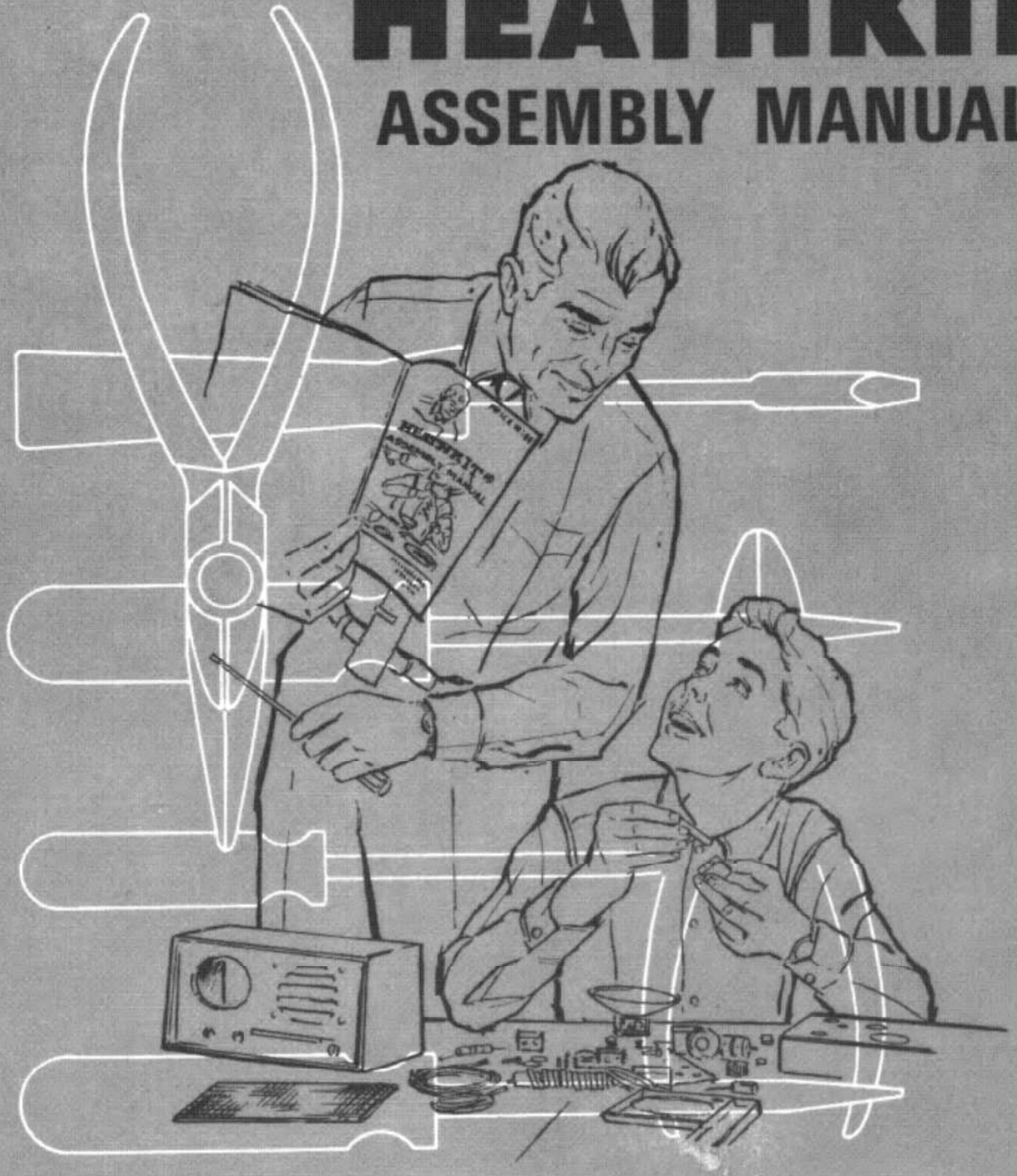
MODEL

SB-220 Linear Amplifier

HEATHKIT®

ASSEMBLY MANUAL



HEATH COMPANY • BENTON HARBOR, MICHIGAN

Model SB-220 Linear Amplifier

HEATHKIT®

595-682-07

PRICE $2.00

Dear Customer:

The Heathkit electronic product you have purchased is one of the best performing electronic products in the world.

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Sincerely,

HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly
and
Operation
of the

HEATHKIT

LINEAR AMPLIFIER

MODEL SB-220

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

TABLE OF CONTENTS

INTRODUCTION

The Heathkit Model SB-220 Linear Amplifier is a completely self-contained, table top, grounded grid, linear amplifier. It is designed to operate at the maximum amateur power limit on SSB, CW, and RTTY. Its styling matches the Heath SB series of amateur equipment.

The Amplifier is designed to be used with exciters which deliver 100 watts or more output. It can be used with less driving power, but will give a lower output.

A broad-band, tuned input circuit for each band feeds the two Eimac 3-500Z triode tubes connected in grounded grid configuration. The tubes are biased beyond cut-off in the receive mode, and zener-regulated bias controls the idling current in the transmit mode. The tubes are cooled by a fan.

An ALC circuit develops negative voltage to be fed back to the exciter to reduce its gain when the Amplifier is overdriven.

The antenna change-over relay is normally actuated by exciter relay contacts to place the Amplifier in the transmit mode.

The Amplifier can be operated from either 120 VAC or 240 VAC 50/60 Hz lines and can be easily changed from one to the other. Operation from a 240 volt line is recommended. Each side of the line cord is equipped with a circuit breaker to protect against overloads.

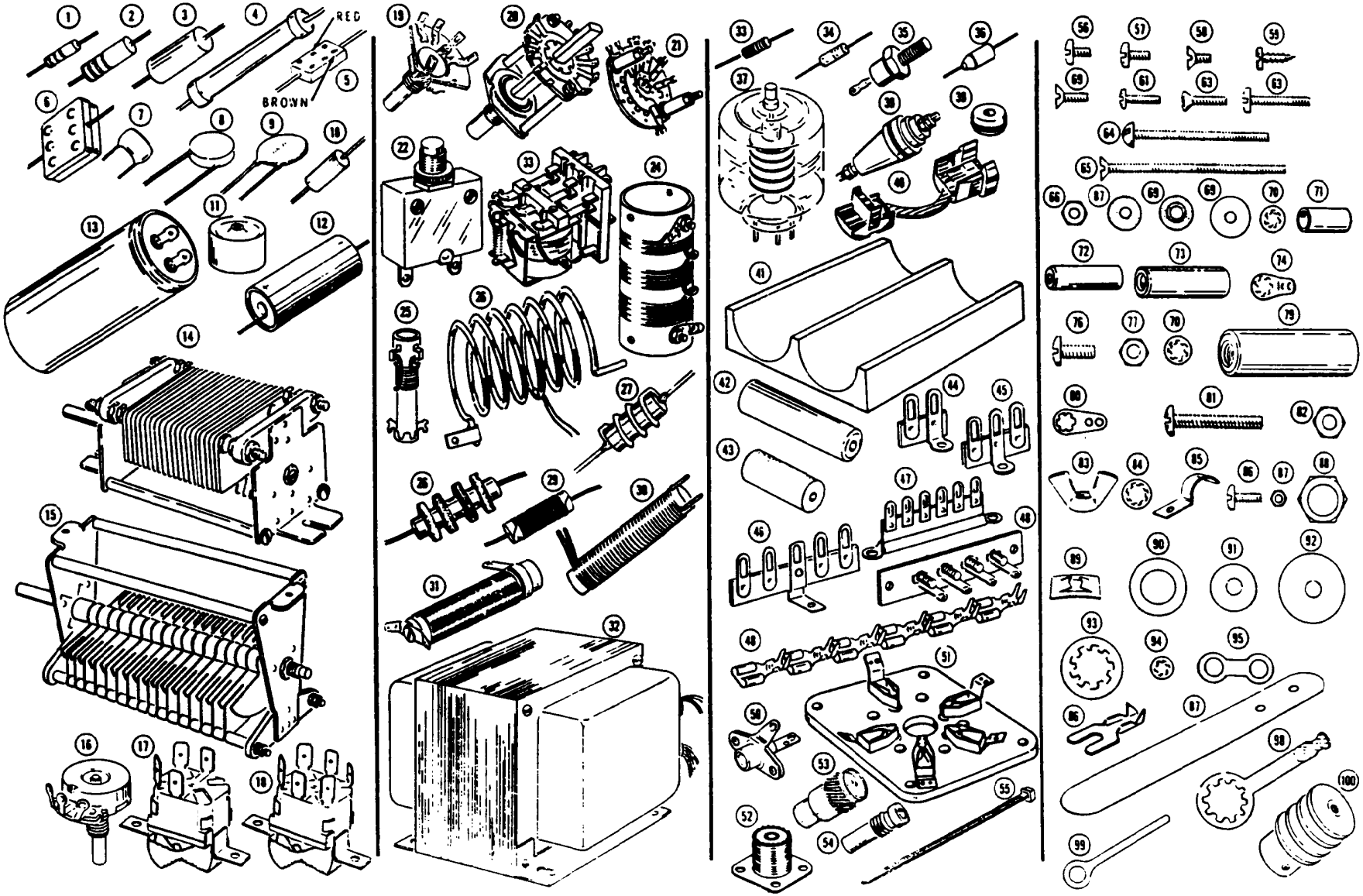
An important feature of this Amplifier is that it can be tuned up at the one kilowatt limit and can then be switched to operate on SSB at two kilowatts P.E.P. input. As the switching changes both the voltage and current to the final tubes, the impedance remains the same and no additional adjustment of tuned circuits is required.

The tubes are "instant heating" types, and transmission may be started as soon as the Amplifier is switched on (after tune-up).

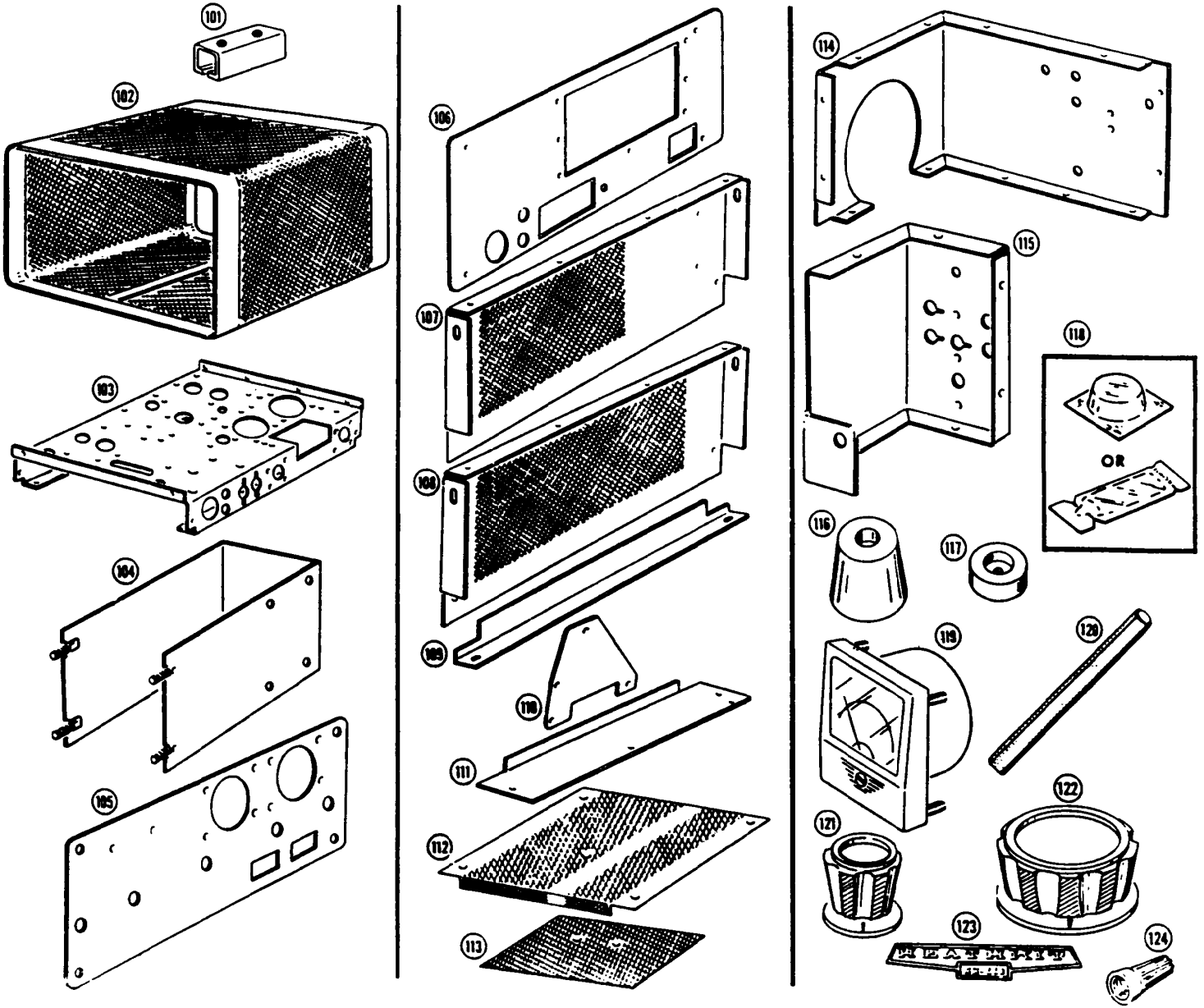
Here is a full legal-limit Amplifier that can take its place on your operating table and give you years of trouble-free pleasure. This Amplifier has a commanding voice.

Read the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS PICTORIAL



PARTS PICTORIAL (cont'd.)



PARTS LIST

This Parts List contains all of the parts used in the assembly of the kit. Some parts are packaged in envelopes with the part number of the contents printed on the outside. Except for the initial parts check, retain these parts in their envelopes until they are called for in the assembly steps.

Check each part against the following list. The key numbers correspond to the numbers on the Parts Pictorial (fold-out from Pages 4 and 7).

To order a replacement part, refer to 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 the Manual. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS			
1/2 Watt			
1	1-9	1	1000 Ω (brown-black-red)
	1-44	2	2200 Ω (red-red-red)
	1-18	1	5600 Ω (green-blue-red)
	1-22	1	22 kΩ (red-red-orange)
	1-23	1	27 kΩ (red-violet-orange)
	1-24	1	33 kΩ (orange-orange-orange)
	1-25	1	47 kΩ (yellow-violet-orange)
	1-26	1	100 kΩ (brown-black-yellow)
Other Resistors			
2	1-8-1	1	68 kΩ 1 watt (blue-gray-orange)
	1-38-1	3	4.7 MΩ 1 watt (yellow-violet-green)
	3-1-2	1	.82 Ω wire-wound 2 watt (gray-red-silver) (same size as 1 watt), 5%
3	3-25-5	1	1 Ω wire-wound, 5 watt, 1%
	3-22-5	1	3600 Ω wire-wound, 5 watt, 1%
4	5-2-7	8	30 kΩ film, 7 watt

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
CAPACITORS			
Molded Mica			
5	20-3	6	200 pF (red-black-brown)
6	20-123	1	500 pF (.0005 μF)
Mica			
7	20-99	2	22 pF
	20-124	2	115 pF
	20-103	1	150 pF
	20-105	1	180 pF
	20-120	1	220 pF
	20-116	2	400 pF
	20-113	2	470 pF
	20-107	2	680 pF
Disc			
8	21-79	1	.001 μF 6 kV
9	21-140	2	.001 μF 500 volt
	21-70	3	.01 μF 1.4 kV
	21-31	12	.02 μF 500 volt

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
Other Capacitors			
10	21-28	1	10 pF (10 MMF or 10 $\mu\mu$F) tubular ceramic
11	21-165	2	.001 μF (1000 MMFD) 6 kV, ceramic
12	25-19	1	20 μF (MFD) electrolytic
13	25-224	8	200 μF (MFD) electrolytic
14	26-145	1	840 pF variable
15	26-131	1	250 pF variable
CONTROLS-SWITCHES			
16	10-12	1	100 kΩ control
17	61-14	1	DPST rocker switch
18	61-15	1	DPDT rocker switch
19	63-47	1	3-position rotary switch
20	63-561	1	5-position rotary switch
21	63-562	1	Rotary switch wafer
22	65-28	2	Circuit breaker
23	69-55	1	TPDT 110 VDC relay
COILS-CHOKES-TRANSFORMERS			
24	40-1666	1	80/20 plate coil
25	40-964	2	10/15-meter input coil
	40-965	1	20-meter input coil
	40-966	1	40-meter input coil
	40-1012	1	80-meter input coil
26	40-968	1	15/10 plate coil
27	45-53	2	Parasitic choke
28	45-4	3	1 mH RF choke
29	45-6	1	8.5 μH RF choke
30	45-78	1	9 μH RF choke
31	45-61	1	50 μH RF choke
32	54-237	1	High voltage transformer
	54-238	1	Filament and bias transformer
DIODES-TUBES			
33	56-24	1	1N458 silicon diode (yellow-green-gray)
34	56-26	1	1N191 germanium diode (brown-white-brown)
35	56-82	1	1N3996A zener diode, 5.1V, 10 watt, w/mounting hardware
36	57-27	15	Silicon diode
37	411-245	2	3-500Z tube

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
INSULATORS-GROMMETS-TERMINAL STRIPS-CONNECTORS			
38	71-2	1	Ceramic feedthrough insulator (disassembled in bag)
39	73-4	1	5/16" grommet
	73-3	4	1/2" grommet
	73-2	1	3/4" grommet
40	75-123	1	Line cord strain relief
	75-124	1	6" x 4-1/2" fish paper insulator
41	75-125	8	Capacitor mounting insulator
42	255-39	1	6-32 x 1-1/4" tapped phenolic spacer
43	255-42	3	6-32 x 3/4" tapped phenolic spacer
44	431-14	1	2-lug terminal strip
45	431-10	3	3-lug terminal strip
46	431-42	1	5-lug terminal strip
47	431-20	1	6-lug terminal strip
48	431-13	1	4-screw terminal strip
49	432-137	6	Connector tab
50	434-42	2	Phono socket
51	434-93	2	5-lug ceramic tube socket
52	436-5	2	Coaxial jack
53	438-9	2	Coaxial plug
54	438-12	1	Coaxial plug insert
WIRE-CABLE-SLEEVING			
	89-40	1	Line cord
	134-36	2	Phono cable assembly
	340-1	1	Small bare wire
	340-4	1	Large bare wire
	343-2	1	Coaxial cable, RG-58A/U
	343-8	1	Coaxial cable, RG-8/U
	344-2	1	Small black stranded wire
	344-7	1	Large black stranded wire
	344-13	1	Blue hookup wire (thick insulation)
	344-50	1	Black hookup wire
	344-51	1	Brown hookup wire
	344-52	1	Red hookup wire
	344-53	1	Orange hookup wire
	344-54	1	Yellow hookup wire
	344-55	1	Green hookup wire
	344-56	1	Blue hookup wire
	345-1	1	Large metal braid
	345-2	1	Small metal braid
	346-4	1	Black sleeving
	346-7	2	Clear sleeving (large)
	346-29	1	Clear sleeving (small)
55	354-5	6	Cable tie

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
HARDWARE			
#6 Hardware			
56	250-138	9	6-32 x 3/16" screw
57	250-56	31	6-32 x 1/4" binder head screw
58	250-416	1	6-32 x 1/4" flat head screw
59	250-8	29	#6 x 3/8" sheet metal screw
60	250-32	18	6-32 x 3/8" flat head screw
61	250-89	15	6-32 x 3/8" binder head screw
62	250-218	4	6-32 x 3/8" phillips head screw
63	250-206	13	6-32 x 11/16" screw
64	250-40	4	6-32 x 1-1/2" screw
65	250-47	1	6-32 x 2" screw
66	252-3	63	6-32 nut
67	253-1	17	#6 fiber flat washer
68	253-2	2	#6 fiber shoulder washer
69	253-96	4	#6 flat metal washer
70	254-1	64	#6 lockwasher
71	255-77	2	7/16" spacer
72	255-71	4	6-32 x 3/4" tapped metal spacer
73	255-21	3	6-32 x 7/8" tapped spacer
74	259-1	19	#6 solder lug
#8 Hardware			
75	250-43	8	8-32 x 1/4" setscrew
76	250-137	8	8-32 x 3/8" screw
77	252-4	8	8-32 nut
78	254-2	8	#8 lockwasher
79	255-66	1	8-32 x 1-3/8" spacer
80	259-2	1	#8 solder lug
#10 Hardware			
81	250-331	1	10-32 x 1" screw
82	252-5	2	10-32 nut
83	252-163	1	10-32 wing nut
84	254-3	2	#10 lockwasher
Other Hardware			
85	207-8	2	Cable clamp
86	250-213	8	4-40 x 5/16" screw
87	252-15	8	4-40 nut
88	252-7	3	Control nut
89	252-10	2	Speednut
90	253-10	3	Control flat washer
91	253-42	14	1/2" flat washer
92	253-19	2	3/4" flat washer
93	254-4	2	Control lockwasher
94	254-9	16	#5 lockwasher
95	259-25	1	#10 double lug
96	259-16	1	#10 solder lug

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
Other Hardware (cont'd.)			
97	258-115	1	Brass spring 5/8" x 3-1/2 "
98	259-10	1	Control solder lug
99	259-24	1	Long solder lug
100	260-12	2	Plate connector
101	456-16	1	Shaft coupler
METAL PARTS			
102	90-464	1	Cabinet
103	200-1251	1	Chassis
104	100-1022	1	Capacitor bank bracket
105	203-643	1	Front panel
106	203-644	1	Rear panel
107	203-646	1	Left side panel
108	203-645	1	Right side panel
109	204-1041	2	Angle bracket
110	204-2102	1	Plate coil bracket
111	205-723	1	Top rear plate cover
112	205-724	1	Perforated top cover
113	205-874	1	Perforated fan cover
114	206-493	1	RF shield
115	206-457	1	Coil mounting shield
MISCELLANEOUS			
	85-344-1	1	Printed circuit board
116	255-59	2	Black tapered spacer
117	261-9	4	Rubber foot
	266-296	1	Fan blade
118	352-13	1	Silicone grease
119	407-145	1	Plate amperes meter
	407-146	1	Multi-meter
	420-601	1	Fan motor
120	453-135	1	Phenolic shaft
121	462-191	2	Small knob
122	462-210	3	Large knob
	390-147	1	Danger high voltage label
123	391-64	1	Nameplate
	391-34	1	Blue and white label
124	432-199	1	Wire nut
	490-5	1	Nut starter
	597-260	1	Parts Order Form
	597-308	1	Kit Builders Guide
		1	Manual (See front cover for part number.)
			Solder

STEP-BY-STEP ASSEMBLY

Before starting to assemble this kit, read the "Kit Builders Guide" for complete information on wiring, soldering, and step-by-step assembly procedures.

The illustrations in this section of the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details are used in addition to the Pictorials to 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.

As the drawings in the Manual may be slightly distorted to show all the parts clearly, look at the Chassis Photos (Pages 86 through 89) from time to time to see the actual positions of wires and components.

Lockwashers and nuts will be used with most screws when mounting parts, unless the assembly steps state otherwise. Consequently, the applicable steps will call out only the size and type of hardware used. For example, the phrase "Use 6-32 x 1/4" hardware" means to use 6-32 x 1/4" screws, one or more #6 lockwashers, and 6-32 nuts. Refer to the Details for the proper installation of hardware. Be sure to position each part as shown in the Pictorials. Follow the instructions carefully, and read the entire step before performing the operation.

When a step directs you to "connect" an insulated wire, first prepare its ends by removing 1/4" of insulation.

CIRCUIT BOARD

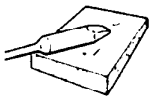
Solder a part or group of parts only when directed. Use 1/2 watt resistors unless directed otherwise in a step. Each resistor will be called out by the resistance value (in Ω, kΩ, or MΩ) and color code. Capacitors will be called out by the capacitance value and type.

On the circuit board, be especially careful not to cover unused holes with solder or bridge solder across foils during assembly. Perform the steps in Pictorial 1-1.

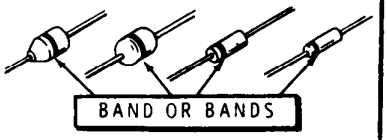
START

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

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. THE CATHODE END OF THE DIODE IS MARKED WITH A BAND OR BANDS. ALWAYS POSITION THIS END AS SHOWN IN THE PICTORIAL.



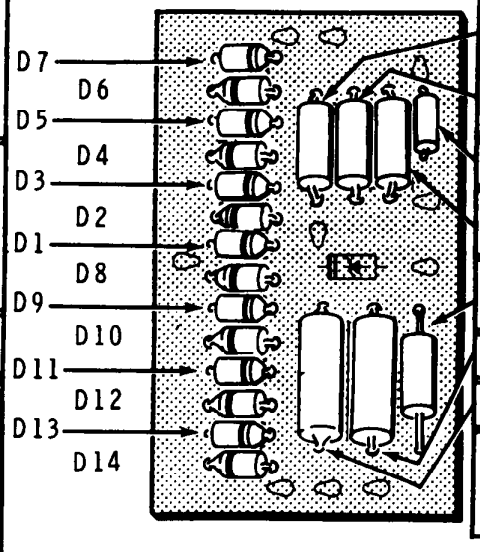
( ) Position the circuit board as shown and install diodes (#57-27) at D7, D5, D3, D1, D9, D11, and D13. Make sure all seven cathode banded ends are to the right.

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

( ) Install diodes (#57-27) at D6, D4, D2, D8, D10, D12, and D14 with their cathode ends to the left.

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

( ) CAREFULLY INSPECT ALL DIODES IN THE PRECEDING STEPS TO BE SURE THEY ARE POSITIONED AS SHOWN IN THE PICTORIAL AND ON THE CIRCUIT BOARD.



CONTINUE

( ) 4.7 MΩ 1 watt (yellow-violet-green).

( ) 4.7 MΩ 1 watt (yellow-violet-green).

( ) 5600 Ω (green-blue-red).

( ) 4.7 MΩ 1 watt (yellow-violet-green).

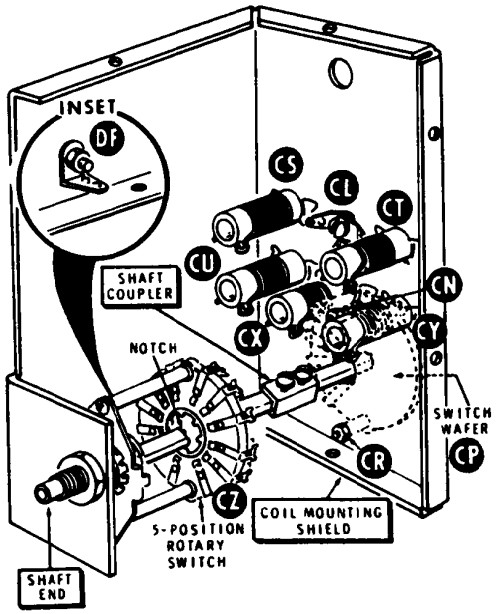
( ) .82 Ω 2 watt (gray-red-silver-gold).

( ) 3600 Ω 5 watt.

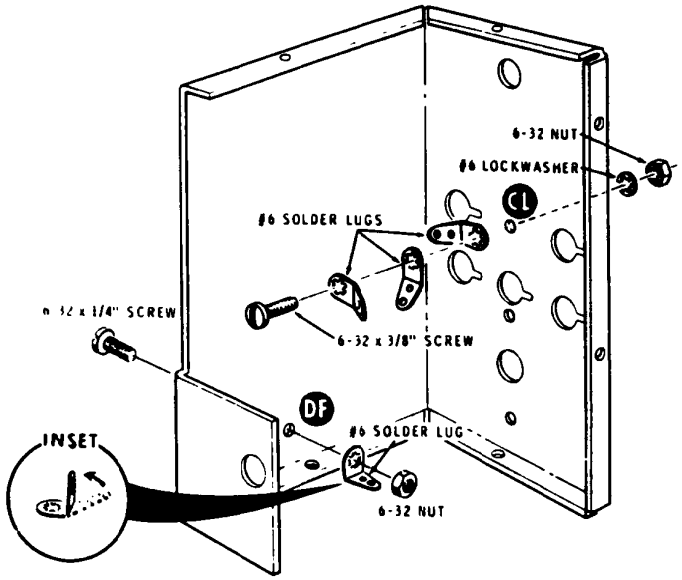
( ) 1 Ω 5 watt.

( ) Solder all leads to the foil and cut off the excess lead lengths. Proceed to "Circuit Board Prewiring."

PICTORIAL 1-1



PICTORIAL 2-1



Detail 2-1A

CIRCUIT BOARD PREWIRING

NOTE: To prepare lengths of hookup wire, as in the following step, cut the wire to the indicated length and remove 1/4" of insulation from each end. If the wire is stranded, twist the ends tightly and apply a small amount of solder to hold the strands together. Unless otherwise stated, "hookup wire" will mean the small solid-conductor wire supplied in various colors.

( ) Prepare the following lengths of hookup wire:

5-1/4" red

3-3/4" black

6-1/2" black

17-1/2" small black stranded wire

7-1/2" orange

6-1/2" yellow

9-1/2" heavy blue (thick insulation)

2-3/4" heavy blue (thick insulation)

Refer to Pictorial 1-2 for the following steps.

From the component side of the circuit board, insert one end of each of the following wires into the designated hole. Solder each wire on the foil side.

( ) Connect a 5-1/4" length of red hookup wire to hole A in the circuit board (S-1).

( ) Connect a 3-3/4" length of black hookup wire to hole B on the circuit board (S-1).

( ) Connect a 6-1/2" length of black hookup wire to hole C on the circuit board (S-1).

( ) Connect a 17-1/2" length of black stranded wire to hole E on the circuit board (S-1).

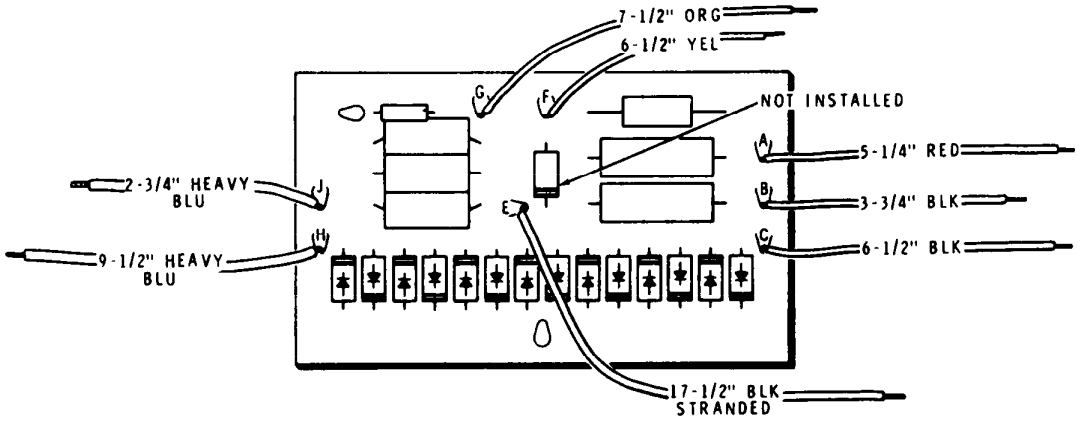
( ) Connect a 7-1/2" length of orange hookup wire to hole G on the circuit board (S-1).

( ) Connect a 6-1/2" length of yellow hookup wire to hole F on the circuit board (S-1).

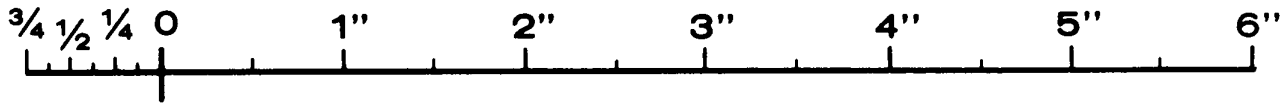
( ) Connect a 9-1/2" length of heavy blue hookup wire to hole H on the circuit board (S-1).

( ) Connect a 2-3/4" length of heavy blue hookup wire to hole J on the circuit board (S-1).

( ) Trim all excess lead lengths from the foil side of the circuit board.



PICTORIAL 1-2



( ) Carefully inspect the foil side of the circuit board; all lettered holes except D and K should be soldered. Make sure there are no solder bridges between foils. Also note that one diode is not installed.

This completes the prewiring of the circuit board. Set it aside until called for later. Proceed with the "Input Coil Assembly" section.

INPUT COIL ASSEMBLY

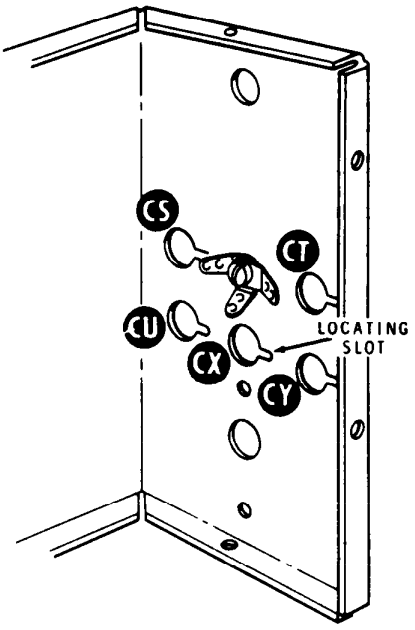
Refer to Pictorial 2-1 for the following steps.

Refer to Detail 2-1A for the next two steps.

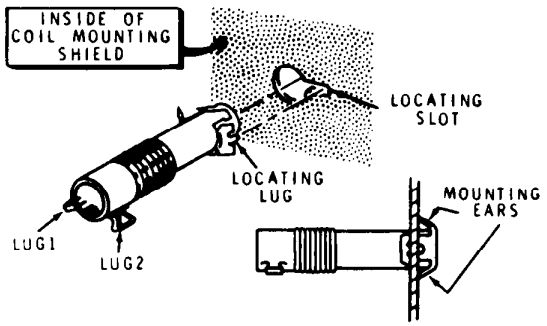
NOTE: A plastic nut starter has been provided with this kit. Use it to hold and start nuts on screws. See Page 3 of the "Kit Builders Guide" for more information.

( ) Install three #6 solder lugs on the coil mounting shield (#206-457) at CL with 6-32 x 3/8" hardware. Position the lugs as shown in Detail 2-1B.

( ) Install a #6 solder lug at DF with a 6-32 x 1/4" screw and a 6-32 nut. Form the solder lug as shown.



Detail 2-1B



Detail 2-1C

Detail 2-1B shows the coil mounting locations for the following steps. Note that the locating lug of each coil must be positioned in the locating slot, and that each coil must be pushed into its mounting hole until the mounting ears snap out to hold the coil in place as shown in Detail 2-1C.

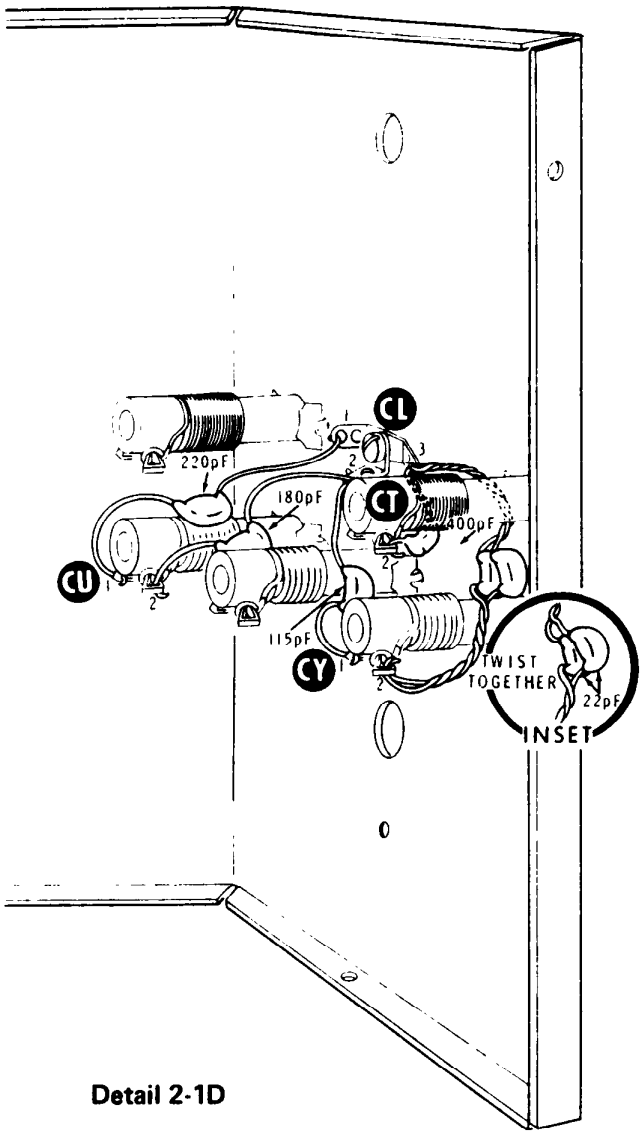
( ) Install the 20-meter coil (#40-965) at CU. See Detail 2-1C.

( ) Install a 10/15-meter coil (#40-964) at CX.

( ) Install a 10/15-meter coil (#40-964) at CY.

( ) Install the 80-meter coil (#40-1012) at CS.

( ) Install the 40-meter coil (#40-966) at CT.



Detail 2-1D

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

NOTE: When you wire capacitors to the five coils in the following steps, position the body of each capacitor against its coil. However, be sure the capacitor leads do not touch the wire of the coil.

Note the positions of lugs 1 and 2 of each coil as shown in Detail 2-1C, on Page 13.

( ) Connect a 220 pF mica capacitor from lug 1 of coil CU (NS) to ground lug CL-1 (NS). Position the capacitor close to the coil as shown.

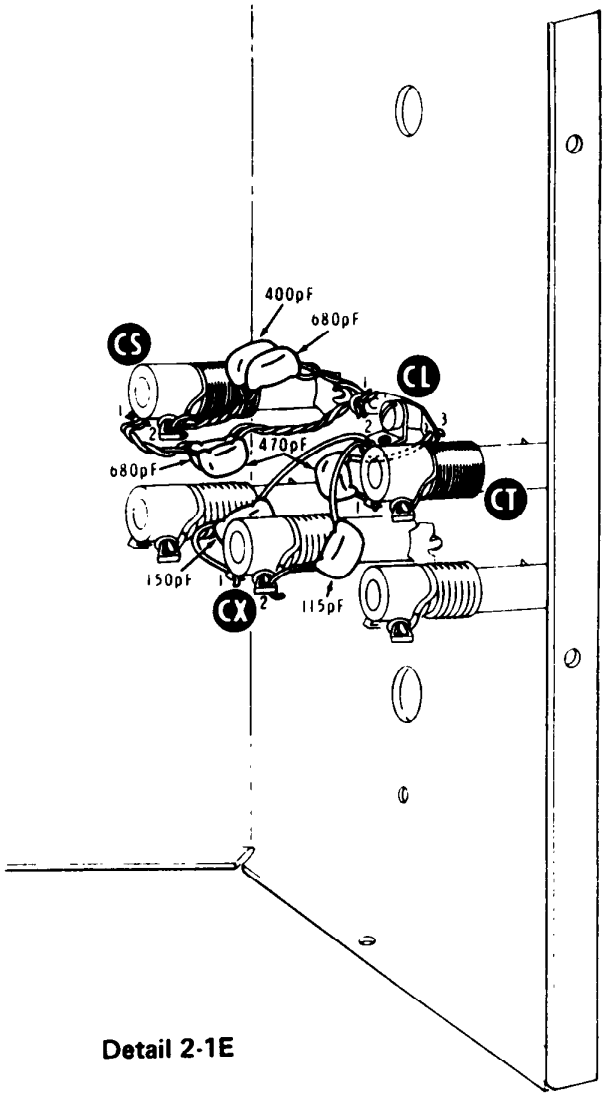
( ) Connect a 180 pF mica capacitor from lug 2 of coil CU (NS) to ground lug CL-2 (NS).

( ) Connect a 400 pF mica capacitor from lug 2 of coil CT (NS) to ground lug CL-3 (NS).

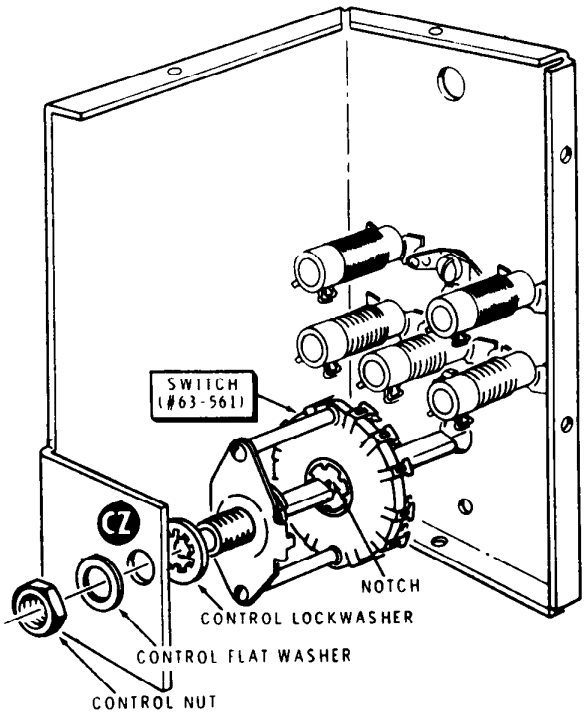
( ) Connect a 115 pF mica capacitor from lug 1 of coil CY (NS) to ground lug CL-2 (NS).

( ) Refer to the inset drawing on Detail 2-1D and twist together the leads of two 22 pF mica capacitors as shown. NOTE: Each twisted pair of leads will be counted as <u>two</u> leads in a solder step.

( ) Connect one pair of leads to lug 2 of coil CY (NS) and the other pair of leads to ground lug CL-3 (NS).



Detail 2-1E



Detail 2-1F

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

( ) Connect a 150 pF mica capacitor from lug 1 of coil CX (NS) to ground lug CL-2 (NS). Position the capacitor as shown.

( ) Connect a 115 pF mica capacitor from lug 2 of coil CX (NS) to ground lug CL-2 (S-4).

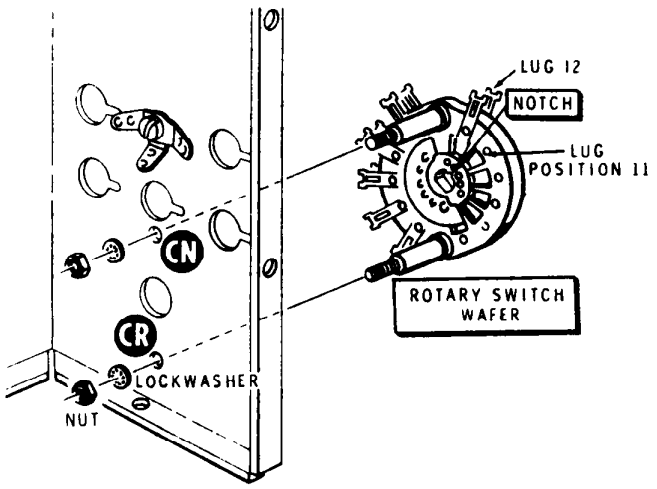
( ) Twist the leads of a 470 pF and a 680 pF mica capacitor together as in a previous step. Connect one pair of leads to lug 1 of coil CS (NS) and the other pair of leads to ground lug CL-1 (NS). Position the capacitors as shown.

( ) Twist the leads of a 400 pF and a 680 pF mica capacitor together. Connect one peir of leads to lug 2 of coil CS (NS) and the other pair of leads to ground lug CL-1 (S-5).

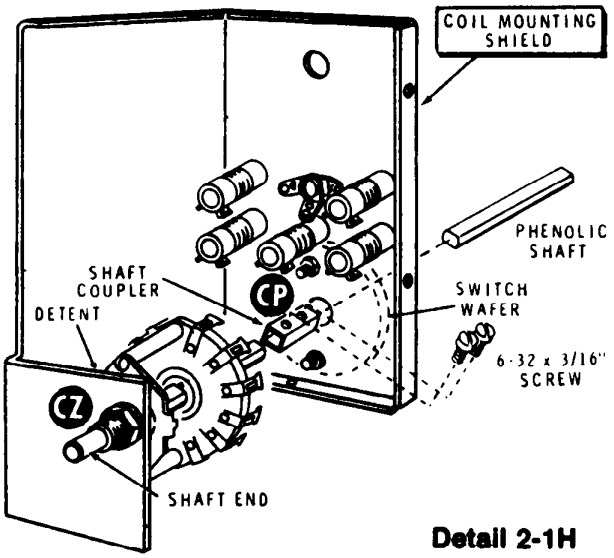
( ) Connect a 470 pF mica capacitor from lug 1 of coil CT (NS) to ground lug CL-3 (S-4). Position the capacitor as shown.

( ) Turn the shaft of the 5-position rotary switch (#63-561) fully clockwise as viewed from the shaft end.

( ) Refer to Detail 2-1F and mount the 5-position rotary switch on the coil mounting shield at CZ. Use a control nut, a control lockwasher, and a control flat washer. Be sure the two switch spacers and the switch shaft are aligned vertically and that the notch in the rotor is positioned as shown. Tighten the hardware only finger tight.



Detail 2-1G



Detail 2-1H

( ) Refer to Detail 2-1G and remove the two nuts from the screws passing through the two spacers of the separate rotary switch wafer (#63-562). Retain the spacers on the screws.

( ) Insert the bared screw ends into holes CN and CR of the coil mounting shield with lug 12 positioned as shown. Secure the switch with two #6 lockwashers and with the two nuts previously removed.

( ) Position the rotating portion of the switch wafer as shown so the notch points between switch lugs 11 and 12. The phenolic shaft (#453-135) may be used to turn the switch rotor.

( ) Check to be sure that switch CZ is still turned fully clockwise (viewed from the shaft end).

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

( ) Start two 6-32 x 3/16" screws into the tapped holes of the shaft coupler (#456-16). Then slide half the length of the shaft coupler onto the shaft of switch CZ and tighten one screw. The screws should be at the one o'clock position (viewed from the shaft end).

CAUTION: Be careful when you tighten the setscrew in the following step. Use an angle screwdriver if one is available.

( ) Slide the phenolic shaft (#453-135) through the switch wafer on the rear of the coil mounting shield, through hole CP in the shield, and into the shaft coupler. Tighten the remaining setscrew in the shaft coupler onto the phenolic shaft.

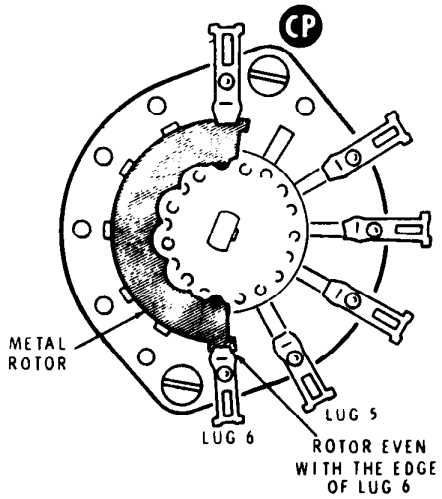
( ) Hold the 5-position rotary switch detent (at CZ) stationary and turn the shaft coupler fully counterclockwise.

Refer to Pictorial 2-1 and Detail 2-1H and Detail 2-1J for the next three steps.

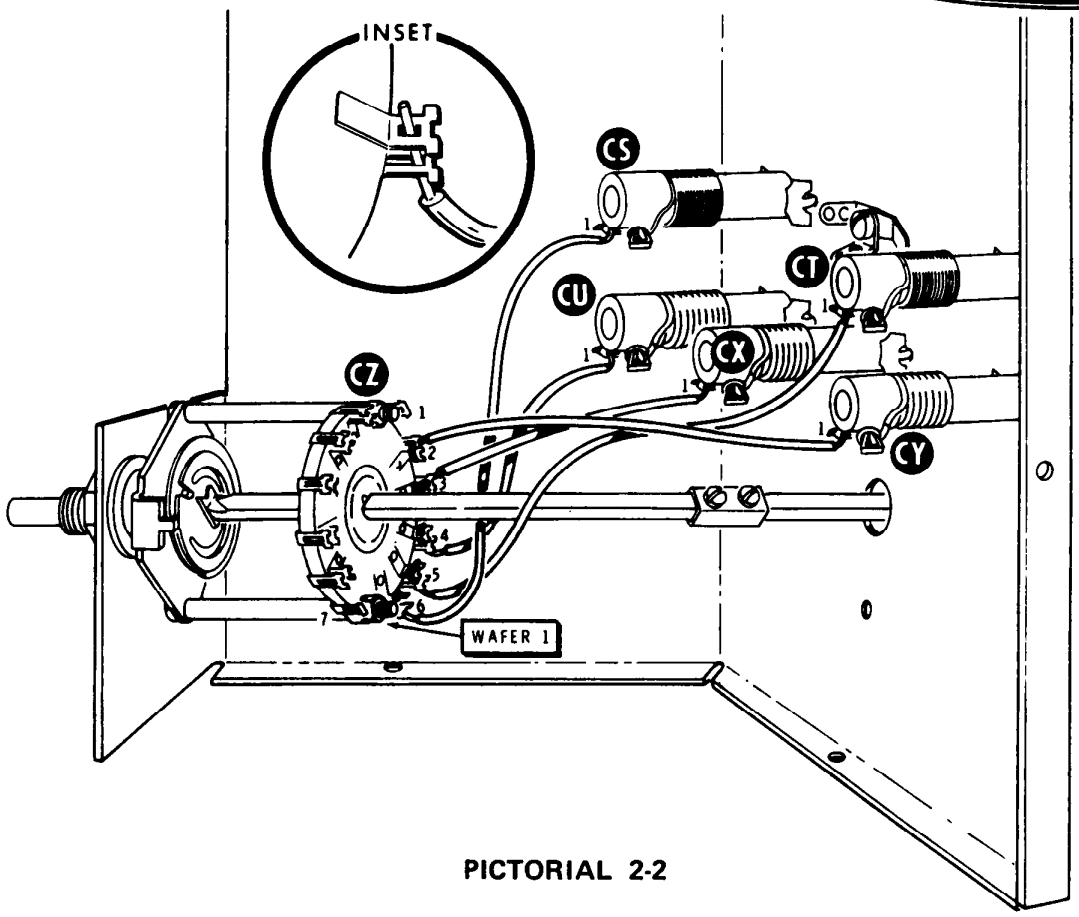
( ) Note the metal rotor of switch wafer CP. Turn the switch detent at CZ slightly so the metal rotor of switch wafer CP is just even with the edge of lug 6 as shown. Then tighten the hardware on switch CZ.

( ) Check the metal rotor of switch wafer CP again. If the metal rotor extends past lug 6, arching can occur between the rotor and lug 5.

( ) Turn the switch shaft through each of its five positions and check the metal rotor to make sure it makes contact with each lug in turn.



Detail 2-1J



PICTORIAL 2-2

Refer to Pictorial 2-2 for the following steps.

( ) Prepare the following lengths of black hookup wire. The wires are listed in the order in which they will be used.

2-1/4"

3-1/2"

3-1/2"

1-3/4"

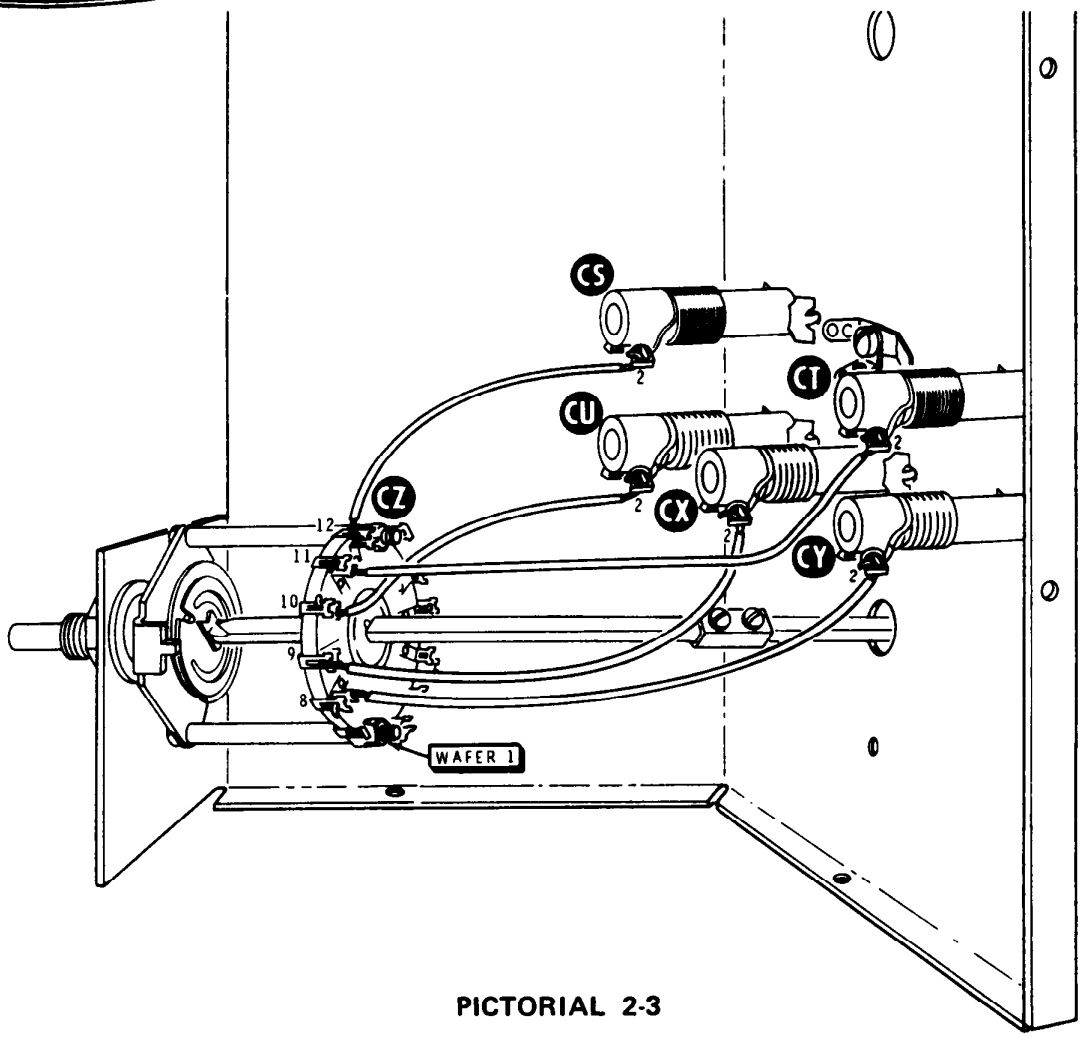
2"

NOTE: Switch CZ has lugs only on the front of the wafer at positions 1 and 7. All other positions on this wafer have lugs on the front and on the reer of the wafer. Be sure to connect the wire to both lugs when there are double lugs.

When a wire passes through a connection and then goes to another point, it will count as two wires in the solder instructions, one entering and one leaving the connection. Thus, when a wire passes through one switch lug and then goes on to the other switch lug at the same position, it will count as three wires (S-3) in the solder instructions.

Connect the prepared hookup wires from the coils to wafer 1 of switch CZ as follows:

	Wire Length	Connect From Lug 1 of	Connect to Wafer 1 of Switch CZ
( )	2-1/4"	Coil CU (S-2)	Lug 4 (S-3)
( )	3-1/2"	Coil CT (S-2)	Lug 5 (S-3)
( )	3-1/2"	Coil CS (S-3)	Lug 6 (S-3)
( )	1-3/4"	Coil CX (S-2)	Lug 3 (S-3)
( )	2"	Coil CY (S-2)	Lug 2 (S-3)



PICTORIAL 2-3

Refer to Pictorial 2-3 for the following steps.

( ) Prepare the following lengths of black hookup wire. Wires are listed in the order in which they will be used.

2-1/2"

2"

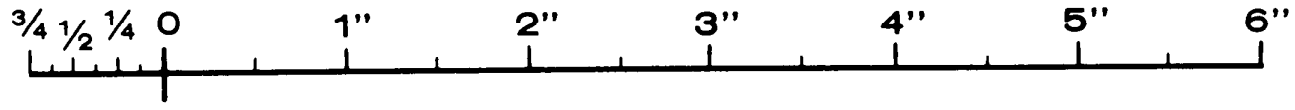
2-1/2"

2-1/2"

2-1/2"

Connect the prepared hookup wire from the coils to wafer 1 of switch CZ as follows:

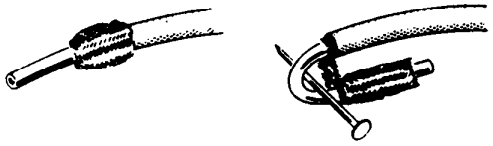
	Wire Length	Connect From Lug 2 of	Connect to Wafer 1 of Switch CZ
( )	2-1/2"	Coil CY (S-3)	Lug 8 (S-3)
( )	2"	Coil CX (S-2)	Lug 9 (S-3)
( )	2-1/2"	Coil CU (S-2)	Lug 10 (S-3)
( )	2-1/2"	Coil CT (S-2)	Lug 11 (S-3)
( )	2-1/2"	Coil CS (S-3)	Lug 12 (S-3)



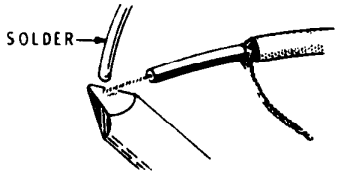
PART A

TAKING CARE NOT TO CUT THE OUTER SHIELD OF VERY THIN WIRES, REMOVE THE OUTER INSULATION.

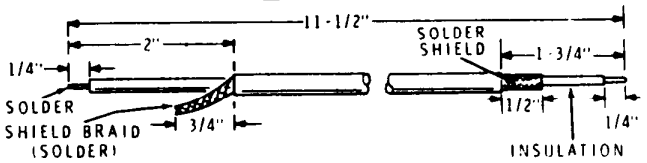
PUSH BACK THE SHIELD. THEN MAKE AN OPENING IN THE SHIELD AND BEND OVER AS SHOWN. PICK OUT THE INNER LEAD.



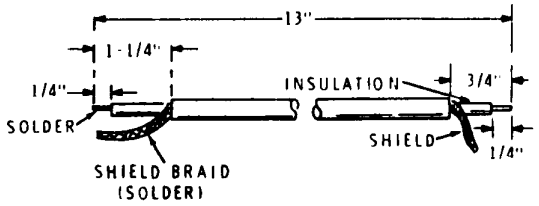
REMOVE THE INNER INSULATION AND STRETCH OUT THE SHIELD. APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE SHIELD AND THE INNER LEAD. USE ONLY ENOUGH HEAT FOR THE SOLDER TO FLOW.



PART B



PART C

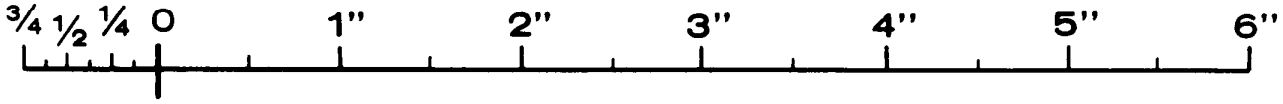


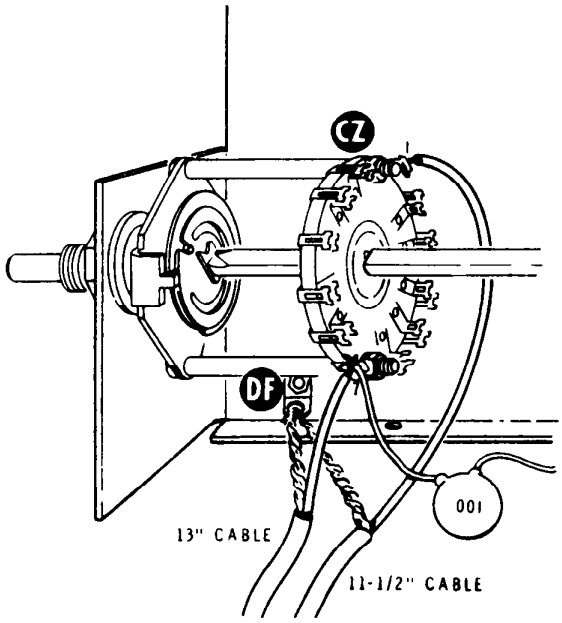
PICTORIAL 2-4

NOTE: When you prepare coaxial cables in the following steps, refer to Part A of Pictorial 2-4 for the method of removing the inside of the cable from the shield braid. Be careful not to melt the inner insulation.

( ) Prepare an 11-1/2" length of RG-58A/U coaxial cable as shown in Pictorial 2-4, Part B. Twist the center conductor wires together and apply a small amount of solder to each end to hold the small strands together. In a like manner, twist and solder the end of the shield braid.

( ) Refer to Pictorial 2-4, Part C, and prepare a 13" length of RG-58A/U coaxial cable as shown.





PICTORIAL 2-5

( ) Refer to Pictorial 2-5 and connect the 1-1/4" end of the center conductor of the 13" coaxial cable to lug 7 of wafer 1 of switch CZ (NS). Connect the shield braid to solder lug DF (NS).

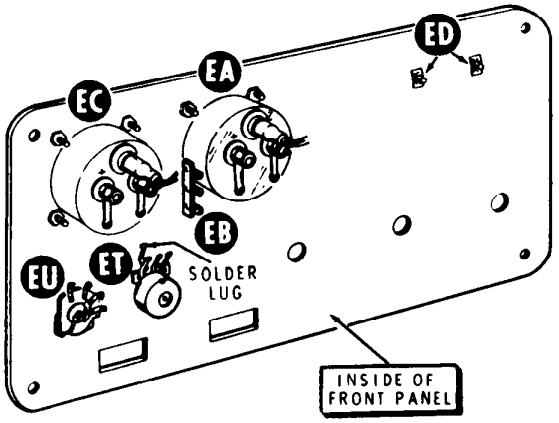
( ) Cut each lead of a 500 volt (smaller) .001 μF disc capacitor to a length of 3/4". Connect one lead of this capacitor to lug 7 of wafer 1 of switch CZ (S-2). The other lead will be connected later.

( ) Connect the 2" end of the center conductor of the 11-1/2" coaxial cable to lug 1 of wafer 1 of switch CZ (S-1). Connect the braid to solder lug DF (S-2). NOTE: The other ends of the coaxial cables will be connected later.

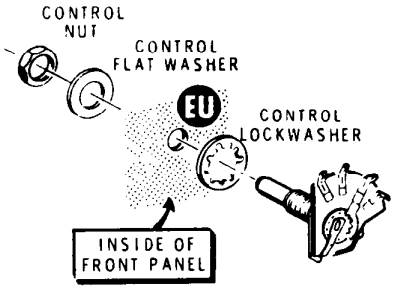
( ) Turn the switch shaft to its stop in each direction and make sure that no wires interfere with the coupling.

This completes the "Input Coil Assembly."

Set the input coil assembly aside until it is called for later.



PICTORIAL 3-1



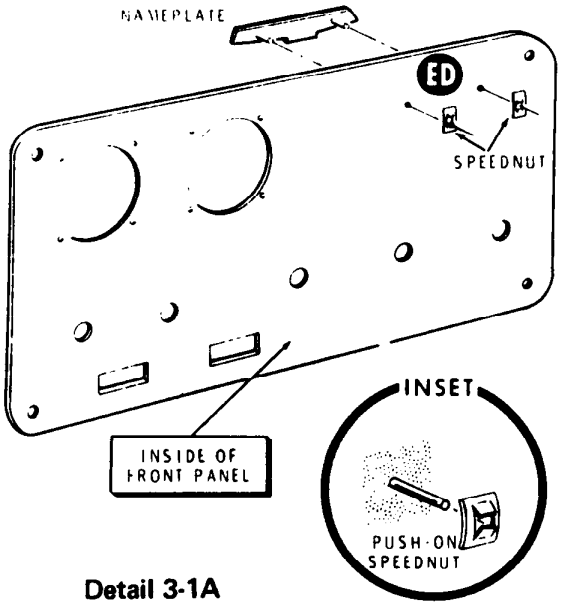
Detail 3-1B

FRONT PANEL

NOTE: To avoid scratching the front panel and meter faces during the following steps, place a soft cloth on your work table.

Refer to Pictorial 3-1 for the following steps.

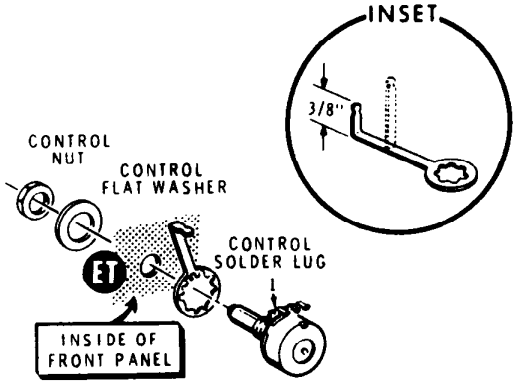
( ) Refer to Detail 3-1A and install the Heathkit nameplate in the two holes marked ED. Use the two speednuts.



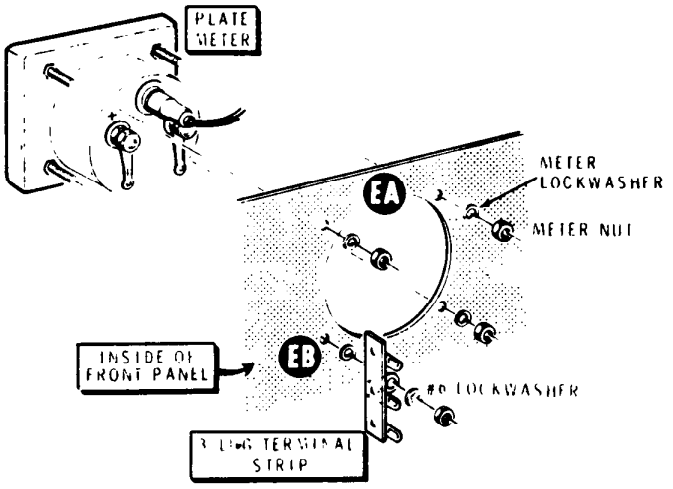
Detail 3-1A

( ) Refer to Detail 3-1B and install the 3-position rotary switch (#63-47) at EU. Use a control lockwasher, a control flat washer, and a control nut. Position the switch lugs as shown in the Pictorial.

( ) Refer to Detail 3-1C and install the 100 kΩ sensitivity control (#10-12) at ET. Use a control solder lug, a control flat washer, and a control nut. Form the control solder lug as shown. Then align the control solder lug with lug 1 of the control.



Detail 3-1C



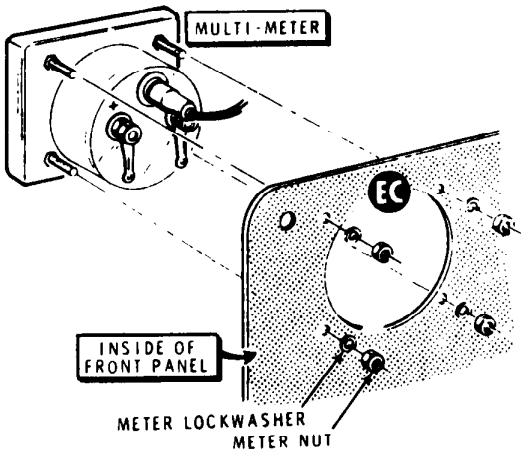
Detail 3-1D

NOTE: Before mounting the terminal strip in the following step, scrape away any paint around hole EB which would prevent the lockwasher and terminal strip foot from making good contact with the panel.

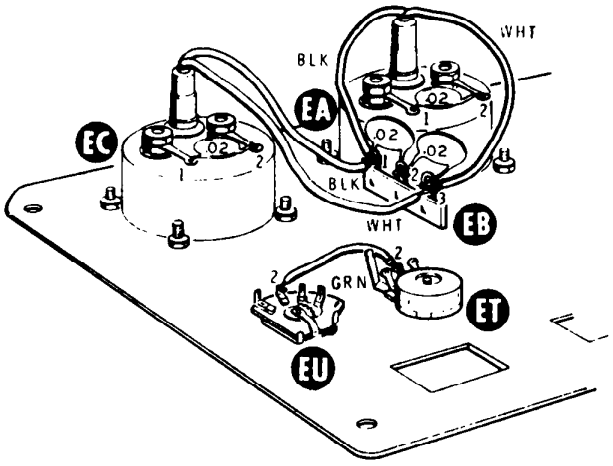
( ) Refer to Detail 3-1D and install the plate meter (#407-145) at EA. Use the hardware supplied with the meter. Install a 3-lug terminal strip at EB. Note the lockwashers used. CAUTION: Do not overtighten the meter hardware as the meter case can be damaged.

( ) Refer to Detail 3-1E and install the multi-meter (#407-146) at EC. Use the hardware supplied with the meter.

( ) Remove and discard the wire jumpers between the meter terminals on each meter.



Detail 3-1E



PICTORIAL 3-2

Refer to Pictorial 3-2 for the following steps.

( ) Connect a .02 μF disc capacitor between lugs 1 (NS) and 2 (NS) of meter EC.

( ) Connect a .02 μF disc capacitor between lugs 1 (NS) and 2 (NS) of meter EA.

( ) Cut the leads of two .02 μF disc capacitors to a length of 1/2". These capacitors will be used in the next two steps.

( ) Install a .02 μF disc capacitor between lugs 1 (NS) and 2 (NS) of terminal strip EB.

( ) Install a .02 μF disc capacitor between lugs 2 (S-2) and 3 (NS) of terminal strip EB.

( ) Cut the black pilot lamp lead from meter EC to 3-1/2" and the white lead to 4".

( ) Connect the black pilot lamp lead coming from meter EC to lug 1 of terminal strip EB (NS).

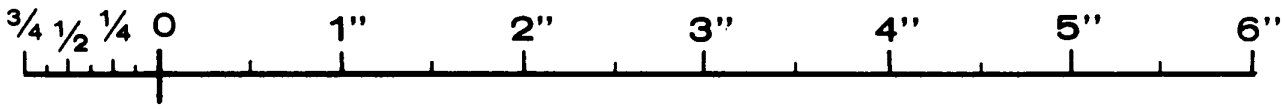
( ) Connect the white pilot lamp lead coming from meter EC to lug 3 of terminal strip EB (NS).

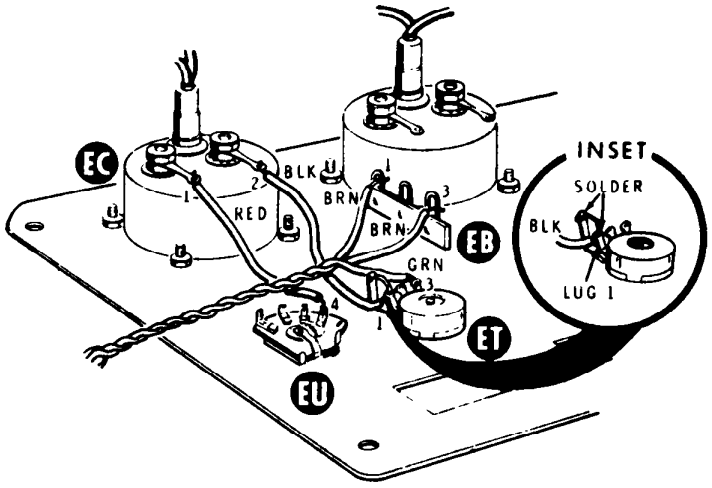
( ) Cut the black pilot lamp lead coming from meter EA to 3" and the white lead to 4".

( ) Connect the black pilot lamp lead coming from meter EA to lug 1 of terminal strip EB (NS).

( ) Connect the white pilot lamp lead coming from meter EA to lug 3 of terminal strip EB (NS).

( ) Connect a 3-1/2" length of green wire from lug 2 of rotary switch EU (S-1) to lug 2 of control ET (S-1).





PICTORIAL 3-3

( ) Prepare the following lengths of hookup wire:

3-1/2" black	18" brown
3-1/2" red	18" brown
	30" green

Refer to Pictorial 3-3 for the following steps.

( ) Remove an additional 1/2" of insulation from one end of the 3-1/2" black wire. Pass this end through lug 1 of control ET (S-2) and wrap it around the control solder lug (S-1). Connect the other end of this black wire to lug 2 of meter EC (S-2).

( ) Connect a 3-1/2" length of red wire from lug 1 (marked + on the case) of meter EC (S-2) to lug 4 of rotary switch EU (S-1).

( ) Connect an 18" length of brown wire to lug 3 of terminal strip EB (S-4).

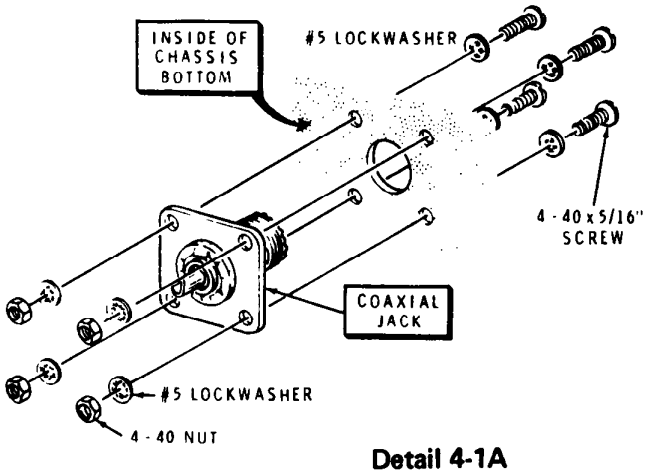
( ) Connect an 18" length of brown wire to lug 1 of terminal strip EB (S-4).

( ) Connect a 30" length of green wire to lug 3 of control ET (S-1).

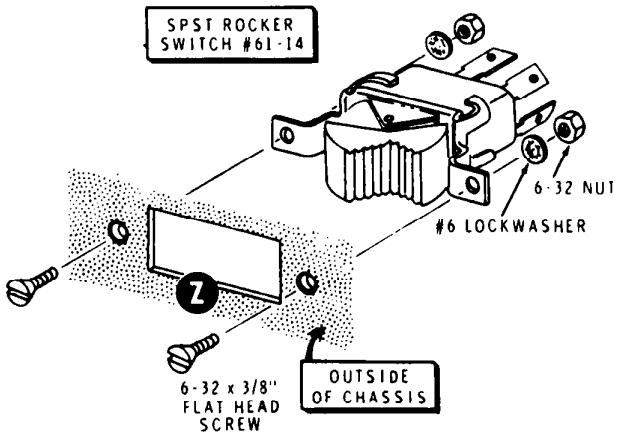
( ) Gather the green wire and the two brown wires and twist them together approximately one turn per inch.

Set the front panel assembly aside until it is required in later steps.

CHASSIS



Detail 4-1A



Detail 4-1C

CHASSIS PARTS MOUNTING

Refer to Pictorial 4-1 (fold-out from Page 27) for the following steps.

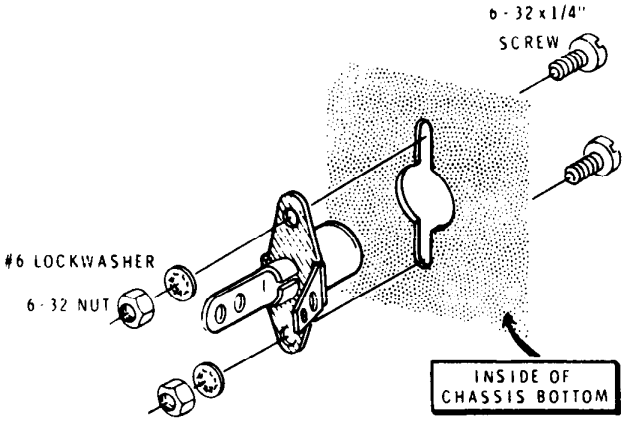
( ) Install 1/2" rubber grommets at Y, T, AK, and AL.

( ) Install a 3/4" rubber grommet at AH.

( ) Refer to Detail 4-1A and mount a coaxial jack at A on the rear apron of the chassis. Use 4-40 x 5/16" hardware and #5 lockwashers.

( ) In the same manner, mount another coaxial jack at L on the rear apron.

( ) Refer to Detail 4-1B and mount a phono socket at U on the rear apron. Use 6-32 x 1/4" hardware. Position the ground lug toward the coaxial jack.



Detail 4-1B

( ) Similarly, mount another phono socket at X.

NOTE: In the following steps, the switch mounting holes are off center and fit in one position only.

( ) Refer to Detail 4-1C and mount the DPST rocker switch (#61-14) at Z on the front apron of the chassis. Use 6-32 x 3/8" flat head screws with lockwashers and nuts. Note the position of the lugs in the Pictorial.

( ) Similarly, mount a DPDT rocker switch (#61-15) at AN on the chassis front apron.

NOTE: Discard any loose metal clips you find in the tube socket boxes.

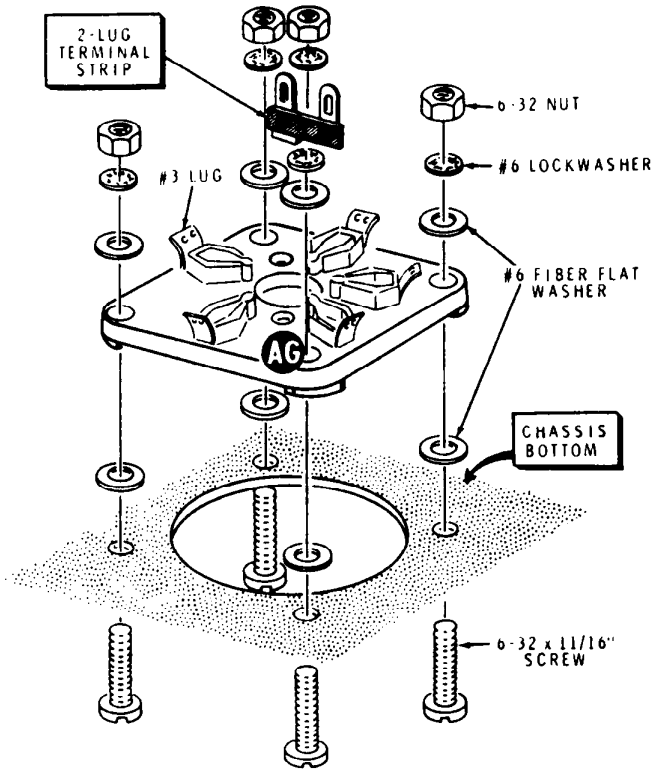
( ) Refer to Detail 4-1D and mount a 5-lug ceramic tube socket at N with a 2-lug terminal strip at AG. Use 6-32 x 11/16" hardware and fiber flat washers. Be sure to properly position the socket, and to place a lockwasher under the terminal strip mounting foot.

( ) Similarly, mount a 5-lug ceramic tube socket at D. Use 6-32 x 11/16" hardware and fiber flat washers. Do not use a terminal strip on this socket.

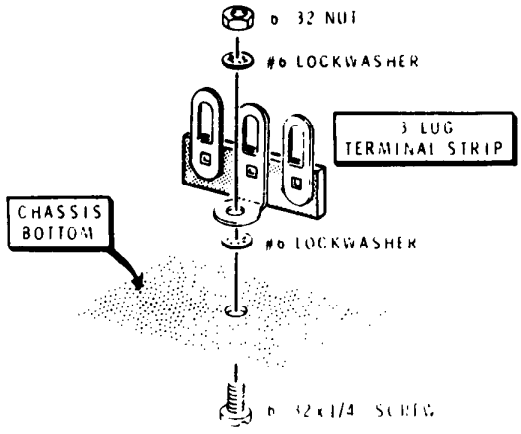
( ) Refer to Detail 4-1E and mount two #6 solder lugs at C. Use 6-32 x 1/4" hardware. Be sure to position the lugs as shown in the Pictorial.

( ) Similarly, mount two #6 solder lugs at M. Position these lugs as shown in the Pictorial.

( ) Similarly, mount one #6 solder lug at E.



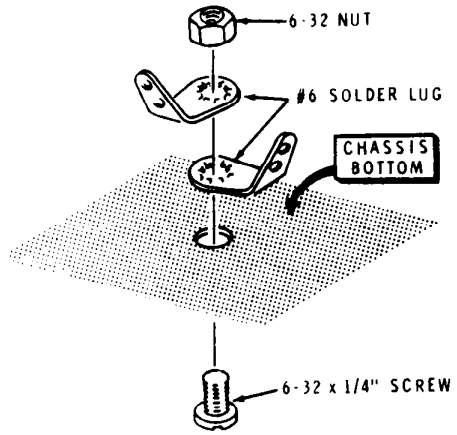
Detail 4-1D



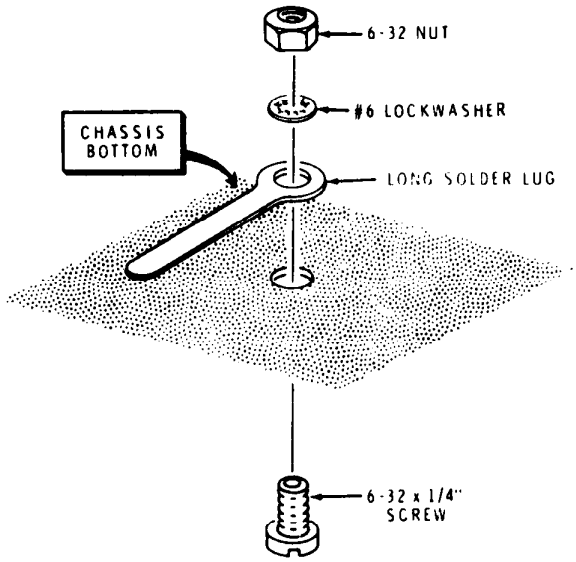
Detail 4-1F

( ) Refer to Detail 4-1F and mount a 3-lug terminal strip at P. Use 6-32 x 1/4" hardware.

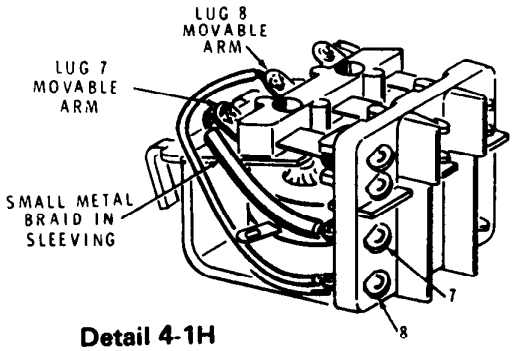
( ) Refer to Detail 4-1G and mount a long solder lug at R. Use 6-32 x 1/4" hardware.



Detail 4-1E



Detail 4-1G



Detail 4-1H

( ) Install a 5/16" rubber grommet at F.

Refer to Detail 4-1H for the following steps.

( ) Position the relay (#69-55) with its lugs to the right as shown. Unsolder and discard the black insulated wire between lug 7 and its movable arm.

NOTE: When you solder the small metal braid in the following steps, use the minimum amount of heat necessary to secure a good connection.

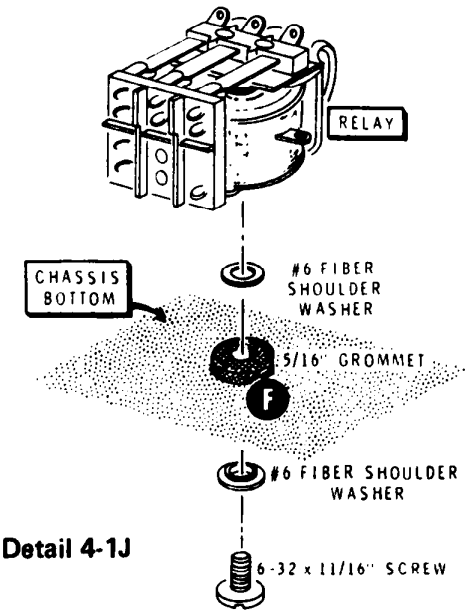
IMPORTANT: Disregard any lug numbers stamped on the relays; refer to the steps and the illustrations for the correct lug numbers.

( ) Replace the wire discarded in the previous step with a 3-1/4" length of small metal braid that is folded in the middle and pushed through a 1" length of black sleeving. Solder one end of the braid wires to relay lug 7 and the other end to its movable arm.

( ) Unsolder and discard the black insulated wire between lug 8 and its arm.

( ) Replace the wire discarded in the previous step with a 5-1/4" length of small metal braid that is folded in the middle and pushed through a 2" length of black sleeving. Solder one end of the braid to lug 8 and the other end to its movable arm.

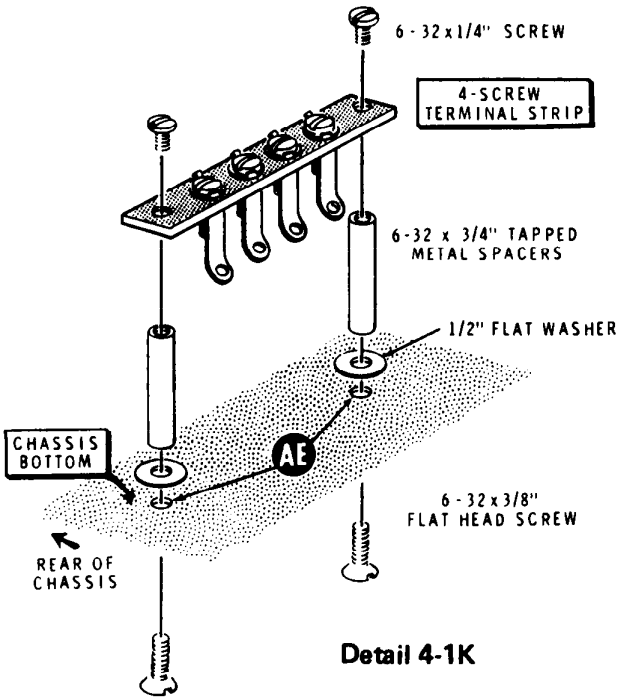
( ) Refer to Detail 4-1J and mount the relay through grommet F. Use a 6-32 x 11/16" screw and two #6 fiber shoulder washers. Do not overtighten this screw. The rubber grommet is used to provide resiliency.



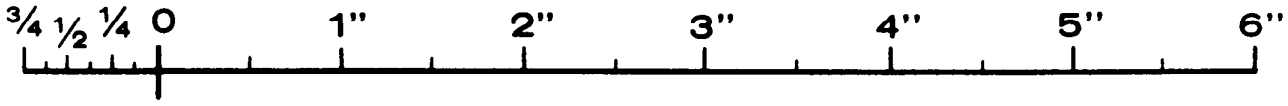
Detail 4-1J

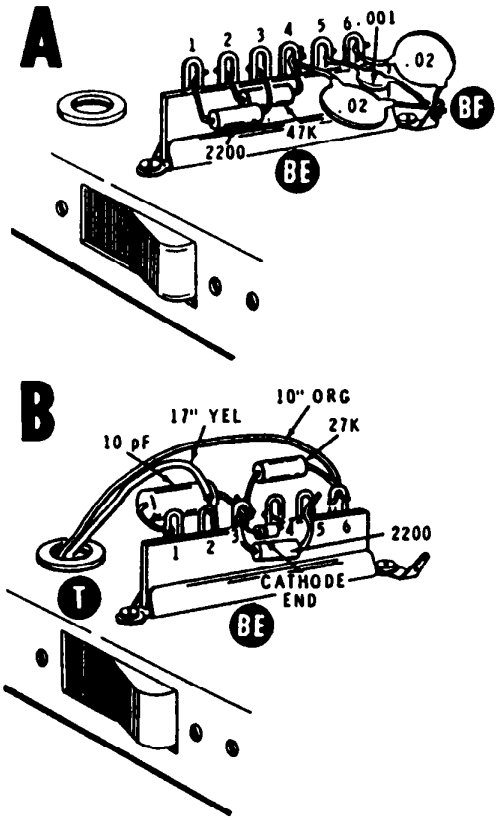
( ) Inspect the relay to make sure that neither piece of metal braid can possibly touch the metal frame of the relay.

( ) Refer to Detail 4-1K and mount the 4-screw terminal strip at AE. Use two 6-32 x 3/8" flat head screws. two 1/2" flat washers, two 6-32 x 3/4" tapped metal spacers, and two 6-32 x 1/4" binder head screws.



Detail 4-1K





PICTORIAL 4-2

ALC WIRING

Refer to Pictorial 4-2 for the following steps.

( ) Refer to Detail 4-2A and mount a 6-lug terminal strip on the top of the chassis at holes BE and BF with 6-32 x 1/4" hardware. Use a #6 solder lug at BF only.

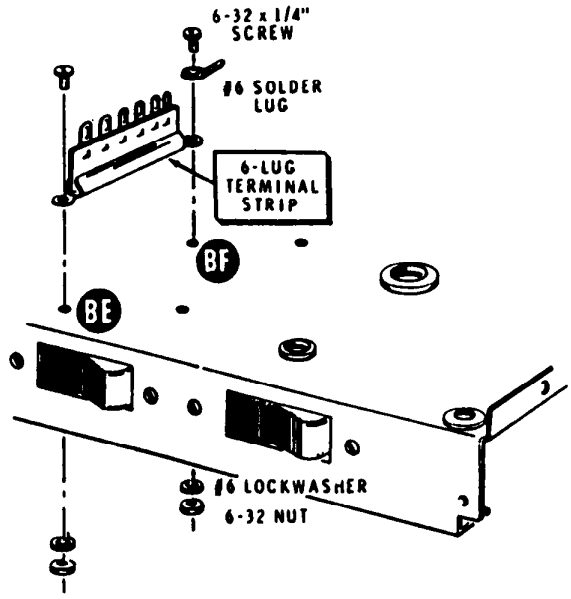
Refer to Part A of the Pictorial for the next five steps. Note the positions of the components.

( ) Connect a 47 kΩ (yellow-violet-orange) resistor from lug 2 (NS) to lug 4 (NS) of terminal strip BE.

( ) Connect a 2200 Ω (red-red-red) resistor from lug 1 (NS) to lug 3 (NS) of terminal strip BE.

( ) Connect a .02 μF disc capacitor from lug 4 of terminal strip BE (NS) to solder lug BF (NS).

( ) Connect a 500 volt (smaller) .001 μF disc capacitor from lug 5 of terminal strip BE (NS) to solder lug BF (NS).



Detail 4-2A

( ) Connect a .02 μF disc capacitor from lug 6 of terminal strip BE (NS) to solder lug BF (S-3).

Refer to Part B of the Pictorial for the next eight steps.

( ) Prepare a 10" length of orange hookup wire and a 17" length of yellow hookup wire.

( ) Connect one end of the orange wire to lug 6 of terminal strip BE (NS).

( ) Connect one end of the yellow wire to lug 2 of terminal strip BE (S-2).

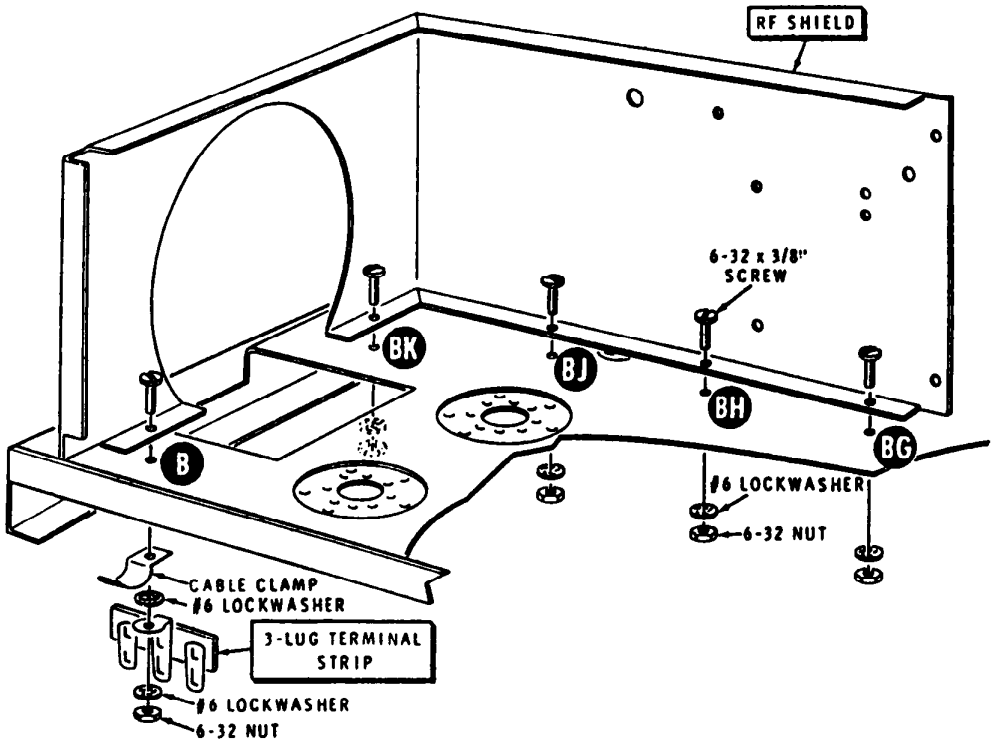
( ) Pass the free ends of the yellow and the orange wires down through grommet T. To temporarily secure the ends of these wires, they can be passed up through some other hole in the chassis.

( ) Connect a 2200 Ω (red-red-red) resistor from lug 3 (NS) to lug 5 (S-2) of terminal strip BE.

( ) Connect a 27 kΩ (red-violet-orange) resistor from lug 3 (NS) to lug 6 (S-3) of terminal strip BE.

( ) Connect the cathode lead of a silicon diode (#56-24, yellow-green-gray) to lug 3 (NS), and the anode lead to lug 4 (S-3) of terminal strip BE.

( ) Connect a 10 pF (may be marked 10 μμF) tubular ceramic capacitor from lug 3 (S-5) to lug 1 (NS) of terminal strip BE.

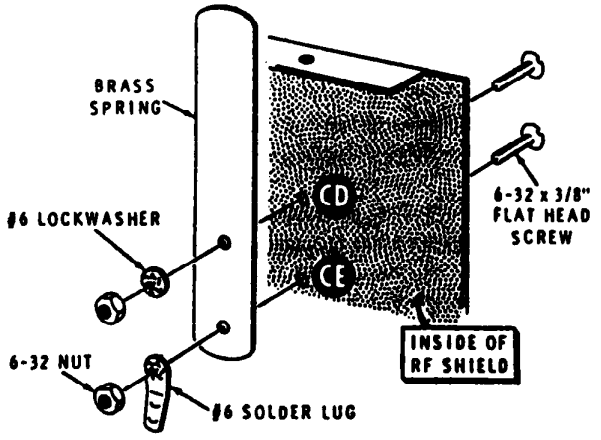


Detail 4-3A

TOP-CHASSIS ASSEMBLY

Refer to Pictorial 4-3 for the following steps.

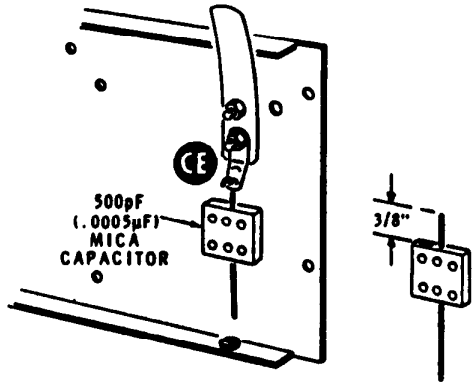
( ) Refer to Detail 4-3A and mount the RF shield (#206-493) on the top of the chassis. At BG, BH, BJ, and BK, use 6-32 x 3/8" screws. At B, use a 6-32 x 3/8" binder head screw with a 3-lug terminal strip, a cable clamp, two #6 lockwashers, and a 6-32 nut.



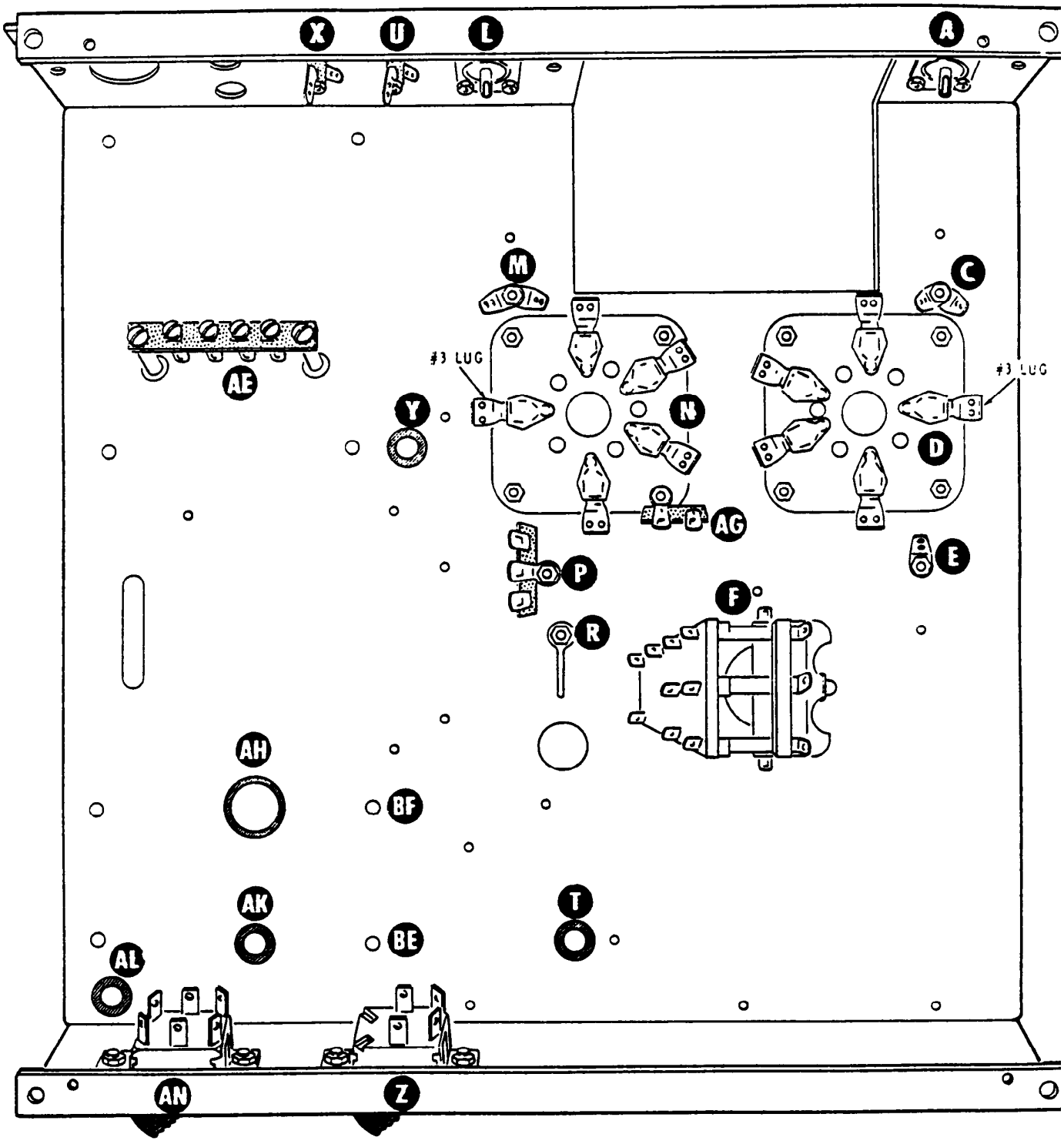
Detail 4-3B

( ) Refer to Detail 4-3B and mount the brass spring (#258-115) at CD and CE on the RF shield. Use 6-32 x 3/8" flat head hardware with a #6 solder lug at CE. When the hardware is tightened, the end of the brass strip will contact the upper lip of the RF shield.

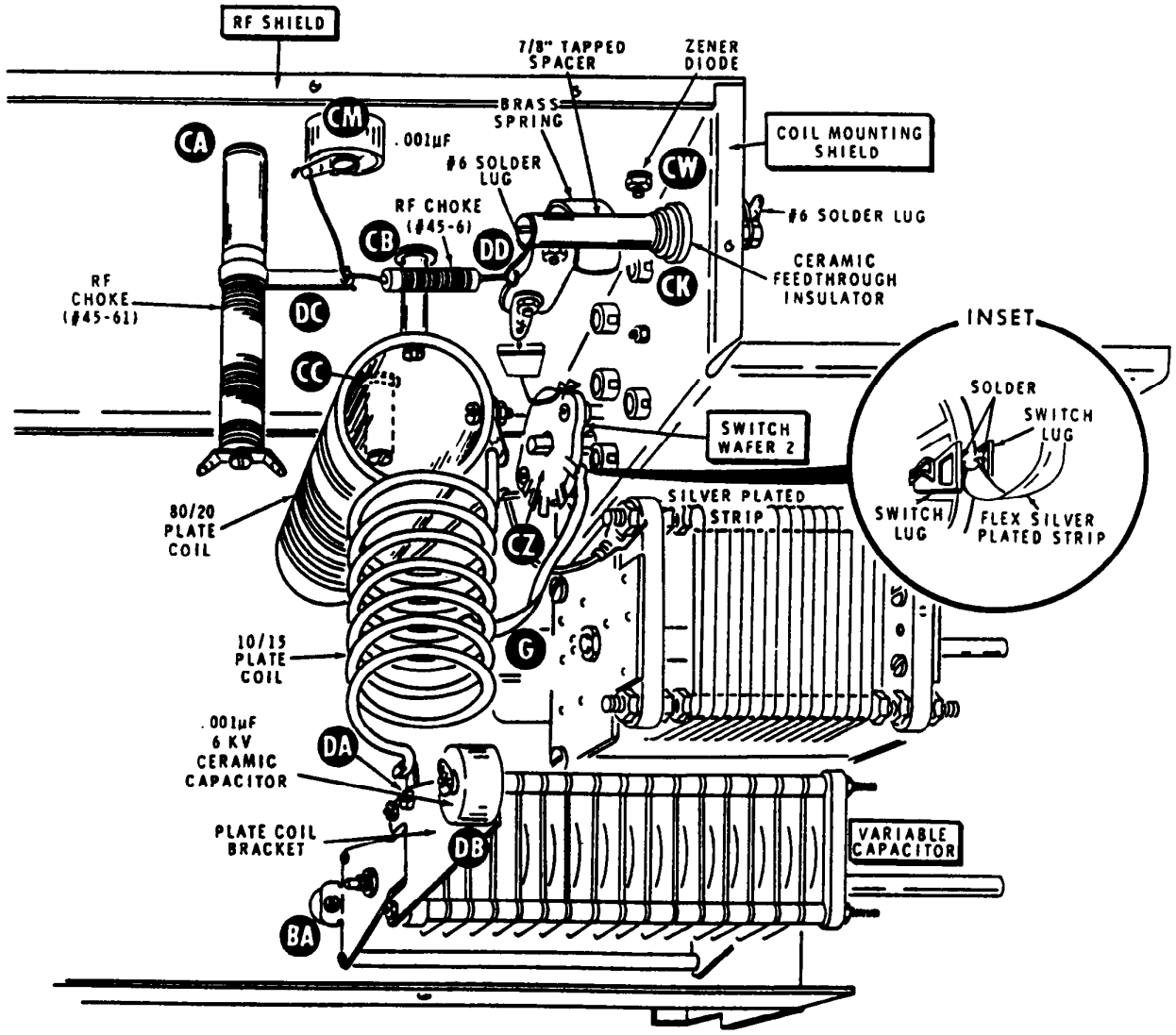
( ) Refer to Detail 4-3C and cut one lead of a 500 pF mica capacitor (may be marked ".0005") to a length of 3/8". Connect this lead to the solder lug at CE (S-1). The other lead will be connected later.



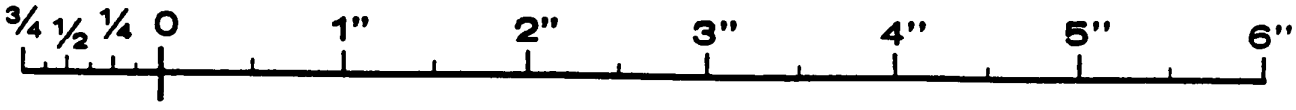
Detail 4-3C

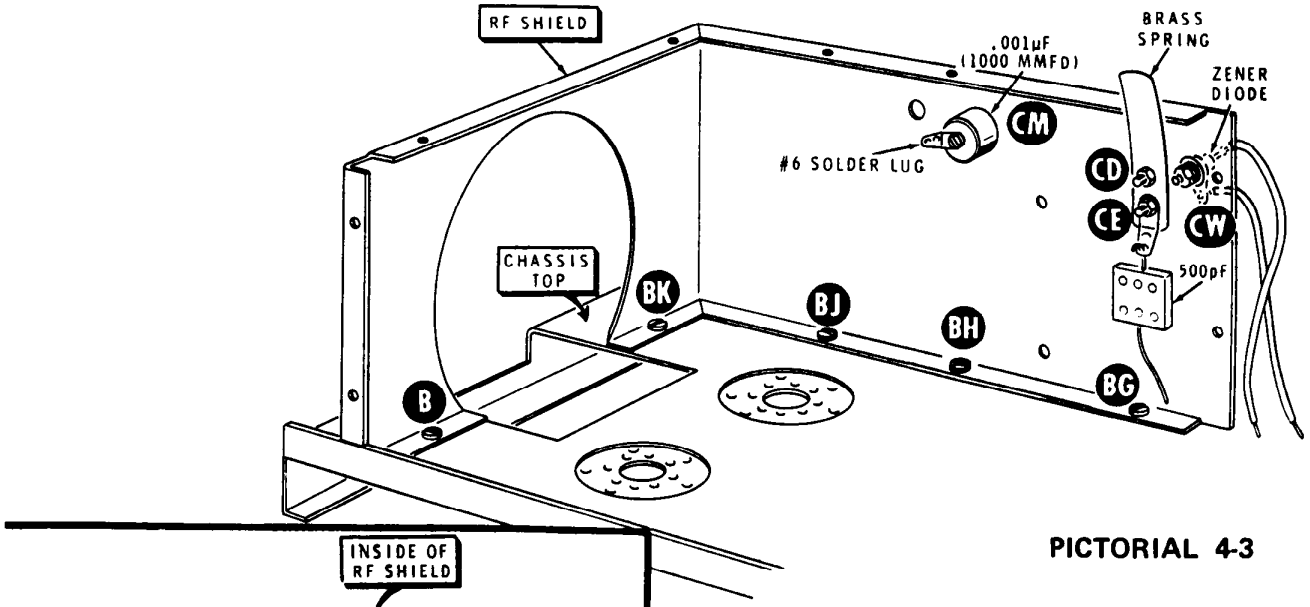


PICTORIAL 4-1

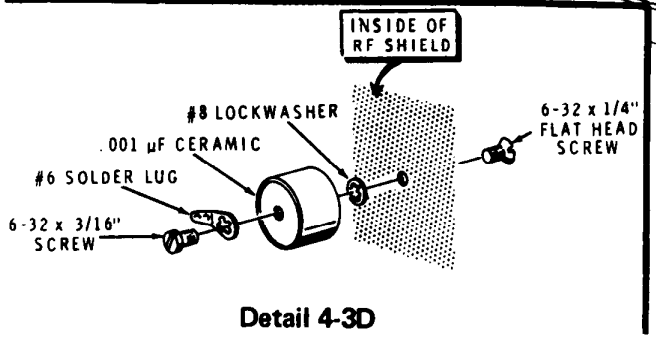


PICTORIAL 4-5





PICTORIAL 4-3



Detail 4-3D

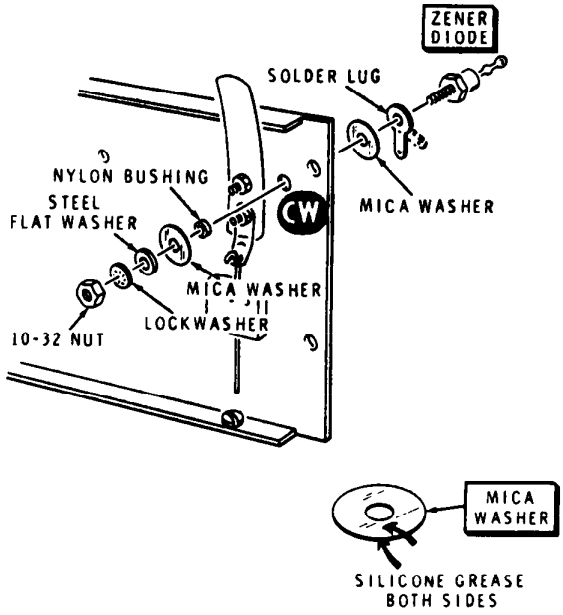
( ) Bend the end of the solder lug up away from the chassis at an angle of approximately 45 degrees.

( ) Prepare two 3" lengths of small black stranded wire. Connect one end of one wire to the solder lug at CW (S-1). Connect one end of the other 3" wire to the solder terminal on the zener diode (S-1). The other ends of these wires will be connected later.

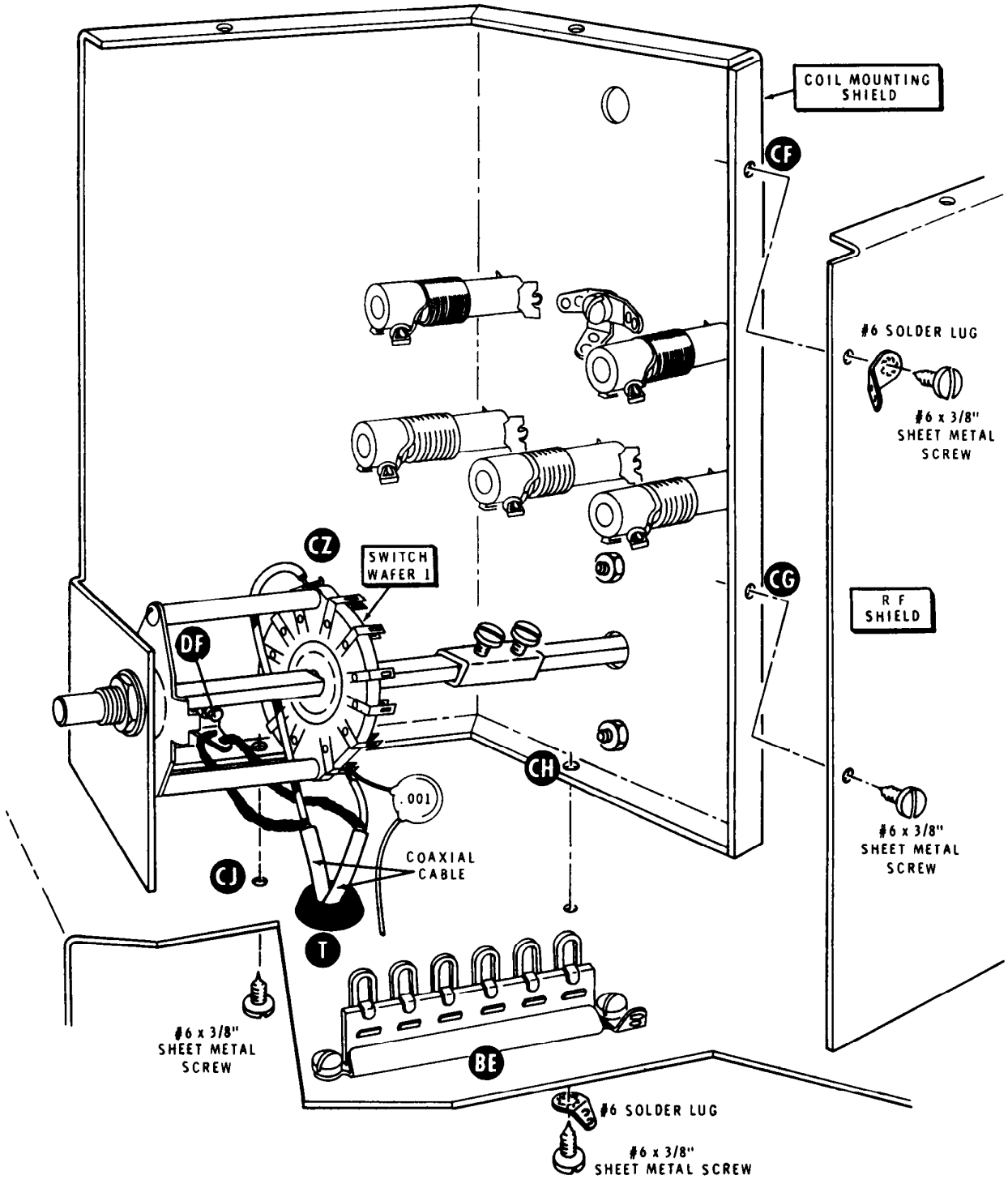
( ) Refer to Detail 4-3D and mount a .001 μF ceramic capacitor (#21-165) at CM on the inside of the RF shield (this capacitor may be marked 1000 MMFD). Use a 6-32 x 1/4" flat head screw with a #8 lockwasher between the capacitor and the RF shield.

( ) Install a #6 solder lug on the other terminal of the capacitor with a 6-32 x 3/16" screw. Position the solder lug as shown.

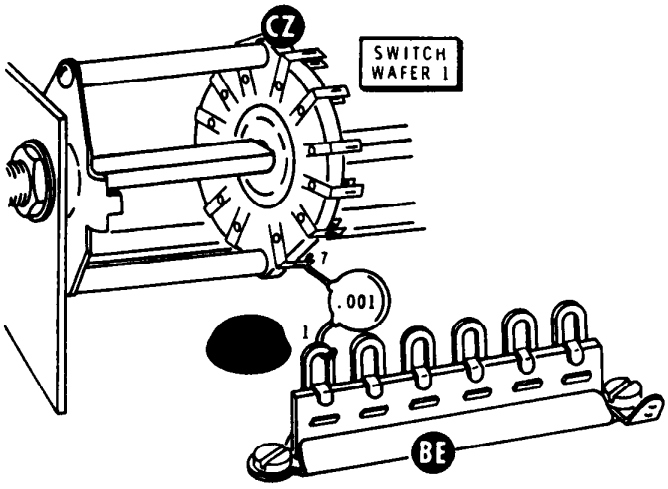
( ) Refer to Detail 4-3E and install the zener diode at CW on the outside of the RF shield with the mounting stud and nut on the same side of the shield as the brass spring, as shown in the Pictorial. Coat both sides of each mica washer with silicone grease before you install it. Make sure the nylon bushing is centered in the hole and that the solder lug points toward the chassis. Tighten the nut firmly, but do not overtighten.



Detail 4-3E



PICTORIAL 4-4



Detail 4-4A

Refer to Pictorial 4-4 for the following steps. For clarity, only the coil mounting shield is shown.

( ) Start the ends of the two coaxial cables coming from wafer 1 of switch CZ down through grommet T, and lower the input coil assembly down onto the chassis. Pull the two coaxial cables through the grommet as you lower the assembly.

( ) From the bottom of the chassis, install a #6 sheet metal screw and a #6 solder lug at CH in the coil mounting shield.

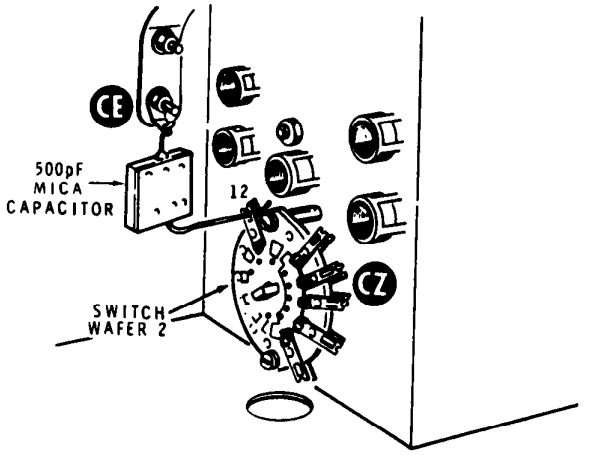
( ) From the bottom of the chassis, install a #6 sheet metal screw at CJ in the coil mounting shield.

( ) Make sure none of the parts on terminal strip BE contact any part on switch CZ.

( ) Install a #6 sheet metal screw and a #6 solder lug at CF. Note the position of the solder lug.

( ) Install a #6 x 3/8" sheet metal screw at CG.

( ) Refer to Detail 4-4A and connect the free lead of the .001 disc capacitor from lug 7 of the switch wafer to lug 1 of terminal strip BE (S-3).



Detail 4-5A

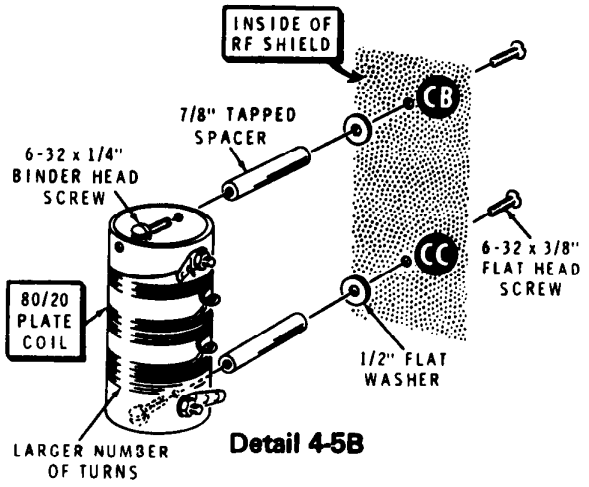
Refer to Pictorial 4-5 (fold-out from Page 28) for the following steps.

( ) Refer to Detail 4-5A and connect the free end of the 500 pF mica capacitor at CE to lug 12 of rotary switch CZ wafer 2 (S-3). Be sure the capacitor lead is soldered to both lugs.

Refer to Detail 4-5B for the next two steps.

( ) Install two 7/8" tapped spacers on the 80/20 plate coil (#40-1666). Use 6-32 x 1/4" binder head screws.

( ) Mount the plate coil assembly at CB and CC on the inside of the RF shield. Be sure to position the coil so the taps are on the side toward the brass spring, and so the winding with the larger number of turns is toward CC. Use 1/2" flat washers and 6-32 x 3/8" flat head screws.



Detail 4-5B