting the compound on your hands.



Detail 2-1F

- () Spread a thin layer of the thermal compound on the flat side of the MDA990-2 bridge rectifier (#57-88). Save the remaining thermal compound for later use.
- () BR1: Refer to Detail 2-1E and mount this bridge rectifier at location BR1 with 6-32 x 5/8" hardware. Tighten the hardware firmly, but, do not overtighten the hardware as the rectifier may break. Be sure to position the positive (+) lug as shown in Pictorial 2-1.

- (✓) Refer to Part 3 of Detail 2-6C and prepare the 4" wire with 3" sleeving.
- (✓) Connect the hooked end of this 4" wire to the bare area (between the length of sleeving) on the wire between capacitor C1 lug 1 and capacitor C2 lug 1 (S-1). Connect the other end of this wire in the hole of rectifier BR1 lug 3 (S-2).
- (✓) Refer to Part 4 of Detail 2-6C and prepare the 9-1/2" wire with the two 4-1/4" lengths of sleeving.
- (✓) Connect this 9-1/2" wire from capacitor C1 lug 2 (NS) to capacitor C2 lug 2 (NS).

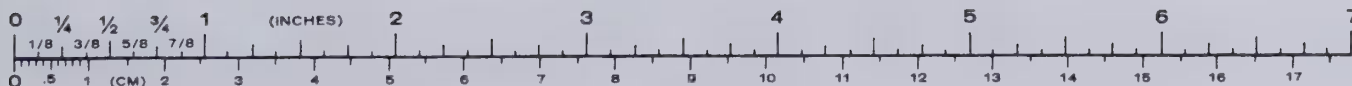
NOTE: The holes in some lugs may be too small to accept two wires. In these instances, install one wire in the lug hole and wrap the other wire around the lug. Be sure both wires are soldered securely when you are instructed to solder the connections.

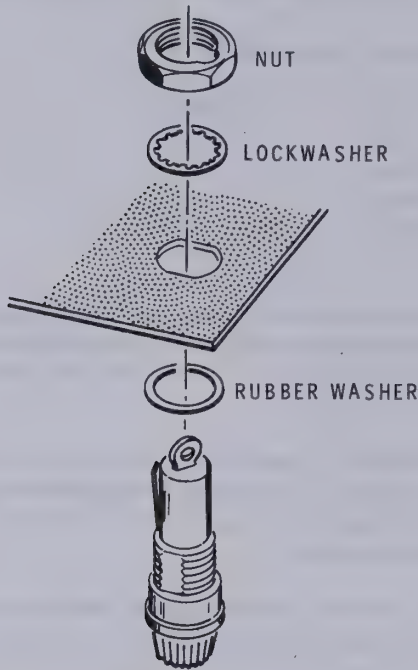
- (✓) Connect the free end of the wire coming from Q4 lug C to capacitor C1 lug 2 (S-2).
- () Connect the free end of the wire coming from Q6 lug C to capacitor C2 lug 2 (S-2).
- (✓) Refer to Part 5 of Detail 2-6C and prepare the 1-3/4" wire.
- (✓) Connect the looped end of this wire to the bare area (between the lengths of sleeving) on the wire between capacitor C1 lug 2 and capacitor C2 lug 2. Do not solder this connection yet. Connect the other end of this wire to rectifier BR1 lug 1 (S-1).

Prepare the following lengths of wire:

	COLOR	LENGTH
(✓)	Black	9"
(✓)	Red	7-1/2"
(✓)	Blue	17"

- (✓) Connect one end of the 9" black wire to the bare area (between the lengths of insulation) on the wire between the two terminal boards (S-1). The other end of this wire will be connected later.
- (✓) Install a female connector at one end of each of the 7-1/2" red and the 17" blue wires. After each connection has cooled, push a female connector insulator onto each female connector.
- (✓) In the same manner, install a female connector and a female connector insulator on the free end of the 7-1/2" yellow wire coming from solder lug F mounted with transformer T1.
- (✓) Connect the free end of the 7-1/2" red wire to the bare area (between the lengths of insulation) on the wire between capacitor C1 lug 2 and capacitor C2 lug 2 (S-2). The other end of the wire will be connected later.
- (✓) Position the free (bare) end of the 17" blue wire between capacitors C1 and C2 and around the right side of transformer T1. Both ends of this wire will be connected later.
- (✓) Set the chassis aside temporarily.





Detail 2-7A

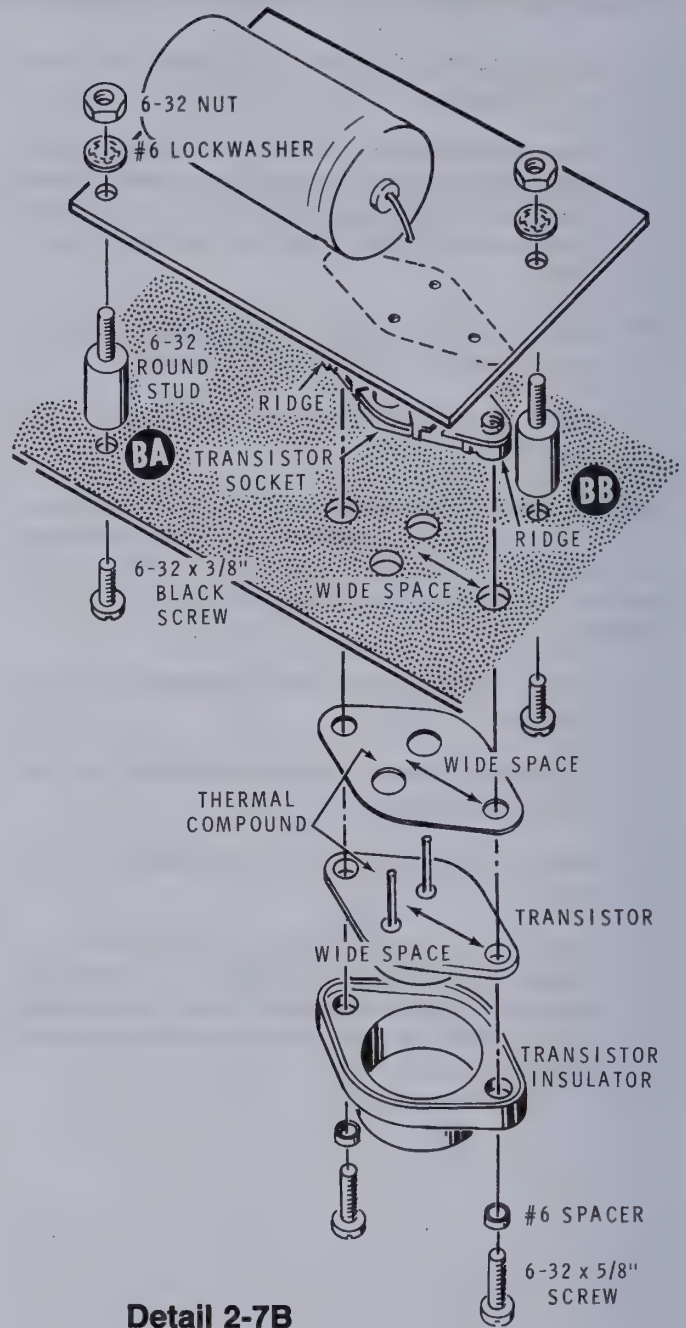
REAR PANEL ASSEMBLY AND WIRING

Refer to Pictorial 2-7 (in the "Illustration Booklet") for the following steps.

- () Refer to Detail 2-7A and mount the fuseholder at location F2 in the rear panel. Use the hardware furnished with the fuseholder. Do not overtighten the nut as the fuseholder can be damaged.
- () Carefully bend lug 1 of F2 away from the fuseholder body as shown.

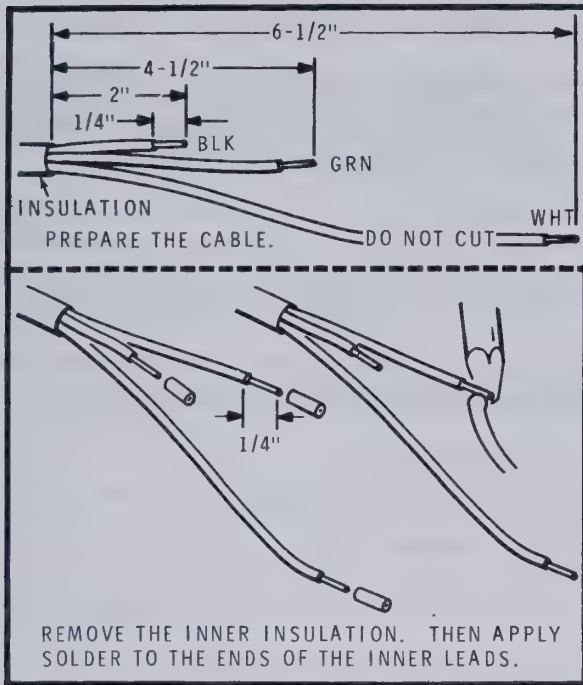
Refer to Detail 2-7B for the following steps.

- () Mount a 6-32 round stud at location BA with a 6-32 x 3/8" black screw.
- () In the same manner, mount a 6-32 round stud at location BB.
- () Mount the circuit board on the studs at BA and BB with #6 lockwashers and 6-32 nuts. Position the ridges on the transistor socket into the indicated holes at location Q2. *If necessary, reheat the solder connections to reposition the transistor socket.*
- () Spread a thin layer of thermal compound on the large flat surface of a 2N3055 (#417-215) transistor.
- () Note the wide space and position a mica insulator on the transistor.



Detail 2-7B

- () Spread a thin layer of thermal compound on the mica insulator. Any remaining thermal compound can now be discarded.
- () Q2: Mount this transistor and a transistor insulator at location Q2 in the rear panel. Use two 6-32 x 5/8" screws and two #6 spacers. Tighten the screws so the #6 spacers are forced into the insulator and against the transistor to provide a good electrical connection. Do not tighten the screws so tight that they break the transistor sockets.

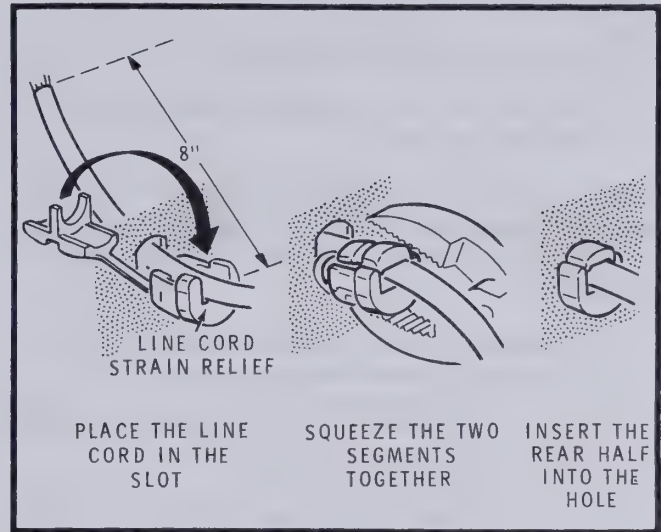


Detail 2-7C

Refer to Pictorial 2-7 for the following steps.

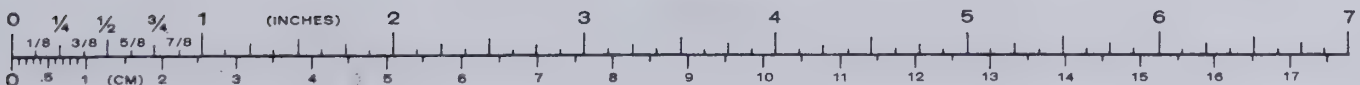
Refer to Detail 2-7C and prepare the end of the line cord as follows:

- () Cut the black lead and green lead (do not cut the white lead) to the specified length. Measure from the end of the insulation.
- () Remove 1/4" of insulation from the end of each lead.
- () Twist the fine wire strands together and melt a small amount of solder on the exposed lead ends.
- () Refer to Detail 2-7D and place the line cord strain relief around the line cord 8" from the end of the outer insulation. Then pass the end of the line cord through hole BC and mount the strain relief in the hole.
- () Position the rear panel next to the rear of the chassis as shown.
- () Pass the free end of the line cord along the right side of transformer T1 for connection later.



Detail 2-7D

- () Prepare the ends of a 15" black wire.
 - () Connect one end of this wire to fuseholder F2 lug 1 (S-1). Pass the other end of this wire along the left side of transformer T1 for connection later.
 - () Connect the free end of the black wire coming from the bare wire connected between the terminal boards to fuseholder F2 lug 2 (NS).
 - () Connect the free end of the blue wire coming from hole A in the circuit board to fuseholder F2 lug 2 (S-2).
- Push the connectors on the ends of the wires coming from the chassis onto the pins of the circuit board as follows. NOTE: Support the underside of the circuit board as you push on the wire connectors.
- () Blue wire onto pin BLU.
 - () Violet wire onto pin VIOL.
 - () Red wire onto pin RED.
 - () Yellow wire onto pin YEL.
- () Refer to Detail 2-7E (in the "Illustration Booklet") and mount the rear panel onto the rear of the chassis with four 6-32 x 3/8" black screws. Be very careful not to pinch any wires between the metal parts.
 - () Position all the wires down into the chassis so they are below the top.
 - () F2: Install the 20-ampere fuse in fuseholder F2.



Refer to Pictorial 2-8 for the following steps.

- (✓) Turn the chassis around as shown.
- (✓) Push the line cord down along the bend in the chassis (left side) as shown.

NOTE: When you are instructed to make a "mechanically secure connection," do this by inserting the wire end through and wrapping it around the lug. See the inset drawing in Pictorial 2-8.

- (✓) Connect the black line cord lead to fuse block F1 lug 1 (S-1). Make a mechanically secure connection.
- (✓) Connect the green line cord lead to solder lug C (S-1). Make a mechanically secure connection.
- (✓) Connect the white line cord lead to terminal strip B lug 5 (NS). Make a mechanically secure connection.

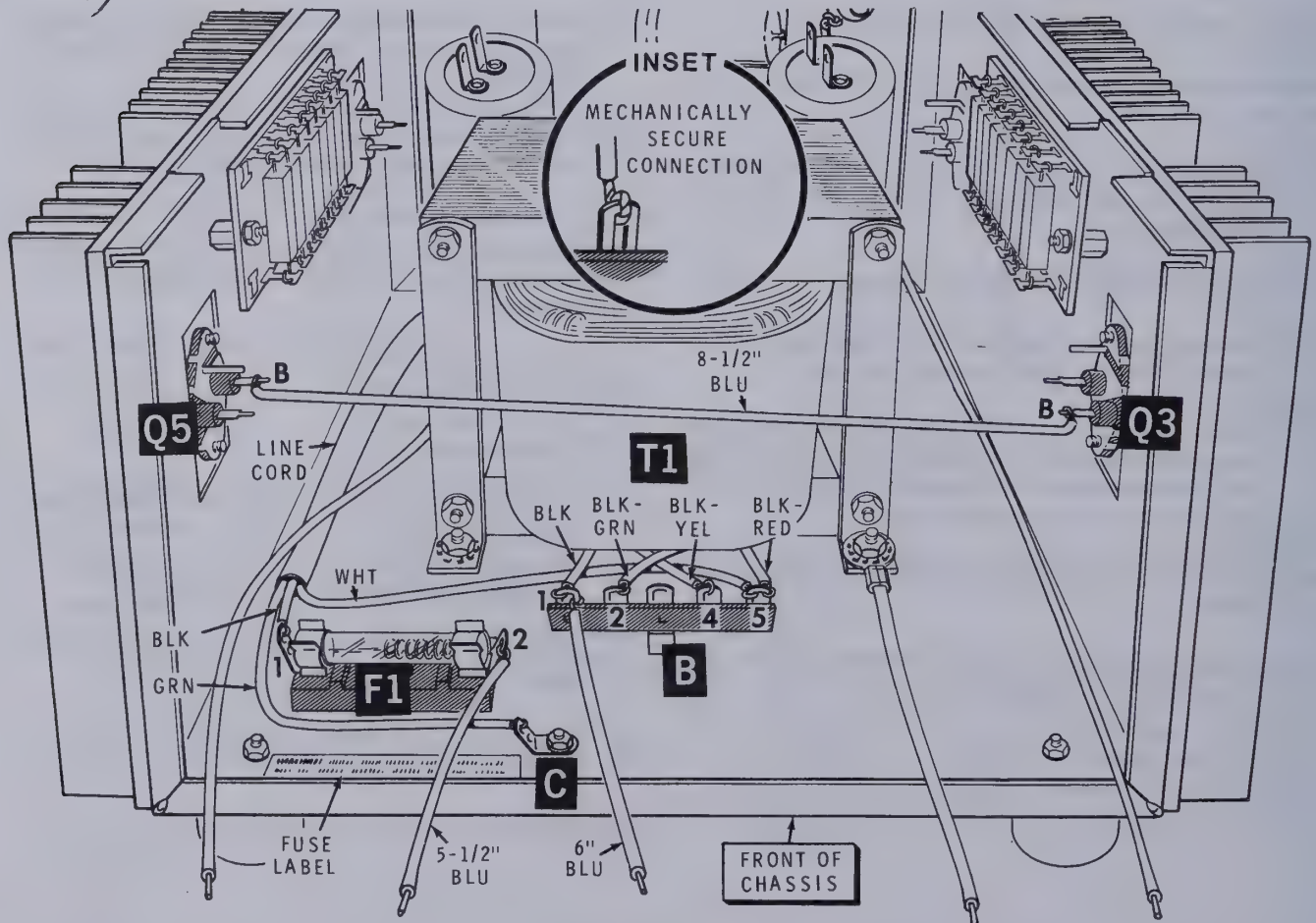
- (✓) Connect an 8-1/2" blue wire from Q3 lug B (S-2) to Q5 lug B (S-2).
- (✓) Connect one end of a 5-1/2" blue wire to fuse block F1 lug 2 (S-1). Make a mechanically secure connection. Then remove an extra 1/2" (total 3/4") of insulation from the free end of this wire to be connected later.
- (✓) Connect one end of a 6" blue wire to terminal strip B lug 1 (NS). Make a mechanically secure connection. Now remove an extra 1" (total 1-1/4") of insulation from the free end of this blue wire. It will be connected later.

Connect the wires from transformer T1 to terminal strip B as follows. Make mechanically secure connections.

- (✓) Black to lug 1 (NS).
- (✓) Black-green to lug 2 (NS).
- (✓) Black-yellow to lug 4 (NS).
- (✓) Black-red to lug 5 (NS).

Prepare the following lengths of wire:

COLOR	LENGTH
Blue	8-1/2"
Blue	5-1/2"
Blue	6"



PICTORIAL 2-8

ALTERNATE LINE VOLTAGE WIRING

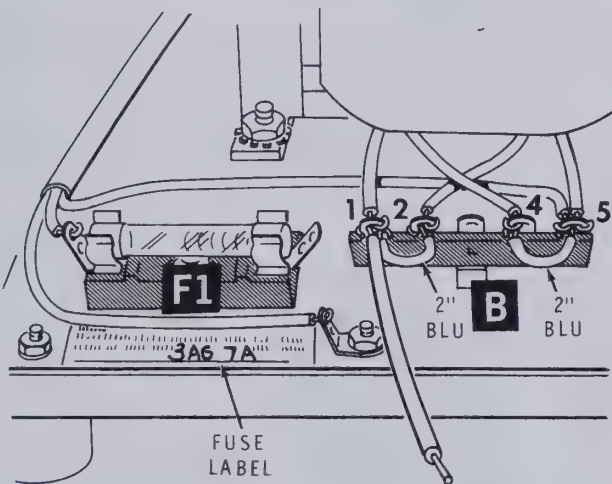
Two sets of line voltage instructions are given below, one for 120 VAC line voltage and the other for 240 VAC line voltage. In the U.S.A., 120 VAC is most often used, while in other countries 240 VAC is more common. USE ONLY THE INSTRUCTIONS THAT AGREE WITH THE LINE VOLTAGE IN YOUR AREA.

NOTE: All the following connections will be made to terminal strip B. Make mechanically secure connections.

120 VAC WIRING

Refer to Detail 2-8A for the following steps.

- (/) Prepare two 2" blue wires.
- (/) Connect a 2" blue wire between lugs 1 (S-3) and 2 (S-2).
- (-) Connect a 2" blue wire between lugs 4 (S-2) and 5 (S-3).
- (/) Install the 7-ampere fuse in fuse block F1.
- (/) Mark the fuse label "3AG, 7A" as shown. Then remove its backing paper and press the label into place near the fuseholder.
- (/) Set the chassis aside temporarily.

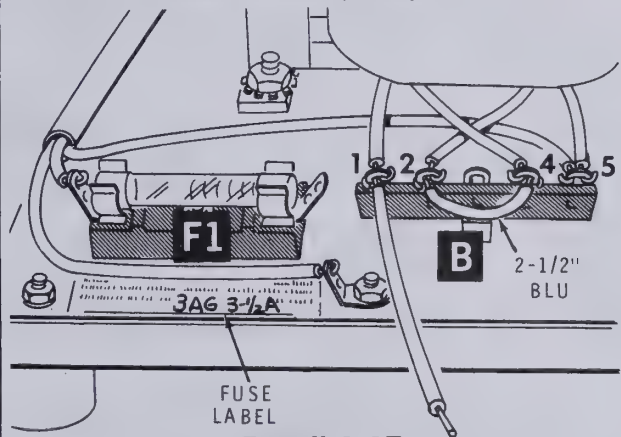


Detail 2-8A

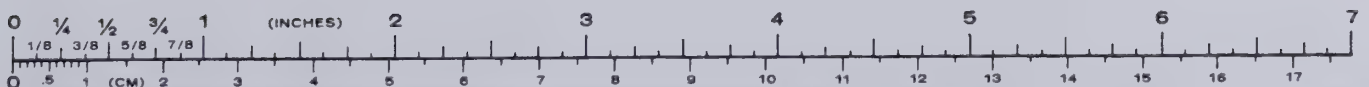
240 VAC WIRING

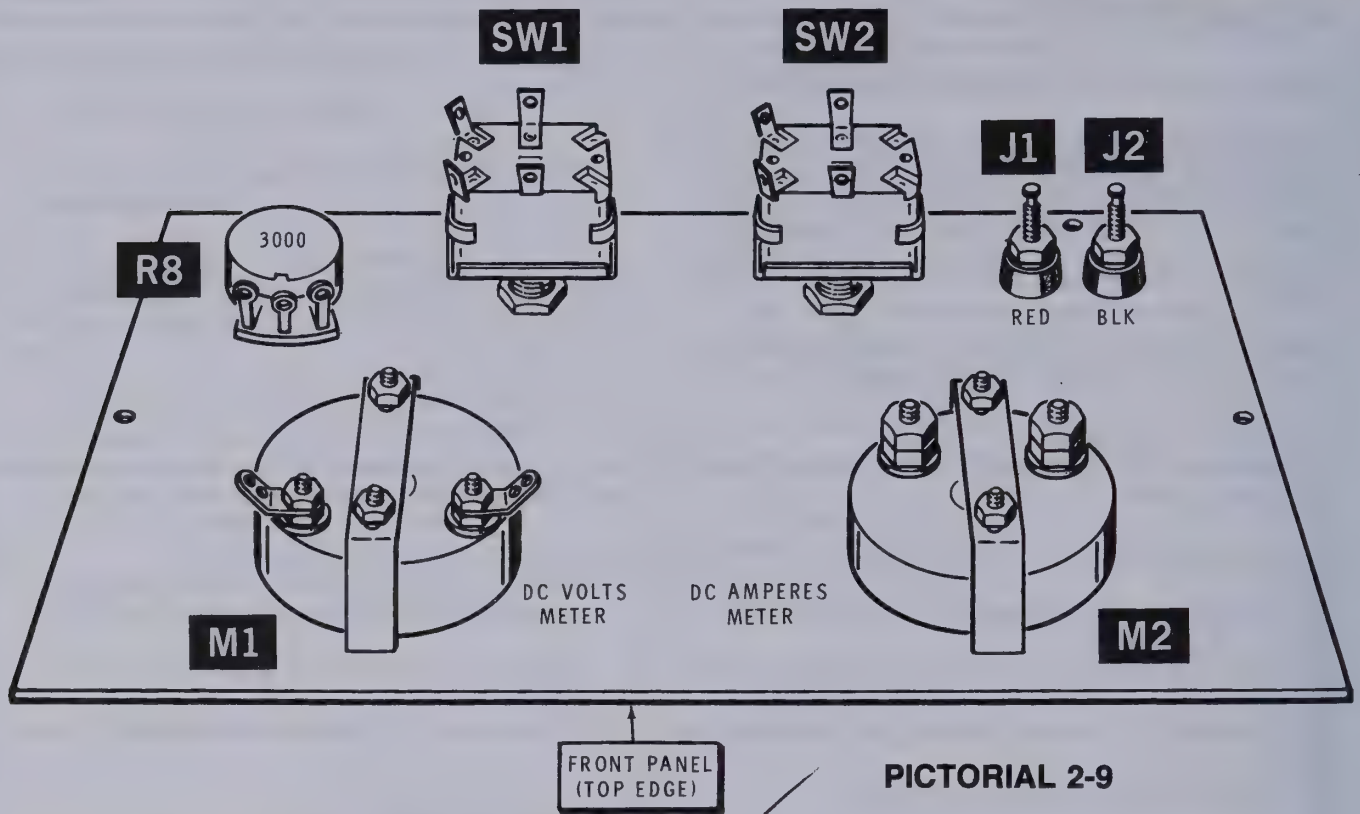
Refer to Detail 2-8B for the following steps.

- () Prepare a 2-1/2" blue wire.
- () Solder lug 1 (S-2).
- () Connect the 2-1/2" blue wire between lugs 2 (S-2) and 4 (S-2).
- () Solder lug 5 (S-2).
- () Install a 3-1/2-ampere slow-blow fuse (obtained locally) in fuseholder F1.
- () Mark the fuse label "3AG, 3-1/2A" as shown. Then remove the backing paper and press the label into place near the fuseholder.
- () Set the chassis aside temporarily.



Detail 2-8B



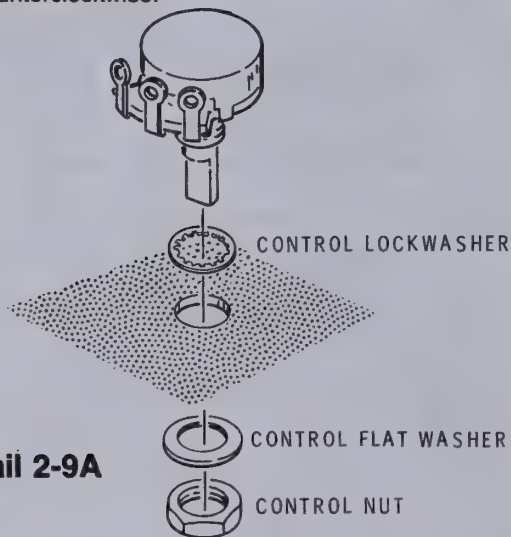


FRONT PANEL ASSEMBLY AND WIRING

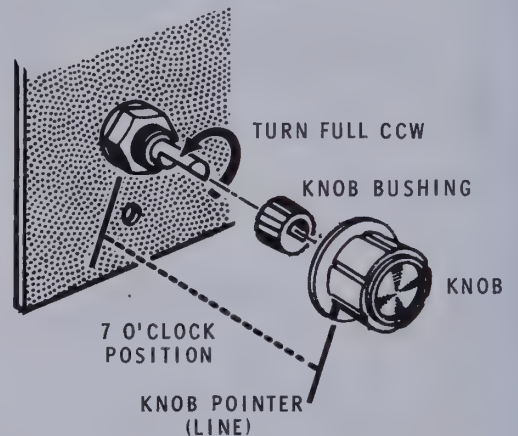
Refer to Pictorial 2-9 for the following steps.

- () Position the front panel on a soft cloth as shown. This will protect the panel and meters from being scratched.
 - () R8: Refer to Detail 2-9A and mount a 3000 Ω (3k) control at location R8. Use a control lockwasher, control flat washer, and a control nut. Position the control as shown.
- Refer to Detail 2-9B for the following steps.
- () Turn the shaft of control R8 (Voltage Adjust) fully counterclockwise.

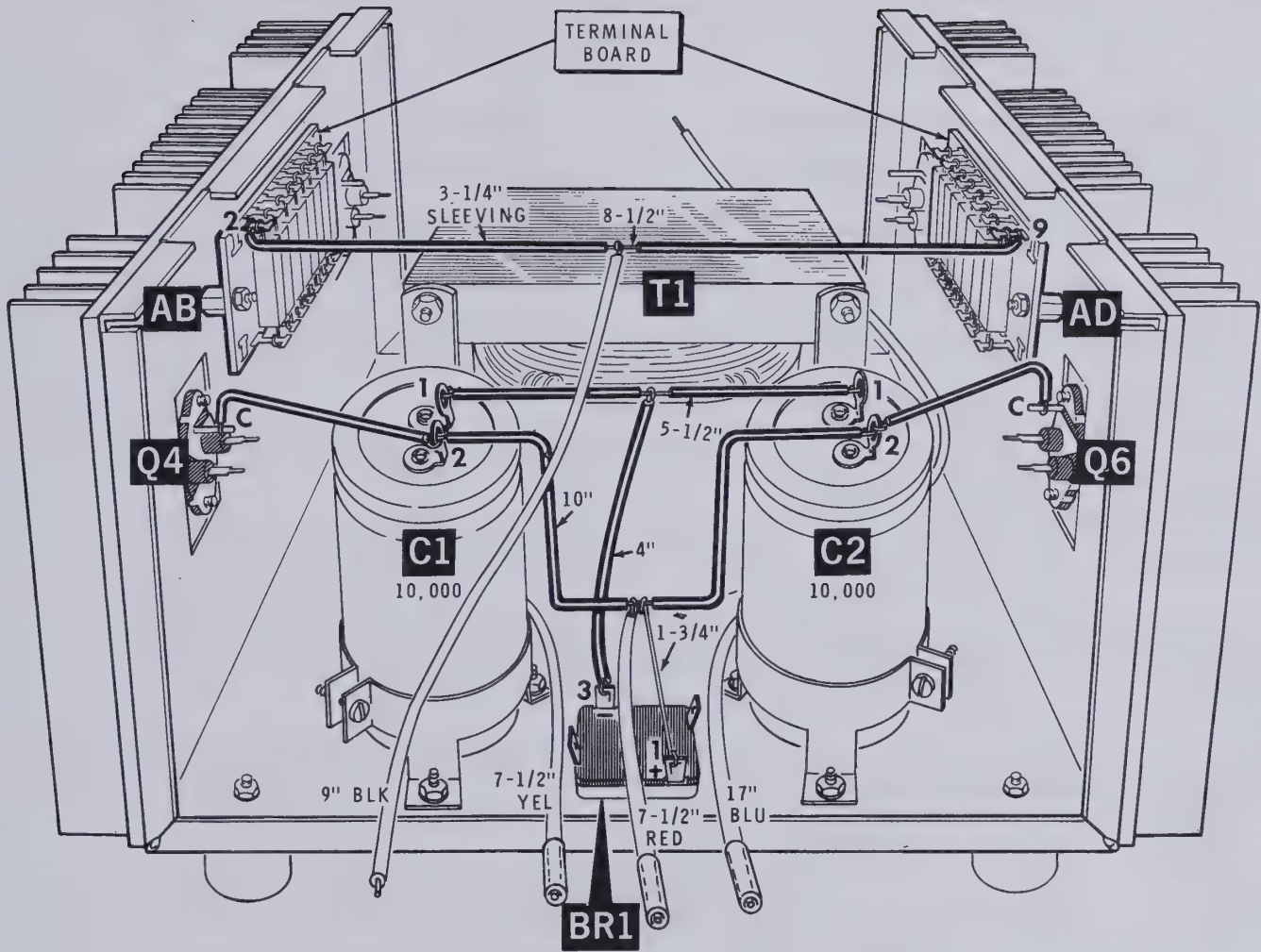
- () Push the knob bushing (large hole side first) onto the control shaft as far as possible.
- () Press the knob onto the knob bushing with the pointer (line) at the 7 o'clock position.
- () Remove the knob and bushing from the control shaft. Then, using a nut driver or other suitable tool, tap the bushing into the knob until it is fully seated.
- () Replace the knob and bushing onto the control shaft.



Detail 2-9A



Detail 2-9B



PICTORIAL 2-6

INITIAL TESTS

In the following steps, if you do not obtain the proper results, refer to the "In Case of Difficulty" section and correct the problem before you proceed.

RESISTANCE CHECKS

If you have a VOM (or VTVM) available, make the following resistance checks before you plug the line cord into an AC outlet.

Refer to Figure 1-1 for the following steps.

- () Remove the fuse from fuseholder F2.
- () Connect the common or ground lead of your meter to the black (-) binding post (J2). Leave this lead connected to J2 for all the resistance checks.
- () Touch either of the flat line cord prongs with the other meter lead. The ohmmeter should read infinity on the $R \times 1 M$ range.
- () Touch the other flat line cord prong with the positive ohmmeter lead. The reading should be at infinity.
- () Check the large, round line cord prong. The meter should indicate "0" on the $R \times 1$ range.
- () Touch lug 2 of capacitor C1 with the positive meter lead. The meter indicator should rise slowly (charging of capacitors C1 and C2) and stop at a high resistance indication.
- () Move this same meter lead to lug 1 of fuseholder F2. The meter should indicate about 3000 ohms on the $R \times 100$ range.
- () Leave the meter lead connected to this point and replace the fuse in fuseholder F2. The meter should now indicate approximately 250 ohms on the $R \times 10$ range.
- () Disconnect the meter from the Battery Eliminator.

OPERATIONAL TESTS

WARNING: When the line cord of the Battery Eliminator is connected to an AC outlet, AC line voltage is present at a number of locations in the chassis. Avoid these areas, shown in Figure 1-1, to prevent getting an electrical shock.

Position the front panel control and switches as follows:

- () R8: VOLTAGE ADJUST—Fully counterclockwise.
- () SW1: POWER switch—OFF.
- () SW2: LOAD switch—STBY.
- () Plug the line cord into a proper AC outlet.
- () Place the AC switch in the ON position. The DC VOLT-METER (M1) should indicate approximately 9 volts.
- () Slowly turn the VOLTAGE ADJUST control clockwise. The DC VOLT meter indication should increase to approximately 15 volts when the control reaches its full clockwise position. The DC AMPERE meter (M2) should remain at (0) zero.
- () Place the LOAD switch in the NORM position. There should be no change in either meter indication.
- () Place the AC switch in the OFF position. The AC VOLT METER will remain at its voltage indication for a few seconds, then gradually move to (0) zero. This is normal (discharge of capacitors C1 and C2).

This completes the "Initial Test." Proceed to "Final Assembly."

FINAL ASSEMBLY

Refer to Pictorial 3-1 (in the "Illustration Booklet") for the following steps.

- () Mount the two plastic handles on the top plate with #10 × 1/2" self-tapping screws. **Do not** overtighten the screws as the handle holes can be stripped out.
- () Carefully peel the backing paper from the blue and white label. Then press the label in place on the underside of

the top plate. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

- () Position the vent slots in the top plate as shown and mount the top plate on the chassis. Use four 6-32 × 3/8" **black** screws.

This completes the assembly of the Battery Eliminator.

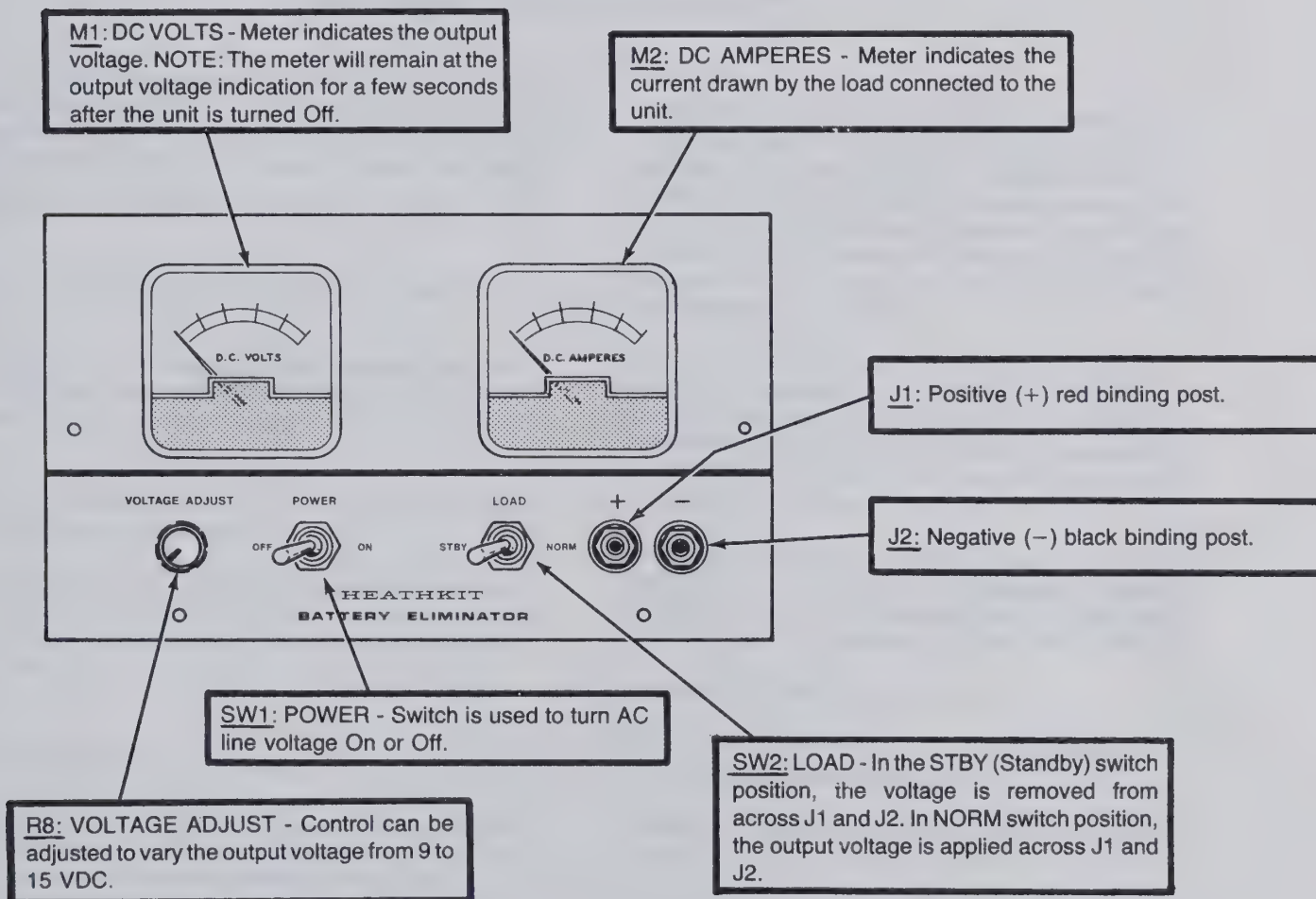


Figure 1

OPERATION

Refer to Figure 1 for an explanation of the control, switches, and meters.

Always place the LOAD switch in the STBY position and set the VOLTAGE ADJUST control to the proper voltage before you apply power to the load. Once the correct voltage is indicated on the DC VOLTS meter, move the LOAD switch to the NORM position. In this way, you will prevent damage to the load, should the voltage be set too high.

CAUTION: It is normal for the Battery Eliminator to become quite warm if it is operated at maximum current for extended periods. Be sure you do not block ventilation to the unit by covering the top or bottom vent holes. Do not block air from moving over the heat sinks. Also, do not touch the heat sinks, as they get quite hot and may cause a burn.

IN CASE OF DIFFICULTY

CAUTION: When the line cord is connected to an AC outlet, AC voltage will be present at several places on the chassis. Be careful you do not contact this voltage or an electrical shock can result.

This section gives suggestions for locating and resolving difficulties.

The first part, "Visual Checks," deals with problems that exist when you have just completed the assembly of your kit. This information primarily covers soldering and assembly problems.

The second part consists of a "Troubleshooting Chart," which gives difficulties and likely causes.

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

VISUAL CHECKS

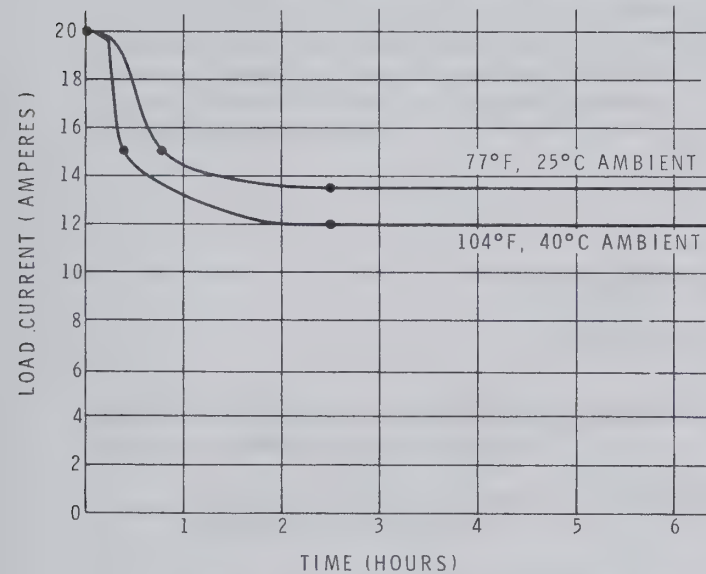
1. Recheck the wiring. Trace each lead in color pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.
2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Assembly Notes." Reheat any doubtful connections. Be sure all the wires are soldered at places where several wires are connected.
3. Be sure the transistors and the integrated circuit 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. Check the integrated circuit for proper positioning and for good contact at each pin connection.
4. 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 lead near the positive (+) marking is at the correct position.
5. Check each resistor value carefully.
6. Be sure the correct diode is installed and that the banded end is positioned correctly.
7. Check all component leads connected to the circuit board.
8. Make sure bare wires do not touch the chassis or other lugs and make sure all wires are properly soldered.

Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
Very low or "0" resistance reading at lug 2 of capacitor C1.	<ol style="list-style-type: none"> 1. Collector of transistor Q2 through Q7 poorly soldered. 2. Capacitor C1 or C2 wired incorrectly. 3. Bridge rectifier BR1 wired incorrectly.
Very low or "0" resistance reading at lug 1 of fuseholder F2 with fuse removed.	<ol style="list-style-type: none"> 1. Emitter of Q3, Q4, Q5, or Q6 wired incorrectly. 2. Capacitor C6. 3. Terminal boards wired incorrectly.
Very low or "0" resistance at lug 1 of fuseholder F2 with fuse installed.	<ol style="list-style-type: none"> 1. Voltmeter M1 wired incorrectly. 2. Control R8 wired incorrectly. 3. Capacitor C6.
No output voltage.	<ol style="list-style-type: none"> 1. Fuse F1. 2. Fuse F2. 3. IC1.
Fuse F1 blows when unit is turned on.	<ol style="list-style-type: none"> 1. Fuse block F1. 2. Switch SW1 wired incorrectly. 3. T1 wired incorrectly. 4. Bridge rectifier wired incorrectly. 5. Capacitor C1 or C2.
Fuse F2 blows	<ol style="list-style-type: none"> 1. Excessive load. 2. Output shorted.
Unable to obtain 15-volts output within current specifications.	<ol style="list-style-type: none"> 1. IC1. 2. Control R8. 3. Resistor R7 or R9. 4. Diode D1.
Output voltage drops considerably when load is applied.	<ol style="list-style-type: none"> 1. IC1. 2. Q1, Q2, Q3, Q4, Q5, or Q6.

SPECIFICATIONS

Output Voltage	Variable from approximately 9 to 15 VDC.
Output Current	20 amperes intermittent (See chart). 12 amperes continuous.
Output Ripple	Less than 1% at full load.
Output Regulation	Less than 2% variation from no load to full load.
Power Requirement	110 to 130 VAC, 7 amperes; or 220 to 260 VAC, 3.5 amperes, 50/60 Hz maximum.
Fuses	7-ampere, 3AG, slow-blow primary. 20-ampere, 3AG, output.
Maximum Continuous Operation	(See chart below)
Dimensions	5-1/4" high × 11" wide × 11" deep (13.34 cm × 27.9 cm × 27.9 cm).
Net Weight	26 lbs. (9.7 kg.)



NOTE: This chart should be used to determine the maximum length of continuous operation at a given load current and ambient temperature. The battery eliminator must be allowed to cool for an equal length of time before you do additional testing to prevent damage due to thermal overload.

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.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (in the "Illustration Booklet") as you read the following description.

The 120 VAC (or 240 VAC) line voltage is applied through primary fuse F1 and the power ON-OFF switch to the primary winding of power transformer T1. From the secondary winding, the voltage is applied to BR1, a full wave bridge rectifier. The rectified DC is then filtered by electrolytic capacitors C1 and C2, and applied to the regulator circuitry.

Transistors Q1 and Q2, with Q3, Q4, Q5, and Q6 form a double Darlington circuit which provides exceptionally high gain for excellent regulation. The conduction of the Darlington circuit and the output voltage is controlled by the base bias provided by integrated circuit IC1. IC1, with its own zener reference diode, samples the output voltage, compares this to the internal reference voltage, and automatically adjusts the base bias of Q1 as needed to maintain a fixed output level under varying load conditions. The output voltage is sampled at the output terminal, thereby compensating for the voltage drop across fuse F2. This allows almost no change in load voltage from no load to full load conditions.

The regulated output voltage level is adjusted by the front panel VOLTAGE ADJUST control R8.

Capacitor C3 provides a nearly pure DC voltage for the integrated circuit regulator IC1. Diode D1 allows C3 to charge from the power path but does not allow it to discharge back. In this way, only the small load of IC1 is placed on C3. R1 prevents excessive current from flowing through D1 when the power supply is turned on.

Resistors R2, R3, R4, and R5 balance the current between the four pass transistors Q3, Q4, Q5, and Q6. Fuse F2 protects the pass transistors against an overload. Resistor R6 is a bleeder resistor and capacitor C6 provides transient protection.

The output voltage is measured by voltmeter M1, and the output current is measured by ammeter M2.

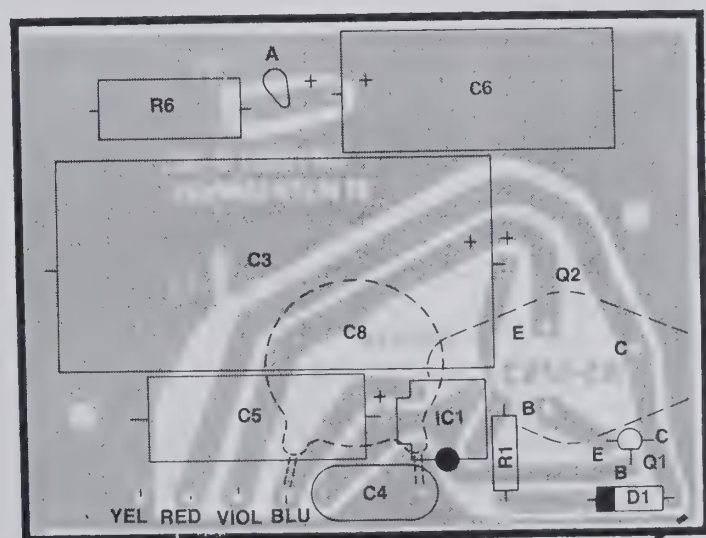
The load is connected through a heavy-duty cable to the front panel connectors.

CIRCUIT BOARD X-RAY VIEW

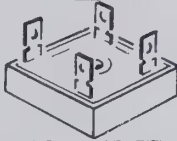
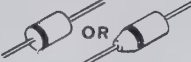
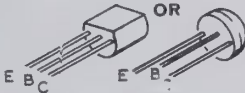


(Shown from the component side)

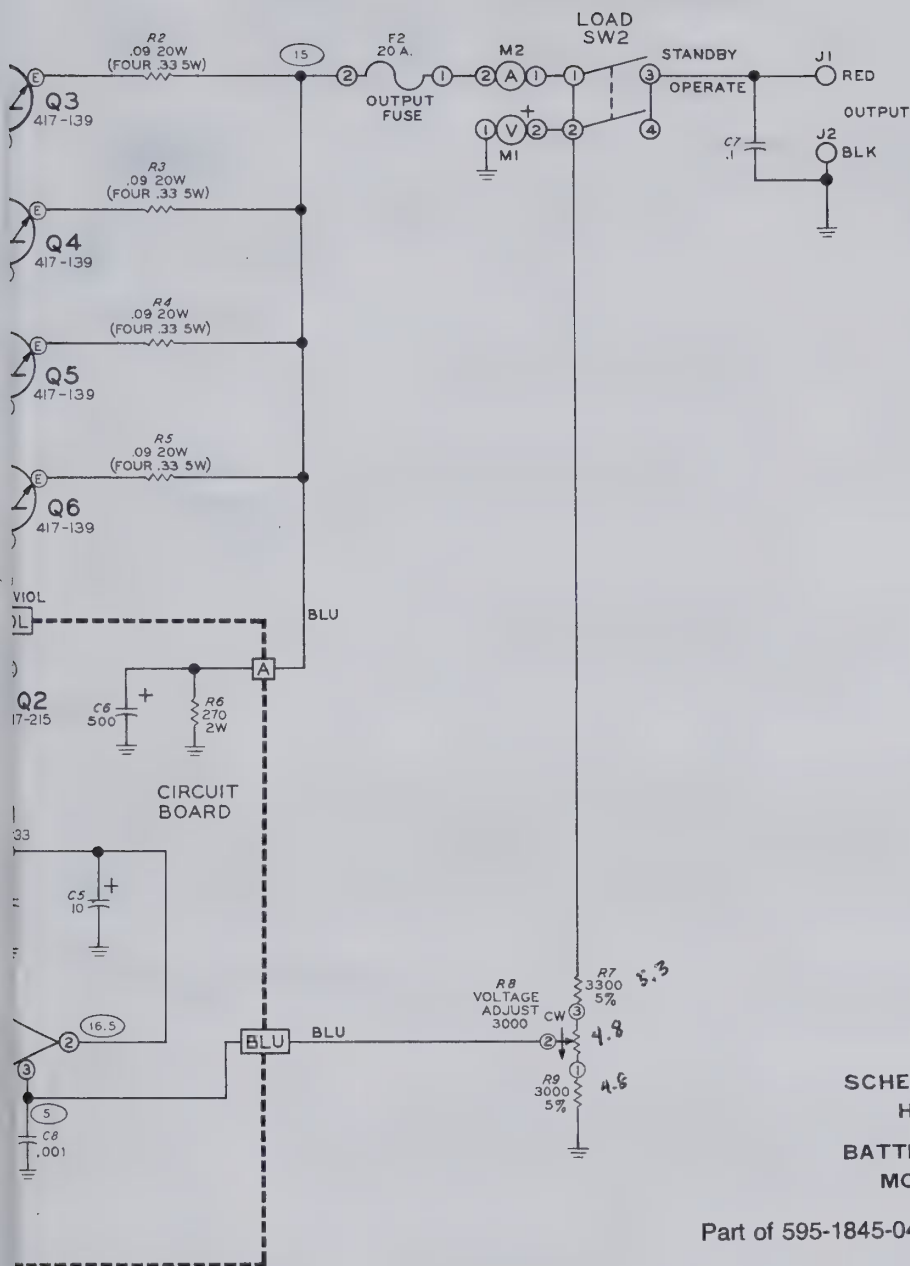
NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R5, C3, etc.) on the "Circuit Board X-Ray View."
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List."
- 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.



SEMICONDUCTOR IDENTIFICATION CHART

COMPONENT NUMBER	HEATH PART NUMBER	REPLACED BY	DESCRIPTION
BR1	57-88	MDA990-2	BRIDGE RECTIFIER 
D1	57-65	1N4002	DIODE 
Q1	417-233	2N3643	TRANSISTOR 
Q2	417-215	2N3055	TRANSISTOR 
Q3, Q4, Q5, Q6	417-139	40411	
IC1	442-626	μ A78MG	INTEGRATED CIRCUIT 



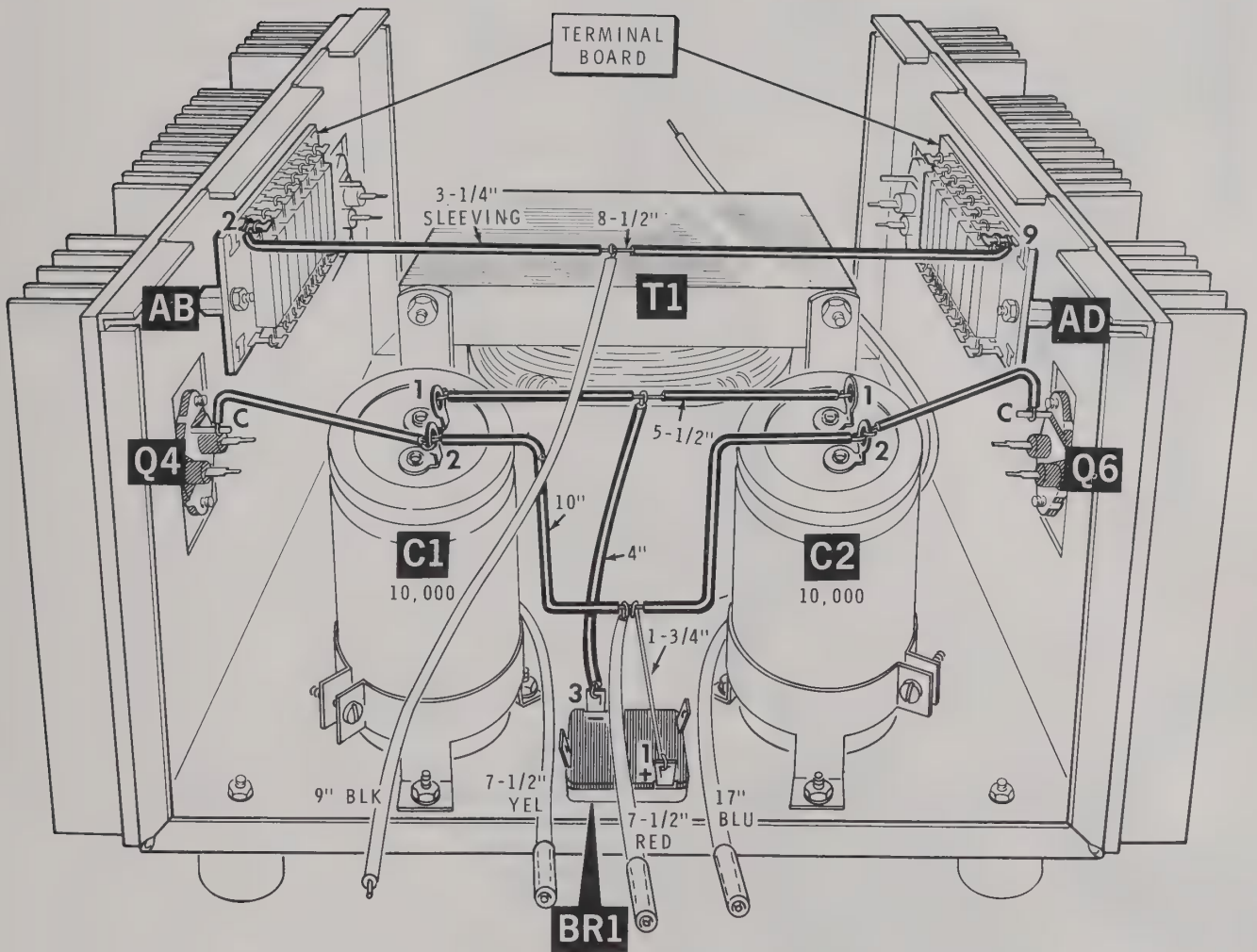
**SCHEMATIC OF THE
HEATHKIT[®]
BATTERY ELIMINATOR
MODEL IP-2715**

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Heath Company
All Rights Reserved

Part of 595-1845-04

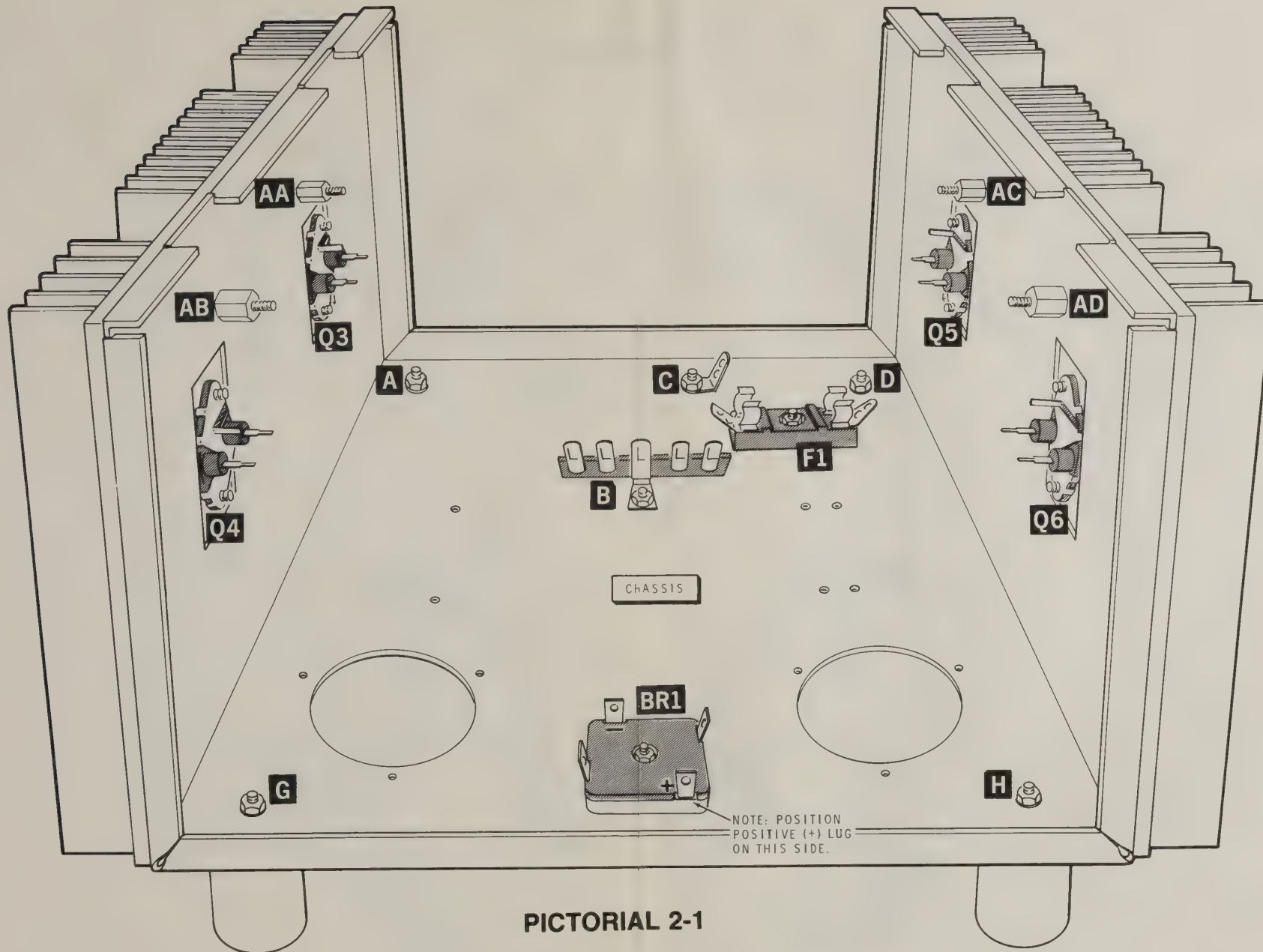
NOTES:

1. RESISTOR VALUES ARE IN OHMS. RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. CAPACITOR VALUES ARE IN μ F.
3. THIS SYMBOL INDICATES CONNECTIONS TO THE CIRCUIT BOARD.
4. THIS SYMBOL INDICATES NO LOAD DC VOLTAGES MEASURED FROM POINT INDICATED TO GROUND. VOLTAGES MAY VARY $\pm 5\%$. VOLTAGES WERE TAKEN WITH VOLTAGE ADJUST CONTROL FULLY CLOCKWISE UNDER NO LOAD CONDITIONS.

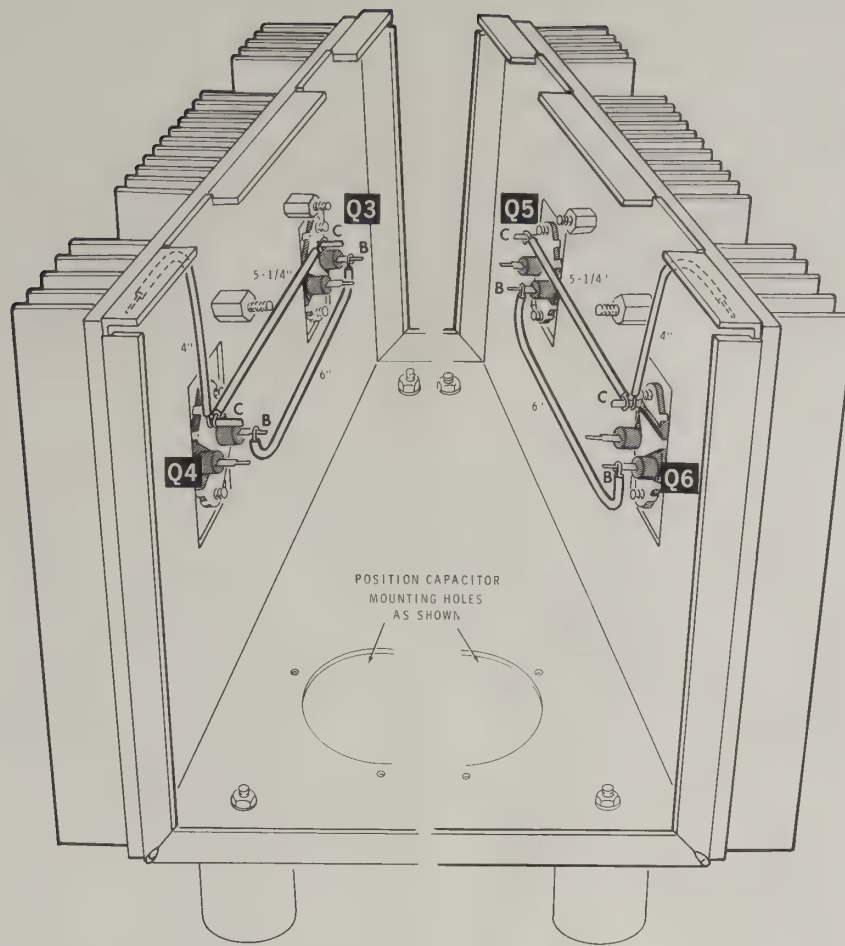


PICTORIAL 2-6

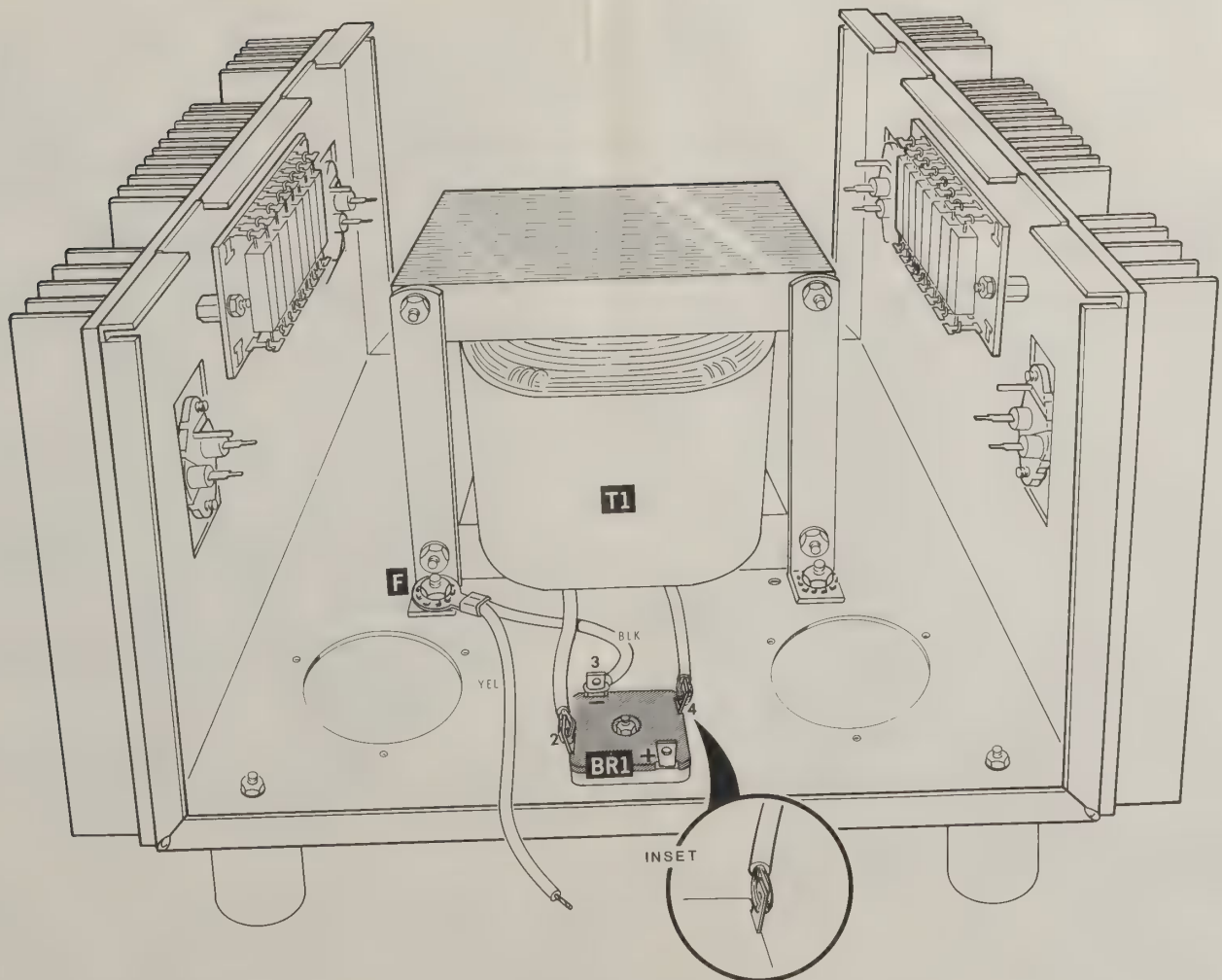
ILLUSTRATION BOOKLET



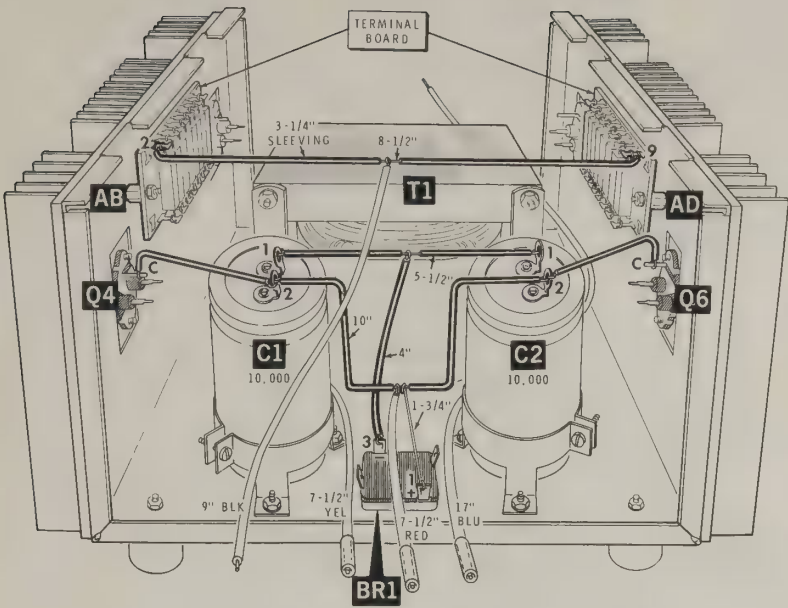
PICTORIAL 2-1



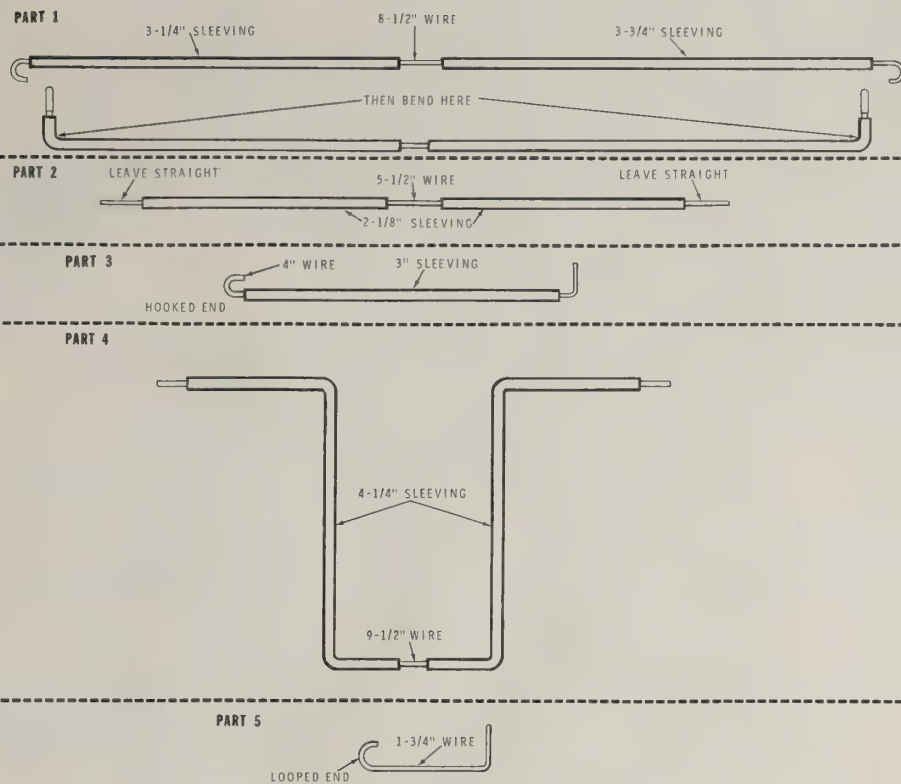
PICTORIAL 2-2



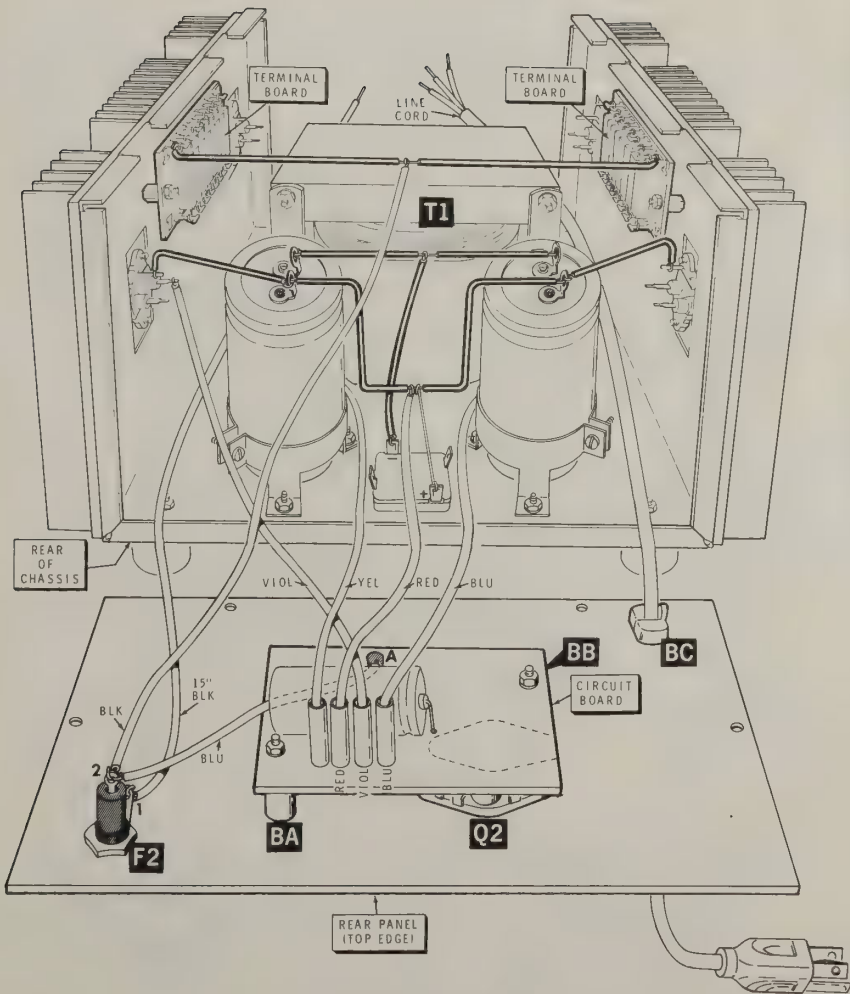
PICTORIAL 2-5



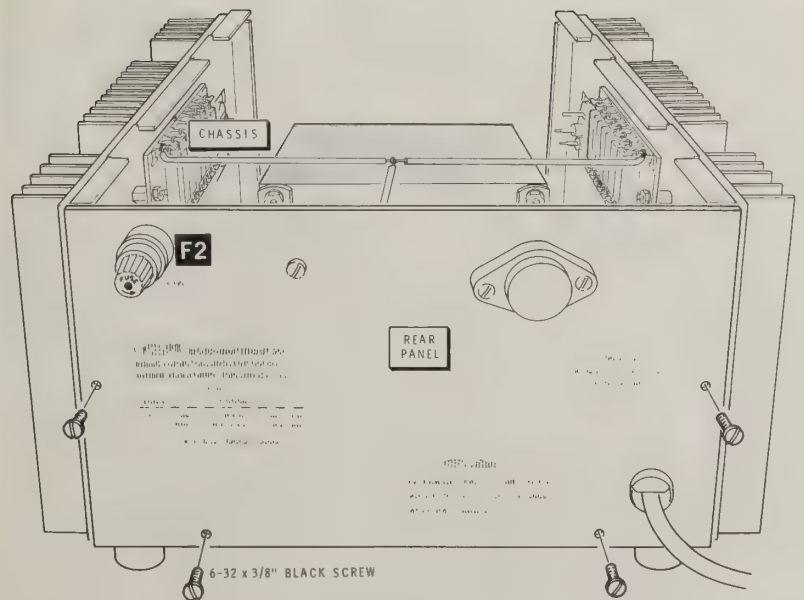
PICTORIAL 2-6



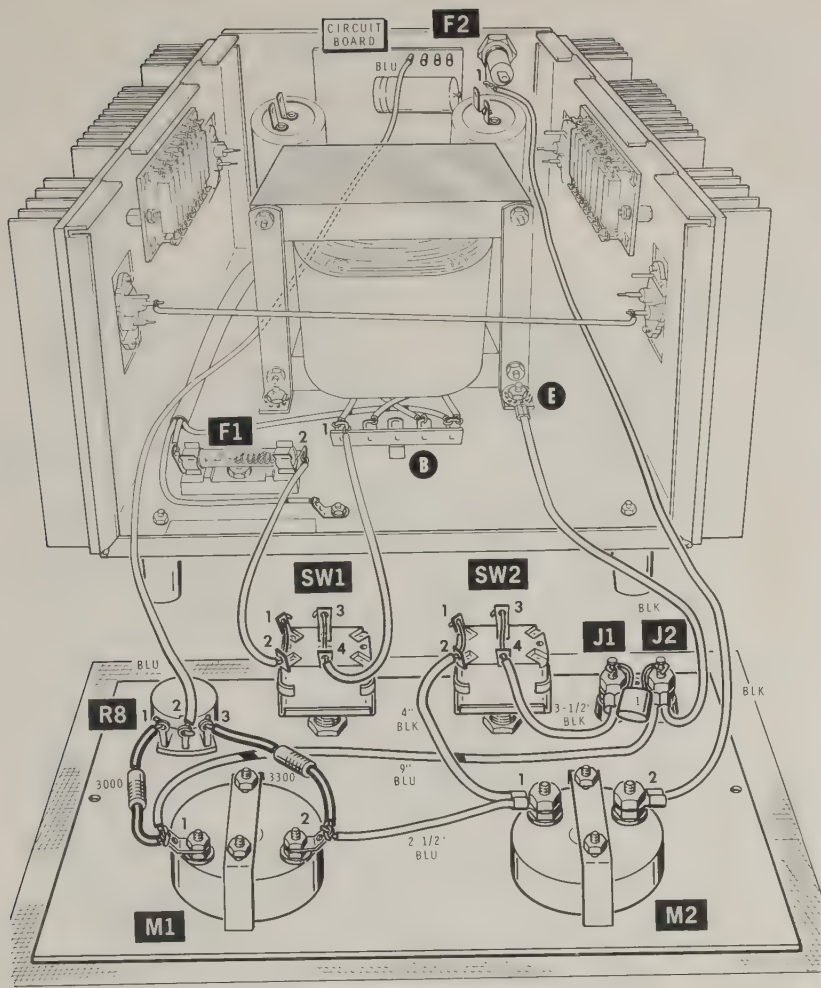
Detail 2-6C



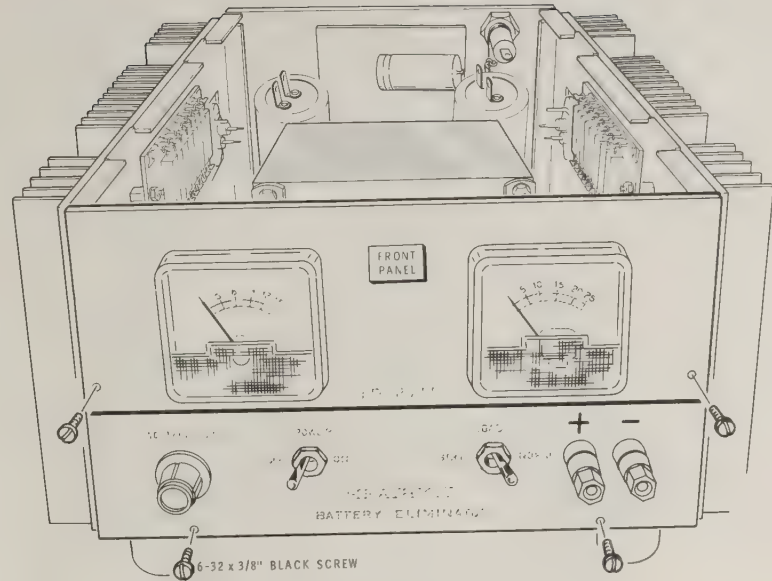
PICTORIAL 2-7



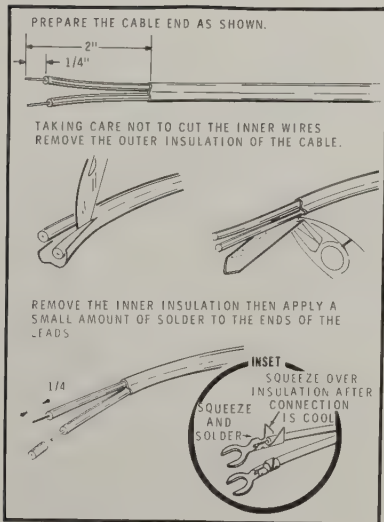
Detail 2-7E



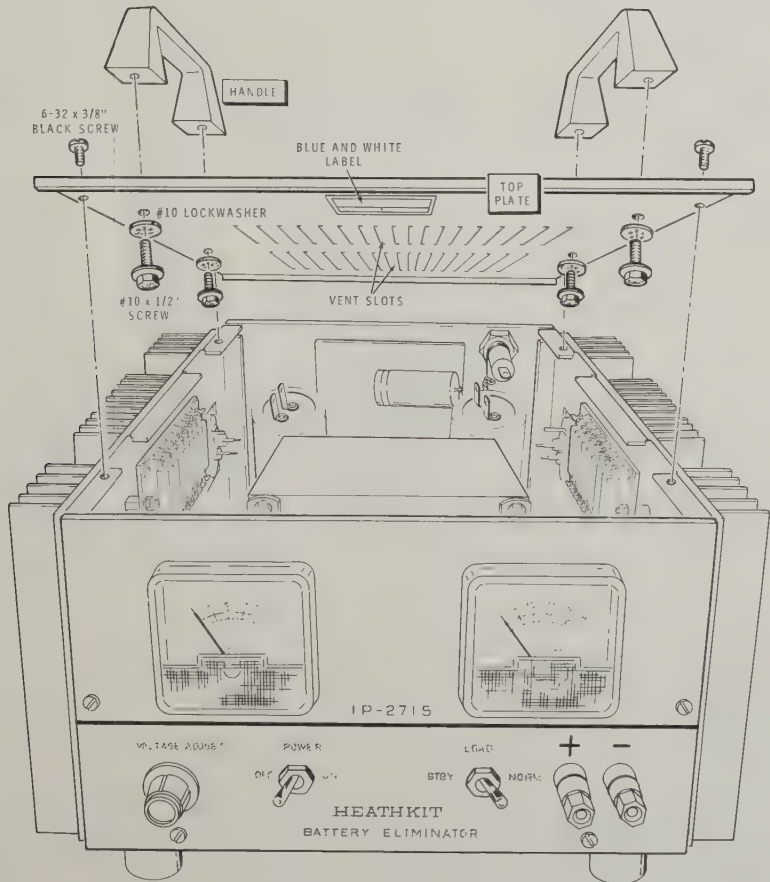
PICTORIAL 2-10



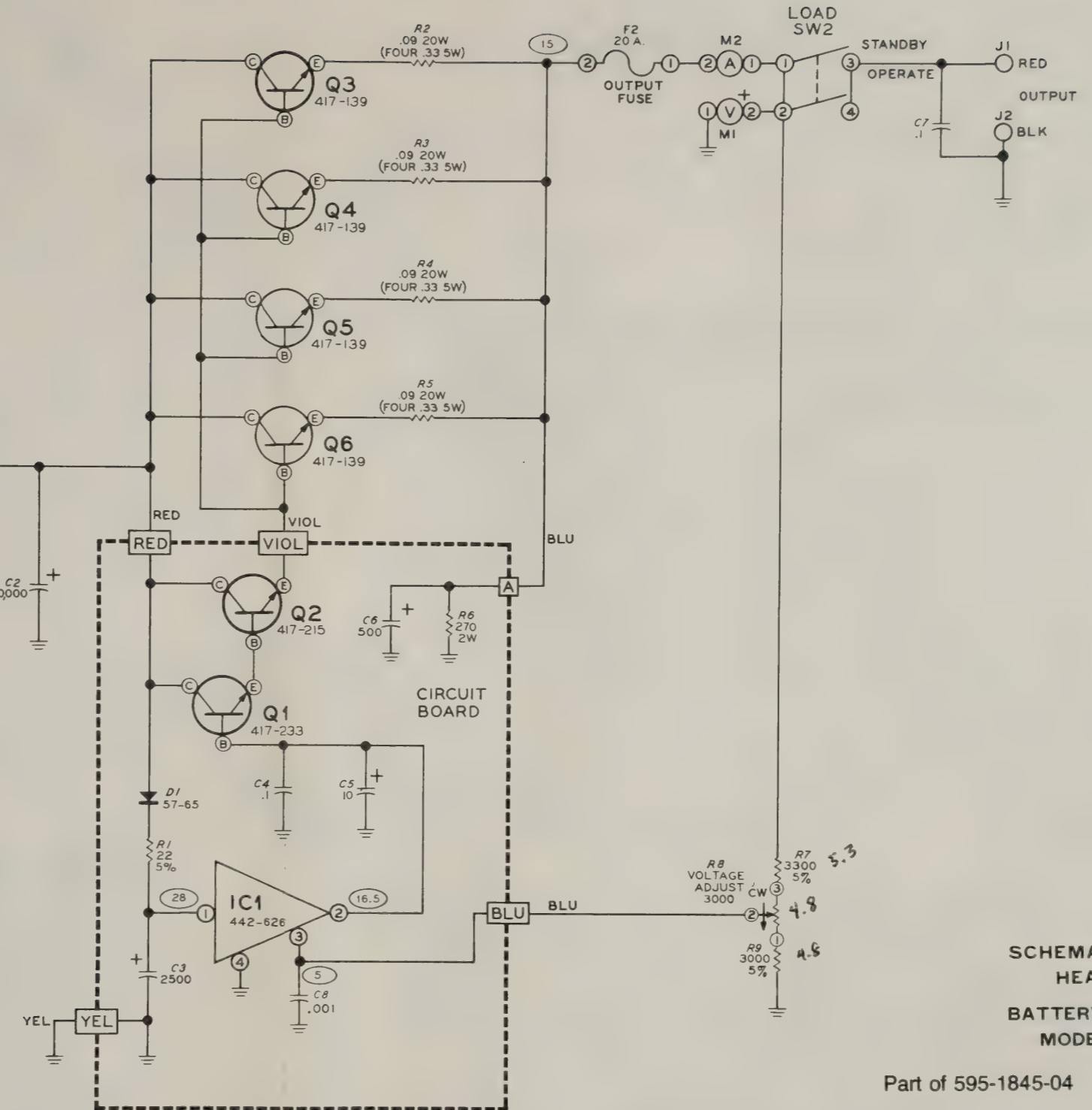
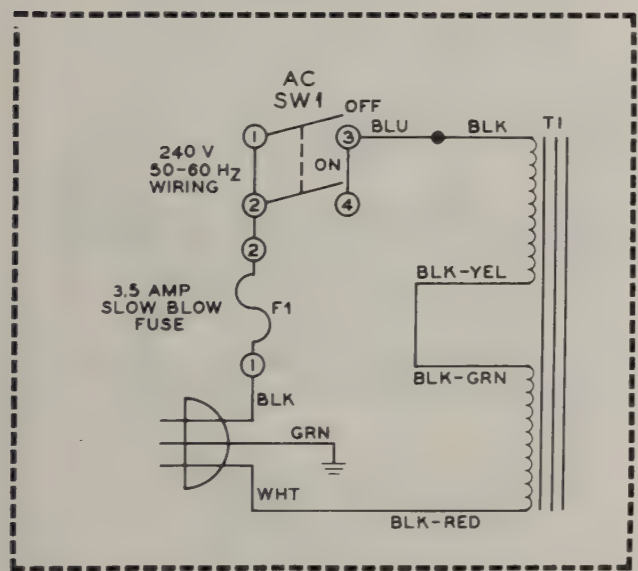
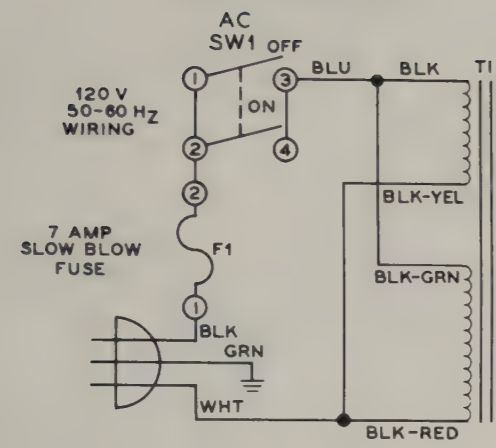
Detail 2-10E



PICTORIAL 2-11



PICTORIAL 3-1



**SCHEMATIC OF THE
HEATHKIT®
BATTERY ELIMINATOR
MODEL IP-2715**

Part of 595-1845-04

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Heath Company
All Rights Reserved

NOTES:

1. RESISTOR VALUES ARE IN OHMS. RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. CAPACITOR VALUES ARE IN μ F.
3. THIS SYMBOL INDICATES CONNECTIONS TO THE CIRCUIT BOARD.
4. THIS SYMBOL INDICATES NO LOAD DC VOLTAGES MEASURED FROM POINT INDICATED TO GROUND. VOLTAGES MAY VARY \pm 5%. VOLTAGES WERE TAKEN WITH VOLTAGE ADJUST CONTROL FULLY CLOCKWISE UNDER NO LOAD CONDITIONS.

Heathkit[®] Manual

for the

BATTERY ELIMINATOR

Model IP-2715

595-1845-04

WARNING: TO PREVENT FIRE OR SHOCK
HAZARD, DO NOT EXPOSE THIS INSTRUMENT
TO RAIN OR MOISTURE.

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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PARTS LIST

Unpack all parts and check each part against the following list. The parts may vary slightly from the illustration. Keep any part that is individually packaged with a part number on it in its package after you identify it until you actually use it. Some parts are marked with a "171-" packaging number. These numbers are used for packaging only and do not appear in the Manual "Parts List." Save all packaging material until you locate all the parts.

The key numbers in the Parts List correspond to the numbers in the parts pictorial. These numbers are to help you identify parts.

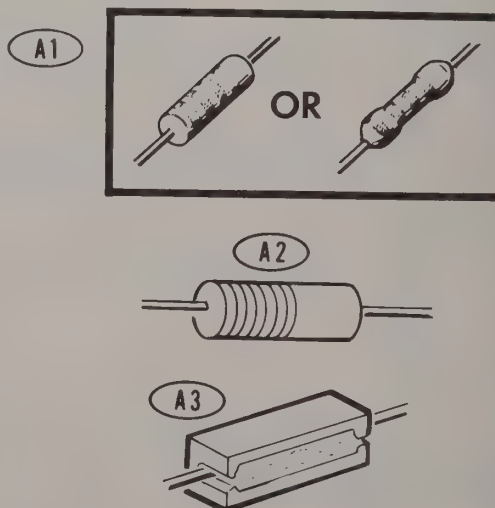
To order a replacement part use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of this Manual. NOTE: Never use a "171-" packaging number if you must order replacement parts; use only the part numbers listed in the following list.

KEY PART	QTY.	DESCRIPTION	CIRCUIT
No.	No.		Comp. No.

RESISTORS

NOTE: The resistors may be packed in more than one envelope. Open all the resistor envelopes before you check the resistors against the Parts List.

A1	6-220	1 22 Ω, 1/2-watt, 5% (red-red-black)	R1 ✓
A1	6-302	1 3000 Ω, 1/2-watt, 5% (orange-black-red-gold)	R9 ✓
A1	6-332	1 3300 Ω, 1/2-watt, 5% (orange-orange-red-gold)	R7 ✓
A2	1-30-2	1 270 Ω, 2-watt (red-violet-brown)	R6 ✓
A3	3-11-5	16 .33 Ω, 5-watt	R2, R3, R4, R5 (4 each) ✓



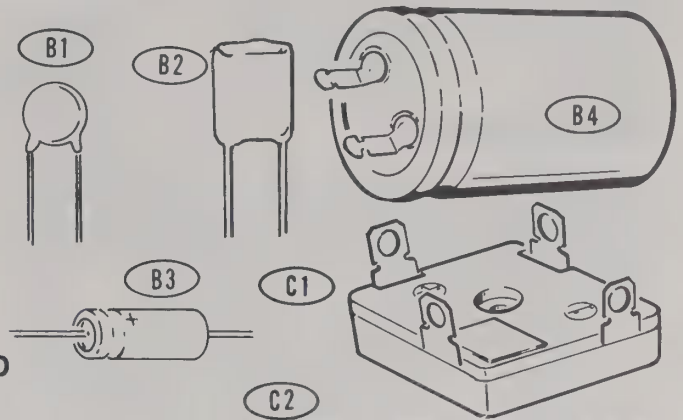
KEY PART No.	QTY.	DESCRIPTION
--------------	------	-------------

CIRCUIT Comp. No.

CAPACITORS

B1	21-140	1 .001 μ F disc
B2	27-47	2 .1 μ F Mylar*
B3	25-95	1 10 μ F electrolytic
B3	25-199	1 500 μ F electrolytic
B3	25-154	1 2500 μ F electrolytic
B4	25-263	2 10,000 μ F electrolytic

C8 ✓
C4, C7 ✓
C5 ✓
C6 ✓
C3 ✓
C1, C2 ✓



RECTIFIER-DIODE-TRANSISTORS-INTEGRATED CIRCUIT (IC)

C1	57-88	1 MDA990-2 bridge rectifier
C2	57-65	1 1N4002 diode

BR1 ✓
D1 ✓

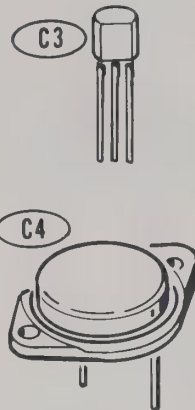
NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES.

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (On integrated circuits this refers only to the numbers, the letters may be different or missing.)
3. Part number and type number.
4. Part number with a type number other than the one listed.

C3	417-233	1 2N3643 transistor
C4	417-215	1 2N3055 transistor
C4	417-139	4 40411 transistor
C5	442-626	1 μ A78MG IC

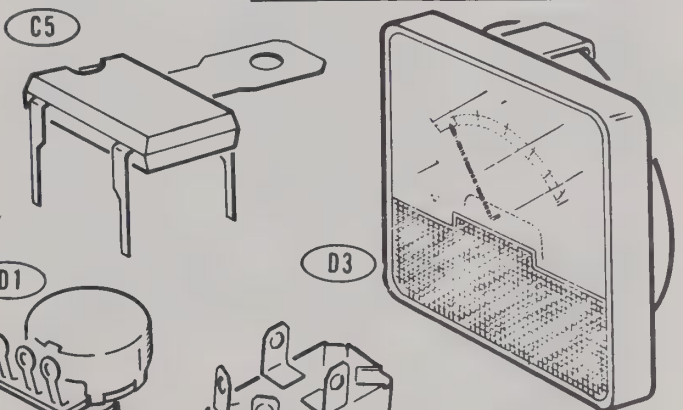
Q1 ✓
Q2 ✓
Q3, Q4 ✓
Q5, Q6 ✓
IC1 ✓



OTHER CIRCUIT COMPONENTS

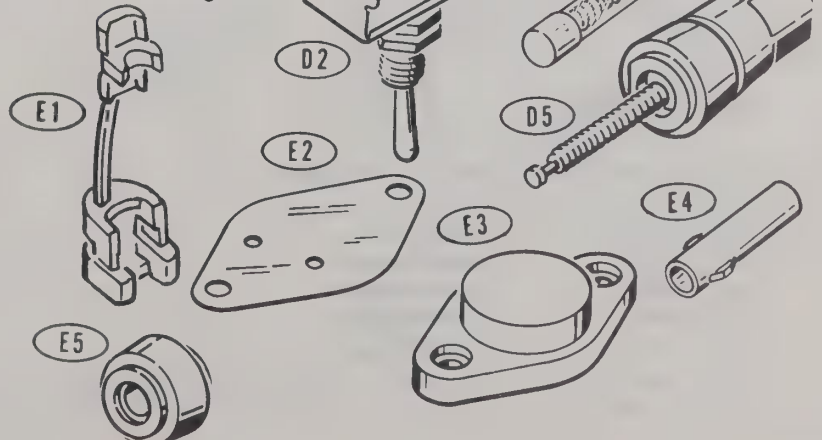
D1	10-1053	1 3000 Ω (3k) control
	54-848	1 Power transformer
D2	61-3	2 Toggle switch (with hardware)
D3	407-723	1 Voltmeter (with hardware)
D3	407-722	1 Ammeter (with hardware)
D4	421-9	1 7-ampere slow-blow fuse
D4	421-18	1 20-ampere fuse
D5	426-10	1 Black binding post
D5	426-11	1 Red binding post

R8 ✓
T1 ✓
SW1, SW2 ✓
M1 ✓
M2 ✓
F1 ✓
F2 ✓
J2 ✓
J1 ✓



STRAIN RELIEF-INSULATORS

E1	75-723	1 Line cord strain relief
E2	75-44	5 Mica insulator (Packed between two pieces of cardboard)
E3	75-88	5 Transistor insulator
E4	432-790	4 Female connector insulator
E5	426-12	1 Black binding post insulator
E5	426-13	1 Red binding post insulator



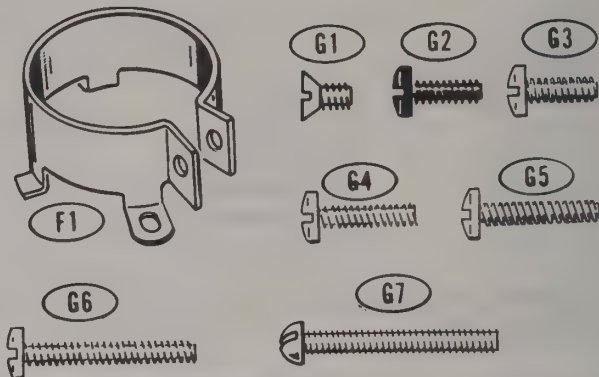
*DuPont Registered Trademark

KEY PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
--------------	------	-------------	-------------------

METAL PARTS

NOTE: Metal parts not shown in the Parts Pictorial have their part number stamped on them. CAUTION: Handle the metal parts carefully as they may have sharp edges.

	200-1259	1	Chassis ✓
	203-1849-1	1	Front panel ✓
	203-1850-1	1	Rear panel ✓
	205-1657-1	1	Top plate ✓
F1	207-2	2	Capacitor mounting clamp ✓
	215-76	2	Heat sink ✓

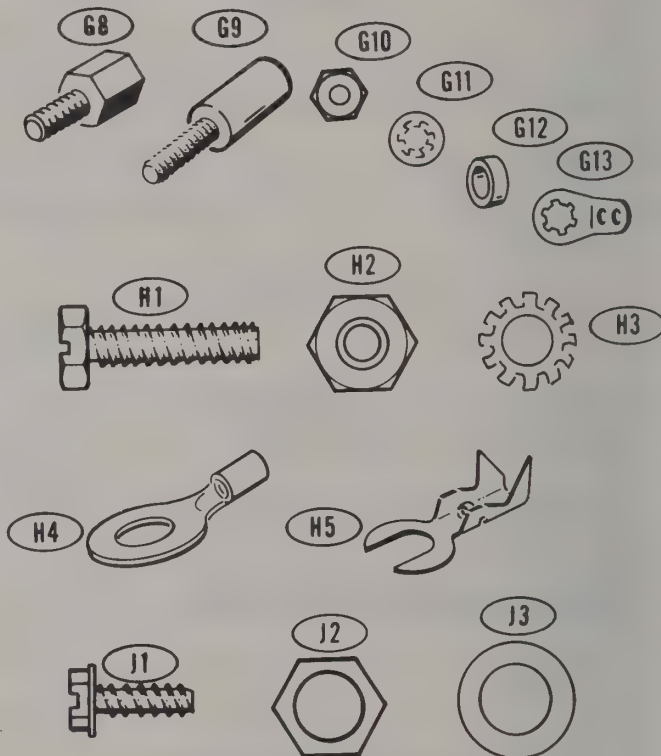


HARDWARE

NOTE: Hardware packs are marked to show the size of hardware they contain (HDW #6 or HDW #1/4, etc.). You may have to open more than one packet to locate all the hardware of any one size (#6, for example).

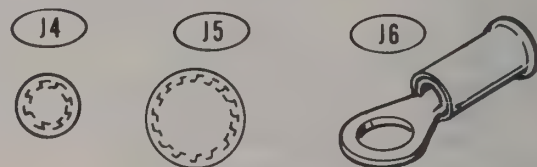
#6 Hardware

G1	250-416	4	6-32 × 1/4" flat head screw
G2	250-381	14	6-32 × 3/8" black screw
G3	250-89	8	6-32 × 3/8" screw
G4	250-162	9	6-32 × 1/2" screw
G5	250-26	5	6-32 × 5/8" screw
G6	250-1173	8	6-32 × 7/8" screw
G7	250-13	4	6-32 × 1" screw
G8	250-305	4	6-32 hex stud
G9	250-271	2	6-32 round stud
G10	252-3	22	6-32 nut
G11	254-1	27	#6 lockwasher
G12	255-1	10	#6 spacer
G13	259-1	3	#6 solder lug



1/4" Hardware

H1	250-253	4	1/4-20 × 7/8" bolt
H2	252-57	4	1/4-20 nut
H3	254-12	6	1/4" lockwasher
H4	259-21	2	1/4" solder lug
H5	259-7	2	1/4" spade lug



Other Hardware

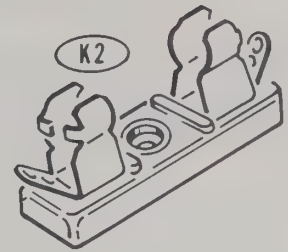
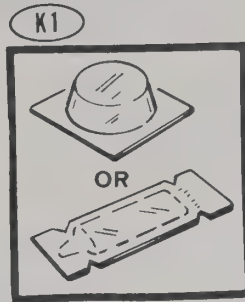
J1	250-83	4	#10 × 1/2" self-tapping screw
J2	252-7	1	Control nut
J3	253-10	1	Control flat washer
J4	254-3	8	#10 lockwasher
J5	254-5	1	Control lockwasher
J6	259-26	4	#10 solder lug
J7	426-14	4	10-32 nut



KEY PART No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
--------------	------	-------------	-------------------

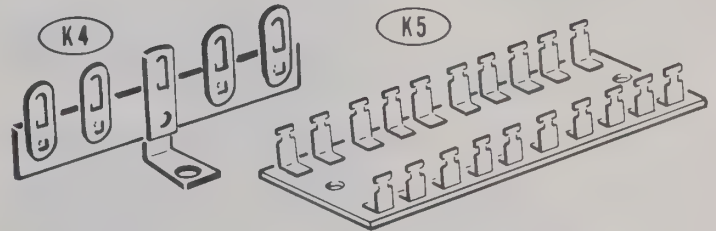
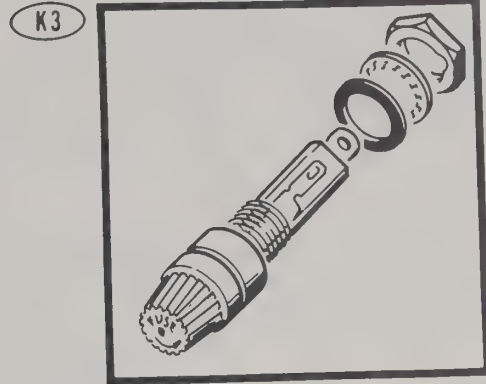
WIRE-SLEEVING-CABLE

89-50	1	Line cord	
340-1	7'	Bare wire	
344-3	1'	Red wire	
344-7	4'	Black wire	
344-28	1'	Yellow wire	
344-29	5'-6"	Blue wire	
344-44	1'	Violet wire	
346-4	5'-6"	Sleeving	
347-13	6'	2-wire cable	



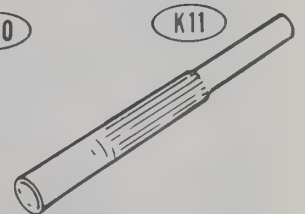
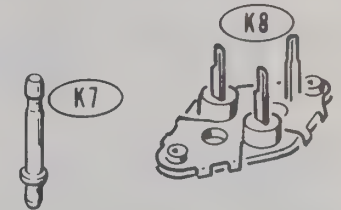
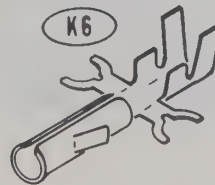
MISCELLANEOUS

	85-1752-1	1	Circuit board ✓
	211-15	2	Plastic handle ✓
	261-21	4	Rubber foot ✓
K1	352-31	1	Dow Corning thermal compound ✓
K2	422-1	1	Fuse block ✓
K3	423-1	1	Fuseholder (with hardware) ✓
K4	431-42	1	5-lug terminal strip ✓
K5	431-67	2	20-lug terminal board ✓
K6	432-851	4	Female connector ✓
K7	432-772	4	Connector pin ✓
K8	434-189	5	Transistor socket ✓
K9	455-619	1	Knob bushing ✓
K10	462-920	1	Knob ✓
K11	490-5	1	Nut starter ✓
			Solder ✓



PRINTED MATERIAL

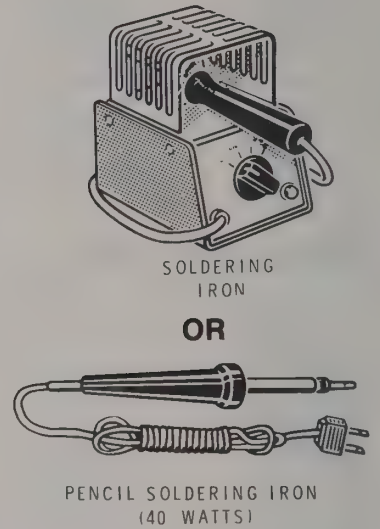
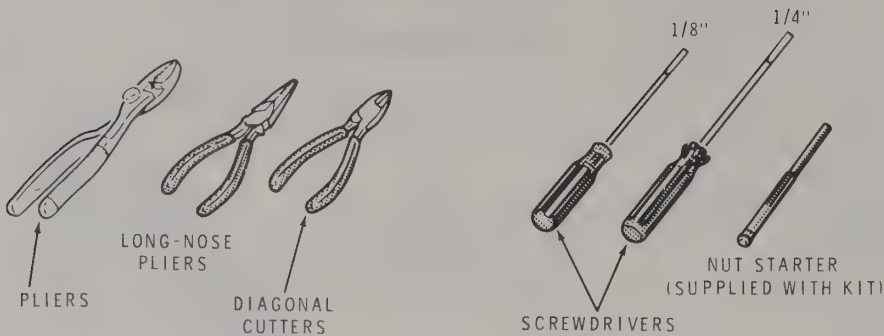
	390-1255	1	Fuse replacement label
	391-34	1	Blue and white label
	597-260	1	Parts Order Form
			Assembly Manual (See front cover for part number.)



ASSEMBLY NOTES

TOOLS

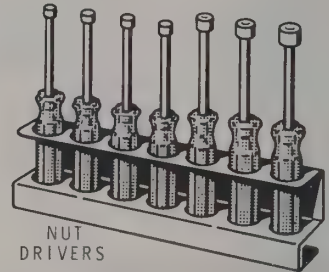
You will need these tools to assemble your kit.



ASSEMBLY

1. Follow the instructions carefully, and read the entire step before you perform the operation.
2. Position all parts as shown in the Pictorials.
3. 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.

OTHER HELPFUL TOOLS



4. A separate "Illustration Booklet" contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. The Pictorials will be called out in the Step-by-Step Assembly as "Refer to Pictorial 3 in the 'Illustration Booklet' for the following steps." The illustrations are arranged in Pictorial number sequence. Place the Booklet in a convenient location and keep it with the assembly Manual.
5. Solder a part or a group of parts only when you are instructed to do so.
6. Resistors will be called out by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms), and color code. Use 1/2-watt resistors unless directed otherwise.
7. Capacitors will be called out by their capacitance value (in pF or μF) and type (ceramic, Mylar, or electrolytic).
8. Each circuit part in this 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 Part List,
 - At the beginning of each step where a component is installed,
 - In some illustrations,
 - In the Schematic,
 - In the sections at the rear of the Manual.
9. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

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.

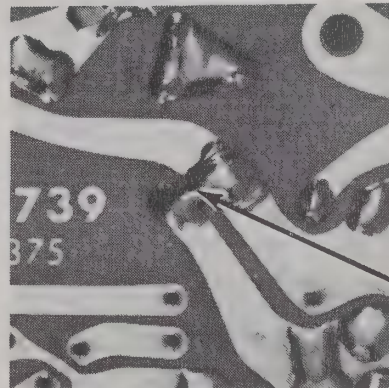
It is easy to make a good solder connection if you follow a few simple rules:

1. Use the right type of soldering iron. A 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. Due to the small foil area around the circuit board holes and the small areas between foils, you must use the utmost care to prevent solder bridges between adjacent foil areas.

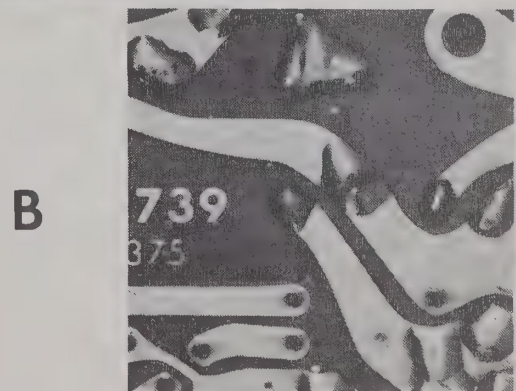
A solder bridge between two adjacent foils is shown in photograph A below. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: Always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge.



A

Solder Bridge



B

4. Use the following procedure when you install parts on the circuit board.
 - A. Insert six or less components unless instructed otherwise.
 - B. Turn the circuit board over, solder the leads to the foil, and cut off the excess lead lengths. To further illustrate this procedure, turn momentarily to page 15. Note the column of steps on each side of the Pictorial and observe that there are no soldering instructions except for a reminder at the end of each column. Therefore, use your discretion as to the number of parts to install. If you install too many, the foil side could become crowded with leads, which makes them difficult to solder.

FOR GOOD SOLDER
CONNECTIONS, YOU MUST
**KEEP THE SOLDERING
IRON TIP CLEAN.**

WIPE IT OFTEN
WITH A DAMP
SPONGE OR CLOTH.



- C. After the circuit board is completed, set it aside.
5. **SAFETY WARNING:** Avoid eye injury when you clip off excess leads. Clip the leads so the ends will not fly toward your eyes.

STEP-BY-STEP ASSEMBLY

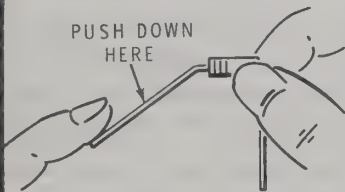
CIRCUIT BOARD ASSEMBLY

START

In the following steps you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

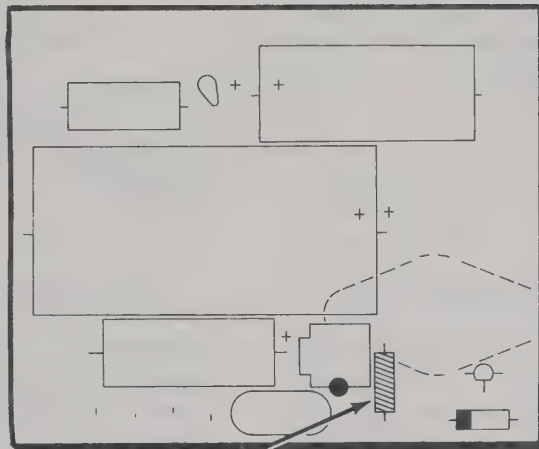
() Position the circuit board as shown with the printed side (not the foil side) up.

() R1: Hold a 22 Ω (red-red-black) resistor by the body as shown and bend the leads straight down.



() Push the leads through the holes at the proper location on the circuit board. The end with color bands may be positioned either way.

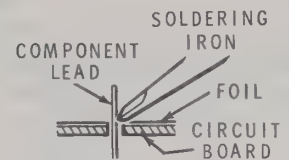
() Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.



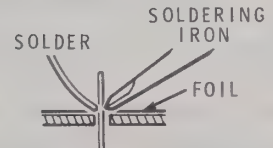
CONTINUE

() Solder the resistor leads to the circuit board as follows:

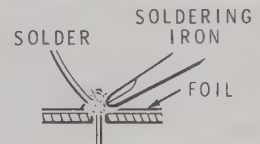
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for 2 or 3 seconds.



2. Then apply solder to the other side of the connection. **IMPORTANT:** Let the heated lead and the circuit board foil melt the solder.



3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.

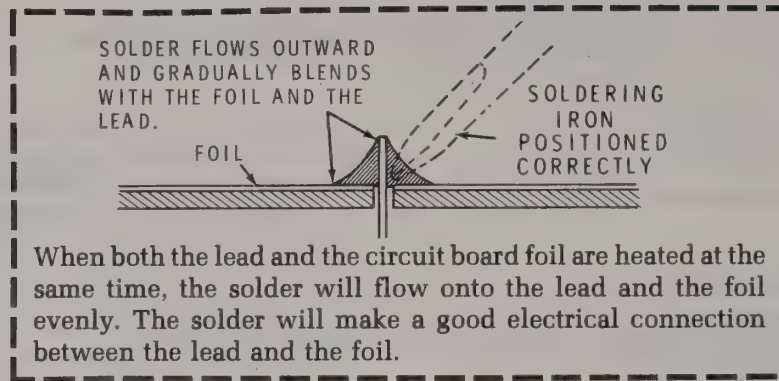


() Hold the lead with one hand while you cut off the excess lead length close to the connection. This will keep you from being hit in the eye by the flying lead.

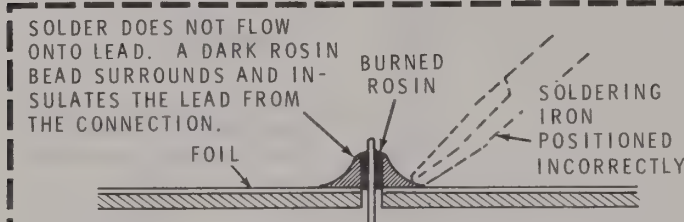
() Check the connection. Compare it to the illustrations on the next page. After you have checked the solder connections, proceed with the assembly on Page 11. Use the same soldering procedure for each connection.

PICTORIAL 1-1

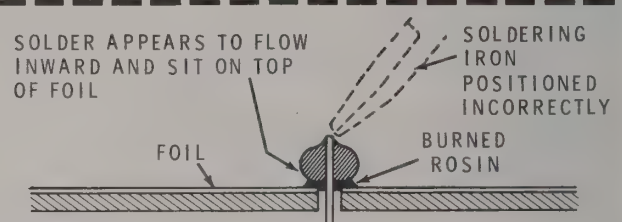
A GOOD SOLDER CONNECTION



POOR SOLDER CONNECTIONS



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.



When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

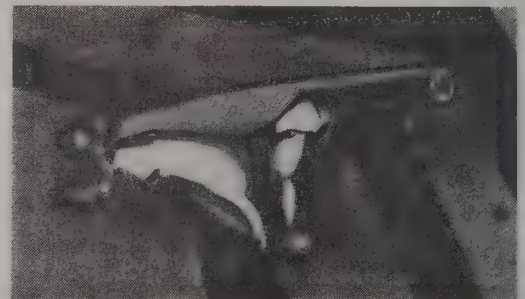
SOLDER CONNECTIONS TO WATCH OUT FOR

The following photographs show examples of the types of bad solder connections that are the most common cause of trouble. If you locate any of these bad solder connections in your kit, correct them as instructed.

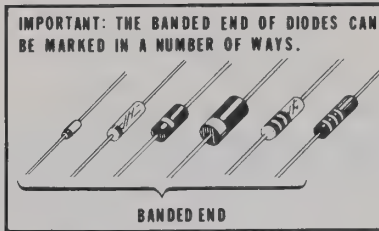


Here, hot solder has been dropped onto the foil and the solder connected or bridged (or crossed) three foils. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron.

NOTE: Solder that bridges two connections on the SAME FOIL is alright and should not be corrected.



Here, solder has flowed along a lead and bridged to another foil. To correct, hold the circuit board above the soldering iron and reheat the solder. As the solder melts, it will flow down the iron. Then cut off the excess lead lengths. PROTECT YOUR EYES.



Detail 1-2A

START ↘

(✓) R6: 270 Ω 2-watt (red-violet-brown).

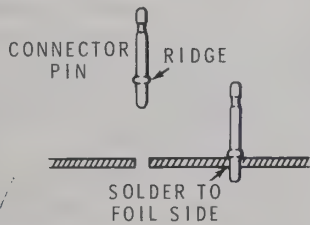
NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. A DIODE WILL NOT WORK IF INSTALLED BACKWARDS. See Detail 1-2A.



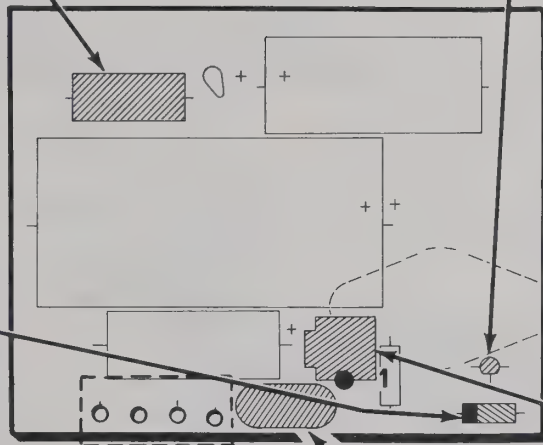
() D1: IN4002 diode (#57-65).

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

NOTE: When you install a connector pin, push the pin into the hole until the ridge is down against the circuit board. Then solder the pin to the foil. Use enough heat to make a good solder connection.



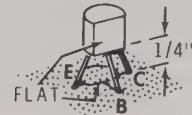
() Install connector pins in the holes marked YEL, RED, VIOL, and BLU.



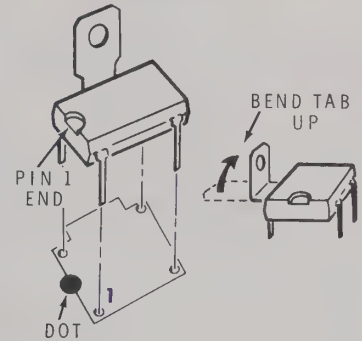
PICTORIAL 1-2

CONTINUE ↘

() Q1: 2N3643 transistor (#417-233). Refer to the Detail and identify the E, B, and C leads. Insert the leads into the indicated holes in the circuit board. Solder each lead to the foil and cut off the excess lead lengths.



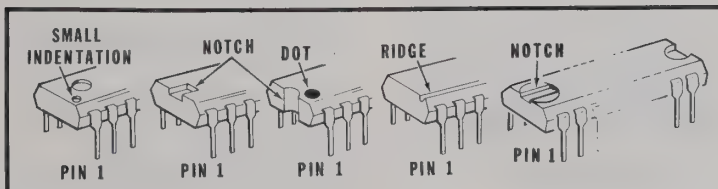
() Locate the μA78MG integrated circuit (#442-626). Grip the IC between your thumb and finger (do not use pliers) and bend the tab up as shown.



() IC1: Position the pin 1 end of the IC (see Detail 1-2B) at the dot on the circuit board and carefully insert the pins into their holes in the circuit board. Do not use the tab for mounting orientation of the IC, as the tab may exit from either side. Solder the pins to the foil and cut off any excess pin lengths.

(✓) C4: .1 μF Mylar.

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

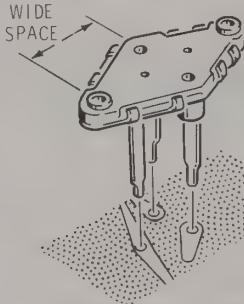


Detail 1-2B

START

Turn the circuit board over and position it as shown.

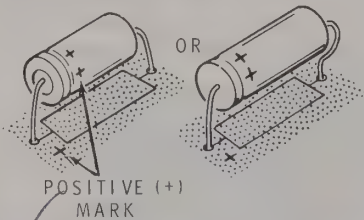
NOTE: When you install the following transistor socket, insert the pins into their holes in the circuit board **only** until the ends of the socket pins are flush with the surface on the other side of the circuit board. Note the wide space between the socket holes. If necessary, twist the socket to position it parallel to the side of the circuit board. Then solder the pins to the foil.



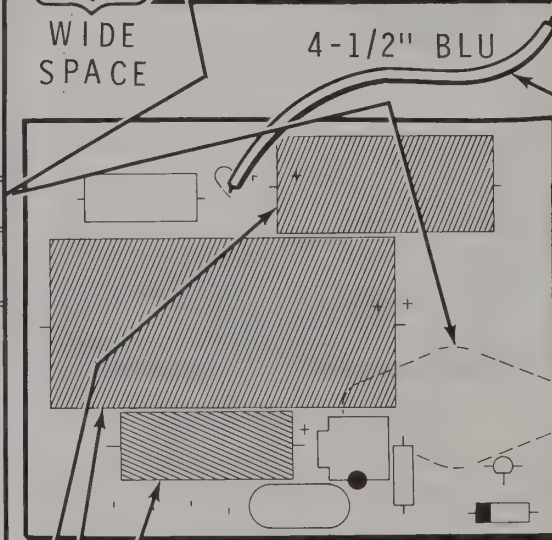
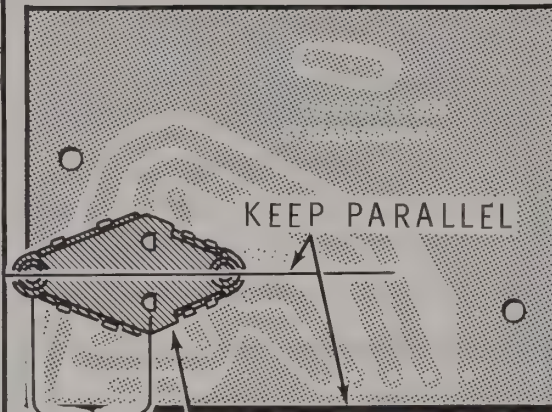
- Transistor socket.

Turn the circuit board over and position it as shown.

NOTE: When you install an electrolytic capacitor, match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board. Since capacitor lengths vary, it may be necessary to form the negative lead on a longer capacitor as shown below. Be sure the positive lead does not touch the capacitor body.



- C6: 500 μ F electrolytic.
- C3: 2500 μ F electrolytic.
- C5: 10 μ F electrolytic.
- Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-3



Detail 1-3A

CONTINUE

NOTE: To prepare a wire, remove 1/4" of insulation from each end of the specified length and color of wire. Twist together the fine strands of wire and melt a small amount of solder on the exposed wire ends.

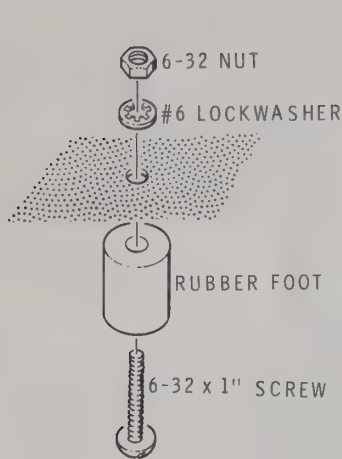
- Prepare a 4-1/2" blue wire. Solder one end of this wire in hole A. Cut off the excess lead length. The free end of this wire will be connected later.
- Cut both leads of the .001 Ω F disc capacitor to 1/2".
- Turn the circuit board over. Then refer to Detail 1-3A and solder the .001 μ F disc as shown between the BLU connector pin and the nearby ground foil. Press the capacitor flat against the circuit board.

CIRCUIT BOARD CHECKOUT

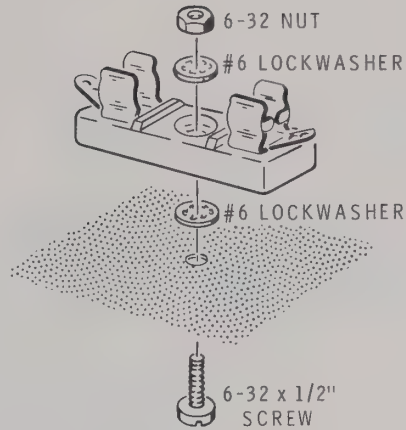
Carefully inspect the circuit board for the following conditions.

- Unsoldered connections.
- Poor solder connections.
- Solder bridges between foil patterns.
- Protruding leads which could touch together.
- Transistor for the proper type and installation.
- Integrated circuit for the correct position of pin 1.
- Diode for the correct position of the banded end.
- Electrolytic capacitors for the correct position of the plus (+) marked lead.

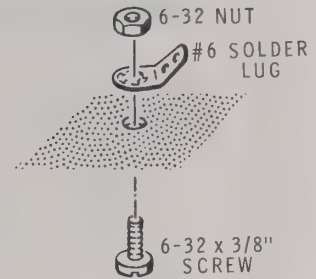
Set the circuit board aside until it is called for later.



Detail 2-1A



Detail 2-1B



Detail 2-1C

CHASSIS ASSEMBLY

Refer to Pictorial 2-1 (in the "Illustration Booklet") for the following steps.

- (/) Locate the chassis and position it with the rear facing you as shown.

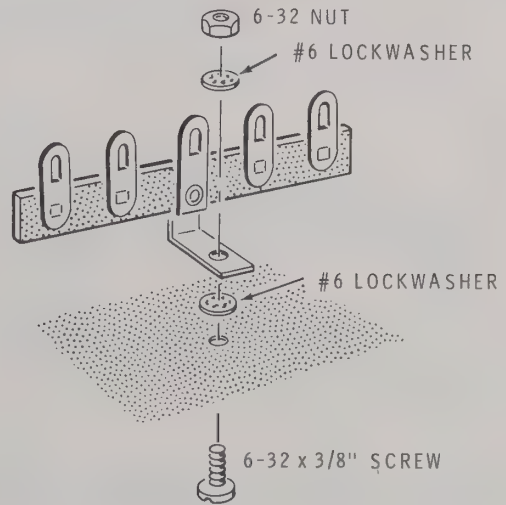
NOTE: The term "hardware" in some of the following steps refers to the screws, nuts, and lockwashers you should use to mount parts. The phrase "Use 6-32 x 1-1/4" hardware," for example, means to use a 6-32 x 1-1/4" screw, one or more #6 lockwashers, and a 6-32 nut. Refer to the Detail called out in the step for the correct number of lockwashers to use and the correct way to install the hardware. Use the plastic nut starter furnished with the kit to pick up #6 nuts and start them on screws.

- () Refer to Detail 2-1A and mount a rubber foot at location G with 6-32 x 1" hardware.
- (/) In the same manner, mount rubber feet at locations A, D, and H.

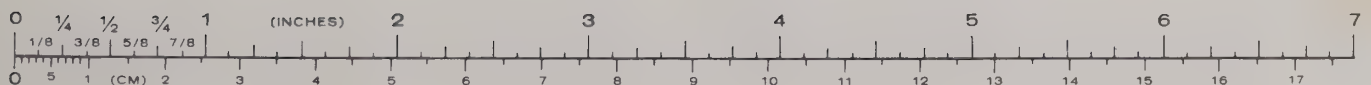
- (/) Refer to Detail 2-1B and mount the fuse block at location F1 with 6-32 x 1/2" hardware. Do not overtighten the hardware as the fuse block may break.

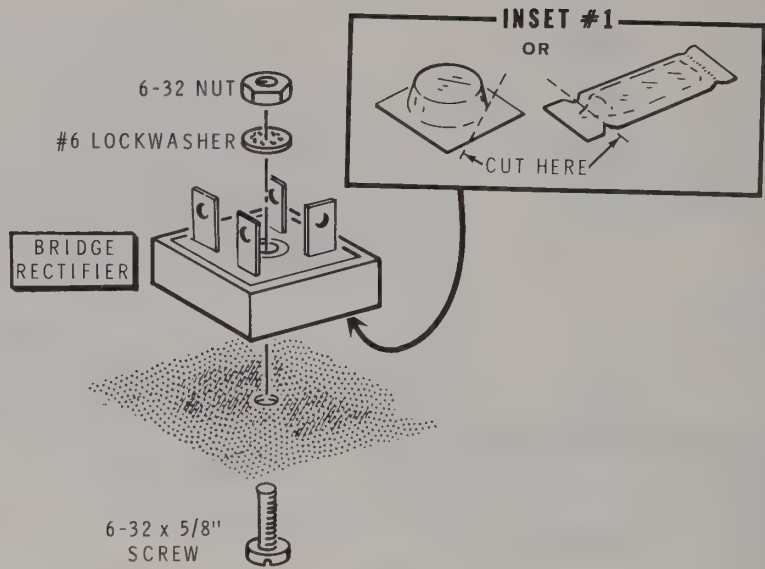
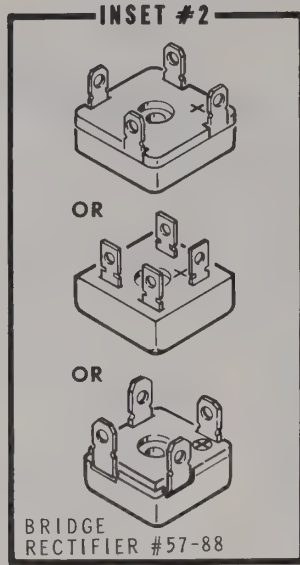
- (/) Refer to Detail 2-1C and mount a #6 solder lug at location C with a 6-32 x 3/8" screw and a 6-32 nut. Do not use the black screws unless they are called for in a step.

- () Refer to Detail 2-1D and mount the 5-lug terminal strip at location B with 6-32 x 3/8" hardware.



Detail 2-1D





Detail 2-1E

WARNING: You will be using Dow Corning 340 thermal compound in the next step. Although the compound is not caustic, it may cause discomfort if it gets into your eyes. If this happens, rinse your eyes with warm water. If the compound gets onto your clothing, the clothing may require professional cleaning. The compound contains Zinc Oxides, SiO₂, and slight traces of CO₂.

- () Refer to Detail 2-1F and mount a 6-32 hex stud at location AA with a 6-32 x 1/4" flat head screw and a #6 lockwasher.
- () In the same manner, mount 6-32 hex studs at locations AB, AC, and AD.

Set the chassis aside temporarily.

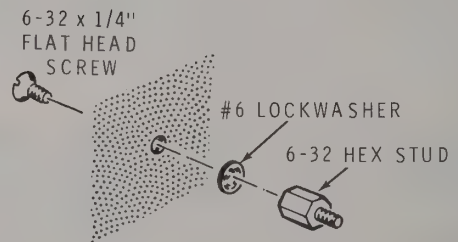
- () Refer to inset drawing #1 in Detail 2-1E and carefully open the thermal compound.

NOTES:

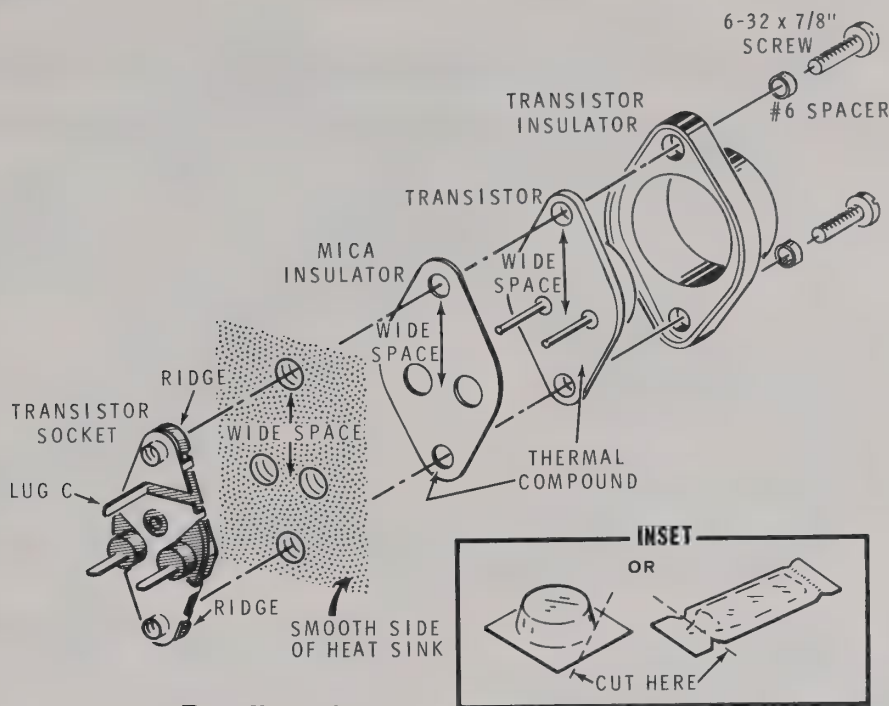
1. Refer to inset drawing #2 on Detail 2-1E to correctly identify the type of bridge rectifier you received, and to identify the location of the positive (+) lug.
2. You can use the blade of a screwdriver to spread the thermal compound, as in the next step, if you wish. This will prevent getting the compound on your hands.

- () Spread a thin layer of the thermal compound on the flat side of the MDA990-2 bridge rectifier (#57-88). Save the remaining thermal compound for later use.

- () BR1: Refer to Detail 2-1E and mount this bridge rectifier at location BR1 with 6-32 x 5/8" hardware. Tighten the hardware firmly, but, do not overtighten the hardware as the rectifier may break. Be sure to position the positive (+) lug as shown in Pictorial 2-1.



Detail 2-1F

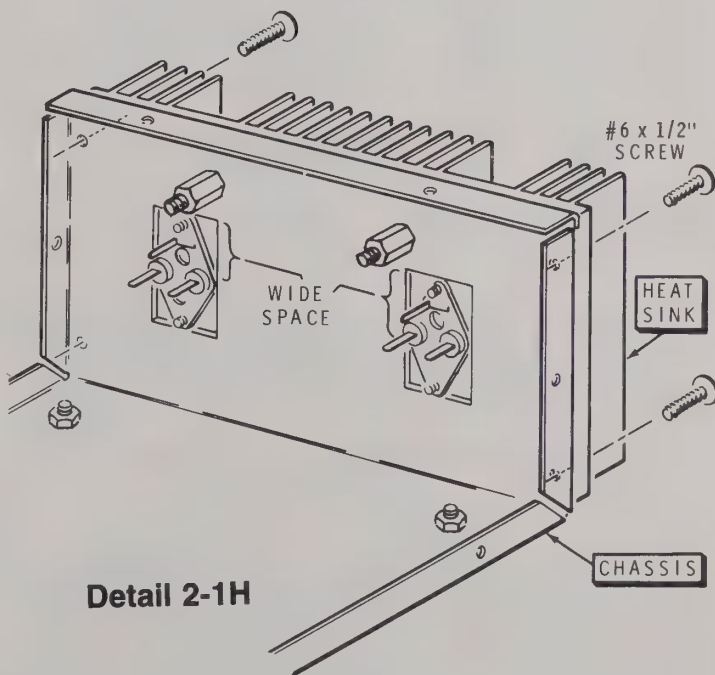


Detail 2-1G

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

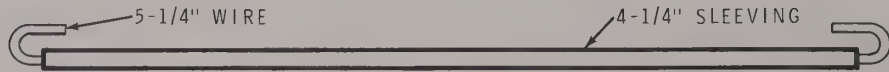
- () Wipe all the dust and packing particles from both heat sinks.
- () Locate the four 40411 transistors (#417-139) and spread a thin layer of thermal compound on the large flat surface of each transistor.
- () Press a mica insulator onto each of these transistors. Note the wide space on the transistors and insulators.
- () Now spread a thin layer of the thermal compound on each of these mica insulators. Save the remaining thermal compound for use later. **NOTE:** As you mount a transistor on the heat sink, line up the wide space on the transistor, heat sink, and transistor socket. Tighten the screws so the #6 spacers are forced into the transistor insulator and against the transistor. Good electrical contact between the spacer and transistor is necessary for proper operation. However, do not tighten the screws so tight that they break the transistor sockets.
- () Mount a transistor (with mica insulator), a transistor insulator, and a transistor socket at each of the transistor locations in one of the heat sinks. Use 6-32 x 7/8" screws and #6 spacers.
- () In the same manner, mount transistors at both transistor locations on the other heat sink.

- (/) Refer to Pictorial 2-1 and Detail 2-1H and mount one of the heat sinks on either side of the chassis with four 6-32 x 1/2" screws. Be sure the wide space of the transistor sockets are positioned as shown.
- () In the same manner, mount the other heat sink on the other side of the chassis.

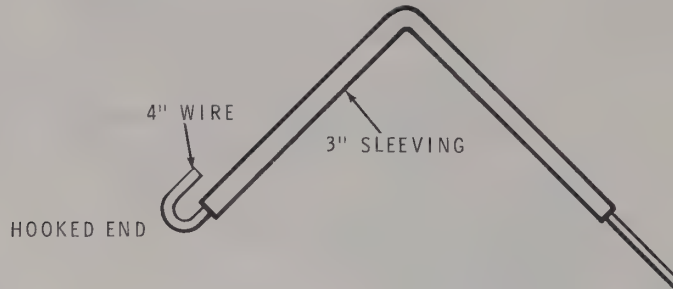


Detail 2-1H

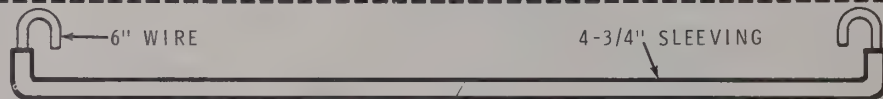
PART 1



PART 2



PART 3



Detail 2-2A

CHASSIS WIRING

Refer to Pictorial 2-2 (in the "Illustration Booklet") for the following steps. Be sure to position the chassis as shown.

NOTE: To prepare bare wire, cut the bare wire and sleeving (if sleeving is required) to the indicated lengths; then place the length(s) of sleeving on the wire. The wires will be used in the order they are listed. If the bare wire has many bends, clamp one end in a vise. Then hold the other end of the wire with pliers and pull the wire until it is straight.

Prepare the following lengths of bare wire and sleeving:

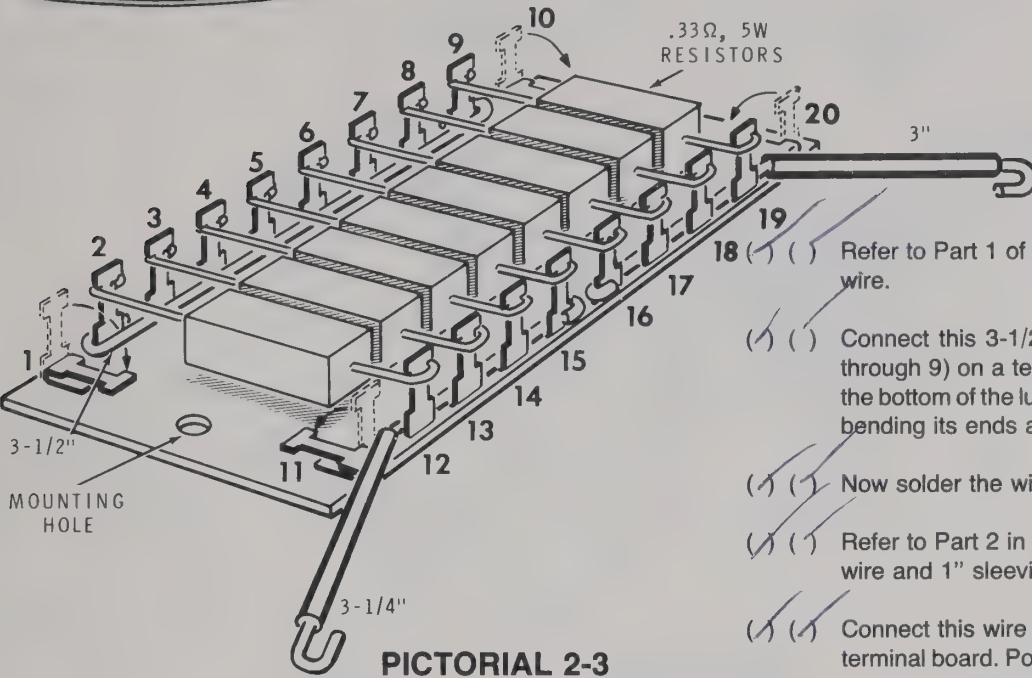
	WIRE	SLEEVING
()	5-1/4"	4-1/4"
()	4"	3"
()	6"	4-3/4"
()	5-1/4"	4-1/4"
()	4"	3"
()	6"	4-3/4"

NOTE: As you prepare each wire, bend the wire to shape by placing it over its respective full size drawing in Detail 2-2A. Be careful not to damage the connecting lug when you install the wire.

() Refer to Part 1 and prepare a 5-1/4" wire and 4-1/4" sleeving.

NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following "S" tells how many wires are at the connection. Use special care when you solder these connections. Apply enough heat and solder so that each wire is properly soldered.

- (/) Connect this 5-1/4" wire from Q4 lug C (NS) to Q3 lug C (S-1).
- (/) Refer to Part 2 in Detail 2-2A and prepare the 4" wire and 3" sleeving.
- (/) Connect the hooked end of this 4" wire to Q4 lug C (S-2). The other end of this wire will be connected later.
- (/) Refer to Part 3 in Detail 2-2A and prepare a 6" wire and 4-3/4" sleeving.
- (/) Connect this 6" wire from Q4 lug B (NS) to Q3 lug B (NS).
- (/) Refer to Part 1 in Detail 2-2A and prepare a 5-1/4" wire and 4-1/4" sleeving.
- (/) Connect this 5-1/4" wire from Q5 lug C (S-1) to Q6 lug C (NS).
- (/) Refer to Part 2 in Detail 2-2A and prepare a 4" wire and 3" sleeving.
- (/) Connect the hooked end of this 4" wire to Q6 lug C (S-2). The other end of this wire will be connected later.
- (/) Refer to Part 3 of Detail 2-2A and prepare a 6" wire and 4-3/4" sleeving.
- () Connect this 6" wire from Q5 lug B (NS) to Q6 lug B (S-1).
- (/) Set the chassis aside temporarily.



PICTORIAL 2-3

Refer to Pictorial 2-3 for the following steps.

NOTE: In the following steps you will be instructed to wire two identical 20-lug terminal boards. Each step must be performed twice, once for each terminal board. Two step checkoff spaces are provided for each step. You can wire each terminal board separately or both at the same time, whichever you choose.

() () Locate a 20-lug terminal board and bend over the lug at each corner (lugs 1, 10, 11, and 20).

Prepare the following lengths of bare wire and sleeving:

WIRE	SLEEVING
3-1/2"	
3-1/4"	1"
3"	3/4"

() () Refer to Part 1 of Detail 2-3A and prepare a 3-1/2" wire.

() () Connect this 3-1/2" wire to the top row of lugs (2 through 9) on a terminal board. Position the wire at the bottom of the lugs and secure the wire in place by bending its ends around lugs 2 and 9.

() () Now solder the wire to each lug (2 through 9).

() () Refer to Part 2 in Detail 2-3A and prepare a 3-1/4" wire and 1" sleeving.

() () Connect this wire to lugs 12, 13, 14, and 15 on the terminal board. Position the wire at the bottom of the lugs. Then solder the wire to each lug.

() () Refer to Part 3 in Detail 2-3A and prepare a 3" wire and 3/4" sleeving.

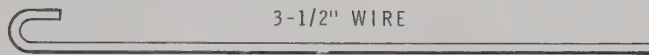
() () Connect this wire to lugs 16, 17, 18, and 19 on the terminal board. Position the wire at the bottom of the lugs. Then solder the wire to each lug.

In the next two steps you will install eight resistors on each of the terminal boards. Center each resistor between its lugs. Keep the resistor leads to the top of the lugs so the body of the resistor is up off of the terminal board. Be sure the end resistors do not cover the mounting holes in the terminal board. Solder the leads of each resistor as it is installed.

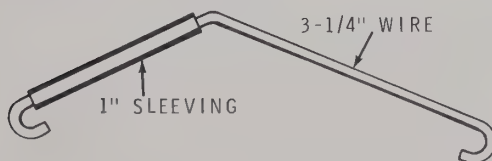
() () Install a .33 Ohm, 5-watt resistor between lug 2 and 12 as shown in Pictorial 2-3.

() () In a similar manner, install seven more .33 Ohm, 5-watt resistors on the terminal board as shown.

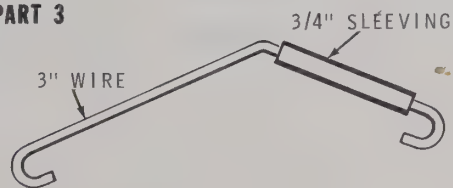
PART 1



PART 2

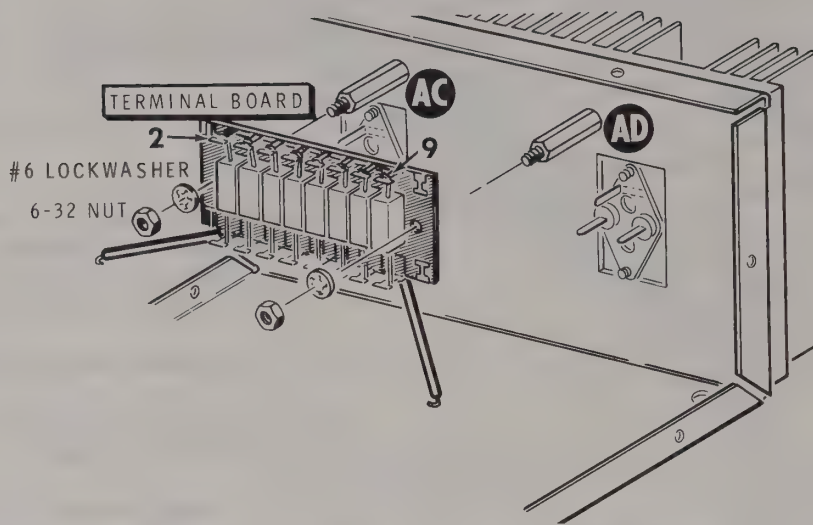


PART 3



Detail 2-3A





Detail 2-4A

Refer to Pictorial 2-4 for the following steps.

- (✓) Refer to Detail 2-4A and mount one of the terminal boards on the studs at AC and AD with #6 lockwashers and 6-32 nuts. Be sure to position lugs 2 through 9 to the top.
- (✓) In the same manner, mount the other terminal board on studs AA and AB.

Connect the wires from the terminal board mounted at AA and AB as follows:

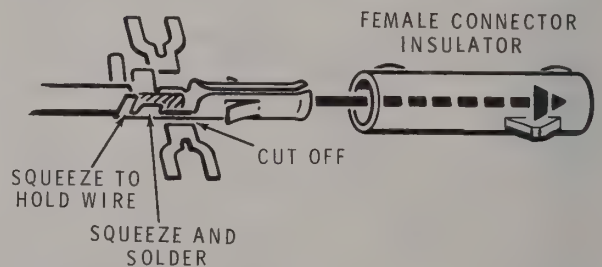
- (✓) Wire from lug 12 to Q4 lug E (S-1).
- (✓) Wire from lug 19 to Q3 lug E (S-1).

Connect the wires from the terminal board mounted at AC and AD as follows:

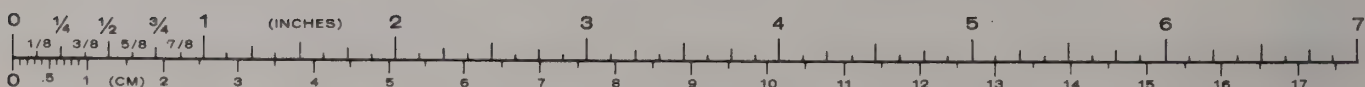
- (✓) Wire from lug 12 to Q5 lug E (S-1).
- (✓) Wire from lug 19 to Q6 lug E (S-1).

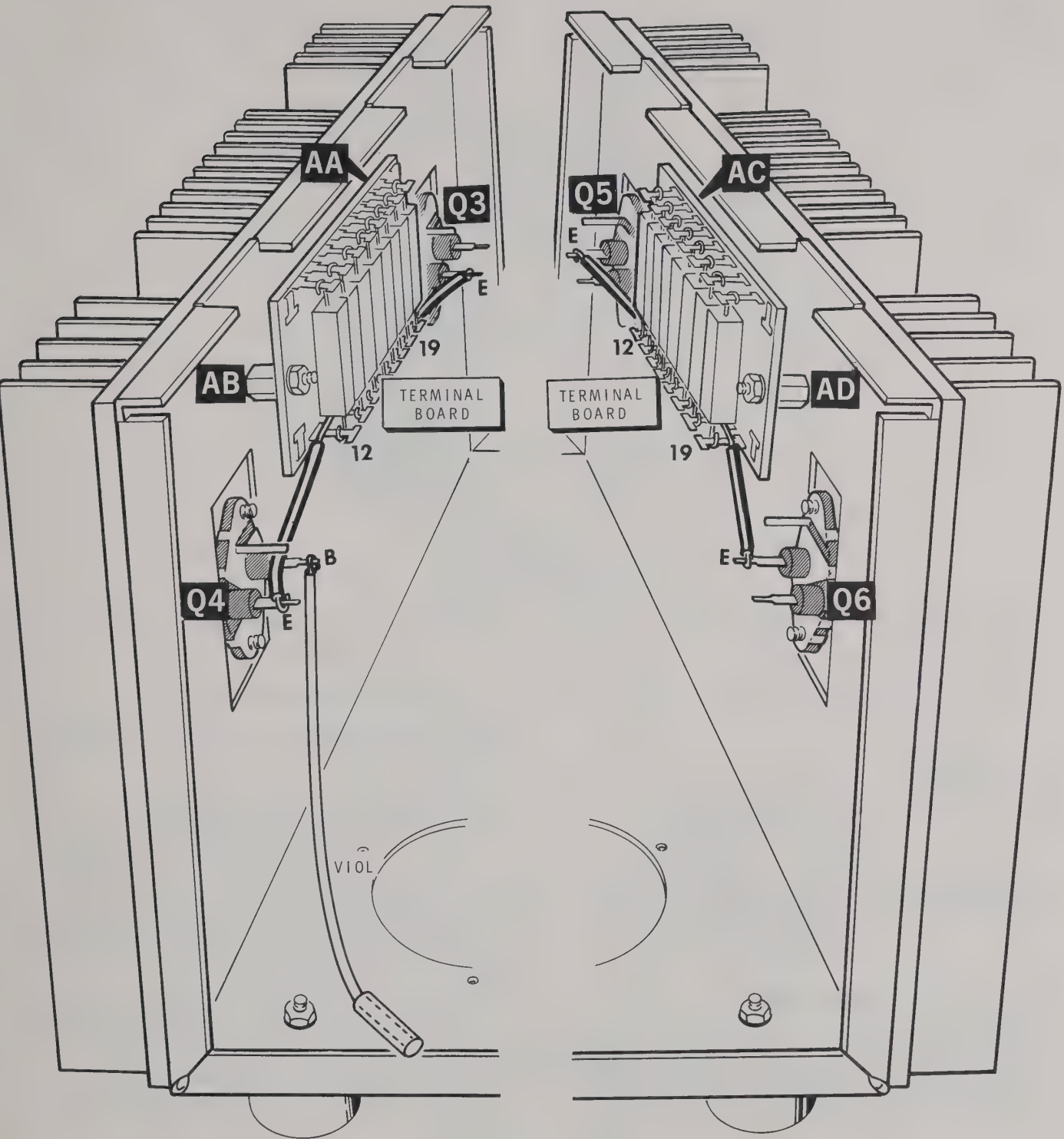
- () Prepare the ends of a 10" violet wire.

- (✓) Refer to Detail 2-4B and install a female connector on one end of the 10" violet wire. After the connection has cooled, push a female connector insulator onto the female connector.
- (✓) Connect the free end of the 10" violet wire to Q4 lug B (S-2).

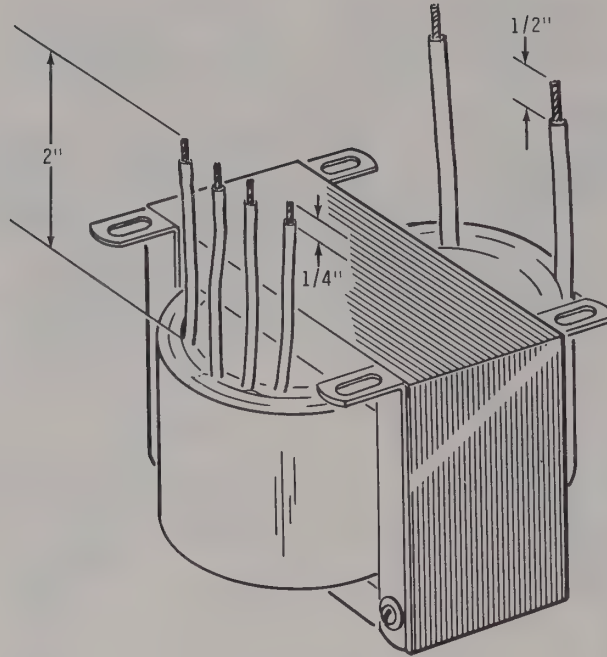


Detail 2-4B





PICTORIAL 2-4



Detail 2-5B

Refer to Pictorial 2-5 (in the "Illustration Booklet") for the following steps.

Prepare the ends of the following wires:

- 3-1/2" black
- 7-1/2" yellow
- 5-1/2" black

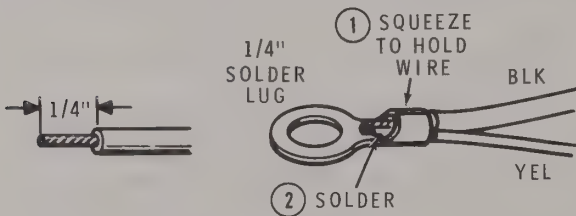
- In the same manner, solder a 1/4" solder lug on one end of the 5-1/2" black wire.

Set these wires aside temporarily.

Refer to Detail 2-5B and prepare the power transformer (#54-848) as follows:

- Position the transformer as shown.
- Cut the four (small) leads to their indicated lengths.

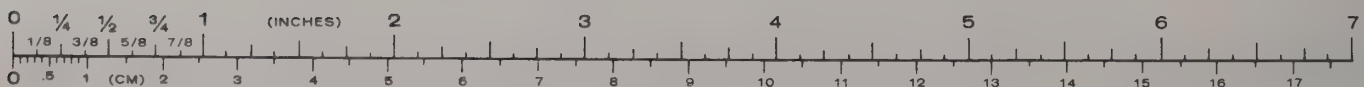
CAUTION: When you remove the insulation from the end of the transformer leads, hold the lead between the transformer and the lead end. Otherwise, you may pull the lead out of the transformer.

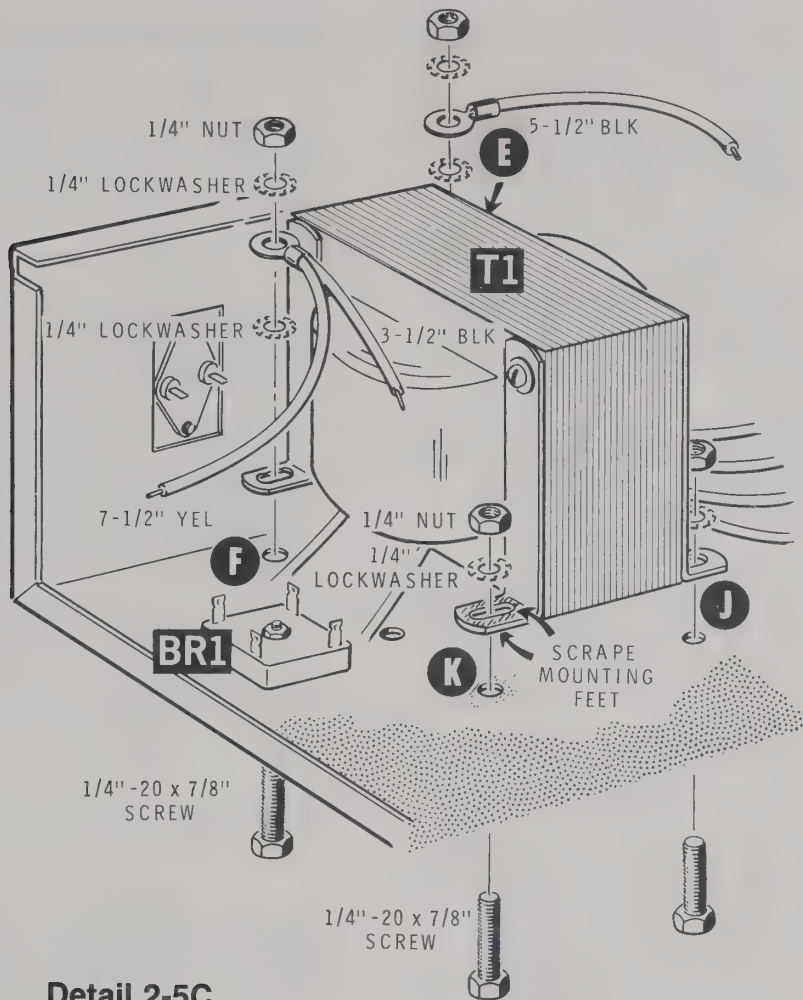


Detail 2-5A

- Refer to Detail 2-5A and solder a 1/4" solder lug on one end of the 3-1/2" black and 7-1/2" yellow wires. Then remove an extra 1/4" (total 1/2") of insulation from the free end of the black wire.

- Remove 1/2" of insulation from the two white leads. **DO NOT** melt solder on these exposed lead ends.
- Remove 1/4" of insulation from the other four leads and melt a small amount of solder on their exposed lead ends.





Detail 2-5C

- () Refer to Detail 2-5C and scrape the top and bottom of each of the transformer mounting feet to provide a good ground for the transformer frame.

CAUTION: Be very careful when you install the power transformer in the next step so you do not damage any of the parts already installed on the chassis. Also, do not pinch any wires between the transformer and chassis. There are six transformer mounting holes in the bottom of the chassis; use the four holes that match the mounting feet on your transformer.

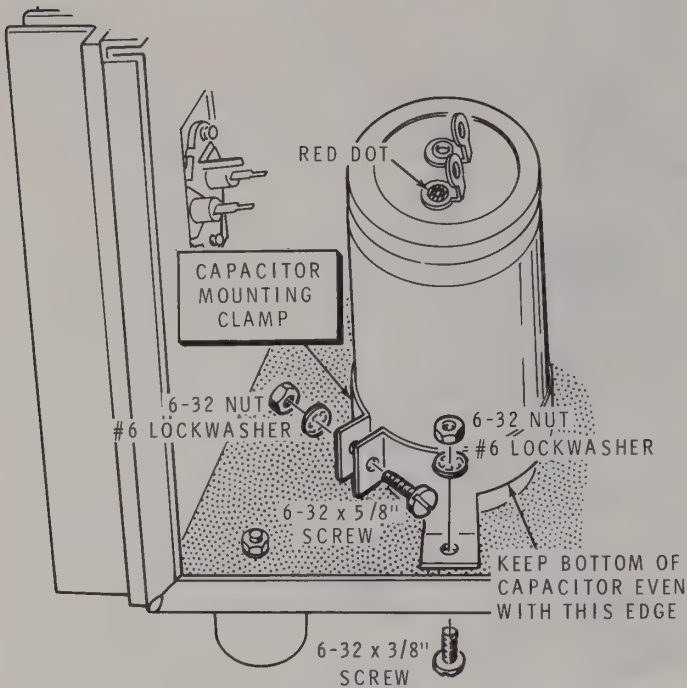
- () T1: Refer to Detail 2-5C and mount the power transformer at location T1. Position the white leads toward rectifier BR1. Use 1/4-20 x 7/8" hardware in chassis holes J and K. Do not tighten the hardware at this time.
- () Install the prepared 3-1/2" black and 7-1/2" yellow wires with solder lug at hole F in the chassis. Use 1/4-20 x 7/8" hardware. Note the extra 1/4" lockwasher between the solder lug and the nut. Do not tighten the hardware.
- () In the same manner install the prepared 5" black wire with solder lug at hole E.

- () Carefully position the transformer so it is centered between the two terminal boards. Be sure the solder lugs at E and F are positioned as shown. Now tighten the transformer mounting hardware.

- () Wrap the free end of the black wire coming from solder lug F around rectifier BR1 lug 3 (NS). Do not cover the (-) hole in the rectifier lug.

NOTE: When you connect the white transformer leads in the next two steps, first melt a small amount of solder on each side of the proper rectifier lugs. Then place half of the small wire strands on each side of the rectifier lug and solder the connection. Then cut off the excess length of small wire strands. Be sure all the strands get soldered and that none touch the chassis, otherwise the unit will be damaged when it is turned on.

- () Connect a white lead coming from T1 to rectifier BR1 lug 2 (S-1).
- () Connect the other white lead coming from T1 to rectifier BR1 lug 4 (S-1).



Detail 2-6A

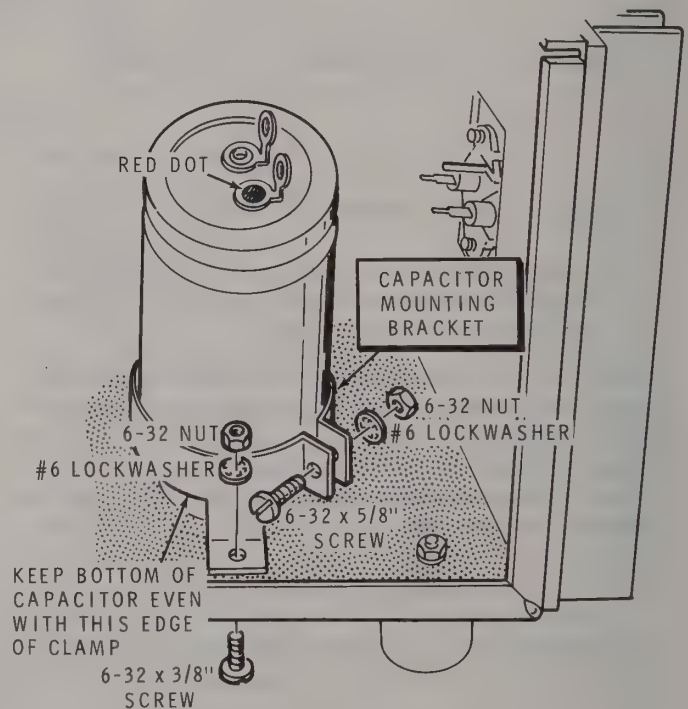
Refer to Pictorial 2-6 (in the "Illustration Booklet") for the following steps.

- (✓) Refer to Detail 2-6A and **start** 6-32 × 5/8" hardware in the clamping hole of a capacitor mounting clamp.
- (✓) Refer to Detail 2-6A and mount this capacitor mounting clamp at location C1 with 6-32 × 3/8" hardware. Do not tighten the hardware at this time.
- (✓) C1: Refer to Detail 2-6A and install a 10,000 μF electrolytic capacitor in the capacitor clamp at C1. Position the capacitor bottom even with the indicated clamp edge and the red dot lug as shown. Tighten the clamping screw; then tighten the three clamp mounting screws.
- (✓) Refer to Detail 2-6B and **start** 6-32 × 5/8" hardware in the clamping hole of a capacitor mounting clamp.
- (✓) Refer to Detail 2-6B and mount this capacitor mounting clamp at location C2 with 6-32 × 3/8" hardware. Do not tighten the hardware at this time.
- (✓) C2: Refer to Detail 2-6B and install a 10,000 μF electrolytic capacitor in the capacitor clamp at C2. Position the capacitor bottom even with the indicated clamp edge and the red dot lug as shown. Tighten the clamping screw; then tighten the three clamp mounting screws.

Prepare the following lengths of bare wire and sleeving:

	WIRE	SLEEVING	SLEEVING
(✓)	8-1/2"	3-1/4"	3-3/4"
(✓)	5-1/2"	2-1/8"	2-1/8"
(✓)	4"	3"	
(✓)	9-1/2"	4-1/4"	4-1/4"
(✓)	1-3/4"		

- (✓) Refer to Part 1 of Detail 2-6C (in the "Illustration Booklet") and prepare the 8-1/2" wire with 3-1/4" sleeving and 3-3/4" sleeving.
- (✓) Connect this 8-1/2" wire from the terminal board at AB lug 2 (S-3) [there are already two wires soldered here] to the terminal board at AD lug 9 (S-3) [there are already two wires soldered here]. Be sure to position the 3-1/4" length of sleeving nearest the terminal board at AB.
- (✓) Refer to Part 2 of Detail 2-6C and prepare the 5-1/2" wire with two 2-1/8" lengths of sleeving.
- (✓) Connect this 5-1/2" wire from capacitor C1 lug 1 (S-1) to capacitor C2 lug 1 (S-1).



Detail 2-6B

- (✓) Refer to Part 3 of Detail 2-6C and prepare the 4" wire with 3" sleeving.
- (✓) Connect the hooked end of this 4" wire to the bare area (between the length of sleeving) on the wire between capacitor C1 lug 1 and capacitor C2 lug 1 (S-1). Connect the other end of this wire in the hole of rectifier BR1 lug 3 (S-2).
- (✓) Refer to Part 4 of Detail 2-6C and prepare the 9-1/2" wire with the two 4-1/4" lengths of sleeving.
- (✓) Connect this 9-1/2" wire from capacitor C1 lug 2 (NS) to capacitor C2 lug 2 (NS).

NOTE: The holes in some lugs may be too small to accept two wires. In these instances, install one wire in the lug hole and wrap the other wire around the lug. Be sure both wires are soldered securely when you are instructed to solder the connections.

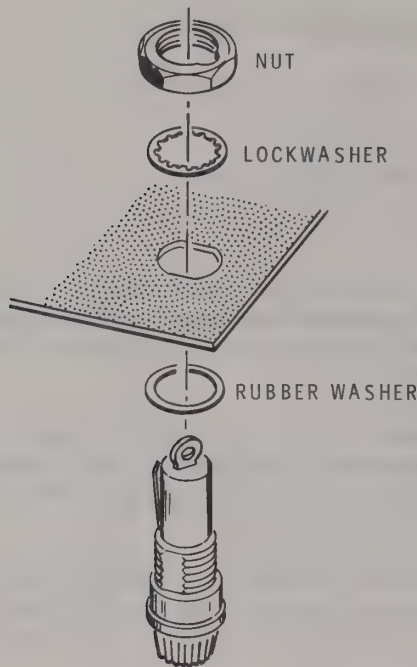
- (✓) Connect the free end of the wire coming from Q4 lug C to capacitor C1 lug 2 (S-2).
- (✓) Connect the free end of the wire coming from Q6 lug C to capacitor C2 lug 2 (S-2).
- (✓) Refer to Part 5 of Detail 2-6C and prepare the 1-3/4" wire.
- (✓) Connect the looped end of this wire to the bare area (between the lengths of sleeving) on the wire between capacitor C1 lug 2 and capacitor C2 lug 2. Do not solder this connection yet. Connect the other end of this wire to rectifier BR1 lug 1 (S-1).

Prepare the following lengths of wire:

COLOR	LENGTH
(✓) Black	9"
(✓) Red	7-1/2"
(✓) Blue	17"

- (✓) Connect one end of the 9" black wire to the bare area (between the lengths of insulation) on the wire between the two terminal boards (S-1). The other end of this wire will be connected later.
- (✓) Install a female connector at one end of each of the 7-1/2" red and the 17" blue wires. After each connection has cooled, push a female connector insulator onto each female connector.
- (✓) In the same manner, install a female connector and a female connector insulator on the free end of the 7-1/2" yellow wire coming from solder lug F mounted with transformer T1.
- (✓) Connect the free end of the 7-1/2" red wire to the bare area (between the lengths of insulation) on the wire between capacitor C1 lug 2 and capacitor C2 lug 2 (S-2). The other end of the wire will be connected later.
- (✓) Position the free (bare) end of the 17" blue wire between capacitors C1 and C2 and around the right side of transformer T1. Both ends of this wire will be connected later.
- (✓) Set the chassis aside temporarily.





Detail 2-7A

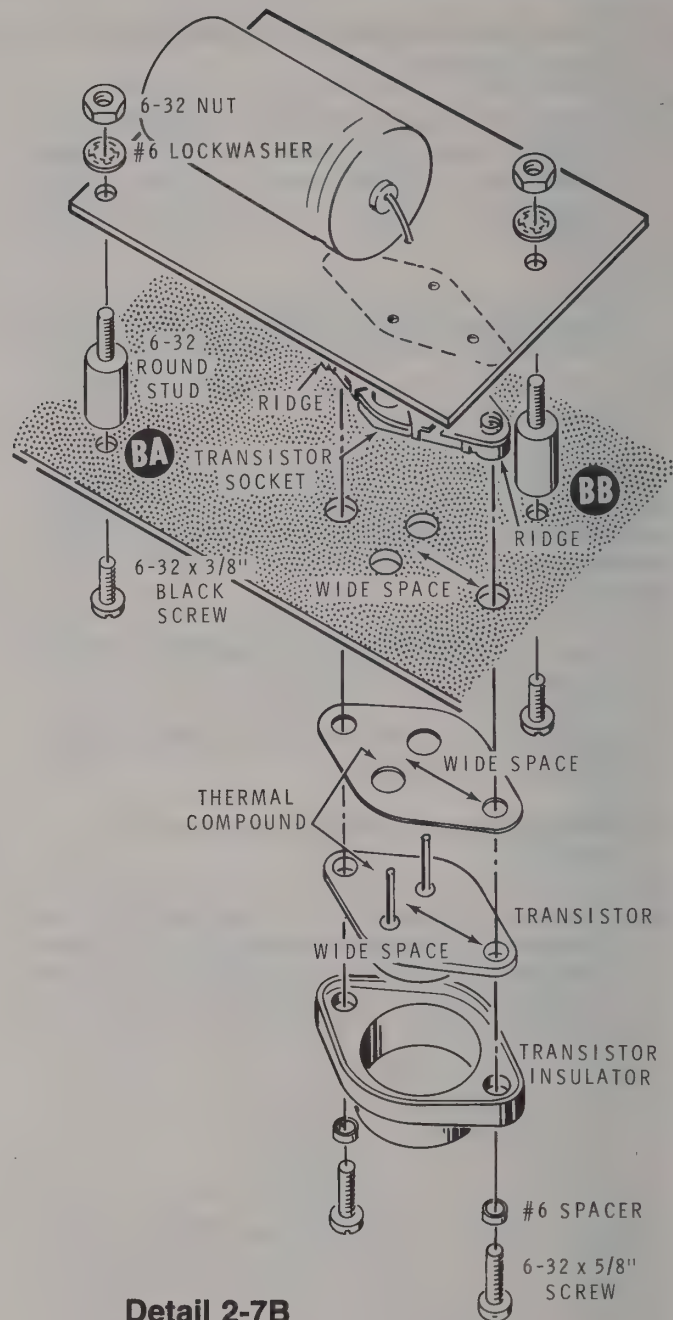
REAR PANEL ASSEMBLY AND WIRING

Refer to Pictorial 2-7 (in the "Illustration Booklet") for the following steps.

- () Refer to Detail 2-7A and mount the fuseholder at location F2 in the rear panel. Use the hardware furnished with the fuseholder. Do not overtighten the nut as the fuseholder can be damaged.
- () Carefully bend lug 1 of F2 away from the fuseholder body as shown.

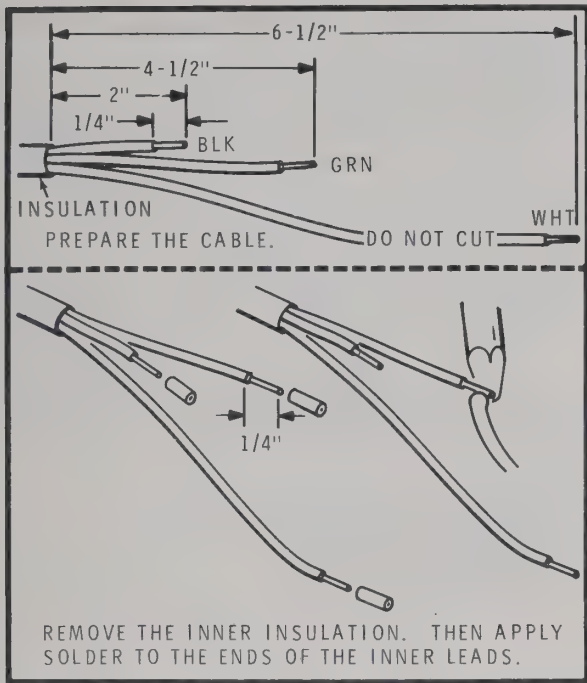
Refer to Detail 2-7B for the following steps.

- () Mount a 6-32 round stud at location BA with a 6-32 x 3/8" black screw.
- () In the same manner, mount a 6-32 round stud at location BB.
- () Mount the circuit board on the studs at BA and BB with #6 lockwashers and 6-32 nuts. Position the ridges on the transistor socket into the indicated holes at location Q2. *If necessary, reheat the solder connections to reposition the transistor socket.*
- () Spread a thin layer of thermal compound on the large flat surface of a 2N3055 (#417-215) transistor.
- () Note the wide space and position a mica insulator on the transistor.



Detail 2-7B

- () Spread a thin layer of thermal compound on the mica insulator. Any remaining thermal compound can now be discarded.
- () Q2: Mount this transistor and a transistor insulator at location Q2 in the rear panel. Use two 6-32 x 5/8" screws and two #6 spacers. Tighten the screws so the #6 spacers are forced into the insulator and against the transistor to provide a good electrical connection. Do not tighten the screws so tight that they break the transistor sockets.

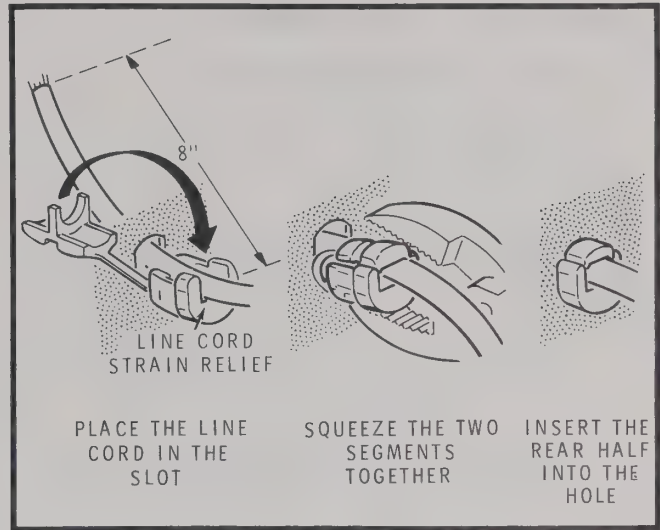


Detail 2-7C

Refer to Pictorial 2-7 for the following steps.

Refer to Detail 2-7C and prepare the end of the line cord as follows:

- (✓) Cut the black lead and green lead (do not cut the white lead) to the specified length. Measure from the end of the insulation.
- (✓) Remove 1/4" of insulation from the end of each lead.
- (✓) Twist the fine wire strands together and melt a small amount of solder on the exposed lead ends.
- (✓) Refer to Detail 2-7D and place the line cord strain relief around the line cord 8" from the end of the outer insulation. Then pass the end of the line cord through hole BC and mount the strain relief in the hole.
- (✓) Position the rear panel next to the rear of the chassis as shown.
- (✓) Pass the free end of the line cord along the right side of transformer T1 for connection later.

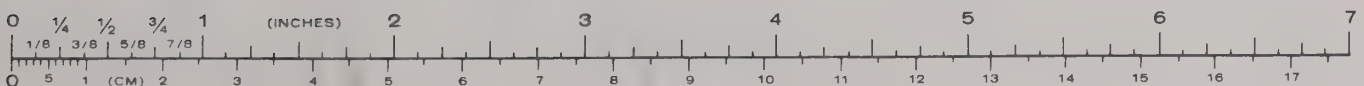


Detail 2-7D

- (✓) Prepare the ends of a 15" black wire.
- (✓) Connect one end of this wire to fuseholder F2 lug 1 (S-1). Pass the other end of this wire along the left side of transformer T1 for connection later.
- (✓) Connect the free end of the black wire coming from the bare wire connected between the terminal boards to fuseholder F2 lug 2 (NS).
- (✓) Connect the free end of the blue wire coming from hole A in the circuit board to fuseholder F2 lug 2 (S-2).

Push the connectors on the ends of the wires coming from the chassis onto the pins of the circuit board as follows. NOTE: Support the underside of the circuit board as you push on the wire connectors.

- (✓) Blue wire onto pin BLU.
- (✓) Violet wire onto pin VIOL.
- (✓) Red wire onto pin RED.
- (✓) Yellow wire onto pin YEL.
- (✓) Refer to Detail 2-7E (in the "Illustration Booklet") and mount the rear panel onto the rear of the chassis with four 6-32 x 3/8" **black** screws. Be very careful not to pinch any wires between the metal parts.
- (✓) Position all the wires down into the chassis so they are below the top.
- (✓) F2: Install the 20-ampere fuse in fuseholder F2.



Refer to Pictorial 2-8 for the following steps.

- () Turn the chassis around as shown.
- () Push the line cord down along the bend in the chassis (left side) as shown.

NOTE: When you are instructed to make a "mechanically secure connection," do this by inserting the wire end through and wrapping it around the lug. See the inset drawing in Pictorial 2-8.

- () Connect the black line cord lead to fuse block F1 lug 1 (S-1). Make a mechanically secure connection.
- () Connect the green line cord lead to solder lug C (S-1). Make a mechanically secure connection.
- () Connect the white line cord lead to terminal strip B lug 5 (NS). Make a mechanically secure connection.

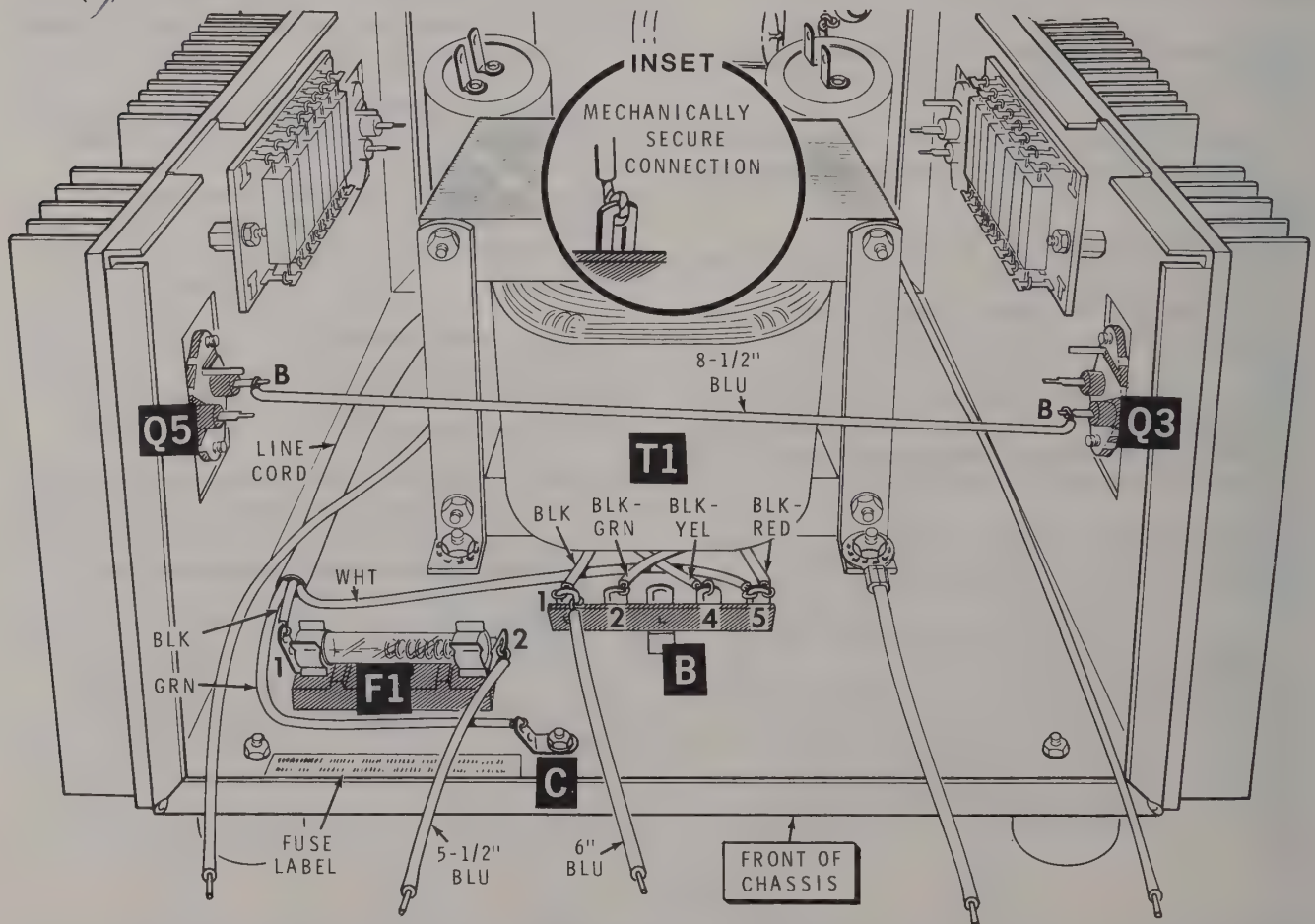
- () Connect an 8-1/2" blue wire from Q3 lug B (S-2) to Q5 lug B (S-2).
- () Connect one end of a 5-1/2" blue wire to fuse block F1 lug 2 (S-1). Make a mechanically secure connection. Then remove an extra 1/2" (total 3/4") of insulation from the free end of this wire to be connected later.
- () Connect one end of a 6" blue wire to terminal strip B lug 1 (NS). Make a mechanically secure connection. Now remove an extra 1" (total 1-1/4") of insulation from the free end of this blue wire. It will be connected later.

Connect the wires from transformer T1 to terminal strip B as follows. Make mechanically secure connections.

- () Black to lug 1 (NS).
- () Black-green to lug 2 (NS).
- () Black-yellow to lug 4 (NS).
- () Black-red to lug 5 (NS).

Prepare the following lengths of wire:

COLOR	LENGTH
Blue	8-1/2"
Blue	5-1/2"
Blue	6"



PICTORIAL 2-8

ALTERNATE LINE VOLTAGE WIRING

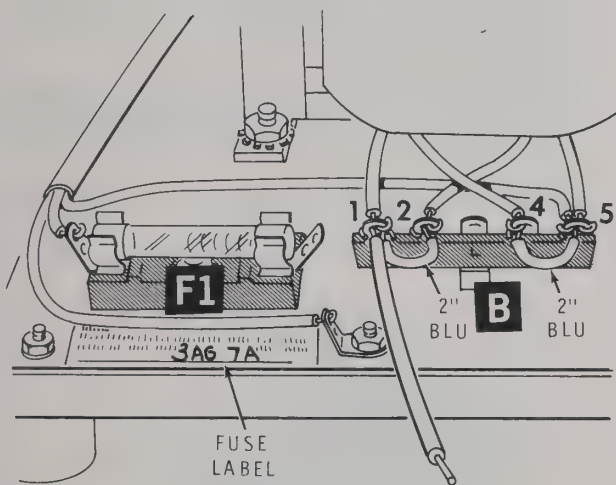
Two sets of line voltage instructions are given below, one for 120 VAC line voltage and the other for 240 VAC line voltage. In the U.S.A., 120 VAC is most often used, while in other countries 240 VAC is more common. USE ONLY THE INSTRUCTIONS THAT AGREE WITH THE LINE VOLTAGE IN YOUR AREA.

NOTE: All the following connections will be made to terminal strip B. Make mechanically secure connections.

120 VAC WIRING

Refer to Detail 2-8A for the following steps.

- Prepare two 2" blue wires.
- Connect a 2" blue wire between lugs 1 (S-3) and 2 (S-2).
- Connect a 2" blue wire between lugs 4 (S-2) and 5 (S-3).
- Install the 7-ampere fuse in fuse block F1.
- Mark the fuse label "3AG, 7A" as shown. Then remove its backing paper and press the label into place near the fuseholder.
- Set the chassis aside temporarily.

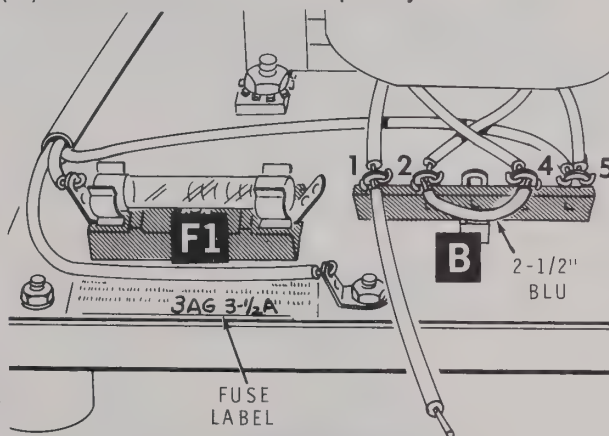


Detail 2-8A

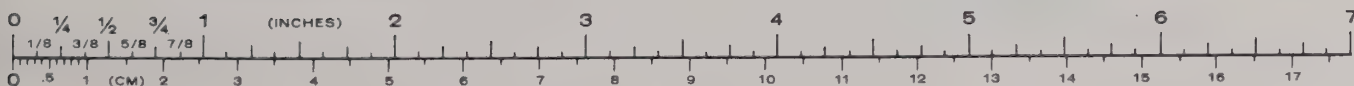
240 VAC WIRING

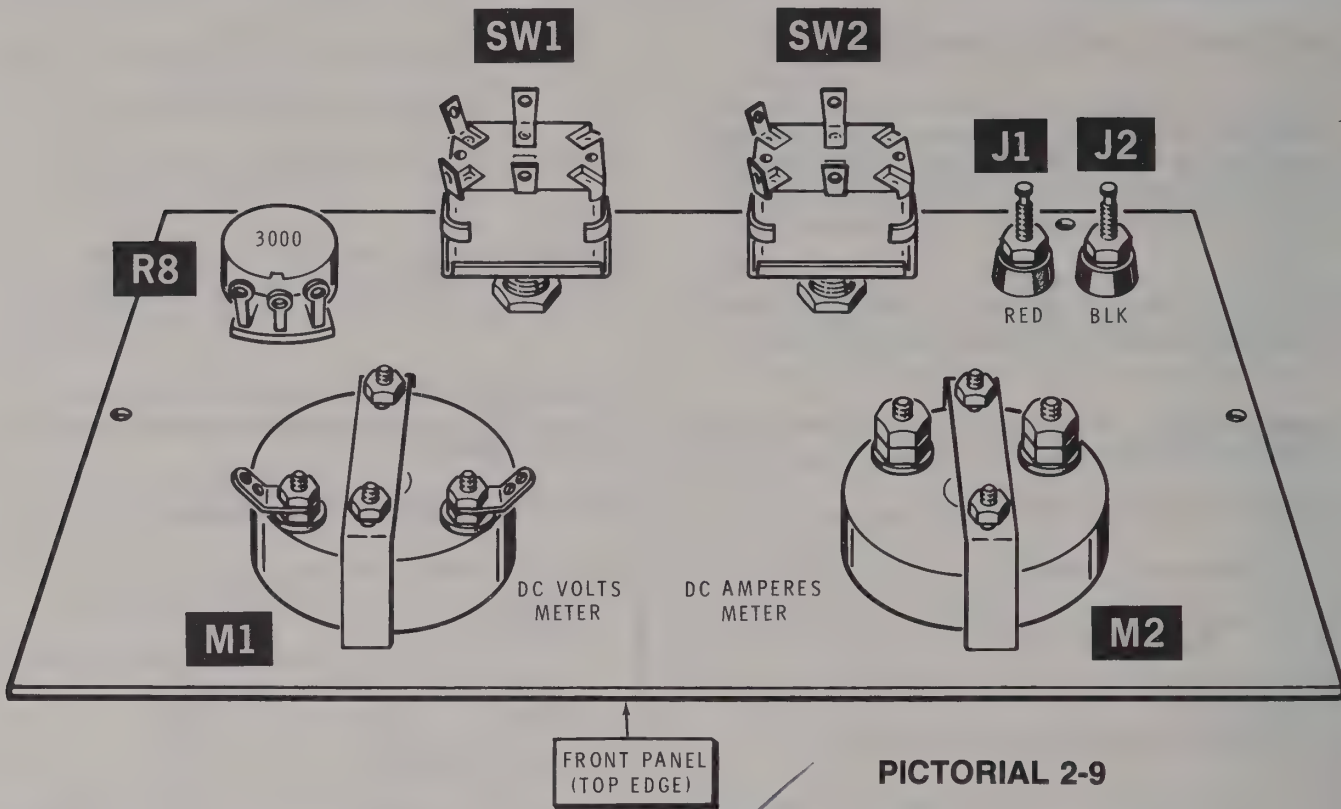
Refer to Detail 2-8B for the following steps.

- Prepare a 2-1/2" blue wire.
- Solder lug 1 (S-2).
- Connect the 2-1/2" blue wire between lugs 2 (S-2) and 4 (S-2).
- Solder lug 5 (S-2).
- Install a 3-1/2-ampere slow-blow fuse (obtained locally) in fuseholder F1.
- Mark the fuse label "3AG, 3-1/2A" as shown. Then remove the backing paper and press the label into place near the fuseholder.
- Set the chassis aside temporarily.



Detail 2-8B





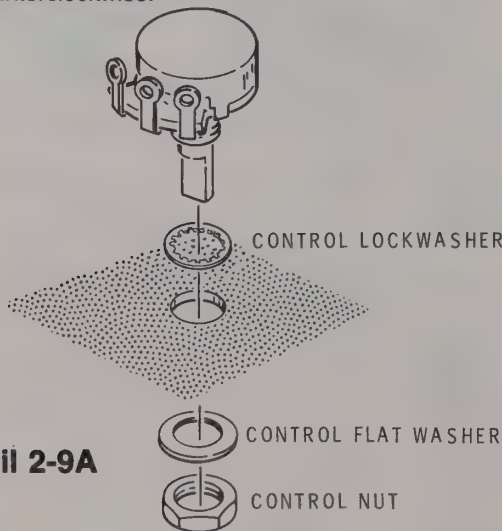
PICTORIAL 2-9

FRONT PANEL ASSEMBLY AND WIRING

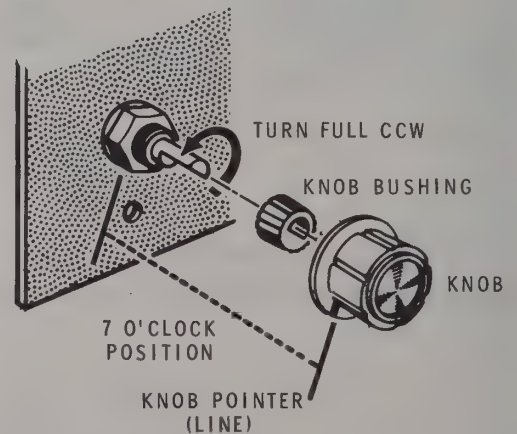
Refer to Pictorial 2-9 for the following steps.

- () Position the front panel on a soft cloth as shown. This will protect the panel and meters from being scratched.
 - () R8: Refer to Detail 2-9A and mount a 3000 Ω (3k) control at location R8. Use a control lockwasher, control flat washer, and a control nut. Position the control as shown.
- Refer to Detail 2-9B for the following steps.
- () Turn the shaft of control R8 (Voltage Adjust) fully counterclockwise.

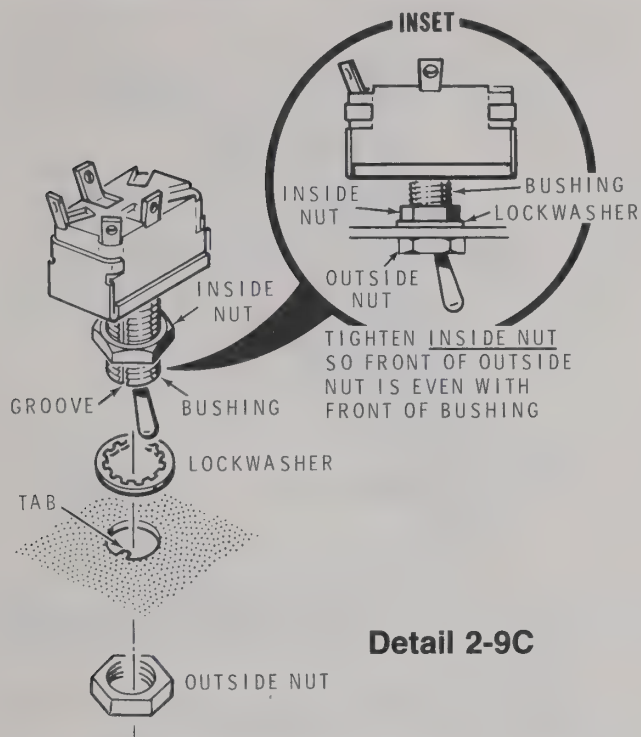
- () Push the knob bushing (large hole side first) onto the control shaft as far as possible.
- () Press the knob onto the knob bushing with the pointer (line) at the 7 o'clock position.
- () Remove the knob and bushing from the control shaft. Then, using a nut driver or other suitable tool, tap the bushing into the knob until it is fully seated.
- () Replace the knob and bushing onto the control shaft.



Detail 2-9A



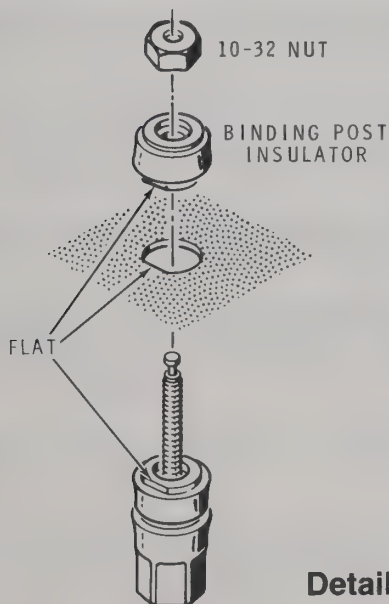
Detail 2-9B



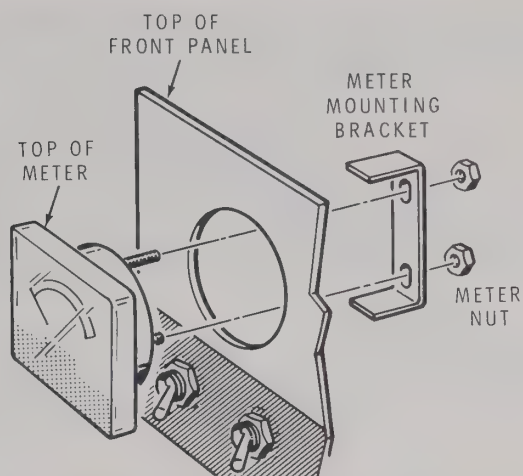
Detail 2-9C

Refer to Pictorial 2-9 for the following steps.

- () SW1: Refer to Detail 2-9C and mount a toggle switch at location SW1 with the hardware furnished with the switch. Align the groove in the switch bushing with the tab in the hole in the front panel. Tighten the inside nut so you do not scratch the front of the front panel. Discard the ON-OFF plate if one is supplied with the switch.
- () SW2: In the same manner, install a toggle switch at location SW2.

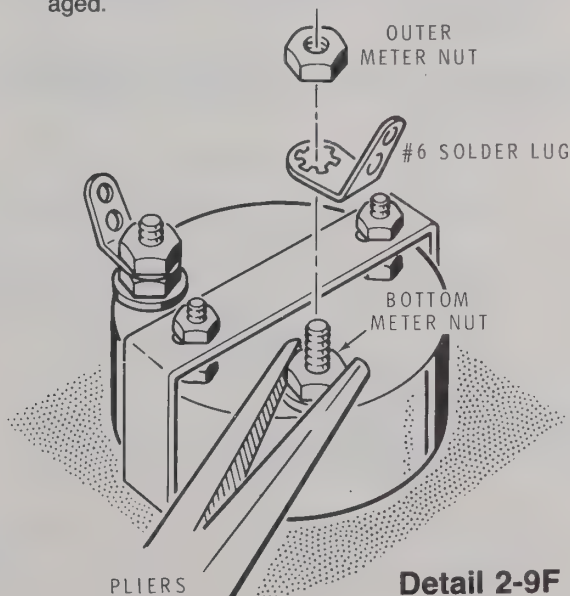


Detail 2-9D

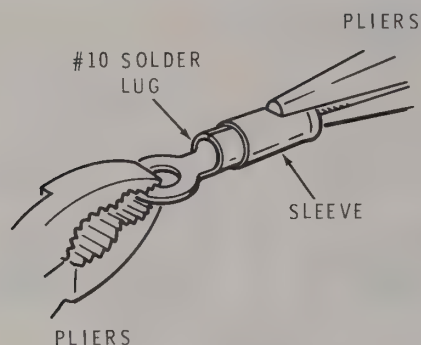


Detail 2-9E

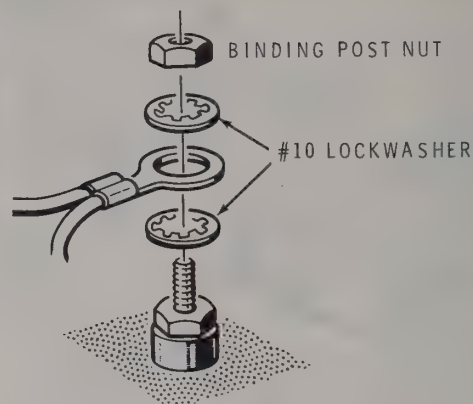
- () J1: Refer to Detail 2-9D and mount the red binding post and red binding post insulator at location J1. Align the flat in the binding post plastic pieces with the flat in the hole. Then use a 10-32 nut to secure them.
- () J2: In the same manner, mount the black binding post and black binding post insulator at location J2.
- () M1: Refer to Detail 2-9E and mount the DC voltmeter at location M1. Be sure to mount the meter right-side-up as viewed from the front of the front panel.
- () M2: In the same manner, mount the DC ammeter at location M2.
- () Refer to Detail 2-9F and install a #6 solder lug on lugs 1 and 2 of meter M1. CAUTION: Remove only the outer nut from the meter bolt. Hold the bottom nut with pliers so it cannot turn. Otherwise, the meter may be damaged.



Detail 2-9F



Detail 2-10A



Detail 2-10C

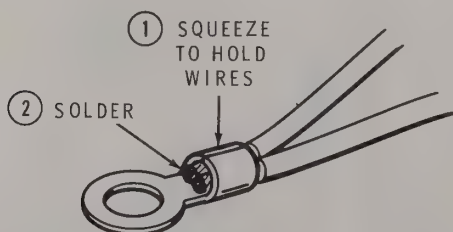
Refer to Pictorial 2-10 (in the "Illustration Booklet") for the following steps.

Prepare the following lengths of wire:

	COLOR	LENGTH
(✓)	Blue	9"
(✓)	Black	3-1/2"
(✓)	Black	4"
(✓)	Blue	2-1/2"

Position the front panel on a soft cloth in front of the chassis as shown in Pictorial 2-10.

- (✓) Locate the four #10 solder lugs. Use two pair of pliers and remove and discard the sleeve from each solder lug as shown in Detail 2-10A.
- (✓) Push one end of a 9" blue wire and the free end of the black wire coming from solder lug E in the chassis into a #10 solder lug.
- (✓) Then refer to Detail 2-10B and solder these wires in a #10 solder lug.

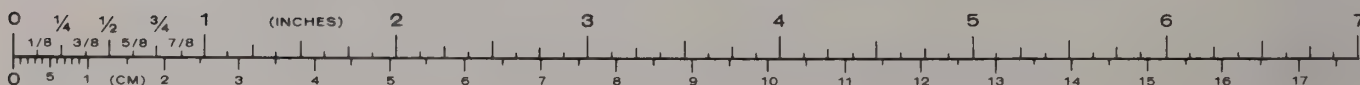


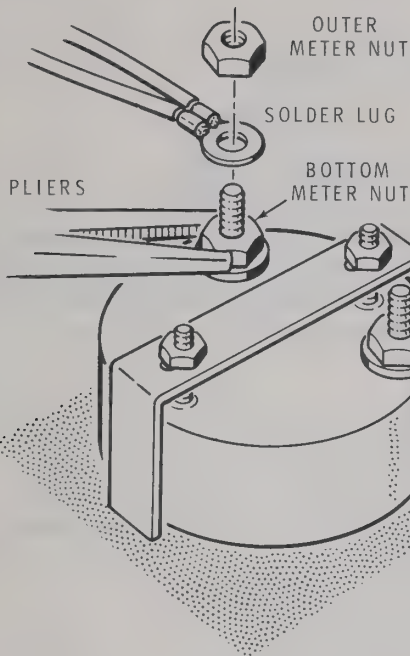
Detail 2-10B

- (✓) Refer to Detail 2-10C and install this solder lug on binding post J2. Use two #10 lockwashers and a 10-32 nut.
- (✓) Connect the free end of the blue wire from J2 to meter M1 lug 1 (NS).
- (✓) Solder one end of a 3-1/2" black wire into a #10 solder lug. Then remove an additional 1" (total 1-1/4") of insulation from the other end of this wire.
- (✓) Refer to Detail 2-10C and install the solder lug on this wire on binding post J1 with two #10 lockwashers and a 10-32 nut.

NOTE: Where a wire passes through a connection and goes to another point, it will count as two wires in the solder instructions (S-2), one entering and one leaving the connection.

- (✓) Connect the free end of this wire to switch SW2 through lug 4 (S-2) to lug 3 (S-1).
- (✓) C7: Connect a .1 μ F Mylar capacitor from binding post J1 (S-1) to binding post J2 (S-1). Connect the capacitor wires in the grooves of the binding posts.
- (✓) Remove an extra 1/2" (total 3/4") of insulation from one end of the 4" black wire.
- (✓) Solder the short bare end of a 4" black wire and one end of a 2-1/2" blue wire into a #10 solder lug.





Detail 2-10D

Refer to Detail 2-10D and mount this solder lug on meter M2 lug 1. Caution: Remove only the outer nut from the meter bolt. Hold the bottom nut so it cannot turn. Otherwise, the meter may be damaged.

Connect the free ends of the wires coming from meter M2 lug 1 as follows:

- () Black wire to switch SW2 through lug 2 (S-2) to lug 1 (S-1).
- () Blue wire to meter M1 lug 2 (NS).

Connect the free end of the blue wire coming from pin BLU on the circuit board to control R8 lug 2 (S-1).

Cut both leads of a 3000 Ω , 5 percent (orange-black-red-gold) resistor to 1" and place a 3/4" length of sleeving on each lead.

R9: Connect this 3000 Ω resistor from control R8 lug 1 (S-1) to meter M1 lug 1 (S-2).

Cut both leads of a 3300 Ω , 5 percent (orange-orange-red-gold) resistor to 1-1/4". Then place a 1" length of sleeving on each lead.

R7: Connect this 3300 Ω resistor from control R8 lug 3 (S-1) to meter M1 lug 2 (S-2).

Connect the free end of the blue wire coming from fuse block F1 lug 2 to switch SW1 through lug 2 (S-2) to lug 1 (S-1). Make a mechanically secure connection.

Connect the free end of the blue wire coming from terminal strip B lug 1 to switch SW1 through lug 4 (S-2) to lug 3 (S-1). Make a mechanically secure connection.

Solder a #10 solder lug on the free end of the black wire coming from fuseholder F2 lug 1.

Install this solder lug on meter M2 lug 2. **Do not loosen the bottom nut on the meter bolt, as this could damage the meter.**

CAUTION: In the following step, be sure there is 1/4" clearance between the wire connections on terminal strip B and the switch lug connections. Carefully bend terminal strip B toward the transformer if necessary.

Refer to Detail 2-10E (in the "Illustration Booklet") and mount the front panel on the chassis with four 6-32 x 3/8" **black** screws.

This completes the wiring of the chassis. Make the following checks to insure proper chassis wiring. Look for:

1. A wire or component connected to the wrong place. Check the wiring against the Pictorials.
2. Electrolytic capacitors installed backwards. Be sure the positive (+) marked lead of each electrolytic capacitor is connected as directed.
3. Transistors installed incorrectly. Check the mounting instructions for each transistor.
4. Poor solder connections. Connections should be smooth (flowed on) and shiny; not rough and dull, or in a blob.
5. Wire ends touching lugs other than the one to which they are connected.
6. Any unsoldered connections. All connections should be soldered at this time.
7. Pinched wires between metal parts.
8. Any wire clippings. These must be removed.

Refer to Pictorial 2-11 (in the "Illustration Booklet") for the following steps.

Prepare one end of the 2-wire cable as shown.

Refer to the inset drawing and solder a 1/4" spade lug on the end of each wire at the prepared end of the 2-wire cable.

Prepare the other end of this 2-wire cable to suit your needs.

Proceed to the "Initial Test" section of the Manual.

INITIAL TESTS

In the following steps, if you do not obtain the proper results, refer to the "In Case of Difficulty" section and correct the problem before you proceed.

RESISTANCE CHECKS

If you have a VOM (or VTVM) available, make the following resistance checks before you plug the line cord into an AC outlet.

Refer to Figure 1-1 for the following steps.

- () Remove the fuse from fuseholder F2.
- () Connect the common or ground lead of your meter to the black (-) binding post (J2). Leave this lead connected to J2 for all the resistance checks.
- () Touch either of the flat line cord prongs with the other meter lead. The ohmmeter should read infinity on the $R \times 1 M$ range.
- () Touch the other flat line cord prong with the positive ohmmeter lead. The reading should be at infinity.
- () Check the large, round line cord prong. The meter should indicate "0" on the $R \times 1$ range.
- () Touch lug 2 of capacitor C1 with the positive meter lead. The meter indicator should rise slowly (charging of capacitors C1 and C2) and stop at a high resistance indication.
- () Move this same meter lead to lug 1 of fuseholder F2. The meter should indicate about 3000 ohms on the $R \times 100$ range.
- () Leave the meter lead connected to this point and replace the fuse in fuseholder F2. The meter should now indicate approximately 250 ohms on the $R \times 10$ range.
- () Disconnect the meter from the Battery Eliminator.

OPERATIONAL TESTS

WARNING: When the line cord of the Battery Eliminator is connected to an AC outlet, AC line voltage is present at a number of locations in the chassis. Avoid these areas, shown in Figure 1-1, to prevent getting an electrical shock.

Position the front panel control and switches as follows:

- () R8: VOLTAGE ADJUST—Fully counterclockwise.
- () SW1: POWER switch—OFF.
- () SW2: LOAD switch—STBY.
- () Plug the line cord into a proper AC outlet.
- () Place the AC switch in the ON position. The DC VOLT-METER (M1) should indicate approximately 9 volts.
- () Slowly turn the VOLTAGE ADJUST control clockwise. The DC VOLT meter indication should increase to approximately 15 volts when the control reaches its full clockwise position. The DC AMPERE meter (M2) should remain at (0) zero.
- () Place the LOAD switch in the NORM position. There should be no change in either meter indication.
- () Place the AC switch in the OFF position. The AC VOLT METER will remain at its voltage indication for a few seconds, then gradually move to (0) zero. This is normal (discharge of capacitors C1 and C2).

This completes the "Initial Test." Proceed to "Final Assembly."

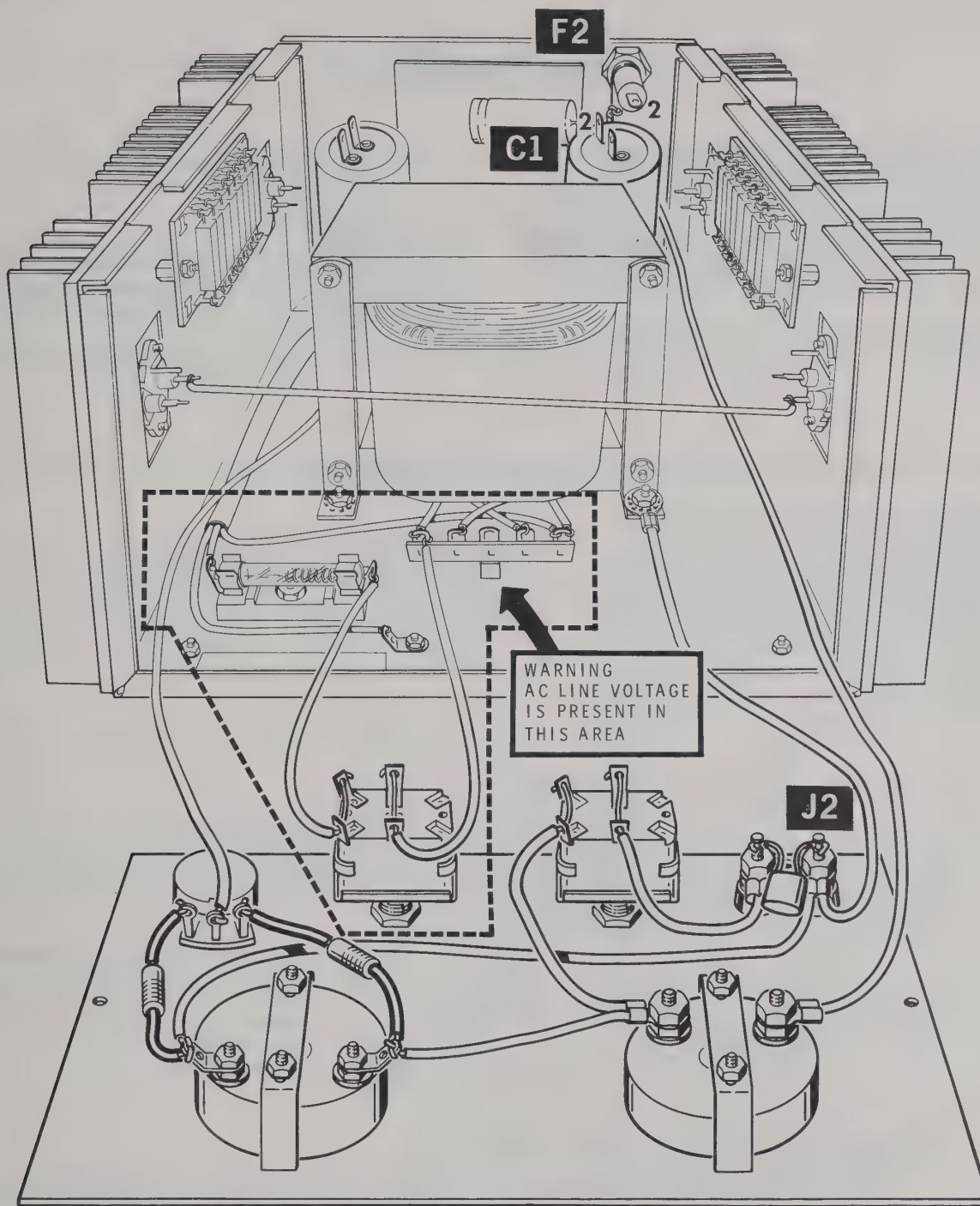


Figure 1-1

FINAL ASSEMBLY

Refer to Pictorial 3-1 (in the "Illustration Booklet") for the following steps.

- () Mount the two plastic handles on the top plate with #10 \times 1/2" self-tapping screws. **Do not** overtighten the screws as the handle holes can be stripped out.
- () Carefully peel the backing paper from the blue and white label. Then press the label in place on the underside of

the top plate. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

- () Position the vent slots in the top plate as shown and mount the top plate on the chassis. Use four 6-32 \times 3/8" **black** screws.

This completes the assembly of the Battery Eliminator.

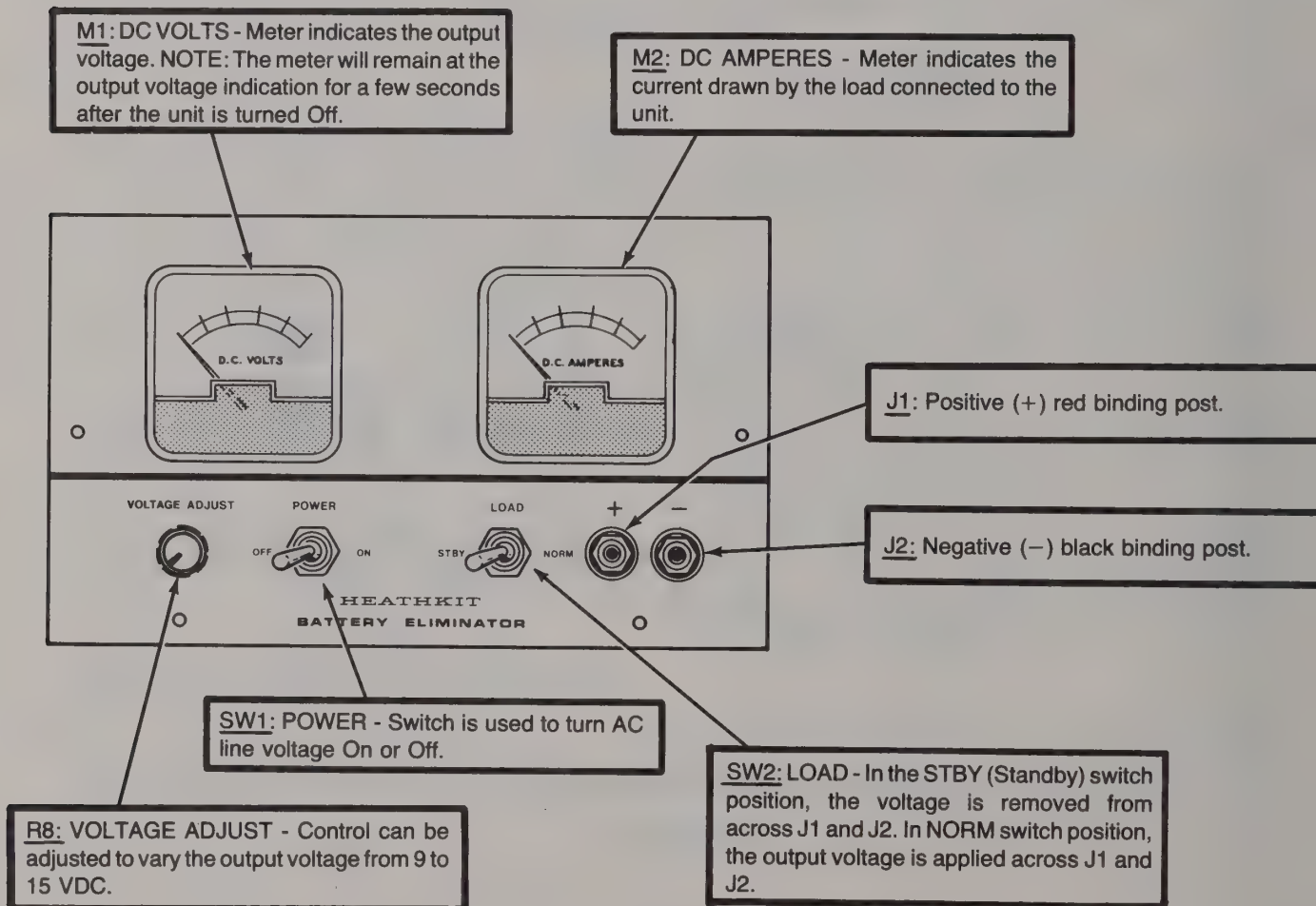


Figure 1

OPERATION

Refer to Figure 1 for an explanation of the control, switches, and meters.

Always place the LOAD switch in the STBY position and set the VOLTAGE ADJUST control to the proper voltage before you apply power to the load. Once the correct voltage is indicated on the DC VOLTS meter, move the LOAD switch to the NORM position. In this way, you will prevent damage to the load, should the voltage be set too high.

CAUTION: It is normal for the Battery Eliminator to become quite warm if it is operated at maximum current for extended periods. Be sure you do not block ventilation to the unit by covering the top or bottom vent holes. Do not block air from moving over the heat sinks. Also, do not touch the heat sinks, as they get quite hot and may cause a burn.

IN CASE OF DIFFICULTY

CAUTION: When the line cord is connected to an AC outlet, AC voltage will be present at several places on the chassis. Be careful you do not contact this voltage or an electrical shock can result.

This section gives suggestions for locating and resolving difficulties.

The first part, "Visual Checks," deals with problems that exist when you have just completed the assembly of your kit. This information primarily covers soldering and assembly problems.

The second part consists of a "Troubleshooting Chart," which gives difficulties and likely causes.

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

VISUAL CHECKS

1. Recheck the wiring. Trace each lead in color 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 you have consistently overlooked.

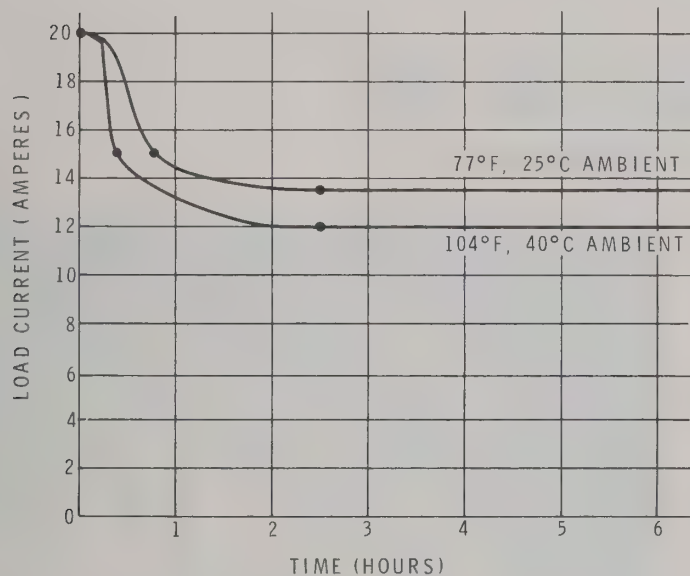
2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Assembly Notes." Reheat any doubtful connections. Be sure all the wires are soldered at places where several wires are connected.
3. Be sure the transistors and the integrated circuit 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. Check the integrated circuit for proper positioning and for good contact at each pin connection.
4. 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 lead near the positive (+) marking is at the correct position.
5. Check each resistor value carefully.
6. Be sure the correct diode is installed and that the banded end is positioned correctly.
7. Check all component leads connected to the circuit board.
8. Make sure bare wires do not touch the chassis or other lugs and make sure all wires are properly soldered.

Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE
Very low or "0" resistance reading at lug 2 of capacitor C1.	<ol style="list-style-type: none"> 1. Collector of transistor Q2 through Q7 poorly soldered. 2. Capacitor C1 or C2 wired incorrectly. 3. Bridge rectifier BR1 wired incorrectly.
Very low or "0" resistance reading at lug 1 of fuseholder F2 with fuse removed.	<ol style="list-style-type: none"> 1. Emitter of Q3, Q4, Q5, or Q6 wired incorrectly. 2. Capacitor C6. 3. Terminal boards wired incorrectly.
Very low or "0" resistance at lug 1 of fuseholder F2 with fuse installed.	<ol style="list-style-type: none"> 1. Voltmeter M1 wired incorrectly. 2. Control R8 wired incorrectly. 3. Capacitor C6.
No output voltage.	<ol style="list-style-type: none"> 1. Fuse F1. 2. Fuse F2. 3. IC1.
Fuse F1 blows when unit is turned on.	<ol style="list-style-type: none"> 1. Fuse block F1. 2. Switch SW1 wired incorrectly. 3. T1 wired incorrectly. 4. Bridge rectifier wired incorrectly. 5. Capacitor C1 or C2.
Fuse F2 blows	<ol style="list-style-type: none"> 1. Excessive load. 2. Output shorted.
Unable to obtain 15-volts output within current specifications.	<ol style="list-style-type: none"> 1. IC1. 2. Control R8. 3. Resistor R7 or R9. 4. Diode D1.
Output voltage drops considerably when load is applied.	<ol style="list-style-type: none"> 1. IC1. 2. Q1, Q2, Q3, Q4, Q5, or Q6.

SPECIFICATIONS

Output Voltage	Variable from approximately 9 to 15 VDC.
Output Current	20 amperes intermittent (See chart). 12 amperes continuous.
Output Ripple	Less than 1% at full load.
Output Regulation	Less than 2% variation from no load to full load.
Power Requirement	110 to 130 VAC, 7 amperes; or 220 to 260 VAC, 3.5 amperes, 50/60 Hz maximum.
Fuses	7-ampere, 3AG, slow-blow primary. 20-ampere, 3AG, output.
Maximum Continuous Operation	(See chart below)
Dimensions	5-1/4" high × 11" wide × 11" deep (13.34 cm × 27.9 cm × 27.9 cm).
Net Weight	26 lbs. (9.7 kg.)



NOTE: This chart should be used to determine the maximum length of continuous operation at a given load current and ambient temperature. The battery eliminator must be allowed to cool for an equal length of time before you do additional testing to prevent damage due to thermal overload.

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.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (in the "Illustration Booklet") as you read the following description.

The 120 VAC (or 240 VAC) line voltage is applied through primary fuse F1 and the power ON-OFF switch to the primary winding of power transformer T1. From the secondary winding, the voltage is applied to BR1, a full wave bridge rectifier. The rectified DC is then filtered by electrolytic capacitors C1 and C2, and applied to the regulator circuitry.

Transistors Q1 and Q2, with Q3, Q4, Q5, and Q6 form a double Darlington circuit which provides exceptionally high gain for excellent regulation. The conduction of the Darlington circuit and the output voltage is controlled by the base bias provided by integrated circuit IC1. IC1, with its own zener reference diode, samples the output voltage, compares this to the internal reference voltage, and automatically adjusts the base bias of Q1 as needed to maintain a fixed output level under varying load conditions. The output voltage is sampled at the output terminal, thereby compensating for the voltage drop across fuse F2. This allows almost no change in load voltage from no load to full load conditions.

The regulated output voltage level is adjusted by the front panel VOLTAGE ADJUST control R8.

Capacitor C3 provides a nearly pure DC voltage for the integrated circuit regulator IC1. Diode D1 allows C3 to charge from the power path but does not allow it to discharge back. In this way, only the small load of IC1 is placed on C3. R1 prevents excessive current from flowing through D1 when the power supply is turned on.

Resistors R2, R3, R4, and R5 balance the current between the four pass transistors Q3, Q4, Q5, and Q6. Fuse F2 protects the pass transistors against an overload. Resistor R6 is a bleeder resistor and capacitor C6 provides transient protection.

The output voltage is measured by voltmeter M1, and the output current is measured by ammeter M2.

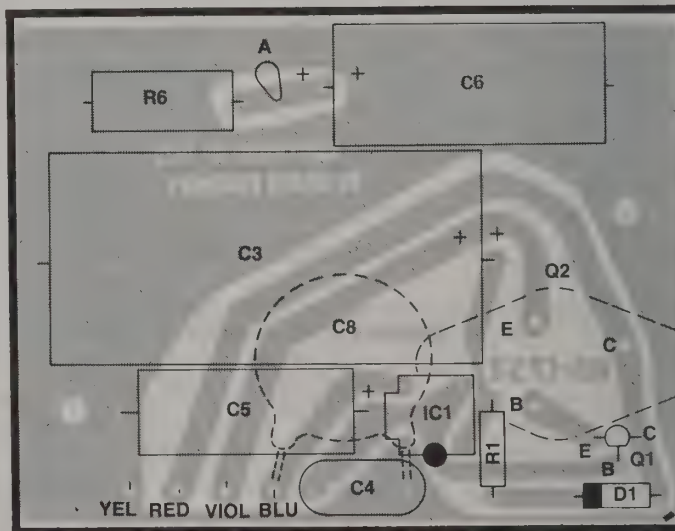
The load is connected through a heavy-duty cable to the front panel connectors.

CIRCUIT BOARD X-RAY VIEW

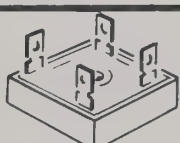
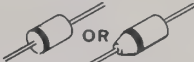
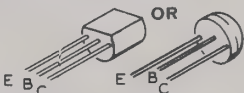


(Shown from the component side)

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

- Find the circuit component number (R5, C3, etc.) on the "Circuit Board X-Ray View."
- Locate this same number in the "Circuit Component Number" column of the "Parts List."
- Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



SEMICONDUCTOR IDENTIFICATION CHART

COMPONENT NUMBER	HEATH PART NUMBER	REPLACED BY	DESCRIPTION
BR1	57-88	MDA990-2	BRIDGE RECTIFIER 
D1	57-65	1N4002	DIODE 
Q1	417-233	2N3643	TRANSISTOR 
Q2	417-215	2N3055	TRANSISTOR 
Q3, Q4, Q5, Q6	417-139	40411	
IC1	442-626	μ A78MG	INTEGRATED CIRCUIT 

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, \$3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax. Total enclosed \$ _____
- If you prefer COD shipment, check the COD box and mail this card. COD

NAME _____
 ADDRESS _____
 CITY _____
 STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____
 Date _____ Location _____
 Purchased _____ Purchased _____

LIST HEATH PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE

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

SEND TO: **HEATH COMPANY**
 BENTON HARBOR
 MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

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SEND TO: **HEATH COMPANY**
 BENTON HARBOR
 MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

CUT ALONG DOTTED LINE

HEATH PARTS PRICE LIST
IP -2715 ECL 05

06/12/80

PAGE 1 OF 1

KEEP THIS PARTS LIST WITH YOUR MANUAL AND USE THE PRICES SHOWN BELOW WHEN ORDERING PARTS. THESE PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

THE PRICES SHOWN ON THE "HEATH PARTS PRICE LIST" APPLY ONLY ON PURCHASES FROM THE HEATH COMPANY, WHERE SHIPMENT IS TO A U.S.A. DESTINATION. ADD 10% (MINIMUM 25 CENTS) TO THE PRICE WHEN ORDERING (MICHIGAN RESIDENTS ADD 4% SALES TAX) TO COVER INSURANCE, POSTAGE, AND HANDLING. OUTSIDE THE U.S.A., PARTS AND SERVICE ARE AVAILABLE FROM YOUR LOCAL HEATHKIT SOURCE AND WILL REFLECT ADDITIONAL TRANSPORTATION, TAXES, DUTIES, AND RATES OF EXCHANGE.

ADDITIONAL 3 FT ROLLS OF SOLDER, #331-6, CAN BE ORDERED FOR 25 CENTS EACH.

PART NUMBER	PRICE	*	PART NUMBER	PRICE	*	PART NUMBER	PRICE	*	PART NUMBER	PRICE	*
1-	30-	2	.40	*	259-	21	.40	*			*
3-	11-	5	.85	*	259-	26	.20	*			*
6-	220		.25	*	261-	21	.20	*			*
6-	302		.25	*	340-	1	.10@	*			*
6-	332		.25	*	344-	3	.10@	*			*
10-	1053		1.25	*	344-	7	.20@	*			*
21-	140		.30	*	344-	28	.10@	*			*
25-	95		.45	*	344-	29	.10@	*			*
25-	154		2.20	*	344-	44	.05@	*			*
25-	199		.95	*	346-	4	.15@	*			*
				*				*			*
25-	263		6.30	*	347-	13	.55@	*			*
27-	47		.45	*	352-	31	.85	*			*
54-	848		43.40	*	390-	1255	.15	*			*
57-	65		.50	*	407-	722	6.30	*			*
57-	88		5.85	*	407-	723	6.55	*			*
61-	3		6.25	*	417-	139	4.50	*			*
75-	44		.15	*	417-	215	3.25	*			*
75-	88		.30	*	417-	233	.55	*			*
75-	723		.20	*	421-	9	.55	*			*
85-	1752-	1	1.85	*	421-	18	.15	*			*
				*				*			*
89-	50		2.25	*	422-	1	.65	*			*
200-	1259		12.20	*	423-	1	1.45	*			*
203-	1849-	1	1.90	*	426-	10	2.95	*			*
203-	1850-	1	1.90	*	426-	11	2.15	*			*
205-	1657-	1	2.75	*	426-	12	.55	*			*
207-	2		.85	*	426-	13	.55	*			*
211-	15		.75	*	426-	14	.40	*			*
215-	76		12.90	*	431-	42	.15	*			*
250-	13		.05	*	431-	67	1.25	*			*
250-	26		.05	*	432-	772	.05	*			*
				*				*			*
250-	83		.05	*	432-	790	.15	*			*
250-	89		.05	*	432-	851	.10	*			*
250-	162		.05	*	434-	189	.45	*			*
250-	253		.10	*	442-	626	3.40	*			*
250-	271		1.10	*	455-	619	.15	*			*
250-	305		.40	*	462-	920	1.10	*			*
250-	381		.05	*	490-	5	.25	*			*
250-	416		.05	*				*			*
250-	1173		.05	*				*			*
252-	3		.05	*				*			*
				*				*			*
252-	7		.05	*				*			*
252-	57		.05	*				*			*
253-	10		.05	*				*			*
254-	1		.05	*				*			*
254-	3		.05	*				*			*
254-	5		.05	*				*			*
254-	12		.05	*				*			*
255-	1		.10	*				*			*
259-	1		.05	*				*			*
259-	7		.10	*				*			*

***** WRITE HEATH COMPANY FOR PRICE INFORMATION.
@ PRICE PER FOOT.

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

LITHO IN U.S.A.