

HEATHKIT[®] MANUAL

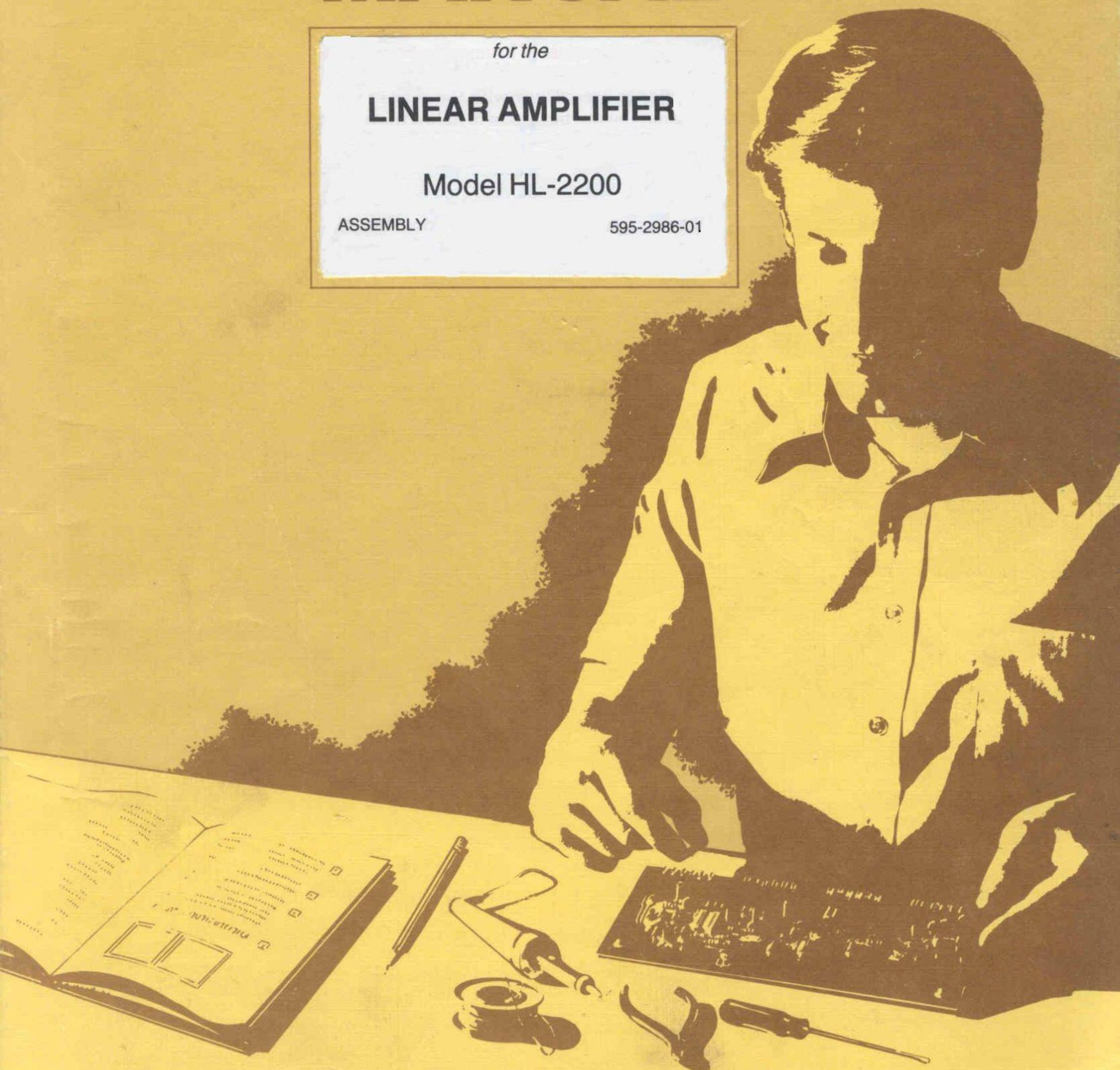
for the

LINEAR AMPLIFIER

Model HL-2200

ASSEMBLY

595-2986-01



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

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

Kit orders and delivery information (616) 982-3411
Credit (616) 982-3561
Replacement Parts (616) 982-3571

Technical Assistance Phone Numbers

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

R/C, Audio, and Electronic Organs (616) 982-3310
Amateur Radio (616) 982-3296
Test Equipment, Weather Instruments and
Home Clocks (616) 982-3315
Television (616) 982-3307
Aircraft, Marine, Security, Scanners, Automotive,
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Computers — Software:
Operating Systems, Languages, Utilities (616) 982-3860
Application Programs (616) 982-3884
Heath Craft Wood Works (616) 982-3423



YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 90 days from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 90 days from the date of purchase, any malfunction caused by defective parts or error in design will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heathkit Electronic Center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACEMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORSEEABLE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's responsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment, (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write directly to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

Heathkit® Manual

for the

LINEAR AMPLIFIER

Model HL-2200

ASSEMBLY

595-2986-01

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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"Federal Communications Commission requirements prescribe type acceptance of linear power amplifiers operating below 144 MHz in Part 97 of the Rules and Regulations. This Linear Amplifier will meet these requirements when constructed in strict accordance with the instructions in this manual, using only components and materials supplied with the kit or the exact equivalent thereof. You will be instructed to sign, date, place your amateur call sign, class of license, expiration date of license on the enclosed label and affix the label to the linear amplifier certifying that you have constructed this linear amplifier in accordance with the above mentioned instructions. In order to meet legal requirements, be certain to follow the instructions exactly as they are stated in this Manual."

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

CAUTION

Use extreme care during initial testing and all subsequent operation of this Linear Amplifier. While the HL-2200 is designed for maximum safety, never lose respect for the high voltage present in this unit. Protect yourself always against lethal or severe electric shock.

HEATH COMPANY

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INTRODUCTION

The Heathkit Model HL-2200 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.

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 power sources. **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).

UNPACKING

Your Linear Amplifier components were shipped in two separate cartons. The smaller carton contains the high-voltage power transformer for your kit. Keep the transformer in its original carton until it is called for in an assembly step.

First, you will be instructed to open the remainder of the carton in which this Manual was packed and to check the parts against the Parts List, starting on Page 9. When you have checked the contents of the larger carton, you will be directed to the "Step-by-Step Assembly" portion of the Manual.

Any part, or group of parts, that is packaged in a bag or envelope with a part number on it should be returned to its container after you identify it and remain there until it is actually used in a step. This will prevent intermixing of parts and aid in part

identification. Some parts, however, have been placed in a bag or envelope that is not marked with the actual part number but is instead marked with a packaging number that begins with the number "171-, 172-, or 173-." These numbers are used for packaging purposes only and do not appear in the Manual Parts List. Open each bag or envelope that is marked with only a "171-, 172-, or 173-" packaging number and identify the parts it contains.

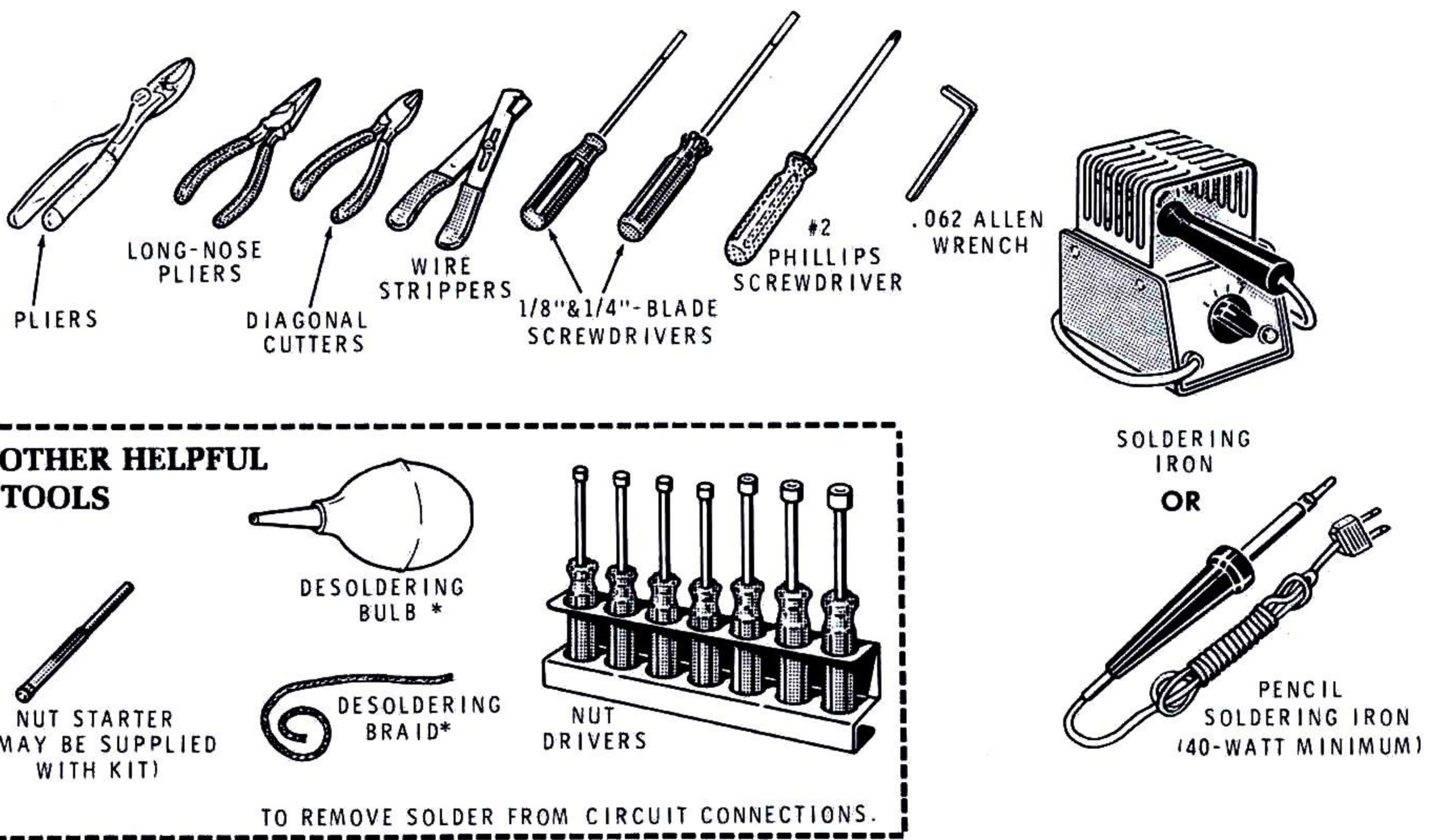
Save all packaging material until all parts have been located and/or until you have finished all the assembly steps.

NOTE: Never use a "171-, 172-, or 173-" packaging number if you must order replacement parts. Use only the part numbers listed in the Manual Parts Lists for this purpose.

ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.



ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.
2. 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.
3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
4. Position all parts as shown in the Pictorials.
5. Solder a part or a group of parts only when you are instructed to do so.

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

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

SOLDERING

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

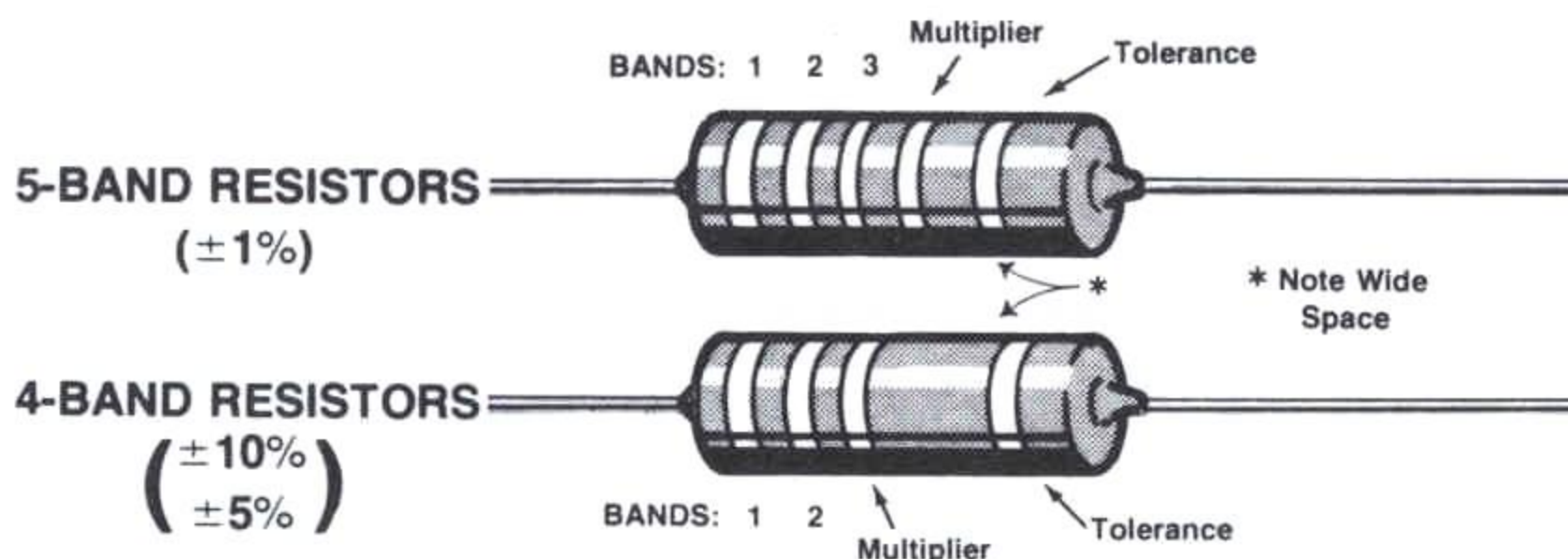
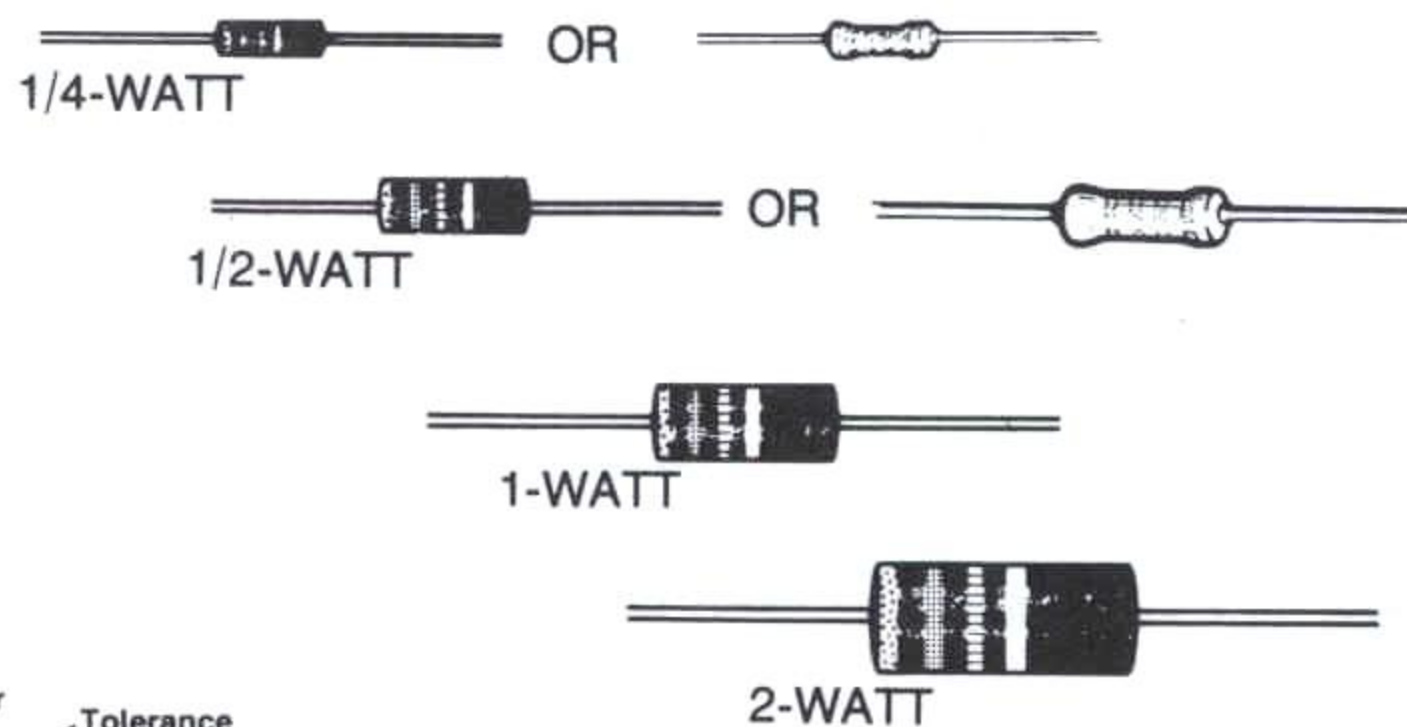
It is easy to make a good solder connection if you follow a few simple rules:

1. Use the right type of soldering iron. A 40-watt (or heavier) 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.

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

PARTS

Resistors will be called out by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). Certain types of resistors will have the value printed on the body, while others will be identified by a color code. The colors of the bands and the value will be given in the steps, therefore the following color code is given for information only. NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (Ω or $k\Omega$).



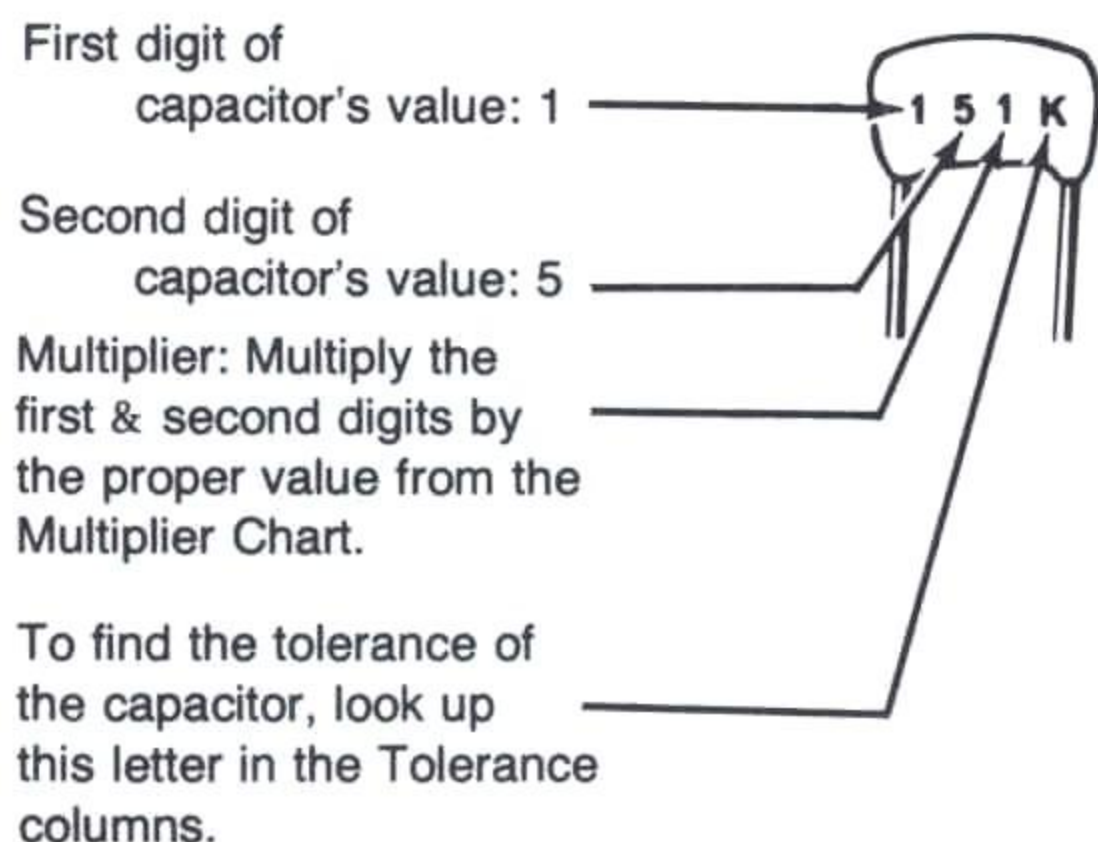
Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	±10%
Brown	1	Brown	1	Brown	1	Brown	10	Gold	±5%
Red	2	Red	2	Red	2	Red	100	Brown	±1%
Orange	3	Orange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

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

EXAMPLES:

151K = $15 \times 10 = 150$ pF
 759 = $75 \times 0.1 = 7.5$ pF

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



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

*DuPont Registered Trademark

PARTS LIST

Check each part against the following list. The key numbers correspond to the numbers on the Parts Pictorial (Illustration Booklet Pages 1, 2, and 3).

To order a replacement part, always include the Part Number and use the Parts Order Form furnished with

this kit. If a Parts Order Form is not available, refer to "Replacement Parts" at the rear of this Manual. Your Warranty is inside the front cover. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
RESISTORS				
1/4-Watt				
A1	6-2151-12	1	2150 Ω (red-brown-green-brown)	R10
A1	6-8871-12	1	8870 Ω (gray-gray-violet-brown)	R2
1/2-Watt				
A2	6-621	1	620 Ω (blue-red-brown)	R9
A2	6-102	1	1000 Ω (brown-black-red)	R25
A2	6-222	2	2200 Ω (red-red-red)	R21, R22
A2	6-472	1	4700 Ω (yellow-violet-red)	R31
A2	6-203	1	20 k Ω (red-black-orange)	R28
A2	6-273	3	27 k Ω (red-violet-orange)	R4, R5, R11
A2	6-473	2	47 k Ω (yellow-violet-orange)	R23, R29
A2	6-104	1	100 k Ω (brown-black-yellow)	R27
Other Resistors				
A3	1-8-1	1	68 k Ω , 1-watt (blue-gray-orange)	R24
A3	1-38-1	3	4.7 M Ω , 1-watt (yellow-violet-green)	R6, R7, R8
A3	3-1-2	1	.82 Ω , 2-watt, 1% (gray-red-silver) (same size as 1-watt)	R3
A4	3-25-5	1	1 Ω , 5-watt, 1% wire-wound	R1
A5	5-2-7	8	30 k Ω , 7-watt film	R12 through R19

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
CAPACITORS				
Mica				
B1	20-105	1	180 pF	C33
B1	20-124	7	115 pF	C16, C19, C26, C27, C28, C31, C58
B1	20-189	1	140 pF	C55
B1	20-108	1	200 pF	C56
B1	20-120	1	220 pF	C34
B1	20-139	1	330 pF	C57
B1	20-116	2	400 pF	C35, C39
B1	20-113	2	470 pF	C36, C38
B1	20-711	1	500 pF, 2KV	C62
B1	20-184	2	680 pF	C37, C41
Ceramic				
B2	21-79	1	.001 μ F, 6 KV	C7
B3	21-723	1	15 pF	C48
B3	21-140	2	.001 μ F, 500-volt (.001 M)	C47, C49
B3	21-70	1	.01 μ F	C32
B3	21-31	10	.02 μ F	C3, C5, C8, C21, C22, C23, C51, C52, C53, C54
B3	21-72	2	.005 μ F*	C1, C2

* These parts are critical for continued safety. Replace them only with parts of the same rating or with the proper Heath parts.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Other Capacitors

B4	21-165	2	.001 μ F (1000 PF), 6 KV ceramic	C6, C29
B5	25-19	1	20 μ F (20 MFD) electrolytic	C4
B6	25-224	8	200 μ F (200 MFD) electrolytic	C10 through C17
B7	26-145	1	Load capacitor	C61
B8	26-164	1	Tune capacitor	C59

CONTROLS — SWITCHES

C1	61-45	2	DPDT switch	SW1, SW2
C2	61-46	1	SPDT switch	SW5
C3	63-1399	1	4-position rotary switch	SW3
C4	63-1338	1	4-position rotary switch	SW4A
C5	63-562	1	Rotary switch wafer	SW4B
C6	65-28	2	Circuit breaker	CB1, CB2
C7	69-55	1	TPDT relay	K1

COILS — CHOKES — TRANSFORMERS

D1	40-1666	1	80/20 plate coil	L5
D2	40-2117	1	15-meter input coil	L8
D2	40-964	1	15-meter input coil	L7
D2	40-965	2	20-meter input coil	L1, L6
D2	40-966	1	40-meter input coil	L2
D2	40-1012	1	80-meter input coil	L3
D3	40-1950	1	Plate coil	L4
D4	45-53	2	Parasitic choke	PC1, PC2
D5	45-4	3	1 mH RF choke	RFC4, RFC5, RFC6
D6	45-6	1	8.5 mH RF choke	RFC2
D7	45-78	1	10.3 μ H RF choke	RFC3
D8	45-61	1	50 μ H RF choke	RFC1
D9	54-237	1	High-voltage transformer (packaged separately)	T1
D9	54-238	1	Low-voltage transformer	T2

DIODES — TUBES

E1	56-24	1	1N458 diode	D18
E1	56-26	1	1N191 diode (brown-white-brown)	D17
E1	57-27	15	1N2071 diode	D1 through D14, D16
E2	56-82	1	1N3996A diode with hardware	ZD1
E3	411-245	2	3-500Z tube	V1, V2

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
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METAL PARTS

F1	90-1303-1	1	Cabinet top
F2	90-1304-1	1	Cabinet bottom
F3	200-1435	1	Chassis
F4	100-1022	1	Capacitor bank bracket
F5	206-1444	1	Coil shield
F6	203-2147-1	1	Front panel
F7	203-2148-1	1	Rear panel
F8	203-2149	1	Left side panel
F9	203-2150	1	Right side panel
F10	204-1041	2	Angle bracket
F11	204-2102	1	Plate coil bracket
F12	205-723	1	Top rear plate cover
F13	205-724	1	Perforated top cover
F14	205-1794	2	Transformer mounting plate
F15	205-1780	1	Rectangular spacer
F16	206-493	1	RF shield
F17	258-115	1	5/8" \times 3-1/2" brass spring
F18	260-12	2	Plate connector
F19	456-7	1	Shaft coupler

PLASTIC PARTS

G1	255-59	2	Black tapered spacer
G2	261-9	4	Foot
	266-296	1	Fan blade
G3	354-5	6	Cable tie
G4	453-135	1	Phenolic shaft

HARDWARE

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

#6 Hardware

H1	250-1282	1	6-32 \times 1/8" allen setscrew
H1	250-230	6	6-32 \times 3/16" allen setscrew
H2	250-138	10	6-32 \times 3/16" screw
H3	250-1325	23	6-32 \times 1/4" black screw
H4	250-1419	1	6-32 \times 1/4" black flat head screw
H5	250-1432	29	#6 \times 3/8" black sheet metal screw
H6	250-1280	15	6-32 \times 3/8" black screw
H7	250-1420	24	6-32 \times 3/8" black flat head screw
H8	250-1425	4	6-32 \times 1/2" black screw
H9	250-206	13	6-32 \times 11/16" screw
H10	250-40	2	6-32 \times 1-1/2" screw
H11	250-1284	2	6-32 \times 1-9/16" black screw
H12	250-47	1	6-32 \times 2" screw
H13	252-3	53	6-32 nut
H14	253-1	17	#6 fiber flat washer
H15	253-2	2	#6 fiber shoulder washer

KEY HEATH QTY. DESCRIPTION
No. Part No.

Hardware (cont'd.)

H16	254-1	69	#6 lockwasher
H17	255-77	2	7/16" spacer
H18	255-103	1	6-32 × 5/16" metal spacer
H19	255-71	4	6-32 × 3/4" metal spacer
H20	255-21	3	6-32 × 7/8" metal spacer
H21	255-129	1	6-32 × 1-1/2" metal spacer
H22	259-1	22	#6 solder lug

#8 Hardware

J1	250-1436	4	8-32 × 3/8" black screw
J2	252-4	4	8-32 nut
J3	253-9	4	#8 flat washer
J4	254-2	5	#8 lockwasher
J5	255-66	1	8-32 × 1-3/8" spacer

#10 Hardware

J6	250-126	4	10-32 × 1/2" screw
J7	250-331	1	10-32 × 1" screw
J8	252-5	1	10-32 nut
J9	252-163	1	10-32 wing nut
J10	254-3	2	#10 lockwasher

Other Hardware

K1	207-8	2	Cable clamp
K2	250-213	8	4-40 × 5/16" screw
K3	252-15	8	4-40 nut
K4	252-7	2	Control nut
K5	252-32	1	Push-on nut
K6	253-10	2	Control flat washer
K7	253-42	1	1/2" flat washer
K8	253-19	5	3/4" flat washer
K9	254-5	2	Control lockwasher
K10	254-9	8	#4 lockwasher
K11	259-25	1	#10 double lug
K12	259-16	1	#10 spade lug
K13	259-24	1	Long solder lug

INSULATORS — GROMMETS — TERMINAL STRIPS — CONNECTORS

L1	71-2	1	Ceramic feedthrough insulator (disassembled in bag)
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KEY HEATH QTY. DESCRIPTION
No. Part No.

Insulators — Grommets — Terminal Strips — Connectors (cont'd.)

L2	73-4	1	5/16" grommet
L3	73-3	3	1/2" grommet
L4	73-2	1	3/4" grommet
L5	75-123	1	Line cord strain relief
	75-124	1	6" × 4-1/2" paper insulator
L6	75-125	8	Capacitor mounting insulator
L7	255-39	1	6-32 × 1-1/4" phenolic spacer
L8	255-42	3	6-32 × 3/4" phenolic spacer
L9	431-14	1	2-lug terminal strip
L10	431-10	2	3-lug terminal strip
L11	431-39	1	Small 5-lug terminal strip
L12	431-42	1	Large 5-lug terminal strip
L13	431-20	1	6-lug terminal strip
L14	431-13	1	4-screw terminal strip
L15	431-82	1	3-lug terminal collar
L16	432-137	14	Push-on connector
L17	432-199	1	Wire nut
L18	432-862	6	Male connector pin
L19	432-982	6	Female connector pin
L20	432-1090	1	Socket shell
L21	432-1091	1	Plug shell
L22	434-42	2	Phono socket
L23	434-93	2	5-lug ceramic tube socket
L24	436-5	2	Coaxial jack

WIRE — CABLE — SLEEVING

89-40	1	Line cord
340-1	36"	Medium bare wire
340-4	5"	Large bare wire
343-2	42"	Coaxial cable, RG-58A/U
343-8	14"	Coaxial cable, RG-8/U
344-2	60"	Medium black stranded wire
344-7	84"	Large black stranded wire
344-13	13"	Blue hookup wire (thick insulation)
344-118	30"	Large red stranded wire
344-146	24"	Large white stranded wire
345-1	3-1/2"	Large metal braid
345-2	9"	Untinned braided wire
346-4	12"	Small black sleeving
346-20	24"	Large black (heat-shrinkable) sleeving
346-26	7"	Large clear sleeving
346-29	8-1/2"	Small clear sleeving



KEY No.	HEATH Part No.	QTY.	DESCRIPTION
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Hookup Wire (small solid)

	344-50	54"	Black hookup wire
	344-51	42"	Brown hookup wire
	344-52	24"	Red hookup wire
	344-53	18"	Orange hookup wire
	344-54	24"	Yellow hookup wire
	344-55	36"	Green hookup wire
	344-56	30"	Blue hookup wire

MISCELLANEOUS

	74-29	8"	Double-sided tape
	85-344-2	1	Printed circuit board
M1	352-13	1	Silicone grease
M2	407-763	1	Plate current meter
M3	407-764	1	Plate volt meter
M4	412-31	1	Small lamp
M5	413-10	1	Red lens
M6	413-43	1	Diffuser
M7	420-621	1	Fan motor

CIRCUIT Comp. No.

M1
M2
PL1

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

Miscellaneous (Cont'd.)

M8	462-1130	1	Small knob
M9	462-1155	3	Large knob
	489-1	1	Sandpaper
M10	490-5	1	Nut starter Solder

PRINTED MATERIAL

	390-147	1	"Danger High Voltage" label
	390-2532-1	1	FCC label
		1	Blue and white label
	597-260	1	Parts Order Form
		1	Assembly Manual (See title page for part number)

STEP-BY-STEP ASSEMBLY

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.

CIRCUIT BOARD ASSEMBLY

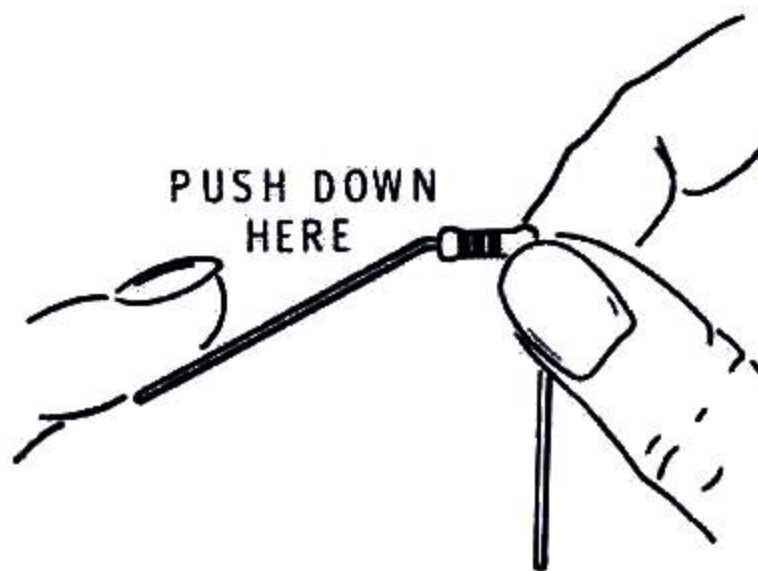
START

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.

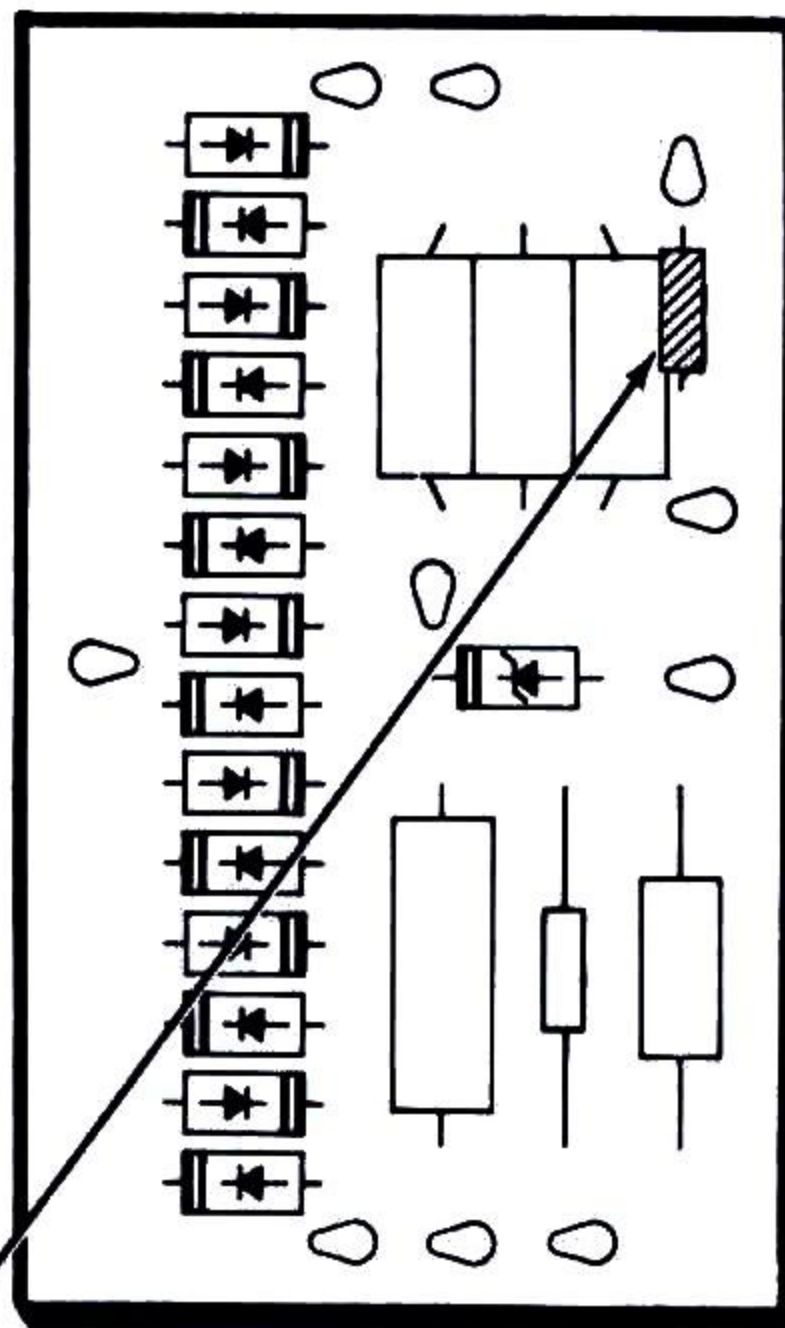
NOTE: When you install a component that has its value printed on it, position the value marking up, so it can be easily read. Diodes should be mounted with their type or part number up, if possible.

- () Hold a 620 Ω , 1/2-watt (blue-red-brown) resistor and bend the leads straight down to fit the hole spacing on the circuit board.



- () R9: Push the resistor leads through the holes at the indicated location on the circuit board. The end with color bands may be positioned either way.

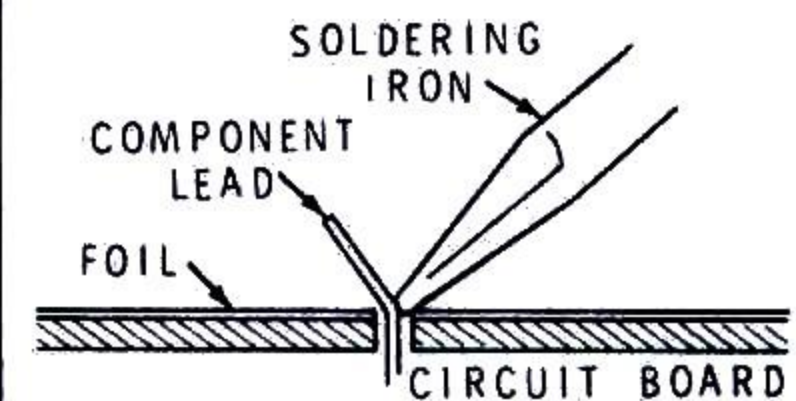
- () Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.



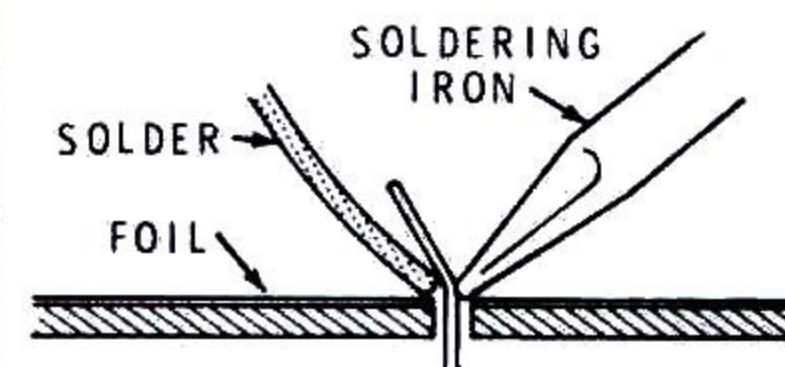
CONTINUE

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

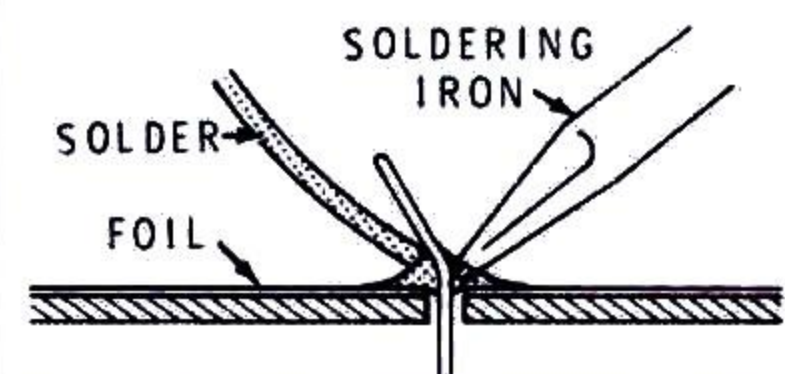
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat both for two or three seconds.



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.

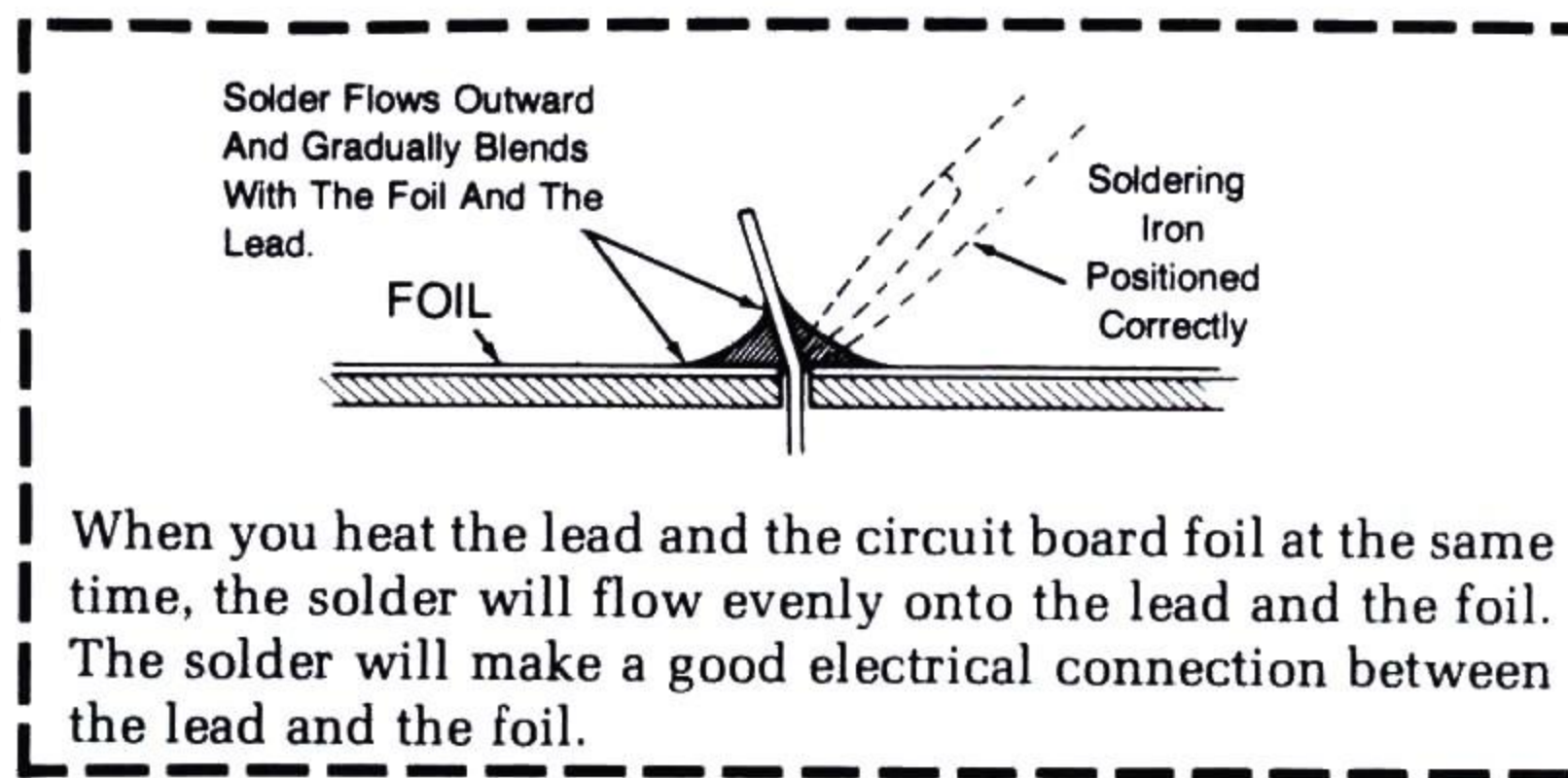


- () Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.

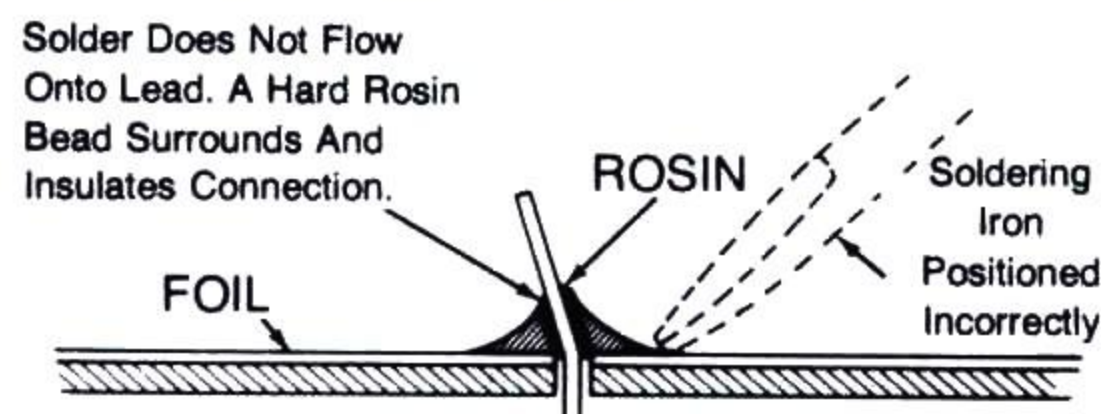
- () Check each connection. Compare it to the illustrations on Page 15. After you have checked the solder connections, proceed with the assembly on Page 16. Use the same soldering procedure for each connection.

PICTORIAL 1-1

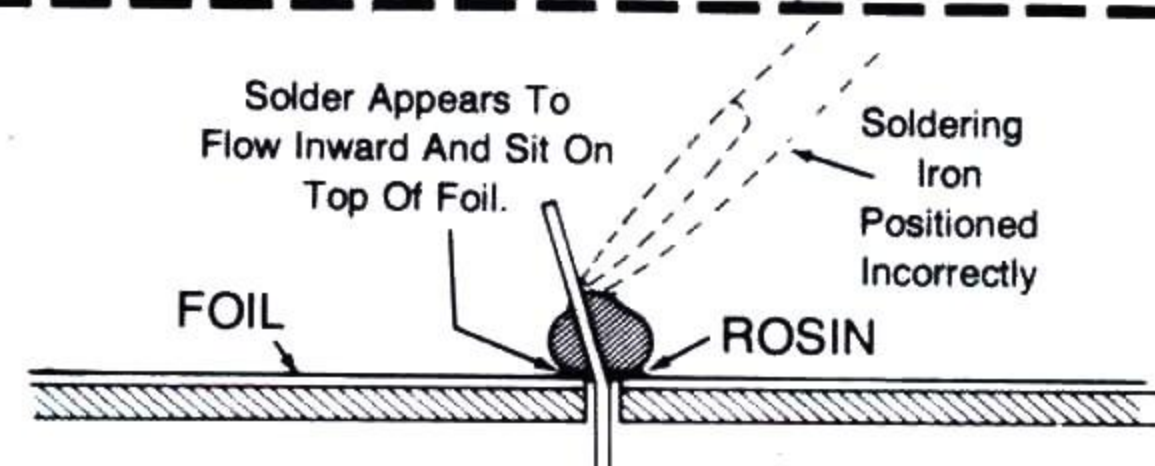
A GOOD SOLDER CONNECTION



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.

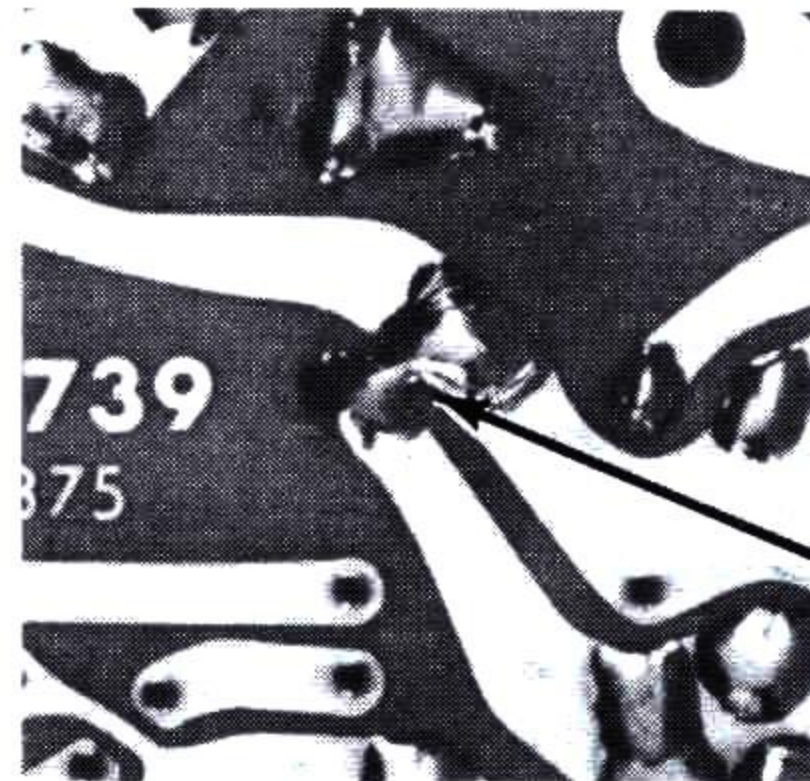


When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph A. 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. NOTE: It is alright for solder to bridge two connections on the same foil.

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. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.



A

SOLDER BRIDGE

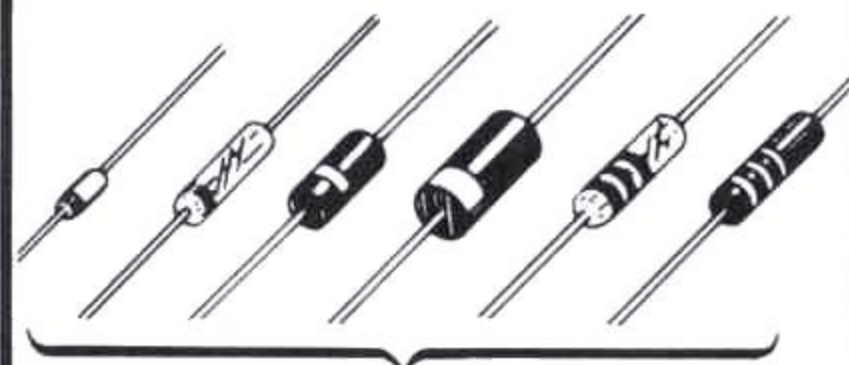


B

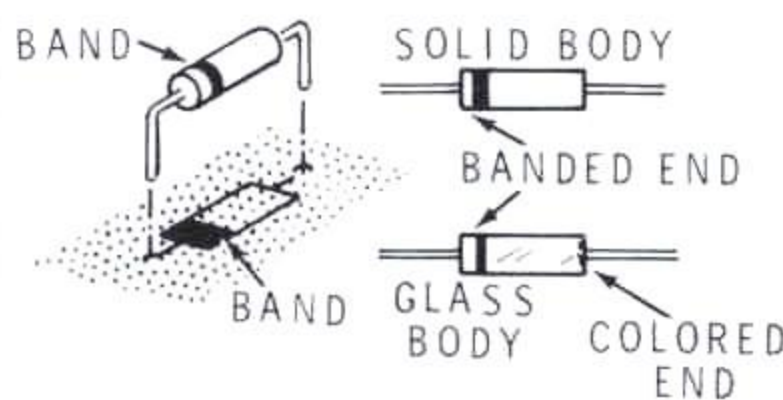
START ↘

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. THE CIRCUIT WILL NOT WORK IF THE DIODE IS INSTALLED BACKWARDS.

IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.



BANDED END



() Install 1N2071 diodes (#57-27) at D7, D5, D3, D1, D9, D11, and D13. Make sure all seven cathode banded ends are to the **right**.

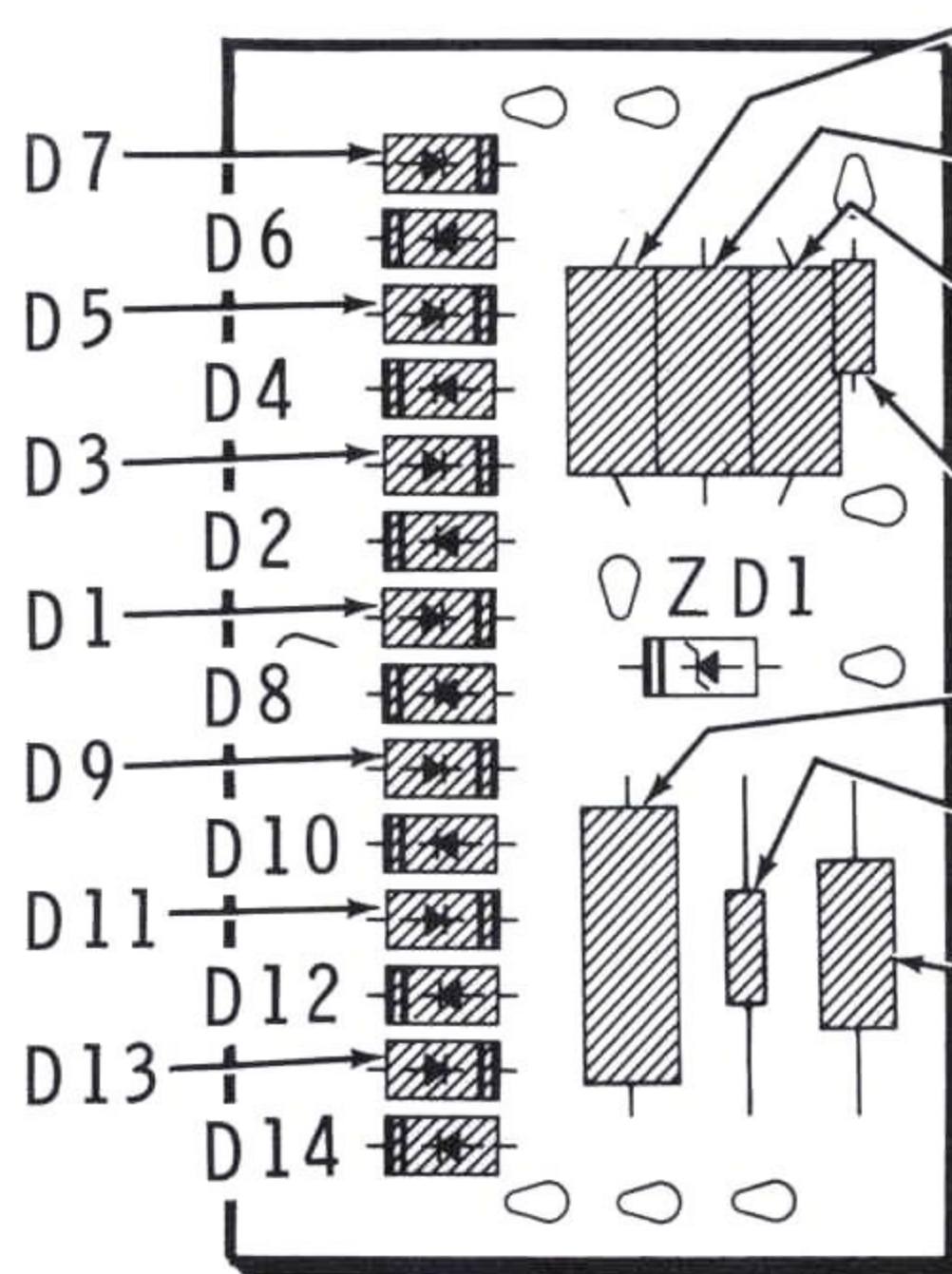
() Solder all the leads to the foil and cut off the excess lead lengths.

() Install 1N2071 diodes (#57-27) at D6, D4, D2, D8, D10, D12, and D14 with their cathode ends to the **left**.

() Solder all the 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 ↘



() R6: 4.7 MΩ, 1-watt (yellow-violet-green).

() R7: 4.7 MΩ, 1-watt (yellow-violet-green).

() R8: 4.7 MΩ, 1-watt (yellow-violet-green).

() R9: Be sure you installed 620 Ω (blue-red-brown) resistor R9 in Pictorial 1-1, on Page 14.

() R1: 1 Ω, 5-watt wire-wound.

() R2: 8870 Ω, 1/4-watt (gray-gray-violet-brown).

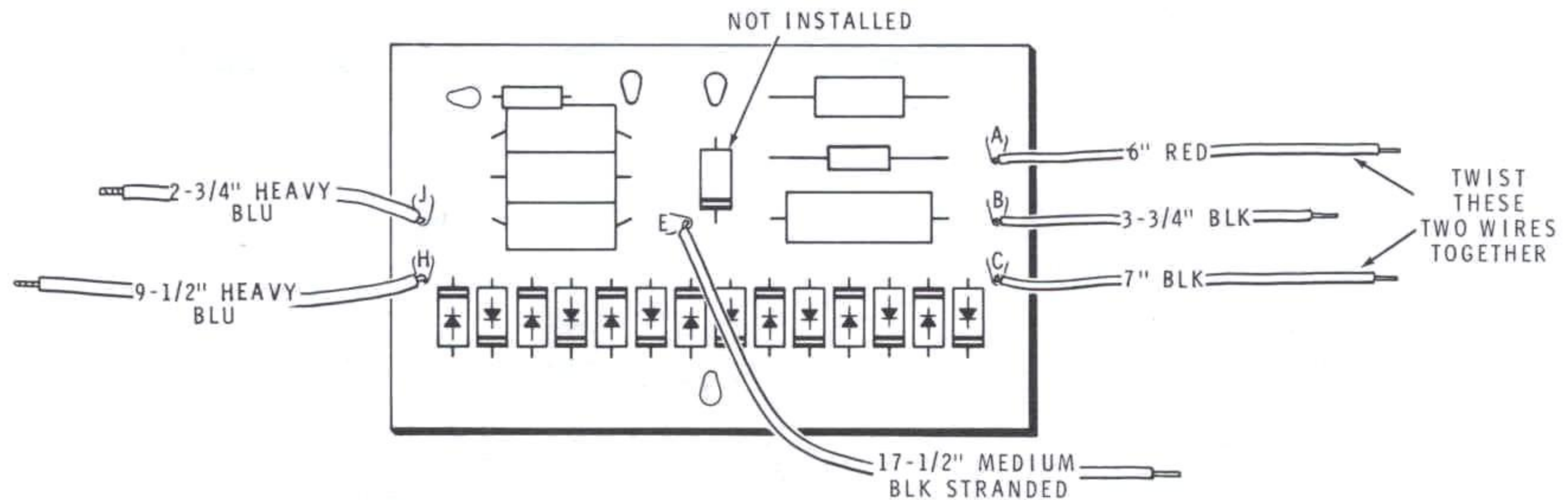
() R3: .82 Ω, 2-watt, wire-wound (gray-red-silver-gold).

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

NOTE: No component will be installed directly onto the circuit board at ZD1.

PICTORIAL 1-2





PICTORIAL 1-3

CIRCUIT BOARD PREWIRING

NOTE: To prepare wires, as in the following step, cut each wire to the length indicated 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 fine 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:

6" red

7" black

3-3/4" black

17-1/2" medium black **stranded** wire

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

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

Refer to Pictorial 1-3 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 to the foil side of the board as you install it, then cut off the excess wire ends.

() Connect a 6" red hookup wire to circuit board hole A.

() Connect a 7" black hookup wire to circuit board hole C.

() Twist together the red and black wires coming from A and C.

() Connect a 3-3/4" black hookup wire to circuit board hole B.

() Connect a 17-1/2" medium black **stranded** wire to circuit board hole E.

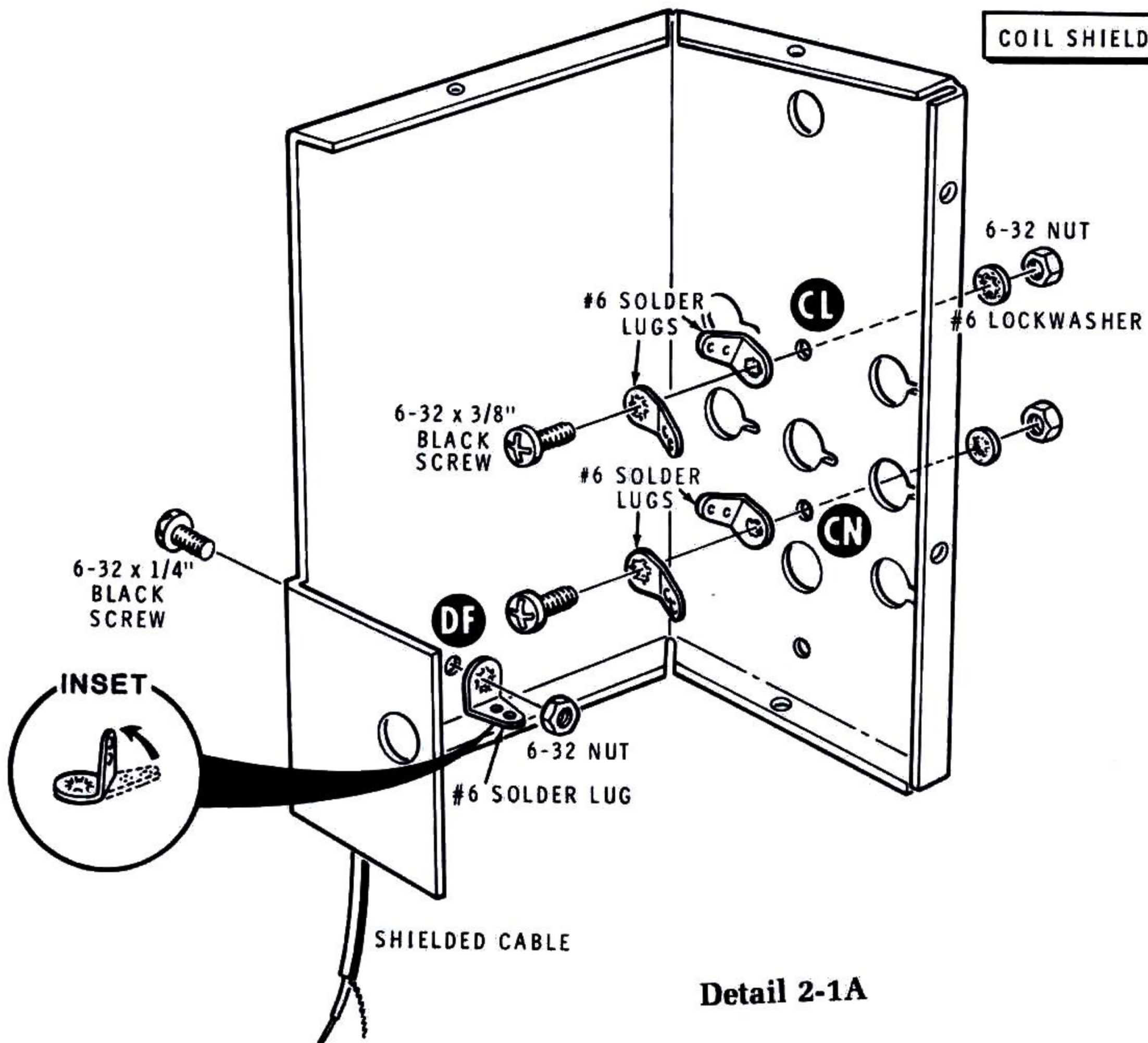
() Connect a 9-1/2" heavy blue hookup wire to circuit board hole H.

() Connect a 2-3/4" heavy blue hookup wire to circuit board hole J.

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

() Carefully inspect the foil side of the circuit board; all lettered holes except D, F, G, and K should be soldered. Make sure there are no solder bridges between foils. Also note that one diode (ZD1) is not installed.

This completes the "Circuit Board Prewiring." Set the board aside until it is called for later. Proceed with "Input Coil Assembly."



Detail 2-1A

INPUT COIL ASSEMBLY

Refer to Pictorial 2-1 (Illustration Booklet, Page 4) for the following steps.

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

NOTE: The term "hardware" in the following steps refers to the screws, nuts, and lockwashers you will use to mount parts. The phrase "Use 6-32 × 3/8" black hardware," for example, means to use a 6-32 × 3/8" black 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 #4 and #6 nuts and start them on screws.

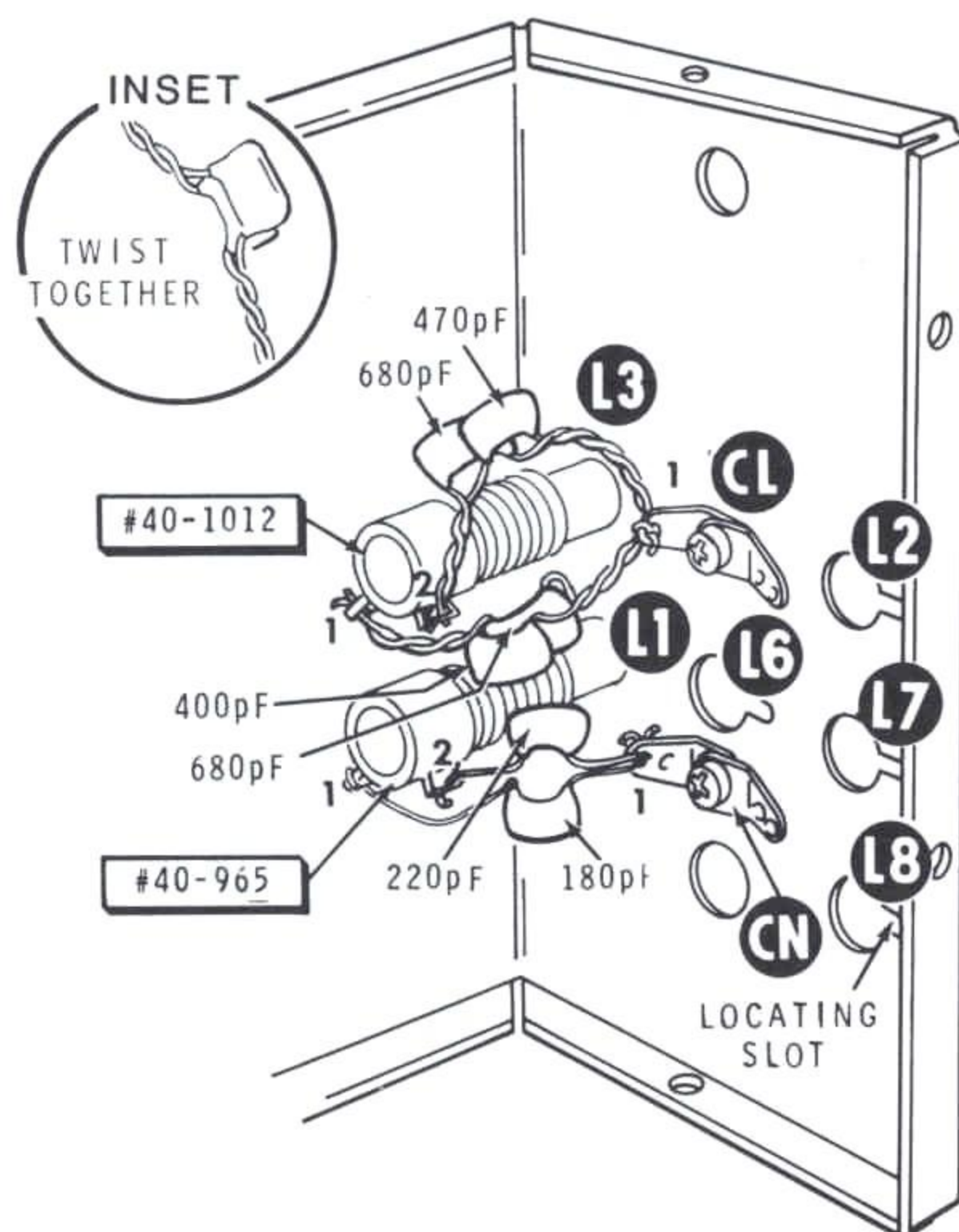
- () Install two #6 solder lugs on the coil shield (#206-1444) at CL with 6-32 × 3/8" black hardware. Position the lugs as shown in Detail 2-1B.

- () In the same manner, install two #6 solder lugs at hole CN.

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

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.

- () L3: Refer to Detail 2-1C and install the 80-meter coil (#40-1012) at L3.



Detail 2-1B

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

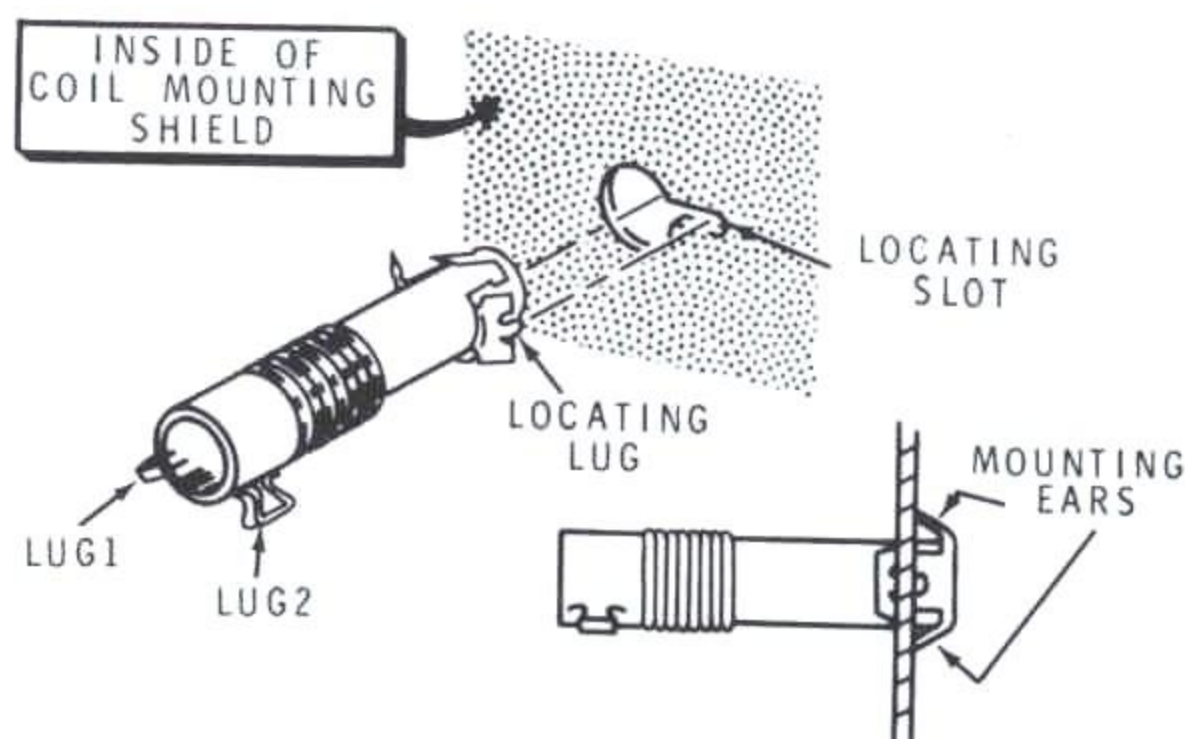
NOTE: When you wire capacitors to the coils in the following steps, position the body of each capacitor against its coil. However, be sure the capacitor leads do not touch the wire of the coil.

Note the positions of lugs 1 and 2 of coil L3 as shown in Detail 2-1B.

- () Refer to the inset drawing on Detail 2-1B and twist together the leads of a 470 pF (C38) and a 680 pF (C37) mica capacitor as shown.

NOTES:

1. In the following steps, each twisted pair of leads will be counted as **two** leads in a solder step.

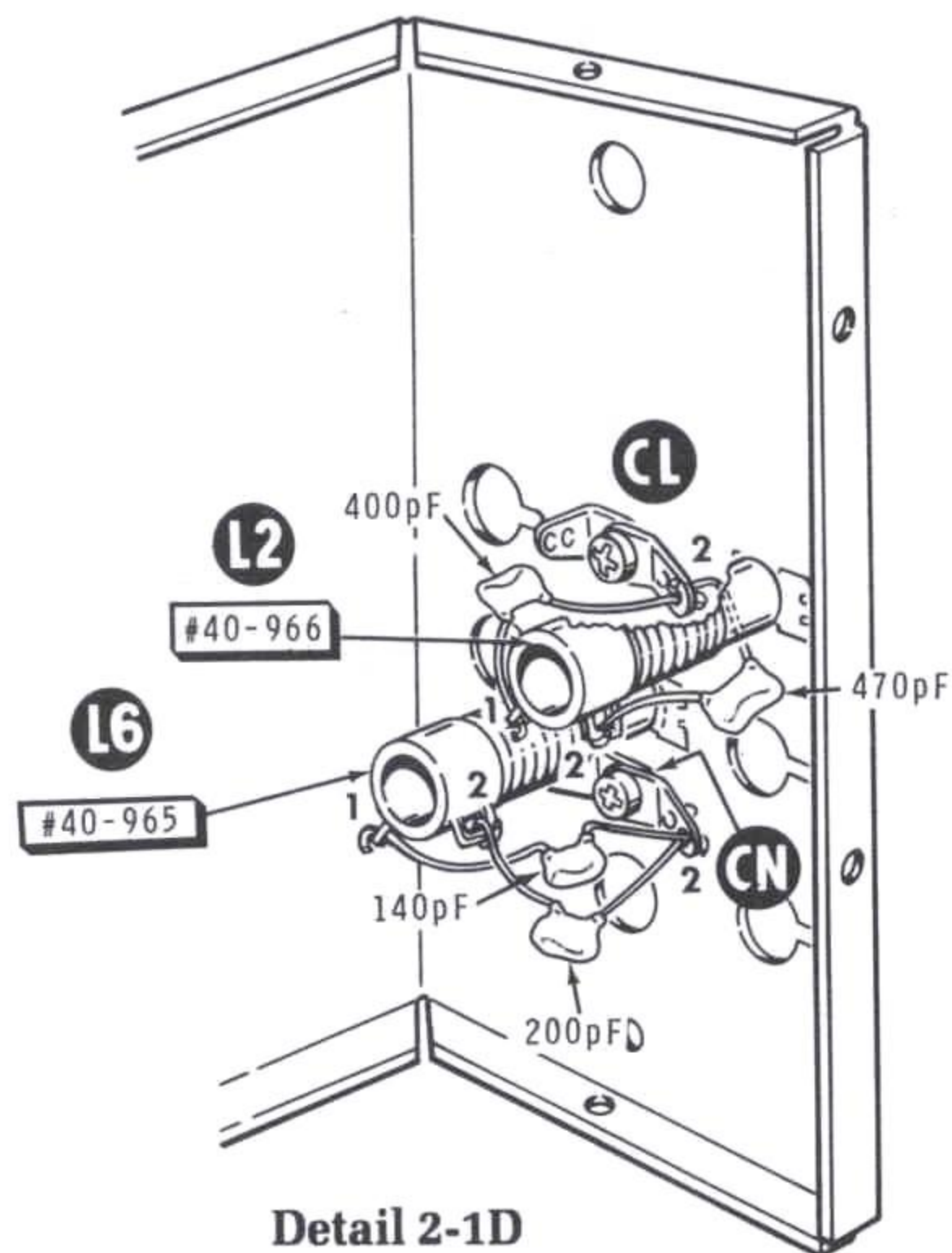


Detail 2-1C

2. (NS) means not to solder the connection because other wires will be added later. (S-) with a number, such as (S-3), means to solder the connection. The number tells how many wires are in the connection.

- () C39, C41: Connect one pair of twisted leads of the 470 pF and 680 pF capacitors to coil L3 lug 2 (NS), and connect the other pair of leads to ground lug CL1 (NS).
- () C37, C38: Twist together the leads of a 400 pF mica and a 680 pF mica capacitor as in a previous step. Connect one pair of twisted leads to coil L3 lug 1 (NS) and the other pair to ground lug CL1 (S-4). Position the capacitors as shown.
- () L1: Install the 20-meter coil (#40-965) at L1.
- () C33: Connect a 180 pF mica capacitor from coil L1 lug 1 (NS) to ground lug CN1 (NS).
- () C34: Connect a 220 pF mica capacitor from coil L1 lug 2 (NS) to ground lug CN1 (S-2).

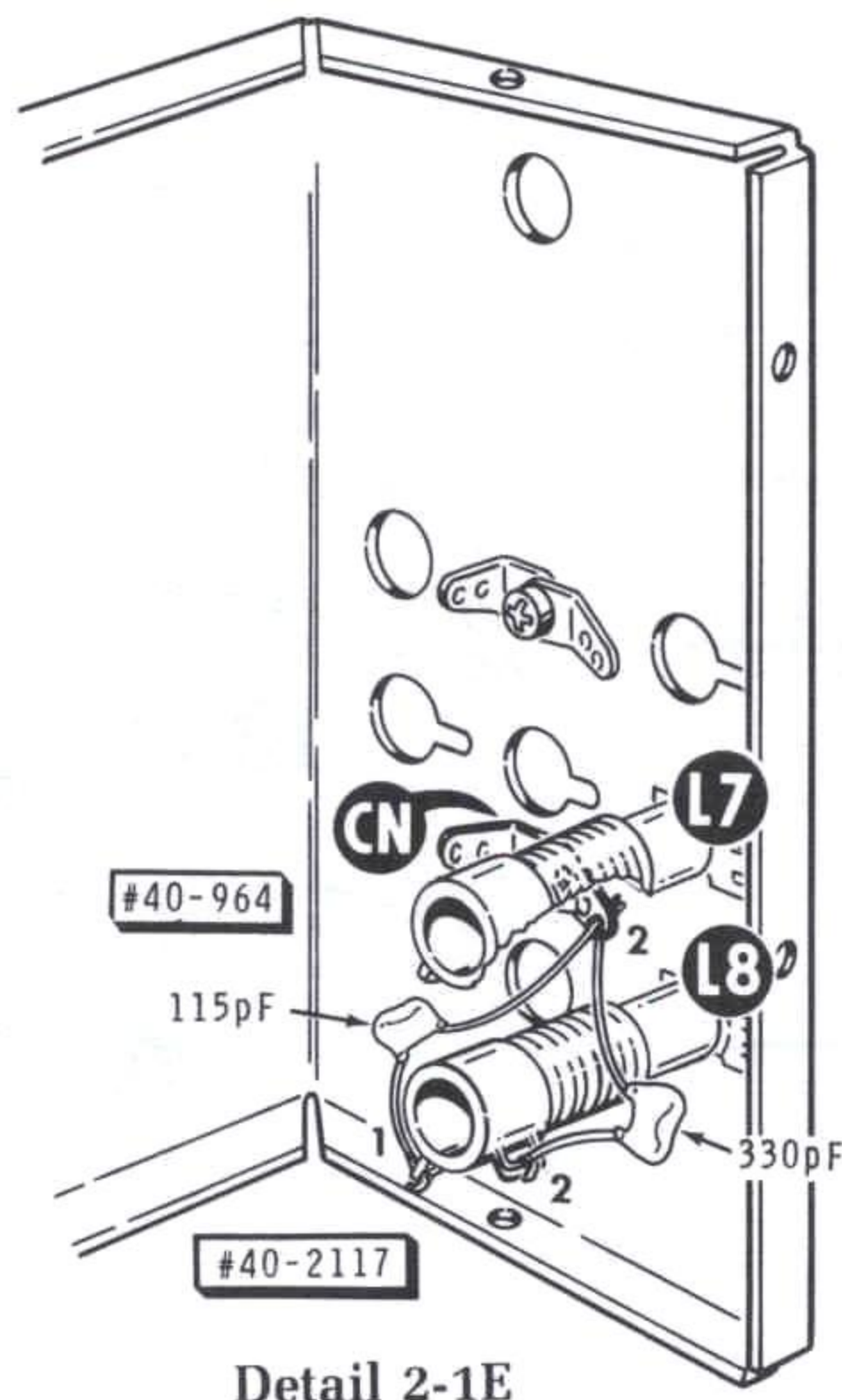




Detail 2-1D

Refer to Detail 2-1D for the next six steps.

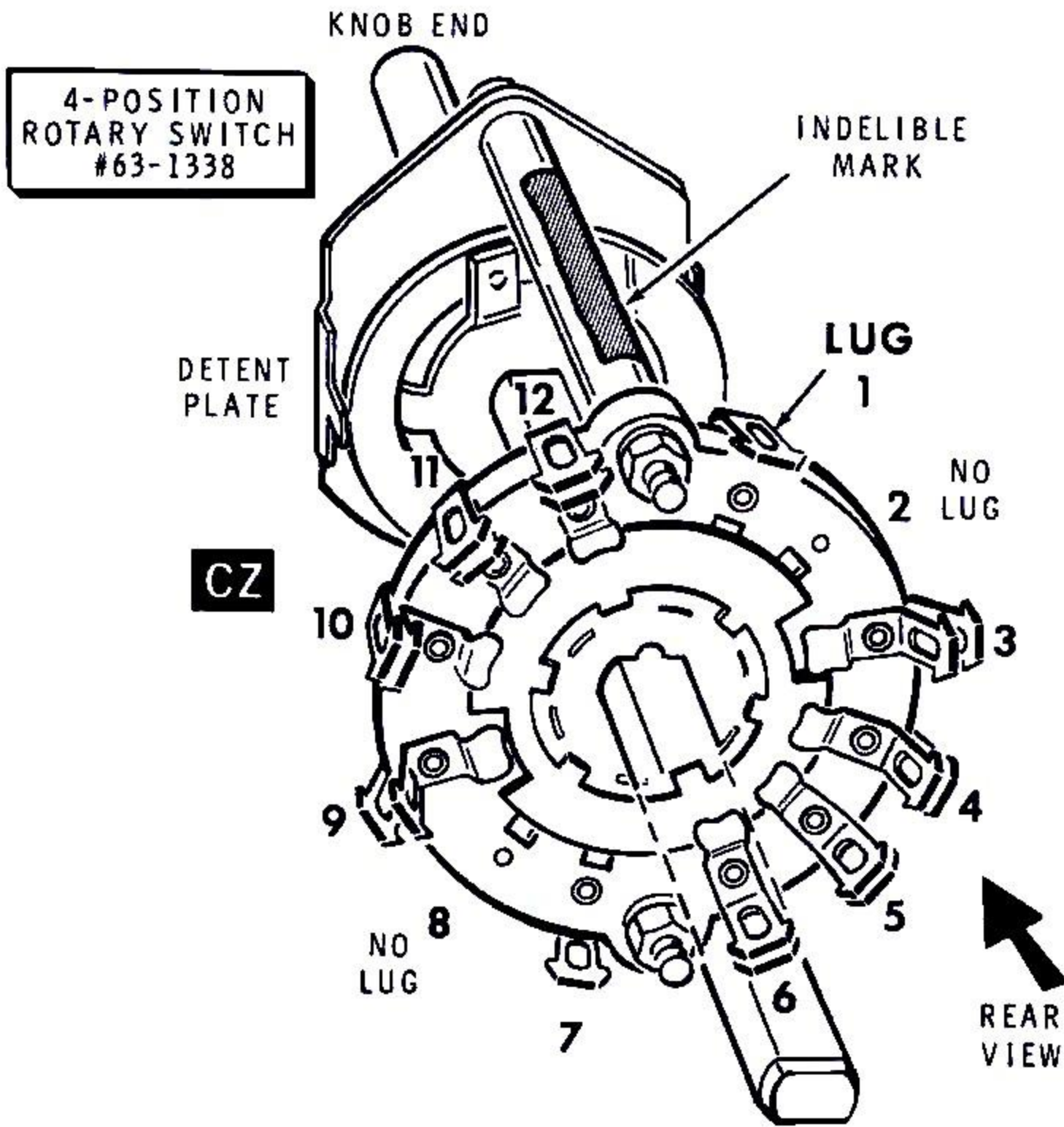
- () L6: Install the 20-meter coil (#40-965) at L6. NOTE: This coil is actually used in the 15-meter circuit.
- () C55: Connect a 140 pF mica capacitor from coil L6 lug 1 (NS) to ground lug CN2 (NS).
- () C56: Connect a 200 pF mica capacitor from coil L6 lug 2 (NS) to ground lug CN2 (NS).
- () L2: Install the 40-meter coil (#40-966) at L2.
- () C35: Connect a 400 pF mica capacitor from coil L2 lug 1 (NS) to ground lug CL2 (NS).
- () C36: Connect a 470 pF mica capacitor from coil L2 lug 2 (NS) to ground lug CL2 (S-2).



Detail 2-1E

Refer to Detail 2-1E for the next four steps.

- () L7: Install a 15-meter coil (#40-964) at L7.
- () L8: Install a 15-meter coil (#40-2117) at L8.
- () C58: Connect a 115 pF mica capacitor from coil L8 lug 1 (NS) to ground lug CN2 (NS).
- () C57: Connect a 330 pF mica capacitor from coil L8 lug 2 (NS) to ground lug CN2 (S-4).



Detail 2-1F

Refer to Detail 2-1F for the next four steps.

- () 1. Locate the 4-position rotary switch (#63-1338).

NOTE: The switch **detent plate** may be different than illustrated in these drawings.

- () 2. As viewed from the **knob** end, turn the switch shaft fully clockwise.
- () 3. Position the switch with the switch detent as shown. Note that the switch wafer is symmetrical. Mark the **top** switch spacer with an indelible pencil, pen, or other marker.
- () 4. **IMPORTANT:** From the marked **top** switch spacer, as viewed from the rear, the **top lug** immediately clockwise from the marked spacer, as shown, is **switch CZ lug 1**. All switch-lug positions are numbered clockwise as indicated, even when there is no lug at a given location.

Refer to Detail 2-1G for the next nine steps.

- () 1. Position the 4-position rotary switch on your work area as shown.
- () 2. Prepare the following black hookup (solid) wires:

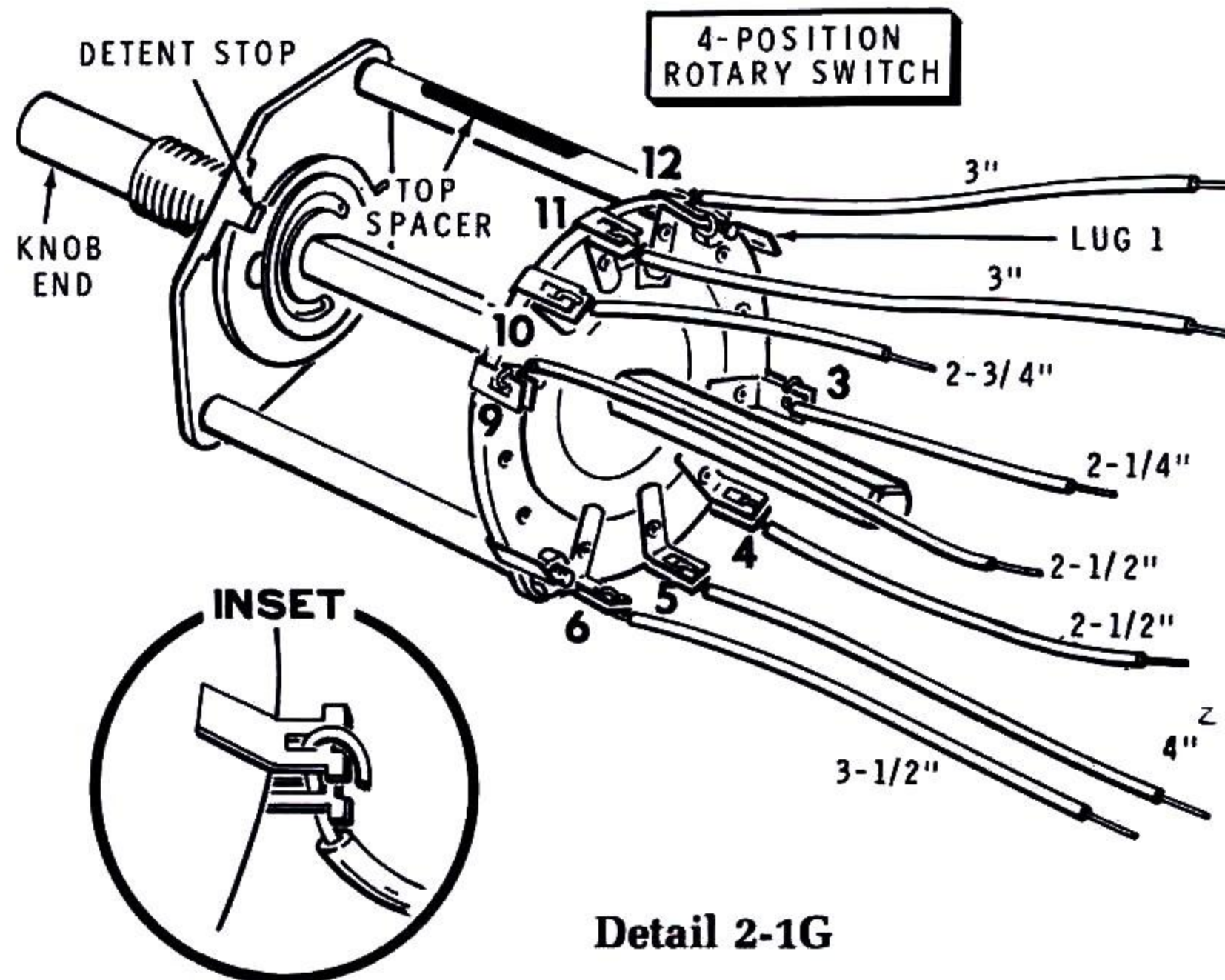
2-1/4"	2-1/2"
2-1/2"	2-3/4"
4"	3"
3-1/2"	3"

NOTES:

- 1. 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 another switch lug at the same position, it will count as **three** wires (S-3) in the solder instructions.
- 2. When you connect a wire to the 4-position rotary switch, be sure to wrap the wire end around **both** switch lugs before you solder the connection, as shown in the inset drawing on Detail 2-1G. The free wire ends will be connected later.

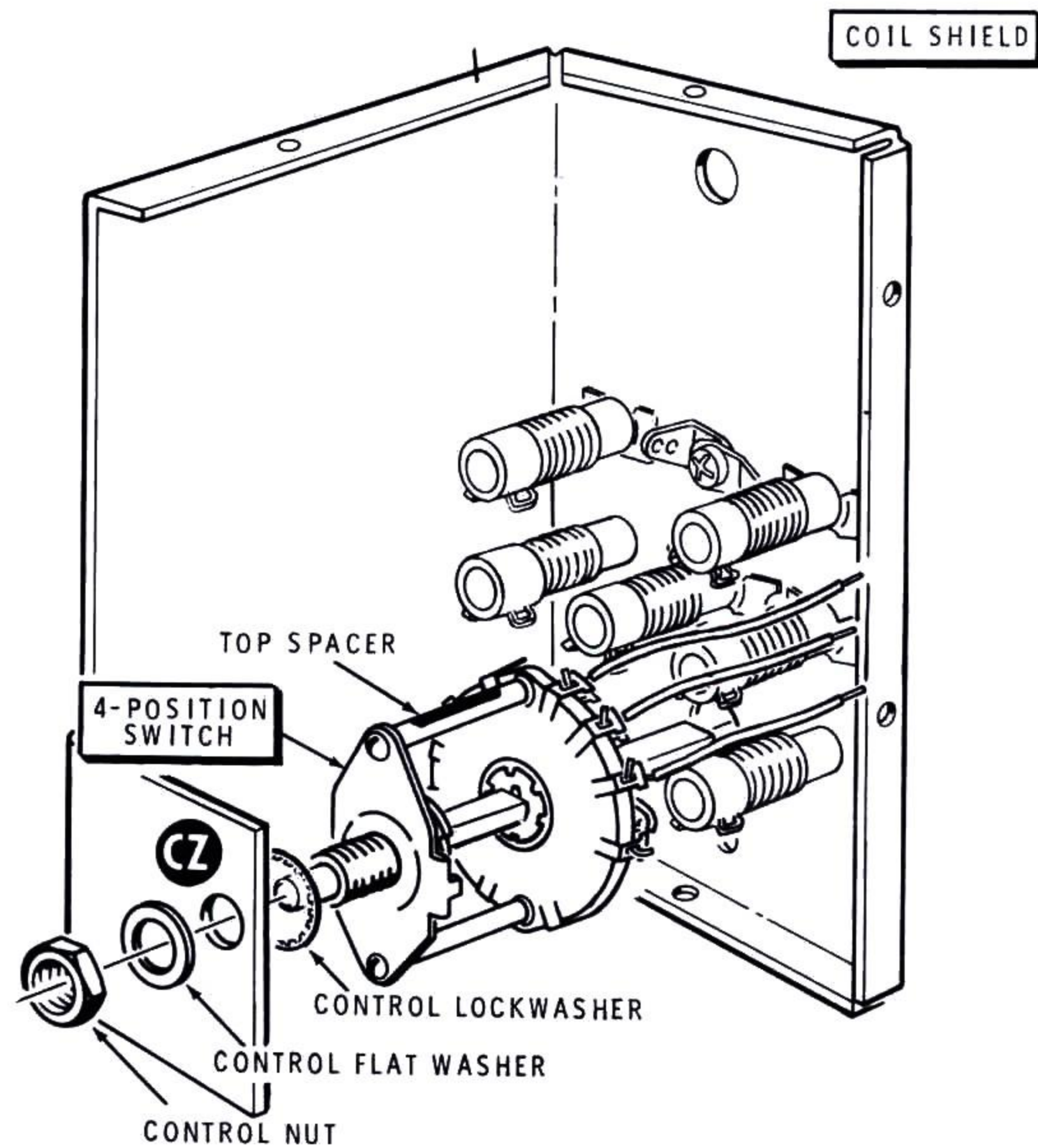
Connect the prepared wires to the rotary switch as follows:

- () 3. Connect a 2-1/4" black wire to switch lug 3 (S-3).
- () 4. Connect a 2-1/2" black wire to switch lug 4 (S-3).
- () 5. Connect a 4" black wire to switch lug 5 (S-3).
- () 6. Connect a 3-1/2" black wire to switch lug 6 (S-3).
- () 7. Connect a 2-1/2" black wire to switch lug 9 (S-3).
- () 8. Connect a 2-3/4" black wire to switch lug 10 (S-3).
- () 9. Connect a 3" black wire to switch lug 11 (S-3).
- () 10. Connect a 3" black wire to switch lug 12 (S-3).



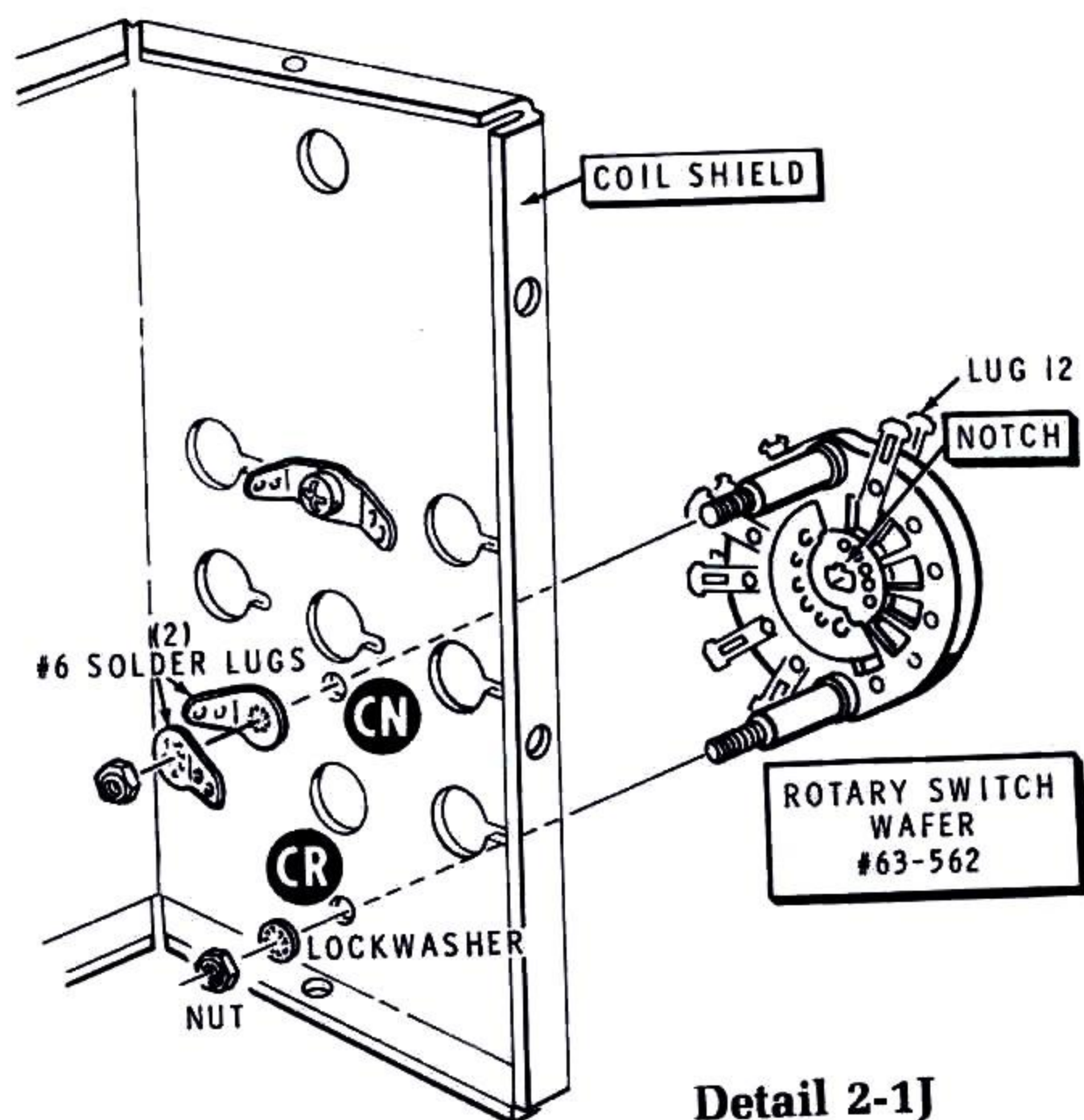
Heathkit®

- () SW4: Refer to Detail 2-1H and mount the 4-position rotary switch on the coil/filter shield at CZ. Use a control lockwasher, a control flat washer, and a control nut. Be sure the two switch spacers are aligned vertically and that the **marked top** spacer is positioned as shown. Tighten the hardware only finger tight.

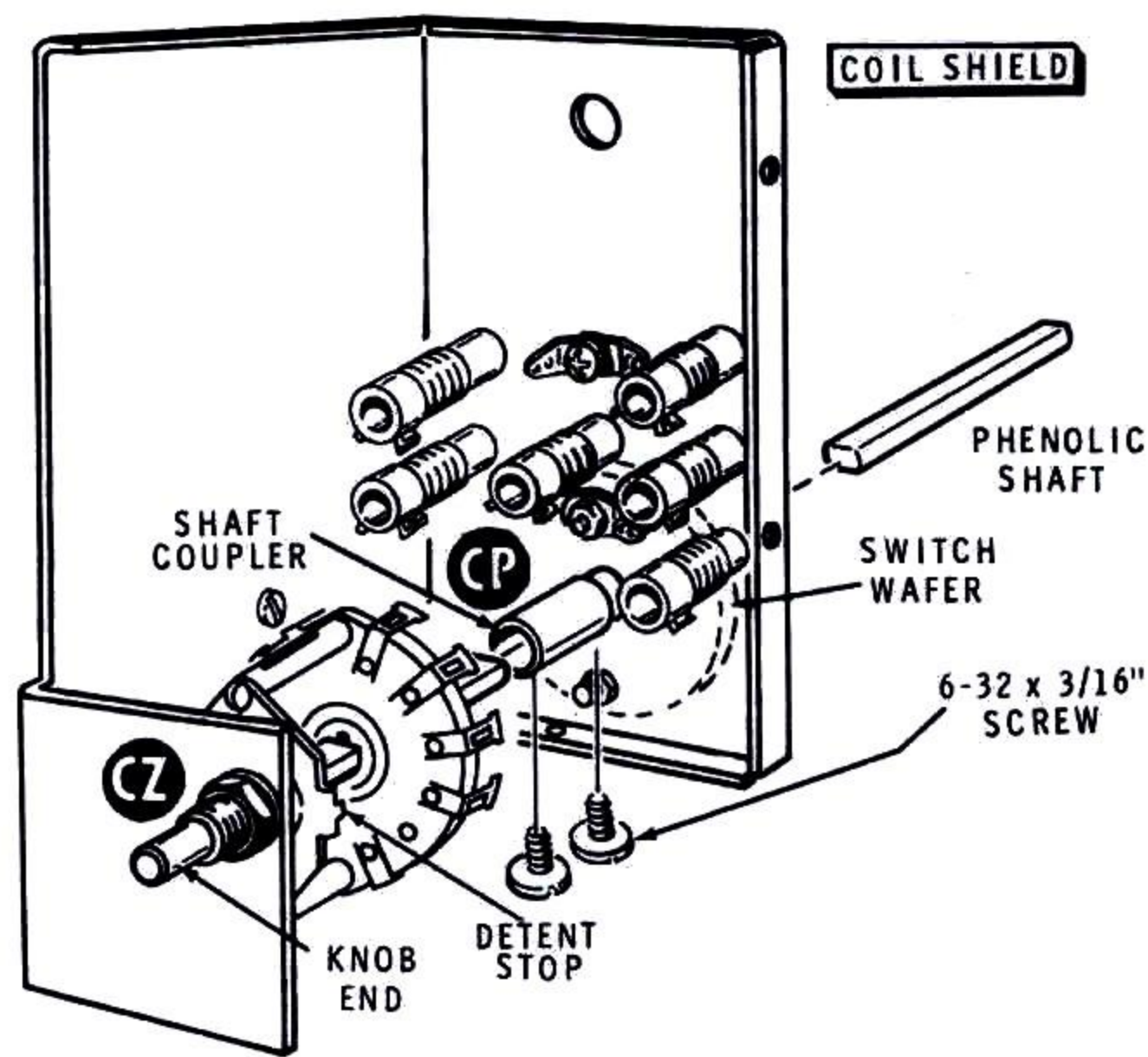


Detail 2-1H





Detail 2-1J



Detail 2-1K

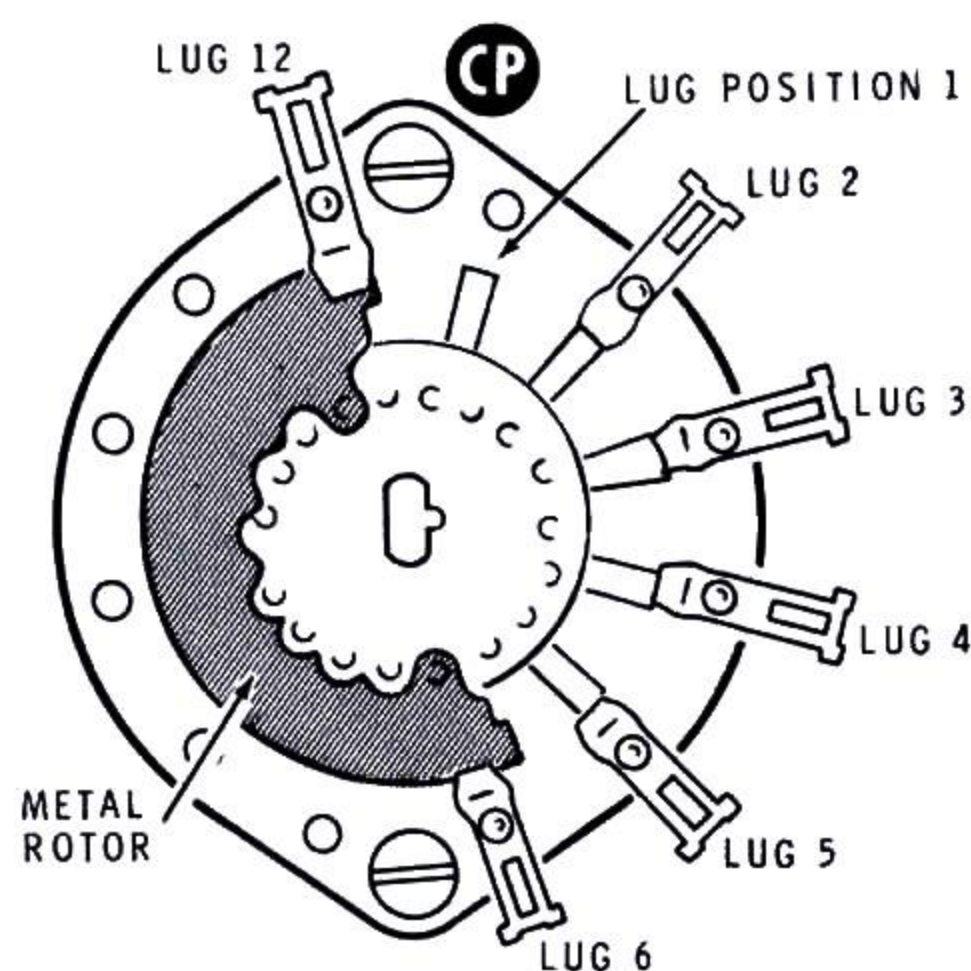
- () Remove the hardware that holds the (wired) ground lugs at hole CN. See Detail 2-1J.
- () Refer to Detail 2-1J and remove the two nuts from the screws passing through the two spacers of the separate rotary switch wafer (#63-562). Retain the spacers on the screws.
- () SW4B: Insert the bared screw ends into hole CN (and the (wired) ground lugs at CN) and hole CR of the coil shield with lug 12 positioned as shown. Secure the switch with one #6 lockwasher and with one nut previously removed at CR. Secure the switch at CN with two #6 solder lugs and a switch nut. Position the solder lugs as shown.
- () Position the rotating portion of the switch wafer as shown so the notch points between switch lugs 1 and 12. The phenolic shaft (#453-135) may be used to turn the switch rotor.

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

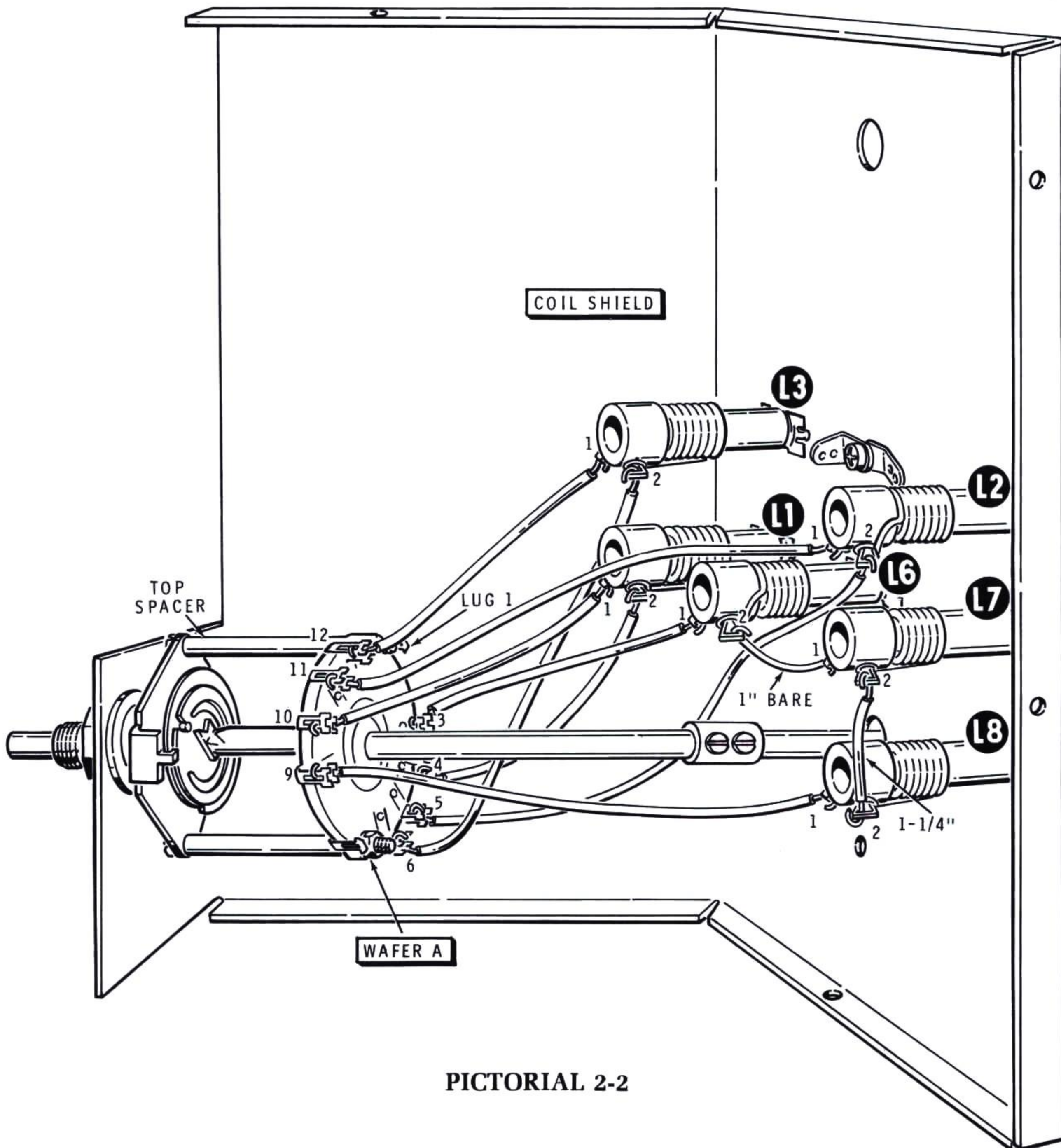
- () Check to be sure that switch CZ is still turned fully clockwise (viewed from the knob end).
- () Start two 6-32 × 3/16" screws into the tapped holes of the shaft coupler (#456-7). Then slide half the length of the shaft coupler onto the shaft of switch CZ and tighten one screw. The screws should be at the six o'clock position (viewed from the shaft end).
- () Slide the phenolic shaft (#453-135) through the switch wafer on the rear of the coil shield, through hole CP in the shield, and into the shaft coupler. Tighten the remaining screw in the shaft coupler onto the phenolic shaft.

Refer to Pictorial 2-1 and Detail 2-1K and Detail 2-1L for the next three steps.

- () Hold the 4-position rotary switch detent (at CZ) stationary and turn the shaft coupler fully counterclockwise, as viewed from the knob end.
- () Note the metal rotor of switch wafer CP. Turn the switch detent at CZ slightly so the metal rotor of switch wafer CP makes equal contact on lugs 6 and 12 as shown. Then tighten the mounting hardware on switch CZ.
- () Refer to Detail 2-1L and check the metal rotor of switch wafer CP again. If the metal rotor extends past lug 6, arcing can occur between the rotor and lug 5.
- () Turn the switch shaft through each of its four positions and check the metal rotor to make sure it makes contact with each lug in turn.



Detail 2-1L



Refer to Pictorial 2-2 for the following steps.

- () Remove all the insulation from a 1" length of black hookup wire. Connect this wire from coil L6 lug 2 (S-2) to coil L7 lug 1 (S-1).
- () Prepare a 1-1/4" black hookup wire. Connect this wire from coil L7 lug 2 (S-1) to coil L8 lug 2 (S-2).

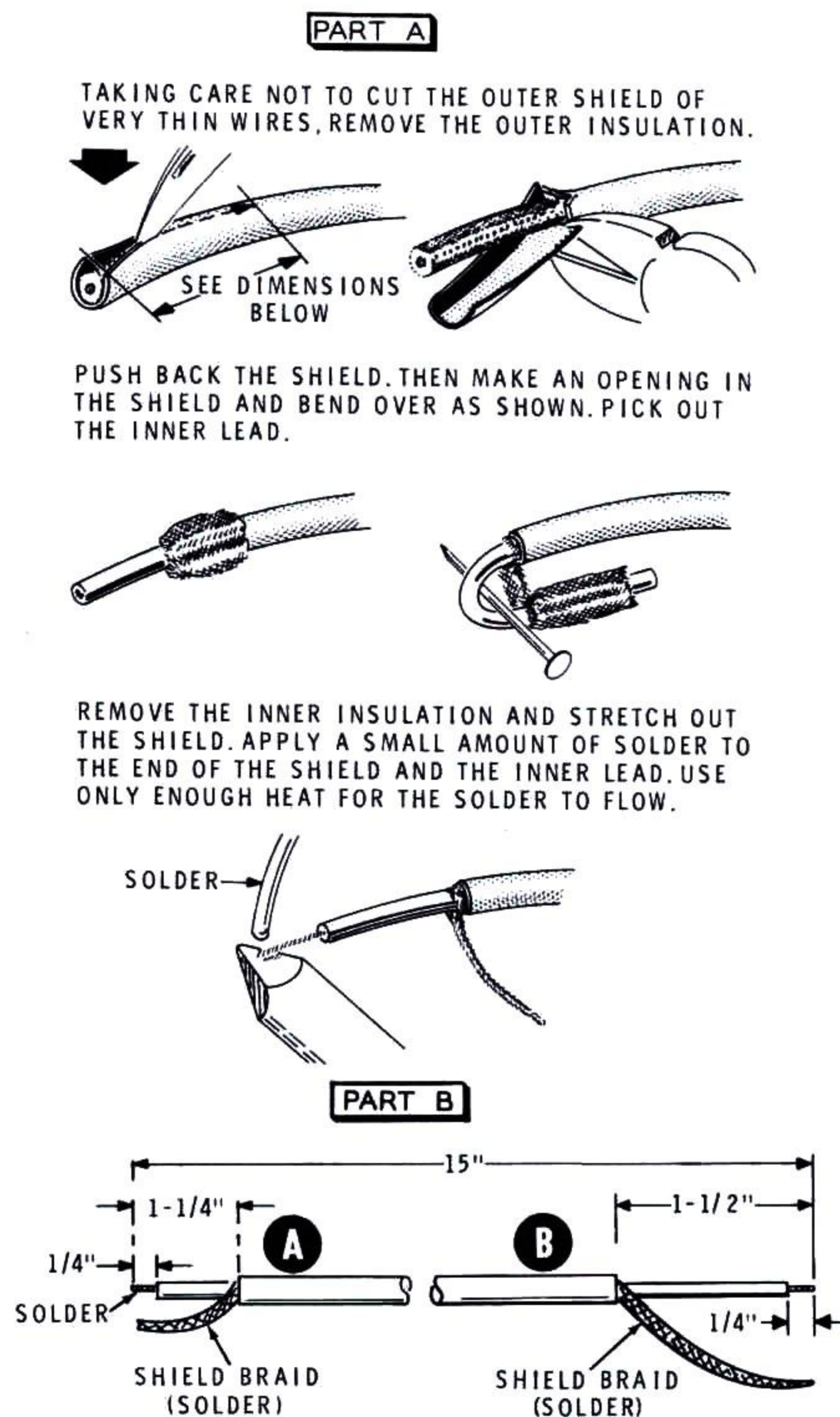
Route and connect the prepared hookup wires coming from switch CZ as follows:

Wire Length	Coming From Switch CZ Wafer A	Connect To
() 2-1/4"	Lug 3	Coil L6 lug 1 (S-2)
() 2-1/2"	Lug 4	Coil L1 lug 2 (S-2)
() 4"	Lug 5	Coil L2 lug 2 (S-2)

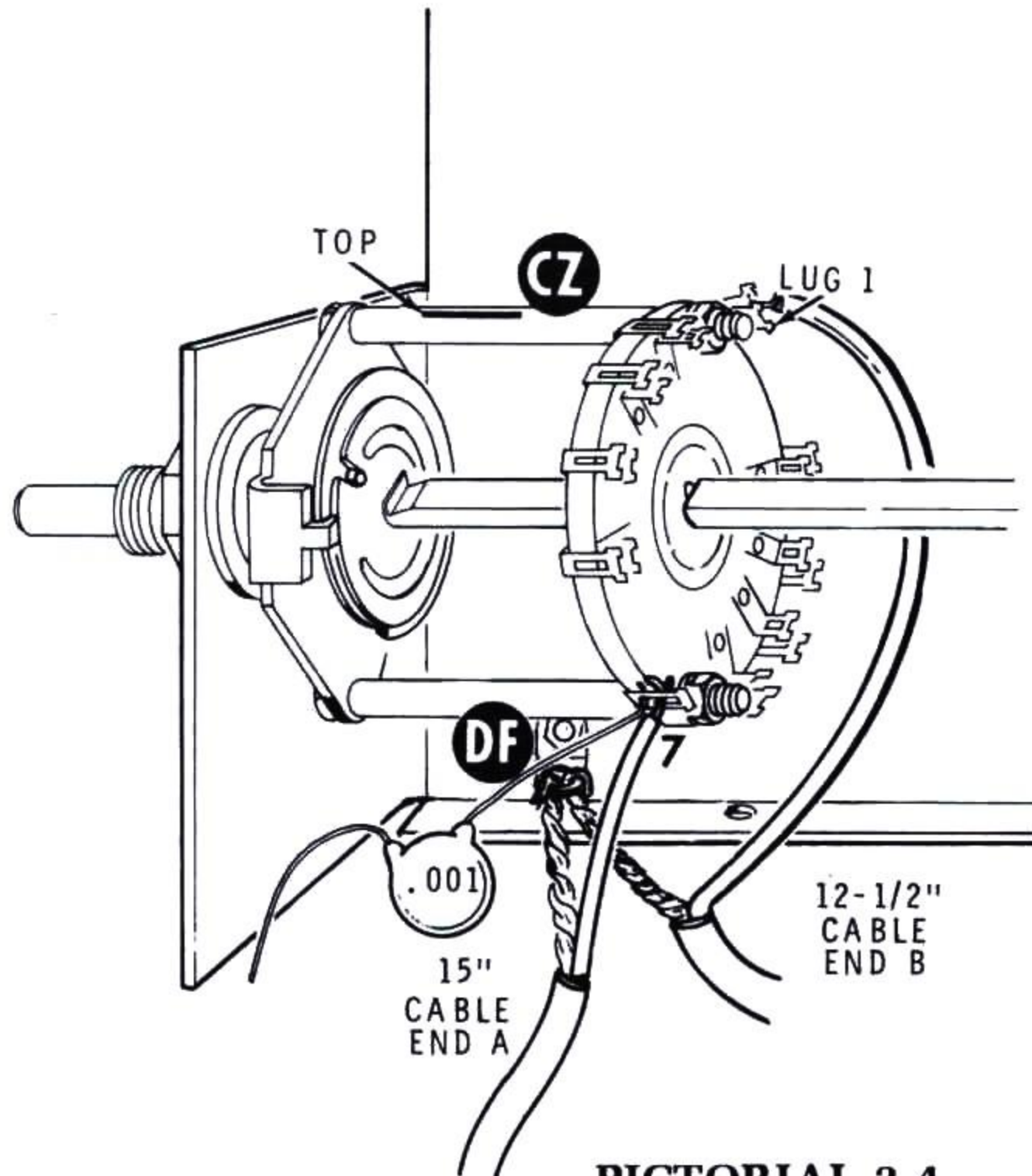
Wire Length	Coming From Switch CZ Wafer A	Connect To
() 3-1/2"	Lug 6	Coil L3 lug 2 (S-3)
() 2-1/2"	Lug 9	Coil L8 lug 1 (S-2)
() 2-3/4"	Lug 10	Coil L1 lug 1 (S-2)
() 3"	Lug 11	Coil L2 lug 1 (S-2)
() 3"	Lug 12	Coil L3 lug 1 (S-3)

NOTE: When you prepare the coaxial cable in the following step, refer to Part A of Pictorial 2-3 for the method of removing the inside of the cable from the shield braid. Be careful not to melt the inner insulation.

- () Prepare a 15" length of RG-58A/U coaxial cable as shown in Pictorial 2-3, Part B. **At end A**, twist the inner lead wires together and apply a **small** amount of solder to each end to hold the fine strands together. In a like manner, twist and solder the end of the shield braid. **At end B** cut the braid to 1/2", smooth the braid down over the inner insulation, and then add solder to the braid.

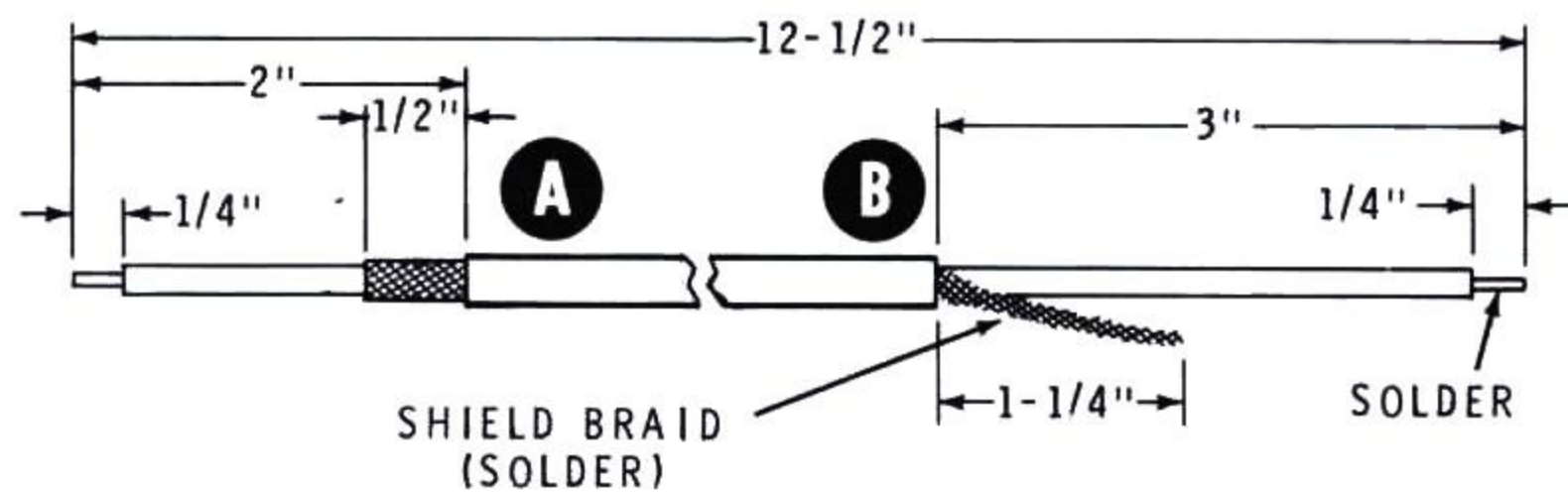


PICTORIAL 2-3



PICTORIAL 2-4

- () Refer to Pictorial 2-4 and connect end A inner lead of the 15" coaxial cable to switch CZ lug 7 (NS). Connect the shield braid to solder lug DF (NS). The free end of the cable will be connected later.
- () Refer to Pictorial 2-4 and connect the inner lead at end B of this cable to switch CZ lug 1 (S-1) and the shield braid to solder lug DF (S-2). The free end of the cable will be connected later.
- () Refer to Detail 2-4A and prepare the ends of a 12-1/2" RG-58A/U coaxial cable as shown.



Detail 2-4A



- () C47: Cut each lead of a 500 volt (small) .001 μ F ceramic capacitor to a length of 3/4". Connect one lead of this capacitor to switch CZ, lug 7 (S-2). The other lead 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.

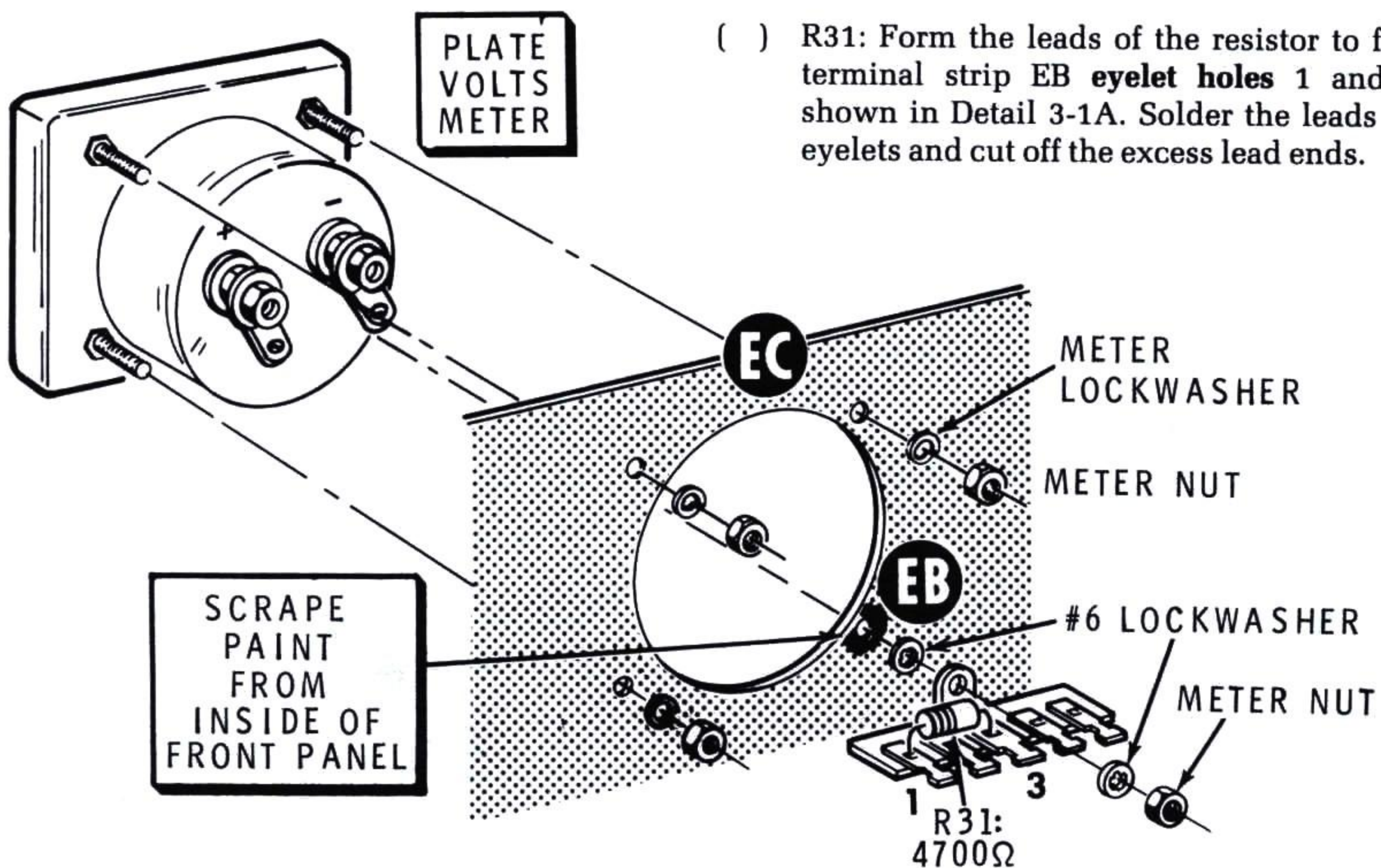
FRONT PANEL

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 (Illustration Booklet, Page 4) for the following steps.

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

- () M2: Refer to Detail 3-1A and install the plate volts meter (#407-764) at EC. Use the hardware supplied with the meter. Install a 5-lug terminal strip at EB. Use #6 lockwashers at EB. CAUTION: Do not overtighten the meter hardware as the meter case can be damaged.
- () Cut the leads of a 4700 Ω (yel-viol-red) resistor to 1/2".
- () R31: Form the leads of the resistor to fit into terminal strip EB eyelet holes 1 and 3 as shown in Detail 3-1A. Solder the leads to the eyelets and cut off the excess lead ends.

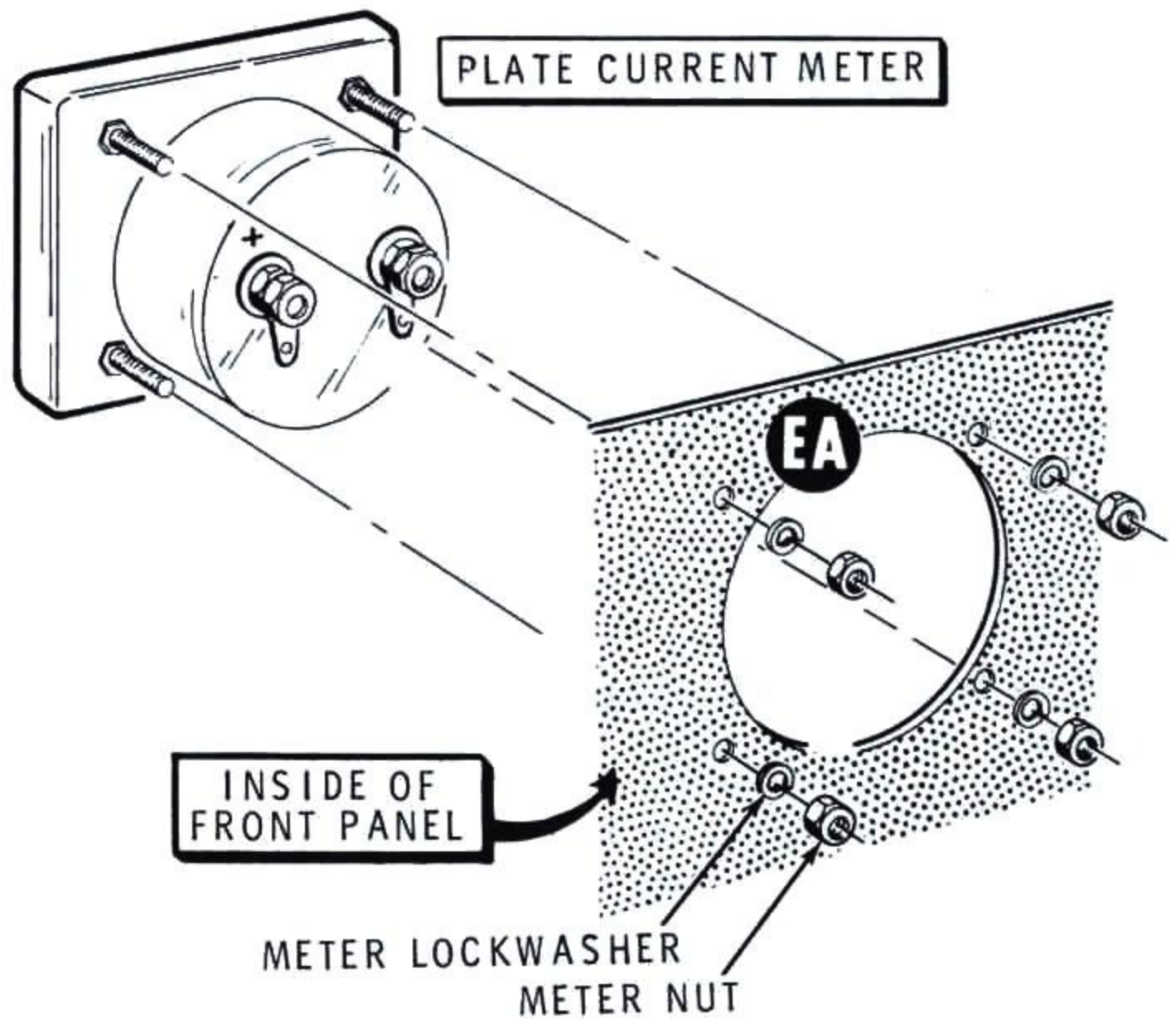


Detail 3-1A

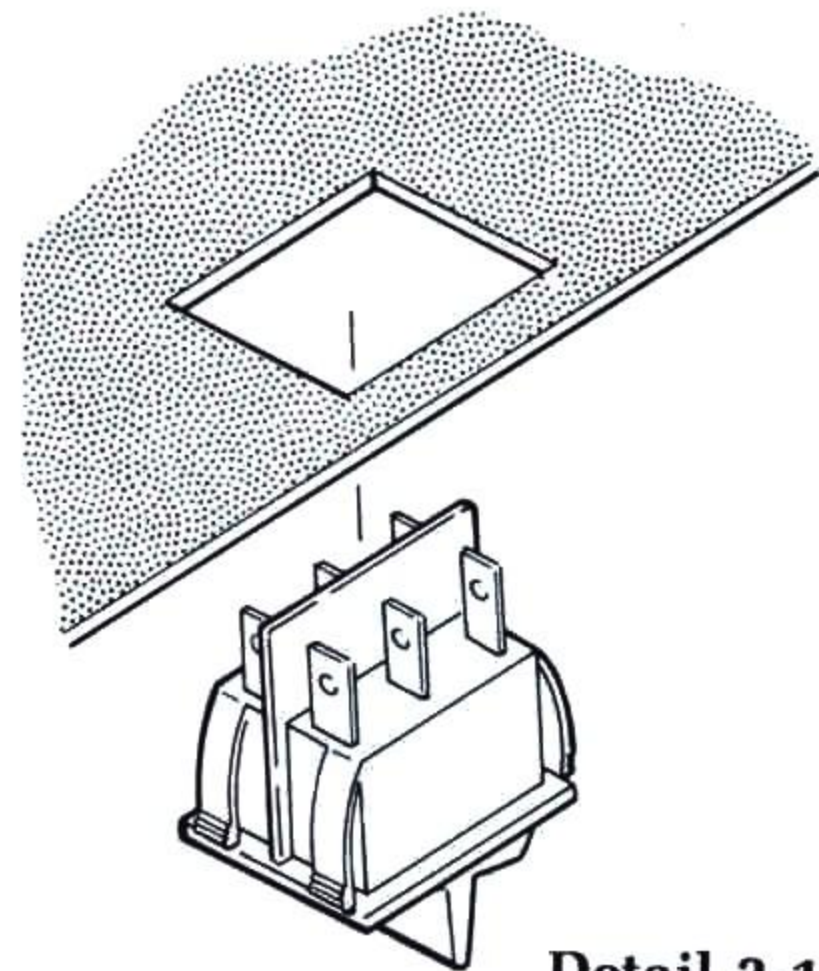
- () M1: Refer to Detail 3-1B and install the plate current meter (#407-763) at EA. Use the hardware supplied with the meter.
- () Remove and discard the wire jumpers between the meter terminals on each meter.
- () SW3: Refer to Detail 3-1C and install the 4-position rotary switch (#63-1399) at ET. Use a control lockwasher, a control flat washer, and a control nut. Position the switch lugs as shown in the Pictorial.
- () SW2: Refer to Detail 3-1D and snap a DPDT switch into the cutout at location Z in the front panel.
- () SW1: In the same manner, snap a DPDT switch into the cutout at location EU in the front panel.
- () SW5: Snap a SPDT switch into the cutout at location ED.

Refer to Detail 3-1E for the next four steps.

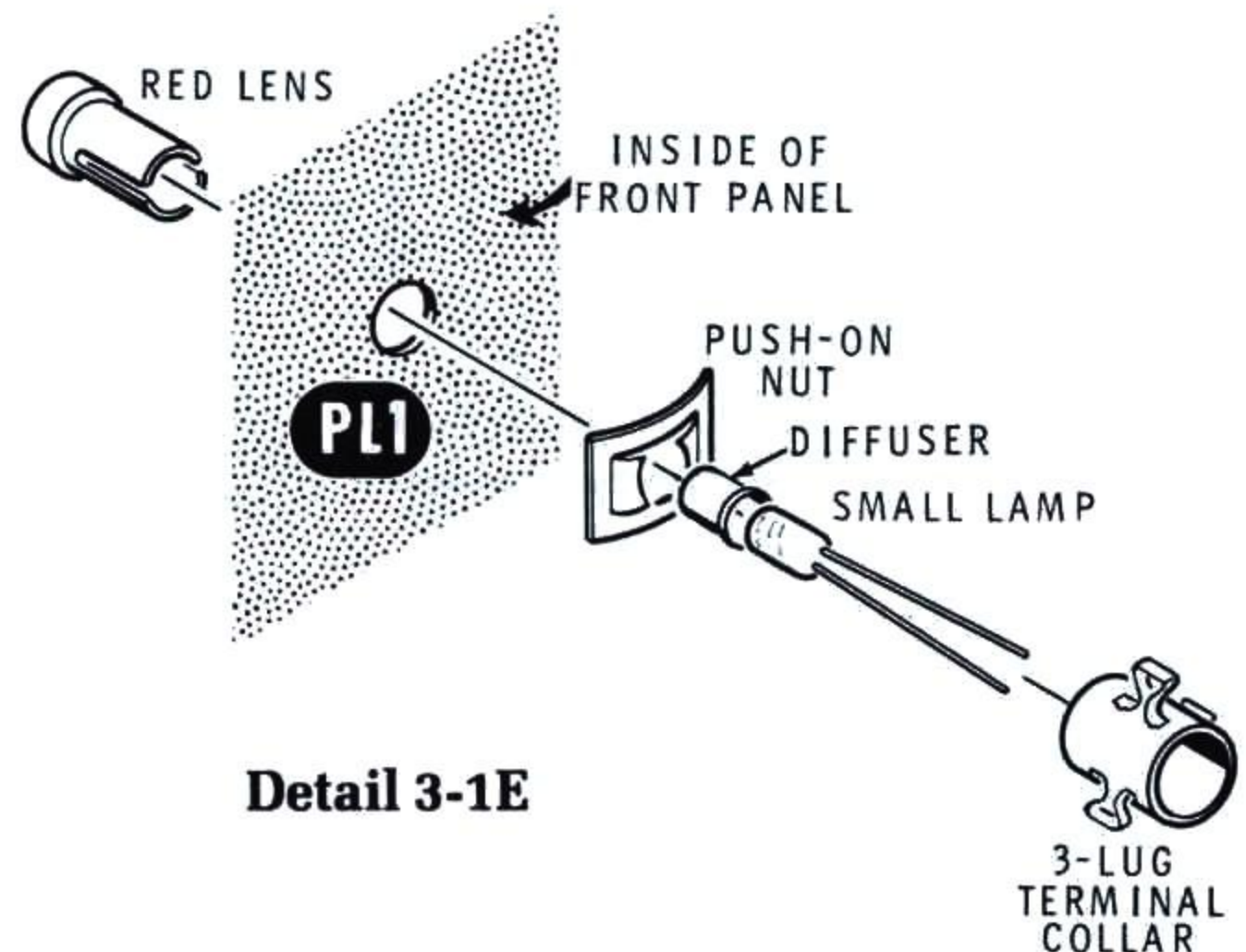
- () From the outside of the front panel, push a red lens through the hole at PL1. Secure the leads to the panel with a push-on nut as shown.
- () Place the small red diffuser onto the small lamp as shown and push the small lamp all the way into the lens. Make sure the lamp leads protrude straight out of the lens.
- () Push the 3-lug terminal collar all the way onto the lens with the lugs positioned as shown in Pictorial 3-1.
- () Connect one of the lamp leads to terminal collar lug 1 (NS) and the other lamp lead to lug 3 (NS).



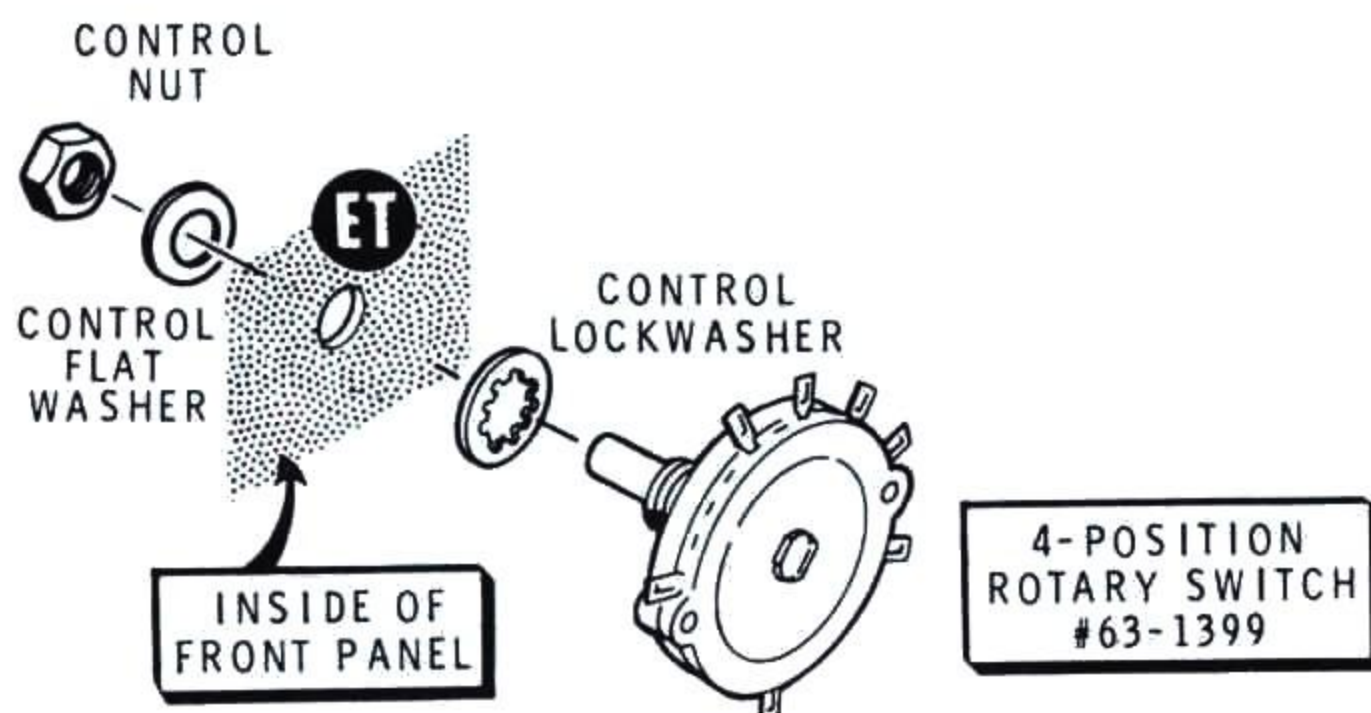
Detail 3-1B



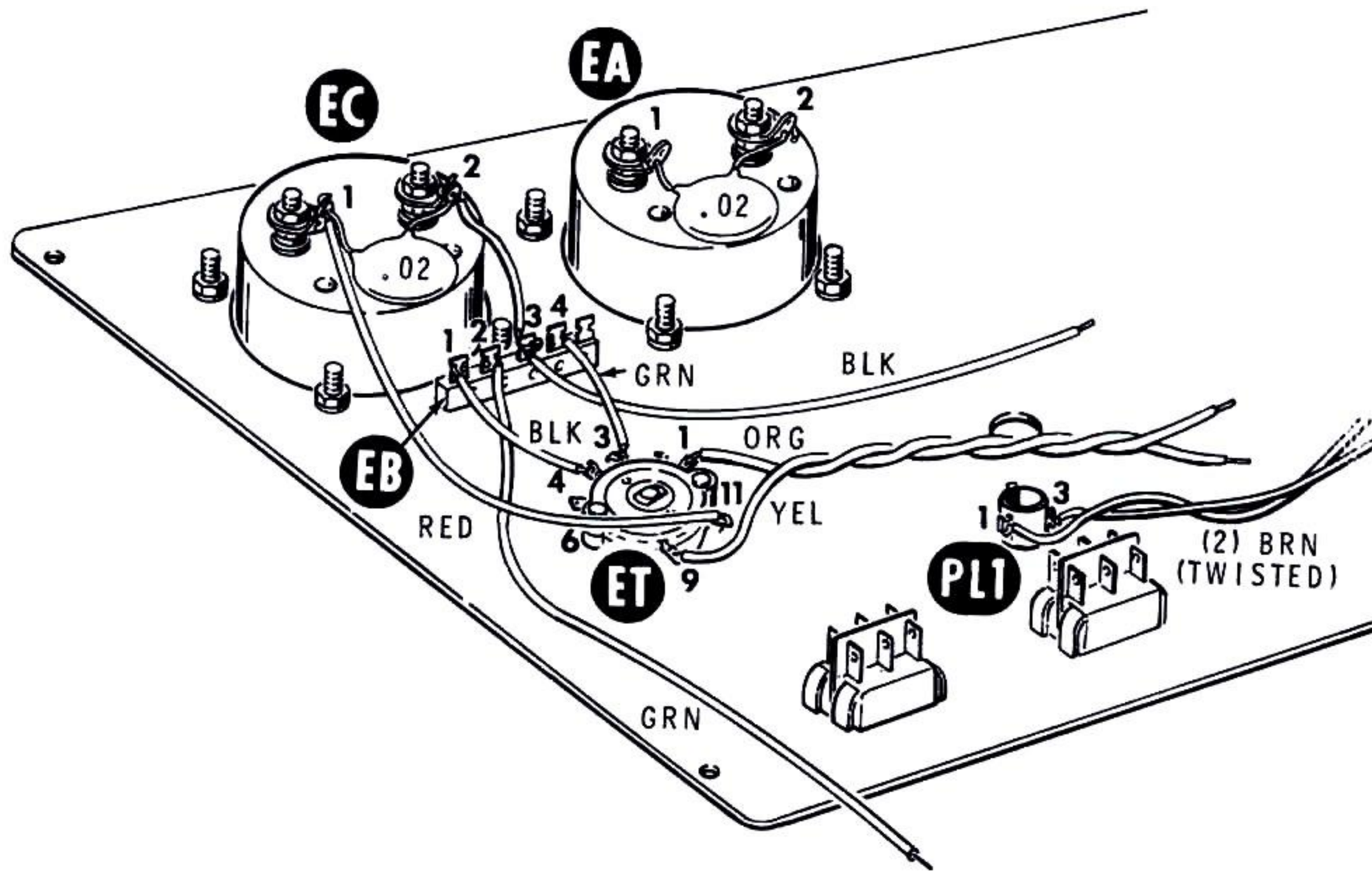
Detail 3-1D



Detail 3-1E



Detail 3-1C



PICTORIAL 3-2

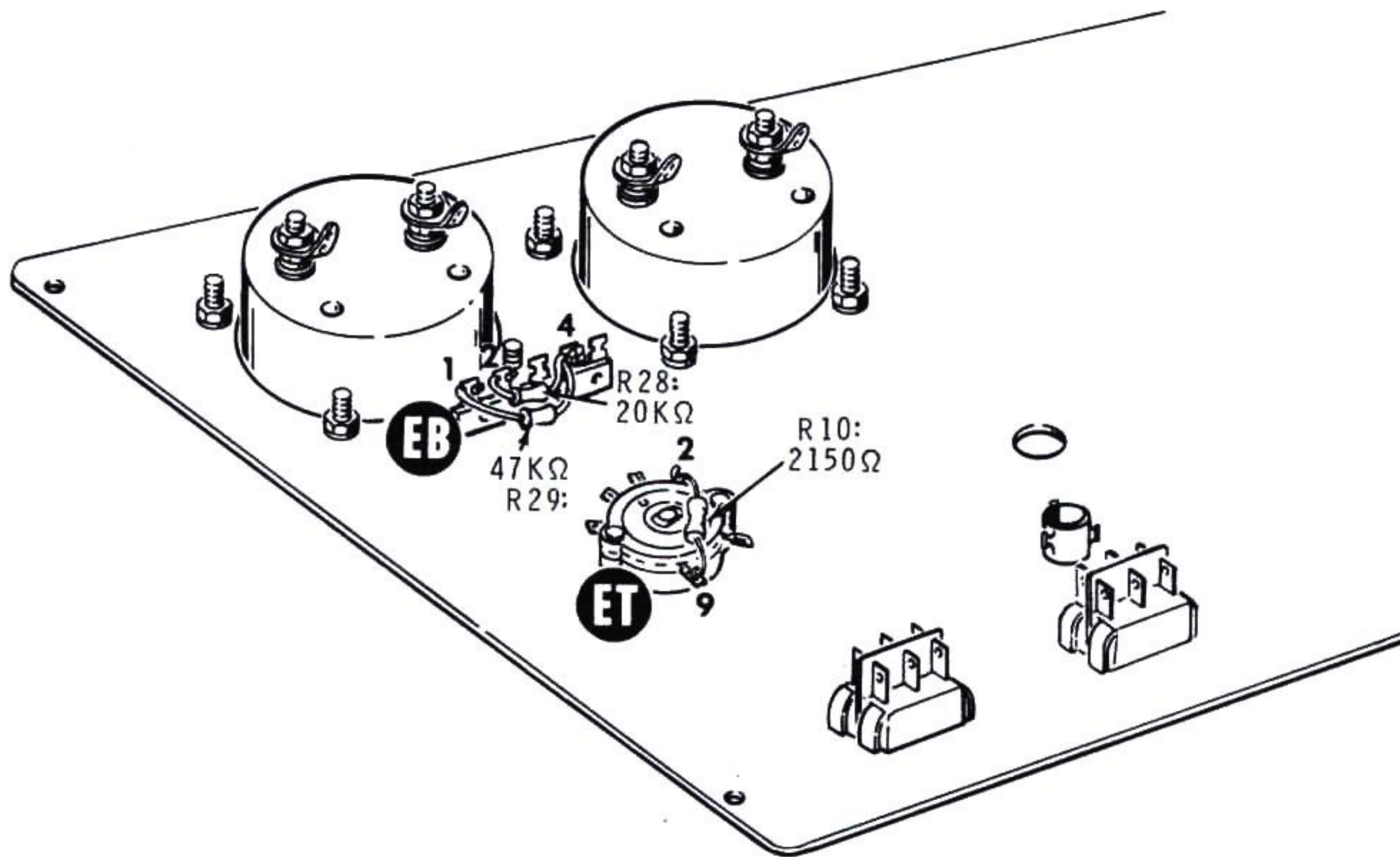
Refer to Pictorial 3-2 for the following steps.

- () Bend all four EA and EC meter lugs outward approximately 45 degrees.
- () C8: Connect a .02 μ F ceramic capacitor between meter EC lugs 1 (NS) and 2 (NS).
- () C3: Connect a .02 μ F ceramic capacitor between meter EA lugs 1 (NS) and 2 (NS).
- () Prepare the following lengths of hookup (solid) wire:

5" red	6-1/2" black
2-1/2" black	2-1/2" green
30" green	7" orange
2" black	7-1/2" yellow
	Two 19" brown
- () Connect the 5" red wire from meter EC lug 1 (S-2) to switch ET lug 11 (S-1).
- () Connect the 2-1/2" black wire from terminal strip EB lug 1 (NS) to switch ET lug 4 (S-1).

- () Connect one end of the 30" green wire to terminal strip EB lug 2 (NS). Position its free end under the red wire for connection later.
- () Connect the 2" black wire from meter EC lug 2 (S-2) to terminal strip EB lug 3 (NS).
- () Connect one end of the 6-1/2" black wire to terminal strip EB lug 3 (S-2).
- () Connect the 2-1/2" green wire from terminal strip EB lug 4 (NS) to switch ET lug 3 (S-1).
- () Connect the 7" orange wire to switch ET lug 1 (S-1). The free end will be connected later.
- () Connect one end of the 7-1/2" yellow wire to switch ET lug 9 (NS). The other end will be connected later. Twist the yellow and orange wires together to form a twisted pair.
- () Twist together the two 19" brown wires. At one end, connect one brown wire to terminal collar PL1 lug 1 (S-2) and the other wire to lug 3 (S-2). The free wire ends will be connected later.





PICTORIAL 3-3

Refer to Pictorial 3-3 for the following steps.

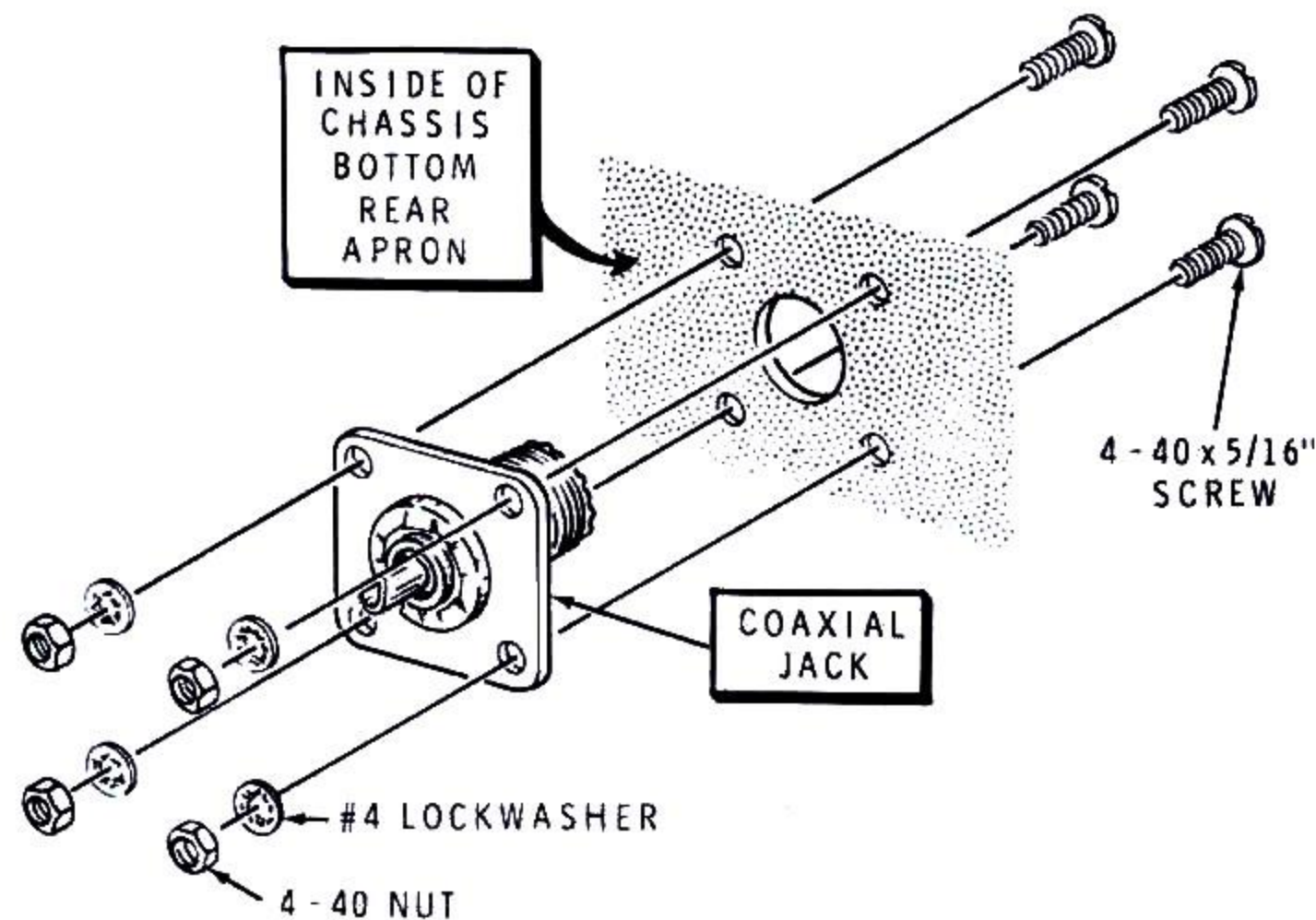
- () R28: Connect a 20 k Ω (red-black-orange) resistor to terminal strip EB lugs 2 (S-2) and 4 (NS).
- () R29: Connect a 47 k Ω (yellow-violet-orange) resistor to terminal strip EB between lugs 1 (S-2) and 4 (S-3).

- () R10: Connect a 2150 Ω (red-brown-green-brown) resistor to switch ET between lugs 2 (S-1) and 9 (S-2).

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



CHASSIS



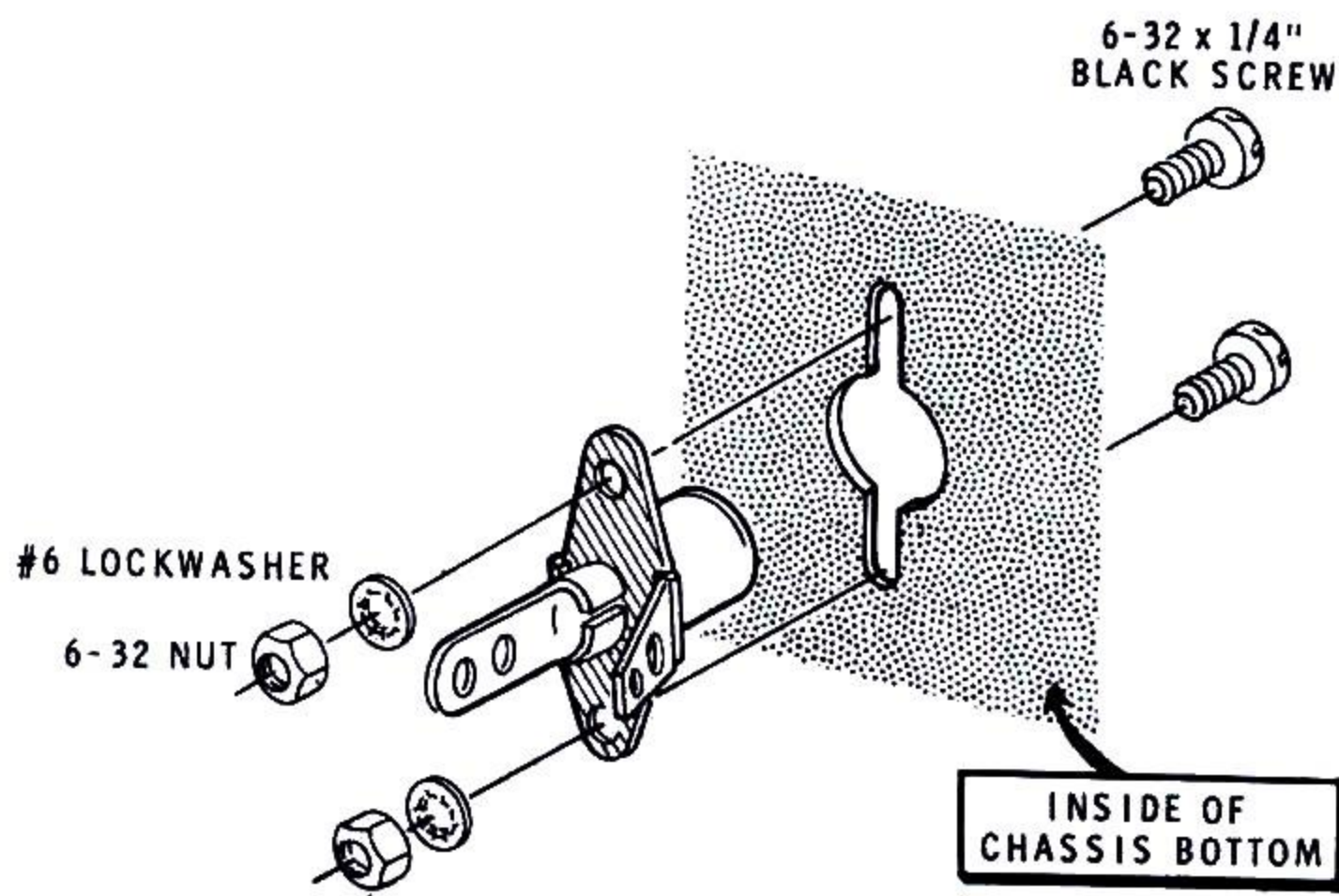
Detail 4-1A

CHASSIS PARTS MOUNTING

Refer to Pictorial 4-1 (Illustration Booklet, Page 5) for the following steps.

- () Install 1/2" rubber grommets at T, AK, and AL.
- () Install a 3/4" rubber grommet at AH.
- () J4: 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.

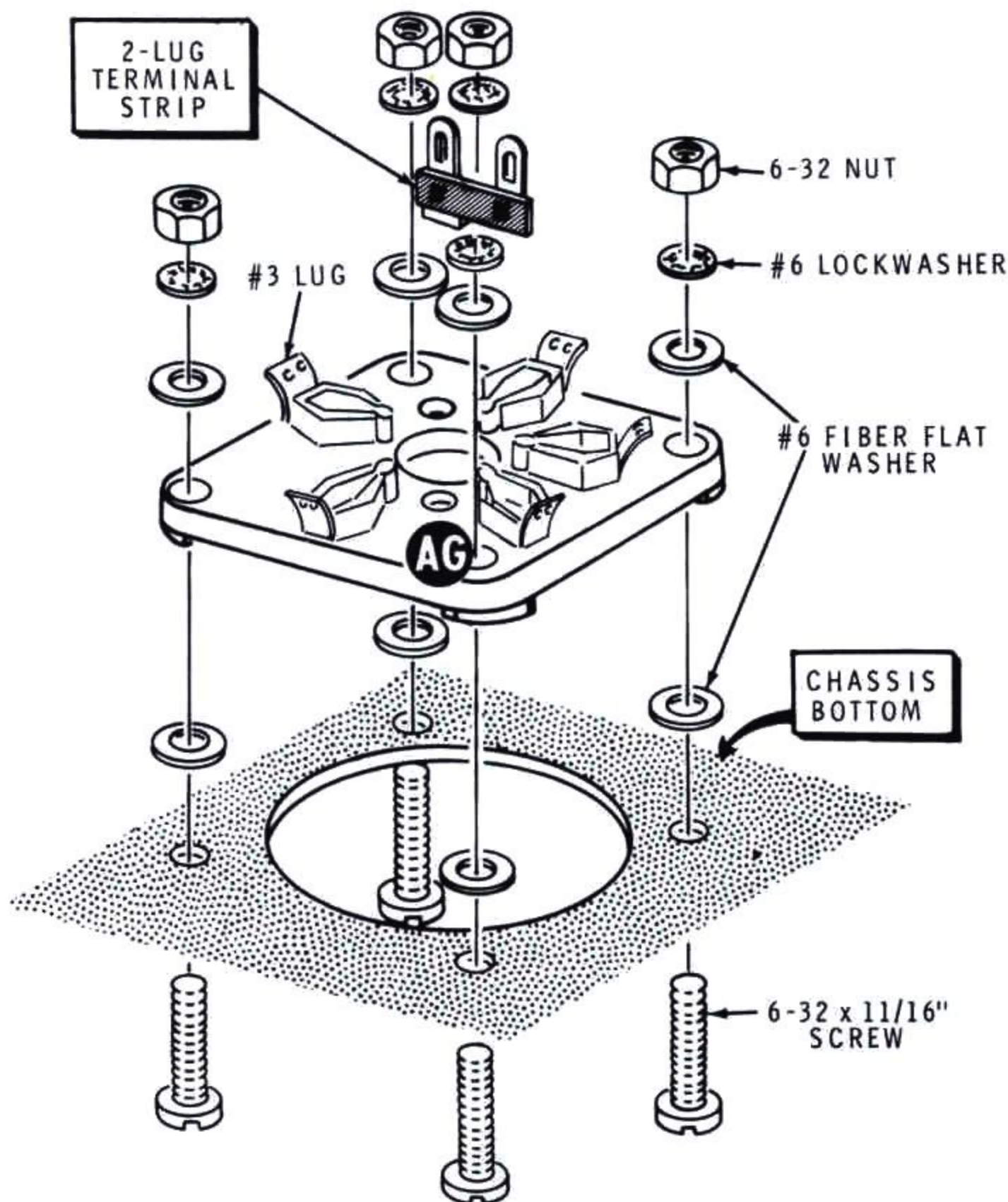
- () J3: In the same manner, mount another coaxial jack at L on the rear apron.
- () J2: Refer to Detail 4-1B and mount a phono socket at U on the rear apron. Use 6-32 x 1/4" black hardware. Position the ground lug toward the coaxial jack.
- () J1: In the same manner, mount another phono socket at X.



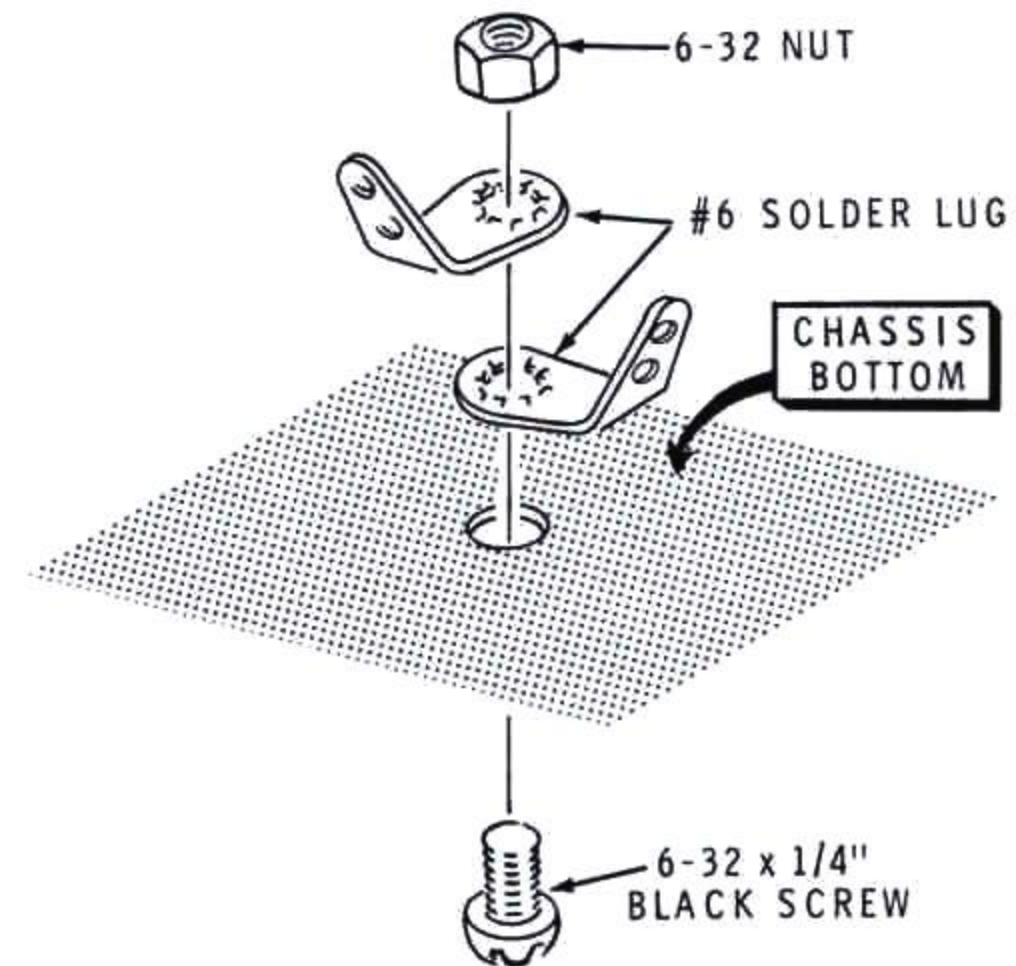
Detail 4-1B

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

- () Refer to Detail 4-1C and mount a 5-lug ceramic tube socket at N with a 2-lug terminal strip at AG. Use 6-32 \times 11/16" hardware and fiber flat washers. Be sure to properly position socket lug 3 exactly as shown, and to place a lock-washer **under** the terminal strip mounting foot.
- () Similarly, mount a 5-lug ceramic tube socket at D. Use 6-32 \times 11/16" hardware and fiber flat washers. Do not use a terminal strip on this socket. Note the position of socket lug 3.
- () Refer to Detail 4-1D and mount two #6 solder lugs at C. Use 6-32 \times 1/4" black 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.

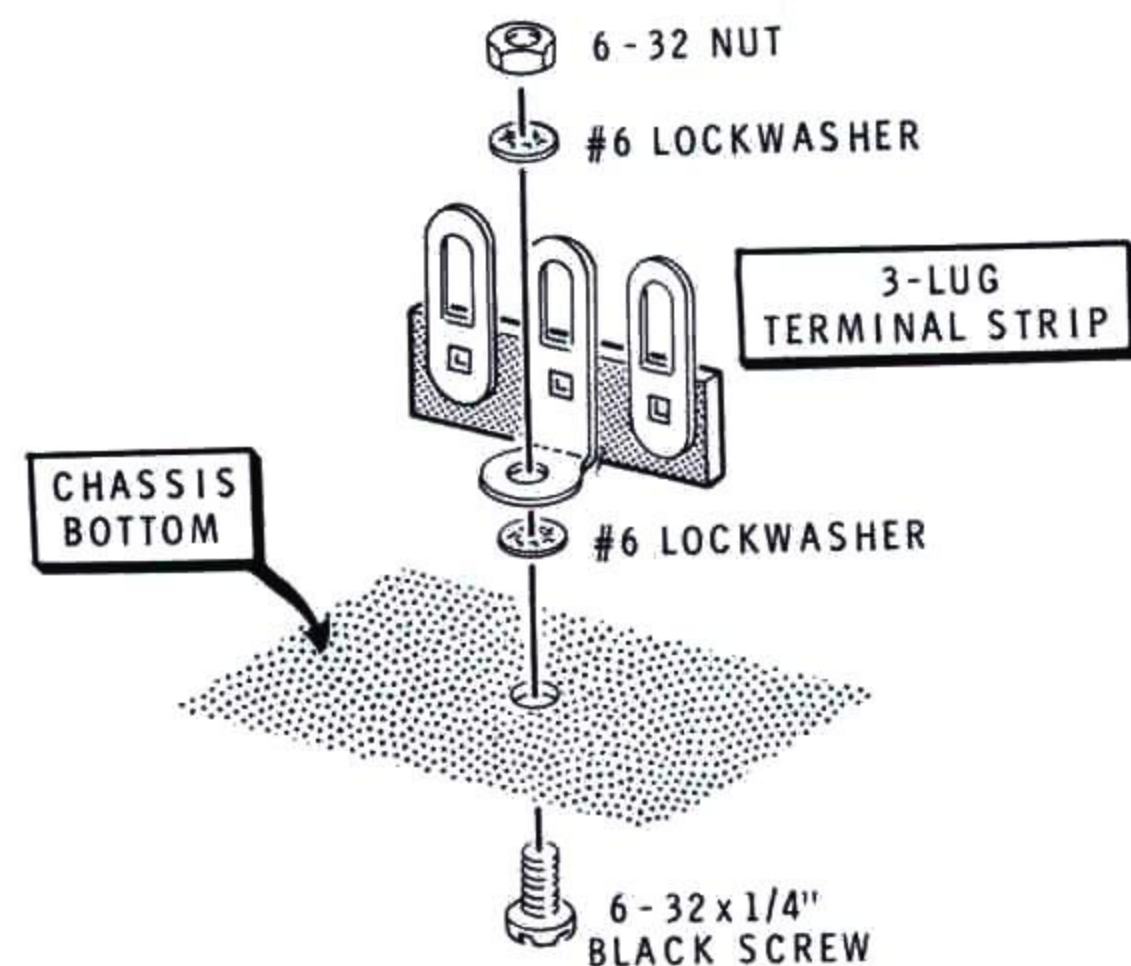


Detail 4-1C

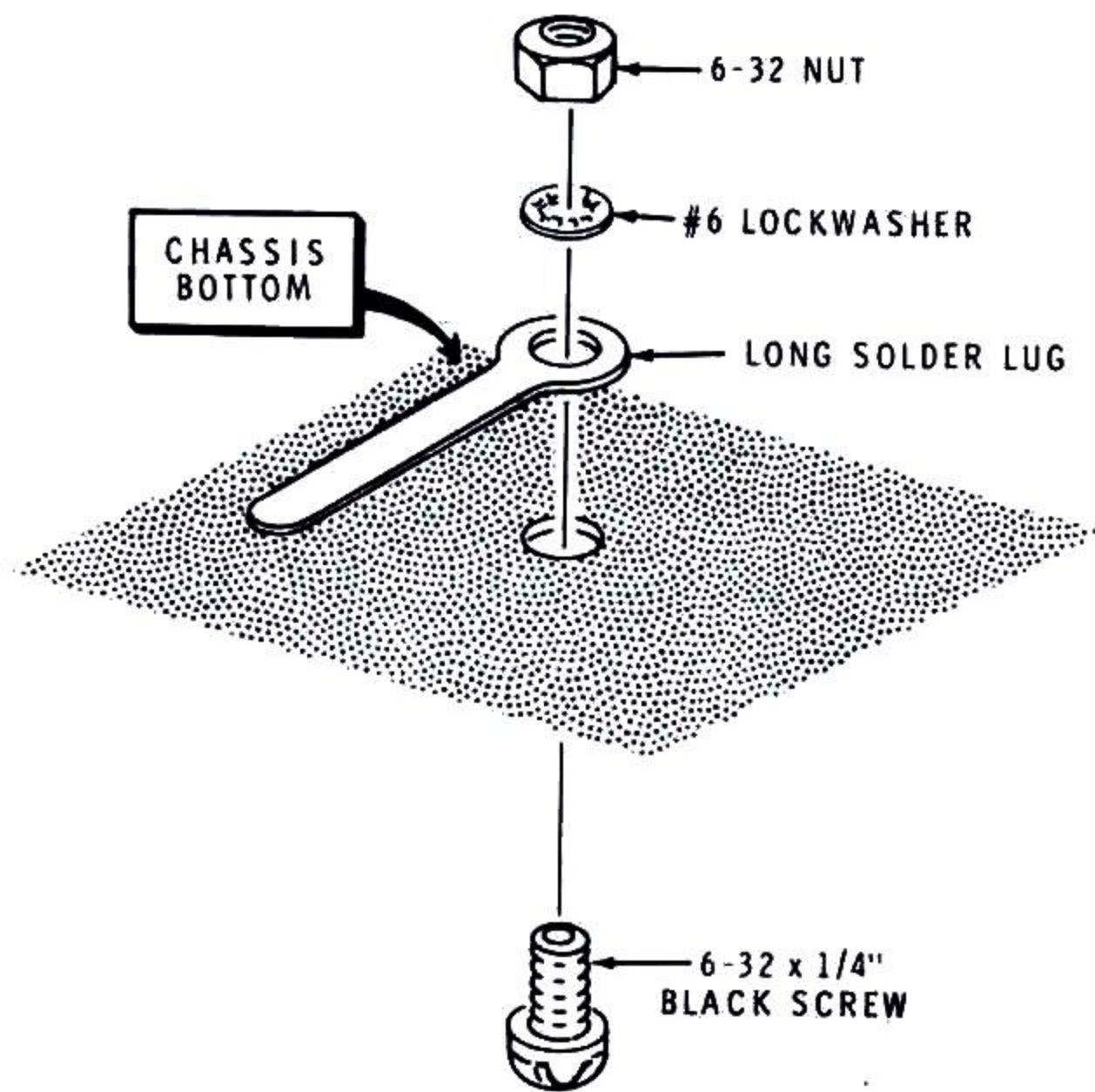


Detail 4-1D

- () Mount one #6 solder lug at AX. Use 6-32 \times 3/8" black flat head hardware.
- () Refer to Detail 4-1E and mount a 3-lug terminal strip at P. Use 6-32 \times 1/4" black hardware.



Detail 4-1E



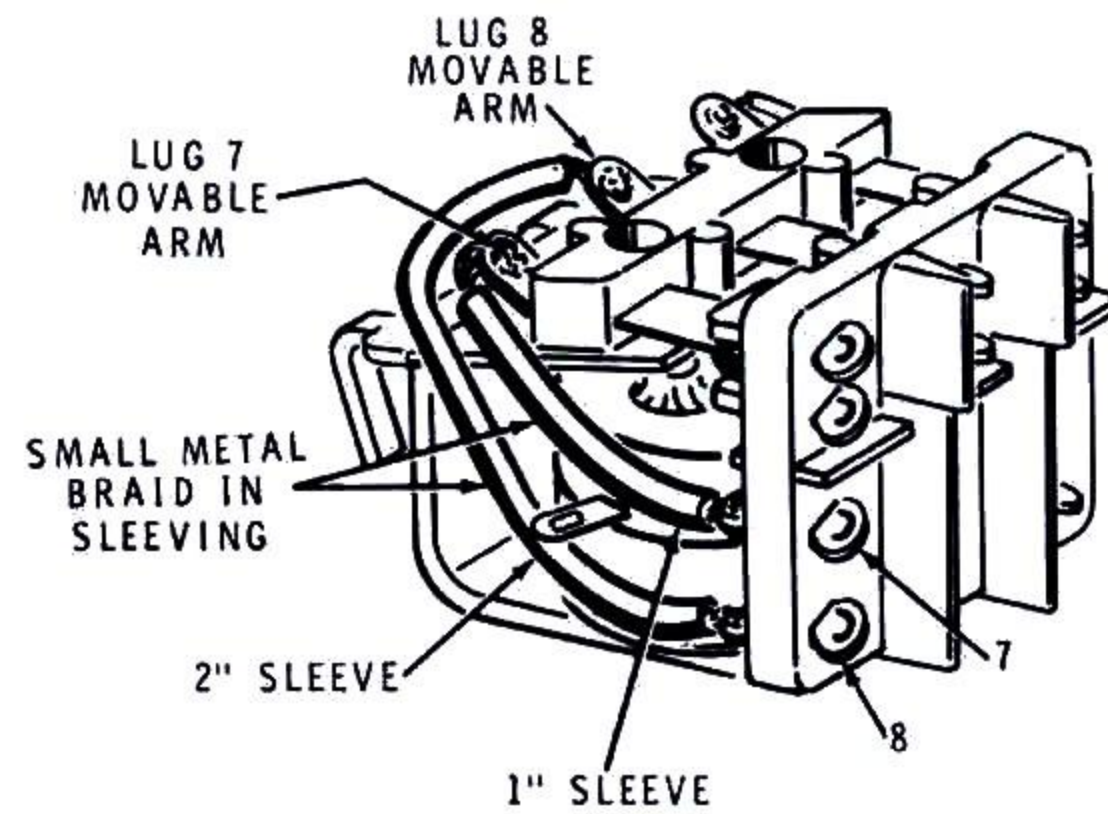
Detail 4-1F

- () Refer to Detail 4-1F and mount a long solder lug at R. Use 6-32 × 1/4" black hardware.
- () Install a 5/16" rubber grommet at F. NOTE: Grommet F is under the center of relay K1 in Pictorial 4-1.

Refer to Detail 4-1G 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.

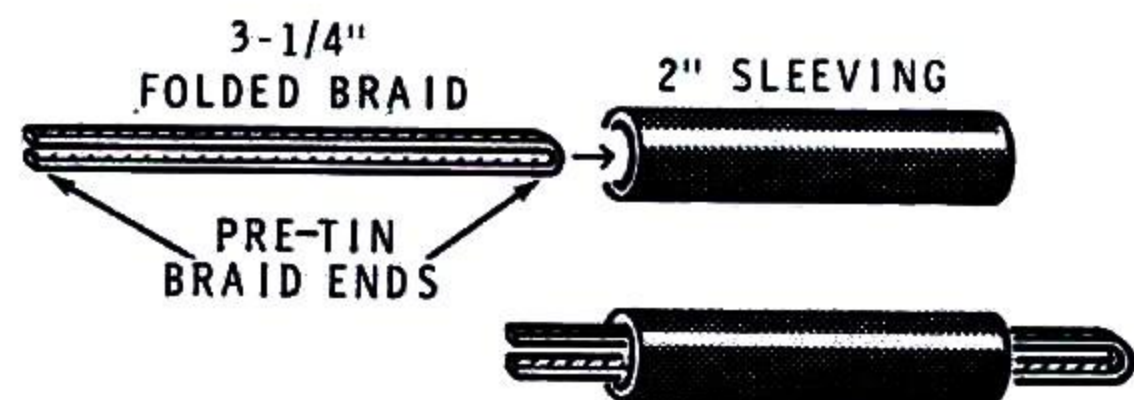
NOTE: When you solder the small metal braid in the following steps, use the minimum amount of heat necessary to secure a good connection.



Detail 4-1G

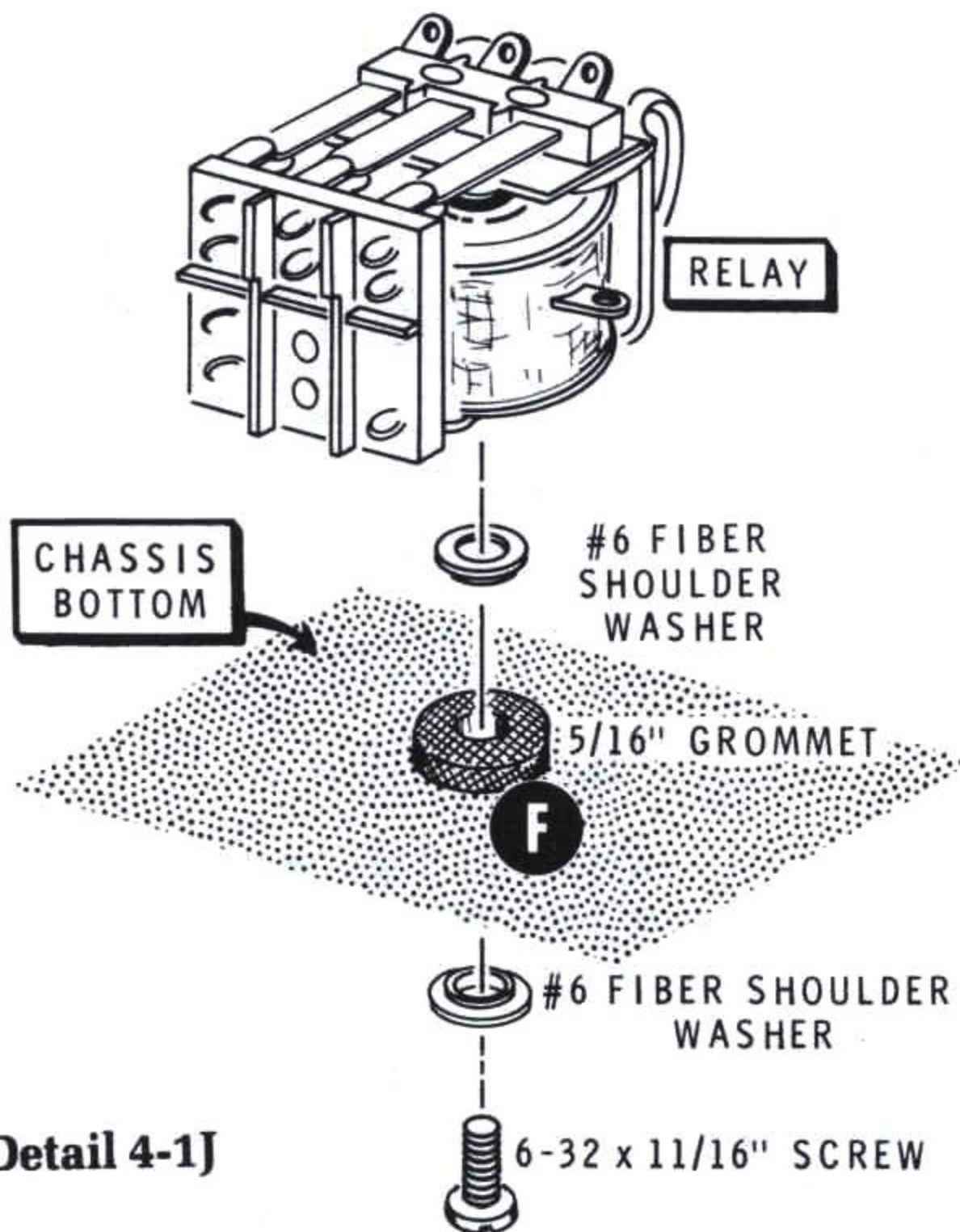
IMPORTANT: Disregard any lug numbers stamped on the relay; refer to the steps and the illustrations for the correct lug numbers.

- () Replace the wire discarded in the previous step with a 3-1/4" length of untinned braided wire that is folded in the middle and pushed through a 1" length of small black sleeving. (See Detail 4-1H.) 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 untinned braid that is folded in the middle and pushed through a 2" length of small black sleeving. Solder one end of the braid to lug 8 and the other end to its movable arm.

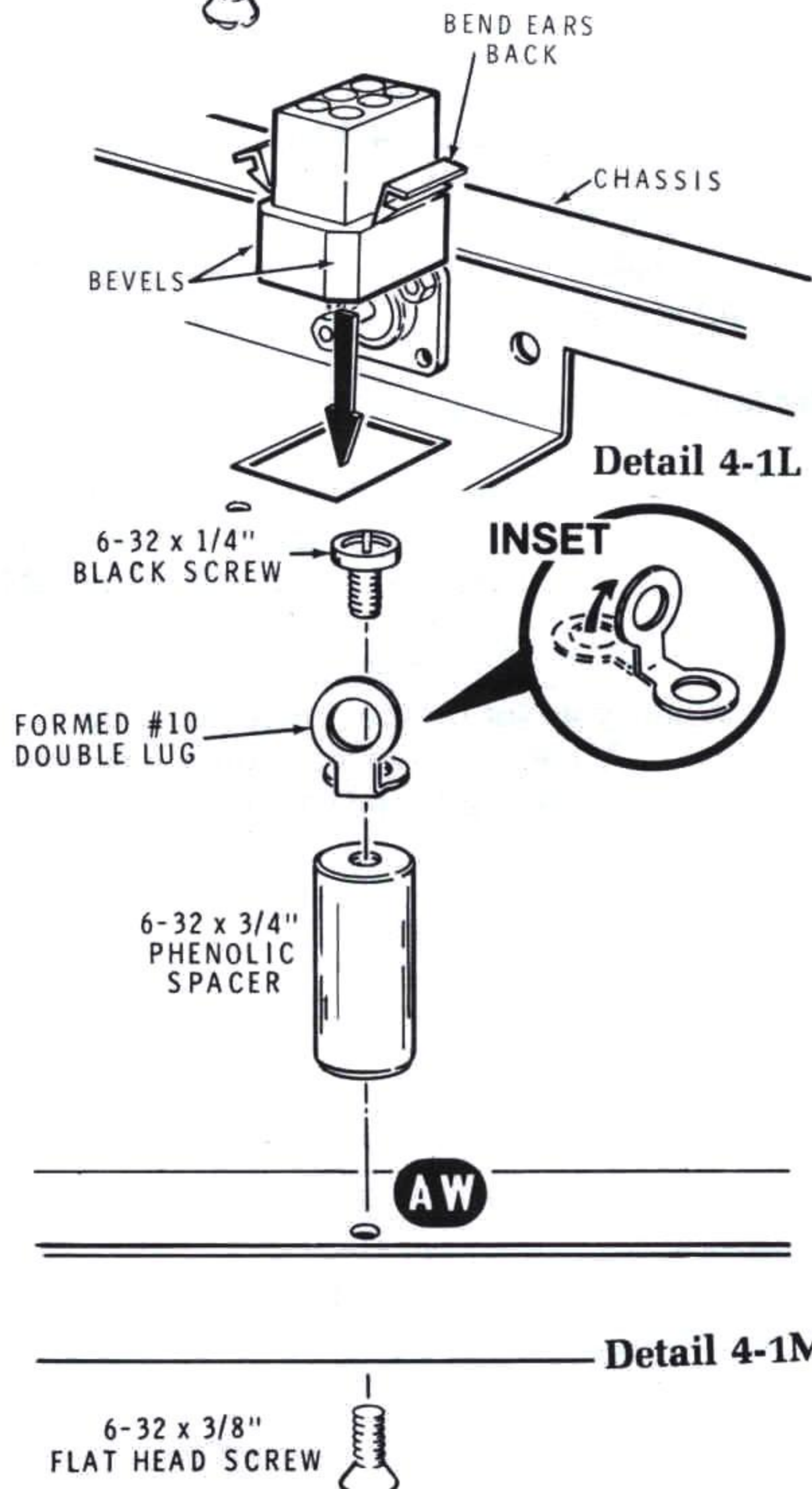
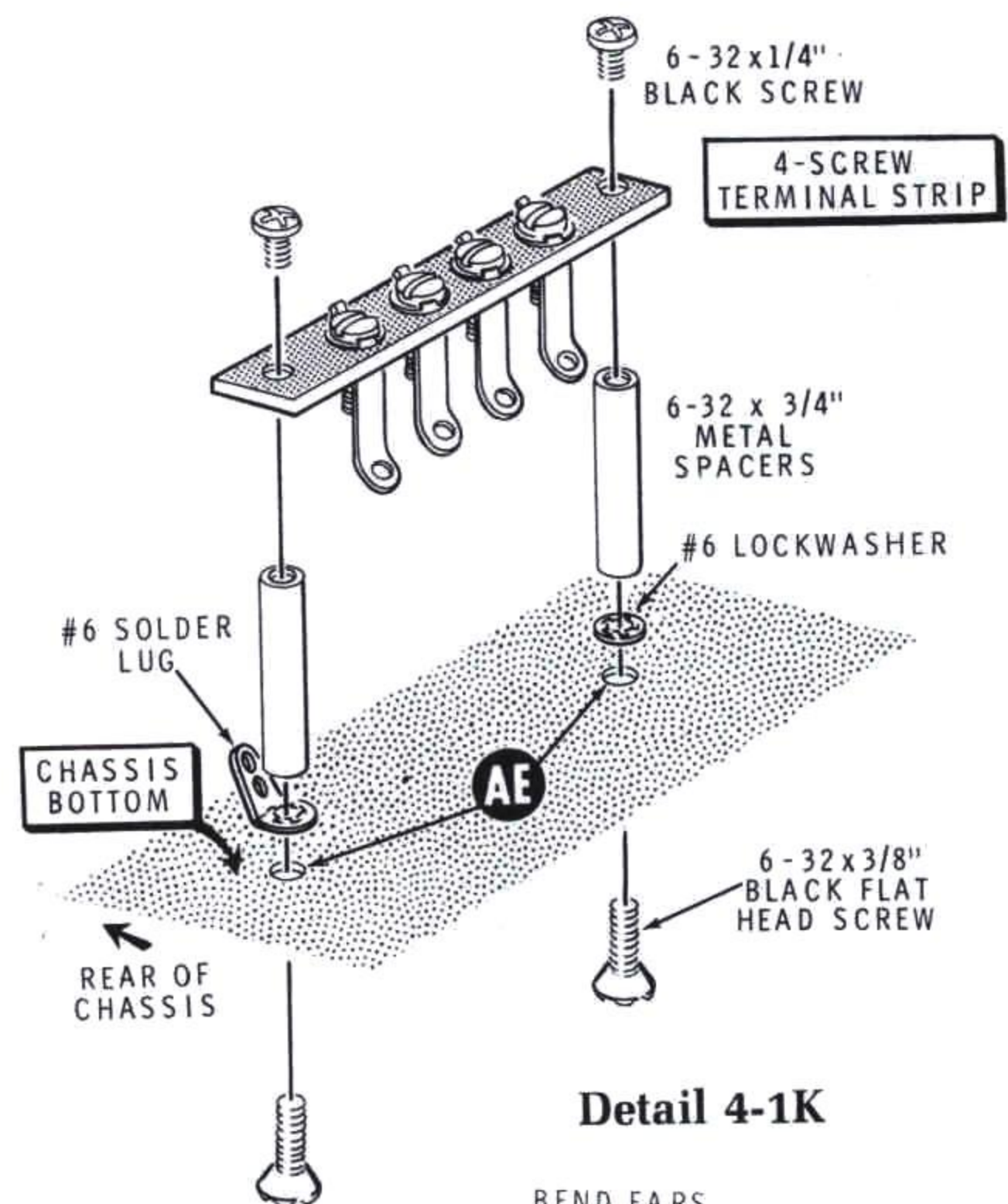


Detail 4-1H





- () K1: Refer to Detail 4-1J and mount a relay K1 (#69-55) 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.
- () Inspect the relay to make sure that neither piece of untinned 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" black flat head screws, a #6 lockwasher, a #6 solder lug, two 6-32 x 3/4" metal spacers, and two 6-32 x 1/4" black screws. Be sure to position the solder lug as shown in the Detail and Pictorial.
- () Refer to Detail 4-1L and install a socket shell in hole Y. Be sure to install this socket so the beveled corners are positioned **away** from the nearby edge of the chassis as shown.
- () Refer to Detail 4-1M and mount a 6-32 x 3/4" phenolic spacer at AW with a 6-32 x 3/8" black flat head screw.
- () Refer to the inset drawing on Detail 4-1M and bend a #10 double lug as shown.
- () Install the formed #10 double lug on the phenolic spacer with a 6-32 x 1/4" black screw.



ALC WIRING

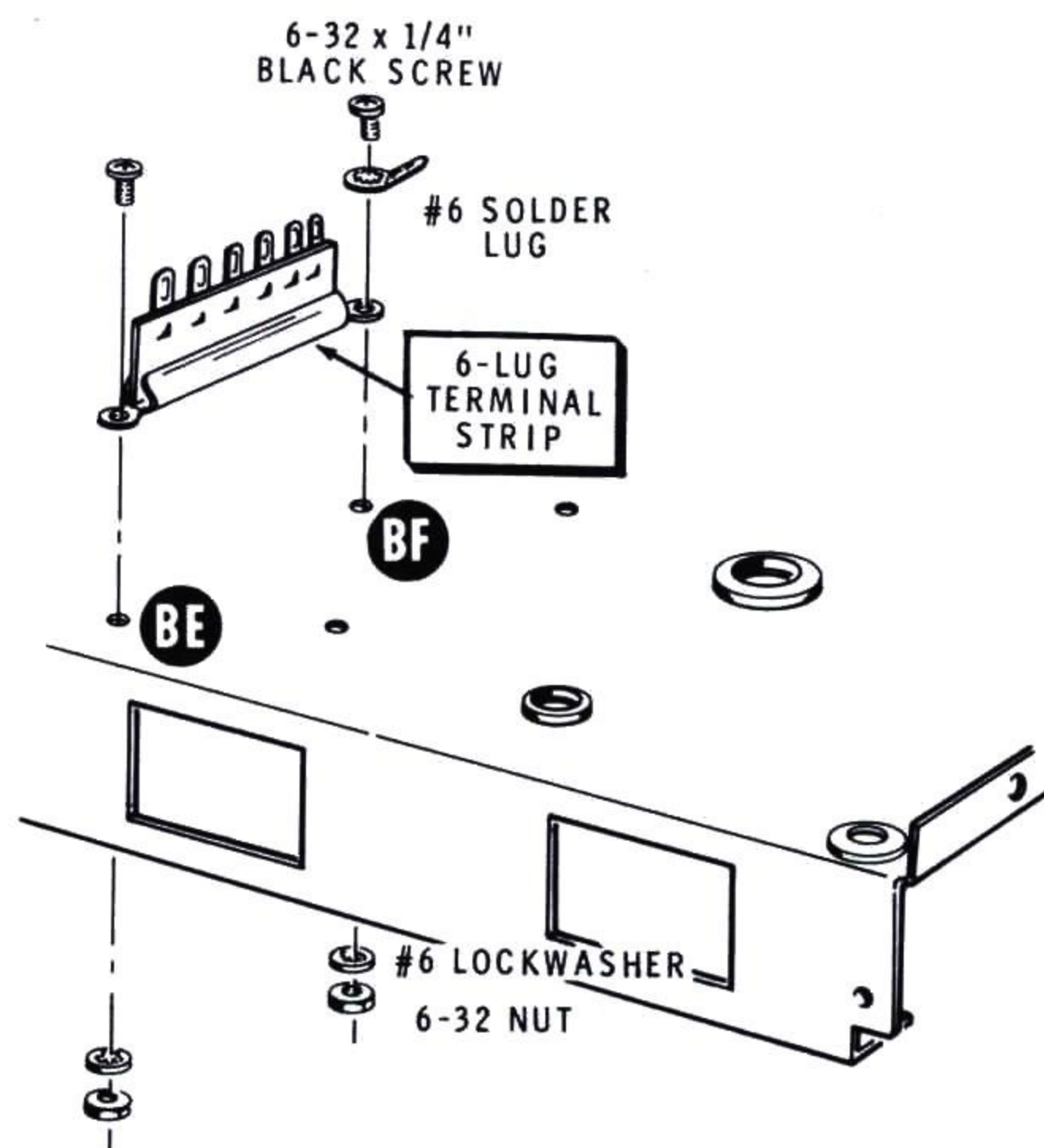
Refer to Pictorial 4-2 (Illustration Booklet, Page 5) for the following steps.

- () Refer to Detail 4-2A and mount a 6-lug terminal strip on the top front of the chassis at holes BE and BF with 6-32 × 1/4" black 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.
- () R23: Connect a 47 kΩ (yellow-violet-orange) resistor between terminal strip BE lugs 2 (NS) and 4 (NS).
- () R21: Connect a 2200 Ω (red-red-red) resistor between terminal strip BE lugs 1 (NS) and 3 (NS).
- () C51: Connect a .02 μF ceramic capacitor from terminal strip BE lug 4 (NS) to solder lug BF (NS).
- () C49: Connect a 500-volt (small) .001 μF ceramic capacitor from terminal strip BE lug 5 (NS) to solder lug BF (NS).
- () C5: Connect a .02 μF ceramic capacitor from terminal strip BE lug 6 (NS) to solder lug BF (S-3).

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

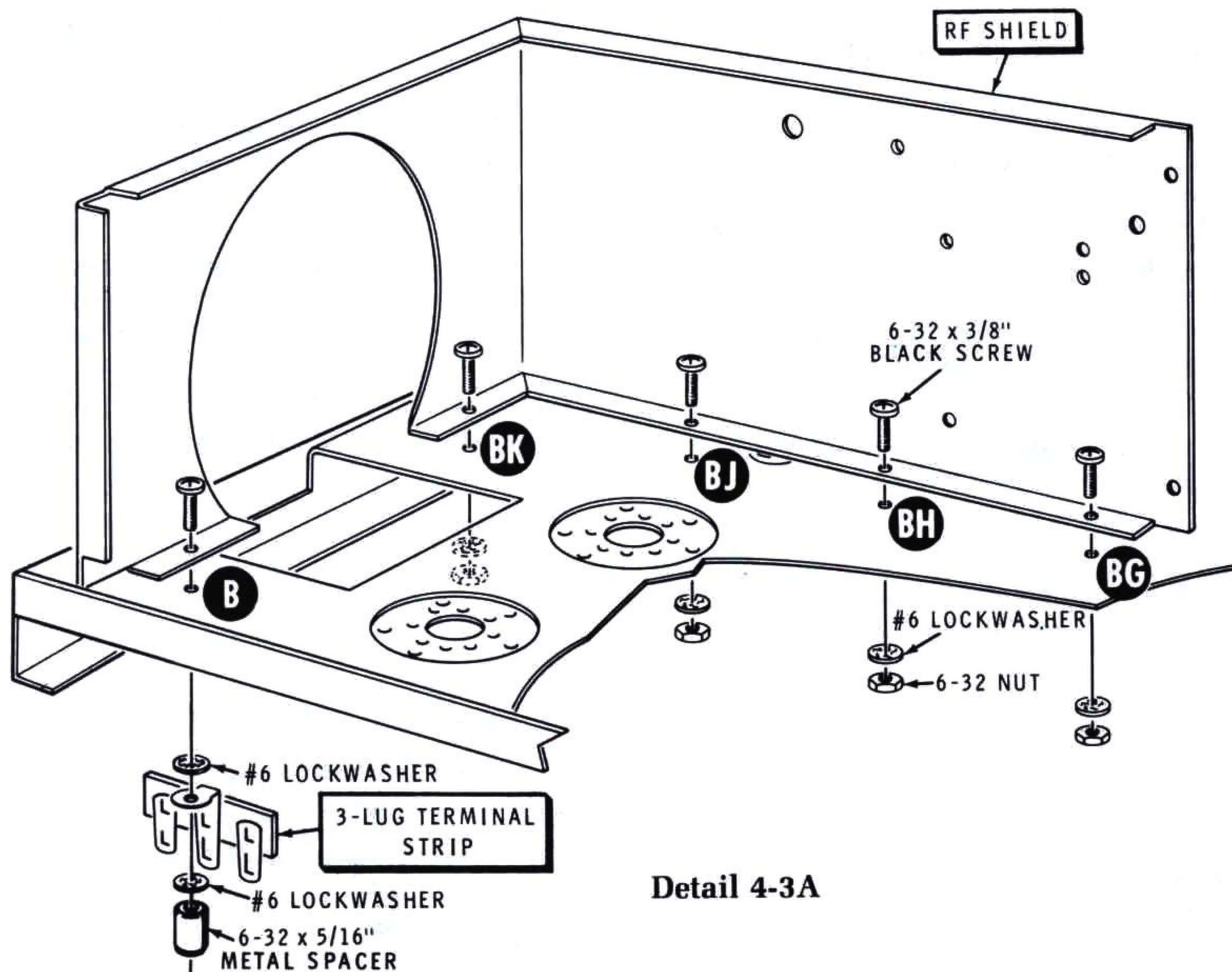
- () Prepare a 10" orange hookup (solid) wire and a 17" yellow hookup (solid) wire.
- () Connect one end of the 10" orange wire to terminal strip BE lug 6 (NS).
- () Connect one end of the 17" yellow wire to terminal strip BE lug 2 (S-2).
- () Pass the free ends of the yellow and the orange wires down through grommet T. To temporarily secure the ends of these wires, they can be passed up through some other hole in the chassis. The free ends will be connected later.

- () R22: Connect a 2200 Ω (red-red-red) resistor between terminal strip BE lugs 3 (NS) and 5 (S-2).
- () R11: Connect a 27 kΩ (red-violet-orange) resistor between terminal strip BE lugs 3 (NS) and 6 (S-3).
- () D18: Connect the cathode lead (banded end) of a 1N458 diode (#56-24) to terminal strip BE lug 3 (NS) and connect the anode lead to lug 4 (S-3).
- () C48: Connect a 15 pF ceramic capacitor between terminal strip BE lugs 3 (S-5) and 1 (NS).



Detail 4-2A



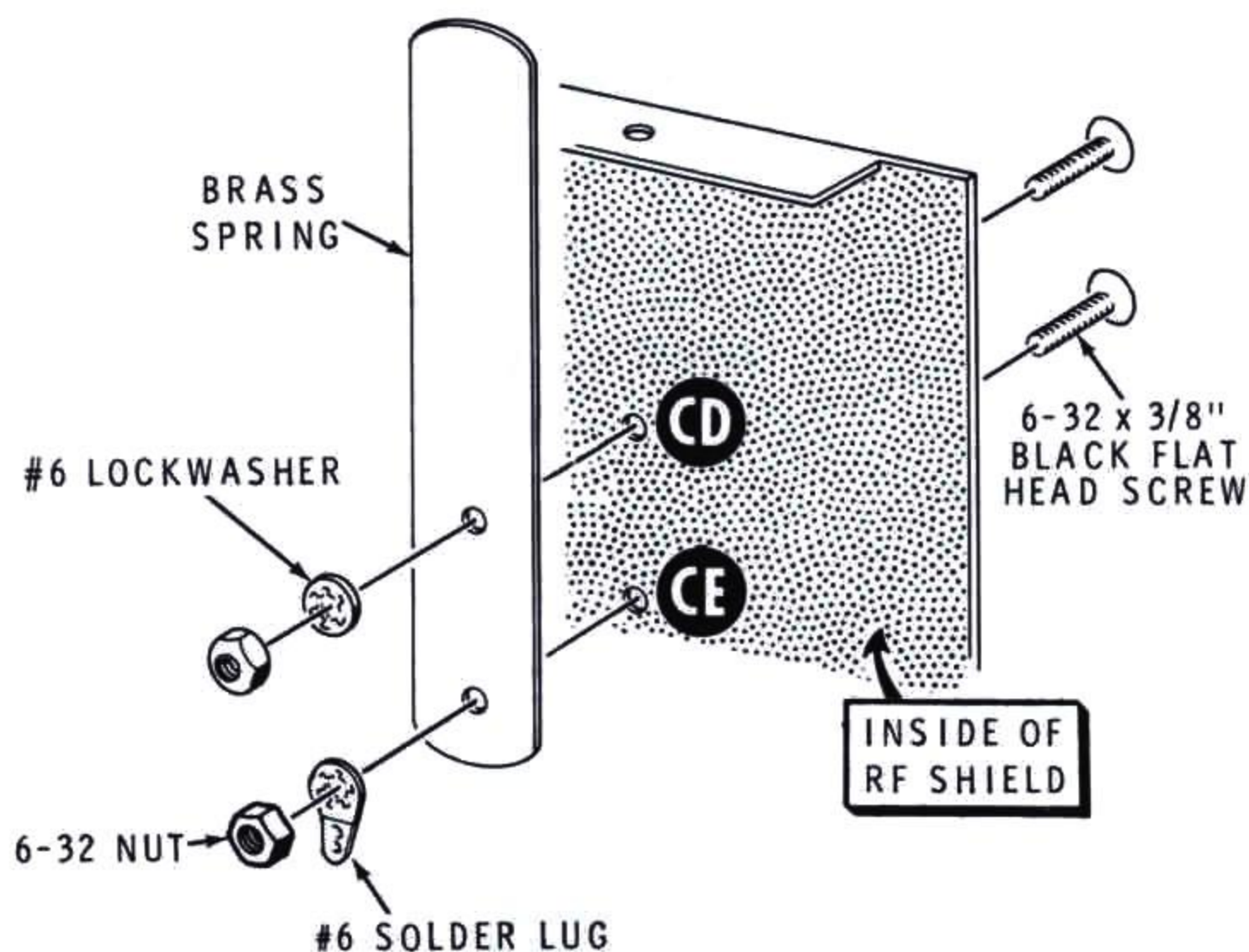


Detail 4-3A

TOP-CHASSIS ASSEMBLY

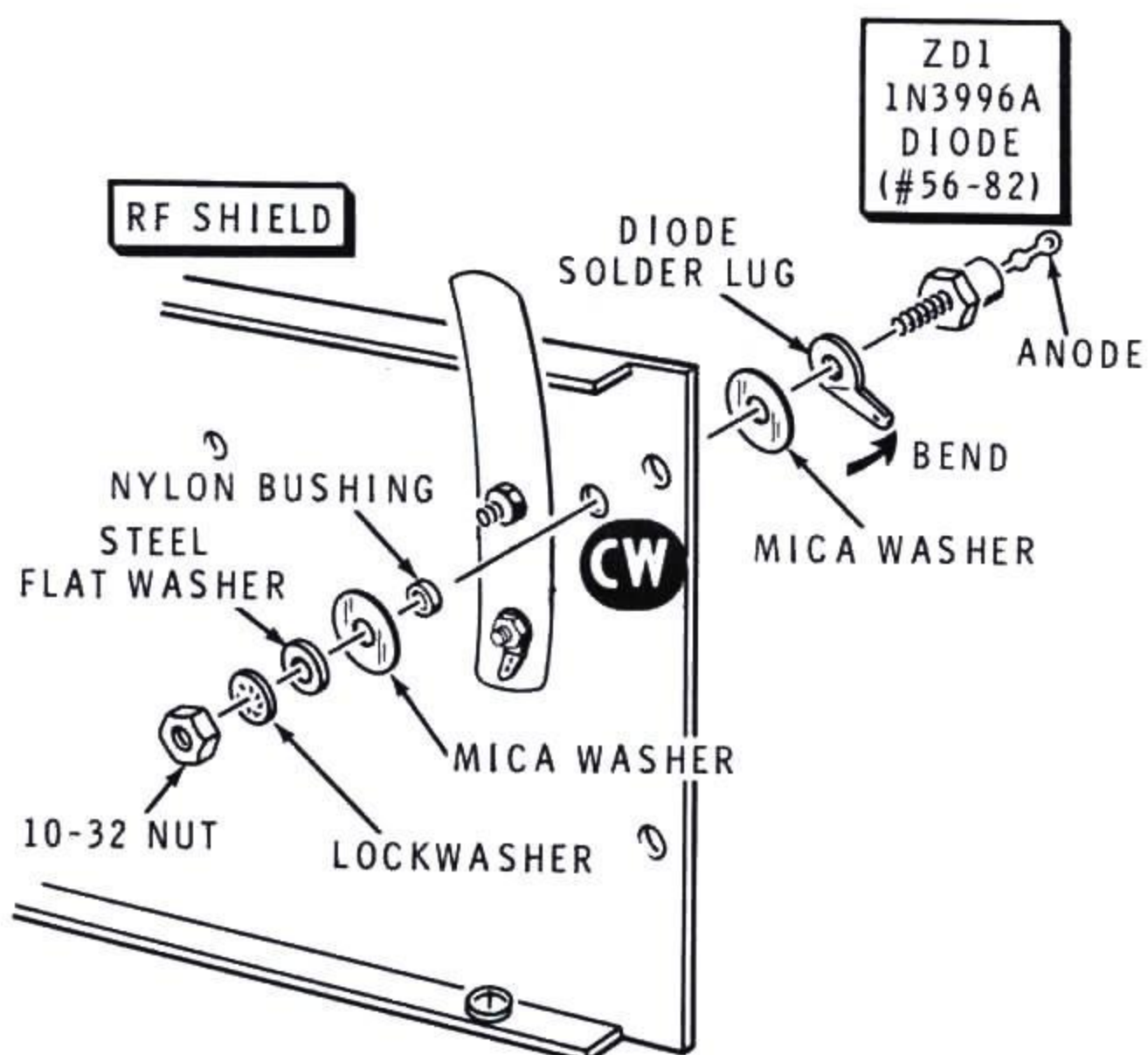
Refer to Pictorial 4-3 (Illustration Booklet, Page 5) for the following steps.

- () 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" black screws. At B, use a 6-32 x 3/8" black screw with a 3-lug terminal strip, two #6 lockwashers, and a 6-32 x 5/16" metal spacer as shown. NOTE: Use pliers on the spacer to be sure it is tightened securely.
- () 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" black 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.

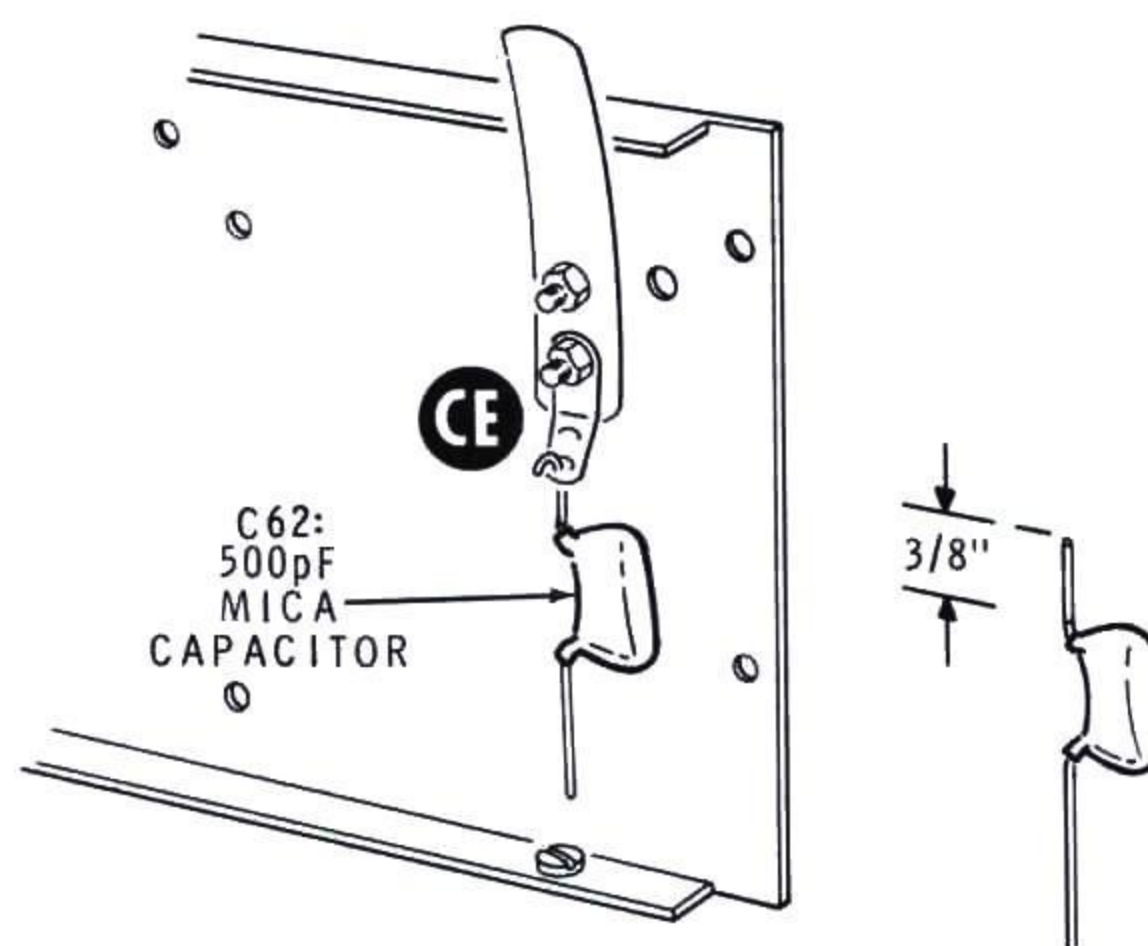


Detail 4-3B





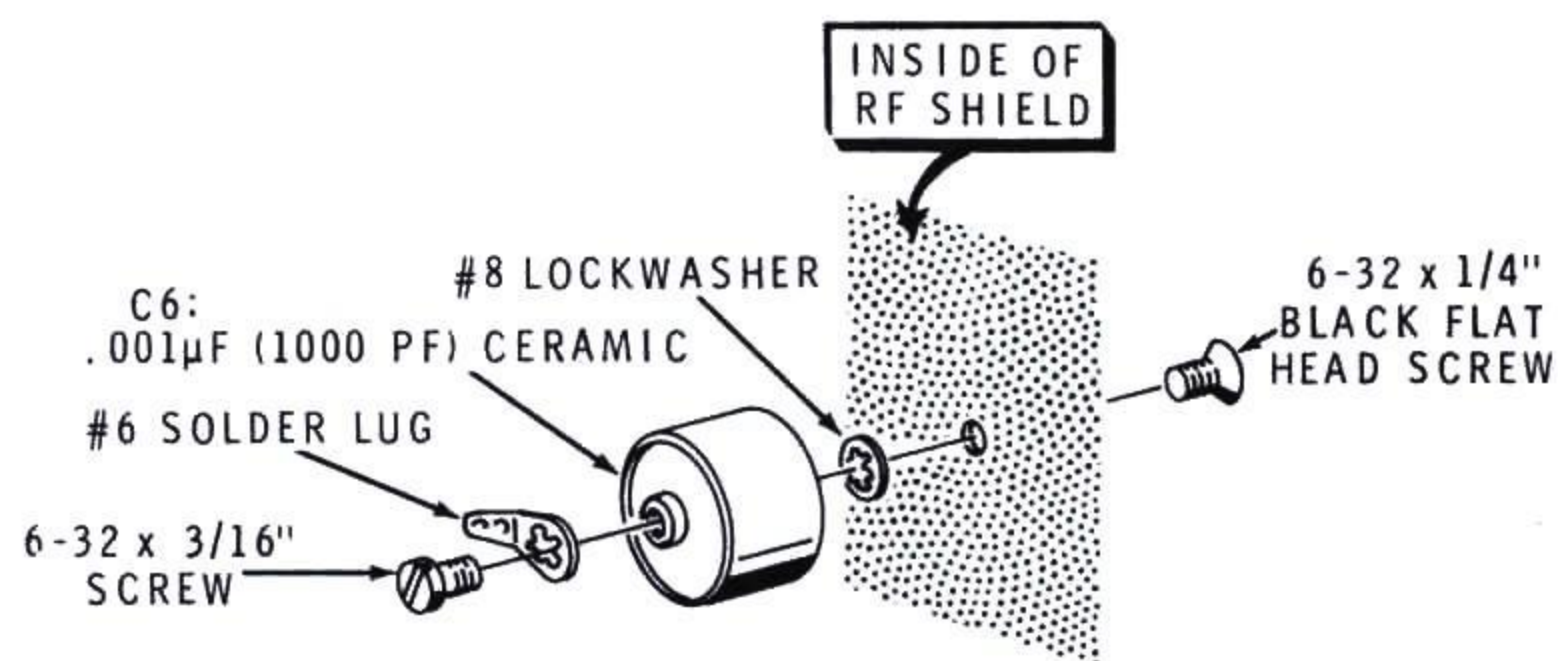
Detail 4-3C



Detail 4-3D

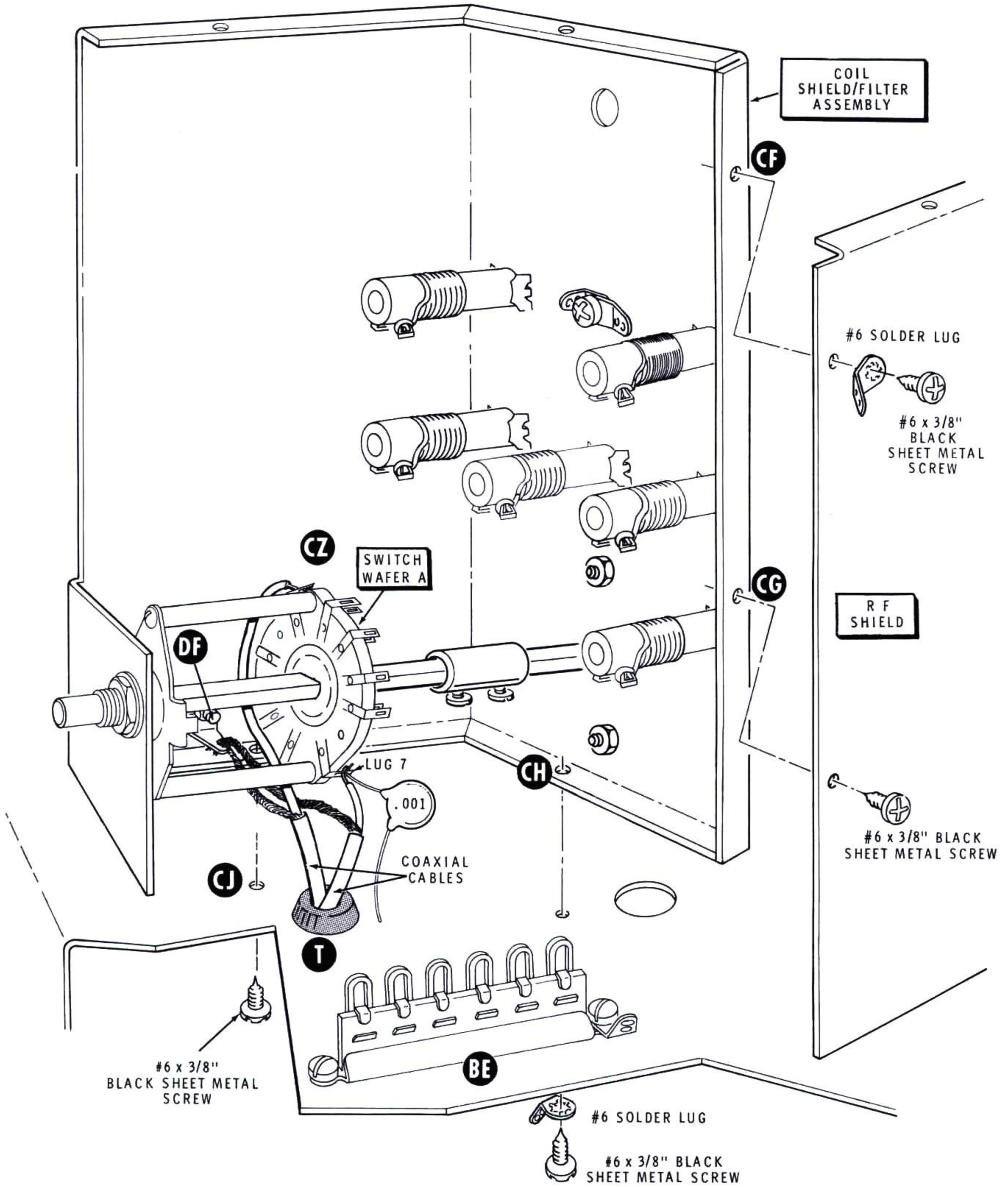
- () ZD1: Refer to Detail 4-3C and install the 1N3996A diode (#56-82) at CW on the outside of the RF shield with the mounting stud and nut on the same side of the shield as the brass spring, as shown in the Pictorial. Use the hardware supplied with the diode. Coat both sides of each mica washer with silicone grease before you install it. Make sure the nylon bushing is centered in hole CW and that the solder lug points downward. Tighten the nut firmly, but do not overtighten.
- () Bend the end of the diode solder lug out away from the chassis at an angle of approximately 45 degrees.
- () If you have an ohmmeter, measure the resistance from diode ZD1 anode terminal to chassis ground and make sure the diode is not shorted.
- () Prepare two 3" lengths of medium black stranded wire. Refer to Pictorial 4-3 and connect one end of one wire to the diode solder lug at CW (S-1). Connect one end of the other 3" wire to the anode terminal on diode ZD1 (S-1). The other ends of these wires will be connected later.

- () C62: Refer to Detail 4-3D 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.

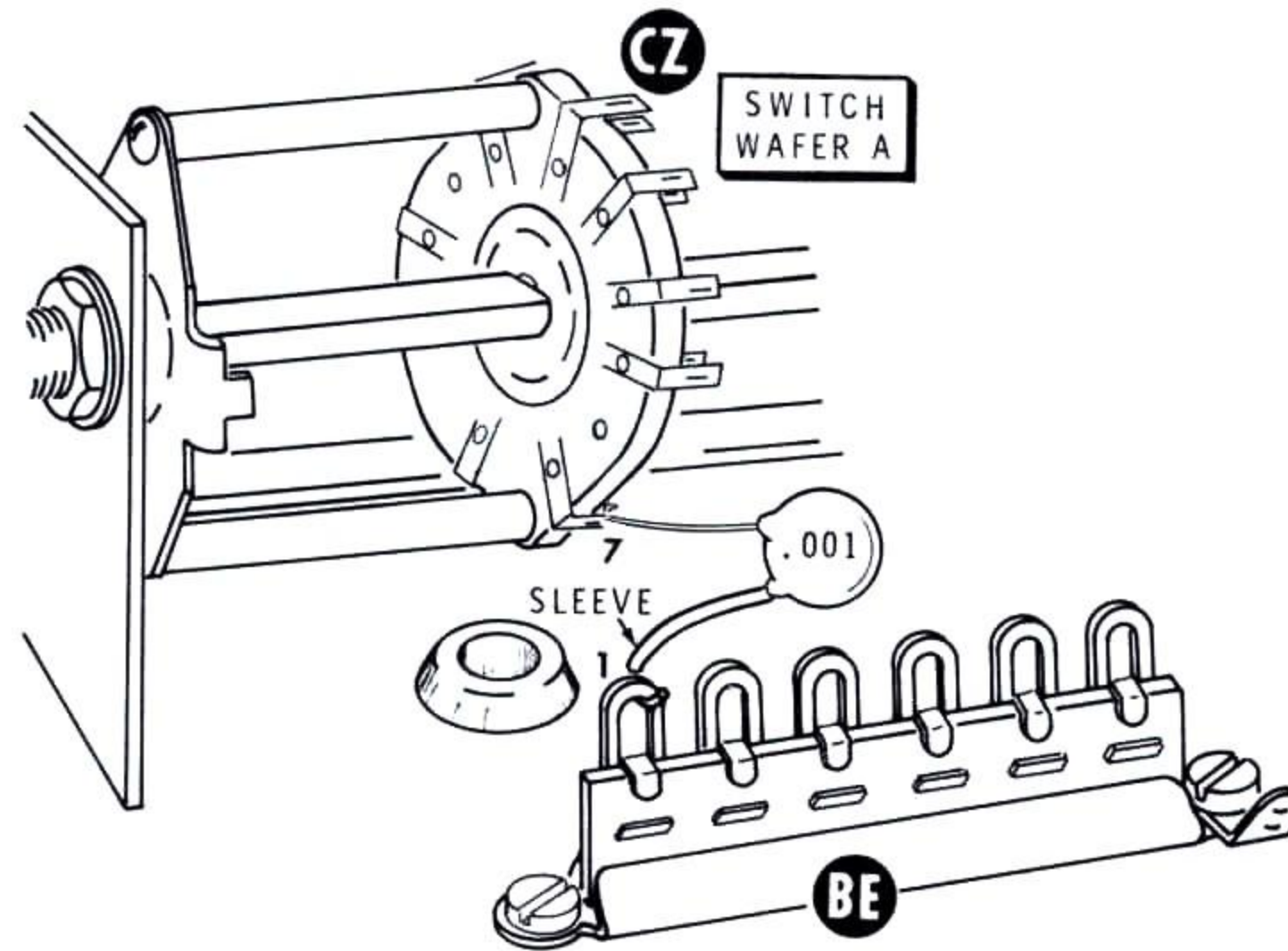


Detail 4-3E

- () C6: Refer to Detail 4-3E and mount a .001 μ F ceramic capacitor (#21-165) at CM on the inside of the RF shield (this capacitor may be marked 1000 PF). Use a 6-32 \times 1/4" black 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 \times 3/16" screw. Position the solder lug as shown.



PICTORIAL 4-4

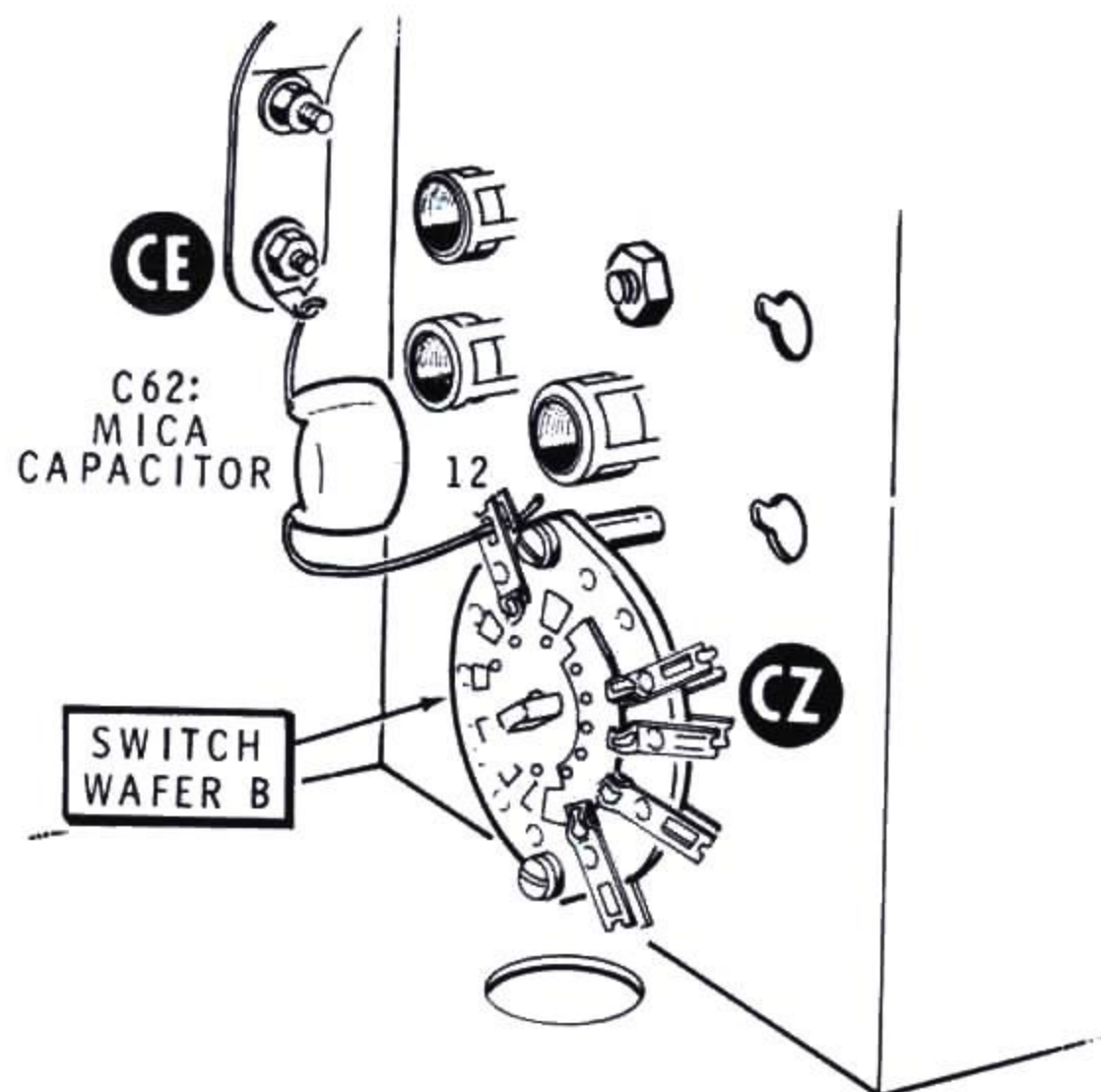


Detail 4-4A

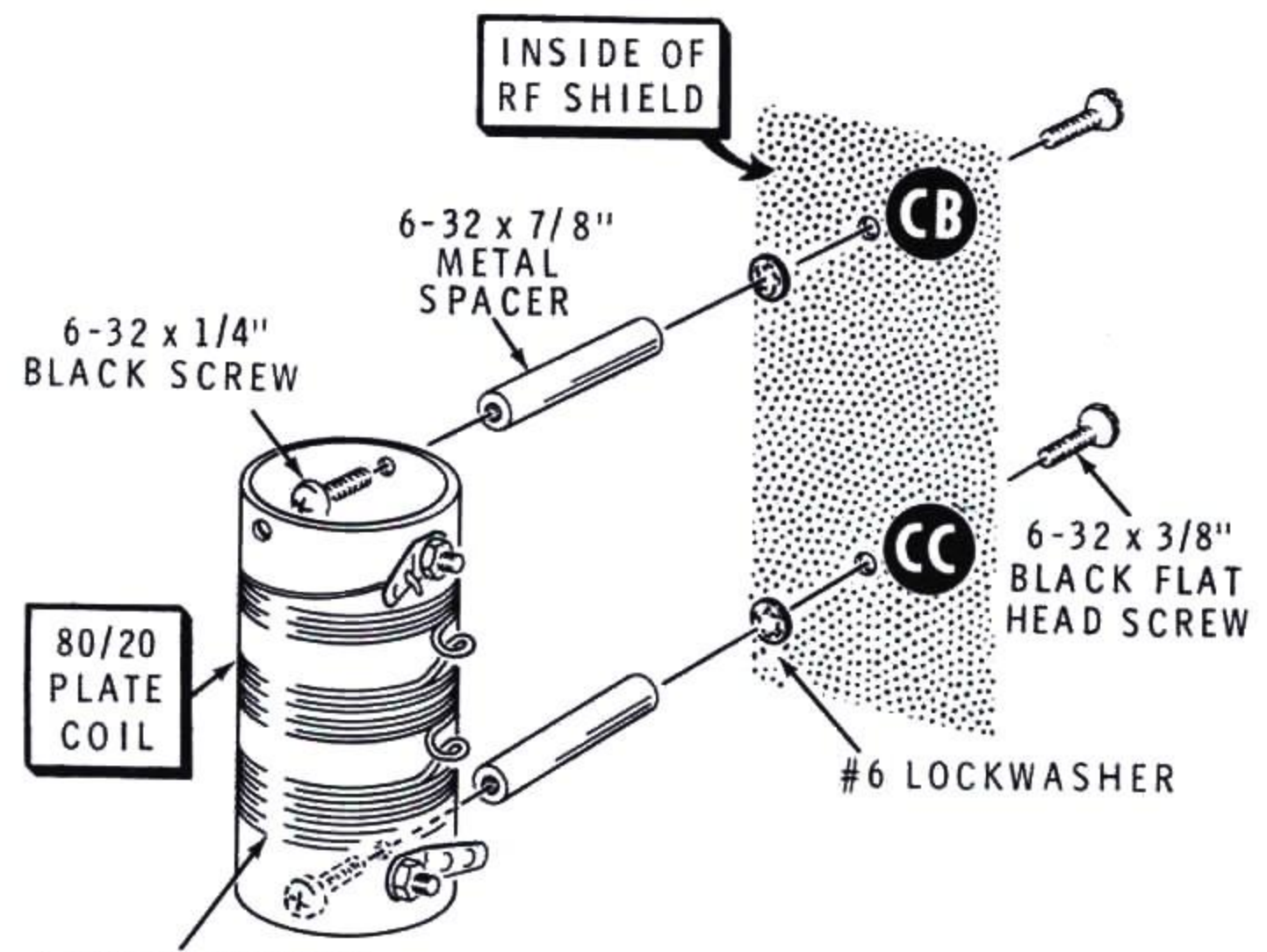
Refer to Pictorial 4-4 for the following steps. For clarity, only the coil shield/filter assembly is shown.

- () Start the ends of the two coaxial cables coming from wafer A of switch CZ down through grommet T, and lower the input coil shield 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 × 3/8" black sheet metal screw and a #6 solder lug at CH in the coil shield assembly.
- () From the bottom of the chassis, install a #6 × 3/8" black sheet metal screw at CJ in the coil shield assembly.
- () Make sure none of the parts on terminal strip BE contact any part on switch CZ.
- () Install a #6 × 3/8" black sheet metal screw and a #6 solder lug at CF. Note the position of the solder lug.
- () Install a #6 × 3/8" black sheet metal screw at CG.
- () Cut a 1/2" piece of small black sleeving. Use this sleeving in the next step.
- () Refer to Detail 4-4A and connect the free lead of the .001 μF ceramic capacitor coming from switch CZ wafer A lug 7 to terminal strip BE lug 1 (S-3). Use the precut 1/2" of sleeving on this lead.





Detail 4-5A



Detail 4-5B

Refer to Pictorial 4-5 (Illustration Booklet, Page 6) for the following steps.

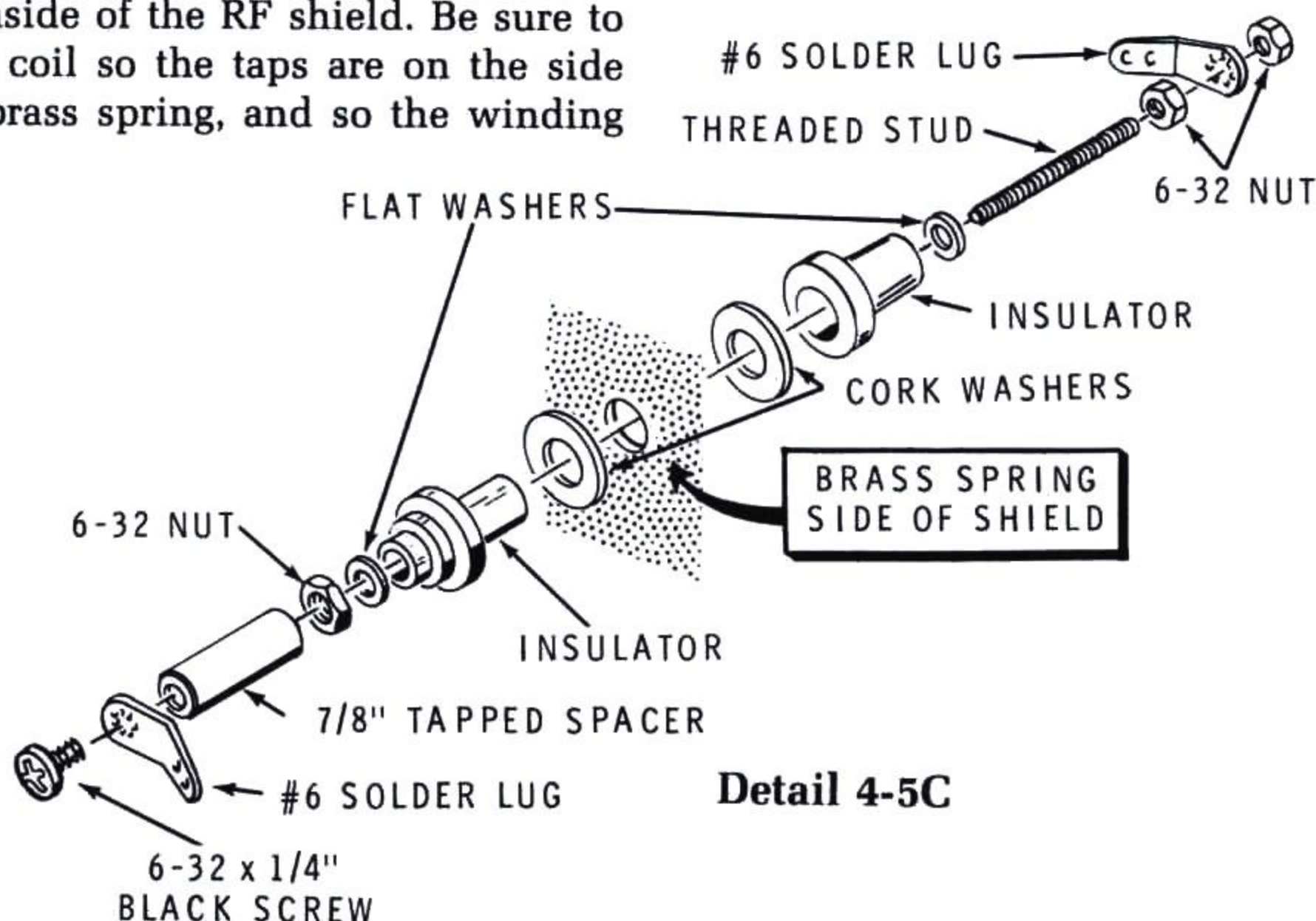
- () Refer to Detail 4-5A and connect the free lead of 500 pF capacitor C62 to rotary switch CZ, wafer B lug 12 (S-3). Be sure the capacitor lead is soldered to both lugs.

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

- () Install two 6-32 × 7/8" metal spacers on the 80/20 plate coil (#40-1666) assembly. Use 6-32 × 1/4" black screws. Check to make sure the spacers do not touch the coil windings.
- () L5: 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 spacer CC. Use #6 lockwashers and 6-32 × 3/8" black flat head screws.

- () Refer to Detail 4-5C and install a ceramic feed-through insulator (#71-2) at CK. In addition to the parts in the plastic bag, use a 7/8" tapped spacer, two #6 solder lugs, and a 6-32 × 1/4" black screw. Before the spacer is screwed onto the threaded stud running through the insulator, hold the brass spring down so it will bear against the under side of the installed spacer as shown in the Pictorial. Discard the unused nut.



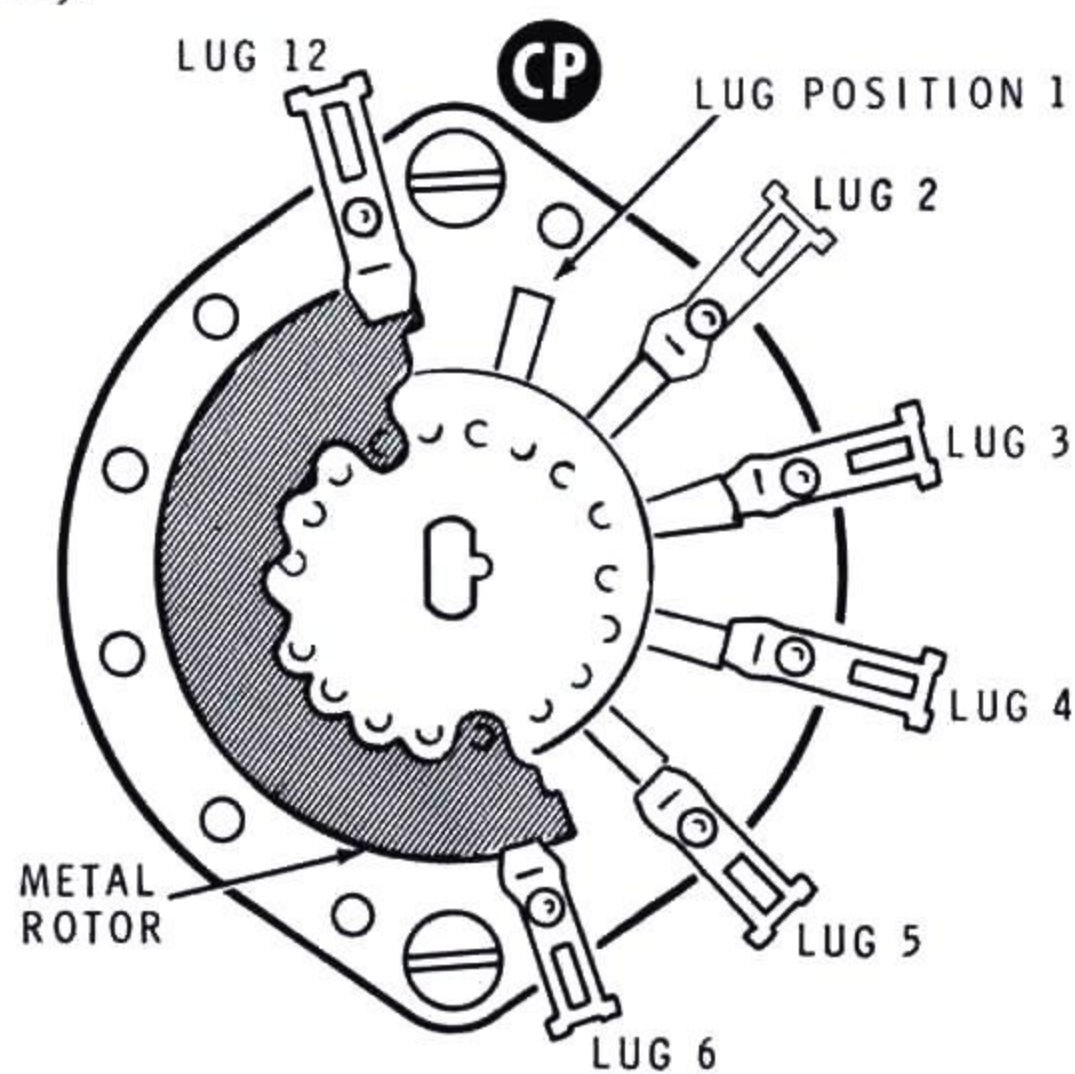
Detail 4-5C

Heathkit®

NOTE: In the following steps, wires will be connected between switch CZ wafer B and the taps on the plate coil. Each wire should be fitted before it is soldered in place. The end of each wire going through the switch lugs must first be flattened as shown in the inset drawing of Detail 4-5E (Illustration Booklet, Page 6). **DO NOT** use the switch lugs to hold one end of the wire when forming it, as the switch lugs and the ceramic switch wafer can be damaged.

When soldering wires to the switch, make sure the wire is soldered to **both** switch lugs. After you fit the wires, cut off any excess wire lengths.

Refer to Detail 4-5D for the switch lug numbering system. The Detail shows the switch rotor as it was positioned when the shaft was installed (viewed from the rear).

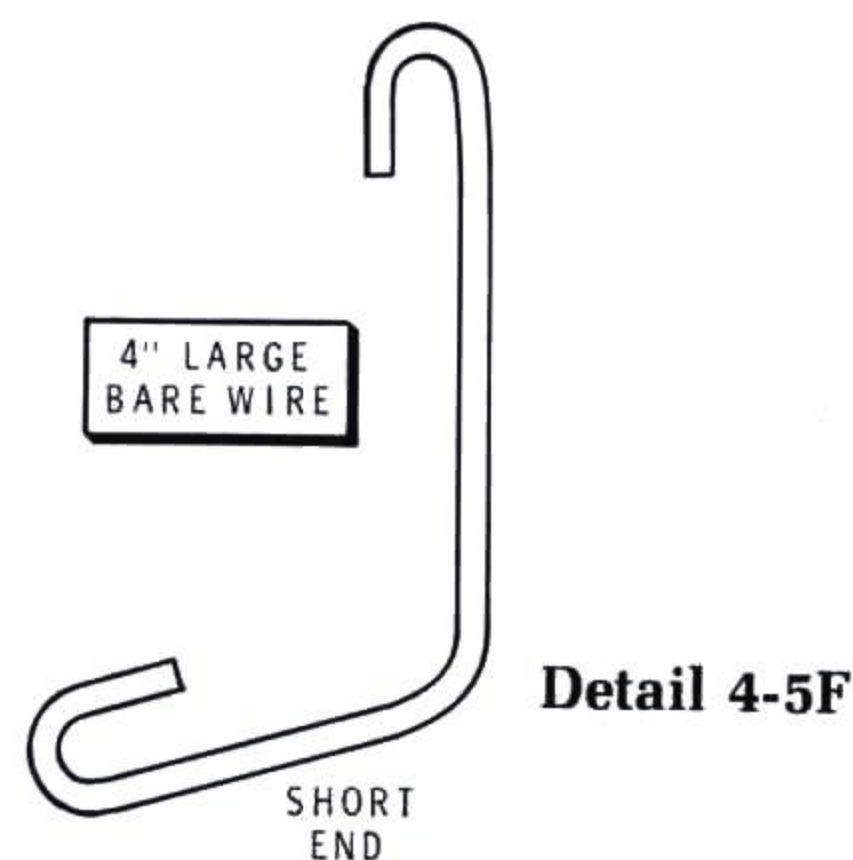


Detail 4-5D

Refer to Detail 4-5E (Illustration Booklet, Page 6) and connect a medium bare wire from rotary switch CZ wafer B to the tap on the plate coil as follows. Be sure to connect to both lugs at each switch position.

	<u>Wire Length</u>	<u>Switch Lug No.</u>	<u>Coil Tap</u>
()	1-1/2"	6 (S-3)	4 (S-1)

() Refer to Detail 4-5F and cut and bend a 4" length of **large** bare wire. Use the illustration as a template to form the wire. Then compress the hooks on the short end to fit the wire in the next step.

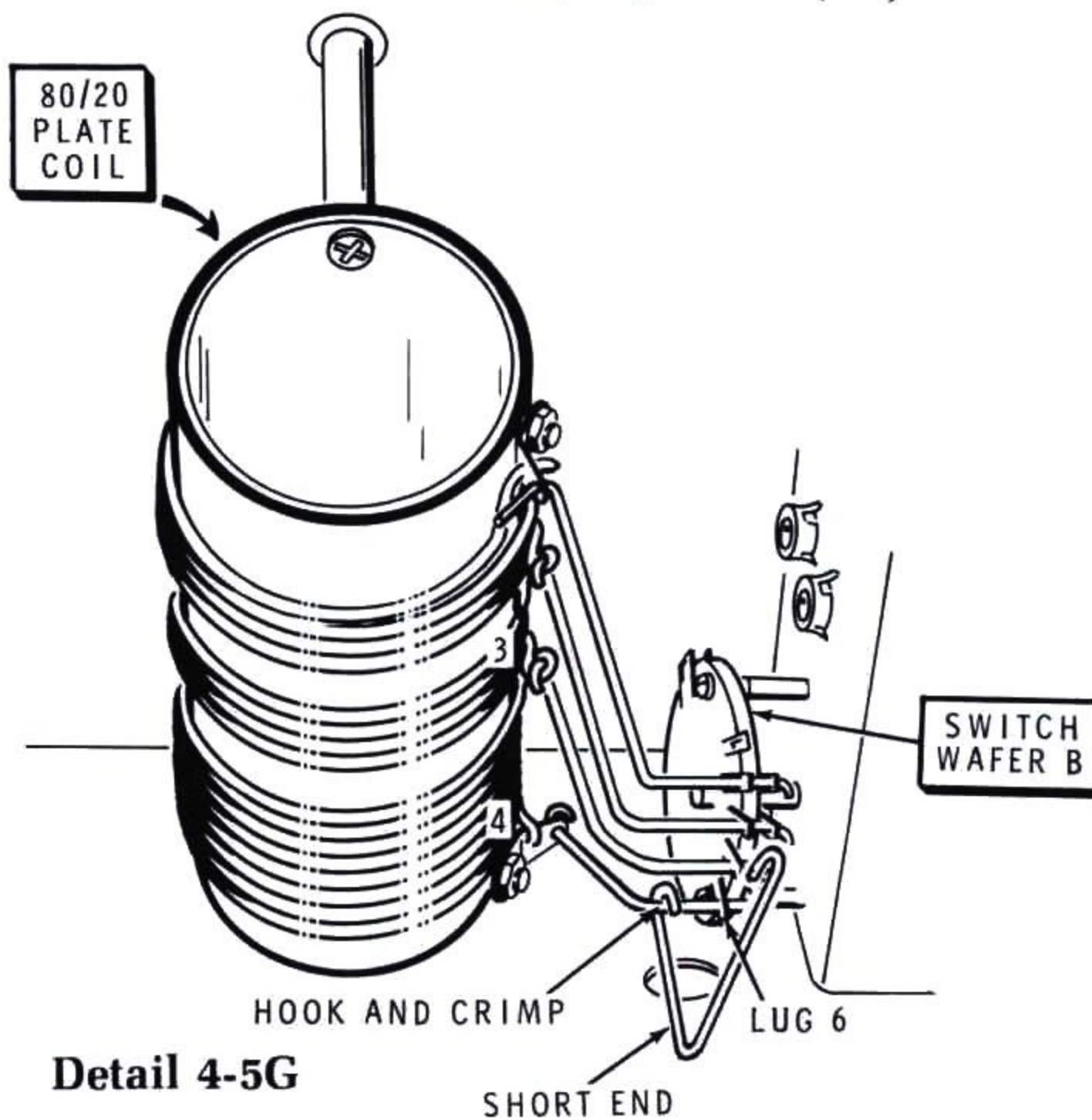


Detail 4-5F

() Refer to Detail 4-5G and hook the short end of the bare wire around the switch wire at lug 4 of the 80/20 plate coil. Position the wires as shown. Then crimp but do **not** solder the hook to the wire.

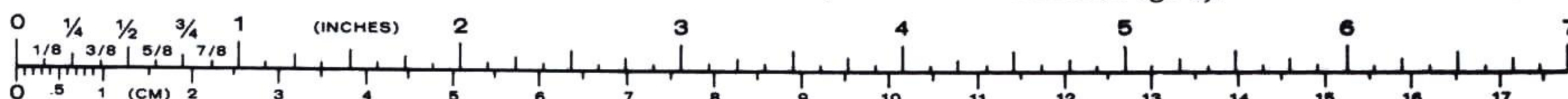
Prepare and install the following medium bare wires:

	<u>Wire Length</u>	<u>Switch Lug No.</u>	<u>Coil Tap</u>
()	2-1/2"	5 (S-3)	3 (S-1)
()	3"	4 (S-3)	2 (S-1)
()	3-1/2"	3 (S-3)	1 (NS)*

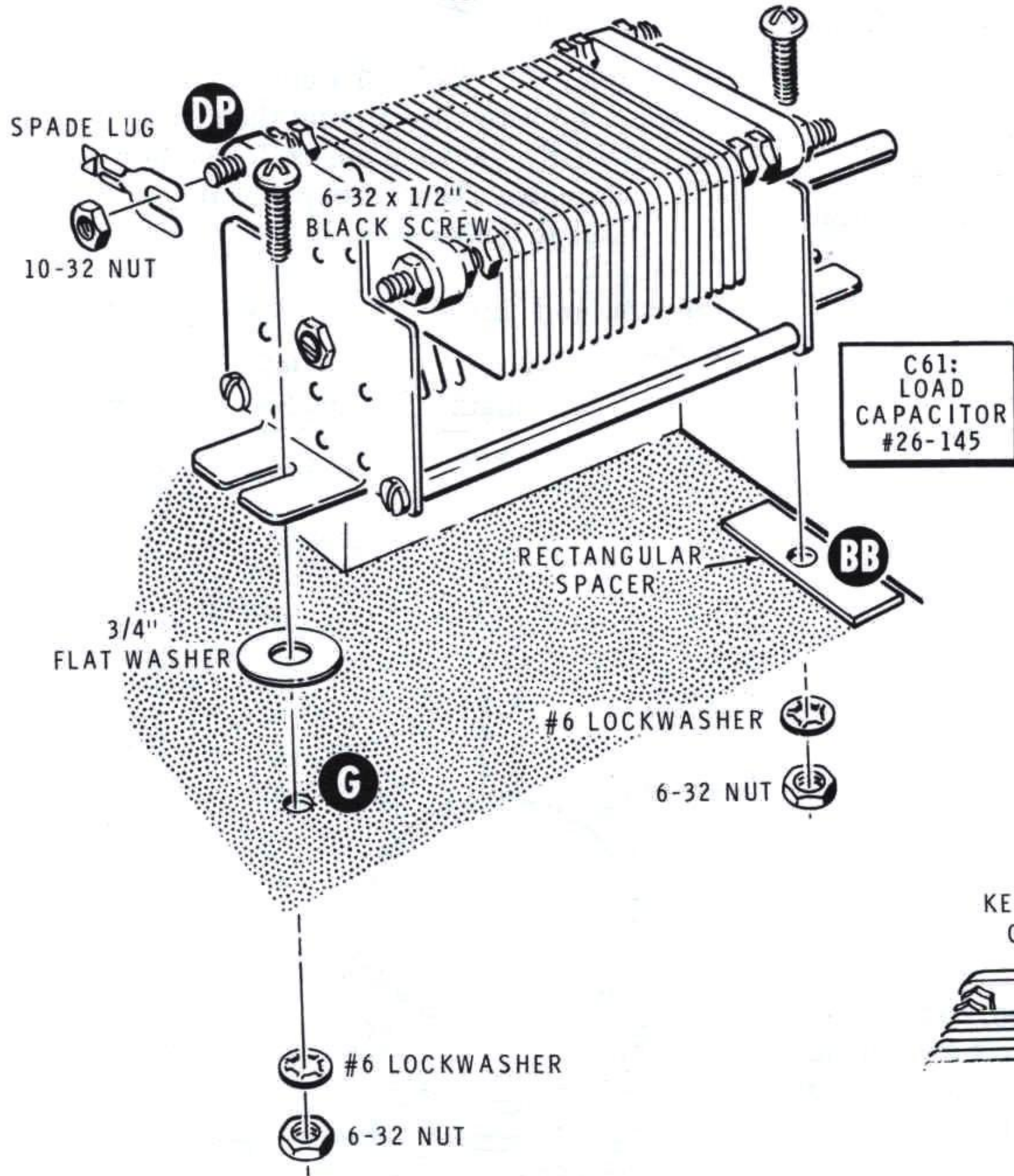
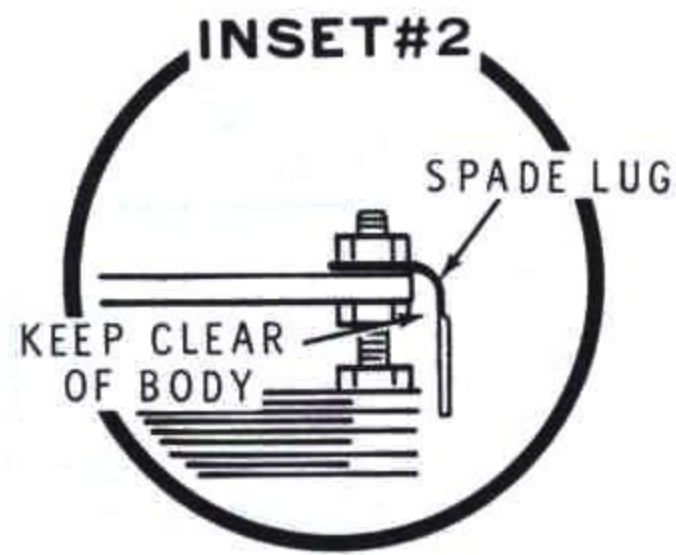
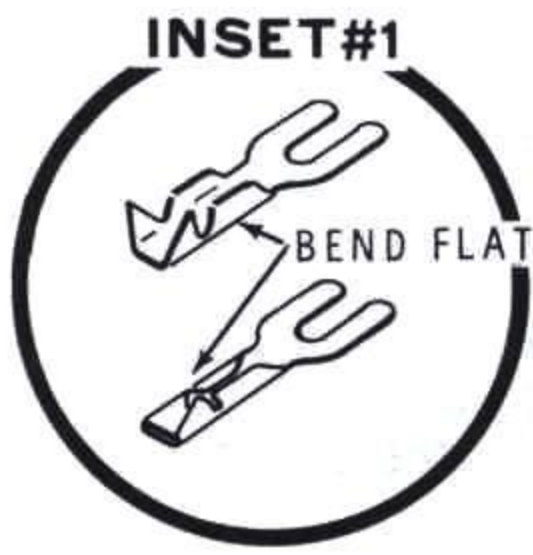


Detail 4-5G

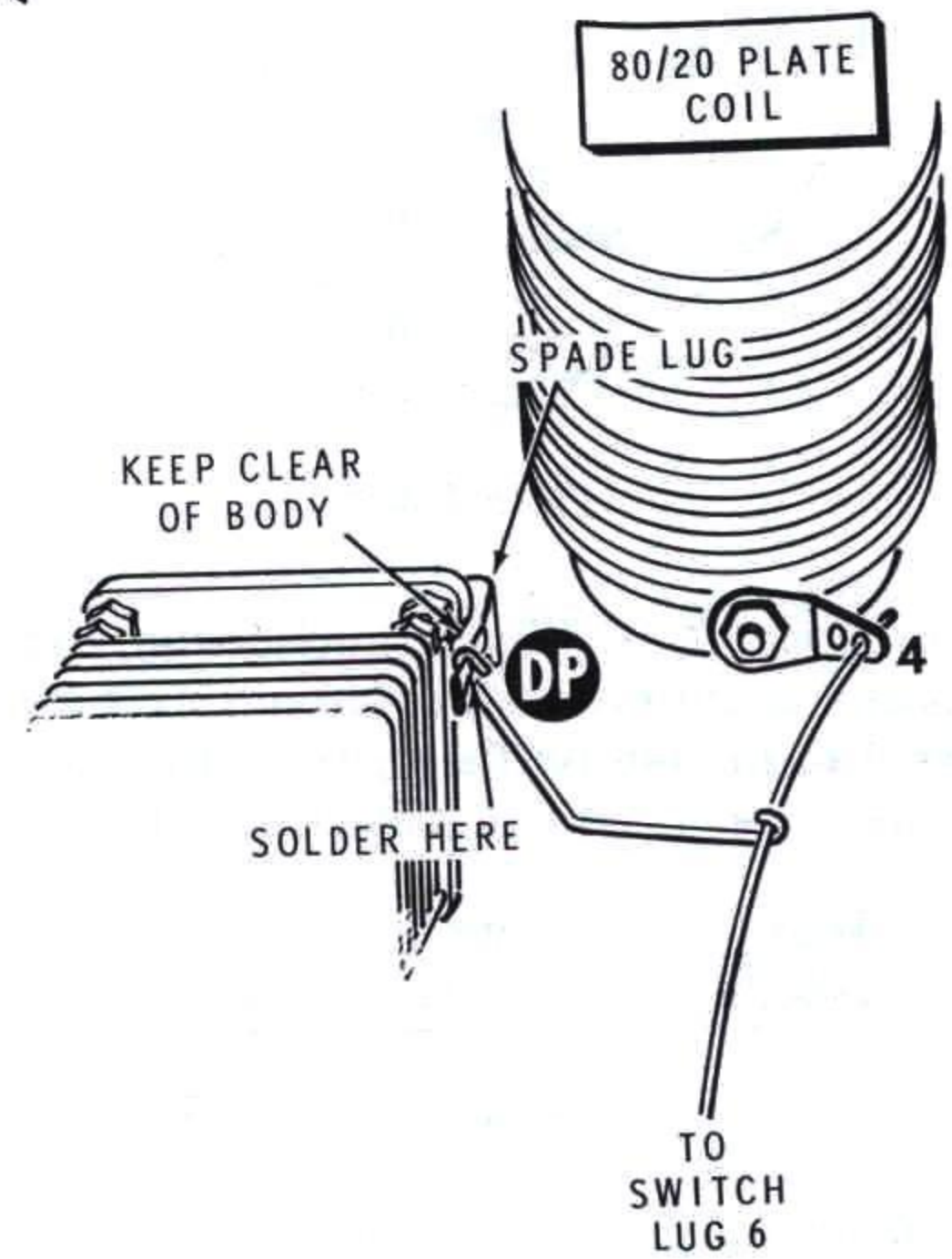
*Extend the wire 1/4" through the solder lug as shown in the upper inset drawing on Detail 4-5E (Illustration Booklet, Page 6).



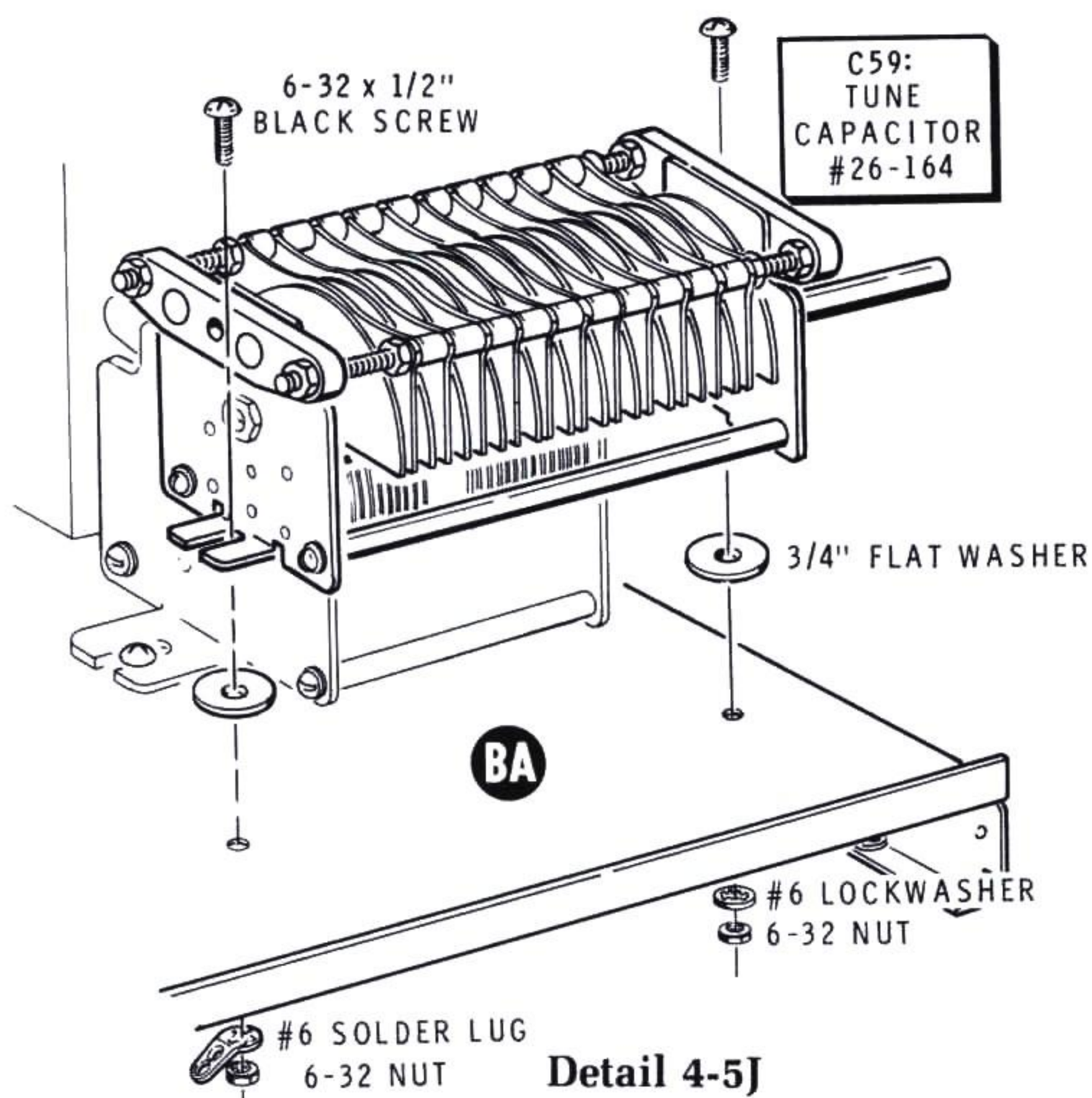
PART 1



PART 2



Detail 4-5H

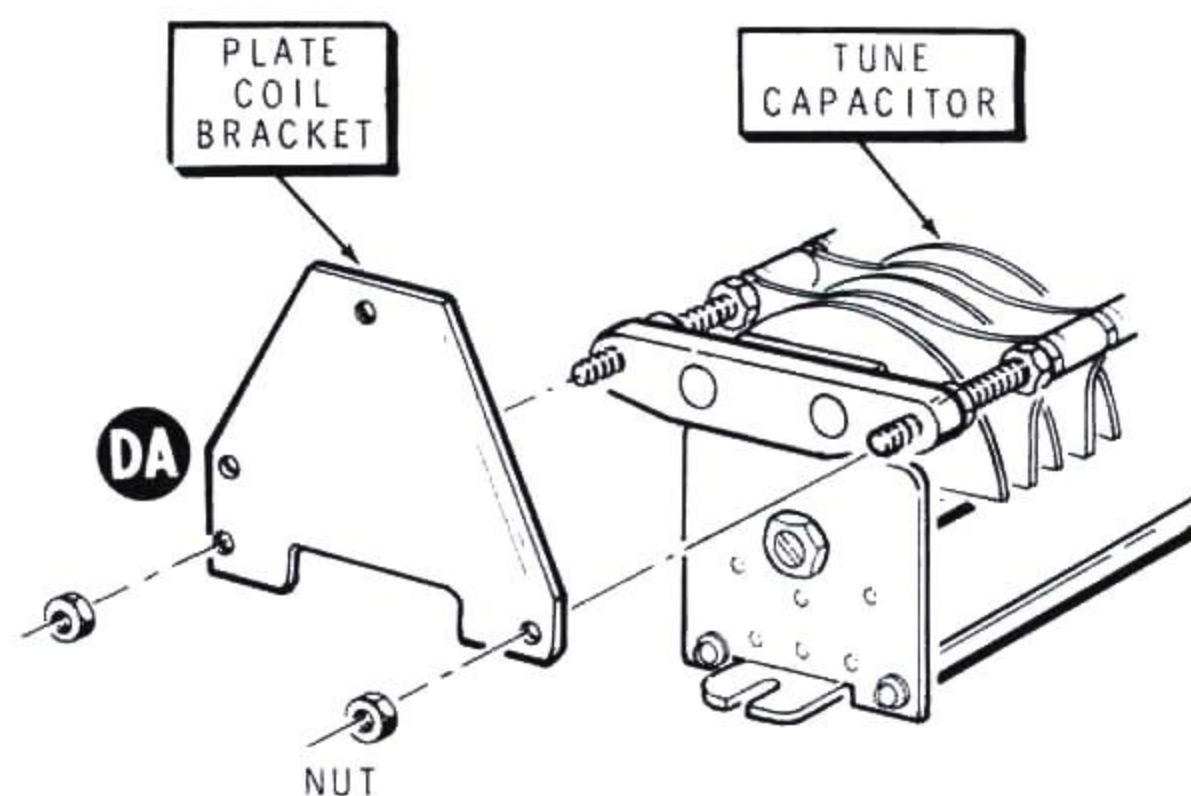


Refer to Detail 4-5H Part 1 for the following numbered steps.

- () 1. Close the end of the spade lug with a pair of pliers as shown in inset drawing #1.
- () 2. Loosen the 10-32 nut on the Load capacitor (#26-145) at screw DP. Position the spade lug as shown and mount the lug on the screw. Retighten the nut.
- () 3. Refer to inset drawing #2 and bend the spade lug over the edge of the capacitor 90° as shown.

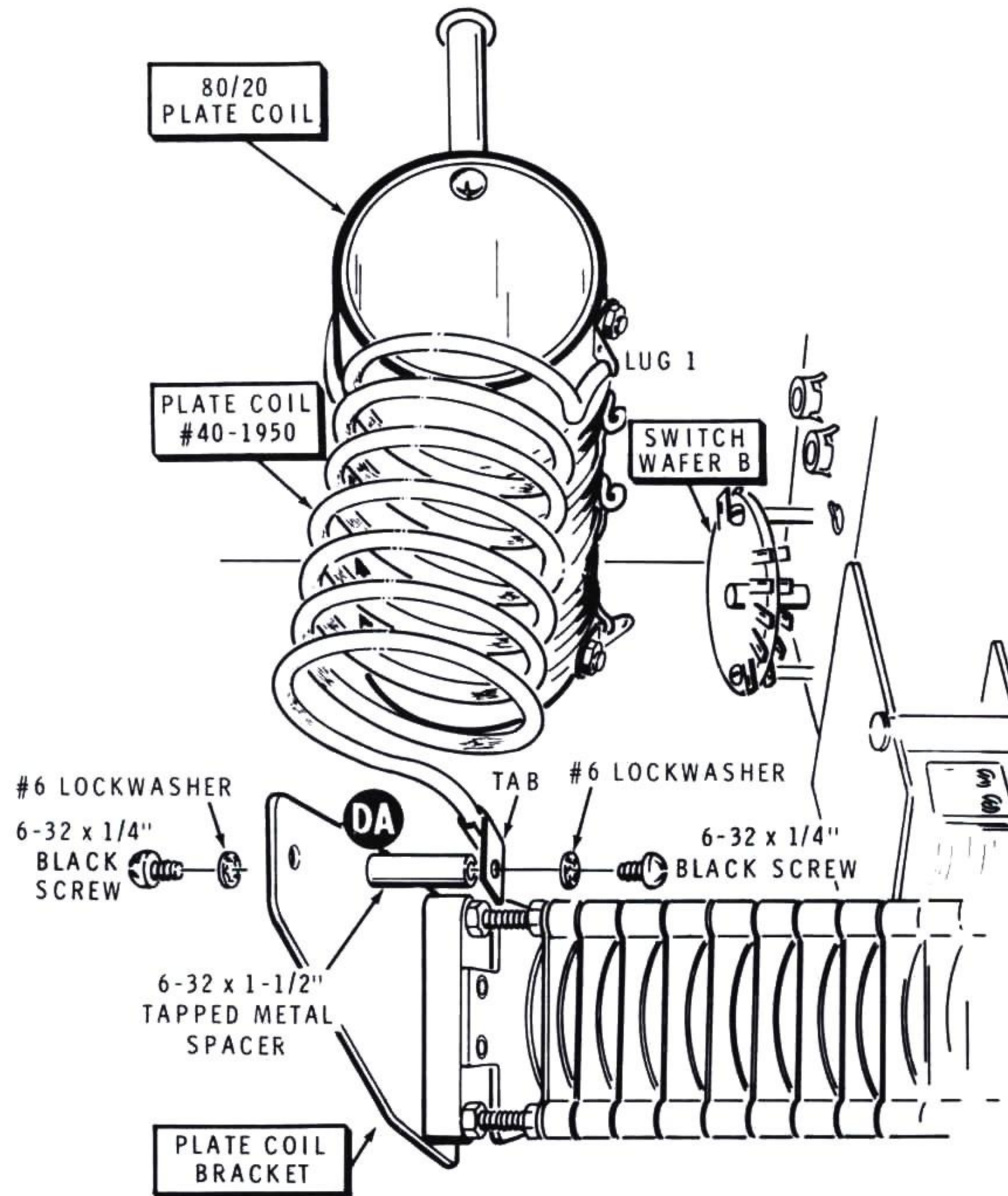
IMPORTANT: When you mount the Tune and Load capacitors in the following steps, make sure that the mounting feet and hardware do not protrude beyond the front edge of the chassis.

- () 4. C61: Mount the prepared Load capacitor on the chassis. Use 6-32 x 1/2" black hardware and a rectangular spacer at BB. Use 6-32 x 1/2" black hardware and a 3/4" flat washer at G.

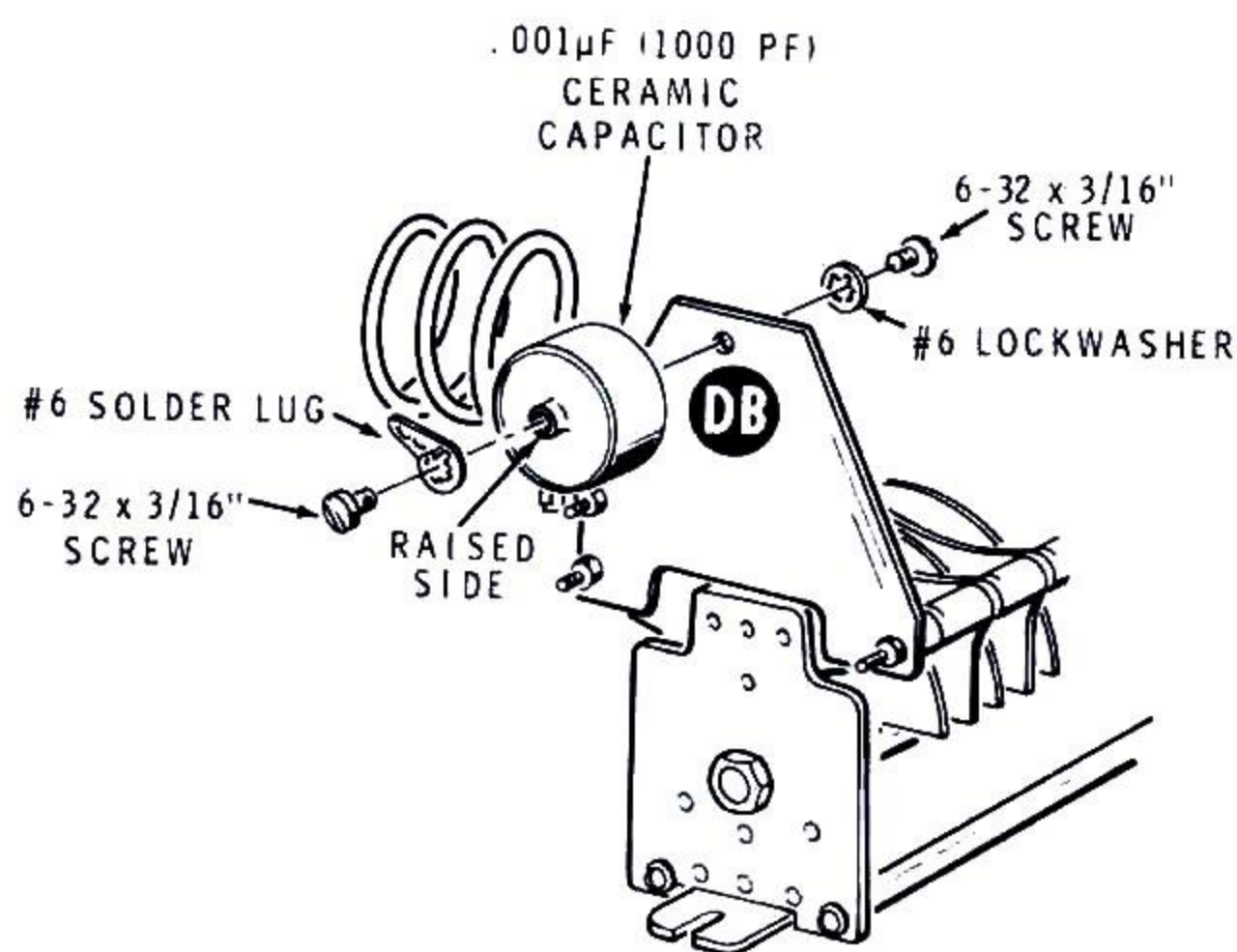


Detail 4-5K

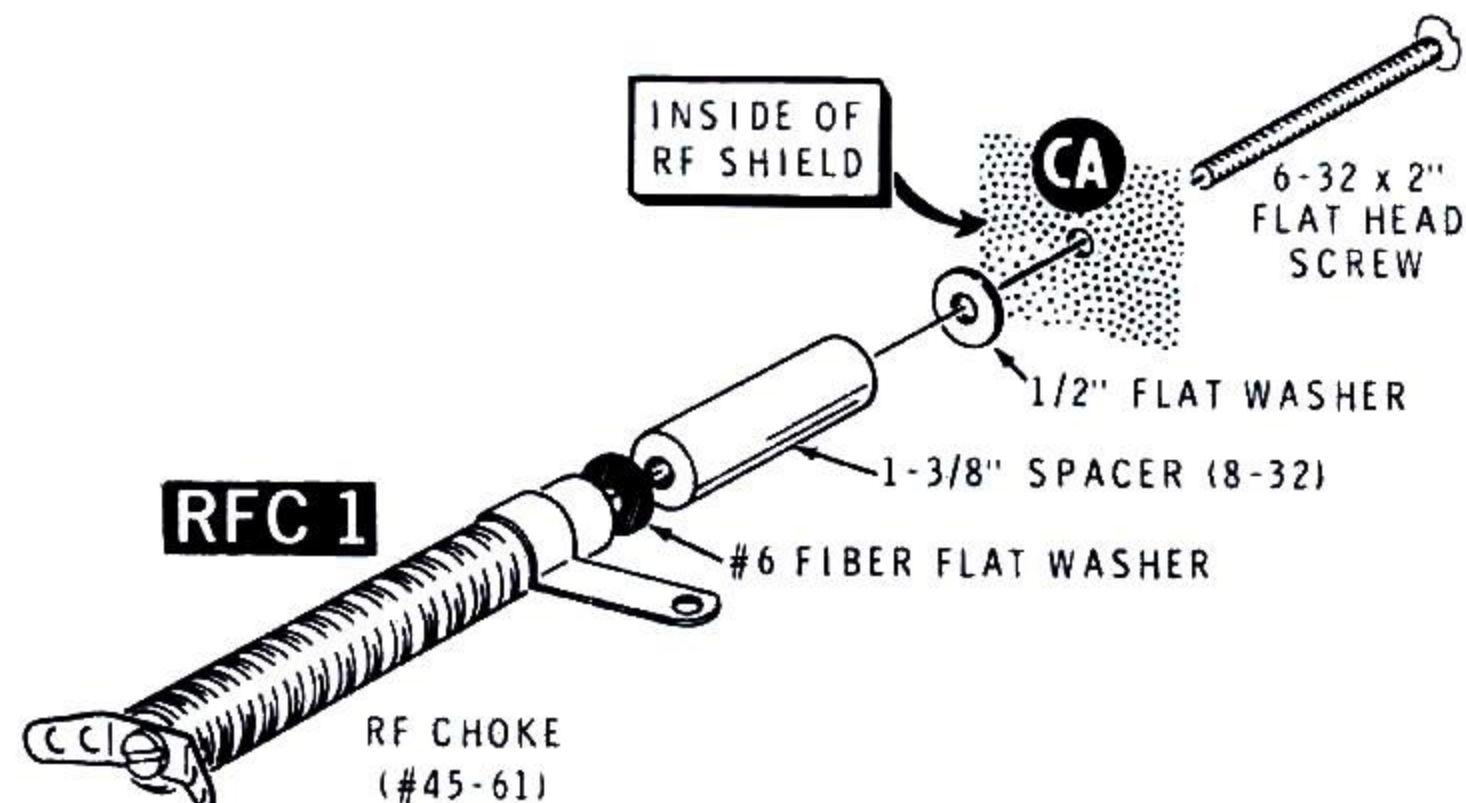
- () Refer to Detail 4-5H Part 2 and hook the remaining end of the 4" large bare wire around the spade lug on the Load capacitor at DP. Crimp and solder both connections. Make sure the wire is positioned away from the capacitor body and any adjacent wiring. **CAUTION:** Do not use too much force on the wire — you may break the lug or ceramic wafer of the rotary switch.
- () C59: Refer to Detail 4-5J and mount the Tune capacitor (#26-164) at BA as shown. Use two 6-32 x 1/2" black screws, two 3/4" flat washers, a #6 solder lug, a #6 lockwasher, and two 6-32 nuts.
- () Refer to Detail 4-5K and use the following procedure to install the plate coil bracket (#204-2102) on the rear of Tune capacitor BA:
 1. Temporarily remove the nuts from the top studs on the back of the capacitor.
 2. Slide the plate coil bracket onto the studs. Be sure to position the bracket with hole DA as shown.
 3. Replace the nuts on the top capacitor studs to secure the bracket.



Detail 4-5L



Detail 4-5M



Detail 4-5N

- () Refer to Detail 4-5L and mount a 6-32 × 1-1/2" tapped metal spacer at plate coil bracket hole DA. Use a 6-32 × 1/4" black screw and a #6 lockwasher.

NOTE: In the following steps it may be necessary to slightly stretch the plate coil before you install it.

Refer to Detail 4-5L for the following steps.

- () L4: Place the open end of the plate coil (#40-1950) tubing over the wire projecting from 80/20 plate coil lug 1. Form the solder lug so the coil tubing will butt snugly against it.
- () Connect the tab on the coil to spacer DA with a 6-32 × 1/4" black screw and a #6 lockwasher.
- () Solder the coil tubing and the wire lead from the switch wafer to 80/20 plate coil lug 1. Make sure the end of the tubing is against the solder lug and that this connection is well soldered.

Refer to Detail 4-5M for the following steps.

- () Install a #6 solder lug on the raised side of a .001 µF (1000 PF) ceramic capacitor (#21-165). Use a 6-32 × 3/16" screw.

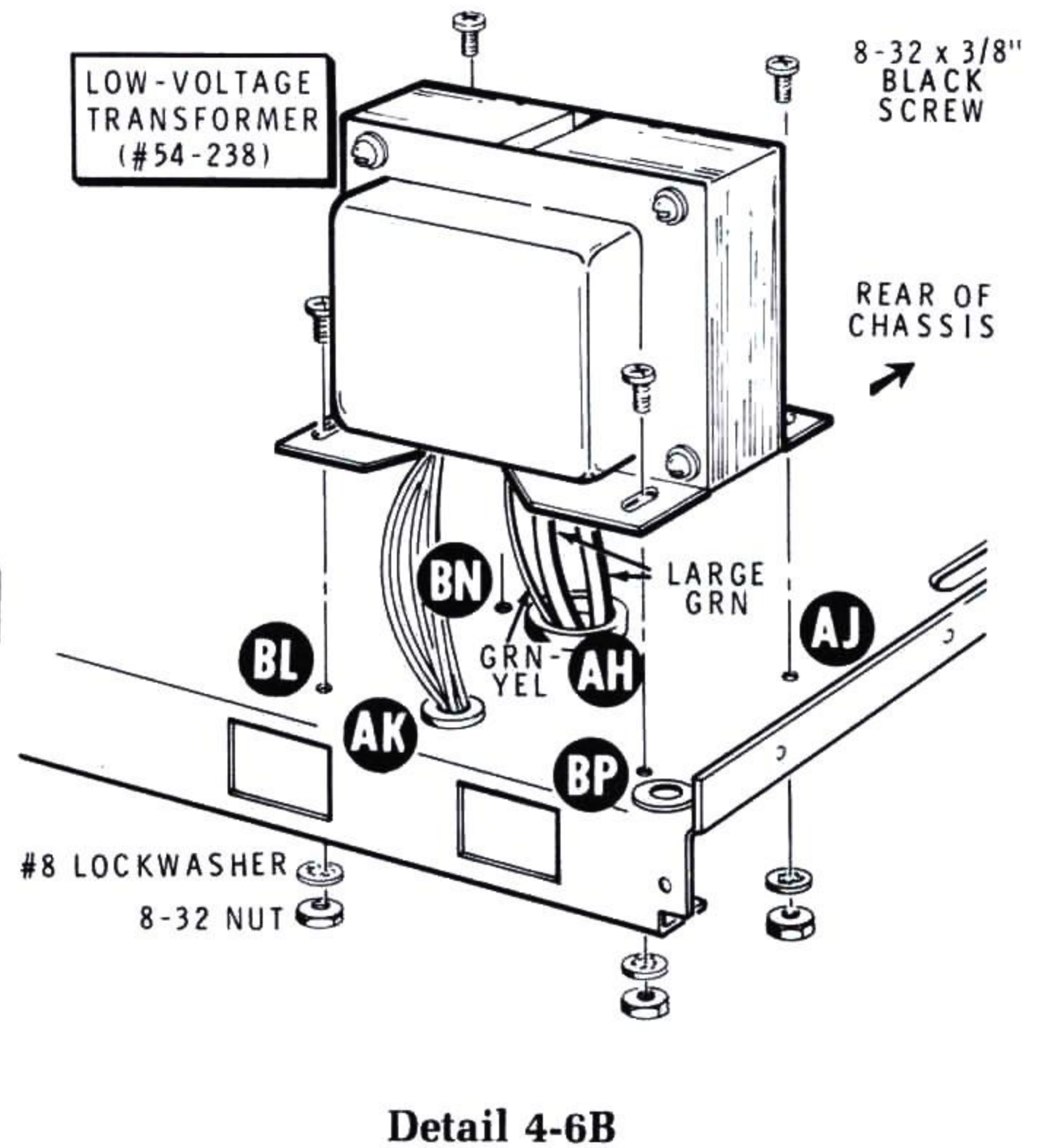
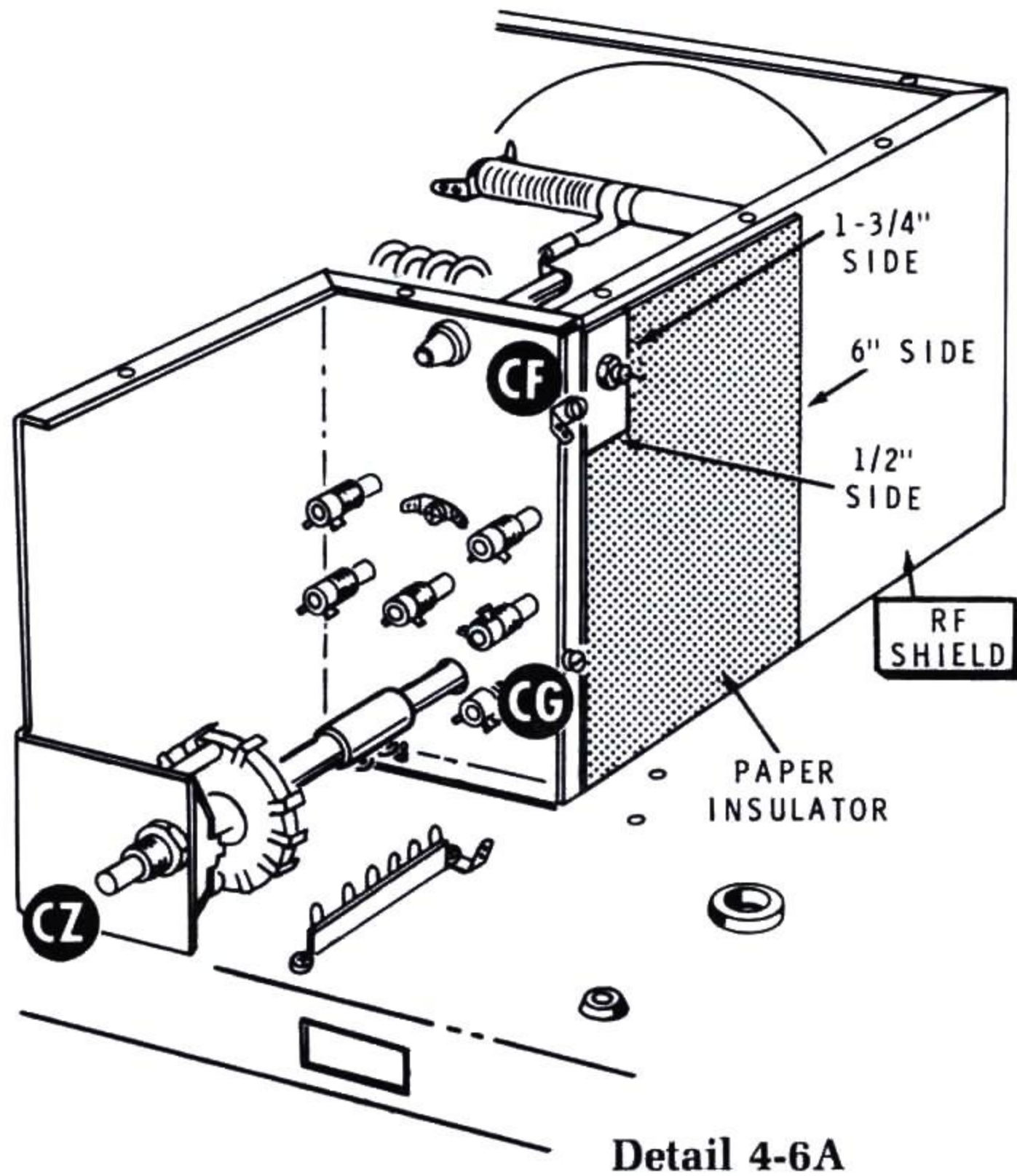
- () C29: Mount this capacitor at plate coil bracket hole DB. Use a 6-32 × 3/16" screw and a #6 lockwasher. Before tightening the screw, position the solder lug as shown.

- () RFC1: Refer to Detail 4-5N and mount an RF choke (#45-61) at CA on the RF shield. Use a 1-3/8" spacer (8-32), a 1/2" flat washer, a #6 fiber flat washer, and 6-32 × 2" flat head screw. Do not overtighten the screw as the threads in the ceramic choke form can be damaged. Position the choke so solder lug DC points toward spacer DD.

Refer to Pictorial 4-5 for the next two steps.

- () Connect a 1-1/2" medium bare wire from capacitor solder lug CM (S-1) to RFC1 solder lug DC (NS).
- () RFC2: Cut each lead of RF choke (#45-6) to a length of 3/8". Connect one lead to choke lug DC (S-2) and the other lead to solder lug on spacer DD (S-1).





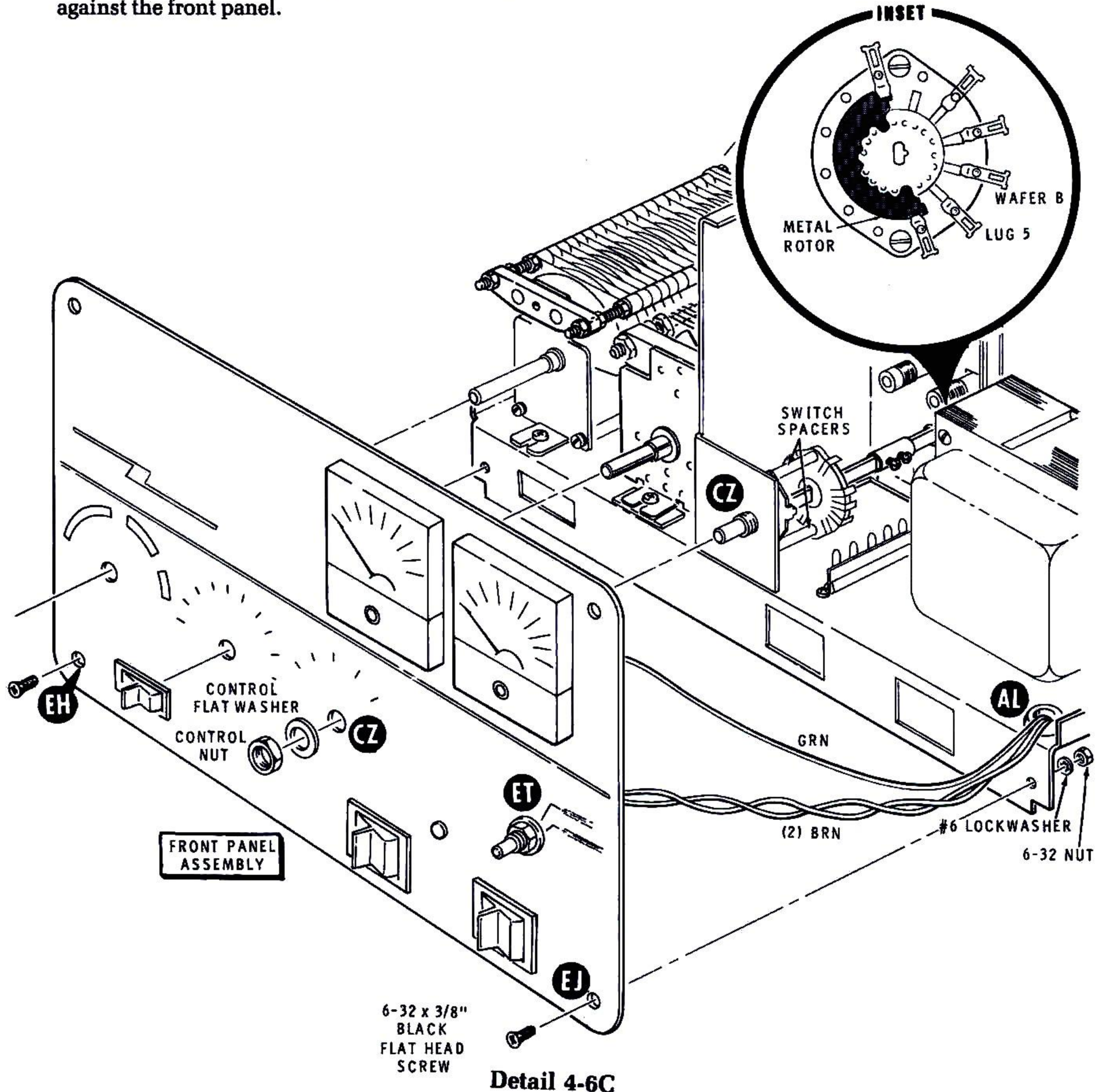
Refer to Pictorial 4-6 (Illustration Booklet, Page 7) for the following steps.

- () Refer to Detail 4-6A and cut a 1/2" × 1-3/4" notch out one corner of the 4-1/2" × 6" paper insulator as shown. Make sure the 1-3/4" side of the notch is along the 6" side of the paper insulator.
- () Remove the paper backing from the paper insulator; then position the paper insulator with the 6" side vertical and with the adhesive side against the RF shield. Make sure the insulator clears the zener diode and the sheet metal screw at CG. Rub the paper firmly into place.
- () T2: Refer to Detail 4-6B and mount the low-voltage transformer (#54-238) on the top of the chassis. As you position the transformer, push the two large green leads and the green-yellow lead down through grommet AH. Push the other leads through grommet AK. Use 8-32 × 3/8" black hardware at AJ, BL, BN, and BP. Position the transformer toward the rear of the chassis as far as possible before you tighten the hardware.
- () Temporarily remove the control nut and the control flat washer from rotary switch CZ (Detail 4-6A).

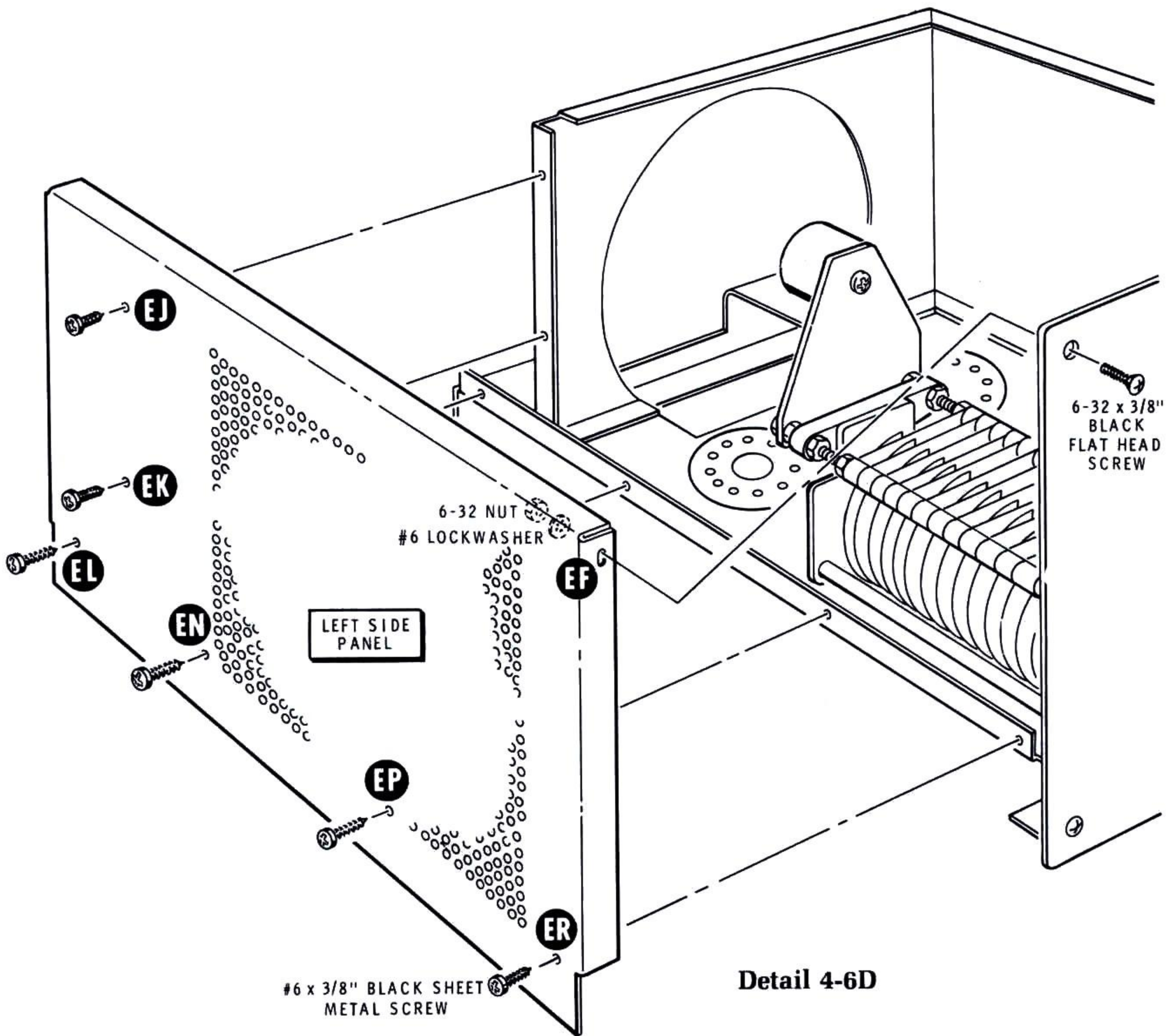


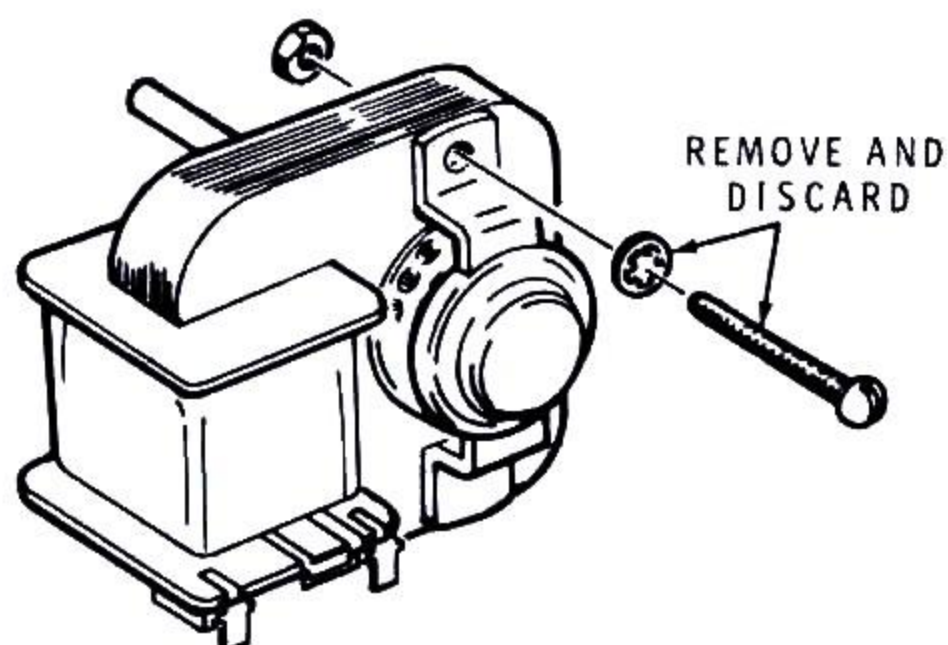
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- () Refer to Detail 4-6C and mount the front panel assembly on the front of the chassis. Push the front panel green wire and the twisted pair of brown wires down through grommet AL. Use 6-32 x 3/8" black flat head hardware at EH and EJ. Make sure there are no wires pinched between the chassis and the front panel.
- () Replace the control flat washer and the control nut on switch CZ. Rotate switch shaft CZ fully counterclockwise. Make the nut just snug against the front panel.
- () Refer to the inset drawing and check the metal rotor of switch wafer B. Make sure the rotor edge does not rest too close to lug 5 or arcing will occur between the rotor and lug. If the rotor edge is too close to lug 5, carefully twist the switch spacers until the rotor is spaced correctly and then tighten the front panel nut securely.

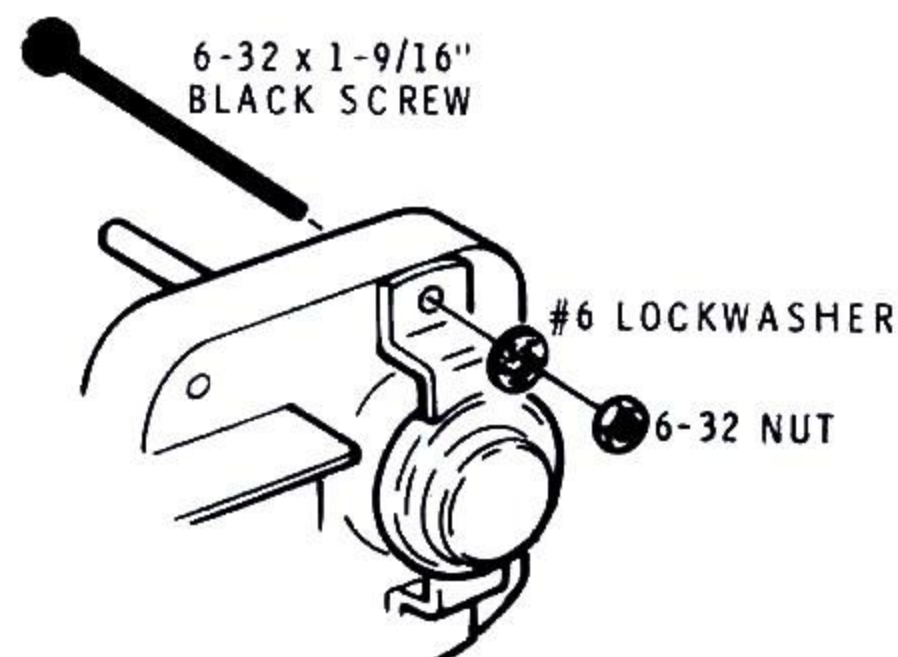


- () Refer to Detail 4-6D and install the left side panel (#203-2149). Use 6-32 × 3/8" black flat head hardware at EF. Use #6 × 3/8" black sheet metal screws at EJ, EK, EL, EN, EP, and ER.





Detail 4-6E



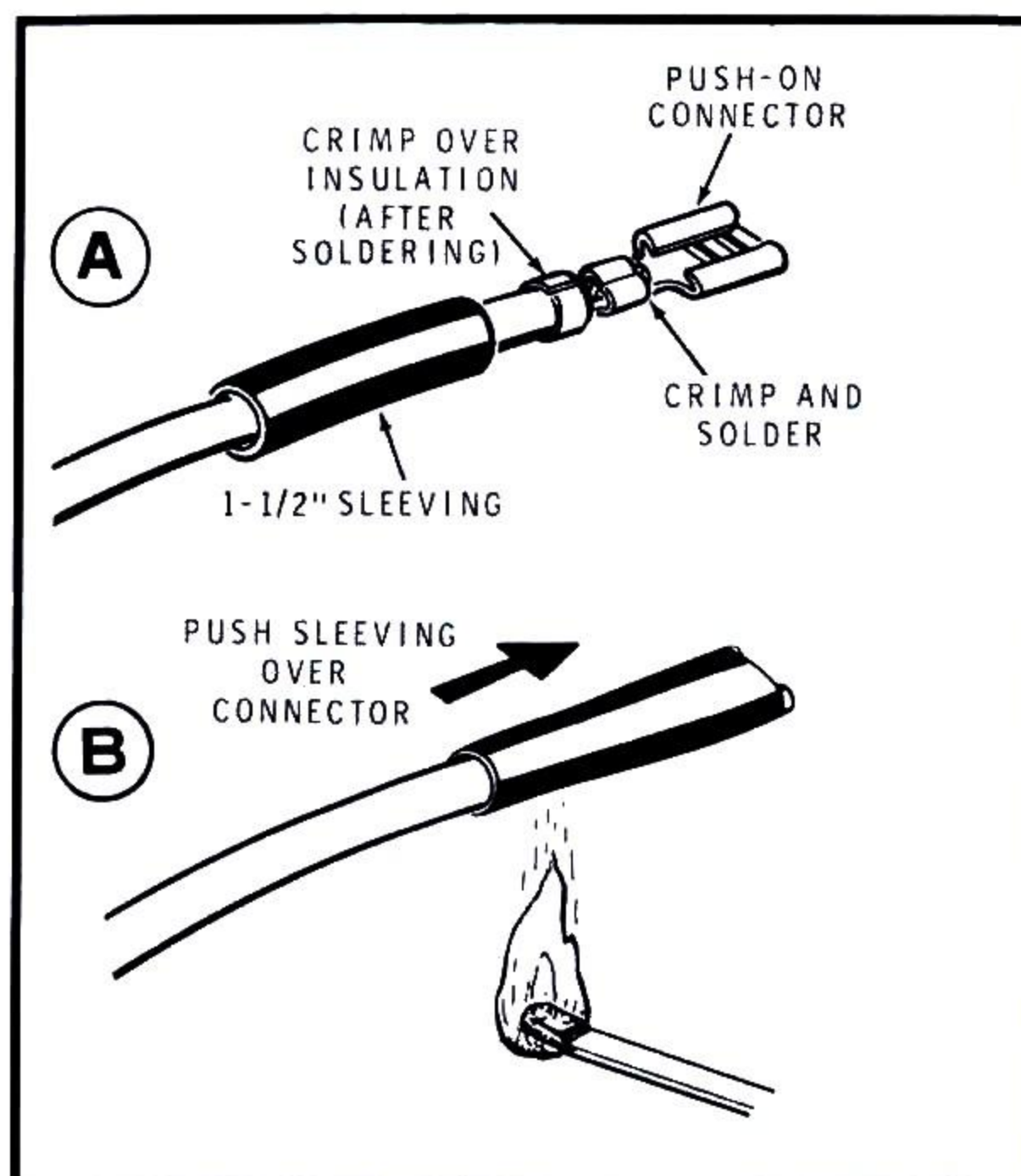
Detail 4-6F

Refer to Detail 4-6E for the next three steps.

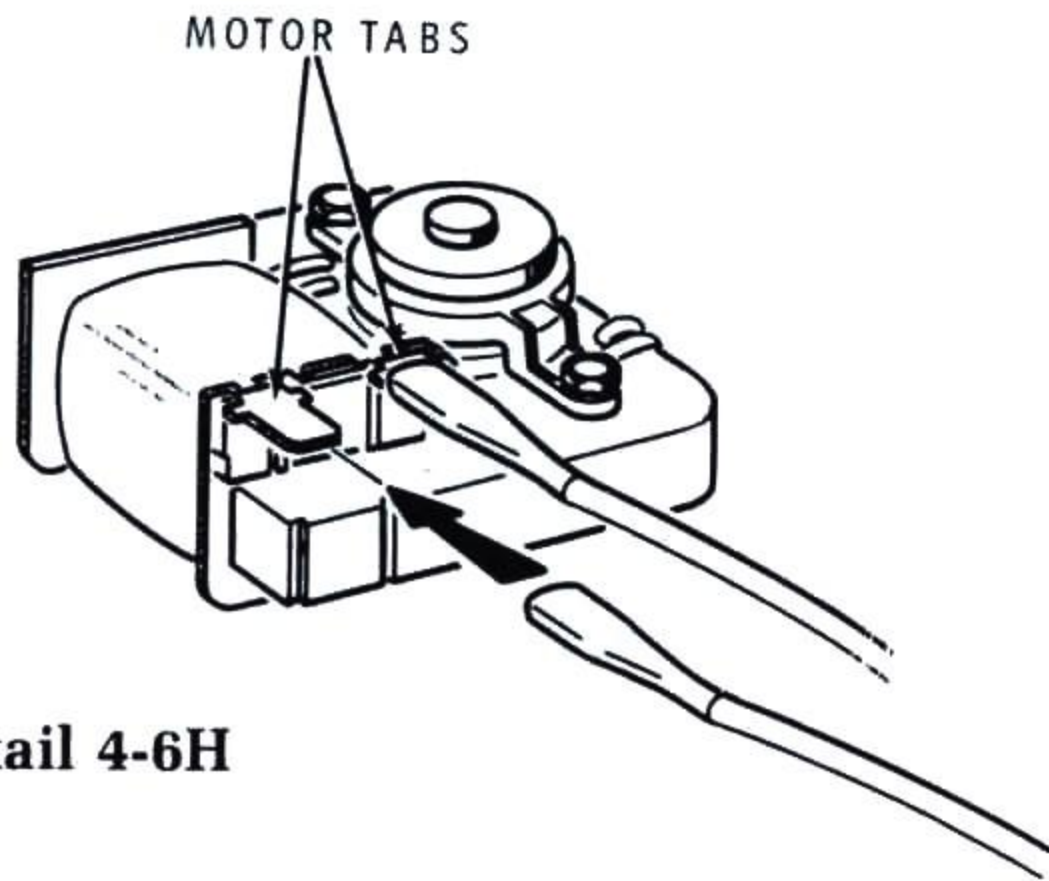
- () 1. Carefully remove the mounting hardware from **one side** of the motor as shown. Discard the hardware.
- () 2. Refer to Detail 4-6F and, from the shaft side of the motor, insert a 6-32 × 1-9/16" black screw through the mounting hole. Then secure the screw with a #6 lockwasher and a 6-32 nut.
- () 3. In the same manner, modify the hardware on the other side of the motor. Be sure to install the new screw from the shaft side of the motor.
- () Prepare both ends of a 13" and a 20" medium black stranded wire.

() Refer to Detail 4-6G and prepare the free ends of the two wires as follows:

- 1. Cut two 1-1/2" lengths of large black (heat shrinkable) sleeving. Place a length of sleeving on each wire.
- 2. Solder a push-on connector (#432-137) onto the free end of each wire as shown in Part A. Then crimp the rear tabs over the insulation.
- 3. Slide the sleeving down until it is all the way to the end of the connector. With a match or other heat source, shrink the sleeving onto each connector as shown in Part B.

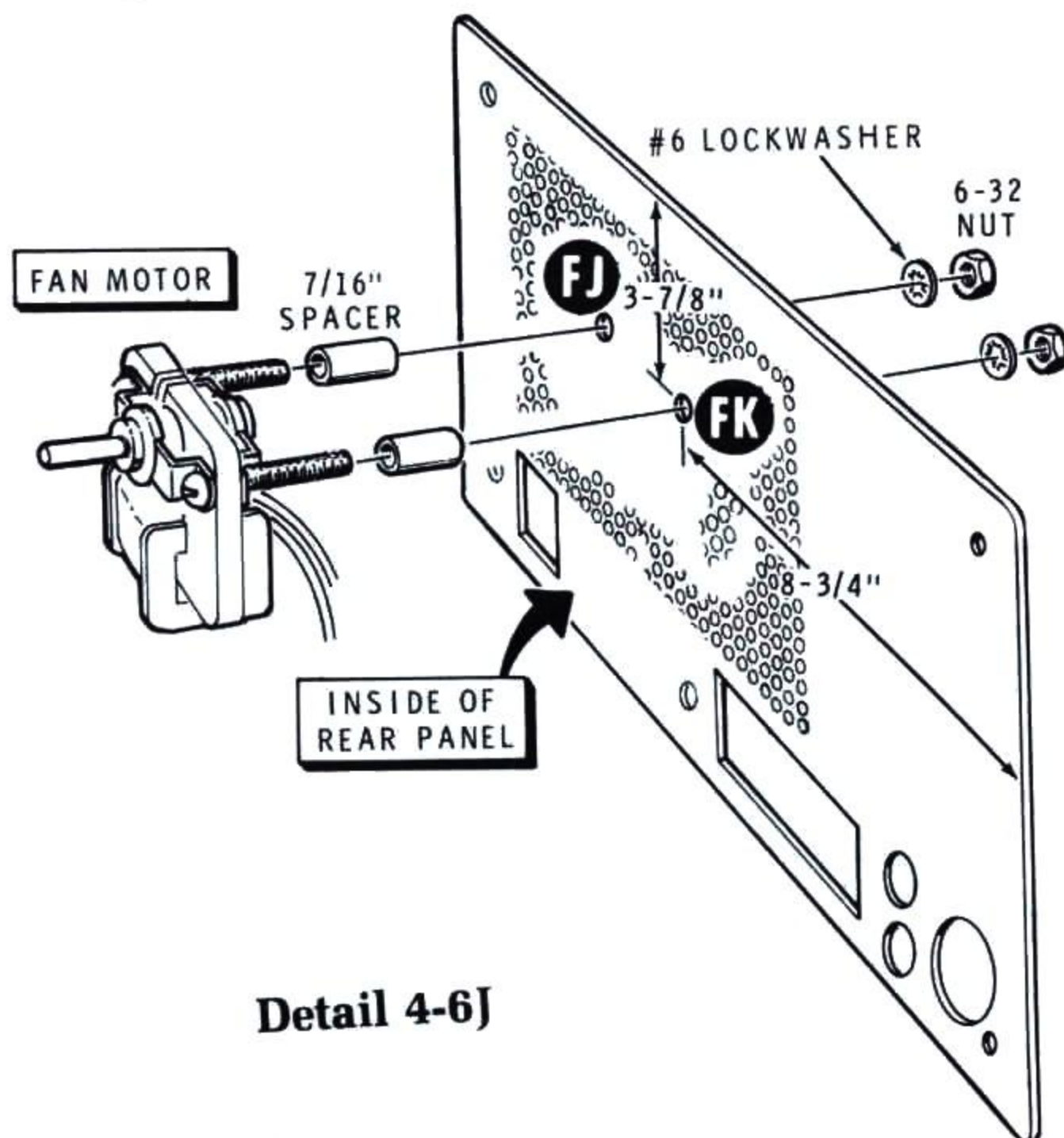


Detail 4-6G

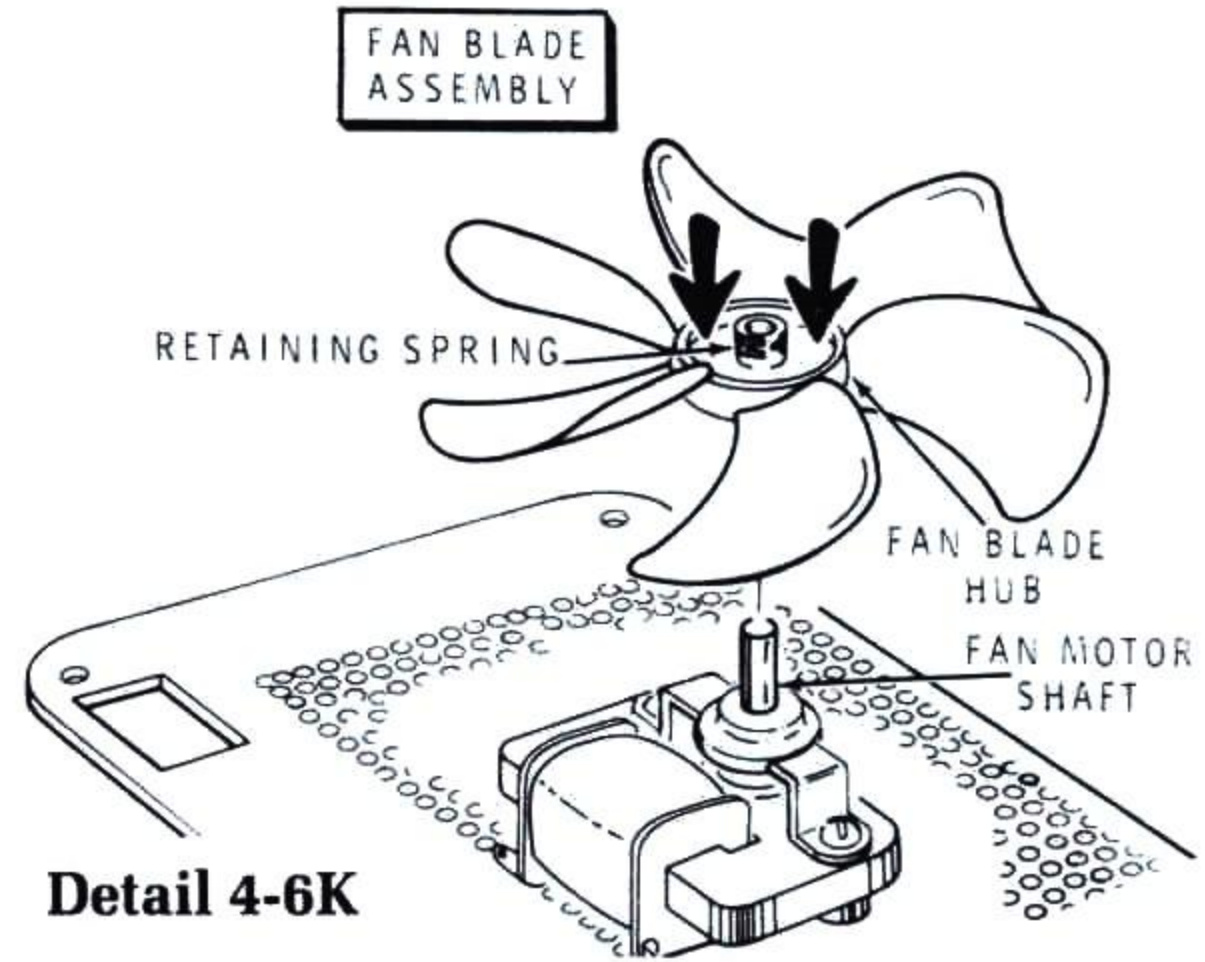


Detail 4-6H

- () Refer to (Detail 4-6H) and push the connector on one of the prepared black wires onto one of the motor tabs, and push the other connector onto the remaining motor tab, as shown.
- () Position the rear panel as shown in Detail 4-6J. Then locate hole FK. This hole is 3-7/8" down from the top edge of the panel and 8-3/4" in from the right edge of the panel.
- () Refer again to Detail 4-6J and mount the fan motor on the rear panel at holes FJ and FK. Use two 7/16" spacers, two #6 lockwashers, and two 6-32 nuts as shown. NOTE: When you have the motor mounted correctly, the sides of the motor frame will be parallel to the edges of the panel.



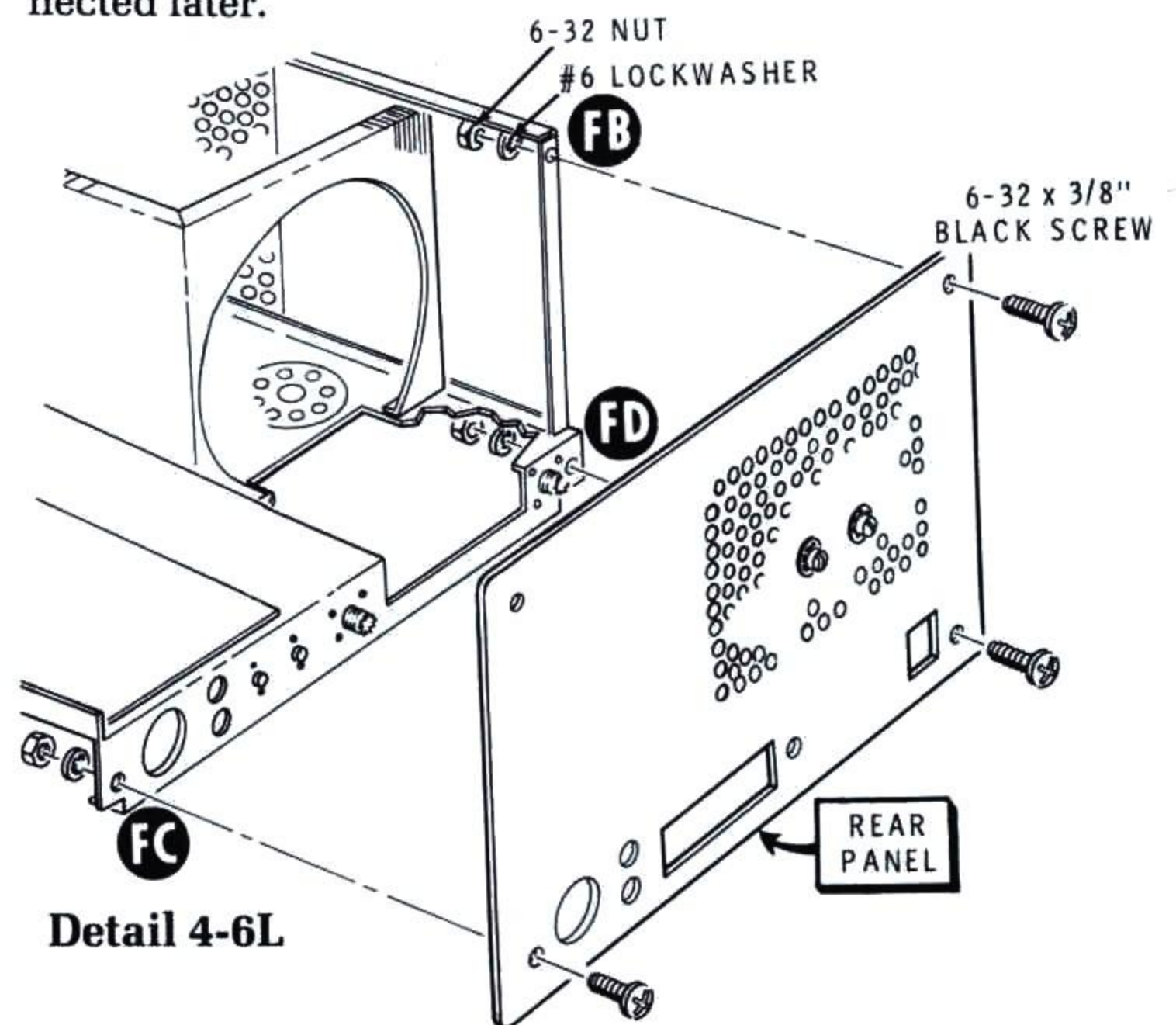
Detail 4-6J



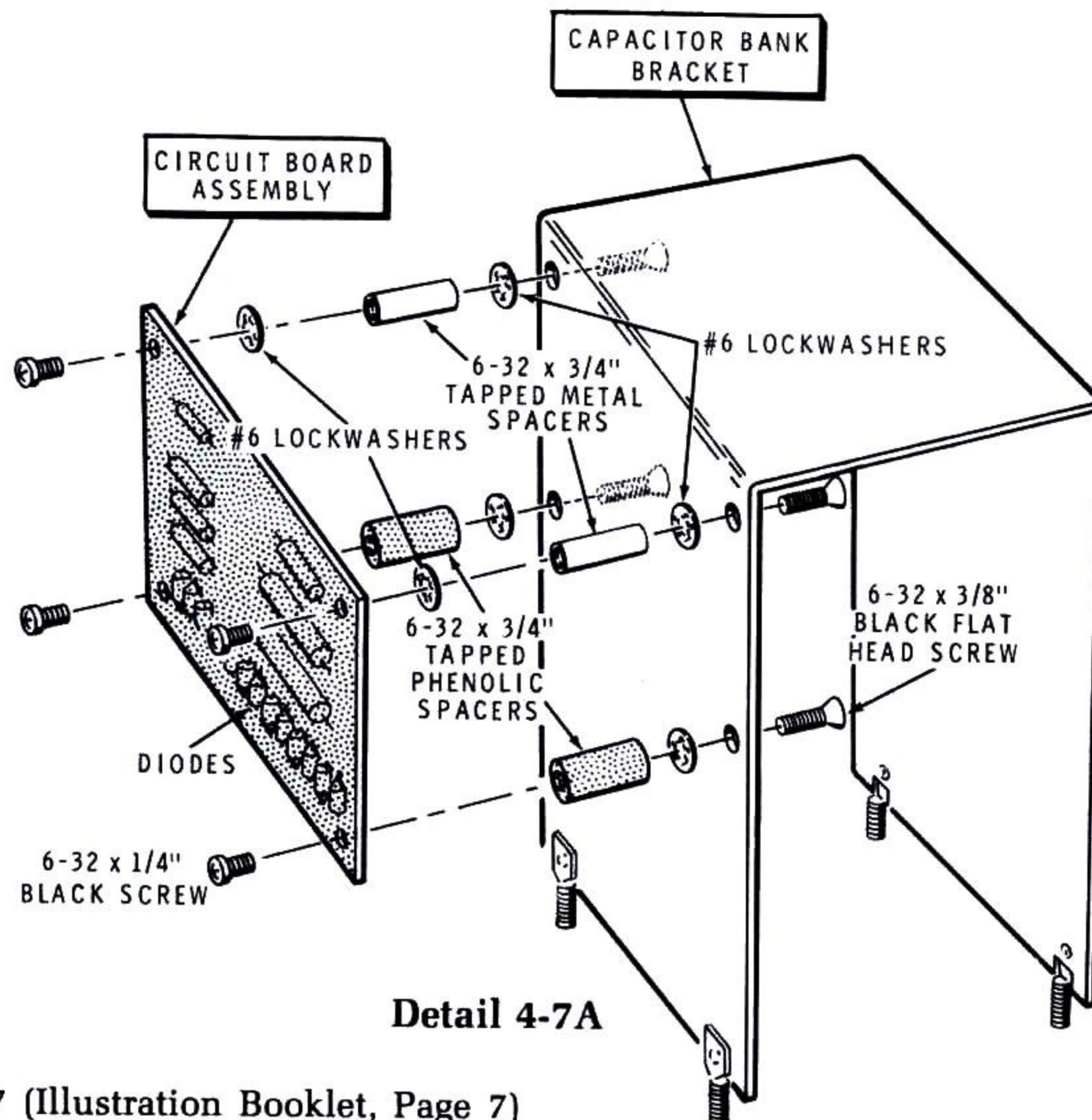
Detail 4-6K

- () Refer to Detail 4-6K and install the fan blade assembly (#266-296) on the fan motor shaft. Position the fan motor and the blade assembly as shown, and apply firm downward pressure with both thumbs on the fan blade hub. A slight rocking motion will help. Push the fan blades onto the motor shaft until there is 1/16" to 1/32" clearance between the outer end of the fan blade hub and the tip of the motor shaft.
- () Refer to Detail 4-6L and mount the rear panel to the chassis rear apron at FC and FD, and to the left side panel at FB. Use 6-32 x 3/8" black hardware.
- () Rotate the fan blades to make sure they do not hit anything. Reposition the motor mounting as necessary.

NOTE: The free ends of the motor wires will be connected later.

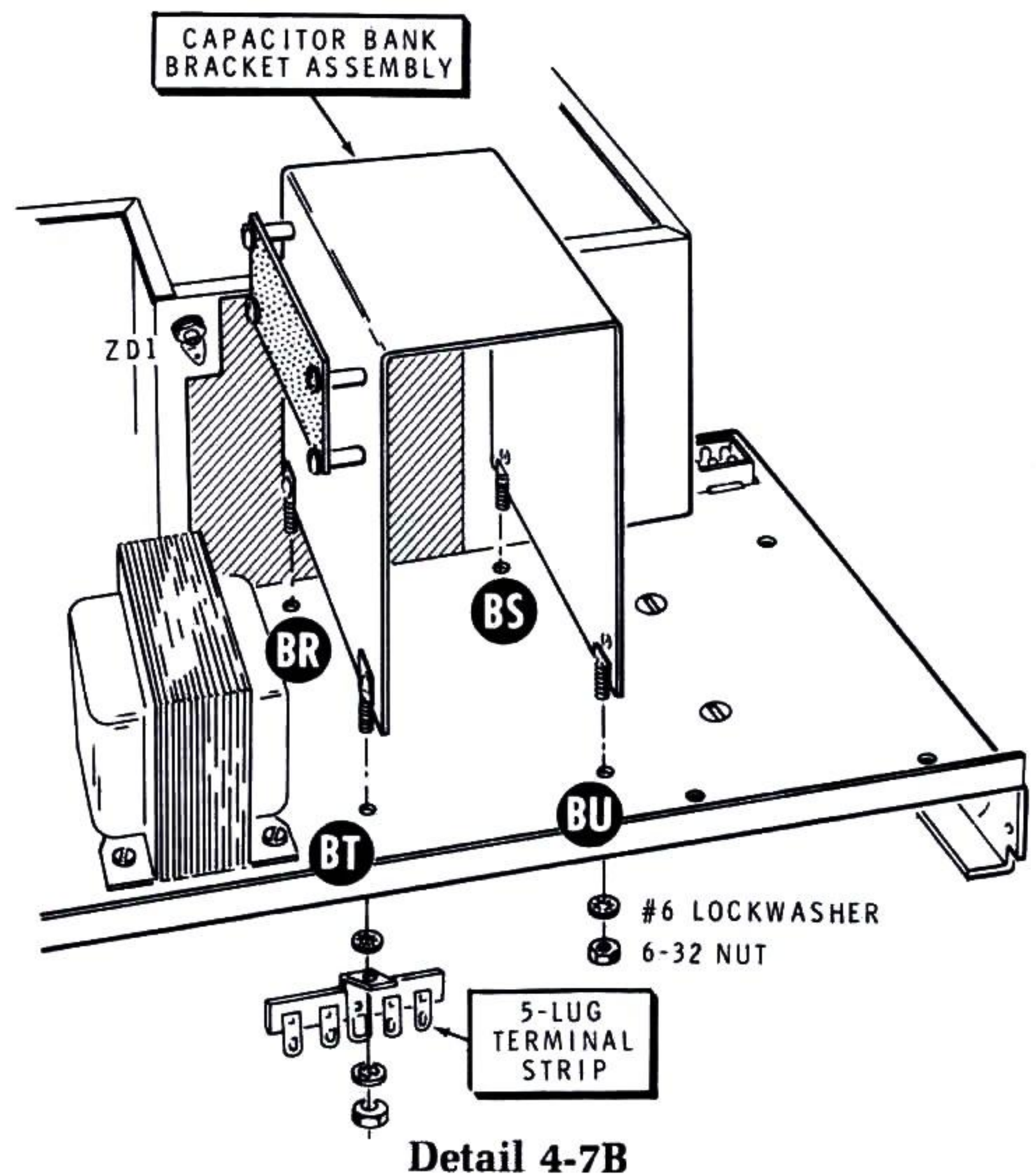


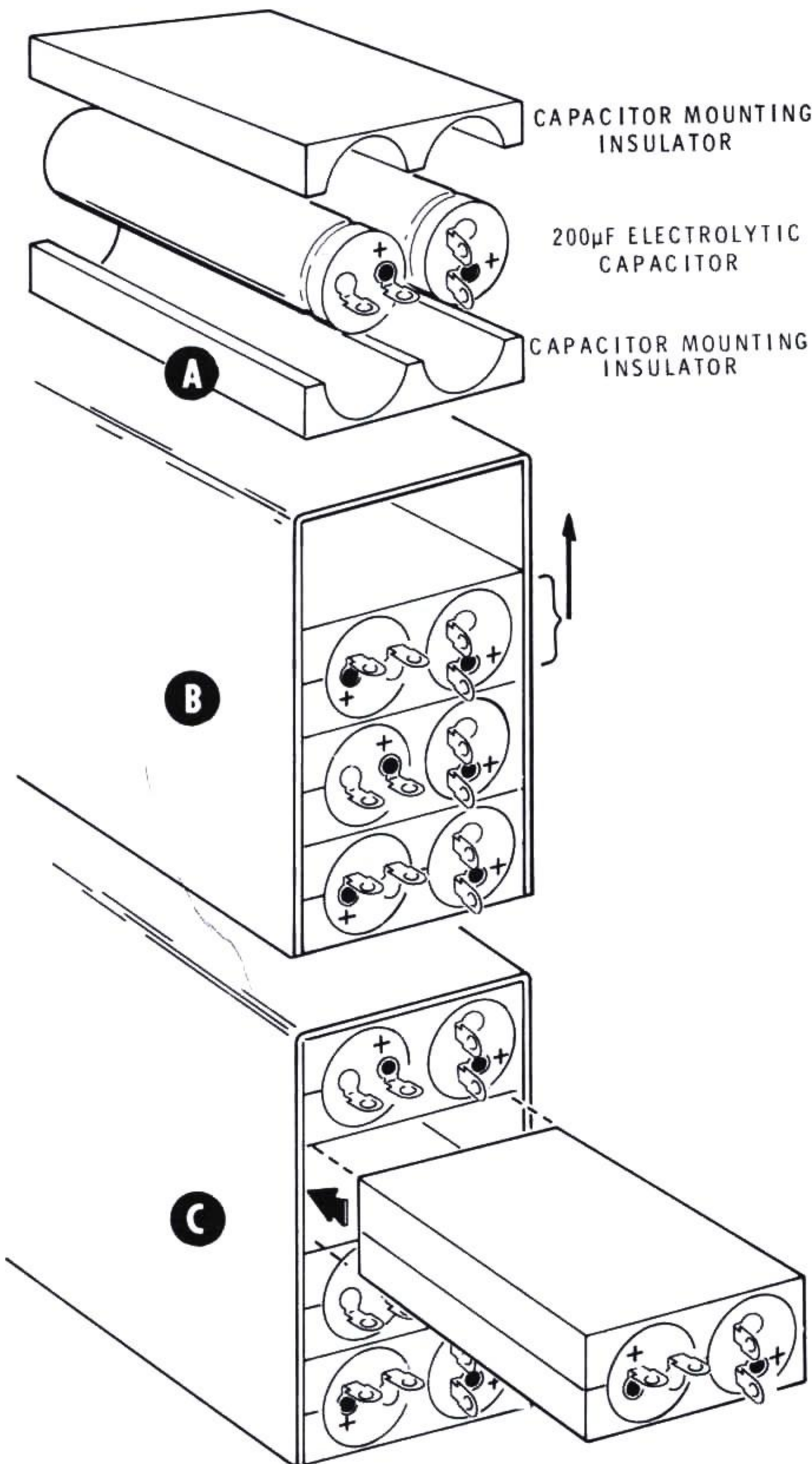
Detail 4-6L



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

- () Refer to Detail 4-7A and mount the circuit board assembly on the capacitor bank bracket. Use 6-32 × 1/4" black screws, 6-32 × 3/4" tapped metal spacers, 6-32 × 3/4" tapped phenolic spacers, 6-32 × 3/8" black flat head screws, and #6 lockwashers. Note that the diodes, and the phenolic spacers, are along the lower edge of the circuit board.
- () Refer to Detail 4-7B and mount the capacitor bank bracket with one spade bolt entering each of holes BR, BS, BT, and BU. Use #6 lockwashers and 6-32 nuts only on spade bolts BR, BS, and BU. Leave the nuts flush with the ends of the spade bolts.
- () Route the two black wires coming from diode ZD1 **between** the circuit board assembly and the capacitor bank bracket.
- () Mount a 5-lug terminal strip (#431-42) on spade bolt BT. Use two #6 lockwashers and a 6-32 nut. Leave the face of the nut flush with the end of the spade bolt.



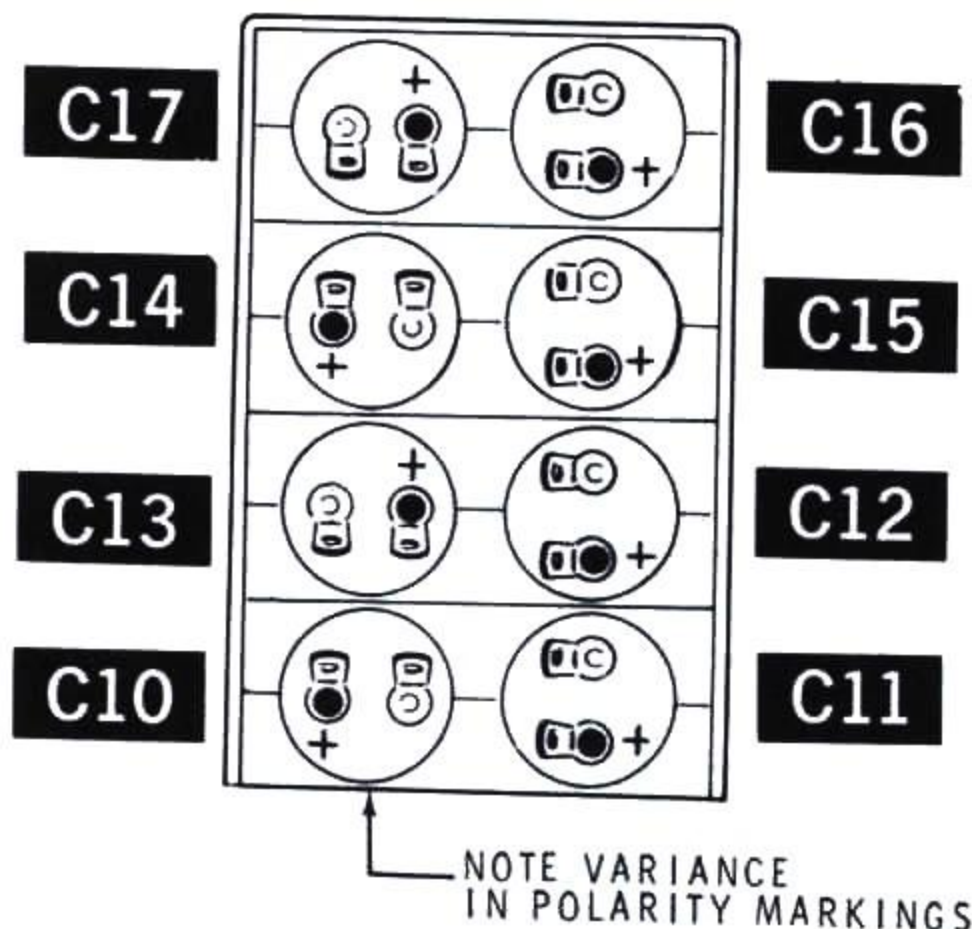


Detail 4-7D

Refer to Detail 4-7C for the steps covering the capacitor bank assembly, capacitors C10 through C17.

NOTE: The 200 μ F electrolytic capacitors supplied with your kit may have the terminal tabs on either side of the mounting rivet.

- () **Part A:** Assemble four capacitor sections, each composed of two capacitor mounting insulators (#75-125) and two 200 μ F electrolytic capacitors (#25-224).
- () **Part B:** Stack three capacitor sections in the capacitor bank bracket. Then lift up the top section to the top of the bracket.
- () **Part C:** Insert the fourth capacitor section into the vacated space in the bracket.
- () **Part D:** Align the capacitor lugs and the positive (+ or red dot) polarity markings as shown. Then push the capacitors snugly against the fish paper and tighten the spade bolt nuts on the bottom of the chassis just to the point where you can no longer rotate the capacitors with your fingers. Do not overtighten. Note the position of the terminal strip mounting foot in Detail 4-7B.
- () Refer to Detail 4-7D and cut four pieces of medium bare wire 1-5/8" long and one piece 1-1/2" long. Bend down 1/8" at one end of each. These wires will be used in the capacitor bank wiring.
- () Cut four pieces of small black sleeving 3/4" long for use in wiring the capacitor bank.

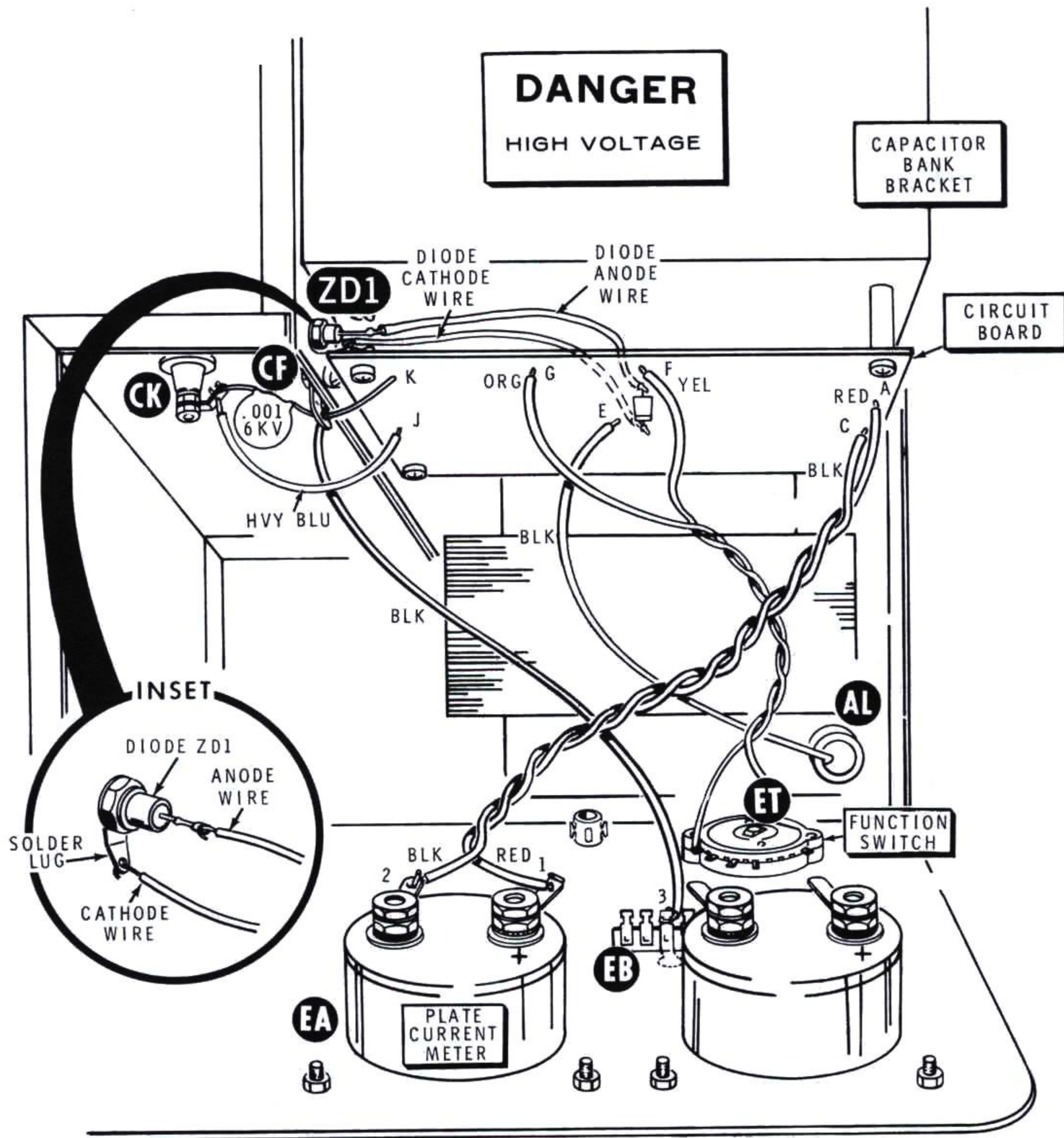


Detail 4-7C

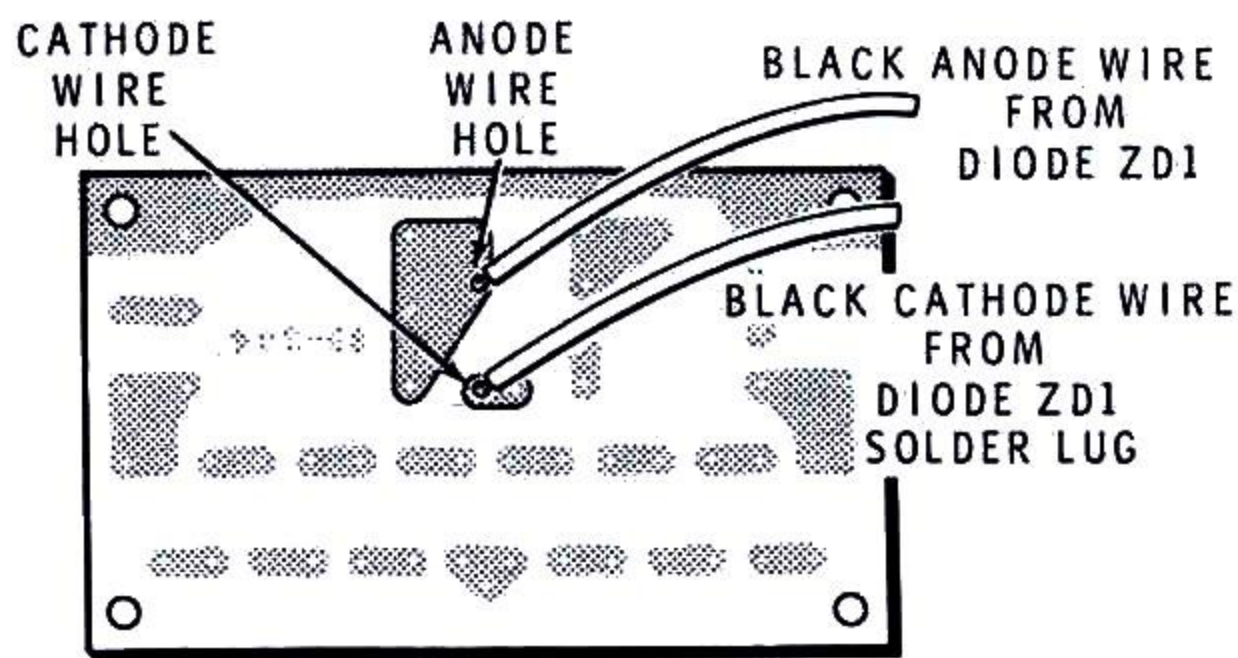
IMPORTANT: When you connect resistors in the following steps, align them as shown in the Pictorial. **Space the resistors 1/2" from the capacitors as shown in the inset drawing.** After fitting and soldering the resistors, cut off and discard any excess lead lengths. No resistor should be closer than 1/4" to any metallic object to which it is not intentionally connected.

- () R18: Refer to the Pictorial 4-7 and place one of the 3/4" lengths of sleeving on one lead of a 30 k Ω resistor. Connect this lead to the positive (+ or red dot) lug of capacitor C17 (NS). Pass the other resistor lead through the positive lug of capacitor C16 (S-2) to the negative lug of capacitor C15 (NS).
- () R14: Place one of the 3/4" lengths of sleeving on one lead of a 30 k Ω resistor and connect this lead to the positive lug of capacitor C13 (NS). Pass the other lead through the positive lug of capacitor C12 (S-2) to the negative lug of capacitor C11 (NS).
- () Pass the straight end of one of the 1-5/8" bare wires through the negative lug of capacitor C16 (NS). Place the bent end of the wire into the positive lug of capacitor C17 (S-2).
- () Connect the black hookup wire coming from circuit board hole B to the negative lug of capacitor C17 (NS).
- () R19: Connect a 30 k Ω resistor from the negative lug of capacitor C17 (S-2) to the negative lug of capacitor C16 (S-2).
- () Connect the bent end of one of the 1-5/8" bare wires to the negative lug of capacitor C14 (NS) and the straight end to the positive lug of capacitor C15 (NS).
- () R17: Place a 3/4" length of sleeving on one lead of a 30 k Ω resistor and connect this lead to the negative lug of capacitor C14 (S-2). Connect the other lead to the negative lug of capacitor C15 (S-2).
- () Place the bent end of a 1-5/8" bare wire in the positive lug of capacitor C13 (S-2), and the straight end in the negative lug of capacitor C12 (NS).
- () R15: Connect a 30 k Ω resistor from the negative lug of capacitor C13 (NS) to the negative lug of capacitor C12 (S-2).
- () Place the bent end of a 1-5/8" bare wire in the negative lug of capacitor C10 (NS) and the straight end in the positive lead of capacitor C11 (NS).
- () R13: Place a 3/4" length of sleeving on one lead of a 30 k Ω resistor and connect this lead to the negative lug of capacitor C10 (S-2). Connect the other lead to the negative lug of capacitor C11 (S-2).
- () Connect the blue wire from hole H of the circuit board to the positive lug of capacitor C10 (NS).
- () R12: Connect one lead of a 30 k Ω resistor to the positive lug of capacitor C10 (S-2). Connect the other lead to the positive lug of capacitor C11 (S-2).
- () R16: Connect one lead of a 30 k Ω resistor to the positive lug of capacitor C14 (NS). Connect the other lead to the positive lug of capacitor C15 (S-2).
- () Connect the bent end of the 1-1/2" length of bare wire to the positive lug of capacitor C14 (NS) and the straight end to the negative lug of capacitor C13 (S-2).
- () Carefully compare your work in the foregoing steps to the Pictorial (and the Details) for wiring errors and for proper capacitor polarity. Incorrect connections in this high-voltage circuit area can cause serious damage. **NOTE:** The positive (+) lug of C14 will be soldered later.





PICTORIAL 4-8



Detail 4-8A

Refer to Pictorial 4-8 for the following steps.

- () C7: Pass one lead of a .001 μ F, 6 kV, capacitor through solder lug CF (NS) to hole K in the circuit board (S-1). Connect the other lead of this capacitor to solder lug CK (NS).
- () Connect the heavy blue wire coming from hole J in the circuit board to solder lug CK (S-2).

Connect the yellow and orange twisted wires coming from Function Switch ET to the circuit board as follows:

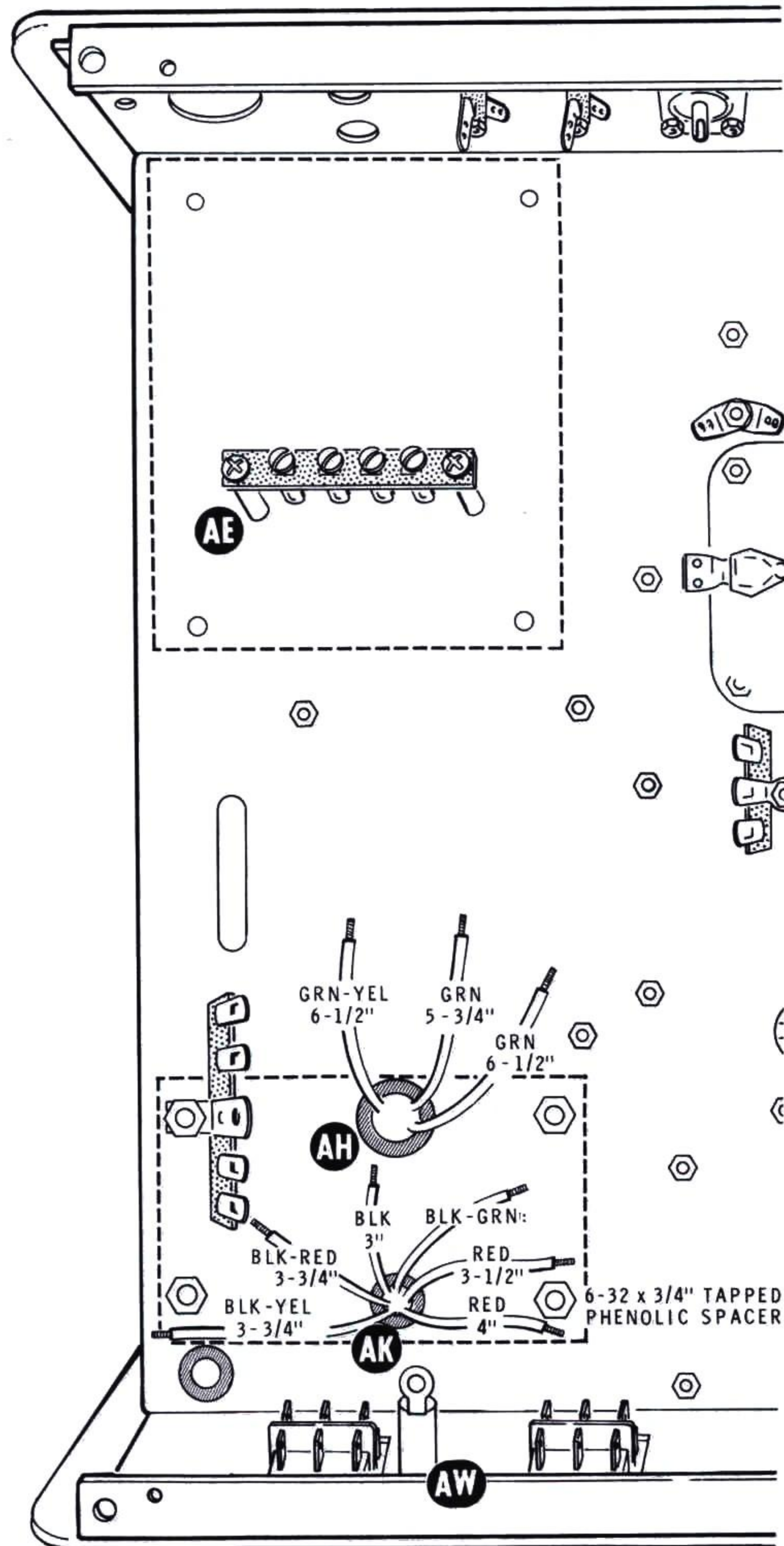
- () Orange wire to hole G (S-1).
- () Yellow wire to hole F (S-1).
- () Connect the black wire coming from terminal strip EB to solder lug CF (S-3).

Connect the black and red twisted wires coming from the circuit board to Plate Current meter EA as follows:

- () Red wire to lug 1 (S-2).
- () Black wire to lug 2 (S-2).

Refer to the inset drawing of Pictorial 4-8 and Detail 4-8A for the next two steps.

- () Connect the black cathode wire, coming from the solder lug of diode ZD1, to the foil side of the circuit board (S-1). Detail 4-8A shows the foil pattern.
- () Connect the black anode wire, from diode ZD1 to the foil side of the circuit board (S-1). Refer to Detail 4-8A for the foil configuration.
- () Insert the black stranded wire coming from hole E in the circuit board down through grommet AL.
- () Peel off the backing paper from the red "DANGER HIGH VOLTAGE" label and press it into place on the top of the capacitor bank bracket.



PICTORIAL 4-9

UNDER-CHASSIS WIRING

Refer to Pictorial 4-9 and cut the transformer leads coming through the chassis at AH and AK to the indicated lengths. Be sure you have selected the proper location before you cut. Measure the length of each lead from the chassis.

- () At grommet AH, cut the transformer leads as follows:

One large green	6-1/2"
Green-Yellow	6-1/2"
Other large green	5-3/4"

- () At grommet AK, cut the transformer leads as follows:

Black-Green	DO NOT cut
One red	4"
Other red	3-1/2"
Black-Red	3-3/4"
Black-Yellow	3-3/4"
Black	3"

NOTE: When you remove insulation from transformer leads in the following steps, grasp the wires where they emerge from the chassis so no strain will be placed on the connections at the transformer end of the leads.

- () Remove 1/4" of insulation from the cut ends of the two heavy green leads coming from AH. Melt a **small** amount of solder on the bared wire ends.
- () Remove 1/4" of insulation from the end of each remaining transformer lead coming from AH and AK. Then, if necessary, twist the fine wire strands together and melt a **small** amount of solder on each bared end.

NOTE: Before you start the wiring in the following steps, look ahead to the under-chassis drawings in Pictorials 4-10 through 4-14 (Illustration Booklet, Pages 8—10). Observe how wires are routed down the center of the chassis and are then bound together by ties to form a cable. As an aid in forming a neat cable, you can mark the main wiring guide lines on the underside of the chassis with an indelible marker or china marking pencil. Then follow these guide lines when routing the individual wires.

Refer to Pictorial 4-10 (Illustration Booklet, Page 8) for the following steps.

- () C22: Connect a .02 μ F ceramic capacitor between terminal strip P lugs 1 (NS) and 2 (NS).
- () C23: Connect a .02 μ F ceramic capacitor between terminal strip P lugs 3 (NS) and 2 (S-2) of terminal strip P.
- () Locate the twisted brown wires coming from left front grommet AL. Route the wires across the chassis toward the center as shown.
- () Connect one of the brown wires to terminal strip P lug 1 (NS) and the other brown wire to lug 3 (NS).
- () Connect the green wire from grommet AL to terminal strip B lug 1 (NS).

Connect the transformer leads from grommet AK as follows:

<u>Lead</u>	<u>Connect to</u>
() 4" Red	Terminal strip BT, lug 3 (NS).
() 3-1/2" Red	Terminal strip BT, lug 4 (NS).

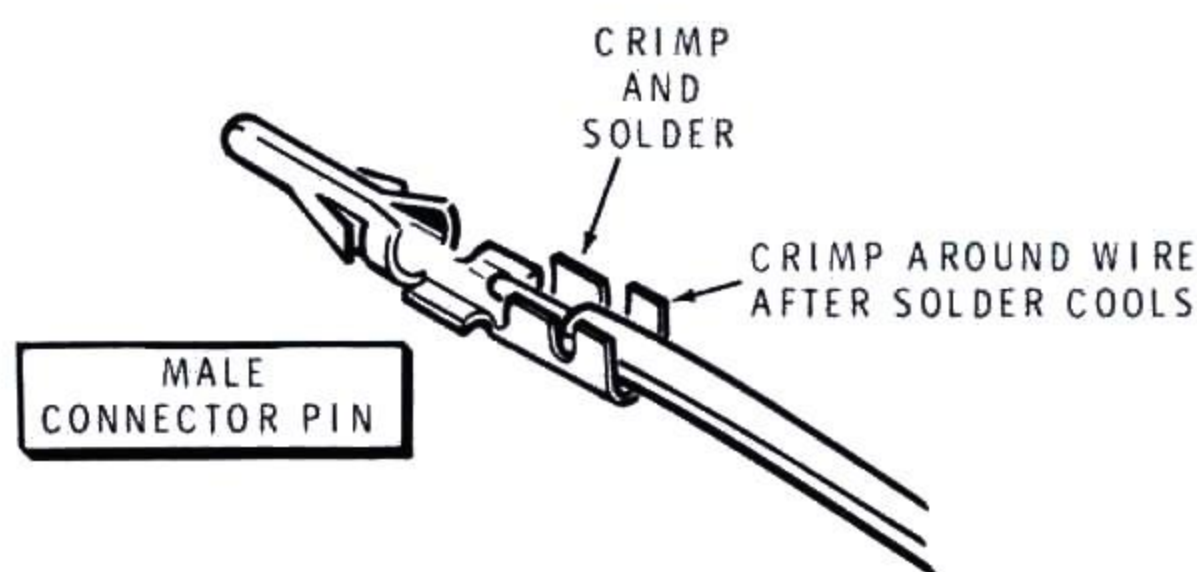
NOTE: If you are wiring your Linear Amplifier for 240VAC, do not connect the black-green wire.

- () Black-green Terminal strip AE, lug 3 (NS).

Prepare the following **large** stranded wires.

13-1/2" black

7" white



Detail 4-10A

- () Refer to Detail 4-10A and install male connector pins (#432-862) on **one end** of each of the prepared wires.

NOTE: When you insert the male connector pins into the holes of socket Y, in the following steps, be sure to insert the pins into the correct holes as shown in inset drawing #2 on the Pictorial. These pins are almost impossible to remove once they lock into place.

- () Push the male connector pin on the end of the 13-1/2" black wire into socket Y hole 1 until it locks in place. Connect the free end of this wire to double solder lug AW (NS). Make a secure mechanical connection as shown in inset drawing #1 on the Pictorial.
- () Push the male connector pin on the end of the 7" white wire into socket Y hole 4 until it locks in place. Connect the free end of this wire to terminal strip AE lug 3 (S-2). Make a secure mechanical connection.
- () Prepare the following **large** stranded wires:

14-1/2" red	14" white
14" black	14-1/2" red
- () Install male connector pins (#432-862) on one end of each of the prepared wires. Use the same procedure as before.



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NOTE: If necessary, refer to Detail 4-6G (Page 51) for the next three steps.

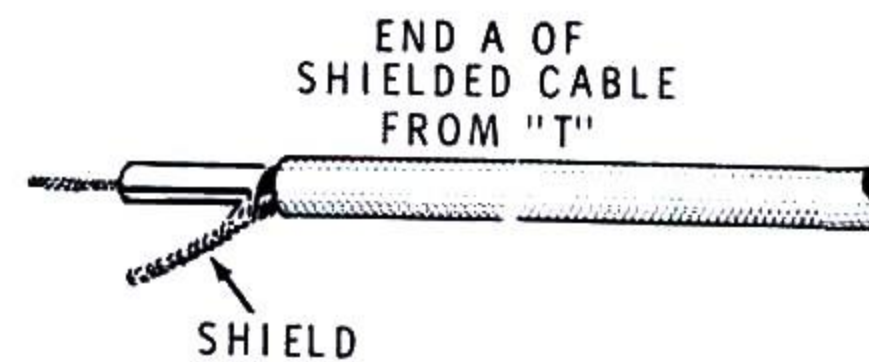
- () Cut four 1-1/2" lengths of large black (heat shrinkable) sleeving. Place a length of sleeving on each wire.
- () Crimp and solder a push-on connector (#432-137) onto the free end of each wire.
- () Slide the sleeving down until it is all the way to the end of the connector. With a match or other heat source, shrink the sleeving onto each connector.

NOTE: When you connect each of the four prepared wires, in the following steps, first push the male connector pin on the wire into the indicated hole of socket Y (until it locks in place). Then install the push-on connector on the other end of the wire onto the indicated lug of switch AN.

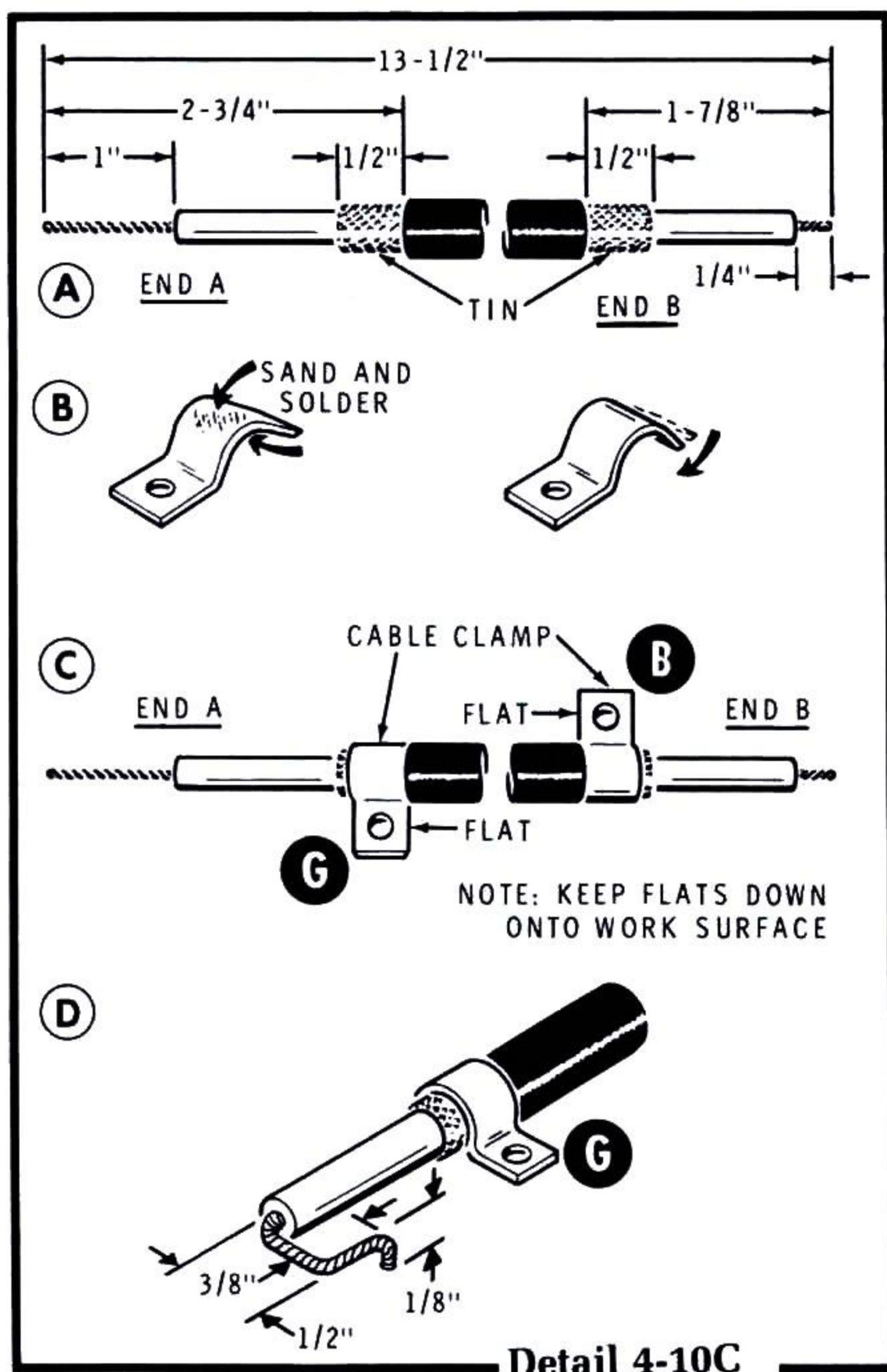
Connect the four prepared wires as follows:

- () 14-1/2" red from socket Y hole 2 to switch AN lug 1.
- () 14" black from socket Y hole 5 to switch AN lug 4.
- () 14" white from socket Y hole 3 to switch AN lug 3.
- () 14-1/2" red from socket Y hole 6 to switch AN lug 6.
- () Prepare a 2" length of black hookup (solid) wire.
- () Connect the 2" black wire between terminal strip BT lugs 3 (S-2) and 1 (NS).
- () Connect the yellow hookup wire coming from grommet T to phono socket U lug 1 (NS).
- () Connect the orange wire coming from grommet T to terminal strip BT lug 2 (NS).

- () Prepare a 4" length of large black stranded wire.
- () Install one of the push-on connectors onto one end of the 4" large black stranded wire (S-1).
- () Cut a 1-1/2" piece of large black heat-shrinkable sleeving. Shrink the sleeving over the end of the connector on the 4" wire.
- () Install the push-on connector from the preceding step onto switch Z lug 2. Connect the other end of this wire to double lug AW (NS).
- () Connect the black lead coming from grommet AK to double lug AW (NS). Make a secure mechanical connection.
- () Locate the **long** shielded cable coming through grommet T (from switch CZ wafer A lug 7), the end of which was prepared earlier as shown in Detail 4-10B. Connect the center conductor of this coaxial cable to terminal strip AG lug 1 (NS). Connect the shield lead to lug 2 (S-1).



Detail 4-10B



Detail 4-10C

Refer to Detail 4-10C for the next six steps.

- () 1. Refer to Part A of the Detail and prepare a 13-1/2" length of RG-8/U coaxial cable as shown. Tin the exposed braid at each end, being careful not to melt the inner insulation. Tin each center lead.
- () 2. Locate two cable clamps (#207-8). Refer to Part B of the Detail and on the inside and on top of the curved portion of each clamp, thoroughly sand each clamp to remove the outer coating. Apply a good coating of solder to both the inside and outside of the sanded clamp (only the curved portion).
- () 3. Slightly squeeze the curved portion of both clamps to form a symmetrical half-circle.

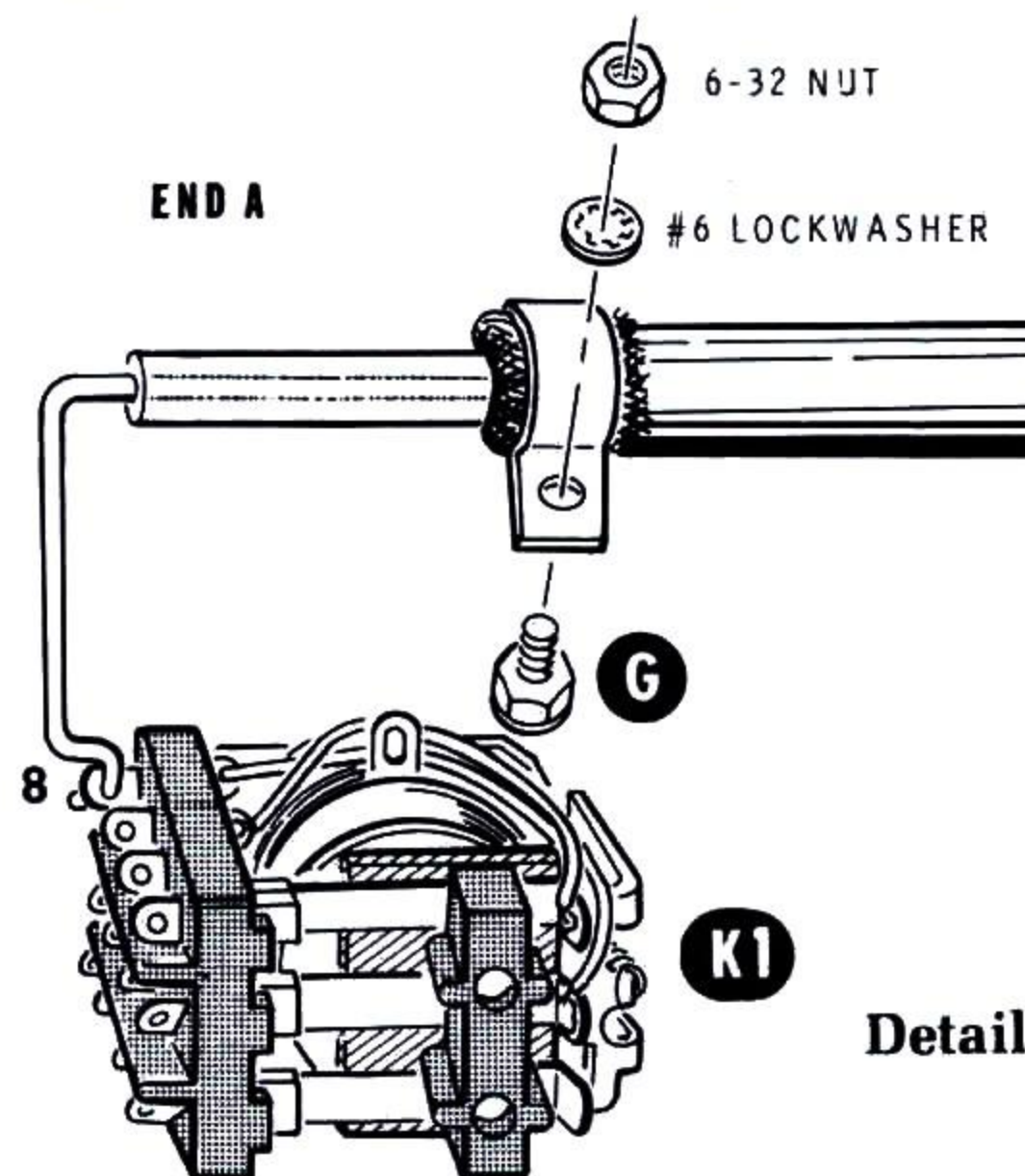
NOTE: Carefully study Part C of Detail 4-10C and note the position of the clamps at end A and at end

B of the cable. When you install the clamps, both of them must fit over the tinned cable braid, and the flat on each of them must be flat against the top of your work surface.

- () 4. Install and solder a cable clamp onto end A of the 13-1/2" shielded cable **exactly** as shown in Part C of the Detail.
- () 5. Similarly, install and solder the other cable clamp on end B of the cable.
- () 6. Refer to Part D of Detail 4-10C and form the inner lead at end A of the shielded cable as shown.

Refer to Detail 4-10D for the next two steps.

- () At end A of the RG-8/U coaxial cable, connect the inner lead to relay K1 lug 8 (S-1).



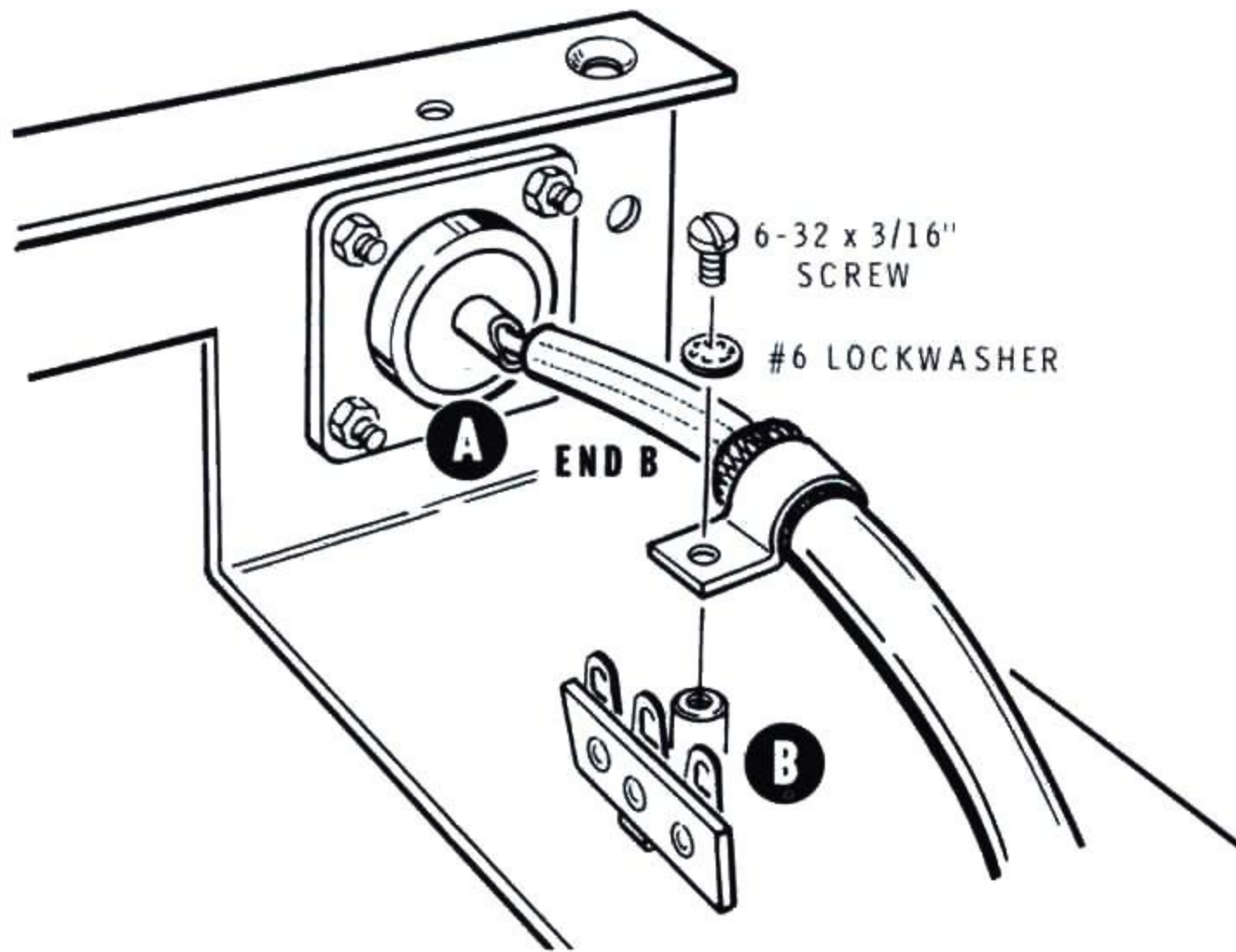
Detail 4-10D

- () Secure the cable clamp at cable end A to the end of the screw at G with a #6 lockwasher and a 6-32 nut.
- () Refer to Detail 4-10E and, at cable end B, solder the inner lead to coaxial jack A (S-1). Then secure the cable clamp to the top of the 5/16" tapped spacer at B with a #6 lockwasher and 6-32 x 3/16" screw as shown.

Refer to Pictorial 4-11 (Illustration Booklet, Page 8) for the following steps.

- () Cut three 1-1/2" pieces of large black (heat-shrinkable) sleeving.





Detail 4-10E

- () Prepare a 12-1/2" length of **large** black stranded wire.
- () Cut a 1-1/2" piece of large black heat-shrinkable sleeving for use over the connector in the next step.

NOTE: If you are wiring your Linear Amplifier for 240 VAC, skip the next step.

- () Connect the free end of the black-yellow wire coming from grommet AK and one end of the 12-1/2" wire prepared in the preceding step to one push-on connector (S-2). Shrink the sleeving onto the connector. Then push this connector onto switch AN lug 2.
- () Connect one end of the 12-1/2" wire to one push-on connector (S-1). Shrink the sleeving onto the connector. Then push this connector onto switch AN lug 2.
- () If you are wiring the unit for 240 VAC, connect the black-green and the black-yellow wires coming from grommet AK together with the wire nut as shown in the inset on the Pictorial.
- () Prepare the following lengths of **large** black stranded wire:

4-1/2"

13-1/2"

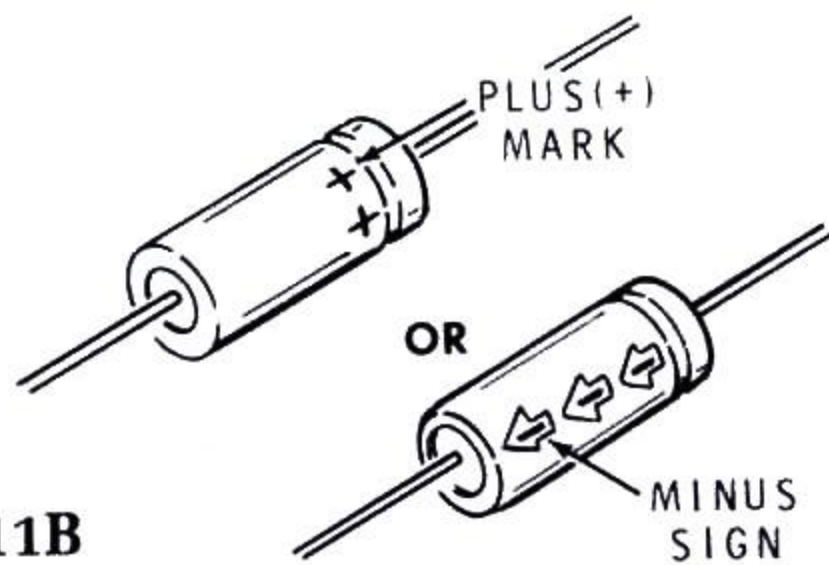
13-1/2"

- () Install a push-on connector (#432-137) and a 1-1/2" sleeve on **one** end of **each** of the three wires. Shrink the sleeve onto the wires and connectors as in a previous step.
- () Push the connector on the 4-1/2" wire onto switch AN lug 5.
- () Push the connector on one of the 13-1/2" wires onto switch Z lug 1.
- () Push the connector on the other 13-1/2" wire onto switch Z lug 4.
- () Cut a 1-1/2" piece of large black heat-shrinkable sleeving for use over the two wires and the connector in the next step.
- () Solder the free end of the black-red lead coming from grommet AK and the free end of the 4-1/2" black wire coming from lug 5 of switch AN to one push-on connector (S-2). Push this connector onto switch Z lug 5.

The free ends of the "tabbed" wires prepared in the preceding steps will be connected later.

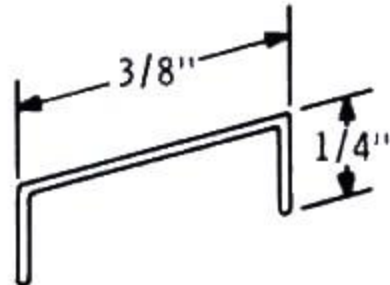
- () D16: Refer to the Detail 4-11A (Illustration Booklet, Page 8) and connect a 1N2071 diode (#57-27) between terminal strip BT lugs 4 (S-2) and 5 (NS). Be **sure** to position the banded (cathode) end to lug 5 as shown in Pictorial 4-11.
- () R5: Connect a 27 kΩ (red-violet-orange) resistor between terminal strip BT lugs 1 (NS) and 2 (NS).
- () Cut two 1/2" pieces of small black sleeving.
- () R4: Place a 1/2" piece of sleeving on each lead of a 27 kΩ (red-violet-orange) resistor. Then connect the resistor between terminal strip BT lugs 2 (S-3) and 5 (NS).





Detail 4-11B

- () C4: Refer to Detail 4-11B and connect the positive (+) lead of a 20 μ F electrolytic capacitor to terminal strip BT lug 5 (NS). Connect the other lead to lug 1 (S-3).
- () Connect the black stranded wire coming from grommet AL to relay K1 lug 6 (S-1).
- () Prepare a 2" and an 8-1/2" small red wire.
- () Connect a 2" red wire between relay K1 lugs 3 (NS) and 11 (S-1).
- () Connect an 8-1/2" length of red wire from terminal strip BT lug 5 (S-4) to relay K1 lug 3 (NS).



- () Refer to Detail 4-11C and form a 7/8" length of medium bare wire as shown.
- () Connect the bare wire between relay K1 lugs 1 (S-1) and 2 (S-1).

Refer to Pictorial 4-12 (Illustration Booklet, Page 9) for the following steps.

- () Connect the green-yellow transformer lead from grommet AH to relay K1 lug 9 (NS).
- () Cut two 1-1/2" pieces of large black heat-shrinkable sleeving.
- () Cut and prepare a 7-1/2" and a 19-1/2" length of small blue wire.
- () As in a previous step, crimp and solder a push-on connector onto one end of each wire. Then shrink a piece of sleeving onto each connector.
- () Connect the end of the 7-1/2" small blue wire to relay K1 lug 10 (S-1). Push the connector on the other end of the wire onto switch ED lug 2.
- () Connect the end of the 19-1/2" small blue wire to phono socket X lug 1 (NS). Push the connector on the other end of the wire onto switch ED lug 1.
- () C52: Connect a .02 μ F ceramic capacitor between phono socket X lugs 1 (S-2) and 2 (NS).
- () C53: Connect a .02 μ F ceramic capacitor from phono socket U lug 1 (S-2) to phono socket X lug 2 (S-2).

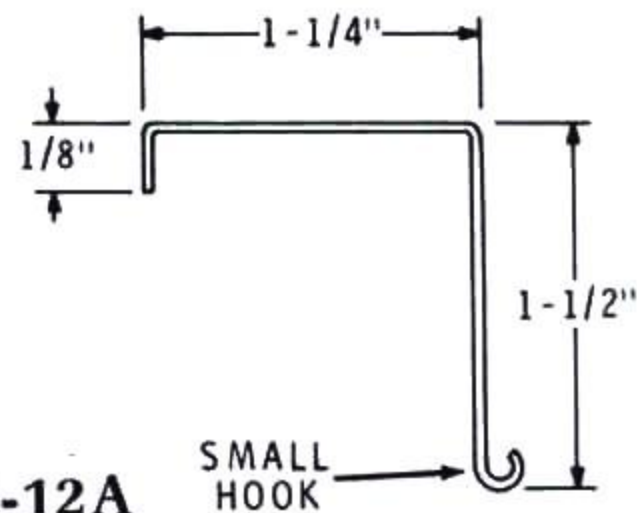
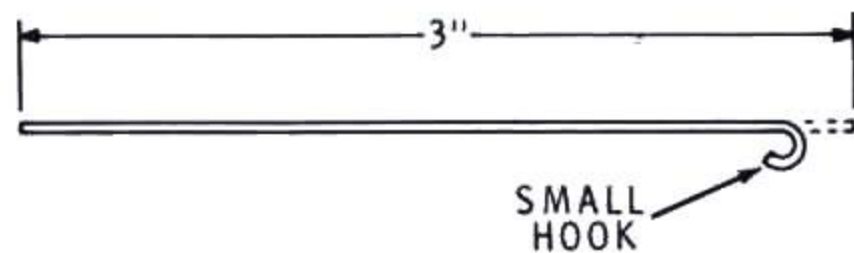
Connect 115 pF mica capacitors (#20-124) to tube socket lugs as follows:

<u>Tube Socket and Lug</u>	<u>Connect to</u>
() C26: Socket D, lug 4 (S-1)	Solder lug E (S-1).
() C19: Socket D, lug 3 (S-1)	Solder lug C1 (NS).
() C16: Socket D, lug 2 (NS)	Solder lug C2 (S-1).
() C28: Socket N, lug 3 (S-1)	Solder lug M2 (NS).
() C31: Socket N, lug 4 (NS)	Solder lug M1 (S-1).

NOTE: In the following step, form the leads of C27 so the body of the capacitor is close to the chassis.

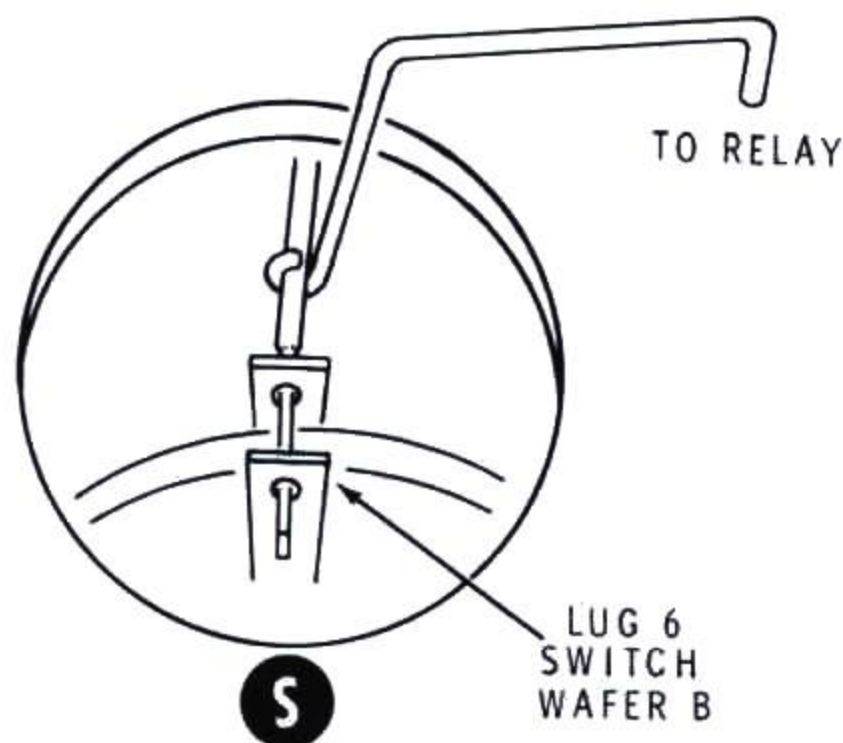
- () C27: Socket N, lug 2 (S-1) Terminal strip P, eyelet of lug 2 (S-1).
- () RFC4: Connect a 1 mH RF choke (#45-4) from tube socket D lug 2 (S-2) to solder lug C1 (S-2).
- () RFC5: Connect a 1 mH RF choke (#45-4) from tube socket N lug 4 (S-2) to solder lug M2 (S-2).
- () C54: Connect a .02 μ F ceramic capacitor between terminal strip B lug 1 (NS) and lug 2 (NS).
- () Connect one lead of a 1000 Ω (brown-black-red) resistor between terminal strip B lugs 2 (S-2) and 3 (NS).
- () D17: Connect the banded lead of a 1N191 diode (#56-26, brown-white-brown) to terminal strip B lug 1 (S-3). Connect the other lead to lug 3 (NS).
- () Cut two 1/2" pieces of small black sleeving.

- () R24: Place a 1/2" piece of sleeving on one lead of a 68 k Ω (blue-gray-orange) 1-watt resistor and then connect the lead to terminal strip B lug 3 (S-3). Place a 1/2" sleeve on the other lead and hook the other lead around coaxial connector A as shown in inset drawing 1 of Pictorial 4-12 (S-1).
- () Refer to Detail 4-12A and form a 3" length of medium bare wire as shown. The hook should be just large enough to fit around another piece of the same size of bare wire.



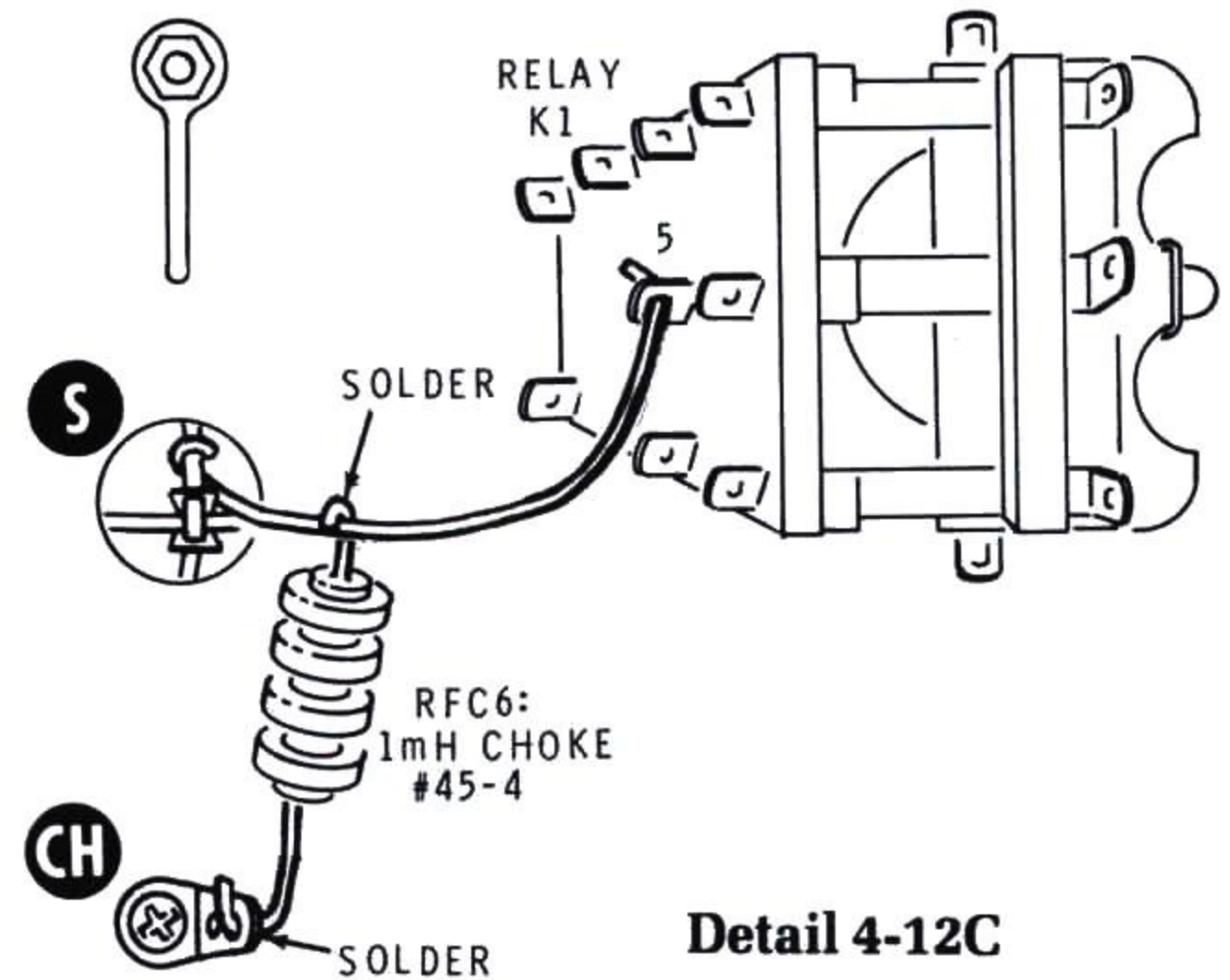
Detail 4-12A

- () Refer to Detail 4-12B and connect the hook on the end of the formed wire through hole S to switch CZ, wafer B lug 6 (S-1). Connect the other end of this wire to relay K1 lug 5 (S-1) as shown in the Pictorial.



Detail 4-12B

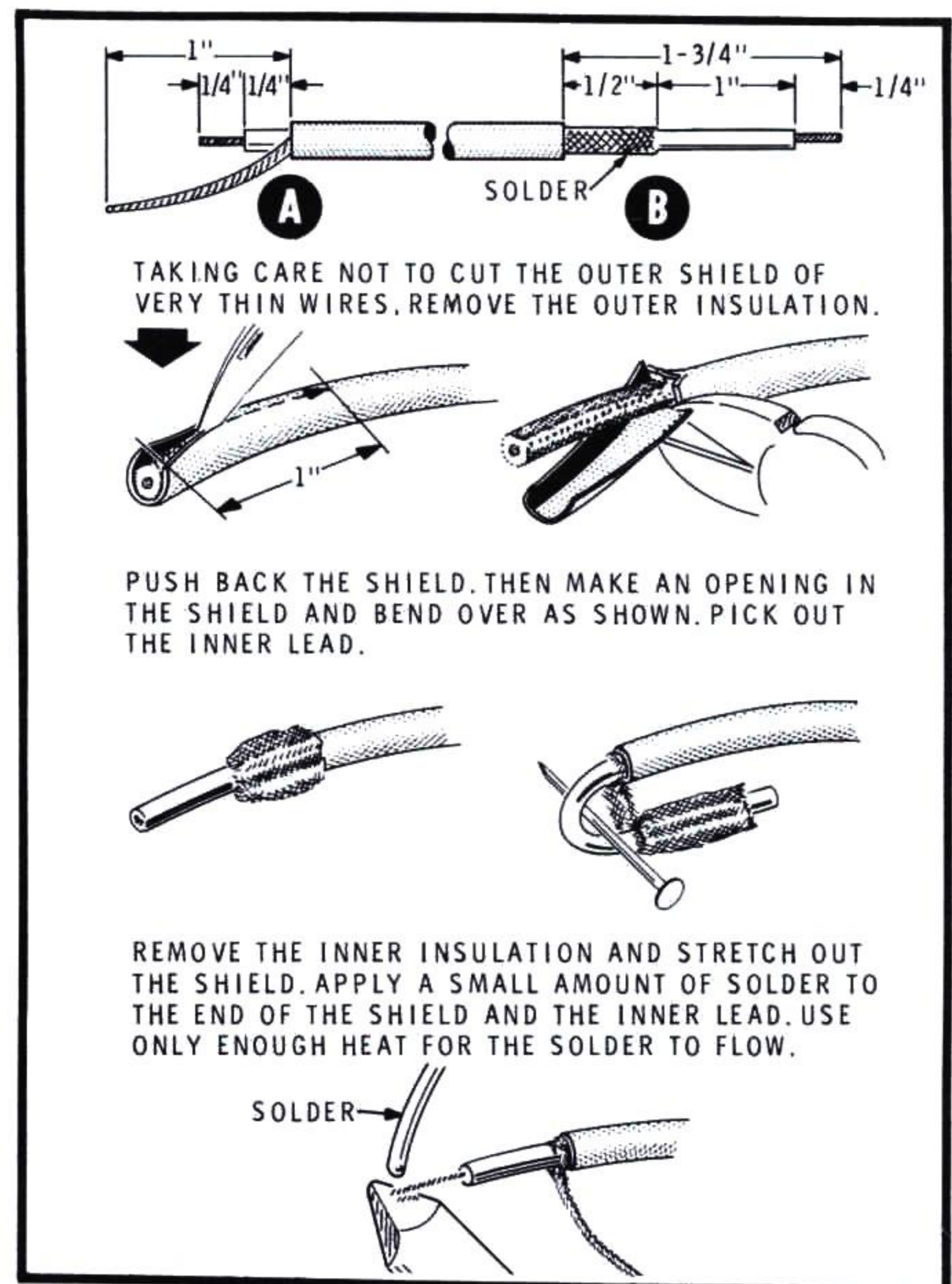
- () RFC6: Refer to Detail 4-12C and connect one lead of a 1 mH RF choke (#45-4) to solder lug CH (S-1). Wind the other lead around the bare wire coming from relay K1 lug 5 (S-1). Position the choke parallel to the chassis with a clearance of approximately 1/2".



Detail 4-12C

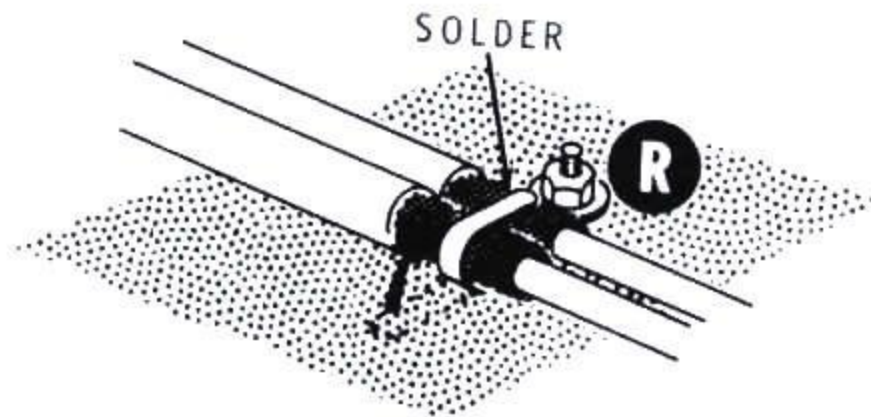
Refer to Detail 4-12D for the next two steps.

- () Prepare an 11-1/2" length of RG-58A/U coaxial cable. Tin the shield braid on end B. Use a minimum amount of heat to avoid melting the inner insulation.
- () At end B of the 11-1/2" cable, connect the center conductor to relay K1 lug 7 (S-1).



Detail 4-12D

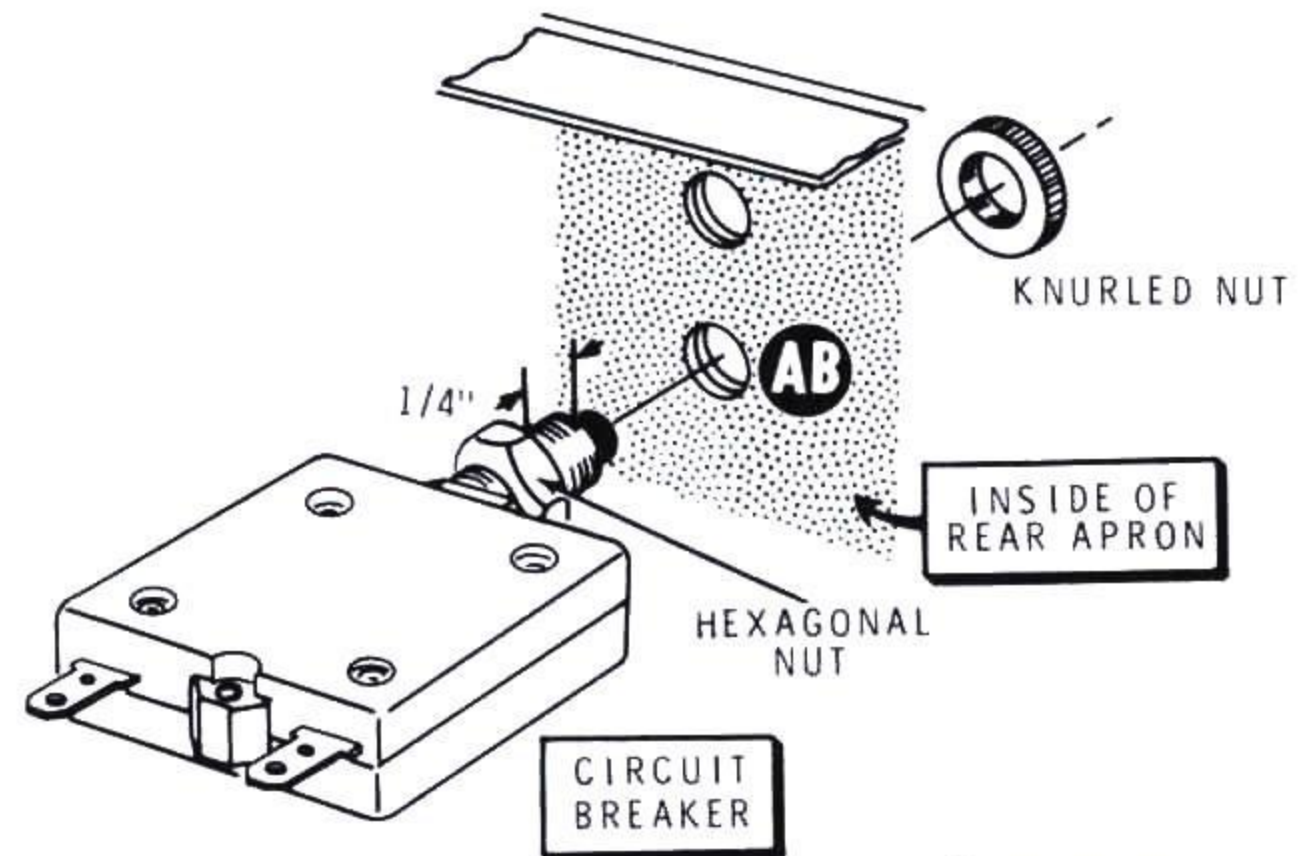
- () Locate the remaining coaxial cable coming through grommet T (from switch CZ wafer A lug 1). Connect the center conductor of this cable to relay K1 lug 4 (S-1).
- () Carefully check all of K1 lugs to be certain that no leads or wires are shorted from one lug to another.



Detail 4-12E

- () Refer to Detail 4-12E and position the prepared shields of the coaxial cables connected in the two preceding steps, over long solder lug R. Bend the solder lug back over both shield braids and solder. Use a minimum, but adequate, amount of heat.
- () Connect the center conductor at the free end of the coaxial cable coming from relay K1 lug 7 to the center conductor of coaxial jack L (S-1). Connect the shield wires to phono socket U lug 2 (S-1).
- () Cut **two** 1/4" pieces of small black sleeving.
- () Cut both leads of a 100 kΩ resistor (brown-black-yellow) to 1/2".
- () R27: Place a 1/4" sleeve on each resistor lead. Then connect the 100 kΩ resistor between relay K1 lugs 9 (S-2) and 3 (S-3) as shown in inset drawing 2 of the Pictorial.

Refer to Pictorial 4-13 (Illustration Booklet, Page 9) for the following steps.



Detail 4-13A

Refer to Detail 4-13A for the following three steps.

- () Remove a knurled nut from each of the two circuit breakers (#65-28).
- () Position the face of each hexagonal nut 1/4" from the end of the mounting bushing.
- () CB1: Mount a circuit breaker on the chassis rear apron at AB. Use the knurled nut provided. NOTE: For convenience in wiring, position the lugs to provide the maximum distance between them and the chassis.
- () CB2: **In the same manner**, mount the other circuit breaker at AA.
- () Locate the shorter medium black wire coming from the fan motor. Connect the end of this wire to terminal strip AE lug 2 (NS).
- () Locate the remaining fan motor wire. Route the end of this wire forward to the front panel. Then connect the wire end to double lug AW (S-4).
- () Position the fan wires as shown in Pictorial 4-13, making sure they are completely away from the fan blades.

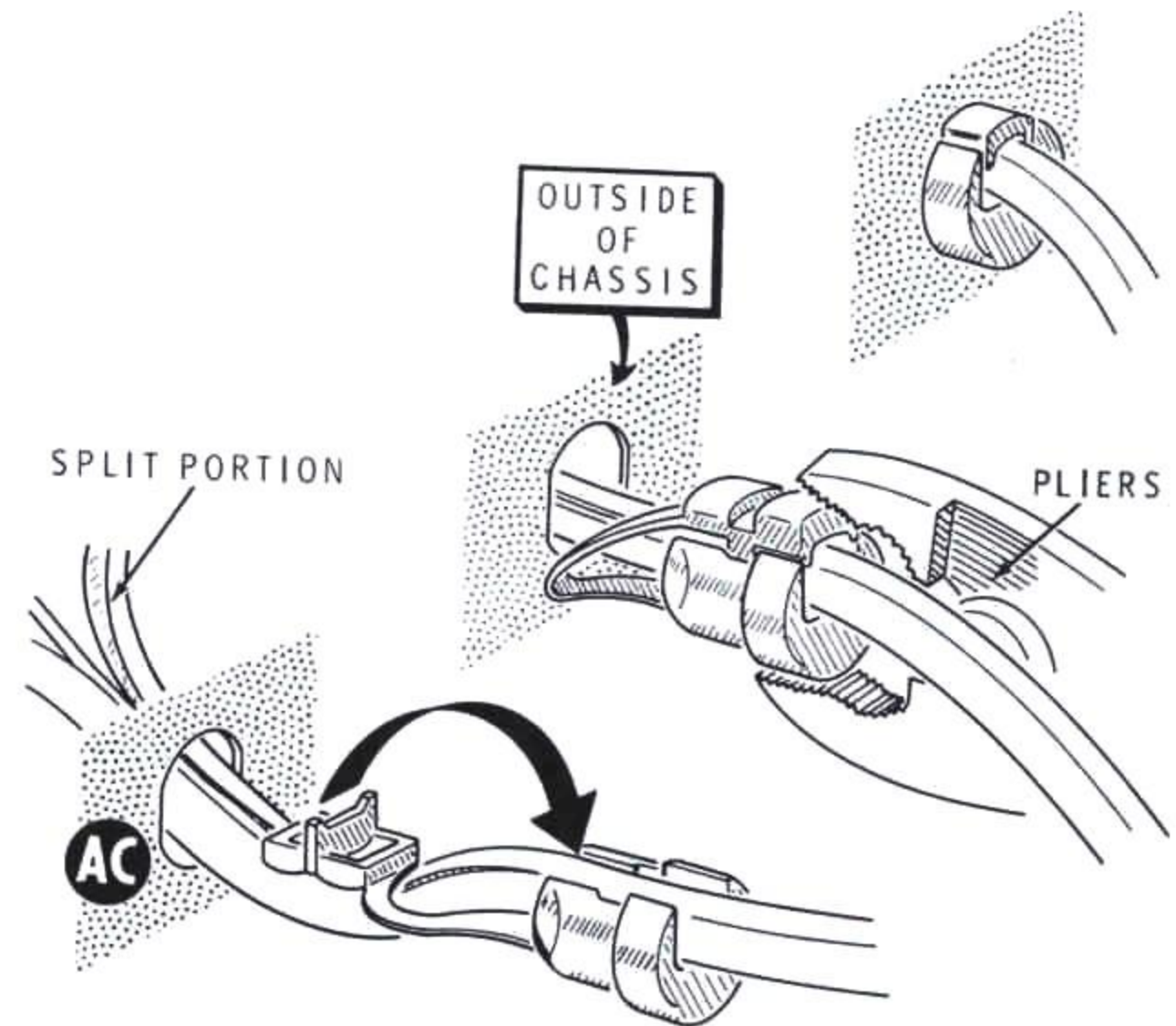


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NOTE: Make secure mechanical connections in each wiring step on this page.

Connect the wires from switches AN and Z as follows. If necessary, wrap a wire securely around a lug.

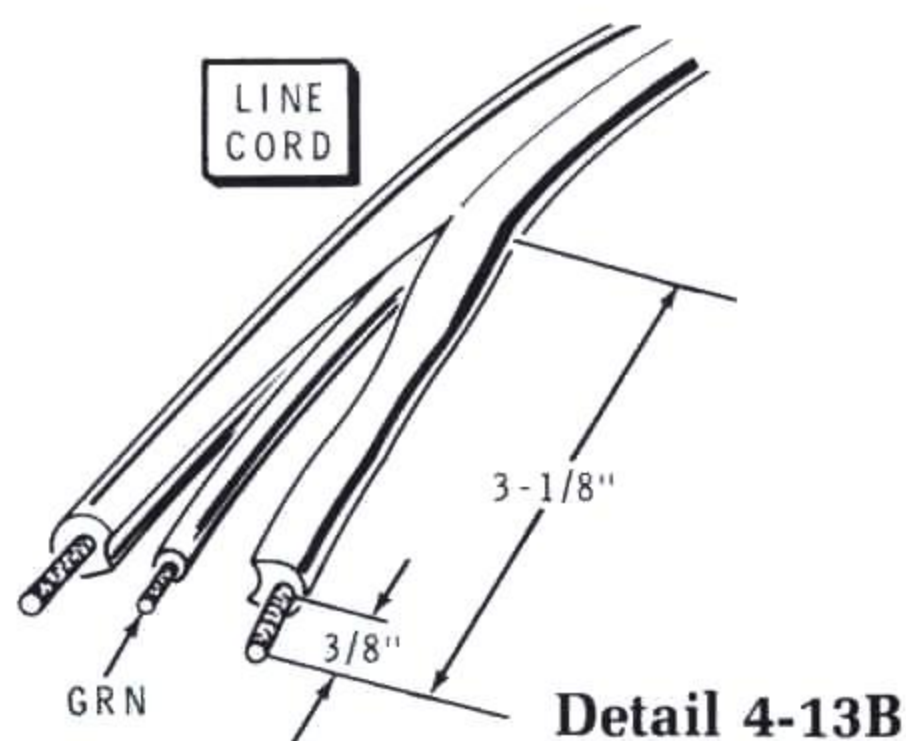
<u>Wire Coming from</u>	<u>Connect to</u>
() Lug 2, switch AN	Lug 2, terminal strip AE (S-2).
() Lug 1, switch Z	Lug 1, circuit breaker AB (S-1).
() Lug 4, switch Z	Lug 1, circuit breaker AA (S-1).



Detail 4-13C

- () Prepare a 3-1/2" and a 4" **large** black stranded wire by cutting to length and removing 3/8" of insulation from each end of each wire.
- () Connect one end of the 3-1/2" wire to terminal strip AE lug 4 (S-1). Connect the other end of this wire to circuit breaker AB lug 2 (NS). Use the hole next to the circuit breaker body.
- () In the same manner, connect the 4" wire from terminal strip AE lug 1 (S-1) to circuit breaker AA lug 2 (NS).
- () Refer to Detail 4-13B and prepare the end of the line cord as shown. Remove 3/8" of insulation from the end of each of the three leads. Melt a **small** amount of solder on the end of each.
- () Refer to Detail 4-13C and place the strain relief on the line cord just beyond the split portion of the cord, as shown. Use a pair of gas pliers to compress the strain relief, and then insert it into hole AC from the outside of the chassis.

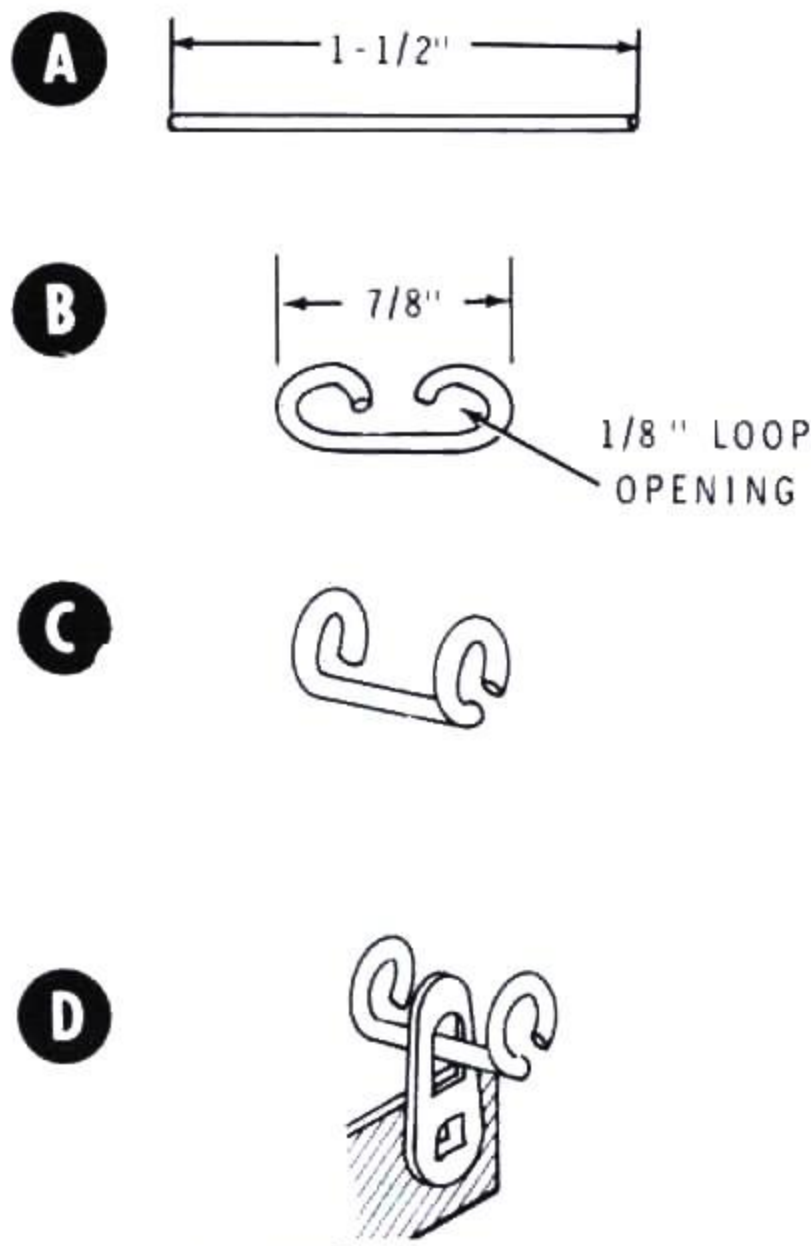
- () Connect the green line cord wire to solder lug AX (S-1).
- () Connect one line cord lead to lug 2 of circuit breaker AB (NS).
- () Connect the other line cord lead to lug 2 of circuit breaker AA (NS).
- () Cut two 3/4" pieces of small black sleeving. These will be used in the next two steps.
- () C1: Cut one lead of a .005 μ F (#21-72) ceramic capacitor to 1" and place a 3/4" sleeve on this lead. Connect this lead to circuit breaker AB lug 2 (S-3) and connect the other lead to solder lug AE (NS).
- () C2: Cut one lead of a .005 μ F (#21-72) ceramic capacitor to 1" and place a 3/4" sleeve on this lead. Connect this lead to circuit breaker AA lug 2 (S-3) and connect the other lead to solder lug AE (S-2).



Detail 4-13B

IMPORTANT: Recheck all the wiring steps on this page; work each wire connection with pliers to be certain that all the wires and leads at each connection are firmly soldered. Reheat any doubtful connection and add a little more solder if necessary.

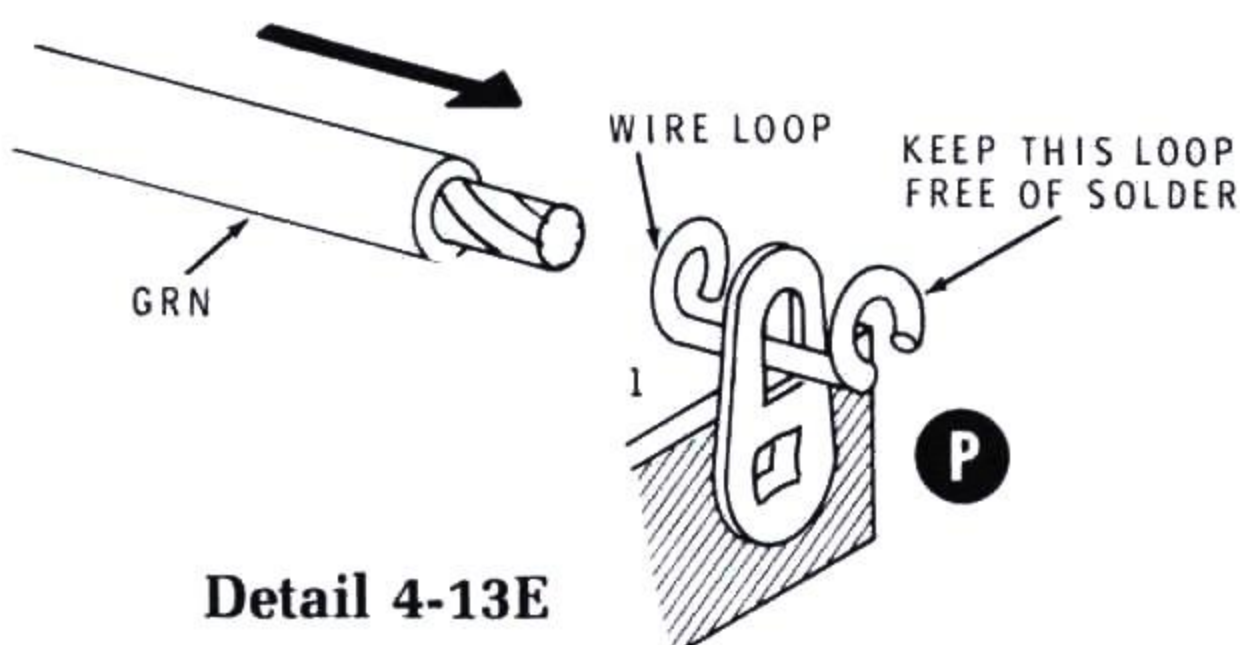




Detail 4-13D

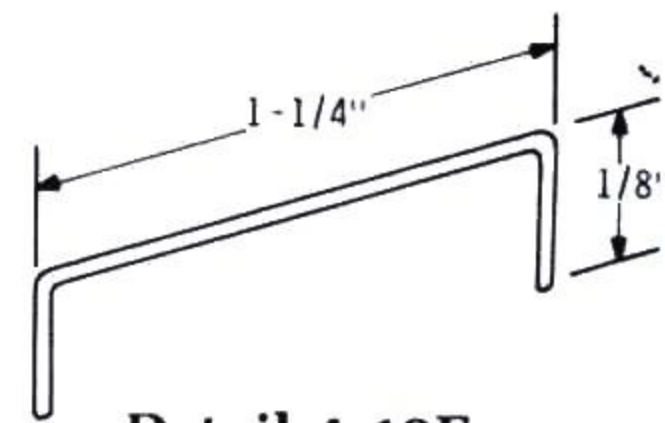
Refer to Detail 4-13D for the following steps.

- () **Part A.** Cut a 1-1/2" length of medium bare wire.
- () **Part B.** On each end of the bare wire, form a loop having an inside diameter of approximately 1/8". Adjust the size of the loops so they will just slide onto the tinned end of one of the large green transformer leads from hole AH.
- () **Part C.** Bend the two wire loops up as shown.
- () **Part D.** Pass the formed wire through lug 1 of terminal strip P.
- () Form another bare wire in the same manner, except pass this wire through lug 3 of terminal strip P.



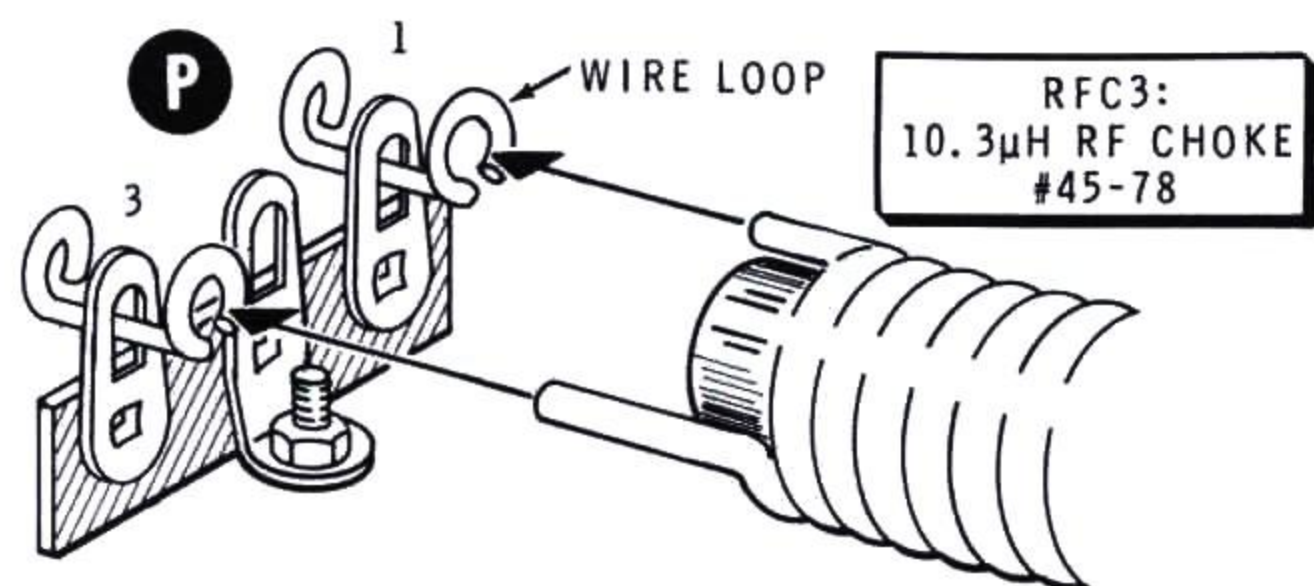
Detail 4-13E

- () Refer to Detail 4-13E and position the wire loops at lug 1 of the terminal strip so they point up away from the chassis. Then insert the end of the 6-1/2" green lead from hole AH all the way into the wire loop. Be careful to keep the two wire loops equally distant from the terminal strip solder lug. Then use pliers to compress the wire loop on the green wire. Solder the green lead to the wire loop and the wire loop to the solder lug, but be **sure** to keep the other wire loop free of solder. Also solder the lead from the .02 μ F disc capacitor and the brown wire to lug 1 at this time.
- () Repeat the preceding step at lug 3 of terminal strip P for the 5-3/4" green lead.



Detail 4-13F

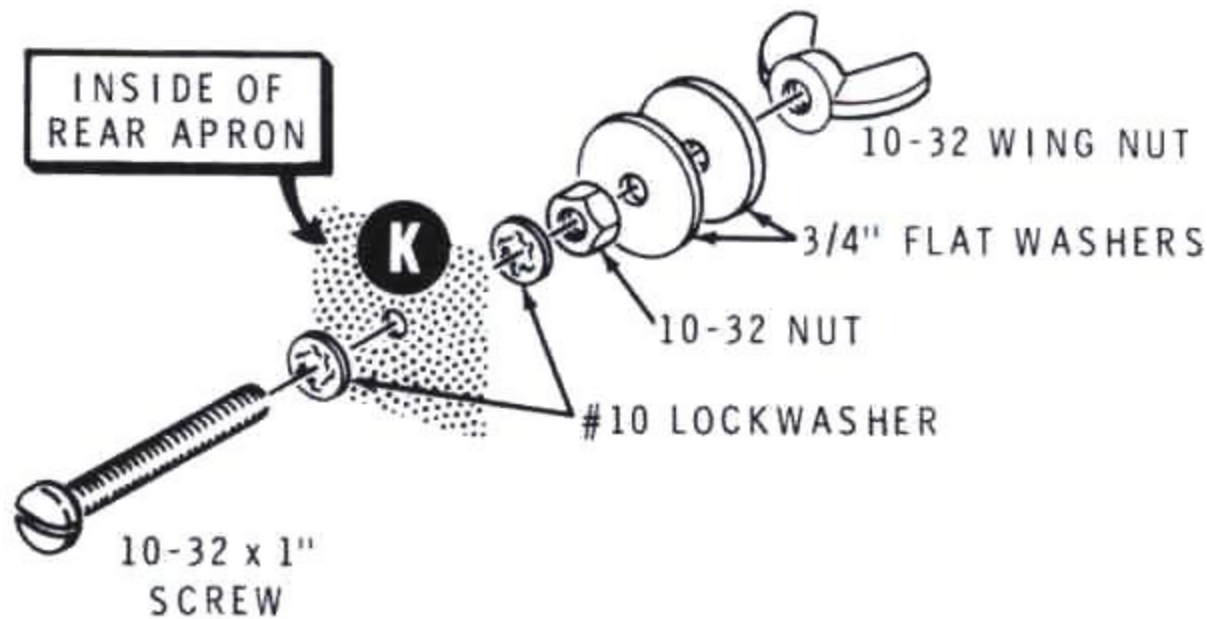
- () Refer to Detail 4-13F and form two 1-1/2" lengths of medium bare wire. Then, fit one wire from lug 1 of tube socket D (S-1) to lug 5 of tube socket N (NS).
- () Fit the other 1-1/2" wire from lug 5 of tube socket D (S-1) to lug 1 of tube socket N (NS).
- () C21: Connect a .02 μ F disc capacitor between tube socket N lugs 5 (S-2) and 1 (NS).
- () C32: Connect a .01 μ F (#21-70) disc capacitor from tube socket N lug 1 (S-3) to terminal strip AG lug 1 (S-2).



Detail 4-13G



- () RFC3: Refer to Detail 4-13G and fit the 10.3 μ H RF choke (#45-78) so the two short leads at one end fit into the two wire loops on terminal strip P. At the other end of the choke, form the two leads so they loop around the bare wire filament leads between the two tubes as shown. **Make sure the RF choke leads clear the chassis bottom by at least 1/8"** (use a straightedge). Solder the four RF choke leads carefully as these leads carry heavy current.

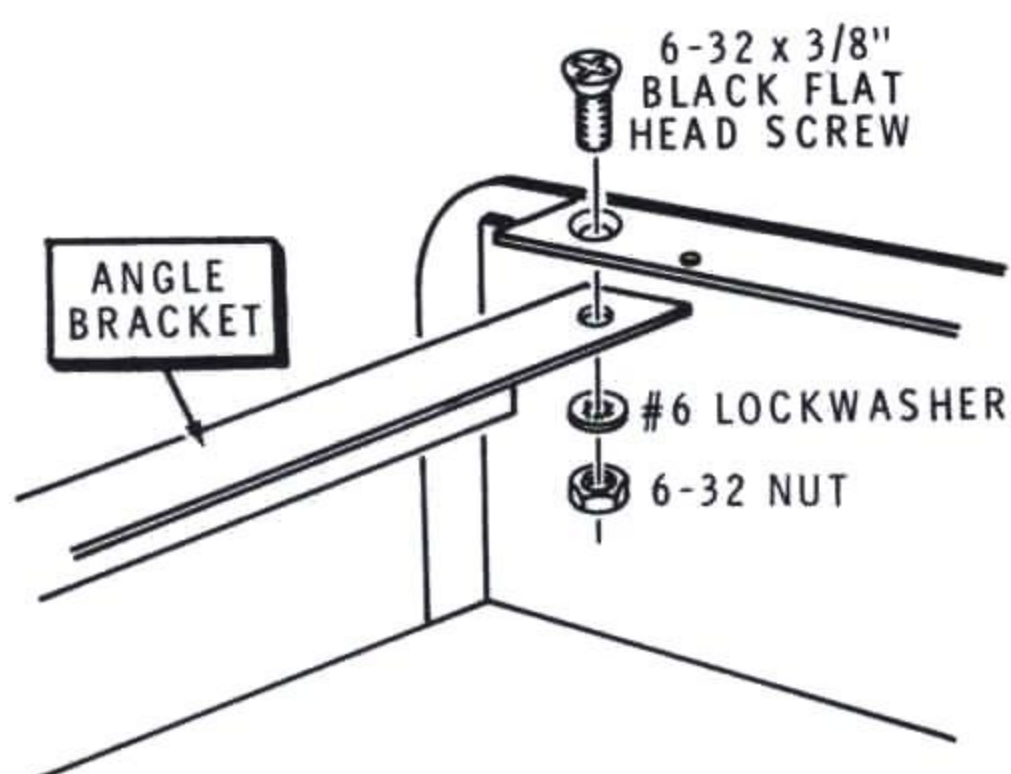


Detail 4-13H

- () Refer to Detail 4-13H and install the ground post at K on the chassis rear apron. Use a 10-32 \times 1" screw, two #10 lockwashers, a 10-32 nut, two 3/4" flat washers, and a 10-32 wing nut.

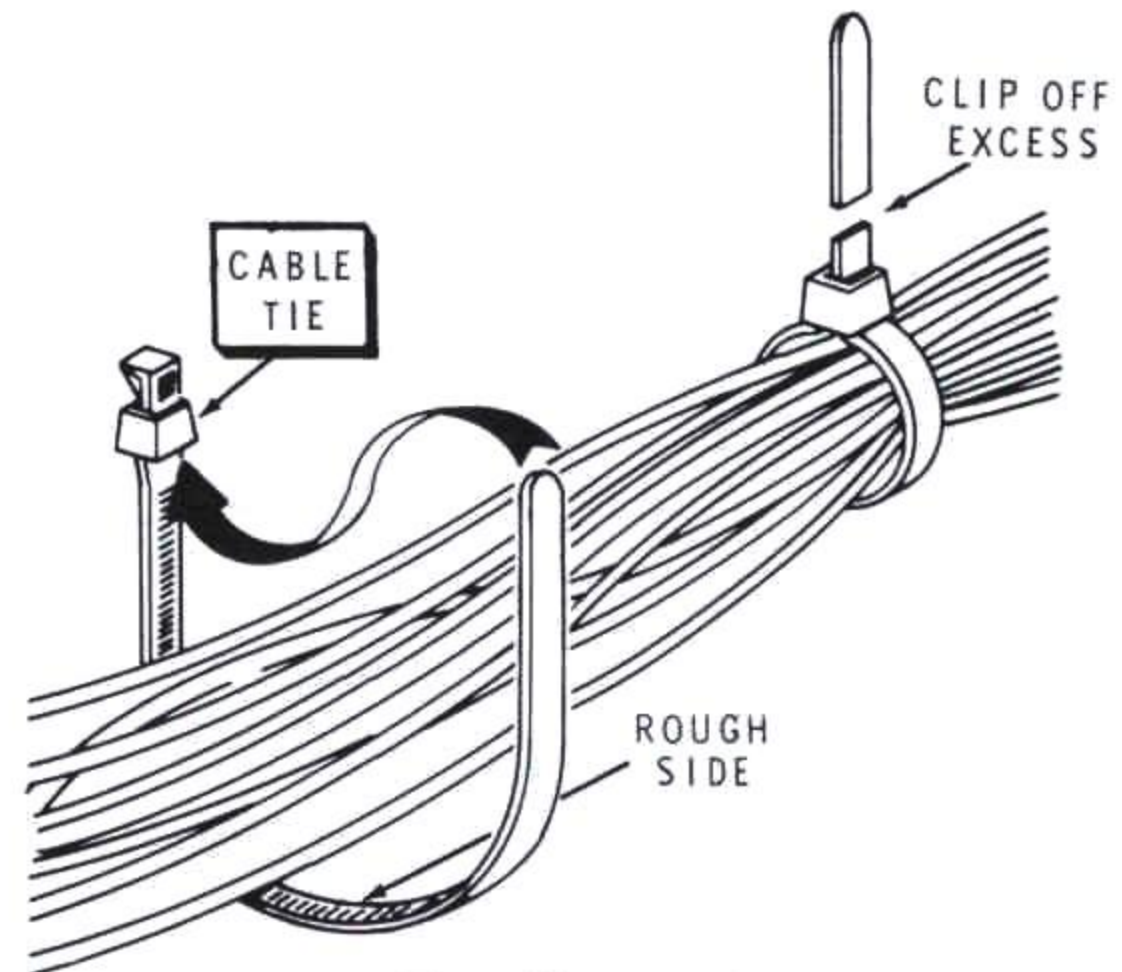
Refer to Pictorial 4-14 (Illustration Booklet, Page 10) for the following steps.

- () Refer to Detail 4-14A and install an angle bracket (#204-1041) on the chassis at AS and AT. Use 6-32 \times 3/8" black flat head hardware.



Detail 4-14A

- () In the same manner, install the other angle bracket between AP and AR.
- () Refer to Detail 4-14B and pass a cable tie (#354-5) around all of the wires at each of the six points shown in the Pictorial to form a neat cable. Equalize any slack in each wire between the ends of the wire. Then pull each cable tie snug and clip off the excess length of the tie.



Detail 4-14B

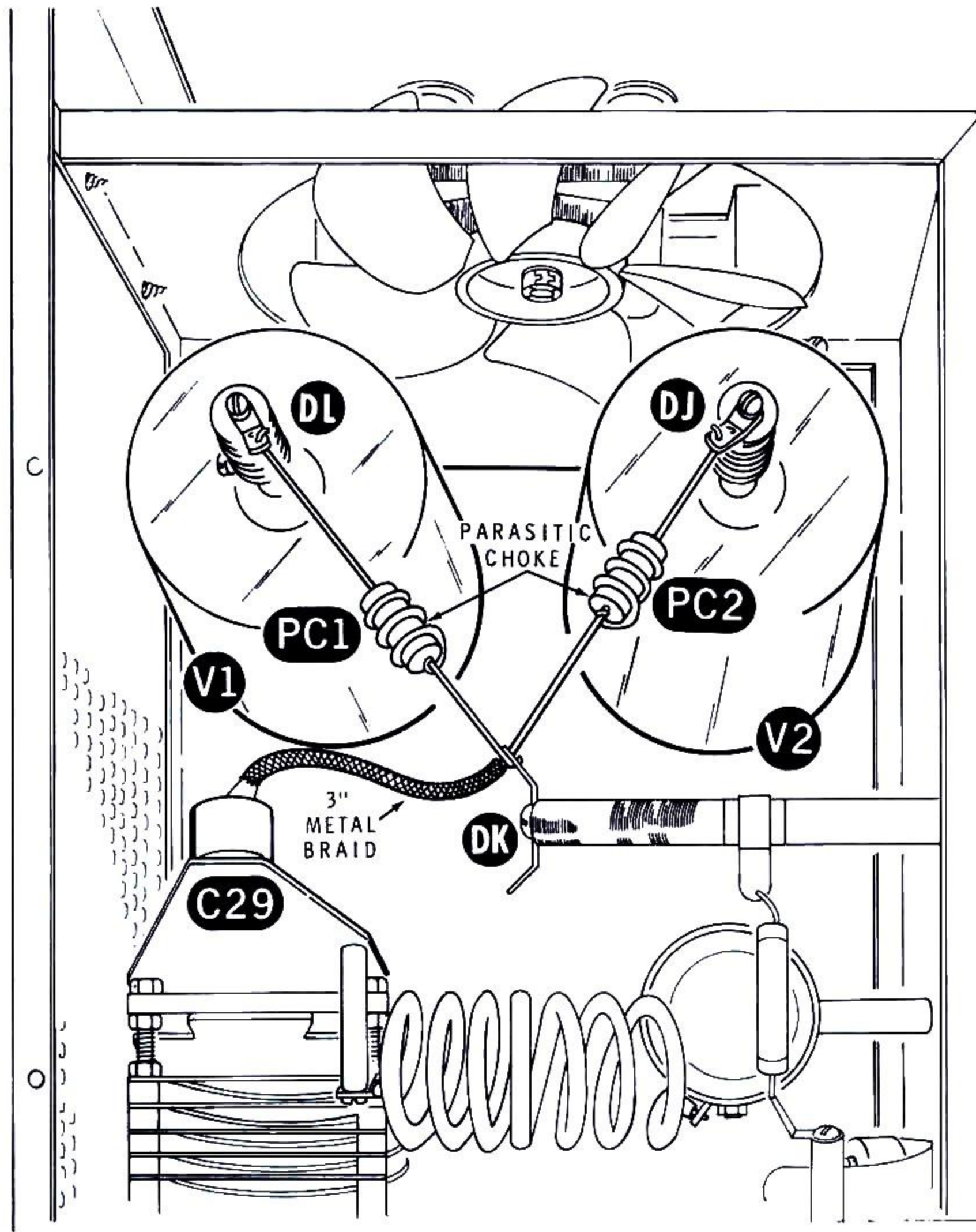
120-240 VOLT WIRING

IMPORTANT: Before you perform the next two steps, be sure to read "Power Considerations" on Page 80.

This Amplifier can be operated from 120 or 240 volts, 50/60 Hertz, alternating current.

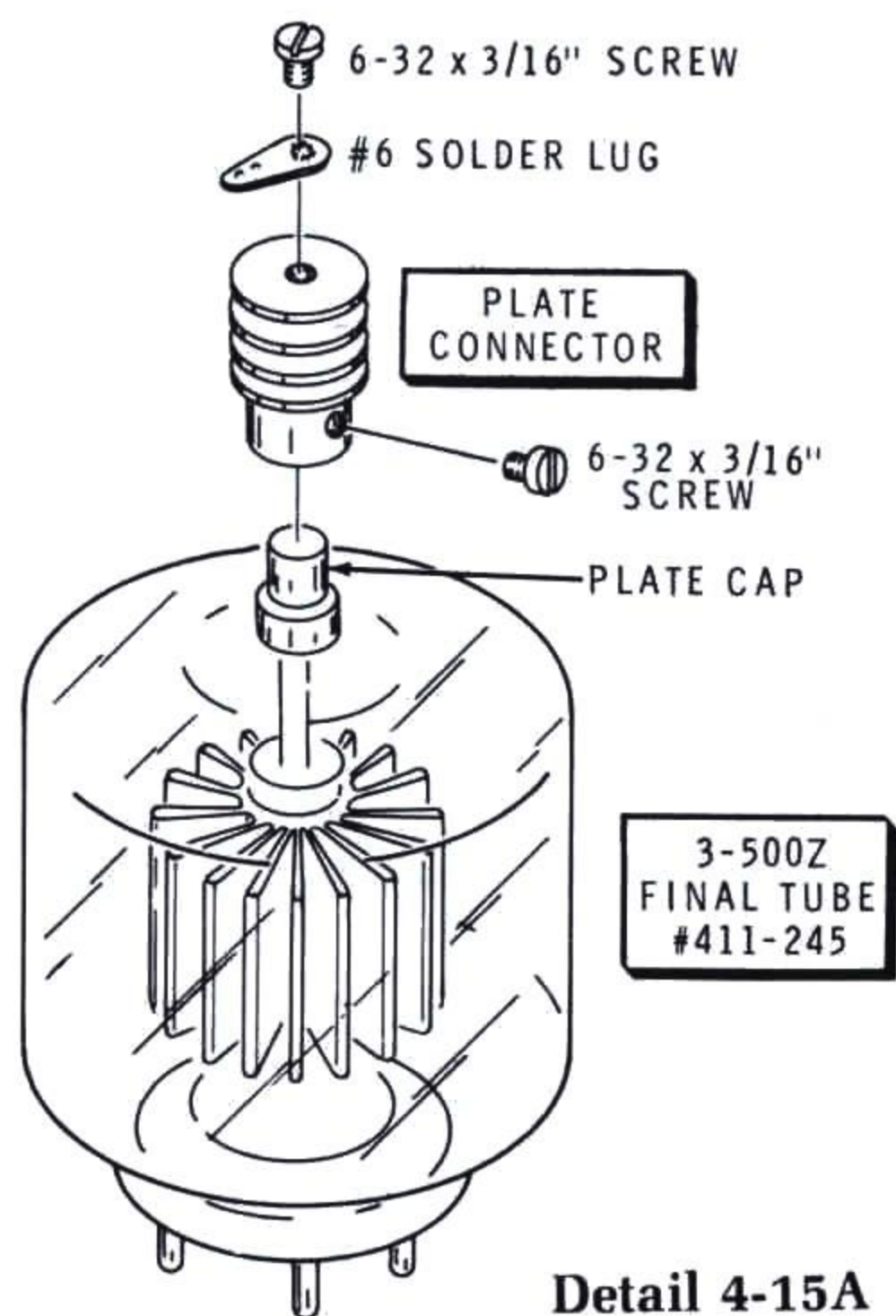
Make the proper connections on terminal strip AE for the supply voltage you will use. Refer to the inset drawing of Pictorial 4-14 and perform one of the following steps, depending on the line voltage to be used.

- () For 120 VAC operation, connect a 1-3/8" medium bare wire between terminals 1 and 2 and another bare wire between terminals 3 and 4 of terminal strip AE.
- () For 240 VAC operation, connect a 1-3/8" medium bare wire between terminals 2 and 3 of terminal strip AE.



PICTORIAL 4-15



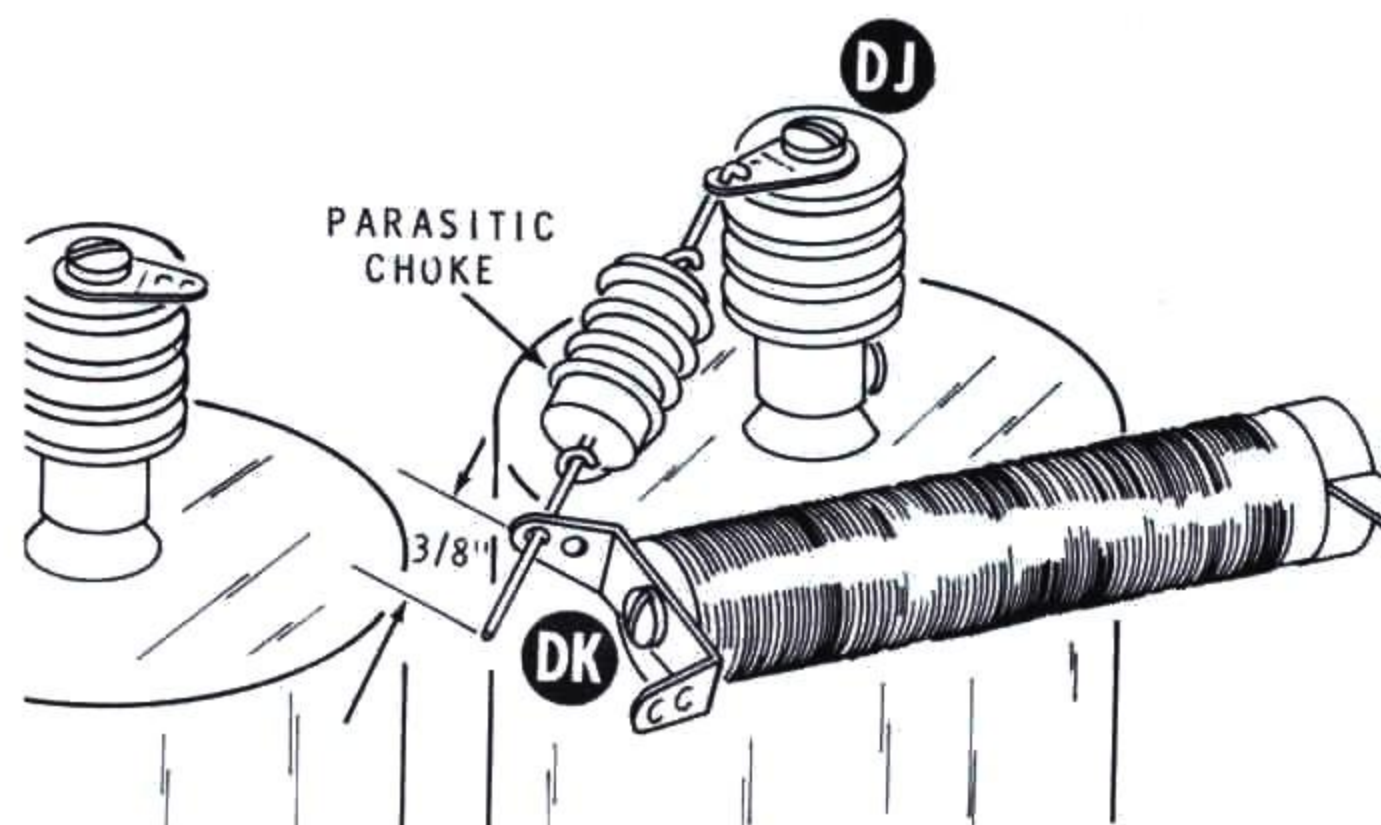


FINAL TOP-CHASSIS WIRING

Refer to Pictorial 4-15 for the following steps.

Refer to Detail 4-15A for the following three steps.

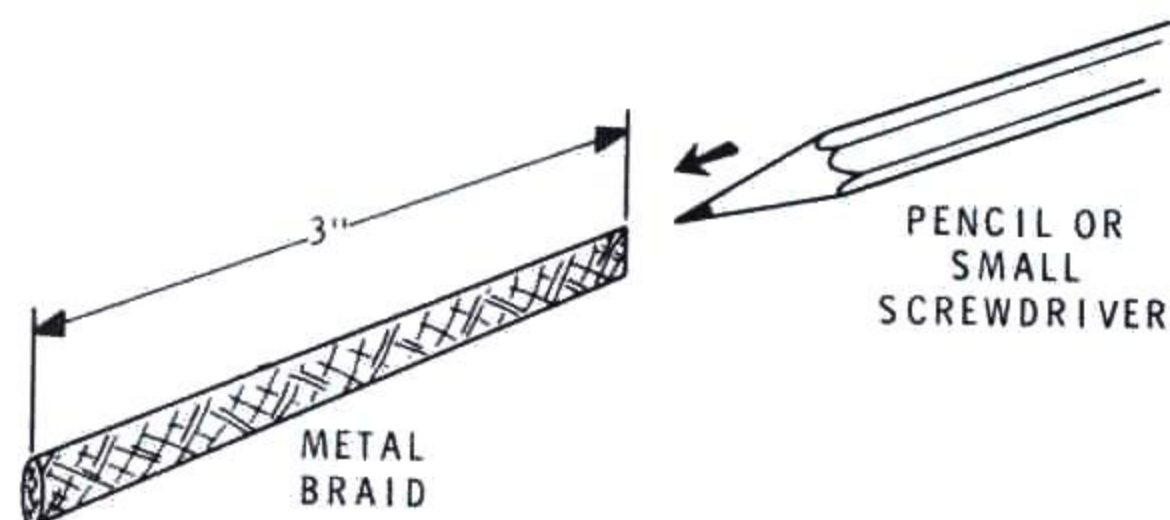
- () Loosely install a #6 solder lug on the top end of each plate connector (#260-12) with a 6-32 × 3/16" screw. Flatten both solder lugs.
- () Start a 6-32 × 3/16" screw into the side of each plate connector.
- () Place each plate connector on the plate cap of a final tube (3-500Z) and tighten the screw on the side of each connector.
- () V1, V2: Place a final tube in each tube socket. **CAUTION:** Use extreme care when you install a 3-500Z final tube (#411-245). Without rocking, gently push the tube into its socket. Too much pressure or lateral force (from rocking) may crack the glass beads around the socket pins, and damage the tube. Heath Company cannot be held responsible for any damage sustained through improper installation.



Detail 4-15B

NOTE: When you install parasitic chokes in the following steps, center the chokes between the solder lugs.

- () Cut each lead of the two parasitic chokes (#45-53) to a length of 7/8".
- () PC2: Refer to Detail 4-15B and install a parasitic choke from solder lug DJ (S-1) to solder lug DK (NS). Note that the lead of the parasitic choke extends through solder lug DK for approximately 3/8". Leave this lead straight as shown in the Detail.
- () PC1: Install the remaining parasitic choke from solder lug DL (S-1) to solder lug DK (NS).
- () Tighten the screws in the tops of the two plate connectors.
- () Refer to Detail 4-15C and open up the ends of a 3" length of metal braid with a pencil. (Note that the metal braid is actually flattened tubular braid.) Push one end onto the 3/8" projecting end of parasitic choke PC2 (S-3). Push the other end over the solder lug on capacitor C29 (S-1).

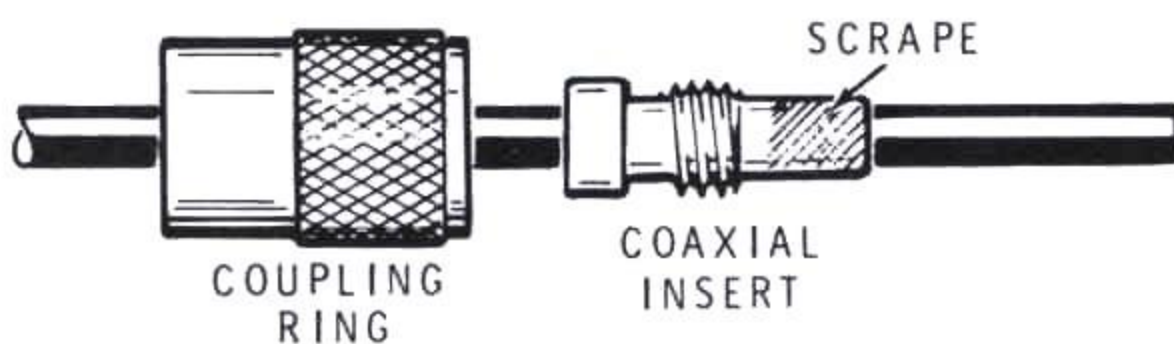


Detail 4-15C

PROCEDURE FOR INSTALLING A COAXIAL PLUG ON RG-58 CABLE

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

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



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



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



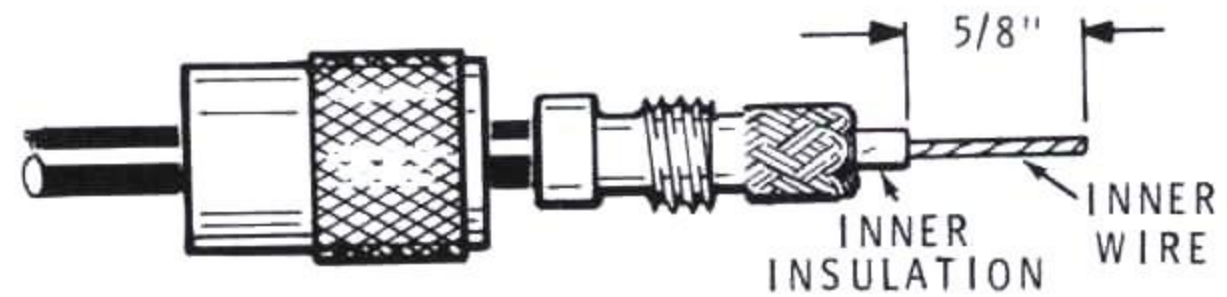
4. Taking care not to nick the outer shield of wires, remove another 3/8" of the outer insulation.



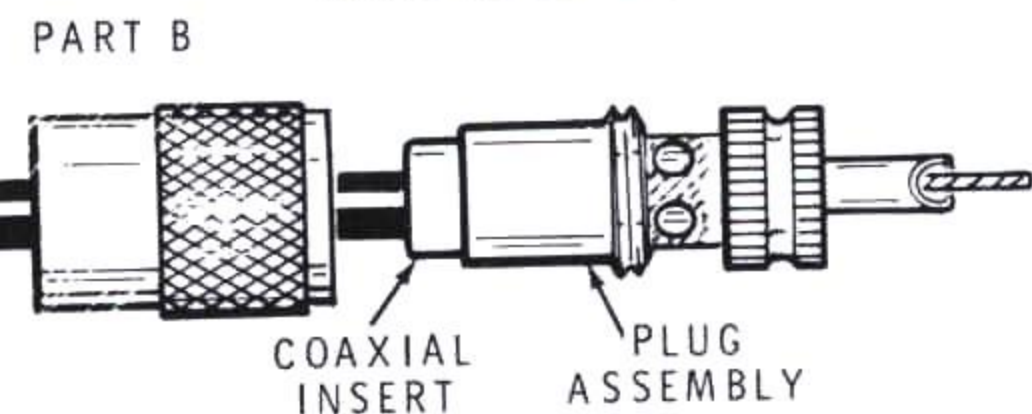
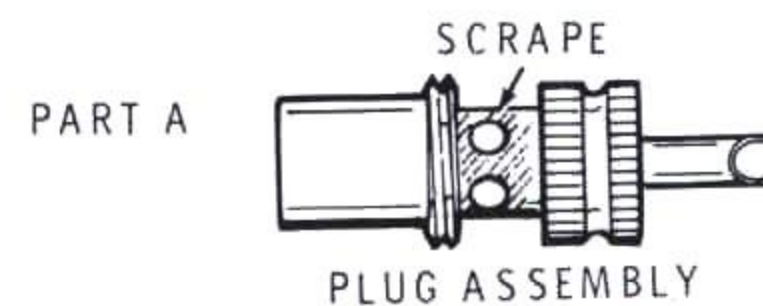
5. Position the coaxial insert even with the end of the outer insulation. Then carefully fold the shield wires back until they are neatly against the coaxial insert. It is not necessary to un-braid the shield wires.



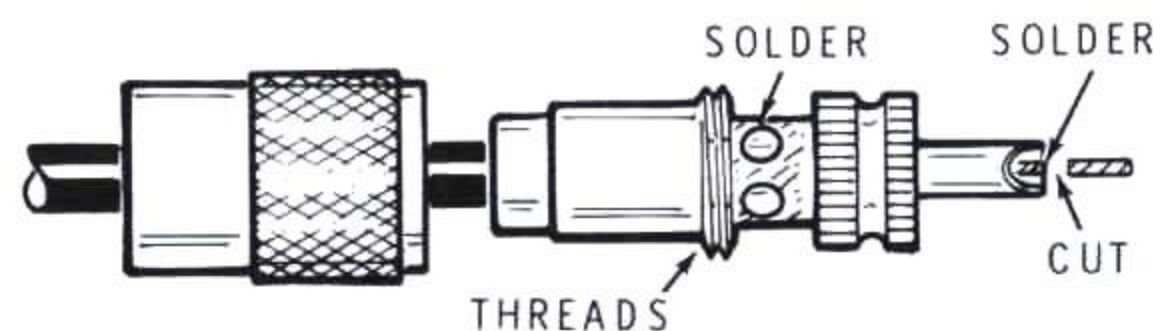
6. Taking care not to nick the inner wire (or wires), remove 5/8" of the inner insulation. NOTE: If your particular cable has more than one inner wire, twist them together tightly. Then melt a small amount of solder to their ends to hold them together.



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



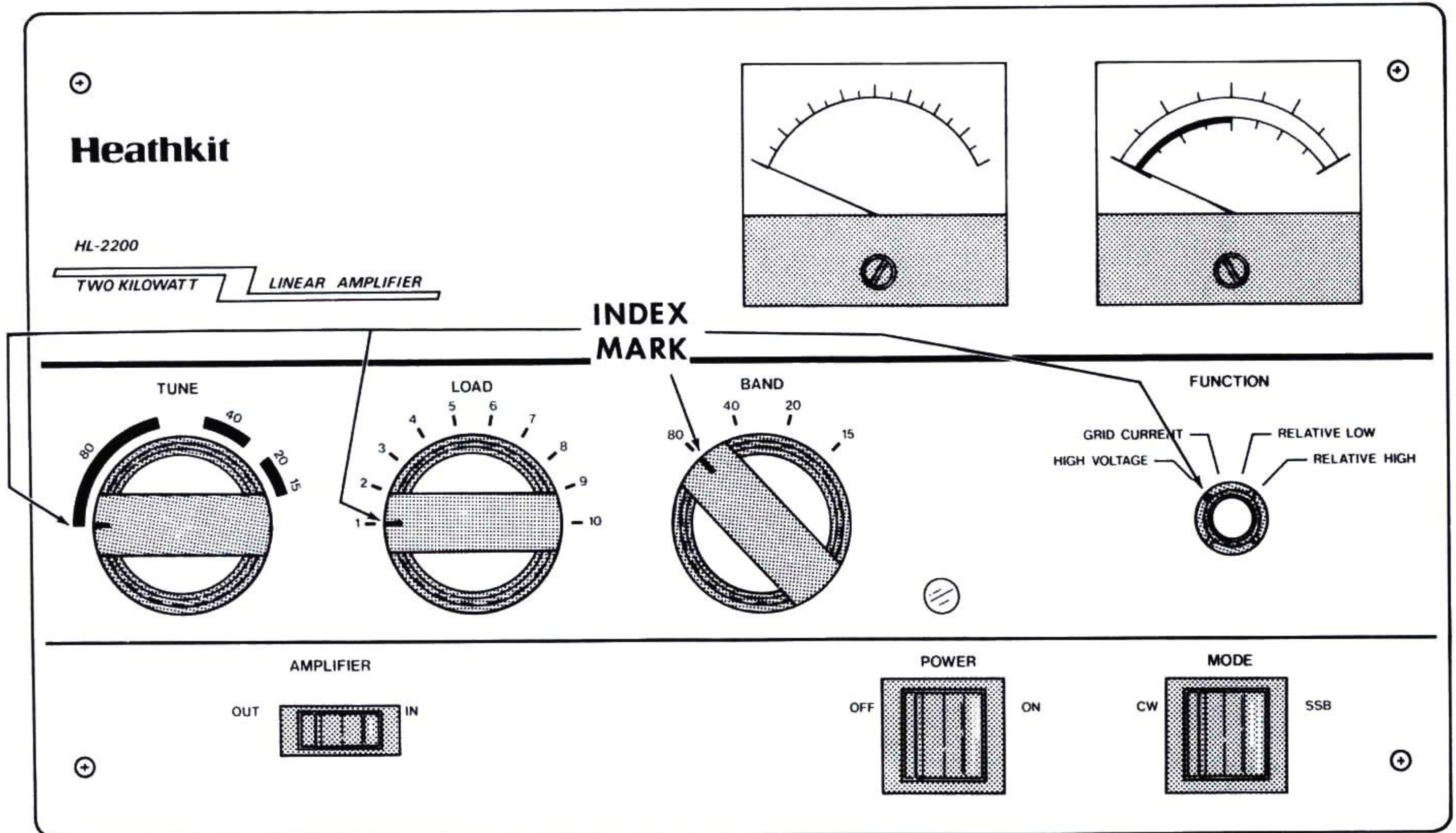
8. Solder the plug assembly to the shield wires through each of the four holes. Be sure you do not get solder on the threads. NOTE: You will need plenty of heat to do this properly. Then solder the inner wire (or wires) to the plug assembly and cut off any excess wire end.



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



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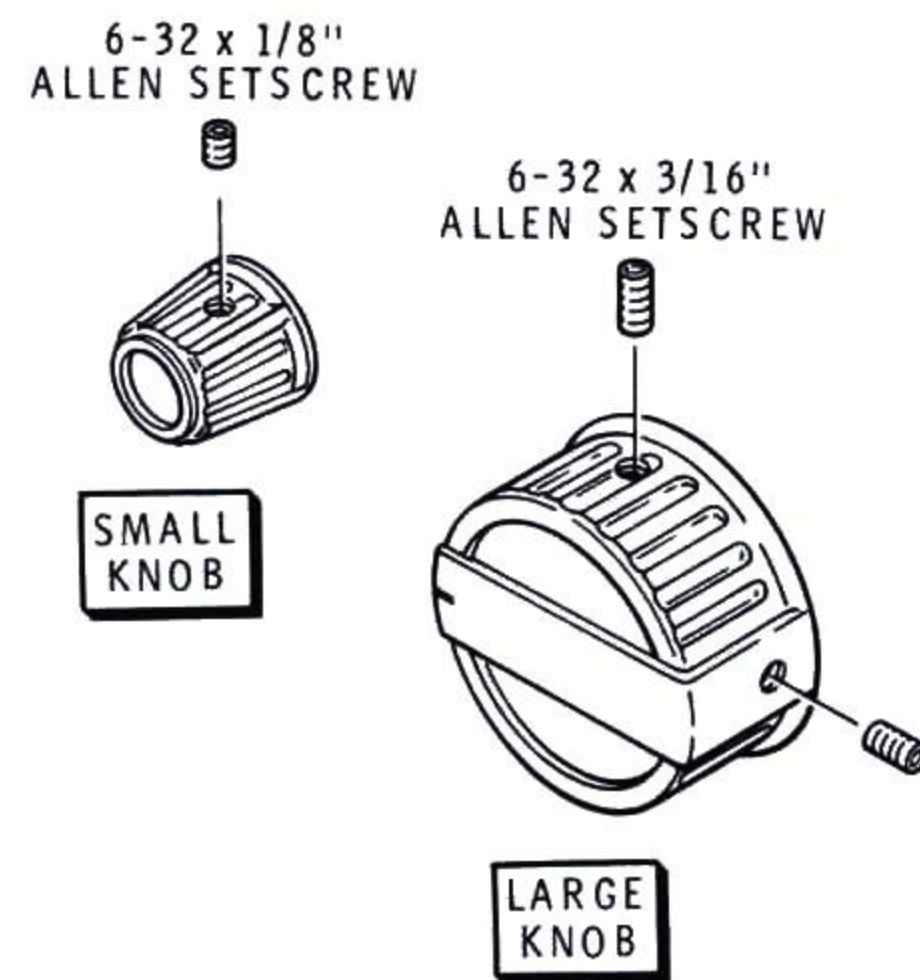


PICTORIAL 4-16

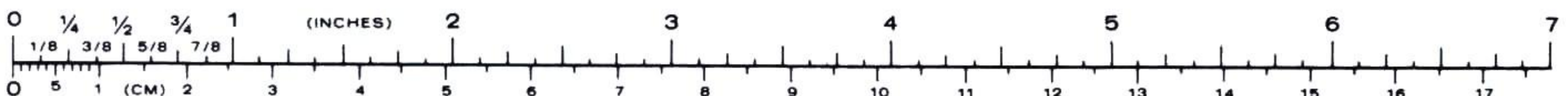
KNOB INSTALLATION

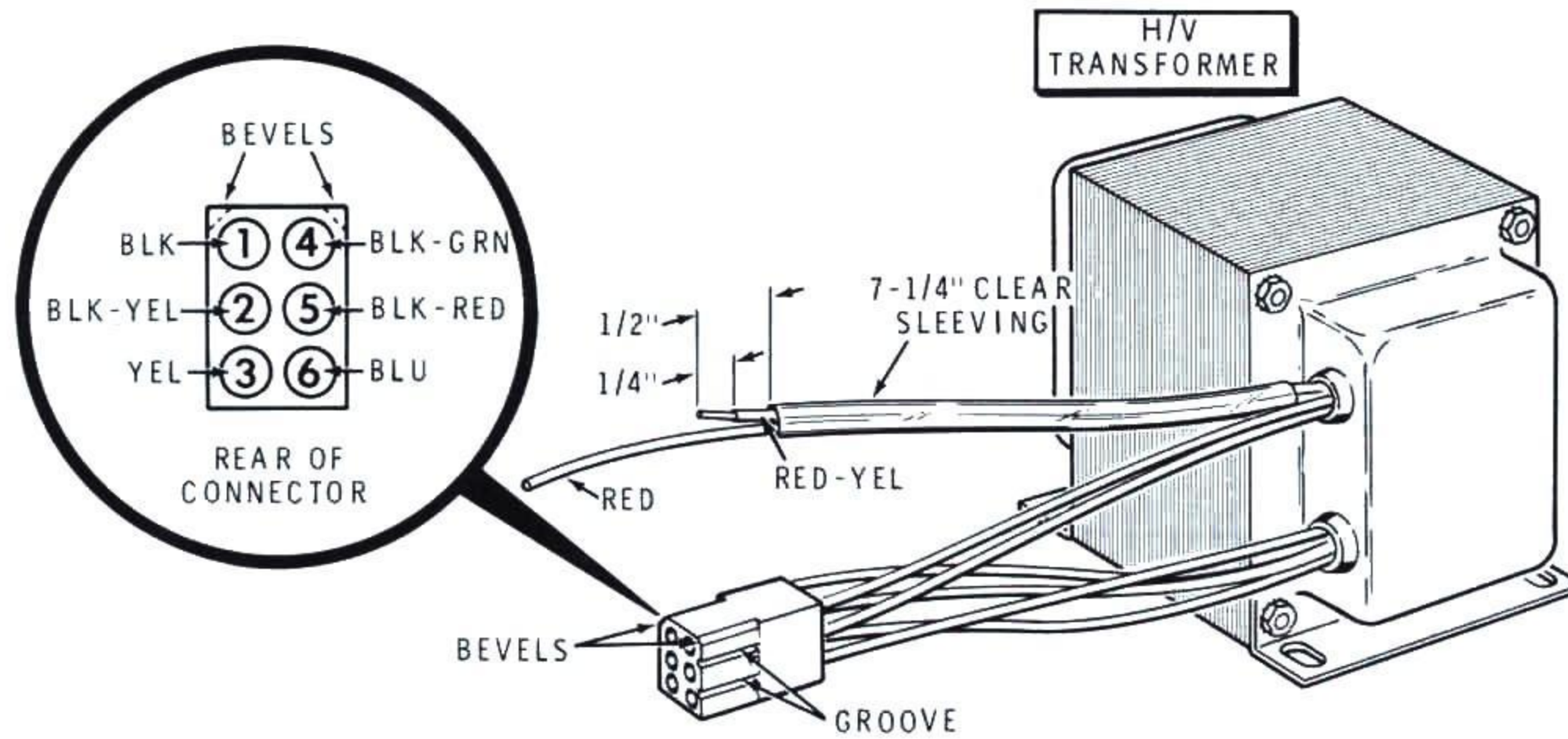
Refer to Pictorial 4-16 for the following steps.

- () Refer to Detail 4-16A and start two 6-32 × 3/16" allen setscrews into each of the three large knobs.
- () Start a single 6-32 × 1/8" allen setscrew into the small knob.
- () Turn the shafts of the Tune and Load capacitors so the plates are fully meshed.
- () Turn the two other shafts fully counterclockwise.
- () Install the knobs on the shafts so the index marks are positioned as shown in the Pictorial, and tighten the setscrews.



Detail 4-16A





PICTORIAL 4-17

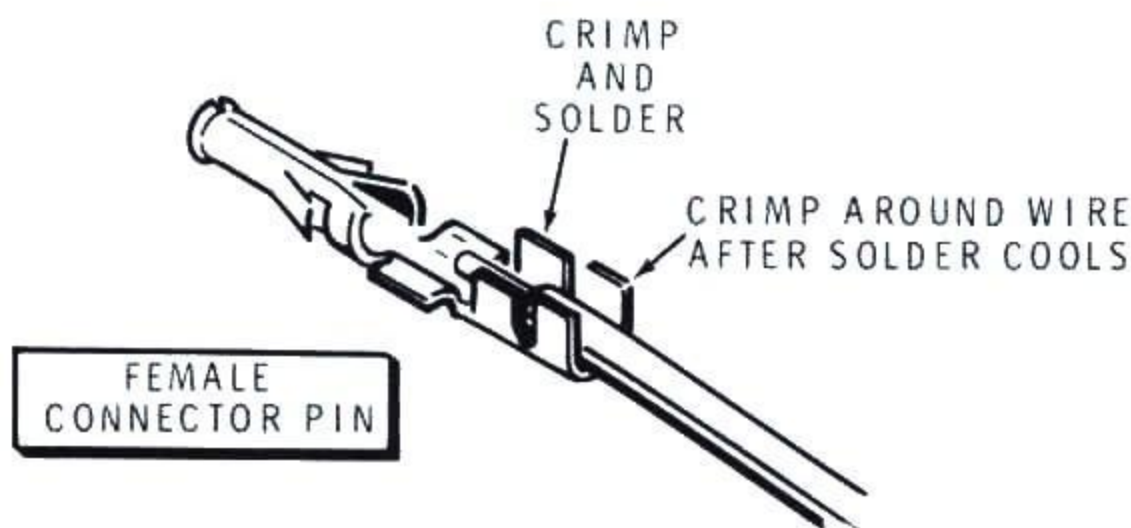
HIGH VOLTAGE (HV) TRANSFORMER INSTALLATION

Refer to Pictorial 4-17 for the following steps.

- () Cut the following HV transformer leads to 7". Measure the leads from the point where they exit the transformer. **Do not shorten the red and red-yellow leads.**

Black	Black-Green
Black-Yellow	Black-Red
Yellow	Blue

- () Remove 1/4" of insulation from the end of each of the 7" transformer leads. Then twist the fine wire strands together and melt a **small** amount of solder on each bared end.



Detail 4-17A

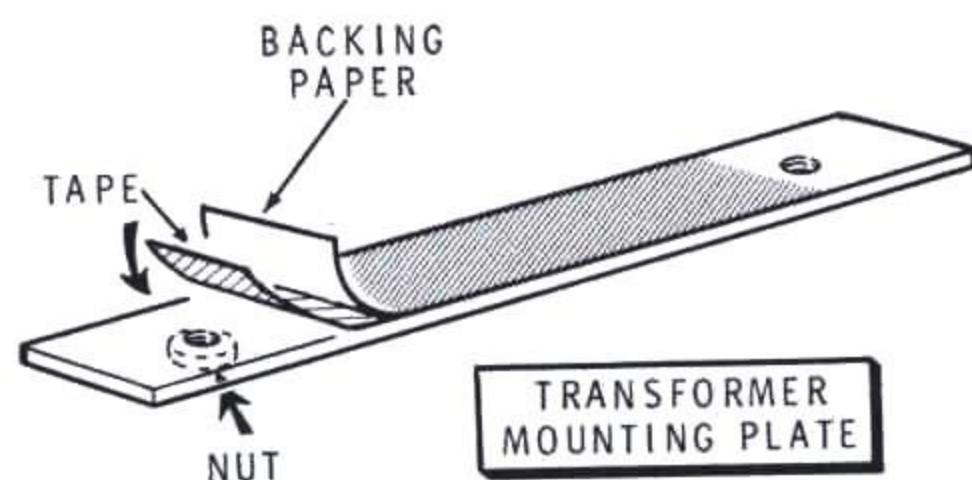
- () Refer to Detail 4-17A and install female connector pins (#432-982) on one end of each of the 7" long transformer leads. **Do not install connectors on the red and red-yellow transformer leads.**

Position the plug shell as shown in the Pictorial (note the position of the grooves and beveled corners). Then push the connector pins on the transformer leads into the holes of the plug shell as follows. Make sure each pin locks into place.

- () Black into hole 1.
- () Black-yellow into hole 2.
- () Yellow into hole 3.
- () Black-green into hole 4.
- () Black-red into hole 5.
- () Blue into hole 6.

NOTE: Be sure to use the **small** clear sleeving in the next step.

- () Pass a 7-1/4" length of small clear sleeving over the red and the red-yellow leads coming from the HV transformer. Slide the sleeving on the leads as far as it will go.
- () Cut off the red-yellow lead 1/2" beyond the end of the sleeving. Remove 1/4" of insulation. Do not shorten the red transformer lead.



Detail 4-18A

Refer to Pictorial 4-18 (Illustration Booklet, Page 10) for the following steps.

- () Cut two 4" lengths of double-sided sticky tape.
- () Carefully peel the backing paper from one side of each length of tape. Refer to Detail 4-18A and press a length of tape on each of the transformer mounting plates as shown. Then carefully peel the backing paper from the other side of the tape.
- () Refer to Detail 4-18B (Illustration Booklet, Page 11) and press the transformer mounting plates to the bottom of the chassis as shown. Make sure the nuts line up with the holes in the chassis. Move the wiring slightly if necessary.

NOTE: When you perform the next step, use the length of large clear sleeving to hold the 10-32 screws until you get them started. (See the inset drawing on the Pictorial).

- () T1: Refer to Detail 4-18B (Illustration Booklet, Page 11) and mount the HV transformer to the chassis. Be sure to mount the transformer so the leads are positioned as shown. Use four 10-32 × 1/2" screws.
- () Match the beveled corners of the plug, coming from the transformer, with the beveled corners on socket Y. Then push the plug into the socket as far as possible.
- () Route the remaining two transformer wires as shown in the Pictorial. Then connect the red-yellow lead to the positive lug of capacitor C14 or to its large bare wire (S-3).

NOTE: In the following steps, if solder on the bare end of the red lead prevents it from entering hole D of the circuit board, carefully cut off just enough of the soldered lead end to allow it to fit into the hole. Be careful not to cut the lead too short.

- () Connect the red lead coming from the HV transformer to circuit board hole D (S-1). Reach in between the circuit board and the capacitor bracket to solder this connection. Make sure this connection is well soldered.

This completes the "Step-by-Step Assembly" section. Carefully inspect all connections for loose wires or unsoldered connections. Remove any wire clippings or solder splashes. Then proceed to "Test and Final Assembly."



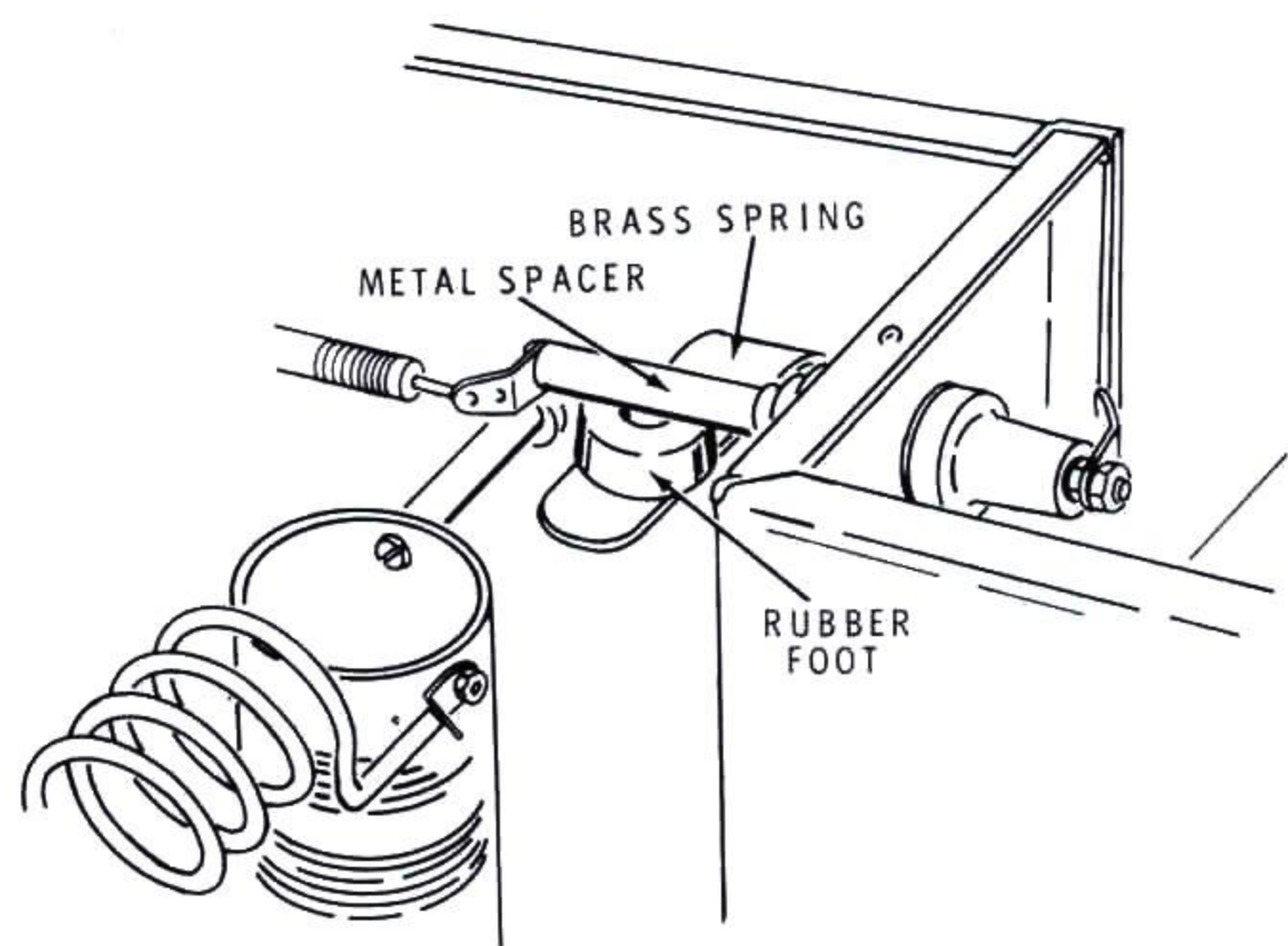
TEST AND FINAL ASSEMBLY

The input coils are factory adjusted and do not require any further alignment.

The brass spring and the metal spacer form a safety "interlock" which grounds the high voltage power supply and removes the high voltage from points which are exposed when the perforated cover is removed.

RESISTANCE CHECK

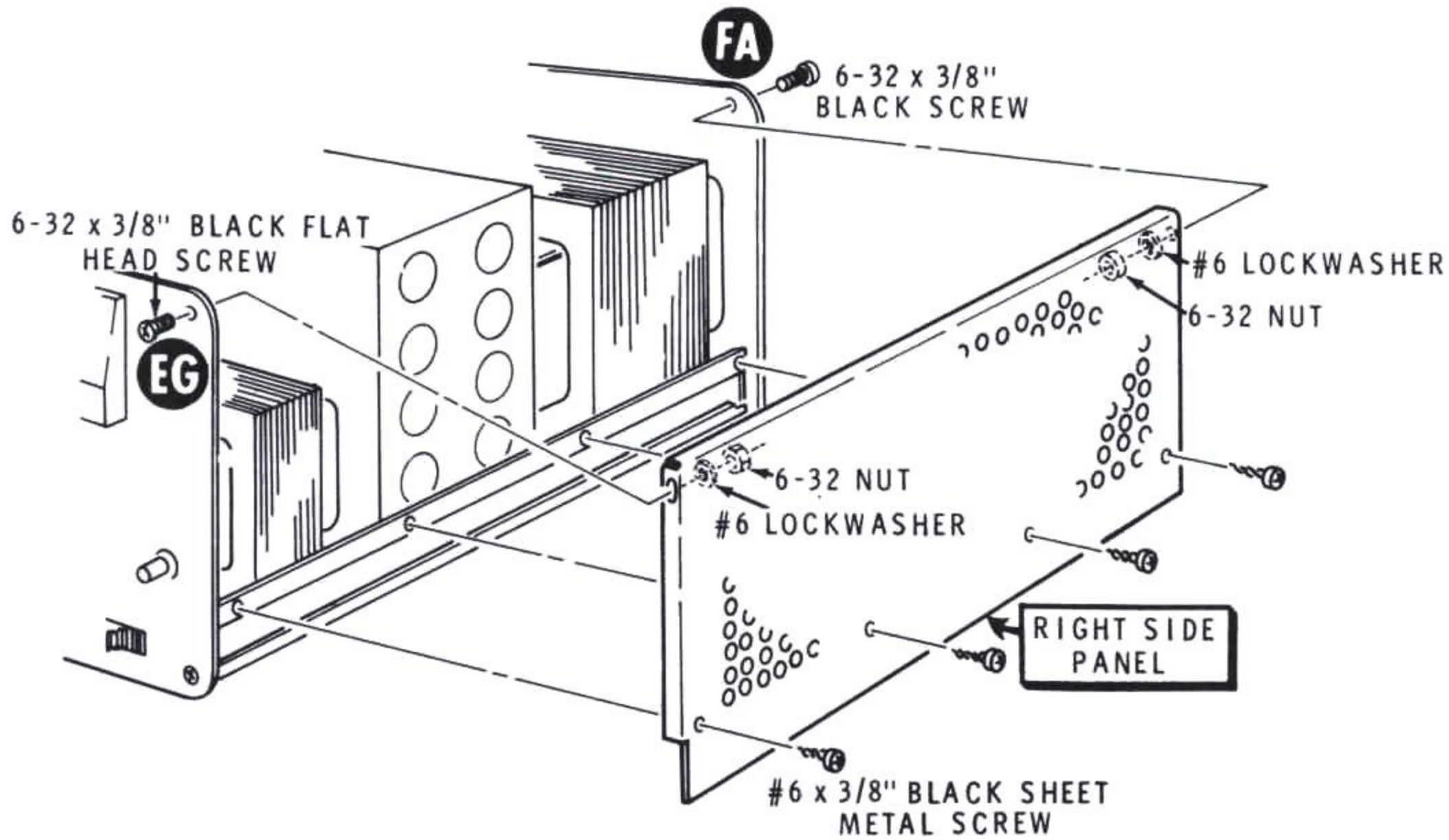
- () **IMPORTANT:** Refer to Pictorial 5-1, push down the brass spring of the interlock, and temporarily insert a rubber foot between the brass spring and the metal spacer. **If you fail to do this, the high voltage circuit will be short-circuited, you will be unable to obtain a plate connector resistance reading, and damage will result if power is applied.**
- () The resistance between the plate connectors and the chassis should measure approximately 200 k Ω after the meter stabilizes. See Pictorial 5-2 (Illustration Booklet, Page 11).
- () The resistance between lugs 2, 3, and 4 of each tube socket and the chassis (Pictorial 4-14 Illustration Booklet, Page 10) should measure approximately 20 Ω .



PICTORIAL 5-1

If any difficulty is encountered in obtaining either of these resistance readings, refer to the "In Case of Difficulty" section of the Manual on Page 88.

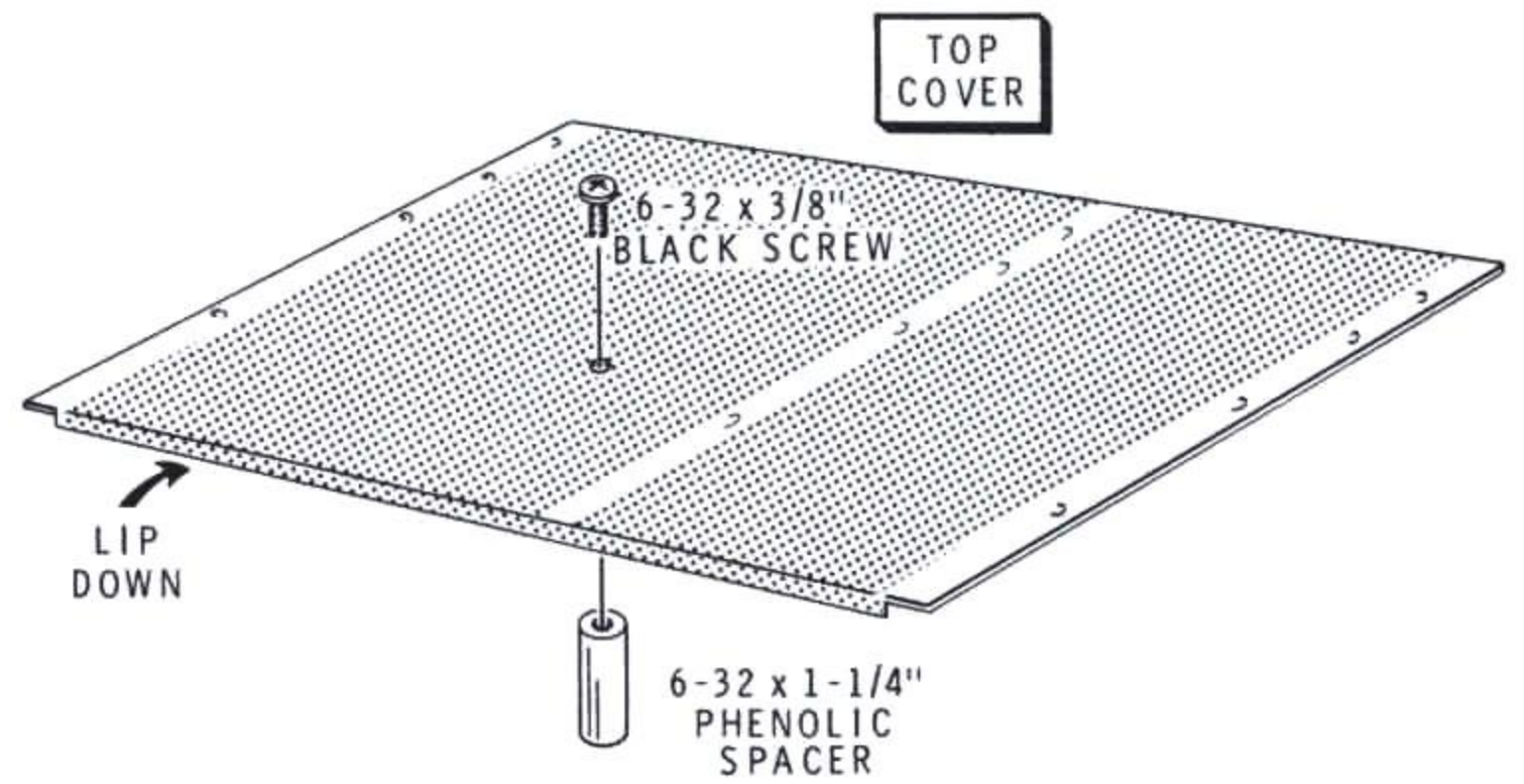
- () Remove the rubber foot from the interlock.



Detail 5-2A

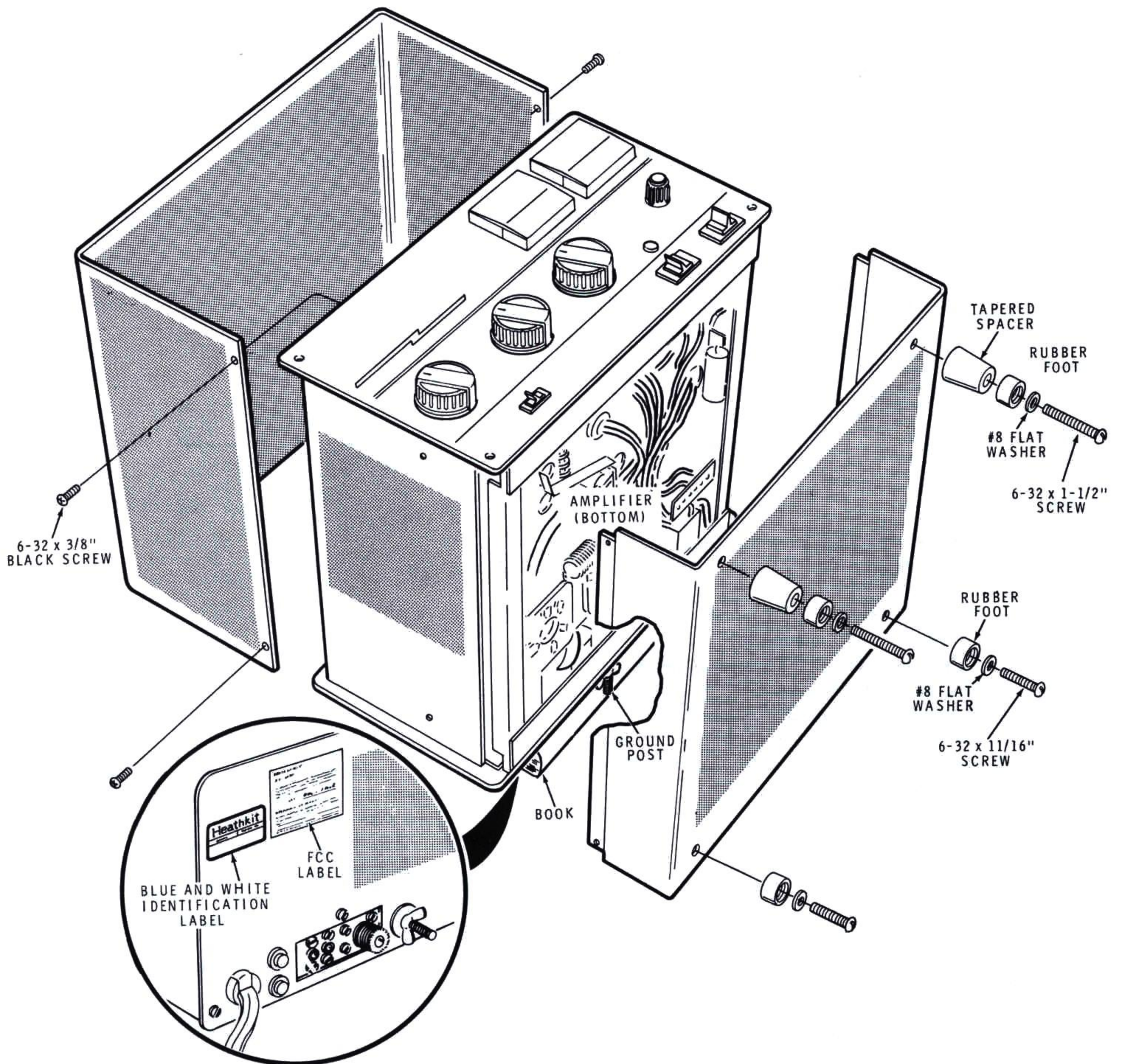
Refer to Pictorial 5-2 (Illustration Booklet, Page 11) for the following steps.

- () Refer to Detail 5-2A and install the right side panel. Use #6 x 3/8" black sheet metal screws along the lower edge, 6-32 x 3/8" black flat head hardware at EG, and 6-32 x 3/8" black hardware at FA. CAUTION: After the panel is installed, check to make sure there is at least 1/4" clearance between the point of the sheet metal screw and any connections to the positive (+) lug of filter capacitor C10. (See Pictorial 4-7, Illustration Booklet, Page 7).
- () As shown in the Pictorial, place the perforated top cover (#205-724) on the top of the Amplifier with the lip against the front panel pointing down. Align the mounting screw holes. Then mark the hole in the cover which is directly over that portion of the brass spring which protrudes beyond the metal spacer.
- () Refer to Detail 5-2B and install a 6-32 x 1-1/4" phenolic spacer on the underside of the perforated cover at the marked hole. Use a 6-32 x 3/8" black screw.



Detail 5-2B

- () Install the perforated top cover and the top rear plate cover (#205-723) on the top of the amplifier. Use #6 x 3/8" black sheet metal screws. First, install a screw near each corner of the top cover and then check visually to make sure that the phenolic spacer on the under side of the top cover pushes the interlock spring down away from the metal spacer mounted on the feedthrough insulator. Any required repositioning of the phenolic spacer should be accomplished before completing the top cover installation. Then install the rest of the sheet metal screws.
- () If necessary, adjust each meter pointer to "0" with the meter adjusting screw (see Pictorial 6-1 Illustration Booklet, Page 12).



PICTORIAL 5-3

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NOTE: If at any time during the testing and operation the Linear Amplifier does not perform as described, unplug the Linear Amplifier line cord and refer to the "In Case of Difficulty" section of the Manual.

Position the switches and controls as follows:

TUNE	9 o'clock
LOAD	9 o'clock
BAND	Any
FUNCTION SWITCH	HIGH VOLTAGE
POWER SWITCH	OFF
MODE SWITCH	CW
AMPLIFIER SWITCH	IN

- () Plug the line cord into the power source for which the unit is wired, either 120 volts or 240 volts AC.

CAUTION: LETHAL VOLTAGES ARE PRESENT IN THIS UNIT. USE EXTREME CARE WHEN MAKING ANY TESTS.

- () Push the POWER switch to ON.
- () Check to see that the tube filaments light, and that the fan operates. The right-hand meter should read approximately 2400 volts, depending on your line voltage.
- () Push the MODE switch to SSB. The meter should read approximately 3200 volts, depending on your line voltage.

NOTE: There should be no indication on either panel meter except when the FUNCTION SWITCH is at the HIGH VOLTAGE position.

- () Push the POWER switch to OFF and unplug the line cord.

NOTE: Read through the following steps and decide whether you want your amplifier to sit level, or whether you wish the front of the chassis elevated. Then select the feet and mounting hardware so the parts will be immediately available as you install the cabinet. The screws for the mounting feet will be inserted through the four holes in the cabinet bottom and screwed into the captive nuts in the flange of the chassis.

Refer to Pictorial 5-3 for the following steps.

- () Place a book on a flat surface and balance the amplifier chassis on the book, front panel upmost.

- () Position the cabinet bottom onto the chassis so the captive nuts in the chassis bottom flange are aligned with the four holes in the cabinet bottom.

Perform only **one** of the following two steps, depending upon how you wish the amplifier cabinet positioned.

- () If you wish to have the amplifier cabinet sit level, install a rubber foot at each corner of the cabinet. Use 6-32 × 11/16" screws and #8 flat washers. Tighten the hardware finger tight.
- () If you wish the front of the cabinet to be elevated, install a rubber foot on each rear corner with 6-32 × 11/16" screws. Then, install a tapered spacer and a rubber foot at each front corner of the cabinet with 6-32 × 1-1/2" screws. Use a #8 flat washer on each screw. Tighten the hardware finger tight.

- () Position the Amplifier on its feet.
- () Fit the cabinet top onto the unit and secure it with four 6-32 × 3/8" black screws as shown.
- () Tighten the foot-mounting screws.

NOTE: The blue and white identification label shows the Model Number of your kit. Refer to these numbers if any communications with the Heath Company.

- () Remove the paper backing from the blue and white label. Then press the label onto the rear panel, just above the line cord, as shown in the inset drawing on Pictorial 5-3.

- () Prepare the following FCC label as follows:

At the bottom of the label, fill in the required information: Sign your name, put in today's date, your call sign issued by the FCC, your class of license (General, Advanced, or Extra) and the expiration date on the license.

- () Remove the paper backing from the FCC label and press it onto the rear panel in the open area shown.

NOTE: If it ever becomes necessary to return your Amplifier to the Heath Company for service, refer to "Special Shipping Instructions" on Page 88.

This completes the assembly of your Linear Amplifier. Proceed to "Installation."

INSTALLATION

LOCATION

Do not operate the Amplifier in excessively warm locations or near heating vents or radiators. Be sure air can circulate freely around and through the amplifier cabinet; and provide an unobstructed air inlet for the blower. Do not place any books, magazines, or equipment on top of the cabinet to impede the free flow of air.

POWER CONSIDERATIONS

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

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

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

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

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

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

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

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

ANTENNA

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

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

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

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

GROUNDING

Connect a good earth or water pipe ground to the ground post on the rear panel of the Amplifier. Use the heaviest and shortest connection possible.

Before you use a water pipe ground, inspect the connections around your water meter and make sure that no plastic or rubber hose connections are used which interrupt electrical continuity to the water supply line. Install a jumper around any insulating water connectors found. Use heavy copper wire and pipe

clamps. It is best to ground all equipment to one point at the operating position and then ground this point as discussed above.

EQUIPMENT INTERCONNECTIONS

Interconnections between this Amplifier and other Heath equipment are shown in the Pictorial 7-series of illustrations (Illustration Booklet, Page 13 through 16). Other makes of equipment will usually follow the same general pattern.

ANTENNA RELAY

OPERATION

The antenna relay circuit in the Amplifier must be grounded in the transmit mode with the Amplifier switch (SW5) at its IN position. Heath exciters contain a provision to accomplish this action. If a relay terminal, or other switching provision is not available, this function must be provided by other means. If you have a separate coaxial send-receive relay in your station, it may have external contacts available. A separate switch can also be used.

HEATH TRANSCEIVERS WITH 11-PIN POWER PLUGS

If you will use your Amplifier with a Heath transceiver which has an 11-pin power plug on the rear panel, refer to Pictorial 8-1 (Illustration Booklet, Page 16) and perform the following steps to accomplish the antenna relay connection.

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

- () Cut off and discard the phono plug from one end **only** of a phono cable.
- () Remove 3/4" of the outer insulation of the cable.
- () Unwind the shield wires from the center conductor insulation. Then twist the shield wires tightly together and melt a **small** amount of solder on the ends of the wires.

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

Model HW-101 Transceiver

NOTE: Perform the following steps if you intend to use your Linear Amplifier with a Heathkit Model HW-101 Transceiver.

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

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

- () Connect the center conductor of the phono cable to lug 11 (S-1) and the shield wires to lug 5 (S-1) of the power socket. Use 1/2" sleeving on the shield wires.
- () Snap the power socket cap back into place.

Model SB-104A Transceiver

NOTE: Perform the following steps if you intend to use your Linear Amplifier with the Heathkit Model SB-104A Transceiver.

- () Remove the transceiver accessory socket cap. Then push the prepared end of the phono cable through the socket cap as shown in the Pictorial.
- () Connect the center conductor of the phono cable to lug 8 (S-1) and the shield wires to lug 9 (S-1) of the accessory socket. Use 1/2" sleeving on the shield wires.
- () Snap the accessory socket cap back into place.

Models HW-5400 and SS-9000 Transceivers

The connections between the Linear Amplifier and the HW-5400 and SS-9000 Transceivers are shown in Pictorials 7-6 and 7-7 respectively.

OPERATION

CONTROLS, CONNECTORS, AND METERS

Refer to Pictorial 6-1 (Illustration Booklet, Page 12) for identification of the front panel controls and a concise description of the functions of each.

Refer to Pictorial 6-2 (Illustration Booklet, Page 12) for rear panel connections.

READING THE METER

Refer to Pictorial 6-3 for illustrations of the two panel meters.

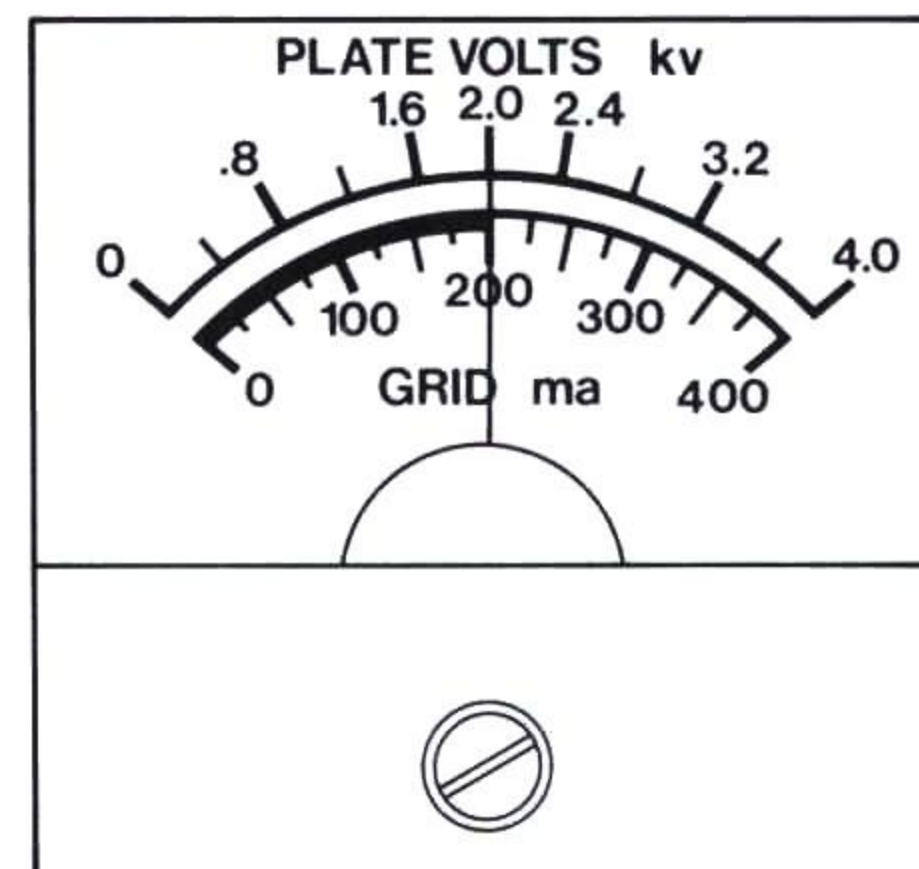
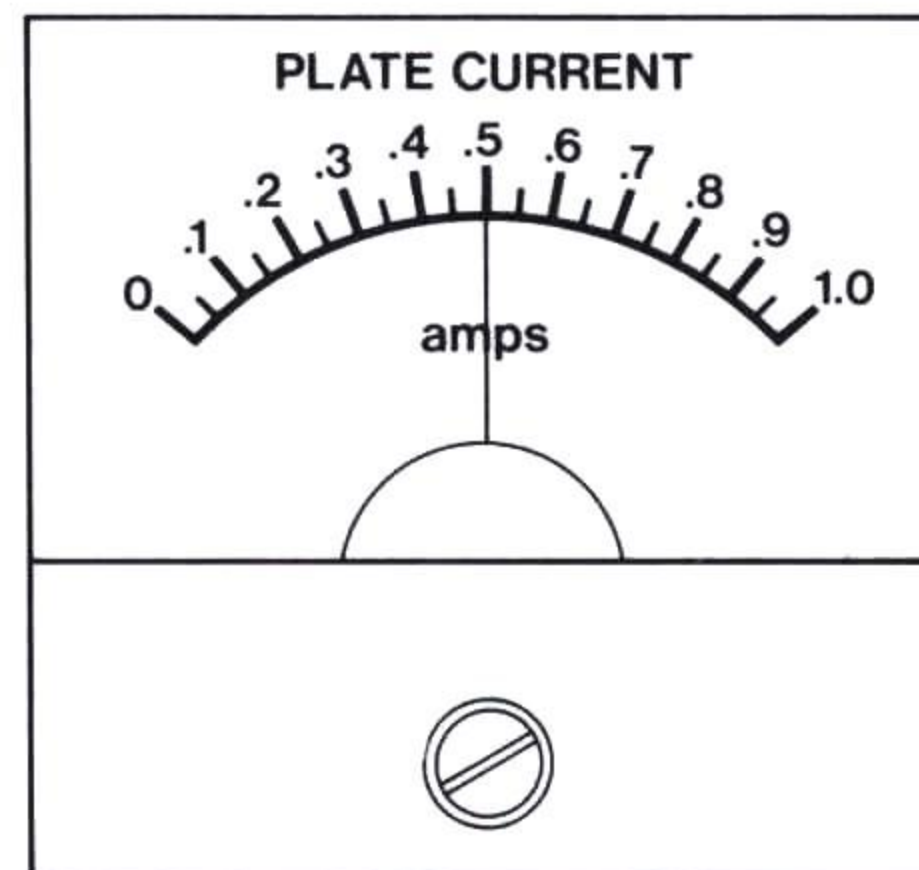
Plate Current

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

Plate Volts

Read the Plate Volts meter scale which corresponds to the setting of the FUNCTION SWITCH:

FUNCTION SWITCH POSITION	MEASURES	SCALE READING
GRID CURRENT	Grid current	0-400 milliamperes (normal operating range 0-200 mA).
RELATIVE LOW	Relative power output	0-400 (lower scale)
RELATIVE HIGH		
HIGH VOLTAGE	High voltage	0-4 kilovolts (upper scale)



PICTORIAL 6-3

GENERAL

SAFETY INTERLOCK

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

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

CIRCUIT BREAKERS

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

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

TUBES

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

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

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

DC INPUT POWER

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

DRIVING POWER

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

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

ALC (Automatic Level Control)

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

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

AMPLIFIER

The AMPLIFIER switch is used to remove the Linear Amplifier from the RF line when you tune the transceiver (or equivalent). It does not switch off the AC or DC power supplies.

TUNE-UP

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

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

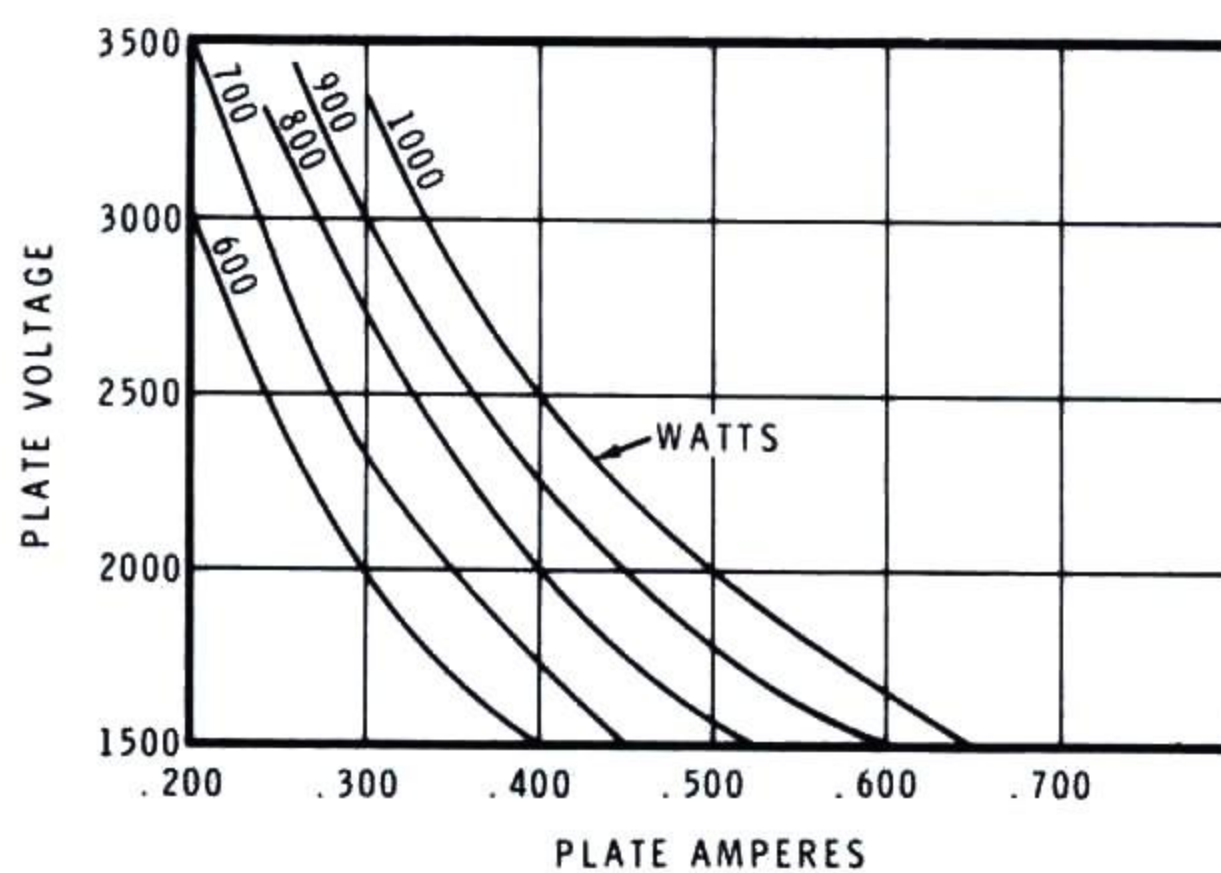
CW AND RTTY PROCEDURE

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

() Set the Amplifier controls as follows:

SWITCH OR CONTROL	POSITION	COMMENTS
TUNE	Desired band segment	
LOAD	1 (80 and 40 bands) 4 (20, and 15, bands)	After tune-up, note position so control can be preset in the future.
BAND	Desired band	
METER	REL. PWR.	
POWER	OFF	
MODE	CW/TUNE	
AMPLIFIER	IN	

- () Tune your exciter for full CW output at the desired frequency. The PLATE VOLTS meter on the Amplifier, when switched to indicate REL PWR, will show the relative power output of the exciter and may be used even though the Amplifier is off.
- () Reduce the exciter output to 0 by placing its controls in the receive mode; also turn its MIC/CW Level control fully counterclockwise.
- () Turn the Amplifier on.
- () Place the exciter in the tune mode. The amplifier plate meter should read approximately .12 ampere resting plate current. Then advance the Level control until the PLATE METER shows .3 ampere.
- () Peak (adjust) the amplifier TUNE and LOAD controls for maximum PLATE VOLTS meter Relative Power indication.
- () Advance the drive to .4 ampere plate current and repeak the TUNE and LOAD controls. The Meter readings should then be approximately:
 - Plate amperes = .35
 - High voltage = 2100
 - Grid mA = 110
- () Alternately adjust the TUNE, LOAD, and exciter drive controls for the desired input. Refer to Pictorial 6-4; the meter readings at one full kilowatt input will be as shown.
- () Turn the exciter Mode switch to Standby or the desired transmission mode.



PICTORIAL 6-4

The Linear Amplifier is now loaded for operation on CW or RTTY. If you are using an oscilloscope for monitoring, you should obtain a display similar to that shown in Pictorial 6-5. If you have a monitor scope, you may find that its optional trapezoid display pattern is more easily interpreted for voice patterns.

CAUTION: As you transmit, **DO NOT** switch between CW/TUNE and SSB modes.

SSB PROCEDURE

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

Low Power SSB

- () For 1000 watts P.E.P. operation, switch the exciter **only** to the SSB mode. Leave the amplifier MODE switch at CW/TUNE.
- () Adjust the exciter drive control so the PLATE METER will indicate between .12 and .2 ampere with average speech. Hard voice peaks should not exceed .250 ampere.

High Power SSB

- () For 2000 watts P.E.P. operation, switch **both** the exciter and the amplifier MODE switch to SSB.
- () Advance the exciter drive level until the PLATE METER reads from .2 to .3 ampere with average speech and no higher than .33 ampere on hard voice peaks. A higher drive level will cause "flat topping."

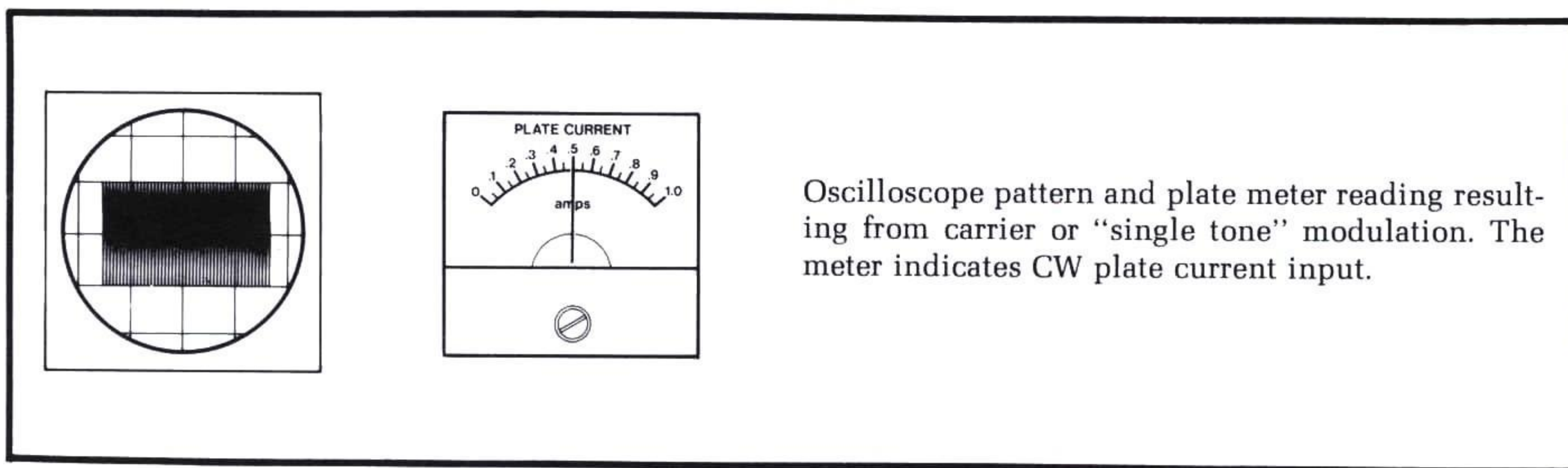
An example of a proper SSB oscilloscope pattern is shown in Pictorial 6-6. Note that there are sharp, distinct peaks. The number of patterns or "christmas trees" will depend upon the operator's voice characteristics and the scope sweep speed. Set the scope for approximately 30 Hz sweep.

Note that the meter reading on voice peaks will not be high, due to meter inertia and voice characteristics; however, the height of the oscilloscope pattern is greater than that shown in Pictorial 6-5.

Pictorial 6-7 shows the same voice pattern but with extreme "flat topping." The oscilloscope shows that no more useful power is being developed. When the drive level is too high the meter reads higher, but only distortion is developed.

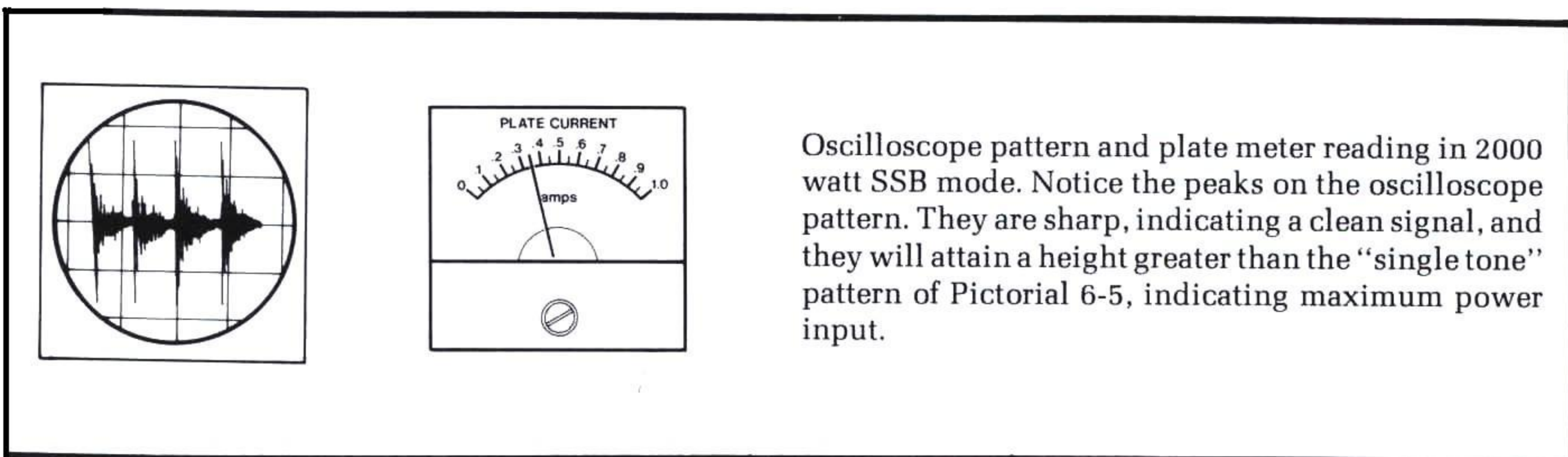
PERIODIC MAINTENANCE

Remove the top cover of the Amplifier and remove the dust at least once a year. Use the blower connection on a vacuum cleaner or a soft bristle brush. While the top cover is removed, add **one** drop of light machine oil to each fan bearing.



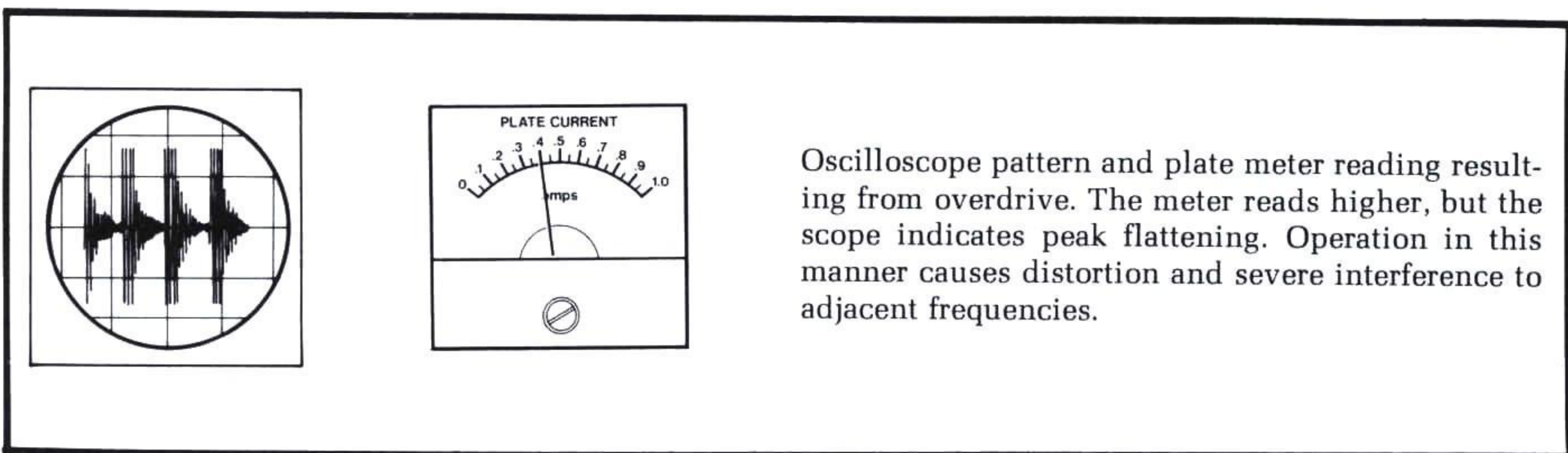
Oscilloscope pattern and plate meter reading resulting from carrier or "single tone" modulation. The meter indicates CW plate current input.

PICTORIAL 6-5



Oscilloscope pattern and plate meter reading in 2000 watt SSB mode. Notice the peaks on the oscilloscope pattern. They are sharp, indicating a clean signal, and they will attain a height greater than the "single tone" pattern of Pictorial 6-5, indicating maximum power input.

PICTORIAL 6-6



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

PICTORIAL 6-7

IN CASE OF DIFFICULTY

NOTE: When you operate the Amplifier outside the specified power or frequency range (or both), components may be damaged. Such damage is not covered by the Heath warranty.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something that you have consistently overlooked.
2. The majority of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, you can often eliminate many troubles by carefully reheating all connections to make sure that they are properly soldered.
3. Make sure that the tubes light up properly. If they do not, remove the tubes from their sockets and check for continuity between pins 1 and 5 with an ohmmeter. An infinite resistance will indicate a faulty tube filament.
4. Check the values of the parts. Be sure that the proper part has been wired into the circuit as shown in the Pictorial Diagrams and as called out in the wiring instructions.
5. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
6. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

NOTE: Refer to the "Circuit Board X-Ray View" (Page 96) for the physical location of parts.

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

SPECIAL SHIPPING INSTRUCTIONS

If you return this Amplifier to the Heath Company for servicing, do not ship the Amplifier with the high-voltage transformer installed. To remove the transformer, use the following procedure:

1. Remove the cabinet from the Amplifier. Be sure you disconnect the line cord.
2. Remove the top cover from the Amplifier.
3. Remove the right side panel from the chassis.
4. Carefully unsolder the red wire from hole D on the circuit board.
5. Carefully unsolder the red-yellow wire from the positive lug of capacitor C14.
6. Unplug the transformer from socket Y.
7. Remove the four mounting screws and remove the transformer.
8. Replace the right side panel, the top cover, and cabinet. Be sure to use plenty of packing material.

NOTE: It is not necessary to return the transformer with the Amplifier when you return it for service.

TROUBLESHOOTING CHART

DIFFICULTY	POSSIBLE CAUSE
1. No AC power	A. Circuit breakers open. B. Jumpers missing on terminal strip AE. C. Terminal strip AE wired wrong. D. High-voltage transformer not plugged in.
2. Meter inoperative in one position: A. GRID. B. REL. PWR. C. HV.	A. Resistor R1, R3. B. D17, R25, R24, C54, R26, R28, R29, R31. C. R6, R7, R8, R9. D. Function switch.
3. Meter circuits inoperative	A. Meter jumper wire not removed. B. R2, C3, C8. C. Function switch. D. (Refer to Page 95.)
4. Idle current over .15A in CW/TUNE position.	A. ZD1.
5. No idle current	A. Relay. B. ZD1. C. V1-V2.
6. No high voltage	A. D1-D14. B. C10-C17. C. R12-R19. D. T1. E. R1 or R3. F. C6, C7, C29. G. Top cover off (interlock).
7. Relay K1 will not activate	A. D16. B. C4. C. Ant. relay jack. D. Amplifier switch SW5 in OUT position. E. T2. F. RL-1.
8. Final tune has no effect.	A. Band switch wafer #2 180 degrees out of position. B. L5 installed wrong. C. Improper load on the Linear Amplifier. D. V1, V2.
9. No RF output	A. Relay wired wrong. B. L5 installed wrong. C. Coax shorted. D. C29. E. Amplifier switch in "OUT" position, or incorrectly wired.
10. ALC inoperative	A. Wiring error or component failure on terminal strip BE. B. ALC jack.
11. Amplifier hard to drive.	A. Coaxial leads to the input band switch reversed.
12. Plate current does not increase with added drive power.	A. Driver and Amplifier set on different bands.
13. Filament transformer T2 burns out on 220 volts.	A. Open primary on Transformer T1.

SPECIFICATIONS

Band Coverage	80, 40, 20, and 15 meter amateur bands.
Driving Power Required	100 watts, maximum.
Maximum Power Input	SSB: 2000 watts P.E.P. CW: 1000 watts. RTTY: 1000 watts.
Duty Cycle	SSB: Continuous voice modulation. CW: Continuous (maximum key-down 10 minutes.) RTTY: 50% (maximum transmit time 10 minutes).
Third Order Distortion	-30 dB or better.
Input Impedance	52 Ω unbalanced.
Output Impedance	50 Ω unbalanced; SWR 2:1 or less.
Front Panel	Tune. Load. Band switch. Function switch. Power. CW — SSB. Power lamp. Plate Current meter. Plate Volts meter (grid mA, High or Low Relative Power, and High Voltage). Amplifier IN-OUT

Rear Panel	Line cord. Circuit breakers (two 10-ampere). Antenna Relay (phono). ALC (phono). RF Input (SO-239). Ground post. RF output (SO-239).
Tubes	Two 3-500Z.
Power Required	120 VAC, 50/60 Hz, at 20 amperes maximum. 240 VAC, 50/60 Hz, at 10 amperes maximum.
Cabinet Size	14-7/8" wide, 8-1/4" high, 14-1/2" deep (37.8 × 21 × 36.8 cm).
Net Weight	50 lbs (22.7 kg).

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

CIRCUIT DESCRIPTION

Refer to the Schematic (fold-in) to identify the circuit components while you read this section.

POWER SUPPLY

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

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

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

HIGH VOLTAGE SUPPLY

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

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

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

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

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

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

Chokes RFC1 and RFC2 and bypass capacitors C6 and C7 are used to keep RF energy out of the power supply circuits.

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

FILAMENT AND BIAS SUPPLY

Transformer T2 has two secondary windings. One winding furnishes 5 VAC at 30 amperes for the amplifier tube filaments. The #2114D pilot lamp, PL1, which is used for power indication is also connected across the filament line.

Filament supply is fed to the two tubes through RFC3, a coil which is bifilar wound on a ferrite core. This coil forms a choke to raise the tube filaments above RF ground so the driving voltage will not be short-circuited.

The second winding on transformer T2 is used in a half-wave rectifier circuit for the bias supply voltage, to operate relay K1 and to furnish ALC threshold voltage. The AC voltage from this winding is rectified

by diode D16 and filtered by capacitor C4.

This DC voltage is connected to lugs 3 and 11 of relay K1. In the receive mode, this voltage is applied through lug 9 to the center-tap of the filament winding. This positive voltage increases the voltage difference between the tube grids (which are grounded for DC) and the tube filaments, which now carry the positive DC voltage in addition to the AC filament voltage. The tube grids are consequently biased beyond cutoff and no plate current flows.

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

RELAY

Relay K1 has three sets of single-pole, double-throw contacts. When the relay coil circuit is open the contacts are in the receive mode. Amplifier switch (SW5) can be used to turn K1 on and off.

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

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

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

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

RF CIRCUITS

INPUT CIRCUIT

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

TUBES

The amplifier tubes are connected in parallel in a class B grounded grid circuit. RF driving power is applied to the filaments in the normal cathode-driven configuration. As mentioned in the "Power Supply" section, choke RFC3 holds the filaments above RF ground.

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

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

The positive side of the power supply is connected in parallel to the tubes through RFC1.

Cooling air is circulated around the tubes by the fan.

OUTPUT CIRCUIT

The tuned output circuit of the Amplifier is a pi network composed of plate Tune capacitor C59, loading capacitors C61 and C62 (in 80 M only), and coils L4 and L5.

Band switch wafer 2 progressively shorts out the unused portions of coils L4 and L5. The coil turns in use are tuned to resonance by Tune capacitor C59. Load capacitor C61 is tuned to complete the impedance match between the tubes and the load connected to the RF Output. On the 80 meter band, fixed capacitor C62 is switched in parallel with Load capacitor C61 to provide the additional capacitance required on this band.

If a DC voltage is unintentionally applied to the plate output circuit, RFC6 will provide a DC path to ground, thus short-circuiting the high voltage supply and opening the circuit breakers.

ALC CIRCUIT

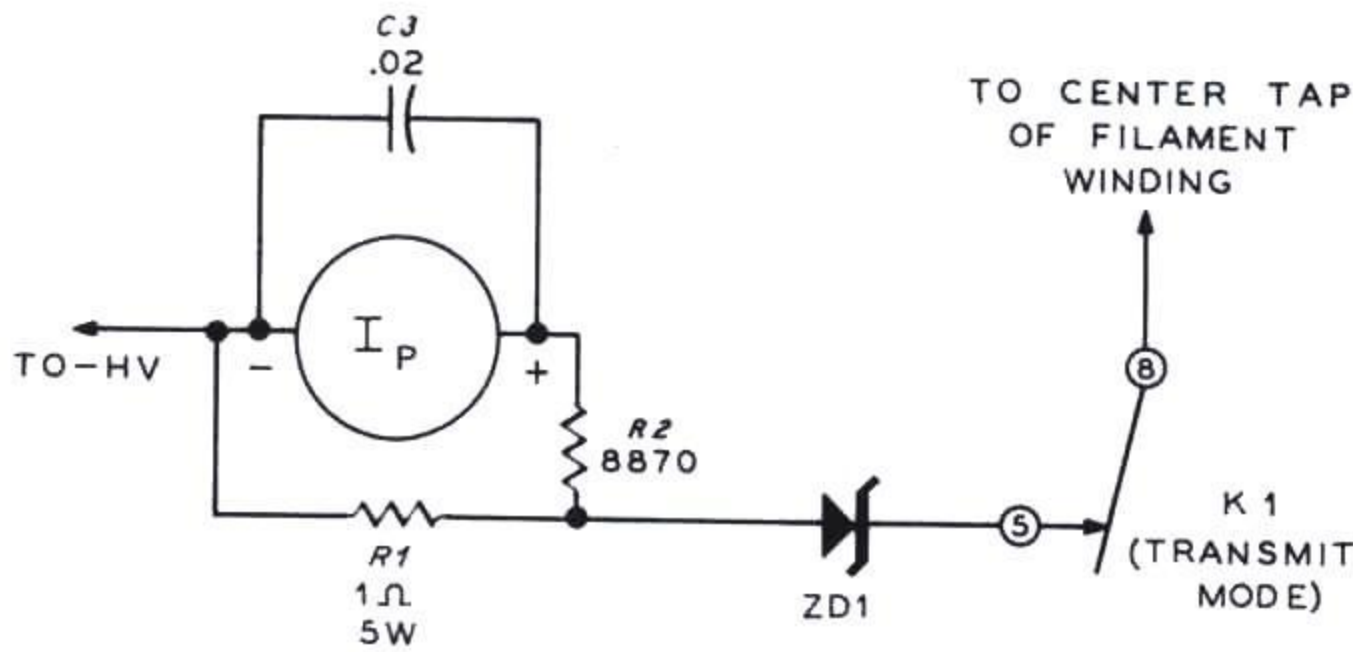
Approximately 60 VDC ALC threshold voltage is available at the junction of resistors R4 and R5, which form a voltage divider across the bias supply winding of transformer T2. Capacitor C5 is an RF bypass, and resistor R11 is an isolation resistor.

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

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

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

METERING CIRCUITS



PICTORIAL 9-1

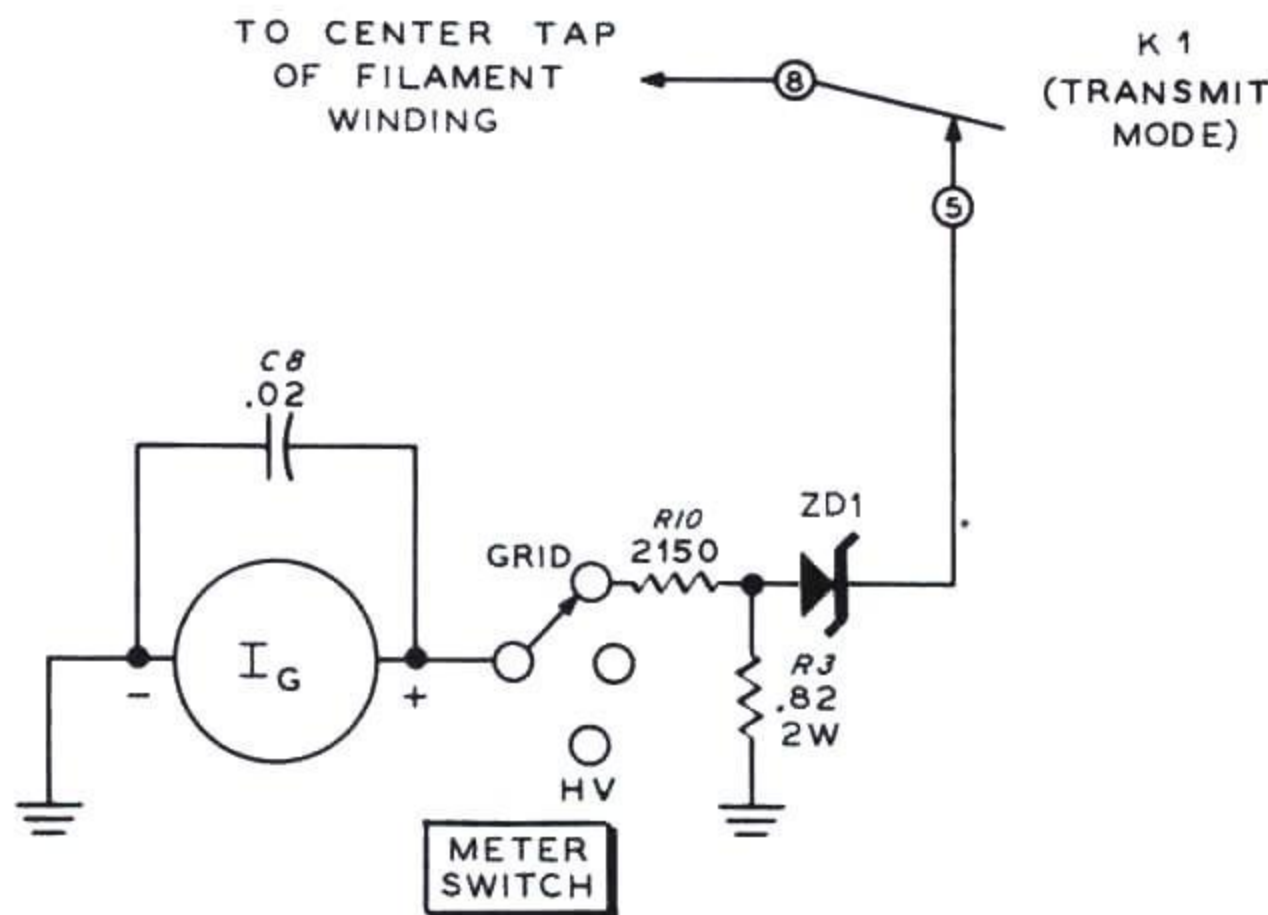
PLATE CURRENT METER (Pictorial 9-1)

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

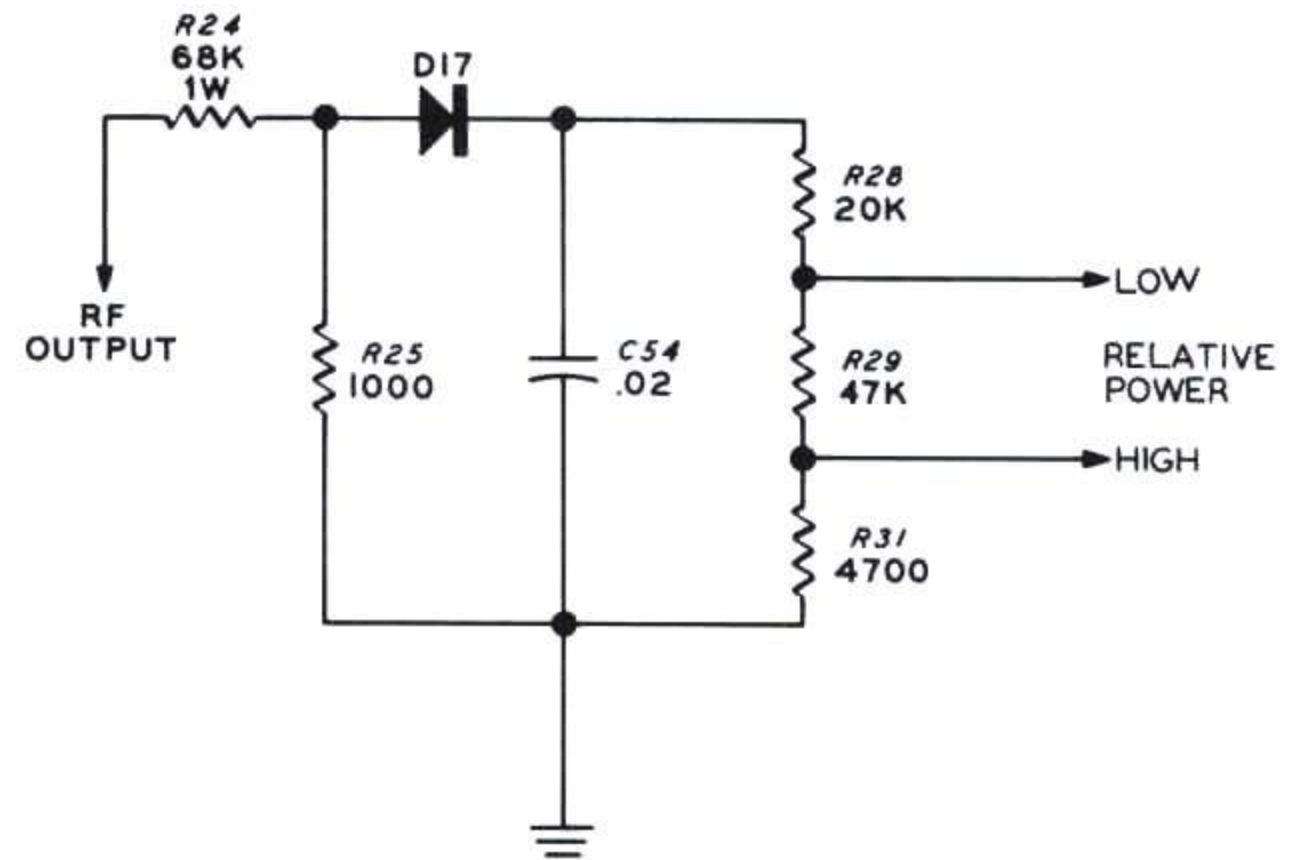
PLATE VOLTAGE METER

Grid Current (Pictorial 9-2)

To read grid current, the grid-current meter is switched in parallel with shunt resistor R3. The grid circuit return is to the center tap of the filament winding of transformer T2. Note that grid current only passes through resistor R3, as the return for the high voltage circuit is through resistors R1, R2, and the Plate meter. R10 is a series current-limiting resistor.



PICTORIAL 9-2



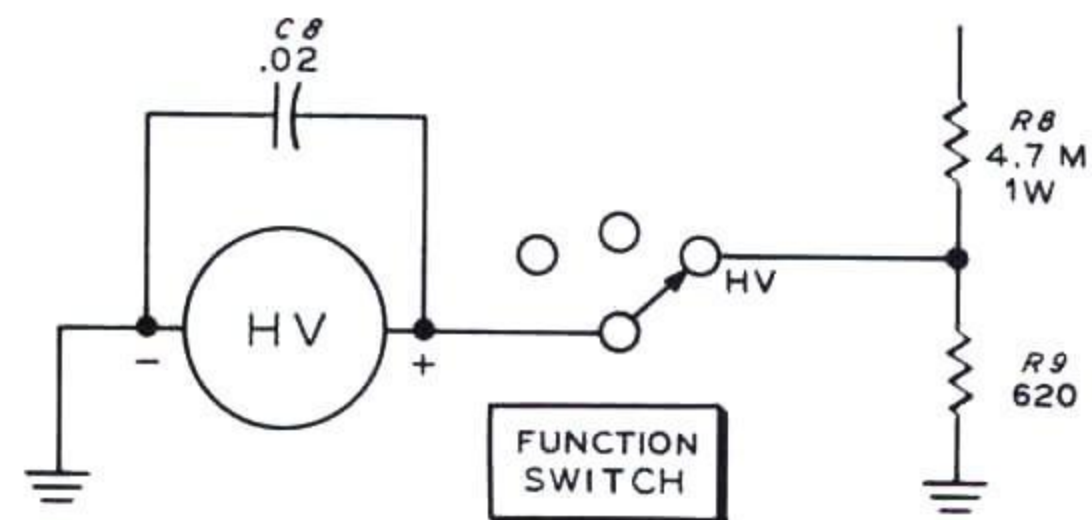
PICTORIAL 9-3

Relative Power (Pictorial 9-3)

Voltage divider resistors R24 and R25 are connected across the RF Output. The voltage at the junction of these resistors is rectified by diode D17, filtered by capacitor C54, and applied through divider resistors R28, R29, and R31 to the meter. Taps between R28 and R29, or R29 and R31, allow low or high relative power.

High Voltage (Pictorial 9-4)

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



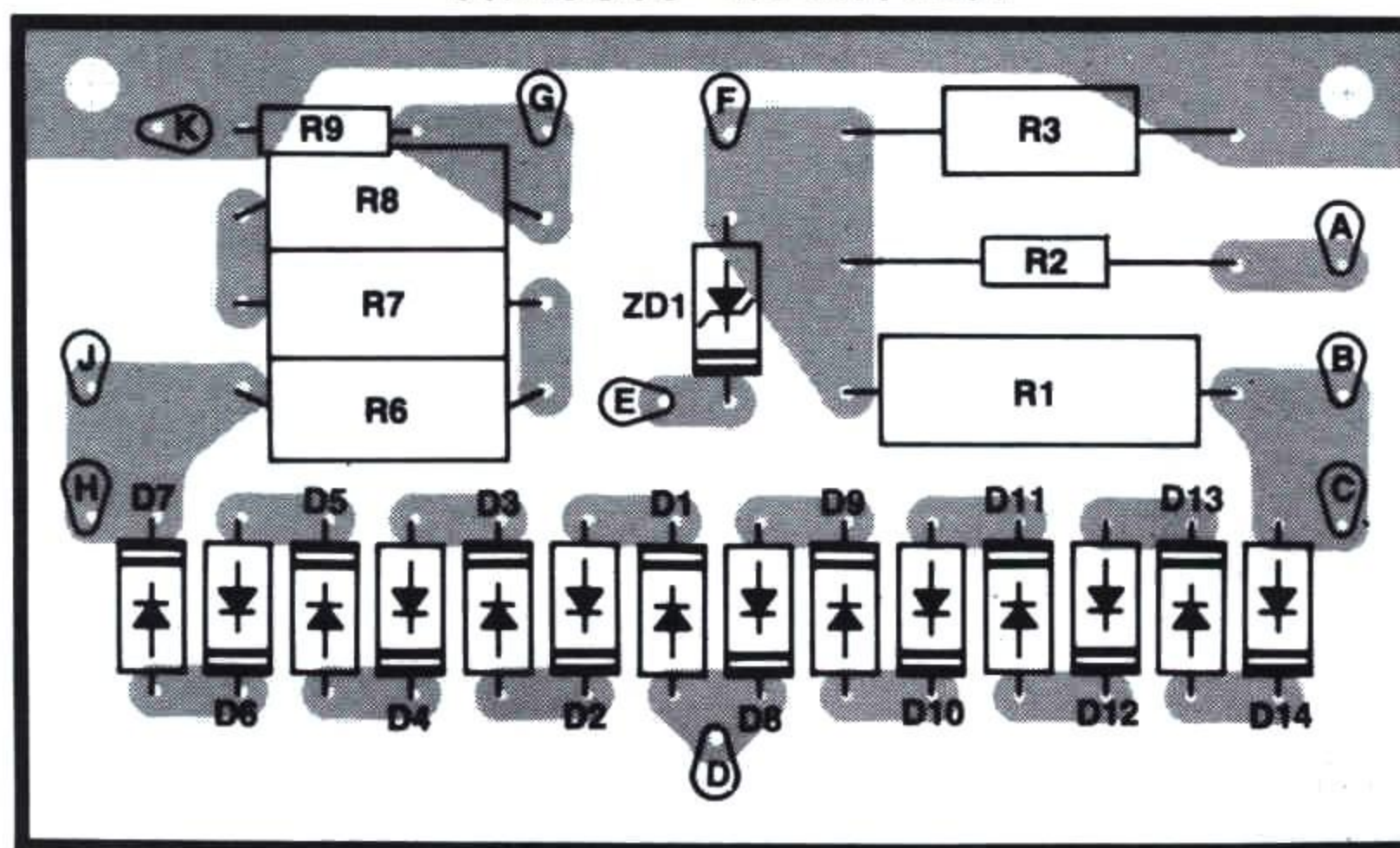
PICTORIAL 9-4

CIRCUIT BOARD X-RAY VIEW

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

- A. Find the circuit component number (R1, C1, etc.) on the "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.

(NOTE: ZD1 IS WIRE-CONNECTED,
CHASSIS-MOUNTED.)



(Shown from the component side.)

CUSTOMER SERVICE

REPLACEMENT PARTS

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

ORDERING FROM THE FACTORY

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

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

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

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

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

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

TECHNICAL CONSULTATION

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

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

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

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

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

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

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

REPAIR SERVICE

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

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

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

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

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

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

Heath Company
Service Department
Benton Harbor, Michigan 49022



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

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